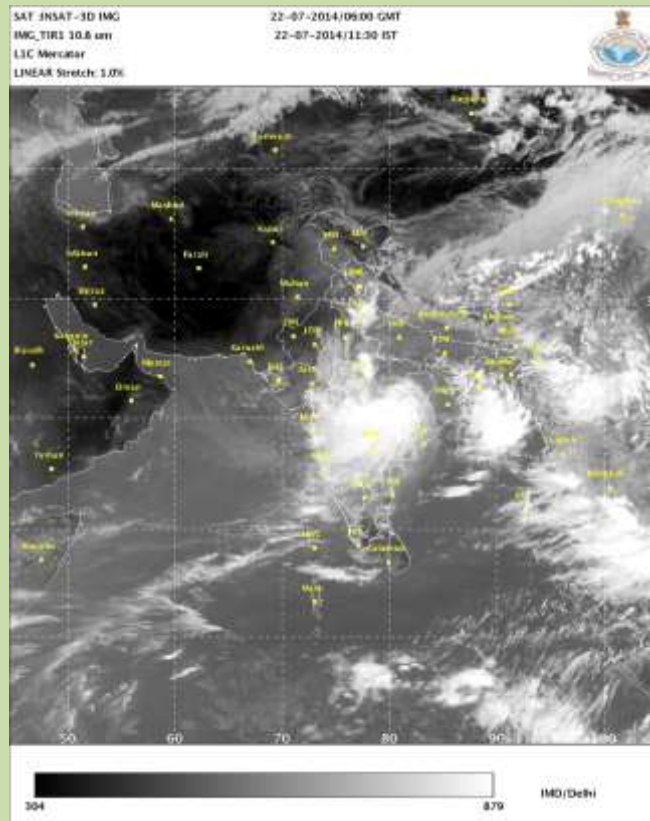




**GOVERNMENT OF INDIA**  
**MINISTRY OF EARTH SCIENCES**  
**EARTH SYSTEM SCIENCE ORGANISATION**  
**INDIA METEOROLOGICAL DEPARTMENT**

**A Preliminary Report on Land Depression over northeastern parts of Odisha and adjoining areas of Gangetic West Bengal (21 - 23 July 2014)**



INSAT – 3D IMAGERY BASED ON 0600 UTC OF 22<sup>ND</sup> JUL, 2014

**CYCLONE WARNING DIVISION, NEW DELHI**

**JULY 2014**

## Land Depression over northeastern parts of Odisha and adjoining areas of Gangetic West Bengal during 21<sup>st</sup> - 23<sup>rd</sup> July 2014

### 1. Introduction

A land depression formed and lay centred over northeastern parts of Odisha and adjoining areas of Gangetic West Bengal on 21<sup>st</sup> July 2014 morning. It moved westnorthwestwards and weakened into a well marked low pressure area over west Madhya Pradesh and neighbourhood on 23<sup>rd</sup> July. The salient features of the system are as follows:

- (i) It caused heavy to very heavy rainfall at a few places with isolated extremely heavy falls over central part of the country including Odisha, Chhattisgarh, east & west Madhya Pradesh and Vidarbha.
- (ii) Deficiency in monsoon rainfall during the month of June and the 1<sup>st</sup> week of July due to sluggish advance of monsoon was largely compensated due to formation of this system.

### 2. Monitoring and Prediction:

The depression was monitored with satellite network, ocean buoys, coastal, observations and Doppler Weather Radar (DWR), Kolkata & Nagpur. The half hourly INSAT/ Kalpana imageries & scattrometer wind and every 10 minutes DWR imageries and products were used for monitoring of depression. The intensity of the depression was mainly monitored through synoptic observations from surface stations. Various numerical weather prediction (NWP) models including IMD's global and meso-scale models were utilized to predict the track and intensity of the depression.

### 3. Genesis:

During the 3<sup>rd</sup> week of July, southwest monsoon was active as the Monsoon trough lay south of its normal position and extended to southeastwards upto eastcentral Bay of Bengal. An upper air cyclonic circulation between 1.5 & 5.8km above mean sea level lay over northeast Bay of Bengal and neighbourhood on 19th. Under its influence, a low pressure area formed over north Bay of Bengal and adjoining areas of Gangetic West Bengal and Odisha and associated cyclonic circulation extended upto 7.6km above mean sea level on 20th. It into a **Depression** and lay centred over northeastern parts of Odisha and adjoining areas of Gangetic West Bengal, near Lat. 22°N / Long. 87°E, about 50 km east of Baripada at 0300 UTC of 21st.

