

Weather in India

MONSOON SEASON (June to September 2010)†

1. Characteristic features of southwest Monsoon 2010

1.1. The seasonal rainfall (during June to September 2010) over the country as a whole was 102% of its Long Period Average (LPA).

1.2. The seasonal rainfall was 112% of its LPA over Northwest India, 104% of its LPA over Central India, 118% of its LPA over South peninsula and 82% of its LPA over Northeast India.

1.3. Out of 597 meteorological districts, 173 districts (29%) received *excess**, 240 districts (40%) *normal*, 173 districts (29%) received *deficient* and the remaining 11 districts (2%) received *scanty* rainfall during the season.

1.4. For the country as a whole, the rainfall was 84% of LPA in June, 103% of LPA in July, 105% of LPA in August and 112% of LPA in September.

1.5. The entire Monsoon season was devoid of any Monsoon depression. Thus, 2010 has been the only year in the recorded history after 2002, to have no depression during the entire season.

1.6. Typical break condition did not occur all through the season. However, there had been subdued phases during July & August.

1.7. The El-Nino neutral conditions changed over to La-Nina conditions during the first half of the season and persisted all through.

1.8. Weak negative Indian Ocean Dipole pattern was present over the equatorial Indian Ocean during the season.

1.9. The MJO signal, as per the CPC / NOAA analysis, remained weak/incoherent nearly all through the season. The active convective phase in association with MJO was reported only during 3-10 May, 12-26 July and subsequently during 4-18 October.

1.10. There was noticeable delay in the withdrawal of southwest monsoon.

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

2. Various aspects of southwest monsoon - 2010

2.1. Advance of southwest monsoon

The progress of Monsoon over the country is given chronologically in Table 1 and Fig. 1.

The southwest Monsoon set in over the Andaman Sea on 17th May, 3 days prior to normal date in association with a Severe Cyclonic Storm (Laila, 16th - 21st May 2010) over the Bay of Bengal. The southwest Monsoon further advanced over parts of Comorin area and some more parts of the Bay of Bengal on 21st May and thereafter there was a hiatus in the Monsoon advance lasting for more than a week. However, Monsoon set in over Kerala on 31st May, just one day before its normal onset date (1st June). The advance of Monsoon over northeastern parts of the country was earlier than the respective normal date. But Monsoon advance over most parts of Bihar and Jharkhand, interior Orissa and Chhattisgarh was delayed by 2-3 weeks than the respective normal.

Subsequent to the onset over Kerala, the northwestward movement of the Very Severe Cyclonic Storm (Phet, 31st May - 7th June), over the Arabian Sea, away from the coast, which initially in its formative stage had served as the onset vortex, delayed further advancement of the Monsoon along the west coast by about one week. Around 6th June, Monsoon got activated and by middle of June, it covered nearly half of the country. A prolonged hiatus occurred in the further advance till 30th June, due to weakening of Monsoon current and prevalence of non-conducive conditions for the formation of low pressure systems over the Bay of Bengal. As a result, over most parts of central and north India including Madhya Pradesh and Uttar Pradesh, Monsoon advance was delayed by 2-3 weeks and 1-2 weeks respectively. Severe heat wave/heat wave conditions prevailed over many parts of north, northwest and central India during this period.

Associated with the formation of a low pressure area over the north Bay of Bengal and neighbourhood on 2nd July and its subsequent west-northwestward movement, the Monsoon current advanced over most parts of the country, outside parts of west Rajasthan by 5th July itself. The southwest Monsoon covered the entire country by 6th July, about 9 days earlier than its normal date of 15th July.

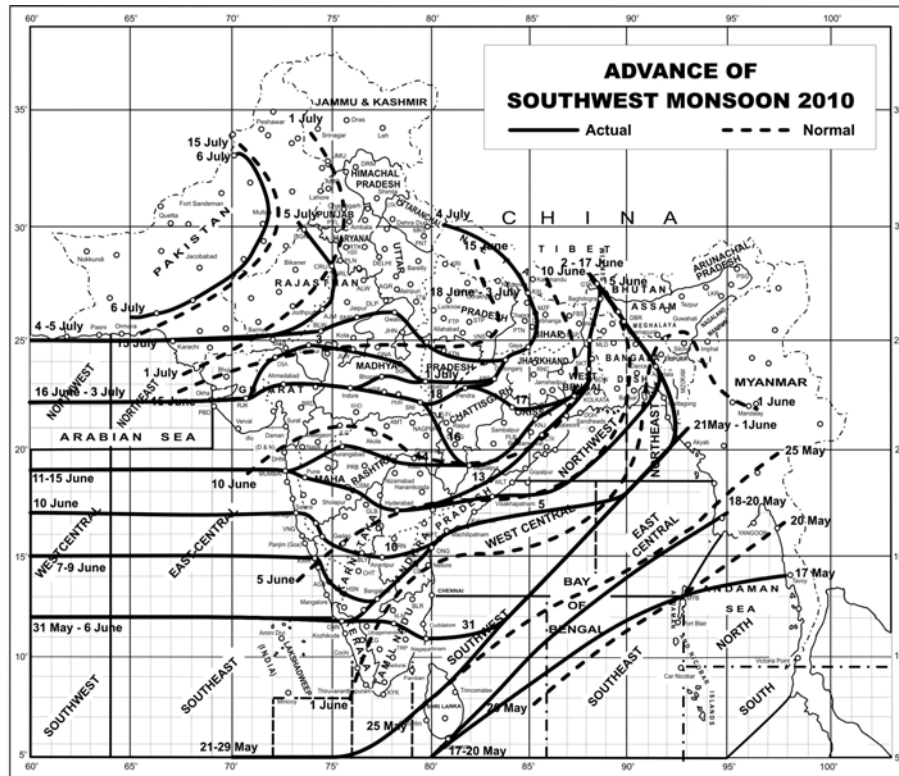


Fig. 1. Advance of southwest monsoon 2010

2.2. Weekly rainfall distribution

Meteorological sub-divisionwise week by week and cumulative weekly rainfall departures (percentage departure from normal) during the southwest monsoon season from 1 June 2010 to 30 September 2010 comprising of 19 weeks are given in Figs. 2 (a&b).

2.2.1. Week by week rainfall

It is seen from Fig. 2(a) that the met. sub-divisions in the central and northern parts received *scanty/deficient* rainfall due to the delayed advance, in most of the weeks during June. Peninsular India received *normal/excess* rainfall during the second fortnight of June. *Excess/normal* rainfall occurred over major parts of the country outside northeast India during the 1st, 3rd and 4th weeks of July. The above normal rainfall was in general well distributed all through the remaining period except during the weeks ending on 11th August and 1st September.

2.2.2. Weekly cumulative rainfall distribution

Meteorological sub-division wise cumulative rainfall departures (percentage departure from normal) during the

season from 1 June to 30 September, comprising of 18 weeks are given in Fig. 2 (b). It may be noted from Fig. 2(b) that Jharkhand and east Uttar Pradesh were the only two sub-divisions which remained deficient all through the season. The other sub-divisions dominated by *deficient* periods were Assam & Meghalaya, Gangetic West Bengal and Bihar. The sub-divisions, Nagaland-Manipur-Mizoram-Tripura, Sub-Himalayan West Bengal & Sikkim, Punjab, Himachal Pradesh, Jammu & Kashmir, west Rajasthan, Saurashtra & Kutch, Rayalaseema and south interior Karnataka remained either *excess/normal* all through the season, while Tamil Nadu remained *excess* during the entire period.

2.3. Monthly rainfall distribution

Figs. 3 - 6 show monthwise distribution of monsoon rainfall. Sub-divisionwise rainfall figures and departures for each month and season as a whole are given in Table 2.

The monthly monsoon rainfall for the country as a whole during June [84% of Long Period Average (LPA)] was below the LPA. However, the rainfall during July (103% of LPA), August (105%) and September (112%)

TABLE 1

Advance of the Southwest Monsoon 2010

S.No.	Date	Southwest monsoon advanced over	Northern limit of monsoon passed through
1.	17 th May	Parts of southwest and southeast Bay of Bengal, parts of Andaman & Nicobar Islands and most parts of Andaman sea	Lat. 5° N / Long. 80° E, Lat. 10° N / Long. 87° E, Maya Bandar and Lat. 14° N / Long. 98° E
2.	18 th May	Some more parts of southwest Bay of Bengal, most parts of southeast Bay of Bengal, some parts of eastcentral Bay of Bengal, entire Andaman & Nicobar Islands and remaining parts of Andaman Sea	Lat. 5° N / Long. 80° E, Lat. 8° N / Long. 83° E, Lat. 10° N / Long. 85° E, Lat. 14° N / Long. 90° E and Lat. 17° N / Long. 95° E
3.	21 st May	Some parts of Comorin area, some more parts of southwest Bay of Bengal, remaining parts of southeast Bay of Bengal, some parts of westcentral Bay of Bengal, most parts of eastcentral Bay of Bengal and some parts of northeast Bay of Bengal	Lat. 5° N / Long. 70° E, Lat. 5° N / Long. 75° E, Lat. 8° N / Long. 80° E, Lat. 12° N / Long. 84° E, Lat. 15° N / Long. 87° E, Lat. 18° N / Long. 90° E and Lat. 21° N / Long. 93° E
Hiatus during 22nd - 30th May			
4.	31 st May	The southwest monsoon set in over Kerala. It advanced into entire south Arabian Sea, most parts of Kerala, some parts of Tamil Nadu and some more parts of southwest Bay of Bengal	Lat. 12° N / Long. 60° E, Lat. 12° N / Long. 70° E, Kannur, Salem, Nagapattinam, Lat. 12° N / Long. 84° E, Lat. 15° N / Long. 87° E, Lat. 18° N / Long. 90° E and Lat. 21° N / Long. 93° E
5.	2 nd June	Entire Arunachal Pradesh, Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura and some parts of Sub Himalayan west Bengal & Sikkim	Lat. 12° N / Long. 60° E, Lat. 12° N / Long. 70° E, Kannur, Salem, Nagapattinam, Lat. 12° N / Long. 84° E, Lat. 15° N / Long. 87° E, Lat. 18° N / Long. 90° E, Lat. 20° N / Long. 92° E, Agartala, Dhubri and Gangtok
6.	5 th June	Some more parts of south interior Karnataka, entire Tamil Nadu, some parts of Rayalaseema and coastal Andhra Pradesh, entire southwest Bay of Bengal and most parts of west and east central Bay of Bengal	Lat. 12° N / Long. 60° E, Lat. 12° N / Long. 70° E, Kannur, Bangalore, Cuddapah, Bapatla, Lat. 17° N / Long. 85° E, Lat. 20° N / Long. 92° E, Agartala, Dhubri and Gangtok
7.	7 th June	Some parts of central Arabian Sea, most parts of coastal Karnataka and some more parts of south interior Karnataka	Lat. 15° N / Long. 60° E, Lat. 15° N / Long. 70° E, Karwar, Agumbe, Hassan, Bangalore, Cuddapah, Bapatla, Lat. 17° N / Long. 85° E, Lat. 18° N / Long. 90° E, Lat. 20° N / Long. 92° E, Agartala, Dhubri and Gangtok
8.	10 th June	Some more parts of central Arabian Sea, southern parts of Konkan & Goa and Madhya Maharashtra, some parts of north interior Karnataka, most parts of south interior Karnataka and some more parts of Rayalaseema and coastal Andhra Pradesh	Lat. 17° N / Long. 60° E, Lat. 17° N / Long. 70° E, Ratnagiri, Sangli, Bijapur, Anantpur, Bapatla, Lat. 17° N / Long. 85° E, Lat. 18° N / Long. 90° E, Lat. 20° N / Long. 92° E, Agartala, Dhubri and Gangtok
9.	11 th June	Some more parts of central Arabian Sea, most parts of Konkan (including Mumbai), some more parts of Madhya Maharashtra (including Pune), some parts of Marathwada, most parts of Karnataka, remaining parts of Rayalaseema, some parts of Telangana, some more parts of coastal Andhra Pradesh, most parts of west central Bay of Bengal and some more parts of north Bay of Bengal	Lat. 19° N / Long. 60° E, Lat. 19° N / Long. 70° E, Mumbai, Pune, Osmanabad, Hyderabad, Visakhapatnam, Lat. 18° N / Long. 86° E, Lat. 21° N / Long. 90° E, Agartala, Dhubri and Gangtok
10.	13 th June	Most parts of coastal Andhra Pradesh, remaining parts of north Bay of Bengal, most parts of coastal Orissa, some parts of Gangetic west Bengal and some more parts of Sikkim	Lat. 19° N / Long. 60° E, Lat. 19° N / Long. 70° E, Mumbai, Pune, Osmanabad, Hyderabad, Waltair, Cuttack, Burdwan, Malda and Gangtok
11.	14 th June	Some more parts of Konkan, Madhya Maharashtra, most parts of Marathwada, southern most parts of Vidarbha, remaining parts of Karnataka and Andhra Pradesh, southern parts of Chattisgarh and some more parts of Orissa and Gangetic west Bengal	Lat. 19° N / Long. 60° E, Lat. 19° N / Long. 70° E, Mumbai, Aurangabad, Adilabad, Jagdalpur, Phulbani, Keonjhar, Burdwan, Malda and Gangtok
12.	16 th June	Remaining parts of central Arabian Sea, some parts of north Arabian Sea, southern parts of Gujarat state, remaining parts of Maharashtra, southern parts of Madhya Pradesh and some more parts of Chattisgarh	Lat. 22° N / Long. 60° E, Lat. 22° N / Long. 69° E, Rajkot, Ahmedabad, Indore, Seoni, Jagdalpur, Phulbani, Keonjhar, Bardwan, Malda and Gangtok
13.	17 th June	Some more parts of east Madhya Pradesh and Chattisgarh and most parts of Orissa	Lat. 22° N / Long. 60° E, Lat. 22° N / Long. 69° E, Rajkot, Ahmedabad, Indore, Seoni, Pendra, Jharsuguda, Burdwan, Malda and Gangtok

TABLE 1 (Contd.)

S.No.	Date	Southwest monsoon advanced over	Northern limit of monsoon passed through
14.	18 th June	Some more parts of Chattisgarh, remaining parts of Orissa and West Bengal & Sikkim; most parts of Jharkhand and parts of Bihar	Lat. 22° N / Long. 60° E, Lat. 22° N / Long. 69° E, Rajkot, Ahmedabad, Indore, Seoni, Pendra, Ambikapur, Daltonganj, Gaya, Muzaffapur and Raxaul
Prolonged Hiatus during 19th-30th June			
15.	1 st July	Some more parts of Madhya Pradesh	Lat. 22° N / Long. 60° E, Lat. 22° N / Long. 69° E, Rajkot, Ahmedabad, Indore, Bhopal, Jabalpur, Ambikapur, Daltonganj, Gaya, Muzaffarpur and Raxaul
16.	3 rd July	Some more parts of Saurashtra & Kutch, most parts of Gujarat Region, some parts of southeast Rajasthan and some more parts of Madhya Pradesh	Lat. 22° N / Long. 60° E, Lat. 22° N / Long. 69° E, Rajkot, Deesa, Udaipur, Sagar, Jabalpur, Ambikapur, Daltonganj, Gaya, Muzaffarpur and Raxaul
17.	4 th July	Remaining parts of Arabian Sea, entire Gujarat State, most parts of Madhya Pradesh, some more parts of south Rajasthan and some parts of south Uttar Pradesh	Lat. 25° N / Long. 60° E, Lat. 25° N / Long. 65° E, Lat. 25° N / Long. 71° E, Jawai Bandh, Bhilwara, Sawai Madhopur, Gwalior, Khajuraho, Daltonganj, Gaya, Muzaffarpur, Raxaul and Dharchula
18.	5 th July	Remaining parts of Madhya Pradesh, Jharkhand, Bihar, Uttar Pradesh, entire Uttarakhand, Haryana (including Delhi), Punjab, Himachal Pradesh, Jammu & Kashmir and most parts of east Rajasthan	Lat. 25° N / Long. 60° E, Lat. 25° N / Long. 71° E, Jawai Bandh, Ajmer, Churu and Ganganagar
19.	6 th July	Remaining parts of Rajasthan and thus it covered the entire country	-

were above the respective LPA. A large rainfall deficiency was observed over many sub-divisions of central, northern and eastern parts of the country due to delayed Monsoon advance over these regions in June. However, the rainfall situation over the country improved significantly during July, especially during the second half of this month. *Normal or excess* rainfall was received over most of the subdivisions except a few sub-divisions from eastern and northeastern parts of the country where the rainfall was deficient. Rainfall distribution over the country during August was more non-uniform than that of July, as the number of sub-divisions with *excess* and deficient rainfall during August (*excess* 17 & *deficient* 10) was more than that during July (*excess* 13 & *deficient* 5). During August, most of the sub-divisions over northwest and Peninsular India received *excess* rainfall and most of the subdivisions over eastern part of the country received deficient rainfall. However, sub-divisions from northeastern part received *normal* or excess rainfall.

2.4. Seasonal rainfall distribution

Meteorological sub-division wise seasonal rainfall distribution in terms of percentage departures from normal is given in Fig. 7. The seasonal rainfall was *excess* in 14, *normal* in 17 and *deficient* in the remaining 5 met. sub-divisions (Assam & Meghalaya, Gangetic West Bengal, Jharkhand, Bihar and east Uttar Pradesh). No sub-division reported *scanty* rainfall.

The cumulative rainfall distribution shows large deficiency during the early part of the season. As a result, the cumulative weekly rainfall remained negative till the end of August. In the first week of September only, the cumulative weekly rainfall became positive and remained so till the end of the season. The cumulative seasonal rainfall deficiency by more than 10% prevailed from the week ending 23rd June to the week ending 21st July.

2.5. District wise distribution of monsoon rainfall

Out of the 597 meteorological districts for which data was available, 69% received *excess/normal* rainfall and the remaining 31% received *deficient/scanty* rainfall during the period 1 June - 30 September 2010. Out of this, 65 districts (13%) experienced moderate drought and 17 districts (3%) experienced severe drought at the end of the season.

The percentage of districts with *excess/normal* and *deficient/scanty* rainfall for the years 2005-2010 is given in Table 3.

2.6. Withdrawal of southwest monsoon

There was considerable delay in the withdrawal of southwest monsoon from west Rajasthan due to the prevalence of moisture in the lower levels and conducive conditions for rainfall created by the presence of mid-

Week by week rainfall during SW monsoon - 2010

Week ending on

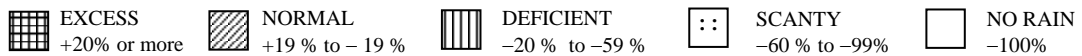
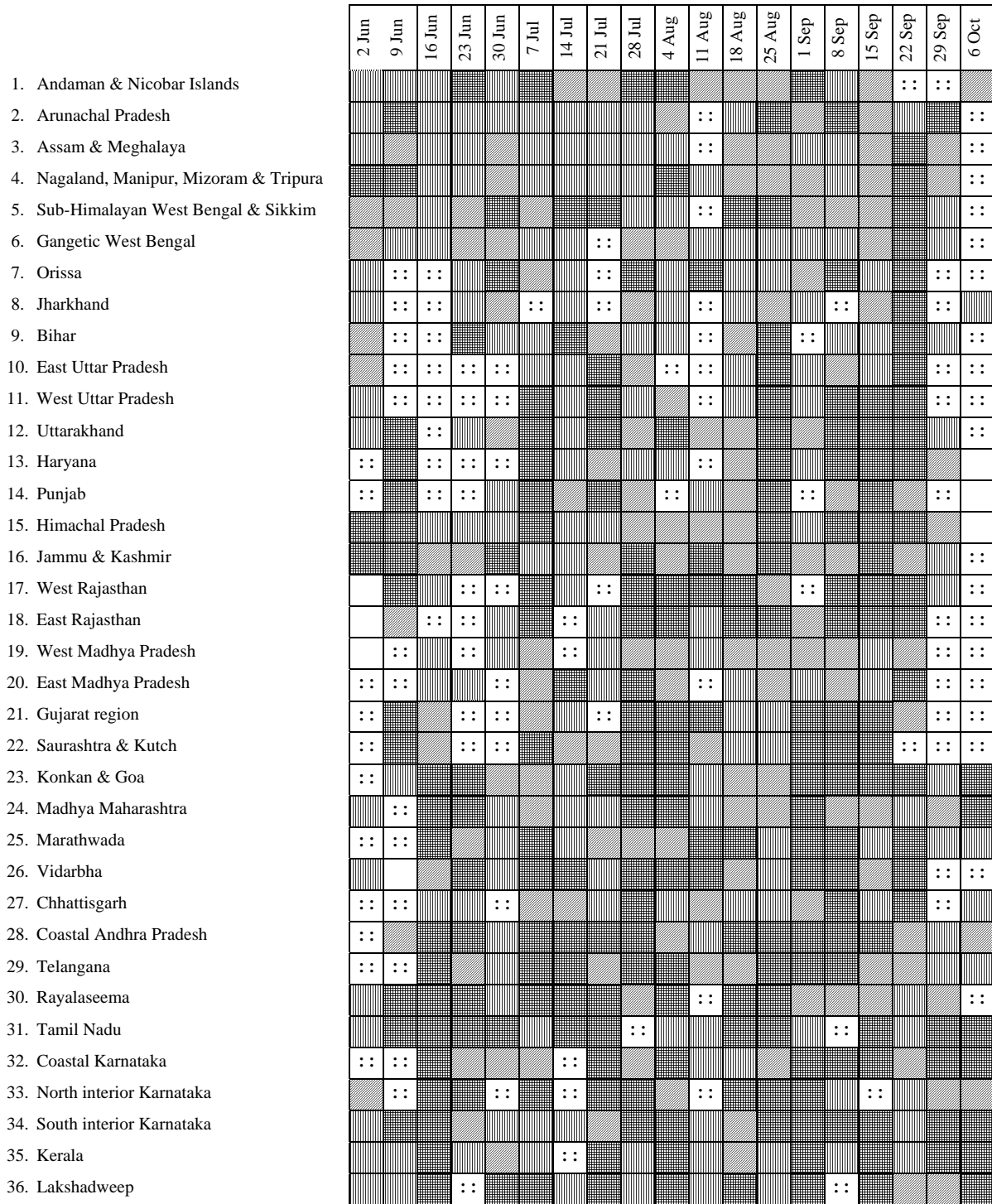


Fig. 2(a). Week by week rainfall during SW Monsoon 2010

Week by week cumulative rainfall (1 June – 30 September 2010)

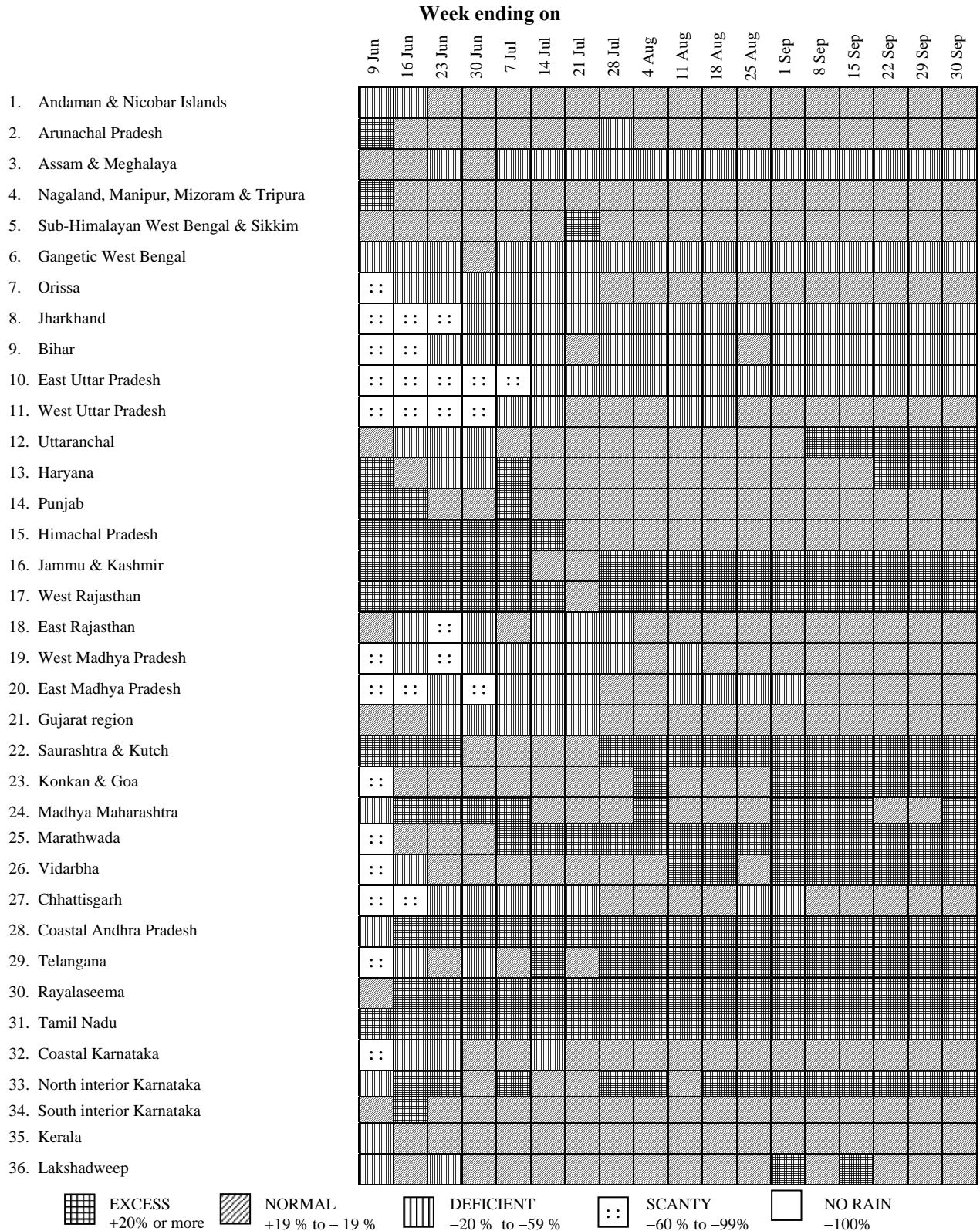


Fig. 2(b). Week by week cumulative rainfall during SW monsoon 2009 (1 June to 30 September 2010)

TABLE 2

Rainfall figures (mm) for each month and season as a whole (June – September 2010)

S. No.	Meteorological Sub-divisions	June			July			August			September			Season		
		Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)
1.	A. & N. Islands	435.0	461.8	-6	522.1	400.2	30	550.0	404.8	36	261.3	426.3	-39	1768.4	1693.1	4
2.	Arunachal Pradesh	397.3	476.2	-17	426.0	523.5	-19	343.3	353.4	-3	407.4	356.4	14	1574.0	1709.5	-8
3.	Assam & Meghalaya	485.8	595.4	-18	374.3	575.0	-35	346.2	438.8	-21	316.2	342.4	-8	1523.2	1951.6	-22
4.	Naga., Mani., Mizo. and Tripura	402.9	418.5	-4	272.6	374.5	-27	326.0	341.1	-4	235.9	264.6	-11	1237.4	1398.7	-12
5.	S. H. W. B. & Sikkim	568.1	492.2	15	667.9	590.2	13	551.4	462.9	19	399.2	380.4	5	2186.6	1925.7	14
6.	Gangetic West Bengal	200.2	238.4	-16	193.8	324.2	-40	187.6	313.3	-40	205.8	264.7	-22	787.4	1140.6	-31
7.	Orissa	154.0	206.9	-26	315.4	346.1	-9	286.8	366.3	-22	235.7	250.0	-6	991.8	1169.3	-15
8.	Jharkhand	108.3	187.0	-42	181.4	333.7	-46	182.9	323.6	-43	175.5	240.1	-27	648.1	1084.4	-40
9.	Bihar	114.7	169.8	-32	277.2	339.0	-18	228.7	292.4	-22	175.2	223.1	-21	795.8	1024.3	-22
10.	East Uttar Pradesh	29.2	104.0	-72	236.1	307.9	-23	240.5	301.1	-20	196.7	196.6	0	702.5	909.6	-23
11.	West Uttar Pradesh	12.7	68.3	-81	272.5	267.2	2	238.6	285.6	-16	248.4	149.9	66	772.3	771.0	0
12.	Uttarakhand	109.2	163.1	-33	538.8	420.2	28	515.7	419.2	23	522.3	205.6	154	1686.0	1208.1	40
13.	Haryana, Chandigarh & Delhi	19.9	42.0	-53	176.4	170.4	4	183.5	166.5	10	185.7	88.4	110	565.5	467.3	21
14.	Punjab	34.5	40.8	-15	208.6	186.3	12	121.3	167.4	-28	94.6	101.2	-6	459.0	495.7	-7
15.	Himachal Pradesh	125.8	89.9	40	269.8	288.2	-6	284.3	261.6	9	195.2	134.2	45	875.1	773.9	13
16.	Jammu & Kashmir	91.9	57.7	59	231.5	190.0	22	256.5	179.5	43	93.8	97.0	-3	673.7	524.2	29
17.	West Rajasthan	48.4	27.2	78	127.6	101.5	26	161.7	93.5	73	101.9	40.3	153	439.7	262.5	67
18.	East Rajasthan	28.1	61.5	-54	202.7	227.6	-11	284.1	235.0	21	144.6	106.2	36	659.5	630.3	5
19.	West Madhya Pradesh	60.5	108.0	-44	258.0	304.5	-15	298.6	314.5	-5	135.1	176.4	-23	752.2	903.4	-17
20.	East Madhya Pradesh	58.8	143.0	-59	366.5	368.2	0	279.5	378.1	-26	215.1	198.2	9	919.9	1087.5	-15
21.	Gujarat region	61.1	118.6	-49	342.8	350.4	-2	386.4	284.8	36	220.9	156.6	41	1011.1	910.4	11
22.	Saurashtra & Kutch	72.6	81.5	-11	408.0	194.9	109	340.8	138.5	146	184.5	72.2	156	1005.9	487.1	107
23.	Konkan & Goa	671.8	674.2	0	1405.5	1068.0	32	838.1	711.3	18	522.0	346.0	51	3437.5	2799.5	23
24.	Madhya Maharashtra	184.3	134.3	37	263.7	238.8	10	229.1	177.2	29	161.8	150.8	7	838.8	701.1	20
25.	Marathwada	118.3	144.8	-18	328.6	194.8	69	297.7	197.2	51	159.7	174.3	-8	904.3	711.1	27
26.	Vidarbha	145.0	167.3	-13	448.3	328.3	37	387.8	299.9	29	233.6	179.4	30	1214.7	974.9	25
27.	Chattisgarh	89.6	187.9	-52	397.3	393.8	1	303.8	390.2	-22	244.0	231.3	5	1034.6	1203.2	-14
28.	Coastal Andhra Pradesh	138.4	99.6	39	272.5	159.6	71	231.8	153.9	51	193.9	162.2	20	836.6	575.3	45
29.	Telangana	102.3	135.2	-24	389.5	242.2	61	278.9	217.9	28	242.3	171.3	41	1013.1	766.6	32
30.	Rayalaseema	94.6	60.2	57	155.0	91.0	70	169.4	97.4	74	100.6	132.2	-24	519.5	380.8	36
31.	Tamil Nadu	71.0	42.1	69	80.2	70.8	13	107.8	89.2	21	117.1	111.6	5	376.2	313.7	20
32.	Coastal Karnataka	751.6	901.3	-17	1286.5	1188.4	8	677.4	766.4	-12	532.1	318.0	67	3247.6	3174.1	2
33.	North interior Karnataka	113.6	98.5	15	180.7	126.5	43	208.7	113.1	85	112.2	152.9	-27	615.2	491.0	25
34.	South interior Karnataka	133.9	135.5	-1	225.8	231.6	-2	228.7	167.1	37	152.3	138.0	10	740.7	672.2	10
35.	Kerala	669.1	678.7	-1	630.0	756.2	-17	358.3	445.9	-20	273.8	258.9	6	1931.1	2139.7	-10
36.	Lakshadweep	320.2	325.6	-2	338.4	282.3	20	333.4	212.9	57	162.9	164.4	-1	1154.9	985.2	17

