



**CLIMATE-RESILIENT DAMS AND
HYDROPOWER INFRASTRUCTURE
INTEGRATING
ENVIRONMENTAL SUSTAINABILITY
IN PLANNING AND DEVELOPMENT**

**Performance of Rainfall Forecasts from 17th to 29th Aug
2025 over the River sub-basins under Bhakra Beas
Management Board (BBMB) in Himachal Pradesh and
Punjab, India: A Case study**

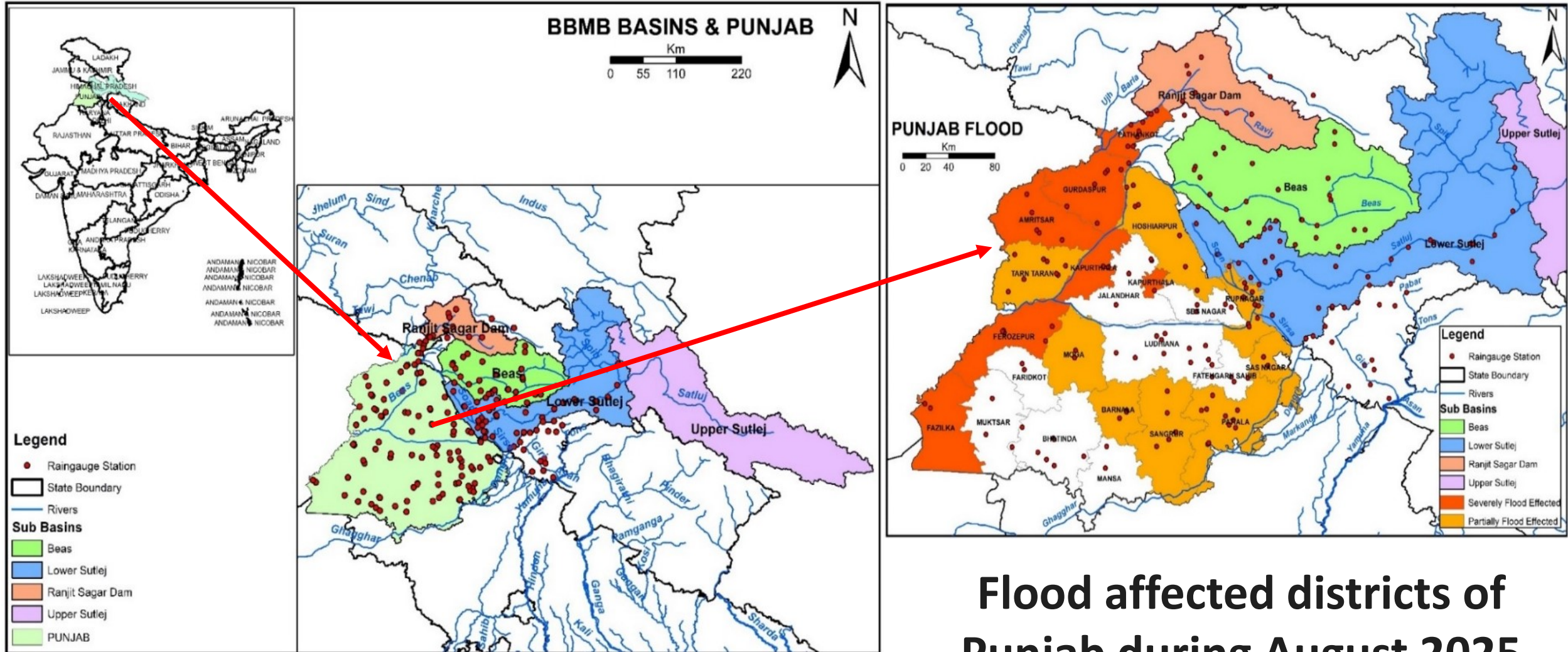
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INTRODUCTION

- Every year, various regions of India experience floods due to heavy, very heavy, or extremely heavy rainfall events. These extreme weather conditions can lead to severe hydro-meteorological disasters, such as flash floods and riverine floods, which significantly impact human life, infrastructure, and ecosystems.
- In August 2025, Punjab faced severe flood situation, primarily driven by heavy rainfall in Himachal Pradesh.
- India Meteorological Department (IMD) issues Flash Flood Bulletins, which include Persistent Flash Flood Threat (PFFT) and Flash Flood Risk (FFR), with 6hrs and 24hrs lead times respectively. These warnings are issued three times a day at 00, 06, and 12 UTC for small watersheds within districts.
- Additionally, riverine flood forecaste issued by Central Water Commission (CWC), relies on Quantitative Precipitation Forecasts (QPF) provided by IMD for 162 river sub-basins.
- IMD also delivers rainfall forecasts at the district, meteorological subdivision and state levels and issues warnings for heavy, very heavy, and extremely heavy rainfall events across these spatial domains.



STUDY AREA



STUDY AREA WITH RAIN GAUGE STATIONS

Flood affected districts of Punjab during August 2025



Synoptic situation and Forecast for 17 to 25 Aug. 2025



16th Aug. 2025: The monsoon trough at mean sea level passed through Jaisalmer, Jodhpur, Kota, Guna, Betul, centre of low-pressure area over south Chhattisgarh, Vishakhapatnam and thence east-southeastwards to east-central Bay of Bengal. The upper air cyclonic circulation over Jammu-Kashmir and neighbourhood at 3.1 km above mean sea level persisted. **Forecast Issued:** Under the influence of these systems, **Isolated heavy** rainfall likely over East Rajasthan & Uttarakhand during next 7 days; Himachal Pradesh during 16th -20th Aug., Punjab during 16th -19th August 2025.

24th Aug., 2025: The monsoon trough at mean sea level now passes through Bikaner, Jaipur, Gwalior, Prayagraj, centre of low-pressure area over northeast Madhya Pradesh; neighbourhood, Purulia, Digha and thence southeastwards to northeast Bay of Bengal. The Western Disturbance as a trough between 3.1 & 9.6 km above mean sea level with its axis at 3.1 km above mean sea level roughly along Long. 70°E to north of Lat. 28°N persists. The upper air cyclonic circulation over Punjab neighbourhood extending upto 1.5 km above mean sea level persists. **Forecast Issued: Isolated heavy** rainfall likely over Himachal Pradesh during next 7 days; Punjab during 24th -26th Aug. & on 29th and 30th Aug.; with **isolated very heavy** rainfall over Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana and Chandigarh on 24th August 2025.



SYNOPTIC SITUATION AND FORECAST FOR 26 AUG 2025



25th Aug., 2025: The monsoon trough at mean sea level now passes through Bikaner, Jaipur, Agra, Prayagraj, Daltonganj, Jamshedpur, Digha and thence southeastwards to northeast Bay of Bengal. The Western Disturbance as a trough between 3.1 km; 9.6 km above mean sea level with its axis at 3.1 km above mean sea level roughly along Long. 70°E to north of Lat. 28°N persists. The upper air cyclonic circulation over south Haryana and adjoining northeast Rajasthan and extending upto 5.8 km above mean sea level persists and tilting southwards with height.

Forecast Issued: **Isolated heavy** rainfall likely over Himachal Pradesh during next 7 days; Punjab during 25th to 27th Aug., & on 29th, 30th Aug.; with isolated **very heavy rainfall** over Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana and Chandigarh on 25th & 26th August.

STATION WISE (H, VH & EH) RAINFALL STATISTICS

Heavy to Extremely Heavy Rainfall on 17 Aug., 2025

Station level Rainfall categories:

Heavy (H) rainfall : 64.5 to 115.5mm

Very Heavy (VH) : 115.6 to 204.4mm

Extremely Heavy (EH) : ≥ 204.5 mm

Date	Sub-basin Name	Station wise H, VH, EH (Out of Total 203 Stations)
15-08-2025	Punjab & HP	12H
16-08-2025	Punjab & HP	2H, 1VH
17-08-2025	Punjab & HP	10H, 1VH, 1EH
18-08-2025	Punjab & HP	3H
19-08-2025	Punjab & HP	1H, 2VH
20-08-2025	Punjab & HP	1H, 1VH
21-08-2025	Punjab & HP	1H, 1VH
22-08-2025	Punjab & HP	-
23-08-2025	Punjab & HP	2H
24-08-2025	Punjab & HP	5H, 6VH
25-08-2025	Punjab & HP	37H, 12VH, 1EH
26-08-2025	Punjab & HP	37H, 14VH, 1EH
27-08-2025	Punjab & HP	8H
28-08-2025	Punjab & HP	2H
29-08-2025	Punjab & HP	8H, 1VH

Sr. No.	State Name	District Name	Station Name	Latitude	Longitude	SUB_BASIN	Aug_17
1	PUNJAB	PATHANKOT	PHANGOTA	32.4653	75.8011	Ranjit Sagar Dam	221.2
2	PUNJAB	PATHANKOT	RANJIT SAGAR DAM SITE	32.44436	75.73214	Ranjit Sagar Dam	185.5
3	PUNJAB	PATHANKOT	MADHOPUR	32.36667	75.6	NA	85
4	PUNJAB	PATHANKOT	THEIN DAM AWS	32.44102	75.75747	Ranjit Sagar Dam	76.5
5	PUNJAB	PATHANKOT	MALIKPUR	32.21667	75.61667	NA	65
6	HIMACHAL PRADESH	KANGRA	KANGRA AERO	32.16535	76.25911	Beas	110.8
7	HIMACHAL PRADESH	KANGRA	NAGROTA SURIAN	32.05509	76.09285	Beas	107
8	HIMACHAL PRADESH	SIRMAUR	NAHAN	30.55	77.3	NA	103.2
9	HIMACHAL PRADESH	MANDI	JOGINDARNAGAR	31.91666	76.75	Beas	84
10	HIMACHAL PRADESH	SOLAN	NALAGARH	31.0445	76.7047	Lower Sutlej	80
11	HIMACHAL PRADESH	SIRMAUR	PAONTA	30.4666	77.61666	Yamuna upto Hathnikund	69.8
12	HIMACHAL PRADESH	CHAMBA	KHERI	32.77732	76.03629	Ranjit Sagar Dam	67.6