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 21<sup>st</sup> July. The vorticity was maximum at the southwest sector of the system. Lower-level convergence and upper-level divergence also increased and were about  $20 \times 10^{-5} \text{ sec}^{-1}$  and  $20 \times 10^{-5} \text{ sec}^{-1}$  respectively. The vertical wind shear was low and it was about 5-10knots. Hence all the environmental features supported the genesis of the system.

### 4. Intensification and movement:

The above mentioned favorable environmental features continued to prevail on 21<sup>st</sup> and 22<sup>nd</sup>. 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 32°North. As a result, the steering winds in upper troposphere were east to eastsoutheasterly leading to westward/ westnorthwestward movement of the system. The system moved west northwestwards and lay centred over south Jharkhand and neighbourhood near Lat. 22.5°N / Long.85.0°E about 100km west southwest of Jamshedpur at 1200UTC 21st. It further moved westwards and lay centred over north Chhattisgarh and neighbourhood near Lat.22.5°N / Long.82.5°E about 50km southeast of Pendra at 0300UTC of 22nd and moved westwards and lay centered over east Madhya Pradesh and neighbourhood near Lat.22.5°N / Long.81.0°E about 100km southeast of Jabalpur at 1200UTC of 22nd. It further moved westwards and lay centred over west Madhya Pradesh and neighbourhood near Lat. 22.5°N / Long. 77.5°E about 50 km southeast of Bhopal at 0300UTC of 23rd and weakened into a well marked low pressure area over the same region by the afternoon of 23<sup>rd</sup> and persisted there in the same evening. It lay as a low pressure area over northwest Madhya Pradesh and neighbourhood on 24th, over southwest Rajasthan and neighbourhood in the evening and merged with the monsoon trough on 25th. However, the associated cyclonic circulation extending upto lower tropospheric levels persisted over southwest Rajasthan and neighbourhood on 25<sup>th</sup>, over northeast Rajasthan and neighbourhood on 26th & 27th; over Punjab and adjoining north Rajasthan on 28th and over Punjab and neighbourhood on 29th & 30<sup>th</sup> and became less marked on 31<sup>st</sup> July.

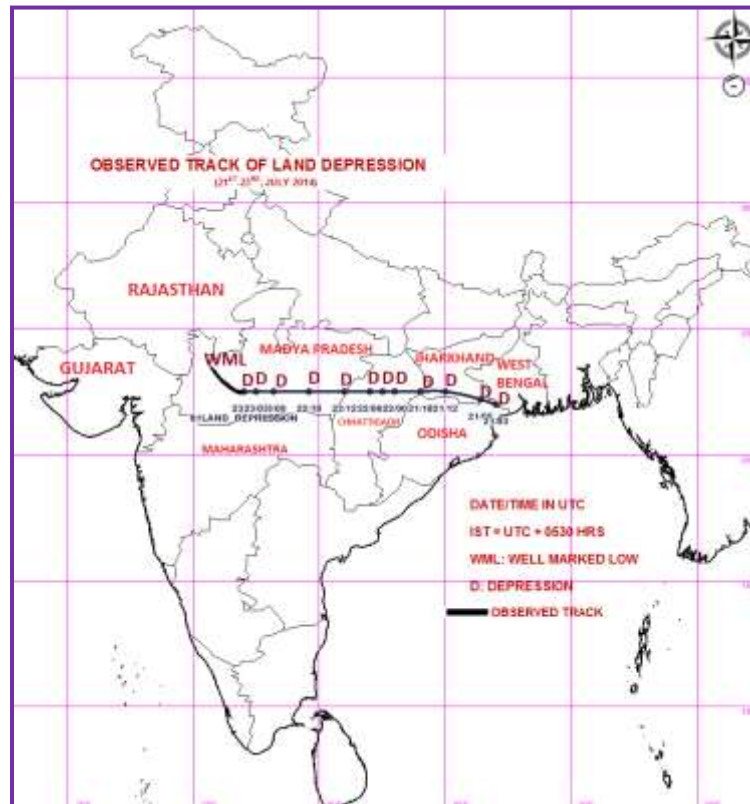
The best track of the depression is shown in fig.1. The best track parameters are given in Table.1.

