

INDIA METEOROLOGICAL DEPARTMENT (MINISTRY OF EARTH SCIENCES)

SOUTHWEST MONSOON -2016 END OF SEASON REPORT RAJASTHAN

HIGHLIGHTS

- The rainfall during monsoon season (June-September) over the country as a whole was 97% of its long period average (LPA).
- Seasonal rainfall over Northwest India and Rajasthan were 95% and 128% of their respective LPA.
- Seasonal rainfall was 132% of its LPA over East Rajasthan and 120% of its LPA over West Rajasthan.
- Monthly rainfall over the state was 104% of LPA in June, 121% of LPA in July, 184% of LPA in August and 36% of LPA in September.
- Out of 33 districts, 21 districts received excess rainfall; 11 districts received normal rainfall and 1 district received deficient rainfall during the season.
- On a micro level, out of 245 tehsils, 128 tehsils received excess rainfall; 88 tehsils received normal rainfall; 23 tehsils received deficient rainfall and 6 tehsils received scanty rainfall during the season.
- Southwest monsoon advanced into south Andaman Sea and Nicobar Islands on 18th May (2 days ahead of its normal date). It set in over some parts of Rajasthan on 22nd June (7 days late from its normal date) and covered the entire country by 13th July (against the normal date of 15th July).
- Monsoon withdrawal commenced from West Rajasthan on 15th September with a delay of 2 weeks. It completely withdrew from Rajasthan on 12th October, 2016.

1. Onset and Advance of southwest Monsoon

Associated with the genesis phase of the Cyclonic Storm '**Roanu**', southwest monsoon advanced over parts of south Bay of Bengal, Nicobar Islands and adjoining Andaman Sea on 18th May (2 days ahead of its normal date). Further progress of monsoon was sluggish. As a result, monsoon set in over Kerala only on 8th June (7 days after its normal date of 1st June).

In the third week of June, as the active phase of the Madden Julian Oscillation (MJO) moved eastwards over the Indian Seas, the Bay of Bengal became more convectively active. Triggered by this, the further advance of monsoon was rapid and it covered most parts of peninsular India & western Himalayan region, entire central & east India and some parts of north Arabian Sea and northwest India by 22nd June. After a brief hiatus during the last week of June, monsoon advanced further very rapidly to cover most parts of the country, outside some areas of Kutch and west Rajasthan by 5th July. The monsoon covered the entire country on 13th July in association with the formation of an east-west shear zone at mid tropospheric levels and its northward shifting to the north of Lat. 20° N. **Isochrones of advance of monsoon 2016 is shown in Fig. 1.**



Fig.1: Progress of Southwest Monsoon – 2016

2. Chief Synoptic Features

During the season, 14 monsoon low pressure systems (LPSs) (2 Deep Depressions, 2 Depressions, 3 well marked low pressure areas & 7 low pressure areas) formed against an average of 6 Depressions & 8 low pressure areas. The frequencies of monsoon depressions were subdued over Bay of Bengal. Out of four depressions/deep depressions, one depression formed over the Bay of Bengal & one over Arabian Sea and remaining two over the land region.

Systems / Month	Deep Depression	Depression	Well marked low pressure area	Low pressure area				
June	0	1	0	1				
July	0	1	0	1				
August	2	0	2	3				
Sept.	0	0	1	2				

Table : Frequency of low pressure systems over Indian region during monsoon season, 2016

The first Depression formed over northeast Arabian Sea in June (27th–29th) and the second as a Land Depression over northeast Madhya Pradesh & neighborhood in July (6th–7th). Thereafter, two Deep Depressions formed in August (9th–12th & 16th–20th); 1st over coastal areas of West Bengal & neighborhood and the 2nd over northwest Bay of Bengal. In addition, 5 low pressure areas also formed in August. In the month of September, 3 low pressure areas formed. **Tracks of Depressions & Deep Depressions are given in Fig.2.**



Fig.2: Track of the monsoon Depressions and Cyclonic Storms

An east-west shear zone was observed along Lat. 15°N. All these systems enhanced the rainfall activity over northern plains, Peninsular India and central India towards the end of the June.

A cyclonic circulation extending between lower & mid tropospheric levels lay over Kutch & neighborhood during 1st - 5th July, which increased the rainfall activity over the Gujarat Region and West Rajasthan. A Land Depression (6th – 7th July) formed over northeast Madhya Pradesh & neighborhood, which caused active to vigorous monsoon conditions over Madhya Pradesh and East Rajasthan. The presence of an off-shore trough along the west coast caused active to vigorous monsoon conditions over western parts of central India during the 2nd week of July. The deep convection over central & western parts of peninsular India due to northward shifting of an east-west shear zone during 10th – 13th July increased the rainfall activity over the extreme western parts during same period.

