MAUSAM, **69**, 4 (October 2018), 635-656

Weather in India

POST MONSOON SEASON (October - December 2017)†

1. Introduction

Post monsoon season was cyclogenetically active with 5 intense low pressure systems forming over the Indian seas. Apart from the very severe cyclonic storm 'Ockhi' (during 29 November-5 December) there were 4 more Depressions, two in the month of October and one each in the months of November and December formed during the season. 'Ockhi'formed as a depression over the southwest Bay of Bengal before moving west northwestwards and intensifying into a severe cyclonic storm over Southeast Arabian Sea off Kerala coast. Its rapid intensification over the coastal areas and the re-curving track were rare events. This cyclone caused considerable damage and loss of lives over Tamilnadu and Kerala.

The southwest monsoon withdrew from the entire country on 25th October and the northeast monsoon rain commenced over the south peninsula on 27th October.

Rainfall activity over the Northeast Monsoon core region (comprising of 5 subdivisions *viz*., Coastal Andhra Pradesh, Rayalaseema, Tamil Nadu & Puducherry, South Interior Karnataka and Kerala) was below normal [86.1% of Long Period Average (LPA)]. It was normal during October and December (96% of LPA, 89% of LPA) respectively and was below normal during November (69% of LPA).

Both the maximum and minimum temperatures were above normal over major parts of the country during the season. However, cold wave, severe cold day and cold day conditions occurred at isolated places over parts of north India and interior peninsular India on few days during the season. Dense to very dense Fog also prevailed over prolonged periods across the northern plains especially during the month of December.

2. Seasonal rainfall (October-December)

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

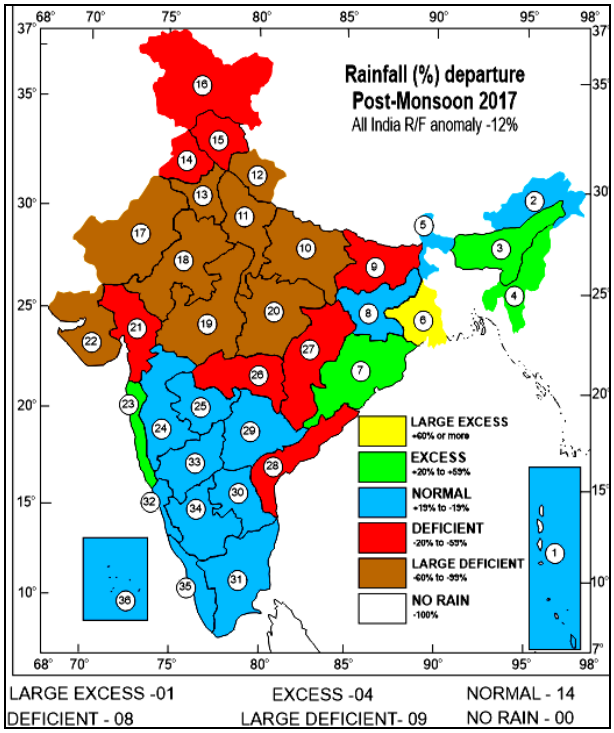

Fig. 1. Sub-divisionwise seasonal rainfall departure from normal (%) for post monsoon season (October to December 2017). Sub-divisions are indicated by number on the map & bold letters in legend. The rainfall anomaly values for these 36 sub-divisions are indicated below :

1	2	**7**	36	**13**	-80	**19**	-70	**25**	4	**31**	-10
2	-10	**8**	16	**14**	-44	**20**	-66	**26**	-29	**32**	-19
3	20	**9**	-35	**15**	-49	**21**	-23	**27**	-21	**33**	6
4	50	**10**	-95	**16**	-29	**22**	-79	**28**	-48	**34**	-5
5	-8	**11**	-96	**17**	-74	**23**	22	**29**	-2	**35**	-8
6	63	**12**	-76	**18**	-86	**24**	14	**30**	19	**36**	8

Rainfall over the country as a whole during the season was normal (89% of LPA value). It was 101%, 49% and 98% of its LPA during October, November and December months respectively. Eastern/northeastern region, south peninsular region and islands received large excess/excess/normal rainfall, while remaining parts of the country received deficient/large deficient rainfall. During the season, out of 36 meteorological subdivisions, 1 subdivision received large excess rainfall, 4 subdivisions

* *Definitions of terms in italics (other than subtitles) are given in Appendix.*

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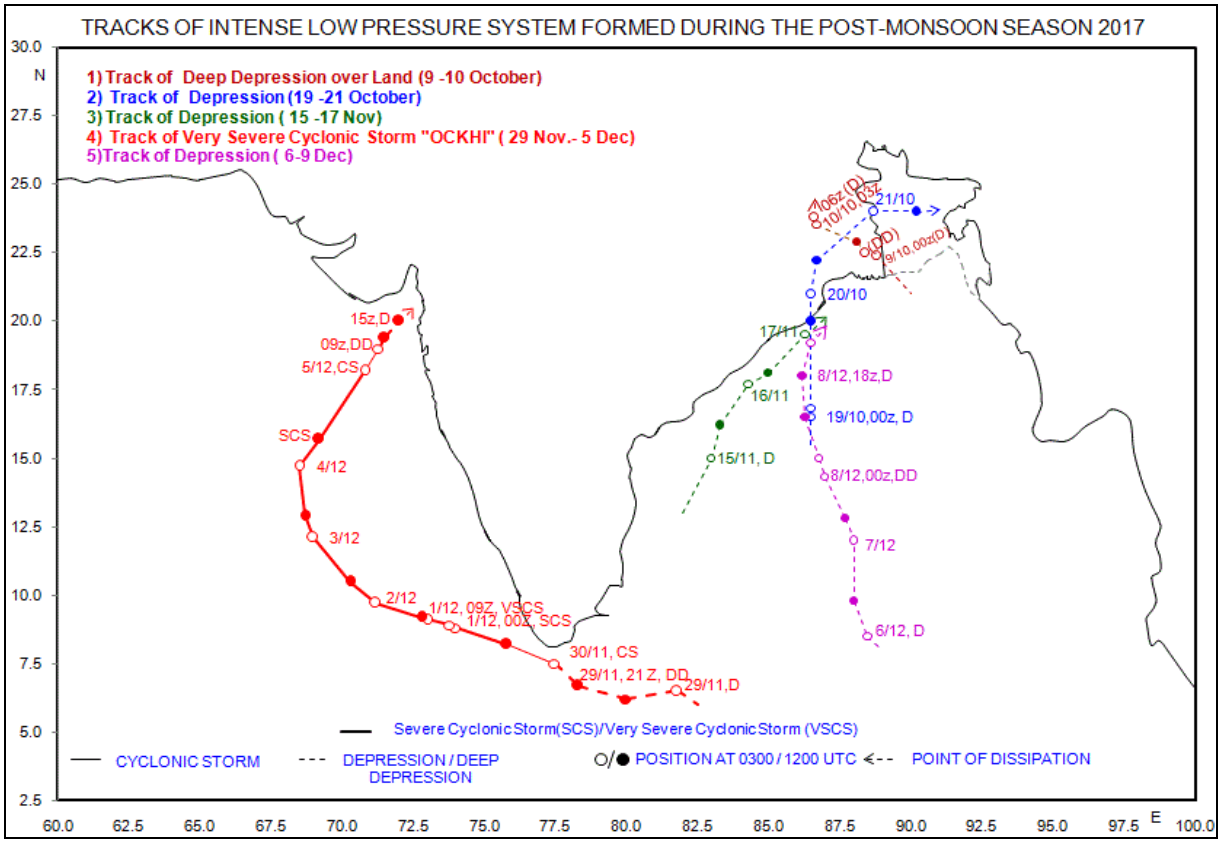

Fig. 2. Cyclones and depressions during post-monsoon season 2017

received excess rainfall, 14 subdivisions received normal rainfall, 8 subdivisions received deficient rainfall and remaining 9 subdivisions received large deficient rainfall.

3. Monthly features

3.1. *October*

3.1.1. *Withdrawal of southwest monsoon*

With the changeover of the lower tropospheric circulation pattern from cyclonic to anticyclonic, reduction of humidity in the lower tropospheric levels and dry weather prevailing over many parts of west and northwest India, southwest monsoon started its withdrawal from 27th September onwards. Initially it withdrew from some parts of Punjab and Haryana, most parts of west Rajasthan, some parts of Kutch and north Arabian Sea. It further withdrew from Jammu and Kashmir and some more north and northwestern regions on 30th September before halting for ten days. The withdrawal of monsoon resumed on 11th October and it withdrew from entire Uttarakhand and some parts of central India and remaining parts of North West India. Gradually it withdrew from the remaining parts of India. With the setting in of the northeasterly and easterly winds in lower tropospheric levels over the Indian region, the southwest monsoon completely withdrew from the entire country on 25th October.

3.1.2. *Commencement of northeast monsoon rains*

The southward shifting of the Subtropical westerly Jet and the Tibetan anticyclone and the emergence of the Inter tropical convergence zone (ITCZ) at its normal position (Lat. 10° N) during the last week of October created conditions favourable for the commencement of North east Monsoon rains. With the establishment of the northeasterly winds in the lower tropospheric levels along the east coast, the northeast monsoon rains commenced over Tamil Nadu and Puducherry, Kerala and adjoining areas of Andhra Pradesh and Karnataka from 27th October, seven days later than the normal date of 20th October.

3.1.3. *Storms and Depressions*

No cyclonic storm formed during the month. However a Deep Depression formed over Gangetic West Bengal and adjoining North Bay of Bengal during 9-10 October and a depression formed over west central Bay of Bengal and neighbourhood during 19-22 October.