Heavy to Extremely Heavy Rainfall on 25th & 26th Aug., 2025



Sr. No.	State Name	District Name	Station Name	Latitude	Longitude	SUB_BASIN	25 Aug 2025
1	HIMACHAL PRADESH	BILASPUR	KAHU	31.34294	76.7625	Lower Sutlej	190.5
2	HIMACHAL PRADESH	BILASPUR	GHUMARWIN	31.44914	76.70479	Lower Sutlej	160
3	HIMACHAL PRADESH	BILASPUR	BARTHIN	31.41972	76.64861	Lower Sutlej	156.4
4	HIMACHAL PRADESH	BILASPUR	NAINA DAVI	31.30642	76.53582	Lower Sutlej	148.4
5	HIMACHAL PRADESH	CHAMBA	KHERI	32.77732	76.03629	Ranjit Sagar Dam	142
6	HIMACHAL PRADESH	BILASPUR	BILASPUR SADAR	31.32764	76.76395	Lower Sutlej	140.8
7	HIMACHAL PRADESH	CHAMBA	CHUARI	32.4337	76.0168	NA	140.2
8	HIMACHAL PRADESH	HAMIRPUR	MEHRE (BARSAR)	31.5282	76.4661	Beas	127
9	HIMACHAL PRADESH	UNA	AMB	31.68	76.11	Lower Sutlej	111
10	HIMACHAL PRADESH	HAMIRPUR	AGHAR	31.59066	76.59964	Lower Sutlej	110.6
11	HIMACHAL PRADESH	UNA	BANGANA_R	31.4684	76.2717	Lower Sutlej	104
12	HIMACHAL PRADESH	KANGRA	GHAMROOR	32.07611	76.10305	Beas	95.8
13	HIMACHAL PRADESH	UNA	BHARWAIN	31.7993	76.1247	Beas	94.4
14	HIMACHAL PRADESH	HAMIRPUR	NADAUN	31.7785	76.34446	Beas	94
15	HIMACHAL PRADESH	HAMIRPUR	HAMIRPUR	31.686	76.5211	Beas	92
16	HIMACHAL PRADESH	KANGRA	DHARMSALA	32.2076	76.32312	Beas	87.4
17	HIMACHAL PRADESH	HAMIRPUR	BHARARI	31.65017	76.68783	Lower Sutlej	85.9
18	HIMACHAL PRADESH	SOLAN	KASALI	30.88333	76.96667	Lower Sutlej	85
19	HIMACHAL PRADESH	MANDI	SUNDARNAGAR	31.5333	76.8833	Beas	84.2
20	HIMACHAL PRADESH	MANDI	BALDWARA	31.5576	76.7639	Lower Sutlej	84
21	HIMACHAL PRADESH	CHAMBA	SALONI	32.7206	76.0519	Ranjit Sagar Dam	83.3
22	HIMACHAL PRADESH	UNA	UNA	31.4666	76.2833	Lower Sutlej	80.8
23	HIMACHAL PRADESH	HAMIRPUR	SUJANPUR TIRA	31.83333	76.5	Beas	80
24	HIMACHAL PRADESH	SOLAN	NALAGARH	31.0445	76.7047	Lower Sutlej	75
25	HIMACHAL PRADESH	SOLAN	DHARAMPUR	30.9001	77.0226	Lower Sutlej	68.6
26	HIMACHAL PRADESH	KANGRA	DEHRA GOPIPUR	31.88333	76.21667	Beas	68.3
27	HIMACHAL PRADESH	BILASPUR	R L BBMB	31.40555	76.44072	Lower Sutlej	66
28	HIMACHAL PRADESH	KANGRA	PALAMPUR	32.0981	76.54859	Beas	65.4
29	PUNJAB	SANGRUR	SANGRUR	30.233333	75.95	NA	216.4
30	PUNJAB	SANGRUR	SANGRUR AWS	30.182154	75.895662	NA	169
31	PUNJAB	PATHANKOT	PHANGOTA	32.4653	75.8011	Ranjit Sagar Dam	163.4
32	PUNJAB	PATHANKOT	RANJIT SAGAR DAM SITE	32.44436	75.73214	Ranjit Sagar Dam	147
33	PUNJAB	RUPNAGAR	GANGUWAL	31.26861	76.4875	Lower Sutlej	121.2
34	PUNJAB	LUDHIANA	BUL IRR	30.778611	75.856944	NA	104
35	PUNJAB	RUPNAGAR	KOTLA	31.2055	76.5477	Lower Sutlej	98.2
36	PUNJAB	PATHANKOT	MADHOPUR	32.366667	75.6	NA	98
37	PUNJAB	PATHANKOT	MALIKPUR	32.216667	75.616667	NA	95.2
38	PUNJAB	BARNALA	BARNALA	30.383333	75.566667	NA	90
39	PUNJAB	LUDHIANA	SAMRALA	30.833333	76.183333	NA	90
40	PUNJAB	PATHANKOT	SHAHPUR KANDI	32.3849	75.6921	NA	88.5
41	PUNJAB	SANGRUR	SUNAM	30.133333	75.8	NA	85.6
42	PUNJAB	SANGRUR	MALERKOTLA	30.516667	75.883333	NA	85.5
43	PUNJAB	LUDHIANA	JAGRAON	30.783333	75.483333	NA	81
44	PUNJAB	FEROZPUR	FEROZPUR KVK AWS	30.933	74.5964	NA	78
45	PUNJAB	JALANDHAR	NAKODAR	31.116667	75.483333	NA	76
46	PUNJAB	LUDHIANA	PAU LUDHIANA	30.9	75.8	NA	72.4
47	PUNJAB	JALANDHAR	JALANDHAR	31.333333	75.583333	NA	66.4
48	PUNJAB	GURDASPUR	GURDASPUR	32.033333	75.4	NA	66.2
49	PUNJAB	RUPNAGAR	LOHAND	31.11871	76.56745	Lower Sutlej	65
50	PUNJAB	HOSHIARPUR	DASUYA	31.8	75.633333	NA	65

Sr. No.	State Name	District Name	Station Name	Latitude	Longitude	SUB_BASIN	26 Aug 2025
1	HIMACHAL PRADESH	BILASPUR	NAINA DAVI	31.30642	76.53582	Lower Sutlej	160.8
2	HIMACHAL PRADESH	CHAMBA	KHERI	32.77732	76.03629	Ranjit Sagar Dam	128.6
3	HIMACHAL PRADESH	CHAMBA	CHUARI	32.4337	76.0168	NA	125.2
4	HIMACHAL PRADESH	KANGRA	DHARMSALA	32.2076	76.32312	Beas	102
5	HIMACHAL PRADESH	KULLU	MANALI	32.23241	77.19111	Beas	102
6	HIMACHAL PRADESH	KANGRA	GHAMROOR	32.07611	76.10305	Beas	91.4
7	HIMACHAL PRADESH	KANGRA	KANGRA AERO	32.16535	76.25911	Beas	89
8	HIMACHAL PRADESH	KANGRA	NAGROTA SURIAN	32.05509	76.09285	Beas	88.8
9	HIMACHAL PRADESH	KANGRA	PALAMPUR	32.0981	76.54859	Beas	88
10	HIMACHAL PRADESH	KULLU	KOTHI	32.31749	77.19223	Beas	85.8
11	HIMACHAL PRADESH	UNA	BHARWAIN	31.7993	76.1247	Beas	85
12	HIMACHAL PRADESH	CHAMBA	TISSA	32.8358	76.15	Ranjit Sagar Dam	80
13	HIMACHAL PRADESH	KULLU	BHUNTAR AERO	31.8769	77.15205	Beas	77.2
14	HIMACHAL PRADESH	SIRMAUR	SANGRAHA	30.6957	77.4257	Yamuna upto Hathnikund	72
15	HIMACHAL PRADESH	KANGRA	GULER	32.00175	76.13924	Beas	71.8
16	HIMACHAL PRADESH	LAHAUL & SPITI	KUKUMSHERI AWS	32.7003	76.6885	NA	71.5
17	HIMACHAL PRADESH	KULLU	SEO BAGH	31.9955	77.1398	Beas	70.8
18	HIMACHAL PRADESH	SHIMLA	KUMARSAIN	31.3115	77.4517	Lower Sutlej	70.6
19	HIMACHAL PRADESH	MANDI	KARSOG	31.38333	77.2	Lower Sutlej	65.2
20	PUNJAB	GURDASPUR	GURDASPUR	32.03333	75.4	NA	220
21	PUNJAB	TARN TARAN	TARAN TARAN	31.4333	74.9167	NA	190
22	PUNJAB	GURDASPUR	GURDASPUR AMFU	32.05	75.41667	NA	189.8
23	PUNJAB	GURDASPUR	GURDASPUR AMFU	32.05	75.41667	NA	189.8
24	PUNJAB	GURDASPUR	TIBRI	32.1	75.58333	NA	180
25	PUNJAB	AMRITSAR	AMRITSAR	31.61667	74.88333	NA	154.2
26	PUNJAB	BARNALA	HANDIAYA HMO	30.32889	75.51028	NA	136
27	PUNJAB	GURDASPUR	DHARIWAL IRR	31.95417	75.31583	NA	135
28	PUNJAB	PATHANKOT	MALIKPUR	32.21667	75.61667	NA	126.8
29	PUNJAB	PATHANKOT	MADHOPUR	32.36667	75.6	NA	126
30	PUNJAB	PATHANKOT	PHANGOTA	32.4653	75.8011	Ranjit Sagar Dam	120.6
31	PUNJAB	GURDASPUR	ALIWAL	31.8	75.1	NA	120
32	PUNJAB	AMRITSAR	AMRITSAR IRR	31.63528	74.86444	NA	106
33	PUNJAB	PATHANKOT	SHAHPUR KANDI	32.3849	75.6921	NA	102
34	PUNJAB	TARN TARAN	PATTI	31.33333	75.01667	NA	98
35	PUNJAB	LUDHIANA	PAYAL REV	30.7167	76.0667	NA	97
36	PUNJAB	AMRITSAR	JANDIALA IRR	31.56722	75.06111	NA	92
37	PUNJAB	TARN TARAN	VALTOHA IRR	31.2075	74.64139	NA	92
38	PUNJAB	PATHANKOT	R S DAM SITE	32.44436	75.73214	Ranjit Sagar Dam	90.5
39	PUNJAB	GURDASPUR	ATHWAL IRR	31.68333	75.33611	NA	90
40	PUNJAB	TARN TARAN	RASULPUR IRR	31.41833	74.945	NA	90
41	PUNJAB	AMRITSAR	RANEWALI IRR	31.75778	74.82611	NA	90
42	PUNJAB	TARN TARAN	MANIHALA IRR	31.2944	74.7639	NA	88
43	PUNJAB	FEROZPUR	FEROZPUR KVK AWS	30.933	74.5964	NA	84
44	PUNJAB	TARN TARAN	BHUCHAR IRR	31.4656	74.6925	NA	84
45	PUNJAB	FARIDKOT	FARIDKOT	30.66667	74.76667	NA	80.6
46	PUNJAB	HOSHIARPUR	DASUYA	31.8	75.63333	NA	80
47	PUNJAB	LUDHIANA	SAMRALA	30.83333	76.18333	NA	78
48	PUNJAB	TARN TARAN	KHAWASPUR IRR	31.38722	75.08889	NA	75
49	PUNJAB	MOGA	MOGA	30.8	75.16667	NA	72
50	PUNJAB	BARNALA	BARNALA	30.38333	75.56667	NA	70
51	PUNJAB	SBS NAGAR	NAWANSHAHR	31.11667	76.11667	NA	69
52	PUNJAB	JALANDHAR	JALANDHAR	31.22222	75.52222	NA	65.4

