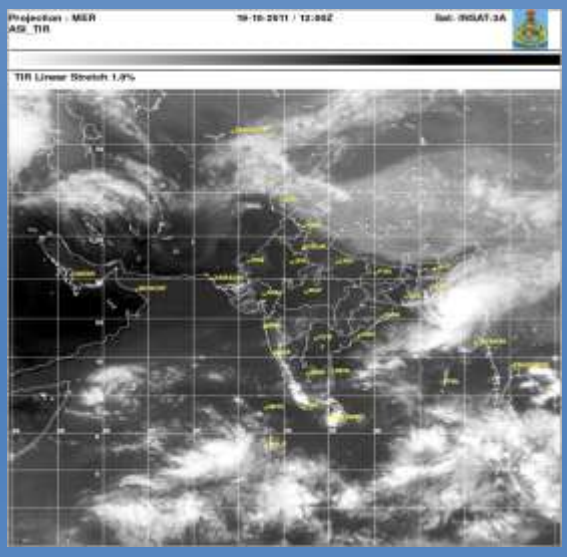
INDIA METEOROLOGICAL DEPARTMENT

Report No.: FDP/TCR/1/2012

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

Implementation of Pilot Phase, 2011:
A Report



Satellite imagery of Deep Depression

M. Mohapatra, T.N. Jha, Suman Goel, Charan Singh, Naresh Kumar, K. Nagaratna, S.D. Kotal, S. Tomar, S. Balachandran, Ajit Tyagi, B.K. Bandyopadhyay, O.P. Singh, U.C. Mohanty, Osuri Krishna, D.R. Sikka, Swati Basu, R.G. Ashrit

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Track, Intensity and Landfall of Bay of Bengal Tropical Cyclones

Implementation of Pilot Phase, 2011: A Report (15 October-30 November, 2011)

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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, 2011 (15 October – 30 November).

The Pilot Phase of FDP on landfalling cyclones over the Bay of Bengal was conducted during 15th October to 30th November, 2011 as per the Implementation Plan. The IOP was declared for 2 days in association with a Deep Depression (19-20 Oct., 2011). 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. M.G. Mittal, Mr. D. P. Nayak and Mrs. Monica Sharma of Cyclone Warning Division for their valuable contribution to bring out this report on “Pilot Phase of Forecast Demonstration Project -2011”.

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

Dr. L.S. Rathore
August 2012 Director General of Meteorology

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 pilot phase.

The Pilot Phase of FDP on landfalling cyclones over the Bay of Bengal was conducted during 15th October to 30th November, 2011 as per the implementation plan. The IOP was declared for 2 days in association with a Deep Depression (19-20 Oct., 2011). 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 2011 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 recently installed in Synergie System was also used for monitoring and prediction of cyclone.

As a result of above, the average cyclone track forecast error was reduced in 2011 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 2011, 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, structured satellite and radar bulletin and DWR data with uniform scanning strategy for mosaicing and NWP modeling.

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-254, T-3 & currently T-574), regional(LAM and QLM), and meso-scale(MM5, ETA, WRF/HWRF) models for generating short(up to 48-72hrs. in advance) and medium range (3-7 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.

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

A 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, 2009

(ii) Pilot phase : Oct-Nov. 2011, 2011

(iii) Final phase : Oct-Nov. 2012-13

During pilot phase **(15 Oct - 30 Nov, 2011),** several national institutions participated for joint observational, communicational & NWP activities like that during 2008.

The detailed implementation programme is presented in Chapter II. The salient features of cyclone Season 2011 are presented and discussed in Chapter III. Daily weather summary and advisory issued during FDP-2011 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-2011

2.1. Introduction

The objectives of the programme was to be met by conducting a joint observational communication and NWP efforts by several institutes in the country during the period 15 Oct.-30 Nov. 2011. Intensive Observational Periods (IOPs) were carried out within this period tuning actual cyclone events. A National Operational Centre (NOC) functioned at IMD at New Delhi and a Field Operational Centre (FOC) worked at Chennai.

2.2. National Operational Centre (NOC):

NOC monitored the overall campaign and provided guidance by a Weather Monitoring and Advisory Group (WMAG) at National Weather Forecasting Centre (NWFC), IMD. In addition, communication conferencing and data exchange were facilitated from this nodal cell. The announcement of IOP were made by NOC. (Temporary contact: e-mail cwdhq2008@gmail.com, Phone no. 011-24652484, 24631913 Mobil: 9868623475, Fax No. 011-24626815).

2.3. Field Operational Centre (FOC):

The FOC, Chennai worked in unison with the NOC coordinating all activities of every institution during the IOP. (Temporary contact:yearaj@gmail.com, Phone No. 044-28276752, Fax No. 044-28276752)

2.4. 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. INCOAR
12. NPOL
13. DRDO
14. Kolkata University

15. Jadavpur University
16. Guwahati University

2.5. Targeted FDP Requirements for the Pilot FDP Campaign of October-November 2011

2.5.1. Observational program:-

(I)AWS:

Operational surface meso-scale AWS network of IMD along the east coast of India available for pilot phase and expansion programme for next two years is shown below.

S. No.	State	No. of AWS Stations of IMD
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 ensured the real-time transmission of data from AWS stations along east coast of India and additional 14 in the Northeast to DDGM(Telecom) Delhi in GTS mobile synop format. DDGM(SI) submitted status report by 10th October 2011 to Project Manager on the availability of such data.
- Data from PRWONAM and northeast India Meso-scale AWS network was made available by ISRO from the MOSDAC server of SAC, Ahmedabad on real time (Fig.2).
- SAC Ahmedabad intimated to DDGM(Sat. Met) arrangements to download ISRO AWS data and relay it to NOC for operational and NWP application.
- Data formatting issues associated with ISRO AWS data were sorted out through joint effort of Shri S. Bhatia, Project Director (Instrumentation) and Dr S.K. Roy

Bhowmik, Scientist F NWP unit of IMD by first 10th October 2011. On finalisation the process of converting ISRO AWS data into mobile synop (GTS) format were automated in liaison with DDGM(Telecom) prior to the FDP-2011 period.

- AWS data from 10 stations commissioned (under STORM Project) by Kolkata University and Guwahati university were also communicated to NOC. DDGM, RMC, Kolkata and Guwahati coordinated the status to NOC and FOC by 10th October 2011.
- For real-time collection of AWS data over NE India RMCs at Kolkata and Guwahati worked 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 first week of October. Formatting issues as described above were addressed. The data were transmitted through AMSS of respective RMC. FOC coordinated this exercise.

S. No.	State	Existing No. of AWS Stations of IMD
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 reported data on hourly basis, during IOP. During normal period of FDP, 3 hrly SYNOP were collected.
- RMC Kolkata and Chennai ensured hourly observation and transmission through telephone/fax/e-mail of all synops of coastal stations during IOP to National Operational Centre and Field Operation Centre. In addition, RMC Chennai organised transmission of such data through AMSS.
- RSMC, New Delhi wrote to concerned WMO/ESCAP Panel member countries to ensure the availability of synoptic data from their respective region for the FDP period.
- FOC also intimated the status of CDMC stations along east coast to NOC and ensured 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

- NOC & FOC l utilised these data received through GTS/E-mail.

- INCOIS ensured 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

The following ten stations also became operational during the FDP period.

Kalingapatnam	: Andhra Pradesh
Kakinada	: Andhra Pradesh
Cuddalore	: Andhra Pradesh
Haldia	: West Bengal
Sagar Island	: West Bengal
Chandbali	: Orissa
Naliya	: Gujarat
Porbandar	: Gujarat
Bhuj	: Gujarat
Goa	: Goa

FOC, Chennai had certained the functioning of the HWSRs along the east coast. It made arrangement for collection and dissemination of HWSR data on real time basis to NOC and NWP Division of IMD. It also made arrangement for archival of this data.

(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 12hrly for normal days of FDP period. However, during the IOP phase of FDP, 6hrly data shall be collected. The flights terminating below 250 hPa are to be repeated.
- DDGM(UI), RMCs Kolkata, Chennai and Guwahati took all necessary steps in support of FDP observational requirements. The readiness report was sent to NOC by 10th October 2011.
- Additional GPS Sonde soundings were taken at Balasore, Gopalpur, Kalingapatnam, Ongole/Bapatla and Pamban with the support of ISRO.
- DDGM, Chennai liaised with VSSC, Trivendrum to ensure commissioning of equipment along with training to IMD staff to operate during the IOP phase of FDP. DDGM, Kolkata to depute suitable staff for Balasore and Gopalpur and remained in touch with RMC Chennai.
- Upper air GPS Sonde data from Indian Navy stations were made available by the DNOM HQs, Delhi through e-mail. Shri S. Bhatia, Project Director (Instrumentation) liaised with DNOM and ensured real time data transfer for the FDP period.
- Upper air data from GPS Sonde network of ISRO at Gadanki, SHAR, Arakkonam, Kochi etc. became available through E-Mail for the IOP Phase of FDP as intimated by the FOC. DDGM, Chennai liaised with VSSC, Trivendrum to ensure commissioning of equipment along with training to IMD staff to operate during the IOP phase.
- ITR, Chandipur (DRDO) was to operate GPS sonde flights for the IOP phase of FDP. Director MC Bhubaneswar was to liaise with ITR for organizing necessary logistics to receive upper air data accordingly by 10th October, 2011.
- Due arrangements are to be made by DDGM (UI) to receive all available Pilot Balloon data sets for the FDP 2011 period.
- Arrangements were made by Project Director (Instrumentation) to collect pilot balloon data from IAF. In case of becoming dark by 12UTC, IAF was to be advised to take the Pilot ascent by 11UTC. Daily flight level winds as collected by IAF flights between Car Nicobar and Tambaram are also to be received for FDP 2011 period. Project Director (Instrumentation) liaisoned with IAF to receive GTS coded data.
- NWP Division of IMD ensured the synchronization of data formats and collection at the NWFC/Telecom 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 were to be activated so as to receive hourly profiles in the lower troposphere.

(VI) DWR Support

DWR supported from 5 locations (Fig.6) at Kolkata, Visakhapatanm, Machillipatnam SHAR, and Chennai with uniform storm scanning strategy were

ensured prior to the FDP-2011. DDGM(UI) made due arrangements to receive the DWR data in real time to DDGM (Telecom) for the FDP 2011.

(VII) Satellite Observations

DDG(Sat Met) made 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 2011 period.

2.5.2. Telecommunication

i. DDG(Telecom) took all necessary steps so as receive the observational data at the National Operations Centre (NWFC) and Field Operations Center from all identified sources both from FDP partners and the regional countries (Bangladesh, Myanmar, Malaysia, Thailand and Indonesia, Sri Lanka) in real time. ISSD and NWP division shall continuously monitor the data reception at NWFC/Telecom and ensure the timely data reception and onward transmission of data to NWP Division and NCMRWF throughout the FDP 2011 period.
ii. ISSD, IMD established FDP Web Page on IMD (linked at NCMRWF as well). The existing FDP e-mail group was updated with full contact details). An FDP discussion group for the exchange of FDP related information among the FDP partners was to be setup. DDGM(Telecom), IT cell took necessary action in this regard.

2.5.3. NWP analysis and prediction

(a) NWP Division made all necessary arrangements for the generation of global and regional analysis fields by using special FDP 2011 data at 4 analysis times (00, 06,12,18 UTC) for the whole of FDP 2011 period. Arrangements are also made to keep FDP 2011 analyses fields and forecast boundary fields up to 72hrs. On ftp servers of NCMRWF and IMD for their utilization by FDP partners in India. Efforts were made to bring out the 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-2011 period.

2.5.4. International Cooperation

Director RSMC, New Delhi requested the ESCAP Panel, SAARC and BIMSTEC countries about the FDP over the Bay of Bengal programme of India and solicited 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.

2.5.5. FDP Operation Centre

Project Manager established a National FDP Operations Centre at NWFC and a FDP Weather Monitoring and Advisory Group will be constituted to identify the IOP phases during FDP 2011 period.

2.5.6. FDP Weather Monitoring and Advisory Group (WMAG)

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

The WMAG met thrice a week (Monday, Wednesday & Friday) at 1530 hrs. (including holidays) during the period 15 Oct.- 30 Nov., 2011 at NWFC Meeting Room IInd floor to review the FDP activity regularly and decided on IOP declaration. Weather summaries and current information were presented by Project Scientist, FDP.

2.5.7. Implementation Strategy

- Preparatory Phase for the FDP Pilot 2011: 1-15 October 2011
  (Actions to be completed as mentioned above)

- FDP-2011 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
- NOC: The NOC will be established at NWFC, New Delhi which will be responsible for entire co-ordination and declaration of IOP. The centre will function independently. The usual operational activity of RSMC will be separate.
- FOC: 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 2011 pilot observational campaign.
- FDP Data Centre: All special observations collected by the FDP project partners shall be archived alongwith meso-scale analysis and forecast fields at IMD and NCMRWF computing centres.

2.5.8. Post Experiment Phase:

1. Preparation of weather summary data CD was to be carried out by the project management team and NWP group of IMD.

2. Project management team was to 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.

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

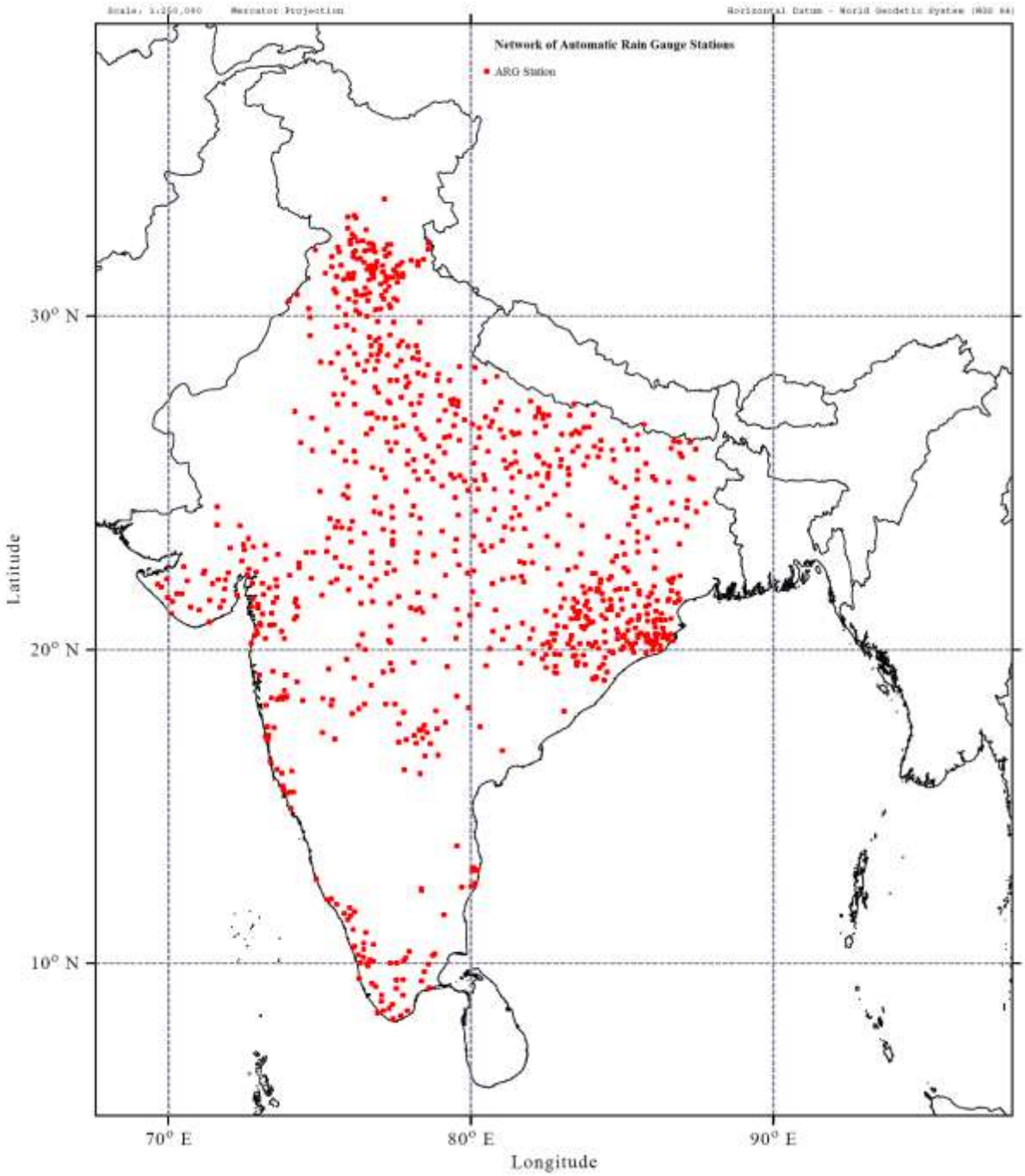


Fig.1(b). IMD's network of 900 Automatic Rain Gauge (ARG)

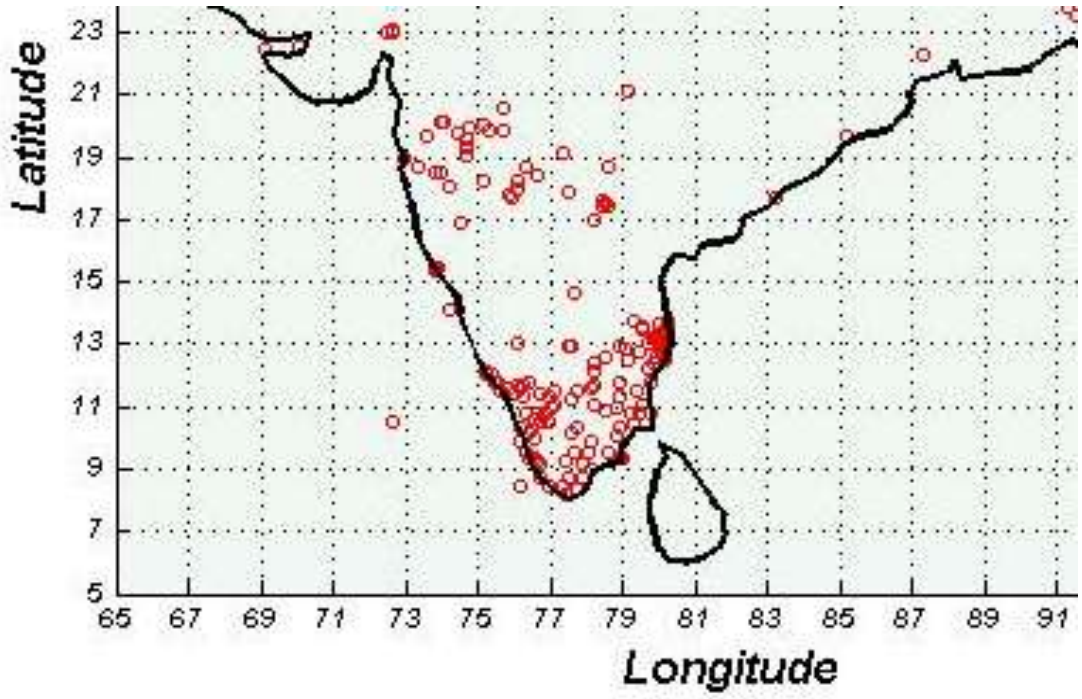


Fig.2. ISRO AWS stations under PRWONAM project.

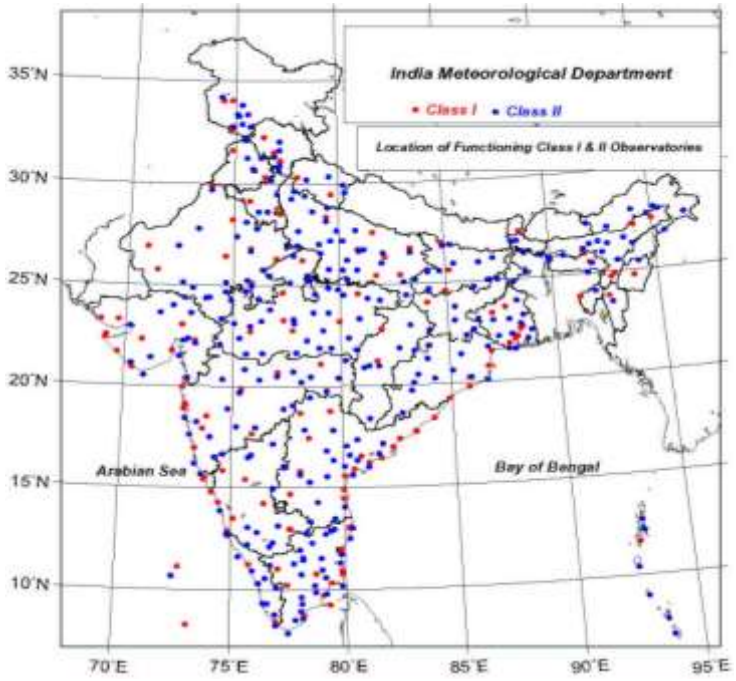


Fig.3. Synoptic stations of IMD

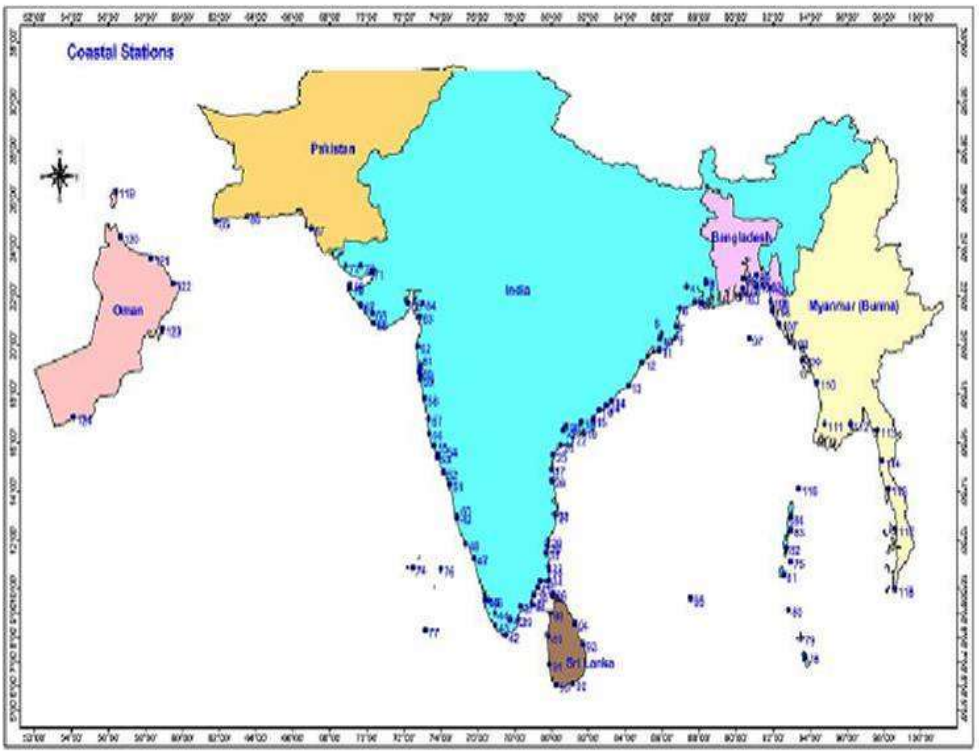
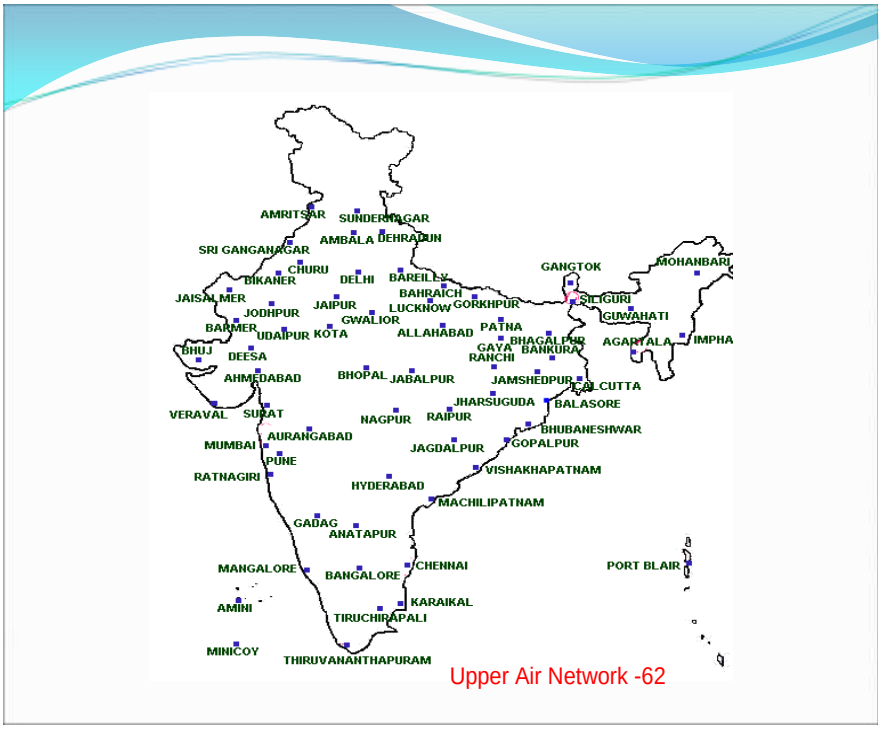


Fig.4. Coastal synoptic stations



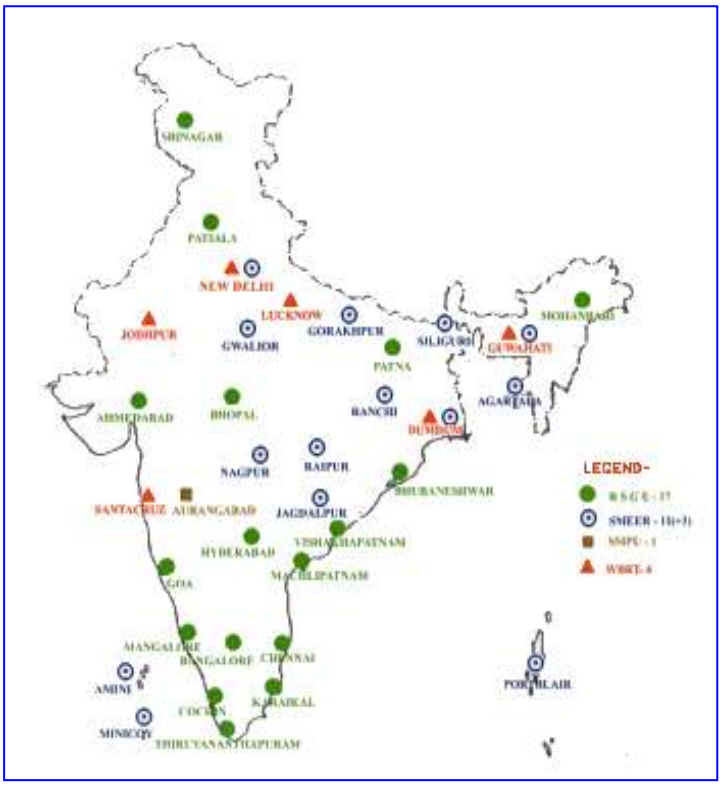
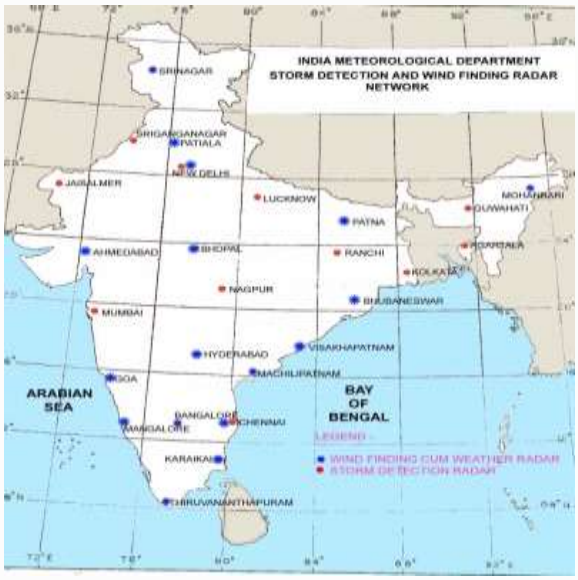


Fig.5. Pilot balloon and RS/RW (including 10 GPS stations) network of IMD



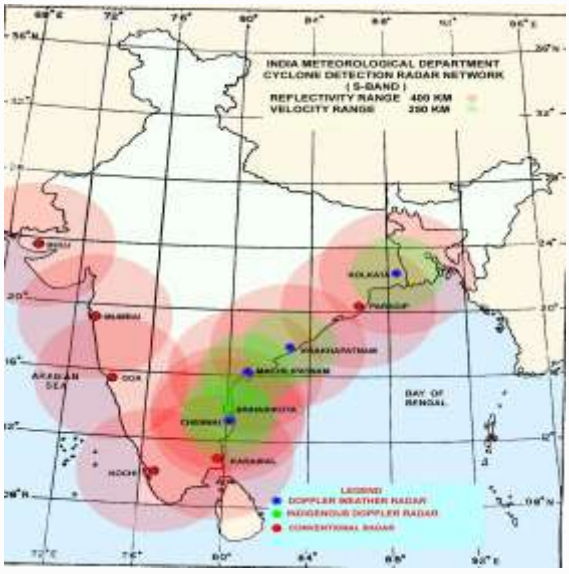


Fig. 8 Existing Cyclone Detection Radar Network

Fig.6. DWR Network of IMD

Table1. List of surface 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

Table2. List of surface Foreign Coastal stations

Station	Index	Latitude	Longitude	00 Z	03 Z	06 Z	09 Z	12 Z	15 Z	18 Z	21 Z
SRI LANKA											
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	0
Galle	43495	06 02N	80 13E	X	X	X	X	X	0	X	X
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	0
Jaffna	43404	09 39N	88 01E	X	X	X	X	X	0	X	0
BAGLADESH											
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	X
Yangon	48097	16 46N	96 10E	X	X	X	X	X	X	X	0
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	

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				
1	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 – 2011

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.2011. There were two Intensive Observational Phase (IOP) within this period as there was only one cyclonic disturbance 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 program

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 2011.

IMD has augmented AWS network under its modernisation programme. The number of AWS/ Automatic Rain Gauge (ARG) stations in the country exceeds 500 by the end of 2011. 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.

3.3. Operation Management

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. 2011. 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. The announcement of IOP 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 2011

- IOP: 18-19 October, 2011 (2 Days) :(Deep Depression 19-20 Oct, 2011)

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 the 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 suggest cyclogenesis, otherwise not.

Track forecasting:

i) Methods based on climatology
ii) Methods based on Persistence & Climatology
iii) Synoptic Techniques – Empirical Techniques
iv) Satellite Techniques (Microwave)
v) Statistical Techniques (CLIPER, Chaos theory and Generic Algorithm method)
vi) Climatology and persistence(CLIPER)
vii) Analogue Techniques
vii) NWP Models
    - MME based on Tropical Cyclone Module (TCM)
    - IMD GFS (T382), NCEP GFS, ECMWF, UKMO, JMA, IMD WRF, IITD WRF & NCMRWF (T574)
    - ARPs Model of Meteo France
    - WRF model at 27, 18 & 9 km

Experimental Models used:

- HWRF
- Ensemble Prediction System(EPS) (JMA, UKMO, ECMWF, NCEP)

Operational consensus is based on 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 :

Use was mainly based on dynamical statistical model and satellite and other conventional inputs for intensity monitoring and forecasting. However, microwave imagery in TCM the following techniques were used.

- Climatology persistence Analogue
- Synoptic
- Satellite
- NWP Models Dynamical
- Statistical Model (SCIP)

Tropical Cyclone Module:

The Tropical Cyclone Module 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 products before and after initiative are shown in Fig.1.

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

- Analysis of all synoptic, satellite 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

The official landfall forecast errors during FDP-2011 are shown in Table 3.1. For comparison, the landfall forecast errors during FDP-2008 are shown in Table 3.2. It is found that the error has decreased over the years. There were no cyclonic disturbances during FDP-2009 and hence could not be compared. The track forecast errors during 2011 as shown in Table 3.3 were also less and the skill score during FDP-2011 as shown in Table 3.4 was higher.

Table3.1. Official landfall forecast errors (km) of IMD during FDP-2011

Lead time hours (Landfall point error in km.)				Landfall time error (in hrs.)		
Hours	F/C	Actual	Error (km)	F/C(UTC)	Actual(UTC)	Error
12	21.4^0N /92.0^0E	21.2^0N /92.1^0E	25	191830	191300 UTC	-5.5

Table3.2. Official intensity forecast errors (km) of IMD during FDP-2011

Lead Period of forecast	Intensity Error (knots)			No. of observations verified
	Average	Absolute Average	RMS	

12	2.2	2.2	2.7	3
24	16.2	16.2	16.2	1

Table3.3. Official landfall forecast errors (km) of IMD during FDP-2011

System	Lead Time (hours)					
	12	**24**	**36**	**48**	**60**	**72**
GIRI	55	55	55	--	--	--
JAL	35	25	33	44	22	101
MEAN	45	40	44	44	22	101

Table 3.4. Official landfall forecast errors (km) of IMD during FDP-2008

System	***Error (km)***
RASHMI	***21***
KHAIMUK	***150***
NISHA	***100***
MEAN	***90***

Table 3.5. Official track forecast errors (km) of IMD during FDP-2011

Lead time (hours)	Direct position error (km)	Number of forecasts verified
12	43	3
24	55	1

Table 3.6. Official track forecast errors (km) of IMD during FDP-2011

System	Lead Time (Hrs)					
	12	**24**	**36**	**48**	**60**	**72**
GIRI	45(7)	73(5)	68(3)	117(1)	-	-
JAL	41(11)	78(9)	56(7)	83(5)	54(3)	54(01)

Figures inside parenthesis indicate the number of forecasts verified.

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 2011. 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 PRE-PILOT PHASE - 2011

4.1 Introduction

The north Indian and adjoining land surface Ocean witnessed the formation of ten cyclonic disturbances during the year 2011 as given in Table 4.1. Out of ten disturbances five cyclonic disturbances formed over the Bay of Bengal, four over the Arabian Sea and one over land. Out of the five cyclonic disturbances over the Bay of Bengal, one intensified upto the stage of very severe cyclonic storm, THANE, two upto the stage of deep depression and rest two upto the stage of depression. Out of four cyclonic disturbances formed over the Arabian Sea, one intensified upto the stage of cyclonic storm, KEILA, two upto the stage of deep depression and one upto the stage of depression. Tracks of the cyclonic disturbances formed over the north Indian Ocean during the year 2011 are shown in Fig 4.1.

During the pre- pilot phase-2011 only one deep depression formed over the Bay of Bengal during 19-20 October, 2011. The salient features of this deep depression are discussed in section 4.2.

Table 4.1:Cyclonic disturbances formed over north Indian Ocean and adjoining land areas during 2011

1.	Depression over the Bay of Bengal 02-03 February 2011
2.	Depression over the Arabian Sea (11-12 June 2011)
3.	Deep depression over the Bay of Bengal (16-23 June, 2011)
4.	Land depression over Jharkhand (22-23 July 2011)
5.	Depression over Bay of Bengal (22-23 Sept 2011)
6.	**Deep depression over the Bay of Bengal (19-20 October, 2011)**
7.	Cyclonic storm 'KEILA' over the Arabian Sea (29 October- 04 November, 2011)
8.	Deep Depression over the Arabian Sea (06- 10 November 2011)
9.	Deep depression over the Arabian Sea (26 November to 1st December, 2011)
10	Very Severe Cyclonic Storm Over the Bay of Bengal 25-31 December 2011

4.2 Salient features of the systems formed during FDP Phase-2011

4.2.1 Deep depression over the Bay of Bengal (19-20 Oct. 2011)

4.2.1.1 Introduction

A deep depression formed over northeast Bay of Bengal on 19 October, 2011 morning. Moving northeaster wards, it crossed Bangladesh coast near lat. 21.2^0N and long. 92.1^0E (south of Cox's Bazar) around 1300 UTC of 19th October. The characteristics of the system are described below.

4.2.1.2 Genesis

Synoptic analysis suggested that a low level cyclonic circulation lay over the southeast and adjoining eastcentral Bay of Bengal from 12th October onwards.

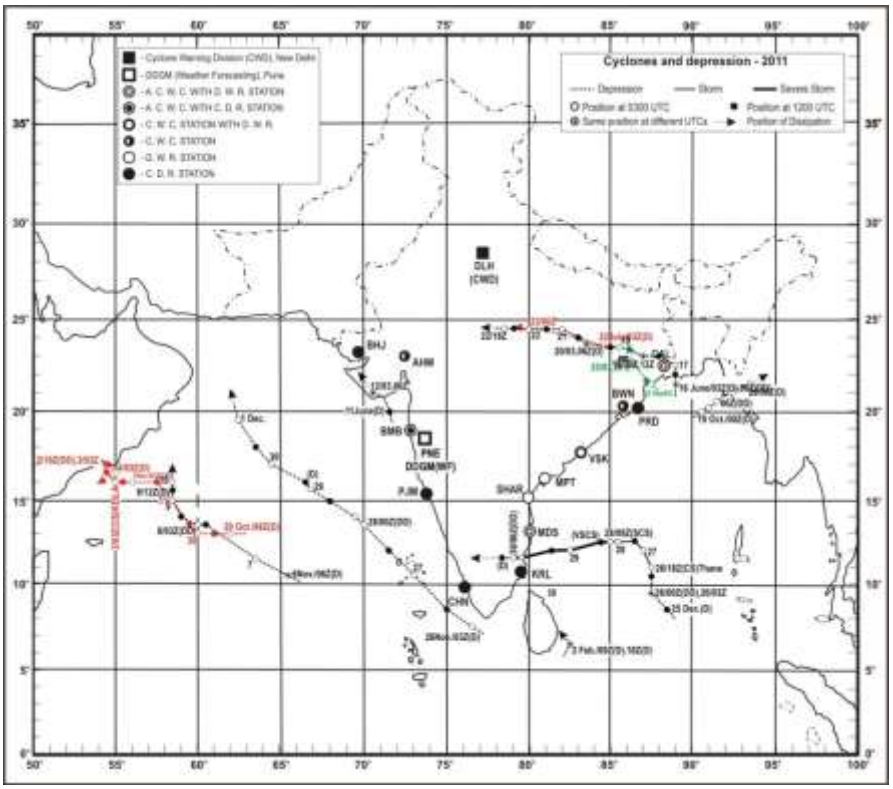


Fig. 4.1

There was an active east-west shear zone passing through this circulation. Under the influence of these synoptic conditions, the cross equatorial flow over the Bay of Bengal leading to southerly surge increased gradually. As a result, the lower level positive relative vorticity and convergence also increased. It was manifested in the satellite imageries with gradual organisation of convective clouds over the southeast and eastcentral Bay of Bengal.

Considering the large scale environmental conditions, the Sea surface temperature over the Bay of Bengal continued to be about $28\text{-}32^0$C. The upper tropospheric ridge at 200 hPa level lay too far north of the area of circulation (around 19^0N on 15th October) and provided the required divergence over the region. The vertical wind shear was low to moderate over the central and north Bay of Bengal. There was no significant system over the south China Sea. The cyclone, Banyan over the south China Sea lay as a depression near 17.5^0 N and 116^0E on 14th and became less marked on 15th October. However, the Ocean heat content was about 80 KJ/cm^2 over the south and central Bay of Bengal and less than 50 KJ/cm^2 over the north Bay of Bengal. The Madden Julian Oscillation (MJO) index lay in phase 8 on 14th and moved gradually to phase 1 during 14-19th. As such, it was not

favourable for cyclogenesis. Due to this unfavourable MJO condition, the convection could not be amplified rapidly. Rather, the convection exhibited a marked diurnal

Date	Time (UTC)	Centre (lat^{0}N/long ^{0}E)	C. I. No.	Estimated centre pressure (hPa)	Estimated pressure drop at the centre (hPa)	Estimated Maximum sustained wind (kts)	Grade

variation. However, the cyclonic circulation over southeast & adjoining east central Bay of Bengal moved to east central Bay of Bengal & neighbourhood and extended upto mid tropospheric level on 16th October 2011. The east-west trough also extended upto mid tropospheric level through the above system. Under the influence the cyclonic circulation, a low pressure area formed over the same region with associated cyclonic circulation extending upto mid-tropospheric level on 17th October. It became well marked over east central & adjoining north and west central Bay of Bengal on 18th. The well marked low pressure area concentrated into a depression over north Bay of Bengal and lay centred at 0000 UTC of 19th October 2011 over north Bay of Bengal near latitude 20.0^{0}N and longitude 90.5^{0}E.

4.2.1.3 Intensification and movement

All the above mentioned favourable and unfavourable conditions continued during 19th and 20th. At 0300 UTC of 19th October, the 24 hrs pressure change was negative over Bangladesh coast (around -3.0 hPa) and negative over north Andhra Pradesh and Orissa-West Bengal coast (around -2.0 hPa). Maximum pressure fall was reported as -4.2 hPa over Cox's Bazar. Pressure departure from normal was negative (-5.0 to -6.0 hPa) over Cox's Bazar and Chittagong. The depression moved to the north of upper tropospheric ridge, which roughly ran along 19^{0}N on 19th October 2011 in association with an anticyclonic circulation to the southeast of the system centre. As a result of these, the system moved east-northeast wards and intensified into a deep depression and lay centred at 0300 UTC over northeast Bay of Bengal near lat 20.2^{0}N and long. 91.0^{0}E. It then moved northeast wards and crossed Bangladesh coast near lat. 21.2^{0}N and long. 92.1^{0}E (south of Cox's Bazar) around 1300 UTC of 19th October. After the landfall it also continued to move northeastwards for sometimes and then eastwards and weakened gradually. It weakened into a low pressure area at 0300 UTC of 20th October 2011 over Myanmar and adjoining Bangladesh, Mizoram and northeast Bay of Bengal.

At 0900 UTC of 19th, Cox's Bazar reported lowest pressure of 999.5 hPa and northeasterly wind of 15 knots. Sittwe (Myanmar) reported southwesterly wind of 20 knots. The track of deep depression is shown in Fig. 4.1. The best track parameters are shown in Table 4.2. The typical satellite imageries of the system are shown in fig. 4.2.1. The ECMWF model analyses of lower level vorticity, upper level divergence, upper level wind and vertical wind shear are shown in fig. 4.2.2.

Table 2.6.1: Best track position and other parameters of deep depression over the northeast Bay of Bengal during 19-20 October, 2011

19-10-2011	0000	20.0/90.5	1.5	1002	3	25	D
	0300	20.2/91.0	1.5	1000	3	25	D
	0600	20.5/91.5	2.0	1000	5	30	DD
	1200	21.0/92.0	2.0	1000	5	30	DD
	The system crossed Bangladesh coast near lat. 21.2^0N and long. 92.1^0E (south of Cox's Bazar) around 1300 UTC.						
	1800	21.5/92.5	2.0	1002	5	30	DD
20-10-2011	0000	21.5/93.5	1.5	1004	3	25	D
	0300	The system weakened into a low pressure area over Myanmar and adjoining Bangladesh, Mizoram and northeast Bay of Bengal.					

4.2.1.4. Realised Weather:

Not available from Bangladesh and Myanmar. However according to media reports, along the border between Myanmar and Bangladesh, torrential rain produced devastating flash floods. Squally winds also prevailed over the region.

4.2.1.5. Damage:

In the Magway region, roughly 2000 homes were washed away and more than 6000 remained flooded for days. Initial estimates placed the damage of 1.64 million US dollars. At least 215 people were confirmed to have been killed with many more missing.

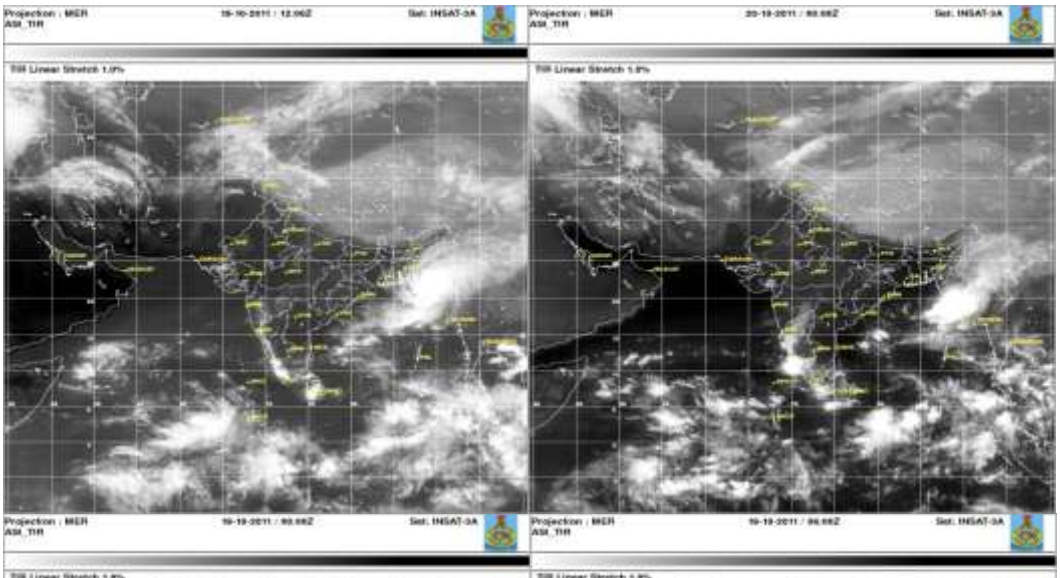
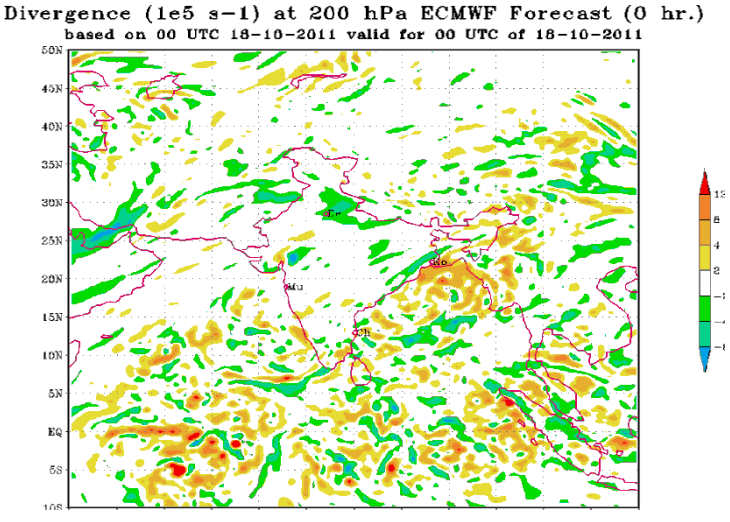
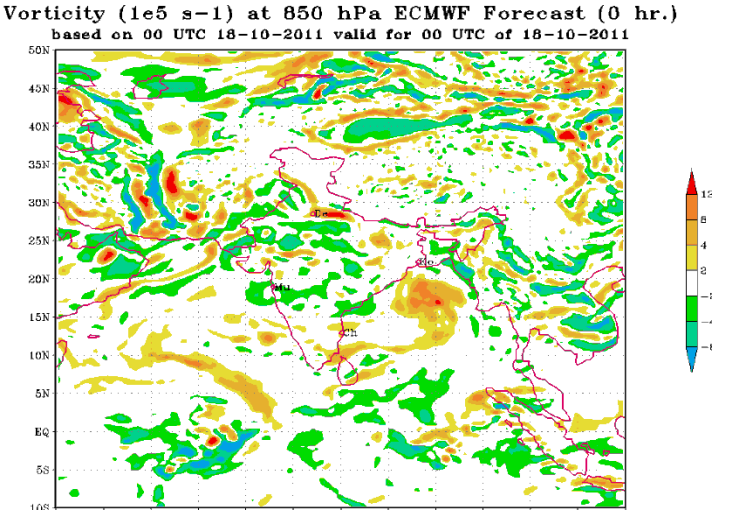


Fig. 4.2.1 Typical Satellite imageries at 0000, 0600 and 1200 UTC of 19-10-2011 and 0000 UTC of 20-10-2011 in association with the depression over the Bay of Bengal.





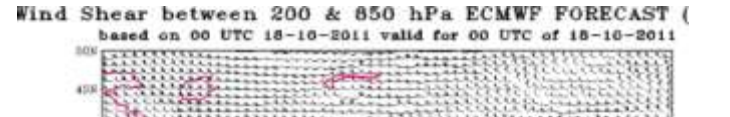
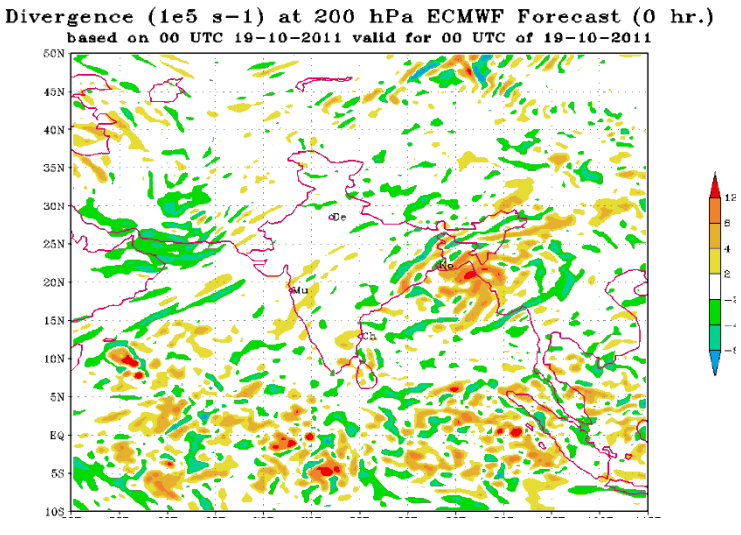


Fig. 4.2.2 (a) (i) Upper level divergence at 200 hPa level (ii) low level relative vorticity at 850 hPa level (iii) wind at 850 hPa level (iv) vertical wind shear of horizontal wind between 200 and 850 hPa level based on the ECMWF model analysis of 0000 UTC of 18th October, 2011.



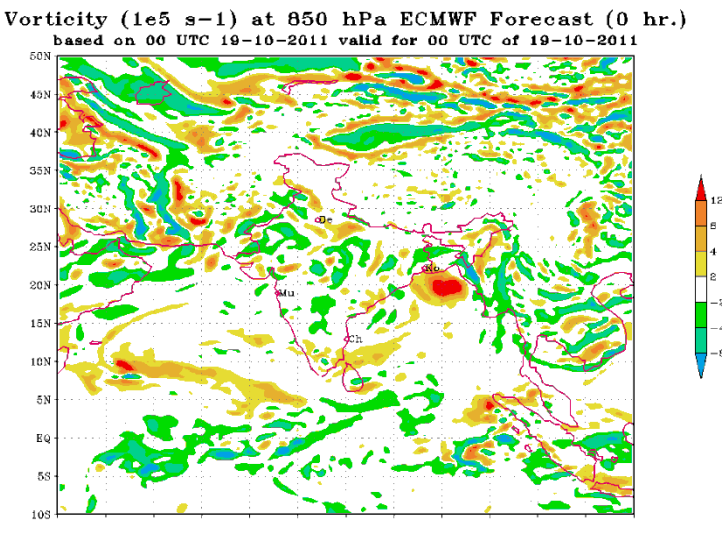
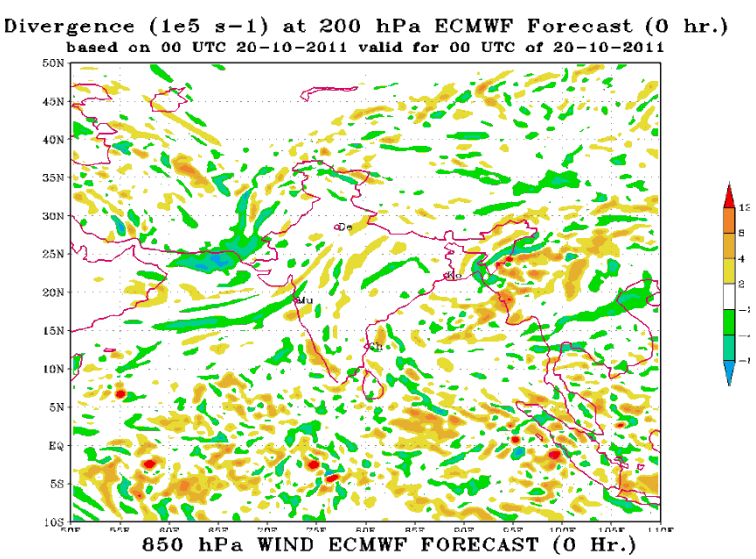
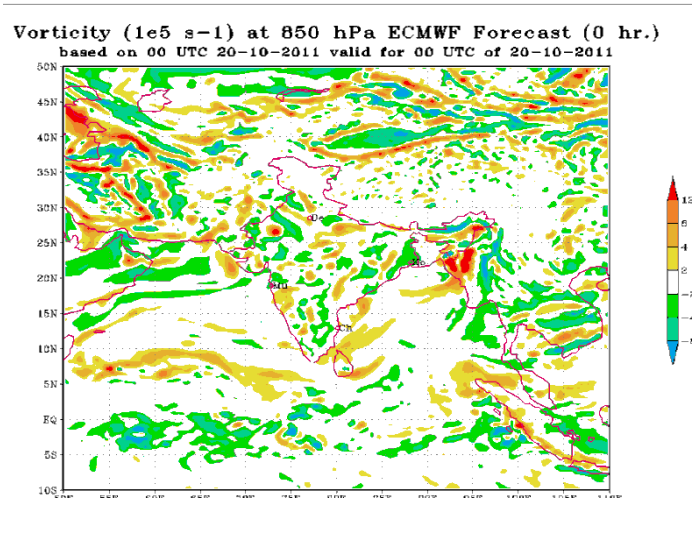
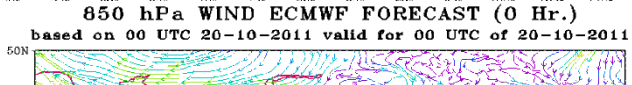


Fig. 4.2.2(b) (i) Upper level divergence at 200 hPa level (ii) low level relative vorticity at 850 hPa level (iii) wind at 850 hPa level (iv) vertical wind shear of horizontal wind between 200 and 850 hPa level based on the ECMWF model analysis of 0000 UTC of 19th October, 2011.







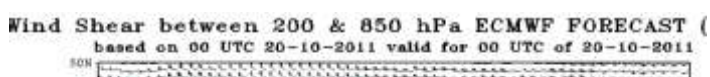


Fig. 4.2.2 (c) (i) Upper level divergence at 200 hPa level (ii) low level relative vorticity at 850 hPa level (iii) wind at 850 hPa level (iv) vertical wind shear of horizontal wind between 200 & 850 hPa level based on the ECMWF model analysis of 0000 UTC of 20th October, 2011.

CHAPTER V

Daily Weather summary and advisories issued during FDP-2011

FDP-2011 was conducted during the period 15 Oct.-30 Nov.,2011. 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 Octoberr, 2011, 1730 hours IST

Synoptic features:

- A cyclonic circulation lies. over southeast & adjoining east central Bay of Bengal . extending upto 3.1 kms a.s.l It is persisting over the same region for consecutive 4th day
- A trough extending upto 3.1 kms a.s.l lies. from the above system to Lakshadweep area across southwest Bay of Bengal, Tamil Nadu, and Kerala with the embedded cyclonic circulation over south Tamil Nadu & adjoining Sri Lanka.
- Pressure change in last 24 hrs. at 0300 UTC is of the order -0.5 to -1.0 hPa over Andaman & Nicober islands, Myanmar, Bangladesh, West Bengal, Odisha, Andhra Pradesh, Tamilnadu and Puducherry coasts.
- Pressure departure from normal at 0300 UTC is of the order -1.0 to -3.0 hPa over the above region.
- Past 24 hrs. rainfall ending at 0300 UTC : Widespread rainfall occurred over Andaman & Nicobar islands

Environmental features

Sea Surface Temperature:

- SST around 28.0 - 31.0^{0}C over Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy is mainly 60-80 KJ cm^{-2} over south and central Bay of Bengal and less than 40 KJ cm^{-2} over north Bay of Bengal

Relative Vorticity:

- Relative vorticity at 850 hPa is positive over south east and east central Bay of Bengal with magnitude of 4.0*10^{-5} s^{-1}. There are two voticity centres one to the southwest and other to the northeast of the circulation centre.

Convergence:

- Lower level positive convergence (5* 10^{-5} s^{-1}) prevails over south of the circulation centre.

Divergence:

- Upper air positive divergence (10*10^{-5} s^{-1}) prevails over south of the circulation centre and negative divergence (5*10^{-5} s^{-1}) over north and adjoining central Bay of Bengal.

Wind Shear:

- Wind Shear is low to moderate (5-10 knots) over southeast and central Bay of Bengal and Andaman Sea.

Wind Shear Tendency:

- Decreasing (10 knots) over southBay and (5-10 knots) over southwest Bay of Bengal no change over rest Bay of Bengal.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 19.0^{0}N at 200 hPa level.

M.J.O. Index:

- Located over phase 8 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 1 & 2 during next 15 days.
- Dynamical forecast:- MJO located in phase 8 with amplitude greater than 1.0 and moves through phase 1 & 2 during next 15 days.

Status of observational system:

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

Satellite

Inference based on INSAT imagery of 270900 UTC

Bay of Bengal:-

Broken low/medium clouds with embedded isolotaed moderate to intense convection seen over Bay of Bengal between latitude 9.5^{0}N to 16.0^{0}N east of long 85.5^{0}E. Satellite observations indicates that convection has not increased much within last 24 hours,but further increase in convection in the next 24 hrs..

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

NWP Analysis

- **ECMWF** model shows formation of low pressure over east central Bay of Bengal on 17 **Oct 2011,** which will intensify into a depression at 00UTc of 19 Oct 2011 and a Deep Depression by 18UTC of 19th. The system will move initially northeastwards and then recurve northnortheastwards and cross Bangladesh coast as deep depression near latitude 22^{0}N and longitude 91^{0}E around 00UTC of 20th. The vorticty, divergence, windshear and 850hPa wind are given in Annexure II.
- **IMD-GFS** model of 00UTC of today shows an low pressure over east central Bay of Bengal on 16th which will become well marked on 17th . It will cross Bangladesh coast around 00UTC of 20th.
- **WRF-ARW** model analysis of 00UTC of today indicates an cyclonic circulation over Southeast Bay of Bengal and is likely to move northwestward and lie over Central Bay of Bengal on 18th .
- **UKMET** model analysis of 00UTC of today indicates an cyclonic circulation over Southeast Bay of Bengal and is likely to move northwestward and lie over Central Bay of Bengal on 18th

- **NCMRWF-GFS** model shows low on 16th 12UTC over southeast Bay of Bengal and likely to move northwestwards during next three days.

- **JMA** model shows low on 17th over southeast Bay of Bengal and likely to move northwestwards during next three days

http://www.imd.gov.in/section/nhac/dynamic/welcome.htm)
ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter(GPP): The GPP based on IMDGFS shows increasingly favourable conditions for formation of depression over east central Bay of Bengal during next 48 hrs.. TheGPP forecast for 17th is given in Annexure III

Summary and Conclusion:

The analysis of the sysnoptic situations, current observations and NWP model analysis indicate that the existing lower level cyclonic circulation over southeast and adjoining east central Bay of Bengal is likely to intensify into a low pressure area by 17th . It may further intensify into a Depression on 19th. Compare to yesterday ll the NWP models have downgraded the intensification of the system.

Advisory.

- **NO IOP will be conducted till 17th October 2011. However a continuous watch will be made in view of the likely formation of the above synoptic system.**

Annexure I

Status of Observation system:

Synop

Region	**Date/Time (UTC)**		
	14/12	**15/00**	**15/03**
India	191	126	80
Coastal stations			
WB	11	06	07
Odisha	10	03	06
AP	18	11	12
Tamil Nadu & Puducherry	14	10	12
A & N	01	03	06
Bangladesh	09	14	15
Myanmar	08	09	09
Thailand	08	07	07

Sri Lanka	08	09	10

- **AWS**

Region	**Date/Time (UTC)**		
	14/12	**15/00**	**15/03**
India	192	408	408
WB	11	17	17
ODS	17	17	14
AP	22	26	22
TN & PDC	16	17	14

- **RSRW** (12Z) 14 -10-2011: - 08/39
- **No. of Ascents reaching 250 hPa levels:03, MISDA:-**31

- **RSRW** (00Z) 15 -10-2011: - 34/39
- **No. of Ascents reaching 250 hPa levels:34, MISDA:** 5
- **No. of PILOT Ascents**

14-10-2011		15-10-2011	
12Z	**18Z**	**00Z**	**06Z**
12		17	

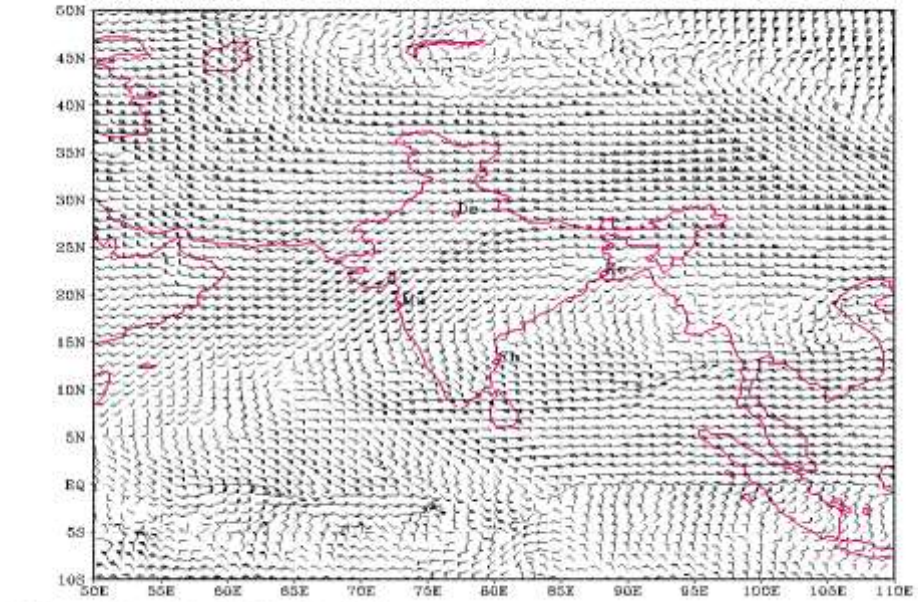
- **Buoy Data**

14-10-2011					15-10-2011		
09Z	**12Z**	**15Z**	**18Z**	**21Z**	**00Z**	**03Z**	**06Z**
	12				9	12	

Annexure II

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

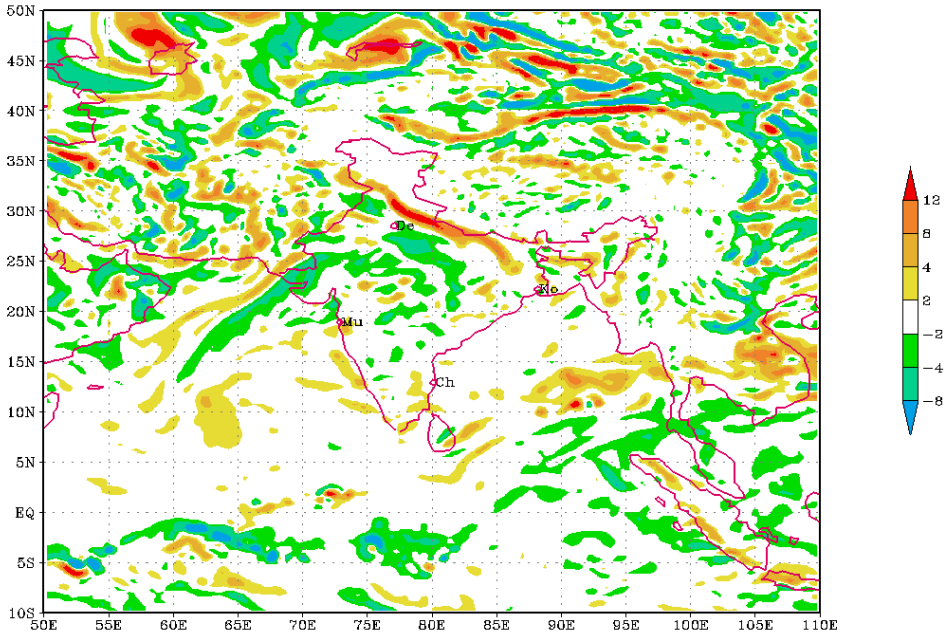
based on 00 UTC 15-10-2011 valid for 00 UTC of 15-10-2011



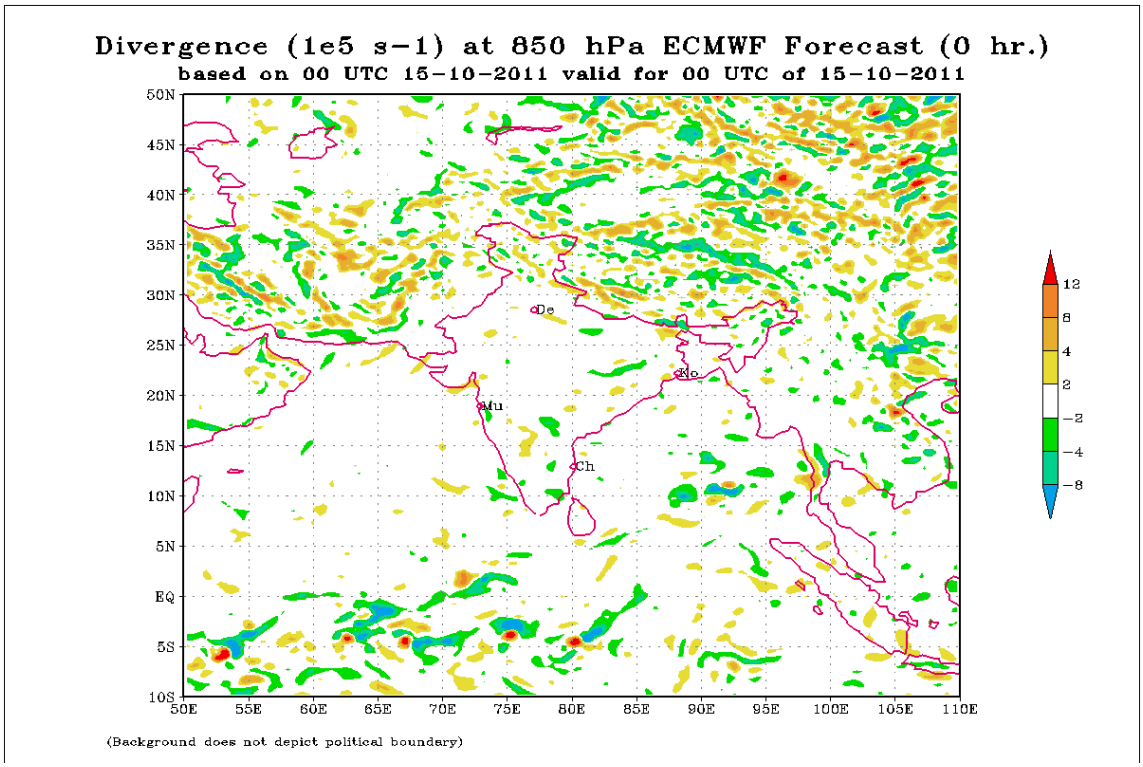
(Background does not depict political boundary)

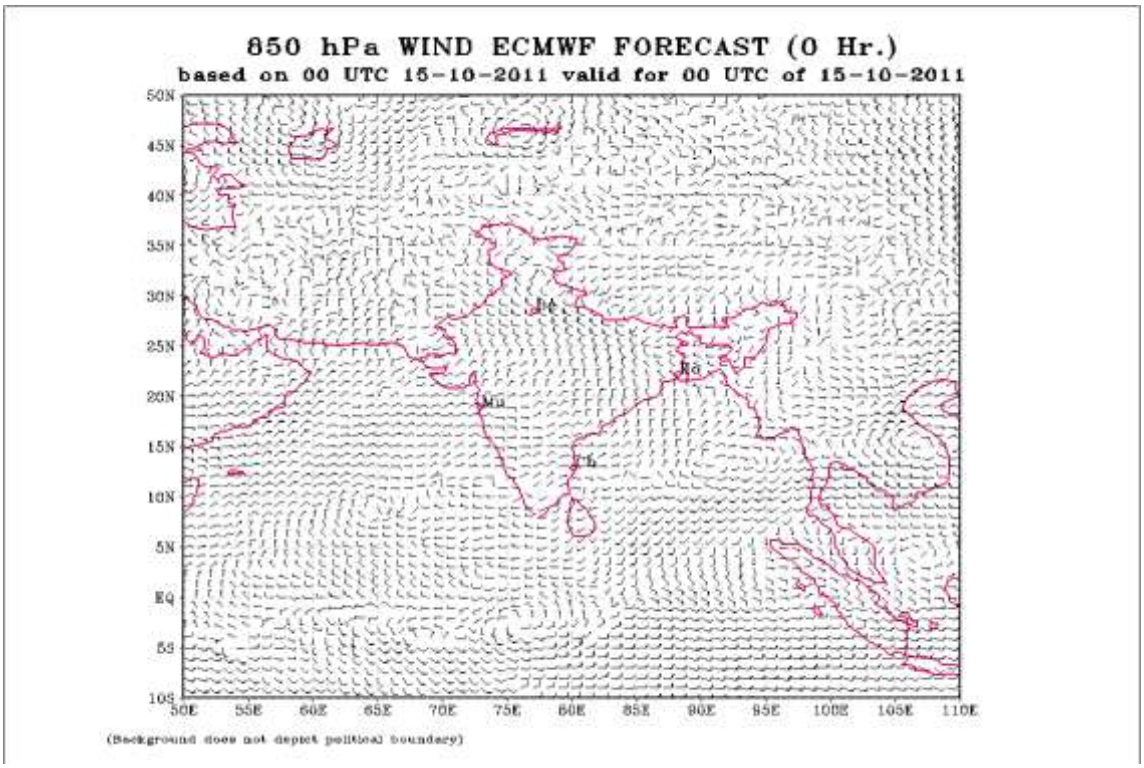
Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)

based on 00 UTC 15-10-2011 valid for 00 UTC of 15-10-2011

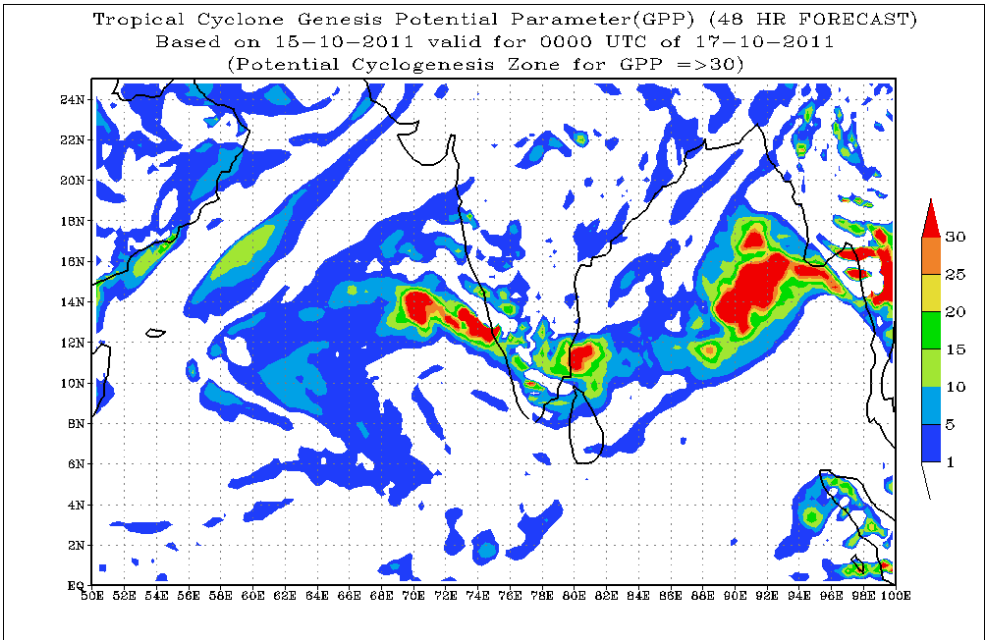


(Background does not depict political boundary)





Annexure III



FDP (Cyclone) NOC Report Dated 16 October, 2011

Synoptic features based on 0300 UTC:

- Yesterday's cyclonic circulation over southeast & adjoining east central Bay of Bengal (BoB), now lies over east central BoB & neighbourhood and extending upto mid tropospheric level.
- The east-west trough also extends upto mid tropospheric level through the above system.
- Pressure fall in last 24 hrs. at 0300 UTC of today is of the order 1.0- 2.0 hPa over Andaman Islands and no significant change over Myanmar, Bangladesh, West Bengal, Odisha, Andhra Pradesh,Tamilnadu and Puducherry coasts.
- Pressure departure from normal at 0300 UTC of today is negative over the above region and is between 1.0 to 3.5 hPa.
- Past 24 hrs. rainfall ending at 0300 UTC of today: Fairly widespread rainfall occurred over Andaman & Nicobar islands and mainly dry weather prevailed along the east coast of India.

Environmental features based on 0900 UTC of today:

Sea Surface Temperature:

- SST around 28.0 - 30.0^{0}C over BoB.

Ocean thermal energy:

- Ocean thermal energy is between 60-85 KJ cm^{-2} over south & central BoB and less than 40 KJ cm^{-2} over north BoB.

Relative Vorticity:

- Relative vorticity at 850 hPa is positive over southeast, east central and southwest BoB with magnitude of order $4.0*10^{-5}$ s^{-1}.

Convergence:

- Lower level positive convergence ($5* 10^{-5}$ s^{-1}) prevails close to the circulation centre and negative convergence prevails over southwest and north BoB.

Divergence:

- Upper air positive divergence ($10*10^{-5}$ s^{-1}) prevails over south of the circulation centre and negative divergence ($5*10^{-5}$ s^{-1}) over southwest and adjoining west central BoB.

Wind Shear:

- Wind Shear is moderate (of order 10 knots) over east central and adjoining areas of BoB.

Wind Shear Tendency:

- Increasing of order 5- 10 knots over east central and adjoining areas of Bay of Bengal and no change over rest of BoB.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 17.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 8 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 1 & 2 during next 15 days.
- Dynamical forecast:- MJO located in phase 8 with amplitude greater than 1.0 and moves through phase 1 & 2 during next 15 days.

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:

Broken low/medium clouds with embedded isolated moderate to intense convection lies over Bay of Bengal between lat 9.0^0N to 18.5^0N east of long 83.5^0E. Convection has not increased much in last 24 hours. Satellite observations indicates further increase in convection in the next 24 hrs.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model shows formation of a low pressure over east central BoB on 17 **Oct 2011,** which will intensify into a depression at 0000 UTC of 18 Oct 2011 and a Deep Depression by 0000 UTC of 19th. The system likely to move initially northwards and then recurve northeastwards and cross Bangladesh coast as deep depression near latitude 22^0N and longitude 92^0E around 1200 UTC of 19th. The vorticty, divergence, windshear and 850hPa wind are given in **Annexure II**.
- **IMD-GFS** model of 0000 UTC of today shows formation of a low pressure area over east central BoB on 17th October 2011. The system likely to cross Bangladesh coast around 1200 UTC of 19th.
- **WRF-ARW** model analysis of 0000 UTC of today shows a cyclonic circulation over east central BoB. The system likely to intensify into a LOW on 18th and cross West Bengal coast around 0000 UTC of 19th as Depression.
- **UKMET** model analysis of 0000 UTC of today shows a cyclonic circulation over east central BoB and is likely to intensify and cross the Bangladesh coast around 0000 UTC of 20th.
- **NCMRWF-GFS** model shows a CYCIR over east central BoB and likely to move northward direction and cross Bangladesh coast around 0000 UTC of 20th.

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

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP based on IMDGFS shows favourable conditions for formation of a depression over east central BoB during next 24 hrs.. The GPP analysis, 24-h and 48-h forecasts are given in **Annexure III**.

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

Summary and Conclusion:

The analysis of the synoptic situations, current observations and NWP model indicate that the existing cyclonic circulation over eastcentral BoB is likely to intensify into a low pressure area by 17th. It may further intensify into a Depression on 18th and cross Bangladesh coast near 22.0º N and 92.0º E around 1200 UTC of 19th. Compared to yesterday all the NWP models have maintained the similar forecast.

Advisory:

- **NO IOP will be conducted till 17th October 2011. However a continuous watch will be made in view of the likely formation of the above synoptic system.**

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	15/12	16/00	16/03
India	191	125	188
Coastal stations			
WB	11	5	11
Odisha	10	6	10
AP	18	17	18
Tamil Nadu	13	11	14
Puducherry	1	2	2
A & N	2	2	2
Bangladesh	08	8	13
Myanmar	09	5	8
Thailand	02	1	1
Sri Lanka	10	07	10

AWS

Region	Date/Time (UTC)		
	15/12	16/00	16/03
India	455	80	438
WB	---	5	9
ODS	---	5	22
AP	---	9	22
TN & PDC	--	9	17

- **RS/RW** (12Z) of 15 -10-2011: 09/39
- **No. of Ascents reaching 250 hPa levels:05, MISDA:-**30
- **RS/RW** (00Z) of 16 -10-2011: 34/39
- **No. of Ascents reaching 250 hPa levels:23, MISDA:** 5

No. of PILOT Ascents

15/12Z	16/00Z
16	24

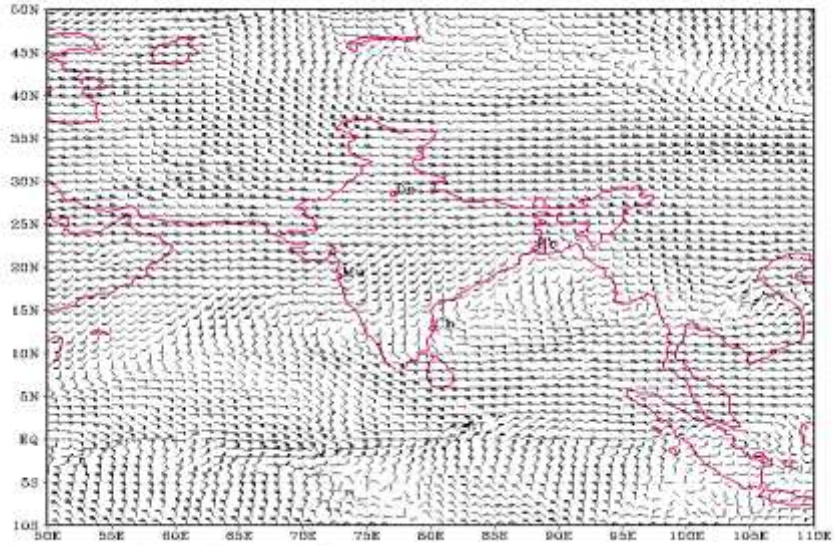
Buoy Data

15/12Z	16/00Z	16/03Z
12	9	12

Annexure II

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

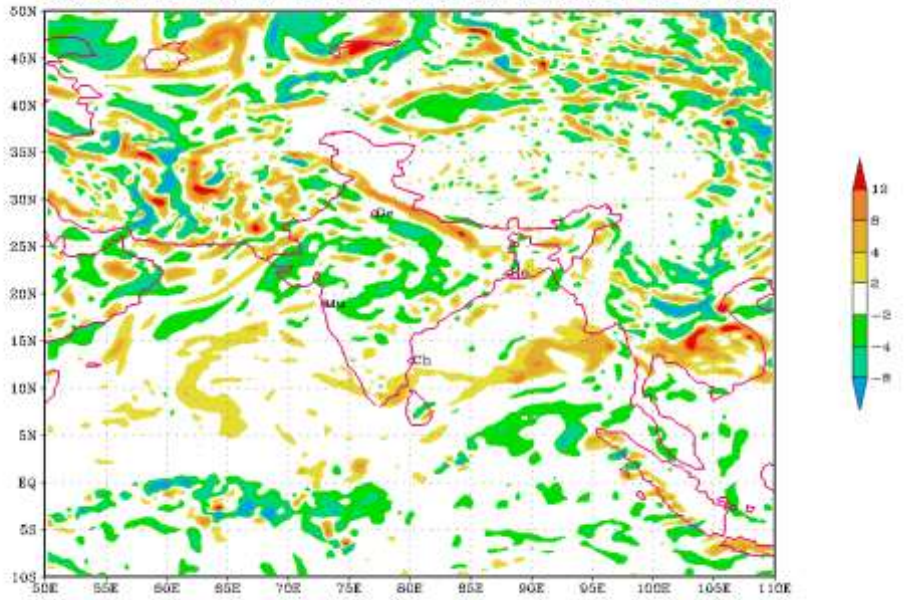
based on 00 UTC 16-10-2011 valid for 00 UTC of 16-10-2011



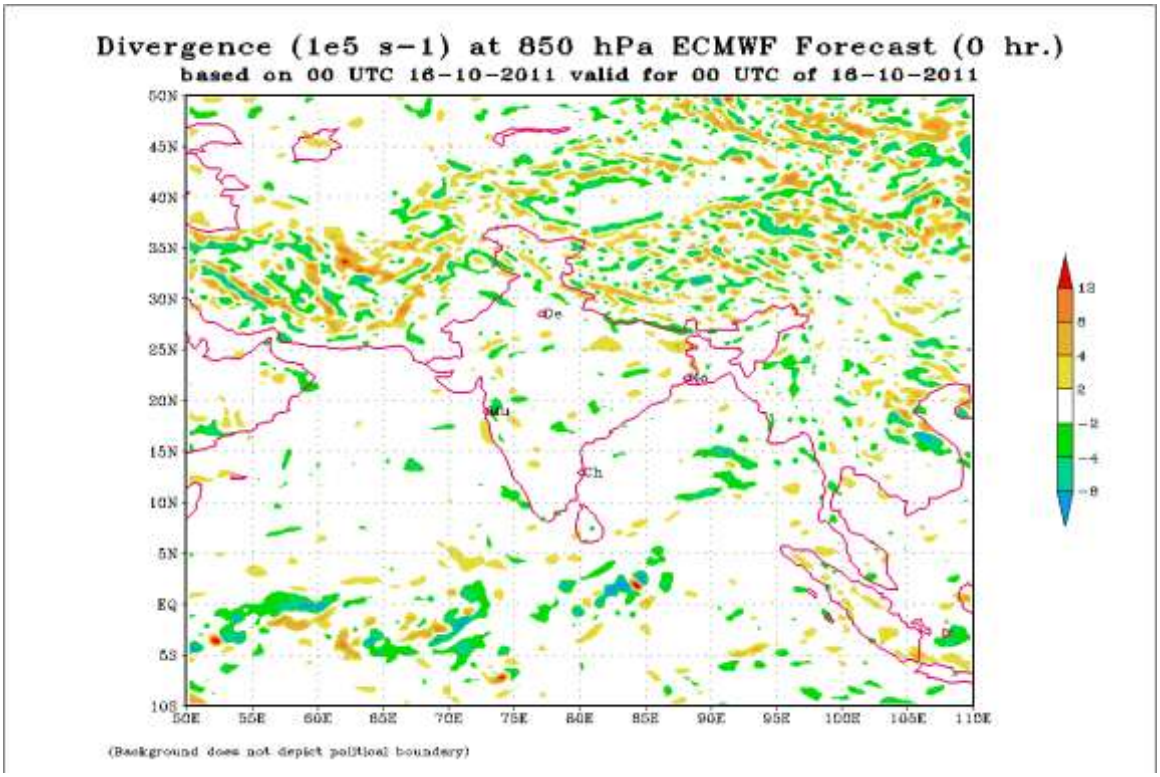
(Background does not depict political boundary)

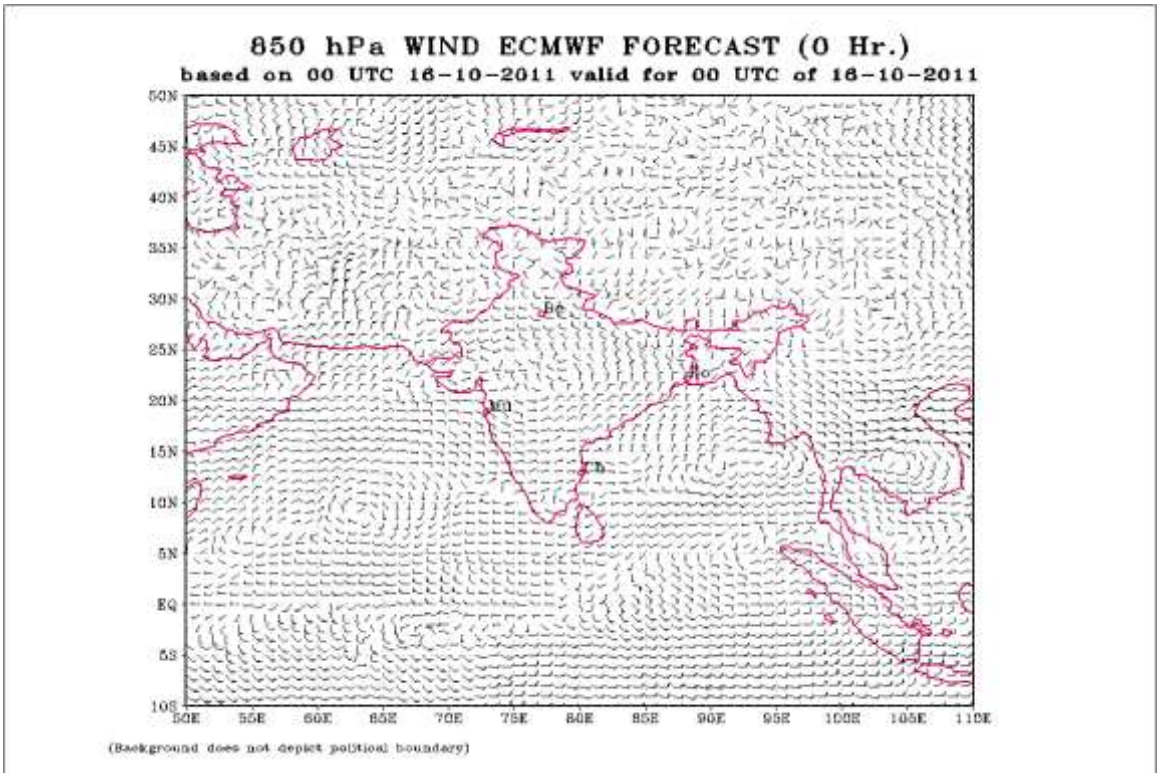
Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)

based on 00 UTC 16-10-2011 valid for 00 UTC of 16-10-2011

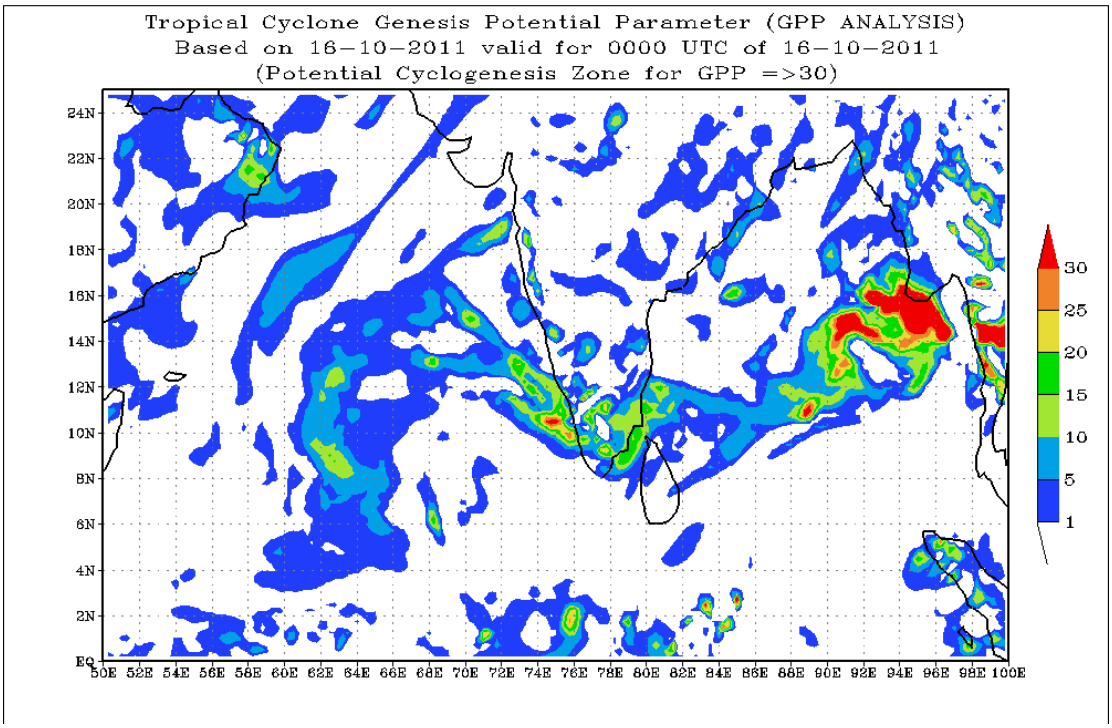


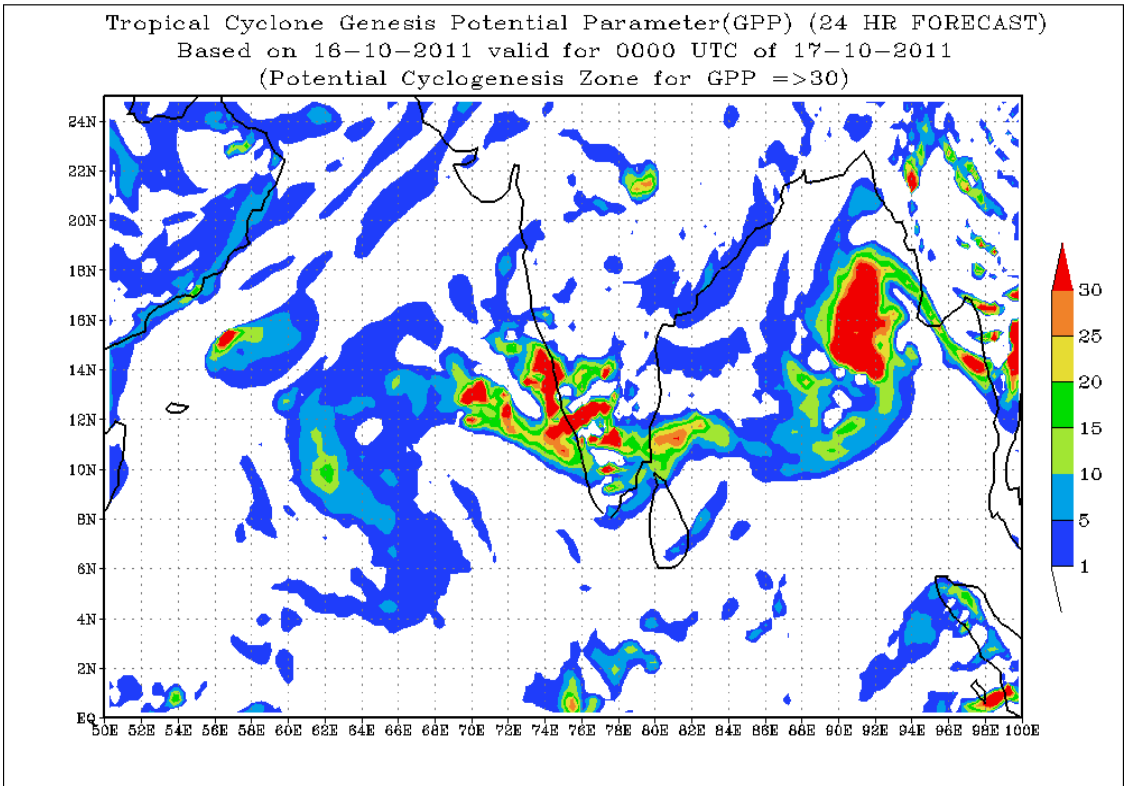
(Background does not depict political boundary)





Annexure III


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 16-10-2011 valid for 0000 UTC of 16-10-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 16-10-2011 valid for 0000 UTC of 17-10-2011
(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
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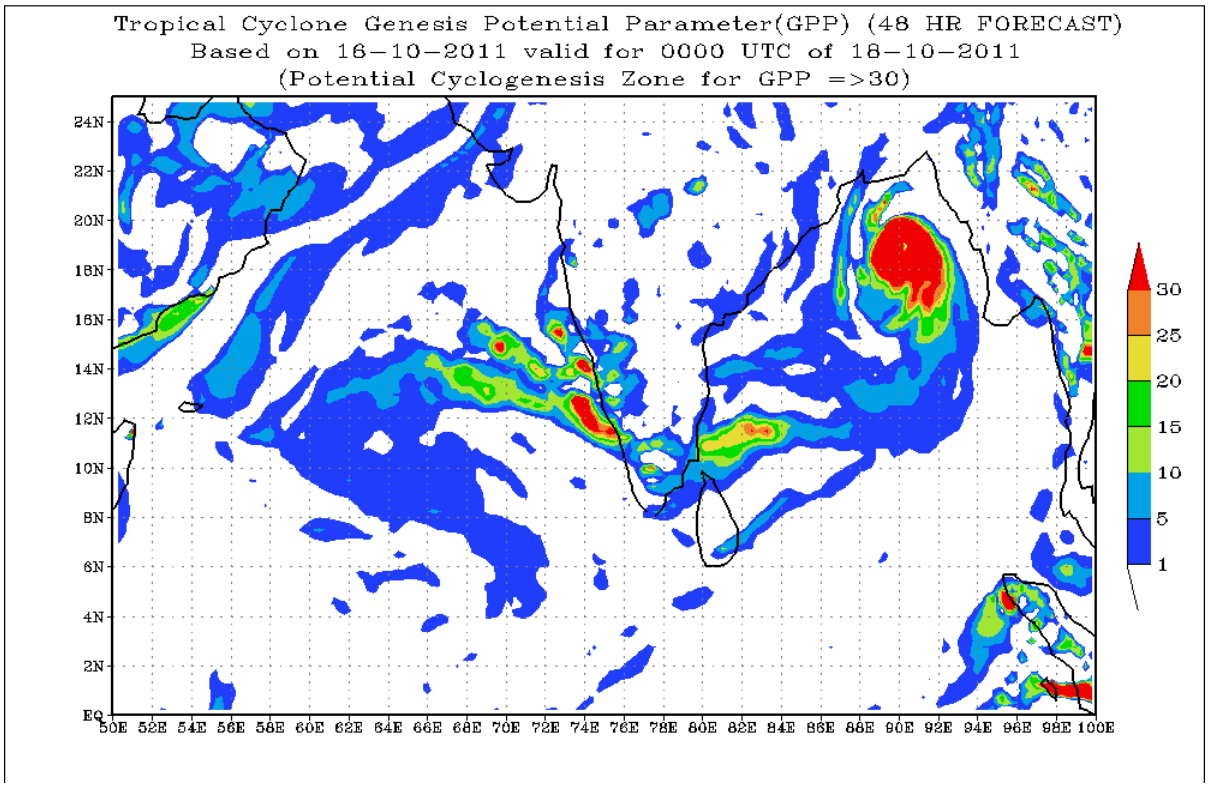
1



FDP (Cyclone) NOC Report Dated 17 October, 2011

Synoptic features based on 0300 UTC:

- Under the influence of the yesterday's cyclonic circulation over east central Bay of Bengal & neighbourhood, a low pressure area has formed over the same region with associated cyclonic circulation extending upto mid tropospheric level.
- 24 hrs. pressure change is not significant over Andaman & Nicobar island , Thailand, Myanmar, Bangladesh, and east coast of India.
- Pressure departure from normal is negative over Andaman & Nicobar islands (around 1.0 hPa) and no significant departure over east coast of India.
- : Fairly widespread rainfall occurred over Andaman & Nicobar islands and mainly dry weather prevailed along the east coast of India during Past 24 hrs.
- Buoys data show that warm SST around 29-30^{0}C over the central Bay of Bengal over cyclogenesis area .

Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST around 29.0^{0}C over central Bay of Bengal

Ocean thermal energy:

- Ocean thermal energy lies between 90-100 KJ cm^{-2} over central Bay of Bengal..

Relative Vorticity:

- Relative vorticity at 850 hPa is positive over central Bay of Bengal with magnitude of order $4.5*10^{-5}$ s^{-1}.

Convergence:

- Lower level convergence of $5*10^{-5}$ s^{-1} prevails over the region of low pressure area.

Divergence:

- Upper air positive divergence of $10*10^{-5}$ s^{-1} prevails over the region of the low pressure area.

- **Wind Shear:**

- Wind Shear is moderate (10 knots) over central bay of Bengal.

Wind Shear Tendency:

- Decreasing order of -5 knots over the region of low pressure area.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 19.0^0N at 200 hPa level in association with the anticyclonic circulation over north coastal Myanmar. A trough in westerlies in upper tropospheric level roughly runs along 60^0E to the north of 18^0N.

M.J.O. Index:

- Located over phase 1 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 1, 2 & 3 during next 15 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1.0 and moves through phase 1, 2 & 3 during next 15 days.

Status of observational system:

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

Satellite

Inference based on INSAT imagery of 170900 UTC

Bay of Bengal:

- A Vortex with T1.0 formed over east central Bay of Bengal at 0300 UTC of today the 17th Oct. 2011 near Lat. 15.5^0N and Log.90.5^0E. It moved slightly westwards and lay centred at 0900 UTC near Lat.15.5^0N and Long. 90.0^0E
- Convective organization has been observed over central Bay of Bengal since 170000 UTC. There are 2-3 mesoscale cloud clusters embedded in the imageries over the area of cyclogenesis. The convective organisation shows arch shaped pattern with lowest CTT in the range -65 to -75^0C. Diurnal variability is quite significant such that the cluster having the minimum CTT at

the time of minimum pressure and maximum CTT at the time of maximum pressure. The clusters are lying in the cyclogenesis area.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model shows formation that low pressure intensified into WML during next 24 hours which may intensify into a depression at 0000 UTC of 19 Oct 2011. The system likely to move initially northwards and then recurve northeastwards and cross Bangladesh coast as deep depression around 0000 UTC of 20th. The vorticty, divergence, wind shear and 850hPa wind are given in **Annexure II**.
- **IMD-GFS** model analysis 0000 UTC of today shows formation of a low level cyclonic circulation over east central BoB on 17th October 2011. The system likely to cross Bangladesh coast around 1200 UTC of 19th.
- **WRF-ARW** model analysis of today shows a cyclonic circulation over east central BoB. The system is likely to move northwestwards on 18th and cross West Bengal coast around 0000 UTC of 20th.
- **UKMET** model analysis of 0000 UTC of today shows a cyclonic circulation over east central BoB and is likely to intensify and cross the Bangladesh coast around 0000 UTC of 20th.
- **NCMRWF-GFS** model analysis shows a low level cyclonic circulation over east central BoB and likely to move northward direction and cross Bangladesh coast around 0000 UTC of 20th.

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

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP shows that high potential region lies over the area of cloud clusters with high GPP of 30. Model forecast of GPP suggests that high GPP area become quasi circular and move northwestwards and cross Bangladesh during next 48 hours. GPP charts fo 24 and 48 hours are shown in **Annexure III**.

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

Summary and Conclusion:

A low pressure area lies over east central Bay of Bengal centred near about Lat.17.0^{0}N and Long.89.6^{0}E. There is a mesoscale organization fluctuating on a diurnal scale. The cloud cluster lies in the environment of warm SST (29-30^{0}C) and SST minus Air temperature positive by 2-3^{0}C. Model derived GPP also show region to have high potential for development (core region with GPP of 30). NWP model forecasts have no consensus with regard to intensification and movement at this

early stage; whereas IMD GFS shows marginal intensification in wind field and movement towards Bangladesh by 19th night. ECMWF model shows intensification upto deep depression and crossing Bangladesh near Lat.22^{0}N and Long.92^{0}E around 0000 UTC of 20th.

Advisory:

- **As the system has potential for development, We advice IOP over West Bengal coast and Bangladesh on 18th and 19th October, 2011.**

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	16/12	**17/00**	**17/03**
India	191/205	111/159	192/208
Coastal stations			
WB	11/11	5/7	11/1
Odisha	10/10	6/7	10/10
AP	18/18	1717	18/18
Tamil Nadu	14/14	11/11	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	11	12	14
Myanmar	10	9	9
Thailand	1	1	1
Sri Lanka	13	12	14

AWS

Region	Date/Time (UTC)		
	16/12	**17/00**	**17/03**
India	425/616	426/616	0/616
WB	9/20	-	-
ODS	25/38	-	-
AP	22/35	-	-
TN	7/26	-	-
PDC	0/2	-	-

- **RS/RW** (12Z) of 16 -10-2011: 11/39
- **No. of Ascents reaching 250 hPa levels: 4, MISDA:-**28
- **RS/RW** (00Z) of 17 -10-2011: 34/39

- **No. of Ascents reaching 250 hPa levels: 21 , MISDA:** 5

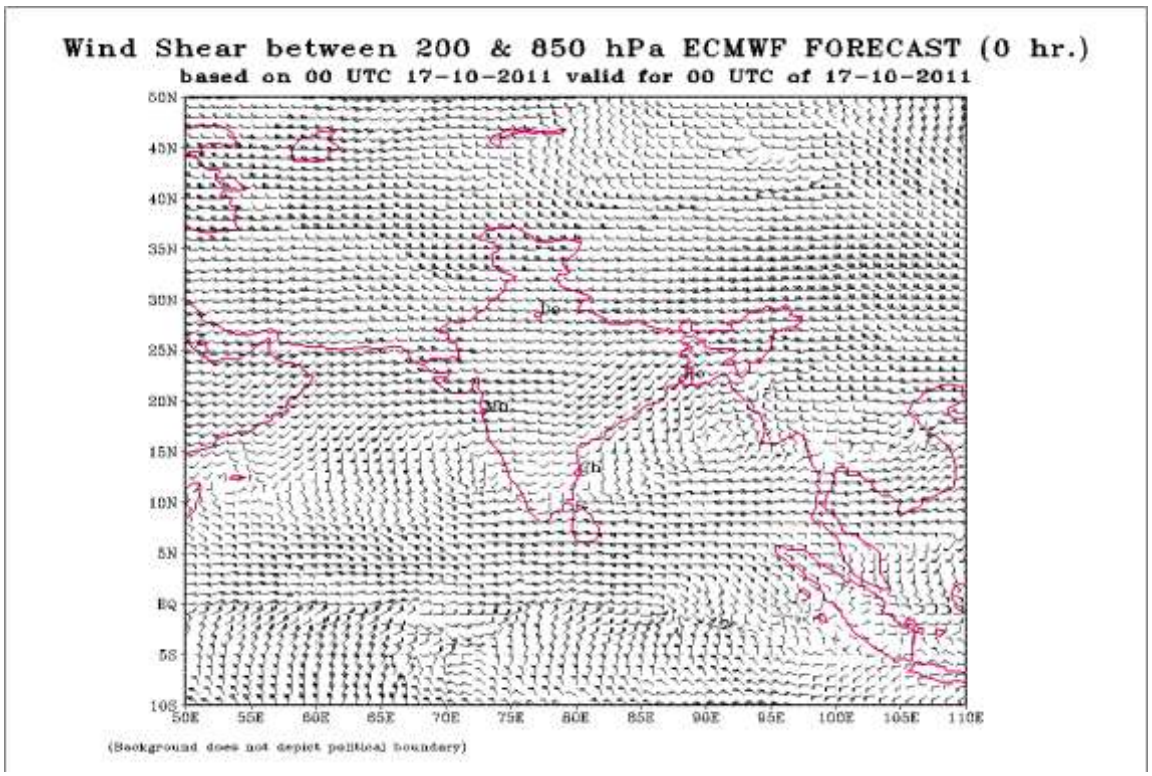
No. of PILOT Ascents

16/12Z	17/00Z
15/37	17/18

Buoy Data

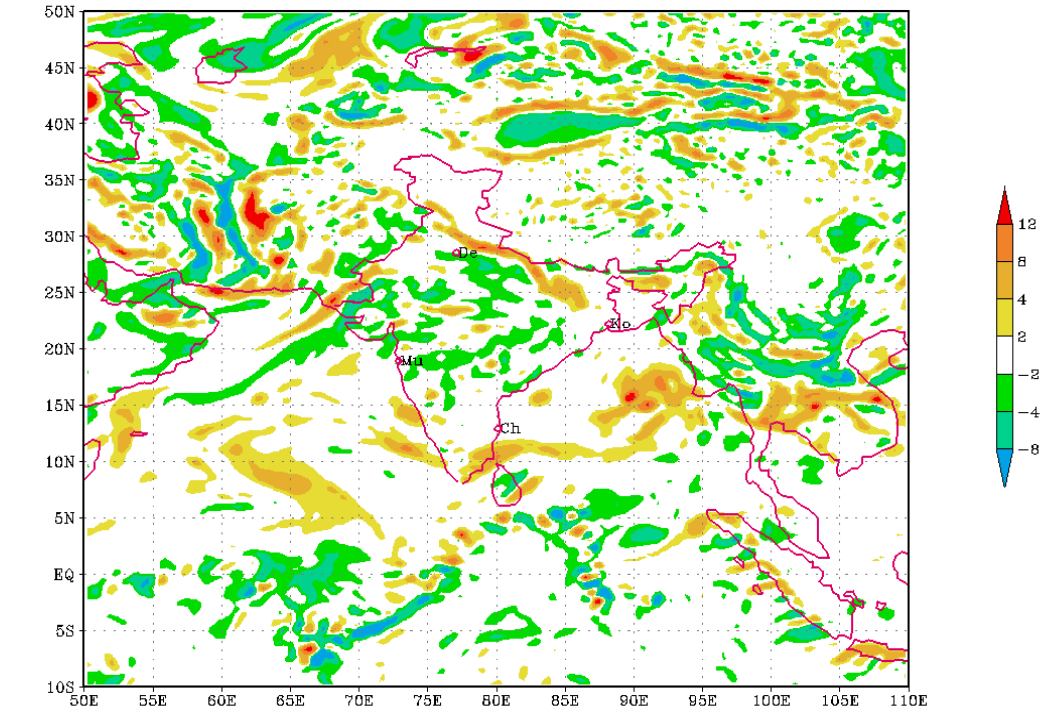
16/12Z	17/00Z	17/03Z
12	14	12

Annexure II



Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

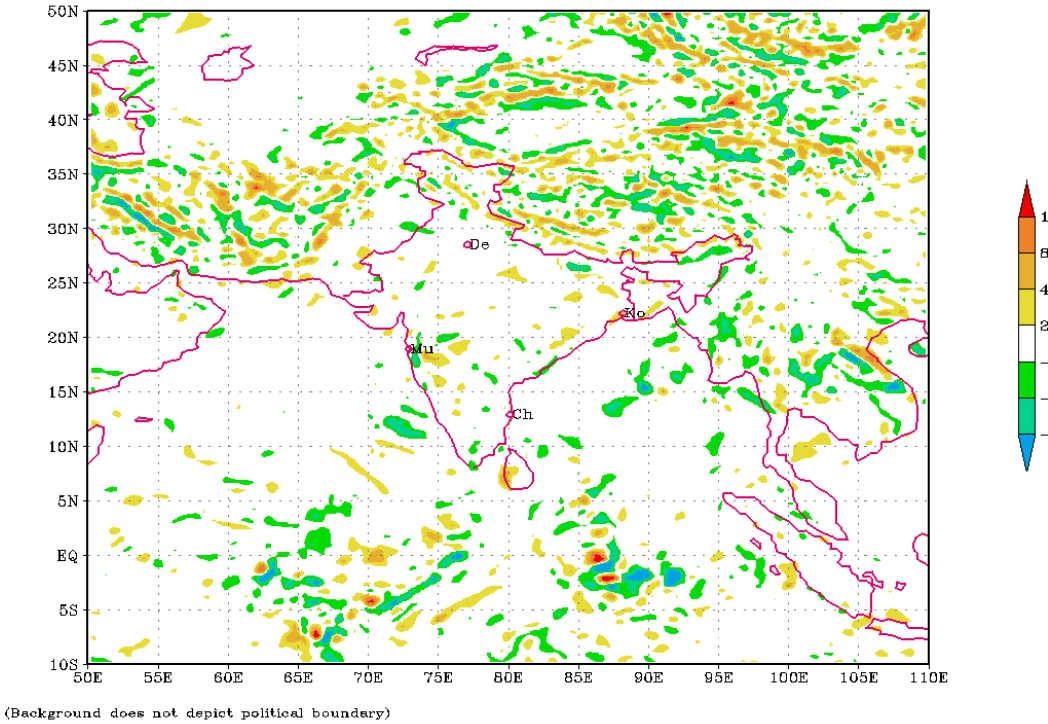
based on 00 UTC 17−10−2011 valid for 00 UTC of 17−10−2011



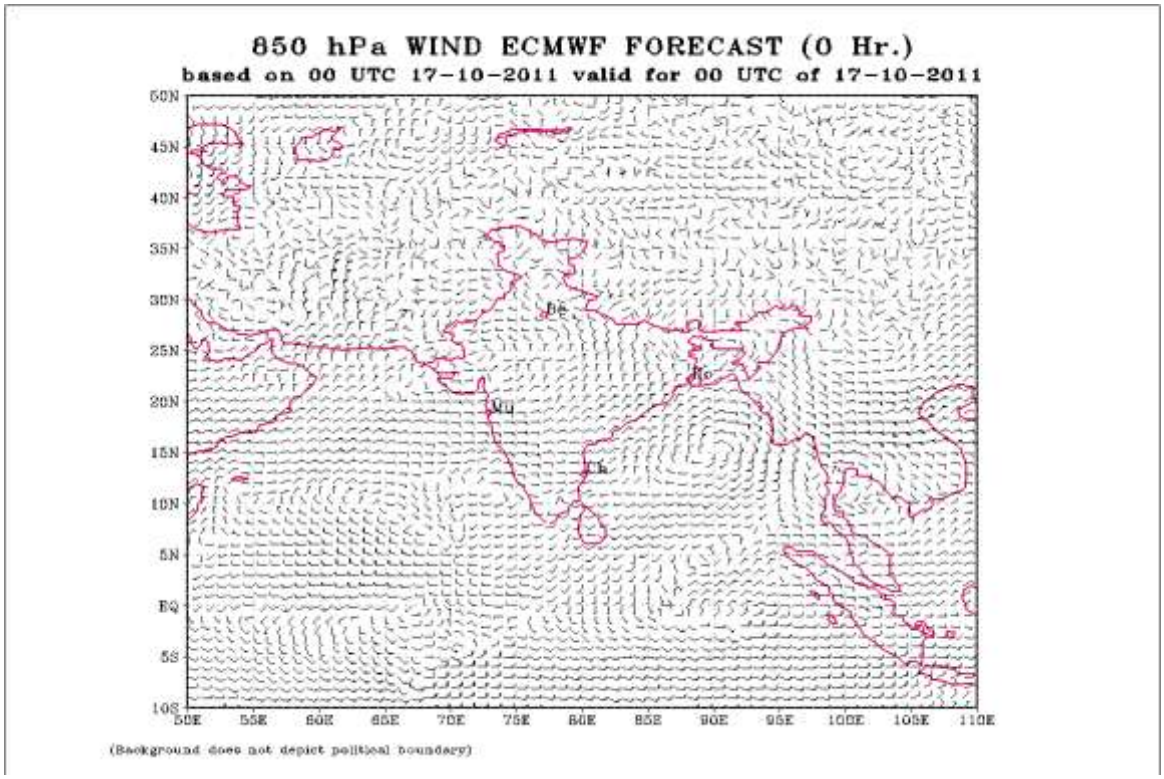
(Background does not depict political boundary)

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

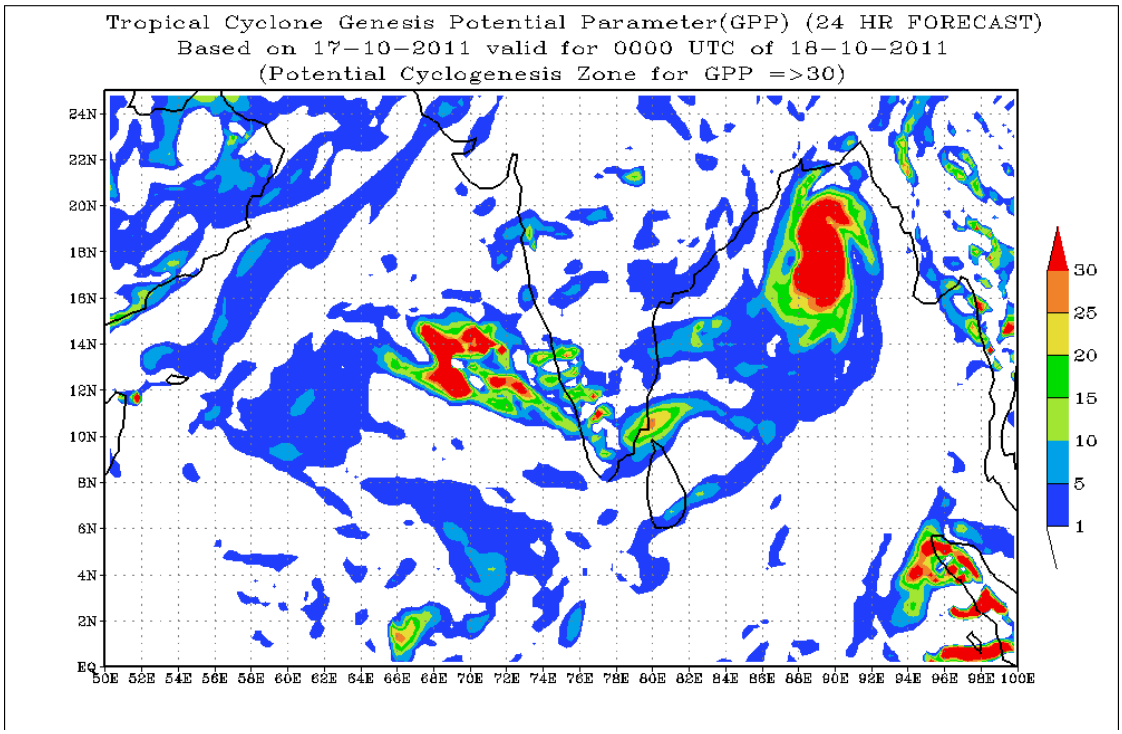
based on 00 UTC 17−10−2011 valid for 00 UTC of 17−10−2011

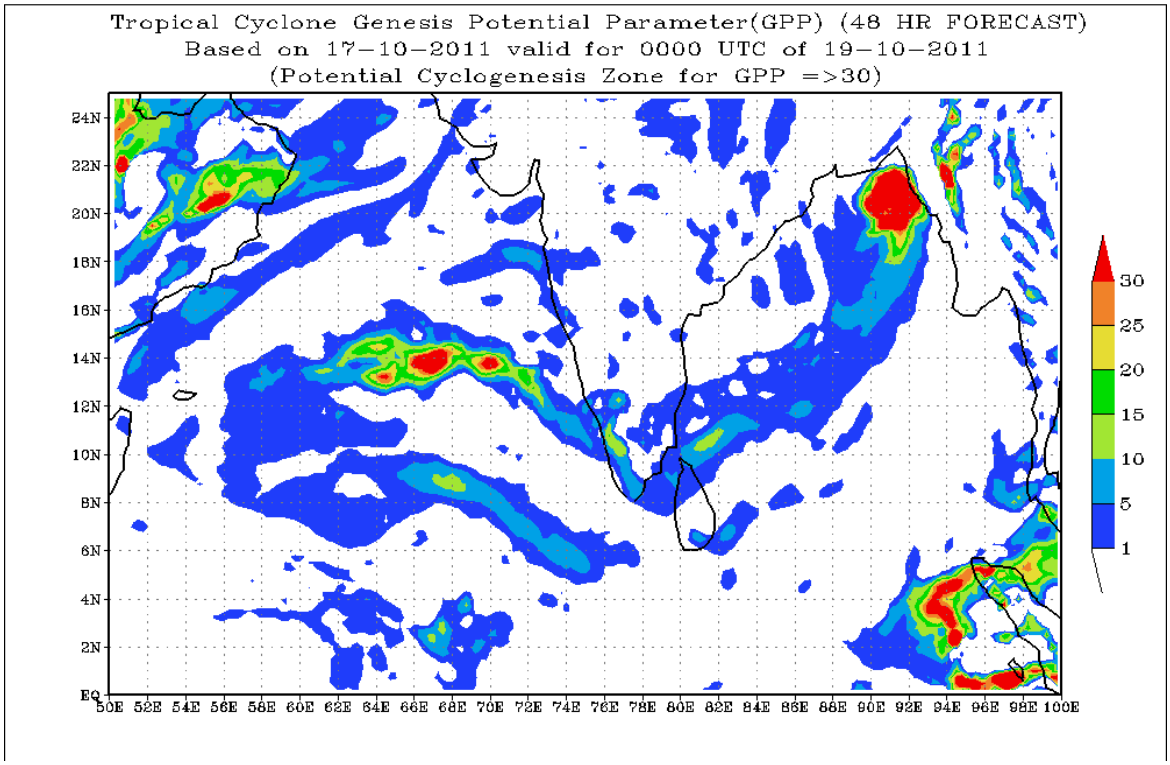


(Background does not depict political boundary)



Annexure III





FDP (Cyclone) NOC Report Dated 18 October, 2011

Synoptic features based on 0300 UTC:

- The yesterday's low pressure area over east central Bay of Bengal & neighbourhood now lies as a well marked low pressure area over east central & adjoining north and west central Bay of Bengal with associated upper air cyclonic circulation extending upto mid tropospheric levels.
- 24 hrs. pressure change is positive over Thailand, Myanmar, Bangladesh (around 0.5 hPa), and negative over north Andhra Pradesh and Orissa-West Bengal coast (-0.5 hPa).
- Pressure departure from normal is positive over Andaman & Nicober islands (around 0.5 hPa) and significant negative departure over north Andhra Pradesh and Orissa-West Bengal coast (around 1.5 hPa).
- Fairly widespread rainfall occurred over Andaman & Nicobar islands and mainly dry weather prevailed along the east coast of India during Past 24 hrs.
- Buoys data show that SST around 29^0C over the central Bay of Bengal.

Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST around 28-30^0C over central and north Bay of Bengal

Ocean thermal energy:

- Ocean thermal energy lies between 90-100 KJ cm^{-2} over central and 40 KJ cm^{-2} over north Bay of Bengal.

Relative Vorticity:

- Relative vorticity at 850 hPa increased and is of order $5*10^{-5}$ s^{-1} over central Bay of Bengal

Convergence:

- Lower level convergence increased and is of order of 5-10* 10^{-5} s^{-1} over the region of low pressure area.

Divergence:

- Upper air positive divergence increased and is order of $10*10^{-5}$ s^{-1} over the region of the low pressure area.

Wind Shear:

- Wind Shear is moderate (10-20 knots) over the region of low pressure area and to the north of the system.

Wind Shear Tendency:

- Negative (-5 knots) to the west of 90^0E and positive (+10 knots) to the east of 90^0E.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat. 19.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 1 with amplitude greater than 1.0.

- Statistical forecast: - MJO moves through phase 2 & 3 during next 15 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1.0 and moves through phase 2 & 3 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbances over north west Pacific Ocean

Status of observational system:

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

Satellite

Inference based on INSAT imagery of 180900 UTC

Bay of Bengal:

- Vortex over central Bay of Bengal centred near Lat.18.5^{0}N and Long.88.5^{0}E with intensity T1.0 (.)
- Yesterday's cloud cluster showed diurnal variation becoming maximum intense around 180000 UTC with CTT of -80^{0}C. The distance between the clusters decreased over cyclogenesis area.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis 0000 UTC of today shows the low pressure area over east-central Bay of Bengal adjoining west central Bay of Bengal likely to move NNE-ly direction and cross Bangladesh coast near 22 deg N/91.5 deg. E around 0000 UTC of 20 October 2011 as Depression. The vorticty, divergence, windshear and 850hPa wind are given in **Annexure II**.
- **IMD-GFS** model analysis 0000 UTC of today shows the low pressure area over east-central Bay of Bengal adjoining west central Bay of Bengal likely to move NNE-ly direction and cross Bangladesh coast near 22 deg N/91 deg. E around 0000 UTC of 20 October 2011. The model also indicates formation of a low pressure area over south east Bay of Bengal on 23 October and likely to move northwesterly direction.
- **WRF-ARW** model analysis of today shows the low pressure area over east-central Bay of Bengal adjoining west central Bay of Bengal likely to move NNW-ly direction and cross West Bengal coast around 0000 UTC of 20 October 2011.
- **UKMET** model analysis 0000 UTC of today shows the low pressure area over east-central Bay of Bengal adjoining west central Bay of Bengal likely to move NNE-ly direction and cross Bangladesh coast near 22 deg N/91 deg. E around 0000 UTC of 20 October 2011.
- **NCMRWF-GFS** model analysis 0000 UTC of today shows the low pressure area over east-central Bay of Bengal adjoining west central Bay of Bengal likely to move NNE-ly direction and cross Bangladesh coast near 22 deg N/91 deg. E around 1200 UTC of 19 October 2011.

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

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP shows that high potential region lies over the area of cloud clusters with high GPP of 30. Model forecast of GPP suggests that high GPP area move north northeastwards and cross Bangladesh during next 48 hours. GPP charts for 24 and 48 hours are shown in **Annexure III**.

Analysis of GPP also suggests that decrease of moisture in the middle troposphere and increase of vertical wind shear from 1200 UTC of 19 October will inhibit the further intensification of the system.

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

Summary and Conclusion:

- Synoptic, satellite, dynamical, Oceanic and atmospheric parameters show The system may concentrate into a depression during next 24 hrs. and move north-northeasttwards. and cross Bangladesh coast near Lat.22 deg N and Long.91.5 deg. E close to Sandwip by morning of 20th October 2011..

