



## **Earth System Science Organization (ESSO) Ministry of Earth Sciences (MoES)**

### **India Meteorological Department**

#### **2015 Southwest Monsoon End of Season Report**

##### **HIGHLIGHTS**

- The season (June-September) rainfall over the country as a whole was 86% of its long period average (LPA). Thus years 2014 & 2015 was the fourth case of two consecutive all India deficient monsoon years during the last 115 years.
- Seasonal rainfall was 83% of its LPA over Northwest India, 84% of its LPA over Central India, 85% of its LPA over south Peninsula and 92% of its LPA over Northeast (NE) India.
- Out of the total 36 meteorological subdivisions, 18 subdivisions constituting 55% of the total area of the country received normal season rainfall and 17 subdivisions (39% of the total area of the country) received deficient season rainfall. One subdivision (West Rajasthan) constituting 6% of the total area of the country received excess rainfall.
- Monthly rainfall over the country as a whole was 116% of LPA in June, 84% of LPA in July, 78% of LPA in August, and 76% of LPA in September.
- Monsoon current advanced over the Andaman Sea 4 days earlier than its normal date of 20<sup>th</sup> May. However, it set in over Kerala on 5<sup>th</sup> June, 4 days later than its normal date of 1<sup>st</sup> June and covered the entire country by 26<sup>th</sup> June, nearly 20 days earlier than its normal date of 15<sup>th</sup> July. Withdrawal of monsoon from west Rajasthan commenced on 4<sup>th</sup> September against its normal date of 1<sup>st</sup> September.
- During the season, 2 Cyclonic Storms ('Ashobaa' and 'Kemon'), 6 monsoon depressions and 3 monsoon low pressure areas were formed as against the normal of 6 monsoon depressions and 6 monsoon low pressure areas per season.
- The monsoon onset over Kerala for this year was on 5<sup>th</sup> June against the forecast of 30<sup>th</sup> May  $\pm$  4 days.
- All the operational forecasts for the 2015 southwest monsoon season rainfall over the country as a whole and that over 4 broad geographical regions were within the limits of forecast issued in June and accurate. The forecasts for the rainfall for the second half of the monsoon season and that for the July over the country as a whole were also within the forecast limits. However, the forecast for the August rainfall was slightly below the lower forecast limit.

## 1. Onset and Advance of southwest Monsoon

This year, the southwest monsoon set over the south Andaman Sea on 16<sup>th</sup> May, four days earlier than the normal date. On 21<sup>st</sup> May, monsoon advanced further over remaining parts of Andaman Sea, some more parts of southeast Bay of Bengal and some parts of southwest and eastcentral Bay of Bengal.

The southwest monsoon set in over Kerala on 5<sup>th</sup> June, 4 days later than its normal date. Associated with this event, monsoon advanced into entire south Arabian Sea, some parts of central Arabian Sea, entire Lakshadweep area, some parts of coastal & south interior Karnataka and Tamil Nadu, most parts of south Bay of Bengal, some more parts of westcentral Bay of Bengal and some parts of northeast Bay of Bengal. By 14<sup>th</sup> June monsoon covered central Arabian Sea, some parts of north Arabian Sea, entire south Peninsula, and most parts of central and northeast India. The formation of couple of intense low pressure systems one each in Arabian Sea (Deep Depression) and in Bay of Bengal (Depression) towards the end of third week helped rapid advance of monsoon resulting monsoon covering entire country by 26<sup>th</sup> June.

***Fig.1 shows the isochrones of advance of monsoon 2015.***

## 2. Chief Synoptic Features

During the season, 11 low pressure systems (LPS) (low pressure areas and stronger systems) were formed. Out of these, 8 further intensified (Depression, deep depression, cyclonic storms) against a normal of 4-6 Depressions during the season. Two of which intensified into cyclonic storm 'Ashobaa' (7– 12 June) & 'Kemon' (26 July– 2 Aug.), over Arabian Sea and Bay of Bengal respectively and the 3 as Deep Depressions with 2 over land (27- 30 July & 16-19 Sept.) and one over Arabian Sea (22– 24 June). The 3 Depressions of which 2 formed as land Depression over Jharkhand and neighborhood (10 – 12 July) and over East Madhya Pradesh and adjoining Chhattisgarh (4 Aug.). The remaining formed over Bay of Bengal (20 – 21 June). Of 3 low pressure areas, one intensified as well marked low pressure area.

***Fig.2 shows the tracks of the monsoon depressions and Cyclonic Storms formed during the season.***

The setting of Southwest Monsoon over Kerala on 5<sup>th</sup> June was associated with strengthening and eastward movement of Madden Julian Oscillation (MJO)

through the Indian Ocean. This also helped the intensification of the onset vortex over the eastcentral Arabian Sea into Cyclonic Storm 'Ashobaa' (7 – 12 June).

The northeastward movement of the deep depression formed over Arabian Sea (22– 24 June) towards Gujarat caused widespread to fairly widespread rainfall over Konkan & Goa and Madhya Maharashtra and scattered to isolated rainfall over Gujarat region and Saurashtra & Kutch with isolated extremely heavy rainfall for couple of days. The presence of perturbations in the form of trough and cyclonic vortex in mid latitude westerlies caused active monsoon conditions over extreme north and western Himalayan region. Consequently, the southwest monsoon advanced further and covered major parts of central India, northern plains and western Himalayan region by 24<sup>th</sup> June and the entire country by 26 June. Thereafter, the rainfall activity reduced substantially over the major parts of south peninsular and central India, in the wake of unfavourable phase of MJO, which moved eastward into the western Pacific region.

The subsequent MJO activity in the western Pacific directed the significant part of cross equatorial flow towards the Typhoons developed over west Pacific Ocean, leading to weak monsoon circulation pattern, very well reflected by the presence of an anomalous anticyclone at 850 hPa level over central India and the western part of axis of monsoon trough laying close to foothills of the Himalayas. This caused subdued rainfall activity over major parts of central and Peninsular India during the first week of July. With the formation of a low pressure area over north Bay of Bengal on 8<sup>th</sup> July and its movement in northwest direction along the axis of monsoon trough plus abundant moisture present in the lower levels over the Indo-Gangetic plains aided its rapid intensification into a Land Depression over Jharkhand and neighbourhood on 10<sup>th</sup> July. In addition, the presence of cyclonic circulation over southwest Uttar Pradesh and adjoining areas and couple of western disturbances as a cyclonic circulation led to increase in rainfall activity all along the Indo- Gangetic plains and northwest India during the second week of July.

The third & fourth week of July witnessed rapid movement of number of disturbances in mid latitude westerlies, in the form of cyclonic vortex and, the active monsoon trough caused active to vigorous monsoon conditions over central India and western Himalayan region. Further the strengthening of cross equatorial flow in the lower troposphere led to enhanced rainfall along the west coast, however the rainfall activity over peninsular India remained subdued. Towards the end of the July,

two intense low pressure systems (Deep Depressions) formed along the axis of monsoon trough at the both ends, one over northeast Bay of Bengal and the other, over southwest Rajasthan. As the monsoon trough lacked the characteristic southwards tilt with height, the rainfall associated with the Deep Depression over Rajasthan was confined to the core area surrounding the system. The Deep Depression over Bay of Bengal intensified further into a cyclonic storm 'Komen'. As it moved in northwestwards direction, it caused heavy to very heavy rainfall with extremely heavy rainfall at isolated places over the eastern and central parts of the country. Its subsequent movement over inland after weakening caused vigorous to active monsoon conditions along its track.

