

## Weather in India

### POST-MONSOON SEASON (October-December 2004)\*

#### 1. Introduction

The beginning of the post monsoon season this year, in a way behaved complimentary to the southwest monsoon season, in terms of rainfall, as the southwest monsoon in its withdrawal phase, provided plenty of rain. The sub-divisions which turned up deficient in rainfall upto the end of the monsoon season (June to September) received good rainfall in the beginning of October.

Intense cyclogenesis over the Indian seas was very much subdued and another noteworthy feature was no cyclone had a landfall as they weakened over the sea itself. In all, during the season, only a depression (2 - 8 October over the Bay of Bengal), a deep depression (2 - 7 November over the Arabian Sea) and a Severe Cyclonic Storm (29 November - 2 December over the Arabian Sea) formed. The later two systems weakened over the Ocean. Tracks of these systems are shown in Fig. 2.

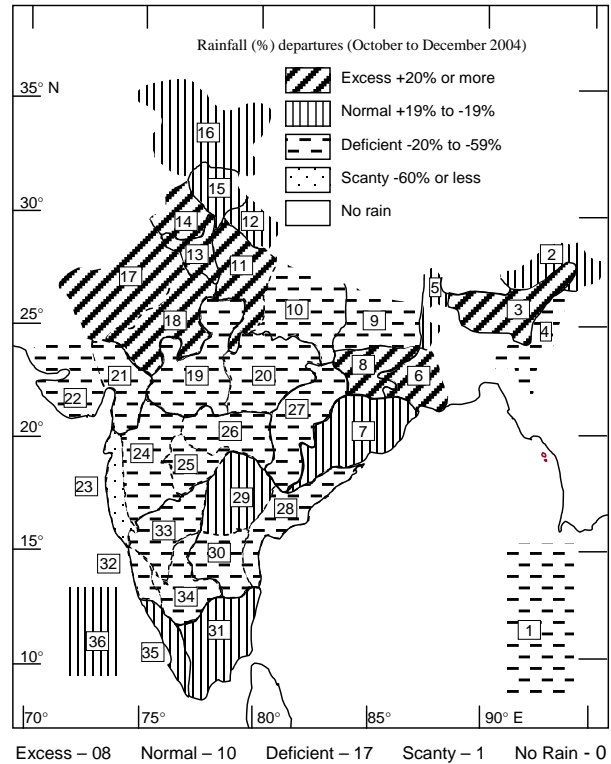
Southwest monsoon withdrew from the entire country on 18 October, and simultaneously northeast monsoon rains commenced over Tamil Nadu, Kerala and adjoining parts of Karnataka and Andhra Pradesh. During the season, the northeast monsoon rainfall was *normal*† in Tamil Nadu, Kerala, Lakshadweep and Telangana; and *deficient* in coastal Andhra Pradesh, Rayalaseema & Karnataka.

#### 2. Seasonal rainfall (October-December)

Out of the 36 meteorological sub-divisions, rainfall was *excess* in 8 viz., Assam & Meghalaya, Gangetic West Bengal, Jharkhand, west Uttar Pradesh, Haryana, Punjab, east & west Rajasthan; *normal* in 10 viz., Arunachal Pradesh, Sub-Himalayan West Bengal & Sikkim, Orissa, Uttaranchal, Himachal Pradesh, Jammu & Kashmir, Telangana, Tamil Nadu, Kerala and Lakshadweep; *deficient* in 17, viz., Andaman & Nicobar Islands, Nagaland-Manipur-Mizoram-Tripura, Bihar, east Uttar Pradesh, east & west Madhya Pradesh, Gujarat Region, Saurashtra & Kutch, Madhya Maharashtra, Marathwada, Vidarbha, Chattisgarh, coastal Andhra Pradesh, Rayalaseema, north & south interior Karnataka and coastal Karnataka and was *scanty* in one sub-division,

† Definition of terms in 'Italics' (other than sub-headings) are given in Appendix

\* Compiled by : N. Jayanthi, A. B. Mazumdar, Sunitha Devi S., Meteorological Office, Pune - 411 005, India



**Fig. 1.** Sub-divisionwise seasonal rainfall departure from normal (%) for Post monsoon season (October to December 2004). Sub-divisions are indicated by number on the map & bold letters in legend. The rainfall anomaly values for these 36 sub-divisions are indicated below :

<b>1</b>	-38	<b>7</b>	-2	<b>13</b>	119	<b>19</b>	-20	<b>25</b>	-34	<b>31</b>	1
<b>2</b>	11	<b>8</b>	21	<b>14</b>	32	<b>20</b>	-48	<b>26</b>	-47	<b>32</b>	-29
<b>3</b>	54	<b>9</b>	-54	<b>15</b>	5	<b>21</b>	-36	<b>27</b>	-33	<b>33</b>	-48
<b>4</b>	-23	<b>10</b>	-41	<b>16</b>	2	<b>22</b>	-20	<b>28</b>	-28	<b>34</b>	-31
<b>5</b>	19	<b>11</b>	26	<b>17</b>	151	<b>23</b>	-67	<b>29</b>	-12	<b>35</b>	-10
<b>6</b>	26	<b>12</b>	-7	<b>18</b>	47	<b>24</b>	-55	<b>30</b>	-40	<b>36</b>	-8

viz., Konkan & Goa. Seasonal sub-divisionwise percentage rainfall departures are given in Fig. 1 and also in Table 1.

#### 3. Monthly features

##### 3.1. October

##### 3.1.1. Withdrawal of southwest monsoon

Southwest monsoon withdrew from most parts of north and central India by 8 October, most parts of

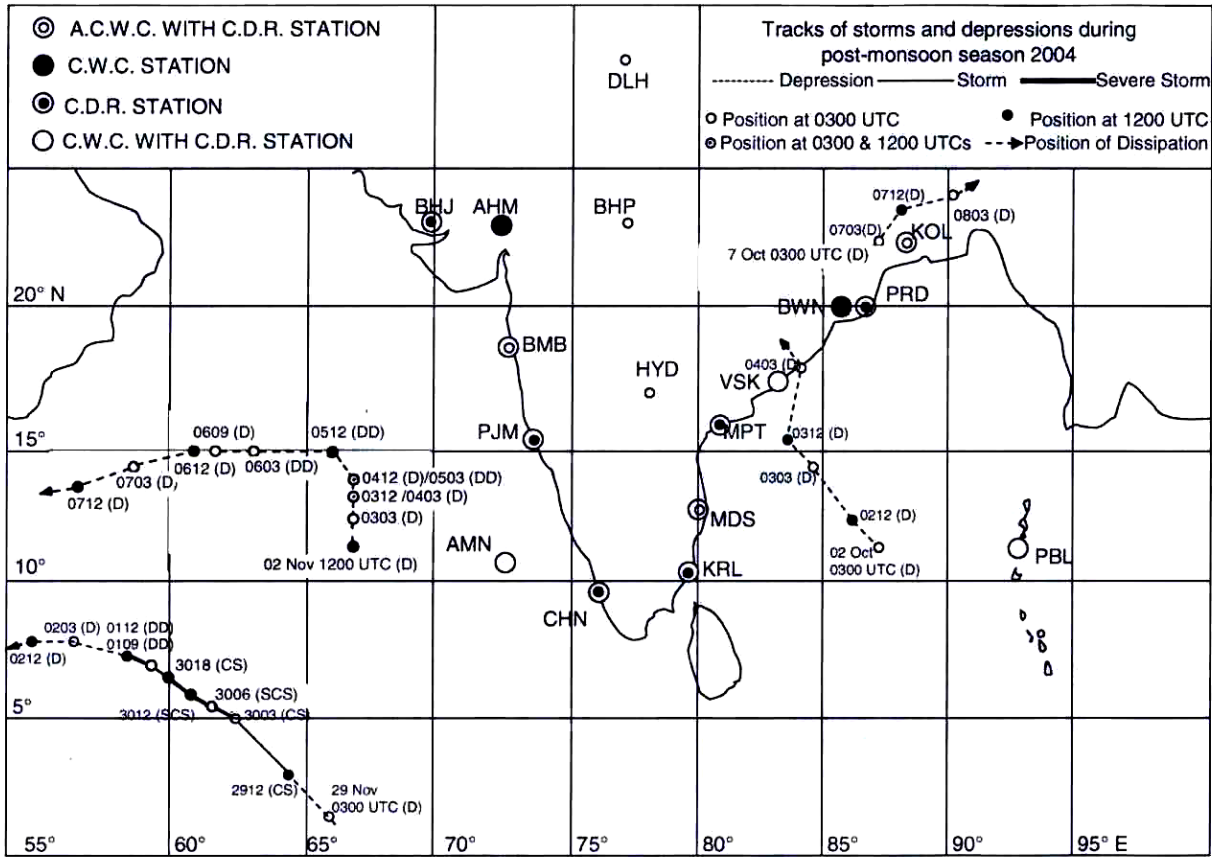


Fig. 2. Tracks of cyclonic storms during the period October to December 2004

southern peninsula and northeast India by 11 October and from the entire country on 18 October, with a delay of three days.