Advisory:

- **As the system has potential for development, We advice to continue IOP over West Bengal coast and Bangladesh on and 19th and 20th October, 2011.**

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	17/12	**18/00**	**18/03**
India	182/205	127/159	193/208
Coastal stations			
WB	11/11	5/7	11/11
Odisha	10/10	6/7	10/10
AP	18/18	17/17	18/18
Tamil Nadu	14/14	11/11	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	15	12	15
Myanmar	15	14	14
Thailand	1	1	1
Sri Lanka	12	9	9

AWS

Region	Date/Time (UTC)		
	17/12	**18/00**	**18/03**
India	426/616	499/616	448/616

WB	20/20	19/20	20/20
ODS	29/38	29/38	29/38
AP	32/35	31/35	21/35
TN	26/26	26/26	26/26
PDC	1/2	0/2	1/2

- **RS/RW** (12Z) of 17 -10-2011: 12/39
- **No. of Ascents reaching 250 hPa levels: 4, MISDA:-**27
- **RS/RW** (00Z) of 18 -10-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 23 , MISDA:** 4

No. of PILOT Ascents

17/12Z	**18/00Z**
20/37	23/34

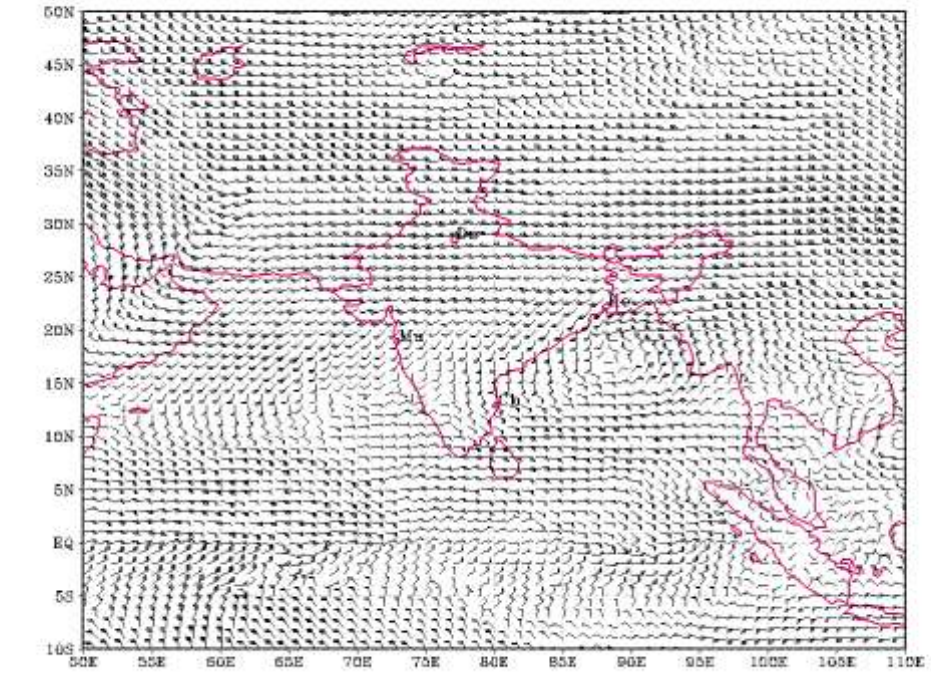
Buoy Data

17/12Z	**18/00Z**	**18/03Z**
12	14	17

Annexure II

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

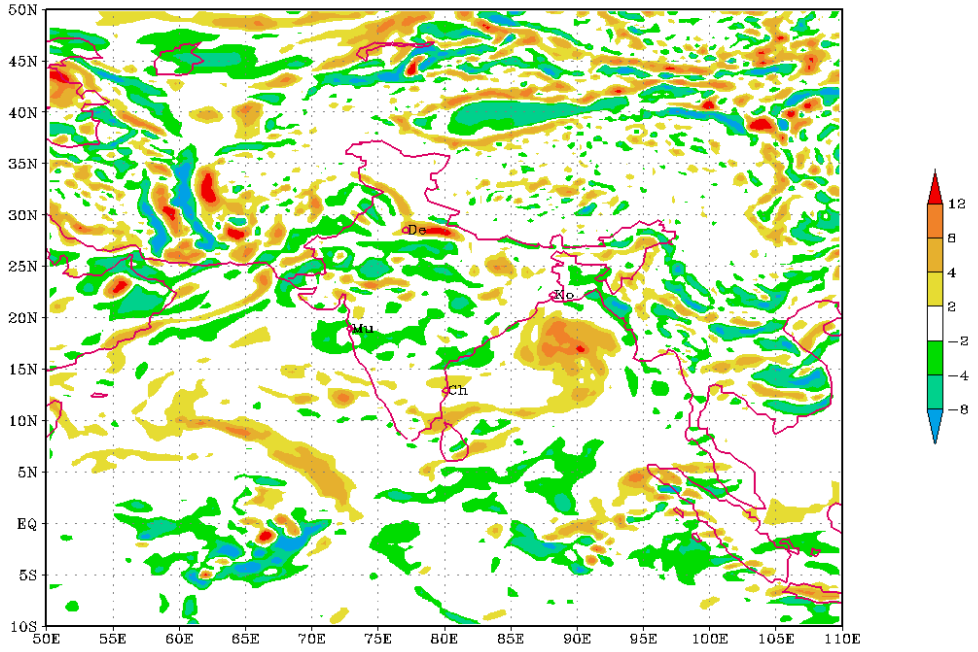
based on 00 UTC 18-10-2011 valid for 00 UTC of 18-10-2011



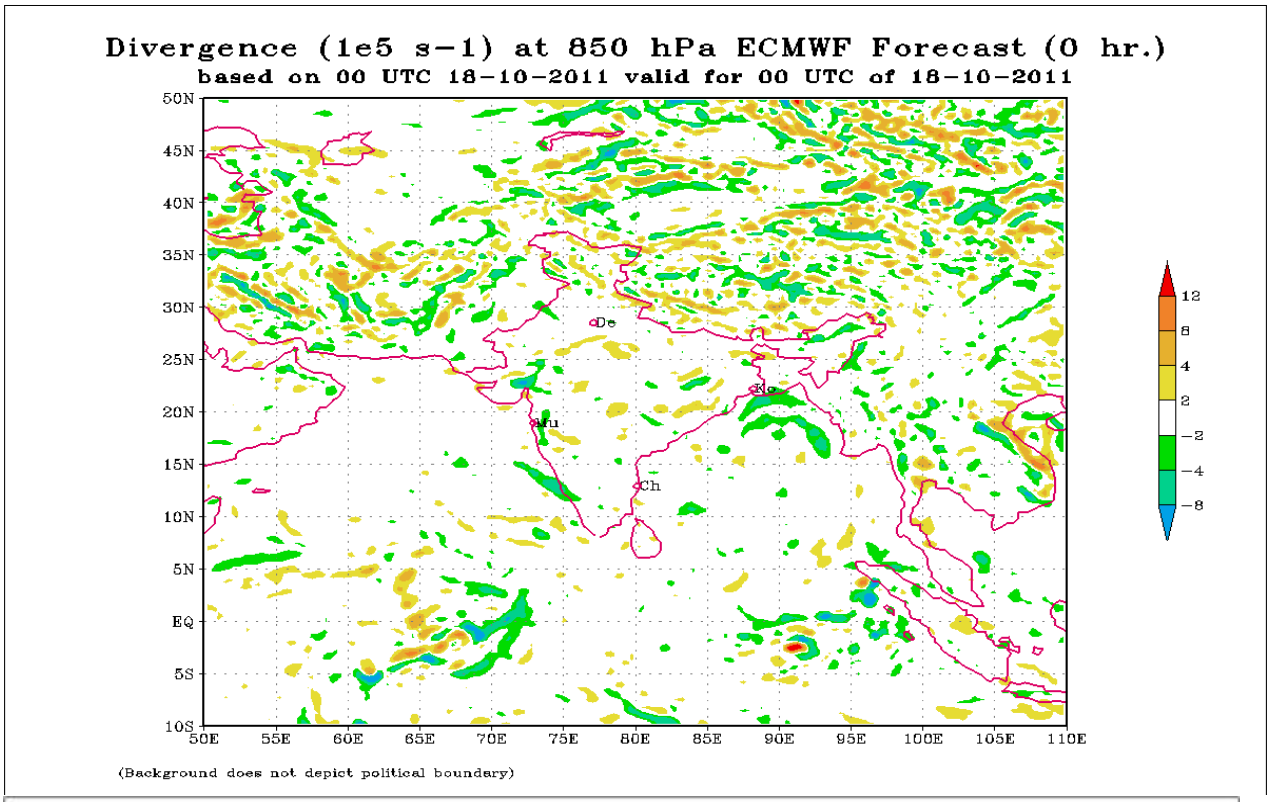
(Background does not depict political boundary)

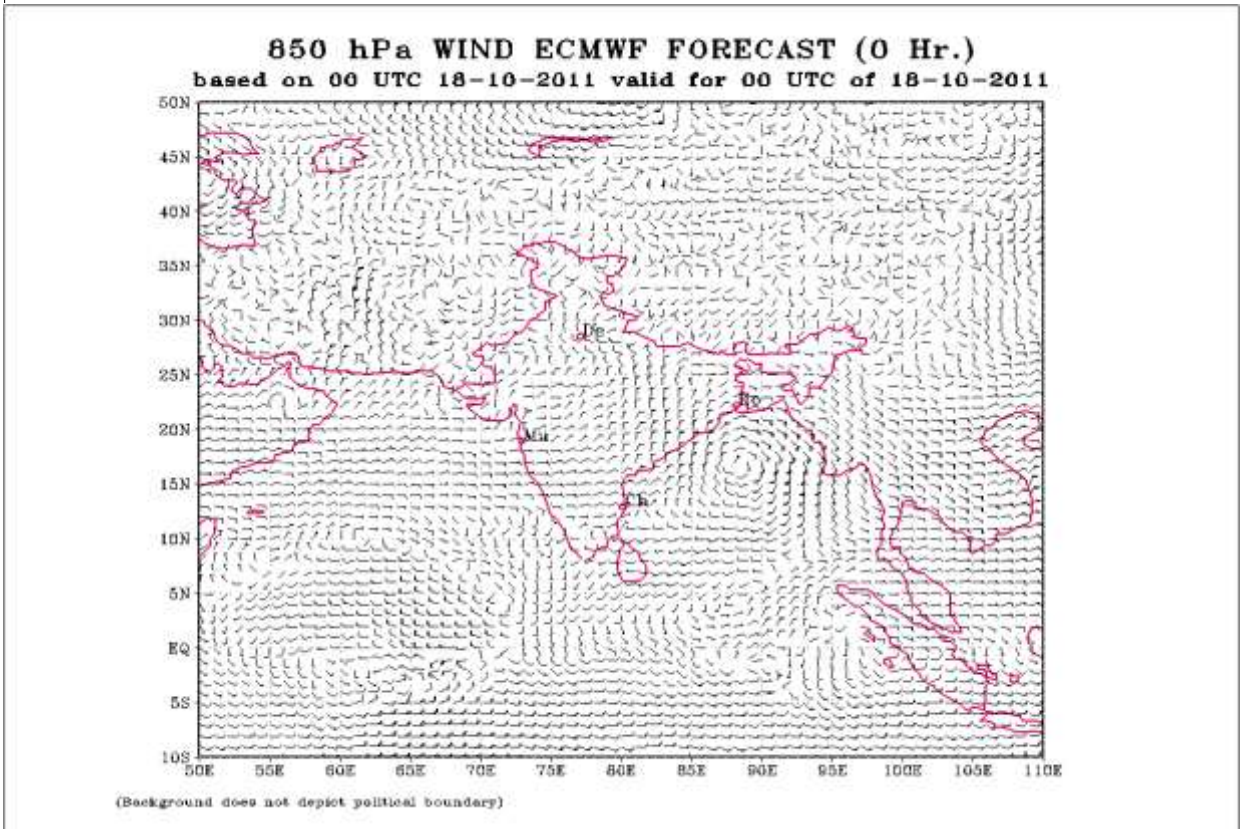
Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)

based on 00 UTC 18-10-2011 valid for 00 UTC of 18-10-2011

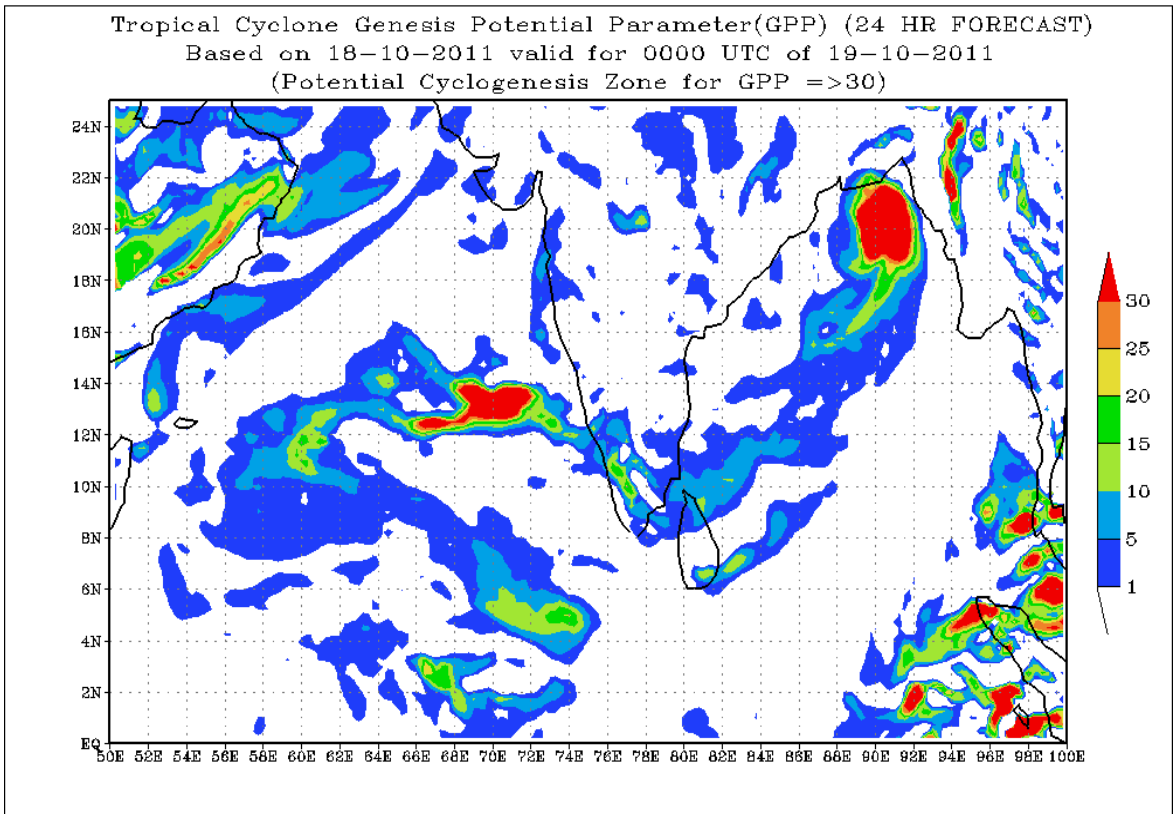


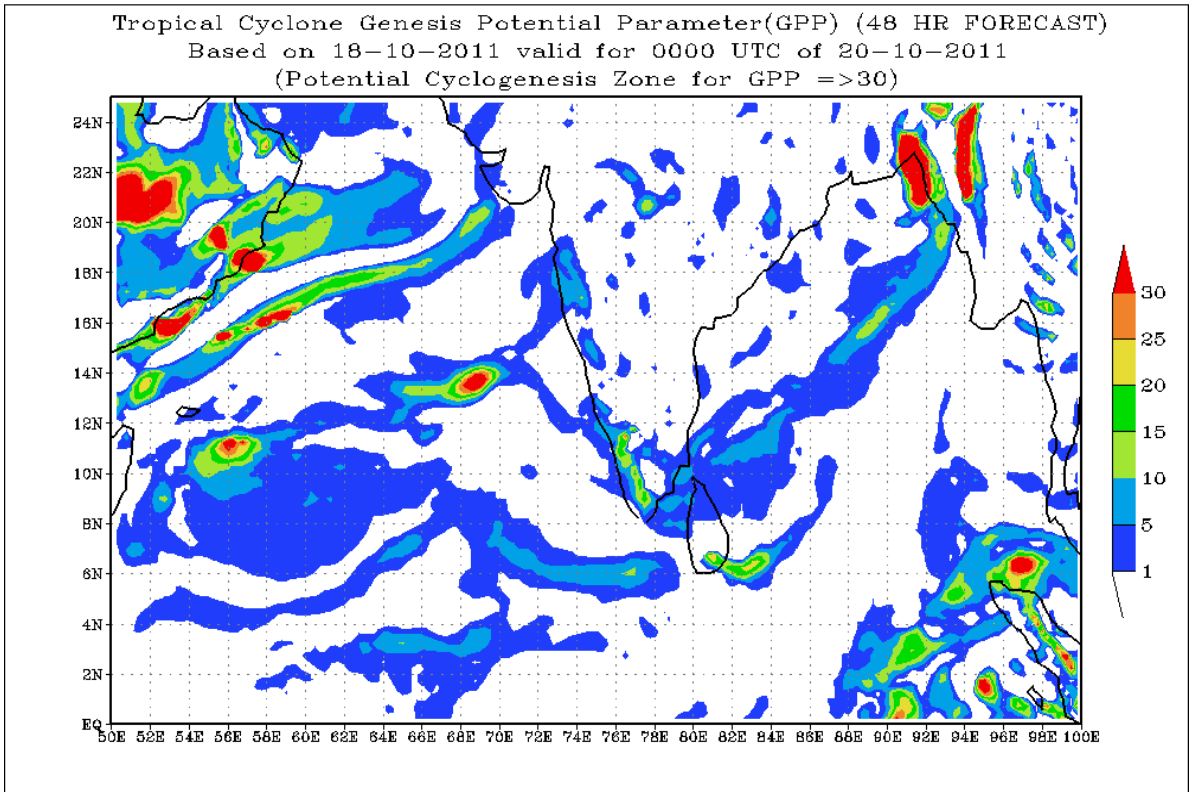
(Background does not depict political boundary)





Annexure III





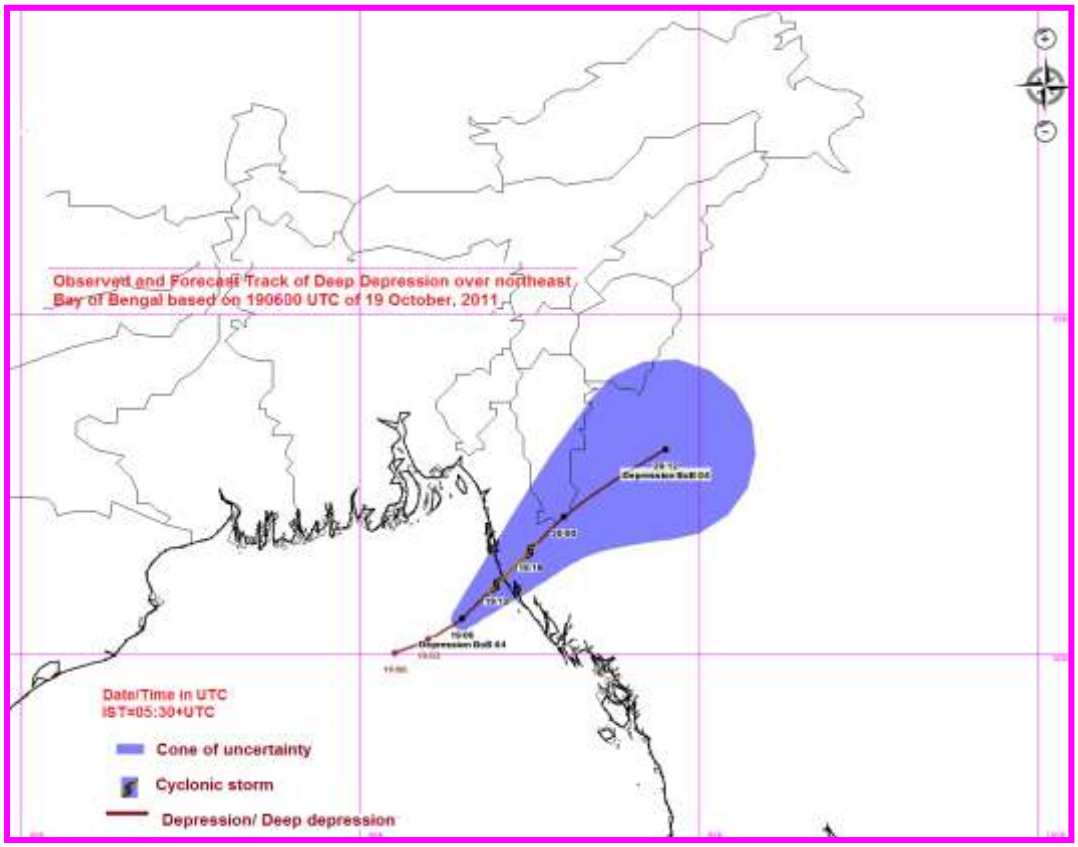
FDP (Cyclone) NOC Report Dated 19 October, 2011

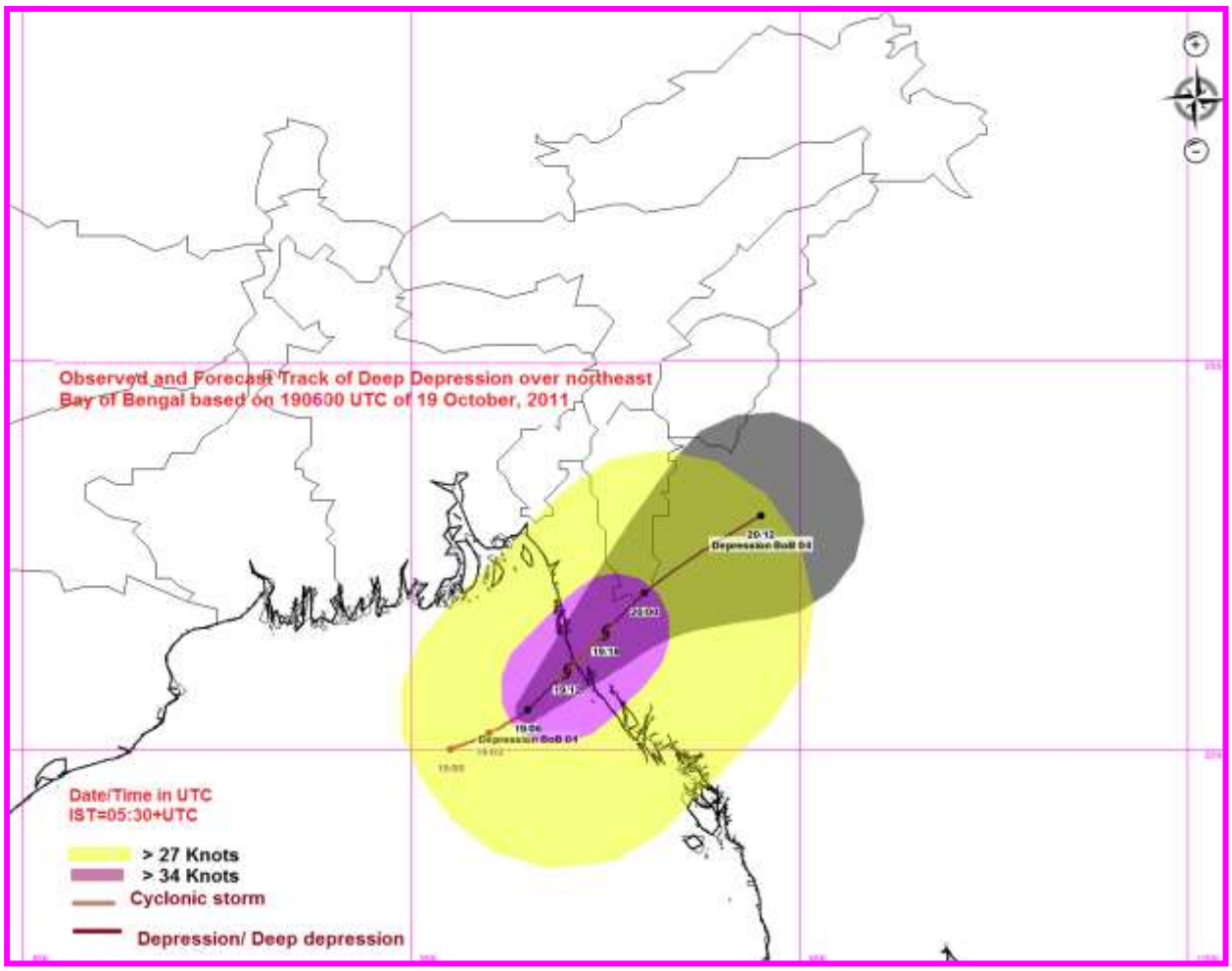
Synoptic features based on 0300 UTC:

The yesterday's well marked low pressure area over east central & adjoining north and west central Bay of Bengal concentrated into depression over north Bay of Bengal and lay centred at 0530 hrs. IST of today, the 19th October 2011 over north Bay of Bengal near latitude 20.0^0N and longitude 90.5^0E. The system moved northeastwards and intensified into a deep depression and lay centred at 0600 UTC over northeast Bay of Bengal near lat 20.5^0N and long. 91.0^0E.

It is likely to intensify further into a cyclonic storm and move northeastwards and cross Bangladesh coast close to Cox's Bazar by tonight.

- 24 hrs. pressure change is negative over Bangladesh coast (around -3.0 hPa) and negative over north Andhra Pradesh and Orissa-West Bengal coast (around -2.0 hPa). Maximum pressure fall reported -4.2 hPa over Cox's Bazar. At 0900 UTC of today Cox's Bazar reported of lowest pressure of 999.5 hPa and wind speed northeasterly 15 knots. Sittwe (Myanmar) reported southwesterly 20 knots.
- Pressure departure from normal is negative (-5.0 to -6.0 hPa) over Cox's Bazar and Chittagong.
- Fairly widespread rainfall occurred over coastal Orissa, West Bengal and Bangladesh coastal area during Past 24 hrs..
- Buoys data show that SST around 29^0C over the north and central Bay of Bengal.





Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST around 30^0C over central and north Bay of Bengal

Ocean thermal energy:

- Ocean thermal energy lies between 80-90 KJ cm^{-2} over central and 40 KJ cm^{-2} over north Bay of Bengal.

Relative Vorticity:

- Relative vorticity at 850 hPa increased and is of order $10*10^{-4}$ s^{-1} over central Bay of Bengal

Convergence:

- Lower level convergence increased and is of order of $10* 10^{-5}$ s^{-1} over northeast Bay of Bengal.

Divergence:

- Upper air positive divergence increased and is order of $20\text{-}30*10^{-5}$ s^{-1} over northeast Bay of Bengal.

Wind Shear:

- Wind Shear is weak (5-10 knots) over northeast Bay of Bengal.

Wind Shear Tendency:

- Negative (-5 to -10 knots) to the east of 90^0E.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 20.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 1 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 2, 3 & 4 during next 15 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1.0 and moves through phase 2 & 3 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbances over north west Pacific Ocean.

Status of observational system:

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

Satellite

Inference based on INSAT imagery of 190900 UTC

Bay of Bengal:

- Vortex over northeast Bay of Bengal is centered near 20.9N/92.0E close to Myanmar coast with intensity T2.0. During last 24-hours vortex has intensified from T1.0 to T2.0.
- Cloud top temperature has decreased from around –75°C to –80°C during last 24hours

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis 0000 UTC of today shows the low pressure area over east-central Bay of Bengal adjoining west central Bay of Bengal likely to move NNE-ly direction and cross Bangladesh coast near 22 deg N/91.5 deg. E around 1200 UTC of 19 October 2011 as Depression in **Annexure II**.
- **IMD-GFS** model analysis 0000 UTC of today shows the low pressure area over east-central Bay of Bengal adjoining west central Bay of Bengal likely to move NNE-ly direction and cross Bangladesh coast near 22 deg N/91 deg. E around 0000 UTC of 20 October 2011. The model also indicates formation of a low pressure area over south east Bay of Bengal on 23 October and likely to move northwesterly direction.

- **WRF-ARW** model analysis of today shows the low pressure area over west-central Bay of Bengal likely to move NE-ly direction and cross Bangladesh coast around 0000 UTC of 20 October 2011.
- **UKMET** model analysis 0000 UTC of today shows the low pressure area over east-central Bay of Bengal adjoining west central Bay of Bengal likely to move NE-ly direction and cross Bangladesh coast near 22 deg N/91 deg. E around 1200 UTC of 19 October 2011.
- **NCMRWF-GFS** model analysis 0000 UTC of today shows the low pressure area over east-central Bay of Bengal adjoining west central Bay of Bengal likely to move NNE-ly direction and cross Bangladesh coast near 22 deg N/91 deg. E around 1200 UTC of 19 October 2011.
- http://www.imd.gov.in/section/nhac/dynamic/welcome.htm)

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP shows that high potential region lies over the area of cloud clusters with high GPP of 30. Model forecast of GPP suggests that high GPP area move north northeastwards and cross Bangladesh during next 24 hours. GPP charts for analysis and 24 hours are shown in **Annexure III**.

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

Summary and Conclusion:

- Synoptic, Satellite and ECMWF model models suggest that the deep depression will move northeasttwards and cross Bangladesh coast close to Cox's Bazar by tonight.
- Comparing the performance of various numerical models, ECMWF model picked up the track and intensity of the system better.
- Though there is large variation in the landfall point in different models, the northeastward recurvature could be picked up by most models.

Advisory:

As the system will cross Bangladesh coast by tonight. No IOP will be conducted over West Bengal coast and Bangladesh on 20th October, 2011.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	18/12	**19/00**	**19/03**
India	182/205	127/159	193/208
Coastal stations			
WB	11/11	5/7	11/11
Odisha	10/10	6/7	10/10
AP	18/18	17/17	18/18
Tamil Nadu	14/14	11/11	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	15	12	15
Myanmar	15	14	14
Thailand	1	1	1
Sri Lanka	12	9	9

AWS

Region	Date/Time (UTC)		
	18/12	**19/00**	**19/03**
India	426/616	499/616	448/616
WB	20/20	19/20	20/20
ODS	29/38	29/38	29/38
AP	32/35	31/35	21/35
TN	26/26	26/26	26/26
PDC	1/2	0/2	1/2

- **RS/RW** (12Z) of 17 -10-2011: 12/39
- **No. of Ascents reaching 250 hPa levels: 4, MISDA:-**27
- **RS/RW** (00Z) of 18 -10-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 23 , MISDA:** 4

No. of PILOT Ascents

18/12Z	19/00Z
20/37	23/34

Buoy Data

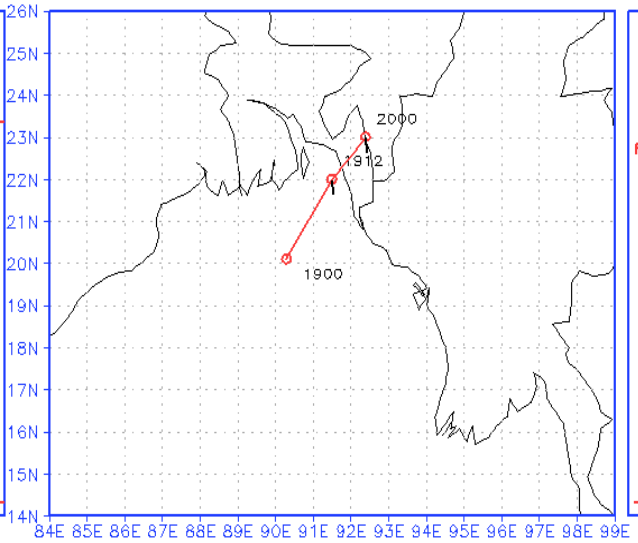
18/12Z	19/00Z	19/03Z
12	14	17

Annexure II

TRACK PREDICTION BY IMD MULTIMODEL ENSEMBLE(MME)
based on 00 UTC of 19-10-2011

TRACK PREDICTION BY IMD MME based on 00 UTC of 19-10-2011

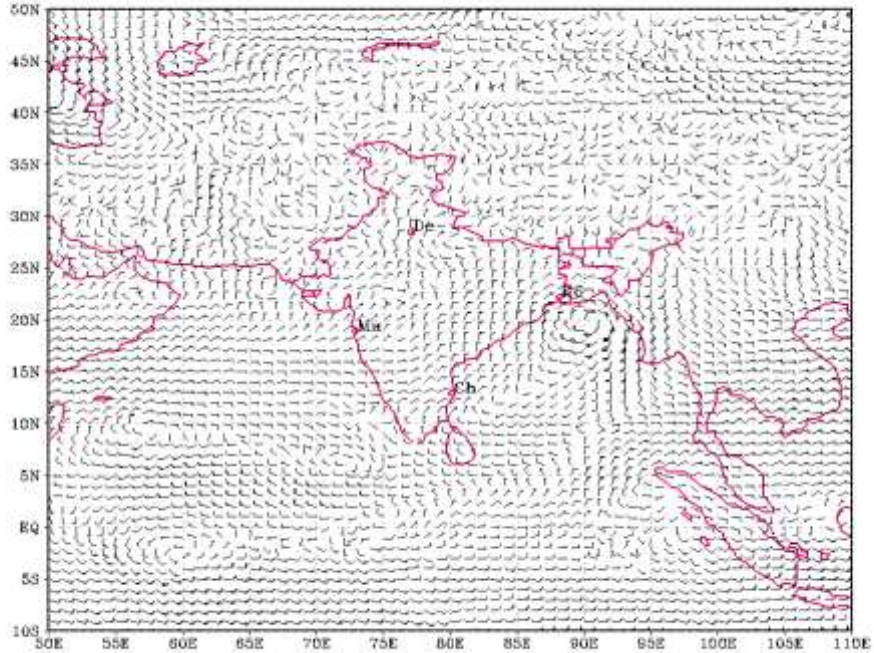
FORECAST HOUR	LAT	LON
2011101900	20.1	90.3
2011101912	22.0	91.5
2011102000	23.0	92.4



INTENSITY PREDICTION BY IMD SCIP MODEL based on 00 UTC of 19-10-2011

FORECAST HOUR	INTENSITY
2011101900	25 kts
2011101912	30 kts

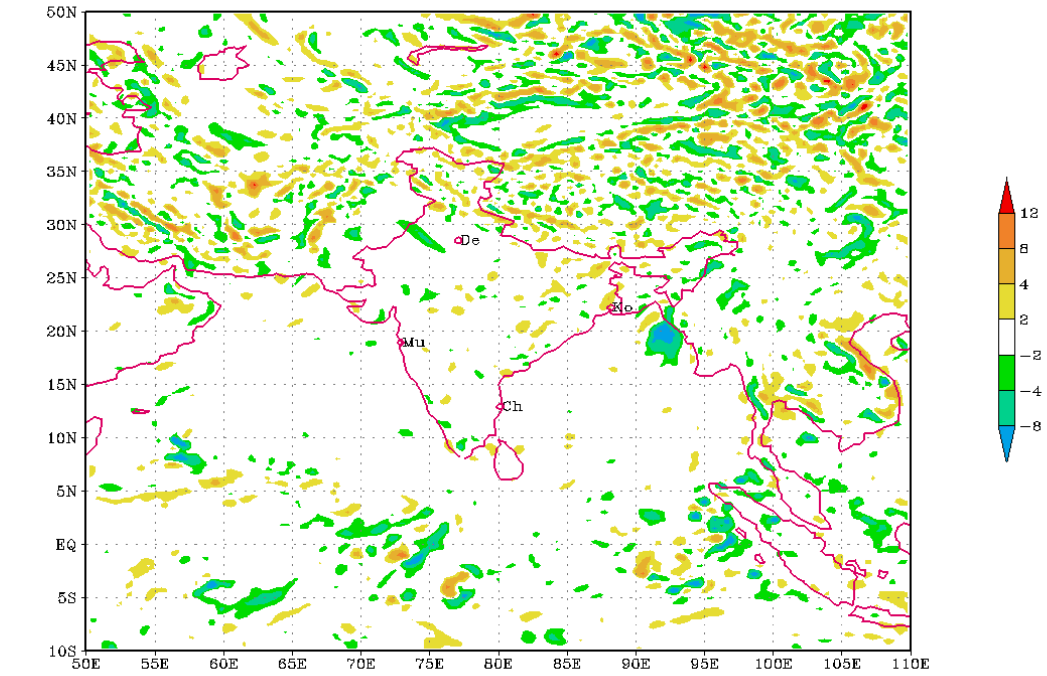
850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 19-10-2011 valid for 00 UTC of 19-10-2011



(Background does not depict political boundary)

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

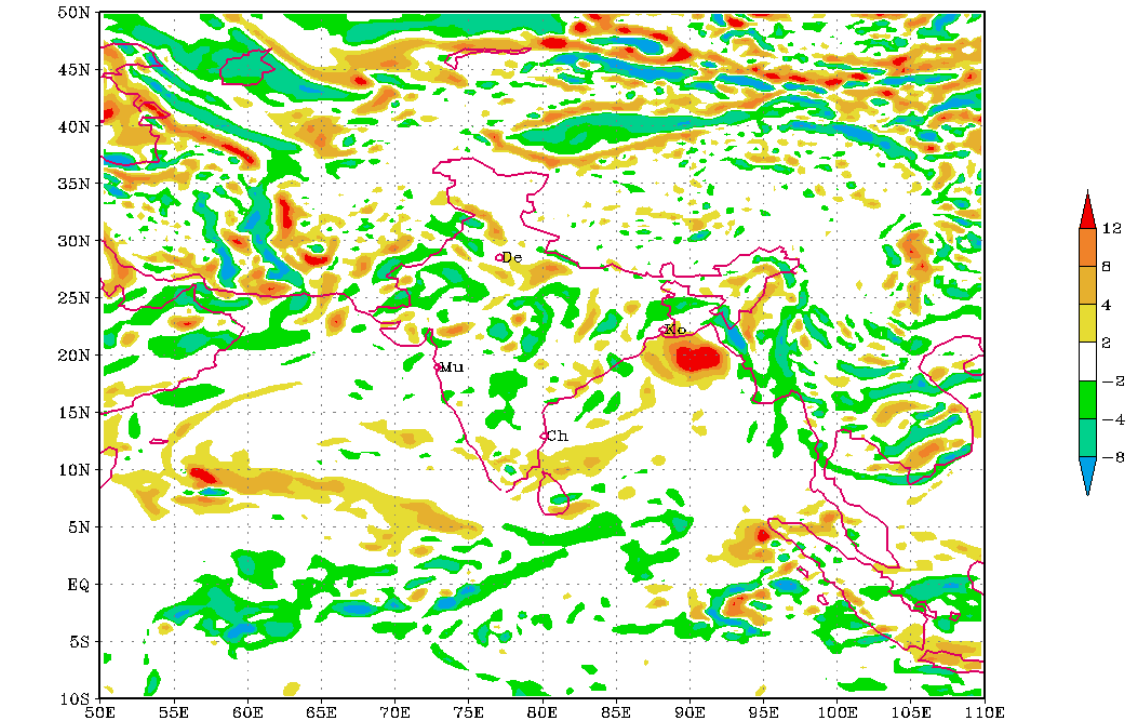
based on 00 UTC 19−10−2011 valid for 00 UTC of 19−10−2011



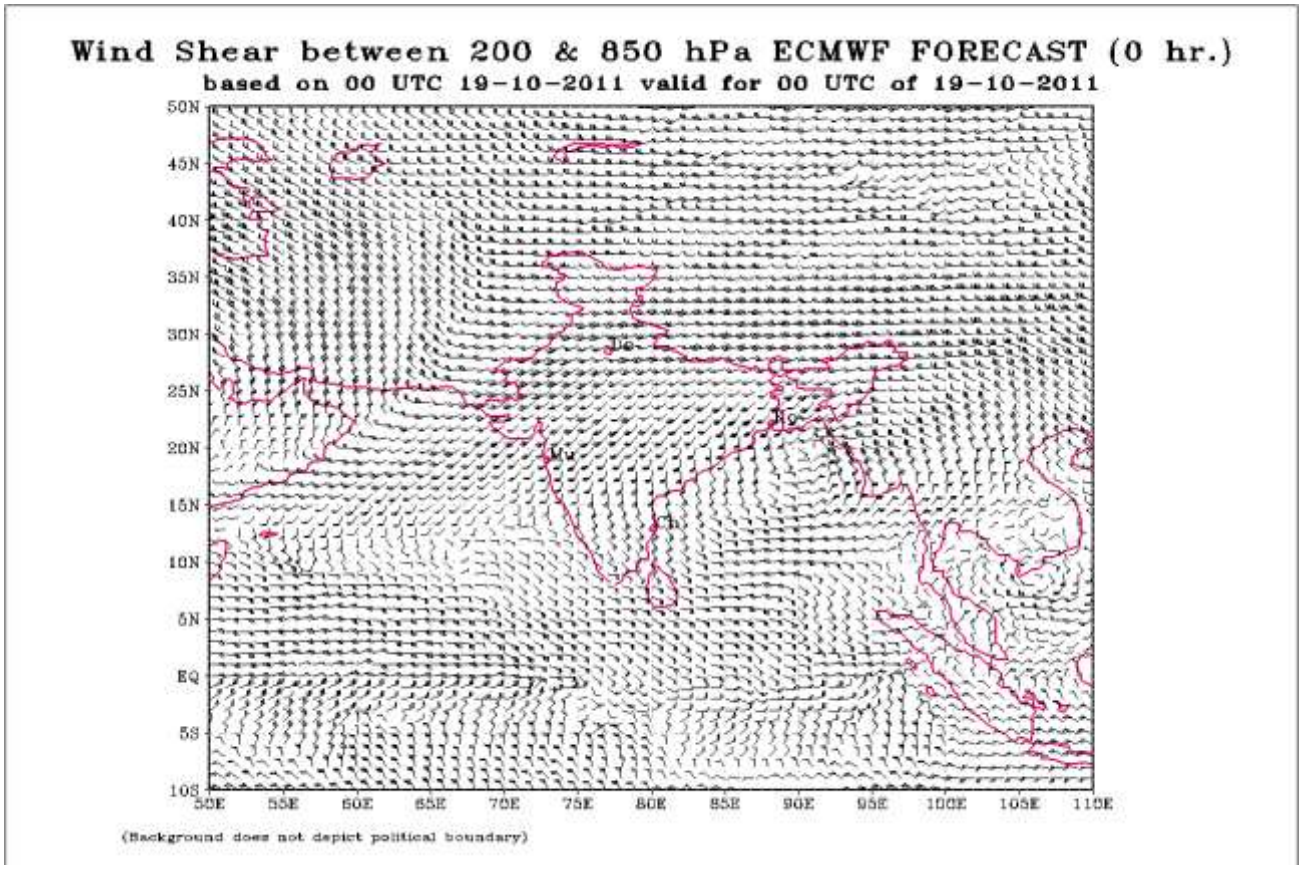
(Background does not depict political boundary)

Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

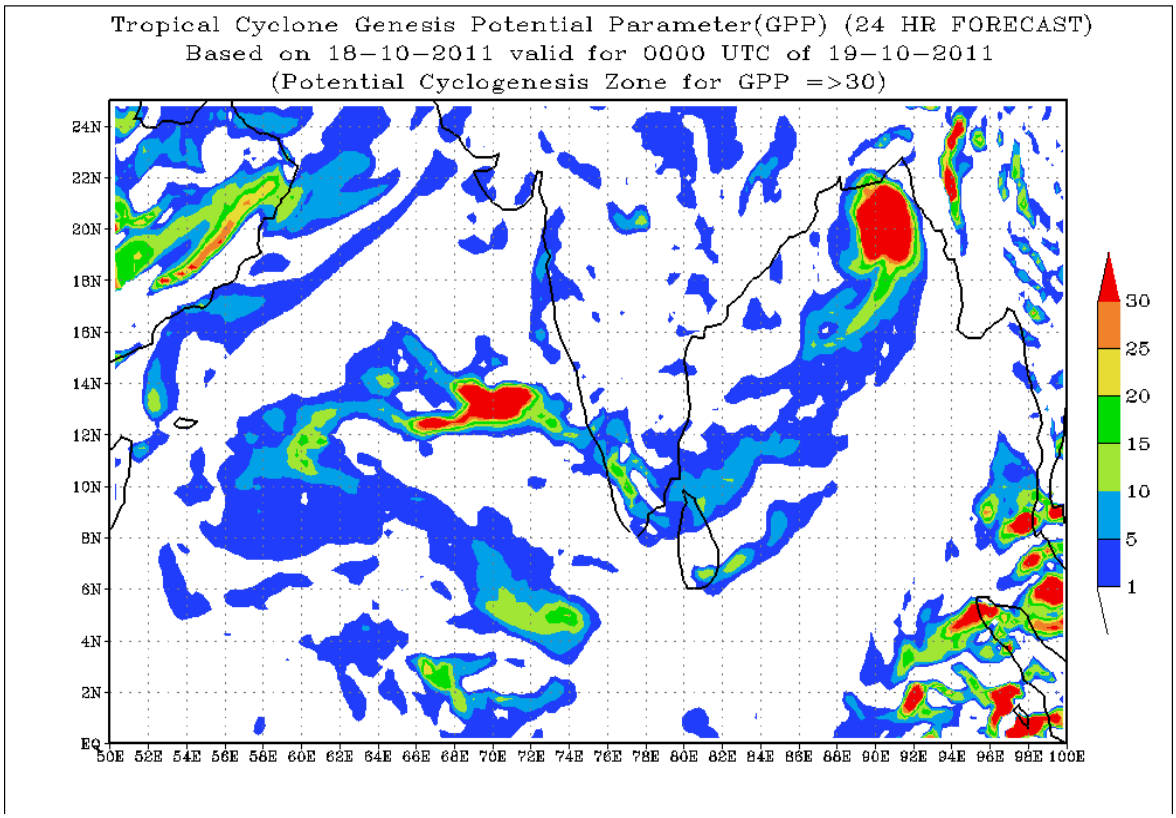
based on 00 UTC 19−10−2011 valid for 00 UTC of 19−10−2011

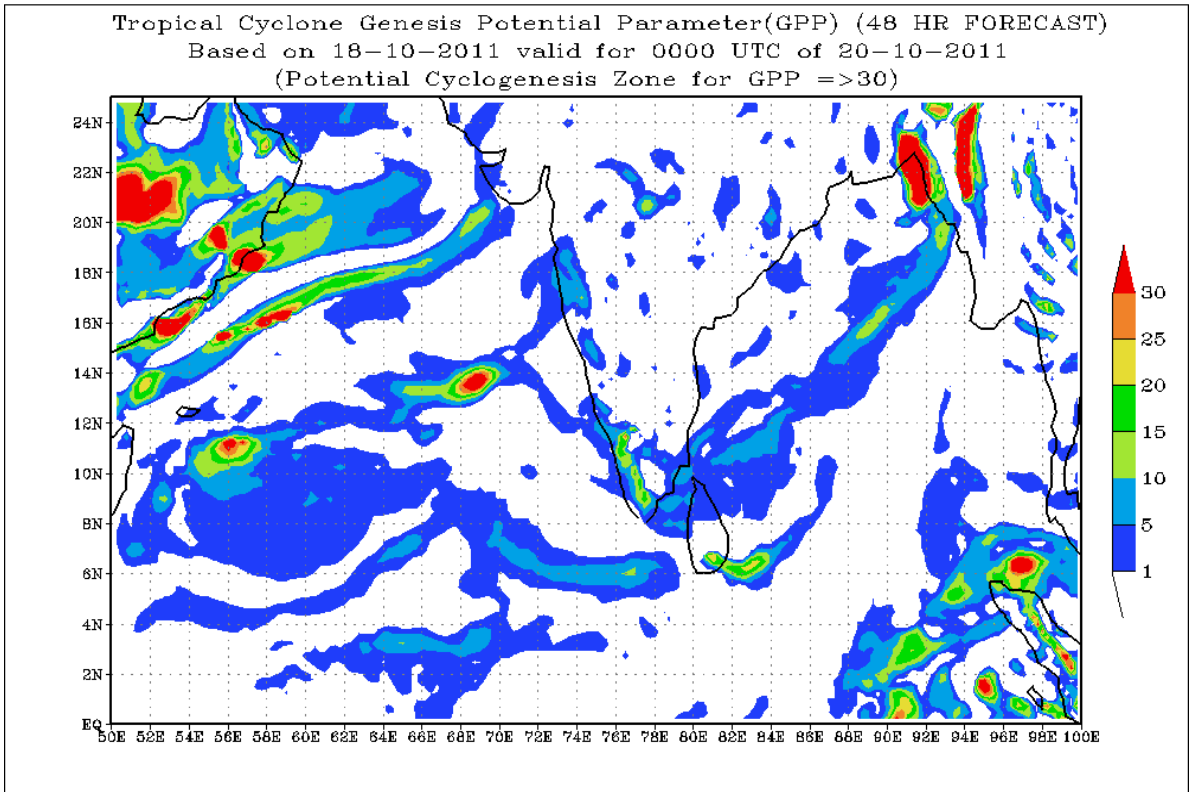


(Background does not depict political boundary)



Annexure III

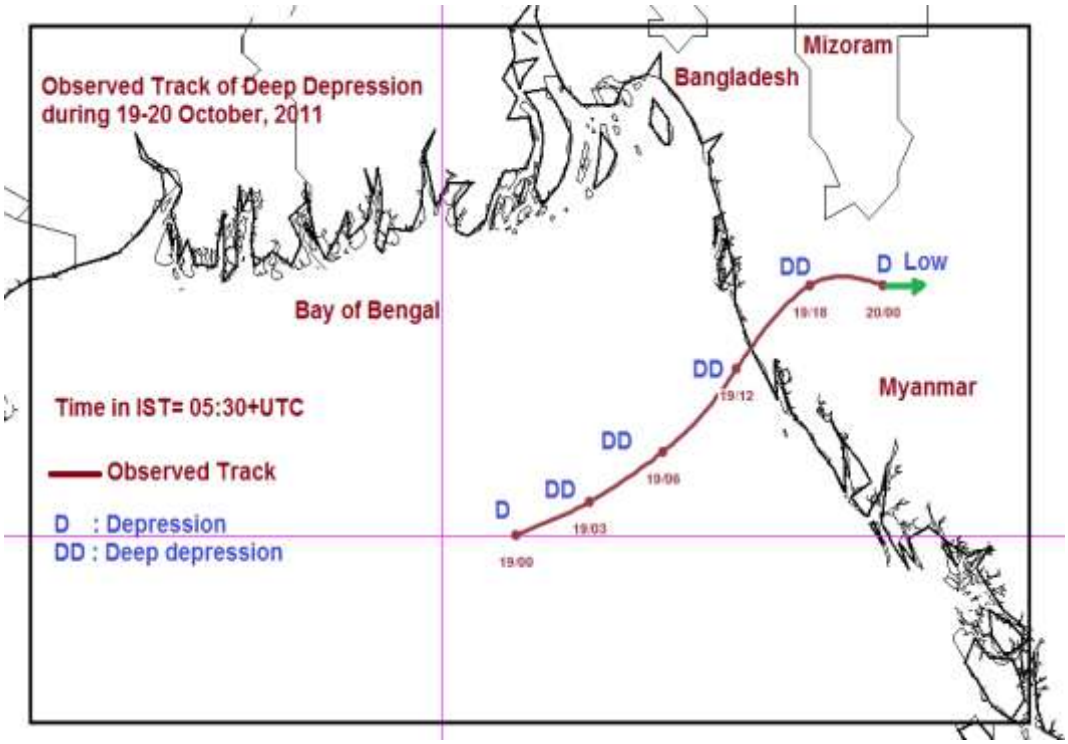




FDP (Cyclone) NOC Report Dated 20 October, 2011

Synoptic features based on 0300 UTC:

- Yesterday's **Deep Depression** over northeast Bay of Bengal moved northeastwards and crossed Bangladesh coast close to the south of Cox's Bazar (21.2^0N and 92.1^0E) around 1300 UTC. It then continued to move northeastwards for some time and then eastwards and weakened gradually. It lay as a low pressure area at 0300 UTC of today over Myanmar & adjoining Bangladesh and Mizoram and northeast Bay of Bengal. The track of the system is given below.
- 24 hrs.. pressure change is slight negative over Nicobar island and positive of the order 1 to 2 hPa over Myanmar, Bangladesh, west Bengal, Orissa, north Andhra Pradesh coast and no significant change over south Andhra Pradesh, Tamilnadu and Sri Lanka coast.
- Pressure departure from normal is negative (1 to 3 hPa) over Andaman and Nicobar island
- Rainfall occurred at many places over Andaman & Nicobar islands, Manipur, Mizoram and Tripura and mainly dry weather prevails over east coast of India during Past 24 hrs..
- Buoys data show that SST around 28-30^0C over the Bay of Bengal.



Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST is around 30^0C over central and north Bay of Bengal

Ocean thermal energy:

- Ocean thermal energy lies between 80-90 KJ cm^{-2} over central Bay and 40 KJ cm^{-2} over north Bay of Bengal.

Relative Vorticity:

- Relative vorticity at 850 hPa is of order $40*10^{-4}$ s^{-1} over southwest, central and northeast Bay of Bengal

Convergence:

- Lower level convergence is of order of $20* 10^{-5}$ s^{-1} over Arakan coast.

Divergence:

- Upper air positive divergence increased and is order of $10*10^{-5}$ s^{-1} over Arakan coast.

Wind Shear:

- Wind Shear is weak (5-10 knots) over northeast Bay of Bengal and adjoining Arakan coast and 30 knots over south east Bay of Bengal .

Wind Shear Tendency:

- Negative (-10 knots) over Northeast Bay and Arakan coast.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 19.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 1 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 2 & 3 during next 15 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1.0 and moves through phase 2 & 3 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over north west Pacific Ocean.

Status of observational system:

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

Satellite

Inference based on INSAT imagery of 20/0900 UTC

Bay of Bengal:

- Intense to very intense convection is observed over central adjoining north Bay of Bengal between latitude 16.0°N to 19.5°N east of longitude 85.0°E Arakan coast adjoining Myanmar in association with vortex over the region.
- Cloud top temperatures are around –73°C.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis 0000 UTC of today shows the low pressure area lies over Myanmar. Model analysis also shows fresh a CYCIR over southwest Bay of Bengal and another CYCIR over south Andaman Sea and adjoining southwest Bay of Bengal at 850 hPa. The Forecasts show the CYCIR over southwest Bay of Bengal dissipates the same area on day3 and the CYCIR over south Andaman Sea moves westwards and lies over Sri-Lanka on day5. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis 0000 UTC of today shows the low pressure area over Myanmar and adjoining Bangladesh. The model also indicates formation of a low pressure area over south west Bay of Bengal on 23 October and likely to move west northwesterly direction.
- **WRF-ARW** model analysis of today shows the low pressure area lies over Myanmar and adjoining Bangladesh. No significant development during next three days.
- **UKMET** model analysis 0000 UTC of today shows the low pressure area lies over Myanmar. No significant development during next five days
- **NCMRWF-GFS** model analysis 0000 UTC of today shows the low pressure area lies over Myanmar. No significant development during next five days.
- http://www.imd.gov.in/section/nhac/dynamic/welcome.htm)

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows that two GPP cell of 30 lies over the south Andaman Sea. GPP forecast suggests no potential cyclogenesis zone during next 72 hour. GPP charts for analysis and 24 hours are shown in **Annexure III**.

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

Summary and Conclusion:

- Synoptic, Satellite and NWP models suggest that no significant system likely to form during next three days. However the Northeast monsoon rains are likely to commence.
-

Advisory:

- A brief report on the satellite and NWP products may be sent to cyclone warning division for preparation of consolidated report for the last deep depression.
- No IOP at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	19/12	**20/00**	**20/03**
India	182/205	127/159	193/208
Coastal stations			
WB	11/11	5/7	11/11
Odisha	10/10	6/7	10/10
AP	18/18	16/17	18/18
Tamil Nadu	12/14	11/11	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	13	13	18
Myanmar	14	16	21
Thailand	1	1	1
Sri Lanka	12	13	15

AWS

Region	Date/Time (UTC)		
	19/12	**20/00**	**20/03**
India	529/616	498/616	517/616
WB	20/20	20/20	20/20
ODS	28/38	28/38	29/38
AP	32/35	31/35	32/35
TN	26/26	21/26	26/26
PDC	1/2	0/2	1/2

- **RS/RW** (12Z) of 19 -10-2011: 10/39
- **No. of Ascents reaching 250 hPa levels: 7, MISDA:-**29
-
- **RS/RW** (00Z) of 20 -10-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 18 , MISDA:** 4

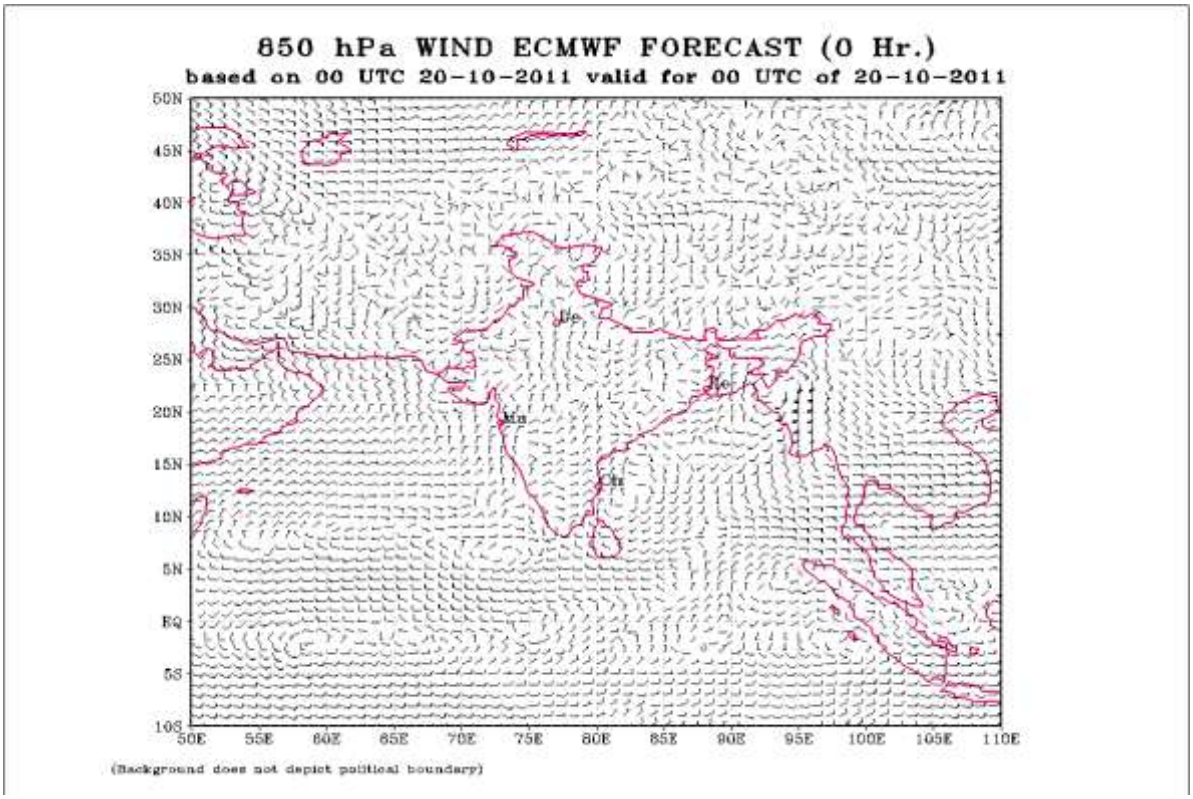
No. of PILOT Ascents

19/12Z	20/00Z
13/37	18/34

Buoy Data

19/12Z	20/00Z	20/03Z
11	5	12

Annexure II


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 20-10-2011 valid for 00 UTC of 20-10-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
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80E
85E
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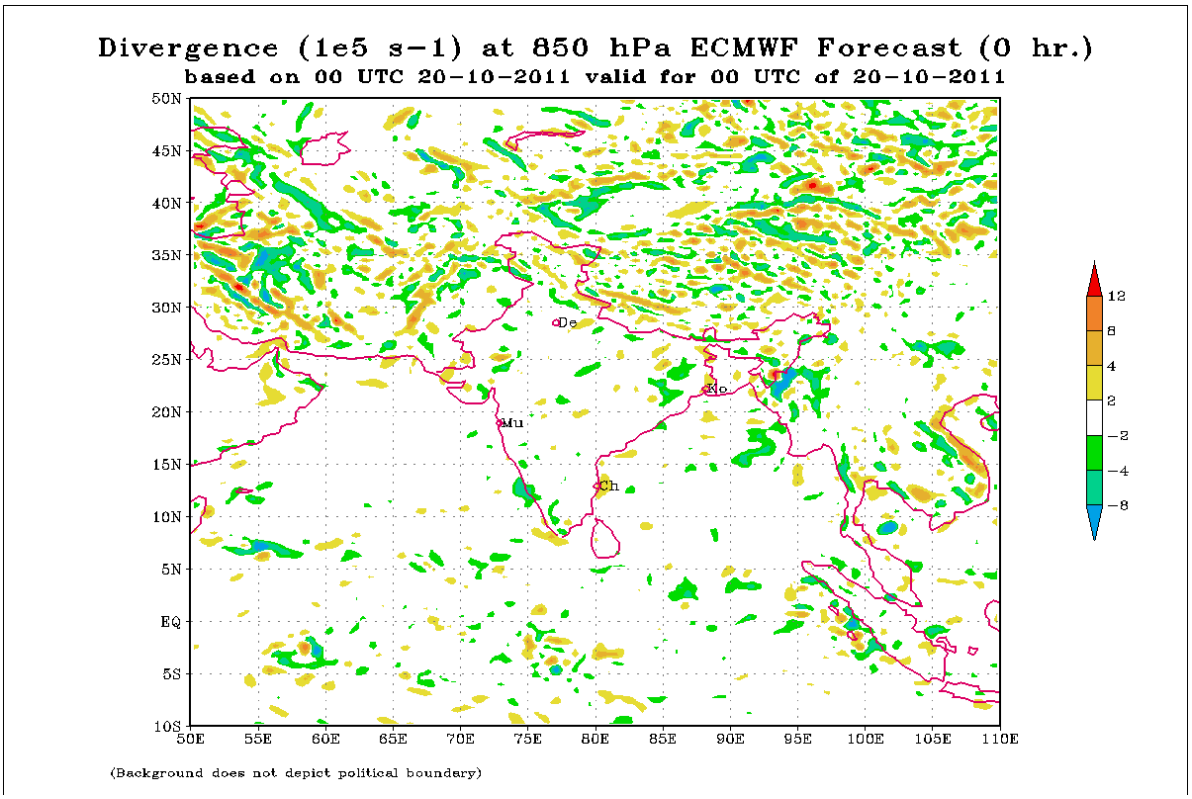
95E
100E
105E
110E
(Background does not depict political boundary)


Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 20-10-2011 valid for 00 UTC of 20-10-2011
50N
45N
40N
35N
30N
25N
20N
15N
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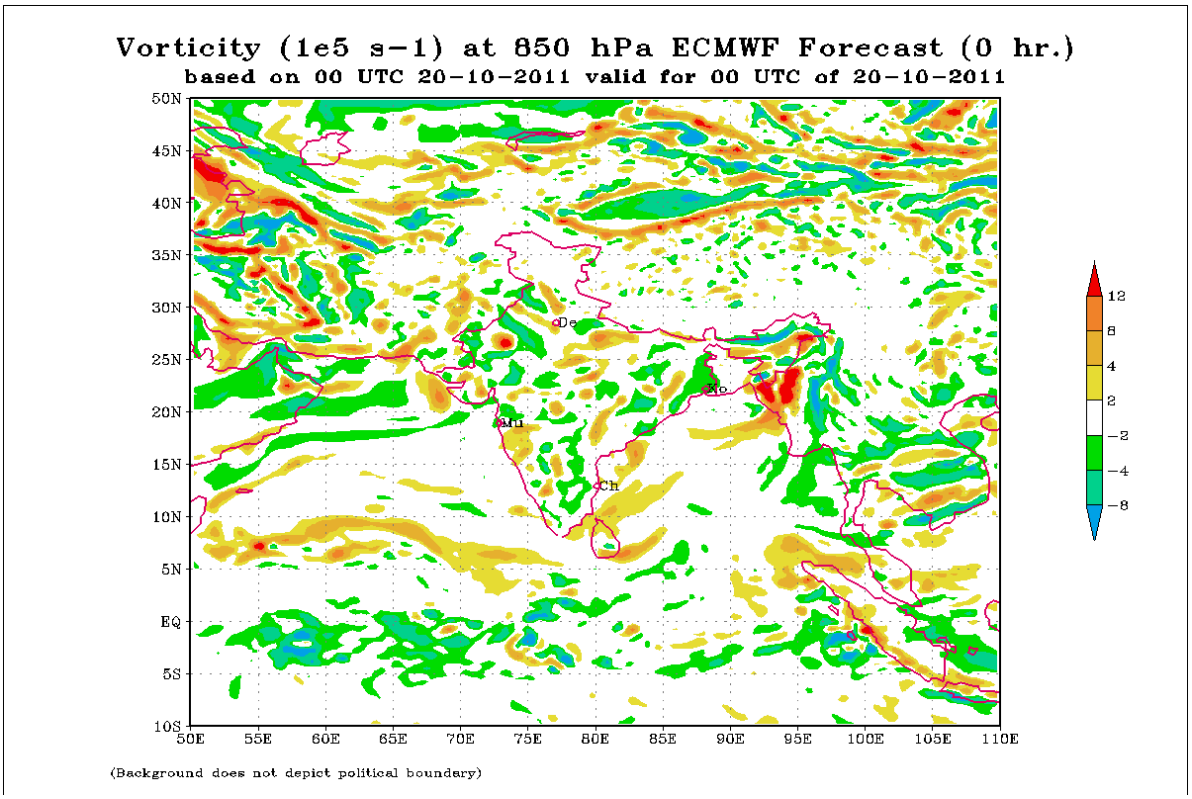
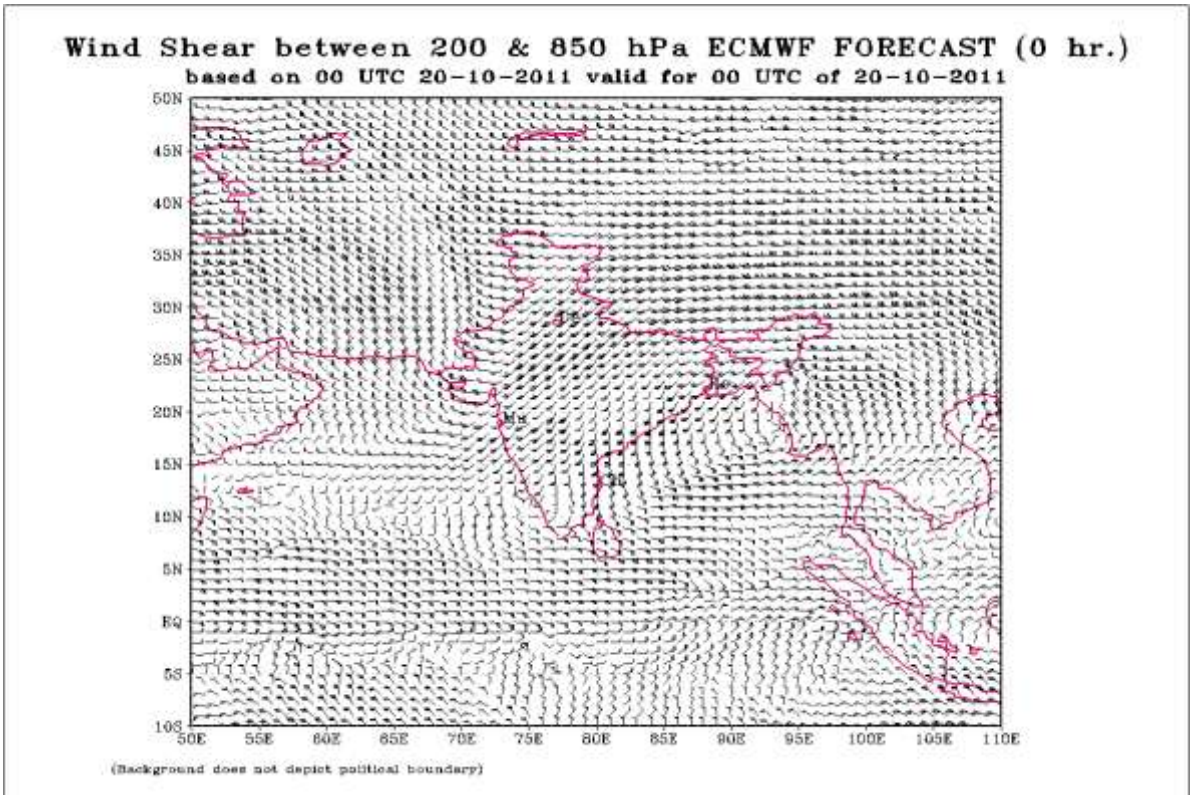
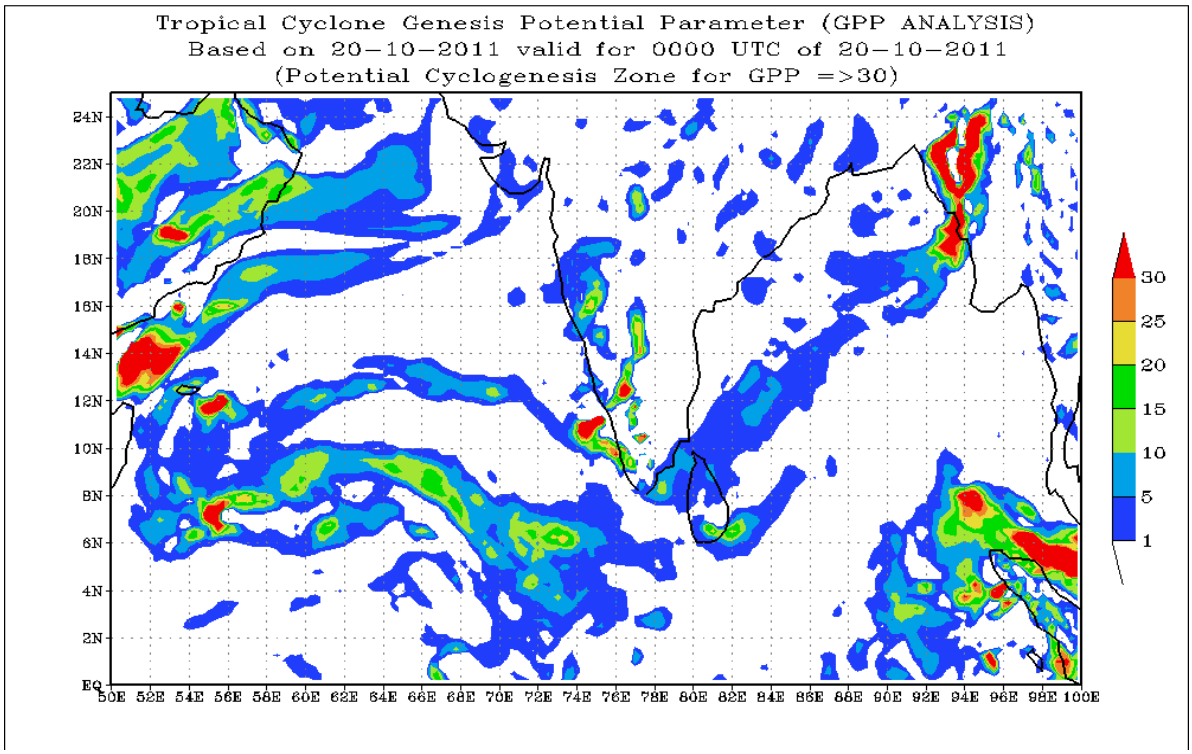
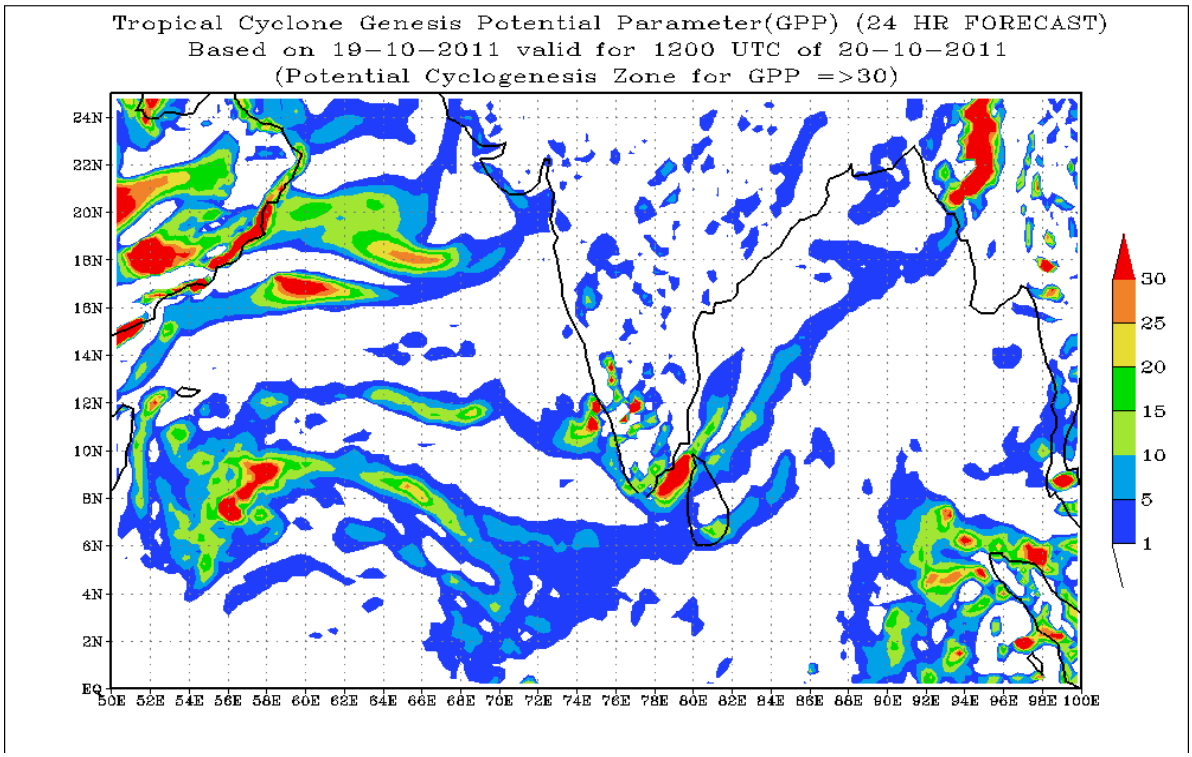
-8
(Background does not depict political boundary)





Annexure III





FDP (Cyclone) NOC Report Dated 21 October, 2011

Synoptic features based on 0300 UTC:

- Yesterday's low pressure area over Myanmar & adjoining Bangladesh and Mizoram and northeast Bay of Bengal has become less marked.
- ITCZ runs at 850 hPa around 8^0N over North Indian Ocean.
- 24 hrs. pressure change is positive over east coast, Myanmar and Bangladesh of the order 1 to 2 hPa and no significant change over Tamilnadu and Sri Lanka coast.
- Pressure departure from normal is negative (around 1 hPa) over Tamilnadu coast.
- Rainfall occurred at many places over Andaman & Nicobar Islands, Manipur, Mizoram and Tripura and mainly dry weather prevails over east coast of India during Past 24 hrs..
- Buoys data show that SST around 29^0C over the Bay of Bengal.

Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST is around 28-30^0C over central and north Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy lies between 60-80 KJ cm^{-2} over central Bay of Bengal.

Relative Vorticity:

- Relative vorticity at 850 hPa is of order $5*10^{-5}$ s^{-1} over southeast Bay of Bengal.

Convergence:

- Lower level convergence is of order of $20* 10^{-5}$ s^{-1} over Arakan coast.

Divergence:

- Upper air positive divergence increased and is order of $5*10^{-5}$ s^{-1} over southeast Arabian Sea.

Wind Shear:

- Wind Shear is strong (20 knots) over central Bay of Bengal and adjoining Arakan coast .

Wind Shear Tendency:

- Negative (-5 to -10 knots) over central Bay of Bengal.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat. 20.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 1 with amplitude greater than 1.0.

- Statistical forecast: - MJO moves through phase 2, 3 & 4 during next 15 days.
- Dynamical forecast:- MJO located in phase 1 with amplitude greater than 1.0 and moves through phase 2 & 3 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over north west Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone satellite inference 210900 UTC.

Intense convection is observed over North Bay and east central Bay

adjoining southeast Bay east of longitude 88.0°E Arakan coast Andaman Sea (CTT= -63 Degree Cel.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis 0000 UTC of today shows no significant change in weather during next 5 days. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis 0000 UTC of today shows no significant change in weather during next 5 days. The forecast for day 5 shows a low pressure over southeast Bay of Bengal and is likely to develop into a well marked low and move westwards.
- **WRF-ARW** model shows no significant weather during next three days. A low pressure is likely to form over southeast Arabian Sea on day 3.
- **UKMET** model also shows no significant development during 96 hours.
- **NCMRWF-GFS** model also shows no significant development during next five days.
- http://www.imd.gov.in/section/nhac/dynamic/welcome.htm)

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows that there is no significant development in GPP in analysis and upto 48 hours forecast. GPP charts of 24 hours and 48 hours are enclosed here with in **Annexure III**

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

Summary and Conclusion:

- After weakening of deep depression over Bangladesh and Myanmar Seasonal weather condition prevailed over Bay of Bengal without any significant system.

ECMWF and IMD both models show increase in northeasterly wind speed from Orissa to Tamilnadu coast that indicating setting of northeast monsoon during next 5 days.

Advisory:

- Synoptic satellite and NWP products suggest no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	20/12	**21/00**	**21/03**
India	191/205	125/159	190/208
Coastal stations			
WB	11/11	5/7	11/11
Odisha	10/10	6/7	10/10
AP	18/18	17/17	18/18
Tamil Nadu	14/14	11/11	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	15	13	14
Myanmar	12	11	12
Thailand	1	1	1
Sri Lanka	13	13	13

AWS

Region	Date/Time (UTC)		
	20/12	**21/00**	**21/03**
India	451/616	503/616	402/616
WB	20/20	19/20	20/20
ODS	29/38	28/38	29/38
AP	32/35	32/35	32/35
TN	26/26	26/26	26/26
PDC	1/2	0/2	1/2

- **RS/RW** (12Z) of 20 -10-2011: 12/39
- **No. of Ascents reaching 250 hPa levels: 8, MISDA:-**27
- **RS/RW** (00Z) of 21 -10-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 25 , MISDA:** 4

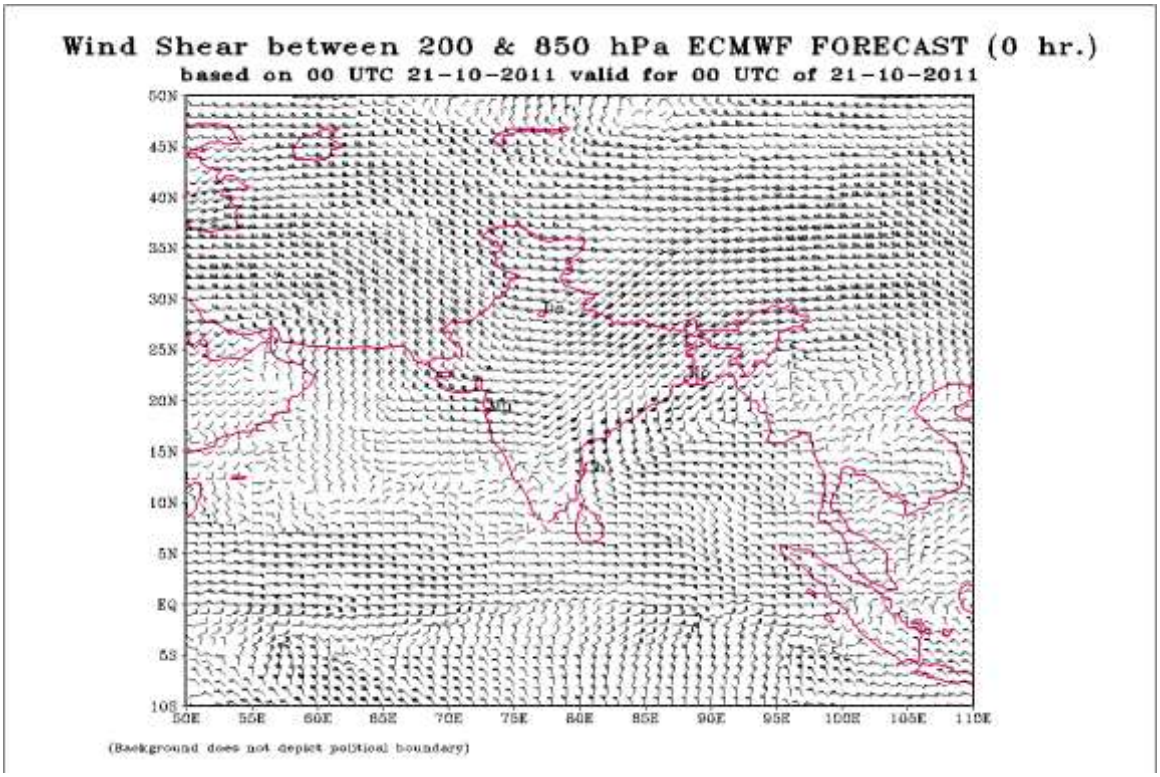
No. of PILOT Ascents

20/12Z	21/00Z
15/37	13/34

Buoy Data

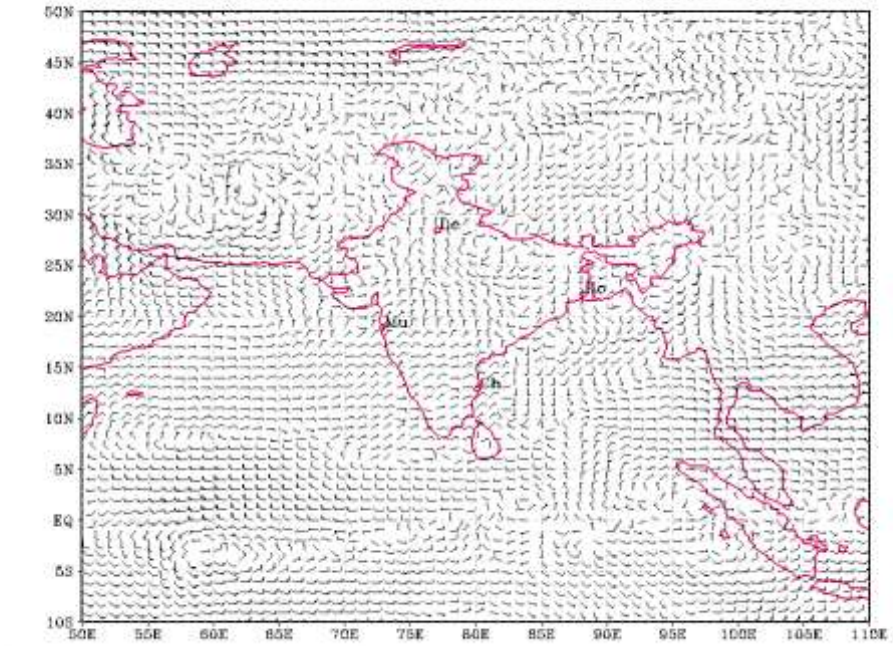
20/12Z	21/00Z	21/03Z
09	10	11

Annexure II



850 hPa WIND ECMWF FORECAST (0 Hr.)

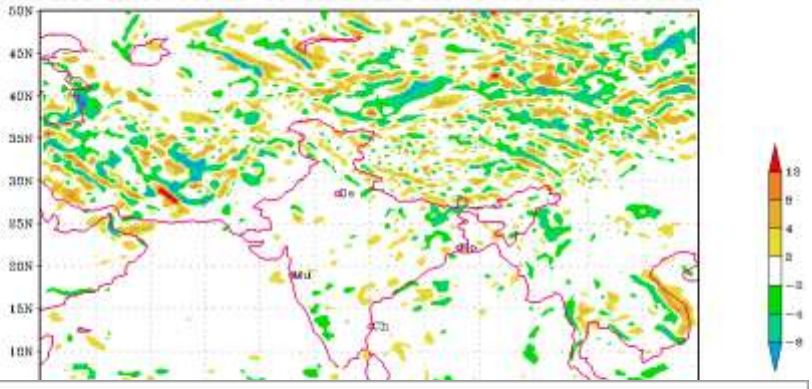
based on 00 UTC 21-10-2011 valid for 00 UTC of 21-10-2011



(Background does not depict political boundary)

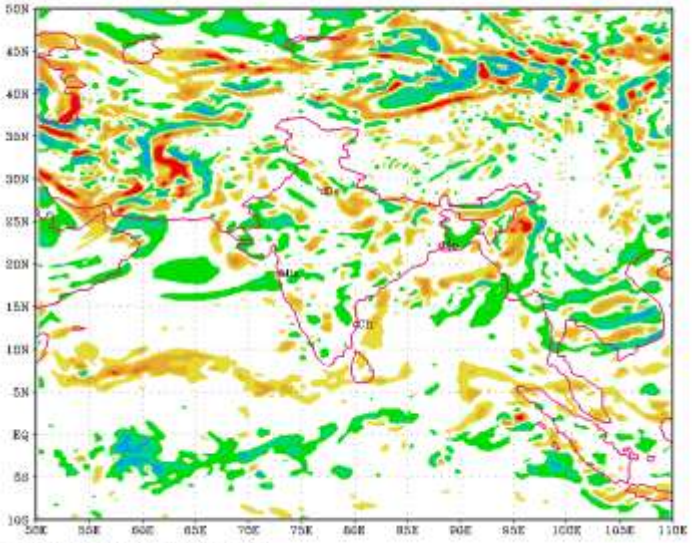
Divergence (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)

based on 00 UTC 21-10-2011 valid for 00 UTC of 21-10-2011



Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)

based on 00 UTC 21-10-2011 valid for 00 UTC of 21-10-2011



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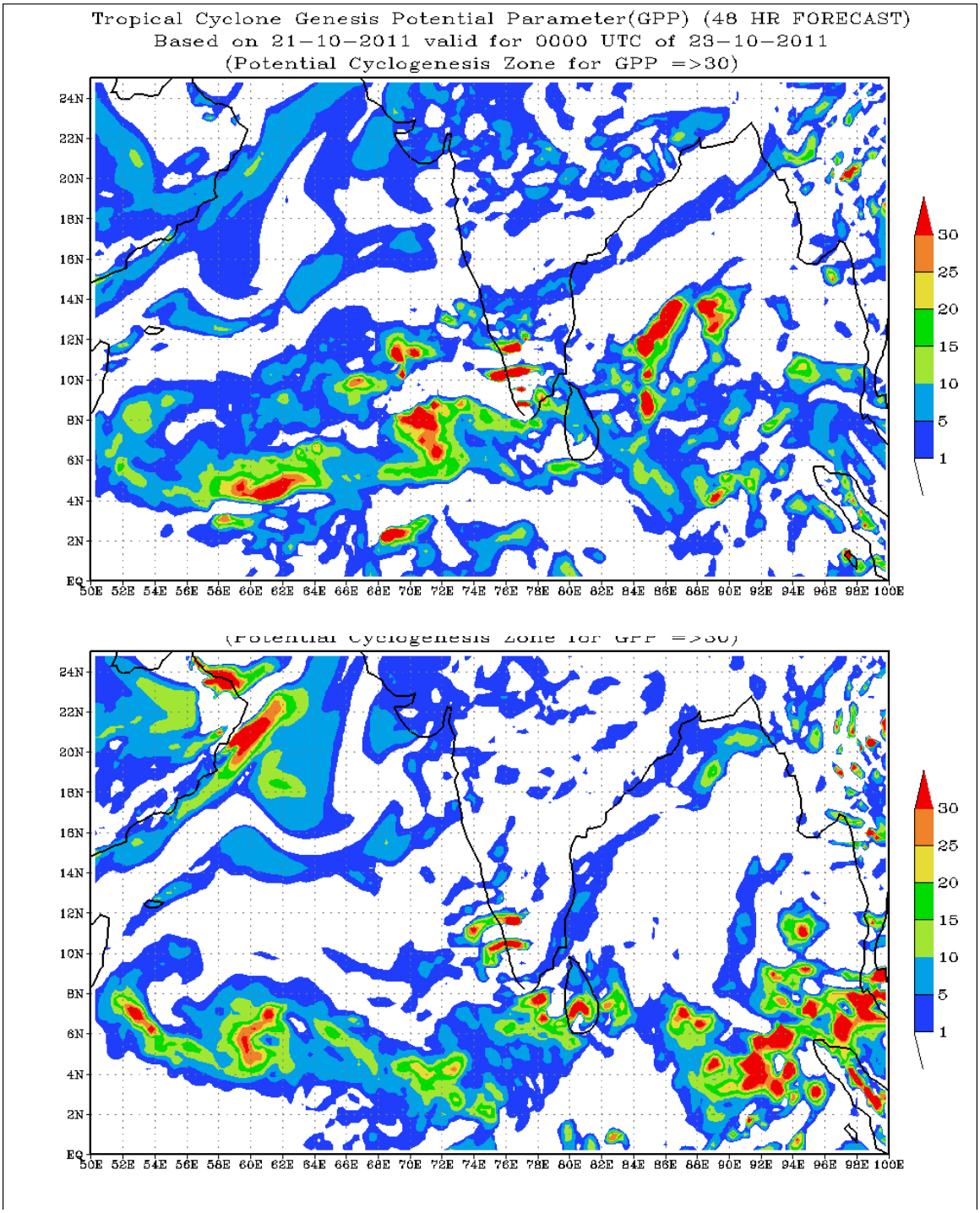
Annexure III



FDP (Cyclone) NOC Report Dated 22 October, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa continues runs around 8^0N over North Indian Ocean.
- 24 hrs. pressure change is not significant over Andaman & Nicobar island, east coast of India.
- Pressure departure from normal is negative (around 1 hPa) along east coast of India.
- Rainfall occurred at many places over West Bengal & Sikkim, northeastern States and Andaman & Nicobar Islands and mainly dry weather prevails over rest east coast India during past 24 hrs..
- Buoys data show that SST around 29^0C over the Bay of Bengal.

Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST is around 28 - 30^0C over central and north Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy lies between 60-80 KJ cm^{-2} over central Bay of Bengal and less than 60 - 80 KJ cm^{-2} over north Bay of Bengal

Relative Vorticity:

- Relative vorticity at 850 hPa is of order $20*10^{-5}$ s^{-1} over west central Bay of Bengal.

Convergence:

- Lower level convergence is of order of 5 - $10* 10^{-5}$ s^{-1} over west central Bay of Bengal and adjoining areas.

Divergence:

- Upper air positive divergence increased and is order of 5 - $10*10^{-5}$ s^{-1} over south Bay and $-5*10^{-5}$ s^{-1} over central Bay of Bengal

Wind Shear:

- Wind Shear is strong (20-40 knots) over north Bay of Bengal and adjoining Arakan coast and weak (5-10) over rest Bay of Bengal.

Wind Shear Tendency:

- Negative (-5 to -10 knots) over Bay of Bengal.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 13.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 2 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 2, 3 & 4 during next 15 days.

- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 2 & 3 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over north west Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone satellite inference 220900 UTC.

Broken low/medium clouds with embeded moderate to intense convection lies over Bay of Bengal west of longitude 90^0 E southeast and east central Bay of Bengal and south Andaman Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast charts do not show any significant development over the Seas during next 5 days. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model shows no significant development during next five days. However a fresh low pressure is likely to develop over southeast Arabian Sea on day 4, which is likely to move westwards and become well marked low pressure on day 5 and likely to intensify to depression.
- **WRF-ARW** model shows no significant weather during next three days.
- **UKMET** model also shows no significant development during next five days.
- **NCMRWF-GFS** model also shows no significant development during next five days.
- http://www.imd.gov.in/section/nhac/dynamic/welcome.htm)

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis does not show any significant values over Bay of Bengal. However, 24 hours and 48 hours forecasts show GPP cell of 30 lies over central Bay of Bengal. GPP charts for 24hours and 48 hours are shown in **Annexure III**.

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

Summary and Conclusion:

- ECMWF and IMDGFS & WRF Models show no significant development over Bay of Bengal. However, models show increase in northeasterly wind speed from

Orissa to Tamilnadu coast indicating, favourable for the commencement of the northeast monsoon in the next 48 hours.

Advisory:

- Synoptic satellite and NWP products suggest no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	21/12	**22/00**	**22/03**
India	190/205	128/159	193/208
Coastal stations			
WB	11/11	5/11	11/11
Odisha	10/10	6/10	10/10
AP	18/18	17/18	18/18
Tamil Nadu	14/14	11/14	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	7	1	7
Myanmar	1	7	7
Thailand	1	1	1
Sri Lanka	10	10	10

AWS

Region	Date/Time (UTC)		
	21/12	**22/00**	**22/03**
India	453/616	496/616	446/616
WB	18/18	19/19	20/20
ODS	29/29	27/27	29/29
AP	33/33	32/32	31/31
TN	27/27	26/26	27/27
PDC	1/1	0/1	1/1

- **RS/RW** (12Z) of 21 -10-2011: 11/39
- **No. of Ascents reaching 250 hPa levels: 3, MISDA:-**28

- **RS/RW** (00Z) of 22 -10-2011: 34/39

- **No. of Ascents reaching 250 hPa levels: 22 , MISDA: 5**

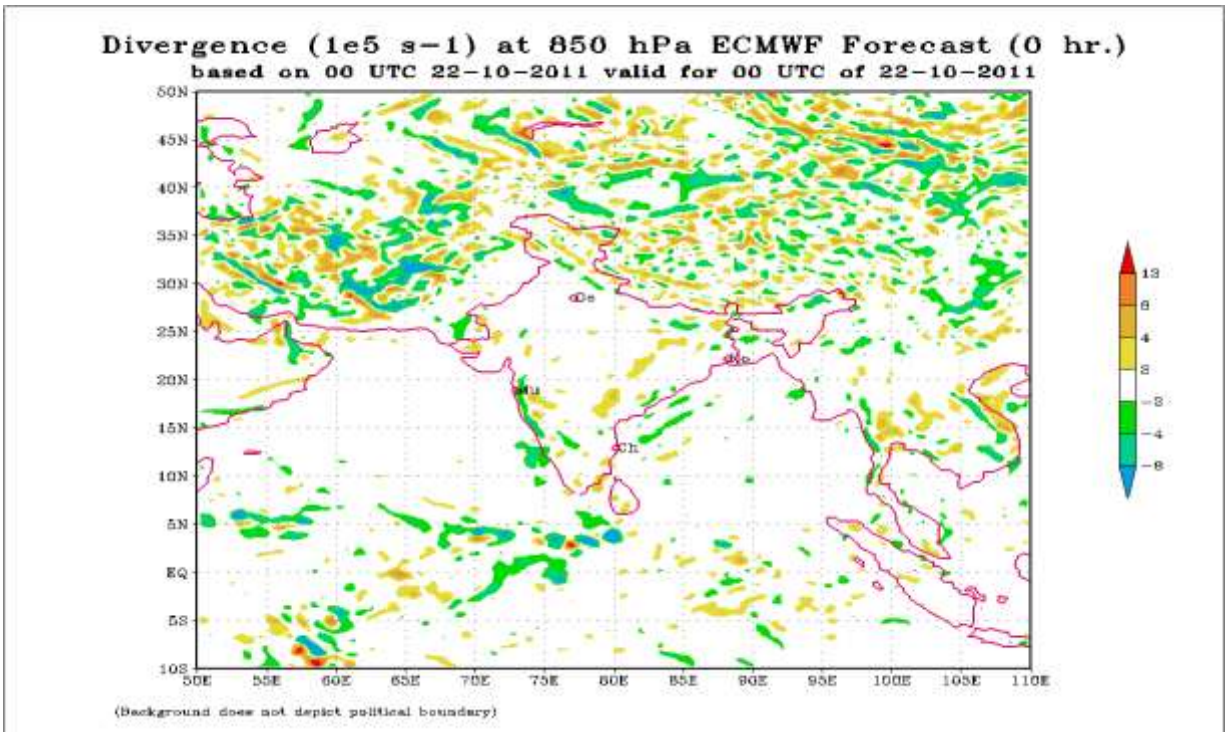
No. of PILOT Ascents

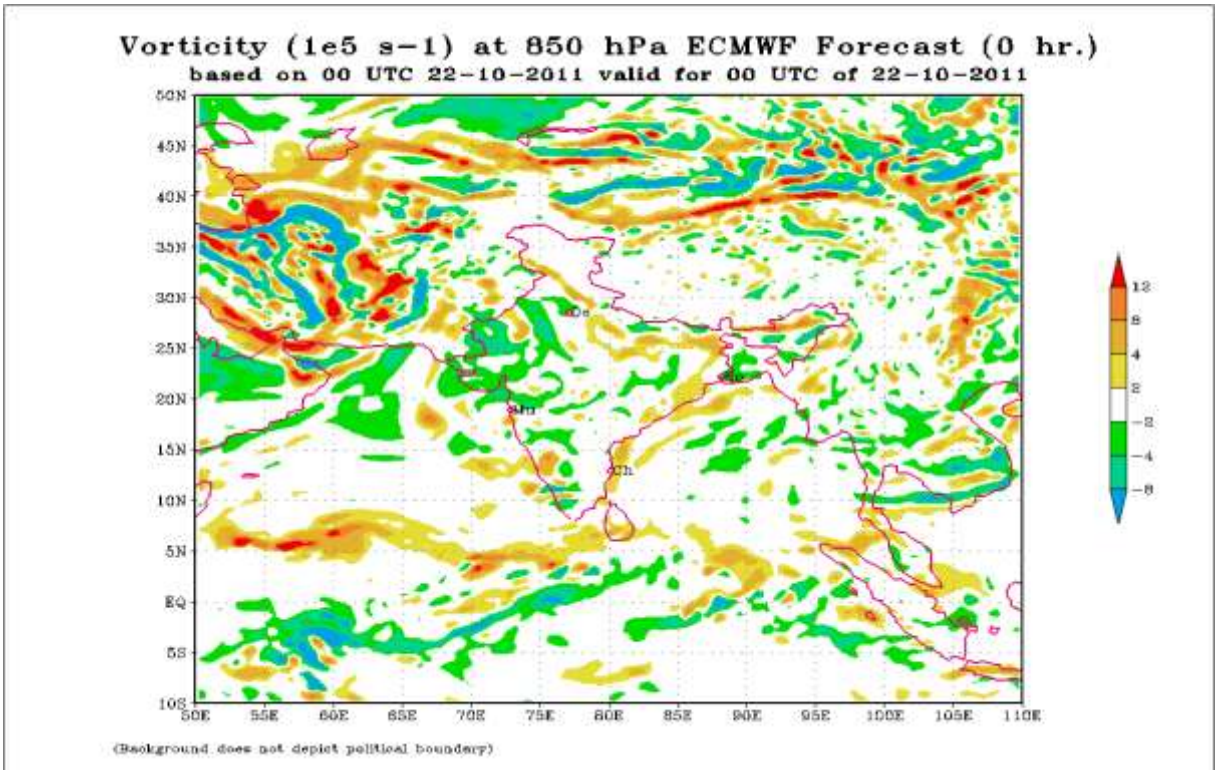
21/12Z	22/00Z
15/37	13/34

Buoy Data

21/12Z	22/00Z	22/03Z
10	11	14

Annexure II




Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 22-10-2011 valid for 00 UTC of 22-10-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
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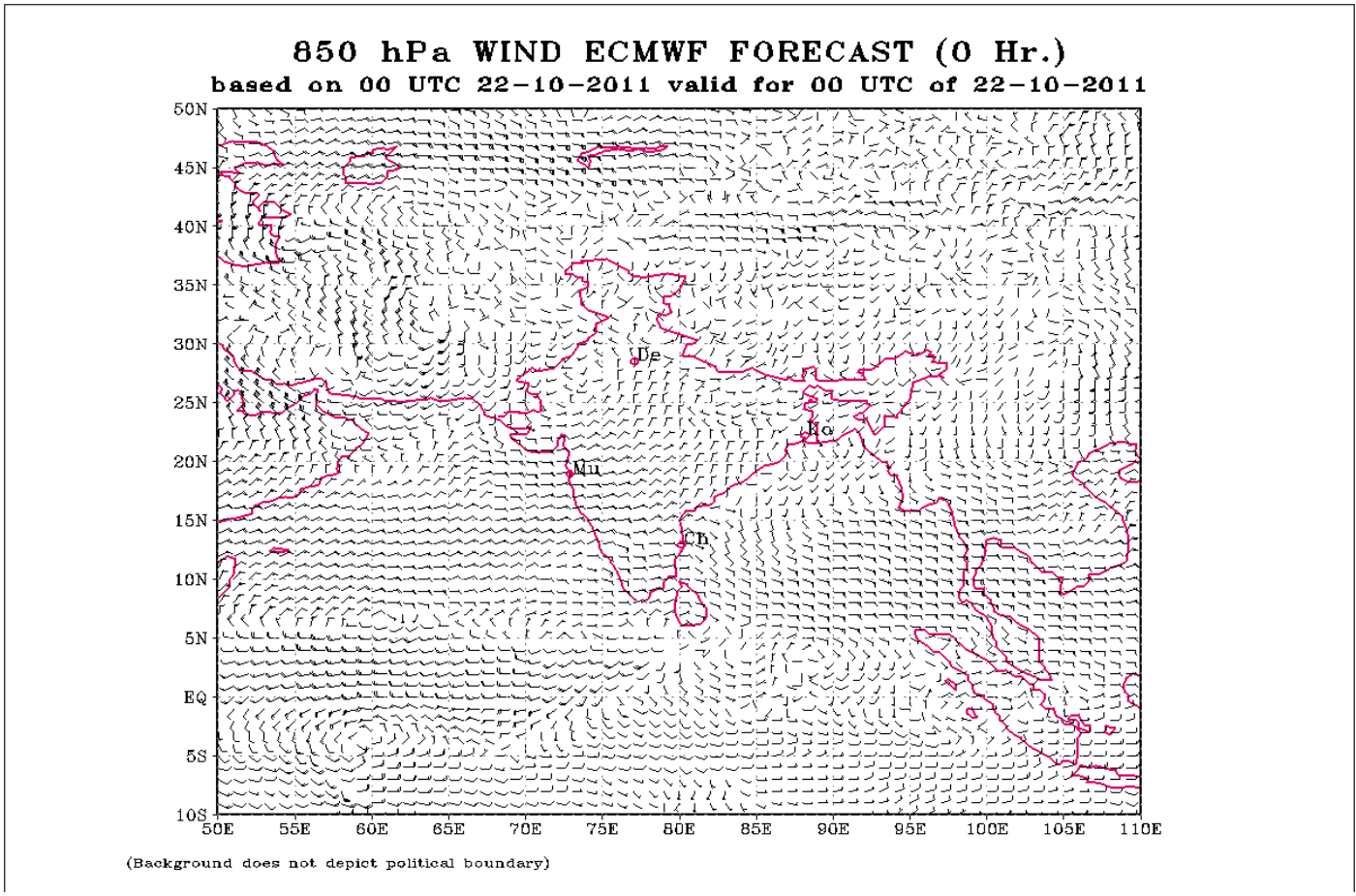
(Background does not depict political boundary)


850 hPa WIND ECMWF FORECAST (0 Hr.)
based on 00 UTC 22-10-2011 valid for 00 UTC of 22-10-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
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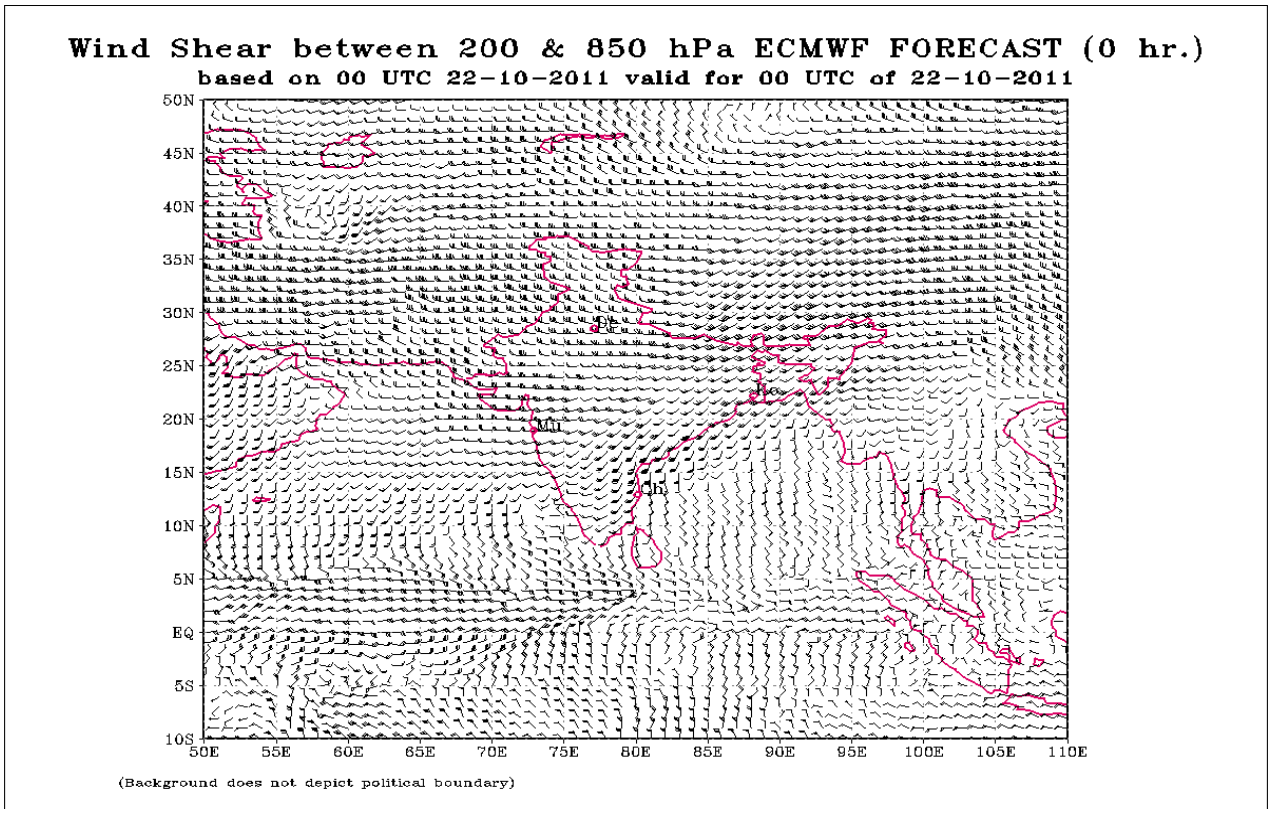
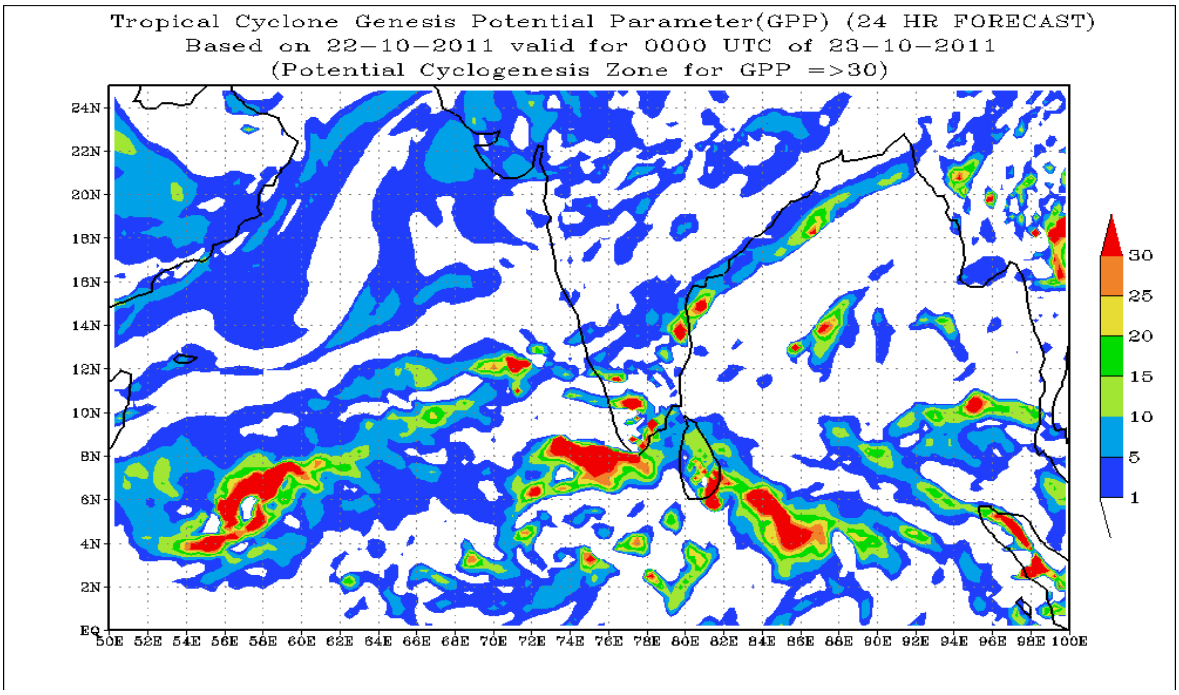
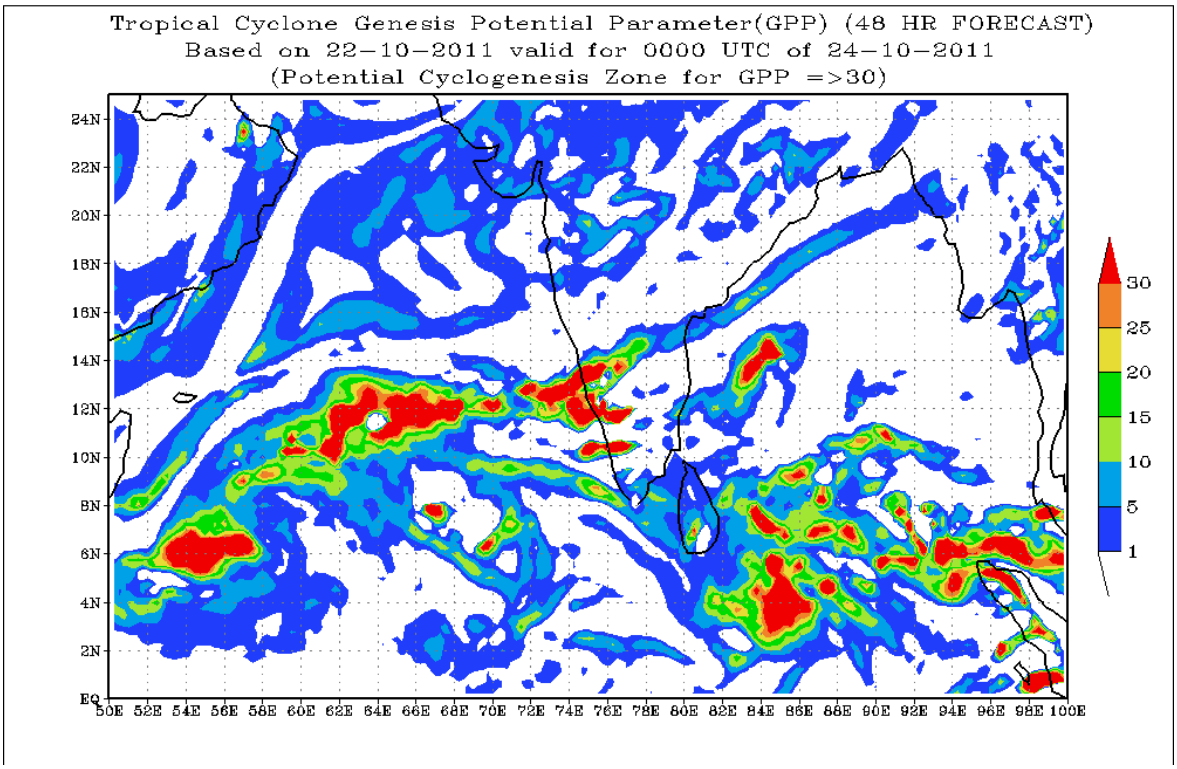
110E
(Background does not depict political boundary)



Annexure III





FDP (Cyclone) NOC Report Dated 23 October, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 7^0 N over North Indian Ocean.
- 24 hrs.. pressure change shows a rise of order 1 hPa along the east coast of India and no significant change over Andaman & Nicobar islands.
- Pressure departure from normal is negative (around 1 hPa) along Tamilnadu coast and over Andaman & Nicobar islands.
- Rainfall occurred at many places over Tamilnadu coast and few places at Andaman & Nicobar Islands during past 24 hrs..
- Buoys data show that SST around 28- 29^0C over the Bay of Bengal.

Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST is around 28 - 30^0C over central and north Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy lies between 60-80 KJ cm^{-2} over central Bay of Bengal and less than 60 - 80 KJ cm^{-2} over north Bay of Bengal

Relative Vorticity:

- Relative vorticity at 850 hPa is of order $20*10^{-5}$ s^{-1} over south Bay of Bengal.

Convergence:

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

Divergence:

- Upper air positive divergence increased and is order of 5 - $10*10^{-5}$ s^{-1} over south Andaman Sea and $5*10^{-5}$ s^{-1} over central Bay of Bengal

Wind Shear:

- Wind Shear is of order 5- 10 knots over south Andaman Sea and of order 10- 20 knots over central Bay of Bengal.

Wind Shear Tendency:

- Negative (-5 to -10 knots) over north Bay of Bengal.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat. 16.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 2 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 2, 3 & 4 during next 15 days.
- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 2 & 3 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone satellite inference 230900 UTC.

Broken low/medium clouds with embedded isolated moderate to intense convection over Bay of Bengal between lat. 13.5^oN to 17.5^oN long. 83.0^oE to 90.5^oE and south Bay of Bengal south of lat. 10.0^o N Andaman Sea South Tenasserim coast (.)

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast charts do not show any significant development over the Seas during next 5 days. However, model shows a low level circulation over the southwest Arabian Sea but shows no intensification of the system during next seven days. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.

- **IMD-GFS** model shows no significant development during next seven days.
- **WRF-ARW** model shows no significant weather during next three days. However model forecast shows formation of a Depression over southwest Arabian Sea on day3.
- **UKMET** model also shows no significant development during next five days.
- **NCMRWF-GFS** model shows a low level circulation over the southwest Arabian Sea but shows no intensification of the system during next seven days.
- http://www.imd.gov.in/section/nhac/dynamic/welcome.htm)

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows isolated cell of GPP along the ITCZ over the north Indian Ocean near latitude 8 deg. N. However, 24 hours and 48 hours forecasts show organization of a GPP cell of 30 over southwest Arabian Sea. GPP charts for 24hours and 48 hours are shown in **Annexure III**.

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

Summary and Conclusion:

- ECMWF and IMDGFS & WRF Models show no significant development over Bay of Bengal. However, models show increase in northeasterly wind speed from Orissa to Tamilnadu coast indicating, favourable for the commencement of the northeast monsoon in the next 48 hours.

Advisory:

- Synoptic satellite and NWP products suggest no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	22/12	23/00	23/03
India	191/205	126/159	193/208
Coastal stations			
WB	11/11	5/11	11/11
Odisha	10/10	6/10	10/10
AP	18/18	17/18	18/18
Tamil Nadu	14/14	12/14	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	8	6	7
Myanmar	8	8	1
Thailand	1	1	1
Sri Lanka	10	8	10

AWS

Region	Date/Time (UTC)		
	22/12	23/00	23/03
India	448/616	484/616	450/484
WB	19	8	6
ODS	28	29	28
AP	33	32	25
TN	27	24	21
PDC	1	1	0

- **RS/RW** (12Z) of 22 -10-2011: 10/39
- **No. of Ascents reaching 250 hPa levels: 4, MISDA:-**29

- **RS/RW** (00Z) of 23 -10-2011: 33/39
- **No. of Ascents reaching 250 hPa levels: 21 , MISDA: 6**

No. of PILOT Ascents

22/12Z	23/00Z
12/37	22/34

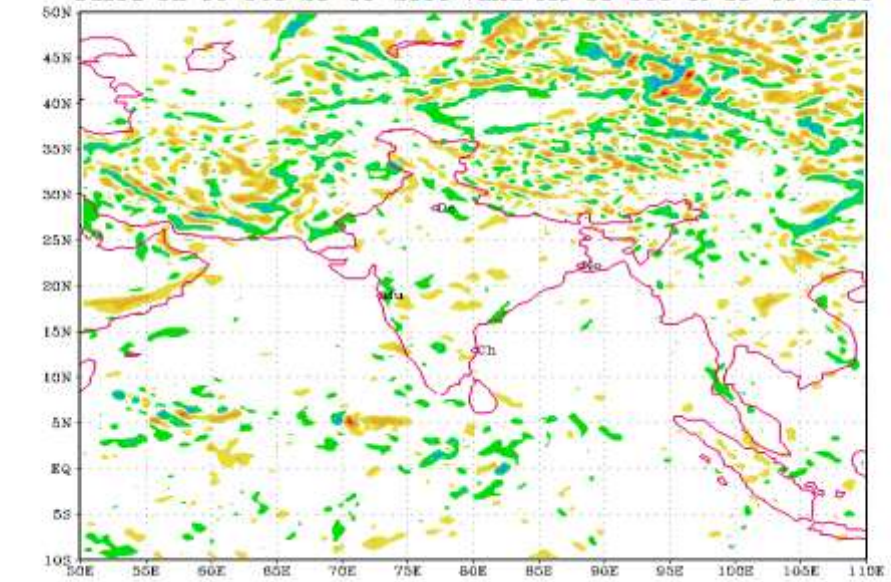
Buoy Data

22/12Z	23/00Z	23/03Z
11	8	13

Annexure II

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

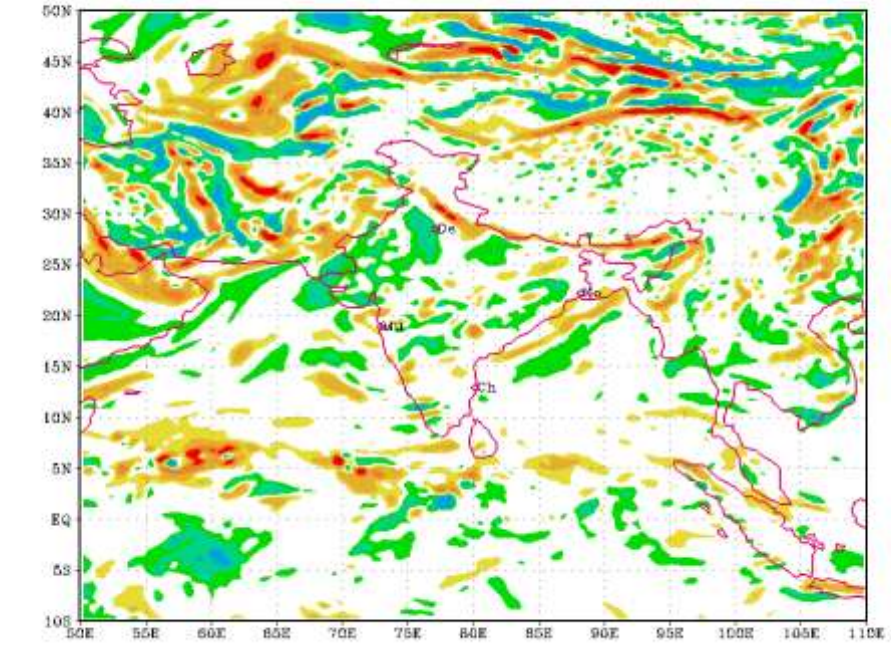
based on 00 UTC 23-10-2011 valid for 00 UTC of 23-10-2011



(Background does not depict political boundary)

Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

based on 00 UTC 23-10-2011 valid for 00 UTC of 23-10-2011



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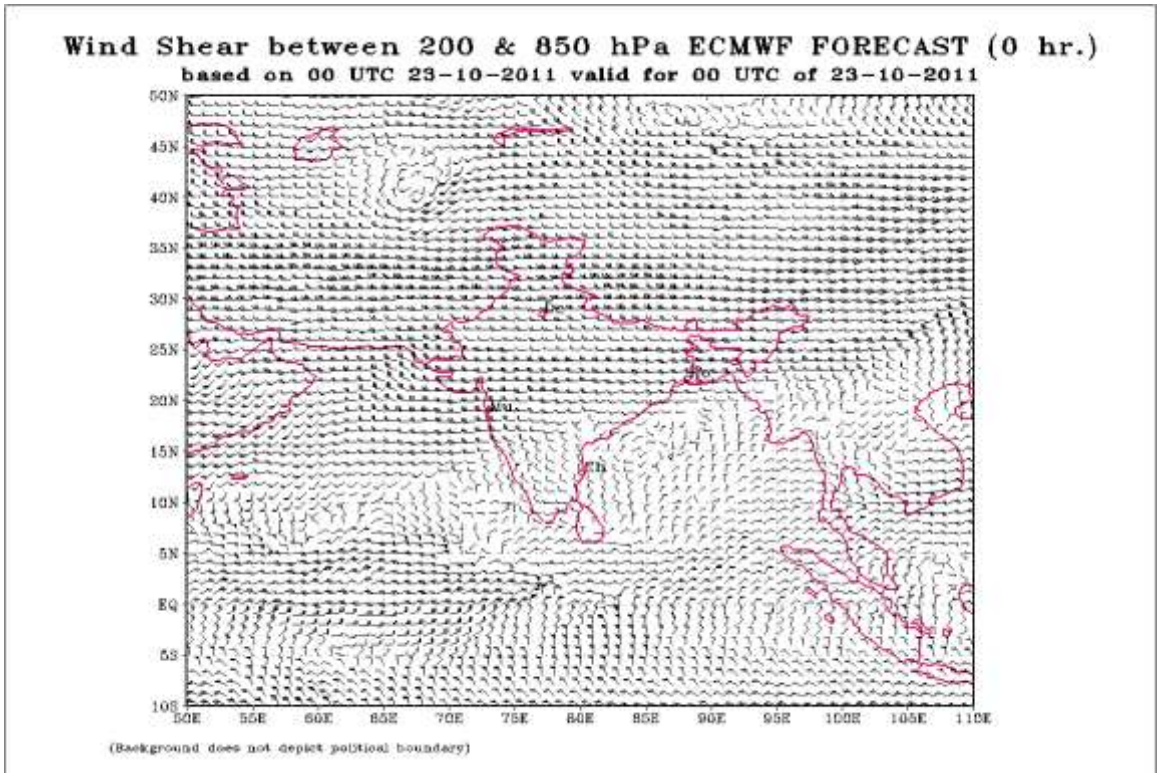
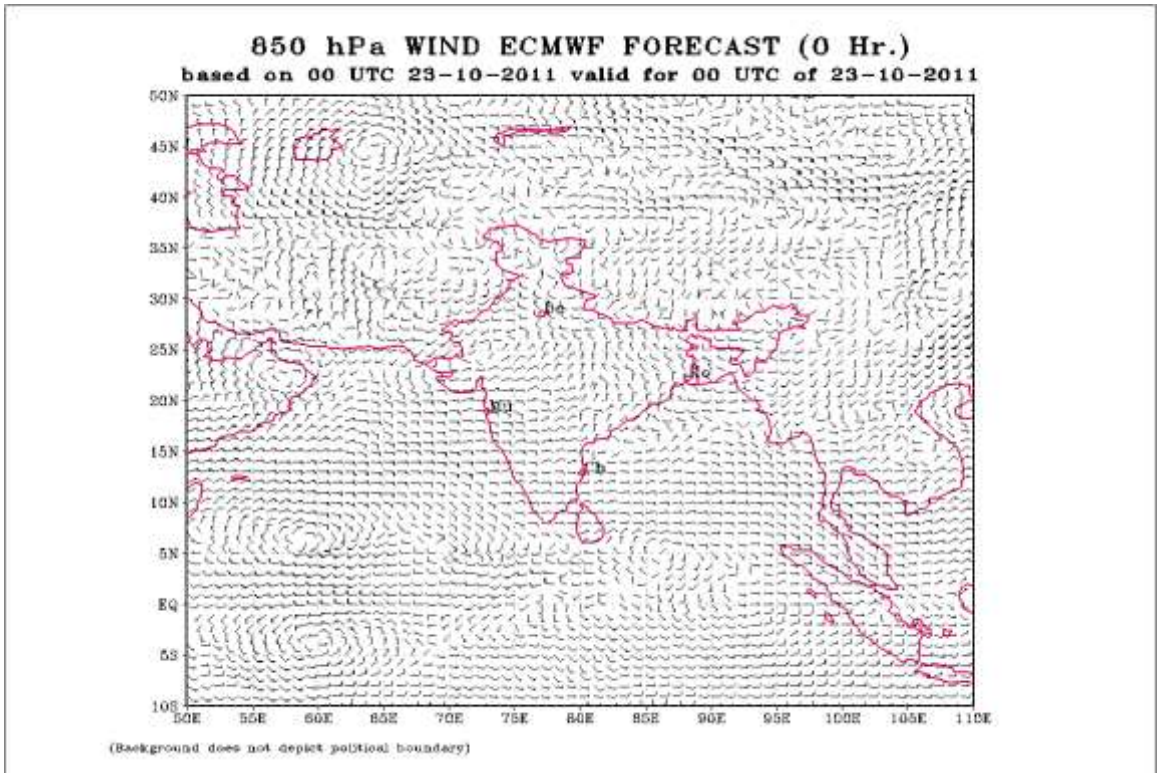
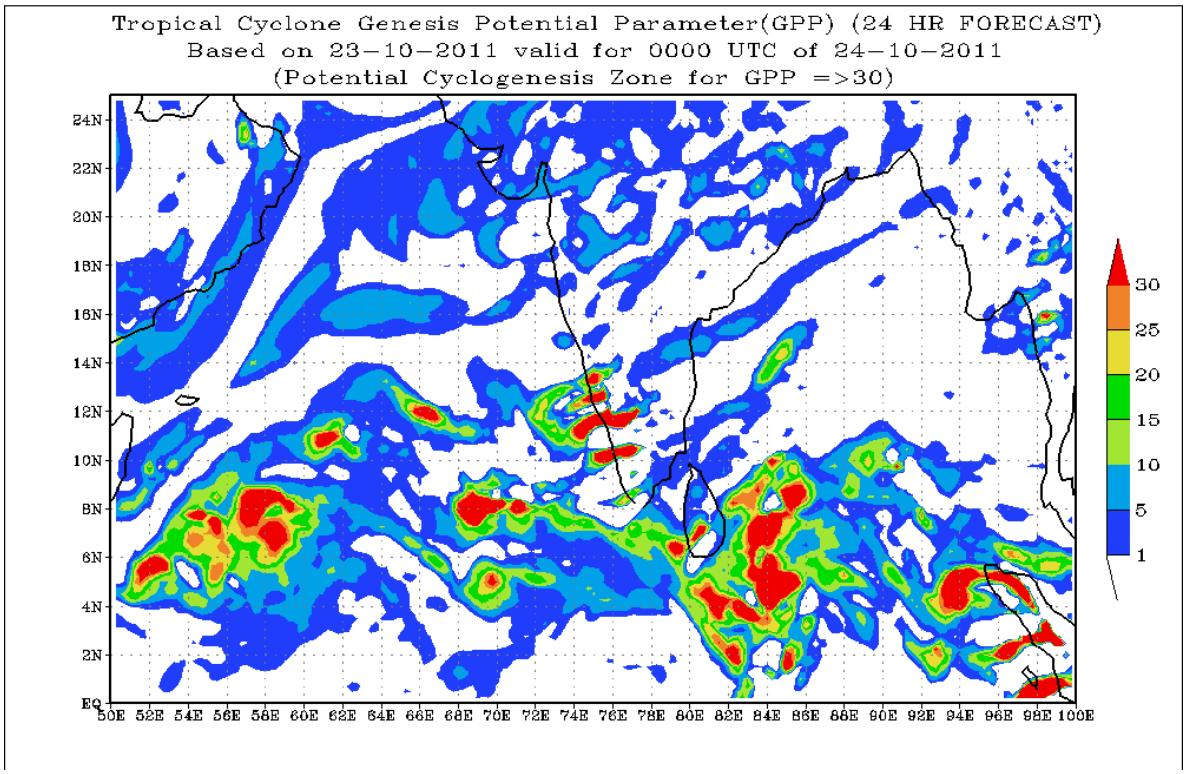
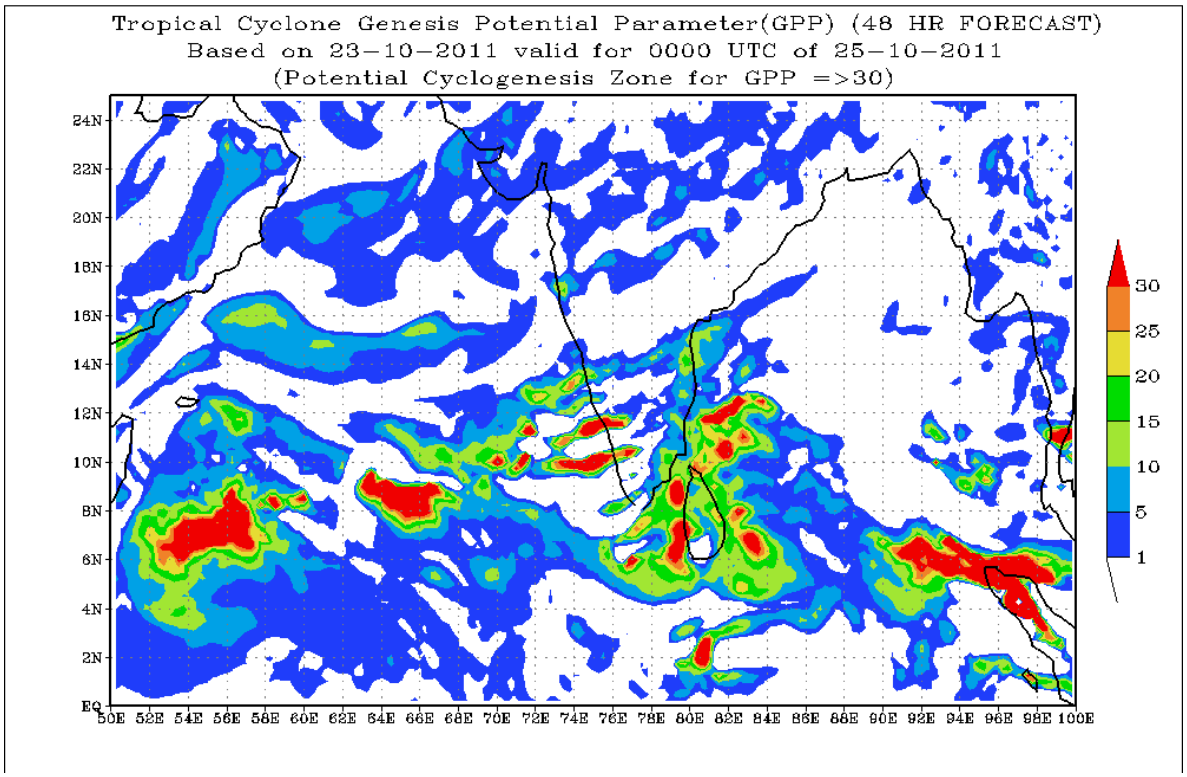




Annexure III





FDP (Cyclone) NOC Report Dated 24 October, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 5^0 N over North Indian Ocean.
- 24 hrs. pressure change is positive (around 1 hPa) along the east coast of India and over Andaman & Nicobar islands.
- Pressure departure from normal is positive (around 1 hPa) along east coast of India except Tamilnadu coast where the same is negative (around -1 hPa).
- Rainfall occurred at many places over Tamilnadu coast and Andaman & Nicobar Islands during past 24 hrs.
- Buoys data show that SST around 28- 30^0C over the Bay of Bengal.

Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST is around 28 - 30^0C over central and north Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy lies between 60-80 KJ cm^{-2} over central Bay of Bengal and less than 40 KJ cm^{-2} over north Bay of Bengal

Relative Vorticity:

- Relative vorticity at 850 hPa is of order 20 - $40*10^{-5}$ s^{-1} over southwest Bay of Bengal.

Convergence:

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

Divergence:

- Upper air divergence is positive of the order of 5 - $10*10^{-5}$ s^{-1} over south Bay of Bengal.

Wind Shear:

- Wind Shear is of order 5 -10 knots over south Bay of Bengal.

Wind Shear Tendency:

- Negative (-5 to -10 knots) over south Bay of Bengal.
- **Upper tropospheric ridge**:
  - The upper tropospheric ridge line roughly runs along Lat 16.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 2 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 3 & 4 during next 15 days.
- Dynamical forecast:- MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 3 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone satellite inference 240900 UTC.

Broken low/medium clouds with embedded moderate to intense convection lies over westcentral & southwest Bay of Bengal and south Andaman Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model shows no significant change in weather during next 5 days. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis 0000 UTC of today shows no significant development during next 5 days.
- **WRF-ARW** model shows no significant development during next three days.
- **UKMET** model also shows no significant development during 5 days.
- **NCMRWF-GFS** model also shows no significant development during next five days.
- http://www.imd.gov.in/section/nhac/dynamic/welcome.htm)

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows that there is no significant development in GPP in analysis and upto 48 hours forecast. GPP charts of analysis and 24 hours are enclosed here with in **Annexure III**

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

Summary and Conclusion:

- Synoptic and NWP models show that ITCZ may move northwards and strengthening easterly wind over Tamilnadu. Pressure pattern of easterly waves shows that northeast monsoon set in over east coast of India. Relatively higher GPP exit over westcentral Arabian Sea on 28th October 2011 (near Lat.11.5^{0}N/Long.61.0^{0}E) and from 27th and 28th October cyclonic turning of wind may take place over Tamilnadu coast.

Advisory:

- No significant weather system over Bay of Bengal.

- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	23/12	**24/00**	**24/03**
India	186/208	126/159	192/208
Coastal stations			
WB	11/11	5/11	11/11
Odisha	10/10	6/10	10/10
AP	17/18	17/18	18/18
Tamil Nadu	14/14	11/14	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	12	10	14
Myanmar	12	12	13
Thailand	1	1	1
Sri Lanka	12	14	16

AWS

Region	Date/Time (UTC)		
	23/12	**24/00**	**24/03**
India	451/616	438/616	490/616
WB	18	19	20
ODS	29	27	29
AP	32	31	31
TN	27	26	27
PDC	1	1	1

- **RS/RW** (12Z) of 23 -10-2011: 10/39
- **No. of Ascents reaching 250 hPa levels: 6, MISDA:-**29
- **RS/RW** (00Z) of 24 -10-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 24 , MISDA: 4**

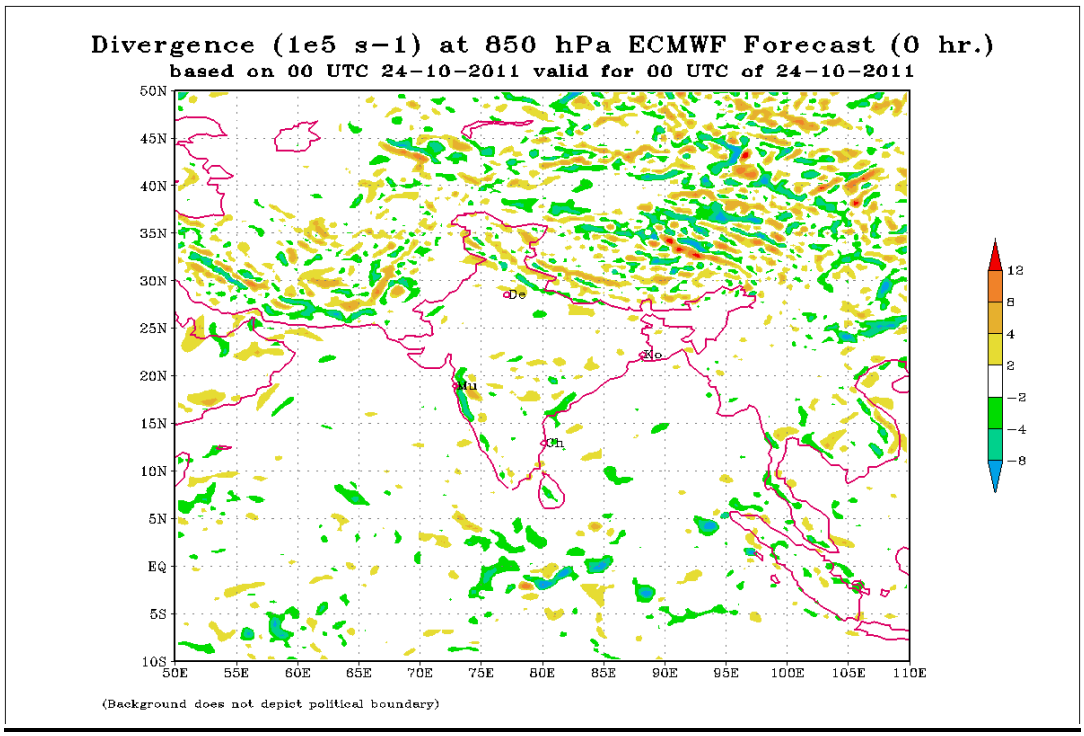
No. of PILOT Ascents

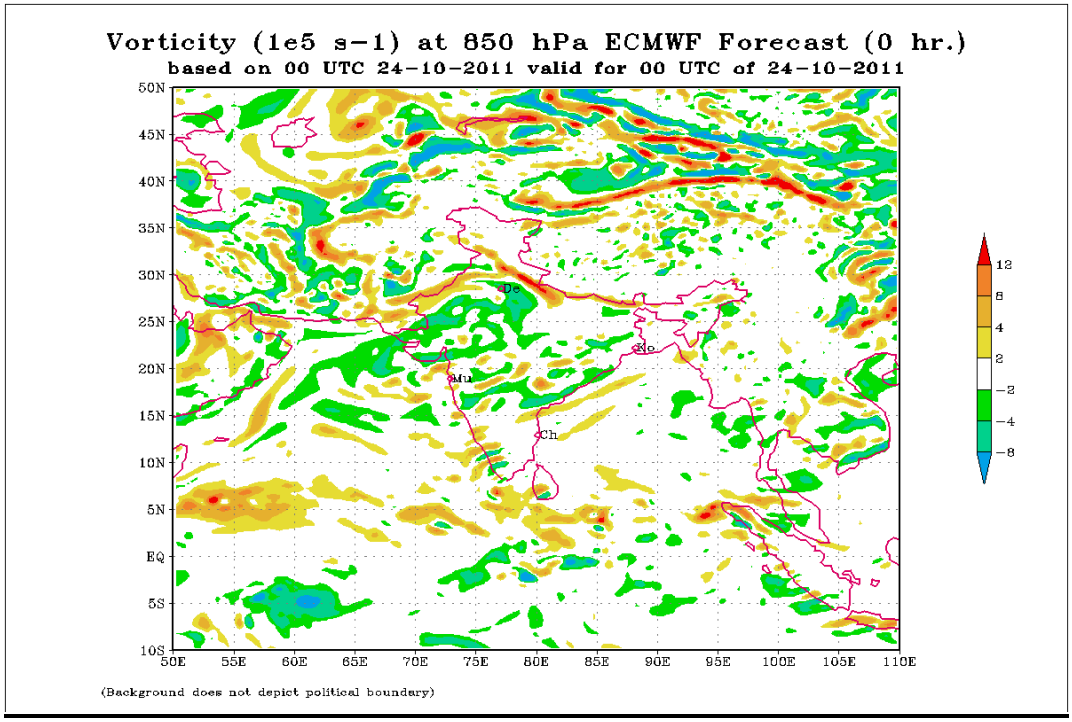
23/12Z	**24/00Z**
19/37	23/34

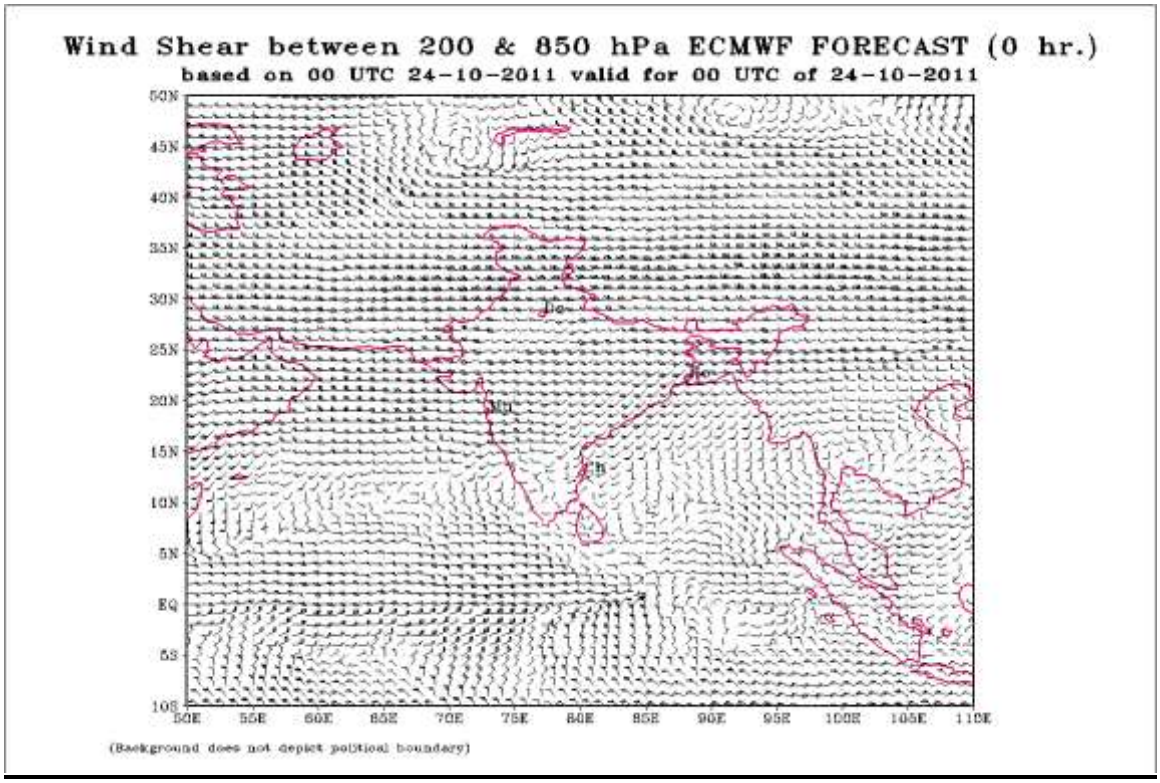
Buoy Data

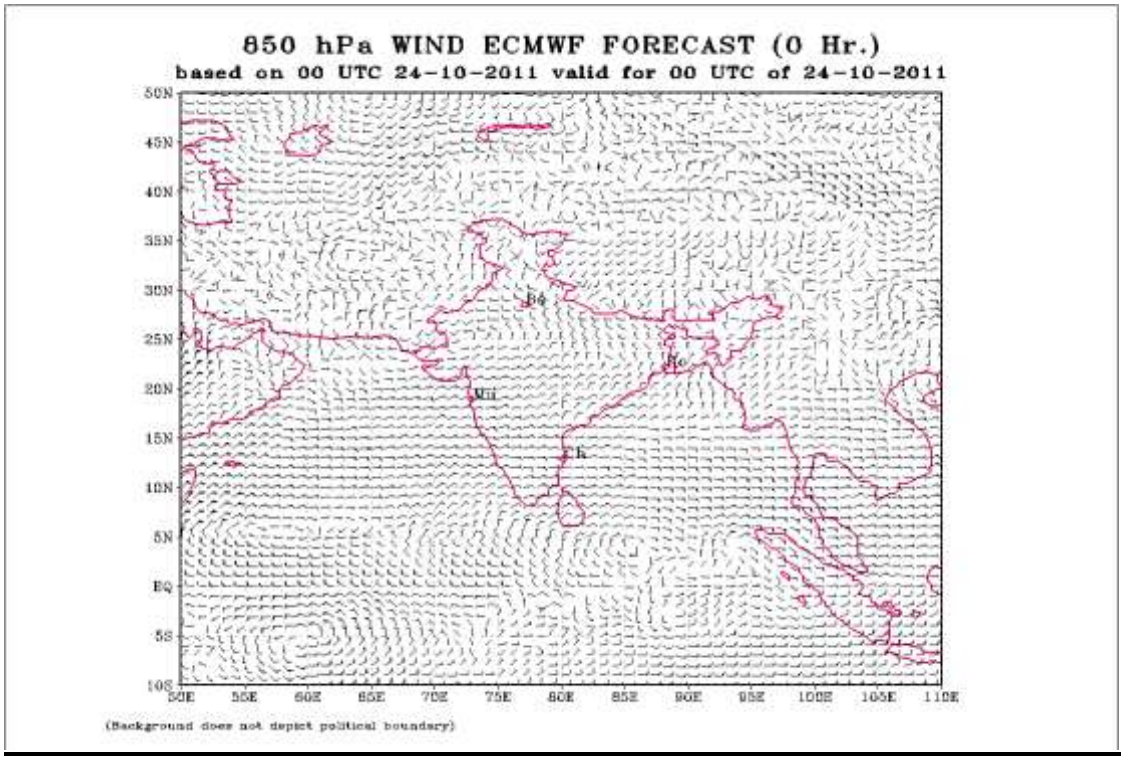
23/12Z	24/00Z	24/03Z
10	11	7

Annexure-II

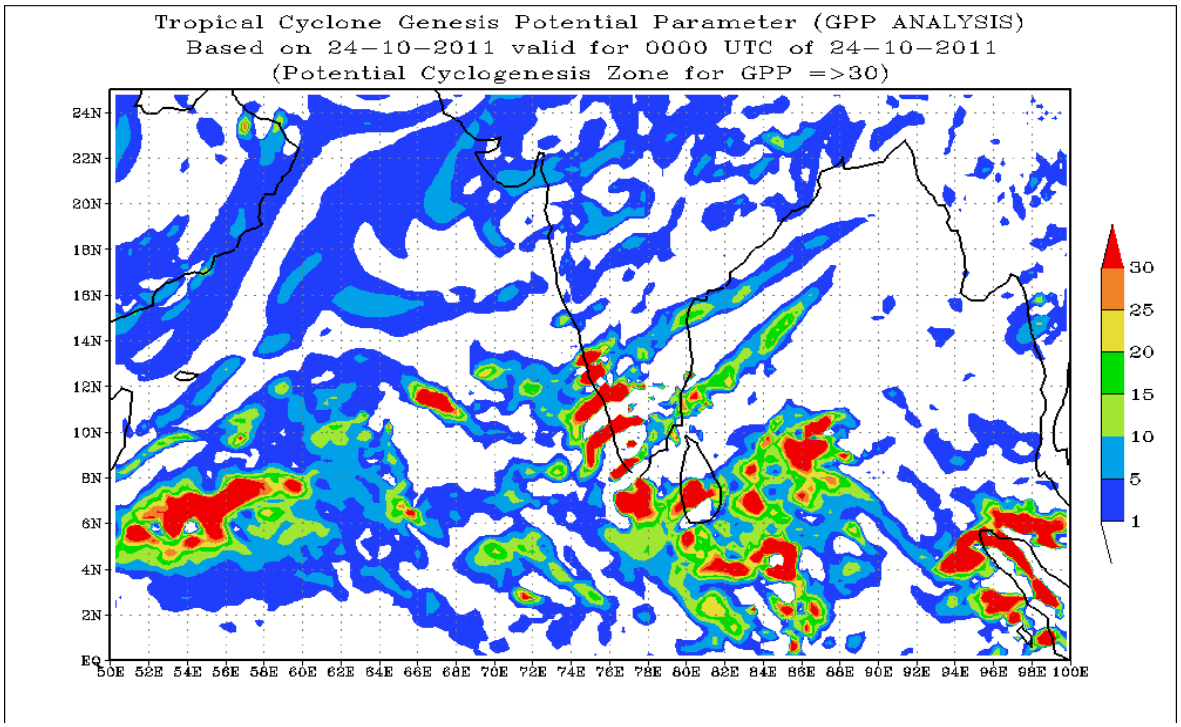


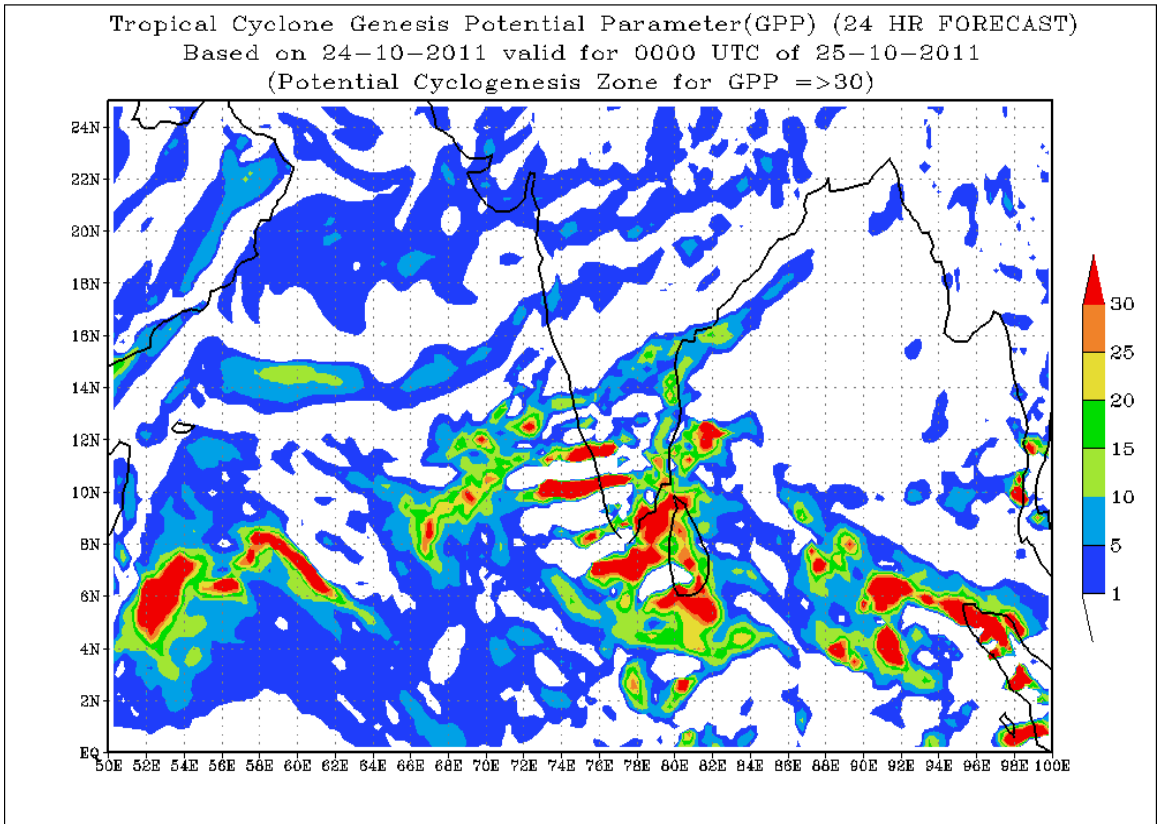






Annexure-III





FDP (Cyclone) NOC Report Dated 25 October, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 5^0 N over North Indian Ocean.
- A trough of low pressure on mean Sea level runs from west central to southwest across eastcentral Bay of Bengal.
- 24 hrs. pressure change is not signficant along the east coast of India and over Andaman & Nicobar islands.
- Pressure departure from normal is not significant along east coast of India except Tamilnadu coast and Andaman Nicobar Island, where the same is nergative (around -1 hPa).
- Rainfall occurred at many places over Tamilnadu coast and coastal Andha Pradesh during past 24 hrs..
- Buoys data show that SST around 29^0C over the central Bay of Bengal.

Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST is around 29 - 30^0C over Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy lies between 80 - 100 KJ cm^{-2} over southeast Bay of Bengal and less than 40 KJ cm^{-2} over north Bay of Bengal

Relative Vorticity:

- Relative vorticity at 850 hPa is of order $40*10^{-5}$ s^{-1} over southwest Bay of Bengal.

Convergence:

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

Divergence:

- Upper air divergence is positive of the order of $5 – 10*10^{-5}$ s^{-1} over southwest and westcentral Bay of Bengal.

Wind Shear:

- Wind Shear is of order 5 -10 knots over south and central Bay of Bengal.

Wind Shear Tendency:

- Negative (-5 to -10 knots) over south Bay of Bengal.
- **Upper tropospheric ridge**:
  - The upper tropospheric ridge line roughly runs along Lat 15.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 2 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 3, 4 & 5 during next 15 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 3 & 4 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone satellite inference 250900 UTC.

Broken low/medium clouds with embedded moderate to intense convection lies over Bay of Bengal between Lat.9.0^{0}N and Long.18.5^{0}N west of longitude 86.5^{0}E, rest Bay of Bengal south of Lat.11.5^{0}N, south Andaman Sea and Tenasserim coast..

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model forecast based on 0000 UTC of today shows formation of a low level CYCIR over southeast Arabian Sea on day1 and moves westward but shows no intensification during next 7 days. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model forecast based on 0000 UTC of today shows formation of a low level CYCIR over southeast Arabian Sea on day2 and moves westward. Model forecasts also show formation of a fresh CYCIR over southeast Arabian Sea on day4 and a CYCIR over southeast Bay of Bengal on day5 and both the CYCIRs moves westwards. None of the CYCIRs likely to intentnsify during next 7 days.
- **WRF-ARW** model shows no significant development during next three days.
- **UKMET** model also shows no significant development during 5 days.
- **NCMRWF-GFS** model also shows no significant development during next five days.
- http://www.imd.gov.in/section/nhac/dynamic/welcome.htm

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows scattered cell of GPP of 30 over southern parts of Bay of Bengal and Arabian Sea but there is no significant development in GPP in analysis and upto 48 hours forecast. GPP charts of analysis and 24 hours are enclosed here with in **Annexure III**

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

Summary and Conclusion:

- Synoptic and NWP models show that easterly wind will be strengthening over Tamilnadu and neighbourhood and a low pressure area may form over southwest Bay of Bengal off south Tamilnadu coast by 29th. Oct 2011.

Advisory:

- No significant weather system over Bay of Bengal.
- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	24/12	**25/00**	**25/03**
India	186/205	128/159	192/208
Coastal stations			
WB	11/11	5/11	11/11
Odisha	10/10	6/10	10/10
AP	18/18	16/18	18/18
Tamil Nadu	14/14	11/14	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	16	16	17
Myanmar	16	13	17
Thailand	1	1	1
Sri Lanka	12	13	13

AWS

Region	Date/Time (UTC)		
	24/12	**25/00**	**25/03**
India	455/616	509/616	490/616

WB	20	19	16
ODS	28	28	27
AP	32	32	29
TN	26	26	31
PDC	1	1	1

- **RS/RW** (12Z) of 24 -10-2011: 10/39
- **No. of Ascents reaching 250 hPa levels: 5, MISDA:-**29
- **RS/RW** (00Z) of 25 -10-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 25 , MISDA: 4**

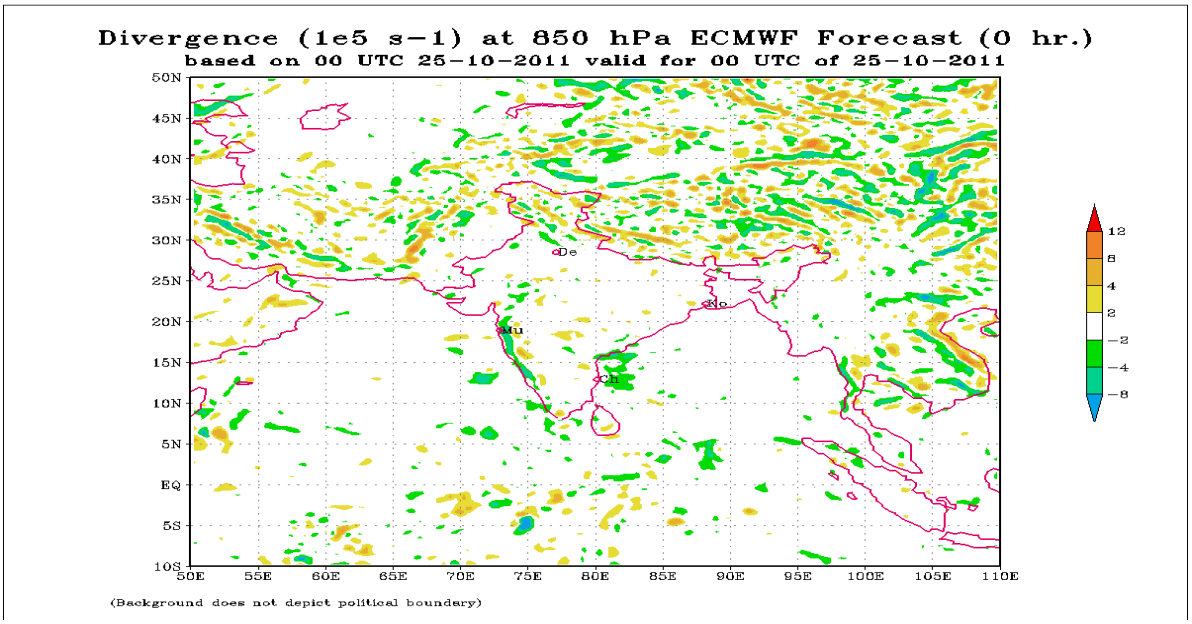
No. of PILOT Ascents

24/12Z	25/00Z
14/37	19/34

Buoy Data

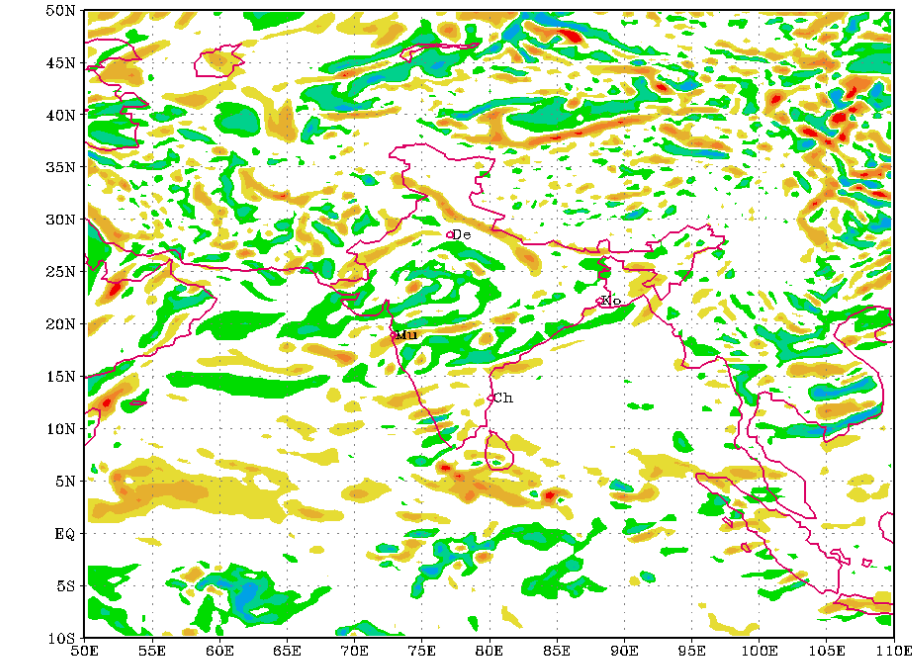
24/12Z	25/00Z	25/03Z
11	11	9

Annexure II



Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

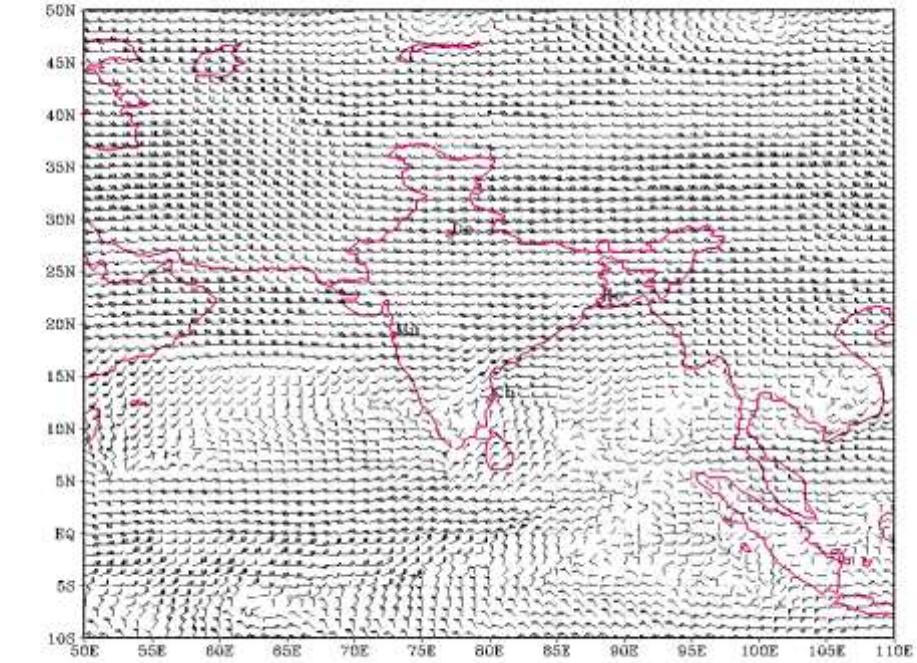
based on 00 UTC 25−10−2011 valid for 00 UTC of 25−10−2011



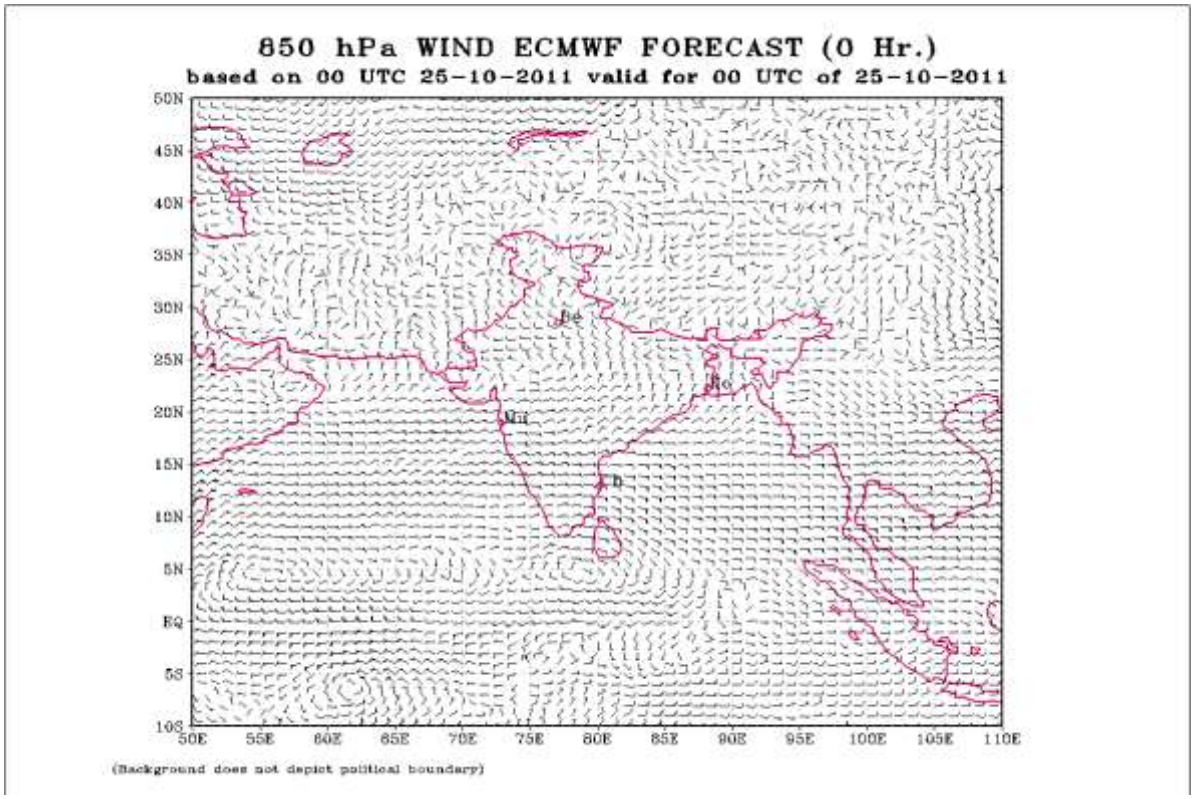
(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

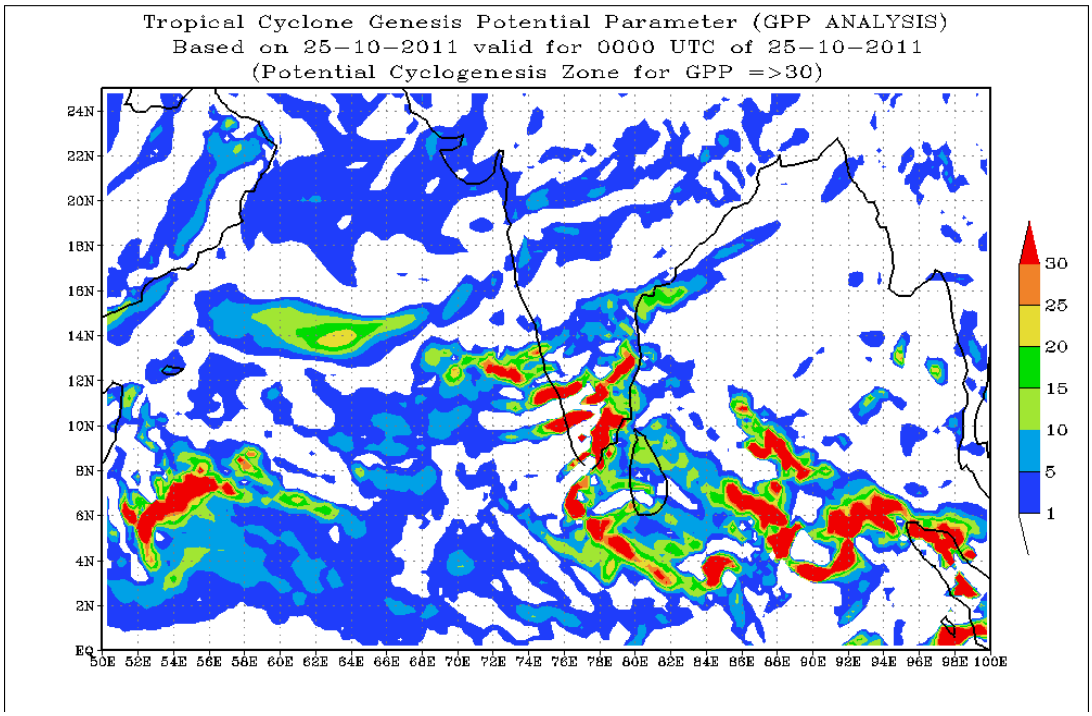
based on 00 UTC 25−10−2011 valid for 00 UTC of 25−10−2011

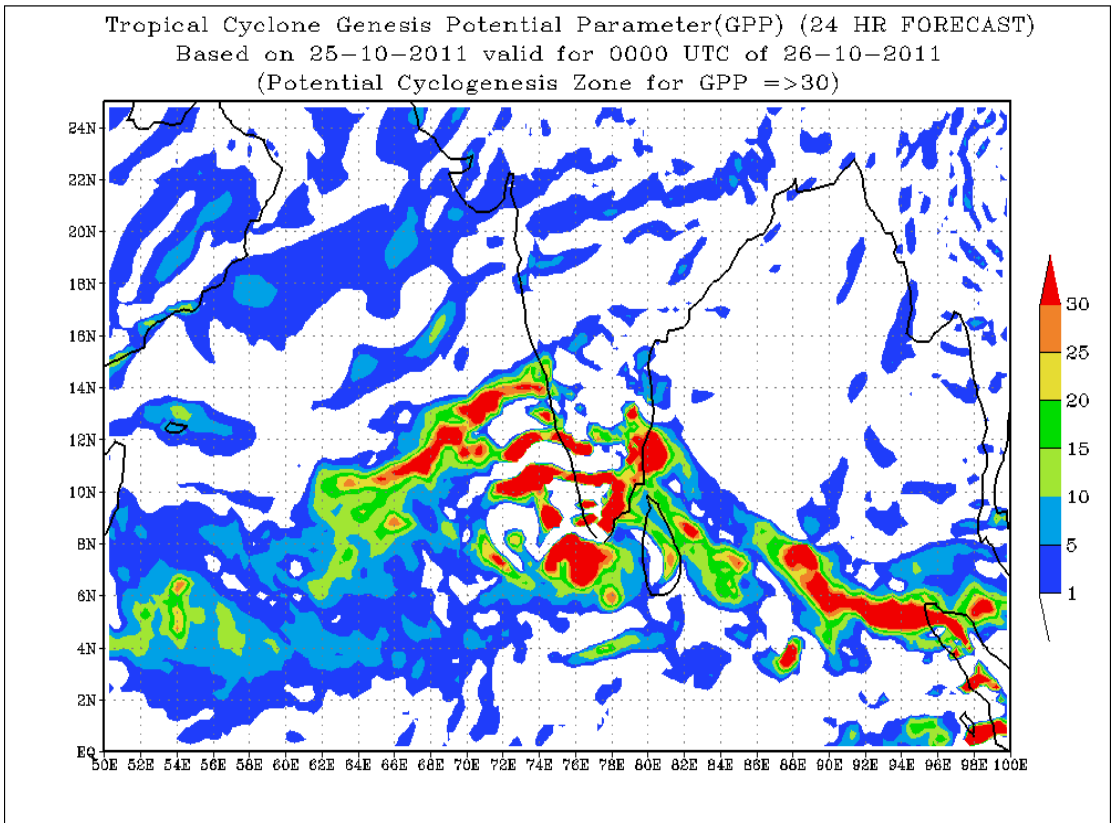


(Background does not depict political boundary)



Annexure-III





FDP (Cyclone) NOC Report Dated 26 October, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 5^0 N over North Indian Ocean.
- Yesterday's trough of low pressure on mean Sea level from eastcentral to southwest Bay across westcentral Bay of Bengal has become less marked.
- 24 hrs. pressure change is positive (around 1 hPa) along the east coast of India, Andaman & Nicobar islands, Bangladesh and Myanmar coast..
- Rainfall occurred at most places over Tamilnadu coast and coastal Andhra Pradesh during past 24 hrs..
- Buoys data show that SST around 28-29^{0}C over the central Bay of Bengal.

Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST is around 29 - 30^{0}C over Bay of Bengal southwest and westcentral Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy lies between 80 - 100 KJ cm^{-2} over south Bay of Bengal and 60-80 KJ cm^{-2} over central Bay of Bengal

Relative Vorticity:

- Relative vorticity at 850 hPa is of order $25*10^{-5}$ s^{-1} over southwest Bay of Bengal.

Convergence:

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

Divergence:

- Upper air divergence is positive of the order of 5 – $10*10^{-5}$ s^{-1} over south Bay of Bengal.

Wind Shear:

- Wind Shear is of order 10–20 knots over south and 5-10 knots over central Bay of Bengal.

Wind Shear Tendency:

- Positive (5 to 10 knots) over south Bay of Bengal.
- **Upper tropospheric ridge**:
  - The upper tropospheric ridge line roughly runs along Lat 15.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 2 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 3, 4 & 5 during next 15 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 3 & 4 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone satellite inference 260900 UTC.

Broken low/medium clouds with embedded isolated moderate to intense convection lies over south Bay of Bengal & Andaman Sea and weak to moderate convection lies over westcentral; Bay of Bengal..

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis 0000 UTC of today shows no significant change in weather during next 5 days. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model shows no significant weather over Bay of Bengal during next 5 days.
- **WRF-ARW** model shows no significant weather during next three days. A low pressure isl likely to form over southeast Arabian Sea on day 3.
- **UKMET** model also shows no significant development during 96 hours, except a feeble low-level lying over the Southwest Arabian Sea on day5
- **NCMRWF-GFS** model also shows no significant development during next five days.
- http://www.imd.gov.in/section/nhac/dynamic/welcome.htm)

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows that there is no significant development in GPP in analysis and upto 48 hours forecast over Bay of Bengal GPP charts of 24 hours and 48 hours are enclosed here with in **Annexure III**

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

Summary and Conclusion:

- Synoptic and NWP models show that easterly wind of 15-20 knots would prevail over central Bay of Bengal during next 3 days and a low pressure area may form over southwest Bay of Bengal off south Tamilnadu coast by 29th. Oct 2011.

Advisory:

- No significant weather system over Bay of Bengal.
- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	25/12	**26/00**	**26/03**
India	190/205	128/159	187/208
Coastal stations			
WB	10/11	4/7	11/11
Odisha	10/10	5/6	10/10

AP	18/18	17/18	17/18
Tamil Nadu	14/14	11/14	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	16	13	8
Myanmar	11	12	10
Thailand	1	1	1
Sri Lanka	12	12	12

AWS

Region	**Date/Time (UTC)**		
	25/12	**26/00**	**26/03**
India	454/616	499/616	513/616
WB	20	18	20
ODS	29	28	29
AP	33	32	31
TN	27	26	26
PDC	0	0	0

- **RS/RW** (12Z) of 25 -10-2011: 11/39
- **No. of Ascents reaching 250 hPa levels:4 , MISDA:-**28
- **RS/RW** (00Z) of 26 -10-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 25 , MISDA: 4**

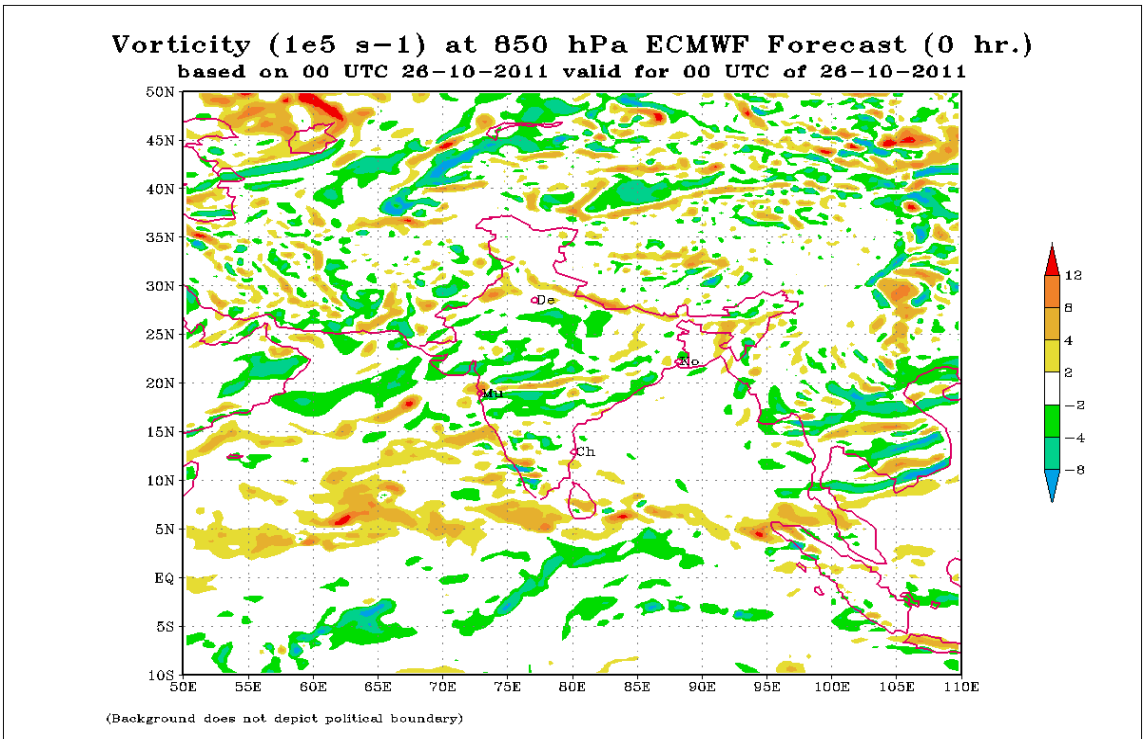
No. of PILOT Ascents

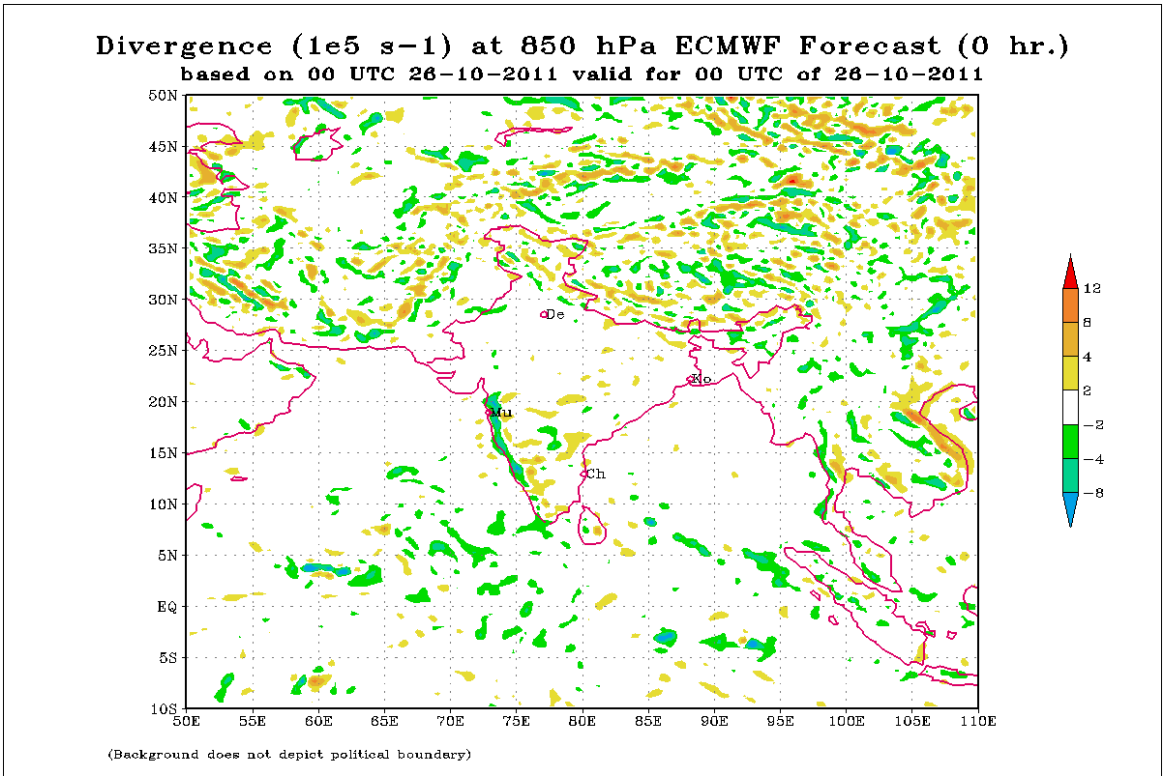
25/12Z	**26/00Z**
20/37	19/34

Buoy Data

25/12Z	**26/00Z**	**26/03Z**
10	11	11

Annexure II


Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 26−10−2011 valid for 00 UTC of 26−10−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
De
No
Mu
Ch
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)


Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 26−10−2011 valid for 00 UTC of 26−10−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
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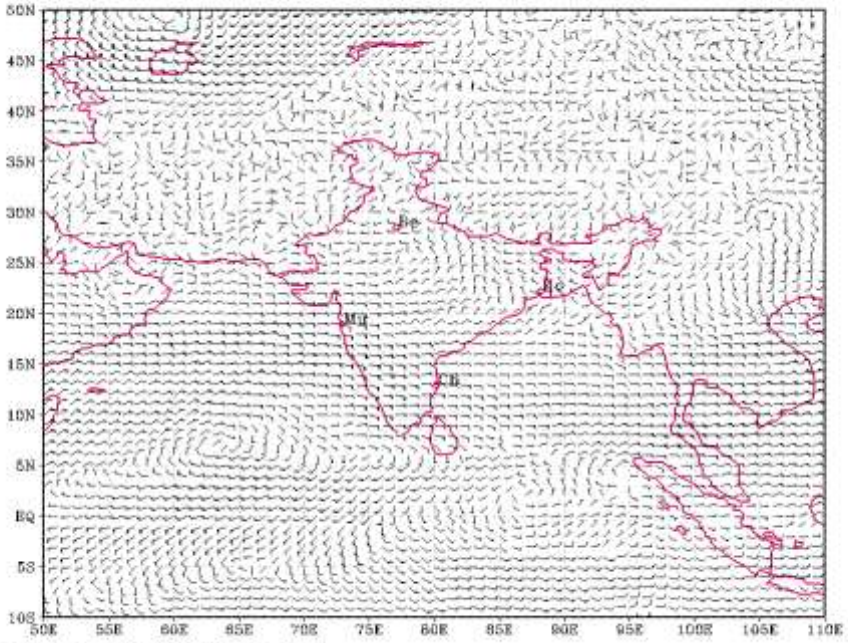
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)

850 hPa WIND ECMWF FORECAST (0 Hr.)

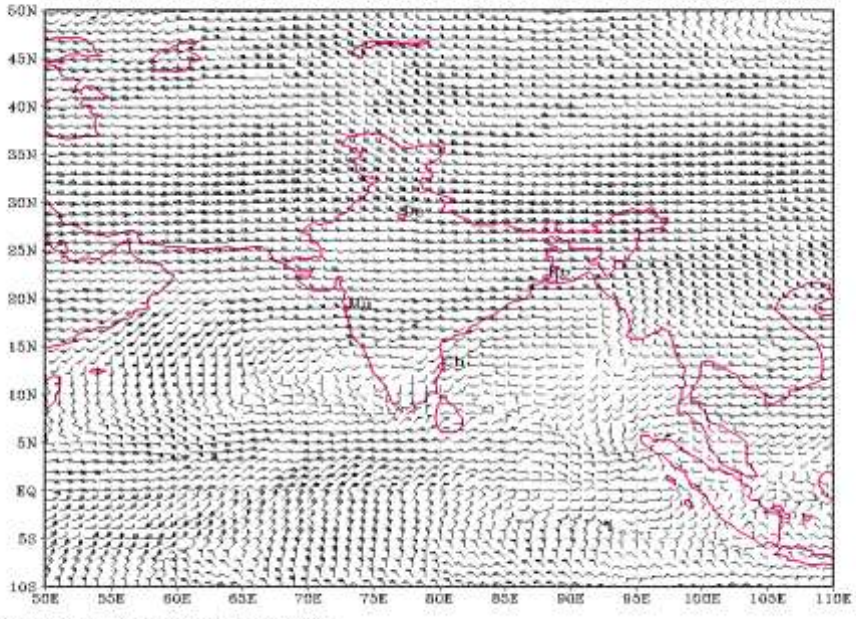
based on 00 UTC 26-10-2011 valid for 00 UTC of 26-10-2011



(Background does not depict political boundary)

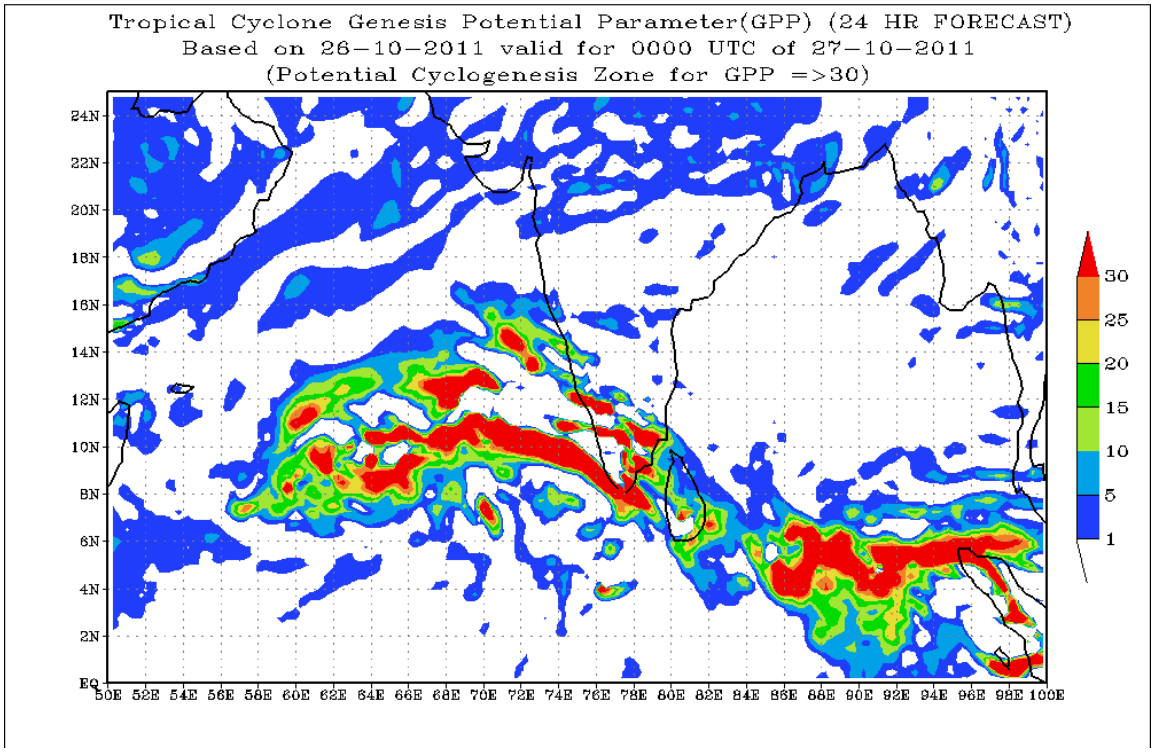
Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

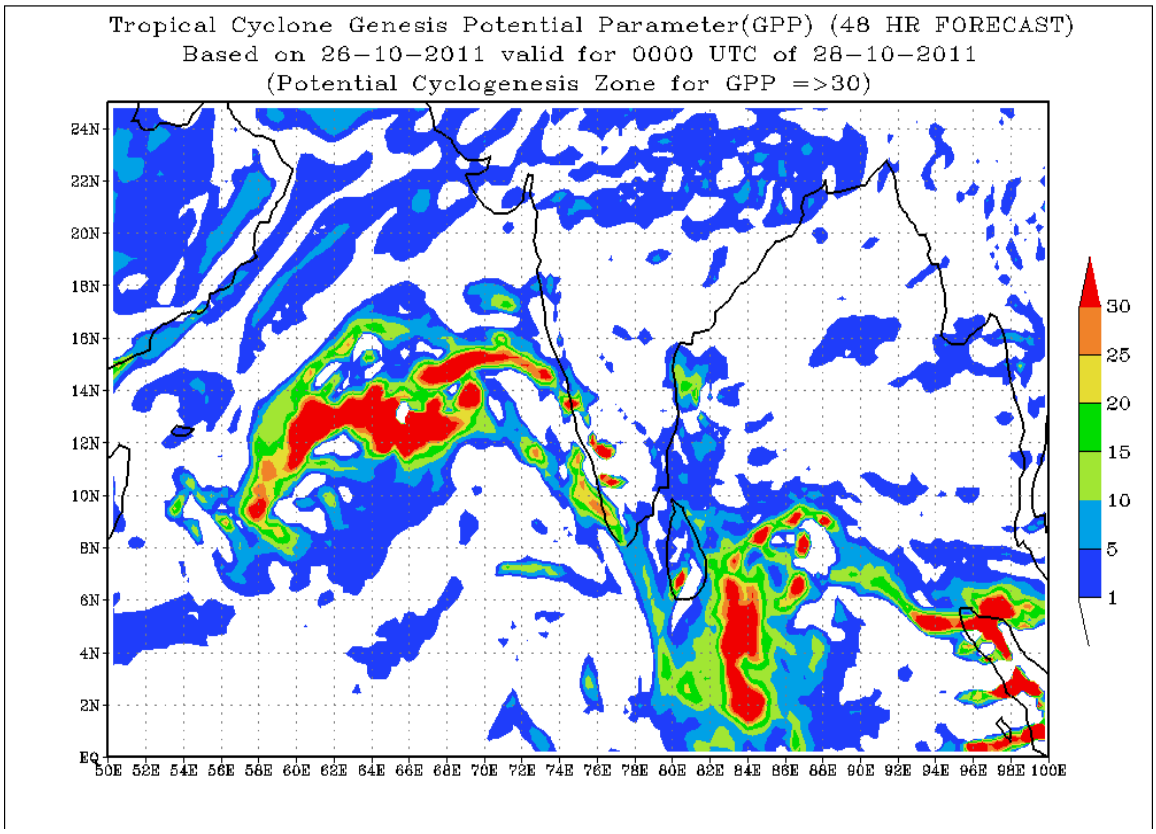
based on 00 UTC 26-10-2011 valid for 00 UTC of 26-10-2011



(Background does not depict political boundary)

Annexure-III





FDP (Cyclone) NOC Report Dated 27 October, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 5^0 N over North Indian Ocean.
- Yesterday's trough of low at mean Sea level extending from southwest to west central Bay of Bengal now extends from south Bay of Bengal to south Arabian Sea.
- 24 hrs. pressure change shows no significant change along the east coast of India, Andaman & Nicobar islands, Bangladesh and Myanmar coast.
- Rainfall occurred at most places over Tamilnadu coast and coastal Andhra Pradesh during past 24 hrs.
- Buoys data show that SST around 29^0C over the central Bay of Bengal.

Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST is around 28 - 30^0C over Bay of Bengal southwest and westcentral Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy lies between 80 - 100 KJ cm^{-2} over Bay of Bengal except north Bay of Bengal where it is less than 20 KJ cm^{-2} .

Relative Vorticity:

- Relative vorticity at 850 hPa is negative and of order 20-40*10^{-5} s^{-1} over central Bay of Bengal and positive of the order of 20*10^{-5} s^{-1} over southwest and east central Bay of Bengal.

Convergence:

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

Divergence:

- Upper air divergence is positive of the order of 5 – 10*$10^{-5}s^{-1}$ over southwest and adjoining westcentral Bay of Bengal and southeast Bay of Bengal.

Wind Shear:

- Wind Shear is of order 30-40 knots over north Bay of Bengal and 10-20 knots over the rest Bay of Bengal.

Wind Shear Tendency:

- Positive (5 to 10 knots) over east central and southeast Bay of Bengal and negative (-5 to -10 knots) over westcentral Bay of Bengal and adjoining areas.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat. 15.0^0N at 200 hPa level.

M.J.O. Index:

- Located over phase 2 with amplitude less than 1.0.
- Statistical forecast: - MJO moves through phase 3, 4 & 5 during next 15 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 3, 4 & 5during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone satellite inference 270900 UTC.

Broken low/medium clouds with embedded isolated moderate to intense convection lies over southeast Bay of Bengal, extended westcentral Bay of Bengal & south Andaman Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today shows formation of a low pressure area over southwest Arabian Sea. The system likely to move west northwestward but shows no intensification during next 7 days. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model forecast based on 0000 UTC of today shows formation of a low level CYCIR over southwest Arabian Sea on day1 and another CYCIR over COMORIN on day2. Both the systems moves westward but shows no intensification during next 7 days.
- **WRF-ARW** model shows formation of a low level CYCIR over southwest Arabian Sea on day2 and moves westward but shows no intensification.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows scattered cell of GPP of 30 over southern parts of Bay of Bengal and Arabian Sea. The organization of GPP cell over westcentral and adjoining southwest Arabian Sea indicates the potential zone of cyclogenesis over the area but disorganization of the cell from day3 indicates no significant development thereafter. GPP charts of analysis and three days forecasts are enclosed here with in **Annexure III**

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

Summary and Conclusion:

- Synoptic and NWP models show easterly wind of 15-20 knots would prevail over central Bay of Bengal during next 3 days and a low pressure area may form over southwest Bay of Bengal off south Tamilnadu coast by 29th Oct 2011.

Advisory:

- No significant weather system over Bay of Bengal.
- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	26/12	**27/00**	**27/03**
India	187/205	126/159	190/208
Coastal stations			
WB	11/11	5/7	11/11
Odisha	10/10	6/7	10/10

AP	18/18	17/17	18/18
Tamil Nadu	14/14	11/14	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	12	10	11
Myanmar	7	8	7
Thailand	1	1	1
Sri Lanka	10	10	10

AWS

Region	**Date/Time (UTC)**		
	26/12	**27/00**	**27/03**
India	544/616	537/616	464/616
WB	20	19	4
ODS	29	28	28
AP	32	32	27
TN	27	26	25
PDC	0	0	0

- **RS/RW** (12Z) of 26 -10-2011: 11/39
- **No. of Ascents reaching 250 hPa levels:4 , MISDA:-**28
- **RS/RW** (00Z) of 27 -10-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 21, MISDA: 4**

No. of PILOT Ascents

26/12Z	**27/00Z**
13/37	15/34

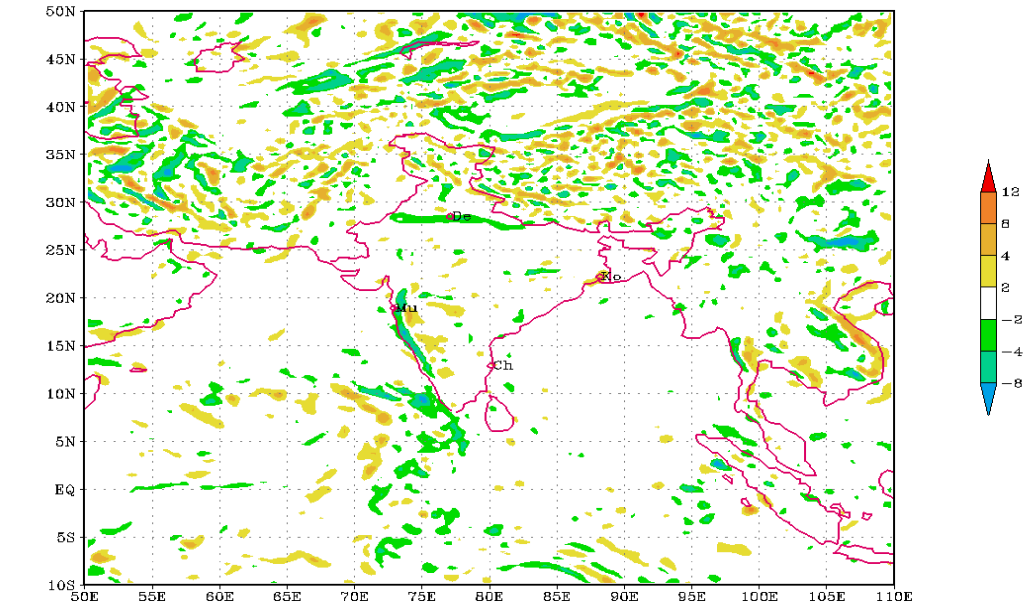
Buoy Data

26/12Z	**27/00Z**	**27/03Z**
14	8	13

Annexure II

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

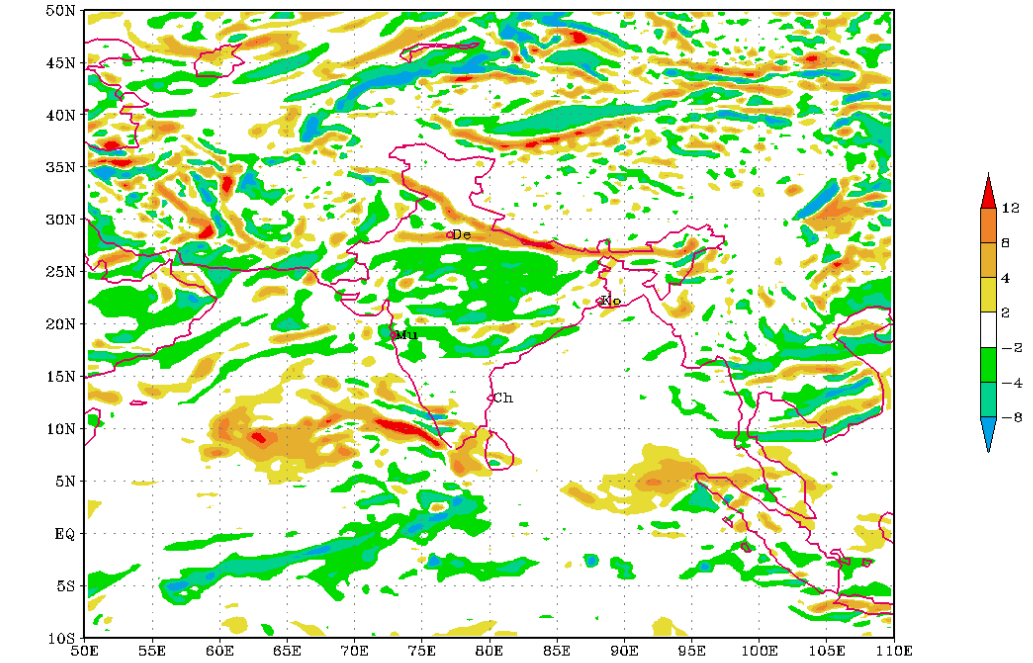
based on 00 UTC 27-10-2011 valid for 00 UTC of 27-10-2011



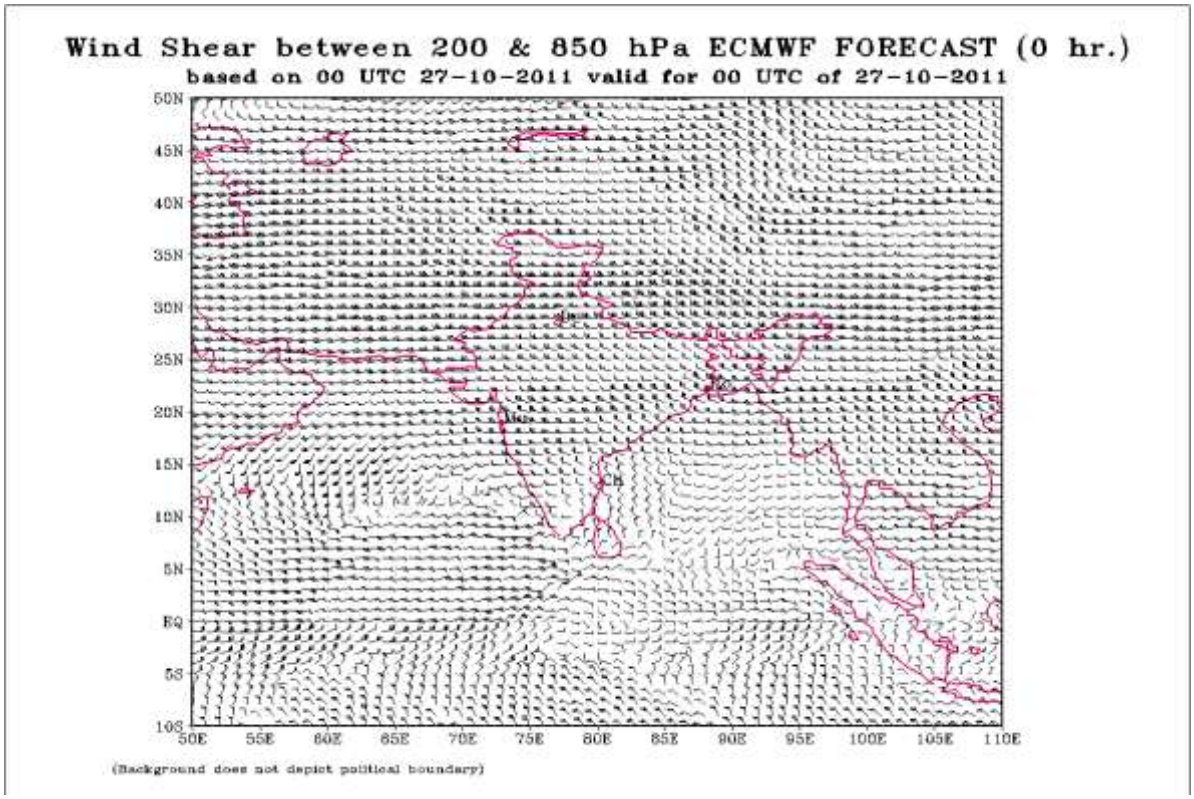
(Background does not depict political boundary)

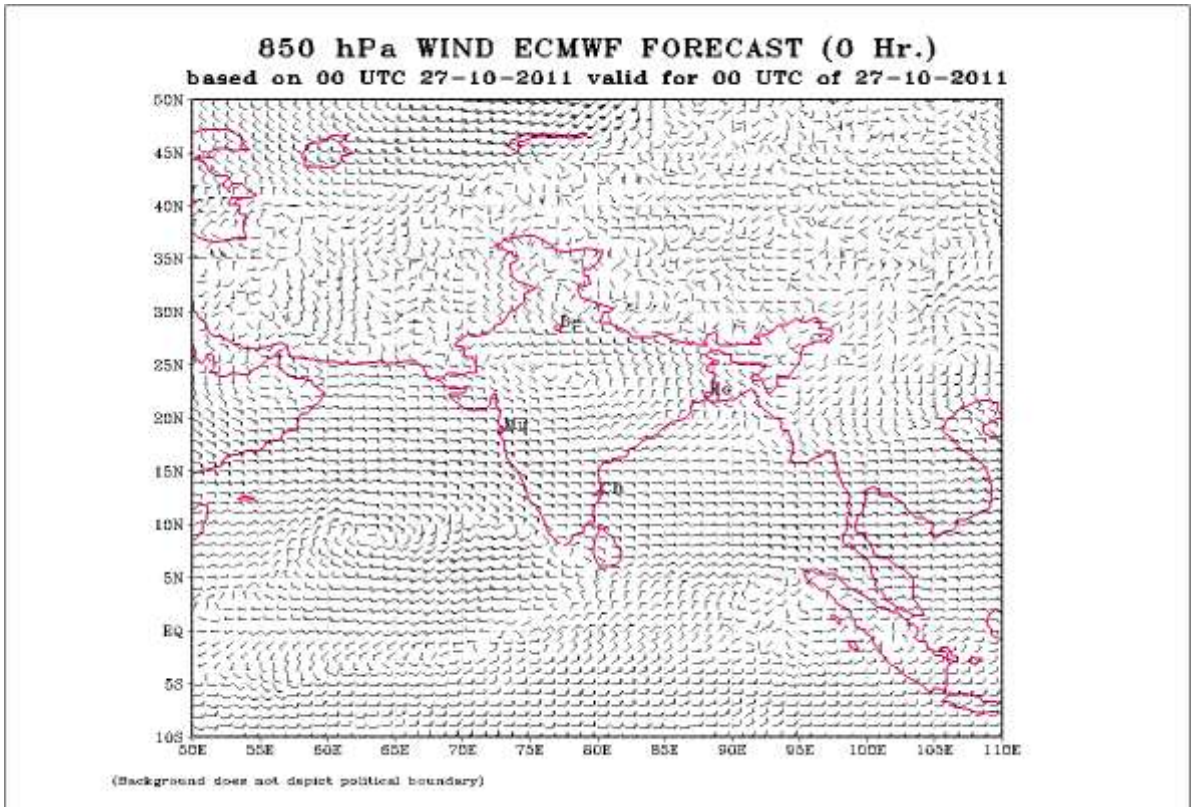
Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

based on 00 UTC 27-10-2011 valid for 00 UTC of 27-10-2011



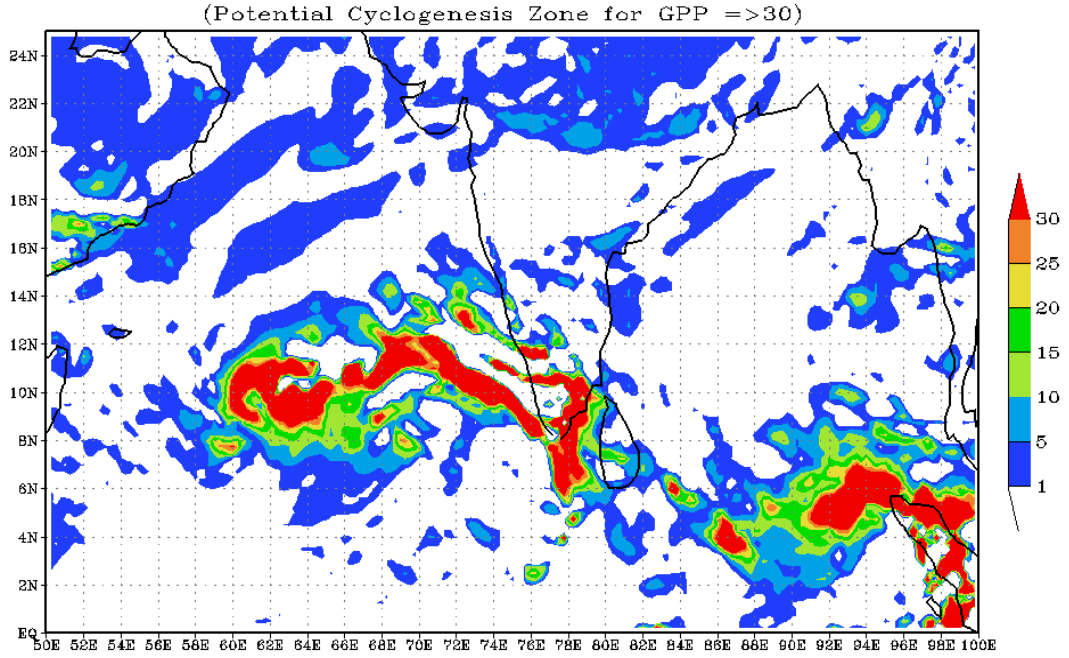
(Background does not depict political boundary)



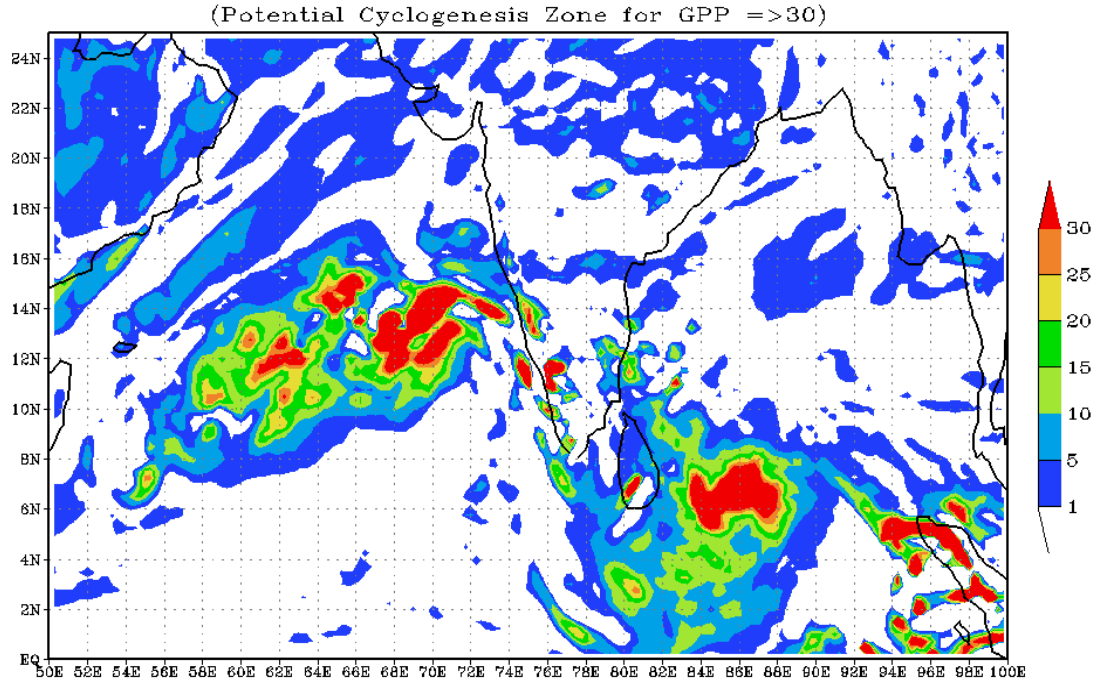


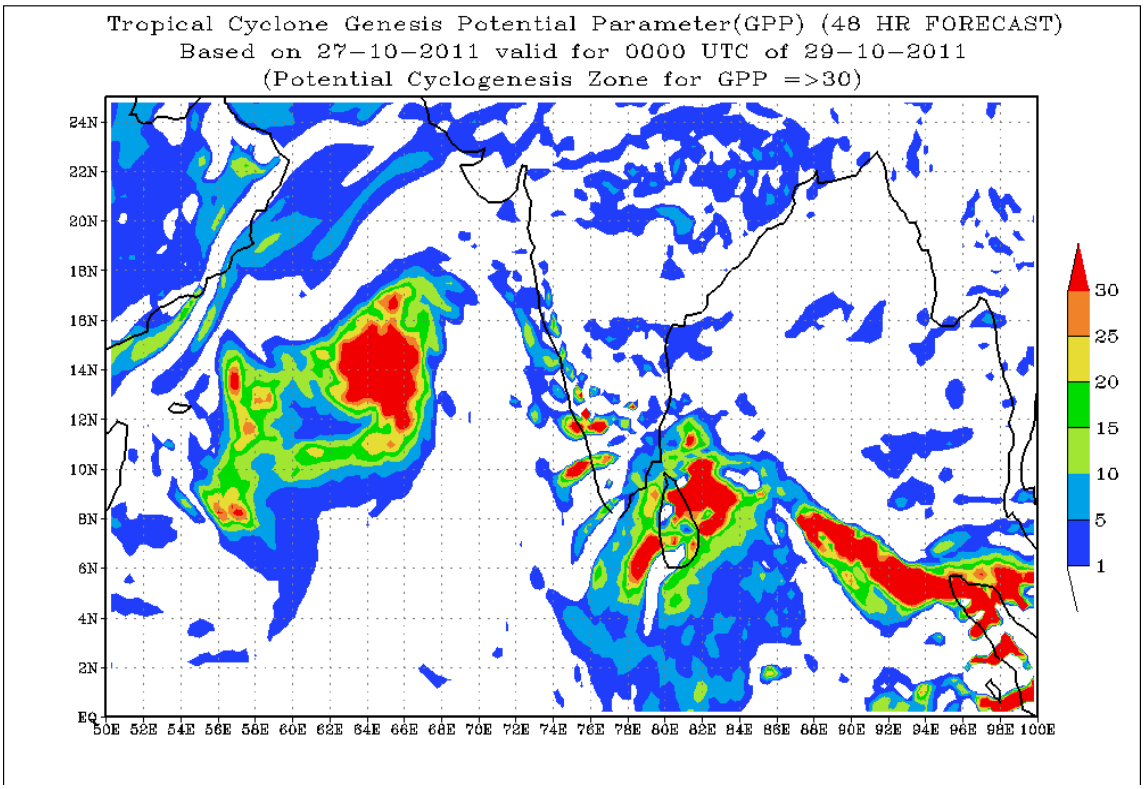
Annexure-III

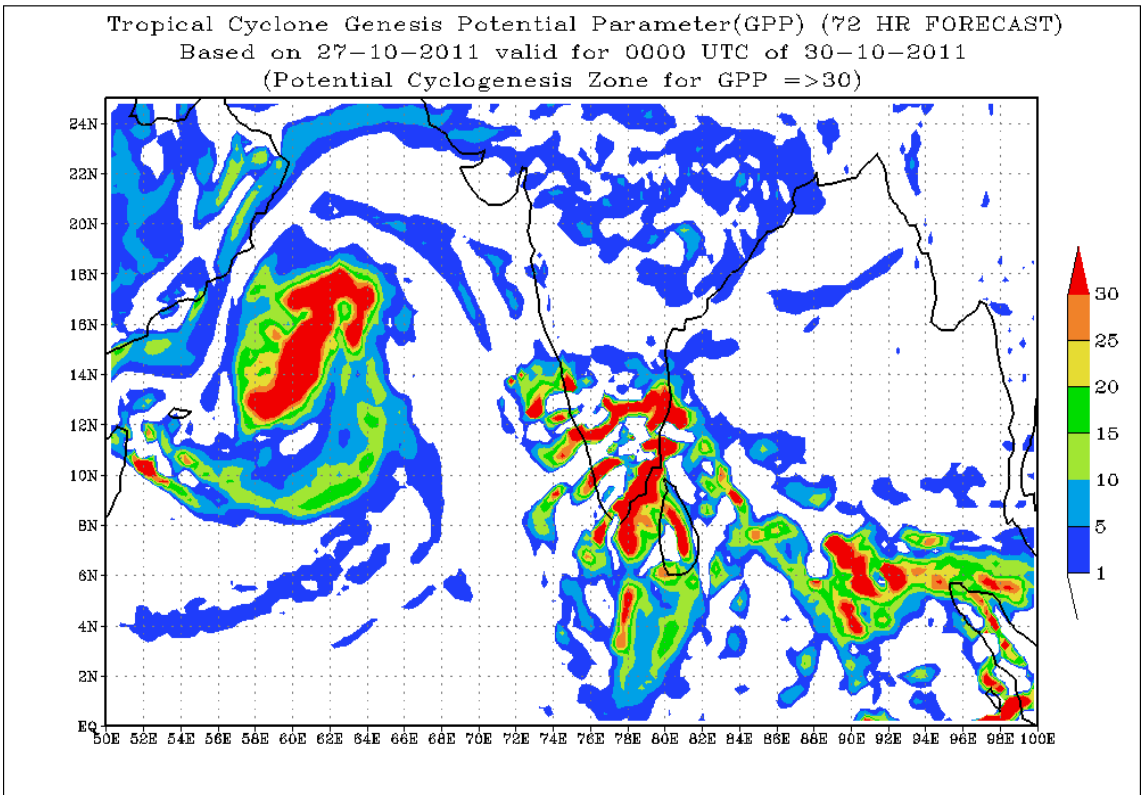
Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 27-10-2011 valid for 0000 UTC of 27-10-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 27-10-2011 valid for 0000 UTC of 28-10-2011
(Potential Cyclogenesis Zone for GPP =>30)







FDP (Cyclone) NOC Report Dated 29 October, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 5^0 N over Bay of Bengal and around 10^0 N over Arabian Sea.
- A cyclonic circulation extending upto mid tropospheric levels lies over Commorin area and neighbourhood.
- A depression has formed over west central and adjoining southwest Arabian Sea and lay centred at 0600 UTC of today, the 29th October 2011 near latitude 13.0^0N and longitude 62.0^0E.
- 24 hrs. pressure change shows change of -0.5 to -1.0 along east coast of India and -0.5 to -1.5 over Andaman Islands.
- Rainfall has occurred at most places over Tamilnadu and Rayalaseema at many places over Andaman & Nicobar Islands during past 24 hrs..
- Buoys data show that SST around 29^0C over the central Bay of Bengal.

Environmental features based on 0300 UTC of today:

Sea Surface Temperature:

- SST is around 30 - 32^0C over southwest and westcentral Bay of Bengal and southeast & central Arabian Sea.

Ocean thermal energy:

- Ocean thermal energy lies between 80 - 100 KJ cm^{-2} over south Bay of Bengal except north Bay of Bengal where it is less than 40 KJ cm^{-2} .

Relative Vorticity:

- Relative vorticity at 850 hPa is positive order of 20 - $40*10^{-5}$ s^{-1} over Comorin area & south Tamil Nadu coast and of $20*10^{-5}$ s^{-1} over Andaman Sea.
- Lower level convergence is of order of 10 - $20*10^{-5}s^{-1}$ over Comorin area and south Tamil Nadu coast

Divergence:

- Upper air divergence is positive of the order of 5 – $10*10^{-5}s^{-1}$ over Comorin area and south Tamil Nadu coast..

Wind Shear:

- Wind Shear is of order 5 - 10 knots over Comorin area and south Tamil Nadu coast.

Wind Shear Tendency:

- .Positive (5 to 10 knots) over Commorin area and south Tamil Nadu coast.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 10.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 2 with amplitude less than 1.0.
- Statistical forecast: - MJO moves through phase 3, 4 & 5 during next 15 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 3, 4 & 5during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean. A depression is lying over westcentral Arabian Sea.

Status of observational system:

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

Satellite

FDP cyclone satellite inference 290900 UTC.

Broken low/med clouds with embedded moderate to intense convection over south Bay adjoining westcentral bay.

Vortex over central Arabian Sea adjoin south Arabian Sea centred near 13.0^0N latitude and 61.0^0E longitude with intensity T1.5.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today shows a low pressure area over southwest Arabian Sea. The system is likely to move west northwestward but shows no intensification during next 3 days. However, on day 3 a fresh CYCIR is likely to develop over COMORIN and adjoining regions of south Tamilnadu coast and is likely to become well marked low on day 4 and day 5. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.

- **IMD-GFS** model analysis based on 0000 UTC of today shows low level CYCIR lying over southwest Arabian Sea and likely to move westwards during next three days. However, this does not show any intensification. Another fresh CYCIR forms over Maldives region on day 3. The system is likely to move westward and to intensify to depression.

- **WRF-ARW** model analysis shows low level CYCIR lying over southwest Arabian Sea and moves westward but shows no intensification.

- **UKMET** model analysis shows low level CYCIR lying over southwest Arabian Sea and moves westwards during next 3 days, but does not show intensification. A fresh CYCIR is likely to develop over South Tamilnadu coast on day 3.

- **NCMRWF-GFS** model analysis shows low level CYCIR lying over southwest Arabian Sea and likely to move westwards during next 3 days but shows no

intensification. However, there is likely formation of new CYCIR over COMORIN region on day 3 and is likely to intensify into a cyclonic storm and move westward.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows cell of GPP of 30 over westcentral Arabian Sea and adjoining areas. The GPP cell over westcentral and adjoining southwest Arabian Sea is organized on day 1 and day 2, but disorganization of the cell from day3 indicates no significant development thereafter. GPP charts of three days forecasts are enclosed here with in **Annexure III (**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm**)**

Summary and Conclusion:

Synoptic and NWP models suggest that

- A cyclonic circulation may form over south Sri Lanka coast and move towards southern peninsular India tips by 30th October 2011.
- Yesterday's low pressure intensified into depression is lying over westcentral and adjoining southwest Arabian Sea is likely move west- northwestwards towards Gulf of Aden.

Advisory:

- No significant weather system over Bay of Bengal till 31st October 2011.
- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	28/12	**29/00**	**29/03**
India	186/208	126/159	191/208
Coastal stations			
WB	11/11	5/7	11/11
Odisha	10/10	6/7	10/10
AP	18/18	17/17	18/18
Tamil Nadu	14/14	11/14	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1

Bangladesh	17	16	17
Myanmar	13	14	15
Thailand	1	1	1
Sri Lanka	14	12	13

AWS

Region	**Date/Time (UTC)**		
	28/12	**29/00**	**29/03**
India	456/616	500/616	452/616
WB	21	19	21
ODS	29	28	29
AP	31	32	29
TN	27	27	27
PDC	1	1	1

- **RS/RW** (12Z) of 28 -10-2011: 12/39
- **No. of Ascents reaching 250 hPa levels:4 , MISDA:-**27
- **RS/RW** (00Z) of 29 -10-2011: 34/39
- **No. of Ascents reaching 250 hPa levels: 14, MISDA: 4**

No. of PILOT Ascents

28/12Z	**29/00Z**
14/37	17/34

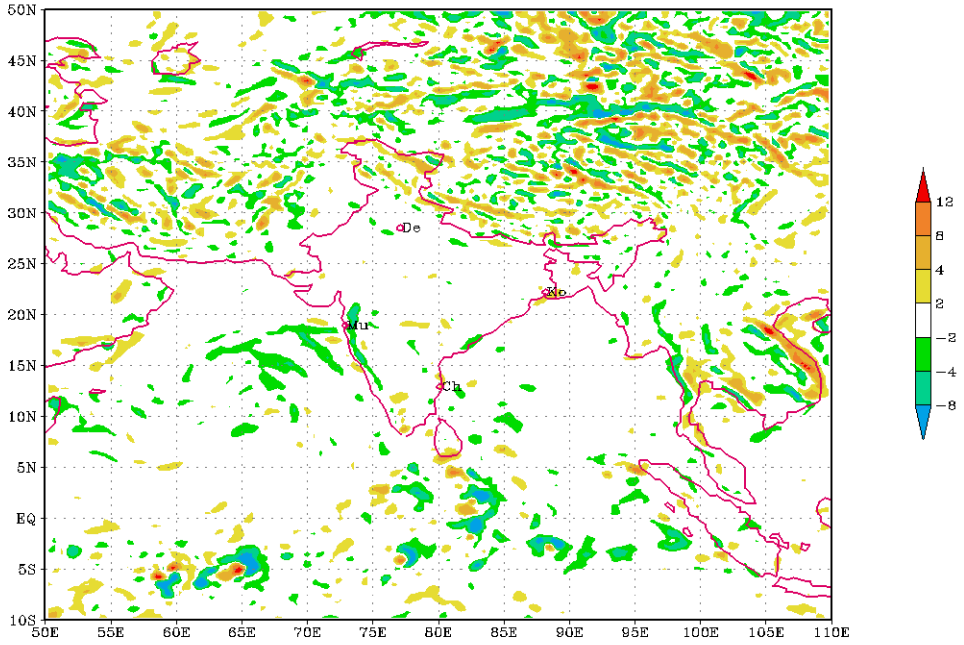
Buoy Data

27/12Z	**28/00Z**	**27/03Z**
6	9	11

Annexure II

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

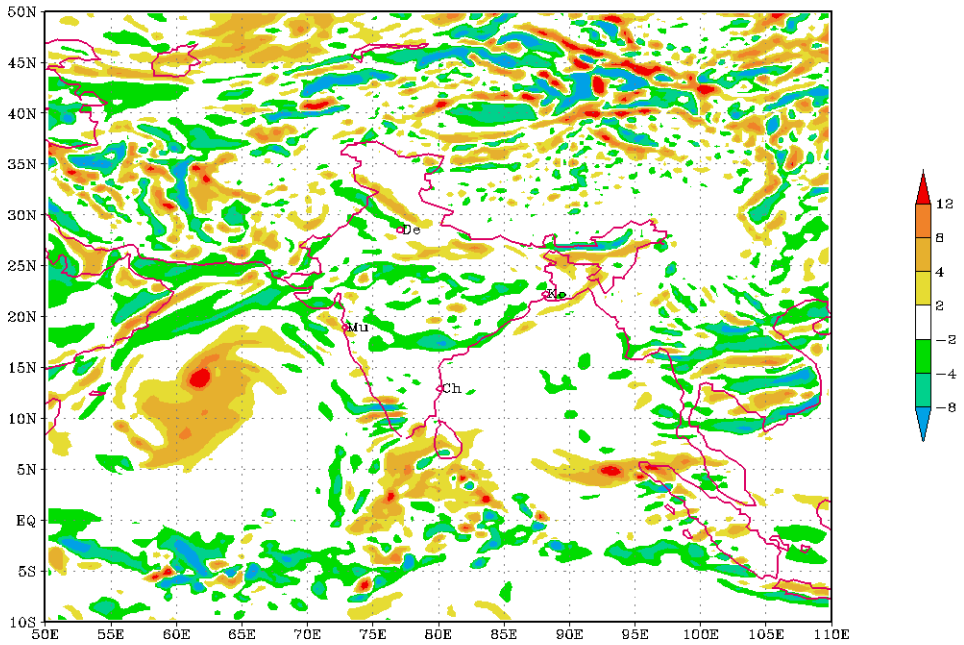
based on 00 UTC 29-10-2011 valid for 00 UTC of 29-10-2011



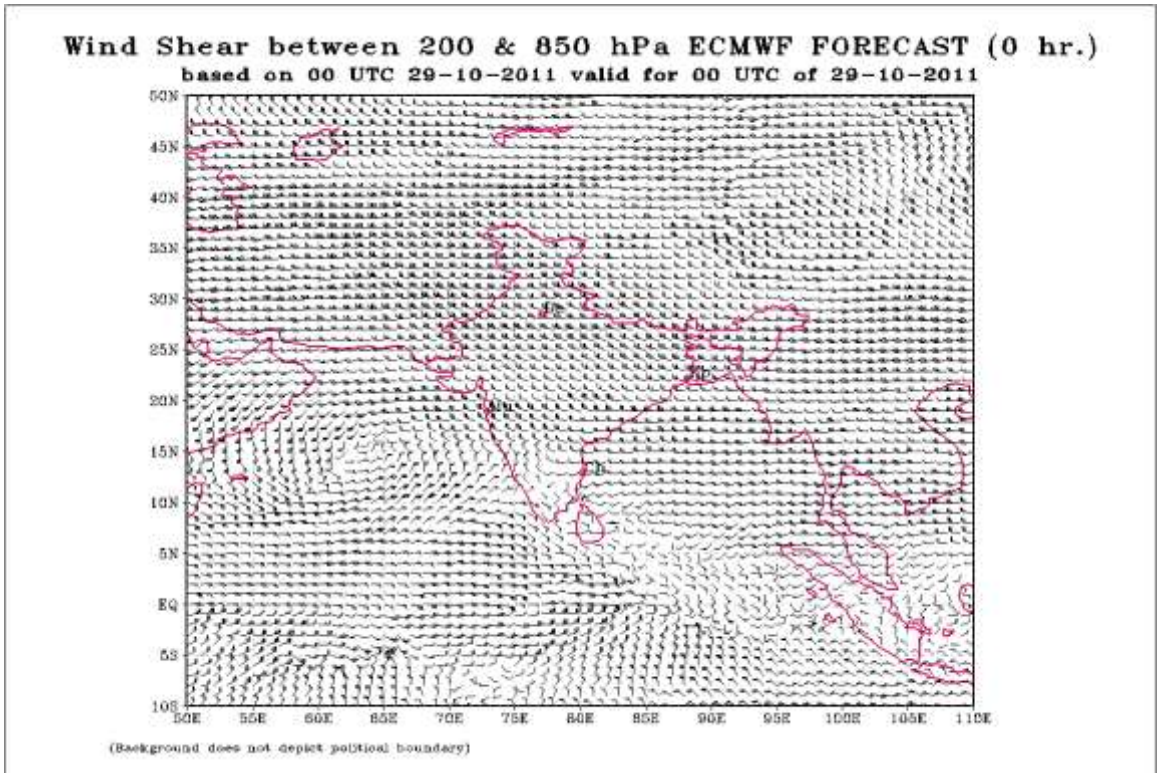
(Background does not depict political boundary)

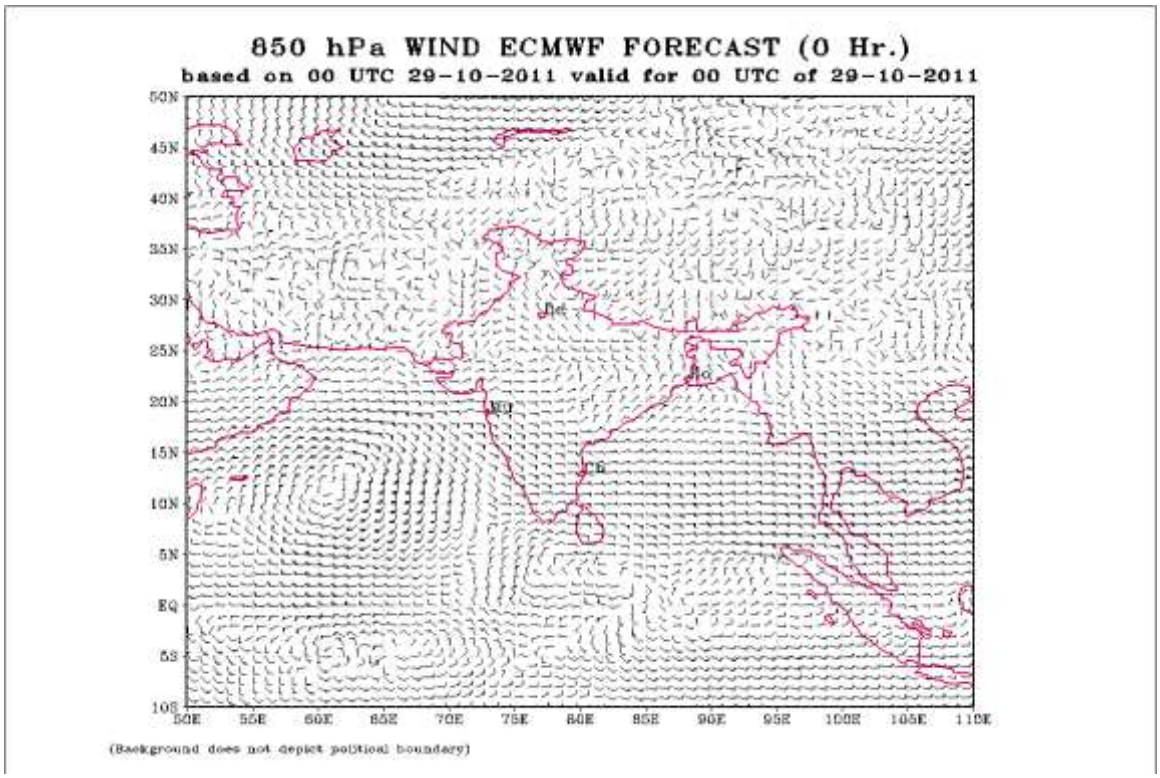
Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

based on 00 UTC 29-10-2011 valid for 00 UTC of 29-10-2011



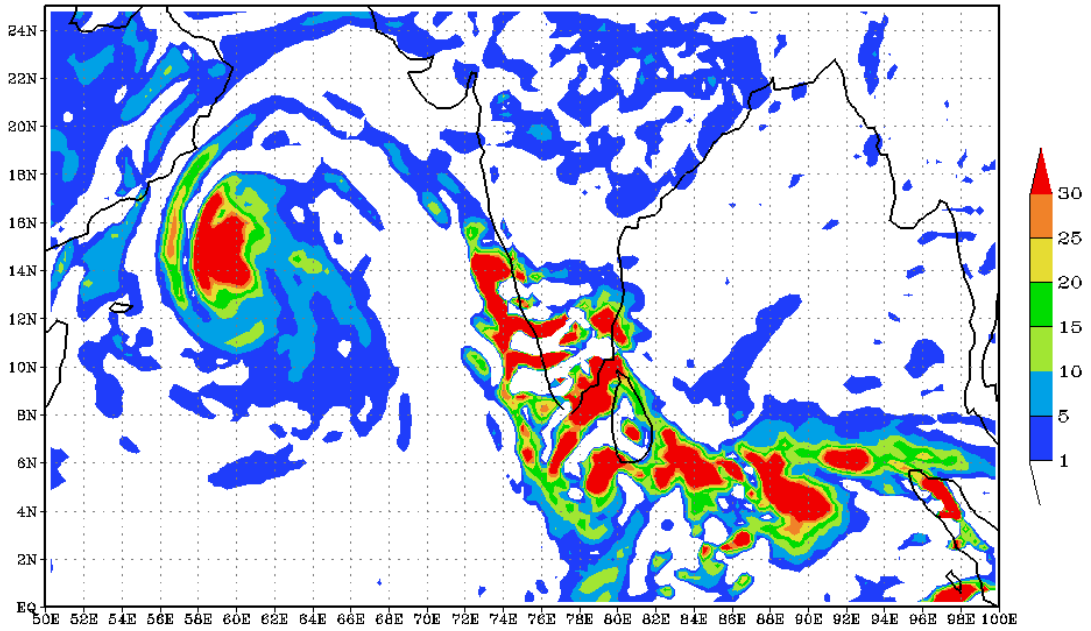
(Background does not depict political boundary)



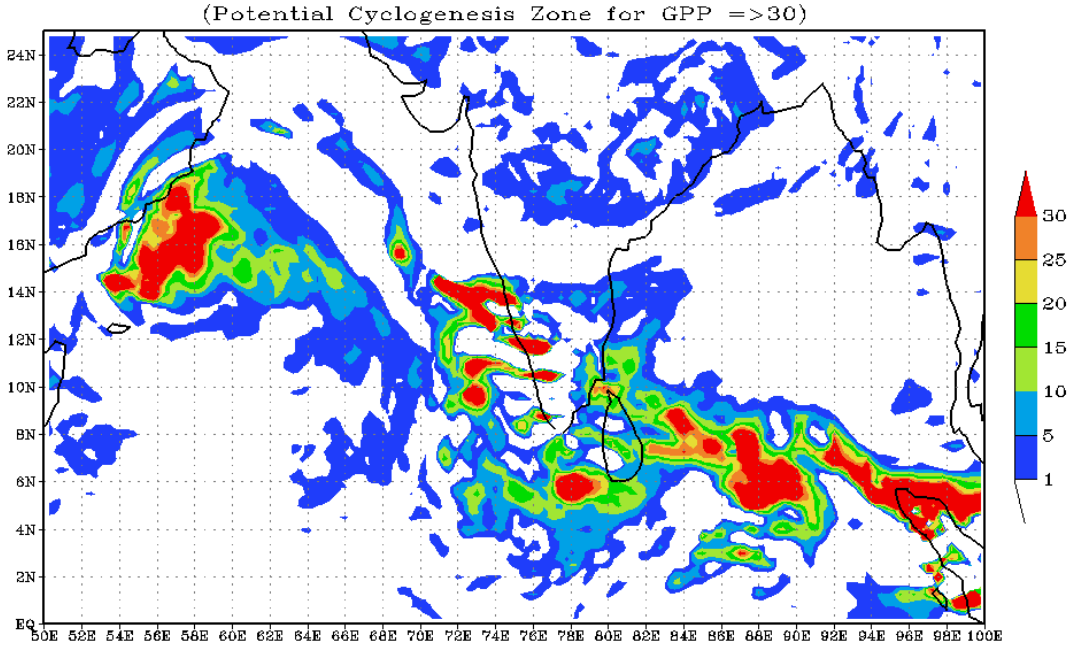


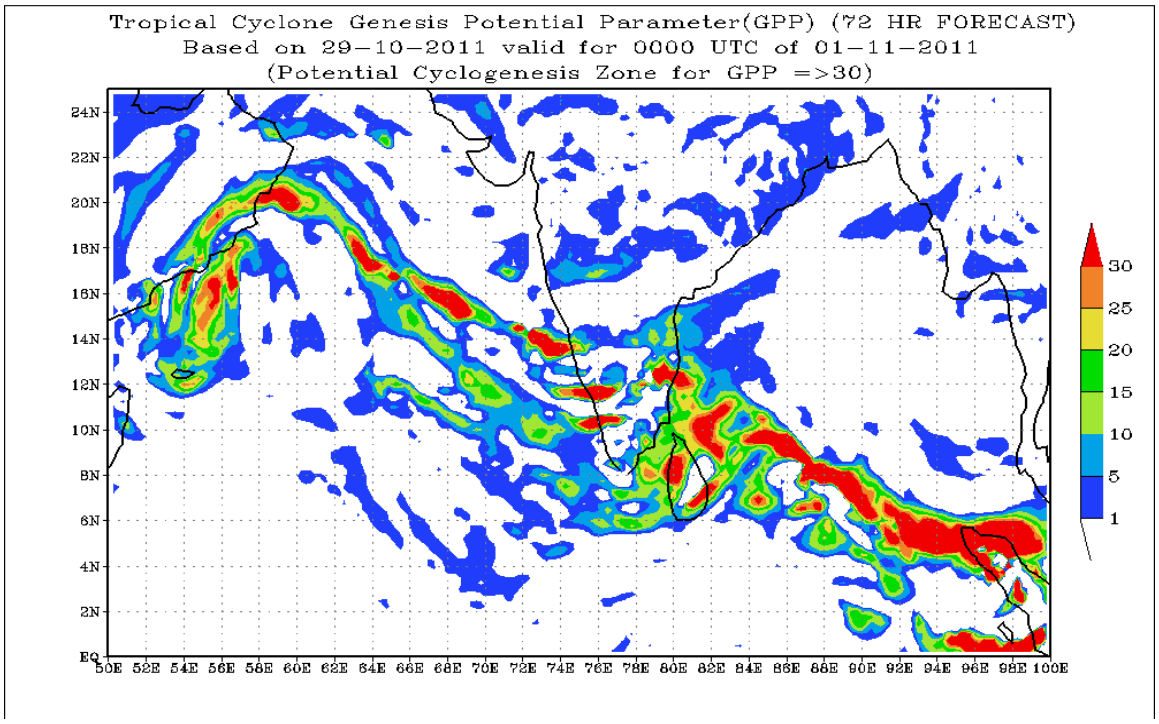
Annexure III

Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 29-10-2011 valid for 0000 UTC of 30-10-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 29-10-2011 valid for 0000 UTC of 31-10-2011
(Potential Cyclogenesis Zone for GPP =>30)





FDP (Cyclone) NOC Report Dated 30 October, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 6^0 N over Bay of Bengal and around 10^0 N over Arabian Sea.
- Yesterday's cyclonic circulation over Comorin area & neighbourhood persists and extends upto mid tropospheric levels.
- Yesterday's depression over west central and adjoining southwest Arabian Sea moved westwards and lay centred at 0300 UTC of today, the 30th October 2011 near latitude 13.0^0N and longitude 60.0^0E.
- 24 hrs. pressure change shows change of -0.5 to -1.0 along east coast of India and no significant change over Andaman & Nicobar Islands.
- Rainfall has occurred at most places over Tamilnadu and north coastal Andhra Pradesh with isolated heavy falls over the region and rainfall occurs at few places over Andaman & Nicobar Islands during past 24 hrs..
- Buoys data show that SST around 29^0C over north and central Bay of Bengal.

Environmental features based on 0900 UTC of today:

Sea Surface Temperature:

- SST is around 30 - 32^{0}C over southwest and westcentral Bay of Bengal and southeast & central Arabian Sea.

Ocean thermal energy:

- Ocean thermal energy lies between 80 - 100 KJ cm^{-2} over south Bay of Bengal except north Bay of Bengal where it is less than 40 KJ cm^{-2} .

Relative Vorticity:

- Relative vorticity at 850 hPa is positive order of 30 - 40*10^{-5} s^{-1} over Comorin area & south Bay of Bengal.

Convergence:

- Lower level convergence is of order of 10 - 20*10^{-5}s^{-1} over Comorin area & south Bay of Bengal.

Divergence:

- Upper air divergence is positive of the order of 10 – 20*10^{-5}s^{-1} over Comorin area & south Bay of Bengal.

Wind Shear:

- Wind Shear is negative and of order of 5-10 knots over Comorin area and south Tamilnadu coast.

Wind Shear Tendency:

- Negative (of order 5 knots) over Commorin area.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 8.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 2 with amplitude less than 1.0.
- Statistical forecast: - MJO moves through phase 3, 4 & 5 during next 15 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 3, 4 & 5during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean. A depression is lying over westcentral Arabian Sea.

Status of observational system:

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

Satellite

FDP cyclone satellite inference 300900 UTC.

Bay Of Bengal & Andaman Sea: -

Scattered low/medium clouds with embedded isolated moderate to intense convection over southwest Bay south Bay south of latitude 8.5º N and south Andaman Sea (.)Scattered low/med clouds with embedded isolated weak to moderate convection over rest central Bay northwest Andaman Sea (.)

Arabian Sea:

Vortex over central Arabian Sea adjoining south Arabian Sea centered near 13.5ºN/60.0ºE (.) Intensity T1.5 (.) Associated broken low/medium clouds with embedded intense to very intense convection over Arabian Sea between lat 10.0ºN to 20.0 ºN long 54.5 ºE to 65.0 ºE (.) Minimum ctt minus 83ºC (.) Wind shear is between 10kt to 15kts and water vapour wind indicates northwest movement of the system (.)

Broken low/med clouds with embedded moderate to intense convection over rest Arabian Sea east of long 67.0 º E (.)

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today shows a Deep Depression over westcentral Arabian Sea. The system is likely to move west northwestward and likely to intensify into a cyclonic storm on day4. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.

- **IMD-GFS** model analysis and forecast based on 0000 UTC of today shows a low pressure area over westcentral Arabian Sea. The system is likely to move west northwestward but shows no intensification. A fresh low pressure is likely to develop over southeast Arabian Sea off Kerala coast on day3 and is likely to move northwestward direction and become Depression on day 4 and and Deep Depression on day 5.

- **WRF-ARW** model analysis and forecast based on 0000 UTC of today shows a low pressure area over westcentral Arabian Sea. The system is likely to move west northwestward but shows no intensification. A fresh low pressure is likely to develop over southeast Arabian Sea off Kerala coast on day3.

- **UKMET** model analysis shows low level CYCIR lying over west central Arabian Sea and moves northwestwards, but does not show intensification.

- **NCMRWF-GFS** model analysis shows low level CYCIR lying over westcentral Arabian Sea and likely to move west northwards direction but shows no intensification. However, there is likely formation of new CYCIR over COMORIN region on day1 and is likely to intensify into a cyclonic storm on day3 and move west northwestward.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows cell of GPP of 30 over westcentral Arabian Sea. The organization of GPP cell over westcentral Arabian Sea indicates the Deep Depression is likely to intensify into cyclonic storm on day4. GPP charts of four days forecasts are enclosed here with in **Annexure III (**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm**)**

Summary and Conclusion:

Synoptic and NWP models suggest that

- A cyclonic circulation may form over south Sri Lanka coast and move towards southern peninsular India tips by 30th October 2011.
- Yesterday's low pressure intensified into depression is lying over westcentral and adjoining southwest Arabian Sea is likely move west- northwestwards towards Gulf of Aden.

Advisory:

- No significant weather system over Bay of Bengal till 31st October 2011.
- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	29/12	**30/00**	**30/03**
India	189/205	129/159	191/208
Coastal stations			
WB	11/11	5/7	11/11
Odisha	10/10	6/7	10/10
AP	18/18	17/17	17/18
Tamil Nadu	14/14	12/14	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	6	8	9
Myanmar	7	7	6
Thailand	1	1	1
Sri Lanka	10	7	10

AWS

Region	Date/Time (UTC)		
	29/12	30/00	30/03
India	508/616	76/616	446/616
WB	-	4	29
ODS	-	3	28
AP	-	11	27
TN	-	9	27
PDC	-	1	-

- **RS/RW** (12Z) of 29 -10-2011: 12/39
- **No. of Ascents reaching 250 hPa levels:3 , MISDA:-**27
- **RS/RW** (00Z) of 30 -10-2011: 34/39
- **No. of Ascents reaching 250 hPa levels: 16, MISDA: 5**

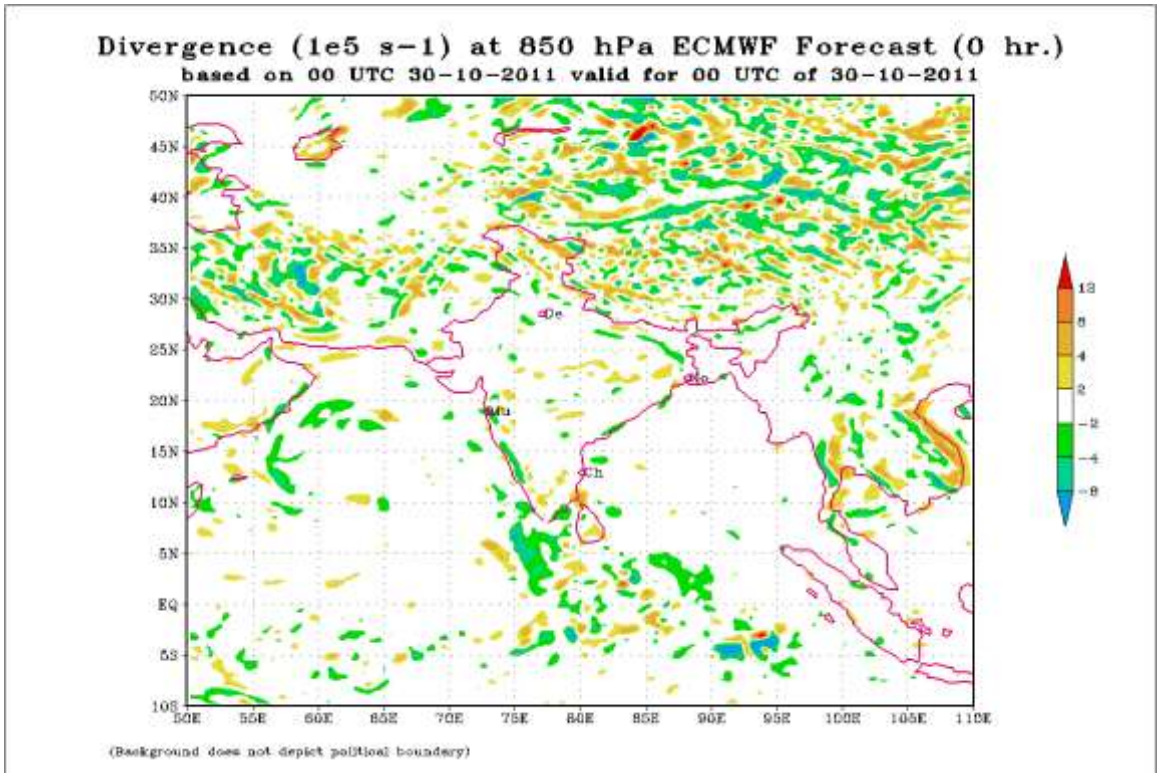
No. of PILOT Ascents

29/12Z	30/00Z
15/37	21/34

Buoy Data

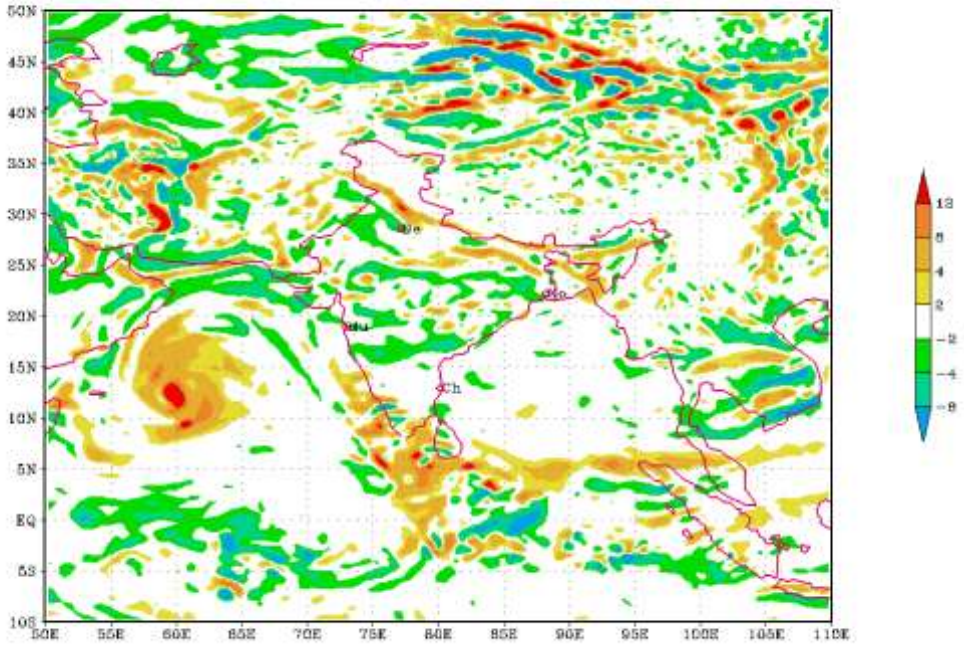
29/12	30/00	30/03
11	12	14

Annexure II



Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

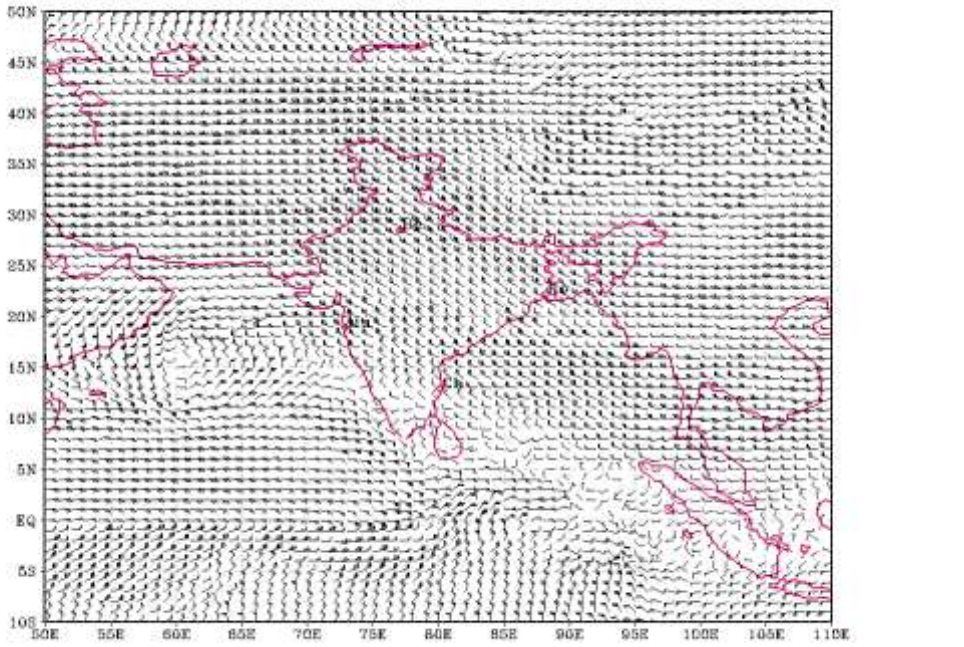
based on 00 UTC 30-10-2011 valid for 00 UTC of 30-10-2011



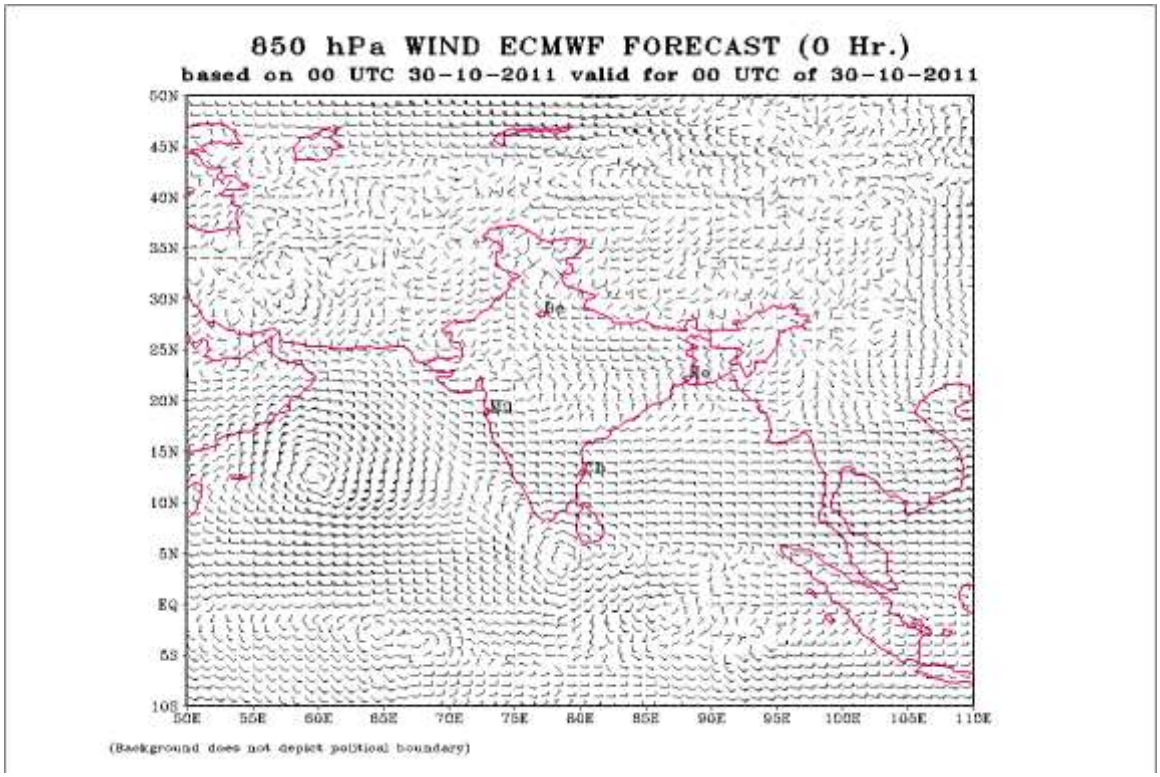
(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

based on 00 UTC 30-10-2011 valid for 00 UTC of 30-10-2011

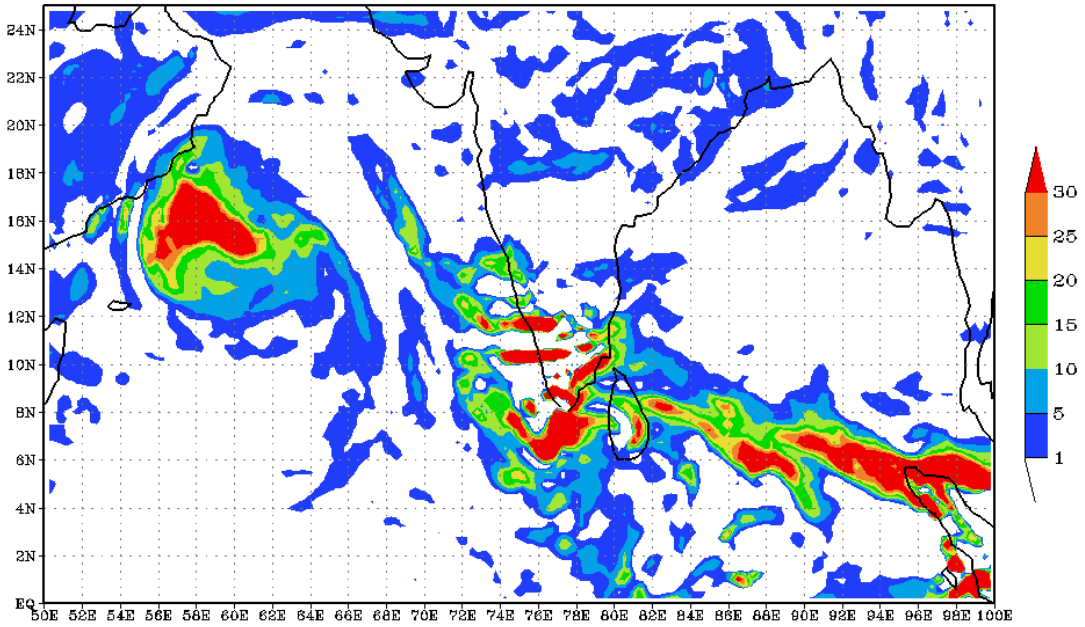


(Background does not depict political boundary)

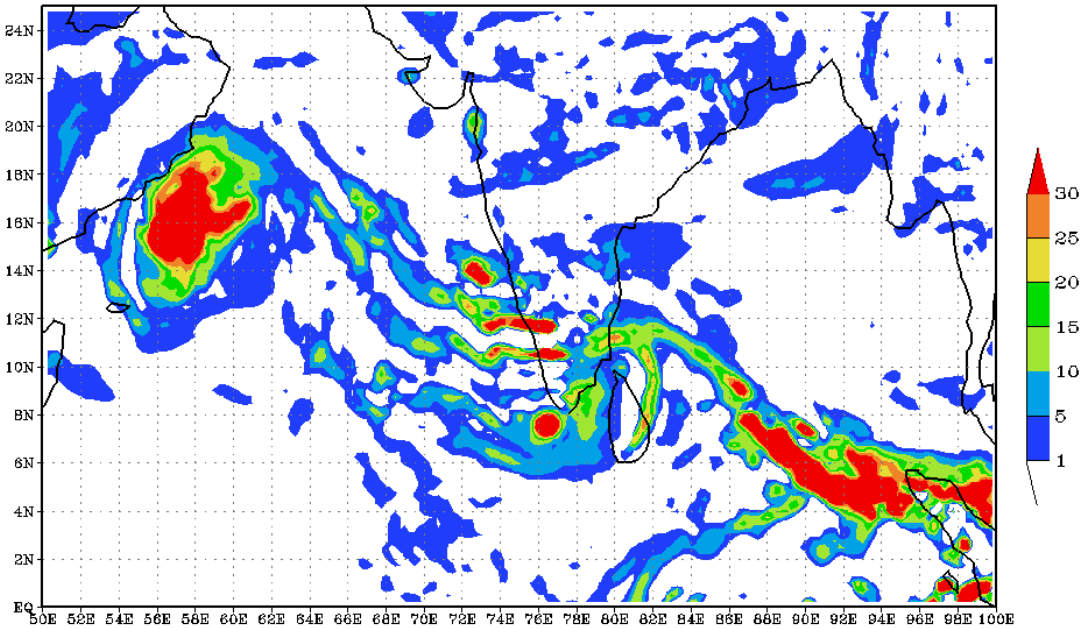


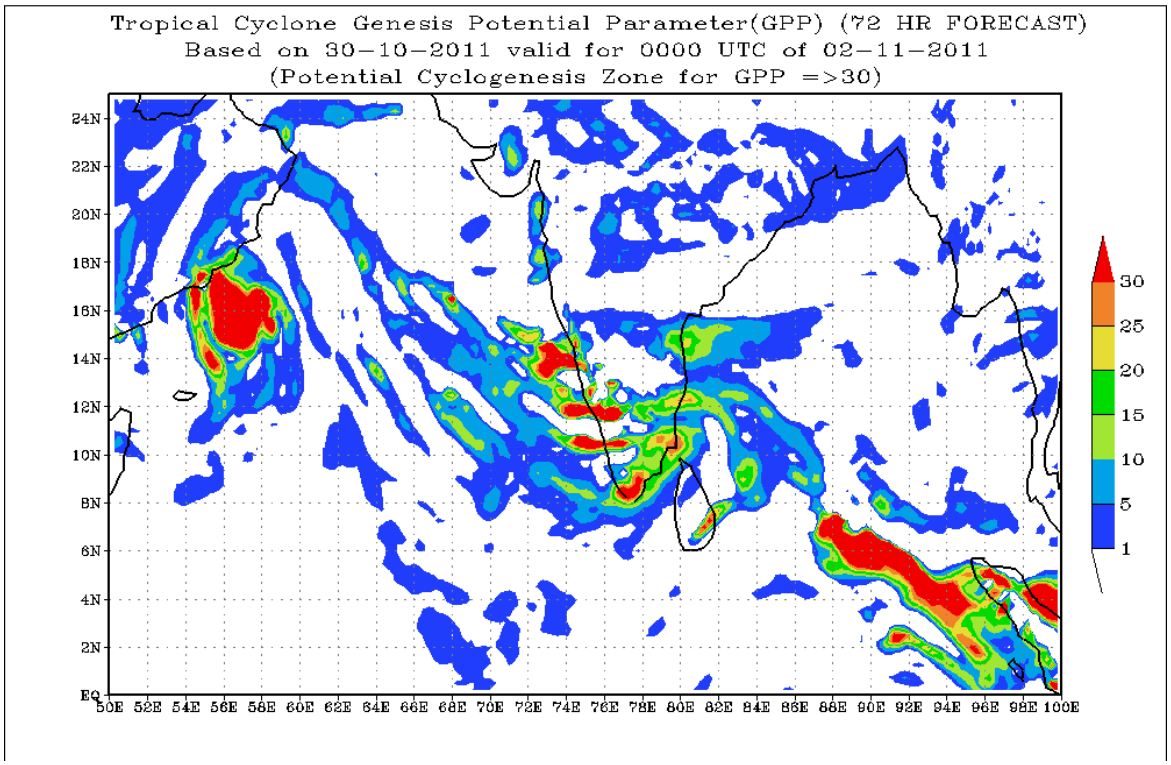
Annexure III

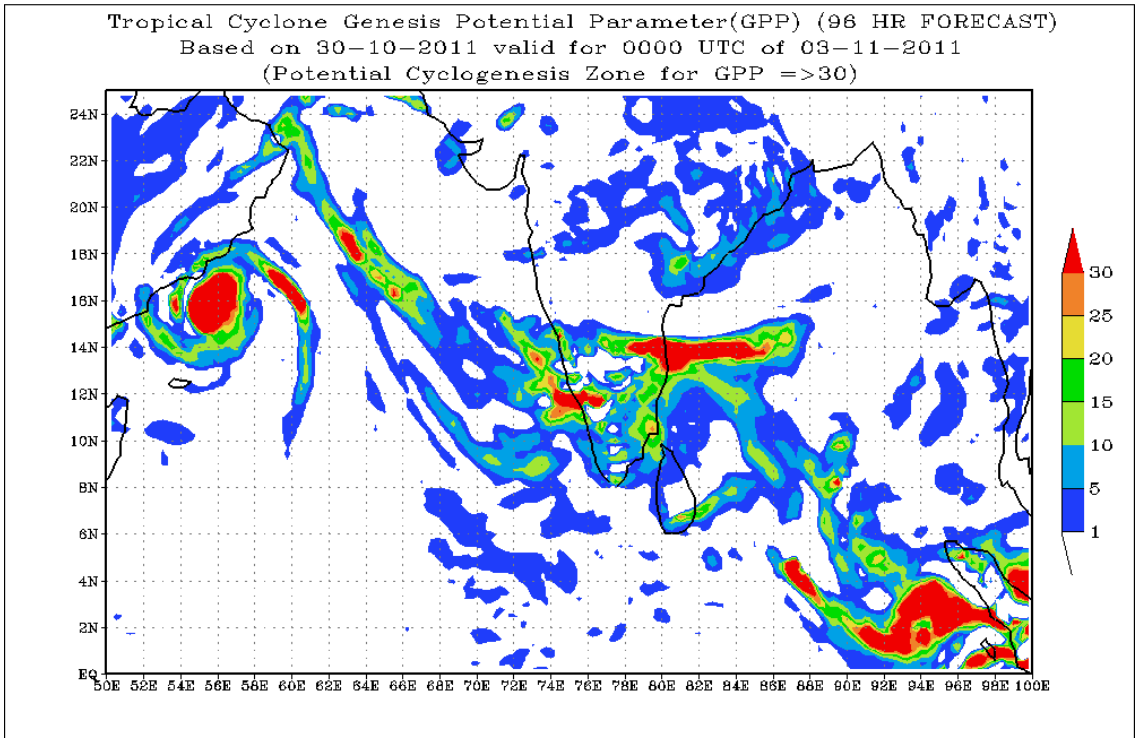
Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 30-10-2011 valid for 0000 UTC of 31-10-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 30-10-2011 valid for 0000 UTC of 01-11-2011
(Potential Cyclogenesis Zone for GPP =>30)







FDP (Cyclone) NOC Report Dated 31 October, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 7^0 N over Bay of Bengal and around 15^0 N over Arabian Sea.
- Yesterday's cyclonic circulation over Commorin area & neighbourhood extending upto mid tropospheric levels persists.
- Yesterday's depression moved northwestwards and lay centred at 0300 UTC of today, the 31st October 2011 near latitude 15.0^0N and longitude 58.5^0E about 550 km northeast of Socotra Island (Yemen).
- 24 hrs. pressure tendency shows no significant change along east coast of India and Andaman & Nicobar Islands.
- Rainfall has occurred at most places over Tamilnadu and north coastal Karnataka, Kerala and Lakshadweep and at few places over Andaman & Nicobar Islands during past 24 hrs..
- Buoys data show that SST around 29-30^0C over north and central Bay of Bengal.

Environmental features based on 0900 UTC of today:

Sea Surface Temperature:

- SST is around 30 - 32^0C over southwest and westcentral Bay of Bengal and 26-28^0C over the depression area.

Ocean thermal energy:

- Ocean thermal energy lies between 80 - 100 KJ cm^{-2} over south Bay of Bengal except north Bay of Bengal and the depression area where it is less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative vorticity at 850 hPa is positive order of 20 - $30*10^{-5}$ s^{-1} over Comorin area & south Bay of Bengal and of $10.0*10^{-4}s^{-1}$ over the depression area in westcentral Arabian Sea.

Convergence:

- Lower level convergence is of order of 5 $*10^{-5}s^{-1}$ over Comorin area & south Bay of Bengal 5-10 $*10^{-5}s^{-1}$ over the depression area.