The strengthening of winds at lower levels and circulation features during the first week of August led to formation of a low pressure area (11 – 15 Aug.) over westcentral and adjoining northwest Bay of Bengal off north Andhra Pradesh- south Odisha coasts. This revived the active monsoon conditions over major parts of the country and caused heavy to very heavy rainfall at isolated places over eastern, northern and central parts of India. Thereafter, the weakening of low pressure area and subsequent shifting of monsoon trough more northwards at the foot hills of Himalayas, led to weak monsoon flow pattern thereby keeping the rainfall activity confined to the east and northeast India during the second week. The formation of the well marked low pressure area (26 – 30 Aug.) over the same area caused scattered to fairly widespread rainfall with heavy to very heavy at isolated places over parts of eastern and northern parts of east coast.

The first week of September, witnessed the reduced rainfall activity mainly over northwestern parts of India thereby indicating favorable conditions for withdrawal of SW monsoon from West Rajasthan. The change in circulation pattern in the lower tropospheric levels led to withdrawal of monsoon from western parts of Rajasthan on 4 Sept. However, the presence of trough in lower tropospheric westerlies, east- west shear zone and couple of cyclonic vortex between lower and mid tropospheric levels revived the rainfall activity over parts of south Peninsular India. The low pressure area formed over westcentral & adjoining northwest Bay of Bengal on 12<sup>th</sup> Sept. intensified as Depression over south Odisha and neighbourhood on 16<sup>th</sup> and into Deep Depression over Vidarbha and adjoining south Chhattisgarh on 17<sup>th</sup> resulting strengthening of the monsoon activity over northern parts of peninsular India thereby delayed the further withdrawal.

### 3. Withdrawal of southwest Monsoon

The rainfall activity over the northwestern parts of Rajasthan remained subdued since last week of August. A change over in the lower tropospheric circulation pattern over the region from cyclonic to anti cyclonic resulted in the withdrawal of southwest monsoon from the northwestern parts of Rajasthan on 4<sup>th</sup> September. Monsoon withdrew from some more parts of Rajasthan and some parts of Punjab and Haryana on 9<sup>th</sup> September. On 29<sup>th</sup> September, monsoon withdrew from remaining parts of Rajasthan, Punjab, Haryana, Chandigarh & Delhi, entire Jammu & Kashmir, Himachal Pradesh, Uttarakhand, most parts of West Uttar Pradesh and some parts of West Madhya Pradesh, Gujarat State and north Arabian Sea and the withdrawal line passed through. On 6<sup>th</sup> October, the monsoon further withdrew from some more parts of Bihar; remaining parts of Madhya Pradesh; some parts of Jharkhand, Chhattisgarh, Vidarbha, Madhya Maharashtra; some more parts of Gujarat state and north Arabian sea. On 15<sup>th</sup> October, southwest monsoon further withdrew from some more parts of Jharkhand, most parts of Chhattisgarh, remaining parts of Vidarbha, Madhya Maharashtra, Gujarat State and north Arabian Sea, entire Marathwada and Konkan & Goa and some parts of Odisha, Telangana, North Interior Karnataka and central Arabian Sea. As on 16<sup>th</sup> October, the withdrawal line of Southwest Monsoon now passed through Forbesganj, Ranchi, Jharsuguda, Hanamkonda, Belgaum, Goa, Lat.15°N/Long. 70°E and Lat. 15°N/Long. 60°E.

***Fig.3 shows the isochrones of withdrawal of monsoon 2015.***

### 4. High Impact Weather Events

**Fig. 4** depicts the met. Sub-divisions or parts thereof, which experienced high impact weather events like, floods, landslides and Heat waves during the southwest monsoon season (June- September) along with the dates. The figure also indicates areas that experienced isolated extremely heavy rainfall (Rainfall amount  $\geq 25\text{cm}$  reported during the 24 hours ending at 0830 hrs IST) events during the season without any reference to the dates of these occurrences.

Incessant rainfall associated with the active monsoon conditions and, the formation and movement of the monsoon low pressure systems often caused flood situations over various areas during different parts of the season.

During this season, the heat wave conditions continued to have impact over Odisha subdivision and claimed 35 lives. Due to relatively more cyclogenetic activity during the first half of season, incessant heavy rains and major floods were observed

over the regions along the track of the systems. The presence of cyclonic vortex and formation of a couple of low pressure areas, of which one intensified into a cyclonic storm 'Komen' led to incessant heavy rainfall and major floods in Assam, West Bengal, Odisha and Uttar Pradesh. Heavy rain and floods incidences over Gujarat State and Rajasthan were mainly due to formation and movement of couple of Deep Depressions. Similarly the formation and movement of other various systems led to active monsoon conditions that caused heavy rainfall leading to flash floods/landslides in Arunachal Pradesh, Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim Konkan & Goa and Vidarbha causing damages to property and life. Frequent Intense convective activity over Western Himalayan region also led to flash floods /landslides and damaged life and property in Himachal Pradesh, Jammu & Kashmir and Uttarakhand.

## 5. Rainfall Distribution

The realized 2015 southwest monsoon season (June to September) rainfall over the country as a whole and four broad geographical regions are given in the table below along with respective long period average (LPA) values. The rainfall during the 4 monsoon months and the second half of the monsoon season (August + September) over the country as whole are also given.

<b>Season (June to September) rainfall</b>			
Region	LPA (mm)	Actual Rainfall for 2015 SW Monsoon Season	
		Rainfall (mm)	Rainfall (% of LPA)
All India	887.5	760.6	86
Northwest India	615.0	510.6	83
Central India	975.5	815.5	84
Northeast India	1437.3	1317.5	92
South Peninsula	715.1	605.7	85
<b>Monthly &amp; second half of the monsoon season rainfall over the country as a whole (All India)</b>			
Month	LPA (mm)	Actual Rainfall for 2015 SW Monsoon Season	
		Rainfall (mm)	Rainfall (% of LPA)
June	163.6	189.5	116
July	289.2	241.9	84
August	261.3	204.2	78
September	173.4	131.4	76
August + September	434.7	335.6	77

As seen in the table above, the 2015 season rainfall over the country as a whole (86% of LPA) was deficient (<90% of LPA) and 13<sup>th</sup> lowest season rainfall recorded during the last 115 years (1901-2015) and third lowest during the last 15 years. The lowest ever season rainfall (75% of LPA) was recorded in 1918 followed by 1972 (76% of LPA). Last year (2014) was also a deficient monsoon year with actual rainfall of 88% of LPA. Thus years 2014-2015 are the fourth two consecutive deficient monsoon years during the last 115 years. Earlier 3 cases were 1904-05, 1965-1966 & 1986-1987.