**Table.1: Best track positions and other parameters of land depression over northeastern parts of Odisha and adjoining areas of Gangetic West Bengal during 21<sup>st</sup> - 23<sup>rd</sup> July 2014.**

Date	Time (UTC)	Location of the centre lat. <sup>0</sup> N/ long. <sup>0</sup> E	CI No.	ECP in hPa	Estimated Sustained Maximum Wind in KT	Estimated pressure drop at the centre in hPa	Grade
21.07.2014	0300	22.0/87.0	1.5	988.0	25	04	D
21.07.2014	0600	22.2/86.4	-	988.0	20	04	D
21.07.2014	1200	22.5/85.0	-	988.0	20	04	D
21.07.2014	1800	22.5/84.0	-	990.0	20	04	D
22.07.2014	0000	22.5/83.0	-	990.0	20	04	D
22.07.2014	0300	22.5/82.5	-	990.0	20	04	D
22.07.2014	0600	22.5/82.0	-	990.0	20	04	D
22.07.2014	1200	22.5/81.0	-	990.0	20	04	D
22.07.2014	1800	22.5/79.6	-	992.0	20	03	D
23.07.2014	0000	22.5/78.2	-	992.0	20	03	D
23.07.2014	0300	22.5/77.5	-	992.0	20	03	D
23.07.2014	0600	22.5/77.0	-	992.0	20	03	D

23.07.2014	1200	Weakened into a well-marked low over west Madhya Pradesh and neighbourhood.
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Typical satellite imageries of the depression are shown in fig.2 and radar imageries in fig.3. Satellite imageries indicate shearing of convective clouds to the west of low level circulation centre under the influence of the high easterly vertical wind shear. Reflectivity images from Doppler weather Radar (DWR) Kolkatta also indicated convective clouds lying to the southwest of centre of depression.



**Fig.1: Observed track of the land depression over northeastern parts of Odisha and adjoining areas of Gangetic West Bengal during 21<sup>st</sup> - 23<sup>rd</sup> July 2014.**

