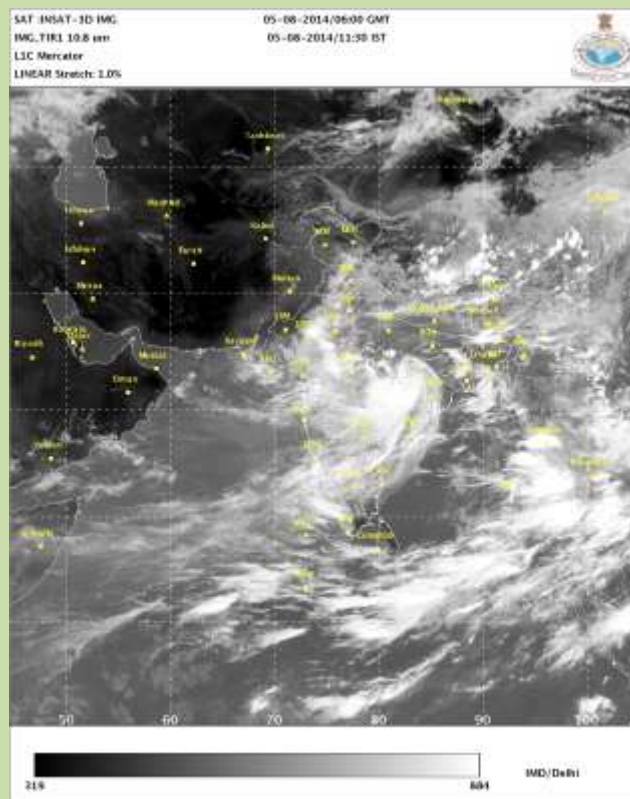




GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
EARTH SYSTEM SCIENCE ORGANISATION
INDIA METEOROLOGICAL DEPARTMENT

**A Preliminary Report on Deep Depression over Bay of Bengal
(3 - 7 AUGUST 2014)**



INSAT – 3D IMAGERY BASED ON 0600 UTC OF 5TH AUG, 2014

CYCLONE WARNING DIVISION, NEW DELHI

AUGUST 2014

Deep Depression over Bay of Bengal during 3rd - 7th Aug 2014

1. Introduction

A **Depression** formed over northwest Bay of Bengal and adjoining coastal areas of West Bengal and north Odisha during evening of 3rd August. It moved westnorthwestwards and intensified into a **Deep Depression** over Gangetic West Bengal and neighbourhood around midnight of 3rd. Further moving west northwestwards, it weakened into a **Depression** and lay centered over north Chhattisgarh and adjoining east Madhya Pradesh close to the east of Umaria in the afternoon of 5th August. Continuing the west-northwestward movement, it weakened into a well marked low pressure area over northwest Madhya Pradesh and neighbourhood on 7th morning. The salient features of the system are as follows:

- I. The monsoon condition over central India was activated with the deep depression which contributed to bountiful rains and compensated the deficit in monsoon rainfall.
- II. The deep depression resulted in torrential rains and flood over many rivers and rivulets of Odisha.

2. Genesis:

A cyclonic circulation between 5.8 & 9.5 km above mean sea level(a.s.l). lay over northwest Bay of Bengal and neighbourhood on 1st Aug. Under its influence, a low pressure area formed over north Bay of Bengal and neighbourhood on 2nd morning. It lay as a well marked low pressure area over the same region on 3rd morning. It concentrated into a **Depression** and lay centered over northwest Bay of Bengal and adjoining coastal areas of West Bengal and north Odisha near Lat. 21.5°N and Long. 88.5°E, about 80 km southeast of Diamond Harbor at 1730 hrs IST of 3rd August.

Considering the environmental features, the low-level relative vorticity gradually increased and was about $100 \times 10^{-5} \text{ sec}^{-1}$ in the morning of 3rd August. Lower-level convergence and upper-level divergence also increased and were about $20 \times 10^{-5} \text{ sec}^{-1}$ and $40 \times 10^{-5} \text{ sec}^{-1}$ respectively. The vertical wind shear was moderate and it was about 10-20 knots. Hence, the environmental features supported the genesis of the system.

