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Climate Research and Services (CRS)

Climate Summary for the month of September 2022

1. Monthly Rainfall Scenario (01 to 30 September, 2022)

Rainfall over the country as a whole for the month of September 2022 shows that it has recorded 181.3 mm, which is 8% more than its Long Period Average (LPA) 167.9 mm. The monthly rainfall for All India and four homogeneous regions for September 2022 is given in the table below:

Regions	Actual Rainfall (mm)	Normal Rainfall (mm)	% Departure from LPA
Country as a whole	181.3	167.9	8.0
Northwest India	116.3	102.7	13.0
Central India	219.3	177.6	23.0
South Peninsula	166.7	160.0	4.0
East & northeast India	244.2	282.8	-14.0

During September there are 3 sub-divisions received large excess, 12 excess, 17 normal and 4 received deficient rainfall category.

The observed spatial rainfall (normal rainfall for the period 1971 to 2020) and its departures from normal for the month of September 2022 is given in Figure 1.

RAINFALL OVER THE COUNTRY FOR SEPTEMBER 2022

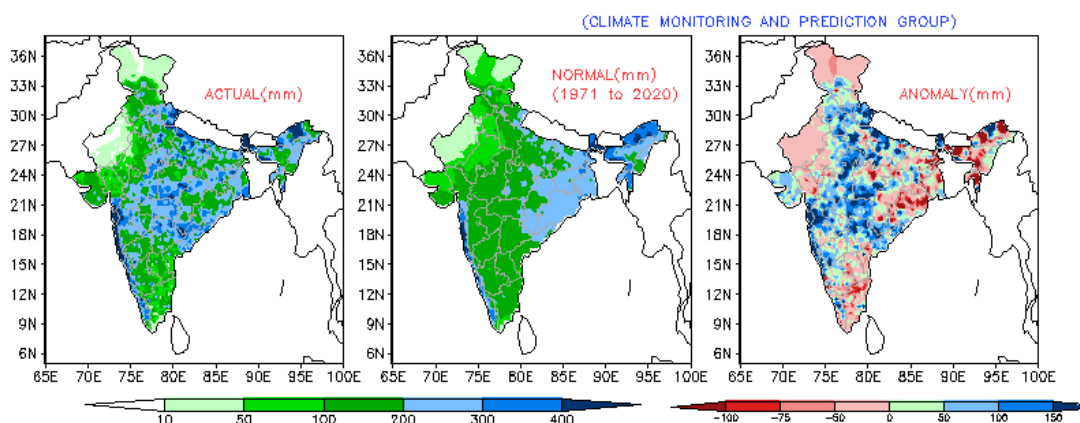


Fig 1: Observed spatial Rainfall pattern for the month of September 2022 over India and their departure from normal (1971 to 2020 period).

2. Withdrawal of southwest monsoon over the country

Southwest Monsoon has withdrawn from parts of southwest Rajasthan & adjoining Kutch on 20th September 2022 against its normal date of withdrawal from southwest Rajasthan of 17th September. The map showing date of withdrawal and its normal date is shown in Fig.2.