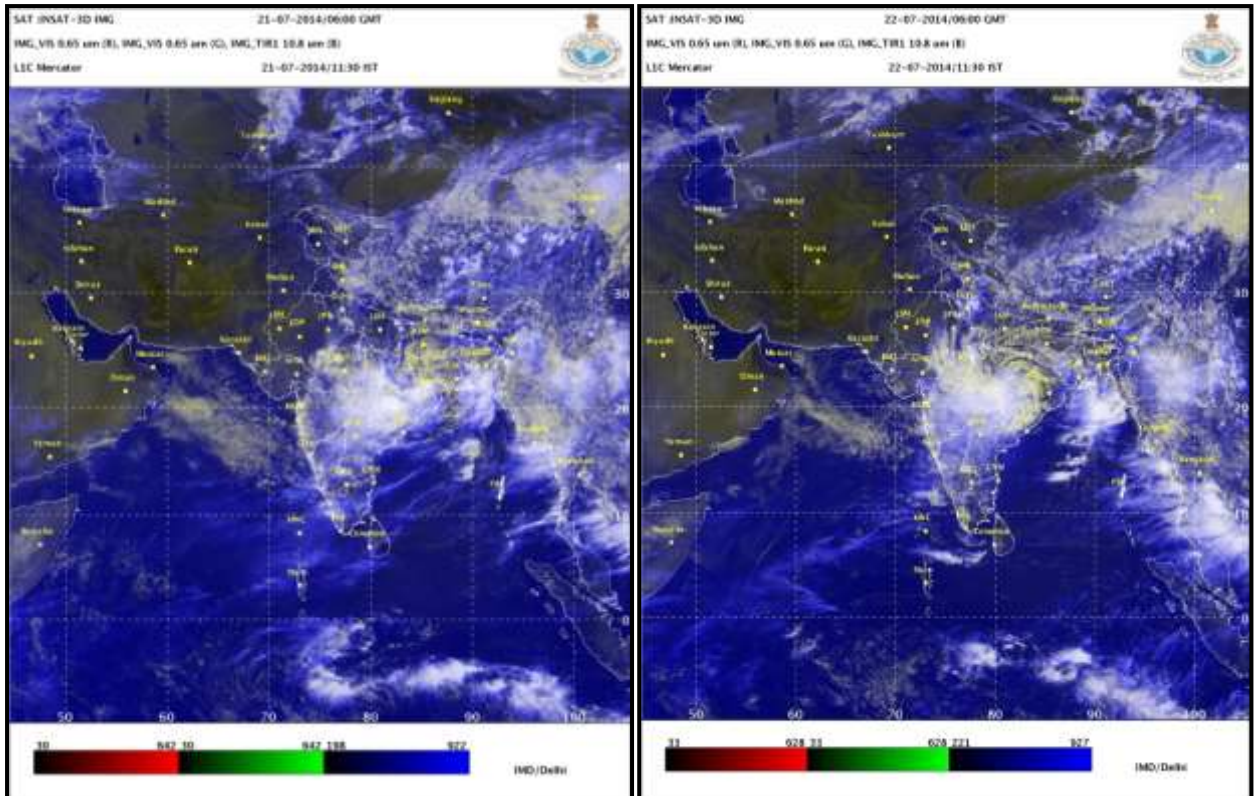
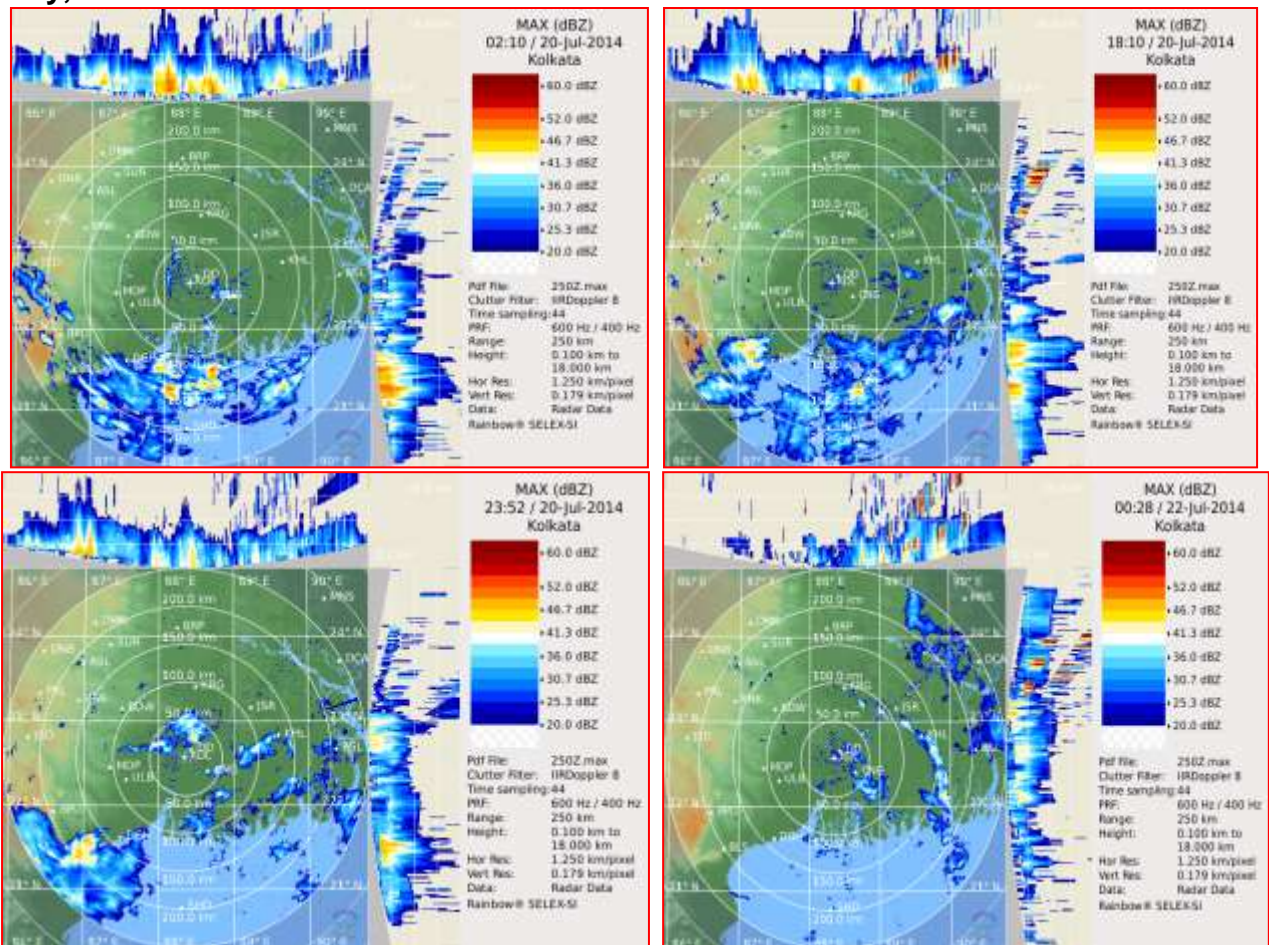