In third week of July, the monsoon trough shifted northwards closes to the foothills of the Himalayas and led to weak monsoon conditions over major parts of India. Thus, a lull in the monsoon activity was noticed over major parts of the country and break like situation prevailed. The monsoon trough remained close to the foothills of the Himalayas up to 21st July and shifted back to its normal position from 22nd July.

Thereafter, with the formation of a Depression over the coastal areas of West Bengal & neighborhood on 9th of August and its immediate intensification into a Deep Depression on next day, the rainfall activity shifted northwards. Due to movement of Deep Depression and formation of two more low pressure areas during 2nd week of August led to active to vigorous monsoon activity over Gangetic West Bengal, Odisha, Jharkhand, Madhya Pradesh, Rajasthan and Gujarat State.

In mid-August, the western end of the monsoon trough gradually shifted northwards and lay close to the foothills of the Himalayas on 17th August. However, the eastern end of the trough continued to remain active with the formation of a Deep Depression on 16th August over northwest Bay of Bengal & neighborhood. The system followed the west-northwestward track after crossing the coast and traversed up to East Rajasthan. While moving west-northwestwards, it caused fairly widespread to widespread rainfall with isolated extremely heavy falls and caused flood situations all along its track. However, the subdued rainfall activity continued to prevail over south peninsular India since second week of August. Thereafter, the weakening of cross equatorial flow led to weak monsoon flow pattern over the Indian regime during the last week of August. The troughs in midlatitude westerly's which intruded more southwards affected the monsoon flow. However, it maintained the rainfall activity mainly over the northwestern parts. During the first half of September, the monsoon trough shifted to the foothills of the Himalayas, which led to weak monsoon activity over the country.

3. High Impact Weather Events

Fig. 3 depicts the met. Sub-divisions or parts thereof, which experienced high impact weather events like, floods, landslides and Heat waves during the southwest monsoon season (June-September) along with the dates.



Fig.3: Areas of high impact weather events during the 2016 southwest Monsoon.

Incessant rainfall associated with the formation and movement of the monsoon low pressure systems in the presence of strong cross equatorial flow often caused flood situations over various areas during different parts of the season. During the 2016 southwest monsoon season, very heavy rainfall (>12.5 cm in 24 hours)/ extremely heavy rainfall (>22 cm in 24 hours) events were reported at many stations of Rajasthan state. The station wise list of extremely heavy rainfall is given in the table below.

Date	Station	District	Rainfall in cm
04/07/2016	Kherwara	Udaipur	23
10/07/2016	Pachpahar	Jhalawar	23
14/07/2016	Railmagra	Rajsamand	23
08/08/2016	Chittorgarh	Chittorgarh	23
09/08/2016	Begu	Chittorgarh	34
09/08/2016	Chittorgarh	Chittorgarh	26
10/08/2016	Bali	Pali	29
20/08/2016	Manohar Thana	Jhalawar	31
20/08/2016	Chipabarod	Baran	25
21/08/2016	Danpur	Banswara	23
21/08/2016	Arnod	Pratapgarh	23
21/08/2016	Badesar	Chittorgarh	23
21/08/2016	Nimbahera	Chittorgarh	23

 Table: List of stations which reported extremely heavy rainfall (> 22 cm in 24 hours) during monsoon season.

4. Withdrawal of southwest Monsoon

The rainfall activity over the northwestern parts of Rajasthan remained subdued since 5th September. Due to change in the lower tropospheric circulation pattern over the region from cyclonic to anti-cyclonic on 15th September, the southwest monsoon withdrawal commenced from west Rajasthan. Subsequent to this, moisture incursion due to the low level southeasterlies caused isolated rainfall over most parts of northwest India. The monsoon further withdrew from some more parts of the northwest India on 28th. Thereafter, with the southward shift of the Sub-tropical westerly Jetstream over to the northern most Indian Latitudes from 5th October. Thereafter, it further withdrew from some parts of East Rajasthan and some more parts of West Rajasthan on 8th October. Then, it further withdrew from remaining parts of Rajasthan on 12th October. Isochrones of withdrawal of monsoon 2016 are shown in Fig. 4.