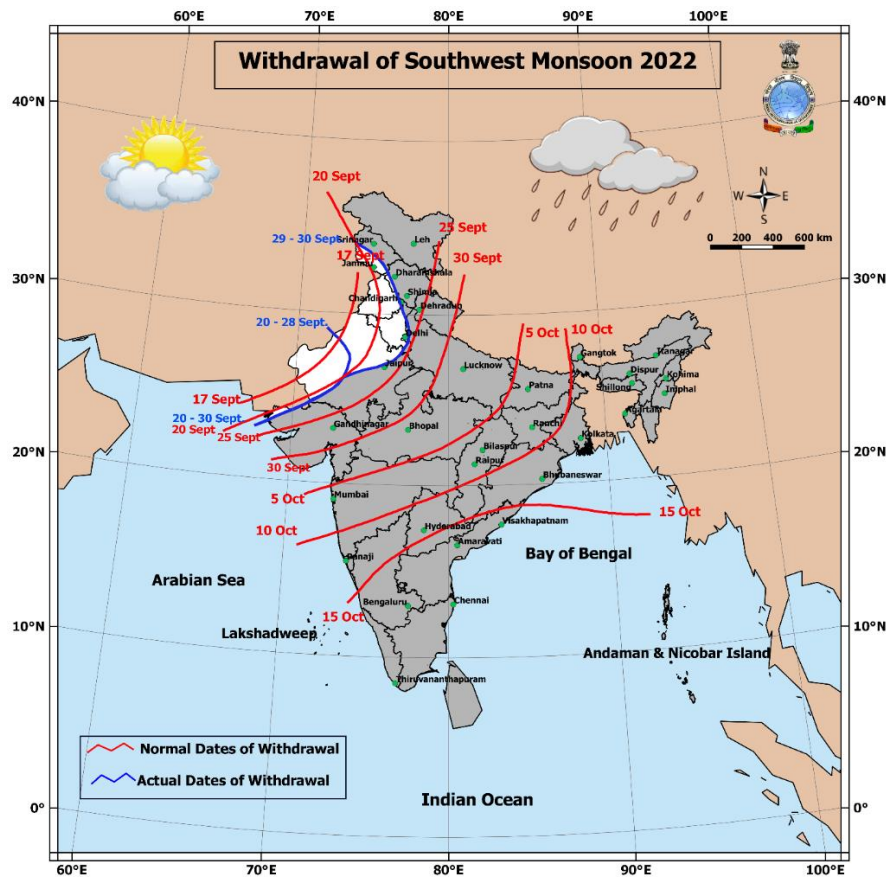
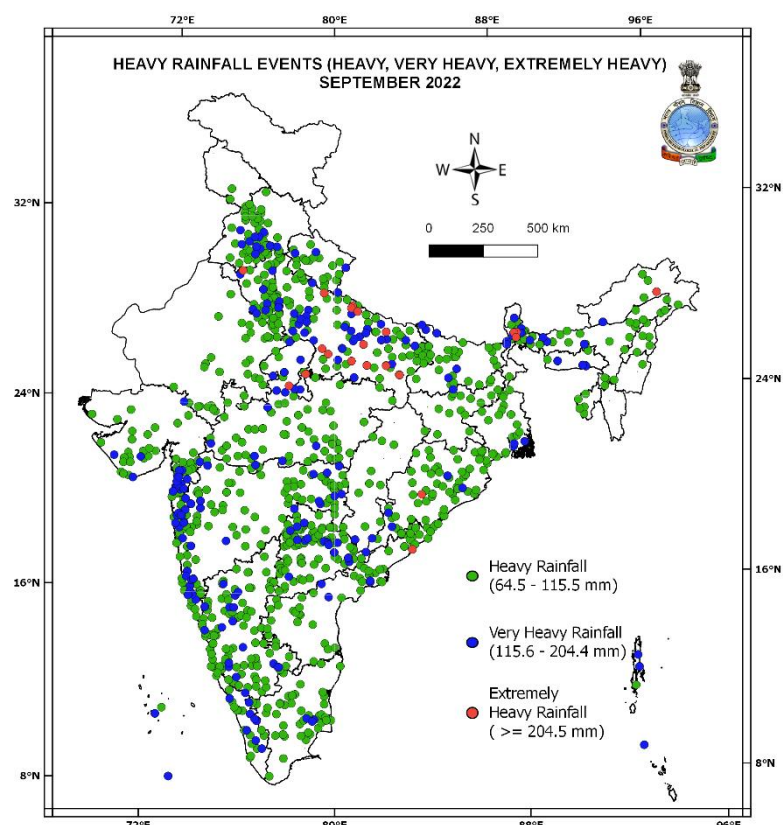


Fig.2 Withdrawal of Southwest Monsoon 2022.

3. Heavy Rainfall events observed in September 2022

The September 2022 witnessed extremely heavy rainfall events mainly over foot hills of Himalayas. The location of occurrences of heavy, very heavy and extremely heavy rainfall events is shown in the Figure 3. Out of total 1071 events reported, 21 stations reported extremely heavy rainfall (>204.5 mm), 200 station reported very heavy rainfall (115.6 to 204.4 mm) and 850 stations reported heavy rainfall (64.5 to 115.5 mm of rainfall) during this month.



(Only highest category of rainfall event considered for a station)

Fig 3: The location of occurrences of heavy rainfall events in the month September 2022.

Some stations received record rainfall (24 hour). The table below shows stations received 24-hour record rainfall and its previous record.

STATION	24 hour record Rainfall In September 2022(mm)#	DATE	PREVIOUS RAINFALL RECORD(mm)	DATE
TUENSANG	68.2	24	60	22-09-1972
PAURI	75	16	50	18-09-2010
DHARCHULA	132.2	10	120.2	16-09-1964
ROHTAK	165.4	25	158.9	11-09-2009
PATHANKOT	76.7	25	57	03-09-2017
DELHI RIDGE	88.8	21	82	17-09-2011
JAIPUR TEHSIL	67	24	54.4	25-09-1981
ARVI	68.5	12	61.5	28-09-1988
NANDURBAR	148	14	140	29-09-1990
KARIPUR	115.2	2	113	30-09-2001
PALAKKAD	171.3	1	102.3	19-09-1989

based on real time available data

4. Chief synoptic features during September 2022

During the month, one depression formed over Bay of Bengal during 11-12 September and two low pressure area formed (one over Bay of Bengal during 19 - 22 September and another over land during 25-26 September). Track of depression is shown in figure 4.

