

Weather

WINTER SEASON (JANUARY & FEBRUARY 1988)*

1. Introduction

During winter season meteorological sub-divisions which receive good amounts of rainfall are Andaman & Nicobar Islands, Arunachal Pradesh, hills of west Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir, where the normal rainfall for the season is more than 10 cm. The normal rainfall for the season for the plains of north India, east Madhya Pradesh, Vidarbha, Tamil-Nadu and Kerala ranges between 3 and 6 cm. The other parts of the country receive even smaller amount.

For classification of rainfall two norms have been adopted, one for describing the seasonal rainfall and the other for describing the monthly rainfall. This has been done because the limits for describing normal rainfall are generally decided on the basis of the variability or standard deviation of rainfall. As the period increases the standard deviation decreases and *vice-versa*. Thus, in the case of seasonal rainfall, where the period is larger, the limits of ± 10 per cent departure from the normal has been considered for defining the normal rainfall, whereas in case of monthly rainfall the limits of ± 19 per cent departure has been considered for defining the same. The other norms considered for describing the monthly rainfall are : excess (± 20 per cent or more), deficient (-20 to -59%) and scanty (-60 per cent or less) and for seasonal rainfall are : large excess ($+51$ per cent or more), moderate excess ($+26$ to $+50$ per cent), slight excess ($+11$ to $+25$ per cent), slight deficient (-11 to -25 per cent), moderate deficient (-26 to -50 per cent) and large deficient (-51 per cent or less).

2. Chief features

- (i) Snowfall over Himachal Pradesh and Jammu & Kashmir.
- (ii) Moderate cold wave conditions in Jammu on 26 January.
- (iii) Abnormally high night temperatures in some parts of the country.
- (iv) The rainfall for the season was excess, slightly in Sub-Himalayan West Bengal & Sikkim and Bihar plateau; normal in Nagaland, Manipur, Mizoram & Tripura, Orissa and Jammu & Kashmir; deficient slightly in Assam & Meghalaya, hills of west Uttar Pradesh and Telangana; moderately in Andaman & Nicobar Islands, Gangetic West Bengal, Bihar

plains, Haryana, Punjab, Himachal Pradesh, Madhya Pradesh, coastal Andhra Pradesh and Kerala and largely in the rest of the country outside Gujarat, Konkan & Goa, Marathwada and coastal Karnataka, where there was no rain during the season (Fig. 1).

3. January

3.1. Weather and associated synoptic features

Eight western disturbances affected extreme north India during the month. The ninth western disturbance of the month was observed over north Pakistan and adjoining Afghanistan in the evening of 31st. The synoptic features of the month are listed in Table 1.

There were three spells of snowfall over Jammu & Kashmir during the month. The first spell was between 3rd and 6th and the spell was fairly widespread on 6th. The second spell was between 9th and 15th and snowfall was generally widespread on 12th and 13th. The third spell of snowfall was reported from the Kashmir valley on 22nd and it was widespread.

Rain or thundershowers were generally widespread over hills of west Uttar Pradesh and Himachal Pradesh between 12th and 14th and over Himachal Pradesh and Jammu & Kashmir between 28th and 29th. They were scattered or isolated on 1 to 5 days over the rest of the country outside Orissa, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Kerala and Lakshadweep where the weather was mainly dry.

3.2. Rainfall during January

Rainfall was normal over Jammu & Kashmir; deficient over Arunachal Pradesh, Assam, Meghalaya, Himachal Pradesh, west Rajasthan and west Madhya Pradesh and scanty over the rest of the country outside Orissa, Gujarat, Maharashtra, coastal Andhra Pradesh, Telangana, Karnataka and Kerala, where there was no rain.