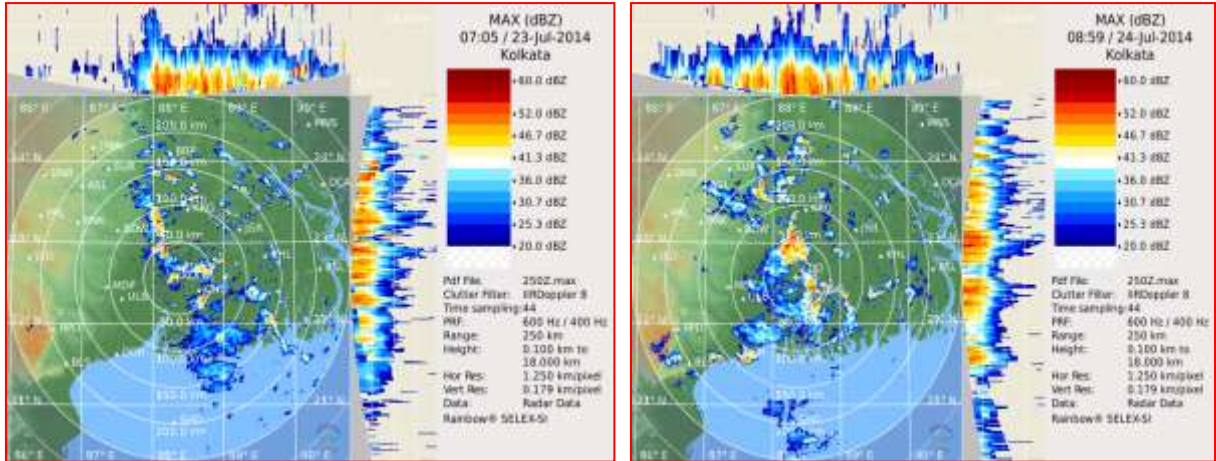


