INDIA METEOROLOGICAL DEPARTMENT METEOROLOGICAL CENTRE, JAIPUR



RAJASTHAN MONSOON REPORT-2021

Prepared by:

METEOROLOGICAL CENTRE JAIPUR PRABHUDAYAL MARG, SANGANER JAIPUR, RAJASTHAN

HIGHLIGHT

- The rainfall during monsoon season (June-September, 2021) over the Rajasthan state as a whole was 117% of its long period average (LPA) based on data of 1961-2010. The rainfall received over the state was normal (Departure +17% of long period average).
- Seasonal rainfall was 116 % of its LPA over East Rajasthan and 120 % of its LPA over West Rajasthan.
- Monthly rainfall received over the state was 106% of LPA in June, 85% of LPA in July, 86% of LPA in August and 176% of LPA in September.
- Southwest monsoon advanced over Kerala on 3rd June, and over Rajasthan on 18th June (8 days ahead the normal schedule of 26th June). Thereafter, monsoon covered the entire state by 13th July against normal date of 8th July (about 5 days behind of normal date).
- Out of total 33 districts, Two districts received large excess rainfall (Departure +60% or more), 10 districts received excess rainfall (Departure +20% to +59%), 19 districts received normal rainfall (Departure -19% to +19%) and 2 districts received deficient rainfall (Departure -20% to -59%) during the season.

1. Onset and Advance of southwest Monsoon 2021

It was a good beginning for the season in terms of rainfall with formation and movement of the cyclone Tauktae, over the Arabian Sea in the second week of June. It helped the monsoon to advance into main-land along the west coast. Subsequent features favored timely advance of monsoon. This year SW monsoon entered Rajasthan State from Udaipur, and Kota divisions on 18th June and covered entire State and country by 13th July against normal date of 8th July (about 5 days behind of normal date). Isochrones of advance of monsoon 2021 is shown in Fig. 1.



Fig.1: Progress of Southwest Monsoon – 2021

2. Chief Synoptic Features

A Severe Cyclonic storm Tauktae was formed over Arabian sea in the second week of June and no significant systems were formed thereafter in the month of June & July. During August & September by the formation of back to back low pressure systems over the Bay of Bengal and their movement towards West to Northwest India and south Rajasthan leads to the good rainfall activities over the state. Monsoon trough was mostly south of the normal position and remained active.

Climatologically, about 6 monsoon depressions form over the North Indian Ocean during SWM season with a standard deviation of about 2.5. On an average about 2 systems each form during July and August and one each during June and September. This year there were 3 systems, one Deep Depression and 2 Cyclonic Storms, all of them forming in the month of September. The tracks of these systems are given in **Fig. 2**



Apart from the above depicted intense Low pressure systems, there were 12 more systems of comparatively lesser intensity which manifested as Low Pressure Area / Well marked Low Pressure Area at mean Sea level pressure field. The approximate track followed by these are shown in **Fig. 3**.



Fig. 3: Tracks of low / well marked low pressure areas during SWM 2021

There were 119 upper air cyclonic circulations (in lower, middle and upper tropospheric levels) during the season. The month-wise break-up of these is: 46, 34, 21 & 18 during June, July, August and September respectively.

There were 22 eastward-moving systems as upper air cyclonic circulations. The monthwise distribution of these is: 7, 4, 7 & 4 during June, July, August and September respectively.

3. Significant weather events during the season :

The significant weather events which affected normal life and damage to property, excluding those from the lack of timely rains, are depicted in **Fig. 4**.

High impact weather manifested as extremely heavy rainfall (rainfall amount ≥ 25 cm during 24 hours) is also marked over the affected sub-divisions and representative amounts with their location and dates of occurrence are given in the Table along with the figure.



Rainfall (>=21 cm)

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- 30 June 25 Chengmusi/Diana and Butaduar; 23 Hasimani, 14 Aug. 23 -Butaduar; 17 Aug. 23 Saibari; 2 Sup. 21 Alipurduar (CWC) and Alipurduar PTO.
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- 99 15 June 28 Rammagar and Champa Sa; 30 June 21 Gaanaba; 27 Jule 28 -Forbesiganj
- Foth-cognity 10 (5) June 27 Dhaurashara, 16 June 23 Dhaumhans, 18 Jule 25 -Chaederotogylasi, 22 Jule 37 Dhaunahans, 28 Juli 25 Kunda, 17 Sep: 37 -Apodhya and Azaragash, 28 Laharpur, 25 Ramagar, 23 Tirswa, 21 -Tanda and Simuli Chaugur Tehsil, 23 Sep: 21 Dhaunahans, 25 Sep: 21 -Kunda.
- Kuttaa.
 11 20 Juli: 25 Sikandra Rao; 23 En h; 3 Ang: 21 Talbehat.
 12 28 June 21 Haldwani; 20 Juli: 23 Haldwani; 14 Ang: 23 Haldwani; 25 Ang: 21 Rishikesh.
- 13 14 Jul: 25 Karmil and Kamal REV; 20 Jul: 25 Pensuli; 1 Sop: 21 -Petuali