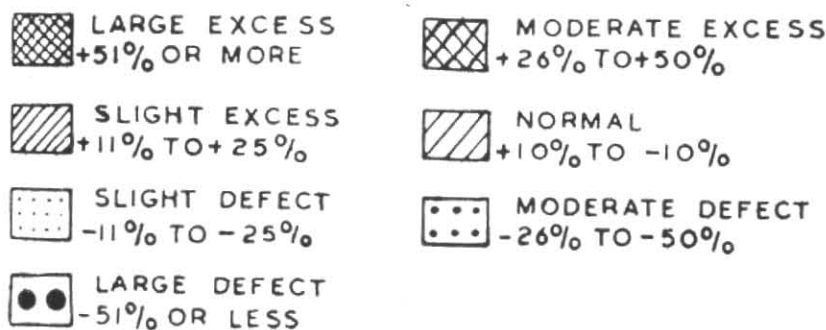
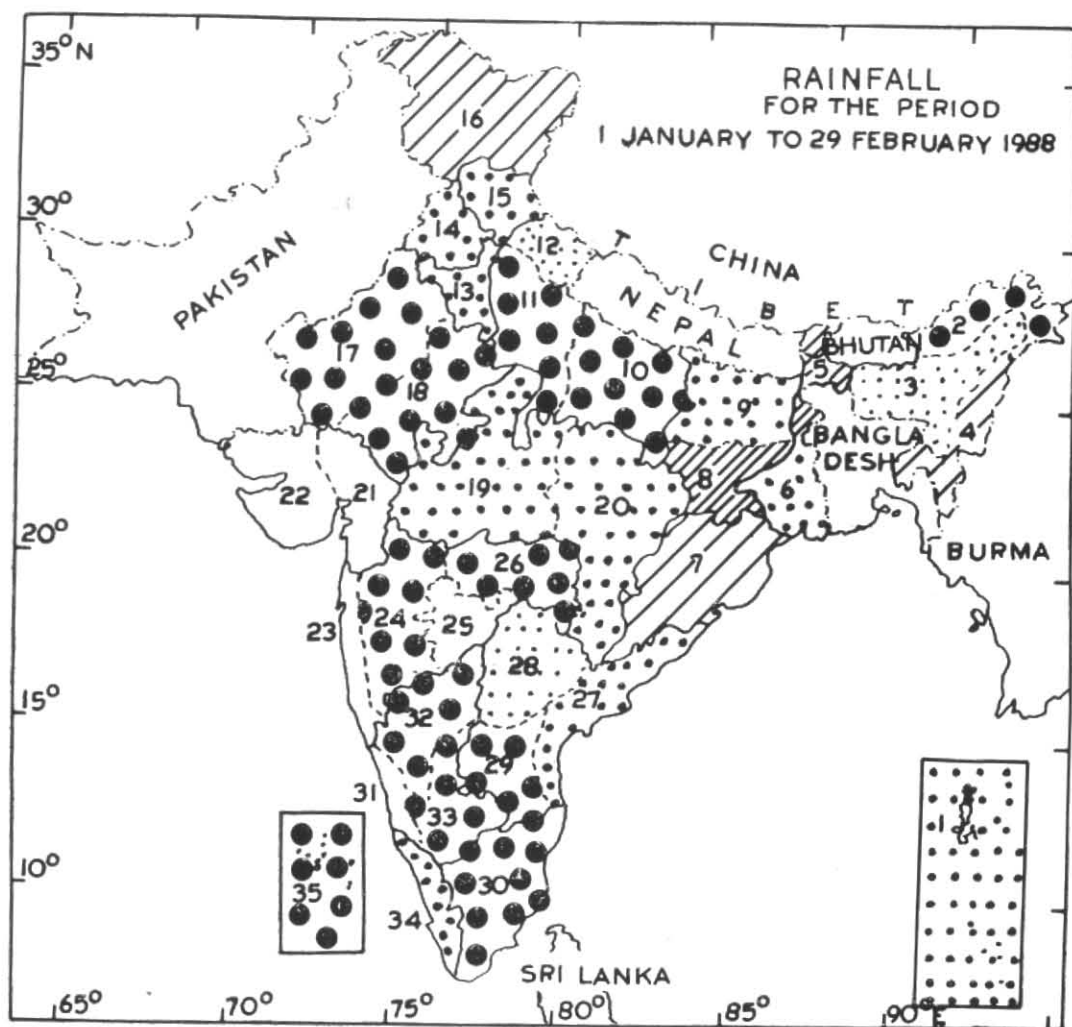
The significant amounts (cm) of rainfall were :