Observation Vs Forecast from 17th to 29th Aug., 2025 over BBMB

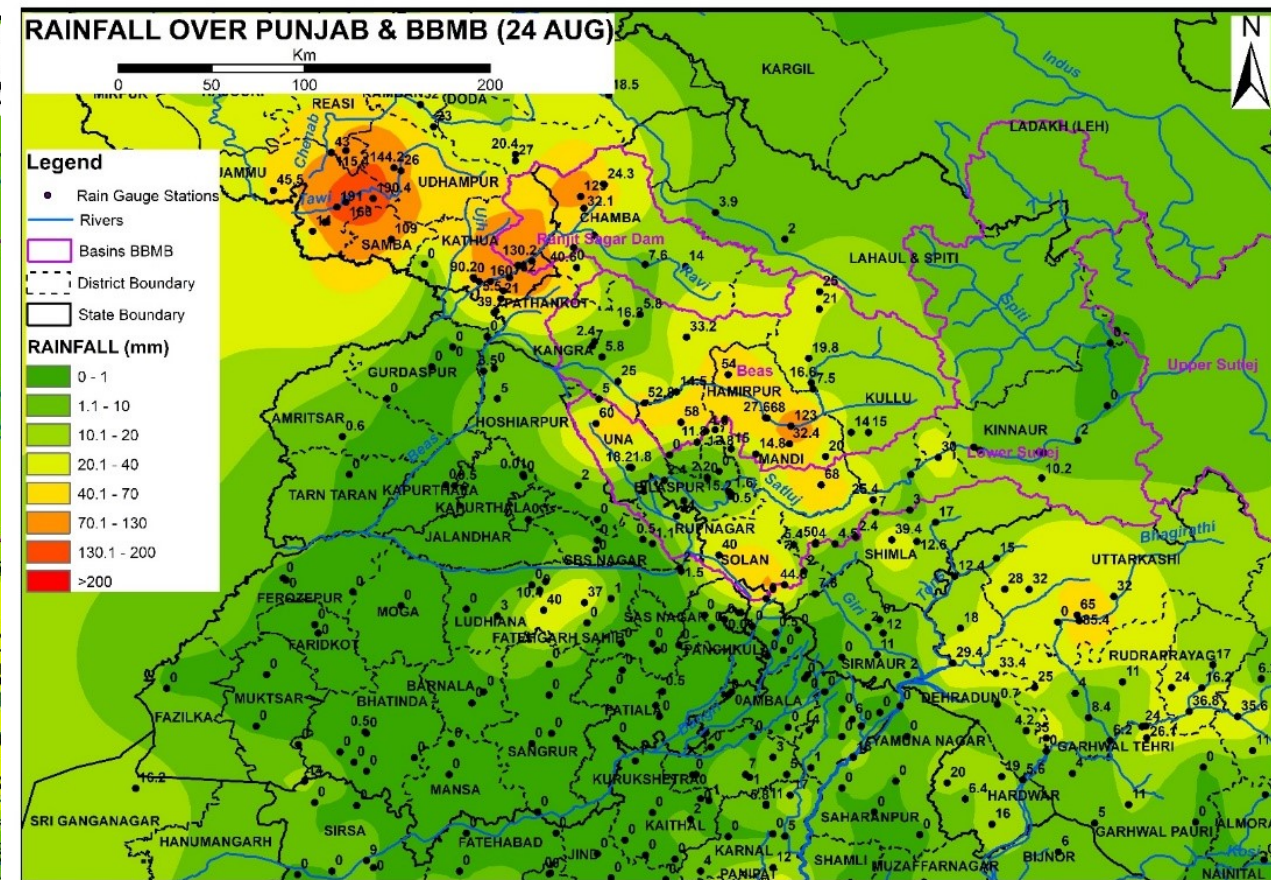
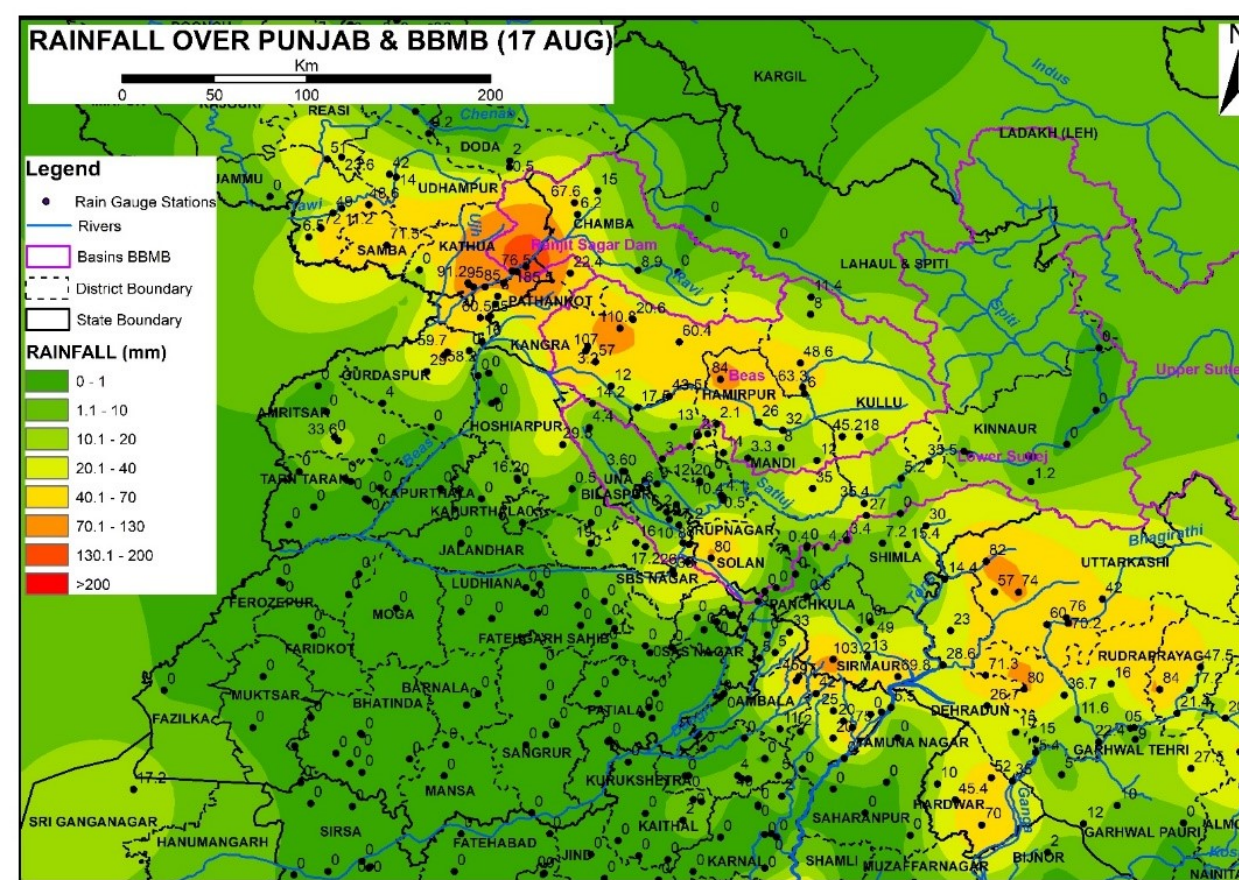
Date	Sub-basin Name	Warning(Day-1)	Observed Station wise H, VH, EH (Out of 41 Stations)
17-08-2025	Lower Sutlej	Nil	1H
18-08-2025	Lower Sutlej	Nil	1H
19-08-2025	Lower Sutlej	Nil	1H
20-08-2025	Lower Sutlej	Nil	1VH
21-08-2025	Lower Sutlej	H	1H, 1VH
22-08-2025	Lower Sutlej	Nil	-
23-08-2025	Lower Sutlej	Nil	1H
24-08-2025	Lower Sutlej	H	2H
25-08-2025	Lower Sutlej	H	13H, 5VH
26-08-2025	Lower Sutlej	VH	2H, 1VH
27-08-2025	Lower Sutlej	H	-
28-08-2025	Lower Sutlej	Nil	-
29-08-2025	Lower Sutlej	Nil	-

