

## Weather in India

### WINTER SEASON (JANUARY-FEBRUARY) 2021<sup>†</sup>

#### 1. Introduction

The month of January began with cold wave conditions over few sub-divisions of northwest India in continuation of the December 2020 season but this cold experience was brief and it was only in the second fortnight of January that *cold waves*\* were observed over northwest India and adjoining sub-divisions of central and east India. These conditions subsided by the end of the month and the frequency as well as the extent of *cold waves* reduced substantially by the beginning of February.

A persistent change in the wind pattern replaced maritime air over the southern peninsular India by dry continental air, marking end of the northeast monsoon rain over Tamil Nadu, Puducherry, Kerala, adjoining parts of Andhra Pradesh and Karnataka from 19<sup>th</sup> January, 2021.

In the month of January, the rainfall for the country was above normal (117% of long period average-LPA) while in February and the winter season as a whole (*viz.*, January & February), rainfall was *below normal* at -68% of LPA and -32% of LPA respectively.

The core of Sub-Tropical Westerly Jet (STWJ) was seen between Latitude 23° N and 34° N all through the season.

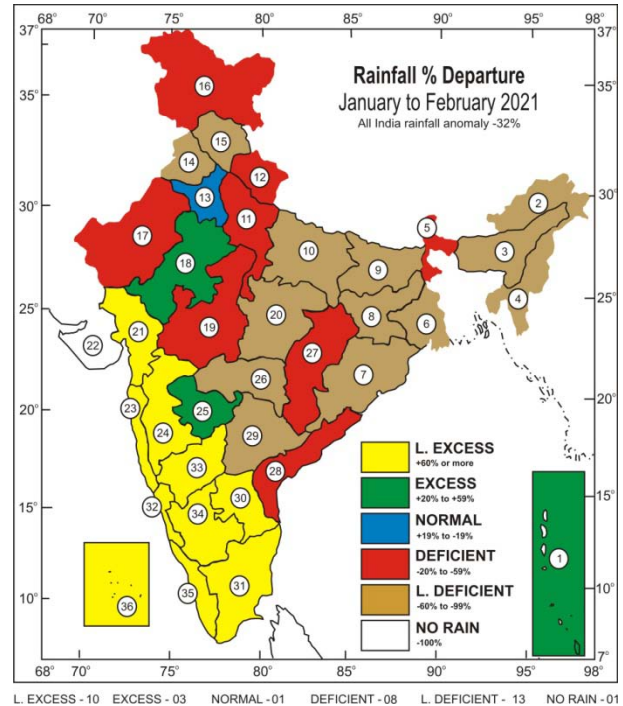
Very dense fog to dense fog was observed over northwest India on most days and over east & northeast India on some days over isolated pockets of Madhya Pradesh in central India and occasionally over Peninsular India.

No intense system formed over the Indian Seas during the season.

#### 2. Seasonal Rainfall (January-February)

Rainfall during the season over the country as a whole was *deficient* with departure of -32% of LPA. The precipitation over homogenous region of south peninsula was extraordinarily high especially in the month of January which aided in bringing down the disparity caused by the rainfall deficit in the other three regions.

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



**Fig. 1.** Sub-divisionwise seasonal rainfall departure from normal (%) for post monsoon season (January to February, 2021). Sub-divisions are indicated by number on the map & bold letters in legend. The rainfall anomaly values for these 36 sub-divisions are indicated below :

<b>1</b>	21	<b>7</b>	-86	<b>13</b>	-15	<b>19</b>	-48	<b>25</b>	57	<b>31</b>	439
<b>2</b>	-72	<b>8</b>	-87	<b>14</b>	-73	<b>20</b>	-62	<b>26</b>	-72	<b>32</b>	2973
<b>3</b>	-76	<b>9</b>	-97	<b>15</b>	-70	<b>21</b>	73	<b>27</b>	-40	<b>33</b>	141
<b>4</b>	-82	<b>10</b>	-93	<b>16</b>	-45	<b>22</b>	-100	<b>28</b>	-25	<b>34</b>	738
<b>5</b>	-54	<b>11</b>	-45	<b>17</b>	-59	<b>23</b>	2107	<b>29</b>	-76	<b>35</b>	409
<b>6</b>	-98	<b>12</b>	-56	<b>18</b>	57	<b>24</b>	607	<b>30</b>	330	<b>36</b>	761

Precipitation over all the homogenous regions except south peninsular region were *deficient* or *large deficient* in February as well as the season. In contrast, the south peninsular region (461% of LPA) recorded *large excess* rainfall in the month of January and season while February rainfall was *excess* at 28% of LPA. Over the homogenous region of east and northeast India, rainfall was either *deficient* or *large deficient* in all the sub-divisions in both the months and the season. The easterly winds regime dominated the overall weather over the country during most parts of the season. Perturbations in the mid-latitude westerlies moved across the northern

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TABLE 1

Sub-division wise rainfall (mm) for each month and season as a whole (January - February 2020)

S. No.	Meteorological Sub-divisions	January			February			Season		
		Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)
1.	A. & N. Islands	42.7	51.6	-17%	48.8	23.8	105%	91.5	75.4	21%
2.	Arunachal Pradesh	29.1	47.2	-38%	12.7	99.5	-87%	41.8	146.7	-72%
3.	Assam & Meghalaya	8.8	15.5	-43%	2.3	31.2	-93%	11.2	46.7	-76%
4.	Naga., Mani., Mizo. and Tri.	5.8	12.1	-52%	0.9	25.7	-96%	6.7	37.8	-82%
5.	Sub-Himalayan West Bengal & Sikkim	8.5	16.0	-47%	12.8	29.9	-57%	21.3	45.9	-54%
6.	Gangetic West Bengal	0.1	12.4	-99%	0.7	20.4	-96%	0.8	32.8	-98%
7.	Orissa	1.3	12.1	-90%	2.9	17.1	-83%	4.2	29.2	-86%
8.	Jharkhand	1.0	12.2	-92%	2.6	16.0	-84%	3.6	28.2	-87%
9.	Bihar	0.2	10.0	-98%	0.5	10.1	-95%	0.7	20.1	-97%
10.	East Uttar Pradesh	0.3	12.2	-98%	1.4	13.3	-90%	1.7	25.5	-93%
11.	West Uttar Pradesh	13.2	12.3	7%	3.0	17.0	-82%	16.2	29.3	-45%
12.	Uttarakhand	27.3	41.6	-34%	17.2	59.8	-71%	44.5	101.4	-56%
13.	Haryana, Chandigarh & Delhi	21.3	14.3	49%	4.9	16.6	-70%	26.2	30.9	-15%
14.	Punjab	10.4	21.0	-50%	2.6	27.7	-91%	13.0	48.7	-73%
15.	Himachal Pradesh	38.4	89.9	-57%	19.3	102.8	-81%	57.7	192.7	-70%
16.	Jammu & Kashmir and Ladakh	87.3	93.1	-6%	35.3	130.9	-73%	122.6	224.0	-45%
17.	West Rajasthan	3.6	2.9	25%	0.0	5.9	-100%	3.6	8.8	-59%
18.	East Rajasthan	15.5	4.4	252%	0.2	5.6	-97%	15.7	10.0	57%
19.	West Madhya Pradesh	4.6	6.6	-30%	1.9	5.9	-68%	6.5	12.5	-48%
20.	East Madhya Pradesh	1.5	16.0	-91%	11.1	16.9	-34%	12.6	32.9	-62%
21.	Gujarat Region	2.5	1.0	147%	0.1	0.5	-75%	2.6	1.5	73%
22.	Saurashtra & Kutch & Diu	0.0	0.4	-100%	0.0	0.6	-100%	0.0	1.0	-100%
23.	Konkan & Goa	5.6	0.5	1029%	9.8	0.2	4799%	15.4	0.7	2107%
24.	Madhya Maharashtra	15.6	1.6	875%	4.9	1.3	277%	20.5	2.9	607%
25.	Marathwada	2.4	4.4	-44%	8.4	2.5	235%	10.8	6.9	57%
26.	Vidarbha	0.8	10.1	-92%	4.2	7.7	-46%	5.0	17.8	-72%
27.	Chhattisgarh	2.3	11.1	-79%	10.5	10.2	3%	12.8	21.3	-40%
28.	Coastal Andhra Pradesh & Yanam	10.7	9.7	10%	6.1	12.7	-52%	16.8	22.4	-25%
29.	Telangana	1.7	7.8	-78%	1.7	6.7	-74%	3.5	14.5	-76%
30.	Rayalaseema	22.8	3.6	534%	12.0	4.5	167%	34.8	8.1	330%
31.	Tamil Nadu, Pudcherry & Karaikal	139.3	15.5	799%	12.2	12.6	-3%	151.5	28.1	439%
32.	Coastal Karnataka	62.7	1.7	3590%	14.1	0.8	1661%	76.8	2.5	2973%
33.	North Interior Karnataka	8.1	3.0	168%	4.5	2.2	104%	12.5	5.2	141%
34.	South Interior Karnataka	26.6	2.2	1108%	22.0	3.6	511%	48.6	5.8	738%
35.	Kerala & Mahe	105.5	8.4	1156%	8.6	14.0	-39%	114.1	22.4	409%
36.	Lakshadweep	167.5	15.4	988%	49.3	9.8	403%	216.9	25.2	761%