- I. J. Judi. 25 Karami and Kansal REV; 20 Juli: 25 Patauki; I. Sop: 21 Patauki.
 I. J. Juli: 23 Dinama ada; 21 Palampur; 19 Juli: 23 Palampur;
 S. Juli: 23 Dinama ada; 21 Palampur; 19 Juli: 23 Palampur;
 S. Juli: 21 Marwar Junction; 1 Aug: 25 Makhman SR.
 J. Marwar Junction; 1 Aug: 25 Makhman SR.
 J. Jahyan SR; 24 ag: 25 Shahabad; 3 Aug: 25 Shahabad; 4 Aug: 25 Pana; 23 Ladyan SR; 21 Shahabad; 3 Aug: 25 Shahabad; 4 Aug: 25 Pana; 23 Ladyan SR; 21 Shahabad; 3 Aug: 25 Shahabad; 4 Aug: 27 Juli: 20 Sionig; 24 Juli: 21 Shahabad; 4 Shahabad; 4 Aug: 25 Juli: 20 Sionig; 24 Juli: 27 Kaifwanda and Jaron; 26 Makhgan; 28 Pana; 20 Ladyan SR; 21 Shahabad; 42 Fobloque; 13 Palampin; 31 Russing; 34 Juli: 21 Shahabad; 42 Fobloque; 35 Zaraga; 21 Banari, 24 Juli: 21 Shahabad; 42 Fobloque; 39 Palam; 31 Panari, 24 Juli: 21 Shahabad; 42 Fobloque; 39 Palam; 31 Panarori, 31 Panari, 31 Panari, 31 Panarori, 31 Panaron; 31 Panaron; 32 Panaron; 33 Panaron; 32 Panaron; 34 Panaron; 34 Panaron; 34 Panaron; 35 Panaron; 34 Panababab; 34 Panaron; 34 Panaron; 34 Panaron; 34 -
- 22 Ditoronyi and Tanghadia AWS; 21 Junagadh and Kotlann nguni; 30 Sanc. 29 Vian value.
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- Cohengarh. 24 17 Jun: 29 Organoborovada; 21 Mahadandonhov ar; 12 Jun: 29 Organoborovada; 19 Jul: 33 Orthankhoda Frinci, 23 Igrapari; 22 Jul: 49 -Mahahadanborovada; 19 Jul: 33 Orthankhoda Frinci, 23 Igrapari; 22 Jul: 49 -Orthar Hochs Frins and I Agarpari; 23 Hamaid Frinci, 22 Trinfordado Ivare; 20 Juli: 59 Mahahadanborov; 40 Ajan and Radhanagari; 36 Organito wada; 31 Patier; 29 Chanzigad and Larovavida ARO; 27 Pathala; 25 Ordanightaji; 23 Shadawada; 21 Veille; 24 Juli: 33 Mahahadanborov; 23 Kagad; 21 -Frinford
- Protokula, 28 27 Song: 29 Visuk hag-atmann and Chajag-athiens genera: 28 Nellim arks; 27 Visukh aga man AP; 25 Mentaka; 24 Panagating ga. 29 (6 Juli): 21 Che geneta: 22 Juli: 25 Dilensor gan; 22 Sar ang nganeth; 21 Boards; 23 Juli: 26 Dilensor gan; 22 Sar ang nganeth; 21 Huarandynak; 20 Kothagaalens, Magailapandit, Dhamraanna and Khaeragane; 21 Junitabali; 78 Song: 26 Nallabelly; 25 Huarandynak; 21 Kothagaalens, Magailapandit, Dhamraanna and Khaeragane; 21 Junitabali; 27 Song: 20 Juli: 20 Dhar Palle; and Navipet. 39 18 Jul: 23 - Kadin AP; 21 - Kadin.