Date	Sub-basin Name	Warning (Day-1)	Observed Station wise H, VH, EH (Out of 27 Stations)
17-08-2025	Beas	Nil	3H
18-08-2025	Beas	H	-
19-08-2025	Beas	H	-
20-08-2025	Beas	Nil	1H
21-08-2025	Beas	H	-
22-08-2025	Beas	Nil	-
23-08-2025	Beas	Nil	-
24-08-2025	Beas	H	2H, 1VH
25-08-2025	Beas	VH	10H
26-08-2025	Beas	VH	11H
27-08-2025	Beas	VH	1H
28-08-2025	Beas	Nil	1H
29-08-2025	Beas	Nil	2H

Date	Sub-basin Name	Warning(Day-1)	Observed Station wise H, VH, EH (Out of 10 Stations)
17-08-2025	Ranjit Sagar Dam	H	2H, 1VH, 1EH
18-08-2025	Ranjit Sagar Dam	Nil	-
19-08-2025	Ranjit Sagar Dam	H	-
20-08-2025	Ranjit Sagar Dam	Nil	-
21-08-2025	Ranjit Sagar Dam	H	-
22-08-2025	Ranjit Sagar Dam	Nil	-
23-08-2025	Ranjit Sagar Dam	Nil	1H
24-08-2025	Ranjit Sagar Dam	H	1H, 3VH
25-08-2025	Ranjit Sagar Dam	VH	2H, 3VH
26-08-2025	Ranjit Sagar Dam	VH	3H, 2VH
27-08-2025	Ranjit Sagar Dam	VH	2H
28-08-2025	Ranjit Sagar Dam	Nil	-
29-08-2025	Ranjit Sagar Dam	Nil	-

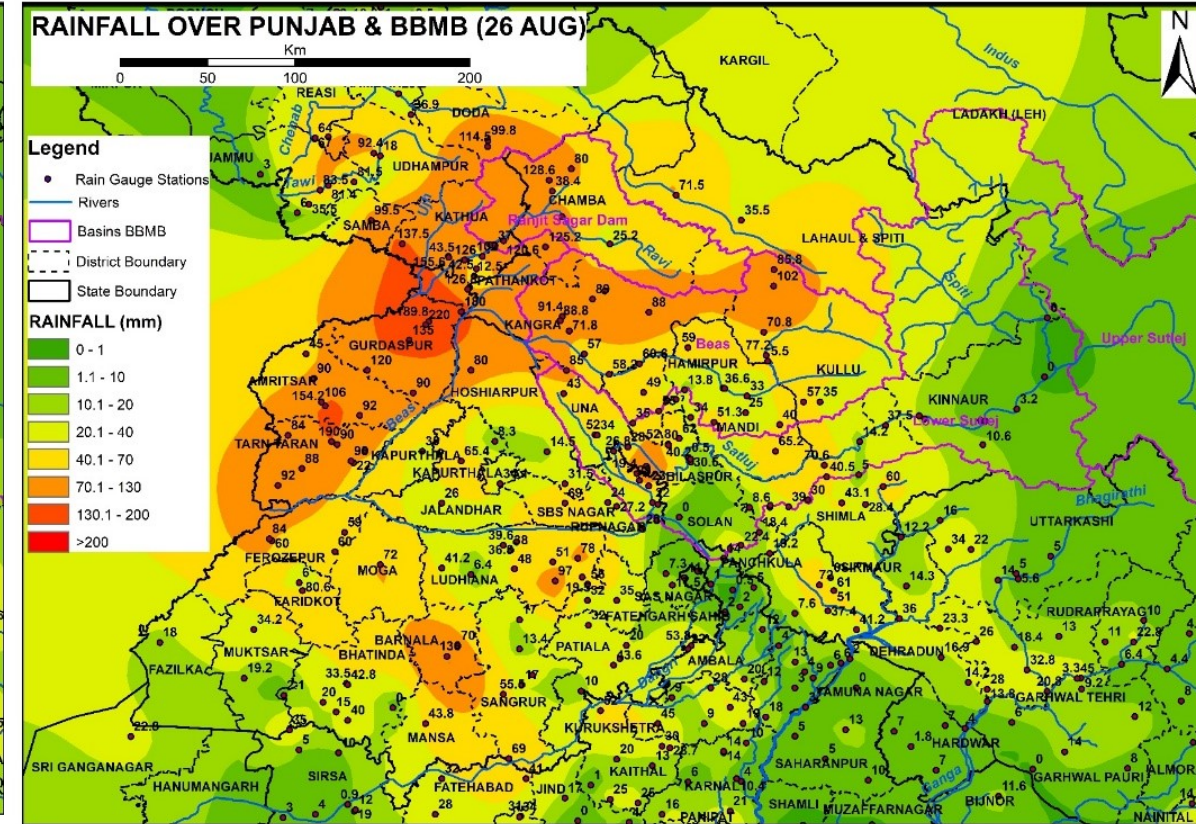
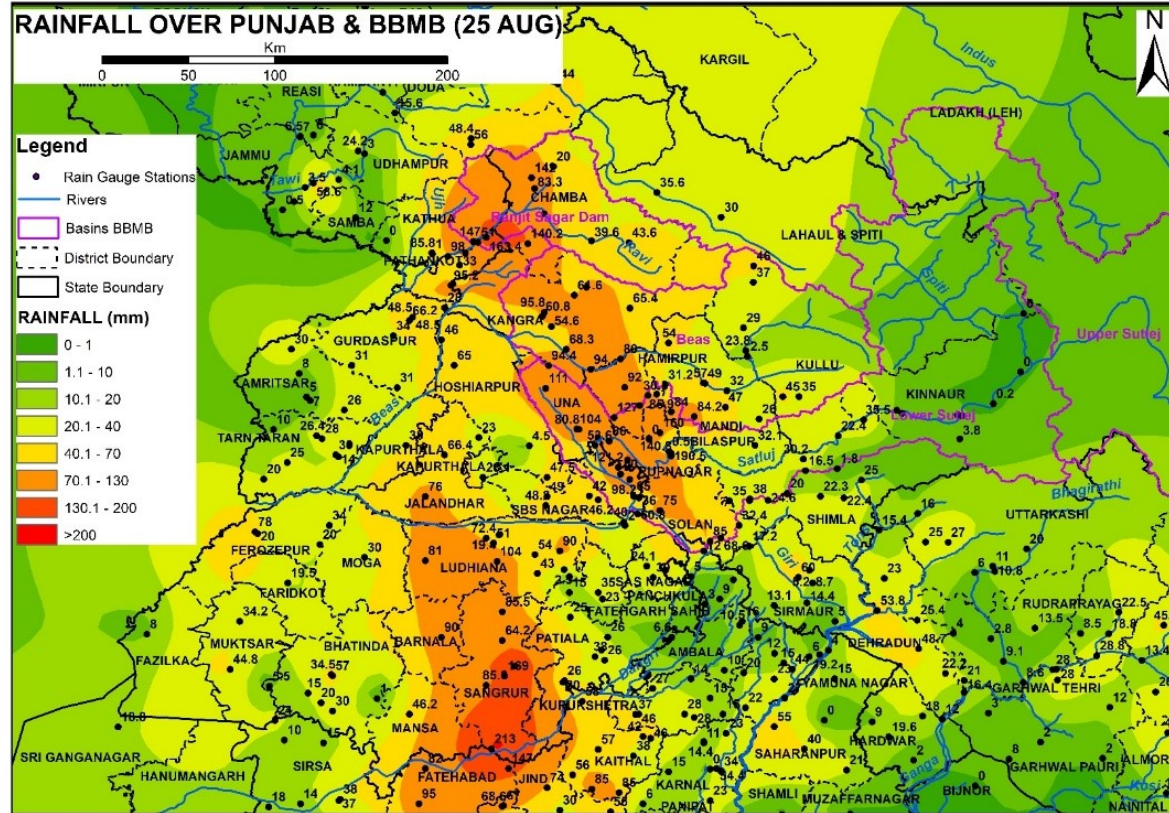
The observations indicate that heavy to extremely heavy rainfall occurred on 17th, 25th, and 26th August over the Ranjit Sagar Dam; on 25th and 26th August over the Beas and Lower Sutlej sub-basins.

