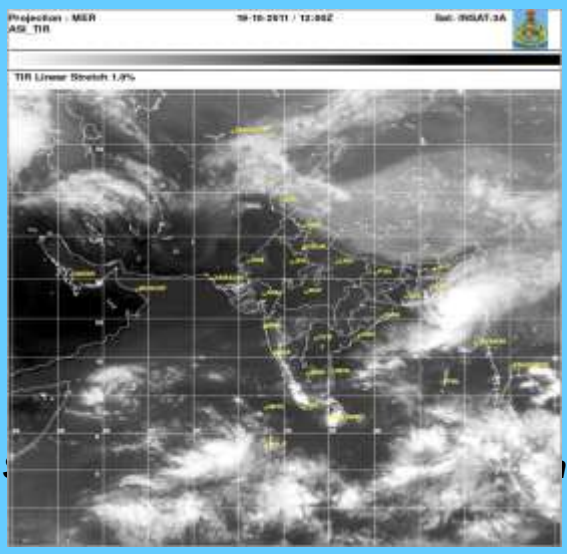
INDIA METEOROLOGICAL DEPARTMENT

**Report No.: FDP/TCR/1/2013**

Forecast Demonstration Project (FDP) for Improving
Track, Intensity and Landfall of
Bay of Bengal Tropical Cyclones

Implementation of Pilot Phase, 2012:
A Report



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**Forecast Demonstration Project (FDP) for Improving
Track, Intensity and Landfall of
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**Implementation of Pilot Phase, 2012:
A Report**
**(15 October-30 November, 2012)**

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**CONTENTS**

## Preface

Worldwide huge technological advancements have been achieved to observe the inner core of the cyclone. Accordingly a programme has been evolved on prediction of track of tropical cyclone over north Indian ocean resulting in planning of the Forecast Demonstration Project (FDP) over Bay of Bengal since 2008 (15 October – 30 November). FDP Programme is scheduled to be implemented in three phases. The programme is aimed to demonstrate the improvement in cyclogenesis, intensification and movement of cyclones over the north Indian Ocean with enhanced observations over the data sparse region. The programme is scheduled to be implemented in three phases. This report deals with implementation of the programme, salient features of the systems developed, weather summaries issued and the lessons learnt during the pilot phase, 2012 (15 October – 30 November).

The Pilot Phase of FDP on landfalling cyclones over the Bay of Bengal was conducted during 15$^{th}$ October to 30$^{th}$ November, 2012 as per the Implementation Plan. The daily bulletin was prepared during the period and circulated to all concerned. The NOC meeting was held thrice a week, viz. Monday, Wednesday and Friday.

The FDP helped in continuous monitoring of environmental conditions for cyclogenesis. Further, intense observation during IOP helped in better monitoring and prediction of cyclonic disturbances. The additional data collected during the pilot phase included enhanced AWS network of the coast, twelve activated buoy observations from the Bay of Bengal, Oceansat-II observations and microwave imagery products. As a result of above, the cyclone track forecast errors reduced in 2011 compared to previous FDP campaigns. It also helped in refining the Standard Operation Procedure of the IMD and in strengthening the multi-institutional mechanism which will further improve the FDP campaign in future. Various lessons were also learnt during the campaign.

Many research and observational inputs were received from various national agencies including Indian Space Research Organisation, National Centre for Medium Range Weather Forecasting, Indian Air Force, Indian Navy, Indian Institute of Technology- Delhi, Indian Institute of Science, Indian National Centre for Ocean Information Services, National Institute of Ocean Technology, Indian National Centre for Ocean & Atmospheric Research and Cyclone Warning Division at India Meteorological Department Head Quarter, which are highly appreciated and duly acknowledged. I would like to place my appreciation on record to Dr. M. Mohapatra, Shri. B. K. Bandyopadhyay and Shri R.P. Sharma of IMD, New Delhi for their contribution in compilation, editing and publication of this document. I also thank to Mr. D. P. Nayak, Mr. R.G. Bali and Mrs. Monica Sharma of Cyclone Warning Division for their valuable contribution to bring out this report on “Pilot Phase of Forecast Demonstration Project -2012”.

I am thankful to Shri D.R. Sikka for reviewing this document and providing useful suggestions.

**Dr. L.S. Rathore**
Director General of Meteorology

January 2013

## Abstract

During the past few years huge technological advancements have been achieved elsewhere in the world to observe the inner core of the cyclone. Accordingly a programme has been evolved on prediction of track of tropical cyclone over north Indian Ocean in collaboration with USA resulting in planning of the Forecast Demonstration Project (FDP) over Bay of Bengal.

FDP programme is aimed to demonstrate the improvement in cyclogenesis, intensification and movement of cyclones over the north Indian Ocean with enhanced observations over the data sparse region. FDP Programme is scheduled to be implemented in three phases. Several national institutions participated for joint observational, communicational & NWP activities during pre-pilot phase. This report deals with implementation programme, salient features of the systems developed, weather summaries issued and the lessons learnt during the final phase.

The Pilot Phase of FDP on landfalling cyclones over the Bay of Bengal was conducted during 15$^{th}$ October to 30$^{th}$ November, 2012 as per the implementation plan. The IOP was declared for 6 days in association with Cyclone Nilam (29$^{th}$ October to 1$^{st}$ November) and Depression (19$^{th}$ to 20$^{th}$ November). The daily bulletin was prepared during the period and circulated to all concerned. The NOC meeting was held thrice a week, viz. Monday, Wednesday and Friday.

The FDP helped in continuous monitoring of environmental conditions for cyclogenesis. Further, intense observation during IOP helped in better monitoring and prediction of cyclonic disturbances. The additional data collected during FDP 2012 included enhanced AWS network of the coast, twelve activated buoy observations from the Bay of Bengal, Oceansat-II observations and microwave imagery products. The Tropical Cyclone module in Synergie System was also used for monitoring, prediction and preparation of track of cyclone.

As a result of above, the average cyclone track forecast error was reduced in 2012 compared to previous FDP campaign. It helped in refining the Standard Operation Procedure of the IMD and in strengthening the multi-institutional mechanism. Various lessons were also learnt from the FDP campaign 2012, which will further help in improving the campaign in future. To mention a few, we should have better availability of consumables and other logistic support for the coastal observatories and ships to ensure good collection of data, better data reception from the coastal stations of all WMO/ESCAP Panel countries on real time basis, improved buoy network, improved NWP model guidance, objective analysis of various cyclogenesis, intensification and track forecast parameters by preparing a check list, threshold values of various NWP products for genesis, intensification and movement and structured satellite bulletin like oher international centres.



**Key words:** Tropical cyclone, Bay of Bengal, Forecast Demonstration Project (FDP)

## *CHAPTER–I*

## Introduction

### 1.1 Background

Extensive operational mode activities are in place involving a range of global(T-386 & currently T-574), regional(LAM and QLM), and meso-scale(MM5, ETA, WRF/HWRF) models for generating short(up to 3 days in advance) and medium range (4-7 days in advance) forecast products for use in the prediction of tropical cyclone genesis, intensification, movement and landfall characteristics. Continuous assimilation of all available land based, ocean based and space based observations is carried out at the NCMRWF and IMD for Global models. Regional scale assimilation is also carried out at NCMRWF and IMD for generating most representative 3-D atmospheric fields for forcing the regional and meso-scale models.

Extensive performance evaluation and numerical experimentation studies carried out by the operational, R & D and academic groups on tropical cyclone forecasting over the Indian Seas of Bay of Bengal and Arabian Sea have concluded that the large tropical cyclone track and intensity forecast errors are due to lack of critical observations from the cyclone core environment. Hence, it is strongly believed that the establishment of necessary aircraft probing of cyclone (APC) facility for generating data from the cyclone core environment can successfully address this critical data gap in cyclone intensity and track forecasting.

During the past more than two decades there have seen huge technological advancements in USA to observe the inner core, both through in situ means, and by remote sensing. During 2005, delegation level meetings between scientists from India and NCAR, USA have identified six themes for Indo-US collaboration. Out of these themes evolving a programme on improving the prediction skill of track of tropical cyclones over the Bay of Bengal was marked as the top priority item and the NCMRWF was asked to lead the joint programme from India side. Since then advanced high resolution global and meso-scale assimilation-forecast systems have been implemented in India. Capabilities to assimilate data from non-conventional observational platforms (satellite, radar) have been also developed.

Follow up meetings between Indo-US groups have culminated to the organizational planning of the Forecast Demonstration Project (FDP) over Bay of Bengal on the lines of NOAA-HRD and NCARs experience on cyclone probing over the Atlantic region. A Committee chaired by Shri D. R. Sikka had addressed this issue and came out with an overall Science Plan for the FDP. Keeping in mind the nature and scale of the programme that needs to be supported with adequate funding, an appropriate project management structure has been put in place to ensure the deliverables to get fully integrated with the operational cyclone forecast systems. IMD has been made the nodal agency for this purpose.

## 1.2. Key Scientific Objectives and Goals for FDP

The key objectives of the FDP are:

i) To demonstrate the ability of the Numerical Models using enhanced observation over the region including the measurements from the dropsonde's over the periphery of the cyclone and to assess overall accuracy limits in terms of the cyclone track, intensity and landfall for one to two Seasons.

ii) To incorporate modification into the models which could be specific to the Bay of Bengal based on the in-situ measurements and following the actual track through Satellite and Radar observations.

## 1.3. Programme

An FDP on landfalling tropical cyclones over the Bay of Bengal has been taken up by the IMD which aims to improve the skill of TC track prediction and even in intensity forecasts. The programme has been divided into three phases :

(i) Pre- pilot phase : Oct-Nov. 2008-11
(ii) Pilot phase : Oct-Nov. 2012,
(iii) Final phase : Oct-Nov. 2013-14

During pilot phase **(15 Oct - 30 Nov, 2012),** several national institutions participated for joint observational, communicational & NWP activities like that during previous years. In the Pilot Phase (October –November,2012), IOP was declared for 4 days in view of the Cyclone Nilam (29$^{th}$ Oct. to 1$^{st}$ November) and for 2 days on 19$^{th}$ and 20$^{th}$ November due to Depression over east central Bay of Bengal.

The detailed implementation programme is presented in Chapter-II. The salient features of cyclone Season 2012 are presented and discussed in Chapter-III. Daily weather summary and advisory issued during FDP-2012 are presented in Chapter-IV. The lessons learnt are presented in Chapter-V. The summary and conclusions are presented in Chapter-VI.

## CHAPTER–II
## PROGRAMME IMPLEMENTATION PLAN FOR FDP-2012

### *Background*

Currently in India, extensive operational mode activities are in place involving a range of global(GFS-IMD,T-382, T-574), regional(QLM), and meso-scale(MM5, ETA, WRF/HWRF) models for generating short(up to 3 days in advance) and medium range(4-7 days in advance) forecast products for use in the prediction of tropical cyclone genesis, intensification, movement and landfall characteristics. Continuous assimilation of all available land based, ocean based and space based observations is carried out at the NCMRWF and regional scale assimilation is carried out at NCMRWF and IMD for generating most representative 3-D atmospheric fields for forcing the regional and meso-scale models.

Extensive performance evaluation and numerical experimentation studies carried out by the operational, R & D and academic groups on tropical cyclone forecasting over the Indian seas of Bay of Bengal and Arabian Sea have concluded that the large tropical cyclone track and intensity forecast errors are due to lack of critical observations from the cyclone core environment. Hence, it is strongly believed that the establishment of necessary aircraft probing of cyclone (APC) facility for generating data from the cyclone core environment can successfully address this critical data gap in cyclone intensity and track forecasting.

The past few years elsewhere in the world have seen huge technological advancements to observe the inner core, both through in situ means, and by remote sensing. During 2005, delegation level meetings from India working in the field of meteorology and atmospheric science to NCAR, USA have identified six themes for Indo-US collaboration. Out of these themes evolution, evolving a programme on prediction of track of tropical cyclones over the Bay of Bengal was marked as the top priority item and the NCMRWF was asked to lead the joint programme from India side. Advanced high resolution global and meso-scale assimilation-forecast systems have been implemented. Capabilities to assimilate data from non-conventional observational platforms (satellite, radar) have been developed.

### Recent initiatives for FDP Planning

Follow up meetings between Indo-US groups have culminated to the organizational planning of the FDP over Bay of Bengal on the lines of NOAA-HRD and NCARs experience on cyclone probing over the Atlantic region. A Committee chaired by Shri D R Sikka had addressed this issue and has come out with an overall science plan. This Science Plan has been subsequently modified. Keeping in mind the nature and scale of the programme that needs to be supported with adequate funding, an appropriate project management structure is put in place to ensure the deliverables to get fully integrated with the operational cyclone forecast systems. IMD has been made the nodal agency for this purpose. The Pilot Phase of

the programme started in 2008 based upon the available observational, NWP and communication infrastructure. It continued in 2009-11 with the upgradation observational network and NWP modeling system. Based on the experience of these past pre-pilot phases of FDP, the implementation plan has been modified and presented here for the year 2012.

**Key Scientific Objectives and Goals for FDP**

i) To demonstrate the ability of the Numerical Models using enhanced observation over the region including the measurements from the dropsonde's over the periphery of the cyclone and to assess overall accuracy limits in terms of the cyclone track, intensity and landfall for one to two seasons.

ii) To incorporate modification into the models which could be specific to the Bay of Bengal based on the in-situ measurements and following the actual track through Satellite and Radar observations.

**Programme**

The objectives of the programme will be met by conducting a joint observational communication and NWP effort by several institutes in the country during the period 15 Oct.-30 Nov. 2012. There will be Intensive Observational Phases (IOP) within this period tuning actual cyclone events. There will be a National Operational Centre (NOC) and a Field Operational Centre (FOC) at Chennai.

**National Operational Centre (NOC):**

The overall campaign will be monitored and guided by a Weather Monitoring and Advisory Group (WMAG) at National Weather Forecasting Centre (NWFC), IMD. In addition, communication conferencing and data exchange will be facilitated from this nodal cell. It will be called the NOC. The announcement of IOP will be made by NOC. (Contact: Dr. M. Mohapatra, Cyclone Warning Division, IMD, New Delhi, e-mail mohapatraimd@gmail.com & cwdhq2008@gmail.com, Phone no. 011-24652484, 24631913 Mobil: 9868623475, Fax No. 011-24623220).

**Field Operational Centre (FOC):**

The FOC, Chennai will work in unison with the NOC coordinating all activities of every institution during the IOP (Contact: Dr. Y.E.A. Raj, DDGM, RMC Chennai e-mail: yearaj@gmail.com & Dr. S. Balachandran, Sc. E, Cyclone Warning Research Centre, RMC, Chennai, E-mail: balaimd@gmail.com, Phone No. 044-28276752, Fax No. 044-28276752)

**Multi institutional initiative**

The institutions involved in the program are as follows:-

1. IMD
2. NCMRWF
3. ISRO
4. IAF

5. INDIAN NAVY
6. IIT KHARAGPUR
7. IIT DELHI
8. INDIAN INSTITUTE OF SCIENCE
9. NIOT
10. INCOIS
11. NCAOR

**Targeted FDP Requirements for the FDP Campaign of October-November 2012**
**Observational program:**

**(I)AWS:**

Operational meso-scale AWS network of IMD along the east coast of India available for pilot phase is shown below.

| S. No. | State | Existing No. of AWS Stations |
|---|---|---|
| 1 | West Bengal | 17 |
| 2 | Orissa | 30 |
| 3 | Andhra Pradesh | 22 |
| 4 | Tamilnadu and Puducherry | 18 |
| 5 | Andaman & Nicobar | 1 |
| 6 | Lakshadweep | 1 |
| 7 | Kerala | 10 |
| 8 | Karnataka | 21 |
| 9 | Goa | 2 |
| 10 | Maharashtra | 37 |
| 11 | Gujarat, Daman & Diu and Dadra Nagar & Haveli | 27 |
| 12 | East coast + A&N Islands | 88 |
| 13 | West coast + Lakshadweep | 97 |

The locations of the stations are shown in Fig.1

- DDGM(SI), Pune will ensure the real time transmission of data from AWS stations along east coast of India and additional 14 in the Northeast to DDGM(ISSD) Delhi in GTS mobile synop format. DDGM(SI) will submit status report by 1st October 2012 to Project Manager on the availability of such data.
- Data from PRWONAM and northeast India Meso-scale AWS network will be made available by ISRO from the MOSDAC server of SAC, Ahmedabad on real time (Fig.2).
- DDGM(Sat. Met) will make arrangements to download ISRO AWS data and relay it to NOC for operational and NWP application.

- Data formatting issues associated with ISRO AWS data are to be sorted out through joint effort of Shri A.K. Sharma DDGM (Satmet) and Dr S.K. Roy Bhowmik, DDGM (NWP) of IMD by first 30th September 2012. On finalisation the process of converting ISRO AWS data into mobile synop (GTS) format need to be automated in liaison with DDGM(ISSD) prior to the FDP-2012 period.
- AWS data from 10 stations commissioned (under STORM Project) by Kolkata University and Guwahati university will also be communicated to NOC. DDGM, RMC, Kolkata and Guwahati will coordinate and intimate the status to NOC and FOC by 1ST October 2012.
- RMCs at Kolkata and Guwahati will work out modalities to collect and transmit data on real time basis from AWS network established under the storm programme by Kolkata University, Jadavpur University and Guwahati University by 1st October. Formatting issues as described above shall also be addressed. The data will be transmitted through AMSS of respective RMC. FOC shall coordinate the exercise.

IMD AWS network over NE India is given below.

| S. No. | State | Existing No. of AWS Stations |
|---|---|---|
| 1 | Assam | 26 |
| 2 | Meghalaya | 7 |
| 3 | Nagaland | 7 |
| 4 | Arunachal Pradesh | 7 |
| 5 | Tripura | 4 |
| 6 | Manipur | 10 |
| 7 | Mizoram | 8 |
| 8 | Sikkim | 3 |

**(II) Synop**

- Synoptic observatories of IMD network (Fig.3 and Fig.4) over the peninsular/east India under the RMCs of Chennai and Kolkata shall report data on hourly basis, during IOP. During normal period of FDP, 3 hrly. SYNOP will be collected.
- RMC Kolkata and Chennai will ensure hourly observation and transmission through telephone/fax/e-mail of all synops of coastal stations during IOP to NOC and FOC. In addition, RMC Chennai shall organize transmission of such data through AMSS.
- RSMC, New Delhi will write to concerned WMO/ESCAP Panel member countries to ensure the availability of synoptic data from there respective region for the FDP period.
- FOC will also intimate the status of Cyclone Distress Mitigation Committee (CDMC) stations along east coast to NOC and ensure their functioning during FDP period.

**(III) Buoys:**

Real-time collection of hourly data from deep ocean and met-ocean buoy network over the Bay of Bengal from INCOIS Server will be ensured by DDGM(ISSD).

- NOC & FOC will utilize these data received through GTS/E-mail.
- INCOIS will ensure availability of additional marine surface pressure observation through E-mail to NOC & FOC

**(IV) High wind speed recorder(HWSR)**

There are twelve HWSRs along the coast of India in the operational conditions as mentioned below.

| | |
|---|---|
| Digha | : West Bengal |
| Visakhapatnam | : Andhra Pradesh |
| Machilipatnam | : Andhra Pradesh |
| Nellore | : Andhra Pradesh |
| Chennai | : Tamil Nadu |
| Karaikal | : Puducherry |
| Mumbai | : Maharashtra |
| Puri | : Orissa |
| Paradip | : Orissa |
| Gopalpur | : Orissa |
| Veraval | : Gujarat |
| Dwarka | : Gujarat |

FOC, Chennai will ascertain the functioning of the HWSRs along the east coast. It will make arrangement for collection and dissemination of HWSR data on real time basis to NOC and NWP Division of IMD. It will also make arrangement for archival of this data. NWP Division of IMD and NCMRWF will try to ingest these data in NWP models. The performance of HWSRs during IOP period will be evaluated.

**(V) Upper air:**

Augmentation of coastal/peninsular upper air measurements (Fig.5)

- Upper air RS/RW data from IMD stations (Guwahati, Kolkata, Port Blair, Bhubaneswar, Visakhapatnam, Machilipatnam, Hyderabad, Chennai, Karaikal, Minicoy/Amini Divi, Trivendrum) will be collected at least once(based on 0000 UTC) for normal days of FDP period. However, during the IOP phase of FDP, 12 hrly. data shall be collected. The flights terminating below 250 hPa are to be repeated.
- DDGM(UI), RMCs Kolkata, Chennai and Guwahati will take all necessary steps in support of FDP observational requirements. The readiness report should be sent to NOC by 1$^{st}$ October 2012.

- Additional GPS Sonde soundings will be taken at Balasore, Gopalpur, Kalingapatnam, Ongole/Bapatla and Pamban with the support of ISRO.
- DDGM, Chennai and DDGM(UI) shall liaise with VSSC, Trivendrum to ensure commissioning of equipment along with training to IMD staff to operate during the IOP phase of FDP. DDGM, Kolkata will depute suitable staff for Balasore and Gopalpur and remain in touch with RMC Chennai.
- Upper air GPS Sonde data from Indian Navy stations shall be made available by the DNOM HQs, Delhi through e-mail. DDGM(UI) shall liaise with DNOM and ensure real time data transfer for the FDP period.
- FOC may explore the availability of Upper air data from GPS Sonde network of ISRO at Gadanki, SHAR, Arakkonam, Kochi etc. for the IOP Phase of FDP. DDGM, Chennai shall liaise with VSSC, Trivendrum to ensure commissioning of equipment along with training to IMD staff to operate at these station if agreed by ISRO during the IOP phase.
- Due arrangements are to be made by DDGM (UI) to receive all available Pilot Balloon data sets for the FDP 2012 period.
- Arrangements have to be made by DDGM(UI) to collect pilot balloon data from IAF. In case of becoming dark by 12UTC, IAF be advised to take the Pilot assent by 11UTC. Daily flight level winds as collected by IAF flights between Carnicobar and Tambaram are also to be received for FDP 2012 period. DDGM(UI) shall liaison with IAF to receive GTS coded data.
- DDGM(NWP) of IMD shall ensure the synchronization of data formats and collection at the NWP/NWFC of data received from outside IMD institutions in order to facilitate for the Data Processing and quality control systems at IMD and NCMRWF.
- Wind profiler support from the existing Gadanki and SHAR is to be activated so as to receive hourly profiles in the lower troposphere. FOC, Chennai will request ISRO (Principal Scientist) for organizing necessary observational support during FDP campaign. ISSD, IMD, New Delhi will identify nodal officers to workout real time data reception modalities in this regard.

**(VI) DWR Support**

DWR Support from 5 locations (Fig.6) at Kolkata, Visakhapatanm, Machillipatnam, SHAR and Chennai with uniform storm scanning strategy will be ensured prior to the FDP-2012. DDGM(UI) shall make due arrangements to receive the DWR data in real time to DDGM (ISSD) for the FDP 2012.

**(VII) Satellite observations**

DDG(Sat Met) shall make all available satellite derived products (high resolution AMVs; rapid scan winds; OLR; OceanSat and WINDSAT winds; local HRPT Temperature and moisture profiles from INCOIS; GPS occultation data; MODIS moisture data; TMI; SSMI and AMSU data sets etc.) for its utilization by the global

and regional data assimilation-forecast systems of IMD and NCMRWF during the FDP 2012 period.

Satmet. Division will issue special bulletin every three hourly about the cyclonic disturbance.

**Telecommunication**

i. DDG(ISSD) shall take all necessary steps so as to receive the observational data at the NOC and FOC from all identified sources both from FDP partners and the regional countries ( Bangladesh, Myanmar, Malaysia, Thailand, Indonesia and Sri Lanka) in real time. ISSD and NWP division shall continuously monitor the data reception at NWP/Telecom and ensure the timely data reception and onward transmission of data to NWP Division and NCMRWF throughout the FDP 2012 period.

ii. IMD shall update FDP Web Page on IMD (linked at NCMRWF as well). The existing FDP e-mail group will be updated with full contact details).An FDP discussion group for the exchange of FDP related information among the FDP partners may be created. DDGM(ISSD), IT cell will take necessary action in this regard.

**NWP analysis and prediction**

a) NWP Division shall make all necessary arrangements for the generation of global and regional analyses fields by using special FDP 2012 data at 4 analysis times (00, 06,12,18 UTC) for the whole of FDP 2012 period. Arrangements are also to be made to keep FDP 2012 analyses and forecast boundary fields upto 72hrs on ftp servers of NCMRWF and IMD for their utilization by FDP partners in India. Efforts will be made to bring out the Regional Model forecast within three hours of the observation time.

b) NWP Division, IMD shall workout arrangements to provide analyses fields of ECMWF and UKMO as well on the ftp servers at NCMRWF and IMD for the FDP 2012 period.

**International Cooperation**

Director RSMC, New Delhi shall request the ESCAP Panel, SAARC and BIMSTEC countries about the FDP over the Bay of Bengal programme of India and solicit their cooperation in the real time exchange of data (surface, upper air and special observations) for their utilization in the generation of most representative meso-scale analysis fields over the Bay of Bengal and its neighbourhood for generating improved quality of track, intensity and landfall of tropical cyclones.

**FDP Operation Centre**

Project Director will be assisted by a National FDP Operations Centre (NOC) at NWFC and a FDP Weather Monitoring and Advisory Group will be constituted to identify the IOP phases during FDP 2012 period.

**FDP Weather Monitoring and Advisory Group (WMAG)**

1. DGM Chairman
2. Shri D.R. Sikka
3. Prof. U.C. Mohanty
4. Head ,NCMRWF
5. DDGM(S), Scientist-E (S)
6. All members of FDP Project Team
7. Representatives from IAF, Indian Navy.

The WMAG shall meet thrice a week (Monday, Wednesday & Friday) at 1530 hrs. (including holidays) during the period 15 Oct.- 30 Nov., 2012 at NWFC Meeting Room II$^{nd}$ floor to review the FDP activity regularly and decide on IOP declaration. Weather summaries and current information will be presented by Project Scientist, FDP. The weather summaries and information will be prepared daily and uploaded in the website along with circulation through e-mail like previous years.

**Implementation Strategy**

- Preparatory Phase for the
  FDP Pilot 2012: 1-30 September 2012
  (Actions to be completed as mentioned above)
- FDP-2012 Field Phase: 15 October to 30 November
  (Actions to be completed as mentioned above)
- IOP Phase: Identified by the NOC at NWFC in consultation with the Weather Monitoring and Advisory Group

The NOC will be established at NWFC, New Delhi which will be responsible for entire co-ordination and declaration of IOP. The center will function independently. The usual operational activity of RSMC will be separate.

Cyclone Warning Research Centre at RMC, Chennai shall function as the FOC and establish links with all FDP partners, notify all IOP phases to FDP partners, coordinate and update the status of observation collection and transmission from FDP partners from time to time. The RMCs at Kolkata and Guwahati; ACWCs at Kolkata and CWCs at Visakhapatnam and Bhubaneswar shall work in close liaison with FDP FOC and NOC, NWFC, Delhi for smooth and efficient organization of FDP 2012 pilot observational campaign.

- FDP Data Centre: All special observations collected by the FDP project partners shall be archived along with meso-scale analysis and forecast fields at IMD and NCMRWF computing centres.
- Post Experiment Phase:

1. Preparation of weather summery data CD will be carried out by the project management team and NWP group of IMD.

2. Project management team shall Plan and coordinate necessary R&D work involving not only FDP partners but also other academic and research groups in the country to maximize the utilization of FDP data for accomplishing the envisaged targets of the project.
3. An article on implementation report will be prepared at the end of FDP-2012. It will highlight societal issues along with the programme implementation, out come and lessons learnt.
4. The daily rainfall data along the coast during landfall of a cyclone will be analysed to find out the diurnal variation of rainfall.
5. A report will be prepared at the end of FDP about the performance of HWSR.


**Fig.1(a). IMD's network of 675 (127 Agro+548) AWS**

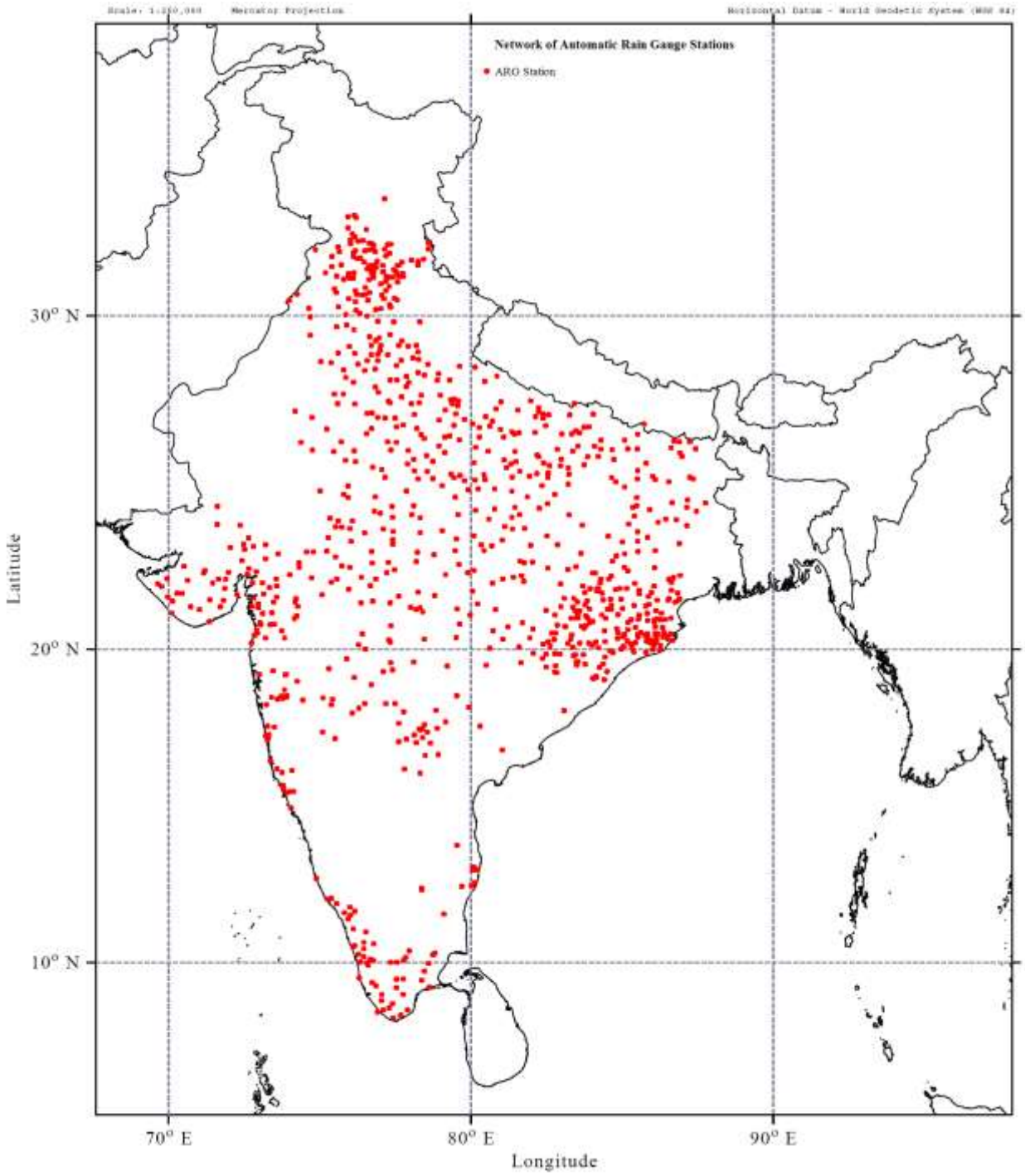



**Fig.1(b). IMD's network of 900 Automatic Rain Gauge (ARG)**

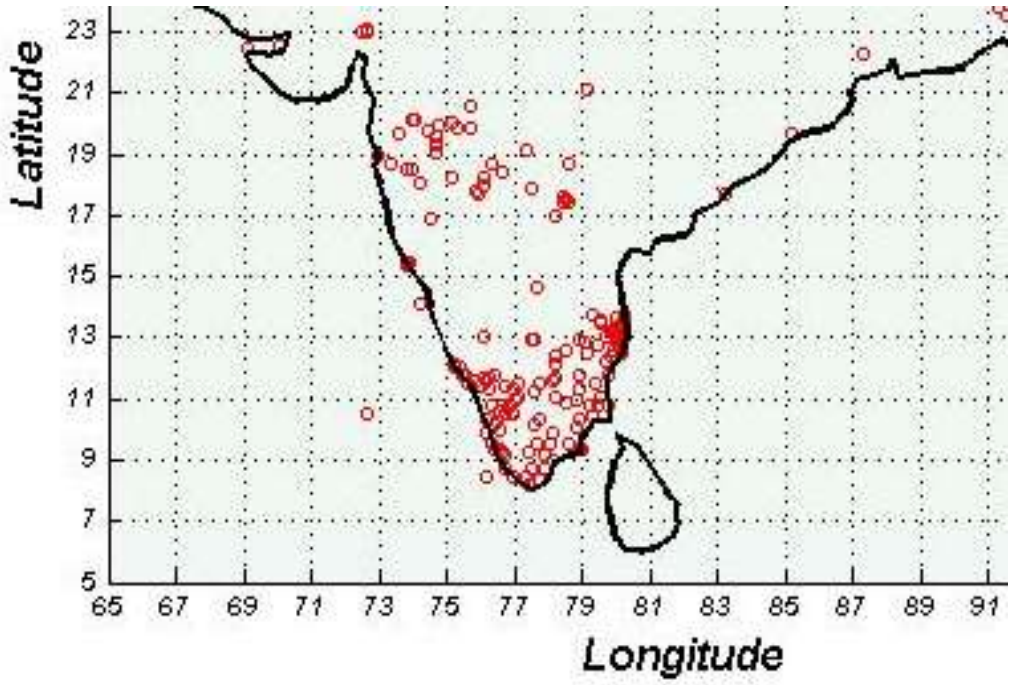



**Fig.2. ISRO AWS stations under PRWONAM project.**

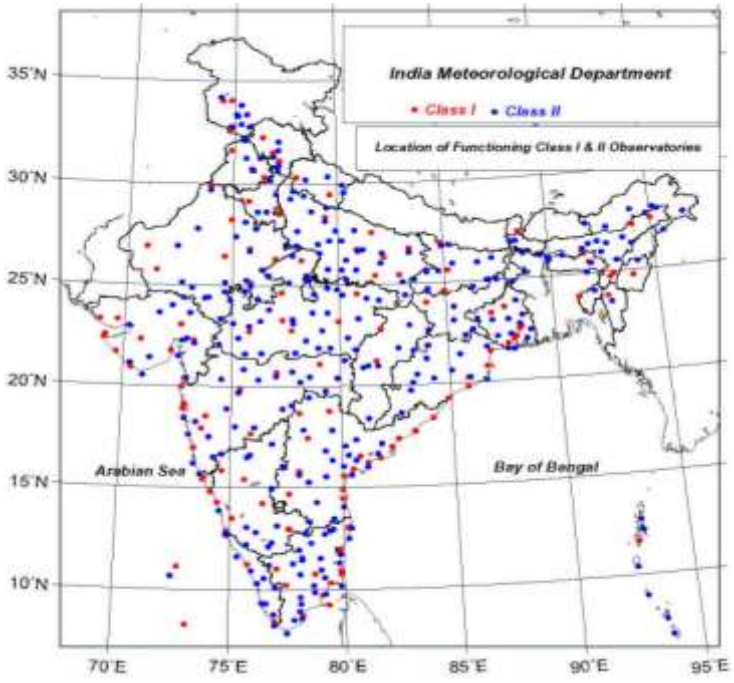



**Fig.3. Synoptic stations of IMD**

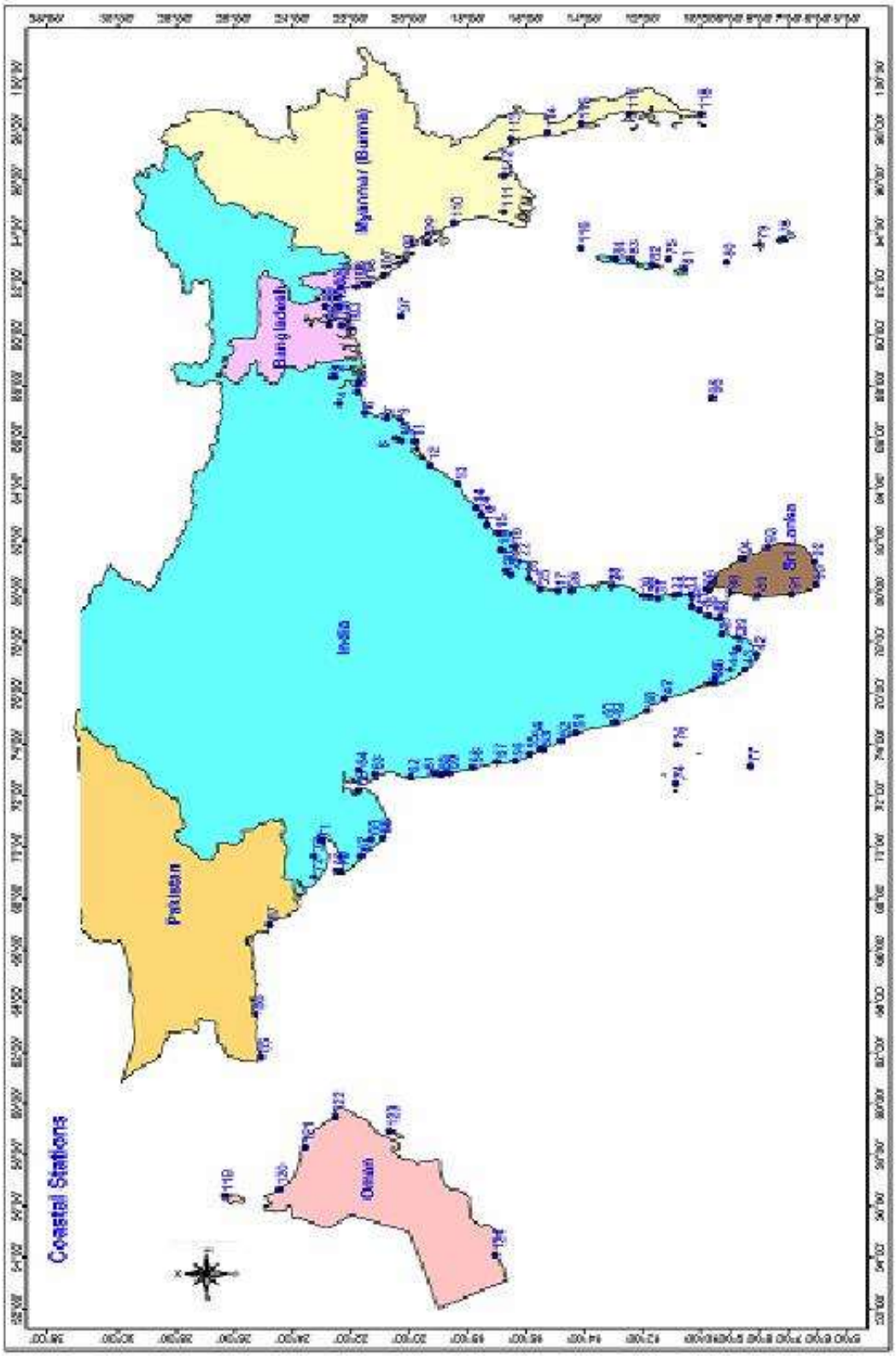
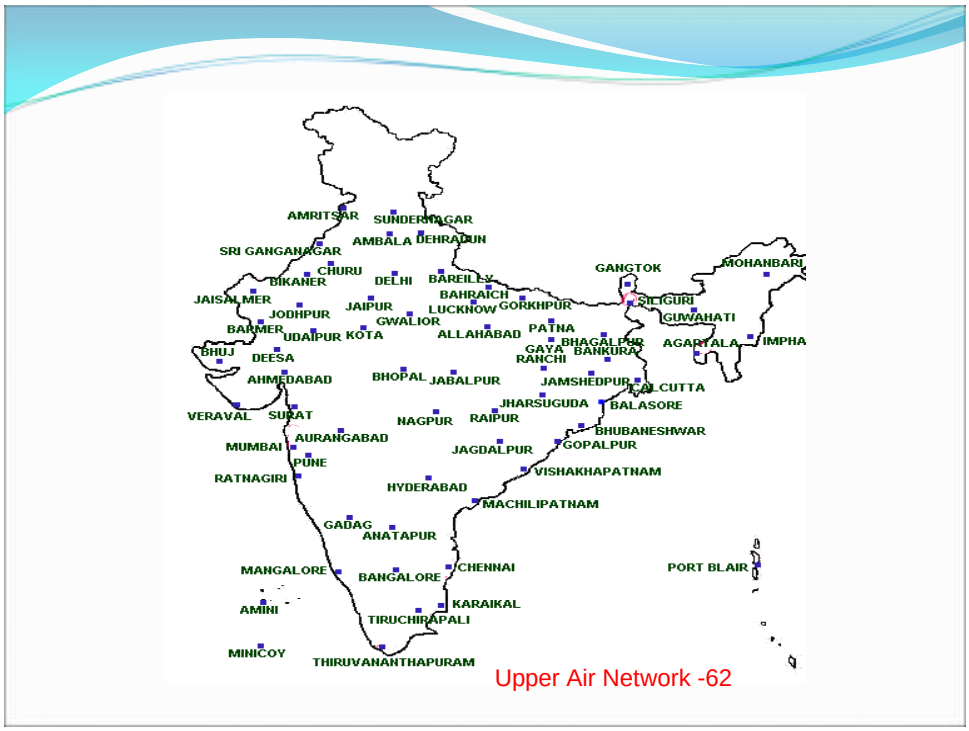



**Fig.4. Coastal synoptic stations**



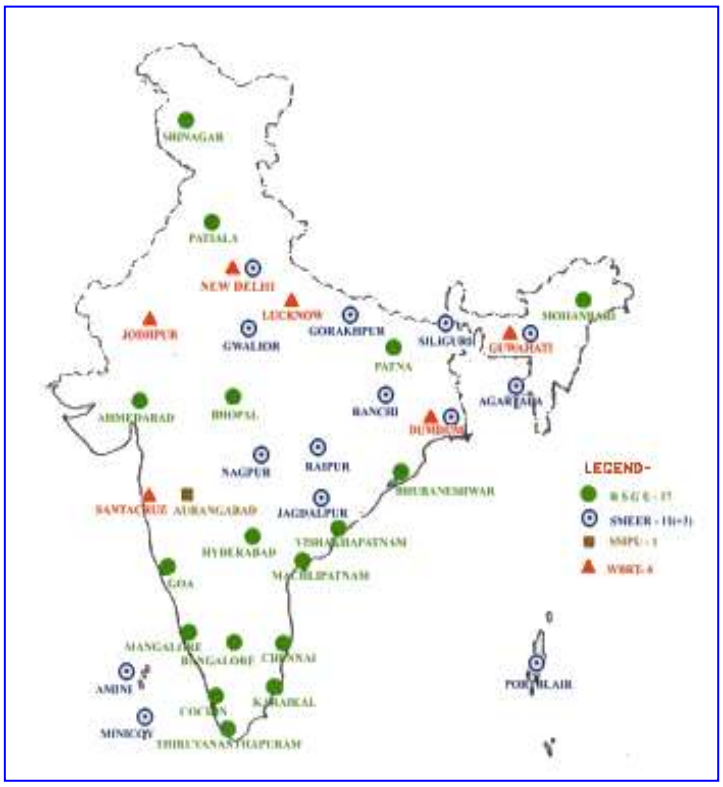




**Fig.5. Pilot balloon and RS/RW (including 10 GPS stations) network of IMD**

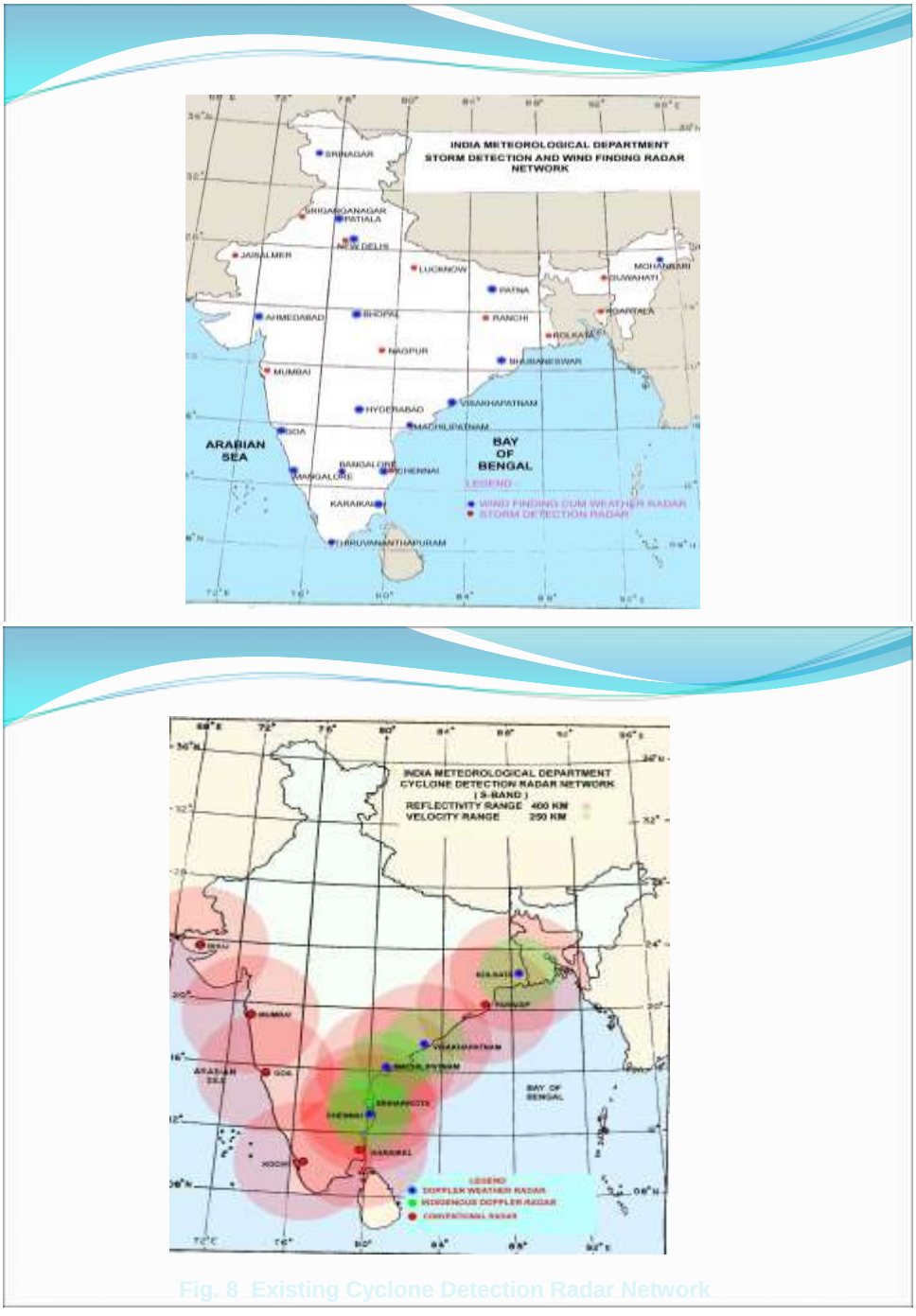



Fig. 8 Existing Cyclone Detection Radar Network

**Fig.6. Cyclone detection radar network of IMD**

**Table 1. List of East Coast stations in India**

| Station | Index | Latitude | Longitude | Class | 00Z | 03Z | 06Z | 09Z | 12Z | 15Z | 18Z | 21Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kolkota(Alipore) | 42807 | 22 32N | 88 20E | I | X | X | X | X | X | X | X | X |
| Kolkota(DumDum) | 42809 | 22 39N | 88 20E | I | X | X | X | X | X | X | X | X |
| Diamond Harbour | 42811 | 22 11N | 88 12E | | X | X | X | X | X | X | X | X |
| Canning | 42812 | 22 15n | 88 40 E | | 0 | X | 0 | 0 | X | 0 | 0 | 0 |
| Midnapore | 42803 | 22 25N | 87 19E | IIb | 0 | X | 0 | 0 | X | 0 | 0 | 0 |
| Digha | 42901 | 21 50N | 87 47 E | | X | X | X | X | X | X | X | X |
| Basirhat | 42810 | | | | 0 | X | X | X | X | 0 | 0 | 0 |
| Contai | 42900 | 21 47N | 87 45E | IIb | 0 | X | 0 | 0 | X | 0 | 0 | 0 |
| Balasore | 42895 | 21 31N | 86 56E | I | 0 | X | X | X | X | X | 0 | 0 |
| Chandbali | 42973 | 20 47N | 86 44E | I | 0 | X | X | X | X | X | X | X |
| Cuttack | 42970 | 20 28N | 85 56E | IIb | 0 | X | 0 | 0 | X | 0 | 0 | 0 |
| Paradip | 42976 | 20 18N | 86 41E | IIa | 0 | X | 0 | 0 | X | 0 | 0 | 0 |
| Bubaneshwar | 42971 | 20 15N | 85 50E | I | X | X | X | X | X | X | X | X |
| Puri | 43053 | 19 48N | 85 49E | I | X | X | X | X | X | X | X | X |
| Gopalpur | 43049 | 19 16N | 84 53E | I | X | X | X | X | X | X | X | X |
| Kalingapatnam | 43105 | 18 20N | 84 08E | I | X | X | X | X | X | X | X | X |
| Vishakapatnam | 43149 | 17 43N | 83 14E | I | X | X | X | X | X | X | X | X |
| Kakinada | 43189 | 16 57N | 82 14E | I | X | X | X | X | X | X | X | X |
| Tuni | 43147 | 17 21N | 82 33E | I | X | X | X | X | X | X | X | X |
| Kavali | 43243 | 14 54N | 79 59E | I | X | X | X | X | X | X | X | X |
| Nidadavole | 43184 | 16 50N | 81 35E | IIb | 0 | X | 0 | X | X | 0 | 0 | 0 |
| Narsapur | 43187 | 16 26N | 81 42E | I | X | X | X | X | X | X | X | X |
| Gannavaram | 43181 | 16 42N | 80 48E | I | X | X | X | X | X | X | X | X |
| Machlipatnam | 43185 | 16 12N | 81 09E | I | X | X | X | X | X | X | X | X |
| Bapatla | 43220 | 15 54N | 80 28E | I | 0 | X | X | X | X | 0 | 0 | 0 |
| Ongole | 43221 | 15 30N | 80 05E | I | X | X | X | X | X | X | X | X |
| Nellore | 43245 | 14 27N | 79 59E | I | X | X | X | X | X | X | X | X |
| Minambakkam | 43279 | 13 00N | 80 12E | I | X | X | X | X | X | X | X | X |
| Pondicherry | 43331 | 11 58N | 79 49E | I | X | X | X | X | X | X | X | X |
| Cuddalore | 43329 | 11 46N | 79 46E | I | X | X | X | X | X | X | X | X |
| Karaikal | 43346 | 10 55N | 79 50E | I | X | X | X | X | X | X | X | X |
| Nagapattinam | 43347 | 10 46N | 79 51E | I | X | X | X | X | X | X | X | X |
| Vedaranyam | 43349 | 10 22N | 79 51E | IIb | 0 | X | 0 | 0 | X | 0 | 0 | 0 |
| Adiramapattinam | 43348 | 10 20N | 79 23E | I | X | X | X | X | X | X | X | X |
| Tondi | 43361 | 09 44N | 79 02E | I | X | X | X | X | X | X | X | X |
| Pamban | 43363 | 09 16N | 78 18E | I | X | X | X | X | X | X | X | X |
| Tuticorin | 43379 | 08 45N | 78 11E | I0 | 0 | X | X | X | X | 0 | 0 | 0 |
| Palayamkottai | 43376 | 08 44N | 77 45E | IIb | 0 | X | 0 | 0 | X | 0 | 0 | 0 |
| Kanniyakumari | 43377 | 08 05N | 77 30E | IIa | 0 | X | X | 0 | X | 0 | 0 | 0 |
| Kondul | 43385 | 07 13N | 93 44E | IIb | 0 | X | 0 | 0 | X | 0 | 0 | 0 |
| Nancowri | 43382 | 07 59N | 93 32E | IIb | 0 | X | 0 | 0 | X | 0 | 0 | 0 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Carnicobar | 43367 | 09 09N | 92 49E | IIb | X | X | X | X | X | X | X | X |
| Hut bay | 43364 | 10 35N | 92 33E | IIb0 | 0 | X | 0 | 0 | X | 0 | 0 | 0 |
| Portblair | 43333 | 11 40N | 92 43E | I | X | X | X | X | X | X | X | X |
| Longisland | 43310 | 12 25N | 92 56E | IIb | 0 | X | 0 | 0 | X | 0 | 0 | 0 |
| Mayabandar | 43309 | 12 55N | 92 55E | IIb | 0 | X | 0 | 0 | X | 0 | 0 | 0 |

**Table 2. List of Foreign Coastal stations**

| Station | Index | Latitude | Longitude | 00Z | 03Z | 06Z | 09Z | 12Z | 15Z | 18Z | 21Z |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **SRILANKA** | | | | | | | | | | | |
| Mannar | 43413 | 08 59N | 79 55E | X | X | X | X | X | X | X | X |
| Puttalam | 43424 | 08 02N | 79 50E | X | X | X | X | X | X | X | X |
| Galle | 43495 | 06 02N | 80 13E | X | X | X | X | X | 0 | X | 0 |
| Colombo | 43466 | 06 54N | 79 52E | X | X | X | X | X | X | X | X |
| Hambantota | 43497 | 06 07N | 81 08E | X | X | X | X | X | X | X | X |
| Batticloa | 43436 | 07 43N | 81 42E | X | X | X | X | X | X | X | X |
| Trincomalee | 43418 | 08 35N | 81 15E | X | X | X | X | X | X | X | X |
| Jaffna | 43404 | 09 39N | 88 01E | X | X | X | X | X | 0 | X | 0 |
| **BANGLADESH** | | | | | | | | | | | |
| Chandpur | 41941 | 20 16N | 90 42E | X | X | X | X | X | X | X | X |
| Barisal | 41950 | 22 45N | 90 22E | X | X | X | X | X | X | X | X |
| Majidcourt | 41953 | 22 52N | 91 06E | X | X | X | X | X | X | X | X |
| Patuakhali | 41960 | 22 20N | 90 20E | X | X | X | X | X | X | X | X |
| Hatia | 41963 | 22 26N | 91 06E | X | X | X | X | X | X | X | X |
| Sandwip | 41964 | 22 29N | 91 26E | X | X | X | X | X | X | X | X |
| Khepura | 41984 | 21 59N | 90 14E | X | X | X | X | X | X | X | X |
| Chittagong | 41977 | 22 21N | 91 49E | X | X | X | X | X | X | X | X |
| Cox'sBazzar | 41992 | 21 26N | 91 56E | X | X | X | X | X | X | X | X |
| Kutubdia | 41989 | 21 49N | 91 51E | X | X | X | X | X | X | X | X |
| Teknaf | 41998 | 20 52N | 92 18E | X | X | X | X | X | X | X | X |
| **MYANMAR** | | | | | | | | | | | |
| Sittwe | 48062 | 20 08N | 92 53E | X | X | X | X | X | 0 | X | 0 |
| Kyaukpyu | 48071 | 19 25N | 93 33E | X | X | X | X | X | 0 | X | 0 |
| Sandoway | 48080 | 18 28N | 94 21E | X | X | X | X | X | 0 | X | 0 |
| Pathein | 48094 | 16 46N | 94 46E | X | X | X | X | X | 0 | X | 0 |
| Yangon | 48097 | 16 46N | 96 10E | X | X | X | X | X | X | X | X |
| Moulmein | 48103 | 16 30N | 97 37E | X | X | X | X | X | 0 | X | 0 |
| Ye | 48107 | 15 15N | 97 52E | X | X | X | X | X | 0 | X | 0 |
| Dawei | 48108 | 14 06N | 98 13E | X | X | X | X | X | 0 | X | 0 |
| Mergui | 48110 | 12 26N | 98 36E | X | X | X | X | X | 0 | X | 0 |
| Bictoria Point | 48112 | 09 58N | 98 35E | X | X | X | X | X | 0 | X | 0 |
| **THIALAND** | | | | | | | | | | | |
| Phuket Airport | 48565 | 08 07 N | 98 19 E | X | X | X | X | X | X | X | X |

**Table 3. List of Co-operative Cyclone Reporting Network of Stations (Andhra Pradesh & Orissa)**

| S. No | Station | District | Nearest Telegraphic Office | Distance From Station |
|---|---|---|---|---|
| **Andhra Pradesh** | | | | |
| | Palasa | Srikakulam | Palasa | 2 km |
| 2 | Sompeta | Srikakulam | Sompeta | 100 meters |
| 3 | Anakapalli | Vishakapatnam | Anakapalli | 1.5 km |
| 4 | Rajamundry | East Godavari | Rajamundry | 2.5 km |
| 5 | Yanam | East Godavari | Yanam | 1.0 km |
| 6 | Razaole | East Godavari | Razaole | 200 meters |
| 7 | Eluru | West Godavari | Eluru | 1.0 km |
| 8 | Challapalli | Krishna | Challapalli | 0.5 km |
| 9 | Avani Gadda | Krishna | Avani Gadda | 200 meters |
| 10 | Nagayalanka | Krishna | Nagayalanka | 1.0 km |
| 11 | Bantimalli | Krishna | Bantimalli | 1.0 km |
| 12 | Kothapatnam | Prakasam | Kothapatnam | 200 meters |
| 13 | Narasapuram | Nellore | Narasapuram | 0.5 km |
| **ORISSA** | | | | |
| 1 | Bhogral | Balasore | Bhogral | 2Km |
| 2 | Basta | Balasore | Basta | 1 Km |
| 3 | Bhadrak | Balasore | Bhadrak | 2 Km |
| 4 | Bansara | Balasore | Bansara | 2 Km |
| 5 | Rajkanika | Cuttack | Rajkanika | 2 Km |
| 6 | Aul | Cuttack | Aul | 2 Km |
| 7 | Rajnagar | Cuttack | Rajnagar | 1 Km |
| 8 | Kendrapara | Cuttack | Kendrapara | 2 Km |
| 9 | Mahakalpara | Cuttack | Mahakalpara | 2 Km |
| 10 | Jagatsingpur | Cuttack | Jagatsingpur | 1 Km |
| 11 | Ersama | Cuttack | Ersama | 2 Km |
| 12 | Nimapara | Puri | Nimapara | 0.5 Km |
| 13 | Brahmagiri | Puri | Brahmagiri | 1 Km |
| 14 | Krishnaprasad | Puri | Krishnaprasad | 0.5 Km |
| 15 | Chatrapur | Ganjam | Chatrapur | 0.5 Km |
| 16 | Berhampur | Ganjam | Berhampur | 3 Km |

## CHAPTER–III
## IMPLEMENTATION OF FDP – 2012

### 3.1. Introduction

The objectives of the programme were met by conducting a joint observational communication and NWP effort by several institutes in the country during the period 15 Oct.-30 Nov.2012. There were two Intensive Observational Phase (IOP) within this period as there were only two cyclonic disturbances over the Bay of Bengal during this period.

The overall campaign was monitored and guided by a Weather Monitoring and Advisory Group (WMAG) at National Operation Centre (NOC) in NHAC, IMD. In addition, communication conferencing and data exchange were facilitated from this nodal cell.

Field Operational Centre (FOC) worked at Regional Meteorological Centre, Chennai in unison with the NOC coordinating all activities of every institution during the IOP.

### 3.2. Observational programme

The observational programme was taken up as per the project implementation plan prepared by NOC. However, the buoy data improved with 12 such stations in Bay of Bengal during the campaign in 2012.

IMD has augmented AWS network under its modernisation programme. The number of AWS/ Automatic Rain Gauge (ARG) stations in the country is 965 by the end of 2012. The AWS data including wind and pressure could very well help in monitoring the genesis, intensity, structure and movement of the landfalling cyclonic disturbances.

Availability of hourly observations without an observer's need at the site helped immensely the monitoring and prediction of cyclonic disturbances.

Eleven GPS sonde stations at Thiruvananthapuram, Mohanbari, Chennai, Port Blair, Minicoy, Goa, Hyderabad, Visakhapatnam, Patna, Srinagar and New Delhi helped in improving the initial conditions of the NWP models resulting in forecast also. The DWR products from Chennai helped immensely in monitoring and preduction of cyclonic storms Nilam.

### 3.3. Operation Management

The announcement of IOP was made by NOC. Field Operational Centre (FOC) worked at Regional Meteorological Centre, Chennai in unison with the NOC coordinating all activities of every institution during the IOP.

**The following were the periods of IOP declared during 2012**

IOP: 29$^{th}$ October to 1$^{st}$ November, 2012 (4 Days)in association with cyclonic storm Nilam , 19-20 Nov, 2012(2 days) in association with depressionover the Bay of Bengal

**The following methods were used for monitoring and forecasting of cyclonic disturbances**.

**Genesis:**

Genesis of the disturbances (formation of depression) was monitored and predicted using following methods.

- Synoptic
- Satellite
- NWP Models
- Dynamic Statistical Models
- Genesis Potential Parameter(GPP)

GPP was calculated based on a dynamic statistical model. It uses mainly the Gray's parameters for the IMD GFS model. The genesis parameter for the entire north Indian Ocean was introduced for the first time. If the GPP> 30, it suggests cyclogenesis, otherwise not.

**Track forecasting:**

i) Analogue Techniques
ii) Methods based on climatology
iii) Methods based on Persistence
iv) Climatology and persistence(CLIPER)
v) Synoptic Techniques
vi) Satellite Techniques
vii) Radar Technique
viii) NWP Models
- IMD GFS (T-574), NCEP GFS, ECMWF, UKMO, JMA, IMD WRF, IITD WRF
- ARP Model of Meteo France
- NCMRWF Unified Model
- HWRF

ix) Multi Model Ensemble (MME) technique developed by NWP Division
x) MME based on Tropical Cyclone Module (TCM)
xi) Ensemble Prediction System( EPS) (JMA, UKMO, ECMWF, NCEP)
xii) TIGGE (THORPEX Grand Global Ensemble) forecast

Operational consensus is based mainly on the above NWP guidance supported with synoptic and statistical guidance. The forecast was issued up to 72 hrs. lead time alongwith cone of uncertainty.

**Intensity forecast:**

Intensity forecast was mainly based on deterministic NWP model, dynamical statistical model, synoptic, satellite and Radar inputs. However following techniques were used.

- Climatology persistence Analogue
- Synoptic
- Satellite
- Radar
- NWP Models
- Dynamical Statistical Model: Statistical Cyclone Intensity Prediction (SCIP) model of IMD

**Tropical Cyclone Module:**

The Tropical Cyclone Module (TCM)installed in this forecasting system has the facilities to serve the above purpose. The automation of the process has increased the efficiency of system, visibility of IMD and utility of warning products.

The TCM installed in this forecasting system has the following facilities.

- Analysis of all synoptic, satellite, radar and NWP model products for genesis, intensity and track monitoring and prediction
- Preparation of past and forecast tracks upto 120 hrs.
- Depiction of uncertainty in track forecast
- Structure forecasting (Forecast of wind in different sectors of cyclone)
- However all the data are not still available in TCM through synergie system. For better monitoring and prediction, additional help is taken of ftp and websites

## 3.4. Achievements

### 3.4.1. Official forecast

During FDP-2012 only two cyclonic disturbances formed over the Bay of Bengal. One of them intensified into a cyclonic storm Nilam(28 October-1 November, 2012) whereas other intensified into a deep depression(17-19 Nov. 2012) and dissipated over the Sea. The official landfall point & time, average track and intensity forecast errors are shown in Table 3.1-3.5 for both systems.

**Table 3.1 Landfall point and time error of Cyclone 'NILAM' over the Bay of Bengal (28 October-1 November, 2012)**

| Landfall Forecast Error of Cyclonic Storm, Nilam | | |
|---|---|---|
| **Lead Period (hrs) of forecast from the time of landfall** | **Landfall Point Forecast Error (km)** | **Landfall Time Forecast Error (hr)** |
| 12 | 16 | 1.5 |
| 24 | 11 | 2.0 |
| 36 | 74 | 3.0 |
| 48 | 45 | 1.0 |

| | | |
|---|---|---|
| 60 | 11 | 3.0 |
| 72 | It was predicted that the system would move towards north Srilanka and Tamil Nadu Coast. | |

**Table 3.2 Average track forecast errors (Direct position error in Km)**

| Lead time (hours) | Direct position error (Km) | Number of forecasts verified |
|---|---|---|
| 12 | 70 | 11 |
| 24 | 114 | 10 |
| 36 | 174 | 9 |
| 48 | 186 | 7 |
| 60 | 197 | 5 |
| 72 | 240 | 3 |

**Table 3.3 Average Intensity forecast error**

| Lead Period of forecast | Intensity Error (knots) | | No. of Forecasts verified |
|---|---|---|---|
| | Average | RMS | |
| 12 | 5.7 | 6.9 | 11 |
| 24 | 7.8 | 9.2 | 10 |
| 36 | 6.8 | 8.4 | 9 |
| 48 | 8.6 | 11.7 | 7 |
| 60 | 7.9 | 8.5 | 5 |
| 72 | 6.7 | 7.8 | 3 |

**Table 3.4 Average track forecast errors (Direct position error in km) for deep depression over Bay of Bengal (17-19 Nov. 2012)**

| Lead time (hours) | Direct position error (km) | Number of forecasts verified |
|---|---|---|
| 12 | 55 | 6 |
| 24 | 66 | 5 |
| 36 | 80 | 3 |
| 48 | 55 | 1 |

**Table 3.5 Average Intensity forecast error for deep depression over Bay of Bengal (17-19 Nov. 2012)**

| Lead Period of forecast | Intensity Error (knots) | | No. of forecasts verified |
|---|---|---|---|
| | Average | RMS | |
| 12 | 16.4 | 18.4 | 6 |
| 24 | 14.9 | 16.3 | 5 |
| 36 | 9.1 | 9.4 | 3 |
| 48 | 9.7 | 9.7 | 1 |

Mean landfall forecast has been less than the long period average and has decreased. Track forecast has been issued upto 72 hrs. lead period during 2012. However, track and landfall error can be further reduced. Intensity error is still very large. We could not collect observation from the inner core due to absence of aircraft reconnaissance.

## CHAPTER-IV

## CYCLONIC ACTIVITIES OVER THE BAY OF BENGAL DURING PILOT PHASE - 2012

### 4.1 Introduction

The north Indian and adjoining land surface Ocean witnessed the formation of five cyclonic disturbances during the year 2012. Out of five disturbances three formed over the Bay of Bengal and two over the Arabian Sea. Out of the three cyclonic disturbances over the Bay of Bengal, one intensified upto the stage of cyclonic storm, NILAM, two upto the stage of deep depression. Out of two cyclonic disturbances formed over the Arabian Sea, one intensified upto the stage of cyclonic storm, MURJAN and one upto the stage of deep depression. Tracks of the cyclonic disturbances formed over the north Indian Ocean during the period are shown in Fig 4.1.

During the pilot phase-2012 one cyclonic storm 'Nilam' formed during 28 October- 1 November 2012 and one deep depression formed during 17-19 November 2012 over the Bay of Bengal. The salient features of these two cyclonic disturbances are discussed in section 4.2.

**Table 4.1: Cyclonic disturbances formed over north Indian Ocean and adjoining land areas during 2012**

| | |
|---|---|
| 1. | Deep Depression over Bay of Bengal 10-11 October 2012 |
| 2. | Cyclonic storm 'MURJAN' over Arabian Sea 23-26 October 2012 |
| 3. | Cyclonic storm 'NILAM' over Bay of Bengal 28 October- 1 November 2012 |
| 4. | Deep Depression over Bay of Bengal 17-19 November 2012 |
| 5 | Deep Depression over Arabian sea 22-25 December 2012 |

### 4.2 Salient features of the systems formed during FDP Phase-2012

### 4.2.1 Cyclonic Storm, NILAM over Bay of Bengal (28 October- 01 November, 2012)

#### 4.2.1.1 Introduction

A cyclonic storm, NILAM crossed Tamilnadu coast near Mahabalipuram (south of Chennai) in the evening of 31$^{st}$ October 2012 with a sustained maximum wind speed about 80 kmph. The salient features of this storm are as follows.

(i) It followed a unique track with many rapid changes in direction of movement. It initially moved westwards, remained practically

stationary for quite some time near Sri Lanka coast and then moved north-northwestwards till landfall. It moved west-northwestwards initially over land upto south interior Karnataka and then moved northwest and northwards. The remnant low pressure area moved northeastwards across Andhra Pradesh

(ii) It moved very fast on the day of landfall, i.e. 31st October 2012.

(iii) Maximum rainfall occurred over southwest sector of the system centre and heavy to very heavy rainfall extended upto 300 km during landfall.

(iv) Over the land surface, the cloud mass was significantly sheared to the northeast of system centre during its dissipation stage leading to heavy rainfall activity over entire Andhra Pradesh and adjoining Odisha

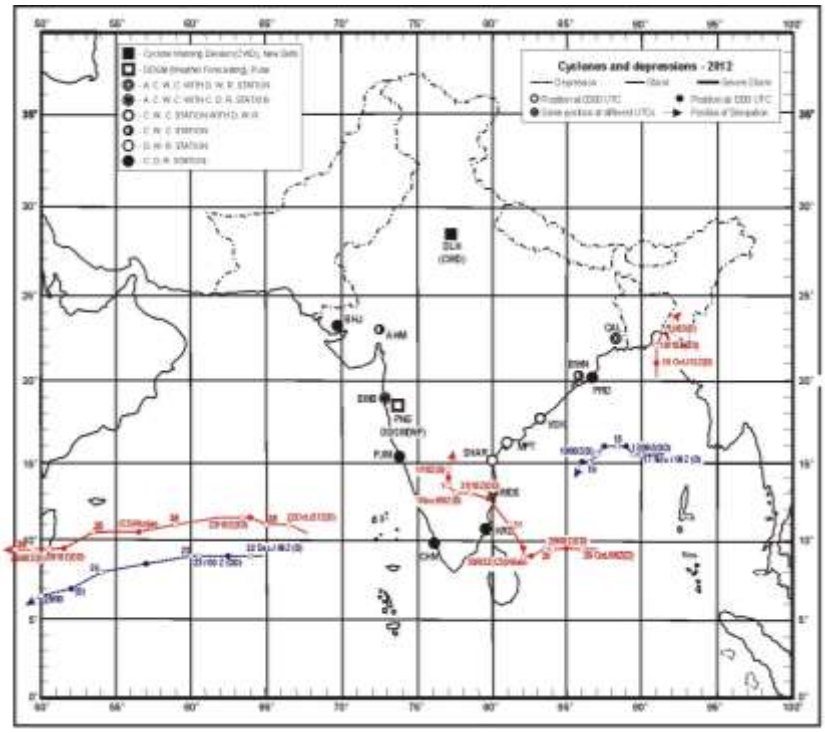



**Fig. 4.1**

### 4.2.1.2. Monitoring and Prediction

The cyclonic storm, NILAM was monitored mainly with satellite supported by meteorological buoys and coastal and island observations. It was monitored by Doppler Weather Radar (DWR), Chennaiand Sriharikota from the night of 29th October, when the cyclonic storm was at about 500 km southeast of Chennai. While coastal surface observations were taken on hourly basis, the half hourly INSAT/ Kalpana imageries and every 10 minutes DWR imageries and products were used for monitoring of cyclonic storm.

Various NWP and dynamical-statistical models including IMD's global and meso-scale models were utilized to predict the track and intensity of the storm. Recently installed Tropical Cyclone Module in the digitized forecasting system of IMD was utilized for analysis and comparison of various NWP models and decision making process.

### 4.2.1.3 Genesis:

A remnant cyclonic circulation from the south China Sea entered into south Andaman Sea on 25$^{th}$ October 2012 across the Gulf of Thailand. It gradually moved westwards and concentrated into a low pressure area in the early hours of 27$^{th}$ October. It further concentrated into a depression over southeast and adjoining southwest Bay of Bengal at 0600 UTC of 28$^{th}$ October 2012 near latitude 9.5$^0$N and longitude 86.0$^0$E. Considering the satellite observations, the convection increased gradually in terms of its height and organization from 27$^{th}$ to 28$^{th}$ October. The lowest cloud top temperature(CTT) was about -70$^0$C at the time of formation of depression, i.e. at 0600 UTC of 28$^{th}$ October 2012.

Considering the environmental features, the sea surface temperature on the day of genesis was 29-30$^0$C over south Bay of Bengal and the Ocean thermal energy was about 50-80 KJ/cm$^2$ around the area of genesis. The Madden Julian Oscillation (MJO) index lay over phase 2, which is favourable for cyclogenesis. The upper tropospheric ridge at 200 hPa level ran along 13$^0$N and provided required upper level divergence for intensification of the system. The lower level convergence and the vorticity also increased from 27$^{th}$ to 28$^{th}$ October. The vertical wind shear between 200 and 850 hPa levels was low to moderate (10-20 knots) over the region, which was also favourable for genesis and intensification.

The best track parameters of the system is shown in Table 4.2.1.1. The best track is shown in Fig. 4.2.1.1.

**Table 4.2.1.1 Best track positions and other parameters of the Cyclone, 'Nilam' over the Bay of Bengal during 28 October-01 November, 2012**

| Date | Time (UTC) | Centre lat.$^0$ N/ long.$^0$ E | C.I. NO. | Estimated Central Pressure (hPa) | Estimated Maximum Sustained Surface Wind (kt) | Estimated Pressure drop at the Centre (hPa) | Grade |
|---|---|---|---|---|---|---|---|
| 28-10-2012 | 0600 | 9.5/86.0 | 1.5 | 1004 | 25 | 3 | D |
| | 1200 | 9.5/85.0 | 1.5 | 1003 | 25 | 3 | D |
| | 1800 | 9.5/84.5 | 1.5 | 1002 | 25 | 4 | D |
| 29-10-2012 | 0000 | 9.5/84.0 | 2.0 | 1000 | 30 | 4 | DD |
| | 0300 | 9.5/83.5 | 2.0 | 1000 | 30 | 4 | DD |
| | 0600 | 9.0/83.0 | 2.0 | 1000 | 30 | 4 | DD |
| | 1200 | 9.0/82.5 | 2.0 | 1000 | 30 | 5 | DD |
| | 1800 | 9.0/82.0 | 2.0 | 1000 | 30 | 5 | DD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 30-10-2012 | 0000 | 9.0/82.0 | 2.0 | 999 | 30 | 5 | DD |
| | 0300 | 9.0/82.0 | 2.5 | 998 | 35 | 6 | CS |
| | 0600 | 9.0/82.0 | 2.5 | 996 | 35 | 6 | CS |
| | 0900 | 9.5/82.0 | 2.5 | 996 | 35 | 6 | CS |
| | 1200 | 9.5/82.0 | 2.5 | 994 | 40 | 8 | CS |
| | 1500 | 9.5/82.0 | 2.5 | 994 | 40 | 8 | CS |
| | 1800 | 10.0/82.0 | 2.5 | 992 | 40 | 8 | CS |
| | 2100 | 10.0/82.0 | 2.5 | 990 | 40 | 10 | CS |
| 31-10-2012 | 0000 | 10.5.81.5 | 3.0 | 988 | 45 | 12 | CS |
| | 0300 | 11.0/81.0 | 3.0 | 987 | 45 | 13 | CS |
| | 0600 | 11.5/81.0 | 3.0 | 987 | 45 | 13 | CS |
| | 0900 | 12.3/80.5 | 3.0 | 987 | 45 | 13 | CS |
| | The system crossed north Tamilnadu coast near Mahabalipuram, south of Chennai (near latitude $12.5^0$N and longitude $80.2^0$E) between 1030 and 1130 UTC | | | | | | |
| | 1200 | 12.7/79.8 | | 991 | 35 | 8 | CS |
| | 1500 | 13.0/79.5 | | 996 | 35 | 7 | CS |
| | 1800 | 13.0/78.5 | | 998 | 30 | 5 | DD |
| 01-11-2012 | 0000 | 13.0/77.5 | | 999 | 20 | 4 | D |
| | 0300 | 13.5/77.0 | | 1002 | 20 | 3 | D |
| | 0600 | 13.5/77.0 | | 1002 | 20 | 3 | D |
| | 1200 | 14.0/77.0 | | 1002 | 20 | 3 | D |
| | 1800 | 14.5/77.0 | | 1004 | 20 | 3 | D |
| 02-11-2012 | 0000 | Weakened into a well marked low pressure area over Rayalaseema and neighbourhood | | | | | |

D : Depression, DD : Deep Depression, CS : Cyclonic storm

**4.2.1.4. Intensification and movement**

In association with favourable environmental conditions like low to moderate wind shear, increase in convergence and vorticity in lower levels, increase in upper level divergence and its location to the south of upper tropospheric steering ridge, the depression continued to move westwards and intensified into a deep depression and lay centred at 0000 UTC of 29th over southwest Bay of Bengal near Lat. $9.5^0$ N/Long. $84.0^0$ E, about 550 kms southeast of Chennai. Continuing the westward movement, it lay centred at 0300 UTC over southwest Bay of Bengal near Lat. $9.5^0$ N/Long. $83.5^0$ E, about 530 kms southeast of Chennai and at 1200 UTC of 29th near Lat. $9.0^0$ N/ Long. $82.5^0$ E, about 500 kms south-southeast of Chennai.

Similar favourable environmental conditions continued on 29th and 30th October. As a result, the deep depression further intensified into a cyclonic storm (Nilam) and lay centred at 0300 UTC of 30th over southwest Bay of Bengal near Lat. $9.0^0$ N / Long. $82.0^0$ E, about 500 kms south–southeast of Chennai. Further, it moved northwards and lay centred at 1200 UTC of 30th near Lat. $9.5^0$ N/ Long. $82.0^0$ E, about 450 kms south-southeast of Chennai. The cyclonic storm moved very slowly during 0000 UTC of 29th to 1200 UTC of 30th, remaining almost stationary.It then moved northwestwards and lay centred at 0300 UTC of 31st over southwest Bay of Bengal near Lat. $11.0^0$ N/Long. $81.0^0$ E, about 260 kms south-southeast of Chennai.

Moving north-northwestwards, it crossed north Tamil Nadu coast near Lat. $12.5^0$ N / Long. $80.2^0$ E, south of Chennai, near Mahabalipuram between 1030 and 1130 UTC of 31st and lay centred at 1200 UTC of 31st near Lat. 12.7° N/Long. 79.8° E, about 50 kms south–southwest of Chennai. It moved west-northwestwards and weakened into a deep depression and lay centred over north Tamil Nadu and adjoining areas of Rayalaseema and interior Karnataka at 1800 UTC of 31st October, near Lat. $13.0^0$ N / Long. $78.5^0$ E, about 180 kms west–northwest of Chennai. It further moved west-northwestwards and weakened into a depression over Rayalaseema and adjoining areas of south interior Karnataka and lay centred at 0000 UTC of 1 November 2012 near Lat. $13.0^0$ N / Long. $77.5^0$ E, about 75 kms, south of Anantpur and at 0300 UTC over south Interior Karnataka, near Lat. $13.5^0$ N / Long. $77.0^0$ E, close to Chitradurga. It moved further northward and lay centred at 1200 UTC near Lat. $14.0^0$ N/ Long. $77.0^0$ E, and at 1800 UTC of 1st November 2012 near Lat. $14.5^0$N/ Long. $77.0^0$ E. It further weakened into a well marked low pressure area over Rayalaseema and neighbourhood in the morning of 2nd November. It further weakened into a low Pressure area over Telangana and neighbourhood on 3rd and over North coastal Andhra Pradesh and neighbourhood on 4th November. It became less marked on 5th November.

According to survey report, “NILAM” crossed North Tamil Nadu coast, south of Kalpakkam and north of Koovathur, a small coastal village situated close to river Palar Estuary (landfall near $12^0$ 27’ and $80^0$ 09’) between 1040 and 1110 UTC of 31st October 2012. The crucial observations showing the landfall point and time of cyclone, Nilam are shown in Fig. 4.2.1.1

Hourly Surface Observations of NILAM cyclonic storm on 31 October 2012

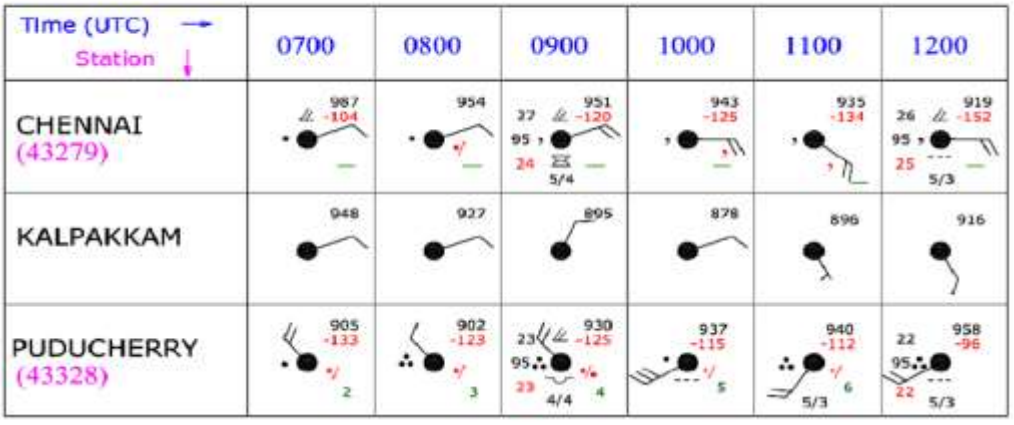



**Fig. 4.2.1.1 Hourly surface observation indicating landfall point and time of Nilam.**

### 4.2.1.5. Lowest pressure and maximum wind

The lowest estimated central pressure (ECP) was 986 hPa *(post cyclone survey report)*. The lowest observed pressure was 987.8 hPa at 1040 UTC of 31 October at Kalpakkam (ISRO-AWS, located south of Chennai). The maximum

estimated mean wind speed was 45 knots. Maximum sustained wind speed of 74 kmph (40 kts) has been reported over Chennai (Nungambakam) at 1110 UTC of 31. The high wind speed recorder (HWSR) at Karaikal reported maximum wind speed of westerly/37 kts on 31st October. The lowest pressure and maximum wind reported by a few coastal stations at the time of landfall are shown in Table 4.2.1.2 and 4.2.1.3

**Table 4.2.1.2. Lowest mean sea level pressure reported by coastal observatories at the time of landfall**

| SN | STATION | SLP in hPa (Lowest) | TIME OF OCCURRENCE in IST | Location |
|---|---|---|---|---|
| 1 | CHENNAI NUNGAMBAKKAM | 992.3 | 31.10.2012 / 1730hrs | North of Kalpakkam |
| 2 | *KALPAKKAM [ISRO-AWS]* | *987.8* | *31.10.2012 / 1610 hrs* | South of Chennai |
| 3 | PUDUCHERRY | 989.4 | 31.10.2012/ 1415 hrs | South of Kalpakkam |

**Table 4.2.1.3. Maximum sustained surface wind reported by coastal observatories at the time of landfall**

| | | | speed |
|---|---|---|---|
| 1 | Chennai [Nungambakkam] | 31/1640 hrs IST | NE/74 Kmph |
| 2 | Kalpakkam | 31/1610 hrs IST | NE/50-55 Kmph |
| 3 | Puducherry | 31/1630 hrs IST | SSW/62 Kmph Gusting to 70kmph |
| 4 | Mylam AWS [NW of Puducherry] | 31/1400 hrs IST | SSW/38 Kmph |

The pressure and wind observations from the Kalpakkam observatory which is nearest to landfall point are shown in Fig. 4.2.1.2. It indicates clearly the landfall time of the cyclone

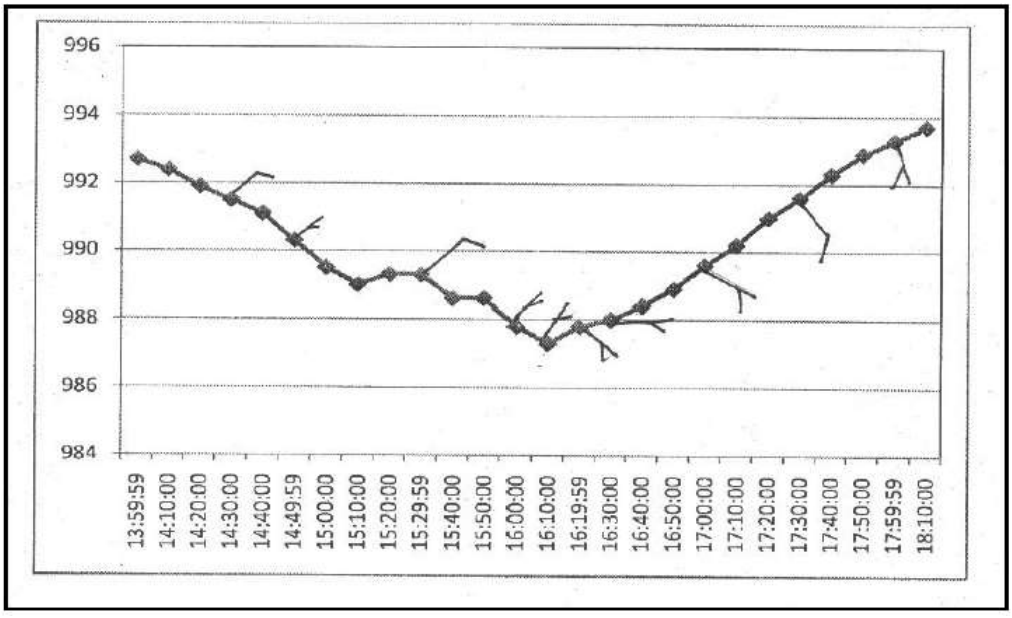



**Fig. 4.2.1.2 Kalpakkam Pressure & Wind data on 31st Oct. (Time in hrs IST)**

### 4.2.1.6. Satellite observations

The system was monitored mainly with satellite supported by meteorological buoys, coastal and island observations during genesis phase and its intensification into cyclonic storm on 29th October. Typical satellite imageries of the system are shown in Fig. 4.2.1.3.

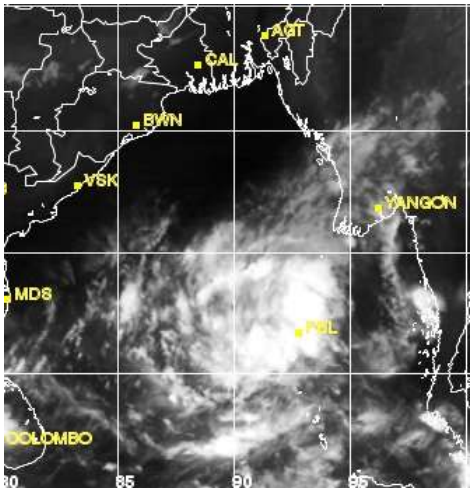
According to satellite observations, a low level circulation developed over south-east Bay of Bengal around 1200 UTC of 25th October 2012, which organized into vortex (T1.0) on next day (26th October 2012) at 1500 UTC centered near 12.0N/91.5E. It intensified upto T3.0. The system was of curved band pattern till 1800 UTC of 30th October. Then it changed into central dense overcast (CDO) pattern. The satellite based T number and CTT are shown in Table 4.2.1.4.

**Table 4.2.1.4 Satellite based observations of cyclone, Nilam**

| Date | Time (UTC) | Lat (E) | Long (E) | T. No. | C.T.T (C) |
|---|---|---|---|---|---|
| 25.10.12 | 1200 | - | - | LLC | - |
| 26.10.12 | 1500 | 12.0 | 91.5 | 1.0 | -75 |
| | 1700 | 12.0 | 91.5 | 1.0 | -71 |
| | 2100 | 12.2 | 91.5 | 1.0 | -81 |
| 27.10.12 | 0000 | 12.2 | 91.5 | 1.0 | -80 |
| | 0300 | 12.0 | 91.0 | 1.0 | -79 |
| | 0600 | 12.0 | 91.0 | 1.0 | -79 |
| | 0900 | 12.0 | 90.5 | 1.0 | -76 |
| | 1200 | 12.0 | 90.0 | 1.0 | -79 |
| | 1500 | 12.0 | 90.0 | 1.0 | -85 |
| | 1700 | 12.0 | 89.5 | 1.0 | -87 |
| | 2100 | 11.5 | 88.5 | 1.0 | -88 |
| 28.10.12 | 0000 | 11.0 | 87.5 | 1.0 | -91 |
| | 0300 | 10.0 | 87.5 | 1.0 | -87 |
| | 0600 | 9.5 | 87.0 | 1.5 | -84 |
| | 0900 | 9.5 | 86.0 | 1.5 | -83 |
| | 1200 | 9.5 | 85.0 | 1.5 | -86 |
| | 1500 | 9.5 | 84.5 | 1.5 | -83 |
| | 1700 | 9.5 | 84.5 | 1.5 | -91 |
| | 2100 | 9.5 | 84.5 | 1.5 | -91 |
| 29.10.12 | 0000 | 9.5 | 84.0 | 2.0 | -86 |
| | 0300 | 9.3 | 83.3 | 2.0 | -80 |
| | 0600 | 8.9 | 82.8 | 2.0 | -81 |
| | 0900 | 8.7 | 82.5 | 2.0 | -85 |
| | 1200 | 8.7 | 82.5 | 2.0 | -84 |
| | 1500 | 8.7 | 82.3 | 2.0 | -79 |
| | 1700 | 8.7 | 82.2 | 2.0 | -83 |

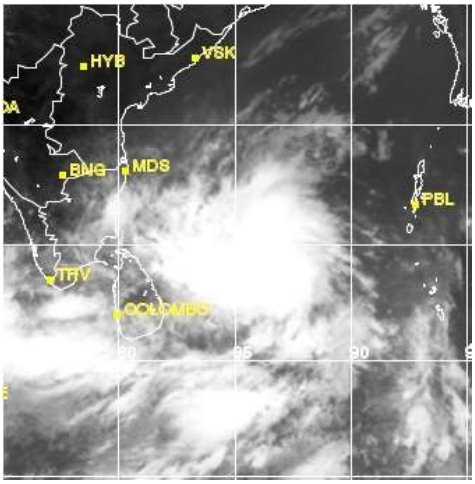
| | | | | | |
|---|---|---|---|---|---|
| | 2300 | 8.7 | 82.0 | 2.0 | -84 |
| 30.10.12 | 0000 | 8.7 | 82.0 | 2.0 | -83 |
| | 0300 | 9.0 | 82.0 | 2.5 | -85 |
| | 0600 | 9.2 | 82.0 | 2.5 | -82 |
| | 0900 | 9.3 | 82.0 | 2.5 | -85 |
| | 1200 | 9.5 | 81.9 | 2.5 | -88 |
| | 1500 | 9.5 | 81.9 | 2.5 | -89 |
| | 1700 | 9.6 | 81.8 | 2.5 | -93 |
| | 2100 | 10.2 | 81.8 | 2.5 | -94 |
| 31.10.12 | 0000 | 10.4 | 81.7 | 3.0 | -96 |
| | 0300 | 10.5 | 81.1 | 3.0 | -85 |
| | 0600 | 11.0 | 80.9 | 3.0 | -84 |
| | 0900 | 11.7 | 80.3 | 3.0 | -86 |
| | 1200 | 12.5 | 80.0 | Overland | -85 |

Formation of vortex



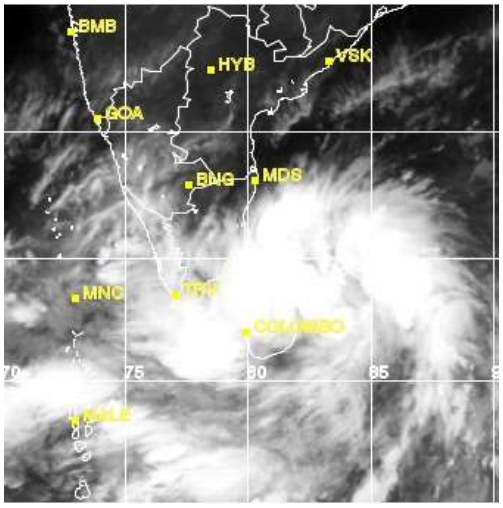

26.10.12, 1500 UTC (T1.0)

Intensified into Depression



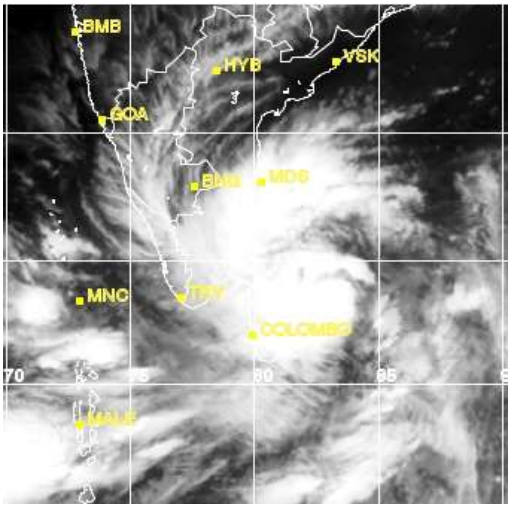

28.10.12, 0600UTC (T1.5)

Intensified into Deep Depression




29.10.12, 0000UTC (T2.0)

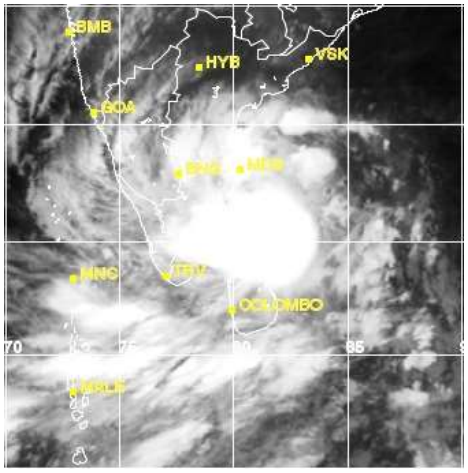
Intensified into Cyclonic storm




30.10.12, 0300UTC (T2.5)

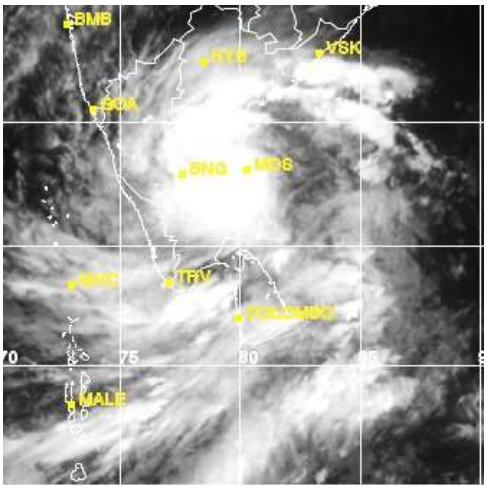
**Fig. 4.2.1.3. IR Imageries based on 15 UTC of 26th Oct., 06 UTC of 28th Oct., 00 UTC of 29th Oct. and 03 UTC of 30th Oct.,2012 in association with different stages of cyclonic storm, NILAM over Bay of Bengal**

Intensified further to T3.0



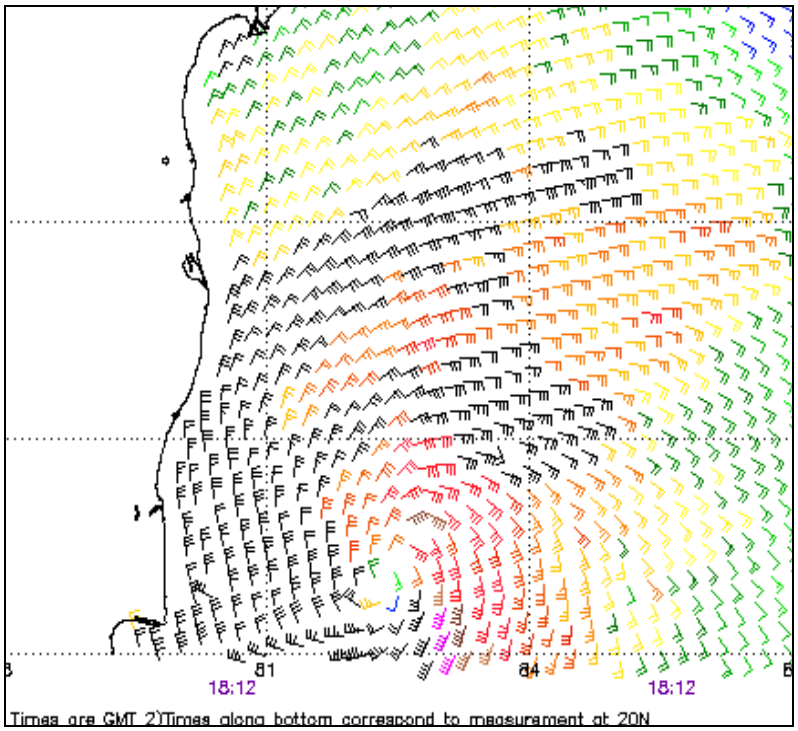

31.10.12, 0000UTC (T3.0)

Landfall of the system




31.10.2012, 1200 UTC (T3.0)

Oceansat-II based surface wind




30.10.12, 1812UTC

**Fig. 4.2.1.3 (Contd). IR Imageries based on 00 and 12 UTC of 31st Oct. and Oceansat II based surface wind at 1812 UTC of 30th October 2012.**

### 4.2.1.7. Radar observations

The cyclonic storm Nilam and Sriharikota was also monitored by Doppler Weather RADAR (DWR), Chennai and conventional S-Band radar, Karaikal.

DWR Chennai monitored the system from the night of 29th October, when the cyclonic storm was about 500 km southeast of Chennai. The DWR performance during the cyclone surveillance period had been very good with optimum power output, sensitivity and stability without any trouble except during the period from 0615 to 0710 UTC (Radome door inter lock switch opened due to strong wind). Prominent features of Eye could not be seen persistently. Radar-echoes in some parts of spiral bands were stronger than the eye-wall echoes on many occasions. Maximum observed reflectivity was around 55 dBZ. The wind field was less symmetric to the eye. Maximum velocity of about 30 mps observed in the cyclone field was associated with the spiral band.

The typical radar imageries of the system from DWR, Chennai are shown in Fig. 4.2.1.4. Features observed through radar are also shown in Table 4.2.1.5

**Table 4.2.1.5 Features observed through DWR, Chennai**

| Bulletin No | Date & Time in UTC | Observation | Remarks |
|---|---|---|---|
| 1-3 | 30.10.2012/17 to 19 | Eye was apparently visible | When the system was away from DWR VIEW [400KM] |
| 4, 5 & 8,12 & 15 | 30/20,21 & 31/00,05 & 09 | Ill defined eye was noticed | When the system was within RADAR preview. |
| 6 & 7 | 30/22 & 23 | Closed eye observed | -do- Closer to coast |
| 9,10 , 11&13 | 31/01 to 03 & 06 | Eye NOT visible | -do- Closer to coast |
| 14 | 31/0800 | Eye distorted | -do- closer to coast |
| 16 | 31/10 | Open elliptical eye | -do- closer to coast |
| 17 | 31/11 | Eye confidence poor | System apparently crossed the coast near Mahabalipuram |

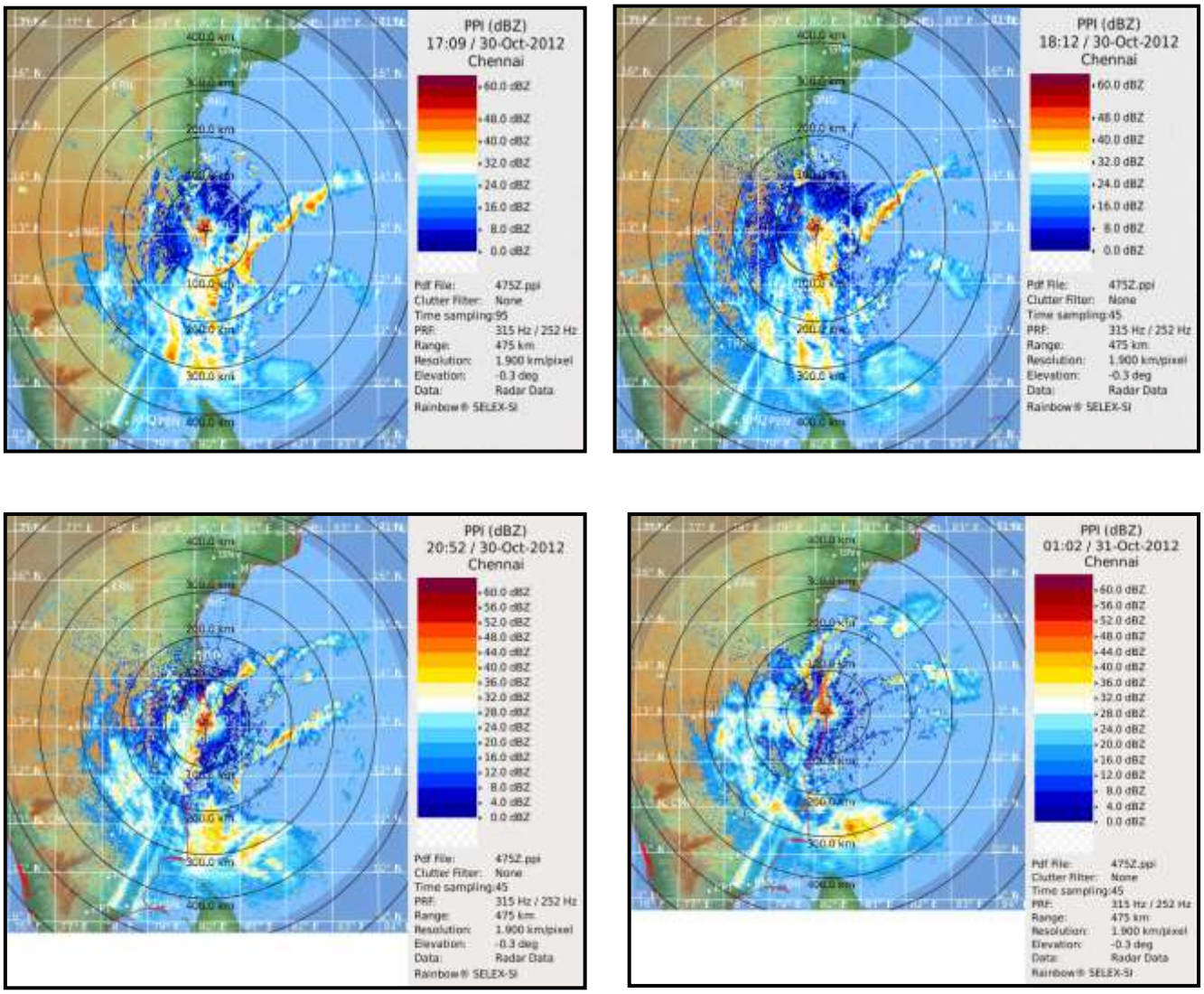



**Fig. 4.2.1.4(a) DWR Chennai imageries based on 17, 18 & 21 UTC of 30th and 01 UTC of 31st Oct 2012 during Cyclonic Storm, NILAM over Bay of Bengal**

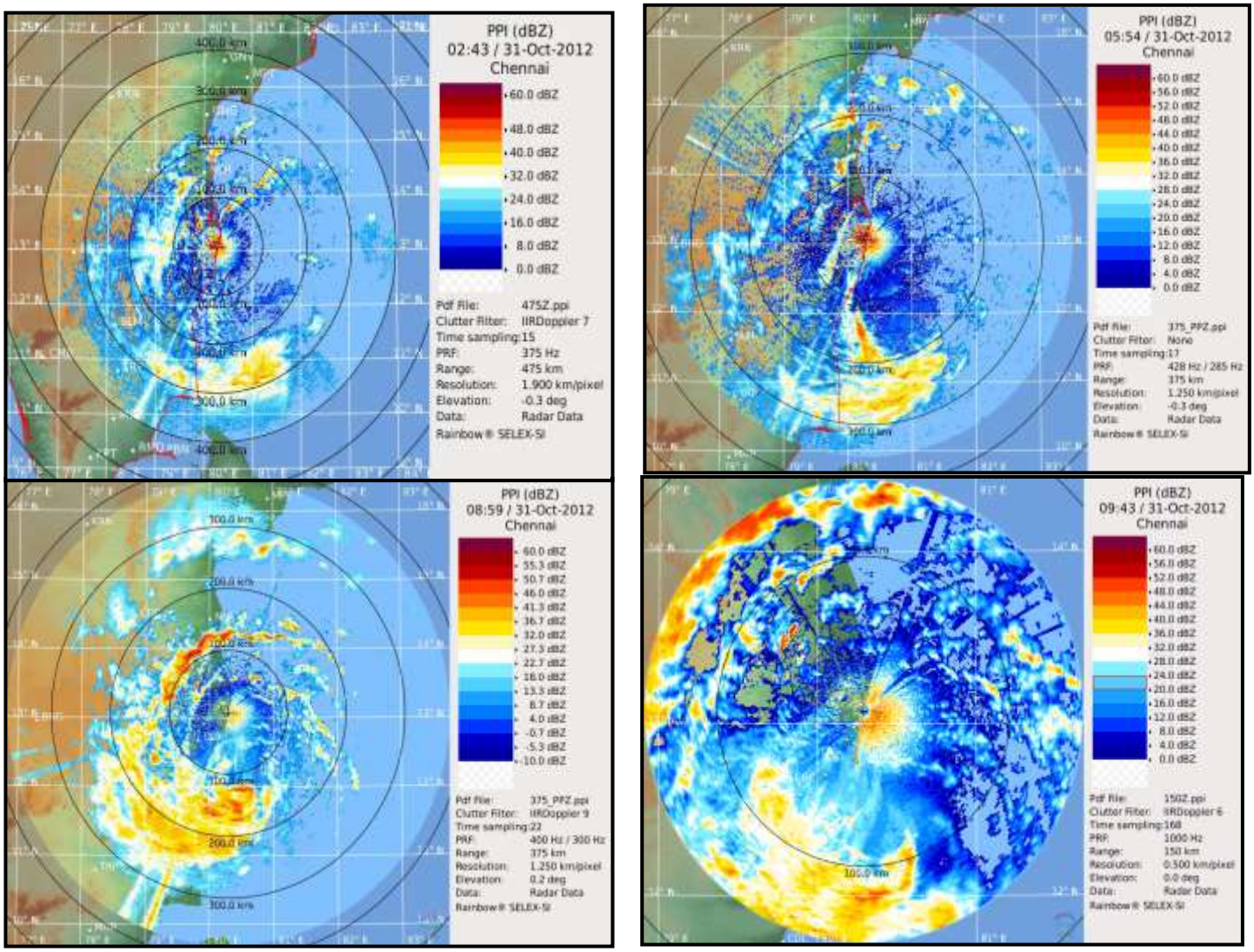



**Fig. 4.2.1.4(b) DWR Chennai imageries based on 03, 06, 09 & 10 UTC UTC of 31st Oct 2012 during Cyclonic Storm, NILAM over Bay of Bengal**

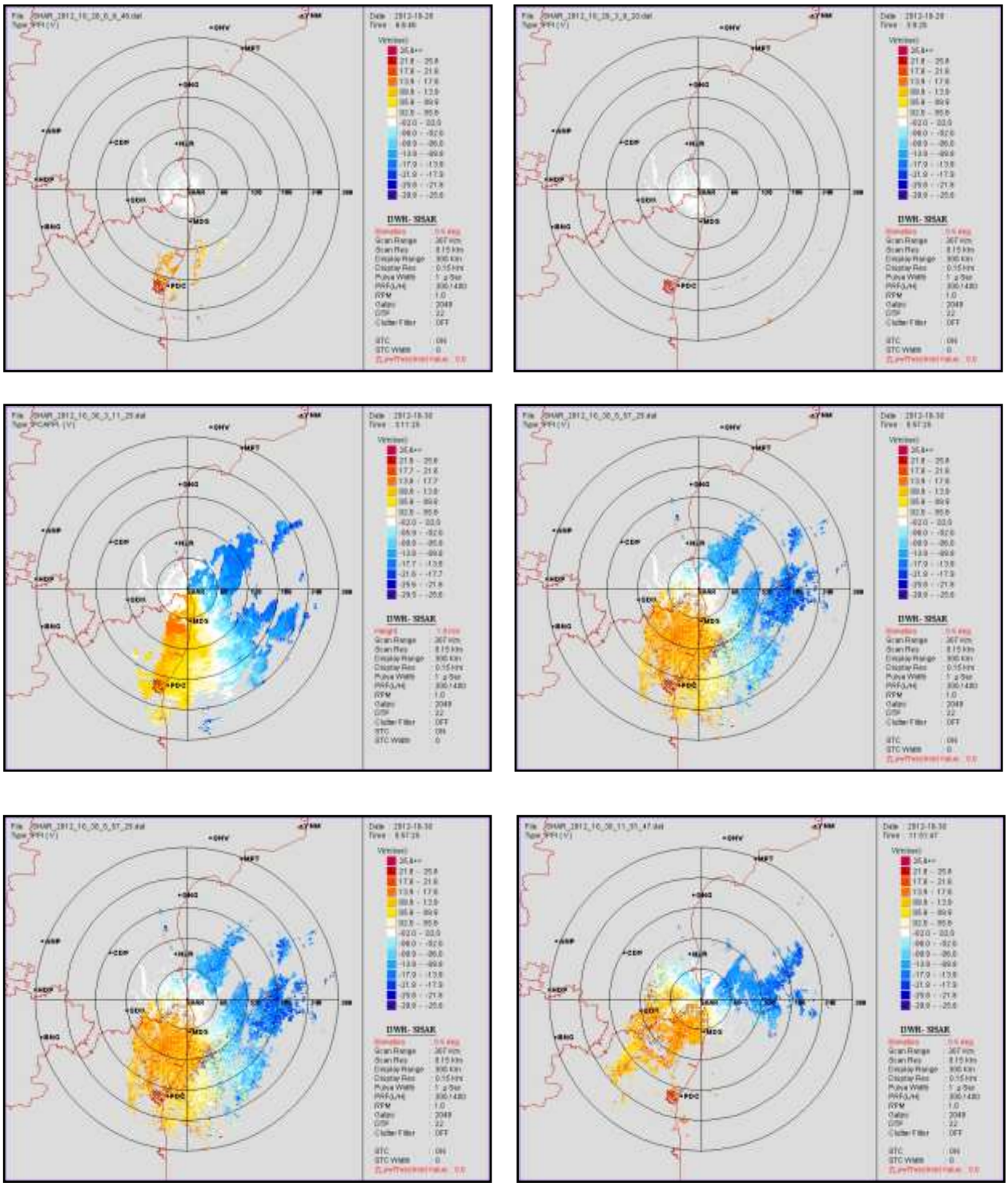


**Fig. 4.2.1.4(c) DWR SHAR PPI_V imageries based on 06 UTC of 28th , 03 UTC of 29th and 03, 06. 09 & 12 UTC of 30th Oct. 2012**

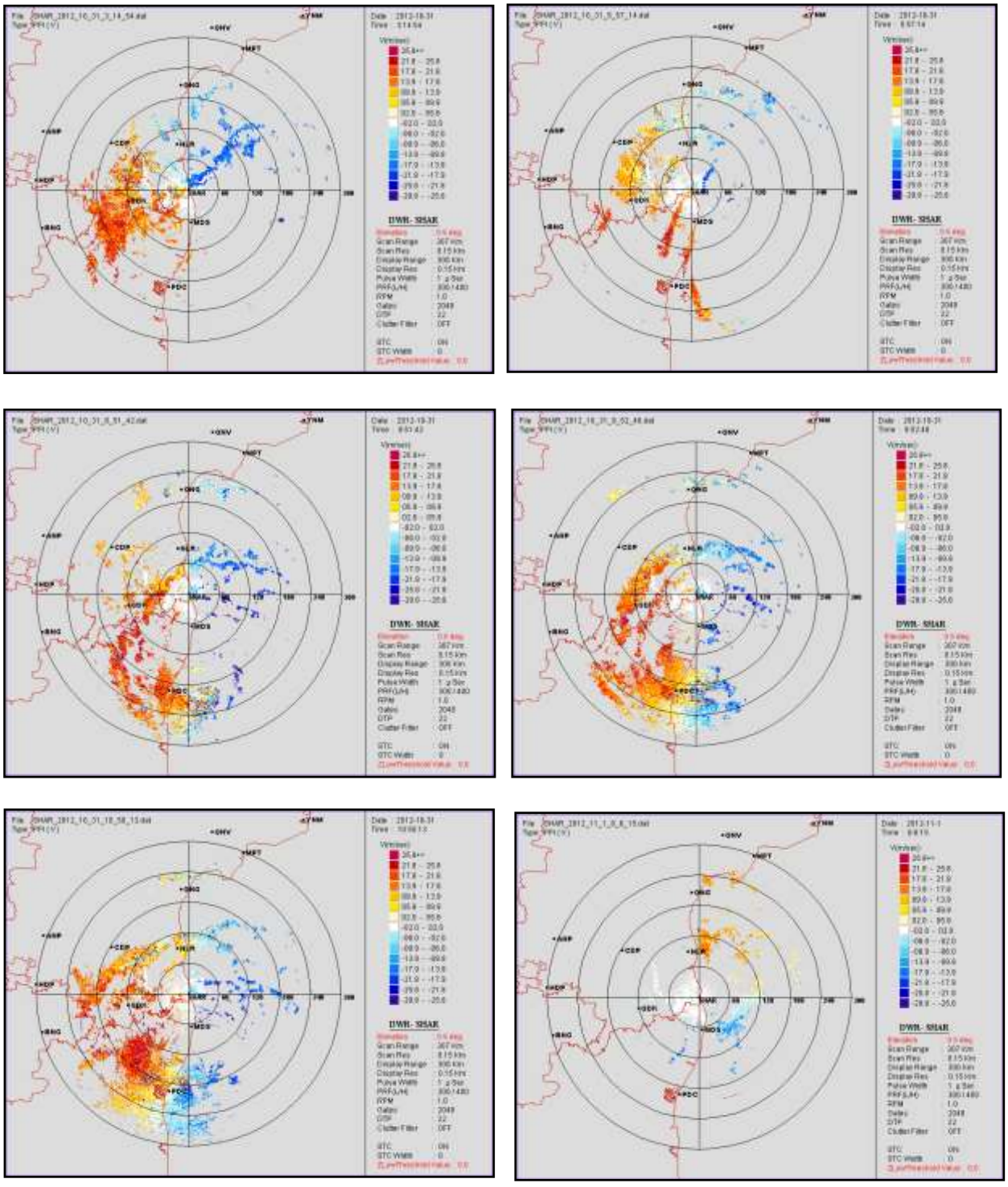


**Fig. 4.2.1.4(d) DWR SHAR PPI_V imageries based on 03, 06 09, 10 & 11 UTC of 31st Oct. and 06 UTC of 1st Nov. 2012**

### 4.2.1.8. Features observed through NWP model analyses

The mean sea level pressure analysis, 850 hPa, 500 hPa and 200 hPa wind analyses of various models are shown in Fig. 4.2.1.5-4.2.1.8. The performance of various models for detection and prediction of this system showed large scale variation with respect to genesis, track and intensification. However, the models guidance converged to each other, as the system came closer to coast.

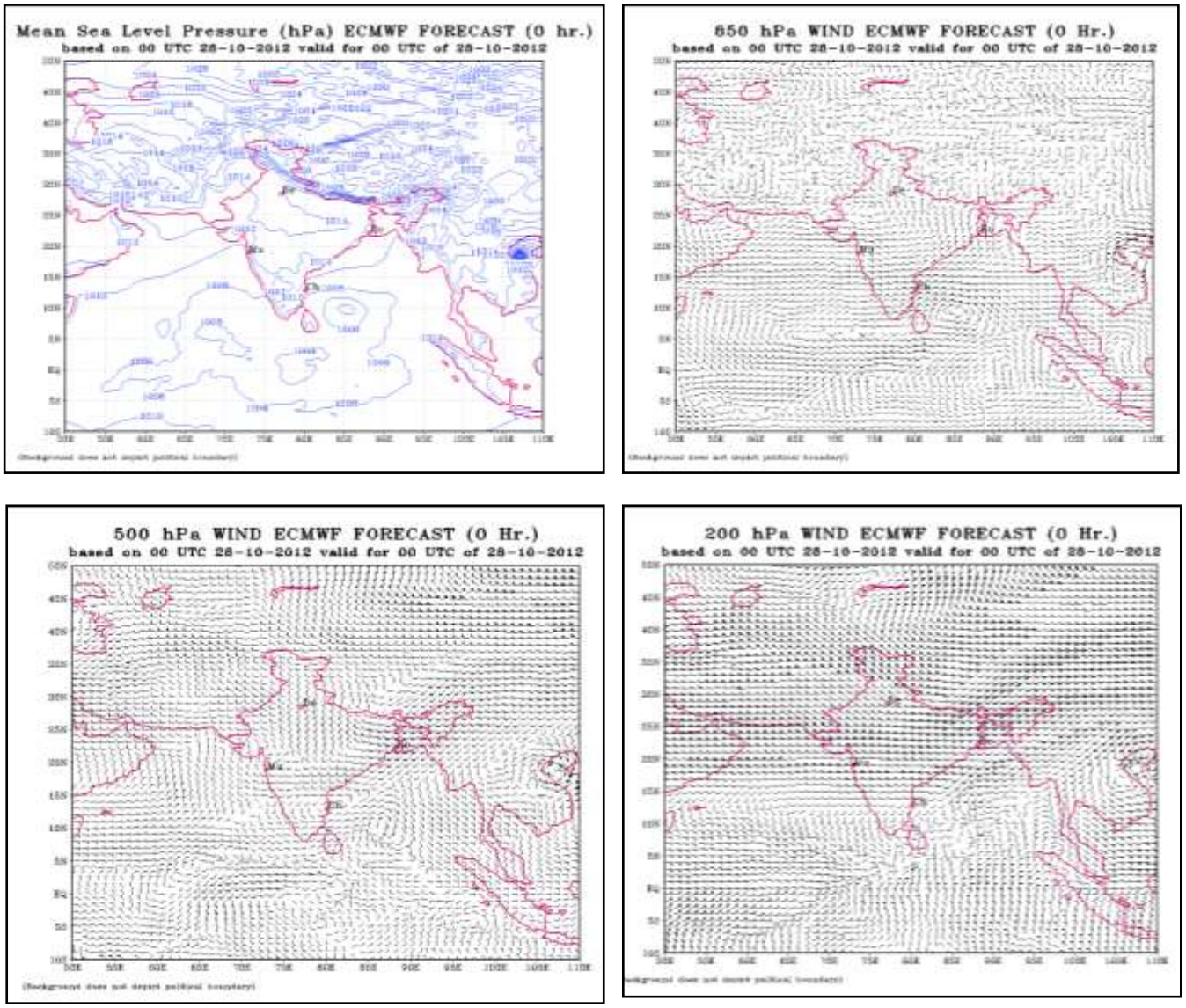



**Fig. 4.2.1.5(a) ECMWF MSLP and 850, 500 & 200 hPa wind analysis based on 00 UTC of 28th Oct. 2012**

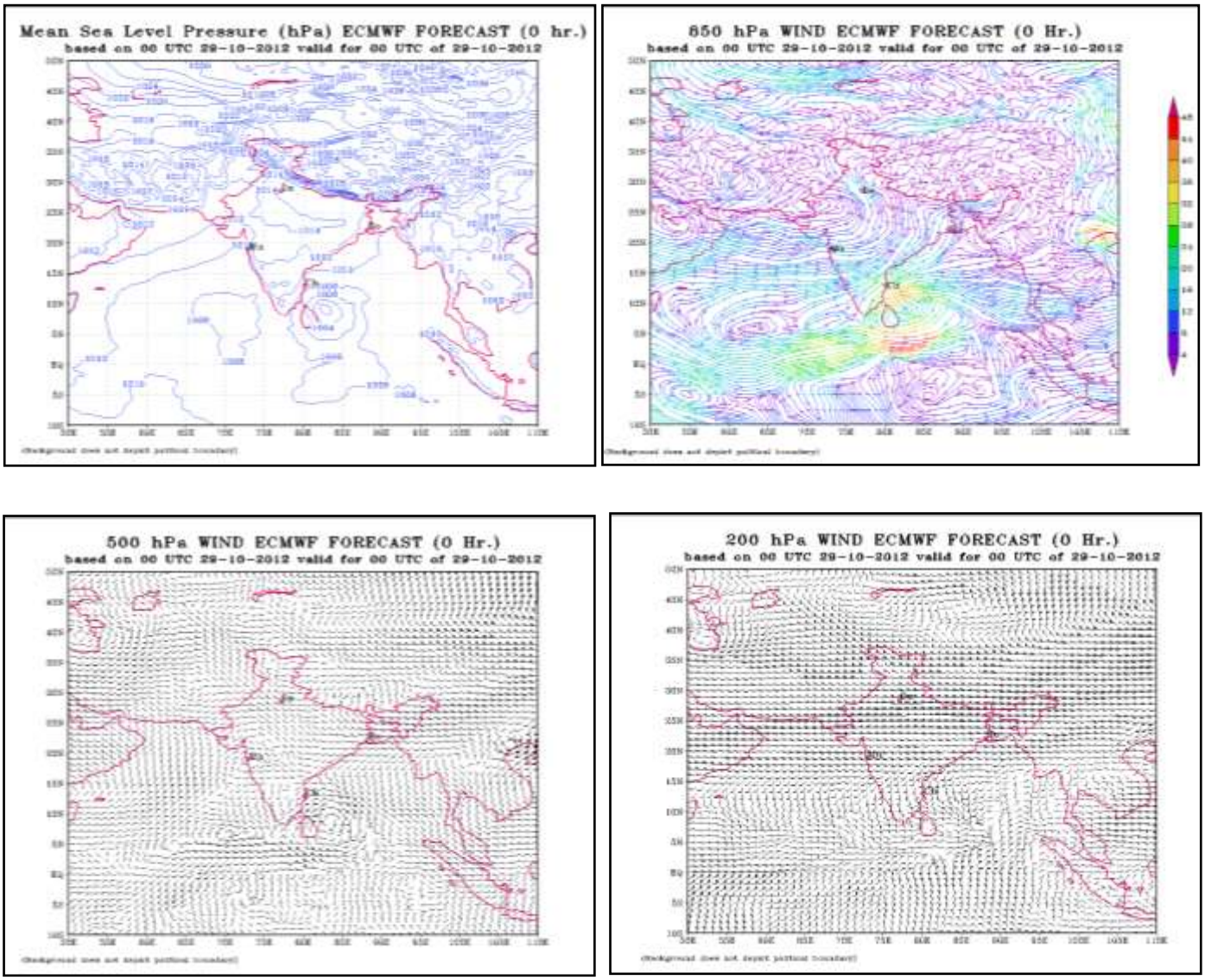
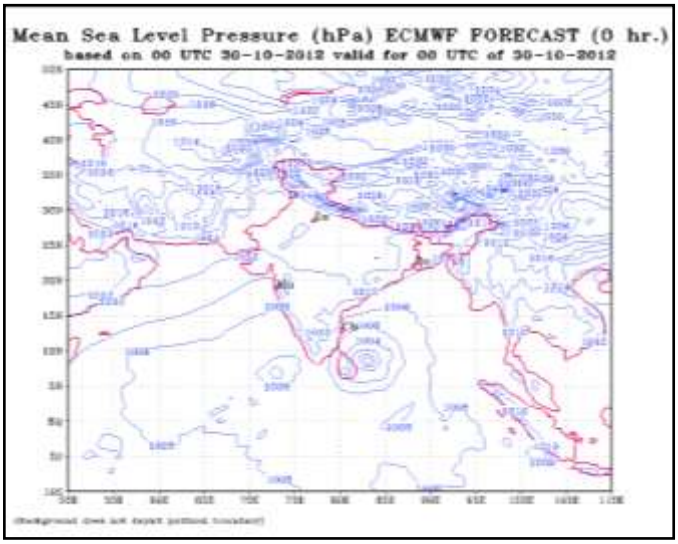
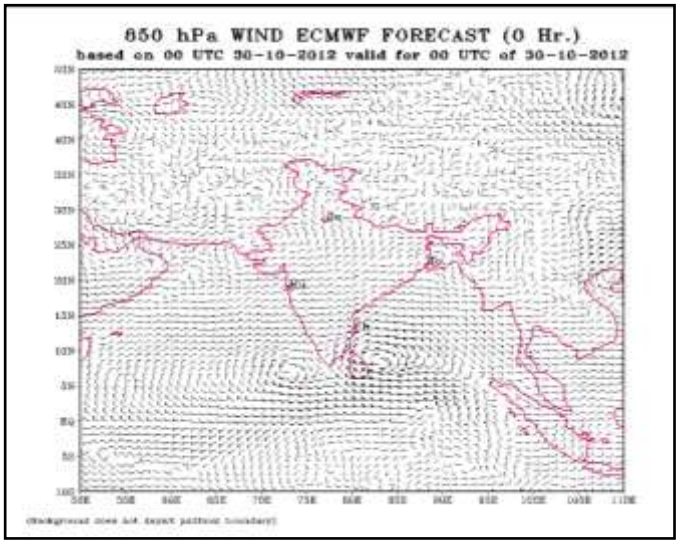
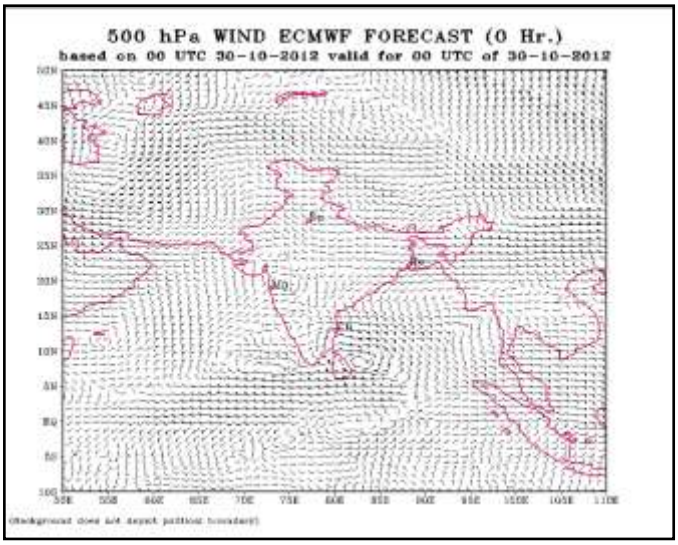



**Fig. 4.2.1.5(b) ECMWF MSLP and 850, 500 & 200 hPa wind analysis based on 00 UTC of 29th Oct. 2012**



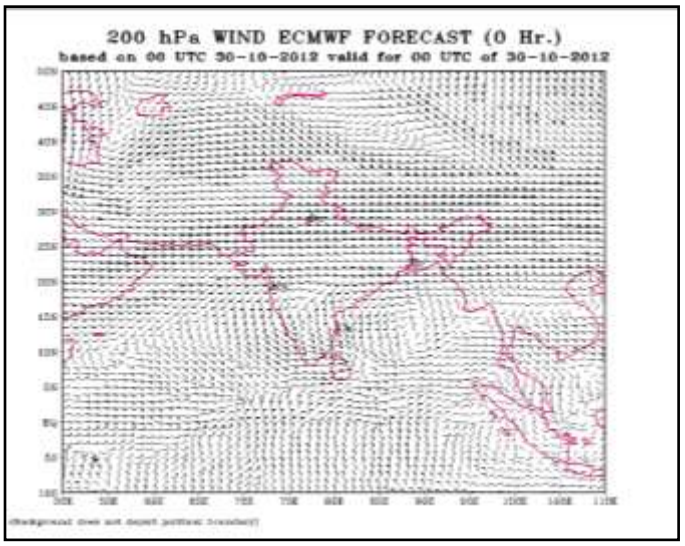
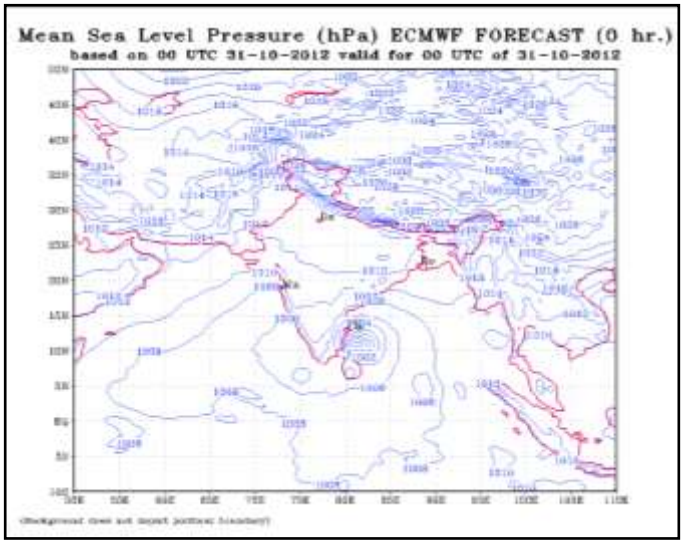
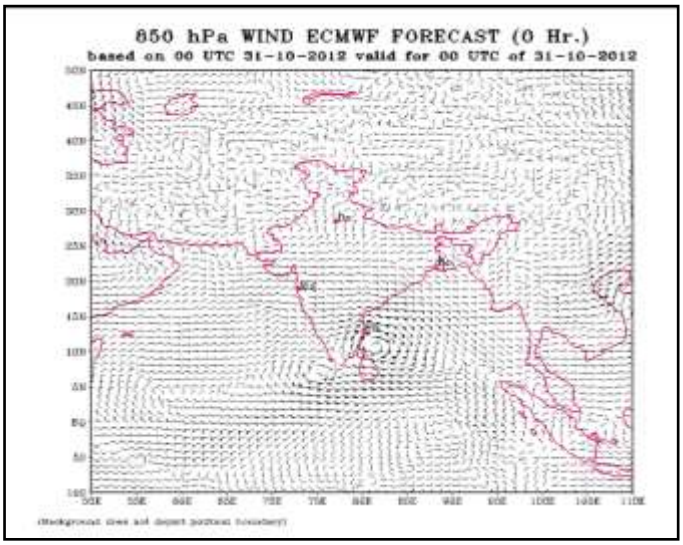
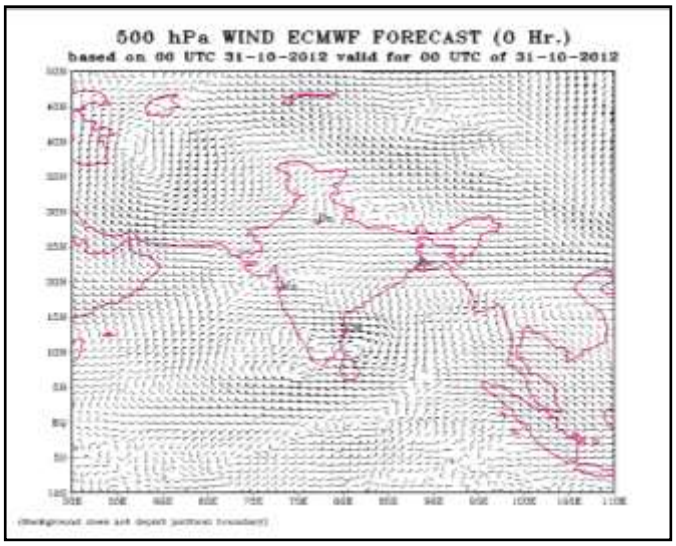




**Fig. 4.2.1.5 (c) ECMWF MSLP and 850, 500 & 200 hPa wind analysis based on 00 UTC of 30th Oct. 2012**



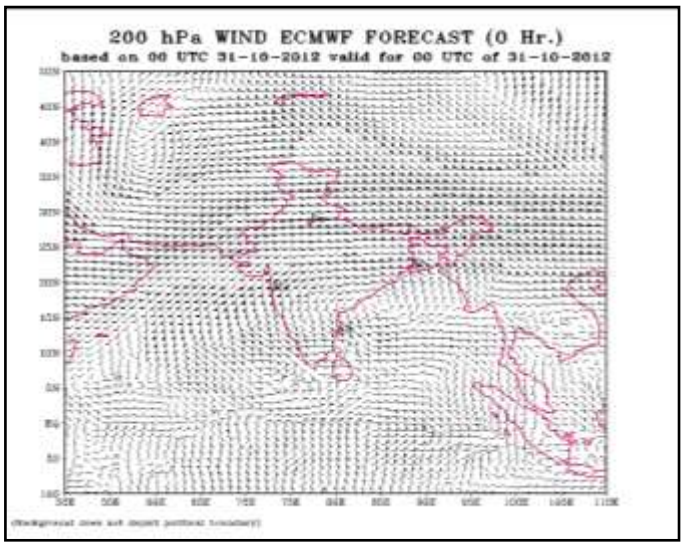




**Fig. 4.2.1.5(d) ECMWF MSLP and 850, 500 & 200 hPa wind analysis based on 00 UTC of 31st Oct. 2012**

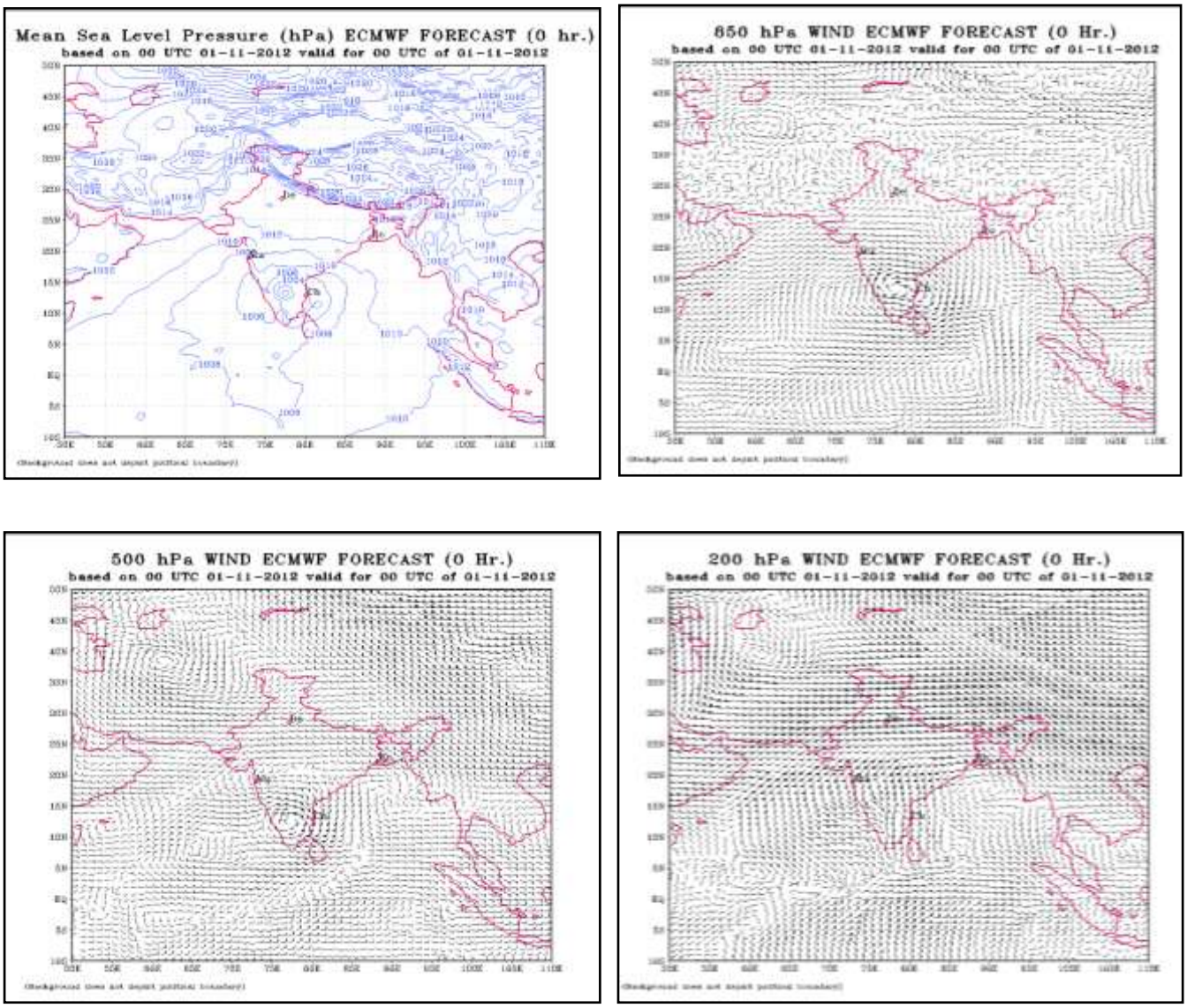
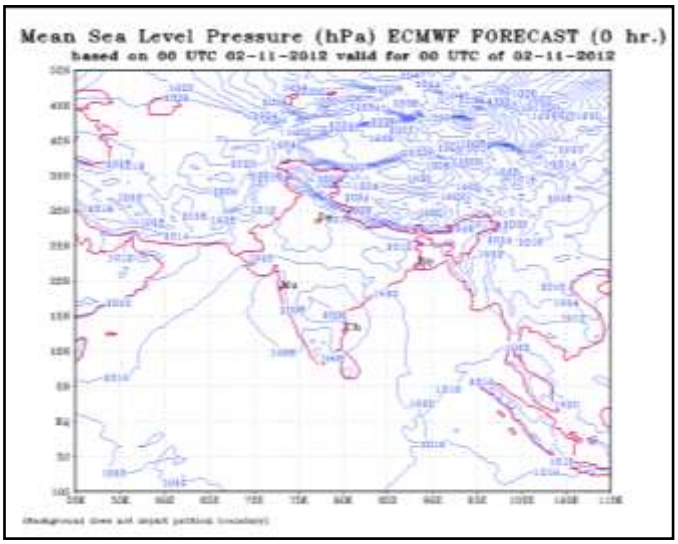
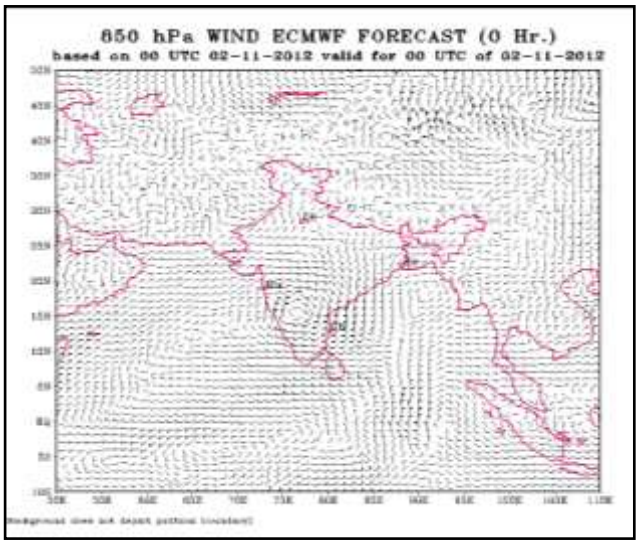
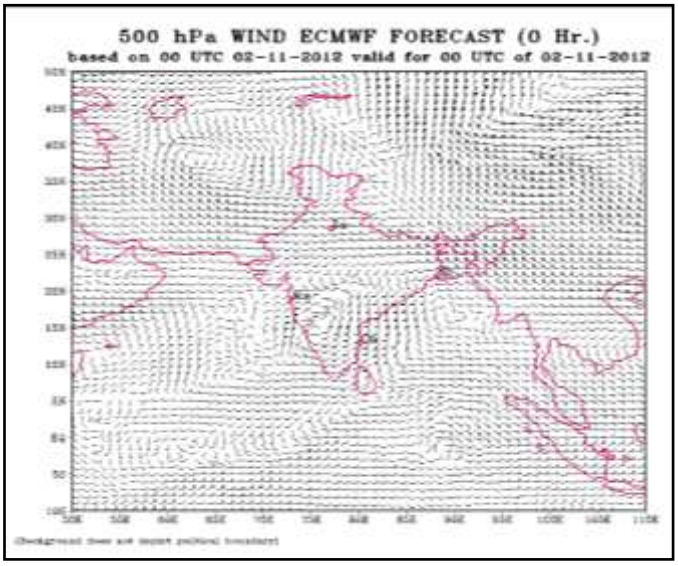