3.1.2. Commencement of northeast monsoon rains

Simultaneous with the withdrawal of southwest monsoon, northeast monsoon rains commenced over Tamil Nadu, Kerala and adjoining areas of Karnataka and Andhra Pradesh on 18 October.

3.1.3. Storms/Depressions

A severe cyclonic storm formed over the Arabian Sea during 30 September – 3 October, the details of which are stated in the previous weather summary for monsoon season along with the track. However, to keep the continuity, Table 2 contains a brief on the same.

Apart from this a depression also formed over the Bay during 2 – 8 October. Details are presented below :

3.1.3.1. Depression over the Bay of Bengal (2 - 4 October 2004) & Land depression (7 - 8 October 2004)

A low pressure area formed over south east Bay of Bengal in the morning of 30<sup>th</sup> September and became well marked in the evening of same day. Moving in north-westerly direction, it concentrated into depression in the morning of 2<sup>nd</sup> October and lay centred near Lat. 11.5° N and Long. 87.0° E at 02/0300 UTC. Subsequently moving in a northwesterly direction it lay centred near Lat. 14.5° N and Long. 84.5° E & Lat. 15.5° N and Long. 83.5° E at 03/0300 UTC and 03/1200 UTC respectively. Buoys DS3 (Lat. 12.5° N / Long. 72.0° E) & MB 11 (Lat. 15.1° N / Long. 87.6° E) reported wind south-southwesterly / 15 kt pressure 1009.6 hPa and easterly / 15 kt. These Buoys were located at east and north of the

TABLE 1

Sub-divisionwise rainfall (mm) for each month and season as a whole (October-December 2004)

S. No.	Meteorological sub – divisions	October			November			December			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	232	305	-24	175	236	-26	25	159	-85	431	700	-38
2.	Arunachal Pradesh	243	166	46	6	42	-86	22	35	-38	270	244	11
3.	Assam & Meghalaya	284	154	85	4	25	-85	6	11	-48	293	191	54
4.	Naga., Mani, Mizo. and Tri.	143	145	-1	6	40	-84	1	10	-95	150	195	-23
5.	Sub-Himalayan West Bengal & Sikkim	205	155	32	9	18	-49	4	10	-59	218	183	19
6.	Gangetic West Bengal	199	130	53	**	23	-99	1	6	-83	201	159	26
7.	Orissa	149	120	24	1	28	-97	**	6	-99	150	153	-2
8.	Jharkhand	121	86	41	0	11	-99	1	5	-71	123	101	21
9.	Bihar	35	69	-49	1	5	-83	1	4	-87	36	78	-54
10.	East Uttar Pradesh	36	52	-30	0	4	-99	0	6	-99	36	62	-41
11.	West Uttar Pradesh	61	40	55	2	4	-43	**	7	-99	64	51	26
12.	Uttaranchal	80	56	42	**	9	-99	1	22	-97	80	87	-7
13.	Haryana, Chandigarh & Delhi	58	16	263	**	5	-99	1	7	-78	60	27	119
14.	Punjab	48	21	122	1	5	-80	6	15	-59	55	41	32
15.	Himachal Pradesh	93	46	102	3	20	-84	21	46	-54	117	111	5
16.	Jammu & Kashmir	90	36	149	30	32	-7	36	84	-57	156	153	2
17.	West Rajasthan	19	4	359	0	3	-100	3	2	53	22	9	151
18.	East Rajasthan	38	15	148	**	7	-95	0	4	-99	38	26	47
19.	West Madhya Pradesh	40	32	25	2	13	-85	0	7	-100	42	52	-20
20.	East Madhya Pradesh	25	39	-36	5	12	-52	0	9	-100	31	59	-48
21.	Gujarat region	22	22	3	0	11	-99	0	2	-100	22	35	-36
22.	Saurashtra & Kutch	21	14	51	0	11	-99	0	1	-100	21	26	-20
23.	Konkan & Goa	43	105	-60	2	26	-94	0	4	-100	44	135	-67
24.	Madhya Maharashtra	45	71	-37	3	28	-89	0	6	-100	47	105	-55
25.	Marathwada	55	67	-18	8	22	-62	0	7	-100	63	96	-34
26.	Vidarbha	23	53	-57	17	15	18	0	7	-100	40	75	-47
27.	Chattisgarh	54	67	-20	1	10	-92	**	5	-91	55	82	-33
28.	Coastal Andhra Pradesh	188	197	-5	48	104	-53	0	26	-99	236	326	-28
29.	Telangana	90	84	6	7	21	-69	0	5	-100	96	110	-12
30.	Rayalaseema	99	121	-19	28	66	-57	0	24	-100	127	212	-40
31.	Tamil Nadu	253	182	39	169	165	2	13	85	-84	435	432	1
32.	Coastal Karnataka	117	179	-34	65	66	0	0	14	-100	183	258	-29
33.	North interior Karnataka	67	103	-34	3	28	-88	**	6	-99	71	137	-48
34.	South interior Karnataka	112	139	-19	26	48	-47	**	13	-97	138	200	-31
35.	Kerala	318	286	11	119	159	-25	1	42	-97	438	486	-10
36.	Lakshadweep	193	153	26	107	117	-8	2	59	-96	303	329	-8

\*\* Rainfall amount from 0.1 to 0.4 mm; amounts less than 0.1 mm are rounded off to 0.

TABLE 2

## Details of the weather systems during October 2004

S. No.	System	Duration	Place of first location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>(A) Storms/Depressions</b>						
1.	Severe cyclonic storm (continued from previous season)	30 Sep – 3 Oct	East–central Arabian Sea	Northwest, North and then northeast	Northeast Arabian sea off Kutch coast	A well marked low pressure area concentrated into a depression on 30 Sept. forenoon. Moving northwestwards, it intensified into a DD on 30 evening, into a CS on 1 October and into a SCS on 2. Subsequently moving northeastwards it weakened over the ocean
2.	Depression	2 – 8	Southeast Bay	Northwest then north and finally northeast	Northern parts of Bangladesh and neighbourhood	Details are given in text
<b>(B) Low pressure area</b>						
1.	Well-marked low pressure area	13 –16	East central Bay and neighbourhood	Northwest	Northeast Bay and neighbourhood	It was first observed as an upper air cyclonic circulation over north Andaman sea and adjoining southeast Bay. The low pressure area became less marked on 17, however, the associated upper air cyclonic circulation lay over Nagaland-Manipur-Mizoram-Tripura and neighbourhood on 17 and became less marked on 18
2.	Low pressure area	25 – 28	Southeast Arabian Sea	West	Southwest Arabian Sea	It was first observed as a trough of low at sea level over southeast Arabian Sea on 20
<b>(C) Western disturbances/Eastward moving systems</b>						
<b>(a) Upper air cyclonic circulations</b>						
1.	Mid tropospheric levels	4 – 7	Pakistan and adjoining Punjab and Jammu & Kashmir	Northeast	Jammu & Kashmir and neighbourhood	Moved away northeastwards on 8
2.	Do	13 – 15	Central Pakistan and neighbourhood	Do	Do	Moved away northeastwards on 16
3.	Lower tropospheric levels	15 – 17	Do	Do	Uttaranchal and neighbourhood	Moved away northeastwards on 18
4.	Mid tropospheric levels	18	North Pakistan and adjoining Jammu & Kashmir	Do	Northern parts of Jammu & Kashmir	Moved away northeastwards on 19
5.	Do	21– 29	Do	Do	Do	Moved away northeastwards on 30
6.	Do	30 Oct – 3 Nov	Do	Eastnortheast	Eastern parts of Jammu & Kashmir	Less marked on 4 November
<b>(b) Induced systems</b>						
1.	Low pressure area	9 – 11	Central Pakistan and neighbourhood	Northeast	North Rajasthan and adjoining Punjab and Haryana	Though it became less marked on 12, the associated upper air cyclonic circulation lay over north Rajasthan and neighbourhood on 12, over west Uttar Pradesh and neighbourhood on 13 and became less marked on 14
2.	Cyclonic circulation upto mid tropospheric levels	13 – 15	Do	Do	Northern parts of Jammu & Kashmir and neighbourhood	Moved away northeastwards on 16

