Earth System Science Organization (ESSO)
Ministry of Earth Sciences(MoES)
India Meteorological Department
2020 Southwest Monsoon End of Season Report

HIGHLIGHTS

The seasonal (June-September) rainfall over the country as a whole was 109% of its Long Period Average (LPA) in 2020. It was the third highest after 112% of LPA in 1994 and 110 % of LPA in 2019.

- Seasonal rainfalls over Northwest India, Central India, South Peninsula and Northeast (NE) India were 84%, 115%, 130% and 106% of their respective LPA.

- Out of 36 meteorological subdivisions, 2 subdivisions (5% of the total area of the country) received large excess rainfall, 13 subdivisions (35% of the total area of the country) received excess rainfall, 16 subdivisions (45% of the total area of the country) received normal seasonal rainfall and 5 subdivisions (15% of the total area of the country) received deficient season rainfall during the season.

- Monthly rainfall over the country as a whole was 118% of LPA in June, 90% of LPA in July, 127% of LPA in August, and 104% of LPA in September.
  - Southwest monsoon current reached south Andaman Sea and Nicobar Islands on 17th May 2020 (5 days ahead of its normal date), but further advance was sluggish. It set in over Kerala on 1st June coinciding with its normal date for onset over Kerala; Monsoon covered the entire country on 26th June 2020; 12 days before its normal date (8th July).
  - Monsoon started withdrawing from western parts of northwest India on 28th September 2020 against the normal date of 17th September 2020 with a delay of around 11 days. The Southwest Monsoon withdrew from the entire country on 28th October 2020
- During the season, one Severe Cyclonic Storm “NISARGA” formed during 1st to 4th June. This year also witnessed absence of monsoon depression during the season.

- The forecast for monsoon onset over Kerala for this year was correct, which is the fifteenth consecutive correct forecast for the event (except for the year 2015) since issuing of forecast for the onset over Kerala started in 2005. The Forecasted date of onset of monsoon over Kerala was 5th June with a model error of ± 4 days and realized date of onset of monsoon over Kerala was 1th June in this year.
- The forecasts for the rainfall over the country as whole during the season, forecasts for the seasonal rainfall over three broad homogeneous geographical regions (Central India, Northeast India and South Peninsula) and forecast for August rainfall and for rainfall of second half of the monsoon season for the country as a whole were found to be underestimated with respect to the actual rainfall whereas the forecasts for the rainfall for the country as whole during July and forecast for the seasonal rainfall for Northwest India were found to be overestimated as compared to the actual rainfall.

1. Onset and Advance of southwest Monsoon

The South West Monsoon (SWM) arrived over Andaman Sea on 17th May 2020, 5 days before its normal date of arrival, however its further advancement was hindered by the formation and intensification of the Super Cyclonic Storm, 'Amphan' over the Bay of Bengal. The SWM arrived over Kerala on its normal date i.e. on 1st June. Further advancement over the country is observed to be almost close to the normal date (with deviation of ± 3-4 days) for most parts of the central India. Advancement of the SWM over northwest India has taken place about 5-10 days earlier than the normal date. Monsoon covered entire country on 26th June against the normal date of 08th July. Thus, monsoon set in over the entire country 12 days before its normal date.

Fig.1 shows the isochrones of advance of monsoon 2020.

2. Chief Synoptic Features

During the monsoon season 2020, a total number of 12 Low Pressure System formed. The first Low Pressure System formed over Arabian Sea on 31st May had intensified into Severe Cyclonic Storm 'NISARGA' on 2nd June. However, none of the other Low pressure systems intensified into Monsoon Depression/Deep Depression categories during the monsoon season.

Month/System	SCS	Low pressure areas	Well-marked low-pressure areas
June	**01**	**01**	**0**
July	**0**	**01**	**01**
August	**0**	**01**	**04**
September	**0**	**02**	**01**

The first Low Pressure System of the season; the Severe Cyclonic Storm 'NISARGA' originated from a low pressure area which formed over Southeast and adjoining East Central Arabian Sea and Lakshadweep area in the early morning of 31st May 2020.It concentrated into a Depression over Eastcentral and adjoining Southeast Arabian Sea in the early morning of 1st June 2020. It intensified further into a Deep Depression over Eastcentral Arabian Sea in the early morning and into a Cyclonic Storm 'NISARGA' in the noon of 2nd June. It moved northwards till evening of 2nd June and gradually

recurved northeastwards and intensified into a Severe Cyclonic Storm in the early morning of 3rd June. Continuing to move northeastwards, it crossed Maharashtra coast close to south of Alibaug as a Severe Cyclonic Storm during the afternoon of 3rd June. Continuing to move northeastwards after landfall, it weakened into a Cyclonic Storm in the evening over north Madhya Maharashtra and into a Deep Depression in the midnight of 3rd June over the same region. It further weakened into a Depression over western parts of Vidarbha and neighbourhood in the early morning and into a Well Marked Low pressure over central parts of Madhya Pradesh in the evening of 4th June. It weakened further into a Low pressure area over southeast Uttar Pradesh and adjoining Bihar in the afternoon of 5th June.

Track of Severe Cyclonic Storm 'NISARGA' formed during SW Monsoon season is given in Fig.2.

During the month of June, apart from the above system, a low pressure area which formed over West central Bay of Bengal (9-12 June) and its associated cyclonic circulation have strengthened the monsoon flow. Cyclonic vortices at upper levels off both the coasts, over central & north India, east-west shear zone across Peninsular India, an east-west trough at mean sea level extending upto lower tropospheric levels with cyclonic circulations embedded in it were also observed. All these systems caused fairly widespread to widespread rainfall activity over most parts of the country and thus supported the advance of monsoon over the country. Towards the end of the month, the monsoon trough shifted northwards with its eastern part close to the foot hills of Himalayas (during 27 June-2 July).

During the month of July, many unfavorable features of monsoon appeared resulting in deficient rainfall for the country. The weak monsoon in July was mainly due to absence of any major monsoon disturbance over Bay of Bengal and due to the prevalence of a weak cross equatorial flow in general. Absence of any major systems caused the monsoon trough also weak. The monsoon trough lay to the north of the normal position or close to the foothills of the Himalayas on many days during the month. It resulted in frequent and prolonged floods over northeastern India, Bihar and adjoining areas of East Uttar Pradesh. At the same time, major parts of central and northwest India received deficient rainfall.

