



**INDIA METEOROLOGICAL DEPARTMENT
(MINISTRY OF EARTH SCIENCES)
SOUTHWEST MONSOON-2017
END OF SEASON REPORT
FOR
UTTARAKHAND STATE
HIGHLIGHTS**

- For the state as a whole, the rainfall for the season (June-September) was 98% of its long period average (LPA) and thus categorized as a normal monsoon.
- Monthly rainfall over Uttarakhand as a whole was 105% of LPA in June, 108% of LPA in July, 82% of LPA in August and 103% of LPA in September respectively.
- Out of the total 13 districts of Uttarakhand 03 districts received excess seasonal rainfall, 08 districts received normal seasonal rainfall and 02 districts received deficient seasonal rainfall.
- Monsoon current advanced over Uttarakhand on 01st July 2017 about 9 day later than its normal date of 22nd June and covered the entire State on the 02nd July 2017.
- The monsoon activity over Uttarakhand was normal during the season (June-September).
- Withdrawal of monsoon from Uttarakhand commenced on 30th September and it withdrew from the entire State on 11th October 2017.

1. ONSET OF SOUTHWEST MONSOON – 2017

The southwest (SW) monsoon 2017 set in over Kerala on 30th May, 2 days earlier than its normal date of 1st June. The SW monsoon further advanced into some parts of northeast Bay of Bengal, Arunachal Pradesh, Nagaland, Manipur, Mizoram and most parts of Tripura and Assam & Meghalaya on 2nd June. The SW monsoon advanced further northwards and covered the most parts of the country by 22nd June. Thereafter, the Arabian Sea branch of SW monsoon continued northward gradually, whereas the Bay of Bengal branch of SW monsoon remained stagnant over Bihar till 30th June. Subsequently, westward movement of cyclonic circulations along the seasonal trough zone caused further advancement of southwest monsoon over Uttarakhand and the Northern Limit of Monsoon (NLM) passed through Barmer, Kota, Gwalior, Bareilly, Mukteshwar, Dharmashala, Baderwah and Pahalgam on 1st July. Next day, on 2nd July, SW monsoon covered the entire state of Uttarakhand. Thereafter, the seasonal trough along the northern plains gradually shifted northwards, due to movement of a Western Disturbance which caused widespread precipitation over parts of northwest India. This led to a weak monsoon pattern, with an anomalous anticyclone prevailing over western India causing a prolonged hiatus of 8 days. As the trough became active and a well-marked low pressure area formed over Indo- Gangetic plains, SWM further advanced and covered the entire country on 19th July 2017.