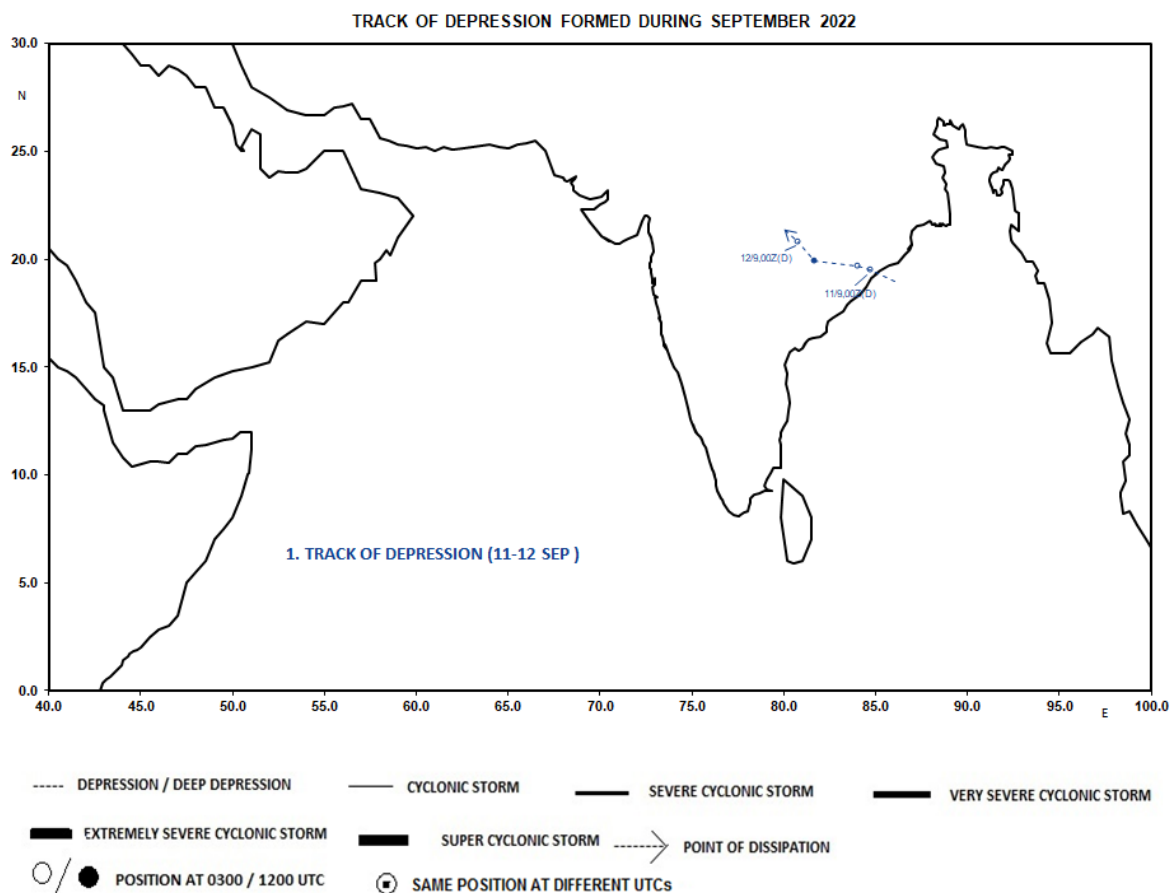


Figure 4: Tracks of Depression formed during September 2022.

The low-pressure systems formed during the monsoon season contribute heavy and very heavy rainfall over many parts of the country. The figure 5 shows number of low-pressure systems during September from 2000 to 2022.

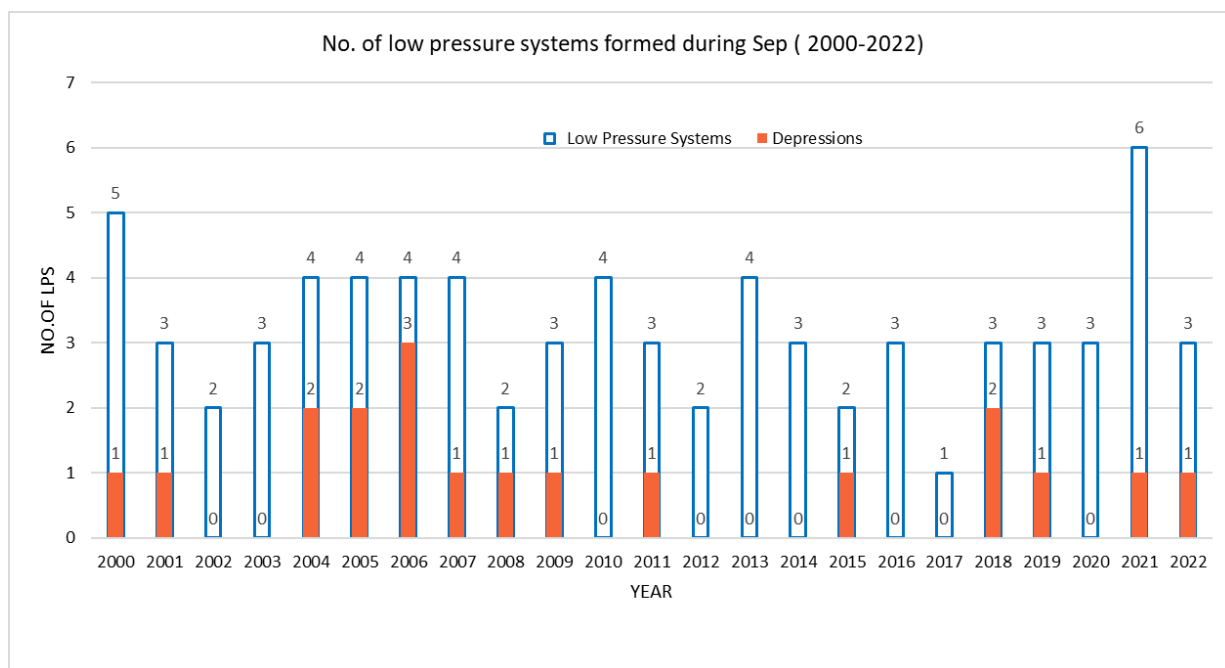


Figure 5. Number of low-pressure systems during September from 2000 to 2022.