3. Intensification and movement:

The above mentioned favorable environmental features continued to prevail on 4th and 5th and there was increased relative vorticity. As a result it intensified into a depression on 3rd August near Lat. 21.9°N and Long. 88.3°E about 80 kms southeast of Kolkata at 2330 hrs IST of 3rd August. However, the system moved westnorthwestwards along the monsoon trough under the influence of middle to upper level steering. The mid-tropospheric ridge ran along latitude 30°North. As a result, the steering winds in upper troposphere were east to eastsoutheasterly leading to westward/ westnorthwestward movement of the system. Moving west northwestwards it lay centered over Jharkhand and adjoining Gangetic West Bengal near Lat. 22.2°N and Long. 86.1°E about 50 kms south of Jamshedpur at 1730 hours IST of 4th August and over north Chhattisgarh, adjoining Jharkhand and east Madhya Pradesh near Lat. 22.2°N and Long. 83.5°E about 100 kms eastsoutheast of Ambikapur at 0830 hours IST of 5th August. Further moving west northwestwards, it weakened into a Depression and lay centered over north Chhattisgarh and adjoining east Madhya Pradesh near Lat. 23.5°N and Long. 82.5°E, about 150 kms east of Umaria at 1430 hours IST of 5th August and over northeast Madhya Pradesh and neighborhood, close to Sidhi (near Lat. 24.0°N and Long. 82.0°E), at 1730 hours

IST of 5th August. It further moved west northwestwards and lay centered over central parts of north Madhya Pradesh and neighborhood about 50 kms southeast of Khajuraho, near Lat. 24.5°N and Long. 80.2°E at 0830 hours IST of 6th August. It remained practically stationary and lay centered over the same region close to Nowgong near Lat. 25.0°N and Long. 79.5°E at 1730 hours IST of 6th August. Moving slightly west-northwestwards it lay centered over northwest Madhya Pradesh and neighbourhood, near lat. 25.5°N and Long. 78.5°E, about 50 km. southeast of Gwalior at 0530 hrs. IST of 7th August. Continuing the west northwestward movement, it weakened into a well marked low pressure area over northwest Madhya Pradesh and neighbourhood on 7th August morning. It lay as a low pressure area over northwest Madhya Pradesh and adjoining east Rajasthan in the same evening. It merged with the monsoon trough on 8th August. However, the associated cyclonic circulation extending upto mid tropospheric levels lay over northeast Rajasthan and neighbourhood on 8th & 9th August, northwest Madhya Pradesh and adjoining southwest Uttar Pradesh on 10th, southwest Uttar Pradesh and neighbourhood on 11th August and became less marked on 12th August.

The best track parameters of the deep depression are given in the Table.1 and the best track is shown in the fig.1.

Table.1: Best track positions and other parameters of Deep Depression during 3rd - 7th Aug 2014.

Date	Time (UTC)	Location of the centre lat. ^o N/ long. ^o E	CI No.	ECP in hPa	Estimated Sustained Maximum Wind in KT	Estimated pressure drop at the centre in hPa	Grade
03.08.2014	1200	21.5/88.5	1.5	990.0	25	4	D
03.08.2014	1800	21.9/88.3	2.0	990.0	30	6	DD
04.08.2014	0000	22.3/87.6	-	990.0	30	6	DD
04.08.2014	0300	22.5/87.2	-	990.0	30	6	DD
04.08.2014	0600	22.5/86.5	-	990.0	30	6	DD
04.08.2014	1200	22.2/86.1	-	988.0	30	6	DD
04.08.2014	1800	22.2/85.1	-	990.0	30	6	DD
05.08.2014	0000	22.2/84.1	-	990.0	30	6	DD
05.08.2014	0300	22.2/83.5	-	994.0	30	6	DD
05.08.2014	0600	22.9/83.0	-	992.0	30	5	DD
05.08.2014	0900	23.5/82.5	-	992.0	25	4	D
05.08.2014	1200	24.0/82.0	-	992.0	25	4	D
05.08.2014	1800	24.2/81.3	-	992.0	25	4	D
06.08.2014	0000	24.4/80.6	-	992.0	25	4	D
06.08.2014	0300	24.5/80.2	-	996.0	25	4	D
06.08.2014	0600	24.6/80.0	-	994.0	25	4	D
06.08.2014	1200	25.0/79.5	-	994.0	25	4	D
06.08.2014	1800	25.3/79.0	-	994.0	25	4	D
07.08.2014	0000	25.5/78.5	-	994.0	25	3	D
07.08.2014	0300	Weakened into a well-marked low pressure area over northwest Madhya Pradesh and neighbourhood					

Typical satellite imageries of the depression are shown in fig.2 indicating active monsoon conditions over Indian region in association with the deep depression and major convection lying to the west of depression centre under the influence of easterly wind shear.