- B. Juli, 23 Kazlini AP, 21 Kazlini.
 S. Avalanchi, E. J. Avalanchi, K. J. Lin, Z. Upper Bhavani.
 J. Avalanchi, K. B. Juli, 22 Upper Bhavani.
 J. Asalanchi, S. J. Kazlini, 23 Yelliquiz, 21 Hullyal and Manchikeen.
 J. B. J. Londe, 27 Khana puz, 21 Belagari PTO.
 J. Juni, 30 Kona ngaz, 21 Relinguit, 21 Linguitori PTO.
 J. Juni, 30 Kona ngaz, 21 Kottigehawa, 18 Juni, 22 Linguitori PMMS, 21 Bhalyal and Manchikeen.
 J. Bagermaniaki, 18 Juli, 21 Hoomagari, 23 Juli, 21 Thomagari, 23 Juli, 27 Thomagari, 23 Anavatti, 23 Anavatti, 23 Agaenham Komandaria and Sagari, 6 Aug., 113 Mercara.



S.No.	Station	Date	Amount	District
			(in mm)	
1	MAKRANA	1-Aug	240	NAGAUR
2	MARWAR JUNCTION	26-Jul	205	PALI
3	CHABRA	27-Jul	215	BARAN
4	SHAHABAD	31-Jul	304	BARAN
5	SHAHABAD	2-Aug	246	BARAN
6	SHAHABAD	3-Aug	255	BARAN
7	SHAHABAD	4-Aug	208	BARAN
8	HURDA	1-Aug	215	BHILWARA
9	PATAN	4-Aug	247	BUNDI
10	PIRAWA	24-Jul	211	JHALAWAR
11	LADPURA	4-Aug	225	KOTA
12	SAWAIMADHOPUR			SAWAI
	TEHSIL	2-Aug	215	MADHOPUR

Table 1: Extremely Heavy Rainfall during Southwest Monsoon 2021

Month wise very heavy and extremely heavy rainfall events are shown in **Fig.5** and **Fig.** 6 respectively. Most number of very heavy to extremely heavy rainfall events occurred in the month of August. Highest rainfall of 304mm occurred in SHAHABAD, BARAN on 31st July.













Fig. 8: Daily Rainfall – East Rajasthan



Fig. 9: Daily Rainfall – West Rajasthan

4. Rainfall Distribution

The seasonal rainfall over Rajasthan was 117% of its LPA during SW monsoon season 2021, East Rajasthan 116% of its LPA and West Rajasthan 120% of its LPA. Out of 33 districts,2 districts received large excess rainfall, 10 districts received excess rainfall, 19 districts received normal rainfall and 2 districts received deficient rainfall during the season. The district wise seasonal distribution of rainfall is shown in **Fig 10**.





It can be seen that most of the districts in West and Southeastern Rajasthan received excess rainfall, North, Central and some parts in East Rajasthan received normal rainfall whereas Sirohi and Ganganagar districts in the state received deficient rainfall. Sirohi district received least rainfall (67% of LPA) and Jaisalmer district received highest rainfall (169% of LPA).

CUMULATIVE RAINFALL STATISTICS AS ON 01/06/2021 to 30/09/2021						
SP		ACTUAL	NORMAL	DEPARTURE		
	NAME	RAINFALL	RAINFALL	FROM		
NO.		(MM)	(MM)	NORMAL		
1	RAJASTHAN AS WHOLE	485.3	414.5	17		
2	EAST RAJASTHAN	696.7	602.2	16		
3	WEST RAJASTHAN	317.5	265.3	20		
		1		I		
1	AJMER	458.1	419.5	9		
2	ALWAR	631.6	553.5	14		
3	BANSWARA	806.4	844.6	-5		
4	BARAN	1131.6	774.5	46		
5	BHARATPUR	596.3	545.2	9		
6	BHILWARA	615.4	580.4	6		
7	BUNDI	975.5	629.7	55		
8	CHITTORGARH	752.3	699.2	8		
9	DAUSA	701	585.9	20		
10	DHOLPUR	621.3	605.2	3		
11	DUNGARPUR	558.6	624.6	-11		
12	JAIPUR	565.8	502.1	13		
13	JHALAWAR	1130.3	841.2	34		
14	JHUNJHUNU	459.6	406.1	13		
15	KARAULI	692	616.9	12		
16	КОТА	1080.9	716.6	51		
17	PRATAPGARH	1162.6	864.1	35		
18	RAJSAMAND	517.9	506	2		
19	SAWAI MADHOPUR	906.2	617.4	47		
20	SIKAR	582.6	391.2	49		
21	SIROHI	563.2	839	-33		
22	TONK	664.5	557	19		
23	UDAIPUR	525.5	587.4	-11		
24	BARMER	242.7	247.9	-2		
25	BIKANER	282.3	229.6	23		
26	CHURU	521.5	315.5	65		
27	HANUMANGARH	293.5	263.5	11		
28	JAISALMER	273.5	162.1	69		
29	JALORE	339.9	385.7	-12		
30	JODHPUR	294.3	278.1	6		
31	NAGAUR	485.9	350.5	39		
32	PALI	396.7	450.3	-12		
33	SRI GANGANAGAR	143.3	201.8	-29		