Fig.4: Isochrones of withdrawal of southwest monsoon - 2016

5. Rainfall Distribution

The rainfall during monsoon season (June to September) for the State as a whole and its two meteorological sub divisions is given in the table below with respective LPA values.

Season (June to September) rainfall									
Region / Area	Actual (in mm)	Long period average LPA (in mm)	Departure from normal %						
Rajasthan	536.4	418.7	+28						
East Rajasthan	813.7	615.1	+32						
West Rajasthan	316.1	262.7	+20						

The seasonal rainfall over Rajasthan was 128% of its LPA, East Rajasthan 132% of its LPA and West Rajasthan 120% of its LPA. The rainfall distribution was not uniform over the State. Out of 33 districts, 21 districts received excess rainfall during the season and 11 districts were normal and 1 district was deficit rainfall category. The district wise seasonal distribution of rainfall is shown in **Figure 5**. It can be seen that most of the districts in Central, Southern and Southeastern Rajasthan received excess rainfall whereas Northeastern and Western Rajasthan received normal rainfall. Only Ganganagar northernmost district was deficient. A more micro distribution shows (**Figure 6**) that out of 245 tehsils in the State, 128(53%) tehsils witnessed excess; 88(36%) witnessed normal; 23(9%) witnessed deficient and only 6 (2%) witnessed scanty rainfalls.



Fig.5: Districtwise rainfall distribution over Rajasthan during southwest monsoon season (June to September) – 2016.



Fig.6: Tehsilwise rainfall distribution over Rajasthan during southwest monsoon season (June to September) -2016.

The monthly rainfall during monsoon season (June to September) for the State as a whole and its two meteorological sub divisions is given in the table below with respective LPA values.

Month	Actual (in mm)	Long period average LPA (in mm)	Departure from normal %	
-------	-------------------	---------------------------------------	-------------------------------	--

45.8

June

Table: Rainfall during southwest monsoon 2016 over Rajasthan

44.1

+4

Month	Actual (in mm)	Long period average LPA (in mm)	Departure from normal %
June	61.7	62.2	-1
July	326.2	225.0	+45
August	385.6	228.4	+69
September	40.2	99.5	-60

Table: Rainfall during southwest monsoon 2016 over East Rajasthan

Table:	Rainfall	during	southwest	monsoon	2016 over	West	Rajasthan

Month	Actual (in mm)	Long period average LPA (in mm)	Departure from normal %
June	33.2	29.8	+11
July	80.0	102.6	-22
August	191.9	89.3	+115
September	11.0	41.1	-73

From the above tables it is observed that Rajasthan received highest rainfall during the month of August, which was 184% of LPA (i.e. excess category). Both East Rajasthan and West Rajasthan received their highest 169% of LPA and 215% of LPA respectively during month of August, thus they were in the excess category. The rainfall trend was not uniform during the season. During first three months of the season Rajasthan's rainfall was in excess category but in the month of September very less rainfall occurred, due to which Rajasthan fell in Scanty category in the last month of the season. West Rajasthan received 111% of LPA rainfall in the month of June whereas East Rajasthan received lesser amount 99% of LPA. Trends reversed during July, East Rajasthan received 145% of LPA rainfall in comparison to 78% of LPA in West Rajasthan. Both East and West Rajasthan received excess rainfall during August. Several stations received extremely heavy rainfall during this period, creating flood like situation in many areas. The month of September witnessed lowest rainfall in both East Rajasthan (40% of LPA) and West Rajasthan (27% of LPA) as well as whole Rajasthan (36% of LPA).

The cumulative seasonal rainfall for the State as a whole was 128% of its LPA and it was 132% and 120% of LPA over East and West Rajasthan respectively. Out of 33 districts, the seasonal rainfall was excess in 21 districts and normal in 11 districts. 1 district was under deficient category. Sri Ganganagar district received least rainfall (66% of LPA) and Pali district in West Rajasthan received highest rainfall (190% of LPA). Chittorgarh district in East Rajasthan received 184% of LPA rainfall during this season. The seasonal rainfall for various districts of Rajasthan is given in table.