The number of Low Pressure System days had been 14 in September 2022 against the normal of 15.43. The low-pressure system, which developed in September month for the year 2018 to 2022 given in the table below;

Year	Monsoon Depression	LPA and WML	Total	Low-Pressure System days
2018	2	1	3	6
2019	1	2	3	21
2020	-	3	3	17
2021	1	5	6	23
2022	1	2	3	14
Climatology (1901-2020)	1.75	1.56	3.72	15.43

5. Characteristics of Temperatures for the month of September 2022

The observed average maximum, average minimum and mean temperature for the country as a whole during September 2022 are 31.76 °C, 23.89 °C and 27.82 °C respectively, against the normal of 31.37 °C, 23.26 °C and 27.31 °C based on period 1981-2010. Thus, the average maximum temperature, average minimum temperature and mean temperature are above normal by 0.39 °C, 0.64 °C and 0.51 °C respectively for the country as a whole. The climatological data based on the period of 1981 to 2010 are used to calculate the normal and hence the anomaly (Actual average temperature in 2022 - normal temperature based on data of 1981-2010). Figure 6 shows time series of monthly average maximum, average minimum and mean temperature over all India for the month of September during 1901-2022. Over all India during September, the average minimum temperature is third highest with 23.89 °C after the years 2020(24.08 °C), 2021(24.06 °C) since 1901.