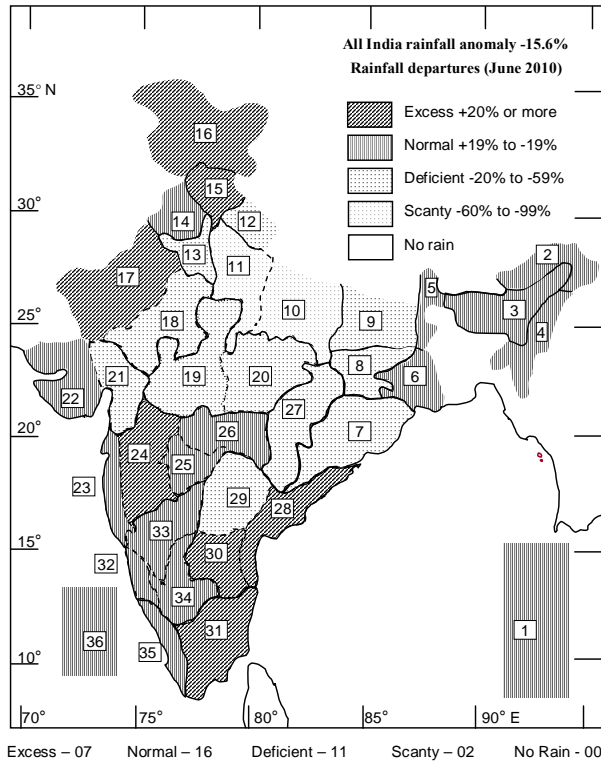


Fig. 3. Sub-divisionwise seasonal rainfall departure from normal (%) for the period (June 2010). 36 Sub-divisions are indicated by numbers on the map & bold letters in legend below. The rainfall anomaly values for these sub-divisions are indicated below :

1	-6	7	-26	13	-53	19	-44	25	-18	31	69
2	-17	8	-42	14	-15	20	-59	26	-13	32	-17
3	-18	9	-32	15	40	21	-49	27	-52	33	15
4	-4	10	-72	16	59	22	-11	28	39	34	-1
5	15	11	-81	17	78	23	0	29	-24	35	-1
6	-16	12	-33	18	-54	24	37	30	57	36	-2

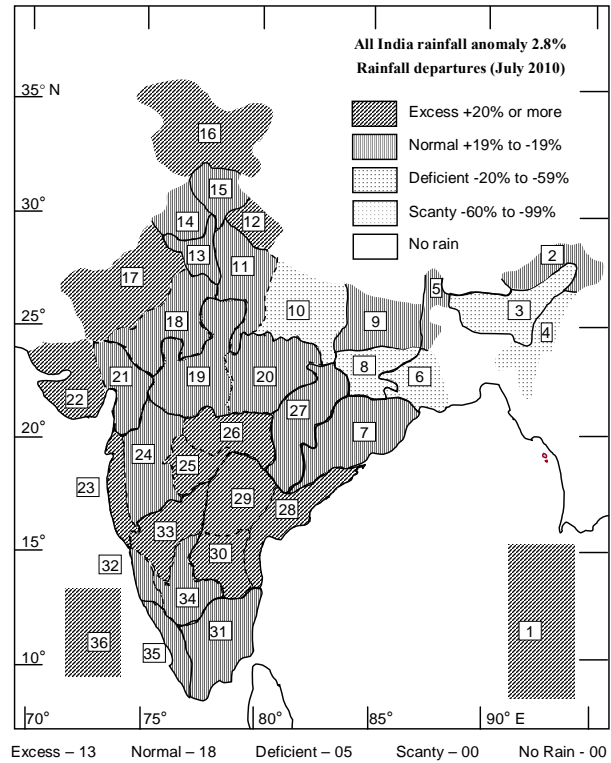


Fig. 4. Sub-divisionwise seasonal rainfall departure from normal (%) for the period (July 2010). 36 Sub-divisions are indicated by numbers on the map & bold letters in legend below. The rainfall anomaly values for these sub-divisions are indicated below :

1	30	7	-9	13	4	19	-15	25	69	31	13
2	-19	8	-46	14	12	20	0	26	37	32	8
3	-35	9	-18	15	-6	21	-2	27	1	33	43
4	-27	10	-23	16	22	22	109	28	71	34	-2
5	13	11	2	17	26	23	32	29	61	35	-17
6	-40	12	28	18	-11	24	10	30	70	36	20

latitude westerlies in the upper levels over the north western parts of the country. The withdrawal started from west Rajasthan on 27th September with a delay of nearly 4 weeks as the normal date of withdrawal from extreme western parts of Rajasthan is 1st September.

The tendency of delayed withdrawal of southwest Monsoon from Rajasthan is being continued since 2006. The withdrawal started from the extreme west Rajasthan on 21st September, 30th September, 29th September and 25th September, respectively in the years 2006, 2007, 2008 and 2009.

The enhanced convection associated with the significant strengthening of MJO phase during 4th - 18th

October 2010 caused further delay in the withdrawal of Monsoon from the central and eastern parts of the country. Two depressions gave rise to widespread rainfall over east central, central and peninsular India during this period.

The southwest monsoon withdrew from the entire country, Bay of Bengal and Arabian Sea on 29th October and simultaneously the northeast monsoon rains commenced over the south peninsula.

The dates of withdrawal of southwest Monsoon are given in Table 4. Fig. 8 gives the isochrones of withdrawal of southwest Monsoon 2010.

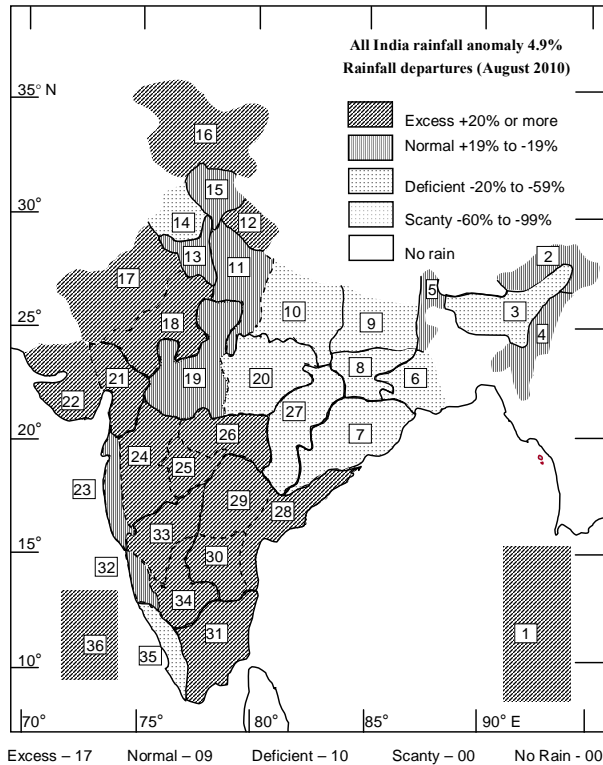


Fig. 5. Sub-divisionwise seasonal rainfall departure from normal (%) for the period (August 2010). 36 Sub-divisions are indicated by numbers on the map & bold letters in legend below. The rainfall anomaly values for these sub-divisions are indicated below :

1	36	7 -22	13	10	19	-5	25	51	31	21	
2	-3	8 -43	14	-28	20	-26	26	29	32	-12	
3	-21	9 -22	15	9	21	36	27	-22	33	85	
4	-4	10 -20	16	43	22	146	28	51	34	37	
5	19	11 -16	17	73	23	18	29	28	35	-20	
6	-40	12	23	18	21	24	29	30	74	36	57

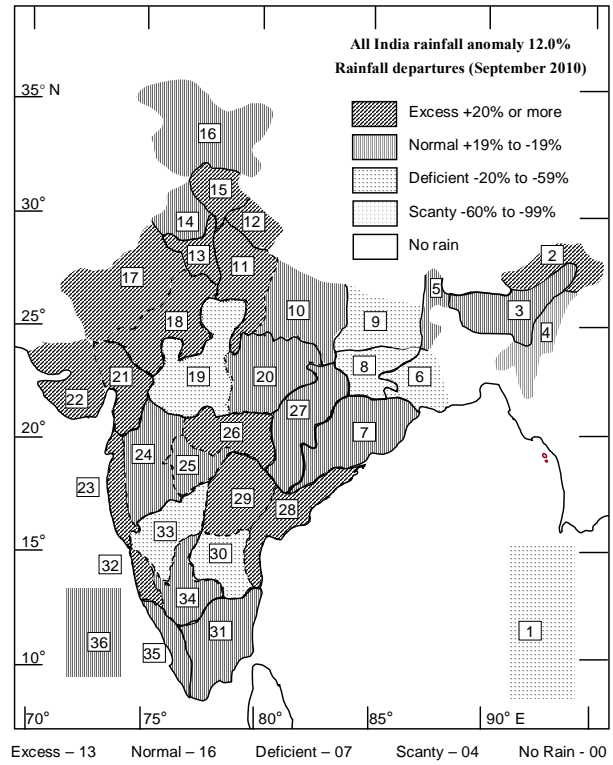


Fig. 6. Sub-divisionwise seasonal rainfall departure from normal (%) for the period (September 2010). 36 Sub-divisions are indicated by numbers on the map & bold letters in legend below. The rainfall anomaly values for these sub-divisions are indicated below :

1	-39	7	-6	13	110	19	-23	25	-8	31	5
2	14	8	-27	14	-6	20	9	26	30	32	67
3	-8	9	-21	15	45	21	41	27	5	33	-27
4	-11	10	0	16	-3	22	156	28	20	34	10
5	5	11	66	17	153	23	51	29	41	35	6
6	-22	12	154	18	36	24	7	30	-24	36	-1

3. Chief synoptic features of southwest monsoon 2010

The synoptic disturbances which affected the Indian Monsoon region during June, July, August and September are given in Tables 5 to 8 respectively.

3.1. Cyclonic storms/depressions

There was only Very severe Cyclonic Storm (Phet, 31st May - 7th June) which formed over the Arabian Sea towards the end of May and influenced the onset/advance process of southwest monsoon season.

Normally, 4-6 Monsoon depressions form per season (June-September). However, no Monsoon depression formed during the period 1st June - 30th September 2010.

3.1.1. Very Severe Cyclonic Storm ‘Phet’ over the Arabian Sea (31st May - 7th June 2010)

Under the influence of an upper air cyclonic circulation over the southeast Arabian Sea and adjoining Lakshadweep area, a low pressure area formed over the east central and adjoining west central Arabian Sea on 31st morning. It rapidly concentrated into a Depression and lay centered at 0600 UTC of 31st May near Lat. 15.0° N / Long. 64.0° E and at 1200 UTC near Lat. 15.5° N / Long. 63.5° E. It remained practically stationary up to 0300 UTC of 1st June and in the mean time intensified into a Deep Depression at 0000 UTC. Then it moved northwestwards and further intensified into a Cyclonic Storm (Phet) and lay centered at 0900 UTC of 1st June, near Lat. 16.0° N / Long. 63.0° E. Continuing the northwestward movement, it lay centered near

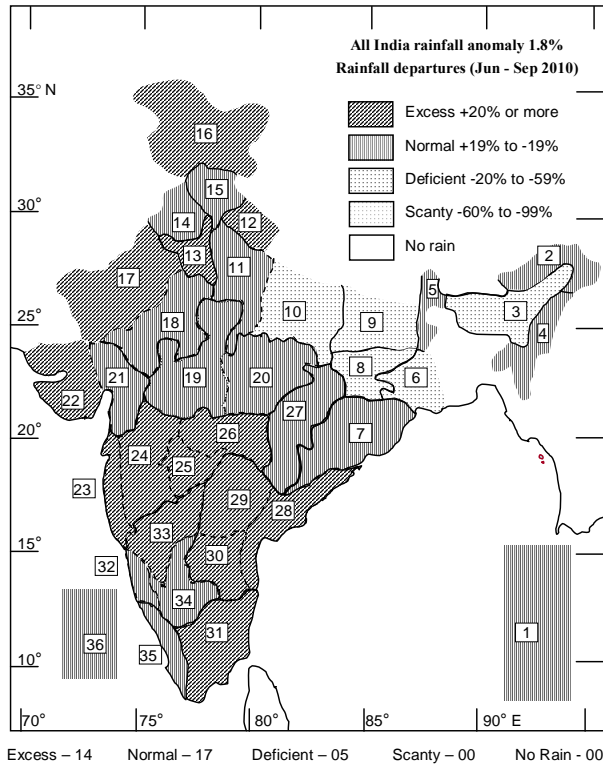


Fig. 7. Sub-divisionwise seasonal rainfall departure from normal (%) for the period (June - September 2010). 36 Sub-divisions are indicated by numbers on the map & bold letters in legend below. The rainfall anomaly values for these sub-divisions are indicated below :

1	4	7-15	13	21	19	-17	25	27	31	21
2	-8	8-40	14	-7	20	-15	26	25	32	2
3	-22	9-22	15	13	21	11	27	-14	33	25
4	-12	10-23	16	29	22	107	28	45	34	10
5	14	11	0	17	67	23	23	29	32	35
6	-31	12	40	18	5	24	20	30	36	17

Lat. 16.5° N / Long. 62.5° E at 1200 UTC. Subsequently, it intensified into a Severe Cyclonic Storm and lay centered at 0000 UTC of 2nd June, near Lat. 17.5° N / Long. 61.5° E. Moving slightly westwards, it lay centered at 0300 UTC of 2nd June, near Lat. 17.5° N / Long. 61.0° E. Remaining practically stationary, it further intensified in to a Very Severe Cyclonic Storm at 0600 UTC of 2nd. It moved further northwestwards and lay centered near Lat. 18.0° N / Long. 60.5° E at 1200 UTC of 2nd June ; near Lat. 18.5° N / Long. 59.5° E at 0300 UTC of 3rd and near Lat. 20.0° N / Long. 59.5° E at 1200 UTC. Moving further northwards, it crossed Oman coast near Lat. 21.5° N between 0000 & 0200 UTC of 4th June, weakened into a Severe Cyclonic Storm and lay centered at 0300 UTC over coastal Oman, near Lat. 22.0° N / Long. 59.5° E. Continuing the northward movement, it emerged into the

TABLE 3

Percentage of districts with excess/normal and deficient/scanty rainfall

Year	Excess/Normal	Deficient/Scanty
2005	72	28
2006	60	40
2007	72	28
2008	76	24
2009	42	58
2010	69	31

northwest Arabian Sea and lay centered at 1200 UTC of 4th, near Lat. 23.0° N / Long. 59.5° E. It further weakened into a Cyclonic Storm and lay centered at 0000 UTC of 5th, near Lat. 24.0° N / Long. 60.5° E. Re-curving northeastwards, it lay centered at 0300 UTC of 5th, near Lat. 24.5° N / Long. 61.0° E and at 1200 UTC, near Lat. 24.5° N / Long. 61.5° E. Moving further eastwards, it weakened into a Deep Depression and lay centered at 1800 UTC of 5th, near Lat. 24.5° N / Long. 62.5° E. It further weakened into a Depression and lay centered at 0300 UTC, near Lat. 24.5° N / Long. 65.0° E and at 1200 UTC, near Lat. 24.5° N / Long. 67.0° E. Moving eastnortheastwards, it crossed Pakistan coast, close to south of Karachi (near Lat. 24.7° N and Long. 67.2° E) between 1230 & 1330 UTC of 6th and lay centered at 1500 UTC, near Lat. 25.0° N / Long. 68.0° E (about 220 kms north northwest of Naliya). Further moving eastnortheastwards, it lay centered at 0300 UTC of 7th, over west Rajasthan, close to Barmer (Lat. 26.5° N / Long. 71.5° E). It weakened into a well marked low pressure area over east Rajasthan and adjoining northwest Madhya Pradesh in the evening of 7th and became less marked on 8th morning. However, the associated upper air cyclonic circulation extending up to lower tropospheric levels lay over west Uttar Pradesh and neighborhood on 8th and became less marked on 9th.

The track of the system is shown in Fig. 9.

3.2. Low pressure areas/well-marked low pressure areas (LPA/WMLPA)

In all 14 low pressure areas/well marked low pressure areas formed during the season. Most of them originated as upper air cyclonic circulations. Twelve of them formed over the Bay of Bengal, one over the Arabian Sea and one over the land. Month wise breakup of the systems is 2 in June and 4 each in July, August and September. The total number of low pressure areas during

TABLE 4
Withdrawal of southwest monsoon – 2010

S.No.	Date	Southwest monsoon withdrew from	Withdrawal line passed through
1.	27 th Sep	Entire west Rajasthan, some parts of Punjab, Haryana, east Rajasthan, Gujarat and of north Arabian Sea	Amritsar, Hissar, Jaipur, Udaipur, Ahmadabad, Porbandar, Lat. 21° N / Long. 65° E and Lat. 21° N / Long. 60° E
2.	28 th Sep	Entire Jammu & Kashmir, Himachal Pradesh, Uttarakhand; some parts of west Uttar Pradesh and west Madhya Pradesh; remaining parts of Punjab, Haryana, Chandigarh & Delhi, east Rajasthan and some more parts of Gujarat Region	Dharchula, Etawah, Guna, Ratlam, Ahmedabad, Porbandar, Lat. 21° N / Long. 65° E and Lat. 21° N / Long. 60° E
3.	1 st Oct	Remaining parts of west Uttar Pradesh; most parts of east Uttar Pradesh; some more parts of west Madhya Pradesh and some parts of Bihar and of east Madhya Pradesh	Raxaul, Patna, Sidhi, Bhopal, Ratlam, Ahmedabad, Porbandar, Lat. 21° N / Long. 65° E and Lat. 21° N / Long. 60° E
4.	11 th Oct	Most parts of Bihar, Jharkhand, Madhya Pradesh; some parts of north Chattisgarh and some more parts of Gujarat State	Lat. 27° N / Long. 87° E, Forbesganj, Dhanbad, Champa, Seoni, Khandwa, Bhavnagar, Porbandar, Lat. 21° N / Long. 65° E and Lat. 21° N / Long. 60° E
5.	26 th Oct	Remaining parts of Bihar, Jharkhand, Madhya Pradesh and of Gujarat State; most parts of West Bengal & Sikkim; some parts of Orissa; some more parts of Chattisgarh; most parts of Vidarbha; some parts of Marathwada, Madhya Maharashtra (including Pune & Mumbai) and of Konkan; remaining parts of north Arabian Sea and some parts of central Arabian Sea	Gangtok, Malda, Kolkata, Balasore, Bolangir, Chandrapur, Parbhani, Harnai, Lat. 17° N / Long. 70° E, Lat. 17° N / Long. 65° E and Lat. 17° N / Long. 60° E
6.	28 th Oct	Remaining parts of West Bengal & Sikkim, Orissa, Chattisgarh, Maharashtra; entire Telangana, Goa; some parts of Arunachal Pradesh, Assam & Meghalaya, Nagaland-Manipur-Mizoram-Tripura, coastal Andhra Pradesh; most parts of north interior Karnataka, northwest Bay of Bengal, some parts of northeast & west central Bay of Bengal and some more parts of central Arabian Sea	Tawang, Agartala, Lat. 20° N / Long. 90° E, Lat. 17° N / Long. 86° E, Machilipatnam, Kurnool, Karwar, Lat. 15° N / Long. 70° E, Lat. 15° N / Long. 65° E and Lat. 15° N / Long. 60° E
7.	29 th Oct	Remaining parts of the country, Bay of Bengal and Arabian Sea and thus from the entire country	Withdrew from the entire country

the past 5 years viz., 2005 to 2009 is 6, 7, 6, 7 and 5 respectively.

3.3. Upper Air Cyclonic Circulations (CYCIR)

There were 24 upper air cyclonic circulations (in lower and middle tropospheric levels) formed during the season. The month wise distribution of these is : 7 each in June and July and 5 each in August and September.

3.4. Off-shore Trough

Off-shore trough along different parts of the west coast persisted from 11th June - 19th September except during 10th - 15th August and 19th - 24th August. It was quite feeble on a few days during June, July and September.

The details of the positions of the off-shore trough are given in Table 9 (a) and that for the years 2005 to 2010 are given in Table 9 (b).

3.5. Eastward moving cyclonic circulations/western disturbances

There were 28 eastward moving systems as upper air cyclonic circulations. The monthwise distribution is 9 each in June and July, 8 in August and 2 in September.

4. Extra Indian features

4.1. Cross equatorial flow

4.1.1. Over the Arabian sea

The Cross Equatorial flow along the equatorial belt (equator to 5° N / 5° S) over the Arabian Sea was stronger than normal by more than 5 kts during the first week of June and third week of September 2010. It was also stronger than normal by about 5-10 kts in third week of June & by more than 10 kts in fourth week of September. The flow was weaker than normal by about 5 kts during first and third week of July, first week of August and

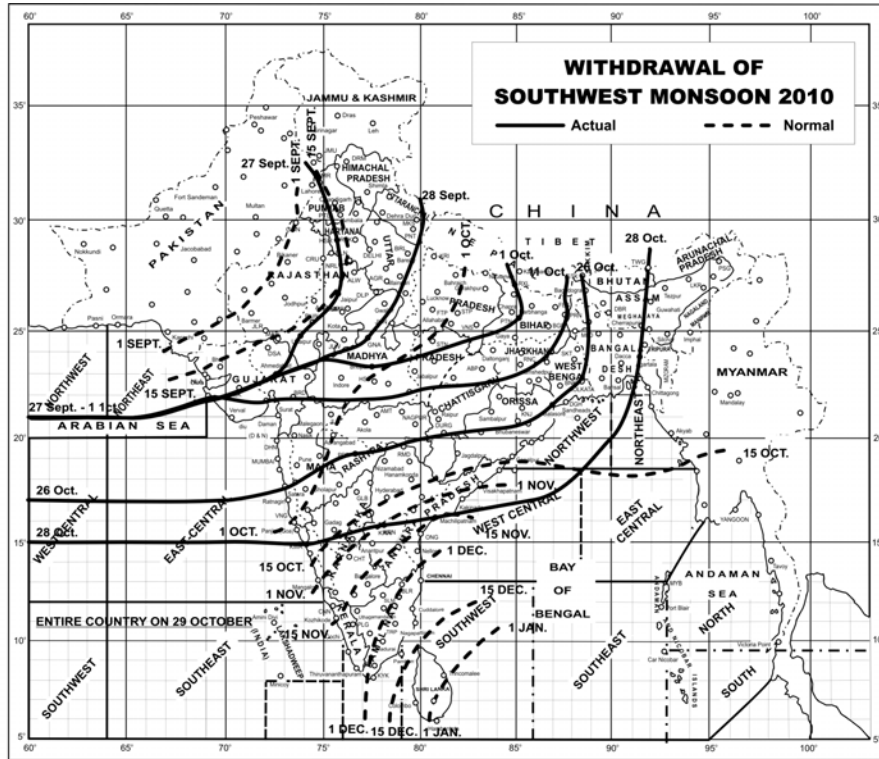


Fig. 8. Withdrawal of southwest monsoon 2010

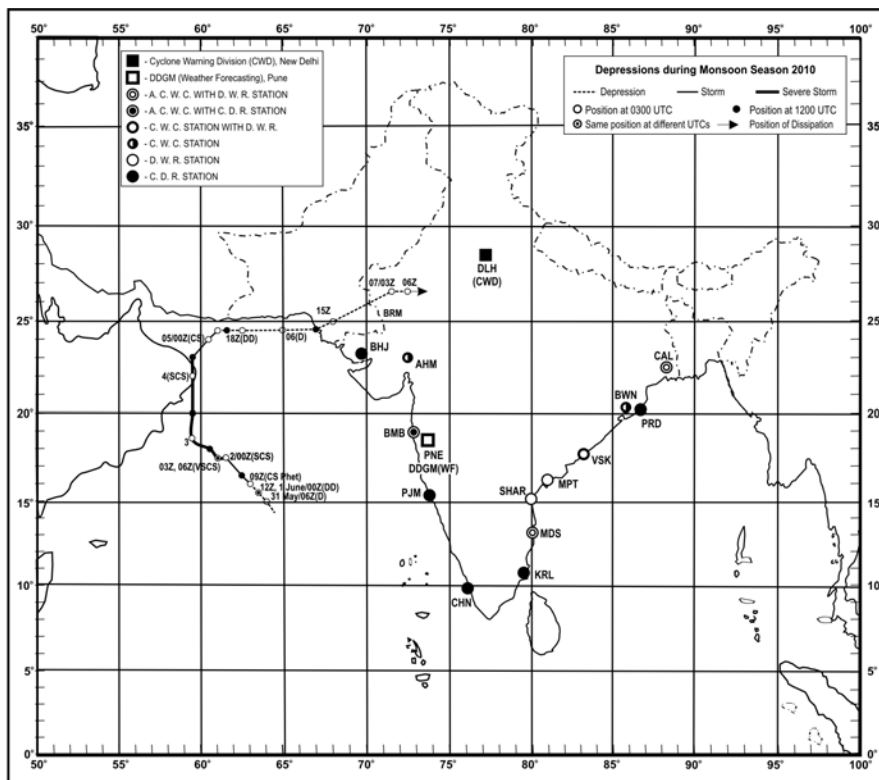


Fig. 9. Storm/depressions during southwest monsoon 2010

TABLE 5
Details of low pressure systems for the month of June 2010

S. No.	System	Duration	Place of first location	Direction of movement	Final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Very severe cyclonic storm						
The details of the Very Severe Cyclonic Storm (Phet) [31 st May – 7 th June] over the Arabian Sea are given in the text						
(B) Low pressure area/well marked low pressure area						
1.	Low pressure area	9 - 13	West central Bay of Bengal and neighbourhood	Stationary	<i>In situ</i>	Became less marked on 14
2.	Do	24 - 26	Northwest Bay of Bengal and neighbourhood	Northwest	Gangetic West Bengal and neighbourhood	Less marked on 27. It was first observed as a cyclonic circulation between 2.1 and 5.8 km a.s.l. over north Bay of Bengal on 23
(C) Upper air cyclonic circulations						
1.	Between 2.1 & 4.5 km a.s.l.	6 - 8	Coastal Tamil Nadu and neighbourhood	Southwest	South Tamil Nadu and adjoining Kerala	Became less marked on 9
2.	Between 2.1 & 5.8 km a.s.l.	9 - 20	East central Arabian Sea off south Maharashtra-Goa coasts	Quasi-Stationary	<i>In situ</i>	It drifted northwards along the off shore trough up to Gujarat coast and re-generated over the initial location, during the period
3.	Up to lower-tropospheric levels	15 - 16	West Uttar Pradesh and neighbourhood	Stationary	<i>In situ</i>	Became less marked on 17
4.	Up to 3.6 km a.s.l.	18 - 20	East Madhya Pradesh and adjoining north Chattisgarh	Northeast	Bihar and neighbourhood	Became less marked on 21
5.	Upto 0.9 km a.s.l.	22 - 30	West Uttar Pradesh and neighbourhood	Stationary	<i>In situ</i>	Less marked on 1 July
6.	Between 2.1 and 4.5 km a.s.l.	25 - 28	North Madhya Maharashtra and adjoining Gujarat Region	Northeast	North Madhya Maharashtra and adjoining Gujarat Region	East central Arabian sea and Konkan on 26; east central Arabian Sea off Maharashtra coast on 27. Became less marked on 29
7.	Between 3.1 and 4.5 kms a.s.l.	30 Jun - 1 Jul	North Bay of Bengal	Northwest	Northwest Bay of Bengal and adjoining coastal areas of north Orissa	Subsequently, it became low pressure area on 2 July. Details of which are given in Table 8
(D) Eastward moving upper air cyclonic circulations						
1.	Up to mid-tropospheric levels	2 - 6	North Pakistan and adjoining Jammu & Kashmir	Northeast	Northern parts of Jammu & Kashmir	Moved away on 7
2.	Do	6 - 11	North Pakistan and neighbourhood	Do	Jammu & Kashmir and neighbourhood	Moved away on 12
3.	Up to lower tropospheric levels	12 - 14	Haryana and adjoining Punjab	Stationary	<i>In situ</i>	Became less marked on 15
4.	Up to mid-tropospheric levels	12 - 14	North Pakistan and adjoining Jammu & Kashmir	Northeast	Jammu & Kashmir and neighbourhood	Moved away on 15
5.	Do	15 - 17	North Pakistan and adjoining Jammu & Kashmir	Do	Jammu & Kashmir and neighbourhood	Moved away on 17

TABLE 5 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
6.	Up to mid-tropospheric levels	18 - 22	North Pakistan and neighbourhood	Northeast	Jammu & Kashmir and neighbourhood	Moved away on 23
7.	Do	22 - 26	North Pakistan and adjoining Jammu & Kashmir	Do	Do	Moved away on 27
8.	Up to 2.1 km a.s.l.	30 Jun - 1 Jul	Punjab and neighbourhood	Stationary	<i>In situ</i>	Less marked on 2 July
9.	Up to mid-tropospheric levels	27 - 30	north Pakistan and neighbourhood	Northeast	Jammu & Kashmir and neighbourhood	Moved away on 1 July
(E) Troughs in westerlies						
1.	Lower levels	1 - 7	Sub-Himalayan West Bengal & Sikkim to north Bay of Bengal	Oscillatory	<i>In situ</i>	It extended from: Sub-Himalayan West Bengal & Sikkim to coastal Andhra Pradesh on 3, Arunachal Pradesh to coastal Andhra Pradesh on 4 and Sub-Himalayan West Bengal & Sikkim from 5 to 7
2.	Between 3.1 & 4.5 km a.s.l.	21 - 24	Sub-Himalayan West Bengal & Sikkim to north Bay of Bengal	Northeast	Arunachal Pradesh to northwest Bay of Bengal	Less marked on 25
3.	Between 2.1 & 4.5 kms a.s.l.	28 - 30	Do	Do	Do	Less marked on 1 July
(F) East-West troughs						
1.	Lower levels/mean sea level	1 - 7	Northern plains of the country to north Bay of Bengal	Oscillatory	Dehra Dun, Kheri, Gaya, Jamshedpur and Sagar Islands	Passed through: Ferozepur, Muzaffarpur, Gonda, Dhanbad, Mainpuri on 4; Gorakhpur, Gaya, Jamshedpur and Chandbali on 5; Raxaul, Purnea and Malda on 6; and Dehra Dun, Kheri, Gaya, Jamshedpur and Sagar Islands on 7 & 8. It became less marked on 9
2.	Lower levels/mean sea level	12 Jun - 6 Jul	Rajasthan to the centre of the low pressure area (west central Bay of Bengal) through Madhya Pradesh, Chattisgarh and Orissa	Oscillatory	<i>In situ</i>	It got established as a monsoon trough on 6, when the southwest Monsoon covered the entire country

weaker than normal by about 5-10 kts in second week of July. Except these, the cross equatorial flow along the equatorial belt was close to the normal during the remaining period.