		Monsoon rainfall	in mm (June - September 201	6)
Sr. No.	State/Districts	Actual (in mm)	Normal (in mm)	%Dep
	RAJASTHAN	536.4	418.7	28
	•			
		EAST RAJASTHAN		
1	AJMER	537.4	429.6	25
2	ALWAR	623.1	555.3	12
3	BANSWARA	1020.0	831.8	23
4	BARAN	1161.1	792.2	47
5	BHARATPUR	639.3	557.6	15
6	BHILWARA	910.0	580.9	57
7	BUNDI	879.7	655.9	34
8	CHITTORGARH	1307.5	709.7	84
9	DAUSA	770.2	612.1	26
10	DHOLPUR	635.7	650.0	-2
11	DUNGARPUR	843.3	637.8	32
12	JAIPUR	569.6	524.6	9
13	JHALAWAR	1112.1	855.1	30
14	JHUNJHUNU	535.0	410.0	30
15	KARAULI	719.9	637.4	13
16	КОТА	907.3	746.3	22
17	PRATAPGARH	1265.4	845.8	50
18	RAJSAMAND	800.9	506.0	58
19	SAWAI MADHOPUR	918.8	664.0	38
20	SIKAR	481.9	402.5	20
21	SIROHI	876.5	868.6	1
22	TONK	728.8	566.0	29
23	UDAIPUR	851.7	591.3	44
	EAST RAJASTHAN	813.7	615.1	32
24	DADAGD	WEST KAJASTHAN	242.4	2
24	BARMER	235.7	243.4	-3
25	BIKANER	265.4	228.7	16
26		408.4	313.7	30
27	HANUMANGARH	205.7	252.5	-19
28	JAISALMEK	138.9	158.4	-12
29	JALORE	435.4	394.2	10
30	JODHPUR	405.2	274.5	48
31	NAGAUR	427.3	348.5	23
32	PALI	849.2	446.7	90
33	SRI GANGANAGAR	132.6	201.4	-34
	WEST RAJASTHAN	316.1	262.7	20

Table: District-wise seasonal rainfall distribution monsoon 2016



Weekly rainfall distribution over the two Meteorological sub divisions of the state is shown in the following charts (**Figure 7 to 10**).

Fig.7 Weekly rainfall distribution over East Rajasthan Monsoon 2016



Fig. 8 Cumulative weekly rainfall distribution over East Rajasthan Monsoon 2016

The highest rainfall (136.2 mm) was received during the week 10th August 2016 because of the passage of deep depression over Rajasthan. After week ending September 7th weekly rainfall was practically insignificant over East Rajasthan.



Fig.9 Weekly rainfall distribution over West Rajasthan Monsoon 2016



Fig. 10 Cumulative weekly rainfall distribution over West Rajasthan Monsoon 2016

Practically, on weekly basis the rainfall was insignificant (less than 15 mm) during most of the weeks except six weeks during the entire season. It can be noted that week ending 10th August, 2016 received 83.3mm of rainfall. West Rajasthan did not receive any significant amount of rainfall after week ending 31st August, 2016.

The district wise weekly rainfall distribution over the state of Rajasthan during South West monsoon season 2016 is shown in the following table.

