MAUSAM, **60**, 4 (October 2009), 549-574

Weather in India

POST MONSOON SEASON (October-December 2008)†

1. Introduction

The season witnessed the formation of 3 Cyclonic Storms and two Deep Depressions. Out of which, 4 systems (all the 3 Cyclonic Storms and a Deep Depression) formed over the Bay of Bengal and one Deep Depression formed over the Arabian Sea. All of them had their origin in the active easterly wave troughs. Except the system over the Arabian Sea, all others contributed to the season's rainfall.

Though there had been frequent passage of Western Disturbances, the weather produced by these was confined mainly to Jammu & Kashmir and higher reaches of Himalayas, as the systems did not intrude into latitudes south of 30° N. Also the formation of induced systems to the south of these primary systems had been quite subdued. Obviously, the implied high zonal index cycle of mid-latitude circulation pattern did not give way to any sort of easterly-westerly interactions as well.

The withdrawal of southwest monsoon, yet another important synoptic feature of the season, though delayed in the beginning, took place in a rapid manner from 11 October and by 15 October and during this period, it withdrew from the entire country.

Simultaneously with the withdrawal of southwest monsoon, northeast monsoon rains commenced over the south peninsula on 15 October. The perturbation in the easterlies which initiated the rains over the northeast monsoon regime, later shifted northwards and gradually intensified into the Cyclonic Storm (Rashmi). This system adversely affected the rainfall over Tamil Nadu. During the period of Cyclonic Storm (Khai Muk), Rayalaseema and coastal Andhra Pradesh received good rainfall, which significantly reduced the seasonal deficit. The Cyclonic Storm (Nisha) provided copious rainfall to the interior districts of north Tamil Nadu as well. Many stations recorded extremely heavy rainfall and many districts were marooned due to flood. After the year 2000, this was the first ever Cyclonic Storm crossing Tamil Nadu.

*Cold wave conditions** manifested over parts of central India towards the end of November and first week of December. They prevailed over parts of northwest India and central peninsula towards the end of December. Compared to last year, its severity and spatial extent had been much lower during this period. The major weather related disasters which occurred over the south peninsula had been caused by the Cyclonic Storms.

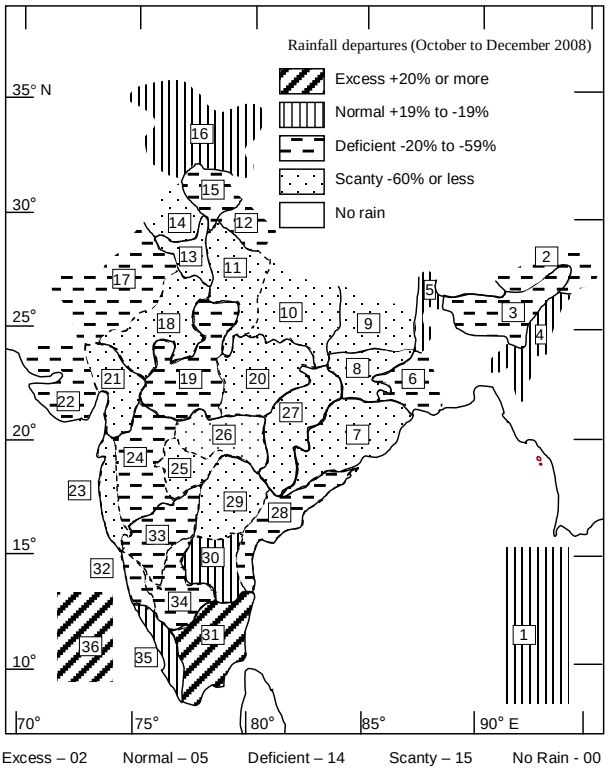

Fig. 1. Sub-divisionwise seasonal rainfall departure from normal (%) for Post monsoon season (October to December 2008). Sub-divisions are indicated by number on the map & bold letters in legend. The rainfall anomaly values for these 36 sub-divisions are indicated below :

1	–8	**7**	–81	**13**	–75	**19**	–50	**25**	–70	**31**	31
2	–40	**8**	–84	**14**	–72	**20**	–78	**26**	–73	**32**	–52
3	–29	**9**	–60	**15**	–51	**21**	–66	**27**	–86	**33**	–27
4	–17	**10**	–74	**16**	4	**22**	–51	**28**	–20	**34**	–27
5	–39	**11**	–78	**17**	–27	**23**	–61	**29**	–61	**35**	–14
6	–56	**12**	–54	**18**	–84	**24**	–41	**30**	19	**36**	37

2. Seasonal rainfall (October-December)

The meteorological sub-divisionwise rainfall departures from normal for the season are given in Fig. 1 and monthly as well as seasonal departures are given in Table 1.

The large deficiency noticed especially over the east central, north and north western parts outside Jammu &

* Terms in Italics other than the sub-titles are explained in Appendix.

†*Compiled by* : A. B. Mazumdar, Medha Khole and S. Sunitha Devi, Meteorological Office, Pune – 411 005, India

TABLE 1

Sub-divisionwise rainfall (mm) for each month and season as a whole (October-December 2007)

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	245	305	-20	326	236	38	73	159	-54	644	700	-8
2.	Arunachal Pradesh	120	166	-28	14	42	-68	12	35	-65	146	244	-40
3.	Assam & Meghalaya	131	154	-15	2	25	-93	1	11	-87	135	191	-29
4.	Naga., Mani., Mizo. and Tri.	156	145	7	3	40	-92	3	10	-68	162	195	-17
5.	Sub-Himalayan West Bengal & Sikkim	94	155	-39	12	18	-31	6	10	-45	112	183	-39
6.	Gangetic West Bengal	70	130	-46	0	23	-100	0	6	-100	70	159	-56
7.	Orissa	26	121	-78	4	28	-87	0	5	-100	30	155	-81
8.	Jharkhand	14	86	-83	2	10	-79	0	5	-100	17	100	-84
9.	Bihar	31	69	-55	0	5	-100	**	4	-95	32	79	-60
10.	East Uttar Pradesh	15	52	-70	1	4	-81	0	6	-100	16	62	-74
11.	West Uttar Pradesh	5	40	-88	6	4	48	0	7	-100	11	51	-78
12.	Uttaranchal	29	56	-49	8	9	-5	3	22	-85	40	87	-54
13.	Haryana, Chandigarh & Delhi	2	16	-89	5	5	5	**	7	-98	7	27	-75
14.	Punjab	9	21	-56	**	5	-98	2	15	-88	11	41	-72
15.	Himachal Pradesh	22	46	-53	1	20	-93	31	46	-31	55	111	-51
16.	Jammu & Kashmir	42	36	16	22	32	-32	95	84	12	159	153	4
17.	West Rajasthan	**	4	-99	0	3	-99	6	2	234	7	9	-27
18.	East Rajasthan	3	15	-82	1	7	-82	**	4	-98	4	26	-84
19.	West Madhya Pradesh	17	32	-46	9	13	-34	**	7	-99	26	52	-50
20.	East Madhya Pradesh	11	39	-72	2	12	-80	0	9	-100	13	59	-78
21.	Gujarat region	10	22	-54	**	11	-99	2	2	-10	12	35	-66
22.	Saurashtra & Kutch	5	14	-65	1	11	-95	7	1	449	13	26	-51
23.	Konkan & Goa	48	105	-54	**	26	-99	5	4	2	53	135	-61
24.	Madhya Maharashtra	55	71	-22	5	28	-82	2	6	-74	62	105	-41
25.	Marathawada	22	67	-67	7	22	-68	**	7	-94	29	96	-70
26.	Vidarbha	19	53	-65	1	15	-93	**	7	-95	20	75	-73
27.	Chattisgarh	11	67	-84	1	10	-94	0	5	-100	11	82	-86
28.	Coastal Andhra Pradesh	89	197	-55	169	104	64	3	26	-88	261	326	-20
29.	Telangana	29	84	-66	14	21	-34	**	5	-93	43	110	-61
30.	Rayalaseema	121	121	0	127	66	92	4	24	-85	252	212	19
31.	Tamil Nadu	241	181	33	273	165	65	49	85	-42	564	432	31
32.	Coastal Karnataka	101	179	-44	15	66	-78	9	14	-33	125	258	-52
33.	North interior Karnataka	68	103	-34	30	28	9	2	6	-64	100	137	-27
34.	South interior Karnataka	121	139	-13	24	48	-51	1	13	-93	145	200	-27
35.	Kerala	354	292	21	57	164	-65	16	43	-63	427	499	-14
36.	Lakshadweep	253	153	65	67	117	-42	130	59	121	451	329	37

** Rainfall amount from 0.01 to 0.4 mm

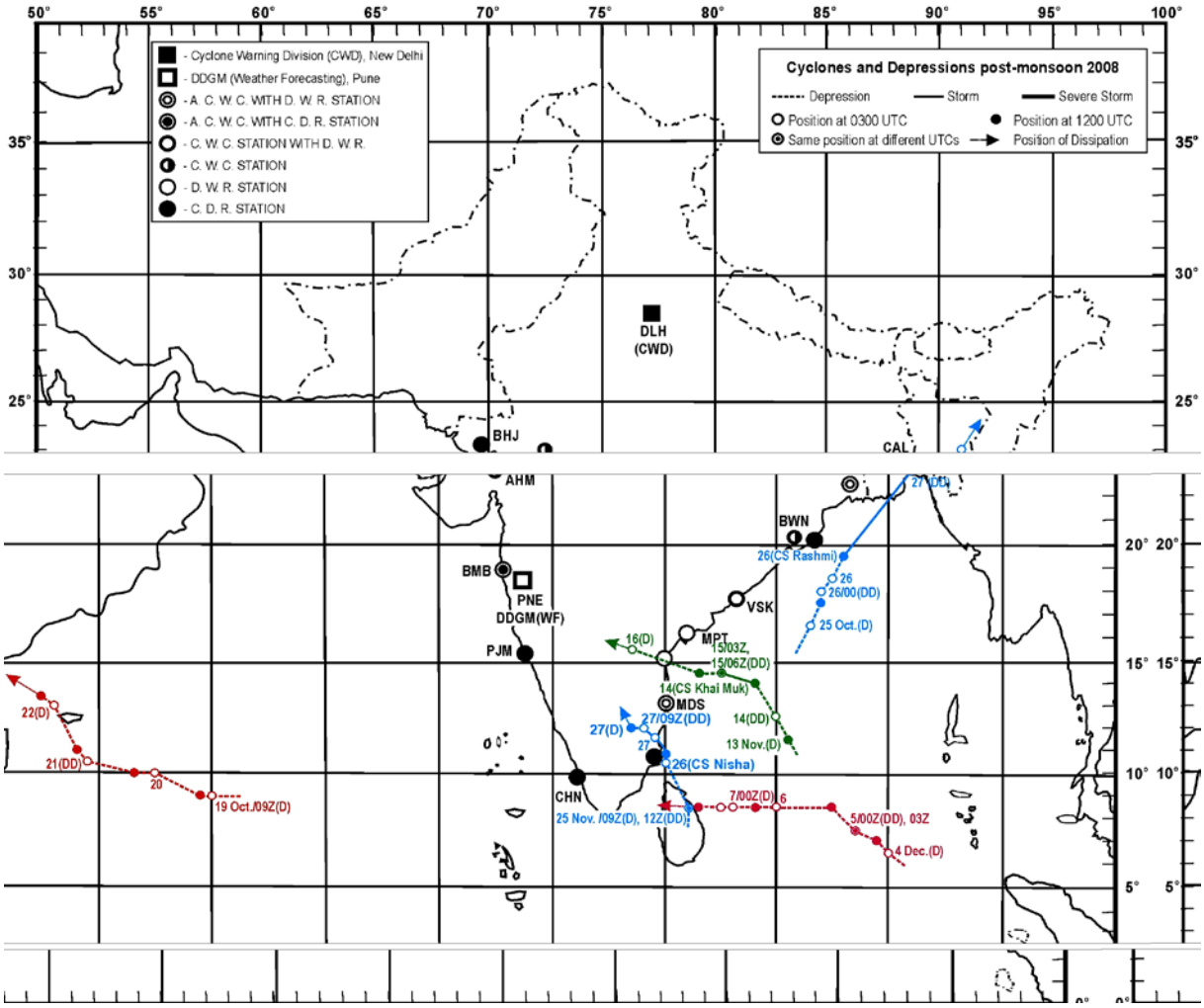

Fig. 2. Tracks of cyclonic storms and depressions during the period October to December 2008

Kashmir could be attributed to the phenomenon of rain producing systems confining their tracks to the extreme south and northern latitudes. These regions experienced dry weather during many weeks after the withdrawal of southwest monsoon from the entire country, especially during the first half of November and almost entire December.

3. Monthly features

3.1. *October*

3.1.1. *Withdrawal of southwest monsoon*

After the withdrawal of southwest monsoon from northwest India on 29 September, prevalence of rain producing systems over northeast India and widespread thundershower activity associated with the withdrawal phase delayed the further retreat of southwest monsoon for some more time. However, the subsequent withdrawal was rapid. It withdrew from rest of northwest India on 11, parts of east and central India on 12, remaining parts of east and central India on 13, entire northeast India and northern parts of peninsular India on 14 and from the entire country on 15.

3.1.2. *Commencement of northeast monsoon rains*

This year, Tamil Nadu started receiving fairly widespread to widespread rainfall from 12 October onwards, owing to the presence of a trough in easterlies.