**Fig. 4.2.1.5(e) ECMWF MSLP and 850, 500 & 200 hPa wind analysis based on 00 UTC of 1st Nov. 2012**



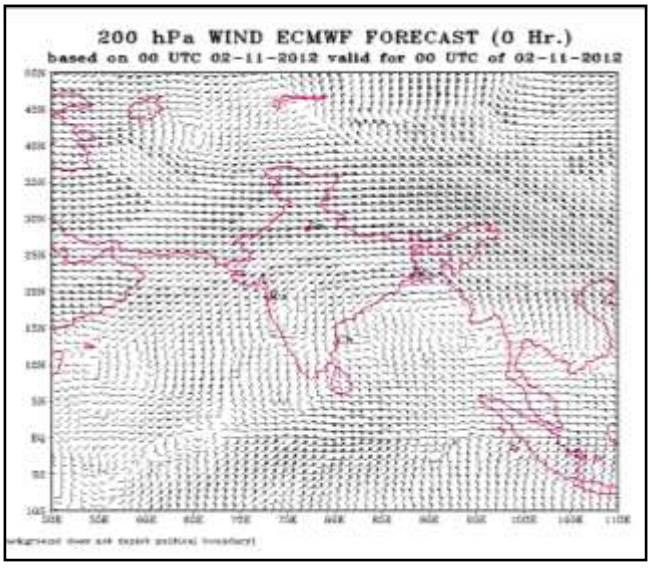




**Fig. 4.2.1.5(f) ECMWF MSLP and 850, 500 & 200 hPa wind analysis based on 00 UTC of 2nd Nov. 2012**

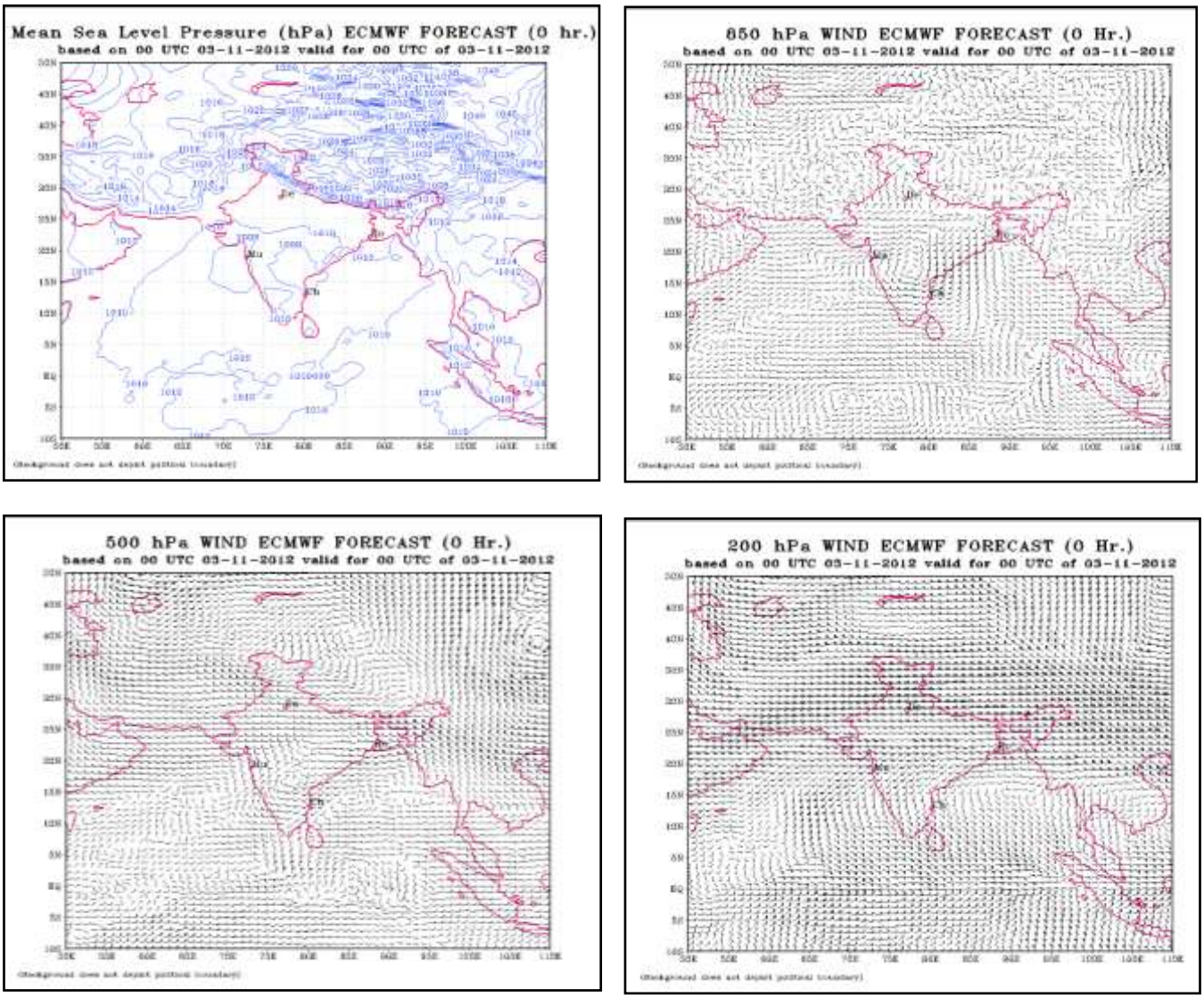



**Fig. 4.2.1.5(g) ECMWF MSLP and 850, 500 & 200 hPa wind analysis based on 00 UTC of 3rd Nov. 2012**

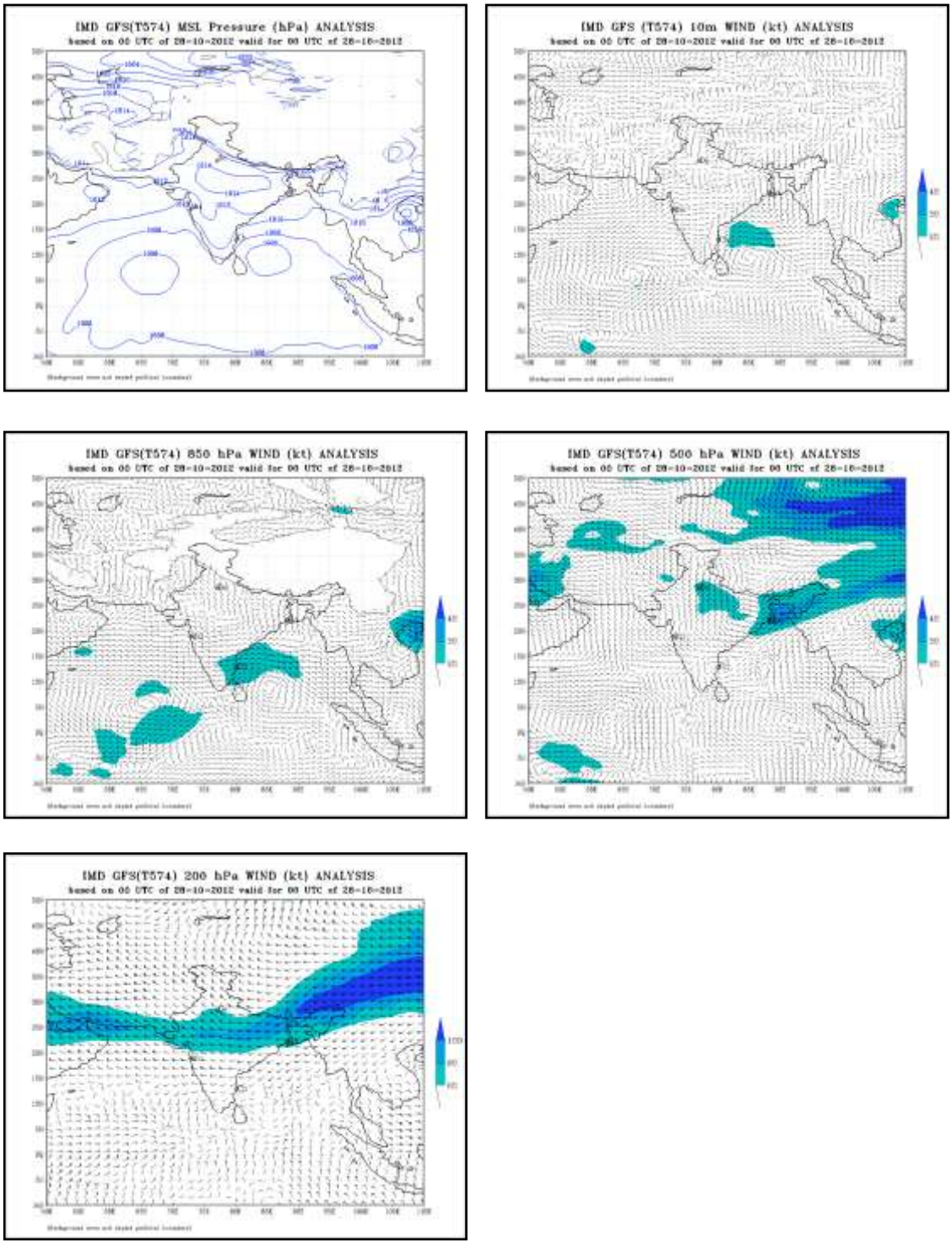



**Fig.4.2.1.6(a) IMD GFS MSLP, 10m wind and winds at 850, 500 & 200 hPa levels analysis based on 00 UTC of 28th Oct. 2012**

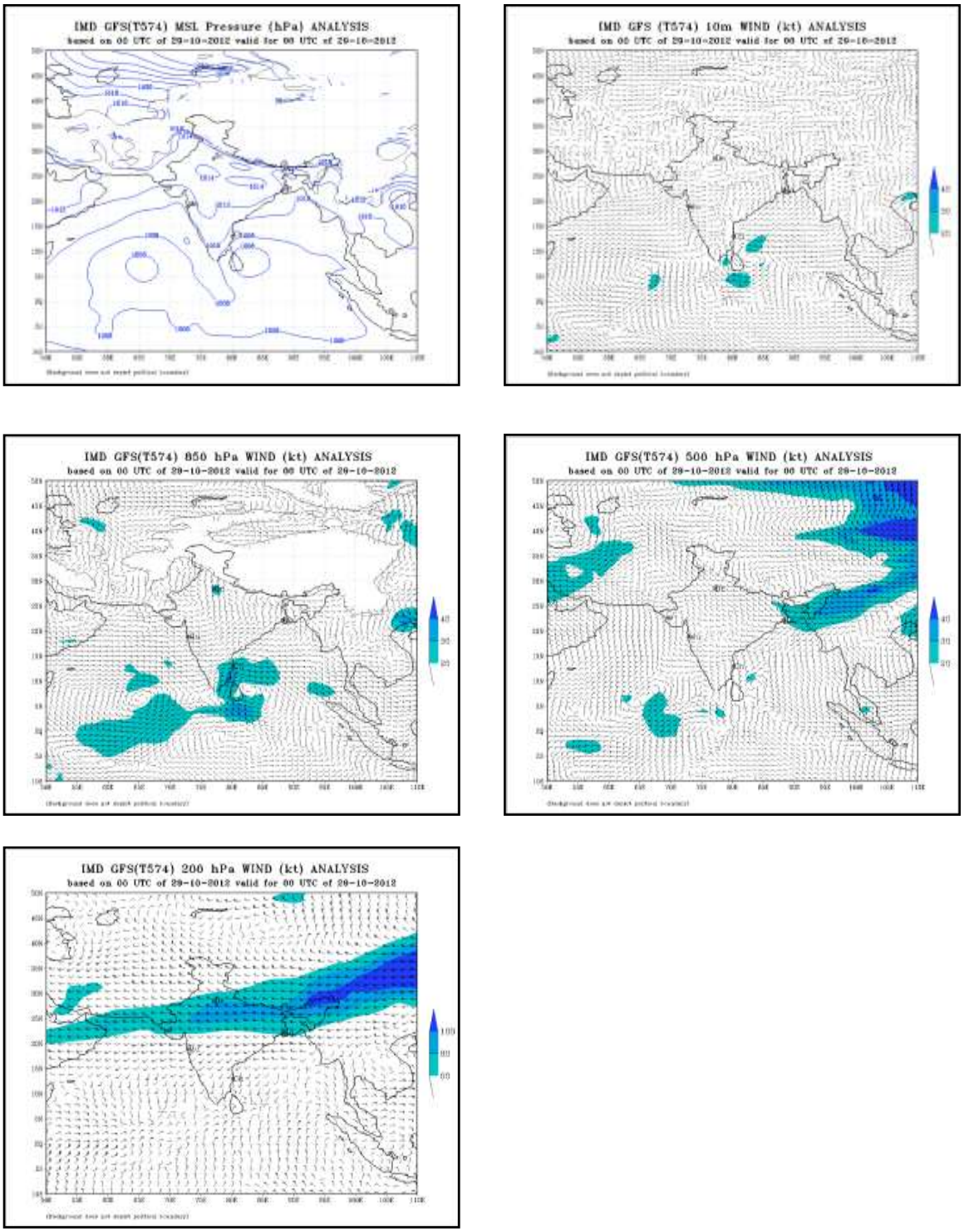



**Fig. 4.2.1.6(b) IMD GFS MSLP, 10m wind and winds at 850, 500 & 200 hPa levels analysis based on 00 UTC of 29th Oct. 2012**

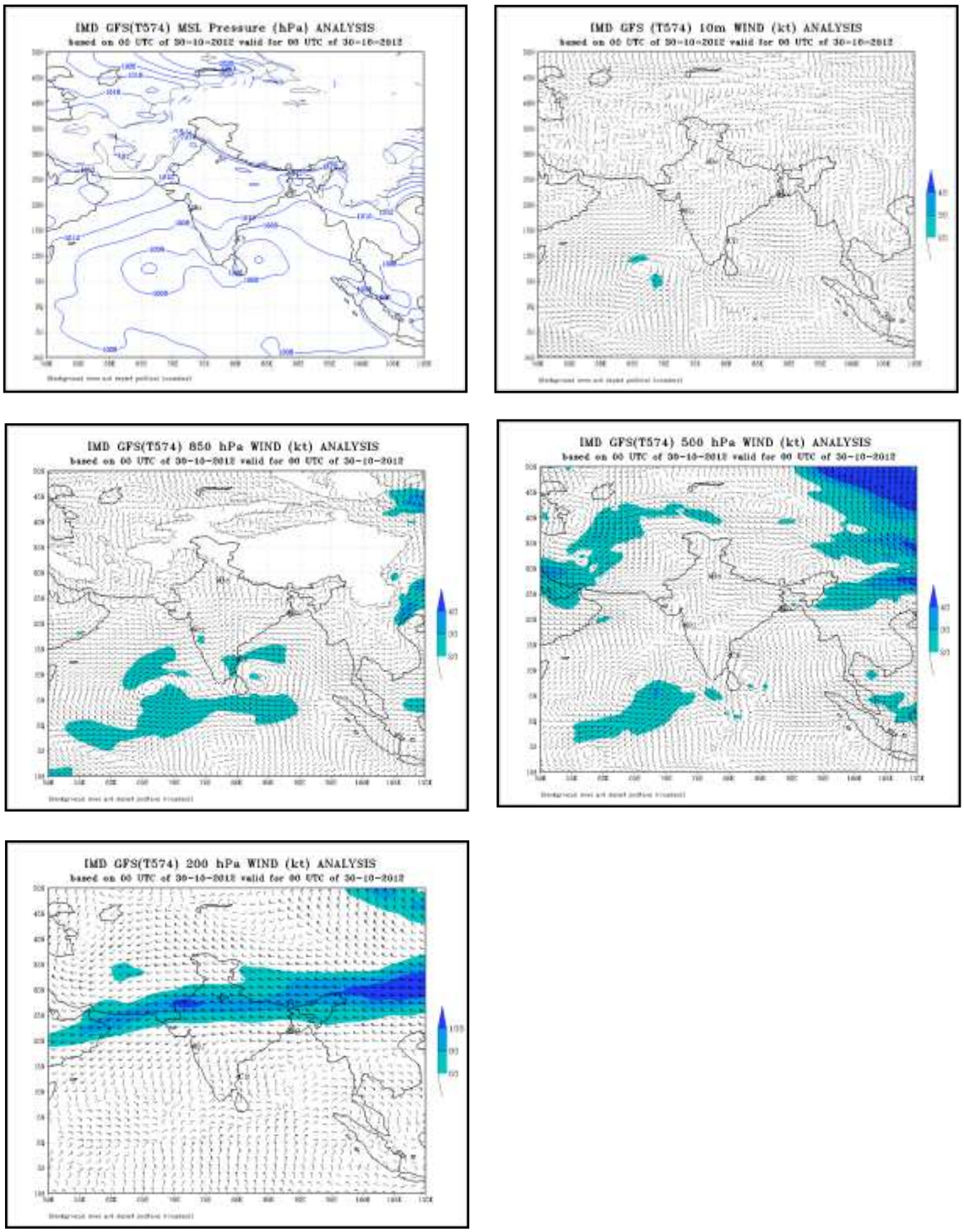



**Fig. 4.2.1.6(c) IMD GFS MSLP, 10m wind and winds at 850, 500 & 200 hPa levels analysis based on 00 UTC of 30th Oct. 2012**

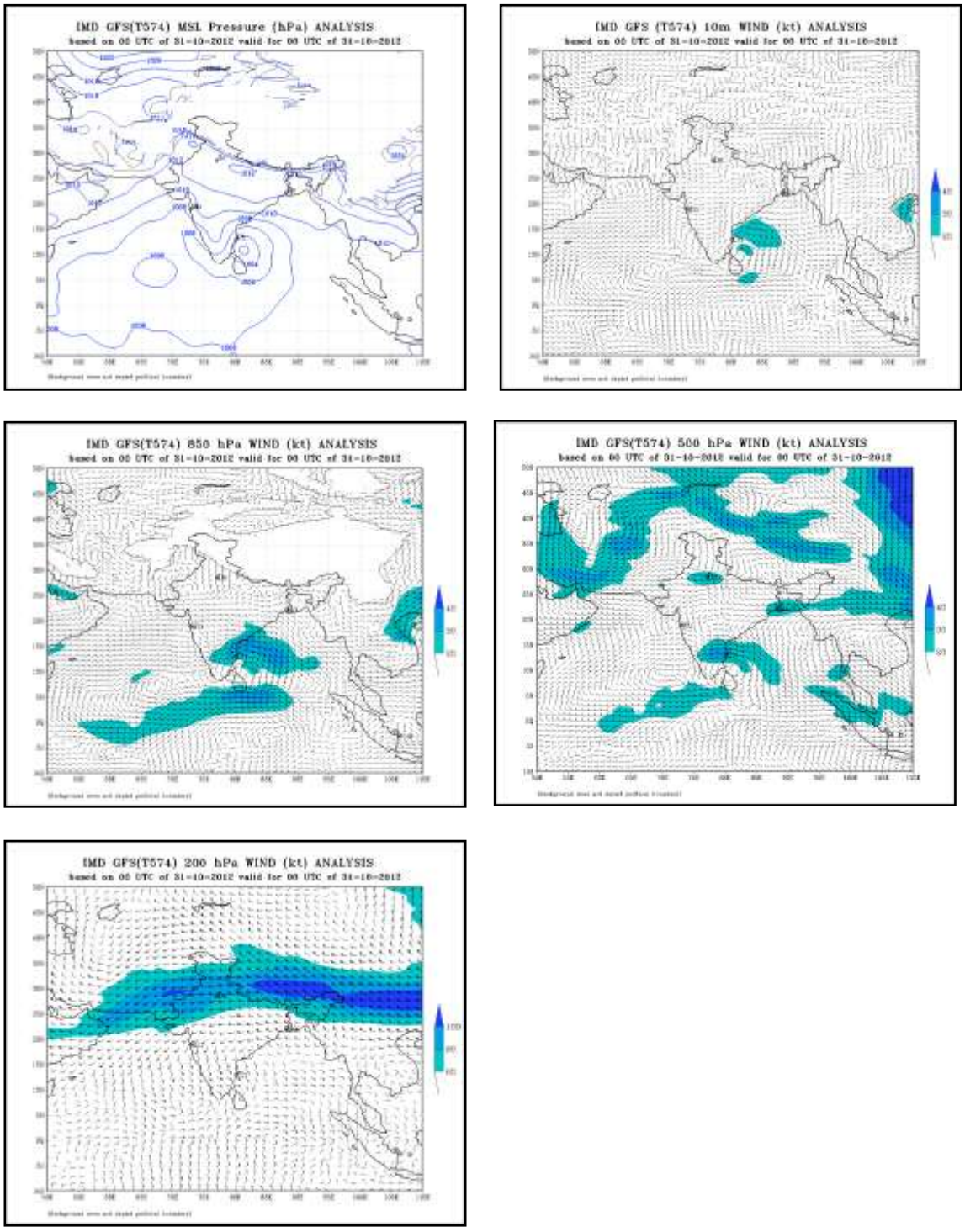



**Fig. 4.2.1.6(d) IMD GFS MSLP, 10m wind and winds at 850, 500 & 200 hPa levels analysis based on 00 UTC of 31st Oct. 2012**

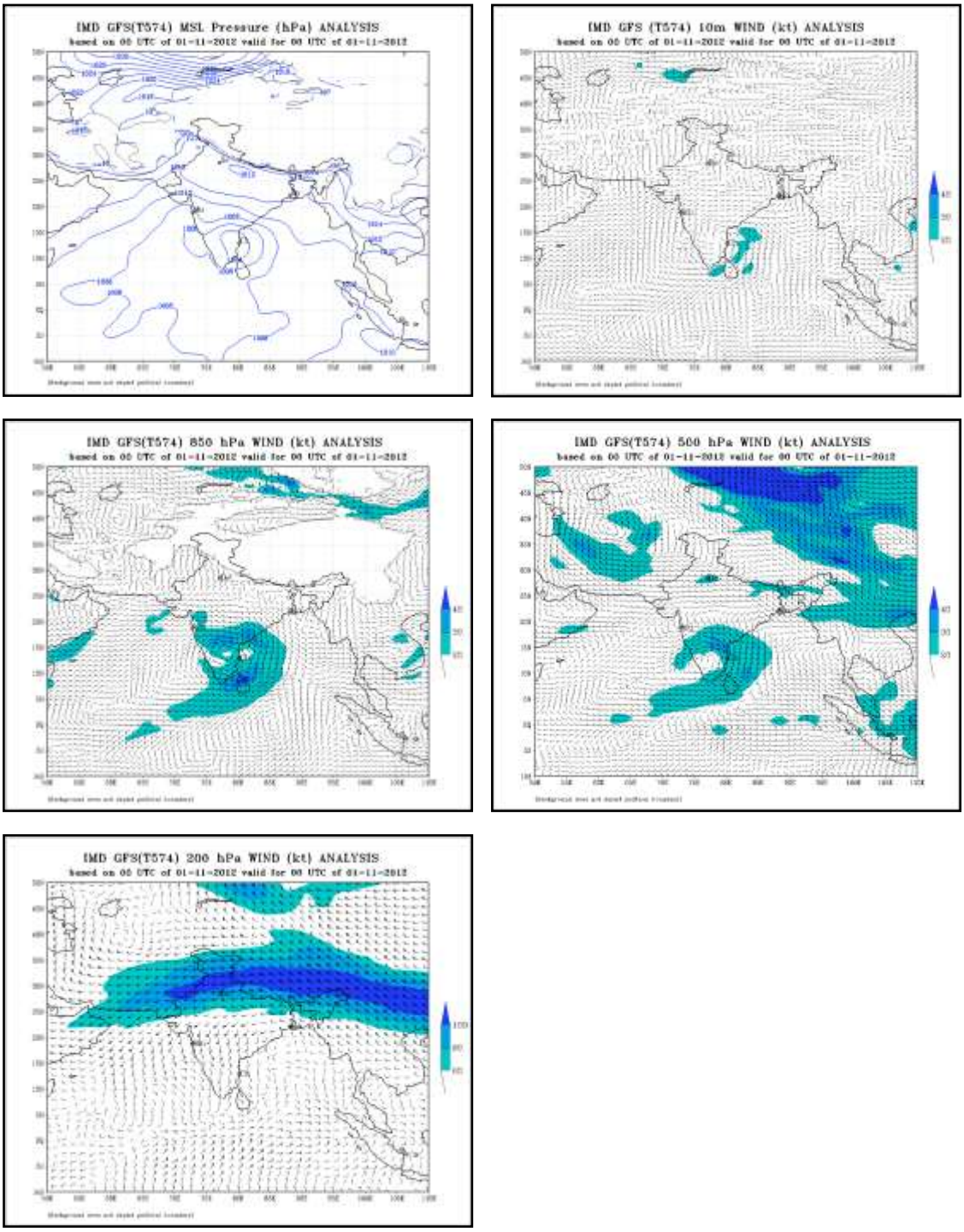



**Fig. 4.2.1.6(e) IMD GFS MSLP, 10m wind and winds at 850, 500 & 200 hPa levels analysis based on 00 UTC of 1st Nov. 2012**

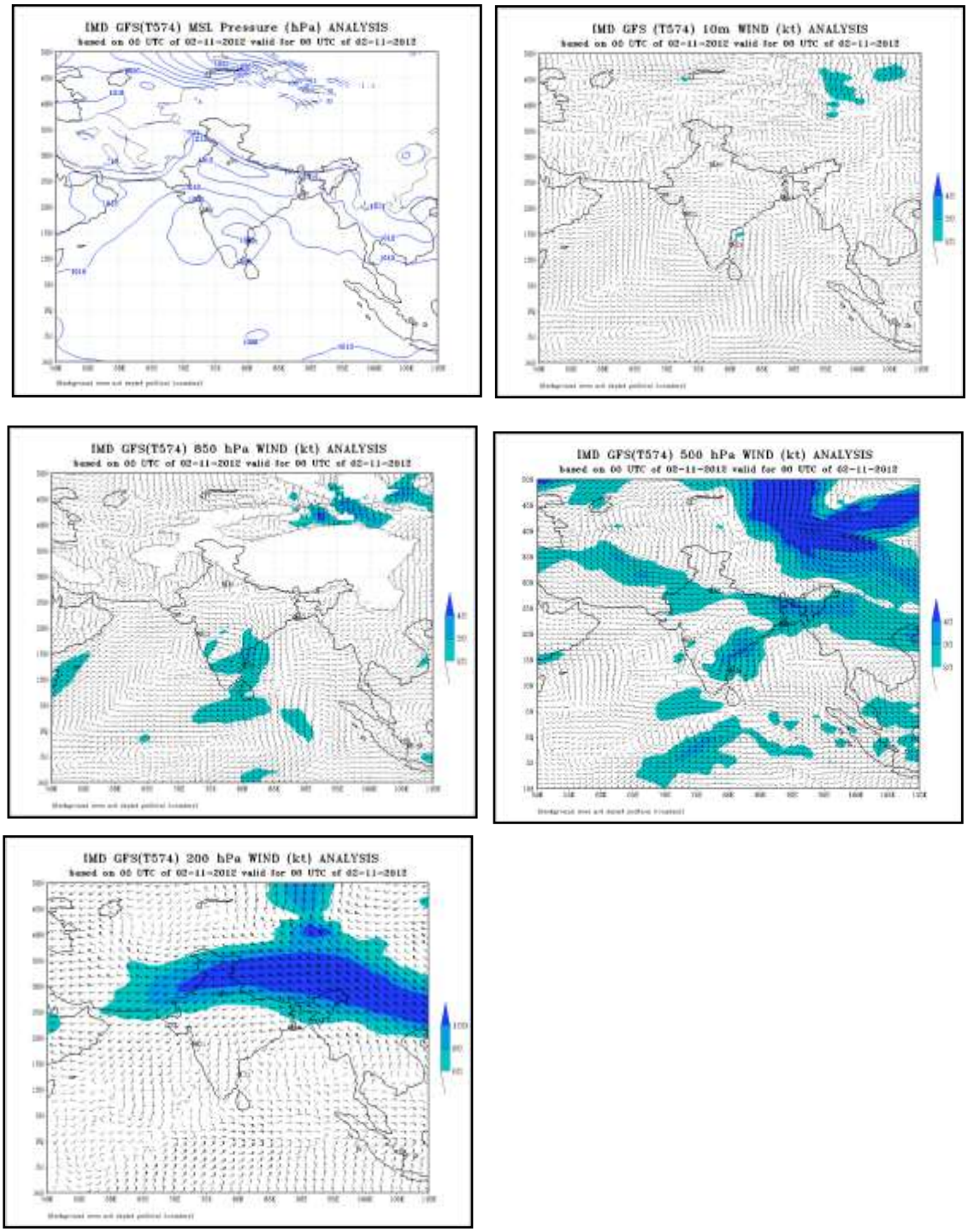



**Fig. 4.2.1.6(f) IMD GFS MSLP, 10m wind and winds at 850, 500 & 200 hPa levels analysis based on 00 UTC of 2nd Nov. 2012**

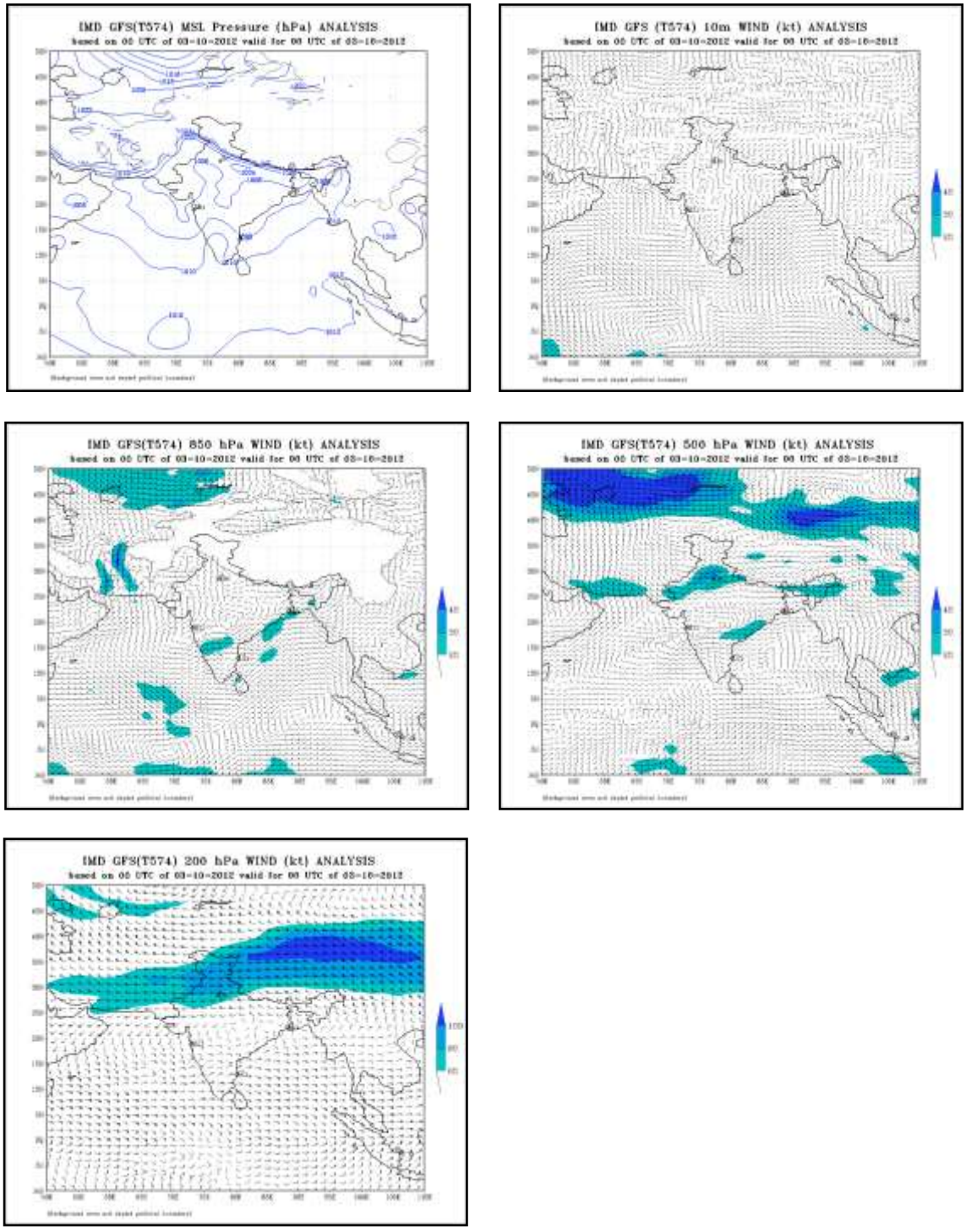



**Fig. 4.2.1.6(g) IMD GFS MSLP, 10m wind and winds at 850, 500 & 200 hPa levels analysis based on 00 UTC of 3rd Nov. 2012**

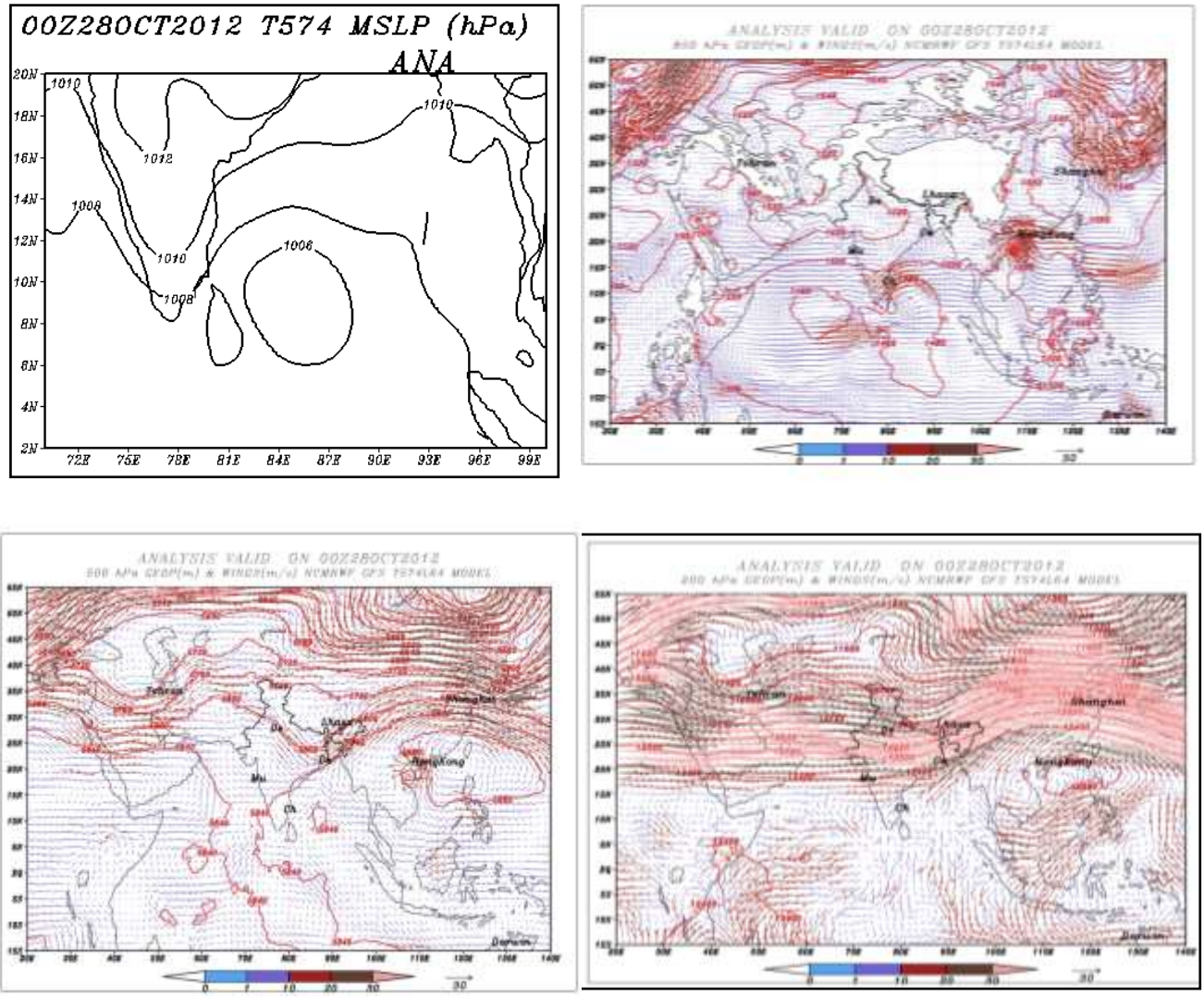
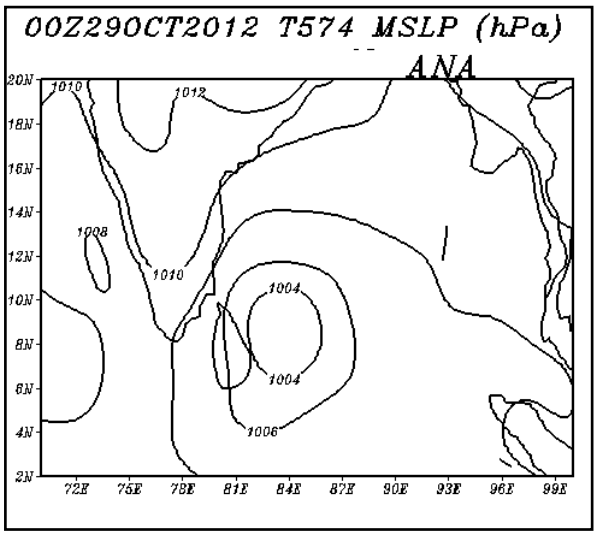
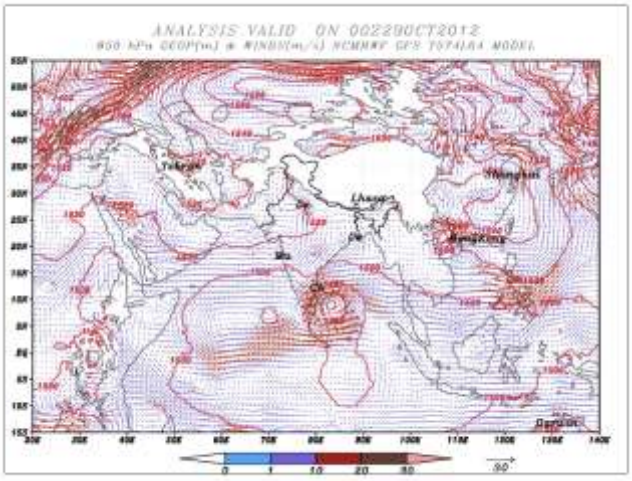
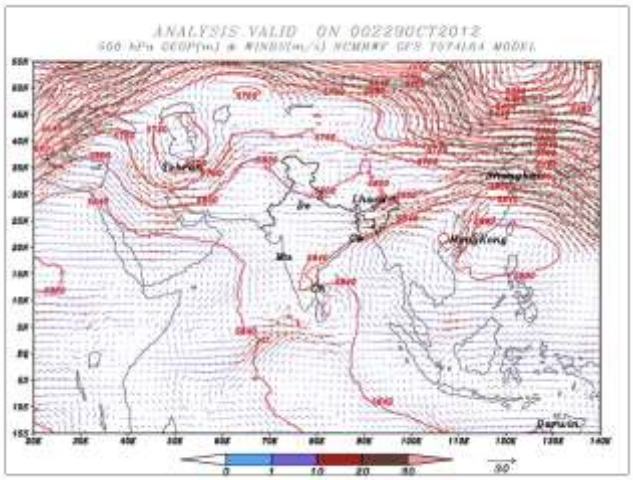



**Fig. 4.2.1.7(a) NCMRWF GFS T-574 model MSLP, 850, 500 and 200 hPa wind analysis based on 00 UTC of 28th Oct. 2012**



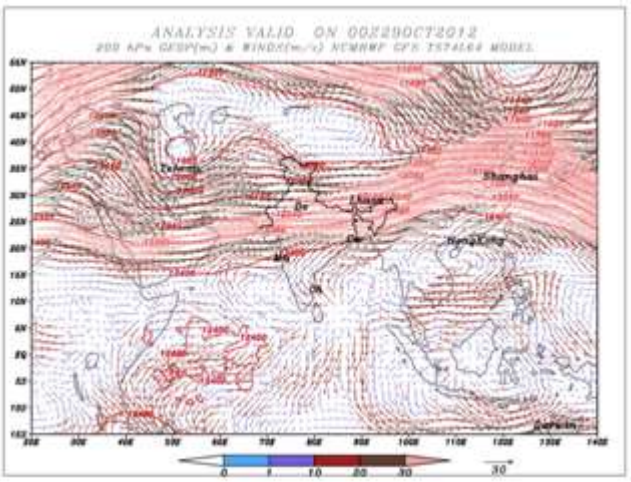




**Fig. 4.2.1.7(b) NCMRWF GFS T-574 model MSLP, 850, 500 and 200 hPa wind analysis based on 00 UTC of 29th Oct. 2012**

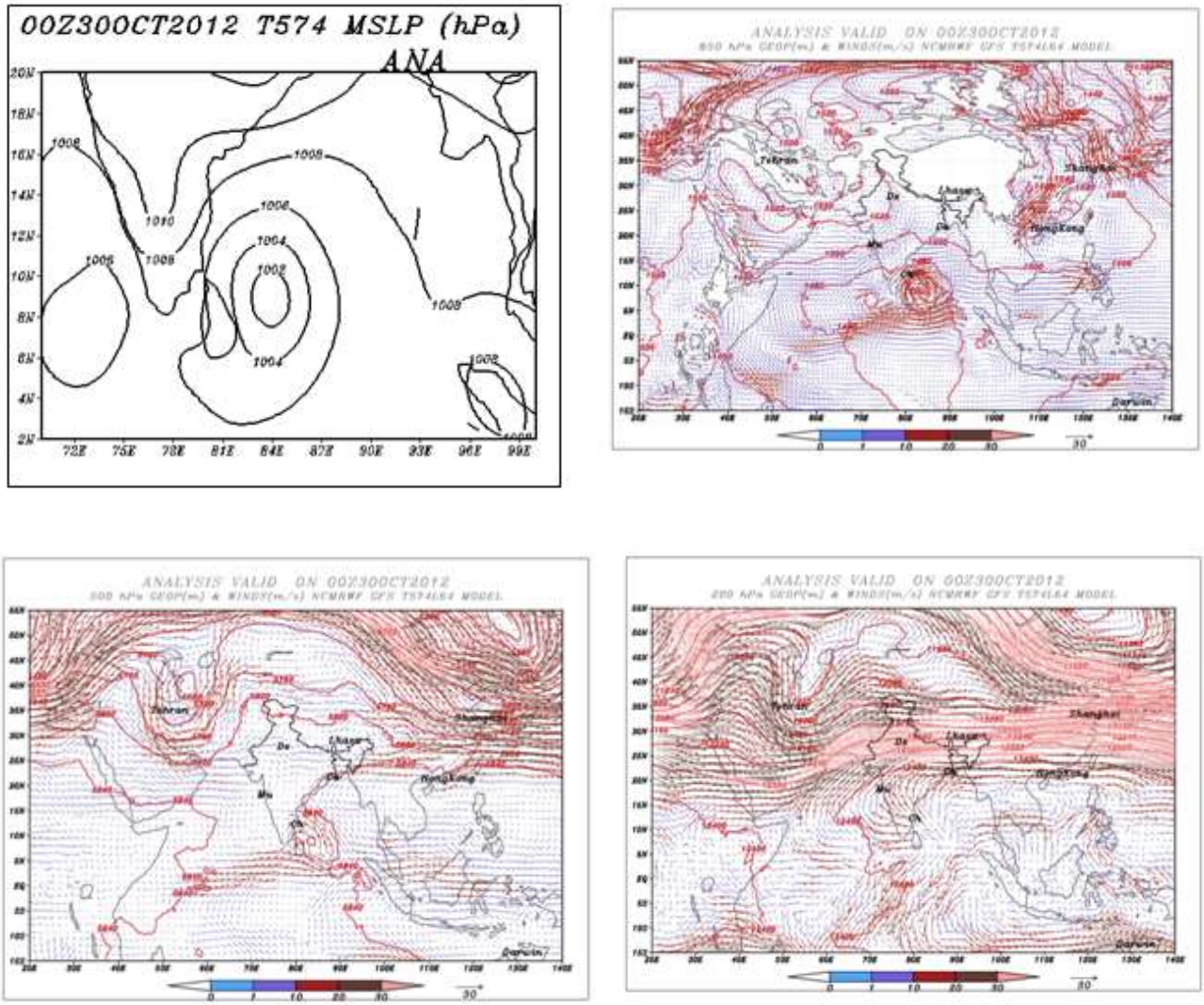



**Fig4.2.1.7(c) NCMRWF GFS T-574 model MSLP, 850, 500 and 200 hPa wind analysis based on 00 UTC of 30th Oct. 2012**

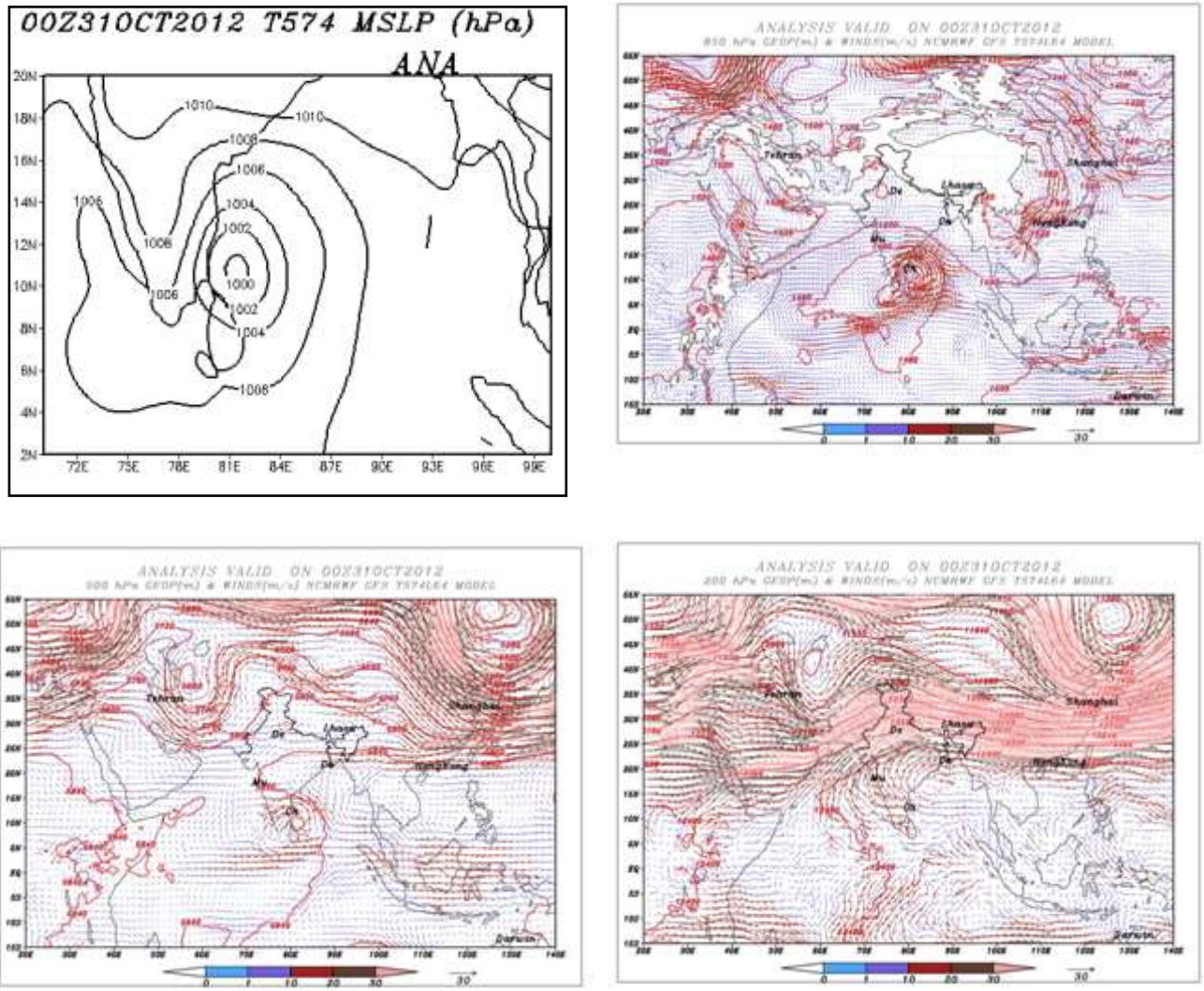



**Fig. 4.2.1.7(d) NCMRWF GFS T-574 model MSLP, 850, 500 and 200 hPa wind analysis based on 00 UTC of 31st Oct. 2012**

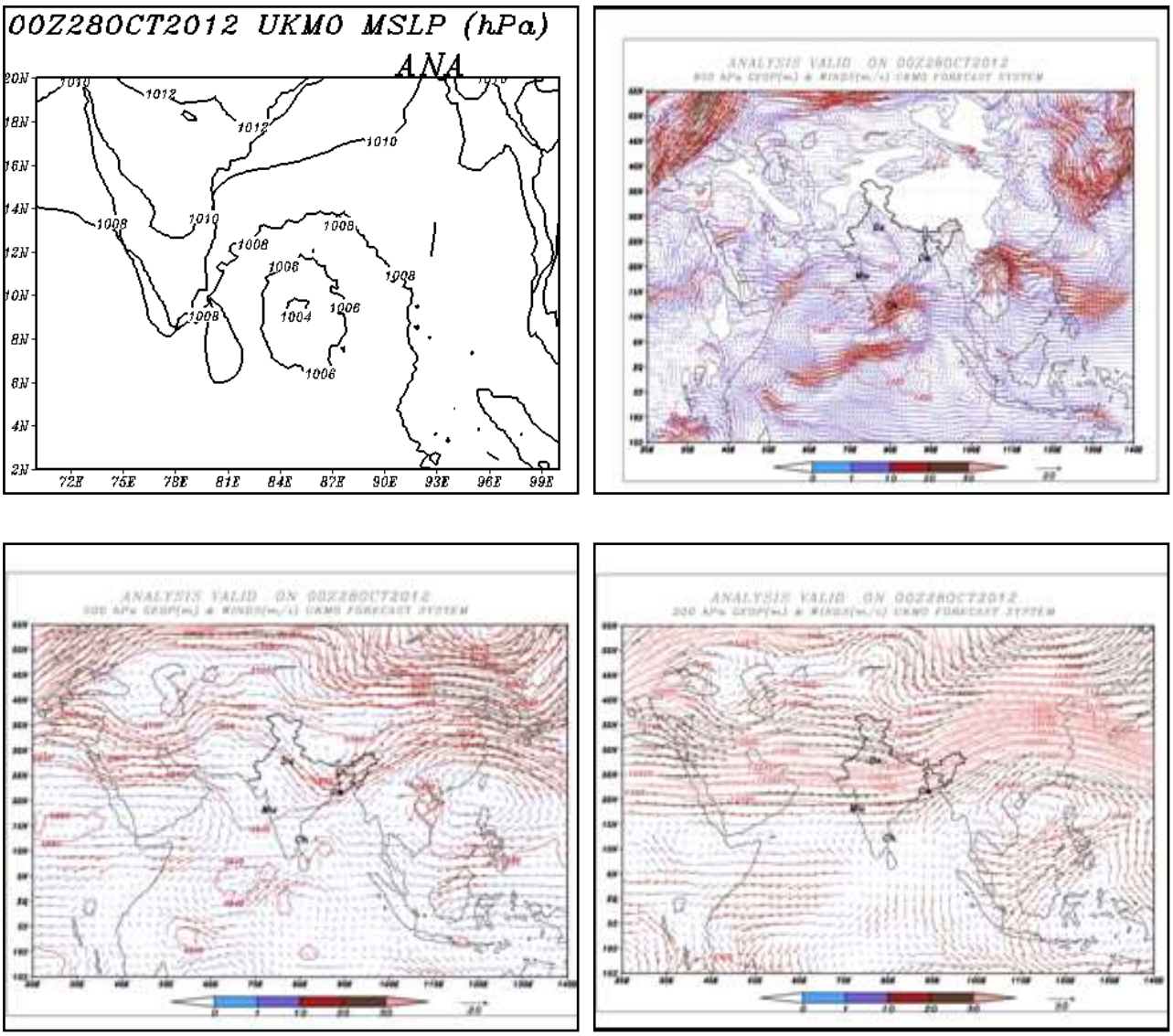



**Fig. 4.2.1.8(a) UKMO model MSLP, 850, 500 and 200 hPa wind analysis based on 00 UTC of 28th Oct. 2012**

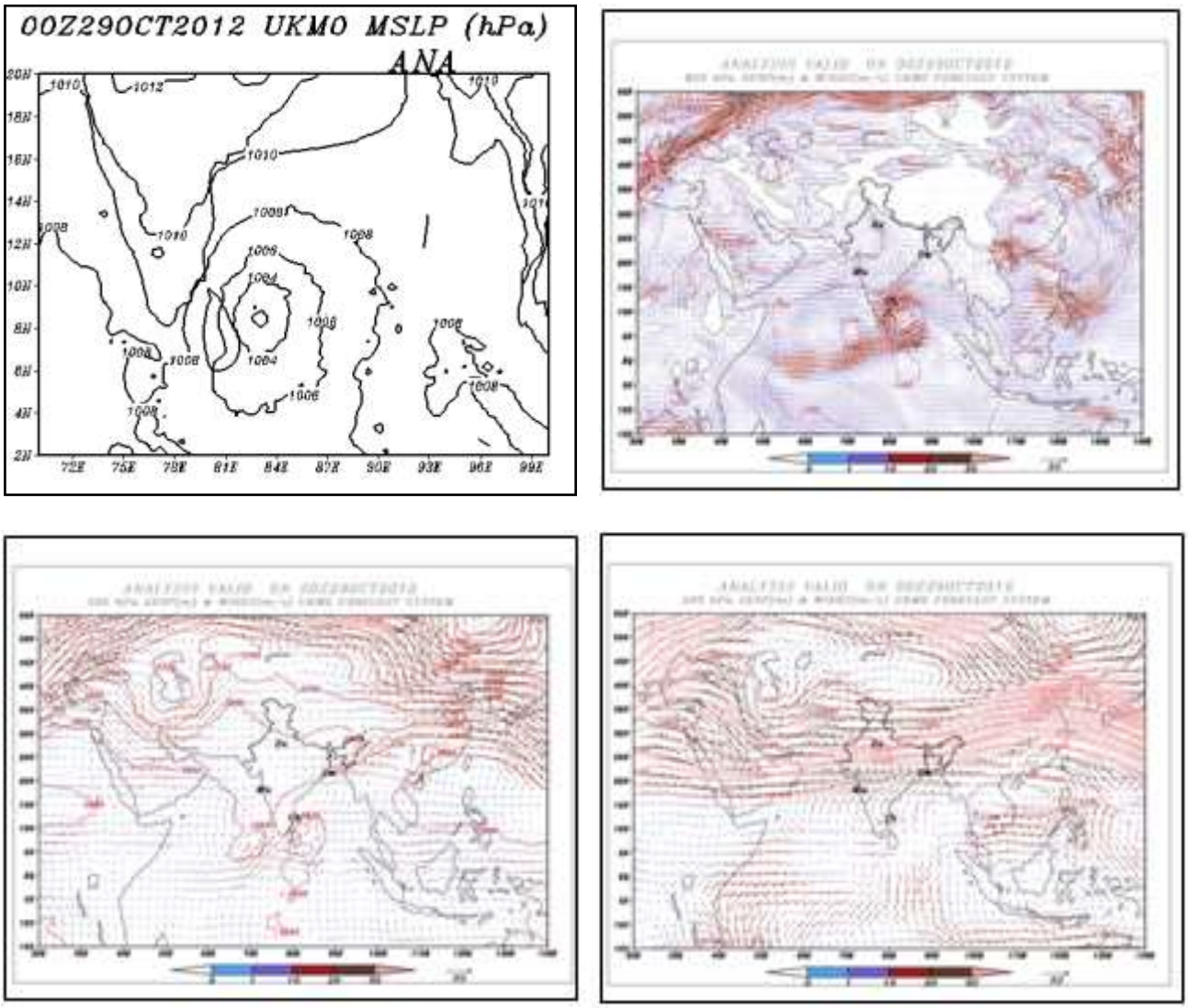



**Fig. 4.2.1.8(b) UKMO model MSLP, 850, 500 and 200 hPa wind analysis based on 00 UTC of 29th Oct. 2012**

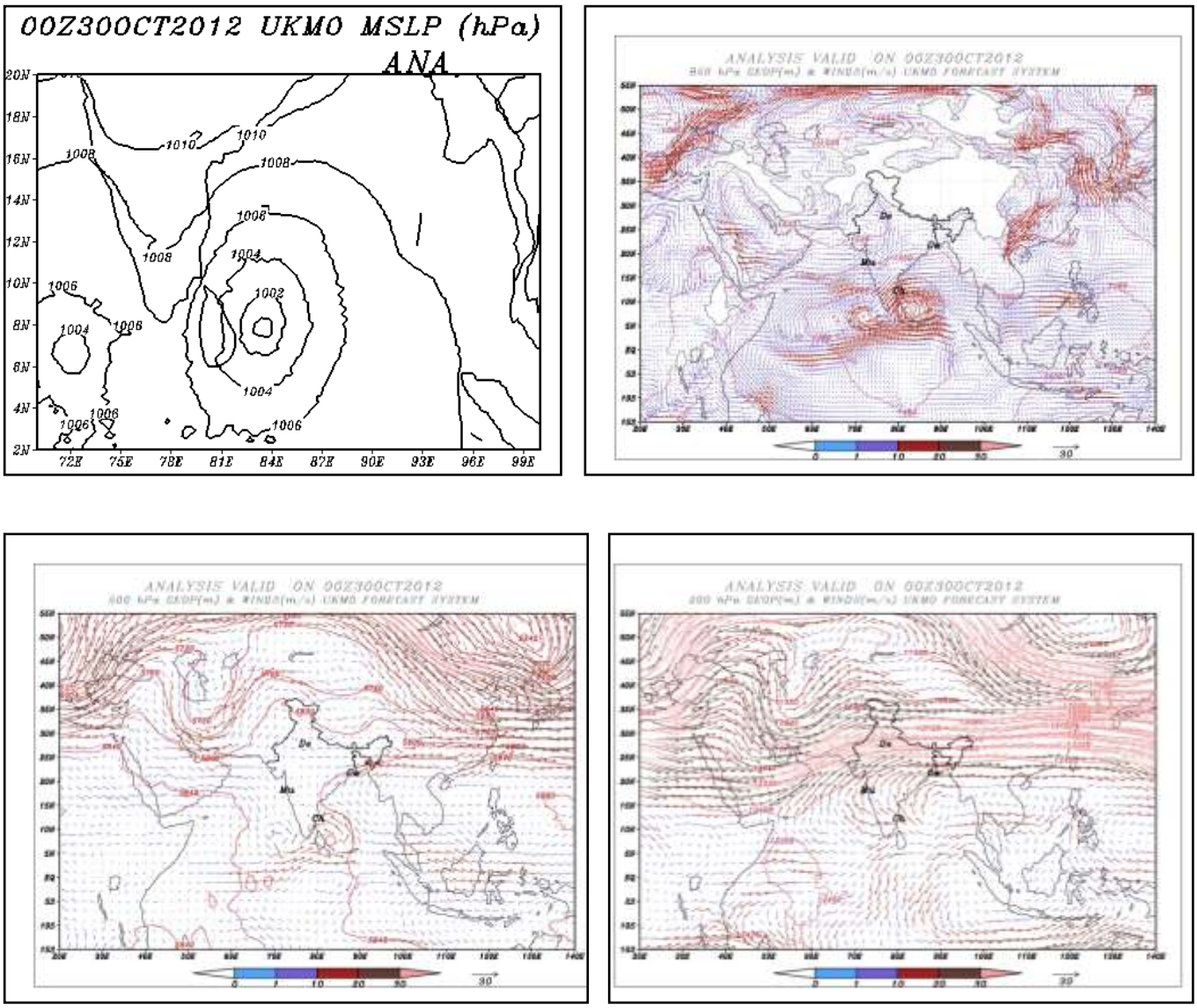



**Fig. 4.2.1.8(c) UKMO model MSLP, 850, 500 and 200 hPa wind analysis based on 00 UTC of 30th Oct. 2012**

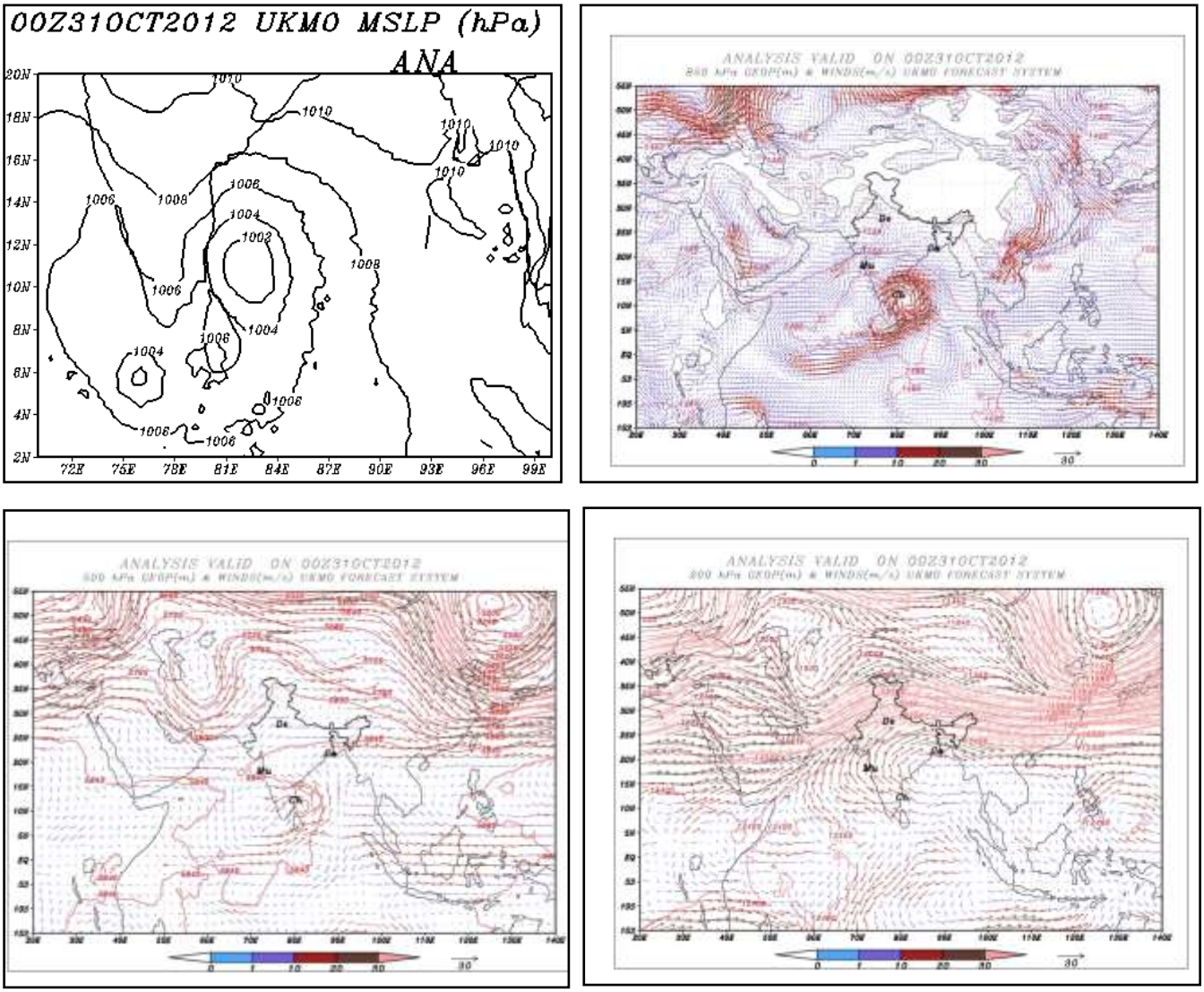



**Fig. 4.2.1.8(d) UKMO model MSLP, 850, 500 and 200 hPa wind analysis based on 00 UTC of 30th Oct. 2012**

### 4.2.1.9. Realized Weather

Under its influence gale wind speed reaching 70-80 kmph prevailed along and off north coastal Tamil Nadu, Puducherry and adjoining south Andhra Pradesh coast Available observations from meteorological observatories indicate that the maximum wind speed of 75 kmph has been reported over Chennai & 65 kmph over Kalpakkam at the time of landfall

Rainfall at most places with scattered heavy to very heavy rainfall occurred over north coastal Tamil Nadu. Rainfall at most places with isolated heavy to very heavy rainfall also occurred over north interior Tamil Nadu on 31st October and 1 November 2012. During weakening phase as a low over Andhra Pradesh, it caused rainfall at most places with scattered heavy to very heavy rainfall and isolated

extremely heavy rainfall over coastal Andhra Pradesh and isolated heavy to very heavy rainfall over Telengana, Rayalaseema and south Odisha during 2nd to 5th November 2012. Chief amounts of 24 hrs rainfall (7 cm or more) ending at 0300 UTC of 31st October- 3rd November 2012 are given below.

**Tamil Nadu and Puducherry:**

**31. 10. 2012**

Vedaranyam (Nagapattinam Dist) and Mahabalipuram (Kancheepuram Dist) 13 each, Trangambadi (Nagapattinam Dist) 10, Ennore AWS (Tiruvallur Dist), Chennai Nungambakkam (Chennai Dist), Nagapattinam (Nagapattinam Dist), Kalpakkam (Kancheepuram Dist) and Tiruvarur (Tiruvarur Dist) 9 each, Madavaram AWS (Tiruvallur Dist), Thiruthuraipoondi and Nannilam (both Tiruvarur Dist), Kelambakkam and Chennai Airport (both Kancheepuram Dist), Karaikal (Karaikal Dist) and Anna University (Chennai Dist) 8 each, Tambaram (Kancheepuram Dist), Sirkali and Mayiladuthurai (both Nagapattinam Dist), Kodavasal and Muthupet (both Tiruvarur Dist), Marakkanam and Vanur (both Villupuram Dist), Chengalpattu (Kancheepuram Dist), Cholavaram (Tiruvallur Dist), Puducherry (Puducherry Dist) and DGP office (Chennai Dist) 7 each,

**01. 11. 2012**

Yercaud (Salem Dist) 24, Alangayam (Vellore Dist) 20, Vandavasi (Tiruvannamalai Dist) 19, Tirukoilur (Villupuram Dist) 14, Vanur and Tindivanam (both Villupuram Dist) 13 each, Gingee, Villupuram and Mylam AWS (all Villupuram Dist), Ambur and Tirupattur (both Vellore Dist) and Valangaiman (Tiruvarur Dist) 11 each, Sirkali (Nagapattinam Dist), Kodavasal (Tiruvarur Dist), Polur (Tiruvannamalai Dist), Sethiathope and Tozhudur (both Cuddalore Dist), Thali (Krishnagiri Dist), Melalathur (Vellore Dist) and Naduvattam (Nilgiris Dist) 10 each, Parangipettai (Cuddalore Dist), Trangambadi and Kollidam (both Nagapattinam Dist), Penucondapuram (Krishnagiri Dist), Needamangalam (Tiruvarur Dist) and Arani (Tiruvannamalai Dist) 9 each, Chengam and Tiruvannamalai (both Tiruvannamalai Dist), Mayiladuthurai (Nagapattinam Dist), Mannargudi (Tiruvarur Dist), Colachel (Kanyakumari Dist), Chidambaram and Cuddalore (both Cuddalore Dist), Pallipattu (Tiruvallur Dist) and Tirukattupalli (Thanjavur Dist) 8 each, Aravakurichi (Karur Dist), Barur, Hosur, Denkanikottai, Krishnagiri, Uthangarai and Pochampalli (all Krishnagiri Dist), Kattumannarkoil, Chidambaram AWS and Neyveli AWS (all Cuddalore Dist), Thanjavur, Thiruvidaimaruthur, Kumbakonam, Madukkur, Vallam, Aduthurai AWS and Grand anaicut (all Thanjavur Dist), Sankarapuram (Villupuram Dist), Nannilam and Thiruthuraipoondi (both Tiruvarur Dist), Vaniaymbadi (Vellore Dist), Puducherry (Puducherry Dist), Pappireddipatti and Dharamapuri (both Dharmapuri Dist),

Thuvakudi and Pullambadi (both Trichy Dist), Eraniel (Kanyakumari Dist)a nd Kothagiri (Nilgiris Dist) 7 each,

**Karnataka:**

**01.11.2012**

Bagepalli (Chikaballapura dt) 14, Koratagere (Tumkur dt) 11, Kolar, Rayalpadu (Kolar dt), GKVK (Bengaluru Urban dt), Hoskote (Bengaluru Rural dt) 10 each, Srinivaspura (Kolar dt), Doddaballapura (Bengaluru Rural dt), Nayakanahatti (Chitradurga dt), CN Halli, Madhugiri (Tumkur dt), Thondebhavi, Gudibande (both Chikaballapura dt) 9 each, MM Hills (Chamarajanagar dt), Mulbagal, Bangarpet (both Kolar dt), Bengaluru City, Bengaluru HAL AP, Nelamangala (Bengaluru Rural dt), Hiriyur (Chitradurga dt), Kibbanahalli, Kunigal, Bargur (all Tumkur dt), Chintamani, Gowribidanur (both Chikaballapura dt) 8 each, Panchanahalli, Kadur (both Chikmagalur dt), Arasikere (Hassan dt), Bandipura (Chamarajanagar dt), Maddur (Mandya dt), Malur (Kolar dt), TG Halli (Bengaluru Urban dt), Devanahalli (Bengaluru Rural dt), Jagalur (Davangere dt), Hosanagara (Chitradurga dt), Chitradurga, Gubbi, Sira (both Tumkur dt), Sidlaghatta (Chikaballapura dt), Magadi, Channapatna, Kanakapura (all Ramanagara dt), Ramanagara 7 each,

**Coastal Andhra Pradesh**

**01/11/2012:**

**Distt. Nellore:** Vinjamur-16, Kavali-13, Rapur- 12, Kavali(a)- 11, Venkatagiri Town-11, Udayagiri-10, Atmakur-8, Gudur-8, Nellore- 8, Seetharampuram-7
**Distt. Prakasam:** Ongole-15, Darsi-14, Addanki-13, Darsi(a)-13, Cumbam-13, Podili-12.
**Distt. Krishna:** Avanigadda- 10.
**Distt. East Godavari:** Kakinada –7.
**Distt. Vishakhapatnam:** Bhimunipatnam-12,

**02/11/2012:**

**Distt. Prakasam:** Addanki-9, Darsi(a)-9, Ongole-8, Podili-7
**Distt. Guntur:** Sathenapalli- 14, Atchempet-10, Lam(a)-8, Bapatla- 8, Guntur- 7, Bapatla(a)-7, Macharla-7, Tenali-7.
**Distt. Krishna:** Vijayawada (AP)-13, Nandigama- 11, Nuzvidu- 11, Gudivada-10, Vuyyuru(a)-9, Tiruvuru-8, Avanigadda-8, Kaikalur-7.
**Distt. West Godavari:** Koderu-10, Tanuku-8, Eluru-7.
**Distt. East Godavari:** Prathipadu-11, Tuni-9, Kakinada-8.
**Distt. Vishakhapatnam:** Chintapalli-8, Araku Valley-8, Yellamanchili-7.

**Distt. Vizianagaram:** Salur-14, Bobbili- 10, Vijayanagaram- 9, Gajapathinagaram- 9, Srungavarapukota-9, Cheepurupalli-7, Parvatipuram-7.
**Distt. Srikakulam:** Palasa-8.

**03/11/2012:**

**Distt. Guntur:** Mangalgiri-18, Bapatla-14, Bapatla(a)-13, Rapalle-12, Tenali-11, Guntur-9, Lam(a)-8.
**Distt. Krishna:** Tiruvuru-21, Gudivada-15, Vuyyuru(a)-13, Avanigadda-11, Nuzvidu-9, Nandigama-8, Kaikalur-7.
**Distt. West Godavari:** Chintalapudi-17, Bhimavaram-14, Tanuku-13, Eluru-13, Tadepalligudem-13, Polavaram-10, Bhimadole-9, Koyyalagudem-8.
**Distt. East Godavari:** Rajahmundry-8.
**Distt. Vishakhapatnam:** Chintapalli-15, Chodavaram-9, Narsipatnam-8, Araku Valley-7, Anakapalli-6, Paderu-6, Anakapalle(a)-5.
**Distt. Vizianagaram:** Srungavarapukota-18, Therlam-8, Parvatipuram-7, Salur-7, Gajapathinagaram-7.
**Distt. Srikakulam:** Sompeta-8, Itchapuram-7.

**04/11/2012:**

**Distt. West Godavari:** Narasapur(a)-31, Koderu-23, Tanuku-17, Tadepalligudem-16, Narsapuram-16, Bhimavaram-14, Polavaram-12.
**Distt. East Godavari:** Amalapuram-27, Rajahmundry-25, Kakinada-20, Tuni-19, Peddapuram-17, Prathipadu-15.
**Distt. Vishakhapatnam:** Yelamanchili(a)-25, Chodavaram-22, Narsipatnam-21, Yellamanchili-18, Anakapalli-18, Anakapalle(a)-17, Visakhapatnam Ap-17, Bhimunipatnam-17, Visakhapatnam-15, Paderu-9, Araku Valley-7.
**Distt. Vizianagaram:** Vijayanagaram-19, Srungavarapukota-16, Cheepurupalli-9, Therlam-9, Gajapathinagaram-9, Salur-7.
**Distt. Srikakulam:** Ranasthalam-16, Gudivada-10, Palakonda-7,Kaikalur-7.

**05/11/2012:**

**Distt. Vishakhapatnam:** Narsipatnam-9, Bhimunipatnam-8.
**Distt. Srikakulam:** Kalingapatnam-26, Tekkali-11, Pathapatnam-9, Palasa-8.

**Rayalseema**

**31/10/2012:**

**Distt. Chittoor:** Srikalahasthi-11, Tirumalla(a)-8, Chittoor-7.

**01/11/2012:**

**Distt. Chittoor:** Tirumalla(a)-15, Venkatagirikota-11, Chittoor-9, Thambalapalli-8, Arogyavaram-8, Srikalahasthi-7, Punganur-7, Puttur-7.
**Distt. Cuddapah:** Rajampet-9.
**Distt. Anantapur:** Madakasira-8, Amarapuram-7, Penukonda-7, Kadiri-7.

**02-04/11/2012:**

**Nil**

**05/11/2012:**

**Distt. Chittoor:** Chittoor-8.

**Telangana**

**02/11/2012:**

**Distt. Khammam:** Khammam-9, Madhira-9.

**03/11/2012:**

**Distt. Khammam:** Dummugudem-15, Aswaraopet(a)-14, Venkatapuram-9, Yellandu-7.
**Distt. Warangal:** Eturnagaram-13.
**Distt. Medak:** Ramayampet-9.

The spatial distribution of rainfall activity associated with this weather system on different days from 1$^{st}$ to 6$^{th}$ November is shown in Fig. 2.3.9. It shows north-northeast ward movement of rainfall activity associated with the system. Associated with the system, heavy to very heavy rainfall was reported over Coastal Andhra Pradesh and adjoining area from 2$^{nd}$ -5$^{th}$ November.

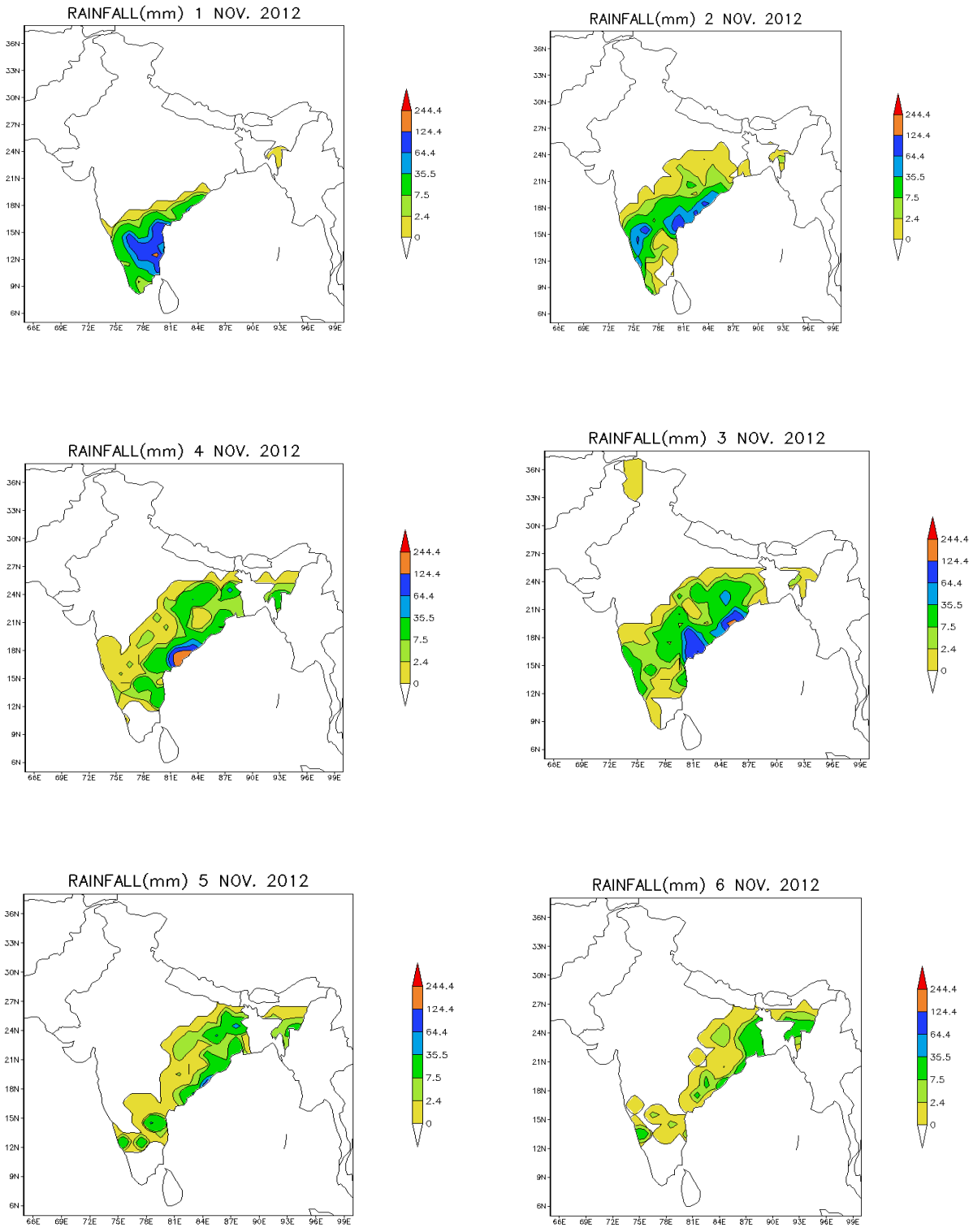



**Fig. 4.2.1.9. Spatial distribution of rainfall (mm) activity during 1st -6th November 2012. The shading is based on IMD classification of rainfall like very light, light, moderate, rather heavy, heavy, very heavy and extremely heavy rainfall**

**4.2.1.10. Damage:**

In Tamil Nadu and incessant heavy rains caused flash floods leading extensive damage. 17 people were killed and loss of live stock was 298. Paddy crop of 4646 hectares was submerged in Tiruvarur district due to heavy rains. About 5000 electric poles were damaged during the storm period. 415 huts were fully damaged and 3283 were partially damaged. 242 km of roads and 3 bridges were damaged by its impact. Samaanthipuram bridge was washed away in the flash floods in the upper reaches of Eastern Ghats. Damage photographs due to NILAM are shown in Fig. 4.2.1.9.

Samanthipuram [Lat $12^0$.39' N and Lon $79^0$.0 6' E] village situated under foothills of Eastern Ghat in Tiruvannamalai district a bridge of length 100 m was washed away in the flash floods which occurred in the upper reaches of Eastern Ghat. This Samaanthipuram Bridge is vital road link for neighboring three tribal villages. The flood water reaching Shenbahathope Dam breached near river sluice in the dam causing flash flood in KamandalaNaga Nadi- a tributary of Palar river.

**Fig. 4.2.1.9. Photographs showing damage due to cyclonic storm, NILAM**

### 4.2.2 Deep depression over Bay of Bengal (17-19 November 2012)

#### 4.2.2.1 Introduction:

A depression formed over the eastcentral Bay of Bengal from a remnant low pressure system of South China Sea, which emerged into Bay of Bengal across Thailand. It initially moved northwestwards and then westwards during 17$^{th}$ and 18$^{th}$ November. On 19$^{th}$, it started moving west-southwestwards over the westcentral Bay of Bengal. Due to entrainment of cold air from the Indian mainland in middle tropospheric levels and relatively colder sea, the deep depression weakened gradually to a low pressure area over southwest and adjoining west central Bay of Bengal off north Tamil Nadu and south Andhra Pradesh coast on 22$^{nd}$ November and became less marked on 23$^{rd}$. It caused isolated heavy rainfall over south coastal Andhra Pradesh and Rayalaseema on 22$^{nd}$ November. The salient features of this system are given below.

1. It moved westwards initially and then west-southwestwards under the influence of the middle tropospheric steering ridge.
2. It weakened over the sea due to entrainment of cold and dry air from Indian main land in middle tropospheric level.
3. There existed a well defined low level circulation centre with banding features though the convection was significantly sheared to northeast under the influence of high wind shear on 18$^{th}$ and 19$^{th}$ November.

#### 4.2.2.2 Monitoring of depression:

As the system was formed over deep sea (east central Bay), the system was mainly monitored by Satellite. The half hourly INSAT/ Kalpana imageries and products, Oceansat observations and microwave products from polar orbiting satellites were used for monitoring the location and intensity of the system. However, the available buoy and island observations helped in improving the satellite estimates of location and intensity. Various NWP and dynamical-statistical models including IMD's global and meso-scale models were utilised to predict the track and intensity of the system.

#### 4.2.2.3 Genesis:

In association with an active inter-tropical convergence zone (ITCZ), a low pressure area formed over southeast Bay of Bengal on 15$^{th}$ November 2012. It moved west-northwestwards and became well marked over southeast and adjoining eastcentral Bay of Bengal on 16$^{th}$ November. It concentrated into a depression over east central Bay of Bengal at 0600 UTC of 17$^{th}$ November 2012 near latitude 15.5$^0$N and longitude 90.0$^0$E.

Considering the environmental features, the favourable features for cyclogenesis included warmer sea surface temperature (SST), which was about 28-30$^0$C over south and central Bay of Bengal. The Ocean heat content was about 50-80 kJ/cm$^2$ over southeast and adjoining east central Bay of Bengal, i.e. around the

system centre. The upper tropospheric ridge ran along latitude $16^0$N and hence provided poleward outflow which is favourable for intensification of the system. The low level convergence and upper level divergence increased with increase in low level relative vorticity from 15th to 17th November. The vertical wind shear of horizontal wind was moderate (10-20 knots) in the morning of 17th.

**Table 4.2.2.1 Best track positions and other parameters of Deep Depression over the Bay of Bengal during 17-19 November, 2012**

| Date | Time (UTC) | Centre lat.$^0$ N/ long.$^0$ E | C.I. NO. | Estimated Central Pressure (hPa) | Estimated Maximum Sustained Surface Wind (kt) | Estimated Pressure drop at the Centre (hPa) | Grade |
|---|---|---|---|---|---|---|---|
| 17.11.2012 | 0600 | 11.5/90.0 | 1.5 | 1004 | 25 | 3 | D |
| | 1200 | 16.0/89.0 | 2.0 | 1002 | 30 | 5 | DD |
| | 1800 | 16.0/89.0 | 2.0 | 1002 | 30 | 5 | DD |
| 18.11.2012 | 0000 | 16.0/88.5 | 2.0 | 1002 | 30 | 5 | DD |
| | 0300 | 16.0/88.5 | 2.0 | 1002 | 30 | 5 | DD |
| | 0600 | 16.0/88.0 | 2.0 | 1002 | 30 | 5 | DD |
| | 1200 | 16.0/87.5 | 2.0 | 1002 | 30 | 5 | DD |
| | 1800 | 16.0/87.5 | 2.0 | 1002 | 30 | 5 | DD |
| 19.11.2012 | 0000 | 15.5/87.0 | 1.5 | 1004 | 25 | 3 | D |
| | 0300 | 15.0/86.5 | 1.5 | 1004 | 25 | 3 | D |
| | 0600 | 15.0/86.5 | 1.5 | 1004 | 25 | 3 | D |
| | 1200 | 15.0/86.0 | 1.5 | 1005 | 20 | 3 | D |
| | 1500 | Weakened into a well marked low pressure area over west central Bay of Bengal | | | | | |

**4.2.2.4 Intensification and Movement:**

The favourable conditions of 17th November morning, as mentioned in the previous section continued in the evening of the same day. In their association, the depression moved initially west-northwestwards and intensified into deep depression at 1200 UTC of 17th November over east central Bay of Bengal near latitude $16.0^0$N and longitude $89.0^0$E. However, as it was lying very close to the upper tropospheric ridge, the movement of the deep depression became slow thereafter. It moved westwards under the influence of the middle tropospheric steering ridge upto 1200 UTC of 18th. After remaining stationary for some time, it moved then west-southwestward and weakened into a Depression at 0000 UTC of 19th. It further weakened into a well marked low pressure over west central Bay of Bengal at 1500 UTC of 19th. As a low pressure area, it moved west-southwestwards close to north Tamil Nadu and south Andhra Pradesh coast during 19th to 24th November, 2012.

The weakening of the system could be attributed to (i) entrainment of dry and cold air into the system from the Indian land mass in the lower and middle tropospheric levels, (ii) gradual increase in the vertical wind shear resulting in the northeastward shearing of convection from the low level circulation centre.

The track of this deep depression is shown below in Fig. 4.2.2.1. The best track parameters are shown in Table 4.2.2.1. The crucial observations supporting the best track are given in Table 4.2.2.2.

**Table 4.2.2.2 Crucial surface observations over Bay of Bengal during Deep Depression (17-19 November 2012)**

**Table 4.2.2.3 Satellite observations of deep depression (14-22 November, 2012)**

| Observational Tool | Time (UTC) | Position of Buoy | Observastion |
|---|---|---|---|
| Buoy | 171200 | $16.5^0$N/$88.0^0$E | MSLP: 1004.2 hPa<br>24 hours Pressure fall: 2.9 hPa<br>Wind: 050/25 kts |
| | 180600 | $16.5^0$N/$88.0^0$E | MSLP: 1005.4 hPa<br>Wind: 070/27 kts |
| | 180900 | $16.5^0$N/$88.0^0$E | Wind: 090/30 kts |
| | 181200 | $16.5^0$N/$88.0^0$E | Wind: 100/25 kts |
| | 190300 | $16.5^0$N/$88.0^0$E | MSLP: 1008.4 hPa<br>Wind: 070/18 kts |
| | 191200 | $16.5^0$N/$88.0^0$E | MSLP: 1007.6hPa<br>Wind: 110/14 kts |
| | | $13.5^0$N/$84.0_0$E | Wind: 340/16 kts |
| Microwave imagery | 191138 | F-16 | Wind: 20-15 kts |

| Date | Time (UTC) | Lat (N) | Long (E) | Intensity (T No/ CI No) | CTT |
|---|---|---|---|---|---|
| 14.11.12 | 0900 | - | - | LLC | - |
| 16.11.12 | 0300 | 14.5 | 91.0 | 1.0 | -71 |
| | 0600 | 14.5 | 91.0 | 1.0 | -73 |
| | 0900 | 14.5 | 91.0 | 1.0 | -69 |
| | 1200 | 14.5 | 91.0 | 1.0 | -68 |
| | 1500 | 14.5 | 90.5 | 1.0 | -73 |
| | 1800 | 14.5 | 90.5 | 1.0 | -79 |
| | 2100 | 14.5 | 90.5 | 1.0 | -82 |
| 17.11.12 | 0000 | 14.5 | 90.5 | 1.0 | -84 |
| | 0300 | 14.5 | 90.0 | 1.0 | -77 |
| | 0600 | 15.5 | 90.0 | 1.5 | -77 |
| | 0900 | 15.5 | 89.5 | 2.0 | -75 |
| | 1200 | 15.9 | 89.2 | 2.0 | -71 |
| | 1500 | 16.1 | 89.0 | 2.0 | -77 |
| | 1800 | 16.1 | 88.9 | 2.0 | -79 |
| | 2100 | 16.1 | 88.9 | 2.0 | -79 |
| 18.11.12 | 0000 | 16.1 | 88.8 | 2.0 | -75 |
| | 0300 | 16.1 | 88.5 | 2.0 | -75 |
| | 0600 | 16.1 | 88.2 | 2.0 | -64 |
| | 0900 | 16.1 | 88.0 | 1.5/2.0 | -59 |

| | | | | | |
|---|---|---|---|---|---|
| | 1500 | 16.0 | 87.8 | 1.5/2.0 | -52 |
| | 1800 | 15.8 | 87.5 | 1.5/2.0 | -52 |
| | 2100 | 15.4 | 87.1 | 1.5/2.0 | -50 |
| 19.11.12 | 0000 | 15.3 | 86.9 | 1.5/2.0 | -50 |
| | 0300 | 15.1 | 86.8 | 1.5/2.0 | -36 |
| | 0600 | 15.1 | 86.6 | 1.5/2.0 | -34 |
| | 0900 | 15.0 | 86.4 | 1.5/2.0 | -37 |
| | 1200 | 15.0 | 86.2 | 1.5/2.0 | -45 |
| | 1500 | 15.0 | 86.0 | 1.0/1.5 | -60 |
| | 1800 | 15.0 | 86.0 | 1.0/1.5 | -68 |
| | 2100 | 15.0 | 85.5 | 1.0/1.5 | -68 |
| 20.11.12 | 0000 | 15.0 | 85.0 | 1.0/1.5 | -67 |
| | 0300 | 15.0 | 85.0 | 1.0/1.5 | -68 |
| | 0600 | 15.0 | 85.0 | 1.0/1.5 | -60 |
| | 0900 | 15.0 | 84.5 | 1.0/1.5 | -68 |
| | 1200 | 14.9 | 84.5 | 1.0/1.5 | -68 |
| | 1500 | 14.9 | 84.3 | 1.0/1.5 | -70 |
| | 1800 | 14.7 | 84.0 | 1.0/1.5 | -81 |
| | 2100 | 14.5 | 83.8 | 1.0/1.5 | -85 |
| 21.11.12 | 0000 | 14.5 | 83.5 | 1.0/1.5 | -87 |
| | 0300 | 14.0 | 83.5 | 1.0/1.5 | -79 |
| | 0600 | 14.0 | 83.0 | 1.0/1.5 | -68 |
| | 0900 | 14.0 | 83.0 | 1.0/1.5 | -75 |
| | 1200 | 14.0 | 83.0 | 1.0/1.5 | -75 |
| | 1500 | 14.0 | 82.8 | 1.0/1.5 | -50 |
| | 1800 | 14.0 | 82.6 | 1.0/1.5 | -50 |
| | 2100 | 13.9 | 82.4 | 1.0/1.5 | -67 |
| 22.11.12 | 0000 | 13.9 | 82.4 | 1.0/1.5 | -70 |
| | 0300 | 13.0 | 82.5 | 1.0 | -64 |
| | 0600 | - | - | LLC | - |

#### 4.2.2.5 Estimated central pressure (ECP) and maximum sustained surface wind (MSW)

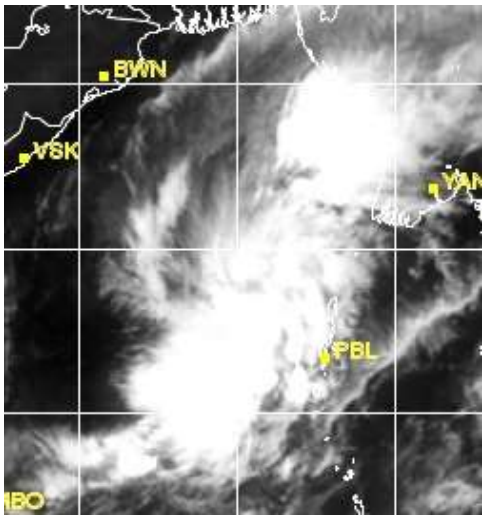
The estimated central pressure (ECP) of the system decreased from 1004 hPa at genesis stage to 1002 hPa at the stage of deep depression. The maximum sustained surface wind (MSW) reached upto 30 knots during 1200 UTC of 17$^{th}$ to 1800 UTC of 18$^{th}$ November 2012. The MSW was also supported by available scatterometry wind observations from various satellites including Oceansat-II.

#### 4.2.2.6 Satellite observations

A low level circulation developed over east-central (EC) Bay of Bengal on 14$^{th}$ November at 0900UTC which intensified into a vortex with intensity T1.0 and lay centered near 10.0$^0$N/91.0$^0$E at 0300 UTC of 16$^{th}$ November. The system remained

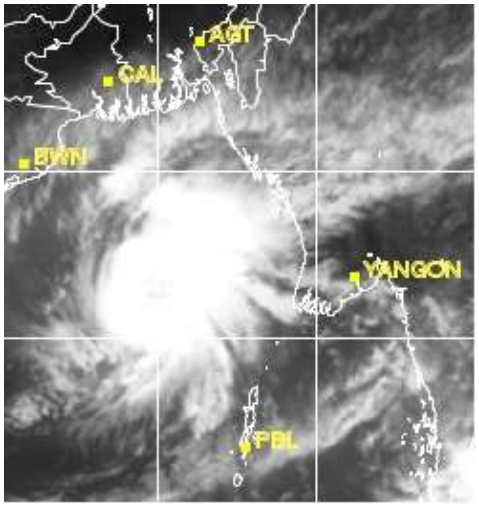
stationary till 1200 UTC and then moved westward till 0300 UTC of 17th. At 0600 UTC of 17th, the system intensified into T1.5 with centre at 15.5N/90.0E, it further intensified into T2.0 at 0900 UTC of 17th with centre near $15.5^0$N/$89.5^0$E and started moving northwestward. The intensity of the system decreased to T1.5 at 0900 UTC of 18th when its position was $16.1^0$N/$88.0^0$E. Intensity further decreased to T1.0 at 1500 UTC of 19th. It became less marked at 0600 UTC of 22nd and remained as Low level circulation near $13.0^0$N/$82.5^0$E.

Formation of vortex (T1.0)



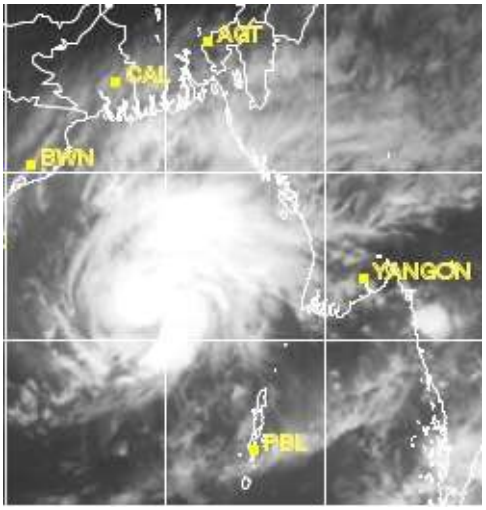

16.11.2012, 0300 UTC

Intensified into Depression (T1.5)



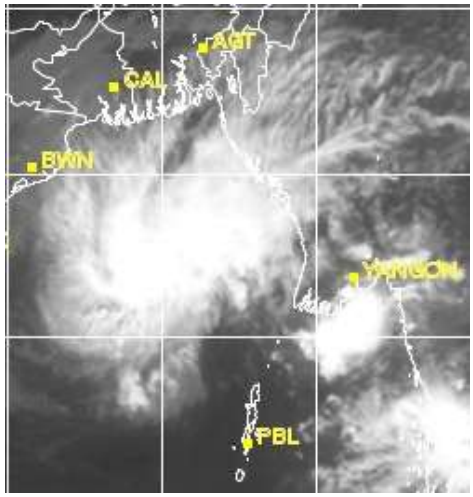

7.11.2012, 0600 UTC

Intensified in to Deep Depression (T2.0)




17.11.2012, 0900 UTC

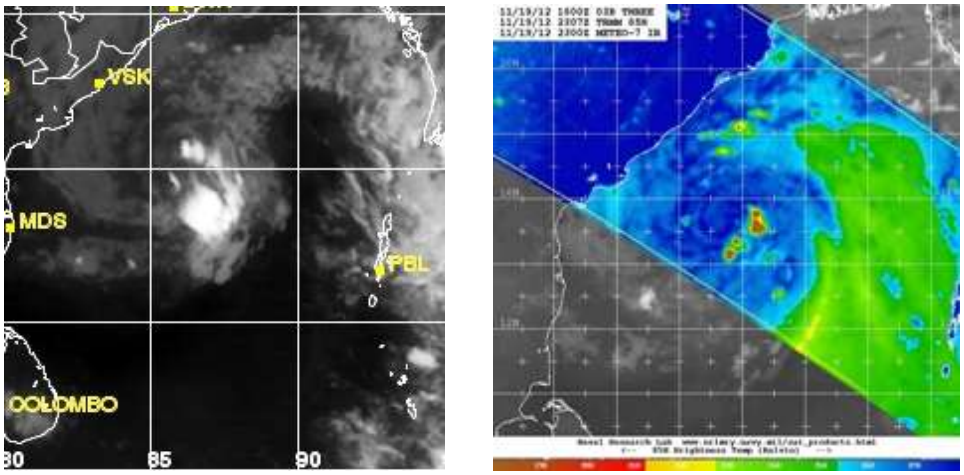
Reduced into Depression (T1.5)




18.11.2012, 0900 UTC

**Fig. 4.2.2.1 Typical satellite imageries showing genesis, intensification, movement of the deep depression (16-18 November 2012)**

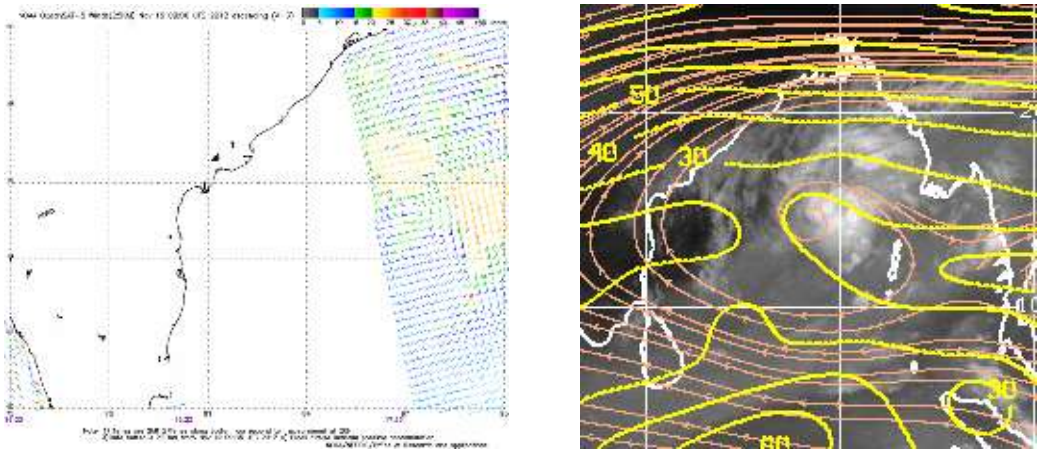
Reduced in to LLC (T1.0) Microwave image




19.11.2012, 1500 UTC 19.11.2012 2307 UTC

**Fig. 4.2.2.1(contd.) Typical satellite imageries showing decay of the deep depression on 19 November 2012**

Oceansat-2 Wind Wind shear




18.11.2012, 1723 UTC 17.11.2012, 0300 UTC

**Fig. 4.2.2.2 Typical Oceansat-II based surface wind at 1723 UTC of 18 November 2012 and Meteosat based vertical wind shear at 0300 UTC of 17 November 2012**

The convective cloud clusters got organized gradually and also there was deep convection. The lowest cloud top temperature (CTT) was about -75$^0$C in the morning of 17$^{th}$. The Madden Julian Oscillation (MJO) index lay over lay over phase 5 with amplitude greater than 1. The The MJO index at phase 5 is favourable for cyclogenesis over the Bay of Bengal. The typical satellite imageries of the system are shown in Fig. 4.2.2.1. Detailed satellite observations are shown in Table 4.2.2.3.

### 4.2.2.7 NWP model performance

The analysis and forecast fields of MSLP and wind at 850, 500 and 200 hPa levels based on ECMWF and IMD GFS models for the period of deep depression are shown in Fig. 4.2.2.3. The genesis, intensity and movement of the deep depression could be reasonably predicted by these two models. The circulation pattern further indicates that the system was steered by the middle tropospheric flow pattern.

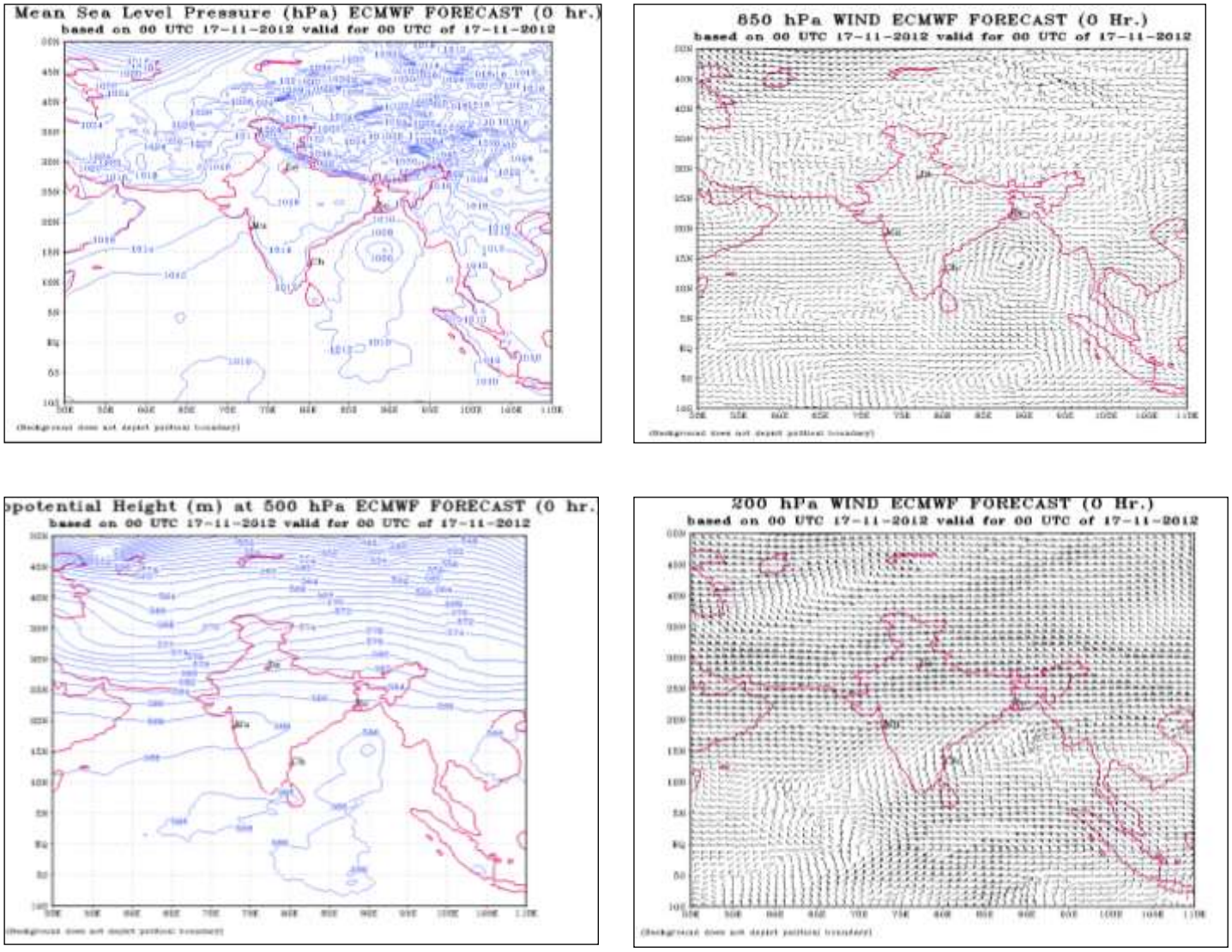



**Fig. 4.2.2.3(a) ECMWF model analyses of MSLP and wind geopotential height at 850, 500 and 200 hPa levels based on 0000 UTC of 17 November 2012.**

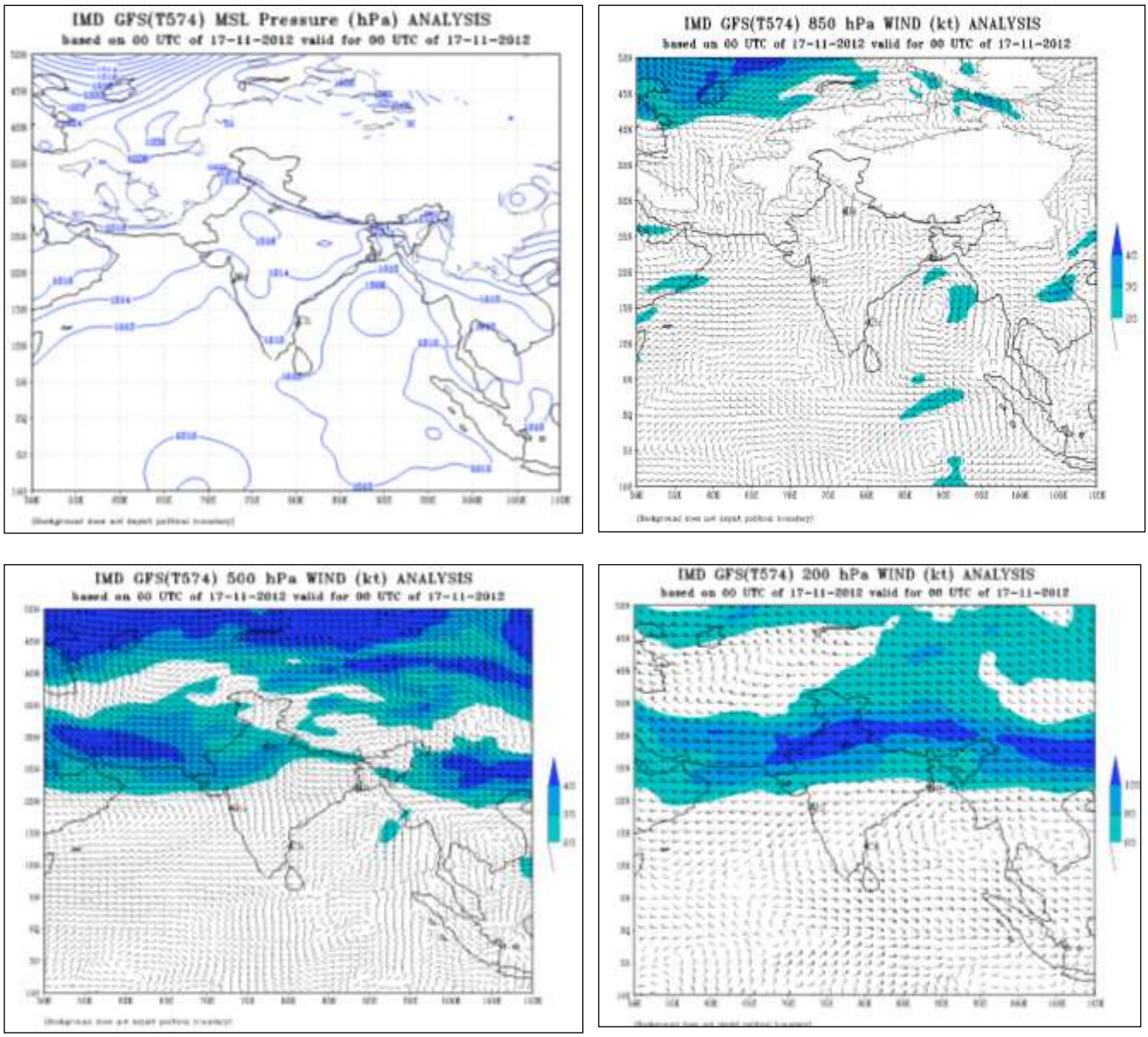



**Fig. 4.2.2.3(b) IMD GFS model analyses of MSLP and wind at 850, 500 and 200 hPa levels based on 0000 UTC of 17 November 2012.**

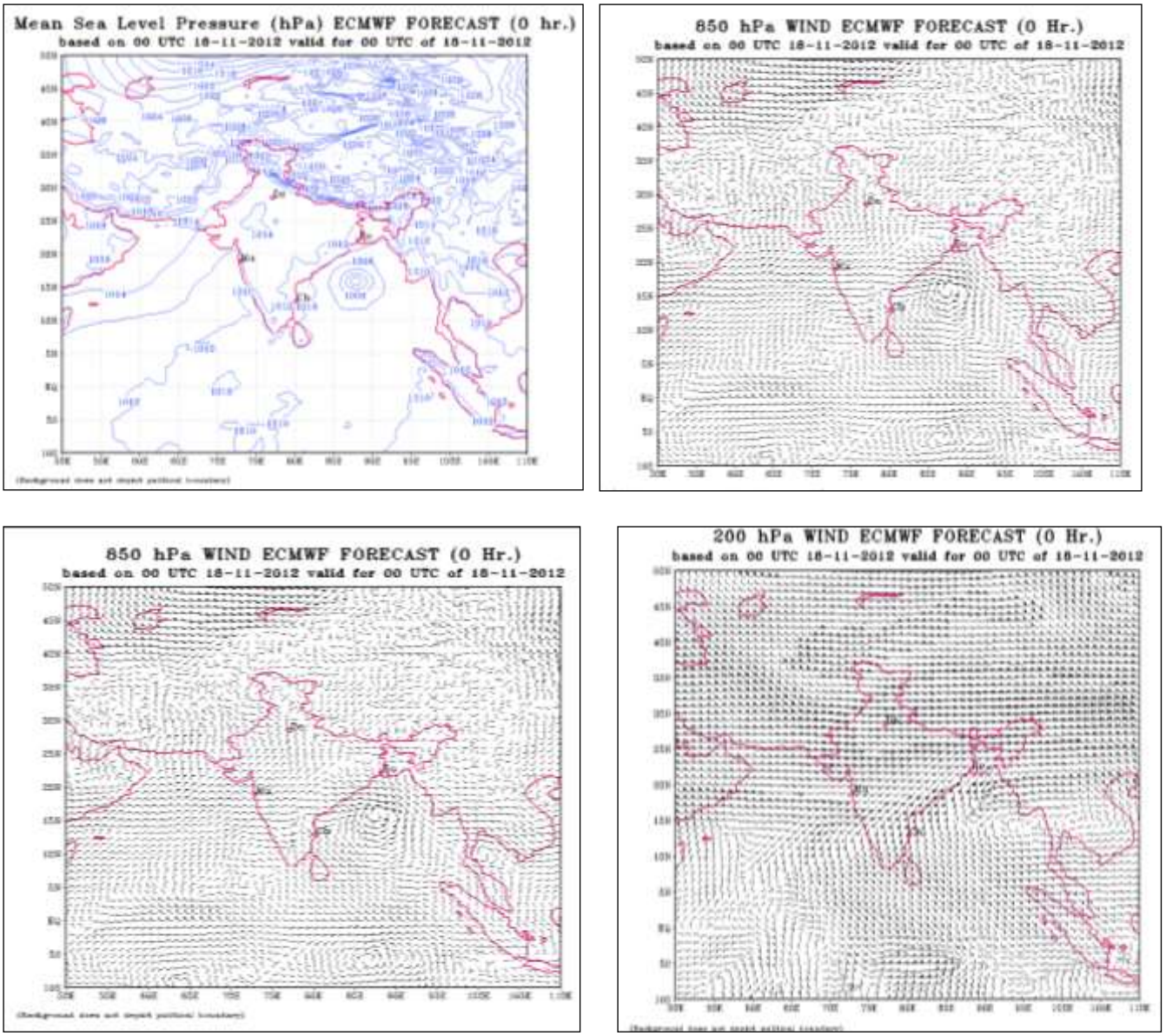



**Fig. 4.2.2.3(c) ECMWF model analyses of MSLP and wind at 850, 500 and 200 hPa levels based on 0000 UTC of 18 November 2012.**

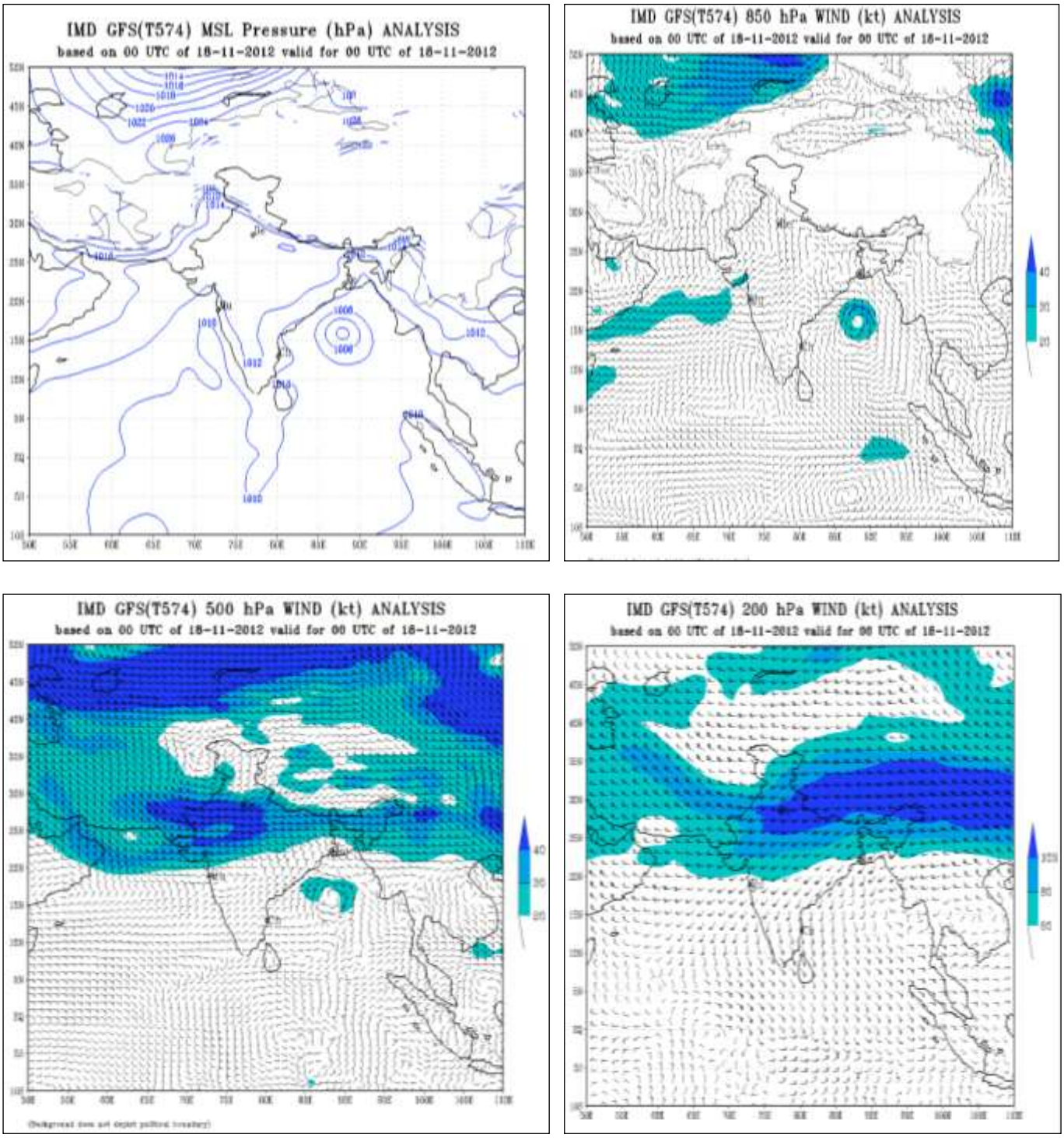



**Fig. 4.2.2.3(d) IMD GFS model analyses of MSLP and wind at 850, 500 and 200 hPa levels based on 0000 UTC of 18 November 2012.**

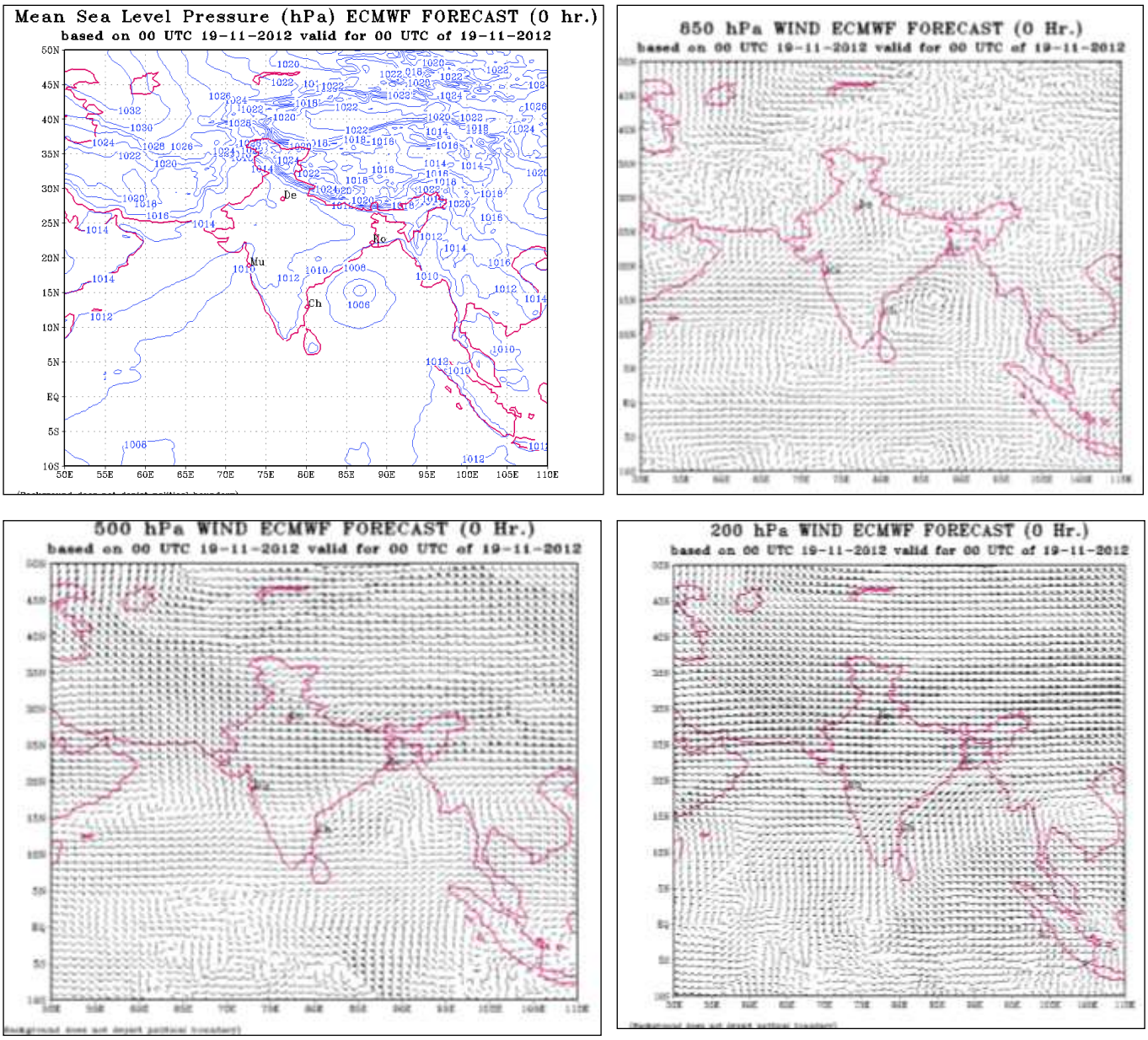



**Fig. 4.2.2.3(e) ECMWF model analyses of MSLP and wind at 850, 500 and 200 hPa levels based on 0000 UTC of 19 November 2012.**

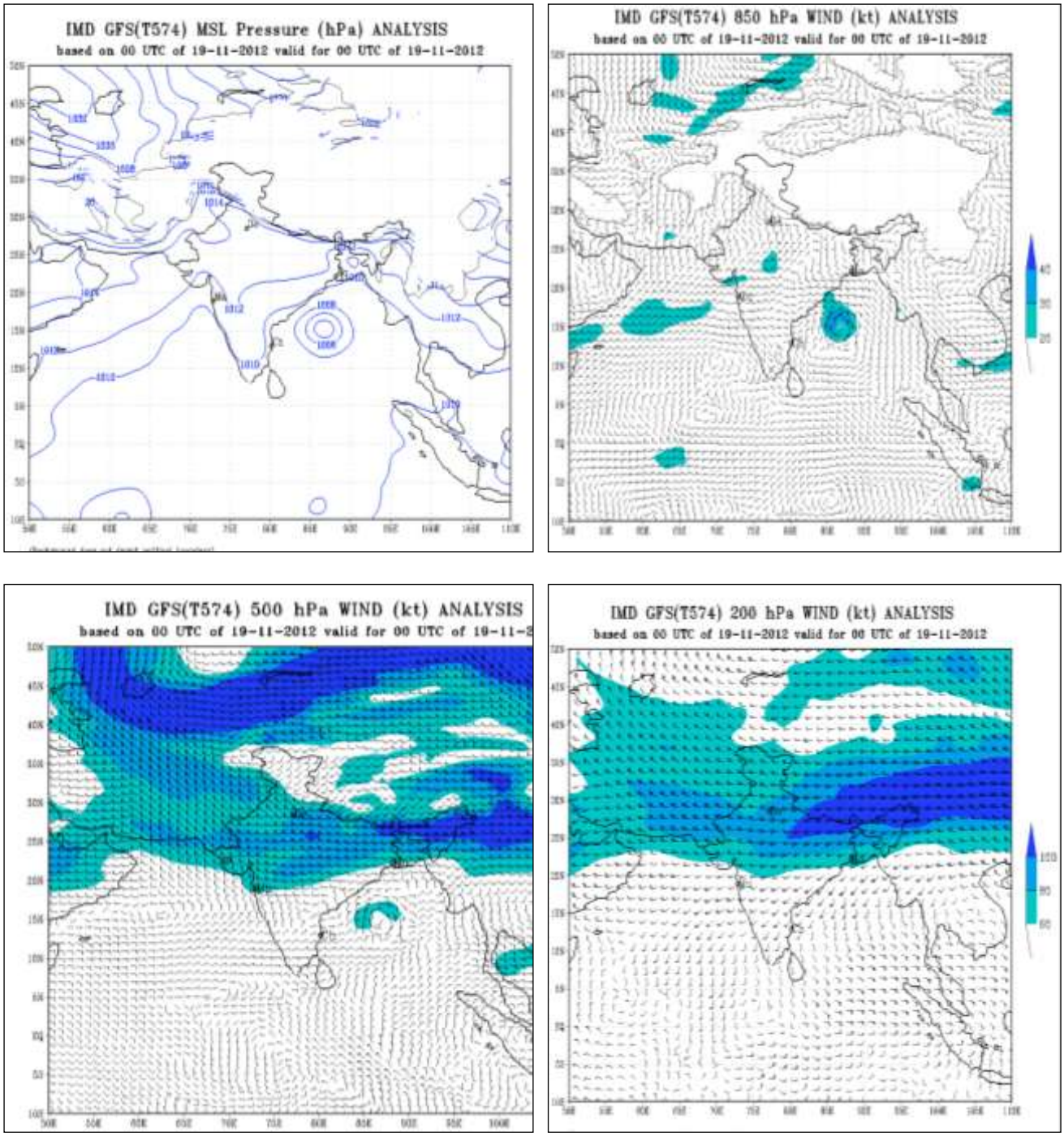



**Fig. 4.2.2.3(f) IMD GFS model analyses of MSLP and wind at 850, 500 and 200 hPa levels based on 0000 UTC of 19 November 2012.**

### 4.2.2.8. Realised Weather

Heavy rainfall occurred over Andhra Pradesh, Puducherry and Tamil Nadu due the remnant low pressure area of this depression. The chief amount of 24 hrs cumulative rainfall (5 cm or more) ending at 0300 UTC of date are given below.

**22 November 12**

Tamil Nadu & Puducherry: Sathanur Dam-10, Padalur-6, Sankarapuram-5,

**23 November 2012**

Coastal Andhra Pradesh: Tada-7,
Rayalaseema: Tirupati (AP)-14, Perumallapalli and Puttur-7 each, Tirupati and Rajampet-6 each, Pakala-5,
Tamil Nadu & Puducherry: Pallipattu-6,

**24 November 2012**

Tamil Nadu & Puducherry: Chengalpattu-14, Watrap and Tuticorin-10 each, Usilampatti, Bodinaickanur, Virudachalam-7 each, Coonoor-6, Viralimalai, Maduranthagam, Kothagiri, Ulundurpet, Vellore, Sirkali and Keeranur-5 each,

**25 November 2012**

Tamil Nadu & Puducherry: Manimutharu-14, Thenkasi-12, Shencottah and Maniyachi-6 each, Illuppur-5.

**4.2.2.9. Damage:**
There was no damage due to the deep depression as, it weakened over the sea.

## CHAPTER-V

## Daily Weather summary and advisories issued during FDP-2012

FDP-2012 was conducted during the period 15 Oct.-30 Nov., 2012. NOC, Delhi and FOC, Chennai worked in liaison with other ACWCs & CWCs for observation, collection and transmission of data during the period. The details of the daily Weather Summaries & Advisories issued during the period are discussed below:

### FDP (Cyclone) NOC Report Dated 15 October, 2012

**Synoptic features based on 0300 UTC:**

- The Southwest Monsoon has further withdrawn from remaining parts of Bihar, Jharkhand, Chattisgarh, Vidarbha, Marathwada, Madhya Maharashtra, Konkan & Goa; some parts of West Bengal & Sikkim, Odisha, Telangana and north interior Karnataka and some more parts of central Arabian Sea. The withdrawal line passes through Gangtok, Malda, Bankura, Keonjhargarh, Koraput, Hyderabad, Gadag, Karwar, Lat. 15° N / Long. 70° E and Lat. 15° N / Long. 60° E. Conditions are favourable for further withdrawal of the southwest monsoon from remaining parts of the country; Bay of Bengal and Arabian Sea during next 2– 3 days. Conditions are also favourable for commencement of northeast Monsoon rains over Tamil Nadu, Kerala and adjoining areas of Andhra Pradesh and Karnataka around 18th – 19th October 2012.
- A trough in lower level easterlies lies over south Andaman Sea and adjoining Tenasserim coast.
- A trough OF Low Pressure extends from westcentral Bay of Bengal to Gulf of Mannar.
- cyclonic circulation lies over Lakshadweep area and adjoining southeast Arabian Sea persists and extends upto 1.5 km a.s.l.
- The wind discontinuity extending upto 1.5 kms a.s.l. runs from northeast Bay of Bengal to south Tamil Nadu coast across northwest & west central Bay of Bengal.
- 24 hrs pressure change is not significant over Andaman & Nicober island , Thailand, Myanmar, Bangladesh, and east coast of India (+1 to 2 hPa)
- Rainfall has occurred at most places over Kerala and Tamilnadu; at a many places over south interior Karnataka and Andaman & Nicobar.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 29-30$^0$C over central Bay of Bengal.
- Buoys data show that warm SST around 29-30$^0$C over the central Bay of Bengal over cyclogenesis area.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ $cm^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ $cm^{-2}$ over north Bay of Bengal and many parts of west central Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive from North Bay of Bengal to Coastal Tamil Nadu.

**Convergence:**

- Lower level convergence of the order of 5-10* $10^{-5}$ $s^{-1}$ prevails over the east equatorial Indian Ocean region.

**Divergence:**

- Upper air positive divergence of 10*$10^{-5}$ $s^{-1}$ prevails over the peninsular region and adjoining Indian Ocean.

**Wind Shear:**

- Wind Shear is moderate (10 knots) over south and north Bay of Bengal and low over central Bay of Bengal.

**Wind Shear Tendency:**

- Increasing order of 5 to 10 knots over north and south Bay of Bengal and and no significant change over central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hpa PASSES THROUGH LATITUDE 13.0°N near 80 deg.E and 15 deg. N near 95 deg. E

**M.J.O. Index:**

- Located over phase 1 with amplitude about 1.0.
- Statistical forecast: - MJO moves through phase 1, during next 4 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude about 1.0 and may continue with phase 1 during next 4 days with increasing amplitude.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

**Satellite**

Inference based on INSAT imagery of 150600 UTC

- A low level circulation has formed from 15/0300UTC over southeast Arabian Sea adjoining north Maldives. Associated low/medium clouds are observed between lat 4.0N to 12.0N and long 62.5E to 75.0E. IR imagery indicates minimum cloud top temperature is around -67.0°C.

- ASCAT pass of 14/1713UTC shows circulation at lower level. There is no pass from Oceansat-II over this region.

**Bay of Bengal:**

- Convective Clouds are observed over Equatorial East Indian Ocean. IR Imagery indicates minimum cloud top temperature around -50.0°C
  (See ftp://192.168.12.75/imd/satmet
  http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** model shows formation of a CYCIR over southeast Bay of Bengal during next 24 hrs. The system likely to move westwards and shows no intensification of the system during next seven days. The 500 hPa and 200 hPa wind are given in **Annexure II.**
- **ECMWF** model also shows formation of a CYCIR over southeast Bay of Bengal during next 24 hrs. The system likely to move westwards and shows no intensification of the system. The vorticty, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **WRF-ARW** model also shows formation of a CYCIR over southeast Bay of Bengal during next 24 hrs. The system likely to move westwards and lies over southwest Bay of Bengal in 72 hrs and shows no intensification of the system.
- **UKMET Unified** model analysis of 0000 UTC of 14 October 2012 shows a cyclonic circulation over southeast Arabian Sea. Model forecast shows formation of a CYCIR over southeast Bay of Bengal on 16 October 2012. Model forecasts also show that both the system likely to move westwards and no intensification of the systems.

(http://www.imd.gov.in/section/nhac/dynamic/welcome.htm )
(http://www.ncmrwf.gov.in/)

**Genesis Potential Parameter (GPP):** The GPP analysis shows isolated cell of GPP of 30 over the NIO. Model forecast of GPP suggests no development of GPP area during next seven days. GPP charts for 24 and 48 hours are shown in **Annexure II**.
( http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm)

**Summary and Conclusion:**

- There is a potential area over the southeast Bay of Bengal close to equator, as it is associated with favourable lower level convergence, upper level divergence, moderate vertical wind shear and high Ocean thermal energy (> 100 KJ/ cm square). However, it is not supported by large scale circulation with unfavourable MJO and its location near the equator. Under these conditions, trough in lower level easterlies over south Andaman Sea and adjoining Tenasserim coast may lead to development of an upper cyclonic circulation during next 2-3 days.
- No cyclogenesis is likely over Bay of Bengal during next 5 days.