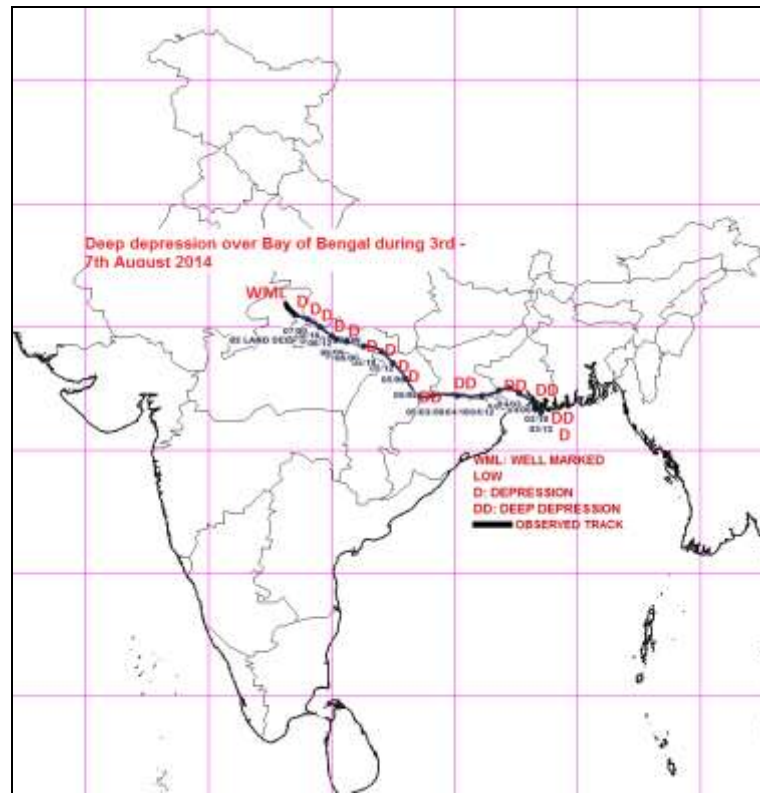


Fig.1: Observed track of Deep Depression during 3rd – 7th Aug 2014.

