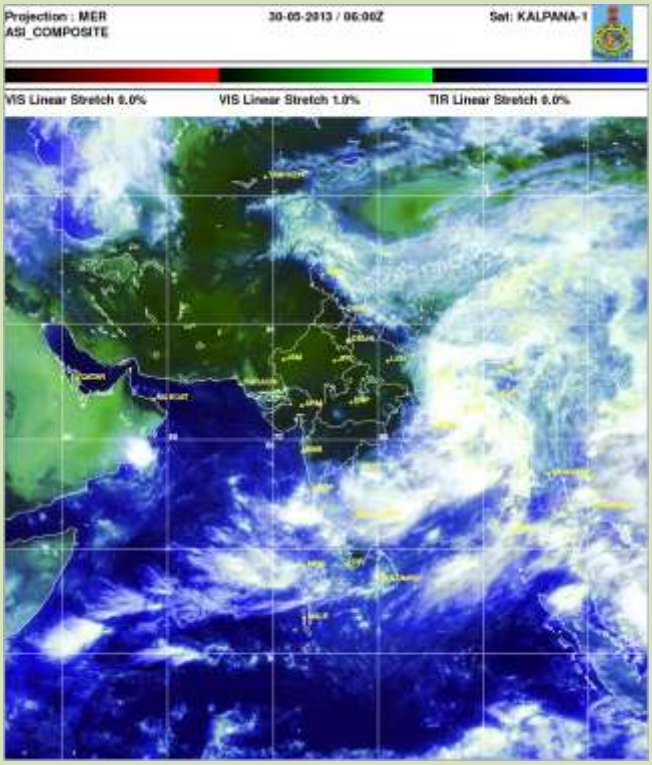
GOVERNMENT OF INDIA

MINISTRY OF EARTH SCIENCES

INDIA METEOROLOGICAL DEPARTMENT

A Preliminary Report on Depression over Bay of Bengal (29-31 May, 2013)



Kalpna Satellite imagery of 0600UTC of 30 May, 2013

CYCLONE WARNING DIVISION, NEW DELHI

JUNE, 2013

Depression over the Bay of Bengal (29-31 May, 2013)

1. Introduction:

A depression formed over north Bay of Bengal on 29th May, 2013. Moving north-northwestwards, it crossed West Bengal coast near lat. 21.8^{0}N and long. 88.7^{0}E, about 30 km south of Canning in the evening of 29th May. It caused heavy to very heavy rainfall over West Bengal, north Odisha, Jharkhand and Bihar and isolated heavy rainfall over Assam and Meghalaya.

The salient feature of this depression are given below:

(i) The track of the depression was unique, as it initially moved north-northwestwards before landfall, then moved slowly for next 24 hrs over Gangetic West Bengal and then moved nearly northwards upto Bihar.

(ii) Due to its slow westward movement over Gangetic West Bengal, it caused very good rainfall activity in southwest sector including Gangetic West Bengal and Odisha.

2. Brief history:

Under the influence of southerly surge, the low level convergence and relative vorticity increased over the central Bay of Bengal in the beginning of the last week of May 2013. It led to the development of an upper air cyclonic circulation over west central Bay of Bengal on 27th May, 213. A low level cyclonic circulation (LLCC) was also observed by Satellite Division of IMD by 25th May. It was declared as a vortex (T1.0) in the evening of 27th. The upper air cyclonic circulation over westt central Bay of Bengal concentrated into a low pressure area on 28th over west central and adjoining northwest Bay of Bengal.