**Advisory:**

- **NO IOP is declared for next 3 days.**

## Annexure-I

### Status of Observation system:

**Synop**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **14/12** | **1/00** | **1703** |
| **India** | 191/205 | 111/159 | 192/208 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 1617 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 1/11 | 0 | 0 |
| **Myanmar** | 10/11 | 7/11 | 7/11 |
| **Thailand** | 1 | 1 | 1 |
| **Srilanka** | 7/9 | 6/9 | 6/9 |

**AWS**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **14/12** | **15/00** | **15/03** |
| **India** | - | 0 | 95 |
| **WB** | - | 0 | 11 |
| **ODS** | - | 0 | 27 |
| **AP** | - | 0 | 30 |
| **TN** | - | 0 | 25 |
| **PDC** | - | 0 | 1 |
| **A & N island** | - | 0 | 1 |

- **RS/RW** (12Z) of 14 -10-2011: 7/39
- **No. of Ascents reaching 250 hPa levels: -, MISDA:-32**
- **RS/RW** (00Z) of 17 -10-2011: 19/39
- **No. of Ascents reaching 250 hPa levels: - , MISDA: 20**

**No. of PILOT Ascents**

| 14/12Z | 15/00Z |
|---|---|
| 17/37 | 21/34 |

**Buoy Data**

| 16/12Z | 17/00Z | 17/03Z |
|---|---|---|
| 14 | 11 | 10 |

**Data statistics over RMC, Chennai region**

**No of Synop data**

| **Date→** | | | | **14.10.2012** | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **22** | **20** | **20** | **22** | **19** | **19** | **18** |

**No. of RS/RW Ascents**

**00Z / 14.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /14.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

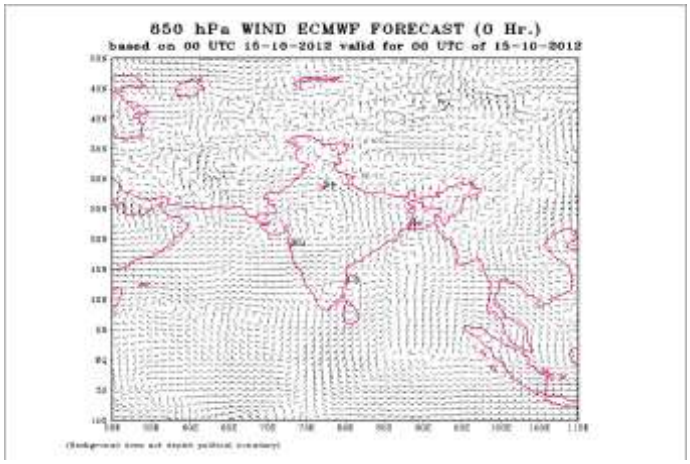
**MISDA : 8**

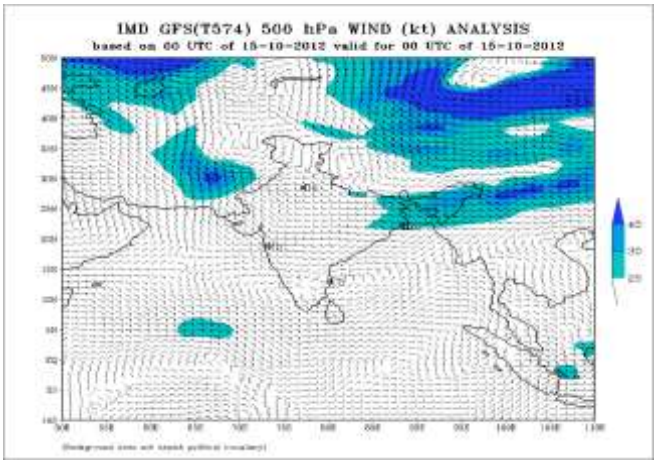
**No. of PILOT Ascents:**

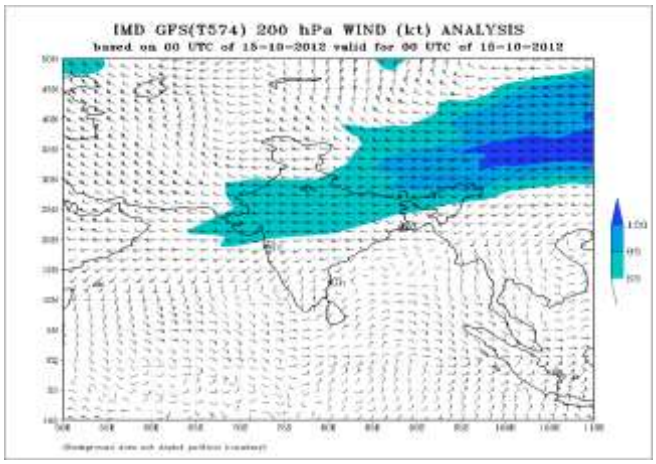
**14.10.2012**

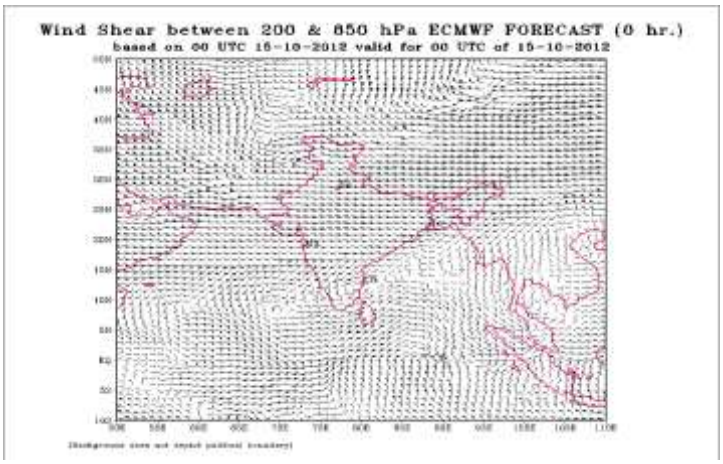
| 06Z | 18Z |
|---|---|
| 5 | 0 |

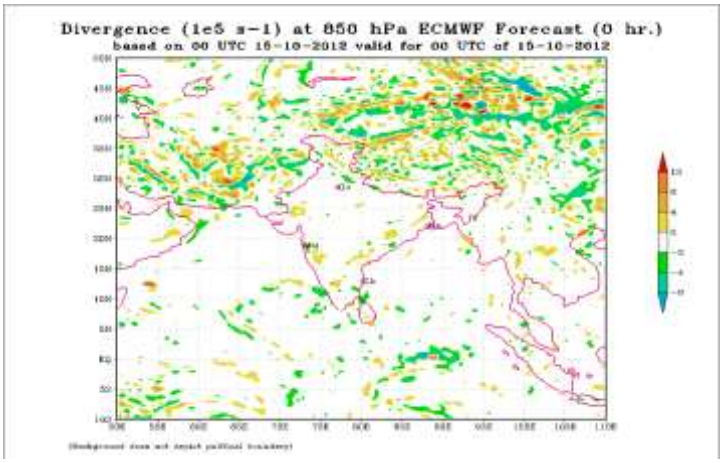
## Annexure II

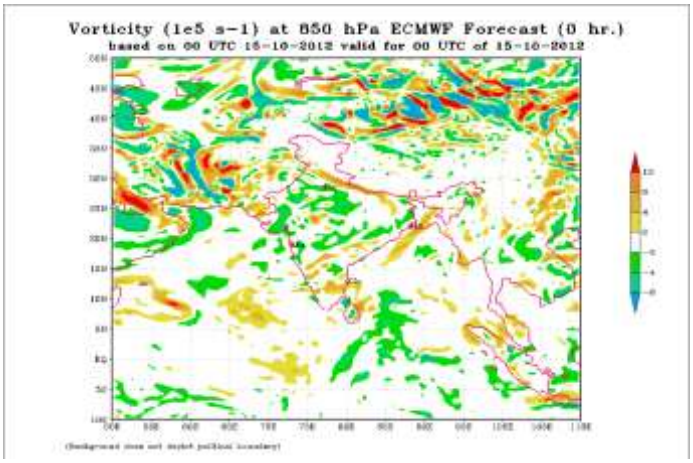

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 15-10-2012 valid for 00 UTC of 15-10-2012

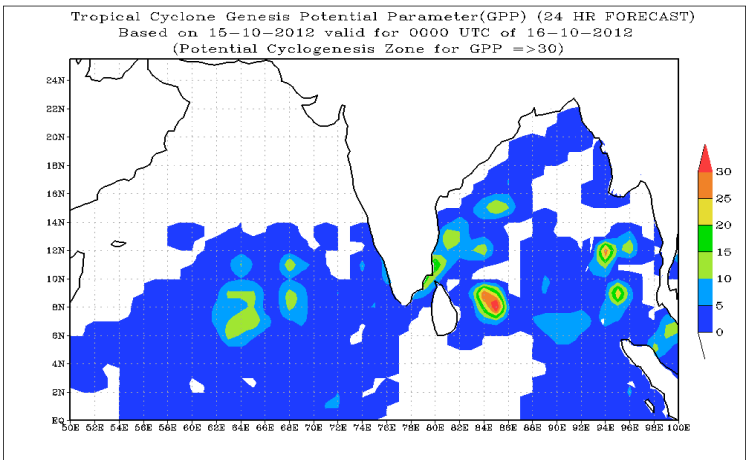

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 15-10-2012 valid for 00 UTC of 15-10-2012

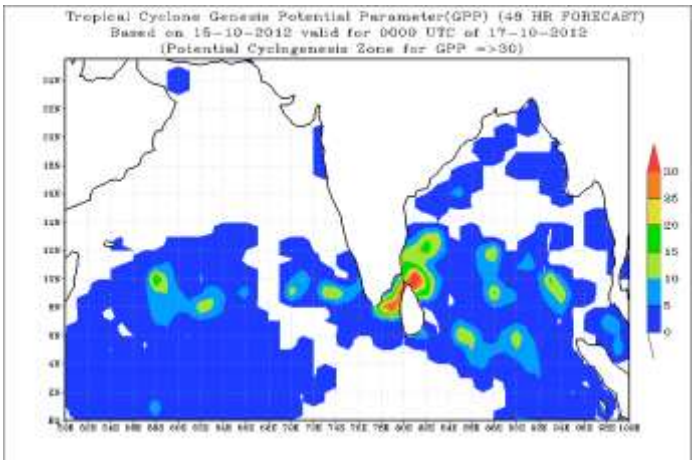

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 15-10-2012 valid for 00 UTC of 15-10-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 15-10-2012 valid for 00 UTC of 15-10-2012


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 15-10-2012 valid for 00 UTC of 15-10-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 15-10-2012 valid for 00 UTC of 15-10-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 15-10-2012 valid for 0000 UTC of 16-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 15-10-2012 valid for 0000 UTC of 17-10-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 16 October, 2012

**Synoptic features based on 0300 UTC:**

- The Southwest Monsoon has further withdrawn from remaining parts of West Bengal & Sikkim and Odisha; entire northeastern States; most parts of north Bay of Bengal; some parts of coastal Andhra Pradesh and some more parts of Telangana. The withdrawal line passes through Lat. 19° N / Long. 94° E, Lat. 18° N / Long. 90° E, Kalingapatnam, Hyderabad, Gadag, Karwar, Lat. 15° N / Long. 70° E and Lat. 15° N / Long. 60° E. Conditions continue to remain favourable for further withdrawal of the southwest monsoon from remaining parts of the country; Bay of Bengal and Arabian Sea during next 48 hours.Conditions also continue to remain favourable for commencement of northeast Monsoon rains over Tamil Nadu, Kerala and adjoining areas of Andhra Pradesh and Karnataka around 18th – 19th October 2012.
- The cyclonic circulation over Lakshadweep area and adjoining southeast Arabian Sea persists and now extends upto 3.1 km a.s.l.
- The trough in lower level easterlies over south Andaman Sea and adjoining Tenasserim coast persists.
- A cyclonic circulation lies between 1.5 & 4.5 kms a.s.l. over southwest Bay of Bengal off Tamil Nadu coast.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 29-30$^0$C over central Bay of Bengal.
- Buoys data show that warm SST around 29-30$^0$C over the central Bay of Bengal over cyclogenesis area.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ cm$^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ cm$^{-2}$ over north Bay of Bengal and many parts of west central Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive from North Bay of Bengal to Coastal Tamil Nadu.

**Convergence:**

- Lower level convergence of the order of 5-10* 10$^{-5}$ s$^{-1}$ prevails over the east equatorial Indian Ocean region and adjoining Southwest Bay of Bengal .

**Divergence:**

- Upper air positive divergence of the order of 20*10$^{-5}$ s$^{-1}$ prevails over southwest Bay of Bengal and divergence of the order of 10*10$^{-5}$ s$^{-1}$ prevails over the peninsular region and adjoining Indian Ocean.

**Wind Shear:**

- Wind Shear is moderate (10 knots) over south and north Bay of Bengal and low over central Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing order of 5 to 10 knots over Bay of Bengal and increasing tendency of 5 to 10 knots near Andhra Pradesh and Tamil Nadu coast.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT 200 hpa passes through latitude 17.0°N

**M.J.O. Index:**

- Located over phase 1 with amplitude about 1.0.
- Statistical forecast: - MJO moves through phase 1, during next 4 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude about 1.0 and may continue with phase 1 during next 4 days with increasing amplitude.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**

Inference based on INSAT imagery of 160900 UTC

**BAY OF BENGAL & ANDAMAN SEA:**

- Convective clouds are observed between lat 8.0N to 9.0N and long 78.27E to 80.0E. IR imagery indicates minimum cloud top temperature around -65.0°C.
- Convective Clouds are also observed over Equatorial East Indian Ocean. IR Imagery indicates minimum cloud top temperature around -50.0°C

(See ftp://192.168.12.75/imd/satmet

http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** model analysis shows a feeble CYCIR over southeast Bay of Bengal. Model forecasts also show that the system likely to move westwards and shows no intensification of the system during next seven days. The 500 hPa and 200 hPa wind are given in **Annexure II.**
- **ECMWF** model analysis also shows a feeble CYCIR over southeast Bay of Bengal. Model forecasts also show that the system likely to move westwards and shows no intensification of the system. The vorticty, divergence, wind shear and 850hPa wind are given in **Annexure II**.

- **WRF-ARW** model analysis also shows a feeble CYCIR over southeast Bay of Bengal. Model forecasts also show that the system likely to move westwards and lies over south Tamilnadu on day3 and shows no intensification of the system.
- **UKMET Unified** model analysis of 0000 UTC of 15 October 2012 shows a cyclonic circulation over southeast Arabian Sea and another CYCIR over southeast Bay of Bengal. Model forecasts also show that both the system likely to move westwards and no intensification of the systems.

(http://www.imd.gov.in/section/nhac/dynamic/welcome.htm )

(http://www.ncmrwf.gov.in/)

**Genesis Potential Parameter (GPP):** The GPP analysis shows scattered cell of GPP of 30 over the NIO. Model forecast of GPP suggests no development of GPP area during next seven days. GPP charts for 24 and 48 hours are shown in **Annexure II**.

( http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm)

**Summary and Conclusion:**

- There is a potential area over the southwest Bay of Bengal off Tamil nadu coast, as it is associated with favourable lower level convergence, upper level divergence, moderate vertical wind shear. However, it is not supported by large scale circulation with unfavourable MJO and low Ocean thermal energy (< 50 KJ $cm^{-2}$).
- No cyclogenesis is likely over Bay of Bengal during next 4 days.

**Advisory:**

- **NO IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system:**

**Synop**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **15/12** | **16/00** | **16/03** |
| **India** | 54/55 | 40/45 | 54/55 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |

| | | | |
|---|---|---|---|
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 0 | 0 | 0 |
| **Myanmar** | 9/11 | 8/11 | 6/11 |
| **Thailand** | 1/1 | 1/1 | 1/1 |
| **Srilanka** | 7/9 | 7/9 | 7/9 |

**AWS**

| **Region** | **Date/Time (UTC)** | | |
|---|---|---|---|
| | **15/12** | **16/00** | **16/03** |
| **India** | 88 | 83 | 91 |
| **WB** | 9 | 7 | 9 |
| **ODS** | 27 | 25 | 27 |
| **AP** | 29 | 28 | 31 |
| **TN** | 22 | 22 | 23 |
| **PDC** | 1 | 1 | 1 |
| **A & N island** | | | |

- **RS/RW** (12Z) of 15 -10-2011: 6/39
- **No. of Ascents reaching 250 hPa levels: -, MISDA:-33**
- **RS/RW** (00Z) of 16 -10-2011: 17/39
- **No. of Ascents reaching 250 hPa levels: - , MISDA: 22**

**No. of PILOT Ascents**

| **15/12Z** | **16/00Z** |
|---|---|
| 17/37 | 18/34 |

**Buoy Data**

| **15/12Z** | **16/00Z** | **16/03Z** |
|---|---|---|
| 12 | 14 | 13 |

## ***Data Statistics for RMC, Chennai Region***

**No of Synop data**

| **Date→** | **15.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **19** | **20** | **22** | **19** | **19** | **18** |

**No. of RS/RW Ascents**

**00Z / 15.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /15.10.2012 : 0**

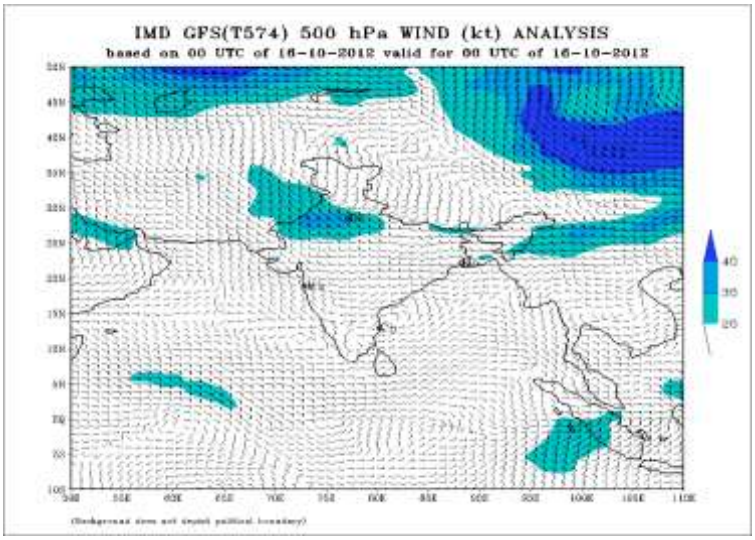
No. of Ascents reaching 250 hpa level =0

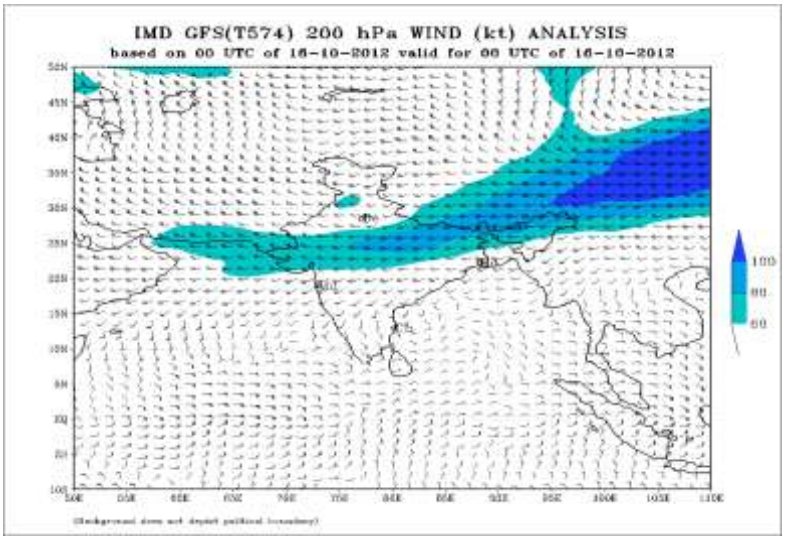
**MISDA : 8**

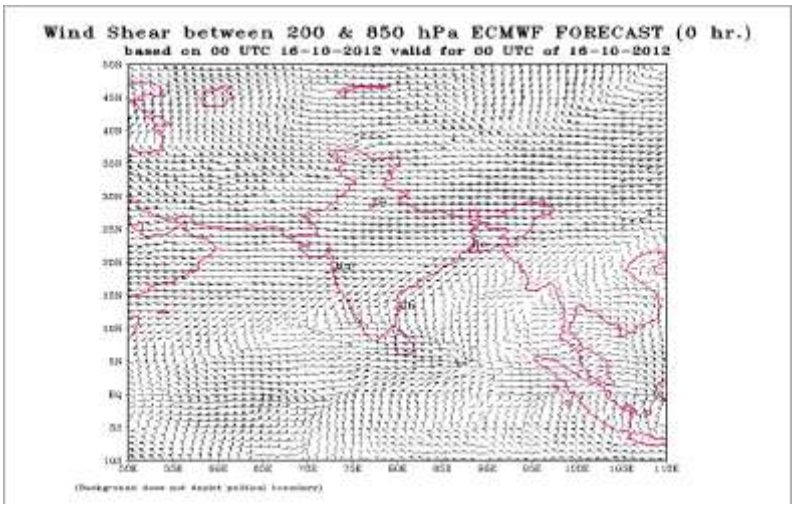
**No. of PILOT Ascents:**

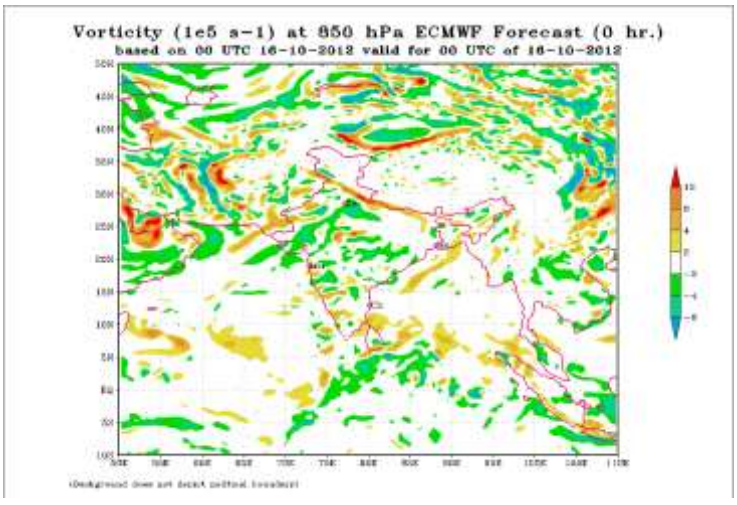
| **15.10.2012** | |
|---|---|
| 06Z | 18Z |
| 6 | 4 |

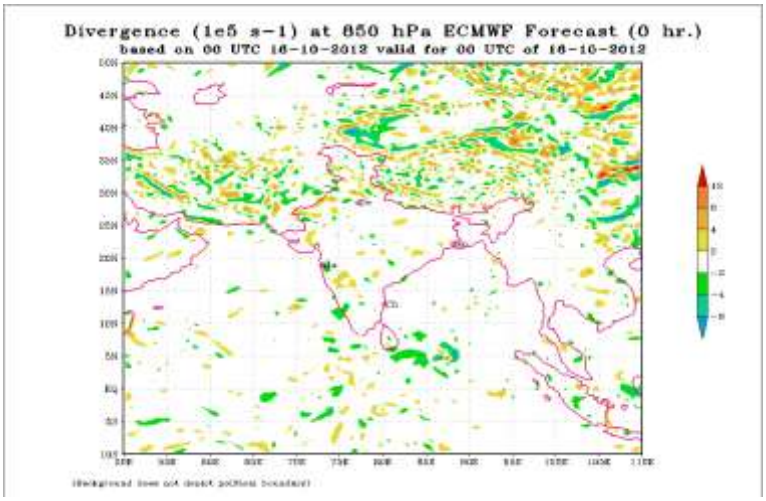
## Annexure II

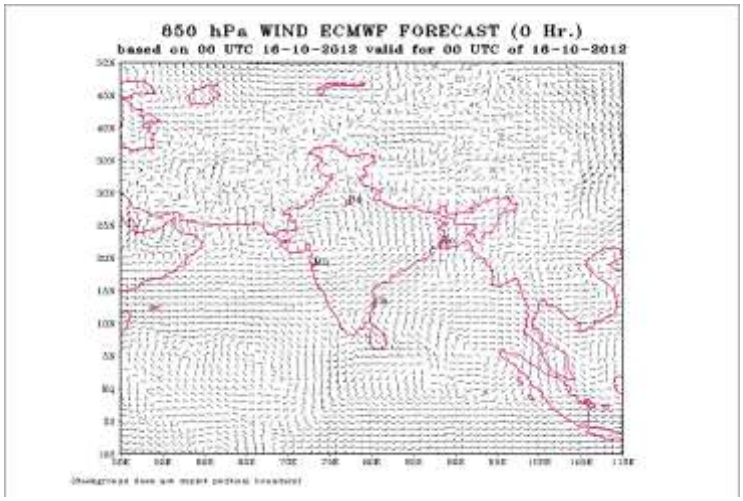

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 16-10-2012 valid for 00 UTC of 16-10-2012

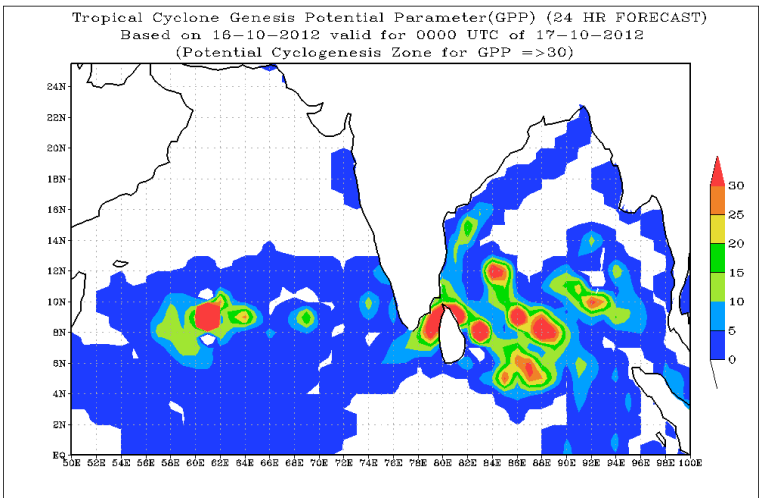

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 16-10-2012 valid for 00 UTC of 16-10-2012

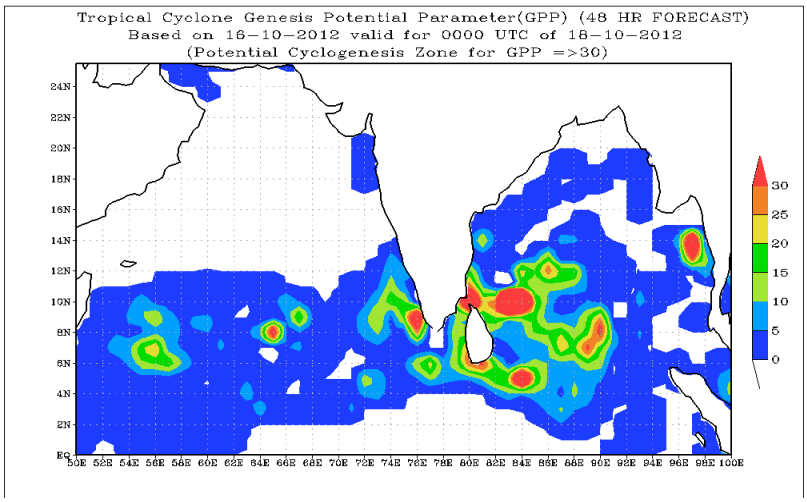

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 16-10-2012 valid for 00 UTC of 16-10-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 16-10-2012 valid for 00 UTC of 16-10-2012


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 16-10-2012 valid for 00 UTC of 16-10-2012


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 16-10-2012 valid for 00 UTC of 16-10-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 16-10-2012 valid for 0000 UTC of 17-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 16-10-2012 valid for 0000 UTC of 18-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0

## FDP (Cyclone) NOC Report Dated 17 October, 2012

**Synoptic features based on 0300 UTC:**

- The withdrawal line continues to pass through Lat. 19° N /Long. 94° E, Lat. 18° N / Long. 90° E, Kalingapatnam,Hyderabad, Gadag, Karwar, Lat. 15° N / Long. 70° E and Lat. 15°N / Long. 60° E. Conditions continue to remain favourable for further withdrawal of the southwest monsoon from remaining parts of the country; Bay of Bengal and Arabian Sea during next 48 hours. Conditions also continue to remain favourable for commencement of northeast Monsoon rains overTamil Nadu, Kerala and adjoining areas of Andhra Pradesh and Karnataka during next 48 hours.
- The southwest Monsoon has been active over Tamil Nadu. It has been subdued over coastal Andhra Pradesh, Telangana and coastal & north interior Karnataka.
- The cyclonic circulation over Lakshadweep area and adjoining southeast Arabian Sea persists and extends upto 1.5 kms a.s.l.
- The trough in lower level easterlies over south Andaman Sea and adjoining Tenasserim coast now lies as a trough of low at mean sea level over southeast Bay of Bengal and neighbourhood, with a cyclonic circulation aloft extending upto 3.1 kms a.s.l.
- The cyclonic circulation over southwest Bay of Bengal off Tamil Nadu coast has become less marked.
- ITCZ roughly runs along 3º N which is south of its normal position.
- A Tropical disturbance lies over South Indian ocean near Lat 14.7S Long 57.9E with MAX SUSTAINED WINDS - 045 KT, GUSTS 055 KT at 170000 UTC.
- A TROPICAL STORM 23W (MARIA) lies near 29.5N 144.8E with MAX SUSTAINED WINDS - 050 KT, GUSTS 065 KTat 170600 UTC.
- A TROPICAL STORM 22W (PRAPIROON)lies NEAR 24.1N 128.7E with max sustained winds of the order of 045 KT, GUSTS 055 KTat 170600 UTC.

**Environmental features based on 0300 UTC of today:**
**Sea Surface Temperature:**

- SST around 29-30$^0$C over central Bay of Bengal.
- Buoys data show that warm SST around 29-30$^0$C over the central Bay of Bengal over cyclogenesis area.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ cm$^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ cm$^{-2}$ over north Bay of Bengal and many parts of west central Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over North and South Bay of Bengal and equatorial Indian Ocean and negative over East central Bay.

**Convergence:**

- Lower level convergence of the order of 5-10* $10^{-5}$ $s^{-1}$ prevails over the east equatorial Indian Ocean region ..

**Divergence:**

- Upper air positive divergence of the order of 20*$10^{-5}$ $s^{-1}$ prevails over equatorial East Indian Ocean.

**Wind Shear:**

Wind Shear is high (>20 knots) over east equatorial Indian Ocean,moderate (10 knots) over south and north Bay of Bengal , low over central Bay of Bengal.

**Wind Shear Tendency:**

Decreasing order of 5 to 10 knots near Andhra Pradesh and Tamil Nadu coast. Increasing order of 10 to 20 knots over east Equatorial Indian Ocean

**Upper tropospheric ridge**:

The upper tropospheric **RIDGE** LINE AT 200 hpa passes through latitude 17.0°N

**M.J.O. Index:**

- Located over phase 1 with amplitude greater than 1
- Statistical forecast: - MJO moves through phase 1, during next 4 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1 and may continue with phase 1 during next 4 days with increasing amplitude.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**

**Satellite**

Inference based on INSAT imagery of 160900 UTC

BAY OF BENGAL & ANDAMAN SEA**: -**

Convective clouds in association with vortex (anais) over south Indian ocean centered near 15.6S/57.3E with intensity T1.0 . Convective Clouds are also observed over Equatorial East Indian Ocean. IR Imagery indicates minimum cloud top temperature around -50.0°C

(See ftp://192.168.12.75/imd/satmet
http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** model analysis shows a CYCIR over southeast Bay of Bengal. Model forecasts show that the system likely to move westwards direction and shows no intensification of the system during next seven days. The 500 hPa and 200 hPa wind are given in **Annexure II.**
- **ECMWF** model analysis also shows a CYCIR over southeast Bay of Bengal. Model forecasts show that the system likely to move westwards direction and also shows slight organization of the system on day6 and day7. The vorticty, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **WRF-ARW** model analysis also shows a CYCIR over southeast Bay of Bengal. Model forecasts also show that the system likely to move westwards direction and lies over COMORIN on day3 and shows no intensification of the system.
- **UKMET Unified** model analysis of 0000 UTC of 16 October 2012 shows a cyclonic circulation over southeast Arabian Sea and another CYCIR over southwest Bay of Bengal. Model forecasts show that both the system likely to move westwards direction and no intensification of the Arabian system. The model also shows that moving westward direction the Bay of Bengal system likely to intensify slightly over the west central Arabian Sea on day7.

(http://www.imd.gov.in/section/nhac/dynamic/welcome.htm )
(http://www.ncmrwf.gov.in/)

**Genesis Potential Parameter (GPP):** The GPP analysis shows scattered cell of GPP of 30 over the NIO. Model forecast of GPP suggests slight organization of GPP area from day3. GPP charts for 24 and 48 hours are shown in **Annexure II**.
( http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm)

**Summary and Conclusion:**

- Unfavourable large scale features like MJO, Southward location of ITCZ, Southward shifting of Subtropical Westerly Jet prevail over North Indian ocean
- Thus no cyclogenesis is likely over Bay of Bengal during next 4 days however a low may develop over SE Arabian Sea around 21$^{st}$ October.

**Advisory:**

- **NO IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system:**

**Synop**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **16112** | **17/00** | **17/03** |
| **India** | 72/76 | 57/66 | 69/76 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| Puducherry | 2/2 | 2/2 | 2/2 |
| A & N | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 0 | 0 | 0 |
| **Myanmar** | 10/11 | 9/11 | 7/11 |
| **Thailand** | 1/1 | 1/1 | 1/1 |
| **Sri Lanka** | 7/9 | 7/9 | 7/9 |

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **16/12** | **17/00** | **17/03** |
| **India** | 91 | 87 | 98 |
| **WB** | 9 | 7 | 11 |
| **ODS** | 28 | 27 | 30 |
| **AP** | 31 | 30 | 32 |
| **TN** | 22 | 22 | 24 |
| **PDC** | **1** | **1** | **1** |

- **RS/RW** (12Z) of 16 -10-2012: 5/39
- **No. of Ascents reaching 250 hPa levels:** -, **MISDA:-34**
- **RS/RW** (00Z) of 17 -10-2012: 20/39
- **No. of Ascents reaching 250 hPa levels: - , MISDA: 19**

**No. of PILOT Ascents**

| 16/12Z | 17100Z |
|---|---|
| 18/37 | 23/34 |

**Buoy Data**

| 16/12Z | 17100Z | 17103Z |
|---|---|---|
| 13 | 13 | 17 |

**Data Statistics over RMC Chennai Region**

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | | | | **17.10.2012** | | | |
|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 16.10.2012 : 2**
No. of Ascents reaching 250 hPa level =2
**MISDA : 6**

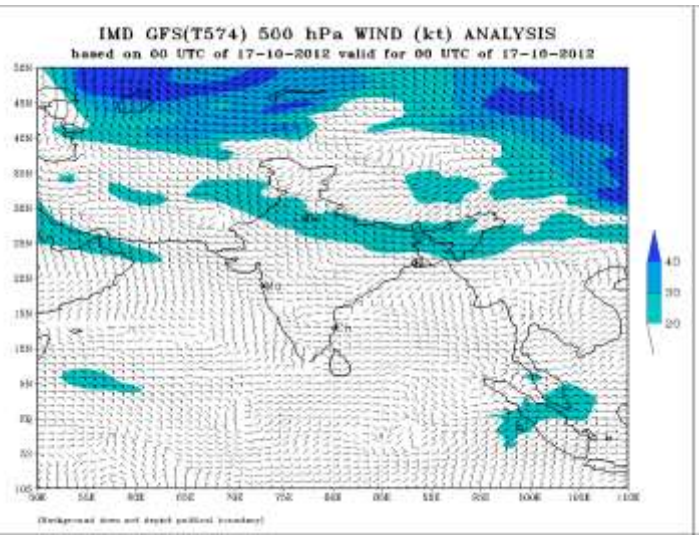
**12Z /16.10.2012 : 0**
No. of Ascents reaching 250 hPa level =0
**MISDA : 8**

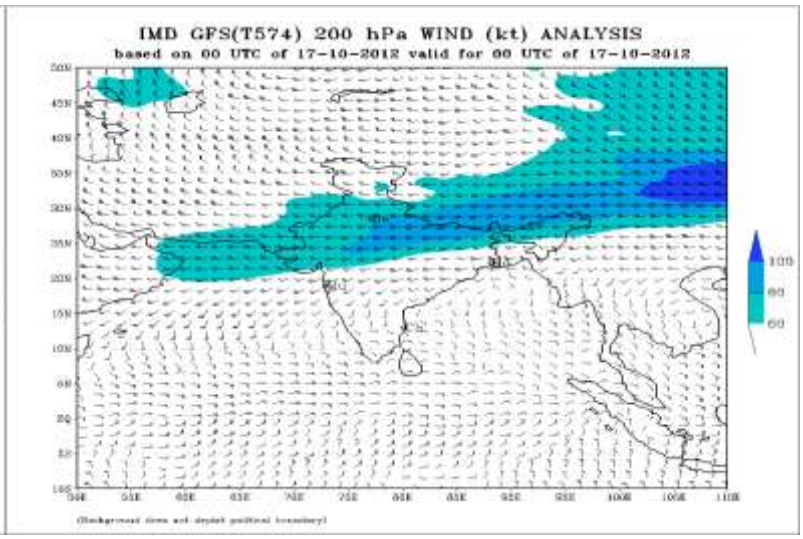
**No. of PILOT Ascents:**

**16.10.2012**

| 06Z | 18Z |
|---|---|
| 6 | 4 |

## Annexure II


IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 17-10-2012 valid for 00 UTC of 17-10-2012


IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
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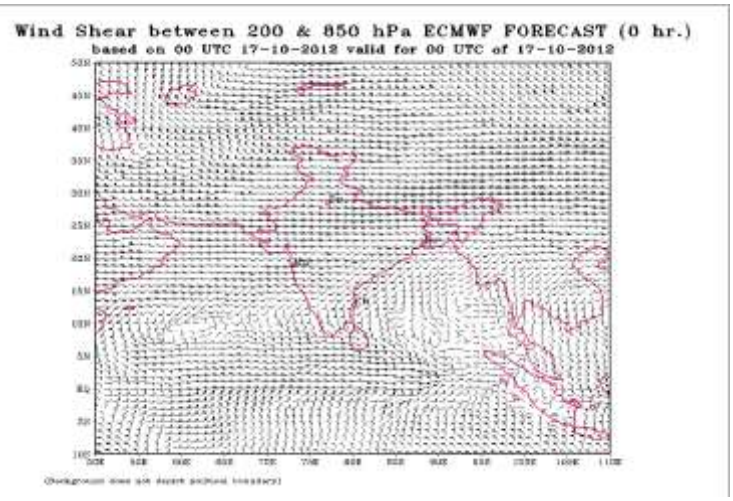
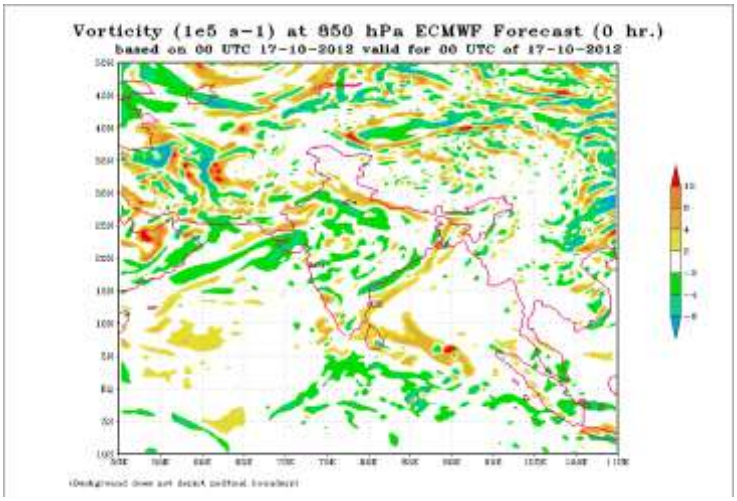
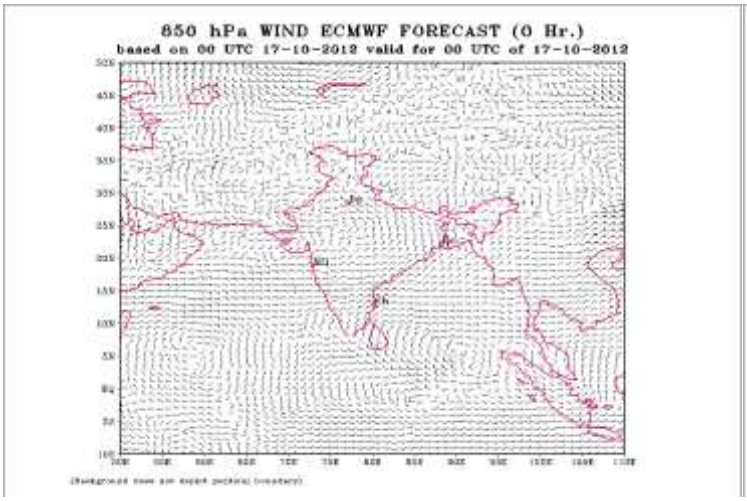
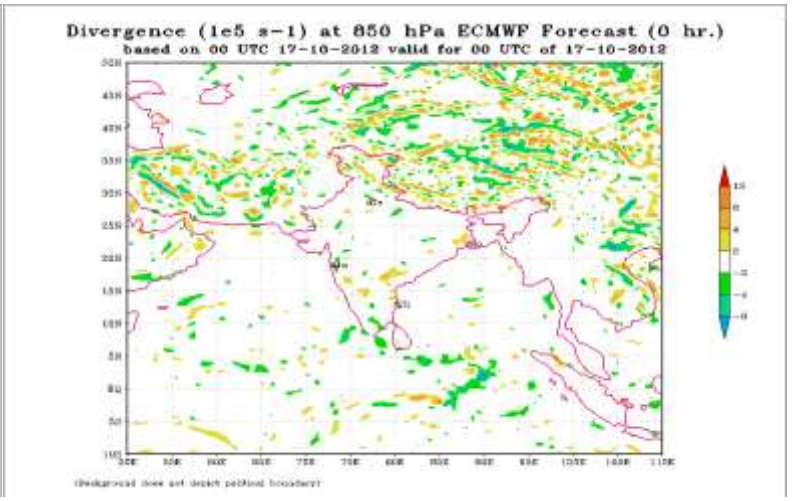
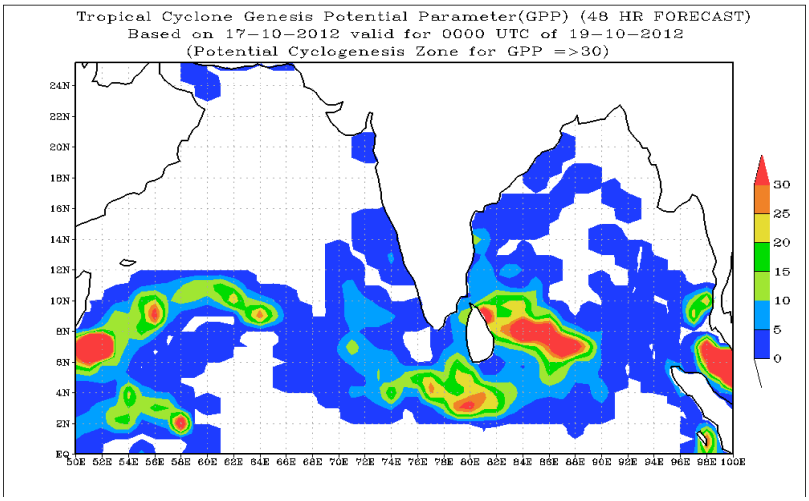
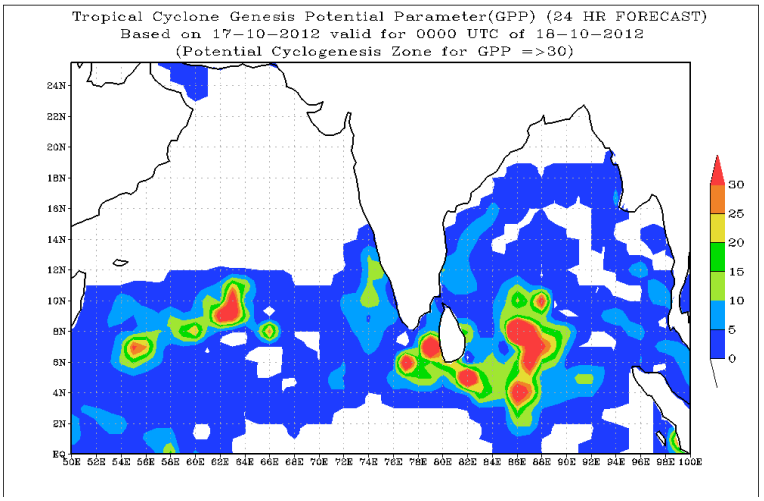

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 17-10-2012 valid for 00 UTC of 17-10-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 17-10-2012 valid for 00 UTC of 17-10-2012


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 17-10-2012 valid for 00 UTC of 17-10-2012


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 17-10-2012 valid for 00 UTC of 17-10-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 17-10-2012 valid for 0000 UTC of 19-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 17-10-2012 valid for 0000 UTC of 18-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0

## FDP (Cyclone) NOC Report Dated 18 October, 2012

**Synoptic features based on 0300 UTC:**

- The Southwest Monsoon has further withdrawn from remaining parts of the country, Bay of Bengal and Arabian Sea. Thus, it has withdrawn from the entire country today, the 18th October 2012. Conditions continue to remain favourable for commencement of northeast Monsoon rains over Tamil Nadu, Kerala and adjoining areas of Andhra Pradesh and Karnataka during next 24 hours.
- The trough of low at mean sea level over southeast Bay of Bengal and neighbourhood now lies over southwest Bay of Bengal off Sri Lanka – Tamil Nadu coasts, with the cyclonic circulation aloft extending upto 3.1 kms a.s.l.
- The cyclonic circulation over Lakshadweep area and adjoining southeast Arabian Sea has moved away westwards and now lies over central part of south Arabian Sea.
- ITCZ roughly runs along 3º N which is south of its normal position.
- TROPICAL CYCLONE 01S (ANAIS) At 171200Z was located near Lat 16.0S Long 56.6E, approximately 310 nm north of la reunion, and had tracked southwestward at 11 knots over the past six hours. Maximum sustained surface winds were estimated at 35 knots gusting to 45 knots.
- A TROPICAL STORM 23W (MARIA) lay near near Lat 32.2N Long 153.3E with max sustained winds 040 KT, gusts 050 KT at 180600 UTC.
- A TROPICAL STORM 22W (PRAPIROON) lay near Lat 28.3N Long 134.0E with max sustained winds of the order of 040 KT, gusts 050 KT at 180600 UTC

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 29-30$^0$C over central Bay of Bengal.
- Buoys data show that warm SST around 29-30$^0$C over the central Bay of Bengal over cyclogenesis area.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ cm$^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ cm$^{-2}$ over north Bay of Bengal and many parts of west central and South west Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over North and South Bay of Bengal and equatorial Indian Ocean and negative over East central Bay.

**Convergence:**

- Lower level convergence of the order of 5-10* 10$^{-5}$ s$^{-1}$ prevails over equatorial Indian Ocean region .

**Divergence:**

- Upper air positive divergence was of the order of $20*10^{-5}$ $s^{-1}$ prevails over equatorial East Indian Ocean.

**Wind Shear:**

- Wind Shear is high (>20 knots) over equatorial Indian Ocean,moderate (10 knots) over south and north Bay of Bengal , low over central Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing order of 5 to 10 knots over east Equatorial Indian Ocean.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hpa passes through latitude 19.0°N

**M.J.O. Index:**

- Located over phase 1 with amplitude greater than 1
- Statistical forecast: - MJO moves through phase 1, during next 4 days.
- Dynamical forecast: - MJO located in phase 1 with amplitude greater than 1 and may continue with phase 1 during next 4 days with increasing amplitude.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

**Satellite advisory**

Inference based on INSAT picture of 18th October/0600UTC

Low/medium clouds with moderate to intense convection are observed at many places over southwest Bay of Bengal adjoining India Ocean between equator to lat 10.0N and long 80.0E to 90.0E, Comorin adjoining Arabian Sea and Maldives. IR imagery indicates minimum cloud top temperature is around -70.0°C (Comorin).Oceansat-II and ASCAT pass shows no significant circulation over North Indian Ocean.

**NWP Analysis**

- **IMD-GFS** model analysis shows a CYCIR over southwest adjoining southeast Bay of Bengal. Model forecasts show that the system likely to move westwards direction and shows intensification of the system into a LOW on 21 Oct over southeast Arabian Sea but shows no further intensification thereafter. The 500 hPa and 200 hPa wind are given in **Annexure II.**
- **ECMWF** model analysis also shows a CYCIR over southwest adjoining southeast Bay of Bengal. Model forecasts show that the system likely to move westwards direction and also shows intensification of the system into a LOW on 22 Oct. but no further intensification thereafter. The vorticty, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **WRF-ARW** model analysis shows a CYCIR over southwest adjoining southeast Bay of Bengal. Model forecasts show that the system likely to move westwards direction and shows intensification of the system into an extended

LOW on 19th over COMORIN area. Model forecasts also show no further intensification of the system thereafter.

- **UKMET Unified** model analysis of 0000 UTC of 16 October 2012 shows a cyclonic circulation over southeast Arabian Sea and another CYCIR over southwest Bay of Bengal. Model forecasts show that both the system likely to move westwards direction and no intensification of the Arabian system. The model also shows that moving westward direction the Bay of Bengal system likely to intensify slightly over the west central Arabian Sea on day7(Model products based on 0000 UTC of 17 October 2012 are not available).
- **Genesis Potential Parameter (GPP):** The GPP analysis shows an extended cell of GPP of 30 over the southwest adjoining southeast Bay of Bengal. Model forecast of GPP suggests slight organization of GPP area over COMORIN from 20 Oct. GPP charts for 24 and 48 hours forecast are shown in **Annexure II**.

**Summary and Conclusion:**

- Unfavourable large scale features like MJO, Southward location of ITCZ, Southward shifting of Subtropical Westerly Jet prevail over North Indian ocean.
- Thus no cyclogenesis is likely over Bay of Bengal during next 4 days however a low may develop over SE Arabian Sea around 21$^{st}$ October.

**Advisory:**

- **NO IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system**

**Synop**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **17/12** | **18/00** | **18/03** |
| **India** | 83/87 | 68/76 | 73/97 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/17 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 11/11 | 10/11 | 8/11 |
| **Myanmar** | 10/11 | 10/11 | 10/11 |
| **Thailand** | 1/1 | 1/1 | 1/1 |
| **Srilanka** | 7/9 | 7/9 | 7/9 |

**AWS**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **17/12** | **18/00** | **18/03** |
| **India** | 88/121 | 85/121 | 95/121 |
| **WB** | 9/20 | 6/20 | 7/20 |
| **ODS** | 27/38 | 25/38 | 30/38 |
| **AP** | 29/35 | 29/35 | 32/35 |
| **TN** | 22/26 | 24/26 | 25/26 |
| **PDC** | 1/2 | 1/2 | 1/2 |

- **RS/RW** (12Z) of 17 -10-2012: 5/39
- **No. of Ascents reaching 250 hPa levels: -, MISDA:-34**
- **RS/RW** (00Z) of 18 -10-2012: 20/39
- **No. of Ascents reaching 250 hPa levels: - , MISDA: 19**

**No. of PILOT Ascents**

| 17/12Z | 18/00Z |
|---|---|
| 23/37 | 21/34 |

**Buoy Data**

| 17/12Z | 18/00Z | 18/03Z |
|---|---|---|
| 16 | 15 | 17 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **17.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 17.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /17.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

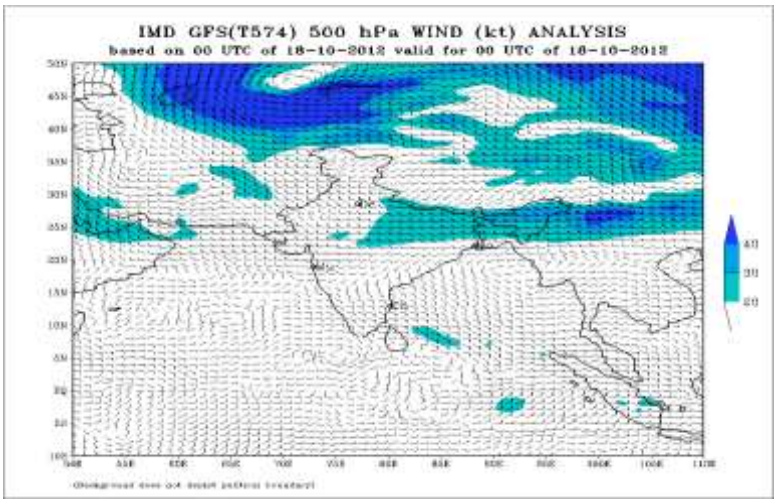
**MISDA : 8**

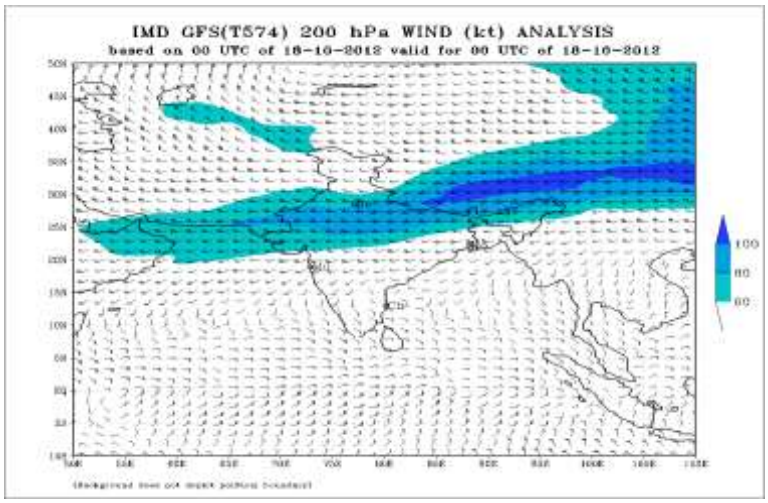
**No. of PILOT Ascents:**

**17.10.2012**

| 06Z | 18Z |
|---|---|
| 6 | 4 |

## Annexure II


IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 18-10-2012 valid for 00 UTC of 18-10-2012


IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
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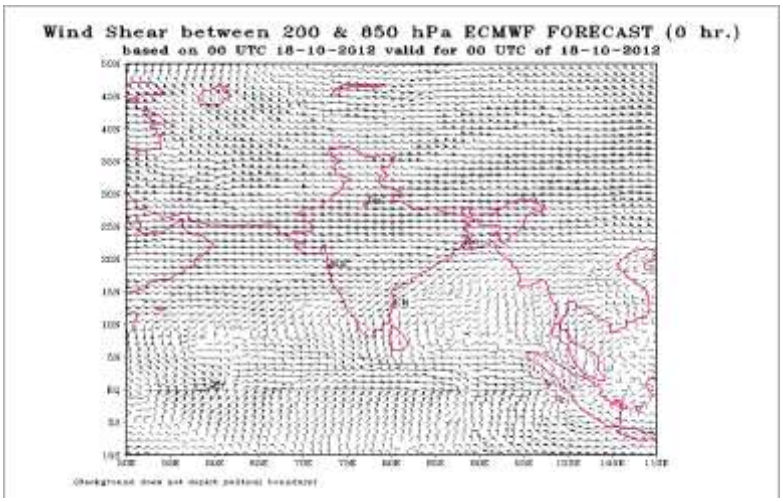
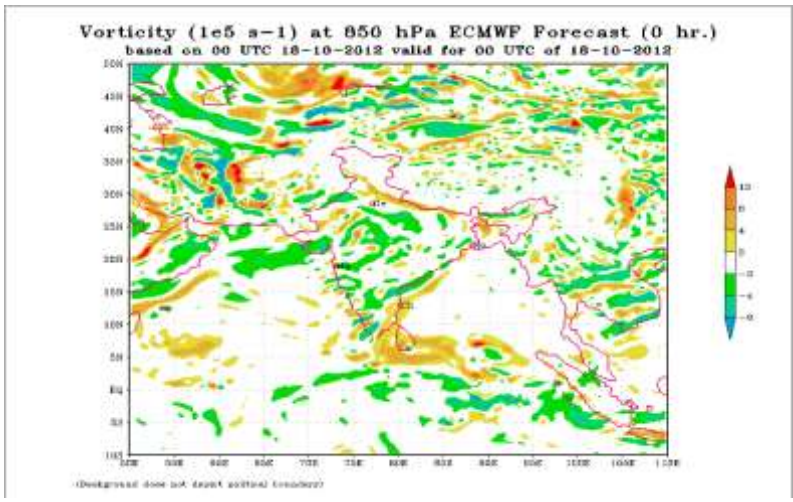
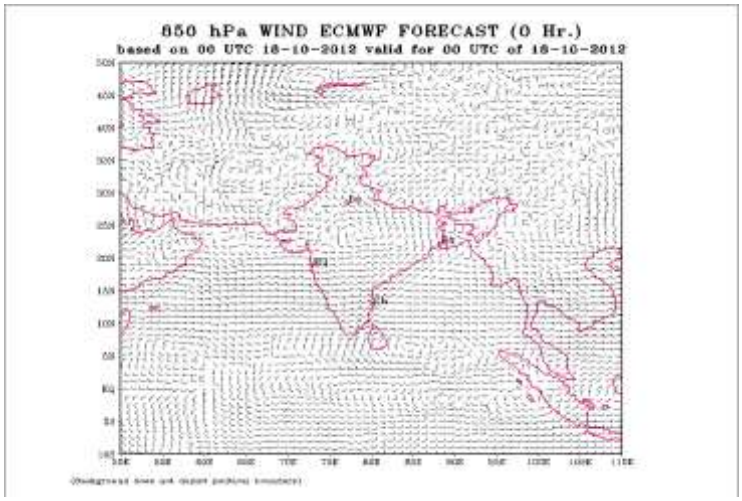
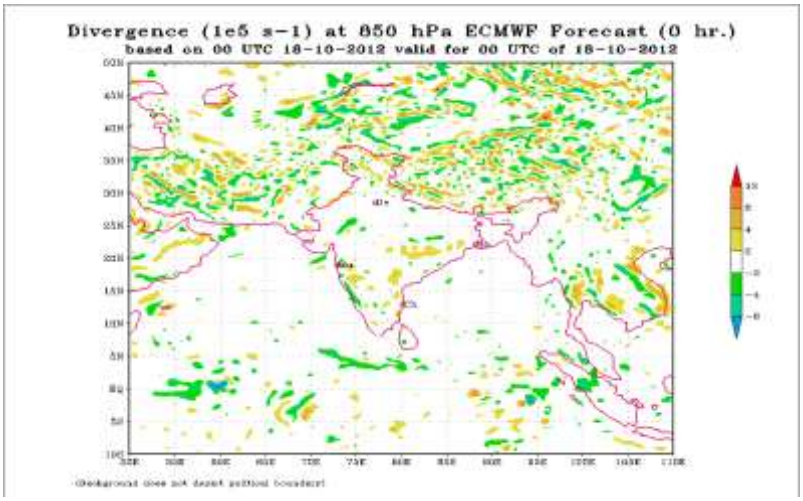
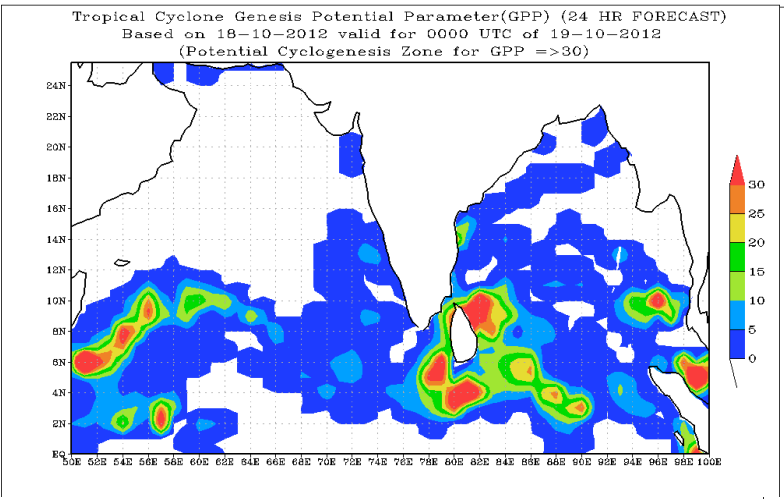
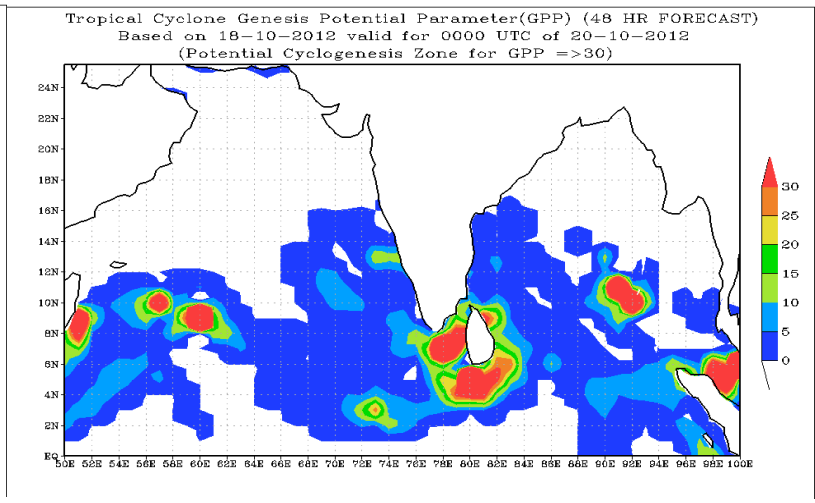

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 18-10-2012 valid for 00 UTC of 18-10-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 18-10-2012 valid for 00 UTC of 18-10-2012


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 18-10-2012 valid for 00 UTC of 18-10-2012


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 18-10-2012 valid for 00 UTC of 18-10-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 18-10-2012 valid for 0000 UTC of 19-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 18-10-2012 valid for 0000 UTC of 20-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0

## FDP (Cyclone) NOC Report Dated 19 October, 2012

**Synoptic features based on 0300 UTC:**

- The northeast Monsoon rains have commenced over Tamil Nadu, Kerala and adjoining areas of Andhra Pradesh and Karnataka on today, the 19th October 2012.
- The northeast Monsoon has been active over Tamil Nadu.
- The trough of low at mean sea level over southwest Bay of Bengal off Sri Lanka – Tamil Nadu coasts now extends from southwest Bay of Bengal to west central Bay of Bengal off Sri Lanka - Tamil Nadu coasts. The cyclonic circulation now lies embedded in this trough over Gulf of Mannar and extends upto 3.1 kms a.s.l.
- Another trough of low at mean sea level lies over Tenasserim coast and adjoining south Andaman Sea..
- ITCZ roughly runs along 5º N.
- TROPICAL CYCLONE 01S (ANAIS) has moved Southwards and become less marked.
- TROPICAL STORM 23W (MARIA) now lies near near Lat NEAR 31.2N Long 158.8E with max sustained winds 030 KT, GUSTS 040 KT at 190600 UTC.
- Tropical storm 22w (Prapiroon) was located at 190000z, near 31.9N 142.6E, approximately 270 nm southeast of Tokyo, Japan, and had tracked east-northeastward at 27 knots over the past six hours. maximum sustained surface winds were estimated at 45 knots gusting to 55 knots.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 29-30$^0$C over central Bay of Bengal and >30º C in Bay of Bengal alongoff coastal Tamil Nadu and Andhra Pradesh.
- Buoys data show that warm SST around 29-30$^0$C over the central Bay of Bengal over cyclogenesis area.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ cm$^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ cm$^{-2}$ over north Bay of Bengal and many parts of west central and South west Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is negative over North and South Bay of Bengal and positive over equatorial Indian Ocean .

**Convergence:**

- Lower level convergence of the order of 10-20* 10$^{-5}$ s$^{-1}$ prevails over South west bay of Bengal (alongoff coastal Tamil nadu and Andhra Pradesh) .

**Divergence:**

- Upper air positive divergence of the order of 20*10$^{-5}$ s$^{-1}$ prevails over South west bay of Bengal (alongoff coastal Tamil nadu and Andhra Pradesh).

**Wind Shear:**

- Wind Shear is high (>20 knots) over equatorial Indian Ocean,moderate (10 knots) over south and north Bay of Bengal and Gulf of Mannar , low over central Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing order of 5 to 10 knots over east Equatorial Indian Ocean.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hpa passes through latitude 17.0°N

**M.J.O. Index:**

- Located over phase 1 with amplitude around 2.
- Statistical forecast: - MJO moves through phase 1, during next 4 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1 and may continue with phase 1 during next 4 days with increasing amplitude.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

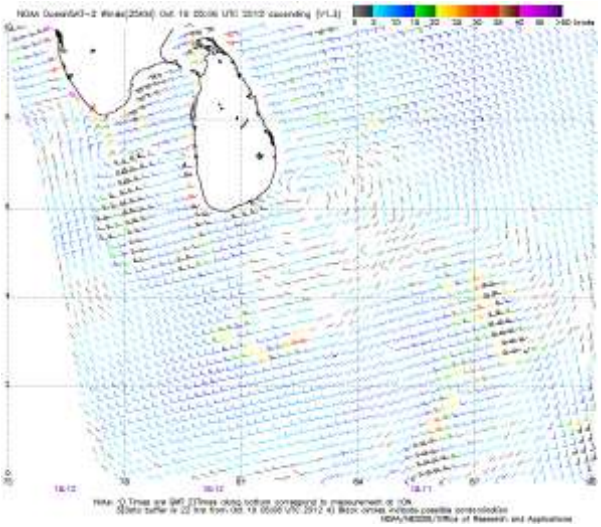
**Satellite advisory**

**Inference based on INSAT picture of 19th October/0600UTC**

A low level circulation has formed over Tamilnadu and neighborhood from 19/0600UTC. Associated low/medium clouds with moderate to intense convection are observed at many places over Tamilnadu adjoining southwest Bay of Bengal, south coastal Andhra Pradesh, Palk Strait and Gulf of Mannar adjoining Comorin and Srilanka.

IR imagery indicates minimum cloud top temperature is around -76.0°C (northeast Tamilnadu adjoining southwest Bay).

OSCAT-II pass for 18th Oct2012/1812UTC shows a cyclonic circulation over Srilanka and neighbourhood (as shown below).



**NWP Analysis**

- **IMD-GFS** model analysis shows a CYCIR over COMORIN area. Model forecasts show that the system likely to move westwards direction and shows intensification of the system into a LOW on day1 over the same area. The forecast also shows slight intensification (two closed isobar) over southeast adjoining southwest Arabian Sea but shows no further intensification till day7. The 500 hPa and 200 hPa wind are given in **Annexure II.**
- **ECMWF** model analysis shows a CYCIR over southwest Bay of Bengal off south Sri-Lanka. Model forecasts show that the system likely to move westwards direction and also shows intensification of the system into a LOW on day3 over southeast Arabian Sea and two closed isobar on day4 but no further intensification till day7. The vorticty, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **UKMET Unified** model analysis of 0000 UTC of 18 October 2012 shows a CYCIR over southwest Bay of Bengal. Model forecasts show that the system likely to move westwards direction and intensify from 22 October 2012 to 25 October 2012 over the Arabian Sea.
- **Genesis Potential Parameter (GPP):** The GPP analysis shows a cell of GPP of 30 over the COMORIN area. Model forecast of GPP suggests organization of the GPP area indicating intensification of the system and its movement towards westward direction during next 7 days. GPP charts for 24, 48 and 72 hours are shown in **Annexure II**.

**Summary and Conclusion:**

- Unfavourable large scale features like MJO and high wind shear prevail over Bay of Bengal.
- Thus no cyclogenesis is likely over Bay of Bengal during next 4 days
- However the current cyclonic circulation over Gulf of Mannar may develop into a low pressure area over SE Arabian Sea around 21$^{st}$ October. Few models like Meteo-France suggest intensification of the circulation into a depression on 21$^{st}$ and deep depression on 22nd.
- **ECMWF** model analysis shows a CYCIR over southwest Bay of Bengal off south Sri-Lanka. Model forecasts show that the system likely to move westwards direction and also shows intensification of the system into a LOW on day3 over southeast Arabian Sea and well marked low on day4 .
- **UKMET Unified** model analysis of 0000 UTC of 18 October 2012 shows a CYCIR over southwest Bay of Bengal. Model forecasts show that the system likely to move westwards direction and intensify from 22 October 2012 to 25 October 2012 over the Arabian Sea.

**Advisory:**

- **System over Arabian Sea needs to be watched for likely cyclogenesis.**
- **NO IOP is declared for next 3 days for Bay of Bengal.**

**Annexure-I**

**Status of Observation system:**

**Synop**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **18/12** | **19/00** | **19/03** |
| **India** | 72/76 | 64/76 | 76/87 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/17 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 0/11 | 07/11 | 6/11 |
| **Myanmar** | 10/11 | 9/11 | 08/11 |
| **Thailand** | 1/1 | 1/1 | 1/1 |
| **Srilanka** | 7/9 | 7/9 | 7/9 |

**AWS**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **18/12** | **19/00** | **19/03** |
| **India** | 94/121 | 89/121 | 98/121 |
| **WB** | 9/20 | 8/20 | 10/20 |
| **ODS** | 29/38 | 28/38 | 30/38 |
| **AP** | 30/35 | 29/35 | 32/35 |
| **TN** | 24/26 | 22/26 | 24/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 18 -10-2012: 7/39
- **No. of Ascents reaching 250 hPa levels: -, MISDA:-34**
- **RS/RW** (00Z) of 19 -10-2012: 20/39
- **No. of Ascents reaching 250 hPa levels: - , MISDA: 19**

**No. of PILOT Ascents**

| 18/12Z | 19/00Z |
|---|---|
| 16/37 | 21/34 |

**Buoy Data**

| 18/12Z | 19/00Z | 19/03Z |
|---|---|---|
| 15 | 17 | 19 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **18.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 18.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /18.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

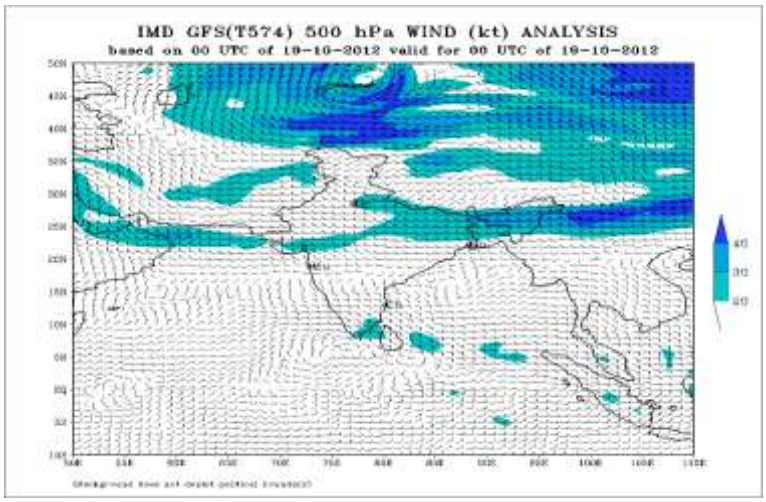
**MISDA : 8**

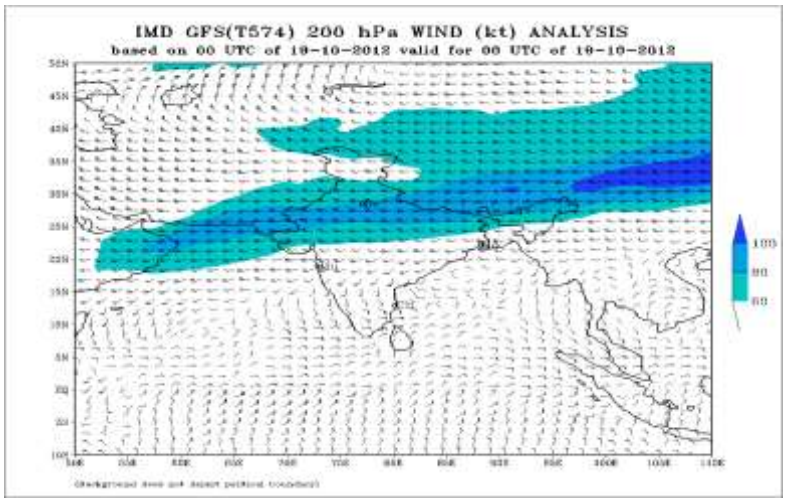
**No. of PILOT Ascents:**

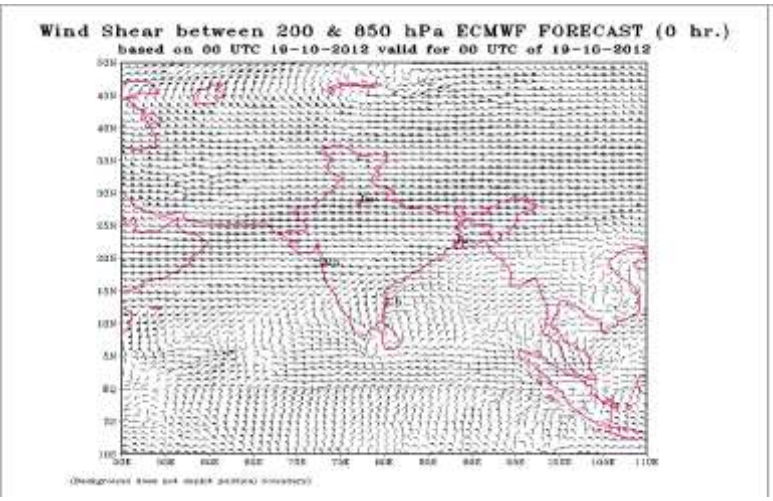
**18.10.2012**

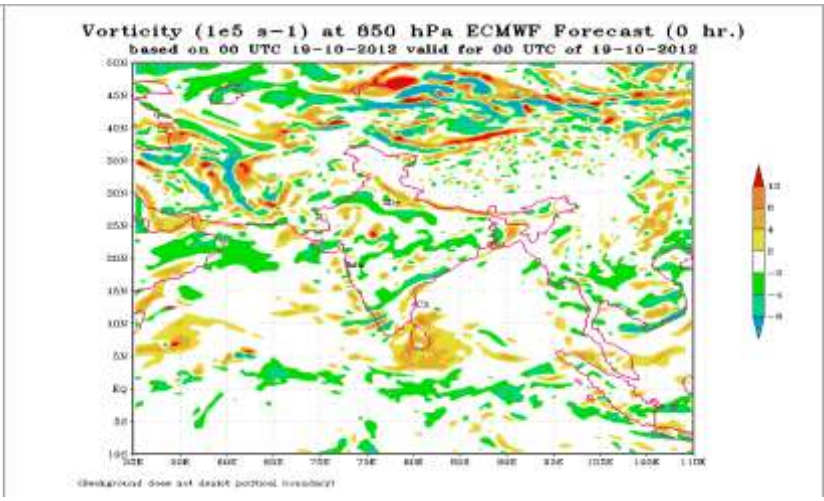
| 06Z | 18Z |
|---|---|
| 4 | 4 |

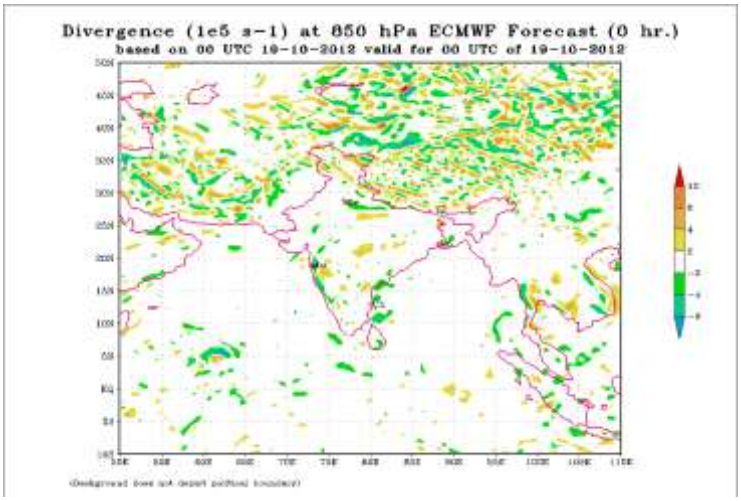
## Annexure II

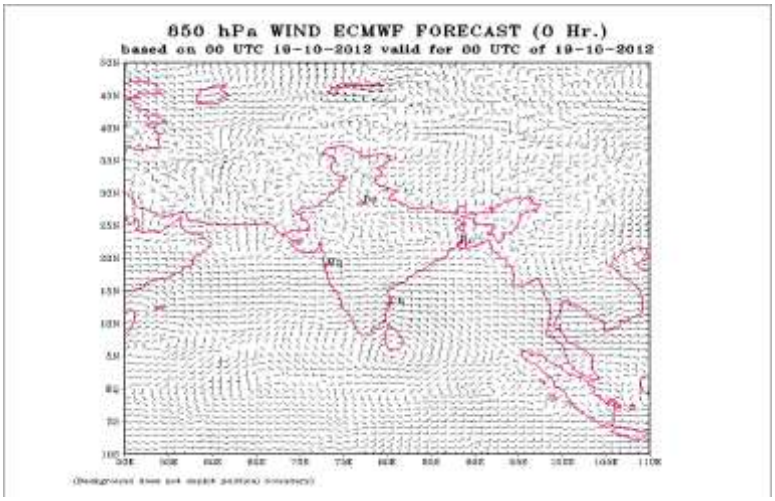

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 19-10-2012 valid for 00 UTC of 19-10-2012

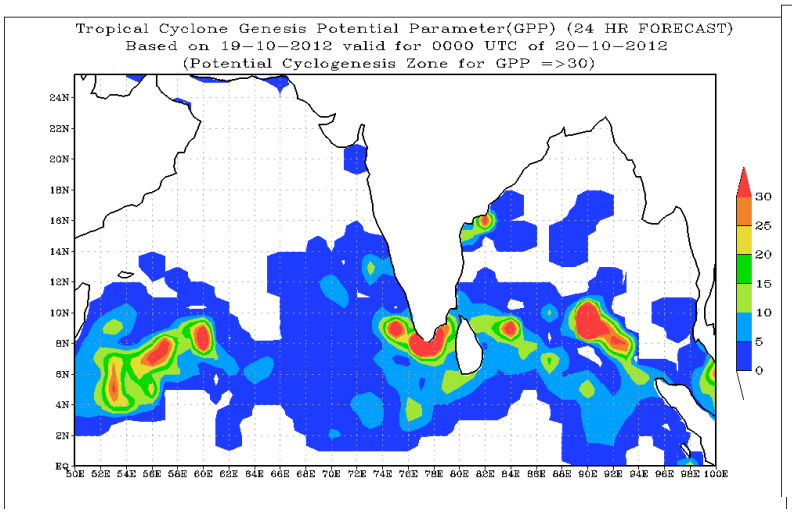

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 19-10-2012 valid for 00 UTC of 19-10-2012

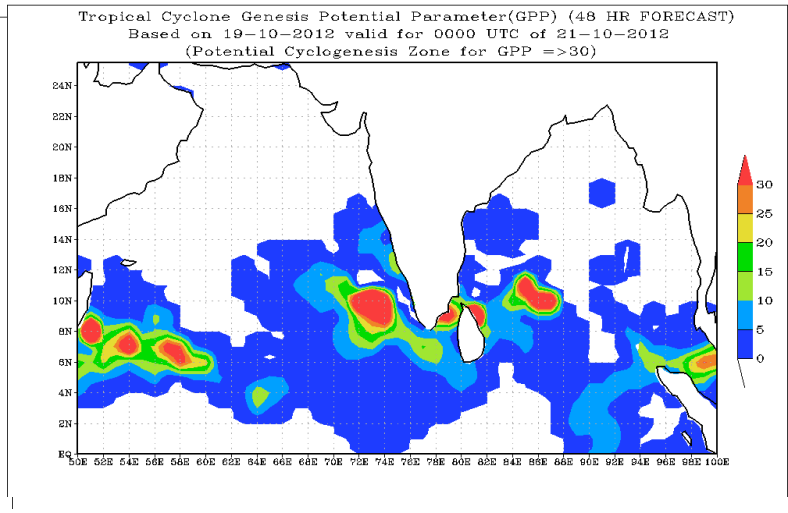

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 19-10-2012 valid for 00 UTC of 19-10-2012

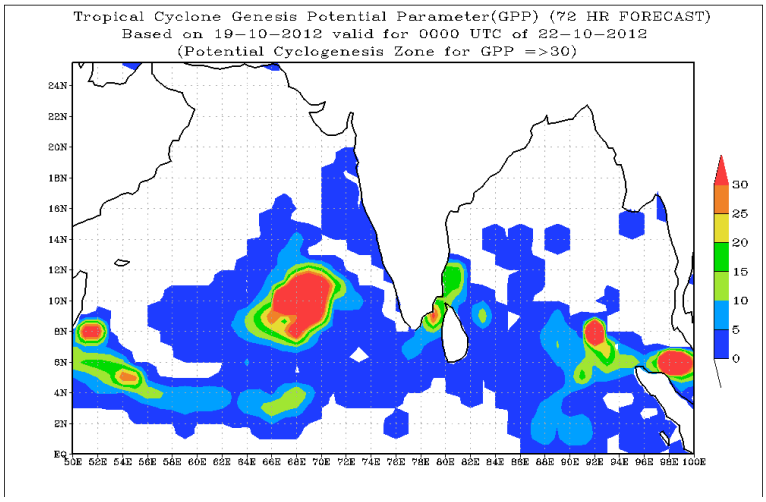

Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 19-10-2012 valid for 00 UTC of 19-10-2012


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 19-10-2012 valid for 00 UTC of 19-10-2012


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 19-10-2012 valid for 00 UTC of 19-10-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 19-10-2012 valid for 0000 UTC of 20-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 19-10-2012 valid for 0000 UTC of 21-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 19-10-2012 valid for 0000 UTC of 22-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0

## FDP (Cyclone) NOC Report Dated 20 October, 2012

**Synoptic features based on 0300 UTC:**

- The northeast Monsoon has been vigorous over coastal Andhra Pradesh, Rayalaseema and Tamil Nadu and active over Kerala.
- The trough of low at mean sea level from southwest Bay of Bengal to west central Bay of Bengal off Sri Lanka - Tamil Nadu coasts now extends from Comorin area to west central Bay of Bengal off Andhra Pradesh coast across coastal Tamil Nadu.
- The embedded cyclonic circulation lies over Comorin area and neighbourhood and extends upto mid tropospheric levels.
- Another trough of low extends from Lakshadweep area to eastcentral Arabian Sea off Maharashtra coast. Under its influence a low pressure area may develop over southeast Arabian Sea during next 48 hours.
- ITCZ roughly runs along 5º N.
- TROPICAL STORM 23W (MARIA) has become less marked.
- Tropical storm 22w (Prapiroon) has also become less marked

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 29-30$^0$C over central Bay of Bengal and >30º C in Bay of Bengal alongoff coastal Tamil Nadu and Andhra Pradesh.
- Buoys data show that warm SST around 29-30$^0$C over the central Bay of Bengal over cyclogenesis area.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ cm$^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ cm$^{-2}$ over north Bay of Bengal and many parts of west central and South west Bay of Bengal.
- Ocean thermal energy is around 80 KJ cm$^{-2}$ over southeast Arabian Sea.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is negative over North & South Bay of Bengal and positive over southeast Arabian Sea & equatorial Indian Ocean.

**Convergence:**

- Lower level convergence of the order of 10-20* 10$^{-5}$ s$^{-1}$ prevails over southeast Arabian Sea and south west bay of Bengal (alongoff coastal Tamil nadu and Andhra Pradesh).

**Divergence:**

- Upper air positive divergence of the order of 20*10$^{-5}$ s$^{-1}$ prevails over southeast Arabian Sea & southwest bay of Bengal (alongoff coastal Tamil nadu and Andhra Pradesh).

**Wind Shear:**

- Wind Shear is of order 5-10 knots over Tamilnadu and Andaman Sea.

**Wind Shear Tendency:**

- Increased over southeast Arabian Sea and decreased over of the order 5 knots over central Bay of Bengal..

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hpa passes through latitude 17.0°N

**M.J.O. Index:**

- Located over phase 1 with amplitude around 2.
- Statistical forecast: - MJO moves through phase 1, during next 4 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1 and may continue with phase 1 during next 4 days with increasing amplitude.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

**Satellite advisory**

- The low level circulation has formed over Tamilnadu and neighbourhood now lies over Lakshadweep area and neighbourhood. Associated low/medium clouds with moderate to intense convection are observed at many places over Tamilnadu adjoining southwest Bay of Bengal, south coastal Andhra Pradesh, Palk Strait and Gulf of Mannar adjoining Comorin, Srilanka and Lakshadweep & adjoining southeast Arabian sea .
- IR imagery indicates minimum cloud top temperature is around -64.0°C over Lakshadweep area.

**NWP Analysis**

- **IMD-GFS** model analysis shows a CYCIR over COMORIN area. Model forecasts show that the system likely to move westwards direction and shows intensification of the system into a LOW on day1 over the southeast Arabian Sea and weakening of the system on day4 over southwest Arabian Sea. The forecast also shows formation of a LOW over southeast Bay of Bengal on day4 and its intensification into a cyclonic storm on day6.
- **IMD-WRF-ARW** model analysis shows a CYCIR over COMORIN area. Model forecasts show that the system likely to move westwards direction and shows intensification of the system into a LOW on day1 over the southeast Arabian Sea and slight intensification of the system till day3.
- **ECMWF** model analysis shows a CYCIR over southwest Bay of Bengal off south Sri-Lanka. Model forecasts show that the system likely to move westwards direction and also shows intensification of the system into a LOW on day2 over southeast Arabian Sea and two closed isobar on day3 but no further intensification till day7. The vorticty, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **UKMET Unified** model analysis of 0000 UTC of 20October 2012 shows a CYCIR over southeast Arabian Sea. Model forecasts show that the system

likely to move westwards direction and intensify from day2 to day7. 22 October 2012 to 25 October 2012 over the Arabian Sea. The forecast also shows formation of a LOW over southeast Bay of Bengal on day5 and its intensification till day7.

- **Genesis Potential Parameter (GPP):** The GPP analysis shows a cell of GPP of 30 over the southeast Arabian Sea. Model forecast of GPP suggests organization of the GPP area indicating intensification of the system and its movement towards westward direction during next 6 days. Model forecast also shows that formation of a new GPP area over southeast Bay of Bengal on day5 and subsequent organization of the GPP cell till day7 indicating formation and intensification of a new system over the Bay of Bengal.

**Advisory:**

- **Circulation over Lakshadweep area needs to be watched as a low pressure area is likely to form over southeast Arabian Sea within 24 hours. Some NWP models suggest likely formation of Depression around 22$^{nd}$.**
- **A upper air cyclonic circulation from south China Sea may emerge into south Andaman Sea around 24$^{th}$.**
- **NO IOP is declared for next 3 days for Bay of Bengal.**

**Annexure-I**

**Status of Observation system:**

**Synop**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **19/12** | **20/00** | **20/03** |
| **India** | 80/89 | 65/79 | 83/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 6/11 | 6/11 | 9/11 |
| **Myanmar** | 10/11 | 8/11 | 9/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 8/9 | 8/9 |

**AWS**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **19/12** | **20/00** | **20/03** |
| **India** | 83/121 | 87/121 | 94/121 |
| **WB** | 9/20 | 9/20 | 9/20 |
| **ODS** | 29/38 | 27/38 | 29/38 |
| **AP** | 29/35 | 28/35 | 30/35 |
| **TN** | 23/26 | 21/26 | 24/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 19 -10-2012: 7/39
- **No. of Ascents reaching 250 hPa levels: 1, MISDA:-32**
- **RS/RW** (00Z) of 20 -10-2012: 21/39
- **No. of Ascents reaching 250 hPa levels: 10 , MISDA: 18**

**No. of PILOT Ascents**

| 19/12Z | 20/00Z |
|---|---|
| 16/37 | 20/34 |

**Buoy Data**

| 19/12Z | 20/00Z | 20/03Z |
|---|---|---|
| 12/22 | 18/22 | 22/22 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **19.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **21** | **21** | **21** | **22** | **19** | **19** | **18** |

**No. of RS/RW Ascents**

**00Z / 19.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /19.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

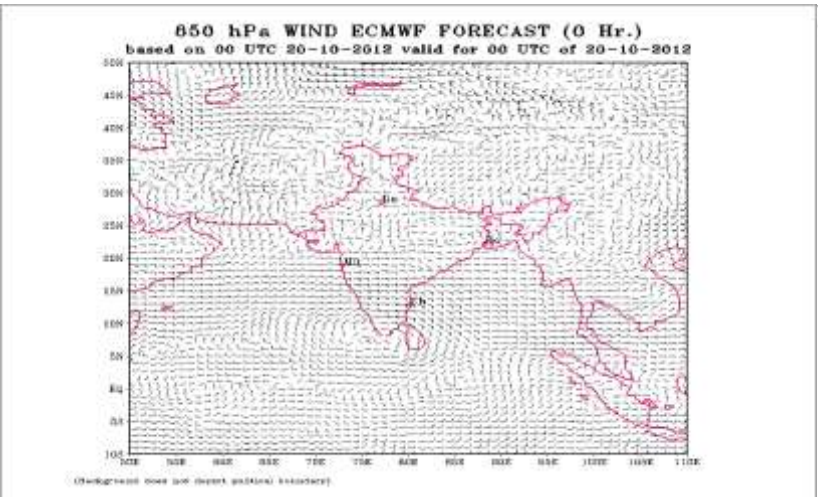
**MISDA : 8**

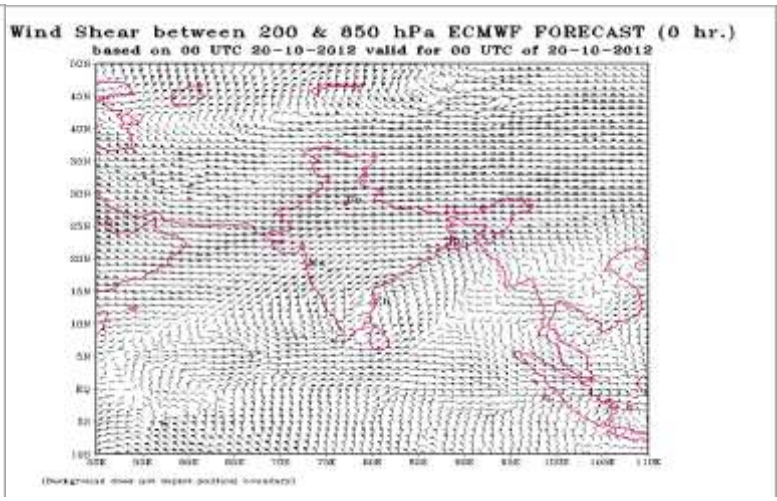
**No. of PILOT Ascents:**

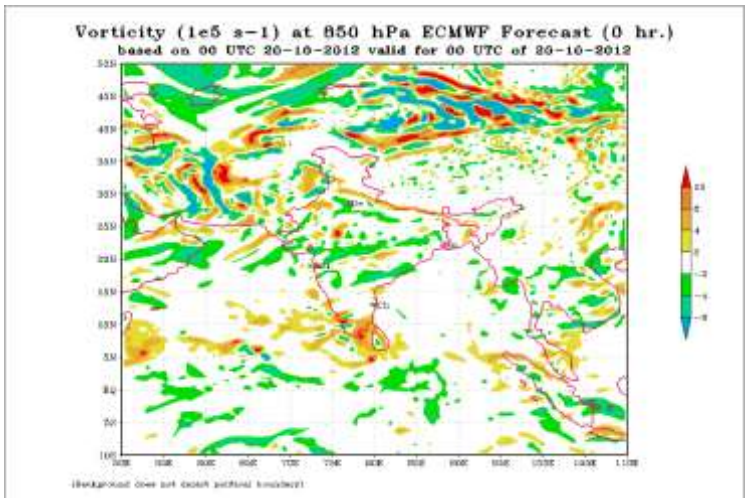
**19.10.2012**

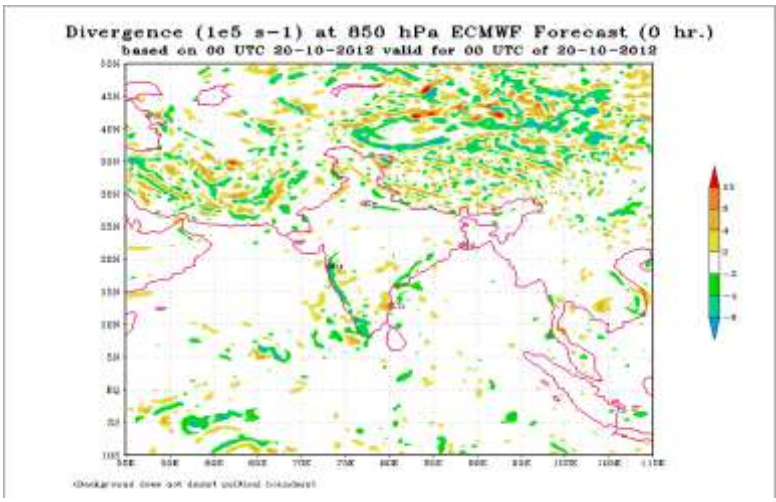
| 06Z | 18Z |
|---|---|
| 4 | 4 |

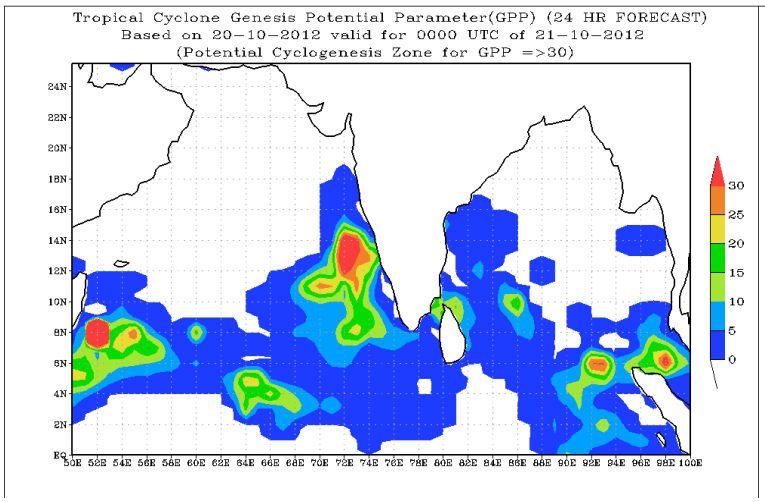
## Annexure II

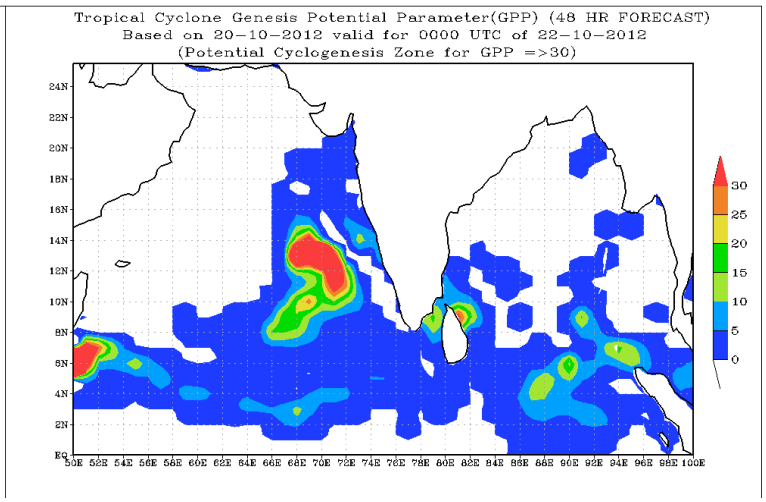

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 20-10-2012 valid for 00 UTC of 20-10-2012

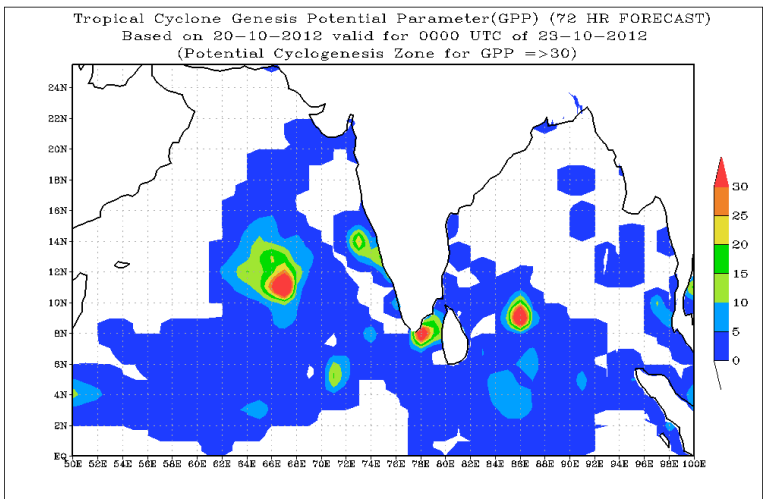

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 20-10-2012 valid for 00 UTC of 20-10-2012

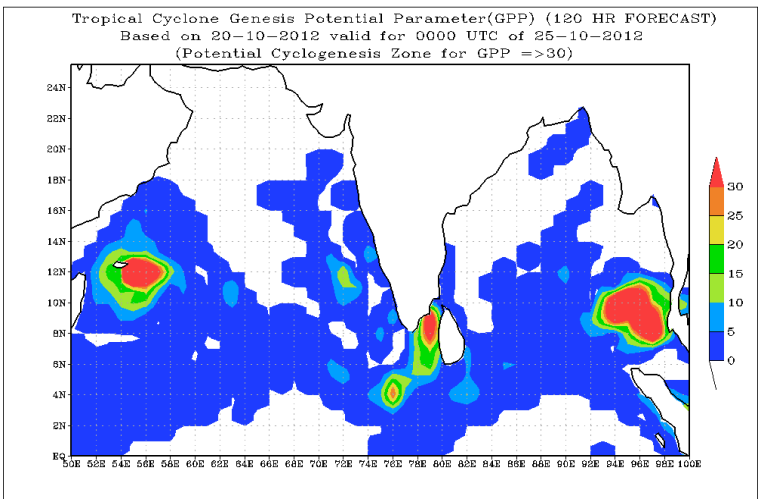

Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 20-10-2012 valid for 00 UTC of 20-10-2012

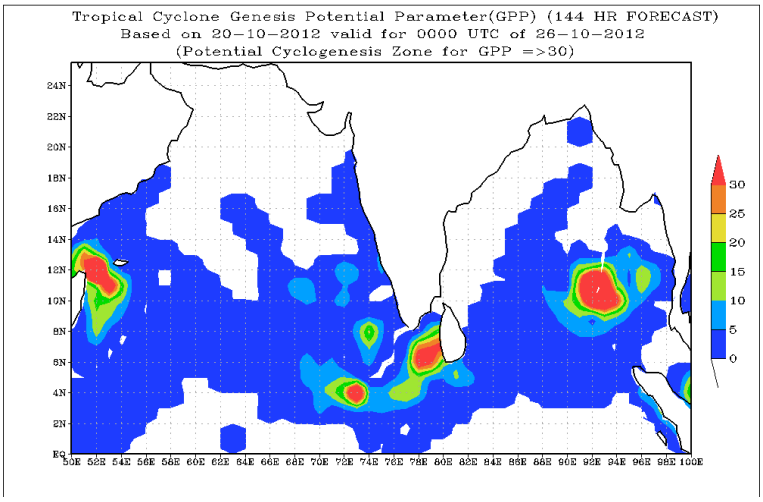

Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 20-10-2012 valid for 00 UTC of 20-10-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 20-10-2012 valid for 0000 UTC of 21-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 20-10-2012 valid for 0000 UTC of 22-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 20-10-2012 valid for 0000 UTC of 23-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 20-10-2012 valid for 0000 UTC of 25-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (144 HR FORECAST)
Based on 20-10-2012 valid for 0000 UTC of 26-10-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 21 October, 2012

**Synoptic features based on 0300 UTC:**

- **The northeast Monsoon has been vigorous over Rayalaseema and active over Tamil Nadu, south interior Karnataka and Kerala.**
- The trough of low extends from Lakshadweep area to Gujarat region across eastcentral Arabian Sea off Maharashtra coast. Under its influence, a low pressure area would develop over southeast Arabian Sea during next 24 hours.
- An upper air cyclonic circulation lies over south Andaman Sea and neighbourhood extends upto 3.1 Km above mean sea level. Under its influence, a low pressure area would form over the same area around 24$^{th}$ October.
- ITCZ roughly runs along 5º N.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 29-30$^0$C over parts of central Bay of Bengal band east-central Arabian Sea. It is greater than 30º C in Bay of Bengal alongoff coastal Tamil Nadu and Kerala.
- Buoys data show that warm SST around 29-30$^0$C over the central Bay of Bengal over cyclogenesis area.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ cm$^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ cm$^{-2}$ over central parts of Bay of Bengal.
- Ocean thermal energy is around 80 KJ cm$^{-2}$ over southeast Arabian Sea.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over central and adjoining south-west Arabian Sea.

**Convergence:**

- Lower level convergence of the order of 5-10* 10$^{-5}$ s$^{-1}$ prevails over southeast Arabian Sea and south-west Bay of Bengal (alongoff coastal Tamil nadu and Andhra Pradesh) .

**Divergence:**

- Upper air positive divergence of the order of 20*10$^{-5}$ s$^{-1}$ prevails over southeast Arabian Sea & of the order of 10*10$^{-5}$ s$^{-1}$ over south Andaman Sea.

**Wind Shear:**

- Wind Shear is of order 5-10 knots over southwest Bay of Bengal & southeast Arabian sea, Tamilnadu, Kerala and Andaman Sea.

**Wind Shear Tendency:**

- Increased over southeast Arabian Sea and decreased over of the order 5 knots over central Bay of Bengal..

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hpa passes through latitude 17.0°N

**M.J.O. Index:**

- Located over phase 1 with amplitude around 2.
- Statistical forecast: - MJO moves through phase 1, during next 4 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1 and may continue with phase 1 during next 4 days with increasing amplitude.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

**Satellite**

A low level circulation has formed over south east Arabian sea from 21/0000UTC. Associated low/medium clouds with moderate to intense convection are observed at many places over the area bet latitude 8.0ºN to 15.0ºN east of long 68.0ºE. The low level circulation over north Tamilnadu adjoining Bay and Rayalseema get weakened IR imagery indicates minimum cloud top temperature is around -54.0°C over Southeast Arabian sea.

**NWP Analysis**

- **IMD-GFS** model analysis shows a LOW over the southeast Arabian Sea. Model forecasts show that the system likely to move westwards direction and shows no intensification of the system and becomes less marked on day 4 over southwest Arabian Sea. The forecast also shows formation of a LOW over southeast Bay of Bengal on day3 and its intensification into a cyclonic storm on day 5 and severe to very severe cyclonic storm on day 6 and day 7. The system is likely to move in the west northwest direction.
- **IMD-WRF-ARW** model analysis shows a LOW over the southeast Arabian Sea. Model forecasts show that the system likely to move westwards direction and shows intensification of the system till day 3 (two closed isobar).
- **ECMWF** model analysis shows a LOW over southeast Arabian Sea. Model forecasts show that the system likely to move westwards direction and also shows intensification of the system (two closed isobar) on day 2 and becomes less marked over southwest Arabian Sea. The forecast also shows formation of a LOW over southeast Bay of Bengal on day4 and its intensification till day7. The system is likely to move in the west northwest direction. The vorticty, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **UKMET Unified** model analysis of 0000 UTC of 20October 2012 shows a CYCIR over southeast Arabian Sea. Model forecasts show that the system likely to move westwards direction and intensify from day 2 to day 7. 22

October 2012 to 25 October 2012 over the Arabian Sea. The forecast also shows formation of a LOW over southeast Bay of Bengal on day5 and its intensification till day7.

- **Genesis Potential Parameter (GPP):** The GPP analysis shows a cell of GPP of 30 over the southeast Arabian Sea. Model forecast of GPP suggests organization of the GPP area indicating slight intensification of the system and its movement towards westward direction and becomes less marked on day5. Model forecast also shows that formation of a new GPP area over southeast Bay of Bengal on day4 and subsequent organization of the GPP cell till day7 indicating formation and intensification of the new system over the Bay of Bengal and its northwestward movement.

**Advisory:**

- **Circulation over Lakshadweep area needs to be watched as a low pressure area is likely to form over southeast Arabian Sea within 24 hours.**
- **Another circulation over south Andaman Sea & neighbourhood also needs to be watched as a low pressure area would form over the same area around 24th October.**
- **NO IOP is declared for next 2 days for Bay of Bengal.**

**Annexure-I**

**Status of Observation system:**

**Synop**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **20/12** | **21/00** | **21/03** |
| **India** | 83/87 | 70/77 | 81/87 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 10/11 | 11/11 | 8/11 |
| **Myanmar** | 10/11 | 10/11 | 10/11 |
| **Thailand** | 1/1 | 1/1 | 1/1 |
| **Srilanka** | 8/9 | 8/9 | 8/9 |

**AWS**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **20/12** | **21/00** | **21/03** |
| **India** | 90/121 | 88/121 | 96/121 |
| **WB** | 8/20 | 8/20 | 8/20 |
| **ODS** | 28/38 | 27/38 | 30/38 |
| **AP** | 29/35 | 29/35 | 32/35 |
| **TN** | 23/26 | 22/26 | 24/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 20 -10-2012: 5/39
- **No. of Ascents reaching 250 hPa levels: 1, MISDA:-32**
- **RS/RW** (00Z) of 21 -10-2012: 20/39
- **No. of Ascents reaching 250 hPa levels: 10 , MISDA: 18**

**No. of PILOT Ascents**

| 20/12Z | 21/00Z |
|---|---|
| 13/37 | 20/34 |

**Buoy Data**

| 20/12Z | 21/00Z | 21/03Z |
|---|---|---|
| 15/22 | 11/22 | 11/22 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **20.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **21** | **21** | **22** | **19** | **18** | **17** |

**No. of RS/RW Ascents**

**00Z / 20.10.2012 : 3**

No. of Ascents reaching 250 hpa level =3

**MISDA : 5**

**12Z /20.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

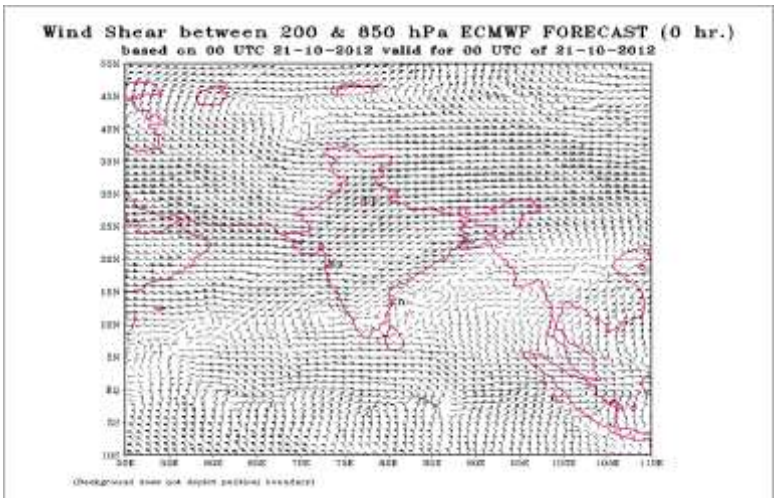
**MISDA : 8**

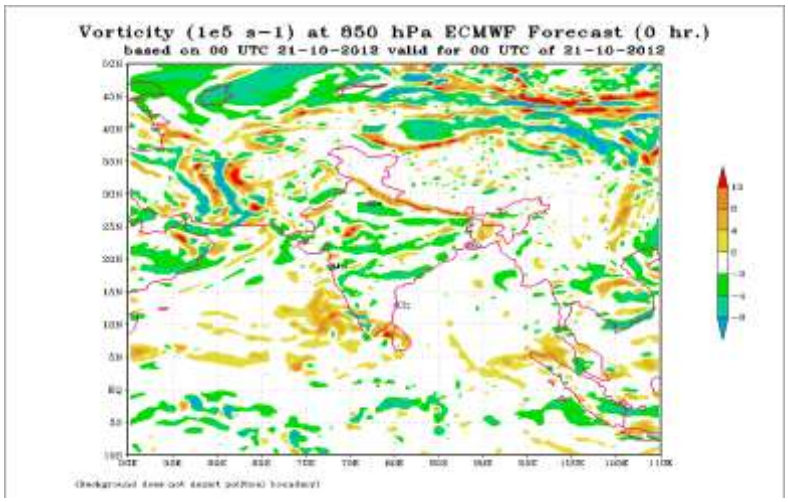
**No. of PILOT Ascents:**

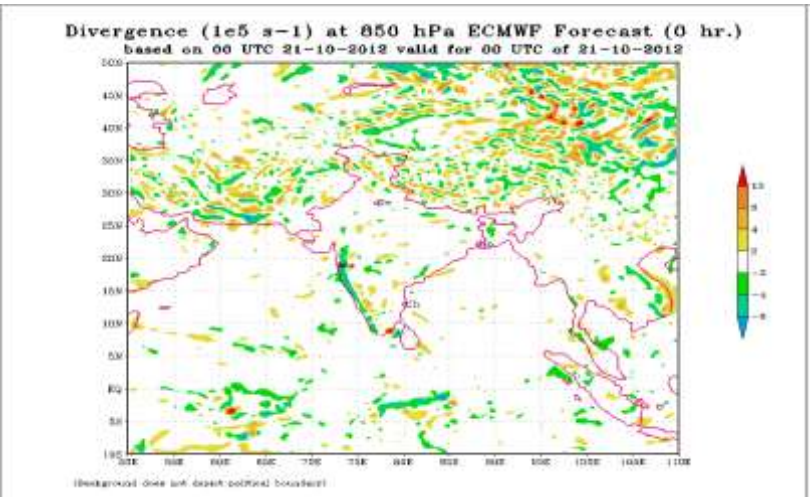
**20.10.2012**

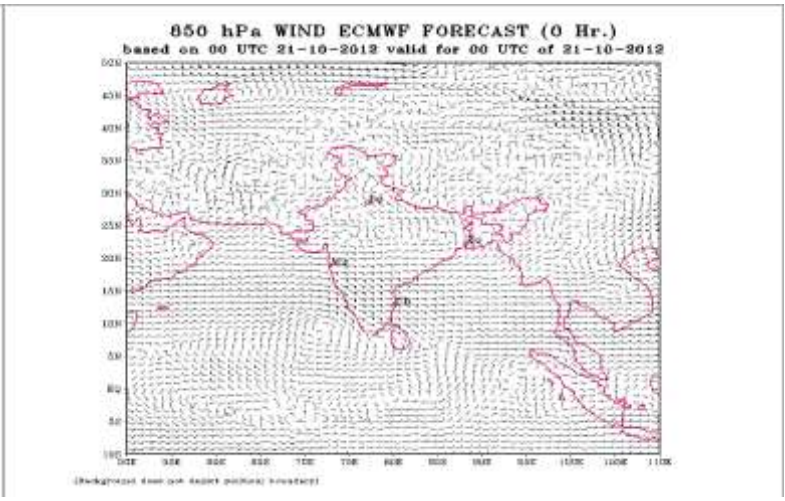
| 06Z | 18Z |
|---|---|
| 1 | 1 |

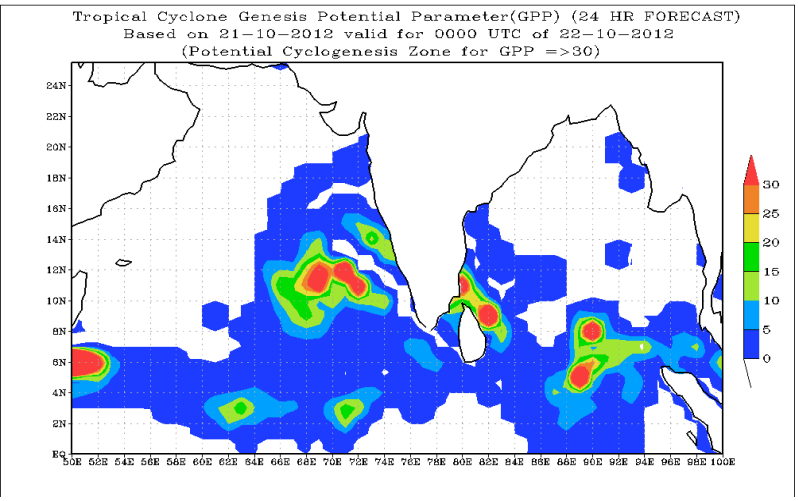
## Annexure II

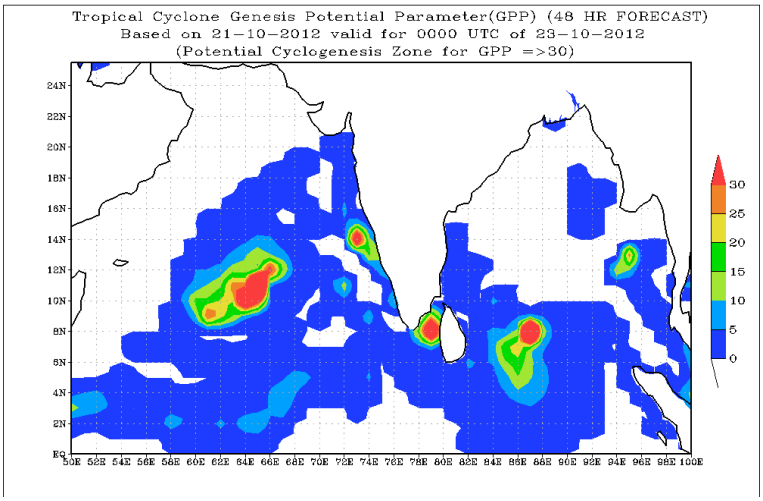

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 21-10-2012 valid for 00 UTC of 21-10-2012

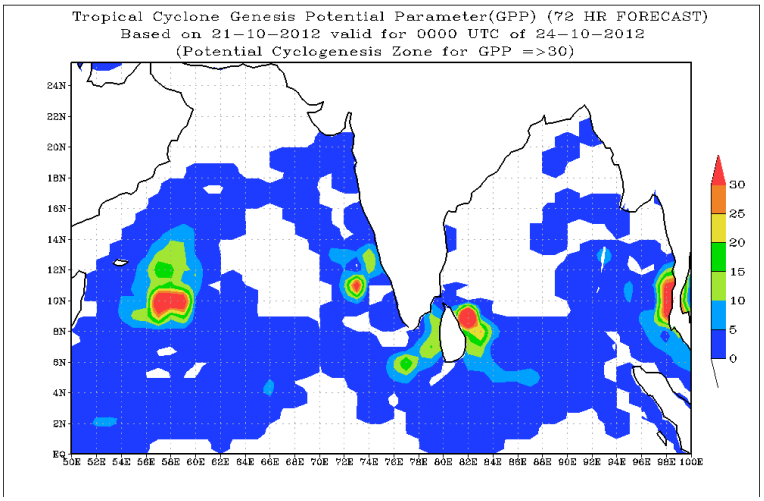

Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 21-10-2012 valid for 00 UTC of 21-10-2012

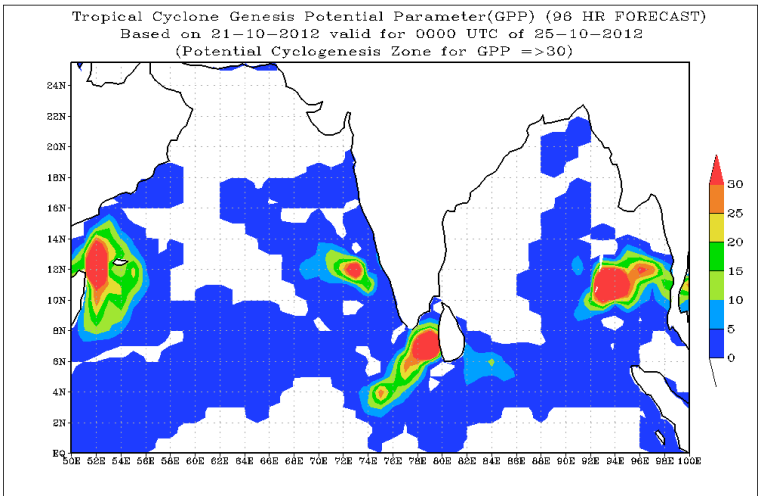

Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 21-10-2012 valid for 00 UTC of 21-10-2012

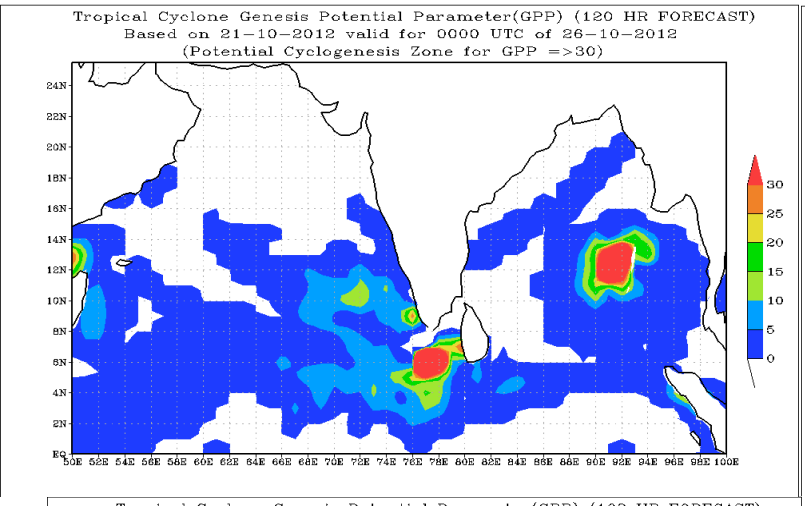

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 21-10-2012 valid for 00 UTC of 21-10-2012

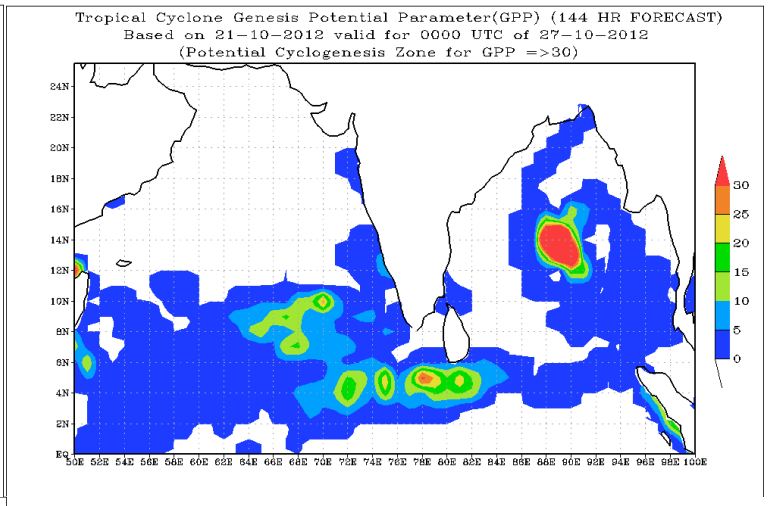

Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 21-10-2012 valid for 0000 UTC of 22-10-2012
(Potential Cyclogenesis Zone for GPP =>30)

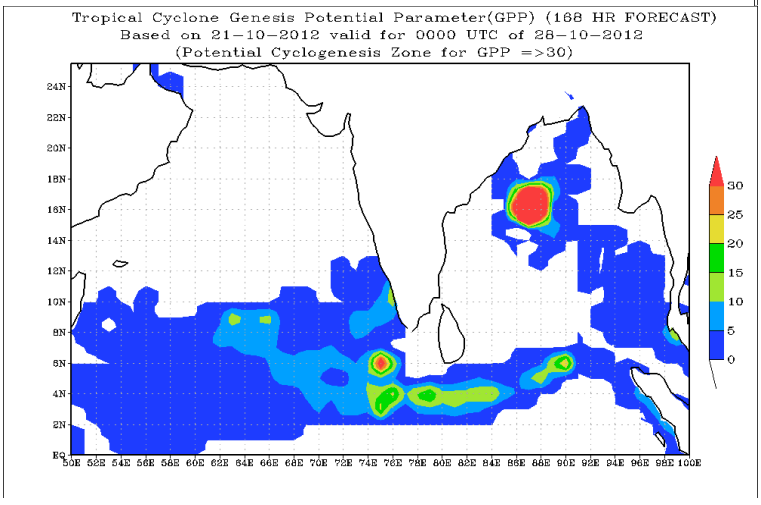

Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 21-10-2012 valid for 0000 UTC of 23-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 21-10-2012 valid for 0000 UTC of 24-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 21-10-2012 valid for 0000 UTC of 25-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 21-10-2012 valid for 0000 UTC of 26-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (144 HR FORECAST)
Based on 21-10-2012 valid for 0000 UTC of 27-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (168 HR FORECAST)
Based on 21-10-2012 valid for 0000 UTC of 28-10-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 22 October, 2012

**Synoptic features based on 0300 UTC:**

- The northeast Monsoon has been vigorous over Tamil Nadu and active over Rayalaseema and Kerala.
- Under the influence of the trough of low at mean sea level from Lakshadweep area to south Gujarat Region with embedded cyclonic circulation over Lakshadweep, a low pressure area has formed over southeast Arabian Sea and neighbourhood. Associated cyclonic circulation extends upto 3.6 kms a.s.l. System may intensify into a depression and move west-northwestwards.
- The other trough of low at mean sea level over south Andaman Sea and neighbourhood now lies over southeast Bay of Bengal and neighbourhood with a cyclonic circulation aloft extending upto 3.1 kms a.s.l.
- A low pressure area lies over Gulf of Siam and neighbourhood. It is likely to move westwards and emerge into south Andaman Sea around $24^{th}$.
- ITCZ roughly runs along 5º N over Bay of Bengal and along 8º N over Arabian Sea.
- The 24 hr change in MSLP shows no significant change over Thailand and Andaman & Nicobar Islands.
- There is no tropical disturbance over northwest Pacific and south Indian Ocean.

**Environmental features based on 0300 UTC of today:**
**Sea Surface Temperature:**

- SST around 29-30$^0$C over parts of central Bay of Bengal and southeast and east-central Arabian Sea. It is greater than 30º C in Bay of Bengal alongoff coastal Tamil Nadu and Kerala and 26-28$^0$C over southwest Bay off Sri Lanka coast.
- Buoys data show that warm SST around 29-30$^0$C over the central Bay of Bengal and east Arabian Sea.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ cm$^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ cm$^{-2}$over central parts of Bay of Bengal.
- Ocean thermal energy is around 80-100 KJ cm$^{-2}$ over southeast and adjoining eastcentral Arabian Sea.

**Relative Vorticity:**

- Relative vorticity at 850 hPa has increased over southeast Arabian Sea and is about 10* 10$^{-5}$ s$^{-1}$. It is about 08* 10$^{-5}$ s$^{-1}$over Gulf of Thailand

**Convergence:**

- Lower level convergence of the order of 5-10* 10$^{-5}$ s$^{-1}$prevails over southeast Arabian Sea and south-west Bay of Bengal and about 20* 10$^{-5}$ s$^{-1}$over Gulf of Thailand.

**Divergence:**

- Upper air positive divergence of the order of $20*10^{-5}$ $s^{-1}$prevails over southeast Arabian Sea (northeast sector of low) & of the order of $10\text{-}20*10^{-5}$ $s^{-1}$over central part of south Bay and Gulf of Thailand.

**Wind Shear:**

- Wind Shear is of order 5-10 knots over southwest Bay of Bengal & southeast Arabian sea, Tamilnadu, Kerala and Andaman Sea.

**Wind Shear Tendency:**

- Increased over southwest Bay and no significant change over southeast Bay and southeast Arabian Sea.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT 200 hpa passes through latitude 15.0°N over Arabian Sea and $13^0$N over Bay of Bengal.

**M.J.O. Index:**

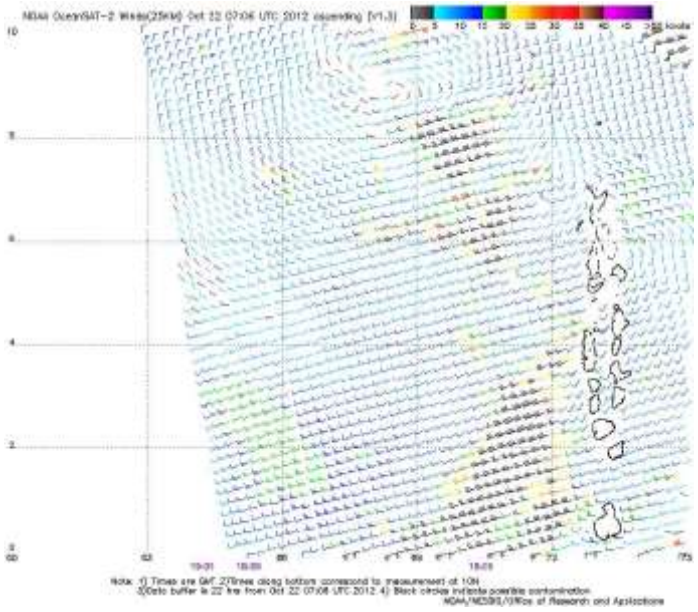
- Located over phase 1 with amplitude around 2.
- Statistical forecast: - MJO moves through phase 1, during next 4 days. Then it may enter into phase 2.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1 and may continue with phase 1 during next 4 days with increasing amplitude.

**Status of observational system:**
Details of the status of observational system are given in **Annexure 1**.

**Satellite**
Yesterday's low level circulation moved westwards and lies over southeast Arabian sea. Associated low/medium clouds with intense to very intense convection are observed at many places over Arabian Sea between lat 10.0N to 11.5N long 68.0E to 70.0E and moderate to intense convection over area between lat 5.0N to 15.5N long 62.5E to 71.5E.
Broken low/med clouds are seen over southwest Bay with embedded moderate to intense convection.
IR imagery indicates minimum cloud top temperature is around -71.0°C over southeast Arabian Sea and minimum cloud top temperature is around -70.0°C over southwest Bay.

**OSCAT-II pass of 21st Oct 2012 , 18:59 UTC also indicates circulation over the same area . Associated wind speed is about 15-20 knots.**

(See ftp://192.168.12.75/imd/satmet
http://www.imd.gov.in/section/satmet/dynamic/insat.htm)



## NWP Analysis

- **IMD-GFS** model analysis shows a LOW over the southeast Arabian Sea. Model forecasts show that the system likely to move westward and shows no intensification of the system and becomes less marked on day 4 over southwest Arabian Sea. The forecast also shows low over Gulf of Thailand and its emergence over south Andaman Sea on 24$^{th}$ . It is likely to intensify into a depression on 25$^{th}$ and into a cyclonic storm on 27$^{th}$ and severe cyclonic storm on28-29$^{th}$ while moving northwestwards. On 30$^{th}$ , it is lying near Odisha coast after moving northward and with intensity reduced to a cyclonic storm.
- **IMD-WRF-ARW** model analysis shows a LOW over the southeast Arabian Sea. Model forecasts show that the system likely to move westwards direction and shows intensification of the system till day 3 (two closed isobar).The low over Gulf of Thailand likely to emerge on 24$^{th}$ into south Andaman Sea
- **ECMWF** model analysis shows a LOW over southeast Arabian Sea. Model forecasts show that the system likely to move westwards direction and also shows intensification of the system (two closed isobar) during next 48 hrs and becomes less marked over southwest Arabian Sea. It is likely to move towards Sucotra Island.
- The forecast also shows emergence of the low over Gulf of Thailand into south Andaman sea and its intensification into a depression over southeast Bay of Bengal on 27$^{th}$ . Thereafter, it is likely to move westwards and then west-southwestwards towards Tamil Nadu coast.
- **UKMET Unified** model analysis of 0000 UTC of 21October 2012 shows a low over southeast Arabian Sea. Model forecasts show that the system likely to move westwards direction and intensify from day 1 to day 4 (22 October 2012 to 25 October 2012 over the Arabian Sea. It is likely to move westwards towards Somalia coast and adjoining Gulf of Aden and shows weakening on 26$^{th}$
- The forecast also shows formation of a LOW over southeast Bay of Bengal and adjoining Andaman Sea on 26$^{th}$ and move northwestwards with gradual intensification into a cyclonic storm on 28$^{th}$ over west central Bay of Bengal. (http://www.imd.gov.in/section/nhac/dynamic/welcome.htm )

(http://www.ncmrwf.gov.in/)

**Genesis Potential Parameter (GPP):** The GPP analysis shows a cell of GPP of 30 over the southeast Arabian Sea. Model forecast of GPP suggests organization of the GPP area indicating intensification of the system and its movement towards west. Model forecast also shows that formation of a new GPP area over Andaman Sea on 24th . Subsequent organization of the GPP cell indicating formation and intensification of the new system over the Bay of Bengal and its northwestward movement.

( http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm)

**Advisory:**

- **low pressure area over southeast Arabian Sea is likely to concentrate into a depression during next 48 hrs.**
- **The circulation over south Andaman Sea & neighbourhood now lies over southeast Bay of Bengal. It is likelt to move westwards**
- **The low pressure area over Gulf of Thailand is likely to emerge into south Andaman Sea on 24th It is likely to move initially west-northwestward and intensify into a depression over southeast Bay of Bengal during subsequent 48 hrs.**
- **As a result, heavy to very heavy rainfall is likely over Andaman & Nicobar Islands during 24-26th October along with squally winds and rough sea conditions.**
- **NO IOP is declared for next 2 days for Bay of Bengal**

**Annexure-I**

**Status of Observation system:**

**Synop**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **21/12** | **22/00** | **22/03** |
| **India** | 80/87 | 64/68 | 7989 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 3/7 | 10/11 |
| **Odisha** | 10/11 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/17 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 12/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 6/11 | 6/11 | 8/11 |
| **Myanmar** | 10/11 | 10/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 6/9 | 7/9 |

**AWS**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | 21/12 | 22/00 | 22/03 |
| India | 96/121 | 94/121 | 100/121 |
| WB | 12/20 | 15/20 | 11/20 |
| ODS | 28/38 | 29/38 | 31/38 |
| AP | 31/35 | 26/35 | 32/35 |
| TN | 23/26 | 22/26 | 24/26 |
| PDC | 2/2 | 2/2 | 2/2 |

- **RS/RW (12Z) of 21 -10-2012: 5/39**
- **No. of Ascents reaching 250 hPa levels: 1, MISDA:-32**
- **RS/RW (OOZ) of 22 -10-2012: 21/39**
- **No. of Ascents reaching 250 hPa levels: 10, MISDA: 18**

**No. of PILOT Ascents**

| 21/12Z | 22/00Z |
|---|---|
| 18/37 | 22/34 |

**Buoy Data**

| 21/12 | 22/00 | 22/03 |
|---|---|---|
| 13/22 | 12/22 | 14/22 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **21.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 21.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /21.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

**MISDA : 8**

**No. of PILOT Ascents: 21.10.2012**

| 06Z | 18Z |
|---|---|
| 4 | 2 |

## FDP (Cyclone) NOC Report Dated 23 October, 2012

**Synoptic features based on 0300 UTC:**

- The northeast Monsoon has been active over Tamil Nadu, coastal Karnataka and Kerala.
- The low pressure area over southeast Arabian Sea and neighbourhood became well marked over southeast and neighbouring areas of central & southwest Arabian Sea in the early morning of today. It concentrated into a **Depression** over the same area and lay centred at 0300 UTC of today, the 23rd October 2012, within half a degree of Lat. 11.0° N / Long. 65.0° E, about 800 kms west of Amini Divi. System would move westnorthwestwards towards Somalia – Yemen coasts and may intensify further during next 72 hours.
- The trough of low at mean sea level over southeast Bay of Bengal and neighbourhood now lies over southeast and adjoining southwest Bay of Bengal and equatorial Indian Ocean.
- The low pressure area over Gulf of Siam now lies over Thailand and neighbourhood. It is likely to move westwards and emerge into south Andaman Sea within next 48 hrs.
- ITCZ roughly runs along 6º N over Bay of Bengal and along 10º N over Arabian Sea.
- The 24 hr change in MSLP shows fall of pressure by 1-2 hPa over Thailand and Andaman & Nicobar Islands.
- There is no tropical disturbance over northwest Pacific and south Indian Ocean.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 29-30$^0$C over parts of central Bay of Bengal and southeast and east-central Arabian Sea. It is greater than 30º C in Bay of Bengal alongoff coastal Tamil Nadu and Kerala and 26-28$^0$C over southwest Bay off Sri Lanka coast. It is about 26-28$^0$C over west central and southwest Arabian Sea (west of 60$^0$E).
- Buoys data show that warm SST around 29-30$^0$C over the central Bay of Bengal and east Arabian Sea.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ cm$^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ cm$^{-2}$ over central parts of Bay of Bengal.
- Ocean thermal energy is around 80-100 KJ cm$^{-2}$ over southeast and adjoining eastcentral Arabian Sea. It is less than 50 KJ cm$^{-2}$ over west central and southwest Arabian Sea (west of 60$^0$E).

**Relative Vorticity:**

- Relative vorticity at 850 hPa has increased over southeast Arabian Sea (southwest sector of depression) and is about 10-15* $10^{-5}$ $s^{-1}$. It is about 08* $10^{-5}$ $s^{-1}$ over Gulf of Thailand

**Convergence:**

- Lower level convergence of the order of 10-15* $10^{-5}$ $s^{-1}$ prevails over southeast Arabian Sea (maximum over southwest sector of depression) and over Gulf of Thailand and about 5* $10^{-5}$ $s^{-1}$ over south-west Bay of Bengal.

**Divergence:**

- Upper air positive divergence of the order of 20*$10^{-5}$ $s^{-1}$ prevails over southeast Arabian Sea (southeast sector of depression) & of the order of 10-20*$10^{-5}$ $s^{-1}$ over central part of south Bay and Gulf of Thailand and southwest and adjoining westcentral Arabian Sea.

**Wind Shear:**

- Wind Shear is of order 5-10 knots over south Bay of Bengal & southeast Arabian sea, Tamilnadu, Kerala and Andaman Sea and Thailand.

**Wind Shear Tendency:**

- Decreased over south Bay and southeast Arabian Sea.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hpa passes through latitude 14.0°N over Arabian Sea and $13^0$N over Bay of Bengal.

**M.J.O. Index:**

- Located over phase 1 with amplitude around 2.
- Statistical forecast: - MJO moves into phase 2, during next 4 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1 and may enter into phase 2 during next 4 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

**Satellite advisory**

Yesterday's low level circulation moved west-north-westwards and intensified into a Vortex T1.0 at 1200 UTC of yesterday. It further intensified and lay centered near 11.2/65.0E over southeast Arabian Sea with intensity of T1.5 at 2100 UTC. Associated low/medium clouds with embedded intense to very intense convection are observed at many places over Arabian sea between lat 8.0N to 12.5N long 59.0E to 64.0E and moderate to intense convection over rest Arabian sea between lat 6.5N to 16.5N east of long 58.0E.

Broken low/med clouds with embedded moderate to intense convection over Andaman sea. IR imagery indicates minimum cloud top temperature is around -76.0°C over south central Arabian sea.

**NWP Analysis**

- **IMD-GFS** model MSLP & wind charts show low pressure area over east-central Arabian Sea on 23rd October. It may intensify into depression on 24th October.The system moves in Westerly direction and lies over Southwest Arabian Sea on 25th October. After that system weakens.
- **IMD-GFS** mode MSLP & wind charts also show the formation of low pressure area over south-east Bay of Bengal on 26th October. This system may intensify into depression on 27th October and move in north-westerly direction. It further intensifies in cyclonic storm on 28th and continues to move in north-westerly direction. On 30th system lies off Andhra coast as cyclonic storm.
- **IMD-WRF** model analysis shows a LOW over the east-central Arabian Sea. Model forecasts show that the system may intensify into depression and move westwards direction. System weakens after 25th October.
- **ECMWF** model analysis shows a low over east-central Arabian Sea on 23rd October and it intensifies into depression on 24th October. The system moves in Westerly direction and lies over Southwest Arabian Sea on 25th October. After that system weakens.
- **ECMWF** model also show the formation of low pressure area over south-east Bay of Bengal on 27th October. This system may move in westerly direction. It continues to move in westerly direction and lies off Chennai coast on 29th October.
- **Genesis Potential Parameter (GPP):**
- The GPP analysis shows a cell of GPP of 30 over the east-central Arabian Sea. Model forecast of GPP suggests organization of the GPP area indicating slight intensification of the system and its movement towards westward direction and becomes less marked after 25th October.
- Model forecast also shows that formation of a new GPP area over southeast Bay of Bengal on 25th October and subsequent organization of the GPP cell. GPP forecast indicates intensification of this system over the Bay of Bengal with northwestward movement. System lays off Andhra coast on 30th with GPP value greater than 30.