TABLE 2 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
3.	Cyclonic circulation upto mid tropospheric levels	20 – 24	Central Pakistan and adjoining west Rajasthan	Eastnortheast	West Uttar Pradesh and adjoining Uttaranchal	Moved away eastnortheastwards on 25
4.	Do	21 – 29	North Pakistan and adjoining Jammu & Kashmir	Northeast	Northern parts of Jammu & Kashmir and neighbourhood	Moved away northeastwards on 30
5.	Do	24 – 29	Central Pakistan and adjoining west Rajasthan	Eastnortheast	West Uttar Pradesh and adjoining Haryana	Do
6.	Cyclonic circulation upto lower tropospheric levels	29 – 30	Northwest Madhya Pradesh and adjoining southeast Rajasthan	Stationary	<i>In situ</i>	Less marked on 31
<b>(D) Other cyclonic circulations</b>						
1.	Lower tropospheric levels	2	North Madhya Pradesh and neighbourhood	East	Chattisgarh	Less marked on 3
2.	Do	14 – 23	South Tamil Nadu and adjoining Sri Lanka	West	Commorin and adjoining Maldives areas	Merged with the trough of low over southwest Arabian Sea
3.	Do	17 – 23	Lakshadweep and adjoining southeast Arabian Sea	Stationary	<i>In situ</i>	Do
<b>(E) Troughs in westerly</b>						
1.	Lower tropospheric levels	11 – 12	North Rajasthan to Gulf of Cambay	Quasi Stationary	Jammu & Kashmir to Gulf of Cambay through Rajasthan, west Madhya Pradesh and north Madhya Maharashtra	Less marked on 13
<b>(F) Troughs in easterly</b>						
1.	Lower tropospheric levels	28 Oct – 3 Nov	Lakshadweep to south Gujarat coast	Northeast	Central Arabian Sea to west Madhya Pradesh	Less marked on 4 November
2.	At sea level	10 – 12	Southeast Bay and adjoining Andaman Sea	West	Southeast and adjoining southwest Bay	Less marked on 13
3.	Do	23	Southwest and adjoining west central Bay off Tamil Nadu – south Andhra coasts	Northwest	Commorin Maldives area	It organised into a low pressure area on 1 Nov. Details are given in table 3
4.	Do	27 – 29	South Andaman Sea	West	Southeast Bay and adjoining Andaman Sea	Merged with the low pressure area over Sri Lanka – Tamil Nadu coasts on 30
5.	Do	22 Oct – 4 Nov	South Andaman Sea and neighbourhood	Do	Sri Lanka – Tamil Nadu coast	It organised into a low pressure area on 5. Details are given in Table 3
6.	Do	27 – 29	South Andaman Sea	Do	Southeast Bay and adjoining Andaman Sea	Merged with another trough (Sr. No.4)

depression during that period. The 24 hour pressure fall was of the order of 2-3 hPa over south coastal Andhra Pradesh and of the order of 4 hPa over the same area on 3<sup>rd</sup> October. The depression started giving weather in the

form of rain and wind prior to reaching the coast. The depression crossed north Andhra Pradesh coast close to Kalingapatnam (43105) in the forenoon of 4<sup>th</sup> October and weakened into a well marked low pressure area over north

central Andhra Pradesh and adjoining Orissa and sea areas in the evening.

The depression which crossed north Andhra coast close to Kalingapatnam in the forenoon of 4 October 2004 weakened rapidly into a well marked low pressure area in the evening. It moved northeastwards and re-intensified into a depression overland and lay centred at 07/0300 UTC, close to Bankura (42706) in Gangetic West Bengal. It further moved in an east-northeasterly direction and lay centred in the afternoon of the same day close to Shantiniketan (42708) and at 08/0300 UTC over Bangladesh (near Lat. 24.0° N / Long. 90° E). Due to incursion of moisture from the Bay of Bengal, the system caused exceptionally heavy rainfall over Gangetic West Bengal and northeastern states during its life span. The system weakened gradually into a low pressure area over northern parts of Bangladesh and neighbourhood in the evening of 8 October 2004.

The maximum intensity based on satellite imagery was T 1.5 throughout the life period of the system.

The depression started giving weather in the form of rain and wind, prior to it's reaching the coast.

*Heavy to very heavy rain* occurred over north Coastal Andhra Pradesh and subsequently in Orissa. The chief amounts of rainfall (cms) are :

- 1 October : Venkatagiri 4  
 2 October : Chittoor 3  
 3 October : Yelamanchili 2  
 4 October : Kalingapatnam 27, Santhabommali 25, Tekkali 23, Vajrapur, Kothur & Nandigama 21 each, Pallana 20, Kotabommali 17, Kanchili, Ranasthalam 16, Sompeta, Narsannapeta & Laveru 15 each, Srikakulam 14, Jalmuru, Polaki & Iohapuram 13 each, Kaviti 12, Kakinada & Nagarjunsagar Dam 11 each, Waltair 9, Jeypore, Soro, Balasore 8, Koderu & Nilgiri 7 each  
 5 October : Athagarh 18, Balasore 14, Chandbali 12, Rajkanika 11, Jeypore, Rajghat & Akhuapada 10 each, Jaleswar, Soro & Alipingal 9 each, Pollangi & Raigarh 16 each, Khandapada 14, Banpur 13, Dhenkanal & Koraput 12 each, Chandanpur, Nayagarh & Ranpur 10 each

- 6 October : Jaipatna 13, Balimundali & Madanpur Rampur 10 each, Baripada, Titlagarh & Bolgaon 9 each, Panagarh 8

Its northeastward movement after re-intensification caused *heavy to very heavy rainfall* over Gangetic West Bengal, Orissa and northeastern States. The significant amounts (cms) are :

- 7 October : Malda 28, Tantloi 27, Tilpara 26, Mahro 23, Suri 20, Massanjore 18, Khesiary 16, Durgapur 15, Shillong, Guwahati and Diamond Harbour 14 each, Haldia 12, Canning 8, Shantiniketan, Talchar and Telkoi 7 each, and Mundali 6  
 8 October : Alipurduar (NH) 31, Shillong 26, Malda and Guwahati 15 each, Tezpur 11, Kolkata, Berhampore, Hindol, Udala and Lanjigarh 6 each, Canning Town, Agartala, Sevoke, Gajoldoba and Mathabhanga 5 each  
 9 October : Tezpur, Passighat and Dibrugarh 4 each and Imphal 2

The system caused the death of 273 people and 3000 migratory birds in Gangetic West Bengal, Orissa and northeastern states. It also affected more than 10 Lakh people in Andhra Pradesh, Orissa, Gangetic West Bengal and northeastern states. A number of villages were marooned, 50,000 acres of paddy fields were submerged, many houses collapsed and a number of Tanks got breached in Andhra Pradesh. Huge Agricultural crops damage was reported in Gangetic West Bengal (more than Rs. 110 crores) and northeastern states (about 98721 Hectares).

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

Table 2 gives a summary of synoptic features for the month of October 2004.

Southwest monsoon was *vigorous* on 3 to 4 days in West Bengal & Sikkim and Orissa and on 1 to 2 days in Arunachal Pradesh, Assam & Meghalaya, Jharkhand, Telangana, Rayalaseema, coastal Andhra Pradesh, Tamil Nadu, Karnataka and Kerala. It was *active* on 3 to 5 days in Arunachal Pradesh, Assam & Meghalaya, Tamil Nadu, north interior Karnataka and Kerala and on 1 to 2 days in Nagaland-Manipur-Mizoram-Tripura, Gangetic West Bengal, Marathwada, coastal Andhra Pradesh, Telangana and coastal and south interior Karnataka. Subsequently northeast monsoon was *vigorous* on 2 to 3 days in coastal Andhra Pradesh and Tamil Nadu and active on 3 to 4 days in Tamil Nadu and Kerala.

*Very Heavy rain* occurred on 3 to 4 days in Assam & Meghalaya, Tamil Nadu and south interior Karnataka and on 1 to 2 days in Andaman & Nicobar Islands, Arunachal Pradesh, West Bengal & Sikkim, Orissa, Haryana, Punjab, Himachal Pradesh, coastal Andhra Pradesh, coastal Karnataka and Kerala. *Heavy rain* also occurred on 9 to 10 days in Tamil Nadu and Kerala; on 4 to 5 days in Arunachal Pradesh, Assam & Meghalaya, Gangetic West Bengal and north interior Karnataka and on 1 to 3 days in Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Orissa, Jharkhand, Bihar, Uttar Pradesh, Uttaranchal, Haryana, Himachal Pradesh, east Rajasthan, Madhya Pradesh, Madhya Maharashtra, Marathwada, coastal Andhra Pradesh, Rayalaseema and coastal & south interior Karnataka.

### 3.1.5. Monthly rainfall

Monthly rainfall was excess in 18 *viz.*, Arunachal Pradesh, Assam & Meghalaya, Gangetic West Bengal, Sub-Himalayan West Bengal & Sikkim, Orissa, Jharkhand, west Uttar Pradesh, Uttaranchal, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir, east Rajasthan, west Rajasthan, west Madhya Pradesh, Saurashtra & Kutch, Tamil Nadu and Lakshadweep; *normal* in 8 *viz.*, Nagaland-Manipur-Mizoram-Tripura, Gujarat region, Marathwada, coastal Andhra Pradesh, Telangana, Rayalaseema, south interior Karnataka and Kerala; *deficient* in 9 *viz.*, Andaman & Nicobar Islands, Bihar, east Uttar Pradesh, east Madhya Pradesh, Madhya Maharashtra, Vidarbha Chattisgarh, coastal and north interior Karnataka and *scanty* in the remaining one *viz.*, Konkan & Goa. The significant amounts of rainfall during the month are given in Table 5.

