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# Weather in India

## HOT WEATHER SEASON (March – May 2001)*

### 1. Introduction

Pre-monsoon thundershower activity was above normal in most parts of north and central India in the month of May. Season's rainfall was *excess* in 20 meteorological sub-divisions (Andaman & Nicobar Islands, Gangetic West Bengal, Orissa, Jharkhand, Bihar, east Uttar Pradesh, west Uttar Pradesh, Uttaranchal, Haryana, Punjab, Himachal Pradesh, west Rajasthan, east Rajasthan, west Madhya Pradesh, east Madhya Pradesh & Chattisgarh, Saurashtra & Kutch, Vidarbha, coastal Andhra Pradesh, coastal Karnataka and Lakshadweep); *normal* in 7 meteorological sub-divisions (Sub-Himalayan West Bengal & Sikkim, Konkan & Goa, Telangana, Rayalaseema, Tamil Nadu, south interior Karnataka and Kerala); *deficient* in 7 meteorological sub-divisions (Arunachal Pradesh, Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Jammu & Kashmir, Gujarat region, Marathwada and north interior Karnataka) and *scanty* in 1 meteorological sub-division (Madhya Maharashtra). Actual rainfall and its departures for each month and season as a whole are given in Table 1 and sub-divisional rainfall departures for the season March-May 2001 are shown in Fig 2.

### 2. Chief features

(*i*) One very severe cyclonic storm formed over the Arabian Sea (21-29 May 2001)

(*ii*) *Severe heat wave*/*heat wave* conditions prevailed over some parts of the country during last week of April and during first fortnight of May 2001

(*iii*) Southwest monsoon advanced over Kerala and Lakshadweep on 23 May, 8 days earlier than normal date of 1 June.

(*iv*) Pre-monsoon thundershower activity was good over many parts of the country.

### 3. Significant features for different months

3.1. *March*

3.1.1. *Weather and associated synoptic features*

Details of weather systems formed during the month are given in Table 2.

Rain/snow occurred on either at *most places* or at *many places* on 3 to 5 days in Uttaranchal, Himachal Pradesh and Jammu & Kashmir. Rain/snow also occurred on either at a *few places* or at *isolated places* on 7 to 8 days in Himachal Pradesh and Jammu & Kashmir and on 3 days in Uttaranchal. Rain/thundershowers also occurred either at most places or at many places on 4 to 6 days in Arunachal Pradesh, Gangetic West Bengal and Orissa and on 1 to 3 days in Andaman & Nicobar Islands, Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Jharkhand, east Madhya Pradesh & Chattisgarh and Vidarbha. Rain/thundershowers also occurred either at a few places or at isolated places on 22 days in Orissa; 11 to 15 days in Andaman & Nicobar Islands, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Vidarbha, coastal Andhra Pradesh, Telangana and Tamil Nadu; on 6 to 10 days in Arunachal Pradesh, Nagaland-Manipur-Mizoram-Tripura, Jharkhand, Punjab, east Madhya Pradesh & Chattisgarh, Marathwada, south interior Karnataka and Kerala and on 1 to 5 days in Gangetic West Bengal, Bihar, east Uttar Pradesh, west Uttar Pradesh, Haryana, west Madhya Pradesh, Madhya Maharashtra and Rayalaseema. *Heavy rain* has occurred on 3 days each in Orissa and Himachal Pradesh.

3.1.2. *Rainfall distribution*

Month's rainfall was excess in 6 meteorological sub-divisions (Andaman & Nicobar Islands, Gangetic West Bengal, Orissa, Jharkhand, Vidarbha and Telangana); normal in 4 meteorological sub-divisions (Arunachal Pradesh, Uttaranchal, Himachal Pradesh and coastal Andhra Pradesh); deficient in 9 meteorological sub-divisions (Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, west Uttar Pradesh, Haryana, Punjab, Jammu & Kashmir, east Madhya Pradesh & Chattisgarh and Madhya Maharashtra) and scanty in 12 meteorological sub-divisions (Bihar, east Uttar Pradesh, west Rajasthan, east Rajasthan, west Madhya Pradesh, Marathwada, Rayalaseema, Tamil Nadu, coastal Karnataka, north interior Karnataka, south interior Karnataka and Kerala). There was no rain in 4 meteorological sub-divisions namely Gujarat region, Saurashtra & Kutch, Konkan & Goa and Lakshadweep. Principal amounts of rainfall are given in Table 5.

* *Compiled by* : V. Thapliyal, A. B. Mazumdar and V. Krishnan, Meteorological Office, Pune, India

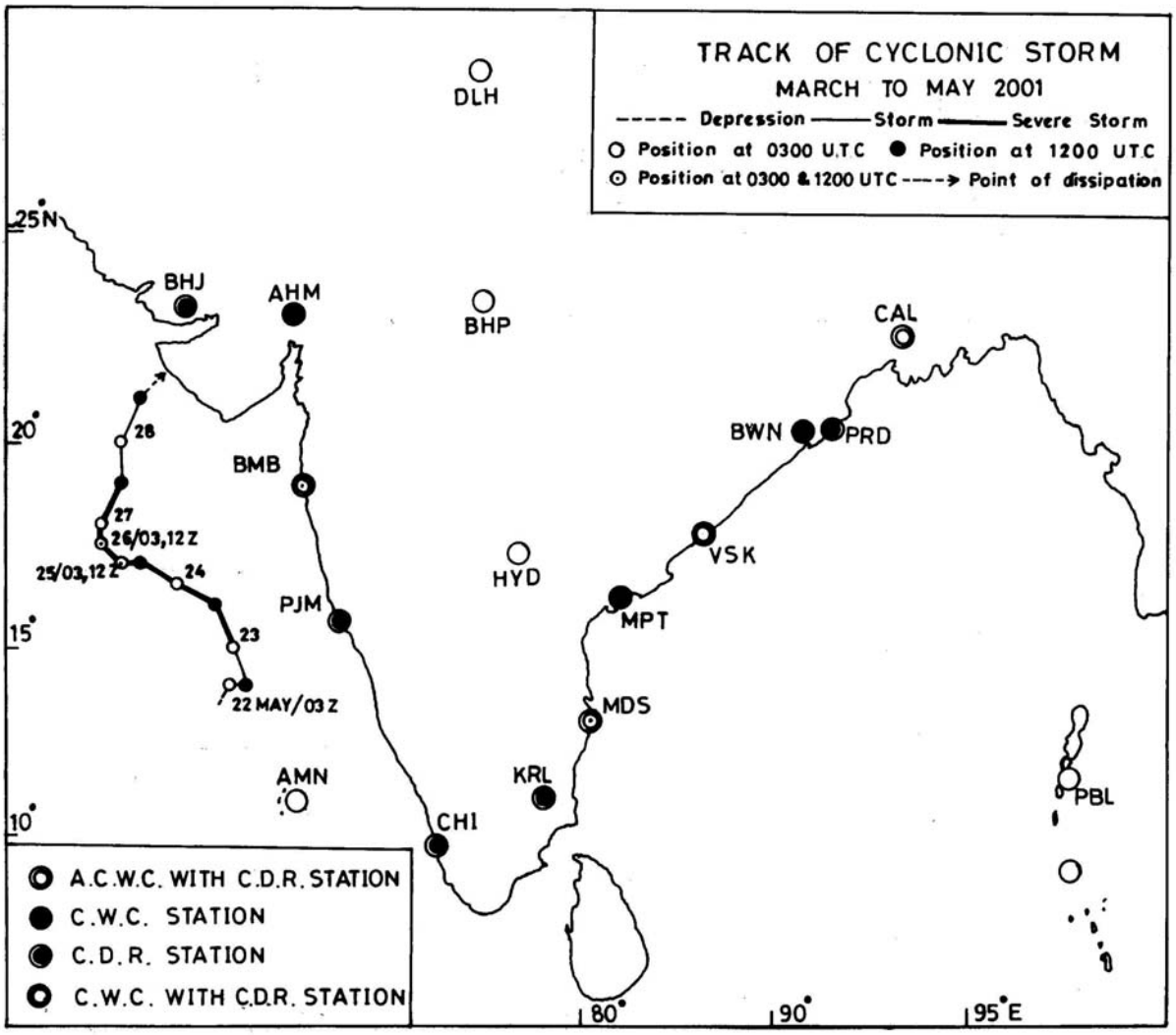


**Fig. 1.** Track of the cyclonic storm (March-May 2001)

3.1.3. *Temperature distribution*

Day temperatures were appreciably to markedly above normal on 17 to 20 days in Himachal Pradesh, Jammu & Kashmir and west Rajasthan; on 11 to 15 days in Assam & Meghalaya, east Rajasthan, east Madhya Pradesh & Chattisgarh, coastal Andhra Pradesh and Tamil Nadu; 6 to 10 days in Haryana, Punjab, west Madhya Pradesh, Saurashtra & Kutch, Rayalaseema and north interior Karnataka and on 1 to 5 days in Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Gangetic West Bengal, Orissa, Jharkhand, Bihar, east Uttar Pradesh, west Uttar Pradesh, Uttaranchal, Gujarat region, Madhya Maharashtra, Vidarbha, Telangana and coastal and south interior Karnataka. They were *appreciably* to *markedly below normal* on 3 to 4 days in Sub-Himalayan West Bengal & Sikkim, Orissa, Jharkhand, east Uttar Pradesh, Jammu & Kashmir, west Madhya Pradesh, east Madhya Pradesh & Chattisgarh, Gujarat region, Saurashtra & Kutch, Vidarbha and Telangana and on 1 to 2 days in Nagaland-Manipur-Mizoram-Tripura, Gangetic West Bengal, west Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, west Rajasthan, east Rajasthan, Madhya Maharashtra and south interior Karnataka. During the month, the highest temperature of 43° C was recorded at Vellore in Tamil Nadu on 26 and 27 March.