The surface winds over Arabian Sea to the north of 5° N were weaker than normal by about 5 kts in second week of June, third week of July and fourth week of August and also weaker than normal by about 5-10 kts in first week of July.

They were stronger than normal by about 5-10 kts in first & third week of September and by about 5 kts in

second week of September. They were almost normal for the remaining period of the season.

However, the CPC analysis shows that the cross equatorial flow was weaker than normal, for the monthly and season as a whole even though there had been shorter spells of higher than normal cross equatorial flow in the latitudinal belt referred to above.

4.1.2. Over the Bay of Bengal

The Cross Equatorial flow along the equatorial belt (equator to 5° N / 5° S) over Bay of Bengal was stronger

TABLE 6
Details of low pressure systems for the month of July 2010

S. No.	System	Duration	Place of first location	Direction of movement	Final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Low pressure areas						
1.	Low pressure area	2 - 5	Northwest Bay of Bengal and adjoining coastal areas of north Orissa and Gangetic West Bengal	West Northwest	Central parts of Rajasthan	Merged with the seasonal low over central Pakistan and adjoining areas. However, the associated cyclonic circulation extending upto lower tropospheric levels lay over west Rajasthan and neighbourhood from 6 to 10, over Haryana and neighbourhood from 11 to 14 and became less marked on 15
2.	Do	6 - 8	Northwest and adjoining west central Bay of Bengal off south Orissa-north Andhra coasts	Do	North Madhya Pradesh and neighbourhood	Less marked on 8. However, the associated cyclonic circulation extending up to lower tropospheric levels lay over east Uttar Pradesh and neighbourhood during 9 to 15 and became less marked on 16
3.	Well-marked low pressure area	24 - 26	Northwest Bay of Bengal and neighbourhood	Do	South Rajasthan and adjoining Gujarat State	Less marked on 27. Associated cyclonic circulation extended upto mid tropospheric levels. It lay over Saurashtra & Kutch and neighbourhood on 28 and became less marked on 29
4.	Low pressure area	28 Jul - 1 Aug	Northwest and adjoining west central Bay of Bengal off south Orissa-north Andhra coasts.	Northwest	Northwest Madhya Pradesh and neighbourhood	Associated cyclonic circulation extended upto mid tropospheric levels. Less marked on 2 Aug.
(B) Upper air cyclonic circulations						
1.	Upto mid tropospheric levels	5 - 9	Gujarat Region and neighbourhood	Quasi-stationary	<i>In situ</i>	Less marked on 10
2.	Between 1.5 and 5.8 kms a.s.l.	14 - 18	Coastal Orissa and neighbourhood	Northwest	Northwest Madhya Pradesh and neighbourhood	Became less marked on 19
3.	Upto 3.6 kms a.s.l.	18 - 21	East central Arabian Sea off south Gujarat-north Maharashtra coasts	Quasi-stationary	Gujarat Region and neighbourhood	It lay over: Gujarat Region and neighbourhood on 19; east central Arabian Sea and adjoining south Gujarat-north Maharashtra coasts on 20 and became less marked on 22
4.	Between 2.1 & 4.5 kms a.s.l.	19 - 22	Coastal Andhra Pradesh and neighbourhood	Northwest	Chattisgarh and neighbourhood	Less marked on 23
5.	Upto lower tropospheric levels	20 - 21	West Uttar Pradesh and neighbourhood	Stationary	<i>In situ</i>	Less marked on 22
6.	Do	30 Jul - 6 Aug	East central Arabian Sea adjoining Maharashtra coast	Oscillatory	Gujarat and neighbourhood	Became less marked on 7 August
7.	Do	30 - 31	West Uttar Pradesh and adjoining Uttarakhand	Quasi-stationary	West Uttar Pradesh and neighbourhood	Became less marked on 1 August

TABLE 6 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>(C) Eastward moving upper air cyclonic circulations</i>						
1.	Up to mid tropospheric levels	1 - 5	North Pakistan and adjoining Jammu & Kashmir	Northeast	Jammu & Kashmir and neighbourhood	Moved away on 6
2.	Do	4 - 6	Do	Do	Do	Moved away on 7
3.	Do	7 - 8	Do	Do	Do	Moved away on 9
4.	Do	9 - 12	North Pakistan and neighbourhood	Do	Do	Moved away on 13
5.	Do	12 - 18	Do	Do	Do	Moved away on 19
6.	Up to mid tropospheric levels	18 - 19	Do	Do	Do	Moved away on 20
7.	Do	20 - 22	Do	Do	Do	Moved away on 23
8.	Do	23 - 26	Do	Do	Do	Moved away on 27
9.	Do	27 - 31	Do	Do	Do	Moved away on 1 August

than normal by more than 5 kts during second week of June and second and fourth week of September. It was also stronger than normal by 5-10 kts in second and third week of August and by 10 kts in third week of September. Except these, the cross equatorial flow along the equatorial belt was close to the normal during entire Monsoon period June-September 2010.

The surface winds over the Bay of Bengal to the north of 5° N were stronger than normal by more than 5 kts in first week of August. They were also stronger than normal by about 5-10 kts in first week of June, fourth week of July and second week of September and stronger than normal by more than 10 kts in third week of September. They were almost normal for the remaining period during the season.

4.2. Mid-Latitude troughs

The number of troughs in upper air westerlies affecting the Indian region which penetrated south of 30° N is given in Table 10.

4.3. Systems in West Pacific Ocean/South China Sea

There were in all 11 low pressure systems (reaching the intensity of Tropical depression and above) in the northwest Pacific Ocean / South China Sea during June - September 2010. The month wise break-up is given in Table 11.

4.4. Systems in southern hemisphere

4.4.1. Tropical storms/depressions

No low pressure system (Tropical Depression, Tropical Storm or Typhoon) was reported in the Southern Hemisphere during June-September 2010.

4.4.2. Troughs in mid and upper tropospheric westerly over the south Indian Ocean

There were 12 troughs in upper air westerlies which moved across the Indian Ocean from west to east, to the north of Lat. 30° S, in the Southern Hemisphere, during June to September 2010. The month wise break-up is 3 each in June and August, 2 in July & 4 in September.

4.4.3. Mascarene HIGH

The intensity of Mascarene HIGH with its mean position at 33° S / 68° E was above normal by 1.4 hPa during the Monsoon period June to September 2010. It was below normal by 1.0 hPa in the month of July 2010. It was above normal by 3.0, 2.0 and 1.5 hPa during the months of June, August, & September 2010.

(Source : Climate Diagnostic Bulletin, NOAA, June to September 2010. Normal based on the means for the base period of 1979-1995).

TABLE 7
Details of low pressure systems for the month of August 2010

S. No.	System	Duration	Place of first location	Direction of movement	Final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Low pressure areas						
1.	Well-marked low pressure area	4 – 8	Northwest Bay of Bengal and adjoining Orissa	Westnorthwest	West Madhya Pradesh and adjoining southeast Rajasthan-north Gujarat Region	It was first observed as a cyclonic circulation extending upto mid tropospheric levels over northwest Bay of Bengal and neighbourhood on 2-3
2.	Low pressure area	12 – 13	Northwest and adjoining west central Bay of Bengal off south Orissa-north Andhra coasts	Do	Vidarbha and adjoining south Chattisgarh and east Madhya Pradesh	Became less marked on 14. However, the associated cyclonic circulation extending upto 4.5 kms a.s.l. lay over west Madhya Pradesh and neighbourhood on 14; west Rajasthan and neighbourhood on 15; northwest Rajasthan and neighbourhood from 16-18 and became less marked on 19
3.	Do	23 – 27	West central Bay of Bengal off south Andhra Pradesh coast	Do	Vidarbha and adjoining Telangana	Became less marked on 28. However, the associated cyclonic circulation extending upto mid tropospheric levels lay over Madhya Maharashtra and neighbourhood on 28; over Gujarat State and neighbourhood on 29 Aug. to 2 Sept; over Saurashtra & Kutch on 3 and became less marked on 4
4.	Do	30 – 31	North Bay of Bengal off Orissa coast	Do	West Madhya Pradesh and adjoining east Rajasthan	Became less marked on 1 Sept. However, the associated cyclonic circulation extending upto 0.9 kms a.s.l. lay over the same area on 1 Sept. and became less marked on 2
(B) Upper air cyclonic circulations						
1.	Lower tropospheric levels	5 - 7	West Rajasthan and neighbourhood	Northwest	Central Pakistan and adjoining west Rajasthan	Less marked on 8
2.	Lower levels	11 - 12	Haryana and neighbourhood	Stationary	<i>In situ</i>	Less marked on 13
3.	Upto mid tropospheric levels	15 - 16	Chattisgarh and neighbourhood	Southwest	Vidarbha and neighbourhood	Less marked on 17
4.	Do	17 - 20	West central Bay of Bengal off south Andhra Pradesh-north Tamil Nadu coasts	Northwest	Rayalaseema and neighbourhood	Less marked on 21
5.	Do	18 - 22	West Uttar Pradesh and neighbourhood	Stationary	<i>In situ</i>	Less marked on 23
(C) Eastward moving upper air cyclonic circulations						
1.	Up to 3.6 kms a.s.l.	1 - 2	North Pakistan and neighbourhood	Northeast	Jammu & Kashmir and neighbourhood	Moved away on 3
2.	Upto 4.5 kms a.s.l.	3 - 7	Do	Do	Do	Moved away on 8
3.	Upto mid tropospheric levels	7 - 9	Do	Do	Do	Moved away on 10
4.	Do	11 - 13	Do	Do	Do	Moved away on 14
5.	Do	14 - 17	Do	Do	Do	Moved away on 18
6.	Do	18 - 19	Do	Do	Do	Moved away on 20
7.	Do	19 - 22	Do	Do	Do	Moved away on 23
8.	Do	23 - 26	Do	Do	Do	Moved away on 27

TABLE 8

Details of low pressure systems for the month of September 2010

S. No.	System	Duration	Place of first location	Direction of movement	Final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A) Low pressure areas						
1.	Low pressure area	3 - 6	West central Bay of Bengal off north Andhra Pradesh-south Orissa coasts	Northwest	Orissa and neighbourhood	Associated cyclonic circulation extended upto mid tropospheric levels. Less marked on 7
2.	Do	8 - 13	Vidarbha, Chattisgarh and southeast Madhya Pradesh	Do	Northeast Rajasthan and adjoining Haryana	Less marked on 13 evening. Associated cyclonic circulation extending upto 0.9 kms a.s.l. persisted on 14 and became less marked on 15
3.	Well marked low pressure area	17 - 20	West central Bay of Bengal and adjoining areas of coastal Orissa-north coastal Andhra Pradesh	Do	North Madhya Pradesh and neighbourhood	Less marked on 21. However, associated cyclonic circulation extending upto mid tropospheric levels lay over southwest Uttar Pradesh and neighbourhood on 21; northeast Rajasthan and neighbourhood on 22; south Haryana and neighbourhood on 23; west Uttar Pradesh and neighbourhood on 24 and became less marked on 25
4.	Low pressure area	29 Sep - 3 Oct	Southeast Arabian Sea and neighbourhood	North north-west	Southeast and adjoining east central Arabian Sea	Became less marked on 4 October. The associated cyclonic circulation extending upto 3.1 kms a.s.l. lay over southeast Arabian Sea and adjoining Lakshadweep area on 4 Oct.; Lakshadweep area and neighbourhood on 5 and became less marked on 6
(B) Upper air cyclonic circulations						
1.	Between 1.5 & 4.5 kms a.s.l.	1 - 5	Orissa and neighbourhood	Northwest	West Uttar Pradesh and neighbourhood	Became less marked on 6
2.	Up to mid-tropospheric levels	10 - 16	West central Bay of Bengal off Andhra Pradesh coast	Northwest	Orissa and adjoining Chattisgarh	Merged with the cyclonic circulation associated with low pressure area on 17
3.	Upto lower tropospheric levels	20 - 23	East central Arabian Sea off south Maharashtra coast	Stationary	<i>In situ</i>	Became less marked on 24
4.	Do	21 - 30	South Tamil Nadu and adjoining Sri Lanka	West	Kerala and neighbourhood	Became less marked on 1 October
5.	Do	23 - 25	Northwest Bay of Bengal and neighbourhood	Northwest	Gangetic West Bengal and neighbourhood.	Became less marked on 26
(C) Troughs in westerlies						
1.	Mid and upper troposphere	17 - 21	North of Lat. 35° N	Northeast	–	Moved away on 22
(D) Eastward moving upper air cyclonic circulations						
1.	Up to lower - tropospheric levels	4 - 8	Northwest Rajasthan and adjoining Punjab	Northeast	Haryana and neighbourhood	Became less marked on 9
2.	Up to mid tropospheric levels	29 Sep - 1 Oct	Jammu & Kashmir and adjoining north Pakistan	Do	Jammu & Kashmir and neighbourhood	Less marked on 2 October

TABLE 9(a)

Positions of off-Shore trough during the monsoon period 2010

Date	Location
11 – 12 June	South Karnataka – Kerala coasts
13 – 14 June	South Konkan & Goa to Kerala coasts
15 June	North Konkan to Kerala coasts
16 June	South Gujarat to Kerala coasts
17 – 23 June	South Maharashtra to Kerala coasts (feeble on 21 & 22)
24 – 25 June	South Gujarat to Kerala coasts
26 – 30 June	Maharashtra to Kerala coasts (feeble on 29)
1 – 4 July	Maharashtra to Kerala coasts
5 – 9 July	South Gujarat to Kerala coasts
10 - 11 July	South Gujarat to Karnataka coasts (feeble)
12 July	South Gujarat to Kerala coast
13 – 15 July	Maharashtra to Karnataka coasts (feeble on 14 & 15)
16 – 17 July	Maharashtra to Kerala coasts
18 July	South Gujarat to Kerala coasts
19 July	Maharashtra to Kerala coasts
20 – 28 July	South Gujarat to Kerala coast
29 – 30 July	Maharashtra to Kerala coasts
31 July	South Gujarat to Kerala coasts
1 – 2 August	Gujarat to Karnataka coasts
3 – 4 August	South Gujarat to Kerala coasts
5 – 7 August	South Gujarat to Karnataka coasts
8 – 9 August	South Gujarat to Kerala coasts
16 – 17 August	Maharashtra to Kerala coasts
18 August	South Gujarat to Kerala coasts
25 – 27 August	Maharashtra to Kerala coasts
28 & 31 August	South Gujarat to Kerala coasts
1 September	South Gujarat to Karnataka coasts
2 – 4 September	South Gujarat to Maharashtra coasts
5 – 7 September	South Gujarat to Karnataka coasts
8 – 14 September	South Gujarat to Kerala coasts (feeble 14)
15 September	Maharashtra to Kerala (feeble)
16 September	Karnataka to Kerala coasts (feeble)
17 – 19 September	South Maharashtra to Kerala coasts
	Less marked from 20 September

TABLE 9(b)

Details of off-shore trough for the years 2004-2009

Year	Details of off – shore trough
2010	Observed along different parts of west coast from 11 June – 19 September except during 10 – 15 August & 19-24 August. Was quite a feeble on 21, 22 & 29 June; 10-11 & 14-15 July and from 14 to 16 September
2009	Observed along different parts of west coast from 6 June – 9 September except during 4 June, 9 – 11 June, 18-21 August. Was quite feeble on many days during August & September
2008	Observed from 30 May to 17 September, except during 4 – 5 June & 18 August – 5 September. Even though present throughout the month of July, it was quite feeble during the period 13 – 24 July
2007	Present along various parts of the west coast from 28 May to 30 September except during 4 – 7 June, 10 – 11 June and 10 – 13 September. It was feeble during many days in June and a few days during the rest of the months
2006	Extended along different parts of the west coast from 27 May to 25 September except during 19 – 20 June, 30 – 31 August and 3 – 11 September. Had been quite feeble in June except during the first week but active in July & August
2005	Off-shore trough observed between 5 June to 24 Sept. except during 7 & 10 August, 22 August – 5 September, 8 – 9 September & 20 – 22 September

TABLE 10

Troughs in mid & upper latitudes

Atmospheric Level	Jun	Jul	Aug	Sep	Total
300 hPa	00	00	00	02	02
500 hPa	02	00	00	01	03

TABLE 11

Systems in West Pacific Ocean/South China Sea

Low Pressure Systems	Jun	Jul	Aug	Sep	Total
Tropical Depression (T.D.)	00	00	00	00	00
Tropical Storm (T.S.)	00	00	04	02	06
Typhoon/Super Typhoon	00	02	01	02	05
Total	00	02	05	04	11

4.5. ENSO Phenomenon

El Nino is the general term used to indicate the anomalous rise in the sea surface temperature over the East Pacific. A see-saw relationship between sea level pressure over the Southeastern Pacific Ocean and the Indian Ocean is known as Southern Oscillation (SO). SO is the atmospheric response to El Nino, which is an oceanographic phenomenon. Both these phenomena, atmospheric and oceanic, together is known as El-Nino Southern Oscillation *i.e.*, ENSO. The phase and magnitude of ENSO can be indicated either by the Sea Surface Temperature (SST) anomalies over the Pacific Ocean or by Southern Oscillation Index (SOI) expressed as the difference in the atmospheric surface pressure between Tahiti, an island station in the Southeast Pacific Ocean and Darwin, Australia. In general, an inverse relationship between ENSO and Indian summer Monsoon rainfall has been observed; though there is no one-to-one correspondence between these two. Also, some of the recent research results indicate that the relationship between ENSO and Indian Summer Monsoon Rainfall has weakened during past few decades.

Table 12 depicts the monthly values of Sea Surface Temperature anomaly indices for Nino1+2, Nino 3 and Nino 4 regions and SOI for the period from October 2009 to September 2010.

It may be noted that the cooling associated with the La-Nina conditions started in June and La-Nina conditions

TABLE 12

SST anomaly indices (ENSO)

Month	PACIFIC SSTA (in °C)			SOI
	Nino 1+2 0°-10° S 90°-80° W 150° W	Nino 3 5° N-5° S 150°-90° W	Nino 4 5° N-5° S 160° E	
	Oct 2009	0.0	0.8	
Nov 2009	0.4	1.3	1.5	-0.8
Dec 2009	0.3	1.6	1.4	-1.0
Jan 2010	0.2	1.0	1.4	-1.5
Feb 2010	0.0	0.7	1.1	-2.1
Mar 2010	-0.2	0.7	1.1	-1.4
Apr 2010	0.6	0.7	0.8	1.2
May 2010	0.1	0.0	0.4	0.8
Jun 2010	-0.2	-0.5	0.1	0.1
Jul 2010	-1.7	-1.0	-0.5	2.0
Aug 2010	-1.5	-1.1	-1.0	1.7
Sep 2010	-1.6	-1.2	-1.4	2.6

with strong negative SST anomalies in all the 3 regions prevailed during July, August & September.

Consistent with the La Nina conditions over the Pacific Ocean, the Southern Oscillation Index (SOI) remained positive all through the months during April to September.

4.6. Indian Ocean Dipole (IOD) Event

Like the ENSO, the Indian Ocean Dipole (IOD) is a coupled ocean-atmosphere phenomenon in the Indian Ocean. It is normally characterized by an anomalous cooling of SSTs in the southeastern equatorial Indian Ocean and an anomalous warming of SSTs in the western equatorial Indian Ocean. Associated with these changes, the normal convection situated over the eastern Indian Ocean warm pool shifts to the west and brings heavy rainfall over the east Africa and severe droughts/forest fires over the Indonesian region.

The intensity of the IOD is represented by an anomalous SST gradient between the western equatorial Indian Ocean (50° E - 70° E and 10° S - 10° N) and the south eastern equatorial Indian Ocean (90° E - 110° E and 10° S - 0° N). This gradient is represented by a value called Dipole Mode Index (DMI), defined by Saji *et al.*, (1999). When the DMI is positive then, the phenomena is

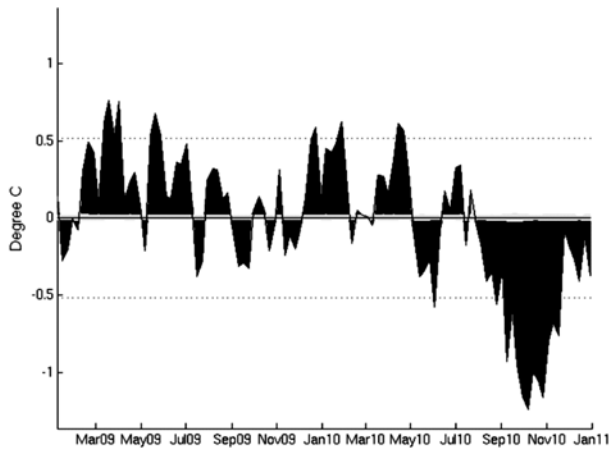


Fig. 10. Dipole mode (DMI) values (Indian ocean Dipole phase – JAMSTEC, Japan)

referred as the positive IOD and when it is negative, it is referred as negative IOD. In general, there is a positive correlation between DMI and All Indian Summer Monsoon Rainfall, though the relationship involves many other complex Ocean-atmospheric phenomena.

Fig. 10 shows the DMI during the period January 2009 to December 2010. It shows that in general, a weak negative phase prevailed during this year's Monsoon season. Thus, it may be perceived that the La-Nina conditions had dominating influence upon the Indian Ocean conditions this time, towards the resultant normal Monsoon.

5. Semi-permanent systems

5.1. Heat low

The heat low got established in its near normal position over Pakistan and neighbourhood around 20th May. It was diffused during 28th May - 9th June and was located in the near normal position on many days during June, August and Sept. and located to the east/northeast of normal position during July. The low started filling up from 14th September and became less marked from 26th September.

The lowest and the second lowest pressure values of the heat low were:

- Jun : 991 hPa (on 21) and 993 hPa (on 13, 20, 26 & 29)
- Jul : 990 hPa (on 11) and 993 hPa (on 1, 4, 25 & 26)

Aug : 993 hPa (on 23 & 24) and 995 hPa (on 1, 2, 9 & 12)

Sep : 995 hPa (on 4 & 7) and 997 hPa (on 2, 4, 6 & 10)

The analysis of the monthly composite patterns of surface air temperature and pressure values (from the CPC-NOAA re-analysis), around the Heat low region normally located near Lat. 28° N / Long. 68° E, close to Jacobabad in Pakistan (figures not re-produced here) reveals that while the surface air temperature anomaly was normal over the Heat low region during July and August, it was negative in June and positive in September. Also a positive temperature anomaly was located to the northeast of normal position all through the months. Similarly the surface pressure anomaly pattern indicates weaker than normal Heat low during June, July and August and near normal with a stronger negative anomaly to the south during September.

The details of the lowest observed isobaric values of the Heat Low during past five years are given in Table 13.

5.2. Axis of the monsoon trough

An east-west oriented heat trough appeared in the lower tropospheric levels over the northern plains, extending southeastwards to the north Bay of Bengal during 29th May - 6th June. It re-organised on 12th June and persisted up to 5th July.

With the Monsoon covering the entire country on 6th July, the trough got established as Monsoon trough extending up to mid tropospheric levels on 7th July. It started shifting to the north from 9th, subsequent to the weakening of a low pressure area over the central parts of the country. It remained there upto 12th July and then shifted to the south on 13th but was confined to the lower tropospheric levels. It oscillated there north-south with its eastern end shifting southward and passing through coastal Andhra Pradesh during 15th - 21st July and tilted southwards with height and extended upto 3.6 kms a.s.l during 15th - 17th July. The formation of consecutive low pressure areas and their west northwestward movement across the peninsula caused the trough to shift south of its normal position during 22nd July - 4th August. During this period, it generally extended up to mid tropospheric levels, tilting southwards with height. Another branch extended eastwards to Nagaland-Manipur-Mizoram-Tripura on 31st July & 1st August. It remained in near normal position during 5th - 9th August while extending upto mid tropospheric levels. It then shifted northwards on 10th August subsequent to the dissipation of the low pressure area and remained confined to the lower

TABLE 13
Details of lowest isobaric values (hPa) of the heat low during past 5 years

Month	Year				
	2005	2006	2007	2008	2009
June	988.0(26 th)	988 (26)	988.3 hPa (on 15)	991 (on 27)	991 hPa (on 21)
July	988 (1 st & 2 nd)	988 (1 st & 2 nd)	990 hPa (on 5)	989 (on 28)	990 hPa (on 11)
August	990.0 (1 st & 2 nd)	990 (1 st & 2 nd)	992 hPa (on 8 & 10)	993 (on 9)	993 hPa (on 23 & 24)
September	996.0(1 st)	996 (1 st) &	997 hPa (on 14 & 19)	997 (on 2)	995 hPa (on 4 & 7)

TABLE 14
Upper air observations of TEJ

Station	Period	Maximum core wind speed (Kts.)	Level (hPa)	Date/Time
Thiruvananthapuram	27 Aug – 7 Jun	115	150	12 July / 0000 UTC
Chennai	4 Jun – 26 Aug	110	105	18 July / 0000 UTC
Minicoy	4 Jun – 3 Aug	80	150	31 July / 1200 UTC
Port Blair	9 Jul – 9 Sep	105	117	11 July / 0000 UTC

tropospheric levels till 11th August. Thereafter, the western end remained to the north of normal with eastern end oscillating north - south during period 12th - 25th August. It was quite shallow during 19th - 25th August. The eastern end remained to the south of its normal position and western end remained in near normal position during 26th August - 1 September. The trough became more marked and was seen up to mid tropospheric levels, tilting southwards with height during 31st August - 8th September. The western end remained to the south of its normal position while the eastern end oscillated north-south during 9th-11th September. Along with the northward movement of a low pressure area, the western end shifted towards normal position. It was seen only up to lower tropospheric levels during 9th - 15th September and extended up to mid tropospheric levels, tilting southwards with height in the presence of a low pressure area during 17th - 20th September. During 21st - 26th September, it remained to the north of normal position and was confined to the lower tropospheric levels.

The trough at sea level became less marked from 27th September. As evident from the above details, the trough

never shifted towards the foothills of the Himalayas during the entire period.

In general, during the southwest Monsoon 2010, the Monsoon trough was not well-established; remained confined to lower tropospheric levels without its characteristics - tilt to south with height - during many days of the season.

5.3. Tibetan Anticyclone/High

The Tibetan Anticyclone (TA) was established in its near normal position at 300 & 200 hPa on 26th June. It was noticed up to 22nd September. It remained to the southeast of its normal position on a few days during August & September.