With the changing over of the circulation pattern to northeasterlies, simultaneous with the withdrawal of southwest monsoon from the entire country, the northeast monsoon rains commenced over Tamil Nadu and adjoining areas of Andhra Pradesh, Karnataka and Kerala on 15 October.

3.1.3. *Storms and depressions*

One Deep Depression and a Cyclonic Storm formed over the Arabian Sea and Bay of Bengal respectively, during the month. The tracks of the systems are given in Fig. 2 and details are given below.

3.1.3.1. *Deep depression over the Arabian Sea (19 – 22 October 2008)*

A trough of low at sea level lay over the southeast Bay on 10 & 11; the southwest and adjoining southeast Bay on 12 and over the southwest Bay on 13. It organized into a feeble low pressure area over Commorin area and neighbourhood on 14 and lay over Maldives and adjoining Commorin areas on 15 and over the southeast Arabian Sea on 16 & 17. Moving westwards, it became well marked over the southwest Arabian Sea and neighbourhood on 18. It subsequently concentrated into a Depression in the evening of 19 and lay centred at 1200 UTC, near Lat. 9.0° N/Long. 59.5° E. Moving westnorthwestwards, it lay centred at 0300 UTC of 20 over the southwest Arabian Sea near Lat. 10.0° N / Long. 57.5° E and at 1200 UTC near Lat. 10.0° N / Long. 56.5° E. Continuing the westnorthwestward movement, it intensified into a Deep Depression and lay centred at 0300 UTC of 21, over the southwest Arabian Sea, near Lat. 10.5° N / Long. 54.5° E and at 1200 UTC near Lat. 11.0° N / Long. 54.0° E. Further moving northwestwards, it weakened into a Depression and lay centred at 0300 UTC of 22 over the westcentral Arabian Sea, near Lat. 13.0° N / Long. 53.0° E and at 1200 UTC near Lat. 13.5° N / Long. 52.5° E. It further moved in a northwesterly direction and weakened into a well marked low pressure area over west central Arabian Sea and adjoining Gulf of Aden on 23.

The system was mainly tracked by satellite. The maximum intensity of T 2.0 was reported from 0600 UTC to 1200 UTC of 21.

The lowest Estimated Central Pressure (ECP) was 1000 hPa at 0300 UTC of 21. The maximum estimated wind speed was 30 kts. The system moved in a westerly to westnorthwesterly direction and dissipated over west central Arabian Sea and adjoining Gulf of Aden. The *in situ* weakening of the system over the ocean could be attributed to colder sea surface temperatures and the shearing of the convective cloud tops to the west.

The system caused no damage over the country as it was far away from the west coast. However, according to press reports, it caused flood in Yemen due to heavy rainfall.

3.1.3.2. *Cyclonic storm (RASHMI) over the Bay of Bengal (25 – 27 October 2008)*

Under the influence of a trough of low over the southwest Bay of Bengal off Andhra Pradesh-Tamil Nadu coasts, a low pressure area formed on 24 over the west central Bay of Bengal off Andhra Pradesh coast. It rapidly concentrated into a Depression at 0300 UTC on 25 with its center near Lat. 16.5° N / Long. 86.5° E and at 1200 UTC, near Lat. 17.5° N / Long. 87.0° E. It moved northwards and intensified into a Deep Depression, at 0300 UTC of 26, centered near Lat. 18.5° N / Long. 87.5° E, about 460 kms southwest of Kolkata. Moving in a northnortheasterly direction, it intensified into a Cyclonic Storm (Rashmi) and lay centred at 1200 UTC of 26 near Lat. 19.5° N / Long. 88.0° E about 350 km south of Kolkata. It futher moved in a northnortheasterly direction and crossed Bangladesh coast near Long. 89.5° E about 50 km west of Khepupura between 2200 & 2300 UTC of 26. Subsequently, it weakened into a Deep Depression and lay centred at 0300 UTC of 27 near Lat. 23.0° N / Long. 91.0° E. It rapidly weakened into a low pressure area over Meghalaya on 27 evening and became less marked on 28. However associated cyclonic circulation between 1.5 & 2.1 km a.s.l. lay over the region on 28 & 29.

As per the satellite account, the vortex moved in northeasterly direction and crossed the Bangladesh coast near 22.1° N / 89.3° E at 2100 UTC of 26 October, 2008. The maximum intensity of T 3.0 was reported at 2100 UTC of 26. Also RADAR observations from DWR Kolkata and CDR Paradip helped in tracking the system.

The lowest ECP was 984 hPa at 2100 UTC of 26. The maximum estimated wind speed was 45 kts at 2100 UTC of 26. The lowest pressure (984.5 hPa) was reported by Khepupara at 2100 UTC of 26.

The system showed intensification with the sustained wind speed reaching upto 45 kts just before the landfall. It

TABLE 2

Details of the weather systems during October 2008

S. No.	System	Duration	Place of first location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**A**)	*Depressions/cyclonic storms*					
1.	Deep depression	19 – 22	Southwest Arabian Sea	Westnorthwest	West central and adjoining Gulf of Aden	Details are given in the text.
2.	Cyclonic storm (Rashmi)	25 – 27	West central Bay of Bengal off Andhra Pradesh coast	Initially north and then northnortheast	Meghalaya	Details are given in the text
(**B**)	*Low pressure areas*					
1.	Low pressure area	23 – 26	Southeast Arabian Sea off Kerala-Karnataka coasts	Northwest	Southeast and adjoining east central Arabian sea	It was first observed as a trough of low at sea level over Lakshadweep-Maldives areas on 21. It re-organised into a feeble low pressure area over southeast Arabian sea off Kerala-Karnataka coasts on 22
(**C**)	*Western disturbances/eastward moving systems*					
(*i*)	*Upper air cyclonic circulations*					
1.	Upto Mid tropospheric levels	1 – 3	North Pakistan and neighbourhood	Northeast	Jammu & Kashmir and neighbourhood	Moved away on 4
2.	Do	4 – 6	Do	Do	Do	Moved away on 7
3.	Do	6 – 10	Do	Do	Do	Moved away on 11
4.	Do	13	Do	Do	Do	Moved away on 14
5.	Do	14 – 16	Do	Do	Do	Moved away on 17
6.	Do	16 – 23	Do	Do	Do	Moved away on 24
7.	Do	23 – 26	Do	Do	Do	Moved away on 27
8.	Do	26 – 28	Do	Do	Do	Moved away on 29
9.	Do	31 Oct – 1 Nov	North Pakistan and adjoining Jammu & Kashmir	Do	Do	Moved away on 2 November
(*ii*)	*Induced cyclonic circulations*					
1.	Upto lower levels	14 – 16	Northwest Rajasthan	Stationary	*In situ*	Less marked on 17
2.	Upto lower tropospheric levels	29 – 30	North Pakistan and adjoining Punjab	Stationary	*In situ*	Less marked on 31
(*iii*)	*Trough in westerlies*					
1.	Mid & upper tropospheric westerlies	3 – 12	Long. 72° E, to the north of Lat. 20° N at 7.6 km a.s.l.	Eastnortheast	Long. 82° E, to the north of Lat. 20° N at 7.6 km a.s.l.	Moved away on 13

TABLE 2 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**D**)	*Other upper air cyclonic circulations*					
1	Upto mid tropospheric levels	2 – 5	East central Arabian Sea off south Gujarat-north Maharashtra coasts	South	Southeast Arabian sea off Karnataka-Kerala coasts	Less marked on 6
2.	Upto lower levels	3 – 5	Rayalaseema and neighbourhood	Southeast	Tamil Nadu and neighbourhood	Less marked on 6
3.	Upto lower levels	12 – 14	Lakshadweep area and neighbourhood	Stationary	*In situ*	Merged with the cyclonic circulation associated with the feeble low pressure area [under system I (1)] on 15.
4.	Upto lower tropospheric levels	18 – 21	Southwest Bay off south Tamil Nadu - Sri Lanka coasts	Northwest	Kerala and adjoining Lakshadweep	Merged with the feeble low pressure area [under system II (1)]on 22
5.	Upto mid tropospheric levels	18 – 20	Lakshadweep area and neighbourhood	Stationary	*In situ*	Merged with the feeble low pressure area [under system II (1)] on 21
6.	Do	29 – 31	Lakshadweep area and neighbourhood	Stationary	*In situ*	Less marked on 1 November
7	Do	29 – 30	southwest Bay of Bengal off south Tamil Nadu-Sri Lanka coasts	Do	Do	Less marked on 31
(**E**)	*Troughs/wind discontinuity*					
1	Lower levels	7 – 8	South Tamil Nadu to Telangana across Rayalaseema	Oscillatory	South Tamil Nadu to Orissa, across coastal Andhra Pradesh	Less marked on 9
2.	Do	9 – 11	South Tamil Nadu to Telangana across Rayalaseema	Oscillatory	Commorin area to north Konkan-coastal Karnataka-Kerala coasts	Less marked on 12. A cyclonic circulation lay embedded in this trough over south Tamil Nadu on 9 & 11; Commorin area on 11 and over south Tamil Nadu and adjoining Sri Lanka on 13. It merged with the feeble low pressure area [under system I(1)] on 14.

rapidly (within a span of 12 hrs) weakened over land into a low pressure area. It moved northeastwards skirting the coast causing rainfall over coastal Andhra Pradesh, Orissa, West Bengal and Bangladesh.

In the past, only 3 cyclonic storms (one each during 1905, 1967 & 1988) out of 9 cyclonic storms originated over the region between 15° - 20° N & 85° - 90° E have crossed Bangladesh coast during the period 1891 – 2007.

Fairly widespread rainfall occurred over coastal Andhra Pradesh on 24 & 25, coastal Orissa during 24 - 26 and Nagaland-Manipur-Mizoram-Tripura during 25 - 28. Widespread rainfall with isolated heavy to very heavy falls occurred on 27 in Gangetic West Bengal, Sub-Himalayan West Bengal on 28 and over Arunachal Pradesh and Assam & Meghalaya on 28 & 29.

Some chief amounts of rainfall in cms are given in Table 5.

TABLE 3

Details of the weather systems during November 2008

S. No. (1)	System (2)	Duration (3)	Place of first location (4)	Direction of movement (5)	Place of final location (6)	Remarks (7)
(**A**)	*Cyclonic storm*					
1.	Cyclonic Storm (Khai Muk)	13 – 16	Southeast and adjoining southwest Bay of Bengal	Northwest	Rayalaseema and neighbourhood	The details are given in the text
2.	Cyclonic storm (Nisha)	25 – 27	Sri Lanka and neighbourhood	Northnorthwest	North Tamil Nadu and adjoining areas of south interior Karnataka and Rayalaseema	Details are given in the text
(**B**)	*Western disturbances/eastward moving systems*					
(*i*)	*Upper air cyclonic circulations*					
1.	Mid tropospheric levels	2 – 3	North Pakistan and adjoining Jammu & Kashmir	Northeast	Jammu & Kashmir	Moved away on 4
2.	Do	4 – 6	Do	Do	Do	Moved away on 7
3.	Do	11 – 14	Do	Do	Do	Moved away on 15
4.	Do	15 – 17	Do	Do	Do	Moved away on 18
5.	Do	19 – 23	Do	Do	Do	Moved away on 24
6.	Do	23 – 24	Do	Do	Do	Moved away on 25
7.	Do	25 – 27	Do	Do	Do	Moved away on 28
8.	Do	28 Nov – 1 Dec	Do	Do	Do	Moved away on 2 December
(*ii*)	*Induced systems*					
1.	Mid tropospheric levels	16 – 21	Northwest Rajasthan and neighbourhood	Northeast	Punjab and neighbourhood	Less marked on 22
(**C**)	*Other upper air cyclonic circulations*					
1.	Lower tropospheric levels	7 – 12	South Tamil Nadu and adjoining Sri Lanka	Southwest	Southwest Bay of Bengal off Sri Lanka coast	Merged with the circulation associated with the low pressure area prior to the formation of Cyclonic Storm (Khai Muk)
2.	Do	7 – 9	Lakshadweep and neighbourhood	Stationary	*In situ*	Less marked on 10
3.	Do	11 – 12	Lakshadweep area and neighbourhood	Do	Do	Less marked on 13
4.	Do	19 – 23	Southwest Bay of Bengal off south Tamil Nadu-Sri Lanka coasts	Do	Do	Merged with the cyclonic circulation associated with the well marked low pressure area, prior to the formation of Cyclonic Storm (Nisha)
5.	Mid tropospheric levels	23 Nov – 1 Dec	Nagaland-Manipur-Mizoram-Tripura	Do	Do	Less marked on 2 December
(**D**)	*Troughs in easterlies*					
1.	Lower levels	4 – 6	Southwest Bay of Bengal to west central Bay of Bengal	Stationary	*In situ*	Less marked on 7
2.	Trough of low at sea level	7 – 10	Southwest and adjoining southeast Bay of Bengal	West	Southwest Bay of Bengal	Less marked on 11
3.	Do	19 – 25	Southeast Bay of Bengal	Do	Do	Merged with the Cyclonic Storm (Nisha)