6th : Nakodar & Raya 3 each

12th : Bhuntar AP, Dalhousie & Jogindernagar 3 each

13th : Jammu AP, Karnal & Narsinghpur 3 each

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<i>Sub-divisions</i>	<i>Dep. from normal</i>	<i>Sub-divisions</i>	<i>Dep. from normal</i>	<i>Sub-divisions</i>	<i>Dep. from normal</i>
1. A. & N. Islands	-47	13. Haryana	-35	25. Marathwada	-100
2. Arunachal Pradesh	-56	14. Punjab	-49	26. Vidarbha	-76
3. Assam & Megha.	-12	15. Himachal Pradesh	-30	27. Coastal A.P.	-41
4. N.M.M. & T.	5	16. Jammu & Kashmir	5	28. Telangana	-24
5. S.H.W.B. & Sikkim	17	17. West Rajasthan	-56	29. Rayalaseema	-91
6. G. West Bengal	-28	18. East Rajasthan	-70	30. Tamil Nadu	-88
7. Orissa	2	19. West M.P.	-47	31. Cot. Karnataka	-100
8. Bihar Plateau	13	20. East M.P.	-37	32. N. I. Karnataka	-99
9. Bihar Plains	-38	21. Gujarat Region	-100	33. S. I. Karnataka	-77
10. East U.P.	-73	22. Saurashtra & Kutch	-100	34. Kerala	-45
11. Plains of W. U.P.	-69	23. Konkan & Goa	-100	35. Lakshadweep	-85
12. Hills of W. U.P.	-13	24. Madhya Maha.	-94		

Fig. 1. Rainfall for the period, 1 January to 29 February 1988 (Percentage departure from normal)

TABLE 1
Details of weather systems during January 1988

S. No.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Special remarks
Cyclonic circulations						
1	Lower trop. levels	31 Dec-3rd	Southeast Arabian Sea off Kerala coast	—	<i>In situ</i>	
2	Do.	5th-10th	Southwest Bay off south Tamil Nadu-Sri Lanka coast	Westerly	Maldives	
3	Lower trop. levels (induced)	5th-7th	West Rajasthan	Easterly	Haryana and neighbourhood	
4	Lower trop. levels	11th	Southwest Bay off Sri Lanka coast	Westerly	Southeast Arabian Sea west of Lakshadweep	
5	Lower trop. (induced)	12th-15th	South Rajasthan	East-south-easterly	Southwest Madhya Pradesh and adjoining Maharashtra	
6	Lower trop. levels	21st-25th	Southeast and adjoining southwest Bay	Westerly	Maldives and adjoining Comorin area	
Western Disturbances (W.D.)						
1	Western disturbance	1st-5th	Northeast Afghanistan	Easterly	Moved away across Western Himalayas	
2	Do.	5th-7th	North Pakistan and neighbourhood	Do.	Do.	
3	Do.	10th-14th	North Pakistan and adjoining Jammu & Kashmir	Do.	Do.	
4	Do.	14th evening-16th evening	Northeast Afghanistan and neighbourhood	Do.	Do.	
5	Do.	20th evening-22nd evening	North Pakistan and neighbourhood	Do.	Do.	
6	Do.	22nd evening-27th	Central Pakistan and adjoining Punjab	East-north-easterly	Do.	
7	Do.	27th-29th evening	North Pakistan and adjoining Jammu & Kashmir	Easterly	Do.	
8	Do.	29th evening-31st evening	South Afghanistan and adjoining Pakistan	Easterly	Do.	
9	Do.	31st evening	North Pakistan and adjoining Afghanistan	—	—	

14th : Bijnore & Varanasi 3 each
 16th : Daporijo
 22nd : Banihal & Gulmarg 5 each, Batote, Kukernag & Pahalgam 4 each, Srinagar 3
 27th : Nedumangad 3
 28th : Verinag 3

3.3. Temperature

Moderate cold wave conditions (dep. -6°C to -7°C) prevailed over Jammu on 26th. Night temperatures were appreciably below normal (-4°C to -5°C) on 1 to 4 days in Nagaland, Manipur, Mizoram & Tripura, West Bengal & Sikkim, Bihar, Plains of Uttar Pradesh,

Jammu and east Rajasthan between 21st and 31st. They were abnormally high ($+6^{\circ}\text{C}$ or more above normal) on 1 to 2 days in Nagaland, Manipur, Mizoram & Tripura, hills of west Uttar Pradesh and Saurashtra & Kutch between 2nd and 7th and on one day each in Haryana, Jammu & Kashmir and west Rajasthan between 11th and 12th.