An analysis of the monthly mean characteristics of this anticyclone using the CPC / NOAA data (Fig. not shown) reveals that the anticyclone remained to the south / southeast of normal position during June, to the east of normal position at 500 hPa during July and Sept., to the north of normal position at 500 hPa, during August and remained in the near normal position at 300 and 200 hPa

TABLE 15
Zonal wind anomalies 2010

	Week ending																	
	2/6	9/6	16/6	23/6	30/6	7/7	14/7	21/7	28/7	4/8	11/8	18/8	25/8	1/9	8/9	15/9	22/9	29/9
TRV																		
850	-8.0	-3.1	3.9	-9.3	-1.4	-3.0	-7.6	5.3	5.9	3.8	-4.5	-5.0	-2.6	-8.0	-	4.3	-2.3	-12.2
500	-10.5	-8.8	-2.5	-12.2	-3.7	-0.2	-11.8	-1.6	5.5	-3.3	3.9	-3.8	2.9	5.9	-	2.7	-0.3	-6.7
200	0.4	-10.5	-6.8	-9.9	2.9	16.5	-2.0	1.0	-9.5	-4.9	2.9	4.7	10.6	0.9	-	-	-11.6	-5.5
MDS																		
850	-2.2	-7.2	-4.0	4.4	-3.1	-0.6	-	5.1	7.5	5.5	-0.7	-12.7	-9.8	6.5	-	-	-	-
500	-0.4	-9.9	-1.1	-6.8	-13.2	-0.1	-	-6.8	7.3	2.5	4.5	-16.4	-19.5	3.8	-	-	-	-
200	-2.7	-6.4	0.8	-11.6	2.4	1.0	-	-0.4	-6.4	-3.1	-0.4	-3.9	-4.9	-12.1	-	-	-	-
BMB																		
850	3.7	8.0	-10.4	-11.5	-13.8	-1.8	2.3	-4.7	6.1	5.6	-2.3	-	-10.5	-14.4	-2.3	-2.2	1.5	-4.5
500	-3.0	5.8	-10.2	-1.8	4.8	6.6	-2.9	-7.0	12.3	1.1	-7.0	-	-	-	-	-	-	-
200	-5.7	-7.7	8.9	-0.6	11.6	-	2.8	-1.8	6.3	0.1	-5.9	-	-	-	-	-	-	-
NGP																		
850						-12.2	3.2	-10.7	4.8	-3.9	-4.5	-13.0	-6.4	-8.8	-2.3	3.9	6.0	-0.2
500	-	-	-	-	-	-14.0	1.2	-12.9	-1.2	5.0	-10.5	-5.1	-8.0	-13.8	-14.2	-3.6	6.8	4.5
200	-	-	-	-	-	-1.6	-12.1	-18.2	-1.2	3.9	2.0	-12.3	-16.1	-19.0	-19.1	-9.4	-5.7	2.8

Note : 1. Easterly anomalies (-ve) at 850 hPa means that westerlies are weaker than normal.
2. Westerly anomalies (+ve) at 200 hPa means that easterlies are weaker than normal.
3. A station reporting '-' means no data.

levels during July, August and September. However, the intensity showed wide variations as seen from the anomalous fields.

The details of Tibetan Anticyclone for the past five years are given below.

Year

Tibetan Anticyclone

2005 Established on 26th June. Remained more or less at normal position in June, slightly to the south in August and north of its normal position till 27th September.

2006 Established on 7th June. Not seen at 500 and 300 hPa on most of the days during June and July. Less marked from 10th September onwards.

2007 Established on 21st June. Less marked from 15th September onwards.

2008 Established on 26th June. It was noticed upto 15th September. On many days during the later half of July, it remained to the east of normal position, to the northeast on many days during August and to the north during September.

2009 Established on 22nd June. It was noticed up to 20th September. It remained to the northeast of its normal position on many days during August & September.

5.4. Sub-Tropical Westerly Jet (STWJ)

STWJ was seen over Delhi and Guwahati latitudes up to 6th July. It re-appeared over Delhi on 26th September.

A blocking event reported to be observed in the STWJ during late July - August is said to be the causative factor for the floods in Pakistan, heat wave in Russia and landslides in China (Marshall, 2010).

The days during which the Sub-tropical Westerly Jet was observed in the past five years are given below:

Year	Sub-Tropical Westerly Jet (STWJ)
2005	Seen over Srinagar upto 22 nd June, over many stations like Delhi, Lucknow, Srinagar and Lucknow during second half of July and August and over Delhi, Srinagar & Lucknow on 15 th 23 rd and 30 th September respectively.
2006	Seen over Srinagar and Delhi Latitudes upto 11 th June, shifted northwards thereafter and made casual re-appearances. It was seen over Delhi and Srinagar from 29 th September.
2007	Seen over Srinagar and Ranchi Latitudes upto 27 th June, it re-appeared over Srinagar on 3 rd October and over Delhi on 7 th October.
2008	Seen over Delhi and Guwahati latitudes upto 10 th June. It re-appeared over Delhi on 10 th September.
2009	Seen over Srinagar and Guwahati latitudes up to 3 rd July. It appeared over Srinagar on 19 th August

5.5. Tropical Easterly Jet (TEJ)

TEJ got established over the southern tip of Peninsular India by 4th June. The southern stations viz., Thiruvananthapuram, Chennai and Minicoy reported easterlies of 90, 85 and 60 kts respectively around 100 hPa levels during 4th - 7th June. A wide latitudinal spread of the easterly jet speed winds was noticed during the whole of July and August. A core wind speed of 115 kts. was noted over Thiruvananthapuram on 12th July. Jet speed winds of the order of 80 kts. were noticed over Mumbai occasionally during July.

Some of the upper air observations which reveal the characteristics of the jet stream are given in Table 14.

Apart from these, Jet speed winds were also reported over Visakhapatnam, Bhubaneswar, Hyderabad, Nagpur, Bhopal, Ranchi and Kolkata on several days during the season.

Details of TEJ in the past five years are as follows.

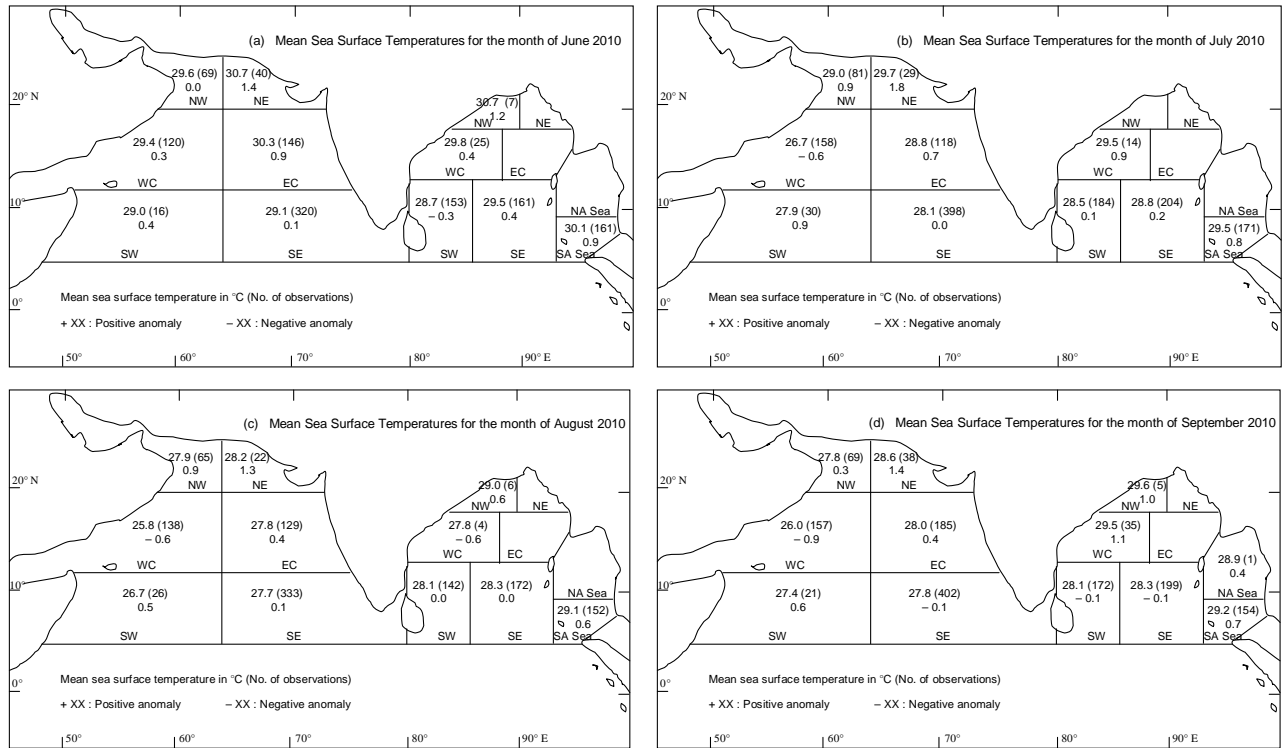
Year	Tropical Easterly Jet (TEJ)
2005	Seen from 6 th June to 28 th September. Maximum wind speed 110 kts at 198 hPa over Thiruvananthapuram on 31 st July and over Chennai at 100 hPa on 8 th July.
2006	Seen from 11 th May to 4 th October. Maximum wind speed 100 kts at 128 hPa on 1 st July over Thiruvananthapuram and over Minicoy on 25 th July and 31 st August at 202 and 200 hPa respectively.
2007	Seen from 19 th May to 6 th October. The maximum wind speed reported was 100 kts at Thiruvananthapuram on 28 th June & 16 th Aug; at Minicoy, on 17 th July, 2 nd August & 10 th September and at Port Blair, on 13 th July & 7 th August.
2008	Seen from 25 May to beginning of October. Maximum wind speed of 100 kts reported at Port Blair for a few days in June July and September.
2009	Seen from 25 May onwards. Maximum wind speed of 125 kts reported at Thiruvananthapuram on 26 July.

6. Sea Surface Temperature (SST)

In Figs. 11(a-d), the monthly mean sea surface temperature values (based on actual SST observations reported by ships) along with the anomalies in northwest, northeast, west central, southwest, southeast blocks of both the seas and also for North Andaman (NA) and South Andaman (SA) seas for the months of June, July, August and September are given. The normal values for each block for calculating the anomalies are estimated from the isopleths of normal values given in the publication, "Climatic Atlas of Indian Ocean, Part-I" by Stephen Hastenrath and Peter J. Lamb.

6.1. June

The west central, east central, southwest and southeast sectors of the Arabian Sea were warmer than normal having positive anomaly in the range 0.1 to 0.9 °C and northeast sector of the Arabian Sea was warmer having anomaly of 1.4 °C. The west central, southeast, northwest sectors of Bay of Bengal were having positive anomaly in the range of 0.4 to 1.2 °C with northwest



Figs. 11(a-d). Mean SST and SST anomaly in (°C) for (a) June, (b) July, (c) August and (d) September 2010

sector of Bay of Bengal is more warm having anomaly of 1.2 °C, southwest sector of Bay was cooler than normal by 0.3 °C. South Andaman Sea was warmer by 0.9 °C than the normal.

6.2. July

The northwest, east central, southwest and northeast sectors of the Arabian Sea were warmer than normal having positive anomaly in the range of 0.7 to 1.8 °C with northeast sector of the Arabian Sea warmer than normal by 1.8 °C. The west central sector of the Arabian Sea was cooler than normal by 0.6 °C. The west central, southwest and southeast sectors of the Bay of Bengal and south Andaman Sea were warmer than normal having positive anomaly in the range 0.1 to 0.9 °C.

6.3. August

The northwest, east central, southwest, southeast and northeast sectors of the Arabian Sea were warmer than normal having positive anomaly in the range 0.1 to 1.3 °C while northeast sector of the Arabian Sea was more

warmer by 1.3 °C and west central sector of the Arabian sea was cooler than normal by 0.6 °C. The northwest sector of the Bay of Bengal and south Andaman Sea were having positive anomaly in the range 0.5 to 0.6 °C while west central, southwest and southeast sectors of the Bay of Bengal were cooler than normal having negative anomaly in the range 0.1 to 0.6 °C.

6.4. September

The northwest, east central, southwest and northeast sectors of the Arabian Sea were warmer having positive anomaly in the range 0.3 to 1.4 °C with northeast sector warmer than normal by 1.4 °C. The west central and southeast sectors of the Arabian Sea were cooler than normal having negative anomaly in the range 0.1 to 0.9 °C. The north & south Andaman Seas were warmer than normal having positive anomaly in the range 0.4 to 0.7 °C. The northwest and west central sectors of the Bay of Bengal were warmer than normal having anomaly in the range 1.0 to 1.1 °C. The southwest and southeast sectors of the Bay of Bengal were cooler having negative anomaly by 0.1 °C.

7. Other features

7.1. Monthly wind anomalies during southwest Monsoon 2010

The circulation anomaly features during the southwest Monsoon season are discussed below month wise at lower, middle and upper tropospheric levels 850, 500, 200 hPa. Table 15 depicts the zonal wind anomalies at these levels over some selected stations.

7.1.1. June wind anomaly features

Anomalous cyclonic circulations were seen over Arunachal Pradesh and neighbourhood, at 850 hPa. Anomalous anticyclonic circulation is observed over northwestern part of India.

During the week ending 9th June, an anomalous cyclonic circulation was seen over Gangetic West Bengal and neighborhood at 850 hPa. Winds were anticyclonic over the east central Arabian Sea and adjoining Maharashtra coast at 850 hPa. A ridge line at 200 hPa was seen along 20° N to 17° N. During the second week ending on 16th June, anomalous anticyclonic circulations were seen, one over Gujarat and adjoining west Madhya Pradesh and another over Gangetic West Bengal and adjoining Jharkhand at 500 hPa.

During the third week ending on 23rd June, an anomalous cyclonic circulation was seen over the east central Arabian Sea off Maharashtra coast extending upto 700 hPa. An anomalous anticyclonic circulation was seen over Assam and Arunachal Pradesh between 500 & 300 hPa.

During last week ending on 30th June, an anomalous anticyclonic circulation was seen over northeast India at 850 hPa.

7.1.2. July wind anomaly features

An anomalous cyclonic circulation was seen over the east central Arabian Sea off Maharashtra coast at 850 hPa extending upto 700 hPa. Another anomalous cyclonic circulation was seen over the west central Bay of Bengal and adjoining southwest Bay off North Andhra Pradesh coast extending up to 700 hPa.

For the week ending 7th July, an anomalous cyclonic circulation was seen over the east central and adjoining southeast Arabian Sea off Maharashtra - Karnataka coasts at 850 hPa. Anomalous anticyclonic circulation was seen over Sub-Himalayan West Bengal and neighborhood at 850 hPa, extending up to 700 hPa. An anomalous cyclonic

circulation was seen over the west central Bay of Bengal off Andhra Pradesh coast at 700 hPa extending up to 300 hPa. Anomalous cyclonic circulation was seen over South Rajasthan and adjoining Gujarat at 850 hPa extending up to 300 hPa.

For the week ending 14th July, two anomalous cyclonic circulations were seen, one over Assam & Meghalaya and neighborhood and another over Jharkhand and neighborhood both extending upto 700 hPa. An anomalous anticyclonic circulation was seen over the east central Arabian Sea and adjoining northeast Arabian Sea off Gujarat-Maharashtra coasts, extending upto 500 hPa. A ridge line at 200 hPa was seen along 25° N.

During the third week ending on 21st July, two anomalous cyclonic circulations were seen, one over south Interior Karnataka and neighborhood and the other over south Tamil Nadu and neighbourhood at 850 hPa. An anomalous cyclonic circulation was seen over the east central Arabian Sea off Maharashtra coast at 700 hPa. An Anomalous anticyclonic circulation was seen over Gangetic West Bengal and neighbourhood at 850 hPa extending up to 200 hPa.

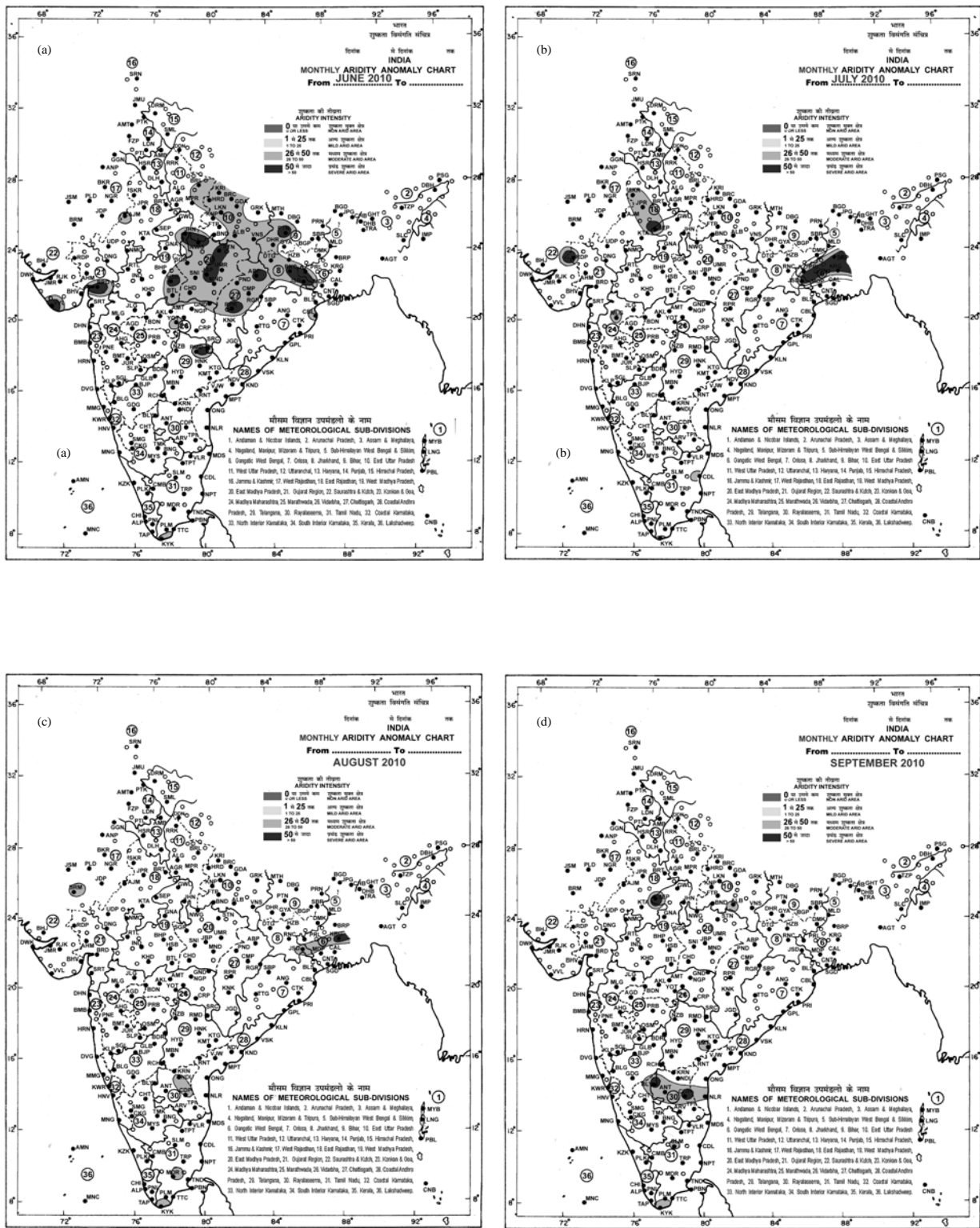
In the last week ending 28th July, three anomalous cyclonic circulations were seen, one over Gujarat and neighborhood extending up to 200 hPa, second over Vidarbha and neighborhood and the third over the northwest and adjoining west central Bay of Bengal off Orissa coast at 850 hPa extending up to 700hPa.

7.1.3. August wind anomaly features

An anomalous anti-cyclonic circulation was seen over Arunachal Pradesh and neighborhood at 700 hPa extending up to 500 hPa.

For the week ending on 4th August, two anomalous cyclonic circulations were seen, one over Gujarat off north east Arabian Sea, extending up to 500 hPa, second over Orissa and neighborhood at 850 hPa extending up to 700 hPa. For the week ending on 11th August, an anomalous cyclonic circulation at 850 hPa was seen over the west central Bay of Bengal off north Andhra - south Orissa coasts extending up to 500 hPa. An anomalous cyclonic circulation was seen over Madhya Maharashtra and neighborhood at 700 hPa extending up to 300 hPa.

During the week ending on 18th August, an anomalous anticyclonic circulation was observed over Gangetic West Bengal adjoining north Bay at 700 hPa extending upto 300 hPa. During the week ending 25th August an anomalous anticyclonic circulation was seen over Gangetic West Bengal and neighbourhood extending



Figs. 12(a-d). Aridity anomaly chart for the month (a) June, (b) July (c) August and (d) September 2010

up to 300 hPa. An anomalous cyclonic circulation was seen over the southwest Bay of Bengal off Tamil Nadu coast at 850 hPa extending up to 500 hPa.

For the last week ending 1st September, an anomalous cyclonic circulation was seen over the east central Arabian Sea off Maharashtra coast at 850 hPa extending up to 700 hPa. A ridge line was seen along 29° N.

7.1.4. September wind anomaly features

An anomalous cyclonic circulation was observed at 850 hPa over East Rajasthan and neighbourhood extending up to 700 hPa. An anomalous anticyclonic circulation was seen over Assam and neighbourhood at 500 hPa.

For the week ending on 8th September, three anomalous cyclonic circulations were seen at 850 hPa, one over Rajasthan and second over east central Arabian Sea off Maharashtra-Goa coasts, third over Orissa and neighbourhood extending up to 700 hPa. Anomalous cyclonic circulations were seen at 500 hPa, one over Arunachal Pradesh and neighbourhood, second over east Uttar Pradesh and neighbourhood, and third over west Uttar Pradesh and neighbourhood. For the week ending on 15th September, anomalous cyclonic circulations were observed one over Gujarat and neighbourhood at 850 hPa extending up to 500 hPa, second over Chattisgarh and neighbourhood and third one over Assam and neighbourhood at 850 hPa. For the week ending on 22nd September, an anomalous cyclonic circulation was seen at 850 hPa over Chandigarh and neighbourhood extending up to 500 hPa. An anomalous anticyclonic circulation was seen over the Peninsula at 850 hPa extending up to 700 hPa. For the last week ending on 29th September, an anomalous anticyclonic circulation was seen over central India at 850 hPa extending up to 300 hPa.

7.2. Aridity conditions during the southwest Monsoon 2010

Aridity Index (AI) is computed based on Thornthwaite's formula :

$$AI = \frac{PE - AE}{PE} \times 100$$

where, PE is Potential Evapotranspiration, which is the loss of water vapour to atmosphere in the form of evaporation from soil and transpiration from the plants, when the supply of water is unlimited. This is the water need of the plants. AE denotes the Actual Evapotranspiration and PE - AE denotes the water

deficiency. PE is computed by Penman's modified equation and AE is obtained from the water balance procedure, which takes into account the water holding capacity of the soil.

The aridity anomaly is worked out by considering the difference between actual aridity and normal aridity for the month. The aridity of a particular region is decided based on the aridity anomalies, which are classified as follows:

Aridity Anomaly	Class
0 or less	non-arid
1 to 25	mild arid
26 to 50	moderate arid
more than 50	severe arid

Aridity Anomaly maps for June, July August and September are given in Figs. 12(a-d).

The details of severe and moderate arid conditions which prevailed over the country during the southwest Monsoon season are given below monthwise.

7.2.1. June

7.2.1.1. Severe arid areas (June)

Small areas over the southeastern parts of Jharkhand and adjoining western parts of Gangetic West Bengal, central and northern parts of east Madhya Pradesh and adjoining southern parts of west Uttar Pradesh and east Uttar Pradesh.

Isolated areas around Veraval (Saurashtra & Kutch), Baroda (Gujarat), Hoshangabad (West Madhya Pradesh), Raipur and Ambikapur (Chattisgarh), Patna (Bihar) and Ramagundam (Telangana).

7.2.1.2. Moderate arid areas (June)

Large areas of east Uttar Pradesh, east Madhya Pradesh, Chattisgarh and Jharkhand.

Small areas of eastcentral and southern parts of west Uttar Pradesh, eastern parts of west Madhya Pradesh, northeastern parts of Vidarbha, central parts of Gujarat Region, southern parts of Saurashtra & Kutch and eastern parts of Telangana.

TABLE 16
Representative rainfall amounts (>7 cm) during June - September 2010

Date	June	July	August	September
(1)	(2)	(3)	(4)	(5)
1. Basar 14, North Lakhimpur 11	Sanguem 21, Maya Bandar 14, Lonar, Motihari & Rongo 13 each, Hingoli 11, Digras, Manora & Mehkar 10 each, Harsud, Mahad, Malegaon, Marsrakh & Nancowary 9 each, Buxaduar, Dowleshwaram, Garhakota, Gokarna, Lakhimpur, Manvi, Mominabad, Parbhani, Saraipali, Sironj & Tadepalligudem 8 each, Bemetara, Bilaspur, Guhagarh, Kawardha, Kudulu, Mussoorie, Pandhana & Tendukheda 7 each	Nagarkata 19, Vada 18, Begu 17, Bhiwandi, Khalapur & Pen 16 each, Igatpuri, Kalyan, Rongo, Talala & Ujjain 15 each, Bhira, Karjat, Murti & Shahapur 14 each, Alibag, Chittorgarh & Sonkatch 13 each, Matheran, Sudhagad & Thane 12 each, Ballabgarh, Bareli, Gaganbawada, Jawhar, Khed, Mahidpur, Neora Silvassa 11 each, Bijoliya, Kalyanpur, Khairi, Madhuban & Murbad 10 each, Bagrakote, Bantwal, Barrackpur, Dhaniakhali, Gautam Buddha Nagar, Jamnagar AP, Jhadol, Khushalgarh, Kotri, Kutiana, Lalpur, Mahabaleshwar, Mangalore, Mangrol, Moradabad, Nuh, Pakur, Pardi, Pirawa & Sanganer Tehsil 9 each, Agumbe, Bajpe, Bisauli, Chiplun, Dahanu, Dapoli, Dhari, Mokheda, Mudubidre, Mumbai, Mumbai AP, Nanipalson, Radhanagari, Rajgangpur, Rajkot AP, Sagwara, Sheopur, Umbergaon, Vapi & Vidisha 8 each, Agar, Arambagh, Bagati, Bhatkal, Budhni, Chengmari Diana, Didwana, Harpur, Jagalbet, Jayal, Laikera, Mandangad, Mulki, Nakur, Panambur, Ranawao, Roha, Sailana, Savarkundla, Tezu & Uluberia s 7 each	Begu 17, Panvel 16, Jaskan, Kutiana, Mahabaleshwar & Matheran 13 each, Bhira, Chiplun, Mumbai & Rongo 12 each, Gandevi, Kalyan & Manavadar 11 each, Castle Rock, Dapoli, Madhuban, Sudhagad, Sutrapada, Tribeni & Vada 10 each, Abdasa, Babra, Bihubar, Dholka, Jawhar, Kalyanpur, Khambha, Lakkavalli, Mhasla, Murbad, Naliya, Nanipalson, Thane, Vanthali & Wav 9 each, Bhiwandi, Garidhar, Igatpuri, Kandla New, Khalapur, Khed, Mokheda, Mumbai AP, Pardi, Paud, Porbandar AP & Umbergaon 8 each, Amraoti, Chhachhrauli, Dhari, Junagadh, Kharsema, Londa, Palitana, Patan & Uran 7 each	
2. Cherrapunji 24, Karimganj & Narayanpur 10 each, Chengmari Diana, Lakhimpur, Nalwatwad & Shella 9 each, Alur, Dinhata, Hungund, Jia Bharali N T Xing & Namsai 8 each, Dhubri & Kakkeri 7 each	Gokarna 22, Honavar & Manki 20 each, Canacona, Galgalia & Thakurganj 18 each, Matheran, Rongo & Taibpur 16 each, Gajoldoba, Karwar & Kumta 15 each, Bagdogra, Bidar, NH31 Bridge & Shirali 14 each, Bidar, Domohani, Koondapur, Malvan & Siricilla 13 each, Bhatkal, Buxaduar, Dholpur Tehsil & Margao 12 each, Bhalki, Dholpur, Gonda, Khalapur & Nanded 11 each, Ankola, Chengmari Diana, Hasimara, Jalpaiguri, Kadra, Khajuri, Marmugao, Poladpur & Sanguem 10 each, Agumbe, Champasari, Gerusoppa, Jawhar, Kamalapur, Kudal, Manthala, Monghyr, Nagarkata, Narayan Khed, Pratapgarh, Rajakhera, Salbari & Sawantwadi 9 each, Chincholi, Dabolim, Dahanu, Karjat, Koida, Pathri, Quepem, Rajapur, Sabalgarh & Umerkhed 8 each, Asnawar, Basawakalyan, Bhira, Govindgarh, Kollur, Mohitnagar, Mokheda, Sholapur & Udipi 7 each	Lalpur 23, Veraval 21, Jamnagar AP 18, Kodinar 17, Jawhar 16, Bansda & Becharaji 15 each, Kalyanpur, Porbandar AP & Sutrapada 14 each, Bhira & Morvi 13 each, Bulsar, Mangrol & Wanakbori 12 each, Igatpuri, Kalwad, Monghyr, Raipur, Sanand & Wadhwan 11 each, Malia, Miyane, Manavadar, Mokheda, Navsari, Okha, Rahapur, Raisen & Vada 10 each, Ahwa, Athgarh, Broach, Chikhli, Chothkabarwara, Dharampur, Dhekiajuli, Gandevi, Hengiri, Jalalpur, Kanva, Khajuraho AP, Laikera, Lakkavalli, Malia, Matheran, Mount Abu, Sironj & Vallabhipur 9 each, Ahmedabad AP, Chotan, Ranawao, Rongo & Sahada 8 each, Contai S, Mounntabu Tehsil, Nanipalson, Pardi, Peint, Pushpajgarh, Rajkot AP, Upleta & Valod 7 each	Guwahati 13, Aonla, Nalbari & Rongo 12 each, Mahabaleshwar 11, Dehra Dun, Garubathan & Pilibhit 10 each, Bareilly P 9, Mandangad, Mandla & Tangla 8 each, Khed 7	

