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Weather

WINTER SEASON (JANUARY & FEBRUARY 1989)*

1. Introduction

During winter season, the 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. The normal winter seasonal rainfall in these sub-divisions is more than 10 cm. The normal rainfall for the season ranges between 3 and 6 cm in plains of north India, east Madhya Pradesh, Vidarbha, Tamil Nadu and Kerala. The other parts of the Indian sub-continent receive even smaller amounts of rainfall.

For classification of rainfall two norms have been adopted, one for describing the seasonal rainfall and the other for describing the monthly rainfall. These have been adopted 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. Thus, in the case of seasonal rainfall, where the period is large, the limits of ± 10 per cent departure from the normal has been considered for defining the normal rainfall, whereas in the case of monthly rainfall, where the period is short, the limit of ± 19 per cent departure has been considered for defining the normal rainfall. The other norms considered for describing the monthly rainfall are excess (dep. +20 per cent or more), deficient (dep. —20 to —59 per cent), scanty (dep. —60 per cent or less). For seasonal rainfall the other norms are large excess (dep. +51 per cent or more), moderate excess (dep. +26 to +51 per cent), slight excess (dep. +11 to +25 per cent), slight deficient (dep. —11 to —25 per cent), moderate deficient (dep. —26 to —50 per cent) and large deficient (dep. —51 per cent or less).

2. Chief features

(*i*) Snowfall over Himachal Pradesh and Jammu & Kashmir.

(*ii*) Cold wave conditions in several parts of north India.

3. Seasonal rainfall for the winter season

Rainfall for the season (Fig. 1) was moderately excess in west Rajasthan and normal in Haryana and Saurashtra & Kutch. It was deficient, slighlty in Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, plains of west Uttar Pradesh, Himachal Pradesh and east Rajasthan; moderately so in Andaman & Nicobar Islands, Nagaland, Manipur, Mizoram & Tripura, Bihar plains, east Uttar Pradesh, Punjab, Jammu & Kashmir, Konkan & Goa and was largely deficient in Arunachal Pradesh, Gangetic West Bengal, Orissa, Bihar plateau, hills of west Uttar Pradesh, Madhya Pradesh, Gujarat region, coastal Andhra Pradesh, Tamil Nadu, Kerala and Lakshadweep. Dry weather prevailed over Madhya Maharashtra, Marathwada, Vidarbha, Telangana, Rayalaseema and Karnataka.

4. January

4.1. *Weather and associated synoptic features*

Seven western disturbances affected extreme north India during the month. Out of these seven western disturbances, the first two were active and the other ones caused hardly any precipitation. Assam & adjacent States were affected by a trough in lower level westerlies between 9th and 12th. A trough in the easterlies in the lower tropospheric levels was observed over southwest Bay off Sri Lanka-Tamil Nadu coast between 4th and 6th. Another trough in lower levels affected extreme south Peninsula between 13th and 18th of this month. Synoptic features of the month are listed in Table 1.

There was only one spell of rainfall between 2nd and 9th over northwest India and neighbourhood. During this period rainfall occurred almost at all the places on 1 to 4 days in Uttar Pradesh, Haryana, Punjab, Himachal Pradesh and Jammu & Kashmir and at many places on 1 to 2 days in Punjab, Himachal Pradesh and east Rajasthan. Also during the same period rainfall occurred at a few places or at one or two places on 1 to 5 days in Uttar Pradesh in all the sub-divisions of northwest India, Madhya Pradesh, Gujarat and Konkan & Goa. In northeast India rainfall occurred almost at all the places in Sub-Himalayan West Bengal & Sikkim and Bihar plains on 9th and in Arunachal Pradesh on 10th.