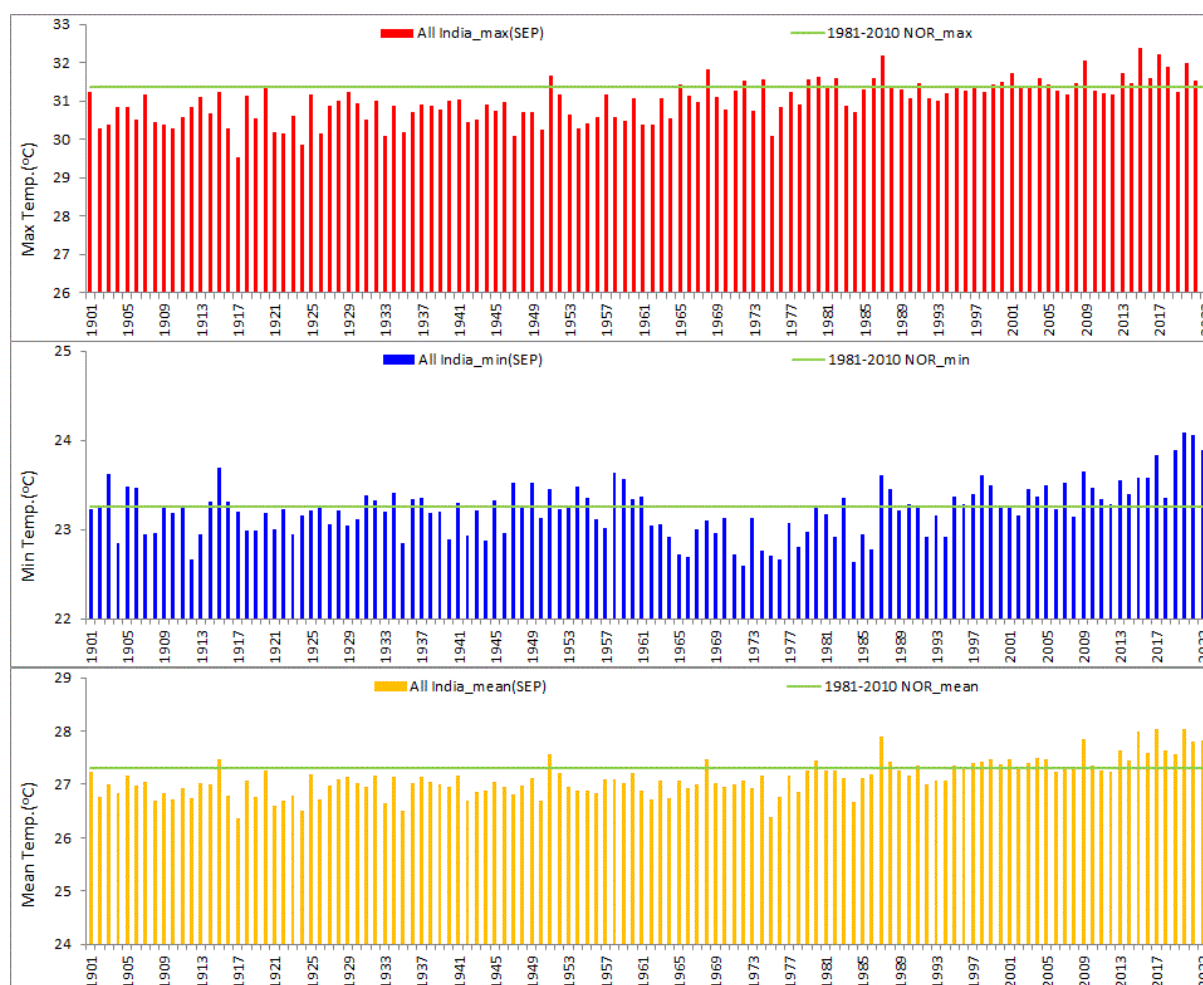


Fig 6: Time series of monthly average maximum, average minimum and mean temperature over All India for the month of September during 1901-2022.

Figure 7 shows time series of monthly average maximum, average minimum and mean temperature over East & Northeast India for the month of September during 1901-2022. Over East & Northeast India during September, the average maximum temperature is fourth highest with 32.52 °C after the years 2021(32.92 °C), 2015(32.67 °C), 2017(32.61 °C) since 1901. The average minimum temperature is ever highest with 24.897 °C since 1901 and it broken the earlier ever highest record of 24.641 °C which was in 2020 for the month of the September for the same period and mean temperature is second highest with 28.71 °C after the year 2021(28.78 °C) since 1901.

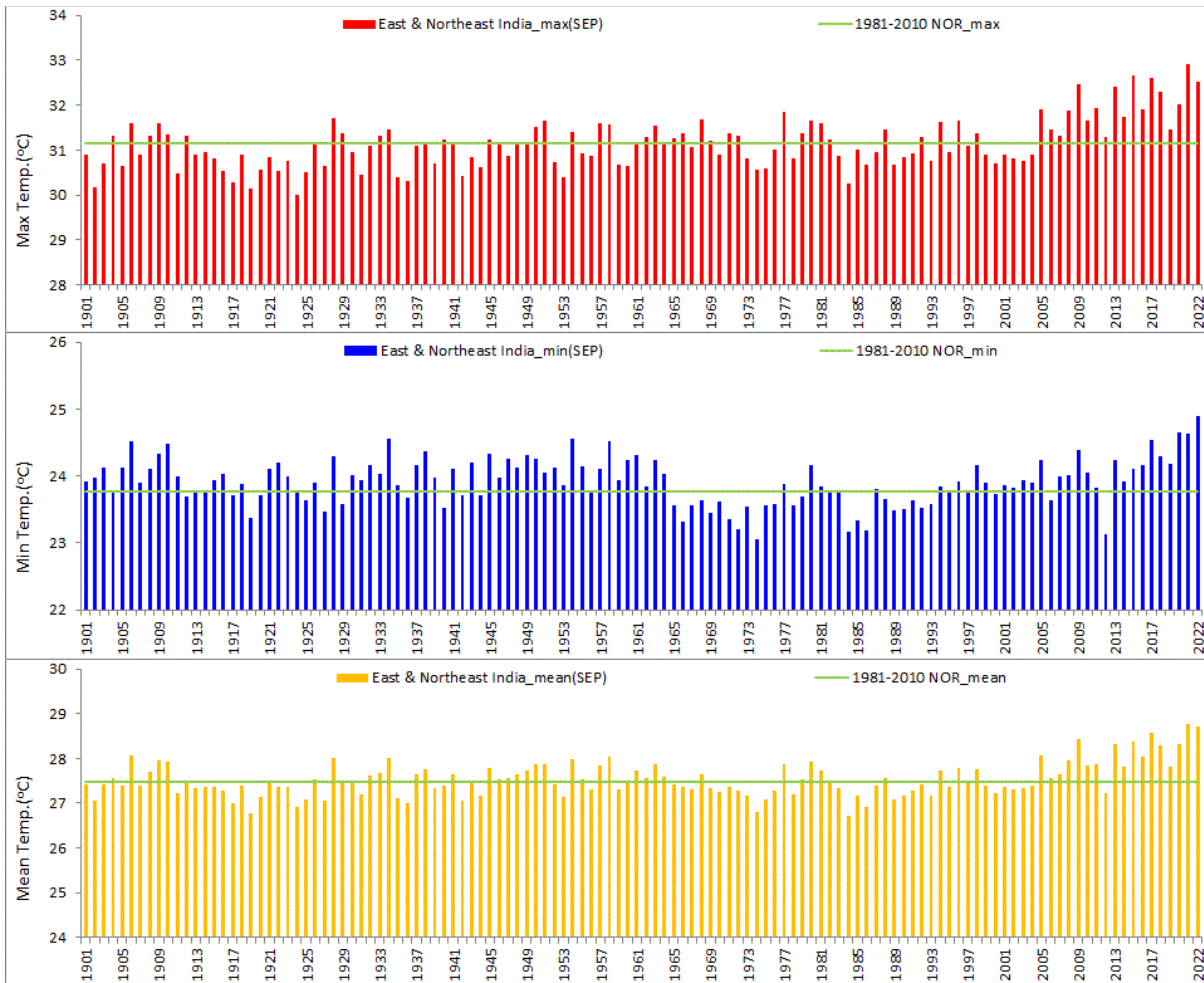


Fig 7: Time series of monthly average maximum, average minimum and mean temperature over East & Northeast India for the month of September during 1901-2022.