Under the favourable conditions like warmer Sea surface temperature (about 30^{0}C), lower level convergence and relative vorticity, the low pressure area further concentrated into a depression at 0300 UTC of 29th over north Bay of Bengal near lat. 21.0^{0}N and 89.5^{0}E, about 200 km southeast of Kolkata. The upper tropospheric ridge ran along 23^{0}N and provided pole ward outflow in association with anticyclonic circulation lying to the northeast of system centre. The vertical wind shear was moderate to high. The Median Julian oscillation (MJO) lay over phase 1 with negligible amplitude. Further the depression lay close to the coast and there was incursion of dry and warm northwesterly wind from northwest India in middle level. Hence though factors were favourable for genesis of depression but they were not favourable for further intensification. However, as the depression was lying close to the south of ridge, it moved north-northwestwards and crossed West Bengal coast near lat. 21.8^{0}N and long. 88.7^{0}E, about 30 km south of Canning (West Bengla) during 1330-1430 UTC of 29th. After the landfall, as the depression lay to the south of ridge and the ridge became stronger, there was slow westerly movement of the system during 29th night to noon of 30th May. However on 31st a trough in upper tropospheric westerlies ran along 80^{0}E to

the north of 20^0N and an anticyclonic circulation with centre near 77^0E and 20^0N lay over central India. Under the influence of these two systems, the depression moved nearly northward on 31st. As it moved northward, due to moisture cut off and interaction with land surface and unfavourable northwesterly winds entering into depression field in middle level and upper troposphere, the depression weakened into a well marked low pressure area at 1200 UTC of 31st May, 2013 over Bihar and adjoining Jharkhand. It lay as a low pressure area over north Chhattisgarh and neighbourhood in the morning of 1st June and became less marked in the same forenoon. The best track parameters are shown in Table 1. The track of the depression over the Bay of Bengal (29-31 May) is shown in Fig. 1 and typical satellite imageries are shown in Fig.2 respectively.

Table 1: Best track positions and other parameters of Depression over the Bay of Bengal during 29-31 May, 2013

Date	Time (UTC)	Centre lat.^{0} N/ long.^{0} E	C.I. NO.	Estimated Central Pressure (hPa)	Estimated Maximum Sustained Surface Wind (kt)	Estimated Pressure drop at the Centre (hPa)	Grade
29-05-2013	0300	21.0/89.5	1.5	996	25	4	D
	0600	21.3/89.3	1.5	996	25	4	D
	0900	21.5/89.0	1.5	996	25	4	D
	1200	21.7/88.8	1.5	994	25	4	D
	The system crossed West Bengal coast near lat. 21.8 and Long. 88.7 between 1330-1430 UTC						
	1500	22.0/88.7	-	994	20	4	D
	1800	22.1/88.4	-	994	20	4	D
30-05-2013	0000	22.2/87.8	-	994	20	4	D
	0300	22.3/87.5	-	990	20	4	D
	0600	22.3/87.5	-	990	20	4	D
	1200	22.7/87.3	-	990	20	4	D
	1800	22.8/87.2					
31-05-2013	0000	23.5/87.1	-	990	20	4	D
	0300	24.0/87.0	-	990	20	4	D
	0600	24.5/87.0	-	994	20	3	D
	0900	25.0/87.0	-	996	20	3	D
	1200	The system weakened into a well marked low pressure area over Bihar & adjoining Jharkhand					