**Advisory:**

- **The depression over southeast and adjoining southwest and central Arabian Sea would move west-northwestwards during next 48 hrs.**
- **It may intensify further during next 24 hrs**
- **The low pressure area over Thailand is likely to emerge into south Andaman Sea during next 24 hrs. It is likely to move initially west-northwestward and intensify into a depression over southeast Bay of Bengal around 26th.**
- **As a result, heavy to very heavy rainfall is likely over Andaman & Nicobar Islands during 24-26th October along with squally winds and rough sea conditions.**
- **NO IOP is declared for next 2 days for Bay of Bengal.**

**Annexure-I**

**Status of Observation system:**

**Synop**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **22/12** | **23/00** | **23/03** |
| **India** | 75/87 | 69/78 | 83/89 |
| **Coastal stations** | | | |
| **WB** | 12/13 | 4/7 | 10/11 |
| **Odisha** | 6/6 | 6/7 | 10/10 |
| **AP** | 18/18 | 16/17 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 3/11 | 9/11 | 11/11 |
| **Myanmar** | 9/11 | 10/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 7/9 |

**AWS**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **22/12** | **23/00** | **23/03** |
| **India** | 89/121 | 91/121 | 99/121 |
| **WB** | 7/20 | 9/20 | 10/20 |
| **ODS** | 26/38 | 27/38 | 29/38 |
| **AP** | 32/35 | 30/35 | 33/35 |
| **TN** | 22/26 | 23/26 | 25/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 22 -10-2012: 6/39
- **No. of Ascents reaching 250 hPa levels: 1, MISDA:-32**
- **RS/RW** (00Z) of 23 -10-2012: 21/39
- **No. of Ascents reaching 250 hPa levels: 10 , MISDA: 18**

**No. of PILOT Ascents**

| 22/12Z | 23/00Z |
|---|---|
| 16/37 | 21/34 |

**Buoy Data**

| 22/12Z | 23/00Z | 23/03Z |
|---|---|---|
| 18/22 | 16/22 | 20/22 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | | | | **22.10.2012** | | | |
|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **21** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 22.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /22.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

**MISDA : 8**

**No. of PILOT Ascents:**

**22.10.2012**

| 06Z | 18Z |
|---|---|
| 4 | 5 |

## FDP (Cyclone) NOC Report Dated 24 October, 2012

**Synoptic features based on 0300 UTC:**

- The northeast Monsoon has been vigorous over Tamil Nadu.
- The Depression over southeast and adjoining areas of central & southwest Arabian Sea moved westnorthwestwards and lay centred at 1200 UTC of yesterday, the 23rd October 2012, within half a degree of Lat. 11.5° N / Long. 64.0° E. Subsequently it moved westwards and intensified into a Deep Depression and lay centred at 0300 UTC of today, the 24th October 2012, near Lat. 11.0° N / Long. 59.0°E over southwest and adjoining west central Arabian Sea. About 1500 kms west of Amini Divi. System would move westsouthwestwards, weaken into a Depression and cross Somalia coast between Latitudes 9.0° N & 10.5° N, around 1800 UTC of 25th October 2012.
- The trough of low at mean sea level over southeast and adjoining southwest Bay of Bengal and equatorial Indian Ocean now lies over southwest Bay of Bengal off Sri Lanka coast.
- The low at mean sea level over Thailand and neighbourhood now lies over Tenasserim coast and neighbourhood. It is likely to move westwards and emerge into south Andaman Sea within next 24 hrs.
- ITCZ roughly runs along 6º N over Bay of Bengal and along 10º N over Arabian Sea.
- The 24 hr change in MSLP shows fall of pressure by 1-2 hPa over Thailand coast and rise by 1-2 hPa over Andaman & Nicobar Islands. The pressure departure from the normal is negative by about 1 hPa over Andaman & Nicobar Islands.
- There is a tropical disturbance over south China Sea (near $10.5^0$N and $125.^0$E and is expected to move northwestwards towards VietNam. There is no disturbance over south Indian Ocean.

**Environmental features based on 0300 UTC of today:**
**Sea Surface Temperature:**

- SST around $29\text{-}30^0$C over parts of central Bay of Bengal and southeast and east-central Arabian Sea. It is greater than 30º C in Bay of Bengal alongoff coastal Tamil Nadu and Kerala and $26\text{-}28^0$C over southwest Bay off Sri Lanka coast. It is about $26\text{-}28^0$C over west central and southwest Arabian Sea (west of $60^0$E).
- Buoys data show that warm SST around $29\text{-}30^0$C over the central Bay of Bengal and east Arabian Sea.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ $cm^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ $cm^{-2}$ over central parts of Bay of Bengal.
- Ocean thermal energy is around 50-80 over deep depression region of Arabian Sea. It is less than 50 KJ $cm^{-2}$over Somalia coast and adjoining west central and southwest Arabian Sea.

**Relative Vorticity:**

- Relative vorticity at 850 hPa has increased over depression region is about 10* $10^{-5}s^{-1}$. It is about 08* $10^{-5}s^{-1}$over Tenasserim coast

**Convergence:**

- Lower level convergence of the order of 10-15* $10^{-5}s^{-1}$prevails over depression region and 10* $10^{-5}s^{-1}$over Tenasserim coast.

**Divergence:**

- Upper air positive divergence has decreased and is about of the order of $10*10^{-5}s^{-1}$over depression region. It has increased and is about $30*10^{-5}s^{-1}$over Tenasserim coast.

**Wind Shear:**

- Wind Shear is of order 5-10 knots over south Bay of Bengal & southeast Arabian sea, Tamilnadu, Kerala and Andaman Sea and Thailand. It is 10-20 knots over southwest Arabian Sea and adjoining west central Arabian Sea

**Wind Shear Tendency:**

- No significant change.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT 200 hpa passes through latitude 14.0°N over Arabian Sea and $13^0$N over Bay of Bengal.

**M.J.O. Index:**

- Located over phase 2 with amplitude > 1.
- Statistical forecast: - MJO will remain in phase 2, during next 4 days.
- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1 and will continue in phase 2 during next 4 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**

Yesterday's. vortex over Arabian sea intensified into T2.0 at 1500 UTC and lay centred at 0600 UTC of today near 10.5/58.0E. Intensity T2.0. Associated low/medium clouds with embedded intense to very intense convection are observed at many places over Arabian sea between lat 7.0N to 15.0N long 51.0E to 60.0E and moderate to intense convection over south-east Arabian sea (.)

Broken low/med clouds with embedded moderate to intense convection over Andaman sea and west parts of south-west Bay (.)

IR imagery indicates minimum cloud top temperature is around -78.0°C over south

west Arabian sea.
(See ftp://192.168.12.75/imd/satmet,
http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** model MSLP & wind charts show depression over southwest and adjoining west central Arabian Sea on 24th October. The system moves in Westerly direction and lies over Southwest Arabian Sea on 25th October. After that system weakens and cross Somalia coast.
- **IMD-GFS** mode MSLP & wind charts also show the formation of low pressure area over south-east Bay of Bengal on 26th October. This system initially moves in north-westerly direction. After 28th October this low moves in south-westerly direction and lies near Sri Lanka coast on 30th October.
- **IMD-WRF** model analysis shows depression over southwest and adjoining west central Arabian Sea on 24th October. Model forecasts show that the system moves in westwards direction. System crosses Somalia coast after 25th October.
- **ECMWF** model analysis show depression and associated cycir southwest and adjoining west central Arabian Sea on 24th October. The system moves in Westerly direction and lies over Southwest Arabian Sea on 25th October. System crosses Somalia coast on 26th October.
- **ECMWF** model MSLP & wind charts also show the formation of extended low pressure area over south-central Bay of Bengal on 28th October. This system may move in westerly direction. It continues to move in westerly direction and lies off Sri Lanka coast on 30th October.

**Genesis Potential Parameter (GPP):**

- The GPP analysis shows a cell of GPP of 30 over the southwest and adjoining west central Arabian Sea. Model forecast of GPP suggests organization of the GPP area moves in westward direction and becomes less marked after 26th October.
- Model forecast also shows that formation of a new GPP area over southeast Bay of Bengal on 26th October and subsequent organization of the GPP cell. GPP forecast indicates GPP area initially moves in northwestwards. After 28th October this low moves in south-westerly direction and lies near Sri Lanka coast with GPP value greater than 30 on 30th October.

(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm)

**Advisory:**

- **The deep depression over southwest Arabian Sea would move west-southwestwards and cross Somalia coast by midnight of 25th October 2012. However, it would weaken gradually to a depression during next 24 hrs due to colder sea, low ocean thermal energy and increasing vertical wind shear.**
- **The low pressure area over Tenasserim coast is likely to emerge into south Andaman Sea during next 24 hrs. It is likely to move initially west-**

**northwestwards.**

- **As a result, heavy to very heavy rainfall is likely over Andaman & Nicobar Islands during 25-26th October along with squally winds.**
    - **NO IOP is declared for next 3 days for Bay of Bengal.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Ti me (UTC) | | |
|---|---|---|---|
| | **23/12** | **24/00** | **24/03** |
| **India** | 79/88 | 70/78 | 83/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 17/17 | 17/17 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 7/11 | 9/11 | 7/11 |
| **Myanmar** | 9/11 | 10/11 | 11/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 8/9 | 8/9 |

**AWS observation**

| Region | Date/Time **(UTC)** | | |
|---|---|---|---|
| | **23/12** | **24/00** | **24/03** |
| **India** | 94/121 | 93/121 | 99/121 |
| **WB** | 9/20 | 7/20 | 10/20 |
| **ODS** | 28/38 | 27/38 | 33/38 |
| **AP** | 31/35 | 290/35 | 31/35 |
| **TN** | 24/26 | 23/26 | 23/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW (12Z) of 23 -10-2012: 46/39**
- **No. of Ascents reaching 250 hPa levels: 1, MISDA:-32**
- **RS/RW (00Z) of 24 -10-2012: 13/39**
- **No. of Ascents reaching 250 hPa levels: 10 , MISDA: 18**

**No. of PILOT Ascents**

| 23/12Z | 24/00Z |
|---|---|
| 17/37 | 22/34 |

**Buoy Data**

| 23/12Z | 24/00Z | 24/03Z |
|---|---|---|
| 8/22 | 17/22 | 15/22 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | | | | **23.10.2012** | | | |
|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 23.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /23.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

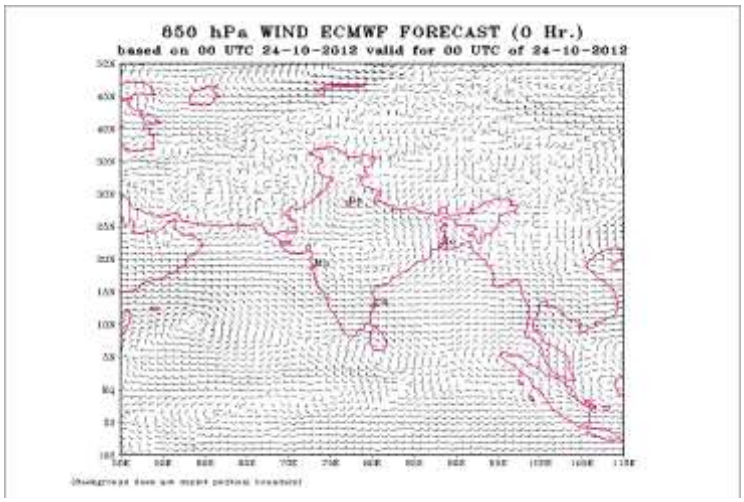
**MISDA : 8**

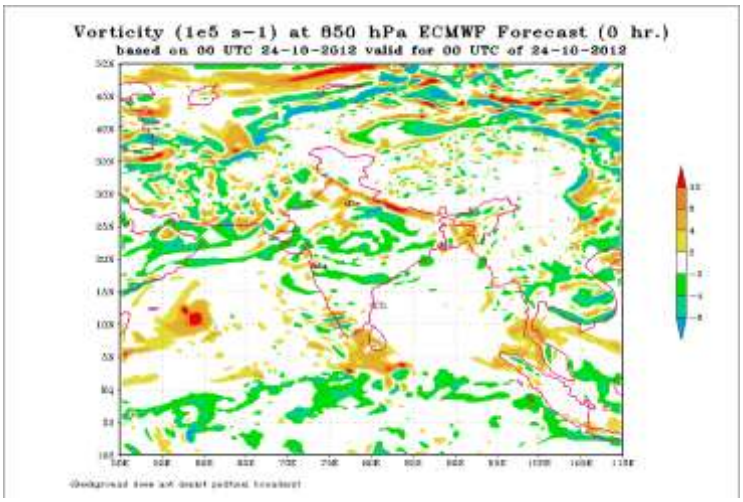
**No. of PILOT Ascents:**

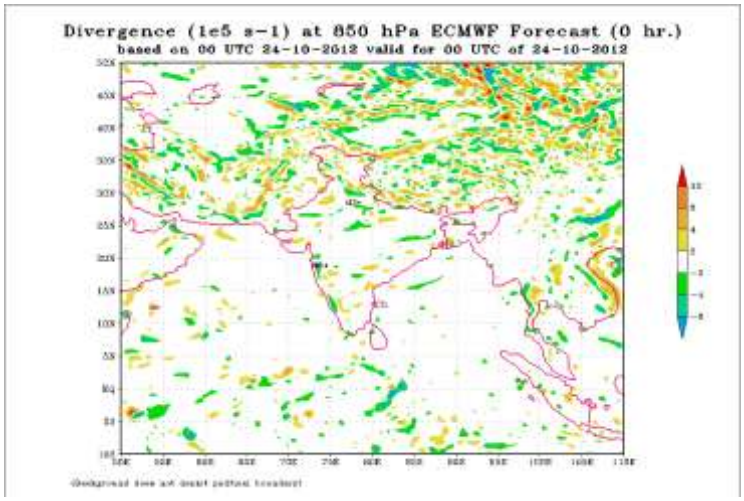
**23.10.2012**

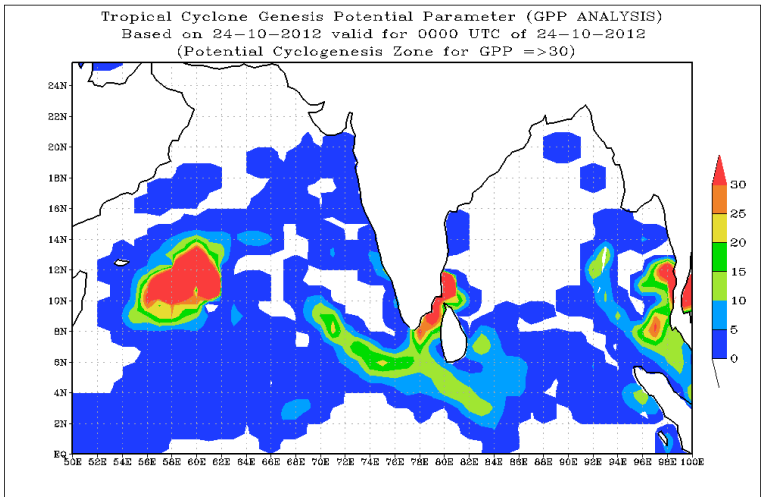
| 06Z | 18Z |
|---|---|
| 2 | 4 |

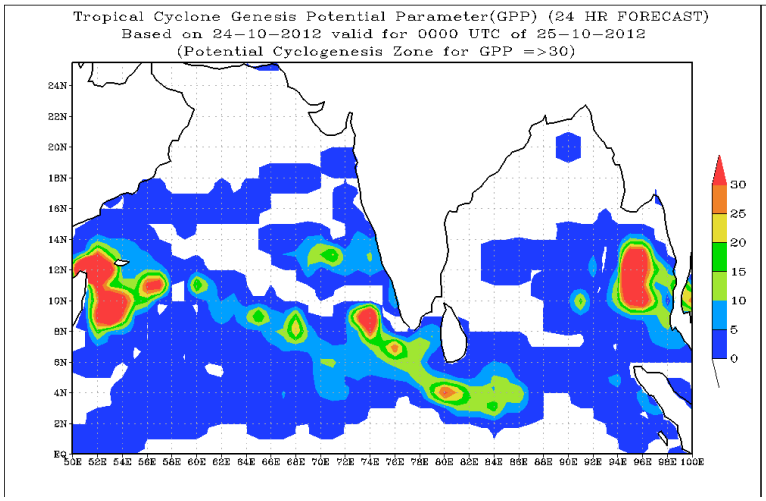
## Annexure II

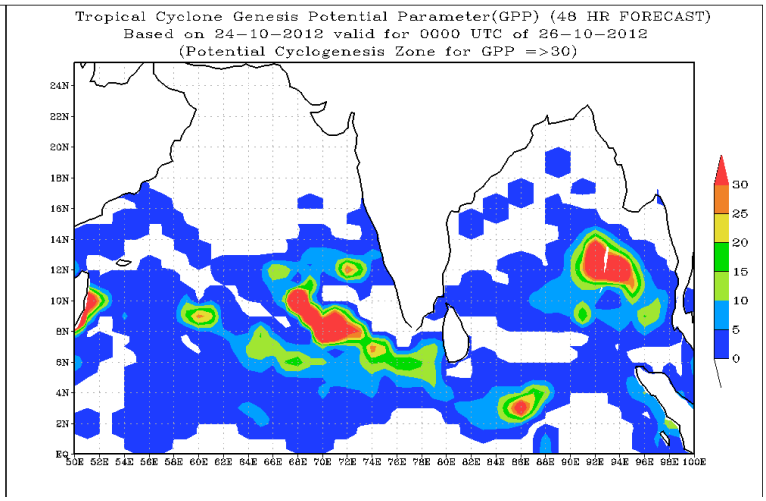

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 24-10-2012 valid for 00 UTC of 24-10-2012

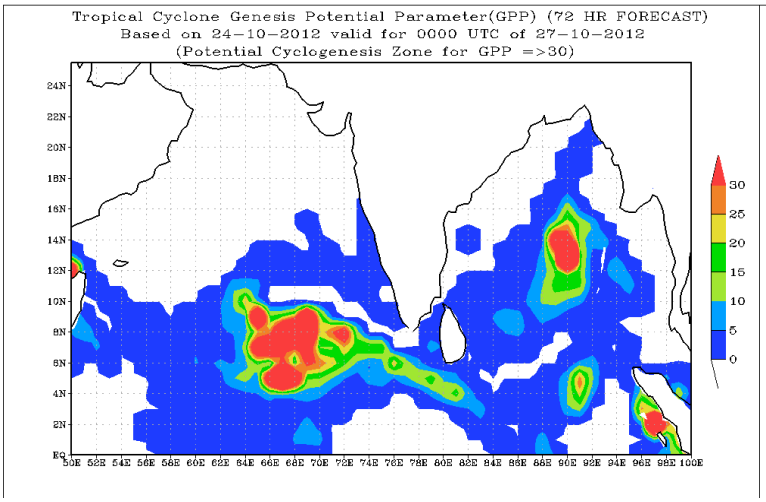

Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 24-10-2012 valid for 00 UTC of 24-10-2012

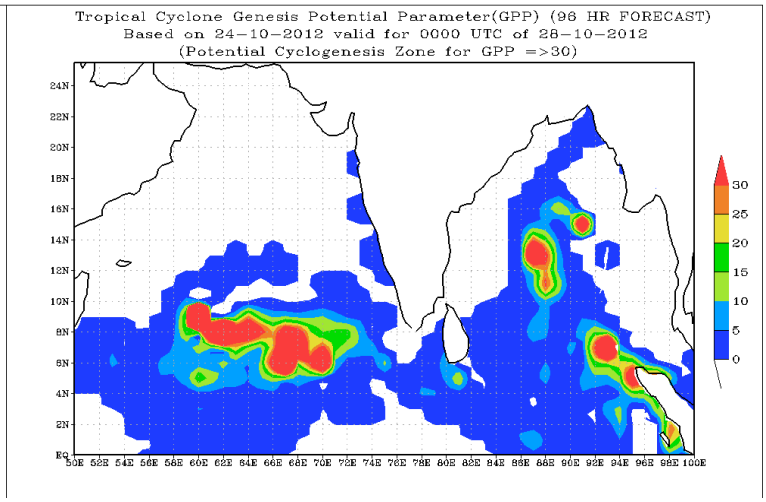

Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 24-10-2012 valid for 00 UTC of 24-10-2012

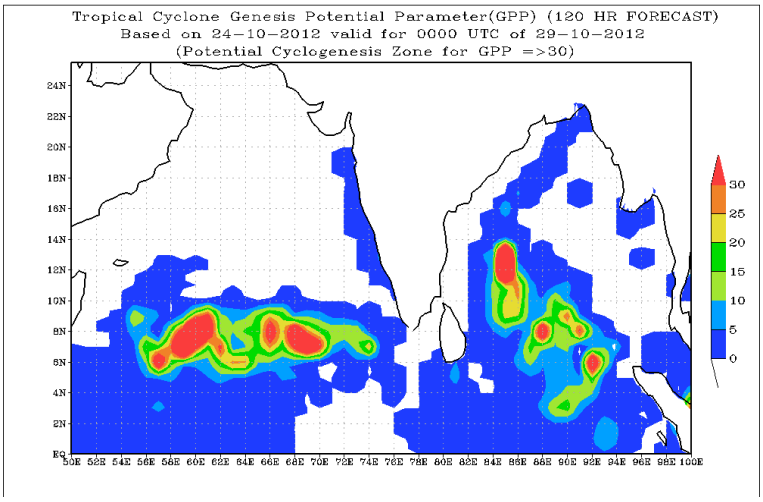

Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 24-10-2012 valid for 0000 UTC of 24-10-2012
(Potential Cyclogenesis Zone for GPP =>30)

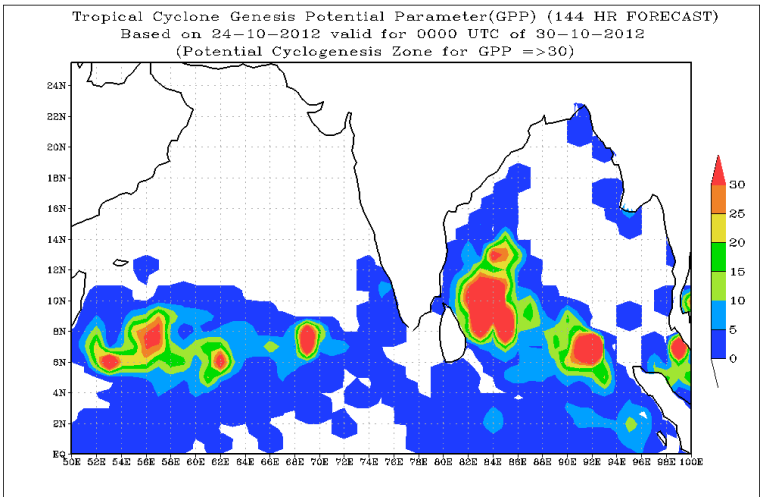

Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 24-10-2012 valid for 0000 UTC of 25-10-2012
(Potential Cyclogenesis Zone for GPP =>30)

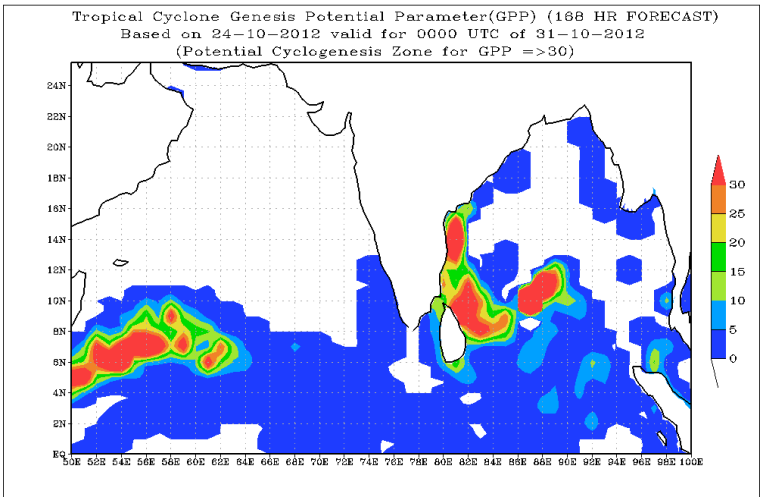

Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 24-10-2012 valid for 0000 UTC of 26-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 24-10-2012 valid for 0000 UTC of 27-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 24-10-2012 valid for 0000 UTC of 28-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 24-10-2012 valid for 0000 UTC of 29-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (144 HR FORECAST)
Based on 24-10-2012 valid for 0000 UTC of 30-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (168 HR FORECAST)
Based on 24-10-2012 valid for 0000 UTC of 31-10-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 25 October, 2012

**Synoptic features based on 0300 UTC:**

- The **Deep Depression** over southwest and adjoining west central Arabian Sea moved west-southwestwards and intensified into a **Cyclonic Storm (Murjan)** and lay centred at 1200 UTC of yesterday, the 24th October 2012 within half a degree of Lat. 10.5° N / Long. 56.5° E. It moved westwards and lies at 0300 UTC of today, the 25th October 2012 within half a degree of Lat. 10.5° N / Long. 53.5° E about 2100 kms west-southwest of Amini Divi. System would move west-southwestwards and cross Somalia coast near Latitude 9.5° N in the early morning of 26th October 2012. It moved westwards and lay centred at 0830 hrs IST of today, the 25$^{th}$ October, 2012 near latitude 10.5$^{0}$N and longitude 53.5$^{0}$E, about 2100 km west-southwest of Amini Divi (Lakshadweep) and about 240 km south of Socotra Island and 350 km east of Scusciuban (Somalia). It would move west-southwestwards and cross Somalia coast near lat.9.5$^{0}$ N around early morning of 26$^{th}$ October 2012. Based on latest analysis with NWP models and other conventional techniques, estimated track and intensity of the system are given in the table below:

| DATE/TIME(UTC) | POSITION (LAT. $^{0}$N/ LONG. $^{0}$E) | SUSTAINED MAXIMUM SURFACE WIND SPEED (KMPH) | CATEGORY |
|---|---|---|---|
| 25-10-2012/0830 | 10.5/53.5 | 65-75 GUSTING TO 85 | CYCLONIC STORM |
| 25-10-2012/1130 | 10.3/53.0 | 65-75 GUSTING TO 85 | CYCLONIC STORM |
| 25-10-2012/1730 | 10.1/52.0 | 65-75 GUSTING TO 85 | CYCLONIC STORM |
| 25-10-2012/2330 | 9.8/51.0 | 65-75 GUSTING TO 85 | CYCLONIC STORM |
| 26-10-2012/0530 | 9.5/50.0 | 55-65 GUSTING TO 75 | DEEP DEPRESSION |
| 26-10-2012/1730 | 8.6/48.5 | 30-40 GUSTING TO 40 | LOW |

- The low at mean sea level over Tenasserim coast and neighbourhood now lies over south Andaman Sea and adjoining Tenasserim coast with a cyclonic circulation aloft extending upto 2.1 kms a.s.l.
- A trough of low at mean sea level over southwest Bay of Bengal off Sri Lanka coast now extends from Comorin area to Karnataka coast.
- ITCZ roughly runs along 6º N over Bay of Bengal and along 10º N over Arabian Sea.
- The 24 hr change in MSLP shows no significant change over Thailand coast and Andaman & Nicobar Islands. The pressure departure from the normal is negative by about 1 hPa over Andaman & Nicobar Islands.

- There is a tropical disturbance over south China Sea (near $10.5^0$N and $125.0^0$E and is expected to move northwestwards towards VietNam. There is no disturbance over south Indian Ocean.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around $29\text{-}30^0$C over parts of central Bay of Bengal and southeast and east-central Arabian Sea. It is greater than 30º C in Bay of Bengal alongoff coastal Tamil Nadu and Kerala and $26\text{-}28^0$C over southwest Bay off Sri Lanka coast. It is about $26\text{-}28^0$C over west central and southwest Arabian Sea (west of $60^0$E).
- Buoys data show that warm SST around $29\text{-}30^0$C over the central Bay of Bengal and east Arabian Sea.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ $cm^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ $cm^{-2}$ over central parts of Bay of Bengal.
- Ocean thermal energy is around 50-80 over deep depression region of Arabian Sea. It is less than 50 KJ $cm^{-2}$ over Somalia coast and adjoining west central and southwest Arabian Sea.

**Relative Vorticity:**

- Relative vorticity at 850 hPa has increased over depression region is about $15^* 10^{-5} s^{-1}$. It is about $08^* 10^{-5} s^{-1}$ over Tenasserim coast

**Convergence:**

- Lower level convergence of the order of $15^* 10^{-5} s^{-1}$ prevails over depression region and $10^* 10^{-5} s^{-1}$ over Tenasserim coast.

**Divergence:**

- Upper air positive divergence has decreased and is about of the order of $20^*10^{-5} s^{-1}$ over depression region. It has increased and is about $30^*10^{-5} s^{-1}$ over Tenasserim coast.

**Wind Shear:**

- Wind Shear is of order 5-15 knots over south Bay of Bengal & southwest Arabian sea, Tamilnadu, Kerala and Andaman Sea and Thailand.

**Wind Shear Tendency:**

- No significant change.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hpa passes through latitude 15.0°N over Arabian Sea and $13^0$N over Bay of Bengal.

**M.J.O. Index:**

- Located over phase 2 with amplitude > 1.
- Statistical forecast: - MJO will remain in phase 2, during next 4 days.

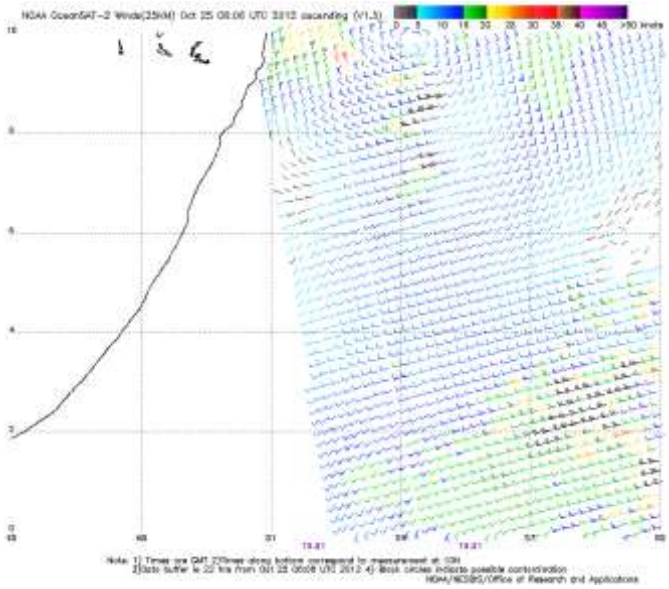
- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1 and will continue in phase 2 during next 4 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

**Satellite advisory**

The cyclonic storm lay centred near 10.1/52.9E with intensity T2.5 (.) Associated low/medium clouds with embedded intense to very intense convection are observed at many places over Arabian sea between lat 6.0N to 13.5N west of long 55.0E and moderate to intense convection over south-east Arabian sea .Broken low/med clouds with embedded moderate to intense convection over Andaman sea, southeast Arabian sea.IR imagery indicates minimum cloud top temperature is around -76.0°C over southeast Arabian sea



**NWP Analysis**

- **IMD-GFS** model MSLP & wind charts show cyclonic storm 'MURJAN' lays. The 850 hPa, 500 hPa and 200 hPa wind are given in **Annexure II.**
- **IMD-GFS** mode MSLP & wind charts also show the formation of low pressure area over south-central Bay of Bengal on 27th October. This system will move in south-westerly direction. This system lies near Sri Lanka coast on 28th October. The 850 hPa, 500 hPa and 200 hPa wind are given in **Annexure II.**
- **IMD-WRF** very close to Somalia Coast on 25th October. The cyclone will move in westward direction and cross Somalia coast today. Thereafter system weakens model analysis show cyclonic storm 'MURJAN' lays very close to Somalia Coast on 25th October. Model forecasts show that the system moves in westwards direction. System will cross Somalia coast today.

- **ECMWF** model analysis cyclone 'MURJAN' lays very close to Somalia Coast on 25th October. The system moves in Westerly direction and cross Somalia coast on 26th October morning. The vorticity, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **ECMWF** model MSLP & wind charts also show the formation of low pressure area over south-central Bay of Bengal on 27th October. This system may intensify and move in west-south westerly direction. It continues to move in west- south westerly direction and lies off Sri Lanka coast on 30th October. The vorticity, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **Genesis Potential Parameter (GPP):**
- The GPP analysis shows a cell of GPP associated with cyclone value greater than 30 over the **southwest** Arabian Sea. Model forecast of GPP suggests that the GPP area will move in westward direction during next 24 hours.
- The GPP analysis also shows another cell of GPP of 30 over the **southeast** Arabian Sea. Model forecast of GPP suggests organization of the GPP area and it moves in westward direction during next 48 hours. GPP charts for 24 and 48 hours are shown in **Annexure II**.
- Model analysis also shows GPP area over **southeast Bay of Bengal** on 25th October and subsequent organization of the GPP cell. GPP forecast indicates GPP area moves in northwestwards and lies over central Bay of Bengal with GPP value greater than 27th October. GPP charts for 24 and 48 hours are shown in **Annexure II**.

**Advisory:**

- The cyclonic storm, Murjan would move west-southwestwards and cross Somalia coast near lat.$9.5^0$ N around early morning of 26th October 2012.
- The low pressure area over Tenasserim coast is likely to emerge into south Andaman Sea and adjoining sourtheast Bay of Bengal during next 24 hrs. It is likely to move westwards during next 48 hrs without any significant intensification leading to cyclogenesis.
- As a result, heavy to very heavy rainfall is likely over Andaman & Nicobar Islands during 25-26th October along with squally winds.
- NO IOP is declared for next 3 days for Bay of Bengal.

**Annexure-I**

**Status of Observation system:**

**Synop**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **24/12** | **25/00** | **25/03** |
| **India** | 85/89 | 67/81 | 83/90 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 4/7 | 10/11 |
| **AP** | 18/18 | 17/17 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/13 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 10/11 | 10/11 | 10/11 |
| **Myanmar** | 10/11 | 8/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 8/9 |

**AWS**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **24/12** | **25/00** | **25/03** |
| **India** | 93/121 | 92/121 | 100/121 |
| **WB** | 9/20 | 9/20 | 9/20 |
| **ODS** | 28/38 | 28/38 | 30/38 |
| **AP** | 31/35 | 30/35 | 33/35 |
| **TN** | 23/26 | 23/26 | 26/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 24 -10-2012: 20/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:-**
- **RS/RW** (00Z) of 25 -10-2012: 24/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:**

**No. of PILOT Ascents**

| 24/12Z | 25/00Z |
|---|---|
| 13/37 | 22/34 |

**Buoy Data**

| 24/12Z | 25/00Z | 25/03Z |
|---|---|---|
| 18/22 | 18/22 | 18/22 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **24.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **18** |

**No. of RS/RW Ascents**

**00Z / 24.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /24.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

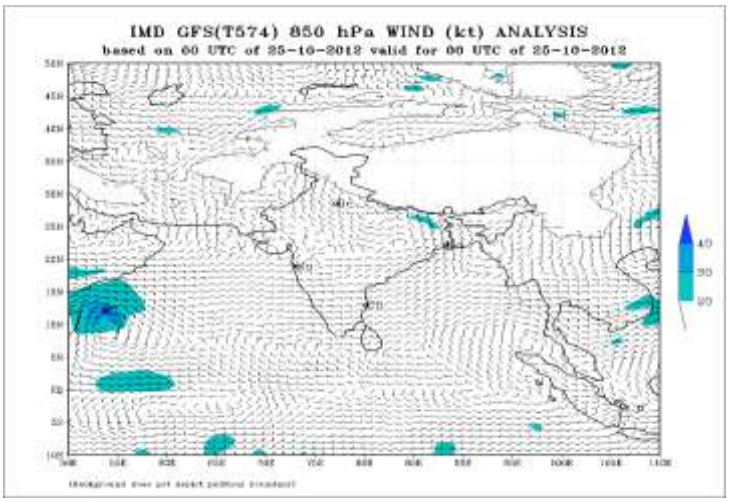
**MISDA : 8**

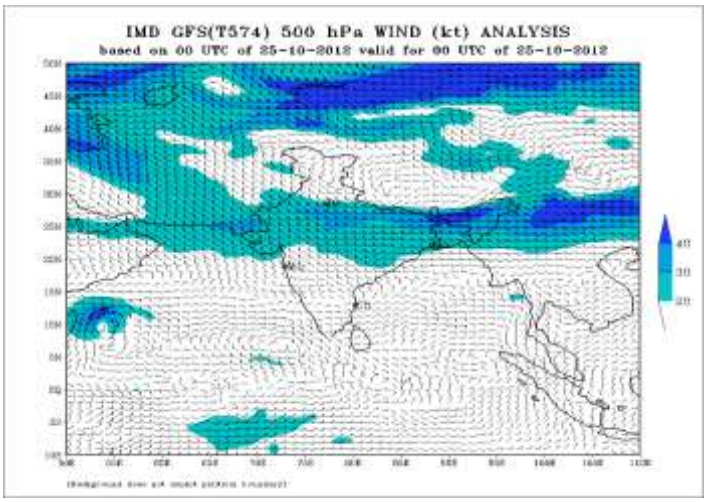
**No. of PILOT Ascents:**

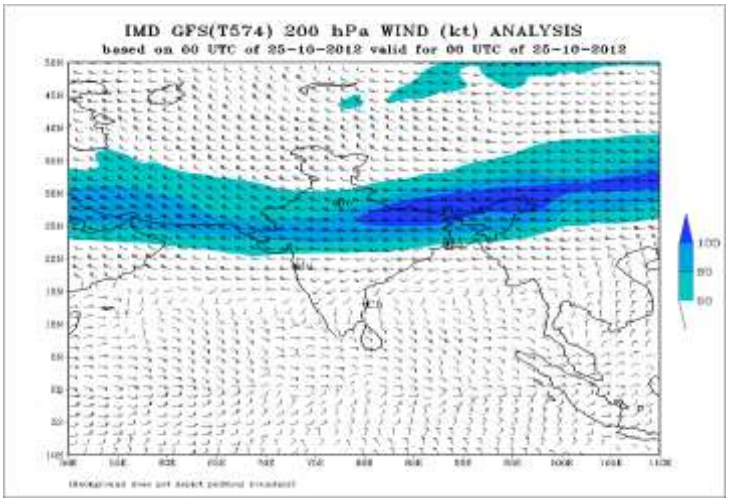
**24.10.2012**

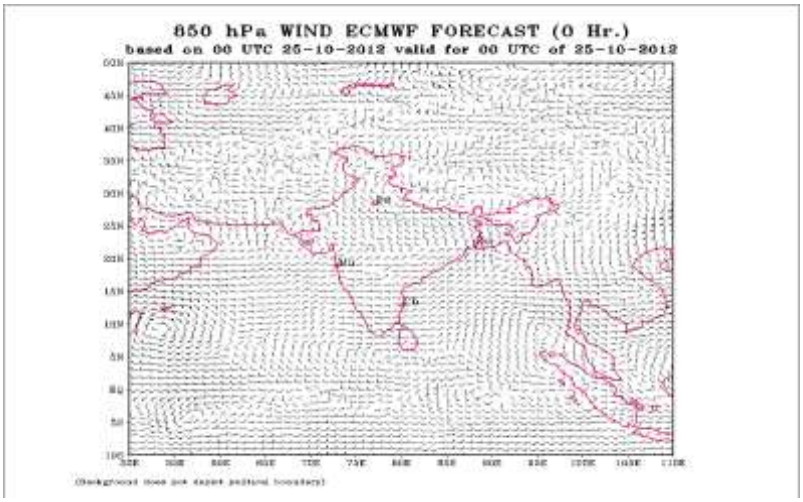
| 06Z | 18Z |
|---|---|
| 3 | 3 |

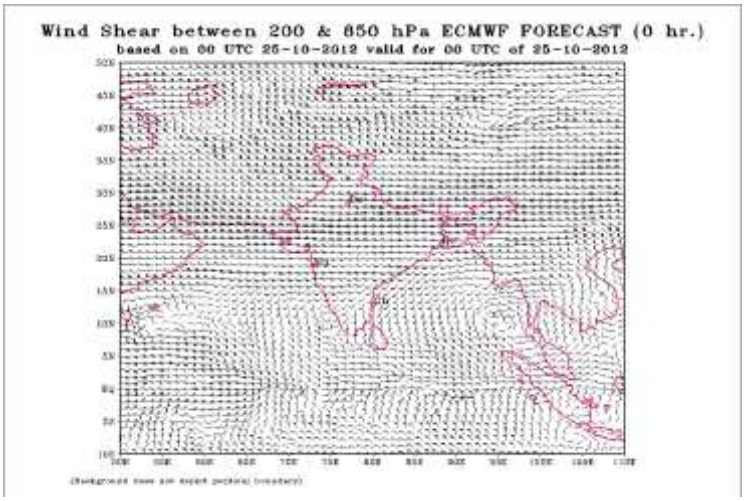
## Annexure II

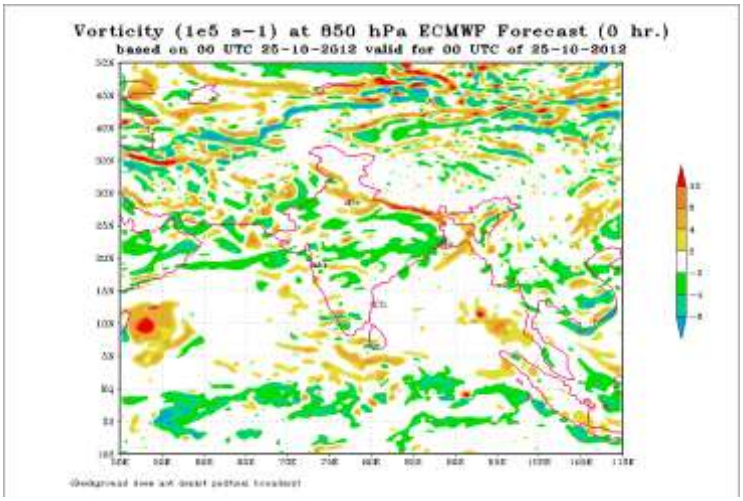

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 25-10-2012 valid for 00 UTC of 25-10-2012

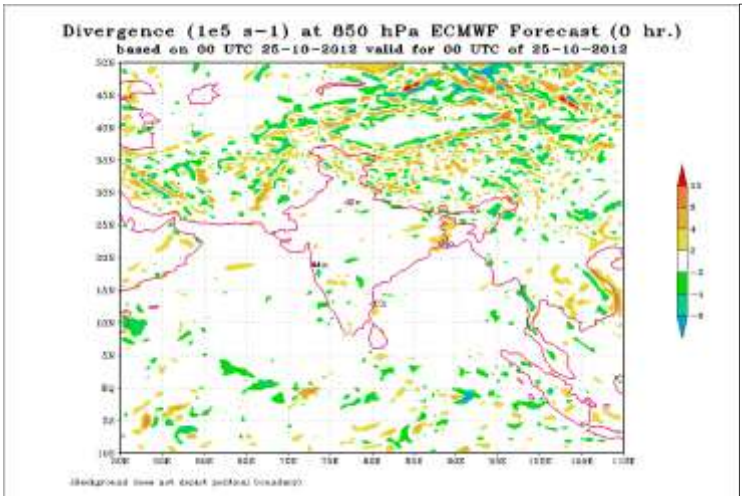

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 25-10-2012 valid for 00 UTC of 25-10-2012

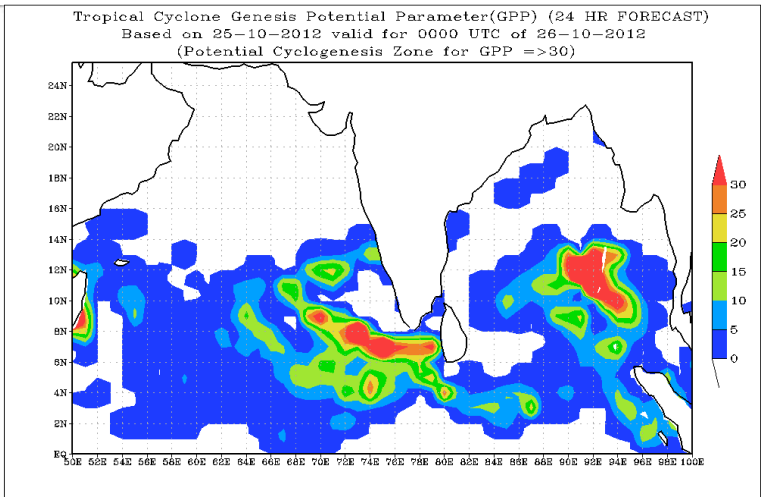

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 25-10-2012 valid for 00 UTC of 25-10-2012

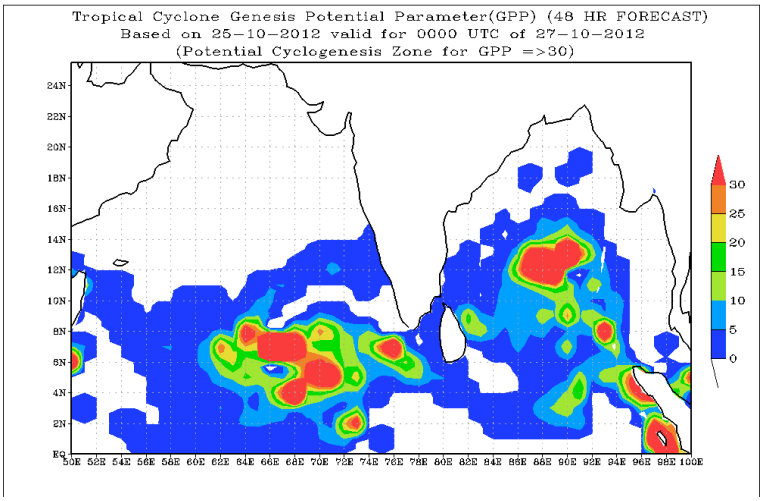

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 25-10-2012 valid for 00 UTC of 25-10-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 25-10-2012 valid for 00 UTC of 25-10-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 25-10-2012 valid for 00 UTC of 25-10-2012


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 25-10-2012 valid for 00 UTC of 25-10-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 25-10-2012 valid for 0000 UTC of 26-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 25-10-2012 valid for 0000 UTC of 27-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0

## FDP (Cyclone) NOC Report Dated 26 October, 2012

**Synoptic features based on 0300 UTC:**

- The **Cyclonic Storm (Murjan)** moved west-southwestwards and lay centred at 1200 UTC of yesterday, the 25th October 2012 within half a degree of Lat. 9.5° N / Long. 51.5° E. Subsequently, it moved westwards, crossed Somalia coast near Lat. 9.5° between 1700 & 1800 UTC of yesterday, the 25th October 2012 and further weakened into a **Deep Depression**. Moving further westwards, it weakened into a **Depression** and lay centred at 0000 UTC of today, the 26th October 2012 over Somalia near Lat. 9.5° N / Long. 49.5° E and lay at 0300 UTC near Lat. 9.5° N / Long. 48.5° E. It moved westwards and weakened into a well marked low pressure area over Somalia at 0600 UTC of today
- The low at mean sea level over south Andaman Sea and adjoining Tenasserim coast now lies as a trough of low over south Andaman Sea with a cyclonic circulation extending upto 3.1 km a.s.l.
- It is likely to emerge into southeast Bay of Bengal during next 48 hrs.
- The trough of low at mean sea level over southwest bay of Bengal now runs from Comorin area to Maharashtra coast.
- ITCZ roughly runs along 8º N over Bay of Bengal
- The 24 hr change in MSLP shows fall of pressure by 1-2 hPa over A & N Islands and coastal Sri Lanka and TN and Puducherry.
- The MSLP is below normal by about 2 hPa over A & N Islands
- There is a tropical storm, SON TINH over south China Sea (near $14^0$N and $117.0^0$E and is expected to move northwestwards and cross VietNam on $27^{th}$ night. There is a vortex over south Indian Ocean near $4^0$S and $55^0$E.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 29-$30^0$C over parts of central Bay of Bengal and southeast and east-central Arabian Sea. It is greater than 30º C in Bay of Bengal alongoff coastal Tamil Nadu and Kerala and 26-$28^0$C over southwest Bay off Sri Lanka coast. It is about 26-$28^0$C over west central and southwest Arabian Sea (west of $60^0$E).
- Buoys data show that warm SST around 29-$30^0$C over the central Bay of Bengal and east Arabian Sea.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ $cm^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is 50-80 KJ $cm^{-2}$ over south and central parts of Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is about 05-08* $10^{-5}$ $s^{-1}$ over south Andaman Sea

**Convergence:**

- Lower level convergence of the order of 10* $10^{-5}$ $s^{-1}$ over South Andaman Sea.

**Divergence:**

- Upper air positive divergence has decreased and is about of the order of 10*$10^{-5}$ $s^{-1}$ over Andaman Sea

**Wind Shear:**

- Wind Shear is of order 10-20 knots over south Bay of Bengal

**Wind Shear Tendency:**

- No significant change.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hpa passes through latitude 13.0°N over Bay of Bengal.

**M.J.O. Index:**

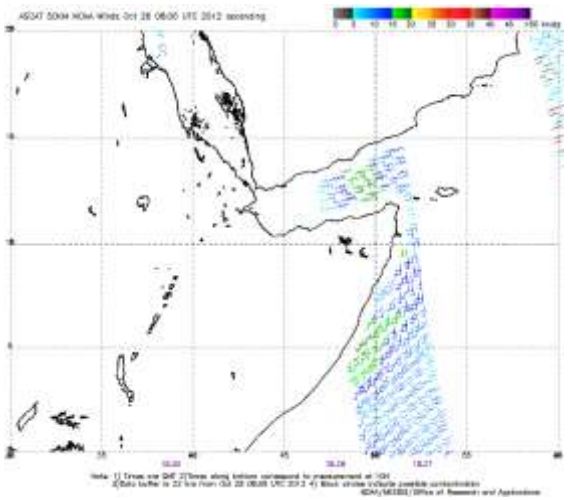
- Located over phase 2 with amplitude > 1.
- Statistical forecast: - MJO will remain in phase 2, during next 3 days.
- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1 and will continue in phase 2 during next 3 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

**Satellite advisory**

The cyclone (MURJAN) crossed over north Somalia coast at 1600 UTC dated 25-10-2012 with centre near 9.5/50.6E. and Intensity T2.5(.) Further Moving in a Westerly direction it now lies as Vortex over Somalia adjoining Ethiopia and adjoining Arabian Sea (.)Broken low/medium clouds with embedded moderate to intense convection lies over Andaman Sea, adjoining SE Bay of Bengal and Bay islands in association with Low Level Circulation over the area .Infrared imagery indicates minimum cloud top temperature is around -60.0°C over North Andaman sea and -70.0°Cover Bay of Bengal.The OSCAT-II winds based on 06 UTC of 26 October 2012 shows 15-20 knots wind over Gulf of Aden and off Somalia coast.



**NWP Analysis**

- **IMD-GFS** mode MSLP & wind charts show the Cycir and associated low pressure area over south- central Bay of Bengal on 27th October. This system will move in west-southwest direction. This system lies near Sri Lanka coast on 28th October. The 850 hPa, 500 hPa and 200 hPa wind are given in **Annexure II.**
- **IMD-WRF** mode MSLP & wind charts show the Cycir and associated low pressure area over south- central Bay of Bengal on 27th October. This system moves in westerly direction, cross Sri Lanka coast on 28th October and lies near Tamilnadu coast on 29th October.
- **ECMWF** model MSLP & wind charts show the formation of low pressure area over south-central Bay of Bengal on 27th October. This system may intensify and move in westerly direction. It continues to intensify & move in westerly direction and lies off Sri Lanka coast on 29th October. On 30th October three closed isobars are seen in MSLP plot and also there is increase in wind speed. This indicates further intensification of system and Depression/Deep Depression may form. Thereafter system moves in north-westerly direction and cross Tamilnadu coast on 31st October. The vorticity, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **Genesis Potential Parameter (GPP):**
- The GPP analysis also shows cell of GPP of 30 over the south-east Arabian Sea and adjoining area on 26th October. Model forecast of GPP suggests organization of the GPP area and it moves slightly in westward direction during next 48 hours. GPP charts for 24 and 48 hours are shown in **Annexure II**.
- Model analysis also shows GPP area over south-east Bay of Bengal on 26th October and subsequent organization of the GPP cell. GPP forecast indicates GPP area moves in west-southwest direction and lies over south-west Bay of Bengal with GPP value greater than 30 on 28th October. GPP charts for 24 and 48 hours are shown in **Annexure II.**

**Advisory:**

- **The low pressure area is likely to develop over south Andaman Sea during next 24 hrs. It would move westwards and may concentrate into a depression around 29th October off Sri Lanka coast.**
- **Hence, IOP is declared for 29th October 2012. Intense observation period will be observed for Tamil Nadu, Puducherry and Sri Lanka coasts on 29th.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **25/12** | **26/00** | **26/03** |
| **India** | 8390 | 69/81 | 85/89 |
| **Coastal stations** | | | |
| **WB** | 12/12 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/10 | 10/10 |
| **AP** | 18/18 | 17/17 | 18/18 |
| **Tamil Nadu** | 13/13 | 09/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 07/11 | 10/11 | 11/11 |
| **Myanmar** | 09/11 | 10/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 7/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **25/12** | **26/00** | **26/03** |
| **India** | 92/121 | 90/121 | 99/121 |
| **WB** | 9/20 | 9/20 | 9/20 |
| **ODS** | 27/38 | 26/38 | 29/38 |
| **AP** | 31/35 | 30/35 | 33/35 |
| **TN** | 23/26 | 23/26 | 26/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 25 -10-2012: 04/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:-**
- **RS/RW** (00Z) of 26 -10-2012 18/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:**

**No. of PILOT Ascents**

| **24/12Z** | **25/00Z** |
|---|---|
| 16/37 | 22/34 |

**Buoy Data**

| **25/12Z** | **26/00Z** | **26/03Z** |
|---|---|---|
| 17/22 | 09/22 | 18/22 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **25.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **18** |

**No. of RS/RW Ascents**

**00Z / 25.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /25.10.2012 : 0**

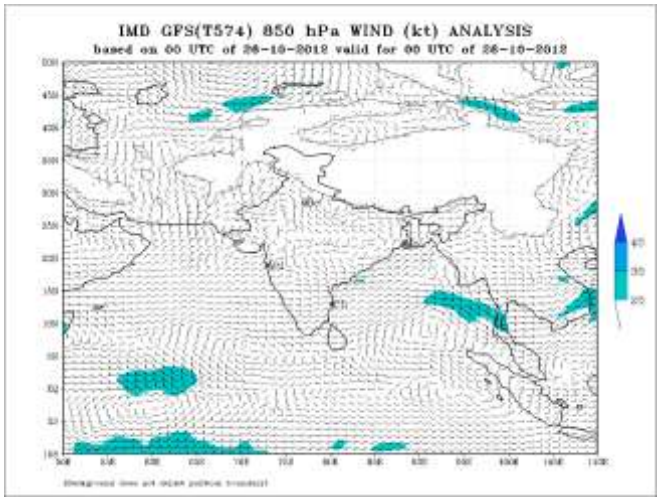
No. of Ascents reaching 250 hpa level =0

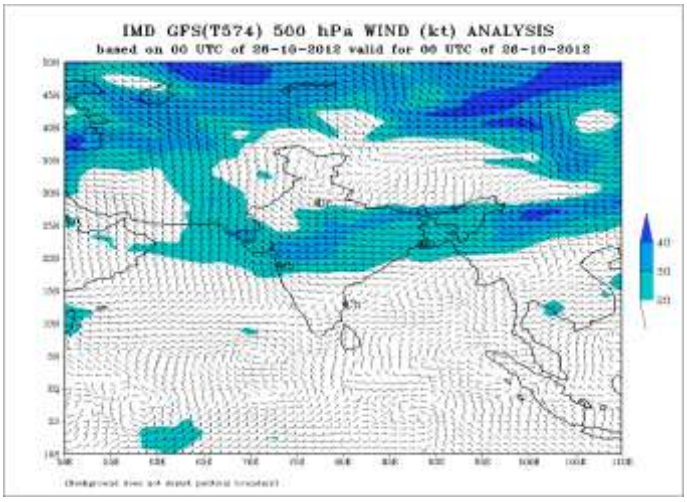
**MISDA : 8**

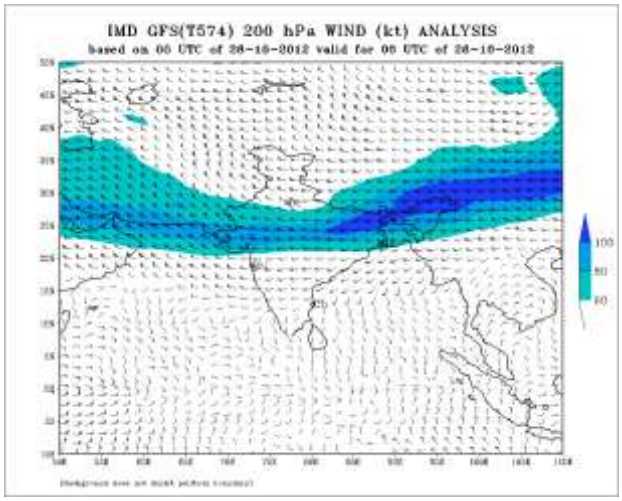
**No. of PILOT Ascents:**

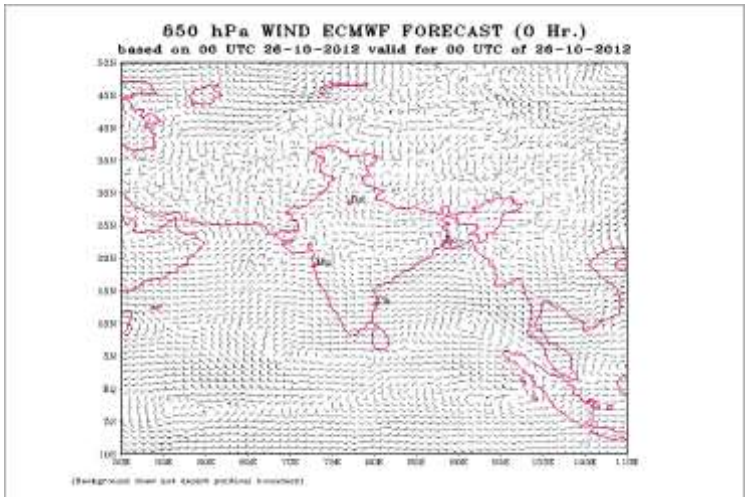
| **25.10.2012** | |
|---|---|
| 06Z | 18Z |
| 4 | 5 |

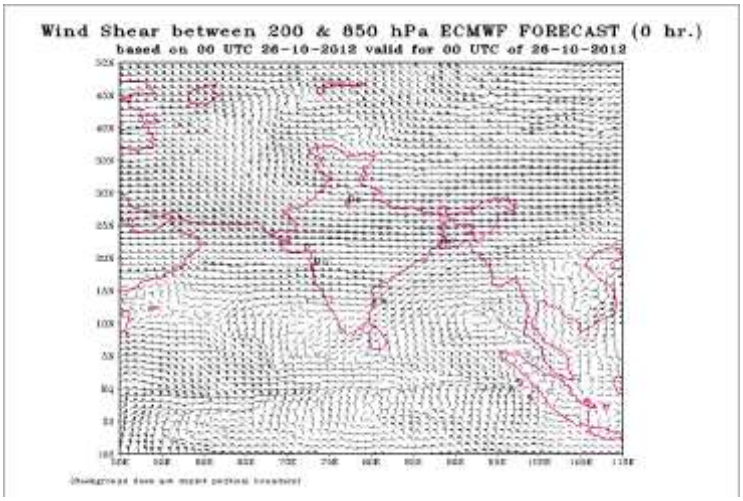
## Annexure II

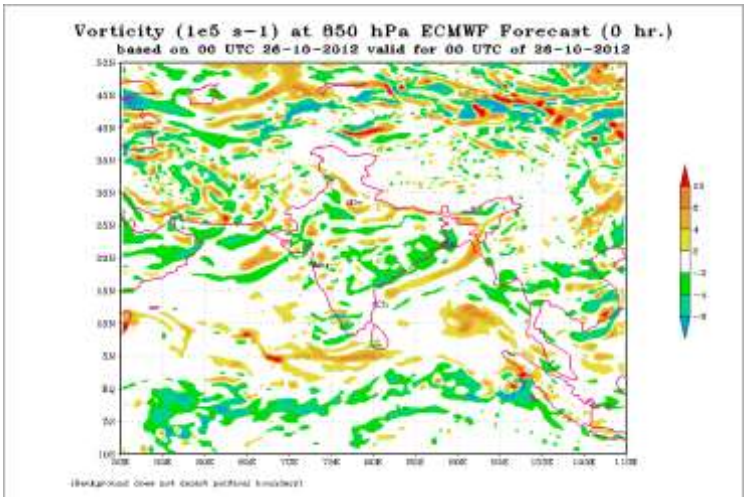

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 26-10-2012 valid for 00 UTC of 26-10-2012

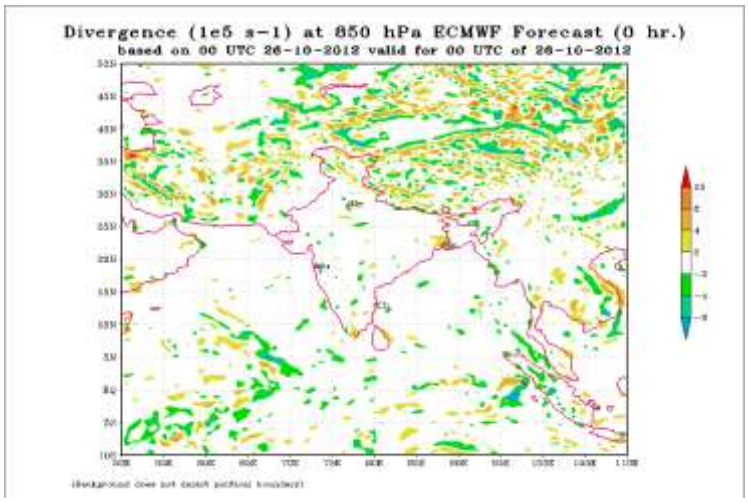

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 26-10-2012 valid for 00 UTC of 26-10-2012

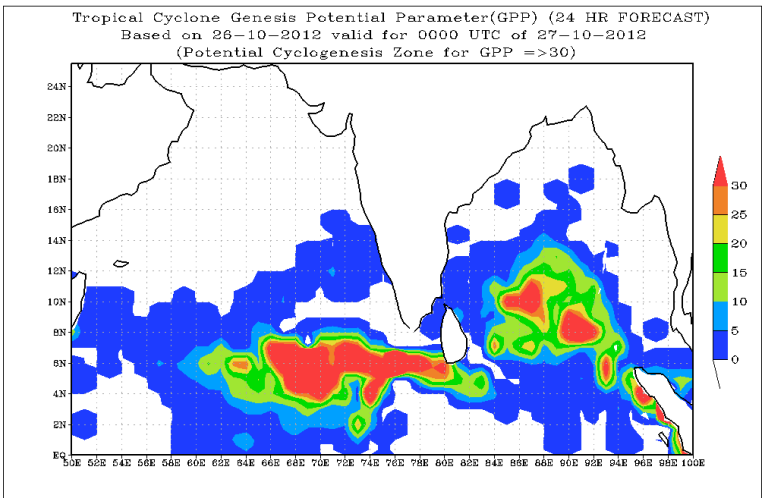

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 26-10-2012 valid for 00 UTC of 26-10-2012

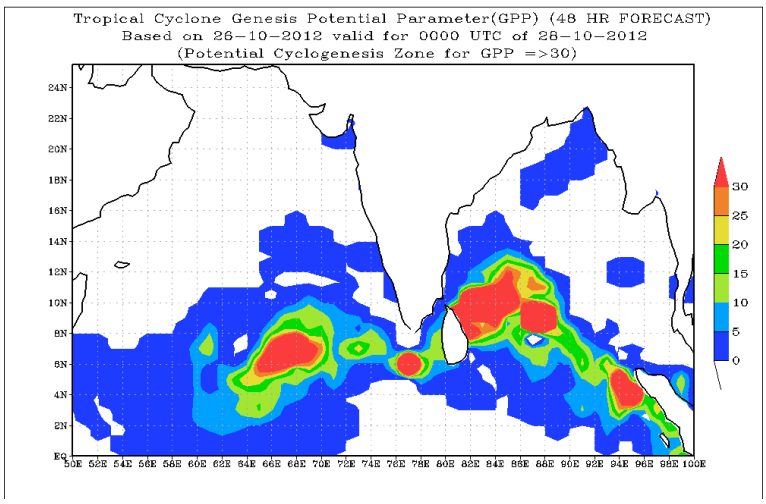

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 26-10-2012 valid for 00 UTC of 26-10-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 26-10-2012 valid for 00 UTC of 26-10-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 26-10-2012 valid for 00 UTC of 26-10-2012


Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 26-10-2012 valid for 00 UTC of 26-10-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 26−10−2012 valid for 0000 UTC of 27−10−2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 26−10−2012 valid for 0000 UTC of 28−10−2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0

## FDP (Cyclone) NOC Report Dated 27th October, 2012

**Synoptic features based on 0300 UTC:**

- Under the influence of the trough of low over Andaman Sea and neighbourhood, a low pressure area has formed over southeast Bay of Bengal and neighbourhood. Associated cyclonic circulation extends upto 3.1 kms a.s.l. System may become depression within next 48 hours while moving west-northwestwards towards Tamilnadu-Sri Lanka coast.
- The trough of low at mean sea level from Comorin area to Maharashtra coast now extends from Lakshadweep area to eastcentral Arabian Sea.
- ITCZ roughly runs along 10º N over Bay of Bengal
- The 24 hr change in MSLP shows fall of pressure by 2-3 hPa over the region of low pressure area and no significant change along Tamilnadu-Sri Lanka coast.
- The MSLP is below normal by about 2-3 hPa over A & N Islands and by 1 hPa south Tamilnadu coast.
- The tropical storm, SON TINH over south China Sea (near $16.5^0$N and $111.5^0$E and is expected to move northwestwards and cross Vietnam on 28th 1200 UTC. There is no vortex over south Indian Ocean.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around $29\text{-}30^0$C over parts of central Bay of Bengal and southeast and east-central Arabian Sea. It is greater than 30º C in Bay of Bengal along and off coastal Tamil Nadu and Kerala and $26\text{-}28^0$C over southwest Bay off Sri Lanka coast.
- Buoys data show that warm SST around $29\text{-}30^0$C over the central Bay of Bengal and east Arabian Sea.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ $cm^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is 80-100 KJ $cm^{-2}$ over south and central parts of Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is about 05-08* $10^{-5}$ $s^{-1}$ over Southeast Bay of Bengal.

**Convergence:**

- Lower level convergence of the order of 10* $10^{-5}$ $s^{-1}$ over Southeast Bay of Bengal.

**Divergence:**

- Upper air positive divergence has decreased and is about of the order of 20*$10^{-5}$ $s^{-1}$ over Southeast Bay of Bengal.

**Wind Shear:**

- Wind Shear is of order 05-15 knots over south Bay of Bengal

**Wind Shear Tendency:**

- Fall in wind shear by 5-10 knots over southeast Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hpa passes through latitude 13.0°N over Bay of Bengal.

**M.J.O. Index:**

- Located over phase 2 with amplitude > 1.
- Statistical forecast: - MJO will move to phase 3, during next 3 days.
- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1 and will continue in phase 2 for one day and move to phase 1 during next 3 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite advisory**

Vortex over east central Bay lay centered at 0600 UTC within half degree of lat 12.0N/91.0E. Intensity T1.0. Associated broken intense to very intense convection lies over area between lat 10.0N to 14.0N long 86.5E to 92.0E.Broken low/med clouds with embedded moderate to intense convection over Somalia adjoining Ethiopia adjoining Arabian Sea in association with feeble low level circulation over the area.

**NWP Analysis**

- **IMD-GFS** mode MSLP & wind charts show the Cycir and associated low pressure area over south- central Bay of Bengal on 27$^{th}$ October. This system will move in west-southwest direction. This system lies near Sri Lanka coast on 29$^{th}$ October. The system weakens thereafter. The 850 hPa, 500 hPa and 200 hPa wind are given in **Annexure II.**
- **IMD-GFS** mode MSLP & wind charts also show low pressure area over southeast Arabian Sea on 27th October. This system moves in west north-westward direction and may intensify on 28$^{th}$ October. After that system further intensify and moves in north-westward direction 29$^{th}$ October. The system further intensifies and continues to moves in north-westward direction. It lays over central Arabian Sea on 31$^{st}$ October. The 850 hPa, 500 hPa and 200 hPa wind are given in **Annexure II.**
- **IMD-WRF** model MSLP & wind charts show the Cycir and associated low pressure area over south- central Bay of Bengal on 27$^{th}$ October. This system moves in west-southwest direction, cross Sri Lanka coast on 29$^{th}$ October.
- **ECMWF** model MSLP & wind charts show the low pressure area over south-central Bay of Bengal on 27$^{th}$ October. This system intensifies and moves in north-westerly direction initially. It continues to intensify & move in westerly direction and lies off Sri Lanka coast on 29$^{th}$ October. On 30$^{th}$ October three closed isobars are seen in MSLP plot and also there is increase in wind speed. This indicates further intensification of system and Depression/Deep

Depression may form. System now moves in north-westerly direction and lay off Tamilnadu coast on 31st October. Thereafter system cross Tamilnadu coast. The vorticity, divergence, wind shear and 850hPa wind are given in **Annexure II**.

**Genesis Potential Parameter (GPP):**

- Model analysis also shows large GPP area extends from over south-central Bay of Bengal to south-central Arabian Sea on 27th October. Entire GPP area moves westward on 28th October. It continues to move westward with decrease in horizontal extension of the cell on 29th October. GPP charts for 24 and 48 hours are shown in **Annexure II.**

**Advisory:**

- The low pressure area over southeast Bay of Bengal is likely to move west-northwestwards and intensify into a depression by 29/0000 UTC near lat.10 deg. N and 84 deg. Thereafter, it may move northwestwards towards Sri Lanka/ Tamil Nadu coast.
- Hence, IOP is declared for 29th October 2012. Intense observation period will be observed for Tamil Nadu, Puducherry and Sri Lanka coasts on 29th.
- Another low pressure area would form over southeast Arabian Sea during next 48 hrs. GFS and Meteo-France ARP models show gradual intensification of the low into depression by 29th 0600 UTC and into a cyclonic storm by 30th. Both these models show northwestward movement. ECMWF model shows formation of low over southeast Arabian Sea around 1st Nov and no further intensification. It moves northward to east central Arabian Sea off Konkan coast.

  Considering these, the cyclogenesis over Arabian Sea needs to be watched

**Annexure I**.

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **26/12** | **27/00** | **27/03** |
| **India** | 78/89 | 63/89 | 80/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/11 | 10/11 |
| **Odisha** | 10/10 | 6/10 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/13 | 18/18 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1/ | 1/1 | 1/1 |
| **Bangladesh** | 6/11 | 4/11 | 7/11 |
| **Myanmar** | 8/11 | 9/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |

| | | | |
|---|---|---|---|
| **Srilanka** | 7/9 | 7/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **26/12** | **27/00** | **27/03** |
| **India** | 91/121 | 91/121 | 92/121 |
| **WB** | 8/20 | 8/20 | 8/20 |
| **ODS** | 27/38 | 29/38 | 29/38 |
| **AP** | 31/35 | 29/35 | 33/35 |
| **TN** | 23/26 | 23/26 | 20/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 26 -10-2012: 04/39
- **No. of Ascents reaching 250 hPa levels: 1, MISDA:-35**
- **RS/RW** (00Z) of 27 -10-2012 19/39
- **No. of Ascents reaching 250 hPa levels: 8, MISDA: 20**

**No. of PILOT Ascents**

| 26/12Z | 27/00Z |
|---|---|
| 16/37 | 21/34 |

**Buoy Data**

| 26/12Z | 27/00Z | 27/03Z |
|---|---|---|
| 14/22 | 15/22 | 16/22 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **26.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 25.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /25.10.2012 : 0**

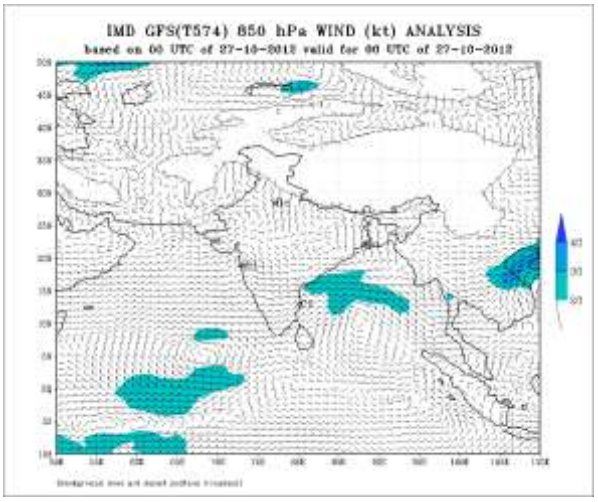
No. of Ascents reaching 250 hpa level =0

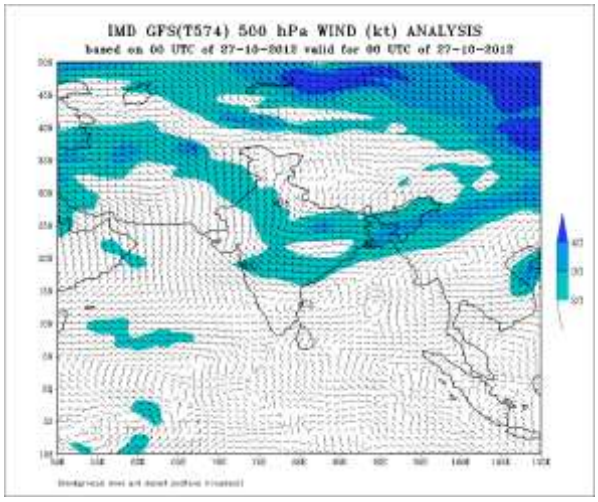
**MISDA : 8**

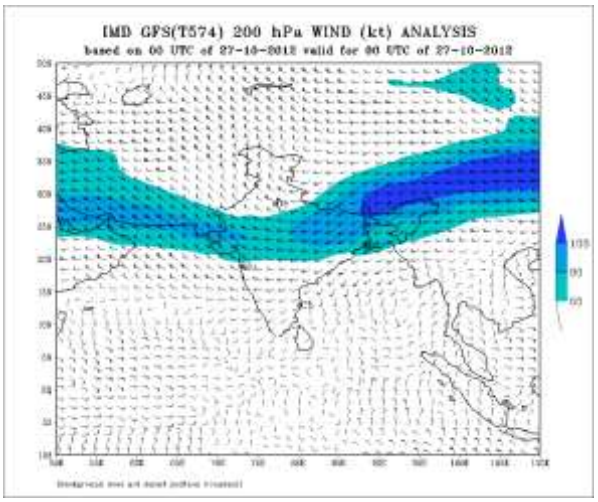
**No. of PILOT Ascents:**

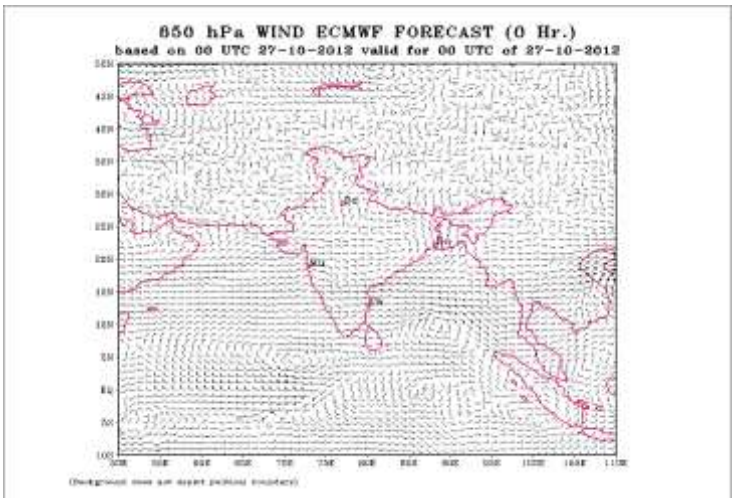
| **25.10.2012** | |
|---|---|
| 06Z | 18Z |
| 3 | 4 |

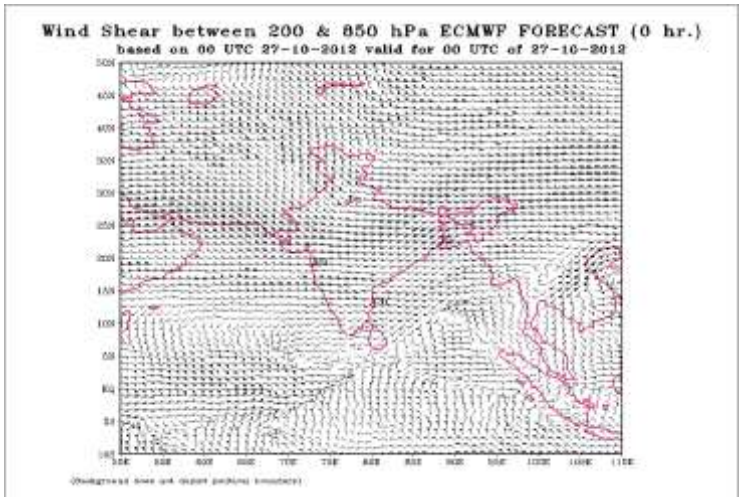
## Annexure II

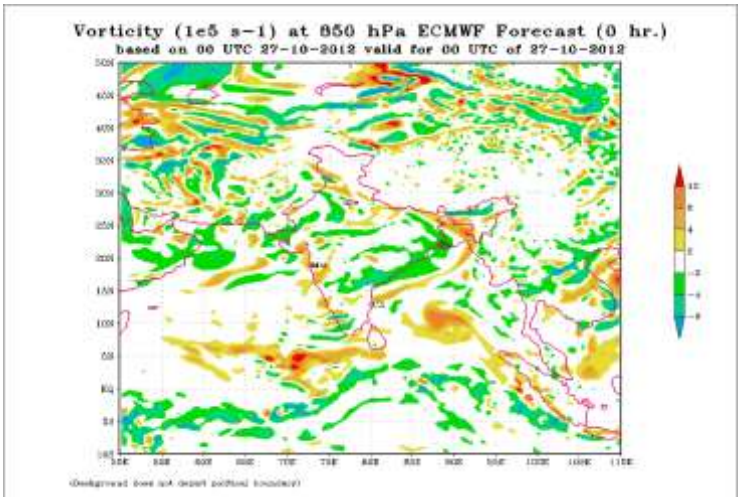

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 27-10-2012 valid for 00 UTC of 27-10-2012

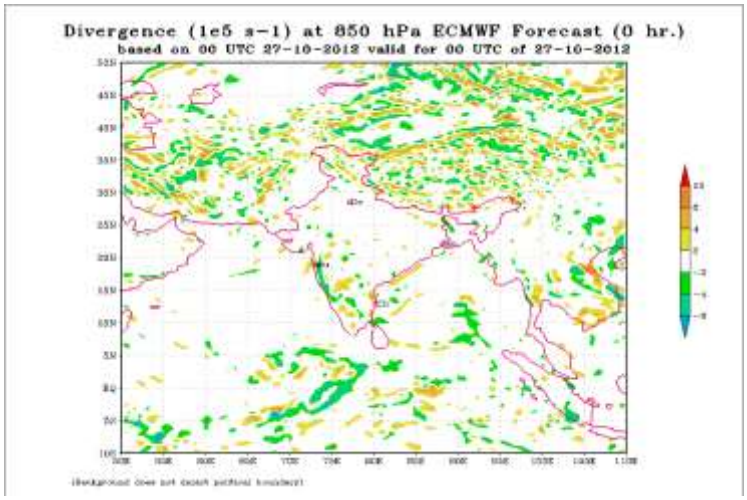

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 27-10-2012 valid for 00 UTC of 27-10-2012

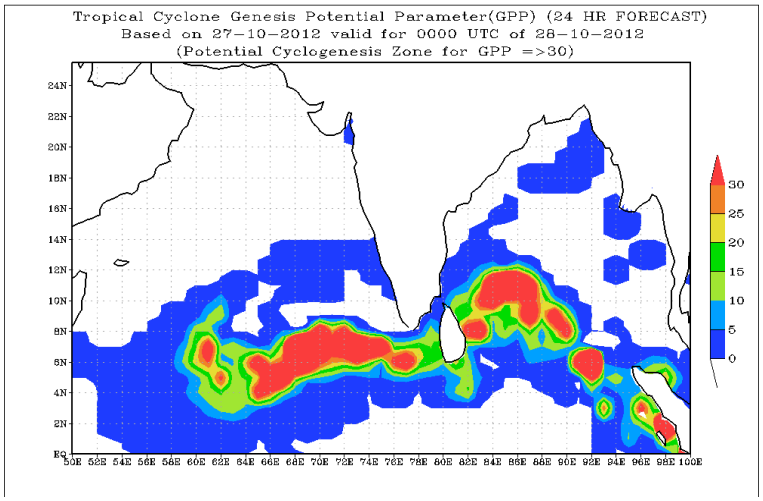

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 27-10-2012 valid for 00 UTC of 27-10-2012

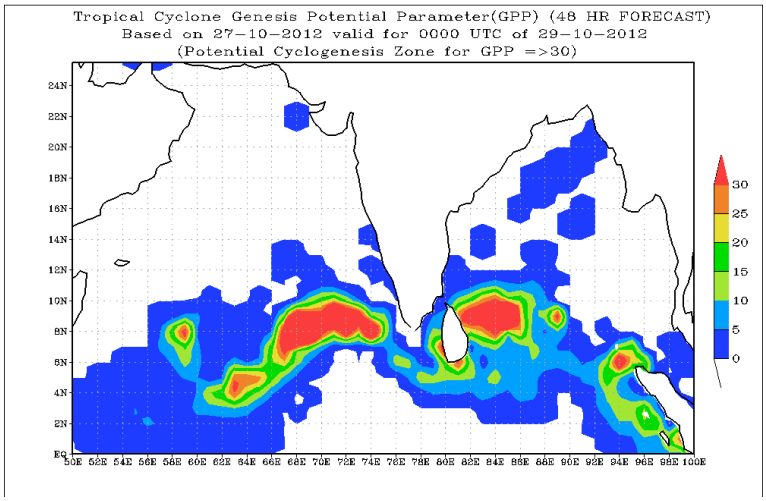

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 27-10-2012 valid for 00 UTC of 27-10-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 27-10-2012 valid for 00 UTC of 27-10-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 27-10-2012 valid for 00 UTC of 27-10-2012


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 27-10-2012 valid for 00 UTC of 27-10-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 27-10-2012 valid for 0000 UTC of 28-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 27-10-2012 valid for 0000 UTC of 29-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0

## FDP (Cyclone) NOC Report Dated 28 October, 2012

**Synoptic features based on 0300 UTC:**

- Latest satellite imagery and current Buoy observations indicate that a depression has formed over southeast and adjoining southwest Bay of Bengal and lay centred at 1130 hrs IST of today, the 28th October 2012 near latitude 9.5$^0$N and longitude 86.0$^0$E, about 730 km southeast of Chennai (Tamilnadu) and 550 km east-northeast of Trincomalee (Srilanka). The system would intensify into a deep depression and move initially westwards towards Tamil Nadu coast.
- Under the influence of this system, rainfall at most places with isolated heavy to very heavy rainfall would commence over north coastal Tamil Nadu and Puducherry from tomorrow onwards.
- Squally winds speed reaching 45-55 kmph would commence along and off north Tamil Nadu and Puducherry coasts from 29th October afternoon onwards. Sea condition will be rough to very rough along and off north Tamil Nadu and Puducherry coast from that period.
- Fishermen along north Tamil Nadu and Puducherry coasts, who are out at sea are advised to return to the coast.
- Sustained maximum surface wind speed is estimated to be about 25 knots gusting to 35 knots around system centre. The state of the sea is rough to very rough around the system centre. The estimated central pressure is about 1004 hPa.
- The buoy observations around system centre shows 20-25 knots wind in the northern sector and about 15 knots in the southern sector. At 0600 UTC of 28th October 2012, buoy (position near 8.1$^0$Nand 85.5$^0$E) reported wind of 240/18 knots wind and 1005 hPa as mean sea level pressure (mslp); buoy (position near 11.0$^0$N and 86.5$^0$E) reported mslp of 1007.5 hpa and wind of 090/23 knots. Earlier scatterometry data indicated 25-30 knots wind in the northern sector of the system.
- The 24 hr change in MSLP shows fall of pressure by 2-3 hPa over the region of depression and no significant change along Tamilnadu-Sri Lanka coast.
- The MSLP is below normal by about 1 hPa over Tamilnadu coast.
- The tropical storm, SON TINH over south China Sea (near 18.5$^0$N and 107$^0$E and is expected to move northwestwards and cross Vietnam on 28th 1800 UTC. There is no vortex over south Indian Ocean.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 29-30$^0$C over Bay of Bengal along and off coastal Tamil Nadu Sri Lanka coast.
- Buoys data show that warm SST around 29-30$^0$C over the central Bay of Bengal and east Arabian Sea.

**Ocean thermal energy:**

- Ocean thermal energy is is 50-80 KJ $cm^{-2}$ over south Bay of Bengal. It decreases towards north Tamil Nadu coast and adjoining sea.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is about 05-08* $10^{-5}$ $s^{-1}$ over depression region.

**Convergence:**

- Lower level convergence has increased and of the order of 15* $10^{-5}$ $s^{-1}$ over the depression region.

**Divergence:**

- Upper air positive divergence has increased and is about of the order of $3*10^{-5}$ $s^{-1}$ over depression region.

**Wind Shear:**

- Wind Shear is of order 10-20 knots over depression region and increases towards north

**Wind Shear Tendency:**

- No change.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hpa passes through latitude 13.0°N over Bay of Bengal.

**M.J.O. Index:**

- Located over phase 2 with amplitude > 1.
- Statistical forecast: - MJO will move to phase 3, during next 3 days.
- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1 and will continue in phase 2 for one day and move to phase 1 during next 3 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**

According to satellite imageries, the intensity of the system is T 1.5 at 0600 UTC. Low/medium clouds with embedded intense to very intense convection seen over bay of bengal between lat $07.0^{0N}$ and $13.0^{0}$N and long $85.0^{0}$E to $89^{0}$E. Broken low/medium clouds with embedded moderate to intense convection lies over rest se bay bet lat 5.0N to 7.0N long 85.0E to 90.0E. The associated convection has increased gradually with respect to height and organisation during past 12 hrs. The lowest cloud top temperature (CTT) is about $-70^{0}$C.

**NWP Analysis**

- **IMD-GFS** mode MSLP & wind charts show low pressure area over south-central Bay of Bengal on 27th October has intensifies in to well marked low and moved in westward direction on 28th october. This system will further intensify and move in westerly direction. This system lies near Sri Lanka coast on 29th October & over Sri Lanka on 30th october. After that system moves in

north westerly direction and cross Tamilnadu coast on 31st October. System weakens thereafter. The 850 hPa, 500 hPa and 200 hPa wind are given in **Annexure II.**

- **IMD-GFS** mode MSLP & wind charts also show low pressure area over southeast Arabian Sea on 28th October. This system lies over same area and continue to intensify on 29th & 30th October. After that system moves in northly direction and lays over central Arabian Sea and adjoining area on 31st October. The 850 hPa, 500 hPa and 200 hPa wind are given in **Annexure II.**
- **IMD-WRF** model MSLP & wind charts show the Cycir and associated low pressure area over south- central Bay of Bengal on 28th October. This system intensifies & moves in westward direction, cross Sri Lanka coast on 29th October. Afterthat system moves in north westerly direction and cross Tamilnadu coast on 31st October.
- **ECMWF** model MSLP & wind charts show the low pressure area over south-central Bay of Bengal on 27th October has intensifies in to well marked low and moves in westward direction. It continues to intensify & move in westerly direction and lies off Sri Lanka coast on 29th & 30th October. On 29th October three closed isobars are seen in MSLP plot and also there is increase in wind speed. This indicates further intensification of system and Depression/Deep Depression may form. System continues to intensify & moves in north-westerly direction and lay off Tamilnadu coast on 31st October. System cross Tamilnadu coast on 1st November. The vorticity, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **Genesis Potential Parameter (GPP):**
- Model analysis also shows large GPP area extends from over south-central Bay of Bengal to south-central Arabian Sea on 28th October. Entire GPP area moves westward on 29th October. Its horizontal extension decrease on 30th October & two seprate cells are seen. GPP charts for 24 and 48 hours are shown in **Annexure II.**

**Advisory:**

- Considering the NWP model guidance, most of the models suggest the intensification of the system into a deep depression and subsequently into a marginal cyclonic storm by next 48 hrs. Dynamical- statistical model of IMD also suggests the system to intensify into a cyclonic storm. With respect to track, most models suggest westward/ west-southwestward movement during next 48 hrs. However, there is divergence in NWP model guidance thereafter as some models suggest northwestward movement towards north Tamil Nadu coast and some other models suggest continuous westward movement towards north Sri Lanka coast.
- Hence, IOP is declared for 29th to 31st October 2012. Intense observation period will be observed for Tamil Nadu, Puducherry and Sri Lanka coasts on 29th to 31st October

- Another low pressure area would form over southeast Arabian Sea during next 48 hrs. GFS model show gradual intensification of the low into cyclonic storm While other models show the formation of a well marked low pressure area. Considering these, the cyclogenesis over Arabian Sea needs to be watched.

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **27/12** | **28/00** | **28/03** |
| **India** | 83/89 | 71/79 | 84/90 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/11 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 18/18 | 19/19 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1/ | 1/1 | 1/1 |
| **Bangladesh** | 9/11 | 9/11 | 10/11 |
| **Myanmar** | 9/11 | 10/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **27/12** | **28/00** | **28/03** |
| **India** | 93/121 | 92/121 | 55/121 |
| **WB** | 7/20 | 8/20 | 5/20 |
| **ODS** | 29/38 | 27/38 | 18/38 |
| **AP** | 31/35 | 30/35 | 16/35 |
| **TN** | 24/26 | 25/26 | 15/26 |
| **PDC** | 2/2 | 2/2 | 1/2 |

- **RS/RW** (12Z) of 27-10-2012: 03/39
- **No. of Ascents reaching 250 hPa levels:3 , MISDA:-36**
- **RS/RW** (00Z) of 28 -10-2012 21/39
- **No. of Ascents reaching 250 hPa levels:11 , MISDA:18**

**No. of PILOT Ascents**

| 27/12Z | 28/00Z |
|---|---|
| 15/37 | 17/34 |

**Buoy Data**

| 27/12Z | 28/00Z | 28/03Z |
|---|---|---|
| 17/22 | 17/22 | 22/22 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | | | | **27.10.2012** | | | |
|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **18** |

**No. of RS/RW Ascents**

**00Z / 27.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /27.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

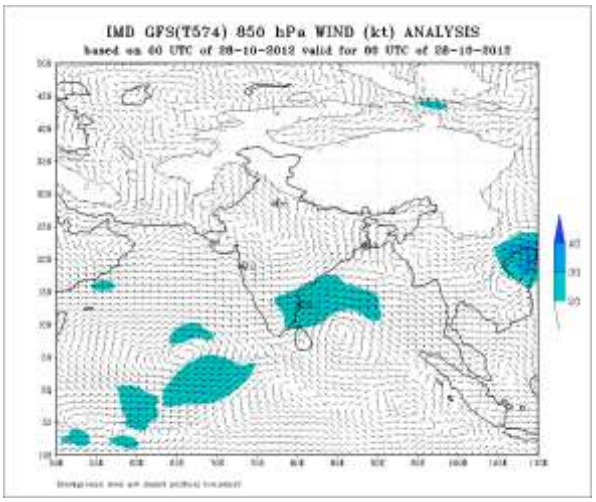
**MISDA : 8**

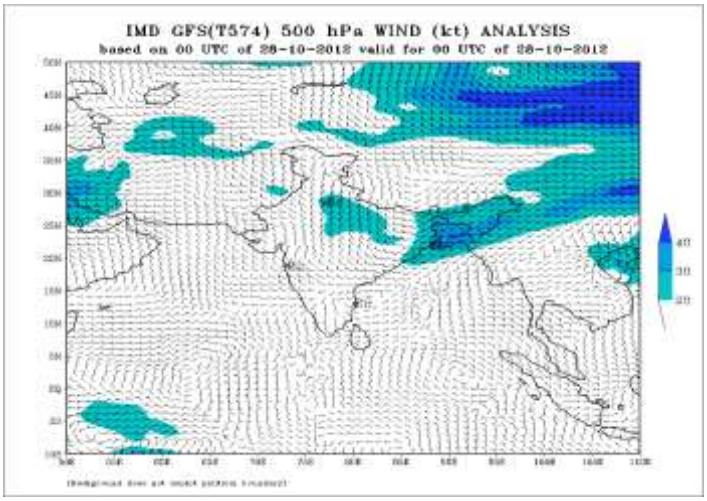
**No. of PILOT Ascents:**

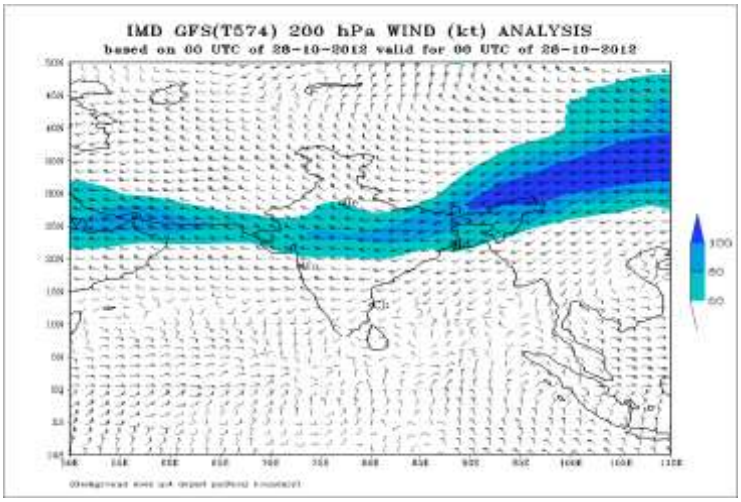
**27.10.2012**

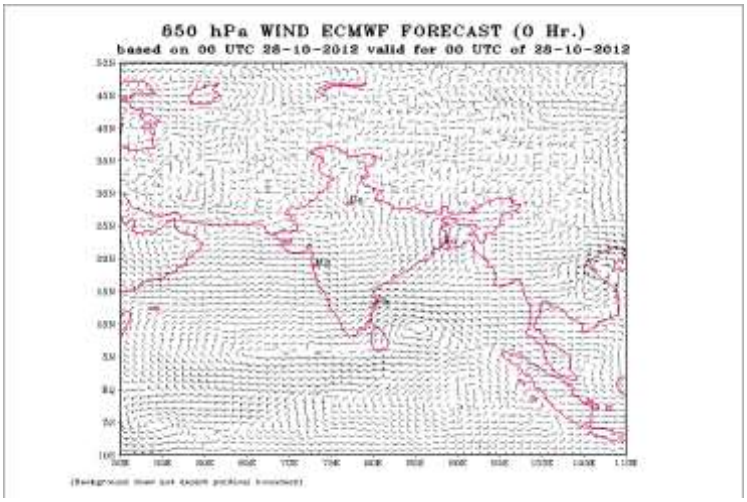
| 06Z | 18Z |
|---|---|
| 5 | 4 |

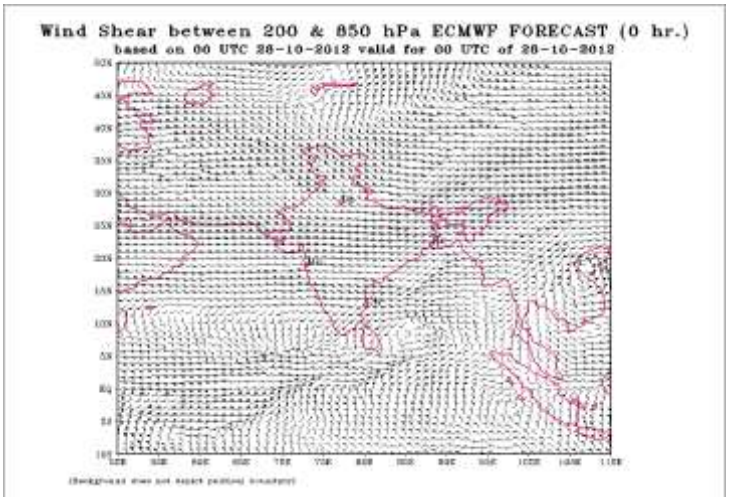
## Annexure II

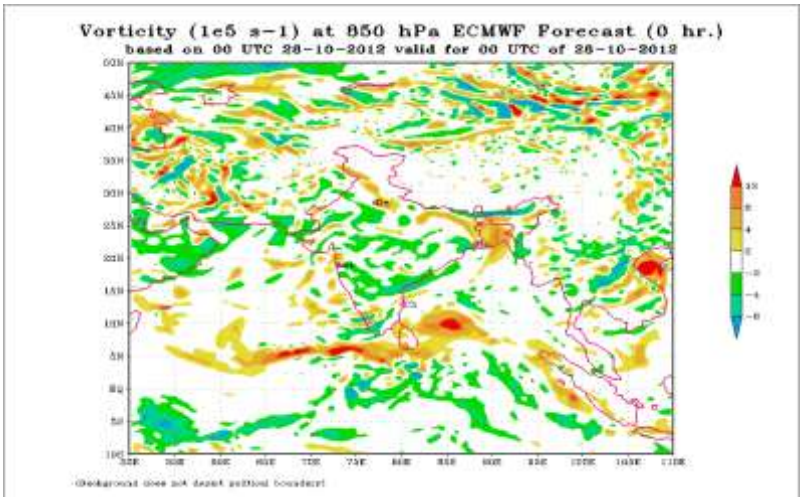

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 28-10-2012 valid for 00 UTC of 28-10-2012

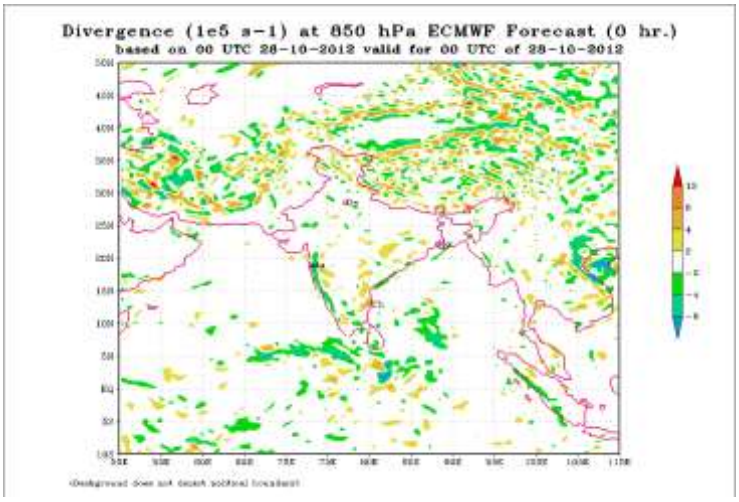

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 28-10-2012 valid for 00 UTC of 28-10-2012

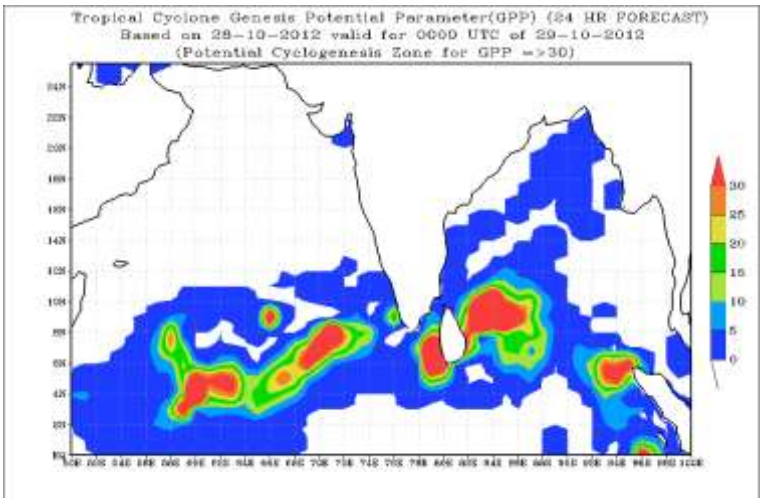

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 28-10-2012 valid for 00 UTC of 28-10-2012

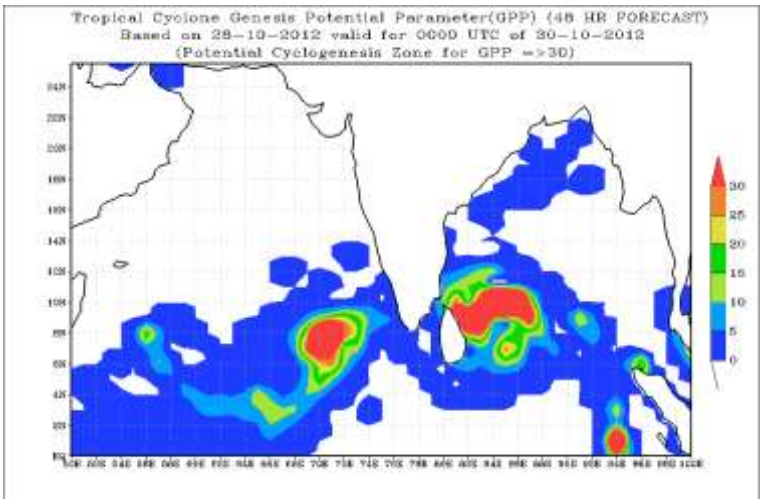

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 28-10-2012 valid for 00 UTC of 28-10-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 28-10-2012 valid for 00 UTC of 28-10-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 28-10-2012 valid for 00 UTC of 28-10-2012


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 28-10-2012 valid for 00 UTC of 28-10-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 28-10-2012 valid for 0000 UTC of 29-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 28-10-2012 valid for 0000 UTC of 30-10-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 29 October, 2012

**Synoptic features based on 0300 UTC:**

- Yesterday's depression intensified into deep depression over southwest Bay of Bengal at 0530 hrs IST of today and moved westwards and lay centred at 0830 hrs IST of today, the 29th October 2012 over southwest Bay of Bengal near latitude $9.5^0$N and longitude $83.5^0$E, about 530 km southeast of Chennai (Tamilnadu) and 270 km northeast of Trincomalee (Srilanka). The system would intensify further into a cyclonic storm and move westwards for some more time and then move northwestwards and cross north Tamil Nadu and adjoining south Andhra Pradesh coast between Nagapattinam and Nellore by 31st October, 2012 evening/night.
- The 24 hr change in MSLP shows fall of pressure by 2-3 hPa over the region of depression, Sri Lanka coast and 1-2 hPa over Tamil Nadu coast.
- The MSLP is below normal by about 2 hPa over Tamilnadu coast.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 29-$30^0$C over Bay of Bengal along and off coastal Tamil Nadu Sri Lanka coast.

**Ocean thermal energy:**

- Ocean thermal energy is is 50-80 KJ $cm^{-2}$ over south Bay of Bengal. It decreases towards north Tamil Nadu coast and adjoining sea.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is about $10* 10^{-4}$ $s^{-1}$ over depression region.

**Convergence:**

- Lower level convergence has increased and of the order of 20-$30* 10^{-5}$ $s^{-1}$ over the depression region.

**Divergence:**

- Upper air positive divergence has increased and is about of the order of $30*10^{-5}$ $s^{-1}$ over depression region.

**Wind Shear:**

- Wind Shear is of order 10-20 knots over depression region and increases towards north

**Wind Shear Tendency:**

- Increasing 10-20 knots over the area to the north of depression.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at 200 hPa passes through latitude 13.0°N over Bay of Bengal.

**M.J.O. Index:**

- Located over phase 2 with amplitude > 1.
- Statistical forecast: - MJO will move to phase 3, during next 3 days.

- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1 and will continue in phase 2 for one day and move to phase 1 during next 3 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

**Satellite**

The Deep Depression centred at 0600 UTC near 8.9 deg N/82.8 deg E with intensity T2.0. Intense to very intense convective clouds are observed at many places in the area between latitude 4.0 deg N to 12.5 deg N west of longitude 87.0 deg E. Wind shear of the area is between 20 to 30 knots.

Intense to very intense convective clouds are seen at many places over southeast Arabian sea between latitude 4.5 deg N to 10.0 deg N, longitude 67.0 deg E to 74.0 deg E in association with low level circulation over the area.

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts show a Deep Depression over southwest Bay of Bengal around Lat. 9.5° N / Long. 83.0° E based on 0000 UTC of 29$^{th}$ October 2012 (today). Continuing the westward movement, it lies centered at 0300 UTC of 30 October 2012 over southwest Bay of Bengal near Sri Lanka east coast within half a degree of Lat. 7.5° N / Long. 82.5° E. The system would intensify further and move westwards for some more time and then move northwestwards and cross north Tamilnadu coasts between Nagapattinam and Chennai by evening / night of 31$^{st}$ October 2012. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **IMD-GFS** model MSLP & wind charts also show a low pressure area over southeast Arabian Sea on 0000 UTC of 29$^{th}$ October 2012. This system lies over same area and continues to intensify further in to a storm on 31st October 2012. After that system moves in northly direction along around **Long 65° E** till 4th Nov 2012 and cross Gujarat Coast on 5th Nover 2012. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **IMD-WRF** model MSLP & wind charts show the Cycir and associated low pressure area over south- central Bay of Bengal on 29$^{th}$ October. This system intensifies & moves in westward direction, cross Sri Lanka coast on 29$^{th}$ October. Afterthat system moves in north westerly direction and cross north Tamilnadu coasts between Nagapattinam and Karaikal by evening / night of 31$^{st}$ October 2012.
- **ECMWF** model data of 29 October 2012 not available due to ftp server down
- **NCMRWF Unified Model** shows the depression over southwest Bay of Bengal and intensified into by 300000 UTC while moving nort/northwestwards and further intensified on 310000 UTC and crossing the coast between Chennai and Nellore by 010000 UTC.
- NCMRWF GEFS (281200 UTC) shows low over southwest Bay of Bengal and

intensified into depression on 290000 UTC. The system may weaken into low on 300000 UTC/ 310000 and cross Tamilnadu coast near lat. 11.5 deg North by 310600 UTC.

**Genesis Potential Parameter (GPP):**

- Model analysis also shows large GPP area extends from over south-central Bay of Bengal to south-central Arabian Sea on 29th October. Entire GPP area moves westward on 30th October.Its horizontal extension decrease on 31st October. GPP charts for 24 and 48 hours are shown in **Annexure II.**

**Advisory:**

- Considering the NWP model guidance, most of the models suggest the intensification of the system into into a marginal cyclonic storm by next 48 hrs. Dynamical- statistical model of IMD also suggests the system to intensify into a cyclonic storm. The system would intensify further and move westwards for some more time and then move northwestwards and cross north Tamilnadu coasts between Nagapattinam and Nellore by evening / night of 31st October 2012.
- Hence, IOP will continue till 31st October 2012. Intense observation period will be observed for Tamil Nadu, Puducherry, and adjoining south Andhra Pradesh coasts and east coast of Sri Lanka coasts till 31st October.

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | 28/12 | 29/00 | 29/03 |
| India | | | |
| Coastal stations | | | |
| WB | 4/7 | 4/7 | |
| Odisha | 10/10 | 6/7 | |
| AP | 18/18 | 17/18 | |
| Tamil Nadu | 10/13 | 10/13 | |
| Puducherry | 2/2 | 2/2 | |
| A & N | 1/1/ | 1/1 | |
| Bangladesh | | | |
| Myanmar | | | |
| Thailand | | | |
| Srilanka | | | |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **28/12** | **29/00** | **29/03** |
| **India** | 96/121 | 90/121 | |
| **WB** | 9/20 | 9/20 | |
| **ODS** | 29/38 | 25/38 | |
| **AP** | 30/35 | 30/35 | |
| **TN** | 26/26 | 24/26 | |
| **PDC** | 2/2 | 2/2 | |

- **RS/RW** (12Z) of 28-10-2012: 05/39
- **No. of Ascents reaching 250 hPa levels:3 , MISDA:-34**
- **RS/RW** (00Z) of 29 -10-2012 20/39
- **No. of Ascents reaching 250 hPa levels:11 , MISDA:19**

**No. of PILOT Ascents**

| **28/12Z** | **29/00Z** |
|---|---|
| 14/37 | 14/34 |

**Buoy Data**

| **28/12Z** | **29/00Z** | **29/03Z** |
|---|---|---|
| - | - | - |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **28.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **22** | **19** | **19** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 28.10.2012 : 2**

No. of Ascents reaching 250 hpa level =2

**MISDA : 6**

**12Z /28.10.2012 : 0**

No. of Ascents reaching 250 hpa level =0

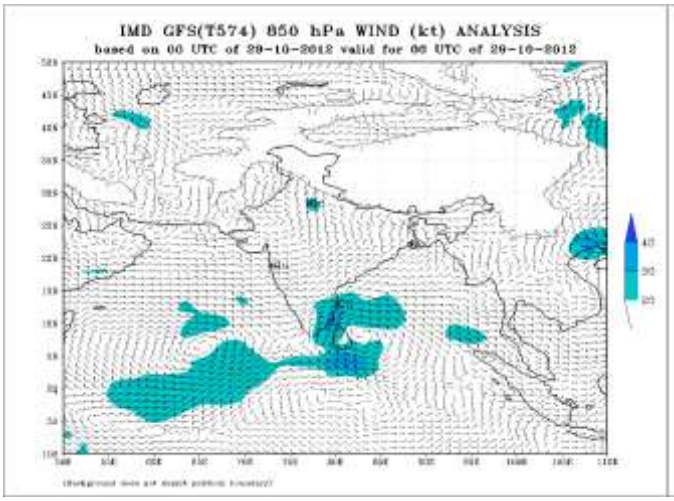
**MISDA : 8**

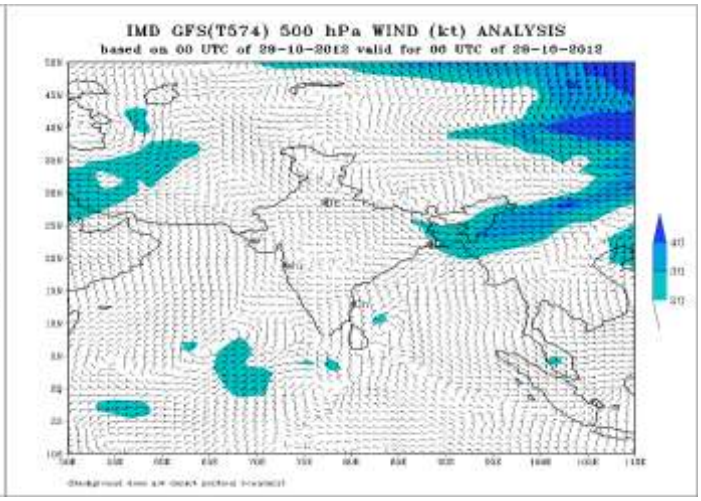
**No. of PILOT Ascents:**

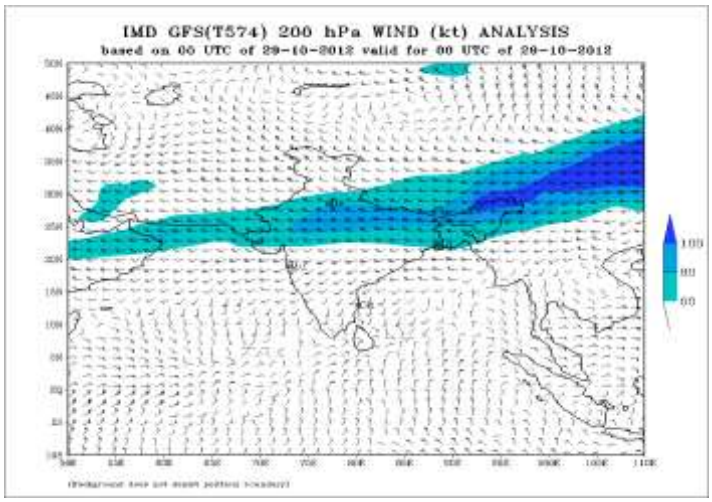
**28.10.2012**

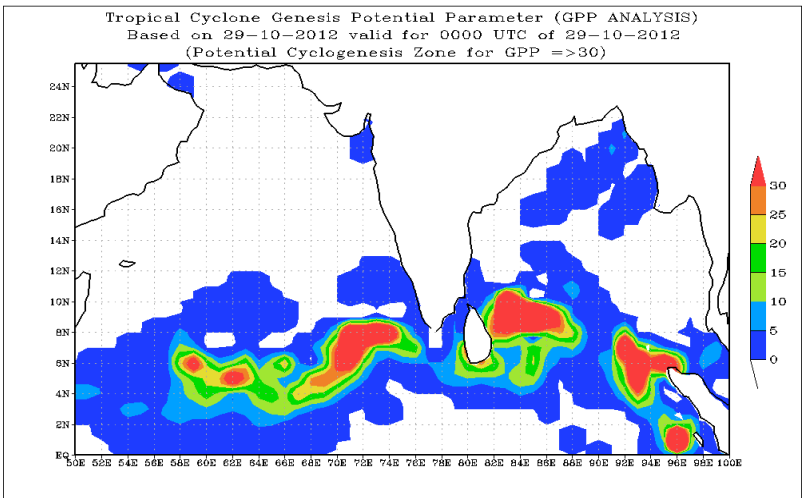
| 06Z | 18Z |
|---|---|
| 2 | 2 |

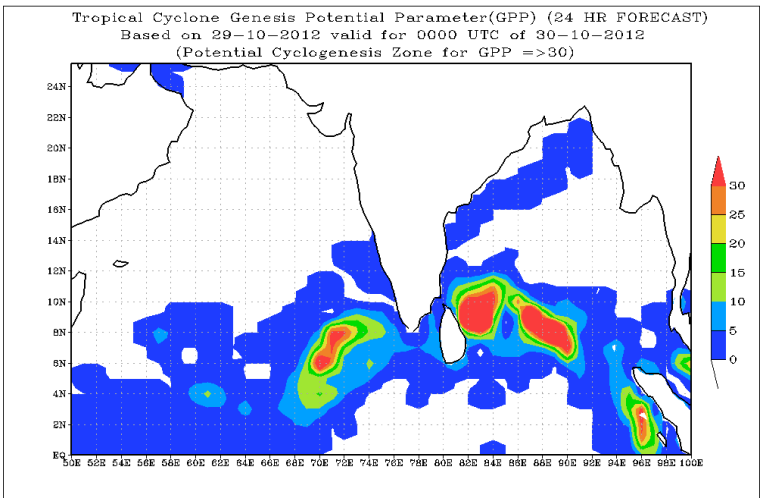
## Annexure II

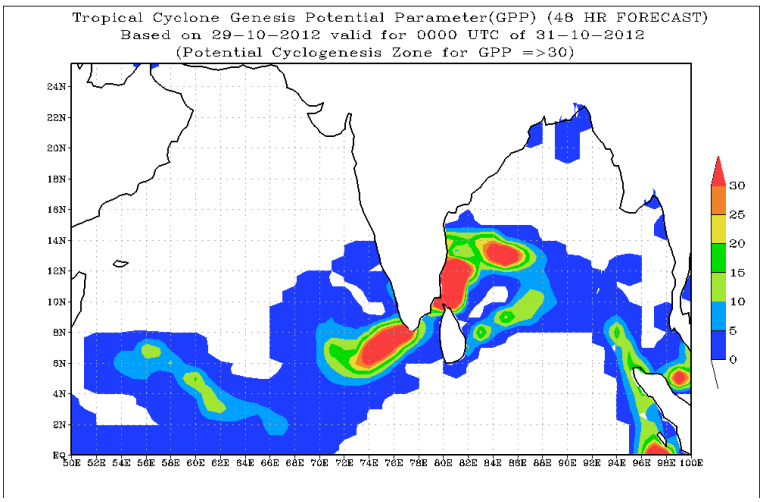

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 29-10-2012 valid for 00 UTC of 29-10-2012


IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 29-10-2012 valid for 00 UTC of 29-10-2012


IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 29-10-2012 valid for 00 UTC of 29-10-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 29-10-2012 valid for 0000 UTC of 29-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 29-10-2012 valid for 0000 UTC of 30-10-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 29-10-2012 valid for 0000 UTC of 31-10-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 30 October, 2012

**Synoptic features based on 0300 UTC:**

- Yesterday's deep depression over southwest Bay of Bengal has intensified into cyclonic storm '**NILAM**' at 0830 hrs IST of today and lay centred near latitude $9.0^0$N and longitude $82.0^0$E, about 500 km south-southeast of Chennai and 100 km east-northeast of Trincomalee (Sri Lanka). The system would move northwestwards and cross north Tamil Nadu and adjoining south Andhra Pradesh coast between Nagapattinam and Nellore by 31st October, 2012 afternoon/evening.
- The 24 hr change in MSLP shows fall of pressure by 1-2 hPa over Tamil Nadu and Andhra Pradesh coast.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 28-$30^0$C over Bay of Bengal along and off coastal Tamil Nadu Sri Lanka coast.

**Ocean thermal energy:**

- Ocean thermal energy is the order of 80-90 KJ $cm^{-2}$ over the storm region.

**Relative Vorticity:**

- Relative vorticity at 850 hPa increased and of the order of about 10-15* $10^{-4}$ $s^{-1}$ over storm region.

**Convergence:**

- Lower level convergence increased and of the order of 20-30* $10^{-5}$ $s^{-1}$ over the storm region.

**Divergence:**

- Upper air positive divergence increased and of the order of 30-40*$10^{-5}$ $s^{-1}$ over depression region.

**Wind Shear:**

- Wind Shear is of order 5-10 knots over storm region and increases towards north

**Wind Shear Tendency:**

- Decreasing of the order of 10-20 knots over storm region and west central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at 200 hPa passes through latitude 15.0°N over Bay of Bengal.

**M.J.O. Index:**

- Located over phase 2 with amplitude > 1.
- Statistical forecast: - MJO will move to phase 3, during next 5 days.
- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1 and will continue in phase 2 for one day and move to phase 1 during next 5 days.

**Status of observational system:**
Details of the status of observational system are given in **Annexure-I**.

**Satellite**
The satellite imagery shows vortex over southwest Bay of Bengal adj Sri Lanka centered near 9.2N/82.0E alongwith with intensity T 2.5. Associated intense to very intense convection over Sri Lanka, gulf of Mannar, Comorin, Palk strait Tamilnadu southwest and adjoining westcentral Bay of Bengal between lat 5.0N to 15.0N west of long 84.5E.
Broken low/medium clouds with embedded into intense to very intense convection over Maldives southeast Arabian Sea adjoining Indian ocean. Broken low/medium clouds with embedded moderate to intense convection over rest south Arabian Sea adjoining Indian ocean between equator to lat 10.0N east of long 76.0E (.)

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts show a Cyclonic Storm over southwest **Bay of Bengal** around Lat. 8.5° N / Long. 82.5° E based on 0000 UTC of 30th October 2012 (today). Continuing the westward movement and cross north Tamil Nadu coasts between Nagapattinam and Chennai by evening of 31 October 2012**.**The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **IMD-GFS** model MSLP & wind charts also shows a low pressure area over southeast **Arabian Sea** on 0000 UTC of 30 October 2012. This system lies over same area and continues to intensify further in to a storm on 31st October 2012 . After that system moves in northly direction along around **Long 65° E** till 4th Nov 2012 and cross Gujarat Coast on 5th November 2012. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

- **IMD-WRF** model MSLP & wind charts show a Cyclonic Storm over south west Bay of Bengal based on 00UTC of 30 October 2012. This system intensifies & moves in westward direction, and cross north Tamilnadu coasts between Nagapattinam and chennai by evening / night of 31$^{st}$ October 2012.

- **ECMWF** model MSLP and WIND charts show a Cyclonic Storm over southwest **Bay of Bengal** around Lat. 8.5° N / Long. 83° E based on 0000 UTC of 30th October 2012 . Continuing the north westward movement and cross north Tamil Nadu coasts between Karaikal and Nellore by evening of 31 October 2012**.**The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **NCMRWF Unified Model** shows the intensification of deep depression into cyclonic storm moving northwestwards and cross north Tamilnadu and south Andhra Pradesh coast north of Chennai around 0000 UTC of 1$^{st}$ November

2012.

- **NCMRWF GEFS** (290000 UTC) shows the intensification of deep depression into cyclonic storm moving northwestwards and cross north Tamilnadu and south Andhra Pradesh coast close to around Chennai 0000 UTC of 31st October 2012.
- **Genesis Potential Parameter (GPP):**
- Model analysis also shows large GPP area extends from over south-central Bay of Bengal to south-central Arabian Sea on 30th October. Entire GPP area moves westward on 31th October.Its horizontal extension decrease on 1st November 2012. GPP charts for 24 and 48 hours are shown in **Annexure II.**

**Advisory:**

- **Considering the NWP model guidance, most of the models suggest that the cyclonic storm 'NILAM' will move northwestwards and cross north Tamilnadu and south Andhra Pradesh coast close to Chennai by afternoon/evening of 31st October 2012.**
- **Hence, IOP will continue till 31st October 2012. Intense observation period will be observed for Tamil Nadu, Puducherry and adjoining south Andhra Pradesh coast.**

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **29/12** | **30/00** | **30/03** |
| **India** | 79/89 | 64/79 | 79/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1/ | 1/1 | 1/1 |
| **Bangladesh** | 7/11 | 6/11 | 5/11 |
| **Myanmar** | 9/11 | 9/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 6/9 | 6/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **29/12** | **30/00** | **30/03** |
| **India** | 94/121 | 93/121 | 24/119 |
| **WB** | 9/20 | 9/20 | 2/20 |
| **ODS** | 28/38 | 28/38 | 11/38 |
| **AP** | 31/35 | 30/35 | 5/35 |
| **TN** | 25/26 | 25/26 | 6/26 |
| **PDC** | 2/2 | 2/2 | - |

- **RS/RW** (12Z) of 29-10-2012: 08/39
- **No. of Ascents reaching 250 hPa levels:3 , MISDA:-31**
- **RS/RW** (00Z) of 30 -10-2012 20/39
- **No. of Ascents reaching 250 hPa levels:11 , MISDA:19**

**No. of PILOT Ascents**

| 28/12Z | 29/00Z |
|---|---|
| 14/37 | 17/34 |

**Buoy Data**

| 29/12Z | 30/00Z | 30/03Z |
|---|---|---|
| 11 | 8 | 11 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **29.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 29.10.2012 : 3**

No. of Ascents reaching 250 hPa level =3

**MISDA : 5**

**12Z /29.10.2012 : 2**

No. of Ascents reaching 250 hPa level =2

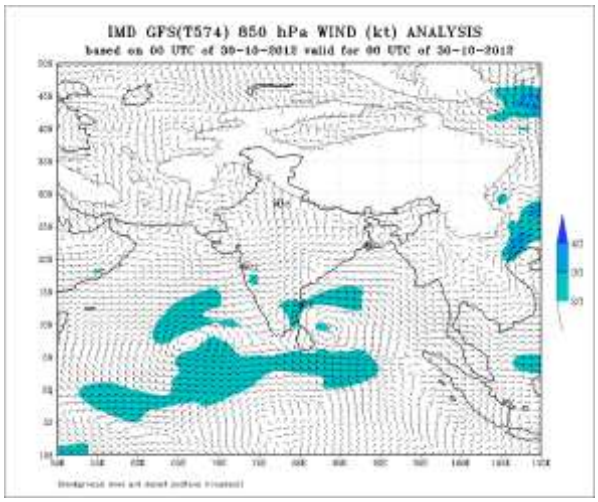
**MISDA : 6**

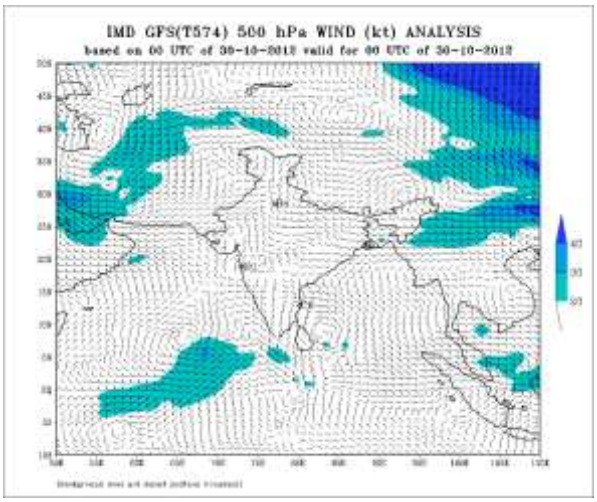
**No. of PILOT Ascents:**

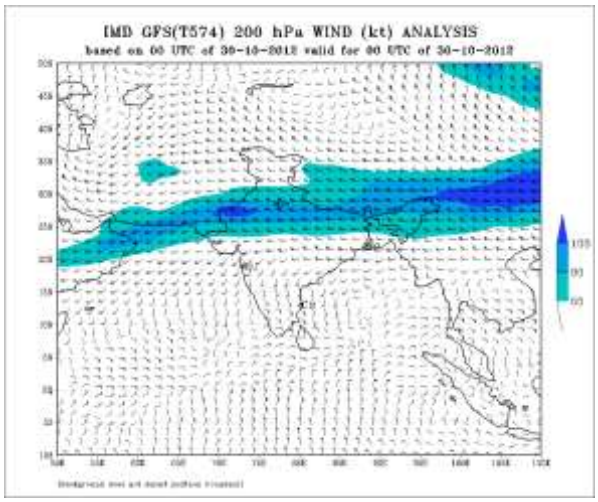
**29.10.2012**

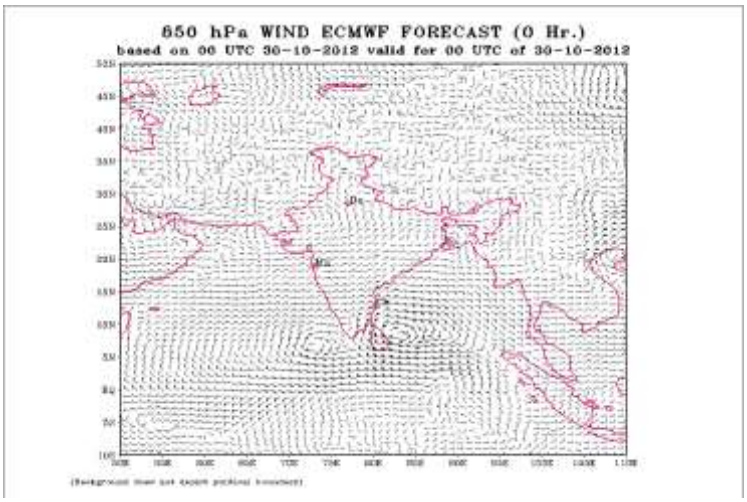
| 06Z | 18Z |
|---|---|
| 3 | 2 |

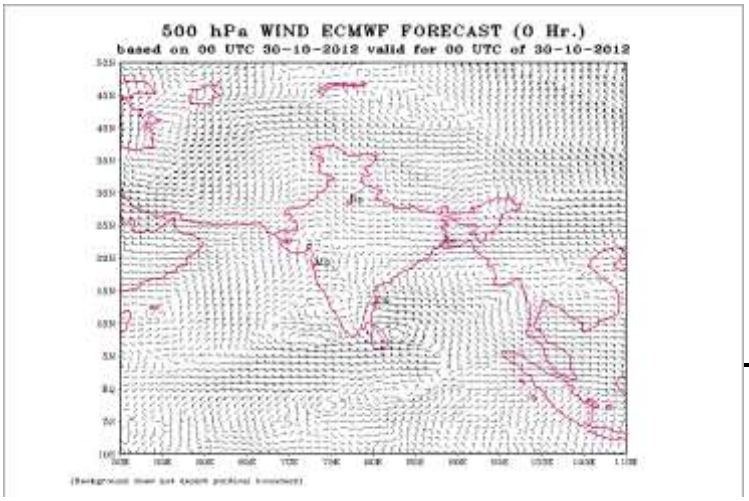
## Annexure II

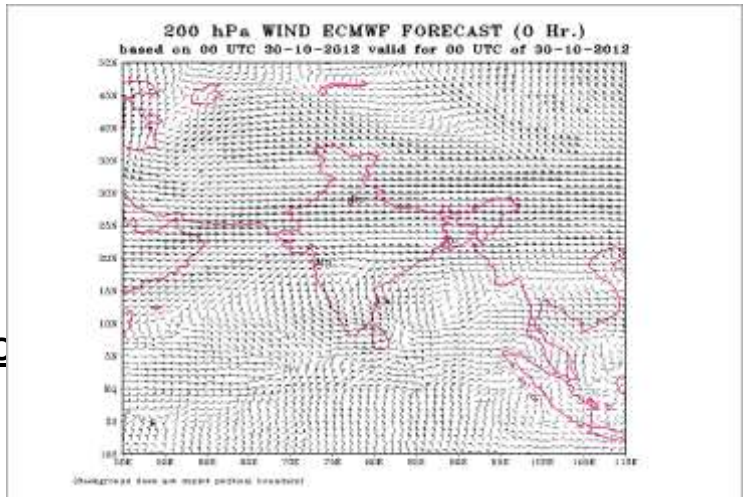

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 30-10-2012 valid for 00 UTC of 30-10-2012

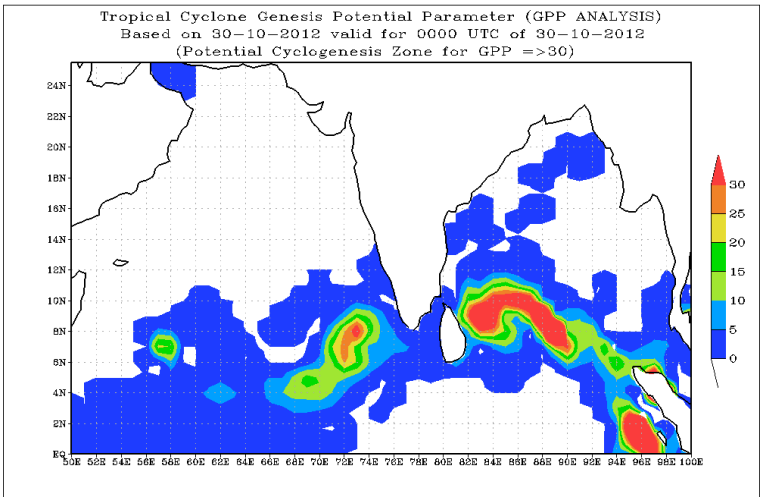

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 30-10-2012 valid for 00 UTC of 30-10-2012

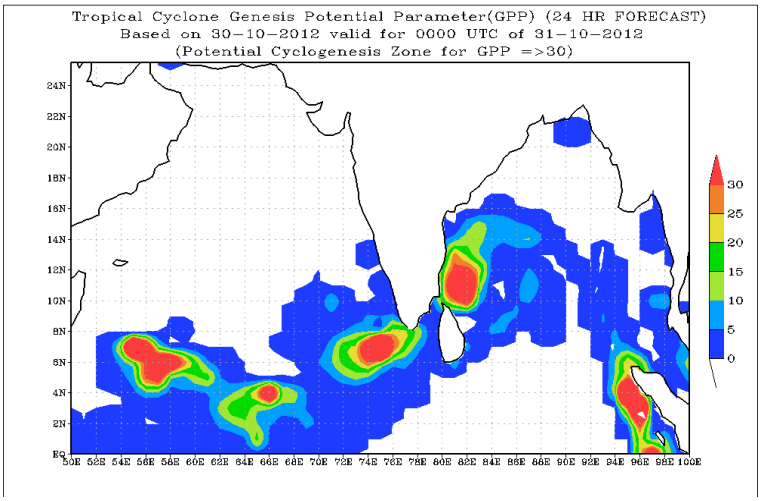

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 30-10-2012 valid for 00 UTC of 30-10-2012

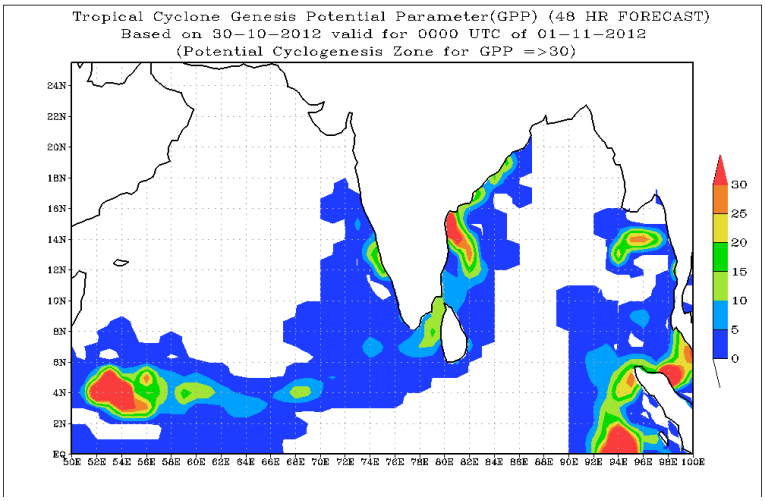

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 30-10-2012 valid for 00 UTC of 30-10-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 30-10-2012 valid for 00 UTC of 30-10-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 30-10-2012 valid for 00 UTC of 30-10-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 30-10-2012 valid for 0000 UTC of 30-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 30-10-2012 valid for 0000 UTC of 31-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 30-10-2012 valid for 0000 UTC of 01-11-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0

## NOC Report Dated 31 October, 2012

**Synoptic features based on 0300 UTC:**

- The Cyclonic Storm '**NILAM**', moved northwestwards and lay centred at 0830 hours IST near latitude $11.0^0$N and longitude $81.0^0$E, about 260 km south-southeast of Chennai and 300 km north of Trincomalee (Sri Lanka). The system would intensify further into a Severe Cyclonic Storm and move northwestwards and cross north Tamil Nadu & adjoining south Andhra Pradesh coast between Puducherry and Nellore, close to Chennai by 31$^{st}$ October, 2012 evening.
- The 24 hour pressure change reported –ve by 2-7 hPa along Coastal Andhra Pradesh and Tamil Nadu. Maximum change of -8 hPa reported at Puducherry and -7 hPa each at Chennai and Cuddalore.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 28-30$^0$C over Bay of Bengal along and off coastal Tamil Nadu Sri Lanka coast.

**Ocean thermal energy:**

- Ocean thermal energy is the order of 80-90 KJ cm$^{-2}$ over the storm region.

**Relative Vorticity:**

- Relative vorticity at 850 hPa of the order of about 10-15* $10^{-4}$ $s^{-1}$ over storm region.

**Convergence:**

- Lower level convergence of the order of 30* $10^{-5}$ $s^{-1}$ over the storm region.

**Divergence:**

- Upper air positive divergence of the order of 30*$10^{-5}$ $s^{-1}$ over storm region.

**Wind Shear:**

- Wind Shear is of order 5-10 knots over storm region.

**Wind Shear Tendency:**

- Decreasing of the order of 10-20 knots over storm region and west central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at 200 hPa passes through latitude 14.0°N.

**M.J.O. Index:**

- Located over phase 2 with amplitude > 1.
- Statistical forecast: - MJO will move to phase 3, during next 5 days.
- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1 and will continue in phase 2 for one day and move to phase 1 during next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

**Satellite advisory**

The satellite imagery shows vortex (NILAM) over southwest Bay of Bengal centred at 11.7N/80.3E. Intensity T3.0. Associated broken to intense to very intense convective clouds over North Tamil Nadu and adjoining Bay of Bengal between lat 9.0N to 14.0N west of long 82.0E and broken low/medium clouds with embedded moderate to intense convection over rest Tamil Nadu, Rayalaseema, Coastal Andhra Pradesh adjoining westcentral Bay of Bengal, South Interior Karnataka, Kerala, Comorin, Palk Strait and north Sri Lankan.

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts show a Cyclonic Storm over southwest **Bay of Bengal** around Lat. 10.0° N / Long. 82.0° E based on 0000 UTC of 31 October 2012 . Continuing the north-westward movement and cross north Tamil Nadu coasts between Nagapattinam and Chennai by evening of 31 October 2012**.**The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **IMD-GFS** model MSLP & wind charts also shows a low pressure area over southeast **Arabian Sea** on 0000 UTC of 31 October 2012. This system lies over same area on 1 November and merged with the low pressure area crossed from Bay of Bengal on 02 November 2012. After merging over land area, the system moves in northly direction along the west coast of India till 4th Nov 2012.The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

- **IMD-WRF** model MSLP & wind charts show a Cyclonic Storm over south west Bay of Bengal based on 00UTC of 31 October 2012. This system moves in north westward direction and cross north Tamilnadu coasts between Nagapattinam and Chennai by 12 UTC of 31st October 2012.

- **ECMWF** model MSLP and WIND charts show a Cyclonic Storm over southwest **Bay of Bengal** around Lat. 10.5° N / Long. 82° E based on 0000 UTC of 31 October 2012. Continuing the north westward movement and cross north Tamil Nadu coasts between Karaikal and Chennai by 12 UTC of 31 October 2012**.** After crossing the coast, the system weakens and become a low pressure area. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **NCMRWF Unified Model** shows the cyclonic storm move northwestwards and cross north Tamilnadu and south Andhra Pradesh coast north of Chennai around 0000 UTC of 1st November 2012.
- **NCMRWF GEFS** (300000 UTC) shows the intensification of deep depression into cyclonic storm moving northwestwards and cross north Tamilnadu and south Andhra Pradesh coast close to Chennai around 0000 UTC of 1st November 2012.