However, in the first week of July, with the formation of two low pressure areas; one over coastal Saurashtra and neighbourhood (5 -12 July) and the other over Northwest Bay of Bengal off Odisha-Gangetic West Bengal coast (5-6 July) and their associated cyclonic circulations tilting southwards with height, monsoon trough was

observed in its normal/south of its normal position during 3-8 July. The low pressure area which formed over coastal Saurashtra and neighbourhood, became Well marked on 6th over Kutch and neighbourhood. In addition to this low pressure area, an off-shore trough, a shear zone along 16°N and the monsoon trough to the south of its normal position resulted in widespread rainfall activity over Gujarat State and over coastal & interior parts of Maharashtra and the other low pressure area over Bay of Bengal caused widespread rainfall activity over eastern parts of India.

During the subsequent three weeks of July, an off-shore trough along south Maharashtra and Kerala coasts, cyclonic vortices over north Konkan coast and east-west shear zone across peninsular India caused widespread / fairly widespread rainfall with heavy to very heavy rainfall activity along the west coast and adjoining interior parts of peninsular India. In the same period, the interactions of the eastern end of monsoon trough (which lay north /close to foot hills of Himalayas) with the cyclonic circulations and convergence of strong southwesterly to southerly winds from Bay of Bengal over east and northeast India triggered monsoon activity over northeast and adjoining east India. The interaction of western end of monsoon trough with the systems in westerlies, circulations in the lower tropospheric levels and moisture incursions from the Arabian Sea caused widespread / fairly widespread rainfall with heavy rainfall over Western Himalayan Region, plains of northwest India & adjoining central & west India during third and fourth week of the month.

A coherent Madden Julian Oscillation (MJO) signal was not evident during June and on most days of July. Only towards the end of July upto mid of August, the signal became active and slight eastward propagation from Indian Ocean to the maritime continent was seen.

In association with absence of low pressure systems over the Bay of Bengal, shifting of monsoon trough to the foothills on many days and unfavourable conditions like MJO, the monsoon rainfall was deficient in July across central India. At the same time it caused flood over northeastern States, Bihar and East Uttar Pradesh on a few occasions.

As the MJO moved eastwards over the Indian seas, the Arabian Sea and Bay of Bengal became convectively active in August. The formation of five low pressure systems over the North Bay of Bengal in succession out of which four of them became Well marked (4-10 , 9-11, 13-18 , 19-26 and 24-31 August) and their west-northwestward movement across central India upto Gujarat and south Rajasthan,

active MJO, active Monsoon trough mostly south of its normal position and stronger winds reaching up to 50-60 kmph in lower levels over Arabian Sea during a few days in the month led to active monsoon conditions over most parts of the country and caused significantly higher than normal rainfall over central and western parts of India during the month of August.

During the month, strengthening of the monsoon flow in the Arabian Sea, led to convergence of strong low level westerlies along the west coast. Also, the presence of cyclonic vortices, off-shore trough, east-west shear zone over peninsular India caused widespread rainfall/thundershowers along the west coast, over parts of Peninsular India, Gujarat state, Konkan & Goa and Madhya Maharashtra. System in westerlies and convergence of moist low level winds from Arabian Sea, cyclonic circulations over northwest India and presence of strong easterlies due to the presence of low pressure systems caused scattered to fairly widespread rainfall/thunderstorms over Western Himalayan Region and adjoining parts of northwest India during the month.

Due to active monsoon conditions, riverine floods occurred over Odisha, Telangana, Madhya Pradesh, Maharashtra, Gujarat and Rajasthan. The active monsoon conditions consecutively for 4 weeks led to excess rainfall activity over the country.

Fairly widespread to widespread rainfall/thunderstorms over parts of Northeast and adjoining parts of East India with heavy to very heavy rainfall was also observed during the first, second and the last week of August due to the convergence of moist southwesterlies to southerlies from the Bay of Bengal and presence of cyclonic vortices in the lower levels.

A weak MJO re-entered eastern Indian Ocean in late August and propagated eastwards into maritime continent with weak amplitude by the end of monsoon season.

From the last week of August till the formation of a low pressure area off north Andhra coast on 13 September, either the western or the eastern end of monsoon trough remained north of its normal position or close to foot hills of Himalayas. Heat LOW also started weakening. The low pressure area which formed on 13th September subsequently became Well Marked Low and dissipated over Telangana and adjoining south Chhattisgarh. It triggered monsoon activity over Central and Peninsular India. After the dissipation of the low pressure area on 16th, the monsoon trough lay north of its normal position and regained it near-normal position with the formation of another low pressure system on 20th over Northeast Bay of Bengal and neighbourhood. This

low pressure system dissipated over east Bihar and neighbourhood on 26th. East Uttar Pradesh, Bihar and Sub Himalayan West Bengal experienced widespread rainfall/thunderstorms due to this system. The monsoon trough became disorganized on 28th September. Apart from the above two low pressure systems in the month, another low-pressure system (6-8 September) formed over Southeast and adjoining East central Arabian Sea and in conjunction with an east-west shear zone over south peninsula caused widespread rainfall activity over south Peninsular India, Lakshadweep area and coastal and interior parts of Maharashtra during the first week of the month. Circulation features favoring convergence of strong moist winds from the Bay of Bengal in the lower tropospheric levels and the alignment of monsoon trough over northeast India and adjoining east India continued to trigger the monsoon activity over the region during the month.

3. Withdrawal of Southwest Monsoon

The formation of two low pressure areas in the month of September led to an active monsoon trough which delayed the withdrawal of monsoon. The withdrawal of monsoon commenced on 28th September from some parts of west Rajasthan and Punjab, against its normal date of 17th September with the establishment of an anti-cyclonic circulation in the lower tropospheric levels over western parts of northwest India and substantial reduction in moisture content & rainfall. A further change in the low level wind pattern into north westerlies, reduction in moisture content and cessation of rainfall over northwest India, led to the withdrawal of southwest monsoon from some more parts of Rajasthan, remaining parts of Punjab, entire Western Himalayan region & Haryana, Chandigarh & Delhi and some parts of Uttar Pradesh on 30th September. It then withdrew from most parts of Rajasthan, some more parts of Uttar Pradesh and some parts of northwest Madhya Pradesh on 3rd October 2020 and from remaining parts of Rajasthan, some more parts of Uttar Pradesh and Madhya Pradesh, most parts of Gujarat state and some parts of North Arabian Sea on 6th October 2020. The Southwest Monsoon withdrew from the entire country on 28th October 2020.