Figure 8 shows time series of monthly average minimum temperature over Central India for the month of September during 1901-2022. Over Central India during September, the average minimum temperature is fifth highest with 24.157 °C after the years 2020(24.701 °C), 2017(24.238 °C), 2021(24.214 °C), 2019(24.207 °C) since 1901.

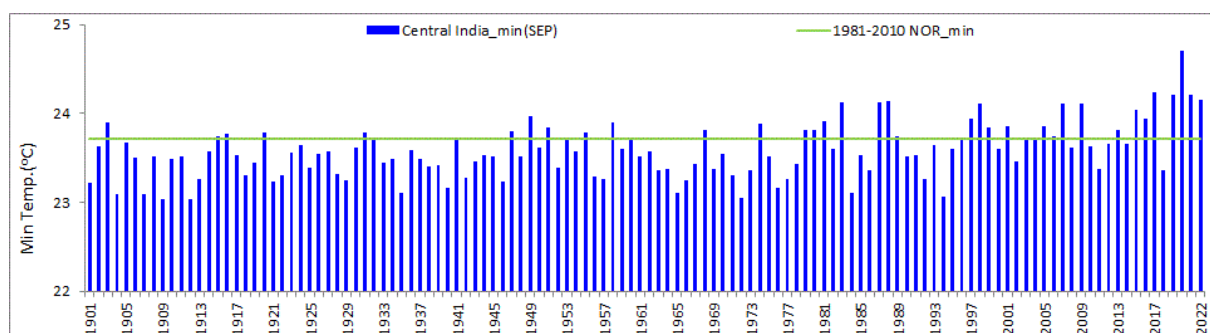


Fig 8: Time series of monthly average minimum temperature over Central India for the month of September during 1901-2022.

The Temperatures during September 2022 for all India and homogeneous regions with its ranks since 1901 are given in the table below;

SEP 2022		Max Temp ($^{\circ}\text{C}$)	Min Temp ($^{\circ}\text{C}$)	Mean Temp ($^{\circ}\text{C}$)
ALL INDIA	ACTUAL	31.76	23.89	27.82
	NORMAL	31.37	23.26	27.31
	ANOMALY	0.39	0.64	0.51
	TOP RANK	8	3	6
	BOT RANK	115	120	117
NORTHWEST INDIA	ACTUAL	31.93	22.04	26.99
	NORMAL	31.76	20.99	26.37
	ANOMALY	0.17	1.05	0.61
	TOP RANK	33	7	11
	BOT RANK	90	116	112
EAST & NORTHEAST INDIA	ACTUAL	32.52	24.90	28.71
	NORMAL	31.16	23.77	27.47
	ANOMALY	1.36	1.12	1.24
	TOP RANK	4	1	2
	BOT RANK	119	122	121
CENTRAL INDIA	ACTUAL	31.56	24.16	27.86
	NORMAL	31.41	23.71	27.56
	ANOMALY	0.15	0.45	0.30
	TOP RANK	25	5	12
	BOT RANK	98	118	111
SOUTH PENNINSULAR INDIA	ACTUAL	31.42	24.44	27.93
	NORMAL	31.19	24.19	27.69
	ANOMALY	0.23	0.25	0.24
	TOP RANK	17	23	13
	BOT RANK	106	100	110

Note: Values are rounded off to nearest two decimal

The five highest temperature records with corresponding ranks since 1901 along with year occurrence for Minimum Temperature averaged over the country, Temperature (Maximum, Minimum and Mean) averaged over East & Northeast India and averaged minimum temperature over Central India are given in the table below;

All India (September 2022)				
Year	TMin	Normal	Anomaly	Rank
2020	24.08	23.26	0.83	1
2021	24.06		0.80	2
2022	23.89		0.64	3
2019	23.89		0.63	4
2017	23.83		0.58	5

East & Northeast India (September 2022)				
Year	TMax	Normal	Anomaly	Rank
2021	32.92	31.16	1.76	1
2015	32.67		1.51	2
2017	32.61		1.44	3
2022	32.52		1.36	4
2009	32.47		1.31	5

East & Northeast India (September 2022)				
Year	TMin	Normal	Anomaly	Rank
2022	24.897	23.77	1.12	1
2020	24.641		0.87	2
2021	24.639		0.87	3
1954	24.561		0.79	4
1934	24.553		0.78	5

East & Northeast India (September 2022)				
Year	TMean	Normal	Anomaly	Rank
2021	28.78	27.47	1.31	1
2022	28.71		1.24	2
2017	28.57		1.10	3
2009	28.43		0.96	4
2015	28.39		0.92	5

Central India (September 2022)				
Year	TMin	Normal	Anomaly	Rank
2020	24.701	23.71	0.99	1
2017	24.238		0.53	2
2021	24.214		0.51	3
2019	24.207		0.50	4
2022	24.157		0.45	5

The observed spatial temperature pattern of monthly average maximum, average minimum and mean temperature over India and their departures from normal (1981 to 2010 period) for the month of September 2022 is given in Figure 9.