TABLE 4

Details of the weather systems during December 2008

S. No.	System	Duration	Place of first location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**A**)	*Depressions/cyclonic storms*					
1.	Deep depression	4-7	Southeast Bay of Bengal and neighbourhood	Northwest and then west	Sri Lanka and adjoining southwest Bay of Bengal	Details are given in the text
(**B**)	*Low pressure areas*					
1.	Low pressure area	15-17	Southwest Arabia sea and neighbourdhood	Stationary	*In situ*	It lay as a trough of low over the same region during 18-21 and became less marked on 22
(**C**)	*Western disturbances/eastward moving cyclonic circulations*					
(*i*)	*Upper air cyclonic circulations*					
1.	Upto mid tropopheric levels	3-6	North Pakistan and adjoining Jammu & Kashmir	Northeast	Jammu & Kashmir	Moved away on 7
2.	Do	3-9	North Pakistan and neighbourhood	Do	Do	Moved away on 10
3.	Do	10-12	Jammu & Kashmir and neighbourdhood	Do	Do	Moved away on 13
4.	Do	12-14	North Pakistan and adjoining Jammu & Kashmir	Do	Do	Moved away on 15
5.	Do	16-24	North Pakistan and neighbourhood	Do	Jammu & Kashmir and neighbourhood	Moved away on 25
6.	Do	25-27	North Pakistan and neighbourhood	Do	Jammu & Kashmir	Moved away on 28
7.	Do	28-30	Northeast Afghanistan and north Pakistan	Do	Do	Moved away on 31
8.	Do	31Dec-1 Jan	North Pakistan and neighbourhood	Do	Do	Moved away on 2 January
(*ii*)	*Induced cyclonic circulations*					
1.	Lower troposhperic levels	16-17	Southwest Rajasthan and adjoining Gujarat	Stationary	*In situ*	Less marked on 18
(*iii*)	*Troughs in westerlies*					
1.	Mid and upper tropospheric levels	6-12	Long 52° E to the north of Lat. 15° N	Northeast	Long 70° E to the north of Lat. 20° N	Moved away on 12
2.	Do	18-22	Long 52° E to the north of 15° N	Do	Long. 68° E to the north of 15° N	Moved away on 23
(**D**)	*Other cyclonic circulations*					
1.	Upto 2.1 kms a.s.l.	1-2	North Bay of Bengal off Bangaladesh-west Bengal coasts.	Stationary	*In situ*	Less marked on 3
2.	Upto lower tropospheric levels	4-8	Commorin area and neighbourhood	West	Lakshadweep-Maldives areas	Less marked on 9
3.	Do	10-11	South Tamil Nadu & adjoining Sri-Lanka	Stationary	*In situ*	Less marked on 12

TABLE 4 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
4.	Upto lower tropospheric levels	23-29	Bangaladesh and adjoining Gangetic west Bengal	Northeast	Assam & neighbourhood on 24	It was seen as a trough in the lower level westerlies over the region on 21 & 22. The cyclonic circulation became less marked on 30
(**E**)	*Troughs in easterlies*					
1.	Lower levels (0.9 km)	2-3	South interior Karnataka to north Konkan	Northwest	Coastal Karnataka to north Konkan on 3	Less marked on 4
2.	At sea level	11-13	Lakshadweep-Maldives area to north Madhya Maharashtra	Stationary	*In situ*	Less marked on 14
3	Trough of low (at sea level)	18-22	Southwest Bay off Sri-Lanka-Tamil Nadu coasts	Do	Do	Less marked on 22
4.	At sea level	28 Dec-12 Jan	Andaman sea	West	Southwest Bay off Tamil Nadu-Sri Lanka coasts	Less marked on 13 January

According to media reports, the damage over the northeastern states are as follows:

The death toll in Meghalaya and Arunachal Pradesh was 5 and 8 respectively. Incessant rains and winds uprooted electric poles in Shillong. Power supply was affected in many parts of Guwahati. Severe thundersquall and continuous heavy rain lashed vast areas of Tawang and Bomdila of west Arunachal Pradesh during the nights of 27 – 28: The road and other communication links were disrupted over these areas. It was reported that several road bridges were broken down and a number of dwelling houses were devastated besides many persons being injured by the devastating thunder squall. It caused major damage in Bangladesh as well.

3.1.4. *Other synoptic features and associated weather*

Table 2 gives the summary of synoptic features for the month of October 2008. The sub-divisionwise percentage departure from normal and significant amounts of rainfall are given respectively in Tables 1 & 5 and the frequency of days of *vigorous/ active* monsoons and heavy rainfall are given in Table 10.

During the withdrawal phase of southwest monsoon, widespread rainfall occurred over northeast India. Also major parts of the country received thundershowers during the first week of October. Subsequently northeast monsoon rains took over the rainfall situation of south peninsula, which received *normal*/*excess* rainfall during the second fortnight of the month. Active western disturbances as upper air cyclonic circulations which moved northeastwards across Jammu & Kashmir caused *excess* rainfall over Jammu & Kashmir, Himachal Pradesh and Punjab during the 3rd week of October. The higher reaches of Himalayas including Kullu, Lahual Valley and Baralacha passes reported continuous snowfall during this period. Later on, the northnortheasterly movement of Cyclonic Storm (Rashmi), its crossing the Bangladesh coast and weakening over Meghalaya caused copious rainfall over northeast India and West Bengal & Sikkim during the last week of the month.

3.1.5. *Temperature*

The dates on which the maximum temperature remained *appreciably to markedly above/below normal* and *above/below normal* are given in Table –6. The same date appearing in two different columns of a sub-division may be reckoned as occurrence of that category over parts of the sub-divisions. The maximum temperatures were *normal* for the rest of the days. No *heat wave condition* occurred during the month.

The month's highest maximum temperature in the plains of the country was 42.0° C recorded at Phalodi (west Rajasthan) on 6 October 2008.

TABLE 5

Representative rainfall amounts in cm (October – December 2008)

Date	October	November	December
(1)	(2)	(3)	(4)
1.	Palakonda & Krishnagiri 6 each, Gonda, Jashpurnagar & Maya Bandar 5 each, Rajghat, Ayodhya & Elginebridge 3 each, Sankarapuram 4, Balrampur, Raipur, Gajapathinagaram & Madurai 2 each, Khariar, Nimapara, Basti, Chandradeepghat, Kakrahi, Datia, Malanjkhand, Rajim, Devbhog, Narsipatnam, Veeraghattam, Salur, Perur, Athur, Harur, Pappireddipatti, Rayakottai, Tirukoilur, Villupuram, Bahraich, Gwalior, Nowgong & Wardha 1 each	Cherthala 4, Piravom 3, Alapuzha 2, Car Nicobar & Shillong 1 each	Panambur 15, Naliya, Ratnagiri, Coonoor & Mangalore 4 each, Bhuj, Kandla, Okha, CIAL Kochi & Thiruvananthapuram 2 each, Valsad, Deesa, Nellore, Kodaikanal & Puducherry 1 each
2.	Bhalukpong, Sibsagar & Jorhat 7 each, Itanagar & Dharmasthala 6 each, North Lakhimpur 3, Silchar, Dharmapuri & Lengpui 2 each, Passighat, Tezpur, Shillong, Imphal, Seoni, Mysore & Phek 1 each	Nil	Pune 6, Nancowry 5, Mahabaleshwar & Amini Divi 1 each
3.	Kokrajhar 9, Cherrapunji 7, Dharamnagar & Baghdogra 6 each, Sriniketan, Santrampur & Kolkata 4 each, Miao, Sevoke, Suri, Asansol, Kadana, Kakinada & Mahad 3 each, Silchar, Matizuri, Margherita, Imphal, Kohima, Lengpui, Sonamura, Gangtok, Tilpara Barrage, Jharsuguda, Jabalpur, Satlasana, Bangalore & Jaina 2 each, Deomali, Dibrugarh, Shillong, Lakhipur, Annapurnaghat, Kailashahar, Tadong, Champasari, Lava, Krishnanagar, Bankura, Durgapur, Basirhat, Ratlam, Jhalod, Unjha, Ambikapur, Machilipatnam & Agumbe 1 each	Car Nicobar & Konni 1 each	Nancowry & Shahuwadi 4 each, Karwar 3, Panjim 2, Satara, Dabholim & Osmanabad 1 each
4.	Mathabhanga 13, Kalagarh 11, Bhavamasagara 8, Cooch Behar, Pachmari & NH-31 Bridge 7 each, Banbasa, Betul & Mathugiri 6 each, Satna, Mohol 5, Bhalukpong, Pandharpur 4, Chhatnag, Hosangabad, Narsinghpur & Umaria, Sholapur, Cuddalore, Salem, Gadag, AIE NH Xing 3 each, Churk, Rishikesh, Dehra Dun, Dharamshala, Sangli & Machilipatnam 2 each, Dhubri, Kolkata, Jharsuguda, Nasik, Raichur, Gulbarga, Belgaum, Bangalore & Chitradurga 1 each	Sevok 9, Car Nicobar 7, Neora & Gajoldoba 5 each, Hut Bay & Maya Bandar 3 each	Car Nicobar 4, Nancowry & Sawantwadi 2 each, Hut Bay & Kottayam 1 each
5.	Bhalukpong 13, Gharmura, Dharmanagar & Sabroom 11 each, Salem, Dhakiajuli & Thondebhavi 9 each, Khalapur & Hindupur 8 each, Amavapuram, Khed & Sawantwadi 7 each, Sevoke 6, Silchar, Kailashahar & Shahjahanpur 5 each, Dibrugarh 4, Shillong, Majbat, Chhatnag, Kolhapur & Kodaikanal 3 each, Tangla, Gangtok & Haldia 2 each, Tezpur, Ambala, Chandigarh, Jalpaiguri, Tadong, Katerniaghat, Panchmari, Betul, Mahabaleshwar & Chitradurga 1 each	Long Island, Tadong & Gangtok 1 each	Nancowry 4, Car Nicobar 1
6.	Bhinga 11, Matheran 10, Sonamura 9, Haldia, Champasari & Durgachack 7 each, Igatpuri 6, Puri & Murud 5 each, Bahraich, Shardanagar, Dharamsala, Bhira & Gharmura 4 each, Silchar, Agartala, Diamond Harbour, Banbasa, Guler, Mahabaleshwar, Parbhani, Mercara, Khowang, Dharmanagar & Palampuri 3 each, Malda, Kolkata, Midnapore, Palliakalan, Kalagarh, Uttarakashi, Bareilly, Basholi & Alibagh 2 each, Shillong, Tadong, Gangtok, Katerniaghat, Kakardharighat, Devprayag, Pantnagar, Rishikesh, Haridwar, Khairi, Jammu, Medha, Osmanabad & Bangalore 1 each	Port Blair 1	Nancowry 2, Car Nicobar, Jaisalmer & Barmer 1 each

TABLE 5 (*Contd.*)

(1)	(2)	(3)	(4)
7.	Golaghat & M.M. Hills 10 each, Doddaballapura 9, Gaganbavada, Nelamanagala & Holalur 8 each, Dholai, Amraghat, Alur & Gundlupet 7 each, Hatimnangala 6, Elginebridge, Ahmednagar & Itanagar 5 each, Malsirsa, Bangalore & Alapuzha 4 each, Basti, Birdghat, Gorakhpur, Turtipar, Uskabazar, Bhuntar, Udaipur, Poladpur, Bansi, Nagpur, Gulbarga & Medikeri 3 each, Jorhat, Rangiya, Balrampur, Mukhlishpur, Didihat, Sundernagar, Sangola, Mysore, Punalur & Kochi 2 each, Passighat, North Lakhimpur, Tangla, Silchar, Gangtok, Digha, Ranchi, Jamshedpur, Khadda, Kakrahi, Chandradeepghat, Allahabad, Sarsawa, Joshimath, Adampur, Pathankot, Shrivardhan, Panvel & Matheran 1 each	Mancompu, Kanjirappally & Port Blair 2 each	Pamban 3, Tuticorin 2, Adirampattinam, Tondi & Vedaranniyam 1 each
8.	Poladpur 14, Matheran & Pamidi 9 each, Alampur 8, Matighura, Mahad, Bellatti, Vempalli & Dhone 7 each, Chiplun 6, Amraghat 5, Chitradurga & Dhubri 4 each, Kailashahar, Malda & Jharsuguda 3 each, Silchar, Jalpaiguri, Chandabali, Gopalpur, Purnea, Indore & Mahabaleshwar 2 each, Hut Bay, Cherrapunji, Shillong, Madhopur, Bhaderwah, Katra, Pahelgam, Kukernag, Quazigund, Sheopurkalan, Sagar, Pune, Ramagundam & Kurnool 1 each	Minicoy 1	Pamban & Gulmarg 3 each, Nancowry & Tondi 2 each, Srinagar, Banihal, Quazi Gund, Kupwara, Vedaranniyam & Tuticorin 1 each
9.	Bijapur & T. Narsipura 7 each, Itanagar, Nandgaon & CIAL Kochi 4 each, Banbasa, Narayanpur, Baghdogra, Dharmanagar, Vita Kalwan, North Lakhimpur & Vellore 3 each, Khadda, Katerniaghat , Ramagundam, Hyderabad, Kochi, Gajoldoba & Hyderabad 2 each, Dibrugarh, Tezpur, Agartala, Gangtok, Rishikesh, Chittorgarh, Tikamgarh, Mumbai & Kozhikode 1 each	Nancowry 4, Maya Bandar, Kanyakumari, Thiruvananthapuram & Neyyattinkara 3 each	Puducherry & Tiruvarur 9 each, Nagapattinam & Needamangalam 8 each, Rameshwaram 7, Karaikal & Adirampattinam 5 each, Cuddalore, Quazi Gund, Kukernag & Minicoy 4 each, Banihal, Kupwara, Pamban & Vedarnniyam 3 each, Srinagar, Batote & Pahalgam 2 each, Jammu, Katra, Tiruchirapalli & Alapuzha 1 each
10.	Jia Bharali NT. Xing. Chiplun & Gowribidanur 7 each, Belgaum 6, Guwahati, Kolhapur & Islampur 5 each, Karad 4, Canning Town, Sangli, Satara & Champasari 3 each, Puthimari, Dharmanagar, Bhubaneshwar & Hyderabad 2 each, Changlang, North Lakhimpur, Tezpur, Motunga, Kailashahar, Uttarkashi, Ratlam, Nagpur, Kodaikanal & Medikeri 1 each	Thiruvananthapuram 5, Konni 3, Kanjirappally, Neyyattinkara, Port Blair & Nancowry 2 each	Agathi, Amini Divi & R.S. Manglam 7 each, Minicoy & Batote 3 each, Quazi Gund, Kukernag, Baderwah, Banihal & Tondi Cuddalore 2 each, Avantipur, Udhampur, Kupwara, Pahalgam, Karaikal, Adirampattinam, Pamban, Vedaranniyam, Kodaikanal, Kanyakumari, Kannur, Kottayam, Thiruvananthapuram & Alapuzha 1 each
11.	Coonoor 11, Sangli 8, Bijapur & Radhanagari 7 each, Satara & Shirol 6 each, Karad & Gaganbavda 5 each, Jorhat 4, Kolhapur, Mahabaleshwar & Gulbarga 3 each, Nashik, Durgapur & Daporijo 2 each, Car Nicobar, Nancowry, Mumbai & Thiruvananthapuram 1 each	Hut Bay 9, Kollam 4, Port Blair & Nancowry 3 each, Thiruvananthapuram & Car Nicobar 2 each, Long Island 1	Piravom, Kozha, Kavaratti & Agathi 5 each, Perumbavur 4, Kodaikanal, Nedumbassery, Kottayam, Amini Divi & CIAL Kochi 3 each, Adirampattinam, Tondi & Alapuzha 2 each, Quazi Gund, Kukernag & Kupwara 1 each
12.	Kunnamkulam 13, Maniyatchi 9, Aruppukottai, Ramanathapuram, Thiruvalla 7, Palayamkottai & Puducherry 5 each, Amini Divi & Gadhinglaj 4 each, Adirampattinam & Ghodegaon 3 each, Cuddalore, Nagapattinam, Kodaikanal, Coimbatore, Chennai, Kochi, Karjat & Mangalvedha 2 each, Port Blair, Kanyakumari, Madurai, Medikeri, Nedumbassery & Kozhikode 1 each	Port Blair 12, Long Island & Alapuzha 6 each, Hut Bay, Car Nicobar, Mancompu & Kanjirappally 3 each, Nancowry 2, Maya Bandar, Mangalore, Kottayam & Punalur 1 each	Kukernag & Quazi Gund 2 each, Pahalgam & Gulmarg 1 each
13.	Parangipettai, Ramanathapuram & Tiruchendur 8 each, Tambaram 7, Karaikal 6, Nagapattinam 5, Chennai 4, Nellore, Vedarnniyam & Pamban 3 each, Tondi, Cuddalore & Puducherry 2 each, Port Blair, Vellore, Coimbatore, Thiruvananthapuram & Tirupathi 1 each	Maya Bandar 10, Long Island 5, Hut Bay & Nancowry 3 each, Neyyattinkara & Car Nicobar 2 each, Port Blair, Kupwara & Alapuzha 1 each	Vedaranniyam & K. Paramathy 1 each