### 3.1.6. Temperature

Day temperatures were *appreciably to markedly above normal* on: 11 to 15 days in Saurashtra & Kutch, Konkan & Goa and coastal Karnataka; 4 to 5 days in Himachal Pradesh and Madhya Pradesh; 1 to 3 days in Sub-Himalayan West Bengal & Sikkim, Orissa, Jharkhand, Bihar, east Uttar Pradesh, Uttaranchal, Haryana, Punjab, Jammu & Kashmir, Rajasthan and Chattisgarh, *above normal* on: 9 to 15 days in Orissa, Madhya Maharashtra, Telangana and Kerala; 4 to 7 days in Sub-Himalayan West Bengal & Sikkim, Jharkhand, Bihar, Uttaranchal, Himachal Pradesh, Jammu & Kashmir, Rajasthan, east Madhya Pradesh, Saurashtra & Kutch, Chattisgarh and coastal Andhra Pradesh; 1 to 3 days in Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Gangetic West Bengal, Uttar Pradesh, Haryana, west Rajasthan, Gujarat Region, Konkan & Goa, Tamil Nadu and interior Karnataka, *appreciably to markedly below normal* on: 10 to 15 days in Haryana,

Punjab and Rajasthan; 4 to 7 days in Uttaranchal, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh and Tamil Nadu; 1 to 3 days in Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Uttar Pradesh, Gujarat State, coastal Andhra Pradesh and Rayalaseema and *below normal* on: 12 days in Punjab; 4 to 7 days in Uttar Pradesh, Haryana, Jammu & Kashmir, west Rajasthan and Gujarat region; 1 to 3 days in Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, West Bengal & Sikkim, Orissa, Jharkhand, Bihar, Uttaranchal, Himachal Pradesh, east Rajasthan, Madhya Pradesh, Saurashtra & Kutch, Madhya Maharashtra, Marathwada, Vidarbha, Chattisgarh, coastal Andhra Pradesh, Telangana, Tamil Nadu and interior Karnataka.

The month's highest maximum temperature in the plains of the country was 39° C recorded at Naliya (Saurashtra & Kutch) and Porbandar (Saurashtra & Kutch) on 22 and Naliya on 24 & 26 October 2004.

Night temperatures were *appreciably to markedly below normal* on : 8 to 12 days in Jharkhand, Punjab, Jammu & Kashmir, Gujarat Region and Vidarbha; 4 to 6 days in Orissa, east Uttar Pradesh, Haryana, Madhya Maharashtra, Marathwada and Chattisgarh; 1 to 3 days in Nagaland-Manipur-Mizoram-Tripura, Bihar, west Uttar Pradesh, Uttaranchal, Himachal Pradesh, Rajasthan, west Madhya Pradesh, Saurashtra & Kutch, Konkan & Goa, Telangana, north interior Karnataka and Kerala, *below normal* on: 8 to 12 days in Orissa, east Uttar Pradesh, Punjab and Gujarat Region; 4 to 7 days in Assam & Meghalaya, Gangetic West Bengal, Jharkhand, Bihar, west Uttar Pradesh, Uttaranchal, Haryana, Jammu & Kashmir, west Rajasthan, Madhya Pradesh, Saurashtra & Kutch, Maharashtra & Goa States, Chattisgarh and Tamil Nadu; 1 to 3 days in Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Himachal Pradesh, east Rajasthan, Andhra Pradesh and Kerala *appreciably to markedly above normal* on : 11 to 12 days in east Rajasthan and west Madhya Pradesh; 5 to 7 days in Haryana, west Rajasthan, east Madhya Pradesh and Saurashtra & Kutch and on 1 to 2 days in Uttar Pradesh, Punjab, Jammu & Kashmir, Gujarat region, Madhya Maharashtra, Marathwada, Vidarbha and Chattisgarh, *above normal* on : 17 days in west Rajasthan; 9 to 10 days in east Rajasthan and Madhya Maharashtra; 4 to 7 days in west Uttar Pradesh, Haryana, Punjab, east Madhya Pradesh, Saurashtra & Kutch, Konkan & Goa, Marathwada and Telangana and on 1 to 3 days in Nagaland-Manipur-Mizoram-Tripura, Gangetic West Bengal, Orissa, Bihar, east Uttar Pradesh, Uttaranchal, Himachal Pradesh, Jammu & Kashmir, west Madhya Pradesh, Gujarat region, Vidarbha, coastal Andhra Pradesh, Rayalaseema, Tamil Nadu and coastal & south interior Karnataka.

TABLE 3

## Details of the weather systems during November 2004

S. No.	System	Duration	Place of first location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>(A) Cyclonic storm/depression</b>						
1.	Deep Depression	2 – 7	Southeast and adjoining east–central Arabian Sea	Initially north then northwest, west and finally westsouthwest	West–central Arabian Sea	Details of the system are given in the text
2.	Severe cyclonic Storm	29 Nov – 2 Dec	North Indian Ocean and adjoining southeast Arabian Sea	Initially northwest and then westnorthwest	Somalia coast	It was first observed as a low pressure area over the same region, details are given in the text
<b>(B) Low pressure area</b>						
1.	Low pressure area	4 – 5	Sri Lanka – Tamil Nadu coast	West	Southeast Bay and adjoining Sri Lanka	It was first seen as a trough of low over south Andaman Sea. Less marked on 6. Associated upper air cyclonic circulation lay over south Tamil Nadu and adjoining areas of Kerala and Lakshadweep on 6. It moved westwards and became less marked on 10
<b>(C) Western disturbances /Eastward moving systems</b>						
<b>(a) Upper air cyclonic circulations</b>						
1.	Mid tropospheric levels	5 – 6	North Pakistan and adjoining Jammu & Kashmir	Northeast	Jammu & Kashmir and neighbourhood	Moved away northeastwards on 7
2.	Do	7 – 8	Do	Do	Do	Moved away northeastwards on 9
3.	Do	9 – 11	Do	Do	Do	Moved away northeastwards on 12
4.	Do	12 – 15	Do	Do	Do	Moved away northeastwards on 16
5.	Do	16 – 17	Do	Do	Do	Moved away northeastwards on 18
6.	Do	20 – 21	Jammu & Kashmir and neighbourhood	Do	Do	Moved away northeastwards on 22
7.	Do	22 – 23	North Pakistan and adjoining Jammu & Kashmir	Do	Do	Moved away northeastwards on 24
8.	Do	24 – 28	Do	Eastnortheast	West Uttar Pradesh and adjoining Haryana	Moved away eastnortheastwards on 29
9.	Do	27 – 29	Do	Northeast	eastern parts of Jammu & Kashmir	Moved away northeastwards on 30
10.	Do	30 Nov – 3 Dec	Central Pakistan and adjoining areas of Punjab and Jammu & Kashmir	Do	eastern parts of Jammu & Kashmir and neighbourhood	Moved away northeastwards on 4 December
<b>(b) Induced systems</b>						
1.	Cyclonic circulation upto mid tropospheric levels	21 – 24	Central Pakistan and adjoining west Rajasthan	Eastnortheast	Haryana and neighbourhood	Moved away eastnortheastwards on 25



TABLE 3 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
2.	Cyclonic circulation upto lower tropospheric levels	30 Nov – 2 Dec	Northwest Rajasthan and neighbourhood	Northeast	Himachal Pradesh and adjoining Uttaranchal	Less marked on 3 December
<b>(D) Other cyclonic circulations</b>						
1.	Mid tropospheric levels	7 – 11	Sri Lanka and adjoining southwest Bay	Northwest	Southeast and adjoining east-central Arabian Sea off Kerala – Karnataka coasts	Less marked on 12
2.	Do	10 – 12	Gujarat State	Stationary	<i>In situ</i>	Less marked on 13
3.	Lower tropospheric levels	16 – 17	Sri Lanka and neighbourhood	Northwest	Tamil Nadu and adjoining Commorin area	Less marked on 18
4.	Mid tropospheric levels	23 – 25	Eastern parts of Bangla Desh and adjoining Tripura and Meghalaya	Northeast	Nagaland-Manipur-Mizoram-Tripura and neighbourhood	Less marked on 26
5.	Do	27 – 29	Gangetic West Bengal and neighbourhood	East	Gangetic West Bengal and adjoining Bangla Desh	Less marked on 30
<b>(E) Troughs in easterly</b>						
1.	At Sea level	1 – 3	South Andaman Sea	West	Southeast Bay and adjoining south Andaman Sea	Merged with the low pressure area over Lakshadweep – Maldives areas
2.	Do	6 – 12	Southwest Bay to west central Bay off Tamil Nadu–Andhra coasts	West	Maldives–Lakshadweep areas off Kerala coast	Less marked on 13
3.	Do	7 – 15	Lakshadweep area to south Gujarat Region	Do	Southwest Arabian Sea	Less marked on 16
4.	Do	9 – 20	South Andaman Sea	Do	Southeast Arabian Sea and adjoining Lakshadweep–Maldives areas	Less marked on 21
5.	Do	13 – 27	Southeast Bay and adjoining south Andaman Sea	Do	Maldives–Lakshadweep areas and adjoining east central Arabian Sea	Less marked on 28
6.	Do	24 Nov – 17 Dec	Southwest Bay off Tamil Nadu– Sri Lanka coasts	Do	Southeast Arabian Sea	Merged with another trough on 18
7.	Do	26 – 30	Andaman Sea	Do	Southeast Bay to east central Bay	Less marked on 31
<b>(G) Troughs in westerly</b>						
1.	Mid tropospheric levels	17–20	Long. 62° E, north of Lat. 25° N	Northeast	Long. 85° E	Moved away on 21

The month's lowest minimum temperature in the plains of the country was 7.5° C, recorded at Amritsar (Punjab) on 31 October 2004.