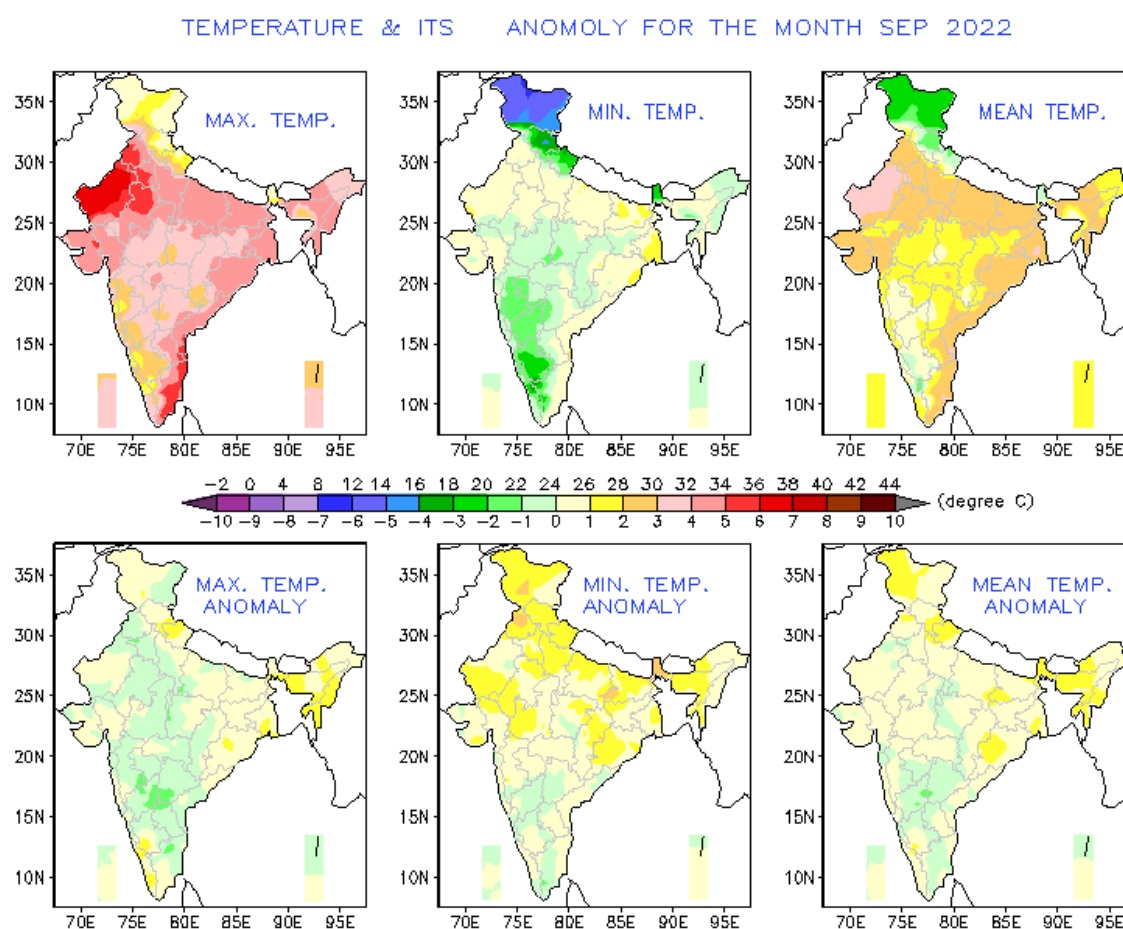


Fig 9: Observed spatial temperature pattern of monthly average maximum, average minimum, and mean temperature over India (top three from left to right) and their departure from normal (1981 to 2010 period) for September 2022 (lower three from left to right).

6. Significant Weather Events for the month of September 2022:~

During September, total 120 persons reportedly claimed dead, more than 35 persons injured & more than 800 livestock perished. The details of casualties given below, which are based on real time media reports and other state government agencies.

Fig. 10 shows significant weather events during the month. (Based on real time media reports.)