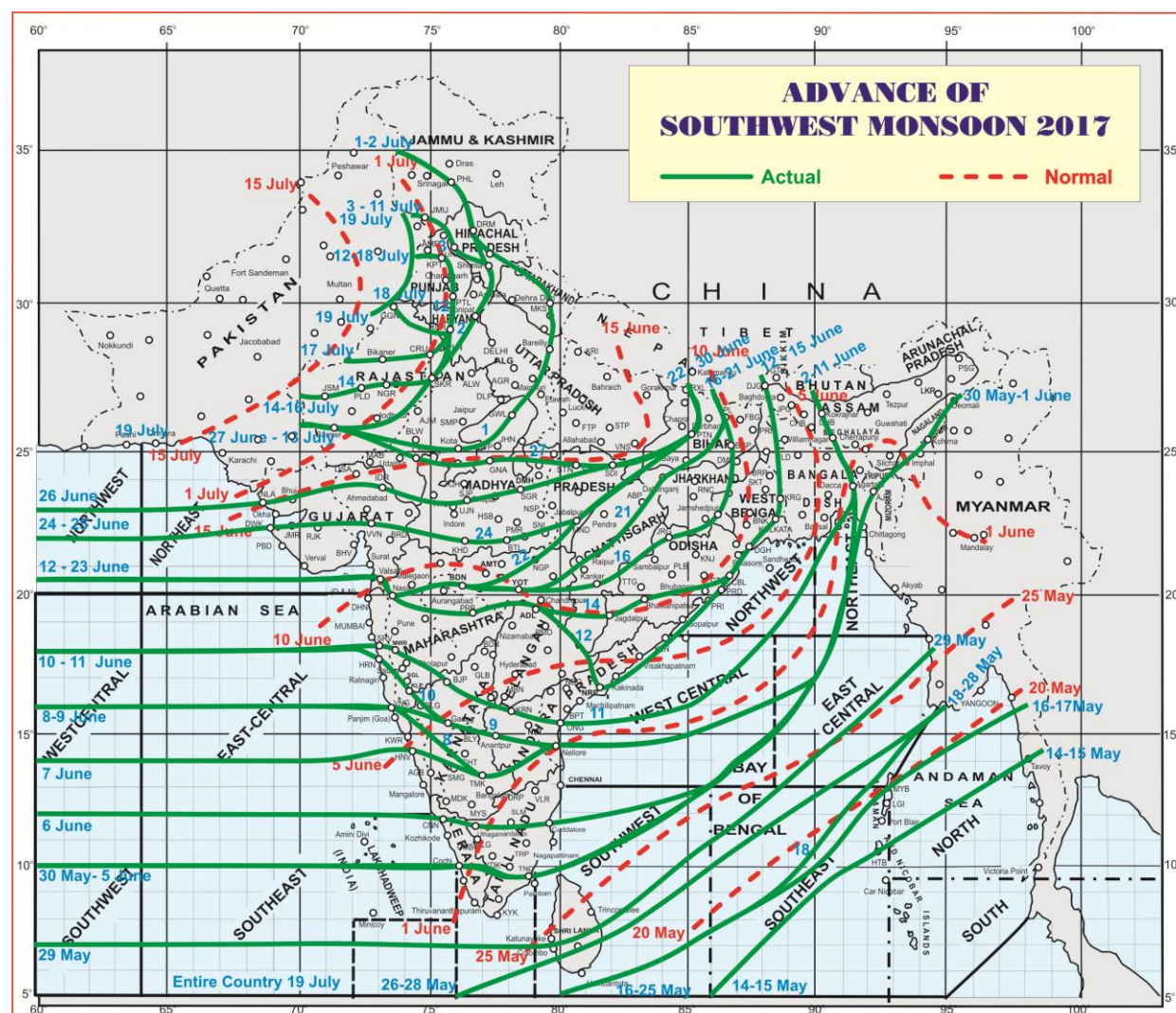


Fig.1 Isochrones of advance of SW Monsoon 2017

2. CHIEF SYNOPTIC FEATURES OF SW MONSOON - 2017:

Date	Synoptic Situation	Monsoon activity and significant rainfall (7 cm and above) (at 08:30 Hours IST. of Next Day)
25.06.2017	<ul style="list-style-type: none"> A trough at mean sea level ran from West Rajasthan to east-central Bay of Bengal across North-west Madhya Pradesh and extended upto 1.5 km a.s.l. An upper air cyclonic circulation laid over south Pakistan and nighbourhood between 0.9 & 2.1 km a.s.l. 	<p>Light to moderate rainfall occurred at most places in Uttarakhand. Heavy to Very heavy rainfall occurred at isolated places.</p> <p>Dehradun-18, Mussoorie-15, Ukhimath-14, Jolly Grant-8, Gairsain-7, Tehri-7</p>
26.06.2017	<ul style="list-style-type: none"> A trough at mean sea level ran from West Rajasthan to east-central Bay of Bengal across North Madhya Pradesh and extended upto 1.5 km a.s.l. An upper air cyclonic circulation over south Pakistan & neighbourhood laid over south Pakistan & adjoining Kutch and extended upto 0.9 km above mean sea level. A western disturbance as a trough in midtropospheric westerlies with its axis at 5.8 km above mean sea level ran roughly along Long. 64.0°E and north of Long. 30.0 °N. 	<p>Very light to moderate rainfall occurred at many places in Uttarakhand. Heavy rainfall occurred at isolated places</p> <p>Dharchula-9</p>
27.06.2017	<ul style="list-style-type: none"> A trough at mean sea level ran from West Rajasthan to east-central Bay of Bengal across North Madhya Pradesh and extended upto 1.5 km a.s.l. persisted. An upper air cyclonic circulation over south Pakistan & adjoining Kutch laid over coastal areas of Saurashtra and neighbourhood and extended upto 0.9 km above mean sea level. A western disturbance as a trough in midtropospheric westerlies with its axis at 5.8 km above mean sea level ran roughly along Long. 66.0°E and north of Lat. 28.0 °N. 	<p>Very light to moderate rainfall occurred at many places in Uttarakhand. Heavy rainfall occurred at isolated places.</p> <p>Roorkee-11</p>
28.06.2017	<ul style="list-style-type: none"> A trough at mean sea level from West Rajasthan to east-central Bay of Bengal laid over West Rajasthan to west central Bay across north Madhya Pradesh, Chhattisgarh and Jharkhand and extended upto 1.5 km above mean sea level. A western disturbance as a trough in midtropospheric westerlies with its axis at 5.8 km above mean sea level roughly along Long. 66.0°E and north of Lat. 28.0 °N persisted. 	<p>Light to moderate rainfall occurred at most places in Uttarakhand. Heavy to very heavy rainfall occurred at isolated places.</p> <p>Jolly Grant-17, Roorkee-13, Dehradun-11, Mussoorie-7 and Dharchula-7</p>
10.07.2017	<ul style="list-style-type: none"> A trough at mean sea level from north Punjab to northwest Bay of Bengal across north Uttar Pradesh, Jharkhand and Gangetic West Bengal persisted. A Western Disturbance as an upper air cyclonic circulation over north Pakistan and adjoining Jammu & Kashmir has moved away east northeastwards. An upper air cyclonic circulation over southwest Rajasthan & neighbourhood between 2.1 km and 3.6 km above mean sea level persisted. An upper air cyclonic circulation lies over south Pakistan & adjoining Kutch and extended upto 1.5 km above mean sea level. 	<p>Light to moderate rainfall occurred at most places in Uttarakhand. Heavy to very heavy rainfall occurred at isolated places.</p> <p>Monsoon remained active in Uttarakhand during past 24 hours.</p> <p>Mussoorie-16, Haldwani-12, Jolly Grant-12, Bageshwar-8, Garud-8, Didihat-8, Nainital-7, Kapkot-7 and Dehradun-7</p>
11.07.2017	<ul style="list-style-type: none"> A trough at mean sea level from north Punjab to northwest Bay of Bengal ran from Punjab to northwest Bay of Bengal across centre of low pressure area over East Uttar Pradesh, Jharkhand and Gangetic West Bengal. An upper air cyclonic circulation over southwest Rajasthan & neighbourhood laid over West Rajasthan & neighbourhood and extended between 3.6 km and 5.8 km above mean sea level. An upper air cyclonic circulation over south Pakistan & adjoining Kutch laid over Kutch & neighbourhood and extended between 2.1 km and 3.1 km above mean sea level. 	<p>Light to moderate rainfall occurred at most places with heavy to very heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained active in Uttarakhand during past 24 hours.</p> <p>Haldwani-17, Nainital-15, Mussoorie-11, Jakholi-11, Jolly Grant-11, Dwarahat-7, Devprayag-7, Tehri (CWC)-7 and Jaspur-7</p>
12.07.2017	<ul style="list-style-type: none"> A trough at mean sea level from Punjab to northwest Bay of Bengal ran from northwest Rajasthan to northwest Bay of Bengal across centre of well marked low pressure area, east Uttar Pradesh, Jharkhand and Gangetic West Bengal. An upper air cyclonic circulation over West Rajasthan & neighbourhood laid over northeast Rajasthan & neighbourhood at 5.8 km above mean sea level. A fresh western disturbance as an upper air cyclonic circulation laid over north Pakistan & neighbourhood between 3.1 & 4.5 Km above mean sea level. 	<p>Light to moderate rainfall occurred at most places with heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained active in Uttarakhand during past 24 hours.</p> <p>Dehradun-11</p>
03.08.2017	<ul style="list-style-type: none"> The axis of monsoon trough at mean sea level passed close to the foothills of Himalaya. An upper air cyclonic circulation over northern parts of central Uttar Pradesh & neighbourhood laid over East Uttar Pradesh & adjoining Bihar between 3.6 & 5.8 Km above mean sea level. A Western Disturbance as an upper air cyclonic circulation over central parts of Pakistan & adjoining area of Punjab laid over Jammu & Kashmir & neighbourhood at 3.1 km above mean sea level. Another Western Disturbance as an upper air cyclonic circulation over West Afghanistan & neighbourhood laid over central parts of Afghanistan at 5.8 Km above mean sea level. 	<p>Very light to moderate rainfall occurred at many places with heavy to extremely heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained active in Uttarakhand during past 24 hours.</p> <p>Kotdwar-25, DDN (AWS)-14, RISHIKESH (CWC)-14, Haldwani-10, Hardwar-9, Didihat-9, Banbasa-9, Lansdown-9, Ramnagar-8, Dehradun-7, Nainital-7</p>
04.08.2017	<ul style="list-style-type: none"> The axis of monsoon trough at mean sea level continued to run close to the foothills of Himalayas. An upper air cyclonic circulation laid over northeast Rajasthan & neighbourhood at 5.8 km above mean sea level. A Western Disturbance as an upper air cyclonic circulation over Jammu & Kashmir & neighbourhood, was seen as a trough with its axis at 3.1 km above mean sea level roughly along longitude 80.0°E and north of latitude 25.0°N. The other Western Disturbance as an upper air cyclonic circulation over central parts of Afghanistan was seen as a trough with its axis at 5.8 km above mean sea level roughly along longitude 64.0°E and north of latitude 28.0°N. 	<p>Very light to moderate rainfall occurred at most places with heavy to extremely heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained active in Uttarakhand during past 24 hours.</p> <p>Rishikesh (CWC) -21, Jollygrant-15, Hardwar-15, Chaukhutia-11, Lansdown-9, Karnaprayag-9, Dehra Dun-9, Bageshwar- 9, Jakholi-7, Deoprayag-7, Tehri (CWC) -7, Didihat-7, Gairsain-7</p>