As in the last year, the 2015 season rainfalls over all the four geographical regions of the country were also less than the respective LPAs with highest rainfall deficiency (-17% of LPA) over northwest India and lowest deficiency over northeast India (-8% of LPA). Month wise, the rainfall over the country as a whole during the June was more than the LPA and that during the remaining 3 months were less than the LPA. It may be mentioned that the rainfall recorded during the second half of the season (August + September) this year (84% of LPA) was fifth lowest August + September rainfall recorded during the last 115 years (1901-2015) and third lowest during the last 15 years. The lowest ever August + September rainfall (69% of LPA) was recorded in 1920 followed by 1913 (70% of LPA). Similarly the August rainfall recorded this year was eighth lowest August rainfall recorded during the last 115 years (1901-2015) and third lowest during the last 15 years. The lowest ever August rainfall (67% of LPA) was recorded in 1920 followed by 2005 (72% of LPA).

***Fig.5 shows the subdivision wise season (June to September) rainfall.***

Out of the total 36 meteorological subdivisions, the season (June-September) rainfall was normal in 18 subdivisions (55% of the total area of the country) and deficient in 17 subdivisions (39% of the total area of the country). Only one subdivision (West Rajasthan) constituting 6% of the total area of the country received excess rainfall. Out of the 17 deficient subdivisions, 6 subdivisions were from northwest India, 5 from central India, 2 from northeast India and 4 from south Peninsula.

***Fig.6 shows the subdivision wise monthly rainfall.***

In June, except for 3 subdivisions (Bihar, Nagaland, Manipur, Mizoram & Tripura, and, Andaman and Nicobar Islands), which received deficient rainfall, all the other subdivisions (34 out of 36) received normal (20 subdivisions) or excess (13 subdivisions). In July, majority of the subdivisions from Peninsular India and that from north India along the Himalayas received deficient or scanty rainfall. In total, 19 subdivisions received deficient rainfall, 4 subdivisions received scanty rainfall and 6

subdivisions received normal rainfall. The remaining 7 subdivisions (3 from northwest India and 2 each from central and east India) received excess rainfall. The scanty rainfall subdivisions were Marathwada, North Interior Karnataka, Telangana and Rayalaseema.

In August, majority of the subdivisions from northwest India, central India and neighboring Peninsula received deficient/ scanty rainfall. On the other hand, majority of the subdivisions from northeast India received normal/ excess rainfall. During August, 3 subdivisions received excess rainfall, 10 subdivisions received normal rainfall, 20 subdivisions received deficient and 3 subdivisions received scanty rainfall. The excess subdivisions were Sub Himalayan West Bengal & Sikkim, Assam and Meghalaya, and Arunachal Pradesh and the scanty subdivisions were Saurashtra and Kutch, Gujarat and Madhya Maharashtra.

In September, majority of the subdivisions from northwest India, westcentral India and east India received deficient/ scanty rainfall. On the other hand, majority of the subdivisions from south Peninsula and neighboring central India, and northeast India received normal/ excess rainfall. During September, 4 subdivisions received excess rainfall, 18 subdivisions received normal rainfall, 6 subdivisions received deficient and 8 subdivisions received scanty rainfall. The excess subdivisions were Jammu and Kashmir, Saurashtra and Kutch, Kerala and Andaman & Nicobar Islands.

From the monthly distribution, it can be seen that all the subdivisions have received deficient/ scanty monthly rainfall during at least one of the four months. However, none of the subdivisions were deficient/ scanty during all the four months of the season. Except in June, during each of the other 3 months, at least 14 out of the 36 subdivisions had received deficient/ scanty rainfalls. During the peak rainfall months of July and August, 23 subdivisions each had received deficient/scanty rainfall. Saurashtra and Kutch received scanty rainfall during August but received excess rainfall during all the other 3 months.

**Fig. 7 and 8 depict the all India weekly and cumulative weekly rainfall anomaly expressed as percentage departure from the LPA.**

The all India weekly rainfall anomalies during 13 of the 17 weeks of the monsoon season were negative. Out of the 4 positive rainfall weeks, 3 weeks (weeks ending 17<sup>th</sup> & 24<sup>th</sup> June and 29<sup>th</sup> July) were from first half and only one week (weeks ending 23<sup>rd</sup> September) was from second half of the season. The highest negative weekly rainfall anomaly of -62% was recorded during the week ending 30<sup>th</sup> September and highest



positive rainfall anomaly of 68.2% was recorded during the week ending 23<sup>rd</sup> September. Except for the first four weeks of the season, the all India cumulative weekly rainfall anomalies were negative throughout the season.

## **6. Verification of the Long Range Forecasts**

Based on an indigenously developed statistical model, it was predicted on 15<sup>th</sup> May 2015 that monsoon will set in over Kerala on 30<sup>th</sup> May with a model error of  $\pm 4$  days. However, the actual monsoon onset over Kerala took place on 5<sup>th</sup> June, 2 day later than the upper forecast limit.

This year, the long range forecast for the 2015 southwest monsoon rainfall was issued in 3 stages. The first stage long range forecast issued on 22<sup>nd</sup> April consisted of only forecast for season (June-September) rainfall over the country as a whole. In the second stage (2<sup>nd</sup> June), along with the update for the April forecast, forecast for season rainfall over the four broad geographical regions (northwest India, central India, south Peninsula and northeast India) and that for monthly rainfall over the country as a whole for the months of July and August were issued. In the 3<sup>rd</sup> stage (2<sup>nd</sup> August), the forecast for the rainfall during the second half of the monsoon season over the country as a whole was issued.

The first stage forecast for the season (June-September) rainfall over the country as a whole issued in April was 93% of LPA (below normal) with a model error of  $\pm 5\%$  of LPA). This forecast was updated to  $88\% \pm 4\%$  of LPA (deficient) in June. The actual season rainfall for the country as a whole was 86% of LPA, which is within the limits of second stage forecast issued in June.

Considering the four broad geographical regions of India, the forecasts issued in June for the season rainfall over northwest India, Central India, northeast India and south Peninsula were 85%, 90%, 90% & 92% of the LPA respectively all with model errors of  $\pm 8\%$ . The actual rainfalls over northwest India, central India, northeast India and south Peninsula were 83%, 84%, 92% and 85% of the LPA respectively. The actual season rainfall of northwest India is 2% of LPA less than the forecast and that of northeast India is 2% of LPA more than the forecast. However, the actual season rainfalls over Central India & South Peninsula were less than the forecast by 6% & 7% of LPA respectively but well above the lower forecast limits.

The forecast for the second half of the monsoon season (August –September) for the country as a whole was 84% with a model error of  $\pm 8\%$  of LPA against the actual

rainfall of 77% of LPA. Thus the forecast for the rainfall during the second half of the monsoon season over the country as a whole is also within the forecast limits.