Note : Amounts less than 0.1 mm are rounded off to zero

**TABLE 2**  
**Details of the weather systems during January 2021**

S. No.	System	Duration	Place of initial Location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>(A) Western disturbances /Eastward moving systems</b>						
<i>(i) Upper air cyclonic circulation</i>						
1.	Between 5.8 & 7.6 kms a.s.l.	1-6	Afghanistan and neighborhood	East	North Pakistan and neighbourhood	With a trough aloft in upper tropospheric level with its axis at 7.6 kms above m.s.l. ran roughly along Long. 68° E to the north of Lat. 15° N on 5.  It Moved away east northeastwards on 7
2.	Between 3.1 & 7.6 kms a.s.l.	7(mor) - 12	Western parts of Afghanistan and neighborhood	Do	Jammu-Kashmir & Ladakh and neighbourhood	With a trough aloft in upper tropospheric level with its axis at 5.8 kms above m. s. l. ran roughly along Long. 72° E to the north of Lat. 32° N on 10.  It Moved away east-northeastwards on 13
3.	At 3.1 km a.s.l.	22 - 25 (eve)	Afghanistan and neighborhood	Do	Do	Initially it lay as a trough in mid tropospheric levels with its axis at 5.8 kms above m.s.l. ran roughly along Long. 58° E to the north of Lat. 32° N on 22 (morning).  Trough and remnant Cyclonic circulation moved away east-northeastwards on 26
<i>(ii) As a trough</i>						
1.	At 0.9 km a.s.l.	13-14	Roughly along Long. 88° E to the north of Lat. 26° N	Stationary	<i>In situ</i>	Moved away east northeastwards on 15
2.	At 3.1 kms a.s.l.	19-20	Roughly along Long. 87° E to the north of Lat. 27° N	East	Long. 88° E to the north of Lat. 25° N	It then lay as a cyclonic circulation over Sub Himalayan west Bengal, Sikkim and neighbourhood between 3.1 & 3.6 kms a.s.l. on 21 and merged with the cyclonic circulation over northeast Bangladesh and neighbourhood on 22
3.	Between 3.6 & 5.8 kms a.s.l.	29	Roughly along Long. 72° E to the north of Lat. 32° N	Stationary	<i>In situ</i>	Moved away east-northeastwards on 30
4.	Lower & Mid tropospheric westerlies with its axis at 3.1 kms a.s.l.	31 Jan	Roughly along Long. 72° E to the north of Lat. 30° N	Do	Do	Moved away northeastwards 1 February
<i>(iii) As an induced cyclonic circulation</i>						
1.	Upto 2.1 kms a.s.l.	22-23	Central Pakistan and adjoining Punjab	East	Punjab & neighbourhood	Became less marked on 24
<b>(B) Other upper air cyclonic circulations</b>						
1.	Upto 4.5 km a.s.l.	6-11	Central parts of south Arabian Sea & adjoining Equatorial Indian ocean	West	Southeast Arabian Sea & adjoining southwest Arabian Sea	Became less marked on 12
2.	Upto 1.5 km a.s.l.	3-5	East Bangladesh and neighborhood	East	South Assam & neighbourhood	Became less marked on 6

TABLE 2 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
3.	Upto 3.1 km a.s.l.	9-17	Equatorial Indian ocean & adjoining central parts of south Bay of Bengal	West	Central parts of Arabian Sea & adjoining Equatorial Indian ocean	Became unimportant on 18
4.	Upto 2.1 km a.s.l.	9	East Bangladesh and neighbourhood	Stationary	<i>In situ</i>	Became less marked on 10
5.	Upto 1.5 kms a.s.l.	10	Southwest Rajasthan and neighbourhood	Do	Do	Became less marked on 11
6.	Upto 0.9 km a.s.l.	14	East Bihar and adjoining Sub Himalayan West Bengal	Do	Do	Became less marked on 15
7.	Between 1.5 & 2.1 kms a.s.l.	14	North Madhya Maharashtra and neighbourhood	Do	Do	Became less marked on 15
8.	Upto 3.1 km a.s.l.	15	East Bangladesh and neighbourhood	Do	Do	Became less marked on 16
9.	Between 5.8 & 7.6 kms a.s.l.	15-19	Southwest Bay of Bengal off Tamil Nadu coast	South	Southwest Bay of Bengal and adjoining Equatorial Indian Ocean	Became less marked on 20
10.	Upto 1.5 km a.s.l.	16	Equatorial Indian Ocean and adjoining southeast Bay of Bengal	Stationary	<i>In situ</i>	Became less marked on 17
11.	Upto 0.9 km a.s.l.	16	Comorin area and neighbourhood	Do	Do	Became less marked on 17
12.	Upto 1.5 kms a.s.l.	16-17	Northeast Arabian Sea and adjoining Saurashtra	Do	Do	It became less marked on 18
13.	At 0.9 km a.s.l.	17	Interior Odisha and neighbourhood	Do	Do	Became less marked on 18
14.	Upto 1.5 kms a.s.l.	17-29	East Bangladesh and neighbourhood	Oscillatory	South Bangladesh and neighbourhood	It became less marked on 30
15.	Upto 2.1 kms a.s.l.	17-20	Southwest Bay of Bengal and adjoining Equatorial Indian Ocean	Stationary	Equatorial Indian Ocean and adjoining Southwest Bay of Bengal	It became less marked on 21
16.	Upto 1.5 kms a.s.l.	18	South Rajasthan and neighbourhood	Do	<i>In situ</i>	It became less marked on 19
17.	Upto 1.5 kms a.s.l.	21	South Gujarat and neighbourhood	Do	Do	Became less marked on 22
18.	At 0.9 km a.s.l.	23	North Madhya Maharashtra and neighbourhood	Do	Do	Became less marked on 24
19.	At 0.9 km a.s.l.	27-29	Madhya Maharashtra and neighbourhood	East	Marathwada and neighbourhood	Became less marked on 30
20.	At 1.5 km a.s.l.	27-28	Southeast Rajasthan and neighbourhood	Stationary	<i>In situ</i>	Became less marked on 29
21.	At 0.9 km a.s.l.	31 Jan	North Madhya Maharashtra and neighbourhood	Do	Do	Became less marked on 1 February
<b>(C) Troughs in easterlies</b>						
1.	At 0.9 km a.s.l.	5-6	From eastcentral Arabian Sea off Karnataka coast to south Madhya Maharashtra across south Konkan & Goa	Stationary	From central parts of south Arabian Sea adjoining Equatorial Indian ocean to north Madhya Maharashtra across eastcentral Arabian Sea & south Konkan & Goa	Became less marked on 7