- **Genesis Potential Parameter (GPP):**
- Model analysis also shows large GPP area over north of Srilanka on 31 October 2012.along .Entire GPP area moves north westward along the north Tamilnadu coast and extends from Karaikal coast to Nellore coast on 1 November 2012.Its horizontal extension decrease on 2 November 2012. GPP charts for 24 and 48 hours are shown in **Annexure II.**

**Advisory:**

- **Considering the NWP model guidance, most of the models suggest that the cyclonic storm 'NILAM' will move northwestwards and cross north Tamil Nadu & adjoining south Andhra Pradesh coast between Puducherry and Nellore, close to Chennai by 31st October, 2012 evening.**
- **Hence, IOP will continue till 1st November 2012. Intense observation period will be observed for Tamil Nadu, Puducherry and adjoining south Andhra Pradesh coast.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **30/12** | **310/00** | **31/03** |
| **India** | 70/78 | 65/82 | 80/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 3/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/13 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1/ | 1/1 | 1/1 |
| **Bangladesh** | 8/11 | 6/11 | 8/11 |
| **Myanmar** | - | 10/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 5/9 | 7/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **30/12** | **31/00** | **31/03** |
| **India** | 94/121 | 94/121 | 82/121 |
| **WB** | 9/20 | 9/20 | 10/20 |
| **ODS** | 29/38 | 28/38 | 24/38 |
| **AP** | 29/35 | 29/35 | 21/35 |
| **TN** | 25/26 | 25/26 | 25/26 |
| **PDC** | 2/2 | 2/2 | 2/2- |

- **RS/RW** (12Z) of 30-10-2012:

09/39

- **No. of Ascents reaching 250 hPa levels: , MISDA:-30**
- **RS/RW** (00Z) of 30 -10-2012 20/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:19**

**No. of PILOT Ascents**

| 30/12Z | 31/00Z |
|---|---|
| 13/37 | 19/34 |

**Buoy Data**

| 30/12Z | 31/00Z | 31/03Z |
|---|---|---|
| 10 | 9 | 9 |

**No of Synop data**

| **Date→** | **30.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **20** | **20** | **20** |

**No. of RS/RW Ascents**

**00Z / 30.10.2012 : 2**

No. of Ascents reaching 250 hPa level =2

**MISDA : 6**

**12Z /30.10.2012 : 1**

No. of Ascents reaching 250 hPa level =1

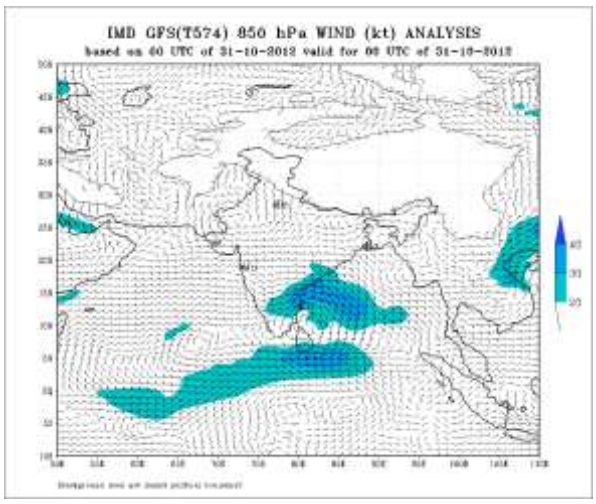
**MISDA : 7**

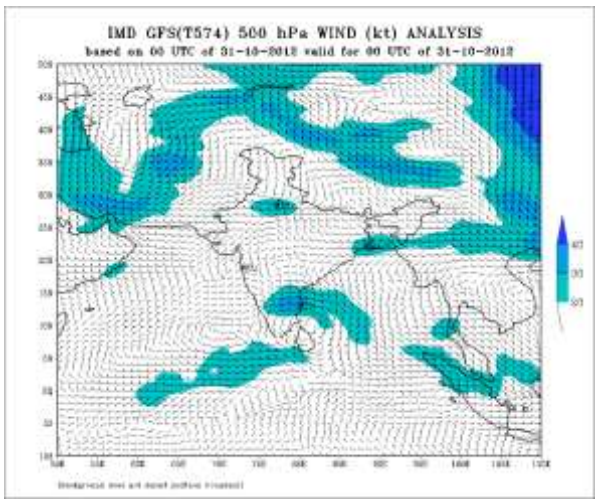
**No. of PILOT Ascents:**

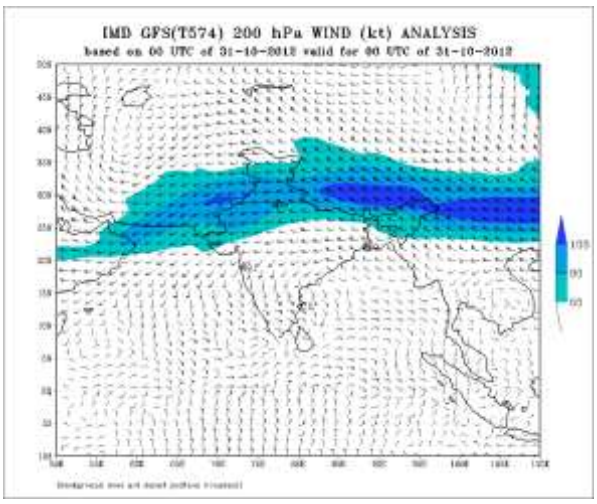
**30.10.2012**

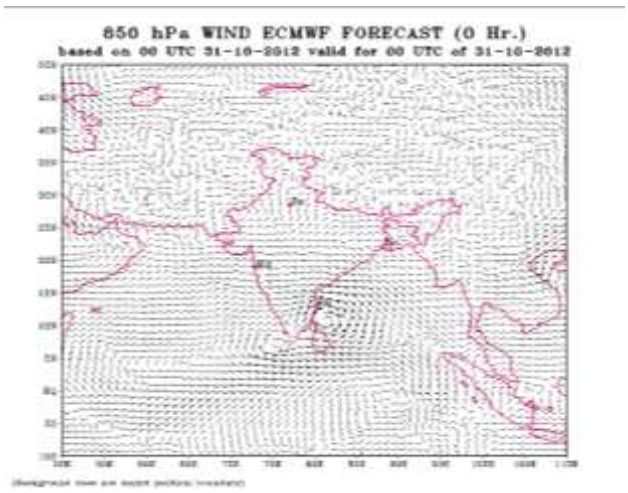
| 06Z | 18Z |
|---|---|
| 3 | 3 |

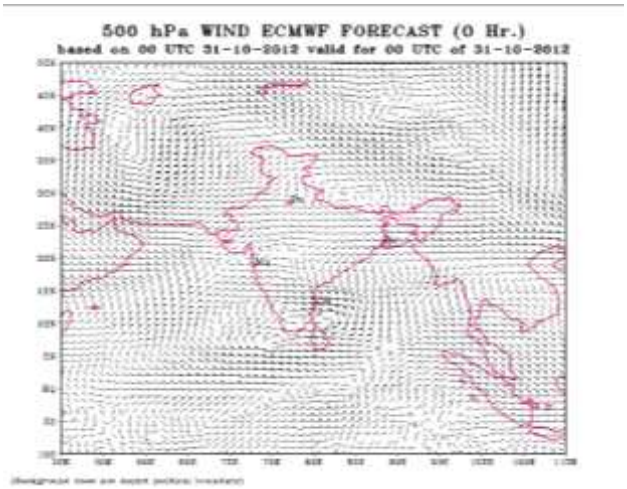
## Annexure II

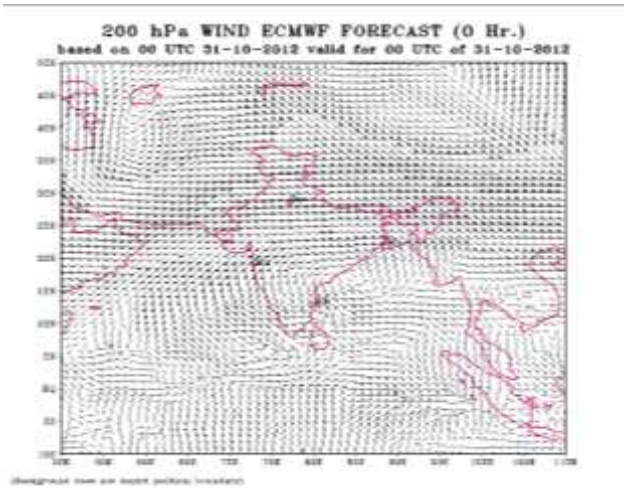

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 31-10-2012 valid for 00 UTC of 31-10-2012

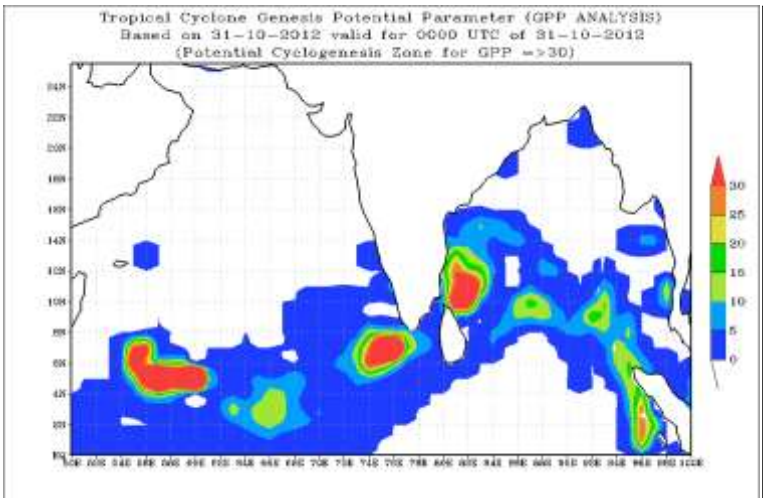

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 31-10-2012 valid for 00 UTC of 31-10-2012

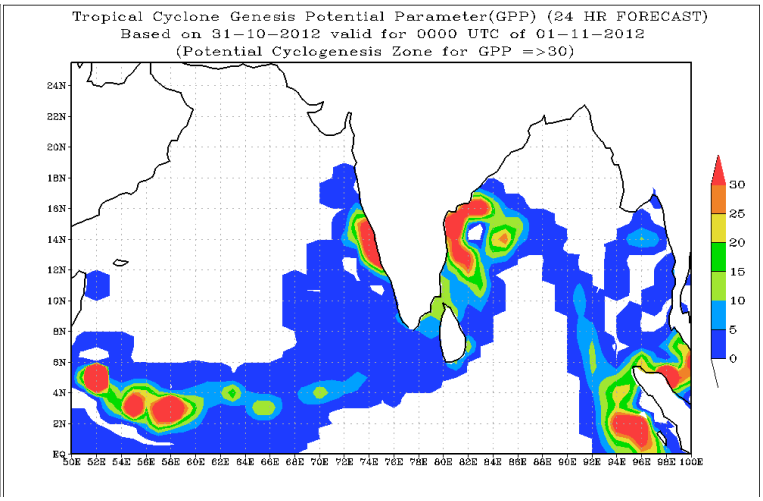

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 31-10-2012 valid for 00 UTC of 31-10-2012

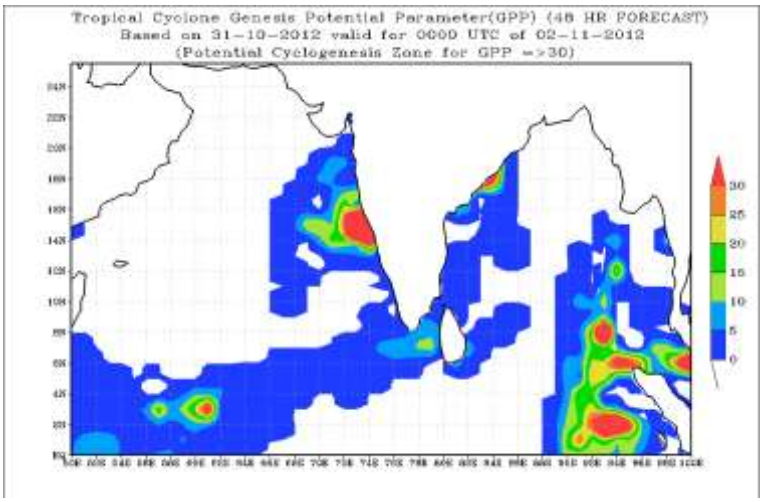

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 31-10-2012 valid for 00 UTC of 31-10-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 31-10-2012 valid for 00 UTC of 31-10-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 31-10-2012 valid for 00 UTC of 31-10-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 31-10-2012 valid for 0000 UTC of 31-10-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 31-10-2012 valid for 0000 UTC of 01-11-2012
(Potential Cyclogenesis Zone for GPP =>30)
24N
22N
20N
18N
16N
14N
12N
10N
8N
6N
4N
2N
EQ
50E 52E 54E 56E 58E 60E 62E 64E 66E 68E 70E 72E 74E 76E 78E 80E 82E 84E 86E 88E 90E 92E 94E 96E 98E 100E
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 31-10-2012 valid for 0000 UTC of 02-11-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0

## FDP (Cyclone) NOC Report Dated 1st November, 2012

**Synoptic features based on 0300 UTC:**

- Yesterday's Cyclone Nilam moved north-northwestwards, crossed north Tamilnadu coast near Mahabalipuram, south of Chennai (near latitude 12.6$^0$N and longitude 80.2$^0$E) between 1600 and 1700 hrs IST of 31st October 2012.It lies as Depression at 0830 hours IST of today, the 1st `November 2012 near latitude 14.0$^0$ N and longitude 76.5$^0$E, near Chitradurga. The system would move northwestwards and weaken further into a low pressure area during next 12 hours.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 28-30$^0$C over Bay of Bengal .

**Ocean thermal energy:**

- Ocean thermal energy is the order of 40-60 KJ cm$^{-2}$ over Bay of Bengal.

**Relative Vorticity:**

- Relative Vorticity at 850 hPa of the order of about 10* 10$^{-5}$ s$^{-1}$ over Depression area.

**Convergence:**

- Lower level convergence is negative over depression area

**Divergence:**

- Upper air positive divergence of the order of 20 *10$^{-5}$ s$^{-1}$ over Depression area.

**Wind Shear:**

- Wind Shear is of order of 10-20 knots over depression area.

**Wind Shear Tendency:**

- Decreasing of the order of 5 knots over Depression area and central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hPa passes through latitude 10.0°N.

**M.J.O. Index:**

- Located over phase 2 with amplitude < 1.
- Statistical forecast: - MJO will move to phase 5, during next 5 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude greater than 1 and will continue in phase 2 during next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure-I**.

**Satellite advisory**

Broken to very intense convection over Andhra Pradesh, adjoining westcentral Bay of Bengal, north interior Karnataka, Marathawada, Madhya Maharashtra and

moderate to intense convection over rest Karnataka adjoining Arabian Sea. Weak to moderate convection vortex centred near lat 14.5 n long 76.5 e (.)

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts show the Cyclonic Storm (NILAM) weakened in to a Depression over Rayalaseema and adjoining areas of south interior Karnataka and lay centred at 0000 UTC of 01 November 2012 near Lat. 14.0° N / Long. 77.5° E. Continuing north-eastward movement as low presuure area and become less marked on 05 November 2012.And another low pressure area over arabian sea merged with the low pressure area crossed from Bay of Bengal on 01 November 2012. After merging over land area, the system moves in north-easterly direction over land till 5th Nov 2012.The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

- **IMD-WRF** model MSLP & wind charts show show the Cyclonic Storm (NILAM) weakened in to a Depression over Rayalaseema and adjoining areas of south interior Karnataka at 0000 UTC of 01 November 2012 near Lat. 14.0° N / Long. 77.5° E. Continuing north-ward movement as low pressure area till 4th November 2012.

- **ECMWF** model MSLP and WIND charts show the Cyclonic Storm (NILAM) weakened in to a Depression over Rayalaseema and adjoining areas of south interior Karnataka and lay centred at 0000 UTC of 01 November 2012. Continuing north ward movement as low presuure area towards central india till 4th November and become less marked on 5th November 2012. It also shows a trough extending from SW Arabian Sea to the center of the low pressure area based on todays analysis and persist till 4th November 2012.The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **Genesis Potential Parameter (GPP):**
- Model analysis also shows large GPP area over off Tamilnadu coast between **12-14 N** on 01 November 2012 .Entire GPP area over east coast of tmailnadu disappear on 02 November 2012 moves. GPP charts for 24 and 48 hours are shown in **Annexure II.**

**Advisory:**

- **In view of the Cyclone weakening into a Depression, IOP is hereby discontinued.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **31/12** | **1/00** | **1/03** |
| **India** | 75/78 | 65/79 | 78/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1/ | 1/1 | 1/1 |
| **Bangladesh** | 10/11 | 8/11 | 6/11 |
| **Myanmar** | - | 9/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 7/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **1/12** | **1/00** | **1/03** |
| **India** | 94/121 | 65/121 | 60/121 |
| **WB** | 9/20 | 4/20 | 4/20 |
| **ODS** | 28/38 | 22/38 | 22/38 |
| **AP** | 31/35 | 21/35 | 19/35 |
| **TN** | 24/26 | 17/26 | 14/26 |
| **PDC** | 2/2 | 1/2 | 1/2- |

- **RS/RW** (12Z) of 31-10-2012: 08/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:-31**
- **RS/RW** (00Z) of 30 -10-2012 22/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:17**

**No. of PILOT Ascents**

| 31/12Z | 1/00Z |
|---|---|
| 10/37 | 13/34 |

**Buoy Data**

| 30/12Z | 31/00Z | 31/03Z |
|---|---|---|
| 9 | 8 | 8 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **31.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **21** | **21** | **21** | **20** | **21** | **19** | **19** | **18** |

**No. of RS/RW Ascents**

**00Z / 31.10.2012 : 2**

No. of Ascents reaching 250 hPa level =2

**MISDA : 6**

**12Z /31.10.2012 : 2**

No. of Ascents reaching 250 hPa level =2

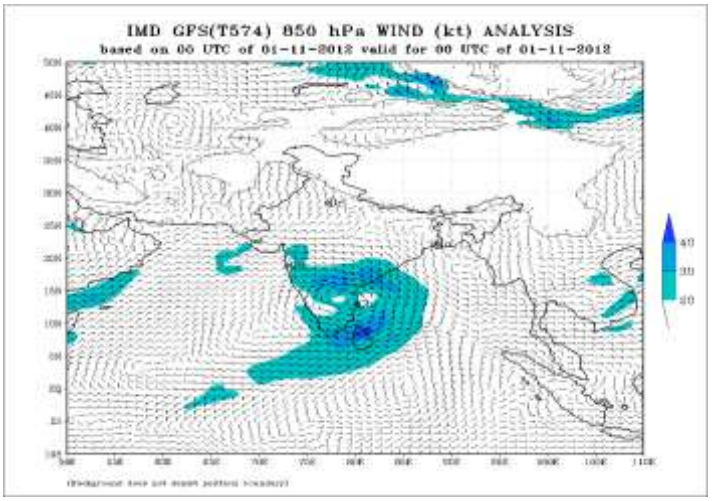
**MISDA : 6**

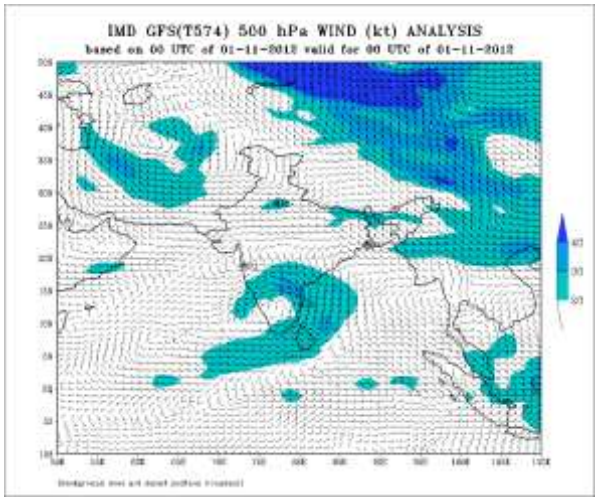
**No. of PILOT Ascents:**

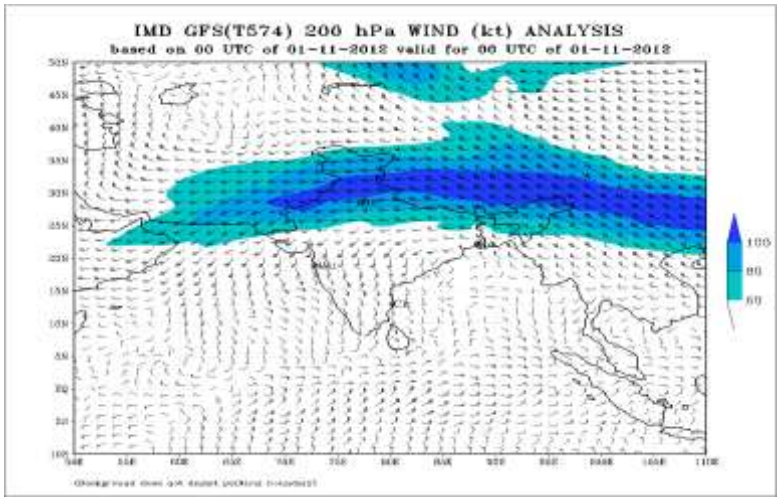
**31.10.2012**

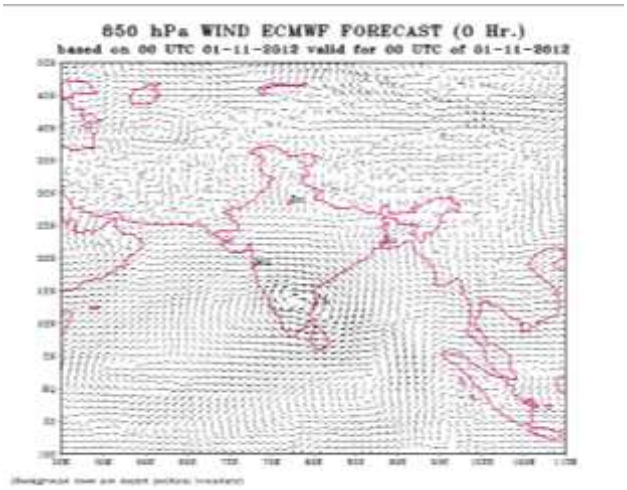
| 06Z | 18Z |
|---|---|
| 4 | 0 |

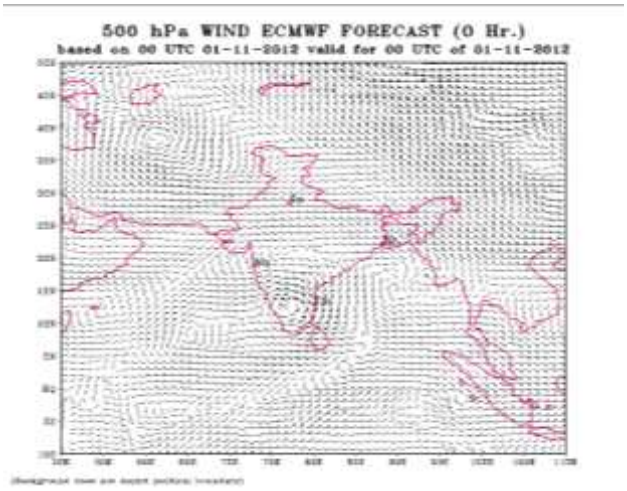
## Annexure II

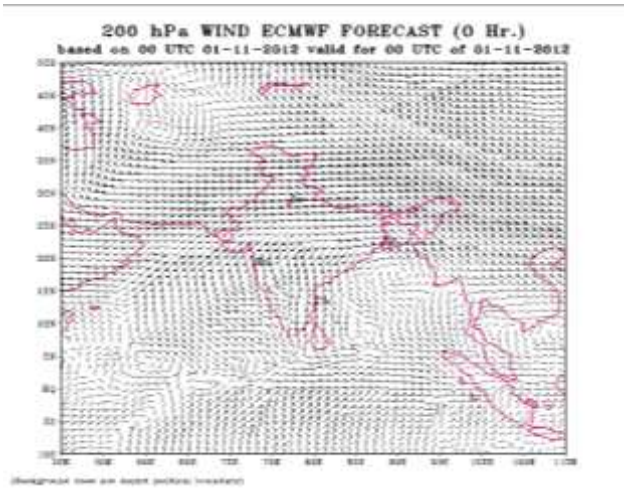

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 01-11-2012 valid for 00 UTC of 01-11-2012

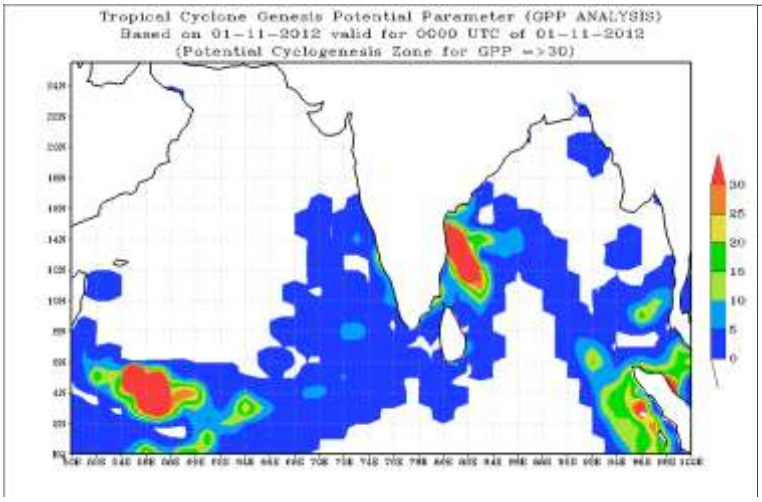

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 01-11-2012 valid for 00 UTC of 01-11-2012

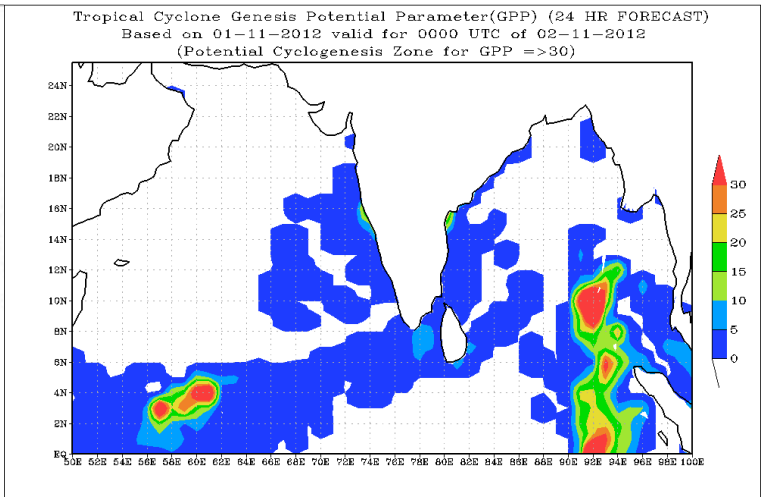

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 01-11-2012 valid for 00 UTC of 01-11-2012

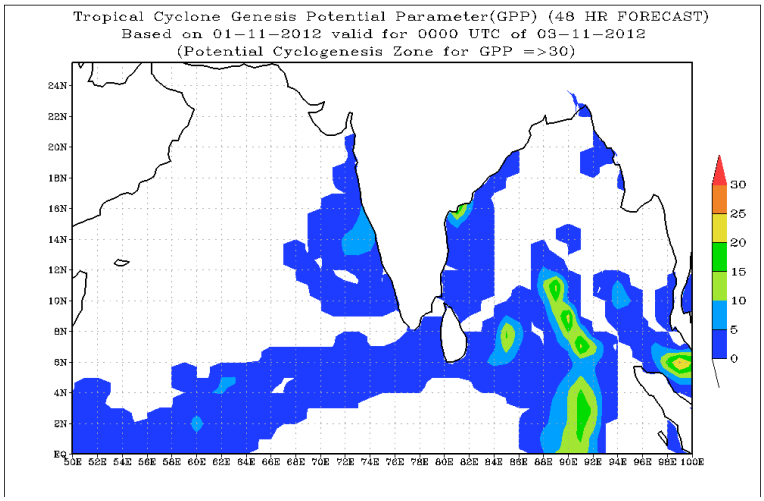

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 01-11-2012 valid for 00 UTC of 01-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 01-11-2012 valid for 00 UTC of 01-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 01-11-2012 valid for 00 UTC of 01-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 01-11-2012 valid for 0000 UTC of 01-11-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 01-11-2012 valid for 0000 UTC of 02-11-2012
(Potential Cyclogenesis Zone for GPP =>30)
24N
22N
20N
18N
16N
14N
12N
10N
8N
6N
4N
2N
EQ
50E 52E 54E 56E 58E 60E 62E 64E 66E 68E 70E 72E 74E 76E 78E 80E 82E 84E 86E 88E 90E 92E 94E 96E 98E 100E
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 01-11-2012 valid for 0000 UTC of 03-11-2012
(Potential Cyclogenesis Zone for GPP =>30)
24N
22N
20N
18N
16N
14N
12N
10N
8N
6N
4N
2N
EQ
50E 52E 54E 56E 58E 60E 62E 64E 66E 68E 70E 72E 74E 76E 78E 80E 82E 84E 86E 88E 90E 92E 94E 96E 98E 100E
30
25
20
15
10
5
0

## FDP (Cyclone) NOC Report Dated 2nd November, 2012

**Synoptic features based on 0300 UTC:**

- Yesterday's Depression over south Interior Karnataka and neighbourhood weakened into a well marked low pressure area over North Interior Karnataka and adjoining Rayalaseema at 0830 hours IST of today, the 2nd November 2012.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 28-30$^0$C over Bay of Bengal .

**Ocean thermal energy:**

- Ocean thermal energy is the order of 50-60 KJ cm$^{-2}$ over Bay of Bengal.

**Relative Vorticity:**

- Relative Vorticity at 850 hPa is of the order of about 10-15* 10$^{-4}$ s$^{-1}$ over well marked Low pressure area.

**Convergence:**

- Lower level convergence of the order of 10 to 15 *10$^{-5}$ s$^{-1}$ over Andhra Pradesh and adjoining Bay of Bengal.

**Divergence:**

- Upper air positive divergence of the order of 10 to 20 *10$^{-5}$ s$^{-1}$ over Andhra Pradesh and adjoining Bay of Bengal.

**Wind Shear:**

- Wind Shear is low of order of 5-10 knots over Bay of Bengal

**Wind Shear Tendency:**

- Decreasing tendency over Andhra Pradesh and adjoining Bay of Bengal

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hPa passes through latitude 17.0°N.

**M.J.O. Index:**

- Located over phase 2 with amplitude < 1.
- Statistical forecast: - MJO will move to phase 3, during next 5 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude less than 1 and will continue in phase 2 during next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite advisory**

Moderate to intense convective clouds are seen at many places over south east Bay of Bengal, west central Andaman Sea and adjoining east central Bay of Bengal. (See

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts show a well marked low pressure area over north interior Karnataka and adjoining areas in the 00 UTC anaysis of 02 November 2012.Associated cyclonic circulation extends upto mid tropospheric levels.The low pressure system moves north wards on 03 Nov and eastwards towards Chattisgrah on 04 Nov 2012. It also shows a trough extending from SW arabian sea to the center of the low pressure area till 4th November 2012. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

- **IMD-WRF** model MSLP & wind charts show show model MSLP and WIND charts show a well marked low pressure area over north interior Karnataka and adjoining areas in the 00 UTC anaysis of 02 November 2012.Associated cyclonic circulation extends upto mid tropospheric levels. Continuing north-ward movement as low pressure area towards central india till 4th November 2012.

- **ECMWF** model MSLP and WIND charts show a well marked low pressure area over south interior Karnataka and adjoining areas of Rayalaseema in the 00 UTC analysis of 02 November 2012. Associated cyclonic circulation extends upto mid tropospheric levels. Continuing north ward movement as low presuure area towards central india till 5th November 2012 and become north-south trough on 6th November 2012. It also shows a trough extending from SW Arabian sea to the center of the low pressure area based on todays analysis and persist till 4th November 2012.The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis also shows large GPP area over off Tamilnadu coast around **16 deg N** on 02 November 2012 .The intensity of GPP area over east coast of Tamilnadu decreases on 03 and 04 November 2012. GPP charts for 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- Depression weakened into a low pressure area and lay over Rayalaseema and neighbourhood.
- No cyclogenesis is likely over Bay of Bengal during next 3 days.

**Advisory:**

- **NO IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **01/12** | **02/00** | **02/03** |
| **India** | 70/78 | 65/82 | 80/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 3/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/13 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1/ | 1/1 | 1/1 |
| **Bangladesh** | 8/11 | 6/11 | 8/11 |
| **Myanmar** | - | 10/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 5/9 | 7/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **01/12** | **02/00** | **02/03** |
| **India** | 94/121 | 94/121 | 82/121 |
| **WB** | 9/20 | 9/20 | 10/20 |
| **ODS** | 29/38 | 28/38 | 24/38 |
| **AP** | 29/35 | 29/35 | 21/35 |
| **TN** | 25/26 | 25/26 | 25/26 |
| **PDC** | 2/2 | 2/2 | 2/2- |

- **RS/RW** (12Z) of 01-11-2012: 09/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:-30**
- **RS/RW** (00Z) of 02 -10-2012 20/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:19**

**No. of PILOT Ascents**

| 01/12Z | 02/00Z |
|---|---|
| 13/37 | 19/34 |

**Buoy Data**

| 01/12Z | 02/00Z | 02/03Z |
|---|---|---|
| 10 | 9 | 9 |

**No of Synop data**

| **Date→** | **01.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **19** | **20** | **20** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z /01.11.2012 : 2**

No. of Ascents reaching 250 hPa level =2

**MISDA : 6**

**12Z /01.11.2012 : 0**

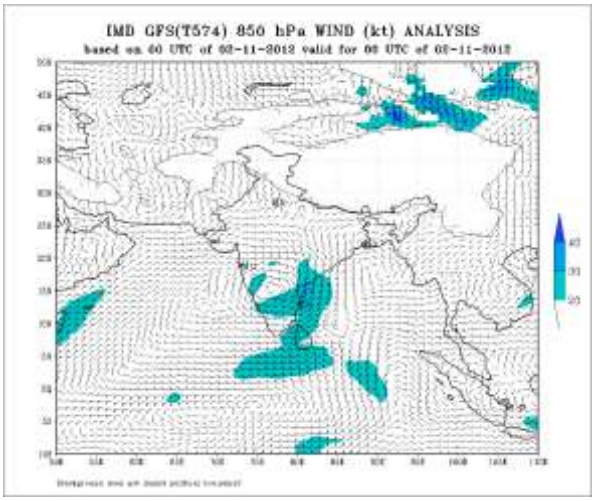
No. of Ascents reaching 250 hPa level =0

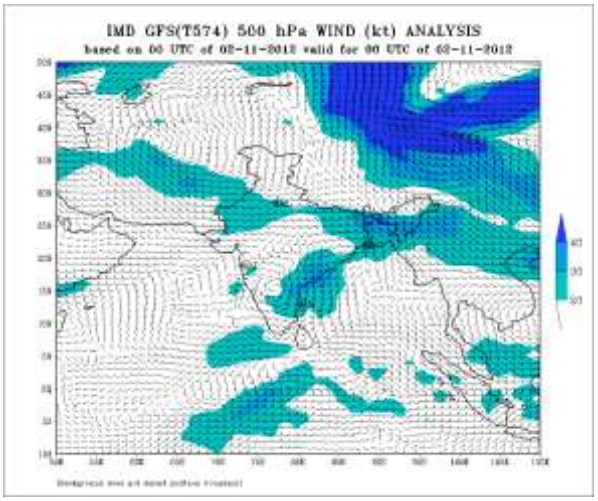
**MISDA : 8**

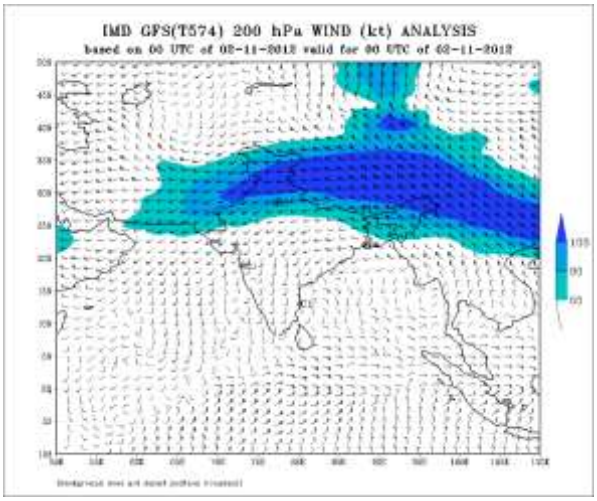
**No. of PILOT Ascents:**

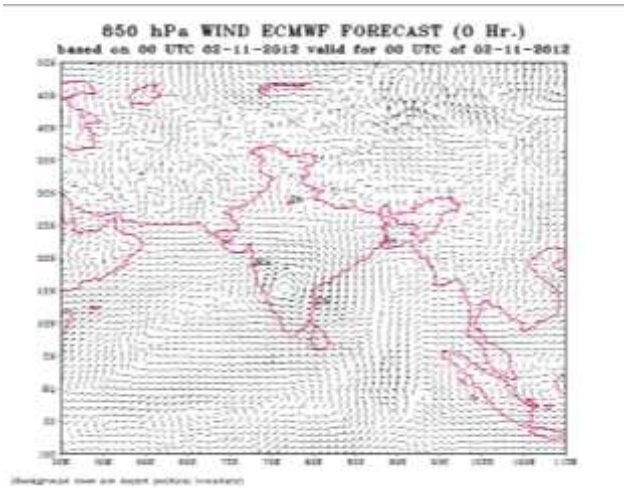
| **01.11.2012** | |
|---|---|
| 06Z | 18Z |
| 1 | 2 |

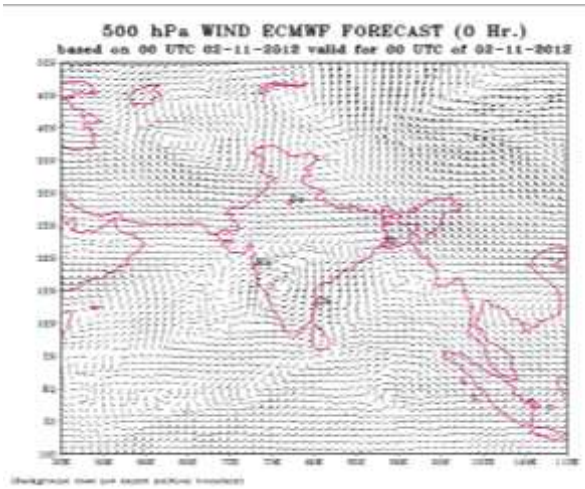
## Annexure II

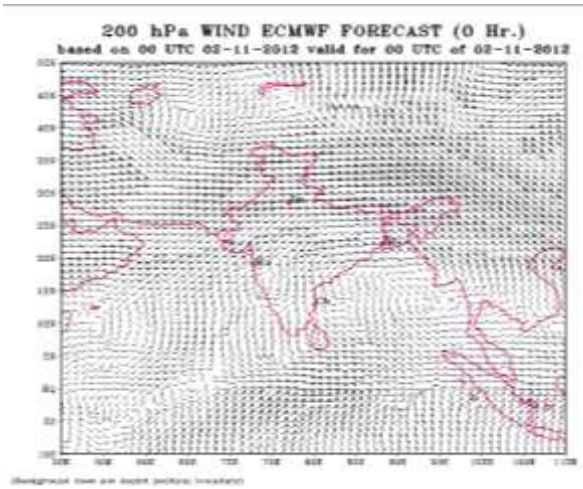

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 02-11-2012 valid for 00 UTC of 02-11-2012

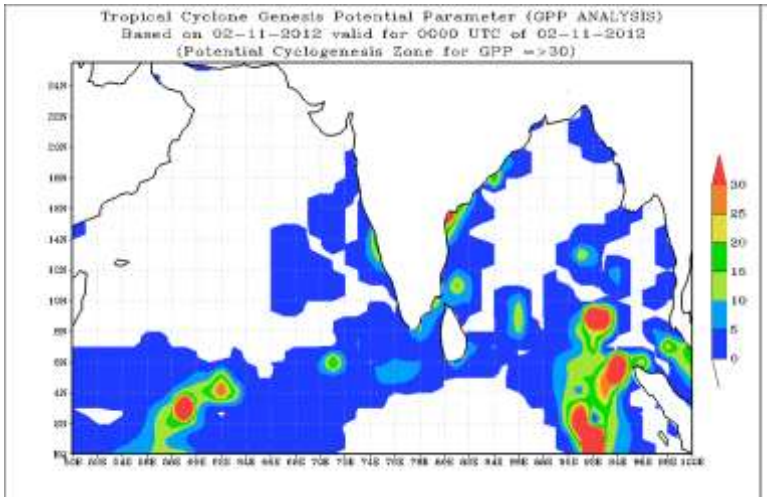

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 02-11-2012 valid for 00 UTC of 02-11-2012

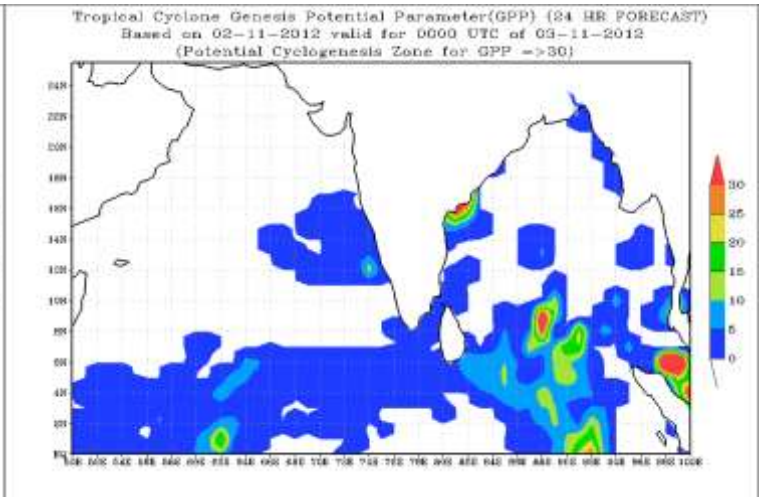

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 02-11-2012 valid for 00 UTC of 02-11-2012

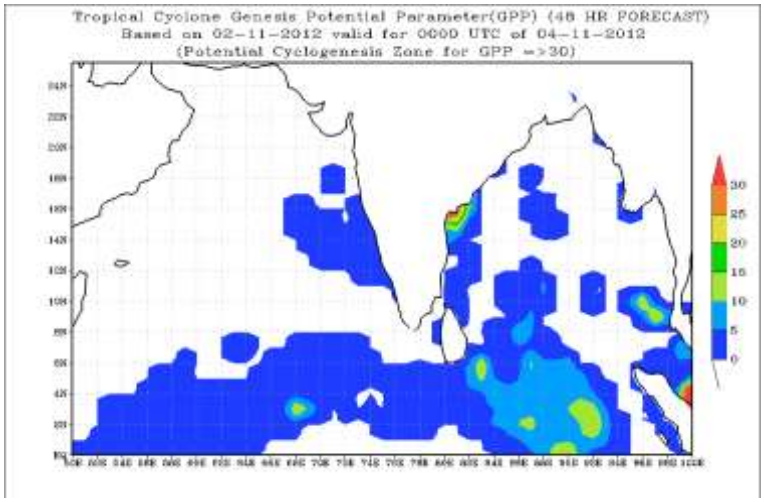

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 02-11-2012 valid for 00 UTC of 02-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 02-11-2012 valid for 00 UTC of 02-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 02-11-2012 valid for 00 UTC of 02-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 02-11-2012 valid for 0000 UTC of 02-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 02-11-2012 valid for 0000 UTC of 03-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 02-11-2012 valid for 0000 UTC of 04-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 3rd November, 2012

**Synoptic features based on 0300 UTC:**

- The low pressure area over Rayalaseema and neighbourhood now lies over Telangana and neighbourhood. Associated cyclonic circulation extends upto 3.1 kms a.s.l.
- A trough extending upto 3.1 kms a.s.l. runs from the centre of the low pressure area to Nagaland-Manipur-Mizoram-Tripura across Odisha and West Bengal.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST around 28-30$^0$C over Bay of Bengal.

**Ocean thermal energy:**

- Ocean thermal energy is the order of 50-60 KJ cm$^{-2}$over Bay of Bengal.

**Relative Vorticity:**

- Relative Vorticity at 850 hPa is positive over Low pressure area and south Andaman Sea.

**Convergence:**

- Lower level convergence of the order of 10 to 15*10$^{-5}$ s$^{-1}$over Andhra Pradesh and south Andaman Sea.

**Divergence:**

- Upper air positive divergence of the order of 10 to 20 *10$^{-5}$ s$^{-1}$ over Andhra Pradesh & adjoining Bay of Bengal and south Andaman Sea.

**Wind Shear:**

- Wind Shear is lowof order of 5-10 knots over Bay of Bengal

**Wind Shear Tendency:**

- Decreasing tendency over Andhra Pradesh and central Bay of Bengal

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hPa passes through latitude 15.0°N.

**M.J.O. Index**

- Located over phase2 with amplitude< 1.
- Statistical forecast: - MJO will move tophase3, during next 5 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude less than 1 and will continue inphase2during next 5 days.

**Satellite**

Moderate to intense convective clouds are seen at many places over south Andaman Sea south Bay of Bengal

**NWP Analysis**

- IMD-GFS model MSLP and Wind charts show a well marked low pressure area over Telangana and adjoining areas in the 00 UTC anaysis of 03 November 2012.Associated cyclonic circulation extends upto mid tropospheric levels.The low pressure system moves northeast wards eastwards towards Andra Pradesh in the 24 and 48 hour forecasts and become less marked in 73 hour forecast( 06 Nov 20120. It also shows a trough extending from SW Arabian sea to the center of the low pressure area till 5th November 2012. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in Annexure II.
- IMD-WRF model MSLP & wind charts show a well marked low pressure area over Telangana and adjoining areas in the 00 UTC anaysis of 03 November 2012.Associated cyclonic circulation extends upto mid tropospheric levels. Continuing north-eastward movement as low pressure area towards Andhra Pradesh in the 24 hour forecast and northward movemnet towards central india in the 48 and 72 hour forecast.
- ECMWF model MSLP and WIND charts show a well marked low pressure area over Telangana and adjoining areas in the 00 UTC anaysis of 03 November 2012. Associated cyclonic circulation extends upto mid tropospheric levels.The low pressure system moves northeast wards eastwards towards Andra predesh in the 24 and 48 hour forecasts and moves towards Chattisgarh in the 72 hour forecast (on 6 Nov 2012); and becmome a north-south trough extending from SHWB to Orissa in the 96 hour forecast (i.e on 07 Nov 2012. Associated cyclonic circulation extends upto mid tropospheric levels. It also shows a trough extending from SW Arabian Sea to the center of the low pressure area based on todays analysis and persist till 5th November 2012.The 850 hPa, 500 hPa and 200 hPa wind analysis are given in Annexure II.

**Genesis Potential Parameter (GPP)**

- Model analysis also shows large GPP area over off east coast near 16 deg N on 03 November 2012 .The intensity and location of GPP area over this east coast off south AP persists on 04 and 05 November 2012. GPP charts for 24 and 48 hours are shown in Annexure II.

**Summary and Conclusion:**

- No cyclogenesis is likely over Bay of Bengal during next 3 days.

**Advisory:**

- **NO IOP is declared for next 3 days.**

**Annexure-I**

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **02.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **22** | **19** | **19** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 02.11.2012 : 3**

No. of Ascents reaching 250 hPa level =2

**MISDA : 5**

**12Z /02.11.2012 : 0**

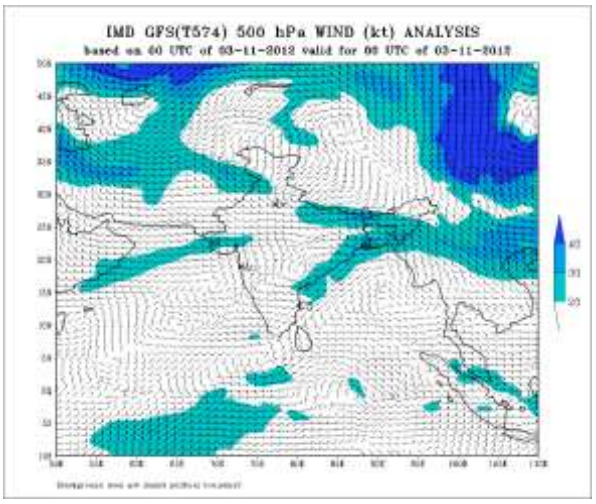
No. of Ascents reaching 250 hPa level =0

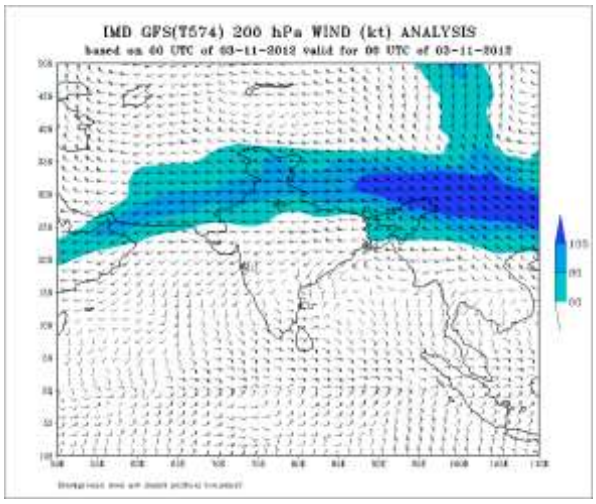
**MISDA : 8**

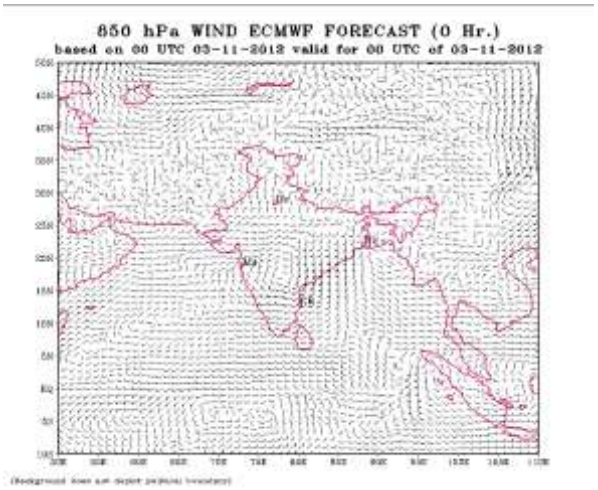
**No. of PILOT Ascents:**

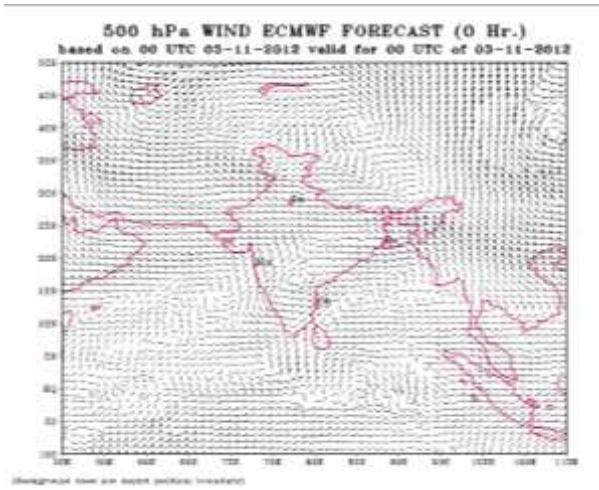
| **02.11.2012** | |
|---|---|
| 06Z | 18Z |
| 4 | 2 |

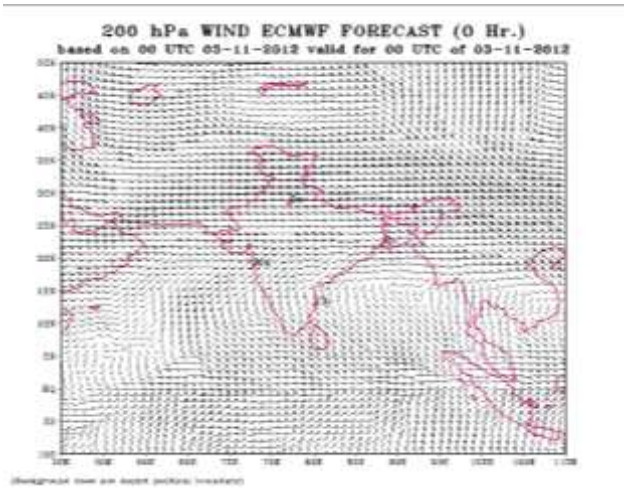
**Annexure- II**

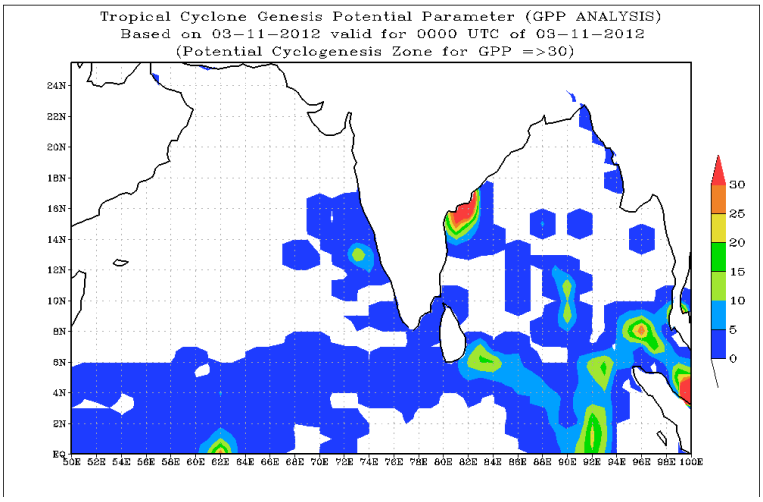

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 03-11-2012 valid for 00 UTC of 03-11-2012

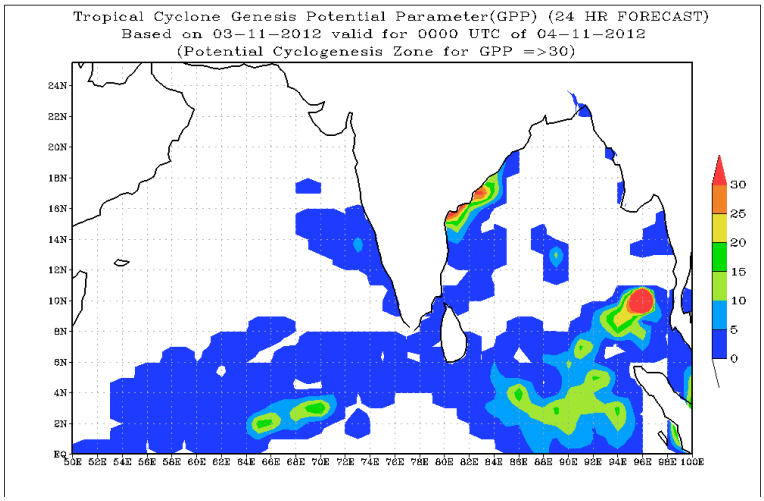

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 03-11-2012 valid for 00 UTC of 03-11-2012

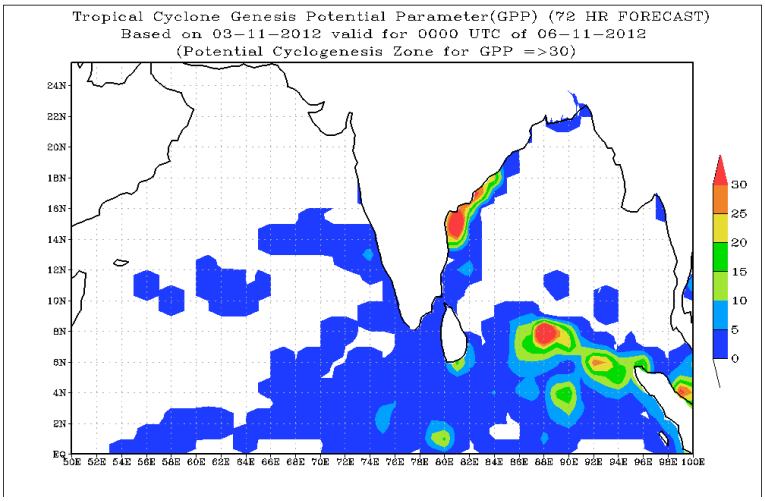

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 03-11-2012 valid for 00 UTC of 03-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 03-11-2012 valid for 00 UTC of 03-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 03-11-2012 valid for 00 UTC of 03-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 03-11-2012 valid for 0000 UTC of 03-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 03-11-2012 valid for 0000 UTC of 04-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 03-11-2012 valid for 0000 UTC of 06-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 4th November, 2012

**Synoptic features based on 0300 UTC:**

- Yesterday's low pressure area lies over north coastal Andhra Pradesh and neighbourhood associated with upper air cyclonic circulation extends upto 1.5 km above mean sea level with trough aloft upto mid tropospheric levels.
- Inter-Tropical Convergent Zone (ITCZ) runs south of the equator around lat 2°S.

**Environmental features:**

**Sea Surface Temperature:**

- SST around 28-30$^0$C over Bay of Bengal and Arabian Sea.

**Ocean thermal energy:**

- Ocean thermal energy is the order of 40-60 KJ cm$^{-2}$over Bay of Bengal and Arabian Sea.

**Relative Vorticity:**

- Relative Vorticity at 850 hPa is order of 5x10$^{-5}$ s$^{-1}$over coastal Andhra Pradesh.

**Convergence:**

- Lower level convergence of the order of 10*10$^{-5}$ s$^{-1}$over Andhra Pradesh, west-central Bay of Bengal and south Andaman Sea.

**Divergence:**

- Upper air positive divergence of the order of 10-20 *10$^{-5}$ s$^{-1}$ over north coastal Andhra Pradesh & west-central Bay of Bengal and Andaman Sea.

**Wind Shear:**

- Wind Shear is low of order of 5-10 knots over Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing tendency over Andhra Pradesh and central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE at** 200 hPa passes through latitude 12.0°N.

**M.J.O. Index**

- Located over phase2 with amplitude>1.
- Statistical forecast: - MJO will move to phase6, during next 5 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude >1 and will continue in phase2 during next 5 days.

**Satellite**

Broken low/medium clouds with embedded intense to very intense convection over west-central Bay of Bengal , north coastal Andhra Pradesh and broken low/medium clouds with embedded moderate to intense convection over south Chhattisgarh, south Odisha, east Telangana and scattered low/medium clouds with embedded weak to moderate convection over rest Chhattisgarh, rest Odisha and rest Telangana in associated low level circulation over the area.

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts show a well marked low pressure area over coastel Andra Pradesh and adjoining areas in the 00 UTC anaysis of 04 November 2012.Associated cyclonic circulation extends upto mid tropospheric levels.This low pressure system moves northeast wards eastwards towards in the 24 hour forecasts and becmome less marked in 48 hour forecast( 06 Nov 20120. It also shows a trough extending from SW arabian sea to the center of the low pressure area till 5th November 2012.
- **IMD-WRF** model MSLP & wind charts show a well marked low pressure area over coastel AP and adjoining areas in the 00 UTC anaysis of 04 November 2012.Associated cyclonic circulation extends upto mid tropospheric levels. Continuing north-eastward movement as low pressure area towards andra pradesh in the 24 hour forecast and northward movemnet towards central india in the 48 hour forecast.
- **ECMWF** model MSLP and WIND charts show a well marked low pressure area over CAP and adjoining areas in the 00 UTC anaysis of 04 November 2012.Associated cyclonic circulation extends upto mid tropospheric levels.The low pressure system moves northeast wards eastwards towards Andra predesh in the 24 hour forecasts and a north-south trough extending from GWB to Orissa in the 48 hour forecast (i.e on 06 Nov 2012. Associated cyclonic circulation extends upto mid tropospheric levels. It also shows a cycir over arabian sea near kerala coast based on todays analysis and persist till 5th November 2012.The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis also shows large GPP area over off east coast near 16 deg N on 04 November 2012 .The intensity and location of GPP area over this east coast off **south AP** persists on 05 November 2012. GPP charts for 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- All NWP models and environmental parameters suggest that low pressure area over north coastal Andhra Pradesh is not likely to intensify..

**Advisory:**

- **NO IOP for next 3 days.**

**Annexure-I**

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **03.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **21** | **21** | **23** | **19** | **19** | **17** |

**No. of RS/RW Ascents**

**00Z / 03.11.2012 : 2**

No. of Ascents reaching 250 hPa level =0

**MISDA : 6**

**12Z /03.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

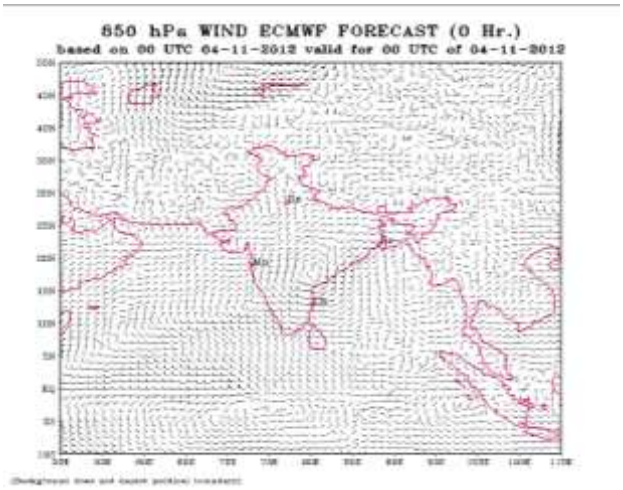
**MISDA : 8**

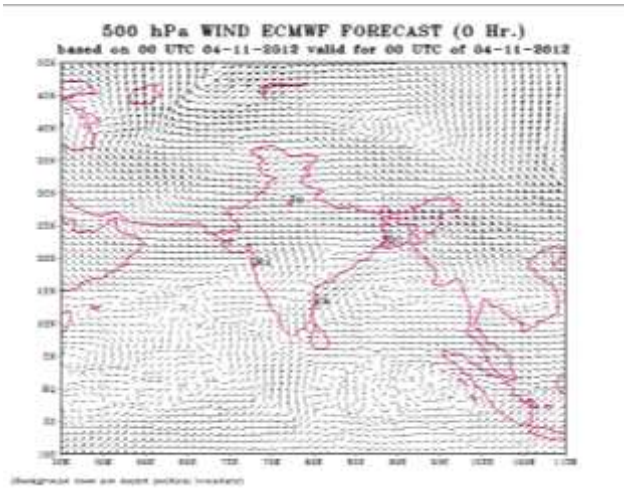
**No. of PILOT Ascents:**

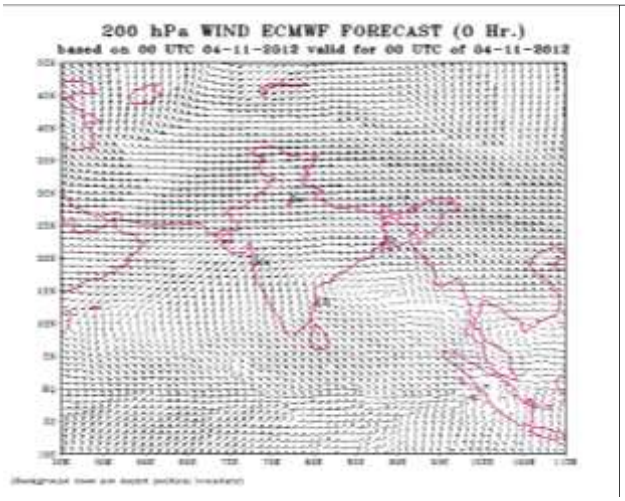
**03.11.2012**

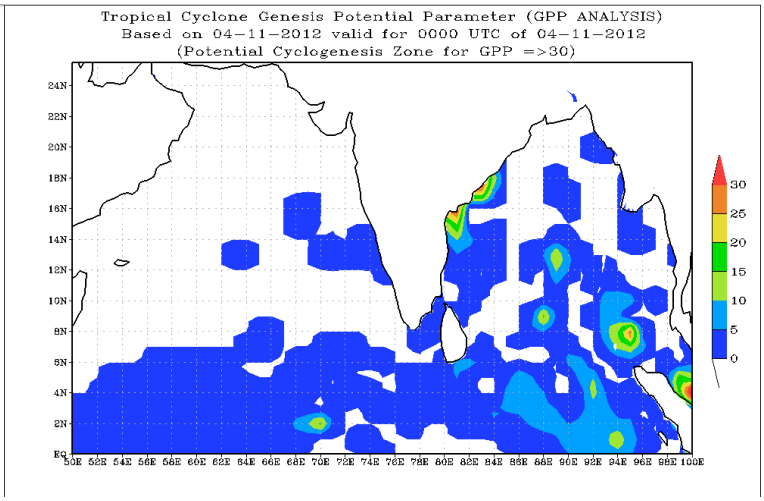
| 06Z | 18Z |
|---|---|
| 4 | 4 |

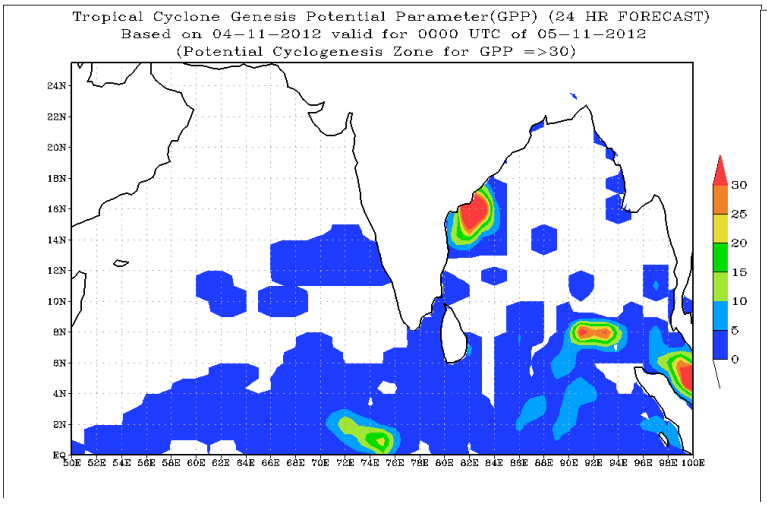
## Annexure II

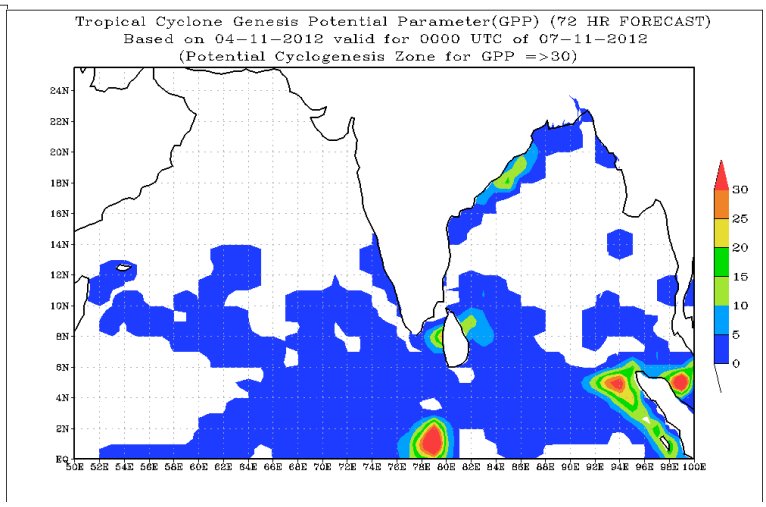

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 04-11-2012 valid for 00 UTC of 04-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 04-11-2012 valid for 00 UTC of 04-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 04-11-2012 valid for 00 UTC of 04-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 04-11-2012 valid for 0000 UTC of 04-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 04-11-2012 valid for 0000 UTC of 05-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 04-11-2012 valid for 0000 UTC of 07-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 5nd November, 2012

**Synoptic features based on 0300 UTC:**

- The low pressure area over coastal Andhra Pradesh and neighbourhood has become less marked. However, the associated cyclonic circulation persists over north coastal Andhra Pradesh and neighbourhood and extends upto 3.1 kms a.s.l.A trough runs from the above system to Assam & Meghalaya across Odisha and West Bengal and extends upto 1.5 kms a.s.l.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 26-28$^0$C over Bay of Bengal along the east coast and 28 to 30 $^o$C over central Bay of Bengal.

**Ocean thermal energy:**

- Ocean thermal energy is the order of 40-50 KJ cm$^{-2}$over Bay of Bengal.

**Relative Vorticity:**

- Relative Vorticity at 850 hPa is positive along Andhra Pradesh and Orissa Coast.

**Convergence:**

- Lower level convergence of the order of 5 to 10*10$^{-5}$ s$^{-1}$over Andhra Pradesh and adjoining Bay of Bengal.

**Divergence:**

- Upper air positive divergence of the order of 5 to 10 *10$^{-5}$ s$^{-1}$ over Andhra Pradesh and adjoining Bay of Bengal.

**Wind Shear:**

- Wind Shear is low of order of 5-10 knots over Coastal Bay of Bengal along off Andhra Pradesh coast.

**Wind Shear Tendency:**

- Decreasing tendency over Andhra Pradesh and adjoining Bay of Bengal

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hPa passes through latitude 15.0°N.

**M.J.O. Index:**

- Located over phase2 with amplitude< 1.
- Statistical forecast: - MJO moved to phase3 and will move to phase 4 after 2 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude less than 1 and will continue in phase2 during next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**

Moderate to intense convective clouds are seen at many places over West Central and adjoining Bay of Bengal, between Latitude 14.5 N and 20.0 N and west of Longitude 88.5 E and ,adjoining coastal Orissa.

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts show a well marked low pressure area over coastel Andra Pradesh and adjoining areas in the 00 UTC anaysis of 05 November 2012. A trough overlies the circulation at 850 hPa and extends from coastal Karnataka in the west to over the surface low over coastal Andhra Pradesh, and onward over Orissa, Gangetic West Bengal, upto Bangladesh in the east. The trough becomes less marked in the 48 hour forecast and is not visible 72 hours ahead. Scattered to fairly widespread rainfall is expected over coastal Orissa and West Bengal in the 24 hour charts associated with the position of the low. A western disturbance approaches the Indian region, and an associated low level circulation, extending from the surface to 850 hPa now lies over West Rajasthan and adjoining Pakistan. This system becomes less marked in the 24 hour forecast before moving eastwards to over Bihar and east UttarPradesh in the 48 hour forecast. Isolated rainfall is expected over Himachal Pradesh and Punjab in association with the movement of the low.
- **IMD-WRF** model MSLP & wind charts show a well marked low pressure area over coastel AP and adjoining areas in the 00 UTC anaysis of 05 November 2012. Associated cyclonic circulation extends as a trough upto mid tropospheric levels. The low pressure area becomes less marked in the 24 hour charts and lies over coastal Orissa and West Bengal in the 48 hour charts. The trough overlying it becomes less marked in the 24 hour chart. Scattered to fairly widespread rainfall is expected over coastal Orissa, West Bengal, Andhra Pradesh and Karnataka in the 24 hour period associated with the position of the low. This is likely to decrease inland, but continue over coastal Karnataka and Orissa in the next 48 hours. There is a well marked low over Rajasthan and adjoining Madhya Pradesh in association with the movement of the western disturbance over the Indian region. The associated cyclonic circulation is tilted northwards with height and extends upto 850 hPa. It becomes less marked in the 24 hour charts. Isolated rainfall is expected over Himachal Pradesh and Punjab in association with the movement of the low.
- **ECMWF** model MSLP and WIND charts show a well marked low pressure area over coastel Andra Pradesh and adjoining areas in the 00 UTC anaysis of 05 November 2012. A trough overlies the circulation at 850 hPa and extends from coastal Karnataka in the west to over the surface low over coastal Andhra Pradesh, and onward over Orissa, Gangetic West Bengal, upto Bangladesh in the east. The trough becomes less marked in the 48 hour forecast. The 850 hPa and 500 hPa wind analysis are given in **Annexure II.**

**Summary and Conclusion:**

- The low pressure area over coastal Andhra Pradesh and neighbourhood has become less marked.
- No cyclogenesis is likely over Bay of Bengal during next 3 days.

**Advisory:**

- **NO IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **04/12** | **05/00** | **05/03** |
| **India** | | 67/79 | 82/89 |
| **Coastal stations** | | | |
| **WB** | | 4/7 | 10/11 |
| **Odisha** | | 6/7 | 10/10 |
| **AP** | | 17/18 | 18/18 |
| **Tamil Nadu** | | 10/10 | 13/13 |
| **Puducherry** | | 2/2 | 2/2 |
| **A & N** | | 1/1 | 1/1 |
| **Bangladesh** | 9/11 | 9/11 | 7/11 |
| **Myanmar** | 10/11 | 9/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 6/9 | 8/9 |

| | Date/Time (UTC) |
|---|---|

**AWS observation**

| Region | 04/12 | 05/00 | 05/03 |
|---|---|---|---|
| **India** | | 80/121 | 57/121 |
| **WB** | | 7/20 | 4/20 |
| **ODS** | | 26/38 | 20/38 |
| **AP** | | 24/35 | 17/35 |
| **TN** | | 21/26 | 14/26 |
| **PDC** | | 2/2 | 2/2- |

- **RS/RW** (12Z) of 04-11-2012: 03/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-36**
- **RS/RW** (00Z) of 05-10-2012: 16/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:23**

**No. of PILOT Ascents**

| 04/12Z | 05/00Z |
|---|---|
| -/37 | 12/34 |

**Buoy Data**

| 04/12Z | 05/00Z | 05/03Z |
|---|---|---|
| 11 | 7 | 6 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | | | | **04.11.2012** | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **22** | **20** | **20** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 04.11.2012 : 3**

No. of Ascents reaching 250 hPa level =2

**MISDA : 5**

**12Z /04.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

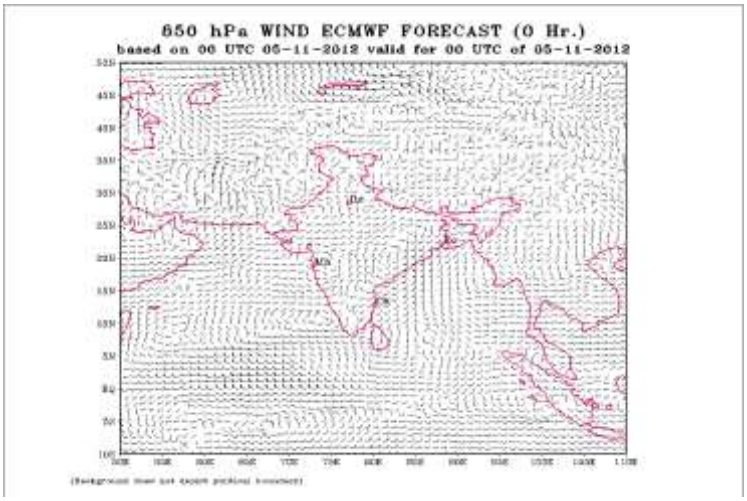
**MISDA : 8**

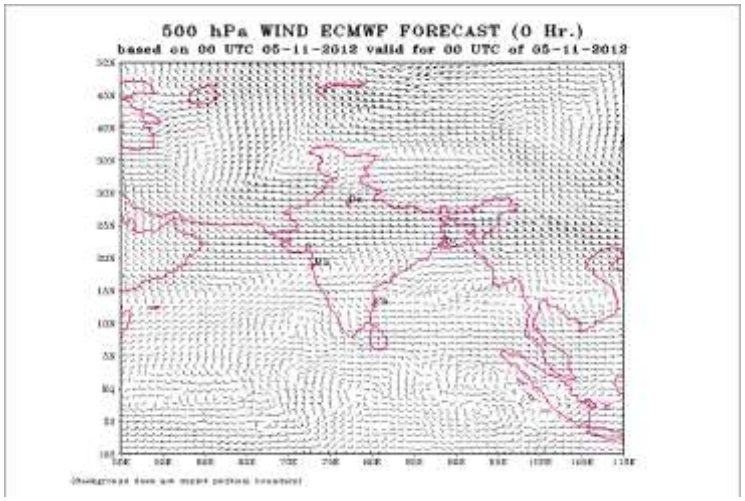
**No. of PILOT Ascents:**

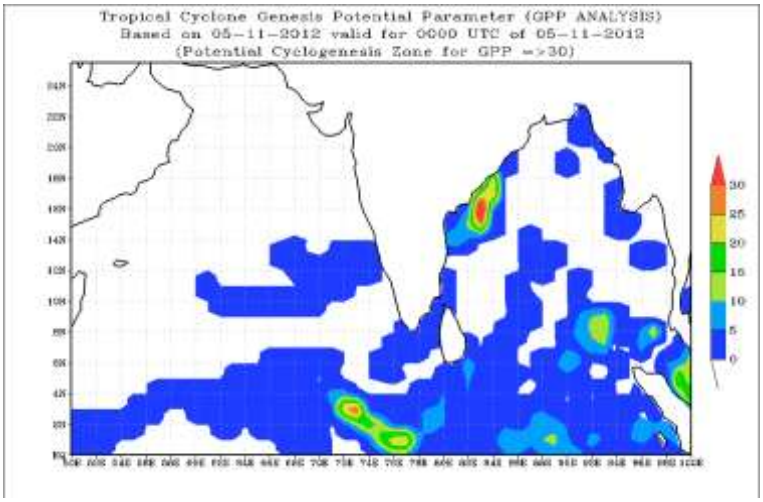
**04.11.2012**

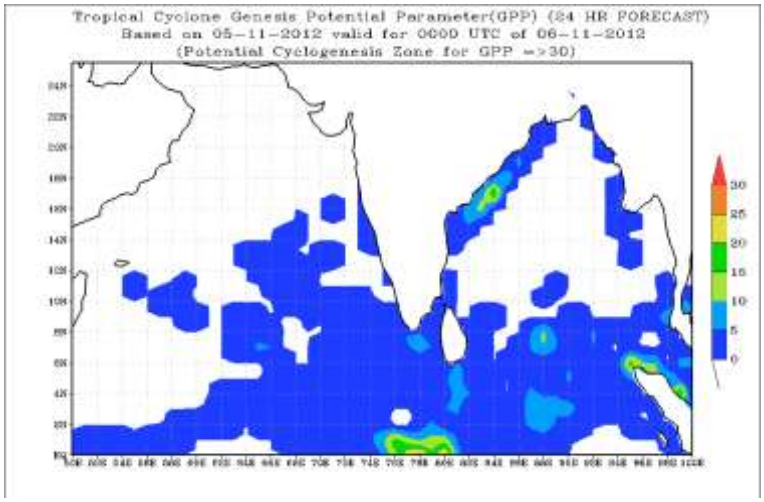
| 06Z | 18Z |
|---|---|
| 4 | 6 |

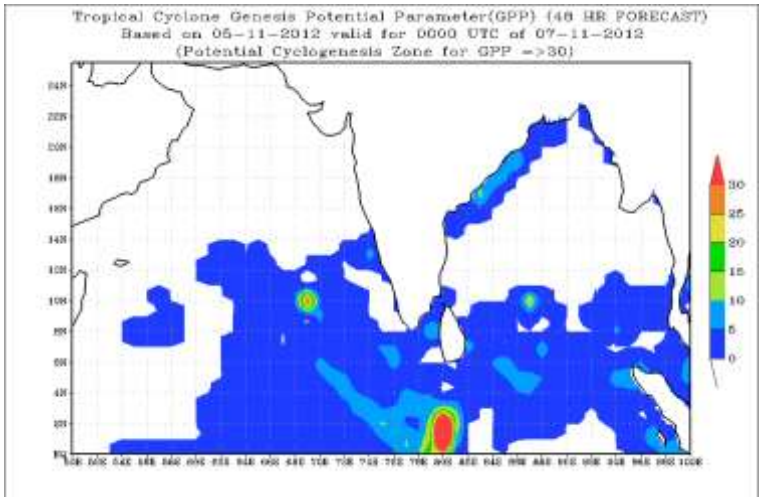
## Annexure II


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 05-11-2012 valid for 00 UTC of 05-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 05-11-2012 valid for 00 UTC of 05-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 05-11-2012 valid for 0000 UTC of 05-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 05-11-2012 valid for 0000 UTC of 06-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 05-11-2012 valid for 0000 UTC of 07-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 6th November, 2012

**Synoptic features based on 0300 UTC:**

- The cyclonic circulation over north coastal Andhra Pradesh and neighbourhood persists and now extends upto 1.5 kms a.s.l.The trough from the above system extending upto 1.5 kms a.s.l. upto Assam & Meghalaya across Odisha and West Bengal persists.
- A cyclonic circulation extending upto 2.1 kms a.s.l lies over Gulf of Mannar off south Tamil Nadu coast.A trough at mean sea level runs from Gulf of Mannar to east central Arabian Sea across Lakshadweep area.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 26-28$^0$C over Bay of Bengal along the east coast and 28 to 30 $^o$C over central Bay of Bengal.

**Ocean thermal energy:**

- Ocean thermal energy is the order of 40-50 KJ cm$^{-2}$over Bay of Bengal.

**Relative Vorticity:**

- Relative Vorticity at 850 hPa is positive along Andhra Pradesh and Orissa Coast.

**Convergence:**

- Lower level convergence of the order of 5 to 10*10$^{-5}$ s$^{-1}$over Andhra Pradesh and adjoining Bay of Bengal.

**Divergence:**

- Upper air positive divergence of the order of 5 to 10 *10$^{-5}$ s$^{-1}$ over central and adjoining South east Bay of Bengal.

**Wind Shear:**

- Wind Shear is low of order of 5-10 knots over Coastal Bay of Bengal along off Andhra Pradesh coast.

**Wind Shear Tendency:**

- Decreasing tendency over Bay of Bengal

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT 200 hpa passes through latitude 15.0°N.

**M.J.O. Index:**

- Located over phase2 with amplitude< 1.
- Statistical forecast: - MJO moved to phase3 and will move to phase 4 after 2 days.

- Dynamical forecast: - MJO located in phase 2 with amplitude less than 1 and will continue in phase2 during next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**

Broken low/medium clouds with embeded moderate to intense convection over South Andaman sea adjoining Southeasy Bay. Scattered low/med clouds with embeded isolated weak to moderate convection over north Bay ,rest West Cental Bay and southwest Bay. (See ftp://192.168.12.75/imd/satmet,

http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts show that yesterday's low pressure area over coastal Andra Pradesh and adjoining areas has weakened and is not visible as a closed isobar on surface charts of the 00 UTC analysis of 06 November 2012. The trough overlying the circulation is visible upto 850 hPa on the east coast of India and extends from coastal Orissa, Gangetic West Bengal and upto Nagaland in the east. The trough becomes less marked in the 24 hour forecast and is not visible 48 hours ahead. Scattered to fairly widespread moderate rainfall is expected over coastal Andhra Pradesh, Orissa, West Bengal and Assam in the 24 hour charts associated with the position of the trough, likely to decrease thereafter. A surface low pressure area is developing over the south west coast of India. This is overlaid with a trough in the lower levels between 60 and 80 deg.E at 10 deg. N. This is likely to bring scattered moderate rainfall over the south west peninsular coast of India in the coming 2-3 days. The low level cyclonic circulation associated with the approaching western disturbance has moved in a north-easterly direction and now lies over Punjab and adjoing Pakistan. The circulation is likely to weaken in the next 24 hours.

- **IMD-WRF** model MSLP & wind charts of 00 UTC anaysis of 06 November 2012 show a weakening of the low pressure area seen yesterday over coastal AP and adjoining areas. Associated trough extends upto 850 hPa and lies over the west coast of India, extending from coastal Orissa, Gangetic West Bengal and upto Nagaland in the east. Scattered to fairly widespread moderate rainfall is expected over coastal Andhra Pradesh, Orissa, West Bengal and Assam in the 24 hour charts associated with the position of the trough, likely to decrease thereafter. A trough is visible in the lower levels between 60 and 80 deg.E at 10 deg. N. However, unlike the GFS, the surface low does not strengthen in the 48 and 72 hour charts. This is likely to bring scattered moderate rainfall over the south west peninsular coast of India in

the nest 24 hours, increasing thereafter on day 2 and 3.

- **ECMWF** model MSLP and WIND charts also show a weakening of the low pressure area over coastal Andhra Pradesh and adjoining areas in the 00 UTC anaysis of 06 November 2012. A trough overlies the circulation at 850 hPa and extends from coastal Andhra Pradesh onward to Orissa, Gangetic West Bengal, upto Bangladesh in the east. The trough becomes less marked in the 48 hour forecast. The 850 hPa and 500 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis also shows an area off the west coast of India between 10 and 13 deg.N with large GPP values (>30) on 08 November 2012.The intensity and location of GPP area over this same area decreases on the subsequent day. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- No cyclogenesis is likely over Bay of Bengal during next 3 days.

**Advisory:**

- **NO IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **05/12** | **06/00** | **06/03** |
| **India** | 54 | 40 | 54 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 9/11 | 9/11 | 9/11 |
| **Myanmar** | 7/11 | 10/11 | 9/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 7/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **04/12** | **05/00** | **05/03** |
| **India** | 80/121 | 78/121 | 83/121 |
| **WB** | 7/20 | 8/20 | 8/20 |
| **ODS** | 25/38 | 23/38 | 26/38 |
| **AP** | 25/35 | 24/35 | 26/35 |
| **TN** | 21/26 | 21/26 | 21/26 |
| **PDC** | 2/2 | 2/2 | 2/2- |

- **RS/RW** (12Z) of05-11-2012: 06/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-33**
- **RS/RW** (00Z) of 06-10-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:20**

**No. of PILOT Ascents**

| 05/12Z | 06/00Z |
|---|---|
| 9/37 | 13/34 |

**Buoy Data**

| 05/12Z | 06/00Z | 06/03Z |
|---|---|---|
| 13 | 21 | 22 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **05.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **22** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 05.11.2012 : 3**

No. of Ascents reaching 250 hpa level =3

**MISDA : 5**

**12Z /05.11.2012 : 0**

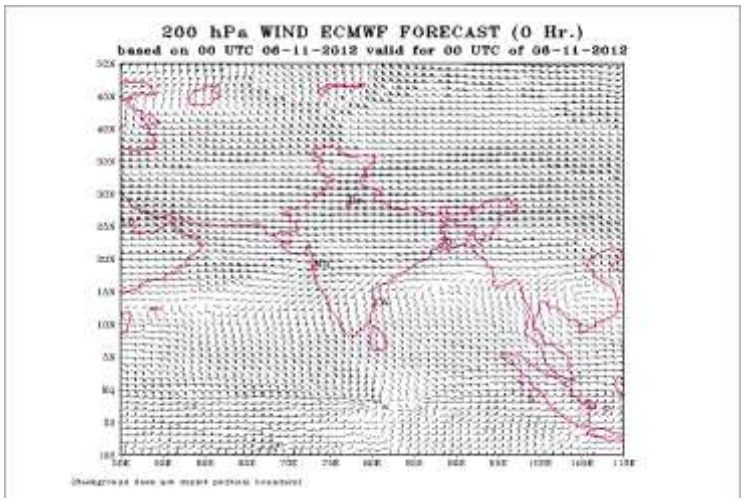
No. of Ascents reaching 250 hpa level =0

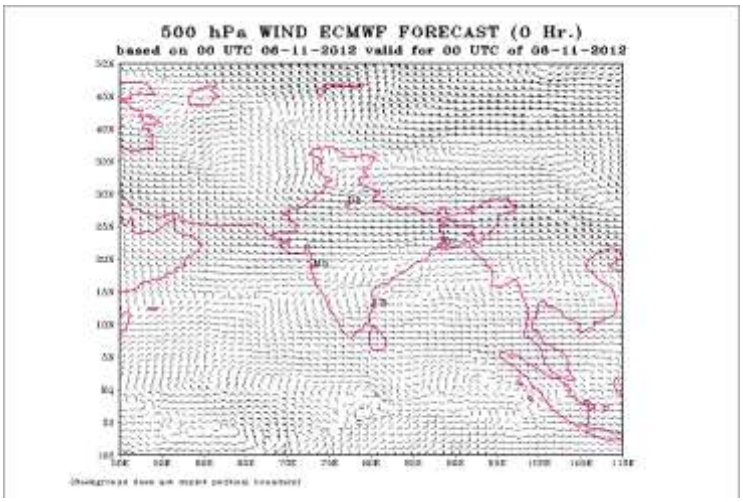
**MISDA : 8**

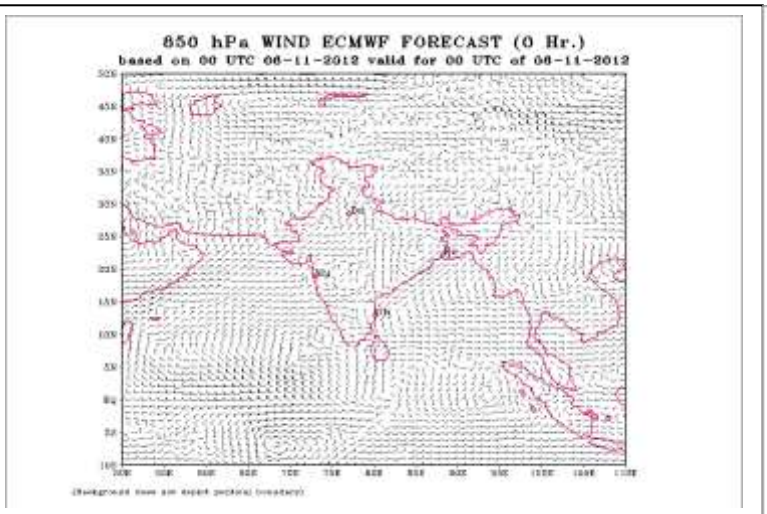
**No. of PILOT Ascents:**

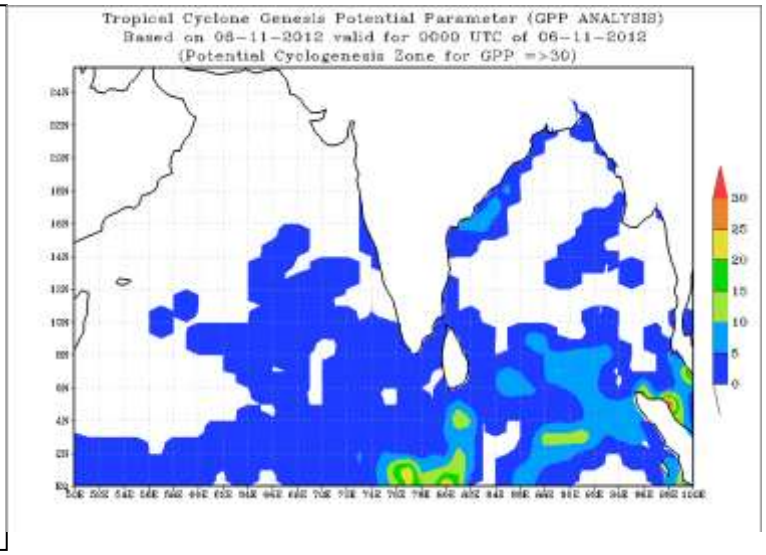
| 05.11.2012 | |
|---|---|
| 06Z | 18Z |
| 3 | 6 |

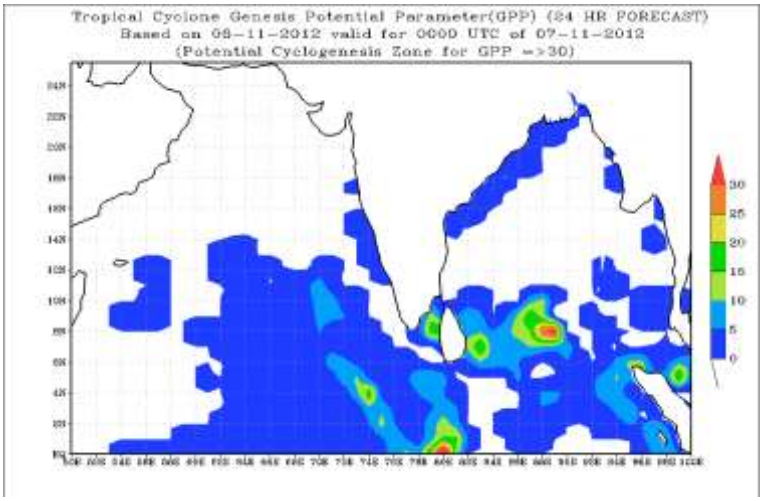
## Annexure II

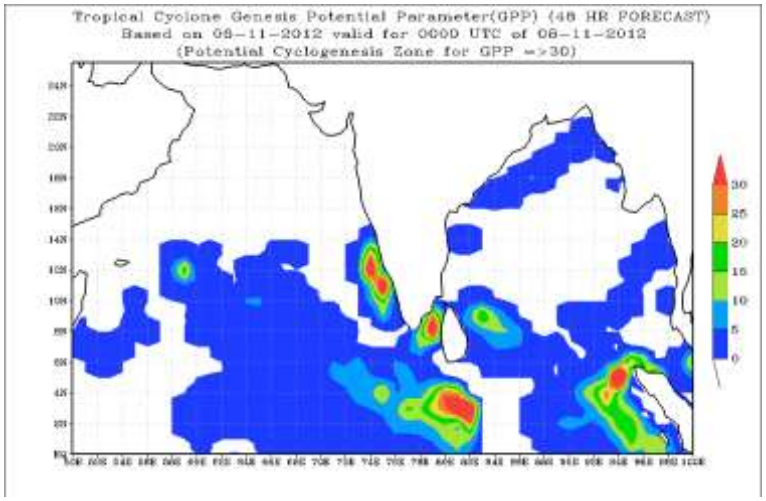

200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 06-11-2012 valid for 00 UTC of 06-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 06-11-2012 valid for 00 UTC of 06-11-2012


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 06-11-2012 valid for 00 UTC of 06-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 06-11-2012 valid for 0000 UTC of 06-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 06-11-2012 valid for 0000 UTC of 07-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 06-11-2012 valid for 0000 UTC of 08-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 7th November, 2012

**Synoptic features based on 0300 UTC:**

- The cyclonic circulation over north coastal Andhra Pradesh and Neighbourhood has become less marked, However, a trough in the lower level westerlies extending upto 0.9 km a.s.l. runs from Assam & Meghalaya to west central Bay of Bengal off north Andhra Pradesh coast.
- The trough at mean sea level from Gulf of Mannar to east central Arabian Sea now extends from Comorin area to south Gujarat coast, across coastal areas of Kerala, Karnataka and Maharashtra.
- The cyclonic circulation over Gulf of Mannar off south Tamil Nadu coast now lies over southern parts of Kerala & neighbourhood and extends upto 0.9 km a.s.l.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 26-28$^0$C over Bay of Bengal along the east coast and 28 to 30 $^o$C over central Bay of Bengal.

**Ocean thermal energy:**

- Ocean thermal energy is the order of 40-50 KJ cm$^{-2}$over North and south west Bay of Bengal.

**Relative Vorticity:**

- Relative Vorticity at 850 hPa is negative over bay of Bengal.

**Convergence:**

- No area shows Lower level convergence

**Divergence:**

- Upper air divergence is low over Bay of Bengal.

**Wind Shear:**

- Wind Shear is low of order of 10-20 knots over Bay of Bengal

**Wind Shear Tendency:**

- Increasing tendency over Bay of Bengal

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hPa passes through latitude 15.0°N.

**M.J.O. Index:**

- Located over phase 4 with amplitude< 1.
- Statistical forecast: - MJO moved to phase 4 and will move to phase 5 after 2 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude less than 1 and will continue in phase4 during next 3 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite advisory**

Broken low/medium clouds with embedded moderate to intense convection over North bay and north Andaman Sea. Scattered low/med clouds with embedded isolated weak to moderate convection over rest Bay between Lat 10.0N to 15.0N, Long 83.0 to 88.5 E (See

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts for 00 UTC analysis of 07 November 2012 show that yesterday's trough over the east coast of India from over coastal Andra Pradesh to GWB and Bangladesh has become less marked and is now seen between 925 hPa and 850 hPa. The trough becomes even less marked in the 24 hour charts. Due to the effect of the trough, isolated to scattered light rainfall is expected at one or two places of the east coast of India in the next 24 hours likely to decrease thereafter. The east-west oriented trough seen yesterday at 10 deg N persists at a slightly lower latitude of 7 deg N. This trough intersects with a north-south trough present along the west coast of India south of 20 deg. N at a location south of India, close to the west coast of Sri Lanka. Due to the effect of the troughs, scattered to fairly widespread rainfall is expected over the south-west peninsular coast of India over the next 24 hours, decreasing thereafter. A fresh western disturbance is likely to move over the Indian region in the next 72 hours.
- **IMD-WRF** model MSLP & wind charts of 00 UTC analysis of 07 November 2012 show that yesterday's trough over the east coast of India from over coastal Andra Pradesh to GWB and Bangladesh has become less marked and is now seen between 925 hPa and 850 hPa. Scattered moderate rainfall is expected over coastal Andhra Pradesh, Orissa and West Bengal in the 24 hours associated with the position of the trough, likely to decrease thereafter. A trough is visible in the lower levels between 60 and 80 deg.E at 10 deg. N. However, unlike the GFS, the surface low does not strengthen in the 48 and 72 hour charts. This is likely to bring scattered moderate rainfall over the south west peninsular coast of India in the nest 24 hours, increasing thereafter on day 2 and 3. However, unlike the GFS, the rainfall belt in this case extend to much of the west coast of India, including coastal Kerala, Karnataka and Maharashtra. The rainfall amount is likely to decrease after 24 hours, but likely to have a greater spatial spread upto 72 hours.
- **ECMWF** model MSLP and WIND charts also show a weakening of the trough over the east coast of India. However, unlike the GFS and WRF, no north-south oriented trough is seen over the west coast of India. The associated rainfall belt is also confined to coastal Kerala like for GFS. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis does not show significant values of the GPP in the domain of interest, surrounding the Indian seas. In the 24 hour forecast, two areas with GPP values greater than 30 develop- one along the south-west peninsular coast, and another area south of the Indian peninsula, off the west coast of Sri Lanka. The intensity of the GPP values over these areas decreases on the subsequent day. GPP charts for 00 and 24 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- No cyclogenesis is likely over Bay of Bengal during next 3 days.

**Advisory:**

- **NO IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **06/12** | **07/00** | **07/03** |
| **India** | 74/78 | 69/79 | 77/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 8/11 | 9/11 | 7/11 |
| **Myanmar** | - | 9/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 5/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **06/12** | **07/00** | **07/03** |
| **India** | 84/121 | 81/121 | 84/121 |
| **WB** | 8/20 | 7/20 | 8/20 |
| **ODS** | 26/38 | 25/38 | 25/38 |
| **AP** | 26/35 | 25/35 | 25/35 |
| **TN** | 21/26 | 21/26 | 21/26 |
| **PDC** | 2/2 | 2/2 | 2/2- |

- **RS/RW** (12Z) of 06-11-2012: 06/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-33**
- **RS/RW** (00Z) of 07-10-2012: 21/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:18**

**No. of PILOT Ascents**

| 06/12Z | 07/00Z |
|---|---|
| 11/37 | 21/34 |

**Buoy Data**

| 06/12Z | 07/00Z | 07/03Z |
|---|---|---|
| 9 | 1 | 5 |

**No of Synop data**

| **Date→** | **06.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **22** | **20** | **19** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 06.11.2012 : 3**

No. of Ascents reaching 250 hPa level =3

**MISDA : 5**

**12Z /06.11.2012 : 0**

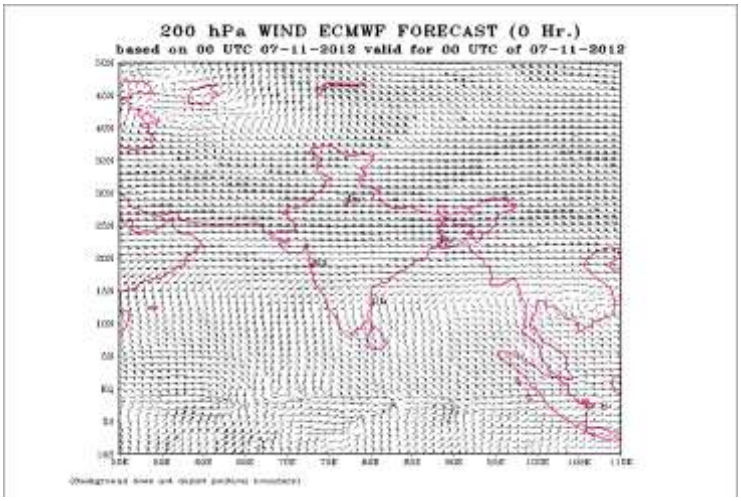
No. of Ascents reaching 250 hPa level =0

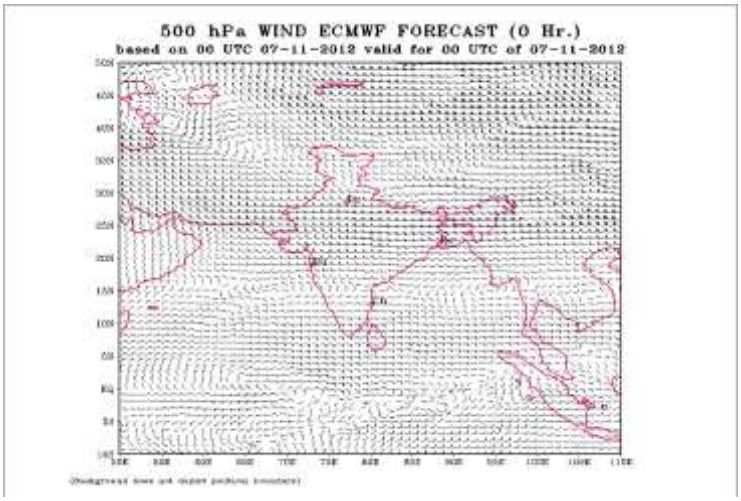
**MISDA : 8**

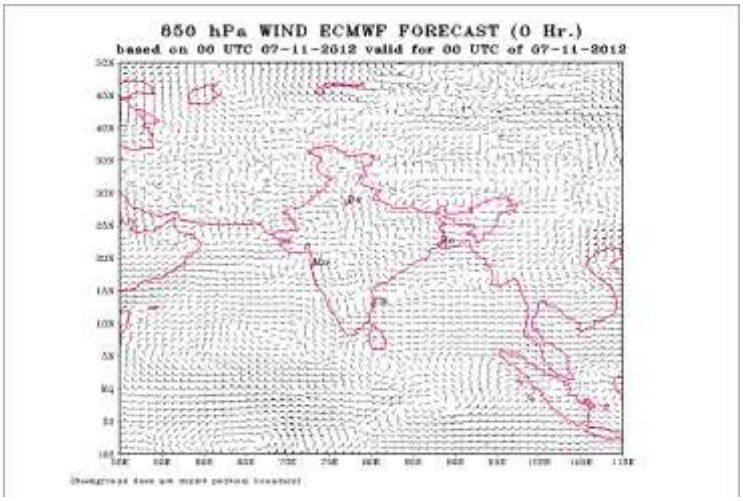
**No. of PILOT Ascents:**

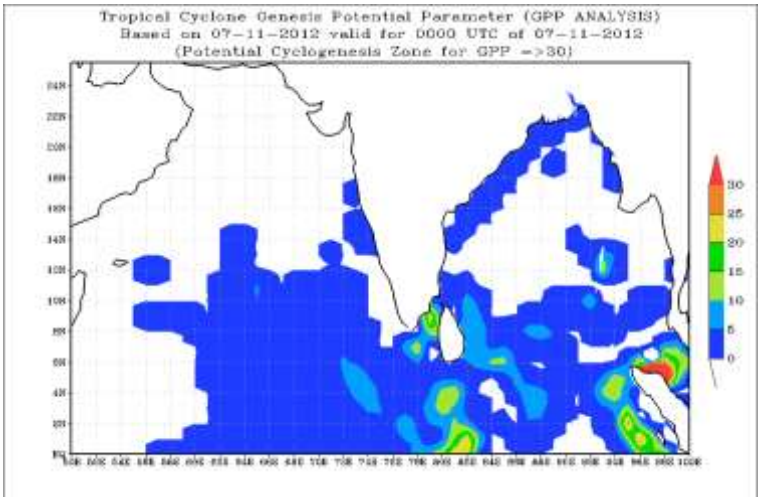
| **06.11.2012** | |
|---|---|
| 06Z | 18Z |
| 4 | 6 |

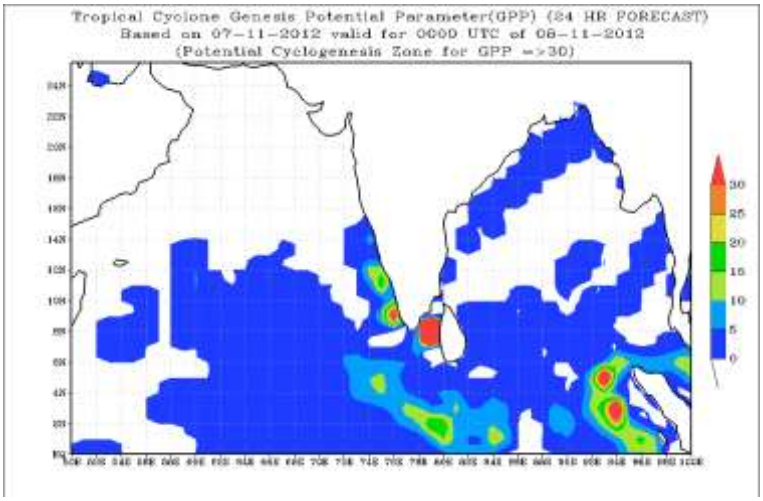
## Annexure II


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 07-11-2012 valid for 00 UTC of 07-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 07-11-2012 valid for 00 UTC of 07-11-2012


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 07-11-2012 valid for 00 UTC of 07-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 07-11-2012 valid for 0000 UTC of 07-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 07-11-2012 valid for 0000 UTC of 08-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

**Synoptic features based on 0300 UTC:**

- The cyclonic circulation over north coastal Andhra Pradesh and Neighbourhood has become less marked, However, a trough in the lower level westerlies extending upto 0.9 km a.s.l. runs from Assam & Meghalaya to west central Bay of Bengal off north Andhra Pradesh coast.
- The trough at mean sea level from Gulf of Mannar to east central Arabian Sea now extends from Comorin area to south Gujarat coast, across coastal areas of Kerala, Karnataka and Maharashtra.
- The cyclonic circulation over Gulf of Mannar off south Tamil Nadu coast now lies over southern parts of Kerala & neighbourhood and extends upto 0.9 km a.s.l.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 26-28$^0$C over Bay of Bengal along the east coast and 28 to 30 ºC over central Bay of Bengal.

**Ocean thermal energy:**

- Ocean thermal energy is >100 KJ cm$^{-2}$ over east equatorial Indian Ocean. It decreases towards north. It is < 50 KJ cm$^{-2}$ over north Bay of Bengal and many parts of west central and South west Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is negative over North & South Bay of Bengal and positive over equatorial Indian Ocean

**Convergence:**

- Lower level convergence of the order of 5-10* 10$^{-5}$ s$^{-1}$ prevails over equatorial Indian Ocean region .

**Divergence:**

- Upper air positive divergence of the order of 20*10$^{-5}$ s$^{-1}$ prevails over equatorial East Indian Ocean.

**Wind Shear:**

- Wind Shear is low of order of 10-20 knots over Bay of Bengal

**Wind Shear Tendency:**

- Increasing tendency over Bay of Bengal

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT 200 hpa passes through latitude 11.0°N.

**M.J.O. Index:**

- Located over phase 5 with amplitude< 1.

- Statistical forecast: - MJO moved to phase 5 and will move to phase 6 after 2 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude less than 1 and will continue in phase4 during next 2 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**

Broken low/medium clouds with embedded moderate to intense convection over coastal Tamil Nadu,South west Bay and north Andaman Sea. Scattered low/med clouds with embedded isolated weak to moderate convection over rest Bay between Lat 10.0N to 15.0N, Long 83.0 to 88.5 E (See ftp://192.168.12.75/imd/satmet,

http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts for 00 UTC analysis of 08 November 2012 show that yesterday's trough over the east coast of India extending from coastal Andhra Pradesh to GWB and Bangladesh has become less marked and is now seen between 925 hPa and 850 hPa. The trough becomes even less marked in the 24 hour charts. Due to the effect of the trough, isolated light rainfall is expected at one or two places of coastal Orissa and Andhra Pradesh in the next 24 hours likely to decrease thereafter. The east-west oriented trough seen yesterday at 7 deg N persists in the same location. This trough is likely to move southwards in the next 2-3 days. This trough intersects with a north-south trough present along the west coast of India south of 20 deg. N south of the Indian Peninsula, close to the west coast of Sri Lanka. Due to the effect of the troughs, scattered to fairly widespread moderate rainfall is expected over the south-west peninsular coast of India over the next 24 hours, decreasing in intensity thereafter, but increasing spatially, northwards along the west coast. An induced low level cyclonic circulation associated with a mid-tropospheric westerly trough now lies over west Rajasthan and adjoining Pakistan. This is likely to move in a north-easterly direction in the next 24 hours and thereafter in a easterly-southeasterly direction the next 72 hours.
- **IMD-WRF** model MSLP & wind charts of 00 UTC anaysis of 08 November 2012 show that yesterday's trough over the east coast of India extending from coastal Andra Pradesh to GWB and Bangladesh has become less marked and is now seen between 925 hPa and 850 hPa. Isolated light rainfall is expected over coastal Andhra Pradesh and Orissa in the 24 hours associated with the position of the trough, likely to decrease thereafter. The east-west and the north-south trough locations are in the same place as in GFS. However, the associated rainfall has greater spread northward along the west coast of India as compared to GFS. Rainfall decreases after 24 hours.

- **ECMWF** model MSLP and WIND charts also show a weakening of the trough over the east coast of India. However, a north-south oriented trough is seen over the west coast of India. This intersects with a east-west oriented trough at about 8 deg.N. The associated rainfall belt is also confined to coastal Kerala like for GFS for the next 24 hours, decreasing in intensity thereafter. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis does not show significant values of the GPP in the domain of interest, surrounding the Indian seas. However, a large region with high GPP values (>30) are seen at about 4 deg.N and 92 deg.E. The 24 hr, 48 hr and 72 hour forecasts show similar values over the region. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- Unfavourable large scale features like MJO and high wind shear prevail over Bay of Bengal.
- Thus no cyclogenesis is likely over Bay of Bengal during next 3 days

**Advisory:**

- **NO IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **07/12** | **08/00** | **08/03** |
| **India** | 77/89 | 65/78 | 68/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/17 | 14/18 |
| **Tamil Nadu** | 7/13 | 7/10 | 5/13 |
| **Puducherry** | 1/2 | 1/2 | 1/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 10/11 | 10/11 | 7/11 |
| **Myanmar** | 9/11 | 9/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 7/9 | 7/9 |

- **RS/RW** (12Z) of07-11-2012: 05/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-34**
- **RS/RW** (00Z) of 08-10-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:20**

**No. of PILOT Ascents**

| 07/12Z | 08/00Z |
|---|---|
| 12/37 | 15/34 |

**Buoy Data**

| 07/12Z | 08/00Z | 08/03Z |
|---|---|---|
| 6 | 6 | 4 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **07.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

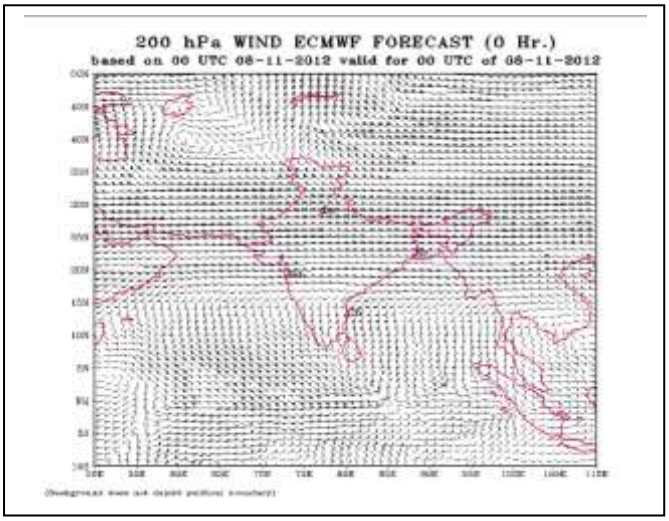
**00Z / 07.11.2012 : 3**
No. of Ascents reaching 250 hPa level =3
**MISDA : 5**

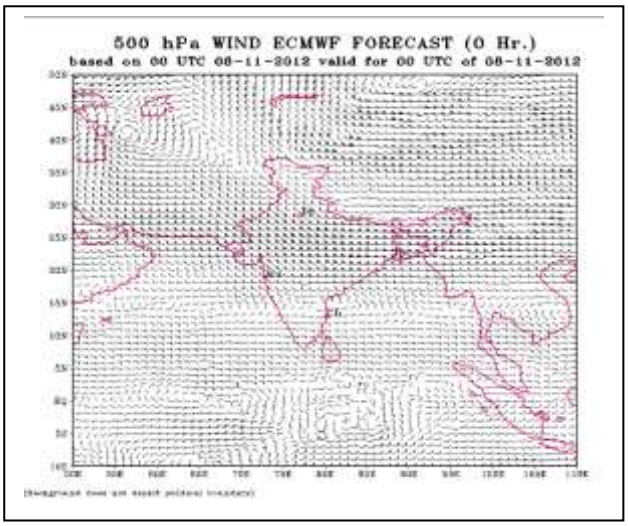
**12Z /07.11.2012 : 0**
No. of Ascents reaching 250 hPa level =0
**MISDA : 8**

**No. of PILOT Ascents:**

| **07.11.2012** | |
|---|---|
| 06Z | 18Z |
| 5 | 4 |

**Annexure II**


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 08-11-2012 valid for 00 UTC of 08-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
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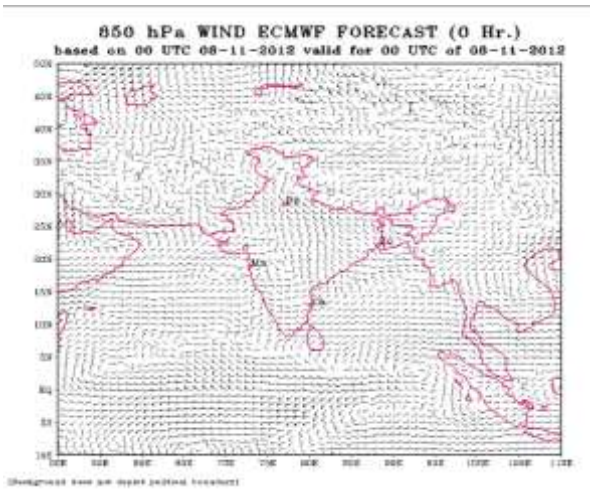
850 hPa WIND ECMWF FORECAST (0 Hr.)
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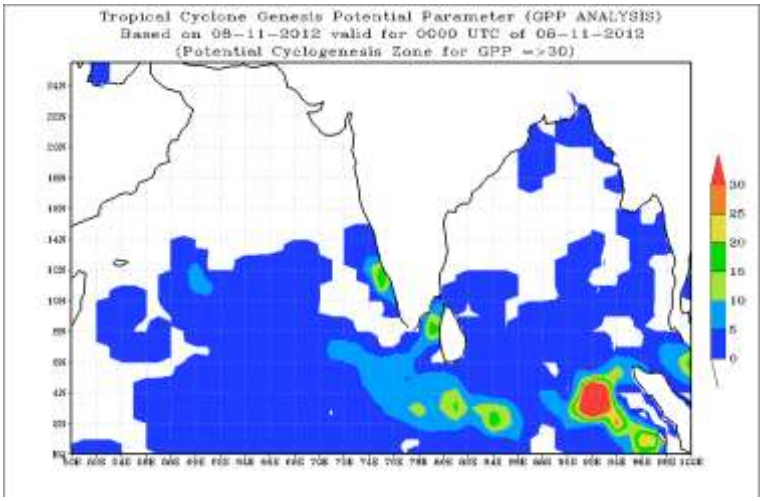
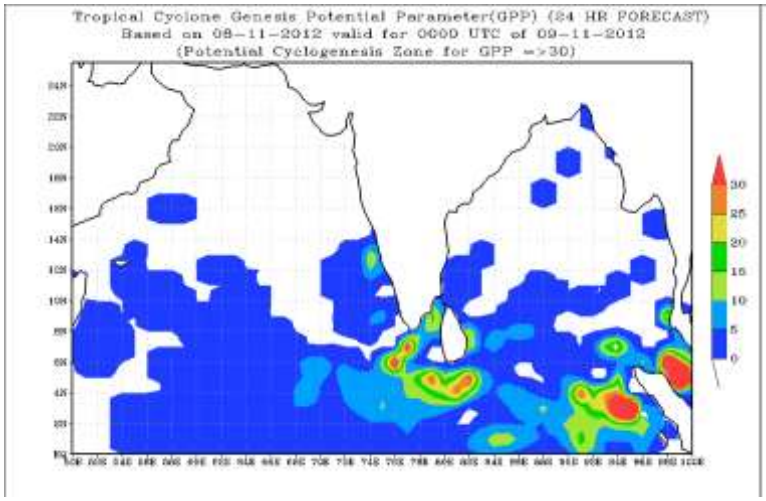
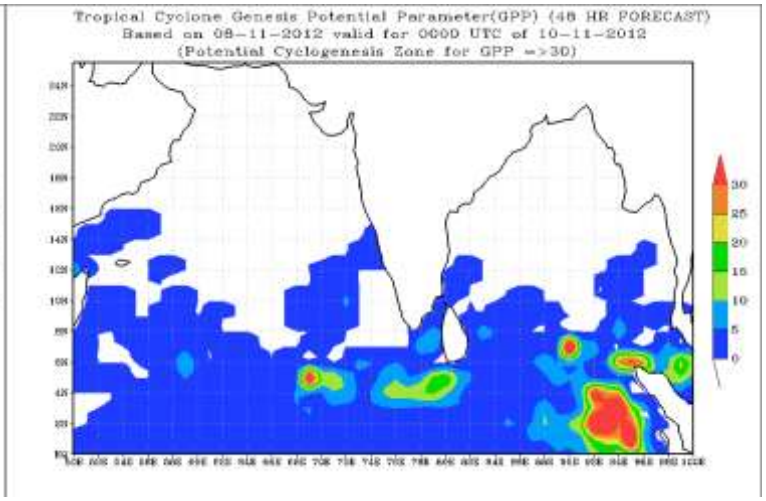

Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 08-11-2012 valid for 0000 UTC of 08-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 08-11-2012 valid for 0000 UTC of 09-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 08-11-2012 valid for 0000 UTC of 10-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

**Synoptic features based on 0300 UTC:**

- The trough of low pressure at mean sea level from comorin area to eastcentral Arabian Sea persists.
- ITCZ runs south of 5°N.
- Anti-cyclone lies over central India.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over Bay of Bengal.

**Ocean thermal energy:**

- Ocean thermal energy is 80-90 KJ cm$^{-2}$ over south & eastcentral Bay of Bengal elsewhere over the Bay < 50 KJ cm$^{-2}$.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is 2.5* 10$^{-5}$ s$^{-1}$ over Southwest Bay of Bengal.

**Convergence:**

- Lower level convergence of the order of 5-10* 10$^{-5}$ s$^{-1}$ over southwest Bay of Bengal.

**Divergence:**

- Upper air divergence of the order of 10-20*10$^{-5}$ s$^{-1}$ over southwest Bay of Bengal.

**Wind Shear:**

- Wind Shear is low of order of 20 knots over Bay of Bengal

**Wind Shear Tendency:**

- Increasing tendency over southwest and decreasing of the order of 10- 20 Knots southwest & central Arabian sea.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hPa passes through latitude 12.0°N.

**M.J.O. Index:**

- Located over phase 5 with amplitude< 1.
- Statistical forecast: - MJO moved to phase 5 and will move to phase 6 after 2 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude less than 1 and will continue in phase4 during next 2 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite advisory**

Low/medium clouds are seen at many places with embedded moderate to intense convection at one/two places over rest south bay south of latitude 9.0N and south Andaman sea and weak convection at one/two places over rest central bay and north Andaman sea.

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts for 00 UTC analysis of 09 November 2012 show that yesterday's trough over the east coast of India is not seen on

the charts anymore. The east-west oriented trough seen yesterday at 7 deg N has moved southward to about 5 deg.N. This trough intersects with a north-south trough present along the west coast of India south of 20 deg. N south of the Indian Peninsula, close to the west coast of Sri Lanka. Due to the effect of the troughs, scattered light to moderate rainfall is expected over the south-west peninsular coast of India over the next 24 hours, decreasing in intensity thereafter but increasing spatially, northwards along the west coast. An induced low level cyclonic circulation associated with a mid-tropospheric westerly trough now lies over Punjab and adjoining Pakistan. This is likely to move in a south-easterly direction in the next 24 hours and become less marked thereafter. A northwest-southeast oriented trough line is seen in the lower levels over eastern India, extending in the west from Assam to over Meghalaya, Tripura and Mizoram.

- **IMD-WRF** model MSLP & wind charts of 00 UTC analysis of 09 November 2012 show that the east-west and the north-south trough locations are in the same place as in GFS. However, the north-south trough on the west coast of India is stronger than in GFS or ECMWF, and so is the associated rainfall. Rainfall decreases on day 2 and 3, although light isolated rainfall is expected in the north west peninsular coast, south of Mumbai, on day 3.
- **ECMWF** model MSLP and WIND charts also do not show the trough on the east coast of India. The north-south trough seen in GFS along the east coast is very less marked in this model. However, the east-west oriented trough is seen in the lower levels below 850 hPa at about 5 deg.N. There is associated light scattered rainfall over coastal Kerala in the next 24 hours, decreasing thereafter. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis does not show significant values of the GPP in the domain of interest, surrounding the Indian seas. However, a large region with high GPP values (>30) are seen at about 2 deg.N and 94 deg.E in the 24 hour forecast. The zone is likely to persist, while moving in a north-northeasterly direction on day 2 and 3. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- **ECMWF** model shows that a trough southeast of Sri Lanka in northeast oriented may develop on 13$^{th}$ and remain prominent till 15$^{th}$ and may develop into low pressure area over southeast and adjoining areas of west central Bay of Bengal by 15$^{th}$ November .
- **IMD-GFS** shows possibility of split of cyclonic circulation over central Bay of Bengal on 13$^{th}$. One cyclonic circulation would form over southeast Bay of Bengal by 15$^{th}$ and another would move westwards. The circulation over southeast Bay of Bengal moved over central Bay of Bengal and become prominent on 15$^{th}$ as low/well marked low pressure area.

**Advisory:**

- **No cyclogenesis over Bay of Bengal during next 3 days, thus no IOP is declared.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **08/12** | **09/00** | **09/03** |
| **India** | 77/89 | 69/79 | 80/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 7/13 | 10/10 | 10/13 |
| **Puducherry** | 1/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 10/11 | 8/11 | 11/11 |
| **Myanmar** | 9/11 | 10/11 | 7/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 8/9 |

- **RS/RW** (12Z) of 08-11-2012: 05/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-34**
- **RS/RW** (00Z) of 09-10-2012: 16/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:23**

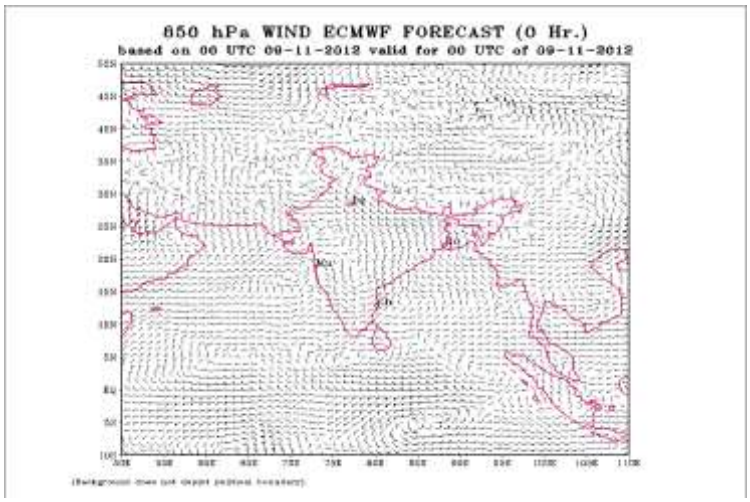
**No. of PILOT Ascents**

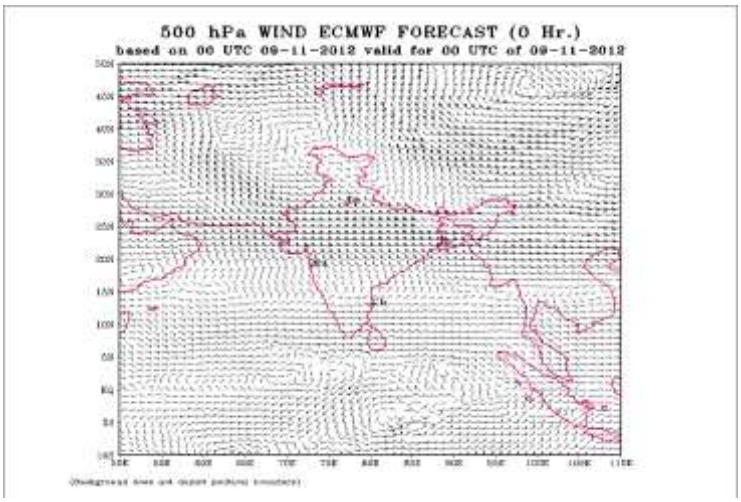
| 08/12Z | 09/00Z |
|---|---|
| 12/37 | 15/34 |

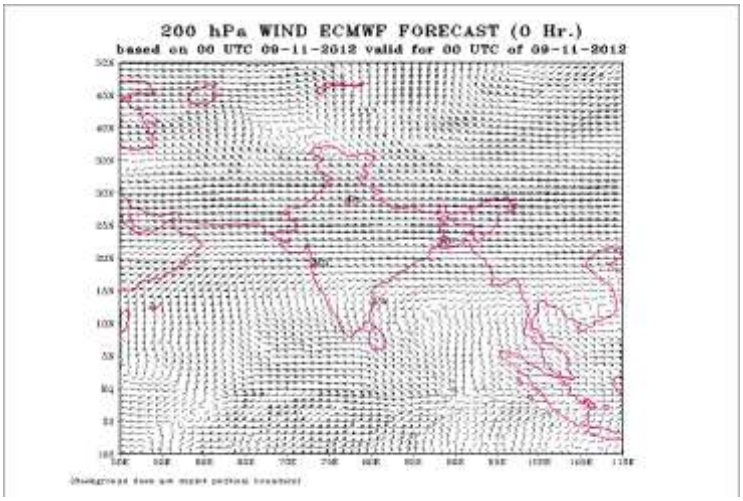
**Buoy Data**

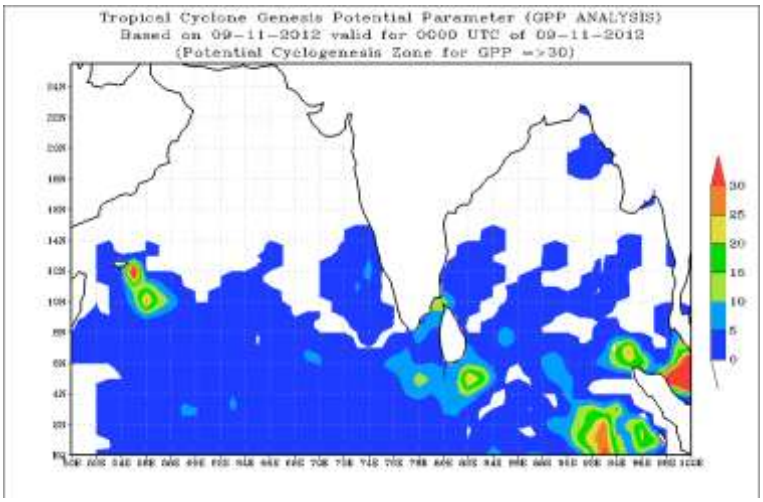
| 08/12Z | 09/00Z | 09/03Z |
|---|---|---|
| 6 | 6 | 9 |

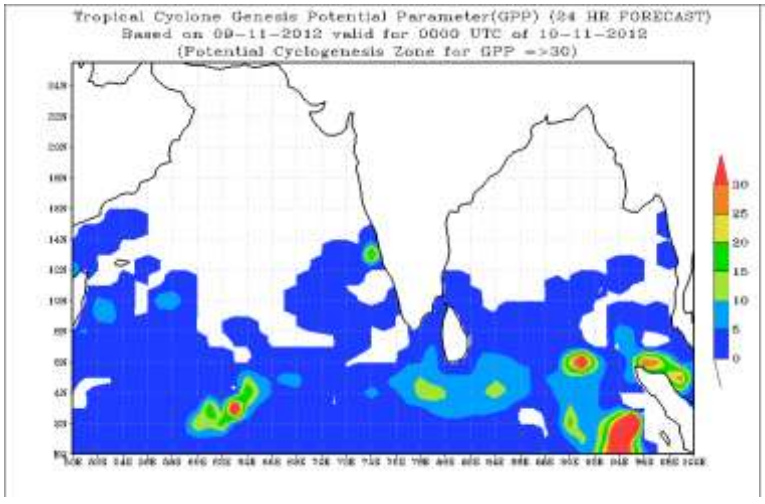
## Annexure II

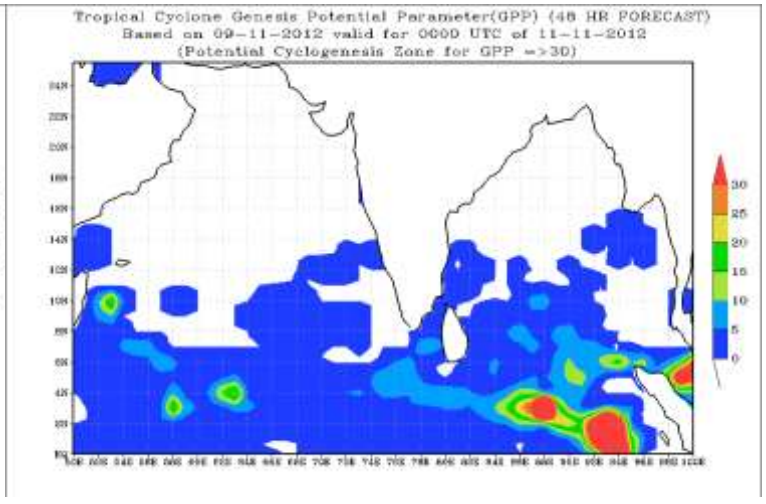

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 09-11-2012 valid for 00 UTC of 09-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 09-11-2012 valid for 00 UTC of 09-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 09-11-2012 valid for 00 UTC of 09-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 09-11-2012 valid for 0000 UTC of 09-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 09-11-2012 valid for 0000 UTC of 10-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 09-11-2012 valid for 0000 UTC of 11-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 10th November, 2012

**Synoptic features based on 0300 UTC:**

- The trough at mean sea level from Comorin area to Karnataka Coast now extends from Comorin area to east central Arabian Sea.
- ITCZ runs around 5°N.
- Anti-cyclone persists over central India.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over Bay of Bengal.

**Ocean thermal energy:**

- Ocean thermal energy is 80-90 KJ cm$^{-2}$ over south & eastcentral Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is 2.5* 10$^{-5}$ s$^{-1}$ over Southwest Bay of Bengal and Andaman sea.

**Convergence:**

- Lower level convergence of the order of 5-10* 10$^{-5}$ s$^{-1}$ over south Bay of Bengal and Andaman sea.

**Divergence:**

- Upper air divergence of the order of 10-20*10$^{-5}$ s$^{-1}$ over south Bay of Bengal and Andaman sea.

**Wind Shear:**

- Wind Shear is low of order of 10 to 20 knots over Bay of Bengal.

**Wind Shear Tendency:**

- Increasing tendency over southwest of the order of 10 knots and decreasing over south Andaman sea of the order of -5 to- 10 Knots

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** LINE AT200 hPa passes through latitude 12.0°N.

**M.J.O. Index:**

- Located over phase 5 with amplitude> 1.
- Statistical forecast: - MJO moved to phase .8 during next 5 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude > 1 and will move in phase 8 in next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite analysis**

Broken low/med clouds with embedded moderate to intense convection over southeast Bay south of lat 10.0$^0$N east of long 85.0$^0$E south Andaman sea and weak to moderate convection over rest Andaman sea and rest South Bay of Bengal.

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts for 00 UTC analysis of 10 November 2012 show that yesterday's trough over the west coast of India still persists. It is deeper in the northern end, and weaker in the southern end. The east-west oriented trough seen yesterday at 5 deg N has become less marked in the same location, likely to weaken further. Scattered light to moderate rainfall is expected over the south-west peninsular coast of India over the next 24 hours, decreasing in intensity thereafter. An induced weak low level cyclonic circulation associated with the passage of a mid-tropospheric westerly trough now lies over Punjab and Haryana and extends upto 925 hPa likely to move in a south-easterly direction in the next 24 hours and become less marked thereafter. Under its effect isolated light rainfall may occur in one or two places of the nofth Indian plains, decreasing thereafter. A northwest-southeast oriented trough line is seen in the lower levels upto 700 hPa over eastern India, extending in the west from Assam to over Meghalaya, Tripura and Mizoram. A low level circulation currently extending upto 700 hPa, located just north of the equator along 95 deg.E in the analysis charts, shows strong potential for north-westward movement and cyclogenesis from Day 3 onwards. There is likely strong interaction of the cycir with a strong cyclonic circulation south of the equator along 85 deg.E. This is likely to affect the Indian coasts on day 4 onwards. The consistently high values of GPP (>30) over the circulation zone also support the above fact.
- **IMD-WRF** model MSLP & wind charts of 00 UTC anaysis of 10 November 2012 show that the east-west and the north-south trough locations are in the same place as in GFS. However, the north-south trough on the west coast of India is stronger than in GFS or ECMWF, and so is the associated rainfall. Rainfall decreases on day 2 and 3, although light isolated rainfall is expected in the north west peninsular coast, south of Mumbai, on day 3. The analysis wind field also shows a low level circulation along 95 deg.E. However, this shows a more west-northwesterly movement, and is likely to affect extreme south peninsula on day 3 onwards.
- **ECMWF** model MSLP and WIND charts show a further weakening of the north-south trough as well as the east west trough off the west coast of India. Light rainfall in isolated regions is expected in the next 24 hours over extreme south peninsula, decreases thereafter. The wind field in this model too shows a low level circulation over the east Indian ocean at the equator between 90-95 deg.E. This is likely to move in a west north-westerly direction in the coming 2-3 days and develop further. However, it is likely to take a more southerly track as compared to GFS and is not likely to intensify as much as predicted by GFS. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- GFS Model analysis shows a zone with significant GPP values (>30) at about 2°N and 94°E. The zone is likely to persist, while moving in a north-north-westerly direction on day 2 and 3. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**
- Day 2 and 3. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- **ECMWF** model shows that a trough southeast of Sri Lanka in northeast oriented may develop on 13th and remain prominent till 14th and may develop into low pressure area over southwest Bay of Bengal east of Srilanka on 15th November. Moving west-northwestwards it is not likely to intensify further.
- **IMD-GFS** shows a low Pressure area would form over central Bay of Bengal on 14th. moving northwestwards it is likely to intensify further into well marked low pressure area on 15th .