The forecasts for the monthly rainfall over the country as a whole for the months of July & August issued in June were 92% & 90% respectively with a model error of  $\pm 9\%$ . The actual monthly rainfalls during July and August were 84% & 78% of LPA respectively, which are below the forecasts by 8% of LPA and 12% of LPA respectively. Thus whereas the actual July rainfall was within the forecast limit, the actual August rainfall was 3% of LPA below the lower forecast limit.

The Table below gives the summary of the verification of the long range forecasts issued for the 2015 Southwest monsoon.

**Table: Details of long range forecasts and actual rainfall.**

Region	Period	Forecast (% of LPA)		Actual Rainfall (% of LPA)
		22 <sup>th</sup> April	2 <sup>th</sup> June (Update)	
All India	June to September	93 $\pm$ 5	88 $\pm$ 4	86
Northwest India	June to September		85 $\pm$ 8	83
Central India	June to September		90 $\pm$ 8	84
Northeast India	June to September		90 $\pm$ 8	92
South Peninsula	June to September		92 $\pm$ 8	85
All India	July		92 $\pm$ 9	84
All India	August		90 $\pm$ 9	78
All India	August to September		84 $\pm$ 8	77

As seen in the table, the season rainfall over the country as a whole and that over four broad geographical regions (northwest India, central India, northeast India and south Peninsula) are within the limits of the forecasts issued in June and accurate. Similarly, the forecasts for the July as well as that for the rainfall during the second half of the monsoon season over the country as a whole are also accurate. However, the August forecast was an overestimate to the realized rainfall.

The observed large seasonal rainfall deficiency over the country as whole (-14 % of LPA) was distributed among all the four broad geographical regions with highest rainfall deficiency (-17% of LPA) over northwest India and lowest deficiency over northeast India (-8% of LPA). Within the season, except in June, the rainfalls during all the other 3 months were below normal. In spite of delayed onset of monsoon over Kerala and early formation (by end of March 2015) of El Nino conditions over equatorial Pacific, the monsoon progressed over the country faster than normal and covered entire country by 26<sup>th</sup> of June and resulted in above normal June. This was helped by two factors. One factor was the favorable phases of MJO

(for the strengthening of monsoon) after the monsoon onset over Kerala and subsequent northward propagation of the monsoon trough. The other factor was the formation two depressions; once each in Arabian Sea (Deep Depression) and in Bay of Bengal (Depression) towards the end of third week of June and their interaction with western disturbances passing through north India. However, strengthening of El Nino conditions and unfavorable phases of MJO from end June to middle of July caused large rainfall deficiency during this period. Though there was revival of monsoon in the second half of the monsoon season due to the formation of two depressions one over southwest Rajasthan and another over northeast Bay of Bengal (this system later became cyclonic storm), July ended with a large rainfall deficiency of -16% of LPA.

Moderate to strong El Nino conditions during the second half of the monsoon season and absence of other favorable intra seasonal or synoptic conditions except formation of 2 low pressure systems (one low pressure and one depression) in Bay of Bengal, may have resulted large rainfall deficiency (-23% of LPA) during second half of the season.