Fig.3 shows the isochrones of withdrawal of monsoon 2020.

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. **Fig.4** also indicates areas that experienced isolated extremely heavy rainfall (Rainfall amount ≥20 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 formation and movement of the monsoon low pressure systems in the presence of strong cross equatorial flow often caused flood situations over various areas during different parts of the season.

5. Rainfall Distribution

The realized 2020 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 a whole are also given.

Season (June to September) rainfall			
Region	**Long Period Average (LPA) (mm)**	**Actual Rainfall for 2020**	
		Rainfall (mm)	**Rainfall (% of LPA)**
All India	880.6	957.6	109
Northwest India	599.7	505.7	84
Central India	976.7	1123.8	115
East & Northeast India	1410.4	1500.3	106
South Peninsula	726.2	939.9	130
Monthly & second half of the monsoon season rainfall over the country as a whole (All India)			
Month	**LPA (mm)**	**Actual Rainfall for 2020**	
		Rainfall (mm)	**Rainfall (% of LPA)**
June	166.9	196.2	118
July	285.4	257.6	90
August	258.1	327.0	127
September	170.2	177.3	104
August + September	428.3	504.3	118

As seen in the table above, the 2020 season rainfall over the country as a whole (109% of LPA) was more than the long period average (LPA). The 2020 seasonal rainfalls over three of the four geographical regions of the country (except Northwest India) were also more than the respective LPAs. The highest rainfall (130% of LPA) was received by South Peninsula and lowest rainfall (84% of LPA) was received by Northwest India. Central India and East & Northeast India received season rainfalls of 115% of LPA and 106% of LPA respectively. The monthly rainfall over the country as a whole were more than LPA during three months of the season (118% of LPA in June , 127 % of LPA

in August and 104% in September) and were less than LPA during the months of the July (90% of LPA in July)

Country as a whole received rainfall of 109% of LPA during the first half (118% of LPA in June and 90% of LPA in July), which was less than that during the second half (118% of LPA) with 127% of LPA in August and 104% of LPA in September. Thus among the four months, rainfall deficiency was highest during July and rainfall was excess in August.

Fig.5 shows the subdivision wise season (June to September) rainfall.Out of the total 36 meteorological subdivisions (Fig.5), the seasonal (June-September) rainfall was normal in 16 subdivisions (45% of the total area of the country) and excess in 13 subdivisions measuring 35% of the total area of the country and large excess in 2 subdivisions measuring 5% of the total area of the country. However, the seasonal rainfall was deficient in 5 subdivisions constituting 15% of the total area of the country. Out of the 5 deficient subdivisions, 1 subdivision was from East & Northeast India (Nagaland, Manipur, Mizoram and Tripura (NMMT)) and remaining 4 subdivisions were from the Northwest India (West Uttar Pradesh, Uttarakhand, Himachal Pradesh and Jammu & Kashmir and Ladakh).

Fig.6 shows the subdivision wise monthly rainfall.

In the month of June 2020, among 36 subdivisions, 4 subdivisions received large excess rainfall, 10 subdivisions received excess rainfall, 16 subdivisions received normal rainfall, and 6 subdivisions received deficient rainfall. Among the four subdivisions which received Large Excess rainfall one each were from East, Northwest, Central and South Peninsular India. Out of six deficient subdivisions, 3,1,1, and 1 were from Northwest, Northeast, Central and South Peninsular India respectively. Most noticeable feature of rainfall distribution during June was the large spatial variability over Central India with excess rainfall in 6 of the 10 subdivisions and deficient rainfall over 1 subdivision. Regionwise, Northwest India(104% of LPA) and South Peninsular India (108% of LPA) have received normal rainfall and remaining two regions received excess rainfall(116% of LPA for Northeast India and 131 % of LPA for Central India).

In the month of July, 4 subdivisions from South Peninsula reported Large Excess rainfall, 7 subdivisions reported Excess rainfall, 13 subdivisions reported normal rainfall and 12 subdivisions received deficient rainfall. Out of 12 deficient subdivisions, 4,2,5,1 were from Northwest, Northeast, Central and South Peninsular India respectively. Regionwise, South Peninsula (116% of LPA) and Northeast India (109% of LPA) have

received above normal rainfall and other two geographical regions have received below normal rainfall.

In the month of August 2020, 6 subdivisions (1 from Northwest India, 4 from Central India and 1 from South Peninsula) received Large Excess rainfall, 10 subdivisions (1 from Northwest India, 4 from Central India and 5 from South Peninsula) received Excess rainfall, 5 subdivisions (2 from Northwest India and 3 from Northeast India) received deficient rainfall and remaining 15 subdivisions received normal rainfall. Most noticeable feature of rainfall distribution during August was the large excess/excess rainfall over Central India. Region wise, East and Northeast India received below normal rainfall(81% of LPA) and Central India and South Peninsula received above normal rainfall(161% and 131% of LPA respectively) and Northwest India received normal rainfall.

In September, 14 subdivisions were deficient/ large deficient category, 4 subdivisions received normal rainfall (1 from Northwest India, 2 from Central India and 1 from South Peninsula). Remaining 18 subdivisions received large excess/excess rainfall. The region that mainly benefited during September was Northeast India (122% of LPA) and South Peninsula (162% of LPA). The other two geographical regions experienced below normal rainfall (54% of LPA for Northwest India and 89% LPA for Central India India).

Thus it is very clear that all the four broad geographical regions have experienced above normal rainfall during the month of June. However, East and Northeast India experienced above normal rainfall during all months of the season except in August. At the same time, Central India experienced above normal rainfall during June & August and below normal rainfall during July & September. South Peninsula received above normal rainfall during all the four months and Northwest India experienced normal to below normal rainfall during all the four months. Thus the seasonal rainfall above normal by 9% of LPA over the country as a whole was caused by the large excess to excess monthly rainfall (more than 50% of LPA) during June & August months of the season. The above normal rainfall over Central India during August and South Peninsula during August & September was also another factor.