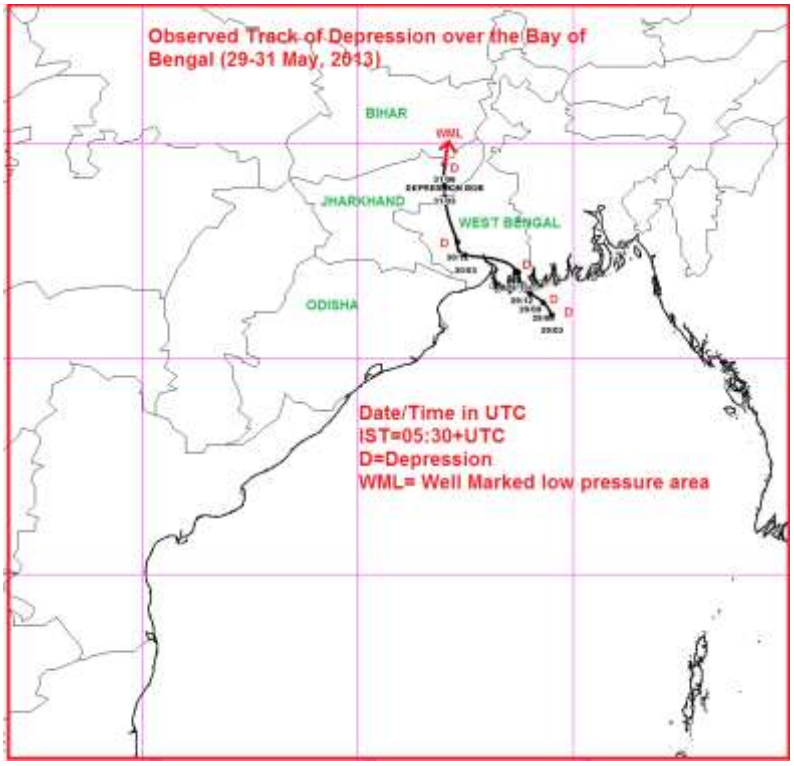


Fig.1 Track of depression over the Bay of Bengal (29-31 May, 2013)

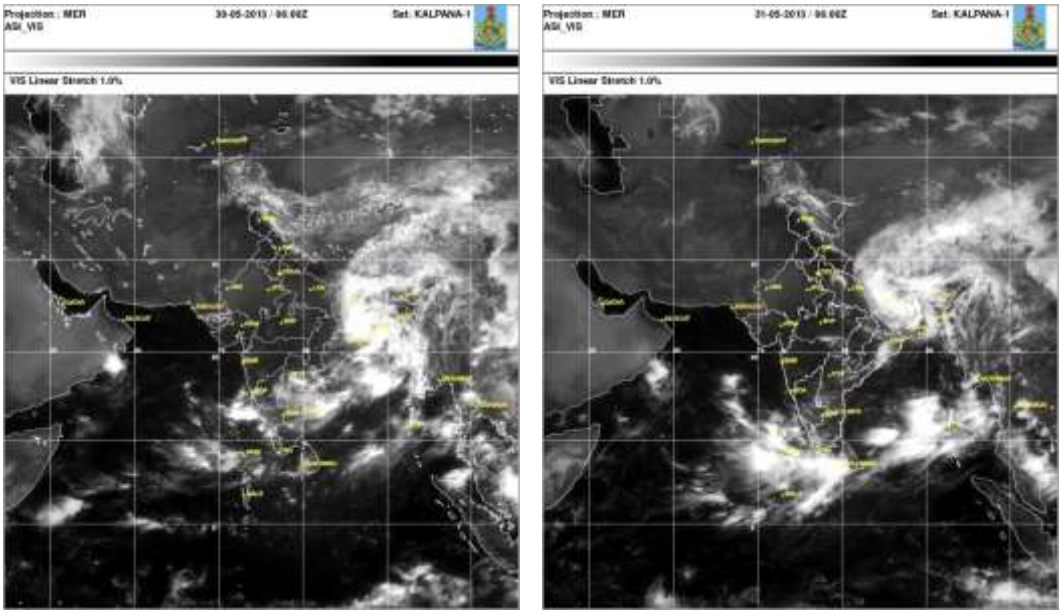


Fig.2. Typical Kalpana-1 Satellite imageries of depression at 0600 UTC of 30-31 May, 2013.

3. Monitoring and Prediction:

The depression was monitored mainly with satellite supported by meteorological buoys, coastal, island observations and Doppler Weather Radar (DWR),

Kolkata. The half hourly INSAT/ Kalpana imageries & scattrometer wind and every 10 minutes DWR imageries and products were used for monitoring of depression.

Various numerical weather prediction (NWP) models and dynamical-statistical models including IMD's global and meso-scale models were utilized to predict the track and intensity of the depression. The Tropical Cyclone Module in the digitized forecasting system of IMD was utilized for analysis and comparison of various NWP models and decision making process. Though genesis of depression was well predicted by most of the NWP models but there was large variation in track prediction. No model could predict such unique track with slow movement of the depression on 29-30th May, 2013.