However, rainfall occurred at a few places on 1 to 2 days in Assam & Meghalaya and Nagaland, Manipur, Mizoram & Tripura. In the Peninsular India, the

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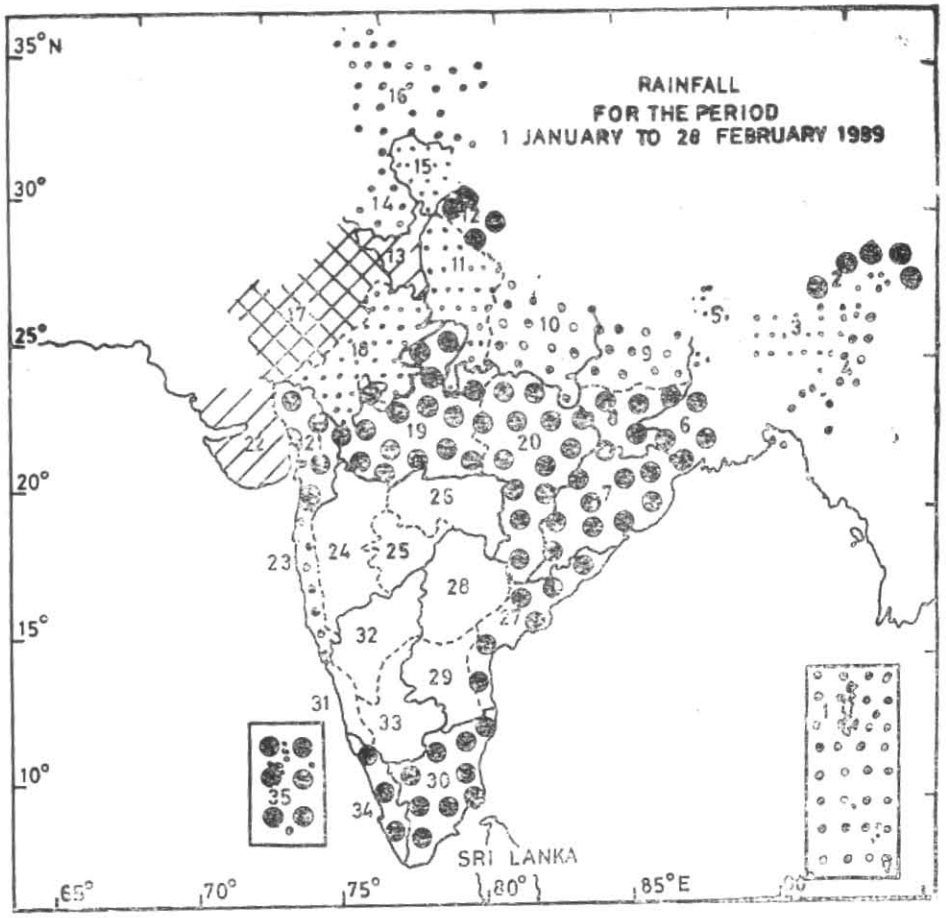

Sub-div.	*Dep. from normal*	*Sub-div.*	*Dep. from normal*	*Sub-div.*	*Dep. from normal*
1. A. & N. Island	—47	13. Haryana	8	25. Marathwada	—100
2. Arunachal Pradesh	—63	14. Punjab	—39	26. Vidarbha	—100
3. Assam & Megha.	—18	15. Himachal Prad.	—22	27. Coastal A.P.	—97
4. N.M.M. & T.	—32	16. Jammu & Kash.	—42	28. Telangana	—100
5. S.H. W.B. & Sik.	—23	17. West Rajasthan	33	29. Rayalaseema	—100
6. G. West Bengal	—68	18. East Rajasthan	—24	30. Tamil Nadu	—71
7. Orissa	—98	19. West M.P.	—82	31. Cot. Karnataka	—100
8. Bihar plateau	—99	20. East M.P.	—99	32. N.I. Karnataka	—100
9. Bihar plains	—44	21. Gujarat region	—55	33. S.I. Karnataka	—100
10. East U.P.	—35	22. Saurashtra & Kut.	9	34. Kerala	—60
11. Plains of West U.P.	—17	23. Konkan & Goa	—37	35. Lakshadweep	—65
12. Hills of West U.P.	—67	24. Madhya Mah.	—100		

Fig. 1. Rainfall for the period 1 January to 28 February 1989 (Percentage departure from normal)