Fig.7 depicts the All India weekly and cumulative weekly rainfall anomaly expressed as percentage departure from the LPA.

The All India weekly rainfall anomalies during 5 of the 18 weeks of the monsoon season were negative. Out of the 13 positive rainfall anomaly weeks, 4 weeks were from June (weeks ending 3rd ,10th,17th & 24th) , two weeks from July (weeks ending 2nd, 8th

&15th), three weeks from August (weeks ending 12th, 19th& 26th) and four weeks from September (weeks ending 2nd,16th,23rd & 30th). However, all weeks from June have positive rainfall anomaly. The highest negative weekly rainfall anomaly were recorded during the week ending on 9th September (-29.8% from LPA), followed by the week ending on 29th July (-28.8% from LPA). Highest positive rainfall anomaly was recorded during the week ending 3rd June (61% from LPA) followed by the week ending 19th and16th August (42.3 & 41.0 from LPA resp.). The increase in the weekly rainfall during the season was mainly associated with the low pressure systems which moved along the monsoon trough region.

The All India cumulative weekly rainfall anomaly was positive for all the weeks of monsoon season except 5th August (-1.0% of LPA). The negative cumulative rainfall anomaly has reduced significantly on 8th week (week ending on 29th July (-9% of LPA)). There was increment in the cumulative rainfall during 17th and 18th weeks of September. The season ended with all India cumulative rainfall anomaly of 9% of LPA.

6. Verification of the Long Range Forecasts

Based on an indigenously developed statistical model, it was predicted on 15th May 2020 that monsoon will set in over Kerala on 5th June with a model error of ±4 days. The actual monsoon onset over Kerala was on 1st June and therefore the forecast was correct.

The long range forecast for the 2020 southwest monsoon rainfall was issued in 3 stages. The first stage long range forecast issued on 15th April consisted of only forecast for seasonal (June-September) rainfall over the country as a whole. In the second stage forecast issued on 1st June, along with the update for the April forecast, forecast for seasonal rainfall over the four broad homogeneous regions (Northwest India, Central India, South Peninsula and Northeast India) and forecast for monthly rainfall over the country as a whole for the months of July and August were issued. In the 3rd stage issued on 31st July, 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 100% of LPA with a model error of ± 5% of LPA. The update issued in June for this forecast was (102% of LPA) with a model error of ± 4% of LPA. The actual seasonal rainfall for the country as a whole was 109% of LPA, which is 4% and 3% of LPA more than upper forecast limits of the April and June forecasts

respectively. Thus both the forecasts were not within forecast limits and has underestimated the rainfall value.

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 107%, 103%, 96% & 102% of the LPA respectively all with model errors of ± 8%. The actual rainfalls over Northwest India, Central India, Northeast India and South Peninsula were 84%, 115%, 106% and 130% of the LPA respectively. Thus the forecasts of seasonal rainfall over the Central India, Northeast India and South Peninsula regions were underestimate to the actual season rainfalls. However, forecast for Northwest India is overestimated to the actual season rainfalls.

The forecast for the second half of the monsoon season (August –September) for the country as a whole was 104% with a model error of ±8% of LPA against the actual rainfall of 118% of LPA, which is 6% more than the upper forecast limit. Thus, the forecast for the rainfall during the second half of the monsoon season over the country as a whole was also underestimate to the actual rainfall.

The forecasts for the monthly rainfall over the country as a whole for the months of July & August issued in June were 103% & 97% of LPA respectively with a model error of ± 9%. Thus the monthly forecasts for July was overestimated and August rainfall was underestimate to the actual monthly rainfalls (90% & 127% of LPA respectively).

The Table below gives the summary of the verification of the long range forecasts issued for the 2020 Southwest monsoon.

Table: Details of long range forecasts and actual rainfall.

Region	Period	Forecast (% of LPA)		Actual Rainfall
		15thApril	1st June	(% of LPA)
All India	June to September	100± 5	102± 4	109
Northwest India	June to September		107± 8	84
Central India	June to September		103± 8	115
Northeast India	June to September		96± 8	106
South Peninsula	June to September		102± 8	130
All India	July		103± 9	90
All India	August		97± 9	127
All India	August to September (issued on 31st July)		104± 8	118

The seasonal rainfall was 3% of LPA above the upper limit of the forecast value over the country as a whole and it was mainly caused by the large monthly excess rainfall during June & August month. The above normal rainfall over Central India

during August and South Peninsula during August & September was also another factor.

While issuing the long range forecast in the month of April, El Nino conditions were prevailing over Pacific Ocean. IMD's analysis of weakening of El Nino and development of La Nina during the second half of the monsoon season came correct. The development of the La Nina is one of the factors which helps to get good rainfall activity during the second half of the season. However, the emergence of negative Indian Ocean Dipole (IOD) in the middle of the monsoon season did not happen. The impact of synoptic scale systems and intra-seasonal variations dominated the rainfall during the monsoon season. The excess rainfall received in the month of June and August month were mainly due to synoptic scale Low Pressure Systems. However, in the month of July rainfall was deficient (90% of LPA) due to the absence of formation of Low Pressure systems and unfavorable MJO activity. However, the rainfall during the second half was more than expected by IMD mainly due to the longer life period of a series of low-pressure systems formed over the region, which mostly moved along the monsoon trough resulting in above normal season rainfalls over Central India & South Peninsula and below normal seasonal rainfall over North-East India. Seasonal rainfall over North-West India was deficit (84% of LPA) mainly due to the fact that most of the Low Pressure Systems dissipated before reaching to northern latitudes. Overall, the impact of synoptic scales systems on the monsoon performance was very significant this year resulting in increased uncertainty in the predictability of monsoon at seasonal scales.