**Advisory:**

- **No IOP during next 3 days**

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **09/12** | **10/00** | **10/03** |
| **India** | 51 | 40 | 54 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 15/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 10/11 | 10/11 | 10/11 |
| **Myanmar** | 10/11 | 10/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 7/9 | 7/9 |

- **RS/RW** (12Z) of 09-11-2012: 02/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-37**

- **RS/RW** (00Z) of 10-11-2012: 18/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:21**

**No. of PILOT Ascents**

| 09/12Z | 10/00Z |
|---|---|
| 14/37 | 20/34 |

**Buoy Data**

| 09/12Z | 10/00Z | 10/03Z |
|---|---|---|
| 11 | 12 | 13 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | | | | **09.11.2012** | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **21** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 09.11.2012 : 3**

No. of Ascents reaching 250 hPa level =3

**MISDA : 5**

**12Z /09.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

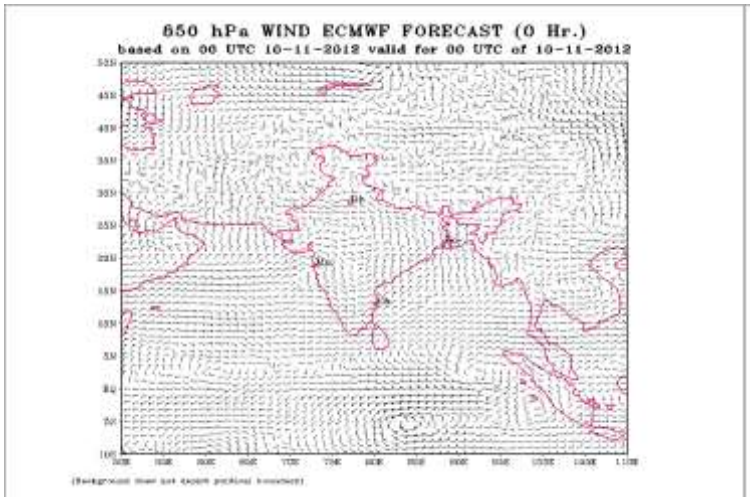
**MISDA : 8**

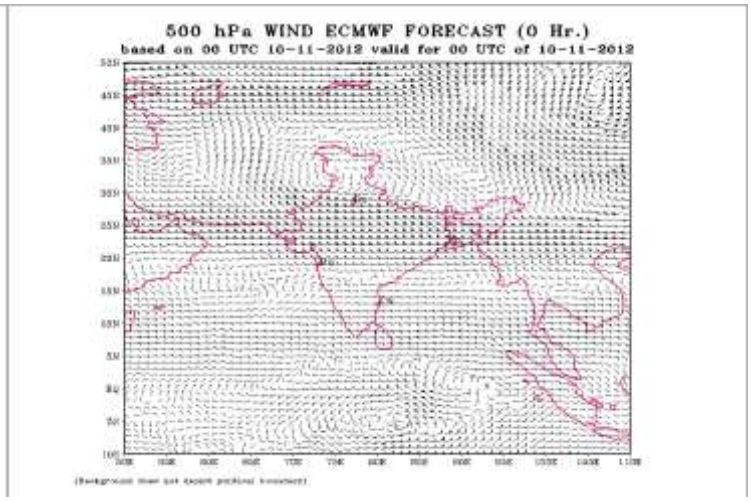
**No. of PILOT Ascents:**

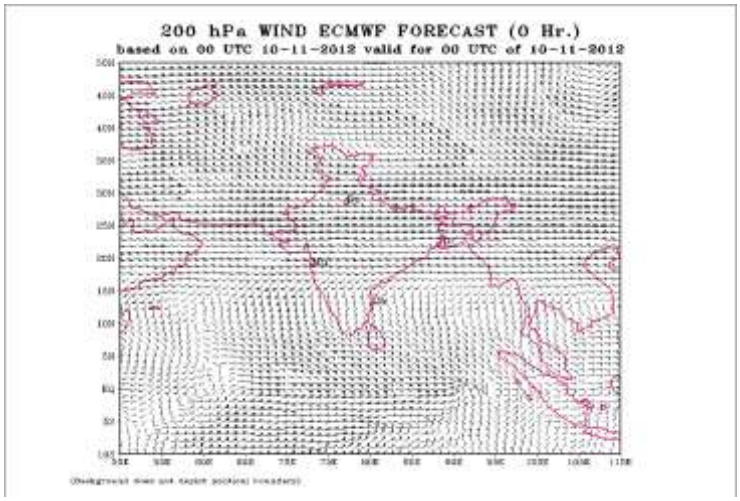
**09.11.2012**

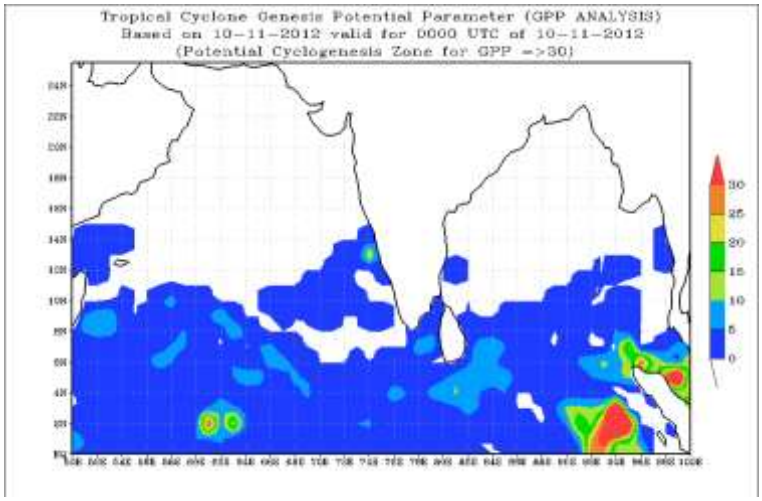
| 06Z | 18Z |
|---|---|
| 4 | 5 |

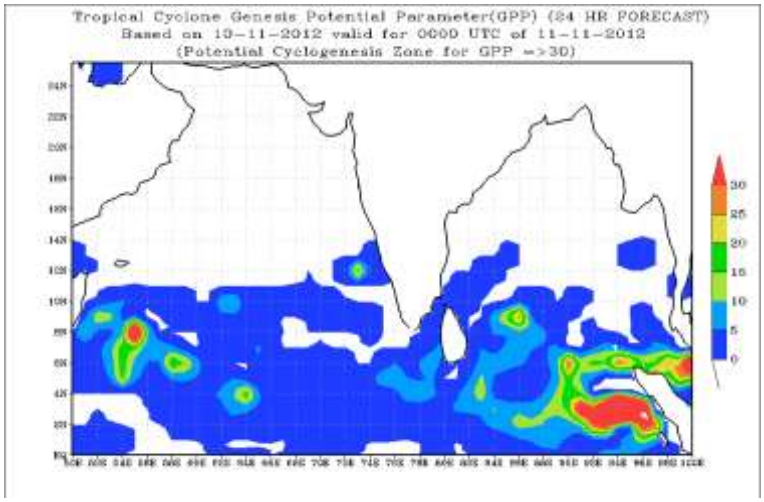
## Annexure II

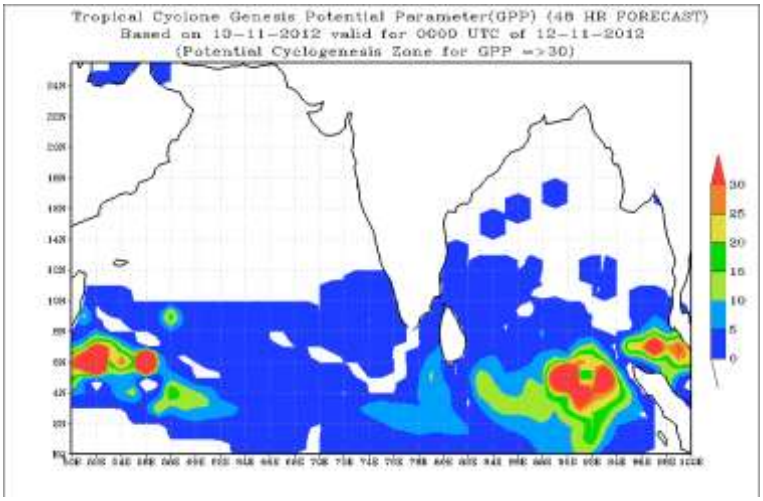

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 10-11-2012 valid for 00 UTC of 10-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 10-11-2012 valid for 00 UTC of 10-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 10-11-2012 valid for 00 UTC of 10-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 10-11-2012 valid for 0000 UTC of 10-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 10-11-2012 valid for 0000 UTC of 11-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 10-11-2012 valid for 0000 UTC of 12-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 11th November, 2012

**Synoptic features based on 0300 UTC:**

- A trough of low at mean sea level runs from southeast Bay of Bengal to eastcentral Bay of Bengal across Andaman Sea with associated upper air trough extending upto 2.1 Km above mean sea level.
- ITCZ runs around 5°N.
- Anti-cyclone persists over central India.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over Bay of Bengal.

**Ocean thermal energy:**

- Ocean thermal energy is 80-100 KJ cm$^{-2}$ over south & eastcentral Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is 3.0-5.0* 10$^{-5}$ s$^{-1}$ over SouthBay of Bengal and Andaman sea.

**Convergence:** Lower level convergence of the order of 10-20* 10$^{-5}$ s$^{-1}$ over south

- Bay of Bengal and Andaman sea.

**Divergence:**

- Upper air divergence of the order of 20-30*10$^{-5}$ s$^{-1}$ over south Bay of Bengal and Andaman sea.

**Wind Shear:**

- Wind Shear is low of order of 20 to 30 knots over Bay of Bengal.

**Wind Shear Tendency:**

- Increasing tendency over central Bay of Bengal of the order of 5 knots and decreasing over south Bay of Bengal and Andaman sea of the order of -5 Knots

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through latitude 14.0°N.

**M.J.O. Index:**

- Located over phase 5 with amplitude> 1.
- Statistical forecast: - MJO moved to phase .8 during next 5 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude <1 and will move in phase 1 in next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite analysis**

Intense to very Intense convective clouds are observed at few places over south Bay of Bengal adjoining Srilanka between lat 5.0N to 10.0N long 80.0E to 85.0E and rest south Bay of Bengal adjoining Indian Ocean between equator to lat 07.0N east of

long 86.0E and adjoining northwest Sumatra coast. Moderate to intense convective clouds are also seen at few places over rest south Bay of Bengal south of lat 10.0N and south Andaman Sea.

**NWP Analysis**

- **IMD-GFS** model MSLP and WIND charts for 00 UTC analysis of 11 November 2012 show that yesterday's trough in the lower levels below 850 hPa over the west coast of India persists in the same location. It is deeper in the northern end, and weaker in the southern end. The east-west oriented trough seen yesterday at 5 deg N has shifted northward and intersects the north-south trough off the coast of Kerala. Scattered light rainfall is expected over the south-west peninsular coast of India during the next 24 hours, decreasing in intensity thereafter. The low level circulation seen yesterday over Punjab and Haryana now is visible as a weak trough over the same region, likely to become less marked in the thereafter. A northwest-southeast oriented trough line is seen in the lower levels upto 700 hPa over eastern India, extending in the west from Sub-Himalayan West Bengal to over Meghalaya, Tripura and Mizoram. A low level circulation currently extending upto 700 hPa, located just north of the equator along 95 deg.E in the analysis charts, shows strong potential for north-westward movement and likely to affect the east coast of India and Sri Lanka as a trough in the easterlies on day 3 onwards. However, rainfall is likely over SriLanka in the next 2-3 days but not over the Indian east coast.
- **IMD-WRF** model MSLP & wind charts of 00 UTC anaysis of 11 November 2012 does not show any substantial difference in the wind flow patterns from GFS for the next three days. However, the movement of the low level circulation seen in the analysis charts centered at 95 deg. E, 5 deg.N shows a faster movement northwestwards and is likely to bring rainfall over the extreme south-east coast of India as a trough in the easterlies from day 3 onwards. The west coast rainfall is also more intense as compared to GFS, and has a greater spatial spread northwards along the coast.
- **ECMWF** model MSLP and WIND charts do not show substantial difference from GFS analysis fields. However,the 24 hour forecast of west coast rainfall is lighter, and decreases thereafter. The rainfall due to the trough in the easterlies, however, is likely to affect Sri Lanka in the next 2-3 days, but may not bring much rainfall over the Indian east coast. The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **Genesis Potential Parameter (GPP):**
- GFS Model analysis shows a zone with significant GPP values (>30) at about 2 deg.N and 94 deg.E. The zone is likely to persist, while moving in a north-northwesterly direction on day 2 and 3. It matches well the forecast wind fields, of the later development of the circulation into a trough in the easterlies in the Bay of Bengal. GPP charts for 00, 24 and 48 hours are shown in

**Annexure II.**

- **Summary and Conclusion:**
- **IMD & NCMRWF-GFS** forecast show formation of a low Pressure area at 140000 UTC over southeast and adjoining central Bay of Bengal. The system is likely to move initially north-westward and intensify into depression around 160000 UTC over west central Bay of Bengal.
- **ECMWF** model forecast shows that the trough on mean sea level will intensify into low pressure area at 140000 UTC over southeast and adjoining central Bay of Bengal. It will move west north-westwards and will not intensify further.

**Advisory:**

- GFS and ECMWF models show divergent view regarding intensification of the low pressure area. The conditions are under constant watch. No IOP during next 3 days

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **10/12** | **11/00** | **11/03** |
| **India** | 54 | 40 | 54 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 9/11 | 9/11 | 10/11 |
| **Myanmar** | 10/11 | 10/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 6/9 | 7/9 |

**AWS observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **10/12** | **11/00** | **11/03** |

| | | | |
|---|---|---|---|
| **India** | 84/121 | 72/121 | 87/121 |
| **WB** | 9/20 | 9/20 | 9/20 |
| **ODS** | 25/38 | 24/38 | 28/38 |
| **AP** | 26/35 | 25/35 | 26/35 |
| **TN** | 22/26 | 22/26 | 22/26 |
| **PDC** | 2/2 | 2/2 | 2/2- |

- **RS/RW** (12Z) of 10-11-2012: 03/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-36**
- **RS/RW** (00Z) of 11-11-2012: 18/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:21**

**No. of PILOT Ascents**

| **10/12Z** | **11/00Z** |
|---|---|
| 14/37 | 20/34 |

**Buoy Data**

| **10/12Z** | **11/00Z** | **11/03Z** |
|---|---|---|
| 14 | 13 | 17 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **10.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 10.11.2012 : 3**

No. of Ascents reaching 250 hPa level =3

**MISDA : 5**

**12Z /10.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

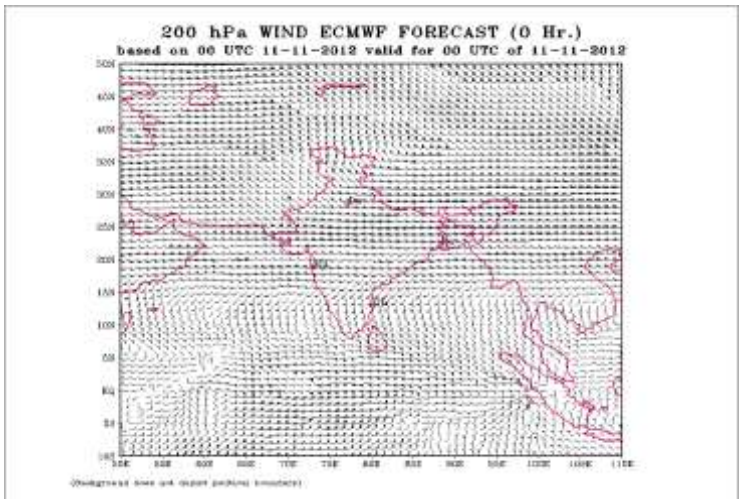
**MISDA : 8**

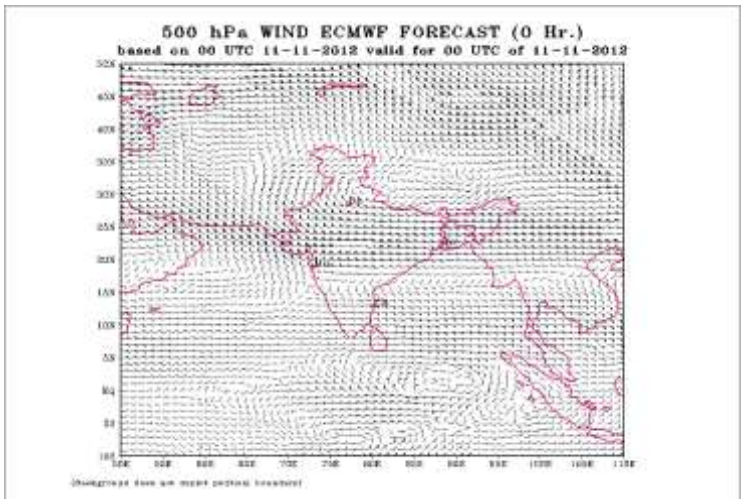
**No. of PILOT Ascents:**

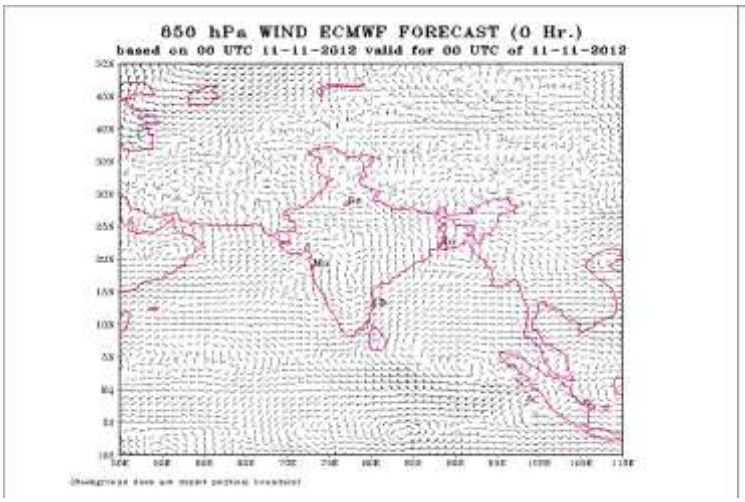
**10.11.2012**

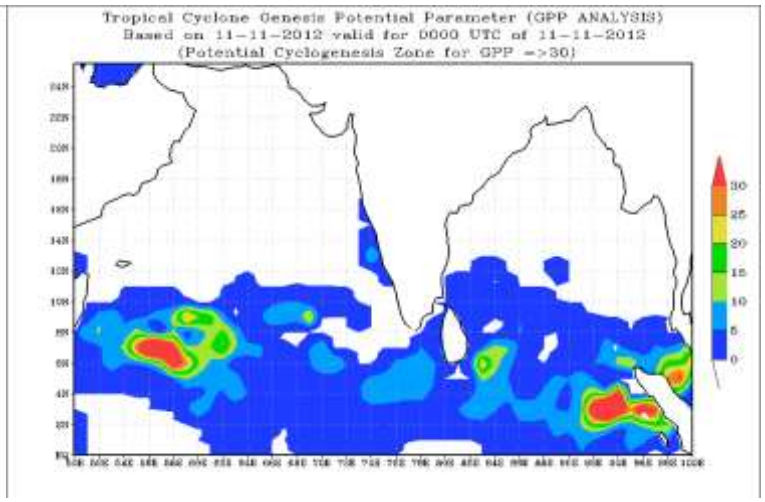
| 06Z | 18Z |
|---|---|
| 5 | 6 |

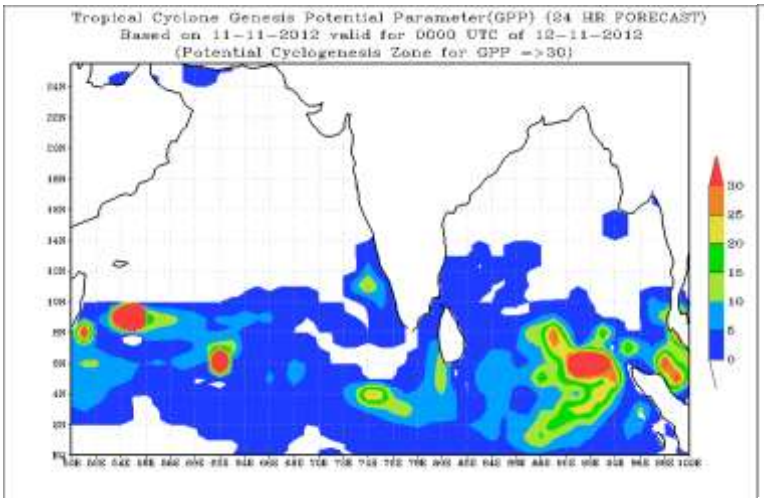
## Annexure II

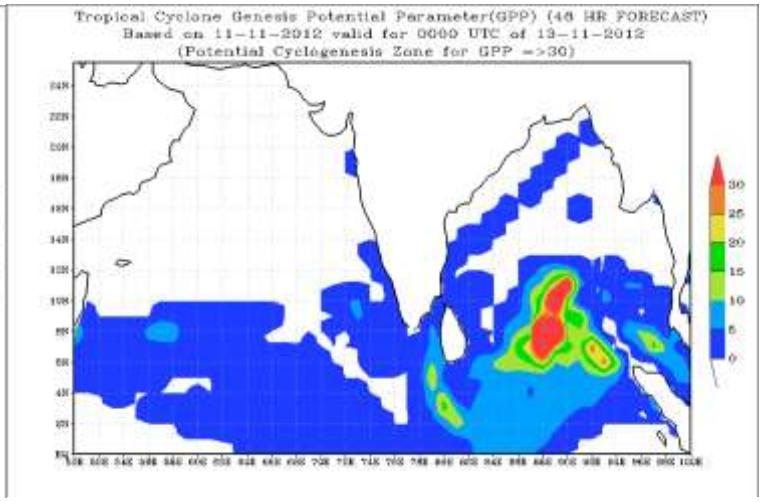

200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 11-11-2012 valid for 00 UTC of 11-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 11-11-2012 valid for 00 UTC of 11-11-2012


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 11-11-2012 valid for 00 UTC of 11-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 11-11-2012 valid for 0000 UTC of 11-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 11-11-2012 valid for 0000 UTC of 12-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 11-11-2012 valid for 0000 UTC of 13-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 12th November, 2012

**Synoptic features based on 0300 UTC:**

- The trough of low at mean sea level now runs from southeast Bay of Bengal to eastcentral Bay of Bengal with associated upper air cyclonic circulation extending upto 3.1 Km above mean sea level.
- ITCZ lies along $5^0$N
- 24 hr pressure change is negative (about 1 hPa)
- Pressure departure from normal is positive (about 1-2 hPa)

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over Bay of Bengal.
- **Ocean thermal energy:**
- Ocean thermal energy is 60-80 KJ cm$^{-2}$ over south & eastcentral Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is negative (3.0-5.0* $10^{-5}$ $s^{-1}$ ) over SouthBay of Bengal and Andaman sea.
- **Convergence:** Lower level convergence of the order of 10-15* $10^{-5}$ $s^{-1}$ over south Bay of Bengal and Andaman sea.
- **Divergence:** Upper air divergence of the order of 20-30*$10^{-5}$ $s^{-1}$ over south Bay of Bengal and Andaman sea.

**Wind Shear:**

- Wind Shear is moderate of order of 10-20 knots over Bay of Bengal.
- **Wind Shear Tendency:**
- No change
- **Upper tropospheric ridge**:
- The upper tropospheric **RIDGE** line AT 200 hpa passes through latitude 15.0°N.

**M.J.O. Index:**

- Located over phase 5 with amplitude= 1.
- Statistical forecast: - MJO moved to phase .8 during next 5 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude <1 and will move in phase 1 in next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**

Satelite imagery shows convective cloud clusters (CTT <-60$^0$C) centred near lat. 6.0$^0$N/long.87.0$^0$E. Intense to very intense convective clouds are seen at many places over north Andaman Sea, adjoining gulf of Martaban, Tenasserim cost and south east bay ..

(See ftp://192.168.12.75/imd/satmet, http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** – analysis indicates a cyclonic circulation at lower level around 5N/90E and the forecast indicates close low on 14th as indicated from forecast of MSLP and 850 hPa wind over south central Bay on 14th November. Subsequent the system slowly moves in North-westerly direction and it again recurve after reaching away from the Chennai coast. However, southestern coastal states will get rainfall associated with this system.
- The day 5 forecast valid for 17th indicates another system to the east off the main system over the Andaman Sea.
- **IMD-WRF** model MSLP & wind charts of 00 UTC anaysis of 12 November 2012 Indicates a cyclonic circulation around 5N/90E, which moves more westward in the forecast and crossed Srilanka coast on 15th.
- **ECMWF** model MSLP and WIND charts also show a cyclonic circulation in the analysis around 5N/90E and slowly moves in NW direction up to 4 days and seen near the Chennai region on 16th. Subsequently it also recurve and moved in NE direction.
- The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **GEFS-NCMRWF** based on 110000 UTC shows that a trough of low pressure in northeast direction would develop over south Bay of Bengal on 130000 UTC and remains prominent as trough till 140000 UTC. Due to the trough a low pressure area may form over southeast Bay of Bengal on 150000 UTC which would move westwards without intensification
- **ARP METEOFRANCE** model suggest formation of low over southeast Bay of Bengal on 130000 UTC. It would move north northwestwards and intensify into a depression over central Bay of Bengal by 150000 UTC.
- **Genesis Potential Parameter**
- GPP shows value greater than 30 over southeast Bay of Bengal on 13$^{th}$ supporting cyclogenesis. However it remains elongated in shape though it increases in size. It initially moves west-northwestwards and then recurves north-eastwards.
- **Summary and Conclusion:**
- **ECMWF** model charts based on 120000 UTC shows low pressure area is developing near lat.10.0$^0$N/long.90.0$^0$E on 130000 UTC and would become well marked on 160000 UTC near around centre lat.12.0$^0$N/84.0$^0$E.
- **IMD GFS** suggest formation of low over southeast Bay of Bengal by 130000. It is likely to move westwards without intensification

**Advisory:**

- **Most NWP models suggest formation of low pressure area over southeast Bay of Bengal during next 48 hrs. It would move west northwestwards initially for next 3 days and recurve north-eastwards thereafter.**
- **Probability of its intensification into a depression is vey low as only one model (ARP METEOFRANCE) suggest intensification.**
- **The environmental features like vorticity and wind shear are also not favourable for intensification.**
- **No IOP during next 3 days**

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **11/12** | **12/00** | **12/03** |
| **India** | 81/89 | 68/72 | 72/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 6/11 | 9/11 | 10/11 |
| **Myanmar** | 10/11 | 10/11 | 7/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 6/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **11/12** | **12/00** | **12/03** |
| **India** | 85/121 | 84/121 | 55/121 |
| **WB** | 9/20 | 9/20 | 4/20 |
| **ODS** | 25/38 | 25/38 | 20/38 |
| **AP** | 26/35 | 25/35 | 17/35 |
| **TN** | 23/26 | 21/26 | 13/26 |
| **PDC** | 2/2 | 2/2 | 1/2- |

- **RS/RW** (12Z) of 11-11-2012: 05/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-34**
- **RS/RW** (00Z) of 12-11-2012: 18/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:21**

**No. of PILOT Ascents**

| 11/12Z | 12/00Z |
|---|---|
| 10/37 | 17/34 |

**Buoy Data**

| 11/12Z | 12/00Z | 12/03Z |
|---|---|---|
| 10 | 6 | 7 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| Date→ | 10.11.2012 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| UTC→ | 00 | 03 | 06 | 09 | 12 | 15 | 18 | 21 |
| Chennai Region (Coasts of AP & TN) | 19 | 23 | 20 | 20 | 22 | 19 | 19 | 19 |

**No. of RS/RW Ascents**

**00Z / 10.11.2012 : 3**

No. of Ascents reaching 250 hPa level =3

**MISDA : 5**

**12Z /10.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

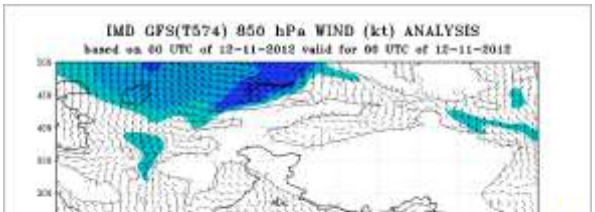
**MISDA : 8**

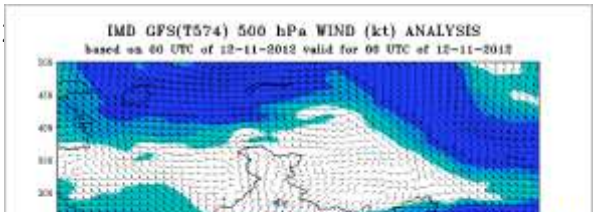
**No. of PILOT Ascents:**

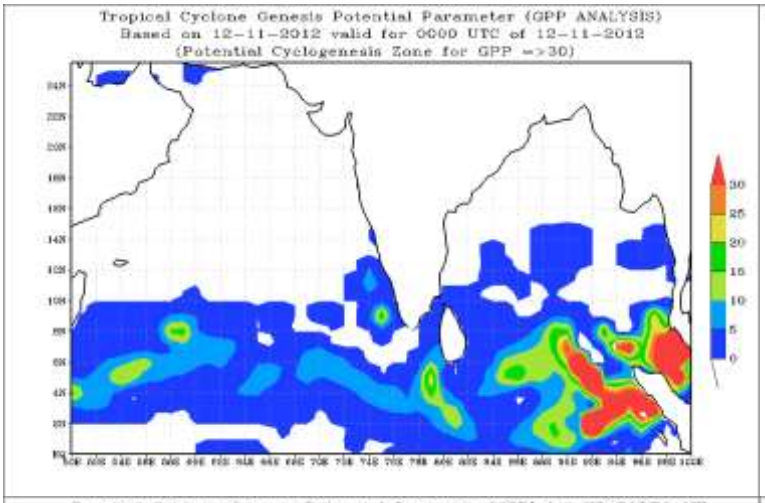
| 10.11.2012 | |
|---|---|
| 06Z | 18Z |
| 5 | 6 |

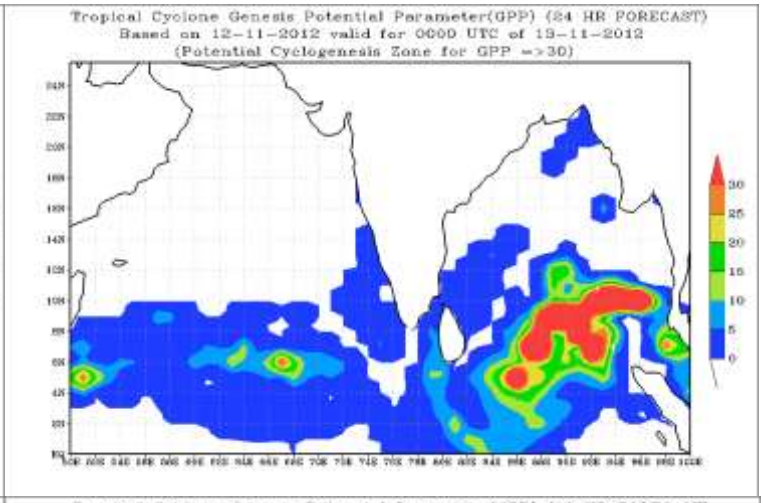
**Annexure II**

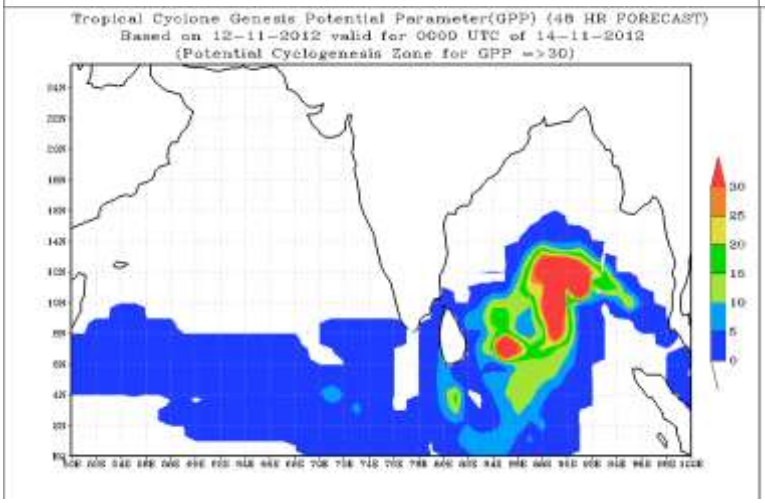


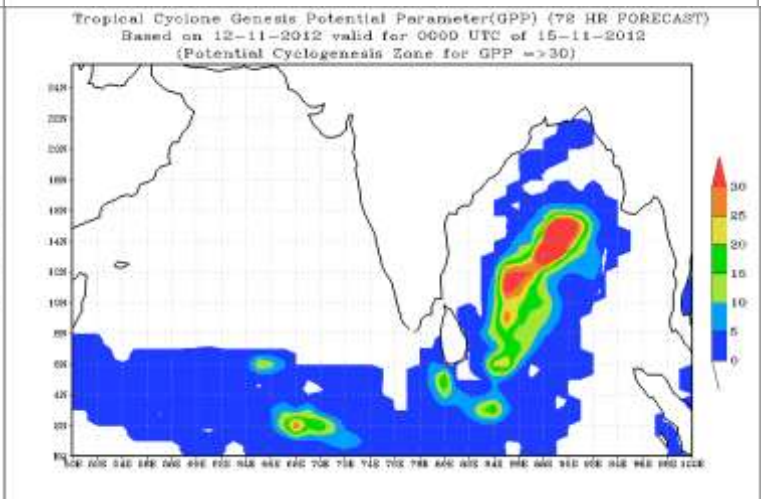



Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 12-11-2012 valid for 0000 UTC of 12-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 12-11-2012 valid for 0000 UTC of 13-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 12-11-2012 valid for 0000 UTC of 14-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 12-11-2012 valid for 0000 UTC of 15-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

**Synoptic features based on 0300 UTC:**

- The trough of low at mean sea level now runs from southeast Bay of Bengal to eastcentral Bay of Bengal with associated upper air cyclonic circulation extending upto 3.1 Km above mean sea level persists.
- ITCZ lies along $5^0$N
- 24 hr pressure change is negative over A & N island, Bangladesh & Myanmar coast and positive over east coast of India .
- Pressure departure from normal is negative (about 1-2 hPa) over A & N island, Bangladesh & Myanmar coast and positive over east coast of India.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-$30^0$C over southeast, east central Bay of of Bengal and A & N island

**Ocean thermal energy:**

- Ocean thermal energy is 80-100 KJ $cm^{-2}$ over southeast, east central Bay of Bengal and Andaman sea.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is negative (5.0* $10^{-5}$ $s^{-1}$) over Southeast Bay of Bengal and Andaman sea.

**Convergence:**

- Lower level convergence of the order of 5-10* $10^{-5}$ $s^{-1}$ over southeast Bay of Bengal and Andaman sea.

**Divergence:**

- Upper air divergence of the order of 10-20*$10^{-5}$ $s^{-1}$ over southeast Bay of Bengal and Andaman sea.

**Wind Shear:**

- Wind Shear is moderate of order of 10-20 knots over southeast Bay of Bengal and Andaman Sea.

**Wind Shear Tendency:**

- Negative of the order of 5 to 10 knot over southeast and Andaman sea.

**Upper tropospheric ridge**:

- The upper tropospheric ridge line at200 hPa passes through latitude 15.0°N.

**M.J.O. Index:**

- Located over phase 5 with amplitude <1.
- Statistical forecast: - MJO moved to phase .8 during next 5 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude <1 and will move in phase 1 in next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite advisory**

Broken low/med clouds with embedded intense to very intense convection seen over south Bay of Bengal south of lat. $10.0^0$N east of long. $84.0^0$E. Broken low/med clouds with embedded moderate to intense convection seen over east central Bay .

**NWP Analysis**

- **IMD-GFS** – analysis indicates a cycir at lower level around 6N/89E and the forecast indicates close low on 14th as indicated from forecast of MSLP and 850 hPa wind over south central Bay on 14th November. Subsequently the system slowly moves in Northwesterly direction in next 24 hr ($15^{th}$) with slight intensification. In subsequent 3 days (16-18 Nov) the system slightly shift to the north and little to the east and almost in same position during these three days.
- **IMD-WRF** model MSLP & wind charts of 00 UTC analysis of 13 November 2012 Indicates a cycer around 6N/89E, which unlike GFS moved westward in the forecast and crossed Srilanka coast on 15th.
- **ECMWF** model MSLP and WIND charts also show a cycir in the analysis around 6N/89E like GFS and slowly moves in NW direction in subsequent 2 days. Subsequently it also recurve and moved in more northerly direction with not much movement.
- The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP): (Based on 13 Nov)**

- GPPanalysis shows a zone with significant GPP values (>30) over southeast Bay of Bengal and Andaman sea elongated in northeast direction. The potential further organised on 140000 UTC in shape of concentric ring over the same area. Moving north westward GPP further organised in concentric circle of different values surrounding the system centre over east central Bay of Bengal and neighbourhood on 170000 UTC and thereafter recurving towards Bangladesh/Myanmar coast maintaining same value and shape. **Annexure II.**

**Summary and Conclusion:**

- **ECMWF** model charts based on 130000 UTC shows low pressure area would form over southeast Bay of Bengal and neighbourhood on $14^{th}$ November. Initially moving north-westward intensify further and after 170000 UTC recurve towards Bangladesh coast.
- **IMD GFS** model charts based on 130000 UTC shows a low pressure area would form over southeast Bay of Bengal and neighbourhood on $14^{th}$ November. Initially moving north-westward intensify further and after 170000 UTC recurve towards Bangladesh coast.

**Advisory:**

- ECMWF, IMD GFS, GEFS NCMRWF and ARP model are in consensus that a low pressure area would form over southeast Bay of Bengal and neighbourhood on $14^{th}$ November. Initially moving north-westward intensify further and after 170000 UTC recurve towards Bangladesh coast/ Myanmar coast.

- **No IOP during next 3 days**

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **12/12** | **13/00** | **13/03** |
| **India** | 53 | 40 | 53 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 17/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 9/11 | 10/11 | 10/11 |
| **Myanmar** | 10/11 | 10/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 7/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **12/12** | **13/00** | **13/03** |
| **India** | 81/121 | 84/121 | 89/121 |
| **WB** | 8/20 | 9/20 | 10/20 |
| **ODS** | 25/38 | 25/38 | 26/38 |
| **AP** | 25/35 | 26/35 | 28/35 |
| **TN** | 21/26 | 22/26 | 23/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 12-11-2012: 06/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-33**
- **RS/RW** (00Z) of 13-11-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:20**

**No. of PILOT Ascents**

| 12/12Z | 13/00Z |
|---|---|
| 11/37 | 16/34 |

**Buoy Data**

| 12/12Z | 13/00Z | 13/03Z |
|---|---|---|
| 10 | 6 | 8 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **12.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z /12.11.2012 : 3**
No. of Ascents reaching 250 hPa level =3
**MISDA : 5**
**12Z /12.11.2012 : 0**
No. of Ascents reaching 250 hPa level =0
**MISDA : 8**

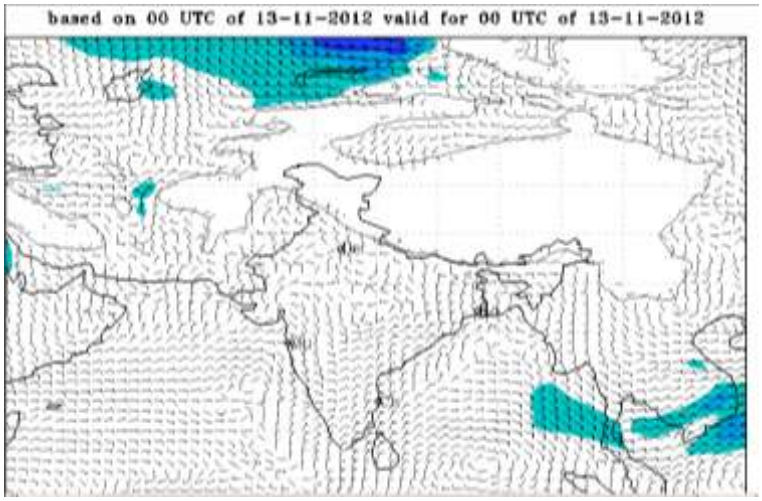
**No. of PILOT Ascents:**

**12.11.2012**

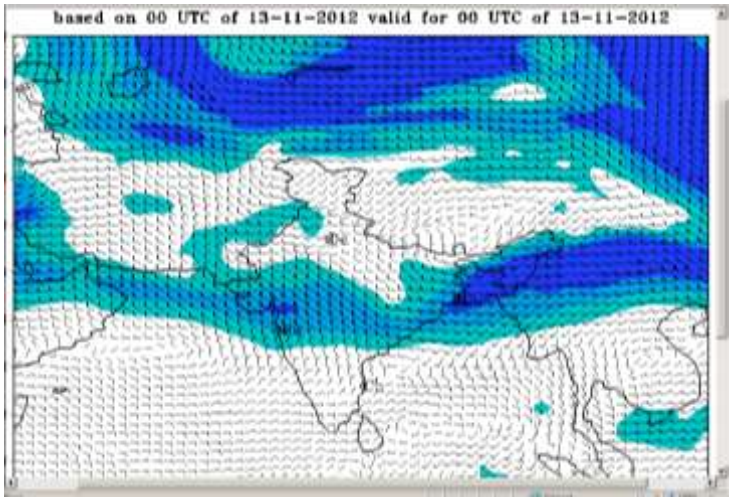
| 06Z | 18Z |
|---|---|
| 6 | 6 |

**Annexure II**

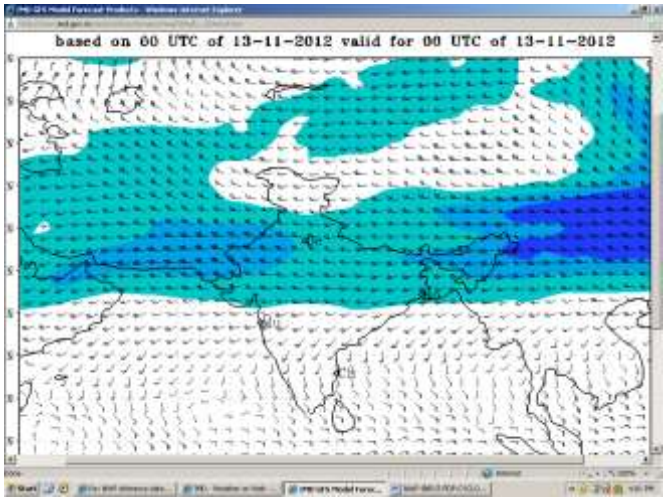
**GFS – 850 hPa analysis**

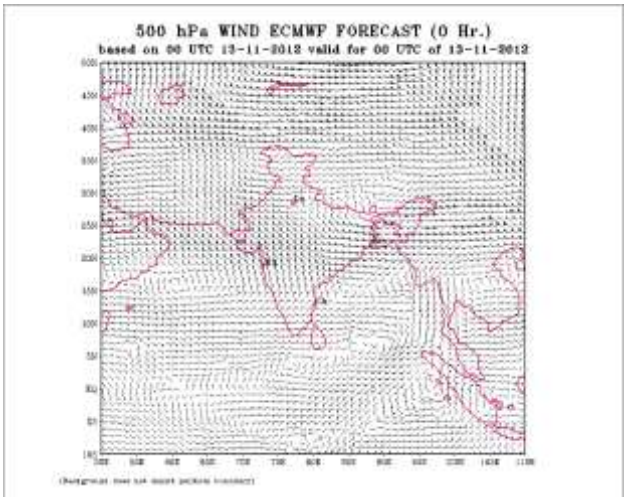


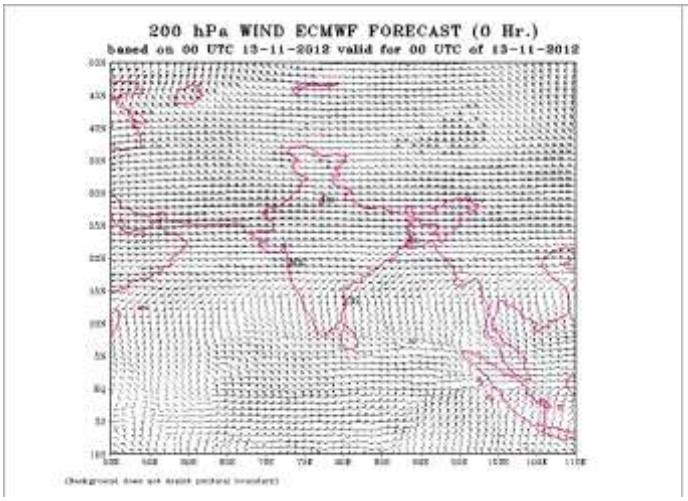

**GFS – 500 hPa analysis**

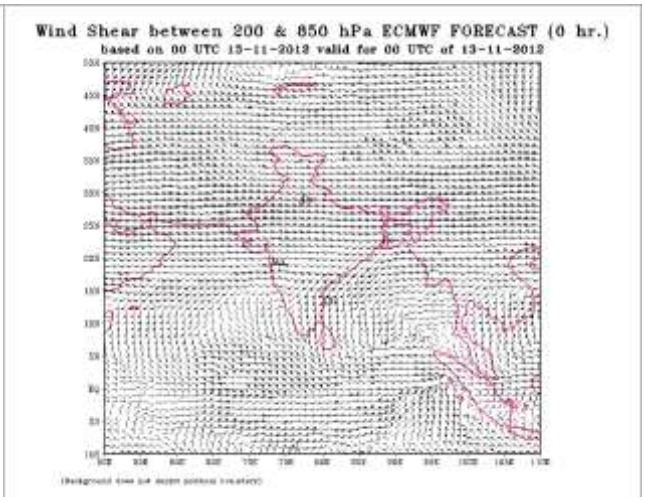


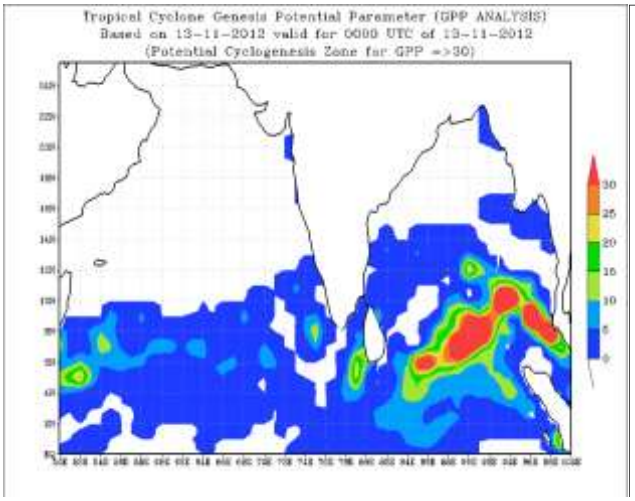

**GFS – 200 hPa analvsis**

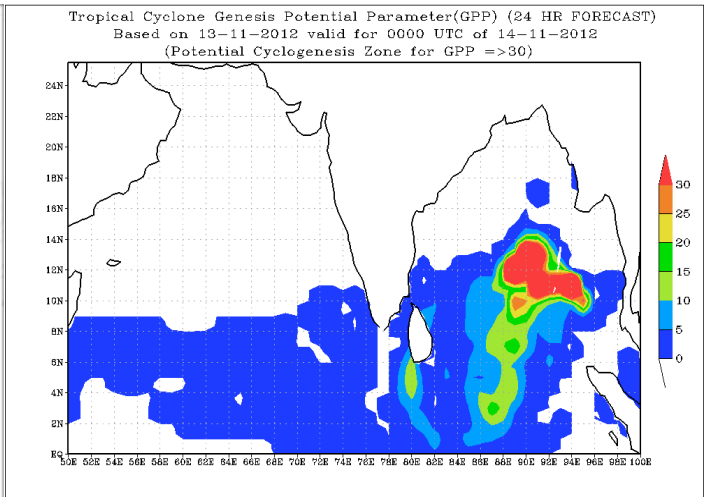


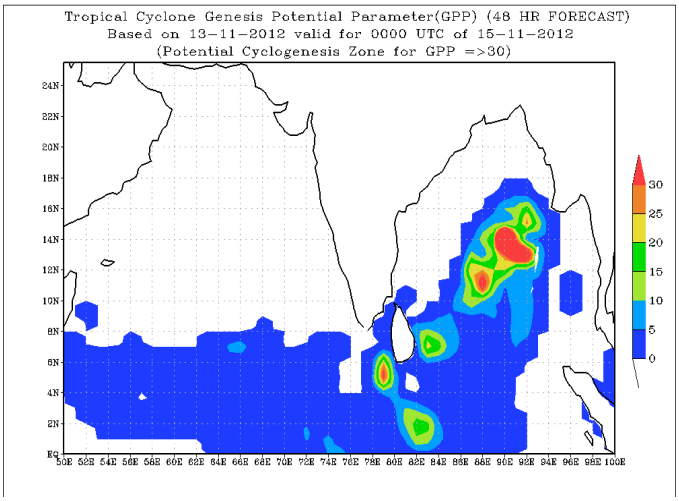




200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 13-11-2012 valid for 00 UTC of 13-11-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 13-11-2012 valid for 00 UTC of 13-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 13-11-2012 valid for 0000 UTC of 13-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 13-11-2012 valid for 0000 UTC of 14-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 13-11-2012 valid for 0000 UTC of 15-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 14th November, 2012

**Synoptic features based on 0300 UTC:**

- Under the influence of yesterday trough of low at mean sea level, a low pressure area has formed over southeast and adjoining southwest Bay of Bengal with associated upper air cyclonic circulation extending upto mid tropospheric level.
- 24 hr pressure change is negative over A & N island, Bangladesh & Myanmar coast and east coast of India.
- ITCZ runs along $9^0$N.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-$30^0$C over southeast, central Bay of Bengal and Andaman sea.

**Ocean thermal energy:**

- Ocean thermal energy is 80-100 KJ $cm^{-2}$ over southeast, east central Bay of Bengal and Andaman sea.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is negative ($5.0* 10^{-5}$ $s^{-1}$ ) over Southeast and, central Bay of Bengal.

**Convergence:**

- Lower level convergence of the order of $15* 10^{-5}$ $s^{-1}$ over southeast Bay of Bengal east of low pressure area oriented in north south orientation.

**Divergence:**

- Upper air divergence of the order of $20*10^{-5}$ $s^{-1}$ over southeast Bay of **Bengal** east of low pressure area oriented in north east direction.

**Wind Shear:**

- Wind Shear is high of order of 20-30 knots over southeast and central Bay of Bengal.

**Wind Shear Tendency:**

- Positive of the order of 5 knot over southeast and central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through latitude 14.0°N.

**M.J.O. Index:**

- Located over phase 5 with amplitude <1.
- Statistical forecast: - MJO moved to phase .8 during next 5 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude <1 and will move in phase 1 in next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**

Broken low/medium clouds with embedded moderate to intense convection seen over Bay of Bengal between lat $6.0^0$N to $12.5^0$N long 86.00E to $93.0^0$E, east central Bay, south Arakan coast and adjoining Myanmar. Broken low/med clouds with embedded isolated moderate to intense convection seen over rest Bay of Bengal bay bet lat $10.0^0$N to $13.5^0$N west of long $85.0^0$E. The CTT in association with low is about $-60^0$C to $-65^0$C.

**NWP Analysis**

- **IMD-GFS** – analysis indicates cycer at lower associated with a low pressure area over SE/EC Bay of Bengal. The forecast indicates movemevt in the direction of N/NE towards Bangladesh/westBengal coast for subsequent 4 days with slight intensification during next 2 days.
- **IMD-WRF** model MSLP & wind charts of 00 UTC anaysis of 14 November 2012 Indicates cycer associated with a low, which unlike GFS moved very slowly northwestward during next 3 days with some intensification.
- **ECMWF** model MSLP and WIND charts also show a cycer in the analysis over SE/EC Bay of Bengal like GFS. The forecast indicates its movement N/NE ward for next 3 days valid till 16th towards Bangladesh coast with slight insensification. However, during subsequent 2 days it again displaced to the south.
- The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- GFS Model analysis shows a zone with significant GPP values (>30) at about 10 deg.N and 90 deg.E. The zone is likely to persist, while moving in a northerly direction on day 2 and 3 days. It matches well the forecast wind fields, of the later development of the circulation into a trough in the easterlies in the Bay of Bengal. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- **ECMWF** model charts based on 140000 UTC shows low pressure area remain prominent as low over central Bay of Bengal till 190000 UTC moving West-northwestwards north Tamilnadu coast.
- **IMD GFS** model charts based on 140000 UTC shows the low pressure area would not intensify further and recurve towards Bangladesh and Myanmar coast from 150000 UTC.
- **ARP model** shows that the low would move northwestwards during next 72 hrs.
- **GEFS-NCMRWF** model shows that the low pressure would move northwestwards during next 72 hrs.
- **Unified model NCMRWF** shows the low pressure would move northwestwards upto $16^{th}$ and then recurve towards Myanmar coast.

**Advisory:**

- **Considering the suggestions of NWP models and environmental parameters the low pressure area would move northwestwards during next 72 hrs.**
- **The probability of its intensification into a Depression during next 48 hrs is low.**
- **No IOP during next 3 days**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **13/12** | **14/00** | **14/03** |
| **India** | 84/89 | 69/78 | 80/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/17 | 17/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 9/11 | 9/11 | 9/11 |
| **Myanmar** | 10/11 | 9/11 | 9/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **13/12** | **14/00** | **14/03** |
| **India** | 85/121 | 85/121 | 86/121 |
| **WB** | 9/20 | 11/20 | 10/20 |
| **ODS** | 26/38 | 24/38 | 26/38 |
| **AP** | 25/35 | 26/35 | 26/35 |
| **TN** | 23/26 | 22/26 | 22/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 13-11-2012: 06/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-33**
- **RS/RW** (00Z) of 14-11-2012: 18/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:21**

**No. of PILOT Ascents**

| 13/12Z | 14/00Z |
|---|---|
| 11/37 | 15/34 |

**Buoy Data**

| 12/12Z | 13/00Z | 13/03Z |
|---|---|---|
| 8 | 4 | 11 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | | | | **12.11.2012** | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z /12.11.2012 : 3**

No. of Ascents reaching 250 hPa level =3

**MISDA : 5**

**12Z /12.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

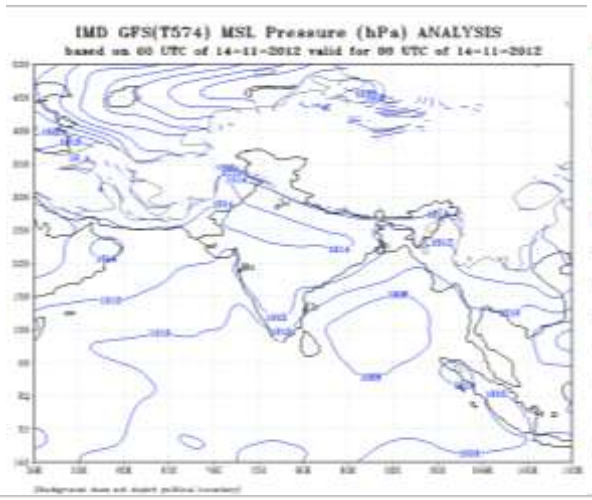
**MISDA : 8**

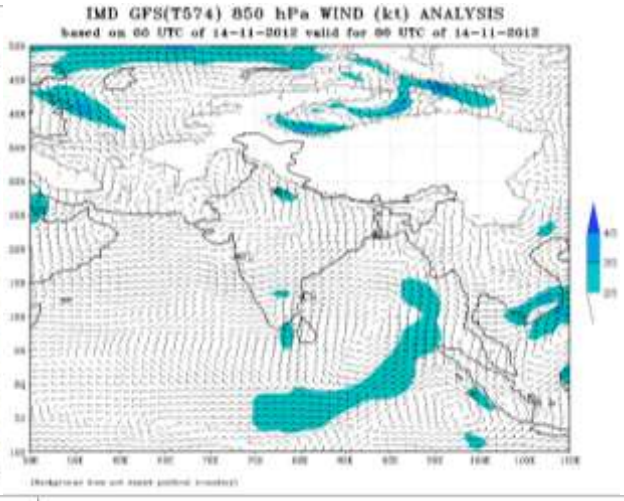
**No. of PILOT Ascents:**

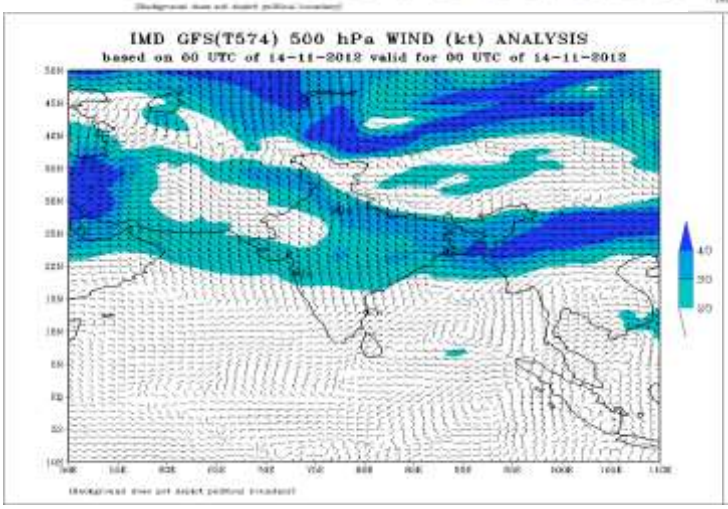
**12.11.2012**

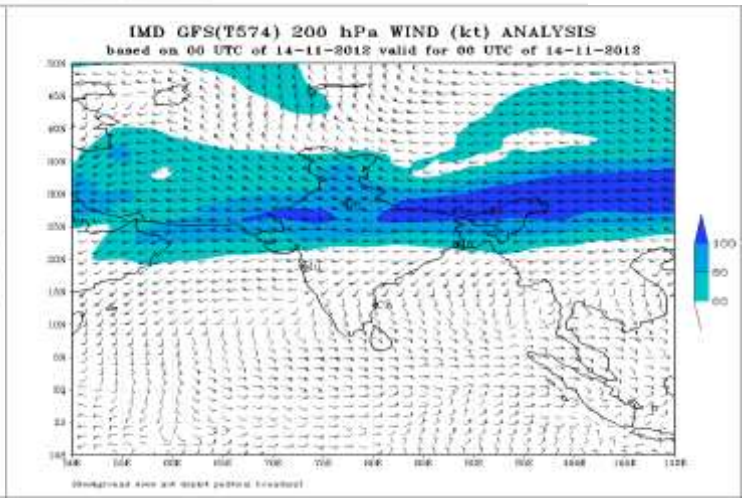
| 06Z | 18Z |
|---|---|
| 6 | 6 |

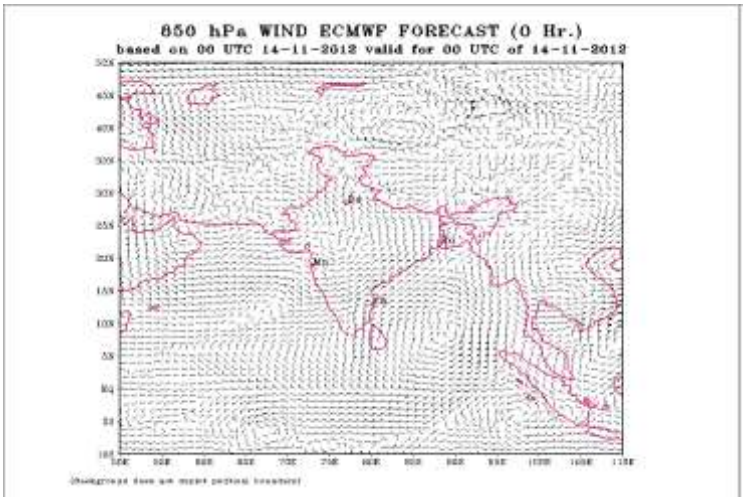
## Annexure II

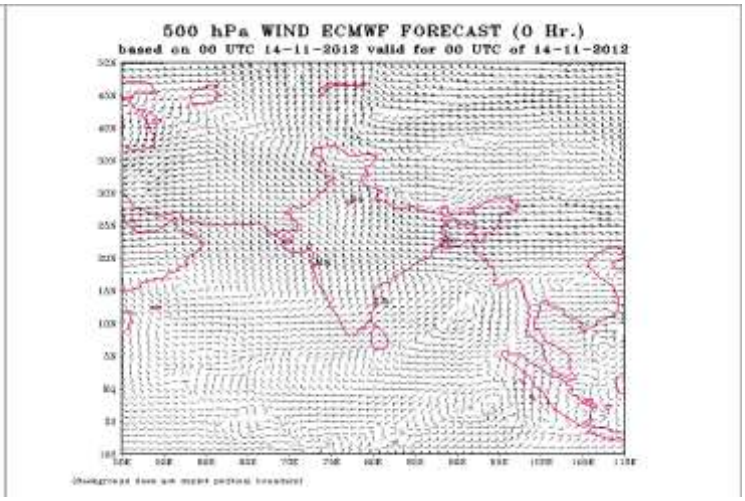

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 14-11-2012 valid for 00 UTC of 14-11-2012

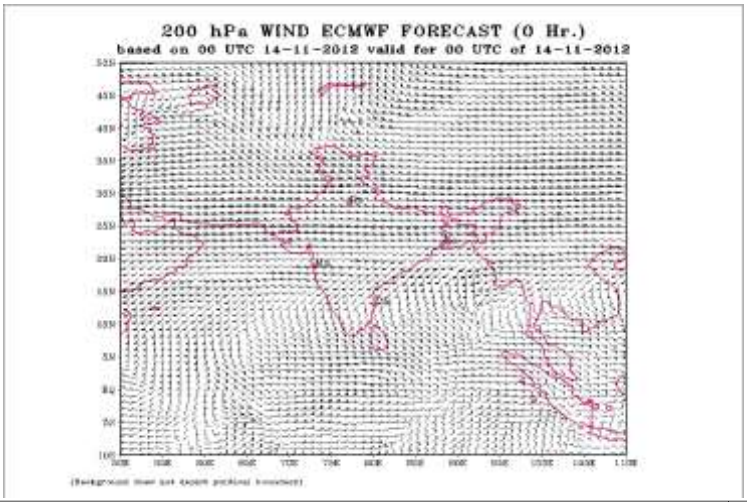

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 14-11-2012 valid for 00 UTC of 14-11-2012

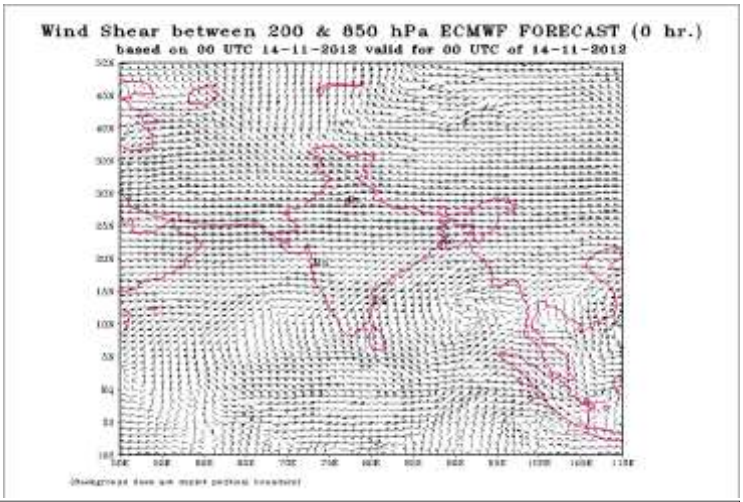

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 14-11-2012 valid for 00 UTC of 14-11-2012

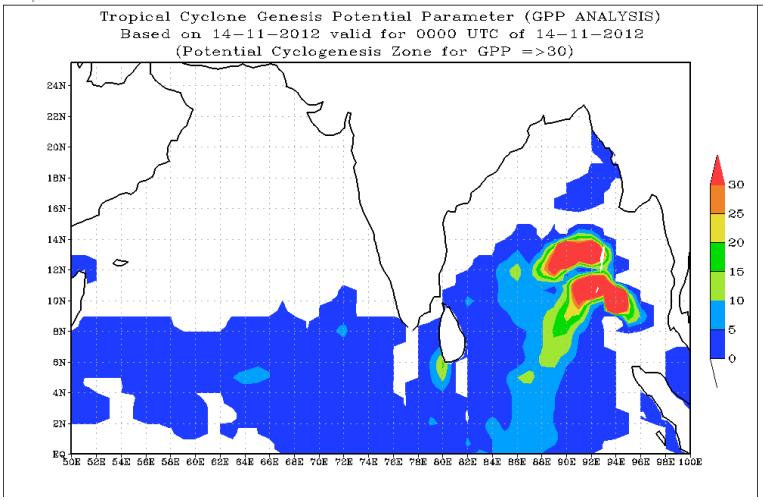

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 14-11-2012 valid for 00 UTC of 14-11-2012

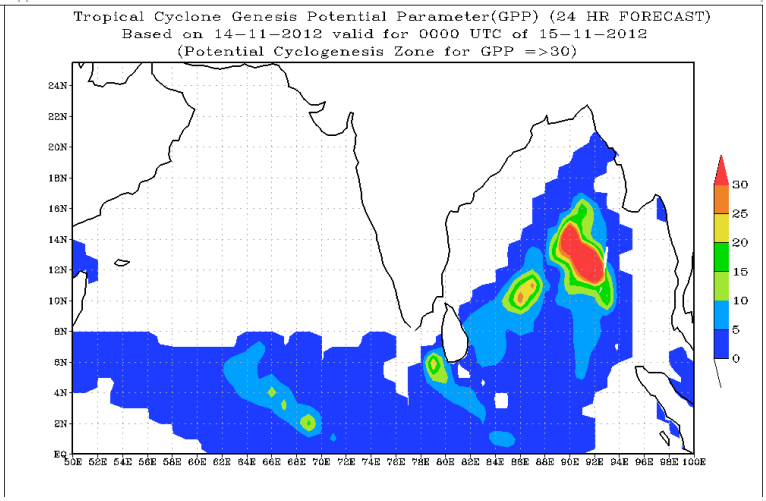

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 14-11-2012 valid for 00 UTC of 14-11-2012

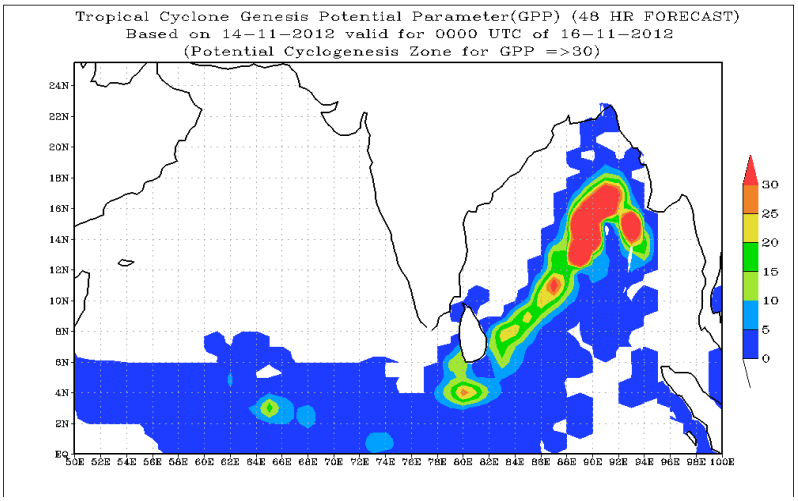

500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 14-11-2012 valid for 00 UTC of 14-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 14-11-2012 valid for 00 UTC of 14-11-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 14-11-2012 valid for 00 UTC of 14-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 14-11-2012 valid for 0000 UTC of 14-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 14-11-2012 valid for 0000 UTC of 15-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 14-11-2012 valid for 0000 UTC of 16-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 15th November, 2012

**Synoptic features based on 0300 UTC:**

- Yesterday's low pressure area now lies over southeast and adjoining central & southwest Bay of Bengal.
- 24 hr pressure change is negative over A & N island by about 1 hPa.
- ITCZ runs along $12^0$N.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-$30^0$C over southeast, central Bay of Bengal and Andaman sea.

**Ocean thermal energy:**

- Ocean thermal energy is 80-100 KJ $cm^{-2}$ over southeast, east central Bay of Bengal and Andaman sea and less than 50 KJ $cm^{-2}$ over southwest Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is negative ($5.0* 10^{-5}$ $s^{-1}$ ) over Southeast and, central Bay of Bengal.

**Convergence:**

- Lower level convergence of the order of $15* 10^{-5}$ $s^{-1}$ over southeast and eastcentral Bay of Bengal, east of low pressure area oriented in north south orientation.

**Divergence:**

- Upper air divergence of the order of 20-30*$10^{-5}$ $s^{-1}$ over southeast and east central Bay of **Bengal,** east of low pressure area oriented in north-south direction.

**Wind Shear:**

- Wind Shear is high of order of 10-20 knots over southeast and central Bay of Bengal.

**Wind Shear Tendency:**

- Negative of the order of 5-10 knot over southeast and central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through latitude 15.0°N.

**M.J.O. Index:**

- Located over phase 5 with amplitude <1.
- Statistical forecast: - MJO moved to phase 6 during next 5 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude <1 and will move in phase 4 and 5 in next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite advisory**

Broken low/medium clouds with embedded moderate to intense convection over Bay between lat 7.5N to 17.0N long 86.5E to 92.5E in association with low level circulation over the area. Broken low/medium clouds with embedded moderate convection over north Andaman sea and rest east central Bay.

**NWP Analysis**

- **IMD-GFS** – analysis indicates a low pressure area centred near 13N/87E over the Bay of Bengal. The forecast indicates movemevt in the direction of N/NE for 3 days and again shifted westward in subsequent 2 days. Slight intensification may be on day 3rd (18th)
- **IMD-WRF** model MSLP & wind charts of 00 UTC analysis of 15 November 2012 Indicates a low, which would moves west/NW in the forecast. Not indicating any intensification.
- **ECMWF** model MSLP and WIND charts also show a Low in the analysis slightly to the south (7N/87E). The forecast indicates its movement N/NE ward in 24 hr and again in Nwly direction in subsequent 24 hr. In subsequent 3 days the sysyem is indicating slight northward movement.
- The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**NCMRWF NCUM (dated 00Z14Nov2012):**

- Weak cyclonic circulation at 90E north of the equator seen at 950 hPa, 850 hPa and 700 hPa levels
- The forecasts (Day-1, and Day-2) indicate northwest ward movement. In the Day-3 forecast valid for 00z17$^{th}$ Nov2012, the cyclonic circulation is located at 14N/ 87E.
- The forecasts (Day-4, Day-5 and Day-6) suggest further intensification with a rapid movement in the north-eastern direction towards Arakan coast.

**NCMRWF GEFS (Analysis dated 00Z14Nov2012):**

- The Ensemble mean analysis shows weak and broad cyclonic circulation at 7N/89E seen at 950 hPa, 850 hPa and 700 hPa levels.
- The ensemble mean forecasts indicate movement of the cyclonic circulation in the northeasterly direction in the day-1, day-2, day-3 and day-4 forecasts and cross Arakan coast between day-4 and day-5.

**Genesis Potential Parameter (GPP):**

- GFS Model analysis shows a zone with significant GPP values (>30) at about 13 deg.N and 91 deg.E. The zone is likely to persist, while moving in a northerly/NE direction on day 1 and 2 days with day 1 forecast indicating slightly more expanded area of GPP > 30. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- **ECMWF** model charts based on 150000 UTC shows low pressure area remain prominent as low moving West-northwestwards near to north Tamilnadu coast by 21$^{st}$ Nov. However, it weakens slightly near the coast.

- **IMD GFS** model charts based on 150000 UTC shows the low pressure area would not intensify further and recurve towards northeast Bay of Bengal during next 4 days and move southwestwards thereafter
- **ARP model** shows that the low would move northwestwards during next 72 hrs without intensification.
- **JMA model** suggests the low to move west-northwestwards towards southwest Bay and adjoining westcentral Bay of Bengal during next 72 hrs
- **GEFS-NCMRWF** model shows that the low pressure would move northeastwards during next 5 days.
- **Unified model NCMRWF** shows the low pressure would move northeastwards towards Myanmar coast during next 5 days.

**Advisory:**

- Considering the suggestions of NWP models and environmental parameters the low pressure area would move northwestwards during next 48 hrs.
- The probability of its intensification into a Depression during next 48 hrs remains low as no model predicts intensification and cloud mass is sheared to bnorth-northeast. However it may becomes well marked as the wind shear over region has decreased during past 24 hrs
- **No IOP during next 3 days**

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **14/12** | **15/00** | **15/03** |
| **India** | 54 | 36 | 54 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 3/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/17 | 17/18 |
| **Tamil Nadu** | 13/13 | 8/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 10/11 | 9/11 | 10/11 |
| **Myanmar** | 10/11 | 10/11 | 6/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 7/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **14/12** | **15/00** | **15/03** |
| **India** | 84 | 0 | 51 |
| **WB** | 9/20 | 0/20 | 7/20 |
| **ODS** | 24/38 | 0/38 | 25/38 |
| **AP** | 26/35 | 0/35 | 19/35 |
| **TN** | 23/26 | 0/26 | 0/26 |
| **PDC** | 2/2 | 0/2 | 0/2 |

- **RS/RW** (12Z) of 14-11-2012: 05/39
- **No. of Ascents reaching 250 hPa levels:, MISDA:-34**
- **RS/RW** (00Z) of 15-11-2012: 18/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:21**

**No. of PILOT Ascents**

| 14/12Z | 15/00Z |
|---|---|
| 13/37 | 14/34 |

**Buoy Data**

| 14/12Z | 15/00Z | 15/03Z |
|---|---|---|
| 15 | 17 | 18 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **14.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **22** | **20** | **20** | **22** | **19** | **18** | **18** |

**No. of RS/RW Ascents**

**00Z /14.11.2012 : 3**

No. of Ascents reaching 250 hPa level =3

**MISDA : 5**

**12Z /14.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

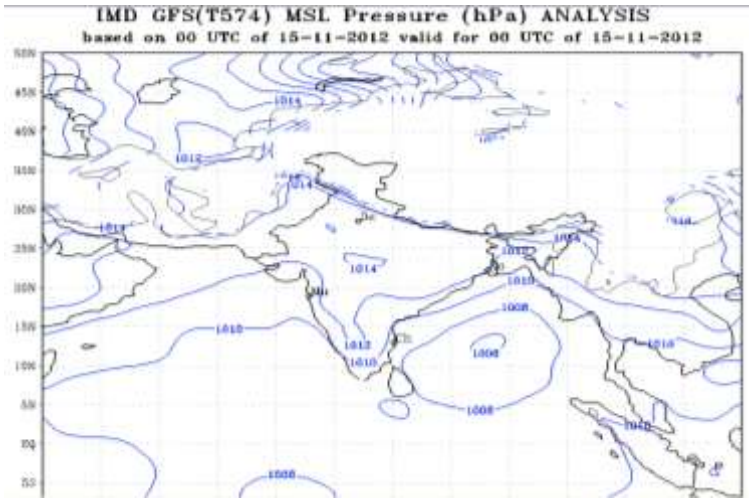
**MISDA : 8**

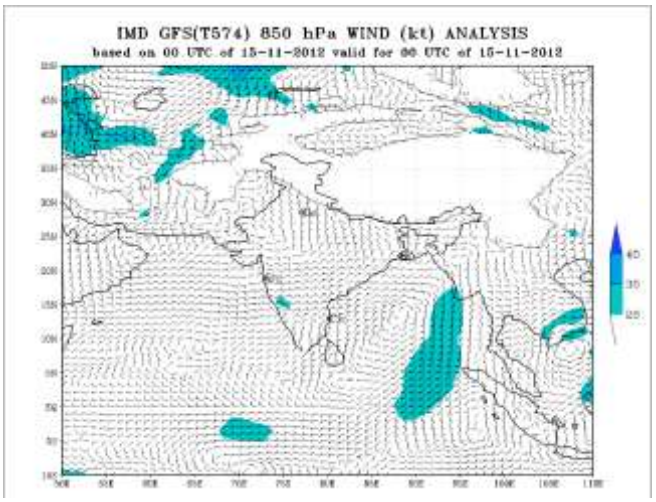
**No. of PILOT Ascents:**

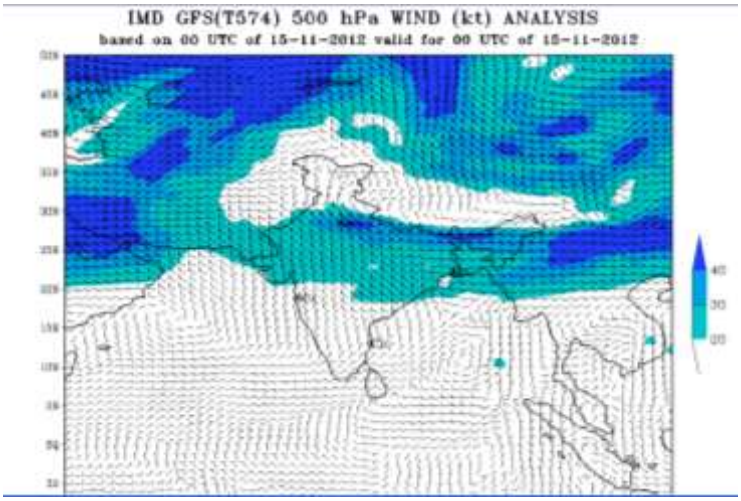
**14.11.2012**

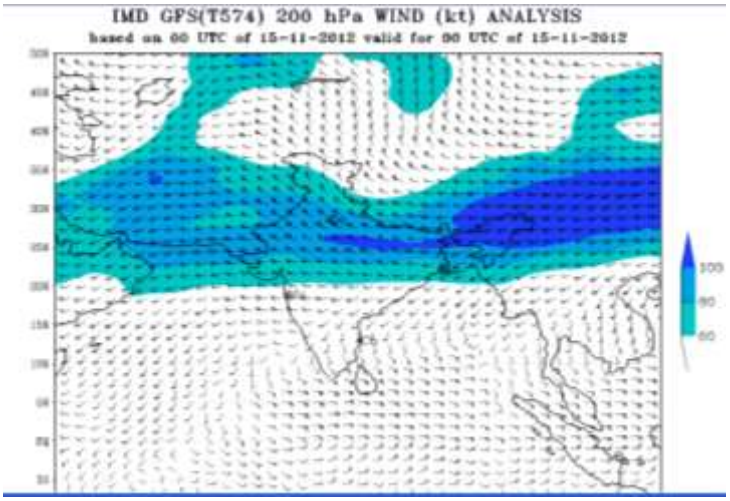
| 06Z | 18Z |
|---|---|
| 7 | 5 |

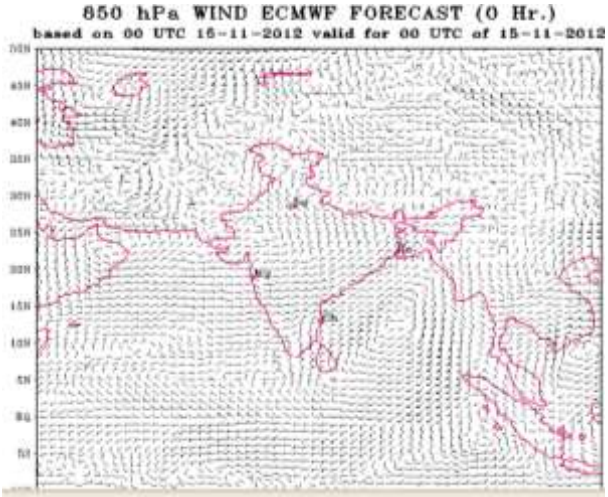
## Annexure II

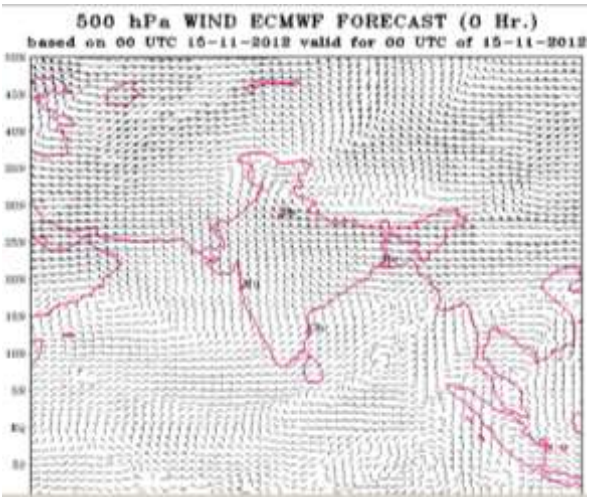

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 15-11-2012 valid for 00 UTC of 15-11-2012

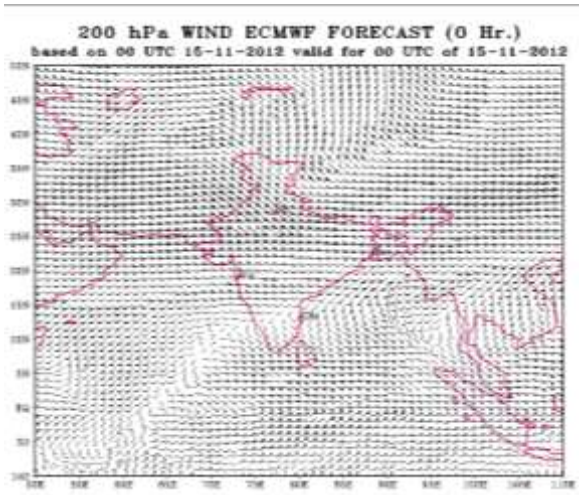

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 15-11-2012 valid for 00 UTC of 15-11-2012

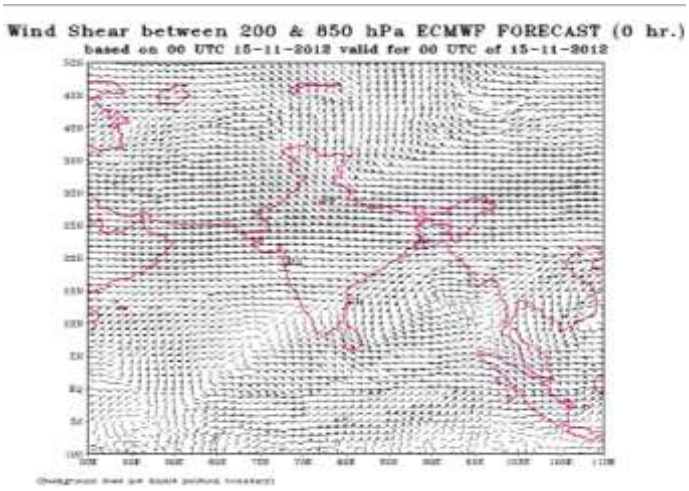

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 15-11-2012 valid for 00 UTC of 15-11-2012

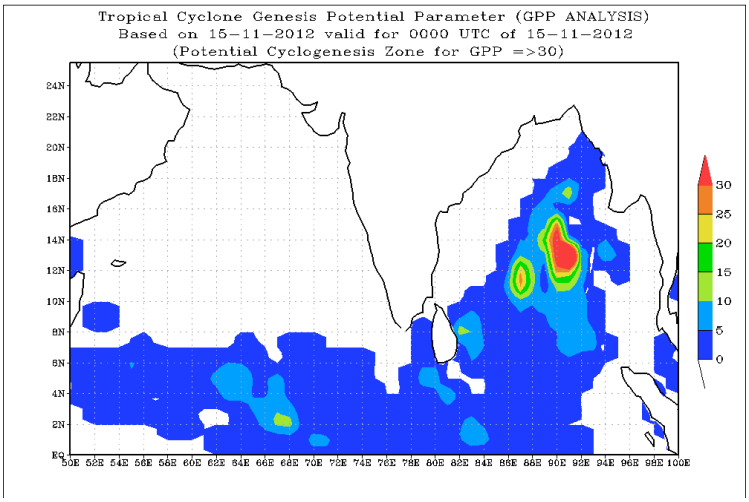

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 15-11-2012 valid for 00 UTC of 15-11-2012

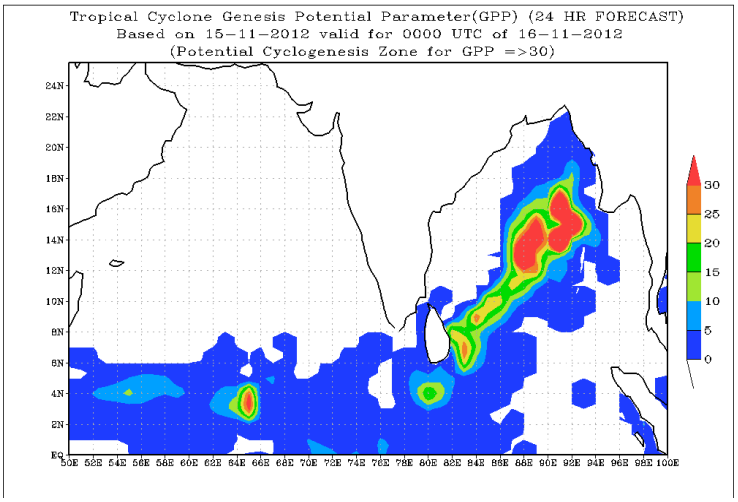

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 15-11-2012 valid for 00 UTC of 15-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 15-11-2012 valid for 00 UTC of 15-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 15-11-2012 valid for 00 UTC of 15-11-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 15-11-2012 valid for 00 UTC of 15-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 15-11-2012 valid for 0000 UTC of 15-11-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 15-11-2012 valid for 0000 UTC of 16-11-2012
(Potential Cyclogenesis Zone for GPP =>30)
30
25
20
15
10
5
0

## FDP (Cyclone) NOC Report Dated 16th November, 2012

**Synoptic features based on 0300 UTC:**

- The low pressure area over southeast and adjoining central & southwest Bay of Bengal now lies over east central Bay of Bengal and adjoining southeast and west central Bay of Bengal. Associated cyclonic circulation extends upto 2.1 kms a.s.l. System may become well marked during next 24 hours.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over southeast, central Bay of Bengal and Andaman sea.

**Ocean thermal energy:**

- Ocean thermal energy is 80-100 KJ cm$^{-2}$ over southeast, east central Bay of Bengal and Andaman sea and less than 50 KJ cm$^{-2}$over southwest Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over Southeast and, central Bay of Bengal

**Convergence:**

- Lower level convergence of the order of 10-15* 10$^{-5}$ s$^{-1}$ over southeast and eastcentral Bay of Bengal, east of low pressure area oriented in north south orientation.

**Divergence:**

- Upper air divergence of the order of 20-30*10$^{-5}$ s$^{-1}$ over southeast and east central Bay of Bengal, east of low pressure area oriented in north-south direction.

**Wind Shear:**

- Wind Shear is of order of 5-10 knots over Low Pressure area in Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing of the order of 5-10 knot over southeast and central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at 200 hPa passes through latitude 12.0°N to the east of 90$^0$E and tilts northward to the western longitude.

**M.J.O. Index:**

- Located over phase 5 with amplitude <1.
- Statistical forecast: - MJO moved to phase 5
- Dynamical forecast: - MJO located in phase 5 with amplitude <1 and will move in phase 6 in next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**
Vortex lies over east central bay centered within half a degree of lat 14.5N long 91.0E .Intensity T1.0 . Associated intense to very intense clouds are seen over Bay of Bengal between lat 7.5 N to 16.0N long 84.0Eto 92.0E and Andaman Islands . Moderate to intense convective clouds are seen at many places over rest east central Bay, Arakan coast. The CTT is about $60^0$C

(See ftp://192.168.12.75/imd/satmet,
http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** – analysis indicates circulation at higher levels associated with a low pressure area over the central Bay of Bengal. The forecast indicates movement in the direction of W/NW for day 2 to day 3 with slight intensification.
- **IMD-WRF** model MSLP & wind charts of 00 UTC anaysis of 16 November 2012 Indicates circulation associated with a low, which indicates west/NW movement in the forecast with slight intensification.
- **ECMWF** model MSLP and WIND charts also show a circulation in the analysis over central BOB. The forecast indicates its movement W/WSW in next 4 days
- The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

GFS Model analysis shows a zone with significant GPP values (>30) over central BoB. The zone is likely to persist for next 3 days. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**NCMRWF NCUM (dated 00Z15Nov2012):**

**Forecast valid from 00Z16 to 00z22 Nov2012**

- The forecasts (Day-1, Day-2 and Day-3) indicate northeast ward movement. In the Day-3 forecast valid for 00z 18th Nov2012, the cyclonic circulation is located at 14N/ 90E. No change in intensity.

**NCMRWF GEFS:(Global Ensemble Forecast System (GEFS) forecast of NCMRWF) (dated 00Z15Nov2012):**
**Forecast valid from 00Z16 to 00z22 Nov2012**

- The ensemble mean forecasts indicate slow movement of the cyclonic circulation in the north easterly direction in the day-1, day-2, day-3 and day-4 forecasts.

**Summary and conclusion**

- **ECMWF** model charts based on 160000 UTC show a low in the analysis over central BOB. The forecast indicates its movement W/WSW in next 4 days

- **IMD GFS** model charts based on 160000 UTC analysis indicates circulation at higher levels associated with a low pressure area over the central Bay of Bengal. The forecast indicates movement in the direction of W/NW for day 2 to day 3 with slight intensification.
- **JMA model** suggests the low to move west-northwestwards towards southwest Bay and adjoining westcentral Bay of Bengal during next 72 hrs.
- **GEFS-NCMRWF** The ensemble mean forecasts indicate slow movement of the cyclonic circulation in the north easterly direction in the day-1, day-2, day-3 and day-4 forecasts.
- **Unified model NCMRWF** The forecasts (Day-1, Day-2 and Day-3) indicate northeast ward movement. In the Day-3 forecast valid for 00z 18$^{th}$ Nov2012, the cyclonic circulation is located at 14N/ 90E. No change in intensity.

**Advisory:**

- Upper-level analysis depicts the disturbance underneath the subtropical ridge axis in an area of light (05-10 knot) vertical windshear, in addition to the good divergence being produced, there is moderate divergence due to the mid-latitude westerlies to the north, however the 850mb vorticity signature is very elongated northeast to southwest; indicative of the general troughing in the area . Sea surface temperatures and Ocean thermal energy are extremely conducive for tropical cyclogenesis at 28-30 degrees C. Maximum sustained surface winds are estimated at 10 to 15 knots as per OSCAT and available Buoys and Ships.
- Most of the models indicate movement in W NW'ly direction. ECMWF indicates W/SW'ly movement and GEFS indicates NE'ly movement over next 72 hours howsoever most models are in agreement that there may be no intensification except ECMWF, which indicates intensification into a depression over next 24 hrs and then further weakening.
- The potential for the development of a significant tropical cyclone within the next 24 hours hence continue to be low.
- **No IOP during next 3 days**

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | 15/12 | 16/00 | 16/03 |
| India | 85/89 | 70/79 | 81/89 |
| Coastal stations | | | |
| WB | 10/11 | 4/7 | 10/11 |
| Odisha | 10/10 | 6/7 | 10/10 |
| AP | 18/18 | 17/18 | 18/18 |
| Tamil Nadu | 13/13 | 10/10 | 13/13 |
| Puducherry | 2/2 | 1/2 | 2/2 |
| A & N | 1/1 | 1/1 | 1/1 |
| Bangladesh | 10/11 | 9/11 | 10/11 |
| Myanmar | 10/11 | 10/11 | 6/11 |

| | | | |
|---|---|---|---|
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 8/9 |

**AWS observation**

| **Region** | **Date/Time (UTC)** | | |
|---|---|---|---|
| | **15/12** | **16/00** | **16/03** |
| **India** | 82/121 | 80/121 | 56/121 |
| **WB** | 9/20 | 9/20 | 5/20 |
| **ODS** | 27/38 | 26/38 | 22/38 |
| **AP** | 25/35 | 25/35 | 17/35 |
| **TN** | 19/26 | 18/26 | 11/26 |
| **PDC** | 2/2 | 0/2 | 0/2 |

- **RS/RW** (12Z) of 15-11-2012: 03/39
- **No. of Ascents reaching 250** hPa levels:, **MISDA:-36**
- **RS/RW** (00Z) of 16-11-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:20**

**No. of PILOT Ascents**

| **14/12Z** | **15/00Z** |
|---|---|
| 4 | 8 |

**Buoy Data**

| **14/12Z** | **15/00Z** | **15/03Z** |
|---|---|---|
| 4 | 8 | 10 |

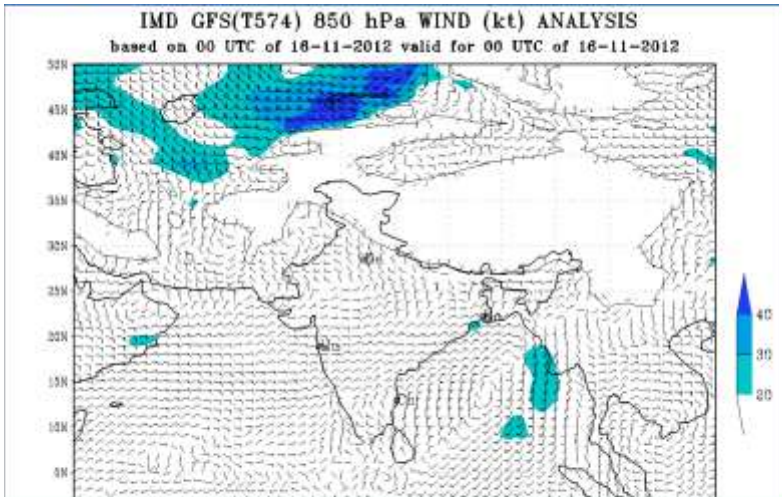
**Data Statistics over RMC Chennai Region**

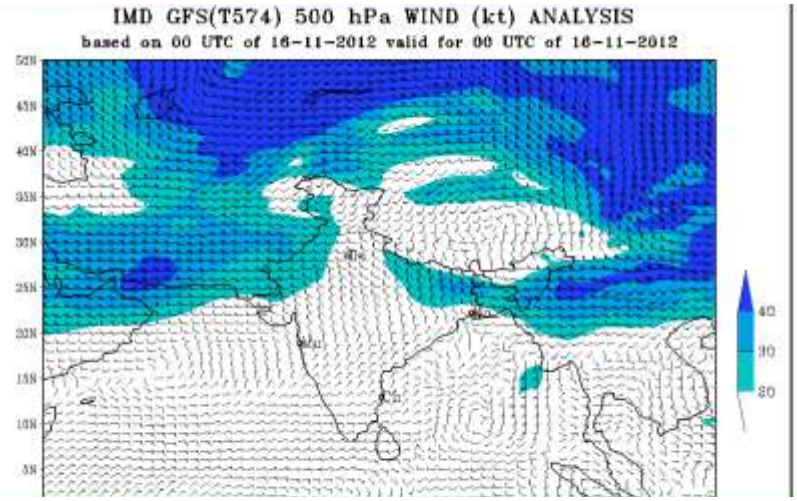
**No of Synop data**

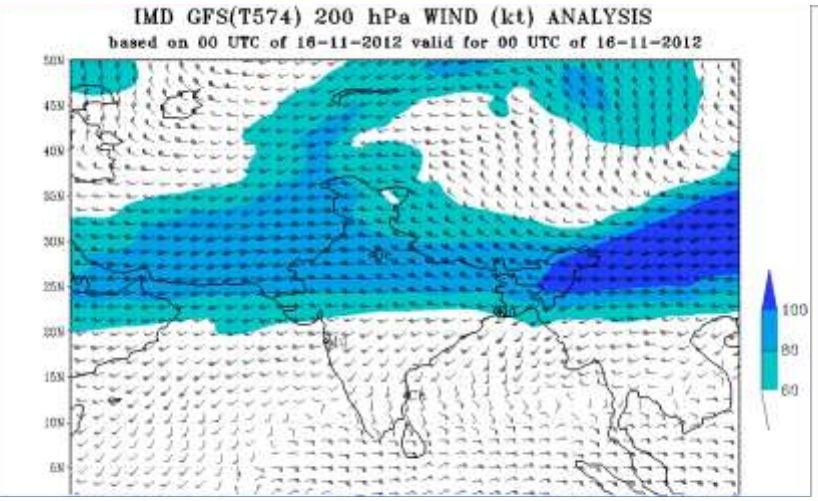
| **Date** | **15.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC—** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

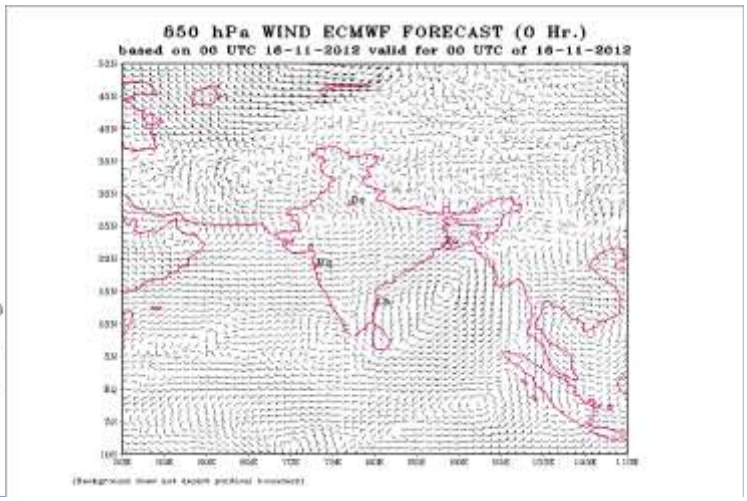
**No. of RS/RW Ascents 00Z /15.11.2012 : 3**
No. of Ascents reaching 250 hPa level =3
**MISDA : 5 12Z /15.11.2012 : 0**
No. of Ascents reaching 250 hPa level =0
**MISDA : 8**

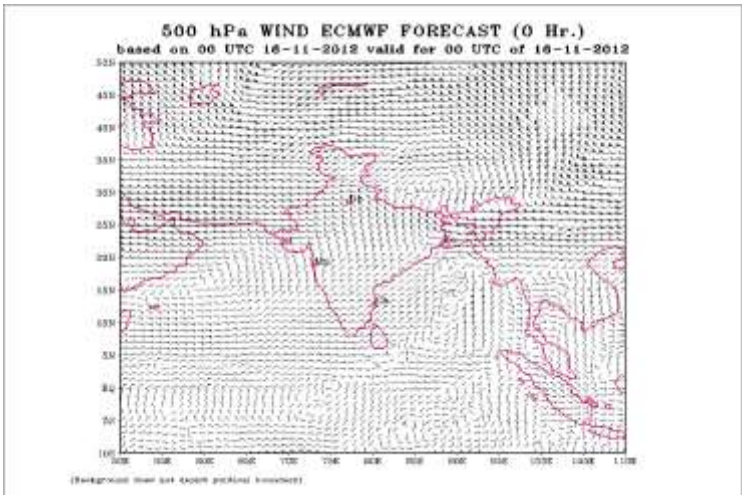
**Annexure- II**

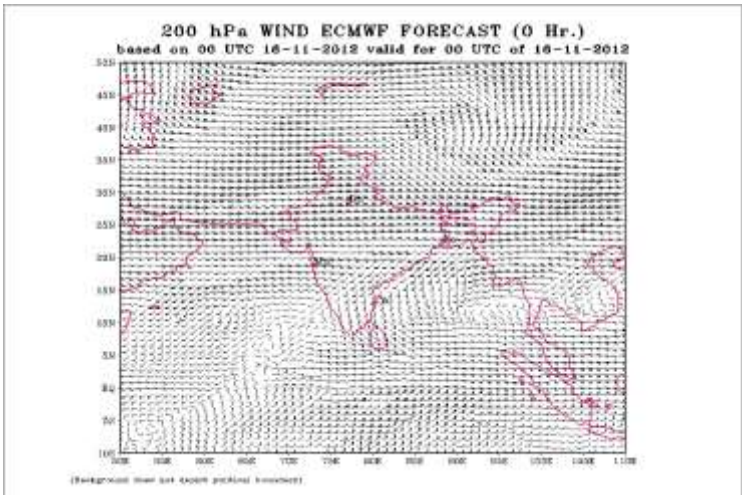

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 16-11-2012 valid for 00 UTC of 16-11-2012
40
30
20

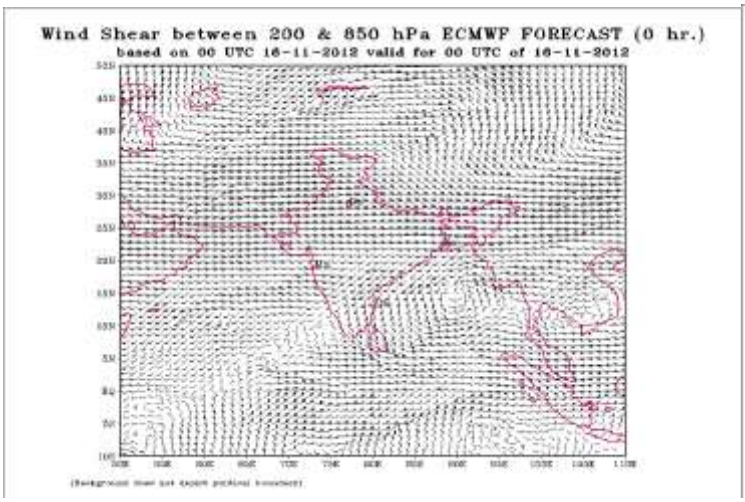

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 16-11-2012 valid for 00 UTC of 16-11-2012
40
30
20

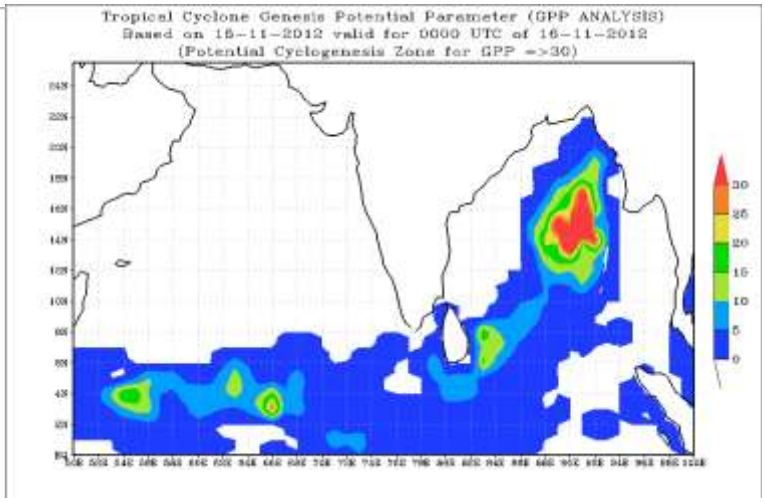

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 16-11-2012 valid for 00 UTC of 16-11-2012
100
80
60

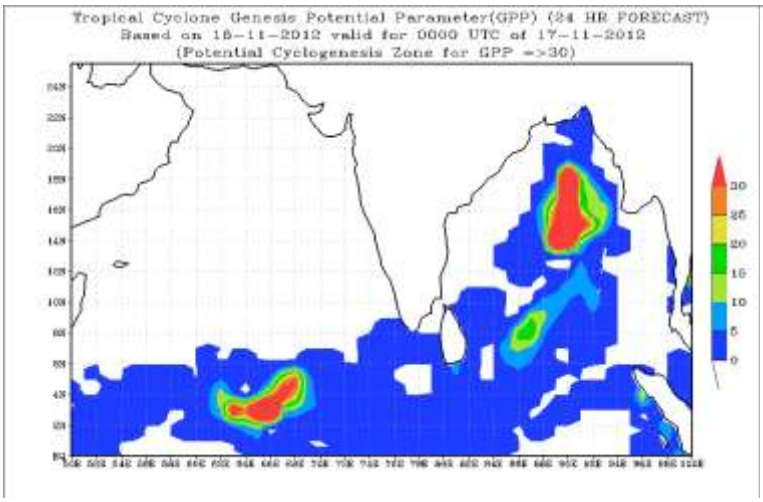

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 16-11-2012 valid for 00 UTC of 16-11-2012

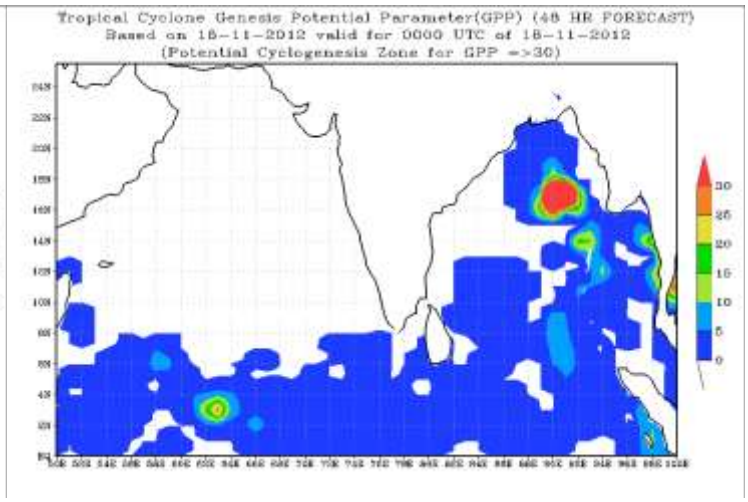

500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 16-11-2012 valid for 00 UTC of 16-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 16-11-2012 valid for 00 UTC of 16-11-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 16-11-2012 valid for 00 UTC of 16-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 15-11-2012 valid for 0000 UTC of 16-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 15-11-2012 valid for 0000 UTC of 17-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 15-11-2012 valid for 0000 UTC of 18-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 17th November, 2012

**Synoptic features based on 0600 UTC:**

- The low pressure area over over east central Bay of Bengal and adjoining southeast and west central Bay of Bengal concentrated into a depression and lay centred at 0600 UTC of today, the 17th November 2012 over eastcentral Bay of Bengal near latitude 15.5° N and longitude 90.0° E, about 1050 km east-northeast of Chennai, 750 km east-southeast of Visakhapatnam, 650 km southeast of Paradip. The system would intensify into a deep depression and move slowly northwestwards during next 24 hrs. It would move west/west-southwestwards towards south Andhra Pradesh and north Tamil Nadu coasts during subsequent 48 hrs.

**Environmental features based on 0600 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over southeast, central Bay of Bengal and Andaman sea.

**Ocean thermal energy:**

- Ocean thermal energy is around 50- 80 KJ cm$^{-2}$ around system centre. It is less (< 50 KJ cm$^{-2}$) over southwest Bay of Bengal off north Tamil Nadu coast and north Bay of Bengal.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over central Bay of Bengal. The maximum vorticity lies over southwest sector of the system.

**Convergence:**

- Lower level convergence is of the order of 5-10* 10$^{-5}$ s$^{-1}$ over central Bay of Bengal.

**Divergence:**

- Upper air divergence of the order of 10- 20*10$^{-5}$ s$^{-1}$ over central and north Bay of Bengal.

**Wind Shear:**

- Wind Shear is of order of 5-10 knots over central Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing of the order of 5-10 knot over north Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through latitude 13.0°N to the east of $90^0$E.

**M.J.O. Index:**

- Located over phase 5 with amplitude <1.
- Statistical forecast: - MJO moved to phase 5
- Dynamical forecast: - MJO located in phase 5 with amplitude <1 and will move in phase 6 in next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite advisory**

Vortex over east central Bay centered near $15.5^0$N/long $90.0^0$E. Intensity T1.5. CTT - 79 °C. Associated broken to solid low/medium clouds with embedded intense to very intense convection seen over Bay of Bengal bet lat. $13.5^0$N to $20.5^0$N east of long $88.0^0$E adjoining Arakan coast

**NWP Analysis**

- **IMD-GFS** – analysis indicates cycer at lower associated with a Dep over the central Bay of Bengal. The forecast indicates movemevt in the direction of W/NW for day 2 to day 3 with slight intensification.
- **IMD-WRF** model MSLP & wind charts of 00 UTC anaysis of 17November 2012 Indicates cycer associated with a low, which indicates west/NW movement in the forecast with slight intensification during next 3 days.
- **ECMWF** model MSLP and WIND charts also show a cycer in the analysis at lower level associated with the system over central BOB. The forecast indicates its movement W/WSW in next 4 to 5 days seen over Chennai coast on day 5.
- The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- GFS Model analysis shows a zone with significant GPP values (>30) over central BoB. The zone is likely to persist for next one day and decrease the value subsequently. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**NCMRWF GEFS: (***Analysis dated 00Z16Nov2012)*

- The Ensemble mean analysis shows well developed and broad cyclonic circulation over Bay of Bengal at about 88E. This is seen at 925 hPa, 850 hPa and 700 hPa levels.

**Forecast valid from (00Z17 to 00z23 Nov2012**)

The ensemble mean forecasts indicate intensification and slow movement of the cyclonic circulation in the north easterly direction in the day-1, day-2, day-3. It can be located at 18N/89E in the day-3 forecast.

**Summary and Conclusion:**

- **ECMWF** model charts based on 160000 UTC show a low in the analysis over central BOB. The forecast indicates its movement W/WSW in next 4 days
- **IMD GFS** model charts based on 160000 UTC analysis indicates circulation at higher levels associated with a low pressure area over the central Bay of Bengal. The forecast indicates movement in the direction of W/NW for day 2 to day 3 with slight intensification.
- **JMA model** suggests the low to move west-northwestwards towards southwest Bay and adjoining westcentral Bay of Bengal during next 72 hrs.
- **GEFS-NCMRWF** The ensemble mean forecasts indicate slow movement of the cyclonic circulation in the north easterly direction in the day-1, day-2, day-3 and day-4 forecasts.
- **Unified model NCMRWF** The forecasts (Day-1, Day-2 and Day-3) indicate northeast ward movement. In the Day-3 forecast valid for 00z18$^{th}$ Nov2012, the cyclonic circulation is located at 14N/ 90E. No change in intensity.

**Advisory:**

- Most of the NWP model models suggest the intensification of the system into a deep depression during next 24 hrs and subsequently, it may weaken gradually as it moves closer to coast. Dynamical- statistical model of IMD also suggests the system to intensify. With respect to track, most models suggest northwestward/ west-northwestward movement during next 24 hrs and westward/west-southwestward movement during subsequent 72 hrs towards north Tamil Nadu and south Andhra Pradesh coasts.
- **IOP is declared for north coastal Tamil Nadu and coastal Andhra Pradesh for 19$^{th}$ and 20$^{th}$ November.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **16/12** | **17/00** | **17/03** |
| **India** | 185/204 | 133/159 | 187/206 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 10/11 | 9/11 | 10/11 |
| **Myanmar** | 10/11 | 10/11 | 6/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **16/12** | **17/00** | **17/03** |
| **India** | 397/616 | 392/616 | 418/616 |
| **WB** | 9/20 | 9/20 | 9/20 |
| **ODS** | 27/38 | 27/38 | 22/38 |
| **AP** | 25/35 | 25/35 | 26/35 |
| **TN** | 19/26 | 18/26 | 19/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 16-11-2012: 05/39
- **No. of Ascents reaching 250 hPa levels: 1, MISDA:-34**
- **RS/RW** (00Z) of 17-11-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: 14 , MISDA:20**

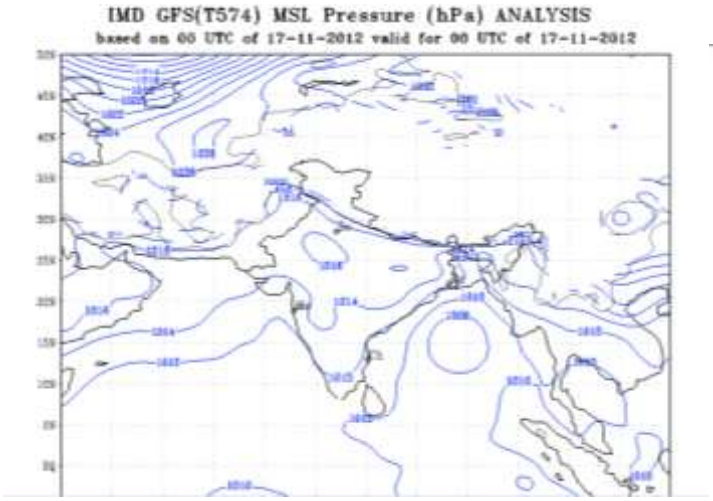
**No. of PILOT Ascents**

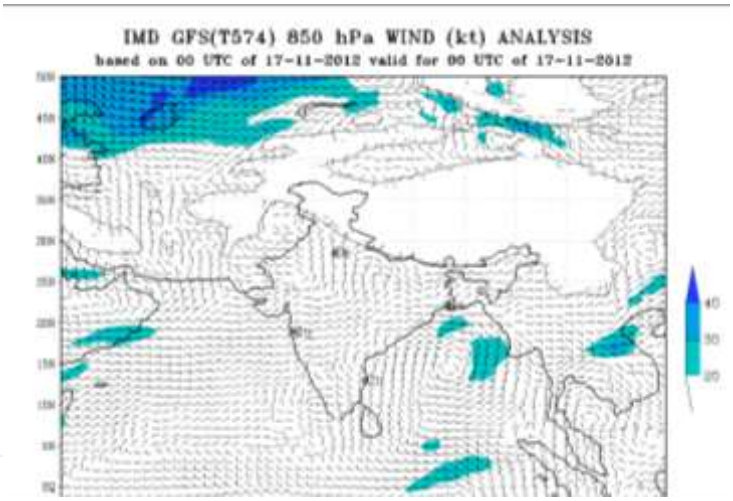
| 16/12Z | 17/00Z |
|---|---|
| 14/37 | 16/34 |

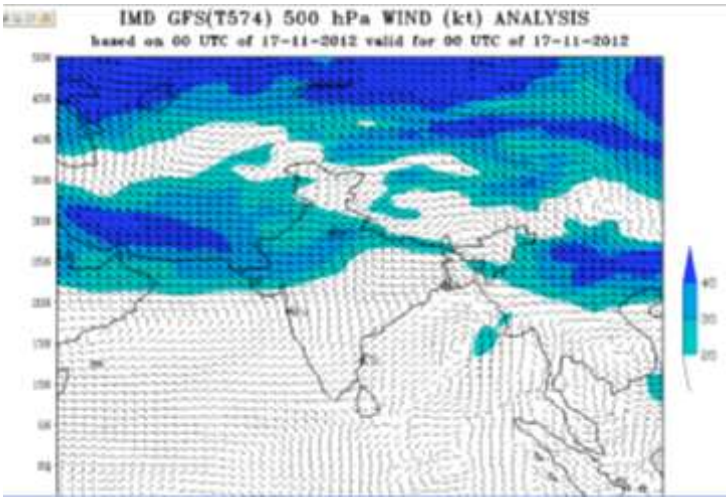
**Buoy Data**

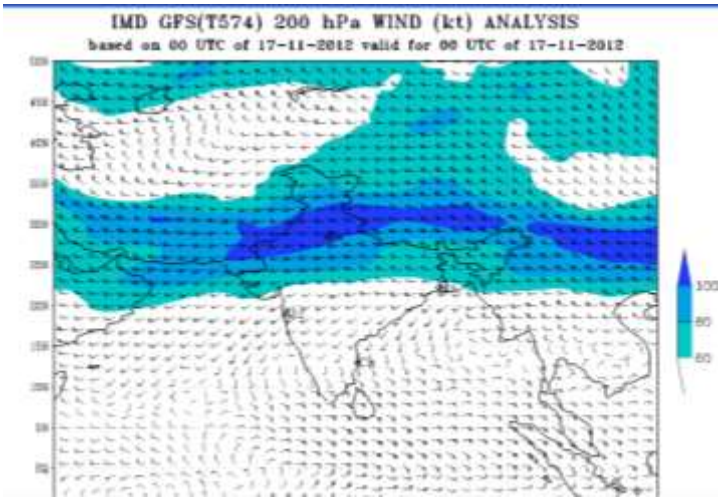
| 16/12Z | 17/00Z | 17/03Z |
|---|---|---|
| 14 | 13 | 13 |

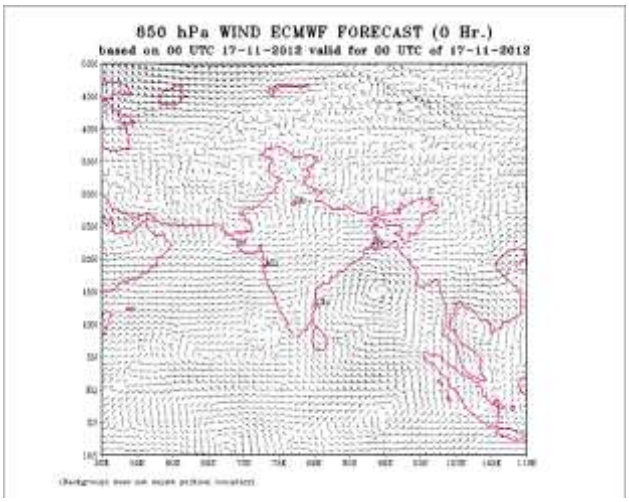
## Annexure II

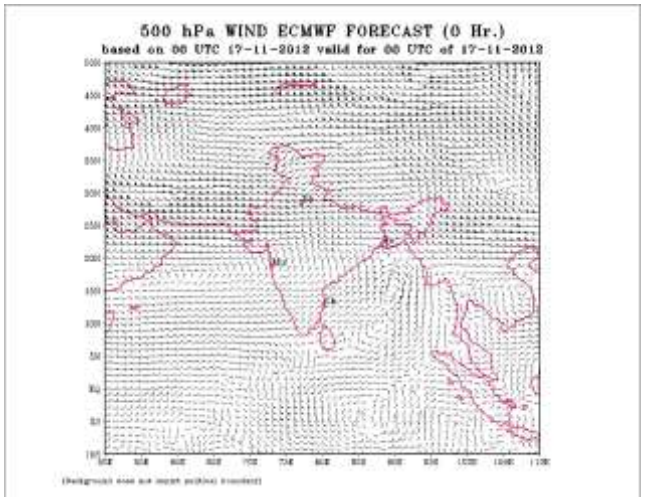

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 17-11-2012 valid for 00 UTC of 17-11-2012

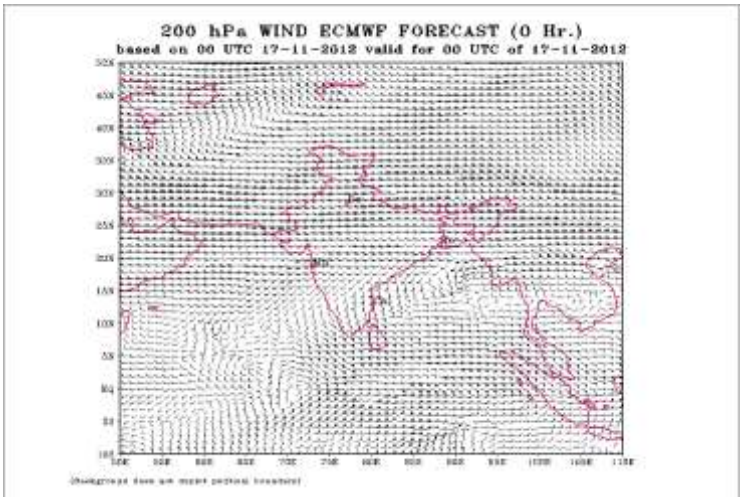

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 17-11-2012 valid for 00 UTC of 17-11-2012

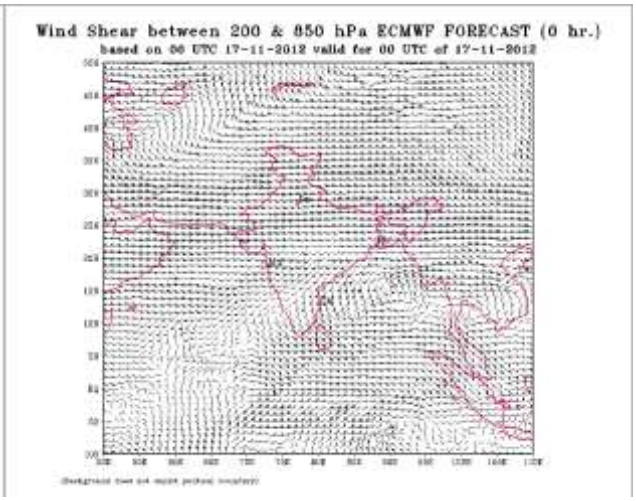

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 17-11-2012 valid for 00 UTC of 17-11-2012

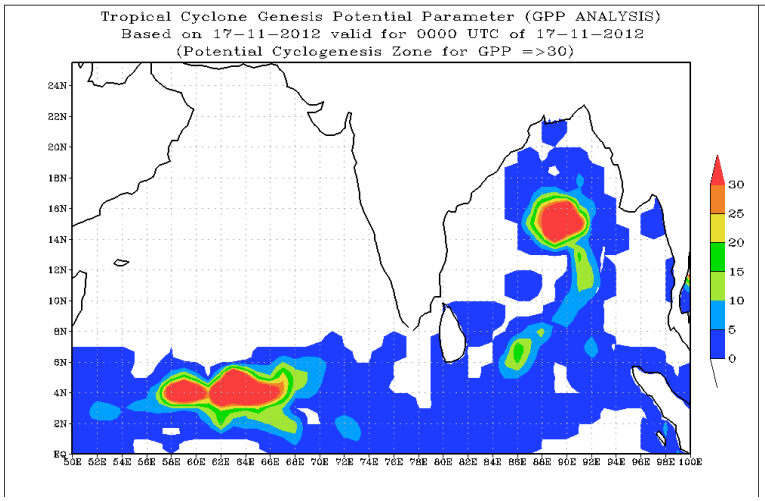

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 17-11-2012 valid for 00 UTC of 17-11-2012

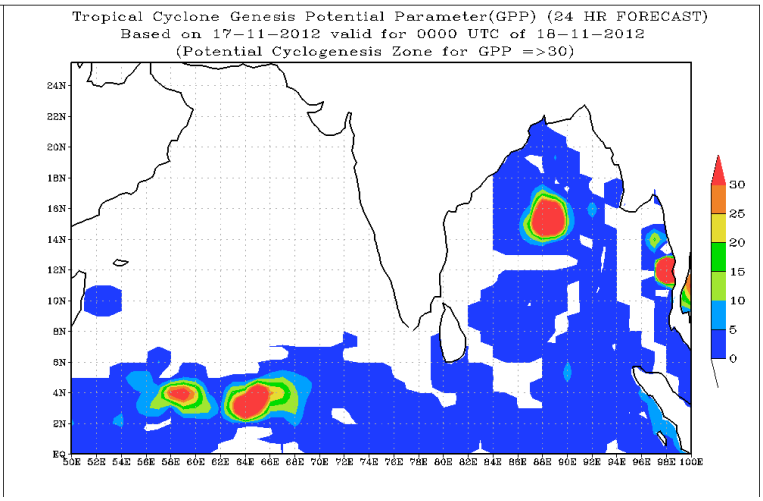

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 17-11-2012 valid for 00 UTC of 17-11-2012

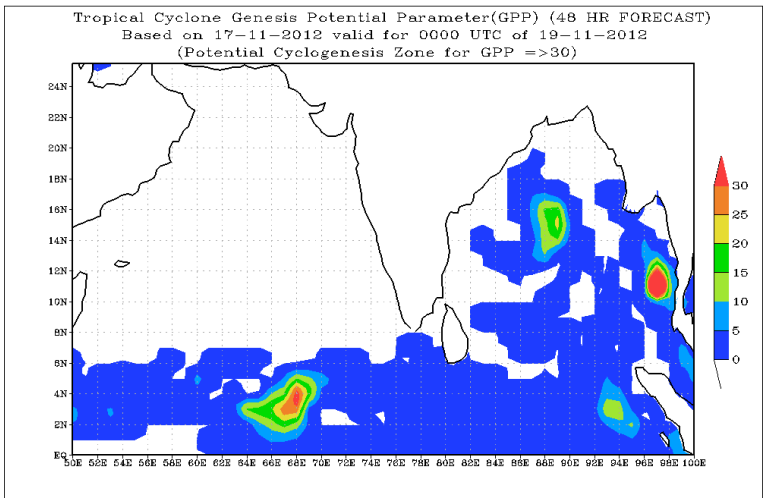

500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 17-11-2012 valid for 00 UTC of 17-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 17-11-2012 valid for 00 UTC of 17-11-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 17-11-2012 valid for 00 UTC of 17-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 17-11-2012 valid for 0000 UTC of 17-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 17-11-2012 valid for 0000 UTC of 18-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 17-11-2012 valid for 0000 UTC of 19-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 18th November, 2012

**Synoptic features based on 0300 UTC:**

- Yesterday depression concentrated into deep depression and lay centered at 0830 hrs IST of today 18th November 2012 near latitude 16.0$^0$N and longitude 88.5$^0$E, about 950 km east-northeast of Chennai, 600 km east-southeast of Visakhapatnam and 520 km southeast of Paradip. The system would move slowly westwards during next 12 hrs and west-southwestwards towards south Andhra Pradesh and north Tamil Nadu coasts and would weaken gradually during next 48 hours.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 30-32$^0$C over east central Bay of Bengal

**Ocean thermal energy:**

- Ocean thermal energy is around 80- 100 KJ cm$^{-2}$ around system centre.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over central Bay of Bengal .of the order of 10* 10-$^4$ s$^{-1}$ .

**Convergence:**

- Lower level convergence is of the order of 10-15* 10$^{-5}$ s$^{-1}$ over central Bay of Bengal.**Divergence:**
- Upper air divergence of the order of 20- 30*10$^{-5}$ s$^{-1}$ over east central Bay of Bengal.

**Wind Shear:**

- Wind Shear is of order of 5-10 knots over central Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing of the order of 5-10 knot over central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at 200 hPa passes through latitude 18.0°N..

**M.J.O. Index:**

- Located over phase 5 with amplitude <1.
- Statistical forecast: - MJO moved to phase 1
- Dynamical forecast: - MJO located in phase 5 with amplitude <1 and will move in phase 1 in next 5 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**

Vortex over east central and adjoining west central Bay of Bengal centred near 16.1N/ 88.2E( Intensity T2.0 . CTT minus 66 deg c ). Broken low/medium clouds with embedded Intense to very intense convection over Bay between lat 15.0N to 19.5N long 86.5E to 93.0E and moderate to intense convection over Bay of Bengal.
(see ftp://192.168.12.75/imd/satmet, http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** – analysis indicates cycer at lower associated with a Dep over the central Bay of Bengal. The forecast indicates movemevt in the direction of W/WSW for day 2 to day 3 with gradual weakening.
- **IMD-WRF** model MSLP & wind charts of 00 UTC anaysis of 18 November 2012 Indicates cycer associated with a low, which indicates west/WSW movement in the forecast for next 2 days with slight weakening. .
- **ECMWF** model MSLP and WIND charts also show a cycer in the analysis at lower level associated with the system over central BOB. The forecast indicates its movement W/WSW in next 3 to 4 days seen over Chennai coast on day 4.
- The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **Genesis Potential Parameter (GPP):**
- GFS Model analysis shows a zone with significant GPP values (>30) over central BoB. The zone of maximum value is likely to decrease tomorrow, although it shows slight increase again on day 2. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**NCMRWF Unified Model (UM) forecast .**

***Analysis dated 00Z17Nov2012***

- **Broad cyclonic circulation over Bay of Bengal at 15N/90E tilting eastward with height; seen at 925,850, and 700 hPa.**

***Forecast valid from 00Z18 to 00z21 Nov2012***

- **The cyclonic circulation is moving westward in day-1, day-2 and day-3 forecasts. In the day-3 forecast valid for 20th Nov 2012, the system is located at 16N/88E**

**NCMRWF GEFS:(Global Ensemble Forecast System (GEFS) forecast of NCMRWF)**

***Analysis dated 00Z17Nov2012***

- **The Ensemble mean analysis shows well developed and broad cyclonic circulation over Bay of Bengal about 16N/90E. The system is seen at 925 hPa, 850 hPa and 700 hPa levels, tilting eastwards with height. The system is further moving in the southwesterly direction and weakening on Sea in day-5 and day-6 forecasts**

***Forecast valid from 00Z18 to 00z21 Nov2012***

**The ensemble mean forecasts indicate intensification and slow movement of the cyclonic circulation westwards in the day-1 and day-2, and south west in day-3 and day4. It can be located at 12N/85E in the day-4 forecast valid for (21st Nov 2012).**

**Summary and Conclusion:**

- **ECMWF, IMD GFS, JMA model, GEFS-NCMRWF and Unified model NCMRWF based on 170000 UTC suggest that the deep depression over east central Bay of Bengal would move west-southwestwards, weaken gradually during next 24 hours and would cross south Tamilnadu and coastal Andhra Pradesh coast by morning of 21$^{th}$ as depression/low.**

**Advisory:**

- Most of the NWP model models suggest that the deep depression would not intensify further.
- **IOP declared for north coastal Tamil Nadu and coastal Andhra Pradesh on 19$^{th}$ and 20$^{th}$ November 2012.**

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **17/12** | **18/00** | **18/03** |
| **India** | 81/89 | 67/79 | 81/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 8/11 | 10/11 | 9/11 |
| **Myanmar** | 9/11 | 8/11 | 7/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 6/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **17/12** | **18/00** | **18/03** |
| **India** | 82/121 | 79/121 | 86/121 |
| **WB** | 8/20 | 8/20 | 9/20 |
| **ODS** | 27/38 | 26/38 | 28/38 |
| **AP** | 26/35 | 25/35 | 26/35 |
| **TN** | 19/26 | 18/26 | 21/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 17-11-2012: 04/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:-35**
- **RS/RW** (00Z) of 18-11-2012: 20/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:19**

**No. of PILOT Ascents**

| 17/12Z | 18/00Z |
|---|---|
| 15/37 | 18/34 |

**Buoy Data**

| 17/12Z | 18/00Z | 18/03Z |
|---|---|---|
| 10 | 10 | 7 |

## No of Synop data

| Date→ | 17.11.2012 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| UTC→ | 00 | 03 | 06 | 09 | 12 | 15 | 18 | 21 |
| Chennai Region (Coasts of AP & TN) | 19 | 23 | 20 | 20 | 20 | 19 | 19 | 18 |

**No. of RS/RW Ascents**

**00Z /17.11.2012 : 3**

No. of Ascents reaching 250 hPa level =3

**MISDA : 5**

**12Z /17.11.2012 : 0**

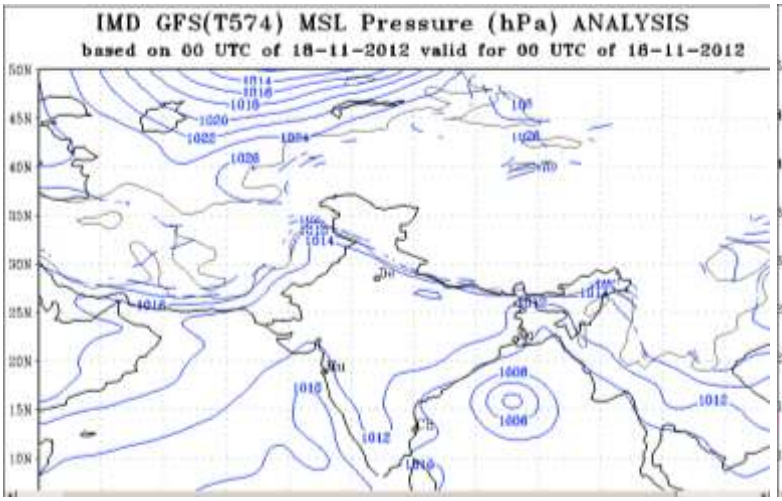
No. of Ascents reaching 250 hPa level =0

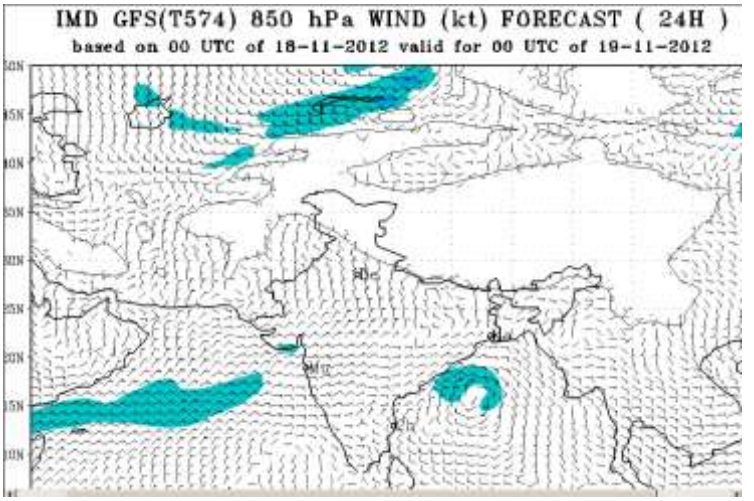
**MISDA : 8**

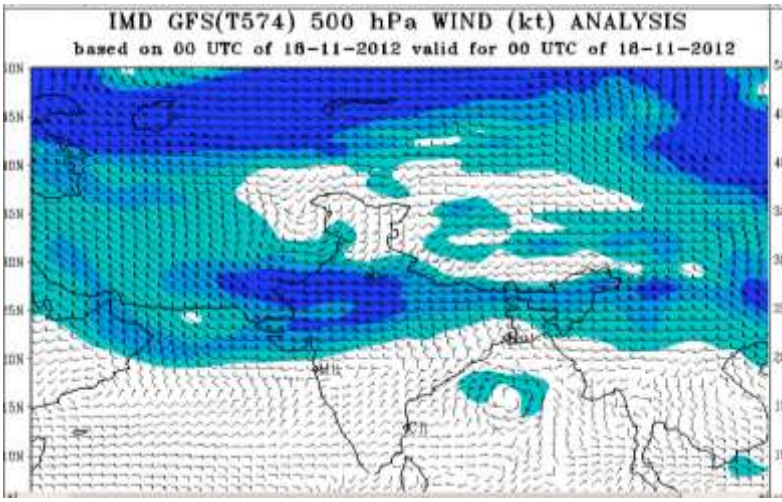
## No. of PILOT Ascents:

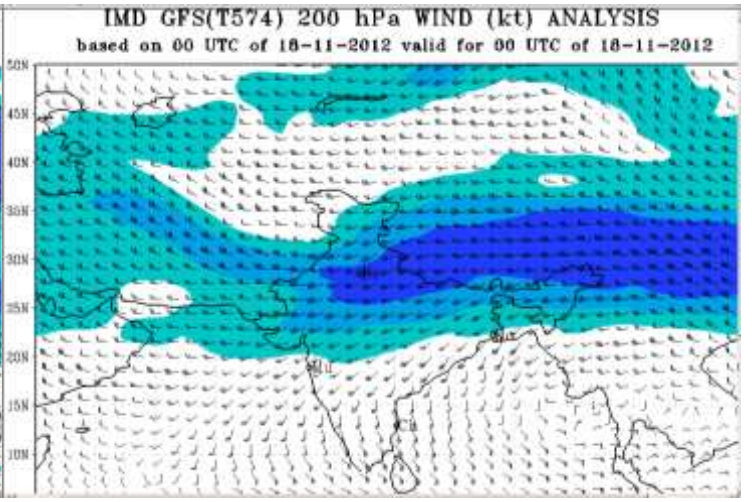
| 17.11.2012 | |
|---|---|
| 06Z | 18Z |
| 7 | 7 |

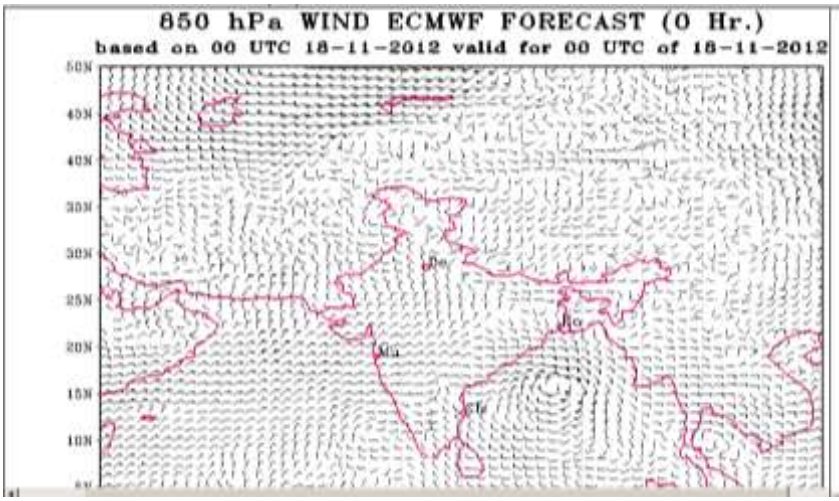
## Annexure II

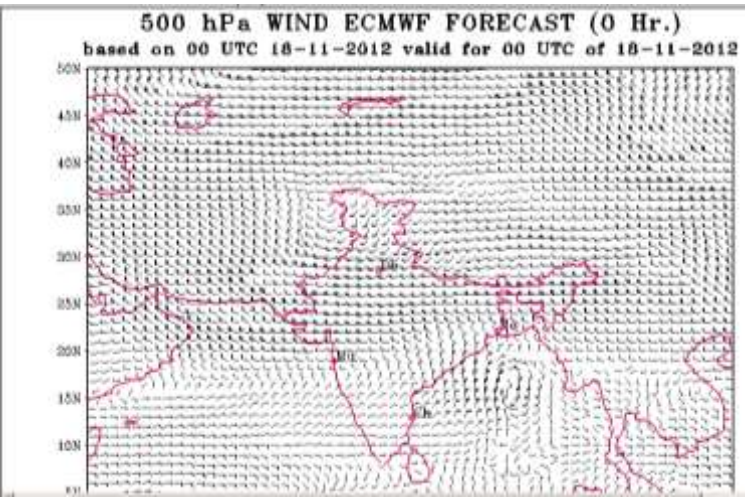

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 18-11-2012 valid for 00 UTC of 18-11-2012


IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 18-11-2012 valid for 00 UTC of 19-11-2012


IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 18-11-2012 valid for 00 UTC of 18-11-2012


IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 18-11-2012 valid for 00 UTC of 18-11-2012


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 18-11-2012 valid for 00 UTC of 18-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
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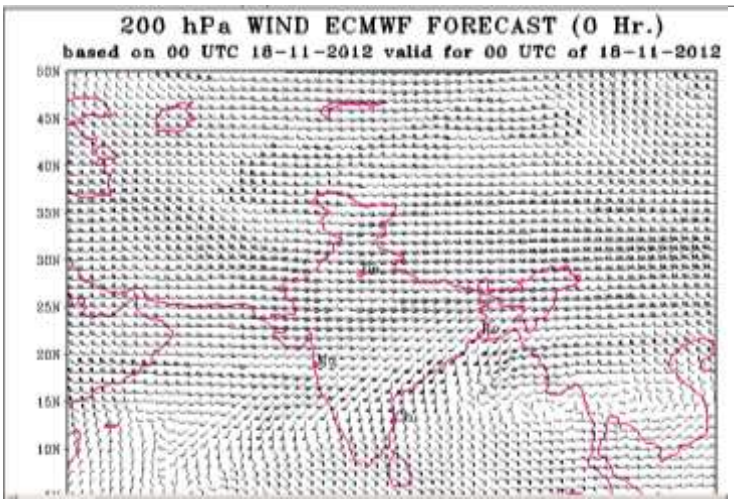
200 hPa WIND ECMWF FORECAST (0 Hr.)
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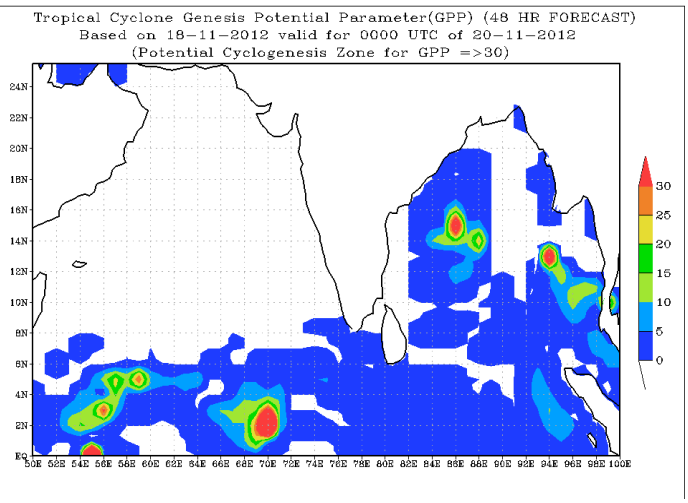
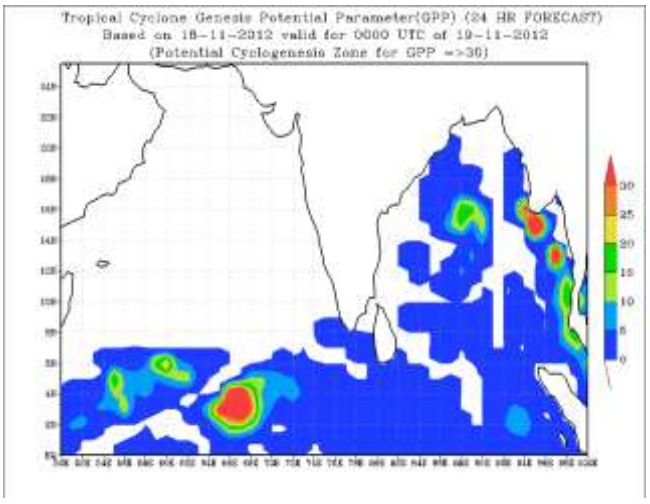
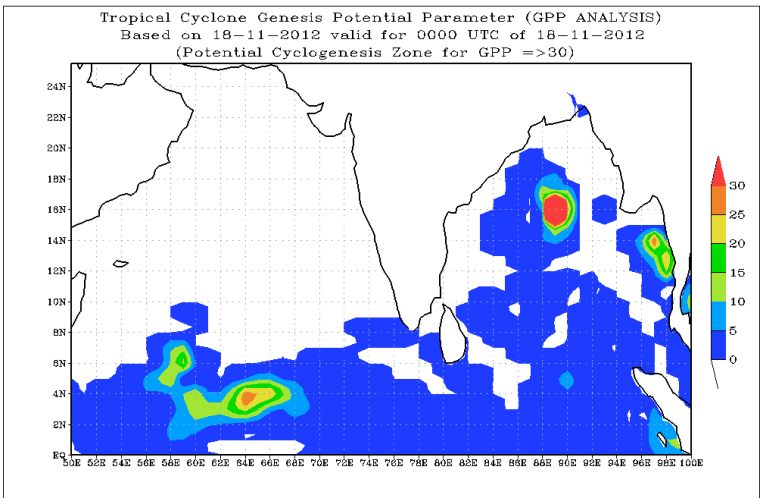

Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 18-11-2012 valid for 0000 UTC of 20-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 18-11-2012 valid for 0000 UTC of 19-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 18-11-2012 valid for 0000 UTC of 18-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 19th November, 2012

**Synoptic features based on 0300 UTC:**

- The depression over westcentral Bay of Bengal moved southwestwards and lay centred at 0830 hrs IST of today the 19th November 2012 near latitude 15.0$^0$N and longitude 86.5$^0$E, about 700 km east-northeast of Chennai and 450 km southeast of Visakhapatnam. The system would move west-southwestwards towards south Andhra Pradesh and north Tamil Nadu coasts and weaken further during next 24 hours.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over east central Bay of Bengal

**Ocean thermal energy:**

- Ocean thermal energy is around 50 to 80 KJ cm$^{-2}$ around system centre.