4. Warning services:

The Cyclone Warning Division/ Regional Specialised Meteorological Centre (RSMC)-Tropical Cyclone, IMD, New Delhi mobilised all its resources for monitoring and prediction of depression. It issued 3/6 hourly warning/advisory bulletins to national disaster management agencies including National Disaster Management (NDM), Ministry of Home Affairs (MHA), concerned state Govts. and other users at regular intervals. It also issued advisories to World Meteorological Organisation (WMO)/Economic and Social Cooperation for Asia and the Pacific (ESCAP) Panel member countries including Bangladesh, Myanmar, Thailand, Pakistan, Oman, Sri Lanka and Maldives during depression period.

The number of bulletins issued by the Regional Specialised Meteorological Centre-Tropical Cyclone, New Delhi and by Cyclone Warning Division, IMD, New Delhi are given below.

Bulletins for India	: 13
Special Tropical Weather Outlook WMO/ESCAP Panel countries	: 04

5. Realised Weather:

Chief amounts of 24 hrs. rainfall (7 cm or more) ending at 0300 UTC of 30th May-1st June, 2013 are given below.

30.5.2013:

Gangetic West Bengal: Contai-26, Sagar Islands-17, Kalaikunda-12, Jhargram-9, Digha, Kharagpore -8, Midnapore, Haldia-7,

Sub-Himalayan West Bengal and Sikkim: Gazolwdoba-13, Sevoke-11, Nagrakata-8, Bagrakote, Champasari, Damthang, Darjeeling, Murti -7 each.

Odisha: Rajghat-12, Jamsholaghat, Dharmanagar-11 each, Bangiriposhi, Rairangpur, Baripada, Jaleswar, Samakhunta-9 each, Soro, Basudevpur,

Pattamundai, Chandbali-8 each, Chandanpur, Jaipur, Chandipore, Tihidi, Udala, Govindpur, Batanati, Nilagiri and Paradip-7 each

Assam: Karimganj-9, Udalguri-9, Beki-Mathanguri-8.

Meghalaya : Cherrapunjee (Rama Krishna Mission)-10 Cherrapunji(AWS)-9

31.05. 2013:
Gangetic West Bengal: Purulia-14, Midnapore-13, Kalaikunda-12, Kharagpur & Bankura -8 each,

Sub-Himalayan West Bengal and Sikkim: Darjeeling-17, Sevok-10, Champasari & Damthang-7 each.

Odisha: Tiring-14, Rairangpur-12, Bangiriposhi-9, Jhorigam & Chandihandi-8

Jharkhand: Jamsedpur(Airport)-13, Jamsedpur-11 and Ranchi-12, Mohanpur-7

Bihar: Saraiya-17, Motihari-12, Jamoi-10, Gaya, Patna, Chhapra, Islampur, Hisua, Vaishali and Muzaffarpur -9 each, Marhura and Chakia -8 each, Sono-7

1.6. 2013:
ASSAM & MEGHALAYA:
Dhekiajuli – 7

BIHAR:
Jamui-12, Purnea and Katihar North -9 each

6. Rainfall forecast verification

Table 2 Heavy rainfall forecast issued by IMD, New Delhi

Date	Synoptic System	Forecast issued	Forecast Realised
29 May 2013 0300 UTC	Depression formed over north Bay of Bengal lay centred at Lat. 21.0^0N and Long. 89.5^0E 130 km south-southwest of Khepupara 200 km southeast of Kolkata. It would move northwards and cross Bangladesh coast near log. 89.5^0E about 50 km west of Khepupara by 29th May 3013 evening.	Isolated heavy to very heavy falls - Gangetic West Bengal during next 24 hrs. Isolated heavy to very heavy falls - Assam, Meghalaya, Nagaland, Manipur and sub-Himalayan West Bengal on 30th and 31st May 2013 - Mizoram and Tripura on 30th May 2013.	**Chief amount of 24 hr cumulative rainfall**(7 cm or more) recorded at 0830 hrs IST of date: **30.5.2013:** **Gangetic West Bengal** : Contai-26, Sagar Islands-17, Kalaikunda-12, Jhargram-9, Digha, Kharagpore -8, Midnapore, Haldia-7,