09.08.2017	<ul style="list-style-type: none"> • The axis of monsoon trough at mean sea level passed through Ferozpur, Karnal, Fursatganj, Digha, Daltonganj and thence southeastwards to northeast Bay of Bengal. • A trough from north Rajasthan to West central Bay of Bengal ran from south Punjab to Gangetic West Bengal at 0.9 Km above mean level across south Uttar Pradesh & Jharkhand. • A Western Disturbance as an upper air cyclonic circulation over east Afghanistan laid over north Pakistan & neighbourhood between 3.1 & 5.8 km above mean sea level. • An upper air cyclonic circulation over south Pakistan & adjoining Kutch laid over northeast Arabian Sea & adjoining Kutch area between 1.5 & 3.6 Km above mean sea level. 	<p>Very light to moderate rainfall occurred at most places with heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained normal in Uttarakhand during past 24 hours.</p> <p>Munsiyari-11, Dharchula-9, Jollygrant-7,</p>
10.08.2017	<ul style="list-style-type: none"> • The axis of monsoon trough at mean sea level passed through Amritsar, Karnal, Bareilly, Gorakhpur, Muzaffarpur, Goalpara and thence eastwards to east Assam. Another branch passed through Muzaffarpur, Bhagalpur, Shantiniketan and thence southeastwards to North Bay of Bengal. • An upper air cyclonic circulation over northern parts of Madhya Pradesh laid over west Uttar Pradesh & neighbourhood and extended upto 0.9 km above mean sea level. • A Western Disturbance as an upper air cyclonic circulation over north Pakistan & adjoining Jammu & Kashmir laid over east Jammu & Kashmir & neighbourhood at 5.8 km above mean sea level. • A trough from south Punjab to Gangetic West Bengal at 0.9 Km above mean level across south Uttar Pradesh & Jharkhand became less marked. 	<p>Very light to moderate rainfall occurred at many places with heavy to very heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained normal in Uttarakhand during past 24 hours.</p> <p>Didihat-14, Jaspur-14, Haridwar-12, Kotdwar-9, Banbasa-9, Kashipur-8, Ukhimath-7</p>
11.08.2017	<ul style="list-style-type: none"> • The axis of monsoon trough at mean sea level ran close to the foot hills of Himalayas. • An upper air cyclonic circulation over Madhya Maharashtra & neighbourhood, laid over Gujarat region & neighbourhood between 3.1Km & 5.8 Km above mean sea level. • An upper air cyclonic circulation over west Uttar Pradesh & neighbourhood extending upto 0.9 km above mean sea level became less marked. 	<p>Very light to moderate rainfall occurred at a few places with heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained normal in Uttarakhand during past 24 hours.</p> <p>Dharchula-8</p>
12.08.2017	<ul style="list-style-type: none"> • The axis of monsoon trough at mean sea level continued to run close to the foothills of Himalayas. • A fresh Western disturbance as an upper air cyclonic circulation laid over Afghanistan & neighbourhood and extended upto 3.6 Km above mean sea level. • An upper air cyclonic circulation laid over eastern parts of Bihar & neighbourhood and extended upto 5.8 Km above mean sea level. • A trough ran from east Bihar to south Assam and extended upto 0.9 Km above mean sea level. 	<p>Very light to moderate rainfall occurred at a few places with heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained weak in Uttarakhand during past 24 hours.</p> <p>Munsiyari-7</p>
13.08.2017	<ul style="list-style-type: none"> • The axis of monsoon trough at mean sea level continued to run close to the foothills of Himalayas. • A Western disturbance as an upper air cyclonic circulation over Afghanistan & neighbourhood extending upto 3.6 km above mean sea level persisted; with a trough aloft runs roughly along longitude 64°E and north of latitude 30°N. • An upper air cyclonic circulation over eastern parts of Bihar & neighbourhood laid over eastern parts of Bihar & adjoining Sub-Himalayan West Bengal and extended upto 5.8 km above mean sea level. • A trough from the upper air cyclonic circulation over eastern parts of Bihar to south Assam ran from eastern parts of Bihar & adjoining Sub Himalayan West Bengal to northwest Bay of Bengal and extended upto 1.5 km above mean sea level. 	<p>Very light to moderate rainfall occurred at a few places with heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained normal in Uttarakhand during past 24 hours.</p> <p>Pantnagar-7</p>
30.08.2017	<ul style="list-style-type: none"> • The well marked low pressure area over central parts of Gujarat & neighbourhood laid over northern parts of Saurashtra and adjoining Gujarat region with the associated upper air cyclonic circulation; extended upto 7.6 km above mean sea level tilting southwards with height, which was likely to concentrate into a depression during next 12 hours over Kutch & neighbourhood. • The axis of monsoon trough at mean sea level passed through centre of the well marked low pressure area over northern parts Saurashtra and adjoining Gujarat region, Khandwa, Seoni, Raipur, Puri and thence southeastwards to eastcentral Bay of Bengal and extended upto 0.9 Km above mean sea level. • A Western disturbance as an upper air cyclonic circulation over north Pakistan and adjoining Jammu & Kashmir persisted at 5.8 Km above mean sea level with the trough aloft which ran roughly along Longitude 70.0°E and north of Latitude 32.0°N at 7.6 km above mean sea level. 	<p>Light to moderate rainfall occurred at many places with heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained normal in Uttarakhand during past 24 hours.</p> <p>Chamoli-9</p>
31.08.2017	<ul style="list-style-type: none"> ♦The well marked low pressure area over Kutch & adjoining areas of south Pakistan & northeast Arabian sea persisted with the associated cyclonic circulation which extended upto 5.8 km above mean sea level. ♦The axis of monsoon trough at mean sea level passed through centre of the well marked low pressure area over Kutch & adjoining area of south Pakistan& northeast Arabian sea, Idar, Rajgarh, Damoh, Ambikapur, Jamshedpur, Digha and thence southeastwards to northeast Bay of Bengal. ♦A Western disturbance as an upper air cyclonic circulation over north Pakistan and adjoining Jammu & Kashmir moved away east northeastwards. ♦A fresh western disturbance as an upper air cyclonic circulation laid over north Pakistan & neighbourhood at 3.1 km above mean sea level with the trough aloft in middle & upper tropospheric westerlies with its axis at 5.8 km above mean sea level ran roughly along Longitude 65.0°E to the north of Latitude 30.0°N 	<p>Light to moderate rainfall occurred at most places with heavy to very heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained vigrous in Uttarakhand during past 24 hours.</p> <p>Dehradun-15, Haldwani-15, Jollygrant-11, Jakholi-10, Mussoorie-9, Barkot-9, Hardwar-8, Tehri-7</p>
01.09.2017	<ul style="list-style-type: none"> • The axis of monsoon trough at mean sea level now passed through Ganganagar, Karnal, Bareilly, Gorakhpur, Muzaffarpur, Malda and thence southeastwards to northeast Bay of Bengal. • The low pressure area over Kutch & adjoining areas of south Pakistan & northeast Arabian Sea laid over south Pakistan & neighbourhood. The associated cyclonic circulation extended upto 4.5 km above mean sea level. • A western disturbance as an upper air cyclonic circulation over north Pakistan & neighbourhood at 3.1 km above mean sea level persisted with the trough aloft in mid & upper tropospheric westerlies with its axis at 5.8 above mean sea level ran roughly along Longitude 72.0°E to the north of Latitude 35.0°N. 	<p>Light to moderate rainfall occurred at most places with heavy to very heavy rainfall at isolated places in Uttarakhand.</p> <p>Monsoon remained active in Uttarakhand during past 24 hours.</p> <p>Haldwani 15, Hardwar 13, Jaspur 12, Nainital 9</p>

22.09.2017

- The well marked low pressure area over northern parts of central Madhya Pradesh & neighborhood and associated cyclonic circulation which extended upto 7.6 km above mean sea level persisted. The trough from the above system to Konkan at 3.1 km above mean sea level ran from Uttarakhand to South Konkan across West Uttar Pradesh, West Madhya Pradesh and Madhya Maharashtra.
- The axis of monsoon trough at mean sea level passed through Anupgarh, Jaipur, centre of Well marked low pressure area, Pendra, Jharsuguda, Balasore and thence eastwards to northeast Bay of Bengal.
- A cyclonic circulation over northwest Rajasthan & neighbourhood persisted and extended upto 0.9 km above mean sea level.
- A Western Disturbance as an upper air cyclonic circulation over eastern parts of Afghanistan & neighbourhood between 3.1 & 5.8 km above mean sea level with the trough aloft laid as a trough in mid and upper tropospheric westerlies with its axis at 5.8 km above mean sea level roughly along Longitude 65.0°E to the north of Latitude 25.0°N.
- Another Western Disturbance as an upper air cyclonic circulation over eastern parts of Jammu & Kashmir and adjoining Himachal Pradesh at 3.1 km above mean sea level moved away east northeastwards.

Light to moderate rainfall occurred at most places with heavy to very heavy rainfall at isolated places and extremely heavy rainfall at one place in Uttarakhand.

Monsoon remained vigorous in Uttarakhand during past 24 hours.

Nainital (Snow view point)-21, Nainital- 15, Haldwani-11, Mukteshwar-11, Jaspur-11, Pantnagar- 9, Gairsain- 8

23.09.2017

- The well marked low pressure area over West Uttar Pradesh & neighbourhood persisted. Associated cyclonic circulation extended upto 5.8 km above mean sea level.
- The axis of monsoon trough at mean sea level passed through Amritsar, Delhi, centre of well marked low pressure area, Muzaffarpur, Daltonganj, Balasore and thence southeastwards to north Andaman sea.
- A cyclonic circulation over northwest Rajasthan & neighbourhood extended upto 0.9 km above mean sea level laid over northwest Rajasthan and adjoining Punjab.
- A Western Disturbance as a trough in mid and upper tropospheric westerlies with its axis at 5.8 km above mean sea level ran roughly along Longitude 70°E to the north of Latitude 25°N.
- A trough at 3.1 km above mean sea level from Uttarakhand to South Konkan across West Uttar Pradesh, West Madhya Pradesh and Madhya Maharashtra became less marked.

Light to moderate rainfall occurred at most places with heavy to very heavy rainfall at a few places in Uttarakhand.

Monsoon remained vigorous in Uttarakhand during past 24 hours.

