

Weather in India

POST MONSOON SEASON (October - December 2012)†

1. Introduction

This was the first year (as per the available data since 1891), when during a year, only post-monsoon season was cyclogenetically active. In all, five intense low pressure systems formed during the season. This includes; two Cyclonic Storms ('Murjan' & 'Nilam') and three Deep Depressions. Out of these systems, three systems formed over the Bay of Bengal (CS Nilam, a Deep Depression and a Depression) and two over the Arabian Sea (CS Murjan and a Deep Depression).

Out of the five systems, the Cyclonic storm Nilam crossed the Indian coast and caused death and damages while the other three systems caused weather except for the last Deep Depression (22-25 December) over the Arabian Sea which did not affect the country.

The northeast monsoon rains commenced over Peninsular India on 19th October and ceased on 11th January 2013. The El-Nino indicators maintained a neutral phase all through the season. An active phase of Madden-Julian Oscillations coincided the commencement phase of Northeast Monsoon.

*Severe cold wave / cold wave conditions** prevailed over parts of central India and interior Karnataka in the third week of November. Passage of perturbations in the westerly and easterly wind regimes led to moisture incursion and cloudiness, thus moderating the severity of cold during October and November. Only towards the last week of December, the *severe cold wave / cold wave conditions* manifested over north, northwest and east India.

The major weather related disasters that occurred over the south Peninsula were caused by heavy rainfall and that over north India by *cold wave* and dense fog.

2. Seasonal rainfall (October–December)

The meteorological sub-divisionwise rainfall departures from normal are given in Fig. 1 and Table 1.

During the season, rainfall activity over the country as a whole was subdued. Northwest and central India received deficient rainfall.

* *Definitions of terms in italics other than sub-titles are given in Appendix A.*

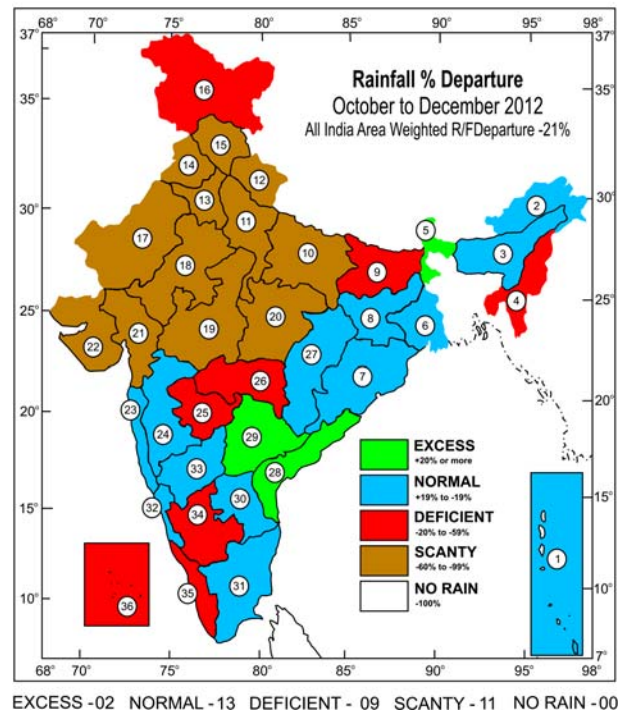


Fig. 1. Sub-divisionwise seasonal rainfall departure from normal (%) for Post monsoon season (October to December 2012). Sub-divisions are indicated by number on the map & bold letters in legend. The rainfall anomaly values for these 36 sub-divisions are indicated below :

1	-4	7	3	13	-71	19	-93	25	-29	31	-16
2	-17	8	-1	14	-72	20	-64	26	-48	32	-16
3	-7	9	-41	15	-62	21	-87	27	-14	33	-4
4	-24	10	-96	16	-28	22	-87	28	33	34	-23
5	-20	11	-93	17	-67	23	18	29	22	35	-35
6	-16	12	-64	18	-99	24	-11	30	-2	36	-50

A large seasonal rainfall deficiency realized over the north and northwestern parts of India as the systems in the westerly moved over more northern latitudes and gave rain/snow in the higher reaches of Himalayas during most parts of the season.

The systems in the easterlies contributed to the normal/excess rainfall over the south Peninsula. However, out of the 5 intense low pressure systems mentioned in the beginning, only one cyclonic storm (Nilam) had a major contribution to the rainfall over the south Peninsula.