Divergence:

- Upper air divergence is positive of the order of 5-$10*10^{-5}s^{-1}$ over Comorin area & westcentral Bay of Bengal and 10-$20*10^{-5}s^{-1}$ over the depression area.

Wind Shear:

- Wind Shear of 10-20 knots over Comorin area and south Tamilnadu coast and the depression area.

Wind Shear Tendency:

- Positive (of order 10-20 knots) over Comorin and the depression area.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 8.0^0N over Bay of Bengal and along Lat 16.0^0N over Arabian Sea.

M.J.O. Index:

- Located over phase 3 with amplitude less than 1.0.
- Statistical forecast: - MJO moves through phase 4 & 5 during next 15 days.
- Dynamical forecast: - MJO located in phase 3 with amplitude greater than 1.0 and moves through phase 4 & 5 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean. A depression is lying over westcentral Arabian Sea.

Status of observational system:

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

Satellite

FDP cyclone satellite inference 310900 UTC.

Bay Of Bengal & Andaman Sea: -

Broken low/medium clouds with embedded isolated moderate to intense convection over southwest and southeast bay extending west parts of westcentral bay and south Andaman Sea. Scattered low/medium clouds with embedded isolated weak to moderate convection over rest south bay.

Arabian Sea: - Broken low/medium clouds with embedded moderate to intense convection over Arabian Sea between lat 5.0N to 15.0N long 64.5E to 71.5E and extending southeast Arabian Sea. Broken low/medium clouds with embedded isolated isolated weak to moderate convection over rest north Arabian Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today shows a low pressure area over westcentral Arabian Sea. The system is likely to move west northwestward as a depression and likely to cross the coast near Salalah on day3. However, on day 4 a fresh CYCIR is likely to develop over Maldives and adjoining areas in southeast Arabian Sea. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis based on 0000 UTC of today shows well marked low pressure area over westcentral Arabian Sea and likely to move west-northwestwards and cross the coast near Salalah on day3. Another fresh low

pressure is likely to form over southeast Arabian Sea on day. The system is likely to move westward and to intensify to deep depression on day 5.

- **WRF-ARW** model analysis shows low pressure are lying over westcentral Arabian Sea and likely to move westwards towards north of Gulf of Aden and cross the coast of day3. It is likely to intensify into deep depression.

- **UKMET** model analysis shows low pressure over westcentral Bay and moves west-northwestwards during next 3 days, but does not show intensification. It is likely to cross the coast on day3. A fresh CYCIR is likely to develop over southeast Arabian Sea coast on day 1.

- **NCMRWF-GFS** model analysis shows low level CYCIR lying over westcentral Bay and likely to move west-northwestwards during next 3 days but, shows no intensification. However, there is likely formation of new CYCIR over Maldives region on day 1 and is further likely to intensify into a depression and move westward.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows a organized cell of GPP of 30 over westcentral Arabian Sea. Further organization of the GPP cell over westcentral Arabian Sea indicates the Depression is likely to intensify into cyclonic storm on day3. GPP charts of four days forecasts are enclosed here with in **Annexure III (** http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that

- The cyclonic circulation over Comorin area likely to move towards southern peninsular India & neighbourhood during next 48 hours.
- The depression over westcentral Arabian Sea is likely to move west-northwestwards and intensify into deep depression and cross Gulf of Aden close to Salalah during next 72 hours.

Advisory:

- No significant weather system over Bay of Bengal till 2nd November, 2011.
- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	30/12	31/00	31/03
India	197/208	130/159	190/208
Coastal stations			
WB	11/11	6/7	11/11
Odisha	10/10	5/7	10/10
AP	17/18	17/17	18/18
Tamil Nadu	14/14	12/14	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	17	17	18
Myanmar	13	11	13
Thailand	1	1	1
Sri Lanka	14	14	14

AWS

Region	Date/Time (UTC)		
	30/12	31/00	31/03
India	540/616	90/616	508/616
WB	20	19	19
ODS	28	28	29
AP	31	53	31
TN	27	26	27
PDC	1	0	0

- **RS/RW** (12Z) of 30 -10-2011: 09/39
- **No. of Ascents reaching 250 hPa levels:5 , MISDA:-**30
- **RS/RW** (00Z) of 31 -10-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 20, MISDA: 4**

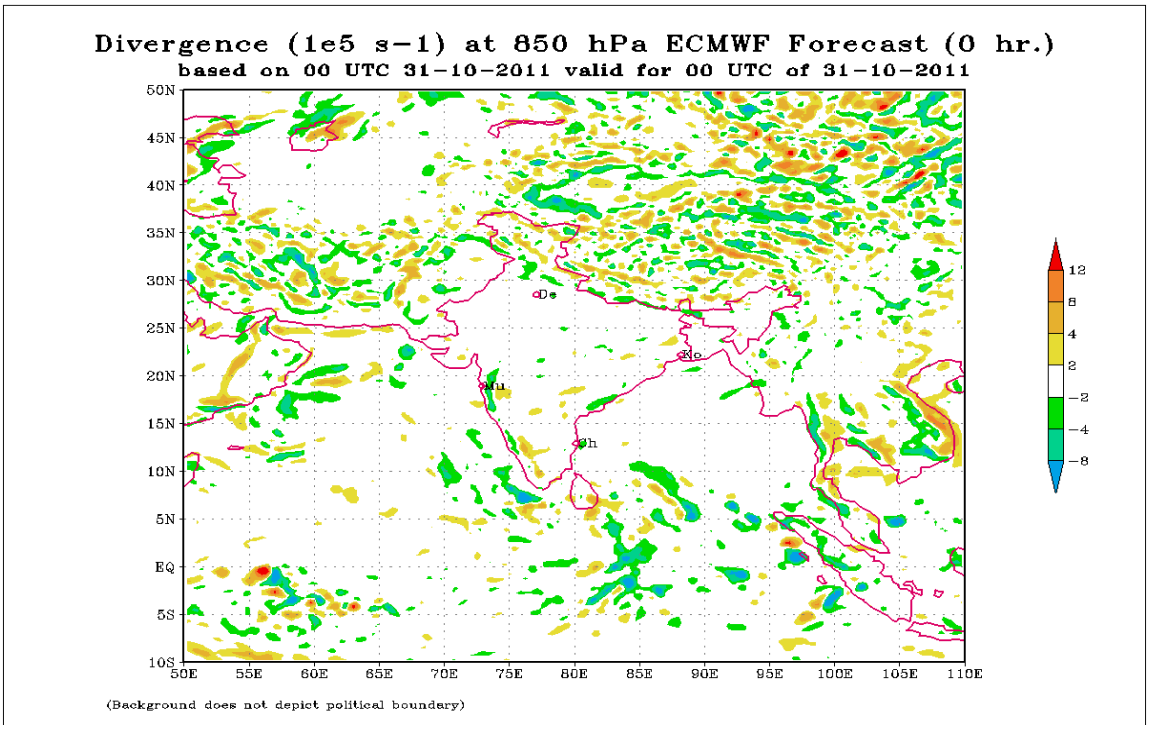
No. of PILOT Ascents

30/12Z	31/00Z
13/37	17/34

Buoy Data

30/12	31/00	31/03
12	10	09

Annexure II


Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 31−10−2011 valid for 00 UTC of 31−10−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
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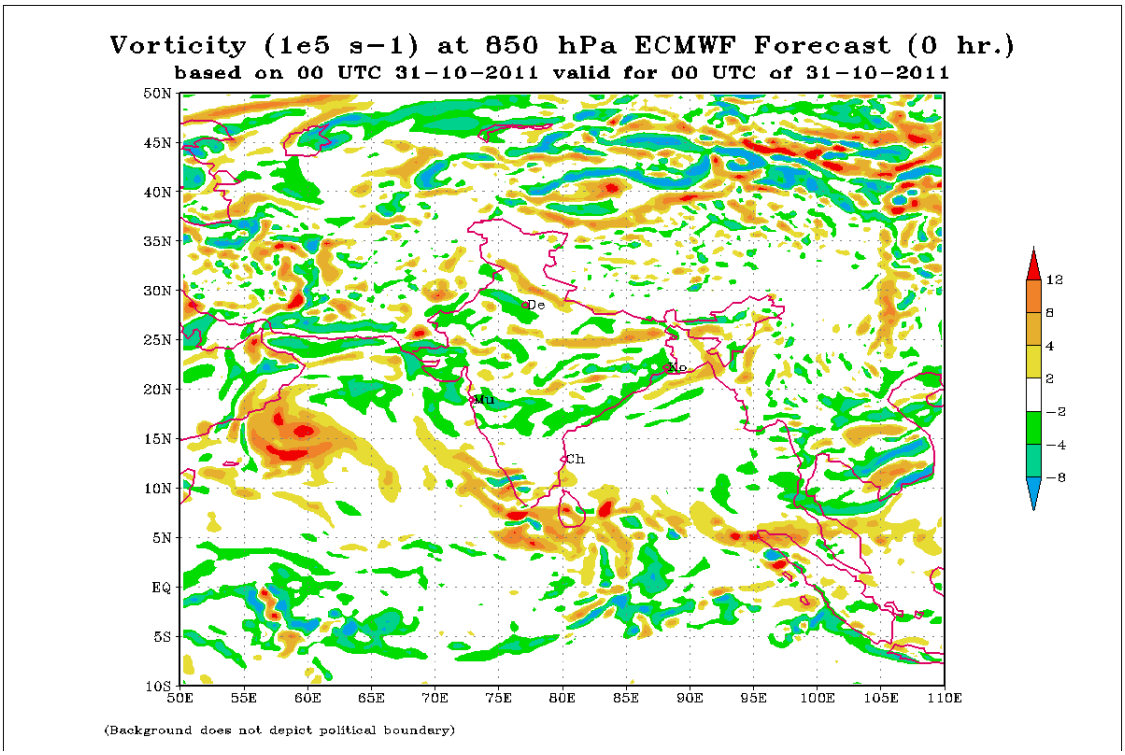
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)


Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 31−10−2011 valid for 00 UTC of 31−10−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
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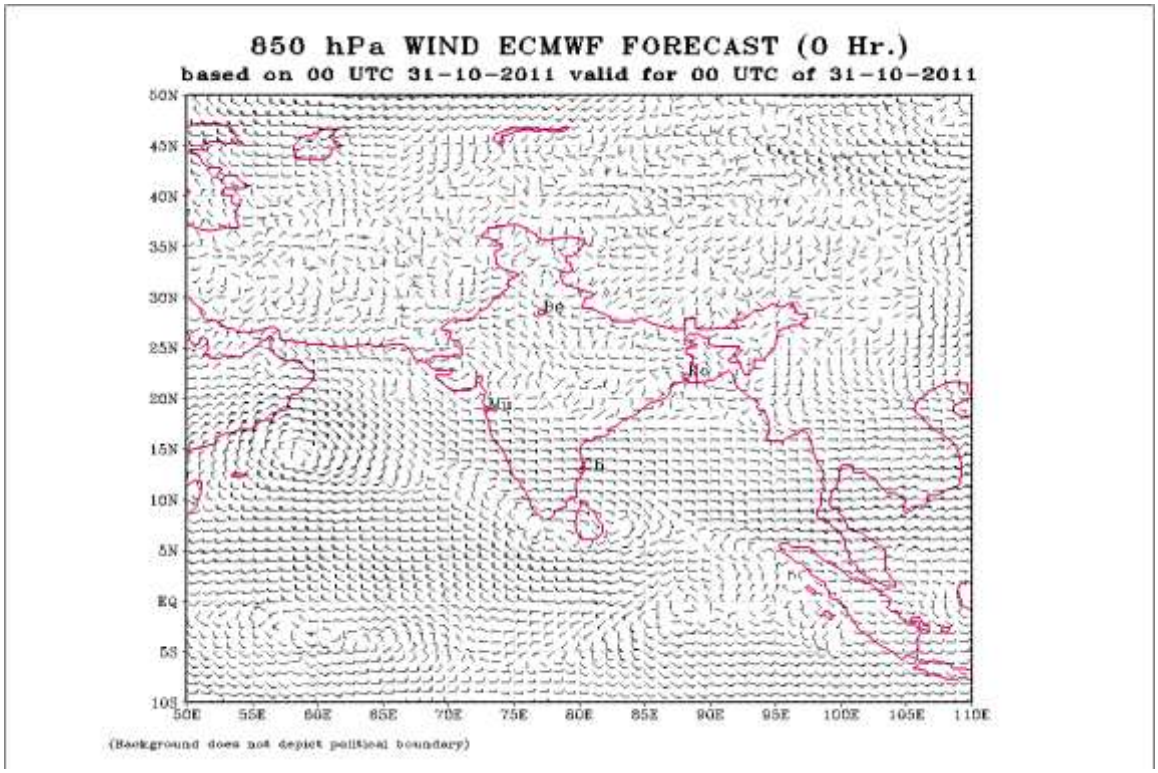
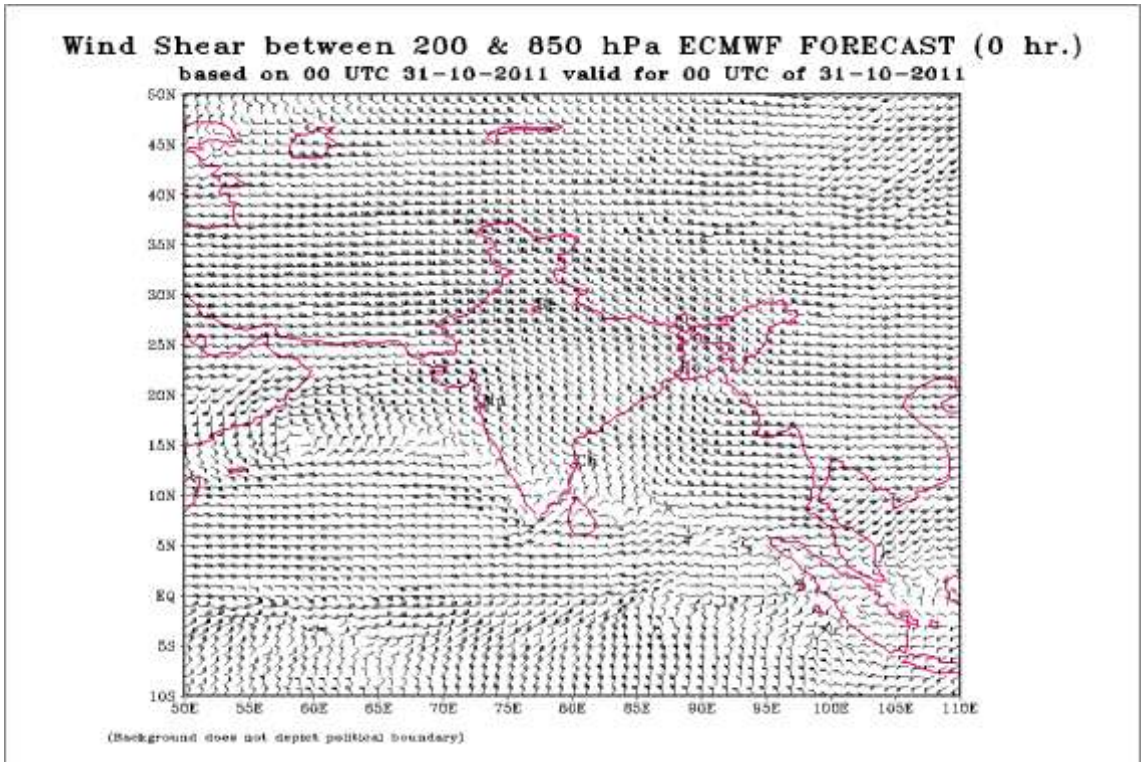
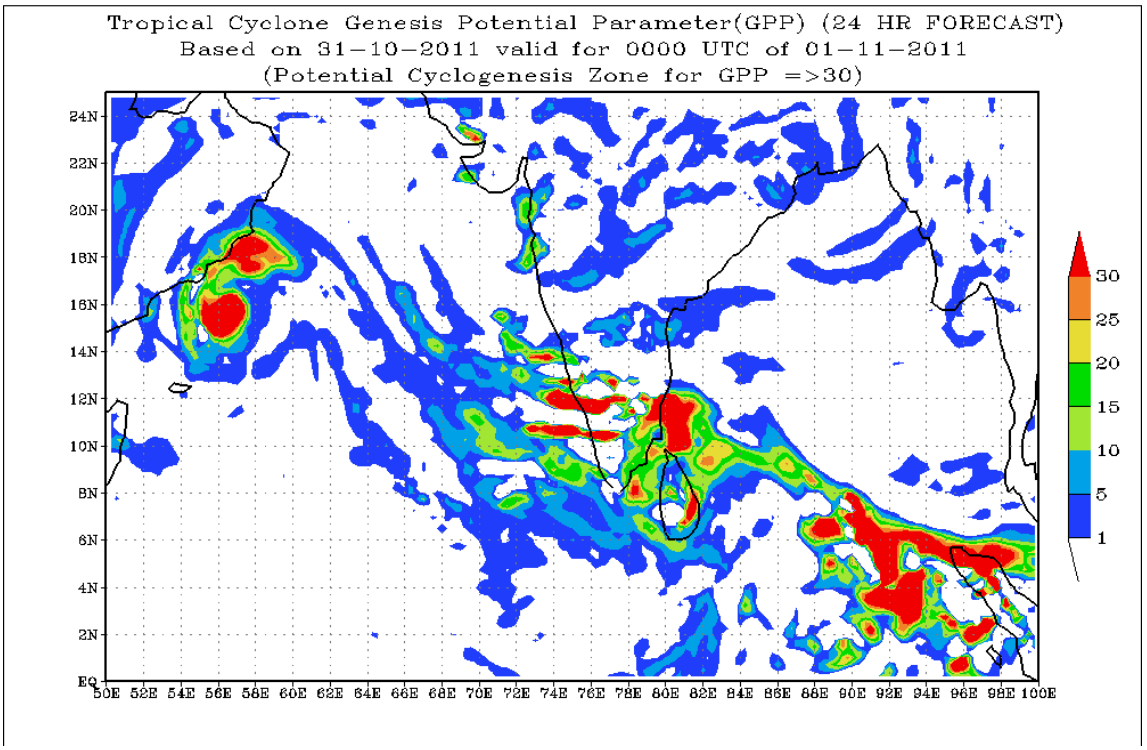
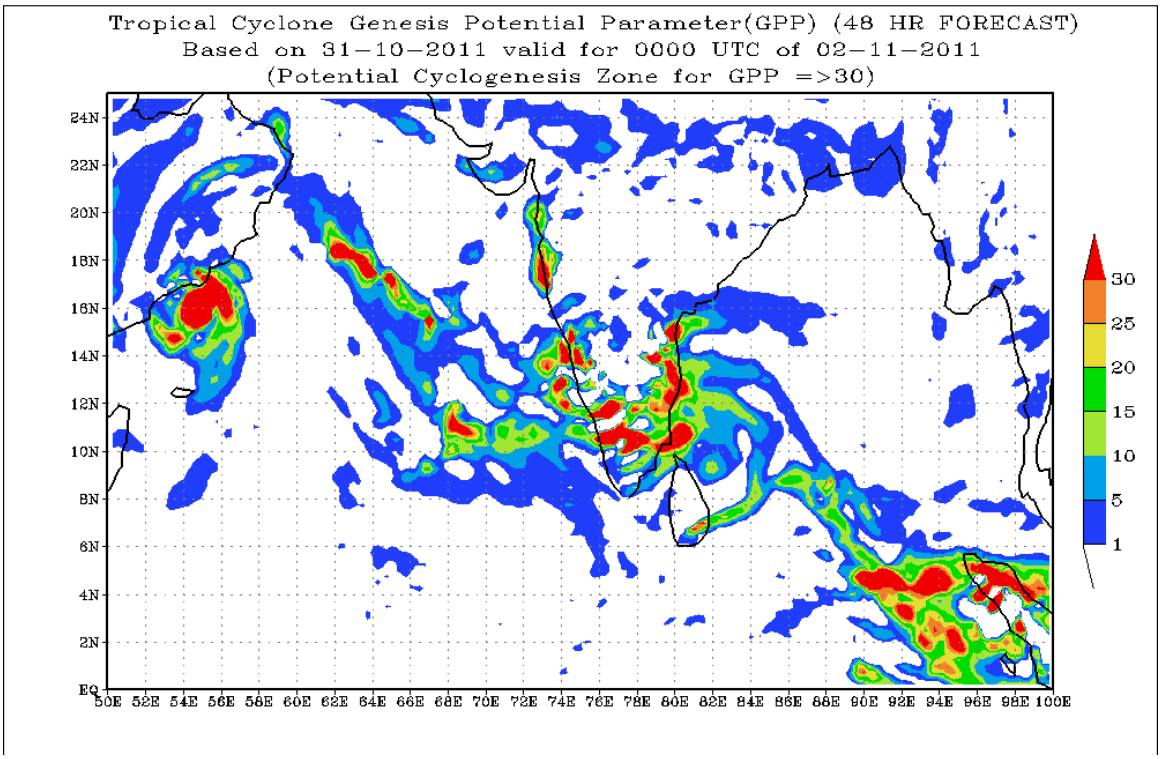
Mu
Ch
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)

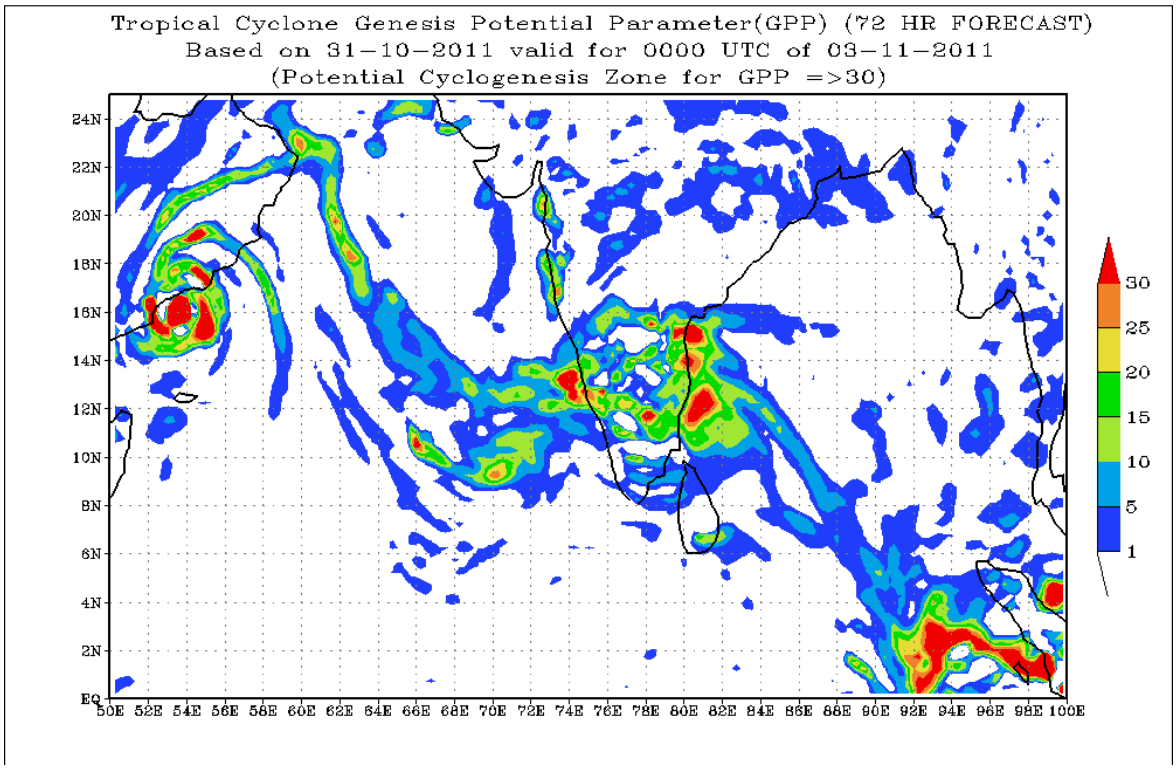




Annexure III


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 31-10-2011 valid for 0000 UTC of 01-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 31-10-2011 valid for 0000 UTC of 02-11-2011
(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
1



FDP (Cyclone) NOC Report Dated 1 November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 6^0 N over Bay of Bengal and around 15^0 N over Arabian Sea.
- Yesterday's cyclonic circulation over Commorin area & neighbourhood extending upto mid tropospheric levels persists.
- Yesterday's depression moved west-northwestwards, intensified into depression and lay centred at 0300 UTC of today, the 1stNovember 2011 near latitude 16.0^0N and longitude 56.0^0E.
- 24 hrs. pressure tendency is positive along east coast of India,Andaman & Nicobar Islands, Bangladesh and Myanmar coast (around 1 hPa).
- Rainfall has occured at most places over Tamil Nadu coast during past 24 hrs..
- Buoys data show that SST around 29-30^0C over north and central Bay of Bengal.

Environmental features based on 0900 UTC of today:

Sea Surface Temperature:

- SST is around 30 - 31^0C over southwest and westcentral Bay of Bengal. **Ocean thermal energy:**
- Ocean thermal energy lies between 80 - 100 KJ cm^{-2} over south Bay of Bengal except north Bay of Bengal where it is less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative vorticity at 850 hPa is positive order of 30 *10^{-5} s^{-1} over Comorin area & southt Bay of Bengal.

Convergence:

- Lower level convergence is of order of 5-10 *$10^{-5}s^{-1}$ over Comorin area & south Bay of Bengal.

Divergence:

- Upper air divergence is positive of the order of 5-10*$10^{-5}s^{-1}$ over Comorin area, southwest and west central Bay of Bengal and negative(of the order of -5-10*$10^{-5}s^{-1}$) over north Bay of Bengal..

Wind Shear:

- Wind Shear of 10-20 knots over south Bay of Bengal and 30-40 knots over central and North Bay

Wind Shear Tendency:

- Positive (of order 5-10 knots) over Commorin area and southwest Bay of Bengal and negative over central and north Bay of Bengal (of order -5 to -10 knots).

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 8.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 3 with amplitude is 1.0.
- Statistical forecast: - MJO moves through phase 4, 5 & 6 during next 15 days.
- Dynamical forecast: - MJO located in phase 3 with amplitude greater than 1.0 and moves through phase 4,5 & 6 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean. A deep depression is lying over westcentral Arabian Sea.

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 010900 UTC.

Broken low/medium clouds with embedded moderate to intense convection over rest Bay south of lat 10.0^0N and westcentral bay between lat 14.0^0N to 17.5^0N west of long 88.0^0E. Scattered low/medium clouds with embedded isolated weak to moderate convection over south Andaman Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today shows a depression over westcentral Arabian Sea. The system is likely to move westward and likely to cross the coast near Salalah on day 2. However, on day 3 a fresh CYCIR is likely to develop over Maldives and adjoining areas in southeast Arabian Sea. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis based on 0000 UTC of today shows depression westcentral Arabian Sea and likely to move westwards and cross the coast near Salalah on day2. Another fresh low level CYCIR is likely to form over southeast Arabian Sea on day2. The system is likely to move westward and to intensify to deep depression on day 5.
- **WRF-ARW** model analysis shows low pressure are lying over westcentral Arabian Sea and likely to move westwards towards north of Gulf of Aden and cross the coast of day2. It is likely to intensify into deep depression.
- **UKMET** model analysis shows depression over westcentral Bay and moves westwards and cross the coast near Salah on day2. A fresh CYCIR is likely to develop over southeast Arabian Sea on day2.

- **NCMRWF-GFS** model analysis shows low pressure over westcentral Bay and moves west-northwestwards and cross the coast near Salalah on day2. A fresh CYCIR is likely to develop over Comorin region on day2 and likely to intensify to a depression on day4, moving westward.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows a organized cell of GPP of 30 over westcentral Arabian Sea. The GPP cell is likely to disorganize on day2 and a new cell is likely yo form over southeast Arabian Sea. GPP charts of four days forecasts are enclosed here with in **Annexure III (** http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that

- The cyclonic circulation over Comorin area likely to move towards southern peninsular India & neighbourhood during next 24 hours.
- The deep depression over westcentral Arabian Sea is likely to intensify further into cyclonic storm, move west-northwest wards and cross south Oman and adjoining Yemen coast close to Salalah at around noon of 2nd November 2011.

Advisory:

- No significant weather system over Bay of Bengal till 3rd November, 2011.
- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	31/12	1/00	1/03
India	196/208	128/159	193/208
Coastal stations			
WB	11/11	5/7	11/11
Odisha	10/10	6/7	10/10
AP	18/18	17/17	18/18
Tamil Nadu	14/14	11/14	14/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	16	17	17
Myanmar	13	11	12
Thailand	1	1	1
Sri Lanka	13	14	14

AWS

Region	Date/Time (UTC)		
	31/12	1/00	1/03
India	440/616	494/616	438/616
WB	19	18	04
ODS	28	27	28
AP	31	33	31
TN	25	26	26
PDC	0	0	0

- **RS/RW** (12Z) of 31 -10-2011: 16/37
- **No. of Ascents reaching 250 hPa levels:5 , MISDA:-**21
- **RS/RW** (00Z) of 1 -11-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 21, MISDA: 4**

No. of PILOT Ascents

31/12Z	1/00Z
16/37	13/34

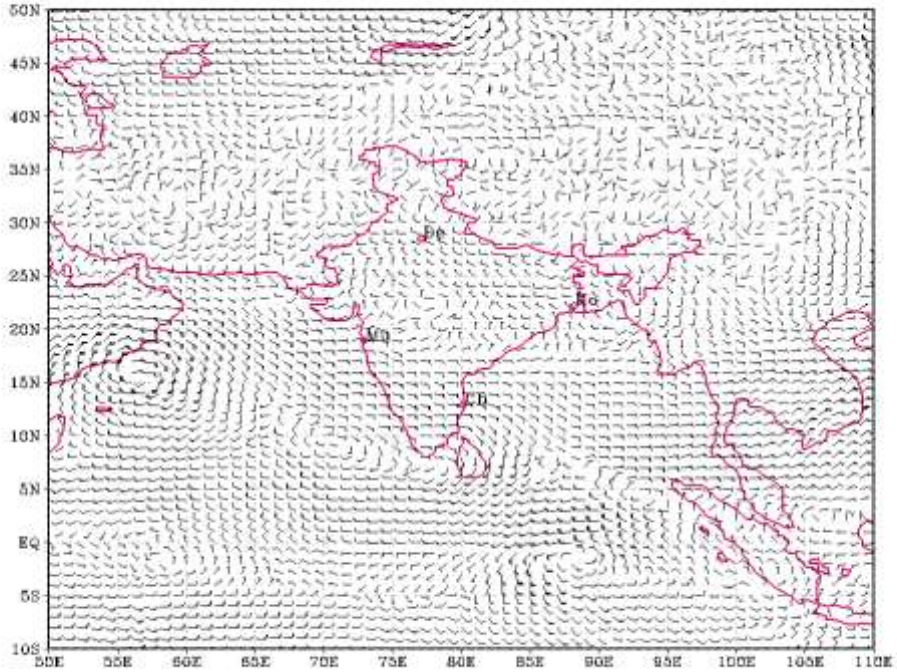
Buoy Data

31/12	1/00	1/03
11	10	11

Annexure II

850 hPa WIND ECMWF FORECAST (0 Hr.)

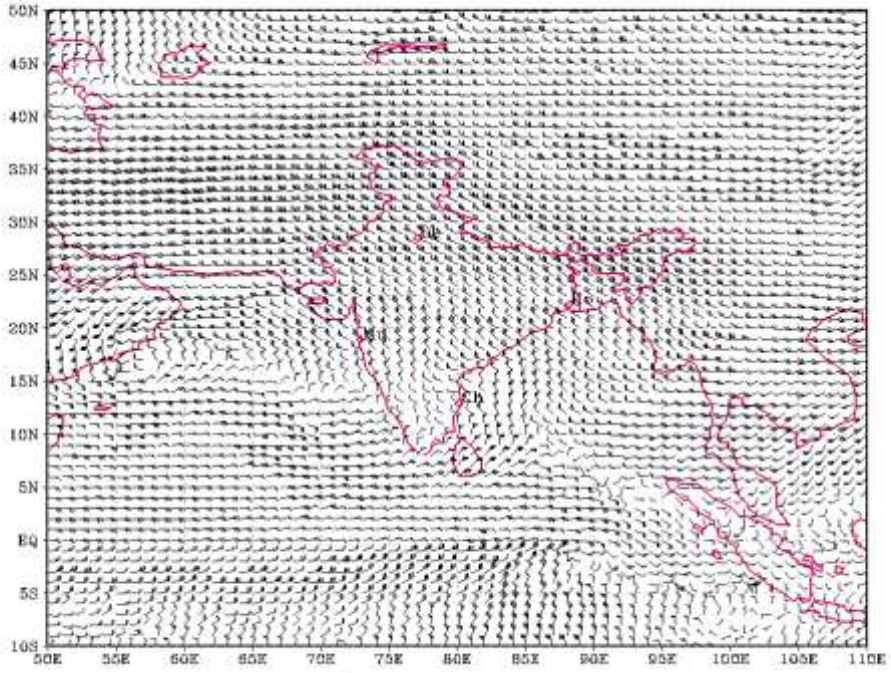
based on 00 UTC 01-11-2011 valid for 00 UTC of 01-11-2011



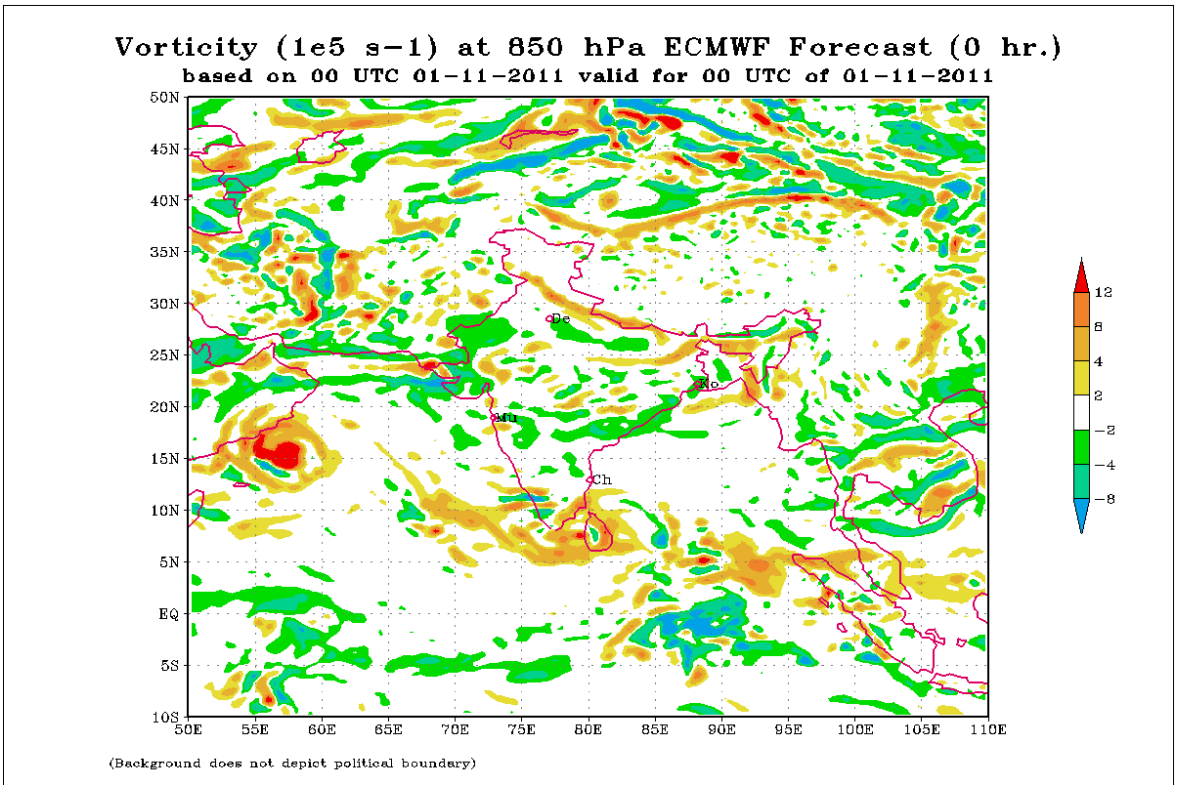
(Background does not depict political boundary)

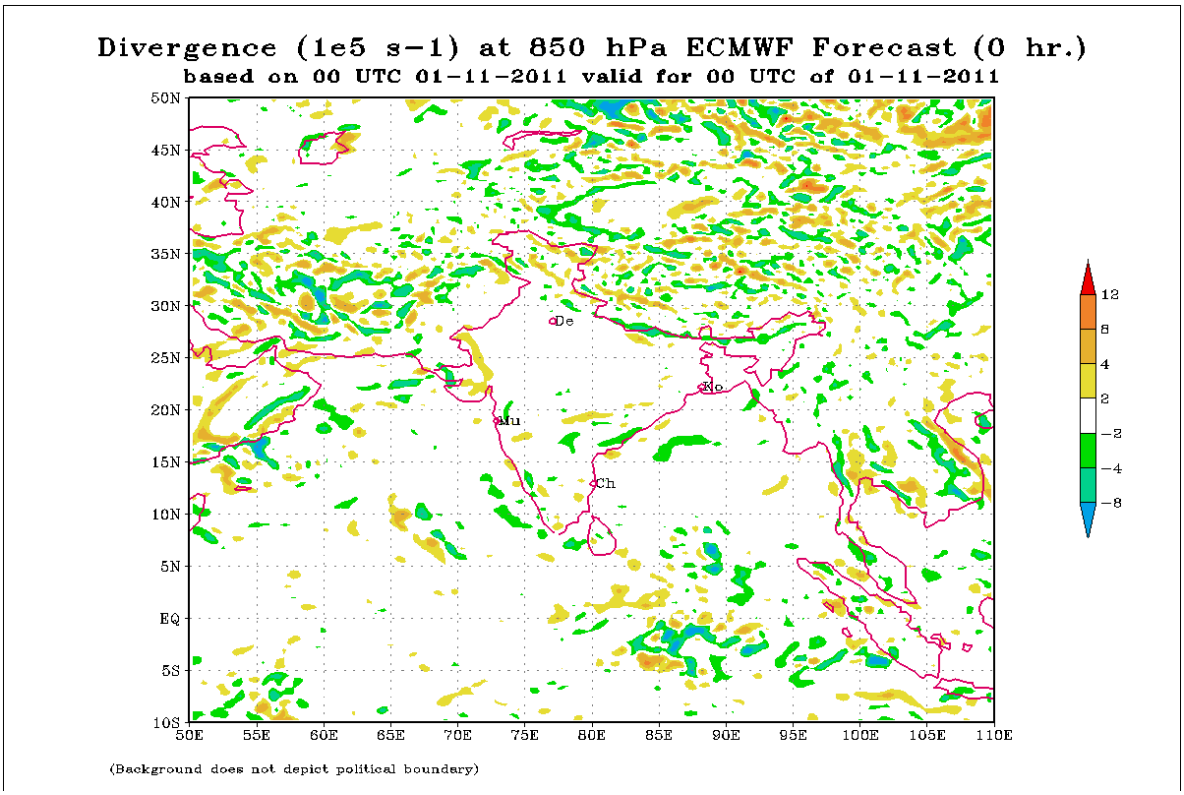
Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

based on 00 UTC 01-11-2011 valid for 00 UTC of 01-11-2011

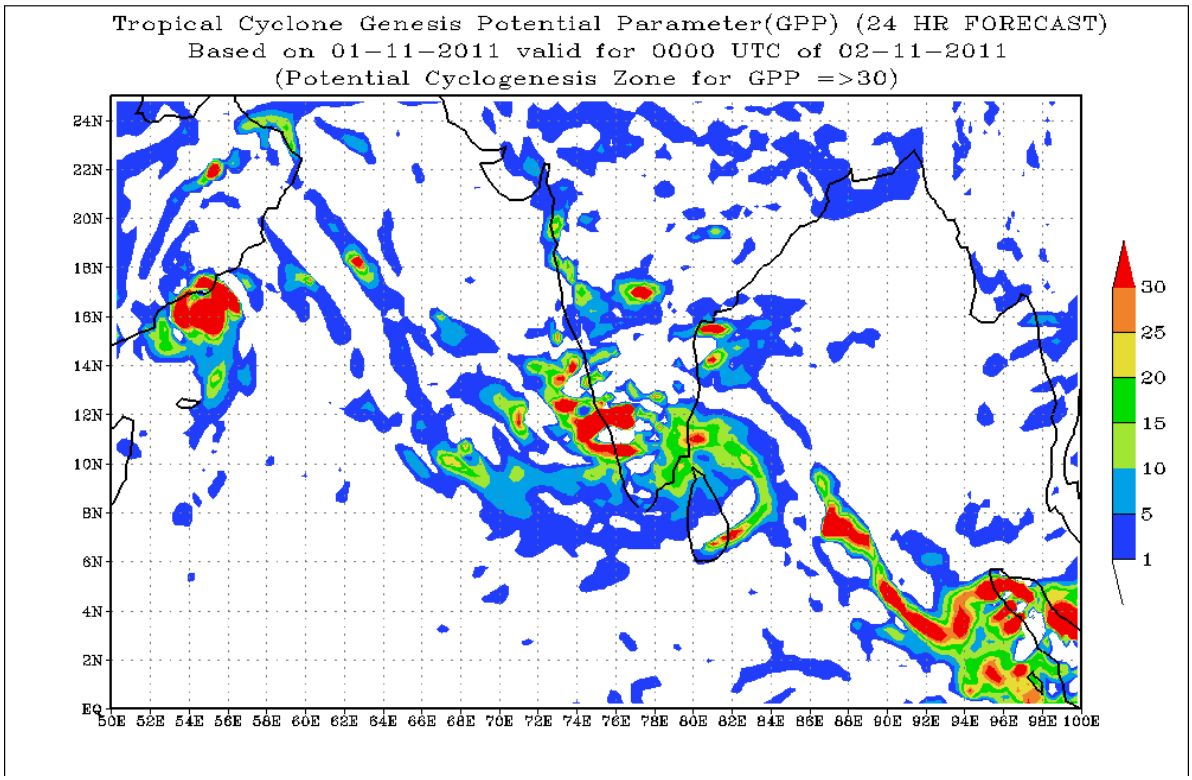


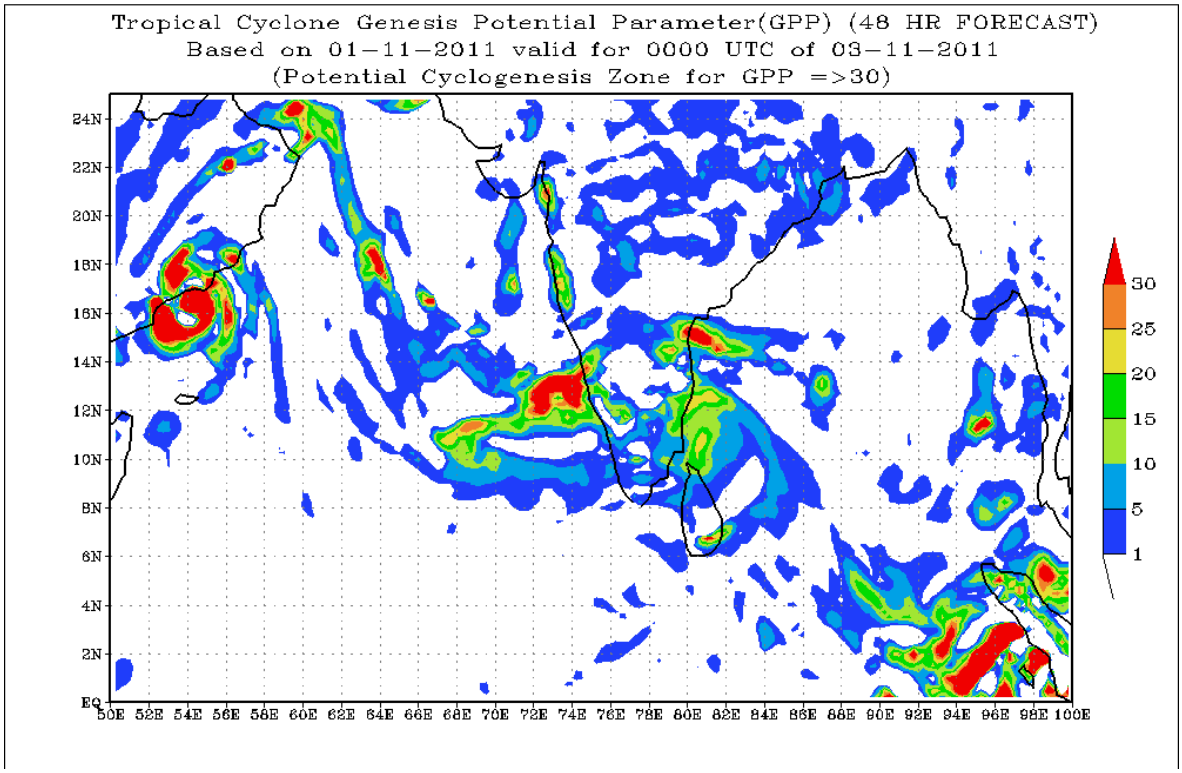
(Background does not depict political boundary)





Annexure III


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 01-11-2011 valid for 0000 UTC of 02-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 01-11-2011 valid for 0000 UTC of 03-11-2011
(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
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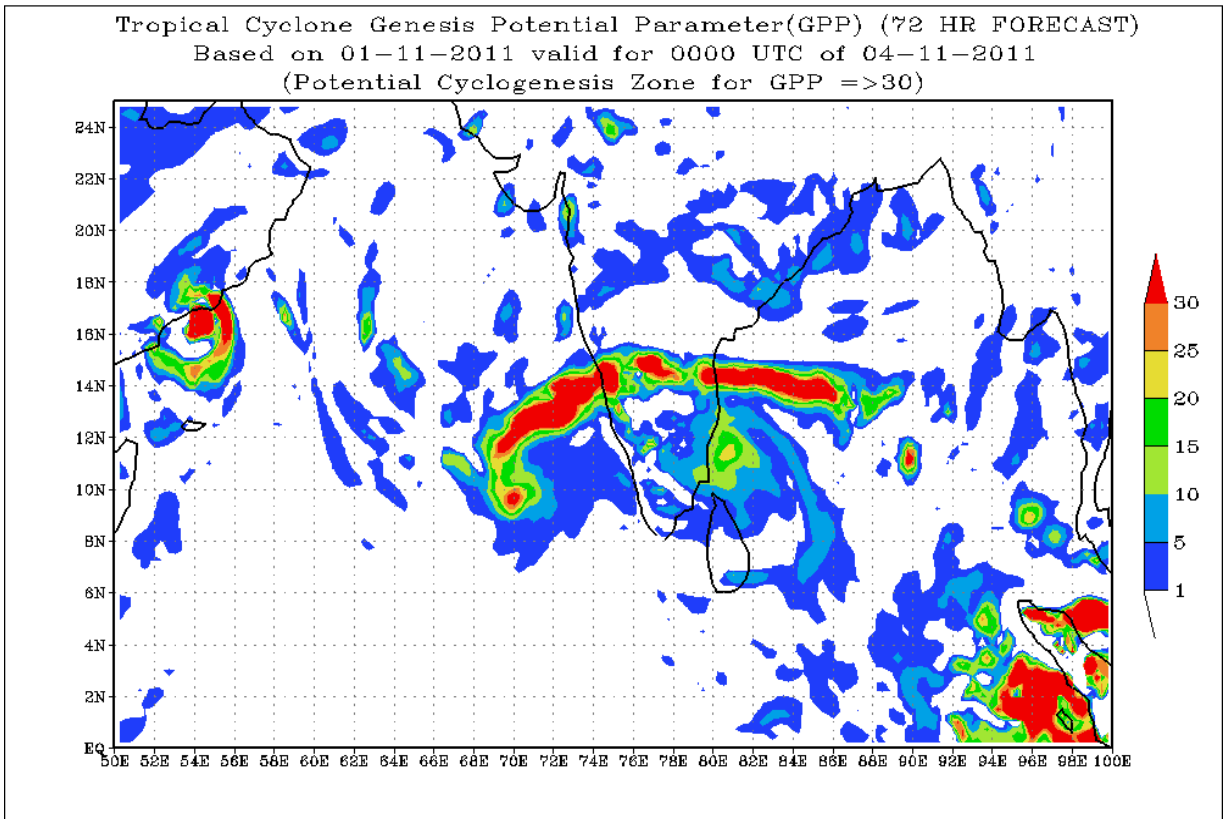
15
10
5
1



FDP (Cyclone) NOC Report Dated 2 November, 2011

Synoptic features based on 0300 UTC:

- Yesterday's cyclonic circulation over Commorin area & neighbourhood moved west-northwest wards now seen as a low pressure area over Maldives & adjoining areas of southeast Arabian Sea associated upper air cyclonic circulation extending upto mid tropospheric levels.
- Yesterday's deep depression moved west-northwestwards, intensified into a cyclonic storm **"KEILA"** and lay centred at 0830 hrs. IST of today, the 2nd November 2011 over westcentral Arabian Sea near latitude 16.0^{0}N and longitude 55.0^{0}E, about 150 km southeast of Salalah (Oman).
- 24 hrs. pressure tendency shows no significant change along east coast of India, Andaman & Nicobar Islands and positive change over Bangladesh and Myanmar coast (around 2 hPa).
- Rainfall has occurred at most places over Tamil Nadu, Rayalaseema and coastal Andhra Pradesh during past 24 hrs..
- Buoys data show that SST around 29-30^{0}C over north and central Bay of Bengal.

Environmental features based on 0900 UTC of today:

Sea Surface Temperature:

- SST is around 28-30^{0}C over south and central Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy lies between 80 - 100 KJ cm^{-2} over south & central Bay of Bengal except north Bay of Bengal where it is less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative vorticity at 850 hPa is positive order of 20-30 *10^{-5} s^{-1} over south & central Bay of Bengal.

Convergence:

- Lower level convergence is of order of 5-10 *10^{-5}s^{-1} over central Bay of Bengal.

Divergence:

- Upper air divergence is positive of the order of 5-10*10^{-5}s^{-1} over Comorin area and west central Bay of Bengal.

Wind Shear:

- Wind Shear of 10-15 knots over central & south Bay of Bengal.

Wind Shear Tendency:

- Negative (of order -10 knots) over southeast & central Bay of Bengal.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 10.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 3 with amplitude is 1.0.
- Statistical forecast: - MJO moves through phase 4, 5 & 6 during next 15 days.
- Dynamical forecast: - MJO located in phase 3 with amplitude greater than 1.0 and moves through phase 4 & 5 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean. A cyclonic storm is lying over westcentral Arabian Sea.

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 020900 UTC.

Bay of Bengal & Andaman Sea: -

Broken low/medium clouds with embedded moderate to intense convection over gulf of Mannar rest bay between lat. 10.0N to 17.5N west of long 90.0E. Scattered low/medium clouds with embedded isolated weak to moderate convection over rest south bay and south Andaman Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today shows that the Deep Depression over the westcentral Arabian Sea persists over the same area. The system is likely to intensify in to a cyclonic storm and likely to dissipate over the same area after day2. A fresh CYCIR is likely to develop over the southeast Arabian Sea on day1 and moves westerly direction but shows no intensification. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis and forecast based on 0000 UTC of today shows that the Deep Depression over the westcentral Arabian Sea persists over the same area and likely to move west-northwestwards and cross the coast near Salalah on day2 but shows no intensification. Two fresh low pressure areas are likely to form over southeast Arabian Sea and southeast Bay of Bengal on day2. The systems are likely to move westward direction but shows no intensification.
- **WRF-ARW** model analysis shows the Deep Depression lying over westcentral Arabian Sea and likely to move westwards direction and intensify in to a cyclonic storm. A fresh low pressure areas are likely to form over southeast Arabian Sea but shows no intensification.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows a cell of GPP of 30 over westcentral Arabian Sea. Further organization of the GPP cell over westcentral Arabian Sea indicates the Depression is likely to intensify into cyclonic storm. The system is likely to dissipate after day3. GPP analysis and three days forecasts are enclosed here with in **Annexure III.**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that

- The cyclonic storm "**KEILA**" is likely to move westwards and cross south Oman and adjoining Yemen coast to south of Salalah around evening/night of 3rd November 2011.

Advisory:

- No significant weather system over Bay of Bengal till 4th November, 2011.
- No IOP at present.

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	1/12	**2/00**	**2/03**
India	192/205	127/159	192/208
Coastal stations			
WB	13/13	5/7	11/11
Odisha	10/10	6/7	10/10
AP	18/18	17/17	18/18
Tamil Nadu	13/14	11/14	13/14
Puducherry	2/2	2/2	2/2
A & N	1/1	1/1	1/1
Bangladesh	16	16	17
Myanmar	14	12	12
Thailand	1	1	1
Sri Lanka	14	13	14

AWS

Region	Date/Time (UTC)		
	1/12	**2/00**	**2/03**
India	439/616	486/616	436/616
WB	20	18	20
ODS	26	25	27
AP	31	32	31
TN	27	26	27
PDC	0	0	0

- **RS/RW** (12Z) of 1 -11-2011: 12/39
- **No. of Ascents reaching 250 hPa levels:4 , MISDA:-**27
- **RS/RW** (00Z) of 2 -11-2011: 36/39
- **No. of Ascents reaching 250 hPa levels: 21, MISDA:** 3

No. of PILOT Ascents

31/12Z	1/00Z
17/37	17/34

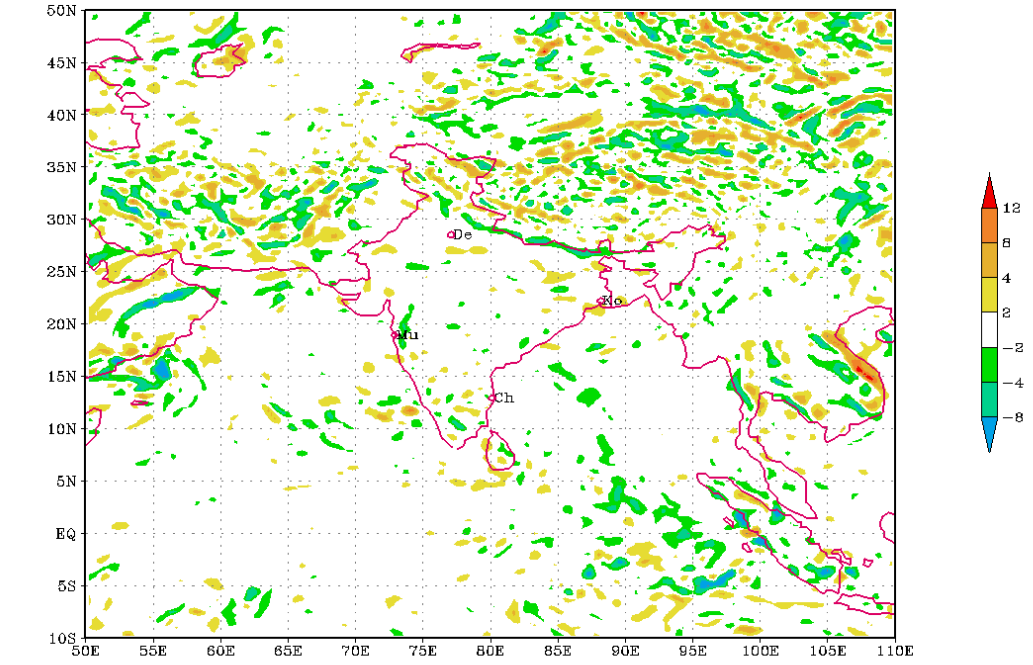
Buoy Data

1/12	2/00	2/03
12	13	12

Annexure II

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

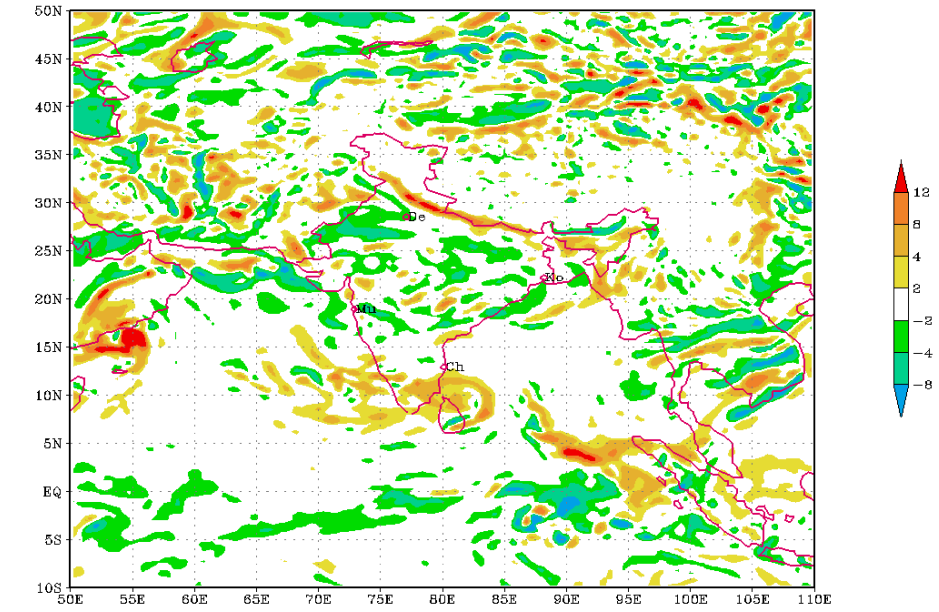
based on 00 UTC 02−11−2011 valid for 00 UTC of 02−11−2011



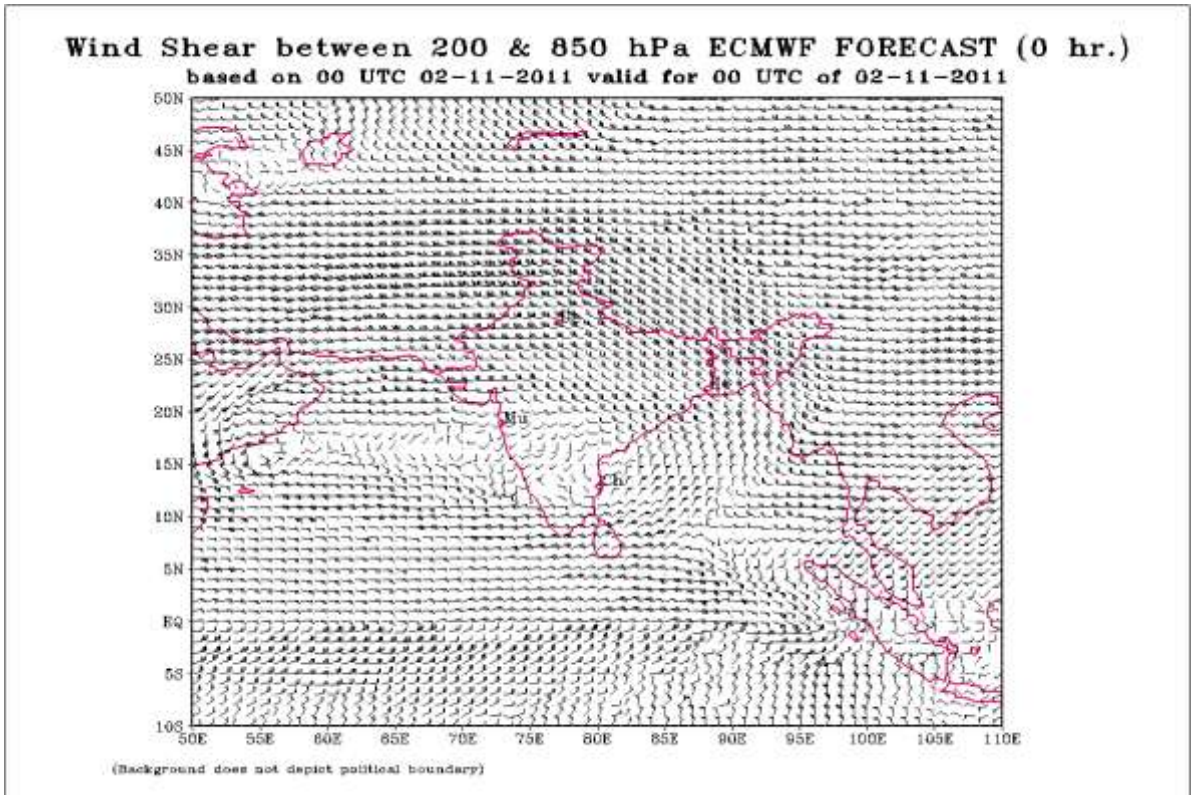
(Background does not depict political boundary)

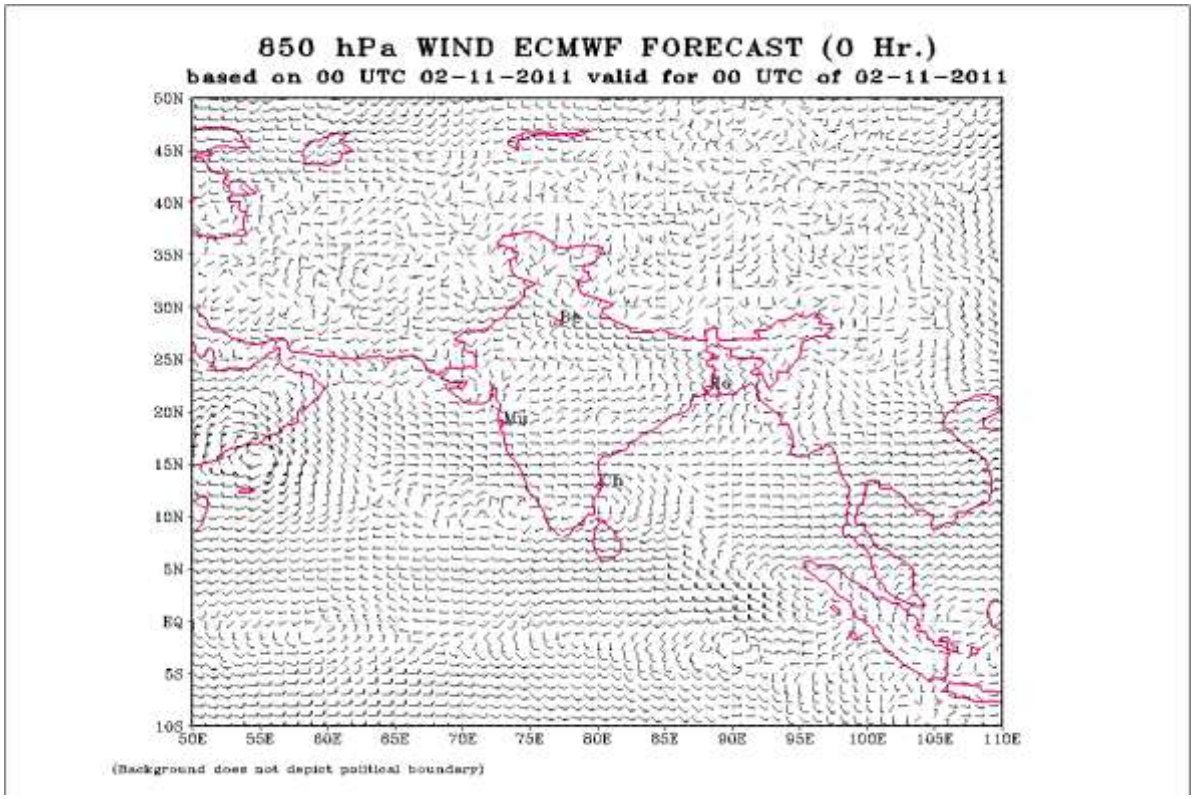
Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

based on 00 UTC 02−11−2011 valid for 00 UTC of 02−11−2011



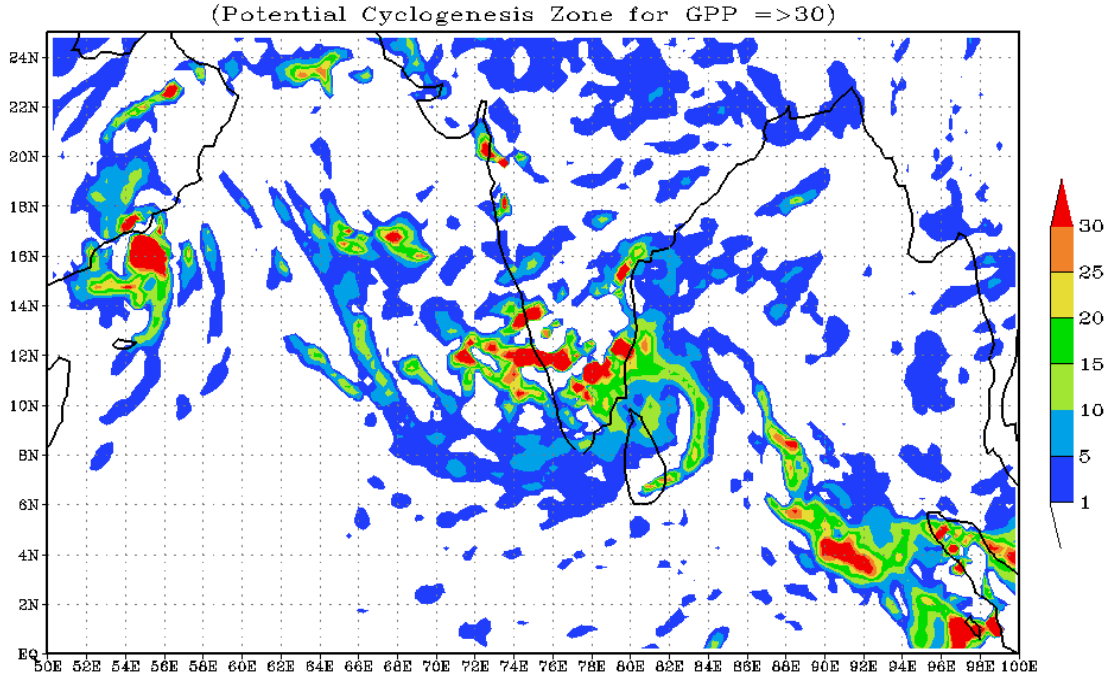
(Background does not depict political boundary)



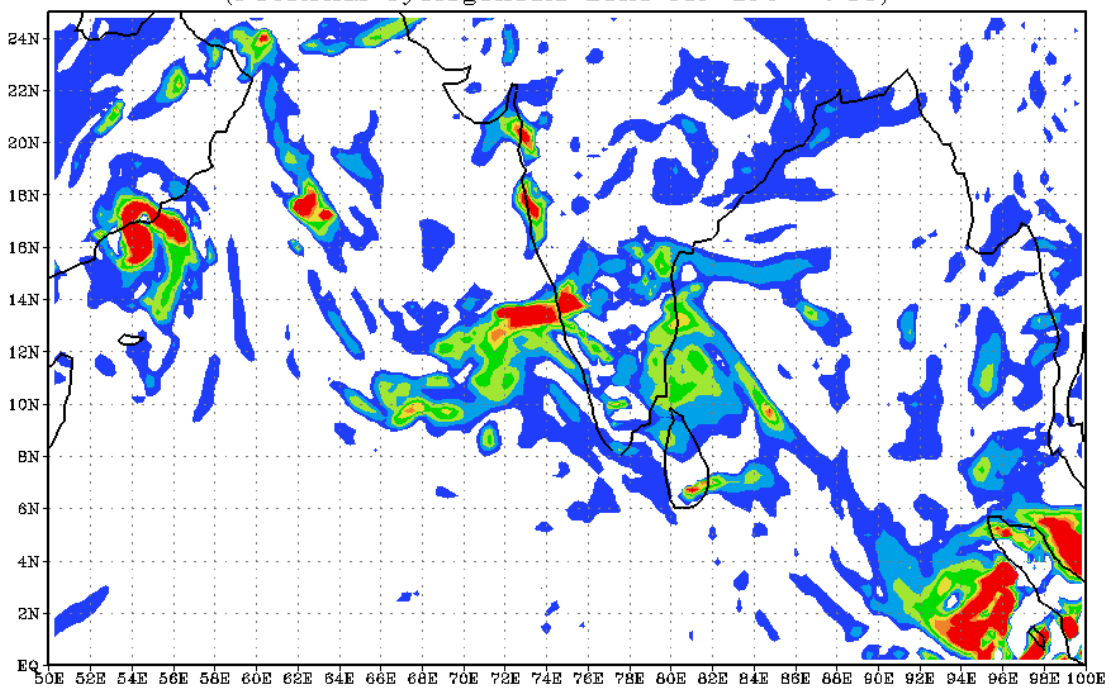


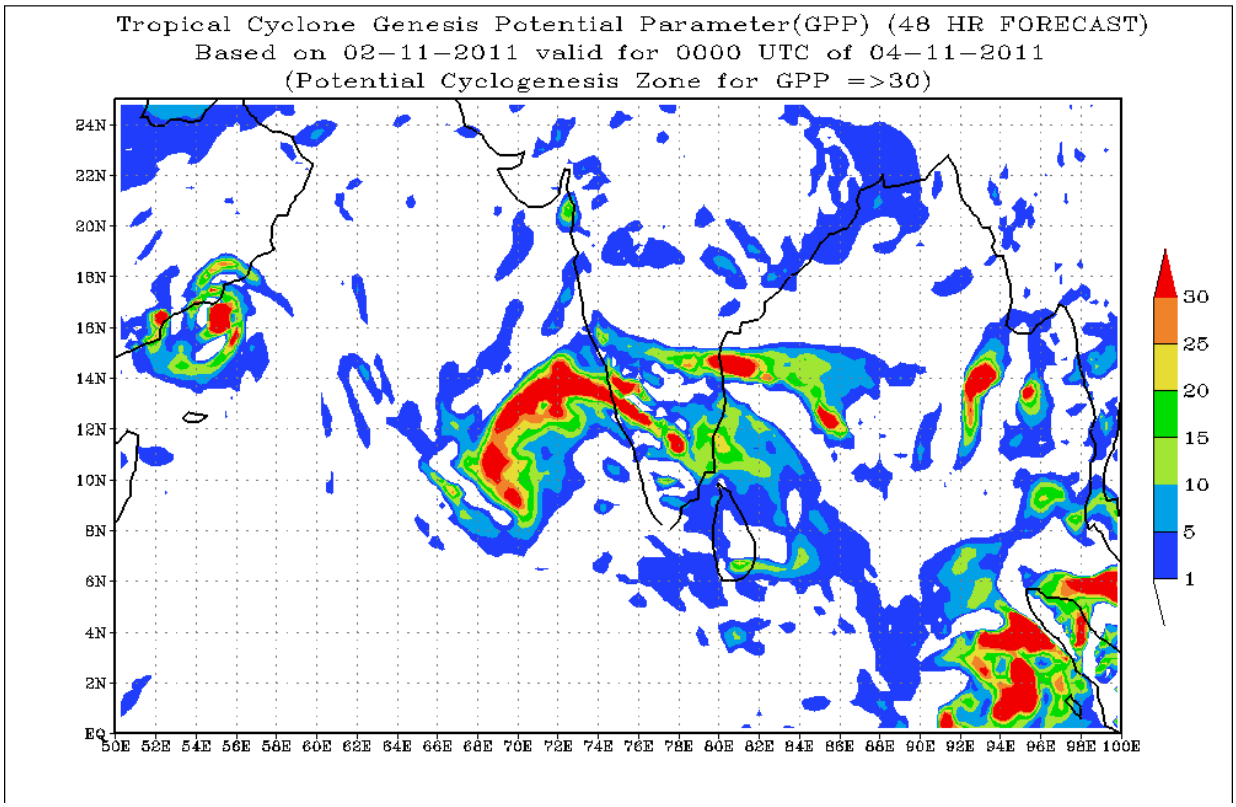
Annexure-III

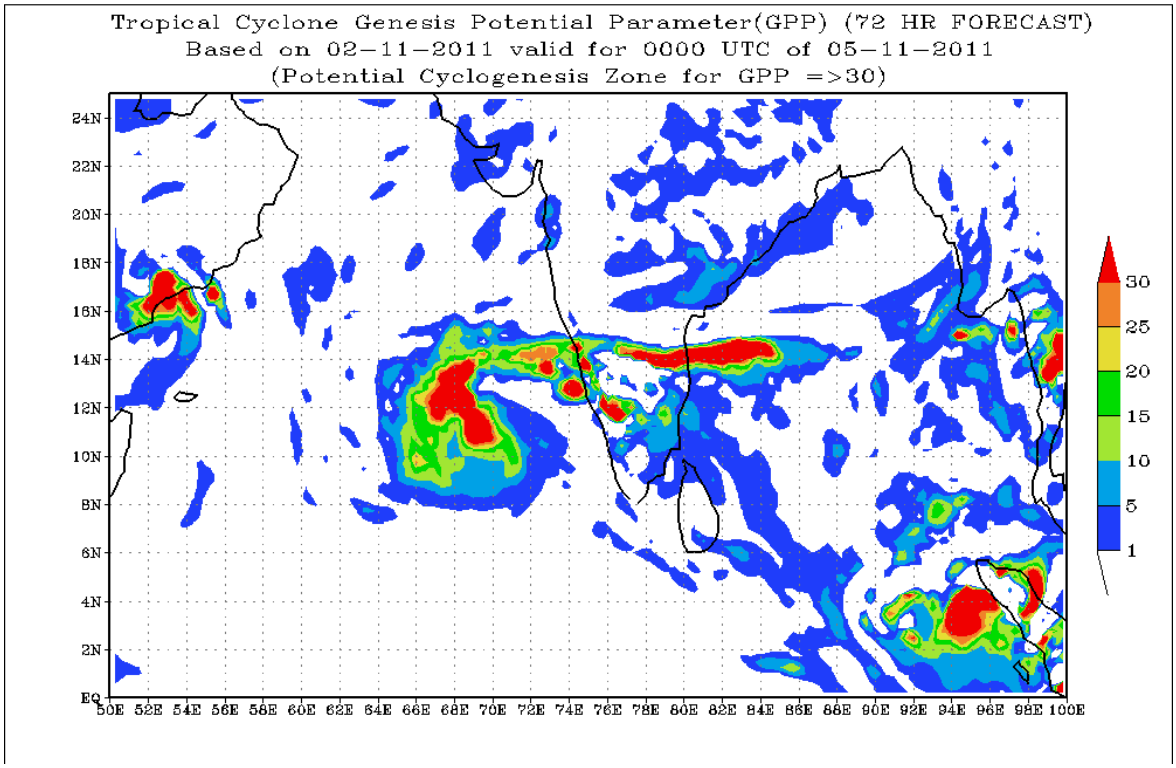
Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 02-11-2011 valid for 0000 UTC of 02-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 02-11-2011 valid for 0000 UTC of 03-11-2011
(Potential Cyclogenesis Zone for GPP =>30)







FDP (Cyclone) NOC Report Dated 4th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 8^0 N over Bay of Bengal.
- Yesterday's deep depression remained practically stationary over coastal Oman and has weakened into low pressure area over the same region.
- The low pressure area over southeast & adjoining central Arabian Sea persists associated with cyclonic circulation extending upto mid tropospheric levels.
- Pressure departure is negative over Tamil Nadu (around 1 hPa) and near normal over coastal Andhra Pradesh, Andaman Nicobar Islands.
- 24 hrs. pressure tendency shows positive change (around 1 hPa) along east coast of India, Andaman & Nicobar Islands, Bangladesh and Myanmar coast.
- Rainfall has occurred at most places over Tamil Nadu and Kerala during past 24 hrs..
- Buoys data show that SST around 29^0C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 30-32^0C over Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy lies between 80 - 100 KJ cm^{-2} over south Bay of Bengal except north Bay of Bengal where it is less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative vorticity at 850 hPa is positive order of 20 *10^{-5} s^{-1} over southwest Bay of Bengal.

Convergence:

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

Divergence:

- Upper air divergence is positive of the order of 5-10*$10^{-5}s^{-1}$ over south Bay of Bengal.

Wind Shear:

- Wind Shear of 5-10 knots over central and south Bay of Bengal and 30-40 knots over north Bay of Bengal.

Wind Shear Tendency:

- Today no data available.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 12.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 4 with amplitude greater than 1.0.

- Statistical forecast: - MJO moves through phase 5, 6 & 7 during next 15 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude greater than 1.0 and moves through phase 5 & 6 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over North West Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 040900 UTC.

Broken low/medium clouds with embedded moderate to intense convection over southeast Bay & adjoining southwest Bay of Bengal and Andaman Sea south of Lat. 13.0N. Scattered low/medium clouds with embedded weal to moderate convection over rest southwest & westcentral Bay of Bengal.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis of 0000 UTC of today shows that the low pressure area will be less marked over the westcentral Arabian Sea at the Coast of Salalah.
- A fresh Low pressure area lies over southeast Arabian Sea and is likely to move westerly direction and then west-northwestwards during next 3 days. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis on 0000 UTC of today shows a fresh CYCIR lies over southeast Arabian Sea and is likely to move westwards, but shows no intensification next 3 days.
- **WRF-ARW** model analysis shows low CYCIR lying southeast Arabian Sea and likely to move west and west-northwestwards direction. The system is likely to intensify into a Deep Depression over southwest Arabian Sea on day3.
- **UKMO** model analysis shows a fresh low pressure area lying over southeast Arabian Sea and moves westwards and thereafter west-northwestward direction during next 3-4 days. Forecasts show the system is likely to intensify during next five days.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows a cell of GPP of 30 l over the southeast Arabian Sea indicates a potential zone of cyclogenesis. 24-h to 72-h forecasts are enclosed here with in **Annexure III.**

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

Summary and Conclusion:

Synoptic and NWP models suggest that

- The low pressure area lies over southeast Arabian Sea and neighbourhood would move west-northwestwards and may become more marked.
- Easterly to northeasterly wind having speed 10 knots would blow over Bay of Bengal during next five days.

Advisory:

- No significant weather system over Bay of Bengal.
- No IOP till 7th November 2011.

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	3/12	**4/00**	**4/03**
India	132/208	124/159	191/208
Coastal stations			
WB	10/13	5/7	11/11
Odisha	10/10	6/7	9/10
AP	17/18	17/17	18/18
Tamil Nadu	14/14	11/14	14/14
Puducherry	2/2	2/2	2/2
A & N	-	1/1	1/1
Bangladesh	21	18	11
Myanmar	17	16	19
Thailand	1	1	1
Sri Lanka	16	14	16

AWS

Region	Date/Time (UTC)		
	3/12	**4/00**	**4/03**

India	481/615	493/616	449/616
WB	18	19	19
ODS	28	26	29
AP	32	32	32
TN	27	26	27
PDC	0	0	0

- **RS/RW** (12Z) of 3 -11-2011: 11/39
- **No. of Ascents reaching 250 hPa levels:4 , MISDA:-3**
- **RS/RW** (00Z) of 3 -11-2011: 10/39
- **No. of Ascents reaching 250 hPa levels: 22, MISDA: 29**

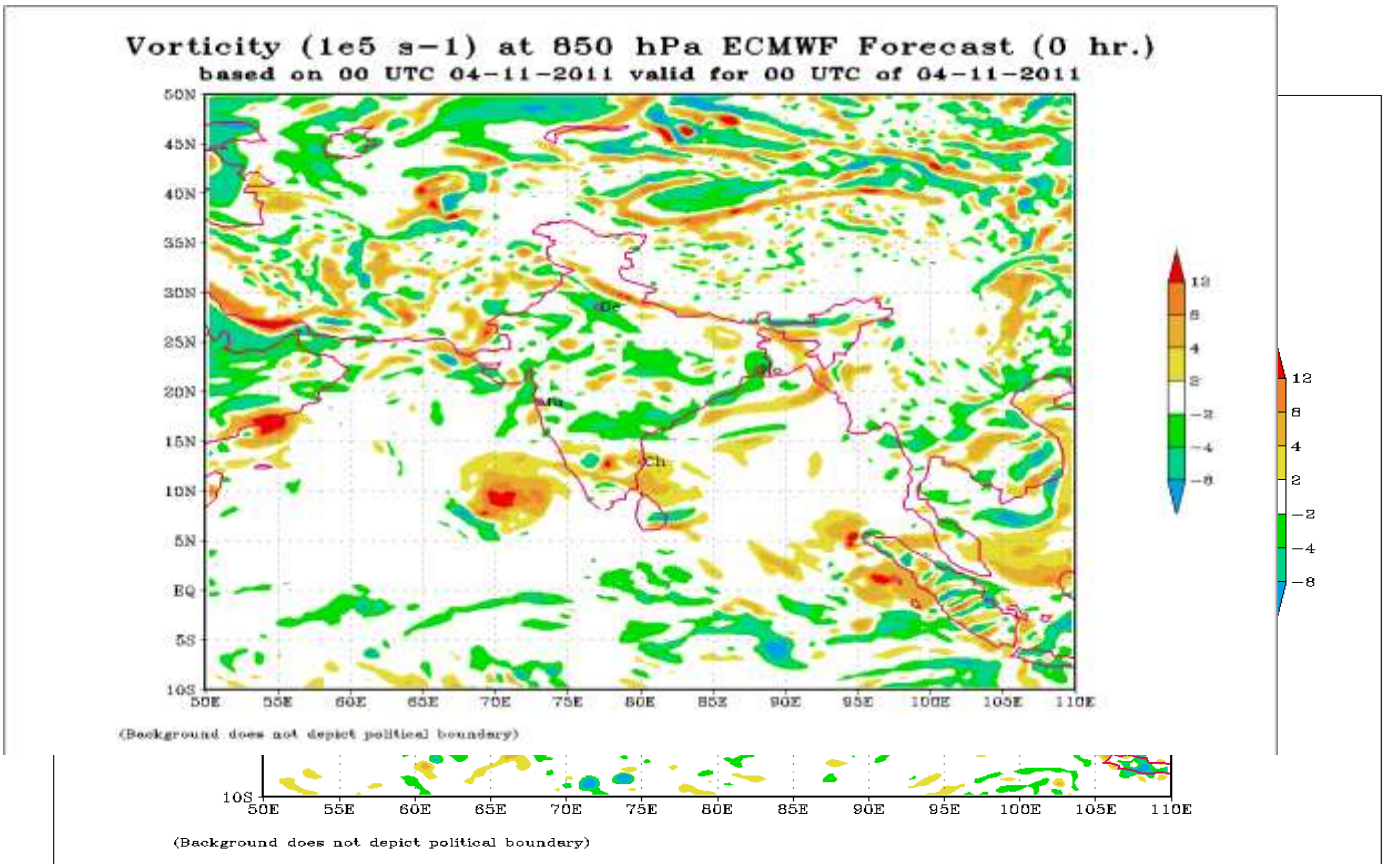
No. of PILOT Ascents

3/12Z	4/00Z
11/37	18/34

Buoy Data

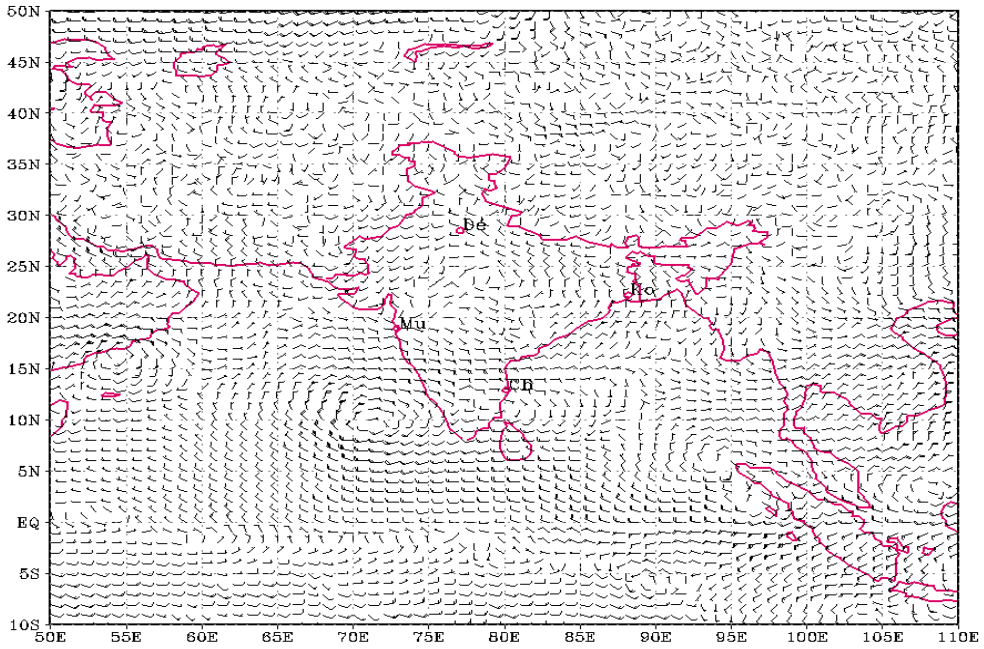
3/12	4/00	4/03
14	13	16

Annexure II



850 hPa WIND ECMWF FORECAST (0 Hr.)

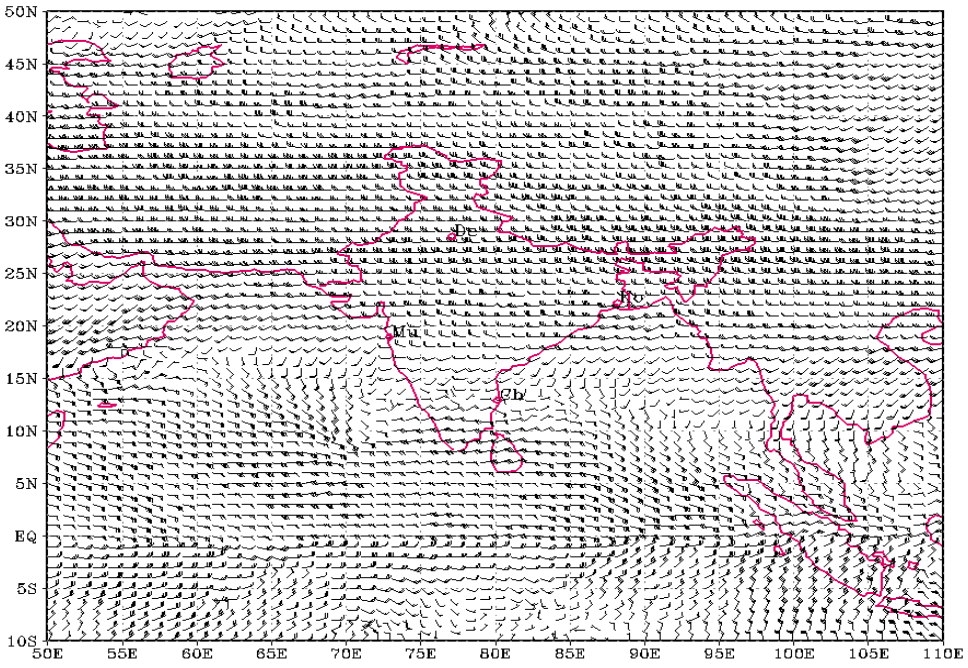
based on 00 UTC 04-11-2011 valid for 00 UTC of 04-11-2011



(Background does not depict political boundary)

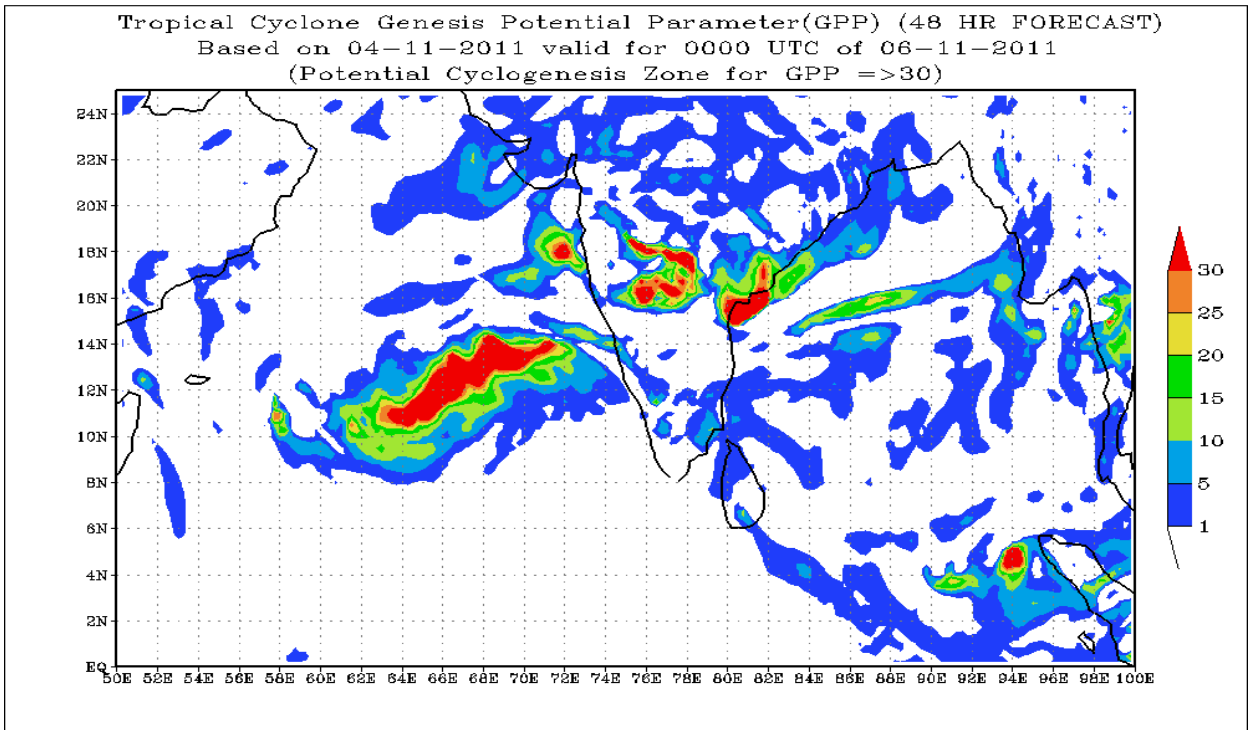
Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

based on 00 UTC 04-11-2011 valid for 00 UTC of 04-11-2011



(Background does not depict political boundary)

Annexure-III


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 04-11-2011 valid for 0000 UTC of 06-11-2011
(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
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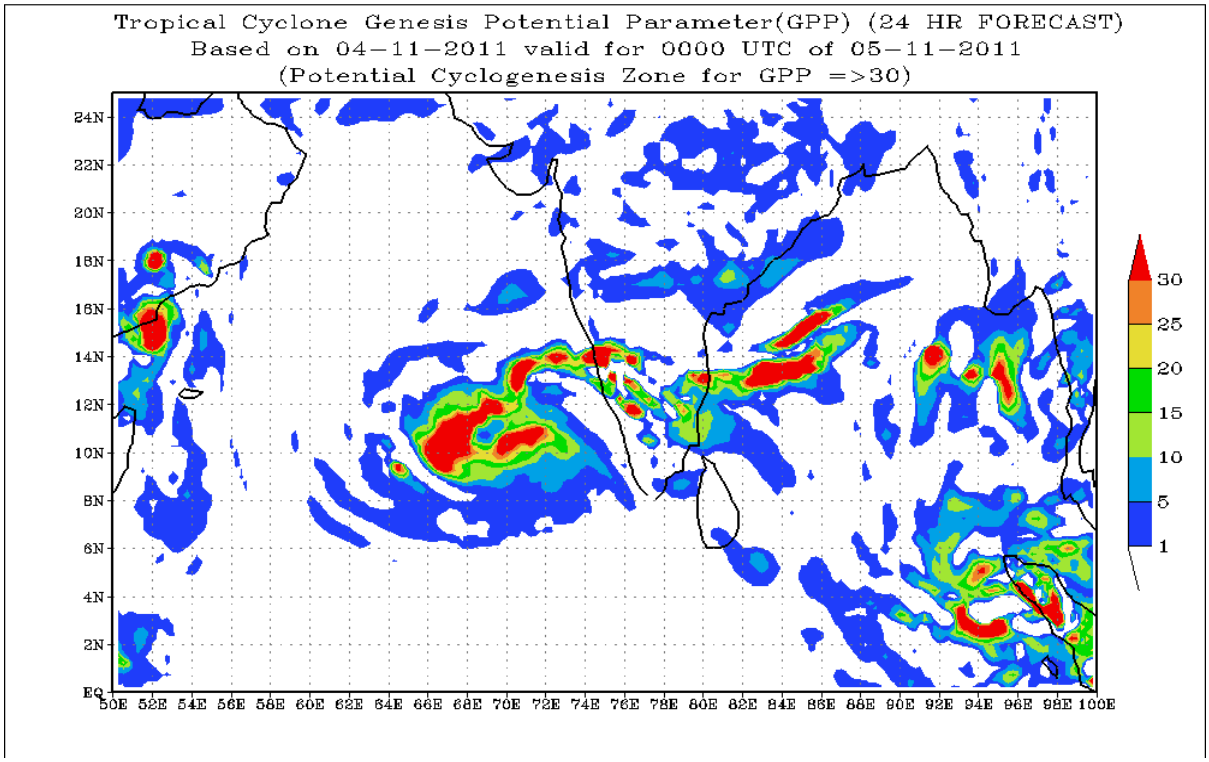
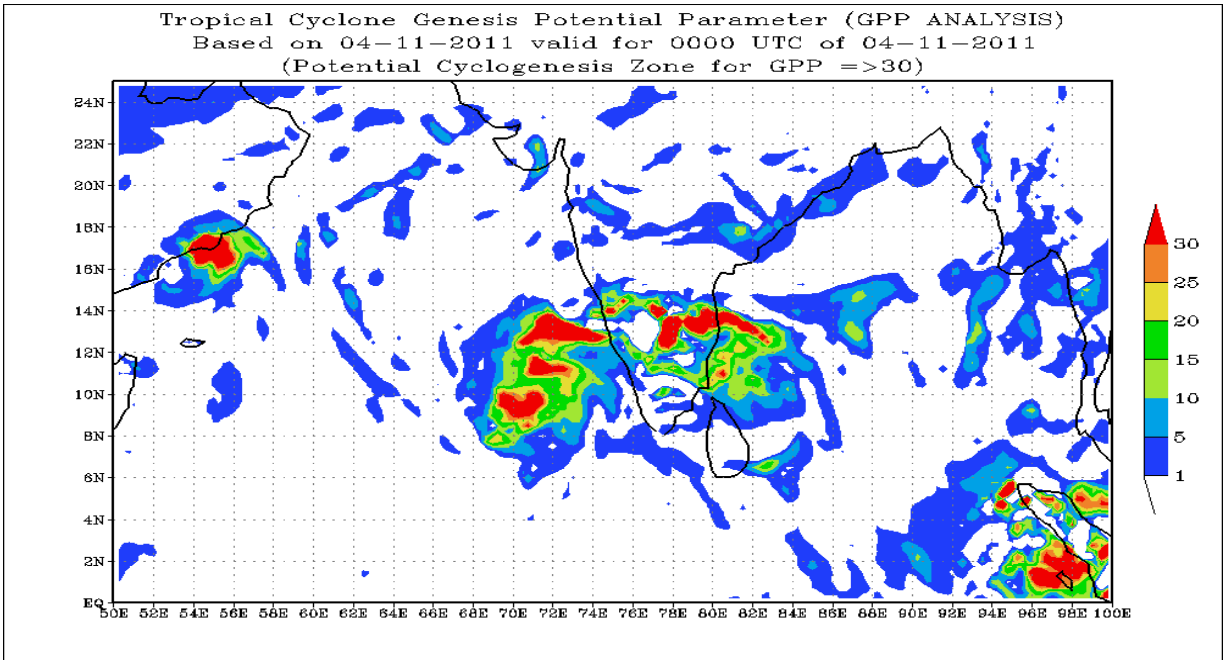
5
1





FDP (Cyclone) NOC Report Dated 6th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 8^0 N over Bay of Bengal.
- Yesterday's low pressure area over Oman and neighbourhood has become unimportant.
- The low pressure area over southeast & adjoining east central Arabian Sea intensified into a depression and lay centred at 0600 UTC of today i.e. 6th November near lat.10.5^0 N and long.65.5^0E . The system is likely intensify further into a deep depression and move west-northwestwards towards Gulf of Aden during next 48 hours.
- Pressure departure is positive (0.5 to 1.0 hPa) along the east coast.
- 24 hrs. pressure tendency shows positive change (around 1 hPa) along Tamilnadu coast and negative (around 0.5 to 1.0 hPa) along Andhra Pradesh, Orissa, West Bengal and Myanmar coasts.
- Rainfall has occurred at most places over Lakshadweep; at many places over Tamilnadu and at one or two places over Rayalaseema and Andaman Nicobar Islands during past 24 hrs..
- Buoys data show that SST around 28-30^0C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^0C over Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over north and central Bay of Bengal is between 40 - 60 KJ cm^{-2} and over south Bay of Bengal 80-100 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of (10-30)*10^{-5} s^{-1} over northeast Bay of Bengal and remaining Bay of Bengal and Andaman Sea (-20 to 10)*$10^{-5}s^{-1}$.

Convergence:

- Lower level convergence is of order of (5)*$10^{-5}s^{-1}$ over Andaman Sea and adjoining southeast Bay of Bengal.

Divergence:

- Upper air divergence is positive of the order of (5)*$10^{-5}s^{-1}$ over south Bay of Bengal and (-5)*$10^{-5}s^{-1}$ over Andaman Sea.

Wind Shear:

- Wind Shear of 5-10 knots over south and adjoing central Bay of Bengal and 20-30 knots over Andaman Sea.

Wind Shear Tendency:

- Decreasing tendency over north Bay of Bengal and increasing over southeast Bay of Bengal and Andaman Sea.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 17.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 4 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 5, 6 & 7 during next 15 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude greater than 1.0 and moves through phase 5, 6, 7 & 8 to 1 during next 15 days.

Cyclonic disturbances over other basins:

- There is no cyclonic disturbance over northwest Pacific Ocean. However, a low pressure area lies over the northwest Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 050900 UTC.

Broken low/medium clouds with embedded moderate to intense convection seen over south Bay of Bengal and Andaman Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecasts based on 0000 UTC of today shows that the low pressure area lying over southeast Arabian Sea likely to move west-northwestwards during next 4 days. The forecast shows no intensification of the low pressure system and likely to dissipate on day 5. Analysis of wind at 850 hPa, wind shear, Vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis of 0000 UTC of today shows a low pressure area is lying over southeast Arabian Sea that is likely to move westwards, but shows no intensification.
- **WRF-ARW** model analysis and forecasts show that low pressure area lying southeast Arabian Sea likely to move west-northwestwards direction. The forecast also shows that system is likely to intensify into a Deep Depression over southwest Arabian Sea during next 72 hours.
- **UKMO** model analysis and forecasts show a low level CYCIR lying over southeast Arabian Sea and initially moves westwards and thereafter northwestward direction during next 3-4 days. Forecasts show no intensification of the system.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows cell of GPP of 30 over southeast Arabian Sea indicates a potential zone of cyclogenesis. The forecasts show the organization of GPP cell during next 72 hours and disorganization during subsequent hours. GPP analysis and forecasts charts are enclosed here with in **Annexure III (**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm**)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- The low pressure lying over southeast Arabian Sea is likely to intensify into a depression during next 48 hours, moving west-northwestwards.
- Easterly to northeasterly wind having speed 10 knots would blow over Bay of Bengal during next five days.

Advisory:

- Presently, no significant weather system over Bay of Bengal and also not likely during next 2-3 days.
- No IOP at present.

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	5/12	6/00	6/03
India	189/205	125/159	191/208
Coastal stations			
WB	11	5	11
Odisha	10	6	10
AP	18	17	18
Tamil Nadu	13	12	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	9	6	8
Myanmar	9	6	8
Thailand	1	1	1
Sri Lanka	10	7	10

AWS

Region	Date/Time (UTC)		
	5/12	6/00	6/03
India	446/616	495/616	397/616

WB	18	19	19
ODS	27	27	29
AP	32	33	33
TN	27	27	27
PDC	-	-	1

- **RS/RW** (12Z) of 5 -11-2011: 8/39
- **No. of Ascents reaching 250 hPa levels: 3 , MISDA:-31**
- **RS/RW** (00Z) of 6 -11-2011: 36/39
- **No. of Ascents reaching 250 hPa levels: 17, MISDA:3**

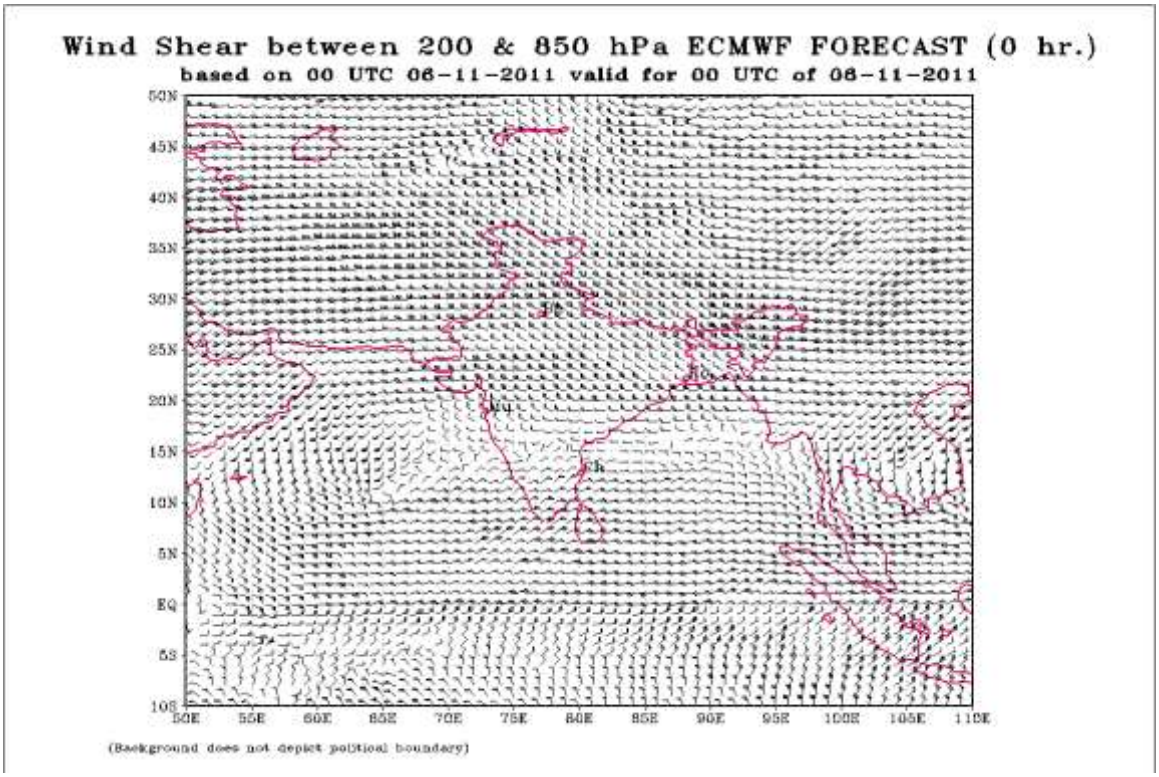
No. of PILOT Ascents

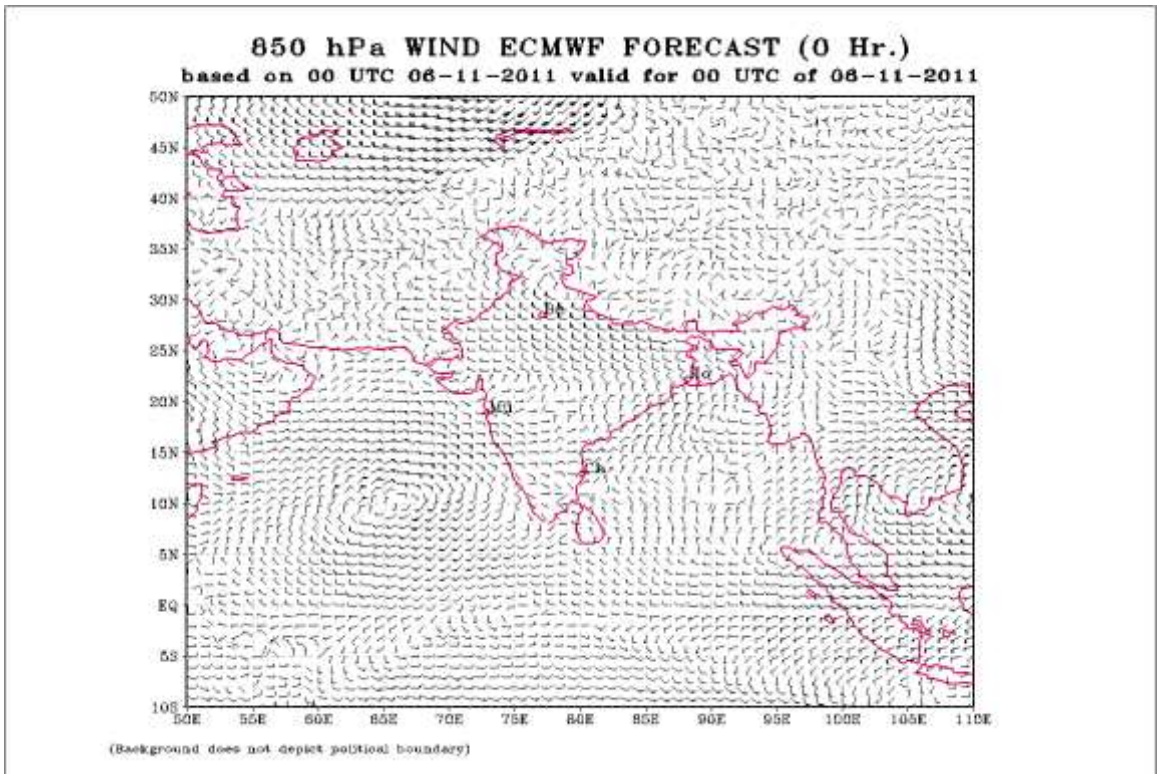
5/12Z	**6/00Z**
20/37	17/34

Buoy Data

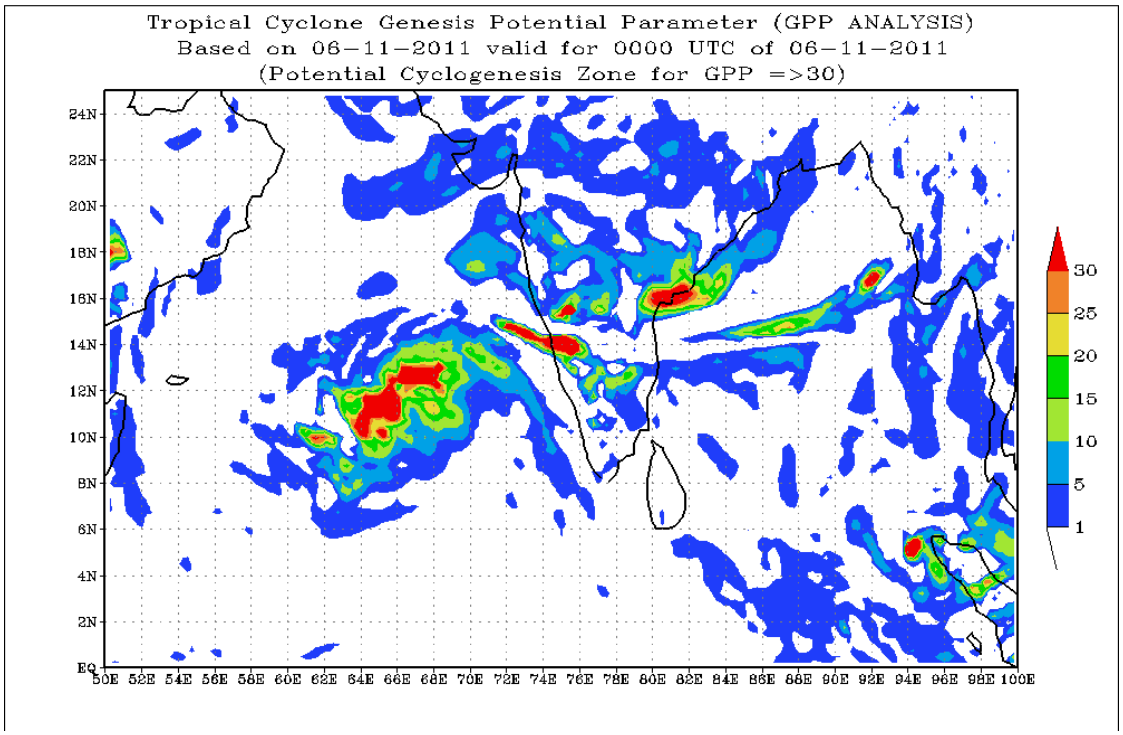
5/12	**6/00**	**6/03**
12	9	7

Annexure II





Annexure III



FDP (Cyclone) NOC Report Dated 7th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 10 N over Bay of Bengal.
- Yesterday's depression lay centred at 0900 UTC of today i.e. 7th November near lat.13.0^{0}N and long.61.0^{0}E (T1.5).
- Pressure departure is positive (1.0 to 2.0 hPa) along east coast except west Bengal coast where the same is nearly normal.
- 24 hrs. pressure tendency shows no significant change along east coast of India, Myanmar and Bangladesh coast.
- Rainfall has occurred at many places over Tamilnadu during past 24 hrs..
- Buoys data show that SST around 28-29^{0}C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 30-32^{0}C over south & central Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south and central Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of $30*10^{-5}$ s^{-1} over south Bay of Bengal and $10*10^{-4}$ s^{-1} over depression area in Arabian Sea.

Convergence:

- Lower level convergence is of order of $5*10^{-5}s^{-1}$ over Bay of Bengal and depression area in Arabian Sea.

Divergence:

- Upper air divergence is positive of the order of $5\text{-}10*10^{-5}s^{-1}$ over southwest Bay of Bengal and over depression area in Arabian Sea.

Wind Shear:

- Wind Shear of 20 knots over south and adjoining central Bay of Bengal and over depression area in Arabian Sea.

Wind Shear Tendency:

- Negative tendency of -5 to -10 knots over south Bay of Bengal and over depression area in Arabian Sea..

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 18.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 4 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 5, 6 & 7 during next 15 days.
- Dynamical forecast: - MJO located in phase 4 with amplitude greater than 1.0 and moves through phase 5, 6 & 7 during next 15 days.

Cyclonic disturbances over other basins:

- There is tropical cyclonic disturbance over north Pacific Ocean lat.15.4^0N and long.110.0^0E (T1.5).

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 070900 UTC.

BAY OF BENGAL & ANDAMAN SEA: -

Broken low/medium clouds with embedded isolated to moderate intense convection over Andaman Sea. Scattered low medium clouds with embedded isolated weak convection over southeast parts of southeast Bay of Bengal.

ARABIAN SEA: - low/medium clouds with embedded isolated to moderate intense convection over Southeast Arabian Sea. Scattered low medium clouds with embedded isolated to moderate weak convection over eastcentral Arabian Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecasts based on 0000 UTC of today shows that the depression lying over southwest Arabian Sea likely to move west-northwestwards during next 4 days and likely to cross the Oman coast on day5. The forecast shows the system is likely to intensify to cyclone on day3. Analysis of wind at 850 hPa, wind shear, Vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis of 0000 UTC of today shows a depression is lying over southwest and adjoining areas of Arabian Sea that is likely to move westwards, and likely to intensify into deep depression. As such the system is likely to weaken over Sea on day4.
- **WRF-ARW** model analysis and forecasts show that depression lying southwest Arabian Sea likely to move west-northwestwards direction and consequently intensify to cyclone.
- **UKMO** model analysis and forecasts show depression lying over southeast Arabian Sea and initially moves westwards and thereafter west-southwestward direction during next 3-4 days.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows cell of GPP of 30 over southeast Arabian Sea indicates a potential zone of cyclogenesis. The forecasts show the organization of GPP cell during next 48 hours and disorganization during subsequent hours. GPP analysis and forecasts charts are enclosed here with in **Annexure III (**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm**)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- The depression lying over westcentral Arabian Sea is likely to intensify into a deep depression during next 48 hours, moving northwestwards.
- Easterly to northeasterly wind having speed 5-10 knots would blow over Bay of Bengal during next three days.

Advisory:

- Presently, no significant weather system over Bay of Bengal and also not likely during next 2-3 days.
- No IOP at present.

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	6/12	**7/00**	**7/03**
India	189/205	128/159	187/208
Coastal stations			
WB	11	5	11
Odisha	10	6	10
AP	18	17	18
Tamil Nadu	14	12	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	9	6	8
Myanmar	8	9	7
Thailand	1	1	1
Sri Lanka	10	7	10

AWS

Region	Date/Time (UTC)		
	6/12	**7/00**	**7/03**
India	443/616	493/616	388/616
WB	19	18	20
ODS	29	29	29
AP	33	33	33
TN	27	26	27
PDC	1	-	-

- **RS/RW** (12Z) of 6 -11-2011: 18/37
- **No. of Ascents reaching 250 hPa levels: 3 , MISDA:-19**
- **RS/RW** (00Z) of 7 -11-2011: 19/39
- **No. of Ascents reaching 250 hPa levels: 17, MISDA:15**

No. of PILOT Ascents

6/12Z	7/00Z
18/37	19/34

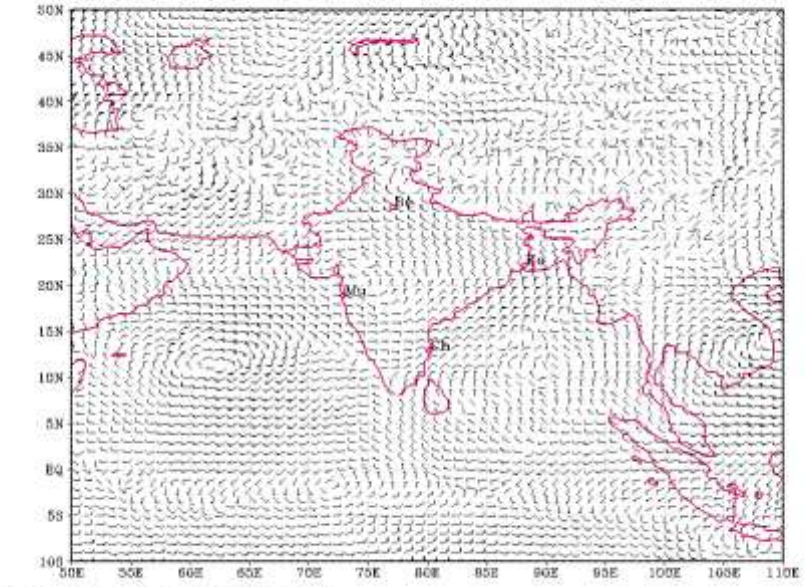
Buoy Data

6/12	7/00	7/03
9	12	14

Annexure II

850 hPa WIND ECMWF FORECAST (0 Hr.)

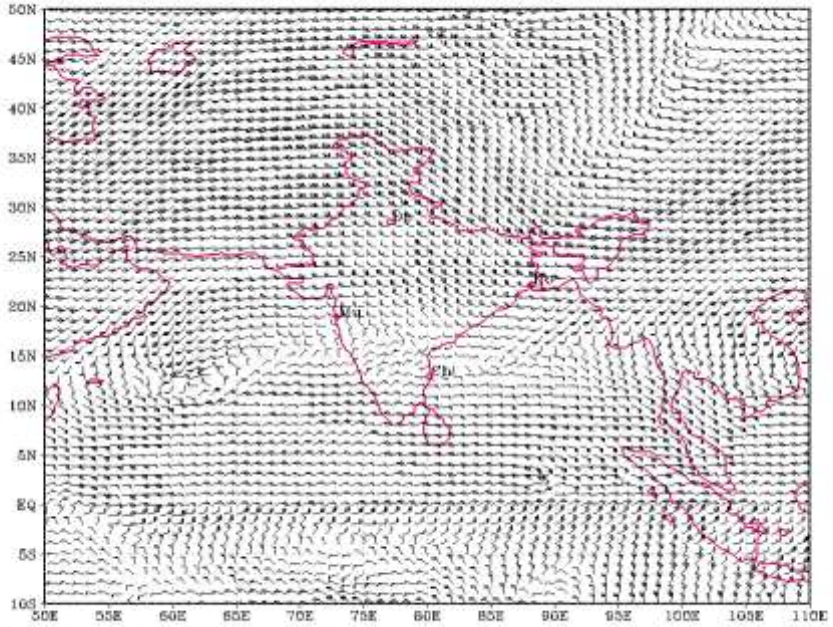
based on 00 UTC 07-11-2011 valid for 00 UTC of 07-11-2011



(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

based on 00 UTC 07-11-2011 valid for 00 UTC of 07-11-2011



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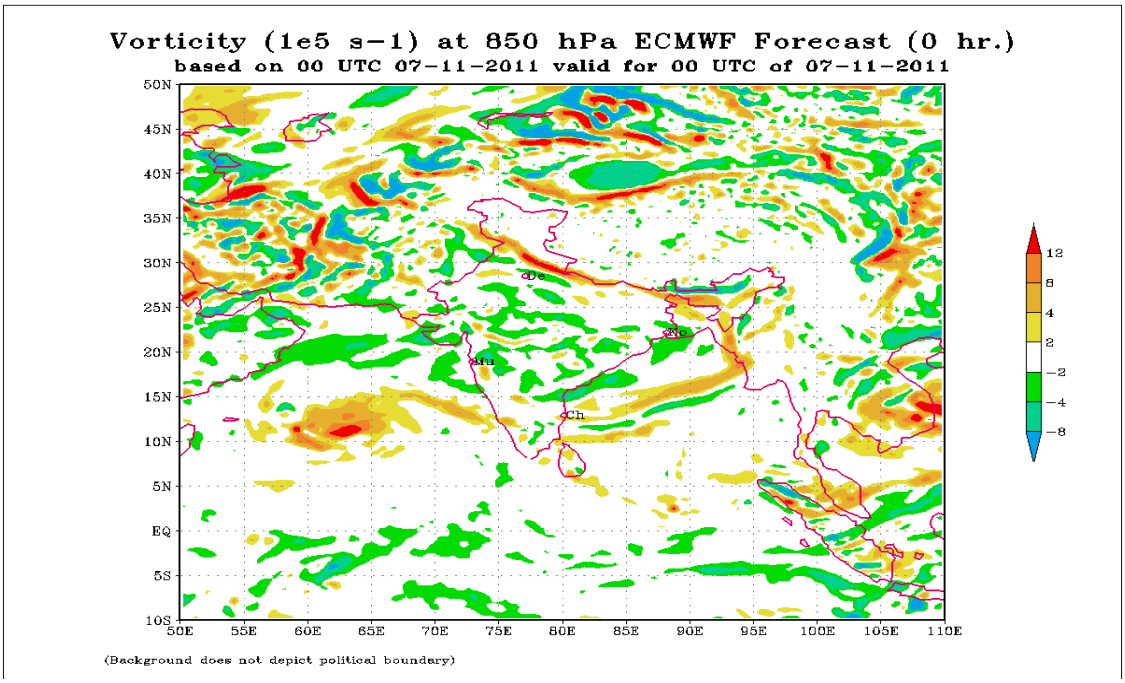
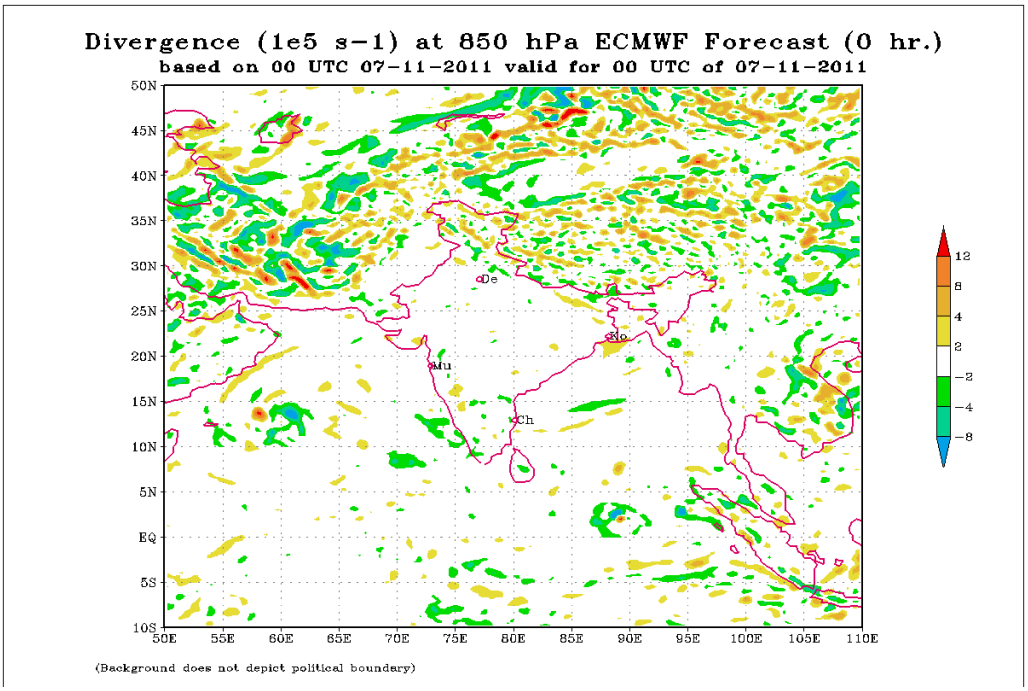
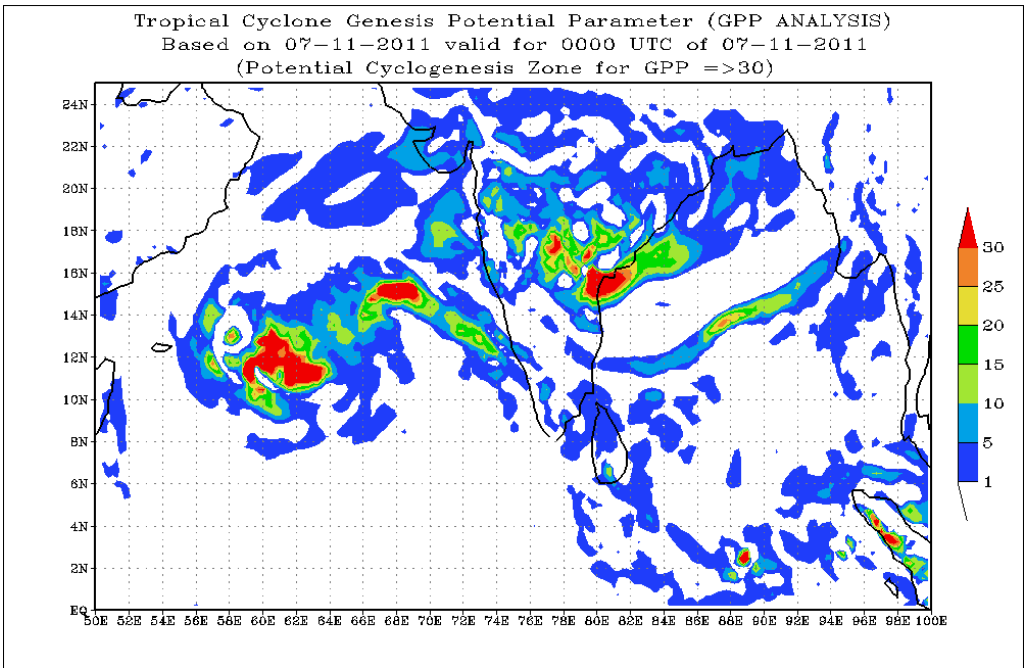
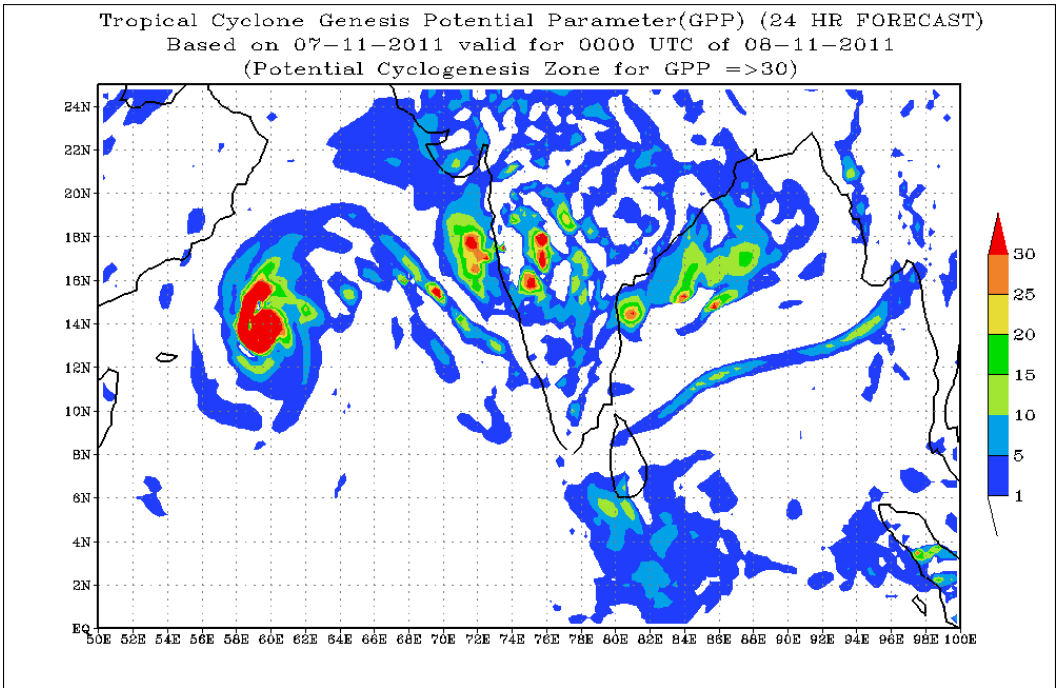
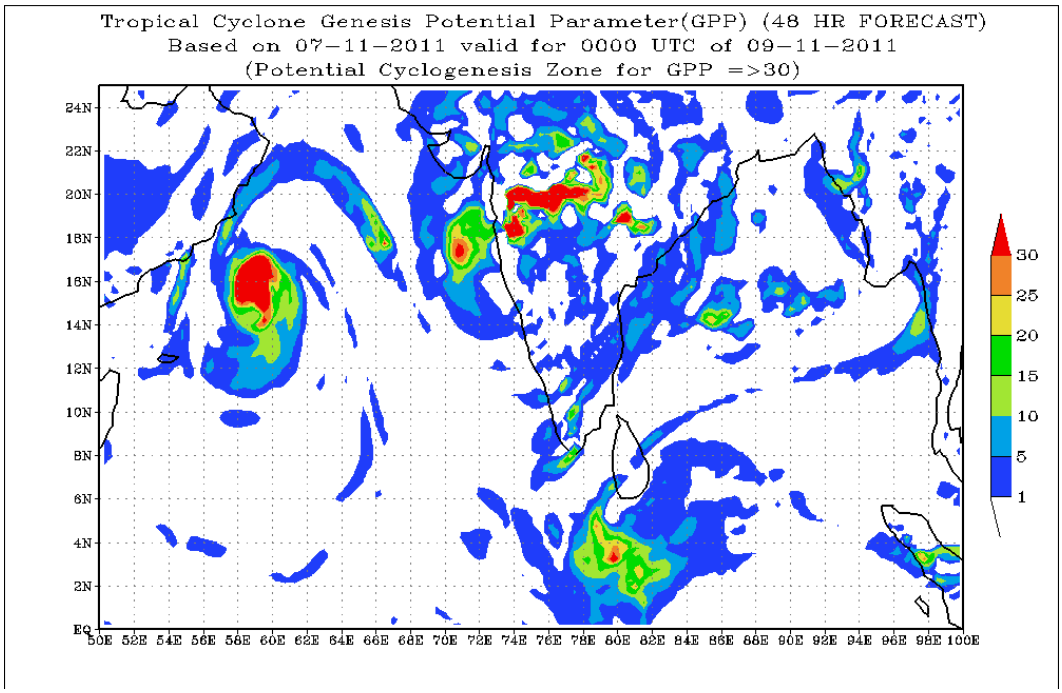


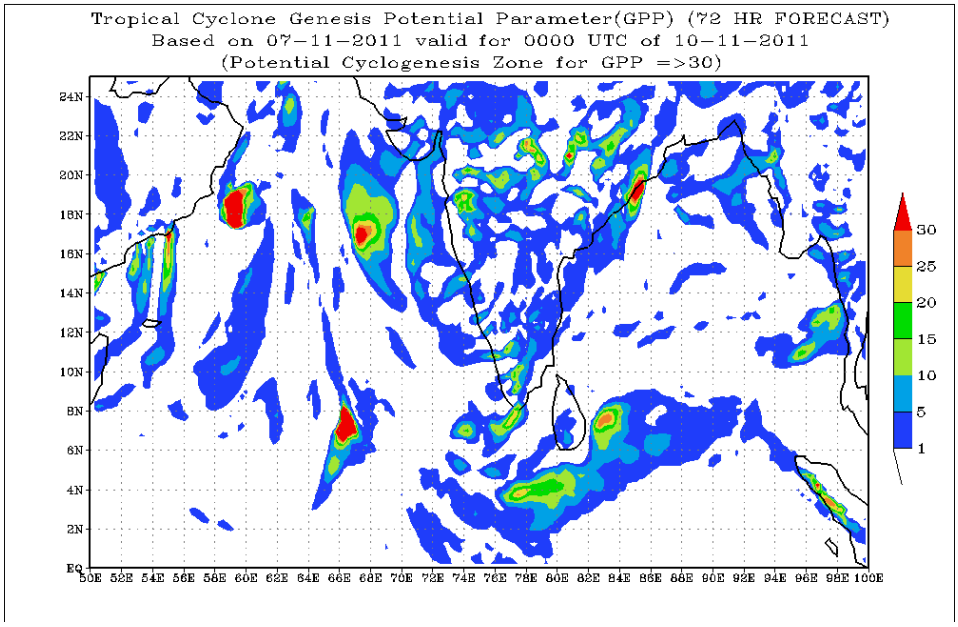


Annexure III


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 07-11-2011 valid for 0000 UTC of 07-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 07-11-2011 valid for 0000 UTC of 08-11-2011
(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
1





FDP (Cyclone) NOC Report Dated 8th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 10 N over Bay of Bengal.
- Yesterday's depression over westcentral Arabian Sea moved westwards, intensified into a deep depression and lay centred at 0830 hrs. IST of today, the 8th November 2011 over westcentral Arabian Sea near latitude 13.5^0N and longitude 60.0^0E.
- Pressure departure is positive (1.0 to 2.0 hPa) along east coast except west Bengal coast where the same is nearly normal.
- 24 hrs. pressure tendency shows no significant change along east coast of India, Myanmar and Bangladesh coast.
- Rainfall has occurred at a few places over Tamilnadu during past 24 hrs..
- Buoys data show that SST around 28-30^0C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 30-32^0C over south & central Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south and central Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 25-30*10^{-5} s^{-1} over south Bay of Bengal and 10*10^{-4} s^{-1} over depression area in westcentral Arabian Sea.