Fig.2. Typical INSAT-3D Satellite images of depression at 0600 UTC of 21 and 22nd July, 2014





**Fig.3. Reflectivity images (Max Z) of DWR Kolkata from 20<sup>th</sup> July-24<sup>th</sup> July, 2014**

## 5. Realised weather:

Chief amounts of rainfall (7 cm and above) during the last 24 hours ending at 0830 Hrs IST of 21-23<sup>rd</sup> July 2014 are given below:

### 21<sup>st</sup> July 2014:

**GANGETIC WEST BENGAL:**Contai-13, Sagar Island (AWS)-8

**ODISHA:** Anandpur, Nawapara- 27 each, Jhorigam (ARG), Balasore- 26 each, Soro- 25, Champua & Pallahara-24 each, Jaipatna-22, Komna-21, Khaprakhol(ARG)-21, Ranital(AWS) & Chandahandi (ARG)-20 each, Ghatagaon & Swam Patna-19 each, Karanjia-17, Rajghat,NH5 Gobindpur & Barkote-16 each, Jhumpura, Umarkote, Keonjhar, Telkoi, Dabugan (ARG), Jharbandh (ARG), Joshipur, Bhograi & Nilgiri-15 each, Remuna (ARG), Paikmal, Bari (ARG) & Kaptipada (ARG)-14 each, Jaleswar, Bonth, Jajpur & Basudevpur (AWS)-13 each, Raigarh (ARG), Patnagarh, Kosagumda, Turekela & Jujumura (ARG)-12 each Harichandanpur (ARG), Lahunipara, Panposh, Danagadi (ARG), Bhadrak (AWS) & Nawana-11 each, Dhamnagar (ARG) & Belgaon-10 each, Binjharpur (ARG), Daitari, Khariar, Kuchinda, Tentulikhunti(ARG), Belpada(ARG), Tarva (ARG), Gurundia (ARG), Rajkanika, Joda (ARG), Kashipur, Nawarangpur, Kendrapara, Baripada & Chandbali-9 each, Akhuapada, Derabis (ARG), Ranpur, Rairangpur, Kantamal, Chandanpur, Reamal, Dhenkanal, Junagarh, Bolangir, Bamra (ARG) & Raghunathpur (ARG)-8 each, Rajgangpur-, Rengali, Nischintakoili (ARG), Tirtol (ARG), Betanati (ARG), Kotraguda, Madanpur, Rampur, Pattamundai, Ambadola, Thakurmunda, Naktideul, Paradeep (CWR), Lanjigarh, Muniguda (ARG), Jamankira, Birmaharajpur (ARG), Mandira Dam, Deogarh, Batagaon, Kesinga (ARG) and Saintala (ARG)-7 each.

### 22nd July 2014:

**ODISHA:** Bijepur-27, Sohela-25, Paikmal-23, Khaprakhol (ARG)-21, Khariar, Ambabhona, Phiringia (ARG) & Komna-19 each, Padampur-18, Nawapara-15,

Junagarh, Raigarh (ARG), Jharbandh (ARG) & Bargarh-13 each, Patnagarh, Banaigarh (AWS), Tensa, Keiri (AWS) & Lahunipara-12 each, Sinapali (ARG), Chandahandi (ARG) & Telkoi-11 each, Jharsuguda, Batli (ARG), Bargaon, Turekela & Jhorigam (ARG)-10 each, Deogaon, Gaisilet (ARG), Pallahara(9), Belpada (ARG), Binika, Narla (ARG), Bhawanipatna & Hemgiri-9 each, Deogarh, Jaipatna, Kesinga (ARG), Barkote, Dunguripalli, Atabira (ARG), Lakhanpur (ARG), Reamal-8 each, Bamra (ARG), Belaguntha (ARG), Titlagarh, Balisankara (ARG) and Salebhata (ARG)-7 each.

**JHARKHAND**: Kurdege-7.

**WEST UTTAR PRADESH**: Jhansi-7.

**EAST RAJASTHAN**: Nadoti-7.

**EAST MADHYA PRADESH**: Malanjkhanda-16, Pushpajgarh and Jaithari-13 each. Narsinghpur(AWS)-11, Jabalpur New (AWS). and Seoni (AWS)-7.

**VIDARBHA**: Deori & Korchi-18 each, Salekasa & Amgaon-17 each, Sadakarjuni & Gondia-14 each, Goregaon-13, Sakoli-11, Tirora, Kurkheda & Lakhani-10 each, Arjuni Morgaon-9, Mohadi, Dhanora, Lakhandur, Bhandara & Pauni-8 each and Desaiganj-7.

**CHHATTISGARH**: Saraipali-34, Mahasamund-23, Bemetara-21, Arang-19, Simga-18, Bhopalpatnam, Bhanupratappur, Mana Raipur AP & Dhamtari-17, Baloda Bazar, Raipur & Gariabund-16 each, Durg, Raigarh, Ambagarh Chowki, Bijapur & Kanker-15 each, Dongargarh, Dantewara & Balod-13 each, Sarangarh & Rajnandgaon-12 each, Pali & Kawardha-11 each, Pallari/Palari & Dondilohara-10 each, Kondagaon, Mungeli, Champa, Bilaspur, Janjgir & Pendra Road-9 each, Rajim-8, Sakti, Katghora, Narayanpur and Dongargaon-7 each.