New Delhi **(M Mohapatra)**

The 19 Dec., 2020 **Director General of Meteorology**

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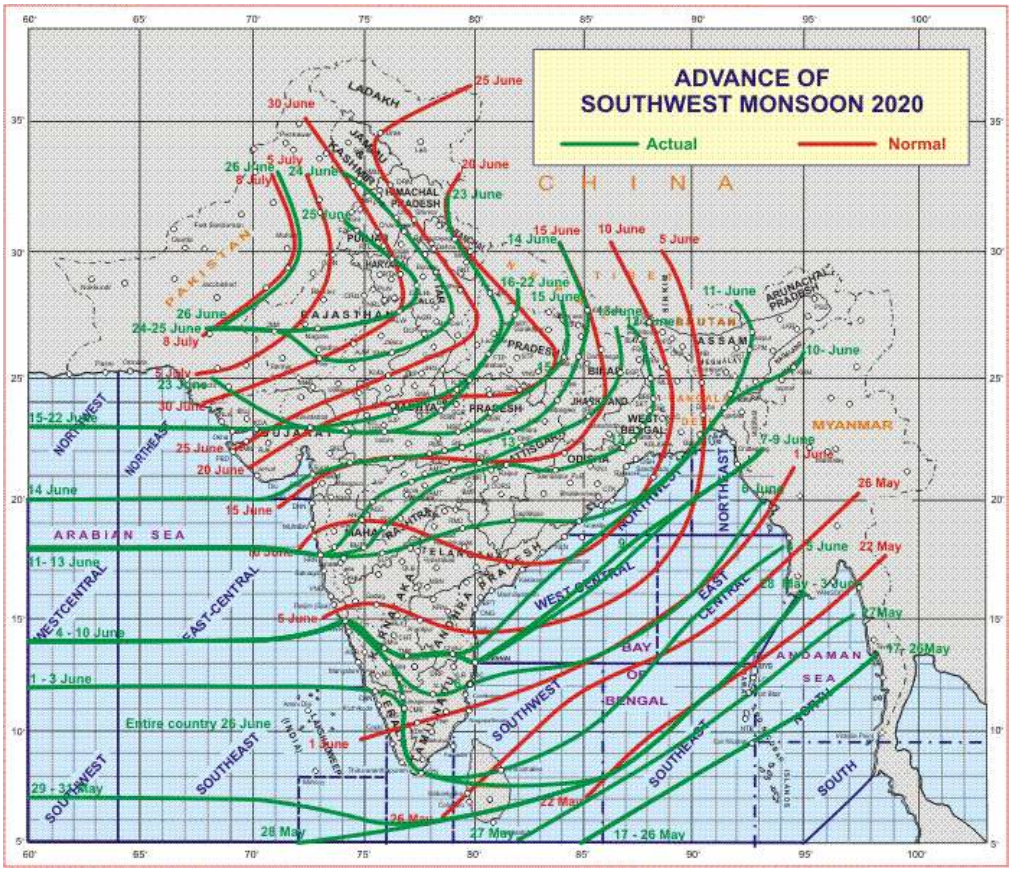

Fig.1: Progress of Southwest Monsoon – 2020

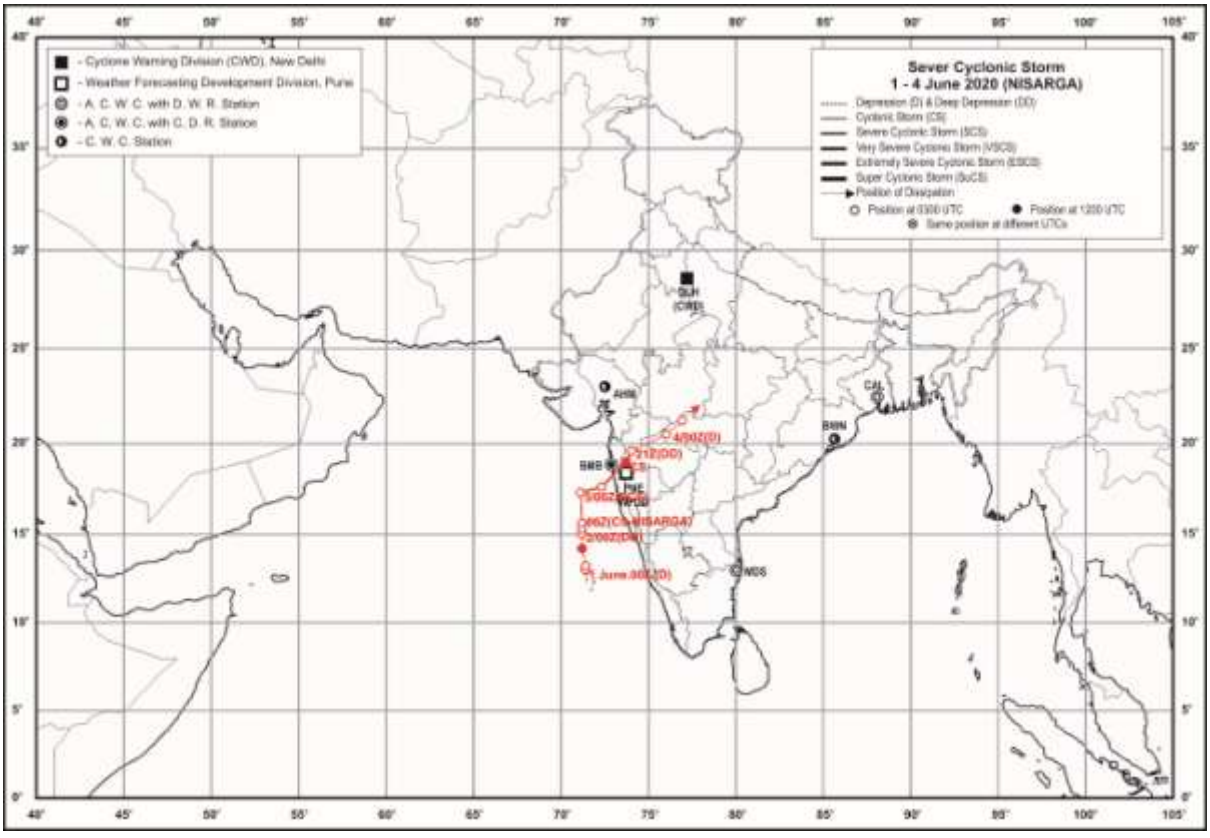

Fig.2: Track of the Severe Cyclonic Storm 'NISARGA'formed during Monsoon Season.