Convergence:

- Lower level convergence is of order of 5-10*$10^{-5}s^{-1}$ over south Bay of Bengal and depression area over westcentral Arabian Sea.

Divergence:

- Upper air divergence is positive of the order of 5-10*$10^{-5}s^{-1}$ over south Bay of Bengal and 10-20*$10^{-5}s^{-1}$ over depression area over westcentral Arabian Sea.

Wind Shear:

- Wind Shear of 5-10 knots over north and central Bay of Bengal and 20-30 knots over Andaman Sea and depression area over westcentral Arabian Sea.

Wind Shear Tendency:

- Negative tendency of -5 to -10 knots over southwest and westcentral Bay of Bengal and over depression area westcentral Arabian Sea.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 17.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 5 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 6, 7 & 8 during next 15 days.

- Dynamical forecast: - MJO located in phase 5 with amplitude greater than 1.0 and moves through phase 6, 7 & 8 during next 15 days.

Cyclonic disturbances over other basins:

- There is a tropical cyclonic depression over west Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 080900 UTC.

BAY OF BENGAL & ANDAMAN SEA: -Scattered low/medium clouds with embedded isolated weak convection over south Bay of Bengal and Andaman Sea (.)

ARABIAN SEA: - Broken low/medium clouds with embedded isolated weak to moderate convection over rest Arabian Sea north of Lat 15.5^0N and Long 62.0^0E to 68.0^0E (.)

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecasts based on 0000 UTC of today shows that the depression over the west central Arabian Sea likely to intensify into a cyclone during next 24 hours and weaken thereafter. The forecast shows the system likely to move westward direction during next 3 days and likely to cross the Oman coast on day4. Analysis of wind at 850 hPa, wind shear, Vorticity and Divergence is shown in **Annexure II**.

- **IMD-GFS** model analysis and forecasts based on 0000 UTC of today shows the Depression over west central Arabian Sea and adjoining areas is likely to move westwards, and likely to intensify into Deep Depression. Forecasts also show that the system is likely to weaken over Sea after day 3.
- **WRF-ARW** model analysis and forecasts show that the Depression over west central Arabian Sea and adjoining areas likely to move westwards direction and intensify into a cyclone during next 24 hours.
- **UKMO** model analysis and forecasts show depression lying over the west central Arabian Sea likely to intensify and move westwards during next 48 hours and dissipate thereafter.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows cell of GPP of 30 over west central Arabian Sea indicates a potential zone of cyclogenesis. The forecasts show the organization of GPP cell during next 24 hours and disorganization during subsequent hours. GPP analysis and forecasts charts are enclosed here with in **Annexure III (**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm**)**

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Summary and Conclusion:

Synoptic and NWP models suggest that:

- The deep depression lying over westcentral Arabian Sea is likely to intensify into a cyclonic storm during next 24 hours, moving west-northwestwards.
- Easterly to northeasterly wind having speed 5-10 knots would blow over Bay of Bengal during next 2-3 days.

Advisory:

- Presently, no significant weather system over Bay of Bengal and also not likely during next 2-3 days.
- No IOP at present.

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	7/12	800	8/03
India	190/205	127/159	192/208
Coastal stations			
WB	10	6	11
Odisha	10	6	10
AP	18	17	18
Tamil Nadu	14	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	16	15	16
Myanmar	15	16	16
Thailand	1	1	1
Sri Lanka	14	13	13

AWS

Region	Date/Time (UTC)		
	7/12	8/00	8/03
India	441/616	494/616	387/616
WB	2	19	16

ODS	22	27	24
AP	31	33	22
TN	23	27	17
PDC	2	-	-

- **RS/RW** (12Z) of 7-11-2011: 10/39
- **No. of Ascents reaching 250 hPa levels: 2 , MISDA:-29**
- **RS/RW** (00Z) of 8-11-2011: 36/39
- **No. of Ascents reaching 250 hPa levels: 20, MISDA:3**

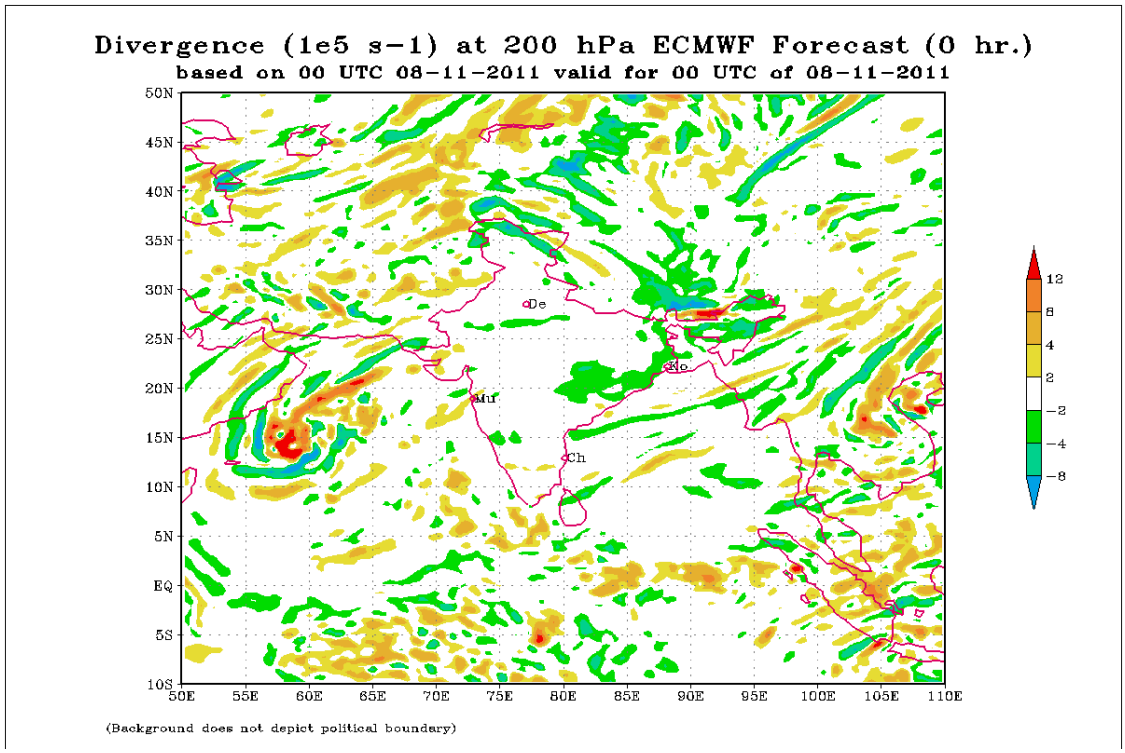
No. of PILOT Ascents

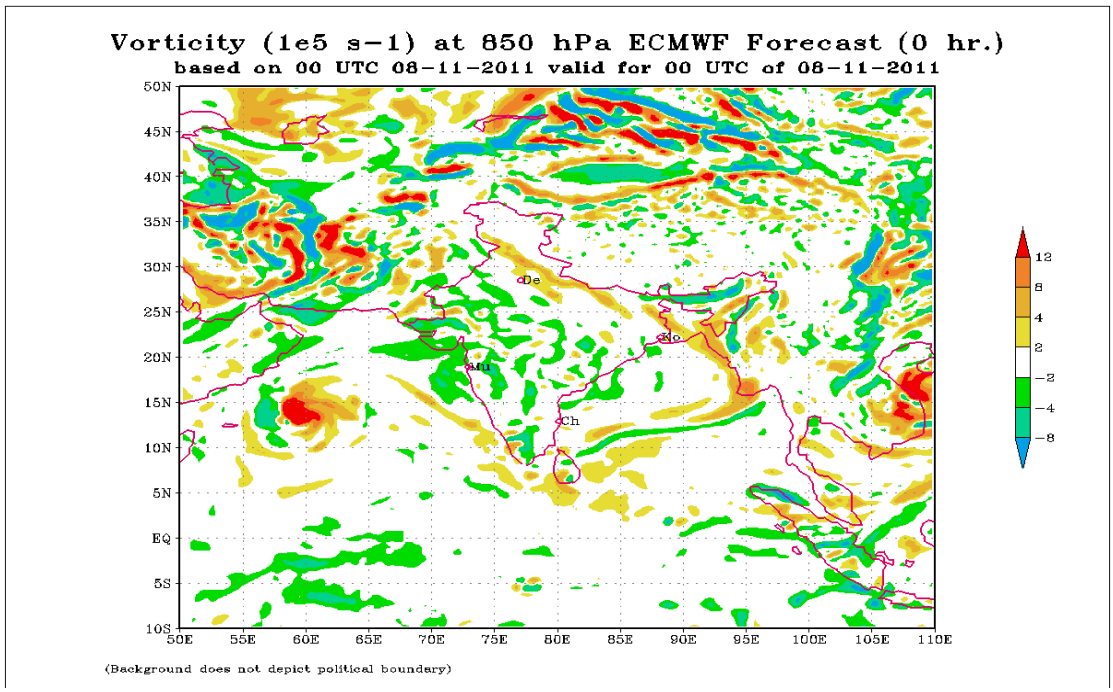
7/12Z	**8/00Z**
18/37	14/34

Buoy Data

7/12	**8/00**	**8/03**
13	13	14

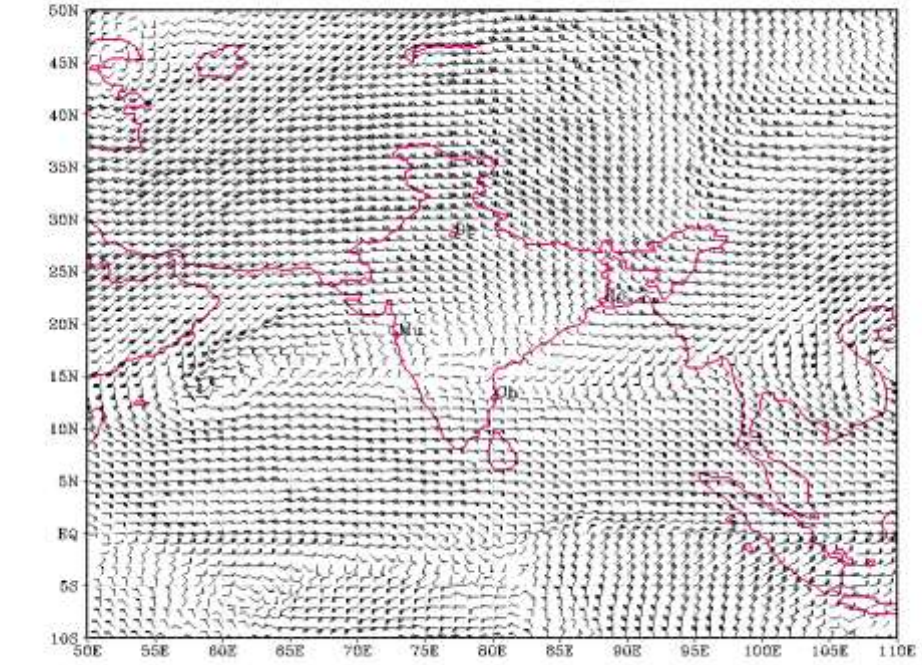
Annexure II


Divergence (1e5 s−1) at 200 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 08−11−2011 valid for 00 UTC of 08−11−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
De
Mo
Mu
Ch
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)


Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 08−11−2011 valid for 00 UTC of 08−11−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
De
Mo
Mu
Ch
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

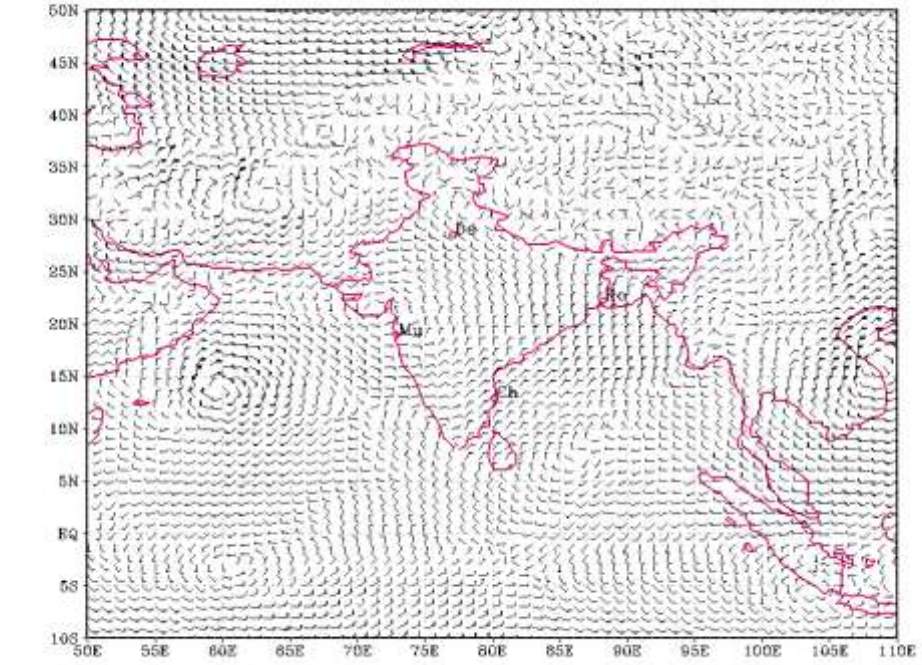
based on 00 UTC 08-11-2011 valid for 00 UTC of 08-11-2011



(Background does not depict political boundary)

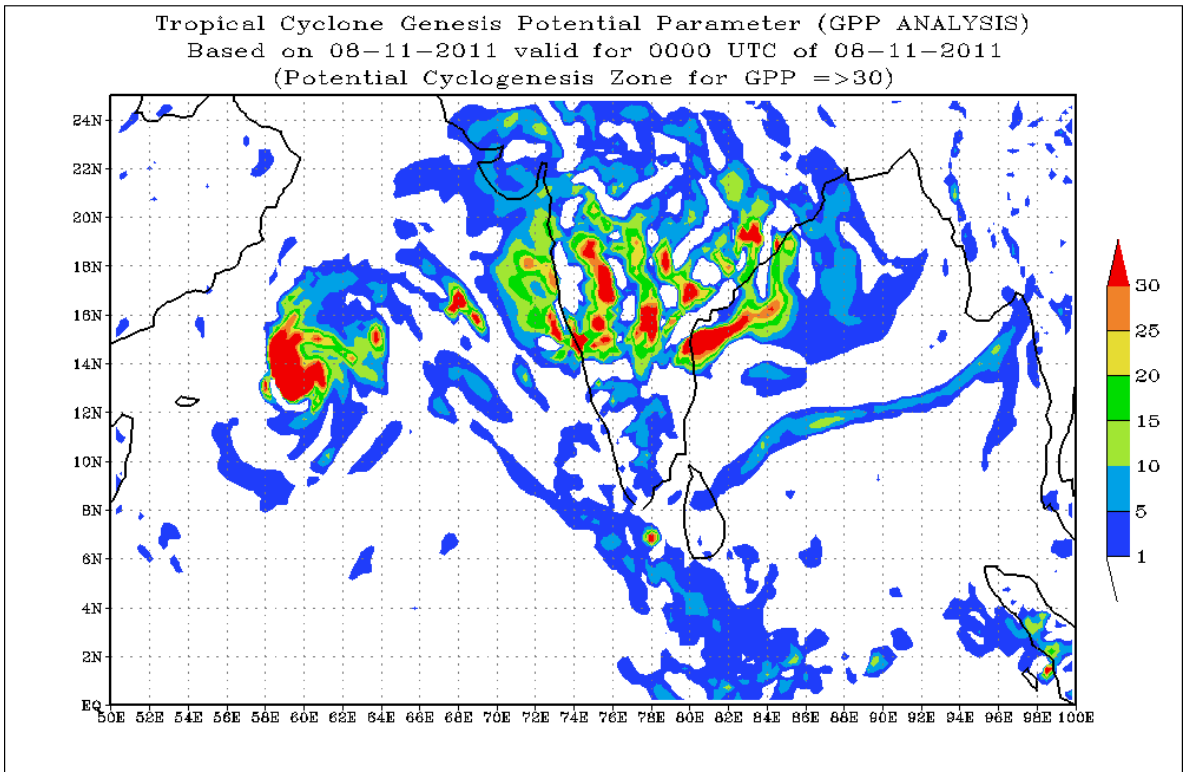
850 hPa WIND ECMWF FORECAST (0 Hr.)

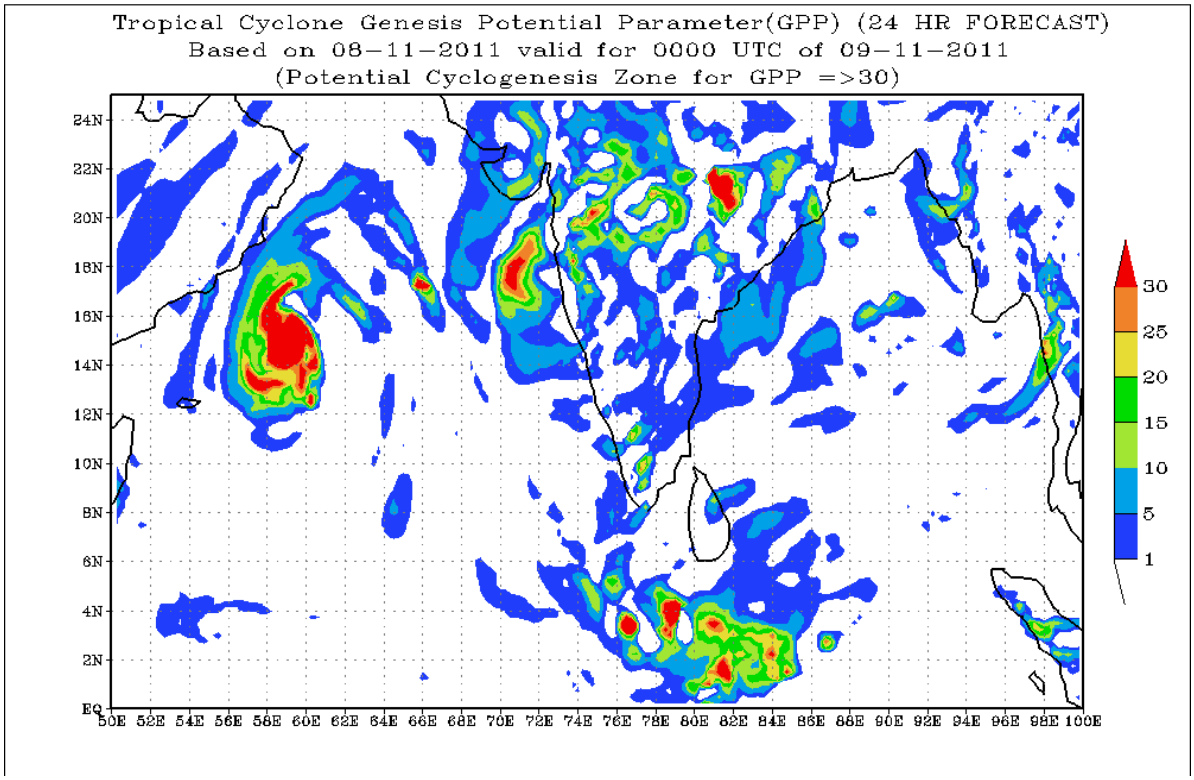
based on 00 UTC 08-11-2011 valid for 00 UTC of 08-11-2011

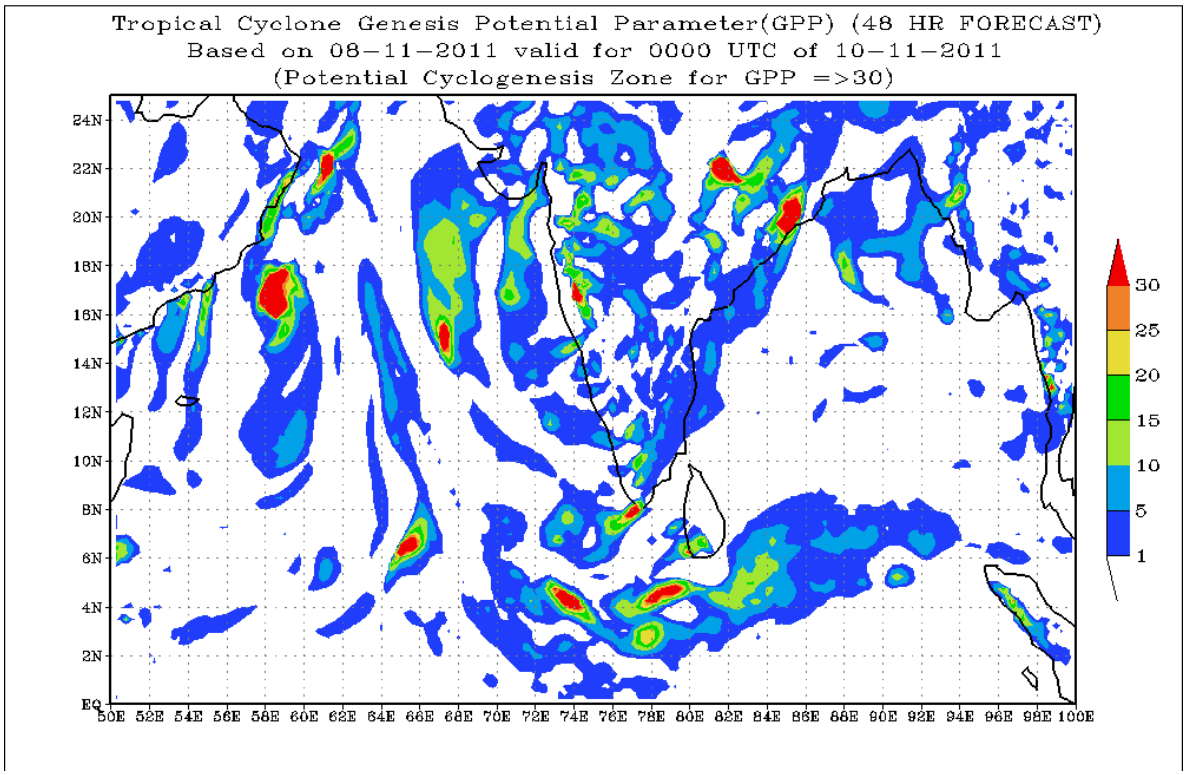


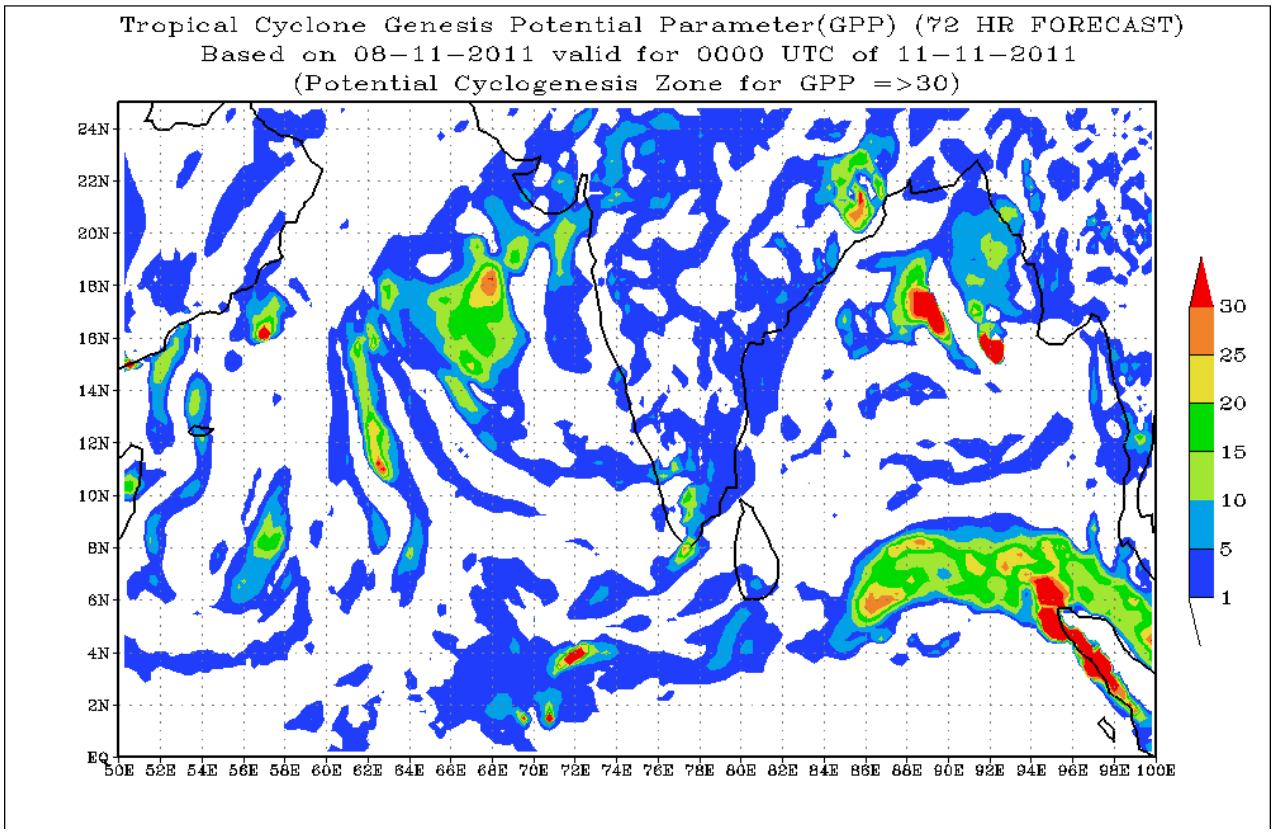
(Background does not depict political boundary)

Annexure-III






Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 08-11-2011 valid for 0000 UTC of 10-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 08-11-2011 valid for 0000 UTC of 11-11-2011
(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
1

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 10 N over Bay of Bengal.
- Yesterday's deep depression over westcentral Arabian Sea moved north-northwestwards and lay centered at 0830 hrs. IST of today, the 9th November 2011 over westcentral Arabian Sea near latitude 15.0^0N and longitude 58.5^0E.
- A trough at 850 hPa runs from eastcentral to southwest bay of Bengal across westcentral Bay of Bengal.
- Pressure departure is positive (1.0 to 2.0 hPa) along east coast except Orissa and West Bengal coast where the same is nearly normal.
- 24 hrs. pressure tendency shows no significant change along east coast of India, Myanmar and Bangladesh coast.
- Buoys data show that SST around $28\text{-}30^0$C over central and north Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around $28\text{-}30^0$C over south & central Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south and central Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of $20*10^{-5}$ s^{-1} over southwest Bay of Bengal and $10*10^{-4}$ s^{-1} over depression area in westcentral Arabian Sea.

Convergence:

- Lower level convergence is of order of $5*10^{-5}s^{-1}$ over southwest Bay of Bengal and depression area over westcentral Arabian Sea.

Divergence:

- Upper air divergence is negative of the order of $-5*10^{-5}s^{-1}$ over south Bay of Bengal and positive of the order of $10\text{-}20*10^{-5}s^{-1}$ over depression area over westcentral Arabian Sea.

Wind Shear:

- Wind Shear of 10-20 knots over south and central Bay of Bengal and 20-30 knots over Andaman Sea and depression area over westcentral Arabian Sea.

Wind Shear Tendency:

- Negative tendency of -5 knots over southwest Bay of Bengal and over depression area over westcentral Arabian Sea.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 15.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 5 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 6, 7 & 8 during next 15 days.
- Dynamical forecast: - MJO located in phase 5 with amplitude greater than 1.0 and moves through phase 6, 7 & 8 during next 15 days.

Cyclonic disturbances over other basins:

- There is a no cyclonic disturbance over west Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 080900 UTC.

BAY OF BENGAL & ANDAMAN SEA: -Scattered low/medium clouds with embedded isolated weak convection over south Bay of Bengal and Andaman Sea (.)

ARABIAN SEA: - Broken low/medium clouds with embedded isolated weak to moderate convection over rest Arabian Sea north of Lat 15.5^0N and Long 62.0^0E to 68.0^0E (.)

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecasts based on 0000 UTC of today shows that the depression over the west central Arabian Sea likely to intensify into a cyclone during next 24 hours and weaken thereafter. The forecast shows the system likely to move westward direction during next 3 days and likely to cross the Oman coast on day4. Analysis of wind at 850 hPa, wind shear, Vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis and forecasts based on 0000 UTC of today shows the Depression over west central Arabian Sea and adjoining areas is likely to move westwards, and likely to intensify into Deep Depression. Forecasts also show that the system is likely to weaken over Sea after day 3.
- **WRF-ARW** model analysis and forecasts show that the Depression over west central Arabian Sea and adjoining areas likely to move westwards direction and intensify into a cyclone during next 24 hours.
- **UKMO** model analysis and forecasts show depression lying over the west central Arabian Sea likely to intensify and move westwards during next 48 hours and dissipate thereafter.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows cell of GPP of 30 over west central Arabian Sea indicates a potential zone of cyclogenesis. The forecasts show the organization of GPP cell during next 24 hours and disorganization during subsequent hours. GPP analysis and forecasts charts are enclosed here with in **Annexure III (**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm**)**
http://www.imd.gov.in/section/nhac/dynamic/welcome.htm

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Summary and Conclusion:

Synoptic and NWP models suggest that:

- The deep depression is likely to move north-northwestwards initially and then westwards towards Gulf of Aden during next 48 hrs. and weaken gradually due to colder Sea and interaction with land surface.
- A cyclonic circulation is likely to form over southeast Bay of Bengal during next 48 hours.

Advisory:

- Presently, no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	8/12	**9/00**	**9/03**
India	197/205	127/159	185/208
Coastal stations			
WB	12	5	11
Odisha	9	6	10
AP	18	16	18
Tamil Nadu	14	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	17	16	18
Myanmar	14	13	13
Thailand	1	0	1
Sri Lanka	15	17	16

AWS

Region	Date/Time (UTC)		
	8/12	**9/00**	**9/03**
India	451/616	491/616	443/616
WB	20	20	20
ODS	29	26	29
AP	32	33	33
TN	27	26	27
PDC	-	-	-

- **RS/RW** (12Z) of 8-11-2011: 10/39
- **No. of Ascents reaching 250 hPa levels: 4 , MISDA:29**
- **RS/RW** (00Z) of 9-11-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 20, MISDA:4**

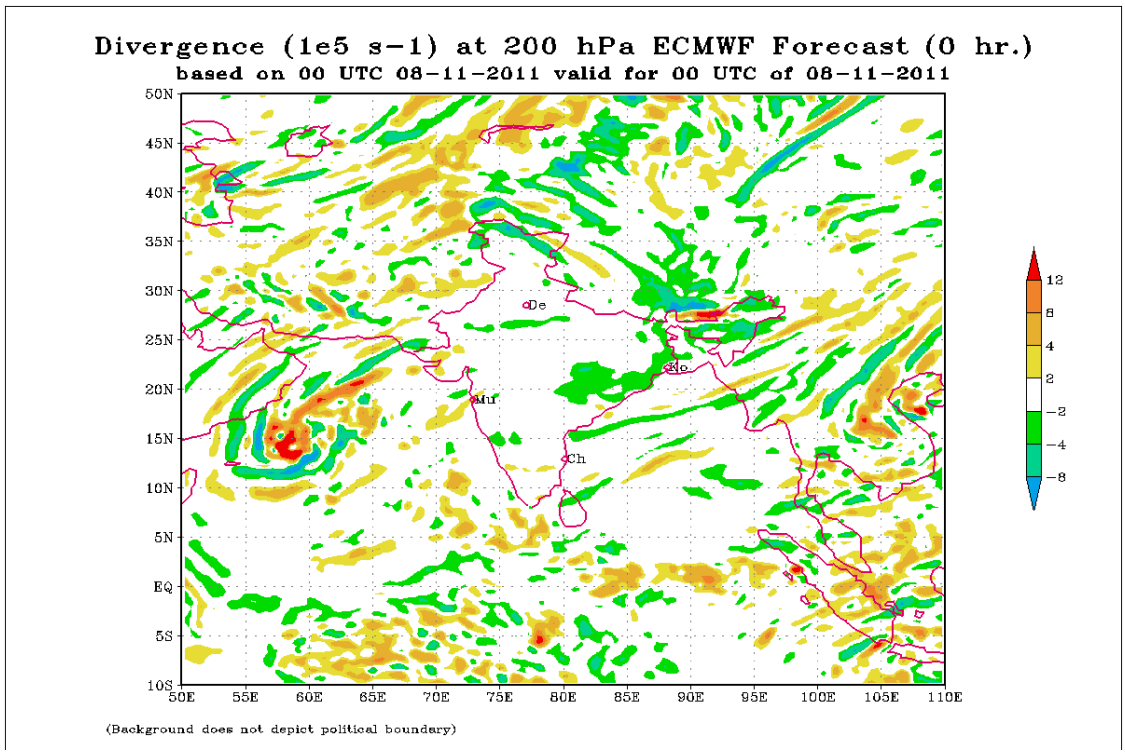
No. of PILOT Ascents

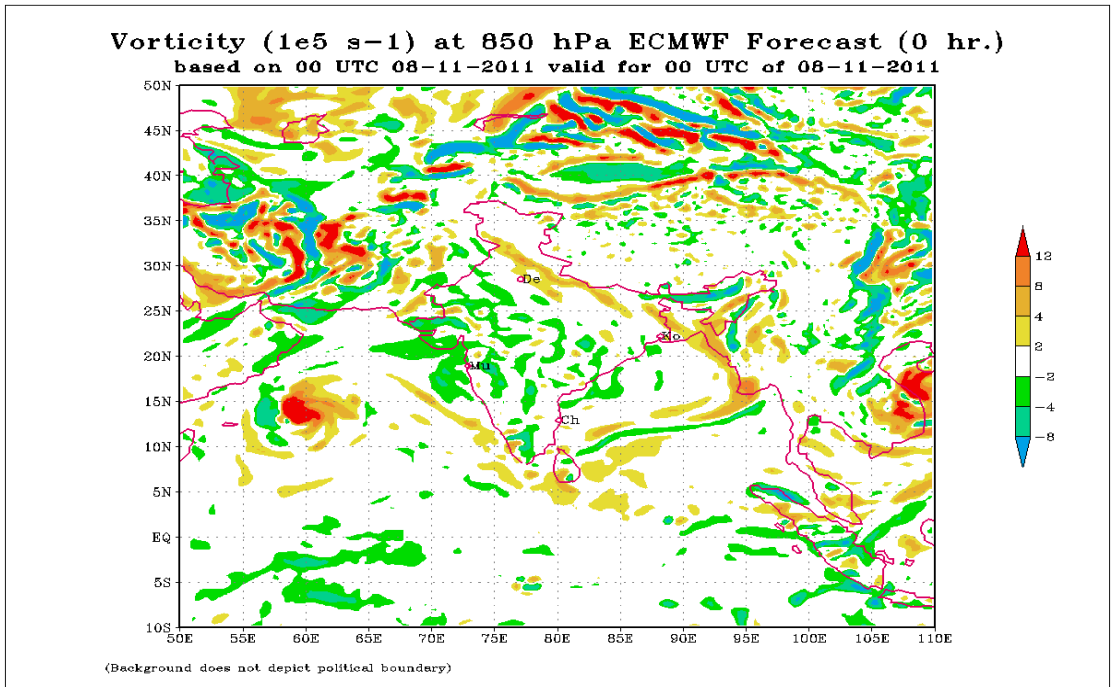
8/12Z	9/00Z
17/37	19/34

Buoy Data

8/12	9/00	903
12	9	14

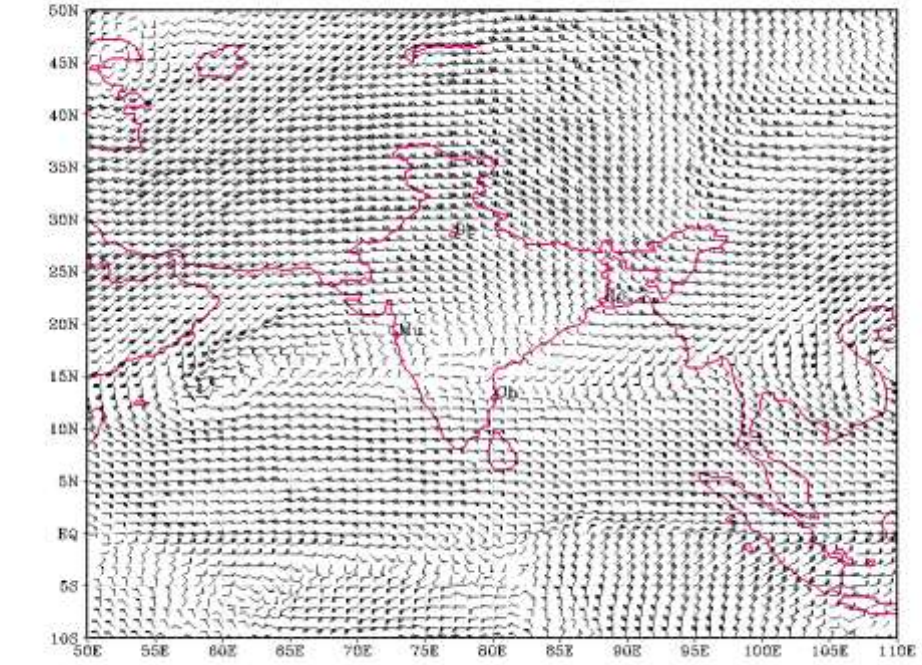
Annexure II


Divergence (1e5 s−1) at 200 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 08−11−2011 valid for 00 UTC of 08−11−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
De
Mo
Mu
Ch
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)


Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 08−11−2011 valid for 00 UTC of 08−11−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
De
Mo
Mu
Ch
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

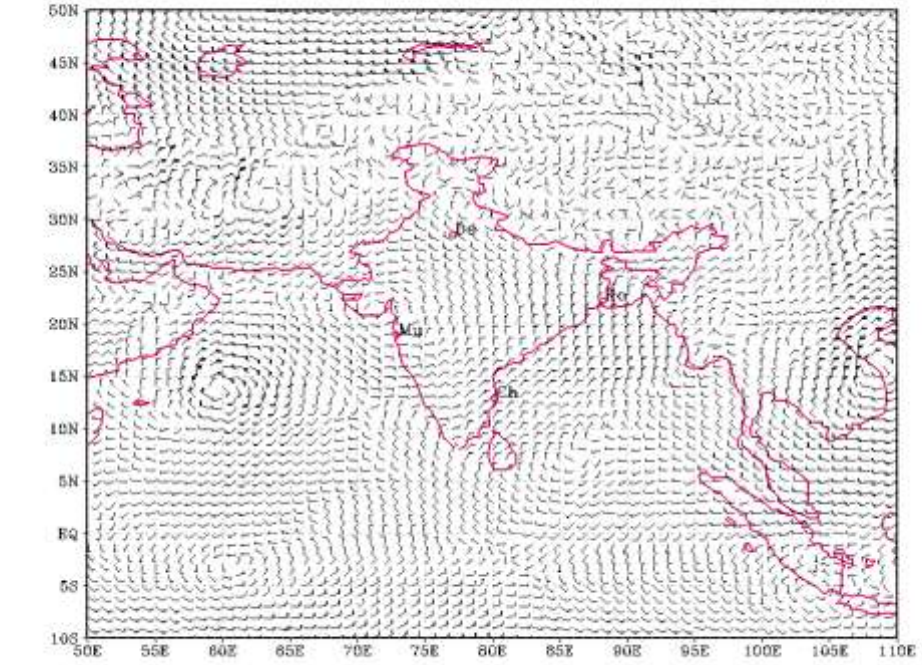
based on 00 UTC 08-11-2011 valid for 00 UTC of 08-11-2011



(Background does not depict political boundary)

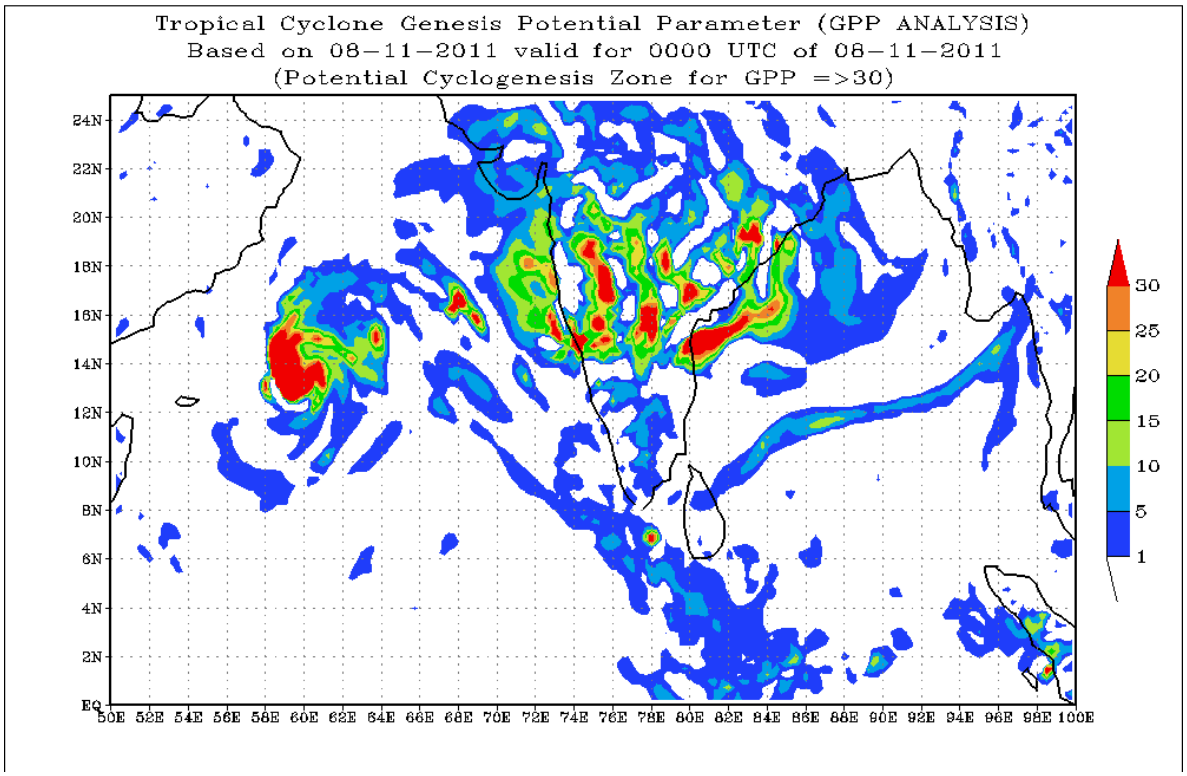
850 hPa WIND ECMWF FORECAST (0 Hr.)

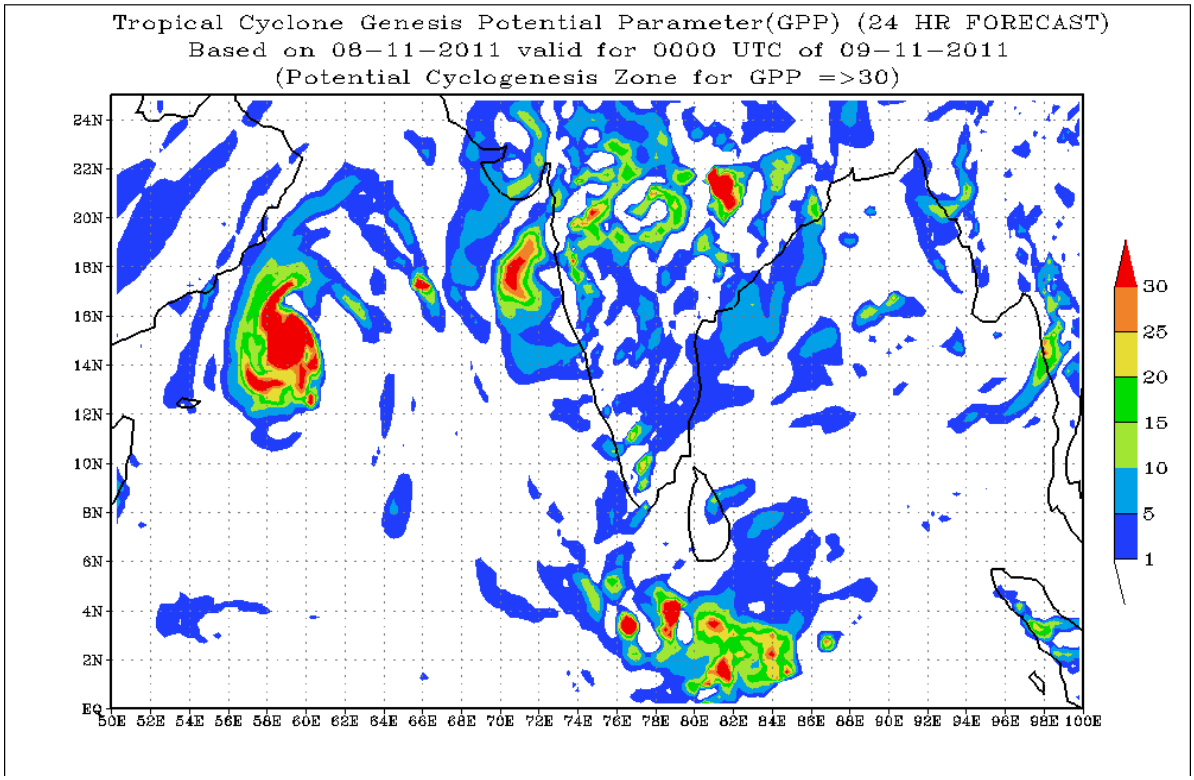
based on 00 UTC 08-11-2011 valid for 00 UTC of 08-11-2011



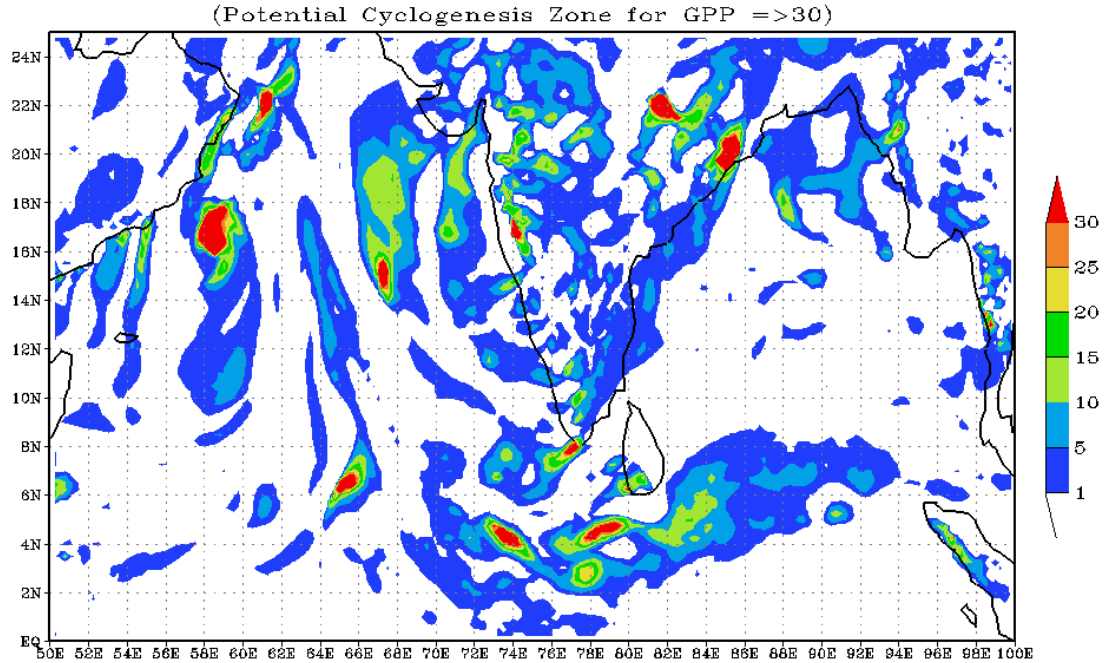
(Background does not depict political boundary)

Annexure-III

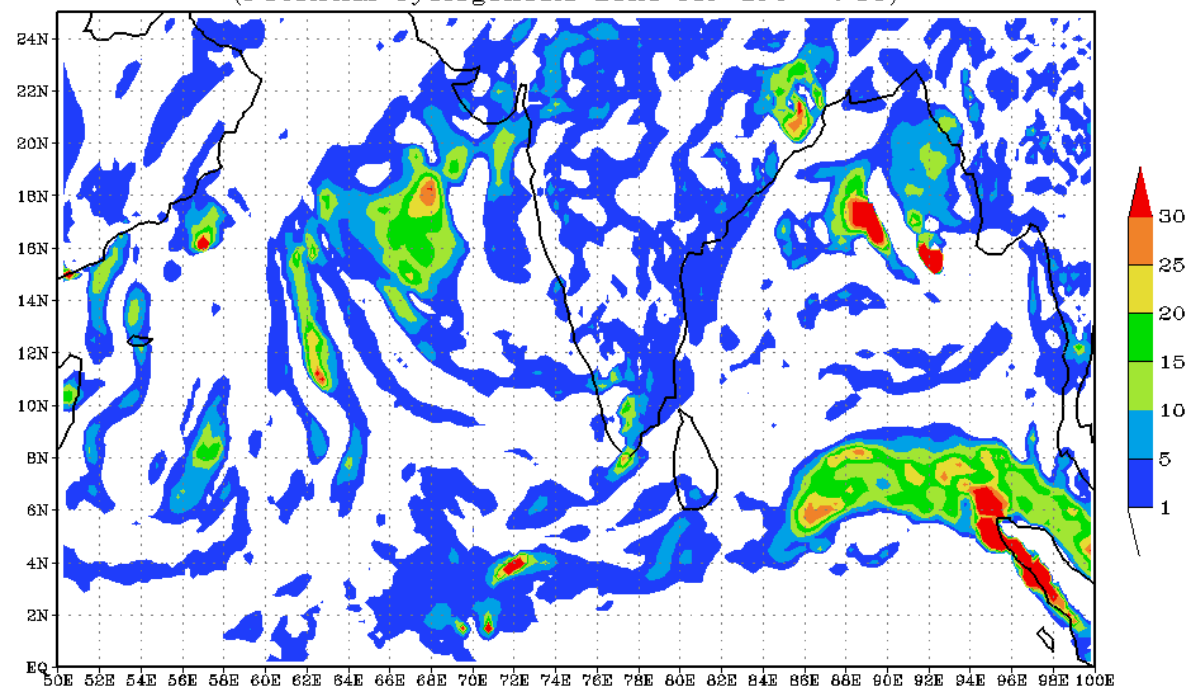




Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 08-11-2011 valid for 0000 UTC of 10-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 08-11-2011 valid for 0000 UTC of 11-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



FDP (Cyclone) NOC Report Dated 10th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 10 N over Bay of Bengal.
- Yesterday's deep depression over Arabian Sea, weakened into depression, moved northwards and lay centred at 0300 UTC of today, 10th November at lat.16.0^{0}N and long.58.5^{0}E (T1.5).
- Pressure departure from normal is not significant along east coast of India and over Andaman & Nicobar Island.
- 24 hrs. pressure tendency shows no significant change along east coast of India, Myanmar and Bangladesh coast.
- Rainfall has occurred at many places over Andaman & Nicobar Island during past 24 hrs. and prevailed dry weather along the west coast of India..
- Buoys data show that SST around 28-29^{0}C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 26-28^{0}C over south & central Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south and central Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 20-30*10^{-5} s^{-1} over south Bay of Bengal.

Convergence:

- Lower level convergence is of order of 15*10^{-5}s^{-1} over south Bay of Bengal and -5*10^{-5}s^{-1} over rest.

Divergence:

- Upper air divergence is negative of the order of 5-10*10^{-5}s^{-1} over Northwest Bay.

Wind Shear:

- Wind Shear of 5-10 knots over south and adjoining central Bay of Bengal and over depression area in Arabian Sea.

Wind Shear Tendency:

- Negative tendency of -5 to -10 knots over Northwest Bay and 10-20 knots over rest Bay.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 18.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 6 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 6, 7 & 8 during next 15 days.
- Dynamical forecast: - MJO located in phase 6 with amplitude greater than 1.0 and moves through phase 6 & 7 during next 15 days.

Cyclonic disturbances over other basins:

- There is tropical disturbance over north Pacific Ocean lying at lat.17.3^{0}N and long.109.6^{0}E (T1.5) weakened.

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 100900 UTC.

Broken low/medium clouds with embedded moderate to intense convection over extension south parts of south bay south of lat 7.5^{0}N west of long 91.0^{0}E.

(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 the Depression lay over the west central Arabian Sea and adjoining areas. Model forecasts show movement of the system in a west southwestward direction and dissipate over Sea on day2.

- **WRF-ARW** model analysis shows the Depression lay over the west central Arabian Sea and adjoining areas. Model forecasts show movement of the system in a west southwestward direction and dissipate over Sea on day2.
- **ECMWF** model analysis and forecast charts show the Depression over the west central Arabian Sea and adjoining areas likely to move in a west southwestward direction and dissipate over Sea on day2. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **UKMET** model shows dissipation of the Depression over the west central Arabian Sea on day2.

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

  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows further disorganization of GPP cell of 30 over west central Arabian Sea and dissipates on day1. GPP analysis and forecast charts are shown in **Annexure III**.

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

Summary and Conclusion:

Synoptic and NWP models suggest that:

- Yesterday's deep depression over Arabian Sea weakened into depression.
- Easterly to northeasterly wind having speed 5-10 knots would blow over Bay of Bengal during next three days.

Advisory:

- Presently, no significant weather system over Bay of Bengal and also not likely during next 2-3 days.
- No IOP at present.

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	9/12	**10/00**	**10/03**
India	185/205	128/159	191/208
Coastal stations			
WB	11	5	11
Odisha	10	6	10
AP	18	17	18
Tamil Nadu	14	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	16	15	16
Myanmar	14	14	15
Thailand	1	1	1
Sri Lanka	16	17	17

AWS

Region	Date/Time (UTC)		
	9/12	**10/00**	**10/03**
India	330/616	493/616	388/616
WB	20	14	20
ODS	27	23	29
AP	32	22	33
TN	27	26	27
PDC	0	0	0

- **RS/RW** (12Z) of 9 -11-2011: 11/37
- **No. of Ascents reaching 250 hPa levels: 4, MISDA:-28**
- **RS/RW** (00Z) of 10 -11-2011: 36/39
- **No. of Ascents reaching 250 hPa levels: 19, MISDA: 3**

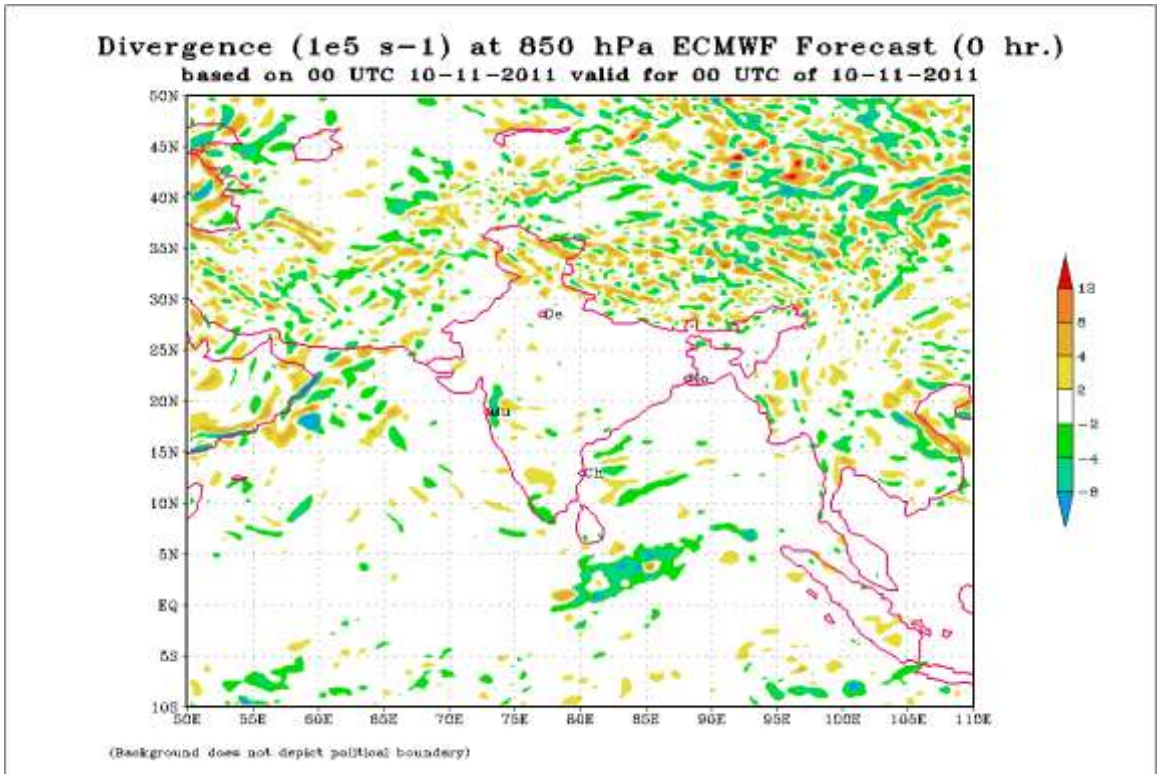
No. of PILOT Ascents

9/12Z	10/00Z
18/37	20/34

Buoy Data

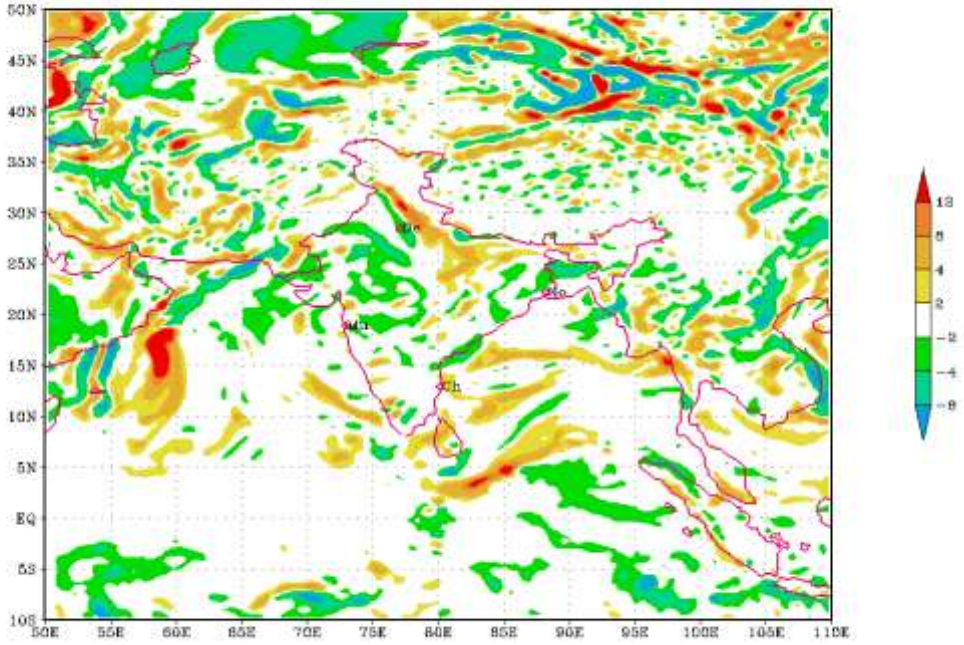
9/12	10/00	10/03
13	12	13

Annexure II



Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

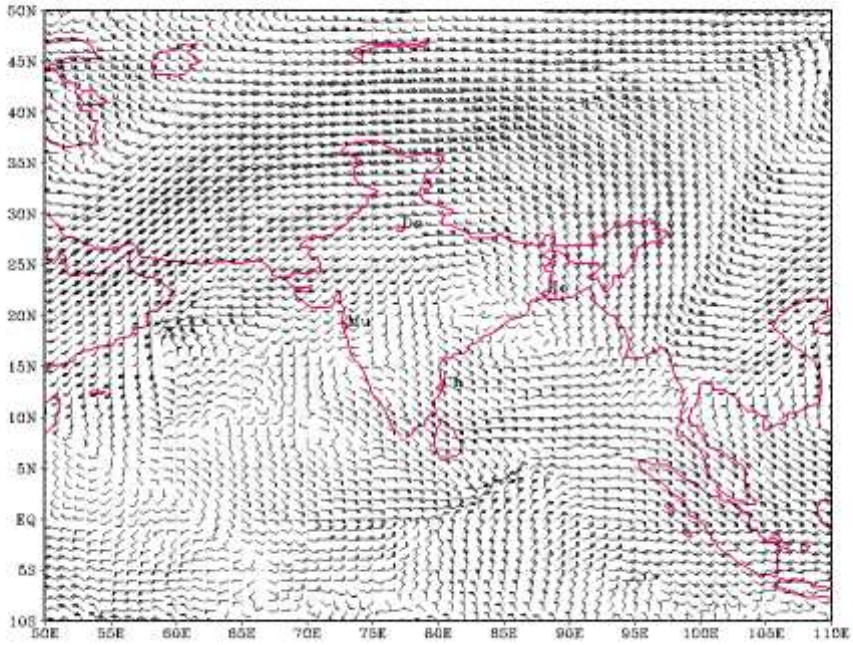
based on 00 UTC 10-11-2011 valid for 00 UTC of 10-11-2011



(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

based on 00 UTC 10-11-2011 valid for 00 UTC of 10-11-2011



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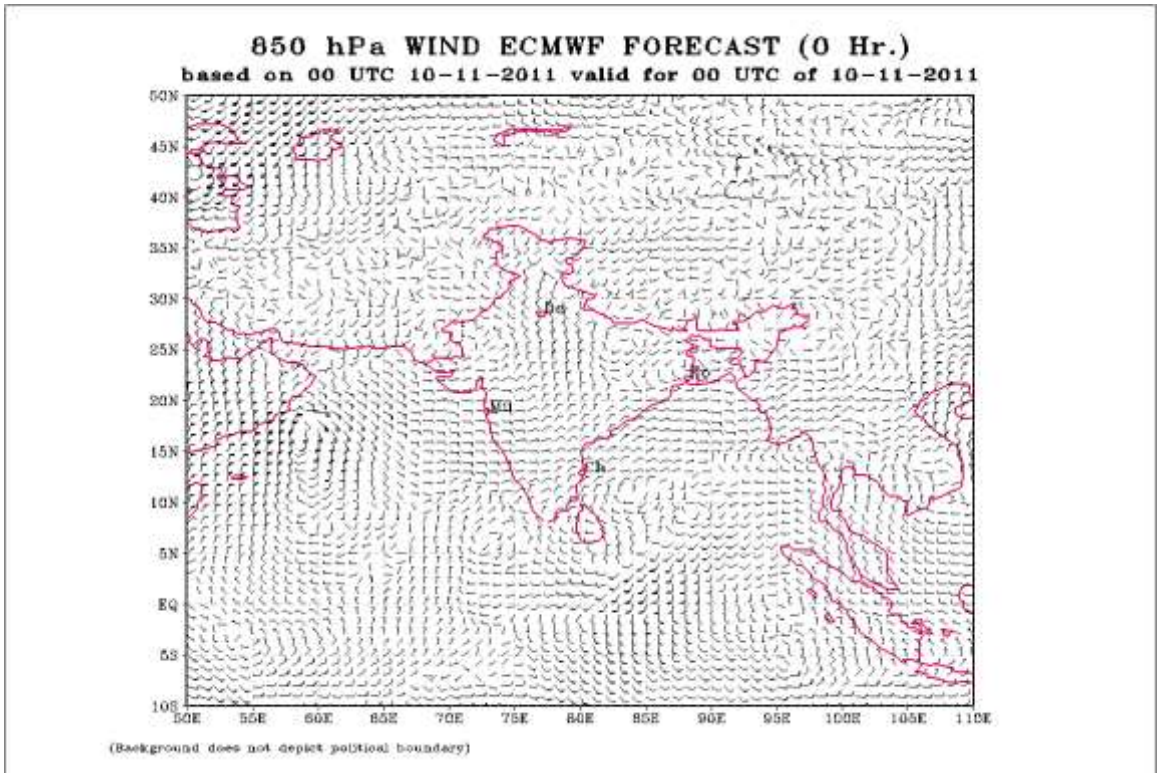
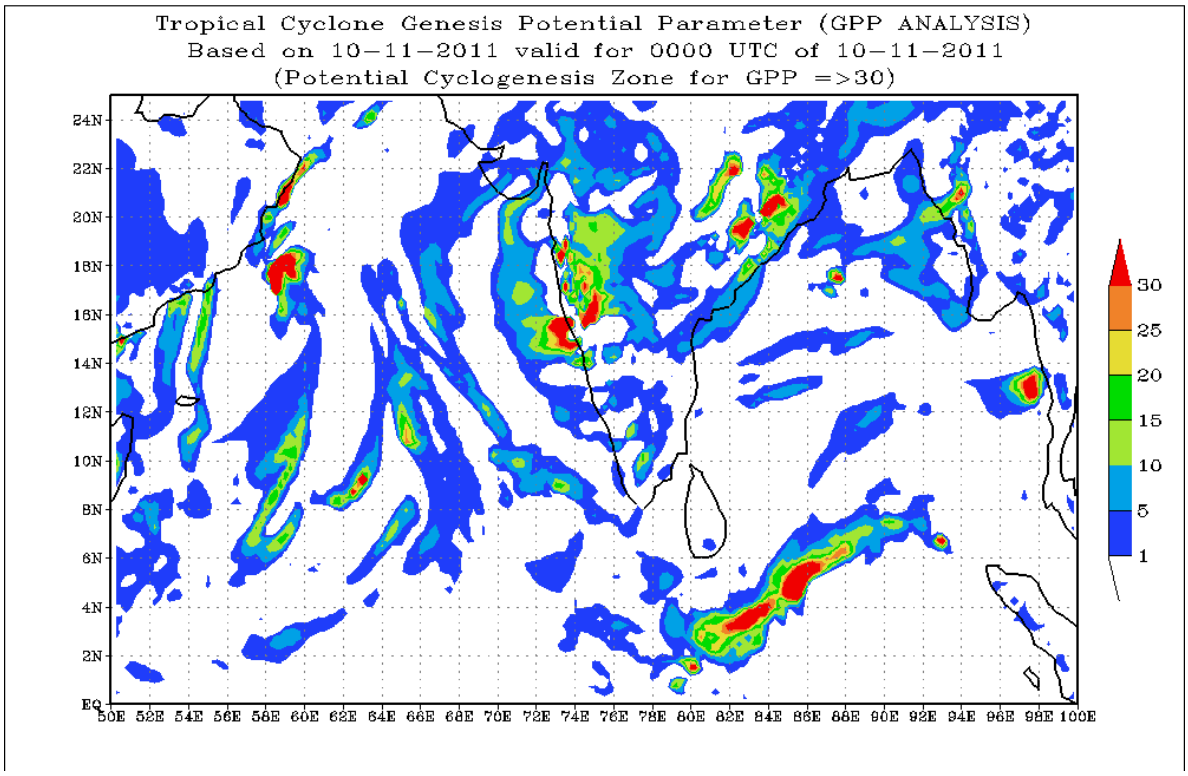
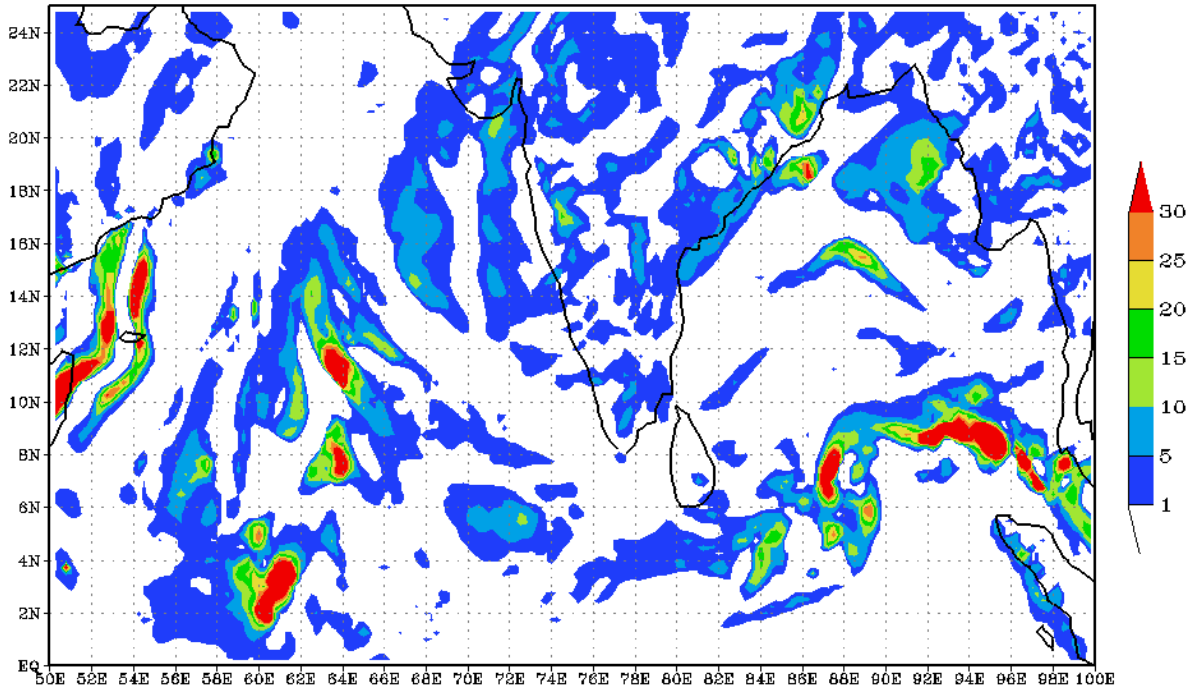


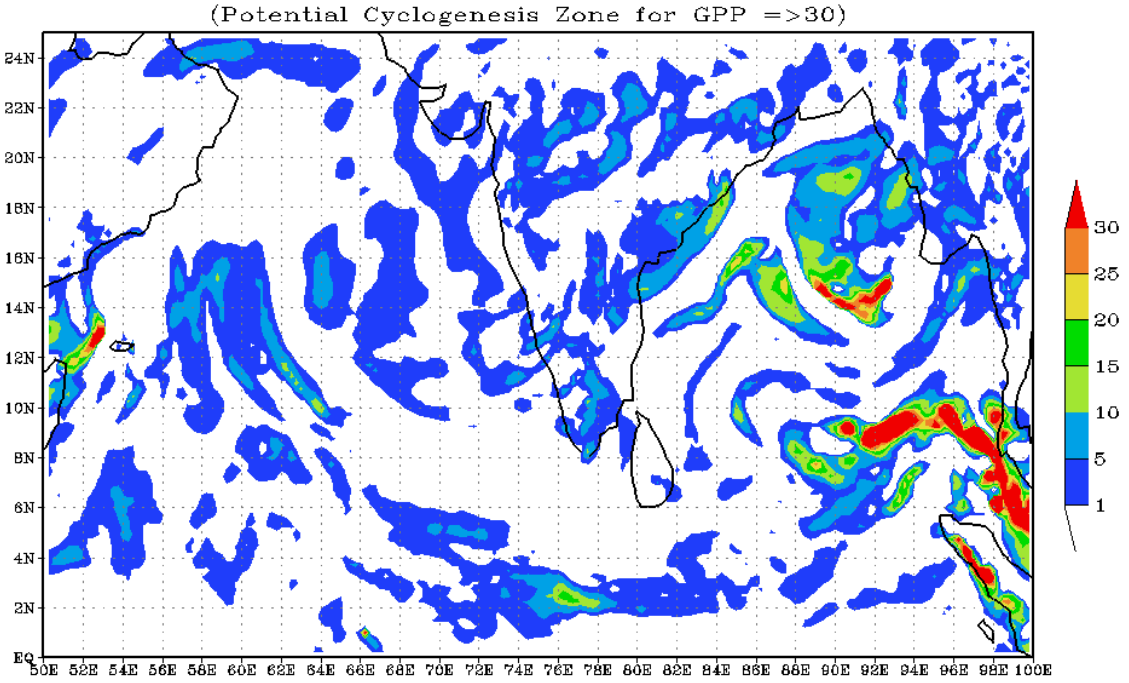
Annexure III



Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 10-11-2011 valid for 0000 UTC of 11-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 10-11-2011 valid for 0000 UTC of 12-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



FDP (Cyclone) NOC Report Dated 11th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 8^0 N over Bay of Bengal.
- Yesterday's depression over westcentral Arabian Sea has weakened into well mark low pressure area at 1730 IST of 10th November 2011 and became unimportant on 11th November 2011.
- Yesterday's trough at 850 hPa over eastcentral Bay of Bengal and neighbourhood now seen at upper air cyclonic circulation extending upto 3.1 km above mean Sea level.
- Pressure departure is positive (around 1.0 hPa) along east coast and Andaman & Nicobar Islands.
- 24 hrs. pressure tendency shows no significant change along east coast of India, Myanmar and Bangladesh coast.
- Buoys data show that SST around 28-29^{0}C over central and south Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^{0}C over south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 25-50*10^{-5} s^{-1} over southeast Bay of Bengal.

Convergence:

- Lower level convergence is of order of 5*10^{-5}s^{-1} over southeast Bay of Bengal.

Divergence:

- Upper air divergence is positive of the order of 5-10*10^{-5}s^{-1} over southeast Bay of Bengal.

Wind Shear:

- Wind Shear of 30 knots over southeast Bay of Bengal and 10-20 knots over central and north Bay of Bengal.

Wind Shear Tendency:

- Positive tendency of 5-10 knots over southeast Bay of Bengal.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 13.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 6 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 7, 8 & 1 during next 15 days.
- Dynamical forecast: - MJO located in phase 6 with amplitude greater than 1.0 and moves through phase 7, 8 & 1 during next 15 days.

Cyclonic disturbances over other basins:

- There is a no cyclonic disturbance over west Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 110900 UTC.

Scattered low/medium clouds with embedded isolated weak to moderate convection over rest south Bay of Bengal South of lat 10.0^0N and rest south Andaman Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today shows a feeble CYCIR lying over Andaman Sea, but no intensification during next 5days. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.

- **IMD-GFS** model analysis based on 0000 UTC of today shows a feeble CYCIR over Andaman Sea and is likely to move in west-northwestward, but no intensification and likely to dissipate over Sea on day3.

- **WRF-ARW** model analysis and forecast does not shows no significant weather over Bay of Bengal during next 3days

- **UKMET** model analysis shows a low level CYCIR lying over Andaman Sea and is likely to move westwards during next 3 days.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows a cell of GPP of 30 is organizing over Andaman Sea and the cell of GPP of 30 is likely to move in west-northwestwards during day1 and day2. GPP charts of three days forecasts are enclosed here with in **Annexure III**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- The well mark low pressure area over westcentral Arabian Sea has become unimportant.
- The cyclonic circulation over southeast Bay of Bengal is not likely to intensify into depression due to unfavorable environmental condition high wind shear, MJO in phase 6 etc.

Advisory:

- Presently, a cyclonic circulation lies over southeast Bay of Bengal.
- No IOP at present.

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	10/12	**11/00**	**11/03**
India	190/205	128/159	191/208
Coastal stations			
WB	11	5	11
Odisha	10	5	10
AP	18	17	18
Tamil Nadu	13	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	20	16	17
Myanmar	13	14	14
Thailand	1	1	1
Sri Lanka	12	13	13

AWS

Region	Date/Time (UTC)		
	10/12	**11/00**	**11/03**
India	429/616	490/616	384/616
WB	15	14	16
ODS	24	22	24
AP	22	22	22
TN	17	16	17
PDC	0	0	0

- **RS/RW** (12Z) of 10-11-2011: 11/39
- **No. of Ascents reaching 250 hPa levels: 3 , MISDA:28**
- **RS/RW** (00Z) of 11-11-2011: 35/39

- **No. of Ascents reaching 250 hPa levels: 21, MISDA:4**

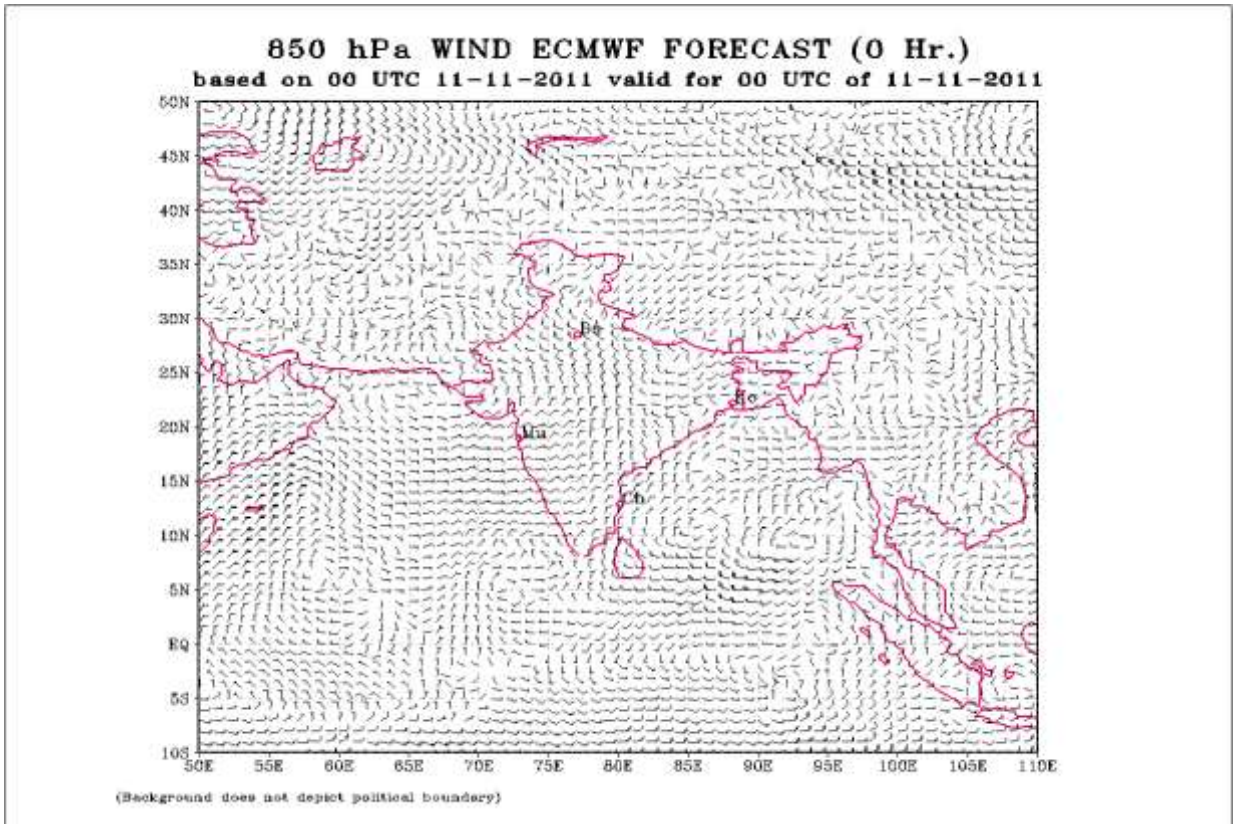
No. of PILOT Ascents

10/12Z	11/00Z
24/37	17/34

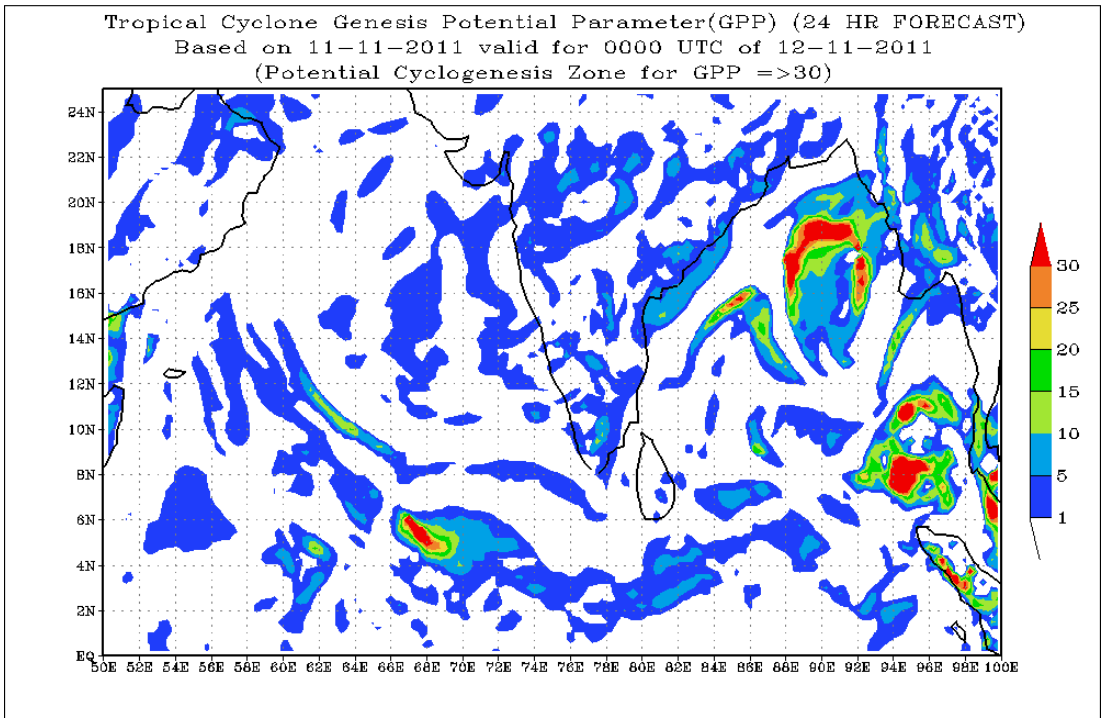
Buoy Data

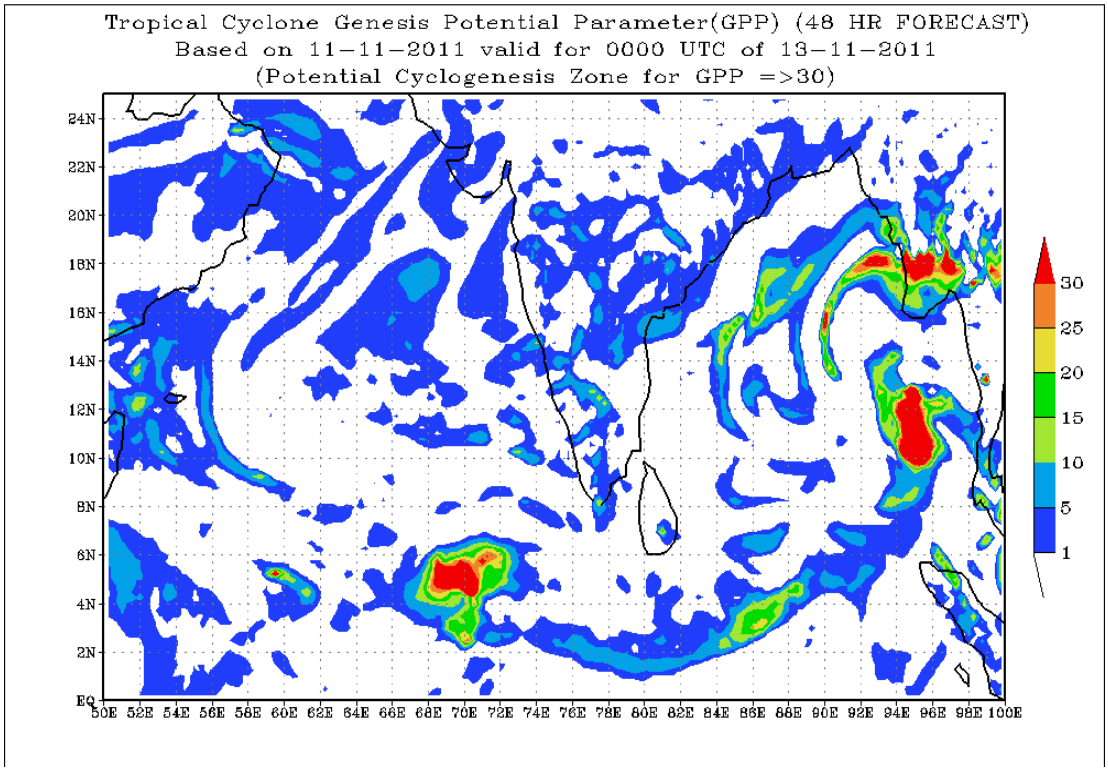
10/12	11/00	11/03
10	12	12

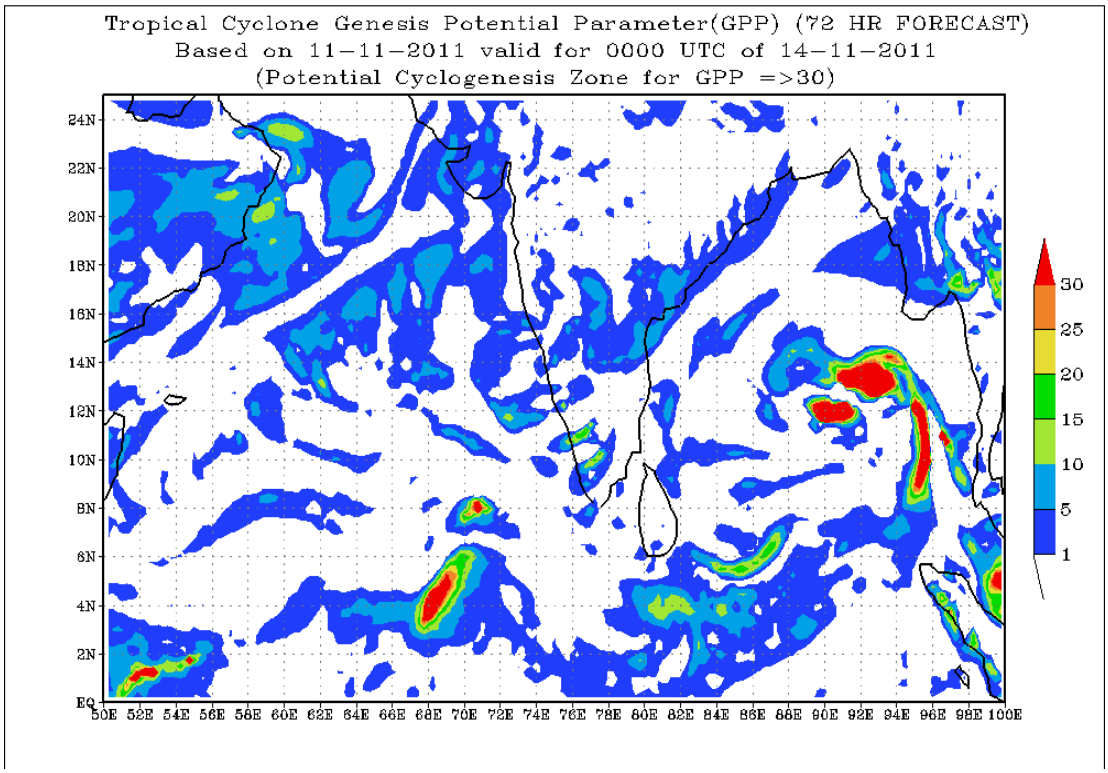
Annexure II



Annexure III


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 11-11-2011 valid for 0000 UTC of 12-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 11-11-2011 valid for 0000 UTC of 13-11-2011
(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
1



FDP (Cyclone) NOC Report Dated 12th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 8^0 N over Bay of Bengal.
- Yesterday's depression over westcentral Arabian Sea has weakened into well mark low pressure area at 1730 IST of 10th November 2011 and became unimportant on 11th November 2011.
- Yesterday's trough at 850 hPa over eastcentral Bay of Bengal and neighbourhood now seen at upper air cyclonic circulation extending upto 3.1 km above mean Sea level.
- Pressure departure is positive (around 1.0 hPa) along east coast and Andaman & Nicobar Islands.
- 24 hrs. pressure tendency shows no significant change along east coast of India, Myanmar and Bangladesh coast.
- Buoys data show that SST around 28-29^{0}C over central and south Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^{0}C over south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 25-50*10^{-5} s^{-1} over southeast Bay of Bengal.

Convergence:

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

Divergence:

- Upper air divergence is positive of the order of 5-10*$10^{-5}s^{-1}$ over southeast Bay of Bengal.

Wind Shear:

- Wind Shear of 30 knots over southeast Bay of Bengal and 10-20 knots over central and north Bay of Bengal.

Wind Shear Tendency:

- Positive tendency of 5-10 knots over southeast Bay of Bengal.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 13.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 6 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 7, 8 & 1 during next 15 days.
- Dynamical forecast: - MJO located in phase 6 with amplitude greater than 1.0 and moves through phase 7, 8 & 1 during next 15 days.

Cyclonic disturbances over other basins:

- There is a no cyclonic disturbance over west Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 120900 UTC.

BAY OF BENGAL & ANDAMAN SEA:- Broken low/medium clouds with embedded moderate to intense convection over central Andaman Sea. Scattered low/medium clouds with embedded weak to moderate convection over southeast Bay of Bengal between Lat. 5.0^0N to 10.0^0N east of Long 90.0^0E and rest south Andaman Sea.

ARABIAN SEA:- Scattered low/medium clouds with embedded isolated moderate to intense convection over north Maldives and adjoining areas.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today does not show any significant weather over Bay of Bengal or Arabian Sea. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.

- **IMD-GFS** model analysis based on 0000 UTC of today shows a feeble CYCIR over Andaman Sea and is likely to move in west-northwestward, but no intensification and likely to dissipate over Sea on day2.

- **WRF-ARW** model analysis and forecast does not show any significant weather over Bay of Bengal during next 3 days.

- **UKMET** model analysis and forecast also does not show any significant weather over Bay of Bengal during next 5days.

-

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows a cell of GPP of 30 is organizing over Andaman Sea and the cell of GPP of 30 is likely to move in west-northwestwestwards during day1 and day2. GPP charts of 24 and 24 hours forecasts are enclosed here with in **Annexure III**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- The well mark low pressure area over westcentral Arabian Sea has become less marked
- The cyclonic circulation over southeast Bay of Bengal is not likely to intensify into depression due to unfavorable environmental condition high wind shear, MJO in phase 6 etc.

Advisory:

- Presently, a cyclonic circulation lies over southeast Bay of Bengal.
- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	11/12	12/00	12/03
India	188/205	127/159	192/208
Coastal stations			
WB	12	6	11
Odisha	10	5	10
AP	18	17	18
Tamil Nadu	14	11	13
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	16	16	17
Myanmar	14	15	14
Thailand	1	1	1
Sri Lanka	13	12	12

AWS

Region	Date/Time (UTC)		
	11/12	12/00	12/03
India	442/616	493/616	442/616
WB	20	19	20
ODS	28	27	29
AP	31	33	33
TN	27	26	27
PDC	1	-	-

- **RS/RW** (12Z) of 11-11-2011: 11/39
- **No. of Ascents reaching 250 hPa levels: 2 , MISDA:28**
- **RS/RW** (00Z) of 12-11-2011: 34/39
- **No. of Ascents reaching 250 hPa levels: 18, MISDA:5**

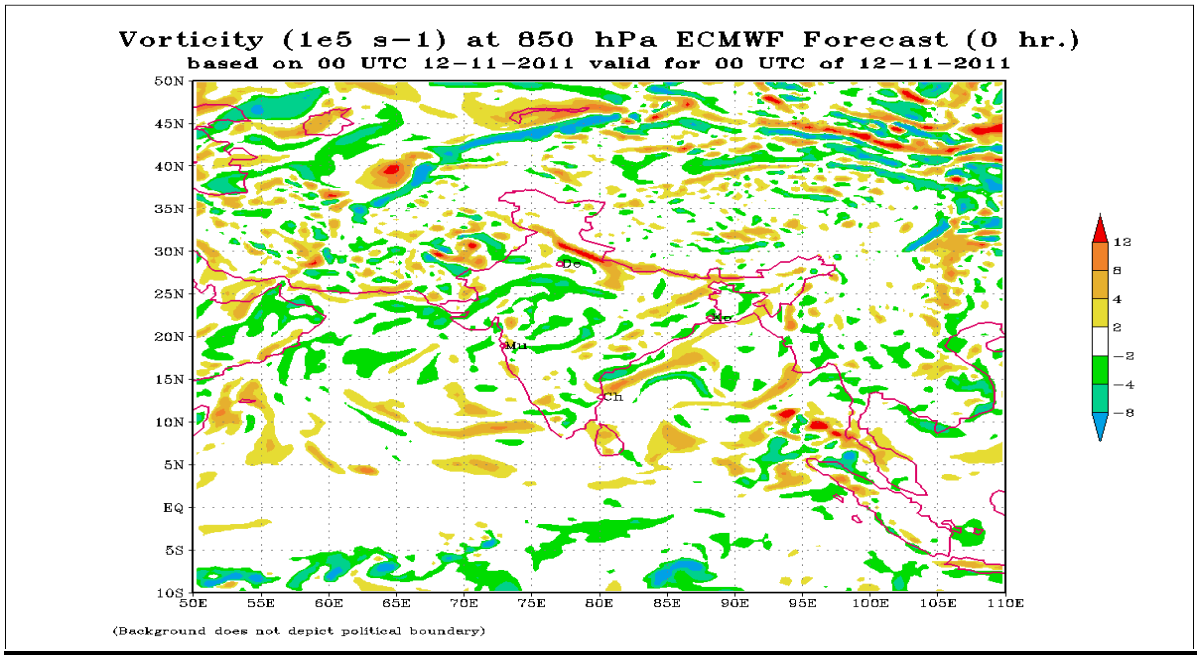
No. of PILOT Ascents

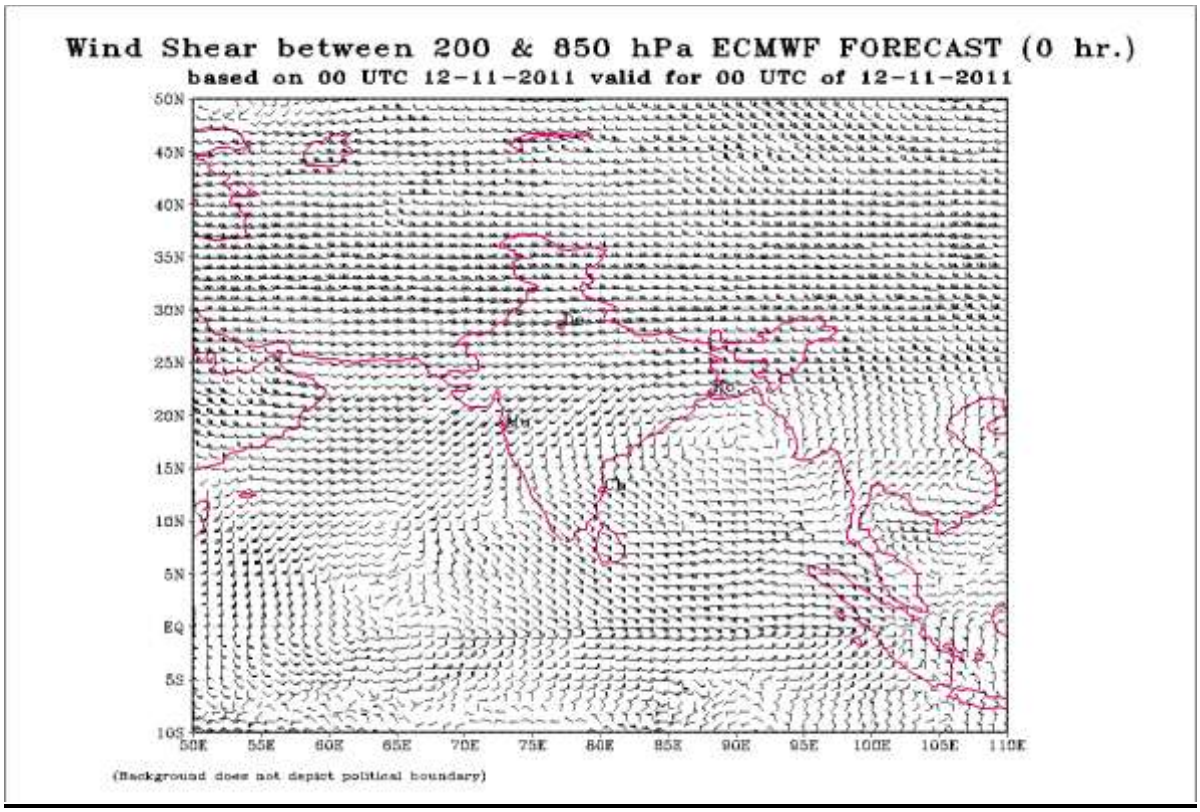
11/12Z	12/00Z
15/37	18/34

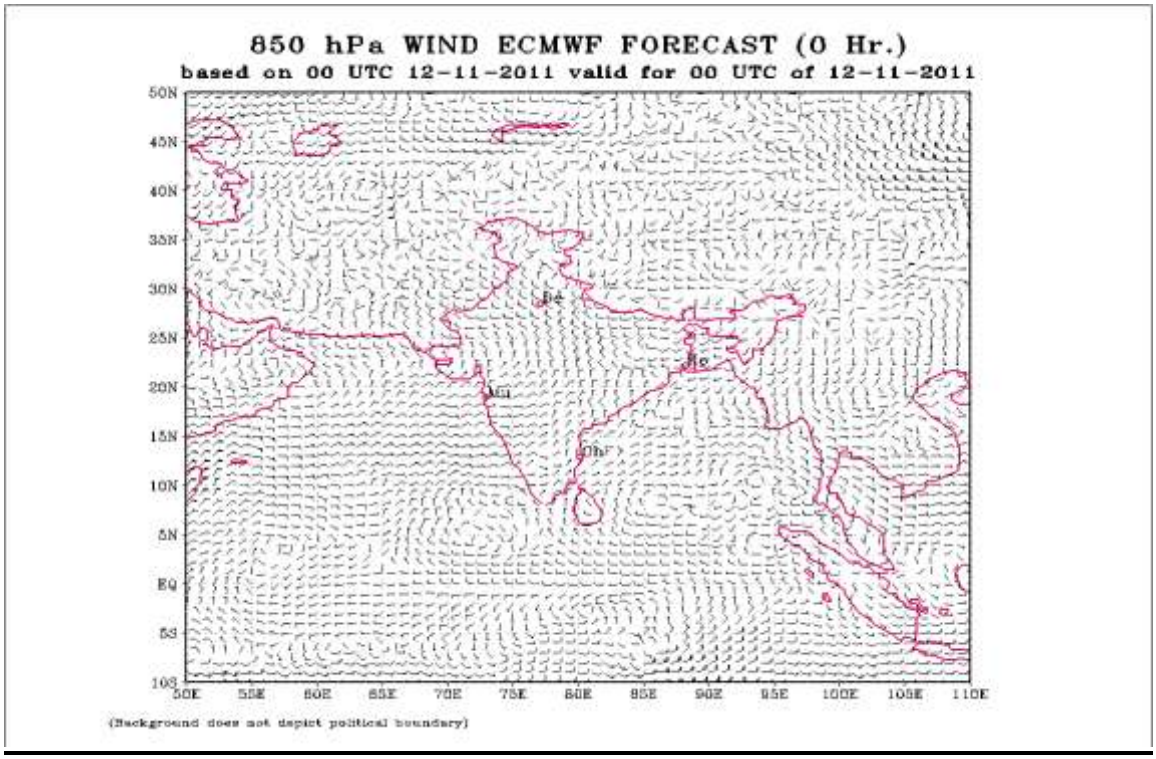
Buoy Data

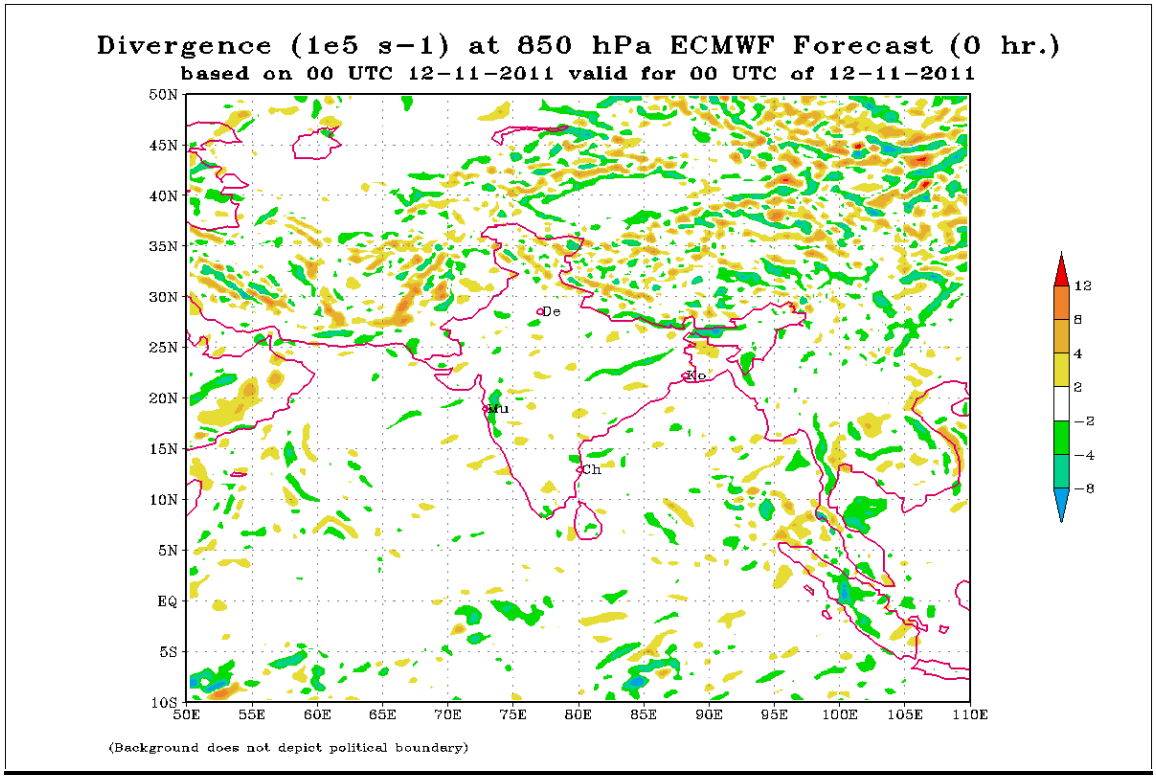
11/12	12/00	12/03
11	13	13

Annexure II


Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 12−11−2011 valid for 00 UTC of 12−11−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)

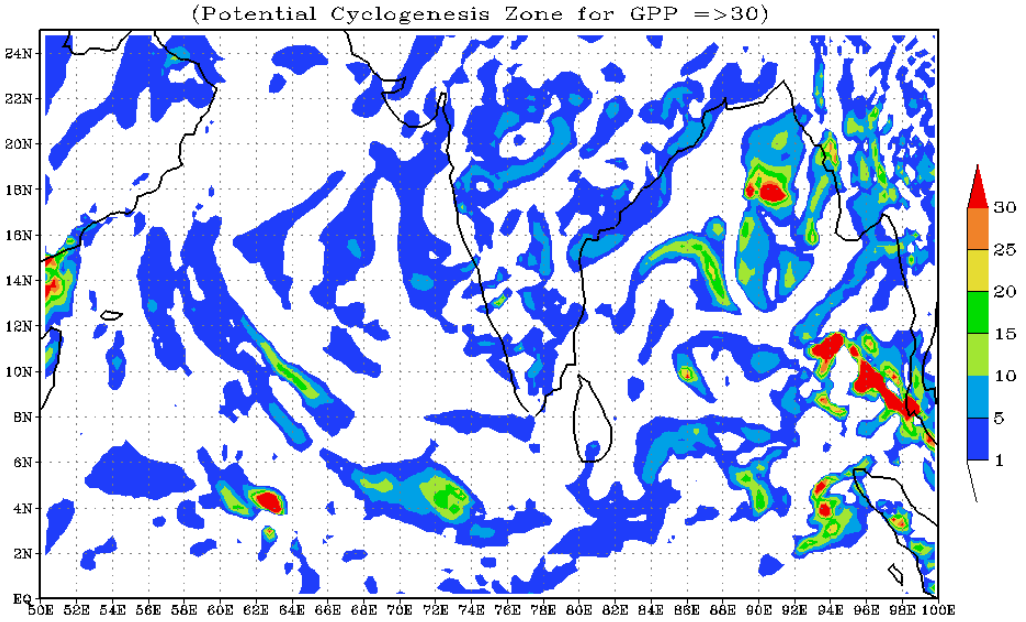

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 12−11−2011 valid for 00 UTC of 12−11−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
(Background does not depict political boundary)



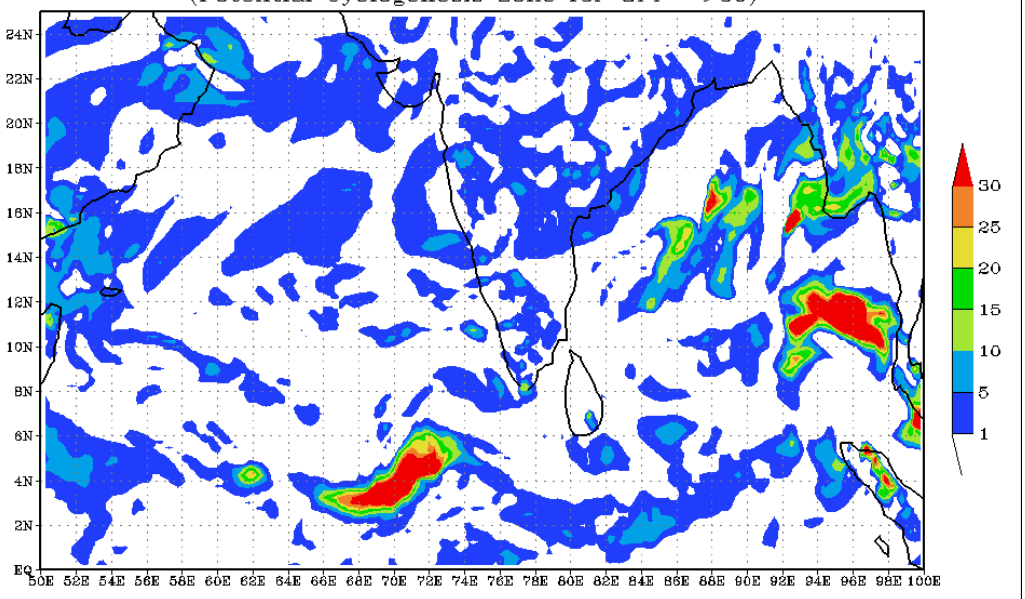


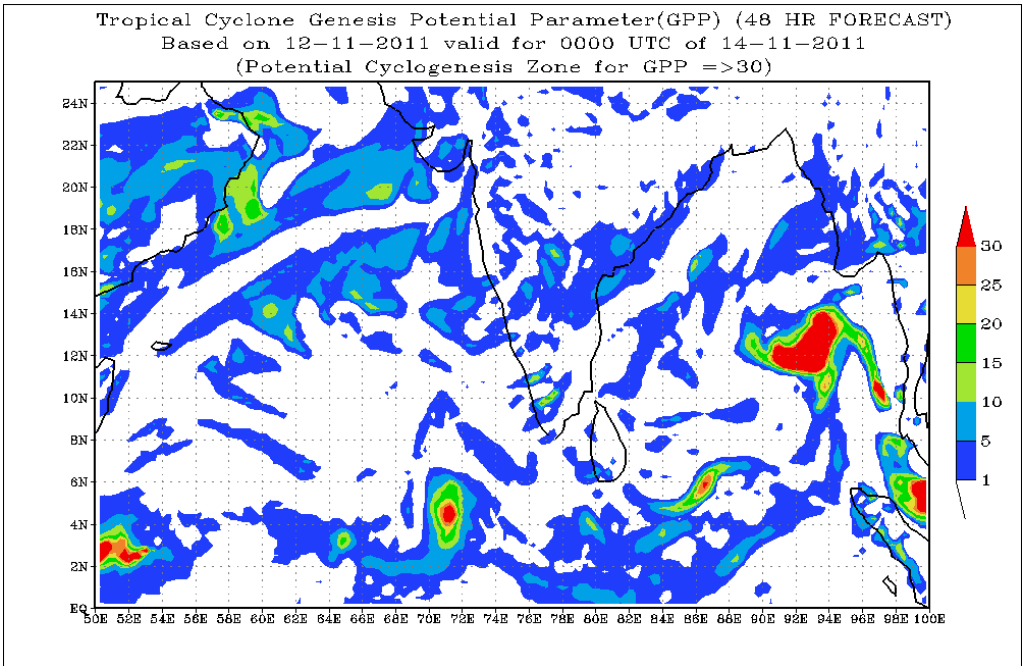
Annexure-III

Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 12-11-2011 valid for 0000 UTC of 12-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 12-11-2011 valid for 0000 UTC of 13-11-2011
(Potential Cyclogenesis Zone for GPP =>30)





FDP (Cyclone) NOC Report Dated 13th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 8^0N over Bay of Bengal.
- Pressure departure is positive (around 1.0 hPa) along east coast and no significant change over Andaman & Nicobar Islands.
- 24 hrs. pressure tendency shows a rise by 1hPa along east coast of India and no significant change over Andaman & Nicobar Islands.
- Buoys data show that SST around 28-29^0C over central and south Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^0C over south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 25-50*10^{-5} s^{-1} over Andaman Sea.

Convergence:

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

Divergence:

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

Wind Shear:

- Wind Shear of the order 10 knots over Andaman Sea.

Wind Shear Tendency:

- Wind shear tendency is negative and of order 5-10 knots over south Andaman Sea.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 14.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 6 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 7, 8 & 1 during next 15 days.
- Dynamical forecast: - MJO located in phase 6 with amplitude greater than 1.0 and moves through phase 7, 8 & 1 during next 15 days.

Cyclonic disturbances over other basins:

- There is a no cyclonic disturbance over west Pacific Ocean.

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 130900 UTC.

BAY OF BENGAL & ANDAMAN SEA:- Broken low/medium clouds with embedded moderate to intense convection over Andaman Sea and adjoining eastcentral Bay of Bengal and south Tenasserim coast

ARABIAN SEA:- No significant cloud over the region.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today shows a feeble CYCIR over Andaman Sea and likely to dissipate over Sea on day1. The model forecast does not show any significant weather over Bay of Bengal or Arabian Sea. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.

- **IMD-GFS** model analysis based on 0000 UTC of today shows a feeble CYCIR over Andaman Sea and is likely to move in west-northwestward, but no intensification and likely to dissipate over Sea on day 2.

- **WRF-ARW** model analysis and forecast does not show any significant weather over Bay of Bengal during next 3 days.

- **UKMET** model analysis and forecast based on 0000 UTC of today does not show any significant weather over Bay of Bengal or Arabian Sea.

http://www.imd.gov.in/section/nhac/dynamic/welcome.htm
ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows a cell of GPP of 30 is organizing over Andaman Sea and the cell of GPP of 30 is likely to move in west-northwestwards during day1 and day2. GPP charts analysis and 24 hours forecasts are enclosed here with in **Annexure III**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- **NWP** model analysis and forecast based on 0000 UTC of today shows a feeble CYCIR over Andaman Sea and likely to dissipate over Sea within 24 hours.

Advisory:

- No IOP at present.

Annexure I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	12/12	**13/00**	**13/03**
India	185/205	128/159	190/208
Coastal stations			
WB	11	6	11
Odisha	10	5	10
AP	18	17	17
Tamil Nadu	14	12	12
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	18	16	16
Myanmar	14	13	15
Thailand	1	1	1
Sri Lanka	12	12	12

AWS

Region	Date/Time (UTC)		
	12/12	**13/00**	**13/03**
India	450/616	495/616	507/616
WB	21	19	20
ODS	29	26	29
AP	33	33	33
TN	27	26	27
PDC	1	-	-

- **RS/RW** (12Z) of 12-11-2011: **9**/39
- **No. of Ascents reaching 250 hPa levels: 2, MISDA:30**
- **RS/RW** (00Z) of 13-11-2011: **35**/39
- **No. of Ascents reaching 250 hPa levels: 23, MISDA:4**

No. of PILOT Ascents

12/12Z	13/00Z
20/37	18/34

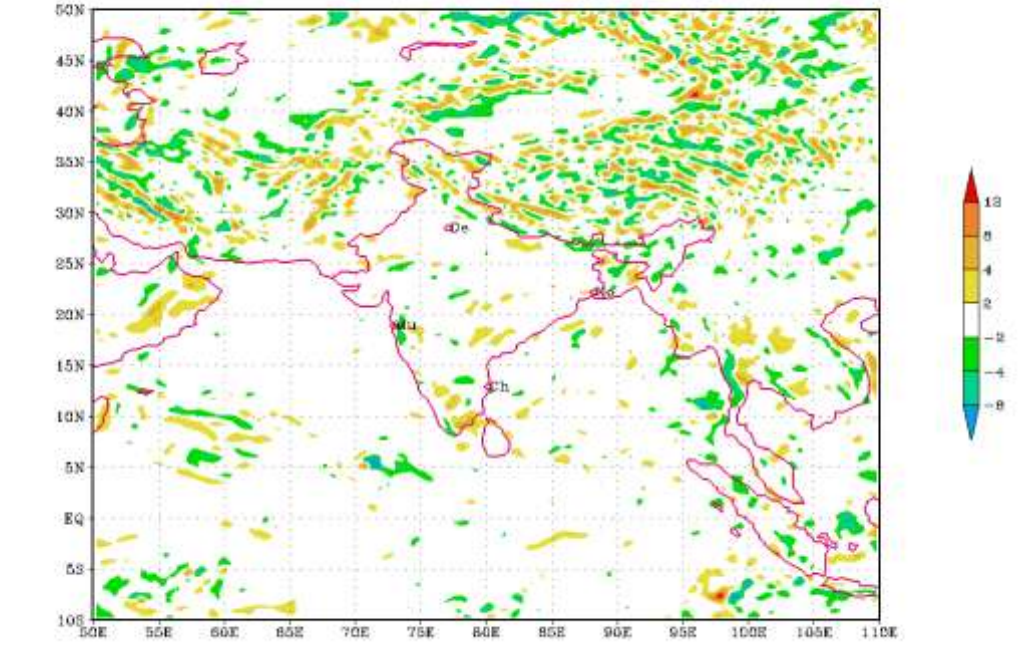
Buoy Data

12/12	13/00	13/03
12	12	13

Annexure II

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

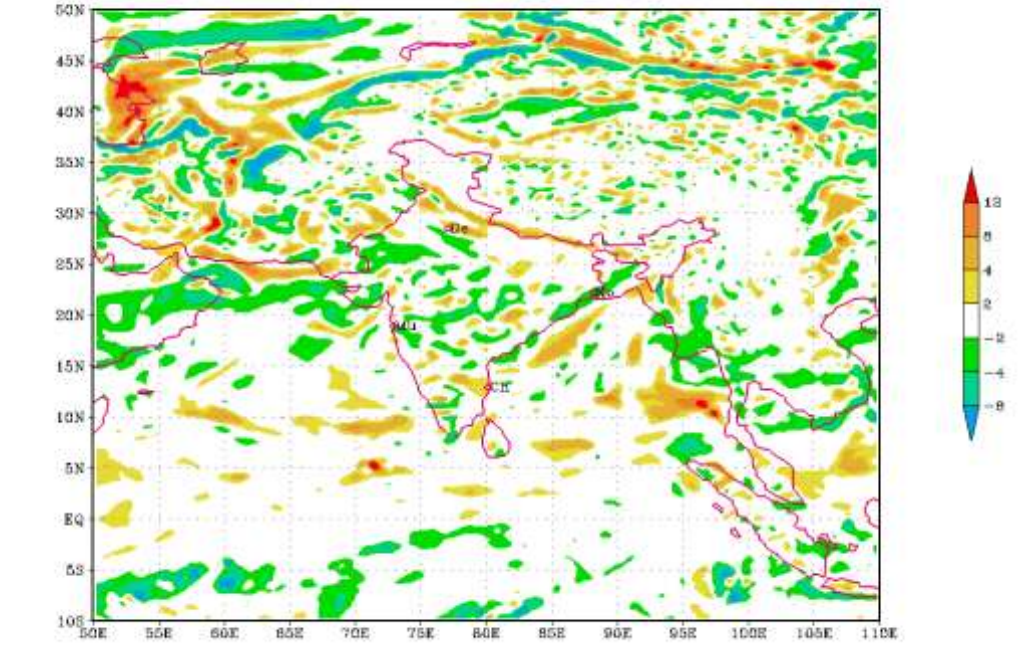
based on 00 UTC 13-11-2011 valid for 00 UTC of 13-11-2011



(Background does not depict political boundary)

Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

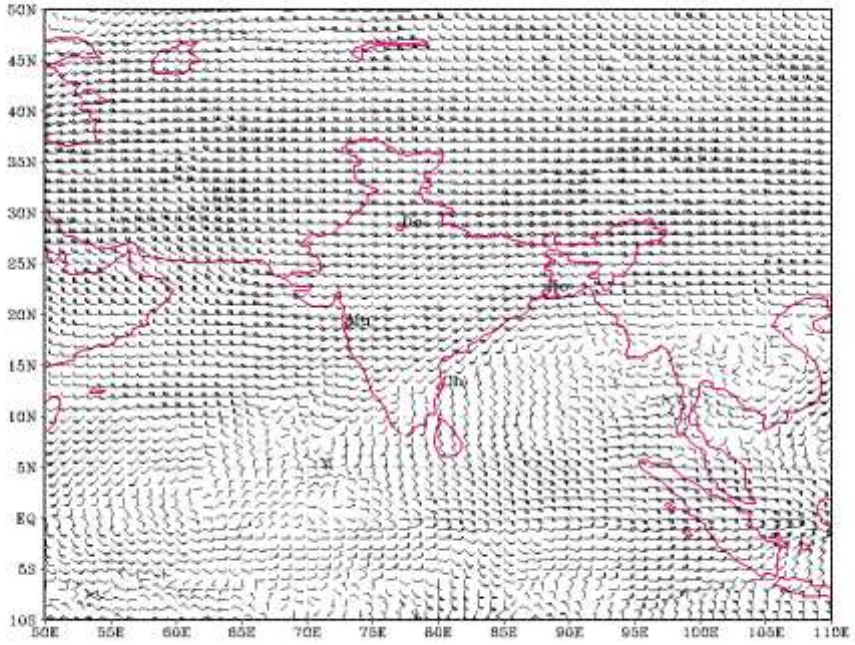
based on 00 UTC 13-11-2011 valid for 00 UTC of 13-11-2011



(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

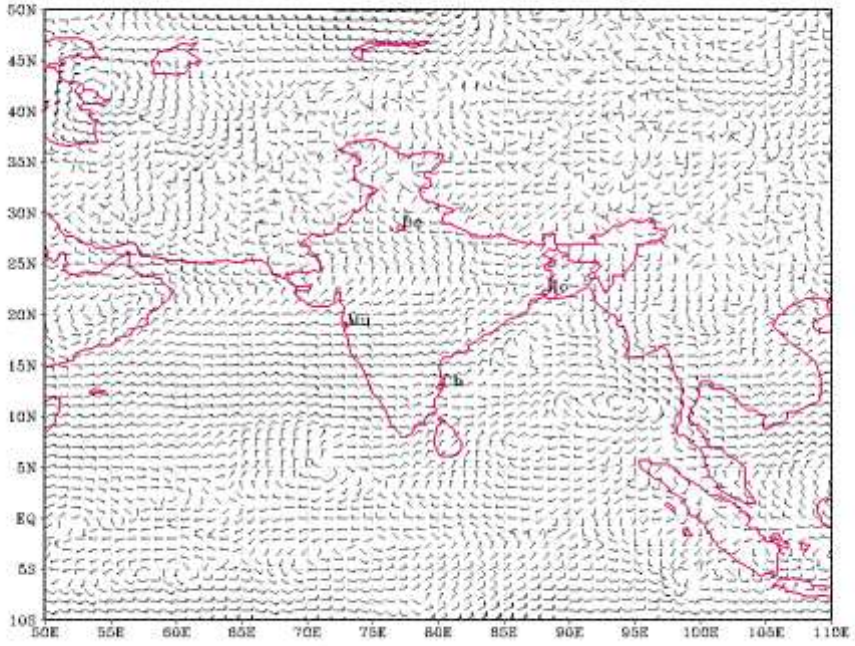
based on 00 UTC 13-11-2011 valid for 00 UTC of 13-11-2011



(Background does not depict political boundary)

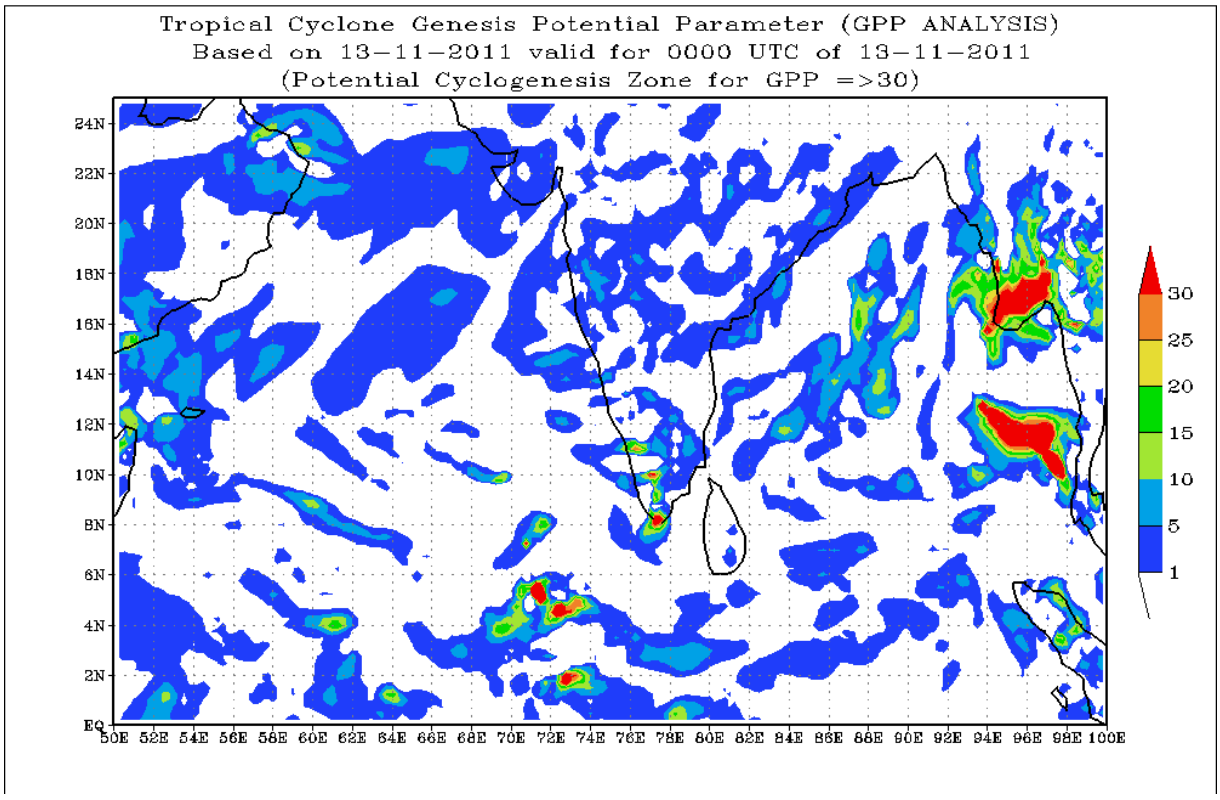
850 hPa WIND ECMWF FORECAST (0 Hr.)

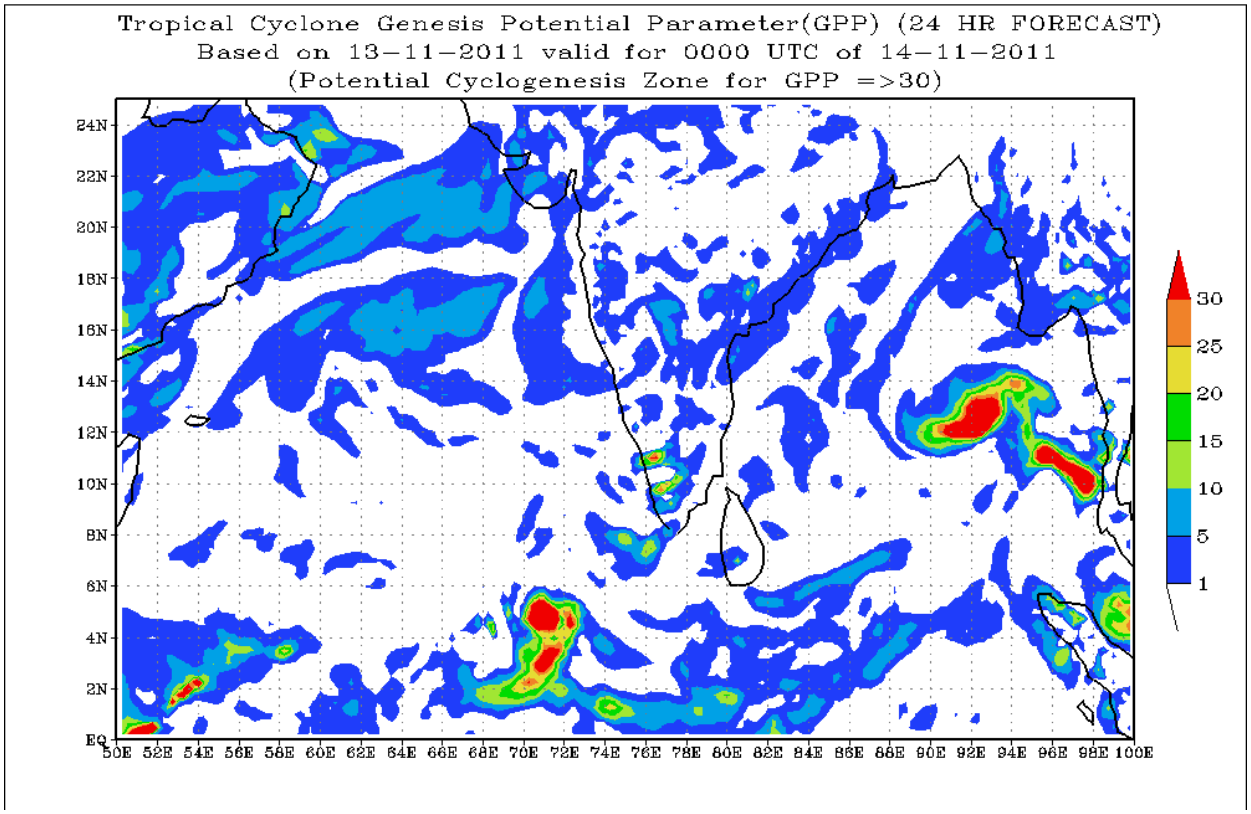
based on 00 UTC 13-11-2011 valid for 00 UTC of 13-11-2011



(Background does not depict political boundary)

Annexure III





FDP (Cyclone) NOC Report Dated 14th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 5^0 N over Bay of Bengal.
- Pressure departure from normal is nearly normal along east coast of India and over Andaman & Nicobar Island.
- 24 hrs. pressure tendency shows no significant change along east coast of India, Myanmar and Bangladesh coast.
- Buoys data show that SST around 28-29^{0}C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^{0}C over central & south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south and central Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 50*10^{-5} s^{-1} over central Bay of Bengal.