**MADHYA MAHARASHTRA**: Mahabaleshwar-21, Igatpuri-10, Gaganbawada & Paud Mulshi-7 each.

**23rd July 2014:**

**Odisha**: Nil.

**EAST RAJASTHAN**: Shahabad-12, Chabra & Aklera-7 each.

**WEST MADHYA PRADESH**: Khaknar-41, Khandwa (AWS)-30, Neapanagar-24, Bhainsdehi-21, Betul (AWS)-20, Atner-19, Multai & Burhanpur-15 each, Chicholi-14, Pandhana-13, Kolaras-12, Bhikangaon-11, Narsingarh & Bhanpura-10, Barwaha, Sonkatch & Khilchipur-9 each, Sarangpur, Shegaon, Khargone (AWS), Kurwai, Khategaon & Udaipura-8 each, Bhopal (AWS) (ARG), Budhni, Shivpuri (AWS), Rajgarh & Harsud (ARG)-7 each.

**EAST MADHYA PRADESH:** Katangi-14, Balaghat (AWS)-13, Sausar-12, Gadarwara, Chindwara (AWS) & Keolari-11 each, Amarwara-9, Seoni (AWS)-8, Waraseoni and Lakhnadon-7 each.

**CHHATTISGARH:** Ambagarh Chowki-10, Gandai & Dongargarh-8 each, Dondilohara, Bemetara, Gariabund, Dongargaon and Rajnandgaon-7 each.

**VIDARBHA:** Chikhaldra-28, Wardha, Ashti & Arvi-20 each, Kharangha & Lakhani-18 each, Tiwsa, Deori, Tirora & Jalgaon Jamod-17 each, Chandur Bazar, Akot, Dharni, Narkheda & Salekasa-16 each, Gondia, Amgaon, Sangrampur, Kurkheda & Goregaon-15 each, Tumsar, Kamptee, Dhamangaon Rlwy, Nagpur Aerodrome, Chandur Rlwy, Yeotmal & Warud-14 each, Umrer, Pauni, Katol, Telhara, Desaignj, Deoli, Anjangaon, Akola, Morsi, Kuhi, Perseoni, Bhandara, Samudrapur & Saoner-13, Nandgaonkazi, Arjuni Morgaon, Sadakarjuni, Mauda, Hingna & Mohadi-12, Bramhapuri, Ramtek, Hinganghat, Daryapur, Sakoli, Chimur, Lakhandur, Ner, Paratwada, Nagbhir, Bhiwapur & Darwha-11, Kalmeshwar & Manora-10, Mangrulpur, Karanjlad, Amraoti, Balapur, Barshitakli, Murtajapur & Washim (AWS)-9 each, Armori, Khamgaon, Malegaon, Selu, Batkuli, Ralegaon & Nandura-8 each, Patur and Kalamb-7 each.

**24th July 2014:**

**MADHYA MAHARASHTRA:** Mahabaleshwar Imd Obsy-20, Shirpur-16, Gaganbawada & Chopda-14 each, Shahuwadi, Yaval-10 each, Amalner, Patan, Surgana, Sindkheda, Radhanagari, Chalisgaon, Jalgaon-9 each, Raver, Chandgad, Shirala, Bhor, Navapur, Shahada-8 each, Gargoti / Bhudargad, Peint, Akkalkuwa, Paud Mulshi, Kalvan, Taloda, Ajra, Satna Baglan & Bhadgaon-7 each.

**EAST RAJASTHAN:** Dungarpur Tehsil SR-11, Devel SR-10, Khushalgarh-9, Kherwara & Danpur-8, Bhungra SR & Kanva SR-7 each.

**GUJARAT REGION:** Kamrej-20, Mahudha-17, Vyara-16, Sankheda & Vandsa-15, Kathalal, Dangs (Ahwa) & V. Vidyanagar SR-14, Godhra, Chhota Udepur, Nadiad, Sojitra, Wanakbori, Halol, & Padra-13 each, Umreth, Borsad, Kapadvanj, Mahemdavad, Balasinor, Anand, Mandvi, Mangrol, Umerpada & Bharuch-12 each, Tarapur, Chikhli, Ghoghamba, Surat City, Songadh Dascroi & Olpad-11 each, Kheda, Shahera, Tilakwada, Petlad, Dabhoi, Jetpur Pavi, Dholka, Bodeli, Gandevi & Matar-10 each, Savli, Dahod, Sinor, Bavla, Valod, Kaprada, Abad City, Kalol, Mahuva, Vadodara, Uchchhal, Ukai, Sagbara & Dhansura-9 each, Mc Ahmedabad ARG, Jambughoda, Bardoli, Karjan, Khambhat, Dharampur, Jalalpor & Modasa-8 each, Anklav, Devgad Baria, Ankleshwer, Navsari, Malpur, Viramgam, Thasra, Rajpipala, Dhanpur, Nandod, Nizer & Valsad-7 each.