TABLE 2 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
2.	Upto 1.5 km a.s.l.	5 (eve) - 6	From south Sri Lanka coast to south coastal Andhra Pradesh across north Tamil Nadu	Oscillatory	From Comorin area to north Tamil Nadu across Gulf of Mannar	It then lay as a cyclonic circulation over Tamil Nadu coast & neighbourhood which extended upto 1.5 kms a.s.l. on 7 & merged with the cyclonic circulation over Equatorial Indian ocean & adjoining central parts of south Bay of Bengal on 10
3.	Upto 0.9 km a.s.l.	1	From eastcentral Arabian Sea off Maharashtra coast to southwest Rajasthan across Gujarat	Stationary	<i>In situ</i>	Became less marked on 2
4.	At 0.9 km a.s.l.	7-10	From Karnataka coast to Maharashtra coast	Oscillatory	From southeast Arabian Sea to north Maharashtra coast across eastcentral Arabian Sea	Became less marked on 11
5.	At 0.9 km a.s.l.	26	From south Madhya Maharashtra to south Chhattigarh across Marathwada and Vidarbha	Stationary	<i>In situ</i>	Became less marked on 27
6.	At 0.9 km a.s.l.	29	From southeast Arabian Sea to eastcentral Arabian Sea off Kerala-Karnataka coast	Do	Do	Became less marked on 30
7.	Upto 1.5 km a.s.l.	29	From Equatorial Indian ocean to southwest Bay of Bengal off Sri Lanka coast	Do	Do	Became less marked on 30
8.	At 0.9 km a.s.l.	30 Jan - 4 Feb	North Kerala to Marathwada across coastal Karnataka and south Madhya Maharashtra	Oscillatory	From north Kerala to south Gujarat coast	Became less marked on 5 February
<b>(D) Other troughs</b>						
1.	Upto 1.5 km a.s.l.	3-6	From north Punjab to northeast Arabian Sea along & off Gujarat coast across induced cyclonic circulation over southwest Rajasthan, Saurashtra & Kutch	Oscillatory	From north Pakistan to south Gujarat coast	Became less marked on 7
2.	Upto 1.5 km a.s.l.	14-17	From cyclonic circulation over southeast Arabian Sea and adjoining Maldives area to Comorin area	Do	From cyclonic circulation over central parts of Arabian Sea and adjoining Equatorial Indian ocean to Comorin area	Became less marked on 18
3.	At m.s.l.	13 (eve)	From Comorin- Maldives area to Lakshadweep area with an embedded cyclonic circulation over Comorin- Maldives area	Stationary	<i>In situ</i>	Became less marked on 14. However, cyclonic circulation lay over southeast Arabian Sea and adjoining Maldives area which extended upto 5.8 kms a.s.l. and became unimportant on 18
4.	At 0.9 km a.s.l.	19	From east Uttar Pradesh to north Konkan across north Madhya Pradesh	Do	Do	Became less marked on 20
5.	At 0.9 km a.s.l.	24-25	From east Bihar to Marathwada across Jharkhand, Chhattisgarh and Vidarbha	Do	South Chhattisgarh to Marathwada across Vidarbha	Became less marked on 26

parts of the country in the form of upper air cyclonic circulations and troughs in the mid and upper tropospheric levels, but they did not cause much precipitation over the northwestern parts of the country.

The monthly and seasonal sub-divisional rainfall (actual, normal and percentage departure) are given in Table 1. Also, representative amount of rainfall on a day-to-day basis are given in Table 4. Out of the 36 meteorological sub-divisions of India, the seasonal rainfall was *large excess* in 10, *excess* in 3, *deficient* in 8, *large deficient* in 13 and there was *no rain* in Saurashtra & Kutch sub-division. This season only one sub-division, Haryana, Chandigarh & Delhi recorded *normal* rainfall. The percentage departure falling under various categories, viz., *large excess*, *excess*, *normal*, *deficient*, *large deficient* and *no rain* are shown in Fig. 1.

### 3. Monthly features

#### 3.1. January

##### 3.1.1. Storms and Depressions

No intense system formed over the Indian Seas during the month.

##### 3.1.2. Weather and associated synoptic features

As given in Table 2, 8 western disturbances (including 3 upper air cyclonic circulations, 4 troughs in westerlies and 1 induced cyclonic circulation), 21 upper air cyclonic circulations, 7 troughs in easterlies and 5 other troughs formed which affected the weather over the country during the month of January.

##### 3.1.3. Monthly rainfall

In this month, the rainfall over south peninsular region was exceptionally high at a departure of 461% of LPA while the precipitation was below normal over all the other regions, with central India (-53% of LPA), east and northeast region (-58% of LPA) being *deficient* while northwest India (-15% of LPA) recorded normal rainfall.

A very slow moving active western disturbance over central Pakistan and neighbourhood along with its induced cyclonic circulation over southwest Rajasthan and neighbourhood, and large amplitude lower tropospheric easterlies generated a confluence zone that extended from north Punjab to northeast Arabian Sea. The associated moisture incursion from both Arabian Sea and Bay of Bengal resulted in an unusually longer spell of precipitation over large areas of northwest India and parts of central India. This western disturbance resulted in large

excess rainfall over northwest India and some parts of central India for the week ending on 6<sup>th</sup> January, 2021. Later in the month, the successive passage of western disturbances did not cause much precipitation over northwest India as the High index pattern in mid latitude winds caused the systems to move along more northern latitudes.

During 1-15 January, 2021, westward moving easterly waves in the form of troughs & cyclonic circulations were frequent which caused large excess rainfall over south peninsular region. This resulted in some stations receiving record 24-hour rainfall in this month. A list of such stations is given below with their previous record and date.

Station name	Previous Record (mm)	Date	New Record (mm)	Date Jan 2021
Pilani	31.0	9/1/1995	39.4	5
Pune	22.3	23/1/1948	33.2	9
Chennai AP	91.7	28/1/1947	126.2	6
Tirupattur	12.0	16/1/1986	14.8	7
Thanjavur	53.0	7/1/1990	64.0	12
Honavar	32.6	8/1/1995	33.2	8
Mangaluru AP	10.9	10/1/1995	56.7	7
Panambur	23.0	21/1/1994	32.6	7
Shirali	6.2	8/1/1995	19.4	7
Hassan	59.7	21/1/1921	79.2	7
Agumbe	32.2	11/1/2003	112.0	8
Shimoga	24.6	7/1/1965	37.0	4
Cial Kochi	11.1	17/1/2006	38.8	7

Source : IMD Climate Diagnostics Bulletin of India January 2021

Out of the 36 met-sub-divisions of India, the month's rainfall was *large excess* in 11, *excess* in 2, *normal* in 4, *deficient* in 9 and *large deficient* in 9 sub-divisions, while *no rain* was reported in one sub division of Saurashtra & Kutch sub-division.

##### 3.1.4. Temperature

Maximum temperatures were below normal over northwest and south peninsular India while mostly above normal over central and northeast India.

The minimum temperatures were generally *normal to above normal* over most parts of the country except for Jammu-Kashmir and Ladakh, Gujarat State and adjoining Rajasthan where the temperatures were below normal by 1 to 2 °C. The season's lowest minimum temperature over the plains of the country was -1.2 °C at Hissar (Haryana) on 1<sup>st</sup> January.