Convergence:

- Lower level convergence is positive of order of 5-10*10^{-5}s^{-1} over central Bay of Bengal.

Divergence:

- Upper air divergence is negative of the order of 5-10*10^{-5}s^{-1} over central Bay of Bengal.

Wind Shear:

- Wind Shear of 5-10 knots over south Bay of Bengal & south Andaman Sea and 30-50 knots over central & north Bay of Bengal.

Wind Shear Tendency:

- Negative tendency of -5 to -10 knots over south Andaman Sea and positive over central and north Bay of Bengal and around 10-20 knots.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 13.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 7 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 8,1 & 2 during next 15 days.
- Dynamical forecast: - MJO located in phase 7 with amplitude greater than 1.0 and moves through phase 8,1 & 2 during next 15 days.

Cyclonic disturbances over other basins:

- There is tropical disturbance over north Pacific Ocean

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 100900 UTC.

Broken low/medium clouds with embedded isolated moderate to intense convection senn over Bay of Bengal between lat 12.0^0N to 17.0^0E east of long 87.0^0E Andaman Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model forecast based on 0000 UTC of today shows a feeble CYCIR formed over Andaman Sea and likely to dissipate over Sea. The model forecast does not show any significant weather over Bay of Bengal or Arabian Sea.

- **IMD-GFS** model analysis based on 0000 UTC of today shows a feeble CYCIR over Andaman Sea and is likely to move in west-northwestward, and a fresh CYCIR is likely to form over Andaman Sea on day5 is likely to develop into depression consequently.

- **WRF-ARW** model analysis and forecast does not show any significant weather over Bay of Bengal during next 3 days.

- **UKMET** model analysis and forecast based on 0000 UTC of today does not show any significant weather over Bay of Bengal or Arabian Sea.

http://www.imd.gov.in/section/nhac/dynamic/welcome.htm
ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis shows a cell of GPP of 30 is organizing over Andaman Sea and the cell of GPP of 30 is likely to move in west-northwestwards during day1 and day2. GPP charts analysis and 24 and 48 hours forecasts are enclosed here with in **Annexure II**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- Easterly to northeasterly wind having speed 10-15 knots would blow over Bay of Bengal during next three days.

Advisory:

- Presently, no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	13/12	**14/00**	**14/03**
India	189/205	125/159	191/208
Coastal stations			
WB	11	5	11
Odisha	10	6	10
AP	18	17	18
Tamil Nadu	14	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	8	8	10
Myanmar	6	7	7
Thailand	1	1	1
Sri Lanka	10	7	10

AWS

Region	Date/Time (UTC)		
	13/12	**14/00**	**14/03**
India	547/616	531/616	553/616
WB	20	19	20
ODS	29	25	29
AP	32	33	33
TN	27	26	27
PDC	1	0	0

- **RS/RW** (12Z) of 13 -11-2011: 11/39
- **No. of Ascents reaching 250 hPa levels: 3, MISDA:-28**
- **RS/RW** (00Z) of 14 -11-2011: 32/39
- **No. of Ascents reaching 250 hPa levels: 20, MISDA: 7**

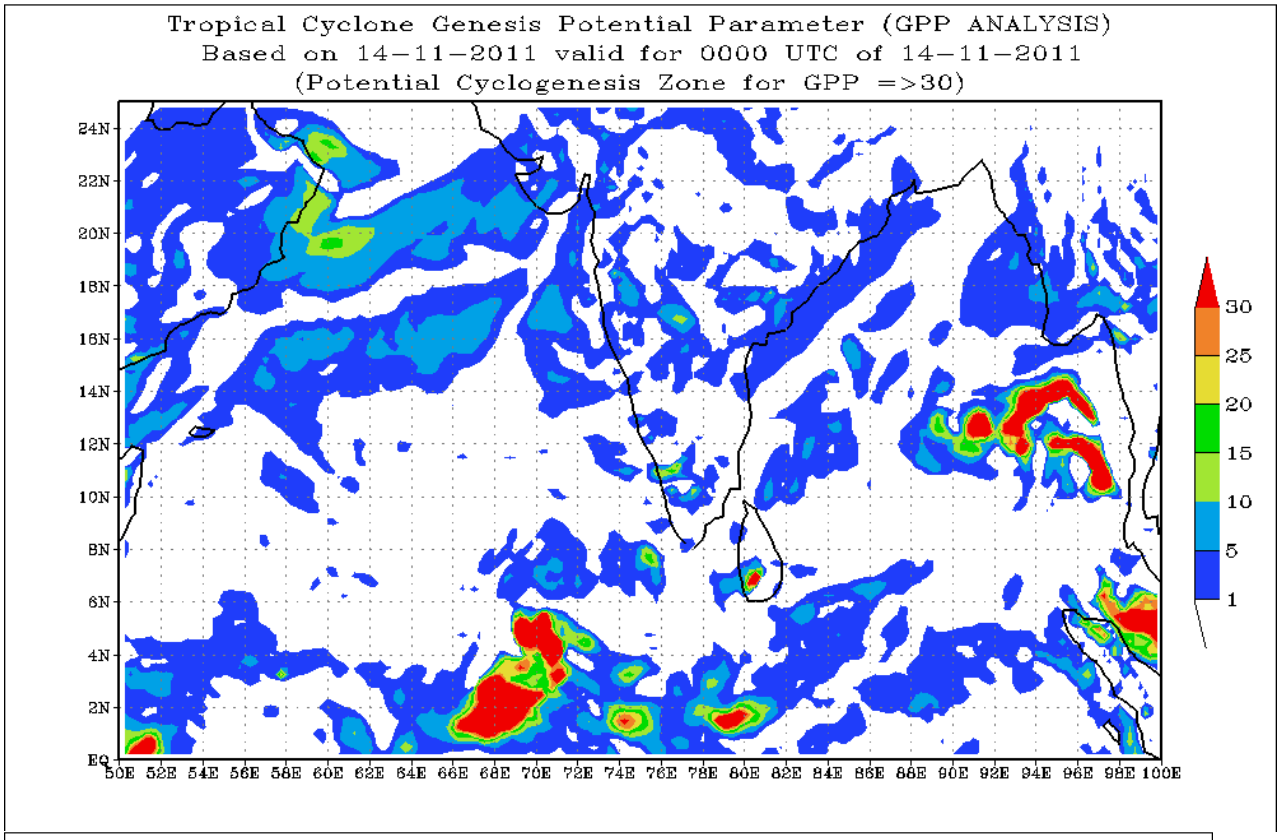
No. of PILOT Ascents

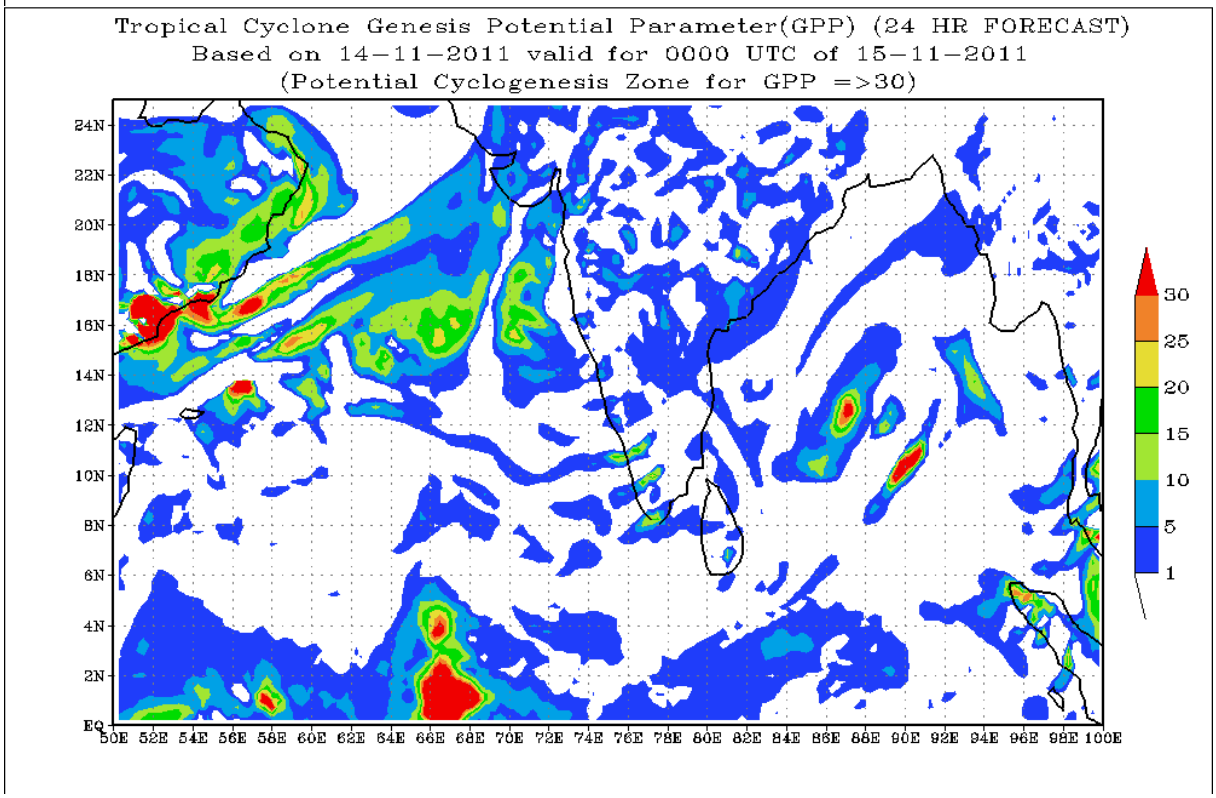
13/12Z	14/00Z
18/37	18/34

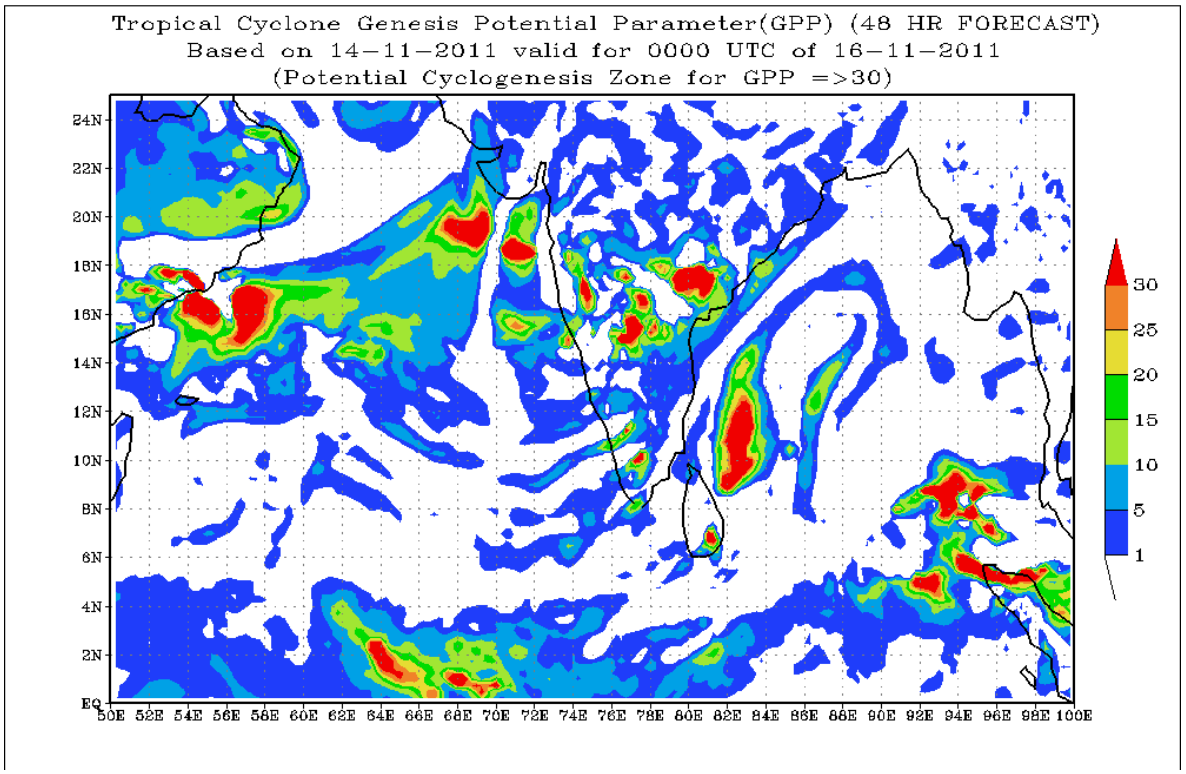
Buoy Data

13/12	14/00	14/03
9	9	11

ANNEXURE-III







FDP (Cyclone) NOC Report Dated 15th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 3^0 N over Bay of Bengal.
- Pressure departure from normal is positive (around 1 to 2 hPa) along east coast of India and over Andaman & Nicobar Island.
- 24 hrs. pressure tendency is positive (around 1 hPa) along east coast of India, Andaman & Nicobar Island, Myanmar and Bangladesh coast.
- Buoys data show that SST around 28-29^{0}C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^{0}C over central & south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south and central Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of $50*10^{-5}$ s^{-1} over southeast Bay of Bengal.

Convergence:

- Lower level convergence is positive of order of $5*10^{-5}s^{-1}$ over south & central Bay of Bengal.

Divergence:

- Upper air divergence is negative of the order of $5\text{-}10*10^{-5}s^{-1}$ over central Bay of Bengal.

Wind Shear:

- Wind Shear of 5-10 knots over south Bay of Bengal & south Andaman Sea and 30-40 knots over central & north Bay of Bengal.

Wind Shear Tendency:

- Negative tendency of -5 to -10 knots over south Bay of Bengal, south Andaman Sea & northwest Bay of Bengal

Upper tropospheric ridge:

- **T**he upper tropospheric ridge line roughly runs along Lat 13.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 7 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 8,1 & 2 during next 15 days.
- Dynamical forecast: - MJO located in phase 7 with amplitude greater than 1.0 and moves through phase 8,1 & 2 during next 15 days.

Cyclonic disturbances over other basins:

- There is tropical disturbance over north Pacific Ocean

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 150900 UTC.

Scattered low/medium clouds with embedded isolated moderate to intense convection seen over Bay of Bengal between lat 10.0^0N to 15.0^0N long 82.0^0E to 88.0^0N.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **IMD-GFS** model analysis and forecast based on 0000 UTC of does not show significant weather system over Bay of Bengal during next 5 days.

- **WRF-ARW** model analysis and forecast does not show any significant weather over Bay of Bengal during next 3 days.

- **UKMET** model analysis and forecast based on 0000 UTC of today does not show any significant weather over Bay of Bengal or Arabian Sea.

http://www.imd.gov.in/section/nhac/dynamic/welcome.htm
ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and 24 and 48 hours forecast does not show any significant cell formation during next 3days. GPP charts analysis and 24 and 48 hours forecasts are enclosed here with in **Annexure II** **(** http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- Easterly to northeasterly wind having speed 10-15 knots would blow over Bay of Bengal during next three days.

Advisory:

- Presently, no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure-I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	14/12	**15/00**	**15/03**
India	190/205	130/159	193/208
Coastal stations			
WB	11	5	11
Odisha	10	6	10
AP	18	17	18
Tamil Nadu	14	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	9	8	10
Myanmar	8	8	8
Thailand	1	1	1
Sri Lanka	11	10	10

AWS

Region	Date/Time (UTC)		
	14/12	15/00	15/03
India	498/616	542/616	547/616
WB	5	19	19
ODS	29	27	28
AP	33	34	33
TN	27	26	27
PDC	0	0	0

- **RS/RW** (12Z) of 14 -11-2011: 12/39
- **No. of Ascents reaching 250 hPa levels: 3, MISDA:-27**
- **RS/RW** (00Z) of 15 -11-2011: 33/39
- **No. of Ascents reaching 250 hPa levels: 20, MISDA: 6**

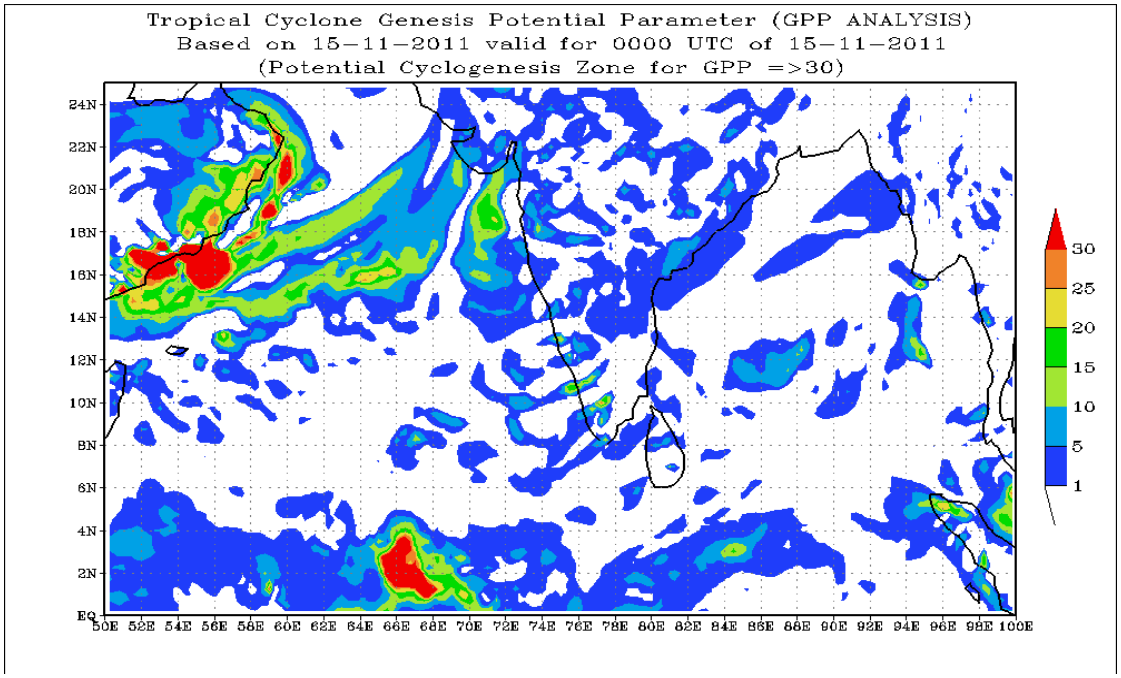
No. of PILOT Ascents

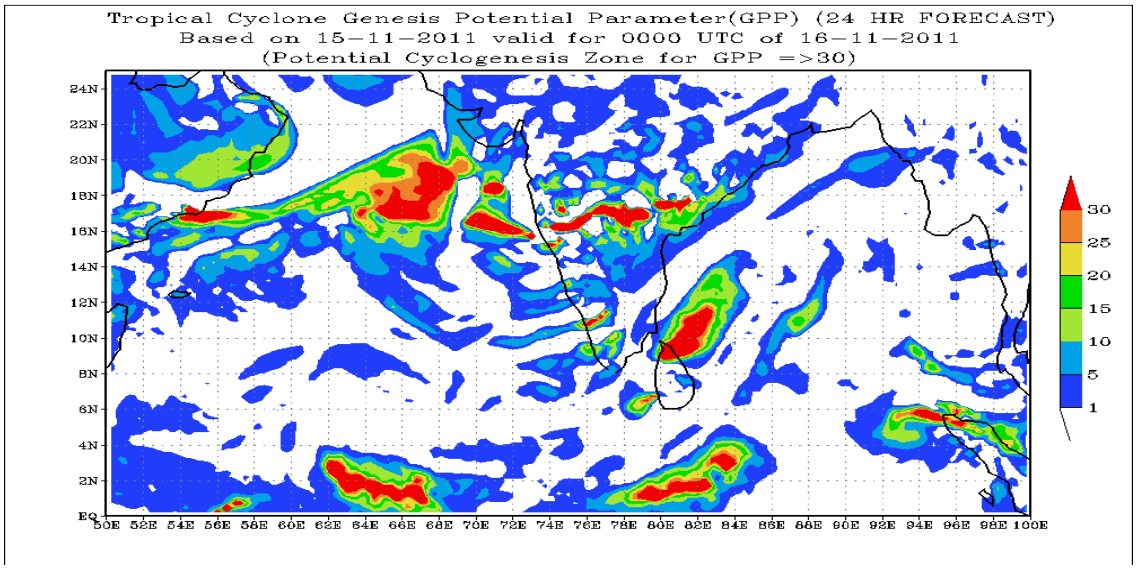
14/12Z	15/00Z
11/37	18/34

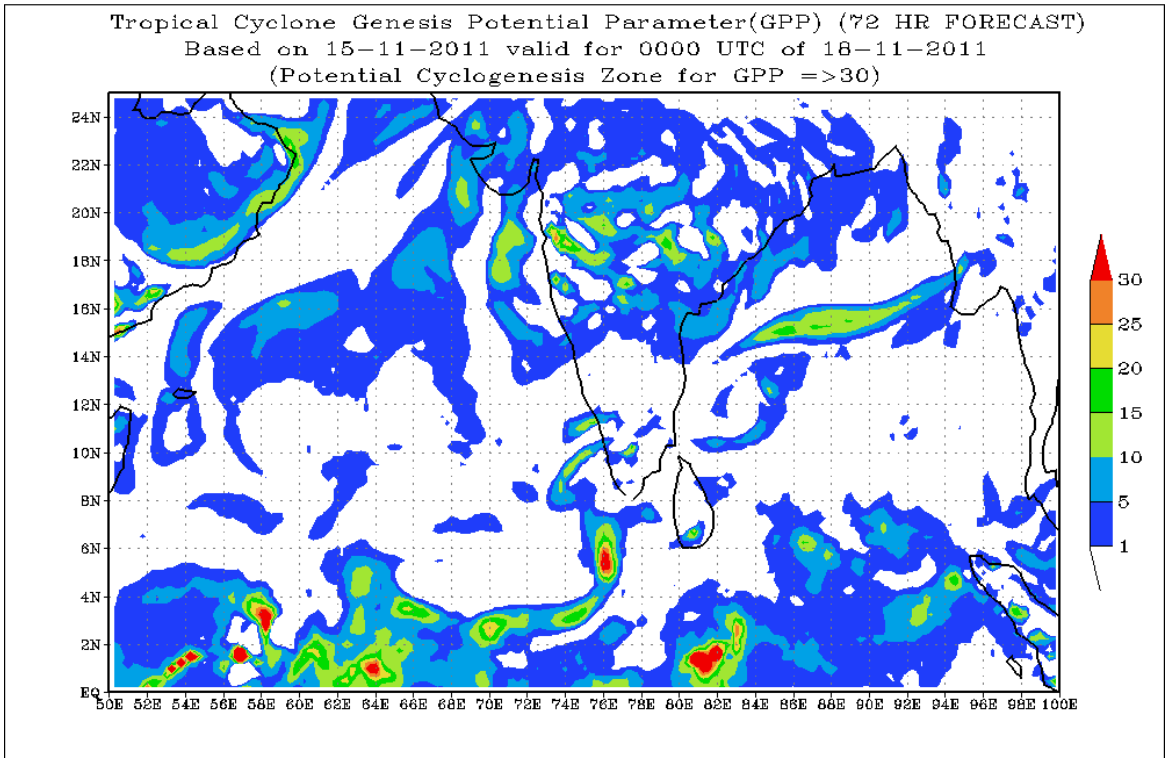
Buoy Data

14/12	15/00	15/03
8	8	8

Annexure-II







FDP (Cyclone) NOC Report Dated 16th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 4^0 N over Bay of Bengal.
- Pressure departure from normal is positive (around 1 hPa) along east coast of India and over Andaman & Nicobar Island except Tamilnadu coast where the departure is nearly normal.
- 24 hrs. pressure tendency is positive (around 1 hPa) along east coast of India, Andaman & Nicobar Island, Myanmar and Bangladesh coast.

- Buoys data show that SST around 28-29^{0}C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^{0}C over central & south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south and central Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 50*10^{-5} s^{-1} over southwest and westcentral Bay of Bengal.

Convergence:

- Lower level convergence is positive of order of 5*10^{-5}s^{-1} over central Bay of Bengal.

Divergence:

- Upper air divergence is positive of the order of 5-10*10^{-5}s^{-1} over southwest & westcentral Bay of Bengal.

Wind Shear:

- Wind Shear of 5-10 knots over south Bay of Bengal & south Andaman Sea and 20-30 knots over central & north Bay of Bengal.

Wind Shear Tendency:

- Negative tendency of -5 to -10 knots over southwest and westcentral Bay of Bengal.

Upper tropospheric ridge:

- **T**he upper tropospheric ridge line roughly runs along Lat 13.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 7 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 8,1 & 2 during next 15 days.
- Dynamical forecast: - MJO located in phase 7 with amplitude greater than 1.0 and moves through phase 8,1 & 2 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over Pacific Ocean

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 160900 UTC.

Scattered low/medium clouds with embedded isolated moderate to intense convection seen over Bay of Bengal between lat 8.0^0N to 14.0^0N west of long 85.0^0E.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today does not show any significant weather system over the North Indian Ocean during next 5 days.
- **IMD-GFS** model analysis and forecast based on 0000 UTC of today does not show any significant weather system over the North Indian Ocean during next 5 days.
- **WRF-ARW** model analysis and forecast based on 0000 UTC of today does not show any significant weather over the North Indian Ocean during next 3 days.
- **UKMET** model analysis and forecast based on 0000 UTC of today does not show any significant weather over the North Indian Ocean during next 5 days.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and forecasts does not show any significant cell formation during next 3 days. GPP forecasts chart of 24hours, 48 hours and 72 hours are enclosed here with in **Annexure II (**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm**)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- Easterly to northeasterly wind having speed 10-20 knots would continue to blow over Bay of Bengal during next three days.

Advisory:

- Presently, no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure-I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	15/12	**16/00**	**16/03**
India	187/205	129/159	191/208
Coastal stations			
WB	11	5	11
Odisha	10	6	10

AP	17	17	18
Tamil Nadu	14	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	8	14	15
Myanmar	9	7	10
Thailand	1	1	1
Sri Lanka	12	12	12

AWS

Region	**Date/Time (UTC)**		
	15/12	**16/00**	**16/03**
India	547/616	541/616	480/616
WB	19	19	4
ODS	27	27	28
AP	34	33	29
TN	27	26	26
PDC	1	0	0

- **RS/RW** (12Z) of 15 -11-2011: 11/39
- **No. of Ascents reaching 250 hPa levels: 3, MISDA:-28**
- **RS/RW** (00Z) of 16 -11-2011: 34/39
- **No. of Ascents reaching 250 hPa levels: 16, MISDA: 5**

No. of PILOT Ascents

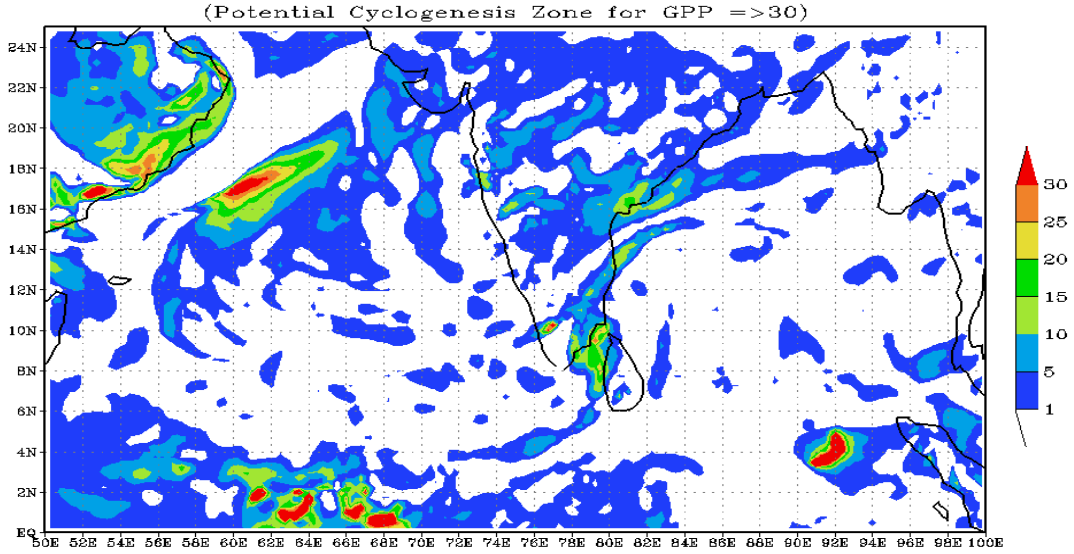
15/12Z	**16/00Z**
10/37	10/34

Buoy Data

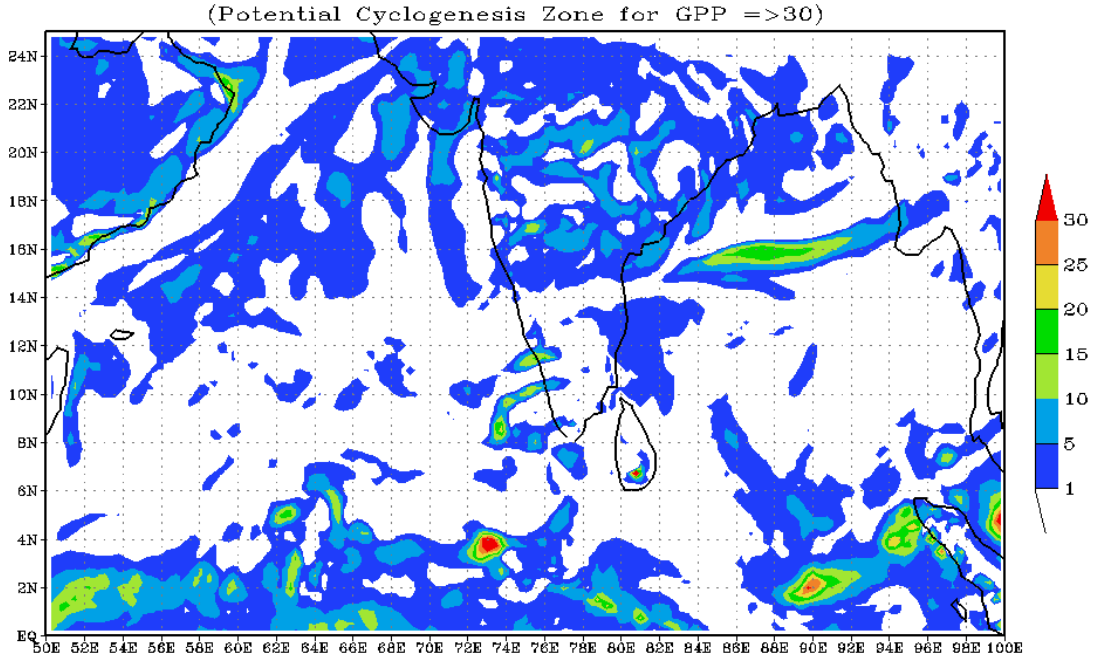
15/12	**16/00**	**16/03**
9	7	8

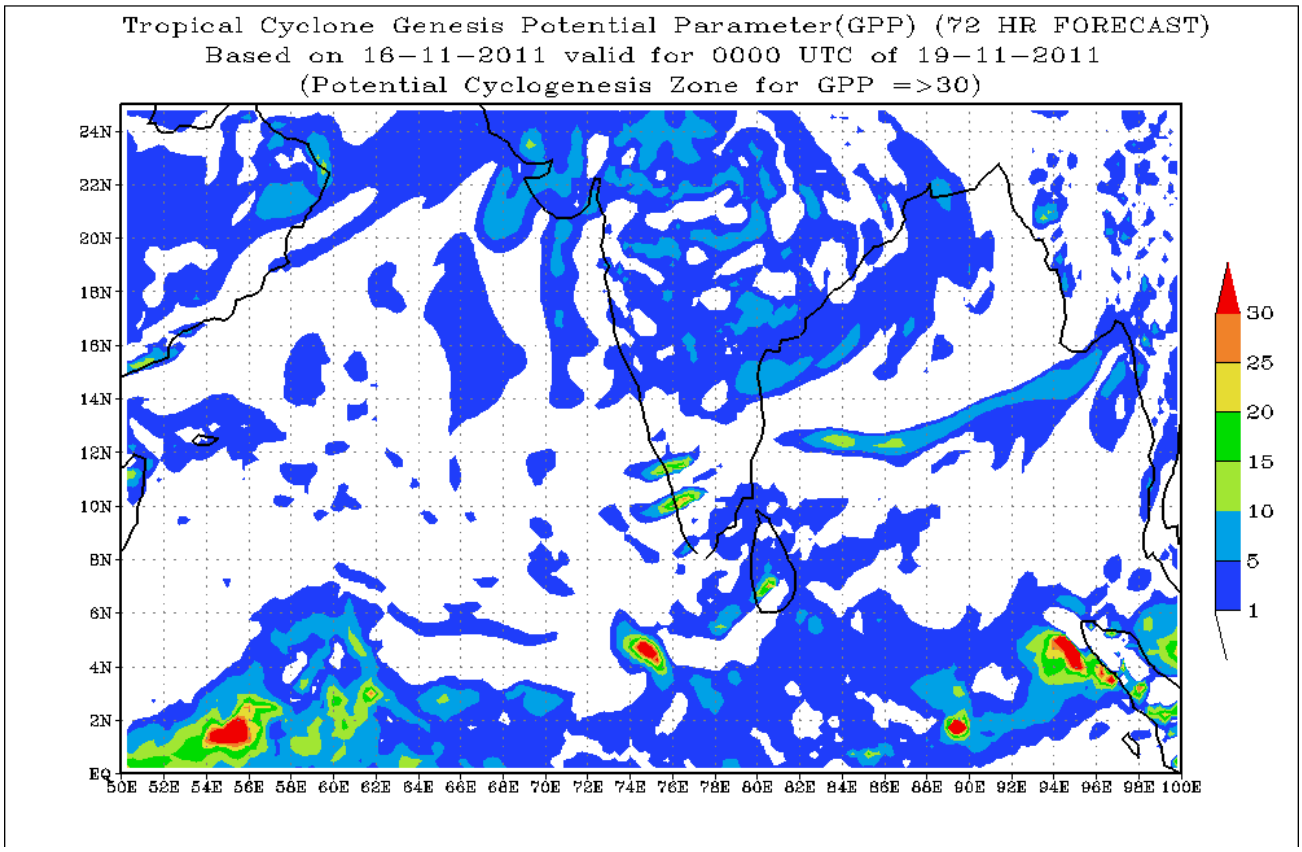
Annexure-II

Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 16-11-2011 valid for 0000 UTC of 17-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 16-11-2011 valid for 0000 UTC of 18-11-2011
(Potential Cyclogenesis Zone for GPP =>30)





FDP (Cyclone) NOC Report Dated 17th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 4^0 N over Bay of Bengal.
- The trough of low at mean Sea level over southwest Bay of Bengal off Sri Lanka-Tamil Nadu coasts now lies over southwest Bay of Bengal off Tamil Nadu coast.
- A trough in lower level westerlies extends from Assam & Meghalaya to northeast Bay of Bengal roughly along Lat. 92° E. System would move east-northeast wards.
- Pressure departure from normal is positive of the order 2 to 4 hPa along east coast of India and over Andaman.
- 24 hrs. pressure tendency is positive (around 1 hPa) along east coast of India, Andaman & Nicobar Island, Myanmar and Bangladesh coast.
- Rainfall occurred at many places over Tamilnadu coast.
- Buoys data show that SST around 28-29^{0}C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^{0}C over central & south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south and central Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 50*10^{-5} s^{-1} over southwest and westcentral Bay of Bengal.

Convergence:

- Lower level convergence is positive of order of 5*10^{-5}s^{-1} over central Bay of Bengal.

Divergence:

- Upper air divergence is positive of the order of 5-10*10^{-5}s^{-1} over southwest & westcentral Bay of Bengal.

Wind Shear:

- Wind Shear of 5-10 knots over south Bay of Bengal & south Andaman Sea and 20-30 knots over central & north Bay of Bengal.

Wind Shear Tendency:

- Negative tendency of -5 to -10 knots over southwest and westcentral Bay of Bengal.

Upper tropospheric ridge:

- **T**he upper tropospheric ridge line roughly runs along Lat 13.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 7 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 8,1 & 2 during next 15 days.
- Dynamical forecast: - MJO located in phase 7 with amplitude greater than 1.0 and moves through phase 8,1 & 2 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over Pacific Ocean

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 170900 UTC.

Scattered low to medium clouds with embedded isolated weak convection over west central Bay of Bengal and some parts of south east Bay and south Andaman Sea..

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today does not show any significant weather system over the North Indian Ocean during next 5 days. Analysis of wind at 850 hPa, wind shear, Vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis and forecast based on 0000 UTC of today does not show any significant weather system over the North Indian Ocean during next 5 days.
- **WRF-ARW** model analysis and forecast based on 0000 UTC of today does not show any significant weather over the North Indian Ocean during next 3 days.
- **UKMET** model analysis and forecast based on 0000 UTC of today does not show any significant weather over the North Indian Ocean during next 5 days.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and forecasts does not show any significant cell formation during next 3 days. GPP analysis and forecast charts of 24hours, 48 hours and 72 hours are enclosed here with in **Annexure III (**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm

Summary and Conclusion:

Synoptic and NWP models suggest that:

- Easterly to northeasterly wind having speed 10-20 knots would continue to blow over Bay of Bengal during next three days.

Advisory:

- Presently, no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure-I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	16/12	**17/00**	**17/03**
India	190/205	126/159	193/208
Coastal stations			
WB	11	5	11

Odisha	10	6	10
AP	18	16	18
Tamil Nadu	14	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	00	11	06
Myanmar	8	8	8
Thailand	1	1	1
Sri Lanka	12	12	12

AWS

Region	**Date/Time (UTC)**		
	16/12	**17/00**	**17/03**
India	538/616	539/616	554/616
WB	18	18	20
ODS	29	27	29
AP	33	33	33
TN	27	25	26
PDC	0	0	0

- **RS/RW** (12Z) of 16 -11-2011: 08/39
- **No. of Ascents reaching 250 hPa levels: 3, MISDA:-31**
- **RS/RW** (00Z) of 17 -11-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 21, MISDA: 4**

No. of PILOT Ascents

16/12Z	**17/00Z**
14/37	15/34

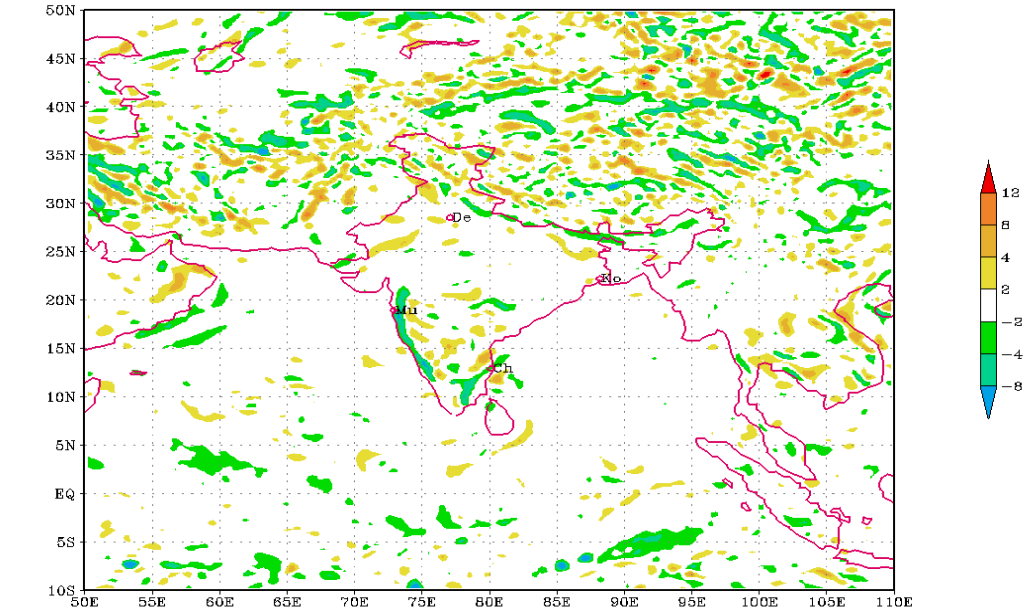
Buoy Data

16/12	**17/00**	**17/03**
13	14	15

Annexure II

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

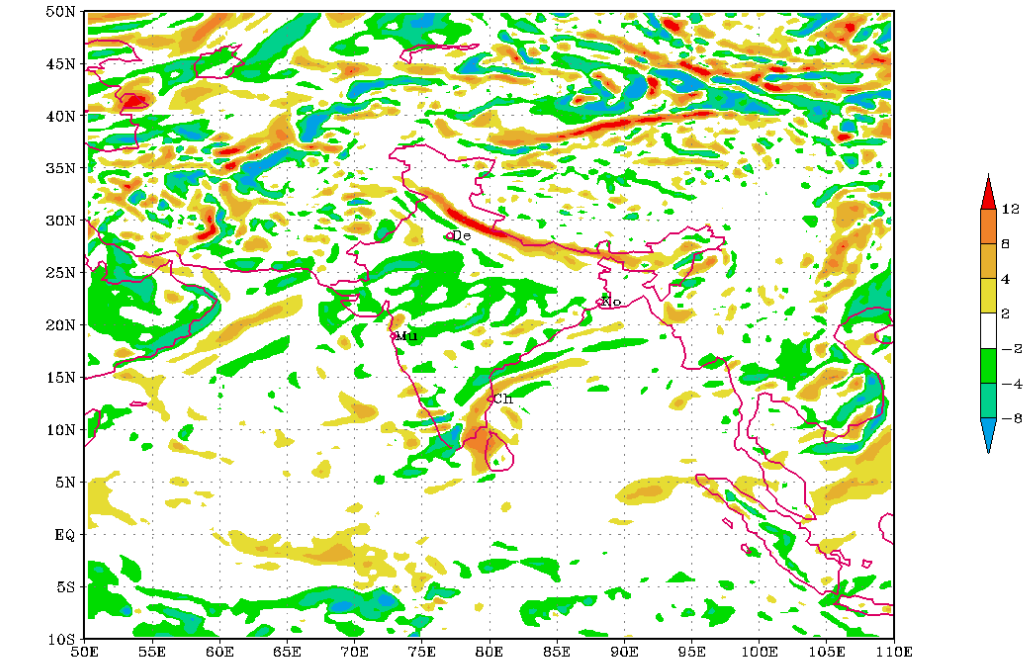
based on 00 UTC 17−11−2011 valid for 00 UTC of 17−11−2011



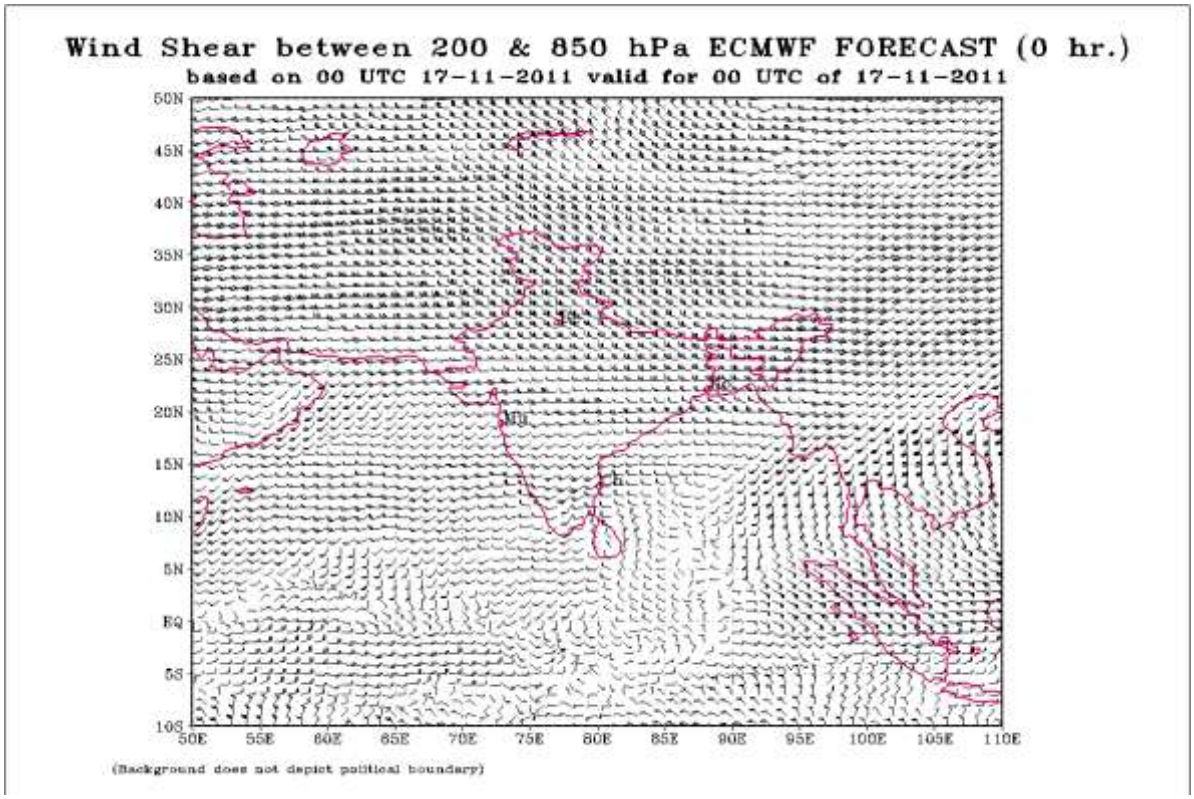
(Background does not depict political boundary)

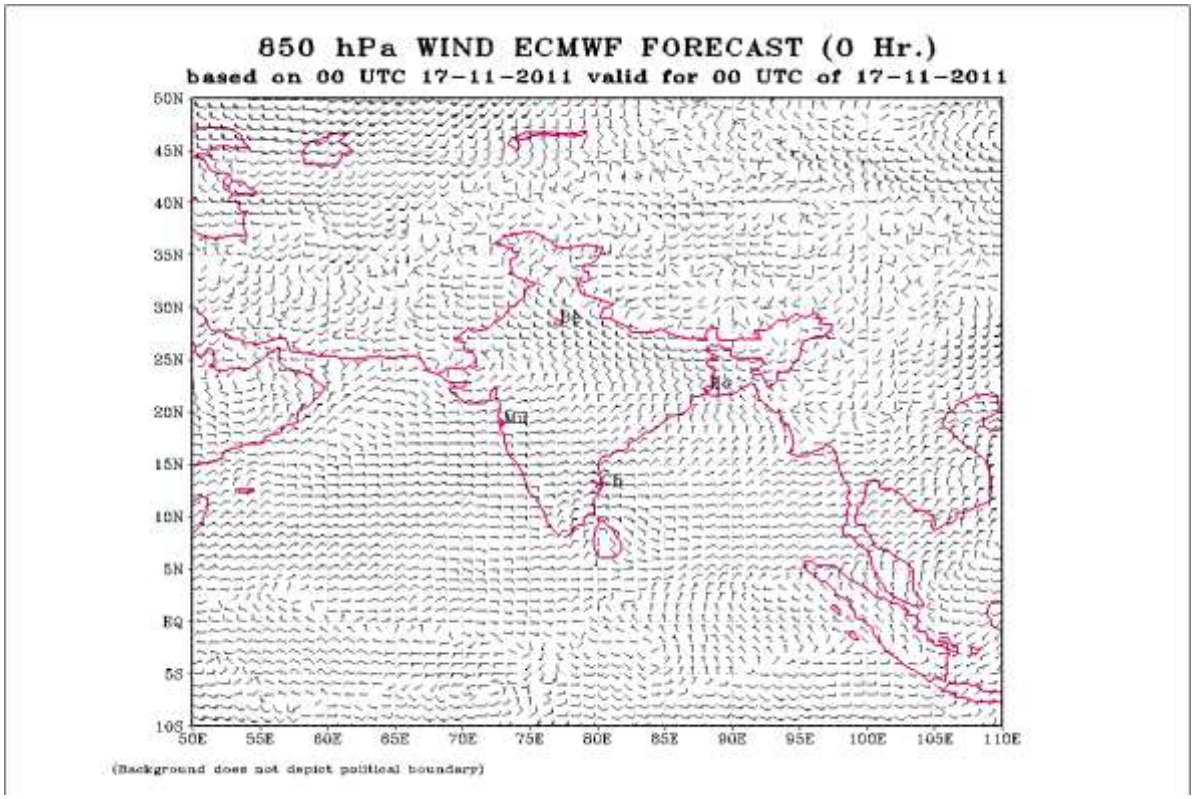
Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

based on 00 UTC 17−11−2011 valid for 00 UTC of 17−11−2011

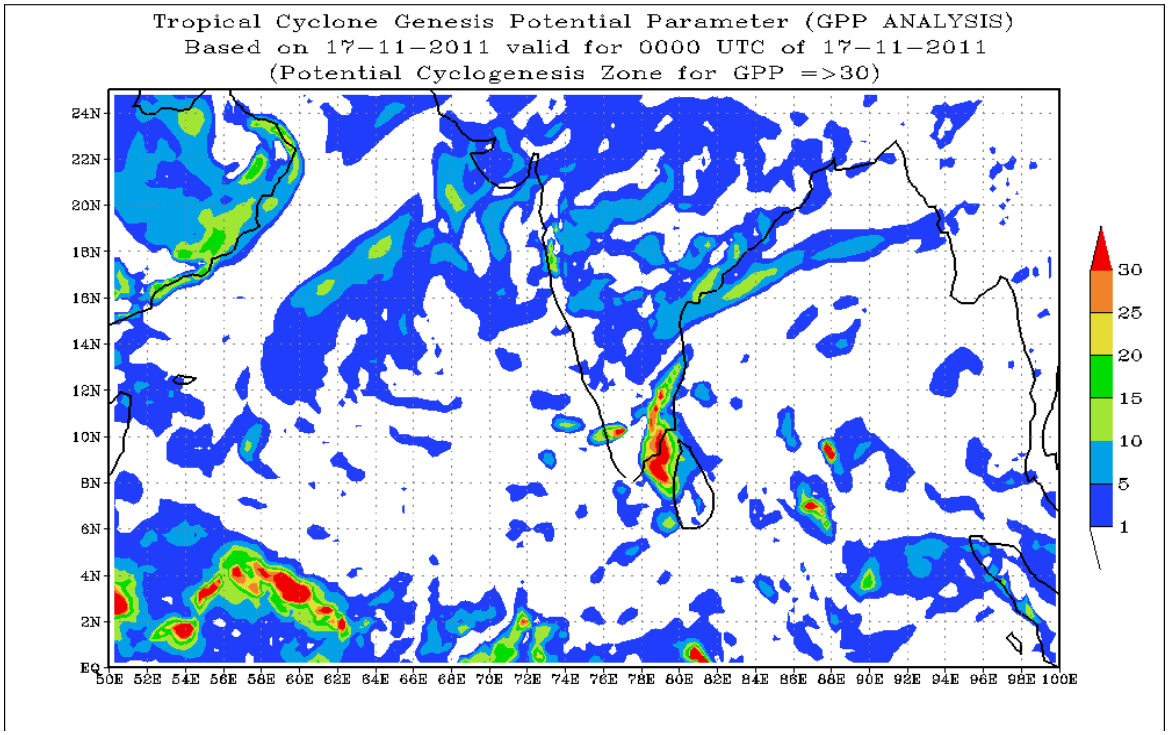


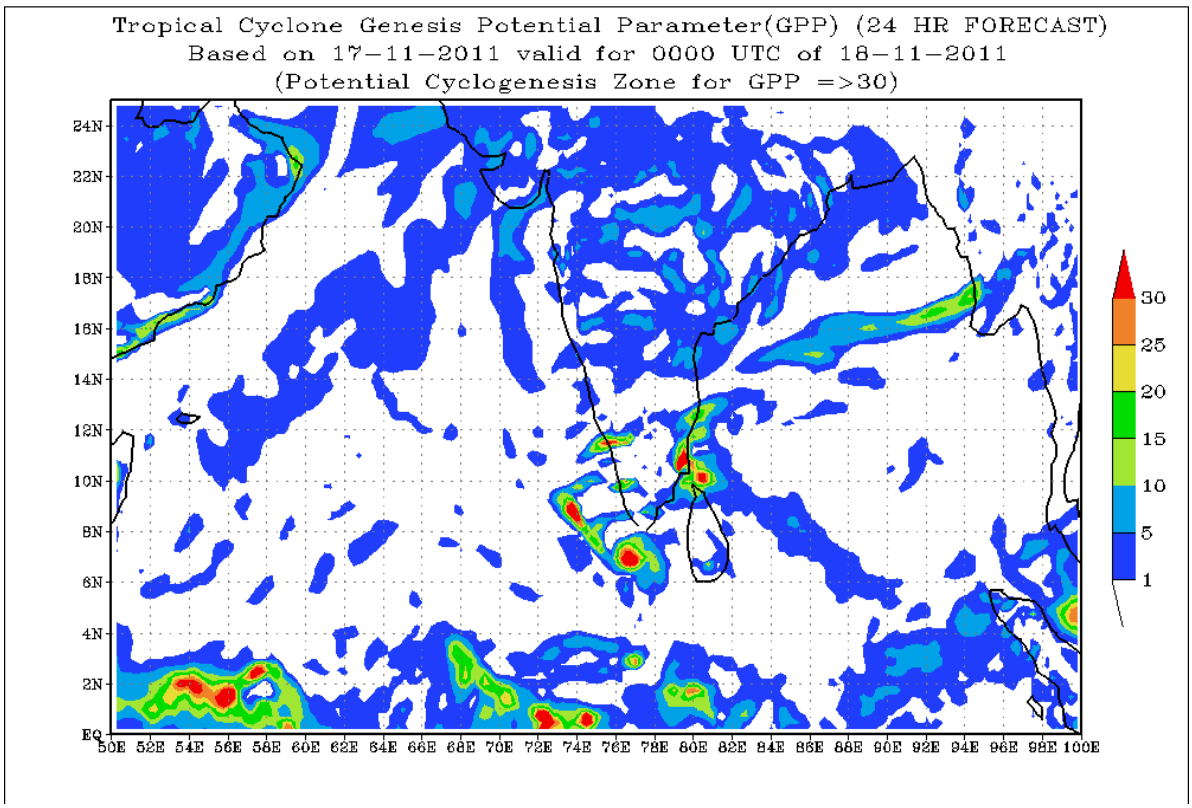
(Background does not depict political boundary)

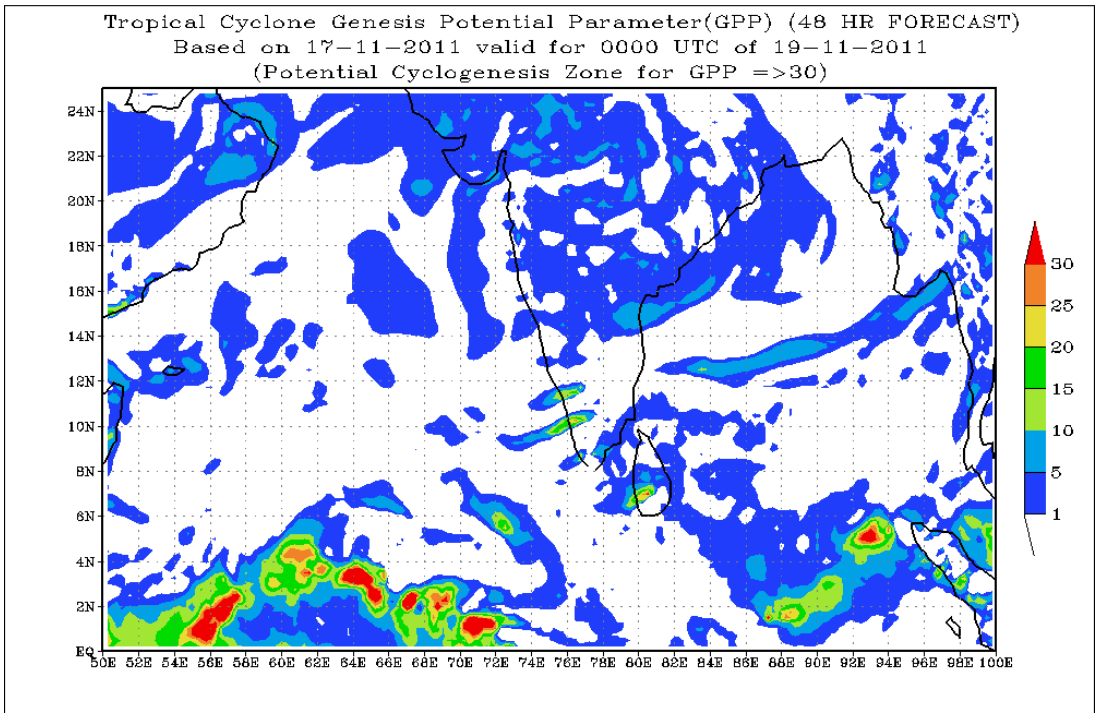


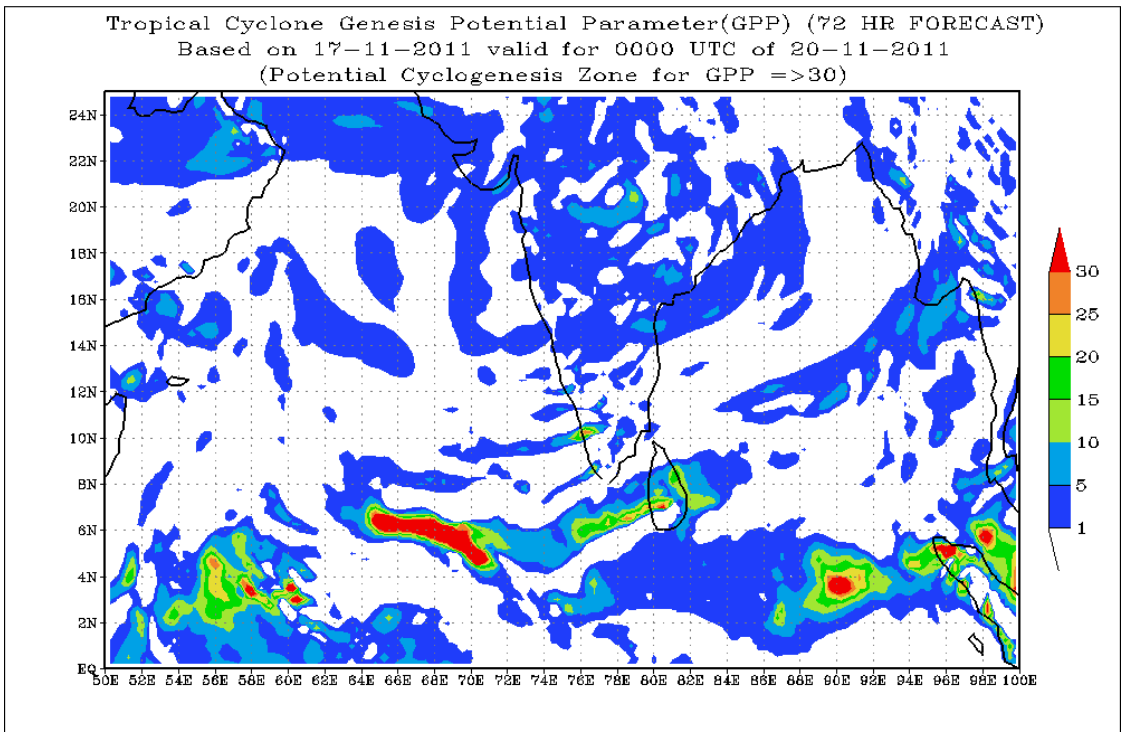


Annexure-III


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 17-11-2011 valid for 0000 UTC of 17-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 17-11-2011 valid for 0000 UTC of 18-11-2011
(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
1





FDP (Cyclone) NOC Report Dated 17th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 4^0 N over Bay of Bengal.

- The trough of low at mean Sea level over southwest Bay of Bengal off Sri Lanka-Tamil Nadu coasts now lies over southwest Bay of Bengal off Tamil Nadu coast.
- A trough in lower level westerlies extends from Assam & Meghalaya to northeast Bay of Bengal roughly along Lat. 92° E. System would move east-northeast wards.
- Pressure departure from normal is positive of the order 2 to 4 hPa along east coast of India and over Andaman.
- 24 hrs. pressure tendency is positive (around 1 hPa) along east coast of India, Andaman & Nicobar Island, Myanmar and Bangladesh coast.
- Rainfall occurred at many places over Tamilnadu coast.
- Buoys data show that SST around 28-29^{0}C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^{0}C over central & south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south and central Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 50*10^{-5} s^{-1} over southwest and westcentral Bay of Bengal.

Convergence:

- Lower level convergence is positive of order of 5*10^{-5}s^{-1} over central Bay of Bengal.

Divergence:

- Upper air divergence is positive of the order of 5-10*10^{-5}s^{-1} over southwest & westcentral Bay of Bengal.

Wind Shear:

- Wind Shear of 5-10 knots over south Bay of Bengal & south Andaman Sea and 20-30 knots over central & north Bay of Bengal.

Wind Shear Tendency:

- Negative tendency of -5 to -10 knots over southwest and westcentral Bay of Bengal.

Upper tropospheric ridge:

- **T**he upper tropospheric ridge line roughly runs along Lat 13.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 7 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 8,1 & 2 during next 15 days.

- Dynamical forecast: - MJO located in phase 7 with amplitude greater than 1.0 and moves through phase 8,1 & 2 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over Pacific Ocean

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 170900 UTC.

Scattered low to medium clouds with embedded isolated weak convection over west central Bay of Bengal and some parts of south east Bay and south Andaman Sea..

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today does not show any significant weather system over the North Indian Ocean during next 5 days. Analysis of wind at 850 hPa, wind shear, Vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis and forecast based on 0000 UTC of today does not show any significant weather system over the North Indian Ocean during next 5 days.
- **WRF-ARW** model analysis and forecast based on 0000 UTC of today does not show any significant weather over the North Indian Ocean during next 3 days.
- **UKMET** model analysis and forecast based on 0000 UTC of today does not show any significant weather over the North Indian Ocean during next 5 days.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and forecasts does not show any significant cell formation during next 3 days. GPP analysis and forecast charts of 24hours, 48 hours and 72 hours are enclosed here with in **Annexure III (**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm

Summary and Conclusion:

Synoptic and NWP models suggest that:

- Easterly to northeasterly wind having speed 10-20 knots would continue to blow over Bay of Bengal during next three days.

Advisory:

- Presently, no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	16/12	**17/00**	**17/03**
India	190/205	126/159	193/208
Coastal stations			
WB	11	5	11
Odisha	10	6	10
AP	18	16	18
Tamil Nadu	14	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	00	11	06
Myanmar	8	8	8
Thailand	1	1	1
Sri Lanka	12	12	12

AWS

Region	Date/Time (UTC)		
	16/12	**17/00**	**17/03**
India	538/616	539/616	554/616
WB	18	18	20
ODS	29	27	29

AP	33	33	33
TN	27	25	26
PDC	0	0	0

- **RS/RW** (12Z) of 16 -11-2011: 08/39
- **No. of Ascents reaching 250 hPa levels: 3, MISDA:-31**
- **RS/RW** (00Z) of 17 -11-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 21, MISDA: 4**

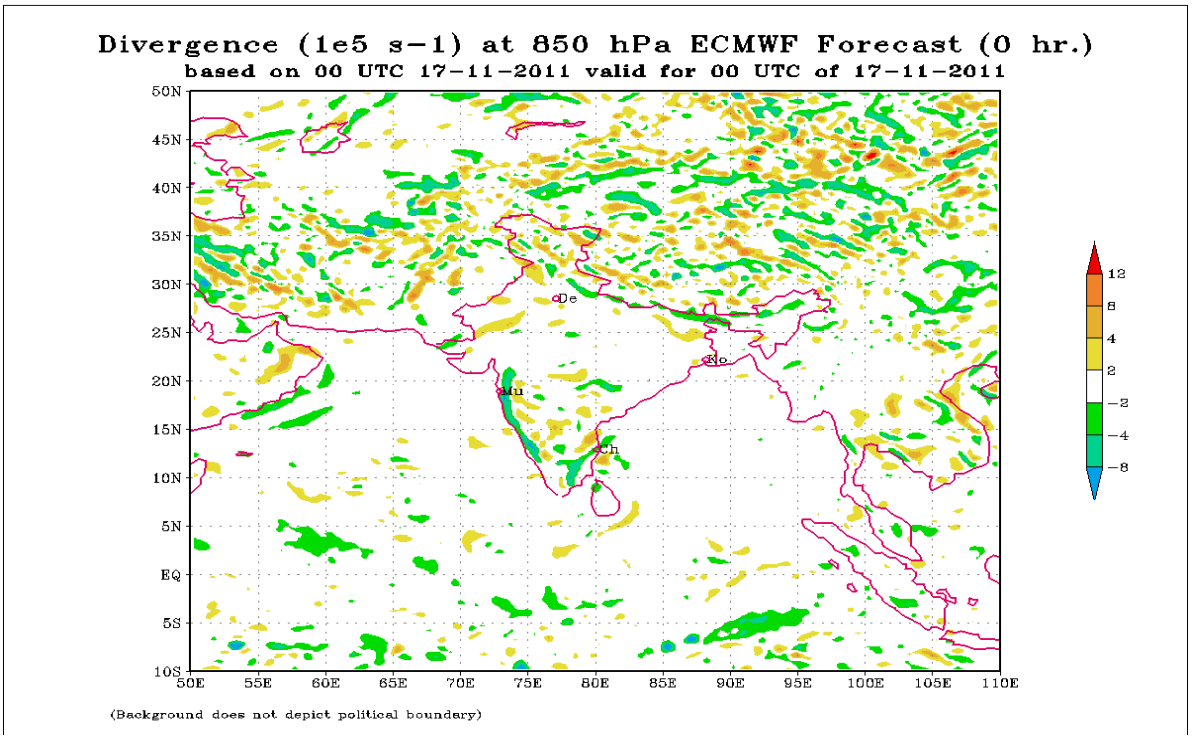
No. of PILOT Ascents

16/12Z	17/00Z
14/37	15/34

Buoy Data

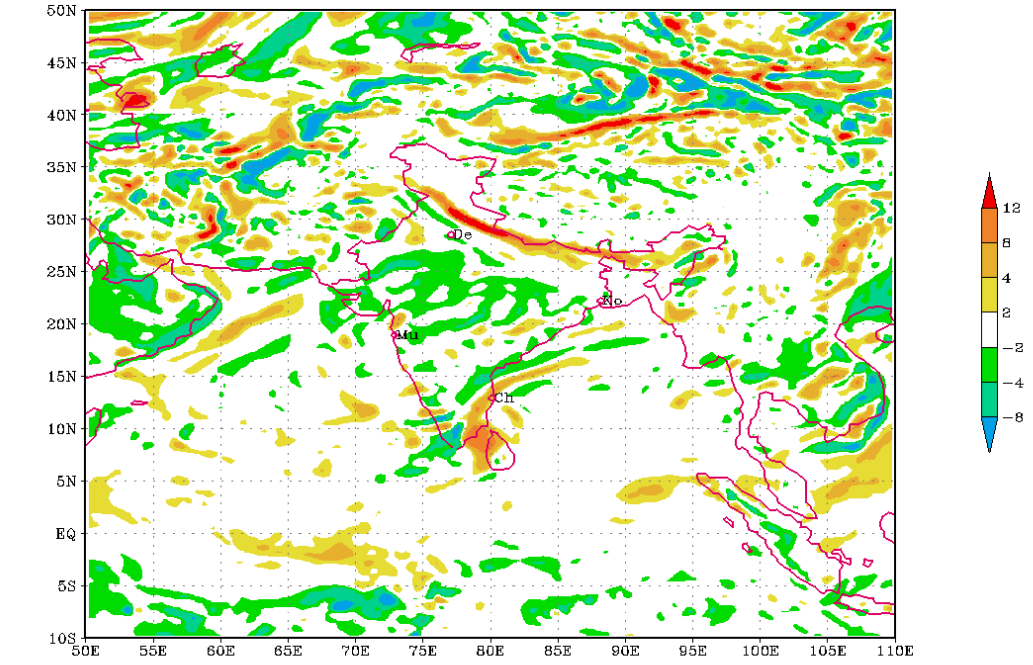
16/12	17/00	17/03
13	14	15

Annexure II



Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

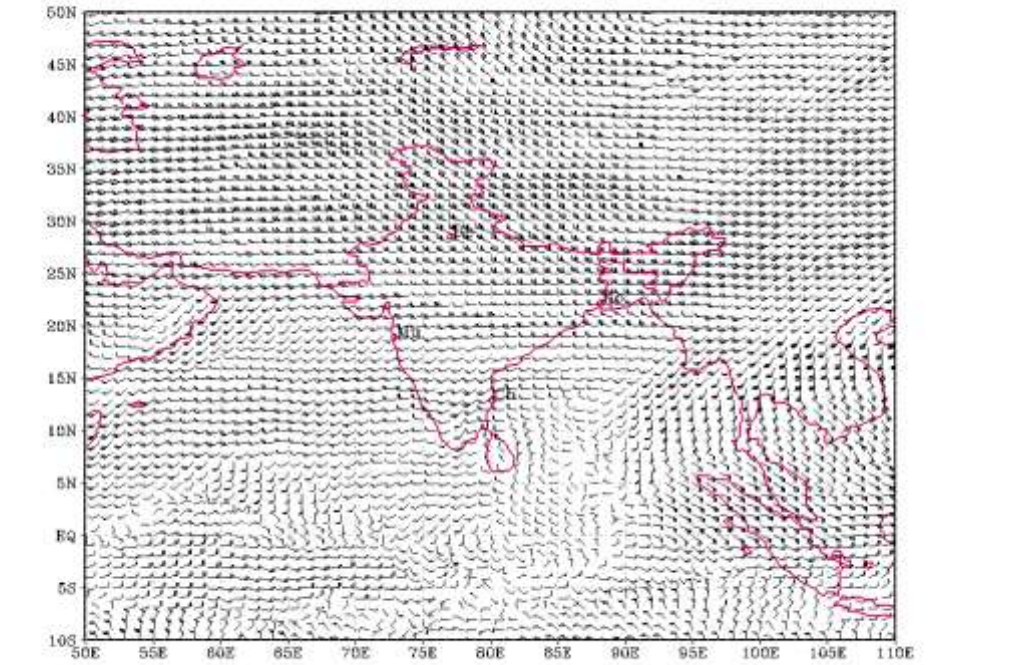
based on 00 UTC 17−11−2011 valid for 00 UTC of 17−11−2011



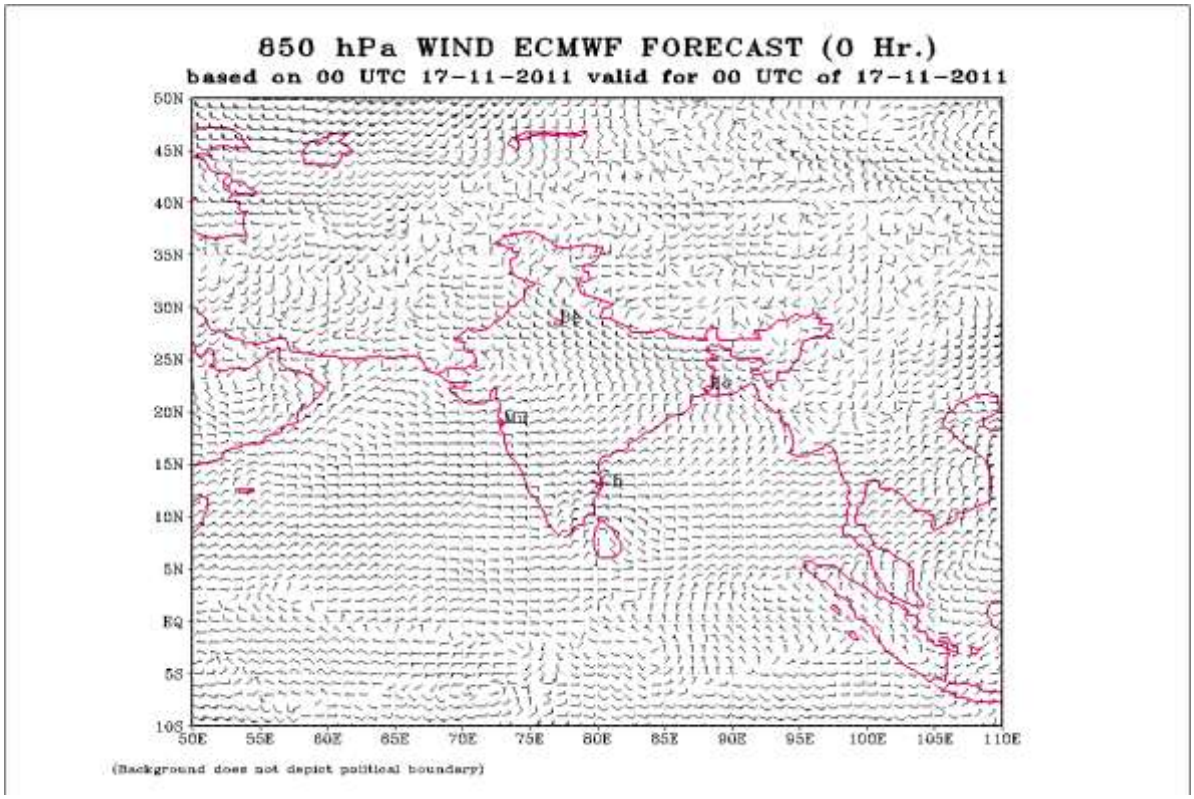
(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

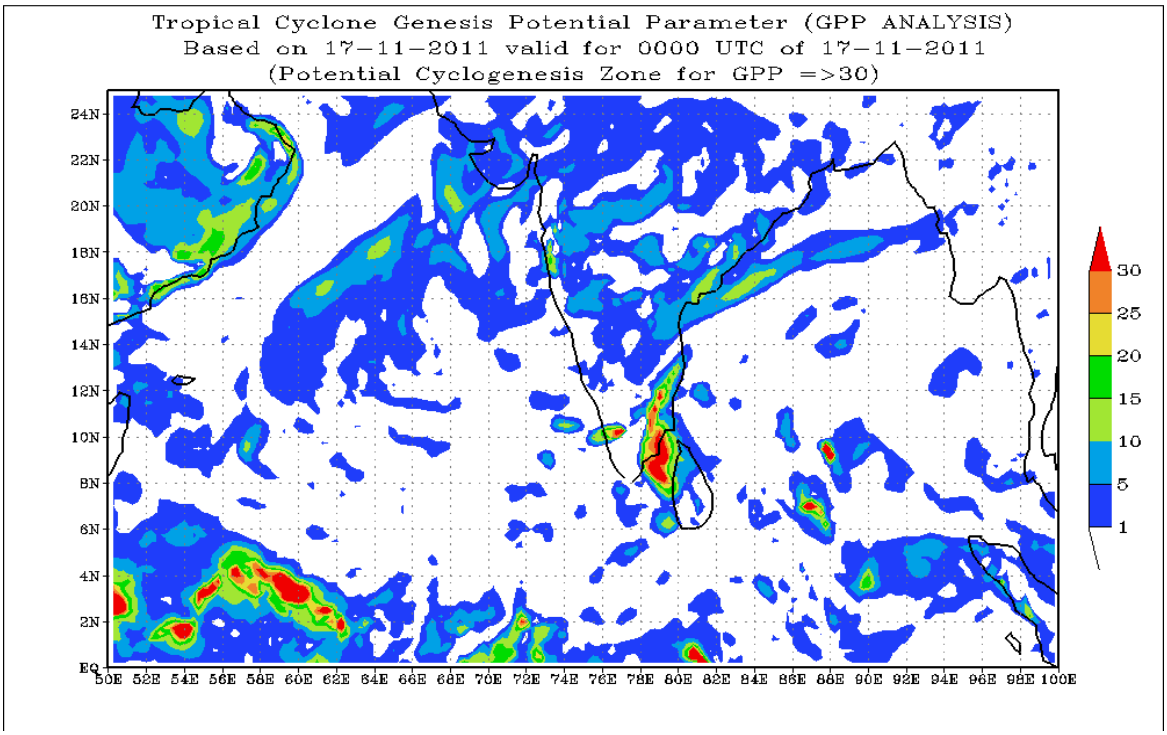
based on 00 UTC 17−11−2011 valid for 00 UTC of 17−11−2011



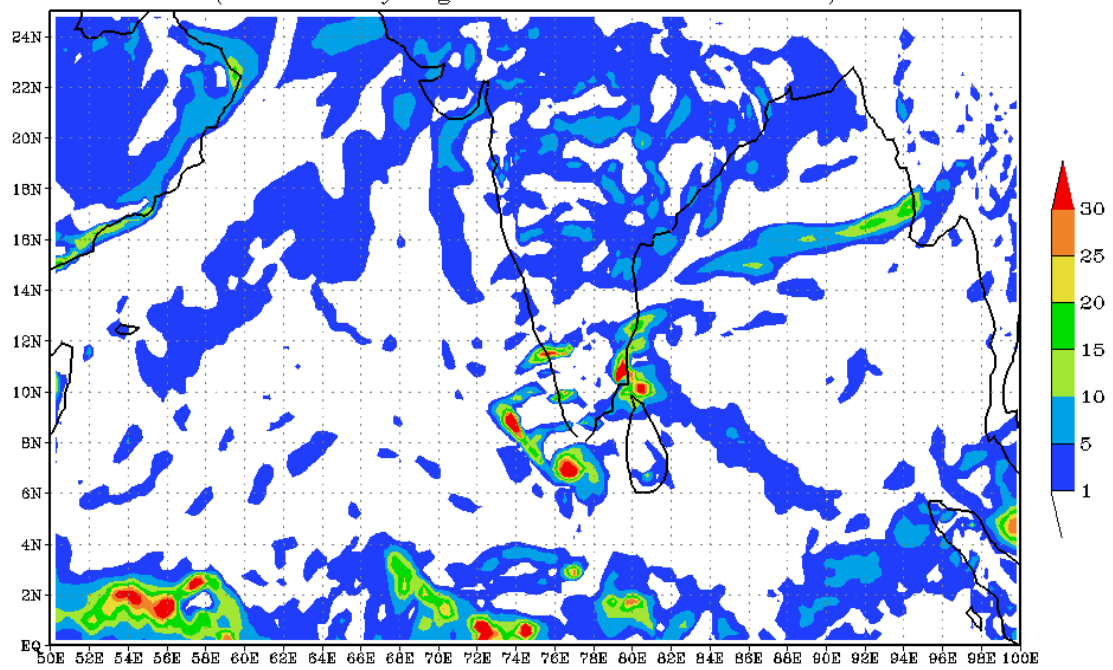
(Background does not depict political boundary)



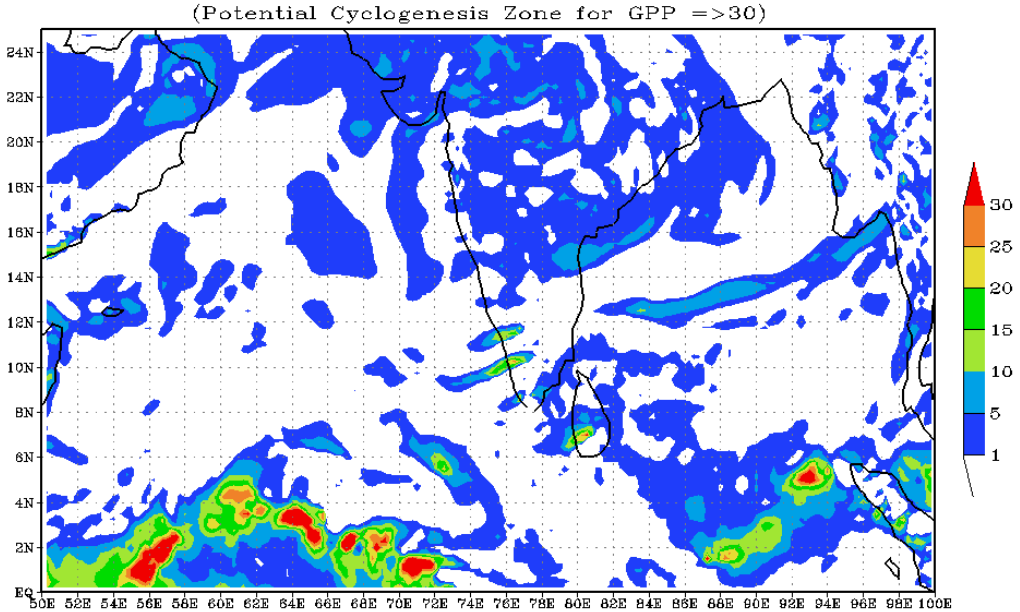
Annexure-III

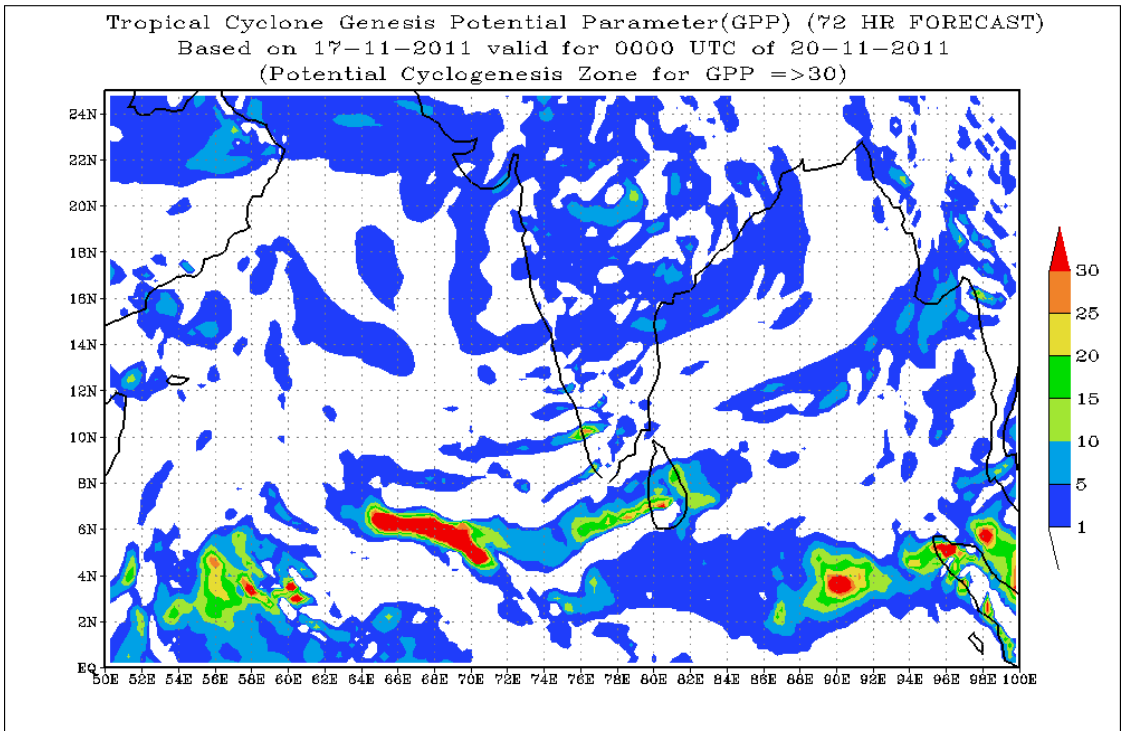


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 17-11-2011 valid for 0000 UTC of 18-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 17-11-2011 valid for 0000 UTC of 19-11-2011
(Potential Cyclogenesis Zone for GPP =>30)





FDP (Cyclone) NOC Report Dated 18th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 4^0 N over Bay of Bengal.
- The trough of low at mean Sea level over southwest Bay of Bengal off Sri Lanka-Tamil Nadu coasts now lies over southwest Bay of Bengal off Tamil Nadu coast.
- A trough in lower level westerlies extends from Assam & Meghalaya to northeast Bay of Bengal roughly along Lat. 92° E. System would move east-northeast wards.
- Pressure departure from normal is positive of the order 2 to 4 hPa along east coast of India and over Andaman.
- 24 hrs. pressure tendency is positive (around 1 hPa) along east coast of India, Andaman & Nicobar Island, Myanmar and Bangladesh coast.
- Rainfall occurred at many places over Tamilnadu coast.
- Buoys data show that SST around 28-29^{0}C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^{0}C over central & south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south and central Bay of Bengal is between 80-100 KJ cm^{-2} and over north Bay of Bengal less than 40 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 50*10^{-5} s^{-1} over southwest and westcentral Bay of Bengal.

Convergence:

- Lower level convergence is positive of order of 5*10^{-5}s^{-1} over central Bay of Bengal.

Divergence:

- Upper air divergence is positive of the order of 5-10*10^{-5}s^{-1} over southwest & westcentral Bay of Bengal.

Wind Shear:

- Wind Shear of 5-10 knots over south Bay of Bengal & south Andaman Sea and 20-30 knots over central & north Bay of Bengal.

Wind Shear Tendency:

- Negative tendency of -5 to -10 knots over southwest and westcentral Bay of Bengal.

Upper tropospheric ridge:

- **T**he upper tropospheric ridge line roughly runs along Lat 13.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 7 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 8,1 & 2 during next 15 days.
- Dynamical forecast: - MJO located in phase 7 with amplitude greater than 1.0 and moves through phase 8,1 & 2 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over Pacific Ocean

Status of observational system:

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

Satellite

FDP cyclone Satellite inference 170900 UTC.

Scattered low to medium clouds with embedded isolated weak convection over west central Bay of Bengal and some parts of south east Bay and south Andaman Sea..

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today does not show any significant weather system over the North Indian Ocean during next 5 days. Analysis of wind at 850 hPa, wind shear, Vorticity and Divergence is shown in **Annexure II**.
    - **IMD-GFS** model analysis and forecast based on 0000 UTC of does not show significant weather system over Bay of Bengal during next 5 days.
    - **WRF-ARW** model analysis and forecast does not show any significant weather over Bay of Bengal during next 3 days.
    - **UKMET** model analysis and forecast based on 0000 UTC of today does not show any significant weather over Bay of Bengal or Arabian Sea.

      http://www.imd.gov.in/section/nhac/dynamic/welcome.htm
      ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

    Genesis Potential Parameter (GPP): The GPP analysis and 24 and 48 hours forecast does not show any significant cell formation during next 3 days. GPP charts analysis and 24 and 48 hours forecasts are enclosed here with in **Annexure III**
    (http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- Easterly to northeasterly wind having speed 10-20 knots would continue to blow over Bay of Bengal during next three days.

Advisory:

- Presently, no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure-I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	16/12	**17/00**	**17/03**
India	190/205	126/159	193/208
Coastal stations			

WB	11	5	11
Odisha	10	6	10
AP	18	16	18
Tamil Nadu	14	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	00	11	06
Myanmar	8	8	8
Thailand	1	1	1
Sri Lanka	12	12	12

AWS

Region	**Date/Time (UTC)**		
	16/12	**17/00**	**17/03**
India	538/616	539/616	554/616
WB	18	18	20
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AP	33	33	33
TN	27	25	26
PDC	0	0	0

- **RS/RW** (12Z) of 16 -11-2011: 08/39
- **No. of Ascents reaching 250 hPa levels: 3, MISDA:-31**
- **RS/RW** (00Z) of 17 -11-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 21, MISDA: 4**

No. of PILOT Ascents

16/12Z	**17/00Z**
14/37	15/34

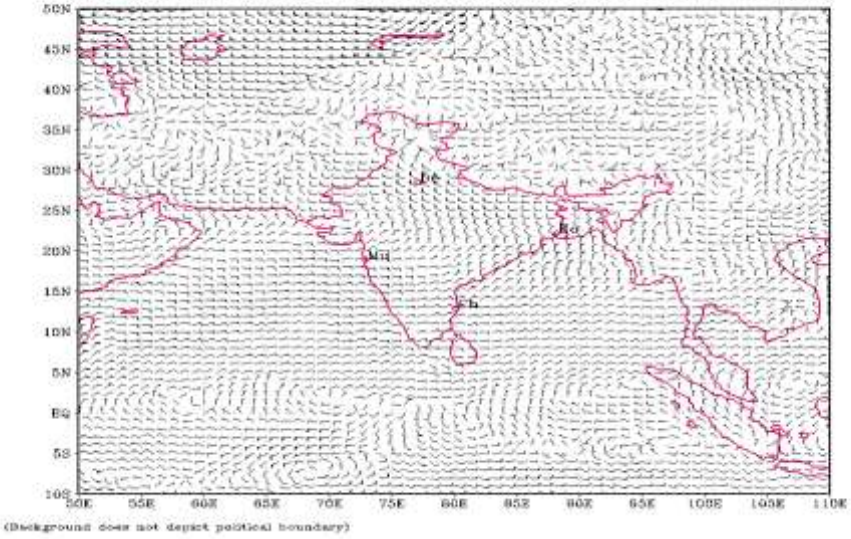
Buoy Data

16/12	17/00	17/03
13	14	15

ANNEXURE-II

850 hPa WIND ECMWF FORECAST (0 Hr.)

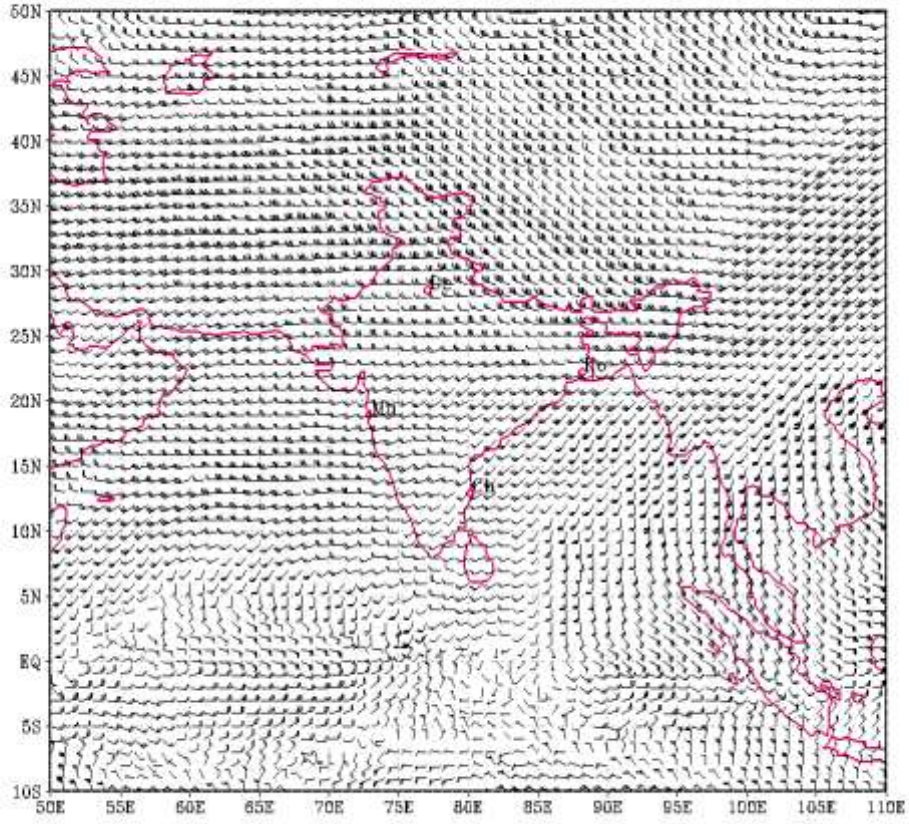
based on 00 UTC 18-11-2011 valid for 00 UTC of 18-11-2011



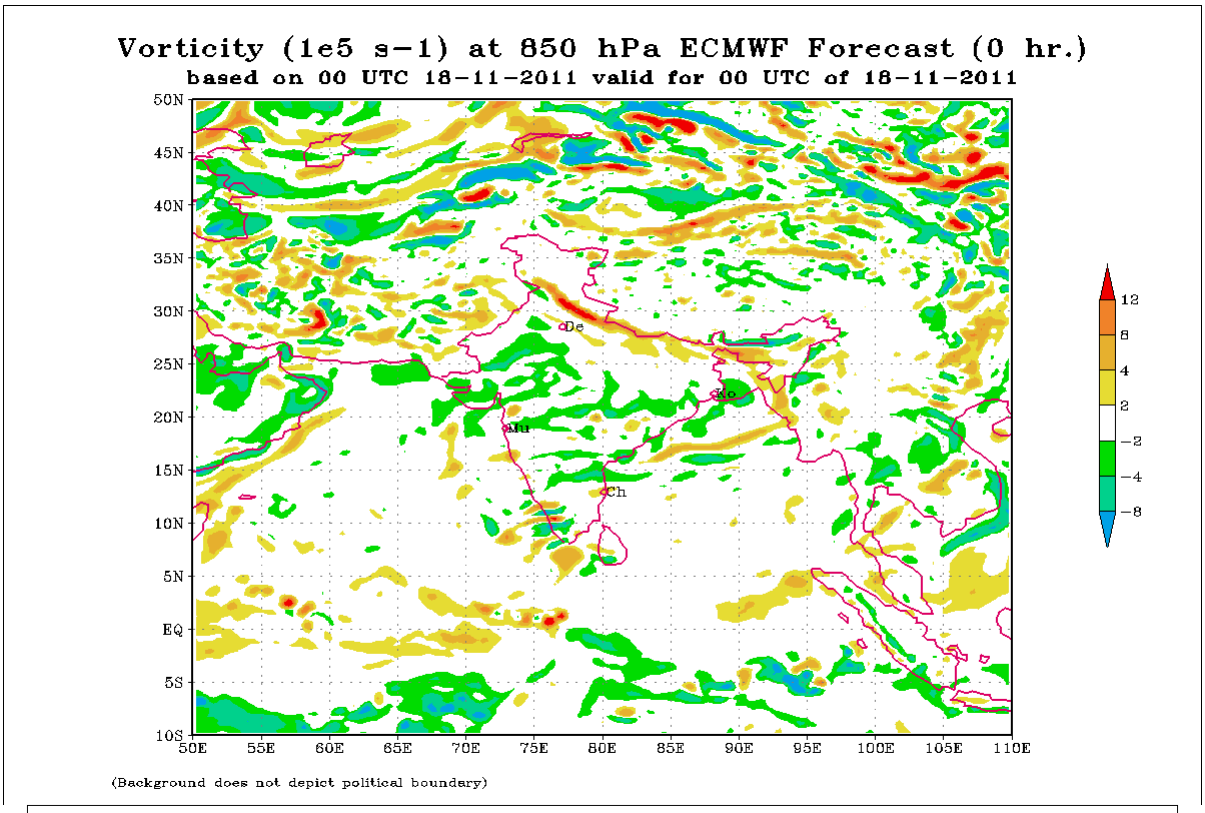
(Background does not depict political boundary)

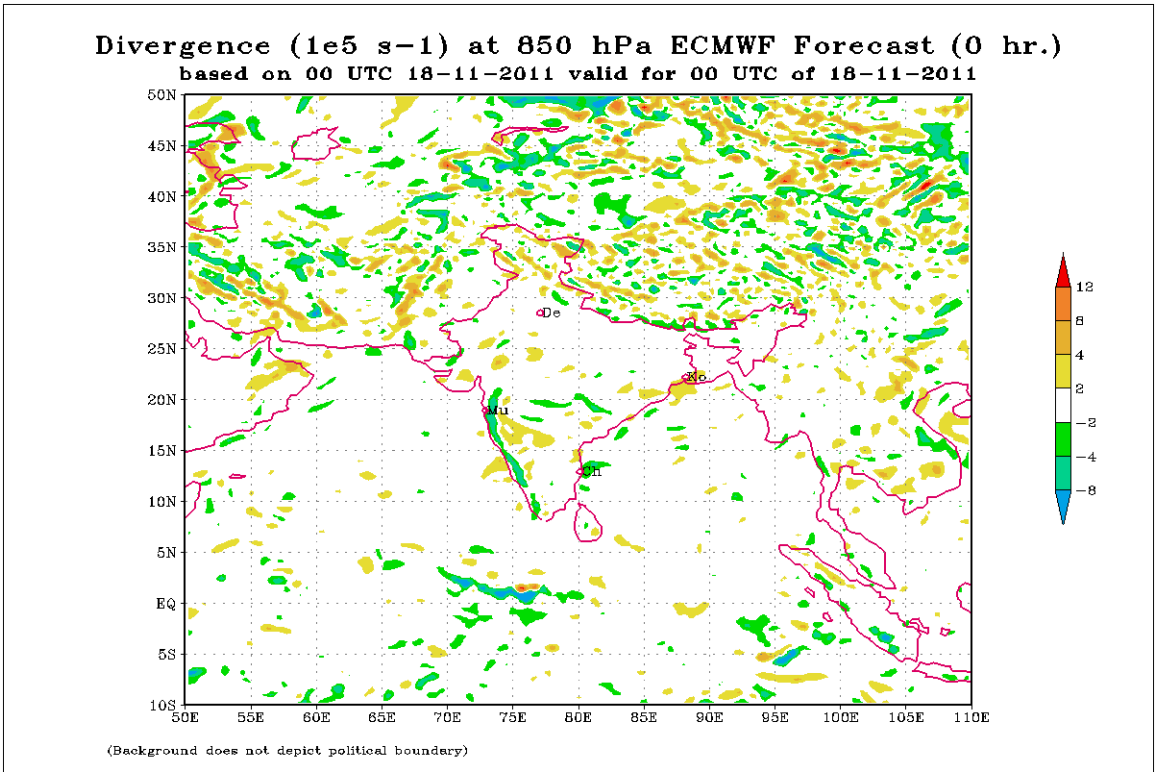
Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

based on 00 UTC 18-11-2011 valid for 00 UTC of 18-11-2011



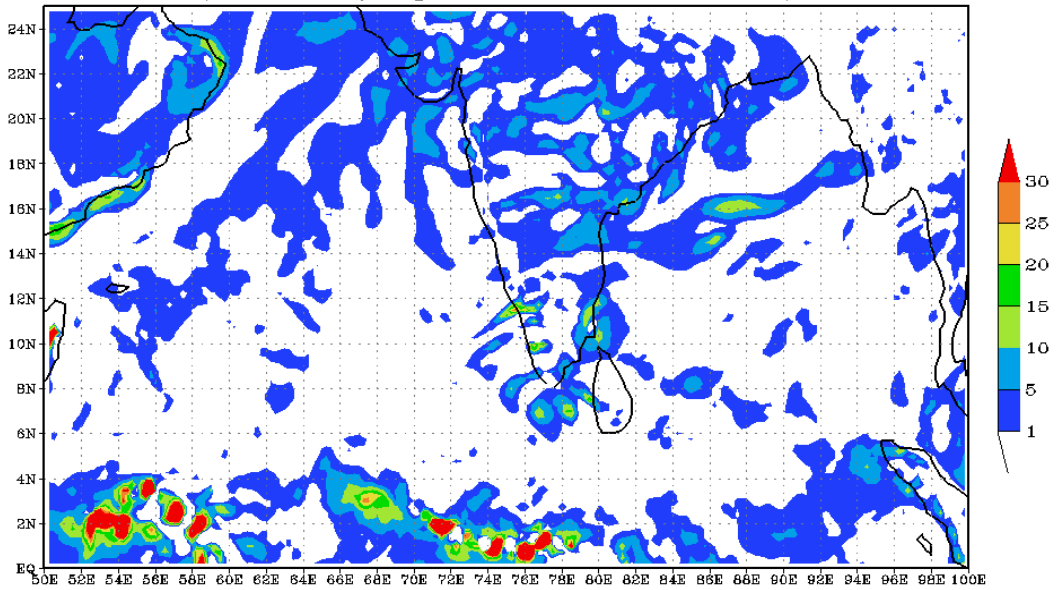
(Background does not depict political boundary)



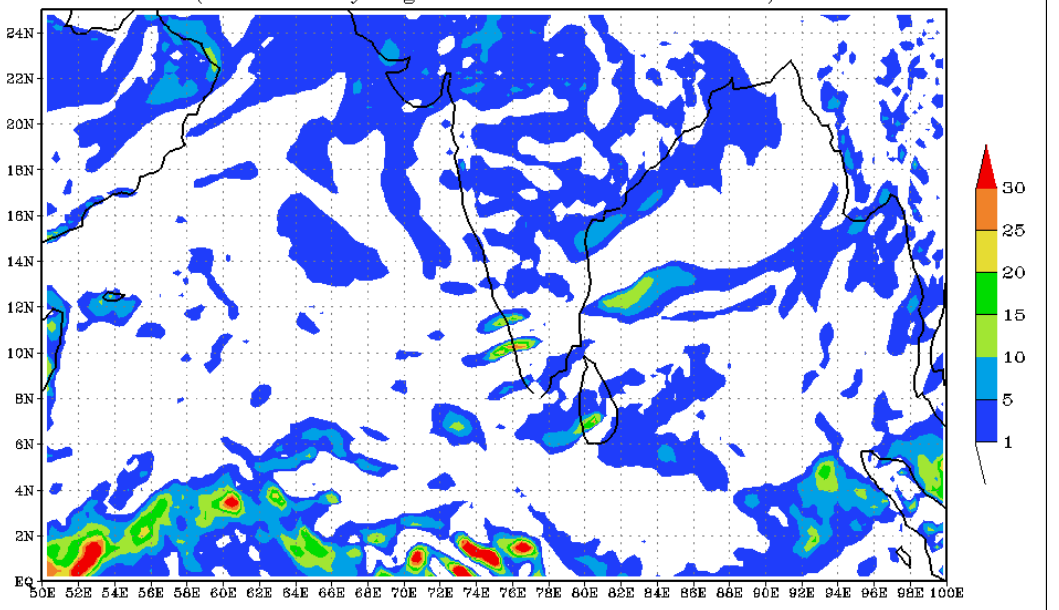


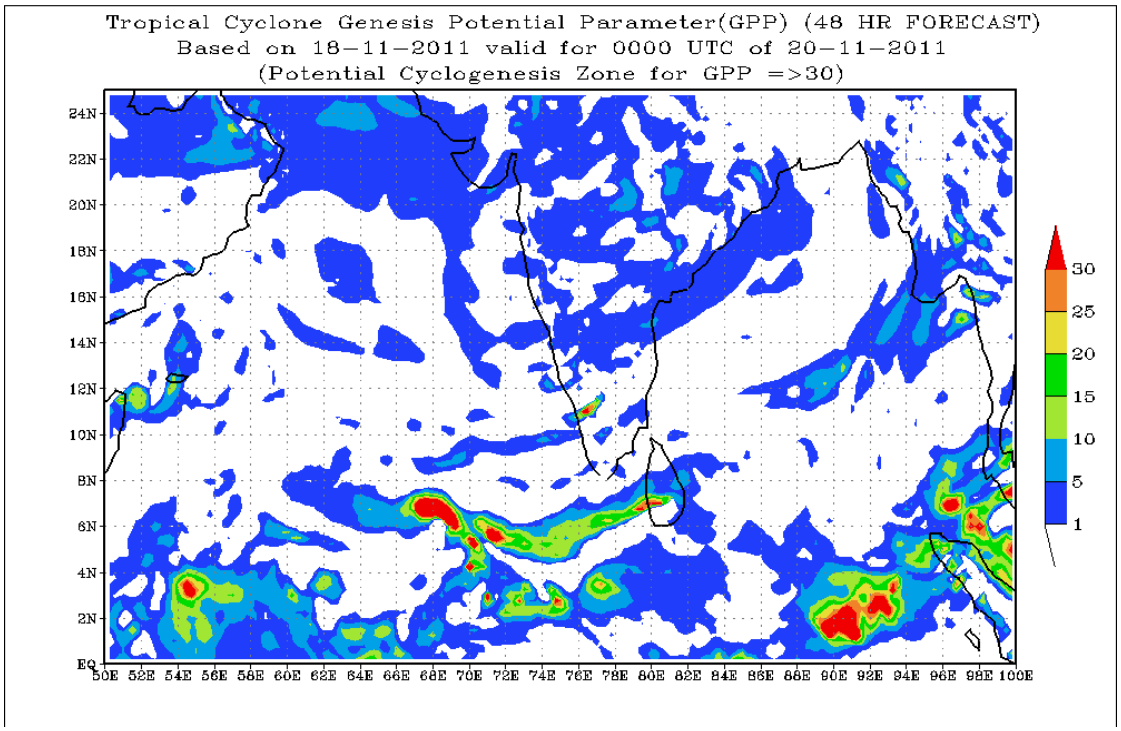
Annexure-III

Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 18-11-2011 valid for 0000 UTC of 18-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 18-11-2011 valid for 0000 UTC of 19-11-2011
(Potential Cyclogenesis Zone for GPP =>30)





FDP (Cyclone) NOC Report Dated 20th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 5^0 N over Bay of Bengal.
- Pressure departure from normal shows a rise by 1-2 hPa along east coast of India and no significant change over Andaman & Nicobar Islands.
- 24 hrs. pressure tendency shows no significant change along east coast of India, Myanmar and Bangladesh coast. It shows fall of surface pressure by 1- 2 hPa over Nicobar Islands.
- Rainfall occurred at most places over Sri Lanka.
- Buoys data show that SST around 28-29^0 C over the Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 29-30^0C over central & south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} and over north & central Bay of Bengal 40-60 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 10-20*10^{-5} s^{-1} over north Bay of Bengal and negative over central & adjoining south Bay of Bengal.

Convergence:

- Lower level convergence is positive of order of 5*$10^{-5}s^{-1}$ over south Andaman Sea.

Divergence:

- Upper air divergence is positive of the order of 5*$10^{-5}s^{-1}$ over south Andaman Sea.

Wind Shear:

- Wind Shear of order 10-20 knots over south Andaman Sea and 20-40 knots over North Bay of Bengal.

Wind Shear Tendency:

- Negative tendency of order 5 to 10 knots over south Bay of Bengal.

Upper tropospheric ridge:

- **T**he upper tropospheric ridge line roughly runs along Lat 12.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 8 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 1, 2 & 3 during next 15 days.
- Dynamical forecast: - MJO located in phase 8 with amplitude greater than 1.0 and moves through phase 1, 2 & 3 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over Pacific Ocean

(See ftp://192.168.12.75/imd/satmet

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

Status of observational system:

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

Satellite

FDP cyclone satellite inference 200900 UTC.

Bay of Bengal and south Andaman Sea: Broken low/medium clouds with embedded moderate to intense convection over southwest Bay of Bengal, south Andaman Sea, adjoining southeast Bay of Bengal and south Tenaserim coast.

Arabian Sea: Broken low/med clouds with embedded moderate to intense convection over south Arabian Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today does not show any significant weather system over the North Indian Ocean during next 4 days. However, forecasts show formation of a low-pressure system over southwest Bay of Bengal on day4 and likely to move westward direction with no significant intensification. Analysis of wind at 850 hPa, wind shear, Vorticity and Divergence is shown in **Annexure II**.

- **IMD-GFS** model analysis and forecast based on 0000 UTC of does not show significant weather system over Bay of Bengal during next 3 days. However, forecasts show formation of a low-pressure system over southwest Bay of Bengal on day4 and likely to move northwest direction and cross Tamilnadu coast on day7 with no significant intensification.

- **WRF-ARW** model analysis and forecast does not show any significant weather over Bay of Bengal during next 3 days.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and forecast shows formation of an organized cell on day3 over the southwest Bay of Bengal. However subsequent forecasts show no intensification of the system. GPP charts analysis and 24, 48 and 72 hours forecasts are enclosed here with in **Annexure III**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm

Advisory:

- Presently, no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	19/12	**20/00**	**20/03**
India	190/205	129/159	192/208
Coastal stations			
WB	10	6	11
Odisha	10	6	10
AP	18	18	18
Tamil Nadu	14	11	14
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	18	17	17
Myanmar	11	11	11
Thailand	1	1	1
Sri Lanka	12	12	12

AWS

Region	Date/Time (UTC)		
	17/12	**18/00**	**18/03**
India	539/616	537/616	552/616
WB	19	19	20
ODS	27	28	29
AP	33	33	33
TN	27	27	26
PDC	0	0	0

- **RS/RW** (12Z) of 19 -11-2011: 09/39
- **No. of Ascents reaching 250 hPa levels: 3, MISDA:-30**
- **RS/RW** (00Z) of 20 -11-2011: 34/39
- **No. of Ascents reaching 250 hPa levels: 17, MISDA: 5**

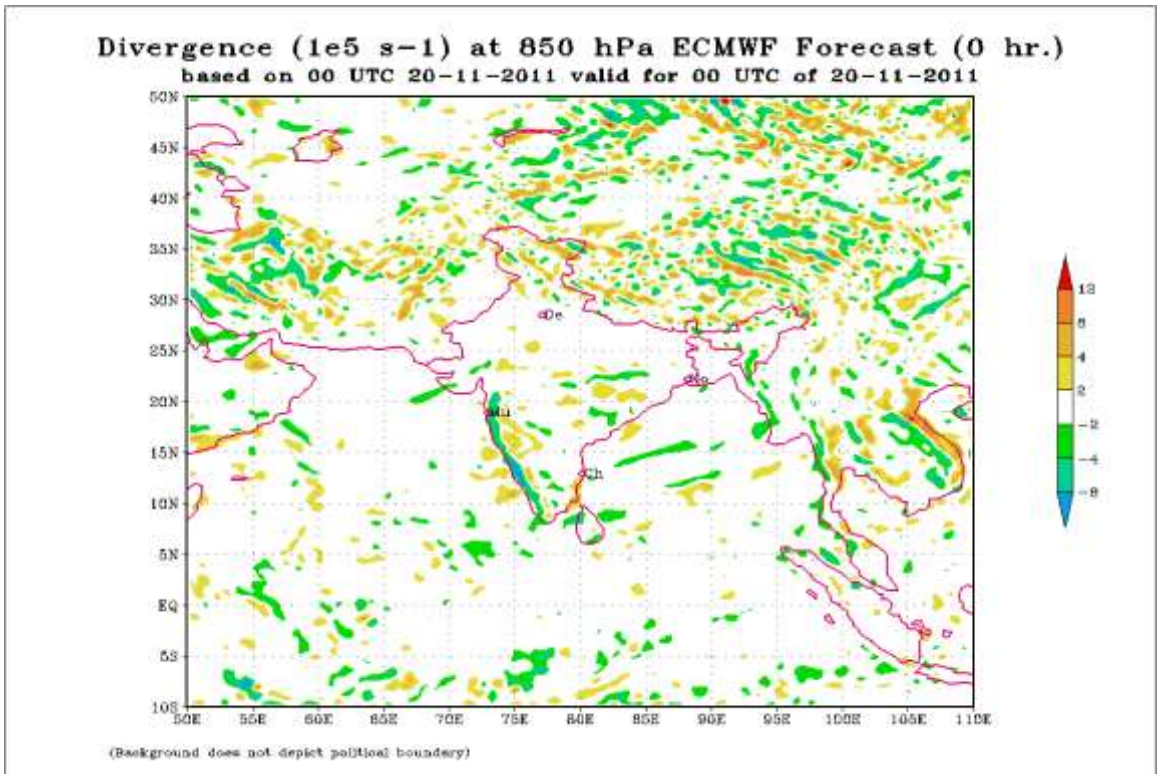
No. of PILOT Ascents

19/12Z	20/00Z
12/37	13/34

Buoy Data

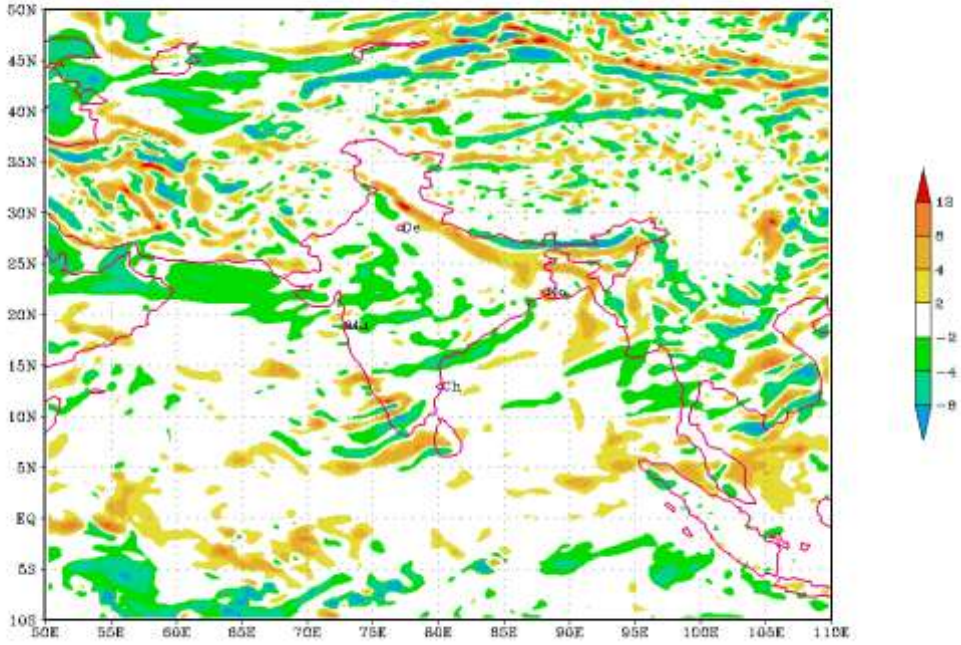
19/12	20/00	20/03
10	9	9

ANNEXURE-II



Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

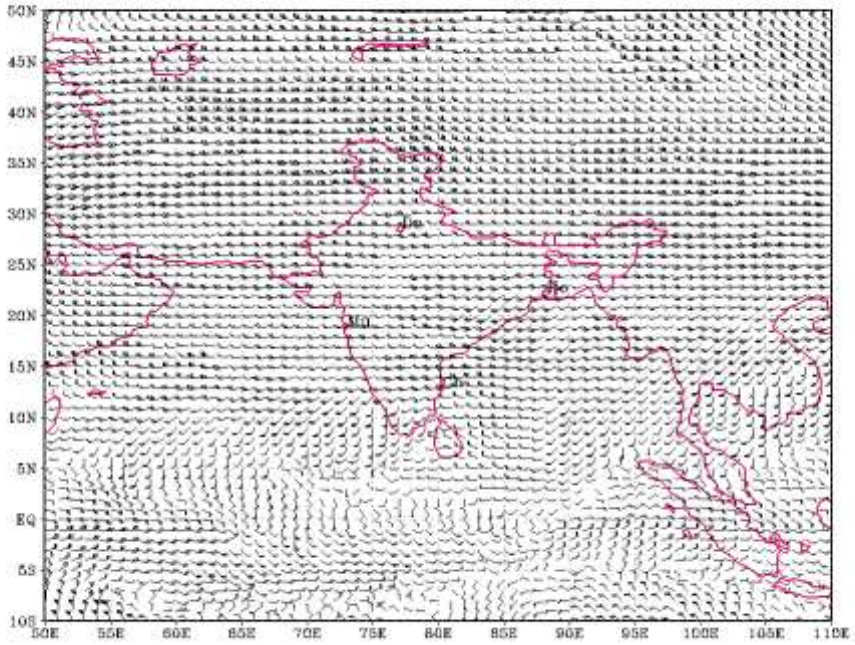
based on 00 UTC 20-11-2011 valid for 00 UTC of 20-11-2011



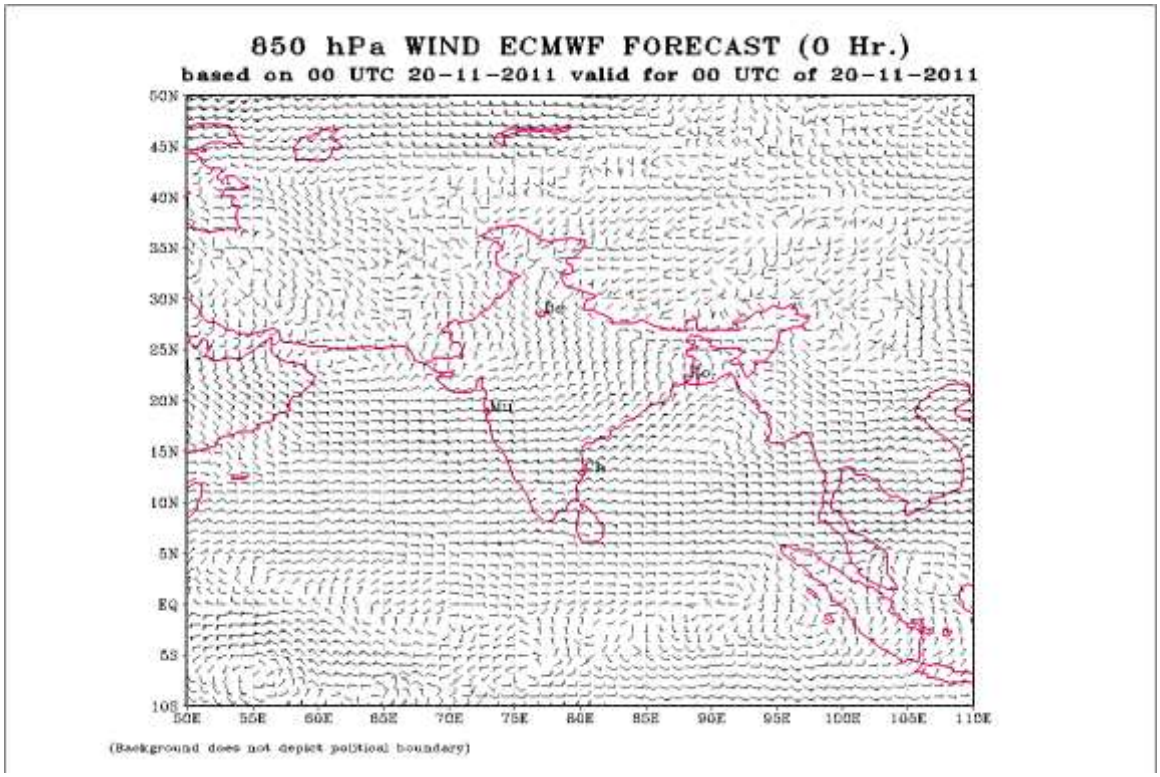
(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

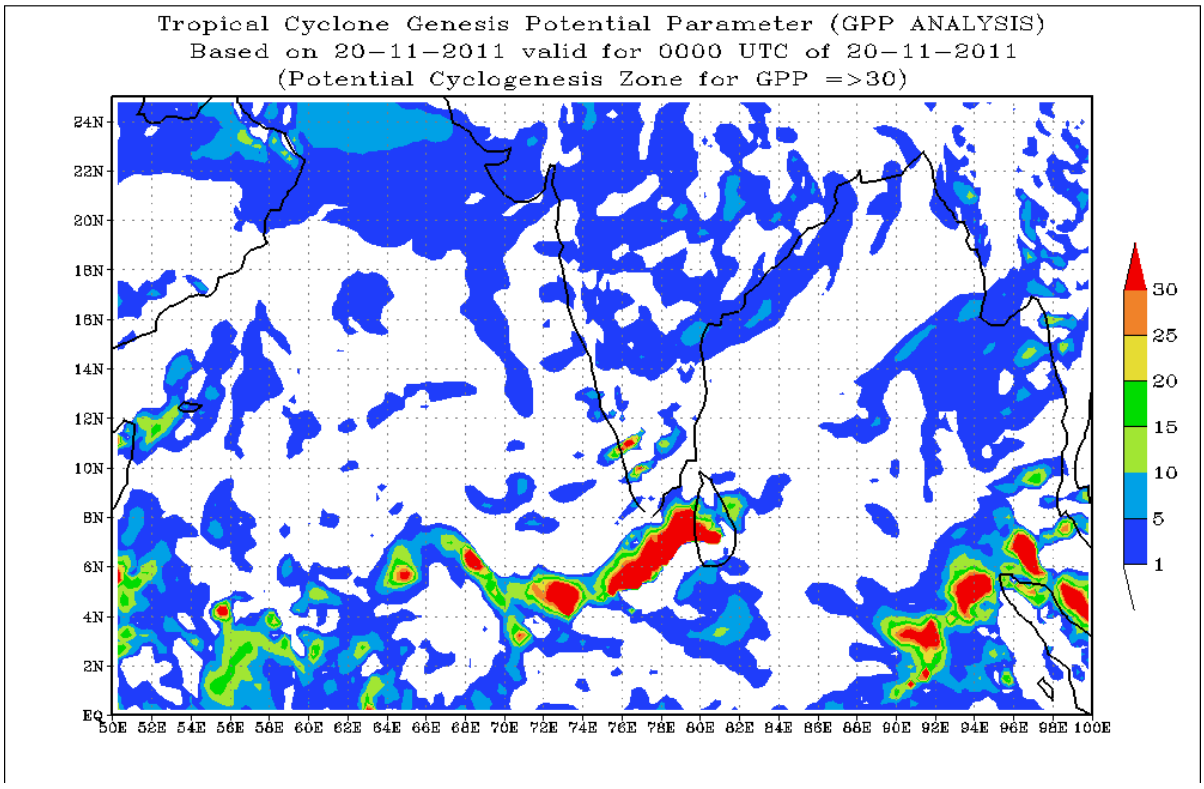
based on 00 UTC 20-11-2011 valid for 00 UTC of 20-11-2011

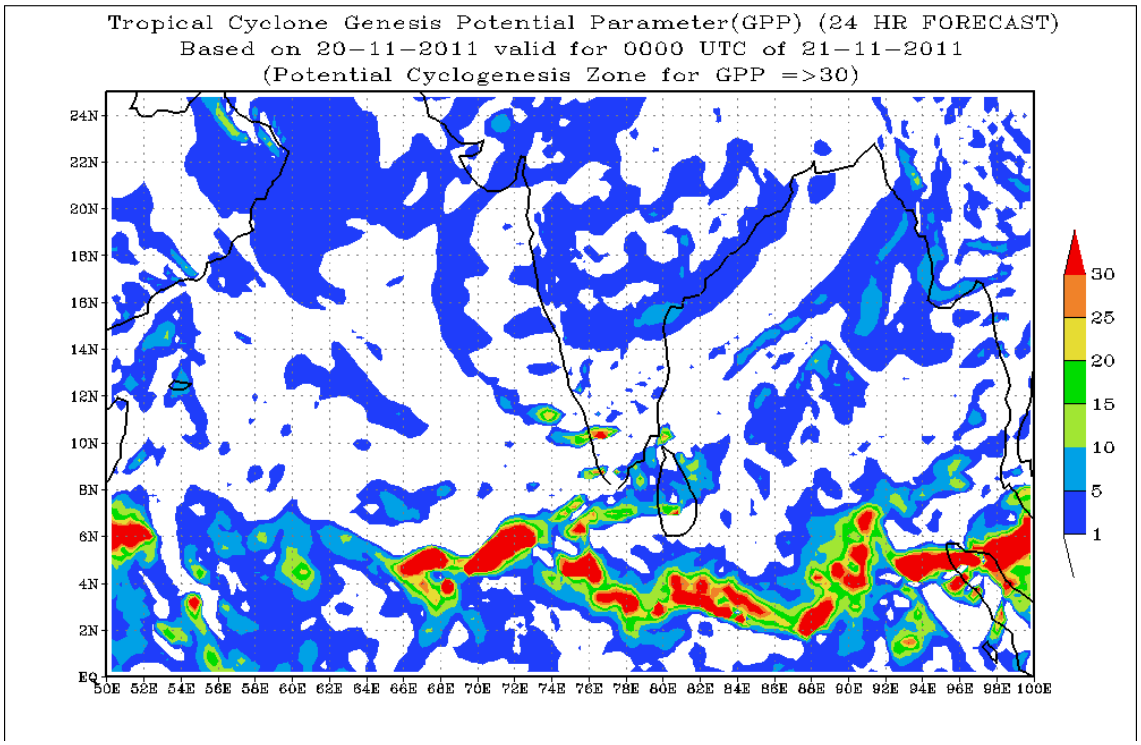


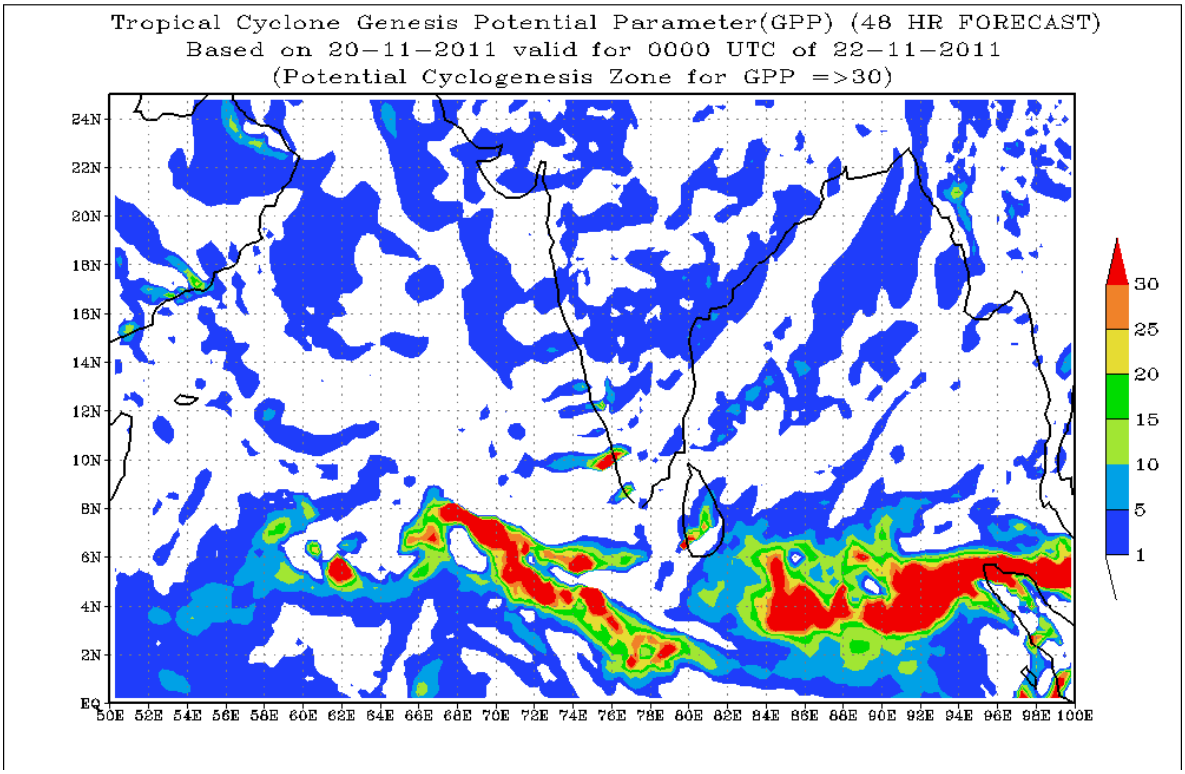
(Background does not depict political boundary)

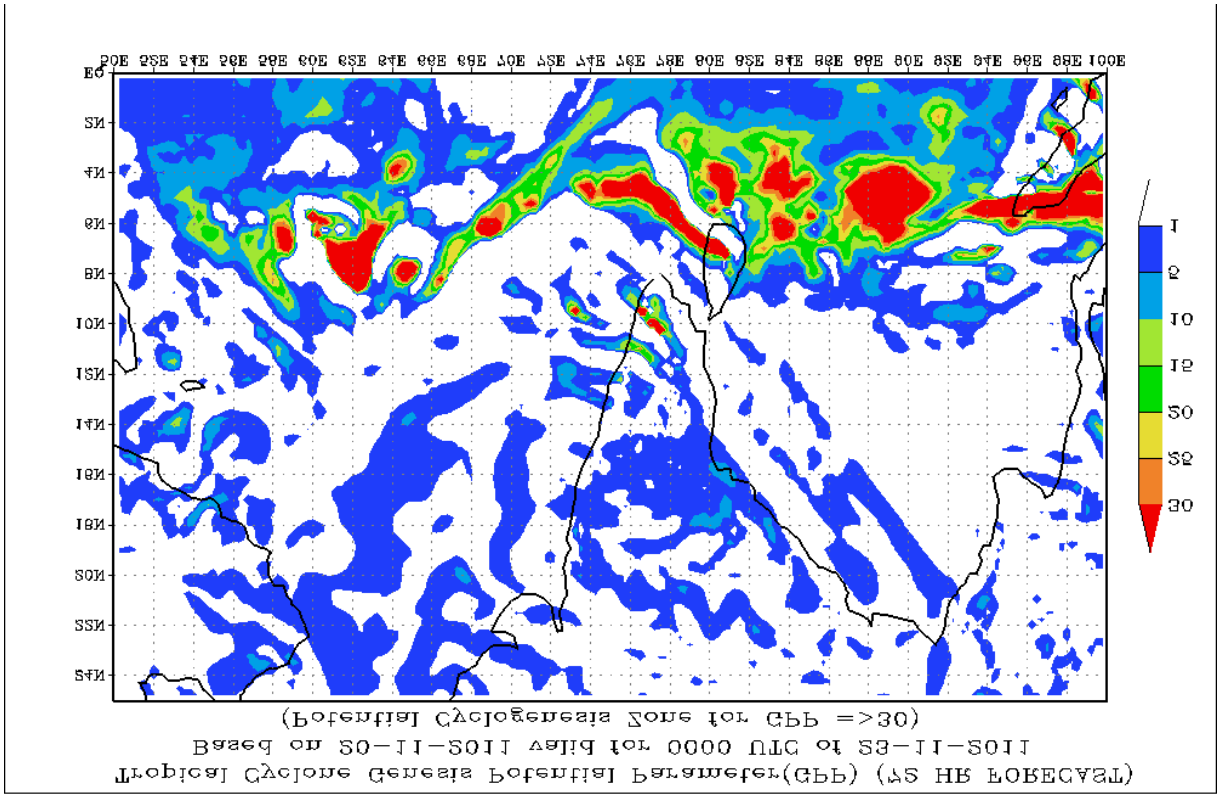


Annexure III




Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 20-11-2011 valid for 0000 UTC of 21-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 20-11-2011 valid for 0000 UTC of 22-11-2011
(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
1



FDP (Cyclone) NOC Report Dated 21th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 5^0 N over Bay of Bengal.
- Pressure departure from normal shows a rise by 1-2 hPa along east coast of India and over Andaman & Nicobar Islands.
- 24 hrs. pressure tendency shows no significant change along east coast of India, Myanmar and Bangladesh coast.
- Buoys data show that SST around 28-29^0 C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 29-30^0C over central & south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} and over north & central Bay of Bengal 40-60 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 10-20*10^{-5} s^{-1} over north Bay of Bengal and negative over central & adjoining south Bay of Bengal.