SPATIAL ANALYSIS ON 17th & 24th Aug., 2025 OVER BBMB



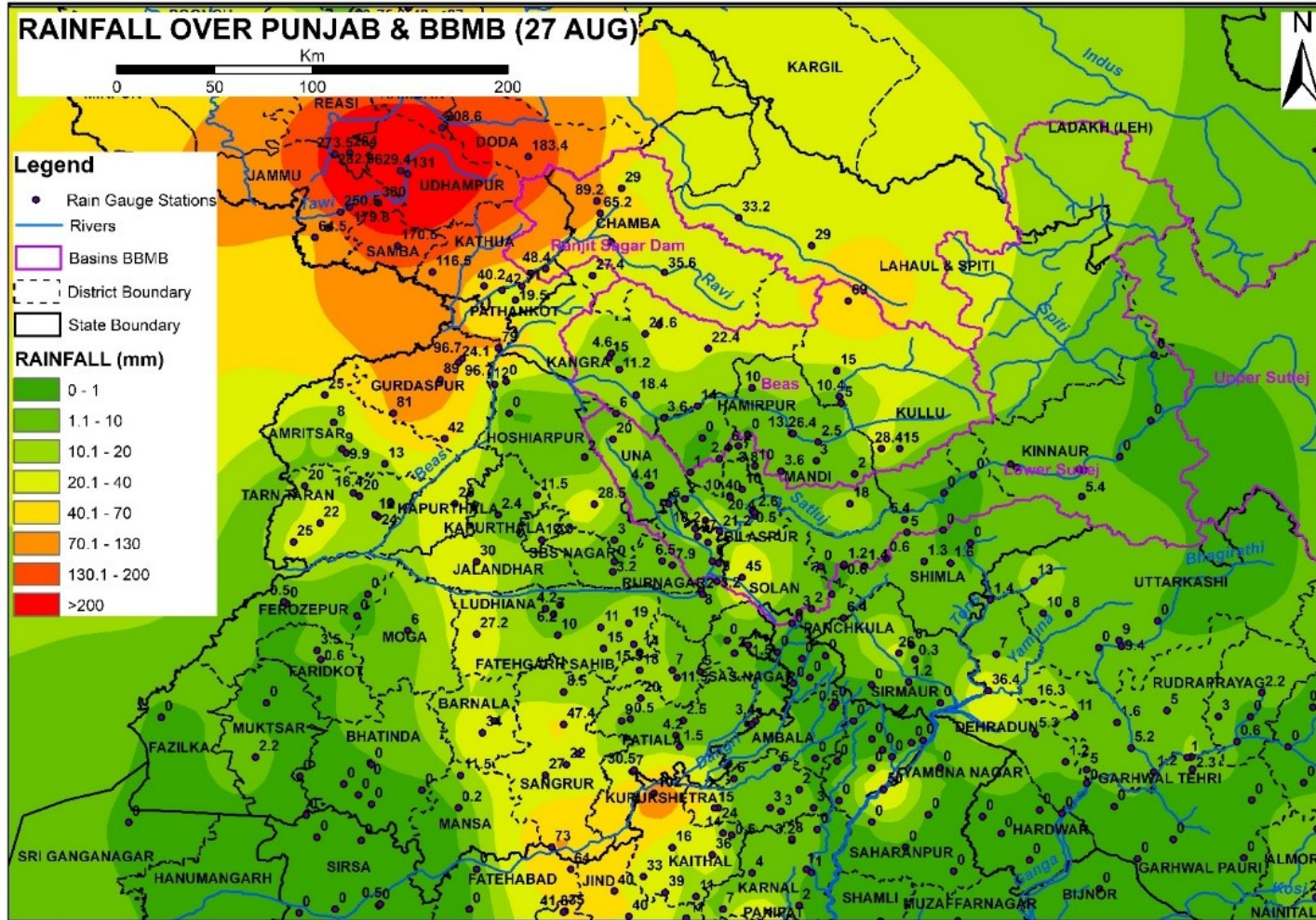
From the spatial analysis it is observed that some parts of the Ranjit Sagar dam area received 70 to 130 mm and some areas received 130 to 200 mm RF and Beas received 40 to 70 & very few areas received 70 to 130 mm RF on 17th Aug. Very few areas of RSD catchment and Beas received 70 to 130 mm RF on 24th Aug.

SPATIAL ANALYSIS ON 25th & 26th Aug., 2025 OVER BBMB



It is observed that very few parts of the Ranjit Sagar dam area received 130 to 200 mm and some areas received 70 to 130 mm RF and very few areas of Beas received 70 to 130 mm RF on 25th Aug. where as Parts of Sangrur, parts of Mansa & Fatehabad dist. of Punjab received 130 to 200 and Ludiana, Barnala, Mansa Fatehabad, Sangrur and Patiala received 70 to 130 mm RF. Very few areas of RSD catchment and Beas received 70 to 130 mm RF on 26th Aug. where as Gurdaspur and parts of Pathankot dist. Received 130 to 200 mm RF. Tarantaran, Amritsar and Gurdaspur received 70 to 130mm RF on 26th Aug.

SPATIAL ANALYSIS ON 27th Aug., 2025 OVER BBMB



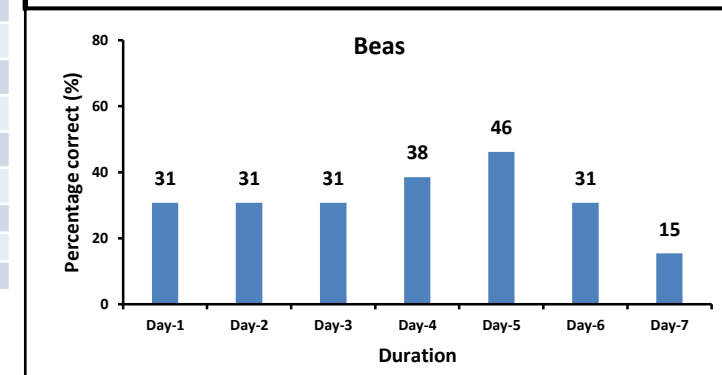
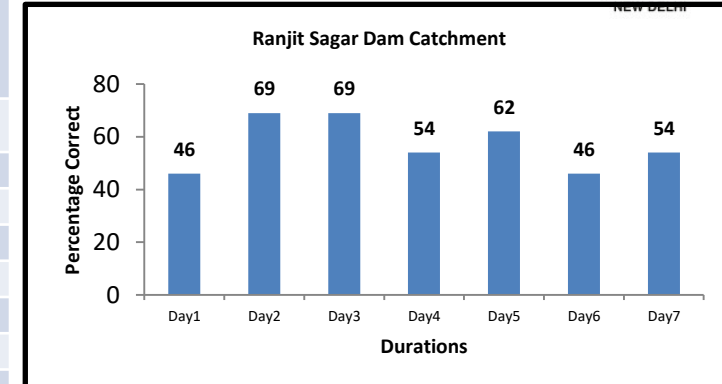
It is observed that no significant RF received over BBMB except few parts of the Ranjit Sagar dam area received 70 to 130 mm RF on 27th Aug. whereas only parts of Gurdaspur and Pathankot dist of Punjab received 70 to 130 mm RF but light rain received over Punjab.

Parts of Udhampur, Reasi, Ramban, Doda, Samba & Jammu received >200mm RF



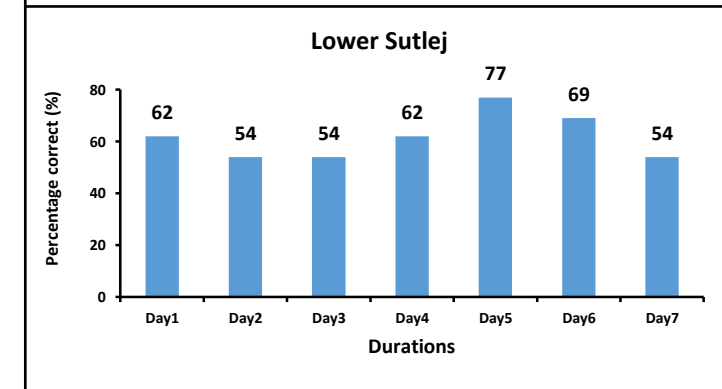
Verification of QPF during 17 to 29th Aug., 2025 OVER BBMB

Ranjit Sagar Dam Catchment										Beas										
Date	Basin	Day-1	Day-2	Day-3	Day-4	Day-5	Day-6	Day-7	Realised (AAP) by FMO	AAP By Isohyetal	Basin	Day-1	Day-2	Day-3	Day-4	Day-5	Day-6	Day-7	Realise d (AAP) by FMO	AAP By Isohyeta I
17-08-2025	RSD	0.1-10	26-37	0.1-10	26-37	0.1-10	0.1-10	0.1-10	1.7	37.5	Beas	0.1-10	11-25	0.1-10	11-25	0.1-10	0.1-10	0.1-10	26.5	36.4
18-08-2025		11-25	11-25	26-37	26-37	26-37	0.1-10	0.1-10	15.5	19.4		26-37	0.1-10	26-37	11-25	11-25	11-25	0.1-10	12.8	15.5
19-08-2025		11-25	0.1-10	0.1-10	26-37	26-37	26-37	11-25	1.5	6.2		11-25	11-25	0.1-10	11-25	11-25	26-37	11-25	8.2	11.4
20-08-2025		0.1-10	0.1-10	0.1-10	0.1-10	11-25	0.1-10	11-25	3.7	8.5		0.1-10	11-25	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	15.5	22.5
21-08-2025		11-25	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	0.6	0.2		26-37	0.1-10	0.1-10	0.1-10	0.1-10	11-25	0.1-10	6.3	9.5
22-08-2025		0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	1.1	0.5		0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	11-25	1.6	4.9
23-08-2025		0.1-10	0.1-10	26-37	0.1-10	0.1-10	0.1-10	0.1-10	1.8	10.9		0.1-10	11-25	38-50	11-25	11-25	11-25	11-25	8.9	13.5
24-08-2025		11-25	0.1-10	11-25	51-75	11-25	11-25	11-25	7.5	38.7		26-37	11-25	26-37	38-50	11-25	11-25	11-25	15.7	26.8
25-08-2025		26-37	0.1-10	0.1-10	11-25	38-50	11-25	11-25	18.5	67.7		26-37	11-25	11-25	26-37	38-50	11-25	11-25	36.0	47.6
26-08-2025		26-37	11-25	11-25	0.1-10	11-25	76-100	0.1-10	11.3	72.6		26-37	11-25	11-25	0.1-10	26-37	76-100	11-25	35.5	62.0
27-08-2025		38-50	11-25	0.1-10	11-25	0.1-10	26-37	>100	4.3	53.0		38-50	26-37	11-25	11-25	11-25	26-37	38-50	5.3	19.2
28-08-2025		11-25	0.1-10	0.1-10	0.1-10	0.1-10	11-25	0.1-10	1.2	3.8		11-25	11-25	11-25	11-25	0.1-10	0.1-10	11-25	7.8	13.1
29-08-2025		0.1-10	26-37	0.1-10	0.1-10	0.1-10	11-25	0.1-10	5.5	15.2		0.1-10	26-37	11-25	11-25	0.1-10	0.1-10	0.1-10	15.7	23.0
Total QPF		13	13	13	13	13	13	13					13	13	13	13	13	13	13	
correct QPF		6	9	9	7	8	6	7				4	6	6	7	7	3	4		
% Correct		46	69	69	54	62	46	54				31	46	46	54	54	23	31		