TABLE 1

Details of weather systems during January 1989

Weather systems	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
(A) Western disturbance					
U/A. system	1st-6th	North Pakistan & adjoining Jammu & Kashmir	Easterly	Moved away across Jammu & Kashmir and neighbourhood	First located over the same area on 31 December
Do.	6th-9th	North Pakistan & neighbourhood	Do.	Do.	Seen as a low pressure area over north Pakistan & neighbourhood on 6th
Do.	10th-11th	Jammu & Kashmir and adjoining north Pakistan	Do.	Do.	
Do.	13th-17th	North Pakistan & neighbourhood	Do.	Do.	
Do.	18th-20th	North Pakistan & adjoining Jammu & Kashmir	Do.	Do.	
Do.	25th-28th	Do.	Do.	Do.	
Do.	29th evening	North Pakistan	Do.	—	Lay over Jammu & Kashmir and adjoining north Pakistan on 31st
(B) Induced cyclonic circulation					
Lower tropospheric levels	1st-5th evening	Northwest Rajasthan and neighbourhood	Easterly	Hills of west Uttar Pradesh and neighbourhood	
Lower levels	4th-5th	North Rajasthan	—	*In situ*	
Do.	5th-7th	Central Pakistan and adjoining Rajasthan	Easterly	Haryana & neighbourhood	
Lower tropospheric levels	7th-9th	North Rajasthan and adjoining Haryana	Northnorth-easterly	Haryana & adjoining Punjab and Himachal Pradesh	
Lower tropospheric levels	7th-8th evening	North Gujarat & adjoining South Rajasthan	Easterly	North Madhya Pradesh and neighbourhood	
Do.	19th-20th	Southwest Rajasthan & adjoining Pakistan	Eastnorth-easterly	Northeast Rajasthan & neighbourhood	
(C) Cyclonic circulation					
Lower tropospheric levels	30 Dec even-3 Jan	North Bay & adjoining land areas of West Bengal & Bangladesh	Northerly	Bangladesh & neighbourhood	
Do.	19th-20th	Southwest Madhya Pradesh & neighbourhood	—	*In situ*	
Do.	21st-23rd even.	East central Arabian Sea off Maharashtra Gujarat coast	Easterly	North Madhya Maharashtra and neighbourhood	
Do.	22nd-23rd	Bangladesh & adjoining Assam & Meghalaya	Quasi-stationary	Assam & Meghalaya and neighbourhood	
Do.	29 Jan-1 Feb	Bangladesh & neighbourhood	—	*In situ*	

first spell of rainfall activity was between 2nd and 6th. During this period, rainfall occurred at a few places on two days and at one or two places on 3 days in Tamil Nadu. Between 28th and 30th of the month, coastal Andhra Pradesh and Tamil Nadu received rainfall at one or two places on 1 to 3 days. Kerala received rainfall on 2 days during the month. Rainfall was at many places on 26th and at one or two places on 27th. The number of rainy days over Andaman & Nicobar Islands, were 15 of which rainfall occurred at many places from 24th to 26th. Over Lakshadweep rainfall occurred at a few places on 18th and 19th.

4.2. *Rainfall*

Rainfall during the month was excess in plains of west Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Rajasthan and Gujarat, normal in east Uttar Pradesh, Konkan & Goa and Kerala and deficient in Andaman & Nicobar Islands, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Bihar plains, hills of west Uttar Pradesh, Jammu & Kashmir and Lakshadweep. It was scanty over the rest of the country outside Madhya Maharashtra, Marathwada, Vidarbha, Telangana, Rayalaseema and Karnataka, where the weather was dry.

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

2nd : Moga 8, Kapurthala, Kasauli & Zira 3 each
3rd : Tambaram & Tibri 3 each
4th : Karaikal 3
5th : Vedaranyam 9, Tissa 3
6th : Jogindernagar 9, Katra 8, Dharmsala 7, Batote & Poonch 6 each, Bhuntar AP, Chamba, Malikpur & Udhampur AP 5 each, Ganganagar 4
7th : Dalhousie 12, Jogindernagar 11, Joshimath 9, Baijanath 7, Batote & Chamba 6 each, Katra 5
8th : Joshimath 15, Mabari 14, Baheri, Jogindernagar & Kasauli 8 each, Sonepat 7, Chandigarh AP, Ambala, Dehradun & Tibri 5 each
9th : Sitapur 4, Tadong 3
10th : Pasighat 2
18th : Minicoy 2
19th : Minicoy 2
23rd : Kondul & Nancowry 2 each
24th : Kondul & Port Blair 2 each
25th : Car Nicobar 5, Port Blair 4
26th : Trivandrum 8, Mavelikare 3
29th : Vedaranyam 2
30th : Car Nicobar 2
31st : Car Nicobar 2