 Table 2: District-wise seasonal rainfall distribution monsoon 2021

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)	Departur e from normal %
June	53.1	50.1	6
July	130.8	153.5	-15
August	126.1	147.3	-14
September	175.3	63.6	176

Table 3: Rainfall during southwest monsoon 2021 over Rajasthan

Table 4: Rainfall during southwest monsoon 2021 over East Rajasthan

Month	Actual (in mm)	Long period average LPA (in mm)	Departur e from normal %
June	56.7	66.7	-15
July	194	218.7	-11
August	236.7	221.9	7
September	209.3	94.9	121

 Table 5: Rainfall during southwest monsoon 2021 over West Rajasthan

Month	Actual (in mm)	Long period average LPA (in mm)	Departur e from normal %
June	50.2	36.9	36
July	80.7	101.7	-21
August	38.3	88	-56
September	148.4	38.8	283

From the above tables it is observed that Rajasthan received highest rainfall during the month of September, which was 176% of LPA (i.e. excess category). Both East Rajasthan and West Rajasthan received their highest rainfall during month of September which was 121% of LPA (excess) and 283% of LPA (large excess) respectively.



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

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Fig. 14 Districtwise Monthly Rainfall Distribution Over Rajasthan - September



Fig 15: Station wise Total Seasonal Rainfall

 Table 6: Districtwise Monthly Rainfall Distribution Over Rajasthan (June-September)

	JUNE	JULY	AUGUST	SEPTEMBER
LARGE EXCESS	2	1	5	28
EXCESS	8	7	3	4
NORMAL	13	11	6	1
DEFICIENT	9	14	8	0
LARGE DEFICIENT	1	0	11	0

Table 7: Monthwise Highest Rainfall	recorded during southwest monsoon 2	2021
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	Station	District	Rainfall Amount(in mm)	Recording Date
June	Banswara	Banswara	121	04/06/2021
July	Sahabad	Baran	304	31/07/2021
August	Sahabad	Baran	255	03/08/2021
September	Shrimadhopur	Sikar	153	23/09/2021

5. Withdrawal of the Southwest Monsoon

The isochrones of withdrawal of monsoon are given in Fig.15. Due to the formation of the Deep Depressionand cyclonic storm, 'Gulab' over the BoB andits movement, widespread rainfall was reported over the central, northern&Northwest Indian region, which delayed the monsoon withdrawal process from Northwest India. With the establishment of an anticyclonic circulation in the lower tropospheric levels over western parts of northwest India and substantial reduction in the moisture content & rainfall, the withdrawal of SWM 2021 commenced on 06th October against the normal date of 17th September. Accordingly, the SWM withdrew from some parts of West Rajasthan and adjoining Gujarat and the withdrawal line passed through 28.5°N / Long. 72.5°E, Bikaner, Jodhpur, Jalore, Bhuj and Lat. 23°N / Long. 68°E on 6th october.Further withdrawal was rapid upto 11th October when the withdrawal line passed through Lat. 27.0°N / Long. 92.0°E, Kohima, Silchar, Krishnanagar, Baripada, Malkangiri, Hanamkonda, Aurangabad, Silvasa, Lat. 20.0°N / Long. 65.0°E and Lat. 20.0°N / Long. 60.0°E.Subsequently, owing to the formation of the low-pressure area over West-central BoB and associated rainfall activity, the withdrawal process got stagnated in thesecond week of October. SWM withdrew from the entire country on 25th October against the normal date of 15th October. Simultaneous with this withdrawal, the northeast monsoon rains also commenced over southern parts of peninsular India from 25th October 2021.



Fig.15: Isochrones of withdrawal of South West Monsoon 2021

Report prepared by: Smt. Deepika Gupta, Met A Sh. Dinesh Ratangwal, SA Sh. Pushkal Karamchandani, SA

> Radheshyam Sharma (Head, Meteorological Centre Jaipur)