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TABLE 1

Sub-divisionwise rainfall (mm) for each month and season as a whole (October-December 2012)

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	207.9	296.7	-30%	272.1	253.7	7	185.3	145.5	27	665.3	695.9	-4
2.	Arunachal Pradesh	173.5	183.0	-5%	15.6	45.8	-66	33.8	38.4	-12	222.9	267.2	-17
3.	Assam & Meghalaya	167.2	154.8	8%	11.0	28.4	-61	3.1	11.8	-74	181.3	195.0	-7
4.	Naga., Mani., Mizo. and Tri.	142.4	179.8	-21%	41.3	50.7	-18	0.1	12.5	-99	183.8	243.0	-24
5.	Sub-Himalayan West Bengal & Sikkim	139.4	154.2	-10%	6.1	20.3	-70	3.0	10.8	-72	148.5	185.3	-20
6.	Gangetic West Bengal	64.1	129.3	-50%	46.6	23.3	100	23.3	7.5	210	133.9	160.1	-16
7.	Orissa	69.2	111.6	-38%	76.1	27.7	175	3.6	4.8	-25	148.8	144.1	3
8.	Jharkhand	27.1	75.2	-64%	53.8	9.9	443	10.2	6.5	57	91.1	91.6	-1
9.	Bihar	40.7	64.8	-37%	5.1	6.9	-26	0.0	5.8	-100	45.8	77.5	-41
10.	East Uttar Pradesh	1.4	49.2	-97%	0.3	4.5	-92	0.7	6.7	-90	2.5	60.4	-96
11.	West Uttar Pradesh	0.6	42.1	-99%	0.1	4.7	-97	3.1	7.6	-59	3.9	54.4	-93
12.	Uttarakhand	8.8	58.6	-85%	4.6	9.7	-52	19.2	21.3	-10	32.7	89.6	-64
13.	Haryana, Chandigarh & Delhi	4.0	17.6	-77%	0.6	4.9	-88	3.9	6.9	-43	8.5	29.4	-71
14.	Punjab	2.8	22.0	-87%	0.4	5.7	-93	8.2	13.3	-38	11.3	41.0	-72
15.	Himachal Pradesh	2.9	42.5	-93%	6.7	20.3	-67	31.8	45.4	-30	41.5	108.2	-62
16.	Jammu & Kashmir	14.9	38.9	-62%	12.7	33.0	-62	67.5	59.9	13	95.0	131.8	-28
17.	West Rajasthan	1.6	5.4	-70%	0.0	2.5	-99	1.5	1.6	-9	3.1	9.5	-67
18.	East Rajasthan	0.3	16.9	-98%	0.0	7.4	-99	0.0	3.3	-99	0.3	27.6	-99
19.	West Madhya Pradesh	3.6	34.4	-90%	0.0	11.0	-100	0.0	7.7	-100	3.6	53.1	-93
20.	East Madhya Pradesh	8.9	37.5	-76%	7.8	9.9	-21	4.1	10.4	-61	20.8	57.8	-64
21.	Gujarat region	4.6	23.7	-81%	0.0	9.5	-100	0.0	1.7	-100	4.6	34.9	-87
22.	Saurashtra & Kutch	2.6	17.9	-85%	0.0	10.3	-100	1.0	0.8	27	3.6	29.0	-87
23.	Konkan & Goa	173.8	121.0	44%	1.7	22.3	-92	0.0	5.3	-100	175.5	148.6	18
24.	Madhya Maharashtra	92.2	79.0	17%	3.2	22.7	-86	0.0	6.1	-100	95.5	107.8	-11
25.	Marathawada	68.6	72.3	-5%	3.5	21.2	-83	0.0	8.1	-100	72.2	101.6	-29
26.	Vidarbha	34.5	59.6	-42%	8.3	13.2	-37	0.0	9.0	-99	42.8	81.8	-48
27.	Chattisgarh	31.9	62.3	-49%	30.0	8.8	241	3.9	5.8	-32	65.9	76.9	-14
28.	Coastal Andhra Pradesh	167.1	193.2	-14%	240.3	106.6	125	27.7	27.6	0	435.1	327.4	33
29.	Telangana	83.8	92.2	-9%	61.3	21.6	184	0.0	5.5	-100	145.1	119.3	22
30.	Rayalaseema	97.7	129.4	-24%	77.3	66.1	17	40.0	23.7	69	215.1	219.2	-2
31.	Tamil Nadu	256.8	180.2	42%	78.2	170.0	-54	32.7	88.0	-63	367.7	438.2	-16
32.	Coastal Karnataka	143.9	189.5	-24%	75.4	59.6	27	0.7	13.7	-95	220.1	262.8	-16
33.	North interior Karnataka	86.5	112.0	-23%	51.6	27.3	89	1.1	6.0	-82	139.1	145.3	-4
34.	South interior Karnataka	65.7	147.7	-55%	90.4	49.2	84	5.3	12.7	-58	161.5	209.6	-23
35.	Kerala	189.3	292.3	-35	113.4	150.9	-25	9.7	37.5	-74	312.4	477.5	-35
36.	Lakshadweep	146.1	157.1	-7%	12.5	117.7	-89	8.7	58.8	-85	167.3	333.6	-50