TABLE 5 (*Contd*.)

(1)	(2)	(3)	(4)
14.	Ramanathapuram 22, Cheyyar 17, Tanjavur 10, Nagapattinam 8, Kanyakumari 7, Karaikal 5, Puducherry, Alapuzha, Thiruvananthapuram & Car Nicobar 3 each, Pamban, Tondi, Chennai, Kochi & Punalur 2 each, Tezpur, Narsapur, Tiruchirapalli, Cuddalore, Kannur & Kottayam 1 each	Kollam 6, Peermade, Srinagar & Kupwara 5 each, Long Islands & Gulmarg 4 each, Kayamkulam 3, Hut Bay & Port Blair 2 each, Avantipur & Chennai 1 each	Pamban & Vedaranniyam 3 each, Adirampattinam, Karaikal & Nagapattinam 1 each
15.	Ramanathapuram 12, Srivaikuntam 8, Mylaudy 7, Tondi 6, Karaikal & Kochi 3 each, Amb, Sundernagar, Sujanpur Tira, Kodaikanal, Madurai, Cuddalore, Kanyakumari, Vellore, Tiruchirapalli, Adirampattinam, Alapuzha, Derabass & Dasuya 2 each, Hut Bay, Ambala, Bhanjar, Bangana, Berthin, Bhuntar, Kasol, Hamirpur, Jhandutta, Pandoh, Sunibhajji, Shimla, Una, Adampur, Nangal, Avantipur, Srinagar, Kupwara, Katra, Pahalgam, Quazigund, Vedaranniyam, Pamban, Coimbatore, Mysore, Thiruvananthapuram, Punalur, Kottayam & Agathi 1 each	Srinagar & Hut Bay 7 each, Kupwara & Port Blair 5 each, Quazi Gund & Puri 4 each, Pahalgam 3, Kakatpur & Krishnaprasad 2 each, Avantipur, Banihal, Paradip, Gopalpur & Haripad 1 each	Chidambaram 16, Sirkali 12, Kollidam 10, Mayiladuthurai 9, Anicut & Parangipettai 7 each, Thanjavur 6, Kumbakonam, Papanasam, Thiruvidaimaruthur, Orthanadu, Mannargudi, Nagapattinam, Tiruvarur & Tarangambadi 5 each, Pattukottai, Peravurani, Thiruthuraipoondi, Valangaiman & Karaikal 4 each, Adirampattinam 3, Cuddalore 2, Tiruchirapalli, Vedaranniyam, Needamangalam, Kodaikanal, Cherthala & Kavarati 1 each
16.	Madurai 7, Coonoor & Tuticorin 6 each, Udaipur & Kozha 5 each, Pamban, Kochi, Arki & Chengannur 4 each, Jalalabad, Shahpur Kandi, Kupwara, Bhaderwah, Banihal, Batote, Tirupathi, Tondi, Cuddalore, Kodaikanal, Dhundi, Bharwain & Kathua 3 each, Pathankot, Amritsar, Sujanpur Tira, Guler, Nagrota Surian, Dharamsala, Kukernag, Srinagar, Quazi Gund, Udhampur, Shahjahanpur, Ongole, Vellore, Karaikal, Nagapattinam, Chitradurga, Kottayam & Kozhikode 2 each, Adampur, Balachaur, Faridkot, Hoshiarpur, Mukerian, Nawanshahar, Ludhiana, Nadaun, Ghamroor, Katra, Avantipur, Jammu, Sarsawa, Nellore, Vedarnniyam, Adirampattinam, Chennai, Puducherry, Bangalore, Minicoy & Alapuzha 1 each	Machilipatnam & Seetharamapuram 13 each, Kaikalur & Porumanilla 12 each, Narsapur & Gudivada 11 each, Avanigadda & Rapur 9 each, Port Blair, Udayagiri, Atmakur, Bhimavaram & Bhimadole 8 each, Eluru, Tanuku, Gudur & Tadepalligudem 7 each, Tiruvuru, Aaddanki, Venkatagiri Town & Vijayawada 6 each, Bapatla, Amalapuram, Sulurupet, Tada & Nuzvid 5 each, Tirupathi 4, Srisailam, Nandyal, Prodattur, Pullivandala, Koilamkundla, Jammalamadugu & Allagadda 3 each, Vimpalli, Dharamavaram, Chennai, Bhadrachalam, Purushottampur & Krishnaprasad 2 each, Hut Bay, Nancowry, Gopalpur, Anantpur, Madnoor, Kalakda & Atmakur 1 each	Rameshwaram 16, Pamban 14, Kadaladi 7, Jaisalmer & Tuticorin 2 each, Adirampattinam, Nagapattinam, Tiruchirapalli, Kodaikanal & Karaikal 1 each
17.	Kavali & Quilandy 5 each, Mangalore & Neyyattinkara 4 each, Ajmer, Udaipur, Ongole, Tirupathi & Vythiri 3 each, Bhatinda, Bapatla, Nellore, Vijaywada, Chennai, Karaikal, Tondi & Kozhikode 2 each, Hut Bay, Agumbe, Bangalore, Minicoy & Bang Manali 1 each	Veemabaram, Yellur & Kaikalur 9 each, Hyderabad, Kushtogi, Ilkal, Mudgal & Anantpur 4 each, Narsapur, Ongole & Puri 3 each, Gadag & Nimapara 2 each, Solapur & Kurnool 1 each	Rameshwaram 7, Kalpa 4, Pamban 2, Dhundi, Banihal, Kupwara, Barmer, Nal & Jaisalmer 1 each
18.	Tirupathi 12, Tondi 7, Quilandy & Tuticorin 6 each, Coonoor & Kannur 5 each, Thalassery 4, Ongole, Chennai, Puducherry & Minicoy 3 each, Karaikal & Jat 2 each, Gulbarga, Panambur, Kozhikode, Punalur, Nedumbassery & Car Nicobar 1 each	Thiruvananthapuram 5, Kaveli 4, Car Nicobar 2, Mahabaleshwar, Ongole, Panjim, Nanded & Medikeri 1 each	Pamban 2, Barmer & Vedaranniyam 1 each
19.	Cuddalore 7, Kodaikanal 6, Tuticorin & Puducherry 3 each, Nellore, Karaikal & Kaveli 2 each, Sangli, Kolhapur, Sholapur, Vedar, Salem, Nagapattinam, Adirampattinam, Bangalore, Amini Divi & Sawantwadi 1 each	Jhalawar & Raisen 3 each, Hoshangabad, Cuddalore, Coonoor & Puducherry 2 each, Rawatbhata, Banda, Jhansi, Guna, Bhopal, Shajapur, Nowgong, Chambal, Tirupathi, Tambaram, Tondi, Karaikal & Raichur 1 each	Pamban 10, Tondi 2, Patsio, Kanykumari & Adirampattinam 1 each
20.	Tondi 16, Thiruvananthapuram 13, Kumarakom 10, Kayamkulam, Piravom & Puttur 9 each, Nedumbassery & CIAL Kochi 8 each, Gundlupet 7, Thiruvananthapuram & Aska 6 each, Alapuzha 5, Tirupathi & Minicoy 4 each,	Vedaranniyam 7, Gohana, Sonepat & Cuddalore 3 each, Jhansi, Jhalawar, Neemuch, Karaikal, Nagapattinam, Jind, Narwara, Dehragopipur, Seoni &	Bhangmanali 8, Manali 7, Minicoy 6, Dhundi 5, Banihal 4, Solangnala, Patsio, Bhuntar, Kalpa, Baderwah, Batote & Kupwara 3 each,

TABLE 5 (*Contd*.)