Lower Sutlej Sub-Basin											
Date	Basin	Day-1	Day-2	Day-3	Day-4	Day-5	Day-6	Day-7	Realised by FMO	AAP By Isohyetal	
17-08-2025	Lower Sutlej	0.1-10	11-25	11-25	26-37	0.1-10	0.1-10	0.1-10	3.2	6.0	
18-08-2025		11-25	0.1-10	26-37	11-25	26-37	0.1-10	0.1-10	2.5	4.6	
19-08-2025		0.1-10	0.1-10	0.1-10	11-25	11-25	26-37	0.1-10	3.8	7.1	
20-08-2025		0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	11-25	0.1-10	3.9	10.1	
21-08-2025		26-37	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	11-25	4.1	6.9	
22-08-2025		0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	0.8	2.0	
23-08-2025		0.1-10	0.1-10	38-50	0.1-10	0.1-10	0.1-10	11-25	1.9	4.2	
24-08-2025		11-25	11-25	11-25	38-50	0.1-10	0.1-10	11-25	6.0	10.4	
25-08-2025		11-25	0.1-10	0.1-10	11-25	38-50	11-25	0.1-10	16.7	28.4	
26-08-2025		11-25	0.1-10	0.1-10	0.1-10	0.1-10	11-25	76-100	0.1-10	12.6	26.2
27-08-2025		11-25	11-25	0.1-10	0.1-10	0.1-10	11-25	38-50	2.8	11.5	
28-08-2025		11-25	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	2.9	6.5	
29-08-2025		0.1-10	26-37	0.1-10	0.1-10	0.1-10	0.1-10	0.1-10	4.7	10.7	
Total QPF		13	13	13	13	13	13	13			
correct QPF		8	7	7	8	10	9	7			
% Correct		62	54	54	62	77	69	54			

Day-1: Forecast Issued One day prior to the date,
Day-2: Forecast Issued Two day prior to the date,
Day-3: Forecast Issued Three day prior to the date,
Day-4: Forecast Issued Four day prior to the date,
Day-5: Forecast Issued Five day prior to the date,
Day-6: Forecast Issued Six day prior to the date,
Day-7: Forecast Issued Seven day prior to the date





FFG Bulletin issued 16, 23 & 24 Aug. 2025



06 UTC 16 Aug., 2025

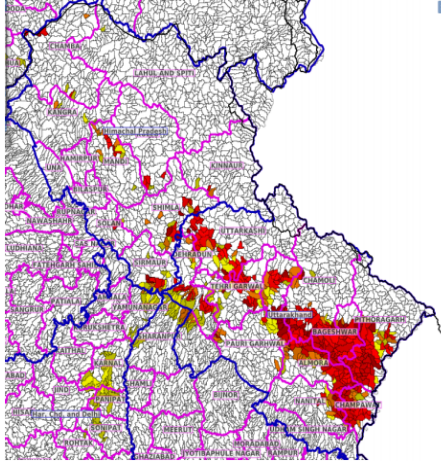
24 hours Outlook for the Flash Flood Risk (FFR) till 1130 IST of 17-08-2025 :

Low to Moderate flash flood risk likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 24 hours.

Himachal Pradesh - Chamba, Kangra, Kullu, Mandi, Shimla, Sirmaur and Solan districts.
Uttarakhand - Almora, Bageshwar, Chamoli, Champawat, Dehradun, Haridwar, Nanital, Pauri Garhwal, Pithoragarh, Rudraprayag, Tehri Garwal and Uttarkashi districts.

Surface runoff/ Inundation may occur at some fully saturated soils & low-lying areas over Area of Concern (AoC) as shown in map due to expected rainfall occurrence in next 24 hours.

Product: WRF FFR | Timescale: 24-hr | Region: "INDIA"
Product Date: 2025-08-16 06:00 UTC | Valid Date: 2025-08-17 06:00 UTC



Note: Next Bulletin will be issued based on 1730 IST of 16-08-2025 .

12 UTC 16 Aug., 2025

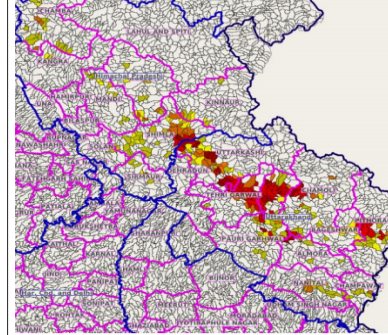
24 hours Outlook for the Flash Flood Risk (FFR) till 1730 IST of 17-08-2025 :

Low to Moderate flash flood risk likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 24 hours.

Himachal Pradesh - Chamba, Kangra, Kinnaur, Kullu, Mandi, Shimla, Sirmaur and Solan districts.
Uttarakhand - Almora, Bageshwar, Chamoli, Champawat, Nanital, Pauri Garhwal, Pithoragarh, Rudraprayag, Tehri Garwal and Uttarkashi districts.

Surface runoff/ Inundation may occur at some fully saturated soils & low-lying areas over Area of Concern (AoC) as shown in map due to expected rainfall occurrence in next 24 hours.

Product: WRF FFR | Timescale: 24-hr | Region: "INDIA"
Product Date: 2025-08-16 12:00 UTC | Valid Date: 2025-08-17 12:00 UTC



Note: Next Bulletin will be issued based on 0530 IST of 17-08-2025 .

12 UTC 23 Aug., 2025



GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
INDIA METEOROLOGICAL DEPARTMENT
HYDROMET DIVISION
FLASH FLOOD GUIDANCE CELL



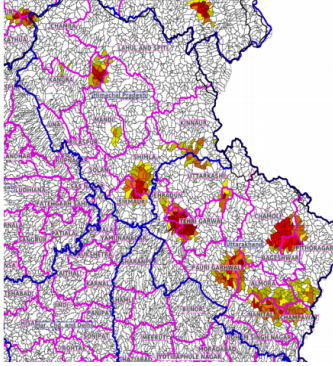
24 hours Outlook for the Flash Flood Risk (FFR) till 1730 IST of 24-08-2025 :

Low to Moderate flash flood risk likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 24 hours.

Himachal Pradesh - Chamba, Kangra, Kinnaur, Lahul&Spiti, Mandi, Shimla and Sirmaur districts.
Uttarakhand - Almora, Bageshwar, Chamoli, Champawat, Dehradun, Nanital, Pauri Garhwal, Pithoragarh, Rudraprayag, Tehri Garwal and Uttarkashi districts.

Surface runoff/ Inundation may occur at some fully saturated soils & low-lying areas over Area of Concern (AoC) as shown in map due to expected rainfall occurrence in next 24 hours.

Product: GFS FFR | Timescale: 24-hr | Region: "INDIA"
Product Date: 2025-08-23 12:00 UTC | Valid Date: 2025-08-24 12:00 UTC



24 hours Outlook for the Flash Flood Risk (FFR) till 0530 IST of 25-08-2025 :

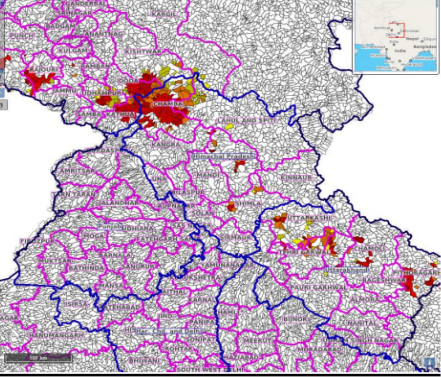
Moderate flash flood risk likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 24 hours.

Jammu & Kashmir and Ladakh - Doda, Kathua, Kishtwar, Mirpur, Reasi, Rajouri and Udhampur districts.

Himachal Pradesh - Chamba, Kangra, Lahul&Spiti, Mandi, Kullu, Shimla districts.
Uttarakhand - Bageshwar, Chamoli, Pauri Garhwal, Pithoragarh, Rudraprayag, Tehri Garwal and Uttarkashi districts.

Surface runoff/ Inundation may occur at some fully saturated soils & low-lying areas over Area of Concern (AoC) as shown in map due to expected rainfall occurrence in next 24 hours.

Product: NCM FFR | Timescale: 24-hr | Region: "REGIONAL"
Product Date: 2025-08-24 00:00 UTC | Valid Date: 2025-08-25 00:00 UTC



00 UTC 24 Aug., 2025

24 hours Outlook for the Flash Flood Risk (FFR) till 1130 IST of 25-08-2025 :

Moderate flash flood risk likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 24 hours.

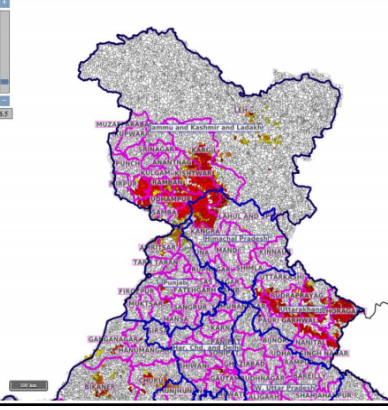
Jammu & Kashmir and Ladakh - Doda, Jammu Kathua, Kargil, Leh, Kishtwar, Mirpur, Ramban, Reasi, Rajouri, Samba and Udhampur districts.

Himachal Pradesh - Chamba, Kangra, Lahul & Spiti, Mandi, Kullu, Shimla and Sirmaur districts.

Uttarakhand - Almora, Bageshwar, Chamoli, Champawat, Nainital, Pauri Garhwal, Pithoragarh, Rudraprayag, Tehri Garwal and Uttarkashi districts.