**TABLE 3**  
**Details of the weather systems during February 2021**

S. No.	System	Duration	Place of initial Location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>(A) Western disturbances / Eastward moving systems</b>						
<i>(i) Upper air cyclonic circulation</i>						
1.	At 3.1 km a.s.l.	1-6 (mor)	Afghanistan & neighbourhood	East	Eastern parts of Jammu-Kashmir and Ladakh, neighbourhood	Initially it lay as a trough in mid & upper tropospheric westerlies with its axis at 5.8 km a.s.l. and along Long. 53° E and to the north of Lat. 28° N on 31 January and became less marked on 4 February.  It then lay as a trough in mid & upper tropospheric westerlies with its axis at 5.8 km a.s.l. roughly along Long. 82° E and to the north of Lat. 24° N on 6 and moved away northeastwards on 8
2.	Do	9-10	Northeast Afghanistan and adjoining Pakistan	Do	Jammu-Kashmir and Ladakh, neighbourhood	Initially it lay as a trough in mid and upper tropospheric westerlies with its axis at 5.8 kms a.s.l. roughly along Long. 55° E and to the north of Lat. 31° N on 8.  It became less marked on 11. However, trough moved away eastward on 13 morning
3.	Between 3.1 & 3.6 km a.s.l.	12	Jammu-Kashmir and Ladakh, neighbourhood	Do	Do	Initially it lay as a trough in mid tropospheric westerlies with its axis at 3.1 kms a.s.l. roughly along Long. 72° E and to the north of Lat. 32° N on 11.  It became less marked on 13
4.	At 3.1 km a.s.l.	25 Feb - 1 Mar	Afghanistan and neighbourhood	Do	Ladakh and neighbourhood	Initially it lay as a trough with its axis at 5.8 kms a.s.l. roughly along Long. 55° E and to the north of Lat. 30° N on 22.  It moved away east-northeastwards on 2 March
<i>(ii) As a trough in westerlies</i>						
1.	At 5.8 km a.s.l.	12 (eve) - 16	Along Long. 60° E to the north of Lat. 32° N	East	Along Long. 76° E to the north of Lat. 28° N	It then lay as a cyclonic circulation over north Pakistan and neighbourhood with the trough aloft on 14 and became less marked on 15.  Trough lay as a tilted trough with N-S orientation from Long. 80° N / Lat. 30° E to the Long. 68° N / Lat. 12° E on 17 and then lay as a cyclonic circulation over Uttarakhand & neighbourhood at 5.8 kms a.s.l. on 17 evening and became less marked on 21
2.	At 3.1 km a.s.l.	16	Along Long. 90° E to the north of Lat. 25° N	Stationary	<i>In situ</i>	Moved away east-northeastward on 17
3.	Do	19	Along Long. 88° E to the north of Lat. 25° N	Do	Do	Became less marked on 20
4.	Between 5.8 & 7.6 km a.s.l.	20-21	From northeast Bihar to southeast Arabian Sea across Jharkhand, Chhattisgarh, Rayalaseema, South interior Karnataka and north Kerala	Do	Nagaland to Lakshadweep area across Gangetic west Bengal, Chhattisgarh, Telangana, southern parts of coastal Karnataka	Became less marked on 22

TABLE 3 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
5.	At 5.8 km a.s.l.	23	Along Long. 70° E to the north of Lat. 32° N	Stationary	<i>In situ</i>	Moved away east-northeastward on 24
<i>(iii) As an induced cyclonic circulation</i>						
1.	Upto 1.5 km a.s.l.	1-4	Central Pakistan & adjoining west Rajasthan	East	North Rajasthan and neighbourhood	Became less marked on 5 (morning)
2.	Upto 0.9 km a.s.l.	23-26	North Pakistan and neighbourhood	Do	North Pakistan and adjoining west Rajasthan	Merged with the cyclonic circulation over north Pakistan and neighbourhood on 27
<b>(B) Other upper air cyclonic circulations</b>						
1.	Upto 0.9 km a.s.l.	1	Southeast Arabian Sea and adjoining Lakshadweep area	Stationary	<i>In situ</i>	Became less marked on 2
2.	Between 1.5 & 3.6 kms a.s.l.	1-2	Bangladesh and neighbourhood	Do	Do	Became less marked on 3
3.	At 0.9 km a.s.l.	5-6	Northeast Madhya Pradesh and neighbourhood	East	North Chhattisgarh and neighbourhood	Became less marked on 7
4.	Between 1.5 & 2.1 kms a.s.l.	6	South Assam and neighbourhood	Stationary	<i>In situ</i>	Became less marked on 7
5.	Upto 0.9 km a.s.l.	10	Haryana and neighbourhood	Do	Do	Became less marked on 11
6.	At 1.5 kms a.s.l.	10	Comorin area and neighbourhood	Do	Do	Became less marked on 11
7.	Do	10-11	Bangladesh and neighbourhood	Do	Do	Became less marked on 12
8.	Upto 3.1 kms a.s.l.	11-12	Equatorial Indian ocean and adjoining central parts of south Bay of Bengal	Do	Do	Became unimportant on 13
9.	Upto 1.5 kms a.s.l.	13-18	North Madhya Maharashtra and neighbourhood	Oscillatory	South Madhya Maharashtra and neighbourhood	Became less marked on 19
10.	Do	13-17	Southwest Rajasthan and neighbourhood	East	Southeast Rajasthan and neighbourhood	Became less marked on 18
11.	At 1.5 km a.s.l.	17-18	East Bangladesh and neighbourhood	West	Bangladesh and neighbourhood	Became less marked on 19
12.	At 3.1 km a.s.l.	18-19	Coastal Andhra Pradesh and neighbourhood	North	North coastal Andhra Pradesh and neighbourhood	Became less marked on 20
13.	Do	20	Sikkim and adjoining south Assam	Stationary	<i>In situ</i>	Became less marked on 21
14.	Between 3.1 & 3.6 km a.s.l.	20-22	Lakshadweep area and neighbourhood	Do	Southeast Arabian Sea and neighbourhood	Became less marked on 23
15.	At 5.8 km a.s.l.	22 Feb - 1 Mar	North Kerala and neighbourhood	Oscillatory	Equatorial Indian ocean and adjoining southwest Arabian Sea	Became unimportant on 2 March
16.	At 3.1 km a.s.l.	23	Northeast Bangladesh and neighbourhood.	Stationary	<i>In situ</i>	Became less marked on 24
17.	At 0.9 km a.s.l.	25	Madhya Maharashtra and neighbourhood	Do	Do	Became less marked on 26



TABLE 3 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
18.	At 1.5 km a.s.l.	25-26	Comorin area and neighbourhood	West	Lakshadweep-Maldives area	Became less marked on 27
19.	At 0.9 km a.s.l.	26 -28 Feb	Bangladesh	East	South Assam and neighbourhood	Became less marked on 1 March
20.	At 1.5 km a.s.l.	26-27	Southwest Bay of Bengal off Sri Lanka coast	Stationary	<i>In situ</i>	Became less marked on 28
<b>(C) Trough in easterlies</b>						
1.	Upto 0.9 km a.s.l.	5	Equatorial Indian ocean to southwest Bay of Bengal off Sri Lanka coast	Stationary	<i>In situ</i>	Became less marked on 6
2.	At 0.9 km a.s.l.	11-21	Central Kerala to Vidarbha across interior Karnataka and Marathwada	Oscillatory	From the cyclonic circulation over Lakshadweep area to north Maharashtra coast	Became less marked on 22
3.	Upto 1.5 kms a.s.l.	13-14	Equatorial Indian ocean to southwest Bay of Bengal	Do	Equatorial Indian ocean to central parts of south Bay of Bengal	Became less marked on 15
4.	At 0.9 km a.s.l.	18-19	Southwest Bay of Bengal off Sri Lanka coast	Do	From Southwest Bay of Bengal and adjoining Sri Lanka coast to north Tamil Nadu coast	Became less marked on 20
5.	At 1.5 km a.s.l.	20-21	Westcentral Bay of Bengal off north Tamil Nadu coast to south Odisha coast	Stationary	South Sri Lanka coast to Andhra Pradesh coast across north Tamil Nadu coast	Became less marked on 22
6.	At 0.9 km a.s.l.	23	Along Kerala-Karnataka coast	Do	<i>In situ</i>	Became less marked on 24
<b>(D) Other Troughs/ Wind Discontinuity</b>						
1.	At 0.9 km a.s.l.	5	From the cyclonic circulation over northeast Madhya Pradesh and neighbourhood to Vidarbha	Stationary	<i>In situ</i>	Became less marked on 6
2.	Between 3.1 & 5.8 km a.s.l.	6	Equatorial Indian ocean to southwest Bay of Bengal and adjoining Sri Lanka coast	Do	Do	Became unimportant on 7
3.	At 0.9 km a.s.l.	14-15	From the cyclonic circulation over northwest Rajasthan and neighbourhood to central Madhya Pradesh	East	From the cyclonic circulation over central parts of west Rajasthan and neighbourhood to central Madhya Pradesh	Became less marked on 16
4.	Do	27 Feb	From south Kerala to north interior Karnataka across south interior Karnataka	Stationary	<i>In situ</i>	It then lay as a cyclonic circulation over Kerala & neighbourhood on 28 February. Again lay as a trough ran from south Sri Lanka to north Kerala on 1 March and became less marked on 2 March