(1)	(2)	(3)	(4)
	Pamban 3, Nellore, Coimbatore, Kanyakumari & Madurai 2 each, Koraput, Kavali, Chennai & Kochi 1 each	Mandla 2 each, Dehra Dun, Hissar, Karnal, Rohtak, Bhiwani, Hoshangabad, Guna, Satna, Tiruchirapalli, Amraoti, Amini Divi & Aagathi 1 each	Rampurbhushar, Quazi Gund & Amini Divi 2 each, Mandi, Pahalgam, Kukernag, Pamban & Tondi 1 each
21.	Alapuzha 15, Kollengode 11, Chennai & Tuticorin 10 each, Puducherry, Nellore, Cuddalore & Chittur 9 each, Tondi & Kushtangi 7 each, Tiruchirapalli, Coimbatore & Kochi 5 each, Kaveli, Karaikal, Nagapattinam, Thiruvananthapuram, Amini Divi & Agathi 4 each, Maya Bandar, Tirupathi, Madurai, Pamban, Kozhikode & Nedumbassery 3 each, Adirampattinam, Vedaranniyam, Kannur & Minicoy 2 each, Kanyakumari & Salem 1 each	Hingoli 9, Muthupet 8, Adirampattinam 6, Tondi, Kottayam & Sangola 5 each, Nancowry, Minicoy, Mangalvedha, Mohol & Pandharpur 4 each, Betul, Pamban, Peravurani, Parenda, Jintoor, Kottayam, Karipur & Minicoy 3 each, Solapur, Parbhani, Orathanadu, Pattukottai, Mannargudi & Thiruthuraipoondi 2 each, Tehri, Pandoh, Sunnibhaji, Coimbatore, Kanyakumari, Alapuzha, Thiruvananthapuram & Agathi 1 each	Banihal 7, Amini Divi 5, Batote, Kupwara & Quazi Gund 4 each, Baderwah & Dhundi 3 each, Pahalgam & Kukernag 2 each, Bhuntar, Kalpa, Srinagar & Udhampur 1 each
22.	Uthagamandalam 15, Kumarakom 12, Paravur 10, Alapuzha 9, Kanyakumari, Adirampattinam & Thiruvananthapuram 7 each, Karipur, Amini Divi & Madurai 6 each, Nagapattinam & Tambaram 5 each, Nellore & Kaveli 4 each, Chennai, Karaikal, Coimbatore & Punalur 3 each, Ongole, Bapatla, Kochi, Kottayam, Minicoy & Agathi 2 each, Anantpur, Puducherry, Pamban, Tirupattur, Cuddalore, Honavar, Chitradurga, Medikeri, Agumbe, Kozhikode, Car Nicobar, Port Blair & Tirupathi 1 each	Kollidam 16, Sirkali 11, Chidambaram 9, Chennai & Gudur 8 each, Puducherry & Venkatagiri Town 7 each, Cuddalore 5, Baripada 4, Nancowry, Chouldhowaghat, Karaikal & Nagapattinam 3 each, Dibrugarh, Motunga & Pamban 2 each, Car Nicobar, Tezu, Tangla, Sibsagar, Keonjhargarh, Tirupathi, Tondi, Madurai, Kanyakumari, Kodaikanal, Raichur, Thiruvananthapuram & Kottayam 1 each	Nil
23.	Agathi 13, Car Nicobar & Amini Divi 12 each, Kalingapatnam 8, Nellore & Belur 7 each, Chennai 6, Port Blair, Tiruchirapalli, Kottayam, Kannur & Minicoy 4 each, Ongole, Kaveli, Visakhapatnam, Kakinada, Raichur & Thiruvananthapuram 3 each, Bapatla & Kurnool 2 each, Hut Bay, Machilipatnam, Narsapur, Tirupathi, Salem, Nagapattinam, Vedaranniyam, Puducherry, Cuddalore, Pamban, Kanyakumari, Gadag, Bangalore, Alapuzha & Punalur 1 each	Rameshwaram 7, Nancowry 5, Alapuzha & Minicoy 4 each, Car Nicobar, Kaveli, Ongole, Nellore, Chennai, Pamban, Thiruvarur & Kollidam 3 each, Kodaikanal, Cuddalore, Coimbatore, Nagapattinam, Mannargudi, Sirkali & Daringibadi 2 each, Tirupathi, Madurai, Puducherry, Adirampattinam, Kumbakonam, Pattukottai, Tiruvidaimaruthur, Kodavasal, Nannilam, Needamangalam, Valangaiman, Mayiladuthurai, Vedaranniyam, Palayamkottai, Karaikal, Kanyakumari, Alapuzha, Punalur & Bangalore 1 each	Nil
24.	Maya Bandar 17, Kozhikode 14, Chennai 11, Kannur 10, Kaveli 9, Port Blair & K. R. Sagara 8 each, CIAL Kochi 7, Car Nicobar 6, Kanyakumari 3, Minicoy, Thiruvananthapuram & Hut Bay 2 each, Paradip, Vellore & Amini Divi 1 each	Parangipettai & Tozhudur 15 each, Adirampattinam, Puducherry & Cuddalore 9 each, Tondi 8, Karaikal 7, Vedaranniyam, Kodaikanal & Pamban 5 each, Nagapattinam & Tiruchirapalli 4 each, Car Nicobar, Tirupathi, Salem & Amini Divi 3 each, Kaveli, Chennai, Madurai, Kanyakumari, K. Paramathy & Thiruvananthapuram 2 each, Nancowry, Anantpur, Bangalore, Coimbatore, Coonoor & Agathi 1 each	Nil
25.	Kozhikode 24, Karipur 17, Chennai & Kannur 12 each, Gundlupet 11, Sira 10, Chennai 8, Chikballapur 7, Paradip 6, Adirampattinam, Kanyakumari & Agathi 5 each, Maya Bandar, Shirali, Chitradurga, Thiruvananthapuram & Punalur 4 each, Chandbali, Bangalore & Medikeri 3 each, Port Blair, Uthagamandalam & Kochi 2 each, Long Island, Hut Bay, Nancowry, Imphal, Kailashahar, Agartala, Puri, Tirupathi, Vellore, Mysore, Alapuzha, Kottayam, Amini Divi & Minicoy 1 each	Pamban 15, Tiruchirapalli & Vedaranniyam 9 each, Karaikal 8, Tondi, Adirampattinam, Cuddalore, Nagapattinam & Puducherry 7 each, Kodaikanal & Car Nicobar 5 each, Madurai, Palayamkottai & Agathi 3 each	Karaikal 2

TABLE 5 (*Contd.*)

(1)	(2)	(3)	(4)
26.	Darjeeling 23, Agartala 10, Kailashahar 9, Silchar, Kozhikode & Karipur 7 each, Coimbatore, Maya Bandar, Chandbali & Car Nicobar 5 each, Lengpui, Imphal & Kottayam 4 each, Paradip, Thiruvananthapuram, Kannur, Kochi & Punalur 3 each, Puducherry 2, Cherrapunji, Diamond Harbour, Puri, Kanyakumari, Medikeri, Alapuzha & Nedumbassery 1 each	Vedaranniyam & Orathanadu 33 each, Chidambaram 28, Cuddalore & Nagapattinam 20 each, Karaikal 19, Puducherry & Adirampattinam 18 each, Chennai 11, Port Blair & Tambaram 8 each, Pamban 6, Nancowry & Tiruchirapalli 5 each, Kodaikanal & Tondi 4 each, Car Nicobar & Hut Bay 3 each, Long Island, Vellore, Alapuzha & Tirupathi 2 each	Pamban 1
27.	Canning Town 15, Shillong & Bashirahat 11 each, Cherrapunji 10, Haldia 9, Diamond Harbour & Kolkata 8 each, Maya Bandar & Krishnanagar 7 each, Sabroom & Barrackpur 6 each, Kohima & Port Blair 5 each, Hut Bay, Daporijo, Tezu, Passighat, Guwahati & Arundhutinagar 4 each, Kherunighat, Jai Bharali NT Xing, Goalpara & Agartala 3 each, Itanagar, Bhalukpong, Dibrugarh, Tezpur, North Lakhimpur, Bahalpur, Barpeta, Khowang, Neematighat, Chouldhowaghat, Dharamtul, Kampur, Margherita, Tikrikilla, Lumding, Rangiya, Dhekiajuli, Dharmanagar, Malda, Sriniketan, Midnapore & Digha 2 each, Long Island, Car Nicobar, Ziro, Silchar, Dhubri, Jorhat, Beki Road Bridge, Annapurnaghat, Golaghat, Tangla, Kokrajhar, Kailashshahar, Belonia, Cooch Behar, Bashirhat & Adirampattinam 1 each	Orathanadu, Thanjavur, Vedaranniyam & Adirampattinam 33 each, Muthupet 30, Srikalahasti 16, Chennai & Tirupathi 14 each, Sulurpet & Tada 12 each, Nagapattinam, Puducherry, Cuddalore & Satyavedu 11 each, Tirupathi & Puttur 10 each, Tiruchirapalli 9, Karaikal 8, Kodaikanal 6, Tondi & Thiruvananthapuram 5 each, Kaveli, Salem & Pamban 3 each, Port Blair, Dharmapuri & Alapuzha 1 each	Car Nicobar, Tezpur & Kohima 1 each
28.	Cherrapunji 15, Shillong 8, Goalpara 7, Car Nicobar 6, Rangiya 5, Hut Bay & Passighat 4 each, Gangtok, Tadong & Alapuzha 3 each, Dhubri & Cooch Behar 2 each, Maya Bandar, Long Island, Nancowry, Port Blair, North Lakhimpur, Siliguri, Jalpaiguri & Alapuzha 1 each	Chennai 28, Cuddalore & Kalakurichi 22 each, Puducherry 21, Vellore 17, Udayagiri 16, Tiruchirapalli & Vinjamur 15 each, Ongole & Puttur 14 each, Tirupathi & Satyavedu 13 each, Kaveli 12, Nellore 9, M. M. Hills & Bapatla 7 each, Machilipatnam & Salem 5 each, Thiruvananthapuram 4, Nagapattinam & Karaikal 3 each, Narsapur, Adirampattinam & Bangalore 2 each, Maya Bandar, Vijayawada, Anantpur, Kanyakumari & Punalur 1 each	Hut Bay 16, Car Nicobar 3, Nancowry 1
29.	Hut Bay & Port Blair 3 each, Nancowry 1	Arkonam 25, Erode 19, Rapur 18, Ongole, Srisailam & Cumbum 16 each, Sriperumbudur 13, Attur 11, Gadag 10, Bapatla 9, Navalgund & Shivani 8 each, Kaveli, Soundatti & Santhebennur 7 each, Narsapur, Chennai & Mangalore 5 each, Nellore 4, Gannavaram, Tirupathi, Salem, Panambur & Chitradurga 3 each, Machilipatnam, Kakinada & Kurnool 2 each, Tuni, Nalgonda, Anantpur, Kodaikanal, Agumbe, Belgaum & Bangalore 1 each	Hut Bay, Gangtok, Tadong, Car Nicobar, Darjeeling & Khanitar 1 each
30.	Nancowry, Idukki & Aryankavu 1 each	Muthupet 22, Radhapuram 12, Ramanathapuram 11, Ongole, Kaveli, Pamban, Cuddalore, Vellore, Palayamkottai & Kannur 3 each, Satara, Sangli, Nellore & Puducherry 2 each, Tirupathi, Nagapattinam, Madurai, Adirampattinam, Agathi & Satara 1 each	Nancowry & Shillong 1 each
31.	Car Nicobar 1	Nil	Nil

The dates of occurrence of *cold waves* and dates on which the minimum temperature remained *appreciably to markedly below/above normal* and *below/above normal* are given in Table 7. Minimum temperatures were normal for the rest of the days. No cold wave condition occurred during the month.

The month's lowest minimum temperature in the plains of the country was 11.0° C recorded at Akola (Vidarbha) and Ujjain (west Madhya Pradesh) on 25, Bhira (Konkan & Goa) on 27 and Raisen (Vidarbha) on 28 October 2008.

3.1.6. *Disastrous weather events and associated damage*

According to media and other reports from various regions, heavy rain, lightning, thunder storm, hail storm and thundersqualls took a toll of 12 lives in Tamil Nadu, 11 in Jharkhand, 10 in Karnataka, 9 in Kerala, 3 in Haryana, 2 in Maharashtra and 1 in Himachal Pradesh. Incessant heavy rains caused flood situations in many parts of Tamil Nadu. Many houses were damaged and extensive damage to agriculture was reported in Tamil Nadu and Kerala. The damage caused by the Cyclonic Storm (Rashmi) is dealt in separately under section 3.1. 3.2.

3.2. *November*

3.2.1. *Storms and depressions*

Two Cyclonic Storms formed during the month. The details are given below.

3.2.1.1. *Cyclonic Storm (KHAI MUK) over the Bay of Bengal (13 – 16 November 2008)*

A trough of low over the southeast Bay and neighbourhood organized into a low pressure area over there on 12 evening and became well marked over the southeast and adjoining southwest Bay on 13 morning. It concentrated into a Depression and lay centred at 1200 UTC of 13, near Lat. 11.5° N / Long. 85.5° E. Moving northnorthwestwards, it intensified into a Deep Depression and lay centred at 0300 UTC of 14, near Lat. 12.5° N / Long. 85.0° E, (about 550 km eastsoutheast of Nellore). Moving in a northwesterly direction it intensified into a Cyclonic Storm (Khai muk) and lay centred at 1200 UTC of 14, near Lat. 14.0° N / Long. 84.0° E (about 400 Km southeast of Machilipatnam). Subsequently moving westnorthwestwards, it lay centred at 0300 UTC of 15, near Lat. 14.5° N / Long. 82.5° E (about 230 km southeast of Machilipatnam). Then it remained practically stationary and weakened into a Deep Depression at 0600 UTC of 15. Further moving westwards, it lay centred at 1200 UTC of 15, near Lat. 14.5° N / Long. 81.5° E. It slowly moved westnorthwest-wards and crossed south Andhra coast to the north of Kavali between 2200 & 2300 UTC of 15. Continuing the westnorthwest-ward movement, it weakened into a Depression and lay centred at 0300 UTC of 16, close to Nandyal (Lat. 15.5° N / Long. 78.5° E). It weakened into a well marked low pressure area over Rayalaseema and neighbourhood in the afternoon; into a low pressure area over the same region in the evening of 16 and became less marked on 17. However, the associated upper air cyclonic circulation extending upto lower tropospheric levels lay over the eastcentral and adjoining southeast Arabian Sea off Karnataka-Goa coasts during 17-19.

The maximum intensity of T 2.5 was reported from 1100 UTC of 14 to 0500 UTC of 15 by Kalpana 1. DWR Chennai also tracked the system during the initial period followed by DWR Machilipatnam.

The lowest ECP was 994 hPa at 2100 UTC of 14. The maximum estimated wind speed was 40 kts. The lowest mean sea level pressure of 995.2 hPa was reported at Kavali at 2200 UTC of 15.

Widespread rainfall activity with isolated heavy to very heavy falls occurred over coastal Andhra Pradesh on 16 and 17. Widespread rainfall activity also occurred over Rayalaseema on 16. Some chief amounts of rainfall (in cms)are given in Table 5.

The system caused huge damage to agriculture and loss to fishermen in Andhra Pradesh.