**Relative Vorticity:**

- Relative vorticity at 850 hPa has decreased as compared to yesterday.

**Convergence:**

- Lower level convergence has decreased and is of the order of 5* 10$^{-5}$ s$^{-1}$ over central Bay of Bengal.

**Divergence:**

- Upper air divergence is of the order of 5*10$^{-5}$ s$^{-1}$ over east central Bay of Bengal.

**Wind Shear:**

- Wind Shear is of order of 20-30 knots near the vortex.

**Wind Shear Tendency:**

- Increasing of the order of 5-10 knot over central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at 200 hPa passes through latitude 16.0°N..

**M.J.O. Index:**

- Located over phase 6 with amplitude <1.
- Statistical forecast: - MJO moved to phase 6

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite**

Vortex over West Central Bay is now centered near 15.1N/ 86.6 E .Intensity T1.5/CI no. 2.0. Minimum CTT minus 34 deg c . Wind shear is of the order of 30kts near the

vortex with associated broken low/med clouds with embedded isolated weak to moderate convection over Bay north of ,between lat 11.5N to 18.5N long 83.0E to 90.0E .
(see ftp://192.168.12.75/imd/satmet, http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** – analysis indicates cycer at lower associated with a Dep over the central Bay of Bengal. The forecast indicates movemevt in the direction of W/WSW for day 2 to day 3 with gradual weakening.
- **IMD-WRF** model MSLP & wind charts of 00 UTC anaysis of 18 November 2012 Indicates cycer associated with a low, which indicates west/WSW movement in the forecast for next 2 days with slight weakening. .
- **ECMWF** model MSLP and WIND charts also show a cycer in the analysis at lower level associated with the system over central BOB. The forecast indicates its movement W/WSW in next 3 to 4 days seen over Chennai coast on day 4.
- The 850 hPa, 500 hPa and 200 hPa wind analysis are given in **Annexure II.**
- **Genesis Potential Parameter (GPP):**
- GFS Model analysis shows a zone with significant GPP values (>30) over central BoB. The zone of maximum value is likely to decrease tomorrow, although it shows slight increase again on day 2. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**NCMRWF Unified Model (UM) forecast .**

***Analysis dated 00Z17Nov2012***

- **Broad cyclonic circulation over Bay of Bengal at 15N/90E tilting eastward with height; seen at 925,850, and 700 hPa.**

***Forecast valid from 00Z18 to 00z21 Nov2012***

- **The cyclonic circulation is moving westward in day-1, day-2 and day-3 forecasts. In the day-3 forecast valid for 20th Nov 2012, the system is located at 16N/88E**

**NCMRWF GEFS:(Global Ensemble Forecast System (GEFS) forecast of NCMRWF)**

***Analysis dated 00Z17Nov2012***

- **The Ensemble mean analysis shows well developed and broad cyclonic circulation over Bay of Bengal about 16N/90E. The system is seen at 925 hPa, 850 hPa and 700 hPa levels, tilting eastwards with height. The system is further moving in the southwesterly direction and weakening on Sea in day-5 and day-6 forecasts**

***Forecast valid from 00Z18 to 00z21 Nov2012***

- **The ensemble mean forecasts indicate intensification and slow movement of the cyclonic circulation westwards in the day-1 and day-2,**

**and south west in day-3 and day4. It can be located at 12N/85E in the day-4 forecast valid for (21st Nov 2012).**

**Summary and Conclusion:**

- **ECMWF, IMD GFS, JMA model, GEFS-NCMRWF and Unified model NCMRWF based on 170000 UTC suggest that the deep depression over east central Bay of Bengal would move west-southwestwards, weaken gradually during next 24 hours and would cross south Tamilnadu and coastal Andhra Pradesh coast by morning of 21th as depression/low.**

**Advisory:**

- Considering the NWP model guidance, most of the models suggest weakening of depression during next 24 hrs over the sea. Dynamical-statistical model of IMD also suggests weakening. with respect to track, most models suggest west-southwestward movement during next 48 hrs towards north Tamil nadu and south Andhra pradesh coasts.
- **IOP declared for north coastal Tamil Nadu and coastal Andhra Pradesh on 20th and 21st November 2012.**

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **18/12** | **19/00** | **19/03** |
| **India** | 81/89 | 66/79 | 81/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 8/11 | 6/11 | 9/11 |
| **Myanmar** | 9/11 | 10/11 | 7/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 7/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **18/12** | **19/00** | **19/03** |
| **India** | 81/121 | 77/121 | 74/121 |
| **WB** | 9/20 | 9/20 | 9/20 |
| **ODS** | 25/38 | 23/38 | 26/38 |
| **AP** | 26/35 | 25/35 | 18/35 |
| **TN** | 19/26 | 18/26 | 19/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 18-11-2012: 05/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:-34**
- **RS/RW** (00Z) of 19-11-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:20**

**No. of PILOT Ascents**

| 18/12Z | 19/00Z |
|---|---|
| 12/37 | 18/34 |

**Buoy Data**

| 18/12Z | 19/00Z | 19/03Z |
|---|---|---|
| 7 | 6 | 7 |

**No of Synop data**

| **Date→** | **17.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **20** | **19** | **19** | **18** |

**No. of RS/RW Ascents**

**00Z /17.11.2012 : 3**

No. of Ascents reaching 250 hPa level =3

**MISDA : 5**

**12Z /17.11.2012 : 0**

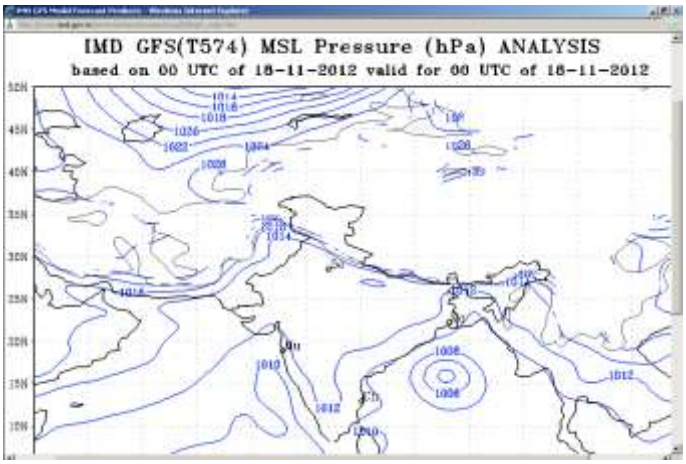
No. of Ascents reaching 250 hPa level =0

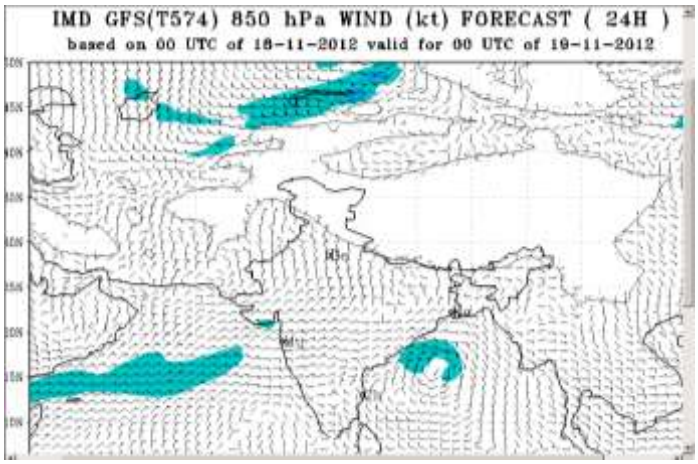
**MISDA : 8**

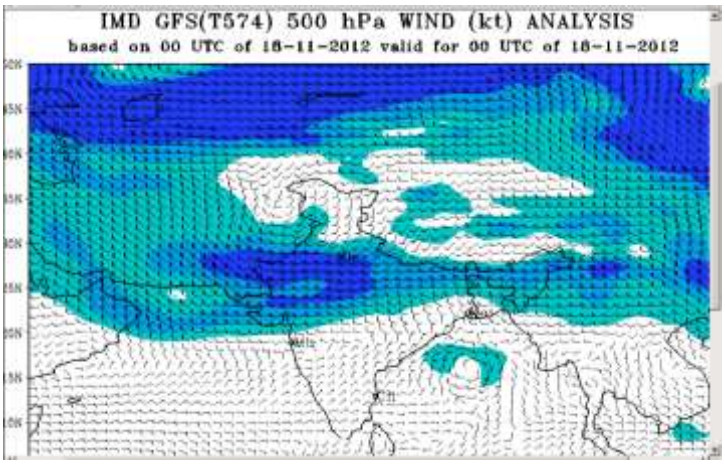
**No. of PILOT Ascents:**

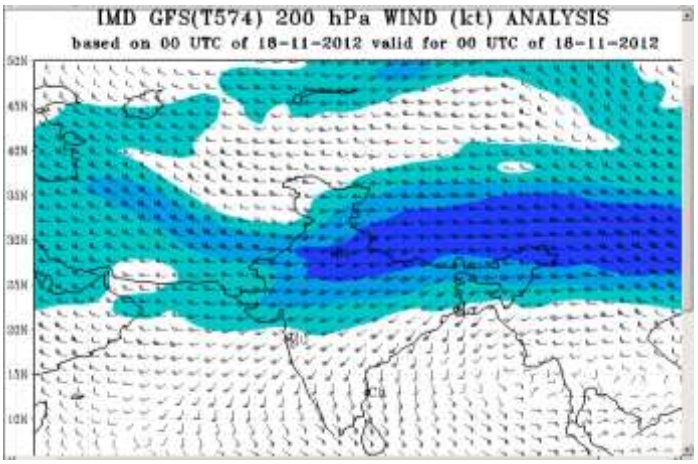
| **17.11.2012** | |
|---|---|
| 06Z | 18Z |
| 7 | 7 |

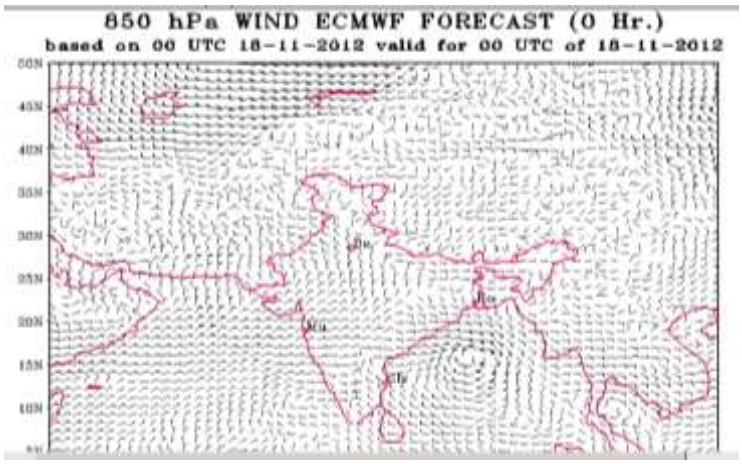
## Annexure II

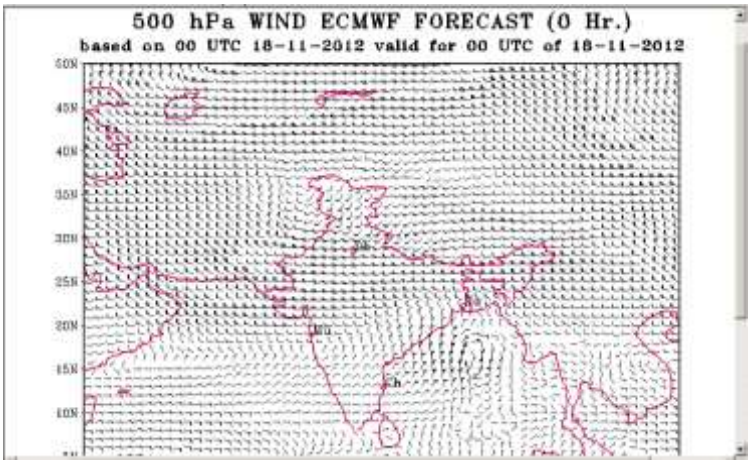

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 18-11-2012 valid for 00 UTC of 18-11-2012

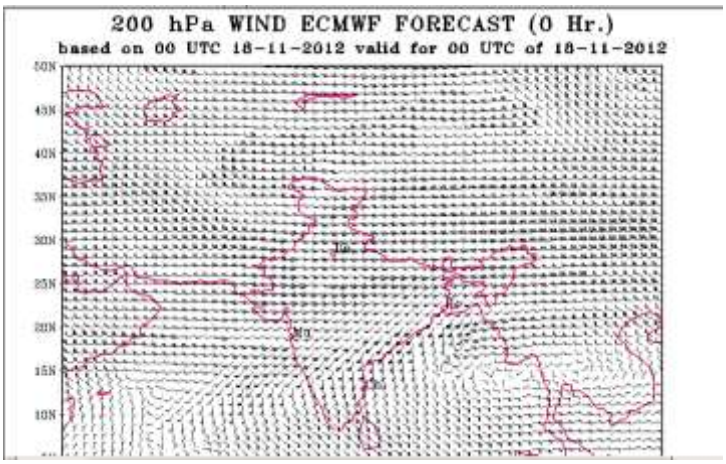

IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 18-11-2012 valid for 00 UTC of 19-11-2012

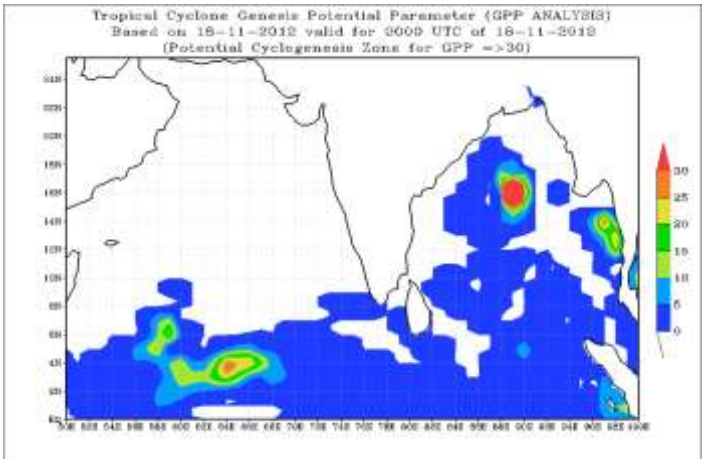

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 18-11-2012 valid for 00 UTC of 18-11-2012

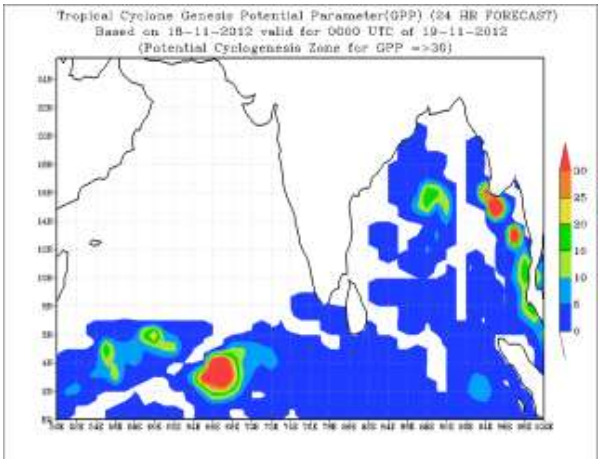

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 18-11-2012 valid for 00 UTC of 18-11-2012

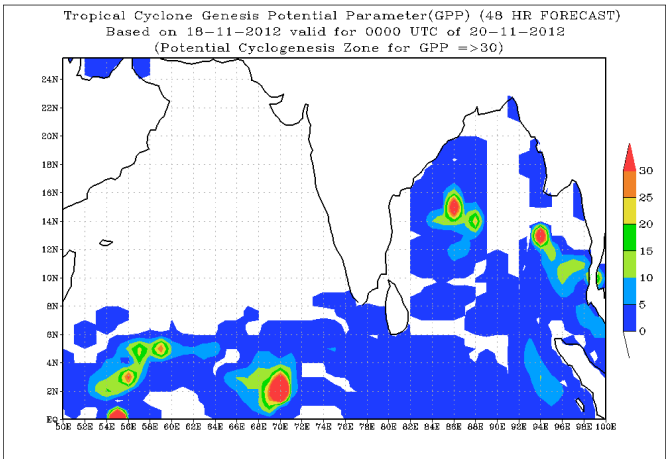

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 18-11-2012 valid for 00 UTC of 18-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 18-11-2012 valid for 00 UTC of 18-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 18-11-2012 valid for 00 UTC of 18-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 18-11-2012 valid for 0000 UTC of 18-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 18-11-2012 valid for 0000 UTC of 19-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 18-11-2012 valid for 0000 UTC of 20-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 20th November, 2012

**Synoptic features based on 0300 UTC:**

- The well marked low pressure area over westcentral Bay of Bengal persists over the same region at 0830 hrs IST of today the 20th November 2012. The system would move west-southwestwards towards south Andhra Pradesh and north Tamil Nadu coasts and weaken further during next 48 hours.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over east central Bay of Bengal

**Ocean thermal energy:**

- Ocean thermal energy is around 50 to 80 KJ cm$^{-2}$ around system centre.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over the well marked LOPAR.

**Convergence:**

- Lower level convergence has decreased and is of the order of 5* 10$^{-5}$ s$^{-1}$ over central Bay of Bengal.

**Divergence:**

- Upper air divergence is of the order of 5*10$^{-5}$ s$^{-1}$ over east central Bay of Bengal.

**Wind Shear:**

- Wind Shear is of order of 20-30 knots near the vortex.

**Wind Shear Tendency:**

- Increasing of the order of 5-10 knot over central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at 200 hPa passes through latitude 11.0°N.

**M.J.O. Index:**

- Located over phase 5 with amplitude <1.
- Statistical forecast: - MJO moved to phase 6

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite Bulletin**

Vortex over West Central Bay is now centered near 15.0 N/ 84.5 E .Intensity T1.0/CI no. 1.5. Minimum CTT minus 54 deg C . Wind shear is of the order of 25kts near the vortex with associated broken low/med clouds with embedded isolated weak to

moderate convection over Bay north of ,between lat 12.0N to 18.0N long 83.0E to 89.0E .
(see ftp://192.168.12.75/imd/satmet, http://www.imd.gov.in/section/satmet/dynamic/insat.htm)

**NWP Analysis**

- **IMD-GFS** – Analysis charts of 00UTC on 20 November 2012, indicate a low pressure area lies over west central Bay of Bengal. The forecasts indicate movement in the W/WSW direction for next 2 days with gradual weakening.
- **IMD-WRF** Analysis charts of 00UTC on 20 November 2012, indicate a low pressure area lies over west central Bay of Bengal. Forecast indicate W/WSW movement of the system which is crossing the east-coast north of Chennai in the next for next 2 days. Forecasts also show slight intensification on day1 and weakening there after.
- **ECMWF -** In the analyses of 00 UTC, 20 November 2012, MSLP and WIND show a low pressure area over west-central BOB. The forecasts indicate W/WSW movement in next 2 days and gradually weakening during next two days.
- NCMRWF(GEFS) and Unified Model also suggest gradual weakening and west southwestward movement during next 48 hours.
- The 850 hPa, 500 hPa and 200 hPa wind analyses and day 1 forecasts of IMD-GFS and ECMWF are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis shows a organised zone of GPP values (~30) over west-central BoB. The forecast shows likely persistance in spatial extent over west central BOB and maximum value in next two days with values greater than 30. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- Upper-level analysis indicates that the system is located poleward of the subtropical ridge axis and is under strong (30-40 knots) vertical wind shear. Maximum sustained surface winds are estimated at 15 to 20 knots. Minimum sea level pressure is estimated to be near 1005 mb. Due to the unfavourable upper-level environment, the potential for reintensification of the system is low. Hence No IOP is declared for next 3 days.

**Annexure-I**

**Status of Observation system:**
**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **19/12** | **20/00** | **20/03** |
| **India** | 82/89 | 68/79 | 72/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 8/11 | 9/11 | 9/11 |
| **Myanmar** | 10/11 | 9/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 7/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **19/12** | **20/00** | **20/03** |
| **India** | 78/121 | 77/121 | 57/121 |
| **WB** | 10/20 | 10/20 | 9/20 |
| **ODS** | 23/38 | 23/38 | 17/38 |
| **AP** | 25/35 | 24/35 | 18/35 |
| **TN** | 18/26 | 18/26 | 11/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 19-11-2012: 07/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:-32**
- **RS/RW** (00Z) of 20-11-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:20**

**No. of PILOT Ascents**

| 19/12Z | 20/00Z |
|---|---|
| 12/37 | 14/34 |

**Buoy Data**

| 19/12Z | 20/00Z | 20/03Z |
|---|---|---|
| 8 | 7 | 8 |

**No of Synop data**

| **Date→** | **19.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z /19.11.2012 : 3**

No. of Ascents reaching 250 hPa level =1

**MISDA : 5**

**12Z /19.11.2012 : 0**

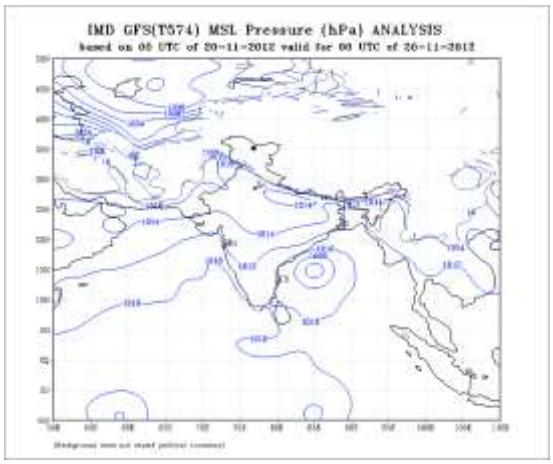
No. of Ascents reaching 250 hPa level =0

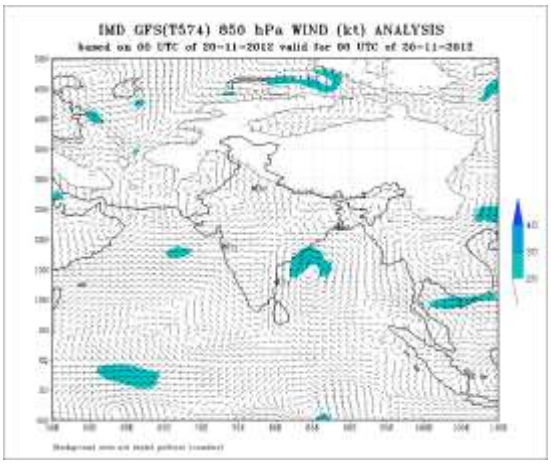
**MISDA : 8**

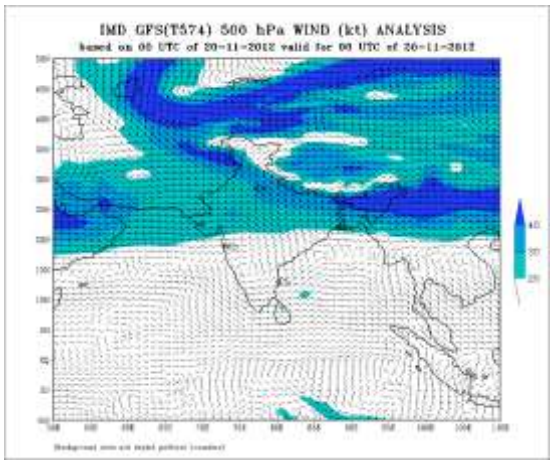
**No. of PILOT Ascents:**

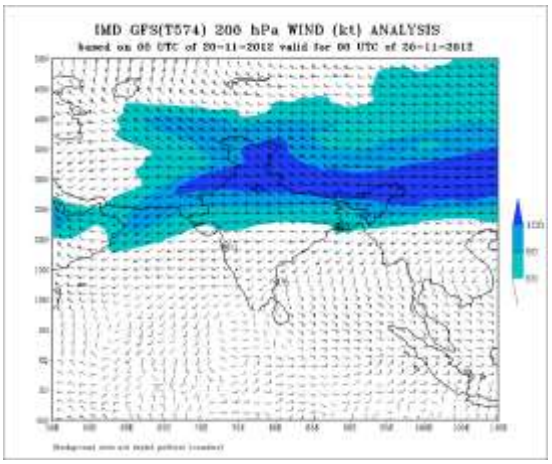
| **19.11.2012** | |
|---|---|
| 06Z | 18Z |
| 4 | 5 |

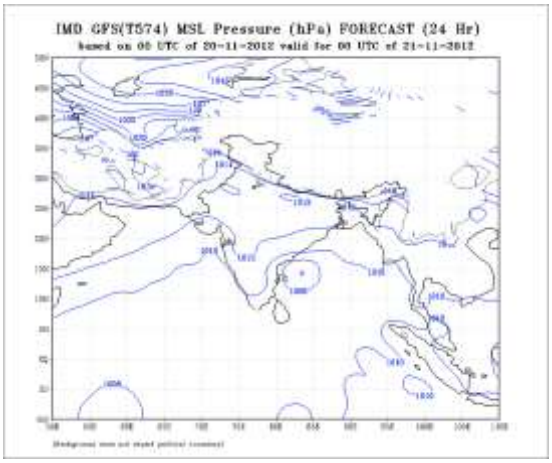
## Annexure II

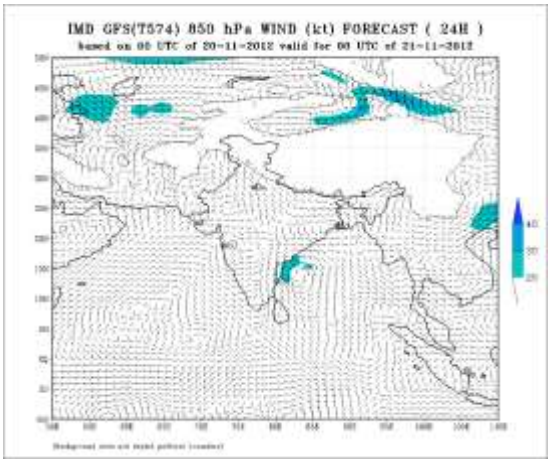

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS

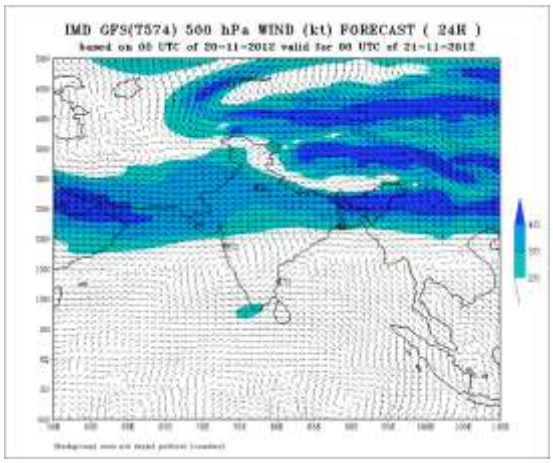

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS

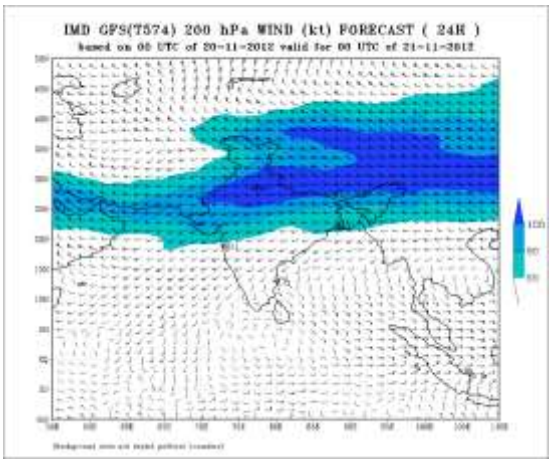

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS

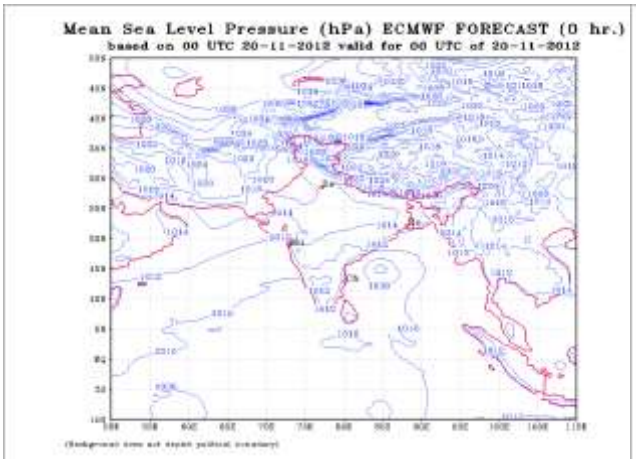

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS

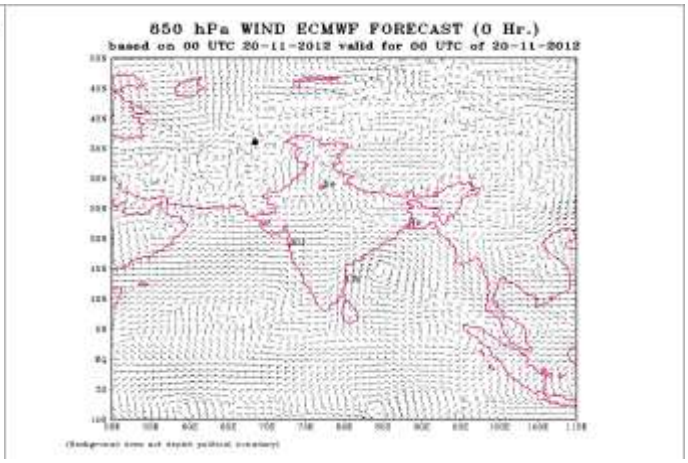

IMD GFS(T574) MSL Pressure (hPa) FORECAST (24 Hr)


IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )


IMD GFS(T574) 500 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 20-11-2012 valid for 00 UTC of 21-11-2012


IMD GFS(T574) 200 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 20-11-2012 valid for 00 UTC of 21-11-2012


Mean Sea Level Pressure (hPa) ECMWF FORECAST (0 hr.)
based on 00 UTC 20-11-2012 valid for 00 UTC of 20-11-2012


850 hPa WIND ECMWF FORECAST (0 Hr.)
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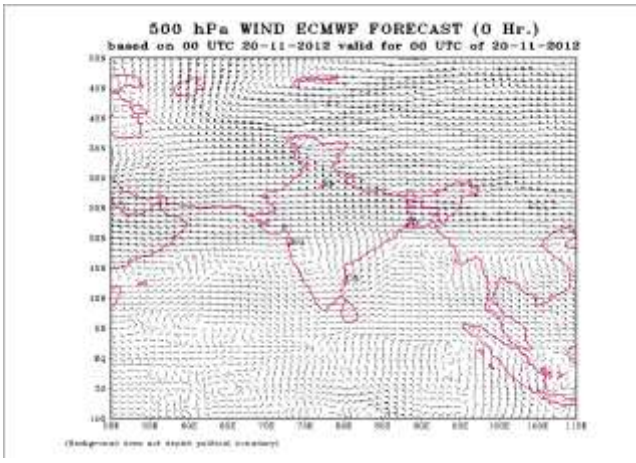
500 hPa WIND ECMWF FORECAST (0 Hr.)
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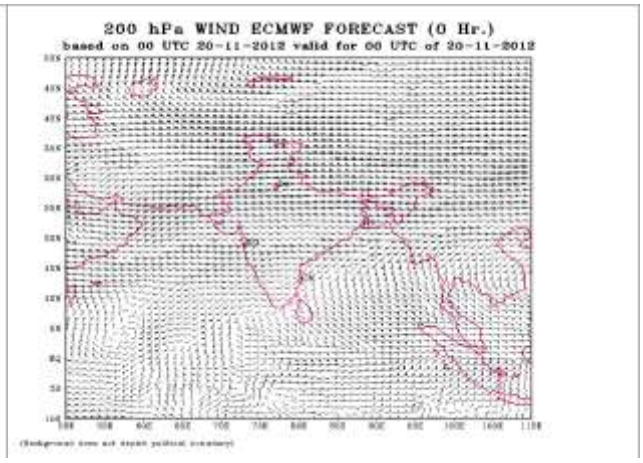
200 hPa WIND ECMWF FORECAST (0 Hr.)
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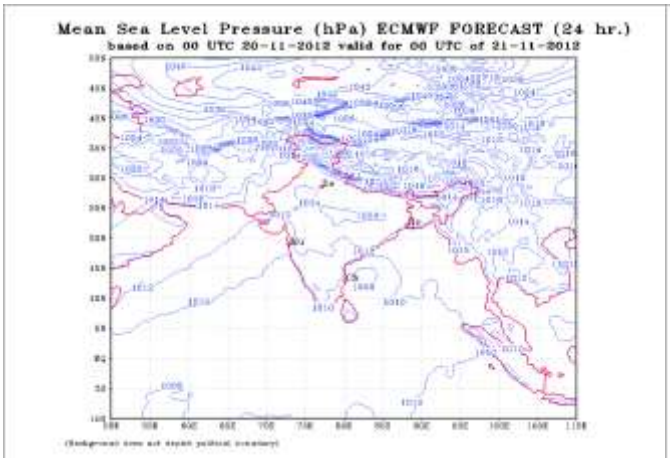
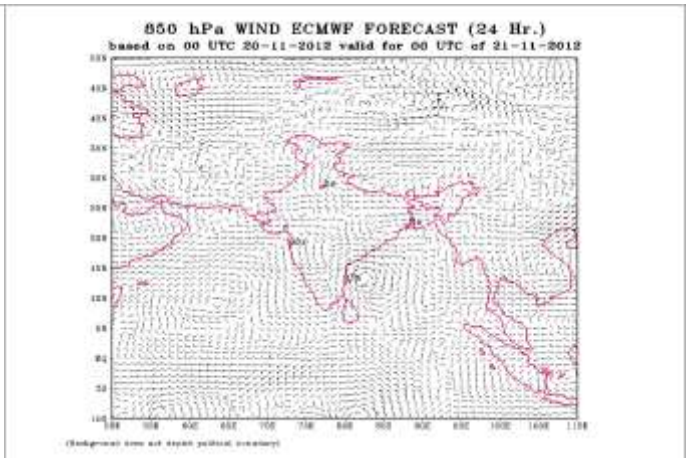
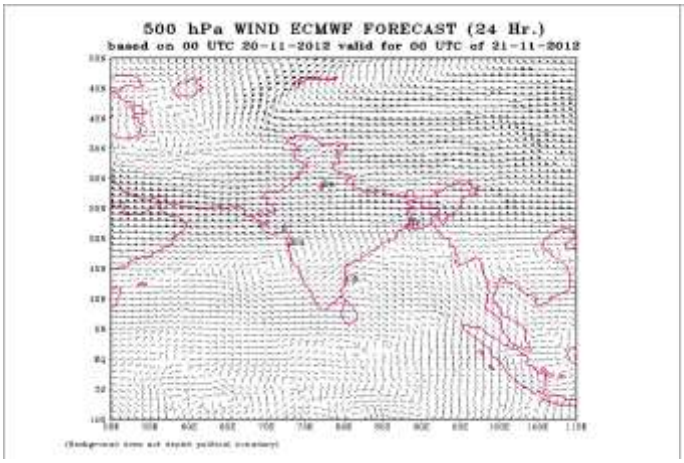
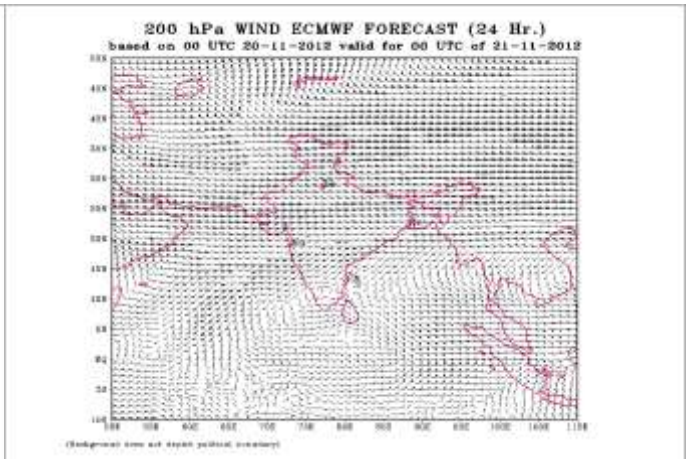
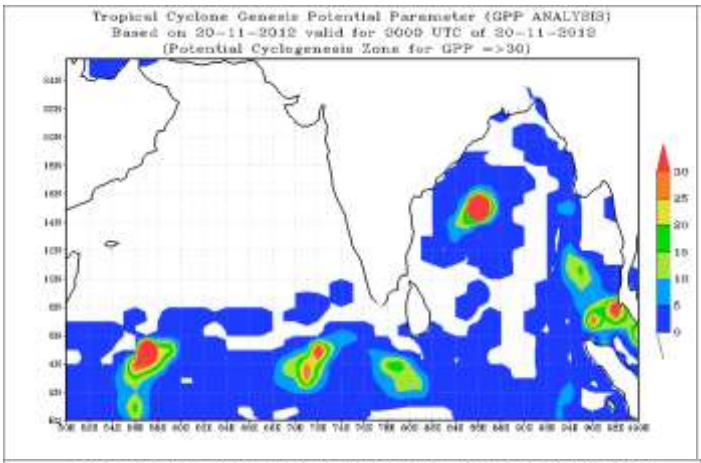
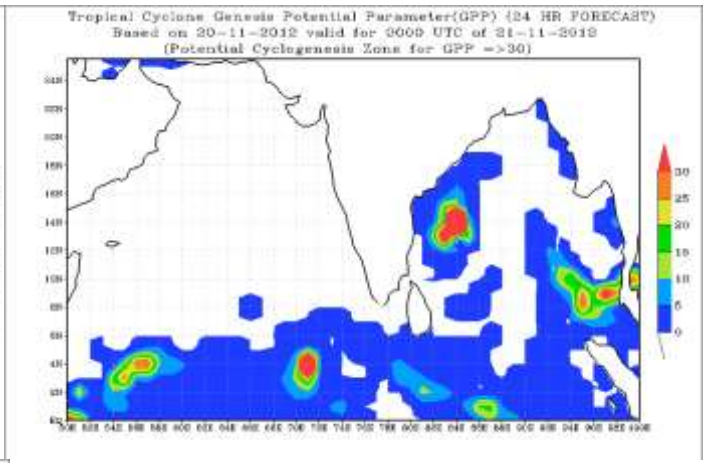

Mean Sea Level Pressure (hPa) ECMWF FORECAST (24 hr.)
based on 00 UTC 20-11-2012 valid for 00 UTC of 21-11-2012

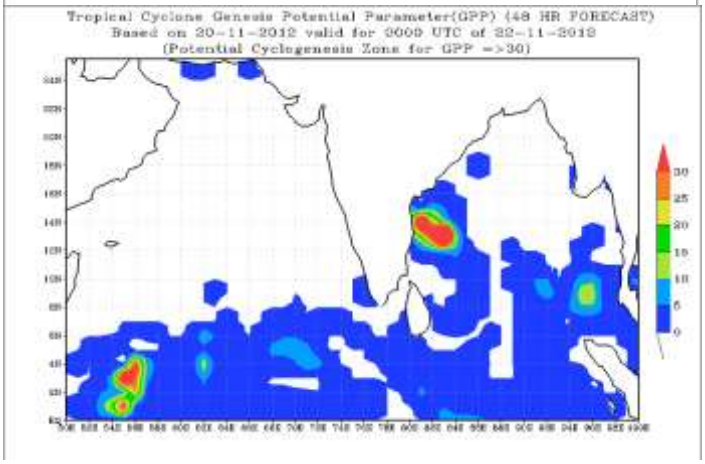

850 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 20-11-2012 valid for 00 UTC of 21-11-2012


500 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 20-11-2012 valid for 00 UTC of 21-11-2012


200 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 20-11-2012 valid for 00 UTC of 21-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 20-11-2012 valid for 0000 UTC of 20-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 20-11-2012 valid for 0000 UTC of 21-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 20-11-2012 valid for 0000 UTC of 22-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 21st November, 2012

**Synoptic features based on 0300 UTC:**

- The well marked low pressure area now lies over west central Bay of Bengal and adjoining southwest Bay of Bengal off south Andhra Pradesh & north Tamil Nadu coasts.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 26-28$^0$C over east central Bay of Bengal

**Ocean thermal energy:**

- Ocean thermal energy is around 50 to 60 KJ cm$^{-2}$ around system centre.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over the well marked LOPAR.

**Convergence:**

- Lower level convergence has decreased and is of the order of 5* 10$^{-5}$ s$^{-1}$ over central Bay of Bengal.

**Divergence:**

- Upper air divergence is of the order of 10-15*10$^{-5}$ s$^{-1}$ over east central Bay of Bengal.

**Wind Shear:**

- Wind Shear is of order of 20-30 knots near the vortex.

**Wind Shear Tendency:**

- Decreasing of the order of 10-20 knots over central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through latitude 11.0°N.

**M.J.O. Index:**

- Located over phase 6 with amplitude <1.
- Statistical forecast: - MJO moved to phase 6

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite advisory:**

Vortex over west central bay and neibourhood centered within half a degree of lat/long 14.0N/ 83.0E . Intensity T1.0/CI 1.5.Minimum CTT minus 68 degree Celsius (.) Wind shear is of the order of 20-30kts near the vortex. Associate broken low/medium clouds with embedded moderate to intense convection over bay between lat 10.5N to 18.0N long 81.5E to 86.0E and broken low/med clouds with embedded isolated weak to moderate convection over coastal Andhra pradesh and south coastal Orissa . Broken low/med clouds with embedded moderate to intense convection over Andaman sea south of lat 12.0N south parts of east central bay. Scattered low/med clouds with embedded isolated weak to moderate convection over south east bay south of lat 10.0N east of long 90.0E and north west and adjoining north east bay.

**NWP Analysis**

- **IMD-GFS** – Analysis charts of 00UTC on 21 November 2012, indicate a low pressure area lies over west central Bay of Bengal. The forecasts indicate movement in the W/WSW direction and crossing near Chennai coast on day1 and weakening on day2.
- **IMD-WRF** Analysis charts of 00UTC on 21 November 2012, indicate a low pressure area lies over west central Bay of Bengal. Forecast indicates W/WSW movement of the system which is crossing the east-near Chennai on day1 and weakens on day2.
- **ECMWF -** In the analyses of 00 UTC, 21 November 2012, MSLP and WIND show a low pressure area over west-central BOB. The forecasts indicate W/WSW movement and crossing near Chennai coast on day1 and weakens on day2.
- The 850 hPa, 500 hPa and 200 hPa wind analyses and day 1 forecasts of IMD-GFS and ECMWF are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis shows a organised zone of GPP values (~30) over west-central BoB. The forecast shows likely persistence over west central BOB and crossing near Chennai coast on day2. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- Upper-level analysis indicates that the system is located poleward of the subtropical ridge axis and is under strong (30-40 knots) vertical wind shear. Maximum sustained surface winds are estimated at 15 to 20 knots. Minimum sea level pressure is estimated to be near 1005 mb. Due to the unfavourable upper-level environment, the potential for reintensification of the system is low. Hence No IOP is declared for next 3 days.

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **20/12** | **21/00** | **21/03** |
| **India** | 53 | 39 | 53 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 9/11 | 10/11 | 10/11 |
| **Myanmar** | 10/11 | 10/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 7/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **20/12** | **21/00** | **21/03** |
| **India** | 78/121 | 76/121 | 81/121 |
| **WB** | 10/20 | 10/20 | 9/20 |
| **ODS** | 22/38 | 22/38 | 23/38 |
| **AP** | 25/35 | 25/35 | 27/35 |
| **TN** | 19/26 | 17/26 | 19/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 20-11-2012: 06/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:-33**
- **RS/RW** (00Z) of 21-11-2012: 20/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:19**

**No. of PILOT Ascents**

| 20/12Z | 21/00Z |
|---|---|
| 11/37 | 16/34 |

**Buoy Data**

| 20/12Z | 21/00Z | 21/03Z |
|---|---|---|
| 16 | 14 | 18 |

## Data Statistics over RMC Chennai Region

### No of Synop data

| Date→ | 20.11.2012 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| UTC→ | 00 | 03 | 06 | 09 | 12 | 15 | 18 | 21 |
| Chennai Region (Coasts of AP & TN) | 19 | 23 | 20 | 20 | 23 | 19 | 19 | 19 |

**No. of RS/RW Ascents**

**00Z /20.11.2012 : 3**

No. of Ascents reaching 250 hPa level =3

**MISDA : 5**

**12Z /20.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

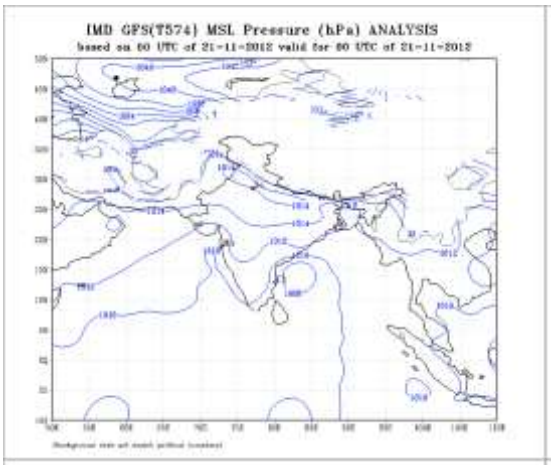
**MISDA : 8**

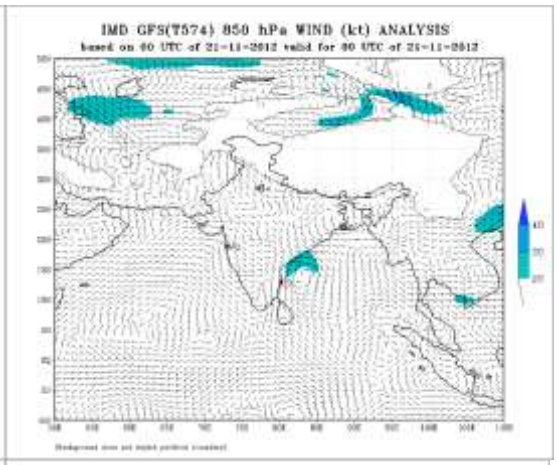
### No. of PILOT Ascents:

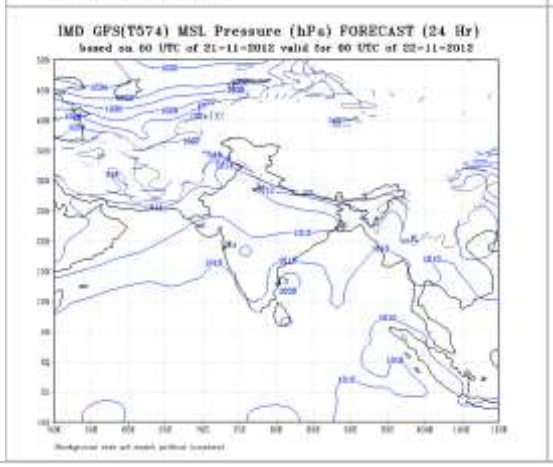
**20.11.2012**

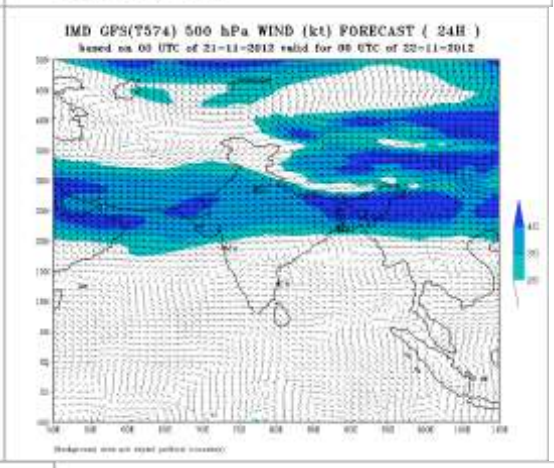
| 06Z | 18Z |
|---|---|
| 6 | 5 |

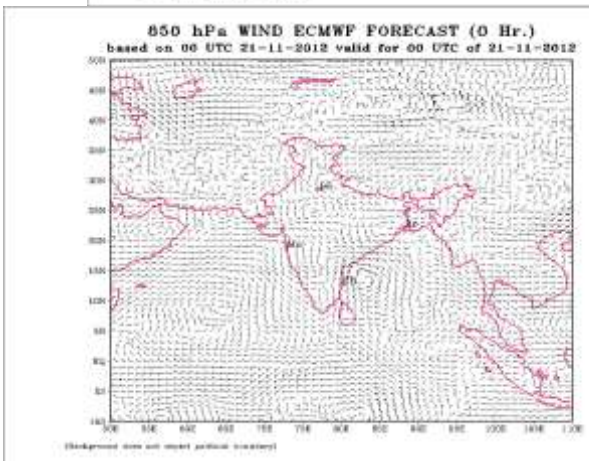
**Annexure-II**

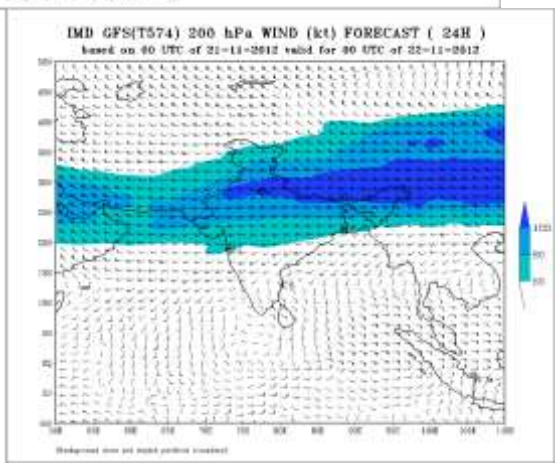

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 21-11-2012 valid for 00 UTC of 21-11-2012


IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 21-11-2012 valid for 00 UTC of 21-11-2012

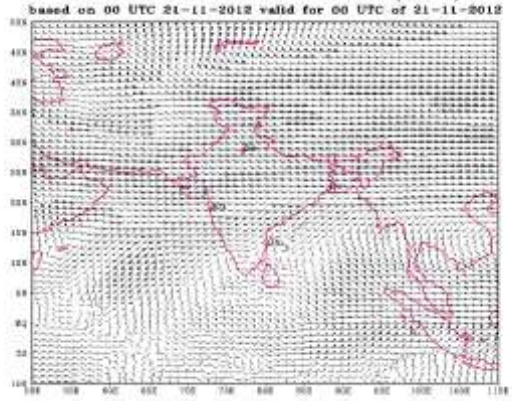

IMD GFS(T574) MSL Pressure (hPa) FORECAST (24 Hr)
based on 00 UTC of 21-11-2012 valid for 00 UTC of 22-11-2012


IMD GFS(T574) 500 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 21-11-2012 valid for 00 UTC of 22-11-2012

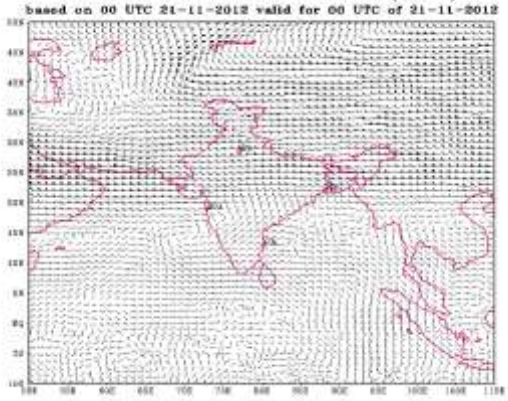

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 21-11-2012 valid for 00 UTC of 21-11-2012


IMD GFS(T574) 200 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 21-11-2012 valid for 00 UTC of 22-11-2012

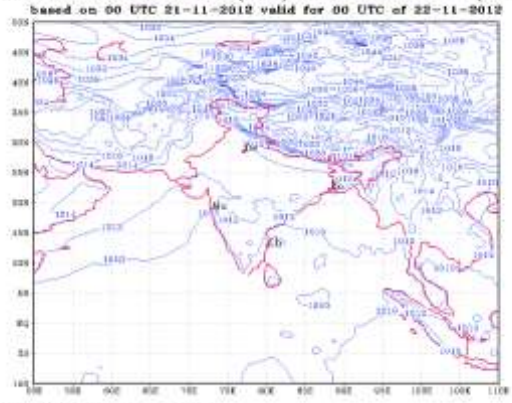
200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 21-11-2012 valid for 00 UTC of 21-11-2012



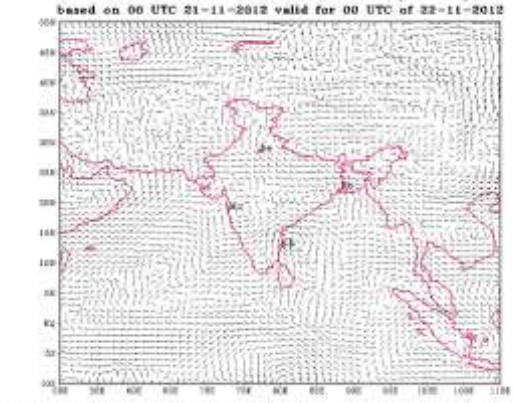
500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 21-11-2012 valid for 00 UTC of 21-11-2012



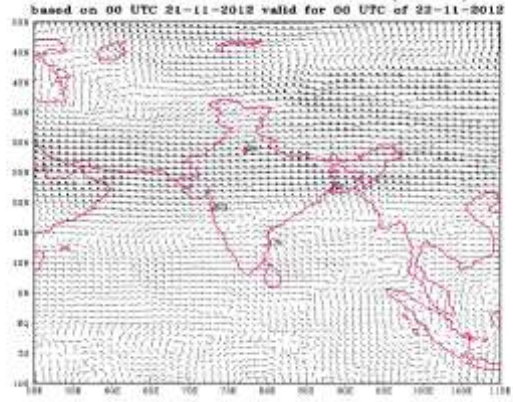
Mean Sea Level Pressure (hPa) ECMWF FORECAST (24 hr.)
based on 00 UTC 21-11-2012 valid for 00 UTC of 22-11-2012



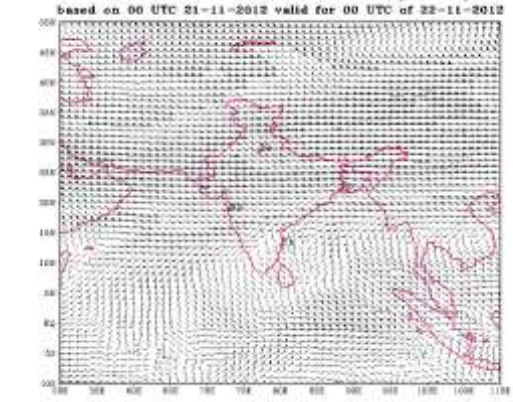
850 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 21-11-2012 valid for 00 UTC of 22-11-2012

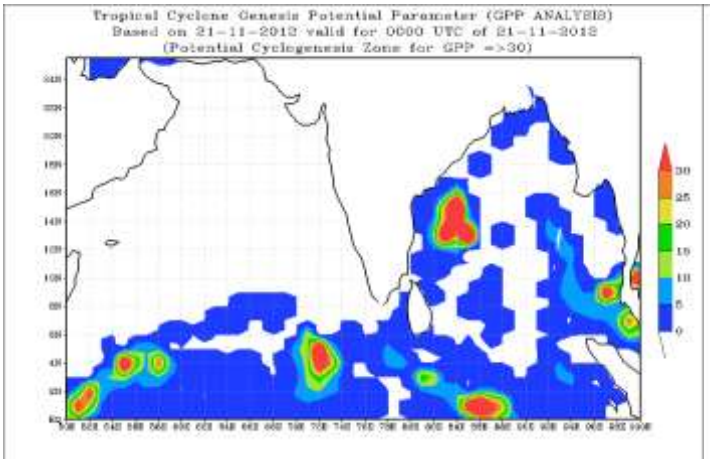


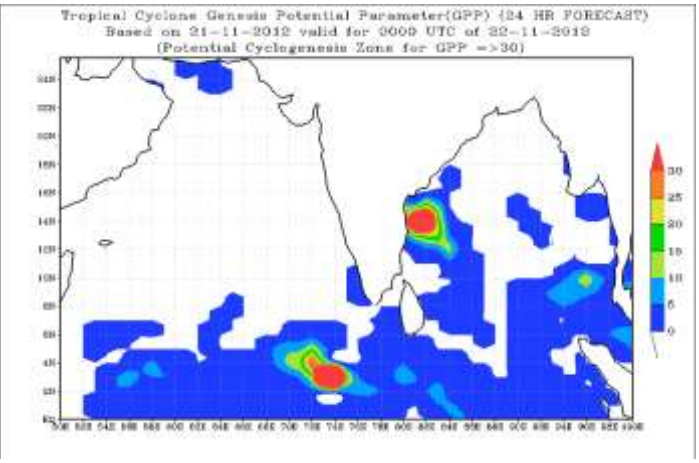
500 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 21-11-2012 valid for 00 UTC of 22-11-2012

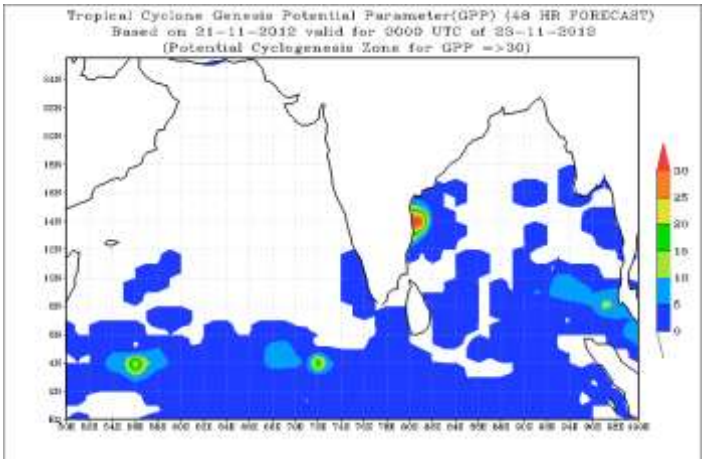


200 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 21-11-2012 valid for 00 UTC of 22-11-2012




Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 21-11-2012 valid for 0000 UTC of 21-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 21-11-2012 valid for 0000 UTC of 22-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 21-11-2012 valid for 0000 UTC of 23-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 22st November, 2012

**Synoptic features based on 0300 UTC:**

- The well marked low pressure area over westcentral & adjoining southwest Bay of Bengal and off Andhra Pradesh coast now lies over southwest and adjoining westcentral Bay of Bengal off north Tamilnadu and south Andhra Pradesh coasts as a low pressure area. The associated upper air cyclonic circulation extends upto 3.6 km above mean sea level.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 26-28$^0$C over Southwest and west central Bay of Bengal. It is around 28 -30ºC over remaining parts of Bay and Indian Ocean.

**Ocean thermal energy:**

- Ocean thermal energy is less than 50 KJ cm$^{-2}$ over Southwest and West Central Bay and 50 -80 KJ cm$^{-2}$ over remaining parts of Bay and Indian Ocean.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over the LOPAR.

**Convergence:**

- Lower level convergence has decreased and is of the order of 5* 10$^{-5}$ s$^{-1}$ over central Bay of Bengal.

**Divergence:**

- Upper air divergence is of the order of 10-15*10$^{-5}$ s$^{-1}$ over west central Bay of Bengal.

**Wind Shear:**

- Wind Shear is of order of 20-30 knots over Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing of the order of 10-20 knots over central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through latitude 14.0°N.

**M.J.O. Index:**

- Located over phase 6 with amplitude= 1.
- Statistical forecast: - MJO is over phase 6 and will continue during next 3 days.
- Dynamical forecast: - MJO located in phase 7 with amplitude <1.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite Advisory**

Vortex over west-central adjoining southwest Bay further weakened and now lies as a low level circulation over the area. Associated low/medium clouds with embedded moderate to intense convection are observed at many places over Bay between lat 10.0N to 17.0N west of long 85.0E adjoining Andhra Coast and adjoining northeast Tamilnadu. Low/medium clouds are also observed at many places over rest Andhra Pradesh, Tamilnadu and Karnataka

**NWP Analysis**

- **IMD-GFS** – Analysis charts of 00UTC on 22 November 2012, indicates a CYCIR over Chennai coast. The next 3 days forecasts shows no significant development over Indian sea.
- **IMD-WRF** Analysis charts of 00UTC on 22 November 2012, indicates a CYCIR over Chennai coast. The next 3 days Forecast shows no significant development over Indian sea.
- **ECMWF -** In the analyses of 00 UTC, 22 November 2012, MSLP and WIND show a feeble low pressure area over Chennai coast. The 3-days forecasts indicate no significant development over Indian sea.
- The 850 hPa, 500 hPa and 200 hPa wind analyses and day 1 forecasts of IMD-GFS and ECMWF are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis shows a organised zone of GPP with values (~30) over the Chennai coast and forecast shows no significant development during next 3 days. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Summary and Conclusion:**

- Due to the unfavorable upper-level environment, the potential for the development of a significant tropical cyclone in the next 24 hours is low.
- **Hence No IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system:**

**Synoptic observation:**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **21/12** | **22/00** | **22/03** |
| **India** | 73/89 | 70/79 | 82/89 |
| **Coastal stations** | | | |
| **WB** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **AP** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **A & N** | 1/1 | 1/1 | 1/1 |
| **Bangladesh** | 9/11 | 9/11 | 10/11 |
| **Myanmar** | 9/11 | 10/11 | 7/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **21/12** | **22/00** | **22/03** |
| **India** | 98/121 | 73/121 | 741/121 |
| **WB** | 10/20 | 9/20 | 10/20 |
| **ODS** | 21/38 | 20/38 | 22/38 |
| **AP** | 26/35 | 25/35 | 22/35 |
| **TN** | 19/26 | 17/26 | 18/26 |
| **PDC** | 2/2 | 2/2 | 2/2 |

- **RS/RW** (12Z) of 21-11-2012: 04/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:-35**
- **RS/RW** (00Z) of 22-11-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:20**

**No. of PILOT Ascents**

| 21/12Z | 22/00Z |
|---|---|
| 10/37 | 19/34 |

**Buoy Data**

| 21/12Z | 22/00Z | 22/03Z |
|---|---|---|
| 5 | 7 | 6 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | | | | **21.11.2012** | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z /21.11.2012 : 2**

No. of Ascents reaching 250 hPa level =2

**MISDA : 6**

**12Z /21.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

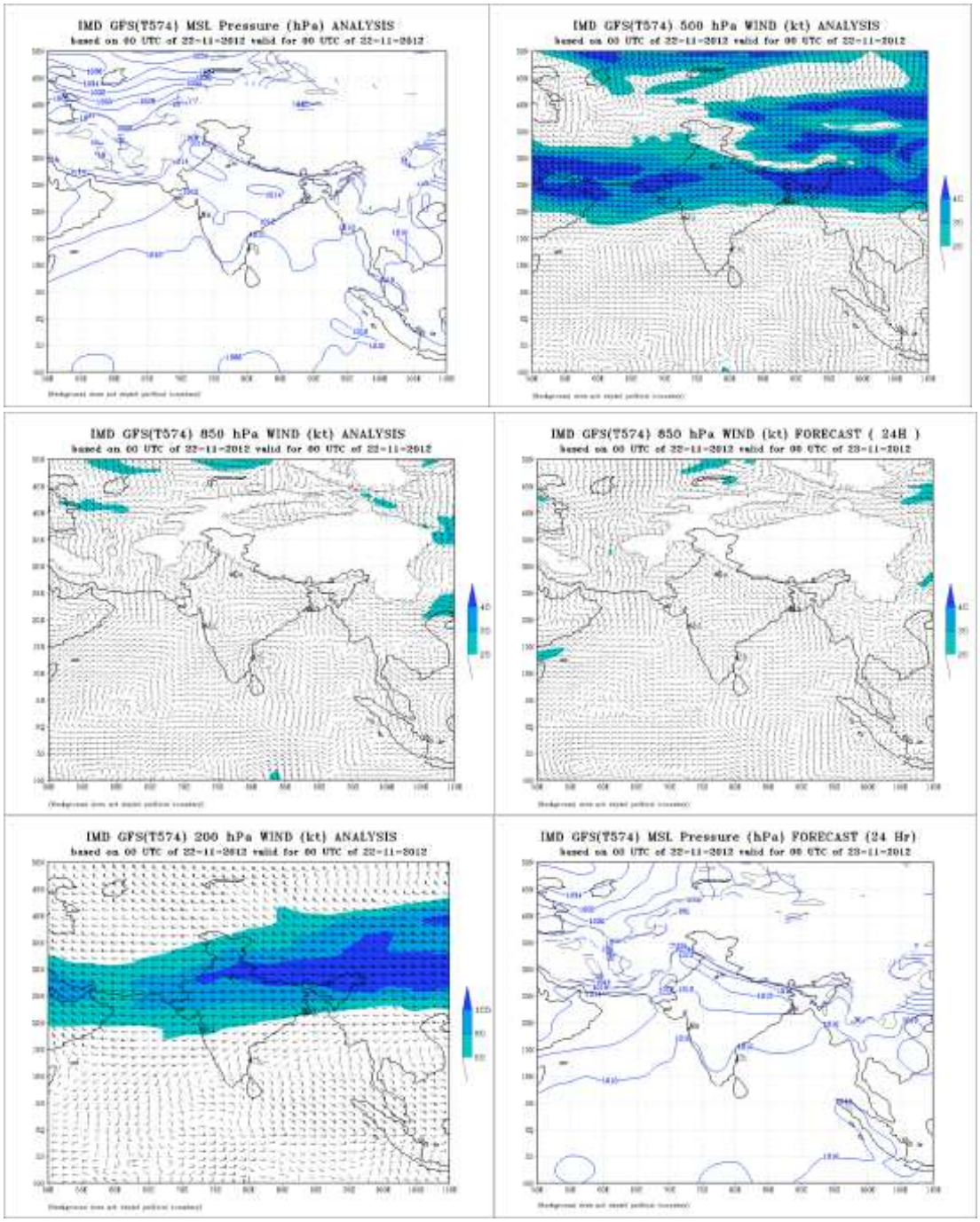
**MISDA : 8**

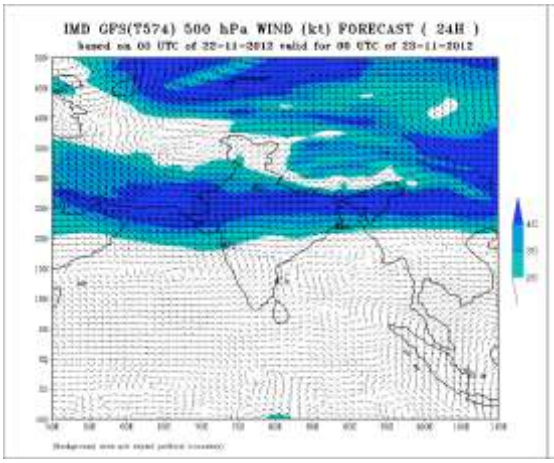
**No. of PILOT Ascents:**

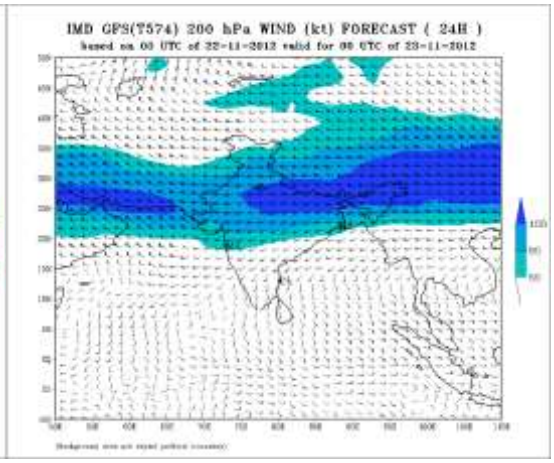
**21.11.2012**

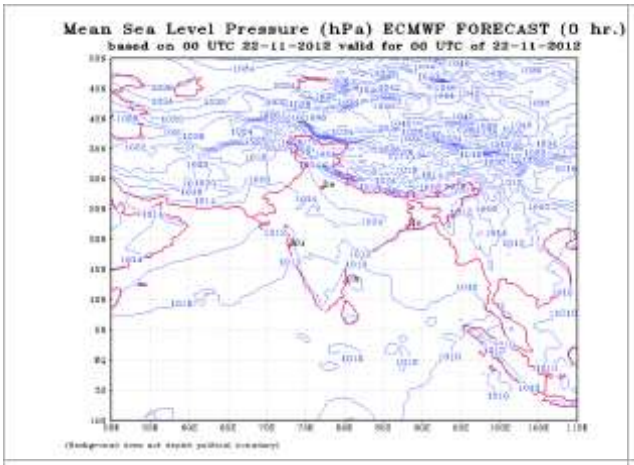
| 06Z | 18Z |
|---|---|
| 6 | 4 |

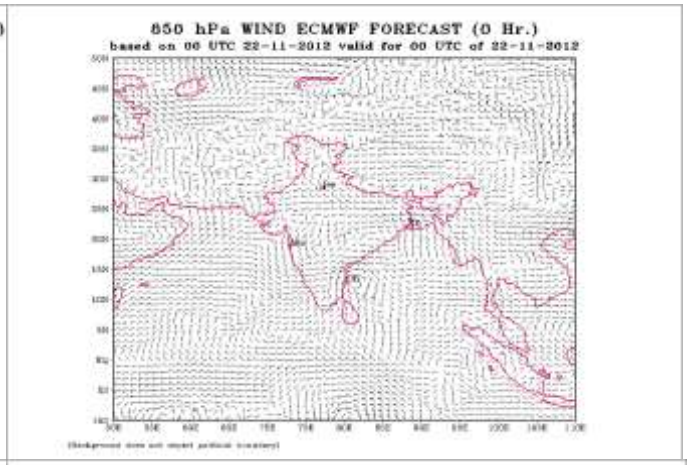
## Annexure II

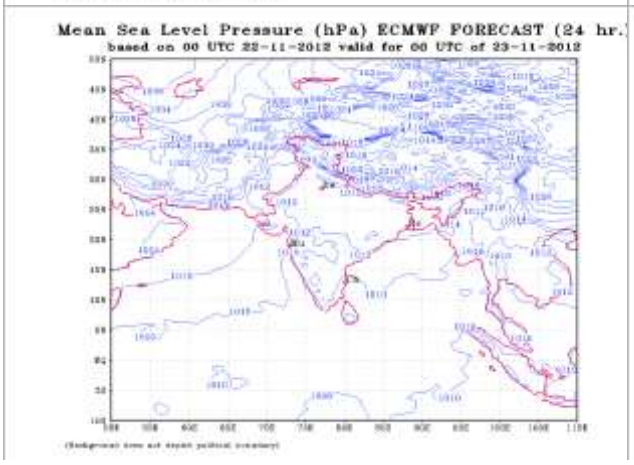

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 22-11-2012 valid for 00 UTC of 22-11-2012
IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 22-11-2012 valid for 00 UTC of 22-11-2012
IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 22-11-2012 valid for 00 UTC of 22-11-2012
IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 22-11-2012 valid for 00 UTC of 23-11-2012
IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 22-11-2012 valid for 00 UTC of 22-11-2012
IMD GFS(T574) MSL Pressure (hPa) FORECAST (24 Hr)
based on 00 UTC of 22-11-2012 valid for 00 UTC of 23-11-2012

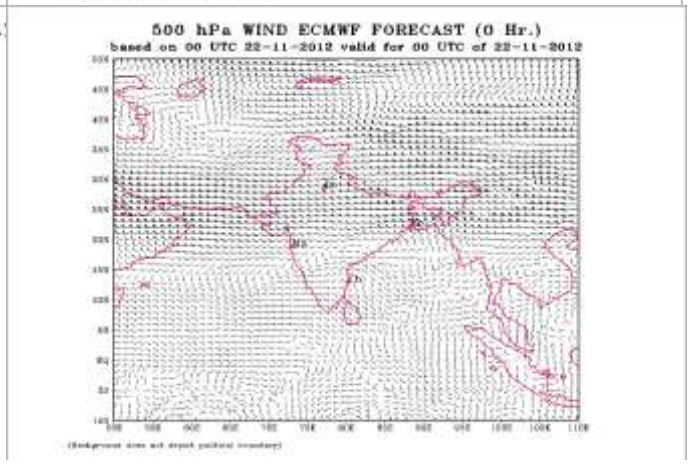

IMD GFS(T574) 500 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 22-11-2012 valid for 00 UTC of 23-11-2012

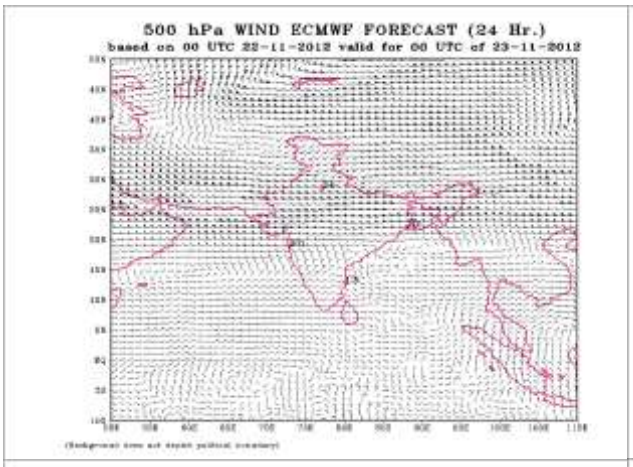

IMD GFS(T574) 200 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 22-11-2012 valid for 00 UTC of 23-11-2012

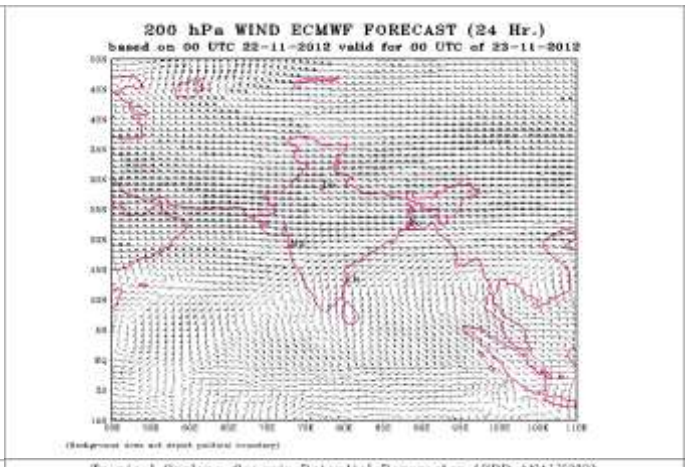

Mean Sea Level Pressure (hPa) ECMWF FORECAST (0 hr.)
based on 00 UTC 22-11-2012 valid for 00 UTC of 22-11-2012

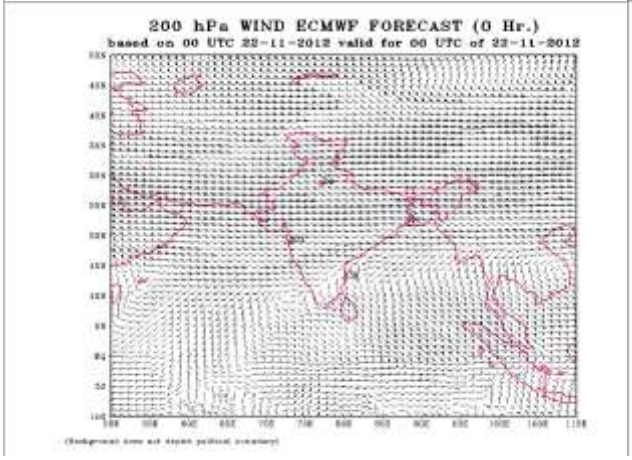

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 22-11-2012 valid for 00 UTC of 22-11-2012

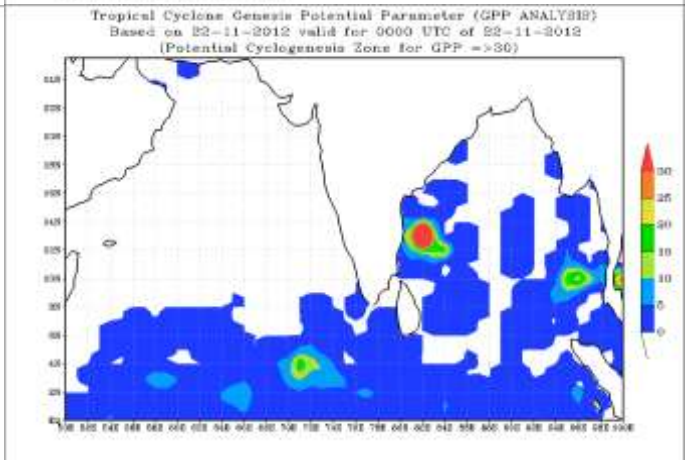

Mean Sea Level Pressure (hPa) ECMWF FORECAST (24 hr.)
based on 00 UTC 22-11-2012 valid for 00 UTC of 23-11-2012

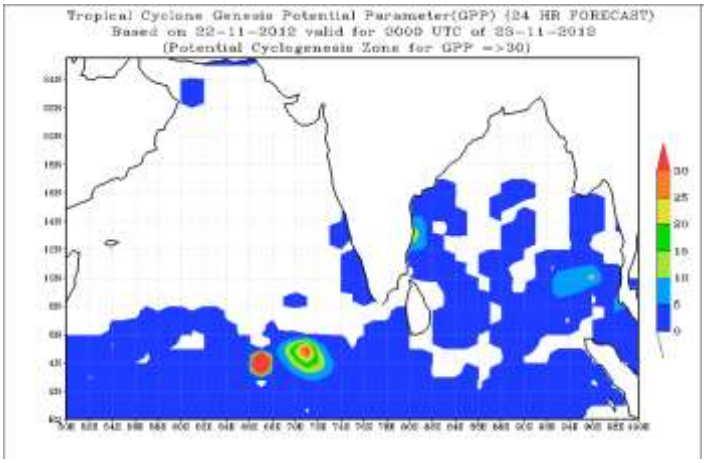

500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 22-11-2012 valid for 00 UTC of 22-11-2012

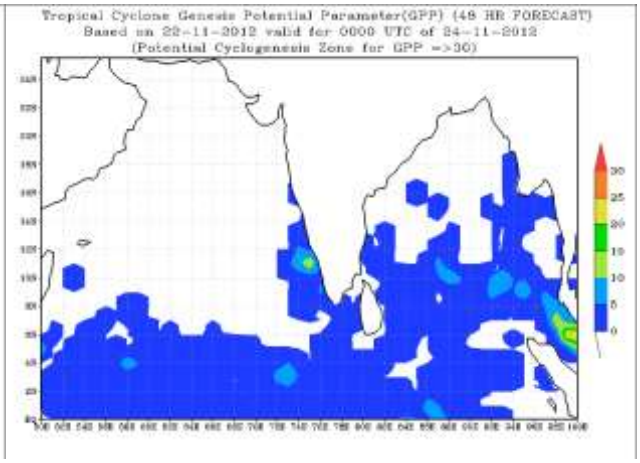

500 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 22-11-2012 valid for 00 UTC of 23-11-2012


200 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 22-11-2012 valid for 00 UTC of 23-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 22-11-2012 valid for 00 UTC of 22-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 22-11-2012 valid for 0000 UTC of 22-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 22-11-2012 valid for 0000 UTC of 23-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 22-11-2012 valid for 0000 UTC of 24-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 23 November, 2012

**Synoptic features based on 0300 UTC:**

- The low pressure area over southwest & adjoining westcentral Bay of Bengal off north Tamilnadu and south Andhra Pradesh coasts has become less marked. However, the trough of low pressure extends from southwest to westcentral Bay of Bengal with embedded upper air cyclonic circulation over southwest Bay of Bengal and adjoining Tamilnadu in lower levels.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 26-28$^0$C over Southwest and west central Bay of Bengal. It is around 28 -30ºC over remaining parts of Bay and Indian Ocean.

**Ocean thermal energy:**

- Ocean thermal energy is less than 50 KJ cm$^{-2}$ over Southwest and West Central Bay and 50 -80 KJ cm$^{-2}$ over remaining parts of Bay and Indian Ocean.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over over south coastal Andhra Pradesh and adjoining Tamil Nadu coast.

**Convergence:**

- Lower level convergence has decreased and is of the order of 5* 10$^{-5}$ s$^{-1}$ over south coastal Andhra Pradesh and adjoining Tamil Nadu coast.

**Divergence:**

- Upper air divergence is of the order of 5-10 *10$^{-5}$ s$^{-1}$ over south coastal Andhra Pradesh and adjoining Tamil Nadu coast.

**Wind Shear:**

- Wind Shear is > 20 knots between 80º and 93ºE and 10º and 15 ºN. It is <20 knots over remaining Bay and North Indian Ocean

**Wind Shear Tendency:**

- Increasing of the order of 10 knots over between 80º and 93ºE and 10º and 15 ºN

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through latitude 14.0°N.

**M.J.O. Index:**

- Located over phase 6 with amplitude= 1.
- Statistical forecast: - MJO is over phase 6 and will continue during next 2 days.
- Dynamical forecast: - MJO located in phase 6 with amplitude <1.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite Advisory**

Low/medium clouds with embedded moderate to intense convection at many places over extreme South Rayalaseema south coastal Andhra Pradesh adjoining west-central Bay north Tamilnadu, adjoining southwest Bay and low/medium clouds with embedded weak to moderate convection at many places over rest coastal Andhra Pradesh, rest Rayalaseema are observed in association with low level circulation over the area. Minimum cloud top temperature is around minus 59 deg C.

Also, low/medium clouds with embedded moderate to intense convection at many places over southeast Bay between lat 8.5N to 15.5N east of long 85.5E and Andaman Sea persists.

**NWP Analysis**

- **IMD-GFS** – Analysis charts at 00UTC on 23 November 2012, indicates no significant cyclonic circulation over Indian seas but with a feeble trough along with easterly-wave like feature below 500 hPa pressure level near Chennai coast. The next 3 days forecasts do not show any significant development over Indian seas.
- **IMD-WRF** - Analysis charts of MSLP and Wind at 00UTC on 23 November 2012 show a feeble trough and associated wind flow pattern over extreme south peninsula and adjoining Chennai coast. The next 3 days Forecast do not indicate any significant development over Indian seas.
- **ECMWF - T**he MSLP analysis of 00 UTC, 23 November 2012, show a feeble trough lies over extreme south peninsula. Wind flow pattern in the analysis does not depict any cyclonic circulation over Indian seas except easterly-wave like feature over the same region. The next 3-days forecasts do not indicate any significant change.
- **NCMRWF (GEFS) and Unified Model** both suggest no cyclogenesis over North Indian Ocean during next 72 hours.
- The 850 hPa, 500 hPa and 200 hPa wind analyses and day 1 forecasts of IMD-GFS and ECMWF are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis shows a weak zone of GPP with values (~25) over the Chennai coast and forecast shows a significant development over south BOB during next 3 days. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**
- **Conclusion and Advisory:**
- **Due to the unfavorable environment and also based on NWP guidance, the potential for the development of a significant tropical cyclone is low in the next 72 hours.**
- **Hence No IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system (Stations received/Total stations):**

**Synoptic observation from Departmental Observatories** (Mean sea Level Pressure, 24 Hour pressure change, Wind speed and direction, 24 Hour accumulated rainfall, cloud type and coverage, Present and past weather etc):

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **21/12** | **22/00** | **22/03** |
| **West Bengal** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **Andhra Pradesh** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **Andaman & Nicobar** | 1/1 | 1/1 | 1/1 |
| **Total** | 54/55 | 40/44 | 54/55 |
| **Bangladesh** | 9/11 | 9/11 | 10/11 |
| **Myanmar** | 9/11 | 10/11 | 7/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **21/12** | **22/00** | **22/03** |
| **West Bengal** | 10/20 | 9/20 | 10/20 |
| **Odisha** | 21/38 | 20/38 | 22/38 |
| **Andhra Pradesh** | 26/35 | 25/35 | 22/35 |
| **Tamil Nadu** | 19/26 | 17/26 | 18/26 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **Total** | 74/125 | 75/125 | 80/125 |

**Buoy Data over Bay of Bengal**

| 22/12Z | 23/00Z | 23/03Z |
|---|---|---|
| 12 | 15 | 6 |

**Upper air Observations over India**

- **RS/RW** (12Z) of 22-11-2012: 03/39
- **No. of Ascents reaching 250 hPa levels:1 , MISDA:-36**
- **RS/RW** (00Z) of 23-11-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: 7 , MISDA:20**

**No. of PILOT Ascents**

| 22/12Z | 23/00Z |
|---|---|
| 11/37 | 15/34 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | | | | **22.11.2012** | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **22** | **20** | **20** | **23** | **19** | **19** | **18** |

**No. of RS/RW Ascents**

**00Z /22.11.2012 : 2**

No. of Ascents reaching 250 hPa level =2

**MISDA : 6**

**12Z /22.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

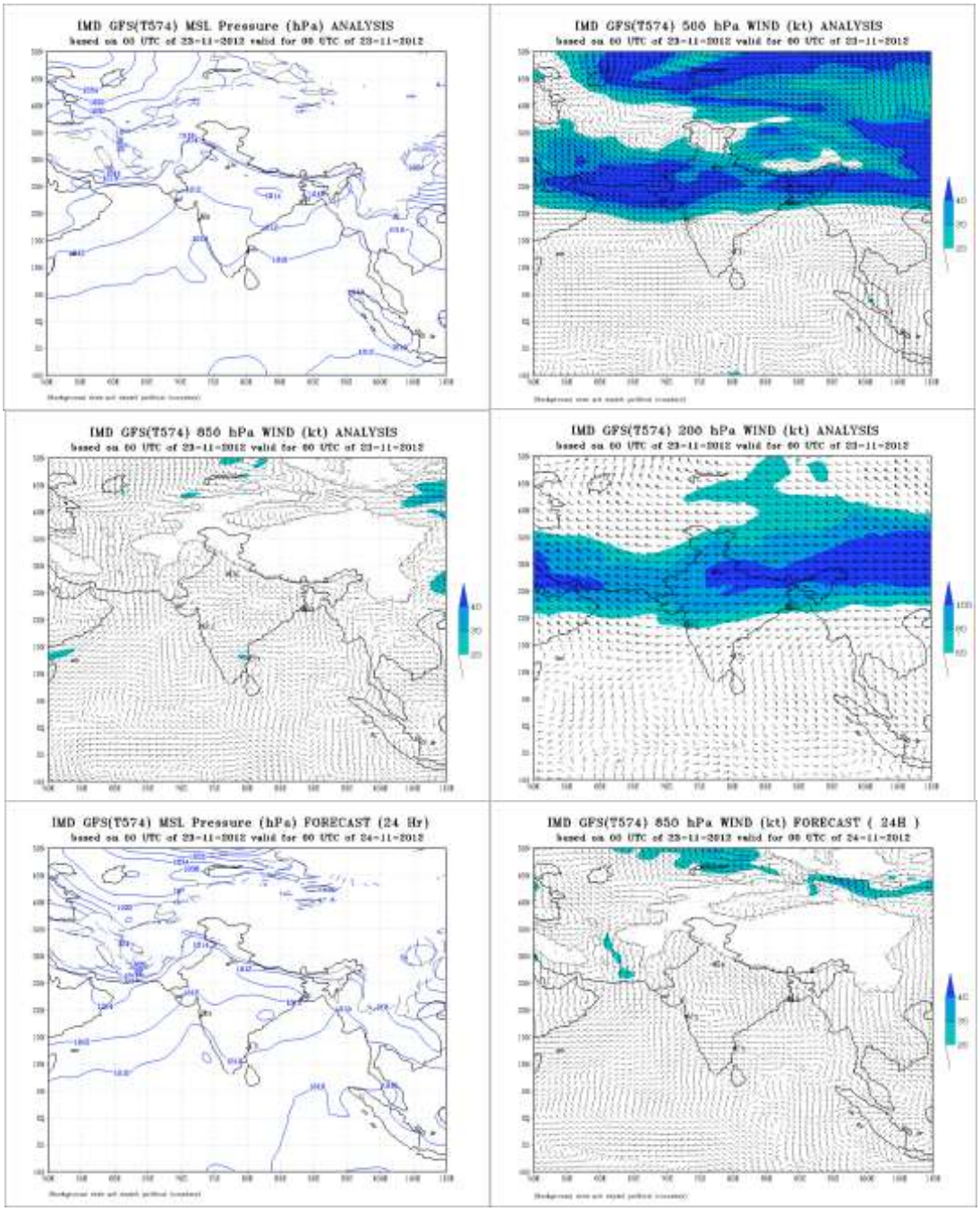
**MISDA : 8**

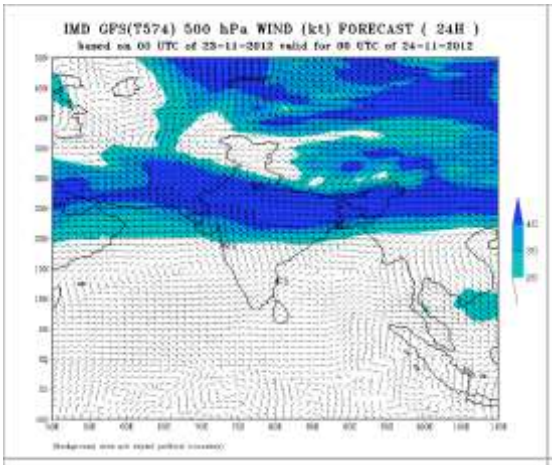
**No. of PILOT Ascents:**

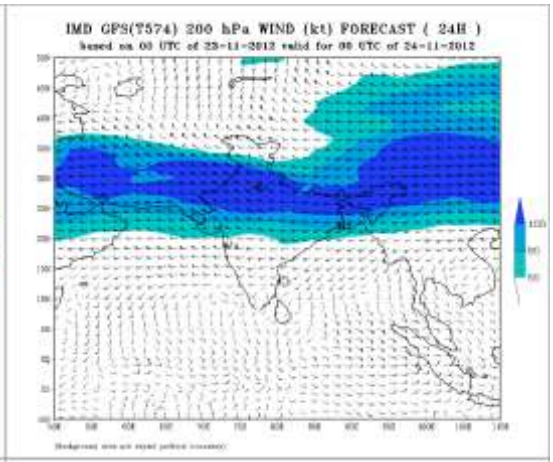
**22.11.2012**

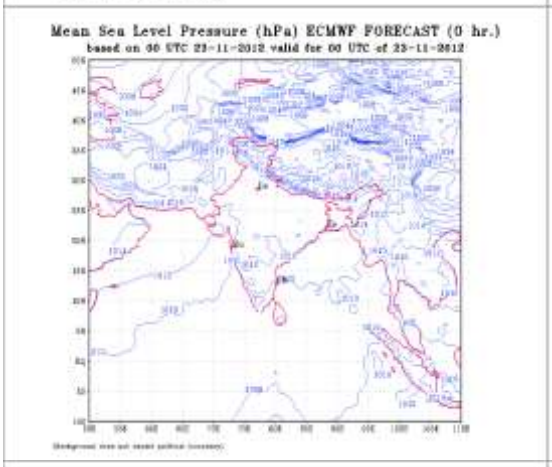
| 06Z | 18Z |
|---|---|
| 2 | 4 |

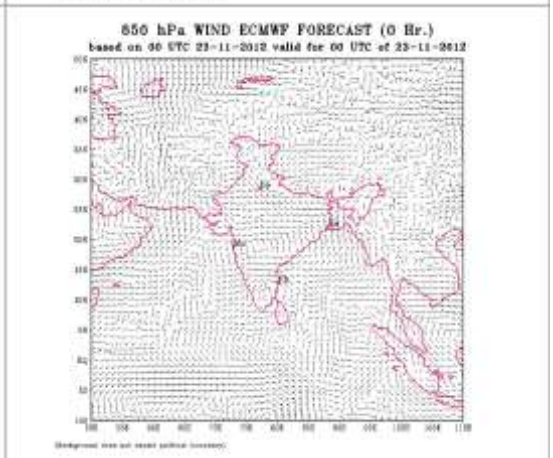
## Annexure II

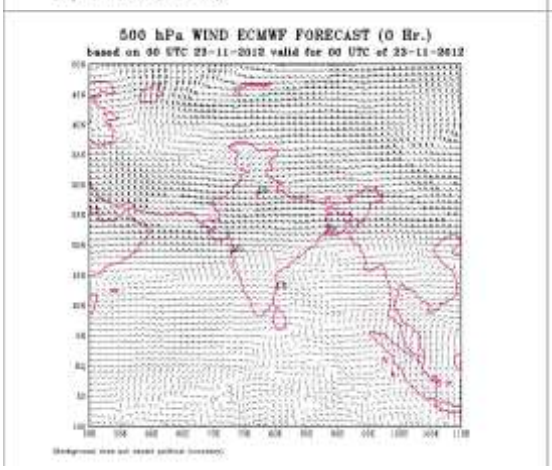

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 23-11-2012 valid for 00 UTC of 23-11-2012
IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 23-11-2012 valid for 00 UTC of 23-11-2012
IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 23-11-2012 valid for 00 UTC of 23-11-2012
IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 23-11-2012 valid for 00 UTC of 23-11-2012
IMD GFS(T574) MSL Pressure (hPa) FORECAST (24 Hr)
based on 00 UTC of 23-11-2012 valid for 00 UTC of 24-11-2012
IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 23-11-2012 valid for 00 UTC of 24-11-2012

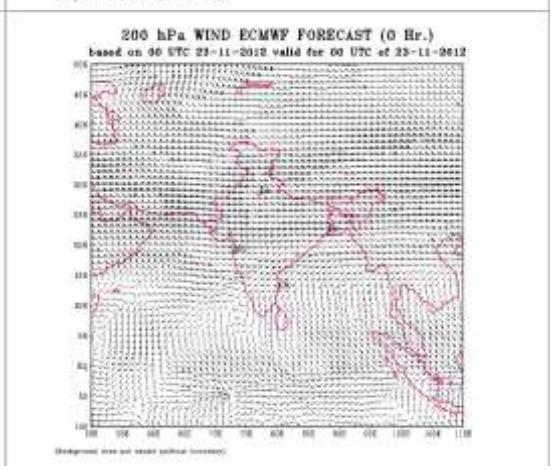

IMD GFS(T574) 500 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 23-11-2012 valid for 00 UTC of 24-11-2012

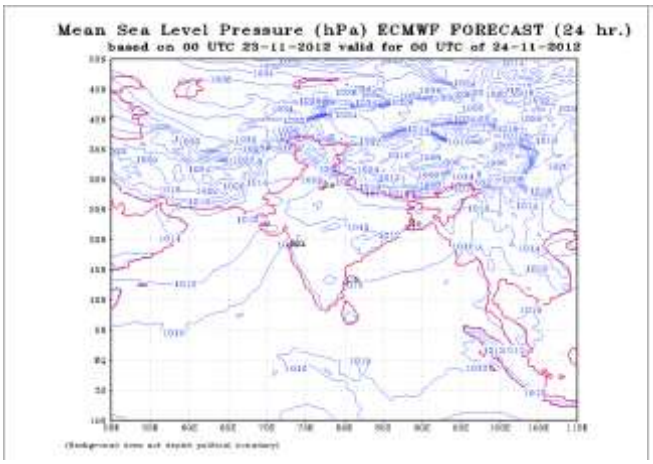

IMD GFS(T574) 200 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 23-11-2012 valid for 00 UTC of 24-11-2012

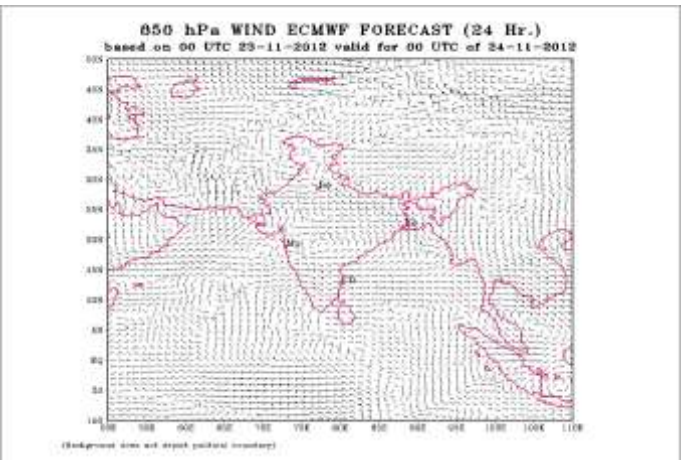

Mean Sea Level Pressure (hPa) ECMWF FORECAST (0 hr.)
based on 00 UTC 23-11-2012 valid for 00 UTC of 23-11-2012

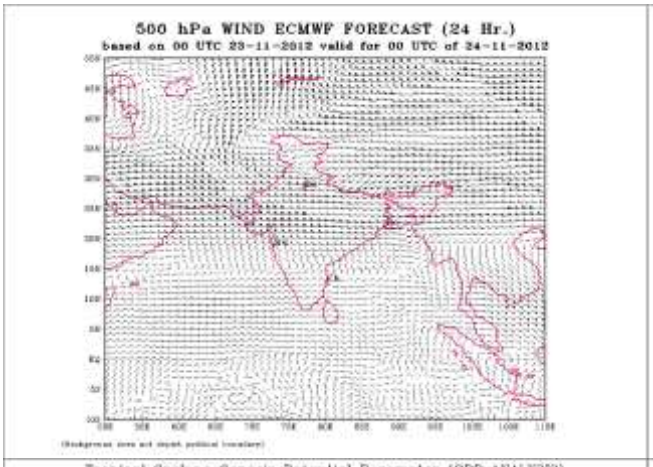

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 23-11-2012 valid for 00 UTC of 23-11-2012

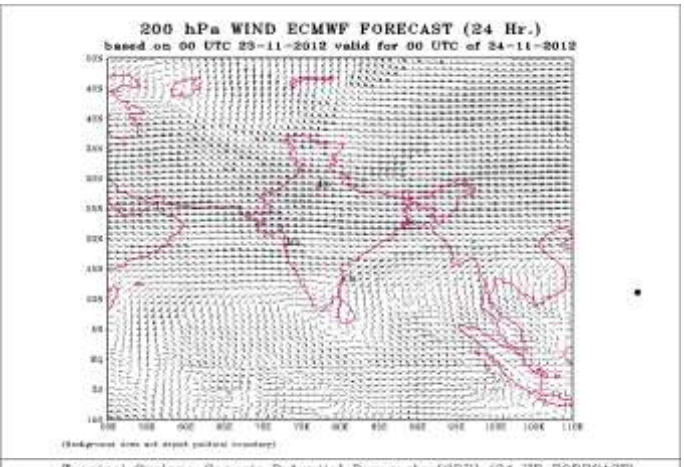

500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 23-11-2012 valid for 00 UTC of 23-11-2012

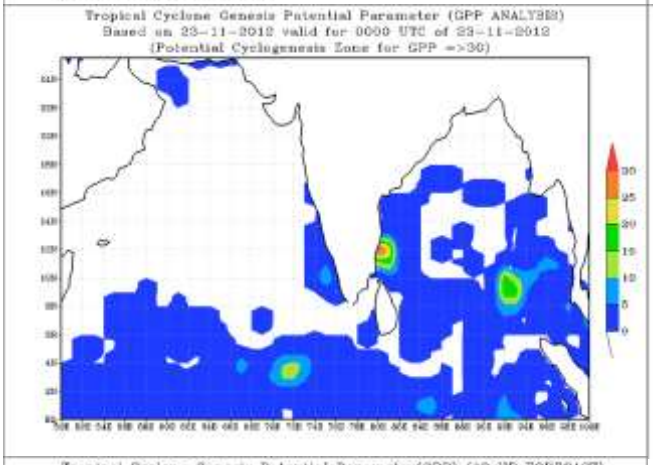

200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 23-11-2012 valid for 00 UTC of 23-11-2012

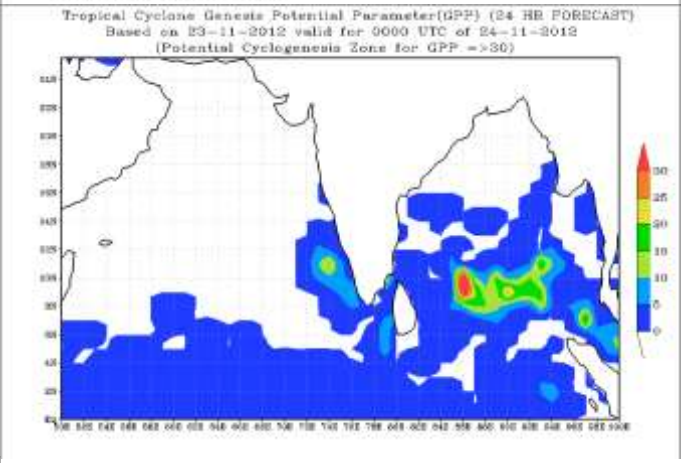

Mean Sea Level Pressure (hPa) ECMWF FORECAST (24 hr.)
based on 00 UTC 23-11-2012 valid for 00 UTC of 24-11-2012

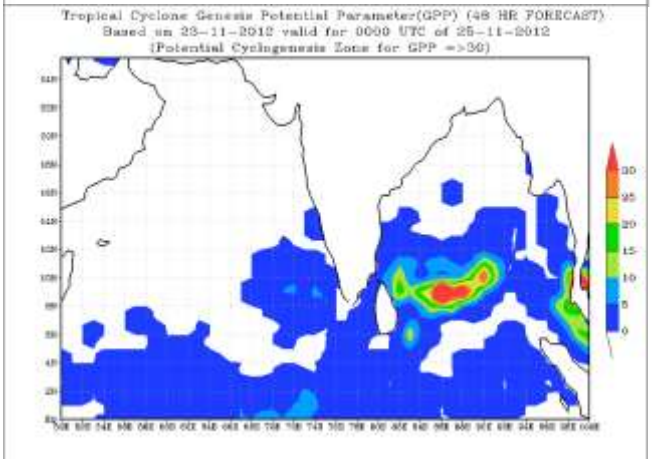

850 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 23-11-2012 valid for 00 UTC of 24-11-2012


500 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 23-11-2012 valid for 00 UTC of 24-11-2012


200 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 23-11-2012 valid for 00 UTC of 24-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 23-11-2012 valid for 0000 UTC of 23-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 23-11-2012 valid for 0000 UTC of 24-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 23-11-2012 valid for 0000 UTC of 25-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 24 November, 2012

**Synoptic features based on 0300 UTC:**

- Yesterday's trough of low pressure extending from southwest to westcentral Bay of Bengal is now seen as an upper air cyclonic circulation over south Tamilnadu and neighbourhood extending upto 3.1 km.

**Environmental features based on 0300 UTC of today**

**Sea Surface Temperature:**

- SST is around 26-28$^0$C over Southwest and west central Bay of Bengal. It is around 28 -30ºC over remaining parts of Bay and Indian Ocean.

**Ocean thermal energy:**

- Ocean thermal energy is less than 50 KJ cm$^{-2}$ over Southwest and West Central Bay and 50 -80 KJ cm$^{-2}$ over remaining parts of Bay and Indian Ocean.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over parts of south Bay of Bengal.

**Convergence:**

- Lower level convergence has decreased and is of the order of 5* 10$^{-5}$ s$^{-1}$ over parts of south Bay of Bengal.

**Divergence:**

- Upper air divergence is of the order of 5-10 *10$^{-5}$ s$^{-1}$ over parts of south Bay of Bengal.

**Wind Shear:**

- Wind Shear is more than 20 knots over north and central Bay of Bengal. It is of the order 5-10 knots over south Bay of Bengal and Comorin Area.

**Wind Shear Tendency:**

- Positive of the order of 5-10 knots over north and central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through latitude 10.0°N.

**M.J.O. Index:**

- Located over phase 6 with amplitude= 1.
- Statistical forecast: - MJO is over phase 6 and will continue during next 2 days.
- Dynamical forecast: - MJO located in phase 6 with amplitude <1.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite advisory**

Low/medium clouds with embedded moderate to intense convection at many places over bay of Bengal between latitude 6.5N to 14.0N long 82.0E to 91.0E and low/medium clouds at a few places over Andaman sea.

**NWP Analysis**

- **IMD-GFS** – Analysis charts at 00UTC on 24 November 2012, indicates no significant cyclonic circulation over Indian seas but with a feeble trough along Tamilnadu coast. The next 3 days forecasts do not show any significant development over Indian seas.
- **IMD-WRF** - Analysis charts of MSLP and Wind at 00UTC on 24 November 2012 show a feeble trough and associated wind flow pattern over extreme south peninsula and Tamilnadu coast. The next 3 days Forecast do not indicate any significant development over Indian seas.
- **ECMWF - T**he MSLP analysis of 00 UTC, 24 November 2012, show a feeble trough lies over exterme south peninsula. Wind flow pattern in the analysis does not depict any cyclonic circulation over Indian seas. The next 3-days forecasts do not indicate any significant change except extended cyclonic circulation over south-central BOB in next 2 days.
- **NCMRWF (GEFS) and Unified Model** both suggest no cyclogenesis over North Indian Ocean during next 72 hours.
- The 850 hPa, 500 hPa and 200 hPa wind analyses of IMD-GFS and ECMWF are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis shows a significant zone of GPP with values (~30) over south-central BOB and forecast shows a significant development over the same area and extending up to Srilanka coast during next 3 days. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Conclusion and Advisory:**

- Due to the unfavorable environment and also based on NWP guidance, the potential for the development of a significant tropical cyclone is low in the next 72 hours. However, a low pressure area may develop over southeast Bay of Bengal around 29$^{th}$ November as predicted by many NWP models.
- **Hence No IOP is declared for next 3 days.**

**Annexure-I**

**Status of Observation system (Stations received/Total stations):**

**Synoptic observation from Departmental Observatories** (Mean sea Level Pressure, 24 Hour pressure change, Wind speed and direction, 24 Hour accumulated rainfall, cloud type and coverage, Present and past weather etc):

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **23/12** | **24/00** | **24/03** |
| **West Bengal** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **Andhra Pradesh** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **Andaman & Nicobar** | 1/1 | 1/1 | 1/1 |
| **Total** | 54/55 | 40/44 | 54/55 |
| **Bangladesh** | 9/11 | 9/11 | 10/11 |
| **Myanmar** | 9/11 | 10/11 | 7/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 8/9 | 8/9 | 8/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **23/12** | **24/00** | **24/03** |
| **West Bengal** | 10/20 | 10/20 | 10/20 |
| **Odisha** | 23/38 | 22/38 | 24/38 |
| **Andhra Pradesh** | 26/35 | 25/35 | 27/35 |
| **Tamil Nadu** | 19/26 | 18/26 | 19/26 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **Total** | 80/125 | 75/125 | 80/125 |

**Buoy Data over Bay of Bengal**

| 23/12 | 24/00 | 24/03 |
|---|---|---|
| 18 | 14 | 19 |

**Upper air Observations over India**

- **RS/RW** (12Z) of 23-11-2012: 08/39
- **No. of Ascents reaching 250 hPa levels:1 , MISDA:-31**
- **RS/RW** (00Z) of 24-11-2012: 17/39
- **No. of Ascents reaching 250 hPa levels: 7 , MISDA:22**

**No. of PILOT Ascents**

| 23/12Z | 24/00Z |
|---|---|
| 14/37 | 17/34 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **23.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z /23.11.2012 : 2**

No. of Ascents reaching 250 hPa level =2

**MISDA : 6**

**12Z /23.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

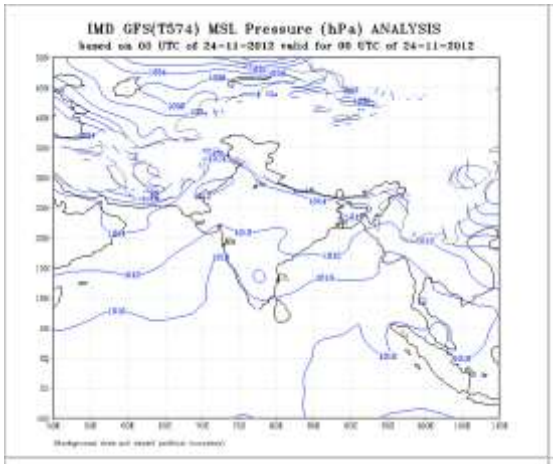
**MISDA : 8**

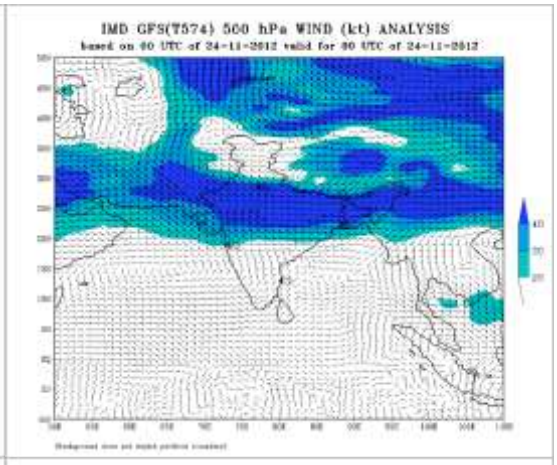
**No. of PILOT Ascents:**

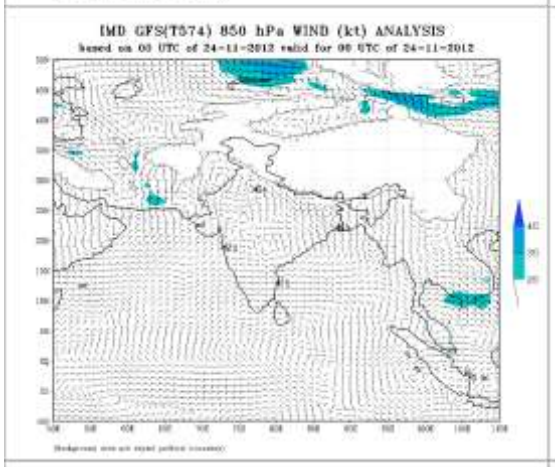
**23.11.2012**

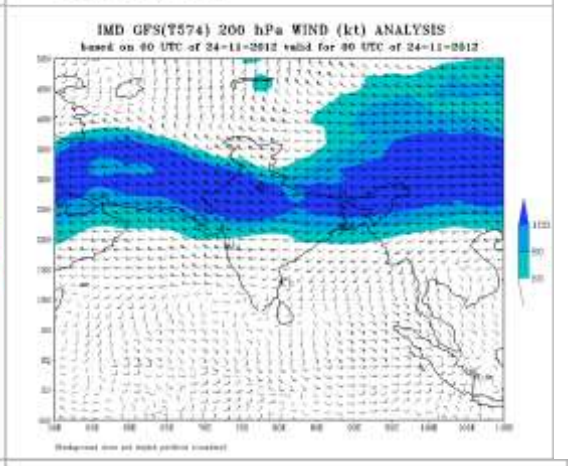
| 06Z | 18Z |
|---|---|
| 4 | 4 |

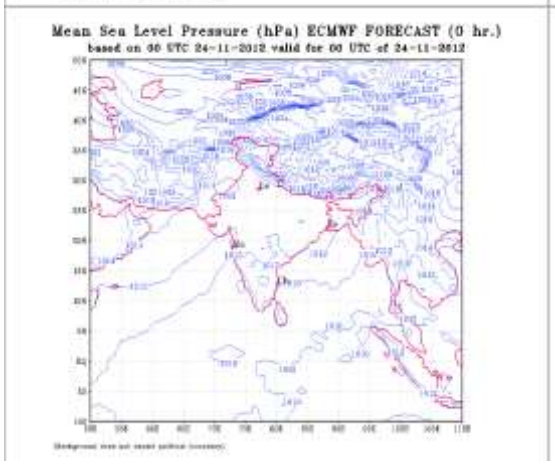
**Annexure-II**

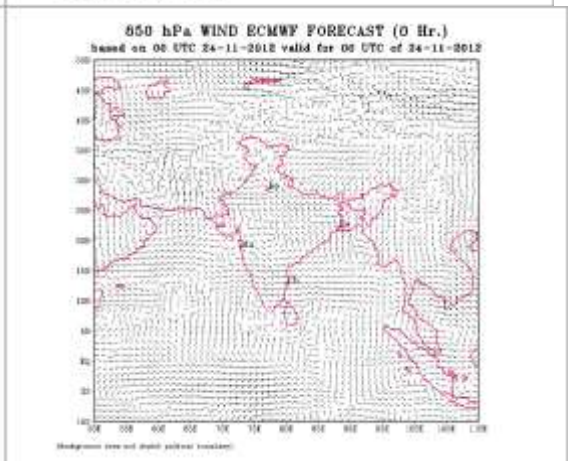

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 24-11-2012 valid for 00 UTC of 24-11-2012

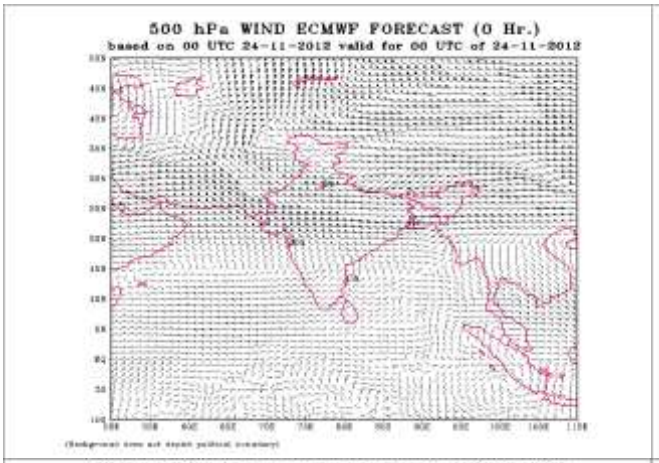

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 24-11-2012 valid for 00 UTC of 24-11-2012

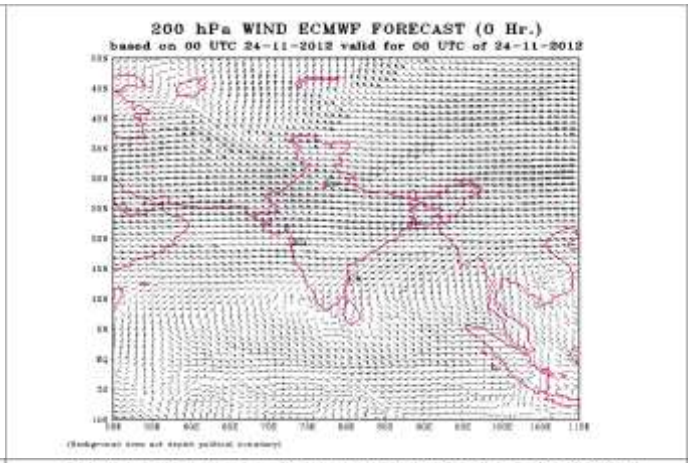

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 24-11-2012 valid for 00 UTC of 24-11-2012

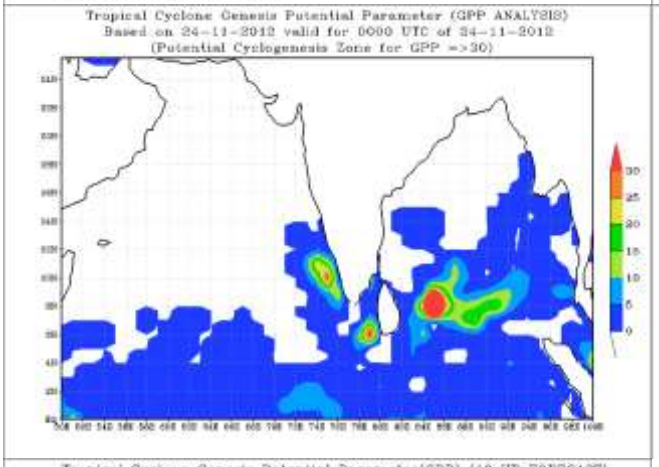

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 24-11-2012 valid for 00 UTC of 24-11-2012

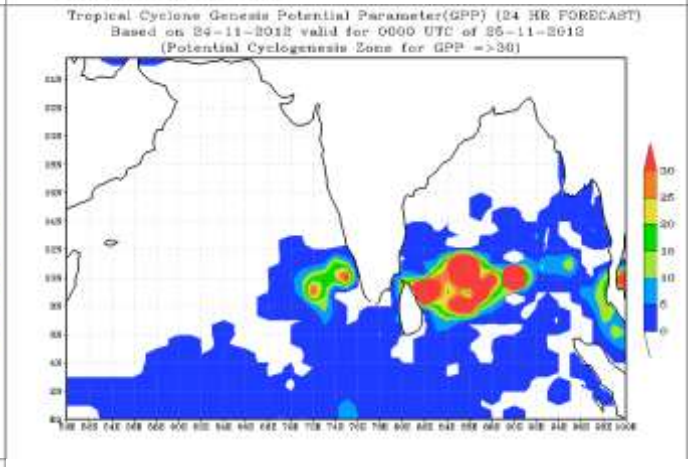

Mean Sea Level Pressure (hPa) ECMWF FORECAST (0 hr.)
based on 00 UTC 24-11-2012 valid for 00 UTC of 24-11-2012

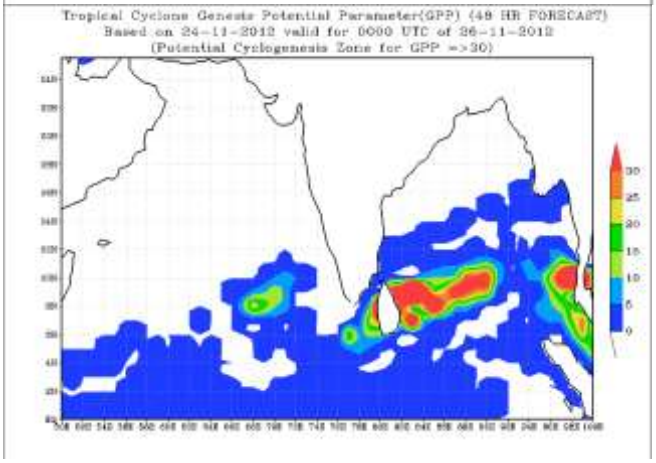

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 24-11-2012 valid for 00 UTC of 24-11-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 24-11-2012 valid for 00 UTC of 24-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 24-11-2012 valid for 00 UTC of 24-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 24-11-2012 valid for 0000 UTC of 24-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 24-11-2012 valid for 0000 UTC of 25-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 24-11-2012 valid for 0000 UTC of 26-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 25 November, 2012

**Synoptic features based on 0300 UTC:**

- Yesterday's upper air cyclonic circulation over south Tamilnadu and neighbourhood persists in lower levels.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over most parts of Andaman Sea and Bay of Bengal outside coastal areas of east coast where it is between 26-28ºC.

**Ocean thermal energy:**

- Ocean thermal energy is between 100-120 KJ cm$^{-2}$ over south Andaman Sea and adjoining southeast Bay of Bengal; between 80-100 KJ cm$^{-2}$ over rest parts of Bay of Bengal outside northwest, westcentral and southwest Bay of Bengal where it is less than 50 KJ cm$^{-2}$.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over parts of southwest and northeast Bay of Bengal.

**Convergence:**

- Lower level convergence has increased over south Bay of Bengal and is of the order of (5-10)* 10$^{-5}$ s$^{-1}$.

**Divergence:**

- Upper air divergence is of the order of (5-15)*10$^{-5}$ s$^{-1}$ over parts of southwest and adjoining southeast Bay of Bengal.

**Wind Shear:**

- Wind shear is of the order of 10-25 knots over some parts of south Bay of Bengal and 25-45 over most parts of north and central Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing tendency of the order of 5-10 knots is over southwest & central Bay of Bengal and increase over parts of south Bay of Bengal and south Andaman Sea is of the order of 5-10 knots.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through along latitude 12.0°N.

**M.J.O. Index:**

- Located over phase 6 with amplitude= 1.
- Statistical forecast: - MJO is over phase 6 and will continue during next 2 days.
- Dynamical forecast: - MJO located in phase 6 with amplitude <1.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite observations**

Broken low/medium clouds with embedded moderate to intense convection lies over south and adjoining central Bay of Bengal bet lat $6.5^0$N to $13.5^0$N west of long $91.5^0$E, gulf of Mannar, Andaman sea, Tenasserim coast and gulf of Martaban.

**NWP Analysis**

- **IMD-GFS** – Analysis charts at 00UTC on 25 November 2012, indicates no significant cyclonic circulation over Indian seas but with a feeble trough over extreme south Peninsula. The next 2 days forecasts do not show any significant development over Indian seas but day 3 forecast shows a feeble low and associated cyclonic circulation below 500 hPa level over south Andaman Sea.
- **IMD-WRF** - Analysis charts of MSLP and Wind at 00UTC on 25 November 2012 show a feeble trough and associated wind flow pattern over extreme south peninsula. Similar to IMD-GFS, only in Day 3 forecast indicate a development of feeble low over south Andaman Sea.
- **ECMWF - T**he MSLP and Wind analyses of 00 UTC, 25 November 2012, show a feeble trough lies over extreme south peninsula. The forecasts also in agreement with other two models and show a significant change in Day 3 as a formation of low pressure system over south Andaman Sea.
- The 850 hPa, 500 hPa and 200 hPa wind analyses and Day 1 forecast of IMD-GFS and ECMWF are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis shows a significant zone of GPP with values (~30) over south-central BOB extending up to Srilanka coast and also over Arabian Sea near Lakshadweep. GPP forecasts show a significant development over south Andaman Sea area on day 2 and 3. The area of significant GPP over Arabian Sea move westward in the consecutive days. GPP charts for 00, 24 and 48 hours are shown in **Annexure II.**

**Conclusion and Advisory:**

- Meteorological conditions and numerical weather prediction models suggest that a low pressure area may develop over southeast Bay of Bengal around $28^{th}$ November and it may become well marked low pressure area subsequently.
- **No IOP is declared for next 2 days.**

**Annexure-I**

**Status of Observation system (Stations received/Total stations):**

**Synoptic observation from Departmental Observatories** (Mean sea Level Pressure, 24 Hour pressure change, Wind speed and direction, 24 Hour accumulated rainfall, cloud type and coverage, Present and past weather etc):

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **24/12** | **25/00** | **25/03** |
| **West Bengal** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **Andhra Pradesh** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **Andaman & Nicobar** | 1/1 | 1/1 | 1/1 |
| **Total** | 54/55 | 40/44 | 54/55 |
| **Bangladesh** | 11/11 | 10/11 | 11/11 |
| **Myanmar** | 10/11 | 10/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 6/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **24/12** | **25/00** | **25/03** |
| **West Bengal** | 11/20 | 10/20 | 10/20 |
| **Odisha** | 24/38 | 24/38 | 23/38 |
| **Andhra Pradesh** | 25/35 | 25/35 | 27/35 |
| **Tamil Nadu** | 19/26 | 18/26 | 19/26 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **Total** | 81/125 | 79/125 | 81/125 |

**Buoy Data over Bay of Bengal**

| 24/12 | 25/00 | 25/03 |
|---|---|---|
| 15 | 15 | 19 |

**Upper air Observations over India**

- **RS/RW** (12Z) of 24-11-2012: 05/39
- **No. of Ascents reaching 250 hPa levels:1 , MISDA:-34**
- **RS/RW** (00Z) of 25-11-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: 11 , MISDA:20**

**No. of PILOT Ascents**

| 24/12Z | 25/00Z |
|---|---|
| 14/37 | 11/34 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **24.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **21** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z /24.11.2012 : 1**

No. of Ascents reaching 250 hPa level =1

**MISDA : 7**

**12Z /24.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

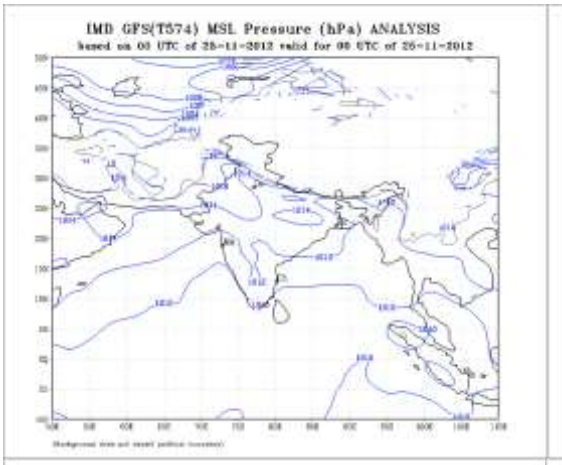
**MISDA : 8**

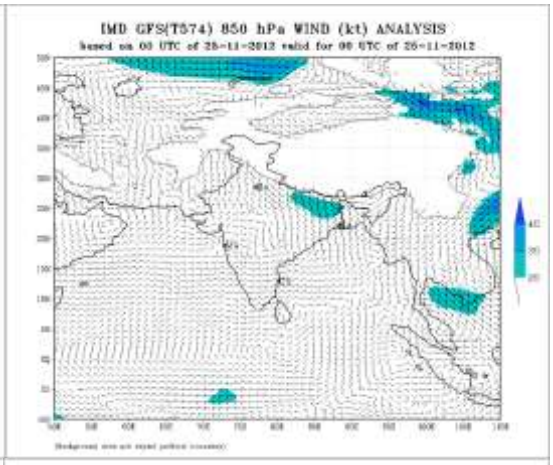
**No. of PILOT Ascents:**

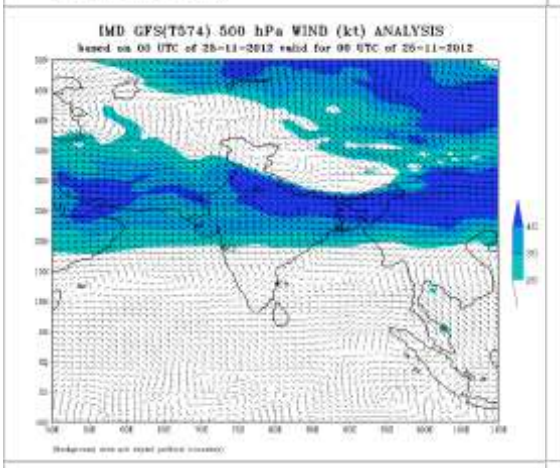
**24.11.2012**

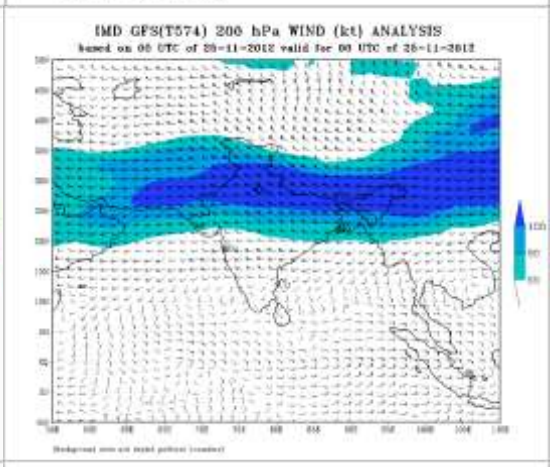
| 06Z | 18Z |
|---|---|
| 5 | 5 |

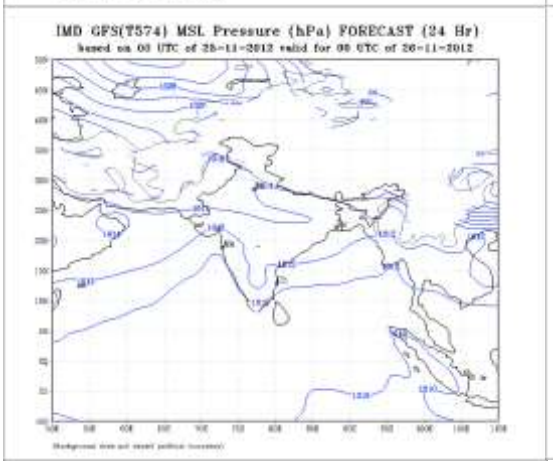
## Annexure II

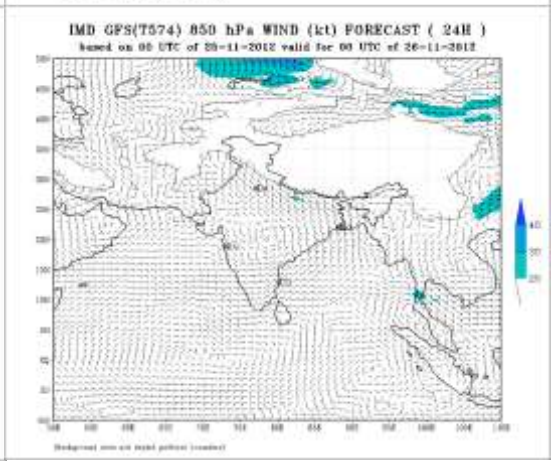

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 25-11-2012 valid for 00 UTC of 26-11-2012

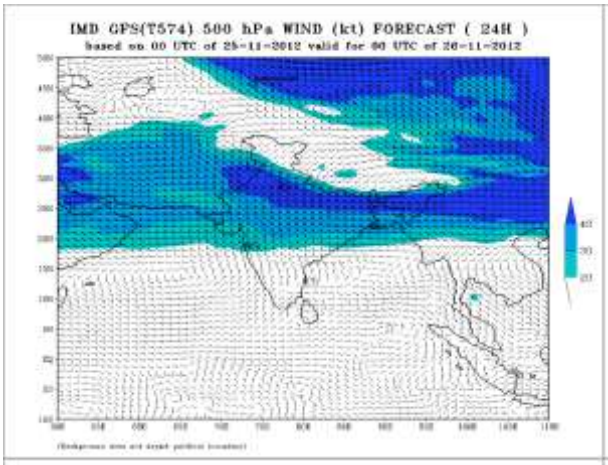

IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 25-11-2012 valid for 00 UTC of 26-11-2012

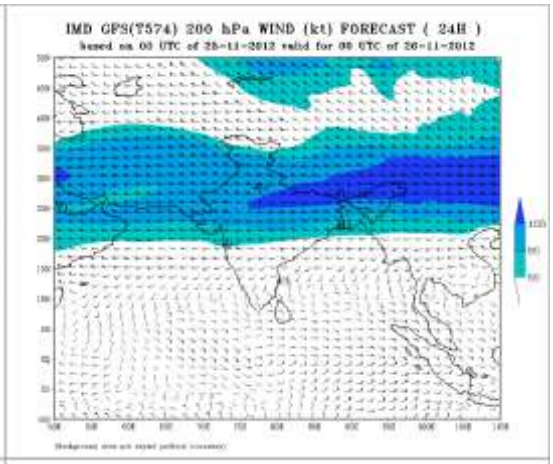

IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 25-11-2012 valid for 00 UTC of 26-11-2012

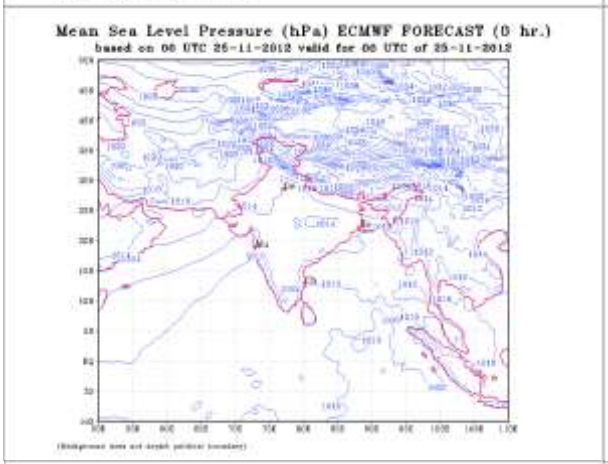

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 25-11-2012 valid for 00 UTC of 26-11-2012

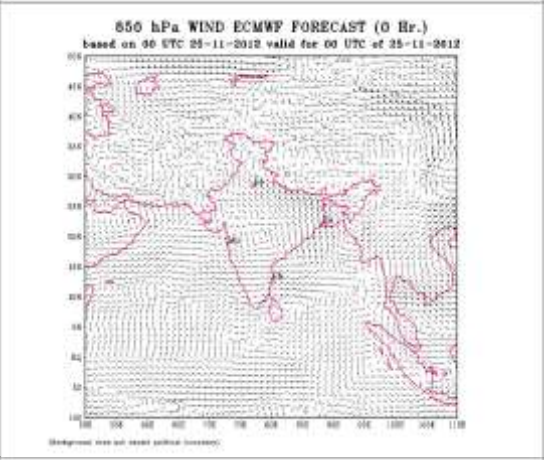

IMD GFS(T574) MSL Pressure (hPa) FORECAST (24 Hr)
based on 00 UTC of 25-11-2012 valid for 00 UTC of 26-11-2012

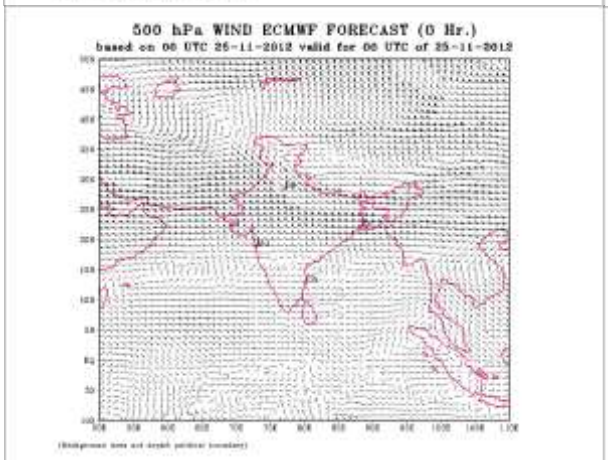

IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 25-11-2012 valid for 00 UTC of 26-11-2012

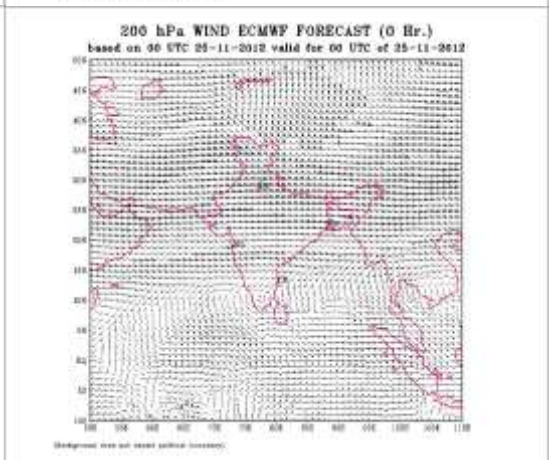

IMD GPS(T574) 500 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 25-11-2012 valid for 00 UTC of 26-11-2012

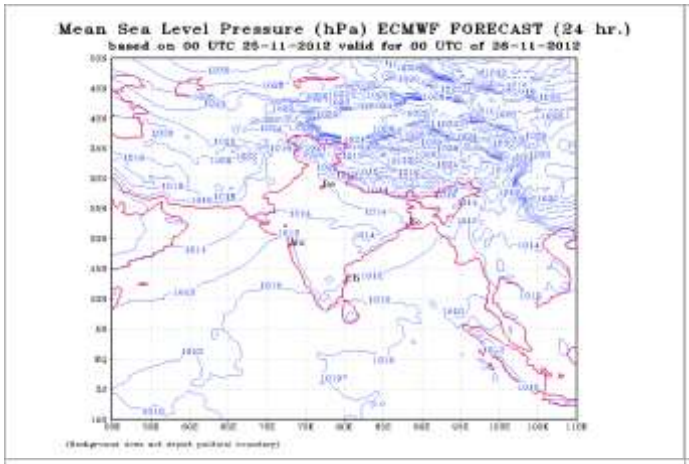

IMD GPS(T574) 200 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 25-11-2012 valid for 00 UTC of 26-11-2012

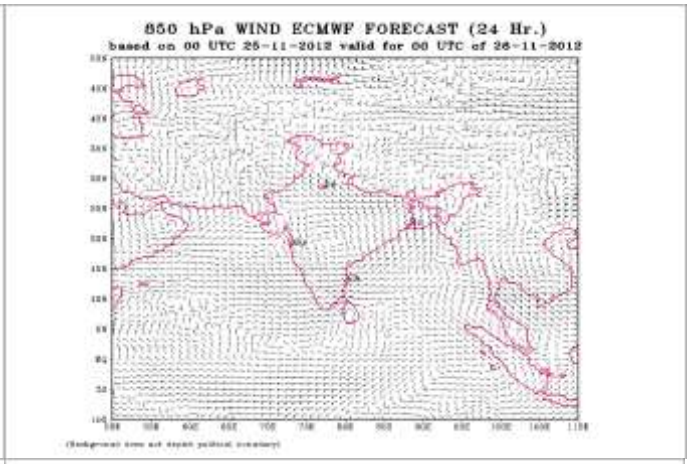

Mean Sea Level Pressure (hPa) ECMWF FORECAST (0 hr.)
based on 00 UTC 25-11-2012 valid for 00 UTC of 25-11-2012

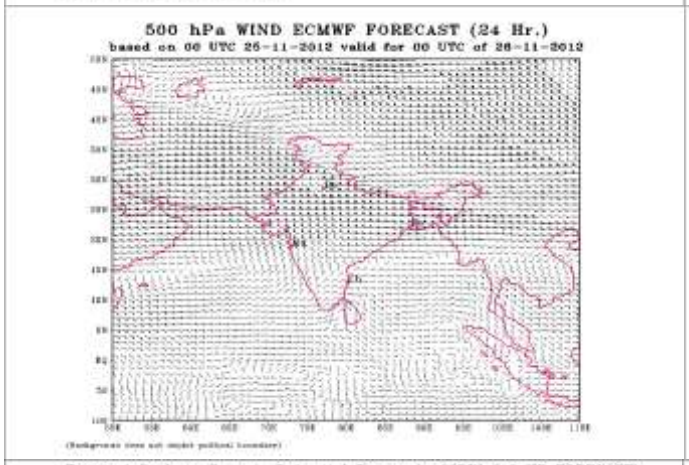

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 25-11-2012 valid for 00 UTC of 25-11-2012

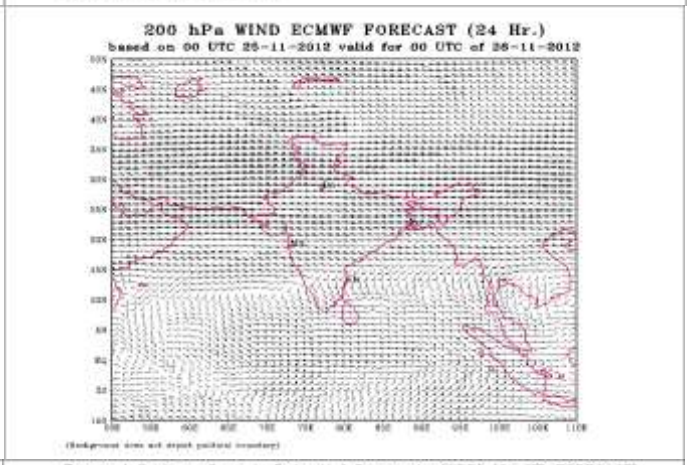

500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 25-11-2012 valid for 00 UTC of 25-11-2012

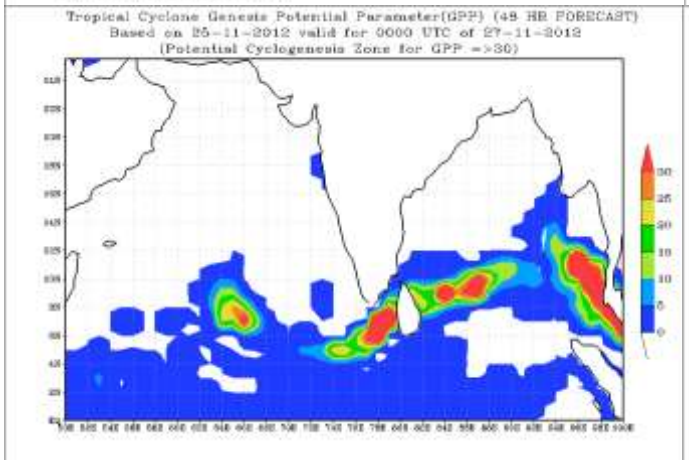

200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 25-11-2012 valid for 00 UTC of 25-11-2012

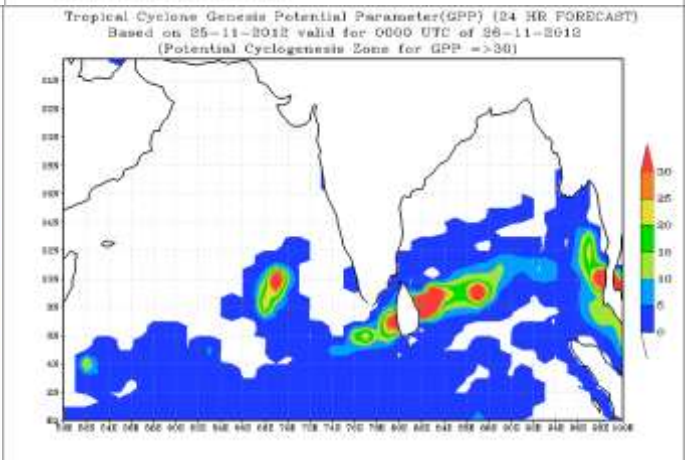

Mean Sea Level Pressure (hPa) ECMWF FORECAST (24 hr.)
based on 00 UTC 25-11-2012 valid for 00 UTC of 26-11-2012


850 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 25-11-2012 valid for 00 UTC of 26-11-2012


500 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 25-11-2012 valid for 00 UTC of 26-11-2012


200 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 25-11-2012 valid for 00 UTC of 26-11-2012


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 25-11-2012 valid for 0000 UTC of 27-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 25-11-2012 valid for 0000 UTC of 26-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 26 November, 2012

**Synoptic features based on 0300 UTC:**

- The upper air cyclonic circulation over south Tamilnadu and adjoining southwest Bay of Bengal in lower levels persists.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over most parts of Andaman Sea and Bay of Bengal outside coastal areas of east coast where it is between 26-28ºC.