4. February

4.1. Weather and associated synoptic features

Besides the last western disturbance of the previous month, which moved away eastwards across Western Himalayas by 2 February, extreme north India was affected by seven more western disturbances. The eighth western disturbance of the month lay on 29th over north

TABLE 2

Details of weather systems during February 1988

S No.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Special remarks
Cyclonic circulations						
1	Lower levels	1st-2nd	Lakshadweep area and neighbourhood	—	<i>In situ</i>	
2	Do.	2nd evening-4th	Extreme south Tamil Nadu and Sri Lanka	Westerly	Lakshadweep and neighbourhood	
3	Lower and middle tropospheric levels	5th-11th	Southeast and adjoining southwest Bay	Westerly	South Tamil Nadu and Sri Lanka	
4	Lower tropospheric levels (Induced)	10th evening-13th	Saurashtra & Kutch	Easterly	Madhya Pradesh and neighbourhood	
5	Lower tropospheric levels	11th-13th	Southwest Bay off south Tamil Nadu coast	West-south westerly	Comorin area	
6	Lower tropospheric levels (Induced)	13th-15th	South Pakistan and adjoining west Rajasthan	East-north-easterly	Sub-montane Bihar and neighbourhood	
7	Lower levels	20th-22nd	Bihar Plateau and adjoining Gangetic West Bengal		<i>In situ</i>	
8	Lower tropospheric levels	21st-25th	North Maharashtra	East-north-easterly	Assam and adjoining Bangladesh	
9	Lower levels	25th-27th	East central Arabian Sea off Maharashtra coast	Easterly	Marathwada and neighbourhood	
10	Lower tropospheric levels (Induced)	27th-29th	North Rajasthan and neighbourhood		<i>In situ</i>	
Western disturbances (WDs)						
1	Western disturbance	31 January evening-2 Feb	North Pakistan and adjoining Afghanistan	Easterly	Moved away eastwards across Western Himalayas	
2	Western disturbance	4th-7th	Afghanistan	Easterly	Moved away across Western Himalayas	
3	Western disturbance	7th-10th evening	Southwest Pakistan and adjoining Afghanistan	East-north-easterly	Moved away across Western Himalayas	
4	Western disturbance	10th-14th	Afghanistan and adjoining north Pakistan	Easterly	Do.	Moved over Jammu & Kashmir on 11th
5	Western disturbance	14th-17th	North Pakistan and neighbourhood	Easterly	Moved away across Western Himalayas	
6	Western disturbance	18th-21st	East Afghanistan and adjoining north Pakistan	Do.	Do.	
7	Western disturbance	20th-23rd	Northeast Afghanistan and adjoining north Pakistan	Do.	Do.	
8	Do.	25th-29th evening	North Pakistan and adjoining Afghanistan	Do.	Do.	
9	Do.	29th	North Pakistan and neighbourhood	Do.	Do.	

Pakistan and neighbourhood. The synoptic features of the month are listed in Table 2.

During the month Jammu & Kashmir experienced three spells of snowfall and Himachal Pradesh one spell of snowfall. Snowfall was widespread over Jammu & Kashmir on 9th and 21st. The third spell commenced on 27th and continued upto 29th. During this spell rain or snow was generally widespread over Himachal Pradesh and Jammu & Kashmir with isolated heavy falls over Himachal Pradesh on 28th.

Rain or thundershowers were generally widespread on 1 to 4 days over northeast India outside Bihar Plains, hills of west Uttar Pradesh, Haryana, Punjab, Himachal Pradesh and Jammu & Kashmir between 13th and 29th with isolated heavy to very heavy falls on 1 to 2 days in Assam & Meghalaya and hills of west Uttar Pradesh. They were scattered or isolated on 2 to 8 days over the country outside east Rajasthan, Gujarat, Konkan & Goa, Marathwada and coastal and north interior Karnataka, where the weather was mainly dry. Andaman & Nicobar Islands experienced scattered or isolated thunder showers activity on 11 days during the month, while it was for a day each in west Rajasthan (14th), Madhya-Maharashtra (20th), Rayalaseema (28th) and Lakshadweep (7th).