### 3.1.7. *Disastrous weather events and associated damage*

Apart from the havoc created by the depression, heavy rains and landslides also took a toll of 36 people in northeast India and 14 in Gangetic West Bengal. Flash floods claimed 500 lives in Assam. Due to lightning and heavy rain 21 people lost their lives in Tamil Nadu, 5 in Kerala and 8 in Karnataka. Road and Rail Transport were disrupted in Kerala, Karnataka and Assam.

## 3.2. *November*

### 3.2.1. *Storms/Depressions*

During the month one deep depression (2 - 7 November) and a Severe Cyclonic Storm (29 November - 2 December) formed over the Arabian Sea. No intense systems formed over the Bay of Bengal. Details of the systems are given below :

#### 3.2.1.1. *Deep depression over the Arabian Sea (2-7 November 2004)*

A well marked low pressure area over the southeast and adjoining east central Arabian Sea concentrated into a depression on 2 evening and lay centred near Lat. 12.0° N / Long. 67.0° E at 1200 UTC of 2; Lat. 13.0° N / Long. 67.0° E at 0300 UTC of 3; Lat. 13.5° N / Long. 67.0° E at 1200 UTC of 3 & 0300 UTC of 4 and near Lat. 14.0° N / Long. 67.0° E at 1200 UTC of 4. It remained practically stationary over there and further intensified into a deep depression at 0300 UTC of 5. It lay centred near Lat. 15.0° N / Long. 66.0° E at 1200 UTC of 5 and near Lat. 15.0° N / Long. 63.0° E at 0300 UTC of 6. Subsequently it weakened into a depression and lay centred near Lat. 15.0° N / Long. 61.5° E at 0900 UTC of 6; near Lat. 15.0° N / Long. 61.0° E at 1200 UTC of 6; near Lat. 14.5° N / Long. 58.5° E at 0300 UTC of 7 and near Lat. 13.5° N / Long. 56.5° E at 1200 UTC of 7. It further weakened into a low pressure area and became unimportant on 8 morning. Track of the system is given in Fig. 2.

The maximum intensity based on satellite imagery was T.2.0 from 0300 UTC of 5 to 0900 UTC of 6.

No damage occurred due to this system, as it moved away from the coast and dissipated over the sea.

#### 3.2.1.2. *Severe cyclonic storm over the Arabian Sea (29 November – 2 December 2004)*

A low pressure area formed in the equatorial wave, concentrated into a depression on 29 morning and lay centred near Lat. 1.5° N / Long. 66.0° E at 0300 UTC of 29. Moving northwestwards, it rapidly intensified into a cyclonic storm and lay centred near Lat. 3.0° N / Long. 64.5° E at 1200 UTC of 29 and near Lat. 5.0° N / Long. 62.5° E at 0300 UTC of 30. It further intensified into a severe cyclonic storm and lay centred near Lat. 5.5° N / Long. 61.5° E at 0600 UTC of 30 and near Lat. 6.0° N / Long. 60.5° E at 1200 UTC of 30. Subsequently it weakened into a cyclonic storm at 1800 UTC of 30 November and lay centred near Lat. 6.0° N / Long. 60.0° E. It lay centred near Lat. 7.0° N / Long. 59.5° E at 0300 UTC of 1 December, and weakened into a deep depression at 0900 UTC of 1, near Lat. 7.5° N / Long. 58.5° E and into a depression at 0300 UTC of 2 near Lat. 8.0° N / Long. 56.5° E and near Lat. 8.0° N / Long. 55.0° E at 1200 UTC of 2. It weakened into a low pressure area off Somalia coast on 3 morning. Track of the system is shown in Fig. 2.

The maximum intensity of the system based on Satellite imagery was T 3.5 from 0600 UTC to 1500 UTC of 30 November.

No damage occurred due to this system as well, as it moved away from the west coast and dissipated over the sea.

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

Summary of the synoptic systems for the month of November 2004 are given in Table 3.

Northeast monsoon was *vigorous* on 1 day in coastal Andhra Pradesh. It was *active* on 9 days in Tamil Nadu, 4 days in Kerala and 1 day each in coastal Andhra Pradesh and Rayalaseema. *Very heavy* rain occurred on 1 to 2 days in coastal Andhra Pradesh, Tamil Nadu and Kerala. *Heavy Rain* also occurred on 9 days in Tamil Nadu; 4 days in Andaman & Nicobar Islands and 1 to 2 days in Marathwada, coastal Andhra Pradesh and Kerala.

### 3.2.3. *Monthly rainfall*

Monthly rainfall was *normal* in 5 subdivisions, viz., Jammu & Kashmir, Vidarbha, Tamil Nadu, coastal Karnataka and Lakshadweep; *deficient* in 8 viz., Andaman & Nicobar Islands, Sub-Himalayan West Bengal & Sikkim, west Uttar Pradesh, east Madhya Pradesh, coastal Andhra Pradesh, Rayalaseema, south interior Karnataka and Kerala; and *scanty* in 22 viz., Arunachal Pradesh, Assam & Meghalaya, Nagaland - Manipur - Mizoram-

**TABLE 4**  
**Details of the weather systems during December 2004**

S. No.	System	Duration	Place of first location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>(A) Low pressure areas</b>						
1.	Low pressure area	11 – 16	Southeast Bay	West	Southeast Bay and adjoining Commorin area	It was first seen as a trough of low over south Andaman Sea and adjoining southeast Bay on 8. A trough extended from this system northwards to west central Bay during 13-15
<b>(B) Western disturbances /Eastward moving cyclonic circulations</b>						
<b>(a) Upper air cyclonic circulations</b>						
1.	Mid tropospheric levels	3 – 5	Northeast Afghanistan and adjoining Pakistan	Northeast	Eastern parts of Jammu & Kashmir	Moved away northeastwards on 6
2.	Do	6 – 12	North Pakistan and adjoining Jammu & Kashmir	Do	Jammu & Kashmir and neighbourhood	Moved away northeastwards on 13
3.	Do	13 – 16	Do	Do	Eastern parts of Jammu & Kashmir	Less marked on 17
4.	Do	16 – 21	Northeast Afghanistan and adjoining Pakistan	Eastnortheast	Do	Moved away eastnortheastwards on 22
5.	Do	21 – 23	Do	Northeast	Do	Moved away northeastwards on 24
6.	Do	23 – 26	Do	Do	Do	Moved away northeastwards on 27
7.	Do	27 – 29	Do	Do	Do	Moved away northeastwards on 30
8.	Do	29 Dec – 2 Jan	Afghanistan and adjoining Pakistan	Do	Jammu & Kashmir and adjoining Punjab and Himachal Pradesh	Moved away northeastwards on 3 January
<b>(b) Induced systems</b>						
1.	Low pressure area	19 – 20	Central Pakistan and adjoining Punjab and Jammu & Kashmir	Northeast	Northeast Rajasthan and adjoining west Uttar Pradesh	Associated upper air cyclonic circulation lay over west Uttar Pradesh and adjoining Uttaranchal on 21 & 22
2.	Cyclonic circulation upto mid tropospheric levels	2 – 3	Central Rajasthan and neighbourhood	Stationary	<i>In situ</i>	Less marked on 4
3.	Depression	31 Dec 04 – 1 Jan 05	Northwest Rajasthan and adjoining Pakistan	Northnortheast	North Pakistan and adjoining Jammu & Kashmir	It was seen as an induced cyclonic circulation over southwest Rajasthan and adjoining Gujarat Region on 22. Under its influence a low pressure area formed over there on 30 and concentrated into a depression on 31. It weakened into a low pressure area on 1 and became less marked on 2
<b>(C) Other cyclonic circulations</b>						
1.	Mid tropospheric levels	16 – 17	Bangla Desh and neighbourhood	Northeast	Nagaland-Manipur-Mizoram-Tripura and neighbourhood	Moved away on 18
2.	Lower levels	21 – 23	Assam & Meghalaya and neighbourhood	Stationary	<i>In situ</i>	Moved away on 24