Table: Districtwise weekly rainfall distribution monsoon 2016

S.NO.	DISTRICTS	1-Jun	8-Jun	15-Jun	22-Jun	29-Jun	6-Jul	13-Jul	20-Jul	27-Jul	3-Aug	10-Aug	17-Aug	24-Aug	31-Aug	7-Sep	14-Sep	21-Sep	28-Sep	30-Sep
	EAST RAJASTHAN					/		-												
1	AJMER	0.6	0	1.9	18.4	47	16.3	41.9	39.3	20.7	117.1	122.7	11.9	49.8	27,3	21.1	0	0.3	1.5	0
2	ALWAR	15.3	6.2	11.4	15.4	18.3	57.2	53.4	120.4	21.7	62.7	24.4	120.4	38.1	51.7	9.6	0	0	5.5	1.4
3	BANSWARA	0	0	0	19.8	23.7	95.6	153.6	29.4	65.1	95.8	201.8	12.9	203.4	20.2	34.6	0.2	30	33.8	0
4	BARAN	0	0	0	16	60.9	113.1	173.9	78.2	66.8	94.8	201.4	139.4	151.3	25.4	17	3.4	9.9	0.1	0
5	BHARATPUR	6.8	11	17.8	9.3	41.4	22.4	46.5	189.9	12.5	85.3	17.9	49.4	76.7	26	21.5	0	0	8	2.1
6	BHILWARA	1.3	0	0	16.5	68.2	30.5	76.1	47.1	50.7	154	235.1	34	104.9	45.5	40.4	1.9	0.3	0.3	0
7	BUNDI	0	0	0	33.2	27.8	29.7	61.8	124.2	31.7	152.8	176.8	33.2	69.5	71.5	60	2.2	1.8	4.2	0
8	CHITTORGARH	0	0	0	23.7	41.2	72.4	166.3	44.8	72.8	155.6	341.2	57.7	221.5	46.9	46.2	1.3	0.4	8	0
9	DAUSA	8.8	1	9.6	27.8	8.8	26.2	78.2	174.8	30.2	74.8	90	108.8	64.4	26.6	31.8	0	0	11.4	0
10	DHOLPUR	9.3	3.7	0.7	5	11.2	25.5	54	177.3	24.2	114	18.3	34.2	131.5	9.8	24.3	0	0	1.2	0
11	DUNGARPUR	0	0	0	13.5	28.8	116.4	144	19.9	39.4	101.3	165.8	9.4	139.1	27.1	11.7	0	7.7	17.7	0
12	JAIPUR	0.9	0.6	2.3	15.9	18.2	101.1	23.7	80.4	20.2	114.5	48.5	32.3	30.6	48,2	20.5	0.6	1.5	10.7	0
13	JHALAWAR	0	0	0	48	37.5	55.6	185.5	18.7	68.5	125.8	177.8	56.2	210.8	38.7	35.4	3.9	27.4	3.7	0
14	JHUNJHUNU	14.8	1.4	18.1	1.3	23.9	131.2	19.1	108.8	8	45	13.5	67.2	8.3	65.1	5.1	0	0	7.1	0
15	KARAULI	2.1	0.4	9.4	25.6	9.8	31.6	58.9	208.8	29.3	73.7	47.8	74.7	88.4	29.2	14.2	0.2	0	17.7	0
16	KOTA	0.6	0	0	28.7	50.8	35.7	95	43.9	35.2	91.6	238	45.4	107.1	46.7	81.1	1	4.5	0.4	0.5
17	PRATAPGARH	0	0	0	13.8	39.8	67.8	149.6	16.6	75.2	182.8	188.8	20.8	359.6	13.6	58	0	8	63.8	0
18	RAJSAMAND	0	0	0	26	66.3	64.6	74.9	60.9	49.6	67.1	165.6	15	124.6	53.9	28.7	0.3	3.4	0.1	0
19	SAWAI MADHOPUR	6.8	0	16.3	11.5	28	71.1	66.9	186.9	18.7	113.8	95.3	142	64.6	75.3	24.4	0	0	3.6	0
20	SIKAR	1	0.3	5.1	5.3	30.4	121.4	11.7	39.5	11	67.5	15.9	59.8	23.6	60.6	9.3	0	5.9	2.3	0
21	SIROHI	0	0	0	1.3	17.7	61.2	65.5	35.9	30	151.4	230.7	35.1	122.5	86.6	38.6	0	0	0	0
22	TONK	0.3	0	0	2.7	31.5	29.7	32.3	141.5	30.3	140.1	133.3	52.1	49	42.8	22.3	0	0	5.5	0
23	UDAIPUR	0	0	0	13.7	40.4	108.7	89.9	34.8	81	121.5	157.1	14.1	129	32	19.4	0.2	5.1	4.8	0
	WEST RAJASTHAN											-								
24	BARMER	0	0	0	0.1	7.4	13.9	0.9	0.2	13.8	8	96.7	2.4	40.5	47,5	3.6	0	0	0	0
25	BIKANER	0	0	10.8	0.9	32.8	11	15.9	23	5.3	21.9	52.2	16.5	5.4	62.1	7.3	0	0	0.2	0
26	CHURU	19.7	3.4	16.9	0.3	17.3	84.5	18	53	10.5	44.5	8.4	27	19.4	67.3	1.6	0	0	22.4	0
27	HANUMANGARH	2	0	28	1.7	8.4	53.9	5.7	20.7	2.1	1.4	4.3	1.3	0.6	66.1	4.7	0	0	6.7	0
28	JAISALMER	0	0	0.7	0.7	17.8	1.2	2.1	2.9	9.1	11.9	27	3.4	2.2	58.6	1.1	0	0	0	0
29	JALORE	0	0	0	10.9	6.7	10.3	9.1	7.1	18.6	25,1	195.3	11	38	87.4	13.9	0	0	0	0
30	JODHPUR	0	0	0	9.2	25.3	21.2	11.6	1.9	8.3	67.2	148.4	23.6	21.3	47.2	12.8	0	0	0.2	0
31	NAGAUR	0	0	0	13.2	44.3	26.7	31	7.3	11	110	84.7	19.1	23.1	32.1	22.1	0	0.9	1.8	0
32	PALI	0	0	0	4.5	36.9	35.9	16.7	13.6	23.8	179.1	268.5	60	108.3	75.9	22.4	0	0	0	0
33	SRI GANGANAGAR	0.5	0.2	4.2	0	2.1	4.3	2.1	3.6	0.7	29.3	23.7	5.3	3.6	32.9	11.2	0	0	6	0