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
3.	Kamalpur 24, Jamnagar AP 11, Piravam 8, Khowai 7	Udgir 20, Sindkhed Raja 17, Shirali 16, Bhatkal & Kollur 15 each, Hosanagar & Maya Bandar 14 each, Broach, Manki & Sankheda 13 each, Agumbe, Ambad, Deolgaon Raja, Jalna & Paithan 12 each, Jintoor, Kottigehara, Osmanabad, Partur, Parvatipuram, Rajpipala & Sendhwa (Med) 11 each, Dinhata, Hunchadakatte, Lakhnadon, Nandol, NH 31 Bridge & Shirpur 10 each, Aurangabad, Baroda AP, Bhalki, Gerusoppa, Kallam, Kandhar, Majagaon, Malvan, Morvi, Padra, Sawantwadi, Sultanabad & Virangam 9 each, Buxaduar, Gokarna, Honavar, Jaipatna, Khuldabad, Koondapur, Kumta, Lonar, Mathabhanga, Mehkar, Pali, Rongo, Siddapura & Taloda 8 each, Hingoli, Kadra, Kumargram, Malegaon, Nanded, Palsana, Purna & Tilakwada 7 each	Okha 23, Kalyanpur & Malia 21 each, Lalpur & Rongo 19 each, Bachau & Ranawao 18 each, Abdasa & Naliya 16 each, Dwarka & Korba 15 each, Mahabaleshwar & Mangrol 14 each, Katghora & Nakhatrana 13 each, Bhanwad, Mangaon, Mhasla, Sakti, Talala & Veraval 12 each, Balaghat & Naharkatia 11 each, Bhira, Hut Bay, Jorhat, Lanji, Porbandar AP & Raigarh 10 each, Baikunthpur, Begu, Dholai, Iगतपुरi, Keshod AP & Nainpur 9 each, Agumbe, Amgaon, Baldwara, Chamoli, Dindori, Jia Bharali N T Xing, Krishnaprasad, Kutiana, Matheran, Mungeli, Upleta, Uttar Kashi & Wav 8 each, Anuppur, Bali, Bhilwara Tehsil, Bulsar, Chikhli, Chotan, Daman, Dharampur, Dhundhi, Gaganbawada, Kumarsain, Manendragarh, Nancowary, Narora, Patan, Rajgangpur, Sahaswan & Vapi 7 each	Lahar 30, Saloni 14, Dehra Dun & Jabalpur-New-Sawaimadhapur 11 each, Arang, Datia, Koraput & Sawai Madhopur 10 each, Chhibramau, Hardwar Mayapur, Kaman & Silchar 9 each, Bareilly P, Bilaspur, Kurnool, Mahbubnagar & Palkot 8 each, Alampur, Dabra, Etawah, Etawah C, Jhansi & Tarabganj 7 each
4.	Guwahati & Majitar 11 each, Carnicobar I, Pedong 10, Dinhata, Govindgarh & Khanitar 9 each, Car Nicobar, Islampur & Namthang 8 each, Gangtok & Rangia 7 each	Buxaduar & Jafarpur 21 each, Pataudi 20, Nagarkata 17, Gurgaon 16, Mumbai 15, Bagsra 14, Cherrapunji & Vanthali 13 each, Mumbai AP 12, Alibag, Chengmari Diana, Karkala & Uran 11 each, Baroda AP, Bhiloda, Farukhnagar, Jamnagar AP, Mani, Thane & Wardha 10 each, Dinhata, Diu, Khargone, Kotkasim, Naharkatia, Porbandar AP, Rajkot AP & Ramgarh 9 each, Chotila, Dillighat, Halflong, Junagadh, Lalpur, Lilia, Malia, Margherita, Matheran, Sohana & Thasra 8 each, Chabra, Chicholi, Darwha, Guna, Khushalgarh, Kodinar, Mangalore, Mangrol, Neora, Paratwada & Tezu 7 each	Rahapur 22, Kottigehara 17, Agumbe & Dharmasala 16 each, Lodhika, Radhanpur & Sayala 15 each, Kadra 14, Becharaji, Canacona, Gandhinagar, Kharaghoda, Kollur, Limbadi, Malia Miyane, Muli, Sami & Siddapura 13 each, Arnod & Valpoi 12 each, Dhrangadhra, Irikkur, Kamardi, Khambhat, Mudigere, Sanguem, Taliparamba & Wav 11 each, Bhagamandala, Harij, Hosdurg, Kalasa, Koppa, Lalpur, Sanchore & Vadakara 10 each, Ahwa, Baijnath, Dabolim, Iगतपुरi, Joida, Londa, Mahabaleshwar, Margao, Matheran, Modasa, Paratwada, Qepem, Sanand, Sojitra, Tarapur, Thirthahalli, V. Vidyanagar, Virangam & Wadhwan 9 each, Bagrakote, Dahanu, Detroj, Dhandhuka, Gohar, Gondal, Gerusoppa, Gudamalani, Halwad, Kudulu, Murti, Nadiad, Panjim, Rajkot AP, Sirsi & Subramanya 8 each, Ankola, Bharwain, Dholka, Jsdan, Kadi, Manchikere, Marmugao, Murbad, Napoklu, Poonampet & Radhanagari 7 each	Gadchiroli 23, Ahiri 22, Etapalli 20, Konta, Mankapur & Masulipatnam 17 each, Koyyalagudem 16, Renuka & Silchar 15 each, Aligarh, Amalapuram, Ayoadhya, Bhimavaram & Saoli 14 each, Balrampur, Govindgarh, Kalyanpur, Venkatapuram & Vijayawada A.P. 13 each, Bambasa, Bisauli, Koida, Kunavaram & Sindewahi 12 each, Bharatpur, Bharatpur Tehsil, Champawat, Farukhnagar, Haldwani, Karimganj & Koderu 11 each, Dhanora, Gerusoppa, Gudivada, Morni, Nainital, Narasaraopet, Passighat, Sirpur & Thakurganj 10 each, Avani-gadda, Bansgaon, Beberu, Bhalukpong, Castle Rock, Linganamakki & Nuh 9 each, Ambagarh Chowki, Gonda, Hasimara, Jaunpur, Mohitnagar, Nuzvidu, Rupbas & Tenali 8 each, Armoor, Bari, Dausa, Dummugudem, Guntur, Prakasan Barrage, Rajura & Tadepalligudem 7 each
5.	Doddaballapura 11, Kamalpur & Mangam 9 each, Rayakottah, Subramanya & Teliamura 8 each, Amarpur & Cuddapah 7 each	Bijnor 20, Nagina 18, Ambala 17, Kalyanpur 16, Derabassi (Basi), Gokarna & Salbari 15 each, Piravam 14, Bajpe, Bantwal, Hasanpur, Panambur & Rajpura 13 each, Ambala I, Champasari, Chandigarh, Hathras & Vaikom 12 each, Chandigarh I, Meerut,	Kosagumda 27, Jambughoda 25, Jaipatna 23, Wav 21, Bisalpur 19, Nawarangpur 18, Krishnaprasad 17, Jagdalpur 16, Bhawanipatna, Jeypore, Pipili & Umakote 14 each, Palliakalan 13, Bhabhra, Bodeli, Junagarh & Mount Abu 12	Perur 25, Jalpaiguri 21, Venkatapuram 17, Eturnagaram, Gondpipri & Taibpur 16 each, Regoli 15, Kaimganj, Mohitnagar, Nuh, Seoni & Surat 14 each, Aligarh & Karjan 13 each, Olpad, Patan, Sindewahi & Warora 12

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
		Nahan, Shahabad & Uttar Kashi 11 each, Dwarka, Gangrar, Moradabad, Sambhar, Thrissur & Udipi 10 each, Dharampur, Enamakal, Gohana, Kandaghat, Karnal, Kozha, Mawana, Murti, Rajgarh & Vadakara 9 each, Ahmedabad AP, Beki Road Bridge, Bilaspur, Dadupur, Deoband, Dhampur, Iglas, Karwar, Kochi, Manohar Thana, Naraina, Nuh & Solan 8 each, Always, Bagdogra, Baran, Bhanwad, Chalakudi, Chengmari Diana, Chipabarod, Dehra Dun, Girva, Julana, Kasauli, Mangalore, Nakur, Quilandi, Renuka, Sangraha & Taliparamba 7 each	each, Dantewara, Gudari, Parvatipuram & Sanand 11 each, Alipingal, Banpur, Bijapur, Halol, Jalore, Jammu, Mahuda, Mundali & Waghodia 10 each, Baroda AP, Bhubaneswar, Bissem-Cuttack, Kaira Kheda, Katghora, Mehmedabad & Nighasan, Puri 9 each, Agumbe, Cuttack, Daskoroi, Dholka, Kashinagar, Khambhat, Kondagaon, Mandal, Savli, Tangi & Thasra 8 each, Anklav, Berhampur, Borsad, Jajpur, Koraput, Kotraguda, Matar, Naduvattam, Palakonda, Poonch, Rahapur, Siwana, Taliparamba & Viramgam 7 each	each, Ater, Betul, Chamorshi, Chhibramau, Jambughoda, Kumargram & Tuting 11 each, Bodeli, Broach, Chinnor, Etapalli, Kalpi, Kalpi C, Kamrej, Nirmal & Sankheda 10 each, Badesar, Bagrakote, Dhanora, Hansot, Kaleswaram, Khalilabad, Khowai, Kosagumda, Kotputli, Madhopur, NH31 Bridge, Salbari, Tenali, Tharad & Vagra 9 each, Ahiri, Arjuni Morgaon, Dummugudem, Gonda, Harda, Kurkheda, Mahidpur, Mulug, Rajsamand, Rajura, Tezu & Thakurdwara 8 each, Ankleshwar, Atrauli, Champasari, Dantewara, Shriramsag, Pocha & Sironcha 7 each
6.	Passighat 17, Jia Bharali N T Xing 15, Basar 13, Chouldhowaghat, Dhekiajuli & Tezu 10 each, Tirupuvanam 9, Amarpur, Belonia, Hosdurg, Panbari, Rangia & Tezpur 8 each	Keylong 25, Ambala 19, Neemkathana 17, Radaur & Taibpur 15 each, Moradabad 14, Bilaspur, Derabassi (Basi), Dhampur, Masani Barrage, Sevoke & Udaipur-Wati 13 each, Guhagarh & Nagina 12 each, Amroha, Bilari, Chandigarh, Dwarka, Indri & Rajpura 11 each, Bhimunipatnam, Dummugudem, Kurnool, Parvatipuram, Turekela, Vijayanagaram & Yellandu 10 each, Ambala I, Chandigarh, Cherrapunji, Deoband, Ibrahimpatnam, Jagadhari, Kashipur, Mangrol, Mulug, Nainital, Okha, Patiala, Ropar, Salur & Sayla 9 each, Agumbe, Eturnagaram, Gokarna, Hakimpet I, Hardwar Mayapur, Katangi, Konta, Malia, Miryalguda, Mohitnagar, Nuzvidu, Polavaram, Ramannapet, Salbari, Tajewala, Titlagarh, Valpoi & Wav 8 each, Alampur, Bharwain, Bhongir, Dahanu, Gajoldoba, Haldwani, Khed, Koilkuntla, Kurkheda, Landsdown, Mehre (Barsar), Nalagarh, Nilokheri, North Lakhimpur, Pachhad, Palakonda, Parkal, Pilibhit, Purola, Rajgarh, Sadulpur, Ranikhet, Rentachintala, Saharanpur, Shadnagar & Veeragattam 7 each	Bhanupratappur 24, Athgarh 18, Dhanora 16, Kosagumda 15, Balod, Bijapur, Titlagarh & Umarkote 14 each, Ambagarh Chowki, Bhopalpatnam, Dondilohara, Gariabund, Kanker, Khairamal & Purushottampur 13 each, Etapalli, Jammu AP, Junagarh, Kakatpur, Kondagaon & Osian 12 each, Baripada, Bhubaneswar & Gadchiroli 11 each, Jaipatna, Katra, Kurkheda, Lanjigarh, Mount Abu, Patnagarh & Sonepur 10 each, Ahiri, Alipingal, Ambadola, Belgaon, Boudhgarh, Dasuya, Khariar, Krishnaprasad, Madanpur Rampur, Nawarangpur & Puri 9 each, Asifabad, Aska, Athmalik, Banpur, Bhanjnar, Chamorshi, Deori, Gop, Harabhanga, Kantamal, Komna, Mandi, Mukerian, Mundali, Pipili, Sidhpur & Talcher 8 each, Abu Road, Arjuni Morgaon, Armori, Bharwain, Dhantari, Jagdalpur, Malkangiri, Manthani, Purola, Raya & Rayagada 7 each	Balod 18, Chittorgarh 13, Buxaduar, Dapoli, Harnai & Jambughoda 12 each, Chiplun, Jabalpur-New, Mungeli & Tuting 11 each, Armori & Mangliawas 10 each, Guhagarh, Kosagumda, Maya Bandar & Shriwardhan 9 each, Agumbe, Ashoknagar, Castle Rock, Gadchiroli, Guler, Iगतपुरi, Khed, Pisagan, Roha, Sabla, Shahapur & Sompeta 8 each, Churk, Dhariabad, Dungarpur Tehsil, Katangi, Kollur, Mahabaleshwar, Murud & Udaipur 7 each
7.	Cherrapunji 23, Passighat 18, Hasimara 13, Pokhran 12, Chouldhowaghat, Jaisalmer & Kalyanpur 11 each, Buxaduar 10, Gangtok, Jaisalmer Sr, Mandvi & Phalodi 9 each, Lalpur & Tezpur 8 each, Jamnagar AP, Nakhatrana, Nokh, Rajkot AP & Shella 7 each	Ambala I 23, Ambala 20, Buxaduar 15, Shahbad 14, Umbergaon 13, Neora & Sevoke 12 each, Anjar, Gajoldoba, Hasimara, Kamalapur, Manki, Naina Devi, Nakodar & Pehowa 11 each, Agumbe, Balachaur, Derabassi (Basi), Khilchipur, Nagarkata, Nanded, Paderu & Roorkee 10 each, Bhopalpatnam, Bulsar, Farukhnagar, Malkangiri, Murti, Olpad, Palasa, Palsana, Pusad, Rajgarh, Solan & Udipi 9 each, Anandpur Sahib, Bagrakote, Bajpe, Daman, Hansot, Honavar, Khaknar, Koondapur, Kudal, Nahan, Roha, Ropar, Simla, Sujanpur Tira, Tezu &	Kannod 21, Badwani 20, Dhanora 18, Arnod, Chamorshi & Parbhani 17 each, Ahwa, Hingoli & Saoli 16 each, Gadchiroli, Gondpipri, Kallamnuri & Nirmal 15 each, Boath, Chandrapur, Dewas & Rajura 14 each, Dhar, Pandherikawara, Purna, Sirpur & Uttoor 13 each, Adilabad, Etapalli, Metpalli, Mudhole, Shriramsag, Pocha & Sindewahi 12 each, Ahiri, Bagli, Jintoor, Mul, Nanded, Pusa, Sonkatch & Umerkhed 11 each, Ambazari, Armori, Bramhapuri, Digras, Indore,	Bramhapuri 22, Kurkheda 19, Bhainsdehi & Ramnagar 17 each, Naraingarh 16, Khandapara & Lakhipur 15 each, Bhiwapur & Tikabali 14 each, Mudubidre 13, Chanpatia, Kanker & Pantnagar 12 each, Armori, Birdghat, Gokarna, Kampur, Mandvi, Nagarkata, Songadh Fort 11, Bhanupratappur, Rajnandgaon & Ramayampet 10 each, Bhimnagar, Mulki & Tiruvuru 9 each, Arang, Harabhanga, Kotma, Maharajganj, Moradabad, Nayagarh & Renuka 8 each, Arjuni Morgaon, Bhimadole,

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
		Veraval 8 each, Ajaigarh, Bhang, Bijapur, Chandigarh I, Chengmari Diana, Jalalpur, Kandaghat, Kudulu, Manali, Maya Bandar, Nadaun, Panambur, Solangnala & Una 7 each	Khanapur, Lakhandur, Nagbhir, Pratapgarh & Yeotmal 10 each, Armoor, Bhadravati, Bhiwapur, Luxettipet, Mangrulpir, Manora, Mhow & Ramsar 9 each, Arjuni Morgaon, Depalpur, Hoshangbad, Jia Bharali N T Xing, Nalchha, Sironcha, Tonkhurd & Udaipur 8 each, Darwha, Jagtial, Kamptee, Sardarpur, Solangnala, Surgana & Washim 7 each	Deori, Depalpur, Jaipatna, Kadra, Karkala, Raigarh, Sompeta, Sudhagad & Vyara 7 each
8.	Cherrapunji 29, Shella 14, Arki 12, Subramanya 10, Gohar, Kahu & Rajpura 9 each, Chandigarh & Lunkaransar 8 each, Dharmanagar Panisagar, Kandaghat, Karwar, Patiala, Ropar & Sunibhaji 7 each	Beki Mathanguri & Mul 16 each, Nagarkata 15, Buxaduar & Chengmari Diana 13 each, Mhasla & Neora 11 each, Barpeta, Beki Road Bridge, Kalyan, Murti & Vada 10 each, Mumbai, Nandigama & Warora 9 each, Alibag, Begumganj, Belthangady, Gangapur, Kamptee, Koyyalagudem, Lanja, Manash NH Xing & Passighat 8 each, Cherrapunji, Dhar, Gohar, imadhpor, Kalmeshwar, Melabazar Motunga, Nuzvidu, Sathenapalli, Shriwardhan, Suvasara & Tezu 7 each	Sankheda 28, Ahmedabad AP & Sanand 24 each, Agumbe 17, Bodeli & Dhanera 13 each, Khowang 12, Jawhar, Kalol, Mahuda, Mandvi & Thirthahalli 11 each, Jambughoda, Pardi, Sanchore & Waghodia 10 each, Dabhoi, Kesarpura, Lakkavalli, Mahuwa, Mangrol & Vijaynagar 9 each, Anklav, Bulsar, Gandhinagar, Meghraj, Sagbara, Sailana & Savli 8 each, Ahwa, Arthuna, Baroda AP, Dahanu, Dharampur, Dholka, Gandevi, Kanva, Koppa, Prantij, Ramganjmandi, Saklespura, Santrapur, Valod & Veja 7 each	Bilaspur 31, Arjuni Morgaon & Tehri 26 each, Luxettipet & Tumsar 25 each, Metpalli 22, Nirmal & Paonta 20 each, Mhow 18, Dhar, Jeypore, Palsana & Uttar Kashi 17 each, Jagadhari, Pachhad & Tuting 16 each, Bhikangaon, Chhachhrauli, Nahan, Renuka, Sakoli & Utmoor 15 each, Mustfabad, Naraingarh, Shriramsag & Pocha 14 each, Depalpur, Jagtial, Jalalpur, Kosagumda, Mulug & Tajewala 13 each, Agumbe, Bardoli, Deori & Shegaon 12 each, Boath, Chanpatia, Dongargaon, Gondia, Kanker, Madhuban, Mangrol, Mauda, Mohadi, Mussoorie, Pisagan, Ramgundam & Silvassa 11 each, Devala, Etapalli, Purola, Rajgarh, Rudraprayag, Sangraha, Seoni, Tirora & Vagra 10 each, Bhagamandala, Bhatwari, Bhopalpatnam, Dadupur, Indore, Karnal, Khanapur, Kishanganj, Kottigehara, Kudulu, Mandla, Mehre (Barsar), Nainpur, Nanipalson & Navsari 9 each, Barthin, Hoshiarpur, Jahazpur, Lanji, Mahuwa, Mancherial, Mulki, Pendra, Sanand, Sojat, Sultanabad, Surgana & Titlagarh 8 each, Aklera, Asifabad, Baran, Barara, Bobbili, Chikhli, Dongargarh, Koraput, Mani, Nakur, Napanagar, Nusrulgunj, Parvatipuram, Sohagpur & Turekela 7 each
9.	Cherrapunji 37, Aie NH Xing & Rampur Bushar 13 each, Dhundhi & Gohar 12 each, Barpeta & Solangnala 11 each, Beki Road Bridge, Bhang, Panbari, Patsio & Sunibhaji 10 each, Manash NH Xing, Shirali & Vadakara 9 each, Ambala, Chandigarh, Dharampur, Kandaghat & Murud 8 each, Chandigarh I, Mumbai AP, Rajpura, Simla & Sundarnagar 7 each	Cherrapunji & Jafrabad 18 each, Beki Mathanguri & Nagarkata 15 each, Murti 14, Chengmari Diana & Lakhandur 13 each, Muthupet, Salbari & Talala 12 each, Alibag, Dharmapuri, Diu, Gajoldoba, Melabazar Motunga, Palacode, Savarkundla, Thally & Vanthali 11 each, Bulsar & Okha 10 each, Bagdogra, Denkanikottai, Lodhika, Mumbai AP & Sholagiri 9 each, Arjuni Morgaon, Bhadravati, Junagadh, Karaikudi, Keshod AP, Kodinar, Mauda & Thirupattur 8 each, Aklera, Buxaduar, Champasari,	Uttar Kashi 18, Kadi 14, Dhanera & Keshod AP 13 each, Maya Bandar & Viramgam 12 each, Bachau 11, Malanjkhand, Mount Abu Tehsil & Sojitra 10 each, Borsad, Malia & Udaipur 9 each, Detroj, Gadra Road, Meghraj, Nakhatrana & Okha 8 each, Agar, Buxaduar, Chhachhrauli, Chouldhowaghat, Dwarka, Jammu AP & Mount Abu 7 each	Kamrej 21, Khaknar 20, Dapoli 19, Tuting 18, Bansda 17, Dharampur 16, Dahanu 15, Bhira, Passighat & Sukma 14 each, Cooch Behar, Madhuban, Mhasla & Silvassa 13 each, Ahwa, Baroda AP, Bulsar, Daman, Harnai, Jalalpur, Olpad & Tajewala 12 each, Jawhar, Khed, Murbad & Navsari 11 each, Bilaspur, Lathi, Mahuwa, Malkapur, Mohanbari, Murud, Nanipalson, Rajjura, Sonkatch & Vapi 10 each, Bardoli, Gossaigaon, Guhagarh, Israna, Kanina,

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
		Manavadar, Panbari, Saharanpur, Sakoli, Sindewahi & Thane 7 each		Kharkoda, Mahabaleshwar, Mangaon, Paonta, Pardi, Rahuri, Rajpipala, Savli, Sayla, Sudhagad & Surat 9 each, Badesar, Chandrapur, Chiplun, Gaganbawada, Garidhar, Jabot, Jamwaramgarh, Narwana, Nepanagar, North Lakhimpur, Shriwardhan & Umbergaon 8 each, Bhabhra, Chamorshi, Dadupur, Deoband, Edalabad, Gondpipri, Hansot, Itanagar, Khonsa, Lanja, Mokhedra, Sonepat & Valod 7 each
10.	Cherrapunji 13, Boudhgarh & Kozhikode 9 each, Dholai, Peermade, Shella & Uthiramerur 8 each, Dholla Bazar & Karimganj 7 each	Cherrapunji & Dinhat 24 each, Cooch Behar 13, Manavadar 12, Lalpur 11, Bagdogra, Balaghat & Shahpura 9 each, Birpur, Garubathan & Kandarakottai 8 each, Hoshangbad & Kodinar 7 each	Dharmasala 11, Garubathan & Kumbhalgarh 7 each	Dholka 36, Beki Road Bridge 23, Itanagar 22, Barpeta, Barwala, Passighat & Umbergaon 17 each, Daman, Islampur, Manash NH Xing, Naharlagun, Panbari, Ranpur & Rongo 15 each, Dhandhuka, Jambusar 14, Jamnagar AP 13, Kamrej, Tikabali & Vallabhipur 12 each, Halol, Karjan, Mandvi, Navsari & Savli 11 each, Amod, Dhariabad, Falakata, Hansot, Kokrajhar, Ponneri, Salimpur & Tiruvallur 10 each, Botad, Dediapada, Dohad, Gandevi, Limbadi, Minicoy, Nandol, Okha, Olpad, Pardi, Petlad, Porbandar AP, Tarapur & V. Vidyanagar 9 each, Bahalpur, Baroda AP, Bhaunagar AP, Bodeli, Bulsar, Cherrapunji, Cholavaram, D.Baria, Dhrol, Gogha, Gossaigaon, Haldibari, Jalalpur, Khambhat, Lalpur, Mehmedabad, Mohanbari, Mohitnagar, Pipalkhunt, Rajkot AP, Salumber, Sojitra, Tezu, Vadakara & Vapi 8 each, Anand, Ankleshwar, Bardoli, Dholla Bazar, Gingee, Khonsa, Khowang, Kozhikode, Kutiana, Mangalore, Matar, Namsai, Palsana, Sarara, Silvassa & Tikrikilla 7 each
11.	Srinivaspur 13, Puducherry 12, Devgad, Domohani & Khonsa 11 each, Shella 10, Gooty & NH31 Bridge 9 each, Indapur, Londa, Melalathur & Orathanadu 8 each, Gudiyatham, Haliyal, Muthupet, Quilandi & Valangaiman 7 each	Buxaduar 21, Kumargram 20, Gaunaha 19, Cherrapunji 17, Chepan & Dharmavaram 16 each, Bahadurganj & Ghazipur 15 each, Chengam, Monghyr, Nandyal & Pennagaram 14 each, Islampur 13, Alipurduar, Anantpur, Gossaigaon & Mathabhanga 12 each, Barobhisha, Chengmari Diana, Hasanpur, Hasimara, Jahanabad, Kanjirappally, Moradabad, Nadaun, Panagarh & Thally 11 each, Hoskote, Kanksa, Macharla, Sevoke & Singrauli 10 each, Chorgharia, Cooch Behar, Dahanu, Falakata, Kokrajhar, Pakur, Tuting & Zamania 9 each, Domohani, Gajoldoba, Haldwani, Harnai, Hosur, Jammalamadugu, Kodaikanal, Mulug, Nagarkata & Pathalgaon 8 each, Ambalavayal, Bagrakote, Bahalpur,	Lanji 16, Gokarna 12, Bharwain & Chamoli 11 each, Sardanagar 10, Kheri Lakhimpur 9, Agumbe, Muhammdi & Sanguem 8 each, Farukhnagar, Lengpui & Sukma 7 each	Kokrajhar 25, Namthang 23, Haldibari 20, Khanitar, Neora & Nuh 18 each, Majitar 16, Garubathan, Murti & NH31 Bridge 14 each, Aie NH Xing 13, Alwar, Domohani, Manash NH Xing & Tikabali 12 each, Beki Road Bridge, Manamadurai, Nalhati, Ramsar, Srinivaspur & Tikrikilla 11 each, Beki Mathanguri, Dinhat, Panambur, Panbari, Pedong & Shahabad 10 each, Aonla, Bajpe, Barpeta, Buxaduar, Cherrapunji, Dwarka, Gajoldoba, Nagarkata, Nawanshahr & Singla Bazar 9 each, Alipurduar, Bagrakote, Gossaigaon, Kalyanpur, Kumargram, Lava, Masuda,