3.2.1.2. *Cyclonic Storm (NISHA) over the Bay of Bengal (25 – 27 November 2008)*

A low pressure area formed over Sri Lanka and neighbourhood on 24. It became well marked on 24 evening. It concentrated into a Depression over Sri Lanka and neighbourhood at 0900 UTC of 25 near Lat. 8.5° N / Long. 81.0° E. It further intensified into a Deep Depression at 1200 UTC on the same day near Lat. 8.5° N / Long. 81.0° E, about 200 kms southeast of Pamban. It further intensified into a Cyclonic Storm (NISHA) at 0300

TABLE 6

Dates of occurrence of heat wave/severe heat wave and various categories of maximum temperatures - October 2008

Sub-division		Dates (Number of days)						
No.	Name	Severe heat wave	Heat wave	Hot day	Appreciably to markedly above normal	Above normal	Appreciably to markedly below normal	Below normal
2.	Arunachal Pradesh	Nil	Nil	Nil	15, 18, 19, 22-25 (7)	Nil	27, 28 (2)	Nil
3.	Assam & Meghalaya	Do	Do	Do	15-25 (11)	31 (1)	27-29 (3)	15 (1)
4.	Naga., Mani., Mizo. and Tripura	Do	Do	Do	15-22, 24 (9)	15 (1)	25, 27, 28 (3)	29 (1)
5.	S. H. W. B. & Sikkim	Do	Do	Do	15, 17-25 (10)	13 (1)	28, 29 (2)	27 (1)
6.	Gangetic West Bengal	Do	Do	Do	Nil	18, 23 (2)	27, 28 (2)	25 (1)
7.	Orissa	Do	Do	Do	13, 14, 16, 18, 19, 20, 29 (7)	12, 14, 16, 17, 21-23, 30, 31 (9)	24 (1)	27 (1)
8.	Jharkhand	Do	Do	Do	13, 15, 16, 19, 20, 21, 22, 29 (8)	14, 16, 17, 18, 23 (5)	27 (1)	Nil
9.	Bihar	Do	Do	Do	16 (1)	14-17, 19, 20, 23 (7)	Nil	28, 29 (2)
10.	East Uttar Pradesh	Do	Do	Do	12 (1)	13, 17, 19-24, 31 (16)	Do	28, 29 (2)
11.	West Uttar Pradesh	Do	Do	Do	6, 8-11, 14 (6)	4, 5, 8, 9, 13, 17, 19, 24, 30, 31. (10)	7 (1)	29 (1)
12.	Uttarakhand	Do	Do	Do	2, 3, 20, 29 (4)	1, 3, 10, 14, 21, 22, 23 (7)	Nil	Nil
13.	Haryana, Chandigarh & Delhi	Do	Do	Do	4-10, 14, 15, 24 (10)	1, 3, 10, 11, 13, 14 (6)	Do	28 (1)
14.	Punjab	Do	Do	Do	4 (1)	10, 14 (2)	16, 21 (2)	2, 8, 18, 19, 23, 27-31 (10)
15.	Himachal Pradesh	Do	Do	Do	1- 4, 6, 8-10, 14, 15, 20, 21, 30, 31 (14)	4, 10-13, 22, 27 (7)	16 (1)	Nil
16.	Jammu & Kashmir	Do	Do	Do	1- 6, 10, 13, 24 (9)	10-12, 19, 20, 27, 28 (7)	8, 16 (2)	9, 18, 29 (3)
17.	West Rajasthan	Do	Do	Do	1-9, 11-16, 20-22, 24, 25, 29, 30 (22)	1, 8-10, 19, 23, 27, 28, 30, 31 (10)	Nil	Nil
18.	East Rajasthan	Do	Do	Do	1-16, 21, 24, 25, 28, 29, 31 (22)	1, 8, 9, 19, 22, 27, 30 (7)	Do	Do
19.	West Madhya Pradesh	Do	Do	Do	11-14, 16, 17, 19, 21, 24, 25, 27-31 (15)	18, 20, 22, 23 (4)	Do	Do
20.	East Madhya Pradesh	Do	Do	Do	12-14, 16, 25, 29, 30 (7)	14, 16, 17, 18, 20 (5)	Do	Do
21.	Gujarat Region	Do	Do	Do	12-16, 18, 20, 22, 25 (9)	11, 16, 17, 23, 24, 28 (6)	Do	Do
22.	Saurashtra & Kutch	Do	Do	Do	13-25, 27 (14)	11, 16, 17, 23, 28 (5)	Do	29 (1)
23.	Konkan & Goa	Do	Do	Do	15-19, 21-25, 27 (11)	28 (1)	Do	Nil
24.	Madhya Maharashtra	Do	Do	Do	15, 16, 27, 28, 30, 31 (6)	13, 14, 16, 19, 21, 22, 24, 29 (8)	24 (1)	Do
25.	Marathawada	Do	Do	Do	15, 16, 29 (3)	17-19, 21, 27, 28 (6)	Nil	Do
26.	Vidarbha	Do	Do	Do	13, 15, 16, 19, 29-31 (7)	17-24, 28 (9)	Do	Do
27.	Chattisgarh	Do	Do	Do	13, 15, 19, 21, 31 (5)	16, 17, 20, 22, 24, 28, 29, 30 (8)	Do	Do
28.	Coastal Andhra Pradesh	Do	Do	Do	15-17, 19-21, 25, 28, 29, 31 (10)	16, 22, 27, 30 (4)	21, 22, 24 (3)	23, 25 (2)
29.	Telangana	Do	Do	Do	29, 31 (2)	16, 17, 20-23, 28, 30 (8)	Nil	Nil
30.	Rayalaseema	Do	Do	Do	19 (1)	16, 21, 28, 31 (4)	22, 24 (2)	23 (1)
31.	Tamil Nadu	Do	Do	Do	29 (1)	28, 30 (2)	15, 16, 21, 22 (4)	15, 18, 19, 23- 25 (6)
32.	Coastal Karnataka	Do	Do	Do	16-19, 21, 22, 24, 25, 27, 31 (10)	27, 29-31 (4)	Nil	25 (7)
33.	North Interior Karnataka	Do	Do	Do	Nil	27 (1)	24 (1)	Nil
34.	South Interior Karnataka	Do	Do	Do	Do	19, 27, 29, 31 (4)	16, 23, 27 (3)	22, 23 (2)
35.	Kerala	Do	Do	Do	19 (1)	17, 20, 24, 27, 31 (5)	Nil	25, 27 (2)

TABLE 7

Dates of occurrence of cold wave/severe cold wave and various categories of minimum temperatures - October 2008

Sub-division		Dates (Number of days)						
No.	Name	Severe cold wave	Cold wave	Cold day	Appreciably to markedly below normal	Below normal	Appreciably to markedly above normal	Above normal
2.	Arunachal Pradesh	Nil	Nil	Nil	Nil	23, 29 (2)	Nil	Nil
3.	Assam & Meghalaya	Do	Do	Do	17 (1)	16, 24, 27 (3)	19, 20, 22 (3)	14, 25, 28 (3)
4.	Naga., Mani., Mizo. and Tripura	Do	Do	Do	18 (1)	28, 30 (2)	24, 29 (2)	22 (1)
5.	S. H. W. B. & Sikkim	Do	Do	Do	17, 27 (2)	16, 20, 23, 25, 26 (5)	Nil	13, 14, 30 (3)
6.	Gangetic West Bengal	Do	Do	Do	16, 27 (2)	18, 28 (2)	Do	15, 18, 19, 25 (4)
7.	Orissa	Do	Do	Do	20-22, 29 (4)	31 (1)	Do	13, 14, 18, 19, 25 (5)
8.	Jharkhand	Do	Do	Do	16, 20- 22, 24, 28, 29 (7)	12, 30 (2)	Do	18, 23 (2)
9.	Bihar	Do	Do	Do	20- 23 (4)	19 (1)	Do	18, 31 (2)
10.	East Uttar Pradesh	Do	Do	Do	19, 20, 22 (3)	21, 23, 25, 27 (4)	13 (1)	12, 14, 15, 24, 28, 29-31 (8)
11.	West Uttar Pradesh	Do	Do	Do	Nil	23 (1)	1, 3-5, 8, 10, 13-15 (9)	7, 11, 24, 29- 31 (6)
12.	Uttarakhand	Do	Do	Do	Do	7, 8, 10, 21, 27 (5)	1, 3 (2)	8, 28 (2)
13.	Haryana, Chandigarh & Delhi	Do	Do	Do	17 (1)	19, 21 (2)	1-8, 13-15, 23, 24, 28-31 (17)	2, 10-12 (4)
14.	Punjab	Do	Do	Do	Nil	19 (1)	1-6, 8, 14, 28, 30, 31 (11)	7, 9, 10, 12, 29 (5)
15.	Himachal Pradesh	Do	Do	Do	15, 16, 18, 24 (4)	Nil	1, 4, 5, 8, 12, 29 (6)	6, 7, 9, 12, 13, 22, 23 (7)
16.	Jammu & Kashmir	Do	Do	Do	6, 16, 22 (3)	10, 18, 19, 27 (4)	3- 6, 30, 31 (6)	1, 7, 8, 28 (4)
17.	West Rajasthan	Do	Do	Do	Nil	26 (1)	1- 16, 18- 31 (30)	9, 10, 21, 28 (4)
18.	East Rajasthan	Do	Do	Do	Do	20, 26 (2)	1-6, 8-12, 14-16, 21-26, 29-31 (23)	9, 10, 18, 21, 28 (5)
19.	West Madhya Pradesh	Do	Do	Do	22, 26, 27, 28 (4)	19, 20, 24, 25, 29 (5)	11, 13, 15- 17 (5)	12, 14, 15, 18, 24, 29, 30 (7)
20.	East Madhya Pradesh	Do	Do	Do	Nil	20, 22, 23, 25, 29 (5)	12, 13, 15, 16 (4)	14, 15, 18, 30 (4)
21.	Gujarat Region	Do	Do	Do	21, 23 (2)	22, 25, 28, 29 (4)	11, 16, 18 (3)	3, 14, 15, 17, 21, 27, 31 (7)
22.	Saurashtra & Kutch	Do	Do	Do	21 (1)	25 (1)	11, 13, 16, 18, 19, 24 (6)	12, 14, 15, 17, 19, 21, 26, 27, 28, 30 (10)
23.	Konkan & Goa	Do	Do	Do	26, 28 (2)	25, 27, 29, 30 (4)	16 (1)	17- 19, 23 (4)
24.	Madhya Maharashtra	Do	Do	Do	15, 16, 21, 22, 24-29, 31 (11)	14, 20, 23, 30, 31 (5)	Nil	19 (1)
25.	Marathawada	Do	Do	Do	16, 21, 22, 25, 28, 29, 31 (7)	14, 23 (2)	Do	18, 19 (2)
26.	Vidarbha	Do	Do	Do	14, 21- 29, 31 (11)	12, 13, 19, 20, 30 (5)	Do	Nil
27.	Chattisgarh	Do	Do	Do	19, 21, 22, 30 (4)	20, 25, 29 (3)	Do	Do
28.	Coastal Andhra Pradesh	Do	Do	Do	27, 28, 31 (3)	17, 27, 28-30 (5)	Do	21 (1)
29.	Telangana	Do	Do	Do	26-29, 31 (5)	14, 30 (2)	16, 19 (2)	18, 24 (2)
30.	Rayalaseema	Do	Do	Do	26- 29, 31 (5)	17, 30 (2)	Nil	Nil
31.	Tamil Nadu	Do	Do	Do	16, 28, 29, 31 (4)	28, 30 (2)	Do	17, 24, 26 (3)
32.	Coastal Karnataka	Do	Do	Do	Nil	30. (1)	16, 18- 20. (4)	17, 21, 22, 24 (4)
33.	North Interior Karnataka	Do	Do	Do	25-27, 29, 31 (5)	Nil	Nil	18 (1)
34.	South Interior Karnataka	Do	Do	Do	26, 27, 29-31 (5)	Do	Do	15, 18, 21, 23, 24 (5)
35.	Kerala	Do	Do	Do	28 (1)	Do	Do	17, 24 (1)

TABLE 8

Dates of occurrence of cold wave/severe cold wave and various categories of minimum temperatures - November 2008

Sub-division		Dates (Number of days)						
No.	Name	Severe cold wave	Cold wave	Cold day	Appreciably to markedly below normal	Below normal	Appreciably to markedly above normal	Above normal
2.	Arunachal Pradesh	Nil	Nil	Nil	Nil	20 (1)	Nil	Nil
3.	Assam & Meghalaya	Do	Do	Do	8-11, 16-19, 26 (9)	7, 12-15, 20, 24, 25, 28, 26, 29, 30 (12)	4,10, 22, 27 (4)	20 (1)
4.	Naga., Mani., Mizo. and Tripura	Do	Do	Do	10 (1)	4, 8, 11, 12, 15, 16 (6)	2, 3, 5, 7, 8, 22 (6)	30 (1)
5.	S. H. W. B. & Sikkim	Do	Do	Do	Do	16, 17, 19, 21, 28, (5)	4, 7-9 (4)	1, 3, 4, 9, 13, 20, 23, 24, 30 (9)
6.	Gangetic West Bengal	Do	Do	Do	Do	Nil	8, 16, 17, 19, 22, 29 (6)	3, 7, 13, 20 (4)
7.	Orissa	Do	Do	Do	6 (1)	1, 25, 26 (3)	5, 8, 9, 15-23 (12)	7,10,12-14, 20, 24, 29, 30 (9)
8.	Jharkhand	Do	Do	Do	25, 26 (2)	1, 24, 28 (3)	18, 20, 22 (15)	5, 7, 8, 12-14, 17, 19, 30 (9)
9.	Bihar	Do	Do	Do	23, 25 (2)	24 (1)	2, 4, 6-9, 20, 21, 28 (9)	5, 10-14, 16, 17, 19, 22, 30 (11)
10.	East Uttar Pradesh	Do	Do	Do	9, 21, 23, (3)	25 (1)	2, 4, 7, 8, 10, 12, 13, 15, 16, 18, 19, 20, 27-30 (16)	3-6, 11, 22, 26, 28 (8)
11.	West Uttar Pradesh	Do	Do	Do	Do	25 (1)	2, 3, 7-10, 12, 13, 15, 18-21, 27, 30 (15)	4-6, 11, 16, 17, 26, 28, 29 (9)
12.	Uttarakhand	Do	Do	Do	15 (1)	5 (1)	9, 10, 27, 29, 30 (5)	4, 7, 8, 11, 17, 20, 28 (7)
13.	Haryana, Chandigarh & Delhi	Do	Do	Do	23 (1)	5, 6, 25 (3)	2, 4, 7-13, 15, 18, 20, 27, 28 (14)	1, 11, 17, 19, 26 (5)
14.	Punjab	Do	Do	Do		5, 6, 21-23, 28-30 (8)	2, 8 13 (3)	7, 9-12, 18, 20, 28 (8)
15.	Himachal Pradesh	Do	Do	Do	20, 21 (2)	Nil	2, 5, 8, 10, 12, 13, 23,25,26, 28-30 (12)	1, 3, 4, 11, 17. (5)
16.	Jammu & Kashmir	Do	Do	Do	1, 22 (2)	21, 24 (2)	1, 5, 8, 13, 22 (5)	7, 9, 12, 14, 17, 18, 29 (7)
17.	West Rajasthan	Do	Do	Do	Nil	22, 24 (2)	1-10, 12, 13, 15-19, 25, 27-29 (21)	4, 11, 22, 23, 30 (5)
18.	East Rajasthan	Do	Do	Do	25 (1)	22, 24, 26 (3)	1-5, 7-9, 12, 13, 15-20, 27-29 (19)	4, 10, 11, 21-23, 30 (7)
19.	West Madhya Pradesh	Do	26, 27 (2)	Do	7, 10, 11, 23, 25-27 (7)	1, 22-24, 29 (5)	2, 3, 9, 12, 13, 15-21, 28, 30 (14)	5, 8, 10, 11, 16, 29 (6)
20.	East Madhya Pradesh	Do	Nil	Do	24, 26, 27 (3)	1, 22 (2)	2, 8-10, 12, 14-21, 29 (14)	6, 11, 16, 22, 28-30 (7)
21.	Gujarat Region	Do	Do	Do	21, 25 (2)	14 (1)	4, 5, 12, 18-20, 22, 29, 30 (9)	4, 7, 15, 17, 21, 24, 28 (7)
22.	Saurashtra & Kutch	Do	Do	Do	21, 23, 25 (3)	14, 16, 22 (3)	2-9, 13, 18-20, 28-30 (15)	1, 3, 4, 11, 21, 27 (6)
23.	Konkan & Goa	Do	Do	Do	Nil	4, 6, 7, 9, 14, 26-28 (8)	12,19-23, 29, 30 (8)	17, 20, 24 (3)