TABLE 4

## Some representative amounts of rainfall in cm for January and February 2021 (3 cm and above)

Date	Some representative amounts of rainfall in cm for October, November and December 2020 (3 cm and above)
1 Jan	Ambasamudram 8, Mandapam, Piravam, Manimutharu and Samayapuram 7 each, Coonoor 6, Budalur, Valinokam, Pamban, Viralmalai, Ponnamaravathi, K. Bridge, Manjalaru, Keeranur, Natham, Kadambur, Ponmalai, Rameswaram, Thenparanadu, Vathalai Anaicut and Kodumudi 5 each, Palavidithi, Alwaye PWD, Mangalapuram, Namakkal, Srimushnam, Ramanathapuram, Pelandurai, Thanjavur and Vallam 4 each, Sankarankoil, Kodaikanal, Thanjai Papanasam, Vembakottai, Nanguneri, Thenkasi, Srivilliputhur, Kariyapatti, Pullambadi, Kangeyam, Palladam, Kozha, Ettayapuram, Kayalpattinam, Tiruchendur, Mannargudi, Annavasal, Ayyampettai, Manapparai, Tirukattupalli, Valangaiman, Thogamalai, Tiruvaiyaru, Musiri, Aravakurichi, Thirumanur, Sendamangalam, Sivagiri, Surangudi, Paramakudi, Ayikudi, Sivaganga, Thuvakudi Imti, Kovilpatti, Sendurai, Kallakurichi, Panchapatti, Paramathivelur, Avalanche, Agaram Seegoor, Labbaikudikadu, Veppanthattai, Rajapalayam and Tiruchipalli AP 3 each
2 Jan	Nil
3 Jan	Tindivanam 5, Tondi, Tiruvarur, Kelambakkam, Safdarjung and Hindusthan University 3 each
4 Jan	Thalaignayer, Nadoti, Anantnag, Thiruthuraiipoondi and Mahwa 7 each, Shalimar Agro 6, Pipalda SR, Patan, Bijoliya SR, Nagar SR, Bamanwas SR, Malerainadunger SR, Sawai Madhopur, Kanth, Sikrai, Hassanpur, Qazi Gund, Banihal, Dharmasthala and Udhampur (IAF) 5 each, Tirupondi, Konibal, Khandar SR, Awantipur IAF, Batote, Adirampatnam, Parangipettai, Shimoga, Arantangi and Begu SR 4 each, Srinagar IAF, Kawa AWS, Badoda, Madurai South, Pahalgam, Srinagar, Tiruvadana, Peravurani, Tindivanam, Needamangalam, Pandavaiyar Head, Vedaranniyam, Muthupet, Thanjavur, Dwarhat, Navile AWS, Cheyyur, Betalghat, Kaman, Karauli, Nainwa, Mandana SR, Malhargarh, Kumher SR, Pahari SR, Sadabad, Vepur, Uniara/Aligarh, Neyyattinkara, Hathras, Vrindavan, Moradabad, K. M. Koil and Mukteshwar 3 each
5 Jan	Chennai (n), Udhampur (IAF), Maduranthagam and Hindusthan University 7 each, Kawa AWS, Kolapakkam ARG, Chennai AP, Kelambakkam, Sambhar SR, Narnaul, Neemkathana SR, Anna Uty ARG, Srimadhapur, Taramani ARG, Tambaram, Badarwah, Tindivanam, Banihal and Pushkar SR 5 each, Batote, Odanchatram, Jhunjhunu, Tellichery, Mavelikara, Pilani and Qazi Gund 4 each, Merta City, Pahalgam, Ennore AWS, Red Hills, Thamaraiappakkam, Konibal, Anantnag, Bahadurgarh, Chengannur, Ambathur, Loharu, Raj Pura ARG, Kiravatti, Haliyal, Pernem, Dujana, Irikkur, Narnaul REV, Cholavaram, Thirukalukundram, Manimutharu, Khetri, Chatha Agro AWS, Cheyyur, Kotputli, Sampla, Chirawa, Kosli, Jammu, Udaipur-wati, Ajmer, Nangal Chaudhary, Amet, Ateli, Sikar Tehsil SR, Kanina, Mahendragarh, Mahabalipuram, Sahlawas and Nawalgarh 3 each
6 Jan	Kelambakkam 21, Tambaram and Anna University 17 each, MGR Nagar 15, Sholinganallur 14, Taramani ARG, Poonamallee, Koratur, Chembarabakkam and Chennai AP 13 each, Perambur 12, Alandur, Poonamalle ARG, Ambathur and Sriperumbudur 11 each, Anna Uty ARG 10, Tiruvallur, Gummidipoondi, Chennai (n), Raj Pura ARG, Shalimar Agro and Banihal 9 each, Hindusthan University 8, Cholavaram, Thamaraiappakkam, Thodupuzha, Udhampur (IAF), Thirupporur, Tada, Satyavedu, Rajouri, Kalpa and Batote 7 each, Thiruvalangadu, Vaippar, Srinagar and Ponneri 6 each, Anantnag, Qazi Gund, Srinagar IAF, Kurudamannil, Pahalgam, Konni, Uthukottai, Konibal, Kawa AWS, Kothi, Thottambedu, Gulmarg R. S., Sullurpeta, Srikalahasti, Ghumarwin, Red Hills, Poondi, Chengalpattu, Srivaikuntam, Nancowry, Pondicherry, Manali, Mahabalipuram, Jammu, Thirukalukundram and Arakonam 5 each, Bakore, Dalhousi Alha AWS, Maduranthagam, Kupwara, Ennore AWS, Gudur, Kodur and Badarwah 4 each, Bandipora, Israna, Chengannur, Pachhad, Sangraha, Karnal REV, Gund, Nilokheri, Rohru, Karnal, Indri, Kanjirappally, Joshimath, Tiruthani, Sarahan, Wangtoo, Kotkhai, Venkatagiri, Gobichettipalayam, Tiruttani PTO, Vanur, Moradabad, Awantipur IAF, Nellore, Chatha Agro AWS, Jammu AP, Khadralla, Surangudi, Tirupati AP, Dhanauli, Chakrata, Bharari, Loharkhet, Samalkha, HMO Kasol, Seo Bagh and Coonoor 3 each
7 Jan	Vadakara 22, Vepur 19, Pelandurai 16, Sankarapuram and Kallakurichi 15 each, Kudulu, Mulki and Karipur Ap. 13 each, Srimushnam, Dharmasthala, Airport Peelamedu, Mudubidre, Udupi, Chitradurga and Poonamallee 11 each, Atlur, Coimbatore South, Kozha, Poonamalle ARG, Thiruvaidamaruthur, Piravam, Konni, Periyanaickenpalayam, Agaram Seegoor, Thammampatty, Rajapalayam, Quilandi, Angadipuram, Harur and Myladumpara ARG 9 each, Vridhachalam, Natham, Gudur, Bhuvanagiri, Vilupuram and Hassan PTO 8 each, Tindivanam, Rajampet, Punalur, Poondi, Pondicherry, Vadipatti, Pullampeta, Veeraganoor, Aravakurichi, Madurai South, Manjalaru, Nilakottai, Alur, Parangipettai, Mannarkkad, Sandur, Tarikere, Sethiyathope and Chembarabakkam 7 each, Tiruvarur, Dindigul, Ennore AWS, Mangaluru AP, Kurudamannil, Penagaluru, K.m.koil and Vanur 6 each, Chalakudi, Alathur, Kurinjipadi, Amini, Palakkad, Ulundurpet, Kozhikode, Venkatagiri, Nedungal, Udumalpet, Marakkanam, Alandur, Ammundi, Keelpennathur, Tiruvallur, Vallur, Mulanur, Pochampalli, Owk, Hosdurg, Utukuru AP, Rapur, Ambalavayal, Attur, Manalmedu, Kumbakonam, Pappireddipatti, Kushalnagar, Belthangadi, Penucondapuram, Tiruvannamalai, K. Paramathi, Anavatti, Magadi, Cuddalore, Kota, Vellanikkara, Chennai AP, Mani, Karkala, Taramani ARG, Harangi, Sendurai, Cuddapah, Uthangarai and Chidambaram 5 each, Valangaiman, Yercaud, Needamangalam, Aduthurai AWS, Suler, Koratur, Kochi C.I.A.L., Talassery, Pollachi, Kamalapuram, Kodumudi, Tirukoilur, Vinjamur, Chittar, Nilambur, Nagari, Kottayam, Kodungallur, Kuppady and Sholavandan 4 each, Kodur, Simhadripuram, Jayapura, Hosapete, Arogyavaram, Tiruchengode, Rolla, Satyavedu, Hirekerur, Munirabad ARG, Kollur, Coonoor, Mannargudi, Varkala, Anna Uty ARG, Ottapalam, Panambur, Subramanya, Banavasi, Koilkuntla, Anna University, Peermade To, Shoolagiri, Kannur, Alwaye PWD, Srinagar Agro AWS, Virinjipuram AWS, Kammardi, Tambaram, Harihar, Thirukoilur ARG, Sivagiri, Viraganur Dam, Tallakulam, Hosur, Denkanikottai, Palavidithi, Suralacode, Sriperumbudur, Damaragidda, Maheswaram, G Bazar, Vedasandur, Agathi, Palacode, Coonoor PTO, Vellore, Odanchatram, Gudiyatham, Ernakulam South, Thirupporur, Mayiladuthurai, Naduvattam, Karaikal, Kanakapura, Ponnai Dam, Katpadi, Thenparanadu, Thandarappettai, Polur, Hindusthan University, Thiruvalangadu, Nagamangala, Mysuru PTO, Bhadravathi, Upper Bhavani, Palladam, Ambathur, Gingee, Kangeyam, Madukkur, Chengam, Kelambakkam, Pallipattu, Kaveripakkam, Kamudhi and Agumbe 3 each
8 Jan	Agumbe 11, Piravam 9, Sringeri HMS and Aluma PWD 7 each, Pulipatti and Chalakudi 6 each, Perumpavur, Kanjirappally, Sakri, Chittampatti and Kurudamannil 5 each, Pilavakkal, Dharmasthala, Mudigere and Devala 4 each, Coonoor, Ponnani, Madurai AP,