TABLE 1

Sub-divisionwise rainfall (mm) for each month and season as a whole (October-December, 2017)

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	263.0	296.7	-11	205.9	253.7	-19	243.7	145.5	67	712.6	695.9	2
2.	Arunachal Pradesh	227.1	183.0	24	9.9	45.8	-78	3.4	38.4	-91	240.3	267.2	-10
3.	Assam & Meghalaya	212.1	154.8	37	10.3	28.4	-64	11.0	11.8	-7	233.5	195.0	20
4.	Naga., Mani., Mizo. and Tri.	287.6	179.8	60	7.6	50.7	-85	68.1	12.5	445	363.3	243.0	50
5.	Sub-Himalayan West Bengal & Sikkim	166.5	154.2	8	3.8	20.3	-81	1.0	10.8	-91	171.3	185.3	-8
6.	Gangetic West Bengal	225.2	129.3	74	21.9	23.3	-6	14.0	7.5	86	261.1	160.1	63
7.	Orissa	161.1	111.6	44	30.0	27.7	8	4.8	4.8	-1	195.9	144.1	36
8.	Jharkhand	103.4	75.2	37	2.3	9.9	-77	0.2	6.5	-97	105.9	91.6	16
9.	Bihar	50.1	64.8	-23	0.0	6.9	-99	0.0	5.8	-99	50.2	77.5	-35
10.	East Uttar Pradesh	3.0	49.2	-94	0.0	4.5	-100	0.0	6.7	-99	3.0	60.4	-95
11.	West Uttar Pradesh	0.6	42.1	-99	0.0	4.7	-100	1.6	7.6	-79	2.2	54.4	-96
12.	Uttarakhand	2.8	58.6	-95	0.2	9.7	-98	18.3	21.3	-14	21.3	89.6	-76
13.	Haryana, Chandigarh & Delhi	0.0	17.6	-100	1.8	4.9	-64	4.2	6.9	-39	6.0	29.4	-80
14.	Punjab	0.0	22.0	-100	5.2	5.7	-9	17.7	13.3	33	22.9	41.0	-44
15.	Himachal Pradesh	0.3	42.5	-99	6.9	20.3	-66	48.0	45.4	6	55.2	108.2	-49
16.	Jammu & Kashmir	0.3	38.9	-99	11.3	33.0	-66	81.5	59.9	36	93.1	131.8	-29
17.	West Rajasthan	0.0	5.4	-100	0.6	2.5	-76	1.8	1.6	15	2.4	9.5	-74
18.	East Rajasthan	0.0	16.9	-100	0.4	7.4	-95	3.4	3.3	2	3.8	27.6	-86
19.	West Madhya Pradesh	13.5	34.4	-61	0.4	11.0	-96	2.0	7.7	-73	16.0	53.1	-70
20.	East Madhya Pradesh	18.8	37.5	-50	0.7	9.9	-93	0.0	10.4	-100	19.5	57.8	-66
21.	Gujarat Region	15.5	23.4	-34	0.0	9.4	-100	11.0	1.7	548	26.6	34.5	-23
22.	Saurashtra & Kutch	4.8	18.1	-73	0.0	10.7	-99	1.3	0.7	84	6.1	29.5	-79
23.	Konkan & Goa	156.9	120.8	30	0.7	22.7	-97	25.0	5.6	346	182.6	149.1	22
24.	Madhya Maharashtra	112.8	79.0	43	5.0	22.7	-78	5.1	6.1	-17	122.9	107.8	14
25.	Marathawada	100.4	72.3	39	2.4	21.2	-89	2.7	8.1	-67	105.4	101.6	4
26.	Vidarbha	57.5	59.6	-3	0.3	13.2	-97	0.0	9.0	-100	57.9	81.8	-29
27.	Chhattisgarh	61.6	63.3	-3	0.2	9.2	-98	0.0	5.5	-100	61.8	78.0	-21
28.	Coastal Andhra Pradesh	123.0	193.2	-36	46.7	106.6	-56	1.2	27.6	-96	170.9	327.4	-48
29.	Telangana	114.6	92.2	24	1.9	21.6	-91	0.0	5.5	-100	116.4	119.3	-2
30.	Rayalaseema	221.1	129.4	71	33.3	66.1	-50	7.4	23.7	-69	261.8	219.2	19
31.	Tamil Nadu	155.5	180.2	-14	141.5	170.0	-17	96.8	88.0	10	393.9	438.2	-10
32.	Coastal Karnataka	185.7	189.5	-2	19.4	59.6	-67	7.2	13.7	-47	212.3	262.8	-19
33.	North Interior Karnataka	147.9	112.0	32	4.9	27.3	-82	0.9	6.0	-85	153.7	145.3	6
34.	South Interior Karnataka	178.3	147.7	21	13.8	49.2	-72	7.7	12.7	-39	199.8	209.6	-5
35.	Kerala	228.0	292.3	-22	152.1	150.9	1	61.4	37.5	64	441.5	480.7	-8
36.	Lakshadweep	137.1	157.1	-13	63.5	117.7	-46	160.1	58.8	172	360.7	333.6	8

TABLE 2

Details of the weather systems during October 2017

S. No.	System	Duration	Place of initial Location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**A**)	*Deep Depression/Depression*					
1.	Deep Depression	9-10	Gangetic West Bengal and adjoining North Bay of Bengal	West north-west wards	Jharkhand and adjoining West Bengal	It weakened into a depression on 10 and into a low pressure on 11, however the associated cyclonic circulation persisted over Jharkhand and adjoining West Bengal
2.	Depression	19-22	West central Bay of Bengal and neighbourhood	North-northeastwards	Central parts of Assam and neighbourhood	It weakened into a low pressure area on 22
(**B**)	*Western Disturbances /Eastward moving systems*					
(*i*)	*Upper air cyclonic circulation*					
1.	Between 3.1 & 4.5 km a.s.l.	4-8	North Pakistan and neighbourhood	East northeast	Northwestern parts of Jammu & Kashmir and neighbourhood	Moved away northeastwards
2.	Between 3.1 & 3.6 kms a.s.l.	8-15	Do	Do	northeastern parts of Jammu & Kashmir and neighbourhood	Moved away east-northeastwards
3.	At 3.1 km a.s.l.	17	Do	Northeast	Northeastwards	Moved away northeastwards
4.	Do	23 –24	J&K neighbourhood	East northeast wards	Do	Moved away northeastwards
5.	Do	28-30	North Pakistan and adjoining Jammu and Kashmir	Do	Eastern parts of J&K and neighbourhood	Moved away
6.	Do	31 Oct - 3 Nov	Over North Pakistan and adjoining J&K	Do	North western parts of J&K	Was feeble and lay as a trough initially
(*ii*)	*As a trough*					
1.	Mid & upper tropospheric levels	29 Sep - 4 Oct	Along Long. 71° E to the north of Lat. 30° N	East north eastwards	Eastern parts of J&K and neighbourhood	Moved away east northeastwards
2.	Mid tropospheric level	25 Oct - 2 Nov	Axis at 3.1 km a.s.l. along Long. 66° E and north of Lat. 35° N	Do	Axis at 5.8 km a.s.l. along 90° E	Became les marked on 2nd November
3.	Do	23-25	Along 66° E and north of Lat. 35°N	Do	Northern parts of J&K	It lay as an upper air cyclonic circulation over J &K Moved away east northeastwards
(**C**)	*Other upper air cyclonic circulations*					
1.	Upto Mid tropospheric levels	30 Sep - 3 Oct	North Andaman Sea and adjoining Arakan coast and neighbourhood	Northwest	East central Bay of Bengal	It became less marked on 3
2.	Between 1.5 & 4.5 km a.s.l.	1-3	West central Bay of Bengal and neighbourhood	Do	Rayalaseema and neighbourhood	Became less marked on 3
3.	Between 1.5 and 3.1 km a.s.l.	28 Sep - 2 Oct	East Uttar Pradesh and neighbourhood	South	Southeast Uttar Pradesh	Became less marked on 3

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
4.	Between 4.5 and 7.6 kms a.s.l.	28 Sep - 2 Oct	North Kerala coast and neighbourhood	North	East central Arabian Sea off Karnataka coast	Became less marked on 2
5.	Upto 1.5 km a.s.l.	4-5	East Central Arabian Sea and adjoining areas of south Madhya Maharashtra &coastal Karnataka.	Stationary	East Central Arabian Sea and adjoining areas of south Madhya Maharashtra & coastal Karnataka	Became less marked on 5
6.	Upto mid tropospheric levels	3-9	Gulf of Siam and neighbourhood	North West	Odisha and neighbourhood	Became less marked on 9
7.	Upto Lower tropospheric levels	3-4	East central Arabian Sea off Karnataka coast	Stationary	East central Arabian Sea off Karnataka coast	Merged with the east west shear zone
8.	Between 1.5 and 3.1 km a.s.l.	8-10	Southwest Uttar Pradesh and neighbourhood	Southwest	Northwest Madhya Pradesh and neighbourhood	Became less marked on 10
9.	Upto Lower tropospheric levels	5-8	East central Arabian Sea off Karnataka-north Kerala coast	Stationary	East central Arabian Sea off Kerala Karnataka coast	It lay as a trough of low at mean sea level initially. It became less marked on 8
10.	Upto mid tropospheric levels	8-18	East central Arabian Sea off Karnataka-north Kerala coast	Do	East central and adjoining areas of south Maharashtra and north Karnataka	It became less marked on 18
11.	Upto lower tropospheric level	9-11	Central Pakistan and west Rajasthan	Do	*In situ*	Became less marked on 12
12.	Upto 3.1 km a.s.l.	12-14	Myanmar and adjoining NMMT	Do	Do	Became less marked on 14
13.	Upto 1.5 km a.s.l.	14-15	Central Pakistan and neighbourhood	Do	Do	Became less marked on 15
14.	At lower levels	14-16	Rayalaseema and neighbourhood	North	Telangana and neighbourhood	Became less marked on 16
15.	Between 3.1 and 3.6 km a.s.l.	17-18	Over eastern parts of Jharkhand and neighbourhood	Stationary	*In situ*	Became les marked on 18
16.	Between 2.1 and 7.6 km a.s.l.	21-22	East central Arabian Sea and adjoining coastal areas of North Karnataka and Maharashtra	Do	Do	Became less marked on 22
17.	Upto 1.5 km a.s.l.	23-25	South Pakistan and adjoining west Rajasthan	Do	Do	Became less marked on 25
18.	At 3.1 km a.s.l.	23-24	Haryana and neighbourhood	Do	Do	Became less marked on 24
19.	At lower and mid tropospheric levels	24-29	Southwest Bay of Bengal and neighbourhood	West	Lakshadweep area and adjoining Kerala coast	Became less marked on 29
20.	Do	24-27	South east Arabian Sea and adjoining Kerala	Stationary	*In situ*	Moved away westwards on 27