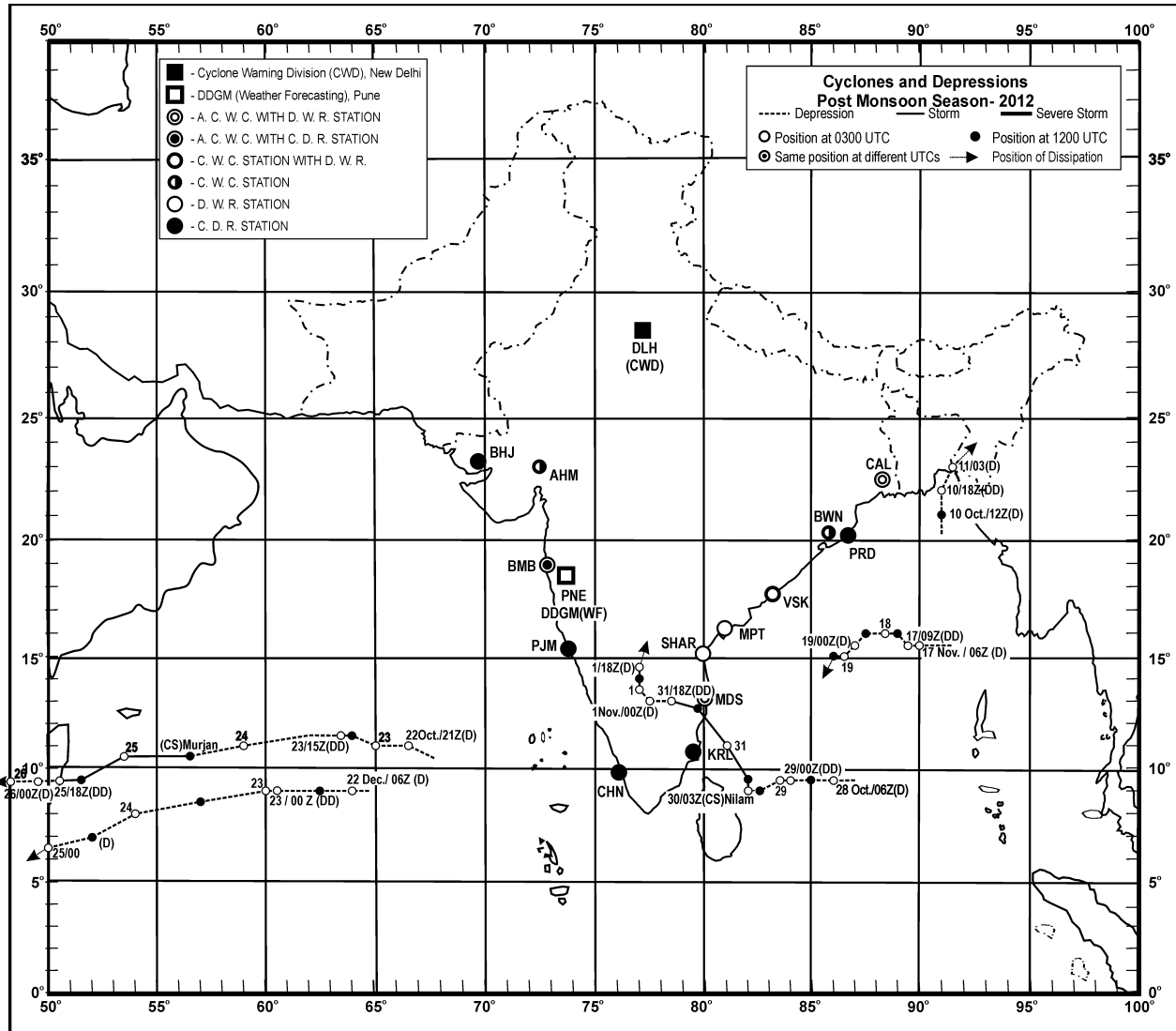


Fig. 2. Tracks of cyclonic storms and depressions during the period October to December, 2012

3. Monthly features

3.1. October

3.1.1. Withdrawal of southwest monsoon

The southwest monsoon withdrew from the entire country on 18th October, 3 days later than the respective normal date of 15th October. The tendency of delayed withdrawal of southwest monsoon from Rajasthan is being continued since 2006. A detailed summary on the withdrawal of southwest monsoon 2012 is provided in the seasonal summary of southwest monsoon published in the July 2013 issue of 'MAUSAM'.

3.1.2. Commencement of northeast monsoon rains

Setting in of the northeasterlies in the lower tropospheric levels and presence of a trough in the easterlies over the southwest Bay of Bengal caused fairly widespread rainfall over Tamil Nadu and south coastal Andhra Pradesh; thereby leading to commencement of northeast monsoon rains over the south Peninsular region on 19th October, one day prior to its normal date (20th October).

3.1.3. Storms and depressions

A Cyclonic Storm (Murjan, 23rd - 26th Oct.) and a Depression (10th - 11th October) over the Arabian Sea and