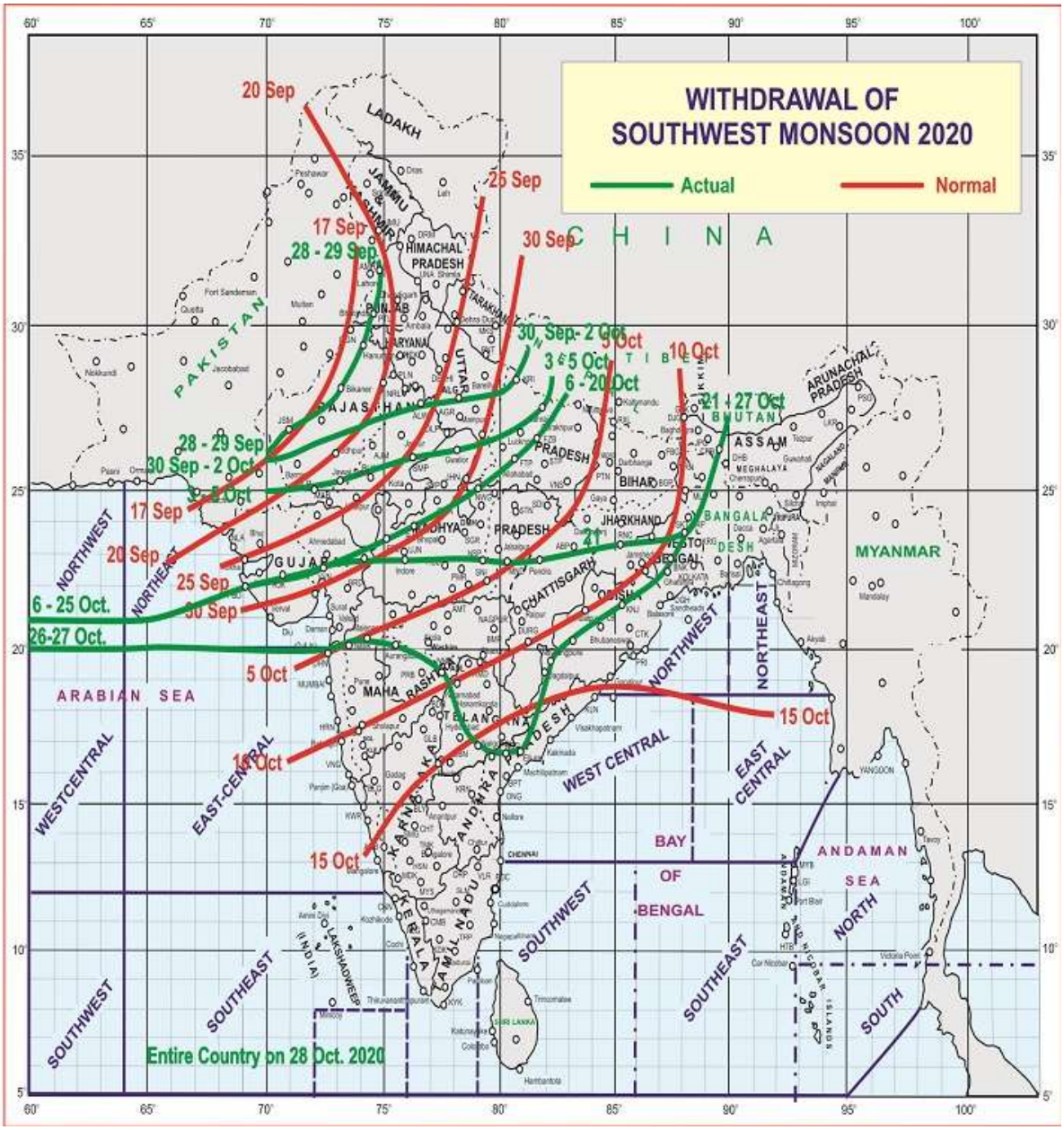

Fig.3: Isochrones of withdrawal of southwest monsoon - 2020.