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
21.	At lower levels	24-25	Interior Tamil Nadu and neighbourhood	Stationary	*In situ*	Merged with the cyclonic circulation that lay over southwest Bay of Bengal and neighbourhood
22.	Upto 2.1 km a.s.l.	24-26	North Andaman Sea and neighbourhood	Do	Do	Became less marked on 26
23.	Upto 1.5 km a.s.l.	26-28	Central Pakistan and adjoining west Rajasthan	West	Central Pakistan	Became less marked on 28
24.	Upto 2.1 km a.s.l.	26-27	Lay over Tripura and neighbourhood	Stationary	*In situ*	Became less marked on 27
25.	Upto 0.9 km a.s.l.	27-29	South Konkan, Goa and neighbourhood	Do	Do	The trough in the low level easterlies ran from this circulation over Lakshadweep area to south Konkan on 28 and became less marked on 29
26.	Upto 3.6 km a.s.l.	27-1 Nov	Bihar to West Bengal	East	Eastern parts of Bangladesh	Existed as a trough in westerlies. Became less marked on 1 November
27.	Between 3.6 and 5.8 km a.s.l.	30 Oct - 4 Nov	Lakshadweep area and neighbourhood	South	Maldives area and neighbourhood	Became less marked on 4 November
28.	Between 3.1 and 4.5 km a.s.l.	30 Oct - 1Nov	Eastern parts of Bihar and neighbourhood	East	Eastern parts of Bangladesh and neighbourhood	Became less marked on 1
29.	Upto 0.9 km a.s.l.	1-4	Central Pakistan and adjoining west Rajasthan	North	North west Rajasthan and neighbourhood	Became less marked on 4
(**D**)	*Other troughs/Wind discontinuity*					
1.	At lower levels	1-2	From the cyclonic circulation over southeast Uttar Pradesh and neighbourhood to the cyclonic circulation over east central Arabian Sea off Karnataka coast across east Madhya Pradesh, Vidarbha and south Madhya Maharashtra	Stationary	*In situ*	It became less marked on 2
2.	Do	2-4	From the cyclonic circulation over north Odisha and neighbourhood to north Kerala across Chhattisgarh, Telangana Rayalaseema and south interior Karnataka	Do	Do	Became less marked on 4
3.	Between Lower & mid tropospheric levels	2-4	East Bihar to north Chhattisgarh across Jharkhand	Do	Do	It became less marked on 4
4.	At lower levels	6-8	From the cyclonic circulation over Telangana to south Tamil Nadu across Rayalaseema and south interior Karnataka	Do	Do	It became less marked on 8

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
5.	At lower levels	6-7	Along Latitude 17° N	Stationary	*In situ*	Cyclonic circulation over SW Uttar Pradesh and neighbourhood and cyclonic circulation over Telangana and neighbourhood embedded in the trough
6.	Do	7-9	From the cyclonic circulation over north interior Karnataka to Odisha across Telangana and south Chhattisgarh	Do	Do	It became less marked on 9
7.	Do	11-12	From the cyclonic circulation over east central Arabian Sea off Kerala Karnataka coast to Vidarbha across Konkan, Madhya Maharashtra and Marathwada	Northeast	Marathwada	Became less marked on 12
8.	Between 2.1 and 3.6 km a.s.l.	12-13	From the above cyclonic circulation over Southeast Bay of Bengal and adjoining Andaman Sea	South	Coastal Tamil Nadu	Became less marked on 13
9.	At lower levels till 3.1 km a.s.l.	13-16	East Bihar to Chhattisgarh	Do	Sub-Himalayan West Bengal to coastal West Bengal	The trough was a cyclonic circulation over Jharkhand and adjoining Gangetic West Bengal associated with the Deep Depression that lay over Gangetic West Bengal. Became less marked on 16
10.	At 5.8 km a.s.l.	18-19	Eastern parts of Bihar to north Odisha across Jharkhand and neighbourhood	Stationary	*In situ*	Became less marked on 19
11.	Upto mid tropospheric levels	20-24	From the low pressure area over northeast Bangladesh and adjoining Meghalaya and south Assam to Lakshadweep area across south Chhattisgarh, Telangana and Karnataka	South west	East central Arabian Sea across Telangana and north interior Karnataka	Became less marked on 24
12.	Upto 1.5 km a.s.l.	21-23	South interior Karnataka	South	South Tamil Nadu	Became less marked on 23
13.	Do	23-25	East Bihar to Gangetic West Bengal	North east	West Assam to north Bay of Bengal	Became less marked on 25
14.	Upto mid tropospheric levels	26-30	Southeast Bay of Bengal and neighbourhood	West	Southwest Bay of Bengal off Sri Lankan coast	Became less marked on 30. However the associated cyclonic circulation lay over Sri Lanka, Gulf of Mannar and adjoining southwest Bay of Bengal
15.	Do	26-28	Bihar to coastal West Bengal	North east	Assam and Meghalaya	Became less marked on 28
16.	At m.s.l.	29-30	Lakshadweep area and neighbourhood	Stationary	*In situ*	Became less marked on 30

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
17.	At m.s.l.	26-4 Nov	Southeast Arabian Sea to off north Maharashtra coast	North	Southeast Arabian Sea to east central Arabian Sea	Became less marked on 4
(E) *East-west shear zone*						
1.	Upto mid tropospheric levels	4-7	Along Lat. 16° N across south Peninsula	North	Along Lat. 13° N	Became less marked on 7
2.	Between 5.8 km a.s.l. and 7.6 km a.s.l.	16-20	Along Lat. 12° N across south Peninsula	North across south Peninsula	Along Lat. 14° N	Became less marked on 20
3.	Between 5.8 km a.s.l. and 7.6 km a.s.l.	13-15	Along Lat. 11° N	North	Do	Became less marked on 15

A low pressure area formed under the influence of a cyclonic circulation over North Bay of Bengal and adjoining coastal Bangladesh and coastal West Bengal before concentrating into a Depression on 9th. It moved west-northwest wards and intensified into a deep depression over Gangetic West Bengal. It then moved west northwest wards and weakened into a depression that lay over Jharkhand and adjoining West Bengal. It caused heavy to very heavy rainfall at isolated places over Gangetic West Bengal and heavy rainfall at isolated places over Bihar on 10th October and heavy rainfall at isolated places over Gangetic West Bengal, Jharkhand and Bihar on 11th October. The other Depression formed over west central Bay of Bengal and neighbourhood on 19th. It moved northwards and lay over northwest Bay of Bengal. It further moved northwards and crossed Odisha coast close to Paradip and then moved north north-eastwards over southeast Jharkhand and adjoining north Odisha and Gangetic West Bengal. It weakened into a well-marked low pressure over northeast Bangladesh on 22nd. It caused heavy rainfall over the east and northeast India during 19-21.

3.1.4. *Other synoptic features and associated weather*

Table 2 gives a summary of the synoptic features for the month of October 2017. The sub-divisionwise percentage departures of rainfall from normal and significant amounts of rainfall are given in Tables 1 & 5 respectively.

The presence of east west shear zone along 15° to 16° Latitude and embedded cyclonic circulations caused *active to vigorous* monsoon conditions over Northeast, Sub Himalayan West Bengal and Sikkim, Gangetic West Bengal and Peninsular India. The North and Northwestern regions experienced dry weather or isolated rainfall only.

In the second week of October the formation of a depression over Gangetic West Bengal and its movement northwestwards over Jharkhand and adjoining West Bengal caused *active to vigorous* rainfall over peninsular India and Odisha while the Gangetic West Bengal, Jharkhand and Bihar regions experienced *heavy to very heavy* rainfall at *isolated* and *scattered* places. The northern regions received no rain while the North western, north eastern and Andaman and Nicobar Islands received *deficient* to *scanty* rains.

During the beginning of the third week formation of a well-marked low pressure area over central and adjoining south Bay of Bengal and cyclonic circulations caused rainfall over peninsular India and north eastern regions. As the third week progressed, dry, mid-latitude air dominated the northern half of India thereby reducing the rainfall activity over the northern parts of the country. This led to further withdrawal of SW monsoon from most parts of northwest India and some parts of western, central and northeast India. The formation of a depression over west central Bay of Bengal and its further movement in the northwestwards moving inland and crossing Odisha coast caused *heavy to very heavy* and *vigorous* rainfall over the northeastern and eastern subdivisions like Odisha while the rest of the country remained largely *deficient* with no rain.

During the month, rainfall over the country as a whole was normal. Northern and northwestern subdivisions generally received *large deficient* rainfall. Haryana, Chandigarh & Delhi, Punjab and Rajasthan did not receive any rain. In the month of October out of 36 meteorological subdivisions, 3 received large excess, 10 received excess rainfall, 7 received normal rainfall, 5 received deficient rainfall, 7 received large deficient rainfall and remaining 4 subdivisions received no rainfall (Fig. 2).

3.1.5. *Temperature*

Inspite of the monsoon activity over the northeastern regions for most part of the month of October the maximum temperatures remained *above normal* there. The rest of the country too experienced *above normal* temperatures except peninsular India which experienced *normal* maximum temperatures. The minimum temperatures over most parts of the country were *above normal* while those over peninsular India were *normal.*

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

The month's highest maximum temperature was 42.2 °C recorded at Bhuj (Saurashtra and Kutch) on 14th October, 2017 and the lowest minimum temperature was 10.5 °C recorded at Damoh (East Madhya Pradesh) on 30th October, 2017 in the plains of the country.

3.1.6. *Damages associated with Disastrous weather events*

According to media reports four people died and three injured due to lightning in Yadgir Karnataka, one person in Andhra Pradesh and seven in Telangana. One person also died due to lightning in Maharashtra. It was reported that one life was lost due to heavy rains in Tamil Nadu, fourteen in Maharashtra. One girl drowned in a drain in Bengaluru as it reeled under rain. Four thousand people were rendered homeless due to flash floods in Tripura. Heavy rainfall caused water logging in Chennai and reported 3 rain-related deaths.

3.2. *November*

3.2.1. *Storms and Depressions*

Very severe Cyclonic storm 'Ockhi' formed towards the end of November. Prior to this a depression had formed over the West central Bay of Bengal during 15-17 November. The *very severe* cyclone 'Ockhi' formed over the southwest Bay of Bengal on 29th November (29 November-5 December). The genesis stage of the above system as a Depression/ Deep Depression caused *isolated extremely* heavy rainfall over south Tamil Nadu and Kerala. *Heavy to very heavy rain* at a few places with *extremely heavy rain* at *isolated places* of Tamil Nadu in the last week of November.

The Depression during formed over west central Bay of Bengal off Andhra Pradesh coast on 15th and its movement caused rainfall activity over the peninsular region. The Depression weakened into a well-marked low pressure area over northwest Bay of Bengal off north Odisha - West Bengal coasts on 17th. *Heavy to very heavy* rainfall occurred over Coastal Andhra Pradesh for two days and *heavy* rainfall occurred over Odisha on one day in association with this system.