DISTRICTWISE WEEKLY RAINFALL IN MM MONSOON - 2016



Fig.11 Districtwise Monthly Rainfall Distribution Over Rajasthan – June



Fig. 13 Districtwise Monthly Rainfall Distribution Over Rajasthan - August



Fig. 12 Districtwise Monthly Rainfall Distribution Over Rajasthan - July



Fig. 14 Districtwise Monthly Rainfall Distribution Over Rajasthan - September

During June 2016 out of 33 districts, 10 districts received excess, 13 districts normal, 7 districts deficient and 3 districts scanty rainfall. During July 22 districts received excess, 5 districts normal, 3 districts deficient and 3 scanty rainfall. During August 27 districts received excess and 6 districts normal rainfall. During September 11 districts received deficient and 22 scanty rainfall.

During the 2016 monsoon season both East Rajasthan and West Rajasthan subdivisions received excess rainfall as shown in **Figure 15**.



भारत मौसम विज्ञान विभाग INDIA METEOROLOGICAL DEPARTMENT

Fig.15 Subdivision Wise Seasonal Rainfall Distribution Over India (June-September 2016)



Fig.16 Districtwise Daily Spatial Rainfall Distribution

Fairly wide spread to wide spread rainfall occurred on 5 days (minimum) to 48 days (maximum) over different districts in Rajasthan during the whole monsoon season. Pratapgarh district got wide spread rainfall on 38 days (highest) during the whole season.



Heavy to very heavy rainfall occurred at isolated to most places in all districts of the state on a few days. The districts namely Chittorgarh, Pratapgarh and Sawai Madhopur received heavy rainfall on 1 or 2 days at most places during the whole season. Banswara, Baran, Bhilwara, Bundi, Chittorgarh, Dungarpur, Karauli, Pratapgarh, Sirohi, Tonk, Kota, Jalore and Pali districts experienced heavy rainfall at many places on 1 to 2 days during the season.



Fig.18 District wise Tehsil Level Seasonal Rainfall Distribution



128 tehsils received excess and 88 tehsils received normal rainfall during the season. The deficient rainfall was received in 23 tehsils and scanty in 6 tehsils. The worst affected districts during this season were Sri Ganganagar, Jalore, Hanumangarh and Jhalawar. Out of 9 tehsils in Sri Ganganagar district, 3 tehsils got scanty and 4 got deficient rainfall. Out of 7 tehsils in Hanumangarh district, 2 tehsils got scanty and 1 got deficient rainfall. The daily rainfall timeseries is shown in **figure 20 to 22** for East Rajasthan, West Rajathan and Rajathan respectively. The intensity of distribution of rainfall (in terms of number of stations reported rainfall) for East and West Rajasthan is shown in **figure 23 and 24**.











Fig.22 Daily Average Rainfall over Rajasthan



Fig.23 Daily Rainfall Intensity Distribution Over East Rajasthan (Monsoon Season 2016)



Fig.24 Daily Rainfall Intensity Distribution Over West Rajasthan (Monsoon Season 2016)

6. Verification of the Long Range Forecasts

The southwest monsoon rainfall for (June to September) over northwest India was predicted excess (108% of LPA) with a model error of $\pm 8\%$. The actual rainfall for this broad region and the State (part of NW India) were 95% of LPA. Thus, the actual season rainfall of northwest India is 13% of LPA less than the forecast. However, the Rajasthan state received excess rainfall during 2016 monsoon season.

7. Performance of Monsoon 2016 over Rajasthan

The monsoon rainfall had been satisfactory on both temporal and spatial scale over the whole state from Agriculture and Hydrology point of view. The rainfall distribution wise MONSOON 2016 WAS BETTER THAN THE PREVIOUS YEAR MONSOON.

Compiled By:-

Shri. G.S. Nagrale , Scientist D, Director

Shri. Radheshyam, Meteorologist-B

Shri. Mukesh Chauhan, S. A.

Smt. Deepika Gupta, S. A.