4.3. *Temperature*

Moderate to severe cold wave conditions prevailed on almost all the days between 9th and 28th over Bihar, plains of Uttar Pradesh, Haryana, Punjab and Jammu & Kashmir and on many days over Himachal Pradesh and west Rajasthan. Moderate to severe cold wave conditions also prevailed on 1 to 3 days between 11th and 14th over Assam & Meghalaya, West Bengal & Sikkim, Orissa, hills of west Uttar Pradesh, east Rajasthan, Madhya Pradesh and Saurashtra & Kutch and on 1 to 4 days between 21st and 25th over east Rajasthan and Madhya Pradesh. During the second fortnight, night temperatures were generally below normal in Nagaland, Manipur, Mizoram & Tripura, West Bengal & Sikkim, Orissa and Marathwada. Markedly above normal night temperatures were recorded on 1 to 4 days between 2nd and 7th in Nagaland, Manipur, Mizoram & Tripura, Haryana and Punjab and on a day each between 8th and 10th in Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Bihar plains and east Uttar Pradesh.

4.4. *Disastrous weather events and damages*

As per media reports, the cold wave that swept over north India claimed 104 lives in Bihar, 11 in Punjab, 16 in Himachal Pradesh, 12 in Gujarat and 2 in Jammu & Kashmir during the month. It was also reported that Lahul and Spiti area received 50 to 100 cm of snowfall during 4th to 8th, Kalpa 175 cm of snowfall between 6th and 7th and Dadra Kwar in Shimla district 300 cm of snowfall between 5th and 7th January.

5. February

5.1. *Weather and associated synoptic features*

The western disturbance of the previous month, moved away eastwards across Western Himalayas by 3 February, in addition six more western disturbances affected the extreme north India during the month. A trough in westerlies in the lower levels affected Assam & adjacent States between 2nd and 10th. Two troughs in the lower level easterlies moved westwards across extreme south Peninsula, one between 4th and 7th and the other between 17th and 19th of this month. The synoptic features of the month are listed in Table 2.

During the month, Himachal Pradesh and Jammu & Kashmir experienced three spells of snowfall. In the first spell between 5th and 6th, snowfall occurred almost at all the places in Jammu & Kashmir on 5th and at many places in Himachal Pradesh on 6th. During the second spell between 14th and 18th, snowfall occurred on 4 days in Himachal Pradesh and 2 days in Jammu & Kashmir. However, it occurred at many places on 17th over these sub-divisions. In the third spell the snowfall occurred at one or two places in Himachal Pradesh on 25th. Assam & adjacent States, Sub-Himalayan West Bengal & Sikkim, Uttar Pradesh, Haryana and Punjab received two spells of rainfall, one between 2nd and 7th and the other between 15th and 24th. During these periods rainfall occurred almost at all the places or at many places on 1 to 2 days in Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim, east Uttar Pradesh and hills of west Uttar Pradesh. The number of rainy days were 4 in Andaman & Nicobar Islands, 2 each in Gangetic West Bengal and Bihar plains and 1 each in east Rajasthan and Kerala. Mainly dry weather prevailed over Bihar plateau, Gujarat, Madhya Pradesh and the Peninsular India outside Kerala.