*Cold wave conditions* prevailed on 1 day each in Punjab and west Rajasthan. Night temperature were

**TABLE 1**

**Sub-divisionwise rainfall (mm) for each month and season as a whole (March-May 2001)**

| S. No | Meteorological sub–divisions | March | | | April | | | May | | | Season | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Actual (mm) | Normal (mm) | Dep. (%) | Actual (mm) | Normal (mm) | Dep. (%) | Actual (mm) | Normal (mm) | Dep. (%) | Actual (mm) | Normal (mm) | Dep. (%) |
| 1. | A & N Islands | 164 | 40 | 309 | 57 | 89 | -36 | 665 | 377 | 76 | 885 | 506 | 75 |
| 2. | Arunachal Pradesh | 85 | 101 | -16 | 184 | 207 | -11 | 201 | 299 | -33 | 471 | 607 | -22 |
| 3. | Assam & Meghalaya | 34 | 81 | -58 | 198 | 201 | -1 | 286 | 397 | -28 | 518 | 680 | -24 |
| 4. | Naga., Mani., Mizo. and Tri. | 45 | 76 | -41 | 87 | 148 | -41 | 241 | 248 | -3 | 373 | 472 | -21 |
| 5. | Sub-Himalayan West Bengal & Sikkim | 28 | 52 | -45 | 114 | 109 | 5 | 359 | 271 | 32 | 501 | 432 | 16 |
| 6. | Gangetic West Bengal | 38 | 27 | 38 | 49 | 44 | 13 | 158 | 104 | 52 | 245 | 175 | 40 |
| 7. | Orissa | 51 | 22 | 131 | 41 | 32 | 29 | 86 | 64 | 34 | 178 | 118 | 51 |
| 8. | Bihar Plateau | 26 | 19 | 38 | 18 | 21 | -15 | 93 | 51 | 81 | 136 | 91 | 50 |
| 9. | Bihar Plains | 1 | 11 | -96 | 8 | 14 | -47 | 119 | 43 | 173 | 127 | 69 | 84 |
| 10. | East Uttar Pradesh | 3 | 9 | -64 | 6 | 6 | -5 | 39 | 16 | 144 | 48 | 31 | 53 |
| 11. | Plains of west Uttar Pradesh | 5 | 13 | -58 | 17 | 6 | 171 | 40 | 11 | 255 | 62 | 31 | 104 |
| 12. | Hills of west Uttar Pradesh | 58 | 61 | -4 | 59 | 34 | 75 | 118 | 56 | 112 | 235 | 150 | 57 |
| 13. | Haryana, Chandigarh & Delhi | 11 | 14 | -20 | 25 | 7 | 281 | 63 | 12 | 430 | 98 | 32 | 208 |
| 14. | Punjab | 12 | 26 | -54 | 34 | 11 | 206 | 40 | 13 | 205 | 86 | 50 | 71 |
| 15. | Himachal Pradesh | 87 | 81 | 8 | 73 | 44 | 65 | 82 | 48 | 72 | 242 | 173 | 40 |
| 16. | Jammu & Kashmir | 58 | 141 | -59 | 72 | 97 | -26 | 51 | 72 | -28 | 181 | 310 | -41 |
| 17. | West Rajasthan | 0 | 5 | -99 | 11 | 3 | 355 | 35 | 7 | 381 | 46 | 15 | 216 |
| 18. | East Rajasthan | 1 | 5 | -90 | 12 | 2 | 474 | 44 | 9 | 402 | 56 | 16 | 246 |
| 19. | West Madhya Pradesh | 2 | 7 | -66 | 12 | 4 | 214 | 26 | 9 | 186 | 40 | 19 | 105 |
| 20. | East Madhya Pradesh | 12 | 17 | -30 | 24 | 12 | 94 | 27 | 17 | 62 | 63 | 46 | 36 |
| 21. | Gujarat region | 0 | 2 | - 100 | 1 | 1 | -27 | 7 | 7 | -7 | 8 | 10 | -25 |
| 22. | Saurashtra & Kutch | 0 | 4 | -100 | 1 | 1 | 1 | 15 | 4 | 296 | 16 | 9 | 88 |
| 23. | Konkan & Goa | 0 | 0 | - 100 | 1 | 5 | -77 | 42 | 42 | -1 | 43 | 48 | -11 |
| 24. | Madhya Maharashtra | 2 | 4 | -52 | 11 | 12 | -7 | 5 | 29 | -84 | 18 | 45 | -61 |
| 25. | Marathwada | 3 | 7 | -62 | 16 | 10 | 66 | 2 | 20 | -88 | 21 | 36 | -42 |
| 26. | Vidarbha | 25 | 15 | 69 | 33 | 12 | 177 | 12 | 13 | -6 | 70 | 40 | 77 |
| 27. | Coastal Andhra Pradesh | 14 | 12 | 10 | 63 | 25 | 155 | 45 | 57 | -20 | 123 | 94 | 30 |
| 28. | Telangana | 17 | 11 | 66 | 33 | 19 | 68 | 7 | 26 | -71 | 57 | 56 | 3 |
| 29. | Rayalaseema | 2 | 6 | -62 | 68 | 20 | 237 | 22 | 52 | -58 | 92 | 78 | 18 |
| 30. | Tamil Nadu | 3 | 21 | -83 | 84 | 50 | 68 | 37 | 71 | -48 | 124 | 141 | -12 |
| 31. | Coastal Karnataka | 0 | 5 | -99 | 94 | 33 | 187 | 209 | 152 | 38 | 303 | 189 | 60 |
| 32. | North interior Karnataka | 0 | 6 | -99 | 36 | 27 | 31 | 21 | 53 | -60 | 57 | 87 | -34 |
| 33. | South interior Karnataka | 2 | 8 | -68 | 117 | 45 | 161 | 64 | 102 | -37 | 184 | 154 | 19 |
| 34. | Kerala | 7 | 40 | -83 | 230 | 113 | 102 | 247 | 263 | -6 | 483 | 416 | 16 |
| 35. | Lakshadweep | 0 | 8 | -100 | 105 | 35 | 202 | 188 | 141 | 33 | 292 | 183 | 59 |

**TABLE 2**

**Details of the weather systems during March 2001**

| S. No. (1) | System (2) | Duration (3) | Place of first location (4) | Direction of movement (5) | Place of dissipation (6) | Remarks (7) |
|---|---|---|---|---|---|---|
| (**A**) | *Low pressure area* | | | | | |
| 1. | Well-marked low pressure area | 12 – 16 | North Andaman Sea | Quasi-stationary | Andaman Sea and neighbourhood | Associated cyclonic circulation extended upto mid tropospheric levels. It was first observed as a trough of low pressure area over Tenasserim coast and adjoining north Andaman Sea on 10 & 11. It lay as a low pressure area on 12 and became well-marked on 13 over the same region. The well-marked low pressure area again observed as a low pressure area on 15 and 16 |
| 2. | Low pressure area | 13 – 15 | Pakistan and adjoining parts of Punjab and Haryana | Northeasterly | Northeast Rajasthan and adjoining parts of Haryana | A trough from this system was running to north interior Karnataka |
| 3. | Well-marked low pressure area | 21 – 25 | Andaman Sea and neighbourhood | Stationary | *In situ* | Associated cyclonic circulation extended upto mid tropospheric levels The system lay as a trough over the same region from 26 to 30° C |
| (**B**) | *Western disturbances* | | | | | |
| 1. | As an upper air system | 2 – 8 | Western parts of Pakistan | Northeasterly | Jammu & Kashmir and neighbourhood | Moved away northeastwards |
| 2. | Do | 21 – 25 | Central Pakistan and neighbourhood | Northeasterly | Pakistan and adjoining Jammu & Kashmir | Do |
| 3. | As a low pressure area | 28 Mar -4 Apr | North Pakistan and adjoining Punjab | Eastsouth-easterly | Orissa and neighbourhood | Associated cyclonic circulation extended upto mid tropospheric levels from 28 Mar to 1 April. A trough from this system to south Tamil Nadu in the lower levels was observed on 30 & 31. The low pressure area lay as a cyclonic circulation over south Uttar Pradesh and adjoining east Madhya Pradesh & Chattisgarh from 31 March to 4 April |
| 4. | As an upper air system | 30 Mar - 3 Apr | Northwest Rajasthan and neighbourhood | Eastnorth-easterly | Uttaranchal | Moved away eastnortheastwards |
| 5. | Do | 31 Mar - 1 Apr | Pakistan and neighbourhood | Northeasterly | Haryana and neighbourhood | Moved away eastnortheastwards |
| (**C**) | *Induced cyclonic circulations* | | | | | |
| (1) | Lower tropospheric levels | 6 – 8 | Southwest Rajasthan and neighbourhood | Stationary | *In situ* | |
| (**D**) | *Other cyclonic circulations* | | | | | |
| 1. | Lower tropospheric levels | 2 – 3 | Orissa and adjoining parts of Chattisgarh | Stationary | *In situ* | |
| 2. | Mid tropospheric levels | 4 – 6 | North Madhya Maharashtra and adjoining Konkan | Northeasterly | Southern parts of west Madhya Pradesh and adjoining parts of Vidarbha | |