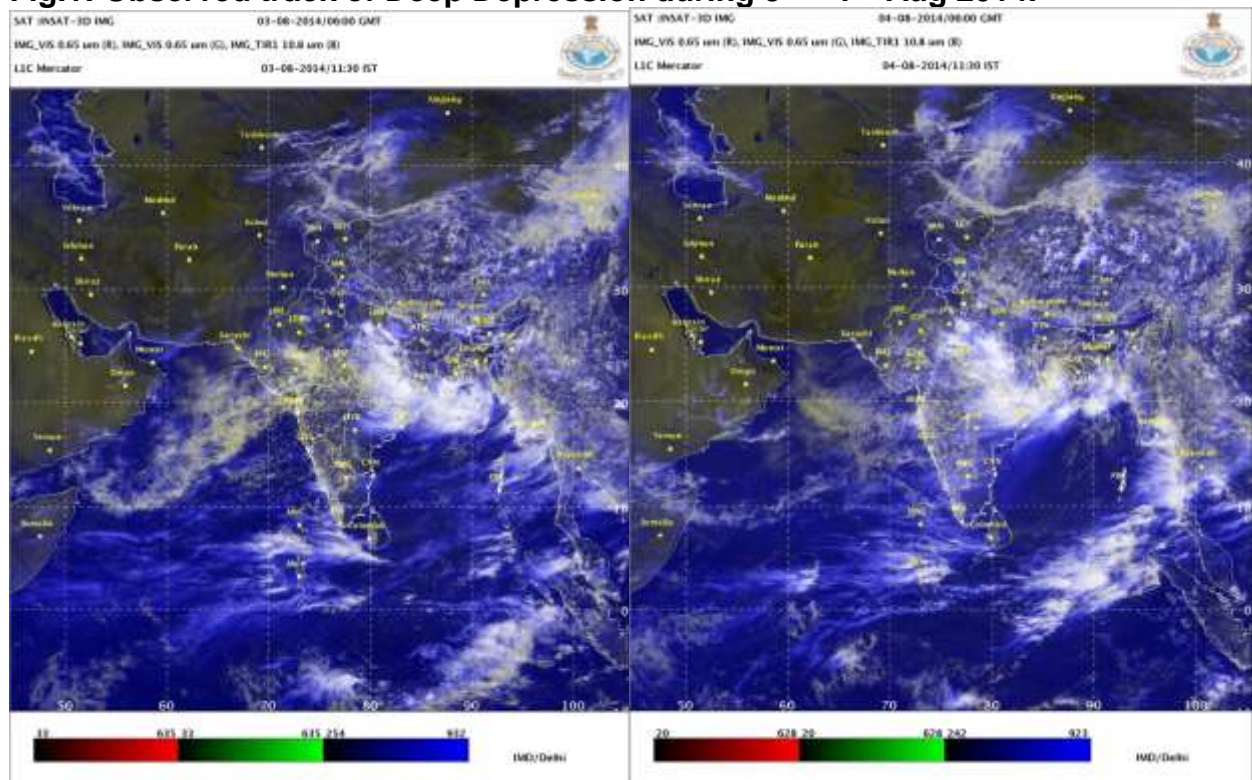


Fig.2(a). Typical INSAT - 3D Satellite imageries of depression at 0600 UTC of 03rd-04th August, 2014.

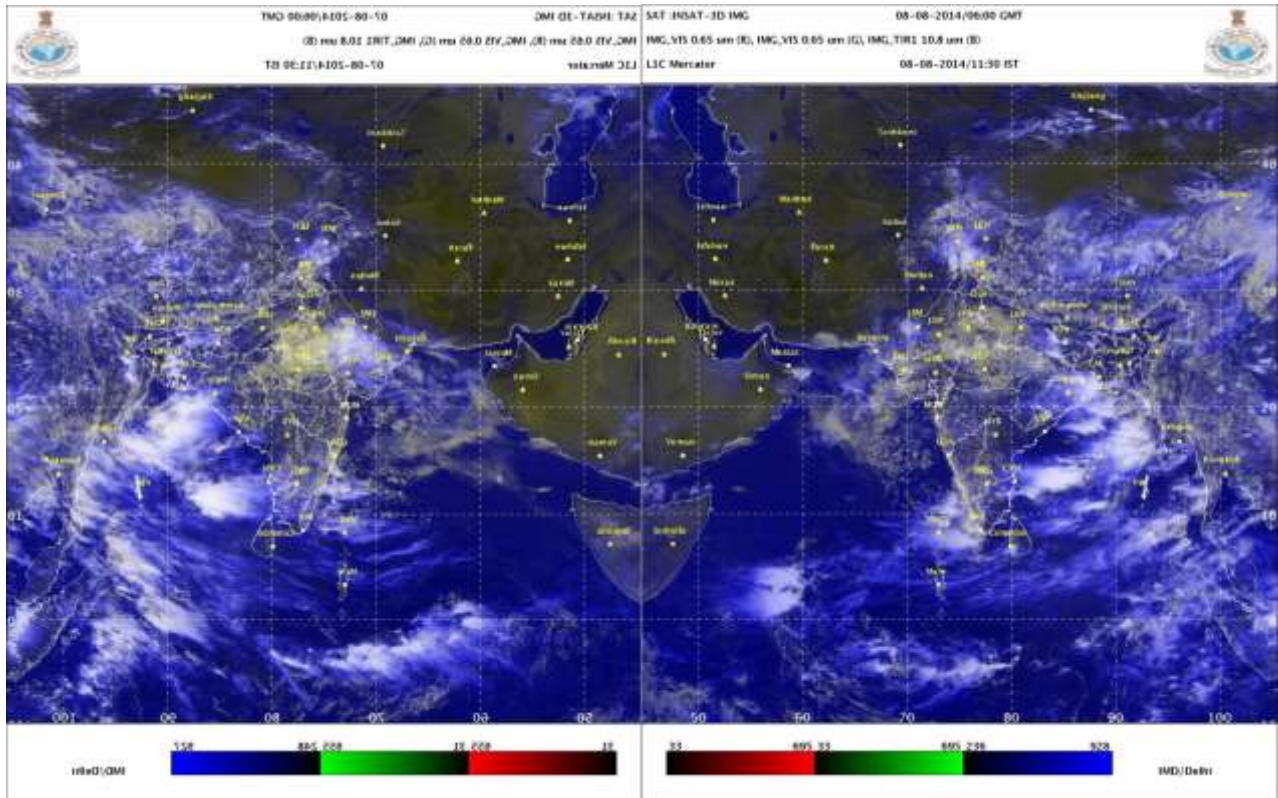
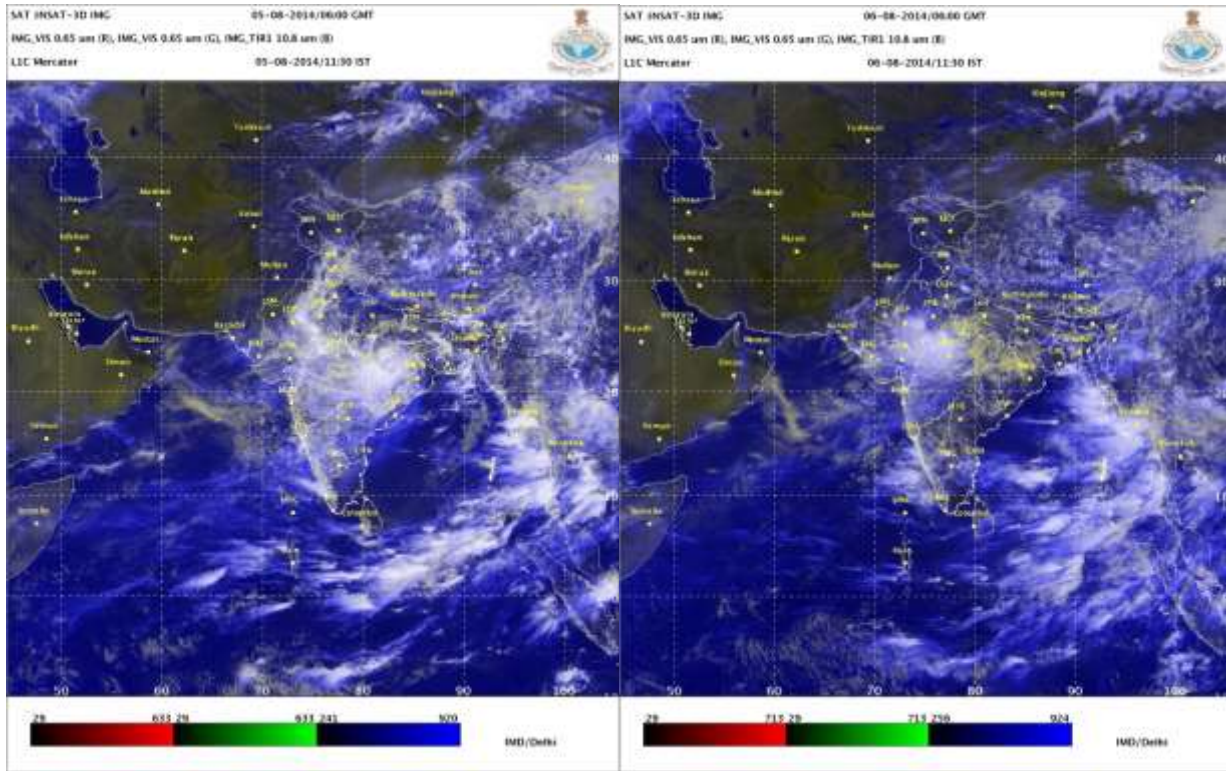