Hardwar-15, Mukteshwar-11, Jakholi-10, Chaukhatia-10, Haldwani-10, Roorkee-9, Gairsain-9, Dwarhat-9, Tehri (CWC)-8, Jollygrant-8, Srinagar-8, Deoprayag-7, Tehri -7

3. WITHDRAWAL OF SOUTHWEST MONSOON:

The rainfall activity was normal in Uttarakhand during the SW Monsoon season. The withdrawal of SW monsoon commenced on 27th September from west Rajasthan with a change in the lower tropospheric circulation pattern. The change in the wind flow pattern over Uttarakhand from southeasterly to northwesterly and the development of anti-cyclonic circulation over west Rajasthan in lower levels made conditions favorable for the further withdrawal of southwest monsoon. Consequently, SW monsoon withdrew from some parts of Uttarakhand on 30th September and it withdrew from the entire State on 11th October 2017. Fig.3 shows the isochrones of withdrawal of SW Monsoon 2017.

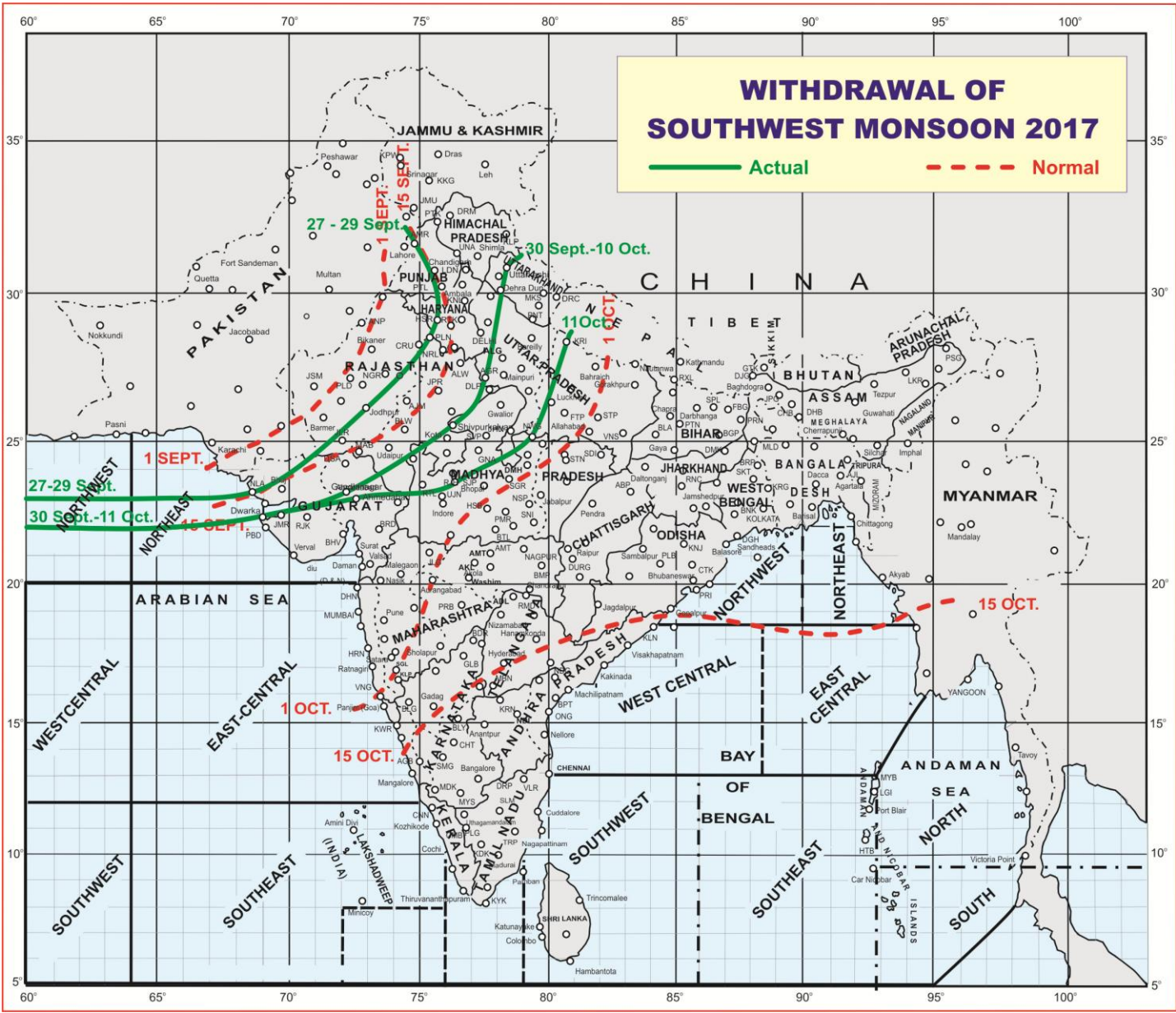


Fig.3: Isochrones of withdrawal of Monsoon 2017

4. RAINFALL DISTRIBUTION OVER UTTARAKHAND DURING MONSOON – 2017:

The rainfall during SW monsoon season (June to September) for the State as a whole is as follows:

Met. Sub-division/ State	Actual Rainfall June-September (in mm)	Normal/Long Period Average (LPA)Rainfall June-September(in mm)	Departure from normal (in %)
Uttarakhand	1199	1229.2	-2

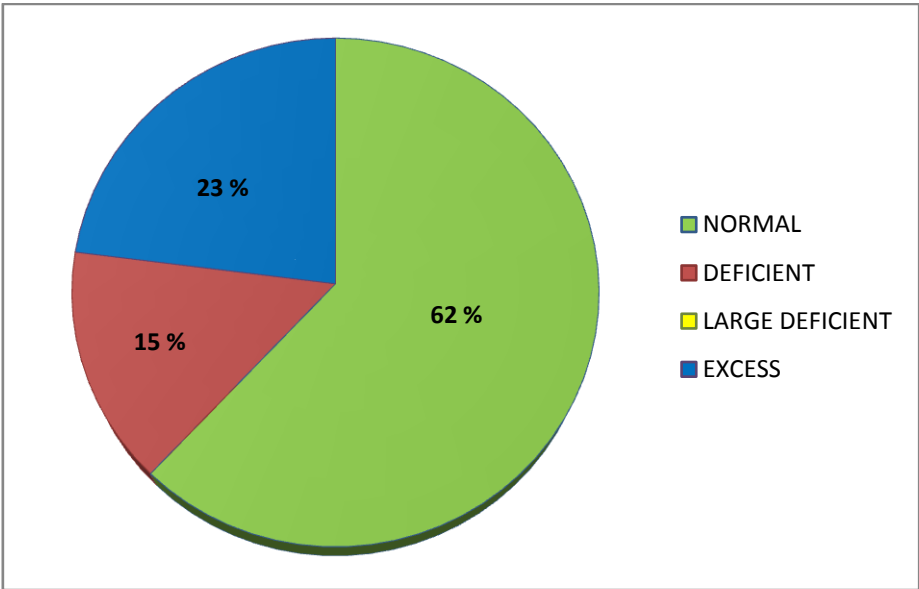


Fig. 4 Rainfall Distribution over the area of Uttarakhand

As seen in the table above, the seasonal rainfall over Uttarakhand State/ sub-division as a whole was 98% of its LPA. The seasonal rainfall intensity distribution over the State was in the categories of excess, normal and deficient. Out of 13 districts of Uttarakhand 03 districts received excess, 08 districts received normal and 02 districts received deficient seasonal rainfall. In terms of area 23% area received excess, 62% area received normal and 15% area received deficient rainfall. In totality, the monsoon rainfall was normal (-2%) over the state.