Surface runoff/ Inundation may occur at some fully

Product: NCM FFR | Timescale: 24-hr | Region: "INDIA"
Product Date: 2025-08-24 06:00 UTC | Valid Date: 2025-08-25 06:00 UTC



06 UTC 24 Aug., 2025

24 hours Outlook for the Flash Flood Risk (FFR) till 1730 IST of 25-08-2025 :

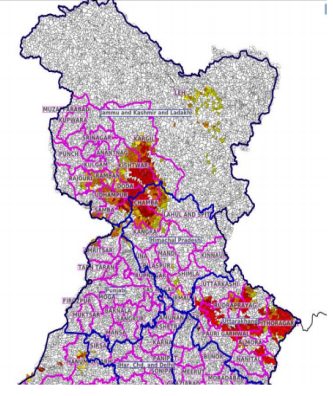
Moderate to High flash flood risk likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 24 hours.

Himachal Pradesh - Chamba, Kangra, Lahul&Spiti, Mandi, Shimla, Sirmaur and Solan districts.
Jammu & Kashmir & Ladakh - Anantnag, Doda, Jammu, Kathua, Kishtwar, Kulgam, Rajouri, Ramban, Riase, Samba, Udhampur, Kargil and Leh And Ladakh districts.

Uttarakhand - Almora, Bageshwar, Chamoli, Champawat, Dehradun, Haridwar, Pauri Garhwal, Pithoragarh, Rudraprayag, Tehri Garwal and Uttarkashi districts.

Surface runoff/ Inundation may occur at some fully saturated soils & low-lying areas over Area of Concern (AoC) as shown in map due to expected rainfall occurrence in next 24 hours.

Product: NCM FFR | Timescale: 24-hr | Region: "INDIA"
Product Date: 2025-08-24 12:00 UTC | Valid Date: 2025-08-25 12:00 UTC



12 UTC 24 Aug., 2025



FFG Bulletin issued 25 & 26 Aug. 2025



Persistent Flash Flood Threat (PFFT) till 1130 IST of 25-08-2025 :

Low to Moderate flash flood threat likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 6 hours.

Himachal Pradesh - Chamba district.
Jammu & Kashmir & Ladakh - Doda, Kathua and Udhampur districts.

Surface runoff/ Inundation may occur at some fully saturated soils & low-lying areas over Area of Concern (AoC) as shown in map due to expected rainfall occurrence in next 6 hours.

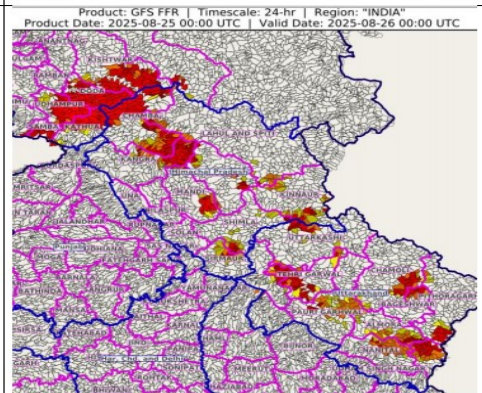
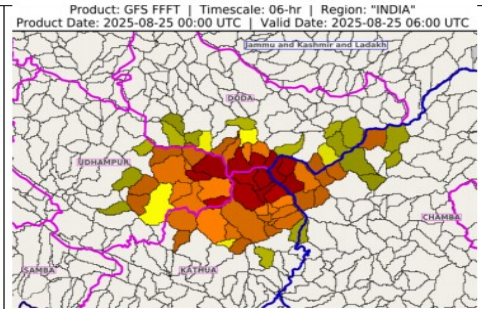
24 hours Outlook for the Flash Flood Risk (FFR) till 0530 IST of 26-08-2025 :

Moderate flash flood risk likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 24 hours.

Jammu & Kashmir & Ladakh - Doda, Kathua, Kistwar, Samba, Udhampur and Kargil districts.

Low to Moderate flash flood risk likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 24 hours.

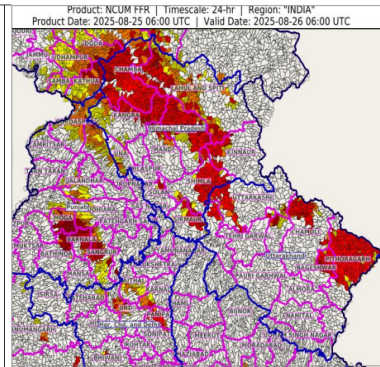
Himachal Pradesh - Chamba, Kangra, Kinnaur, Kullu, Lahul&Spiti, Mandi, Shimla and Sirmaur districts.
Uttarakhand - Almora, Bageshwar, Chamoli, Champawat, Dehradun, Nanital, Pauri Garhwal, Pithoragarh, Rudraprayag, Tehri Garwal and Uttarkashi districts.



24 hours Outlook for the Flash Flood Risk (FFR) till 1130 IST of 26-08-2025 :

Moderate flash flood risk likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 24 hours.
Haryana - Chandigarh & Delhi - Bhiwani, Fatehabad, Hisar, Jind, Kaithal, Karnal and Panipat districts.
Himachal Pradesh - Chamba, Kangra, Kinnaur, Kullu, Lahul&Spiti, Mandi, Shimla, Sirmaur, Solan and Una districts.
Punjab - Amritsar, Barnala, Bathinda, Faridkot, Firozpur, Gurdaspur, Hoshiarpur, Jalandhar, Kapurthala, Ludhiana, Mansa, Moga, Patiala and Sangrur districts.
Uttarakhand - Bageshwar, Chamoli, Dehradun, Pithoragarh, Rudraprayag, Tehri Garwal and Uttarkashi districts.

Surface runoff/ Inundation may occur at some fully saturated soils & low-lying areas over Area of Concern (AoC) as shown in map due to expected rainfall occurrence in next 24 hours.

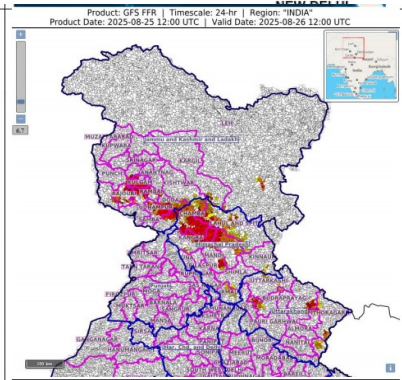


24 hours Outlook for the Flash Flood Risk (FFR) till 1730 IST of 26-08-2025 :

Low to Moderate flash flood risk likely over few watersheds & neighbourhoods of following Met Sub-divisions during next 24 hours.

Jammu & Kashmir & Ladakh - Badgam, Doda, Jammu, Kargil, Kathua, Kistwar, Kulgam, Punch, Ramban, Riase, Shupian, Udhampur and Leh districts.
Himachal Pradesh - Chamba, Kangra, Kinnaur, Kullu, Lahul & Spiti, Mandi, Shimla and Sirmaur districts.
Uttarakhand - Bageshwar, Champawat, Chamoli, Dehradun, Nainital, Pithoragarh, Rudraprayag, Tehri Garwal and Uttarkashi districts.

Surface runoff/ Inundation may occur at some fully saturated soils & low-lying areas over Area of Concern (AoC) as shown in map due to expected rainfall occurrence in next 24 hours.



06 UTC of 25th Aug., 2025

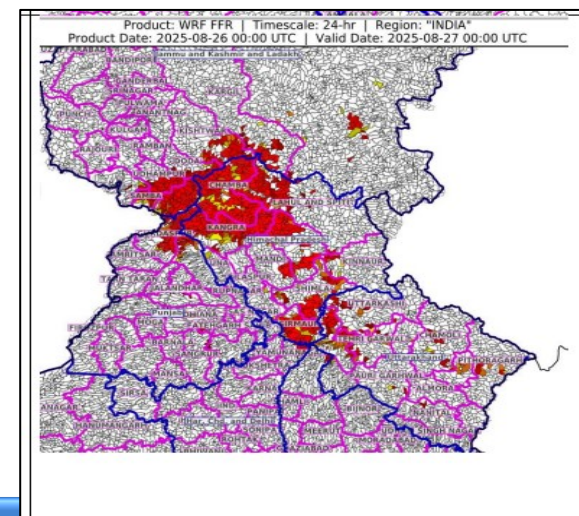
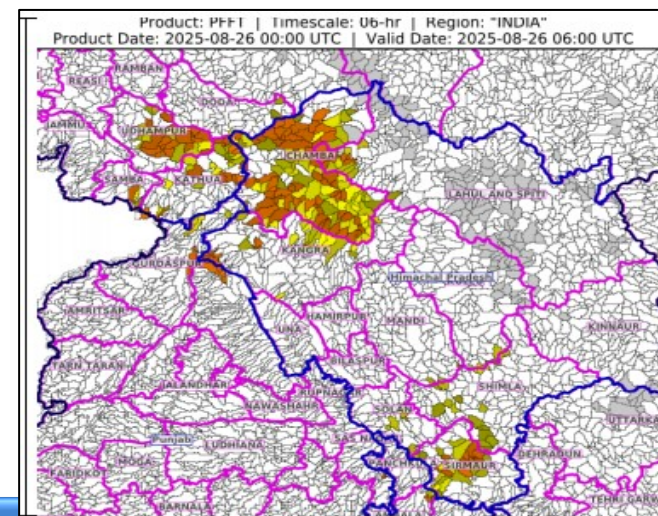
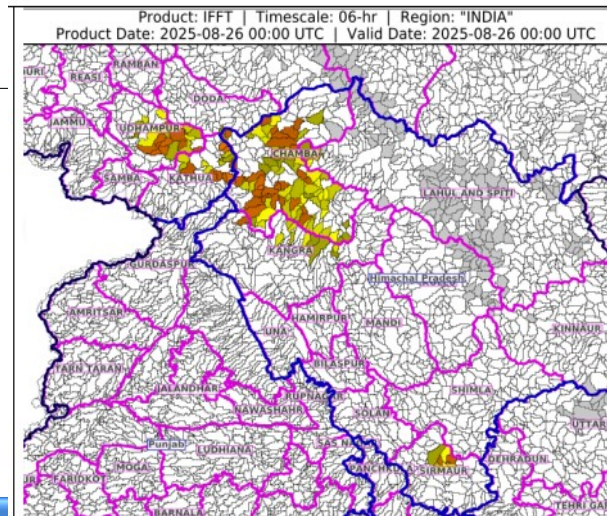
12 UTC of 25th Aug., 2025