A low pressure area formed over southwest Bay of Bengal and adjoining Sri-Lanka and Tamil Nadu coast during 2-6 November. It caused rainfall at *many places* and *extremely heavy to rain at isolated places* over Tamil Nadu and Puducherry *and heavy* rainfall *at a few places* over Rayalaseema. North east monsoon remained active over Tamil Nadu and Puducherry during 3-6 November and vigorous over Rayalaseema on 6th November.

Another low pressure area formed over Andaman Sea and neighbourhood on 21st November. It lay over southeast and adjoining east central Bay of Bengal. It moved nearly westwards and lay over southeast Arabian Sea and adjoining Maldives area before it became less marked on 29th. Tamil Nadu and Puducherry received active rainfall at many places with isolated heavy falls. Kerala received *heavy rainfall at a few places.*

3.2.2. *Weather and associated synoptic features*

A summary of the synoptic systems for the month of November 2017 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&5 respectively.

The North east monsoon was *active* over the southern parts of the peninsula during the first fifteen days of the month. The equatorial easterly wave activity and moisture convergence due to an anomalous cyclone over equatorial region of Indian main land caused *active* monsoon conditions over Tamil Nadu, Rayalaseema, South Interior Karnataka and Kerala. The northeast monsoon remained subdued in the third week of the month. The depression during 15-17 November, 2017 over west central Bay of Bengal off Andhra Pradesh coast during the week and its movement caused rainfall activity over the peninsular region.

In the second half of November *cold wave* conditions prevailed over east Uttar Pradesh and east Rajasthan. The prevalence of the anticyclone, weakening of winds over northwest India led to *dense fog* conditions over Northwest India. The northern plains and eastern part of the country too experienced *moderate to dense fog* during most part of the month.

TABLE 3

Details of the weather systems during November 2017

S. No.	System	Duration	Place of initial Location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**A**) *Cyclonic storm*						
1.	Very Severe Cyclonic storm (Ockhi)	29 Nov-5 Dec (0000 UTC)	Southwest Bay of Bengal off Sri Lanka coast centred near Lat. 6.5° N/ Long. 81.8° E	North-northeast wards	East central and adjoining north east Arabian Sea near Lat. 20.0° N/ Long. 72.0° E about south southwest of Surat and north west of Mumbai	It weakened into well marked low pressure area over east central and adjoining areas of northeast Arabian sea on 5 December. It lay as a low pressure area over south coastal Gujarat and neighbourhood. The associated cyclonic circulation persisted over Gujarat and adjoining south Rajasthan and became less marked on 12 December. Details are given in the article on Storms & Depressions over the north Indian Ocean-2017
(**B**) *Deep Depression/Depression*						
1.	Depression	15-17	230 km Southeast of Machilipatnam near Lat. 15° N/ Long. 83° E	North eastwards	Northwest Bay of Bengal off north Odisha -West Bengal coast	It weakened into a well-marked low pressure area and became less marked on 18. The associated cyclonic circulation extended upto mid and upper tropospheric level and became less marked on 18. Details are given in the article on Storms & Depressions over the north Indian Ocean- 2017
(**C**) *Well marked Low Pressure area/Low Pressure area*						
1.	Low pressure area	2-6	Southwest Bay of Bengal	Northwest	Southwest bay of Bengal and adjoining south east Tamil Nadu and Commorin area	It lay as a trough of low over southwest Bay of Bengal off south Tamil Nadu and south coastal Andhra Pradesh coasts on 4, over southwest Bay of Bengal and adjoining southeast Tamil Nadu and Commorin area on 5. Became less marked on 6
2.	Do	21-29	Andaman Sea and neighbourhood	Southeast	South east Arabian Sea and adjoining Maldives	It lay as a trough of low over south Andaman Sea and Gulf of Martaban on 21. It again lay as a trough of low at mean sea level from 27 to 29 over southeast Arabian Sea and Maldives. An associated cyclonic circulation extended upto 3.1 km a.s.l. on 22 to 24 and upto 1.5 km a.s.l on 25 and 26
(**D**) *Western disturbances /eastward moving systems*						
(*i*) *Upper air cyclonic circulation*						
1.	Between 3.1 and 3.6 km a.s.l.	3-5	North Pakistan and adjoining Afghanistan	North	Eastern parts of J&K	moved away east northeastwards
2.	Upto 3.1 km a.s.l.	8-9	North Pakistan and adjoining J&K	East	Do	moved away east northeastwards
3.	Upto mid tropospheric levels	8-13	Along Long. 65° E to the north of Lat. 32° N	East north eastwards	North Pakistan and adjoining J&K	moved away east northeastwards
4.	Between 3.1 and 3.6 km a.s.l.	21-23	North Pakistan and neighbourhood	Do	Jammu Kashmir and neighbourhood	moved away on northeastwards
5.	Upto 3.1 km a.s.l.	25-27	J&K and neighbourhood	Do	Northern parts of J&K and neighbourhood	moved away East north eastwards

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(*ii*) *Trough in westerlies*						
1.	Upto mid tropospheric level	12-21	Along Long. 55° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)Western parts of Afghanistan and neighbourhood	East north east wards	Along Long. 80.0° E to the north of Lat. 32.0° N	Moved away east northeastwards
2.	Do	23-1 Dec	It extended along Long. 73° E to the north of Lat. 33° N (axis at 3.1 kms a.s.l.)	Do	Northern parts of J&K and neighbourhood	It lay as a cyclonic circulation over North Pakistan and neighbourhood. Moved away northeastwards
3.	Do	24-29	Along Long. 45° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 94° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	Moved away eastwards
4.	Do	28-1 Dec	Along Long. 60° E to the north of Lat. 35° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 72° E to the north of Lat. 32° N (axis at 5.8 kms a.s.l.)	It lay as a cyclonic circulation over north Pakistan and neighbourhood with a trough aloft at 5.8 km a.s.l. Moved away east northeastwards
(*iii*) *As an Induced cyclonic circulation*						
1.	Upto 1.5 km a.s.l.	13-17	Central Pakistan and neighbourhood	East	East Rajasthan and neighbourhood	It became less marked on 17
(**E**) *Other upper air cyclonic circulations*						
1.	Upto 5.8 km a.s.l.	2-	Over Sri Lanka and adjoining Southwest Bay of Bengal	-	-	-
2.	Upto 1.5 km a.s.l.	3-4	East Uttar Pradesh and neighbourhood	Stationary	*In situ*	Became less marked on 4
3.	Do	4-6	Gulf of Mannar and neighbourhood	Do	Do	Became less marked on 6
4.	Between 2.1 & 3.6 km a.s.l.	5-8	Lakshadweep area and neighbourhood	East	Southeast Arabian Sea off south Kerala coast	Became less marked on 8
5.	Upto 1.5 km a.s.l.	8-10	Northeast Bay of Bengal and adjoining Bangladesh coast	Stationary	*In situ*	Became less marked on 10
6.	Between 3.1 & 5.8 km a.s.l.	9-10	Gulf of Mannar and neighbourhood	Do	Do	Became less marked on 10
7.	Upto 1.5 km a.s.l.	11-14	Southeast Arabian Sea and adjoining Kerala- Karnataka coasts	North	Coastal Karnataka and neighbourhood	Became less marked on 14
8.	Upto 1.5 km a.s.l.	13-14	Gulf of Siam	Stationary	*In situ*	Became less marked on 14
9.	Upto 0.9 km a.s.l.	17-18	South Tamil Nadu and neighbourhood	Do	Do	Became less marked on 18
10.	Upto 1.5 km a.s.l.	18-19	Haryana and Uttar Pradesh	Do	Do	Became less marked on 19
11.	Upto 0.9 km a.s.l.	19-20	Southwest Bay of Bengal and adjoining Sri Lanka and equatorial Indian Ocean	Do	Do	Became less marked on 20

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
12.	Upto 0.9 km a.s.l.	19-21	North Karnataka coast and neighbourhood	Stationary	*In situ*	Became less marked on 21
13.	Upto 3.1 km a.s.l.	20-26	Gulf of Martaban and neighbourhood	Do	Do	Became unimportant on 26
14.	Upto 1.5 km a.s.l.	23-25	South Assam and neighbourhood	Do	Do	Became less marked on 25
15.	Upto 1.5 km a.s.l.	26-28	South Assam and Meghalaya and neighbourhood	Do	Do	Became less marked on 28
(**F**)	*Trough in easterlies*					
1.	At lower levels	1-2	From the cyclonic circulation over south west Bay of Bengal and adjoining Sri Lanka to west central Bay of Bengal.	North	West central Bay of Bengal	Became less marked on 2
2.	Upto 1.5 km a.s.l.	17-18	West Madhya Pradesh to north west Rajasthan and neighbourhood	Stationary	*In situ*	Became less marked on 18
3.	Upto 0.9 km a.s.l.	18-19	Maldives area to south coastal Karnataka	Do	Do	Became less marked on 19
(**G**)	*Other troughs / Wind discontinuity*					
1.	At 5.8 km a.s.l.	2-3	Eastern parts of Arunachal Pradesh	West	East Bihar across Assam and Meghalaya	Became less marked on 3
2.	Do	5-7	East Assam to interior Odisha across Gangetic West Bengal	East	Manipur to north east Bay of Bengal	Moved away eastwards on 7
3.	At mean sea level	4-10	Lakshadweep and neighbourhood	North south	Southeast Arabian Sea and neighbourhood	Became less marked on 10
4.	Mean sea level upto 0.9 km a.s.l.	6-7	South west Bay of Bengal and adjoining Sri-Lanka and equatorial Indian Ocean	East west	Equatorial Indian Ocean	Became less marked on 7
5.	At mean sea level	19-24	Maldives area to Southeast Arabian Sea off Karnataka coast	North	Lakshadweep area and neighbourhood	It persisted with a cyclonic circulation aloft extending upto 0.9 km a.s.l. on 23. It became less marked on 25. The cyclonic circulation aloft became less marked on 24
6.	At 3.1 km a.s.l.	29 Nov - 1 Dec	Along 90° E to the north of Lat. 35.0° N	North South	Long. 90.0° E to north of Lat. 25.0° N	Became less marked on 1st December

3.2.3. *Temperature*

Cold wave conditions prevailed for 6 days over East Rajasthan, 3 days over East Uttar Pradesh and 1 day over East Madhya Pradesh.

The minimum temperatures over most subdivisions were *normal* except some sub divisions like East and west Uttar Pradesh, Madhya Pradesh, Uttarakhand, Haryana, Chandigarh and Punjab and west Rajasthan and Maharashtra that were *below normal* minimum temperatures prevailed nearly for the whole month except during the third week, when the Northeastern and eastern subdivisions were *above normal, appreciably above normal and markedly above normal*.