Fig.2(b). Typical INSAT - 3D Satellite imageries of depression at 0600 UTC of 05th-08th August, 2014.

4. Realised weather:

Chief amounts of rainfall (7 cm and above) during the last 24 hours ending at 0300UTC from 4th -8th August 2014 are as given below:

Date.04.08.2014:

GANGETIC WEST BENGAL: Digha-31, Contai-20 and Sagar Island (AWS)-14.

ODISHA: Sambalpur-34, Jujumura (ARG)-29, NH5 Gobindpur, Balasore-23 each, Bhograi-21, Lakhanpur (ARG)-20, Nilgiri, Burla (ARG)-18 each, Jaipur, Basudevpur (AWS), Athmalik, Bonth-17 each, Rajkishorenagar, Barmul-16 each, Rairakhol, Hirakud and Tikarpara-15 each, Danagadi (ARG), Jaleswar & Pallahara-14 each, Bhadrak (AWS), Kankadahad (ARG) & Altuma (CWC)-13 each, Korei (ARG), Anandpur and Banki (ARG)-12 each, Akhuapada, Telkoi, Rajghat, Kotagarh, Nimpara, Tensa, Kamakhyanager-11 each, Tihidi (ARG), Kashipur, Narsinghpur, Dhamnagar (ARG), Sukinda & Jaipatna-10 each, Junagarh, Jajpur, Deogaon, Daitari, Umarkote, Jhorigam (ARG), Khairamal, Jenapur, Gania (ARG), Kendrapara, Pattamundai & Batagaon-9 each, Nischintakoili (ARG), Boudhgarh, Derabis (ARG), Mundali, Narla (ARG), Mohana and Nuagada (ARG)-8 each, Jhumpura, Binjharpur (ARG), Garadapur (ARG), Kantamal, Keonjhar, Hindol, Bari (ARG), Kolabira (ARG), Swam Patna, Khandapara, Cuttack, Chandbali, Rajkanika, Niali (ARG), Dhenkanal, Rengali) and Raighar (ARG)-7 each.