TABLE 4 (Contd.)

Date	Some representative amounts of rainfall in cm for October, November and December 2019 (7 cm and above)
	Irinjalakuda, Hosdurg, Honavar, Minicoy, Vaikom, Dangs (ahwa), Singanamala, Pamidi, Kozha, Sholavandan, Melur, Valparai PTO, Thodupuzha, Cheyyur, Coonoor PTO, Vadipatti, Natham, Sivagiri, Vitla ARG, Belthangadi and Adirampatnam 3 each
9 Jan	Savanur 14, Subramanya 10, Harihar 9, Konni, Kurudamannil, Haveri PTO, Davanagere and Suralacode 7 each, Punalur, Coonoor PTO, Peravurani, Pattukottai, Shikaripur, Perunchani Dam, Vaikom, Cherthala, Vilathikulam, Kozha, Akole, Ranebennur HOS, Haveri Apmc, Shirahatti, Chalakudi and Coonoor 5 each, Piravam, Waghai, Kayamkulam ARG, Kochi IAF, Pechiparai, Yagati, Ernakulam South, Vallam and Manantoddy 4 each, Pune, Kodaikanal, Manjeri, Thritla, Chengannur, Nannilam, Chittar, Orthanad, Balehonnur, Vansda, Mahabaleshwar, Kerur, Bellatti, Pudukottai, Hirekerur, Shiggaon, Karaikal, Madukkur, Davanagere PTO, Perungalur, Dangs (ahwa), Alangudi, Karambakudi, Kamudhi, Adirampatnam, Ayyampettai and Agumbe 3 each
10 Jan	Mimisal and Tiruvadana 7 each, Tondi, Satankulam, Vattanam and Manimutharu 5 each, Airport Peelamedu 4, Umerpada, Kovilpatti AWS, Ambasamudram, Adirampatnam, Thanjai Papanasam, Palayamkottai, Kozha and Vedaranniyam 3 each
11 Jan	Bhuvanagiri 11, Parangipettai 9, Ramanathapuram 7, Mayiladuthurai, Muthupet, Sirkali, K.m.koil, Pamban and Rameswaram 5 each, Surangudi, Ayyampettai, Tuticorin, Mandapam and Arantangi 4 each, Thiruthuraiipoondi, Kayalpattinam, Valinokam, Kulasekarapattinam, Tiruvadana, Kumbakonam, Avudayarkoil, Manalmedu, Chidambaram, Srivaikuntam, Long Island, Pandavaiyar Head, Sethiyathope and Mancompu 3 each
12 Jan	Vedaranniyam 18, Peravurani and Thalaigayyer 15 each, Adirampatnam 14, Tirupoondi 12, Muthupet and Pattukottai 11 each, Tiruvarur, Nagapattinam, Mannargudi, Thiruthuraiipoondi, Madukkur and Kumbakonam 9 each, Manjalaru and Nannilam 8 each, Mimisal, Thanjavur, Pandavaiyar Head, Ayyampettai, Mayiladuthurai, Karaikal, Valangaiman, Arantangi and Needamangalam 7 each, Avudayarkoil 6, Vallam, Tondi, Thanjai Papanasam, Vattanam, Thanjavur PTO, Budalur, Minicoy, Tiruvaiyaru, Karaikudi, Sirkali, Pamban, Rameswaram, Karambakudi, Alangudi, Manalmedu, K. M. Koil and Chidambaram 5 each, Amaravathy Dam, Mandapam, Devakottai and Manimutharu 4 each, Parangipettai, Surangudi, Ambasamudram, Keeranur, Perungalur, Bhuvanagiri, Sendurai, Tiruvadana, Thiruvaidaimaruthur, Orthanad, Aravakurichi and Thirumanur 3 each
13 Jan	Parangipettai 29, Sethiyathope 21, Bhuvanagiri 20, Srimushnam 19, Manimutharu 17, Chidambaram 16, Pelandurai 15, Kurinjipadi and Beki Mathungari 13 each, Sirkali 12, Thiruvaidaimaruthur 11, Vepur, Vridhachalam and Ambasamudram 10 each, Ayyampettai, Manalmedu, Nagapattinam, Labbaikudikadu, Agaram Seegoor, Manjalaru, Sendurai, Mayiladuthurai and Kumbakonam 9 each, Nannilam, Peravurani and Thekkadi 8 each, Budalur, Arantangi, Mannargudi, K. M. Koil, Valangaiman, Cheranmahadevi, Alangudi, Karaikal, Vattanam and Ramanathapuram 7 each, Tondi, Minicoy and Thanjavur 6 each, Avudayarkoil, Kodaikanal, Myladumpara ARG, Pullambadi, Needamangalam, Tiruvadana, Vallam, Ponnamaravathi, Muthupet, Eraiyur, Amaravathy Dam, Veppanthattai, Perambalur, Karaikudi, Vedaranniyam, Thirumanur, Pandavaiyar Head, Tiruvarur, Rameswaram, Tiruvaiyaru, Pattukottai, Tiruchengode, Pudukottai, Nagercoil, Chettikulam, Tirupathur, Satankulam, Padalur and Tirukattupalli 5 each, Grand Anaicut, Natham, Tirupoondi, Thanjavur PTO, Thenparanadu, Hazuah, Sivaganga and Veeraganoor 4 each, Radhapuram, Tiruchipalli AP, Mudukulatur, Ponmalai, Nanguneri, Samayapuram, Thiruthuraiipoondi, Kadambur, Vaippar, Marungapuri, Lalgudi, Palayamkottai, Palavidi, Thanjai Papanasam, Mimisal, Vedasandur, Odanchatram, Thuvakudi Imti, Dindigul, Perungalur, Manapparai, Annavasal, Keeranur, Karambakudi, Illuppur, Viralimalai, Devakottai, Kamudhi, Mandapam, Srivaikuntam, Paramakudi, Valinokam, Illayangudi, Surangudi, Manamadurai, Adirampatnam, Madukkur and Thalaigayyer 3 each
14 Jan	Manimutharu 17, Tuticorin 11, Ambasamudram 9, Thenkasi, Thekkadi, Pilavakkal, Thiruvaidaimaruthur, Valinokam, Ottapadiram and Kodaikanal 7 each, Myladumpara ARG, Watrap and Alangudi 6 each, Kamudhi, Veerapandi, Sankarankoil, Shencottah, Mudukulatur, Kadambur, Cheranmahadevi, Palayamkottai, Kallikudi, Kayathar, Vaippar, Kariyapatti, Srivilliputhur, Aryankavu, Thiruvananthapuram, Coonoor, Peraiyur, Pamban, Rameswaram, Sivagiri, Surangudi, Coonoor PTO and Maniyachi 5 each, Virudhunagar, Aruppukottai, Ayyampettai, Devakottai, Sattur, Vembakottai, Pudukottai, Thanjai Papanasam, Kayalpattinam, Annavasal, Vedasandur, Paramakudi, Tirumangalam and Uttamapalayam 4 each, Kovilankulam, Kulasekarapattinam, Tiruchendur, Melur, Kanyakumari, Marungapuri, Thenparanadu, Pattukottai, Sivakasi, Nedumangad, Radhapuram, Thiruchuzhi, Satankulam, Srivaikuntam, Nanguneri, Ramanathapuram, Chittampatti, Kovilpatti, Avalanche, K Bridge, Karambakudi, Illuppur, Viralimalai, Padalur, Mylaudy, Perungalur, Bodinaickanur, Illayangudi, Manamadurai, Budalur, Madukkur, Kadavur, Bodinayakanur ARG, Ayikudi, Periyar, Manapparai, Keeranur and Madurai AP 3 each
15 Jan	Nagapattinam and Ramanathapuram 9 each, Thiruthuraiipoondi, Madukkur, Mandapam, Rameswaram, Mannargudi and Manimutharu 7 each, Thalaigayyer 6, Cheranmahadevi, Muthupet, Tirupoondi, Thanjavur PTO, Needamangalam, Ambasamudram, Pattukottai, Srivaikuntam, Karaikal, Kayalpattinam, Pandavaiyar Head, Tuticorin and Tiruvarur 5 each, Adirampatnam, Pamban, Coonoor PTO, Tiruchendur, Satankulam and Coonoor 4 each, Kulasekarapattinam, Sattur, Vembakottai, Ettayapuram, Kodaikanal, Tiruchi.palli AP, Nannilam, Kothagiri, Orthanad, Viralimalai, Ketti, Avalanche, Manapparai, Peravurani, Tiruvaiyaru, Valangaiman, Maniyachi and Vedaranniyam 3 each
16 Jan	Thoothukudi Har 30, Agathi 5, Tirukattupalli, Valangaiman, Pandavaiyar Head, Ayyampettai, Manjalaru and Vedaranniyam 3 each
17 Jan	Kollur and Agathi 5 each, Dharmasthala and Hosanagar 3 each
18 Jan	Hut Bay 5
19 Jan	Nil
20 Jan	Beki Mathungari 4, Bhalukpong 3
21 Jan	Kabi, Kamalpur and Gandecherra 3 each
22 Jan	Nil
23 Jan	Vaikom 5, Cherthala 4, Gulmarg R. S. 3