Peninsular India also recorded *above normal* minimum temperature in the third week.

TABLE 4

Details of the weather systems during December 2017

S. No.	System	Duration	Place of initial Location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**A**) *Deep Depression/Depression*						
1.	Deep Depression	6-9	Southeast Bay of Bengal and neighbourhood	North northwest wards	Northwest Bay of Bengal	It further weakened into a low pressure area over North west Bay of Bengal and neighbourhood on 9. The associated cyclonic circulation lay over Bangladesh and adjoining south Assam. It became less marked on 12
(**B**) *Well marked Low Pressure area/Low Pressure area*						
1.	Low pressure area	25-28	South Andaman Sea and adjoining south east Bay and neighbourhood	Stationary	*In situ*	Associated cyclonic circulation extended upto 5.8 km a.s.l. The low pressure area now lay as a trough of low at mean sea level. The details of the trough of low is given in ('Other troughs' No. 2). The trough of low became less marked on 28
(**C**) *Western disturbances/Eastward moving systems*						
(*i*) *Upper air cyclonic circulation*						
1.	Mid and upper tropospheric levels	9-11	Afghanistan and adjoining Pakistan	Northwest	North Pakistan and neighbourhood	Initially it lay as a trough in mid and upper tropospheric westerlies with its axis at 5.8 kms a.s.l. on 8 & 9 and as a trough aloft on 12. It merged with the other WD on 13
2.	Do	13-18	Do	East-northeast	North Pakistan and adjoining Jammu & Kashmir	It lay as a trough with its axis at 5.8 kms a.s.l. on 14 and 16, axis at 9.5 km a.s.l and 5.8 km a.s.l. Moved away east northeastwards
3.	Do	20-22	East Afghanistan and neighbourhood	Do	Jammu & Kashmir and neighbourhood	The feeble WD moved away east northeastwards Initially the WD lay as a trough in mid tropospheric westerlies (18-19)
4.	Between 3.1 and 3.6 km a.s.l.	26-29	North Pakistan and adjoining Jammu and Kashmir	Northeast	Jammu and Kashmir and adjoining north Pakistan	Moved away northeastwards
5.	Between 3.1 and 3.6 km a.s.l.	29-31	North Pakistan and neighbourhood	East north east	Do	A trough lay aloft this cyclonic circulation with axis at 5.8 km a.s.l.
6.	Between 3.1 and 3.6 km a.s.l.	31 Dec - 4 Jan	North Pakistan and adjoining Jammu and Kashmir	East northeast wards	Along Long. 90° E and Lat. 24° N	A trough lay aloft this cyclonic circulation with axis at 5.8 km a.s.l. Became less marked on 4 January
7.	Between 1.5 and 3.1 km a.s.l.	31 Dec - 1 Jan	Haryana and neighbourhood	Stationary	*In situ*	Became less marked on 1 January
(*ii*) *As a trough/ Trough in westerlies*						
1.	Mid tropospheric levels	1-6	Along Long. 60° E to the north of Lat. 30° N (axis at 3.1 kms a.s.l.)	Northeast	Along Long. 71° E to the north of Lat. 25° N (axis at 3.1 kms a.s.l.)	Moved away northeastwards
2.	Do	6-8	Along Long. 65° E to the north of Lat. 18° N (axis at 5.8 kms a.s.l.)	East north east wards	Along Long. 80° E to the north of Lat. 25° N (axis at 3.1 kms a.s.l.)	Moved away on 8

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
3.	At 3.6 km a.s.l.	23-27	Along Long. 65° E to the north of Lat. 28° N (axis at 5.8 kms a.s.l.)	East north eastwards	Along Long. 87° E to the north of Lat. 22° N (axis at 3.1 and 5.8 kms a.s.l.)	Lay as a cyclonic circulation over Jammu and Kashmir and adjoining north Pakistan on 24. Moved away east northeastwards
(*iii*)	*As an induced cyclonic circulation*					
1.	At 1.5 km a.s.l.	3-6	Northwest Rajasthan and neighbourhood	East	Haryana and neighbourhood	Became less marked on 6
2.	Between 1.5 and 3.1 km a.s.l.	7-8	Do	Stationary	*In situ*	Became less marked on 8
3.	Do	10-25	Do	East	West Rajasthan and neighbourhood	Became less marked on 15
(**D**)	*Other upper air cyclonic circulations*					
1.	Upto 1.5 km a.s.l.	2-6	Southwest Bay of Bengal over Tamil Nadu and Puducherry	South	Southwest Bay of Bengal off Tamil Nadu Sri Lanka coast	Became less marked on 6
2.	Between 2.1 and 3.1 km a.s.l.	2-6	Eastern parts of Bangladesh and neighbourhood	North East	Mizoram and neighbourhood	Became less marked on 6
3.	Upto lower and mid tropospheric levels	9-13	South Sri Lanka and neighbourhood	Stationary	*In situ*	Became less marked on 13
4.	Upto lower tropospheric level	13-14	Assam and neighbourhood	South	Southeast Bangladesh and neighbourhood	Became less marked on 14
5.	Do	13-16	Sri Lanka and neighbourhood	West	Maldives Lakshadweep area	Became less marked on 16
6.	Do	14-23	West Assam and neighbourhood	Stationary	Bangladesh and adjoining Gangetic West Bengal	Became less marked on 23
7.	Between 3.1 and 5.8 kms a.s.l.	19-20	East Iran and neighbourhood	East	East Afghanistan and neighbourhood	Merged with the WD that lay as a cyclonic circulation over east Afghanistan and neighbourhood on 20
8.	Between 2.1 and 3.1 km a.s.l.	18-19	Lakshadweep and neighbourhood	Stationary	*In situ*	Became less marked on 19
9.	Upto 1.5 km a.s.l.	19-20	East Uttar Pradesh & neighbourhood	Do	Do	Became less marked on 20
10.	Upto 1.5 km a.s.l.	19-20	North Kerala and neighbourhood	Do	Do	Became less marked on 20
11.	Between 1.5 and 2.1 km a.s.l.	20-22	Comorin area and neighbourhood	Do	Do	Became less marked on 22
12.	Between 2.1 and 3.1 kms a.s.l.	23-28	Over comorin area and neighbourhood	West	Southeast Arabian Sea and neighbourhood	Became less marked on 28
13.	Between 1.5 and 3.1 km a.s.l.	25-28	East Bangladesh and neighbourhood	East	Mizoram and neighbourhood	Became less marked on 28
14.	Upto 0.9 km a.s.l.	28-31	Southwest Bay of Bengal off Sri Lanka coast	Do	Comorin area and neighbourhood	Upto lower tropospheric levels
15.	Upto 1.5 km a.s.l.	29-31	East Uttar Pradesh and adjoining Bihar	Stationary	*In situ*	Became less marked on 31

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
16.	Upto 2.1 km a.s.l.	29 Dec - 3 Jan	East Bangladesh and neighbourhood	Stationary	*In situ*	Became less marked on 3 January
17.	Upto 1.5 km a.s.l.	30 Dec - 2 Jan	Southwest Rajasthan and neighbourhood	Do	Do	Became less marked on 2 January
18.	Between 1.5 and 2.1 km a.s.l.	Do	Coastal Karnataka and neighbourhood	North	North coastal Karnataka and neighbourhood	Became less marked on 2 January
(**E**)	*Trough in easterlies*					
1.	At lower level	14-16	Madhya Maharashtra to south Rajasthan across Gujarat region	Stationary	*Insitu*	Became less marked on 16
2.	Upto 0.9 km a.s.l.	16-17	From Lakshadweep area to southwest Madhya Pradesh across south Konkan and Madhya Maharashtra	Do	Do	Became less marked on 17
3.	Do	18-19	South Andaman Sea and neighbourhood	Do	Do	Became less marked on 19
(**F**)	*Other trough*					
1.	Upto lower tropospheric levels	12-13	North Madhya Maharashtra to north to north interior Tamil Nadu across interior Karnataka	Stationary	*Insitu*	Became less marked on 13
2.	At mean sea level	26 Dec - 5 Jan	South Andaman Sea and adjoining Malay peninsula	West	Southeast Bay of Bengal and adjoining equatorial Indian ocean	The trough became less marked on 5 January. A cyclonic circulation lay aloft and extending upto 3.1 km a.s.l. It initially lay as a low pressure area. (Details given in Low pressure area No. 1)
3.	Do	26 Dec - 4 Jan	Southeast Arabian Sea to off north Maharashtra coast	East	Lakshadweep and adjoining southeast Arabian Sea	Became less marked on 4 January

The month's lowest minimum temperature over the plains of the country was 3.0 °C, recorded at Sikar (East Rajasthan) on 23 and 25 November, 2017.

3.2.4. *Damages associated with Disastrous weather events*

As per the media reports heavy rains claimed 3 lives in Tamil Nadu on 3rd November. Due to Very Severe Cyclonic Storm (OCKHI), 8 persons died in Kanyakumari district of Tamil Nadu on 30th November more than 250 fishermen are reported to be missing from Kerala. Five agricultural labourers, including three women, were killed in lightning on 27th, after being struck by lightning at Keezhakavattankurichi village near Thirumanur in Ariyalur district (Tamil Nadu) in the afternoon.

3.3. *December*

3.3.1. *Storms and Depressions*

Last month's cyclone Ockhi (29 November-5 December), further moved westwards, and intensified into a Severe Cyclonic Storm (SCS) on 1st December. It continued to move west - northwestwards and lay centred over Lakshadweep area and adjoining southeast Arabian Sea. It continued to move in the same direction and intensified further into a Very Severe Cyclonic Storm (VSCS) 'Ockhi' north of Minicoy and 220 kms south-southeast of Amini Divi. It moved further west-northwestwards, came under the influence of a westerly trough and re-curved northeastwards before weakening into a low pressure area over south coastal Gujarat and neighbourhood.