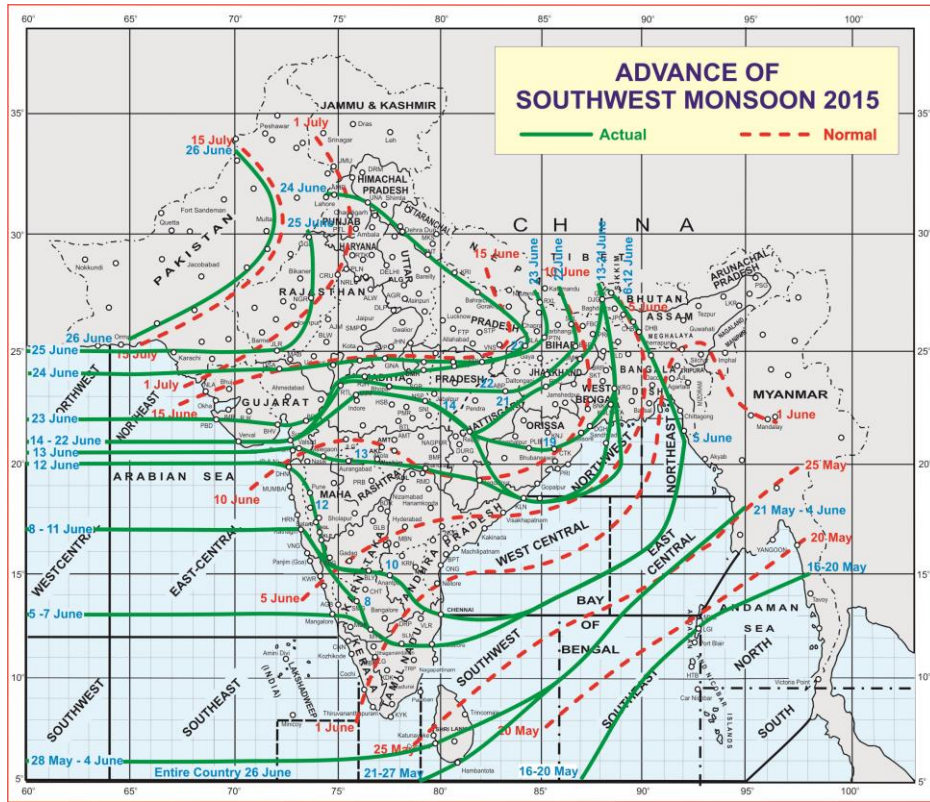
**New Delhi**

**the 16<sup>th</sup> October, 2015**

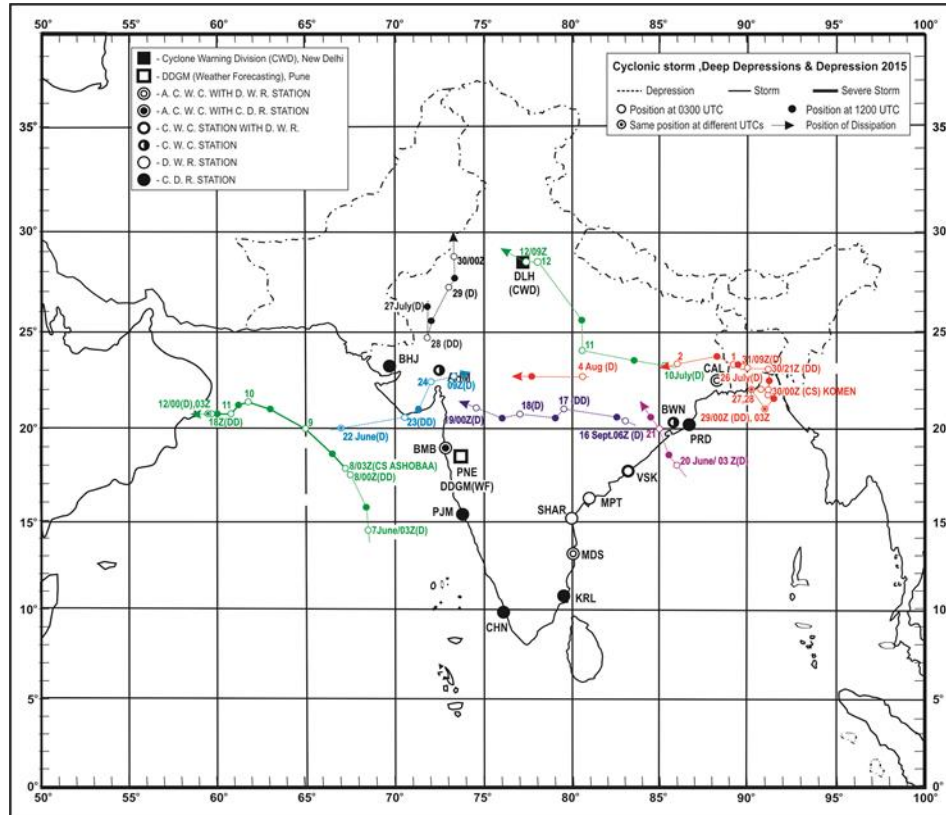
**24<sup>th</sup> Asvina 1937 (SE)**

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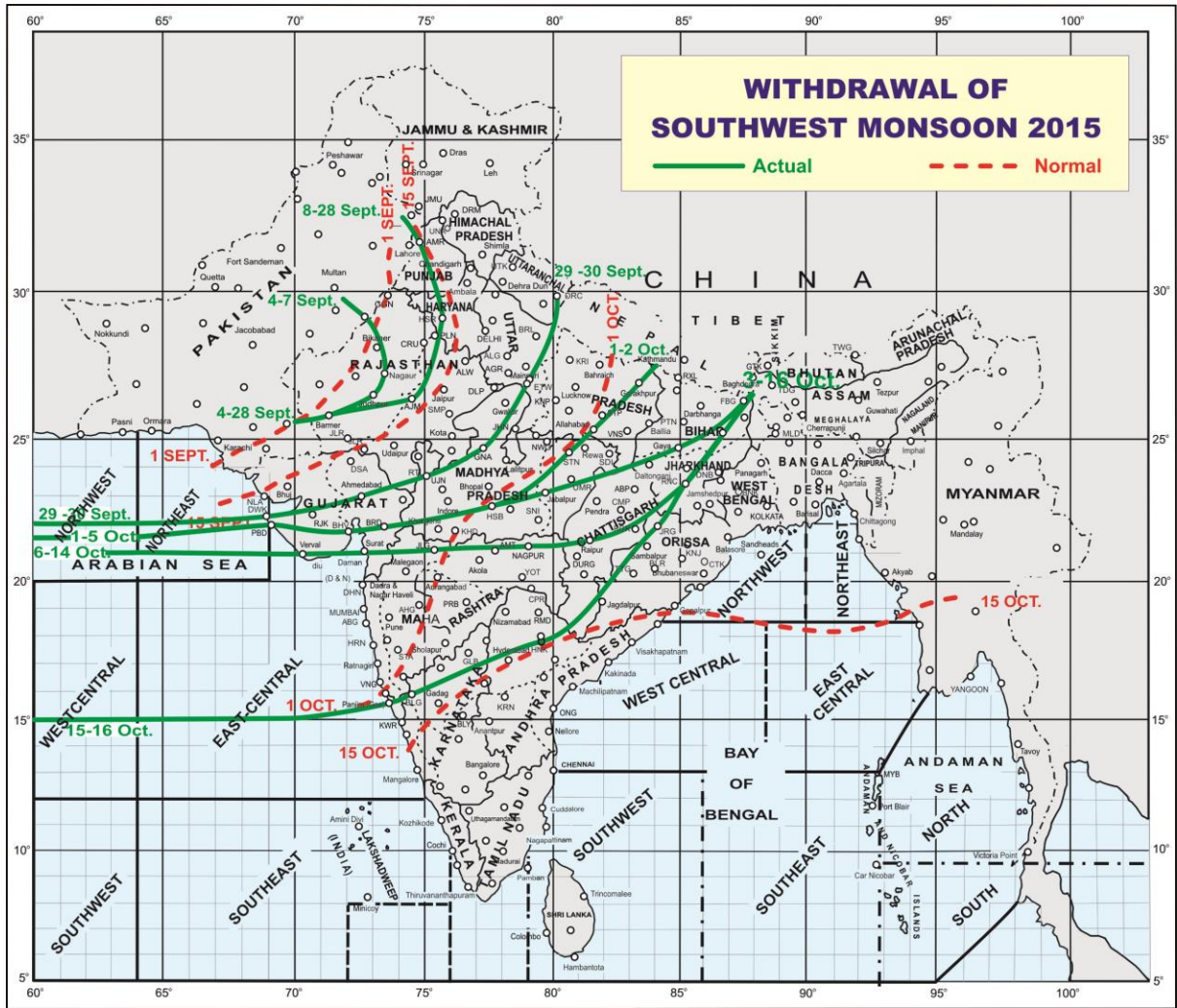
**Director General of Meteorology**