TABLE 2

Details of the weather systems during October 2012

S. No.	System	Duration	Place of first Location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Cyclonic storm						
1.	Cyclonic storm (Murjan)*	23 - 26 Oct	Near Lat. 11.0° N / Long. 65.0° E	West-west southwest and then west	Near Lat. 9.5° N / Long. 48.5° E over Somalia and neighbourhood	Under the influence of a trough of low at mean sea level extending from southeast Arabian Sea to south Maharashtra coast on 20, a low pressure area formed over southeast Arabian Sea and neighbourhood on 22 and as a well marked low pressure area over southeast and neighbouring areas of central & southwest Arabian Sea in the early morning of 23. It subsequently concentrated into a depression on 23 Morning
2.	Cyclonic storm (Nilam)*	28 Oct - 1 Nov	Near Lat. 9.5° N / Long. 86.0° E	West/north and then northwest	Near Lat. 14.5° N / Long. 77.0° E (over Rayalseema & neighbourhood)	First seen as a trough of low at mean sea level extended from Gulf of Siam and neighbourhood on 23. It re-organised into a low pressure area over southeast Bay of Bengal and neighbourhood on 27 and as a well marked low pressure area over southeast and adjoining southwest Bay of Bengal on 28. It subsequently concentrated into a depression. Associated cyclonic circulation extended upto 3.1 kms a.s.l. on 5 & 6 November over north coastal Andhra Pradesh and became less marked on 7 November
(B) Depression/Deep Depressions						
1.	Depression*	10 - 11 Oct	Near Lat. 21.0° N / Long. 91.0° E	North and then Northeast	Near Lat. 23.0° N / Long. 91.5° E over Bangladesh and adjoining areas of Tripura & Mizoram	Under the influence of an embedded cyclonic circulation extending upto lower tropospheric levels over west central Bay of Bengal and neighbourhood, a low pressure area formed over northwest and adjoining west central Bay of Bengal on 7 and as a well marked low pressure area over northeast Bay of Bengal off Bangladesh coast on 10 evening. It subsequently concentrated into a depression. Associated cyclonic circulation extended upto lower tropospheric levels over Assam & Meghalaya on 15
(C) Western disturbances / Eastward moving systems						
(i) Upper air cyclonic circulation						
1.	Upto 4.5 kms a.s.l.	10	North Pakistan neighbourhood	Northeast	-	Moved away on 11
2.	Do	14 - 16	Northeast Afghanistan and neighbourhood	Do	Jammu & Kashmir and neighbourhood	Moved away on 17
3.	Upto Mid tropospheric levels	18 - 22	North Pakistan and neighbourhood	Do	Eastern parts of Jammu & Kashmir	Moved away on 23
4.	Do	21 - 24	Northeast Afghanistan and neighbourhood	Do	Jammu & Kashmir and neighbourhood	It was first seen as a trough in the mid & upper tropospheric westerlies on 20. It moved away on 25
5.	Do	30 Oct - 2 Nov	Afghanistan and adjoining Pakistan	Northeast	Northern parts of Jammu & Kashmir	Moved away on 3 November

TABLE 2 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>(ii) Trough in westerlies</i>						
1.	Upto 4.5 kms a.s.l.	4 - 6	Eastern parts of Bihar & Telangana	East	West central Bay of Bengal and neighbourhood	Less marked on 7
<i>(iii) Induced cyclonic circulation</i>						
2.	Lower levels	21	West Rajasthan and neighbourhood	Stationary	<i>In situ</i>	Less marked on 22
(D) Other upper air cyclonic circulations						
1.	Upto 4.5 kms a.s.l.	13 - 17	Lakshadweep area and neighbourhood	West	Lakshadweep area and adjoining southeast Arabian Sea	Less marked on 18
2.	Between 1.5 & 4.5 kms a.s.l.	16	Southwest Bay of Bengal off Tamil Nadu coast	Stationary	<i>In situ</i>	Less marked on 17
(E) Troughs in easterlies						
1.	Trough of low at mean sea level	17 - 20	Southeast Bay of Bengal and neighbourhood	West	Comorin area to west central Bay of Bengal off Andhra Pradesh coast across coastal Tamil Nadu	It lay initially as a trough in lower easterlies over south Andaman Sea and adjoining Tenasserim coast on 15 th & 16. A cyclonic circulation lay embedded in the system over southeast Bay of Bengal and neighbourhood on 18 and upto mid tropospheric levels and merged with the cyclonic circulation associated with the lopar over southeast Arabian Sea and neighbourhood on 22. It merged with the trough from Lakshadweep area to south Gujarat Region on 21
2.	Do	19 - 31	Tenasserim coast and adjoining south Andaman Sea	West	Southeast Arabian Sea	A cyclonic circulation extending upto 3.1 kms a.s.l. was seen aloft on 21 & 22. The trough became less marked on 1 November
3.	Do	22	Centre of lopar over southeast Arabian Sea and neighbourhood to east central Arabian Sea off Maharashtra coast	Stationary	<i>In situ</i>	Less marked on 23
(F) North-south trough/wind discontinuity						
1.	Lower tropospheric levels	10 - 15	Gangetic West Bengal to north coastal Tamil Nadu	Oscillatory	Northeast Bay of Bengal to south Tamil Nadu coast across northwest & west central Bay of Bengal	An embedded cyclonic circulation extending upto 3.1 kms a.s.l. was seen over Odisha and neighbourhood on 10. The trough became unimportant on 16

* - The other details of the system are given in the 'Cyclones and Depressions 2012' in the July 2013 issue of 'MAUSAM'.

a Cyclonic storm (Nilam, 28th October – 1st November) over the Bay of Bengal formed during the month. Cyclonic Storm 'Nilam', after weakening caused

extremely heavy rainfall and floods situation over entire Andhra Pradesh. The tracks of these systems are given in Fig. 2.