Convergence:

- Lower level convergence is positive of order of 5*$10^{-5}s^{-1}$ over southeast Bay of Bengal

Divergence:

- Upper air divergence is positive of the order of 5*$10^{-5}s^{-1}$ over south Bay of Bengal and negative over westcentral Bay of Bengal and of the order -5*$10^{-5}s^{-1}$

Wind Shear:

- Wind Shear of order 10-20 knots over south Bay of Bengal and Andaman Sea and 30-40 knots over north and central Bay of Bengal.

Wind Shear Tendency:

- Negative tendency of order 10 to 20 knots over south Bay of Bengal.

Upper tropospheric ridge:

- **T**he upper tropospheric ridge line roughly runs along Lat 10.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 1 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 2 & 3 during next 15 days.
- Dynamical forecast: - MJO located in phase 1 with amplitude greater than 1.0 and moves through phase 2 & 3 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over Pacific Ocean

(See ftp://192.168.12.75/imd/satmet

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

Status of observational system:

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

Satellite

FDP cyclone satellite inference 200900 UTC.

Bay of Bengal and south Andaman Sea Broken low/medium clouds with embedded isolated moderate to intense convection seen over southeast Bay of Bengal between lat.7.5^{0}N to 10.5^{0}E east of longitude 84.5^{0}E, Sri Lanka & adjoining southwest Bay of Bengal and southwest Andaman Sea

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today show formation of a low-pressure system over southeast Bay of Bengal on day3 and likely to move westward direction with no significant intensification. Analysis of wind at 850 hPa, wind shear, Vorticity and Divergence is shown in **Annexure II**.

- **IMD-GFS** model analysis and forecast based on 0000 UTC of today show formation of a low-pressure system over southwest Bay of Bengal on day2 and likely to move west-northwest direction and cross Tamilnadu coast on day5 with no significant intensification.
- **WRF-ARW** model analysis and forecast based on 0000 UTC of today show formation of a low-pressure system over southwest Bay of Bengal on day2 and likely to move westward direction with no significant intensification.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and forecast shows formation of an organized cell on day3 over the southwest Bay of Bengal. However subsequent forecasts show no intensification of the system. GPP charts analysis and 24, 48 and 72 hours forecasts are enclosed here with in **Annexure III** **(**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm

Advisory:

- Presently, no significant weather system over Bay of Bengal. NWP models and synoptic analysis indicate that a low pressure area may form over southwest Bay of Bengal during next 48 hrs.. However, it is not likely to intensify further.

- No IOP at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	20/12	**21/00**	**21/03**
India	191/205	129/159	191/208
Coastal stations			
WB	11	5	11
Odisha	10	6	10
AP	18	17	18
Tamil Nadu	13	10	13
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	14	15	13
Myanmar	9	9	9
Thailand	1	1	1
Sri Lanka	12	8	12

AWS

Region	Date/Time (UTC)		
	20/12	**21/00**	**21/03**
India	539/616	537/616	552/616
WB	19	19	21
ODS	27	26	28
AP	33	33	33
TN	27	26	26
PDC	0	0	0

- **RS/RW** (12Z) of 20 -11-2011: 08/39
- **No. of Ascents reaching 250 hPa levels: 3, MISDA:-31**
- **RS/RW** (00Z) of 20 -11-2011: 35/39
- **No. of Ascents reaching 250 hPa levels: 19, MISDA: 4**

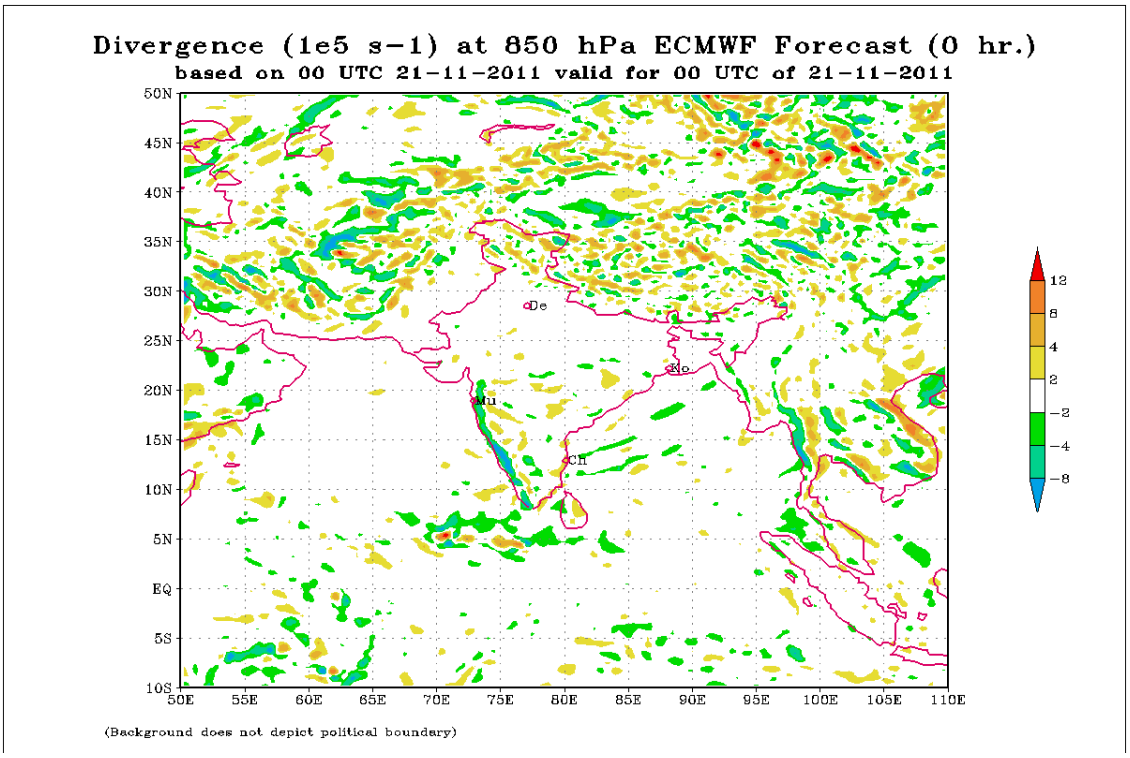
No. of PILOT Ascents

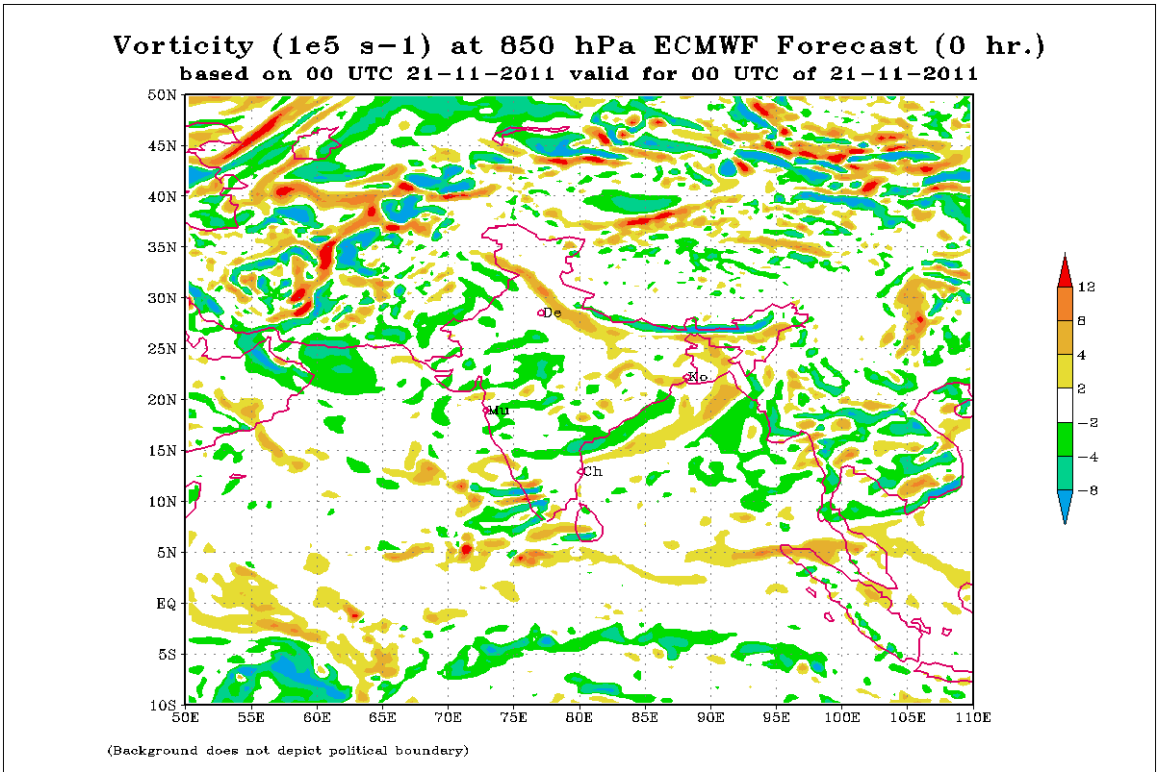
20/12Z	21/00Z
12/37	14/34

Buoy Data

20/12	21/00	21/03
7	7	8

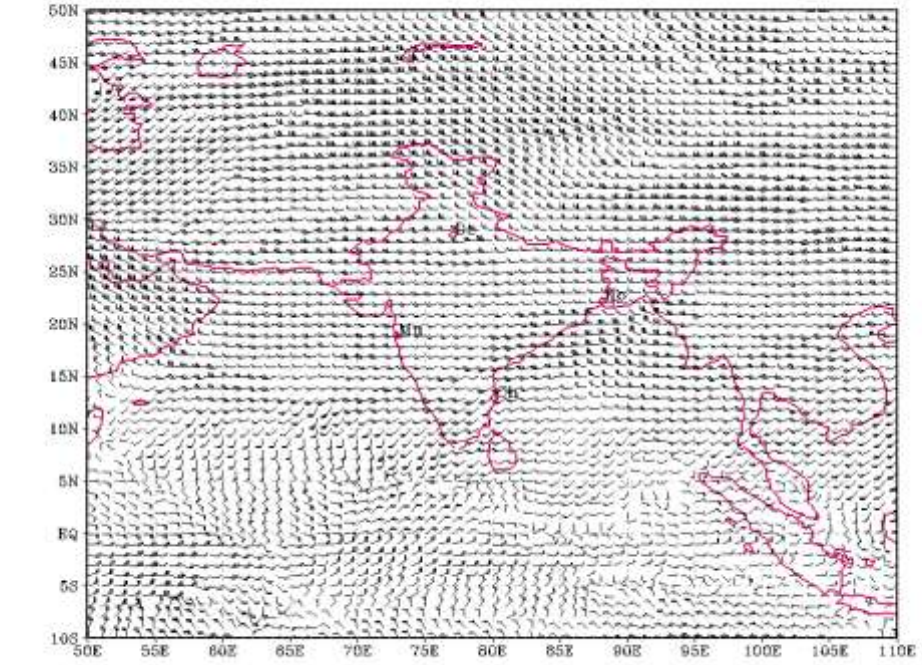
Annexure II


Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 21−11−2011 valid for 00 UTC of 21−11−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
De
Ko
Mu
Ch
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)


Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 21−11−2011 valid for 00 UTC of 21−11−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
De
Ko
Mu
Ch
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

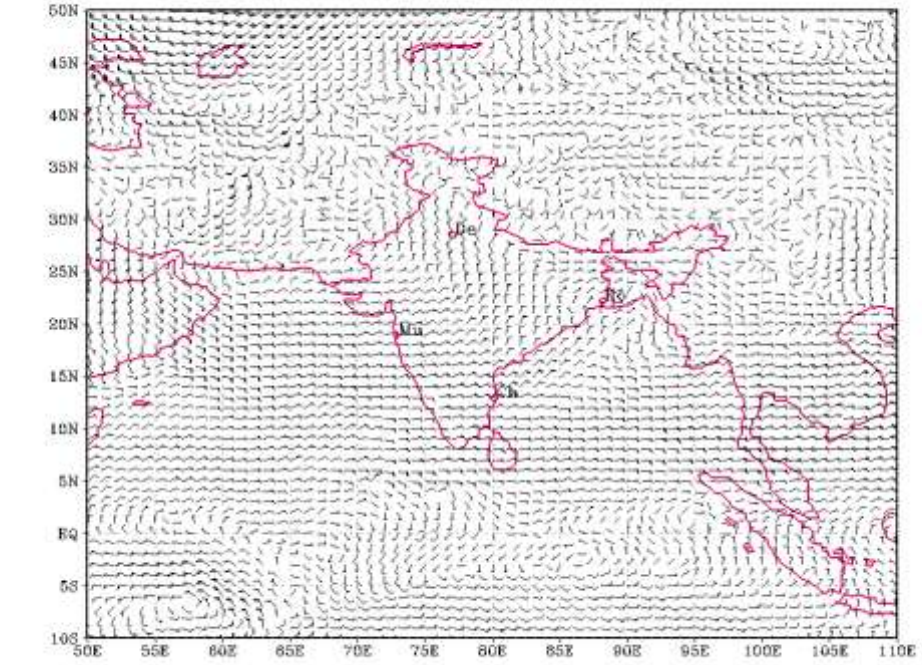
based on 00 UTC 21-11-2011 valid for 00 UTC of 21-11-2011



(Background does not depict political boundary)

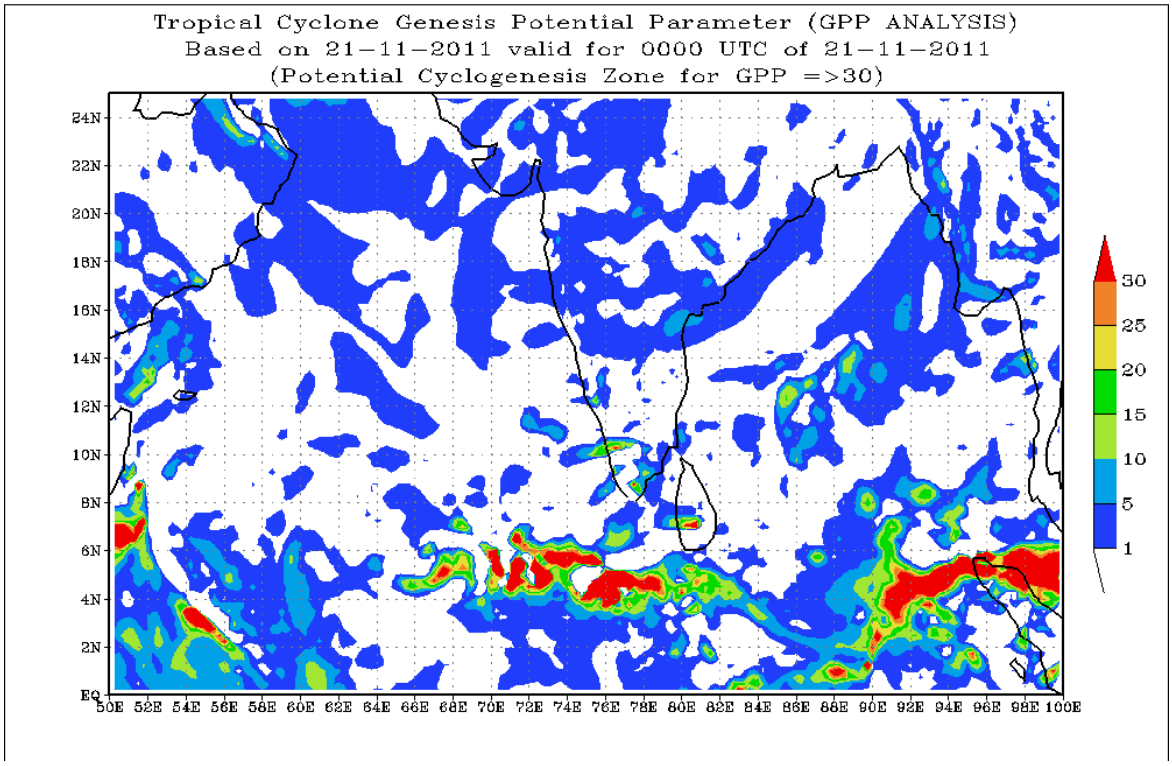
850 hPa WIND ECMWF FORECAST (0 Hr.)

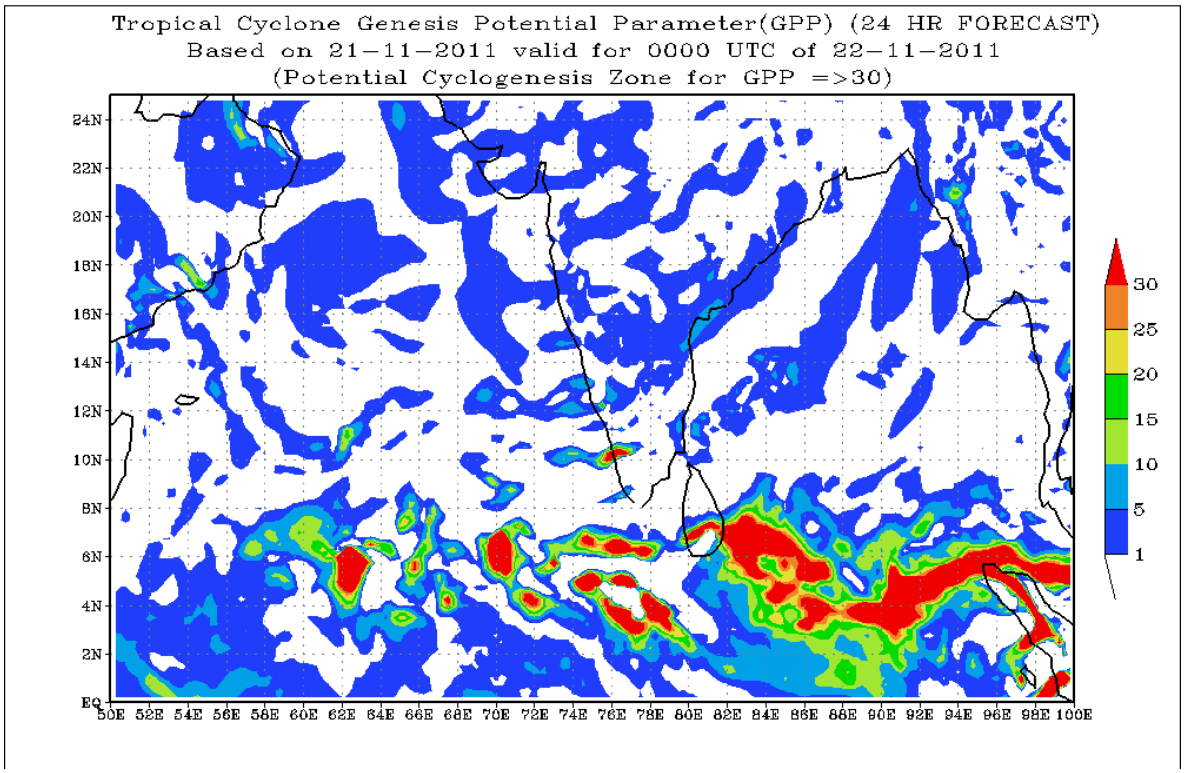
based on 00 UTC 21-11-2011 valid for 00 UTC of 21-11-2011

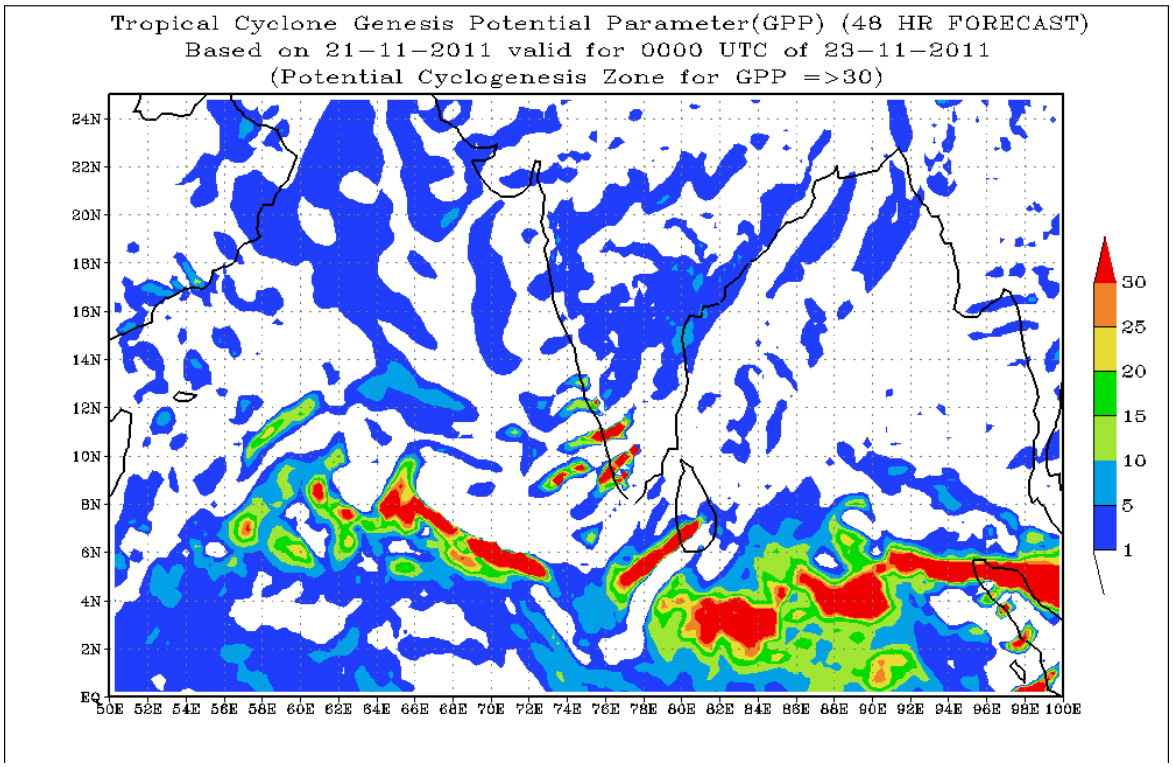


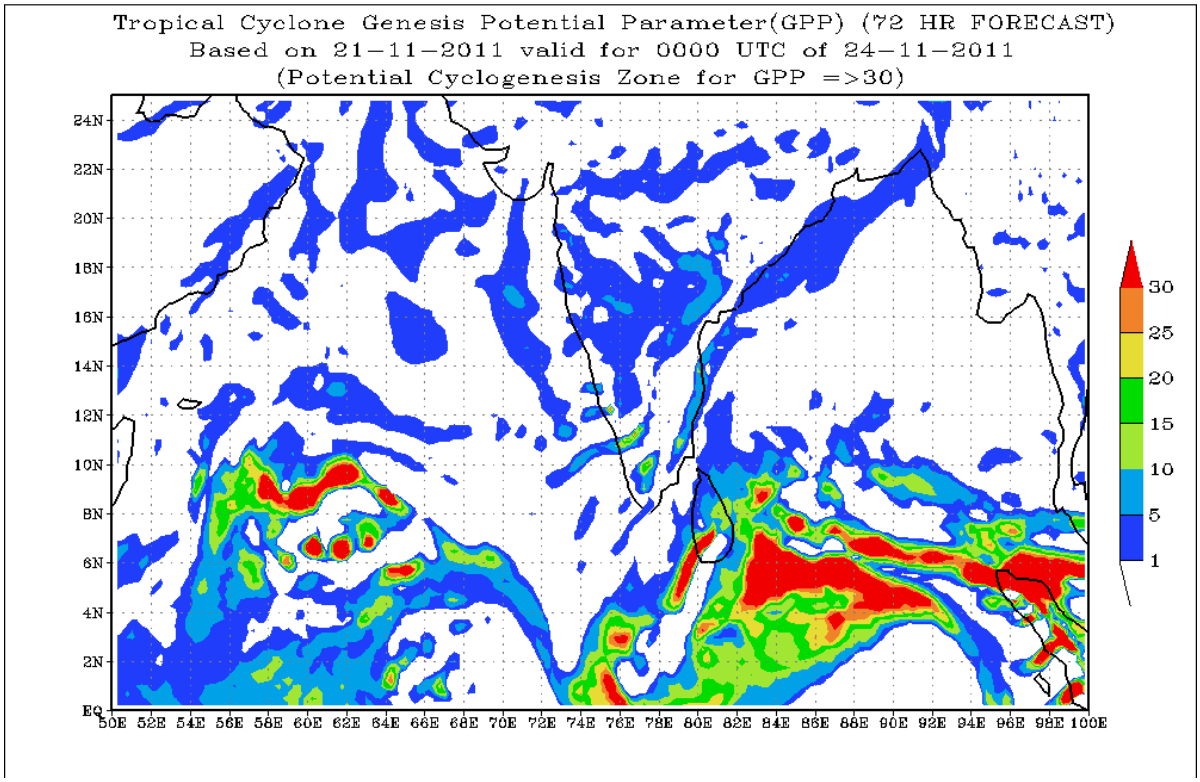
(Background does not depict political boundary)

Annexure-III






Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 21-11-2011 valid for 0000 UTC of 23-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 21-11-2011 valid for 0000 UTC of 24-11-2011
(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
1

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 4^0 N over Bay of Bengal.
- Pressure departure from normal shows a rise (around 1 hPa) along east coast of India except over south Tamilnadu coast and Andaman & Nicobar Islands where the same is nearly normal.
- 24 hrs. pressure tendency is negative (around 1 hPa) along east coast of India and over Andaman & Nicobar island..
- Buoys data show that SST around 28-29^0 C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 29-30^0C over central & south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} over north & central Bay of Bengal 40-60 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 10-20*10^{-5} s^{-1} over south Bay of Bengal.

Convergence:

- Lower level convergence is positive of order of 5 - 10*$10^{-5}s^{-1}$ over southwest Bay of Bengal

Divergence:

- Upper air divergence is positive of the order of 5 - 10*$10^{-5}s^{-1}$ over south Bay of Bengal. and Andman Nicobar Island.

Wind Shear:

- Wind Shear of order 10-20 knots over south Bay of Bengal and Andaman Sea and 20-40 knots over central Bay of Bengal.

Wind Shear Tendency:

- Positive of order 5 to 10 knots over central and north Bay of Bengal.

Upper tropospheric ridge:

- **T**he upper tropospheric ridge line roughly runs along Lat 10.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 1 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 2, 3 & 4 during next 15 days.
- Dynamical forecast: - MJO located in phase 1 with amplitude greater than 1.0 and moves through phase 2, 3 & 4 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over west Pacific Ocean

(See ftp://192.168.12.75/imd/satmet

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

Status of observational system:

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

Satellite

FDP cyclone satellite inference 220900 UTC.

Broken low/medium clouds with embedded moderate to intense convection seen over Bay of Bengal south of lat 10.00N and South Andaman Sea

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis and forecast based on 0000 UTC of today show formation of a low-pressure system over southeast Bay of Bengal on day2 and likely to move westnorthwest direction and intensity into Depression on day6 over the East central Arabian Sea. Analysis of wind at 850 hPa, wind shear, Vorticity and Divergence is shown in **Annexure II**.

- **IMD-GFS** model analysis and forecast based on 0000 UTC of today show formation of a low-pressure system over southwest Bay of Bengal on day2 and likely to move northwest direction and cross Tamilnadu coast on day4. The system is likely to intensify into Depression on day6 over the East central Arabian Sea.
- **WRF-ARW** model analysis and forecast based on 0000 UTC of today show formation of a low-pressure system over southwest Bay of Bengal on day2 and likely to move westward direction and intensify into Depression on day3.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and forecast shows formation of an GPP cell of 30 on day2 over the southwest Bay of Bengal. However subsequent forecasts show no intensification of the system. GPP charts analysis and 24, 48 and 72 hours forecasts are enclosed here with in **Annexure III**

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

Summary and Conclusion:

Synoptic and NWP models suggest that:

- A low pressure area would form over southwest Bay of Bengal during next 48 hours.and thence moving west-northwestwards emerge into southeast Arabian Sea and may further intensify

Advisory:

- Presently, no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	21/12	**22/00**	**22/03**
India	176/205	127/159	190/208
Coastal stations			
WB	11	5	11
Odisha	10	6	10
AP	17	16	18
Tamil Nadu	13	10	13
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	15	14	15
Myanmar	12	13	14
Thailand	1	1	1
Sri Lanka	13	13	13

AWS

Region	Date/Time (UTC)		
	21/12	**22/00**	**22/03**
India	418/616	489/616	393/616
WB	18	20	21
ODS	28	25	28
AP	33	34	33
TN	27	26	27
PDC	0	0	0

- **RS/RW** (12Z) of 21 -11-2011: 08/39
- **No. of Ascents reaching 250 hPa levels:3, MISDA:-31**
- **RS/RW** (00Z) of 22 -11-2011: 35/39
- **No. of Ascents reaching 250 hPa levels:22, MISDA: 4**

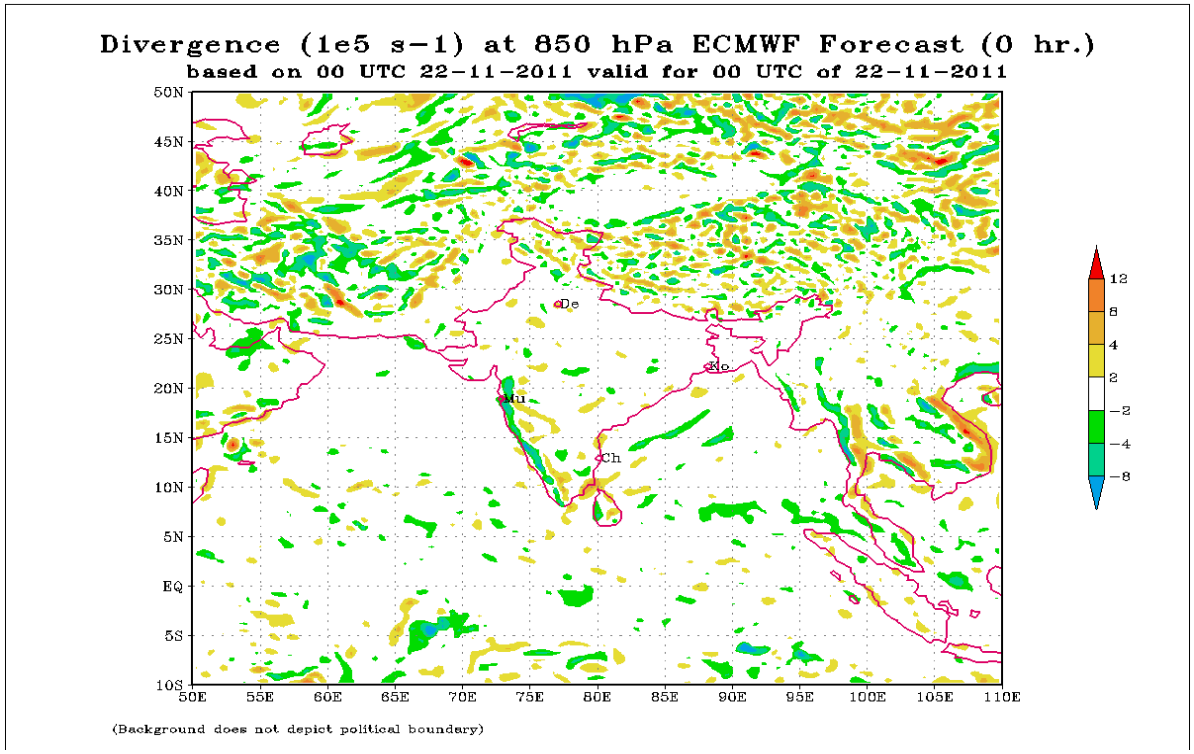
No. of PILOT Ascents

21/12Z	22/00Z
9/37	15/34

Buoy Data

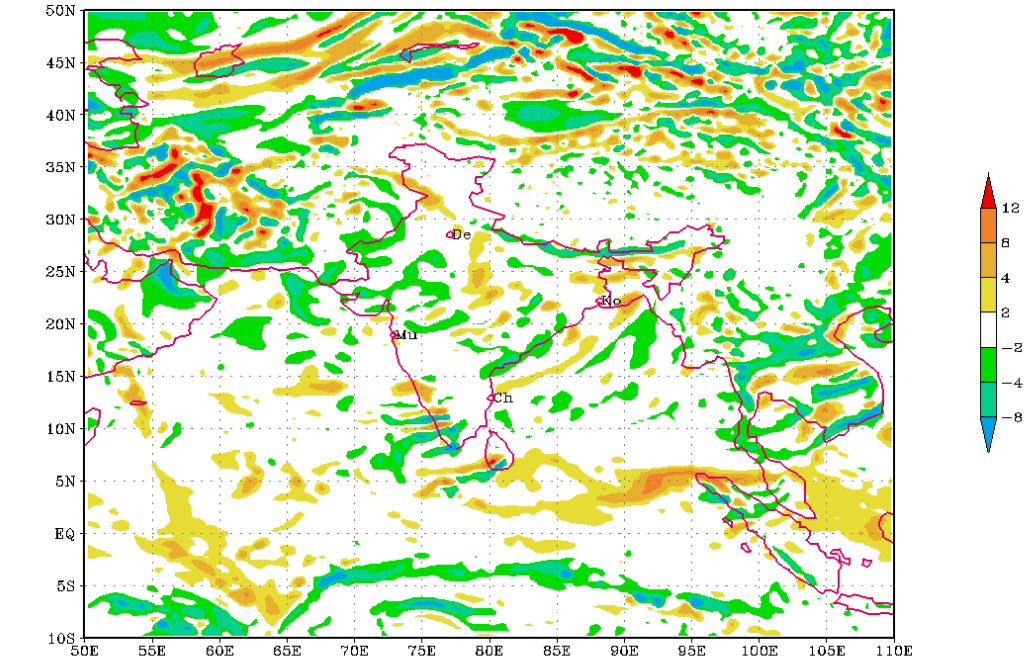
21/12	22/00	22/03
12	5	12

Annexure II



Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

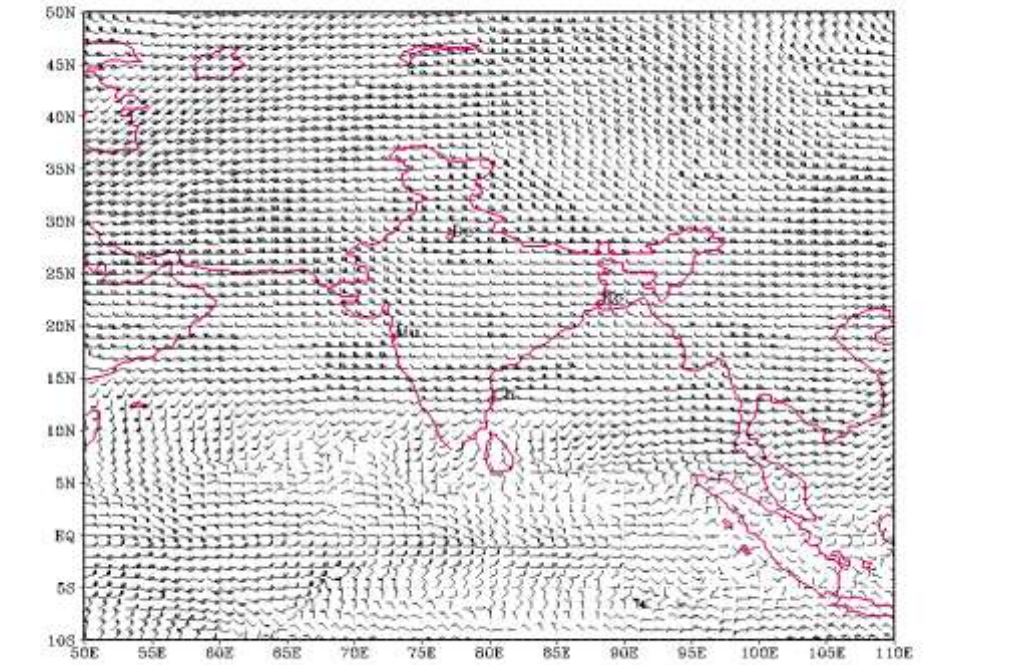
based on 00 UTC 22−11−2011 valid for 00 UTC of 22−11−2011



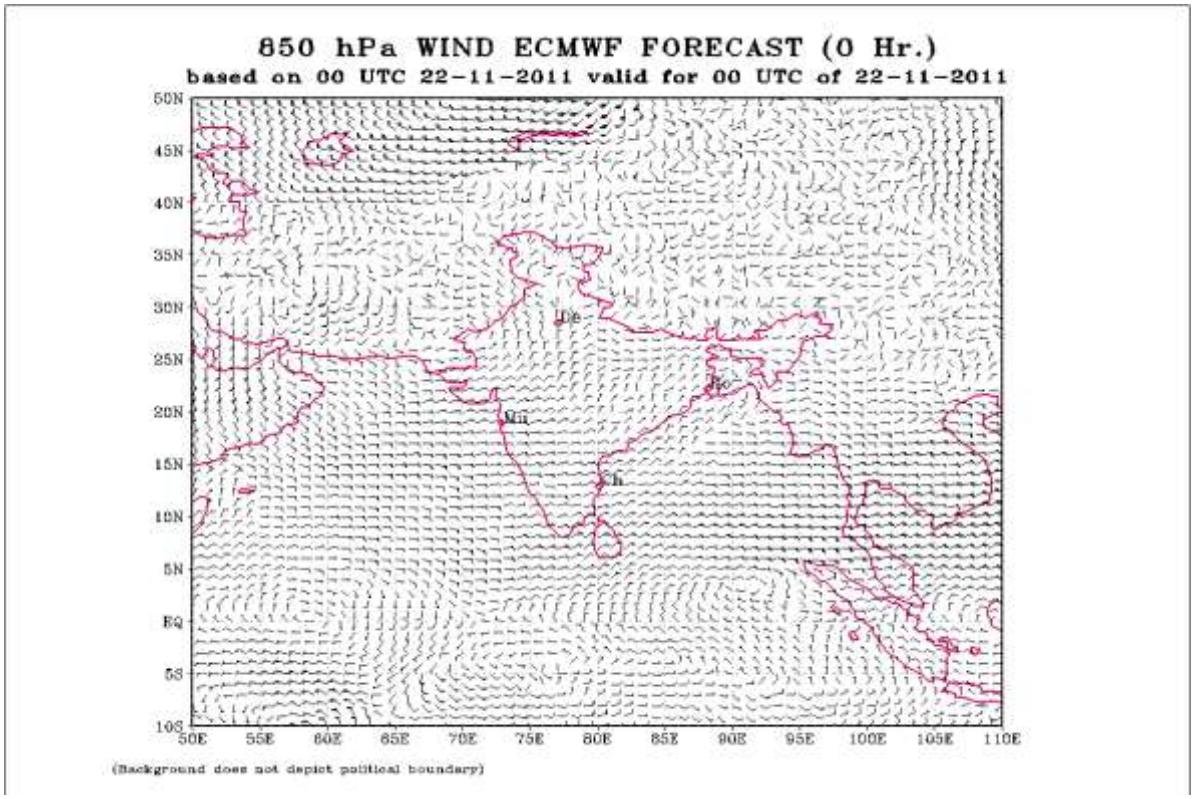
(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

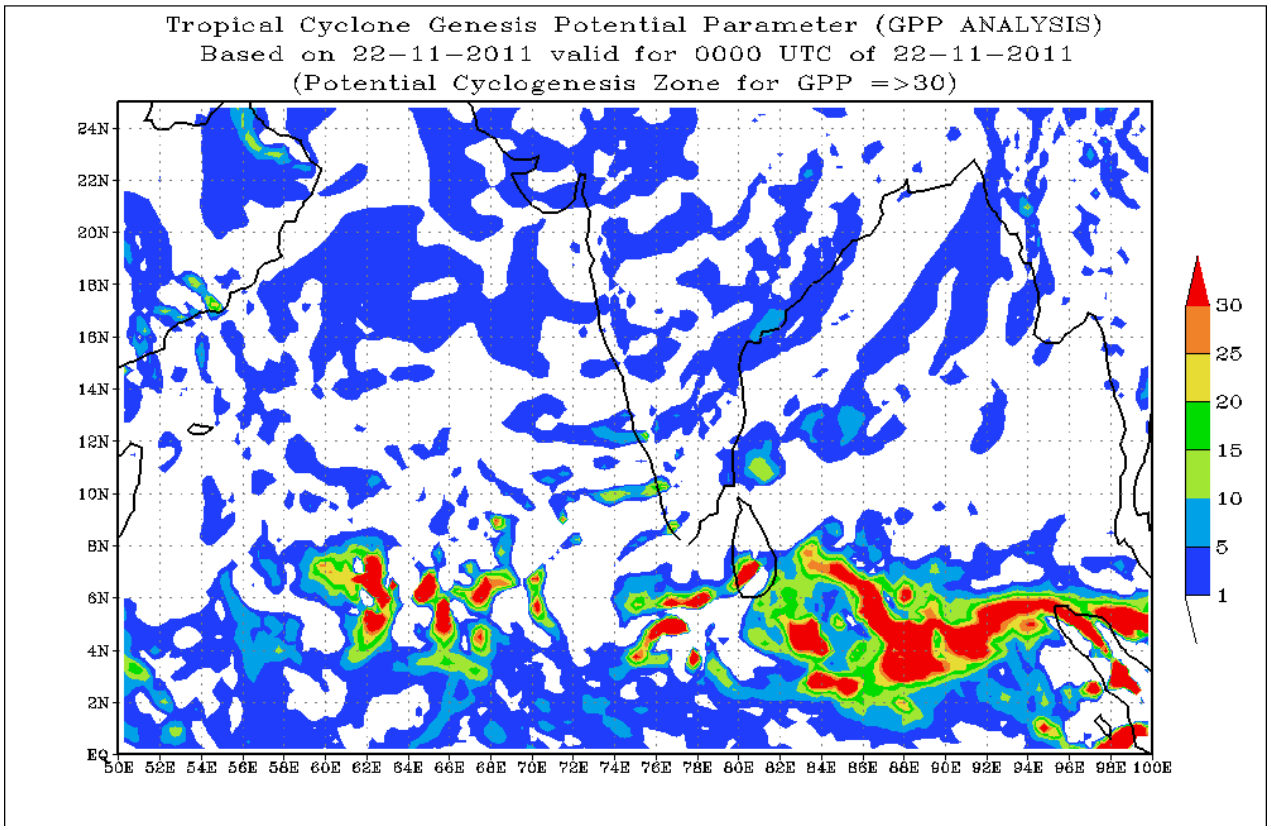
based on 00 UTC 22−11−2011 valid for 00 UTC of 22−11−2011



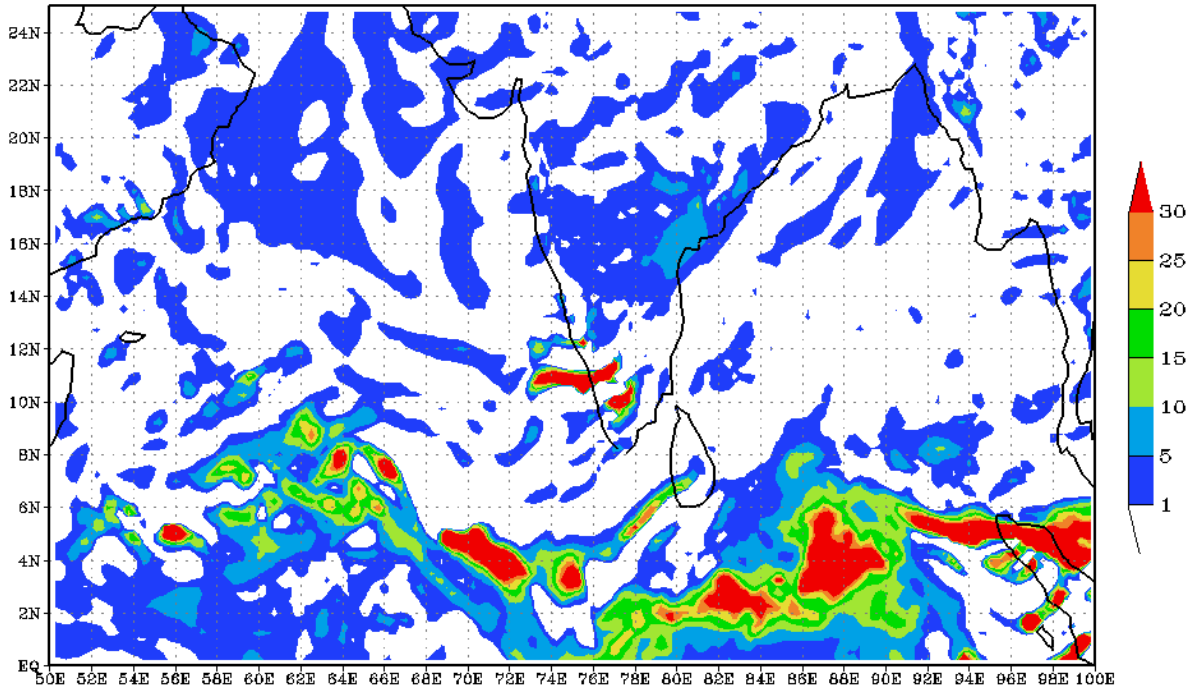
(Background does not depict political boundary)



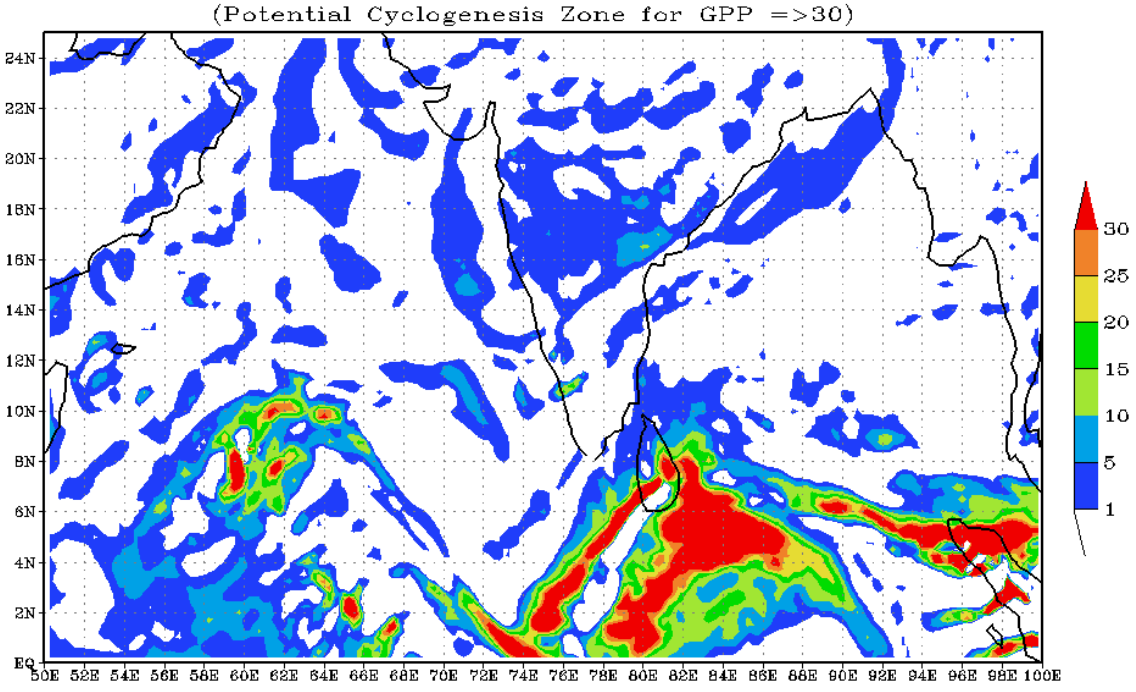
Annexure-III

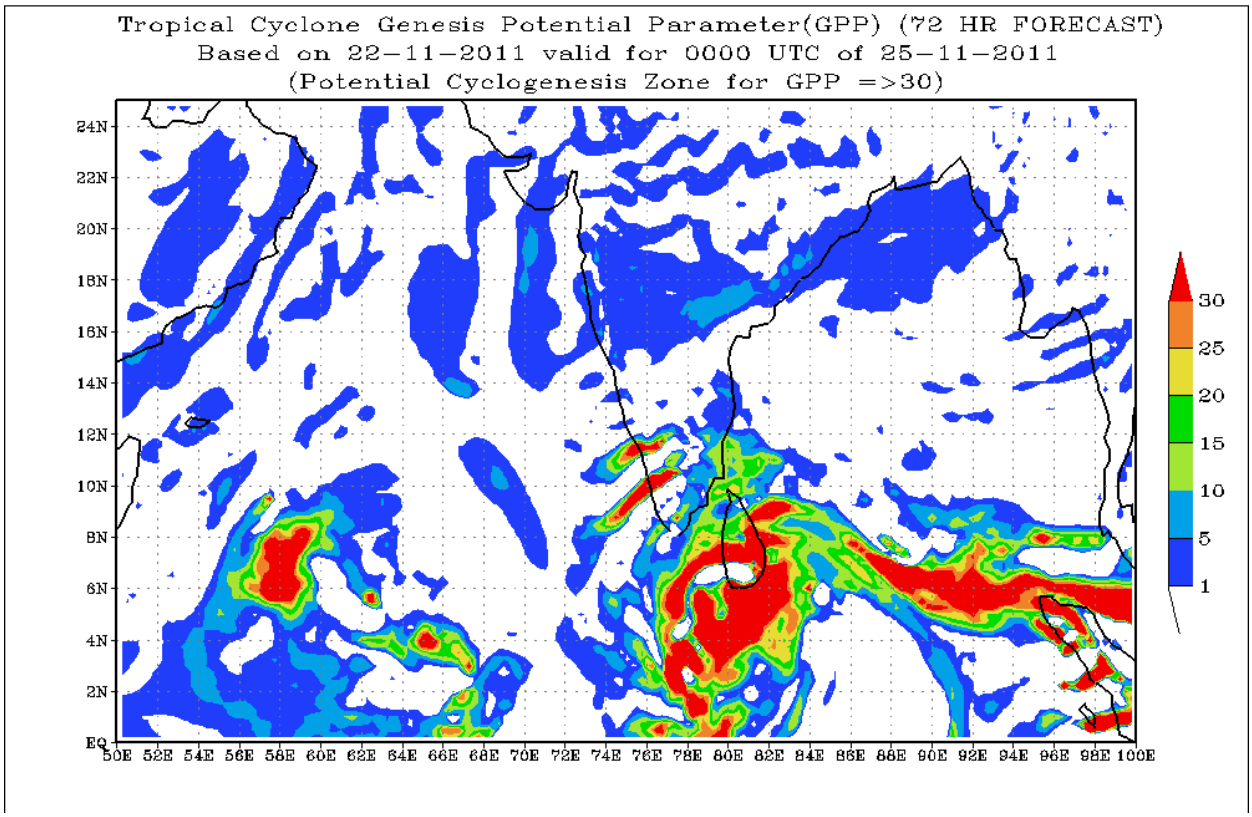


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 22-11-2011 valid for 0000 UTC of 23-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 22-11-2011 valid for 0000 UTC of 24-11-2011
(Potential Cyclogenesis Zone for GPP =>30)





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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and forecast shows a GPP cell of 30 over the southwest Bay of Bengal. However subsequent forecasts show no intensification of the system. GPP charts analysis and 24, 48 and 72 hours forecasts are enclosed here with in **Annexure III**

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

Summary and Conclusion:

Synoptic and NWP models suggest that:

- A low pressure area would form over southwest Bay of Bengal during next 48 hours and thence moving west-northwestwards emerge into southeast Arabian Sea and may further intensify into a depression around 27th November 2011.

Advisory:

- Presently, no significant weather system over Bay of Bengal.
- No IOP at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	22/12	**23/00**	**23/03**
India	176/205	127/159	192/208
Coastal stations			
WB	11	6	11
Odisha	10	6	11
AP	17	15	17
Tamil Nadu	13	9	12
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	14	14	15
Myanmar	13	13	14
Thailand	1	1	1
Sri Lanka	13	12	13

AWS

Region	Date/Time (UTC)		
	22/12	**23/00**	**23/03**
India	418/616	488/616	440/616
WB	20	20	19
ODS	27	26	28
AP	34	34	34
TN	27	26	27
PDC	0	0	0

- **RS/RW** (12Z) of 21 -11-2011: 09/39
- **No. of Ascents reaching 250 hPa levels:4, MISDA:-31**
- **RS/RW** (00Z) of 22 -11-2011: 35/39
- **No. of Ascents reaching 250 hPa levels:24, MISDA: 4**

No. of PILOT Ascents

22/12Z	23/00Z
17/37	14/34

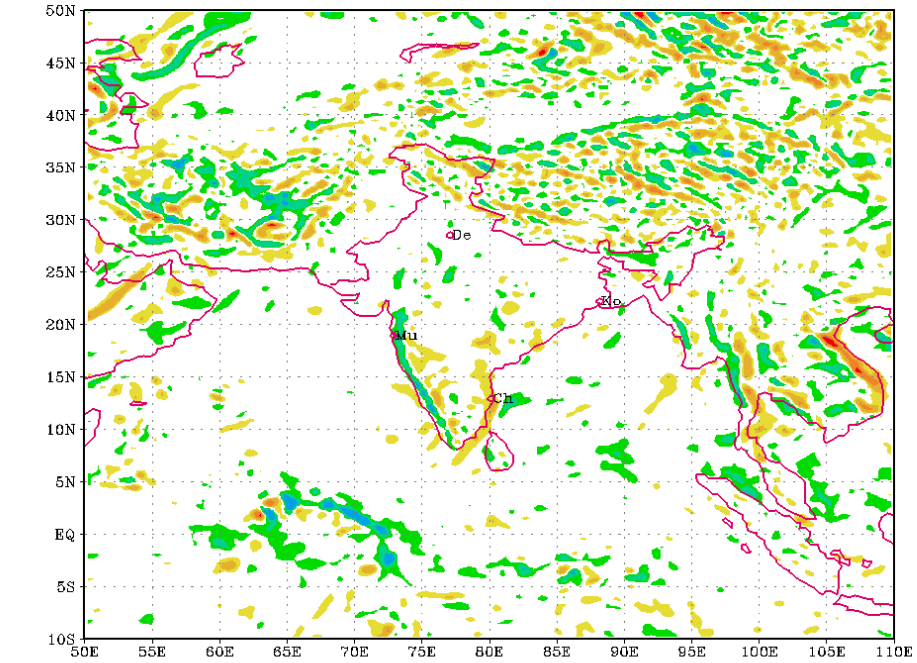
Buoy Data

22/12	23/00	23/03
09	7	08

Annexure II

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

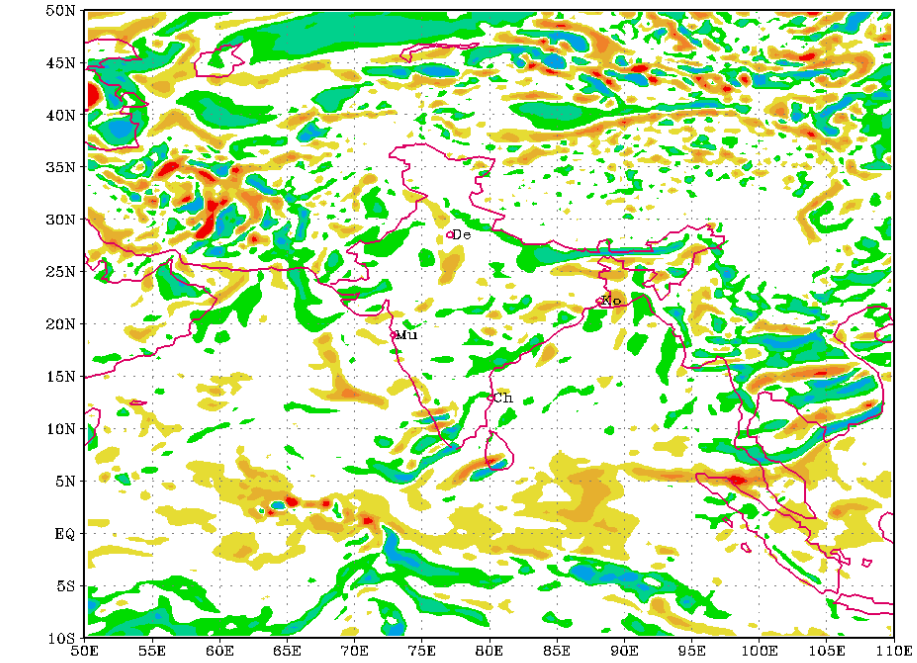
based on 00 UTC 23−11−2011 valid for 00 UTC of 23−11−2011



(Background does not depict political boundary)

Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

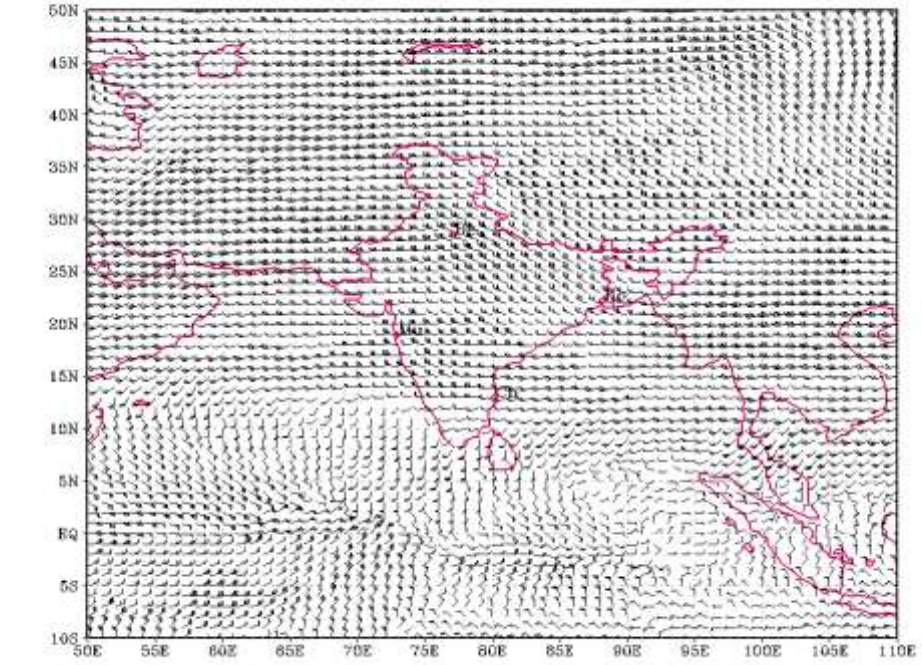
based on 00 UTC 23−11−2011 valid for 00 UTC of 23−11−2011



(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

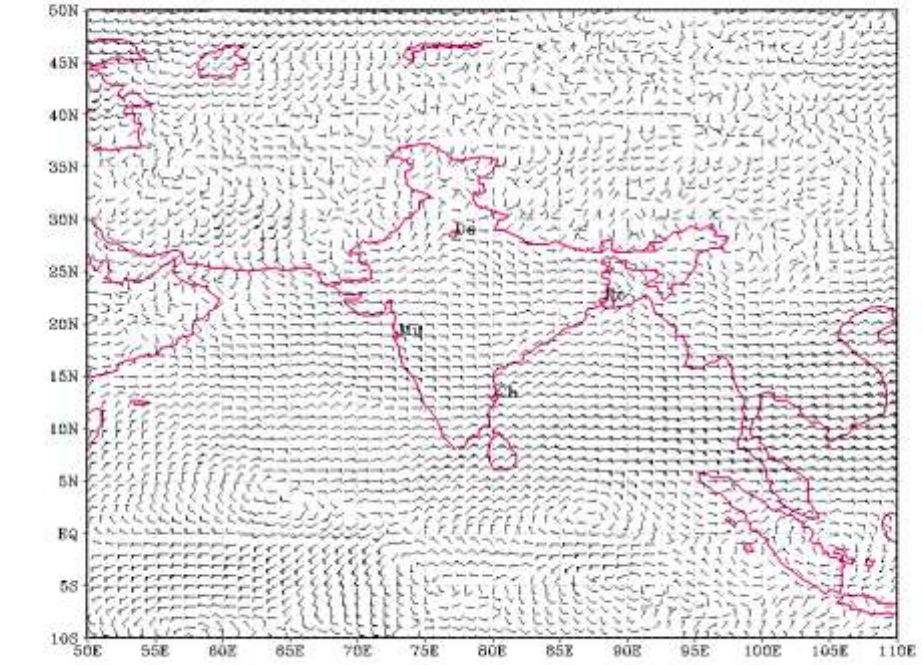
based on 00 UTC 23-11-2011 valid for 00 UTC of 23-11-2011



(Background does not depict political boundary)

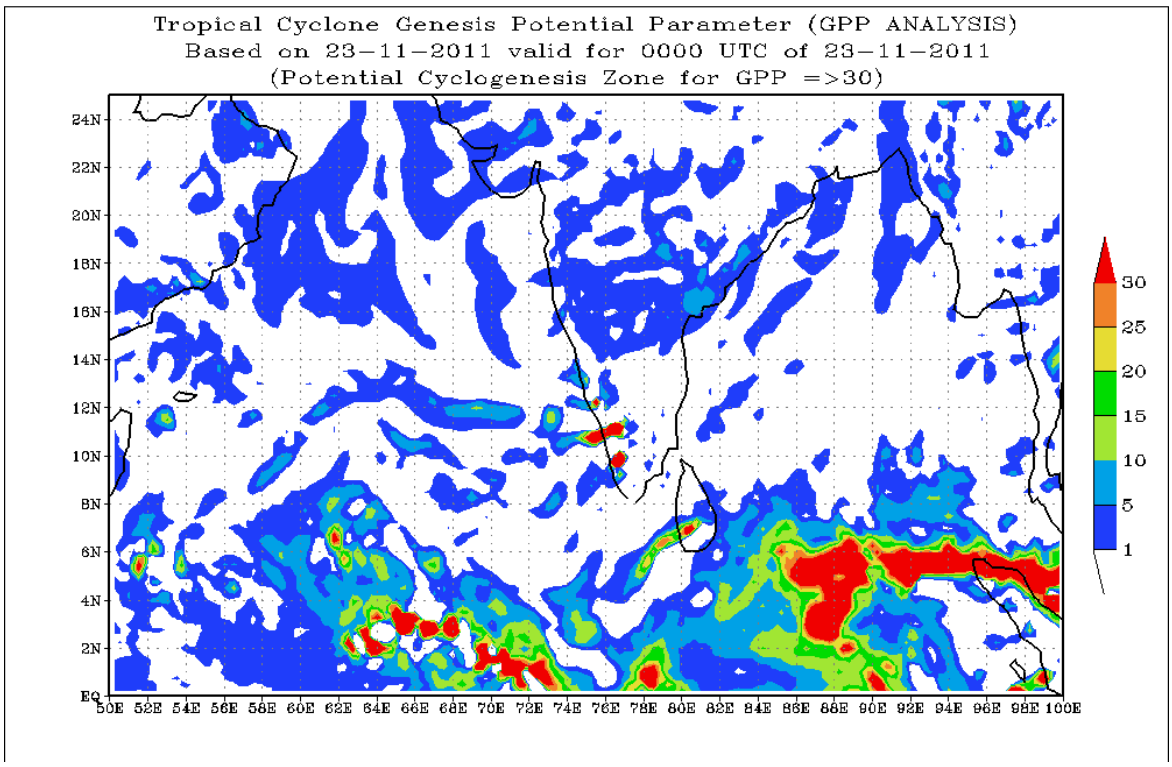
850 hPa WIND ECMWF FORECAST (0 Hr.)

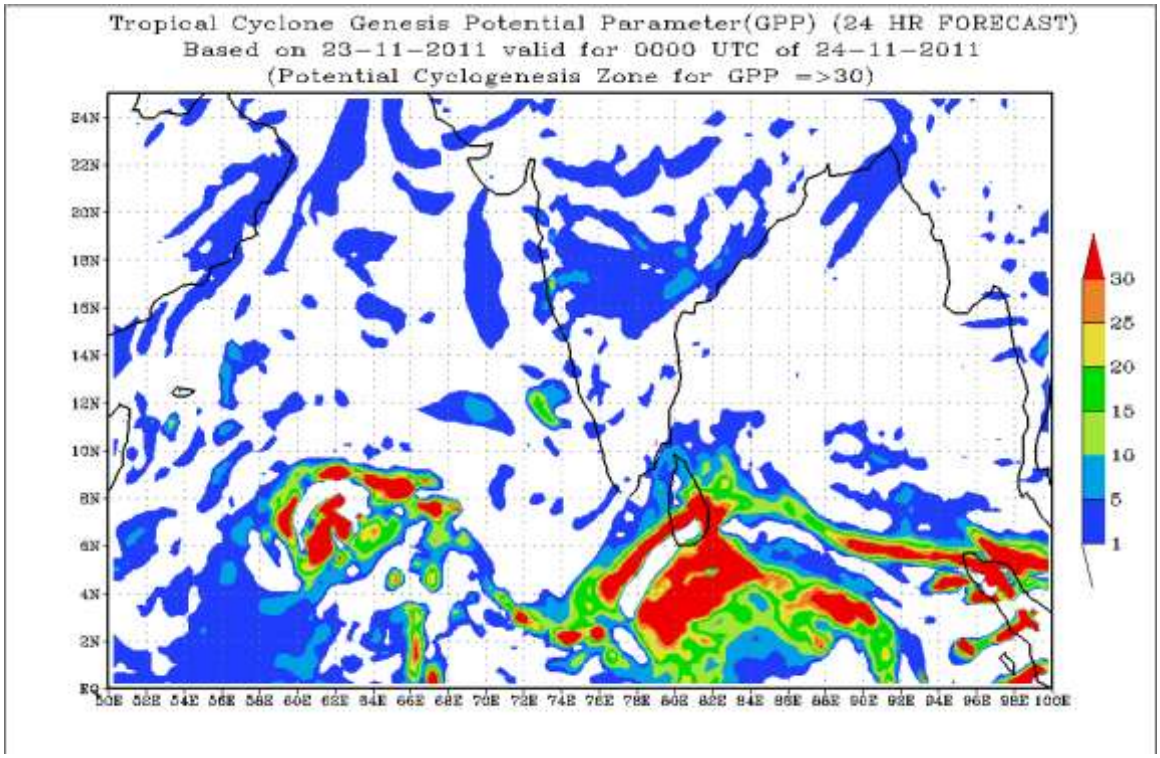
based on 00 UTC 23-11-2011 valid for 00 UTC of 23-11-2011



(Background does not depict political boundary)

Annexure-III





FDP (Cyclone) NOC Report Dated 24th November, 2011

Synoptic features based on 0300 UTC:

- ITCZ at 850 hPa runs around 4^0 N over Bay of Bengal.
- Pressure departure from normal is negative (around 1 to 2 hPa) along south Tamilnadu coast and Andaman & Nicobar Islands and negative (around 2 to 3 hPa) along Kerala coast.
- 24 hrs. pressure tendency is negative (around 1 hPa) over south Tamilnadu, Andaman & Nicobar island, over Sri Lanka and no significant change along east coast of India.
- Buoys data show that SST around 28-29^0 C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around 29-30^0C over central & south Bay of Bengal.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} over north & central Bay of Bengal 40-60 KJ cm^{-2}.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 40-50*10^{-5} s^{-1} over south Bay of Bengal along 3 deg. N.

Convergence:

- Lower level convergence zone (of order of 5 - 20*$10^{-5}s^{-1}$) lies over southwest Bay of Bengal along lat. 3 deg.N.

Divergence:

- Upper air divergence is positive of the order of 5 - 10*$10^{-5}s^{-1}$ over south Bay of Bengal.

Wind Shear:

- Wind Shear of order of 10 - 20 knots over south Bay of Bengal and Andaman Sea and increases northward becoming 60 knots over North Bay of Bengal.

Wind Shear Tendency:

- Positive of order 5 to 10 knots over south Bay of Bengal.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 8.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 2 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 2, 3 & 4 during next 15 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 2, 3 & 4 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over west Pacific Ocean

(See ftp://192.168.12.75/imd/satmet

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

Status of observational system:

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

Satellite

FDP cyclone satellite inference 240900 UTC:

Broken low/medium clouds with embedded moderate to intense convection seen over south Bay and south Andaman Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis based on 0000UTC of today shows a low level CYCIR lying over southwest Bay of Bengal. The model forecast shows the low level CYCIR is likely to become well marked on day2 and move westwards, which is thence likely to move westnorthwestwards. It is likely to intensify to depression on day4 over East central Arabian Sea.

- **IMD-GFS** model analysis based on 0000 UTC of today show a CYCIR lying over Comorin region and is likely to intensify into depression on day3 in Arabian Sea over south Kerala coast and adjoining regions. The system is likely to move west-northwestwards during consequent 3days.

- **WRF-ARW** model analysis based on 0000 UTC of today shows a CYCIR over southwest Bay of Bengal is likely to move westwards and thereafter intensify to depression on day1 which shows further intensification on day3 and moving westnorthwestwards.

- **UKMET** model analysis and forecast based on 0000 UTC of today shows a low level CYCIR over Comorin and adjoining regions and likely to become well marked on day2 and further intensify to depression on day3 in Arabian Sea, moving west-northwestwards.

http://www.imd.gov.in/section/nhac/dynamic/welcome.htm
ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and 24, 48 and 72 hours forecast a cell of 30 over southwest Bay of Bengal, which is likely to get organized moving westwards and then west northwestwards into Arabian Sea. GPP charts analysis and 24, 48 and 72 hours forecasts are enclosed here with in **Annexure III (http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- A low pressure area lying over south Bay of Bengal becomes well marked during next 48 hours and thence moving west-northwestwards emerge into

southeast Arabian Sea and may further intensify into a depression around 27th November 2011.

Advisory:

- A continuous watch will be made in view of the likely formation of the low pressure over southwest Bay of Bengal during next 48 hours.
- No IOP is required at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	23/12	**24/00**	**24/03**
India	187/205	128/159	191/208
Coastal stations			
WB	11	5	10
Odisha	10	6	10
AP	18	17	18
Tamil Nadu	13	10	13
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	14	14	15
Myanmar	14	15	17
Thailand	1	1	1
Sri Lanka	13	13	14

AWS

Region	Date/Time (UTC)		
	23/12	**24/00**	**24/03**
India	483/616	488/616	491/616
WB	19	20	20
ODS	27	25	28
AP	29	32	32
TN	22	26	27
PDC	0	0	0

- **RS/RW** (12Z) of 23 -11-2011: 10/39
- **No. of Ascents reaching 250 hPa levels:4, MISDA:-29**
- **RS/RW** (00Z) of 24 -11-2011: 34/39
- **No. of Ascents reaching 250 hPa levels18, MISDA: 5**

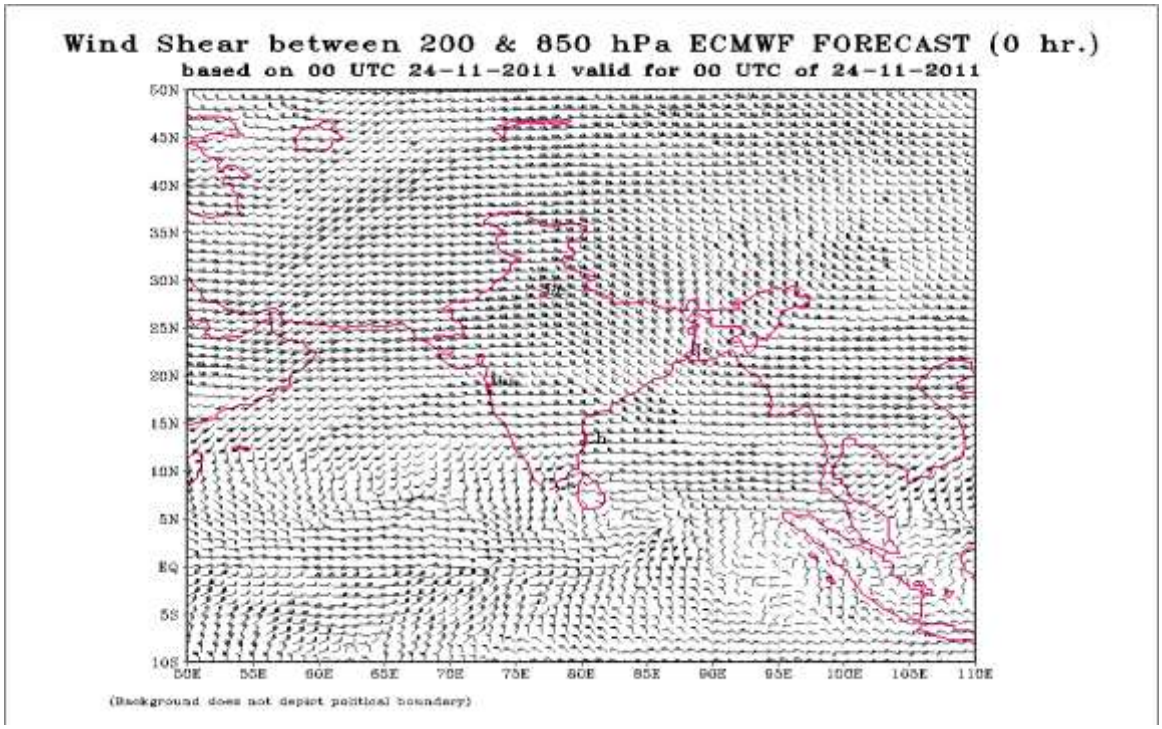
No. of PILOT Ascents

23/12Z	24/00Z
12/37	15/34

Buoy Data

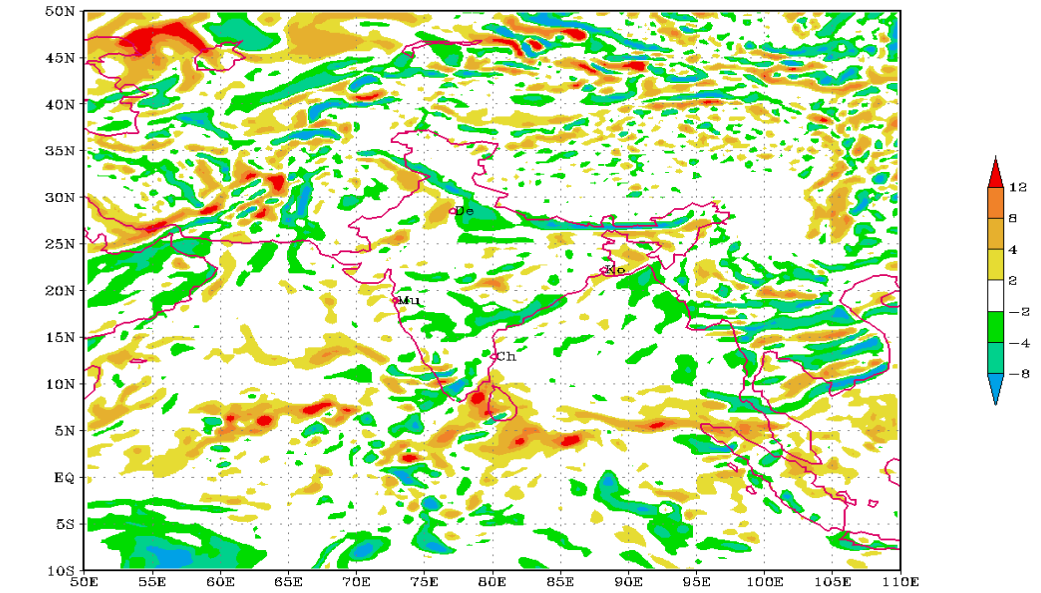
23/12	24/00	24/03
12	11	13

Annexure II



Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

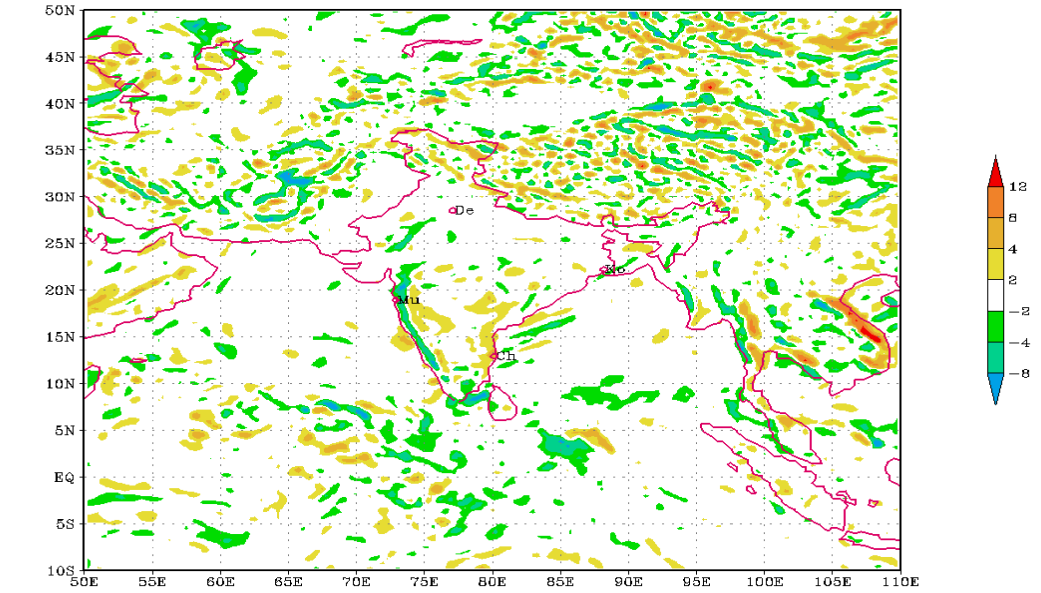
based on 00 UTC 24−11−2011 valid for 00 UTC of 24−11−2011



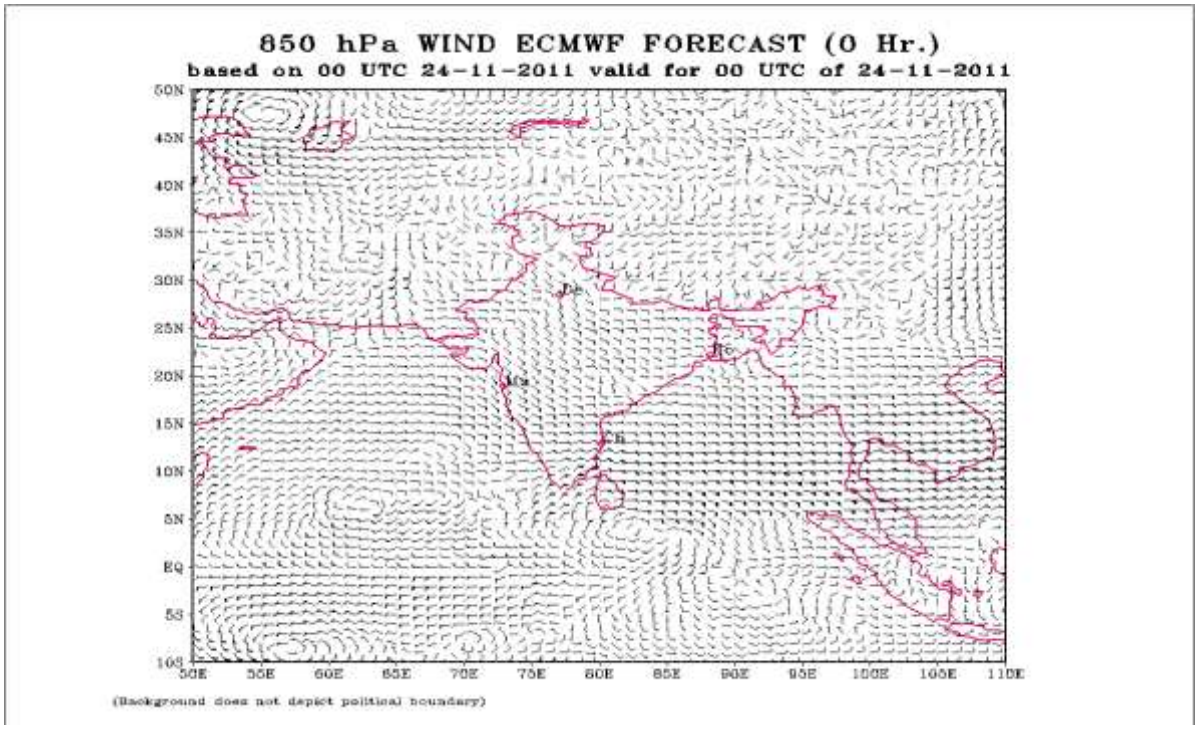
(Background does not depict political boundary)

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

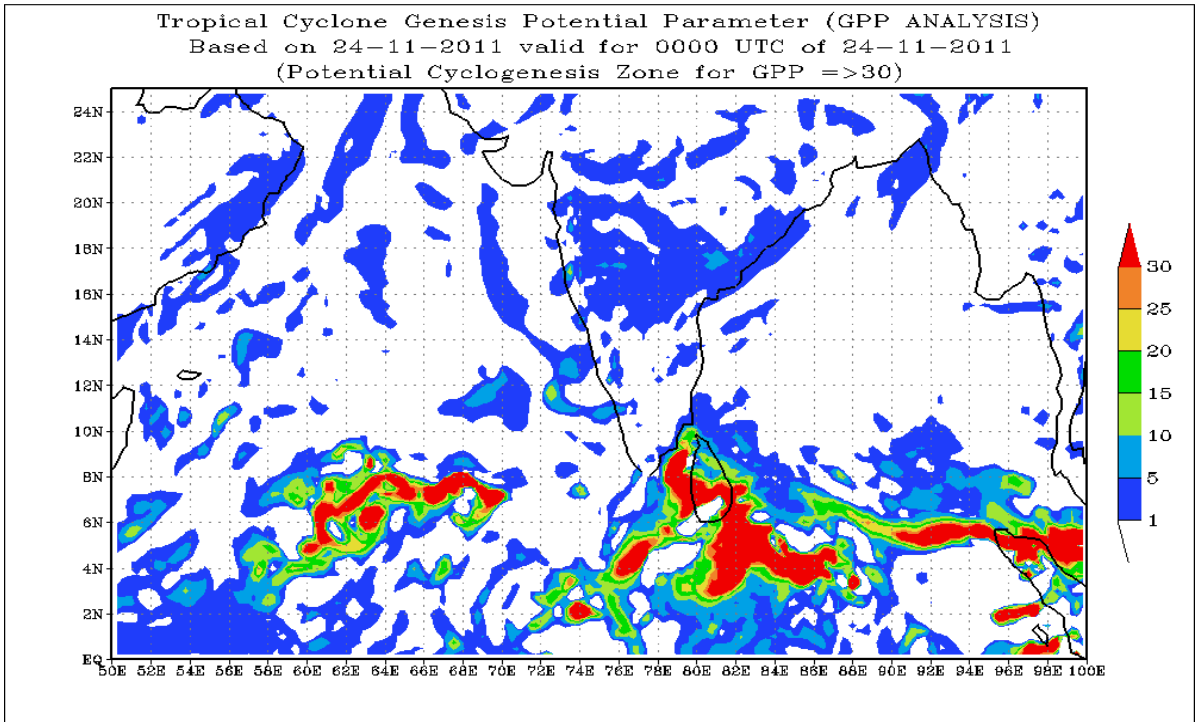
based on 00 UTC 24−11−2011 valid for 00 UTC of 24−11−2011

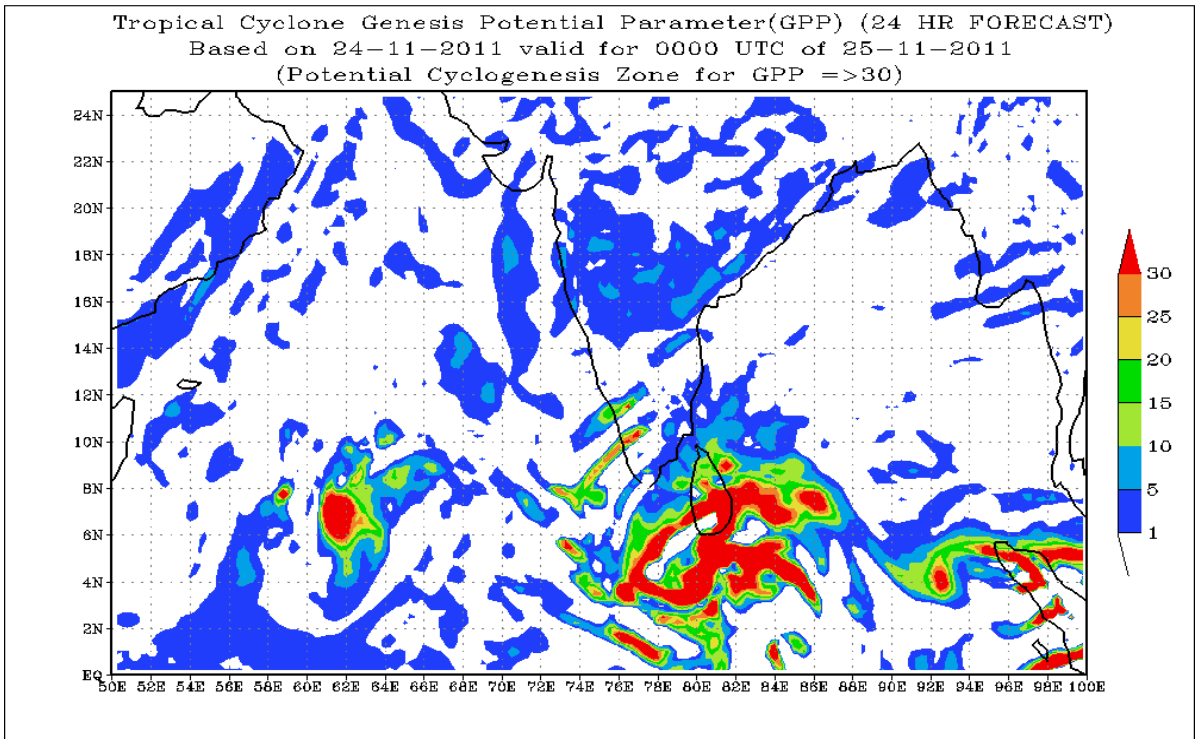


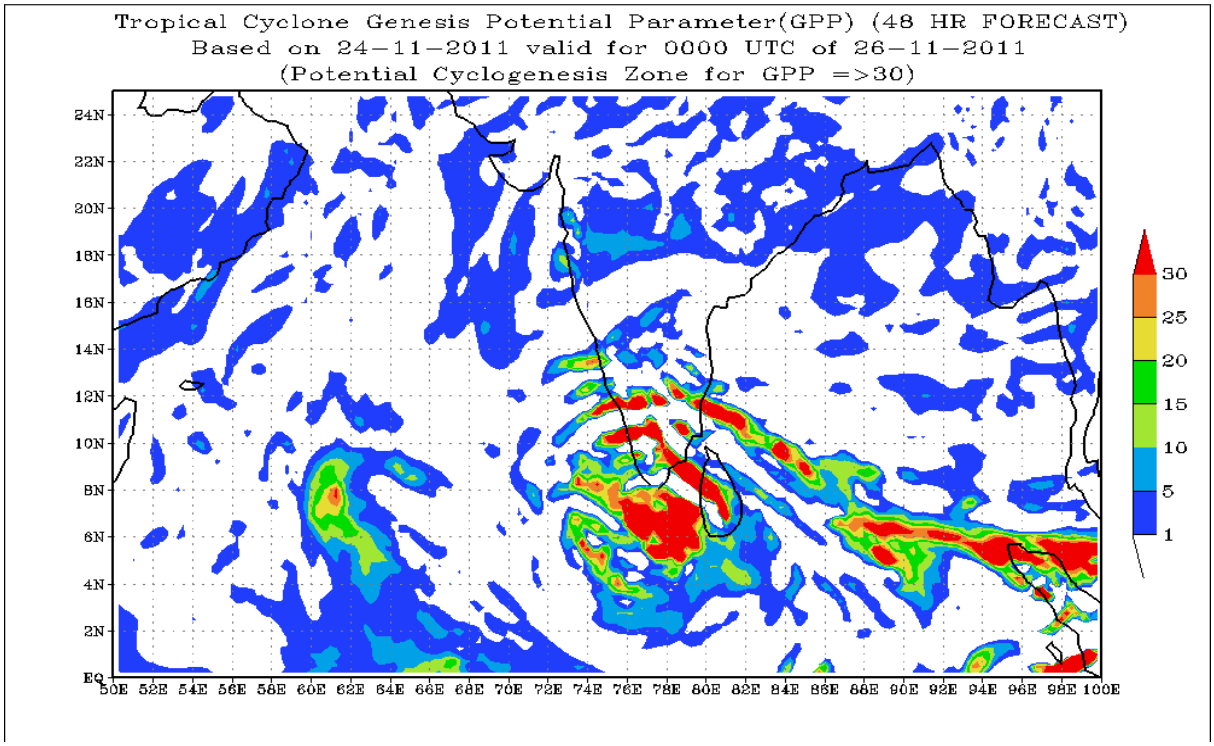
(Background does not depict political boundary)

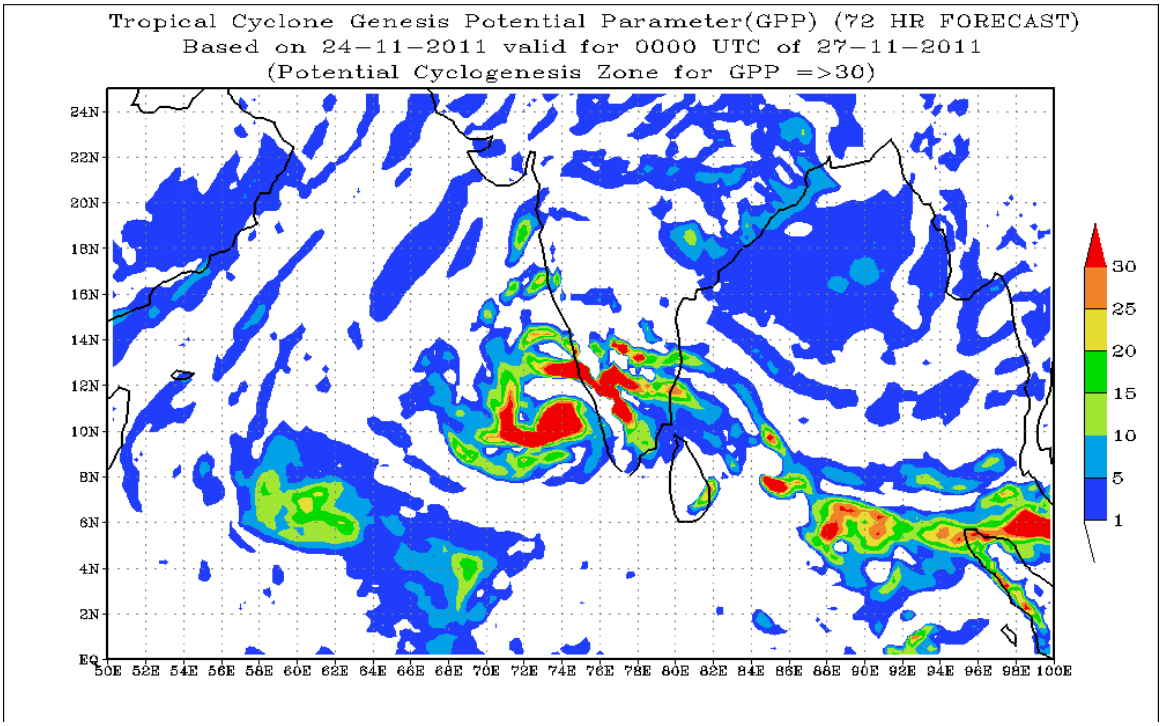


Annexure-III




Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 24-11-2011 valid for 0000 UTC of 25-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 24-11-2011 valid for 0000 UTC of 26-11-2011
(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
1



FDP (Cyclone) NOC Report Dated 25th November, 2011

Synoptic features based on 0300 UTC:

- A well marked low pressure area lies over Comorin and neighbourhood.
- Associated cyclonic circulation extends upto mid-tropospheric level.
- Estimated central pressure is 1001 hPa at 250900 UTC. The pressure dropped at the centre about 3 hPa.
- Associated maximum sustained surface wind is about 15 knots.
- 24 hrs. pressure tendency is negative (around 2 hPa) over Lakshadweep area and Kerala.
- Pressure departure from normal is negative over south peninsula and Lakshadweep. The maximum departure is -6.5 hPa over Thiruvanathapuram. It is about -3 to -4 hPa over Lakshadweep. It is near normal along remaining parts of east coast Bangladesh, Myanmar and Thailand.
- The upper tropospheric ridge roughly runs along 13^0 N at 200 hPa in association with anti-cyclonic circulation over south Karnataka and neighbourhood.
- The easterlies are stronger with speed reaching 20 to 30 knots over south peninsula at 0.9 km above mean Sea level.
- Vertical wind shear over south peninsular region is low to moderate.
- Buoys data show that SST around 28-29^0 C over Bay of Bengal, east Arabia Sea and 26-27^0 C over west Arabian Sea.
- All the above conditions suggest that the low pressure area to intensify into depression during next 24 hours.

Environmental parameters:

Sea Surface Temperature:

- SST is around 29-30^{0}C over central & south Bay of Bengal. It is about 28-29^0 C over east Arabia Sea and 26-27^0 C over west Arabian Sea.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} over north & central Bay of Bengal 40-60 KJ cm^{-2}. It is about 70 KJ cm^{-2} over east Arabian Sea and < 40 KJ cm^{-2} over west Arabian Sea

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 10-20*10^{-5} s^{-1} over southwest Bay of Bengal, Comorin area and adjoining Arabian Sea

Convergence:

- Lower level convergence zone (of order of 10 - 20*10^{-5}s^{-1}) lies over Comorin area and adjoining southwest Bay of Bengal and southeast Arabian Sea. There are two maxima oriented in ESE-WNW direction.

Divergence:

- Upper air divergence is positive of the order of 30 - 40*10^{-5}s^{-1} over Comorin area and adjoining southwest Bay of Bengal and southeast Arabian Sea. There are two maxima oriented in ESE-WNW direction.

Wind Shear:

- Wind Shear of order of 20 - 30 knots over Comorin area and neighbourhood

Wind Shear Tendency:

- Negative of order 5 knots over Comorin area.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 14.0^{0}N over south peninsula and Arabian Sea and along 12.0^{0}N over Bay of Bengal.

M.J.O. Index:

- Located over phase 2 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 2, 3 & 4 during next 15 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 2, 3 & 4 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over west Pacific Ocean

(See ftp://192.168.12.75/imd/satmet

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

Status of observational system:

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

Satellite

FDP cyclone satellite inference 250900 UTC:

Broken low/medium clouds with embedded moderate to intense convection over south Bay and adjoining westcentral Bay extended southwest Andaman Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis based on 0000UTC of today shows a low pressure area lay over Comorin region. The forecast shows the low pressure is likely to intensify to depression on day2 and further to cyclonic storm on day3 and day4, which is likely to move westwards and then northwestwards over east central Arabian Sea.
- **IMD-GFS** model analysis based on 0000 UTC of today shows a low level CYCIR lying over Comorin region. The low level CYCIR is likely to intensify into a depression over Maldives and adjoining regions during next 24 hours. The system is further likely to move northwestwards over southeast Arabian Sea and likely to intensify into a cyclonic storm during next 48 hours. During next 72 hours, this is likely to move northwestwards into east central Arabian Sea.
- **WRF-ARW** model analysis based on 0000 UTC of today shows a low level CYCIR lay over Comorin region. This is likely to move westwards, intensifying to depression during next 24 hours. Thereafter depression is likely to intensify into a cyclonic storm moving northwestwards along south Kerala coast and adjoining regions. In the next 72 hours it is further likely to move into east central Arabian Sea.
- **UKMET** model analysis and forecast based on 0000 UTC of today shows a low level CYCIR lay over Comorin and adjoining regions, is likely to intensify to depression on day2 and day3 over southeast Arabian Sea. This is likely to move west northwestwards and intensify to a cyclonic storm in east central Arabian Sea on day4 and day5.

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

ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and 24, 48 and 72 hours forecast a cell of 30 over southwest Bay of Bengal, which is likely to be well organized during next 24 hours and move westwards and then northwestwards into east central Arabian Sea on day3. GPP charts analysis and 24, 48 and 72 hours forecasts are enclosed here with in **Annexure III**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- A well marked low pressure area lies over Comorin and neighbourhood. It is likely to move northwestwards and further intensify into a depression during next 24 hrs.. Many models are suggesting the system to intensify into a marginal cyclone over central Arabian Sea. System may then move west-northwestwards towards Oman coast and weaken gradually before landfall.

Advisory:

- A continuous watch will be made in view of the likely formation of the depression over the Arabian Sea.
- No IOP is required at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	24/12	**25/00**	**25/03**
India	189/205	129/159	170/208
Coastal stations			
WB	06	05	11
Odisha	10	6	10
AP	18	17	18
Tamil Nadu	13	10	13
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	15	12	16
Myanmar	17	16	17
Thailand	1	1	1
Sri Lanka	16	15	16

AWS

Region	Date/Time (UTC)		
	24/12	**25/00**	**25/03**
India	446/616	491/616	392/616
WB	21	16	21
ODS	27	25	28
AP	32	25	33
TN	27	25	27
PDC	0	0	0

- **RS/RW** (12Z) of 24 -11-2011: 12/39
- **No. of Ascents reaching 250 hPa levels:5, MISDA:-27**
- **RS/RW** (00Z) of 25 -11-2011: 34/39
- **No. of Ascents reaching 250 hPa levels 21, MISDA: 5**

No. of PILOT Ascents

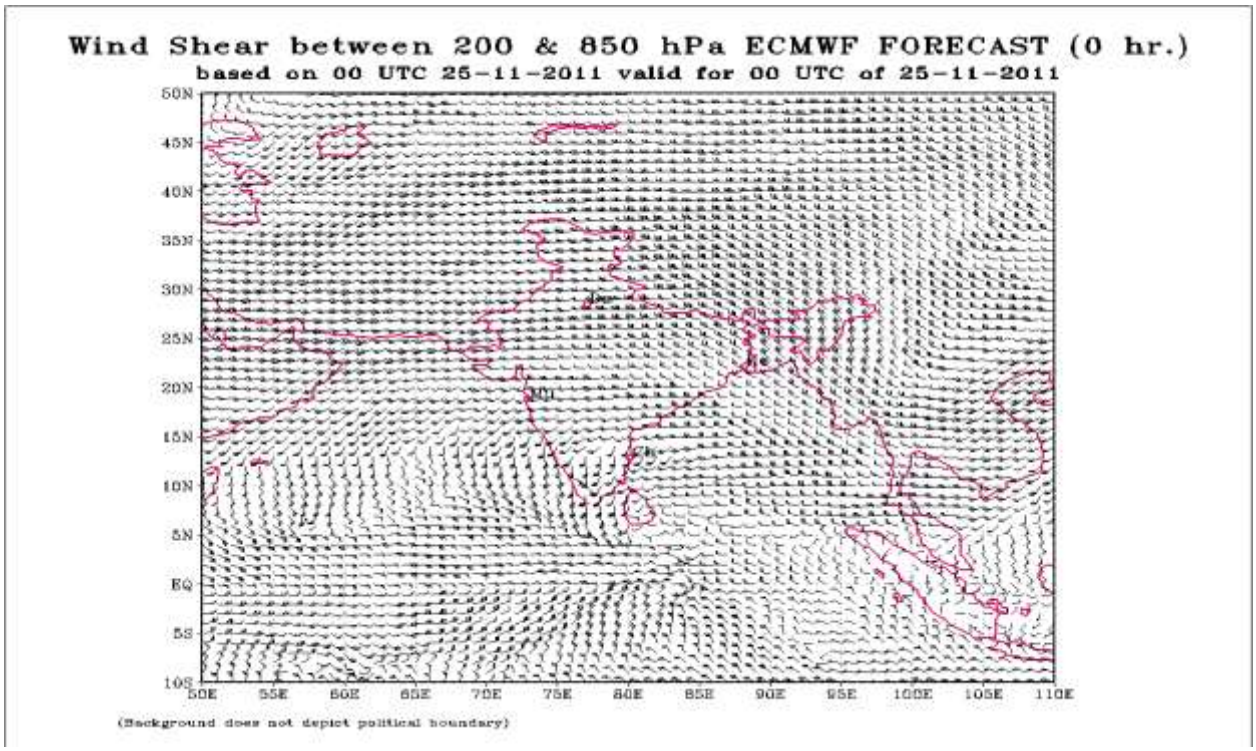
24/12Z	25/00Z
20/37	16/34

Buoy Data

24/12	25/00	25/03

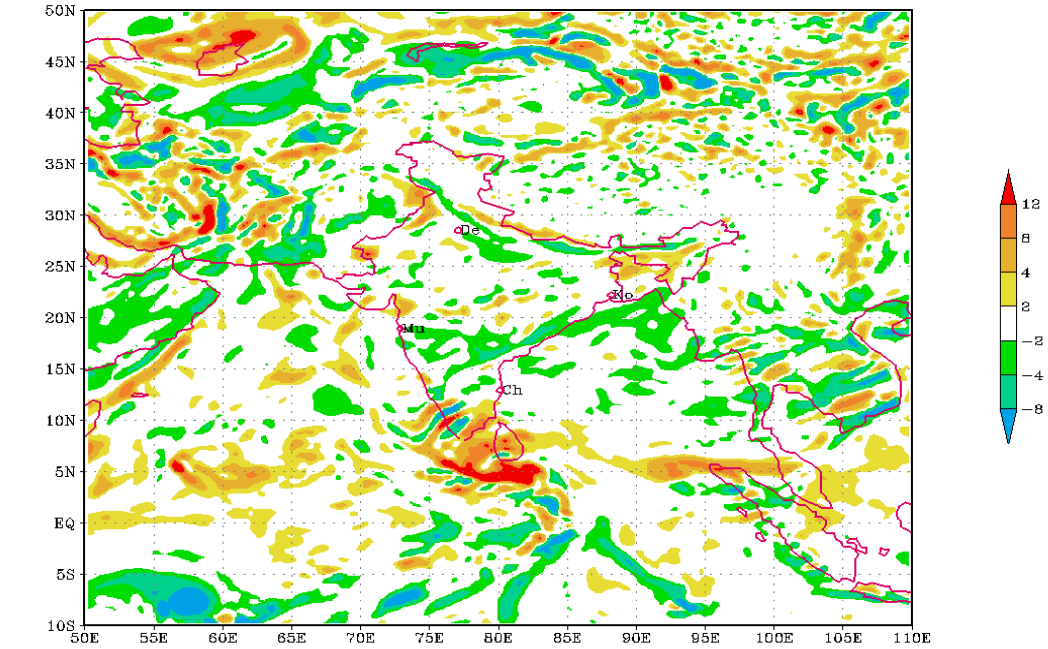
13	12	10

Annexure II



Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

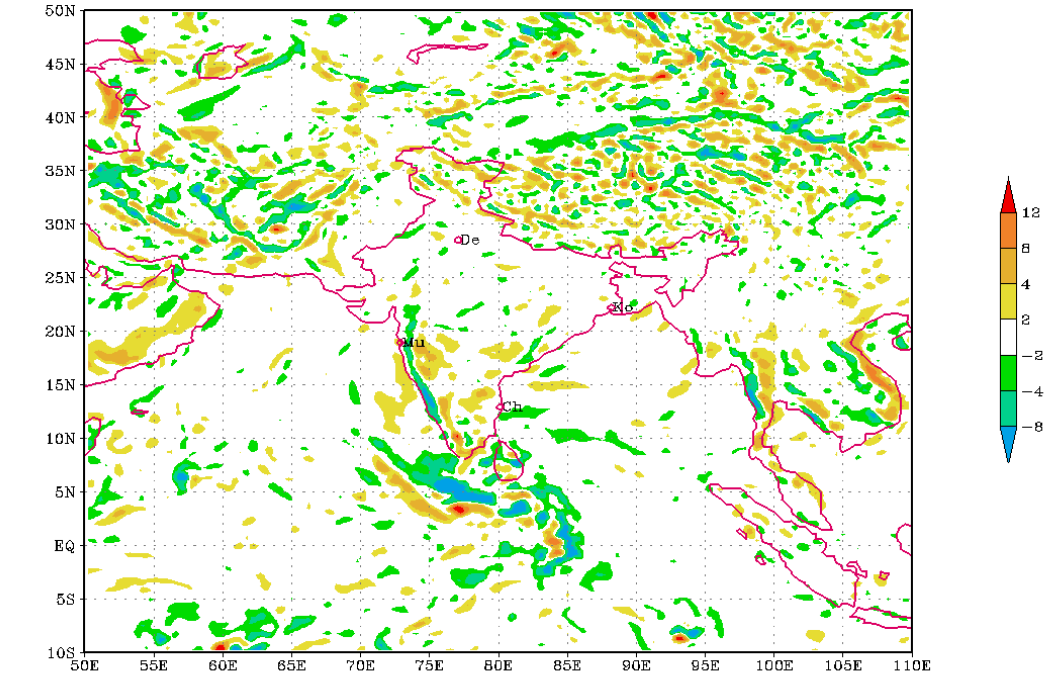
based on 00 UTC 25−11−2011 valid for 00 UTC of 25−11−2011



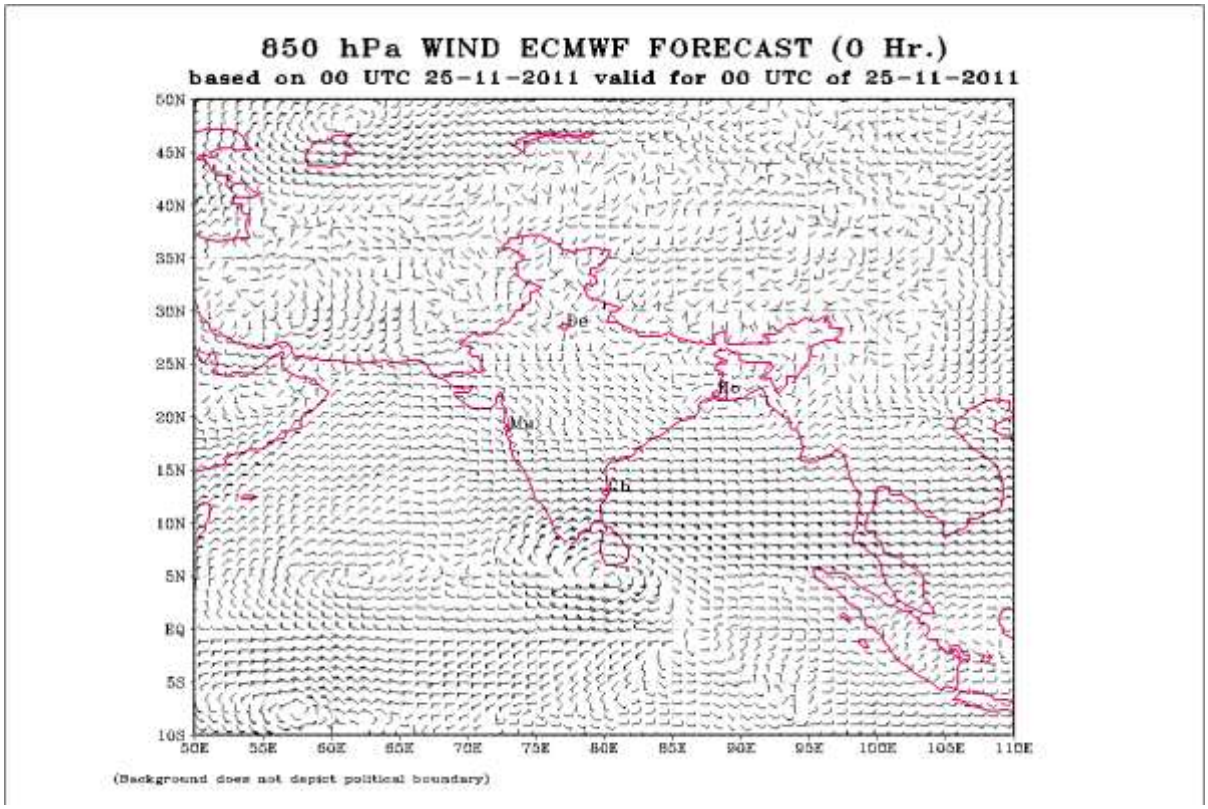
(Background does not depict political boundary)

Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)

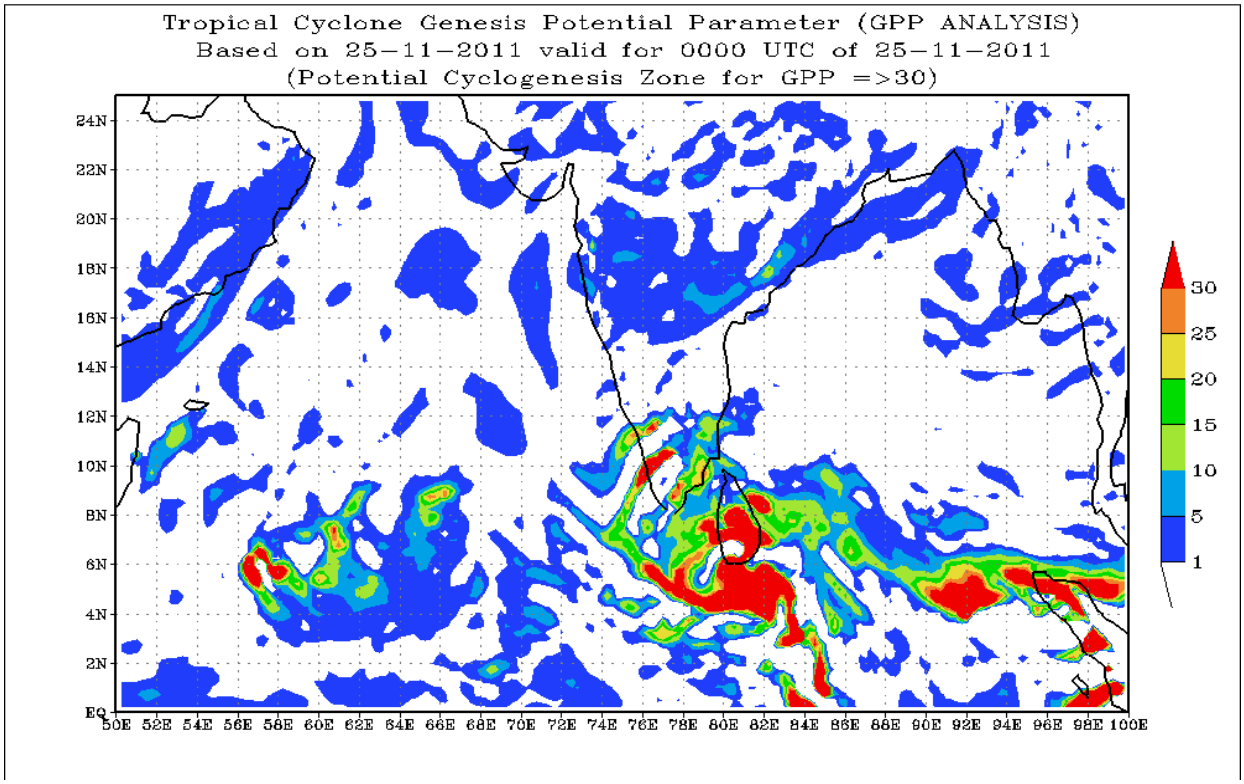
based on 00 UTC 25−11−2011 valid for 00 UTC of 25−11−2011



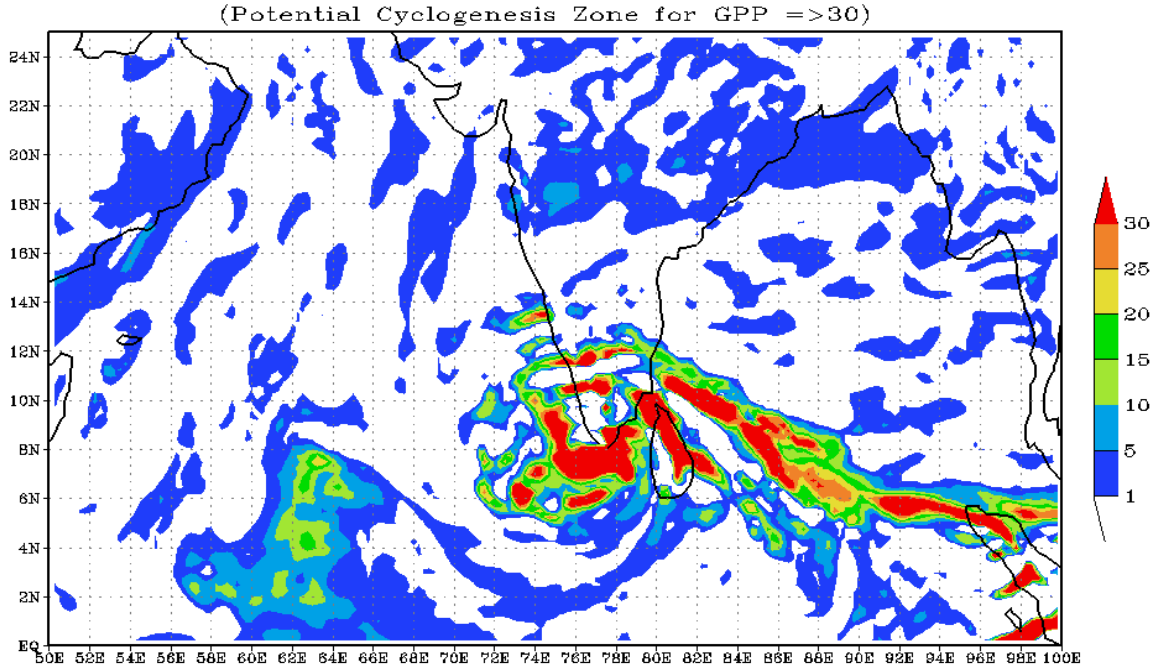
(Background does not depict political boundary)



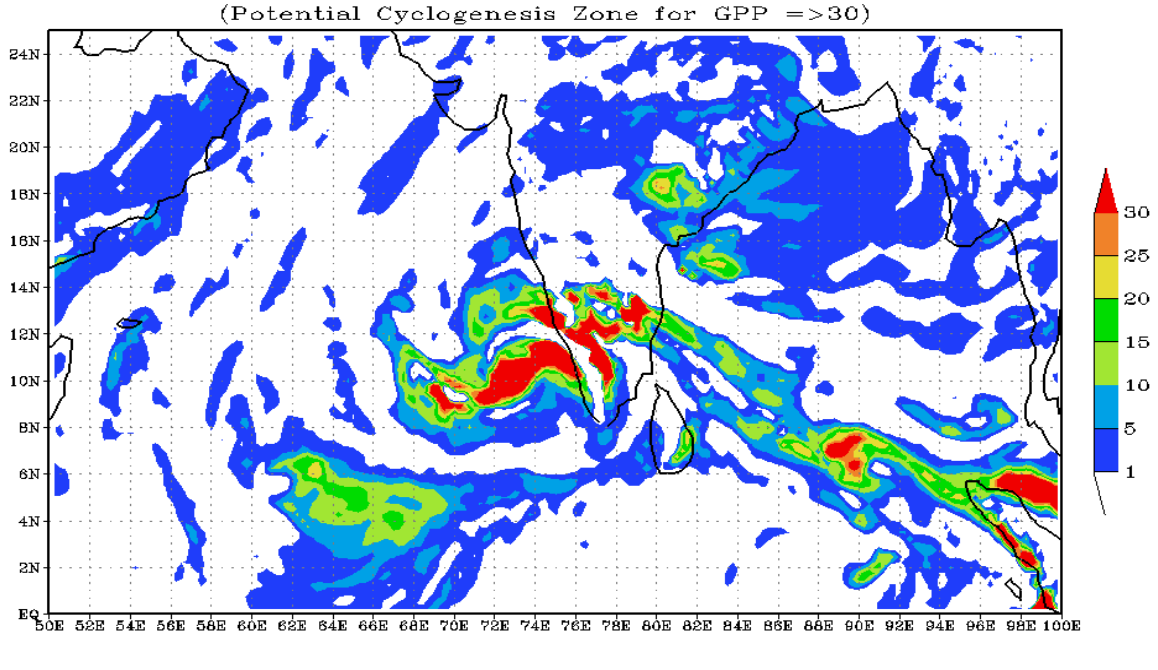
Annexure-III

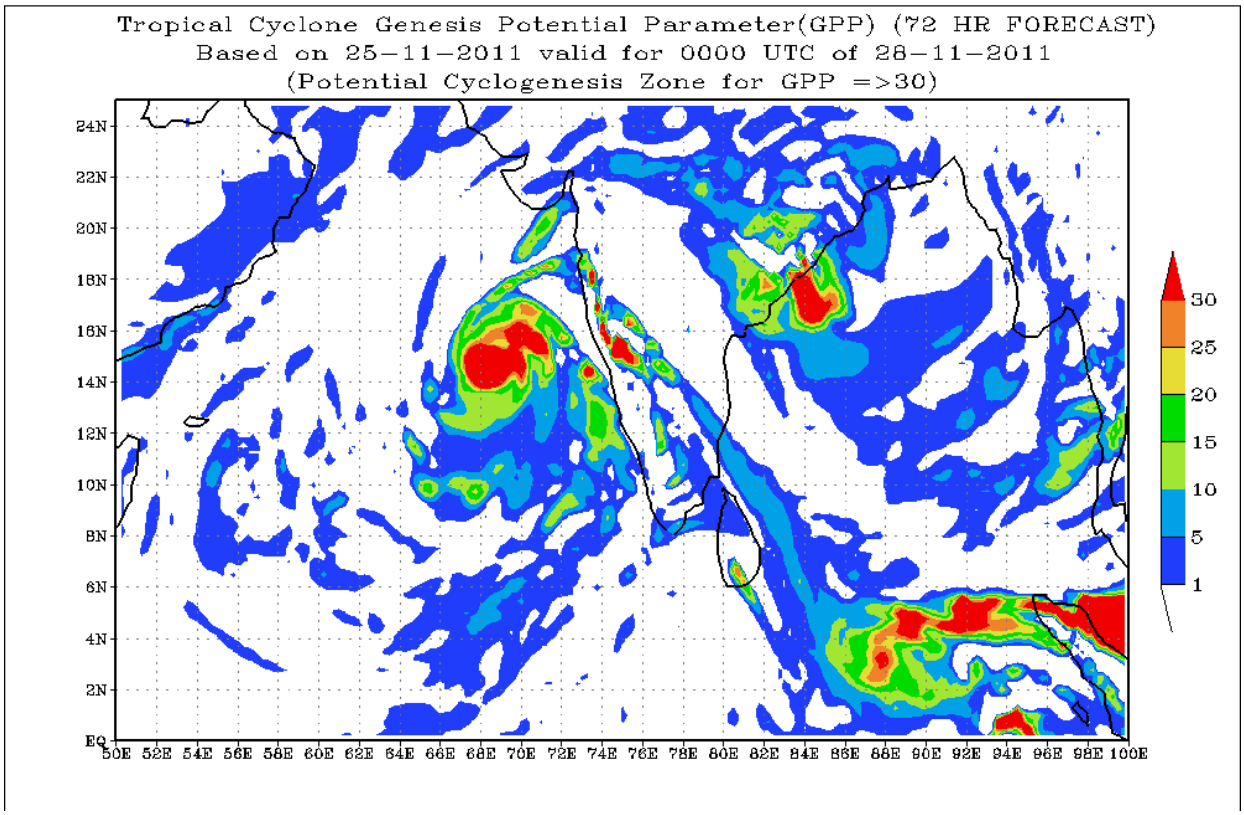


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 25-11-2011 valid for 0000 UTC of 26-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 25-11-2011 valid for 0000 UTC of 27-11-2011
(Potential Cyclogenesis Zone for GPP =>30)





FDP (Cyclone) NOC Report Dated 26th November, 2011

Synoptic features based on 0300 UTC:

- Yesterday's well marked low pressure area over Comorin area & neighbourhood concentrated into a **Depression** and lay centred at 0830 hrs. IST of today, the 26th November 2011 within half a degree of Lat.7.5° N and Long 76.5° E, about 120 kms south-southwest of Thiruvananthapuram (Kerala) and 400 kms east-southeast of Minicoy (Lakshadweep Island). The system would move west-northwest wards across Lakshadweep area and intensity into a Deep depression during next 48 hours.
- The trough of low at mean Sea level over southwest & adjoining southeast Bay of Bengal now extends from the centre of the Depression to west central Bay of Bengal, across southwest Bay of Bengal off north Tamil Nadu – south Andhra Pradesh coasts.
- Estimated central pressure is 1002 hPa at 26000 UTC. The pressure dropped at the centre about 2 hPa.
- Associated maximum sustained surface wind is about 15 knots.
- 24 hrs. pressure tendency is negative (around 3 - 4 hPa) over Lakshadweep area and Kerala coast.
- Pressure departure from normal is negative over south peninsula and Lakshadweep. The maximum departure is -6.5 hPa over Thiruvanathapuram. It is about -3 to -5 hPa over Lakshadweep and Kerala coast. It is near normal along remaining parts of east coast Bangladesh, Myanmar and Thailand.

- The upper tropospheric ridge roughly runs along 13^0 N at 200 hPa in association with anti-cyclonic circulation over south Karnataka and neighbourhood.
- The easterlies are stronger with speed reaching 20 to 30 knots over south peninsula at 0.9 km above mean Sea level.
- Vertical wind shear over south peninsular region is low to moderate.
- Buoys data show that SST around 28-29^0 C over Bay of Bengal, east Arabia Sea and 26-27^0 C over west Arabian Sea.
- Rainfall has occurred at most places over Tamilnadu and Kerala, at many places over Lakshadweep.
- All the above conditions suggest that the low pressure area to intensify into depression during next 24 hours.

Environmental parameters:

Sea Surface Temperature:

- SST is around 29-30^0C over central & south Bay of Bengal. It is about 28-29^0 C over east Arabia Sea and 26-27^0 C over west Arabian Sea.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} over north & central Bay of Bengal 40-60 KJ cm^{-2}. It is about 70 KJ cm^{-2} over east Arabian Sea and < 40 KJ cm^{-2} over west Arabian Sea

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 10-20*10^{-5} s^{-1} over southwest Bay of Bengal, Comorin area and 50-60*10^{-5} s^{-1} over Maldives region.

Convergence:

- Lower level convergence zone (of order of 10 - 20*$10^{-5}s^{-1}$) lies over Maldives area and adjoining southwest Bay of Bengal and southeast Arabian Sea. There are two maxima oriented in ESE-WNW direction.

Divergence:

- Upper air divergence is positive of the order of 10 - 20*$10^{-5}s^{-1}$ over Comorin, Maldives area and adjoining southwest Bay of Bengal and southeast Arabian Sea. There are two maxima oriented in ESE-WNW direction.

Wind Shear:

- Wind Shear of order of 10 - 30 knots over Maldives, Comorin area and neighbourhood

Wind Shear Tendency:

- Pressure of order 10 - 40 knots over Comorin area and Maldives area..

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 15.0^0N over south peninsula and Arabian Sea and along 12.0^0N over Bay of Bengal.

M.J.O. Index:

- Located over phase 2 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 2, 3 & 4 during next 15 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 2, 3 & 4 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over west Pacific Ocean

(See ftp://192.168.12.75/imd/satmet

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

Status of observational system:

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

Satellite

FDP cyclone satellite inference 250900 UTC:

BAY OF BENGAL & ANDAMAN SEA: -

BROKEN LOW/MEDIUM CLOUDS WITH EMBEDDED MODERATE TO INTENSE CONVECTION IS SEEN OVER SOUTHWEST AND ADJOINING SOUTHEAST BAYOF BENGAL AND ISOLATED WEAK TO MODERATE CONVECTION SEEN OVER S PARTS OF SOUITH ANDAMAN SEA.

ARABIAN SEA: -

BROKEN LOW/MEDIUM CLOUDS WITH EMBEDDED MODERATE TO INTENSE CONVCTION IS SEEN OVER S ARABIAN SEA BETWEEN LAT 5.0^0N TO 9.0^0N LONG 59.0^0E TO 66.0^0E AND REST SOUTHEAST ARABIAN SEA AND ADJOINING SOUTH PARTS OF EASTCENTRAL ARABIAN SEA.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis based on 0000UTC of today shows depression lay over Maldives and neighbourhood region. The forecast shows the depression is likely to intensify to deep depression on day2 lay over east central Arabian Sea and is further likely to move west northwestwards towards Oman Coast.

- **IMD-GFS** model analysis based on 0000 UTC of today shows depression lay over Maldives and neighbourhood. The forecast shows the system is likely to move west northwestwards into east central Arabian Sea during next 48 hours and further intensifying to deep depression in next 72 hours.

- **WRF-ARW** model analysis based on 0000 UTC of today shows a depression lay over southeast Bay and is likely to move west northwest during next 3 days. The depression is likely to intensify into a cyclone storm on day1 along

south Kerala coast and shows further intensification on day2 and day3 in east central Arabian Sea.

- **UKMET** model analysis and forecast based on 0000 UTC of today shows depression lay over Maldives and adjoining regions that is likely to intensify to deep depression during next 48 hours over southeast Arabian Sea.

http://www.imd.gov.in/section/nhac/dynamic/welcome.htm
ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and 24, 48 and 72 hours forecast a cell of 30 over southwest Bay of Bengal, which is likely to be well organized during next 24 hours and move northwestwards into east central Arabian Sea on day2 and day3. GPP charts analysis and 24, 48 and 72 hours forecasts are enclosed here with in **Annexure III**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm**)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- Yesterday's well marked low pressure area intensified into a depression lies over Maldives and neighbourhood. Many models are suggesting the system to intensify to marginal cyclone over central Arabian Sea. System may then move west-northwestwards towards Oman coast and weaken gradually before landfall.