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
		Barahara, Dahegam, Dapoli, Erode, Haldibari, Hyderabad, Mahinagar, Malakpur, Mangrol, Mohitnagar, Mungeli, Narsampet, Paikmal, Pargi, Roha & Sankarankoil 7 each		Nasirabad, Passighat & Vandavasi 8 each, Bagdogra, Bahalpur, Champasari, Damthang, Lakkavalli, Patti, Phagwara, Polur, Sayla & Sukiapokhri 7 each
12.	Kozhikode & Perinthalamanna 18 each, Karipur & Mannarkkad 17 each, Enamakkal & Mohitnagar 14 each, Jalpaiguri 12, Cooch Behar, Manjeri & Mulki 11 each, Chinnakallar, Haldibari, Irinjalakuda, Kavali, Peermade, Quilandi & Thrissur 10 each, Chepan, Devala, Dinjata, Kudulu, Kunnamkulam, Vadakara & Vadakkancherry 9 each, Avaniyadda, Domohani, Kandukur, Khandala Bavda, Ottapalam, Parambikulam, Ratnagiri, Thritla & Wai 8 each, Alathur, Amalapuram, Karimganj, Narasaraopet, Patan, Pattambi, Rapalle, Tasgaon, Vaikom & Yadwad 7 each	Birdghat 23, Darjeeling & Gorakhpur 19 each, Darjeeling 18, Rajnagar 17, Hatta & Monghyr 15 each, Lanji & Sukiapokhri 14 each, Hayaghat, Pusa & Turtipar 13 each, Benibad & Chapra 11 each, Buxwaha, Cherrapunji, Marsrakh, Moth, Patan, Sankheda, Tirora & Titlagarh 10 each, Ambadola, Amgaon, D. P. Ghat, Forbesganj, Gharghoda, Gopalganj, Gunupur, Lanjigarh, Ludhiana, Muzaffarpur, Singla Bazar & Swam-Patna 9 each, Barahara, Bijapur, Chamorshi, Chhota-Udepur, Contai, Gaunaha, Gondia, Keolari, Lakhandar, Madhira, Mana-Raipur, Paikmal, Patna, Sakoli, Salimpur & Sankarankoil 8 each, Bara Banki, Gaighat, Hasanpur, Kolebira, Mahasamund, Malanjikhand, Mayanur, Metpalli, Phagwara, R. Udaigiri, Rosera, Saoli & Tuting 7 each	Nowgong 17, Bharwain 16, Dehra Gopipur, Kolaras & Sujapur Tira 13 each, Chandigarh S & Katra 12 each, Hamirpur, Hatta, Jabalpur-New, Madhwapur 11, Delhi Ridge, Pandoh, Sarmathura & Sundarnagar 10 each, Bahadurpur, Bhopalpatnam, Deoghar, Didwana, Gohar, Hindoli, Parbatsar & Ratnagiri 9 each, Baldwara, Bangana, Bhinay, Bhoranj, Gharmura, Khairi, Kharkoda, Khowai, Nagrota Surian & Pawayan 8 each, Birdghat, Guler, Harnai, Kishngarhwas, Pushkar & Sikandarabad 7 each	Radaur & Ranchi 21 each, Saharanpur 19, Ratangarh 16, Rewaghat 15, Chanderdeepghat, Harpur, Sitapur & Tehri 14 each, Mahinagar 13, Hathwa, Roorkee & Uttar Kashi 12 each, Ambala, Deoband & Sardarshahar 11 each, Dwarka, Patiala 10, Ballia, Balrampur, Derabassi (Basi), Gingee, Hanumangarh, Karnal, Kolkata AP, Lunkaransar, Muzaffarpur, Pachhad, Pattamundai & Sangrur 9 each, Aligarh, Ambala I, Chandigarh I, Darauli, Deogaon Lalganj, Gaighat, Gharaunda, Kasauli, Mirzapur & Nalhati 8 each, Amroha, Bagati, Barobhisha, Bhinga, Indri, Kakardarighat, Nakur, Purola, Raisingnagar & Sandila 7 each
13.	Piravam 22, Vytiri 18, Kudulu 17, CIAL Kochi, Kannur & Perumpavur 16 each, Idukki, Nilambur & Udipi 15 each, Kochi & Periyar Dam 14 each, Manjeri 13, Kanjirappally & Quilandi 12 each, Kottayam & Vadakara 11 each, Kudachi, Malvan, Manki, Mudubidre, Tellichery & Thodupuzha 10 each, Bhagamandala, Chinnakallar, Karipur, Mancompu, Teliamura, Thrissur & Valparai 9 each, Agartala, Agumbe, Chengannur, Cherthala, Devala, Kota, Macharla, Mulki, Pattambi, Poonampet, Shirali, Thritla, Vadakkancherry, Vaikom & Virajpet 8 each, Karkala, Kottigehara, Panambur, Perinthalamanna, Sheohar & Tiruvuru 7 each	Hasimara 28, Anupshahar 20, Bramhapuri 17, Kokrajhar 14, Hasanpur 13, Cherrapunji, Nagbhir & Ramnagar 11 each, Alipurduar, Burdawan, Falakata, Namsai, Panchet & Srinivaspur 10 each, Alipurduar, Armori, Bagrakote, Gaunaha, Kaimganj, Katwa, Lava, Motihari, Muhammdi, Orai, Suri & Tiruvallur 9 each, Arakkonam, Darjeeling, Dhundhi, Ganaur, Jind, Satna & Sukiapokhri 8 each, Chepan, Goraul, Panipat, Puttur & Sakti 7 each	Buxaduar 18, Vengurla 16, Chengmari Diana 15, Kankavli 14, Amraghat, Barsi, Dhone & Goraul 13 each, Kamtaul & Manawar 12 each, Alibag, Bansgaon, Bhadravati, Kuknoor, Lakhipur, Madha, Osmanabad, Peddapuram, Perur, Rongo & Sibsagar 11 each, Hungund, Kallam, Kottur, Lakhandur & Zamania 10 each, Bellary, Bhalki, Cuddapah, Kanekal, Singrauli & Tavaregere 9 each, Armori, Bevoor, Dhekiajuli, Gorakhpur, Jath, Pandhana, Sajjangarh & Shorapur 8 each, Badami, Bamanwas, Bhatkal, Bhole, Deogaon Lalganj, Kudal, Kurugodu, Mominabad, Mudagal, Munirabad, Thambalapalli & Uniara / Aligarh 7 each	Monghyr 23, Tikabali 19, Dharmasala 18, Sabong 14, Narsapuram 12, Jogindarnagar 11, Paonta & Sujapur Tira 10 each, Budaun, Deesa, Hardwar Mayapur, Nadaun, Ramsar, Renuka & Siilchar 9 each, Barhiya, Dharmanagar, Panisagar, Gharmura, Kalol, Kheri, Lakhimpur, Nagrota Surian, Seobagh & Tiruvuru 8 each, Baldwara, Biswan, Diamond Harbour, Kankrej, Neemkathana, Palampur, Udaipur-Wati & Uthiramerur 7 each
14.	Malvan 27, Sawantwadi 23, Cherrapunji 21, Vengurla 19, Devgad, Taliparamba & Vadakara 15 each, Agumbe, Bhagamandala & Vytiri 12 each, Chandgad, Chinnakallar, Karkala, Kudal, Kurkheda & Malkangiri 11 each, Gajoldoba, Paradeep,	Muhammadabad 10, Bankura, Binika, Biswan, Jawhar & Pallari 9 each, Umarkote 8	Ukai 21, Bagrakote 18, Rongo 15, Buxaduar, Sevoke & Wav 14 each, Bhikangaon 13, Bahadurganj, Mavli & Mount Abu 12 each, Hazaribagh, Koppal, Manthani & Naraingarh 11 each, Khushalgarh, Koppal R, Nayanagar Beawar, Parkal & Tatgarh 10 each, Chenari, Gogunda, Kishngarhwas,	Bankura 15, Harpur & Kallakurichi 13 each, Sullurpet & Tirukoilur 12 each, Puttur & Ranchi 11 each, Baliguda, Bankura, Boudhgarh, Harur, Maya Bandar, Ongole, Thakurdwara, Tiruvadanai & Ulundurpet 10 each, Dholai, Miryalguda, Nagarjunsagar & Sethiyathope 9

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
	Sevoke & Thritle 10 each, Ajra, Ankola, Galgalia, North Lakhimpur, Pattambi, Peermade, Perinthalamanna, Rongo & Valparai 9 each, Bagrakote, Bramhapuri, Buxaduar, Gharmura, Kamardi, Kankavli, Kannur, Kodungallur, Kottigehara, Manki, Perumpavur & Sringeri 8 each, Bhadravati, Dharmasthala, Gajapathinagaram, Idukki, Khandapara, Mannarkkad, Mudubidre, Ottapalam, Siddapura, Venkatapuram & Virajpet 7 each		Kotkasim, Malpura, Marwar, Moradabad, Nathdwara, Shegaon, Siwana, Veja & Wanakbori 9 each, Akola, Danta, Dhansura, Khamgaon, Malkapur, Mandalgarh, Mohania, Nagarkata, Pindwara, Pisagan, Sillod, Sirohi, Sonepat & Vallabhnagar 8 each, Gohar, Jafferabad, Jintoor, Kansabati Dam, Manasa, Nawa, Piplu, Tajewala, Tarapur & Tenughat 7 each	each, Aranthangi, Buxaduar, Masulipatnam, Thirupatthur & Uthangarai 8 each, Kharkoda, Rajgarh Sadulpur, Ramannapet, Taranagar Reni, Teliamura, Vembavur & Vridhachalam 7 each
15.	Murud & Vengurla 18 each, Sawantwadi 17, Kankavli 16, Bajpe, Karkala, Panambur & Valpoi 13 each, Mudubidre 12, Agumbe, Gerusoppa, Indapur, Malvan, Mulki & Taliparamba 11 each, Buxaduar, Dharmasthala, Kudulu, Mani, Pune, Puttu & Shirali 10 each, Belthangady, Bhagamandala, Bhatkal, Chandgad, Kota, Uppinagadi & Vidisha 9 each, Chinnakallar, Kollur, Koondapur, Kozhikode, Mumbai, Panjim, Roha, Siddapura & Vadakara 8 each, Gaganbawada, Irikkur, Karad, Kottigehara, Linganamakki, Mapusa, Rajapur & Sabroom 7 each	Ashoknagar 17, Kadi 16, Pali 11, Amraghat 10, Chouldhowaghat, Karjat & Vallabhipur 9 each, Aizwal, Jaipur, Jhumpura & Mahasamund 8 each, Illayankudi, Korba & Patti 7 each	Amta-I 18, Jabalpur-New & Tribeni 12 each, Khambhat & Khonsa 11 each, Sakti & Sarath 10 each, Amini Divi, Cherrapunji, Chintalapudi, Khurai, Rangia & Sundargarh 9 each, Alipore, Banswara, Damoh, Grand Anicut, Gudivada, Harinkhola, Laikera, Daltonganj, Durg, Hata, Lakhtar, Limbadi, Nandigram, Rongo, Salem & Yellandu 8 each, Bilari, Chettikulam, Dantiwada, Lalgudi, Polavaram, Raipur, Sagar, Sambhal, Tenali, Udaipur, Uluberia & Wav 7 each	Cherrapunji 16, Chapra & Rongo 15 each, Nainpur & Rairakhol 13 each, Hasanpur & Salimpur 12 each, Birdghat & Khalilabad 11 each, Buxaduar, Dhanbad, Panambur & Safipur 10 each, Bajpe, Balaghat, Barahara, Durg, Hata, Kottigehara, Madanpur Rampur, Raipur, Tilpara Barrage, Titlagarh & Udupi 9 each, Barhiya, Dhanora, Gobindpur, Gorakhpur, Hasimara, Jalesar, Kota, Panagarh & Parbatsar 8 each, Bassi, Baswa, Gokarna, Najibabad (T), Pali & Sawaimadhopur Tesil 7 each
16.	North Lakhimpur 21, Khed 15, Dinhat & Mahabaleshwar 14 each, Dapoli, Guhagarh & Jalalpur 13 each, Chiplun 12, Dahanu, Gondal & Kollur 11 each, Gaganbawada, Hisua, Khonsa, Lanja & Ratnagiri 10 each, Bhanwad, Chandgad, Cherrapunji, Chouldhowaghat, Dhoraji, Durg, Mumbai AP, Murud, Shella & Vadakara 9 each, Agumbe, Athgarh, Kalwad, Kudulu, Mandangad, Manki, Mumbai, Nanipalson, Poladpur, Seoni & Valpoi 8 each, Dhari, Harnai, Indore, Kamrej, Karjat, Kota, Marmugao, Matheran, Roha, Ukai & Washim 7 each	Murti 19, Gokarna 18, Ankola 17, Kumta 16, Chengmari Diana, Mulki & Nagarkata 14 each, New Delhi AN 12, Bajpe, Honavar, Khajuri, Kudulu, Mahbubabad, Mangalore & Panambur 11 each, Bhatkal, Shirali & Udipi 10 each, Bhadrachalam, Champasari, Kanjirappally, Kutiana, Macharla, Manthala, Piravam & Sallopat 9 each, Bhalukpong, Harihar, Katangi, Manki, Ranawao, Salbari & Sanguem 8 each, Kherwara, Mangrol, Mani, Maski, Tikabali & Yadgir 7 each	Quepem 17, Peermade & Saloni 12 each, Hakimpet I, Rupbas, Sikar, Tehsil 11, Hindol 10, Ambazari, Bidar, Buxar, Castle Rock, Garubathan, Hoshangabad, Konni, Kozha, Kunda, Lohar-Daga, Morsi, Narnaul, Nuzvidu, Pechiparai, Perinthalamanna, Perumpavur, Piravam, Srirampura, Thakurganj & Thodupuzha 9 each, Chandur Bazar, Deodurg, Dewas, Gaganbawada, Ganganagar, Ghazipur, Kavaratti, Lanji, Manthralayam, Narkheda, Pusad, Rabkavi, Sanguem, Uttar Kashi & Vadakara 8 each, Amethi, Bareli, Bassi, Darauli, Devgad, Ghatagaon, Gerusoppa, Kannod, Kottigehara, Meerut, Ranpur & Sandur 7 each	Rajmahal 26, Muhammdi 18, Bilari & Mahul Pnulpur 15 each, Anand, Gokarna, Khagadia, Malda & Monghyr 11 each, Dhanbad, Lava, Patan & Tribeni 10 each, Chevella, Hata, Raiganj, Tavaregere & Tenughat 9 each, Ankola, Araku Valley, Gobindpur, Mahasamund, Mohanbari, Saidapur, Tumsar & Varanasi-B.H.U. 8 each, Deogaon Lalganj, Dhekiajuli, Kaliachak, Mankapur, Pithoragarh & Tezpur 7 each
17.	Panbari 28, Karjat 25, Garubathan & Kumargram 24 each, Dapoli, Gaganbawada	Rapalle 23, Nahan 18, Paleru Bridge 14, Mhasla 13, Avaniigadda, Narasaraopet, Sathenapalli &	Kumargram 27, Alipurduar 17, Mumbai AP 16, Alipurduar & Cooch Behar 15 each, Uran 14,	Mahul Pnulpur 16, Hardwar Mayapur 13, Darauli, Gondpipri & Gorakhpur 12 each, Bansaon &

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
	& Hasimara 19 each, Barobhisha, Barpeta, Domohani, Gossaigaon & Harnai 16 each, Bagrakote, Igatpuri, Kankavli & Matheran 15 each, Jalpaiguri, Neora, NH31 Bridge, Rongo & Valpoi 14 each, Chepan, Panhala, Panvel, Radhanagari, Ratnagiri & Siddapura 13 each, Agumbe, Devgad, Gajoldoba & Murti 12 each, Gargoti, Khed & Rajapur 11 each, Ajra, Alipurduar, Car Nicobar, Falakata, Kamardi, Khalapur, Kollur, Mohitnagar, Mudubidre, Shriwardhan & Sudhagad 10 each, Hosanagar, Khamgaon, Kudal, Madhuban, Mangan, Motala, Mumbai, Sringeri & Uran 9 each, Buxaduar, Gadhinglaj, Galgalia, Karkala, Katangi, Kottigehara, Malvan, Radhanpur, Salbari, Sendhwa (Med), Sevoke, Shahuwadi, Vadgaon & Yellapur 8 each, Bhatkal, Chandgad, Kalyan, Kokrajhar, Manchikere, Mulki, Nagarkata, Pen, Taibpur & Thakurganj 7 each	Shriwardhan 12 each, Chamoli, Chepan, Nangal, Pachhad & Yaval 11 each, Agumbe, Alipurduar, Atchempet, Bhatkal, Harnai, Kozhikode, Shirali & Sujanpur Tira 10 each, Bhadrachalam, Dasuya, Guntur, Malkapur, Mannarkkad, Nilambur, Perinthalamanna, Piduguralla, Sadhaura, Sangraha, Uran & Visakhapatnam AP 9 each, Aurangabad, Bansda, Barobhisha, Edalabad, Gaganbawada, Jamnagar AP, Karnaprayag, Khed, Mandangad, Manjeri, Margao, Panvel, Podili, Quilandi, Rahuri, Sanguem, Shevgaon, Subramanya, Uppinagadi & Wankaner 8 each, Bagidora, Karjat, Khuldabad, Kutiana, Mangalore, Mukerian, Mussoorie, Pattambi & Tadpatri 7 each	Cherrapunji & Quepem 13 each, Deoli & Sanguem 12 each, Banswara, Chepan, Gossaigaon, Kadra, Pushkar & Ramganjmandi 11 each, Banswara, Barobhisha, Canacona & Dinhata 10 each, Bhinay, Dholka, Gerusoppa, Haldibari, Hosdurg, Mathabhanga & Salem 9 each, Afzalpur, Agumbe, Atmakur, Banera, Islampur, Kankavli, Malegaon, Mandana, Mudubidre, Murud, Neemuch, Parbatsar, Passighat, Rajura, Sarwar & Yercaud 8 each, Amalapuram, Chaksu, Chengmari Diana, Jawad, Karanpur, Karwar, Nagarkata, Narayan Khed, Nizamasagar & Raipur 7 each	Siswan 11 each, Bhiwandi, Kumta, Murbad & Turtipar 10 each, Ballia, Bulsar, Dehra Dun, Dehri, Gokarna & Indrapuri 9 each, Birdghat, Lanjigarh, Mangrol, Pantnagar, Pardi, Rajura & Vapi 8 each, Akbarpur, Bonth, Canacona, Khalilabad & Raigarh 7 each
18.	Forbesganj 18, Amraghat 17, Dholai 13, Agumbe 12, Rajapur 11, Laxhipur 10, Bajpe, Gerusoppa, Hosanagar, Lanja & Panambur 9 each, Bhiwapur, Mudubidre & Siddapura 8 each, Bansda, Kansabati Dam, Kollur, Koondapur & Udupi 7 each	Buxaduar 33, Hasimara 28, Nagarkata 25, Upleta 19, Murti 18, Champasari, Chengmari Diana & Salbari 17 each, Bagdogra, Beki Mathanguri & Neora 14 each, Cholavaram, Gajoldoba, Kalyanpur & Vengurla 11 each, Bhanwad, NH31 Bridge 10, Baijnath, Guhagarh, Kumargram, Malvan & Venkatapuram 9 each, Kankavli, Miao, Poonamallee & Tada 8 each, Domohani, Galgalia, Honavar, Karwar & Kudal 7 each	Tirikilla 32, Garubathan 23, Gaganbawada & Malvan 21 each, Alibag 20, Bagrakote, Kankavli & Sawantwadi 19 each, Mumbai & Valpoi 17 each, Salbari & Sevoke 16 each, Ratnagiri 15, Bulsar, Cherrapunji, Margao & Rajapur 14 each, Agumbe, Bagdogra, Kokrajhar, Mapusa, Mhasla, Neora, Pushkar & Vengurla 13 each, Champasari, Mangan, R S Dam Site & Roha 12 each, Canacona, Falakata, Gajoldoba, Gangarampur, Malkangiri, Mumbai AP, Murud, Rongo, Sagardighi & Sanguem 11 each, Castle Rock, Dahanu, Kaliaganj, Kudal, Lava, Nagarkata, Quepem, Tezpur & Williamnagar 10 each, Baijnath, Dhubri, Guhagarh, Jia Bharali N T Xing, Palampur, Palliakalan, Palwal, Panjim, Parbatsar & Shriwardhan 9 each, Ballabgarh, Baltara, Dabolim, Devgad, Gangtok, Gopalganj, Harnai, Hassanpur, Khanapur, Malsisar, Marmugao, Murti, Nimbahera, Nungambakkam, Ramgarhshekhata & Tadong 8 each, Bahalpur, Champawat, Dabra, Gandevi & Uran 7 each	Basti 33, Kosagumda 26, Chanderdeepghat 23, Barpeta, Birdghat & Haldwani 16 each, Dapoli & Tikabali 14 each, Manthani 13, Baheri, Dhamtari, Pantnagar, Ranpur, Thakurdwara & Titlagarh 12 each, Gopalpur, Nainital, Nawarangpur & Tehri 11 each, Belgaon, Kashipur, Mukteshwar, Murud, Nimpara, Rajkanika & Shriwardhan 10 each, Almora, Bolangir, Chhatrapur, Durg, Haraiya, Jaipur, Khalilabad, Mapusa, Mundali, Raipur, Roorkee & Umarkote 9 each, Bhubaneswar, Bisalpur, Champawat, Kashinagar, Paonta, Pipili, Salur & Udala 8 each, Gobindpur, Bonth, Chandbali, Deoband, Dhansura, Itchapuram, Kanker, Kantamal, Khandapara, Kunda, Paikmal & Rahuri 7 each

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
19.	Harnai 42, Dapoli 41, Mohitnagar 22, Buxaduar 20, Khed 19, Domohani & Hasimara 17 each, Guhagarh & Taibpur 16 each, Jalpaiguri 15, Mumbai 13, NH31 Bridge 12, Chiplun, Dharmatal, Kumargram, Thakurganj & Vikarabad 10 each, Alipurduar, Chargharia, Cheepurupalli, Mahabaleshwar, Matheran, Uran & Yellandu 9 each, Alibag, Hyderabad, Khirpai, Murud, Shriwardhan, Supaul & Tirupuvanam 8 each, Beki Mathanguri, Chevella, Devala, Joypur, Mandangad & Nalbari 7 each	Baheri 30, Biswan 26, Hardwar Mayapur 20, Nighasan 19, Haldwani, Sevoke 17, Garubathan 14, Bhatkal, Hasanganj, Kashipur, Palliakalan, Pantnagar & Phoolbagh 13 each, Ayoadhya, Bikapur, Murud, Taibpur & Udupi 12 each, Dabolim, Malvan, Marmugao, Panjim & Thakurganj 11 each, Galgalia, Gokarna, Gopalganj, Katerniaghat, Kota, Malakhera, Manki, Puranpur & Shirali 10 each, Ajaigarh, Kudulu, Lucknow, Nainital, Najibabad (T), Pilibhit, Piplu & Sudhagad 9 each, Amroha, Bambasa, Bihubar, Chanchal, Hosdurg, Jaipur AP, Kotdwara, Lava, Margao, Mohanlalganj & Sanguem 8 each, Agumbe, Akbarpur, Basua, Budaun, Deoria, Devgad, Forbesganj, Islampur, Kannur, Kanpur I, Khanpur, Mohitnagar, Panambur, Peermade, Quepem, Sahada, Salimpur & Vadakara 7 each	Seobagh 51, Nainital & Paonta 22 each, Haldwani & Madhopur 20 each, Kotkasim 19, Champawat 16, Balrampur, Chhachhrauli, Nahana, Rongo & Shahpur Kandi 15 each, Dehra Dun & Falakata 14 each, Mussoorie, Sevoke & Tizara 13 each, Amarwara, Bilaspur, Dhaurahara, Jalalpur & Malakpur 12 each, Basti, Depalpur, Hindol, Kathua, Kotdwara, Phagi, Tapan & Uttar Kashi 11 each, Alibag, Anupshahar, Bageshwar, Buxaduar, Dummugudem, Kaman, Kashipur, Khaga, Landsdown, Mankapur, Masani Barrage, Mukteshwar, Nuh, Pantnagar, Pathankot I, Puranpur, Salbari & Sardanagar 10 each, Arnod, Bangana, Barahara, Haldibari, Jagadhari, Jammu, Jatusana, Kalimpong, Kumargram, Mandawar, Mumbai AP, Naraingarh, Phoolbagh, Sahebganj, Sujargarh, Sujanpur Tira, Sukiapokhri, Tajewala, Tikabali & Upleta 9 each, Banka, Chhibramau, Chipabarod, Dadri, Garoth, Guler, Hasimara, Jogindarnagar, Mauda, Mehgaon, Mohanlalganj, Morena, Murti, Orchha, Palampur, Surat & Umbergaon 8 each, Alipur (Jaura), Alipurduar, Bawal, Chambal R.B.Dam, Darjeeling, Dunda, Guhagarh, Hardwar Mayapur, imadhohpur, Jammu AP & Karauli 7 each	Mukteshwar 24, Almora 17, Haldwani, Hardwar Mayapur, Najibabad (T) & Purola 16 each, Dehra Dun & Shedbal 15 each, Bageshwar 14, Champawat, Lakhnadon, Moradabad, Nainital & Ranikhet 12 each, Banda, Deoband, Devgad, Dhekiajuli, Digha, Karnaprayag & Orai 11 each, Amraghat, Broach, Chamoli, Joshimath & Roorkee 10 each, Champa, Chiplun, Dantewara, Dunda, Hardwar, Hindgir, Malvan, Mussoorie, Silchar, Songadh Fort, Ukai & Uttar Kashi 9 each, Bambasa, Bansda, Bareilly P, Barkot, Deoprayag, Gharghoda, Kalpi, Kalpi C, Landsdown, Naharkatia, Pawayan, Pilibhit, Rampur, Sabong & Tharali 8 each, Aonla, Baheri, Bisalpur, Islampur, Kalpa, Kankavli, Pingla, Rudraprayag & Sakti 7 each
20.	Polavaram 14, Eluru 12, Chouldhowaghat, Jia Bharali N T Xing, Lanjigarh & Ramayampet 11 each, Cherrapunji 10, Islampur, Koyyalagudem & Narsampet 9 each, Athgarh, Burdwan, Kumargram & Padalur 8 each, Dummugudem & Shella 7 each	Malvan 35, Sawantwadi 23, Gokarna & Kudal 21 each, Bambasa & Bhatkal 20 each, Nimarana & Ratnagiri 18 each, Devgad & Shirali 17 each, Panambur, Purnea, Rajapur, Shahpura & Vengurla 16 each, Muhammdi 15, Bajpe, Chargharia, Gorakhpur, Karwar, Katerniaghat, Kollur, Manki, Mapusa & Pawayan 14 each, Agumbe, Gerusoppa, Hasanpur, Kakardarighat, Shahabad, Siddapura & Udupi 13 each, Ankola, Birdghat, Canacona, Dhengraghat, Haldwani, Harnai, Jalaun, Mulki, Tellichery & Turtipar 12 each, Bilari, Biswan, Gaganbawada, Ganaur, Kankavli, Lanja, Narnaul, Nawarangpur, Sanguem, Tehri & Valpoi 11 each, Bansgaon, Bantwal, Champawat, Dabolim, Dapoli, Dhansa, Dharmsala, Fatehpur, Honavar, Hosanagar, Koondapur, Kudulu, Kumta, Malihabad, Mangalore, Mani, Mudubidre & Safipur 10 each, Bahadurganj, Baheri, Bhalukpong, Bharthana, Bisauli, Chalakudi, Cherrapunji, Chomu, Jalalabad, Kadra,	Palampur 22, Baijnath 19, Cherrapunji 18, Ramgarh 17, Jogindarnagar, Kosli 16, Dhekiajuli & R S Dam Site 15 each, Regoli 14, Maharajganj, Mehgaon & Neemkathana 13 each, Bahadurpur, Dharmsala, Fatehgarh, Jamwaramgarh & New Delhi 12 each, Indri, Kotputli, Malakpur, Safdarjung, Siruguppa, Tandur, Tiruvuru & Viratnagar 11 each, Amer, Banswada, Bara Banki, Bhalki, Bimalkhed, Chincholi, Guwahati, Khaga, Khanapara, Khetri, Nandigram, Narnaul, Sagar, Shahpur Kandi & Vikarabad 10 each, Asifabad, Buhana, Churu, Churu Sr, Govindgarh, Kekri, Kotraguda, Mancherial, Nagina, Paowta & Todabhim 9 each, Alipurduar, Asansol, Ateli, Janjgir, Kathua, Khanapur, Madhira, Metpalli, Nimarana, Piplu, Purihansa, Railmagra, Sagar, Tonk Tehsil & Tribeni 8 each, Bansur, Berikhas,	Kaman 18, Gwalior 16, Dholpur, Kumber 14, Ambah, Deeg, Deoband & Dholpur Tehsil 13 each, Govindgarh & Uttar Kashi 12 each, Balasore, Hasanpur & Nagar 11 each, Gobindpur, Bareli, Gohad, Kathumer, Lakhipur, Mehgaon, Musafirkhana, Pathalgaon & Sibsagar 10 each, Alipur (Jaura), Ballabgarh, Bhira, Hattin, Komarada, Madakasira, Pahari & Parvatipuram 9 each, Amraghat, Barkot, Hodal, Indapur, Jalesar, Karimganj, Katangi, Kiroli & Orai 8 each, Agra I, Chandigarh S, Chhamonu, Contai S, Dehra Dun, Hassanpur, Hathras, Iglas, Morena, Paonta, Rajakhera & Renuka 7 each