TABLE 3

Details of the weather systems during November 2012

S. No.	System	Duration	Place of first location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Depression / Deep-Depressions						
1.	Deep Depression*	17 – 19 Nov	Lat. 15.5° N / Long. 90.0° E east central Bay of Bengal	West – northwest – southwest – west	Lat. 15.0° N / Long. 86.0° E	<p>Under the influence of a trough of low at mean sea level from southeast Bay of Bengal to east central Bay of Bengal, a low pressure area formed over southeast & adjoining southwest Bay of Bengal on 14. It became well marked over east central and adjoining southeast and west central Bay of Bengal on 16 evening.</p> <p>The depression weakened into a well marled low pressure area on 19 and became less marked on 23.</p> <p>A trough was seen at m.s.l. from southwest to west central Bay of Bengal along and off Tamil Nadu and south Andhra Pradesh coast with an embedded cyclonic circulation aloft on 23 & 24 and became unimportant on 25</p>
(B) Low pressure area						
1.	Low pressure area	27 (eve) Nov - 2 Dec	Andaman Sea and neighbourhood	West	Central parts of south Bay of Bengal	A low pressure area formed under the influence of a trough of low at mean sea level over Andaman Sea and neighbourhood on 27 evening. It was observed as a trough of low over southwest Bay of Bengal and neighbourhood on 3 and merged with the trough of low from southwest to west central Bay of Bengal on 4. Associated cyclonic circulation extended upto 2.1 kms a.s.l. over Comorin area and neighbourhood on 4 & 5 and became less marked 6
(C) Western disturbances / Eastward moving systems						
<i>(i) Upper air cyclonic circulations</i>						
1.	Up to 4.5 kms a.s.l.	4 - 5	Northeast Afghanistan and neighbourhood	Northeast	Jammu & Kashmir and neighbourhood	Moved away on 6
2.	Do	11	North Pakistan and adjoining Jammu & Kashmir	Do	Jammu & Kashmir and neighbourhood	Moved away on 12
3.	Up to Mid Tropospheric levels	15 - 21	North Pakistan and adjoining Jammu & Kashmir	Do	Jammu & Kashmir and neighbourhood	Moved away on 22
4.	Up to 4.5 kms a.s.l.	22 - 25	North Pakistan and neighbourhood	Do	Do	Moved away on 26
5.	Do	25 - 27	North Pakistan and neighbourhood	Do	Eastern parts of Jammu & Kashmir	Moved away on 28
6.	Up to Mid Tropospheric levels	27 - 29	Northeast Afghanistan and adjoining Pakistan	Do	Jammu & Kashmir and neighbourhood	Moved away on 30
(D) Other upper air cyclonic circulations						
1.	Up to mid tropospheric levels	9 - 14	Assam & Meghalaya and adjoining Nagaland-Manipur-Mizoram-Tripura	Stationary	<i>In situ</i>	<p>It was first seen as a trough of low in lower tropospheric levels extending from the centre of low pressure area over Telangana and neighbourhood (Remnant of 'Nilam') to Nagaland-Manipur-Mizoram-Tripura on 3 and then lay as a cyclonic circulation from 9.</p> <p>It became less marked on 15</p>

TABLE 3 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
2.	Between 1.5 & 3.1 kms a.s.l.	30 Nov - 2 Dec	Assam & Meghalaya and neighbourhood	East	Nagaland-Manipur-Mizoram-Tripura and neighbourhood	Less marked on 3 December
3.	Up to lower tropospheric levels	11 - 13	North Maharashtra coast	Stationary	<i>In situ</i>	Less marked on 14
4.	Up to 2.1 kms a.s.l.	25	South Tamil Nadu and neighbourhood	Do	Do	Less marked on 26
(E) Troughs in easterlies						
1.	Up to lower tropospheric levels	6 - 7	Gulf of Mannar off south Tamil Nadu coast	West	Southern parts of Kerala and neighbourhood	Less marked on 8.
2.	Trough of low at mean sea level	6 - 10	Gulf of Mannar to east central Arabian Sea across Lakshadweep area	Quasi-stationary	Comorin area to east central Arabian Sea	Less marked on 11
3.	Do	21 - 27	Southeast Bay of Bengal and adjoining south Andaman sea	West	Comorin area and neighbourhood	Less marked on 28

Details of these systems are given in the 'Cyclones and Depressions 2012' in the July 2013 issue of 'MAUSAM'.

3.1.4. Other synoptic features and associated weather

Table 2 gives a summary of the synoptic features for the month of October 2012. The sub-divisionwise percentage departure of rainfall from normal during the month is given in Table 1.

Southwest monsoon was *vigorous* on 1 to 3 days in Assam & Meghalaya, Bihar, Konkan & Goa, Madhya Maharashtra, Marathwada, Chhattisgarh, coastal Andhra Pradesh & Telangana and *active* on 3 to 4 days in Arunachal Pradesh, Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, Konkan & Goa, Madhya Maharashtra & coastal Karnataka and on 1 to 2 days in West Bengal & Sikkim, Jharkhand, Marathwada, Vidarbha, Andhra Pradesh, Tamil Nadu, north interior Karnataka and Kerala before commencement of northeast monsoon rain.