TABLE 5

Some representative amounts of rainfall in cm for October, November and December 2017 (7 cm and above)

Date	Some representative amounts of rainfall in cm for October, November and December 2017 (7 cm and above)
1 Oct	Mawsynram 19, Manash Nh Xing 15, Aie Nh Xing, Ennore AWS and Chittoor 14 each, Poondi and Red Hills 13 each, Sullurpeta, Daitari and Cholavaram 12 each, Thamaraipakkam and Cuttack 11 each, Gossaigaon, Sriperumbudur, Beky Rly. Bridge, Kudathini and Barpeta 10 each, Basar and Ponneri 9 each, Chepan, Bellary, Ballari PTO, Tiruvallur, Hangal, Karimganj and Alipurduar Cwc 8 each, Barobhisha, Beki Mathungari, Katihar, Cherrapunji, Pakala, Pen, Hirekerur, Mani and Bahalpur 7 each
2 Oct	Manihari 15, Chintamani PTO 12, Mhasla 11, Anantpur, Kursela and Pulivendla 10 each, Vaibhavwadi, Srinivasapura, Rayalpadu, Rajampet, Hindupur and Gersoppa 9 each, Ponnani, Kancheepuram, Vempalle, Ramagiri, Lakkireddipalle and Chikkanahalli PTO 8 each, Gowribidanur, Koilkuntla, Kelambakkam, Chintamani, Tuting, Kondapuram, Rudravaram, Chinnamandem, Pagidyala, Raju Palem, Colgaon, Lanja, Muddanur, Amadagur, Dibrugarh AP, Polur and Maya Bandar 7 each
3 Oct	Tuting 16, Katihar 15, Davanagere 14, Golkonda and Kaliaganj 13 each, Palakurthi 12, Gandeed, Agumbe and Chanchal 11 each, Venkatapur 10, Shamirpet, Kosgi, N. Lakhimpur, Hasanparthy, Parkal and Saroornagar 9 each, Davanagere PTO, Hyderabad, Chauldhowaghat, Jenapur, Raiganj, Jangaon, Shayampet and Doma 8 each, Huzurabad, Paradip, Narayankhed, Itanagar, Jadcherla, Kodangal, Pottangi, Bhuvanagiri, Dindigul, Bihpur, Hiriyur HMS and Boudhgarh 7 each
4 Oct	Palamaner 11, Punganur and Mahabalipuram 10 each, Chikkanahalli PTO, Cheyyar and Santhipuram 9 each, Similiguda AWS, Lepakshi, Tirupathi AP and Allagadda 8 each, Tuting, Pallipattu, Uthiramerur, Mylam AWS, Virinjipuram AWS, Jadcherla, Palasamudram, Chincholi, Gajapathinagaram, Vellore and Agali 7 each
5 Oct	Sankaridurg 11, Chittoor, Tiruchengode, Vazhapadi and Erode 10 each, Thammampatty, Omalur, Bhavani and Yercaud 9 each, Kumarapalayam, Sukma, Puttur and Pochampalli 8 each, Virudhunagar, Badvel, Devakottai, Nimpara, Hosur, Punganur, Karaikudi, Ardhaveedu and Madurai AP 7 each
6 Oct	Srungavarapukota 12, Chinnamandem and Bobbili 11 each, Chhatrapur, Machareddy, Kaveripakkam, Kalingapatnam and Venkatapur 10 each, Long Islands, Chengannur, Kollam Rly, Merakamudidam, Seethanagaram, Venkatagiri Kota, Araku Valley, Mettupatti and Kondapuram 9 each, Pullampeta, Kurudamannil, Kujanga ARG, Bengaluru CO, Bengaluru City, Lakkireddipalle and Vilupuram 8 each, Karimnagar, Govindaraopet, Palakonda, Thirumanur, Krishnaprasad, Vepada, Piravam, Narsapur, Honakere, Mentada, Sirsilla, Garividi, Kamatchipuram, Vadipatti and Kozha 7 each
7 Oct	Mudubidre 17, Bevoor 12, Roha 11, Siddapura 10, Malavalli and Dumka 9 each, Sukma, Bharamsagara, B P Ghat and Nimpara 8 each, Agumbe, Kamalpur, Manki, Nilakottai, Mani, Gooty, Sudhagad Pali, Davanagere PTO, Lengpui and Digapahandi ARG 7 each
8 Oct	Golkonda 12, Amraghat 10, Dholai, Thodupuzha, Badnapur and Gandeed 9 each, Buxaduar, Uran, Kochi AP, Rajahmundry and Kondurg 8 each, Ernakulam South, Majbhat, Dindori, Panjim (Goa) and Sonepur 7 each
9 Oct	Canning Town 14, Palamaner 13, Baruipur, Manmothnagar and Pulivendla 12 each, Rajampet 11, Virinjipuram AWS and Nawabpet 10 each, Talcher, Owk, Degloor-FMO, Singanamala and Kallakkurichchi 9 each, Bhiwandi and Anantpur 8 each, Pudukottai, Cherrapunji, Igatpuri, Tadimarri, Tanakal, Jawhar, Diamond Harbour, Chiplun, Gangadhara, Nambulipulikunta, Kotgiri, Mangaon, Margherita, Allagadda, Atmakur, Kadiri, Ahmedpur, Karimnagar, Chengam, Sadasivanagar, Gandhari and Sambepalle 7 each
10 Oct	Durgapur 19, Tumakuru 18, Burdawan 17, Panagarh AP, Asansol and Simhadripuram 16 each, Asansol Cwc 15, Gheropara 14, Arogyavaram, Kosgi, Bolpur, Yellareddy and Burdwan 13 each, Muddanur and Sriniketan 12 each, Kondapuram, Dumka, Narayanpur, Kanksa BSF and Devanakonda 11 each, Barrackpur IAF and Nandikotkur 10 each, Aurad, Uluberia, Yedrami, Kolar Gold Field, Varni, Mangrulpir, Yemmiganur and Jukkal 9 each, Bagati (Magra), Sukma, Chinsura, Babulgaon, Tiruvuru (Arg), Mangalkote, Rudrur AP and Bongaon 8 each, Hayyal B, Vazhapadi, Nizamabad, Nirmal, Hetampur, Rajim, Nandipet, Uluberia, Dich Palle, Kolkata AP, Vasmat, Vanur, Kolkata, Mudkhed, Chevella, Kallakkurichchi, Gooty, Medchal, Santhipuram, Gonegandla, Alampur, Ghansawangi, Tirukattupalli, Amta, Palamaner, Deodurg, Chevella (Arg), Bengaluru Kial, Bankura, Pochampalli, Niali ARG and Kalgi 7 each
11 Oct	Jamui 19, Sono 18, Mangalvedha, Hogenekal, Suryagadha and Polavaram 17 each, Bhagalpur 15, Jhajha and Srisailam 14 each, Parbatta 13, M M Hills 12, Lakhisarai, Nelamangala, Banka, Renapur and Bihpur 11 each, Denkanikottai, Monghyr, Sabour, Chettikulam and Maganoor 10 each, Asansol, Pandharpur, Sangola, Parli Vaijnath, Gudiyatham, Kopargaon, Bhokardan, Shoolagiri, Madha, Melalathur, Ambejogai / Mominabad and Mohol 9 each, Dumka, Cheria B. Pur, Pennagaram, Katoria and Bheemadevarpalle 8 each, Karjatagri, Marandahalli, Vadipatti, Gogri, Dhule, Luxettipet, Beed, Nanipalson, Ulundurpet, Rasipuram, Devla, Narayanpur, Shrirampur, Yercaud, Ariyalur, Pattikanda, Bhograi, Kalvan, Paramathivelur, Rayakottah and Salem 7 each
12 Oct	Gooty 14, Pattikanda 13, Waghai and Baripada 12 each, Uchchhal and Chitradurga 11 each, Songadh, Raju Palem and Mangrol 10 each, Kamalapuram 9, Yercaud, Hagaribommanahalli, Navapur and Pamidi 8 each, Bellary, Ballari PTO, Royachoti, Mandvi, Jafrabad, Hungund, Konni, Peermade To, Channagiri and Chintamani PTO 7 each
13 Oct	Nalwatwad and Rajula 14 each, Hangal and Mannarkad 12 each, Ambejogai / Mominabad and Arogyavaram 11 each, Chitaguppa, Moranhat and Mudgal 10 each, Atlur, Hoskote, Sono, Chintamani and Humnabad 9 each, Konni, Dholai, Bellur, Amraghat, Amraoti, Similiguda AWS and B P Ghat 8 each, Hosur, Bangarpet, Bengaluru CO, Bengaluru City, Tavaragera, Rayalpadu, Punalur, Vaniaymbadi and Bihubar 7 each

TABLE 5 (*Contd.*)