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
		Kamardi, Karkala, Keertinagar, Kota, Kunda, Mahendragarh, Margao, Marmugao, Mungeshpur, Munnar, Sonapat, Taliparamba & Uppinagadi 9 each, Alipurduar, Ateli, Bahalpur, Bawal, Bhagamandala, Bhind, Bhinga, Guhagarh, Idukki, Kannur, Kasganj, Kathumer, Lahar, Mathabhanga, Meja, Panjim, Quepem, Rajampet, Rewari, Shriwardhan & Vadakara 8 each, Ahirwalia, Ankinghat, Dharmasthala, Fatehgarh, Gossaigaon, Govindgarh, Gurgaon, Jafarpur, Jhajha, Kamtaul, Pantnagar, Phoolbagh, Piravam, Puttu, Sangrur, Sathanur Dam, Siddapur & Siswan 7 each	Jhirka, Khol, Malpura, Masani Barrage, Medak, Nurpur & Rewa 7 each	
21.	Cherrapunji 16, Rongo, Sirur & Williamnagar 10 each, Chouldhowaghat & Dunda 9 each, Dhekiajuli, Gajoldoba & Khed 8 each, Kailashahar 7	Hasimara 39, Domohani 29, Nagarkata 28, Haldwani 25, Mapusa 24, Mohitnagar & Taibpur 23 each, Jalpaiguri 22, Gokarna & Murti 21 each, Thakurdwara 20, Chengmari Diana, Nainital & Thakurganj 19 each, Salbari 18, Kodinar, NH31 Bridge & Sevoke 17 each, Chamorshi 16, Cherrapunji, Gaganbawada, Margao, Pantnagar, Phoolbagh & Pilibhit 15 each, Baheri, Dapoli, Falakata, Gerusoppa & Valpoi 14 each, Agumbe, Dhampur, Guhagarh, Honavar, Lanja, Ratnagiri, Sanguem & Shirali 13 each, Ankinghat, Bahadurganj, Bhatkal, Champasari, Diu, Haldibari, Harnai, Neora & Quepem 12 each, Bagdogra, Bambasa, Birpur, Chiplun, Garubathan, Kumta, Malvan, Panambur, Pawayan & Sawantwadi 11 each, Ankola, Bagrakote, Bhira, Canacona, Gajoldoba, Gohar, Kankavli, Khed, Koondapur, Mangalore, Manki, Moga, Mukteshwar, Siddapura, Simla & Sindewahi 10 each, Ahirwalia, Bajpe, Bisalpur, Cooch Behar, Dasuya, Dhundhi, Ferozepur, Forbesganj, Galgalia, Kashipur, Kudal, Muhammdi, Nagina, Rajapur, Ramayampet & Talala 9 each, Amritsar, Bageshwar, Belthangady, Bramhapuri, Budaun, Devgad, Etah, Ghazipur, Kadra, Karkala, Kota, Kudulu, Madhipura, Mahabaleshwar, Marsrakh, Mhasla, Mukerian, Mungaoli, Panjim, Pathankot I, Ranikhet, Safidon, Sirsi & Vidisha 8 each, Amroha, Arjuni Morgaon, Bantwal, Karwar, Khurai & Marmugao, Siswan 7 each	Kumargram 26, Haldibari, Khetri & Piplu 23 each, Neemkathana 19, Kallakurichi, Kheri Lakhimpur & Ramanathapuram 17 each, NH31 Bridge 16, Chepan, Domohani, Lalsot, Sankarapuram & Sheopur 15 each, Nagamangala 14, Subramanya, Taibpur & Tonk Tehsil 13 each, Ghansore, Hasimara, Nuggehalli, Thakurganj & Tirukoilur 12 each, Arogyavaram, Jalpaiguri, Malpura, Sawaimadhopur Tesil & Udaipur-Wati 11 each, Beki Mathanguri, Birdghat, Buxaduar, Chouldhowaghat, Darsi, Dharmasala, Harda, Muhammdi, Sawai Madhopur, Sravanabelagola & Tarikere 10 each, Adiramapatnam, Bareli, Chandigarh, Cherrapunji, Galgalia, Islampur, Jia Bharali N T Xing, Khalilabad, Manthani, Nagrarfort, Renuka, Sibsagar & Uniera Aligarh 9 each, Ahirwalia, Barobhisha, Biaora, Byad, Denkanikottai, Lalbegiaghat, M M Hills, Mohitnagar, Nahan, Nasirabad, North Lakhimpur, Ponneri, Sarath, Srirampura, Thanagazi & Tondi 8 each, Amarwara, Arai, Bareilly P, Choithkabarwara, Hata, Kasol, Kharangha, Kothagiri, Naraina, Ooty, Pawayan, Sohela, Tozhudur, Vedaranyam & Viratnagar 7 each	Gajoldoba 11, Bagdogra 10, Bhiwani, Rayalpadu & Thathaiyangarpet 9 each, Bhalukpong, Golaghat, Gossaigaon, Manash NH Xing & North Lakhimpur 8 each, Amarpur, Bansur, Dhundhi, Govindgarh & Seodha (Seondha) 7 each
22.	Cherrapunji 28, Garubathan 19, Bagdogra 18, Rongo 17, Thakurganj 16, Hut Bay 12, Tozhudur 11, Port Blair, Sevoke & Shella 10 each, Lava & Maya Bandar 9 each, Carnicobar I, Sukiapokhri, Suri & Tadong 8 each, Car	Roha 27, Diu & Talala 23 each, Cooch Behar & Haldibari 22 each, Kodinar & Sudhagad 21 each, Dapoli & Gaganbawada 19 each, Mahabaleshwar, Mahad & Poladpur 18 each, Bhira & Mhasla 17 each, Khed, Mangaon & Taibpur 16 each, Bambasa, Mandangad, Murud & Pen 15 each,	Tapan 24, Madha & Panbari 21 each, Cherrapunji 20, Kosagumda & Pandharpur 17 each, Thakurdwara 16, Osmanabad 15, Mahinagar & Manash NH Xing 14 each, Kokrajhar, Mangan & Paonta 13 each, Chanchal, Mohol & Rudraprayag 12 each, Agumbe, C	Sikar Tehsil 20, Ramnagar 16, Kalna, Sikar 15, Forbesganj & Malsisar 14 each, Chandigarh, Davangere & Moharo 12 each, Falakata & Shivani 11 each, Nawalgarh & Ramgarhshekhatan 10 each, Bagati, Basirhat, Chandigarh I & Sattur 9 each,

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
Nicobar, Darjeeling, Gangtok & Jia Bharali N T Xing 7 each	Dhari, Falakata & Panvel 14 each, Bulsar & Dahanu 13 each, Agumbe, Bagsra, Malia, Nainital, Siddapura & Valpoi 12 each, Chiplun, Dhaurahara, Dhoraji, Jafrabad, Jalpaiguri, Junagadh, Karjat, Khalapur, Kota, Lunkaransar, Mahuwa, Mathabhanga, Matheran, Tezu & Upleta 11 each, Alibag, Champawat, Fatehpur, Gossaigaon, Jawhar, Lanja, Panbari, Rajapur, Shirali, Shriwardhan, Silvassa, Tarabganj, Udupi & Vada 10 each, Barobhisha, Bhatkal, Bhinga, Chincholi, Elgin Bridge, Fatehgarh, Gandevi, Gerusoppa, Guhagarh, Jammu, Kakardarighat, Kalyan, Kankavli, Kanpur, Khambha, Koondapur, Kosagumda, Malsisar, Malvan, Mapusa, Mumbai AP, Murbad, Palsana, Pardi, Rajgarh, Roorkee, Sanguem, Sawantwadi & Shahapur 9 each, Ashoknagar, Badnagar, Bahraich, Ferozepur, Gautampura, Haldwani, Hardoi, Honavar, Jalalpur, Kaiserganj, Kamardi, Kollapur, Kudal, Madhuban, Manki, Mumbai, Rajkot AP, Ratnagiri, Sarwar, Taran Taran & Veraval 8 each, Bajpe, Balrampur, Bardoli, Belthangady, Bhind, Bidar, Chhibramau, Chothkabarwara, Devgad, Dharampur, Karauli, Karkala, Katerniaghat, Mandrayal, Mani, Margao, Nanipalson, Navsari, Surat & Sutrapada 7 each	N Halli, Canacona, Dehra Dun, Gangapur, Karnaprayag, Koondapur, Kottur, Mozamabad, Mussoorie & Sirkali 11 each, Bhatkal, Fatehpur, Harapanahalli, Nainital & Phagi 10 each, Beki Road Bridge, Chaksu, Chinglepet, Chirawa, Dadupur, Deoband, Mangalvedha, Melabazar, Motunga, Muhammdi, Mundargi, Parbatsar & Yegati 9 each, B. Durga, Bahalpur, Bahraich, Gajoldoba, Jalahalli, Jhirka, Kaiserganj, Kalgi, Khetri, Kudachi, Malerainadunger, Molakamuru, Moradabad, New Delhi A, New Delhi AN, Passighat, Sira, Subramanya, Suratgarh & Tavaregere 8 each, Barpeta, Beki Mathanguri, Bevoor, Cuddalore, Gurgaon, Hindaun, Kollidam, Koppal R, Munirabad, R. S. Mangalam, Tandur, Tiruvarur & Uthiramerur 7 each	Alur, Balehonur, Chitradurga, Hassan, Mahendragarh, Muthupet, Simla & Tilpara Barrage 8 each, Davangere, Halli Mysore, Halwara I & Ramagiri 7 each	
23. Maya Bandar & NH31 Bridge 20 each, Galgalia 17, Mohitnagar 16, Jalpaiguri & Thane 13 each, Mumbai 12, Nagbhir & Osmanabad 11 each, Buxaduar, Chouldhowaghat, Hasimara, Islampur & Shevgaon 10 each, Arambagh, Mangaon, Mumbai AP, Ratnagiri, Taibpur & Uran 9 each, Domohani, Guhagarh, Khirpai & Rajapur 8 each, Nancowary, Sindewahi & Tuting 7 each	Silvassa 25, Mangrol 22, Ranawao 21, Madhuban 20, Dahanu, Dharampur & Mandvi 19 each, Karjat, Lanja & Vada 18 each, Bulsar, Kutiana, Matheran, Raniwada & Umbergaon 17 each, Gaganbawada, Porbandar AP & Talala 16 each, Cherrapunji, Chiplun & Pardi 15 each, Bhira, Chepan, Idar & Veraval 14 each, Jawhar, Malia, Panvel, Ratnagiri & Sutrapada 13 each, Bhiwandi, Dhandhuka, Dharoi Colony, Lathi, Manavadar & Roha 12 each, Bhanwad, Jodia, Kalol, Mahabaleshwar, Mokheda, Murbad, Nanipalson, Poladpur, Rajapur, Rajkot AP & Sudhagad 11 each, Adampur, Bansda, Gossaigaon, Hissar, Kalyan, Khairi, Londa, Mangaon & Sihor 10 each, Babra, Dapoli, Dinhata, Guhagarh, Jaswantpura, Khanpur, Khed, Kokrajhar, Kudal, Mahad, Mahasamund, Makrana, Mandangad, Nandigram, Paradeep, Siwana, Thane & Uran 9 each, Alipurduar, Bahadurganj, Dantiwada, Deoli, Dharmsala, Guhla, Kadi, Kandla New, Kankavli, Keshod AP, Khanapur, Khedbrahma, Mundra, Sanguem, Shriwardhan & Vagra 8 each, Bagoda, Chargharia, Chikhli, Halwara I,	Nawabganj 27, Cherrapunji 25, Gaunaha 21, Sevoke 20, Neora 19, Palliakalan, Ponneri 18, Garubathan 17, Murti 16, Chandardeepghat 15, Cholavaram 14, Nighasan 13, Bagrakote, Panbari, Salbari & Utarala 12 each, Long Island & Redhiils 11 each, Aie NH Xing, Barobhisha, Champasari, Kumargram, Lava & Puranpur 10 each, Kakardarighat, Mangan, Maya Bandar, Moradabad & Tuting 9 each, Bagdogra, Bahalpur, Chepan, Daman, Gajoldoba, Harnai, Naduvattam, Nagarkata & Patna 8 each, Dadri, Elgin Bridge, Manash NH Xing & Panambur 7 each	Kasauli 19, Tohana 16, Avaniagadda 15, Dharampur & Morni 13 each, Devara Hippargi 12, Baghpat, Bankura, Dharapuram, Narwana & Topchanchi 11 each, Kandaghat & Pachhad 10 each, Dumri, Jind & Piravam 9 each, Bankura, Katra, Kumarsain, Monghyr, Mulanur, Pitampura, Renuka, Samba, Simla & Yadwad 8 each, Guhla, Motihari, Palam & Parbhani 7 each	

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
		Igatpuri, Kodinar, Lilia, Lodhika, Mumbai AP, Panbari, Shahapur, Sirpur & Valpoi 7 each		
24.	Dahanu 24, Kurdege 16, Karmala 15, Soro 13, Monghyr 12, Ambabhona 11, Bhatkal & Karjat 10 each, Margao, Panvel, Shirali & Umbergaon 9 each, Mahinagar, Midnapore S, Mumbai AP & Tapan 8 each, Baldwara, Koondapur, Lanja, Nagathan, Quepem & Sanguem 7 each	Gaganbawada & Ratnagiri 21 each, Lanja 20, Pallahara 18, Jia Bharali N T Xing 16, Kurdege & Turekela 15 each, Silvassa 14, Madhuban, Mahabaleshwar & Umbergaon 13 each, Bhira & Lanji 12 each, Kalyanpur, Kutiana, Mahad, Mandira Dam & Titlagarh 11 each, Chiplun, Daman, Khalapur, Nuzvidu, Pokhran, Poladpur, Rajapur, Sawantwadi, Sevoke & Shahuwadi 10 each, Avaniagadda, Bhimavaram, Canning, Dhekiajuli, Guhagarh, Keonjharagarh, Kotma, Lahunipara, Maharajganj, Pardi & Sundargarh 9 each, Jamnagar AP, Jawhar, Kankavli, Karjat, Mandangad, Mangaon, Matheran, Mhasla, Nanipalson, Narsampet, Salbari, Sudhagad, Tenali & Unjha 8 each, Achampet, Altuma, Ambabhona, Belgaon, Jaleswar, Khed, Laikera, Madanpur Rampur, Panposh, Pen, Radhanagari, Raigarh, Rajgangpur, Roha, Sarangarh, Shahapur, Sikrai & Tenughat 7 each	Sevoke 28, Tribeni 22, Islampur 21, Morena 16, Allagadda 15, Neemsar & Siruguppa 14 each, Manvi 13, Dhaurahara & Dhone 12 each, Mangan, Nandyal, Porumamilla & Taibpur 11 each, Bagdogra, Bapouli, Darjeeling & Haidargarh 10 each, Addanki, Champawat, Dholpur, Fatehpur, Lalbegiaghat, Nagarkata, Sindhanoor & Thakurganj 9 each, Anandpur Sahib, Balrampur, Chanderdeepghat, Dholpur Tehsil, Jalahalli, Jiaganj, Kalyandrug, Kolkata AP, Kollapur, Kudathini, Mangalgiri, Mirzapur, Panipat, Paonta, Ramnagar & Sukiapokhri 8 each, Ambah, Baghpat, Bhinga, Champasari, Eturnagaram, Harpur, Kodawanpur, Matheran, Pavagada, Renuka & Udayagiri 7 each	Mulki 19, Kochi 18, Piravam 17, Bajpe 16, Belgaum, Mangalore & Perumpavur 15 each, Alapuzha & Cherthala 14 each, Kodawanpur & Panambur 13 each, Belthangady 12, CIAL Kochi 11, Agumbe, Bydgi, Dabolim & Naharkatia 10 each, Alwaye, Chalakudi, Karkala, Khanapur, Konni & Udupi 9 each, Honnali, Jurala Proj., Koondapur, Kottayam, Kumarakam, Sankeshwar, Sawantwadi, Vaikom, Valpoi & Yadwad 8 each, Chouldhowaghat, Deomali, Holenarsipur, Karwar, Kozha, Mahua, Malvan, Mundgod, Panjim, Rampurhat & Sangareddi 7 each
25.	Mumbai 21, Malvan 20, Kurdege 18, Panjim & Shirali 15 each, Bhatkal & Khandapara 14 each, Dahanu, Devgad, Kota, Manki, Mumbai AP & Vengurla 13 each, Marmugao & Umbergaon 12 each, Kakatpur, Krishnaprasad, Lateri, Nimpara, Ranpur & Tangi 11 each, Alibag, Banpur, Honavar, Narsinghpur & Panambur 10 each, Hindol, Karwar, Koondapur, Mapusa, Mundali, Murud & Thane 9 each, Agumbe, Amraoti, Athgarh, Bhongir, Dabolim, Dhekiajuli, Guna, Kochi, Margao, Matheran, Nayagarh, Piravam, Rajapur, Shriwardhan & Uran 8 each, Bajpe, Barnala, Daspalla, Kudal, Makhdumpur, Mani, Palampur & Udupi 7 each	Karjat 29, Deesa, Lanji & Vadgam 21 each, Athgarh, Baliguda & Binika 19 each, Bilaspur, Devgad, Mumbai, Mundali, Pallari & Ratlam 18 each, Ambadola, Baloda Bazar, Idar, Jeypore, Palanpur, Pattamundai & Uran 17 each, Chhachhrauli, Dapoli, Kankavli, Khed, Mahabaleshwar, Malkangiri & Venkatapuram 16 each, Chiplun, Gaganbawada, Guhagarh, Kendrapara, Khandapara, Mandangad, Metpalli, Mhasla, Shriwardhan & Vadnagar 15 each, Dantewara, Kotraguda, Mangaon, Matheran, Naraj, Panvel, Sawantwadi, Sidhpur & Wav 14 each, Bargarh, Dantiwada, Eturnagaram, Gondia, Kalyan, Khalapur, Malvan, Patan, Sanand, Shergarh & Thane 13 each, Angul, Arang, Bhiloda, Bhira, Chandgad, Ghatol, Jawhar, Kalinga, Lanja, Peint, Pen, Poladpur, Saraipali, Sukma & Tharad 12 each, Bhiwandi, Cuttack, Jagalbet, Kamrej, Khushalgarh, Mana-Raipur, Mandvi, Maya Bandar, Mumbai AP, Perur, Phulbani, Rajapur, Roha, Sami, Sonepur, Sudhagad & Vengurla 11 each, Akhuapada, Alibag, Bissem-Cuttack, Chikali, Dorimanna, Ghatagaon, Gudari, Hirakud, Igatpuri, Jamnagar AP, Jashpurnagar, Kheralu, Lanjigarh, Mahad, Murud, Nanipalson, Raipur, Rajim, Rajkanika, Satlasana, Sironcha & Ukai 10 each, Ahiri, Bagidora, Bardoli, Champua,	Gonda & Tribeni 20 each, Kashipur 17, Nainital 15, Elgin Bridge, Mudubidre & Panambur 14 each, Dantewara, Gohana, Maithon, Mangalore, Mani, Mankapur & Puttu 13 each, Buxar, Kashipur, Manvi, Moradabad, Silchar & Simula 12 each, Bantwal, Hata, Hatwara, Karkala, Mulki, Panchet, Subramanya, Sulya, Tarabganj, Udgir & Udupi 11 each, Bajpe, Kudulu, Nagina, Reamal & Regoli 10 each, Bhagamandala, Dhampur, Margao, Samba, Tensa, Umarkote & Vengurla 9 each, Batagaon, Bhalki, Canacona, Chimur, Chincholi, Darjeeling, Dehra Dun, Hardwar, Mayapur, Honnali, Jahanabad, Jhajha, Jhumpura, Kalmeshwar, Kanpur, Koondapur, Kota, Kudal, Laxhipur, Mauda, Ramgarh, Uppinagadi, Valpoi & Vapi 8 each, Ahirwalia, Gobindpur, Lalbegiaghat, Lingadahalli, Mapusa, Mussoorie, Nagpur APdrome, Nalbari, Nighasan, Nuh, Panjim, Ramnagar, Renuka, Taliparamba & Tenughat 7 each	Kollam 23, Bangalore, Koondapur & Thambalapalli 11 each, Aie NH Xing, Hessarghatta, Patsio & Srinivasapur 10 each, Palasa 9, Kadiri, Khed, Piduguralla & Vinjamur 8 each, Devakottai, Hindupur, Manash NH Xing, Srikalahasthi & Tondebhavi 7 each

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
		Chintapalli, Dharmasala, Dharoi Colony, Halol, Jaora, Jaswantpura, Kotagarh, Kudal, Luni, Manthani, Meghraj, Modasa, Mokhedra, Mulug, Murbad, Nandurbar, Narsinghpur, Paderu, Palliakalan, Radhanagari, Ratnagiri, Sajjangarh, Siddapur, Sohela, Thasra & Tikabali 9 each, Agumbe, Ajra, Alirajpur, Bhimavaram, Chendipada, Chhota-Udepur, Danta, Daspalla, Fatepura, Gariabund, Harij, Junagarh, Kamardi, Kankrej, Kasauli, Kasol, Koderu, Koraput, Luxettipet, Mahuda, Mount Abu, Rajgarh, Ramgundam, Rayagada, Rongo, Sallopat, Sarangarh, Shahapur, Simga, Sultanabad & Vijaynagar 8 each, Ahmedabad AP, Ambabhona, Belthangady, Bhabhra, Bolangir, Bonth, Broach, Daringibadi, Dhansura, Gargoti, Gerusoppa, Himatnagar, Jagdalpur, Jagtial, Jalore, Kaleswaram, Koyyalagudem, Krishnaprasad, Loharia, Madanpur Rampur, Mahasamund, Mohana, Navapur, Nayagarh, Parvatipuram, Shriramsag.Pocha, Simla, Sinderi, Tensa, Vada & Visnagar 7 each		
26.	Vengurla 30, Koondapur 27, Dabolim 26, Malvan 25, Marmugao & Panjim 23 each, Canacona 20, Kota & Kumta 19 each, Kurdege 18, Mapusa & Passighat 17 each, Mani & Sanguem 16 each, Bantwal & Manki 15 each, Ambabhona, Ankola, Bajpe, Bargarh, Hemgiri, Honavar & Mulki 14 each, Bijepur, Gerusoppa, Puttu, Sawantwadi & Siddapura 13 each, Agumbe, Bhatkal, Dehri, Mudubidre & Quepem 12 each, Karwar & Kudal 11 each, Cherrapunji, Hirakud, Mangalore, Ranpur, Sambalpur, Siddapur, Sohela & Sulya 10 each, Naharkatia, Shirali & Udupi 9 each, Bhagamandala, Chouldhowaghat, Devgad, Karkala, Panambur, Saraipali & Valpoi 8 each, Binika, Daringibadi, Hosanagar & Pratapgargh 7 each	Kadi & Mahabaleshwar 29 each, Becharaji 27, Damoh 25, Dhanera 23, Gaganbawada 22, Paratwada 19, Bichhia & Radhanagari 18 each, Bhinmal, Jabalpur-New, Lava, Mandangad & Pallari 16 each, Dantiwada, Detroj, Harnai, Khanapur, Khed, Mandrayal & Poladpur 15 each, Darjeeling, Jagalbet, Kamardi, Mahroni & Morvi 14 each, Balaghat, Chanderi, Chiaplun, Gandai, Garhakota, Kalol, Khurai, Paud, Sagar, Sanchoe & Yellapur 13 each, Gerusoppa, Guna, Hatta, Isagarh, Linganamakki, Nainpur, Sanguem, Siddapur, Sidhpur, Sironj & Viramgam 12 each, Ahwa, Arang, Deesa, Durg, Gargoti, Kankrej, Katangi, Keolari, Khalapur, Kurwai, Lanja, Lanji, Manchikere, Mansa, Mehsana, Rajapur, Sendhwa (Med) & Sukma 11 each, Bhira, Buxwaha, Chamorshi, Jaswantpura, Jayapura, Mahad, Mungaoli, Ratnagiri, Shahuwadi, Soro & Wav 10 each, Agumbe, Ashoknagar, Bansda, Chandgad, Dapoli, Dhrangadhra, Ghansore, Hosanagar, Jodia, Kagal, Kankavli, Kathlal, Kumarsain, Mandal, Mangaon, Margao, Mhasla, Palanpur, Panbari, Patan, Pichhore, Rajim, Sabalgarh, Sedwa Sr, Sringeri & Vallabhnagar 9 each, Akkalkuwa, Badesar, Begumganj, Bhor, Bilaspur, Bodeli, Deoband, Devgad, Gandhinagar, Harij, Kalimpong, Kharaghoda, Kirwati, Kollur, Kudal, Makrana, Malvan, Mapusa, Panjim,	Tajewala 31, Paonta 22, Udgir 18, Hakimpet I, Kasganj & Shriwardhan 14 each, Garubathan, Kolaras & Narayanpur 13 each, Amroha, Aonla, Mhasla & Narasaraopet 12 each, Majitar 11, Galgalia, Nahan & Raisen 10 each, Budaun, Dehra Dun, Fatehgarh, Hospet, Khajuraho AP, Khanitar, Lingasuguru, Medchel, Murud, Nagarkata, Nargund & Rehli 9 each, Alibag, Alur, Ankleshwar, Bisauli, Chachoda, Devara Hippargi, Gogunda, Guhagarh, Harnai, Hut Bay, Jammu AP, Kapasan, Kota, Maihar, Mangalgiri, Partur, Peint, Rajakhera, Saidapur, Sambhal, Siruguppa, Talikote & Udupi 8 each, Barsi, Manki, Panvel, Rajnagar, Shorapur, Sironj, Sudhagad & Uran 7 each	Cherrapunji 18, Dharmasthala 11, Katwa 10, Gubbi & Napoklu 8 each, Itanagar, Nelamangala & Sevoke 7 each

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
		Pune A.P., Raniwada, Rehli, Sawantwadi, Songadh Fort, Sukiapokhri, Udaipur & Udaipur 8 each, Ajra, Amgaon, Bhadravati, Gotegaon, Halwad, Kawardha, Kottigehara, Lakkavalli, Mana-Raipur, Mandla, Mavli, Mehmedabad, N R Pura, Nandurbar, Pachmarhi, Panhala, Patan, Patur, Purola, Raipur, Roha, Sagar Ib, Sami, Satara, Sudhagad, Tendukheda & Vengurla 7 each		
27.	Cherrapunji 34, Buxaduar & Nagarkata 26 each, Chengmari Diana, Kumargram & Sevoke 22 each, Kurdege 21, Beki Mathanguri, Galgalia & Murti 20 each, Alipurduar & Salbari 19 each, Champasari & Jalpaiguri 18 each, Gajoldoba & Manki 17 each, Aie NH Xing & Hasimara 16 each, Bagrakote, Manash NH Xing & Neora 15 each, Bhatkal, Gerusoppa, Mohitnagar & Panbari 14 each, Domohani, Haldibari, Kaliaganj, Shillong, Taibpur & Thakurganj 13 each, Beki Road Bridge, Garubathan, Kamardi, Kumta, Lava & Linganamakki 12 each, NH31 Bridge, Sawantwadi & Siddapur 11 each, Barpeta, Chepan & Islampur 10 each, Cooch Behar, Falakata, Honavar, Thalaguppa, Udaipur & Vengurla 9 each, Bhagamandala, Dinhat, Goalpara, Hosanagar, Manjeri, Mulki, Putki, Shirali, Sonamura & Vijayanagaram 8 each, Ambabhona, Barobhisha, Belonia, Belthangady, Dunguripalli, Koondapur & Passighat 7 each	Jamnagar AP 47, Mandvi 45, Okha 33, Jodia 21, Anjar, Mahabaleshwar & Monghyr 19 each, Bachau & Manasa 17 each, Lalpur & Najibabad (T) 16 each, Kalyanpur & Nimbaheera 15 each, Bhanpura, Kandla New & Malia Miyane 14 each, Amethi & Chandgad 13 each, Bhira, Jawhar, Mundra, Naliya & Paud 12 each, Igatpuri, Karjat, Matheran & Mhasla 11 each, Abdasa, Agumbe, Durg, Gandhi Dham, Jawad, Khalapur, Radhanagari & Rahapur 10 each, Ajra, Bhagamandala, Bhanwad, Dapoli, Dwarka, Hosanagar, Kalasa, Khed, Nakhatrana, Poladpur, Pratapgarh (T), Siddapur & Vada 9 each, Badesar, Bhor, Chandanpur, Devala, Dhrol, Gargoti, Gogunda, Kottigehara, Kutiana, Mahad, Manendragarh, Mangaon, Napoklu, Pachpahar, Panhala, Pindwara, Pirawa, Porbandar AP, Ramganjmandi, Somwarpet T.O., Sudhagad & Thirthahalli 8 each, Ahmedabad AP, Bakani, Dediapada, Deoband, Gandevis, Kamardi, Khanapur, Kollur, Koppa, Kudal, Manohar Thana, Nalagarh, Nasirabad, Panvel, Patan, Thane & Unjha 7 each	Garubathan 17, Bagdogra & Nagarkata 16 each, Chengmari Diana, Gajoldoba & Sompeta 15 each, Champasari, Murti & Salbari 14 each, Gopalpur, Neora & Rongo 13 each, Bhalukpong & Buxaduar 12 each, Bagrakote, Berhampur, Chhatrapur, Chouldhowaghat, Rajapur & Una 11 each, Arki, Damthang, Mohanbari, Motala, North Lakhimpur & Ranasthalam 10 each, Ahmednagar, Ashti, Bhira, Bilgi, Itchapuram, Palasa & Telkoi 9 each, Chikhli, Depalpur, Gaganbawada, Hansot, Jintoor, Karmala, Mandal, Mandasa, Nalwatwad, Paralakhemundi, Pathapatnam, Tadong, Tekkali & Visakhapatnam AP 8 each, Agumbe, Akola, Bhuj R.Mata A., Hasimara, Jafferabad, Kakatpur, Khowang, Peint, Salur, Shegaon & Viramgam 7 each	Chouldhowaghat 23, Arasalu 16, Tirupuvanam 13, Barobhisha 11, Buxaduar & Cherrapunji 10 each, Cholavaram & Phaltan 9 each, Dudda 8, Hatkanangale, Idukki, Jayapura, Kokrajhar, Maniyatchi, Panbari, Shirala & Usilampatti 7 each
28.	Cherrapunji 28, Gossaigaon & Kurdege 21 each, Aie NH Xing & Kokrajhar 18 each, Manash NH Xing 17, Beki Mathanguri 16, Panbari 15, Alipurduar, Barobhisha, Chepan & Dinhat 14 each, Cooch Behar, Raiganj, Shillong & Tribeni 13 each, Bahalpur & Nagarkata 12 each, Barpeta, Beki Road Bridge & Mandsaur 11 each, Hasimara, Kumargram & Murti 10 each, Buxaduar, Chengmari Diana & Dharmatal 9 each,	Agumbe, Bhagamandala & Lanja 16 each, Mahabaleshwar 15, Radhanagari 14, Gaganbawada & Sirpur 13 each, Shahuwadi 12, Malihabad 11, Siddapur & Sringeri 10 each, Irikkur, Jayapura, Kalasa, Napoklu, Rajapur & Vadakara 9 each, Ajra, Bobbili, Devala, Gondpipri, Gudalur, Kamardi, Madapur, Madikeri, Manantoddy, Munnar, Naduvattam, Sirsi & Subramanya 8 each, Alwaye, Bhira, Dhanora, Khanapur, Khed, Kottigehara, Kuppady, Manjeri, Patan & Somwarpet T.O. 7 each	Dhoraji 15, Dholka & Haldwani 11 each, Bhalukpong 10, Akot, Jetpur-Moni, North Lakhimpur, Shirampur & Upleta 9 each, Hasimara, Kalyan, Kodinar, Maharajganj, Malvan & Wankaner 8 each, Amreli, Dhond, Gopalganj, Lodhika, Malia & Tiwsa 7 each	Itanagar 15, Karipur, Naharlagun & Seppa 11 each, Beki Mathanguri, Karmala & Sanguem 9 each, Lanja 8, Quepem & Shriwardhan 7 each