29 May 2013 1200 UTC	Depression over north Bay of Bengal near Lat.21.7^{0}N and Long. 88.8^{0}E , close to West Bengal coast (60 km south-southeast of canning)	Isolated heavy to very heavy falls - Gangetic West Bengal, Mizoram and Tripura during next 24 hrs. Isolated heavy to very heavy falls - Assam, Meghalaya and sub-Himalayan West Bengal on 30th and 31st May 2013 Isolated heavy falls over Nagaland and Manipur on 30th and 31st May 2013	**Sub-Himalayan West Bengal and Sikkim** : Gazolwdoba-13, Sevoke-11, Nagrakata-8, Bagrakote, Champasari, Damthang, Darjeeling, Murti -7 each. **Odisha**:Rajghat-12, Jamsholaghat, Dharmanagar-11 each, Bangiriposhi, Rairangpur, Baripada, Jaleswar, Samakhunta-9 each, Soro, Basudevpur, Pattamundai, Chandbali-8 each, Chandanpur, Jaipur, Chandipore, Tihidi, Udala, Govindpur, Batanati, Nilagiri and Paradip-7 each **Assam** : Karimganj-9, Udalguri-9, Beki-Mathanguri-8. **Meghalaya** : Cherrapunjee (Rama Krishna Mission)-10 Cherrapunji(AWS)-9 **31.05. 2013 :** **Gangetic West Bengal**: Purulia-14, Midnapore-13, Kalaikunda-12, Kharagpur & Bankura -8 each, **Sub-Himalayan West Bengal and Sikkim**: Darjeeling-17, Sevok-10, Champasari & Damthang-7 each. **Odisha**: Tiring-14, Rairangpur-12, Bangiriposhi-9, Jhorigam & Chandihandi-8
30 May 2013 0300 UTC	The depression over coastal West Bengal and neighbourhood near Lat. 22.3^{0}N and Long. 87.5^{0}E, about 30 km southeast of Midnapur.	Isolated heavy to very heavy falls - Gangetic West Bengal during next 24 hours and Jharkhand during next 48 hrs. Isolated heavy falls-north Odisha, Sub-Himalayan West Bengal & Sikkim, east Bihar during next 48 hours and west Assam and Meghalaya during next 24 hours.	
30 May 2013 1200 UTC	The depression lay centred over Gangetic West Bengal near Lat. 22.7^{0}N and Long. 87.3^{0}E about 30 km north of Midnapur.	Isolated heavy to very heavy falls - Jharkhand during next 36 hours. Isolated heavy falls - north Odosha, West Bengal & Sikkim, Bihar during next 36 hours.	
31 May 2013 0300 UTC	The depression over over Jharkhand and neighbourhood near Lat. 24.00N and Long. 87.00E, about 80 km north of Bankura	Isolated heavy falls - Jharkhand, West Bengal & Sikkim and Bihar during next 24 hours.	
31 May 2013 1200 UTC	The depression weakened in to WML and lay over Bihar and adjoining Jharkhand	Isolated heavy falls - Jharkhand, Bihar, West Bengal and Sikkim during next 24 hrs.	

			Jharkhand: Jamsedpur(Airport)-13, Jamsedpur-11 and Ranchi-12, Mohanpur-7 **Bihar**: Saraiya-17, Motihari-12, Jamoi-10, Gaya, Patna, Chhapra, Islampur, Hisua, Vaishali and Muzaffarpur -9 each, Marhura and Chakia -8 each, Sono-7 **1.6. 2013 :** **ASSAM & MEGHALAYA:** Dhekiajuli – 7 **BIHAR:** Jamui-12 Purnea & Katihar North-9 each