**WEST MADHYA PRADESH:** Sendhwa (Med)-16, Badnagar-15, Depalpur-14, Bhikangaon & Shegaon-13 each, Nepanagar, Dhar AWS & Mhow-12 each,



Bhabhra, Thikri, Khaknar, Khargone AWS, Indore AWS & Khandwa AWS-11 each, Jabot, Badnawar & Sardarpur-10 each, Gandhwani, Maheshwar & Barwaha-9 each, Kasarwad & Pandhana-8 each, Khirkiya ARG, Alirajpur AWS, Gautampura, Thandla, Burhanpur, Badwani AWS, Manawar, Jhabua AWS, Ratlam AWS & Nalchha-7 each.

**VIDARBHA:** Amraoti-13, Jalgaon Jamod & Dharni-8 each

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

## 6.) Rainfall forecast verification:

The heavy rainfall warning issued by the IMD along with the realised 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
21.07.2014 (0300)	Depression lay centered over north-eastern parts of Odisha and adjoining areas of Gangetic West Bengal near Lat. 22°N and Long. 87°E, about 50 km east of Baripada.	<p><b>Extremely heavy rainfalls-</b> Isolated places over Chhattisgarh</p> <p><b>Heavy to very heavy rainfall at a few places</b> – Odisha east Madhya Pradesh.and Chhattisgarh</p> <p><b>Heavy to very heavy rainfall at Isolated places</b> - Vidarbha and Jharkhand</p>	<p><b><u>Date.22.07.2014</u></b></p> <p><b>Extremely heavy</b> at isolated places of Odisha and Chhattisgarh.</p> <p><b>Heavy to very heavy rainfall at a few places-</b>Vidarbha east Madhya Pradesh.Odisha Chhattisgarh</p> <p><b>Heavy rainfall at isolated places</b> - Jharkhand, West Uttar Pradesh and east Rajastahan.</p>
22.07.2014 (0300)	Depression lay centred at 0300UTC of 22 July, 2014 over north Chhattisgarh and neighbourhood about 50 km southeast of Pendra.	<p><b>Extremely heavy rainfalls-</b> Isolated places over Chhattisgarh and Vidarbha.</p>	<p><b><u>23.07.2014:</u></b></p> <p><b>Extremely heavy rainfalls-</b> Isolated places over – Vidarbha and West Madhya</p>

		<p><b>Heavy to very heavy rainfall at a few places</b> - Madhya Pradesh Chhattisgarh and Vidarbha.</p> <p><b>Heavy rainfall would occur at isolated places</b> over Odisha.</p>	<p>Pradesh</p> <p><b>Heavy to very heavy rainfall at a few places-</b> Chhattisgarh west and , east Madhya Pradesh and Gujarat.</p> <p><b>Heavy rainfall at isolated places</b> over east Rajasthan</p>
23.07.2014 (0300)	Depression lay centred over west Madhya Pradesh & neighbourhood about 50 km southeast of Bhopal	<p><b>Extremely heavy rainfalls-</b> Isolated places over – Madhya Maharashtra</p> <p><b>Heavy to very heavy rainfall at a few places</b> west Madhya Pradesh, Madhya Maharashtra</p> <p><b>Heavy rainfall would occur at isolated places</b> east Madhya Pradesh, Gujarat, and Vidarbha</p>	<p><b><u>Date.:24.07.2014:</u></b> <b>Extremely heavy rainfalls- Nil</b></p> <p><b>Heavy to very heavy rainfall at a few places-</b> Madhya Maharashtra, Gujarat and west Madhya Pradesh</p> <p><b>Heavy rainfall at isolated places</b> Vidarbha and east Rajasthan.</p>

### 7.) Damages:

Odisha.

- Human casualty- 12,
- Live stock loss-38
- Crop are affected 29479 ha,
- Number of house damage= 1351.

(Source: Govt. of Odisha)

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