Date	Some representative amounts of rainfall in cm for October, November and December 2017 (7 cm and above)
14 Oct	Kumargram 22, Alipurduar Cwc 16, Dhemaji AWS 12, Williamnagar, Shahuwadi, Mandangad, Hasimara and Domohani 11 each, Itanagar, Pune and N. Lakhimpur 10 each, Vaibhavwadi, Alipurduar, Pavagada, Chindwara and Chindwara - AWS 9 each, Bathalapalle, Tadimarri, Hatkanangale, Dharmavaram, Naharlagun and Yelburga 8 each, Chepan, Midnapore, Dibrugarh AP, Buxaduar, NH31 Bridge, Chauldhowaghat, Kambadur, Kunavaram, Kankavli, Midnapore Cwc, Shirol, Vararamachandrapur, Barobhisha, Annapurnaghat, Chinsura, B Durga, Khultabad, Balehonnur and Dholla Bazar 7 each
15 Oct	Kollur 18, Kota and Karkala 13 each, Tindivanam 12, Pernem 11, Kundapur, Mudubidre, Car Nicobar IAF, Tuting and Passighat 10 each, Hoskote, Hut Bay, Dhemaji AWS, Chauldhowaghat and Cherrapunji 9 each, Sathanur Dam, Nanipalson, Chengam, Rajendranagar AP, Vaniaymbadi, Nawapara, Chungthang and Sravanabelagola 8 each, Sukinda, Haveri PTO, Cherrapunji (Rkm), Ranebennur (Hos), Nandikotkur, Bargur, Roing, Uthangarai, Kunurpi, Anini AWS and Colachel 7 each
16 Oct	Allagadda 19, Kavathe Mahakal 12, Kondurg 9, Pottangi and Kundapur 8 each, Ankola, Karamchedu, Shirol, Nagar Kurnool and Vinjamur 7 each
17 Oct	Jagalbet 7
18 Oct	Chhamonu and Belonia 13 each, Udaipur 7
19 Oct	Derabis ARG 8, Kamalpur, Balikuda ARG, Pattamundai, Nimpara and Tirtol ARG 7 each
20 Oct	Balimundali 22, Tikarpara 21, Jaipur and Tirtol ARG 20 each, Gop 19, Tangi 18, Remuna ARG, Pipili and Brahmagiri AWS 17 each, Chandikhol ARG and Puri 16 each, Jajpur, Balasore and Soro 15 each, Banpur, Ranpur, Nilgiri, Kakatpur and Nawana 14 each, Bolagarh ARG and Nimpara 13 each, Krishnaprasad, Alipingal, Satyabadi ARG, Chandbali, Bonth, Chandanpur and Bari ARG 12 each, NH5 Gobindpur, Daitari, Rajkanika, Binjharpur ARG, Nuagada ARG, Udala, Balikuda ARG, Contai, Jagatsinghpur AWS and Kantapada ARG 11 each, Mohana, Contai and Hindol 10 each, Kujanga ARG, Betanati ARG, Astaranga ARG, Dhamnagar ARG, Rajghat, Anandpur, Balipatna ARG, Niali ARG, Phulbani, Kaptipada ARG, Karanjia, Chhatrapur, Sukinda, Banki ARG, Bhadrak AWS, Bhograi and R.Udaigiri 9 each, Jenapur, Manmothnagar, Marsaghai ARG, Bhubaneshwar AP, Mahanga ARG, Mundali, Danagadi ARG, Lanjigarh, Daringibadi, Berhampur, Mahendragarh, Odagaon ARG, Jaleswar, Nayagarh, Akhuapada, Kotagarh, Serchip (Hydro), Kalaikunda, Baliguda and Samakhunta AWS 8 each, Ambadola, Athgarh, Bhuban ARG, Baripada, Garadapur ARG, Harichandanpur ARG, Keongjhargarh, Purushottampur, Khandapara, Jamsolaghat, Muniguda ARG, Tihidi ARG, Bangiriposi, Canning Town., Gopalpur and Naraj 7 each
21 Oct	Bankura 28, Bankura Cwc 21, Kalaikunda 20, Narayanpur and Namsai 18 each, Mawsynram and Manash Nh Xing 14 each, Kokrajhar and Basirhat 13 each, Nawana, Ranibandh, Phulberia and Kansabati Dam 12 each, Bongaon, Suri Cwc, Deganga, Sonamura and Miao 11 each, Basudevpur AWS, Panagarh AP, Tusuma, D. P. Ghat, Bolpur and Sriniketan 10 each, Pingla, Gheropara, Aie Nh Xing, Tilpara Barrage, Indus, Birmaharajpur ARG, Hetampur and Salar 9 each, Joypur, Midnapore Cwc, Bagati (Magra), Manmothnagar, Williamnagar, Amtala, Midnapore and Panbari 8 each, Debagram, Banki ARG, Cooch Behar, Gangarampur, Barmul, Mohana, Rairangpur, Beky Rly.Bridge, Ullunda ARG, Burdwan and Purulia 7 each
22 Oct	Cherrapunji (Rkm) 31, Cherrapunji 28, Mawsynram 21, Amarpur 18, Belonia 17, Kamalpur 15, Haflong 14, Sabroom, Dharmanagar/Panisagar, Margherita and Karimganj 13 each, Williamnagar, Chhamonu and Agartala AP 11 each, Kailashahar, Polur, Khowai and Sonamura 10 each, Arundhutinagar, Hut Bay and Udaipur 9 each, Imphal, Annapurnaghat, Silchar and Sivaganga 8 each, B P Ghat, Aryankavu, Lakhipur, Bokajan and Pechiparai 7 each
23 Oct	Aska 8, Hayathnagar 7
24 Oct	Chepan and Mangan 7 each
25 Oct	Nil
26 Oct	Coonoor and Coonoor PTO 8 each, Chandanpur 7
27 Oct	Punalur 15, Mettupatti 8
28 Oct	Kochi AP and Ernakulam South 15 each, Konni 10, Aruppukottai, Kangeyam and Natham 7 each
29 Oct	Nil
30 Oct	Aizawal 10, Sabroom and Anaikaranchatram (Kollid)) 9 each
31 Oct	Sirkali 31, Parangipettai 26, Anaikaranchatram (Kollid)) 24, Chidambaram AWS and Chidambaram 20 each, Taramani ARG 19, Tambaram and Chembarabakkam 18 each, Poonamallee and Chennai AP 17 each, Ponneri and Papanasam 16 each, Kvk Kattukuppam ARG and Anna Uty ARG 15 each, K. M. Koil, Karaikal, Anna University, Cuddalore and DGP Office 14 each, Sriperumbudur 13, hennai city and Satyabama Uty ARG 12 each, Kelambakkam 11, Thiruthuraipoondi, Red Hills and Mayiladuthurai 10 each, Konni, Nagapattnam, Cholavaram, Tiruvarur, Kumbakonam, Mahabalipuram and Kolapakkam ARG 9 each, Ennore AWS, Thamaraipakkam, Vedaranniyam and Trangambadi (Or Tranqueb) 8 each, Thiruvidaimaruthur, Cheyyur, Nannilam, Chengalpattu, Poonamalle ARG and Marakkanam 7 each
1 Nov	Piravam 11, Ponneri 10, Srikalahasti and Cuddalore 9 each, Thottambedu, Gudur and Vaikom 8 each, Anaikaranchatram (Kollid)), Parangipettai, Venkatagiri and DGP Office 7 each

TABLE 5 (*Contd.*)

Date	Some representative amounts of rainfall in cm for October, November and December 2017 (7 cm and above)
2 Nov	Palayamkottai 13, Tiruchendur 9, Chidambaram AWS, Kelambakkam and Srivaikuntam 8 each, Nagapattnam, Cheranmahadevi and Vedaranniyam 7 each
3 Nov	DGP Office 30, Satyabama Uty ARG 20, Taramani ARG 19, Chennai city 18, Parangipettai, Chennai AP and Sirkali 14 each, Anna University 13, Tambaram 12, Mahabalipuram 11, Kvk Kattukuppam ARG, Anaikaranchatram (Kollid)) and Cholavaram 9 each, Kolapakkam ARG, Karaikal, Red Hills, Chidambaram, Madavaram AWS, Ponneri, Sivagiri, Ennore AWS and Srivaikuntam 8 each, Mayiladuthurai, Thamaraipakkam, Chembarabakkam and Kangeyam 7 each
4 Nov	Vedaranniyam 16, Thiruthuraipoondi 13, Mayiladuthurai and Sirkali 11 each, Ponneri 10, Parangipettai, Anaikaranchatram (Kollid)) and Nagapattnam 9 each, Chidambaram AWS 8, Anna University, Karaikal, Cuddalore and Chennai city 7 each
5 Nov	Papanasam 14, Manimutharu u U and Nagapattnam 12 each, Karaikal and Atmakur 11 each, Thiruthuraipoondi, Nanguneri and Cuddalore 9 each, Taliparamba 8, Aryankavu, Parangipettai, Punalur, Ambasamudram, Tiruvarur, Nedumangad and Kumarakom 7 each
6 Nov	Anaikaranchatram (Kollid)) 19, Chidambaram 15, Sirkali and Chidambaram AWS 14 each, Venkatagiri and Parangipettai 11 each, Puducherry 10, Thamaraipakkam, Tada and Vanur 8 each, Rapur, CIAL Kochi, K. M. Koil, Mayiladuthurai, Atlur and Srikalahasti 7 each
7 Nov	Tada 7
8 Nov	Thiruthuraipoondi 8, Nagapattinam 7
9 Nov	Kurudamannil 13, Piravam, Varkala and Punalur 9 each, Konni, Perinthalamanna and Kollam Rly 8 each, Angadipuram, Pattambi, Palayamkottai and Perumpavur 7 each
10 Nov	Nil
11 Nov	Vedaranniyam 13, Nagapattinam 9, Marakkanam 7
12 Nov	Nil
13 Nov	Ennore AWS 11, Tada 8, Ponneri, Chennai city and Madavaram AWS 7 each
14 Nov	Shar 9, Sullurpeta 8, Tada and Ponneri 7 each
15 Nov	Thanjavur 7
16 Nov	Sompeta 18, Ichchapuram 17, Mandasa 14, Palasa and Kalingapatnam 11 each, Gop, Tekkali and Astaranga ARG 9 each, Puri and Paradip 8 each, Digapahandi ARG, Paralakhemundi, Pathapatnam, Mahendragarh, Tirtol ARG, Balikuda ARG, Kujanga ARG and Nischintakoili ARG 7 each
17 Nov	Krishnagiri 7
18 Nov	Vijaywada AP 9, Tirtol ARG 8, Rajkanika and Binjharpur ARG 7 each
19 Nov	Komarada 12
20 Nov	Komarada 10, Papanasam 9
21 Nov	Manimutharu u U 10, Papanasam 9, Kanyakumari and Piravam 8 each
22 Nov	Papanasam 11
23 Nov	Nil
24 Nov	Nil
25 Nov	Nil
26 Nov	Nil
27 Nov	Rameswaram 14, Chembarabakkam 12, Chembarambakkam ARG 11, Chennai AP and Sirkali 10 each, Kancheepuram 9, Vedaranniyam 8, Poonamalle ARG, Nancowry, Kolapakkam ARG, Kollam Rly, Chidambaram, Anaikaranchatram (Kollid)), Poonamallee and Anna University 7 each
28 Nov	Piravam 7
29 Nov	Nannilam 7
30 Nov	Aryankavu 15, Vallam, Thuckalay and Puducherry 7 each
1 Dec	Papanasam 45, Manimutharu U 38, Aryankavu 26, Minicoy and Mylaudy 19 each, Thenkasi 17, Thuckalay, Pechiparai, Gudalur and Bhoothapandy 16 each, Watrap 15, Maniyachi, Eraniel and Colachel 14 each, Nagercoil, Kodaikanal, Coonoor and Coonoor PTO 13 each, Kuzhithurai, Srivilliputhur, Satankulam, Shencottah, Ayikudi, Myladumparaagri, Samayapuram and Srivaikuntam 12 each, Ottapadiram, Tiruchendur and Kovilpatti AWS 11 each, Thoothukudi, Ambasamudram, Uttamapalayam and Kanyakumari 10 each, Varkala, Radhapuram, Polur, Kovilpatti, Punalur, Madavaram AWS, Sankarankoil and Sattur 9 each, Arani, Sivaganga, Sivagiri, Uthiramerur, Rajapalayam, Thiruvananthapuram AP, Neyyattinkara, Anna University, Uthagamandalam, Grand Anaicut, Chembarabakkam and DGP Office 8 each, Musiri, Vadipatti, K. Paramathy, Karur, Vilathikulam, Anna Uty ARG, Lalgudi, Ambur, Mayanur, Padalur, Panchapatti, K Bridge, Thamaraipakkam, Cholavaram, Nanguneri, Periyakulam, Kalugumalai and Chennai city 7 each

TABLE 5 (*Contd*.)