**Fig.1: Progress of Southwest Monsoon – 2015**



**Fig.2: Track of the monsoon Depressions and Cyclonic Storms**



**Fig.3:** Isochrones of withdrawal of southwest monsoon - 2015.

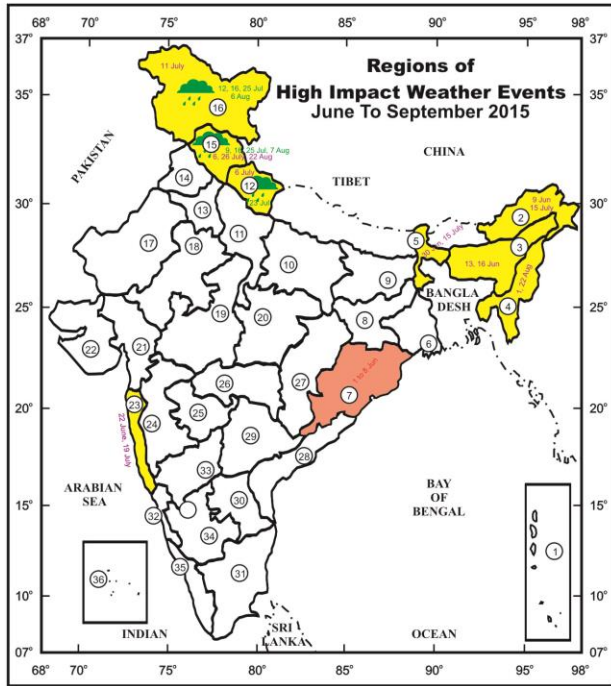
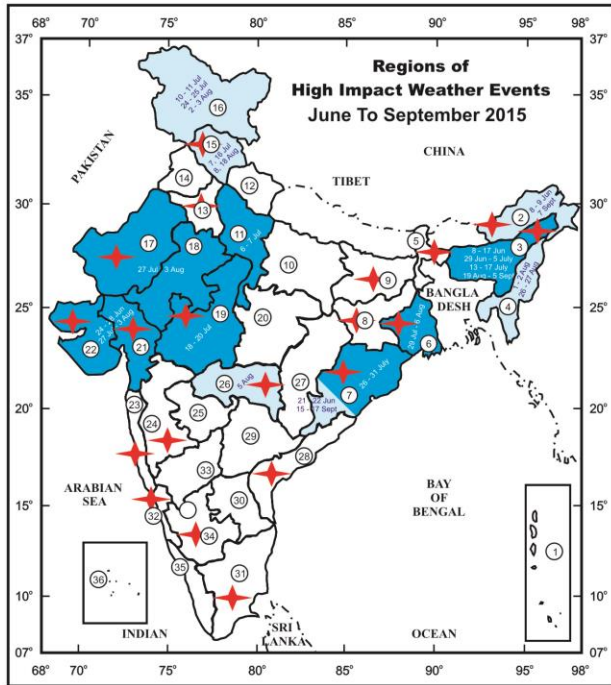
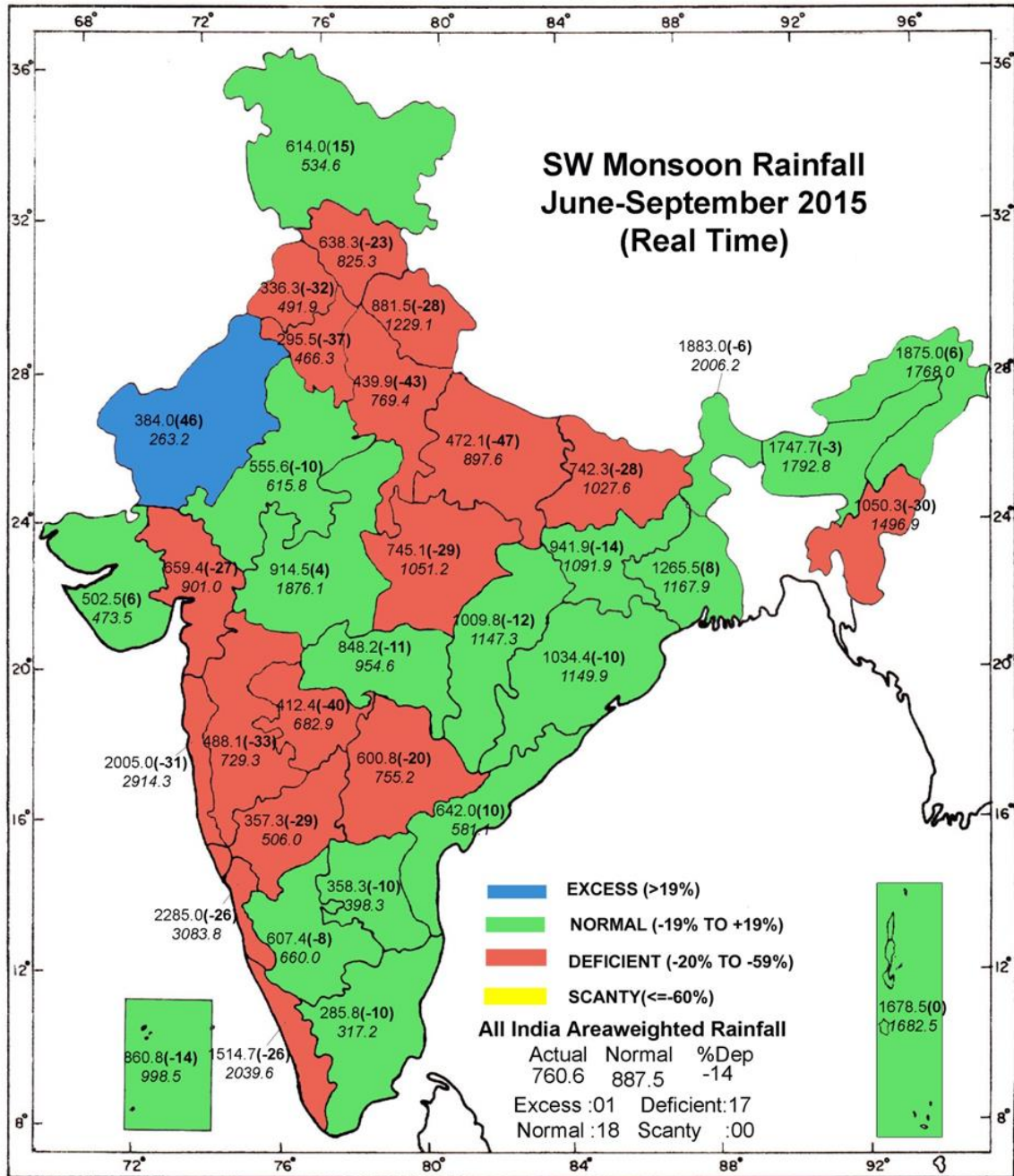


Fig. 3: Areas and Dates of High Impact Weather Events during the 2015 Southwest monsoon

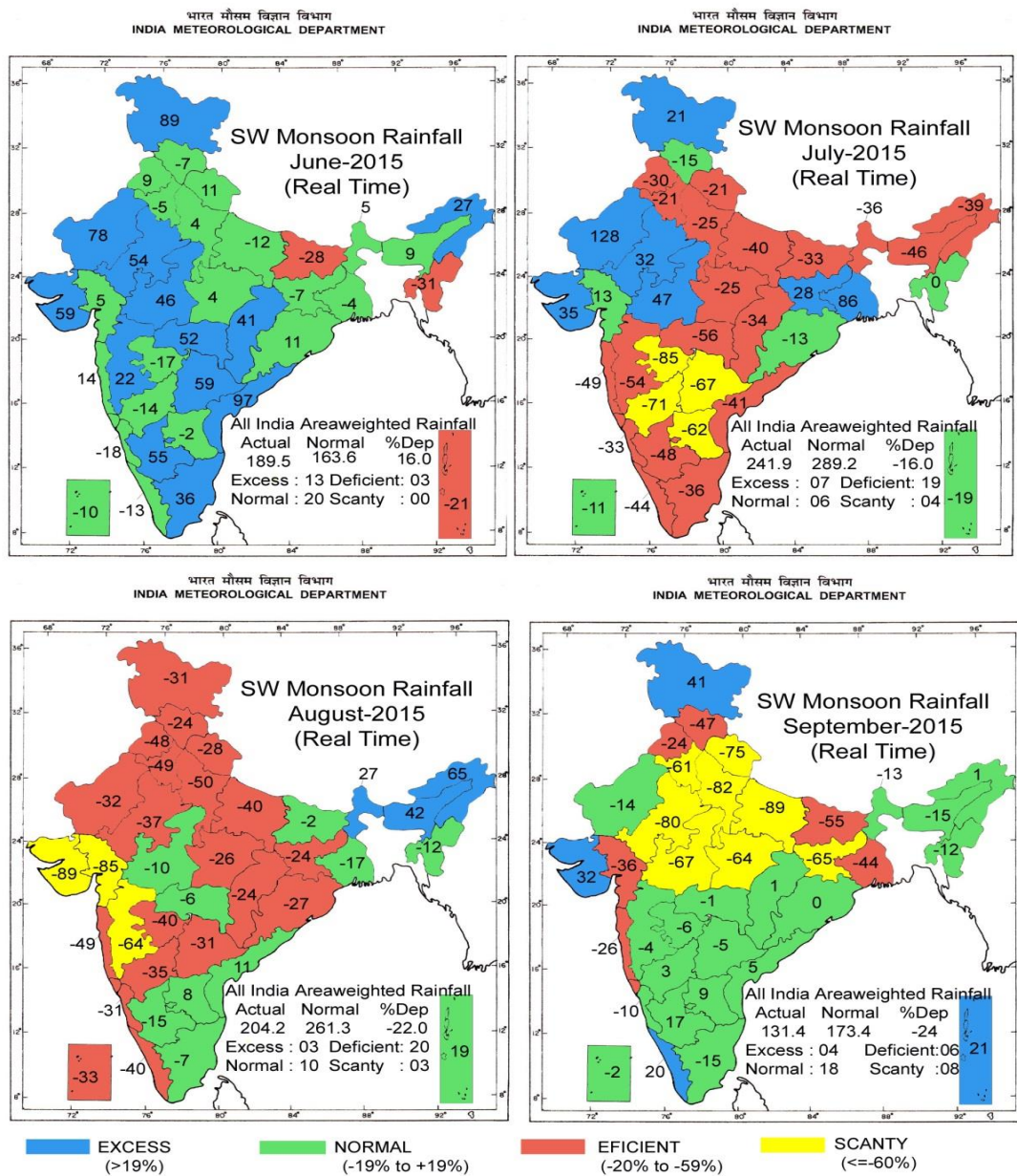
Fig.4: Areas and dates of high impact weather events during the 2015 southwest monsoon.