The northeast monsoon was active on 5 days in Tamil Nadu, 2 days in Rayalaseema and on 1 day each in coastal Andhra Pradesh, coastal & south interior Karnataka and Kerala.

3.1.5. Temperature

The maximum temperatures were generally *above/appreciably above* normal over Peninsular India on

many days during the first fortnight of the month. With the commencement of the northeast monsoon, it reached to its normal range. The maximum temperatures were *below/appreciably below normal* on a few days over north India from the second week of the month. They were near normal over the rest of the country.

The minimum temperatures were generally *below / appreciably below normal* on most of the days.

No *heat wave/cold wave* condition occurred during the month.

The month's highest maximum temperature was 41.0 °C recorded at Palayamkottai (Tamil Nadu) on 5th October 2012 and the lowest minimum temperature was 10.6 °C recorded at Amritsar (Punjab) on 27th October 2012 in the plains of the country.

3.1.6. Disastrous weather events and associated damage

As per press reports, *heavy rains* and lightning took a toll of 28 people in Tamil Nadu, 13 in Karnataka, 9 in Andhra Pradesh, 6 each in Assam and Uttar Pradesh, 4 in Mizoram, 3 each in Maharashtra and Kerala, 2 each in West Bengal and Madhya Pradesh and 1 in Kashmir.

During the last week of October, *heavy snowfall* over Pir-Panjal Mountains of Jammu & Kashmir led to closure of Mughal road and several vehicles got trapped.

TABLE 4
Details of the weather systems during December 2012

S. No.	System	Duration	Place of first location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Deep Depression / Depression						
1.	Deep Depression*	22 – 24 Dec	Central parts of south Arabian Sea near Lat. 9.0° N/ Long. 63.0° E	West - west southwest west	Lat. 6.5° N / Long. 50.0° E	It was first observed as a trough of low at mean sea level over Andaman Sea and neighbourhood on 16 It organized into a low pressure area over the southeast and adjoining southwest Arabian Sea on 22 morning
(B) Western Disturbances / Eastward moving cyclonic circulations						
<i>(i) Upper air cyclonic circulations</i>						
1.	Up to 4.5 kms a.s.l.	2 - 9	North Afghanistan and neighbourhood	Northeast	Northern parts of Jammu & Kashmir	Moved away on 10
2.	Do	9 - 12	Northeast Afghanistan and adjoining Pakistan	Do	Eastern parts of Jammu & Kashmir	Moved away on 13
3.	Upto Mid-tropospheric levels	12 - 16	Northeast Afghanistan and adjoining Pakistan	Do	Do	Moved away on 17
4.	Upto 4.5 kms a.s.l.	16 - 19	North Pakistan and neighbourhood	Do	Northern parts of Jammu & Kashmir	Moved away on 20
5.	Do	22 - 24	North Afghanistan and neighbourhood	Do	Jammu & Kashmir and neighbourhood	Moved away on 25
6.	Upto Mid-tropospheric levels	25 - 30	Northeast Afghanistan and adjoining Pakistan	Do	Eastern parts of Jammu & Kashmir	Moved away on 31
<i>(ii) Induced cyclonic circulations</i>						
1.	Upto 2.1 kms a.s.l.	11 - 12	West Rajasthan and neighbourhood	East	Haryana and neighbourhood	Less marked on 13
2.	Upto 1.5 kms a.s.l.	13 - 14	Central Pakistan and adjoining west Rajasthan	Do	Do	Less marked on 15
3.	Mid tropospheric levels	28 Dec - 1 Jan	West Rajasthan and adjoining central Pakistan	Northeast	Himachal Pradesh and neighbourhood	Moved away on 2 January
<i>(iii) Troughs in westerlies</i>						
1.	Mid and upper troposphere	5 - 6	Long. 65° E, to the north of 20° N (at 9.5 kms a.s.l.)	North	Long. 65° E, to the north of 25° N	Moved away on 7
2.	Upto lower level	12	Gangetic West Bengal to interior Odisha. (upto 0.9 km a.s.l.)	Stationary	<i>In situ</i>	Less marked on 13
(C) Other cyclonic circulations						
1.	Upto 2.1 km a.s.l.	4 - 5	Comorin area and neighbourhood	Stationary	<i>In situ</i>	Less marked on 6
2.	Upto lower tropospheric levels	9 - 11	Gulf of Mannar and adjoining Sri Lanka	West	Southeast Arabian Sea and neighbourhood	Less important on 12
3.	Do	15 - 16	Maldives area and neighbourhood	Stationary	<i>In situ</i>	Less marked on 17
4.	Between 0.9 & 1.5 kms a.s.l.	19 - 20	Lakshadweep area and neighbourhood	Do	Do	Less marked on 21