TABLE 4 (Contd.)

Date	Some representative amounts of rainfall in cm for October, November and December 2019 (7 cm and above)
24 Jan	Dehra Gopipur 5, Bharmaur, Kangra AP, Konibal, Batote, Pahalgam, PTO Gondla, Banihal and Gulmarg 3 each
25 Jan	Nil
26 Jan	Nil
27 Jan	Nil
28 Jan	Nil
29 Jan	Nil
30 Jan	Sompeta 3
31 Jan	Nil
1 Feb	Nil
2 Feb	Nil
3 Feb	Mandapam 3
4 Feb	Nancowry 3
5 Feb	Kandaghat and Kufri AWS 7 each, Bani, HMO Shillaro, Khadralla, Rohru, Dharampur, Solan and Simla 5 each, Iglas, Rampur Bushar and Mussoorie 3 each
6 Feb	Nil
7 Feb	Nil
8 Feb	Port Blair 7
9 Feb	Nil
10 Feb	Nil
11 Feb	Nil
12 Feb	Nancowry 5
13 Feb	Nil
14 Feb	Nil
15 Feb	Nil
16 Feb	Hut Bay 7
17 Feb	Baihar and Keolari 5 each, Karanjia and Mandla-aws 4 each, Kartala, Kabi, Tangarpali, Champua, Lakhampur, Khadgava, Poudi Uparora, Thankhamariya, Marwahi, Tamia, Kolebira, Budhar, Nainpur, Bajag, Jabera and Pendra Road 3 each
18 Feb	Panhala 9
19 Feb	Agati and Matheran 7 each, Chitradurga 6, Parkal 5, Amalner, Hiriya HMS and Kondagaon 4 each, Lamataput, Bailhongal, Daringibadi, Baderajpur, Hosadurga, Dharangaon, Ambejogai/Mominabad, Kaij, Parli Vajinath, Bhum, Govindaraopet and Sardarpur 3 each
20 Feb	Kothagiri 9, Ongole and Coonoor PTO 7 each, Bhuvanagiri, Madanapalle, Tellichery, Amarapuram, Arogyavaram and Udayagiri 5 each, Thandarampettai and Kiravatti 4 each, Marripudi, Seetharamapuram, Sullurpeta, Gurrankonda, Kalakada, Royachoti, Bhimarayanagudi ARG, Chamarajanagar, Coonoor, Agumbe and Kolar G.F. 3 each
21 Feb	Cuddalore and Pondicherry 19 each, Manimutharu and Kurinjipadi 11 each, Papanasam 8, Bhuvanagiri, Parangipettai and Cheranmahadevi 7 each, Coonoor PTO 6, Vanur, Marakkanam, Uthukuli and Shoolagiri 5 each, Sankaridurg, Ambasamudram and Palani 4 each, Kothagiri, Kollidam, Coonoor, Mettur, Vilathikulam, Cheyyur, Mettupalayam, Tirupuvanam, Devanahalli, Bhavanisagar, Kadiri AP, Kadiri, Ongole, Panruti, K. M. Koil, Srimushnam and Adiramapatnam 3 each
22 Feb	Cuddalore 11, Kadur and Sivagiri 7 each, Hassan PTO, Vanur, Parangipettai, Polur and Pondicherry 5 each, Harangi, Karaikal, Sirkali and Subramanya 4 each, Jayapura, Ajjampura, Belur, Alur, Shivani, Aspari, Gowribidanur, Holagunda, Ramagiri, Pamidi, Gingee, Tiruttani PTO, Udumalpet, Kothagiri, Mayiladuthurai, Mettupalayam and Tiruthani 3 each
23 Feb	Bukkapatna 11, Coonoor PTO and Coonoor 6 each, Tiptur and Lingadahalli 5 each, Tarikere 4, Balehonnur, Bellur and Sorab 3 each
24 Feb	Nil
25 Feb	Nil
26 Feb	Myladumpara ARG and Hasimara 3 each
27 Feb	Kupwara and Banihal 5 each, Kukernag, Bandipora and Raj Pura ARG 3 each
28 Feb	Nandigama 33, Kulgam AWS 4, Gulmarg R.S., Raj Pura ARG, Gangtok and Singhik 3 each

Severe cold waves were observed in the last few days of January and in the beginning of February at isolated places from 1 to 3 days over Bihar, Uttar Pradesh, Uttarakhand, Rajasthan, west Madhya Pradesh, Haryana, Chandigarh, Delhi and Saurashtra & Kutch sub-divisions.