CHHATTISGARH: Balod-11, Katghora, Ambikapur-9 each, Gharghoda, Dhamtari, Dondilohar, Surajpur & Korba-8each, Manendragarh, Raigarh, Dongargaon & Saraipali-7 each.

Dt. 05.08.2014:

GANGETIC WEST BENGAL: Jagatballavpur (ARG) 7

ODISHA: Pallahara-40, Kuchinda-32, Barkote-29, Naktideul-28, Sambalpur & Burla (ARG) 27 each, Deogarh, Jujumura (ARG) & Jamankira-26 each, Hirakud, Deogaon & Batagaon- 25 each, Keiri (AWS) & Ambabhona-24 each, Atabira (ARG)-22, Bargarh, Athmalik, Banaigarh (AWS)- 21 each, Lahunipara, Bargaon and Bijepur-20 each, Reamal-19, Swam Patna-18, Karanjia, Rengali, Telkoi and Sundargarh-16 each, Laikera, Rairakhol, Thakurmunda, Keonjhar & Jhumpura-15 each, Banki (ARG), Sohela, Khariar, Rajkishorenagar & Chandahandi (ARG)-14 each, Ghatagaon, Sinapali (ARG), Bamra (ARG), Batli (ARG) & Joshipur-13 each, Kaniha (ARG), Rajgangpur, Kaptipada (ARG), Hemgiri, Joda (ARG) & Chandanpur-12 each, Nawana, Jharsuguda and Junagarh-11 each, Boudhgarh, Champua, Barmul & Kankadahad (ARG)-10 each, Barpalli (ARG), Jhorigam (ARG), Balisankara (ARG), Boden (ARG), Chendipada, Jaipur, Khandapara, Mandira Dam, Narsinghpur, Bangiriposi & Binika-9 each, Kotagarh, Parjang (ARG), Komna, Harichandanpur (ARG), Lanjigarh, Udala, Birmaharajpur (ARG), Remuna (ARG), Bhawanipatna, Phulbani, Ambadola & Daitari-8 each, Harabhanga, Ullunda (ARG), Padampur, Tigiria (ARG), Kantamal, Nischintakoili (ARG), Raighar (ARG), Betanati (ARG), Panposh, Altuma (CWC), Balimundali, Dunguripalli, Daspalla, Daringibadi, Titlagarh, Nh5 Gobindpur and Dharmagarh (ARG)-7 each.

JHARKHAND: Raidih-8 and Kurdege-7.

CHHATTISGARH: Saraipali-16, Dhamtari-15, Deobhog & Bhanupratappur 13 each, Manendragarh-12, Ambagarh Chowki-11, Bilaspur & Sarangarh 10 each, Kanker-8, Janakpur, Katghora & Pali-7 each.

EAST MADHYA PRADESH: Sidhi (AWS)-18, Tikamgarh (AWS)-16, Kotma-12, Jaithari & Gadarwara-10 each, Anuppur (AWS) & Amarkantak-8 each, Dindori (AWS) & Pushpajgarh-7 each.

VIDARBHA: Korchi-17, Deori & Sadakarjuni-12 each, Amgaon-11, Goregaon & Gondia-9 each, Kurkheda-8 and Salekasa-7.

WEST MADHYA PRADESH: Guna (AWS)-10, Chanderi-9, Sheopur (AWS)-8, Pachmarhi & Udaipura-7 each.

MADHYA MAHARASHTRA: Mahabaleshwar-31, Igatpuri-13, Vadgaon Maval-12, Paud Mulshi-10, Gaganbawada & Velhe-9 each and Bhor-7.

EAST RAJASTHAN: Jhalawar-15, Bonli & Lalsot-13 each, Baran & Mangrol-11 each, Jamwaramgarh, Anta & Jhalrapatan-10 each, Kishanganj, Asnawar & Shergarh-8 each, Khanpur, Kishngarhwas, Chabra, Baseri, Indergarh, Ramganjmandi and Sawai Madhopur-7 each.

06.08.2014:

WEST MADHYA PRADESH: Lateri and Khilchipur-15 each, Bhanpura, Kurwai & Chanderi-13 each, Narsingarh, Rajgarh, Guna-AWS-11 each, Pichhore-10, Biaora, Sironj, Chachoda and Ganjbasoda-9 each, Salwani/Silvani, Ashoknagar-AWS and Alipur (Jaura)-8 each, Begumganj, Mungaoli, Dabra, Morena-AWS and Garoth-7 each.