TABLE 8 (*Contd*.)

Sub-division No.	Name	Dates (Number of days) Severe cold wave	Cold wave	Cold day	Appreciably to markedly below normal	Below normal	Appreciably to markedly above normal	Above normal
24.	Madhya Maharashtra	Nil	Nil	Nil	1, 4, 9, 10, 25, 26 (5)	1, 3, 5-9, 28 (8)	12, 16-23, 28, 30 (11)	11, 14, 24 (3)
25.	Marathawada	Do	Do	Do	10, 26, 27 (3)	6 (1)	12, 13, 15-17, 19-23, 29, 30 (12)	7, 11, 14 (3)
26.	Vidarbha	Do	26, 27, 29 (3)	Do	3, 4, 7, 8, 25, 27 (6)	1, 2, 4, 30 (4)	13-17, 19-22, 29, 30 (11)	11 (1)
27.	Chattisgarh	Do	Nil	Do	26 (1)	6, 24 (2)	8, 15, 16-22, 29 (10)	12-14, 16, 28, 30 (6)
28.	Coastal Andhra Pradesh	Do	Do	Do	1-4 (4)	1, 3, 6, 7, 12 (5)	17-24, 26, 29, 30 (11)	14, 15, 21, 25, 27, 28, 30 (7)
29.	Telangana	Do	Do	Do	Nil	4, 6, 26 (3)	16, 17, 19, 20-24, 28-30 (11)	11, 12, 15 (3)
30.	Rayalaseema	Do	Do	Do	1, 2, 5, 7, 9, 10, 13 (7)	3, 8, 14 (3)	12, 19, 22, 28, 29 (5)	17, 23, 24, 25 (4)
31.	Tamil Nadu	Do	Do	Do	1-6 (6)	3-5 (3)	12, 18, 19, 21, 23, 25, 29 (7)	8, 11, 16, 17, 19, 22, 28-30 (9)
32.	Coastal Karnataka	Do	Do	Do	3, 7 (2)	1, 4, 14 (3)	12, 17, 19, 22-24, 28-30 (9)	11, 16, 18, 20, 21, 23 (6)
33.	North Interior Karnataka	Do	Do	Do	1, 6-9 (5)	3, 5, 8, 12, 14, 26 (6)	16, 18, 19, 23, 30 (5)	2, 11, 21, 23, 28 (5)
34.	South Interior Karnataka	Do	Do	Do	1-10, 12, 15 (12)	8, 10, 13, 14, 16 (5)	17-19, 22, 23, 29, 30 (7)	11, 21, 23, 24, 26, 28 (6)
35.	Kerala	Do	Do	Do	12 (1)	Nil	19, 23 (2)	18, 25, 27 (3)

UTC on 26 near Lat. 10.5° N / Long. 80.0° E close to Vedaranyam and at 1200 UTC near Lat. 10.8° N / long. 80.0° E. It crossed Tamil Nadu coast to the north of Karaikal between 0000 and 0100 UTC on 27 and lay centred 50 kms northwest of Karaikal (Lat. 11.5° N / long. 79.5° E) at 0300 UTC on 27. It further weakened into a Deep Depression at 0900 UTC of 27 over coastal Tamil Nadu and lay centered near Lat. 12.0° N / long. 79.0° E. Moving westwards, it further weakened into a Depression over interior Tamil Nadu and lay centered at 1200 UTC on 27 near Lat. 12.0° N / long. 78.5° E. Moving northwestwards, it further weakened into a well marked low pressure area over North Interior Tamil Nadu and adjoining areas of south interior Karnataka and Rayalaseema in the early morning of 28. It moved westnorthwestwards and lay as a feeble low pressure area over the Southeast Arabian Sea off Karnataka – Kerala coasts on 28 morning. A trough from this system extended upto west central Bay of Bengal across south Karnataka, Rayalaseema and south coastal Andhra Pradesh with an embedded cyclonic circulation extending upto mid-tropospheric level over south Interior Karnataka and neighbourhood. The feeble low pressure area lay as a low pressure area over southeast Arabian Sea and neighbourhood at 1200 UTC of 28 and the trough from this system extended to north Maharashtra across north Konkan-Goa and south Madhya Maharashtra. This low pressure area lay over eastcentral and adjoining southeast Arabian Sea off Karnataka coast and a trough from the low pressure area extended upto south Gujarat coast on 29 and 30 November. The low pressure area and the trough from the system became less marked on 1 December.

The maximum intensity of T 3.0 was reported by the satellite imageries from 0800 UTC of 26th to 0000 UTC of 27th. The system attained the intensity of T 3.0 at

TABLE 9

Dates of occurrence of cold wave/severe cold wave and various categories of minimum temperatures - December 2008

Sub-division		Dates (Number of days)						
No.	Name	Severe cold wave	Cold wave	Cold day	Appreciably to markedly below normal	Below normal	Appreciably to markedly above normal	Above normal
2.	Arunachal Pradesh	Nil	Nil	Nil	Nil	Nil	Nil	6, 17 (2)
3.	Assam & Meghalaya	Do	Do	Do	Do	1, 29 (2)	3, 4, 7, 8, 11, 12, 17, 22-27 (13)	2, 6, 9, 10, 13-21, 28, 31 (15)
4.	Naga., Mani, Mizo and Tri.	Do	Do	Do	Do	Do	2-4, 7-12, 15, 21-27 (17)	13, 14 (2)
5.	S. H. W. B. & Sikkim	Do	Do	Do	Do	Do	1-12, 14, 17-19, 21-25, 27, 31 (23)	13, 15, 20, 28, 29, 30 (6)
6.	Gangetic West Bengal	Do	Do	Do	Do	Do	1-12, 14, 22, 28 (15)	13, 16, 17, 21, 29 (5)
7.	Orissa	Do	Do	Do	Do	27-29 (3)	2-17, 20-22, 24 (20)	1-3, 5, 8, 17, 18, 31 (8)
8.	Jharkhand	Do	Do	Do	26 (1)	27, 31 (2)	4, 6, 9-15, 20, 22, 24 (12)	2, 13, 16, 17, 21 (5)
9.	Bihar	Do	Do	Do	Nil	16, 17, 25, 28, 29 (5)	2-4, 7-10, 12, 14, 15, 20, 21, 23 (13)	5, 18 (2)
10.	East Uttar Pradesh	Do	Do	Do	Do	30 (1)	1-3, 5-12, 14, 18-22 (17)	4, 13, 16, 17, 19, 26 (6)
11.	West Uttar Pradesh	Do	Do	Do	Do	25, 30 (2)	1-3, 5-12, 14, 18, 19, 20, 22 (16)	17, 26, 31 (3)
12.	Uttarakhand	Do	Do	Do	Do	Do	4, 7, 9, 12, 15, 19, 21 (7)	5, 10, 14, 16, 23 (5)
13.	Haryana, Chandigarh & Delhi	Do	27 (1)	Do	13, 26, 28 (3)	5, 13, 24, 26, 29 (5)	1, 4, 6, 7, 9, 11, 14, 17-22 (13)	10, 12, 16, 23 (4)
14.	Punjab	Do	Nil	31 (1)	13, 26 (2)	4, 5, 12-14, 23-26, 29 (10)	9-11, 17, 19, 20-22 (8)	6, 11, 12, 16 (4)
15.	Himachal Pradesh	Do	Do	Nil	Nil	13 (1)	1-3, 5-7, 9, 10, 15, 17-22, 31 (16)	14 (1)
16.	Jammu & Kashmir	Do	Do	Do	Do	4, 27 (2)	7-13, 15, 17-23 (15)	1, 2, 24, 25 (4)
17.	West Rajasthan	Do	Do	Do	Do	23 (1)	1-11, 13-16, 17-21, 25, 26, 28 (23)	24, 25, 27-30 (6)
18.	East Rajasthan	Do	Do	Do	23, 24, 26 (3)	Nil	1, 3-18, 20-22, 30 (21)	27, 31 (2)
19.	West Madhya Pradesh	Do	Do	Do	24, 26-29 (5)	25, 27, 31 (3)	1, 2, 4-23 (22)	7, 10, 17, 22, 27, 31 (6)
20.	East Madhya Pradesh	Do	Do	Do	1, 24, 25 (3)	25, 27, 30, 31 (4)	1-5, 7, 9-16, 20-23 (18)	6, 7, 10, 17, 18, 28, 31 (7)
21.	Gujarat Region	Do	Do	Do	29, 30 (2)	25-27 (3)	1, 3-11, 13, 15-20, 22, 23 (19)	2, 11, 12, 24 (4)
22.	Saurashtra & Kutch	Do	Do	Do	12, 13, 23 (3)	13 (1)	1-10, 15-21, 27, 28, 30, 31 (21)	22, 29, 30 (3)
23.	Konkan & Goa	Do	Do	Do	23, 28, 29, 31 (4)	30 (1)	1, 4, 5, 21 (4)	3, 12, 13, 15, 17, 20, 26 (7)
24.	Madhya Maharashtra	Do	29, 31 (2)	Do	8, 26, 29, 30 (4)	25, 27 (2)	1-5, 12, 13, 15, 16, 18, 19-23 (15)	6, 7, 9, 17, 18, 22, 24 (7)
25.	Marathawada	Do	Nil	Do	29, 30 (2)	18, 19, 27 (3)	1-6, 11-16, 20-23 (16)	10, 17, 24 (3)

TABLE 9 (*Contd*.)

Sub-division No.	Name	Dates (Number of days) Severe cold wave	Cold wave	Cold day	Appreciably to markedly below normal	Below normal	Appreciably to markedly above normal	Above normal
26.	Vidarbha	Nil	8, 27 (1)	Nil	1, 8, 24, 26, 29, 30 (5)	4, 6, 18, 19, 21, 25, 27 (7)	1-3, 11, 13-16, 22, 23 (10)	5, 17 (2)
27.	Chattisgarh	Do	Nil	Do	26 (1)	6, 7, 18, 27 (2)	1, 4, 10-15, 20, 22, 23 (11)	3, 24 (2)
28.	Coastal Andhra Pradesh	Do	Do	Do	Nil	30 (1)	1, 2, 4, 8, 11, 12, 14, 24, 25 (9)	3, 5-7, 10, 13, 17-19, 22, 23, 25, 26 (13)
29.	Telangana	Do	Do	Do	26, 27, 29 (3)	18, 19, 20, 22, 30 (5)	1-4, 10-15, 17, 25 (12)	5, 18, 23 (3)
30.	Rayalaseema	Do	Do	Do	7, 12, 21-23, 27-31 (10)	5, 6, 19 (3)	1, 4, 17, 25 (4)	6, 10, 24 (3)
31.	Tamil Nadu	Do	Do	Do	29, 31 (2)	4 (1)	1, 13, 15 (3)	2, 6, 8-11, 15, 16, 18, 19, 24 (11)
32.	Coastal Karnataka	Do	Do	Do	29 (1)	Nil	1, 2, 10, 19, 21 (5)	3, 7, 9, 14, 15, 17-20 (9)
33.	North Interior Karnataka	Do	Do	Do	8, 21, 23, 24, 26, 27, 29-31 (9)	6, 9, 14, 18, 30 (5)	1,2,13. (3)	10, 19 (11)
34.	South Interior Karnataka	Do	Do	Do	12, 22, 23, 26-31 (9)	6, 7, 14, 15, 18-20, 25 (8)	2, 10 (2)	1, 11, 19 (3)
35.	Kerala	Do	Do	Do	24, 29, 30, 31 (4)	11, 21, 25, 26 (4)	11 (1)	2, 7-10, 17, 20 (7)

0800 UTC of 26 November, 2008 with centre 10.3° N / 79.9° E and crossed the coast near centre 11.3° N / 79.8° E with intensity T3.0.