TABLE 4 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
3.	Lower tropospheric levels	23 – 24	Southwest Bay and adjoining Sri Lanka	Quasi-stationary	Commorin Areas and adjoining Sri Lanka	Less marked on 25
<b>(D) Troughs in easterly</b>						
1.	Trough of low at sea level	1 – 4	Lakshadweep – Maldives areas to north Maharashtra coast	Quasi stationary	Lakshadweep area to south Maharashtra coast	Less marked on 5 A cyclonic circulation was embedded on the system at 3.1 kms a.s.l. over east-central Arabian Sea and adjoining Karnataka on 1
2.	Do	7 – 12	Southeast Bay and adjoining Andaman Sea	West	Southwest Bay off Sri Lanka-south Tamil Nadu coasts	Merged with low pressure are over southwest Bay on 13
3.	Do	16 – 31	South Andaman Sea and adjoining southeast Bay	Do	Lakshadweep-Maldives areas	Moved away on 1 January 2005
4.	At sea level	21 – 28	Southeast Bay	Do	Southwest Bay and adjoining Tamil Nadu coast	Moved away on 29
5.	Do	28 – 31	Commorin-Maldives areas	Do	Maldives-Lakshadweep areas	less marked on 1 January
<b>(E) Troughs in westerly</b>						
1.	Mid and upper tropospheric westerlies	30 Dec 04 – 4 Jan 05	North of Long. 63° E/ Lat. 20° N	Eastnortheast	Along Long. 84° E North of Lat. 20° N	Moved away on 5 January 2005

Tripura, Gangetic West Bengal, Orissa, Jharkhand, Bihar, east Uttar Pradesh, Uttaranchal, Haryana, Punjab, Himachal Pradesh, east Rajasthan, west Madhya Pradesh, Gujarat Region, Saurashtra & Kutch, Konkan & Goa, Madhya Maharashtra, Marathwada, Chattisgarh, Telangana and north interior Karnataka. There was no rain in west Rajasthan. The significant amounts of rainfall during the month are given in Table 5.

#### 3.2.4. Temperature

Unlike the previous year, *Cold wave conditions* were not reported during November 2004. Night temperatures were *appreciably to markedly below normal* on : 8 to 11 days in Orissa, Jharkhand, coastal Andhra Pradesh and Rayalaseema; 4 to 7 days in Bihar, Punjab, Telangana and south interior Karnataka and on 1 to 3 days in Sub-Himalayan West Bengal & Sikkim, east Uttar Pradesh, Uttaranchal, Haryana, Himachal Pradesh, Rajasthan, Saurashtra & Kutch, Madhya Maharashtra, Vidarbha, Chattisgarh, Tamil Nadu, coastal and north interior Karnataka and Kerala, *below normal* on : 8 to 11 days in Orissa, Uttar Pradesh, Haryana, Punjab and Jammu & Kashmir; 4 to 7 days in Assam & Meghalaya, Gangetic

West Bengal, Jharkhand, Uttaranchal, east Rajasthan, Madhya Maharashtra, Chattisgarh, coastal Andhra Pradesh, Telangana, Rayalaseema, Tamil Nadu and south interior Karnataka: 1 to 3 days in Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Bihar, Himachal Pradesh, west Rajasthan, Madhya Pradesh, Saurashtra & Kutch, Konkan & Goa, Marathwada, Vidarbha, coastal and north interior Karnataka and Kerala, *appreciably to markedly above normal* on : 19 to 25 days in Rajasthan, west Madhya Pradesh and Gujarat State; 9 to 15 days in Uttar Pradesh, Haryana, east Madhya Pradesh, Madhya Maharashtra, Marathwada, Vidarbha and Telangana; 4 to 8 days in Bihar, Punjab, Konkan & Goa and Chattisgarh; 1 to 3 days in Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Gangetic West Bengal, Orissa, Himachal Pradesh, Jammu & Kashmir, coastal Andhra Pradesh, Rayalaseema and coastal and north interior Karnataka and *above normal* on : 8 to 11 days in Bihar, Madhya Pradesh, Gujarat State and coastal Karnataka; 4 to 7 days in Nagaland-Manipur-Mizoram-Tripura, West Bengal & Sikkim, Orissa, east Uttar Pradesh, Haryana, Rajasthan, Madhya Maharashtra, Marathwada, Vidarbha, Andhra Pradesh and Tamil Nadu and on : 1 to 3 days in Assam & Meghalaya, Jharkhand,

TABLE 5

## Principal amounts of rainfall (cm) (3 cm and above)

Date	October	November	December
(1)	(2)	(3)	(4)
1.	Roing 13, Dhengraghat & Murbad 12 each, Adirampattinam 6, Pharenda & Tondi 5 each, Hengiri & Satna 4 each, Maya Bandar, Indore & Pamban 3 each	Mangalore 12, Kozhikode 11, Ramanathapuram 9, Karaikal, Chickmagalur & Minicoy 6 each, Kodaikanal & Coonoor 5 each, Tuticorin, Madurai, Mangalore & Karipur 4 each, Cuddalore, Chennai & Kanyakumari 3 each	Nancowry 3
2.	Hut Bay & Chanchal 11 each, Chikkanahalli 9, Hut Bay & Udaipur 8 each, Amraghat, Jarda, Yelburga & Gaganbavada 7 each, Port Blair, Lakhipur, Athagarh, Kolhapur & Vaijapur 5 each, Mehbubnagar 4, Gharmura, Gangtok, Keonjhar & Paratwada 3 each	Pambikulam 14, Kovilpatti 9, Valparai 6, Bhagamandala & Coonoor 5 each, Kota, Mangalore, Thiruvananthapuram & Palakkad 4 each, Nancowry & Punalur 3 each	Nil
3.	Cochi 19, Alapuzha 14, New Delhi 13, Kozhikode 11, Bhoranj & Nedumbassary 10 each, Khonsa, Mathura, Katra, Dholpur & Kottayam 9 each, Bharatpur, Uppinangady, Rudraprayag, Daltonganj & Hindupur 8 each, Karipur 7, Una 6, Agra & Mehkar 5 each, Gopalpur, Puri, Paradip, Karnal & Mandya 4 each, Jalpaiguri, Cuttack, Hissar, Ludhiana, Sundernagar, Batote, Kota, Chennai, Bidar, Chitradurga & Agumbe 3 each	Ankola 7, Hut Bay & Karwar 5 each, Thyagarthi & Panjim 4 each, Cuddalore & Satara 3 each	Cuddalore 6, Vedaranyam 3
4.	Thrissur 42, Kalingapatnam 27, Alipingal & Ramdurga 12 each, Gopalpur & Kakinada 11 each, Jalpaiguri & Nasik 10 each, Contai, Bangana, Visakhapatnam, Thiruvananthapuram & Kozhikode 9 each, Gangtok & Mandi 8 each, Petlabad, Tadong, Bhubaneswar & Balasore 7 each, Shillong, Paradip, Bhuntar, Karwar, Amini Divi & Agathi 6 each, Passighat, Tikarikilla, Waltair & Vijayawada 5 each, Puri, Churu, Aurangabad & Honavar 4 each, Bhalukpong, Chouldhowaghat, Canning Town, Haldia, Cuttack, Belgaum & Cochi 3 each	Car Nicobar 4, Thiruvananthapuram 3	Pamban 5, Kondul 4, Palayamkottai 3
5.	Patapatnam 19, Kundapura 17, Balasore 14, Cherrapunji, Chandbali & Shirali 12 each, Contai 11, Itanagar & Digha 10 each, Cuttack 9, Munnar 8, Kaladgi, Gopalpur, Bhubaneswar, Kurnool, Nandyal & Kozhikode 7 each, Diamond Harbour, Puri, Kalingapatnam, Karwar, Honavar & Agumbe 5 each, Dibrugarh & Jamshedpur 4 each, Passighat, Shillong, Imphal, Bankura, Surat, Jagdalpur, Ramagundam & Mehbubnagar 3 each	Nil	Nil
6.	Cherrapunji 39, Shillong 15, Jaipatna 13, Passighat 12, Sevoke & Digha 11 each, Ranchi & Miao 9 each, Peddapuram, Roing, Bhalukpong, Bokajan, Uluberia & Kolkata 7 each, Malda, Berhampore & Visakhapatnam 6 each, Port Blair, Kherunighat, Chouldhowaghat, Chandbali, Paradip, Cuttack, Bhubaneswar & Jagdalpur 5 each, Tezu, Itanagar, Karimganj, Kakinada & Bhadrachalam 4 each, Bansi, Changlang, Khowang, Dibrugarh, Dhollabazar, Goalpara, Tikrikilla, Sabroom, Ratnagiri, Waltair, Machilipatnam, Gannavaram & Ramagundam 3 each	Kavali 17, Parangipettai 15, Nellore 12, Aryankavu 9, Chennai 8, Pondicherry 7, Alapuzha, Karaikal & Cuddalore 6 each, Tirupathi 5, Tiruttani, Nagapattinam & Punalur 4 each, Kondul, Ongole, Ariyalur & Kottayam 3 each	Nil

TABLE 5 (Contd.)