4.2. Rainfall during February

Rainfall was excess in Andaman & Nicobar Islands, Nagaland Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim, Orissa, Bihar, hills of west Uttar Pradesh, Jammu & Kashmir and Telangana; normal in Assam & Meghalaya, Gangetic West Bengal, Haryana, Punjab, Himachal Pradesh, east Madhya Pradesh, coastal Andhra Pradesh and Kerala and deficient in west Madhya Pradesh, Vidarbha and Lakshadweep. It was scanty over the rest of the country outside Gujarat, Konkan & Goa, Marathwada and coastal & north interior Karnataka, where there was no rain.

The significant amounts (cm) of rainfall during the month were:

- 7th : Nancowry 7
- 8th : Car Nicobar 3
- 9th : Car Nicobar 6, Gulmarg 4, Alleppey, Banihal, Quilon & Verinag 3 each
- 10th : Car Nicobar & Verinag 3 each
- 12th : Pehowa 7, Mana & Malari 3 each
- 13th : Malari 10, Mana 7, Joshimath & Shaharanpur 5 each, Chamoli 4, Okhimadh 3
- 14th : Fazilka & Kasauli 3 each
- 15th : Shahajahanpur 6, Kayamkulam & Tuticorin 4 each, Jogindernagar & Kamareddy 3 each

- 16th : Mavelikara 6, Punalur 4, Kottayam & Sambalpur 3 each
- 17th : Kalingapatnam 6, Jamshedpur, Kailashahar & Raipur 3 each
- 18th : Daporijo 3
- 21st : Malari 9, Mana 7, Gulmarg 5, Manali & Srinagar 4 each, Narsipatnam 3
- 22nd : Mana 15, Malari 13, Uttarkashi 10, Chamba & Hyderabad AP 7 each, Gulmarg 5, Batote, Brahmapuri, Joshimath & Manali 4 each
- 23rd : Madikeri 3
- 24th : Jamshedpur 10, Cherrapunji & Rupsi 7 each, Cooch Behar & Jalpaiguri 5 each, Chaparmukh 4, Berhampore, Contai, Purnea & Tezpur 3 each
- 25th : Srivilliputtur 9, Lumding & Silchar AP 3 each
- 27th : Malari 14, Manali 3
- 28th : Mana 15, Malari 14, Jogindernagar 10, Batote, Dharamsala & Gulmarg 6 each, Banihal & Quazigund 5 each
- 29th : Jogindernagar 7, Sundernagar 6, Leh 4, Bhuntar AP & Uttarkashi 3 each

4.3. Temperature

Night temperatures were below normal (-2°C to -3°C) in Orissa and Bihar Plateau during the first week being appreciably (-4°C to -5°C) so over Orissa on 4th and 5th. They were also below normal on 2 to 5 days in Nagaland, Manipur, Mizoram & Tripura, West Bengal & Sikkim, Bihar plains, plains of Uttar Pradesh, Punjab, Madhya Pradesh, Vidarbha, Telangana, Rayalaseema, Tamil-Nadu and Karnataka being appreciably so on 1 or 2 days in some of those sub-divisions during the period from 1st to 9th. Jammu had appreciably below normal night temperatures on the first three days of the month. Night temperatures were abnormally high ($+6^{\circ}\text{C}$ or above) on 4th in hills of west Uttar Pradesh, on 12th and 20th in Madhya Maharashtra and Marathwada and from 25th to 29th in Rayalaseema. They were so on 23rd in east Madhya Pradesh and on 28th in Gangetic West Bengal.

4.4. Disastrous weather events and damages

On 16th hailstorms affected 73 villages in Chandrapur district taking a toll of 6 human lives. Hailstorms in Raipur district on 19th caused heavy damage to crops. On 21st it affected 18 villages in Kamtee tehsil of Nagpur district and 10 villages in Bhandara district. One person lost life in Bhandara district. Gangtok reported hailstorms on 12th and 23rd and Tadong on 15th and 25th of this month.