EAST MADHYA PRADESH: Katni-AWS-21, Khurai-19, Umaria-AWS & Damoh-AWS-17 each, Patan-16, Kotma and Bichhia-15 each, Sohagpur-AWS, Khajuraho Aero & Sagar-AWS-13 each, Tikamgarh-AWS-12, Deori, Buxwaha, Tendukheda & Nainpur-11, Amarkantak-10, Rehli & Narsinghpur-AWS-9 each, Pushpajgarh, Hatta, Jaithari, Chahtarpur-AWS and Gotegaon-8, Kaneli, Ajaigarh, Rajnagar and Dindori-AWS-7.

CHHATTISGARH: Manendragarh-18, Katghora-17, Mungeli-14, Janakpur-9, Pali-8, Baikunthpur, Pendra Road & Kawardha-7 each.

VIDARBHA: Mehkar-19, Sindkhed Raja-19, Chikhli-13, Lonar & Korchi-9 each, Buldana and Deolgaon Raja-7 each.

EAST RAJASTHAN: Baseri SR-21, Hindaun-15, Nainwa-14, Asnawar SR-13, Gangapur & Chothkabarwara SR-12 each, Atru SR, Bakani SR, Shahabad, Deoli & Pisagan SR-11 each, Aklera, Lalsot & Bamanwas SR-10 each, Sapau SR, Dholpur Tehsil SR, Manohar Thana, Hindoli-9 each Kesarpura SR, Khanpur, Jhalawar, & Chipabarod SR-8 each, Indergarh SR,

Niwai Mangliawas SR, Pachpahar SR, Bayana, Tonk Tehsil SR, Bonli, Kishanganj, Jhalarapatan SR, Karauli, Mandana SR, Nagrarfort SR and Chambal/R.B.Dam-7 each.

MADHYA MAHARASHTRA: Mahabaleshwar- Imd Obsy-11 and Gaganbawada-10.

WEST UTTAR PRADESH: Mahroni-13, Garotha-8 and Lalitpur-7.

Date.07.08.2014:

WEST MADHYA PRADESH: Manasa -18, Jawad-17, Bhanpura-15, Neemuch (AWS)-15, Kolaras-13, Mungaoli-13, Garoth & Kurwai-12, Agar & Guna (AWS)-11 each, Sarangpur-10, Mandsaur (AWS) , Khilchipur, Suvasara & Chanderi-8 and Ashoknagar (AWS)-7.

EAST RAJASTHAN: Bhinay-27, Shahabad & Hurda -26 each, Bijoliya -23, Sangod, Geola, Sarwar, Deoli-22 each, Badesar -21, Anta -20, Jahazpur & Hindoli-19 each, Bhainsroadgarh-18, Banera, Baran, Mandal, Gangrar & Nimbahera-17 each , Bhilwara Tehsil, Sawaimadhopur Tesil, Atru, Chambal/ R.B.Dam, Chittorgarh, Mangrol, Nainwa, Patan, Sahada, Pachpahar -15 each , Indergarh, Shahpura, Kotri, Ramganjmandi, Kishanganj-14 each, Bundi, Kapanan, Rashmi, Chhotisadri, Vijaynagar, Asind, Ladpura, Talera -13 each, Mandalgarh, Malpura, Khanpur, Begu, Sawar, Kota Aero-12 each, Tonk Vanasthali, Nagrarfort, Pisagan , Mandana, Railmagra, Piplu-11 each, Bhopalsagar, Tonk Tehsil, Masuda , Bari Sadri, Todaraisingh, Arai, Kekri -10 each, Pratapgarh, Uniara / Aligarh, Vallabhnagar, Nayanagar/Beawar, Deogarh, Jhalawar, Sawai Madhopur, Degod, Asnawar , Gangdhar, Jhalarapatan -9 each, Dungla , Amet, Raipur, Chabra, Dug, Kumbhalgarh, Mavli-8 each, Bhim, Rajsamand, Chothkabarwara, Manohar Thana, Niwai, Tatgarh, Chipabarod , Bakani, Jawaja and Pirawa-7

WEST RAJASTHAN: Jayal-15, Merta City-9, Marwar Junction & Desuri-9, Raipur-9 each, Degana & Rohat-8 each, Jaitran, Pali & Sojat-7 each.

GUJARAT REGION: Mahudha-7.