5. INTENSITY DISTRIBUTION OF RAINFALL DURING MONSOON-2017 OVER UTTARAKHAND:

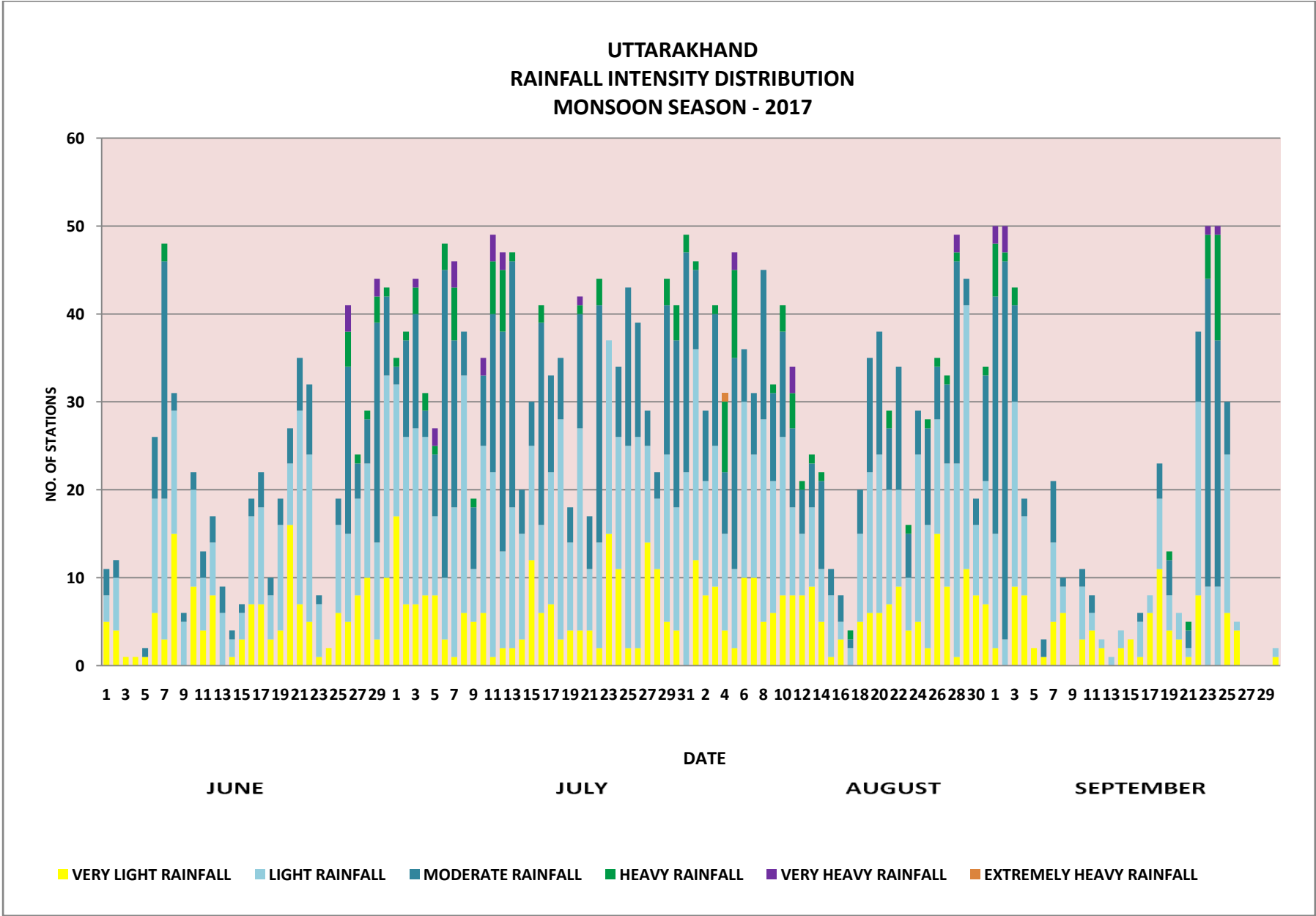


Fig. 5 Rainfall Intensity Distribution

6. MONTHLY DISTRIBUTION OF RAINFALL OVER THE STATE:

The monthly rainfall distribution of the state is given in a table below:

Met. Sub-division/ State	Month	Actual Rainfall (in mm)	Normal or Long period average (LPA) (in mm)	Departure from normal (in %)
Uttarakhand	June-2017	175.6	167.8	5
	July- 2017	460.9	428.1	8
	August- 2017	349.1	426.2	-18
	September-2017	213.4	207.1	3

From the above table, the monthly rainfall was normal over the state during the south-west monsoon season. The June rainfall was 105%, July 108%, August 82% and September 103% of their respective monthly LPAs. The amount of rainfall (in terms of % of LPA) was maximum in July and minimum in August. This year 23% area of Uttarakhand received excess, 62% area received normal and 15% area received deficient rainfall. In this way, the performance of monsoon 2017 was normal (98%) over the State.

7. WEEKLY RAINFALL DISTRIBUTION:

Weekly rainfall distribution and departure over Uttarakhand Meteorological sub-divisions is shown in Fig. 6 and Fig. 7 below respectively:

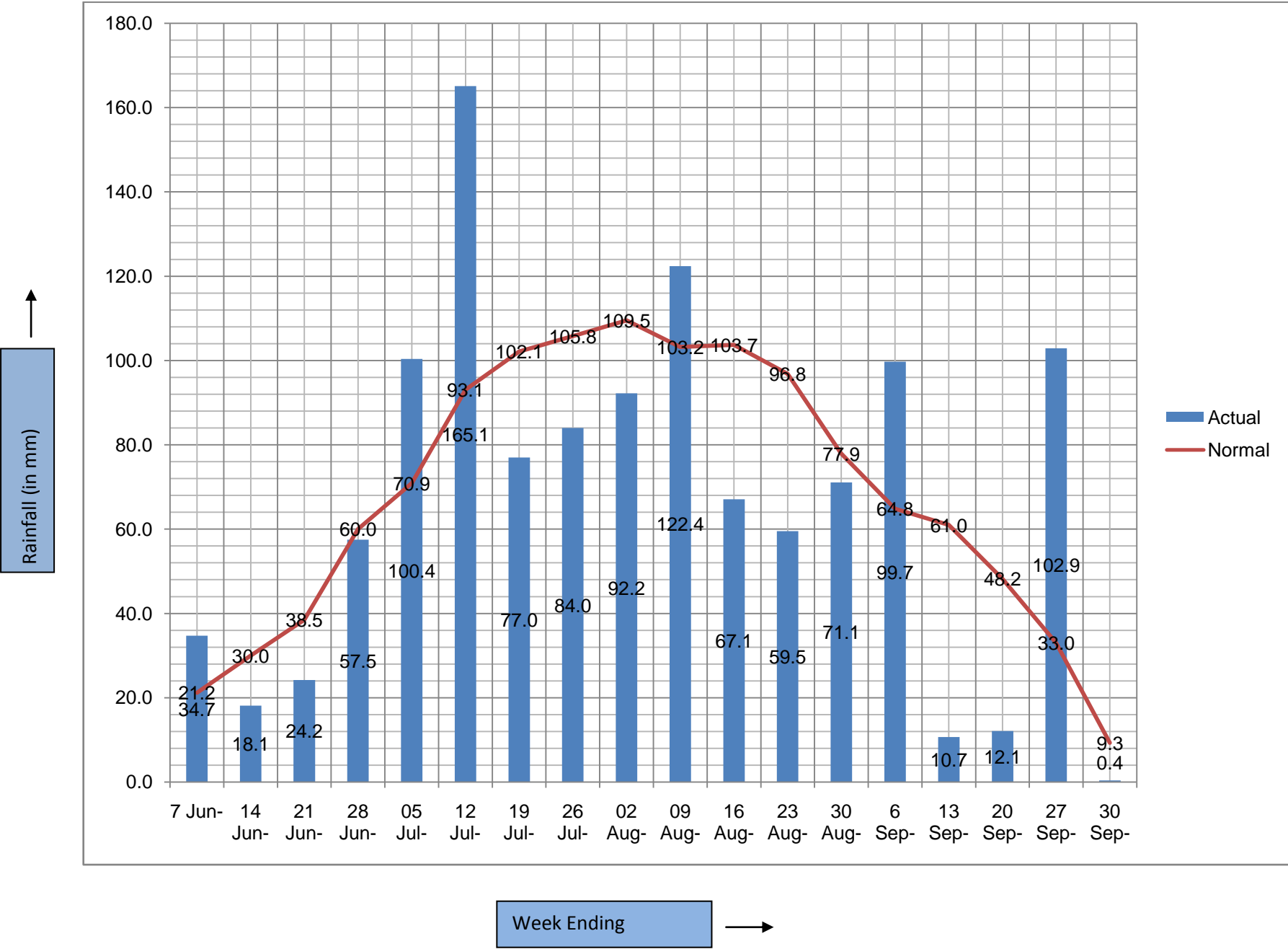


Fig.6: Weekly Monsoon Rainfall-2017 over Uttarakhand

The weekly monsoon rainfall was more than normal over the State on 5 occasions, 1 in June, 2 in July and 2 in September, normal on 4 occasions, 1 in June and 3 in August and it was less than normal on other weeks. In terms of percentage departure from normal, the weekly rainfall was large excess ($\geq +60\%$) during 3 weeks, excess (+20 to +59 %) during 2 weeks, normal (-19%

to +19%) during 4 weeks, deficient (-20% to -59%) during 6 weeks and large deficient (-60% to -99%) during 3 weeks. Thus, week by week monsoon rainfall performance was average.