**TABLE 2 (*Contd*.)**

| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|
| 3. | Mid tropospheric levels | 4 – 5 | Haryana and adjoining Uttaranchal | Northeasterly | Moved away northeastwards | |
| 4. | Lower levels | 5 – 7 | Orissa and neighbourhood | Stationary | *In situ* | |
| 5. | Lower tropospheric levels | 9 – 14 | North Madhya Maharashtra and neighbourhood | Westnorth-westerly | North Konkan and adjoining south Gujarat state | A trough from this system ran to Kerala on 9 and to east Madhya Pradesh & Chattisgarh from 10 to 12 and became less marked on 13 |
| 6. | Lower tropospheric levels | 12 – 13 | Central Pakistan and adjoining Rajasthan, Punjab and Jammu & Kashmir | Stationary | *In situ* | |
| 7. | Do | 15 – 16 | Southwest Rajasthan and adjoining Pakistan | Do | Do | |
| 8. | Do | 16 – 20 | West Vidarbha and neighbourhood | Northeasterly | Chattisgarh and adjoining Orissa | A trough from this system to south Tamil Nadu coast was observed in the lower levels from 16 to 18 and merged with trough from cyclonic circulation (10) to south interior Karnataka on 19 |
| 9. | Do | 17 – 22 | North Pakistan and neighbourhood | Do | Jammu & Kashmir | Moved away northeastwards |
| 10. | Lower levels | 19 – 23 | Southwest Rajasthan and neighbourhood | Eastnorth-easterly | Haryana and adjoining parts of Uttaranchal | Moved away eastnortheastwards across Uttaranchal |
| 11. | Do | 21 – 30 | Northwest Madhya Pradesh and neighbourhood | Southeasterly | Chattisgarh and adjoining parts of Vidarbha | A trough from this system to south Kerala coast was observed in the lower levels from 21 to 28. The cyclonic circulation and the trough merged with the cyclonic circulation associated with the western disturbance as a low pressure area over the same region |
| 12. | Do | 25 – 27 | Southwest Rajasthan and neighbourhood | Eastnorth-easterly | Central parts of Rajasthan | |
| 13. | Do | 28 Mar - 15 Apr | North Bangladesh and neighbourhood | Quasi-stationary | Gangetic West Bengal and adjoining Bangladesh | |
| | | | | (**E**) *Troughs in westerlies* | | |
| 1. | Mid tropospheric levels | 11 – 12 | Sub-Himalayan West Bengal & Sikkim and neighbourhood | Stationary | *In situ* | |
| 2. | Mid and upper troposphere | 29 Mar - 1 Apr | Long. 66° E, north of Lat. 20° N | Easterly | Long. 75° E, north of Lat. 20° N | |
| (**F**) *Other troughs* | | | | | | |
| 1. | Lower levels | 1 – 9 | Southern parts of Chattisgarh to north Madhya Maharashtra and thence southwards to south Kerala | Quasi-stationary | Southwest Madhya Pradesh to Kerala coast | |
| 2. | Lower levels | 16 – 19 | South Andaman Sea and neighbourhood | Stationary | *In situ* | |

**TABLE 3**

**Details of the weather systems during April 2001**

| S. No. (1) | System (2) | Duration (3) | Place of first location (4) | Direction of Movement (5) | Place of Dissipation (6) | Remarks (7) |
|---|---|---|---|---|---|---|
| (**A**) | *Western disturbances* | | | | | |
| 1. | As an upper air system | 3 – 7 | Northwest Rajasthan and adjoining parts of Pakistan | Eastnorth-easterly | Haryana and adjoining parts of west Uttar Pradesh | Moved away eastnortheastwards |
| 2. | Do | 19 – 23 | Pakistan and neighbourhood | Do | Jammu & Kashmir and neighbourhood | Do |
| 3. | Do | 23 – 27 | North Pakistan and neighbourhood | Do | Do | Do |
| 4. | Do | 28 Apr - 1 May | North Pakistan and neighbourhood | Do | Do | Do |
| (**B**) | *Induced cyclonic circulations* | | | | | |
| 1. | Lower tropospheric levels | 24 – 25 | Northwest Rajasthan and neighbourhood | Stationary | *In situ* | |
| (**C**) | *Cyclonic circulations* | | | | | |
| 1. | Lower tropospheric levels | 7 – 9 | South Tamil Nadu coast and neighbourhood | Westerly | South Tamil Nadu and adjoining parts of Kerala | A trough from this system to south Madhya Maharashtra was observed on 7 and to interior Karnataka on 8. It became less marked on 9 |
| 2. | Do | 7 – 11 | Southwest Rajasthan and neighbourhood | Northeasterly | Himachal Pradesh | Moved away across Himachal Pradesh |
| 3. | Lower levels | 9 – 17 | Southwest Bay off Sri Lanka coast | Northwesterly | Lakshadweep area and neighbourhood | A trough in the easterly from this system to Rayalaseema was observed on 10; to south Maharashtra from 11 to 14; to west Vidarbha from 11 to 15 and to Marathwada on 16. It became less marked on 17 |
| 4. | Mid tropospheric levels | 11 – 17 | West Rajasthan and adjoining parts of Pakistan | Easterly | Central parts of Uttar Pradesh | |
| 5. | Do | 13 – 18 | Northwest Rajasthan and adjoining parts of Pakistan | Do | West Uttar Pradesh and adjoining parts of Haryana | A trough from this system to Tamil Nadu across Vidarbha in the lower levels was observed on 17 and became less marked on 18 |
| 6. | Lower tropospheric levels | 18 – 21 | Rajasthan and neighbourhood | Northeasterly | Northern parts of Haryana and neighbourhood | |
| 7. | Do | 19 – 23 | West Madhya Pradesh and neighbourhood | Southeasterly | East Vidarbha and neighbourhood | A trough from this system to south Tamil Nadu was observed from 19 to 22; from southwest Madhya Pradesh to south Kerala on 23; from west Madhya Pradesh to Lakshadweep on 24; from west Madhya Pradesh to south interior Karnataka on 25 and from east Madhya Pradesh & Chattisgarh to north interior Karnataka on 26 |
| 8. | Lower levels | 20 – 26 | North Bangladesh and neighbourhood | Stationary | *In situ* | |
| 9. | Do | 24 – 28 | South coastal Tamil Nadu and neighbourhood | Quasi-stationary | Commorin area and neighbourhood | |

**TABLE 3** (***Contd***.)

| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|
| 10. | Lower levels | 28 Apr - 1 May | Jharkhand and neighbourhood | Stationary | *In situ* | A trough from this system to Assam in the lower levels was observed from 28 to 30 |
| 11. | Lower tropospheric levels | 30 Apr - 3 May | South Tamil Nadu and neighbourhood | Do | Do | |
| (**D**) | *Troughs in the westerlies* | | | | | |
| 1. | Mid and upper troposphere | 3 – 5 | Long. 70° E, north of Lat. 20° N | Stationary | *In situ* | |
| 2. | Lower levels | 6 – 11 | East Uttar Pradesh to Vidarbha | Northeasterly | Bihar to Chattisgarh | Merged with trough in westerly (3) |
| 3. | Lower tropospheric levels | 9 – 11 | Bihar to south Tamil Nadu across Telangana | Quasi-Stationary | Bihar to southeast Madhya Pradesh & Chattisgarh | |
| 4. | Mid and upper troposphere | 13 – 19 | Long. 69° E, north of Lat. 20° N | Eastsouth-easterly | Long. 80° E, north of Lat. 18° N | |
| 5. | Lower tropospheric levels | 27 Apr - 3 May | South Madhya Pradesh & Chattisgarh to south Tamil Nadu | Quasi-Stationary | South Uttar Pradesh to south Tamil Nadu | |
| (**E**) | *Troughs in easterlies* | | | | | |
| 1. | Lower levels | 3 – 6 | South Tamil Nadu to north Madhya Maharashtra | Northwesterly | South Tamil Nadu to Telangana | |
| (**F**) | *Other troughs* | | | | | |
| 1. | Lower tropospheric levels | 16 – 17 | South Tamil Nadu to Telangana | Stationary | *In situ* | |
| 2. | Lower levels | 16 – 17 | Southwest Bay off Sri Lanka coast | Do | Do | |
| 3. | Do | 18 – 19 | West Madhya Pradesh to south Tamil Nadu across interior Karnataka | Do | Do | |
| 4. | Lower tropospheric levels | 26 – 28 | Jharkhand to Arunachal Pradesh | Do | Do | |
| 5. | Lower levels | 27 – 30 | Andaman Sea and neighbourhood | Westerly | Southwest Bay and neighbourhood | Merged with the trough in westerly (5) |
| 6. | Lower tropospheric levels | 27 eve - 28 | Southwest Bay off Sri Lanka coast | Do | South Tamil Nadu and neighbourhood | Merged with trough in westerly (5) |
| 7. | Mid tropospheric levels | 28 Apr - 1 May | Sub-Himalayan West Bengal & Sikkim to north Bay | Stationary | *In situ* | |