Date.:08.08.2014:

WEST RAJASTHAN: Jaitran-10, Desuri & Pali 9 each, Bhopalgarh-8, Marwar Junction & Sojat-7 each.

EAST RAJASTHAN: Nayanagar/Beawar, Amet-9 each, Deogarh-7.

GUJARAT REGION: Matar & Nadiad-7 each.

(AWS: Automatic Weather Station; ARG : Automatic Rain Gauge; AP: Airport)

5. Rainfall forecast verification:

The heavy rainfall warning issued by the IMD along with the realized rainfall is given in the table given below:

Date (Time in UTC)	Synoptic system	Heavy rainfall warning	Heavy rainfall realized at the end of 0830 Hrs of the date
03.08.2014 (0300)	Low pressure area formed over north Bay of Bengal and neighbourhood. Associated upper air cyclonic circulation extends upto 7.6 km above mean sea level.	<p>Heavy to very heavy rainfall at isolated places- Odisha.</p> <p>Heavy rainfall at isolated places - Gangetic West Bengal and Chhattisgarh.</p>	<p><u>04.08.2014:</u> Heavy to very heavy rainfall at a few places with extremely heavy at isolated places – Odisha, Gangetic West Bengal.</p> <p>Heavy rainfall would occur at isolated places- Chhattisgarh.</p>
04.08.2014 (0300)	Depression lay centered over Gangetic West Bengal and is close to Medinipora..	<p>Extremely heavy falls at isolated places- Chhattisgarh and Odisha.</p> <p>Heavy to very heavy rainfall at isolated places – east Madhya Pradesh, Vidarbha and Jharkhand, Chhattisgarh, Odisha.</p> <p>Heavy rainfall at isolated places- East Uttar Pradesh, Gangetic West Bengal, Madhya Maharashtra</p>	<p><u>05.08.2014:</u> Extremely heavy falls at isolated places- Odisha.</p> <p>Heavy to very heavy rainfall at isolated places- Chhattisgarh, east Madhya Pradesh and Vidarbha, Odisha.</p> <p>Heavy rainfall at isolated places- Gangetic West Bengal, Jharkhand, Madhya Maharashtra, East Rajasthan and west Madhya Pradesh</p>
05.08.2014 (0300)	Deep Depression over north Chhattisgarh and adjoining Jharkhand & Odisha remained practically stationary and lay centered at, about 100 km. east-southeast of Ambikapur.	<p>Extremely heavy falls at isolated places - Madhya Pradesh, Vidarbha and Chhattisgarh.</p> <p>Heavy to very heavy rainfall at isolated places - Odisha and Jharkhand.</p> <p>Heavy rainfall at isolated places - South Uttar Pradesh, East Rajasthan, and Madhya Maharashtra.</p>	<p><u>Date.06.08.2014:</u> Extremely heavy falls Nil</p> <p>Heavy to very heavy rainfall at a few places – Madhya Pradesh, East Rajasthan</p> <p>Heavy to very heavy rainfall at isolated places - Chhattisgarh, Vidarbha, West Uttar Pradesh</p> <p>Heavy rainfall at isolated places - Madhya Maharashtra.</p>
06.08.2014 (0300)	Depression over north lay centered over	Extremely heavy falls at	<u>Date.07.08.2014:</u> Extremely heavy falls at

	central parts of north Madhya Pradesh & neighbourhood, about 50 km southeast of Khajuraho.	isolated places - West Madhya Pradesh. Heavy to very heavy rainfall at isolated places – East Rajasthan, Gujarat. Heavy rainfall at isolated places -Uttar Pradesh and East Madhya Pradesh.	isolated places- east Rajasthan. Heavy to very heavy rainfall at isolated places- West MP and West Rajasthan, East Rajasthan Heavy rainfall at isolated places- Gujarat
07.08.2014 (0300)	Well marked low pressure area and over northwest Madhya Pradesh and neighbourhood	Heavy to very heavy rainfall at isolated places -East Rajasthan. Heavy rainfall at isolated places- West Rajasthan, West Madhya Pradesh, Gujarat.	<u>Date.08.08.2014:</u> Very heavy rainfall -Nil. Heavy rainfall at isolated places- West and East Rajasthan, , Gujarat.

Damage Report:

Odisha:

- Human causality due to flood = 32
- Human causality due to lightning = 15
- Livestock loss=149 (due to flood and heavy rainfall.)
- Number of houses damaged = 45953 (massive damage occurred to public infrastructure such as embankments, roads, culverts etc.)
- Crop area affected 367691.7 hec.
(Source: Govt. of Odisha)