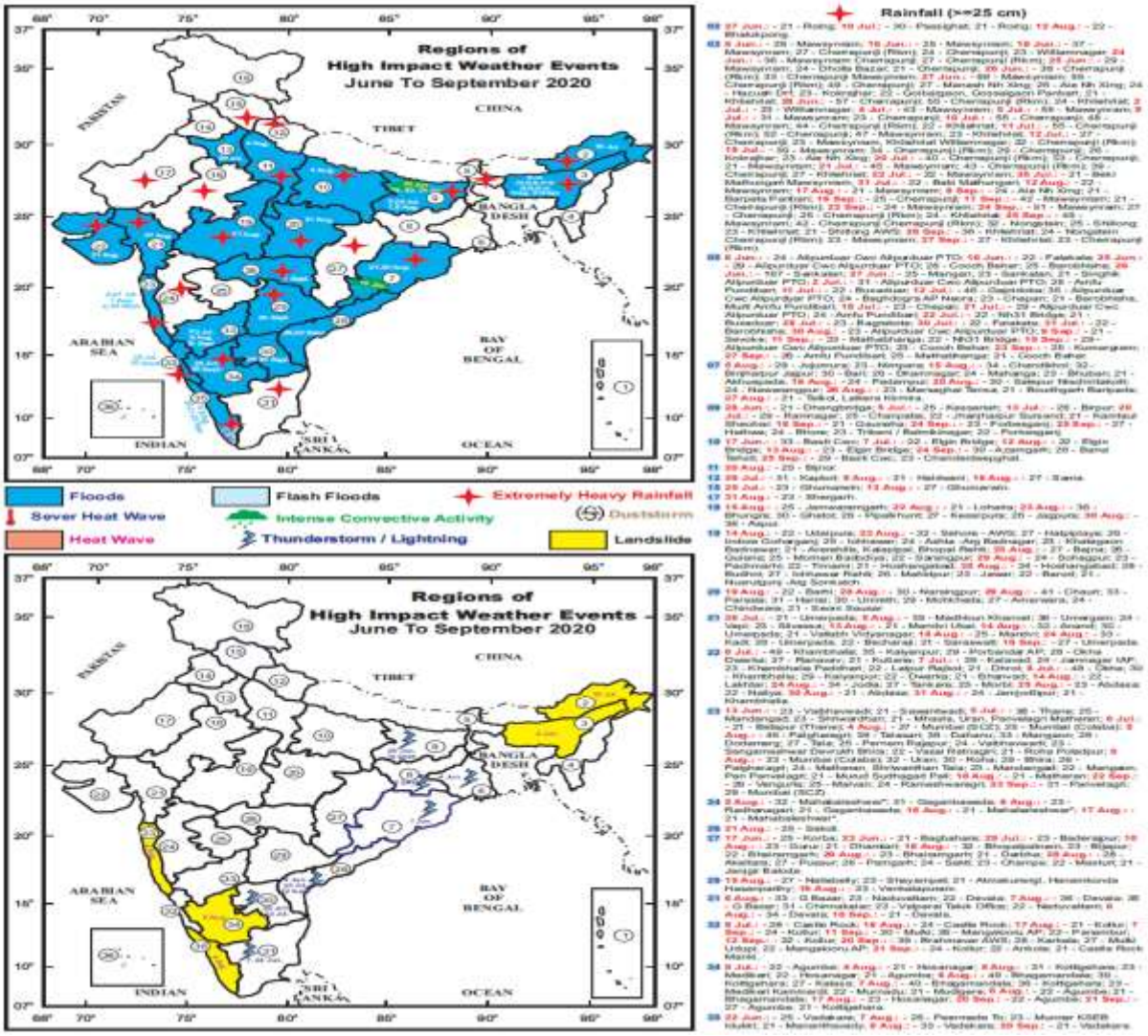

Fig.4: Areas and dates of high impact weather events during the 2020 southwest Monsoon.

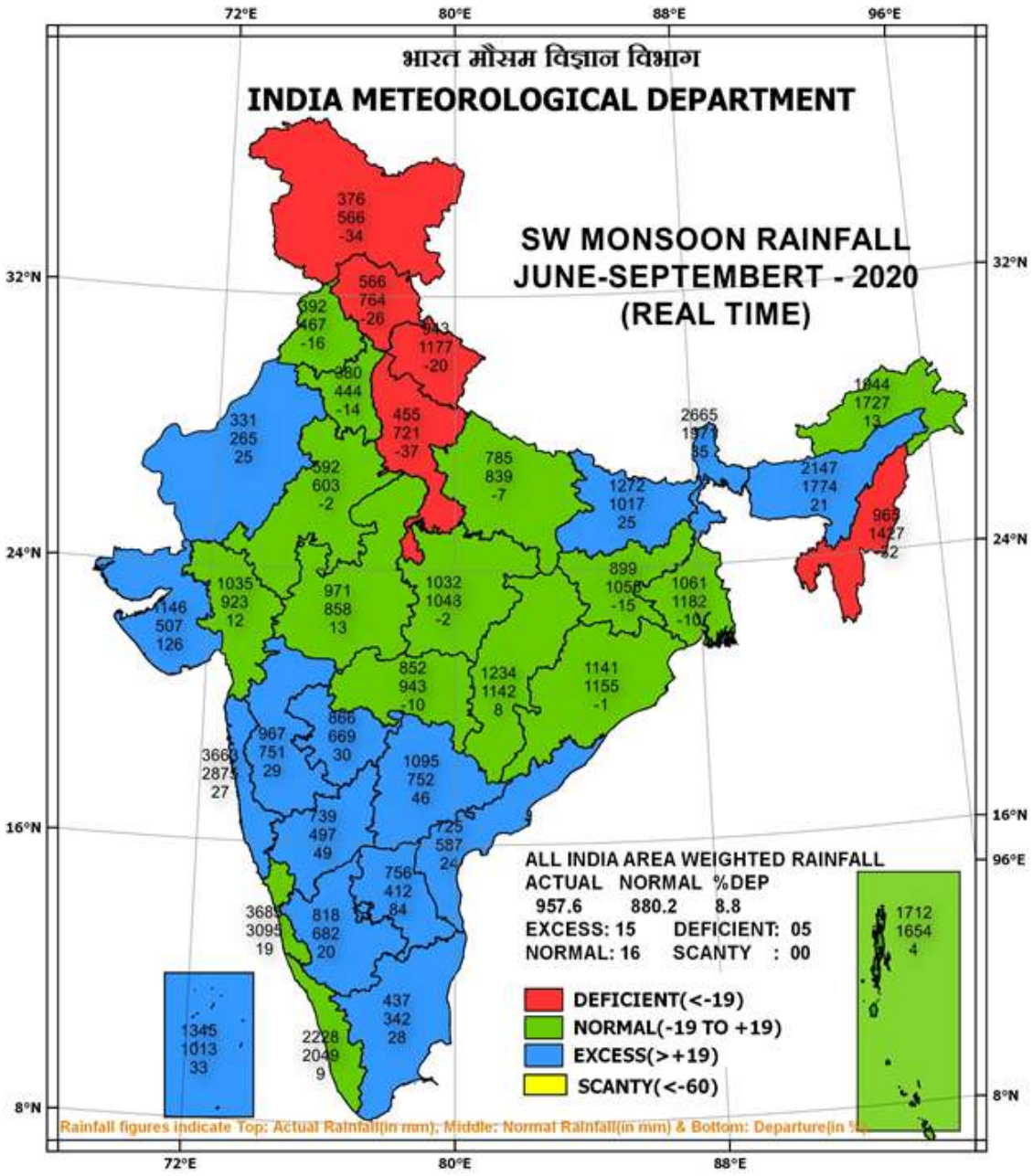

Fig.5: Sub-division wise rainfall distribution over India during southwest monsoon season (June to September) – 2020.