**TABLE 4**

**Details of the weather systems during May 2001**

| S. No. (1) | System (2) | Duration (3) | Place of first location (4) | Direction of Movement (5) | Place of Dissipation (6) | Remarks (7) |
|---|---|---|---|---|---|---|
| (**A**) | *Cyclonic storm* | | | | | |
| 1. | Very severe cyclonic storm | 21 – 29 | East-central Arabian Sea | Initially easterly, northwesterly, northerly and finally northeasterly | Northeast and adjoining parts of east-central Arabian Sea | A low pressure area formed over southern parts of central Arabian Sea on 21 May and became well-marked in the same evening over east-central Arabian Sea. It concentrated into a depression in the night of 21 near Lat.13.5° N/ Long.70.0° E and into a deep depression in the early morning of 22. At 0300 UTC of 22, it intensified into a cyclonic storm and lay centred near Lat. 14.0° N/ Long. 71.0° E, about 350 km westsouthwest of Panjim. It moved slightly eastwards and further intensified into a severe cyclonic storm at 1800 UTC of 22 and into a very severe cyclonic storm at 0000 UTC of 23. It moved in a northwesterly direction and lay centred near Lat. 15.0° N/ Long. 71.0° E at 0300 UTC of 23, about 350 km southwest of Ratnagiri. Moving in a northwesterly direction for some time it weakened into a severe cyclonic storm at 0300 UTC of 26 and lay centred near Lat. 17.5° N/ Long 67.5° E, about 500 kms southsouthwest of Porbandar. It remained almost stationary until 1200 UTC of 26. Thereafter, moving in a northerly to northeasterly direction, it weakened into a cyclonic storm at 1200 UTC of 27 and at 0300 UTC of 28 lay centred near Lat. 20.0° N/ Long. 68.0° E, about 250 km southwest of Porbandar. Further, it moved in a northerly to northeasterly direction and weakened into a depression at 2100 UTC of 28 and into a well-marked low pressure area at 0300 UTC of 29 over northeast and adjoining parts of east-central Arabian Sea. As it didn't cross the coast and dissipated over the sea, no damage was caused over the Indian coast |
| (**B**) | *Trough of low pressure area* | | | | | |
| 1. | Trough of low pressure area | 1 – 3 | North Andaman Sea off Tenasserim coast | Stationary | *In situ* | |
| (**C**) | *Cyclonic circulations* | | | | | |
| 1. | Lower levels | 1 – 3 | North Rajasthan and adjoining areas of Punjab and Haryana | Northeasterly | Haryana | |
| 2. | Lower tropospheric levels | 1 – 4 | North Madhya Pradesh and Chattisgarh and adjoining south Uttar Pradesh | Quasi-stationary | North Madhya Pradesh and adjoining west Uttar Pradesh | A trough from this system extended eastwards roughly along Lat. 25° N upto Nagaland on 1 & 2 and became less marked on 3 |
| 3. | Do | 3 – 5 | Jharkhand and adjoining Bihar and Gangetic West Bengal | Easterly | Gangetic West Bengal | |
| 4. | Do | 4 – 6 | Punjab and neighbourhood | Northeasterly | Jammu & Kashmir and neighbourhood | Moved away northeastwards |

**TABLE 4** (***Contd***.)

| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|
| 5. | Mid tropospheric levels | 4 – 8 | Southeast Arabian Sea and adjoining areas | Quasi-stationary | South Arabian Sea | |
| 6. | Lower tropospheric levels | 7 – 13 | Northwest Rajasthan and adjoining areas | Northeasterly | Himachal Pradesh and neighbourhood | |
| 7. | Do | 12 – 21 | North Pakistan and adjoining areas of Jammu & Kashmir | Northeasterly | West Uttar Pradesh and neighbourhood | A trough from this system was observed on 18 to coastal Karnataka; on 19 & 20 to Konkan & Goa; from west Uttar Pradesh to Konkan & Goa on 21 & 22 and from north Madhya Maharashtra to west Madhya Pradesh on 23. It became less marked on 24 |
| 8. | Mid tropospheric levels | 14 – 17 | South Pakistan and adjoining areas of Gujarat and southwest Rajasthan | Stationary | *In situ* | |
| 9. | Lower tropospheric levels | 18 – 24 | South Pakistan and adjoining areas of west Rajasthan | Do | *In situ* | |
| 10. | Do | 22 – 25 | North Pakistan and adjoining Jammu & Kashmir and Punjab | Northeasterly | Himachal Pradesh and neighbourhood | Moved away northeastwards |
| 11. | Do | 25 – 29 | North Pakistan and adjoining Punjab and Jammu & Kashmir | Northeasterly | Haryana and Chandigarh | Moved away across Himachal Pradesh |
| 12. | Mid tropospheric levels | 27 – 28 | West-central Bay | Stationary | *In situ* | Became unimportant |
| 13. | Do | 28 May - 13 June | North Pakistan and adjoining areas of Jammu & Kashmir | Southeasterly | North Rajasthan and adjoining areas of Haryana and west Uttar Pradesh | |
| (**D**) | *Troughs* | | | | | |
| 1. | Lower levels | 4 May onwards | West Uttar Pradesh to Tamil Nadu through Chattisgarh and Telangana | Quasi-Stationary | | It persisted almost over the same region till 8 June and then observed from Punjab to coastal Andhra Pradesh through west Uttar Pradesh north Madhya Pradesh and Orissa and thereafter remained as a seasonal trough from 10 June.<br>An embedded cyclonic circulation in mid tropospheric levels over coastal Andhra Pradesh and adjoining areas of west-central Bay was observed on 17 and 18 |
| 2. | Lower levels | 4 – 23 | North Rajasthan to Tripura through west Uttar Pradesh and Bihar | Quasi-Stationary | Punjab to Assam & Meghalaya | An embedded cyclonic circulation was observed over Orissa and neighbourhood on 13. It became less marked on 16 |
| 3. | Do | 8 – 14 | Southeast Bay | Westerly | Southwest Bay | |
| 4. | Do | 13 – 20 | Andaman Sea off Tenasserim coast | Do | North coastal Andhra Pradesh to Commorin area off Tamil Nadu-Andhra Pradesh coast | |
| 5. | Lower levels | 25 May - 6 June | East Uttar Pradesh to Tripura, roughly along Lat. 25° N | Quasi-Stationary | East Uttar Pradesh to Tripura | It was observed from east Uttar Pradesh to central Bay on 28 May; from Punjab to Nagaland on 31, east Uttar Pradesh to Nagaland on 1 June and from west Uttar Pradesh to Nagaland from 2 to 5 June.<br>An embedded cyclonic circulation at lower tropospheric levels was observed over west Uttar Pradesh from 2 to 5 June. It became less marked on 6 |

*appreciably* to *markedly below normal* on 6 to 8 days in Bihar, east Uttar Pradesh and Gujarat region; 3 to 5 days in Nagaland-Manipur-Mizoram-Tripura, Orissa, Jharkhand, west Uttar Pradesh, Haryana, Punjab, west Madhya Pradesh, Saurashtra & Kutch, Konkan & Goa, Madhya Maharashtra and north interior Karnataka and on 1 to 2 days in Gangetic West Bengal, Uttaranchal, Himachal Pradesh, Jammu & Kashmir, west Rajasthan, east Rajasthan, east Madhya Pradesh & Chattisgarh, Vidarbha, coastal Andhra Pradesh, Telangana, Tamil Nadu and south interior Karnataka. They were appreciably to markedly above normal on 13 to 17 days in west Rajasthan, east Rajasthan, west Madhya Pradesh, east Madhya Pradesh & Chattisgarh, Gujarat region and Saurashtra & Kutch; 8 to 11 days in Jammu & Kashmir, Madhya Maharashtra, Marathwada, Vidarbha, coastal Andhra Pradesh, Rayalaseema and Tamil Nadu, on 4 to 7 days in Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Gangetic West Bengal, east Uttar Pradesh, west Uttar Pradesh, Haryana, Himachal Pradesh and Telangana and on 1 to 3 days in Orissa, Jharkhand, Bihar, Uttaranchal, Punjab, north interior Karnataka, south interior Karnataka and Kerala. During the season, the lowest temperature of 4.6° C was recorded at Adampur in Punjab on 1 March.