TABLE 4 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
5.	Upto 1.5 kms a.s.l.	19 - 22	Assam & Meghalaya and neighbourhood	Stationary	Southeast Arabian Sea and neighbourhood	Less marked on 23
6.	Upto 2.1 km a.s.l.	25 - 28	Southwest Bay of Bengal and neighbourhood	West	Sri-Lanka and neighbourhood	Less marked on 29
(D) Troughs in easterlies						
1	Trough of low at mean sea level	2 - 6	Tenasserim coast and neighbourhood	West	Southwest to west central Bay of Bengal	Less marked on 7
2	Do	4 - 8	Lakshadweep area to east central Arabian Sea	Do	Southeast to east central Arabian Sea	Moved away on 9
3	Do	10 - 19	South Andaman sea and neighbourhood	Do	Maldives area and neighbourhood	Less marked on 20
4.	Do	22 - 25	Southwest Bay of Bengal off south Sri-Lanka coast	Do	Maldives – Comorin areas to east central Arabian Sea off Karnataka coast	Less marked on 26
5.	Do	25	Southwest Bay of Bengal and neighbourhood	Stationary	<i>In situ</i>	Less marked on 26
6.	Do	26 Dec - 3 Morning Jan	Southeast Bay of Bengal and neighbourhood	West	Lakshadweep area and adjoining southeast Arabian Sea	Less important on 3 evening
7.	Do	14	Lakshadweep area to east central Arabian Sea off Goa coast	Stationary	<i>In situ</i>	Less marked on 15

* - The other details of the system are given in the 'Cyclones and Depressions 2012' in the July 2013 issue of 'Mausam'

3.2. November

3.2.1. Storms and Depressions

Only one Deep Depression (17 - 19) formed over the Bay of Bengal. No intense low pressure system formed over the Arabian Sea. The details of this Deep Depression are given in the 'Cyclones and Depressions 2012' in the July 2013 issue of 'MAUSAM'.

3.2.2. Other synoptic features and associated weather

A summary of the synoptic systems for the month of November 2012 is given in Table 3. The sub-divisionwise percentage departure of rainfall from normal during the month is given in Table 1.

During the month, rainfall activity was mainly confined to south Peninsular India and parts of northeast India. *Cold wave* condition occurred over central India towards the third week of the month.

The northeast monsoon was *active / vigorous* over the sub-divisions of the northeast monsoon regime during the first week of November. *Widespread* rainfall activity was also observed over the eastern India during the same period. *Isolated* rainfall occurred on many days during the remaining days of the month over Peninsular India and northeast India. Towards the end of the month, rainfall was confined to north India.

3.2.3. Temperature

Severe cold wave conditions occurred on two days each in some parts of Madhya Maharashtra (19 & 20) &

north interior Karnataka (18 & 19) and on one day each in Marathwada (18) and south interior Karnataka (19). *Cold wave* conditions also prevailed on 1 to 3 days in some parts of Madhya Maharashtra (17, 18 & 21), north interior Karnataka (17 & 20), Vidarbha & Chhattisgarh (17) and in south interior Karnataka (20) during the month.

Severe cold wave conditions prevailed in higher reaches of Himachal Pradesh and Kashmir from the second week of the month. Also several hill stations in the western Himalayan region reported sub-zero temperatures during the last week of the month.

The minimum temperatures were generally *above/appreciably above normal* in parts of Peninsular India except during the period 15 - 21 November, when they were *markedly below normal* in some parts of central and Peninsular India. It was *below/appreciably below normal* in east and northeast India. They were generally normal over the rest of the country.

Belgaum (north interior Karnataka) recorded a minimum temperature of 7.7 °C on 18 November which was the lowest in the month of November during past 60 years.

Month's lowest minimum temperature over the plains of the country was 4.4 °C, recorded at Adampur (Punjab) on 27th November 2012.

3.2.4. *Disastrous weather events and associated damage*

Cyclonic storm (Nilam) caused immense damage in 12 districts, with Visakhapatnam, East Godavari and West Godavari bearing the brunt of floods. It left behind a trail of death and destruction. In all, 61 persons died in the floods caused by Nilam and 4.95 lakh hectares of crops were submerged. Rail and road traffic was disrupted. The cyclonic storm also claimed 24 lives in Tamil Nadu, 2 in Karnataka, and 1 life each in Odisha & Kerala. It also had peripheral effects in parts of Karnataka by throwing the normal life out of gear due to heavy rainfall.

Cold wave claimed 5 lives in Jharkhand. Smog conditions prevailed in Haryana, Punjab and Uttar Pradesh during the second half of the month.

3.3. *December*

3.3.1. *Storms and depressions*

Only one Deep Depression (22 - 24 December) formed over the Arabian Sea. The Bay of Bengal had been cyclogenetically inactive during the month. The details of

the systems are given in the 'Cyclones and Depressions 2012' in the July 2013 issue of 'Mausam'.

3.3.2. *Weather and associated synoptic features*

Table 4 gives a summary of the synoptic systems during the month of December 2012. The sub-divisionwise percentage departure of rainfall from normal during the month is given in Table 1.

The northeast monsoon was *vigorous* on 1 day each in Rayalaseema and Tamil Nadu. *Isolated* rainfall occurred on few days over major parts of the country during the month. Snowfall occurred in the upper reaches of Jammu & Kashmir, Uttarakhand and Himachal Pradesh during the month.