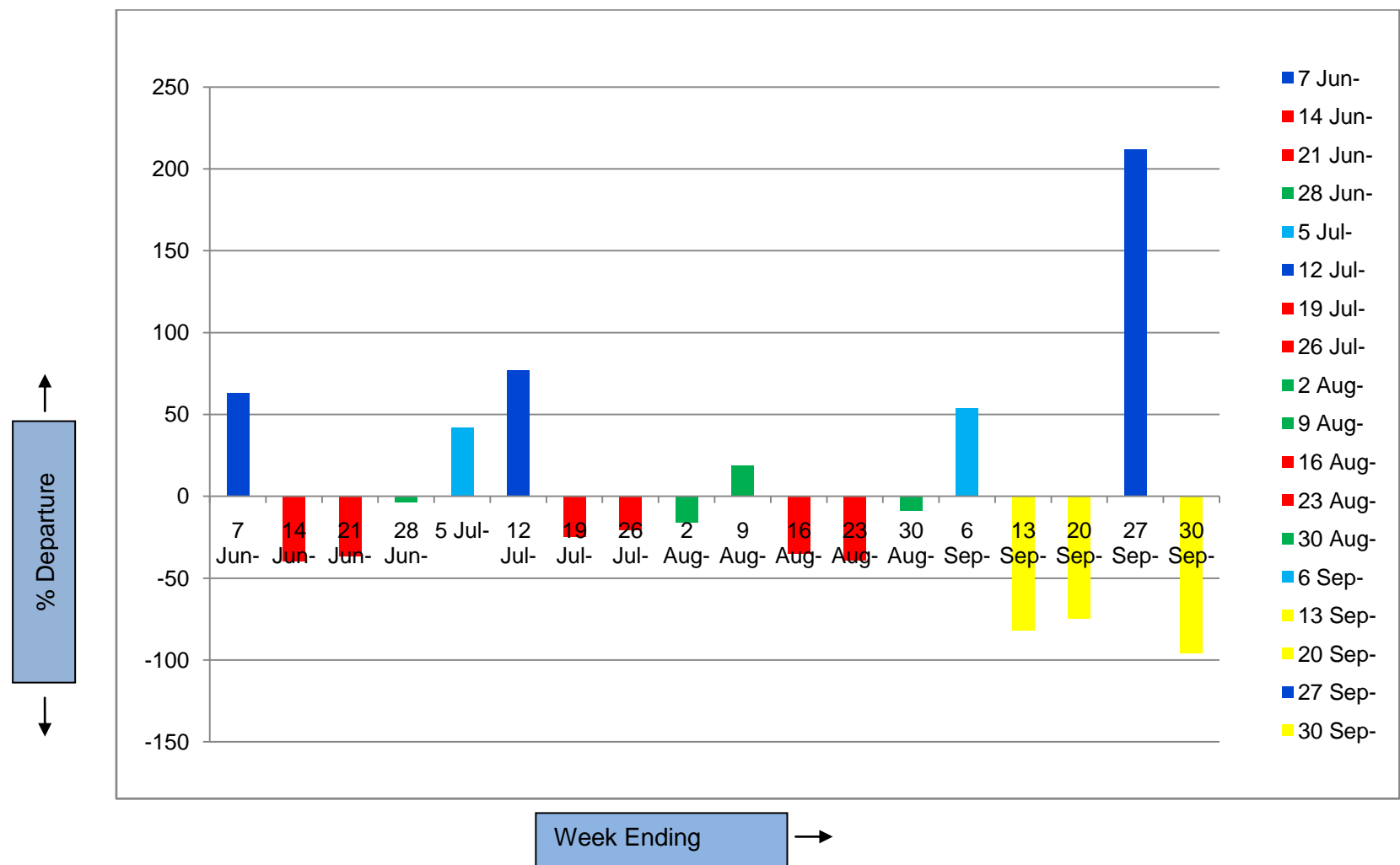


Fig.7 Weekly departure of the Monsoon Rainfall 2017 over Uttarakhand

Week Ending	7 Jun	14 Jun	21 Jun	28 Jun	5 July	12 Jul	19 Jul	26 Jul	2 Aug	9 Aug	16 Aug	23 Aug	30 Aug	6 Sep	13 Sep	20 Sep	27 Sep	30 Sep
Departure	63	-40	-37	-4	42	77	-25	-21	-16	19	-35	-39	-9	54	-82	-75	212	-96

8. DISTRICT-WISE SPATIAL DISTRIBUTION OF RAINFALL MONSOON 2017

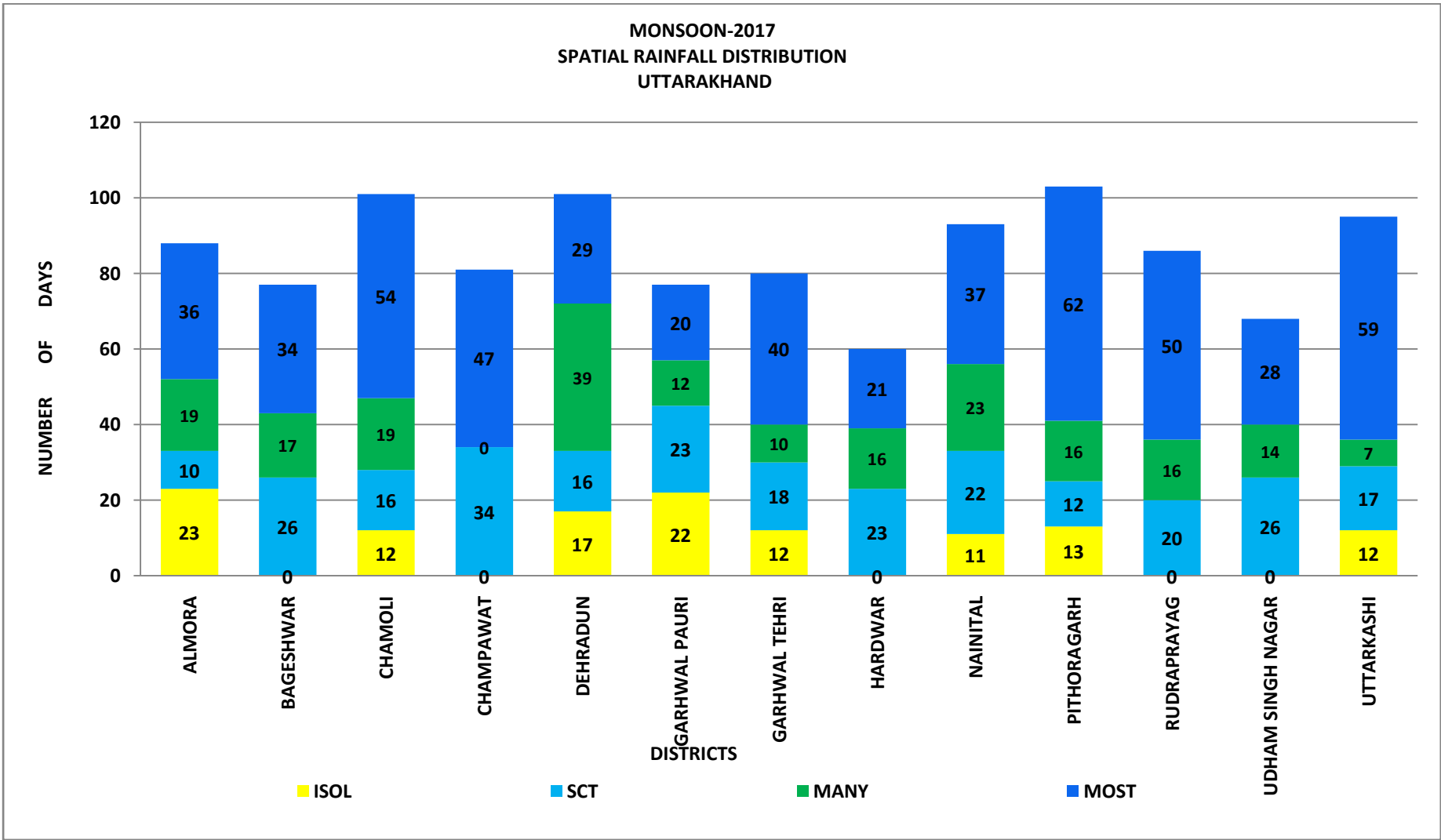


Fig.8 District wise Spatial Distribution of Rainfall during monsoon 2017 over Uttarakhand