(1)	(2)	(3)	(4)
7.	Cherrapunji 38, Malda 28, Tantloi 27, Majihan 21, Shillong 20, Berhampore & Khanapura 15 each, Diamond Harbour 14, Kolkata 13, Haldia 12, Uluberia, Bankura & Kolkata 11 each, Igatpuri & Panagarh 10 each, Itanagar 9, Ajaigarh 8, Shantiniketan 7, Digha 5, Tezpur, Agartala, Balasore, Jharsuguda, Paradip, Cuttack, Bhagalpur, Ranchi & Minicoy 3 each	Cuddalore 12, Kodaikanal 8, Nellore 7, Nil Chennai 6, Bandipura 5, Pondicherry 4	
8.	Cherrapunji 57, Shillong 26, Goalpara 22, Majihan 20, Malda 15, Guwahati 12, Tezpur & Khesiary 11 each, Cooch Behar & Dhengraghat 8 each, Tawang, Jharva & Sabroom 7 each, Kolkata 6, Agartala, Jalpaiguri & Canning Town 5 each, Car Nicobar, Keonjhar, Babaur & Khammam 4 each, Maya Bandar, Uluberia, Chandbali & Bhagalpur 3 each	Cuddalore & Coonoor 7 each, Tirupathi & Karaikal 6 each, Vellore & Tiruchirapalli 4 each, Koraput, Udgir, Sedam, Nagapattinam & Coimbatore 3 each	Nil
9.	Cherrapunji 7, Nawarangpur 5, Passighat, Dibrugarh, Tezpur, Indapur & Udgir 4 each, Nancowry 3	Ramanathapuram 9, Parbhani & Kondul 7 each, Coonoor 6, Shrirampur 5, Kollur & Cochi 4 each, Bhadrachalam, Nagapattinam, Palayamkottai, Tuticorin, Coimbatore & Cuddalore 3 each	Nil
10.	Aurangabad 6, Jenapur & Nalgonda 5 each, Mangal, Kondul, Nancowry, Car Nicobar & Okha 3 each	Ambasamudram 11, Agumbe 6, Car Nicobar, Kollur, Bhalukpong, Pariakhemundi, Car Nicobar & Ariyalur 3 each	Nil
11.	Mishrikh 11, Mettupatti 10, Neemsar 9, Jaipur 8, Auraiya, Sonapat & Batote 7 each, Agra, Banihal & Quazi Gund 6 each, Faridabad, Raya & Mandi 5 each, Talcher, Phool Bagh, Pantnagar, Rohtak, Katra, Srinagar & Bharatpur 4 each, Long Island, Bahraich, Bareilly, Bansoor, Mukteshwar, New Delhi & Dholpur 3 each	Nil	Nil
12.	Khanra 14, Chandigarh & Kandaghat 13 each, Hardwar, Dharampur, Nangal & Vallam 11 each, Kahu 10, Ambala, Uchana & Dhundhi 9 each, Khaga, Mohgaon, Kalka, Bhuntar & Bhanjar 8 each, Bhang, Baggi, Kasol, Pandoh & Shimla 7 each, Naraingarh, Balachaur & Suni Bhajji 6 each, Nowgong, Ludhiana, Berthin, Barsar, Bhoranj, Rampur Bushar & Sundernagar 5 each, Kanpur, Hamirpur & Kasauli 4 each, Maya Bandar, Bahraich, Bareilly, Panchkula, Nawandhahar, Solangnala, Khajuraho, Sagar, Bangalore & Cochi 3 each	Parangipettai 25, Chidambaram 23, Wardha & Yeotmal 5 each, Akola 3	Nancowry 4
13.	Coonoor 8, Timppuvanam 7, Manamelkuddy 5, Goalpara 4, Jalpaiguri, Chennai & Valapara 3 each	Vedaranyam 11, Sri Perumbudur 10, Ketti 8, Tuticorin 7	Nancowry 3
14.	Bhawani, Sitharamapuram & Sankeshwara 8 each, Hassan 7, K. B. Dam 5, Maya Bandar, Kolhapur, Berhampore, Bhalukpong, Chickmagalur, Medikere, Chennai, Bidar & Punalur 3 each	Amraoti 3	Ramanathapuram 11, Pamban 10, Vedaranyam, Tondi & Manamelkudy 7 each, Adirampattinam 5, Karaikal 3
15.	Huliyurduraga 13, Usilampatti 10, Bagati Magra & Vadakara 9 each, Deogarh 8, K. Paramathy 7, Machilipatnam, Mandya & Punalur 6 each, Panjim, Gannavaram & Alapuzha 5 each, Mehbubnagar, Shirali, Kannur & Karipur 4 each, Maya Bandar, Baikuntpur, Valapara, Bangalore, Mysore & Cochi 3 each	Nil	Adirampattinam 3

TABLE 5 (Contd.)

(1)	(2)	(3)	(4)
16.	Kolar 18, Rayakottah 10, Arogyavaram, Sabroom 7, Amraghat & Agartala 6 each, Kailashahar 5, Bangalore 4, Coonoor 3	Shenkottah 7	Nil
17.	Thodupuzha 12, Rayakottah 8, Coimbatore 6, Narsapur & Yercaud 5 each, Dholai & Dharmapuri 4 each, Car Nicobar & Cochi 3 each	Nil	Nil
18.	Thirthala 10, Sular 8, Coimbatore 5, Coonoor & Karaikal 3 each	Port Blair 7	Nil
19.	Palani 8, Mancompu 7, Pamban & Thiruvananthapuram 5 each, Alapuzha 4, Chennai & Bangalore 3 each	Maya Bandar 5	Hamirpur & Kondul 5 each
20.	Cannur 4, Mandya 3	Chepan 4, Maya Bandar 3.	Bajinath 5, Kangra, Batote & Sujanpurtira 4 each, Nangal, Berthin, Dharamshala & Katra 3 each
21.	Kavali 5, Minicoy 4, Ongole, Thanjavur & Karipur 3 each	Nil	Tissa 3
22.	Kottayam 9, Coonoor 7, Amini Divi 6, Cochi 4, Kavali, Pondicherry, Nagapattinam & Alapuzha 3 each	Nil	Tezu 4, Itanagar & Sankalan 3 each
23.	Tondi 4, Tirupathi & Tiruchirapalli 3 each	Karaikal 8, Nagapattinam 4	Nil
24.	Khanapura, Palayamkottai, Kodaikanal & Punalur 4 each, Kavali, Cuddalore, Chennai & Karaikal 3 each	Karaikal 3	Nil
25.	Car Nicobar, Chennai & Minicoy 3 each	Nil	Nil
26.	Ramanathapuram 18, Manamelkuddy 9, Tondi 7, Holenarasipura 6, Tuticorin & Adirampattinam 5 each, Cochi 4, Nellore, Palayamkottai, Pamban & Vedaranyam 3 each	Cochi 5, Kavali 4, Tirupathi & Parangipettai 3 each	Nil
27.	Kavali & Shenkottah 8 each, Karaikal 4, Pamban 3	Port Blair 8, Maya Bandar 5, Hut Bay, Rajgarh, Nellore & Tiruchirapalli 3 each	Nil
28.	Vedaranyam 6, Nancowry, Chennai & Pondicherry 4 each, Gossaigaon, Daringibadi, Karaikal, Cuddalore, Tiruchirapalli & Nagapattinam 3 each	Port Blair 9	Karaikal 3
29.	Vedaranyam 17, Nagapattinam 15, Karaikal 14, Peermade & Manamelkuddy 9 each, Chennai 7, Nagamangala 6, Adirampattinam & Pondicherry 5 each, Rania & Cuddalore 4 each, Kondul, Tondi, Coonoor, Kanyakumari, Nellore & Tirupathi 3 each	Hut Bay 6	Nil
30.	Nagapattinam 31, Karaikal 12, Nellore 9, Kavali 8, Piravom 7, Chennai 6, Somwarpet, Tirupathi, Cuddalore & Kottayam 5 each, Sulya, Pondicherry & Palakkad 4 each, Machilipatnam & Narsapur 3 each	Batote & Banihal 5 each, Car Nicobar & Pahalgam 4 each, Kupwara, Quazi Gund & Srinagar 3 each	Nil
31.	Cuddalore 28, Pondicherry 21, Coonoor 20, Nellore & Adirampattinam 13 each, Tondi 11, Chalakudy 10, Gundlupet & Karaikal 7 each, Nagapattinam & Cochi 6 each, Kodaikanal & Karipur 4 each, Rayagadda & Alapuzha 3 each		

west Uttar Pradesh, Uttaranchal, Himachal Pradesh, Jammu & Kashmir, interior Karnataka and Kerala.