**Ocean thermal energy:**

- Ocean thermal energy is between 100-120 KJ cm$^{-2}$ over south Andaman Sea and adjoining southeast Bay of Bengal; between 80-100 KJ cm$^{-2}$ over rest parts of Bay of Bengal outside northwest, westcentral and southwest Bay of Bengal where it is less than 50 KJ cm$^{-2}$.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over parts of southwest and northeast Bay of Bengal.

**Convergence:**

- Lower level convergence has increased over south Bay of Bengal and is of the order of (5-10)* 10$^{-5}$ s$^{-1}$.

**Divergence:**

- Upper air divergence is of the order of (5-15)*10$^{-5}$ s$^{-1}$ over parts of southwest and adjoining southeast Bay of Bengal.

**Wind Shear:**

- Wind shear is of the order of 10-20 knots over some parts of south Bay of Bengal and 25-30 over most parts of north and central Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing tendency of the order of 5-10 knots is over southwest & central Bay of Bengal.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through along latitude 11.0°N.

**M.J.O. Index:**

- Located over phase 6 with amplitude= 1.
- Statistical forecast: - MJO is over phase 6 and will continue during next 2 days.
- Dynamical forecast: - MJO located in phase 6 with amplitude <1.

**Status of observational system:**

- Details of the status of observational system are given in **Annexure I**.

**Satellite observations**

- Low/medium clouds at many places with embedded moderate to intense convection at few places lies over South-East Bay and rest Bay between latitude 10.0N to 12.0N long 82.0E to 88.0E.

**NWP Analysis**

- **IMD-GFS** – Analysis charts at 00UTC on 26th November 2012, indicates no significant cyclonic circulation over Indian seas .The next 2 days forecasts show a feeble low and associated cyclonic circulation extending up to 500 hPa level over south Andaman Sea.
- **IMD-WRF** - Analysis charts of MSLP and Wind at 00UTC on 26th November 2012 indicates no significant cyclonic circulation over Indian seas. Day 2 forecast indicate a development of feeble low and associated cyclonic circulation extending up to 700 hPa level over south Andaman Sea.
- **ECMWF - T**he MSLP and Wind analyses of 00 UTC, 26th November 2012, show a feeble cyclonic circulation which lies over south west bay of Bengal.
- Day 2 forecast indicate development of cyclonic circulation in the lower level over south Andaman Sea.
- The 850 hPa, 500 hPa and 200 hPa wind analyses and Day 1 forecast of IMD-GFS and ECMWF are given in **Annexure II.**
- **NCMRWF (GEFS) and Unified Models also indicate** development of cyclonic circulation in the lower level over south Andaman Sea on 28th November.

**Genesis Potential Parameter (GPP):**

- Model analysis shows a significant zone of GPP with values 30 over south-east Bay of Bengal extending up to south west Bay of Bengal and also over Andaman Sea area. GPP Forecasts show intensification of GPP over Andaman Sea area on day 2 and slightly northwestwards movement on day3. The area of significant GPP over Arabian Sea move westward in the consecutive days. GPP charts for 00, 24 and 48 hours based on 0000UTC of 26-11-2012 are shown in **Annexure II.**

**Conclusion and Advisory:**

- **Meteorological conditions and numerical weather prediction models suggest that a low pressure area may develop over south Andaman sea around 28th November and it may become well marked low pressure area subsequently.**
- **No IOP is declared for next 2 days.**

**Annexure-I**

**Status of Observation system (Stations received/Total stations):**

**Synoptic observation from Departmental Observatories** (Mean sea Level Pressure, 24 Hour pressure change, Wind speed and direction, 24 Hour accumulated rainfall, cloud type and coverage, Present and past weather etc):

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **25/12** | **26/00** | **26/03** |
| **West Bengal** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **Andhra Pradesh** | 18/18 | 17/18 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 1/2 | 2/2 |
| **Andaman & Nicobar** | 1/1 | 1/1 | 1/1 |
| **Total** | 54/55 | 40/44 | 54/55 |
| **Bangladesh** | 11/11 | 11/11 | 11/11 |
| **Myanmar** | 10/11 | 10/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 6/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **25/12** | **26/00** | **26/03** |
| **West Bengal** | 5/20 | 11/20 | 11/20 |
| **Odisha** | 6/38 | 24/38 | 23/38 |
| **Andhra Pradesh** | 9/35 | 25/35 | 26/35 |
| **Tamil Nadu** | 9/26 | 18/26 | 19/26 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **Total** | 31/125 | 80/125 | 81/125 |

**Buoy Data over Bay of Bengal**

| 25/12 | 26/00 | 26/03 |
|---|---|---|
| 15 | 17 | 16 |

**Upper air Observations over India**

- **RS/RW** (12Z) of 25-11-2012: 05/39
- **No. of Ascents reaching 250 hPa levels:1 , MISDA:-34**
- **RS/RW** (00Z) of 26-11-2012: 19/39
- **No. of Ascents reaching 250 hPa levels: 10 , MISDA:20**

**No. of PILOT Ascents**

| 24/12Z | 25/00Z |
|---|---|
| 14/37 | 11/34 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **25.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z /25.11.2012 : 2**

No. of Ascents reaching 250 hPa level =2

**MISDA : 6**

**12Z /25.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

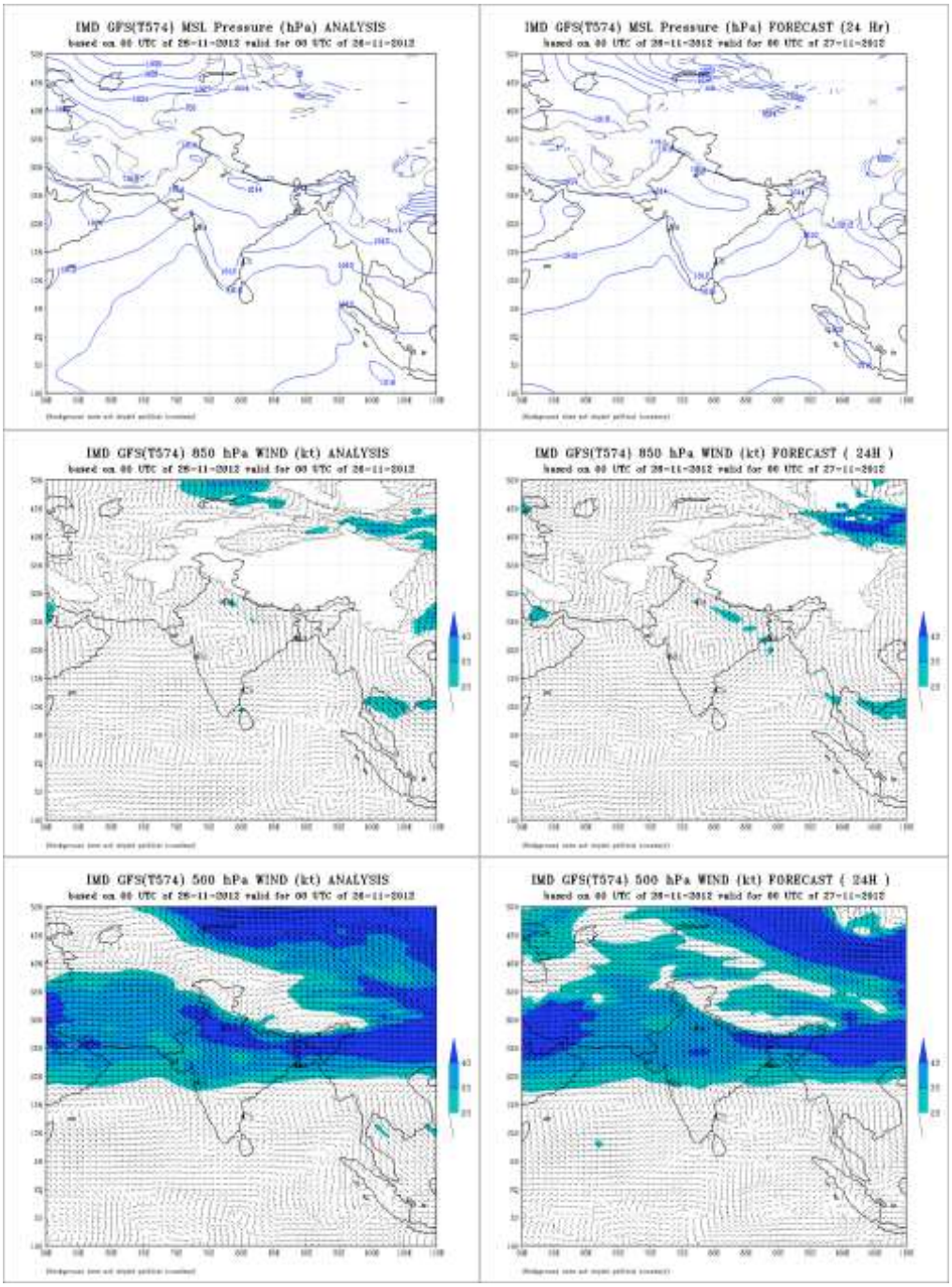
**MISDA : 8**

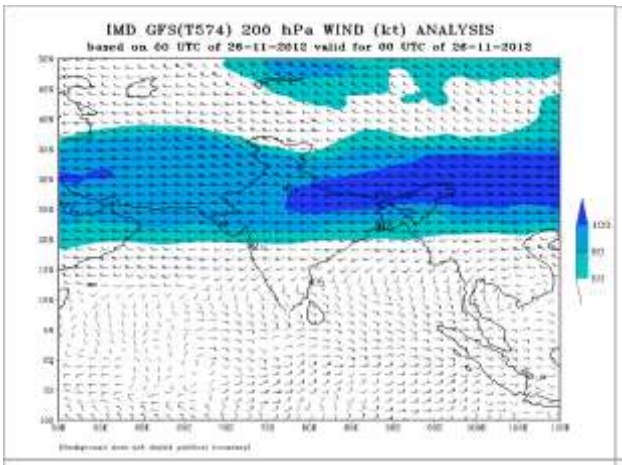
**No. of PILOT Ascents:**

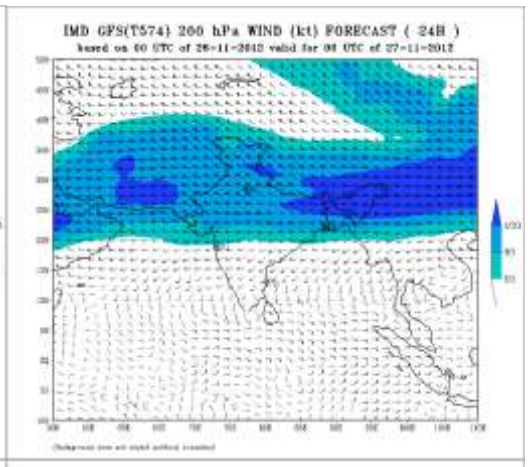
**25.11.2012**

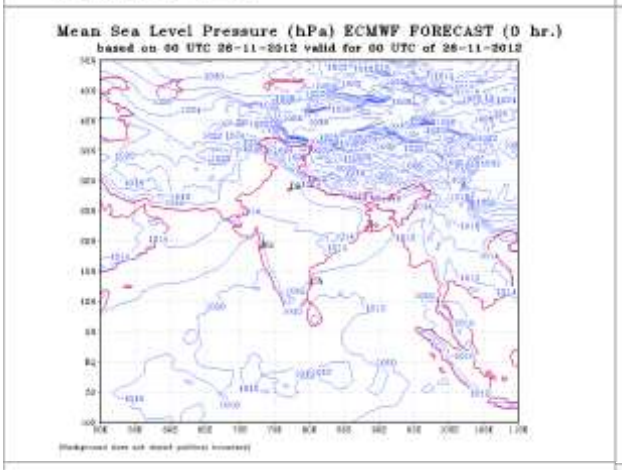
| 06Z | 18Z |
|---|---|
| 5 | 4 |

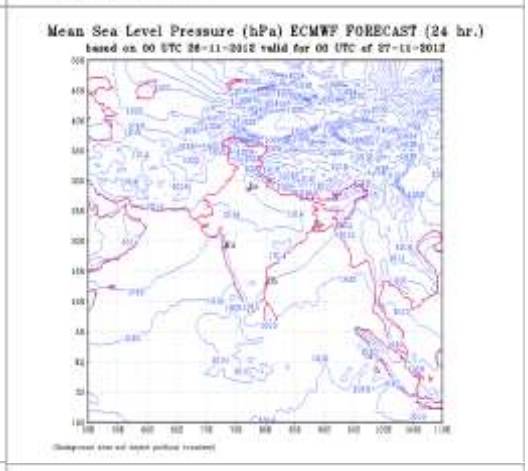
## Annexure II

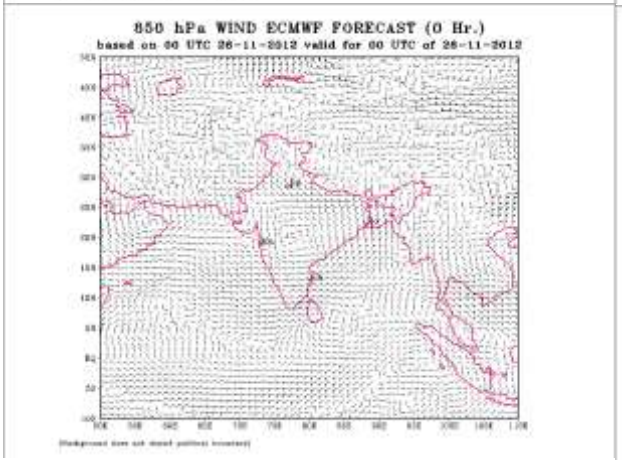

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
IMD GFS(T574) MSL Pressure (hPa) FORECAST (24 Hr)
IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )
IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
IMD GFS(T574) 500 hPa WIND (kt) FORECAST ( 24H )

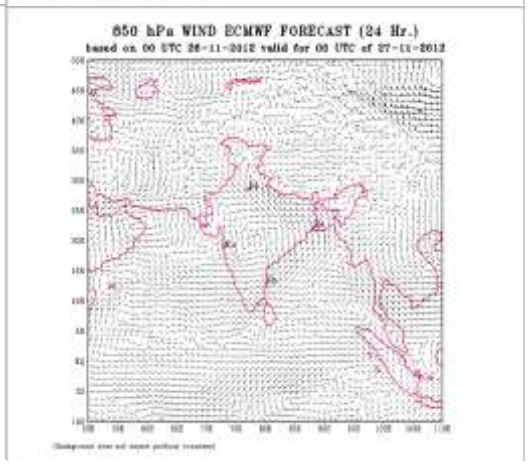

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 26-11-2012 valid for 00 UTC of 26-11-2012

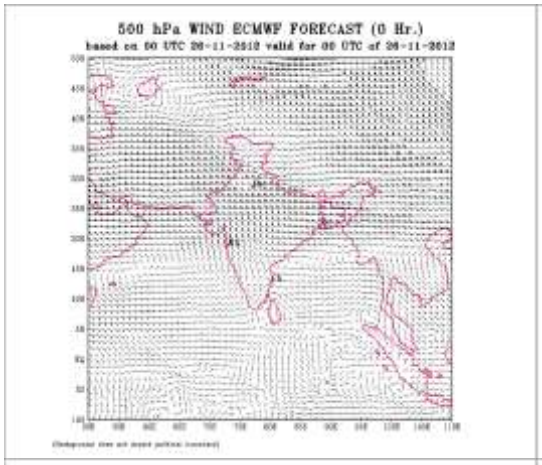

IMD GFS(T574) 200 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 26-11-2012 valid for 00 UTC of 27-11-2012

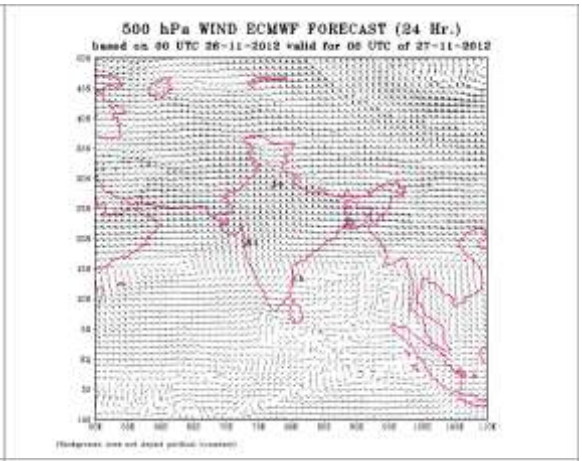

Mean Sea Level Pressure (hPa) ECMWF FORECAST (0 hr.)
based on 00 UTC 26-11-2012 valid for 00 UTC of 26-11-2012

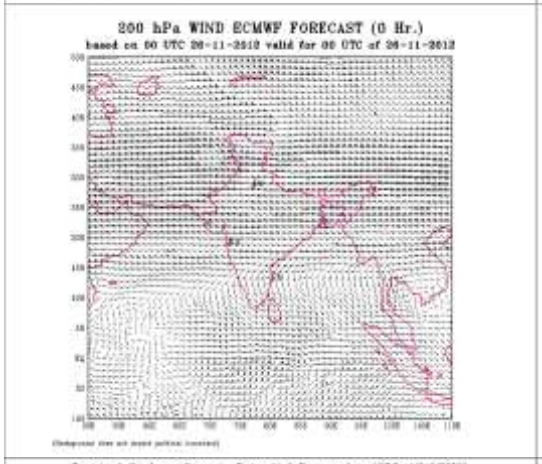

Mean Sea Level Pressure (hPa) ECMWF FORECAST (24 hr.)
based on 00 UTC 26-11-2012 valid for 00 UTC of 27-11-2012

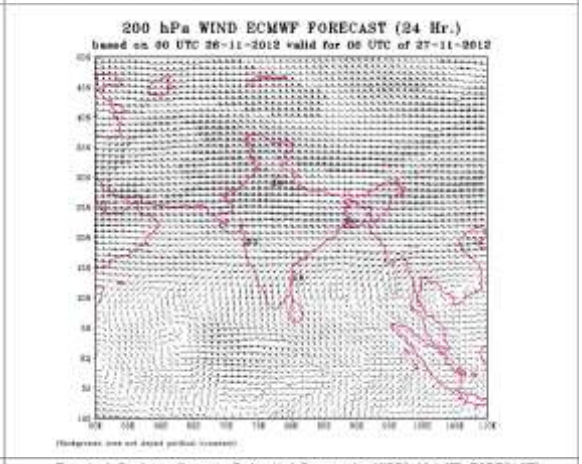

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 26-11-2012 valid for 00 UTC of 26-11-2012

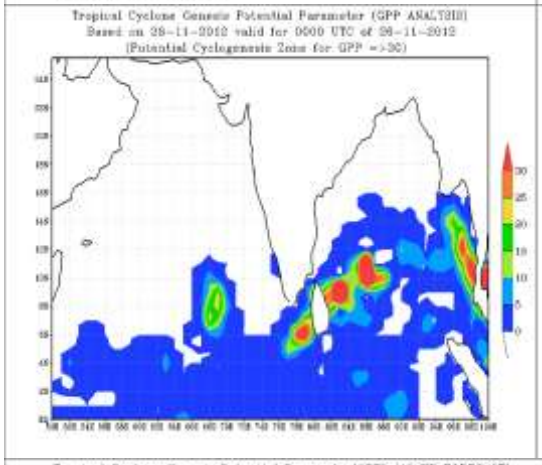

850 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 26-11-2012 valid for 00 UTC of 27-11-2012

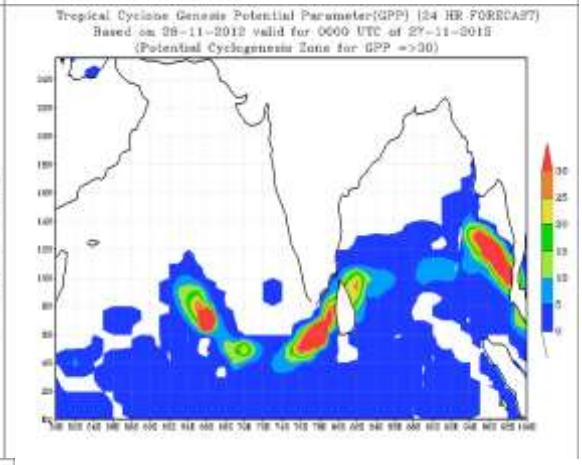

500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 26-11-2012 valid for 00 UTC of 26-11-2012

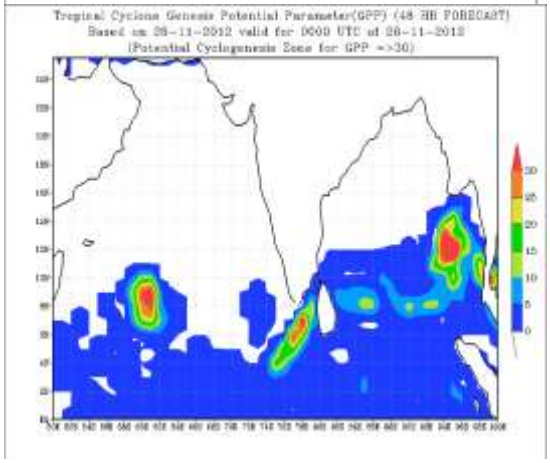

500 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 26-11-2012 valid for 00 UTC of 27-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 26-11-2012 valid for 00 UTC of 26-11-2012


200 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 26-11-2012 valid for 00 UTC of 27-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 26-11-2012 valid for 0000 UTC of 26-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 26-11-2012 valid for 0000 UTC of 27-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 26-11-2012 valid for 0000 UTC of 28-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 27 November, 2012

**Synoptic features based on 0300 UTC:**

- The trough of low at mean sea level over southwest Bay of Bengal off Sri-Lanka coast now lies over Comorin area and neighbourhood.
- The other trough of low at mean sea level over Tenasserim coast and neighbourhood now lies over Andaman Sea and neighbourhood.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 28-30$^0$C over most parts of Andaman Sea and Bay of Bengal outside coastal areas of east coast where it is between 26-28ºC.

**Ocean thermal energy:**

- Ocean thermal energy is between 100-120 KJ cm$^{-2}$ over Andaman Sea and adjoining southeast Bay of Bengal; between 80-100 KJ cm$^{-2}$ over rest parts of Bay of Bengal outside northwest, westcentral and southwest Bay of Bengal where it is less than 50 KJ cm$^{-2}$.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is positive over Andaman sea , parts of southwest and northeast Bay of Bengal.

**Convergence:**

- Lower level convergence is positive over south Bay of Bengal and is of the order of (5-10)* 10$^{-5}$ s$^{-1}$.

**Divergence:**

- Upper air divergence has increased over Andaman & and southeast Bay of Bengal and is of the order of (10-20)*10$^{-5}$ s$^{-1}$ .It is of the order of (5-20)*10$^{-5}$ s$^{-1}$ over parts of southwest Bay of Bengal.

**Wind Shear:**

- Wind shear is of the order of 5-10 over Andaman Sea 10-20 knots over south Bay of Bengal and >30 knots over most parts of north and central Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing tendency of the order of 5-10 knots is over Andaman Sea,

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through along latitude 11.0°N.

**M.J.O. Index:**

- Located over phase 6 with amplitude= 1.
- Statistical forecast: - MJO is over phase 6 and will continue during next 2 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite advisory**

Low level circulation over north Andaman Sea and neighbourhood has rapidly intensified and now lies as a vortex over north Andaman Sea centered within half a degree of lat/long 11.5N/95.0E. Intensity T1.0. Minimum CTT minus 58 deg C. Associated low/medium clouds with embedded moderate to intense convection at many places over north Andaman Sea, Andaman Islands, Gulf of Martaban and north Tenasserim Coast.

Low/medium clouds with embedded moderate to intense convection at many places over south Bay between lat 8.5N to 11.5N east of long 81.0E rest Andaman Sea and rest Tenasserim Coast. Low/medium clouds with embedded weak to moderate convection at few places over rest south Bay.

**NWP Analysis**

**IMD-GFS** – Analysis charts at 00UTC on 27$^{th}$ November 2012, indicate a cyclonic circulation over Andaman sea areas extending up to 500hPa level and another cyclonic circulation over south east Arabian sea and adjoining areas in the lower level. The next 2 days forecasts show a feeble low pressure area over Andaman Sea areas with associated cyclonic circulation extending up to 500 hPa level.

**IMD-WRF** - Analysis charts at 00UTC on 27$^{th}$ November 2012, indicate a cyclonic circulation over Andaman sea areas extending up to 500hPa level. Day 1 and day2 forecasts indicate slight northwest ward movement of the cyclonic circulation.

**ECMWF -** Analysis charts at 00UTC on 27$^{th}$ November 2012, indicate a cyclonic circulation over Andaman sea areas extending up to 500hPa level, day 1 and day 2 forecasts indicate slight northwest ward movement of the cyclonic circulation. Another cyclonic circulation over south east Arabian sea and adjoining areas extending up to 500 hPa level. The next 2 days forecasts also show the cyclonic circulation over south east Arabian sea in the lower level.

The 850 hPa, 500 hPa and 200 hPa wind analyses and Day 1 forecast of IMD-GFS and ECMWF are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

Model analysis shows a significant zone of GPP with values 30 over south-west Bay of Bengal extending up to south east Arabian sea across Srilanka coast and also over Andaman Sea area. Another zone of GPP with values 30 over southwest Arabian sea and adjoining areas of south east Arabian sea. GPP Forecasts of 24 hours show significant zone of GPP with values 30 over Andaman Sea area, south east Arabian sea and southwest Arabian sea. GPP Forecasts of 48 hours show significant zone of GPP with values 30 over south east Bay of Bengal and adjoining east central Bay of Bengal. GPP charts for 00, 24 and 48 hours based on 0000UTC of 27-11-2012 are shown in **Annexure II.**

**Conclusion and Advisory:**

- Meteorological conditions and numerical weather prediction models indicate a cyclonic circulation over Andaman sea areas extending up to 500hPa level,. It may develop into a low pressure area on 28th November and it may become well marked low pressure area subsequently.

- **No IOP during next 2 days.**

**Annexure-I**

**Status of Observation system (Stations received/Total stations):**

**Synoptic observation from Departmental Observatories** (Mean sea Level Pressure, 24 Hour pressure change, Wind speed and direction, 24 Hour accumulated rainfall, cloud type and coverage, Present and past weather etc):

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **26/12** | **27/00** | **27/03** |
| **West Bengal** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **Andhra Pradesh** | 15/18 | 15/18 | 17/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **Andaman & Nicobar** | 1/1 | 1/1 | 1/1 |
| **Total** | 54/55 | 38/45 | 53/55 |
| **Bangladesh** | 11/11 | 11/11 | 11/11 |
| **Myanmar** | 10/11 | 10/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 6/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **26/12** | **27/00** | **27/03** |
| **West Bengal** | 5/20 | 5/20 | 5/20 |
| **Odisha** | 6/38 | 6/38 | 6/38 |
| **Andhra Pradesh** | 9/35 | 9/35 | 9/35 |
| **Tamil Nadu** | 9/26 | 9/26 | 9/26 |
| **Puducherry** | 2/2 | 1/2 | 1/2 |
| **Total** | 31/121 | 30/121 | 30/121 |

**Buoy Data over Bay of Bengal**

| 26/12 | 27/00 | 27/03 |
|---|---|---|
| 05 | 08 | 06 |

**Upper air Observations over India**

- **RS/RW** (12Z) of 26-11-2012: 06/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:-33**
- **RS/RW** (00Z) of 27-11-2012: 18/39
- **No. of Ascents reaching 250 hPa levels: , MISDA:21**

**No. of PILOT Ascents**

| 26/12Z | 27/00Z |
|---|---|
| 16/37 | 12/34 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **26.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **23** | **19** | **19** | **18** |

**No. of RS/RW Ascents**

**00Z /26.11.2012 : 2**

No. of Ascents reaching 250 hPa level =2

**MISDA : 6**

**12Z /26.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

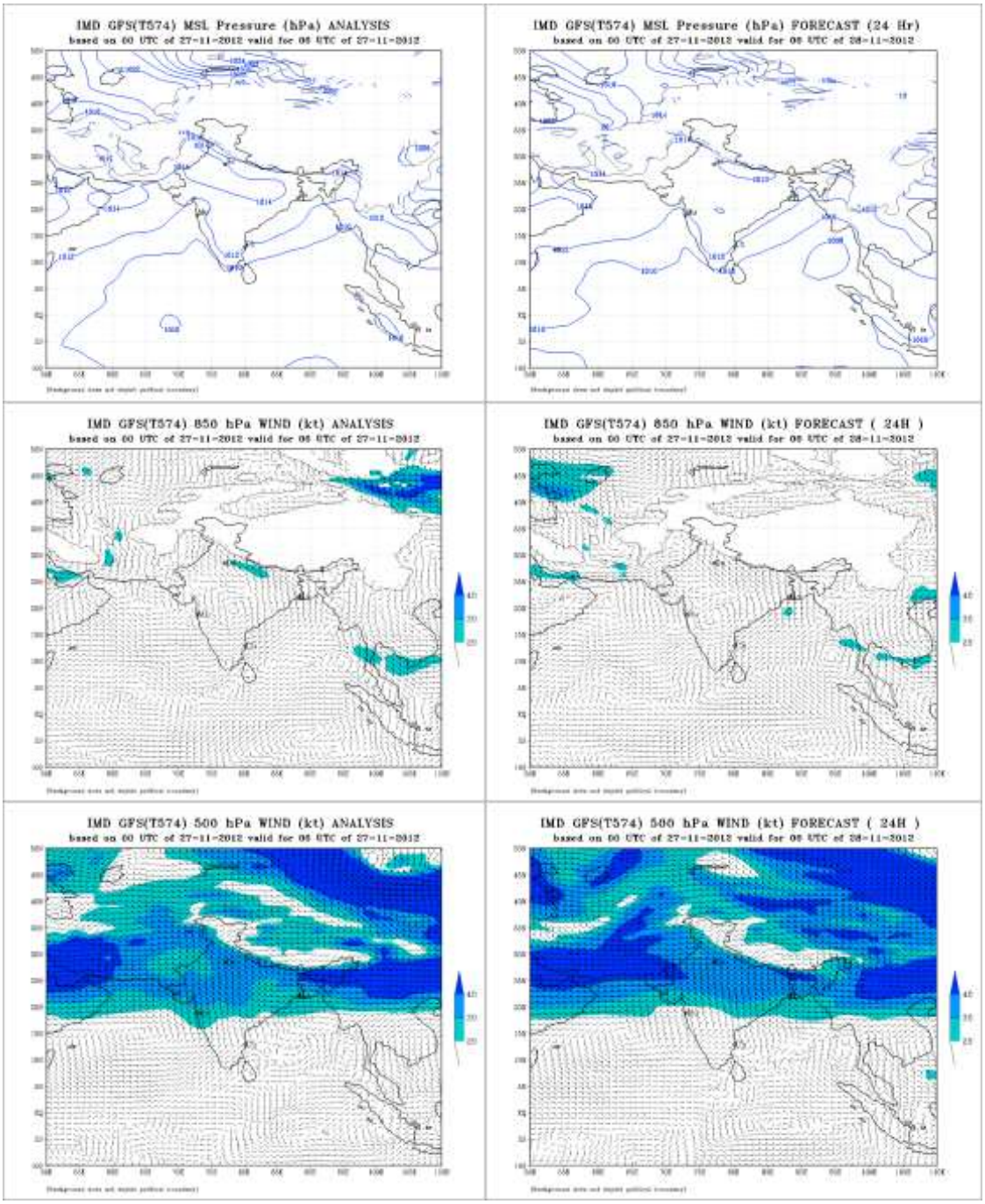
**MISDA : 8**

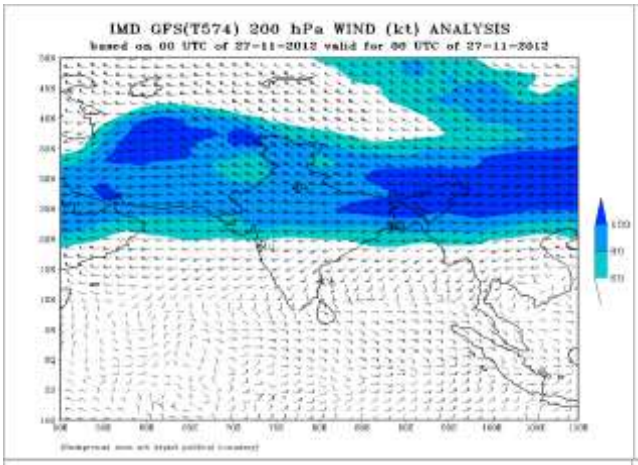
**No. of PILOT Ascents:**

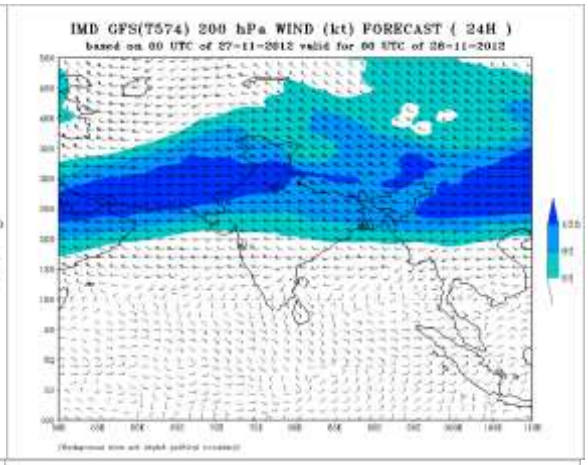
**26.11.2012**

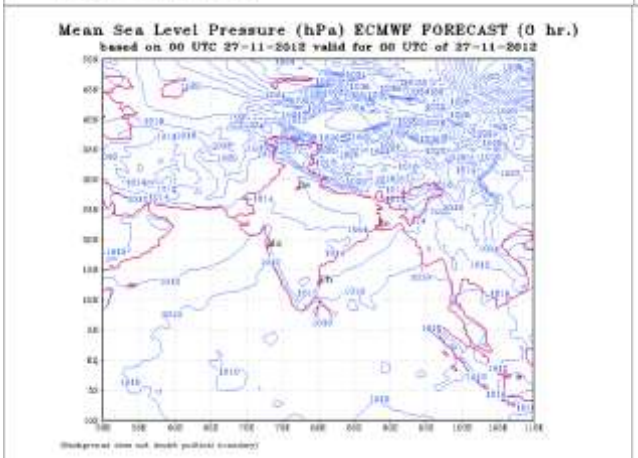
| 06Z | 18Z |
|---|---|
| 6 | 4 |

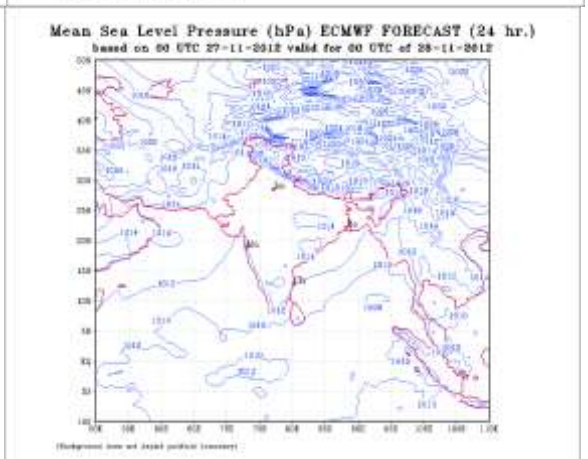
## Annexure II

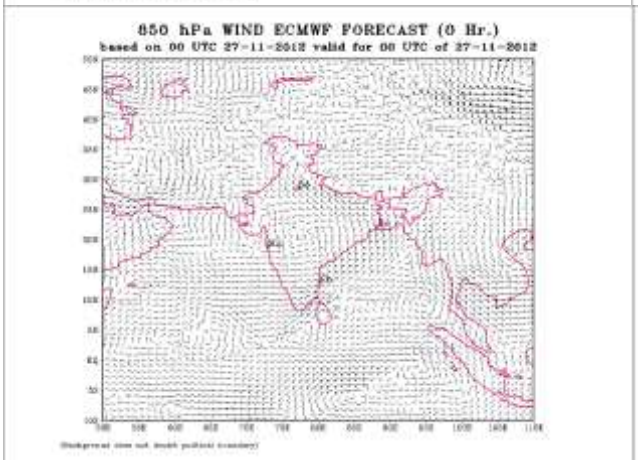

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 27-11-2012 valid for 00 UTC of 27-11-2012
IMD GFS(T574) MSL Pressure (hPa) FORECAST (24 Hr)
based on 00 UTC of 27-11-2012 valid for 00 UTC of 28-11-2012
IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 27-11-2012 valid for 00 UTC of 27-11-2012
IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 27-11-2012 valid for 00 UTC of 28-11-2012
IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 27-11-2012 valid for 00 UTC of 27-11-2012
IMD GFS(T574) 500 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 27-11-2012 valid for 00 UTC of 28-11-2012

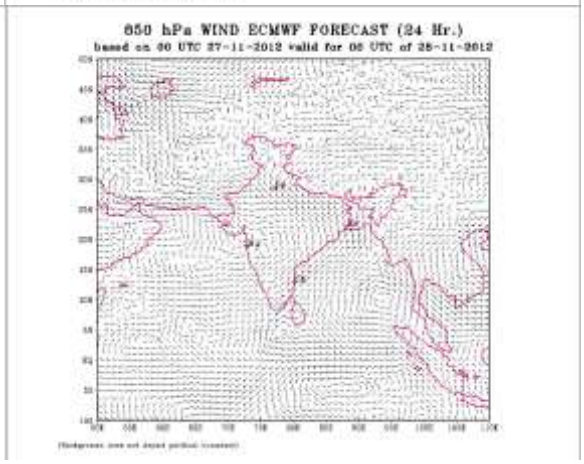

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 27-11-2012 valid for 00 UTC of 27-11-2012

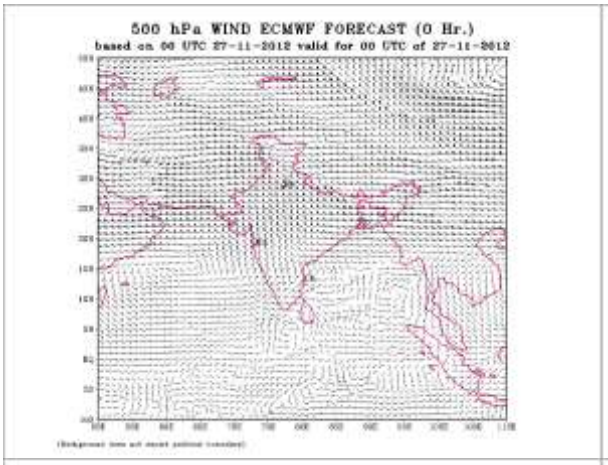

IMD GFS(T574) 200 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 27-11-2012 valid for 00 UTC of 28-11-2012

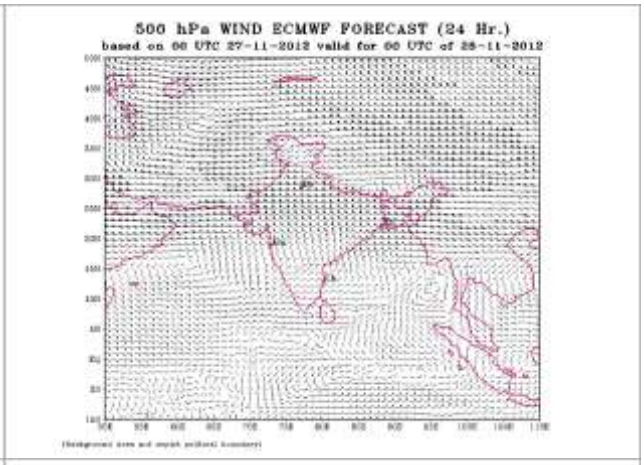

Mean Sea Level Pressure (hPa) ECMWF FORECAST (0 hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 27-11-2012

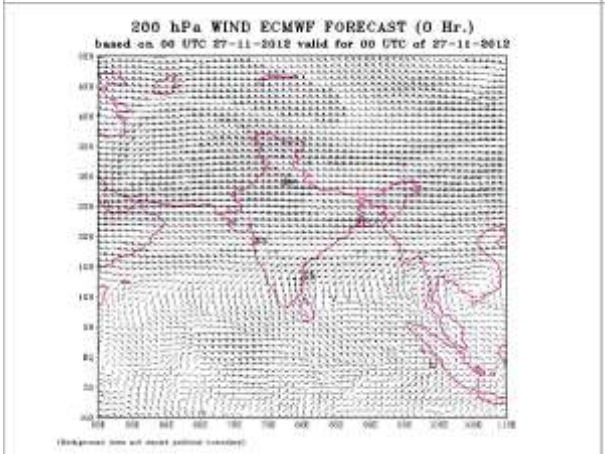

Mean Sea Level Pressure (hPa) ECMWF FORECAST (24 hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 28-11-2012

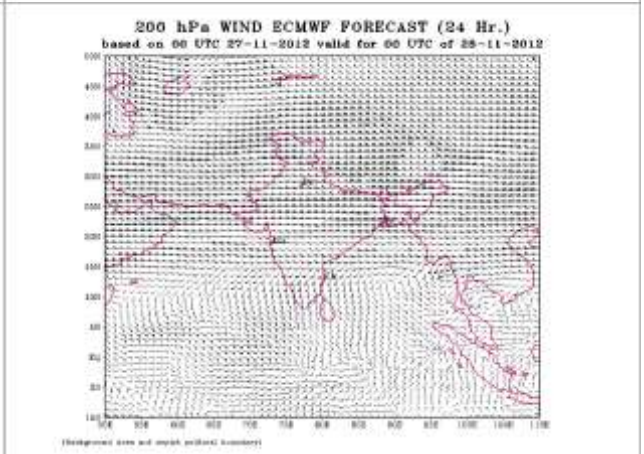

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 27-11-2012

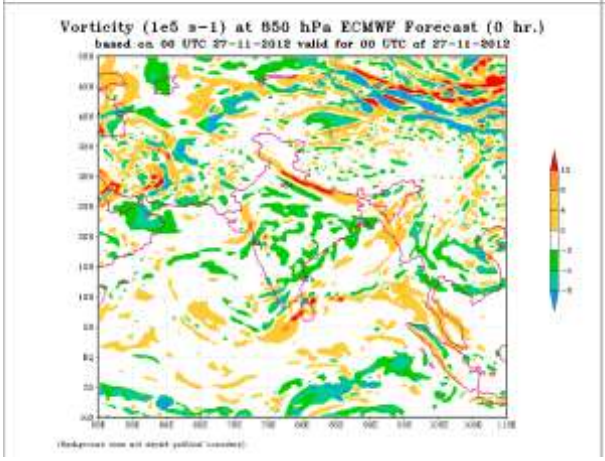

850 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 28-11-2012

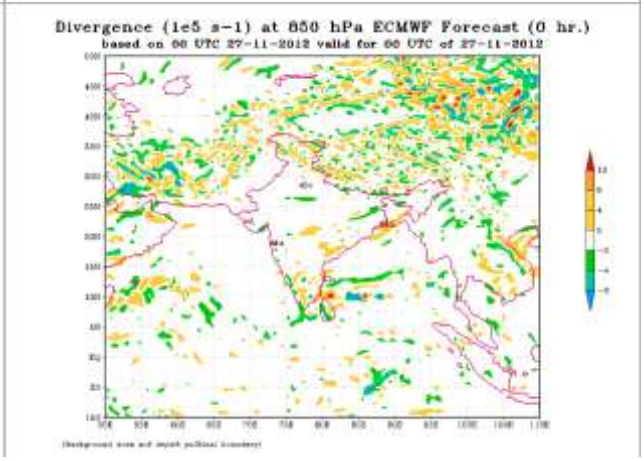

500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 27-11-2012

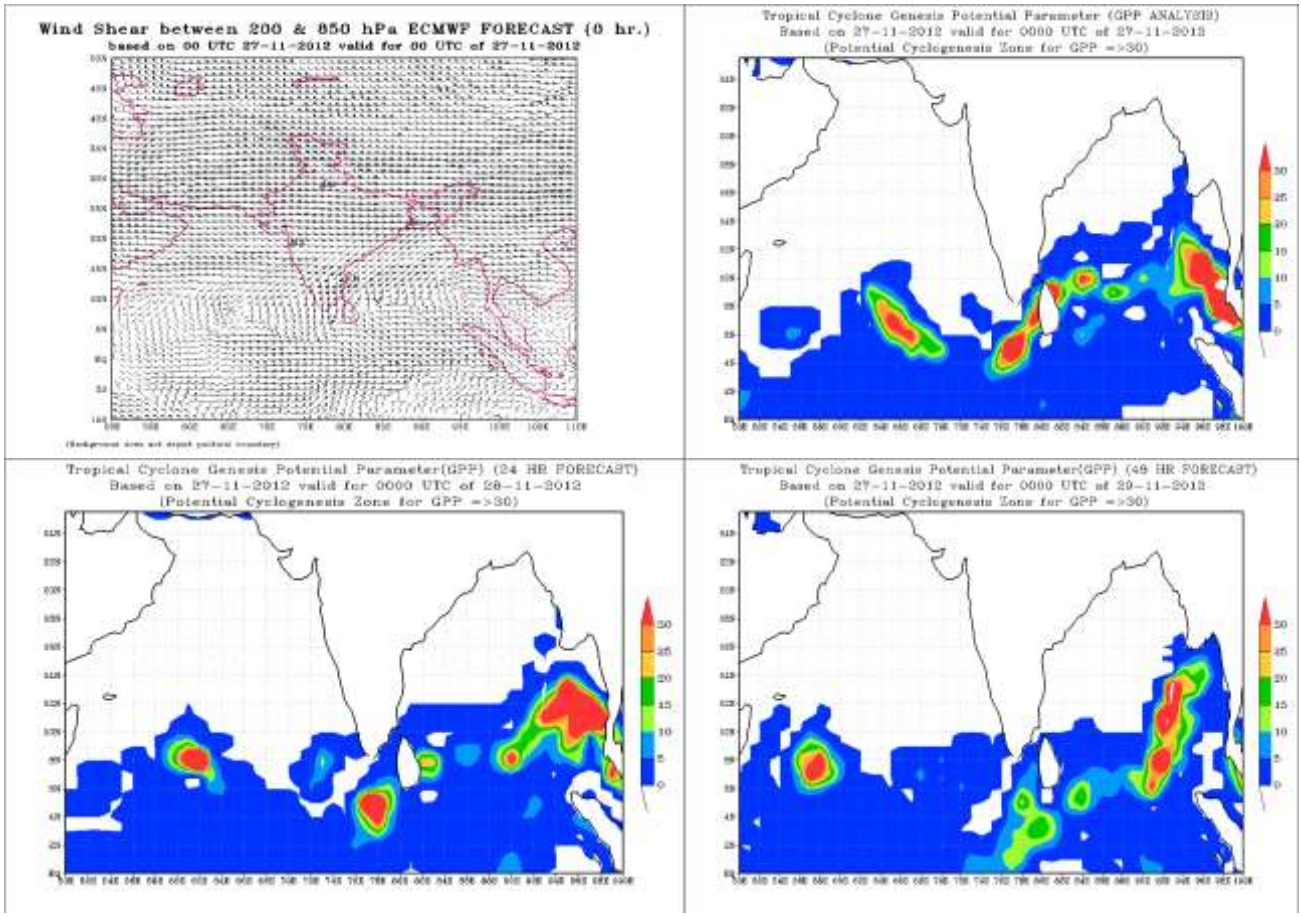

500 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 28-11-2012


200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 27-11-2012


200 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 28-11-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 27-11-2012


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 27-11-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 27-11-2012 valid for 00 UTC of 27-11-2012
Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 27-11-2012 valid for 0000 UTC of 27-11-2012
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 27-11-2012 valid for 0000 UTC of 28-11-2012
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 27-11-2012 valid for 0000 UTC of 29-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 28 November, 2012

**Synoptic features based on 0300 UTC:**

- Under the influence of the upper air cyclonic circulation, a low pressure area has formed over Andaman Sea and neighbourhood and now lay over the same area.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 29-30$^0$C over many parts of Andaman Sea and southeast Bay of Bengal and 28-29$^0$C over most part of Bay of Bengal except western part of Bay of Bengal where it is less than 28$^0$C.

**Ocean thermal energy:**

- Ocean thermal energy is between 100-120 KJ cm$^{-2}$ over Andaman Sea and adjoining southeast Bay of Bengal; between 80-100 KJ cm$^{-2}$ over rest parts of Bay of Bengal outside western parts of Bay of Bengal where it is less than 50 KJ cm$^{-2}$.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is (40-60)* 10$^{-5}$ s$^{-1}$ over Andaman Sea & adjoining eastcentral Bay of Bengal and northeast Bay of Bengal; (20-40) )* 10$^{-5}$ s$^{-1}$ over rest Bay of Bengal except north & westcentral Bay of Bengal where it is negative.

**Convergence:**

- Lower level convergence is positive over most parts of Andaman sea & adjoining southeast Bay of Bengal and is of the order of (5-10)* 10$^{-5}$ s$^{-1}$.

**Divergence:**

- Upper air divergence has increased over Andaman & southeast Bay of Bengal and is of the order of (10-30)*10$^{-5}$ s$^{-1}$ .It is of the order of (5-10)*10$^{-5}$ s$^{-1}$ over parts of southwest Bay of Bengal.

**Wind Shear:**

- Wind shear is of the order of 5-20 kts over Andaman Sea; 10-20 kts over southeast Bay of Bengal and >30 kts over most parts of rest Bay of Bengal.

**Wind Shear Tendency:**

- Decreasing tendency of the order of 5-10 kts is over north Andaman Sea,

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through along latitude 11.0°N.

**M.J.O. Index:**

- Located over phase 6 with amplitude= 1.
- Statistical forecast: MJO is over phase 6 and will continue during next 2 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite observations**

Vortex over north Andaman Sea centred within half a degree of lat/long $12.0^0$N/$94.5^0$E. Intensity T1.0. Associated broken low/medium clouds with embedded moderate to intense convection lies over Andaman Sea, Gulf of Martaban and Tenasserim coast.

**NWP Analysis**

- **IMD-GFS** – Analysis charts at 00UTC on 28th November 2012, indicate a cyclonic circulation over Andaman sea areas extending up to 500hPa level. The next 2 days forecasts show a cyclonic circulation over southeast Bay of Bengal and adjoining areas.
- **IMD-WRF** - Analysis charts at 00UTC on 28th November 2012, indicate a cyclonic circulation over Andaman sea areas extending up to 500hPa level. Day 1 and day2 forecasts indicate a cyclonic circulation over southeast Bay of Bengal and surrounding areas.
- **ECMWF -** Analysis charts at 00UTC on 28th November 2012, indicate a cyclonic circulation over Andaman sea areas extending up to 500hPa level. Day 1 and day 2 forecasts indicate a cyclonic circulation over Andaman sea areas.
- The 850 hPa, 500 hPa and 200 hPa wind analyses and Day 1 forecast of IMD-GFS and the 850 hPa, 500 hPa, 200 hPa wind, 850 hPa vorticity, 850hPa divergence and wind shear between 850hPa and 200hPa level analyses, and Day 1 forecast of 850 hPa, 500 hPa, 200 hPa wind of ECMWF are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

- Model analysis shows a significant zone of GPP with values 30 over Andaman Sea areas. Another two zones of GPP with values 30 over southwest Arabian Sea and southeast Arabian sea. GPP Forecasts of 24 hours show significant zone of GPP with values 30 over Andaman Sea area extending up to southeast Bay of Bengal and another zone of GPP with values 30 over southwest Arabian Sea. GPP Forecasts of 48 hours show significant zone of GPP with values 30 over Andaman Sea and adjoining areas of south east Bay of Bengal. GPP charts for 00, 24 and 48 hours based on 0000UTC of 27-11-2012 are shown in **Annexure II.**

**Conclusion and Advisory:**

- Meteorological conditions and numerical weather prediction models indicates the low pressure area over Andaman Sea and neighbourhood may become well marked low pressure area during next 24 hours.

- **No IOP during next 2 days.**

**Annexure-I**

**Status of Observation system (Stations received/Total stations):**

**Synoptic observation from Departmental Observatories** (Mean sea Level Pressure, 24 Hour pressure change, Wind speed and direction, 24 Hour accumulated rainfall, cloud type and coverage, Present and past weather etc):

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **27/12** | **28/00** | **28/03** |
| **West Bengal** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **Andhra Pradesh** | 18/18 | 17/17 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **Andaman & Nicobar** | 1/1 | 1/1 | 1/1 |
| **Total** | 54/55 | 40/44 | 54/55 |
| **Bangladesh** | 11/11 | 11/11 | 11/11 |
| **Myanmar** | 10/11 | 5/11 | 8/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 6/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **27/12** | **28/00** | **28/03** |
| **West Bengal** | 12/20 | 12/20 | 12/20 |
| **Odisha** | 28/38 | 28/38 | 30/38 |
| **Andhra Pradesh** | 26/35 | 28/35 | 31/35 |
| **Tamil Nadu** | 24/26 | 23/26 | 23/26 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **Total** | 92/121 | 93/121 | 98/121 |

**Buoy Data over Bay of Bengal**

| 27/12 | 28/00 | 28/03 |
|---|---|---|
| 17 | 16 | 17 |

**Upper air Observations over India**

- **RS/RW** (12Z) of 27-11-2012: 06/39
- **No. of Ascents reaching 250 hPa levels: 1 , MISDA: 33**
- **RS/RW** (00Z) of 28-11-2012: 18/39
- **No. of Ascents reaching 250 hPa levels: 10 , MISDA:21**

**No. of PILOT Ascents**

| 27/12Z | 28/00Z |
|---|---|
| 16/37 | 12/34 |

## Data Statistics over RMC Chennai Region

**No of Synop data**

| **Date→** | **27.11.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z /27.11.2012 : 2**

No. of Ascents reaching 250 hPa level =2

**MISDA : 6**

**12Z /27.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

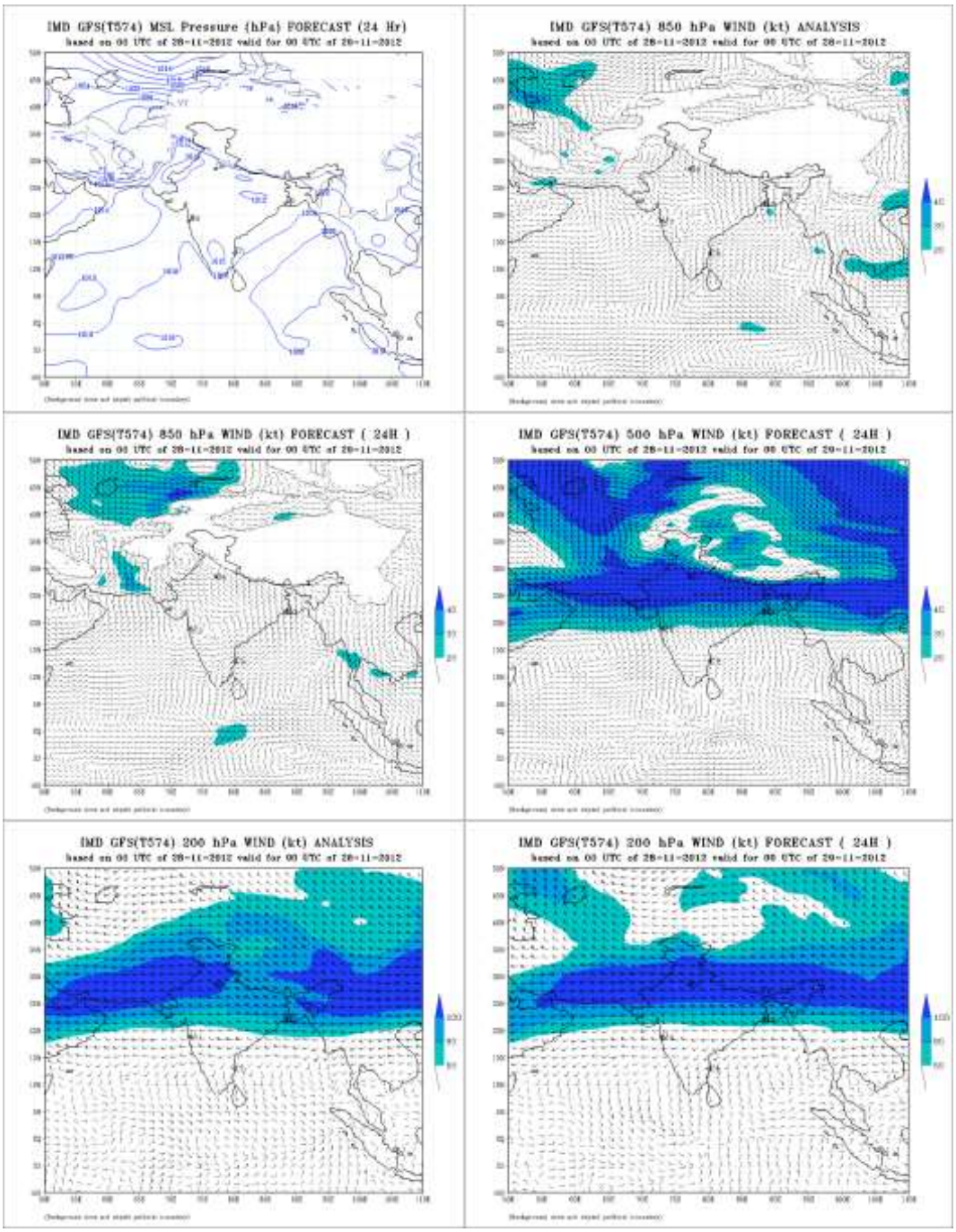
**MISDA : 8**

**No. of PILOT Ascents:**

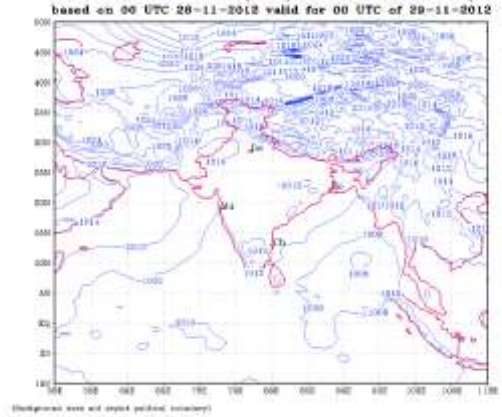
**27.11.2012**

| 06Z | 18Z |
|---|---|
| 4 | 5 |

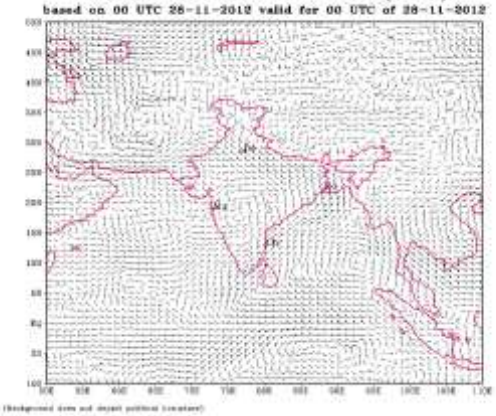
## Annexure II


IMD GFS(T574) MSL Pressure (hPa) FORECAST (24 Hr)
based on 00 UTC of 28-11-2012 valid for 00 UTC of 29-11-2012
IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 28-11-2012 valid for 00 UTC of 28-11-2012
IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 28-11-2012 valid for 00 UTC of 29-11-2012
IMD GFS(T574) 500 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 28-11-2012 valid for 00 UTC of 29-11-2012
IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 28-11-2012 valid for 00 UTC of 28-11-2012
IMD GFS(T574) 200 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 28-11-2012 valid for 00 UTC of 29-11-2012

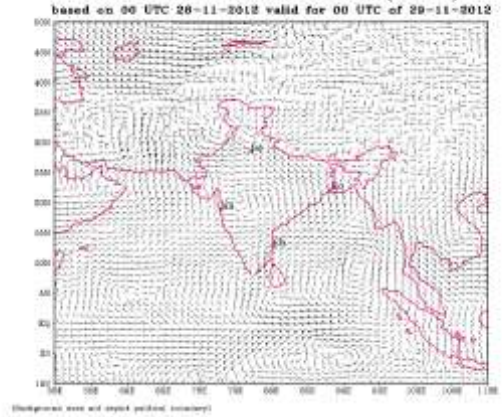
Mean Sea Level Pressure (hPa) ECMWF FORECAST (24 hr.)
based on 00 UTC 28-11-2012 valid for 00 UTC of 29-11-2012



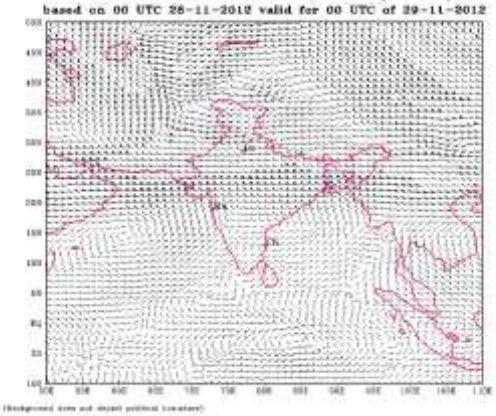
850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 28-11-2012 valid for 00 UTC of 28-11-2012



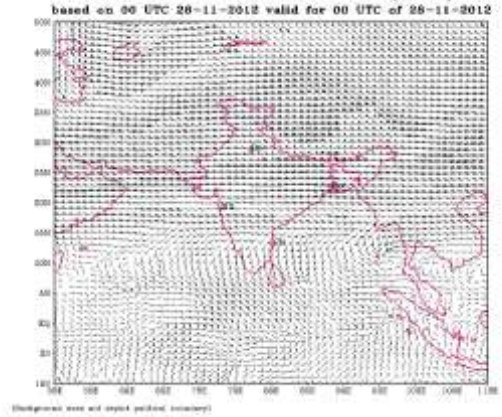
850 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 28-11-2012 valid for 00 UTC of 29-11-2012



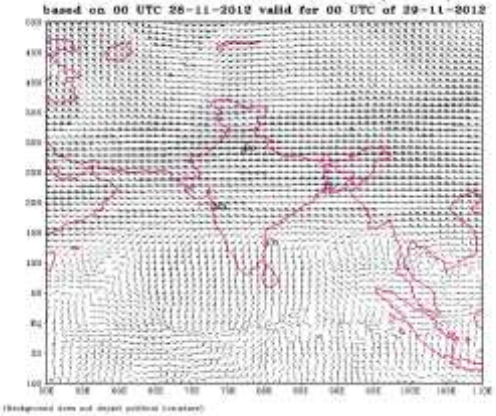
500 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 28-11-2012 valid for 00 UTC of 29-11-2012

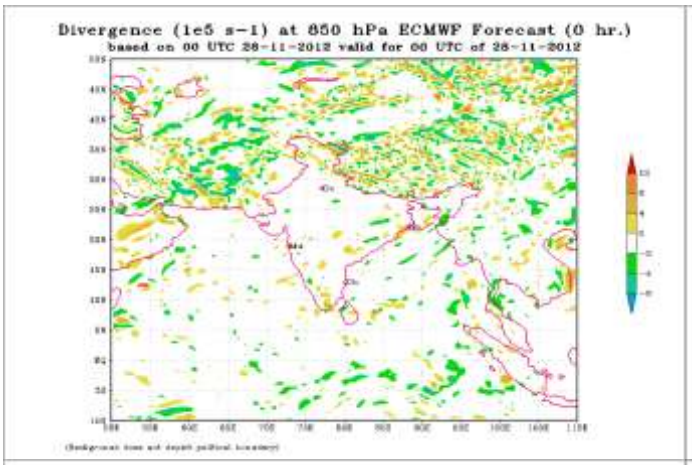


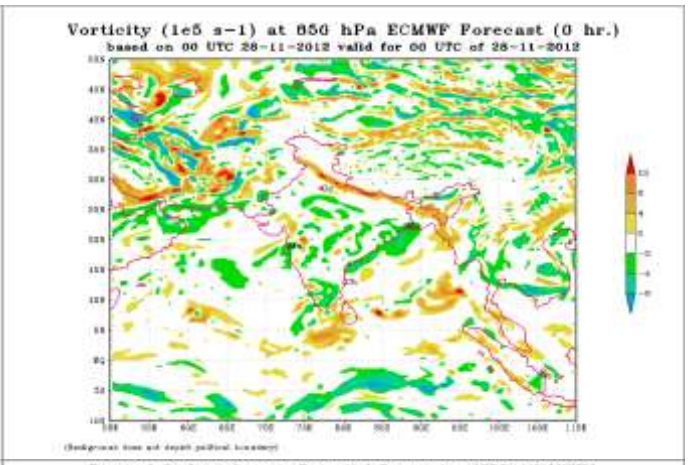
200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 28-11-2012 valid for 00 UTC of 28-11-2012

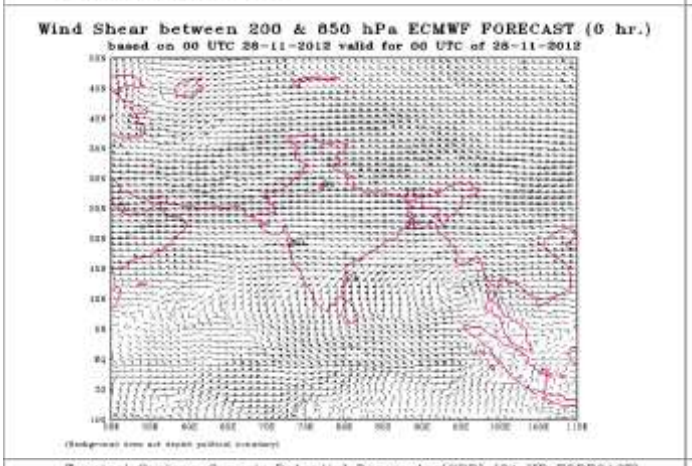


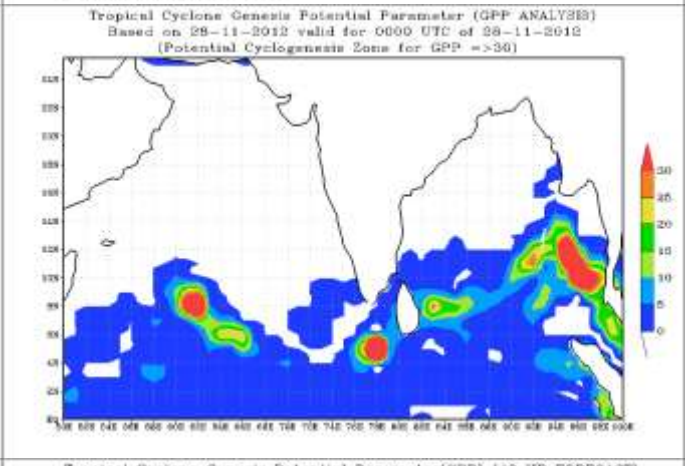
200 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 28-11-2012 valid for 00 UTC of 29-11-2012

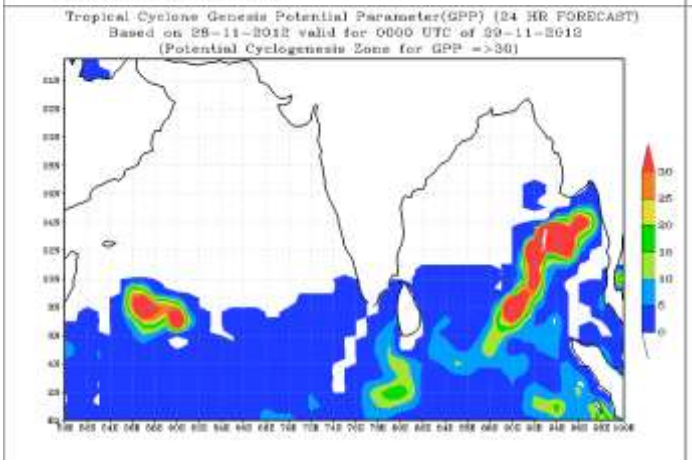


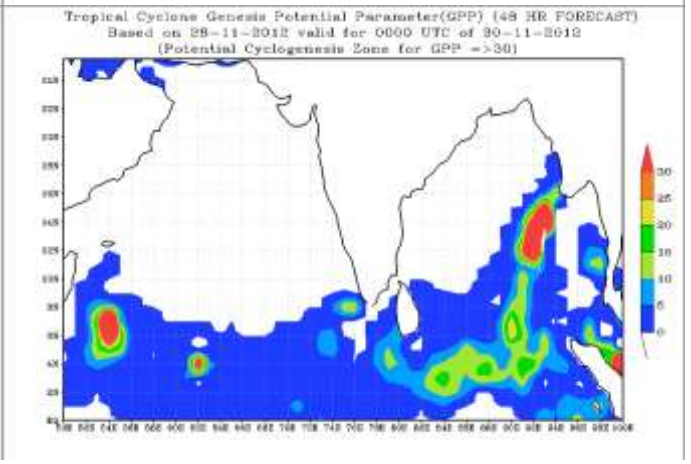

Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 28-11-2012 valid for 00 UTC of 28-11-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 28-11-2012 valid for 00 UTC of 28-11-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 28-11-2012 valid for 00 UTC of 28-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 28-11-2012 valid for 0000 UTC of 28-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 28-11-2012 valid for 0000 UTC of 29-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 28-11-2012 valid for 0000 UTC of 30-11-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 29 November, 2012

**Synoptic features based on 0300 UTC:**

- The low pressure area over Andaman Sea and neighbourhood persists. Associated cyclonic circulation extends upto 4.5 kms above mean sea level.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 29-30$^0$C over many parts of Andaman Sea and southeast Bay of Bengal and 28-29$^0$C over most part of Bay of Bengal except western part of Bay of Bengal where it is less than 28$^0$C.

**Ocean thermal energy:**

- Ocean thermal energy is between 80-100 KJ cm$^{-2}$ over Andaman Sea and adjoining southeast Bay of Bengal; between 60-80 KJ cm$^{-2}$ over rest parts of Bay of Bengal except western parts where it is less than 50 KJ cm$^{-2}$.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is (4-6)* 10$^{-5}$ s$^{-1}$ over Andaman Sea & adjoining southeast Bay of Bengal and .

**Convergence:**

- Lower level convergence is positive over most parts of Andaman sea & adjoining southeast Bay of Bengal and is of the order of (5-10)* 10$^{-5}$ s$^{-1}$.

**Divergence:**

- Upper air divergence has decreased over Andaman & southeast Bay of Bengal and is of the order of 10*10$^{-5}$ s$^{-1}$.

**Wind Shear:**

- Wind shear is of the order of 5-20 kts (low to moderate) over Andaman Sea and adjoining southeast Bay.

**Wind Shear Tendency:**

- Decreased by about 5 knots over Andaman Sea and adjoining southeast Bay during past 24 hrs.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through along latitude 13.0°N.

**M.J.O. Index:**

- Located over phase 2 with amplitude < 1.
- Statistical and dynamical forecast: MJO is over phase 2 and will continue during next 3 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite observations**

Low/medium clouds with embedded moderate to intense convection lies at many places over Bay of Bengal south of latitude $10.5^0$N and over Andaman sea with low level circulation over Andaman sea.

**NWP Analysis**

**IMD-GFS** – Analysis charts at 00UTC on 29th November 2012, indicate a cyclonic circulation over south east bay of Bengal and adjoining areas extending up to 500hPa level. The next 2 days forecasts show a cyclonic circulation over south east Bay of Bengal extending up to 700hPa level.

**IMD-WRF** - Analysis charts at 00UTC on 29th November 2012, indicate a cyclonic circulation over south east Bay of Bengal and adjoining areas extending up to 500hPa level. Day 1 and day2 forecasts indicate westward movement of the cyclonic circulation.

**ECMWF -** Analysis charts at 00UTC on 29th November 2012, indicate a feeble low pressure area over south east Bay of Bengal and adjoining areas with associated cyclonic circulation extending up to 500hPa level. Day 1 and day 2 forecasts indicate slight north westward movement of the low pressure area.

The analyses of MSLP, 850 hPa, 500 hPa and 200 hPa wind and Day 1 forecast of IMD-GFS and the MSLP, 850 hPa, 500 hPa, 200 hPa wind, 850 hPa vorticity, 850hPa divergence and wind shear between 850hPa and 200hPa level analyses, and Day 1 forecast of MSLP, 850 hPa, 500 hPa, 200 hPa wind of ECMWF based on 0000UTC of 29-11-2012 are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

Model analysis and 24 hours forecast show a significant zone of GPP with values 30 over south east Bay of Bengal and adjoining areas of Andaman Sea. Another zone of GPP with values 30 over southwest Arabian Sea. GPP Forecasts of 48 hours show a significant zone of GPP with values 30 over east central Bay of Bengal and adjoining areas. GPP charts for 00, 24 and 48 hours based on 0000UTC of 29-11-2012 are shown in **Annexure II.**

**Conclusion and Advisory:**

- Meteorological conditions and numerical weather prediction models indicates the low pressure area over Andaman Sea and neighbourhood may move west-northwestwards and become well marked low pressure area during next 48 hours.
- **No IOP during next 3 days.**

**Annexure-I**

**Status of Observation system (Stations received/Total stations):**

**Synoptic observation from Departmental Observatories** (Mean sea Level Pressure, 24 Hour pressure change, Wind speed and direction, 24 Hour accumulated rainfall, cloud type and coverage, Present and past weather etc):

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **28/12** | **29/00** | **29/03** |
| **West Bengal** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **Andhra Pradesh** | 18/18 | 17/17 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **Andaman & Nicobar** | 1/1 | 1/1 | 1/1 |
| **Total** | 54/55 | 40/44 | 54/55 |
| **Bangladesh** | 7/11 | 8/11 | 9/11 |
| **Myanmar** | 10/11 | 10/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 7/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **28/12** | **29/00** | **29/03** |
| **West Bengal** | 12/20 | 12/20 | 12/20 |
| **Odisha** | 28/38 | 28/38 | 30/38 |
| **Andhra Pradesh** | 27/35 | 29/35 | 30/35 |
| **Tamil Nadu** | 22/26 | 25/26 | 24/26 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **Total** | 91/121 | 96/121 | 98/121 |

**Buoy Data over Bay of Bengal**

| 28/12 | 29/00 | 29/03 |
|---|---|---|
| 16 | 15 | 17 |

**Upper air Observations over India**

- **RS/RW** (12Z) of 28-11-2012: 04/39
- **No. of Ascents reaching 250 hPa levels: 1 , MISDA: 35**
- **RS/RW** (00Z) of 29-11-2012: 18/39
- **No. of Ascents reaching 250 hPa levels: 9 , MISDA:21**

**No. of PILOT Ascents**

| 28/12Z | 29/00Z |
|---|---|
| 16/37 | 15/34 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | **28.10.2012** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **22** | **19** | **19** | **23** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z / 28.10.2012 : 2**

No. of Ascents reaching 250 hPa level =2

**MISDA : 6**

**12Z /28.10.2012 : 0**

No. of Ascents reaching 250 hPa level =0

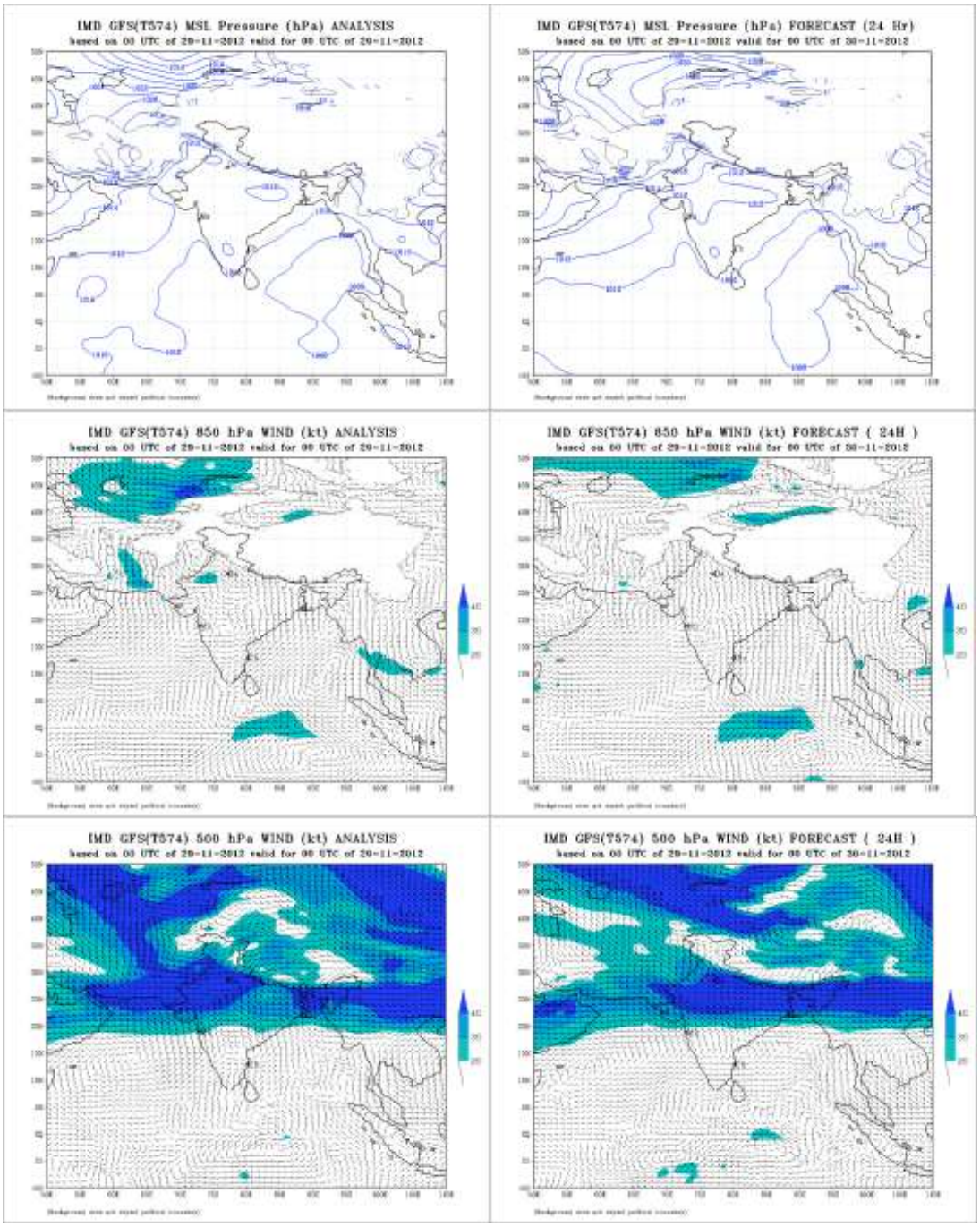
**MISDA : 8**

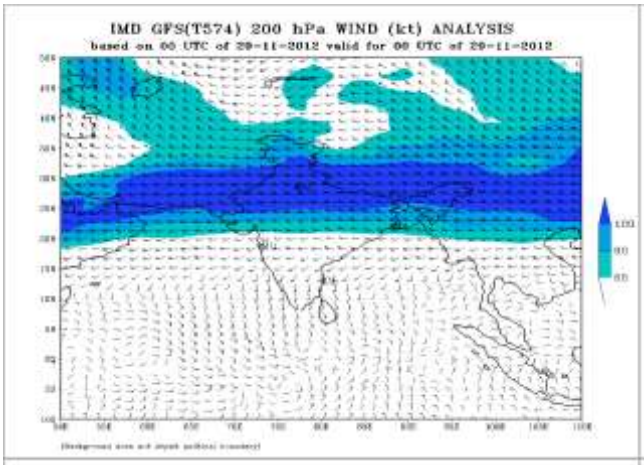
**No. of PILOT Ascents:**

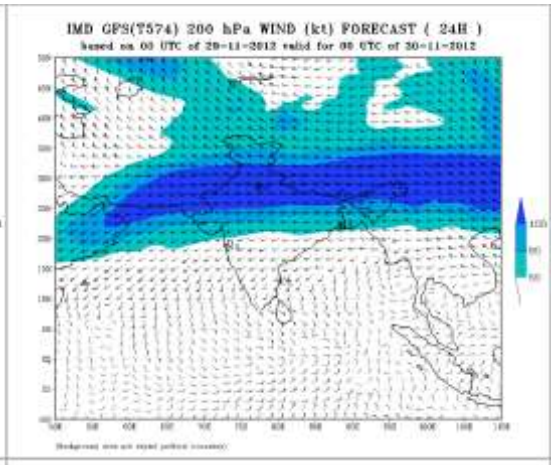
**28.10.2012**

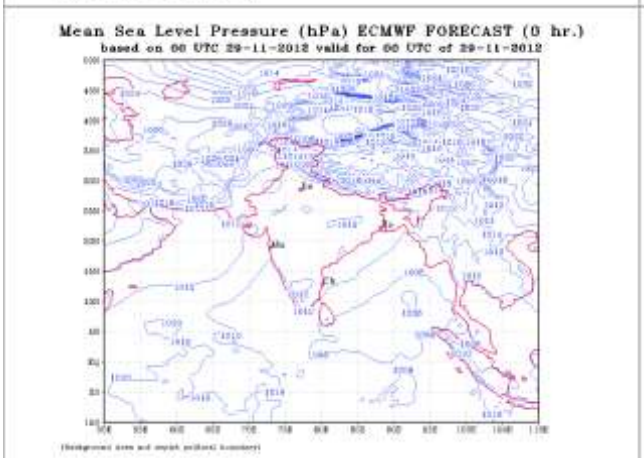
| 06Z | 18Z |
|---|---|
| 2 | 2 |

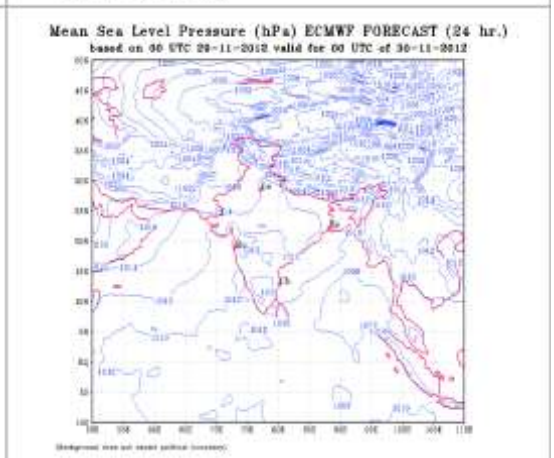
**Annexure II**

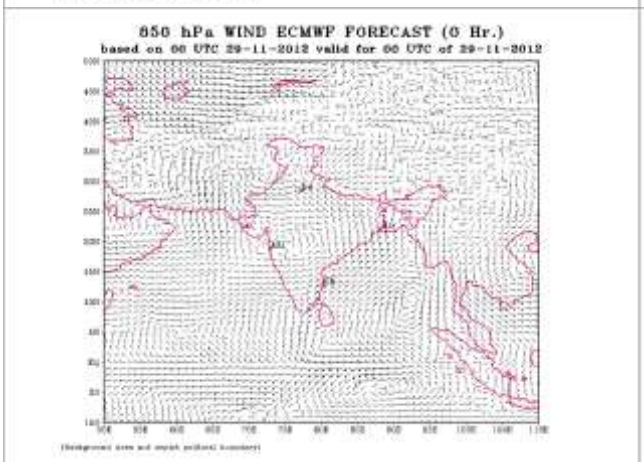

IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 29-11-2012 valid for 00 UTC of 29-11-2012
IMD GFS(T574) MSL Pressure (hPa) FORECAST (24 Hr)
based on 00 UTC of 29-11-2012 valid for 00 UTC of 30-11-2012
IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 29-11-2012 valid for 00 UTC of 29-11-2012
IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 29-11-2012 valid for 00 UTC of 30-11-2012
IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
based on 00 UTC of 29-11-2012 valid for 00 UTC of 29-11-2012
IMD GFS(T574) 500 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 29-11-2012 valid for 00 UTC of 30-11-2012

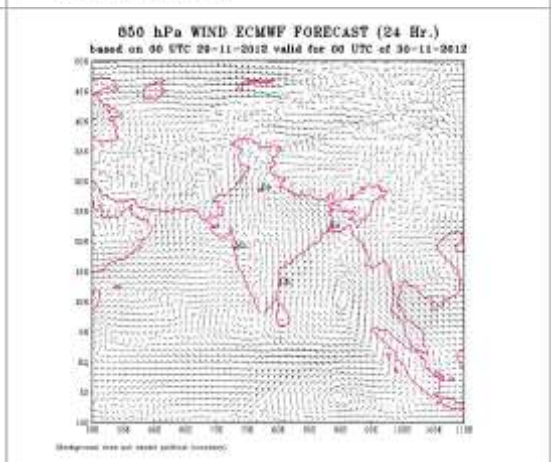

IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 29-11-2012 valid for 00 UTC of 29-11-2012

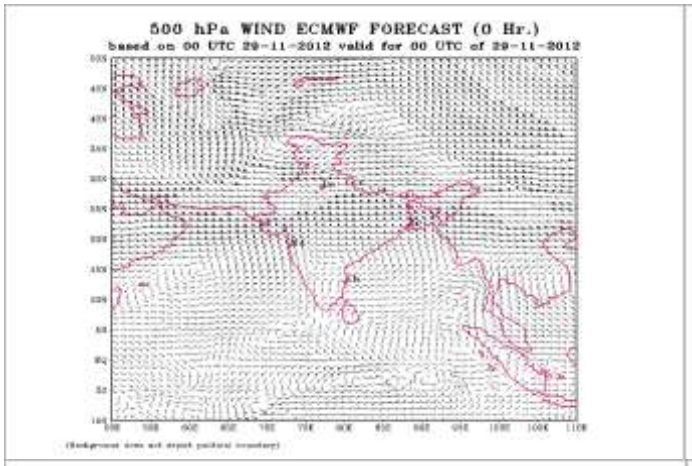

IMD GFS(T574) 200 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 29-11-2012 valid for 00 UTC of 30-11-2012

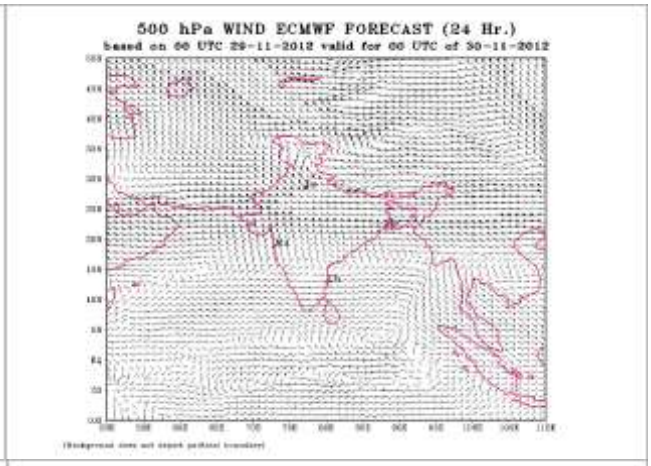

Mean Sea Level Pressure (hPa) ECMWF FORECAST (0 hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 29-11-2012

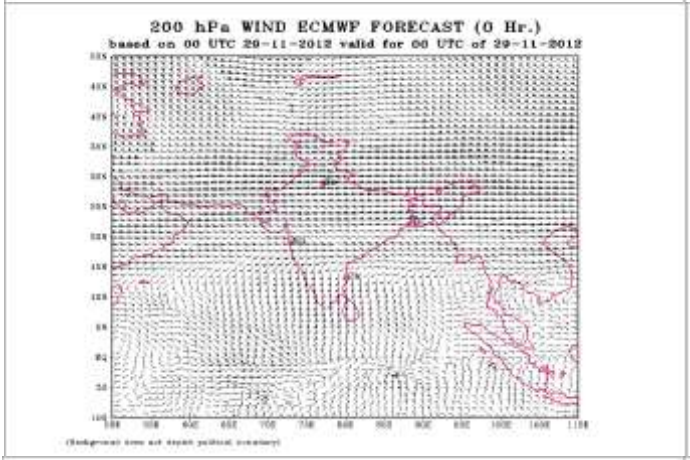

Mean Sea Level Pressure (hPa) ECMWF FORECAST (24 hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 30-11-2012

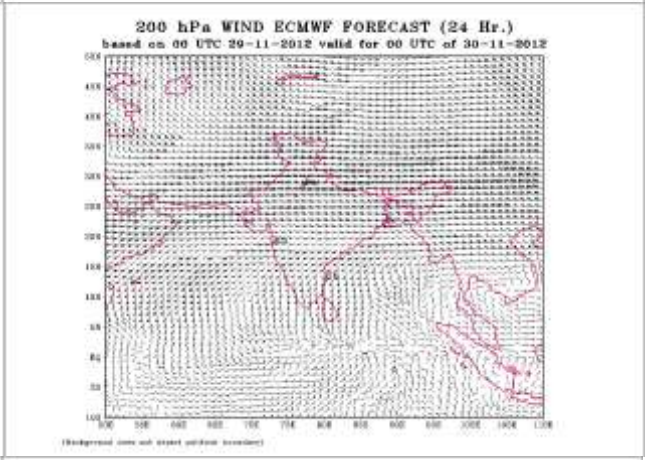

850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 29-11-2012

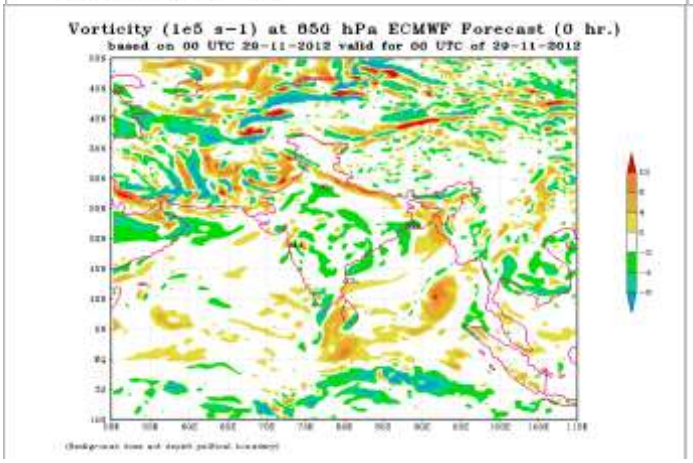

850 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 30-11-2012

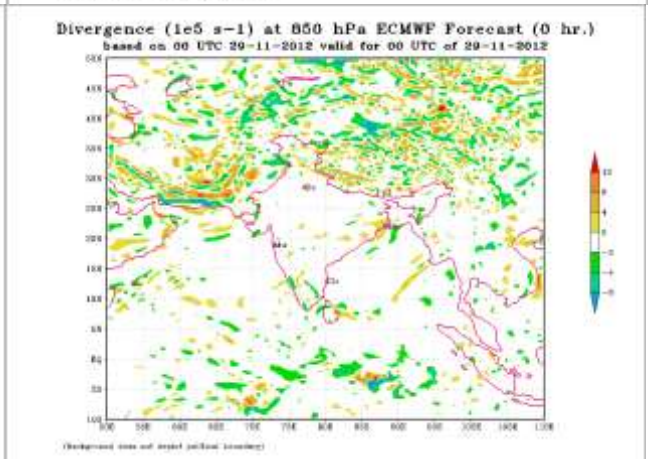

500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 29-11-2012

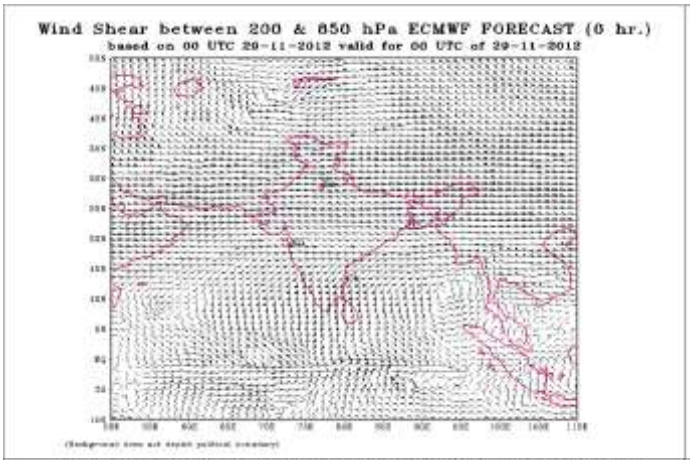

500 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 30-11-2012

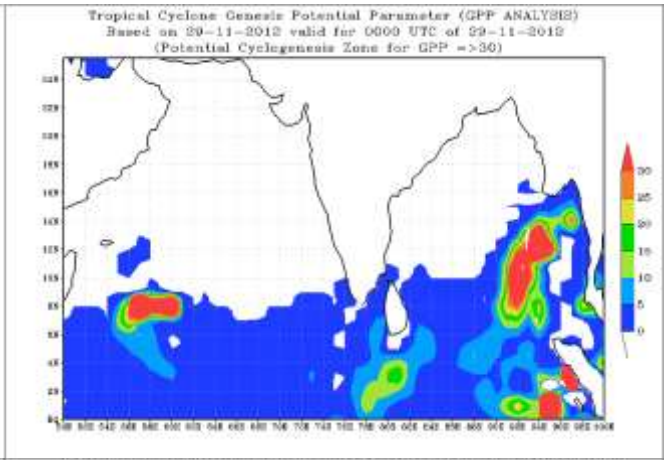

200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 29-11-2012

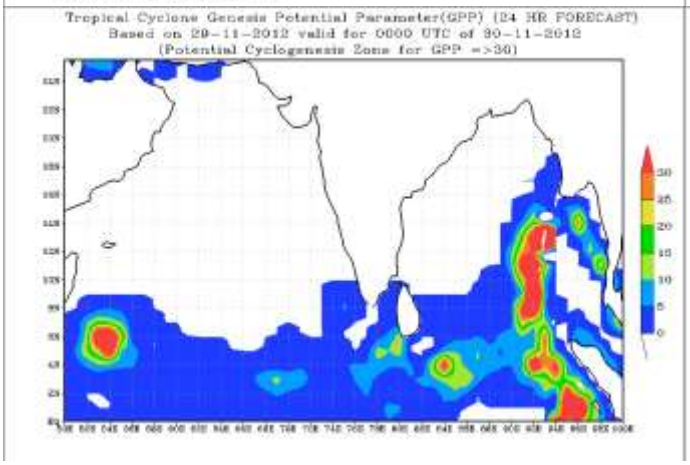

200 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 30-11-2012

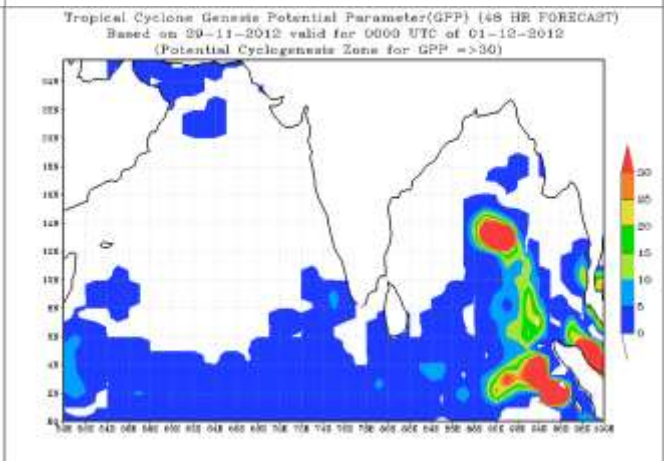

Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 29-11-2012


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 29-11-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 29-11-2012 valid for 00 UTC of 29-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 29-11-2012 valid for 0000 UTC of 29-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 29-11-2012 valid for 0000 UTC of 30-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 29-11-2012 valid for 0000 UTC of 01-12-2012
(Potential Cyclogenesis Zone for GPP =>30)

## FDP (Cyclone) NOC Report Dated 30th November, 2012

**Synoptic features based on 0300 UTC:**

- The low pressure area over Andaman Sea and neighbourhood now lies over east central Bay of Bengal & neighbourhood. Associated cyclonic circulation extends upto 4.5 kms a.s.l. system may become well marked during next 48 hours.

**Environmental features based on 0300 UTC of today:**

**Sea Surface Temperature:**

- SST is around 29-30$^0$C over many parts of Andaman Sea and southeast Bay of Bengal and 26 to 28 $^0$C over most part of Bay of Bengal

**Ocean thermal energy:**

- Ocean thermal energy is between 80-100 KJ cm$^{-2}$ over Andaman Sea and adjoining southeast Bay of Bengal; between 60-80 KJ cm$^{-2}$ over rest parts of Bay of Bengal except western parts where it is less than 50 KJ cm$^{-2}$.

**Relative Vorticity:**

- Relative vorticity at 850 hPa is (4-6)* 10$^{-5}$ s$^{-1}$ over Andaman Sea & adjoining southeast Bay of Bengal.

**Convergence:**

- Lower level convergence is positive over most parts of Andaman sea & adjoining southeast Bay of Bengal and is of the order of (5-10)* 10$^{-5}$ s$^{-1}$.

**Divergence:**

- Upper air divergence has decreased over Andaman & southeast Bay of Bengal and is of the order of 5 - 10*10$^{-5}$ s$^{-1}$.

**Wind Shear:**

- Wind shear is of the order of 20-30 kts (low to moderate) over Andaman Sea and adjoining southeast Bay.

**Wind Shear Tendency:**

- Increasing tendency over Andaman Sea and adjoining southeast Bay during past 24 hrs.

**Upper tropospheric ridge**:

- The upper tropospheric **RIDGE** line at200 hPa passes through along latitude 11.0°N.

**M.J.O. Index:**

- Located over phase 2 with amplitude < 1.
- Statistical and dynamical forecast: MJO is over phase 2 and will continue during next 3 days.

**Status of observational system:**

Details of the status of observational system are given in **Annexure I**.

**Satellite observations**

Vortex lies over southwest Bay adjoining eastcentral Bay centered within half a degree of lat/long 10.0n/90.5E intensity T1.0. wind shear lies between 20kts to 30 kts with associated broken intense to very intense convection over area bet lat 8.0N to 18.0N long 86.0E to 93.0E.

**NWP Analysis**

- **IMD-GFS** – Analysis charts at 00UTC on 30th November 2012, indicate a cyclonic circulation over south east Bay of Bengal and adjoining areas extending up to 700hPa level and another cyclonic circulation over south east Arabian sea and adjoining areas in the lower level . The next 2 days forecasts show a cyclonic circulation over south east Bay of Bengal extending up to 700hPa level.
- **IMD-WRF** - Analysis charts at 00UTC on 30th November 2012, indicate a cyclonic circulation over south east Bay of Bengal and adjoining areas of east central Bay of Bengal extending up to 700hPa level. Day 1 and day 2 forecasts indicate a cyclonic circulation over south east Bay of Bengal extending up to 700hPa level.
- **ECMWF -** Analysis charts at 00UTC on 30th November 2012, indicate a cyclonic circulation over south east Bay of Bengal and adjoining areas extending up to 850hPa level. Day 1 and day 2 forecasts indicate slight westward movement of the system
- The analyses of MSLP, 850 hPa, 500 hPa and 200 hPa wind and Day 1 forecast of IMD-GFS and the MSLP, 850 hPa, 500 hPa, 200 hPa wind, 850 hPa vorticity, 850hPa divergence and wind shear between 850hPa and 200hPa level analyses and Day 1 forecast of MSLP, 850 hPa, 500 hPa, 200 hPa wind of ECMWF based on 0000UTC of 30-11-2012 are given in **Annexure II.**

**Genesis Potential Parameter (GPP):**

Model analysis shows a significant zone of GPP with values 30 over south east Bay of Bengal and adjoining areas of east central Bay of Bengal. Another zone of GPP with values 30 over southwest Arabian Sea. GPP forecast of 24 hours shows a significant zone of GPP with values 30 over south east Bay of Bengal and adjoining areas of east central Bay of Bengal. GPP forecast of 48 hours show a significant zone of GPP with values 30 over south east Bay of Bengal extending up to south Andaman sea areas. GPP charts for 00, 24 and 48 hours based on 0000UTC of 30-11-2012 are shown in **Annexure II.**

**Conclusion and Advisory:**

Meteorological conditions and numerical weather prediction models indicates the low pressure area over Andaman Sea and neighbourhood may move westwards and become well marked low pressure area during next 48 hours. The Low Pressure area is expected to move westward into an area of higher vertical wind shear and will

likely entrain drier air present across the western Bay of Bengal in the days ahead, limiting the time window for further development. The potential for the development of a significant tropical cyclone within the next 24 hours is low.

- **No IOP during next 2 days.**

**Annexure-I**

**Status of Observation system (Stations received/Total stations):**

**Synoptic observation from Departmental Observatories** (Mean sea Level Pressure, 24 Hour pressure change, Wind speed and direction, 24 Hour accumulated rainfall, cloud type and coverage, Present and past weather etc):

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **29/12** | **30/00** | **30/03** |
| **West Bengal** | 10/11 | 4/7 | 10/11 |
| **Odisha** | 10/10 | 6/7 | 10/10 |
| **Andhra Pradesh** | 18/18 | 17/17 | 18/18 |
| **Tamil Nadu** | 13/13 | 10/10 | 13/13 |
| **Puducherry** | 2/2 | 2/2 | 2/2 |
| **Andaman & Nicobar** | 1/1 | 1/1 | 1/1 |
| **Total** | 54/55 | 40/44 | 54/55 |
| **Bangladesh** | 7/11 | 8/11 | 9/11 |
| **Myanmar** | 10/11 | 10/11 | 10/11 |
| **Thailand** | 3/3 | 3/3 | 3/3 |
| **Srilanka** | 7/9 | 7/9 | 7/9 |

**AWS observation**

| Region | Date/Time (UTC) | | |
|---|---|---|---|
| | **29/12** | **30/00** | **30/03** |
| **West Bengal** | 5/20 | 5/20 | 10/20 |
| **Odisha** | 6/38 | 6/38 | 9/38 |
| **Andhra Pradesh** | 9/35 | 9/35 | 32/35 |
| **Tamil Nadu** | 9/26 | 9/26 | 24/26 |
| **Puducherry** | 1/2 | 1/2 | 1/2 |
| **Total** | 30/121 | 30/121 | 76/121 |

**Buoy Data over Bay of Bengal**

| 28/12 | 29/00 | 29/03 |
|---|---|---|
| 16 | 8 | 16 |

**Upper air Observations over India**

- **RS/RW** (12Z) of 29-11-2012: 05/39
- **No. of Ascents reaching 250 hPa levels: , MISDA: 34**=
- **RS/RW** (00Z) of 30-11-2012: 18/39
- **No. of Ascents reaching 250 hPa levels: 9 , MISDA:21**

**No. of PILOT Ascents**

| 29/12Z | 30/00Z |
|---|---|
| 15/37 | 21/34 |

**Data Statistics over RMC Chennai Region**

**No of Synop data**

| **Date→** | | | | **29.11.2012** | | | | |
|---|---|---|---|---|---|---|---|---|
| **UTC→** | **00** | **03** | **06** | **09** | **12** | **15** | **18** | **21** |
| **Chennai Region (Coasts of AP & TN)** | **19** | **23** | **20** | **20** | **22** | **19** | **19** | **19** |

**No. of RS/RW Ascents**

**00Z /29.11.2012 : 1**

No. of Ascents reaching 250 hPa level =1

**MISDA : 7**

**12Z /29.11.2012 : 0**

No. of Ascents reaching 250 hPa level =0

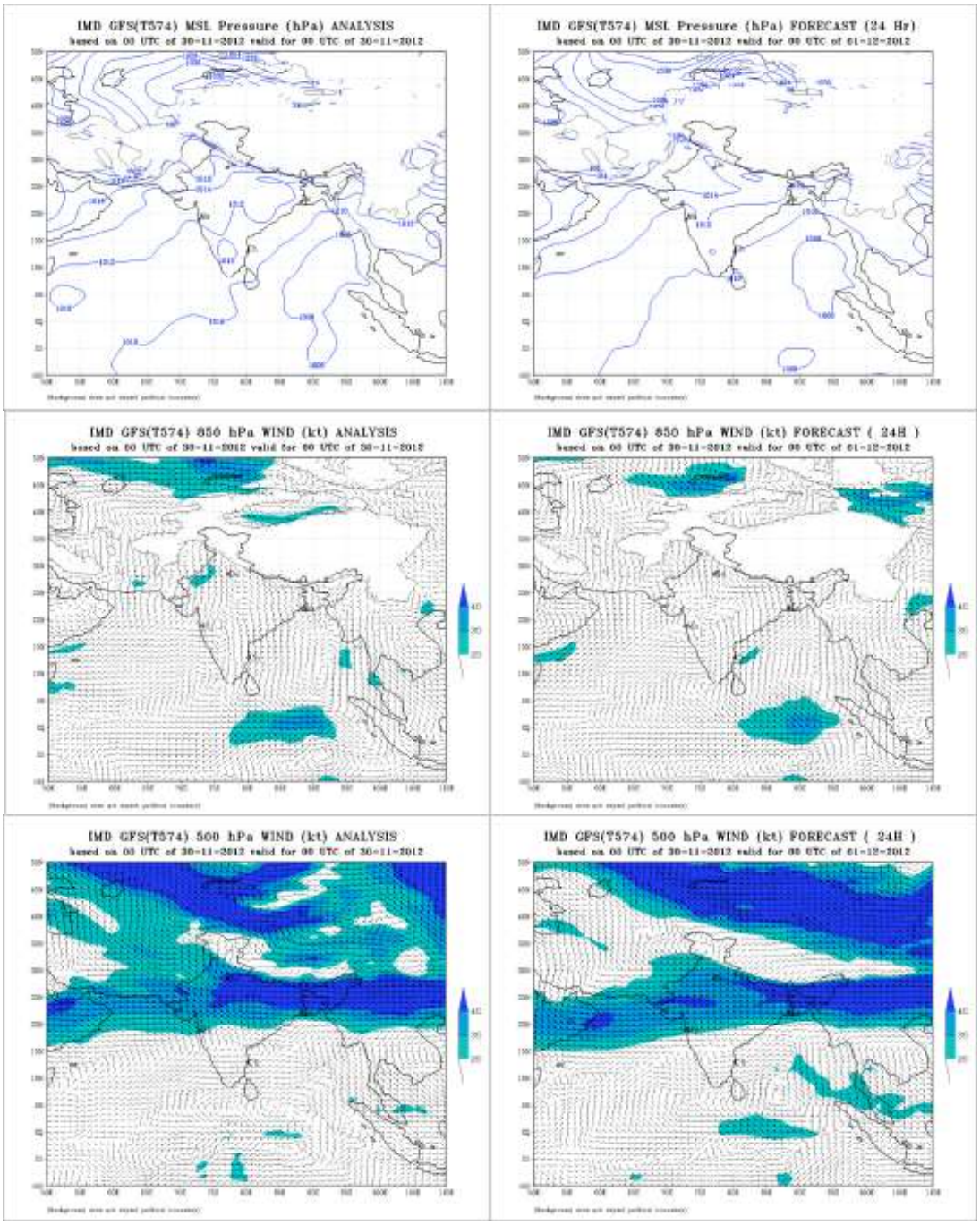
**MISDA : 8**

**No. of PILOT Ascents:**

**29.11.2012**

| 06Z | 18Z |
|---|---|
| 6 | 5 |

## Annexure II


IMD GFS(T574) MSL Pressure (hPa) ANALYSIS
based on 00 UTC of 30-11-2012 valid for 00 UTC of 30-11-2012
IMD GFS(T574) MSL Pressure (hPa) FORECAST (24 Hr)
based on 00 UTC of 30-11-2012 valid for 00 UTC of 01-12-2012
IMD GFS(T574) 850 hPa WIND (kt) ANALYSIS
based on 00 UTC of 30-11-2012 valid for 00 UTC of 30-11-2012
IMD GFS(T574) 850 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 30-11-2012 valid for 00 UTC of 01-12-2012
IMD GFS(T574) 500 hPa WIND (kt) ANALYSIS
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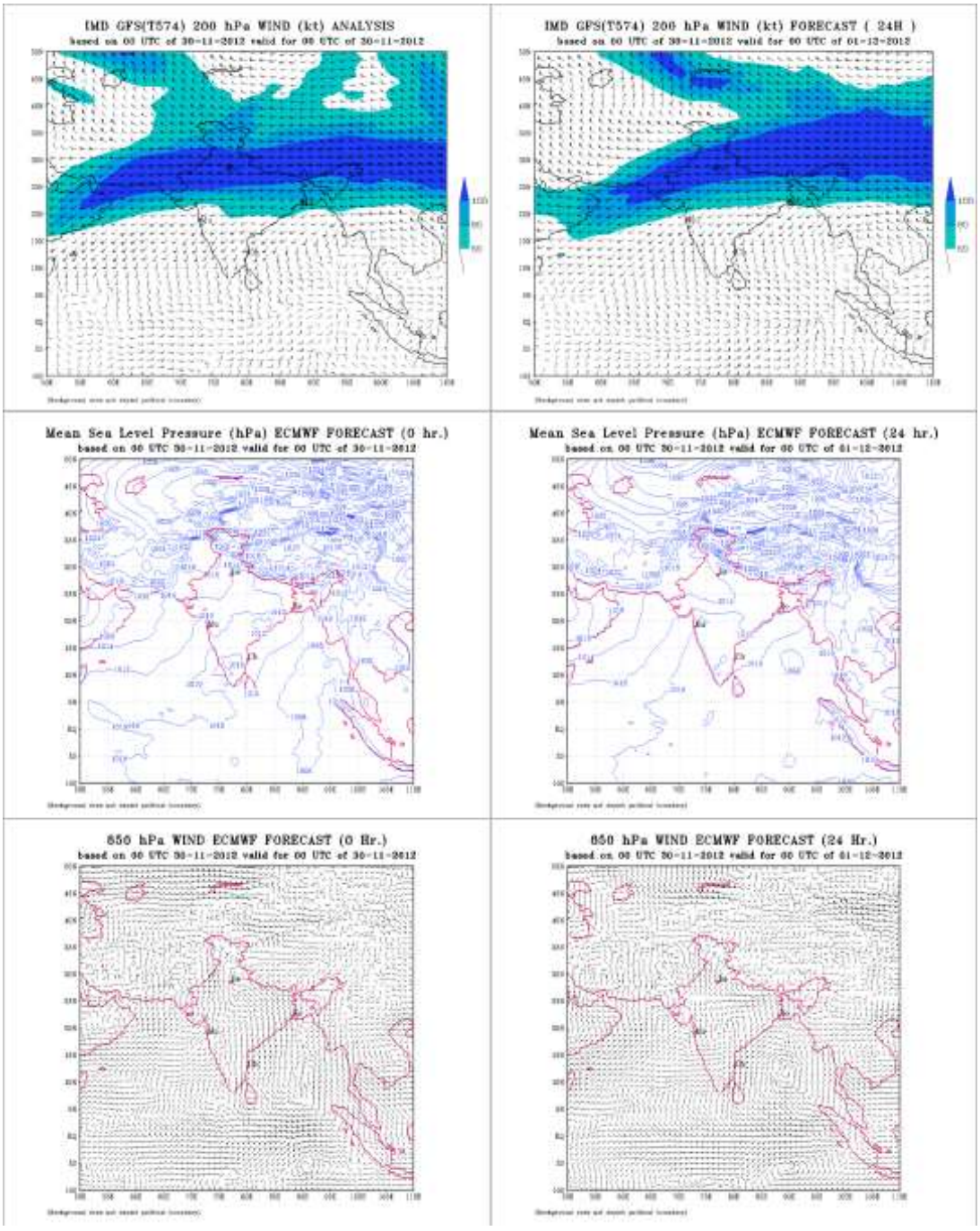
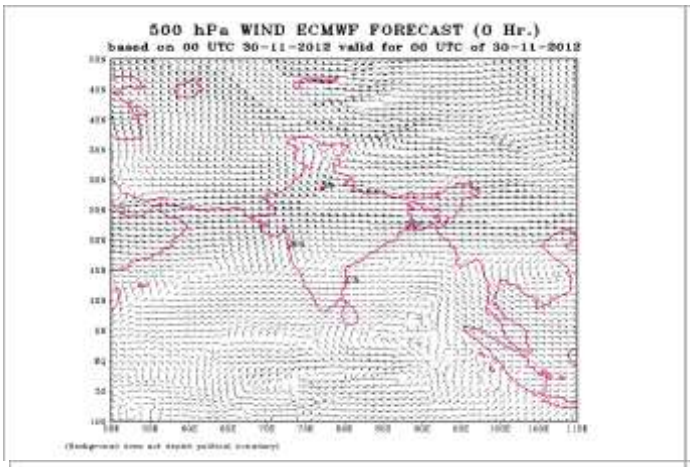
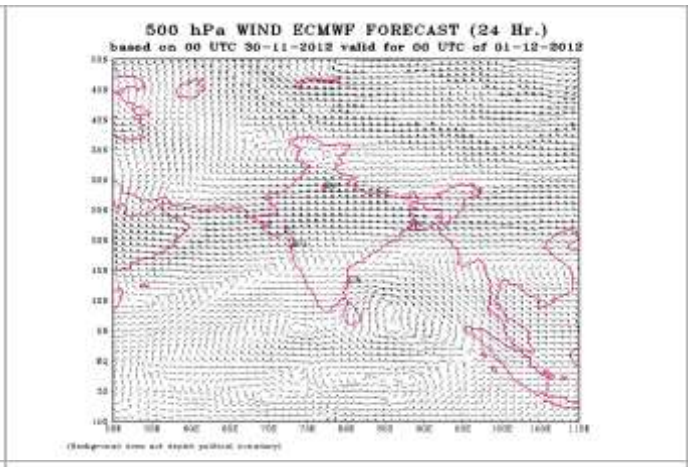
IMD GFS(T574) 500 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 30-11-2012 valid for 00 UTC of 01-12-2012


IMD GFS(T574) 200 hPa WIND (kt) ANALYSIS
based on 00 UTC of 30-11-2012 valid for 00 UTC of 30-11-2012
IMD GFS(T574) 200 hPa WIND (kt) FORECAST ( 24H )
based on 00 UTC of 30-11-2012 valid for 00 UTC of 01-12-2012
Mean Sea Level Pressure (hPa) ECMWF FORECAST (0 hr.)
based on 00 UTC 30-11-2012 valid for 00 UTC of 30-11-2012
Mean Sea Level Pressure (hPa) ECMWF FORECAST (24 hr.)
based on 00 UTC 30-11-2012 valid for 00 UTC of 01-12-2012
850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 30-11-2012 valid for 00 UTC of 30-11-2012
850 hPa WIND ECMWF FORECAST (24 Hr.)
based on 00 UTC 30-11-2012 valid for 00 UTC of 01-12-2012


500 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 30-11-2012 valid for 00 UTC of 30-11-2012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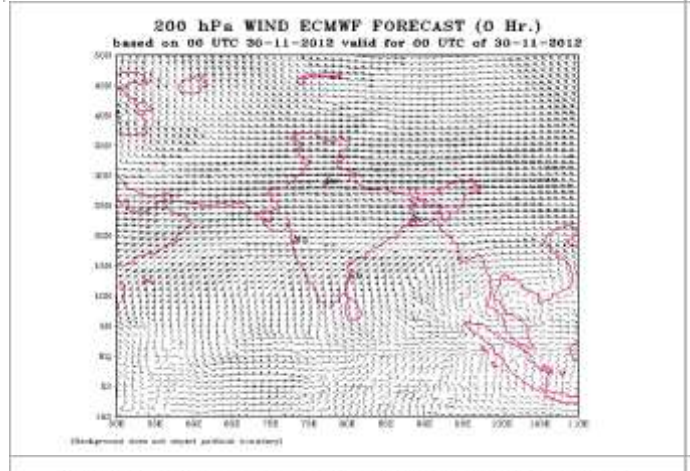
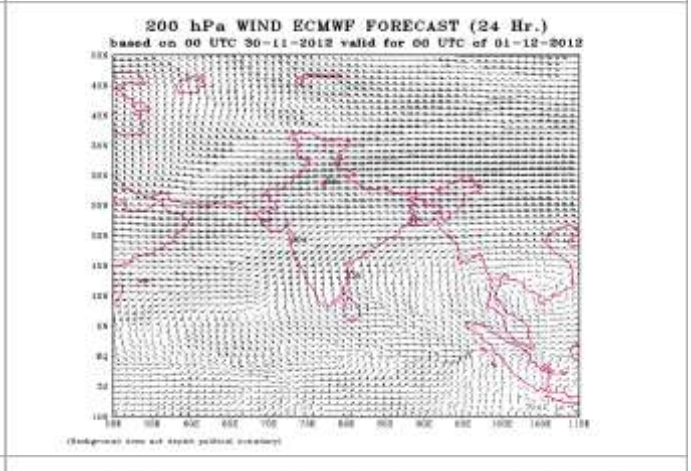

200 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 30-11-2012 valid for 00 UTC of 30-11-2012


200 hPa WIND ECMWF FORECAST (24 Hr.)
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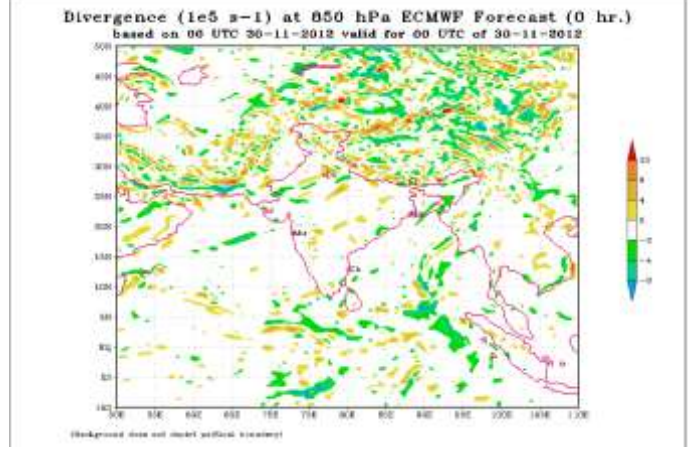
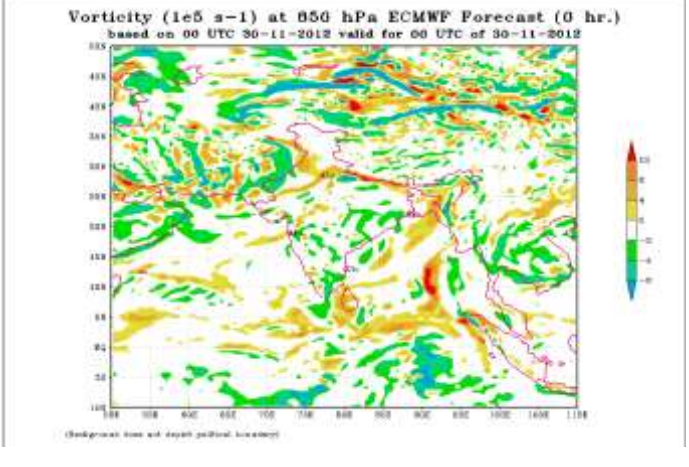
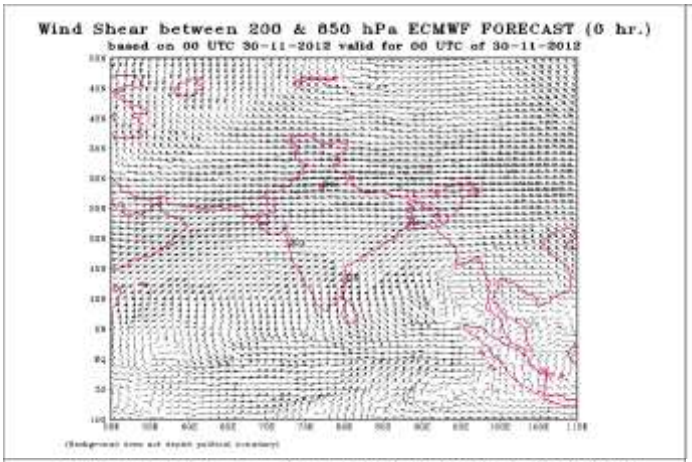
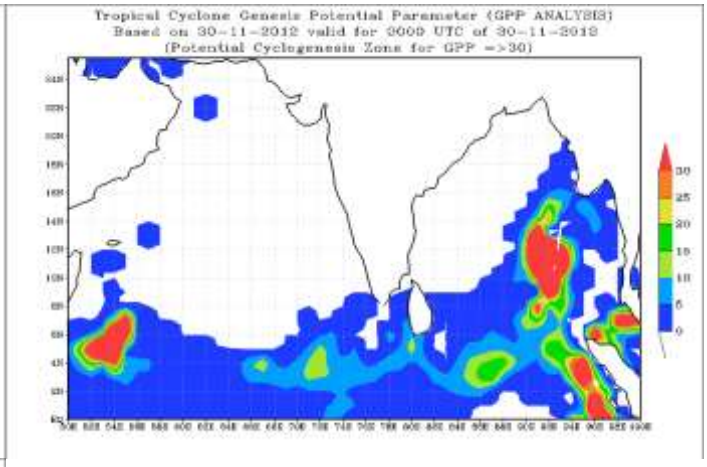
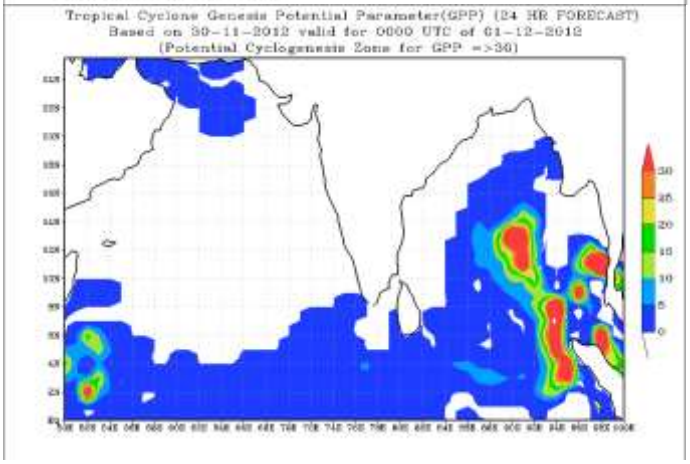

Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 30-11-2012 valid for 00 UTC of 30-11-2012


Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 30-11-2012 valid for 00 UTC of 30-11-2012


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 30-11-2012 valid for 00 UTC of 30-11-2012


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 30-11-2012 valid for 0000 UTC of 30-11-2012
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 30-11-2012 valid for 0000 UTC of 01-12-2012
(Potential Cyclogenesis Zone for GPP =>30)

## CHAPTER-VI

## Lessons learnt from FDP-2012

During 29th October to 1st November, 2012 IOP was declared in connection with Cyclone Nilam and from 19th to 20th November it was declared in connection with Depression that formed over east central Bay of Bengal. The Bay of Bengal was more active for genesis in comparison with last year because of the high Ocean thermal energy.

1. SST observations and ocean thermal energy showed favorable conditions for genesis as it crossed the limit of 100KJ/$cm^{-2}$ over the Bay of Bengal for a number of days.
2. There is constraint in finding centre of the storm during night. Microwave imagery is very useful to monitor intensity and location of cyclonic disturbance for analysing characteristics of cloud cluster evolution and dissipation and brightness temperature structure around the centre of the system. There is a need to make arrangement to ensure availability of all polar satellite products during cyclonic disturbance over NIO. As such arrangement may be made to provide centre of cyclonic storm during night using microwave imageries along with T No which will be highly helpful. Officers/staff can be trained for fixing T.No in microwave imagery.
3. Buoy data was scanty. Two or three buoys data could be available during the period over Bay of Bengal at synoptic hour chart analysis. Buoy observation is highly informative for synoptic analyses and ocean surface wind information. As such number of buoy may be enhanced from existing 12 buoys over entire north Indian Ocean. Structure DWR bulletins were received from DWR Chennai.
4. Coastal Automatic Weather Station observation and Dopplar data was very useful in facilitating early warning of landfall.
5. Diurnal cycle of convection do influence cyclonic disturbance and hence this aspect is required to be monitored.
6. Conventional ship observations under IVOF scheme are very less. Only one or two ship observations were hardly received during cyclonic disturbance period. Hence deployment of Sagar Kanya or Sagar Nidhi cruise could have been very useful for cyclone forecast.
7. Coastal hourly observations were not available from Panel member countries viz Sri Lanka during Nilam Period.
8. There was temporary breakdown of Synergie system during the IOP period and therefore getting ECMWF tracks and other model products was difficult. The tracks could not regularly made due to breakdown of Synergie (Cyclone Module)
9. Due to huge number of hits, the IMD website could not be accessed by general public and disaster managers sometimes on the day of landfall of

cyclone Nilam. Necessary arrangements need to be done to avoid such failures in future.

10. Structured satellite bulletins like that issued by other international centres would be very helpful for better utilization of statellite advisories.

## CHAPTER-VII

## Summary and Conclusions

The Pilot Phase of FDP on landfalling cyclones over the Bay of Bengal was conducted during 15th October to 30th November, 2012 as per the implementation plan. The IOP was declared for total 6 days. Four days during 29th to 1st November, 2012 IOP was declared in connection with Cyclone Nilam and for 2 days from 19th to 20th November in connection with Depression that formed over east central Bay of Bengal.The daily bulletin was prepared during the period and circulated to all concerned. The NOC meeting was held thrice a week, viz. Monday, Wednesday & Friday.

The FDP helped in continuous monitoring of environmental conditions for cyclogenesis. Further, intense observation during IOP helped in better monitoring and prediction of cyclonic disturbances. The additional data collected during FDP 2012 included the data collected from Dopplar Radar at Chennai. Enhanced AWS network of the coast, twelve activated buoy observations from the Bay of Bengal and Arabian Sea, Oceansat-II observations and microwave imagery products. The Tropical Cyclone module installed in Synergie System was also used for monitoring and prediction of cyclone.

As a result of above, the cyclone track forecast errors reduced in 2012 compared to previous FDP campaign. It helped in refining the Standard Operation Procedure and strengthening the multi-institutional mechanism.

Various lessons were also learnt from the FDP campaign 2012, which will further help in improving the campaign in future. To mention a few, we should have:

- better availability of consumables and other logistic support for the coastal surface and upper air observatories to ensure good collection of data,
- better data reception from the coastal stations of all WMO/ESCAP Panel countries on real time basis,
- improved buoy network
- threshold values of various NWP products for genesis, intensification and movement
- Structured satellite bulletins.
- DWR data with uniform scanning strategy for mosaicing and NWP modeling.

## Acknowledgements

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