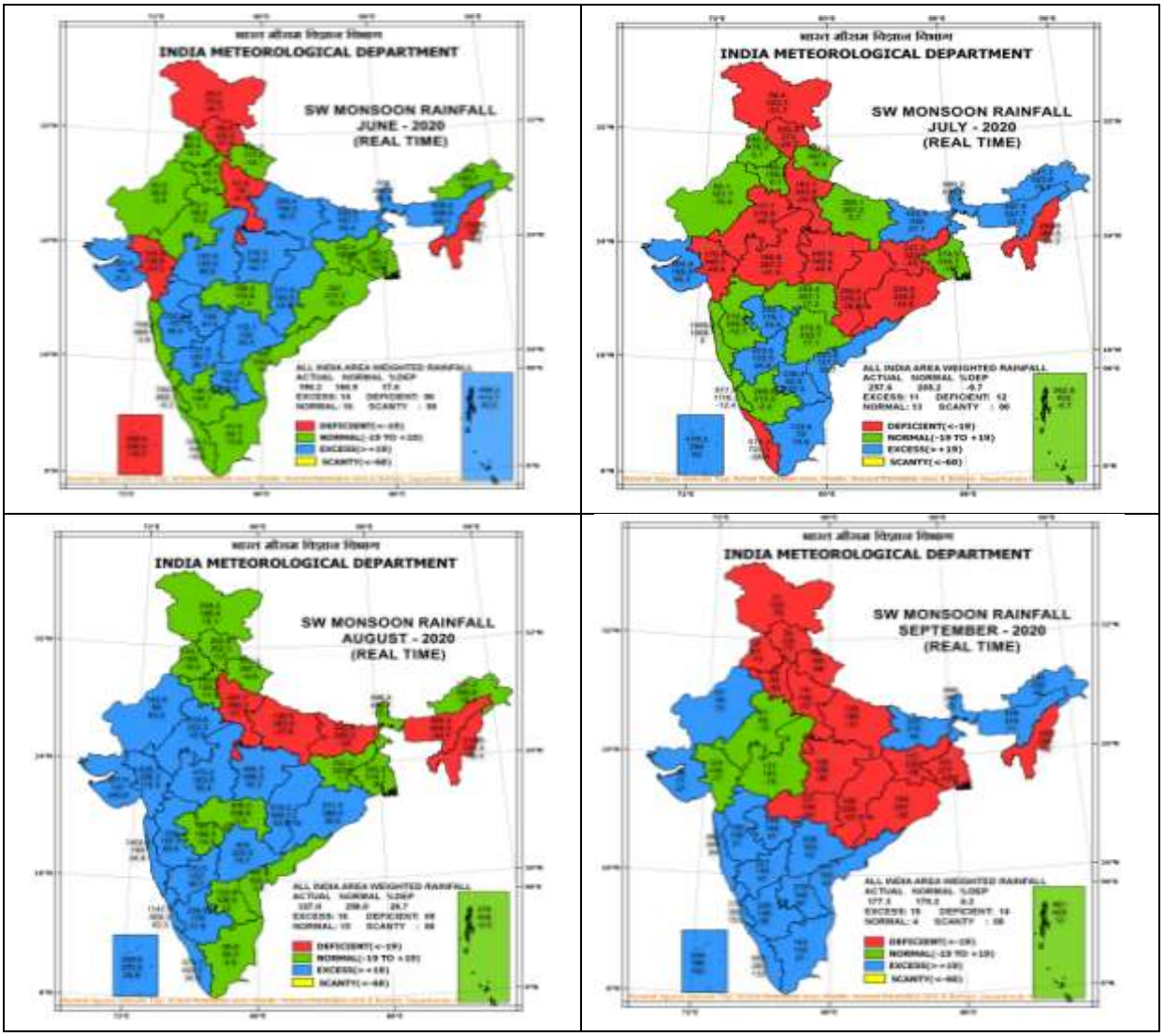

Fig.6: Sub-division wise monthly rainfall distribution over India during southwest monsoon season – 2020

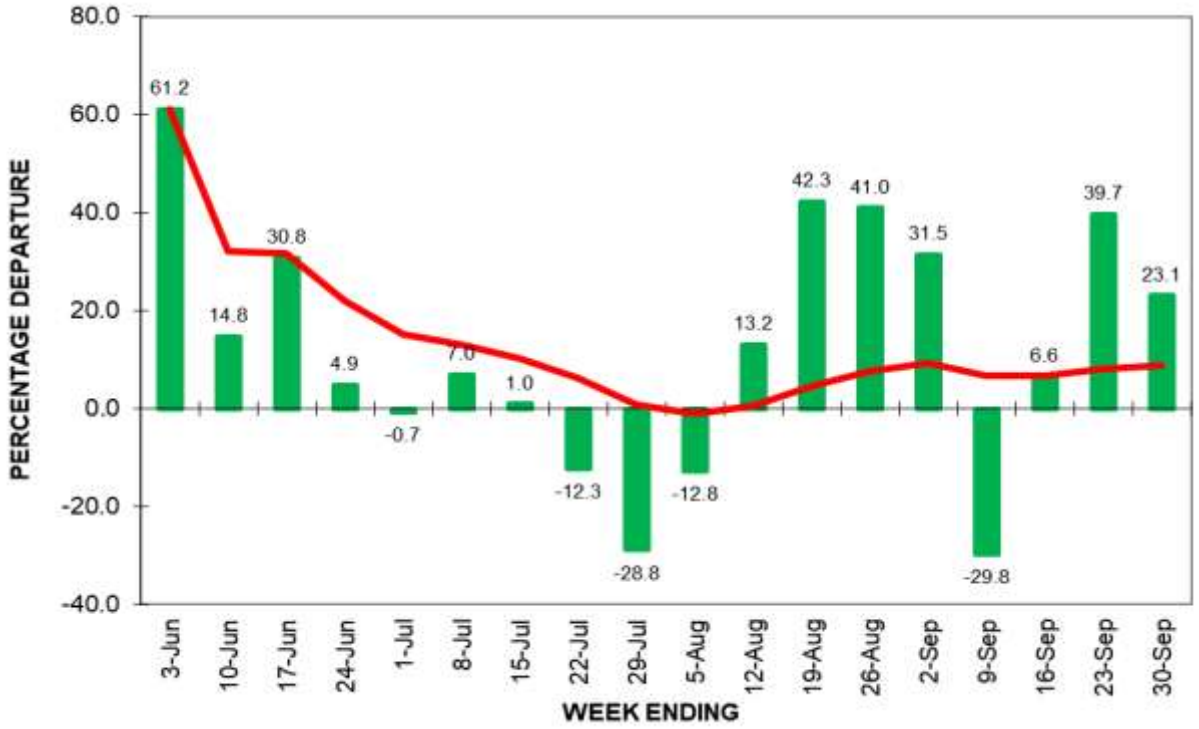

Fig.7: Week - by - Week Progress of the all India weekly and cumulative weekly monsoon rainfall anomalies during the 2020 southwest monsoon season. The rainfall anomalies are expressed as the percentage departure from long period average (LPA).