TABLE 2

Details of weather systems during February 1989

Weather systems	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
(A) Western disturbance					
Upper air system*	29 Jan-3 Feb even.	North Pakistan	Easterly	Moved away across Jammu & Kashmir and neighbourhood	*Last month's last western disturbance
Do.	4th-8th even.	North Pakistan and adjoining Jammu & Kashmir	Do.	Do.	
Do.	9th-12th	North Pakistan and Jammu & Kashmir	Eastnorth-easterly	Do.	
Do.	14th-15th	Do.	Easterly	Do.	
Do.	15th-19th evening	Jammu & Kashmir & adjoining north Pakistan	Do.	Do.	
Do.	20th-21st even.	Northeast Afghanistan & neighbourhood	Do.	Do.	
Do.	25th-28th	North Pakistan	Do.	Do.	
(B) Induced cyclonic/Low pressure area					
Lower tropospheric levels	5th-7th	Haryana and Punjab	Easterly	Haryana & adjoining west Uttar Pradesh	
Do.	9th-11th	Haryana & adjoining west Uttar Pradesh	Quasi-stationary	West Uttar Pradesh & neighbourhood	
Low pressure area	13th-14th even.	South Rajasthan & adjoining north Gujarat region	Do.	Southeast Rajasthan & neighbourhood	
Lower levels	16th-19th	Northwest Rajasthan & adjoining Pakistan	Easterly	Haryana	
Lower tropospheric levels	18th-19th	Northwest Madhya Pradesh & neighbourhood	Do.	East Uttar Pradesh and adjoining northeast Madhya Pradesh	The remnant as a trough become less marked over Assam & Meghalaya & adjoining Tripura on 20th
Low pressure area	24th-26th even.	West Rajasthan	Northeasterly	Associated circulation merged with the western disturbance of 25-28 Feb	
(C) Cyclonic circulation					
Lower tropospheric levels	7th-8th	North Sri Lanka & neighbourhood	Westerly	South Karnataka-Kerala coasts	
Do.	9th-11th	North Gujarat	Easterly	Northwest Madhya Pradesh & neighbourhood	
Do.	22nd-24th	Northeast Madhya Pradesh & adjoining Bihar plateau	Do.	Moved away across Assam & neighbourhood	

5.2. *Rainfall*

Rainfall during February was normal in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim and deficient in Arunachal Pradesh, Gangetic West Bengal, Bihar plains and Jammu & Kashmir. It was scanty over Andaman & Nicobar Islands, Orissa, Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Rajasthan and Kerala. Dry weather prevailed over the rest of the country.

Significant amounts (cm) of rainfall were :

5th : North Lakhimpur 5, Srinagar AP 3

6th : Verinag 7, Nalagarh 5, Batote, Chamba & Dharmsala 4 each, Kukernag & Quazigund 3 each

7th : Cherrapunji 11, Verinag 3

17th : Batote 4, Banihal & Katra 3 each

19th : Cherrapunji & Chipraman 5 each, Gauhati AP & Muzaffarpur 3 each

20th : Kailashahar 5, Dibrugarh AP, Gangtok & Silchar 3 each

23rd : Diamond Harbour 3

27th : Quazigund 4, Baderwah, Gulmarg, Kupwara & Srinagar 2 each

5.3. *Temperature*

Moderate to severe cold wave conditions prevailed on almost all the days in Punjab, Himachal Pradesh between 8th and 23rd and on 1 to 3 days in Sub-Himalayan West Bengal & Sikkim, east Uttar Pradesh, Haryana, Jammu & Kasmhir and Rajasthan between 7th and 13th. Moderate to severe cold wave conditions also prevailed on 1 to 5 days over Sub-Himalayan West Bengal & Sikkim, Orissa, Bihar, Uttar Pradesh, Haryana, Jammu & Kashmir, Rajasthan, east Madhya Pradesh, Saurashtra & Kutch, Madhya Maharashtra, Marathwada, Vidarbha and Telangana during the period from 18th to 25th of the month. Night temperatures were generally below or appreciably below normal in Rayalaseema, Tamil Nadu, coastal & south interior Karnataka and Kerala during the first fortnight of the month.

Markedly above night temperature prevailed over Nagaland, Manipur, Mizoram and Tripura from 5th to 8th and from 17th to 19th.

5.4. *Disastrous weather events and damages*

As per media reports cold wave claimed 2 lives in Haryana. Snowfall on 19th in Darjeeling disrupted conveyance and normal life in the area.