Thick fog prevailed over the northern and northeastern parts of the country on many days, during the second fortnight of the month.

3.3.3. *Temperature*

Minimum temperatures remained above normal over most parts of the country during first three weeks of the month. *Severe cold wave / cold wave conditions* prevailed over many parts of the country mainly during the last weeks of the month.

Severe cold wave conditions prevailed on 1 day in some parts of Vidarbha and *cold wave* conditions also prevailed on 5 days in some parts of Odisha; on 3 to 4 days in some parts of east Uttar Pradesh, Madhya Pradesh, Vidarbha and Chhattisgarh and on 1 to 2 days in some parts of Gangetic West Bengal, Bihar, west Uttar Pradesh and west Rajasthan.

Cold day conditions also prevailed on 5 to 6 days in some parts of Haryana and Punjab; on 3 to 4 days in some parts of Bihar and east Uttar Pradesh and 1 to 2 days in some parts of West Bengal & Sikkim and west Uttar Pradesh.

Kargil, in Kashmir valley recorded minimum temperature of *minus* 17.2 °C on 20th December.

The month's and season's lowest minimum temperature in the plains of the country was 0.6 °C recorded at Sri Ganganagar (west Rajasthan) on 30th December 2012.

3.3.4. *Disastrous weather events and associated damage*

According to media reports, *cold wave* and fog related incidents claimed 92 lives in Uttar Pradesh, 52 in

Jharkhand, 5 in West Bengal, 3 in Punjab, 2 in Haryana and 1 each in Odisha, Bihar, Himachal Pradesh, Jammu & Kashmir and Madhya Pradesh. An avalanche in Siachen glacier claimed the lives of 6 person in Jammu & Kashmir. Heavy rain, thunderstorm/lightning claimed 5 lives each in Odisha, Bihar and West Bengal, 3 in Chhattisgarh and 2 in Tamil Nadu.

Over 2000 vehicles were stranded for three days on Jammu-Kashmir Highway due to snowfall and landslide. Dense fog prevailed over northern and northeastern parts of the country affecting road, rail and air transports on many days during the month.

Crops over thousands of hectares of land were damaged in Odisha, Madhya Pradesh and Andhra Pradesh due to hailstorm accompanied by rain.

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 -19 % to + 19 %.
<i>Deficient</i>	- percentage departure from normal is -20 % to -59 %.
<i>Scanty</i>	- percentage departure from normal is -60 % to -99 %.
<i>Heavy rain</i>	- rainfall amount from 6.5 cm to 12.4 cm.
<i>Very heavy rainfall</i>	- rainfall amount 12.5 cm to 24.4 cm.
<i>Extremely heavy rain</i>	- rainfall amount 24.5 cm and above.
<i>Heavy snowfall</i>	- 35.6 cm to 64.4 cm.
<i>At most places (Widespread)</i>	- 76% or more stations of a meteorological sub-division reporting at least 2.5 mm rainfall.
<i>At many places (Fairly widespread)</i>	- 51% to 75% 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.

At isolated places - 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

According to the revised criteria, since 1 March 2002, Heat Wave will be declared only when the maximum temperature of a station reaches at least 40 °C for plains and at least 30 °C for Hilly regions.

<i>Severe heat wave conditions</i>	- Departure of maximum temperature from normal is +6 °C or more for the regions where the normal maximum temperature is
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	more than 40 °C and +7 °C or more for regions where the normal maximum temperature is 40 °C or less.	<i>Cold wave conditions</i>	when the wind chill effective minimum temperature (WCT_n) is 10 °C or less: For stations whose normal minimum temperature is ≥ 10 °C, when the departure from normal is -5 °C to -6 °C, and for -4 °C to -5 °C. Also when WCT_n stations whose normal minimum temperature is less than 10 °C when the departure from normal is ≤ 0 °C, cold wave is declared irrespective of the departure for those stations whose normal minimum temperature is greater than 0 °C.
<i>Heat wave conditions</i>	- + 4 °C to + 5 °C for the regions where the normal maximum temperature is more than 40 °C and departure of maximum temperature from normal is + 5 °C to + 6 °C for regions where the normal maximum temperature is 40 °C or less. (declared only when the maximum temperature of a station reaches at least 40 °C for Plains and at least 30 °C for Hilly region).		
<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>Cold day conditions</i>	For inland plain stations, when the day temperature is less than or equal to 16 °C.
<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>Markedly below normal</i>	- departure from normal is -5 °C to -6 °C (where the normal minimum temperature is 10 °C or more).
<i>Above normal</i>	- departure from normal is +2 °C.	<i>Appreciably below normal</i>	- departure from normal is between -3 °C to -4 °C (where the normal minimum temperature is 10 °C or more).
<i>Normal</i>	- departure from normal is +1 °C to -1 °C.	<i>Below normal</i>	- departure from normal is -2° C.
(b) Minimum / Night temperature			
<i>Severe cold wave conditions</i>	- departure of WCT_n from normal minimum temperature is -7 °C or less for the regions where normal minimum temperature is ≥ 10 °C and -6 °C or less elsewhere	<i>Normal</i>	- departure from normal is +1 °C to -1 °C.