### 3.2. *April*

#### 3.2.1. *Weather and associated synoptic features*

Details of weather systems formed during the month are given in Table 3.

Rain/thundershowers have occurred either at most places or at many places on 15 days in Arunachal Pradesh; 6 to 10 days in Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Jammu & Kashmir and Kerala and on 1 to 5 days in Andaman & Nicobar Islands, Gangetic West Bengal, Orissa, west Uttar Pradesh, Uttaranchal, Haryana, Punjab, Himachal Pradesh, east Rajasthan, east Madhya Pradesh & Chattisgarh, Marathwada, Vidarbha, coastal Andhra Pradesh, Telangana, Rayalaseema, Tamil Nadu, coastal Karnataka, south interior Karnataka and Lakshadweep. *Very heavy rainfall* occurred on 3 days in Tamil Nadu and on 1 day each in Sub-Himalayan West Bengal & Sikkim, south interior Karnataka and Kerala. Heavy rainfall also occurred on 4 to 9 days in Assam & Meghalaya, coastal Andhra Pradesh, Tamil Nadu, south interior Karnataka and Kerala and on 1 to 3 days in Andaman & Nicobar Islands, Arunachal Pradesh, Sub-Himalayan West Bengal & Sikkim, Gangetic West Bengal, Orissa, Himachal Pradesh, Telangana, coastal Karnataka, north interior Karnataka and Lakshadweep.

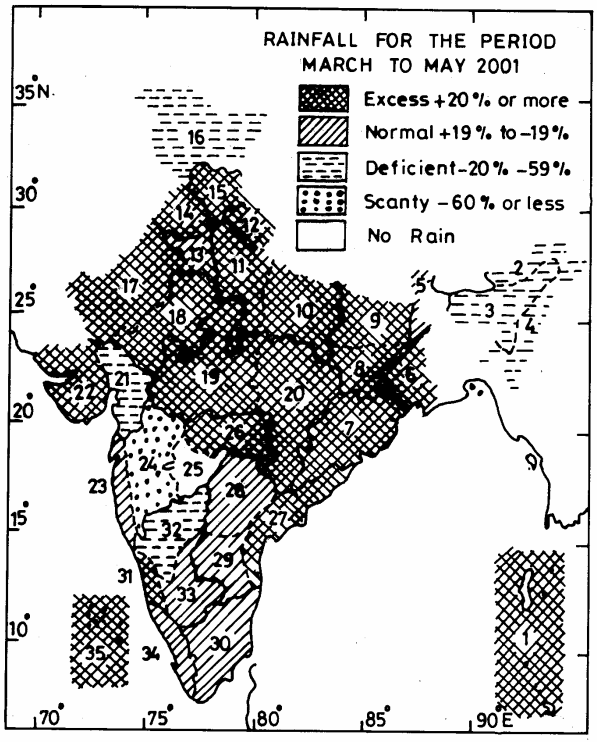


**Fig. 2.** Rainfall percentage departures from normal for the period 1 March-31 May 2001

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1** | 75 | **8** | 50 | **15** | 40 | **22** | 88 | **29** | 18 |
| **2** | –22 | **9** | 84 | **16** | –41 | **23** | –11 | **30** | –12 |
| **3** | –24 | **10** | 53 | **17** | 218 | **24** | –61 | **31** | 60 |
| **4** | 21 | **11** | 104 | **18** | 246 | **25** | –42 | **32** | –34 |
| **5** | 16 | **12** | 57 | **19** | 105 | **26** | 77 | **33** | 19 |
| **6** | 40 | **13** | 208 | **20** | 36 | **27** | 30 | **34** | 16 |
| **7** | 51 | **14** | 71 | **21** | –25 | **28** | 3 | **35** | 59 |

#### 3.2.2. *Rainfall distribution*

Rainfall was excess in 21 meteorological sub-divisions (Orissa, west Uttar Pradesh, Uttaranchal, Haryana, Punjab, Himachal Pradesh, west Rajasthan, east Rajasthan, west Madhya Pradesh, east Madhya Pradesh & Chattisgarh, Marathwada, Vidarbha, coastal Andhra Pradesh, Telangana, Rayalaseema, Tamil Nadu, coastal Karnataka, north interior Karnataka, south interior Karnataka, Kerala and Lakshadweep); normal in 8 meteorological sub-divisions (Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Gangetic West Bengal, Jharkhand, east Uttar Pradesh, Saurashtra & Kutch and Madhya Maharashtra); deficient in 5 meteorological sub-divisions (Andaman & Nicobar Islands, Nagaland-Manipur-Mizoram-Tripura, Bihar, Jammu & Kashmir and Gujarat region) and scanty in 1 meteorological sub-division (Konkan & Goa). The principal amounts of rainfall (cm) are given in Table 5.

**TABLE 5**

**Principal amounts of rainfall (1 cm and above)**
**(March, April and May 2001)**

| Date (1) | March (2) | April (3) | May (4) |
|---|---|---|---|
| 1. | Jamshedpur 2, Kolkata, Midnapore & Ranchi 1 each | Berhampur 19, Gudari & Mahendragarh 6 each, Baripada 4, Jalpaiguri 2, Siliguri, Cooch Behar, Shimla, Jagdalpur & Punalur 1 each | Kondul 8, Thiruvananthapuram 7, Guwahati & Agartala 3 each, Tezpur, Darjeeling, Cooch Behar & Kanyakumari 2 each, Jalpaiguri, Krishnanagar & Kottayam 1 each |
| 2. | Digha & Jharsuguda 1 each | Guwahati 3, Gunupur & Kothagudam 2 each, Agartala, Midnapore & Magra 1 each | Thiruvananthapuram 7, Minicoy 3, Port Blair, Car Nicobar, Agartala, Darjeeling, Pahalgam, Palayamkottai & Punalur 2 each, New Delhi, Rewari, Srinagar & Quazi Gund 1 each |
| 3. | Akola 3 | Car Nicobar & Rajghat 4 each, Cuttack 2, Kolkata, Batote, Pahalgam, Gadag & Chitradurga 1 each | Malda 6, Paradip 3, Midnapore, Banihal & Jagdalpur 2 each, Port Blair, Jamshedpur, Punalur & Minicoy 1 each |
| 4. | Keonjhargarh 3, Jharsuguda 2 | Mahendragarh 3, Yeotmal 2, Banihal, Quazigund & Nagpur 1 each | Agartala 11, Baghdogra 6, Raichur 4, Port Blair, Diamond Harbour & Bangalore 3 each, Mukteswar, Kukernag & Tirupati 2 each, Car Nicobar, Guwahati, Tezpur, Kohima, Imphal, Gangtok, Patna, Dehra Dun & Ambala 1 each |
| 5. | Raipur & Nagpur 1 each | Tuticorin & Cherthala 2 each, Surada, Sholapur, Parbhani, Nanded, Osmanabad, Kottayam & Alapuzha 1 each | Jalpaiguri 10, Balasore & Ranchi 4 each, Kondul & Dibrugarh 3 each, Tezpur, Cooch Behar, Gangtok & Raipur 2 each, Shillong, Agartala, Tuni & Bangalore 1 each |
| 6. | Gopalpur 1 | Punalur & Kottayam 3 each, Kodaikanal 2, Nanded, Tuticorin, Palayamkottai & Thiruvananthapuram 1 each | Baghdogra 15, Port Blair, Paradip & Krishnagiri 7 each, Agartala, Kolkata & Krishnanagar 6 each, Darjeeling 4, Jalpaiguri 3, Guwahati, Gangtok & Ranchi 2 each, Hut Bay, Tezpur & Balasore 1 each |
| 7. | Nil | Kochi, Kottayam & Alapuzha 6 each, Kanyakumari 5, Midnapore, Jaipur, Baripada, Tuticorin, Palayamkottai & Minicoy 1 each | Parangipettai 8, Adirampattinam 6, Hut Bay 5, Kondul 4, Port Blair, Tezpur, Kochi & Thiruvananthapuram 3 each, Gangtok & Panambur 1 each |
| 8. | Kondul 1 | Jaleswar 8, Rajghat & Pamban 3 each, Balasore & Minicoy 2 each, Jaipur, Mahabaleshwar & Palayamkottai 1 each | Thiruvananthapuram 9, Agartala 5, Krishnanagar 4, Kondul, Port Blair & Dibrugarh 3 each, Malda, Pantanagar, Thanesar, Barsar & Kathua 2 each, Imphal, Amritsar & Mangalore 1 each |
| 9. | Bhubaneswar & Bramhapuri 2 each | Perinthalmanna 9, Mangalore 4, Kochi 3, Panambur & Punalur 2 each, Passighat & North Lakhimpur 1 each | Hut Bay 6, Balasore 5, Port Blair & Shillong 4 each, Kolkata & Kochi 3 each, Diamond Harbour 2, Cuttack, Bahraich & Minicoy 1 each |
| 10. | Kondul 6 | Kozha 5, Dibrugarh 3, North Lakhimpur, Satara & Kolhapur 2 each, Tadong, Belgaum & Kodaikanal 1 each | Maya Bandar 11, Imphal 6, North Lakhimpur 5, Nancowry 4, Shillong 3, Tezpur, Guwahati, Dibrugarh & Alapuzha 2 each, Agartala, Diamond Harbour, Punalur & Amini Divi 1 each |
| 11. | Maya Bandar 5, Malegaon 2 | Punalur 7, Palayamkottai & Alapuzha 5 each, Thiruvananthapuram 4, Kashinagar & Kodaikanal 3 each, Kupwara, Satara, Honavar & Tuticorin 2 each, Dibrugarh, Jaleswar, Gadag, Mysore, Madurai, Chennai & Kanyakumari 1 each | Agartala 4, Imphal & Berhampore 2 each, Gangtok, Malda, Darjeeling & Krishnanagar 1 each |
| 12. | Hut Bay & Port Blair 1 each | Minicoy 10, Pamban 9, Uthagamandalam & Gadag 6 each, Kodaikanal 4, Tondi, Madurai, Chennai, Cuddalore, Palayamkottai, Mandya & Cannanore 3 each, Thiruvananthapuram & Kozhikode 2 each, Kohima, Gangtok, Mangalore, Kochi & Alapuzha 1 each | Maya Bandar 5, Nancowry 3, Car Nicobar & Kochi 2 each, Guwahati, Imphal & Dharampur 1 each |