The system was also tracked by DWR Chennai and CDR Karaikal

The lowest ECP was 996 hPa. The maximum estimated wind speed was 45 kts. The system moved in a northwesterly direction and skirted the Tamil Nadu coast from 1200 UTC of 26 to 0000 UTC of 27 and crossed Tamil Nadu coast, north of Karaikal, between 0000 and 0100 UTC of 27. Some of the salient features are (a) The cyclogenesis took place over the land region (north Srilanka) (b) the system remained quasi-stationary for about 24 hours, close to the coast, causing extremely heavy rainfall.

Fairly widespread rainfall activity with very heavy falls to extremely heavy falls at scattered places occurred over Tamil Nadu from 25 to 29. Exceptionally heavy rainfall occurred over the districts of Cauvery Delta. Heavy to very heavy falls also occurred over Rayalaseema on 27 and 28 and over coastal Andhra Pradesh from 27 to 29.

Some chief amounts of rainfall (in cms) are given in Table 5.

As per the Tamil Nadu Govt. Revenue website, loss of life was 100 over the state during 24 to 28 November due to drowning/electrification/wall collapse/tree fallen etc. As per media reports, 8 lakh acres of Paddy in Nagapattinam, Thanjavur and Tiruvarur (delta) districts and 55,250 hectares of Paddy in Cuddalore district were submerged due to heavy rain. The uprooted trees fallen across roads or on electric wires resulted in cut off power supply and disruption in road traffic.

As per the post Cyclone Survey report, the system did not generate any tidal waves. The damage due to the Gales was also less owing to heavy downpour.

In Andhra Pradesh, Chittur, Nellore and Prakasam districts of South Coastal Andhra Pradesh were affected

TABLE 10

Frequency of heavy rainfall events and monsoon activity (Ocotber-December 2008)

S. No.	Sub-division	South-West Monsoon		North-East Monsoon					North-East Monsoon					North-East Monsoon					North-East Monsoon				
		Vigorous	Active	Vigorous	Active	Extr. Heavy Rain	Very Heavy Rain	Heavy Rain	Vigorous	Active	Extr. Heavy Rain	Very Heavy Rain	Heavy Rain	Vigorous	Active	Extr. Heavy Rain	Very Heavy Rain	Heavy Rain	Vigorous	Active	Extr. Heavy Rain	Very Heavy Rain	Heavy Rain
		October		October					November					December					Post Monsoon season				
1.	Andaman & Nicobar Islands	-	-	-	-	-	1	2	-	-	-	-	7	-	-	-	1	-	-	-	-	2	9
2.	Arunachal Pradesh	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
3.	Assam & Meghalaya	-	1	-	-	-	1	8	-	-	-	-	-	-	-	-	-	-	-	-	-	1	8
4.	Naga. Mani. Mizo. & Trip.	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
5.	Sub–Himalayan W B & Sikkim	-	1	-	-	-	-	3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	4
6.	Gangetic West Bengal	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
7.	Orissa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.	Jharkhand	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.	Bihar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10.	East Uttar Pradesh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11.	West Uttar Pradesh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12.	Uttarakhand	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13.	Haryana Chnd. & Delhi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14.	Punjab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15.	Himachal Pradesh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
16.	Jammu & Kashmir	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1
17.	West Rajasthan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18.	East Rajasthan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19.	West Madhya Pradesh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20.	East Madhya Pradesh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21.	Gujarat Region	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22.	Saurashtra & Kutch	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23.	Konkan & Goa	-	-	-	-	-	1	5	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5
24.	Madhya Maharashtra	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
25.	Marathwada	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
26.	Vidarbha	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1

TABLE 10 (*Contd*.)

S. No.	Sub-division	South-West Monsoon		North-East Monsoon					North-East Monsoon					North-East Monsoon					North-East Monsoon				
		Vigorous	Active	Vigorous	Active	Extr. Heavy Rain	Very Heavy Rain	Heavy Rain	Vigorous	Active	Extr. Heavy Rain	Very Heavy Rain	Heavy Rain	Vigorous	Active	Extr. Heavy Rain	Very Heavy Rain	Heavy Rain	Vigorous	Active	Extr. Heavy Rain	Very Heavy Rain	Heavy Rain
		October		October					November					December					Post Monsoon season				
27.	Chattisgarh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28.	Coastal Andhra Pradesh	-	-	1	-	-	-	3	3	-	-	3	2	-	-	-	-	-	4	-	-	3	5
29.	Telangana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30.	Rayalaseema	-	-	1	1	-	-	1	3	-	-	2	-	-	-	-	-	-	4	1	-	2	1
31.	Tamil Nadu & Puducherry	-	3	-	5	-	3	8	6	3	4	4	3	-	2	-	2	4	6	10	4	9	15
32.	Coastal Karnataka	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
33.	North interior Karnataka	-	-	-	-	-	-	4	-	-	-	-	1	-	-	-	-	-	-	-	-	-	5
34.	South interior Karnataka	-	1	-	-	-	-	9	-	-	-	-	1	-	-	-	-	-	-	-	-	-	10
35.	Kerala	-	-	2	2	-	4	3	-	-	-	1	1	-	1	-	-	-	2	3	-	5	4
36.	Lakshadweep	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	1
Total		1	6	4	8	-	13	52	12	3	4	10	17	-	3	-	3	7	16	14	4	26	76

by heavy rains / strong winds. As per News paper reports, 3.63 lakh hectors of crop were damaged due to heavy rains. The heavy rains led to floods in these districts.

3.2.2. *Other synoptic features and associated weather*

A summary of the synoptic systems for the month of November 2008 is given in Table 3. The sub-divisionwise percentage departure of rainfall from normal and the significant amounts of rainfall during the month are given in Tables 1 and 5 respectively and the frequency of days of *vigorous/active* northeast monsoon days and heavy rainfall are given in Table 10.

The first fortnight of the month witnessed subdued rainfall activity over major parts of the country including the northeast monsoon regime. Subsequently the Cyclonic Storm (Khai muk) caused excess rainfall over Andhra Pradesh. It was the extremely heavy rainfall amounts resulted from the Cyclonic Storm (Nisha) that brought Tamil Nadu into the *excess* rainfall category by the end of the season. A few active western disturbances which moved across the northern parts of the country also gave rise to precipitation over the region towards the last week.

3.2.3. *Temperature*

The dates of occurrence of *cold wave conditions* and the dates on which minimum temperature remained under various categories *viz*., *appreciably to markedly below normal*, *below/above normal* are given in Table 8. It may be noted that the frequency of *cold wave conditions* had been low, probably due to the fact that the western disturbances preferred a more northerly course.

Month's lowest minimum temperature over the plains of the country was 4° C recorded at Adampur (Punjab) on 13 & 23 November 2008.

3.2.4. *Disastrous weather events and associated damage*

According to media reports, snow & avalanche claimed the lives of 6 Army personnel in Jammu & Kashmir. Lightning killed 2 people in Kerala. The

damage caused by the Tropical Cyclones Khaimuk and Nisha are dealt briefly under respective sections.

3.3. *December*

3.3.1. *Storms and depressions*

Only one Deep Depression formed over the Bay of Bengal during the month. The details are given below.

3.3.1.1. *Deep Depression over the Bay of Bengal (4-7 December, 2008)*

A trough of low at sea level lay over the southeast Bay of Bengal and neighbourhood on 2 and 3. Under its influence a low pressure area formed over the same area in the evening of 3. It concentrated into a Depression and lay centred at 0300 UTC of 4, near Lat. 6.5° N / Long. 90.0° E (about 1300 km southeast of Chennai). It moved northwestwards and lay centred at 1200 UTC of 4, near Lat. 7.0° N / Long. 89.5° E. Continuing the northwestward movement, it intensified into a Deep Depression at 0000 UTC of 5, near Lat. 7.5° N / Long. 88.5° E, remained practically stationary over there upto 0300 UTC and lay centred near Lat. 8.5° N / 87.5° E at 1200 UTC. Thereafter, it moved westwards and lay centred at 0300 UTC of 6, near Lat. 8.5° N / Long. 85.0° E and at 1200 UTC, near Lat. 8.5° N / Long. 84.0° E. Subsequently it weakened into a Depression and lay centred at 0000 UTC of 7 near Lat. 8.5° N / Long. 83.0° E, at 0300 UTC, near Lat. 8.5° N / Long. 82.5° E and at 1200 UTC, near Lat. 8.5° N / Long. 81.5° E (close to Trincomalee). Moving further westwards, it weakened into a well marked low pressure area over Sri Lanka and adjoining southwest Bay of Bengal at 1500 UTC of 7. It lay as a low pressure area over Sri Lanka and neighbourhood on 8 morning and lay over Sri Lanka and adjoining Commorin area in the evening. The low pressure area moved over to Commorin area and neighbourhood on 9 and lay over Lakshadweep – Maldives areas on 10.

The system was mainly tracked by Satellite. The maximum intensity of T 2.0 was reported from 0000 UTC of 5 to 2300 UTC of 6.

The lowest ECP was 1004 hPa at 0000 UTC of 5. The maximum estimated wind speed was 30 kts. Due to interaction with land surface, the system weakened into a well marked low pressure area over Sri Lanka and adjoining southwest Bay of Bengal at 1500 UTC of 7.

The system caused heavy rainfall at isolated places in Tamil Nadu.

No damage was reported due to this system over the country.

3.3.2. *Weather and associated synoptic features*

Table 4 gives the summary of synoptic systems during the month of December 2008. The sub-divisionwise percentage departure of rainfall and the significant amounts of rainfall during the month are given in Tables 1 and 5 respectively. The frequency of the northeast monsoon activity days and heavy rainfall events are given in Table 10.

The Cyclonic Strom (Nisha) which crossed Tamil Nadu coast moved westwards and weakened. Its remnant as a low pressure area over the southeast Arabian Sea and neighbourhood alongwith a trough at sea level which extended northeastwards from this system, caused *excess* rainfall all along the west coast and interior peninsula in the beginning of the month. Though the Deep Depression did not cross Tamil Nadu coast, the trough from this system gave good rainfall over Tamil Nadu. Thereafter, it was the easterly waves and western disturbances which contributed to rainfall over the extreme south peninsular and northwestern parts of the country.

The presence of a trough in the mid and upper tropospheric westerlies to the west of the country and moisture incursion in the lower levels caused occurrence of fog over many parts of the country towards the end of the month. Northeast monsoon rains ceased over the south Peninsula on 31 December.

3.3.3. *Temperature*

It is evident from Table 9 that, *Severe Cold Wave condition* was completely absent over the country during the month. The frequency of *cold wave* and *cold day* occurrences were also less compared to last year.

The month's and season's lowest minimum temperature in the plains of the country was 1.6° C recorded at Amritsar (Punjab) on 28 December 2008.

3.3.4. *Disastrous weather events and associated damage*

According to media reports, flood situations in coastal Tamil Nadu claimed 180 lives. About 39.4 lakh

people were affected. Several flights were delayed or cancelled due to dense fog conditions which prevailed over Punjab, Haryana, Delhi, Uttar Pradesh and Rajasthan.

Appendix

Definitions of the terms given in '*Italics*'

Rainfall

Excess - percentage departure from normal is + 20% or more.

Normal - percentage departure from normal is –19 % to + 19 %.

Deficient - percentage departure from normal is –20 % to –59 %.

Scanty - percentage departure from normal is –60 % to –99 %.

Heavy rain - rainfall amount from 6.5 cm to 12.4 cm.

Very heavy rainfall - rainfall amount 12.5 cm to 24.4 cm.

Extremely heavy rain rainfall amount 24.5 cms and above.

At most places - 76 % or more stations of a meteorological sub-division reporting at least 2.5 mm rainfall.

At many places - 51% to 75 % stations of a meteorological sub-division reporting at least 2.5 mm rainfall.

At a few places - 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

Vigorous - 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.

Active - 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

Vigorous - 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.

Active - 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.

Severe heat wave conditions - Departure of maximum temperature from normal is +6° C or more for the regions where the normal maximum temperature is more than 40° C and +7° C or more for regions where the normal maximum temperature is 40° C or less.

Heat wave conditions - + 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)

Markedly above normal - departure from normal is +5° C to +6° C (where the normal maximum temperature is 40° C or less).

Appreciably above normal - departure from normal is +3° C to +4° C (where the normal maximum temperature is 40° C or less).

Above normal - departure from normal is +2° C.

Normal - departure from normal is +1° C to –1° C.

(b) Minimum / Night temperature

Severe cold wave conditions - departure of WCT_n from normal minimum temperature is –7° C or less for the regions where normal minimum temperature is $\geq$ 10° C and –6° C or less elsewhere

Cold wave conditions 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° 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_n is ≤ 0° C, cold wave is declared irrespective of the departure for those stations whose normal minimum temperature is greater than 0° C.

Cold day conditions For inland plain stations, when the day temperature is less than or equal to 16° C.

Markedly below normal - departure from normal is –5° C to –6° C (where the normal minimum temperature is 10° C or more).

Appreciably below normal - departure from normal is between –3° C to –4° C (where the normal minimum temperature is 10° C or more).

Below normal - departure from normal is –2° C.

Normal - departure from normal is +1° C to –1° C.