Date	Some representative amounts of rainfall in cm for October, November and December 2017 (7 cm and above)
2 Dec	Sathanur Dam 23, Sirkali 19, Chidambaram and Anaikaranchatram (Kollid)) 18 each, Chidambaram AWS 17, Virudachalam and Chengam 15 each, Gingee, Mylam AWS, K.M.Koil and Minicoy 14 each, Tirukoilur, Vilupuram, Coonoor, Coonoor PTO and Karaikal 13 each, Cuddalore, Sethiathope and Tiruvannamalai 12 each, Puducherry 11, Mayanur, Paramathivelur and Polur 10 each, Parangipettai, Kallakkurichchi, Kodavasal, Nagapattnam, Vanur, Mayiladuthurai, Sankarapuram, Car Nicobar IAF, Eraniel, Jayamkondam, Neyveli AWS, Rayakottah, Kuzhithurai, Ariyalur and Tindivanam 9 each, Srimushnam, Tiruvaiyaru, Tozhudur, Tiruvarur, Valangaiman, Papanasam, Ulundurpet, Thiruvananthapuram AP and Kothagiri 8 each, Harur, Panruti, Perinthalamanna, Needamangalam, Thuckalay, Uthangarai, Nagercoil, Angadipuram, Arani and Attur 7 each
3 Dec	Tiruvarur and Car Nicobar 14 each, Pandavaiyar Head and Kodavasal 13 each, Valangaiman and Nannilam 12 each, Nagapattnam 11, Needamangalam, Kumbakonam and Karaikal 9 each, Thiruthuraipoondi, Aduthurai AWS and Tiruvadanai 8 each, Car Nicobar IAF and Thiruvidaimaruthur 7 each
4 Dec	Nil
5 Dec	Nancowry 19, Car Nicobar and Car Nicobar IAF 15 each
6 Dec	Port Blair 11, Dahanu 10, Umergam, Hut Bay and Vapi 9 each, Talasari and Mumbai (Colaba) 8 each, Pardi, Waghai, Long Islands, Palgharagri, Vansda, Ayikudi and Gandevi ARG 7 each
7 Dec	Virudunagar AWS 11
8 Dec	Gobichettipalayam 8, Rajapalayam 7
9 Dec	Aryankavu 17, Kakatpur 12, Gop 11, Paradip, Puri and Astaranga ARG 10 each, Balikuda ARG and Kujanga ARG 9 each, Niali ARG 8, Satyabadi ARG and Tirtol ARG 7 each
10 Dec	Kamalpur 11, Kailashahar, Khowai and Dholai 7 each
11 Dec	Udaipur and Vaikom 9 each, Karimganj 8, Belonia and Gokulpur AWS 7 each
12 Dec	Katra and Dalhousi Alha AWS 11 each, Banihal, Batote and Dehra Gopipur 10 each, Awantipur IAF and Dharmasala 9 each, Govindpura AWS, Malakpur and Dharmshala AWS 8 each, Pathankot, Ranjit Sagar Dam Site, Phangota, Shahpur Kandi, Saloni, Baderwah, Kathua and Kangra AP 7 each
13 Dec	Nil
14 Dec	CIAL Kochi 9, Mylaudy 7
15 Dec	Nil
16 Dec	Nil
17 Dec	Nil
18 Dec	Nil
19 Dec	Nil
20 Dec	Rameswaram 8
21 Dec	Nil
22 Dec	Nil
23 Dec	Nil
24 Dec	Nil
25 Dec	Nil
26 Dec	Nil
27 Dec	Nil
28 Dec	Nil
29 Dec	Nil
30 Dec	Car Nicobar IAF 8
31 Dec	Car Nicobar 14

A Deep depression (6-9 December), and a low pressure area (25-28 December) formed over the Bay of Bengal during the month. The Depression (6-9 December) was first seen as a low pressure area over Malay Peninsula and adjoining south Andaman Sea and as a well-marked low during 1-5 December over southeast Bay of Bengal and neighbourhood. The depression formed over southeast Bay of Bengal on 6th and moved north northwestwards and lay over west central Bay of Bengal, southeast of Machlipatnam. It intensified into a deep depression on the 8th over west central Bay of Bengal. The deep depression continued to move northnorthwards. It further moved north northwestwards before weakening into a depression on 8th and lay over west central and adjoining north west Bay of Bengal about 190 km south east of Gopalpur. It moved in the north northeast direction and further weakened into a well-marked low pressure area on 9th and then into a low pressure area over northwest Bay of Bengal. It later became less marked. This depression caused very heavy rains at a few places over Odisha on 9th as the depression weakened and moved in the north northeastward direction. It did not give any rain over coastal Andhra Pradesh. A low pressure area lay as a trough of low over south Andaman Sea and Malay Peninsula but it failed to produce any significant weather.

3.3.2. *Weather and associated synoptic features*

Table 4 gives a summary of the synoptic systems during the month of December 2017. The sub-divisionwise percentage departure of rainfall from normal and the significant amounts of rainfall during the month are given in Tables 1 & 5 respectively.

Apart from the weather associated with the low pressure systems depicted above, Northwest India, North India, Northeast India and the West Himalayan Region experienced rainfall and snowfall due to western disturbances. Dense to very dense fog conditions prevailed over the plains of Northwest India and North India. Even parts of peninsular India also experienced moderate to dense fog during the month.

Severe cold day and cold day conditions prevailed at isolated places over North and northwest India for a few days. *Cold wave and cold day* conditions prevailed at isolated places over Telangana and East Uttar Pradesh respectively for a day. The anomalous cyclonic circulation in the eastern Bay of Bengal and Andaman Sea diverted the Northeast winds causing a dry phase over peninsular India. Though western disturbances moved across the Northern parts of the country, the lack of moisture, due to the prevalence of an anomalous cyclonic circulation at lower levels over Oman, preventing moisture incursion into the region, didn't result in precipitation, limiting it to fog situations over the region.

3.3.3. *Temperature*

Cold wave conditions prevailed for 1 day at isolated places over Telangana.

Severe Cold day conditions prevailed at isolated places for 1 day over Punjab and west Rajasthan. The lowest minimum temperature recorded was 1.5 °C at Churu in west Rajasthan on 21st December.

Minimum temperatures were *normal to above normal* over most parts of India except over some eastern subdivisions and parts of peninsular India and north India.

3.3.4. *Damages associated with the Disastrous weather events*

123 people died as cyclone Ockhi battered Tamil Nadu and Kerala and as torrential rains and winds triggered by cyclone Ockhi lashed the two states. Train services were hit in Kanyakumari district in Tamil Nadu. 63 people hospitalized and 74 houses were fully damaged.122 houses were partially damaged in Tamil Nadu due to Cyclone Ockhi on 4th, 39 people killed and 167 fishermen missing after the cyclone hit Tamil Nadu and Kerala coasts. An avalanche in the Uttarakashi districts on 11th took the lives of three local shepherds. Six people, were killed when the car they were travelling in was hit by a massive landslide at Overi in Nirmand tehsil of Kullu district on 10th. Higher reaches of Himachal Pradesh and Jammu and Kashmir received fresh snowfall and rain on 13th, with the Kashmir valley getting cut off from the rest of the country as the Srinagar-Jammu National Highway and Mughal road was closed for traffic and flights at the Srinagar airport were suspended. In the state's summer capital, flight services to and fro from the Srinagar International Airport were hit due to poor visibility caused by heavy snow. Five soldiers went missing as snow avalanches struck upper reaches of Kashmir. Trains were cancelled and three people were killed in accidents due to dense fog in north India.

Appendix

Definitions of the terms given in '*Italics*'

(A) Rainfall

(*i*) *Percentage departure from normal*

Large excess	- + 60% or more
Excess	- +20% to +59%

Normal	- –19% to +19%
Deficient	- –20% to –59%
Large deficient	- –60% to –99%
No Rain	- –100%

(*ii*) *Intensity (during the past 24 hours period ending at 0300 UTC)*

Heavy rainfall	- 6.5-11.5 cm
Very heavy rainfall	- 11.6-19.5 cm
Extremely heavy rainfall	- 19.6 cm or more
Heavy snowfall	- 64.5 cm to 115.5 cm

(*iii*) *Spatial distribution (percentage of the stations in a meteorological sub-division reporting a 24 hour rainfall of 0.1 mm or more)*

At most places (Widespread)	- ≥76% of stations gets rainfall
At many places (Fairly widespread)	- (51-75)% of stations gets rainfall
At a few places (Scattered)	- (26-50)% of stations gets rainfall
At isolated places (Isolated)	- ≤25% of stations gets rainfall

(B) Monsoon activity

(*i*) *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*

(*ii*) *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*

(C) Temperatures

(*i*) *Maximum / Day temperature*

Markedly above normal	- When departure from *normal* is +5 °C or more
Appreciably above normal	- When departure from *normal* is +3.1 °C to +5.0 °C
Above normal	- Departure from *normal* is +1.6 °C to +3.0 °C
Normal	- When departure from *normal* is +1.5 °C to –1.5 °C

(*ii*) *Minimum / Night temperature*

Based on the revised criteria which came into practice with effect from 2016, cold waves are declared based on the actual minimum temperatures. Cold wave is considered when the minimum temperature of a station is 10 °C or less for plains and 0 °C or less for hilly regions. Also to declare cold wave, the criteria should be met at least in 2 stations in a met sub-division for at least 2 consecutive days.

Severe cold wave conditions	- When the negative departure of minimum temperature from normal is more than 6.4 °C or when the actual minimum temperature is ≤2 °C over the plains.
Cold wave conditions	- When the negative departure of minimum temperature from normal is 4.5 °C to 6.4 °C or when the actual minimum temperature is ≤4 °C over the plains.

	For stations located over the coastal areas, when the minimum temperature departure is –4.5 °C or more, 'Cold Wave' may be described if the actual minimum temperature is 15 °C or less.
Cold day to severe cold day conditions	- When the minimum temperature is less 10 °C for plains and 0 °C or less for hilly regions. Cold day may be described if the departure of maximum temperature is –4.5 °C to –6.4 °C and severe cold day when it is more than 6.4 °C.

Markedly below normal	- When departure from *normal* is –5 °C or less
Appreciably below normal	- When departure from *normal* is between –3.1 °C to –5.0 °C
Below normal	- Departure from *normal* is –1.6 °C to +3.0 °C
Normal	- Departure from *normal* is –1.5 °C to +1.5 °C