The maximum number of rainfall days was over Pithoragarh district (103 days) and minimum rainfall days were over Hardwar district (60 days). Widespread to fairly widespread rainfall occurred on 50 days or more (maximum) in Almora, Bageshwar, Chamoli, Dehradun, Garhwal Tehri, Nainital, Pithoragarh, Rudraprayag and Uttarkashi districts and 37 days (minimum) over Hardwar district.

9. DISTRICT-WISE HEAVY RAINFALL DISTRIBUTION MONSOON 2017

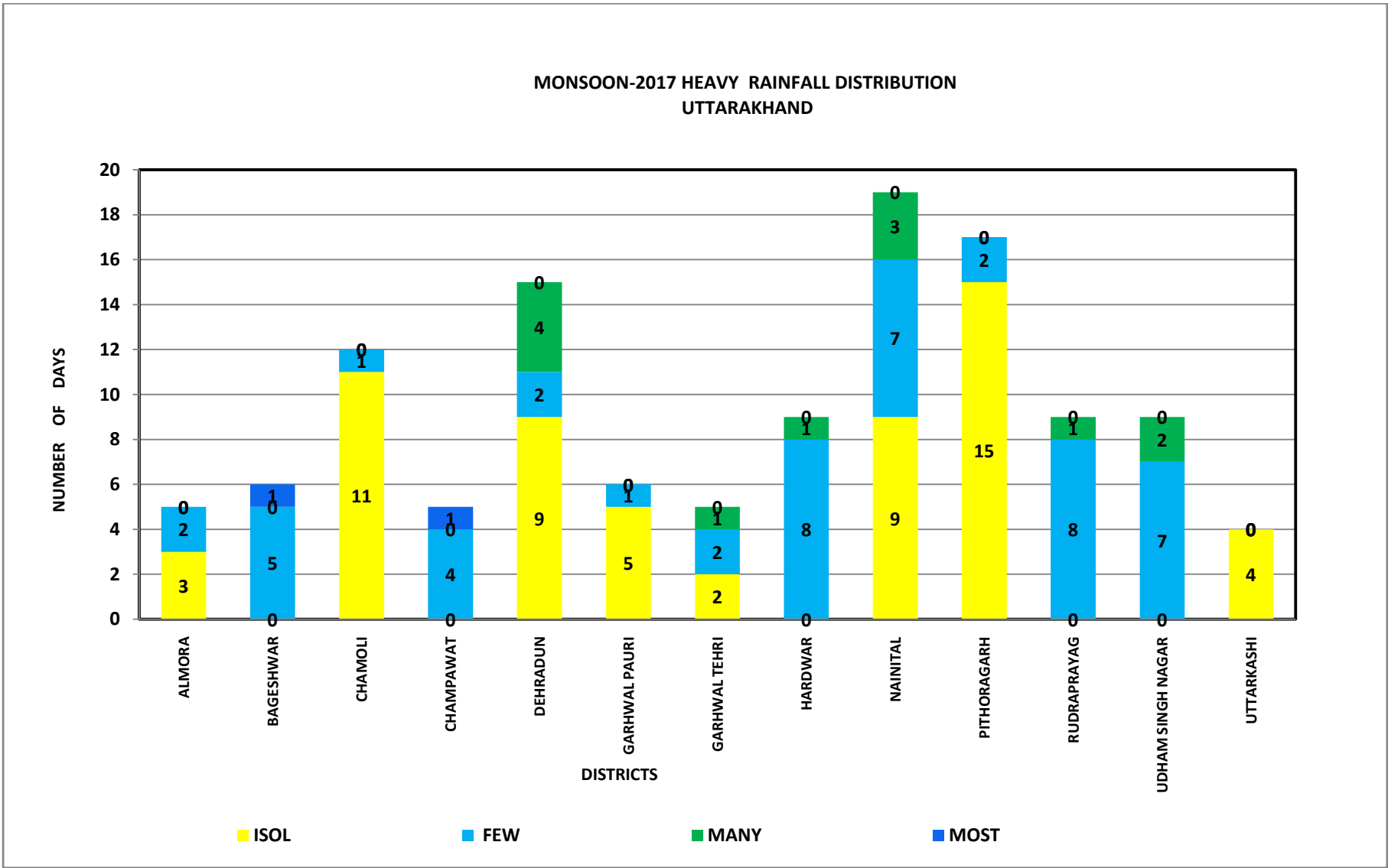


Fig.9 District wise Heavy Rainfall distribution during monsoon 2017 over Uttarakhand

The maximum number of heavy rainfall days was over Nainital district (19 days) and minimum over Uttarkashi district (4 days).

10. DISTRICTS WISE RAINFALL DISTRIBUTION (JUNE-SEPTEMBER) 2017:

The following table shows the district wise rainfall distribution for Uttarakhand:

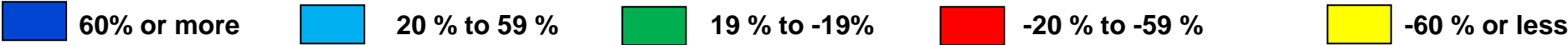
Serial No	State/ Districts	Actual Rainfall June-September (in mm)	Normal/ Long period average (LPA) June-September (in mm)	Departure from normal (in %)
1.	Almora	997.5	858.4	16
2.	Bageshwar	1129.2	858.4	32
3.	Chamoli	1242.1	859.3	45
4.	Champawat	1270.9	1319.7	-4
5.	Dehradun	1718.6	1802.1	-5
6.	Garhwal Pauri	898.3	1213.5	-26
7.	Garhwal Tehri	787.9	1047.1	-25
8.	Hardwar	927.1	961.9	-4
9.	Nainital	1750.8	1439.1	22
10.	Pithoragarh	1488.3	1687.9	-12
11.	Rudraprayag	1492	1671.1	-11
12.	Udham Singh Nagar	946.7	1119.9	-15
13.	Uttarkashi	951.5	1148.6	-17

Out of 13 districts, 2 districts viz. Garhwal Pauri and Garhwal Tehri received the deficient, 8 districts viz. Almora, Champawat, Dehradun, Hardwar, Pithoragarh, Rudraprayag, Udham Singh Nagar and Uttarkashi received the normal and 3

districts viz. Bageshwar, Nainital and Chamoli received excess rainfall in varying intensity. The actual rainfall of the season was maximum over Nainital (1750.8 mm) and minimum over Garhwal Tehri (787.9 mm) districts. However, in terms of % of the normal rainfall/ LPA, Chamoli district received the maximum 145% and Garhwal Pauri minimum 74%. Thus, monsoon 2017 has been a normal (-2%) monsoon year for Uttarakhand.