*Severe cold wave to cold wave* conditions were observed from the second fortnight of the month for one to three days over east and northeast India, about five to six days over central India, viz., Saurashtra, Kutch and Madhya Pradesh. Maximum frequency of cold waves, i.e., seven to ten days were observed over Punjab, Rajasthan and Uttar Pradesh in this month.

### 3.1.5. Damages associated with Disastrous weather events

As per media reports, incessant snowfall in Jammu-Kashmir and Ladakh valley cut it off from the rest of the country, taking toll of 2 people and caused damage to 100 houses, stranding about 4500 vehicles on Srinagar-Jammu National highway and disrupting air traffic at Srinagar airport for a few days in the first fortnight of the month. Cold wave in the beginning of January caused death of 3 farmers in Delhi. Untimely heavy rainfall in Pune district of Maharashtra caused damage worth crores of rupees to *rabi* crops, viz., onion, jowar, wheat, gram, mango blossom, grapes, pomegranate and cotton. Incessant rains caused extensive damage to 20,000 acres of grapes estimated to cost around 1000 crores in Nasik district of Maharashtra

## 3.2. February

### 3.2.1. Storms and depressions

No intense system formed over the Indian Seas during the month.

### 3.2.2. Other synoptic features and associated weather

As given in Table 3, 11 western disturbances (including 4 upper air cyclonic circulations, 5 troughs in westerlies and 2 induced systems), 20 upper air cyclonic circulations, 6 troughs in the easterlies and 4 other troughs/wind discontinuities formed which affected the weather over the country during the month of February.

### 3.2.3. Monthly rainfall

Rainfall over the country during the month was below normal over all the regions and the country except south peninsular region where it was above normal (128% of LPA). Within this region too the rainfall was above

normal over Rayalaseema, State of Karnataka and the islands while over Telangana, Coastal Andhra Pradesh, Kerala & Mahe, the precipitation was either *deficient* or *large deficient*. Rainfall over the homogenous regions of east, northeast India (-88% of LPA) and northwest India (-77% of LPA) were *large deficient* while central Indian region was *deficient* with monthly rainfall departure of -34% of LPA.

High index phase in mid latitude circulation resulted in the more poleward confinement of eastward moving systems which resulted in below normal rainfall activity over northwest India. Movement of the trough in easterlies and enhanced moisture supply from Bay of Bengal caused isolated hailstorms over parts of west, central and south peninsular India during the last week of the month. With the passage of these systems, isolated heavy rainfall was also observed over parts of south peninsular India, Lakshadweep islands and interior Maharashtra.

During this month, out of 36 meteorological sub-divisions, 9 sub-divisions received *large excess* rainfall (6 from south Peninsula and 3 from central India), 2 *normal*, 5 *deficient* and 18 *large deficient* rainfall, while no rain in 2 sub-divisions, similar to last year this year too. No sub-division received *excess rainfall*. Table 1 shows the sub-division wise rainfall statistics (mm) for February 2021.

### 3.2.4. Temperature

The maximum temperatures were above normal over north and central India in accordance with the subdued rainfall activity there, raising the day temperatures while below normal over southern peninsular region.

The minimum temperatures were above normal over northwest India, northeast India and some parts of central India, while they were below normal over Odisha, Chhattisgarh, some parts of Andhra Pradesh and Karnataka.

Some stations recorded highest maximum temperature for the month. A list of such stations is given below with their previous records and date.

Station name	Previous Record (°C)	Date	New Record (°C)	Date
North Lakhimpur	31.8	13/2/1999	31.8*	23
Sambalpur	37.8	28/2/2009	38.5	28
Deharadun	31.2	25/2/2006	31.8	26
Thanjavur	33.3	27/2/1956	33.3*	26
Pilani	35.1	29/2/2008	35.1*	26

\*Extremes occurred more than once

Source : IMD Climate diagnostics bulletin of India, February 2021

The lowest minimum temperature over the plains of the country was 3.0 °C reported at Umaria (east Madhya Pradesh) and Sikar (east Rajasthan) on 1<sup>st</sup> and 7<sup>th</sup> February respectively.

*Severe cold wave* and *cold wave* conditions were observed for one or three days each, in isolated parts of sub Himalayan West Bengal, Sikkim, Gangetic West Bengal, Bihar, east Uttar Pradesh, east Madhya Pradesh, Punjab and Odisha.

### 3.2.5. Damages associated with disastrous weather events and damage

According to media reports, the flight operations at Srinagar airport were disrupted due to accumulation of snow on the runway and poor visibility at the start of the month. Disaster struck Uttarakhand's Chamoli district on February 7, 2021 in the form of an avalanche and deluge, after a portion of the Nandadevi glacier broke off at Joshimath. This event triggered flash flood in Dhauliganga that took toll of atleast 200 people. Two power projects, viz., NTPC's Tapovan-Vishnugad hydel project and the Rishi Ganga Hydel Project were extensively damaged with scores of labourers trapped in tunnels as the water came rushing in. It also caused heavy damage to 13 villages on the bank of Alaknanda river. Thunderstorms and its associated showers in the second fortnight of February caused heavy damage to standing *rabi* crops, viz., wheat, jowar, maize etc. and also to fruit crops, viz., grapes, mangoes in Satara, Sangli, Solapur, Kolhapur and Sindhudurg districts of Maharashtra. Lightning took toll of 4 persons in Buldhana and Nanded districts of the state.

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## Appendix

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

#### (A) Rainfall

(i) Percentage departure from normal	
<i>Large excess</i>	: + 60% or more
<i>Excess</i>	: +20% to +59%
<i>Normal</i>	: -19% to +19%
<i>Deficient</i>	: -20% to -59%
<i>Large deficient</i>	: -60% to -99%
<i>No Rain</i>	: -100%

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

<i>Heavy rainfall</i>	: 6.5 cm to 11.5 cm
<i>Very heavy rainfall</i>	: 11.6 cm to 20.4 cm
<i>Extremely heavy rainfall</i>	: 20.5 cm and above
<i>Heavy snowfall</i>	: 64.5 cm to 115.5 cm

#### (B) Temperatures

Cold Wave is considered when minimum temperature of a station is 10 °C or less for plains and 0 °C or less for Hilly regions

(a) *Based on Departure*

<i>Cold wave</i>	: Negative Departure from normal is 4.5 °C to 6.4 °C
<i>Severe Cold Wave</i>	: Negative Departure from normal is more than 6.4 °C

Based on Actual Minimum temperature (for plain stations only)

<i>Cold wave</i>	: When minimum temperature is $\leq 04$ °C
<i>Severe Cold Wave</i>	: When minimum temperature is $\leq 02$ °C

(b) *Cold Day*

It should be considered when minimum temperature is 10 °C or less for plains and 0 °C or less for Hilly regions

<i>Cold wave</i>	: Maximum temperature Departure is -4.5 °C to -6.4 °C
<i>Severe Cold Wave</i>	: Maximum temperature Departure is $< -6.4$ °C
<i>Markedly below normal</i>	: departure of minimum temperature from normal is from -5 °C or less
<i>Appreciably below normal</i>	: departure of minimum temperature from normal is from -3.1 °C to -5 °C
<i>Below normal</i>	: departure from normal is -1.6 °C to -3.0 °C
<i>Normal</i>	: departure from normal is -1.5 °C to +1.5 °C
<i>Above Normal</i>	: departure of minimum temperature from normal is +1.6 °C to 3.0 °C

<i>Appreciably above normal</i>	: departure of the minimum temperature from normal is from +3.1 °C to +5.0 °C
<i>Markedly above normal</i>	: departure of the minimum temperature from normal is +5 °C or more

(C) *Fog*

<i>Dense Fog</i>	: When the visibility is between 50-200 m
<i>Very Dense Fog</i>	: When the visibility is $< 50$ m