Advisory:

- A continuous watch will be made in view of the intensification of the depression to marginal cyclonic storm over the Arabian Sea.
- No IOP is required at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	25/12	**26/00**	**26/03**
India	186/205	128/159	188/208
Coastal stations			
WB	11	05	11
Odisha	10	6	07
AP	18	17	18
Tamil Nadu	13	10	13
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	16	13	16
Myanmar	16	16	17
Thailand	1	1	1
Sri Lanka	10	9	10

AWS

Region	Date/Time (UTC)		
	25/12	**26/00**	**26/03**
India	443/616	484/616	399/616
WB	20	18	21
ODS	28	26	28
AP	31	33	32
TN	26	26	27
PDC	0	0	0

- **RS/RW** (12Z) of 25 -11-2011: 11/39
- **No. of Ascents reaching 250 hPa levels:4, MISDA:-28**
- **RS/RW** (00Z) of 26 -11-2011: 34/39
- **No. of Ascents reaching 250 hPa levels 21, MISDA: 5**

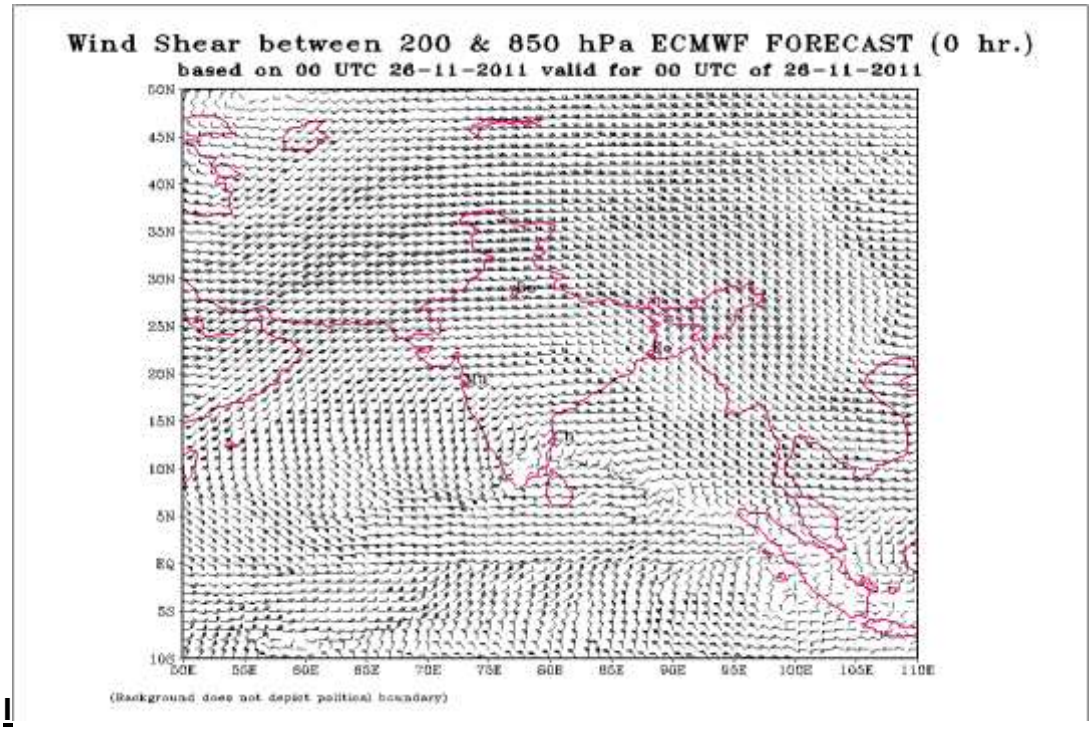
No. of PILOT Ascents

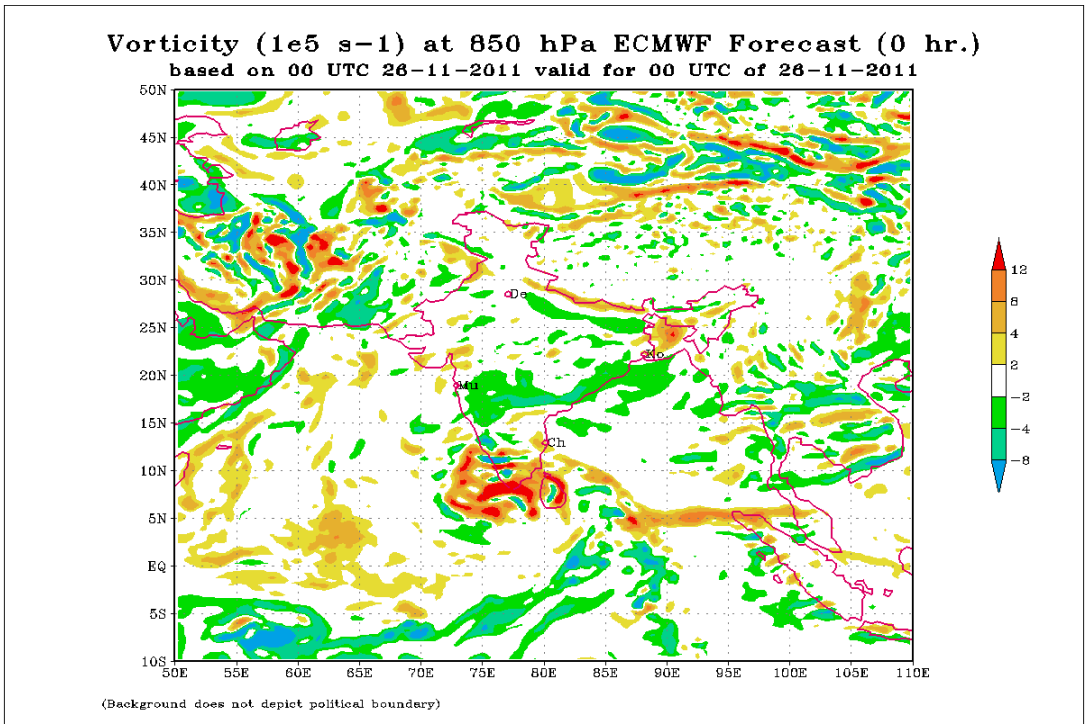
25/12Z	26/00Z
11/37	11/34

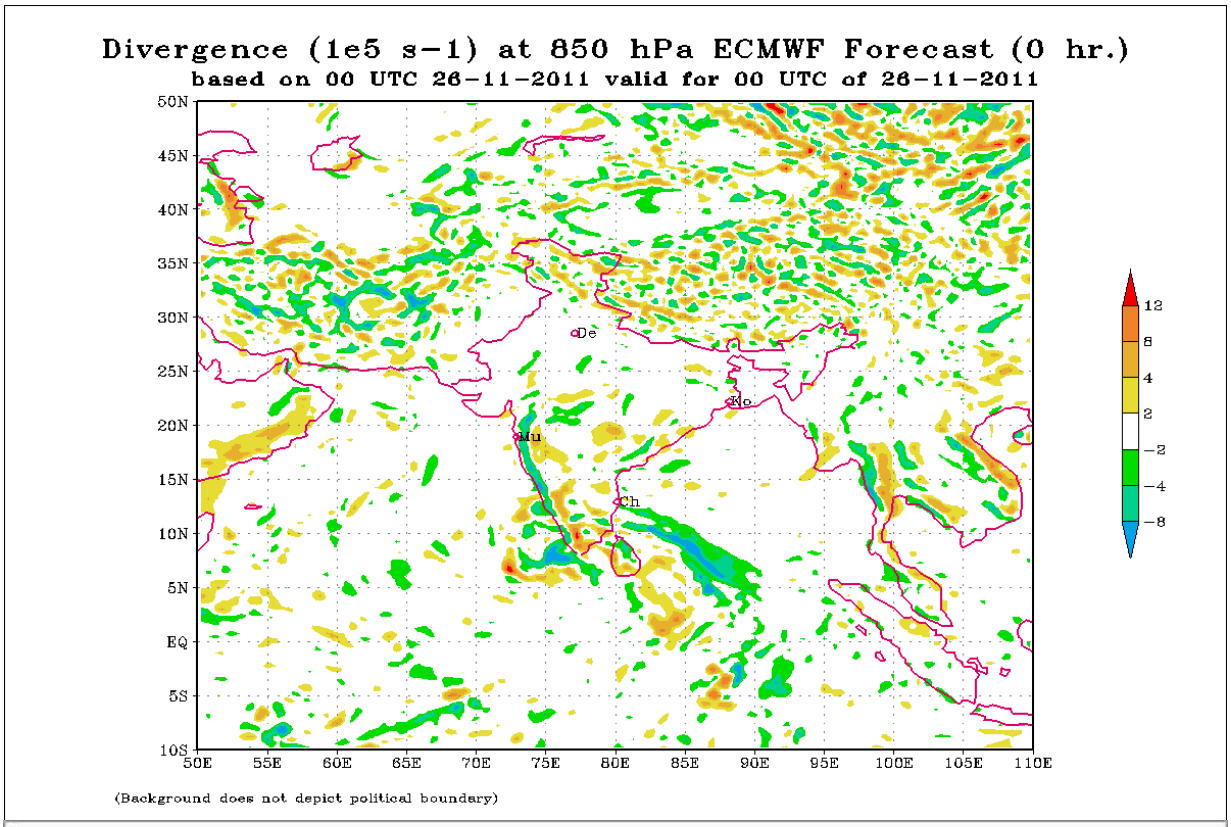
Buoy Data

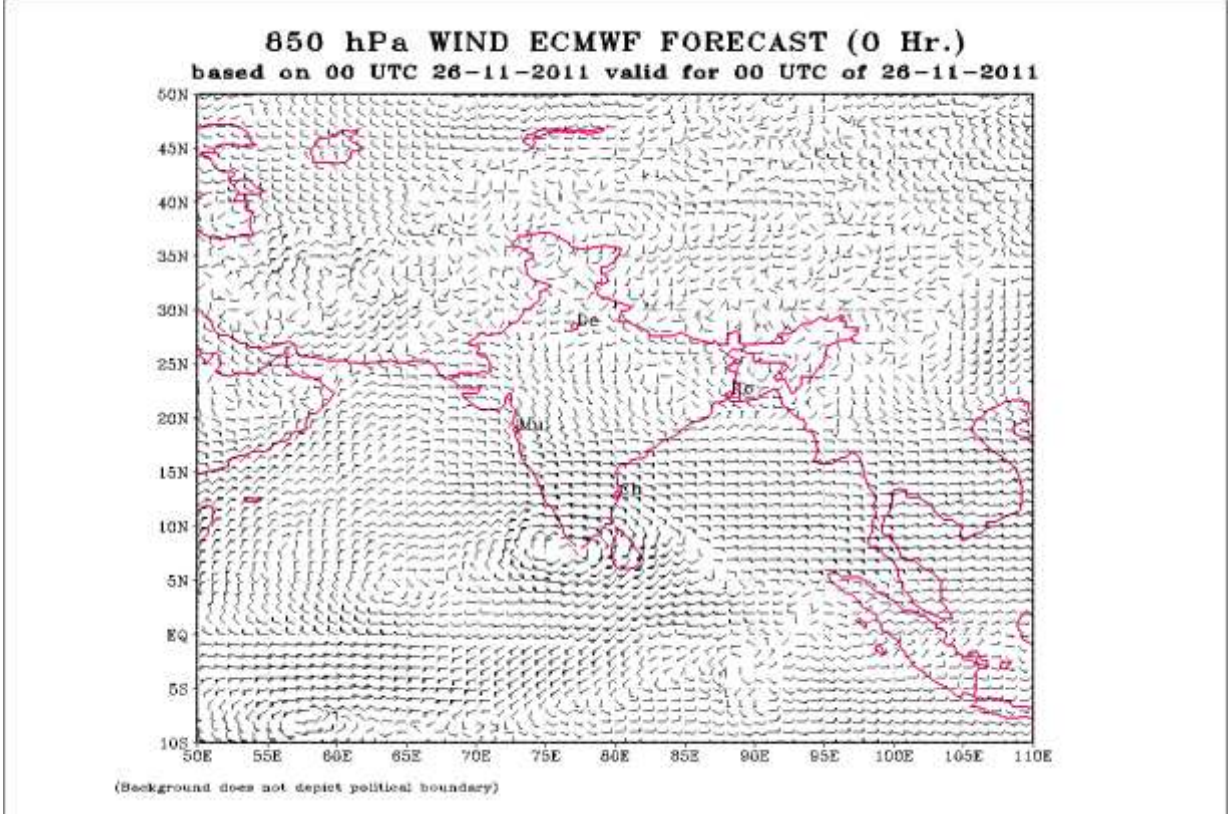
25/12	26/00	26/03
10	09	11

Annexure – II

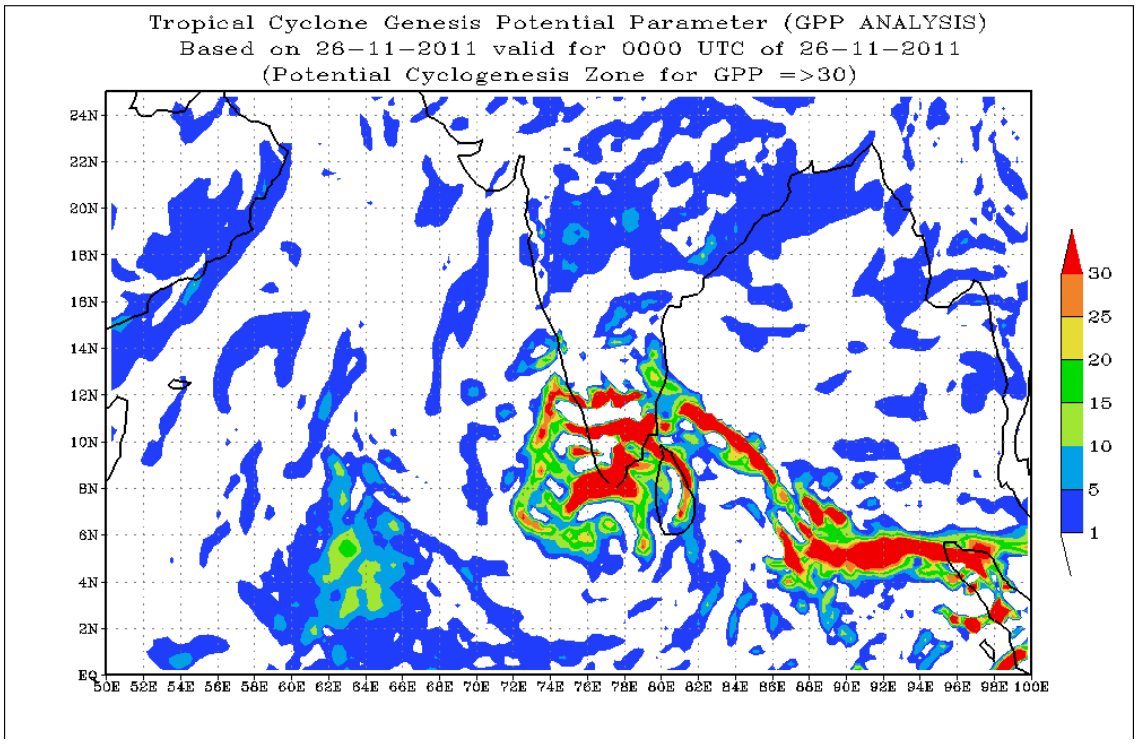

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 26-11-2011 valid for 00 UTC of 26-11-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
(Background does not depict political boundary)

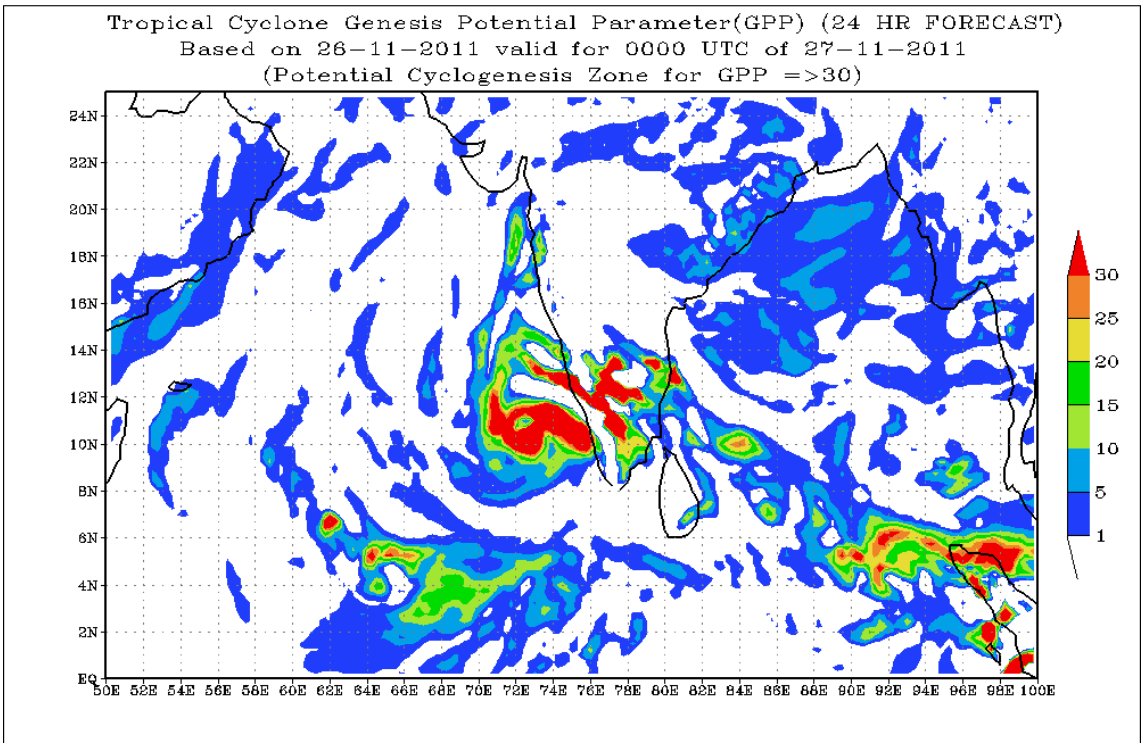

Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 26-11-2011 valid for 00 UTC of 26-11-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
12
8
4
2
-2
-4
-8
(Background does not depict political boundary)

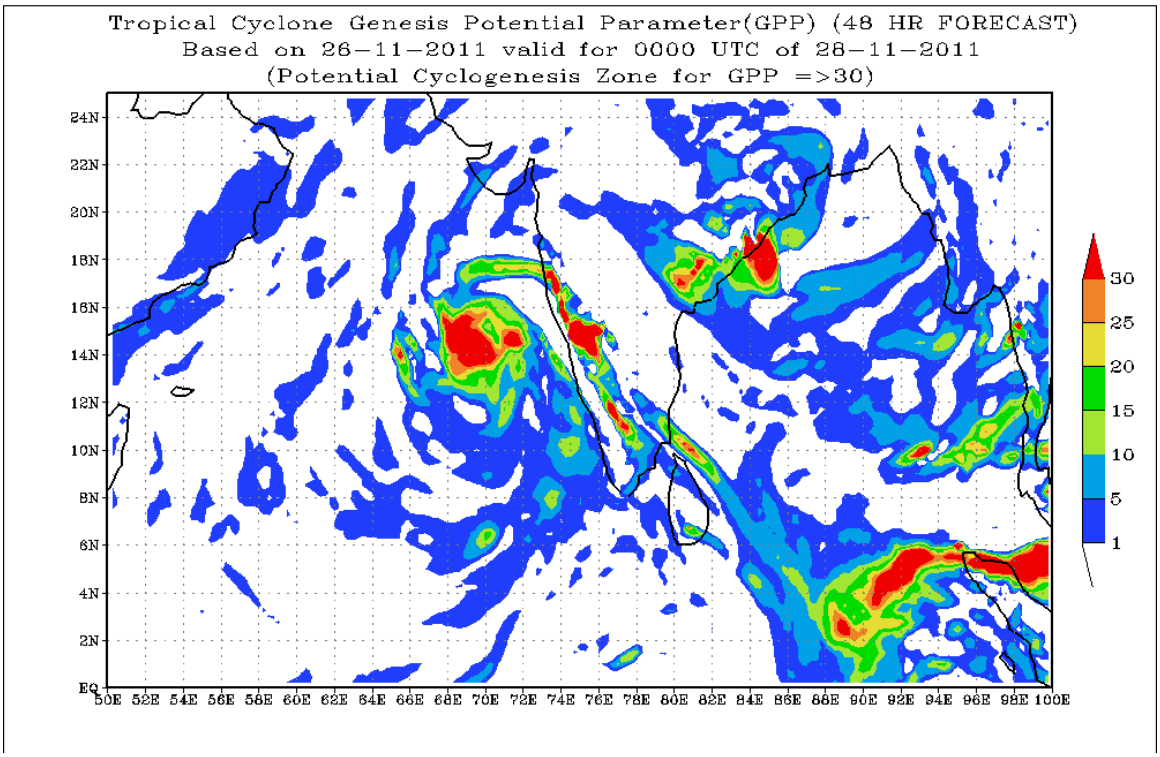


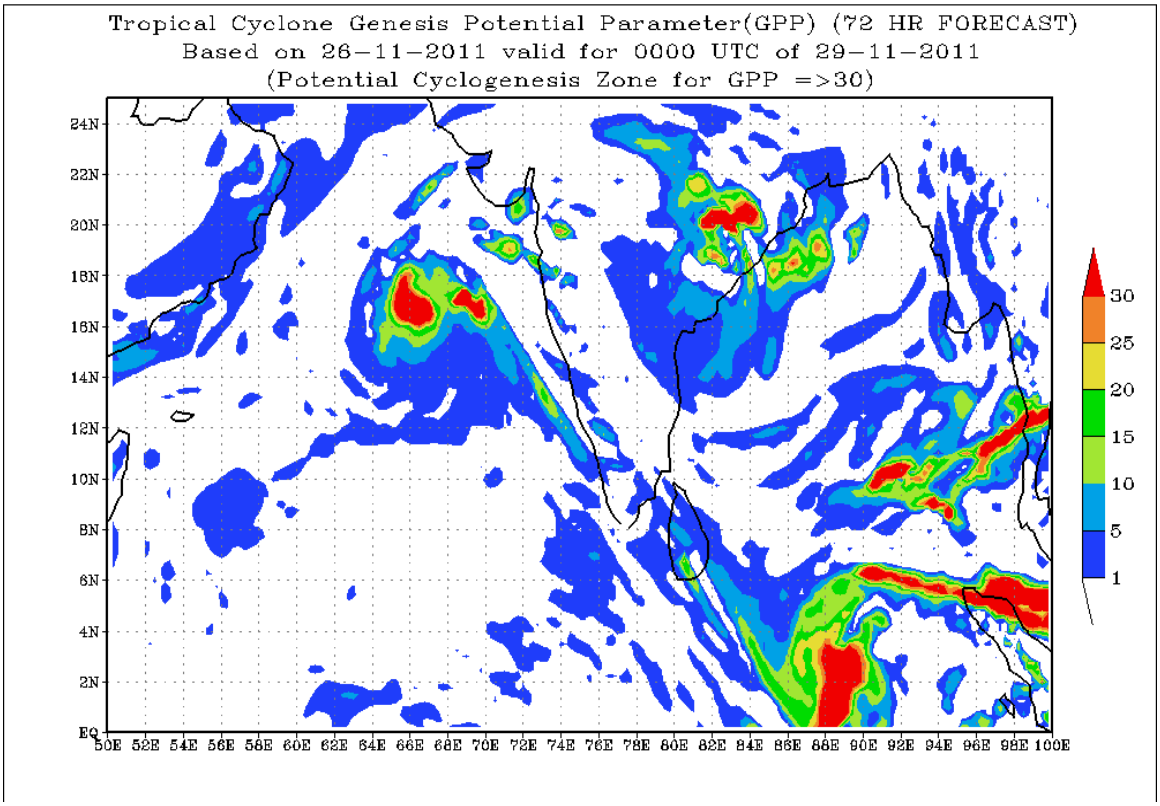


ANNEXURE-III


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 26-11-2011 valid for 0000 UTC of 26-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 26-11-2011 valid for 0000 UTC of 27-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 26-11-2011 valid for 0000 UTC of 28-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 26-11-2011 valid for 0000 UTC of 29-11-2011
(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
1

Synoptic features based on 0300 UTC:

- Yesterday's well marked low pressure area over Comorin & neighbourhood lies over Lakshadweep area & neighbourhood near latitude 11.0^0N and longitude $72.5.^0$E, close to Amini Divi (Lakshadweep Island) at 0300 UTC of today, the 27th November 2011,.
- Estimated central pressure is 1000 hPa at 260300 UTC.
- Associated maximum sustained surface wind is about 25 knots
- 24 hrs. pressure tendency is negative (upto 8 hPa) over Lakshadweep area.
- Pressure departure from normal is negative over south peninsula and Lakshadweep. The maximum departure is -15.6 hPa over Amini Divi.
- The upper tropospheric ridge roughly runs along 17^0 N at 200 hPa over Bay of Bengal in association with anti-cyclonic circulation over north Andhra Pradesh and neighbourhood.
- The easterlies are stronger with speed reaching 20 to 30 knots over south peninsula at 0.9 km above mean Sea level.
- Buoys data show that SST around $28\text{-}29^0$ C over Bay of Bengal and $27\text{-}28^0$ C over Arabian Sea.

Environmental parameters:

Sea Surface Temperature:

- SST is around $29\text{-}30^0$C over central & south Bay of Bengal. It is about $28\text{-}29^0$ C over east Arabia Sea and $26\text{-}27^0$ C over west Arabian Sea.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} over north & central Bay of Bengal 40-60 KJ cm^{-2}. It is about 70 KJ cm^{-2} over east Arabian Sea and < 40 KJ cm^{-2} over west Arabian Sea

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of $10\text{-}20*10^{-5}$ s^{-1} over southwest Bay of Bengal, Comorin area and adjoining Arabian Sea

Convergence:

- Lower level convergence zone (of order of $10 - 20*10^{-5}s^{-1}$) lies over Lakshadweep area & neighbourhood.

Divergence:

- Upper air divergence is positive of the order of $10 - 20*10^{-5}s^{-1}$ over Comorin area and Lakshadweep area & neighbourhood. There are two maxima oriented in ESE-WNW direction.

Wind Shear:

- Wind Shear of order of 5- 10 knots over westcentral Bay of Bengal.

Wind Shear Tendency:

- Negative of order 5-10 knots over northwest and central Bay of Bengal.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 15.0^{0}N over Bay of Bengal and Arabian Sea.

M.J.O. Index:

- Located over phase 2 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 2, 3 & 4 during next 15 days.
- Dynamical forecast: - MJO located in phase 2 with amplitude greater than 1.0 and moves through phase 2, 3 & 4 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over west Pacific Ocean

Status of observational system:

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

Satellite

FDP cyclone satellite inference 270900 UTC:

BAY OF BENGAL & ANDAMAN SEA: -

Broken low/medium clouds with embedded moderate to intense convection is seen over south Bay of Bengal south of lat 10.5^{0}N extreme southwest Andaman Sea and isolated weak to moderate convection over westcentral Bay of Bengal.

ARABIAN SEA: -

Scattered low/medium clouds with embedded moderate to intense convection over rest eastcentral Arabian Sea rest south Arabian Sea east of long 64.0^{0}E. Broken low/medium clouds with embedded isolated weak to moderate convection over southwest Arabian Sea.

(See ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis based on 0000UTC of today shows depression lay over southeast Arabian Sea as cyclonic storm. The forecast shows the system is likely to move northwestwards and intensify further during next three days and weakening into Deep Depression on day4 and becomes less marked on day5. Analysis of wind at 850 hPa, wind shear, vorticity and Divergence is shown in **Annexure II**.
- **IMD-GFS** model analysis based on 0000 UTC of today shows depression lay over southeast Arabian Sea. The forecast shows the system is likely to move northwestwards into east central Arabian Sea but shows no further intensification in next 72 hours and weakening thereafter.
- **WRF-ARW** model analysis based on 0000 UTC of today shows a depression lay over southeast Arabian Sea and is likely to move northwest during next 3 days. The depression is likely to intensify into a Deep Depression on day1 and cyclonic storm on day2 over the east central Arabian Sea.

- **UKMET** model analysis and forecast based on 0000 UTC of today shows depression lay over southeast Arabian Sea and is likely to move northwest during next 3 days. The forecasts show that the depression is likely to intensify till day3 and weakening thereafter.
  http://www.imd.gov.in/section/nhac/dynamic/welcome.htm
  ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and 24 and 48 hours forecast shows a cell of 30 over southeast Arabian Sea, which is likely to be well organized during next 24 hours, indicating its intensification and move northwestwards into east central Arabian Sea on day2. GPP charts analysis and 24,and 48 hours forecasts are enclosed here with in **Annexure III** **(**http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm**)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- The depression over Lakshadweep area & neighbourhood may intensify into a marginal cyclone over central Arabian Sea. System may then move northwestwards.

Advisory:

- No IOP is required at present.

Annexure-I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	26/12	**27/00**	**27/03**
India	188/205	127/159	189/208
Coastal stations			
WB	10	06	11
Odisha	10	06	11
AP	18	15	18
Tamil Nadu	14	11	13
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	18	17	15
Myanmar	15	14	15
Thailand	1	1	1
Sri Lanka	15	13	16

AWS

Region	Date/Time (UTC)		
	26/12	**27/00**	**27/03**
India	410/616	-/616	-/616
WB	11	4	11
ODS	9	4	10
AP	18	17	18
TN	13	10	13
PDC	0	0	0

- **RS/RW** (12Z) of 26 -11-2011: 7/39
- **No. of Ascents reaching 250 hPa levels:3, MISDA:-32**
- **RS/RW** (00Z) of 27 -11-2011: 33/39
- **No. of Ascents reaching 250 hPa levels 20, MISDA: 6**

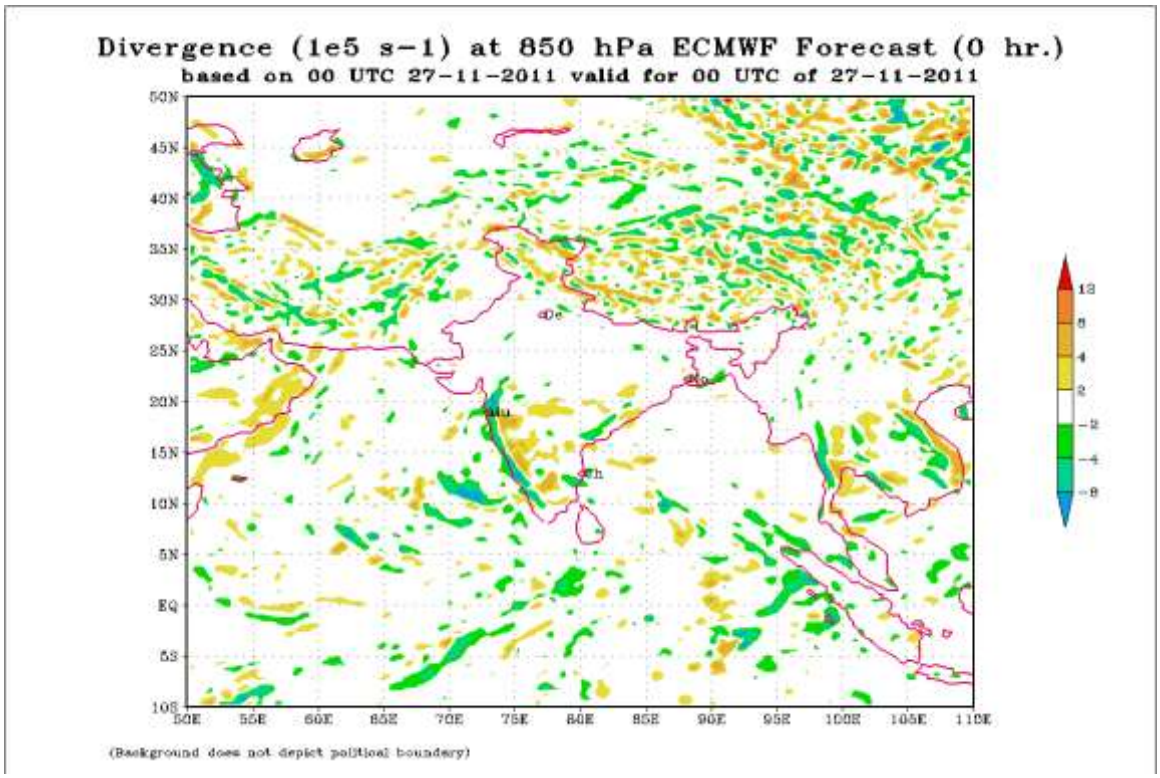
No. of PILOT Ascents

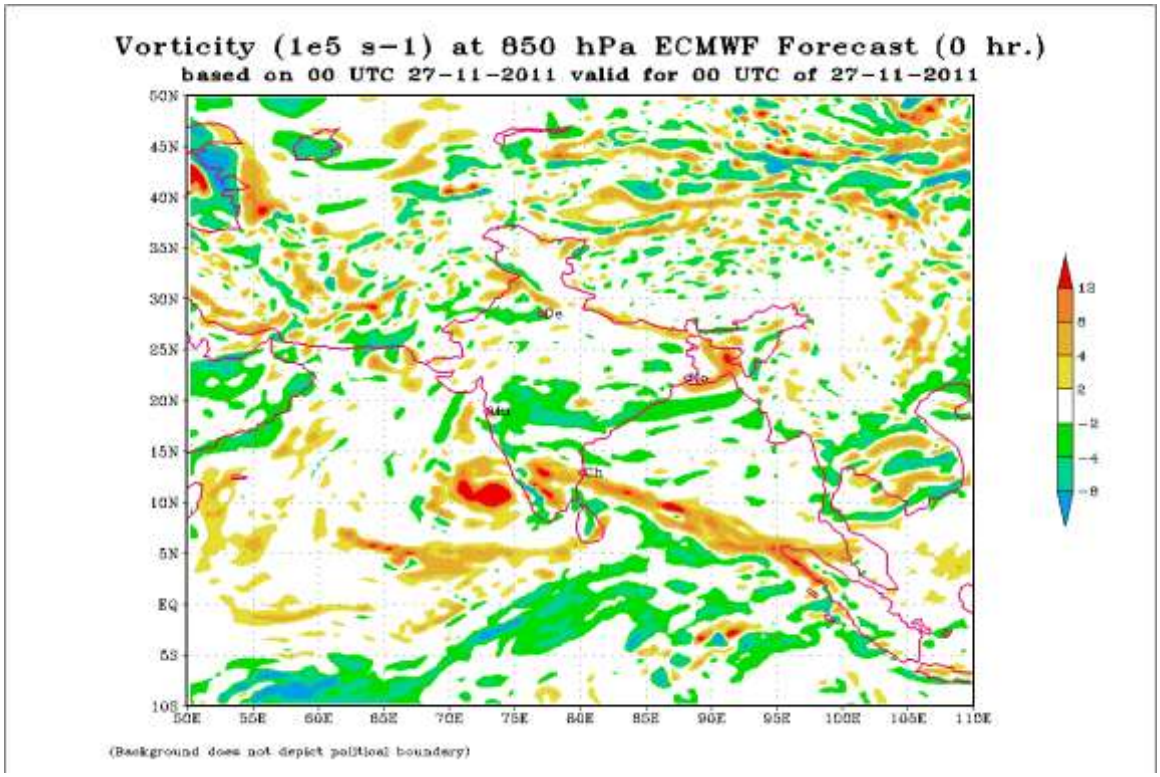
26/12Z	**27/00Z**
14/37	15/34

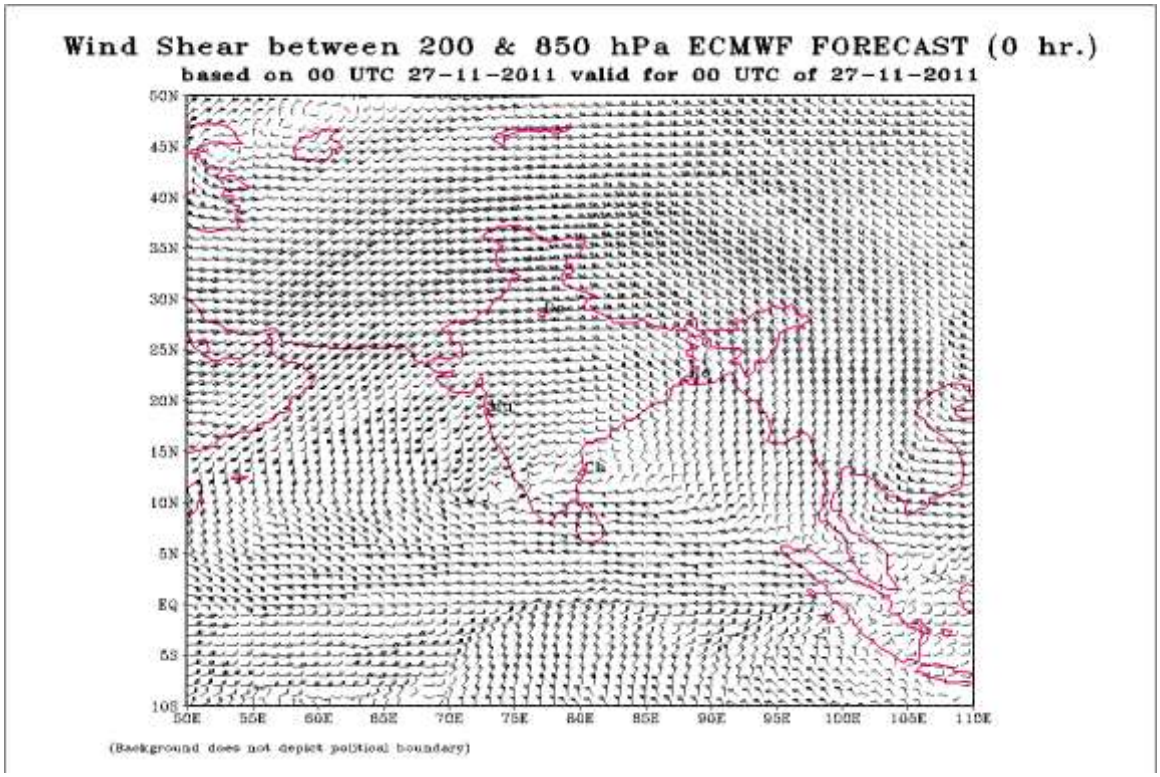
Buoy Data

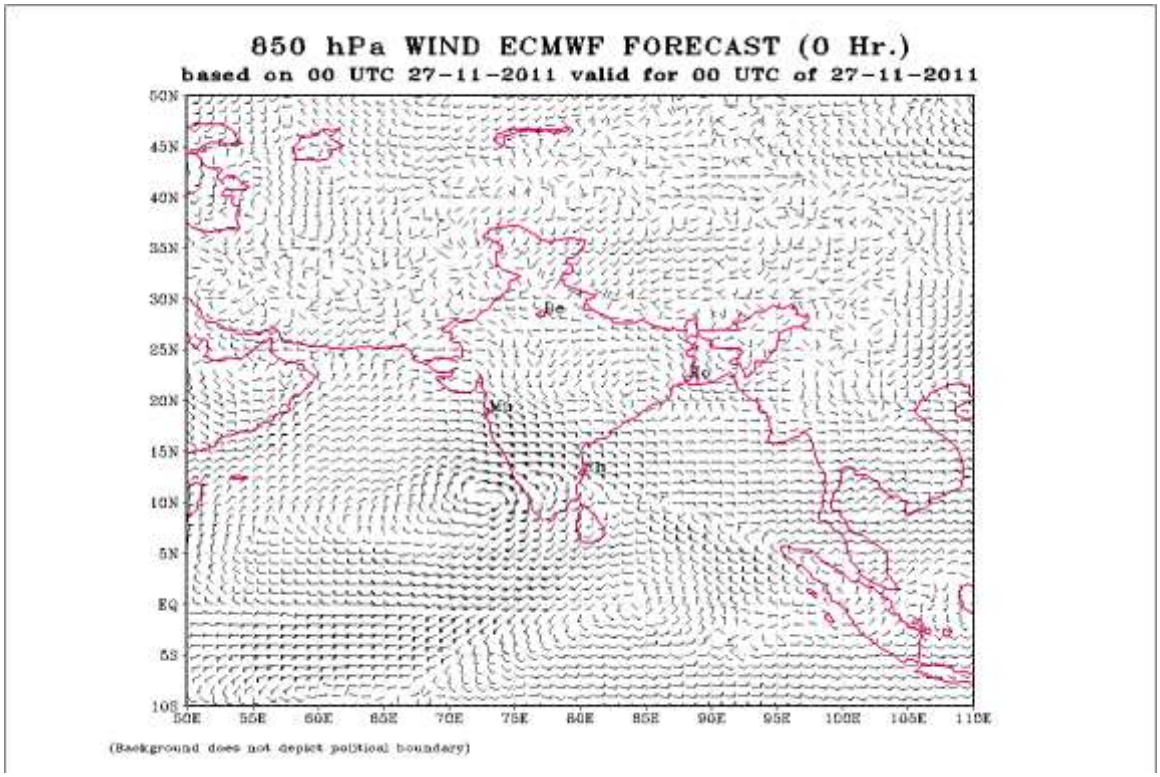
26/12	**27/00**	**27/03**
13	12	14

Annexure II


Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 27-11-2011 valid for 00 UTC of 27-11-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
13
8
4
2
−2
−4
−8
(Background does not depict political boundary)

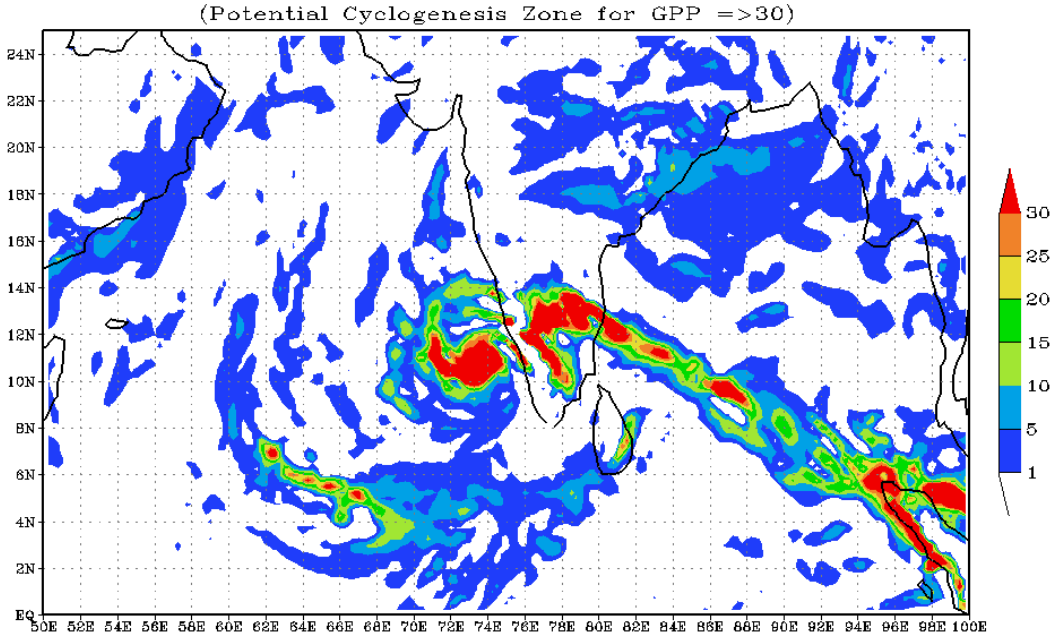

Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 27-11-2011 valid for 00 UTC of 27-11-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
13
8
4
2
−2
−4
−8
(Background does not depict political boundary)



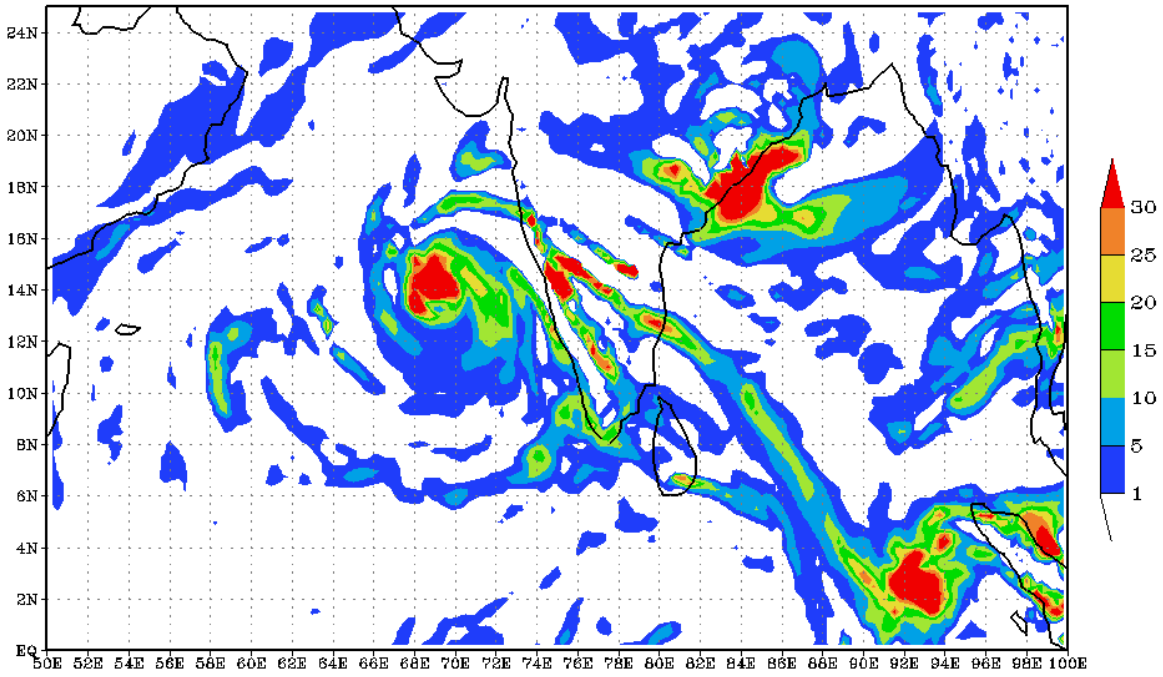


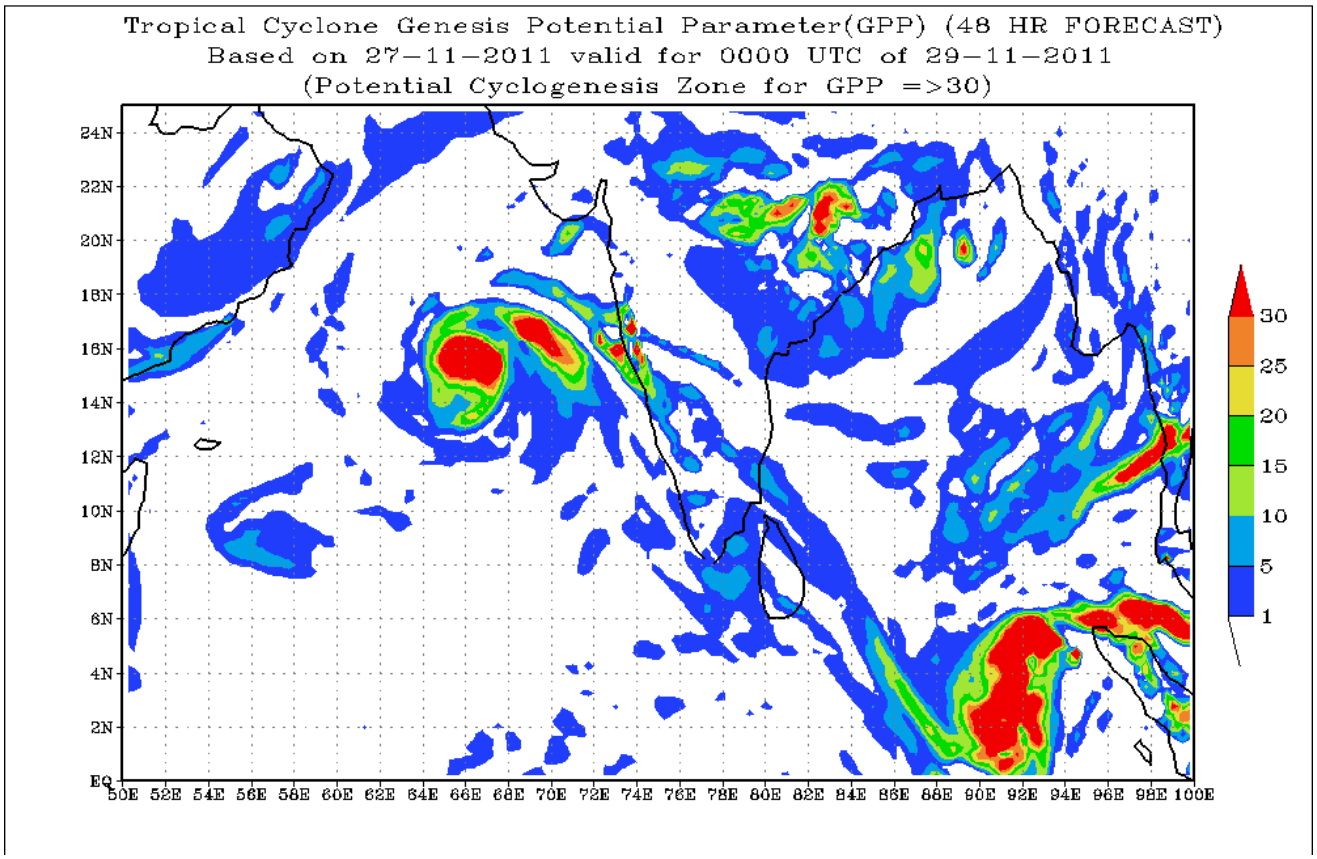
Annexure III

Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 27-11-2011 valid for 0000 UTC of 27-11-2011
(Potential Cyclogenesis Zone for GPP =>30)



Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 27-11-2011 valid for 0000 UTC of 28-11-2011
(Potential Cyclogenesis Zone for GPP =>30)




Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 27-11-2011 valid for 0000 UTC of 29-11-2011
(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
1

FDP (Cyclone) NOC Report Dated 28th November, 2011

Synoptic features based on 0300 UTC:

- Yesterday's depression over Lakshadweep area & neighbourhood moved northwest wards and intensified into deep depression at 0000 UTC of today, the 28th November 2011 and at 0300 UTC lay centred near latitude 14.0^0N and longitude 69.5^0E
- 24 hrs. pressure tendency is negative (around 1 to 2 hPa) along east coast and west coast of India.
- Pressure departure from normal is negative over east coast (around 2 to 3 hPa) and over west coast (around 4 to 6 hPa).
- Buoys data show that SST around $28\text{-}29^0$ C over Bay of Bengal and Arabian Sea.

Environmental parameters:

Sea Surface Temperature:

- SST is around $28\text{-}30^0$C over central & south Bay of Bengal and east central Arabian Sea.

Ocean thermal energy:

- Ocean thermal energy over south Bay of Bengal is between 80-100 KJ cm^{-2} over north & central Bay of Bengal 40-60 KJ cm^{-2}. It is about 70 KJ cm^{-2} over eastcentral Arabian Sea and < 40 KJ cm^{-2} over west Arabian Sea

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of $25\text{-}50*10^{-5}$ s^{-1} over southwest Bay of Bengal, Comorin area and $100*10^{-5}$ s^{-1} over eastcentral Arabian Sea

Convergence:

- Lower level convergence (of order of $5*10^{-5}s^{-1}$) over south Bay of Bengal and of order of$20\text{-}30*10^{-5}s^{-1}$ over eastcentral Arabian Sea..

Divergence:

- Upper air divergence is positive of the order of $5\text{-}10*10^{-5}s^{-1}$ over south Andaman Sea and $20\text{-}30*10^{-5}s^{-1}$ over east central Arabian Sea.

Wind Shear:

- Wind Shear of order of 10-20 knots over central & south Bay of Bengal. and 20-30 knots over central Arabian Sea.

Wind Shear Tendency:

- Negative of order 5-10 knots over northwest and central Bay of Bengal and positive. of order 10-20 knots over southwest Bay of Bengal.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 18.0^0N over Bay of Bengal and Arabian Sea.

M.J.O. Index:

- Located over phase 3 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 4 & 5 during next 15 days.
- Dynamical forecast: - MJO located in phase 3 with amplitude greater than 1.0 and moves through phase 4 & 5 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over west Pacific Ocean

Status of observational system:

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

Satellite

FDP cyclone satellite inference 280900 UTC:

BAY OF BENGAL & ANDAMAN SEA: -

Broken low/medium clouds with embedded moderate to intense convection is seen over southwest and adjoining westcentral Bay of Bengal. scattered low/medium clouds with embedded weak convection over southeast Bay of Bengal.

Arabian Sea: -

Vortex over eastcentral Arabian Sea centered near 14.4^0N/68.3^0E. Intensity is T2.0 . Associated broken intense to very intense convection seen over area bet lat 13.0^0N to 21.0^0N long 61.0^0E to 71.5^0E and mod to intense convection seen over Lakshadweep and rest east central Arabian Sea & adjoining west central Arabian Sea. Minimum cloud top temperature is minus 93 deg c (.)

(see ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis based on 0000UTC of today shows deep depression lay over east central Arabian Sea. The forecast shows the deep depression is further likely to move westwards on day1 and day2 into west central Arabian Sea. This is likely to dissipate over Sea on day3.

- **IMD-GFS** model analysis based on 0000 UTC of today shows depression lay over east central Arabian Sea. The forecast shows the system is likely to move westwards into west central Arabian Sea during next 48 hours and further weaken over Sea.

- **WRF-ARW** model analysis based on 0000 UTC of today shows a deep depression lay over east central Arabian Sea and is likely to move west northwestwards during next 3 days. The deep depression is likely to intensify into a cyclone storm.

- **UKMET** model analysis and forecast based on 0000 UTC of today shows deep depression lay over east central Arabian Sea and that is likely to

intensify to cyclonic storm moving westwards during next 48 hours over west central Arabian Sea. This is likely to weaken over Sea during next 72 hours.

http://www.imd.gov.in/section/nhac/dynamic/welcome.htm
ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and 24, 48 and 72 hours forecast a cell of 30 over East Central Arabian Sea, which is likely move westwards into west central Arabian Sea during next 2 days and disorganize on day3 over Sea. GPP charts analysis and 24, 48 and 72 hours forecasts are enclosed here with in **Annexure III**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- The deep depression over eastcentral Arabian Sea is likely to intensify into a cyclonic storm and move west-northwestwards towards Oman coast during next 72 hrs..

Advisory:

- No significant weather system over Bay of Bengal.
- No IOP is required at present.

Annexure-I

Status of Observation system:

Synop

Region	Date/Time (UTC)		
	27/12	**28/00**	**28/03**
India	189/205	124/159	190/208
Coastal stations			
WB	10	06	11
Odisha	09	06	08
AP	18	17	18
Tamil Nadu	13	10	13
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	18	17	19
Myanmar	17	16	17
Thailand	1	1	1
Sri Lanka	14	12	14

AWS

Region	Date/Time (UTC)		
	27/12	**28/00**	**28/03**
India	447/616	481/616	395/616
WB	21	20	21
ODS	27	26	27
AP	33	32	33
TN	26	26	27
PDC	0	0	0

- **RS/RW** (12Z) of 27 -11-2011: 9/39
- **No. of Ascents reaching 250 hPa levels:3, MISDA:-30**
- **RS/RW** (00Z) of 28 -11-2011: 32/39
- **No. of Ascents reaching 250 hPa levels 20, MISDA: 7**

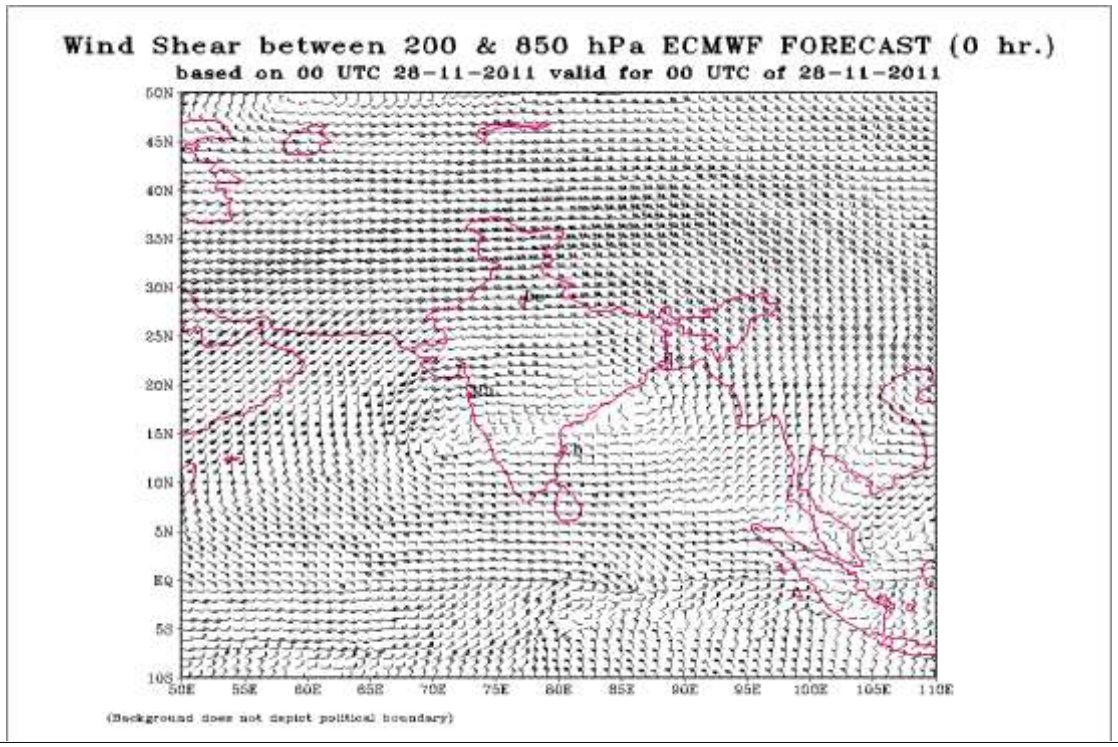
No. of PILOT Ascents

27/12Z	28/00Z
14/37	14/34

Buoy Data

27/12	28/00	28/03
14	09	13

ANNEXURE-II


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 28-11-2011 valid for 00 UTC of 28-11-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
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95E
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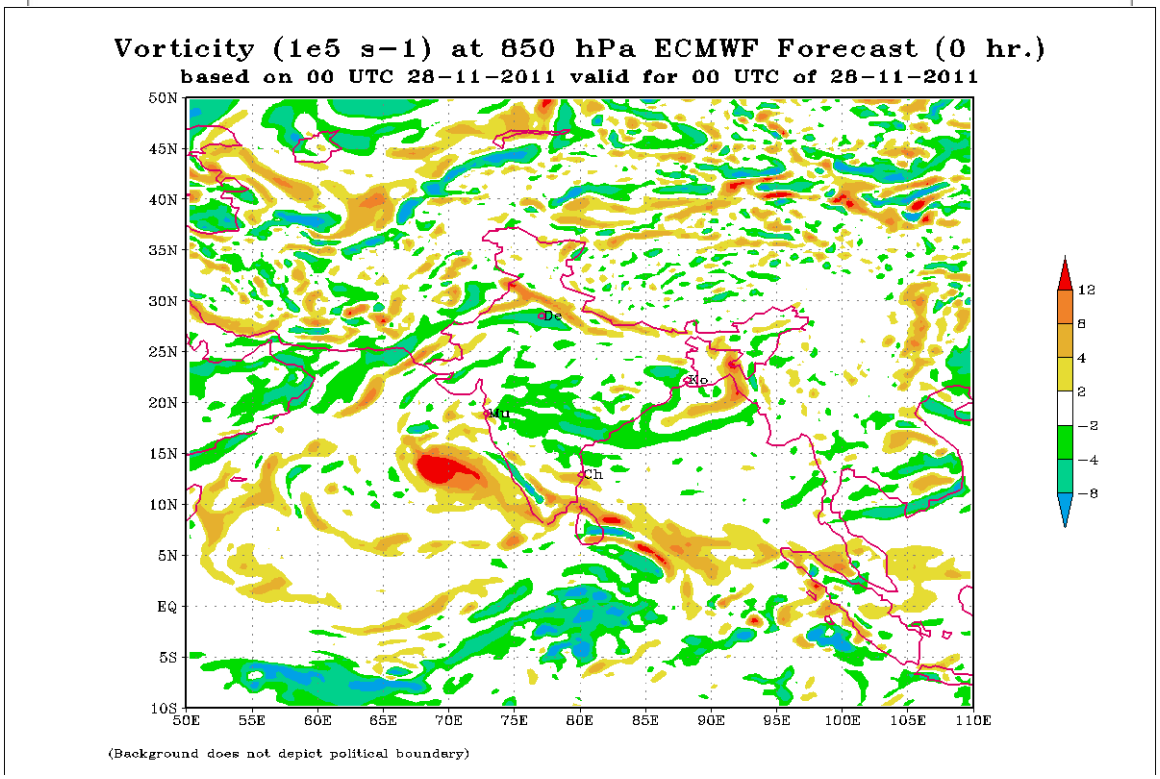
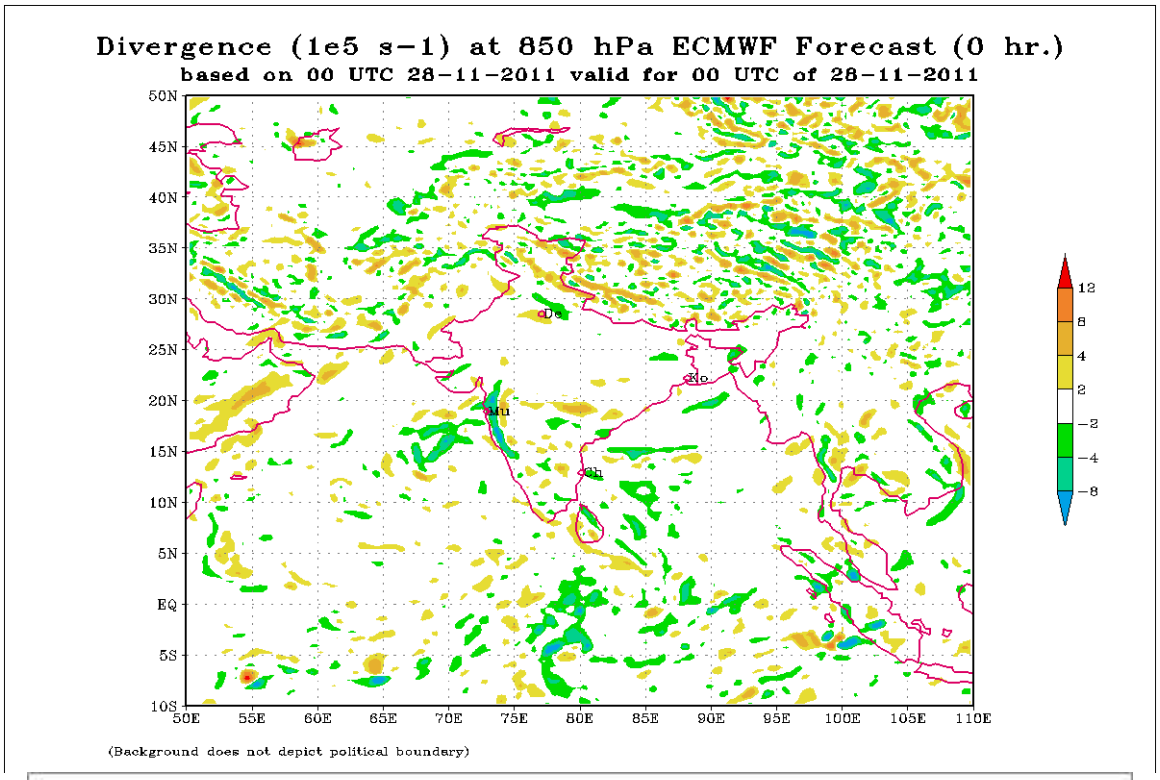
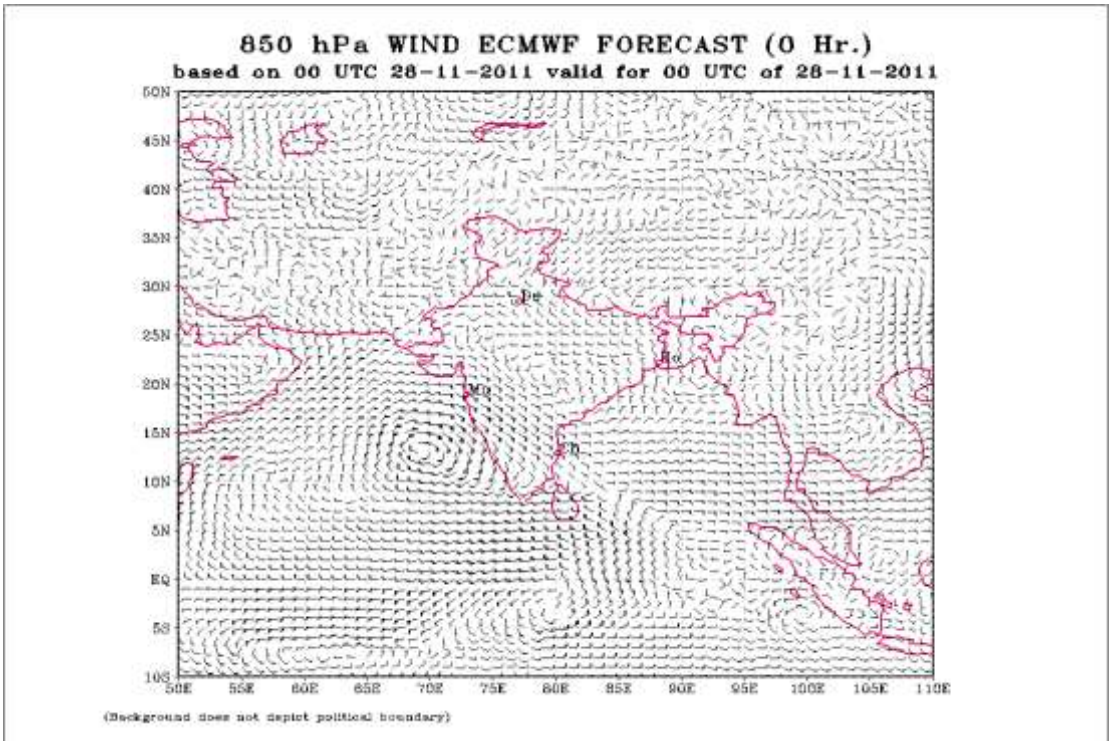
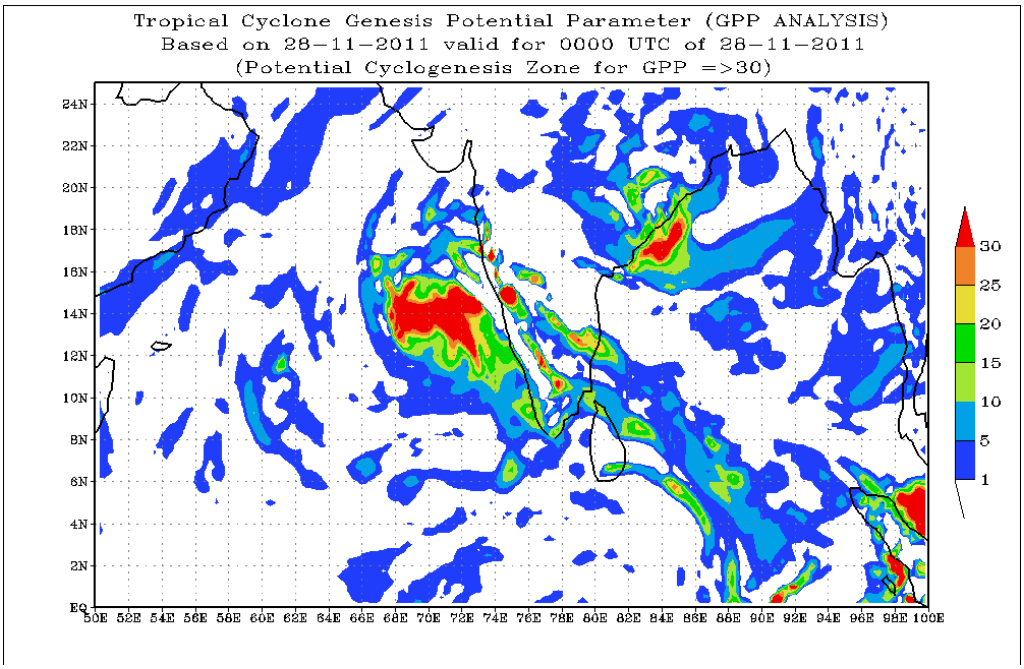
105E
110E
(Background does not depict political boundary)

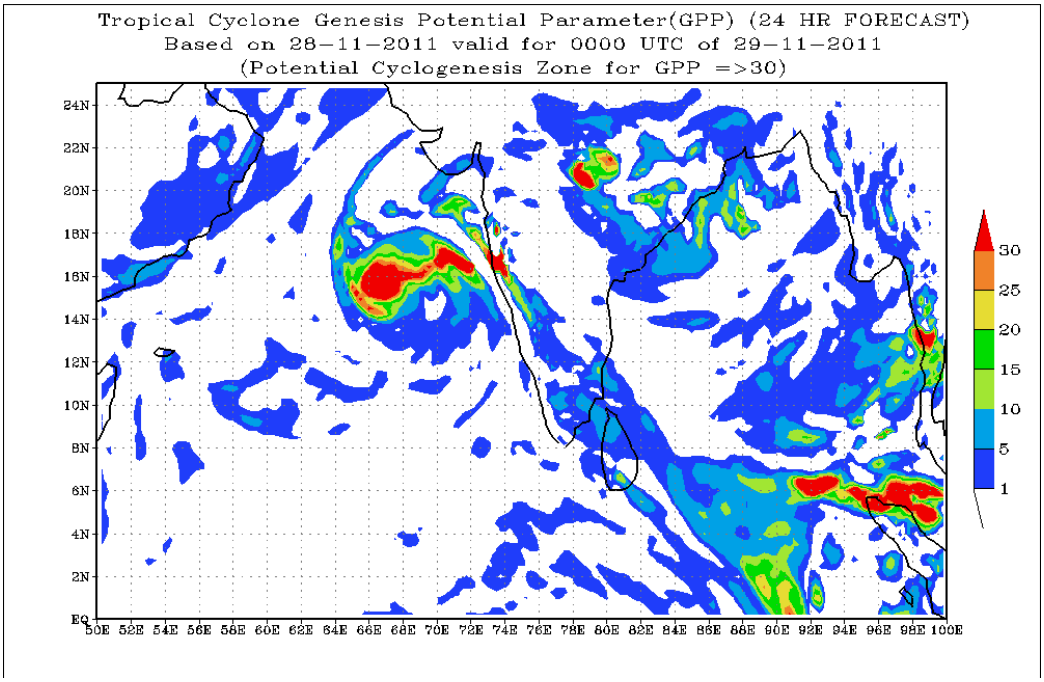

Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 28-11-2011 valid for 00 UTC of 28-11-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
12
8
4
2
-2
-4
-8
(Background does not depict political boundary)

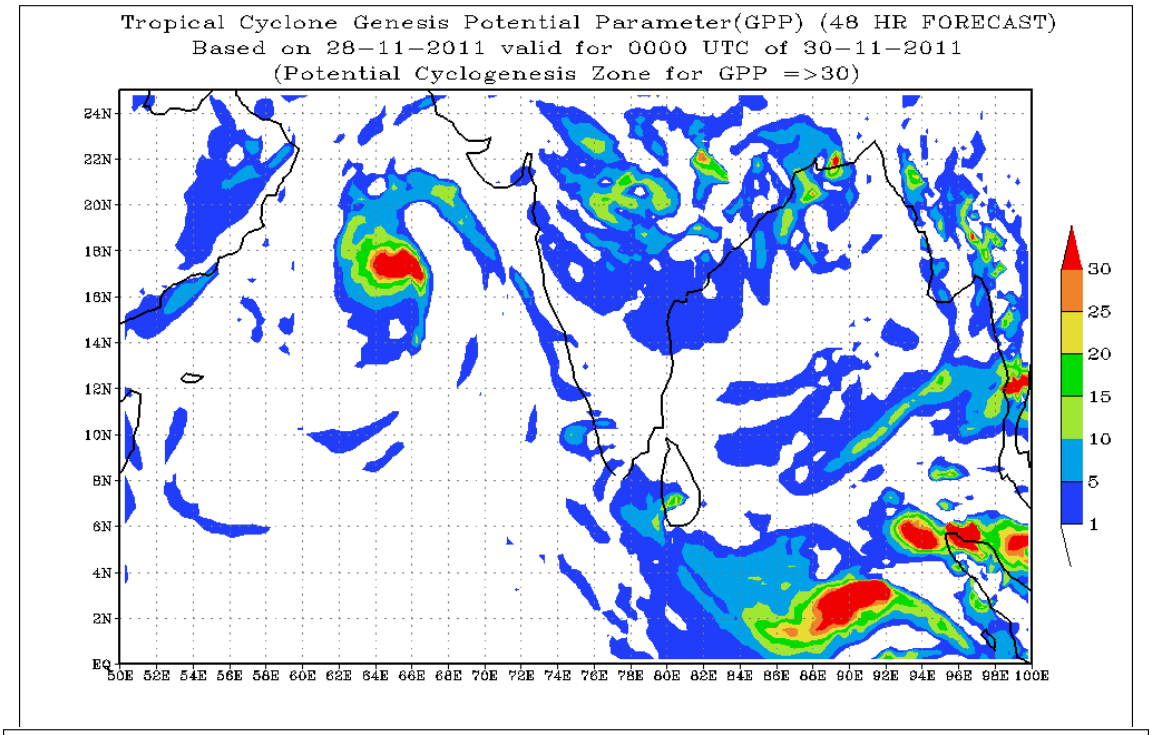




ANNEXURE-III


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 28-11-2011 valid for 0000 UTC of 28-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 28-11-2011 valid for 0000 UTC of 29-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 28-11-2011 valid for 0000 UTC of 30-11-2011
(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
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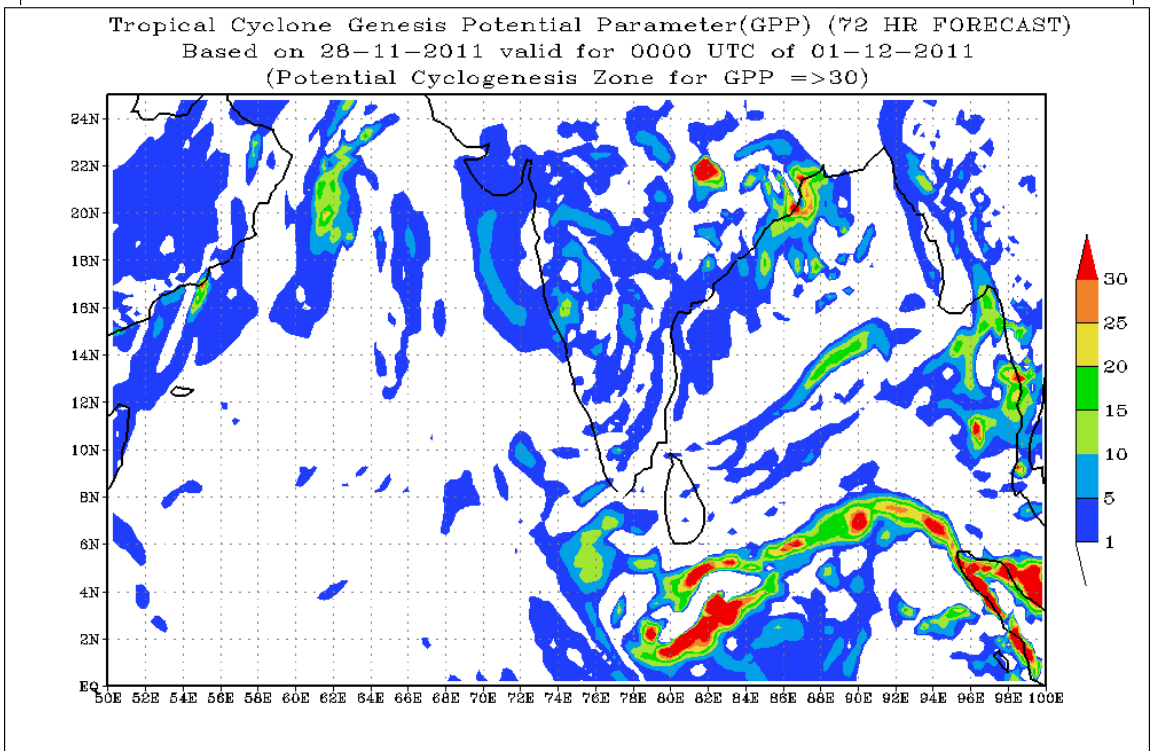
Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 28-11-2011 valid for 0000 UTC of 01-12-2011
(Potential Cyclogenesis Zone for GPP =>30)
24N
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18N
16N
14N
12N
10N
8N
6N
4N
2N
EQ
50E 52E 54E 56E 58E 60E 62E 64E 66E 68E 70E 72E 74E 76E 78E 80E 82E 84E 86E 88E 90E 92E 94E 96E 98E 100E
30
25
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15
10
5
1

Synoptic features based on 0300 UTC:

- Yesterday's deep depression over eastcentral Arabian Sea moved slightly west-northwestwards and lay centred at 0830 hrs. IST of today, the 29th November 2011 near latitude 15.7^0 N and longitude 66.8^0 E, 750 km southwest of Mumbai, 750 km west of Goa, 1000 km southeast of Masirah(Oman).).
- 24 hrs. pressure tendency shows no significant change along east coast and Andaman Nicobar Islands, Bangladesh and Myanmar.
- Pressure departure from normal is negative over east coast (around 2 to 3 hPa).
- Buoys data show that SST around $28\text{-}29^0$ C over Bay of Bengal.

Environmental parameters:

Sea Surface Temperature:

- SST is around $28\text{-}30^0$C over central & south Bay of Bengal and east central Arabian Sea.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of $25\text{-}50*10^{-5}$ s^{-1} over south Bay of Bengal and $10.0*10^{-4}$ s^{-1} at the system area over eastcentral Arabian Sea.

Convergence:

- Lower level convergence (of order of $5*10^{-5}s^{-1}$) over southwest Bay of Bengal and of order of $5\text{-}10*10^{-5}s^{-1}$ over eastcentral Arabian Sea.

Divergence:

- Upper air divergence is positive of the order of $5*10^{-5}s^{-1}$ over south Bay of Bengal and Andaman Sea.

Wind Shear:

- Wind Shear of order of 10-20 knots over Bay of Bengal. and 20-40 knots over central Arabian Sea.

Wind Shear Tendency:

- Positive order of 10-20 knots over northwest and central Bay of Bengal and central Arabian Sea.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 20.0^0N over Bay of Bengal and Arabian Sea.

M.J.O. Index:

- Located over phase 3 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 4, 5 & 6 during next 15 days.
- Dynamical forecast: - MJO located in phase 3 with amplitude greater than 1.0 and moves through phase 4 & 5 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over west Pacific Ocean

Status of observational system:

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

Satellite

FDP cyclone satellite inference 280900 UTC:

BAY OF BENGAL & ANDAMAN SEA: -

Scattered low/medium clouds with embedded isolated weak to convection over southwest Bay of Bengal and adjoining westcentral Bay and south Andaman Sea.

Arabian Sea: -

Scattered low/medium clouds with embedded moderate to intense convection over Arabian Sea. Scattered low/medium clouds with embedded isolated weak to moderate convection over south Arabian Sea east of Long 60.0^0E.

(see ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis based on 0000UTC of today shows the Deep Depression lay over east central Arabian Sea. The forecast shows the system is likely to move west northwestwards during next 72 hours and weaken into LOW on day3 over the West central Arabian Sea. The Divergence, Vorticity, Wind shear and Wind analysis at 850 hPa are enclosed here with in **Annexure II.**

- **IMD-GFS** model analysis based on 0000 UTC of today shows the Deep Depression lay over east central Arabian Sea. The forecast shows the system is likely to move westwards into west central Arabian Sea during next 48 hours and dissipate over Sea on day3.

- **WRF-ARW** model analysis based on 0000 UTC of today shows the Deep Depression lay over east central Arabian Sea and is likely to move westwards during next 3 days. The deep depression is likely to weaken into a LOW on day3 over the west central Arabian Sea.

- **UKMET** model analysis and forecast based on 0000 UTC of today shows the Deep Depression lay over east central Arabian Sea and is likely to intensify to cyclonic storm and move north westwards during next 48 hours. The system is likely to weaken over west central Arabian on day3.

http://www.imd.gov.in/section/nhac/dynamic/welcome.htm
ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and 24, 48 and 72 hours forecasts show an organized cell of 30 over East Central Arabian Sea, which is likely move northwestwards into west central Arabian Sea during next 2 days and disorganize on day3 over Sea. GPP charts analysis and 24, 48 and 72 hours forecasts are enclosed here with in **Annexure III.**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- The deep depression over eastcentral Arabian Sea is likely to move west-northwestwards towards Oman coast during next 48 hrs.. and weaken gradually
- Easterly to northeasterly wind of 10-15 knots would prevail over Bay of Bengal during next 48 hours.

Advisory:

- No significant weather system over Bay of Bengal.
- No IOP is required at present.

Annexure-I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	28/12	**29/00**	**29/03**
India	186/205	127/159	190/208
Coastal stations			
WB	10	05	11
Odisha	09	06	10
AP	18	17	18
Tamil Nadu	13	10	13
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	17	14	16
Myanmar	17	16	17
Thailand	1	1	1
Sri Lanka	17	16	17

AWS

Region	Date/Time (UTC)		
	28/12	**29/00**	**29/03**

India	486/616	532/616	455/616
WB	17	19	04
ODS	28	27	21
AP	32	33	30
TN	26	26	27
PDC	0	0	0

- **RS/RW** (12Z) of 28 -11-2011: 9/39
- **No. of Ascents reaching 250 hPa levels:3, MISDA:-30**
- **RS/RW** (00Z) of 29 -11-2011: 32/39
- **No. of Ascents reaching 250 hPa levels 15, MISDA: 7**

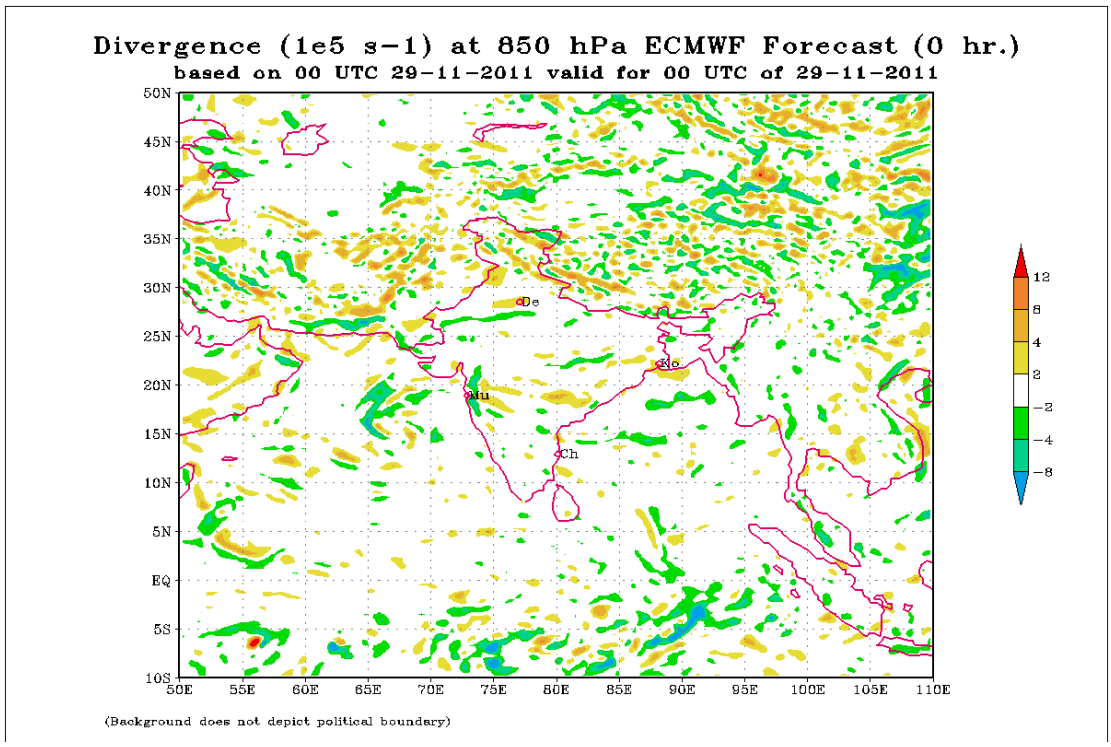
No. of PILOT Ascents

28/12Z	**29/00Z**
15/37	15/34

Buoy Data

28/12	**29/00**	**29/03**
10	12	14

Annexure II


Divergence (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 29−11−2011 valid for 00 UTC of 29−11−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
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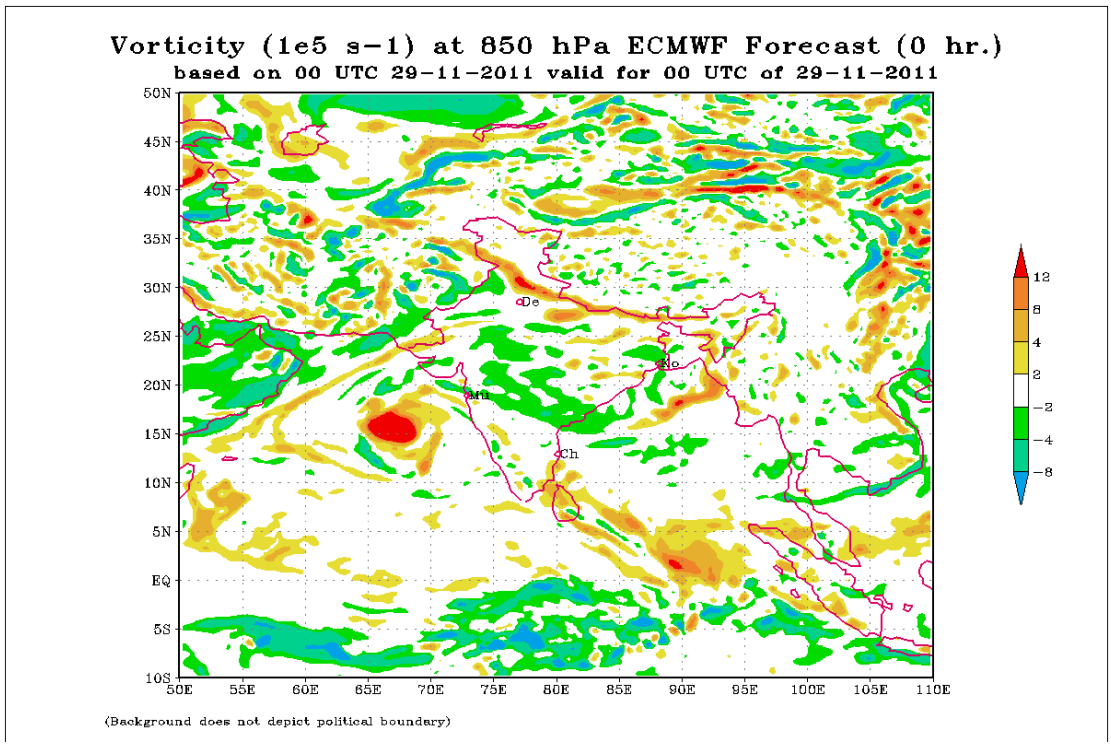
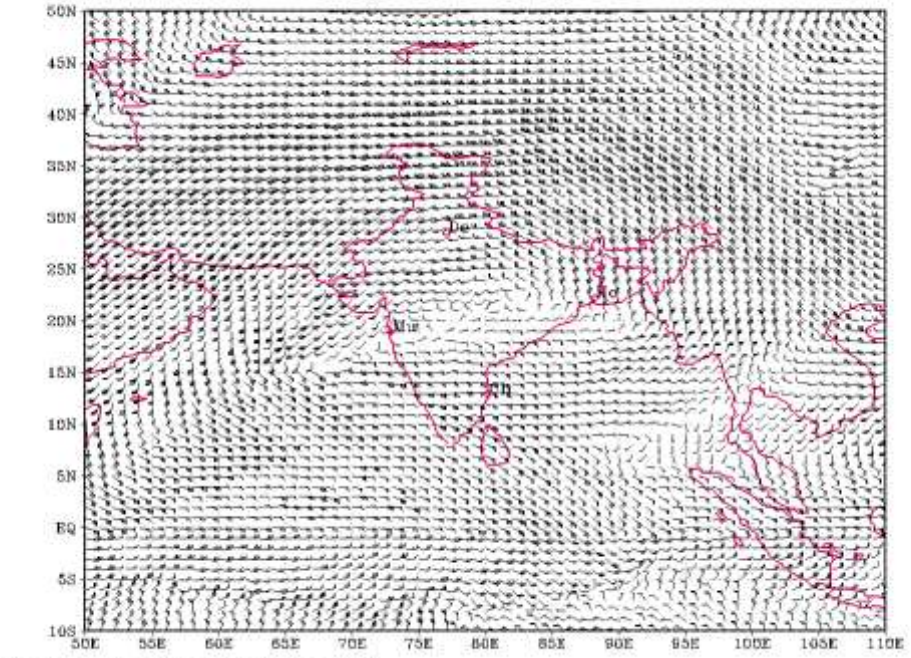
8
4
2
−2
−4
−8
(Background does not depict political boundary)


Vorticity (1e5 s−1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 29−11−2011 valid for 00 UTC of 29−11−2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
65E
70E
75E
80E
85E
90E
95E
100E
105E
110E
De
Mo
Mu
Ch
12
8
4
2
−2
−4
−8
(Background does not depict political boundary)

Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)

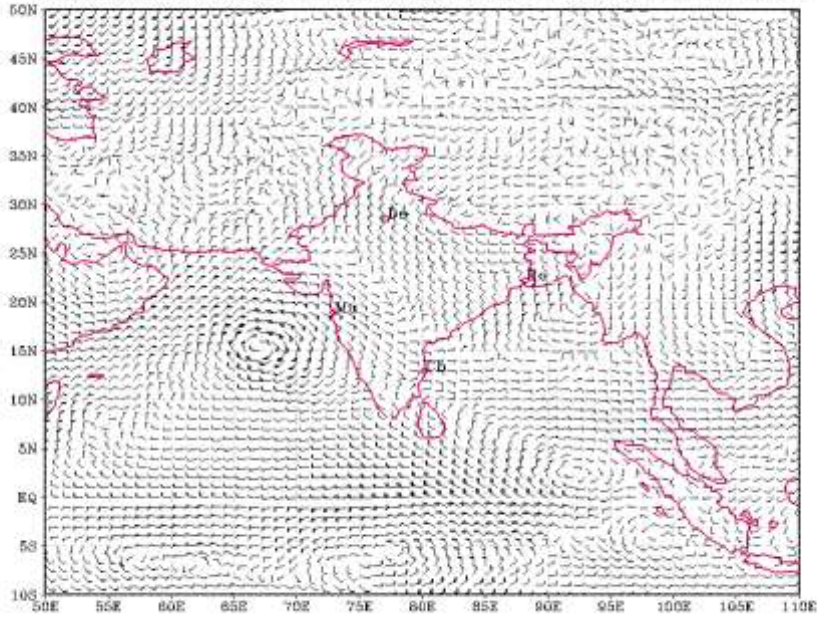
based on 00 UTC 29-11-2011 valid for 00 UTC of 29-11-2011



(Background does not depict political boundary)

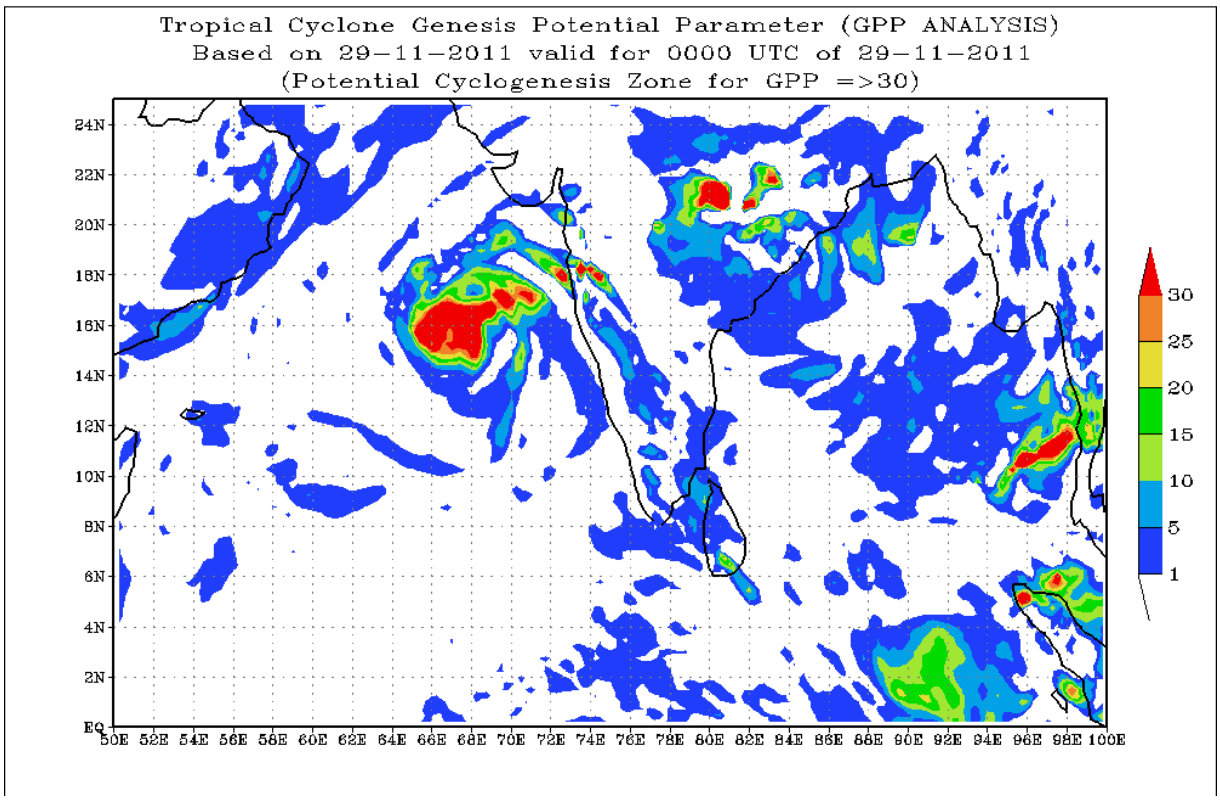
850 hPa WIND ECMWF FORECAST (0 Hr.)

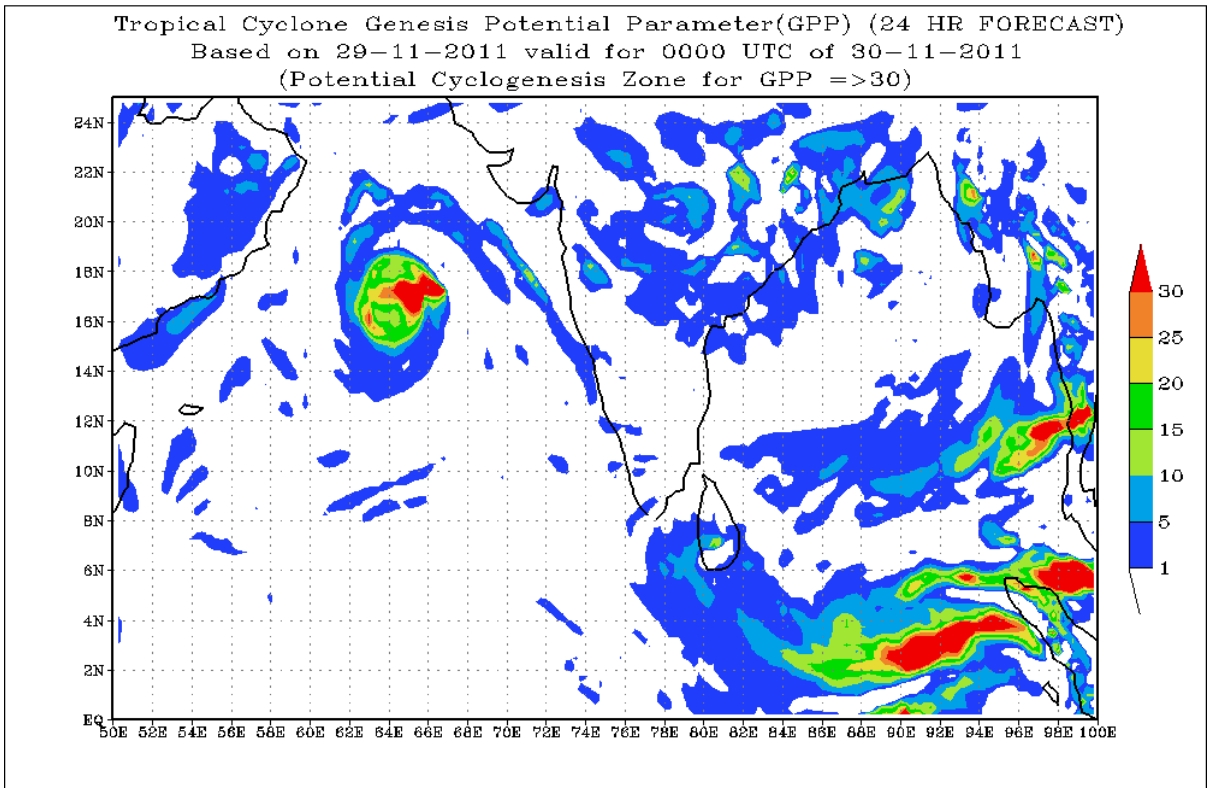
based on 00 UTC 29-11-2011 valid for 00 UTC of 29-11-2011

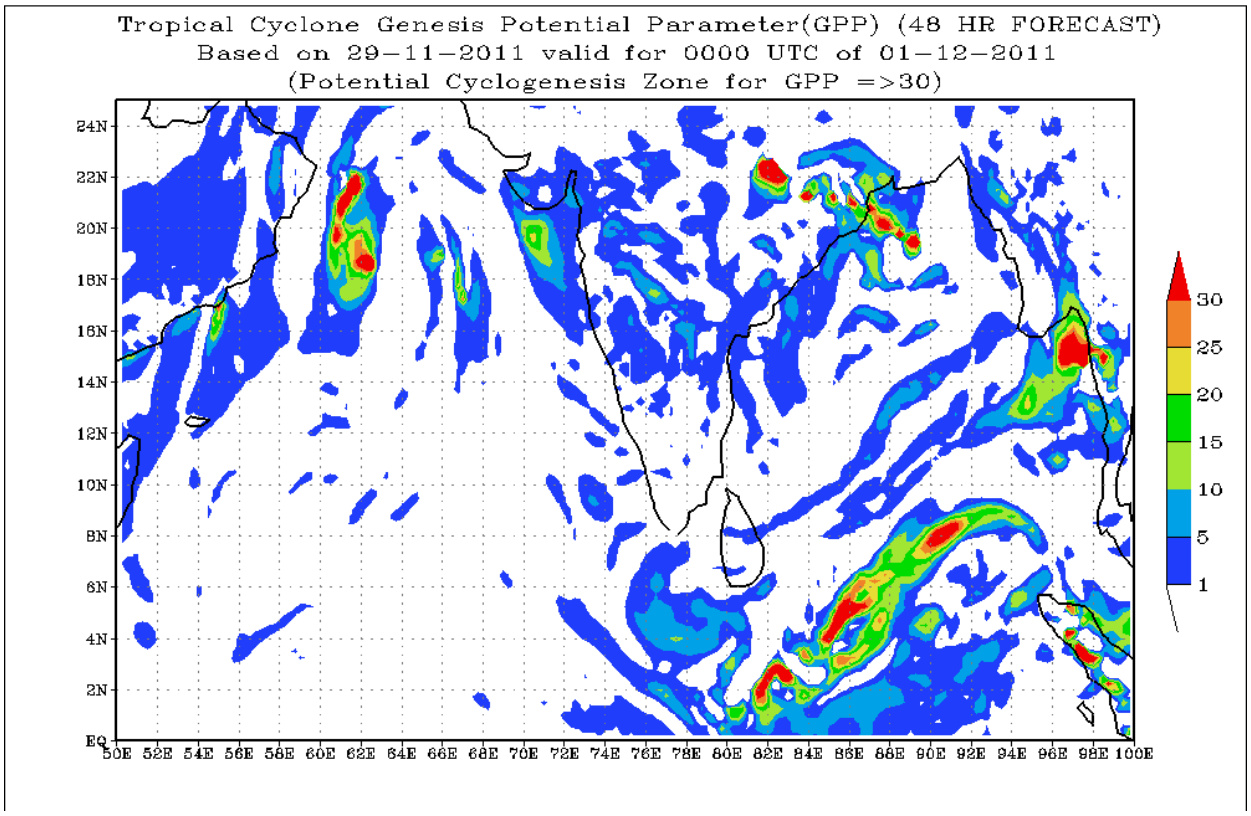


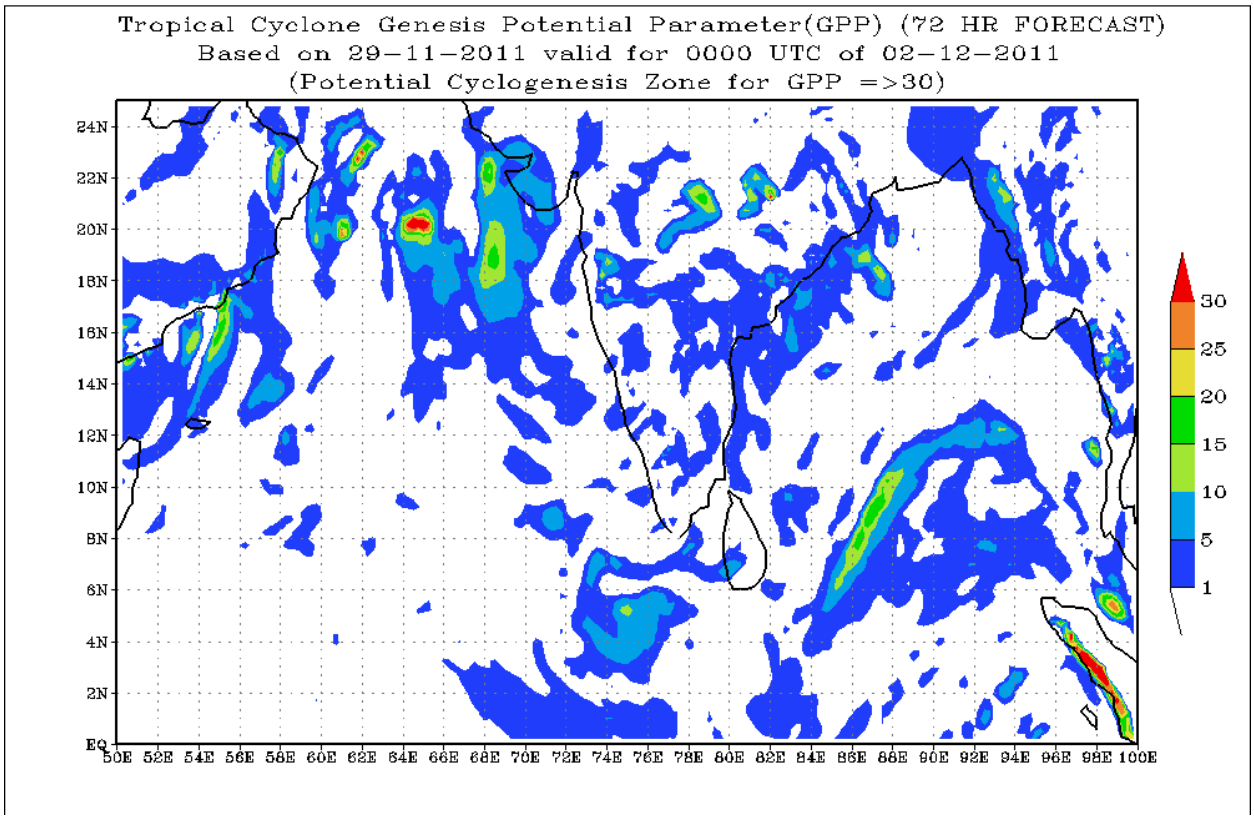
(Background does not depict political boundary)

Annexure-III






Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 29-11-2011 valid for 0000 UTC of 01-12-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 29-11-2011 valid for 0000 UTC of 02-12-2011
(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
1

Synoptic features based on 0300 UTC:

- Yesterday's deep depression weakened into depression at 1730 hrs. IST of 29th November and lay centred at 0830 hrs. IST of today, the 30th November 2011 near latitude 17.0^0 N and longitude 64.0^0 E
- 24 hrs. pressure tendency shows no significant change along eastcoast and Andaman & Nicobar island, Bangladesh and Myanmar coast.
- Pressure departure from normal is negative over east coast (around 2 to 3 hPa)
- Buoys data show that SST around 28-29^0 C over Bay of Bengal and Arabian Sea.

Environmental parameters:

Sea Surface Temperature:

- SST is around 28-30^0C over central & south Bay of Bengal and east central Arabian Sea.

Relative Vorticity:

- Relative Vorticity at 850 hPa is positive of the order of 25-50*10^{-5} s^{-1} over southwest Bay of Bengal and 100*10^{-5} s^{-1} over the depression area.

Convergence:

- Lower level convergence is positive (of order of 5*$10^{-5}s^{-1}$) over southwest Bay of Bengal and of the order of 10-15*$10^{-5}s^{-1}$ over the depression area

Divergence:

- Upper air divergence is negative of the order of -5*$10^{-5}s^{-1}$ over Andaman Sea and positive 15-20*$10^{-5}s^{-1}$ over the depression area.

Wind Shear:

- Wind Shear of order of 10-20 knots over south Bay of Bengal. and 20-40 knots over central Arabian Sea.

Wind Shear Tendency:

- Negative of order -5 to -10 knots over eastcentral & southeast Bay of Bengal and positive. of order 5 knots over the depression area.

Upper tropospheric ridge:

- The upper tropospheric ridge line roughly runs along Lat 19.0^0N over Bay of Bengal and Arabian Sea.

M.J.O. Index:

- Located over phase 3 with amplitude greater than 1.0.
- Statistical forecast: - MJO moves through phase 4, 5 & 6 during next 15 days.
- Dynamical forecast: - MJO located in phase 3 with amplitude greater than 1.0 and moves through phase 4 & 5 during next 15 days.

Cyclonic disturbances over other basins:

- There is no tropical disturbance over west Pacific Ocean

Status of observational system:

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

Satellite

FDP cyclone satellite inference 300900 UTC:

BAY OF BENGAL & ANDAMAN SEA: -

Broken low/medium clouds with embedded intense to very intense convection is seen over extension south Bay of Bengal and adjoining Indian Ocean between lat. 10.0^0N to 7.5^0S east of longitude 74.5^0E. scattered low/medium clouds with embedded isolated weak convection is seen over extension southwest Andaman Sea.

Arabian Sea: -

Vortex over central Arabian Sea centered near 17.8^0N/63.8^0E. Intensity isT1.5. Associated broken intense to very intense convection seen over Arabian Sea north of latitude 18.0^0N and between longitude 60.0^0E to 67.0^0E and weak to moderate convection seen over rest central Arabian Sea between latitude 15.00N and longitude 59.0^0E to 65.0^0E. Minimum cloud top temperature is minus 71 deg c (.)

(see ftp://192.168.12.75/imd/satmet

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

NWP Analysis

- **ECMWF** model analysis based on 0000UTC of today shows depression lay over west central Arabian Sea and adjoining regions. The forecast shows the depression is likely to move westwards on day1 and day2. This is likely to dissipate over Sea on day3.

- **IMD-GFS** model analysis based on 0000 UTC of today shows low level CYCIR lay over west central Arabian Sea. The forecast shows the system is likely to weaken over west central Arabian Sea during next 24 hours.

- **WRF-ARW** model analysis based on 0000 UTC of today shows a low level CYCIR lay over west central Arabian Sea and is likely weaken during next 24 hours over Sea.

- **UKMET** model analysis and forecast based on 0000 UTC of today shows low level CYCIR lay over west central Arabian Sea and that is likely to weaken over west central Arabian Sea during next 24 hours.

http://www.imd.gov.in/section/nhac/dynamic/welcome.htm
ftp://ftp.ncmrwf.gov.in/pub/outgoing/TC_FDP/

Genesis Potential Parameter (GPP): The GPP analysis and 24 hours forecast a cell of 30 over west Central Arabian Sea is likely to get disorganized and minimize

during next 24 hours. GPP charts analysis and 24, 48 and 72 hours forecasts are enclosed here with in **Annexure III**
(http://www.imd.gov.in/section/nhac/dynamic/Analysis.htm **)**

Summary and Conclusion:

Synoptic and NWP models suggest that:

- The depression is likely to move west-northwestwards and maintain the same intensity for some time.

Advisory:

- No significant weather system over Bay of Bengal.
- No IOP is required at present.

Annexure-I

Status of Observation system:
Synop

Region	Date/Time (UTC)		
	29/12	**30/00**	**30/03**
India	195/205	128/159	190/208
Coastal stations			
WB	10	05	11
Odisha	09	06	10
AP	18	17	18
Tamil Nadu	13	10	13
Puducherry	2	2	2
A & N	1	1	1
Bangladesh	17	15	17
Myanmar	16	14	15
Thailand	1	1	1
Sri Lanka	16	15	17

AWS

Region	Date/Time (UTC)		
	29/12	**30/00**	**3003**

India	430/616	426/616	400/616
WB	19	18	18
ODS	26	25	26
AP	32	33	30
TN	26	24	26
PDC	01	01	01

- **RS/RW** (12Z) of 29 -11-2011: 10/39
- **No. of Ascents reaching 250 hPa levels:3, MISDA:-29**
- **RS/RW** (00Z) of 30 -11-2011: 35/39
- **No. of Ascents reaching 250 hPa levels 21, MISDA: 4**

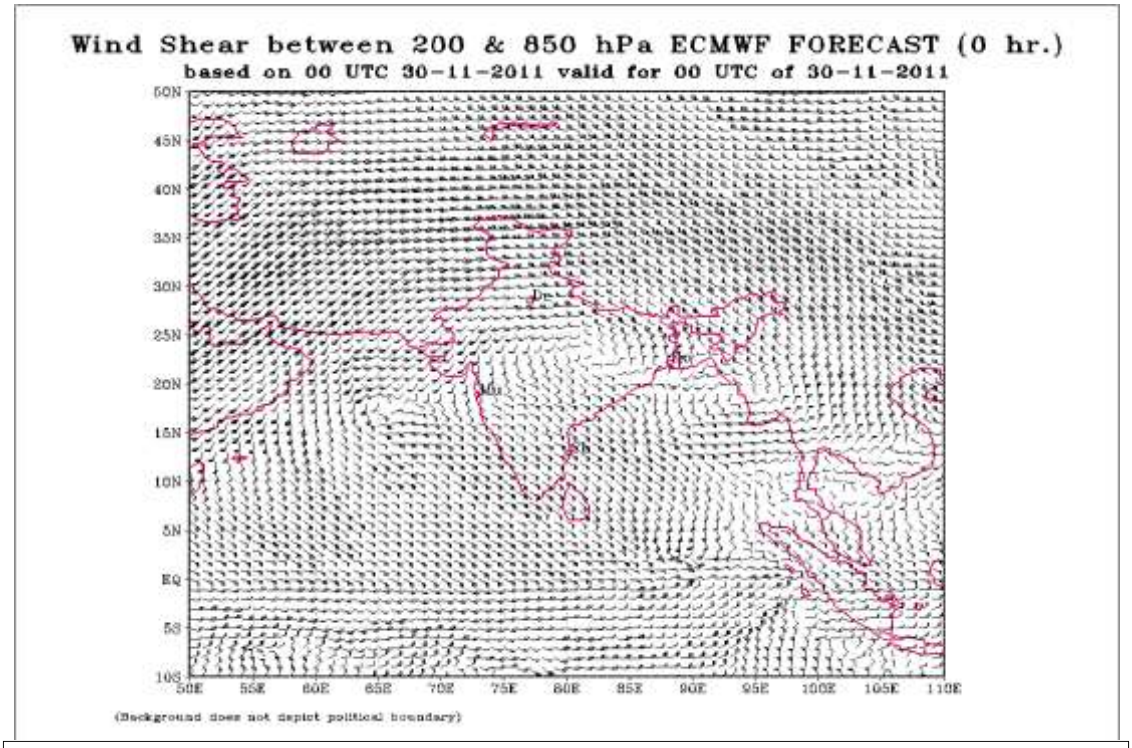
No. of PILOT Ascents

29/12Z	**30/00Z**
16/37	14/34

Buoy Data

29/12	**30/00**	**30/03**
13	14	14

ANNEXURE-II


Wind Shear between 200 & 850 hPa ECMWF FORECAST (0 hr.)
based on 00 UTC 30-11-2011 valid for 00 UTC of 30-11-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
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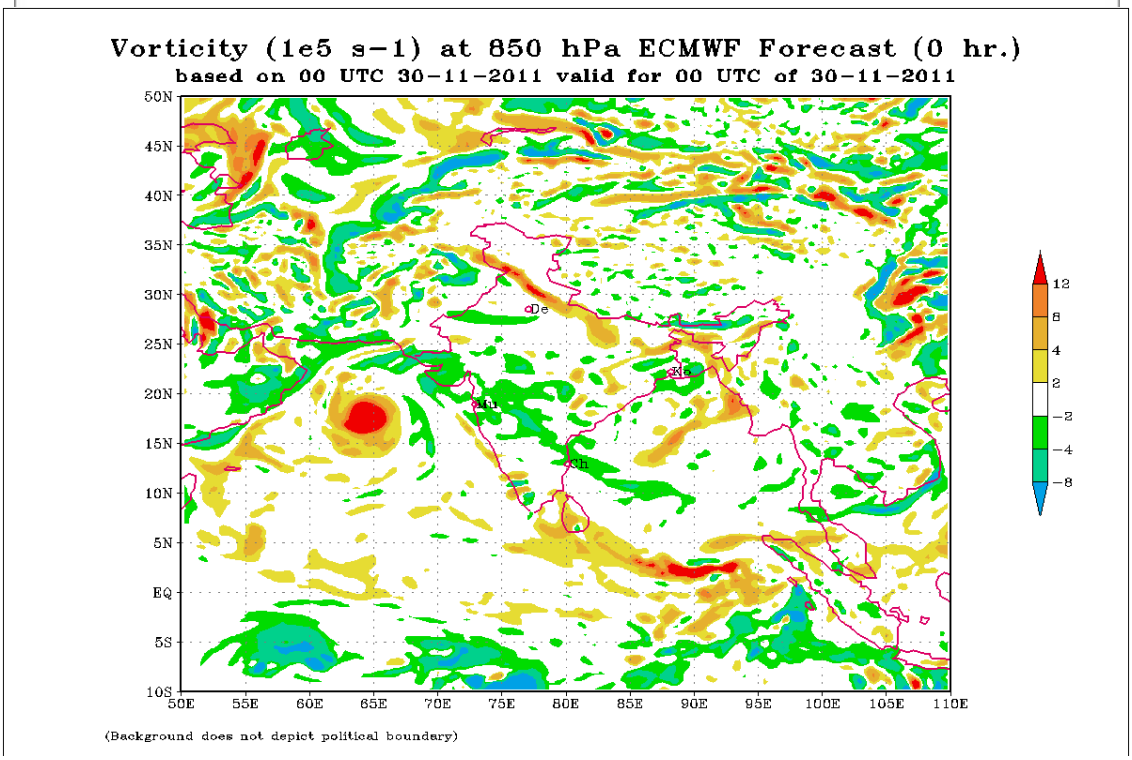
Vorticity (1e5 s-1) at 850 hPa ECMWF Forecast (0 hr.)
based on 00 UTC 30-11-2011 valid for 00 UTC of 30-11-2011
50N
45N
40N
35N
30N
25N
20N
15N
10N
5N
EQ
5S
10S
50E
55E
60E
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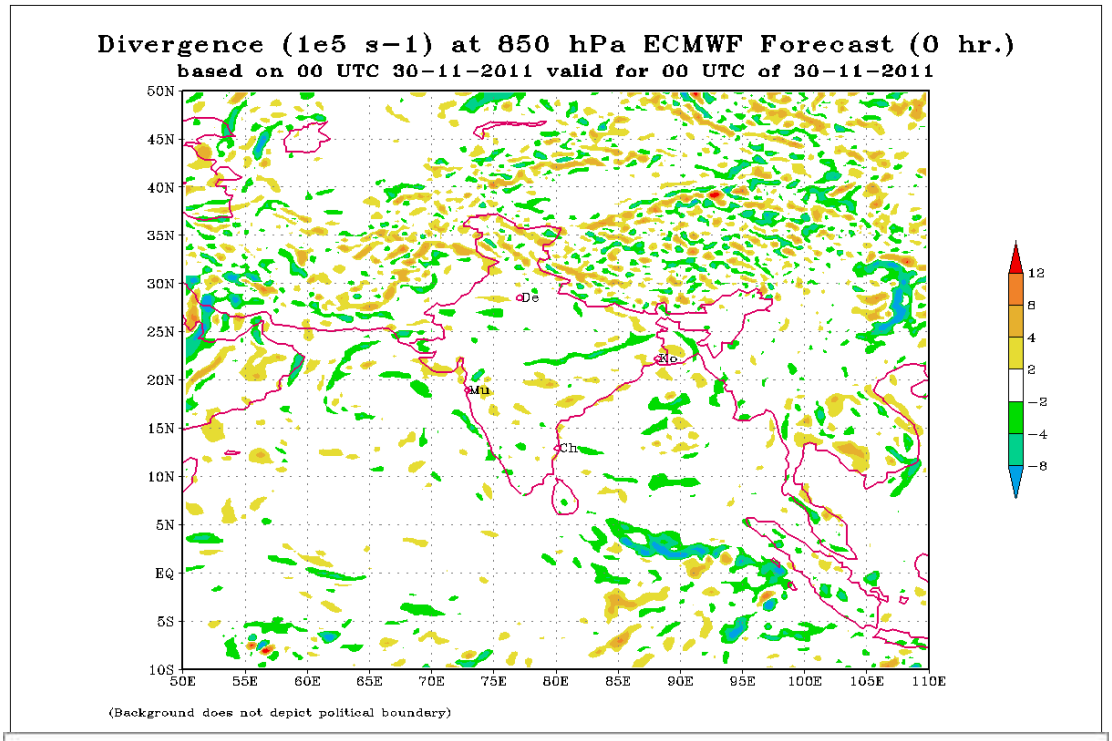
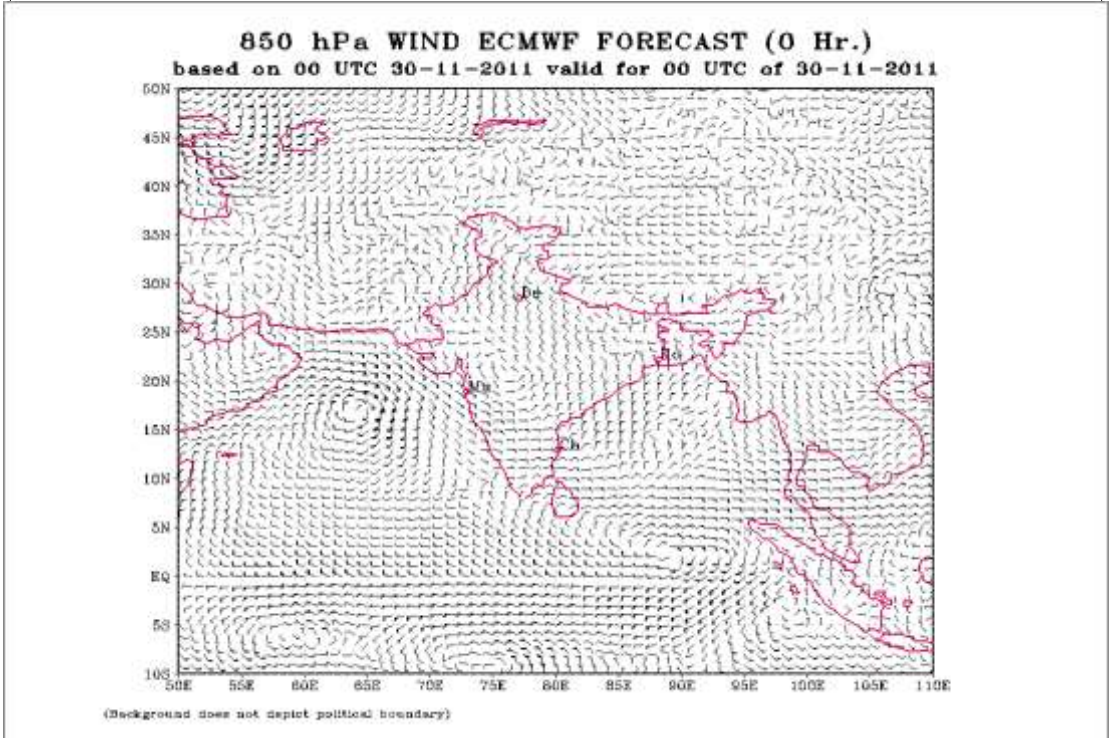
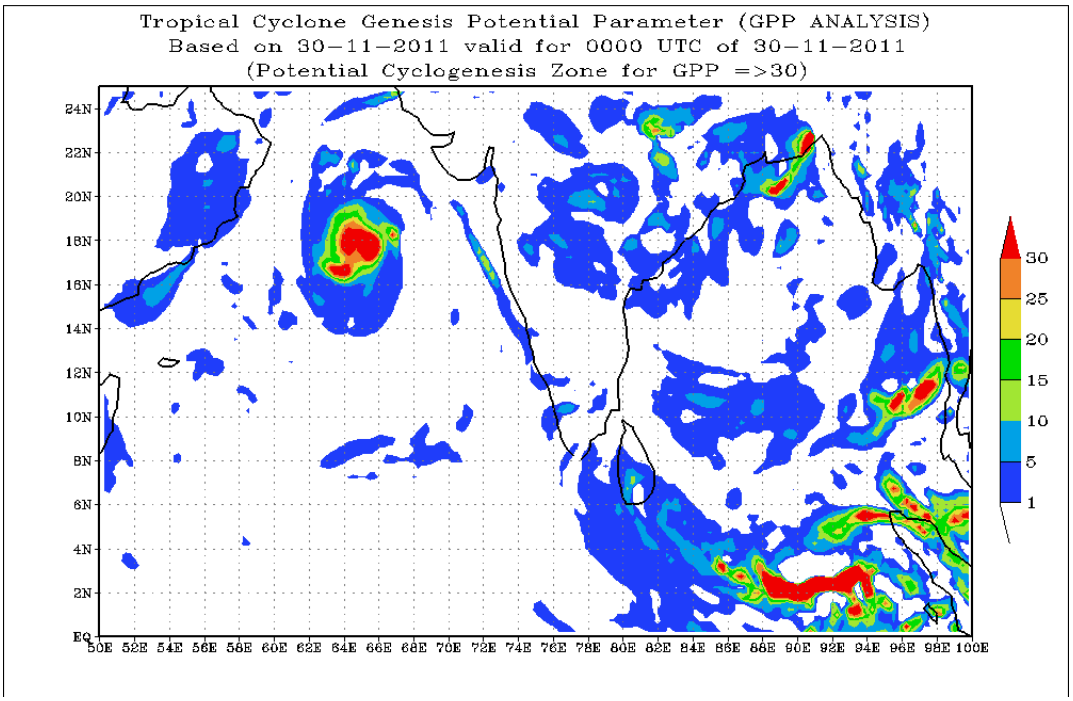
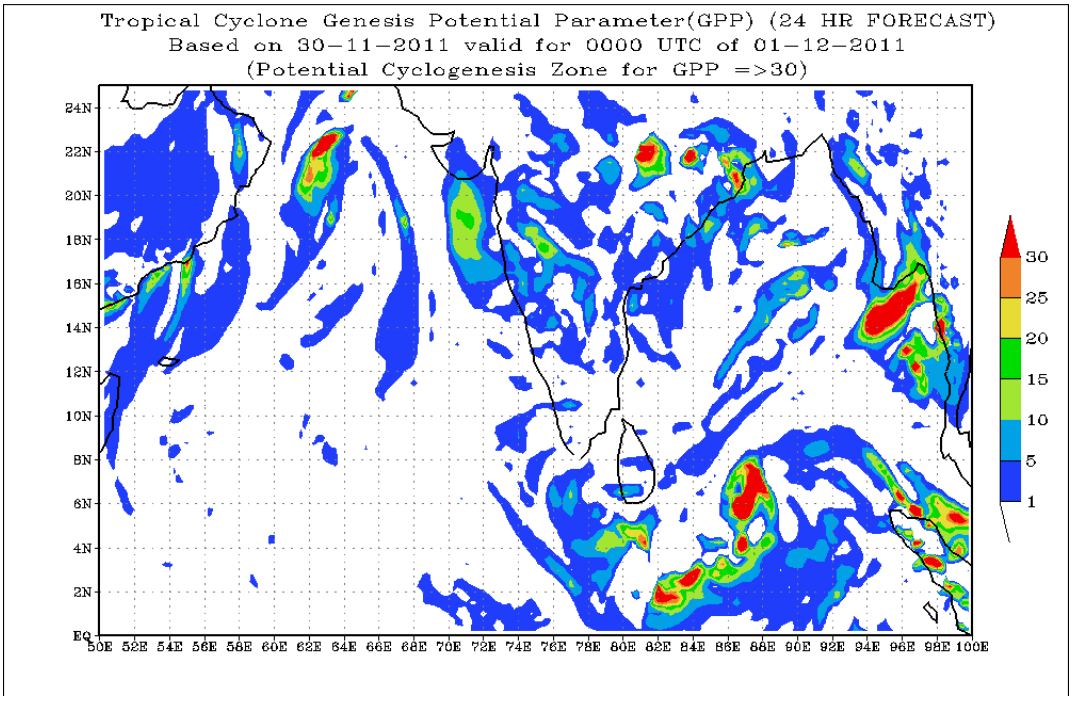
(Background does not depict political boundary)





ANNEXURE-III


Tropical Cyclone Genesis Potential Parameter (GPP ANALYSIS)
Based on 30-11-2011 valid for 0000 UTC of 30-11-2011
(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
1


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 30-11-2011 valid for 0000 UTC of 01-12-2011
(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
1

Chapter VI

Lessons learnt

During 18th to 19th Oct 2011 one IOP declared in connection with intensification of depression in deep depression crossed Bangladesh coast near Cox Bazar. The Bay of Bengal was less active for genesis in comparison with last year because moderate to high wind shear generally prevailed through our the demonstration period.

1. ITCZ activity mainly concentrated along the oceanic corridor between 7-10^0 N in south Bay of Bengal but normal over south Arabian Sea .SST observations showed favourable condition for genesis on the other hand ocean thermal energy could not cross the limit of 100KJ/cm^{-2} over the Bay of Bengal.
2. A deep depression formed over north Bay of Bengal but could not intensify into cyclonic storm because of high wind shear (about 20-30 Knot).
3. 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.
4. Buoy data was scanty. Two or three buoys data could be available during the period over Bay of Bengal at synoptic hour chart analysis while no buoy observation was found over Arabian Sea along off Karnataka & Kerala coast and over central Arabian Sea. Buoy observation is highly informative for synoptic analyses and ocean surface wind information. As such number of buoy may be enhanced and arrangement to be made for real time reception of data particularly when a system forms over NIO.
5. Coastal Automatic Weather Station observation proved very helpful to facilitate early warning of landfall. However one should be cautious regarding AWS wind speed and pressure, as there were few stations with erroneous data.
6. Diurnal cycle of convection do influence cyclonic disturbance and hence this aspect is required to be monitored.
7. Conventional ship observations under IVOF scheme are very less. Only one or two ship observation hardly received during cyclonic disturbance period. Hence deployment of Sagar Kanya or Sagar Nidhi cruise could have been very useful for cyclone forecast.
8. Coastal hourly observations were not available from Penal member countries including Bangladesh and Myanmar.
9. ECMWF model was much better than other numerical weather prediction model operating in Indian subcontinent. But the high resolution forecast from ECMWF was not operationally available to IMD due to some technical

reasons. Hence, arrangement may be made to access forecast product of ECMWF during cyclonic disturbances over NIO during next year.

10. The cyclogenesis was highly suppressed during October-November, 2011 over the Bay of Bengal. Only one deep depression formed during this period against the long period average of about 3 cyclonic disturbances including 1 depression/deep depression and 2 cyclones. The reasons for this suppressed genesis need further investigation. At the same time the Arabian Sea was proactive with regular formation of cyclonic disturbances (3 cyclonic disturbances including one cyclone Keila). It also needs further investigation.

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, 2011 as per the implementation plan. The IOP was declared for 2 days in association with a Deep Depression (19-20 Oct., 2011). 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 2011 included the data collected from 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 recently 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 2011 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 2011, 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
- structured satellite and radar bulletin
- DWR data with uniform scanning strategy for mosaicing and NWP modeling.

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