**TABLE 5** (***Contd***.)

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| 13. | Maya Bandar 5, Hut Bay & Amraoti 2 each | Kozhikode & Karipur 24 each, Kochi 17 & Darsi Bhagamandala 13 each, Alapuzha 7, Uthagamandalam & Kodaikanal 4 each, Machilipatnam, Anantpur, Cuddalore, Nandyal & Ramgundam 3 each, Cooch Behar, Jagdalpur, Gannavaram, Nellore, Chennai & Minicoy 2 each, Digha, Batote, Ongole, Hyderabad, Honavar & Karwar 1 each | Maya Bandar 8, Port Blair & Salem 7 each, Karaikal 5, Munnar 4, Cuddalore 3 |
| 14. | Hyderabad 4, Kupwara 3, Solan, Kalpa, Dhundi & Pusad 2 each, Bhuntar 1 | Cooch Behar 19, Munnar 8, Baptla 7, Cuddapah, Kochi, Kottayam & Alapuzha 6 each, Kanyakumari, Vellore & Tambaram 5 each, Baghdogra, Shimla, Machilipatnam, Ongole & Thiruvananthapuram 4 each, Gangtok, Chennai & Tirupathi 3 each, Batote & Mahabaleshwar 2 each, Shillong, Imphal, Guwahati, Midnapur, Dehra Dun, Berthin, Banihal, Quazigund, Solapur, Minicoy & Gadag 1 each | Port Blair 9, Mukteswar 4, Maya Bandar, Keonjhargarh & Kalingapatnam 3 each, Car Nicobar & Visakhapatnam 2 each, Gopalpur, Pantanagar & Akola 1 each |
| 15. | Hut Bay 4, Bangana 3, Banihal 2, Maya Bandar, Dehragopipur & Batote 1 each | Gangtok, Srinagar & Jharsuguda 2 each, Bhuntar & Rampur Bushar 1 each | Dadaipur 9, Maya Bandar 8, Gorakhpur & Guler 7 each, Darjeeling & Kalimpong 6 each, Port Blair 4, Batote, Yeotmal & Nagpur 2 each, Puthimari, Gangtok, Shimla & Banihal 1 each |
| 16. | Nil | Berhampore 3, Gangtok 2, Krishnanagar, Hardoi & Nadaun 1 each | Hut Bay 11, Car Nicobar 7, Port Blair, Maya Bandar, Namsai & Dehra Dun 4 each, Bareilly, Pantanagar & Bangana 3 each, North Lakhimpur, Chouldhowaghat & Ambala 2 each, Passighat, Bokajan, Bahraich, Lucknow, Bhuntar & Churu 1 each |
| 17. | Nil | Bramhapuri 5, North Lakhimpur, New Delhi, Ludhiana, Dharampur & Chandrapur 3 each, Midnapore, Mukteswar, Jagron & Batote 2 each, Dibrugarh, Guwahati, Imphal, Kolkata, Patna, Agra, Ambala, Amritsar, Patiala, Banihal, Sawai Madhopur, Gwalior & Nagpur 1 each | Kakinada 11, Bhubaneswar 6, Malda, Jhajjar & Satna 5 each, Margherita, Dhubri, Cooch Behar, Varanasi, Kalpi & Etah 4 each, Gwalior & Visakhapatnam 3 each, Ambala, Patiala, Mathura, Mainpuri, Aligarh, Almorah & Mukteswar 2 each, Port Blair, Jalpaiguri, Gangtok, Bankura, Ludhiana, Kangra & Lucknow 1 each |
| 18. | Nancowry 1 | Machilipatnam 11, Canning Town & Bangalore 8 each, Baijnath & Una 7 each, Narwana 6, Digha & Kangra 5 each, Dehra Dun & Balachour 4 each, Balasore, Batote, Katra, Kakinada, Dharamapuri & Chickmagalur 3 each, Jharsuguda, Varanasi, Gohana, Udaipur, Banihal, Nangal, Keonjhargarh, Sagar & Satna 2 each, Dibrugarh, Tezpur, Agartala, Gangtok, Balasore, Jamshedpur, Bhuntar, Shimla, Patiala, Kota, Pendra, Raipur, Ongole & Arogyavaram 1 each | Gangtok 8, Port Blair & Ranikhet 7 each, Namsai & Batala 4 each, Silchar, New Delhi & Sawai Madhopur 3 each, North Lakhimpur, Cooch Behar, Kairana & Jodhpur 2 each, Kondul, Passighat, Guwahati, Baghdogra, Jalpaiguri, Kaisarganj, Shimla, Sri Ganganagar, Ajmer, Bikaner, Churu & Murud 1 each |
| 19. | Nil | Bangalore 11, Kataula & Coimbatore 3 each, Ferozepur, Baijnath & Alapuzha 2 each, Gangtok, Darjeeling, Mukteswar, Quazi Gund, Sagar & Kozhikode 1 each | Port Blair 7, Golaghat, Cuttack, Jamshedpur, Kota & Sagar 5 each, Maya Bandar, Dibrugarh, Sibsagar & Chottabekra 4 each, Purulia, Keonjhargarh, Shimla, Kalingapatnam & Kakinada 3 each, Paradip, Mukteswar, Rajgarh, Ajmer & Guna 2 each, Guwahati, Agartala, Bhubaneswar, Dehra Dun & Jaipur 1 each |
| 20. | Srinagar, Quazi Gund, Banihal & Batote 1 each | Batote & Kathua 5 each, Banihal 4, Gangtok, Jharsuguda, Ambala, Kahu, Baijnath & Punalur 3 each, Guwahati, Thanesar, Dasuya, Mukerian, Shimla & Kottayam 2 each, Car Nicobar, Tezpur, Jaipur, Gwalior, Jagdalpur, Bhavnagar, Visakhapatnam, Arogyavaram & Mysore 1 each | Dhubri & Batote 6 each, Golaghat 5, New Delhi & Bikaner 4 each, Jalpaiguri, Cooch Behar, Rohtak, Berthin, Nadaun & Jammu 3 each, Car Nicobar, Sri Ganganagar, Bhopal, Guna, Ratnagiri, Karad & Gaganbawada 2 each, Guwahati, Purulia, Chandigarh, Shimla, Srinagar, Churu, Jaipur, Kota & Panjim 1 each |