Month's lowest minimum temperature in the plains of the country was 6° C recorded at Amritsar (Punjab) on 14 & 19 November 2004.

### 3.2.5. *Disastrous weather events and associated damage*

*Heavy rains* claimed the lives of 8 people in Karnataka, 4 in Andhra Pradesh and 3 in Tamil Nadu. One person died in Kerala due to lightning. Paddy and Samba crops in thousands of Hectares were damaged in Kerala, Tamil Nadu and Andhra Pradesh due to heavy rain. Also 2285 Hectares of Paddy crops were damaged in West Bengal due to hail storm.

## 3.3. *December*

### 3.3.1. *Storms/Depressions*

No storm or depression formed during the month.

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

Table 4 gives the summary of synoptic systems during the month of December 2004.

Northeast monsoon was not much active all through the month. Tamil Nadu received heavy rain only for a day. Jammu & Kashmir reported the season's first snowfall on 20 December.

### 3.3.3. *Monthly rainfall*

Monthly rainfall was *excess* in west Rajasthan, *deficient* in 6 meteorological sub-divisions *viz.*, Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Punjab, Himachal Pradesh and Jammu & Kashmir and was *scanty* in 18, *viz.*, Andaman & Nicobar Islands, Nagaland-Manipur-Mizoram-Tripura, Gangetic West Bengal, Orissa, Jharkhand, Bihar, east Uttar Pradesh, west Uttar Pradesh, Uttaranchal, Haryana, east Rajasthan, Chattisgarh, coastal Andhra Pradesh, Tamil Nadu, north and south interior Karnataka, Kerala and Lakshadweep. The remaining 11 sub-divisions were dry, *viz.*, east & west Madhya Pradesh, Gujarat region, Saurashtra & Kutch, Madhya Maharashtra, Marathwada, Vidarbha, Konkan & Goa, Telangana, Rayalaseema and coastal Karnataka. The significant amounts of rainfall during the month are given in Table 5.

### 3.3.4. *Temperature*

*Cold wave* conditions prevailed on: 1 to 3 days in Jharkhand and Punjab. Night temperatures were *appreciably to markedly below normal* on : 7 to 9 days in interior Karnataka; 4 to 6 days in Orissa, Punjab, Telangana, Rayalaseema and Tamil Nadu and on 1 to 3 days in Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Jharkhand, Bihar, east Uttar Pradesh, Uttaranchal, Haryana, Jammu & Kashmir, Rajasthan, east Madhya Pradesh, Gujarat region, Konkan & Goa, Madhya Maharashtra, Vidarbha, coastal Karnataka and Kerala, *below normal* on : 11 to 16 days in Madhya Maharashtra, Telangana, Rayalaseema, Tamil Nadu and south interior Karnataka; 4 to 9 days in Orissa, Jharkhand, Haryana, Punjab, Konkan & Goa, Marathwada, Chattisgarh, coastal Andhra Pradesh, coastal Karnataka and Kerala; 1 to 3 days in Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, West Bengal & Sikkim, Bihar, Uttar Pradesh, Uttaranchal, Himachal Pradesh, Jammu & Kashmir, Rajasthan, east Madhya Pradesh, Gujarat State, Vidarbha and north interior Karnataka, *appreciably above normal* on : 22 to 27 days in Rajasthan and Saurashtra & Kutch; 13 to 16 days in West Bengal & Sikkim, east Uttar Pradesh, Himachal Pradesh, west Madhya Pradesh and Gujarat region; 4 to 11 days in Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Orissa, Bihar, west Uttar Pradesh, Punjab, Jammu & Kashmir, east Madhya Pradesh, Madhya Maharashtra and Marathwada; 1 to 3 days in Arunachal Pradesh, Jharkhand, Konkan & Goa, Vidarbha, Chattisgarh, coastal Andhra Pradesh, Rayalaseema and Tamil Nadu and *above normal* on : 7 to 10 days in Assam & Meghalaya, West Bengal & Sikkim, Uttaranchal, Punjab, Jammu & Kashmir, west Uttar Pradesh and Gujarat region; 4 to 6 days in Nagaland-Manipur-Mizoram-Tripura, Orissa, Bihar, east Uttar Pradesh, Haryana, Rajasthan, east Madhya Pradesh, Saurashtra & Kutch, Madhya Maharashtra, Marathwada, Chattisgarh, coastal Andhra Pradesh and Tamil Nadu and on: 1 to 3 days in west Uttar Pradesh, Himachal Pradesh, Konkan & Goa, Vidarbha, Rayalaseema, coastal & south interior Karnataka and Kerala.

Month's and season's lowest minimum temperatures in the plains of the country was 0° C recorded at Amritsar (Punjab) on 29 December 2004.

### 3.3.5. *Disastrous weather events*

The killer Tsunami on 26 December 2004 which struck the Indian coasts as the aftermath of an earthquake of great intensity off Sumatra, took the lives of more than 15,000 people in our country alone. Cold wave claimed the lives of 16 people in Jharkhand during the month.



**Appendix****Definitions of the terms given in 'Italics'****Rainfall**

<i>Excess</i>	- percentage departure from normal is + 20% or more.
<i>Normal</i>	- percentage departure from normal is from -19 % to + 19 %.
<i>Deficient</i>	- percentage departure from normal is from -20 % to -59 %.
<i>Scanty</i>	- percentage departure from normal is from -60 % to -99 %.
<i>Heavy rain</i>	- rainfall amount is from 6.5 cm to 12.4 cm.
<i>Very heavy rainfall</i>	- rainfall amount is 12.5 cm or more.
<i>At most places</i>	- 75 % or more stations of a meteorological sub-division reporting at least 2.5 mm rainfall.
<i>At many places</i>	- 51% to 74 % stations of a meteorological sub-division reporting at least 2.5 mm rainfall.
<i>At a few places</i>	- 26 % to 50% stations of a meteorological sub-division reporting at least 2.5 mm rainfall.
<i>At isolated places</i>	- 25% or less stations of a meteorological sub-division reporting at least 2.5 mm rainfall.

**Monsoon activity****(a) Southwest monsoon**

<i>Vigorous</i>	- rainfall exceeding 4 times the normal with, at least two stations reporting rainfall more than or equal to 8 cm along the west coast and 5 cm elsewhere. Rainfall in that sub-division should be fairly widespread or widespread.
<i>Active</i>	- rainfall more than 1½ to 4 times the normal, with at least two stations reporting rainfall more than or equal to 5 cm along the west coast and 3 cm elsewhere. Rainfall in that sub-division should be fairly widespread or widespread.

**(b) Northeast monsoon**

<i>Vigorous</i>	- rainfall exceeding 4 times the normal with at least two stations reporting rainfall more than or equal to 5 cm in coastal Tamil Nadu and south coastal Andhra Pradesh and 3 cm elsewhere in the northeast monsoon region. Rainfall in that sub-division should be fairly widespread or widespread.
<i>Active</i>	- rainfall more than 1½ to 4 times the normal, with at least two stations reporting rainfall more than or equal to 3 cm in coastal Tamil Nadu and south coastal Andhra Pradesh and 2 cm elsewhere in the northeast monsoon region. Rainfall in that sub-division should be fairly widespread or widespread.

**Temperatures****(a) Maximum / Day temperature**

<i>Markedly above normal</i>	- departure from normal is +5° C to +6° C (where the normal maximum temperature is 40° C or less).
<i>Appreciably above normal</i>	- departure from normal is +3° C to +4° C (where the normal maximum temperature is 40° C or less).
<i>Above normal</i>	- departure from normal is +2° C.
<i>Normal</i>	- departure from normal +1° C to -1° C

**(b) Minimum / Night temperature**

<i>Cold wave conditions</i>	- when the wind chill effective minimum temperature (WCT <sub>n</sub> ) is 10° C or less: For stations whose normal minimum temperature is ≥ 10° C, when the departure from normal is - 5° to - 6° C, and for stations whose normal minimum temperature is less than 10° C when the departure from normal is -4° to -5° C. Also when WCT <sub>n</sub> is ≤ 0° C, cold wave is declared irrespective of the departure for those stations whose normal minimum temperature is greater than 0° C.
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*Markedly below normal* - departure from normal is  $-5^{\circ}\text{C}$  to  $6^{\circ}\text{C}$  (where the normal minimum temperature is  $10^{\circ}\text{C}$  or more).

*Appreciably below normal* - departure from normal is between  $-3^{\circ}\text{C}$  to  $-4^{\circ}\text{C}$  (where the normal minimum temperature is  $10^{\circ}\text{C}$  or more).

*Below normal* - departure from normal is  $-2^{\circ}\text{C}$

*Normal* - departure from normal is  $+1^{\circ}\text{C}$  to  $-1^{\circ}\text{C}$ .

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