- ★ Extremely Heavy Rainfall ( $\geq 25$  cm)
- ② 7 Jun: - 27 - Passighat; 9 Jun: - 26 - Roing; 30 Aug: - 28 - Roing.
- ③ 1 Jun: - 56 - Cherrapunji (Rkm); 54 - Cherrapunji; 29 - Mawsynram; 6 Jun: - 50 - Mawsynram; 41 - Cherrapunji; 37 - Cherrapunji (Rkm); 25 - Kokrajhar; 7 Jun: - 40 - Mawsynram; 34 - Cherrapunji; 27 - Cherrapunji (Rkm); 8 Jun: - 62 - Mawsynram; 58 - Cherrapunji; 54 - Cherrapunji (Rkm); 9 Jun: - 51 - Cherrapunji (Rkm); 40 - Cherrapunji; 37 - Mawsynram; 10 Jun: - 55 - Cherrapunji (Rkm); 51 - Cherrapunji; 39 - Mawsynram; 13 Jun: - 25 - Cherrapunji; 24 Jul: - 29 - Cherrapunji (Rkm); 26 - Cherrapunji; 15 Aug: - 25 - Cherrapunji (Rkm); 16 Aug: - 41 - Mawsynram; 18 Aug: - 53 - Mawsynram; 37 - Cherrapunji (Rkm); 31 - Cherrapunji; 19 Aug: - 75 - Mawsynram; 57 - Cherrapunji (Rkm); 47 - Cherrapunji; 20 Aug: - 42 - B P Ghat; 34 - Cherrapunji (Rkm); 33 - Mawsynram and Williamnagar each; 31 - Cherrapunji; 29 - Aie Nh Xing; 27 - Beki Mathungari; 21 Aug: - 34 - Kokrajhar; 31 - Mawsynram; 26 - Gossaigaon; 25 - Cherrapunji and Gossaigaon AWS each; 30 Aug: - 26 - Cherrapunji (Rkm); 31 Aug: - 39 - Cherrapunji; 36 - Cherrapunji (Rkm); 23 Sep: - 42 - Mawsynram; 37 - Cherrapunji (Rkm); 31 - Cherrapunji.
- ⑤ 10 Jun: - 30 - Alipurduar CWC; 18 Jun: - 25 - Sevoke; 1 Jul: - 28 - Garubathan; 16 Aug: - 25 - Kumargram.
- ⑥ 10 Jul: - 26 - Deganga; 25 - Bongaon.
- ⑦ 14 Jun: - 25 - Dunguripalli; 21 Jun: - 33 - Jhorigam ARG; 11 Jul: - 26 - Sundargarh; 25 - Balsankara ARG; 16 Sep: - 28 - Tentulikhunti ARG; 26 - Muniguda ARG.
- ⑧ 11 Jul: - 39 - Kolebira; 16 Jul: - 29 - Daltonganj; 23 Jul: - 26 - Raidih; 28 Jul: - 25 - Jamshepur.
- ⑨ 20 Aug: - 28 - Cheria B.Pur; 26 - Parbatta; 25 - Kodawanpur / C.Bii.
- ⑬ 19 Sep: - 28 - Mewat Nuh AWS; 25 - Nuh.
- ⑮ 17 Jul: - 27 - Arki.
- ⑰ 27 Jul: - 33 - Gudamalani; 32 - Raniwada; 29 - Jaswantpura.
- ⑱ 27 Jul: - 45 - Mount Abu and Mounntabu Tehsil each; 28 Jul: - 33 - Mount Abu and Mounntabu Tehsil each; 29 Jul: - 41 - Abu Road; 32 - Mount Abu and Mounntabu Tehsil each; 30 - Kotda.
- ⑲ 19 Jul: - 39 - Narsingarh; 32 - Ujjain and Ujjain - AWS each; 31 - Sarangpur; 25 - Badnagar; 20 Jul: - 35 - Nusrulgunj -Arg; 28 - Budhni; 27 - Khachrod; 24 Jul: - 27 - Agar; 26 Jul: - 38 - Jaora; 29 - Mahidpur; 28 - Khachrod and Agar each; 26 - Sailana; 25 - Petlawad and Sardarpur each; 5 Aug: - 29 - Khandwa, Khandwa - AWS and Khirkiya -Arg each.
- ⑳ 25 Jun: - 25 - Wanakbori; 28 Jul: - 43 - Dhanera; 42 - Wav; 40 - Deesa; 35 - Bhabhar; 34 - Kankrej; 33 - Tharad and Dantiwada each; 32 - Radhanpur; 25 - Deodar; 29 Jul: - 49 - Vadgam; 36 - Deesa; 32 - Palanpur; 31 - Amirgadh; 30 - Dhanera; 28 - Siddhpur; 27 - Mahesana, Patan and Dharoi Colony each; 25 - Danta and Unjha each; 19 Sep: - 27 - Dangs (Ahwa).
- ㉑ 24 Jun: - 32 - Una; 27 - Malia; 25 Jun: - 64 - Bagasra; 51 - Dhari; 39 - Vadia; 26 - Gondal; 25 - Lodhika and Palitana each; 28 Jul: - 31 - Nakhatrana; 25 - Bhuj AP; 29 Jul: - 33 - Bhachau; 20 Sep: - 25 - Visavadar.
- ㉒ 19 Jun: - 28 - Mumbai (SCZ); 20 Jun: - 26 - Devgarh; 22 Jun: - 26 - Khed; 25 - Mandangad; 21 Jul: - 48 - PalgharAgri.
- ㉔ 22 Jun: - 37 - Mahabaleshwar\*; 24 Jun: - 27 - Mahabaleshwar\*.
- ㉕ 5 Aug: - 27 - Jalgaon Jamod.
- ㉖ 15 Sep: - 27 - Araku Valley.
- ㉗ 22 Jul: - 30 - Ariyalur.
- ㉘ 10 Jul: - 28 - Kota; 27 - Udupi; 25 - Mulki; 20 Jul: - 30 - Kollur; 8 Sep: - 34 - Kollur.
- ㉙ 21 Jun: - 28 - Hosanagar; 22 Jun: - 41 - Hosanagar; 34 - Kottigehara; 23 Jun: - 30 - Hosanagar; 24 Jun: - 31 - Hosanagar; 25 - Kottigehara; 25 Jun: - 25 - Kottigehara; 26 Jun: - 26 - Bhagamandala; 20 Jul: - 27 - Agumbe.