**TABLE 5** (***Contd***.)

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| 21. | Banihal 4, Kukernag 3, Quazi Gund 2, Srinagar & Rampur 1 each | Kottayam 5, Kochi 3, Tezpur & Rampur Bushar 1 each | Ashti 8, Matunga & Nalbari 7 each, Guwahati 6, Jath 5, Tezpur 4, Guhla, Rania & Koregaon 3 each, Katra, Pahalgam, Rajgarh & Sironj 2 each, Agartala, Sultanpur, Mukerian, Guna & Balaghat 1 each |
| 22. | Car Nicobar, Baijnath & Batote 4 each, Jogindernagar 3, Bhuntar, Manali, Kathua & Quazi Gund 2 each, Gudari, Nangal & Hyderabad 1 each | Gangtok 10, Tuni, Kakinada & Medikeri 2 each, Kurnool, Salem, Cannur & Minicoy 1 each | Cooch Behar 10, Port Blair & Gangtok 6 each, Bahalpur 5, Dibrugarh & Tezpur 4 each, Churu 3, Kondul, Sirsa, Baijnath, Jodhpur, Bikaner, Bhira, Phaltan, Kakinada & Kurnool 2 each, Guwahati, Krishnanagar, Bhatinda, Sri Ganganagar, Solapur, Chennai, Kozhikode, Alapuzha, Cochi & Minicoy 1 each |
| 23. | Kondul, Nancowry & Nayagarh 7 each, Hut Bay & Port Blair 6 each, Midnapore, Diamond Harbour & Gohar 3 each, Balimundali, Keonjhargarh, Baripada & Kumarsain 2 each, Kolkata, Balasore, Ranchi & Pahalgam 1 each | Gangtok 5, Chickmagalur, Kozhikode & Punalur 1 each | Bangana 7, Bhagalpur, Digboi & Jamshedpur 5 each, Kondul & Karjat 4 each, Passighat, Shillong, Agartala, Jalpaiguri & Panjim 3 each, Cooch Behar, Bankura & Ratnagiri 2 each, Port Blair, Guwahati & Kolkata, Mahabaleshwar 1 each |
| 24. | Mahendragarh 10, Swampatna 4, Port Blair & Keonjhargarh 3 each, Nancowry & Gangtok 2 each, Maya Bandar, Tadong & Balasore 1 each | Kottayam 3, Kozhikode 1 | Kozhikode 8, Beki Road Bridge, Honavar & Karwar 6 each, Matunga 5, Passighat & Panjim 4 each, Nancowry, Cooch Behar, Kanyakumari & Thiruvananthapuram 3 each, Car Nicobar, Gangtok, Keonjhargarh & Vengurla 2 each, Chottabekra, Digha, Nasik & Anantpur 1 each |
| 25. | Kondul 5, Imphal 3, Hut Bay, Nayagarh & Madhabarida 2 each, North Lakhimpur 1 | Patsio 1 | Maya Bandar 16, Port Blair 14, Keonjhargarh 13, Cooch Behar 9, Panjim 5, Gangtok & Mangalore 4 each, Ratnagiri, Karwar & Honavar 3 each, Seppa 2, Guwahati, Bhopal, Kalingapatnam & Amini Divi 1 each |
| 26. | Bhubaneswar 6, Cuttack 5, Chandbali 4, Paradip 3, Port Blair, Hut Bay & Puri 1 each | Gangtok 5, Dibrugarh & Tezpur 3 each, North Lakhimpur 2, Nancowry & Car Nicobar 1 each | Jalpaiguri 7, Car Nicobar 6, Karwar 5, Gangtok, Cannur & Kozhikode 4 each, Chouldhowaghat, Baghdogra, Vengurla, Ratnagiri, Panambur & Merkara 3 each, Passighat, Dhubri & Minicoy 2 each, Agartala, Balasore, Banihal, Indore & Panjim 1 each |
| 27. | Gopalpur 2, Kashinagar & Madhabarida 1 each | Hut Bay 10, Kondul & Nancowry 4 each, Tezpur 2, Guwahati, Gangtok, Quazi Gund & Pahalgam 1 each | Hut Bay 11, Nancowry & Kochi 7 each, Kozhikode 6, Bahraich & Rewari 3 each, Malda, Kanpur, Merkara, Thiruvananthapuram & Minicoy 2 each, Jagdalpur, Bhopal, Ratnagiri & Panjim 1 each |
| 28. | Golaghat & Kailashahar 3 each, Kondul 2, Agartala 1 | Hut Bay 7, Kondul & Guwahati 3 each, Imphal, Kailashahar, Cooch Behar, Palayamkottai, Tondi, Thiruvananthapuram & Kottayam 2 each, Tezpur, Dibrugarh, Baghdogra & Punalur 1 each | Kolkata 10, Dehra Dun 5, Pilani 4, Krishnanagar, Rewari, Narnaul, Kozhikode, Alapuzha & Minicoy 3 each, Kondul, Bihubar, Keonjhargarh, Patiala, Jagdalpur, Mumbai, Bhira, Salem & Agumbe 2 each, Chandigarh, Shimla, Bhopal & Karwar 1 each |
| 29. | Nadaun 7, Kondul, Barsar, Bangana & Baijnath 5 each, Naraingarh & Bhuntar 3 each, Nangal Dam & Shimla 2 each, Margherita, Mohana, Sorada, Mahendragarh, Sarsawa, Dehra Dun & Rohtak 1 each | Guwahati 5, Munnar 4, Kottayam 3, Kodaikanal & Palayamkottai 2 each, Gangtok & Minicoy 1 each | Perumbavur 15, Baijnath & Alapuzha 9 each, Dharampur 7, Car Nicobar, Bhalukpong, Amritsar, Bhuj, Mangalore & Amini Divi 5 each, Tezpur 4, Shimla, Batala, Narsinghpur & Karwar 3 each, Port Blair, New Delhi, Hissar, Jagdalpur, Bhira, Ratnagiri, Palayamkottai & Thiruvananthapuram 2 each, Guwahati, Chottabekra, Darjeeling, Midnapore, Jharsuguda, Meerut, Kathua, Jodhpur, Surat, Porbandar, Nagpur, Karaikal, Agumbe & Minicoy 1 each |
| 30. | Tezu, Shimla & Rohru 5 each, Aska & Madhabarida 4 each, Bhuntar 3, Jalpaiguri, Phulbani, Ambala, New Delhi & Baijnath 2 each, North Lakhimpur, Gangtok, Krishnanagar, Batote & Kodaikanal 1 each | Thiruvananthapuram 6, Guwahati & Manamelkudi 5 each, Agartala 3, Tondi 2, Port Blair, Maya Bandar, Kailashahar & Imphal 1 each | Cooch Behar 9, Rajula 8, Jalpaiguri & Digha 6 each, Goalpara & Morbi 5 each, Jamshedpur, Bavla & Ratnagiri 4 each, Patna, New Delhi, Hissar, Surat, Deesa & Minicoy 3 each, Bhavnagar, Tirupathi, Panambur & Kozhikode 2 each, Hut Bay, Nancowry, Dibrugarh, Agartala, Balasore, Sultanpur, Bhatinda & Kolhapur 1 each |

**TABLE 5** (***Contd***.)

| (1) | (2) | (3) | (4) |
|---|---|---|---|
| 31. | Jalpaiguri, & Tadong 4 each, Cooch Behar, Kolkata & Balasore 3 each, Dibrugarh, Bangana, Guler & Thodupuzha 2 each, Tezpur, Guwahati, Kailashahar, Digha, Canning Town, Sambalpur, Keonjhargarh, Hindon, Sarsawa, Dehra Dun, Batote, Uthagamandalam & K. Paramathy 1 each | – | Haripad 12, Karimganj 11, Matijuri 9, Punalur 7, Guwahati & Alapuzha 6 each, Cooch Behar 5, Ahmedabad & Tirupattur 4 each, Maya Bandar, Port Blair, Gangtok, Midnapore, Shirali & Kochi 3 each, Balasore, Paradip, Hissar, Bhatinda & Thiruvananthapuram 2 each, Chottabekra, New Delhi, Jhansi, Sagar, Okha, Veraval, Panjim, Visakhapatnam, Tirupathi & Minicoy 1 each |

3.2.3. *Temperature distribution*

Heat wave conditions prevailed on 3 to 4 days in east Uttar Pradesh, west Uttar Pradesh, Haryana, west Rajasthan and east Rajasthan and on 1 to 2 days in Orissa, Jharkhand, Punjab, west Madhya Pradesh, east Madhya Pradesh & Chattisgarh, Saurashtra & Kutch and Vidarbha. Day temperatures were appreciably to markedly above normal on 14 to 17 days in Jammu & Kashmir, west Rajasthan, east Rajasthan, Gujarat region and Saurashtra & Kutch, on 10 to 13 days in east Uttar Pradesh, Punjab, Himachal Pradesh, east Madhya Pradesh & Chattisgarh and coastal Andhra Pradesh; on 6 to 8 days in Assam & Meghalaya, Orissa, Jharkhand, west Uttar Pradesh, Uttaranchal and Madhya Maharashtra; on 1 to 5 days in Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Bihar, west Madhya Pradesh, Konkan & Goa, Marathwada, Vidarbha, Telangana, Rayalaseema, Tamil Nadu, coastal Karnataka, north interior Karnataka and south interior Karnataka. They were appreciably to markedly below normal on 7 to 11 days in Assam & Meghalaya, Orissa, Jharkhand, Bihar, Uttaranchal, Haryana, Punjab, east Rajasthan, east Madhya Pradesh & Chattisgarh and south interior Karnataka, on 4 to 6 days in Sub-Himalayan West Bengal & Sikkim, Gangetic West Bengal, east Uttar Pradesh, west Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir, west Rajasthan, west Madhya Pradesh, Madhya Maharashtra, Vidarbha, coastal Andhra Pradesh, Telangana, Rayalaseema, Tamil Nadu and north interior Karnataka and on 1 to 3 days in Nagaland-Manipur-Mizoram-Tripura, Gujarat region, Saurashtra & Kutch, Marathwada and Kerala. During the month, the highest temperature of 45° C was recorded at (*i*) Jalgaon (Maharashtra) on 24 & 25, (*ii*) Banswara (Rajasthan) on 24 and (*iii*) Akola and Pusad (Maharashtra) on 25.

3.2.4. *Disastrous weather events and damages*

According to press reports, 13 people (5 in Assam & Meghalaya and 4 each in Madhya Pradesh and Maharashtra) died due to heavy rain, lightning and thundersquall *etc*.