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
	Cholavaram, Falakata, Galgalia, Garubathan, Neora & Thikri 8 each, Alipore, Bagdogra, Begu, Malda, Redhiils, Tiruvallur & Yercaud 7 each			
29.	Kottigehara 18, Vadakara 15, Cherrapunji & Kailashahar 14 each, Dharmanager, Panisagar, Karipur & Ottapalam 13 each, Tellichery 12, CIAL Kochi, Kannur, Pattambi & Thodupuzha 11 each, Basirhat P, Piravam, Thrissur & Vadakkancherry 10 each, Boath & Chalakudi 9 each, Bobbili, Chandrapur, Kunnamkulam & Perinthalamanna 8 each, Bhira, Bishalgarh, Cherthala & Taliparamba 7 each	Kamardi 17, Bhadrachalam & Kollur 16 each, Agumbe & Sanguem 15 each, Koyyalagudem, Kunavaram & Mudubidre 14 each, Chandgad, Margao, Shella & Siddapura 13 each, Aizwal, Ankola, Canacona, Dowleshwaram, Gerusoppa & Subramanya 12 each, Dhanora, Gaganbawada, Hosanagar, Shirali & Thirthahalli 11 each, Bhagamandala, Dabolim, Joida, Kankavli, Marmugao, Rajahmundry, Siddapur, Sringeri, Sulya & Valpoi 10 each, Bhatkal, Dharmasthala, Jayapura, Koppa, Madikeri, Nawarangpur, Panjim, Radhanagari, Ranpur & Sawantwadi 9 each, Ajra, Carnicobar I, Deomali, Honavar, Kalasa, Karkala, Koida, Madapur, Mahabaleshwar, Naduvattam, Naharkatia, Shivpuri, Sirsi & Thalaguppa 8 each, Belthangady, Car Nicobar, Chiplun, Dinhata, Jagalbet, Khanapur, Kudal, Lakkavalli, Linganamakki, Manki, Mapusa, Sagar Ib & Vengurla 7 each	Mahabaleshwar 12, Maudeha, Panvel & Roha 11 each, Kalyan, Nandgaonkazi, Pushkar & Vaduj 10 each, Bambasa, Mahuwa, Mana-Raipur & Shrirampur 9 each, Banda, Harnai, Kollur, Mahad, Mandangad, Mandvi, Orchha, Sidhpur, Tiruvuru & Tribeni 8 each, Alibag, Amet, Dongargarh, Lanja, Lathi, Maya Bandar, Mhasla, Pichhore, Rupbas & Thane 7 each	Mangalore 11, Ayikudi & Musiri 8 each, Gobindpur 7
30.	Vadakara 15, Midnapore, Midnapore C & Vadakkancherry 12 each, Anandpur & Rengali 11 each, Daitari, Karwar & Quilandi 10 each, Bagrakote, Kharagpur, Minicoy, Sevoke, Sundargarh & Tellichery 9 each, Agartala, Altuma, Jharsuguda & Thakurmunda 8 each, Amarpur, Ankola, Burdwan, Lava & Sonamuria 7 each	Manthani 36, Venkatapuram 33, Uttoor 25, Kankavli 24, Karkala & Mangalore 21 each, Mulug & Udupi 20 each, Forbesganj & Tezu 19 each, Bajpe 18, Belthangady, Mudubidre & Tribeni 17 each, Vadakara 16, Agumbe, Bambasa, Bantwal, Bhatkal, Gaganbawada, Guhagarh, Hosdurg, Koondapur & Kota 15 each, Baheri, Dharmasthala, Kudulu, Panambur, Puttu, Shirali, Siddapura & Subramanya 14 each, Ankola, Asifabad, Bhagamandala, Eturagaram, Kannur, Konta, Kozhikode, Kudal, Mani & Taliparamba 13 each, Chiplun, Gerusoppa, Karwar, Mulki & Ottapalam 12 each, Boath, Devgad, Irikkur, Khanapur, Kollur, Linganamakki, Madikeri, Malvan, Jawhar, Jodia, Limbadi, Metpalli, Sawantwadi & Sulya 11 each, Arjuni Morgaon, Jagtial, Karjat, Mancherial, Mandangad, Perur, Rajapur, Ramgundam, Sudhagad & Sultanabad 10 each, Honavar, Karipur, Kumta, Luxettipet, Malkangiri, Parkal, Parambikulam, Pattambi, Quilandi, Rongo, Sringeri, Tellichery & Vengurla 9 each, Armori, Cholavaram, Harnai, Hingoli, Jagalbet, Kalasa, Kottigehara, Kunnamkulam, Kuppady, Lanja, Manantoddy, Manjeri, Manki, Mhasla, Mudigere, Narsampet, Pandherikawara, Radhanagari, Shriwardhan, Silchar,	Bhira 38, Karjat & Navsari 22 each, Upleta 21, Matheran 20, Thane 19, Daman & Sudhagad 18 each, Chintalapudi 17, Roha 16, Baijnath, Bhiwandi, Kutiana, Mahabaleshwar & Umbergaon 15 each, Bardoli, Bhinga, Mumbai AP & Vada 14 each, Bhimavaram, Dhoraji, Jalalpur, Kalyan, Konta & Paud 13 each, Ahiri, Khalapur, Mahad, Muthupet, Vapi & Veraval 12 each, Devala, Mahuda, Murbad, Panvel, Peermade, Silvassa, Sutrapada, Ukai & Uran 11 each, Gilbarga, Harij, Koyyalagudem, Kukshi, Madhuban, Mangaon & Sukinda 10 each, Banswada, Jawhar, Jodia, Limbadi, Malkangiri, Mangrol, Olpad, Palsana, Pathalgaon, Pen, Radhanpur, Rajkot AP, Shahapur & Vadgaon 9 each, D.Barria, Etapalli, Kamrej, Khambhat, Kozha, Maya Bandar, Mokheda, Peint, Poladpur, Rapalle, Tirumanur, Tiruttani & Tiruvuru 8 each, Badesar, Bulsar, Chotila, Jhadol, Kandla New, Kunavaram, Luxettipet, Mahuwa, Neemuch, Sankheda, Savli, Songadh Fort, Talala & Viramgam 7 each	Chiplun 13, Gargoti & Manimuthar 11 each, Gadhinglaj & Radhanagari 9 each, Baramati, Koondapur, Lanja & Pamban 8 each, Devgad, Kamrej & Lakkavalli 7 each

TABLE 16 (Contd.)

(1)	(2)	(3)	(4)	(5)
		Thalaguppa, Thritle, Tiruvallur, Vadakkancherry & Virajpet 8 each, Alathur, Bhira, Chintapalli, Gadchiroli, Haldwani, Hosanagar, Huzurabad, Khed, Kollamkode, Naduvattam, Nirmal, North Lakhimpur & Thirthahalli 7 each		
31. -		Dehra Dun 36, Kashipur 25, Bilaspur, Ahiri 48, Karjat & Wani 21 each, Gerusoppa & Honavar 19 each, Rajura 19, Kottigehara 18, Agumbe & Tajewala 17 each, Devgad Bhiwandi, Kalyan & Linganamakki 17 each, Agumbe, Hosanagar, Kumta, Mangrulpir, Paonta, Gerusoppa & Matheran 16 each, Roorkee & Washim 15 each, Ankola, Begu 15, Bhagamandala 14, Cherrapunji, Deoband, Karkala, Nagina Bhadravati 13, Ammathy, & Sawantwadi 14 each, Bajpe, Koondapur & Kosagumda 12 each, Bantwal, Dapoli, Gohar, Kollur, Kota, Bhira, Gondpipri, Hunchadakatte, Panambur, Sanguem, Shegaon & Karkala, Khalapur, Londa, Morsi, Siddapur 13 each, Hingoli, Malvan, Mudubidre, Mumbai, Manki, Naraingarh, Quepem, Tehri & Pandherikawara, Panvel, Shahapur, Valpoi 12 each, Chhachhrauli, Sudhagad, Thane, Thyagarathi & Dharmasthala, Guhagarh, Landsdown, Valpoi 11 each, Bhopalpatnam, Mangalore, Mani, Mapusa, Margao, Igatpuri, Jawhar, Mumbai AP, Mudubidre, Shirali & Udupi 11 each, Murbad, Selu, Thalaguppa, Udupi & Uran 10 each, Baijnath, Bijapur, Bijnor, Bijoliya, Dadupur, Hardwar, Dharmsala, Kalwad, Kalyanpur, Mayapur, Khamgaon, Kottigehara, Kutiana, Maya Bandar, Kudal, Malegaon, Mulki, Nawarangpur, Paonta, Pen, Nandgaonkazi & Siddapura 10 each, Pratapgarh, Radhanagari, Silvassa, Baijnath, Bhatkal, Chamoli, Digras, Sringeri & Yellapur 9 each, Gheropara, Harnai, Keertinagar, Arasalu, Bhopalsagar, Chargharia, Khaknar, Khed, Khirkiya, Koondapur, Gaganbawada, Honavar, Jayapura, Kotdwara, Linganamakki, Mandagarh, Madikeri, Napoklu, Sanguem, Manora, Moradabad, Murtajapur, Subramanya, Tarapur, Vada & Paratwada, Pithoragarh, Sirsi & Virajpet 8 each, Bhatkal, Thalaguppa 9 each, Bhinay, Chiplun, Chandgad, Daman, Jhadol, Dabra, Dhampur, Kankavli, Motala, Kaleswaram, Kapasan, Murnadu, Neora, Palampur, Pali, Panjim, Puttu, Paratwada, Shikaripur, Utnoor & Renuka, Rudraprayag, Uttar Kashi, Uttar Kashi 7 each, Vijaynagar & Warora 8 each, Aie NH Xing, Auraiya C, Bareilly P, Barrackpur, Bilari, Canacona, Darwha, Jagadhari, Joida, Kahu, Karwar, Lava, Mahabaleshwar, Mandangad, Pratapgarh, Saharanpur & Vengurla 7 each		

Isolated areas around Ajmer (east Rajasthan), Yeotmal (Vidarbha), Kanyakumari (Tamil Nadu) and Chandbali (Orissa).

7.2.2. July

7.2.2.1. Severe arid areas

Small areas of central parts of Gangetic West Bengal and adjoining southeastern part of Jharkhand.

Isolated areas around Sheopur (west Madhya Pradesh) and Radhanpur (Gujarat Region).

7.2.2.2. Moderate arid areas

Small areas of central and northwestern parts of east Rajasthan and adjoining northwestern part of west Madhya Pradesh, northwestern and south central parts of Gangetic West Bengal and adjoining southeastern part of Jharkhand, northeastern parts of Saurashtra & Kutch and adjoining northwestern parts of Gujarat Region.

TABLE 17

No. of days of different rainfall distribution over the country during SW monsoon season June-September 2010

S. No.	Sub-division	Vigorous Active				Vigorous Active				Vigorous Active				Vigorous Active				Vigorous Active									
		Extra heavy rain				Extra heavy rain				Extra heavy rain				Extra heavy rain				Extra heavy rain									
		Very heavy rain				Very heavy rain				Very heavy rain				Very heavy rain				Very heavy rain									
Heavy rain				Heavy rain				Heavy rain				Heavy rain				Heavy rain											
		June				July				August				September				Season									
1	A. & N. Islands	0	0	0	1	4	0	0	0	2	4	0	0	0	0	7	0	0	0	0	2	0	0	0	3	17	
2	Arunachal Pradesh	0	0	0	3	2	0	3	0	0	1	0	1	0	0	2	3	2	0	2	3	3	6	0	5	8	
3	Assam & Meghalaya	0	2	3	1	5	0	0	0	6	7	0	7	2	4	7	0	8	0	4	10	0	17	5	15	29	
4	Naga. Mani. Mizo. & Trip.	0	1	0	1	2	0	2	0	0	1	0	3	0	0	5	0	5	0	0	1	0	11	0	1	9	
5	Sub-Himalayan WB & Sikk.	1	4	1	7	11	1	10	3	16	8	1	10	3	10	7	1	5	0	5	13	4	29	7	38	39	
6	Gangetic West Bengal	0	2	0	1	7	0	3	0	0	6	0	3	0	1	7	1	5	0	3	9	1	13	0	5	29	
7	Orissa	0	4	0	4	4	1	1	0	0	14	1	1	1	3	10	1	3	1	4	11	3	9	2	11	39	
8	Jharkhand	0	1	0	0	1	0	1	0	0	0	0	1	0	0	0	0	6	0	1	1	0	9	0	1	2	
9	Bihar	0	2	0	1	2	0	6	0	1	3	0	5	0	0	1	0	2	0	3	4	0	15	0	5	10	
10	East Uttar Pradesh	0	0	0	0	0	0	1	1	3	3	0	0	0	6	3	0	2	1	2	4	0	3	2	11	10	
11	West Uttar Pradesh	0	0	0	0	0	1	0	1	4	1	0	0	0	2	9	0	0	0	4	7	1	0	1	10	17	
12	Uttarakhand	0	0	0	0	1	0	4	1	3	6	0	4	0	3	7	0	1	0	4	4	0	9	1	10	18	
13	Haryana Chnd. & Delhi	0	0	0	0	1	3	2	0	3	3	0	8	0	0	4	4	4	0	0	3	7	14	0	3	11	
14	Punjab	0	0	0	0	3	2	3	0	2	3	0	2	0	0	1	2	1	0	0	1	4	6	0	2	8	
15	Himachal Pradesh	0	0	0	0	4	4	4	0	1	7	0	10	0	0	7	4	1	0	3	7	8	15	0	4	25	
16	Jammu & Kashmir	0	0	0	0	1	1	2	0	1	3	2	4	0	0	9	0	0	0	0	1	3	6	0	1	14	
17	West Rajasthan	0	0	0	0	1	3	1	0	0	1	4	2	0	0	13	2	0	0	1	9	9	3	0	1	24	
18	East Rajasthan	0	0	0	0	2	0	5	0	1	4	0	9	0	5	16	0	4	0	5	10	0	18	0	11	32	
19	West Madhya Pradesh	0	0	0	0	1	0	5	0	1	3	0	6	0	0	5	0	1	0	2	3	0	12	0	3	12	
20	East Madhya Pradesh	0	0	0	0	0	1	4	1	1	3	0	5	0	1	4	1	3	0	1	4	2	12	1	3	11	
21	Gujarat Region #	0	0	0	0	0	2	8	0	4	8	3	6	1	7	9	2	0	0	1	7	7	14	1	12	24	
22	Saurashtra & Kutch	0	0	0	0	1	7	4	1	4	5	7	2	0	5	6	4	0	0	0	4	18	6	1	9	16	
23	Konkan & Goa	2	5	2	5	6	0	9	3	10	13	1	10	1	7	11	1	4	0	2	8	4	28	6	24	38	
24	Madhya Maharashtra	2	0	0	2	2	0	5	1	8	5	0	3	0	2	5	0	3	0	1	5	2	11	1	13	17	
25	Marathwada	0	2	0	0	0	4	2	0	1	4	1	6	0	3	1	0	3	0	0	1	5	13	0	4	6	
26	Vidarbha	0	1	0	0	4	1	13	0	5	8	2	5	1	0	11	1	2	1	3	6	4	21	2	8	29	
27	Chattisgarh	0	0	0	0	0	1	5	0	0	5	1	4	0	1	1	2	3	0	0	4	4	12	0	1	10	
28	Coastal Andhra Pradesh	4	1	0	1	7	4	4	0	2	14	2	5	0	2	6	0	3	0	2	11	10	13	0	7	38	
29	Telangana	0	2	0	0	4	4	7	1	4	9	3	7	0	2	14	0	3	2	2	8	7	19	3	8	35	
30	Rayalaseema	1	0	0	0	3	3	4	0	1	3	3	4	0	2	4	1	1	0	0	4	8	9	0	3	14	
31	Tamil Nadu & Puduchery	0	0	0	1	9	0	0	0	1	15	2	0	0	2	7	1	2	0	2	10	3	2	0	6	41	
32	Coastal Karnataka	0	9	1	4	10	0	6	0	11	11	1	3	0	5	11	1	6	0	2	12	2	24	1	22	44	
33	North interior Karnataka	1	3	0	0	4	1	8	0	2	8	4	4	0	3	11	0	1	0	3	2	6	16	0	8	25	
34	South interior Karnataka	0	4	0	1	7	0	10	0	8	14	3	6	0	6	14	0	5	0	1	16	3	25	0	16	51	
35	Kerala	1	4	0	5	14	0	5	0	2	14	0	6	0	0	10	1	2	0	2	7	2	17	0	9	45	
36	Lakshadweep	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	5
	Total	12	47	7	38	123	44	147	13	108	218	41	152	9	82	249	33	91	5	65	212	130	437	34	293	802	

TABLE 18

Dates of occurrence of heat wave/severe heat wave and various categories of maximum temperatures - June 2010

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

TABLE 18 (Contd.)

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

Isolated areas around Malegaon (Madhya Maharashtra), Kanyakumari and Cuddalore (Tamil Nadu).

7.2.3. August

7.2.3.1. Severe arid areas

Isolated area around Krishnanagar (Gangetic West Bengal).

7.2.3.2. Moderate arid areas

Small areas of central parts of Gangetic West Bengal and adjoining southeastern part of Jharkhand.

Isolated areas around Barmer (west Rajasthan), Nandyal and Cuddapah (Rayalaseema) and Madurai and Kanyakumari (Tamil Nadu).

7.2.4. September

7.2.4.1. Severe Arid Areas

Isolated areas around Sheopur (west Madhya Pradesh), Bellary (South Interior Karnataka) and Cuddapah (Rayalaseema).

7.2.4.2. Moderate arid areas

Small areas of central parts of Rayalaseema and adjoining south central part of Coastal Andhra Pradesh and northern part of South Interior Karnataka.

Isolated areas around Allahabad (east Uttar Pradesh), Khammam (Telangana), Salem and Kanyakumari (Tamil Nadu).

8. Significant spells of heavy rains

Amounts of *heavy*, *very heavy* and *extremely heavy rainfall* are given in Table 16. The number of *vigorous* and *active* days on a sub-divisional scale along with the number of days on which *extremely heavy*, *very heavy* and *heavy* rainfall occurred is given in Table 17.

9. Significant temperature during the season

A prolonged hiatus occurred in the further advance till 30th June, due to weakening of Monsoon current and prevalence of non-conductive conditions for the formation of low pressure systems over the Bay of Bengal. As a result, over most parts of central and north India including Madhya Pradesh and Uttar Pradesh, Monsoon advance

TABLE 19

The meteorological aspects of severe floods during southwest monsoon 2010

S. No.	Region affected	Period	Cause	Damage	Synoptic features prevailed
1.	Assam	8-9 Jun	Floods triggered by heavy rain. The rivers Bramhaputra, Simen, Jiadhah, Gainadi, Ranganadi, Dikrang, Kushiara, Singla and Langai were flooded.	Over flooding of river Kushiara Singla and Langai inundated vast areas of Barak district affecting almost 3 lakh people and damaging huge quantity of standing crops, poultry farms and fisheries. About 40 villages of Dhemaji, Lakhimpur and Sonitpur district were inundated. A portion of the embankment Chiripali was flown away causing flooding of river Bramhaputra damaging standing crops.	The northeastern region experienced widespread rainfall since 1 June due to presence of a trough in westerlies which oscillated over the region since 1 st June.
2.	Assam	13 Jun	Continuous widespread rain in the region since 1 June. The rivers Singra, Ranganadi, Bogolee and Bubansisri were flooded.	At least 200 villages were submerged and 30,000 people were marooned due to insurging water of river Ranganadi, Bogolee, Bubansisri. National Highway No. 52 was over topped at Harmati in North Lakhimpur district.	Active onset phase of the southwest Monsoon.
3.	Assam	21 Jun	Extremely heavy rain occurred on the day. The rivers Singra, Ranganadi, Bogolee and Bubansisri were flooded.	12 people lost their lives. Almost 3 lakh people were under cover of flood alone in Barak valley.	A trough in lower level westerlies oscillated over the region during 21 st and 24 th .
4.	Assam	27-28 Jun	Flash flood due to extremely heavy rain. The rivers Ranganadi, Singra, Pavoi, Gendali, Beki, Manas, Aei, Saralbhanga and Gaurang were over flooded.	The following incessant rain which caused surging of the above rivers inundated almost 500 villages; affected near about 50,000 people and several hectares of crops in Lakhimpur, Dhemaji, Golghat, Jorhat, Barpeta and Baska district.	A trough in lower level westerlies oscillated over the region during 28 th to 30 th .
5.	Haryana-Punjab	5-15 Jul	Flash floods due to vigorous monsoon spells, heavy to very heavy rains on a few days over the region. Ravi, Sutlej-Yamuna link canal and rain-fed rivers, like Sagarpada, Markanda, Ghaggar, Tangri were flooded.	Crops in more than 42, 000 acres were damaged. Claimed 51 lives. Dam on river Ghaggar had breached near village Jhanda Khurd in Pujab marooning thousands of acres land in Haryana. Ambala-Delhi national highway no 1 was affected. Electric supply affected of nearly 300 villages in Ambala district. Properties of worth Rs. 1 billion was destroyed in Jhapa district. About 1800 houses were submerged under water.	The axis of the Monsoon trough shifted northwards. Also the mid-latitude westerly intrusion had some influence in triggering this rainfall activity.
6.	Assam	10 Jul	Incessant heavy rains for a few days. The rivers Bramhaputra, Gadhahar, and Pahumara were flooded.	Due to incessant rain, the river Pahumara over flooded and breached embankment and inundated more than 20 villages of Barpeta district. Vast areas of Dhubri district was inundated due to over-flooding of river Gadhahar. 2 children lost their lives due to flooding of river Bramhaputra in Marigaon district.	A branch of the axis of the Monsoon trough shifted northward to northeastern regions of the country.
7.	Bihar	12-14 Jul	Flash flood due to heavy to very heavy rain. Rivers Kosi, Gandak, Gudhi Gandak, Kamlabalan, Adhwara and Bagmati were flooded.	About 100 villages inundated. Thousands of people fled their homes. Embankments in Muzaffarpur and Bagaha were damaged.	A cyclonic circulation lay over east Uttar Pradesh from 9 th to 14 th .
8.	Chattisgarh	23-26 Jul	Flash floods due to heavy rain. The southwest Monsoon was vigorous on 2-3 days in the region during the above period. Rivers Ghagra, Sarak, Shabri, Mahanadi and Indravati were flooded.	Raipur, Jagdalpur and Ambikapur city areas were submerged affecting 1.5 lakh people. Normal life was disrupted due to road blocks. Eight people lost their lives.	A cyclonic circulation lay over south Chattisgarh and neighbourhood on 22 nd . The axis of the monsoon trough shifted south of its normal position and passed through the region. It extended upto mid tropospheric levels tilting southward with height.

TABLE 19 (Contd.)

S. No.	Region affected	Period	Cause	Damage	Synoptic features prevailed
9.	Kashmir (Leh)	6 Aug	Flash flood due to cloud burst.	Massive destruction of houses in Leh district. Bridges and roads were washed away. District hospital was flooded. About 200 people lost their lives and more than 500 were reported missing.	Eastward moving system passed through the region.
10.	Uttar Pradesh	18-31 Aug	Heavy to very heavy rains on many days during the month. Ghagra, Ganga, Yamuna and Gomati rivers were over flooded.	Parswal dam on Ghagra river breached in the flood and more than 100 villages were submerged in Barabanki district. The death toll reached 106.	A cyclonic circulation lay over west Uttar Pradesh and neighbourhood during 18-22.
11.	Karnataka Tungabhadra and Hagari rivers were flooded.	26 Aug	Heavy rain during last five days.	2,236 houses in Bellary district inundated and standing crops on 2,162 hectare area were damaged. Estimated loss of about Rs. 150 crores.	Active off-shore trough extended along west coast.

was delayed by 2-3 weeks and 1-2 weeks respectively. *Severe heat wave/heat wave conditions* prevailed over many parts of north, northwest and central India during this period.

The dates of occurrence of heat waves and dates on which the maximum temperature remained appreciably to *markedly above/below normal* and *above/below normal* in the month of June are given in Table 18. A same date appearing in two different columns of a sub-division may be reckoned as occurrence of that category over parts of the sub-divisions. Maximum temperatures were *normal* for the rest of the days.

The highest maximum temperature of 47 °C was recorded in Jhansi (Uttar Pradesh) on 1st June and in Sambalpur (Orissa) on 3rd June 2010.

10. Disastrous weather events and damage during monsoon months

10.1. June

According to media reports, heat wave took a toll of 25 persons (15 in Orissa, 4 in Rajasthan and 3 each in Bihar and Jharkhand). Heavy rains, floods, lightning and landslides took a toll of 145 persons (54 in Maharashtra, 26 in Bihar, 24 in Assam, 11 each in West Bengal and Kashmir, 5 in Kerala, 4 in Tripura, 3 in Jharkhand, 2 each in Tamil Nadu, Vidarbha, Chhattisgarh and 1 in Madhya Pradesh).

Many villages were inundated due to floods. Roofs, poles, trees were uprooted. Telecommunications and

traffic were disrupted. Several Hectares of standing crops, poultry farms were damaged.

10.2. July

According to media reports, heavy rains, floods, lightning and landslides took a toll of 180 persons (51 in Punjab and Haryana, 27 each in Vidarbha and Bihar, 21 in Rajasthan, 15 in Orissa, 9 in Karnataka, 8 in Chhattisgarh, 7 in Kashmir, 5 in Tamil Nadu, 4 each in Madhya Pradesh and Jharkhand, and 2 in Maharashtra).

Rail/Road and air traffic were badly affected due to floods, heavy rains and strong winds in Haryana, Punjab and Delhi. Railway service along the west coast of India was badly affected due to torrential rain.

10.3. August

According to media reports, cloudburst in Kashmir (Leh) took a toll of 200 persons. Heavy rains, floods, lightning, landslides and strong winds took a toll of 308 lives (106 in Uttar Pradesh, 55 in Vidarbha, 30 in Haryana, 28 in Punjab, 21 in Karnataka, 18 in Uttarakhand, 13 in Gujarat, 8 in Tamil Nadu, 7 in Orissa, 6 each in Maharashtra and Madhya Pradesh, 5 in Jharkhand, 2 each in Assam and Himachal Pradesh and 1 in Kashmir).

Incessant rains hit normal life in Himachal Pradesh and affected transport, communication and power services. River Yamuna flowed above danger mark and about 900 people were evacuated from the low lying areas of Delhi. Heavy rain damaged crops and property estimated at over Rs. 150 Crores in Karnataka.

10.3. September

According to media reports, heavy rains, lightning and thunderstorm took a toll of 65 persons (18 in Vidarbha, 14 in Madhya Pradesh, 11 in Uttar Pradesh, 9 in Chhattisgarh, 7 in Karnataka and 6 in Assam)

In Assam, crops were damaged; villages inundated; and huge number of cattle heads was reported to be swept away. Yamuna, Som Nadi and Pathrala rivers flooded parts of Delhi, Haryana and Punjab due to release of Dam water followed by heavy rainfall in the higher reaches of Himachal Pradesh and Uttarakhand.

11. The meteorological aspects of severe floods during southwest monsoon - 2010

During the southwest Monsoon season 2010, many states viz., Assam, Jammu & Kashmir, Uttar Pradesh, Punjab, Haryana, Chattisgarh, Gujarat, Orissa, Maharashtra, Andhra Pradesh and Bihar experienced flood situations during various parts of the season. Incessant heavy rainfall associated with the low pressure systems, interaction of low level monsoon flow with westerly troughs in the upper levels, as well as dis-organized convective activity in the form of scattered thunder showers were the major causes of flood.

The source of the flood data provided in Table 19 is mainly from the website maintained by the Dartmouth flood observatory, supplemented with other media reports and damage reports provided by various RMCs & MCs.

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Appendix

Definitions of the terms given in '*Italics*'

Rainfall

- Excess* - Percentage departure from normal rainfall is + 20% or more.
- Normal* - Percentage departure from normal rainfall is between - 19 % to + 19 %.
- Deficient* - Percentage departure from normal rainfall is between - 20 % to - 59 %.
- Scanty* - Percentage departure from normal rainfall is between - 60 % to - 99 %.
- Widespread (Most places)* - 75% or more stations of a meteorological sub-division reporting at least 2.5 mm rainfall.
- Fairly widespread (Many places)* - 51% to 74% stations of a meteorological sub-division reporting at least 2.5 mm rainfall.
- Heavy rain* - Rainfall amount from 6.5 cm to 12.4 cm.
- Very heavy rain* - Rainfall amount more than 12.5 cm to 24.4 cm.
- Extremely heavy rainfall* - Rainfall amount more than 24.5 cm.
- Exceptionally heavy* - When the amount is a value near about the highest recorded rainfall at or near the station for the month or season. The highest ever recorded should be more than 12 cm.

Monsoon activity

- Active* - Average rainfall of a sub-division is more than 1½ to 4 times the normal with minimum 5 cm along the west coast and 3 cm elsewhere in at least two stations in the sub-division.
- Vigorous* - Average rainfall of a sub-division is more than 4 times or more than the normal with minimum 7 cm along the west coast and 5 cm elsewhere in at least two stations in the sub-division.

Maximum/day temperatures

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

- Severe heat wave conditions* - Departure of maximum temperature from normal is +6 °C or more for the regions where the normal maximum temperature is more than 40 °C and +7 °C or more for regions where the normal maximum temperature is 40 °C or less.
- Heat wave conditions* - Departure of maximum temperature from normal is + 4 °C to + 5 °C or more for the regions where the normal maximum temperature is more than 40 °C and departure of maximum temperature from normal is + 5 °C to + 6 °C for regions where the normal maximum temperature is 40 °C or less
- Markedly above normal* - Departure of maximum temperature from normal is between +5 °C to +6 °C for the regions where the normal maximum temperature is 40 °C or less
- Appreciably above normal* - +3 °C to +4 °C for the regions where the normal maximum temperature is 40 °C or less.
- Appreciably below normal* - Departure of maximum temperature from normal is - 3 °C to - 4 °C.
- Markedly below normal* - Departure of maximum temperature from normal is - 5 °C or less.

Drought

- All India Severe Drought Year* - When the rainfall deficiency is more than 10% and when more than 40% area of the country is under drought conditions, then the year is termed as all India Severe Drought year.