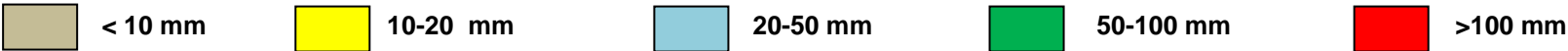
11. Monthly district-wise rainfall (in mm) over Uttarakhand during Monsoon Season-2017

S.N.	State/ Districts	June (in mm)	Departure (%) June	July (in mm)	Departure (%) July	Aug (in mm)	Departure (%) Aug	Sept (in mm)	Departure (%) Sept
1	Almora	133.6	1	451.6	51	196.7	-29	215.6	44
2	Bageshwar	135.5	2	547.8	83	298.2	8	147.7	-1
3	Chamoli	206.6	90	446.4	54	388.4	18	200.9	52
4	Champawat	143	-33	551.5	18	411.9	1	164.5	-30
5	Dehradun	390.5	111	603.5	-12	460.1	-32	264.5	2
6	Garhwal Pauri	102.6	-17	278.3	-38	348.6	-21	168.8	-13
7	Garhwal Tehri	135.8	0	294.8	-21	164.4	-55	192.9	12
8	Hardwar	170.3	61	112	-66	290.9	-21	354	126
9	Nainital	176.3	-14	654.7	27	506.8	11	413.1	58
10	Pithoragarh	180.9	-40	642.6	16	532	-1	132.8	-55
11	Rudraprayag	263.7	21	530.4	-8	413.6	-35	284.4	20
12	Udham Singh Nagar	68.3	-54	360.3	-11	302.1	-17	216	6
13	Uttarkashi	178.2	21	426.7	12	179.9	-56	166.8	-23



12. Weekly district-wise rainfall (in mm) over Uttarakhand during Monsoon Season-2017

Week Ending	7 Jun-	14 Jun-	21 Jun-	28 Jun-	05 Jul-	12 Jul-	19 Jul-	26 Jul-	02 Aug-	09 Aug-	16 Aug-	23 Aug-	30 Aug-	6 Sep-	13 Sep-	20 Sep-	27 Sep-	30 Sep-
ALMORA	31.1	10.4	26.1	43	44	201.7	97.5	78.8	58.4	100.1	4.3	21.2	53.2	83.8	1.5	13.3	129.6	0
BAGESHWAR	28.7	9.2	20	76.2	115.3	226.3	50.8	104.5	57.3	117.5	22.7	93.7	59	54.2	0	9.9	83.3	0.7
CHAMOLI	39.8	25.9	28	73.7	69.3	93.7	101.1	109.8	136.2	118.8	28.9	71.1	105.2	102.4	20.7	13.7	101.7	2.5
CHAMPAWAT	8.5	14.5	32	75.5	200.5	236	13	55.5	70.5	182.9	103	86.5	27.5	57	0	30.5	77.5	0
DEHRADUN	42.4	20.5	54	131.4	205	304.6	87.1	77.9	86.3	229.7	85.6	52.9	58.2	160.9	16.9	7.1	98.5	0
GARHWAL PAURI	24.1	4	20.1	23.8	39.3	106	53.7	44.2	80	193.3	49.1	8.9	72.2	74.6	2.7	0.3	102.3	0
GARHWAL TEHRI	31	3.1	15.2	44.1	52.7	122.8	37.4	59.8	74.5	67.9	10.2	6.2	66.7	80	2	0.7	113.6	0
HARIDWAR	20.8	2.5	1	63.5	98.3	64.1	9.1	15.6	39.7	96.5	83.2	42.5	31.1	153.1	9.5	1.7	194.9	0
NAINITAL	37	25.3	28.5	37.1	164	371.4	41.3	80.3	50.2	154.3	116.2	66.9	165.4	185.4	0.8	17	210.1	0
PITHORAGARH	40	33.6	25.6	57.5	123.9	218.6	119.4	96.2	122.6	130.4	162.9	142.6	72.4	67.5	6.8	19.9	48.3	0
RUDRAPRAYAG	68.6	5.2	29	110.8	140.3	128.4	85.7	110.1	163.2	168.1	63.8	51.7	74.5	110.2	8.8	24.1	149.6	0
U.S NAGAR	4.7	1	5.9	17.7	85.5	155.6	25.5	80	59.7	63.4	166.3	11.4	52.1	95.1	8.2	32.2	82.5	0
UTTARKASHI	44.2	29.1	23.8	49.4	86.4	66.1	118.9	109.1	102.6	51.1	11.2	56.7	25.5	90.2	28.7	4.5	54.2	0

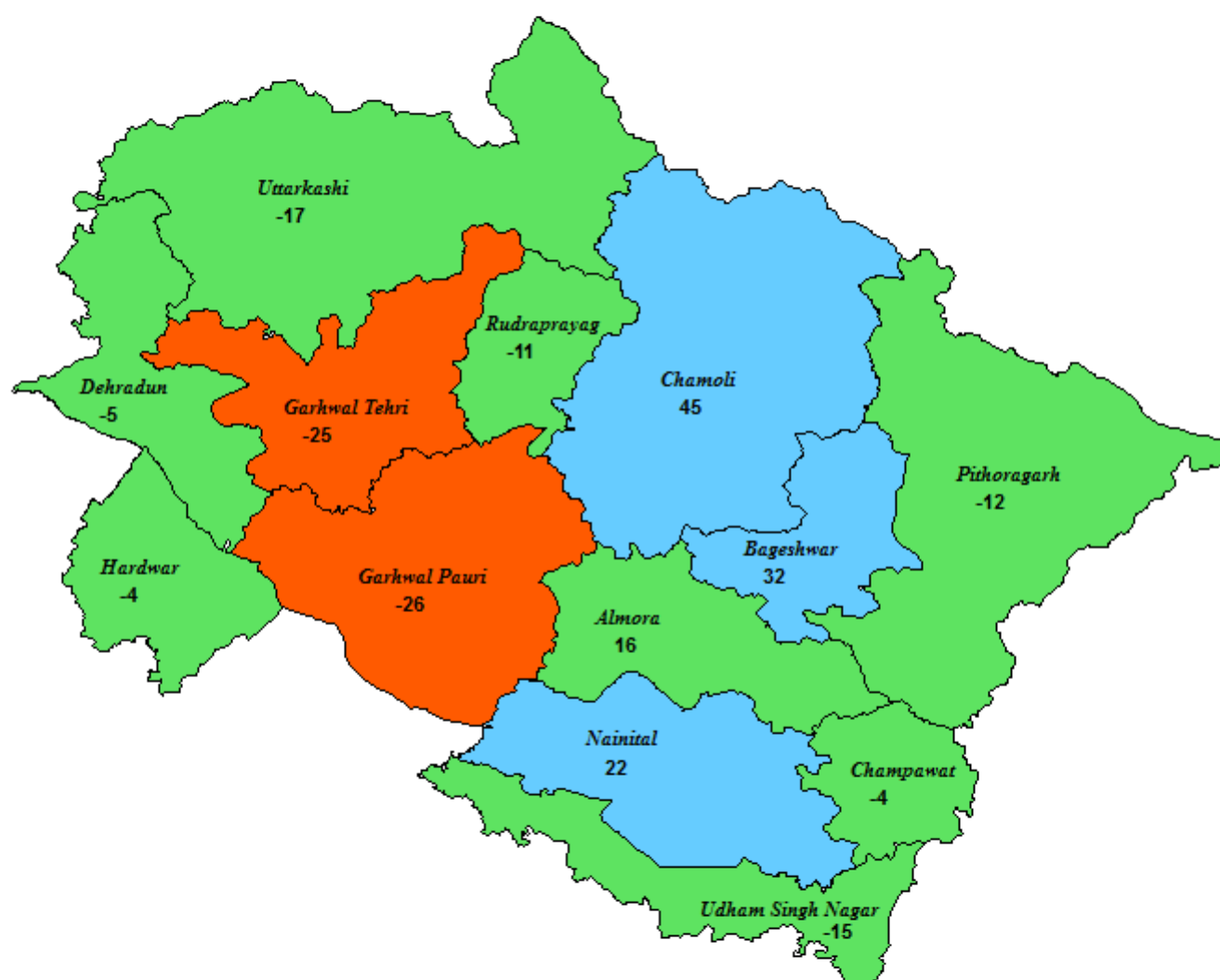


13. Rainfall Map of Monsoon-2017 of different Districts of Uttarakhand Met Sub-division:

INDIA METEOROLOGICAL DEPARTMENT
MC DEHRADUN

Rainfall % Departures from the Long Period Averages
for Districts in UTTARAKHAND

PERIOD : 01.06.2017 - 30.09.2017



LEGEND: ■ L. EXCESS (+60% OR MORE) ■ EXCESS (+20% TO +59%) ■ NORMAL (+19% TO -19%)
■ DEFICIENT (-20% TO -59%) ■ L. DEFICIENT (-60% TO -99%) ■ NO RAIN (-100%) ■ NO DATA