3.3. *May*

3.3.1. *Very severe cyclonic storm over the Arabian Sea (21-29 May 2001)*

A low pressure area formed over southern parts of central Arabian Sea on 21 May and became well-marked in the same evening over east-central Arabian Sea. It concentrated into a depression in the night of 21 near Lat.13.5° N/ Long.70.0° E and into a deep depression in the early morning of 22. At 0300 UTC of 22, it intensified into a cyclonic storm and lay centred near Lat. 14.0° N/ Long. 71.0° E, about 350 km westsouthwest of Panjim. It moved slightly eastwards and further intensified into a severe cyclonic storm at 1800 UTC of 22 and into a very severe cyclonic storm at 0000 UTC of 23. It moved in a northwesterly direction and lay centred near Lat. 15.0° N/Long. 71.0° E at 0300 UTC of 23, about 350 km southwest of Ratnagiri. Moving in a northwesterly direction for some time it weakened into a severe cyclonic storm at 0300 UTC of 26 and lay centred near Lat. 17.5° N/Long. 67.5° E, about 500 km southsouthwest of Porbandar. It remained almost stationary until 1200 UTC of 26. Thereafter, moving in a northerly to northeasterly direction, it weakened into a cyclonic storm at 1200 UTC of 27 and at 0300 UTC of 28, it lay centred near Lat. 20.0° N/ Long. 68.0° E, about 250 km southwest of Porbandar. Further, it moved in a northerly to northeasterly direction and weakened into a depression at 2100 UTC of 28 and into a well-marked low pressure area at 0300 UTC of 29 over northeast and adjoining parts of east-central Arabian Sea. The cyclone did not cross the coast and dissipated over the sea, thus, no damage was caused over the Indian coast. Track of the system is given in Fig. 1.

3.3.2. *Advance of southwest monsoon*

Southwest monsoon arrived over south Andaman Sea and parts of southeast Bay on 15 May 2001. It set in over Kerala on 23, eight days earlier than its normal date of 1 June. By the end of season, it covered south Arabian Sea, south Bay of Bengal, Kerala, Lakshadweep and some parts of south interior Karnataka and Tamil Nadu.

3.3.3. *Weather and associated synoptic features*

Details of the weather systems formed during the month are given in Table 4.

There was good pre-monsoon thundershower activity almost all over the country during second fortnight of the month of May. Southwest monsoon was *active* on 5 days in Kerala. Rain/thundershowers occurred either at most places or at many places on 19 to 22 days in Andaman & Nicobar Islands and Sub-Himalayan West Bengal & Sikkim; on 7 to 11 days in Arunachal Pradesh, Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Gangetic West Bengal, Orissa, Uttaranchal, Konkan & Goa, coastal Karnataka, Kerala and Lakshadweep and on 1 to 5 days in Bihar, east Uttar Pradesh, west Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir, west Rajasthan, east Rajasthan, Madhya Maharashtra and Rayalaseema. Very heavy rainfall occurred on 5 days in Andaman & Nicobar Islands and on 1 to 2 days in Arunachal Pradesh, Sub-Himalayan West Bengal & Sikkim, coastal Karnataka and Kerala. Heavy rainfall also occurred on 4 to 7 days in Andaman & Nicobar Islands, Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim and Kerala and on 1 to 3 days in Arunachal Pradesh, Assam & Meghalaya, Gangetic West Bengal, Orissa, Jharkhand, west Rajasthan, east Rajasthan, Konkan & Goa, coastal Andhra Pradesh, Tamil Nadu and coastal & north interior Karnataka.

3.3.4. *Rainfall distribution*

Rainfall during May was excess in 19 meteorological sub-divisions (Andaman & Nicobar Islands, Sub-Himalayan West Bengal & Sikkim, Gangetic West Bengal, Orissa, Jharkhand, Bihar, east Uttar Pradesh, west Uttar Pradesh, Uttaranchal, Haryana, Punjab, Himachal Pradesh, west Rajasthan, east Rajasthan, west Madhya Pradesh, east Madhya Pradesh & Chattisgarh, Saurashtra & Kutch, coastal Karnataka and Lakshadweep); normal in 5 meteorological sub-divisions (Nagaland-Manipur-Mizoram-Tripura, Gujarat region, Konkan & Goa, Vidarbha and Kerala); deficient in 7 meteorological sub-divisions (Arunachal Pradesh, Assam & Meghalaya, Jammu & Kashmir, coastal Andhra Pradesh, Rayalaseema, Tamil Nadu and south interior Karnataka) and scanty in the remaining 4 meteorological sub-divisions (Madhya Maharashtra, Marathwada, Telangana and north interior Karnataka). The principal amounts of rainfall are given in Table 5.

3.3.5. *Temperature distribution*

Severe heat wave conditions prevailed on 6 to 9 days in west Rajasthan and east Rajasthan and on 1 to 3 days in Haryana, Punjab, west Madhya Pradesh, east Madhya Pradesh & Chattisgarh, Vidarbha and coastal Andhra Pradesh. Heat wave conditions also prevailed on 8 to 12 days in west Rajasthan, east Rajasthan, west Madhya Pradesh, Vidarbha, Telangana and Rayalaseema; on 4 to 7 days in Orissa, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir, east Madhya Pradesh & Chattisgarh, Gujarat region and coastal Andhra Pradesh and on 1 to 3 days in Jharkhand, east Uttar Pradesh, west Uttar Pradesh, Saurashtra & Kutch, Madhya Maharashtra, Marathwada and Tamil Nadu. Day temperatures were appreciably to markedly above normal on 15 to 18 days in Assam & Meghalaya, Jammu & Kashmir and Tamil Nadu; on 4 to 7 days in Orissa, west Uttar Pradesh, Punjab, Himachal Pradesh, east Madhya Pradesh & Chattisgarh, Saurashtra & Kutch, Madhya Maharashtra, Rayalaseema and north interior Karnataka and on 1 to 3 days in Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Jharkhand, east Uttar Pradesh, Uttaranchal, Haryana, west Rajasthan, east Rajasthan, west Madhya Pradesh, Gujarat region, Vidarbha, Telangana, coastal & south interior Karnataka and Kerala. During the month, the highest temperature of 49.0° C was recorded at Sri Ganganagar in Rajasthan on 6 May.

3.3.6. *Disastrous weather events and damages*

According to press reports, 8 persons died in Vidarbha due to heat wave and 16 persons died in Uttar Pradesh due to heavy rain.

## Appendix

### Definitions of the terms given in '*Italics*'

### *Rainfall*

*Excess* - percentage departure from normal rainfall is + 20% or more.
*Normal* - percentage departure from normal rainfall is between –19 % to + 19 %.
*Deficient* - percentage departure from normal rainfall is between –20 % to –59 %.

*Scanty* - percentage departure from normal rainfall is between –60 % to –99 %.
*Most places* - 75 % or more stations of a meteorological sub-division reporting at least 2.5 mm rainfall.
*Many places* - 51% to 74 % stations of a meteorological sub-division; reporting atleast 2.5 mm rainfall
*Few places* - 26 % to 50% stations of a meteorological sub-division reporting atleast 2.5 mm rainfall.
*Isolated places* - 25% or less stations of a meteorological sub-division; reporting atleast 2.5mm rainfall.
*Heavy rain* - rainfall amount from 6.5 cm to 12.4 cm over one or two stations in the sub-division.
*Very heavy rainfall* - rainfall amount more than 12.5 cm over one or two stations in the sub-division.

### *Monsoon activity*

*Active* - Average rainfall of a sub-division is more than 1 ½ to 4 times the normal with minimum 5 cm along the west coast and 3 cm elsewhere in atleast two stations in the sub-division.

### *Maximum/day temperatures*

*Severe heat wave* - departure of maximum temperature from normal is + 5° C or more for the regions where the normal maximum temperature is more than 40° C and departure of maximum temperature from normal is + 7° C or more for the regions where the normal maximum temperature is 40° C or less.

*Heat wave conditions* - departure of maximum temperature from normal is between + 3° C to + 4° C or more for the regions where the normal maximum temperature is more than 40° C.
*Markedly above normal* - departure of maximum temperature from normal is between +5° C to + 6° C for the regions where the normal maximum temperature is 40° C or 1ess.
*Appreciably above normal* - departure of maximum temperature from normal is between +3° C to + 4° C for the regions where the normal maximum temperature is 40° C or less.
*Appreciably below normal* - departure of maximum temperature from normal is between – 3° C to – 4° C.
*Markedly below normal* - departure of maximum temperature from normal is between – 5° C or less.

### *Minimum night temperatures*

*Cold wave conditions* - departure of minimum temperature from normal is – 3° C to – 4° C where normal minimum temperature is less than 10° C.
*Markedly below norma1* - departure of'minimum temperature from normal is –5° C to –6° C for the regions where the normal minimum temperature is 10° C or more.
*Appreciably below normal* - departure of minimum temperature from normal is between –3° C to –4° C for the regions where the normal minimum temperature is 10° C or more.