भारत मौसम विज्ञान विभाग  
INDIA METEOROLOGICAL DEPARTMENT

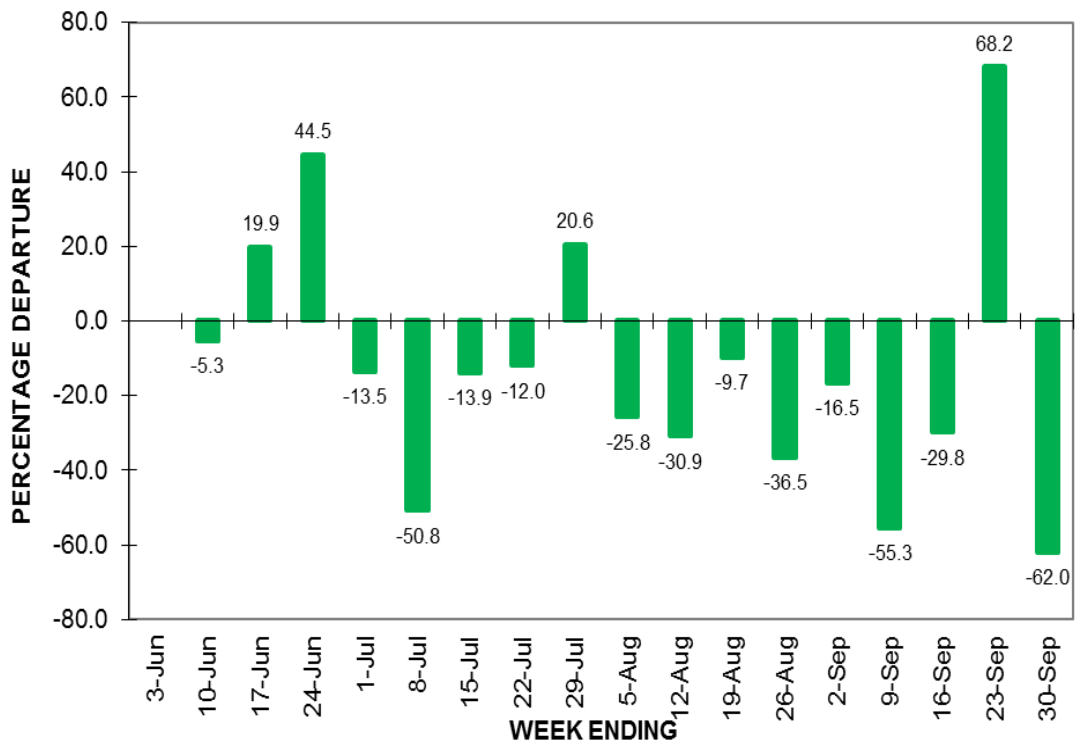


**Fig.5:** Sub-divisionwise rainfall distribution over India during southwest monsoon season (June to September) – 2015

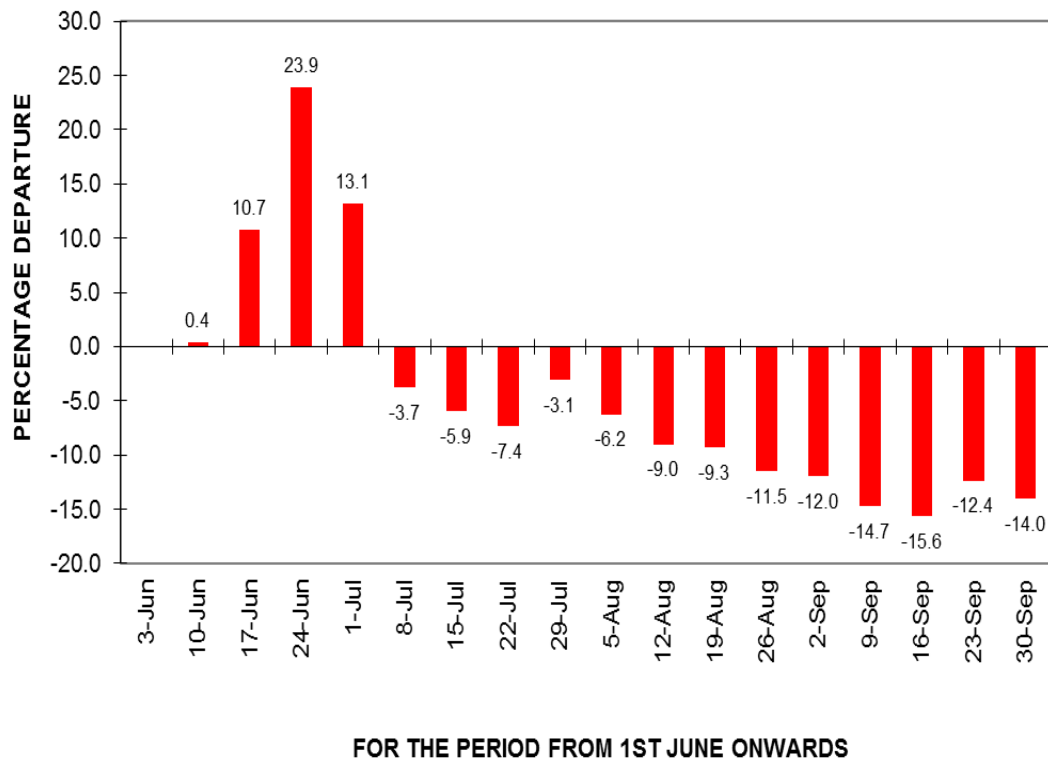


**Fig.6:** Sub-division wise monthly rainfall distribution over India during southwest monsoon season – 2015





**Fig.7:** Week - by - Week Progress of the Monsoon Rainfall – 2015



**Fig.8:** Week - by - Week Progress of the Monsoon Rainfall - 2015 (Cumulative)