Floods, Heavy Rains & Landslide: Total 61 persons reportedly claimed dead, 21 persons injured & 804 livestock perished, during September, due to Floods, Heavy Rains & Landslide. The details of the area effected by the events are summarized and given in the table below;

DATE	DEATH	INJURED	LIVESTOCK	DISTRICT (STATE/UT) AFFECTED
16, 17, 21, 23, 24, 26 Sep.	36	20		Agra, Aligarh, Amethi, Balrampur, Deoria, Fatehpur, Firozabad, Etawah, Gorakhpur, Lucknow, Mathura, Muzaffarnagar, Unnao (Uttar Pradesh)
25 & 26 Sep.	10	1		Chamba, Sirmaur (Himachal Pradesh)
11, 12, 13, 14, 16 Sep.	8			Amaravati, Akola, Bhandara, Pune, Yavatmal (Maharashtra)
4, 5, 6, 9, 11, 12 Sep.	6		804	Bangalore Urban, Chamarajanagar, Uttara Kannada (Karnataka)
22 Sep.	1			Uttarkashi (Uttarakhand)

Lightning: Total 59 persons reportedly claimed dead, 17 persons injured & one livestock perished, during September, because of Lightning. The details of the area effected by the events are summarized and given in the table below;

DATE	DEATH	INJURED	LIVESTOCK	DISTRICT (STATE/UT) AFFECTED
19 Sep.	18			Araria, Banka, Begusarai, Jamui, Nawada, Purnia, Saran, Sheikhpura, Supaul (Bihar)
11 & 12 Sep.	9	4		Jhalawar, Udaipur (Rajasthan)
22, 23, 24 Sep.	8	3		Aligarh, Allahabad / Prayagraj, Balrampur, Chandauli, Hardoi, Sitapur (Uttar Pradesh)
8, 11, 28 Sep.	7	3	1	Amaravati, Chandrapur, Pune, Yavatmal (Maharashtra)
10 & 28 Sep.	6	1		Yadgir (Karnataka)
18, 26 Sep.	3			Pudukkottai, Thiruvallur (Tamil Nadu)
19 Sep.	2	3		Surajpur (Chhattisgarh)
3 Sep.	2	1		Biswanath, Dhubri, (Assam)
10 Sep.	2			Dumka, East Singhbhum (Jharkhand)
18 Sep.	1	2		Udham Singh Nagar (Uttarakhand)

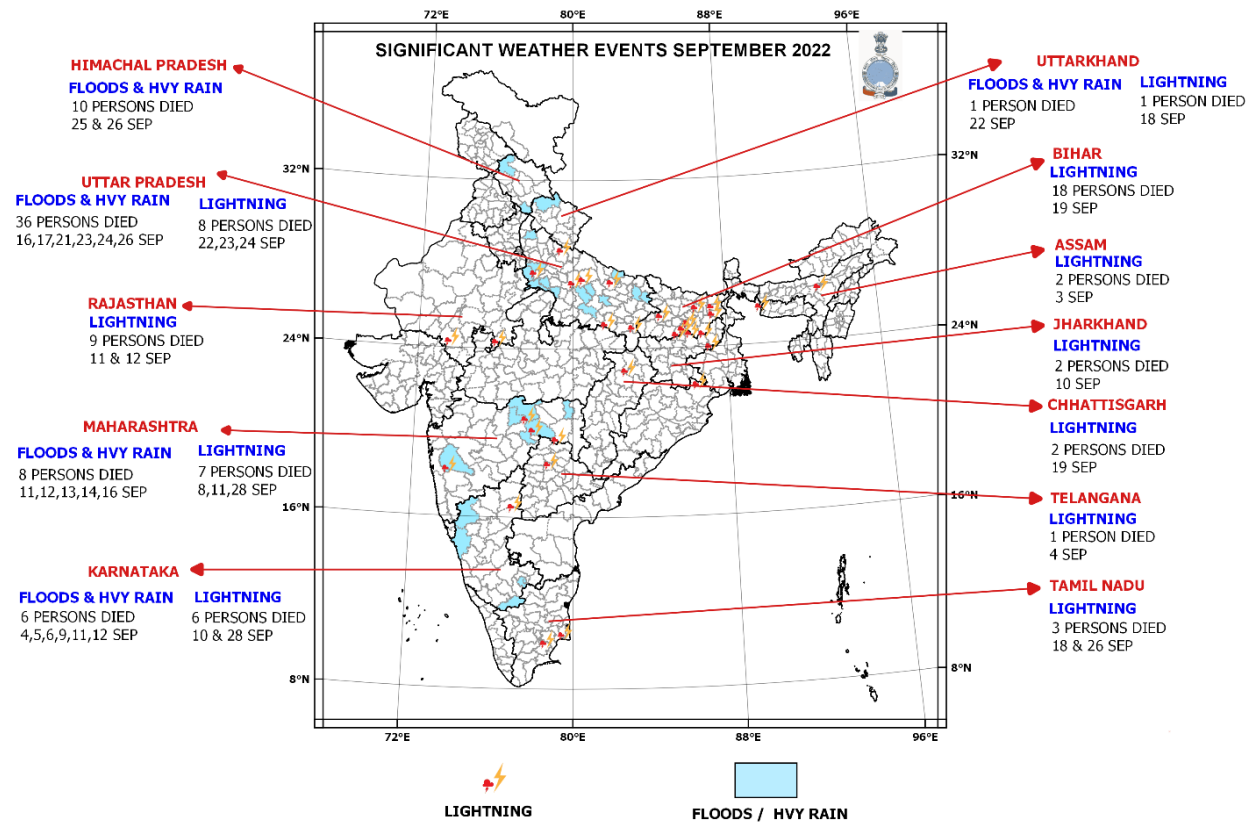


Fig 10: Significant weather events during September 2022 (Based on real-time media report)