IFFT

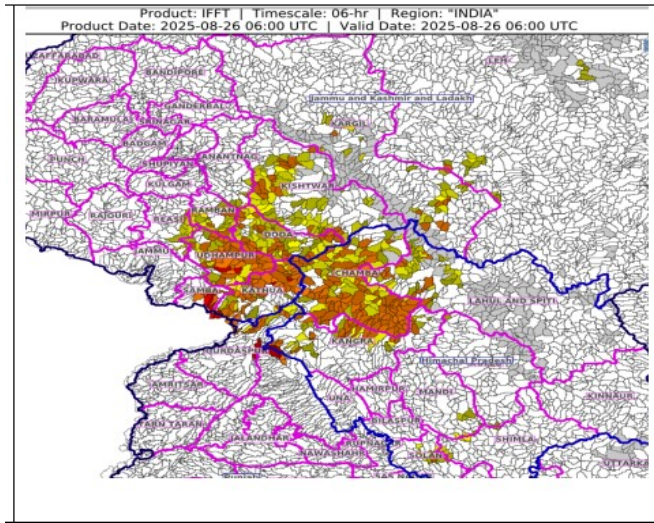
PFFT

FFR at 00 UTC of 26th Aug., 2025

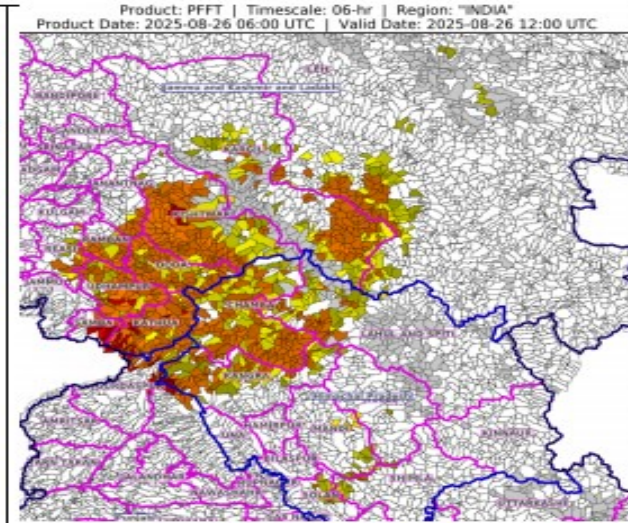
00 UTC of 25th Aug., 2025



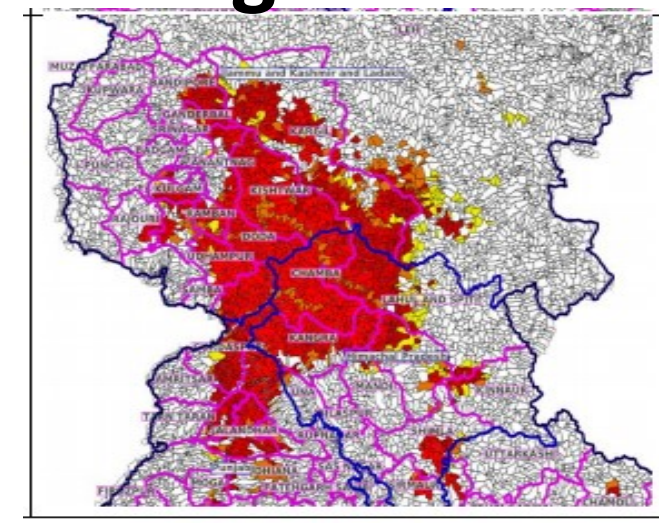
FFG Bulletin issued 06 & 12 UTC 26 Aug. 2025



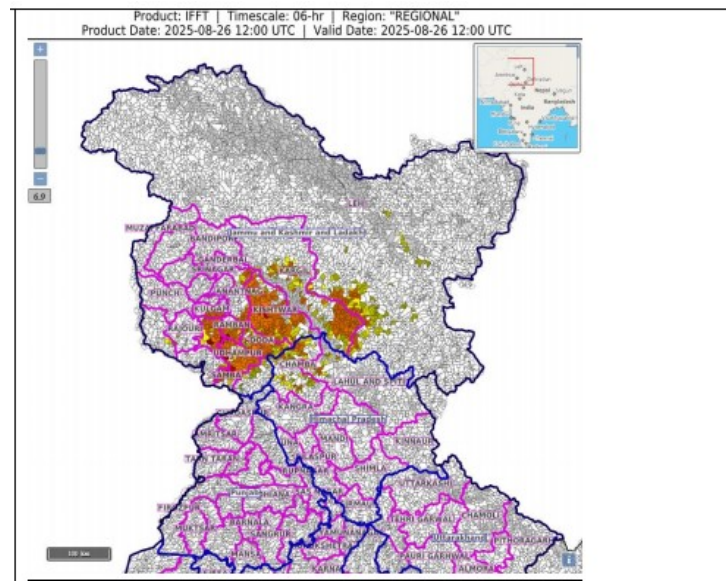
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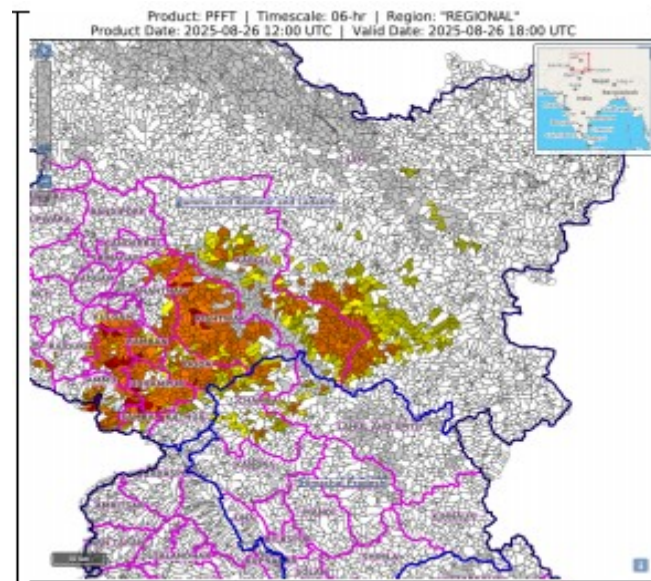
PFFT



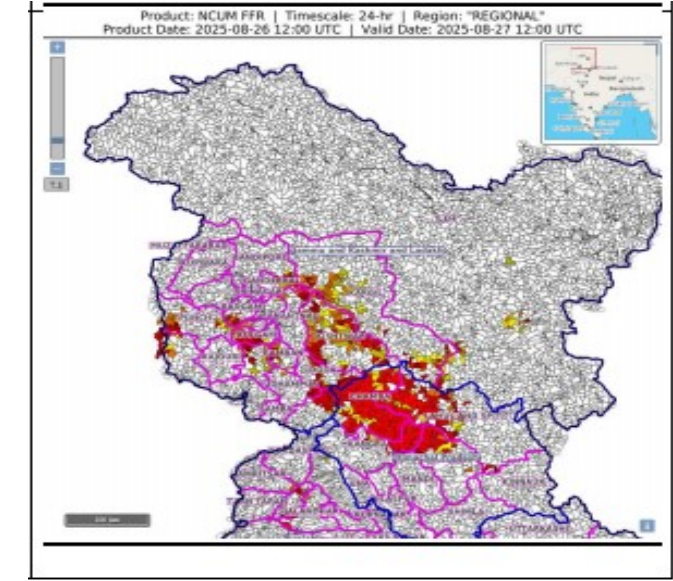
FFR at 06 UTC of 26th Aug., 2025



IFFT



PFFT



FFR at 12 UTC of 26th Aug., 2025

Conclusion

Based on the observed rainfall, it is evident that the IMD provided highly accurate forecasts for all river sub-basins of Himachal Pradesh in terms of Quantitative Precipitation Forecast (QPF) and heavy rainfall warnings. Additionally, the IMD issued Flash Flood Threat (PFFT) warnings for the next 6 hours and Flash Flood Risk (FFR) forecasts for the next 24 hours, as part of the daily South Asia Flash Flood Guidance (SAsiaFFG) bulletins. These forecasts, issued based on 00, 06, and 12 UTC data, were provided for the days of 16th August and from 23rd to 26th August 2025, with 6-hour and 24-hour lead times, respectively; for both Himachal Pradesh and Punjab.

Name of Sub-Basin	Date	Observed AAP (mm)	QPF prior to Day-1
Beas	09-07-2023	100.0	51-100
Sutlej (Upper & Lower)	09-07-2023	50.2	11-25
Ranjit Sagar Dam	09-07-2023	102.6	>100

The Average Areal Precipitation (AAP) on 17th August 2025 was 36.4 mm over the Beas sub-basin and 37.5 mm over the RSD catchment. On subsequent days—24th, 25th, and 26th August 2025—the AAP values were as follows: Beas: 26.8 mm, 47.6 mm, and 62 mm; RSD catchment: 38.7 mm, 67.7 mm, and 72.6 mm; Lower Sutlej: 10.4 mm, 28.4 mm, and 26.2 mm. These AAP values, calculated during the period from 15th to 29th August 2025, were all lower than the AAP calculated on 9th July 2023 (Table 7), which recorded the higher AAP values for these river sub-basins during the 2023 flood season.



Thank You