

Babarmahal, Kathmandu

27th October 2024

## Preliminary Precipitation and Temperature Summary Monsoon Season (June – September), 2024

## **Highlights**

Precipitation over the country as a whole during monsoon season (June – September, 2024) was 122.0% of the normal precipitation of the season. Most parts of the country recorded above normal maximum and minimum temperature.

## **Onset and Withdrawal of Monsoon**

The normal Monsoon onset and withdrawal date in Nepal is 13<sup>th</sup> June and 2<sup>nd</sup> October respectively. In Nepal, four months period from June to September is considered as Monsoon season. Monsoon entered into eastern Nepal three day earlier than normal onset day on 10<sup>th</sup> June and withdrew from eastern Nepal on 12<sup>th</sup> October delayed by ten days. The duration of Monsoon was 125 days, which was thirteen days longer than normal Monsoon period (112 days). The dates of onset and withdrawal of monsoon over Nepal are shown in Figure 1.

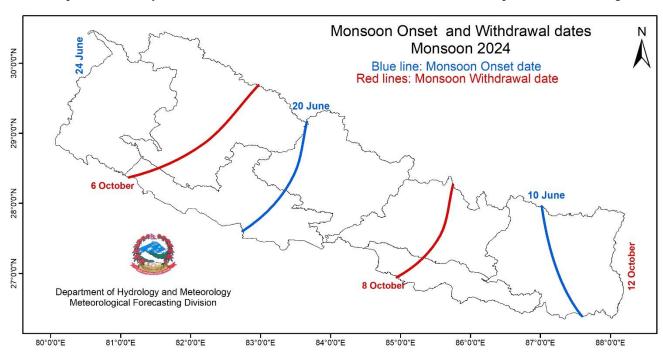


Figure 1: Monsoon onset and withdrawal dates in 2024.

## **Precipitation**

Country received above normal precipitation during the Monsoon season. Some parts over Kaski district recorded precipitation above 3000 mm while north-western part of Gandaki Province and north-east part of Karnali Province recorded precipitation less than 500 mm (Figure 2). Most part of the country recorded above normal precipitation (Figure 3). However, south-eastern part of Koshi Province, central and western part of Madhesh Province, central part of Gandaki Province, western part of Lumbini Province and south-western part of Karnali Province recorded near normal precipitation and isolated part over Gandaki and Karnali Province recorded below normal precipitation in this Monsoon season.

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Lumle station recorded the highest seasonal precipitation of 3949.1 mm while Jomsom station recorded the lowest of 284.1 mm. Similarly, the highest (188.4%) and the lowest (81.4%) percentage of seasonal normal precipitation were recorded at Khumaltar station and Nagma station respectively (Annex 1). Based on the average of 94 stations shown in figure 3, Nepal received 122.0% of the normal precipitation of the season. In general, less than 90% of normal precipitation is considered as below normal, 90 to 110% is considered as near normal, and more than 110% of normal precipitation is considered as above normal precipitation for the season.

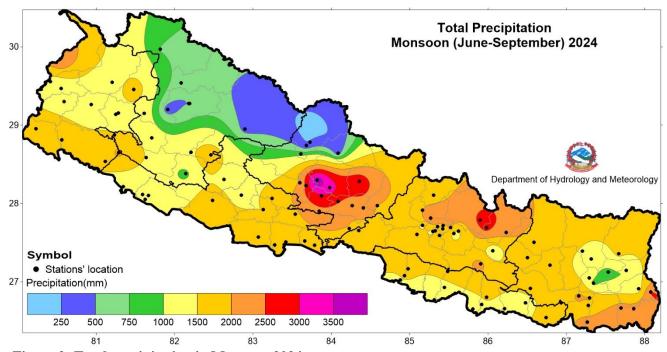


Figure 2: Total precipitation in Monsoon 2024.

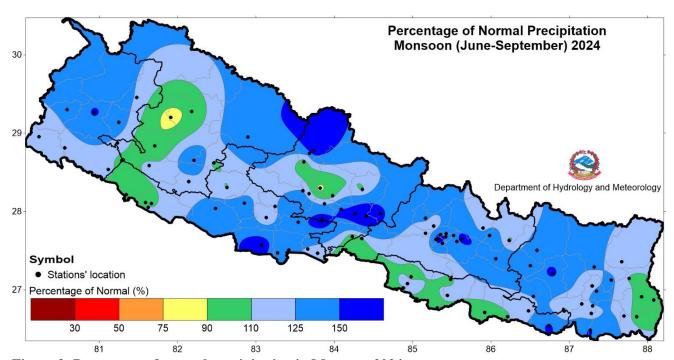


Figure 3: Percentage of normal precipitation in Monsoon 2024.



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The temporal distribution of seasonal cumulative average of daily precipitation shows that precipitation remained near normal in the first and last week of June, below normal in the second and third week of June, and above normal for the remaining of the period (Figure 4). The country averaged total precipitation of monsoon 2024 was the second highest since 1981 (Figure 5).

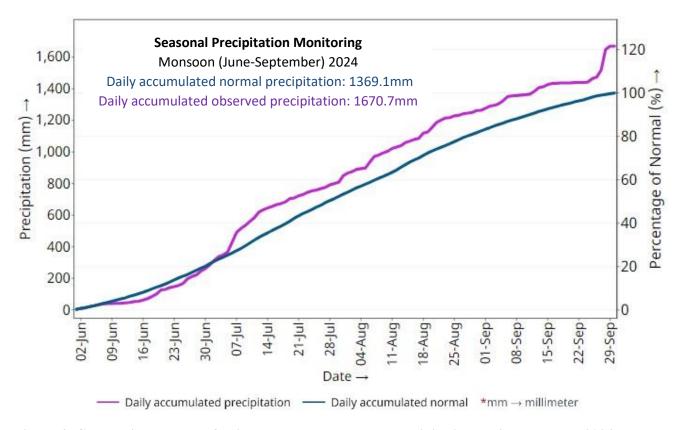


Figure 4: Cumulative average of daily normal and observed precipitation during Monsoon 2024.

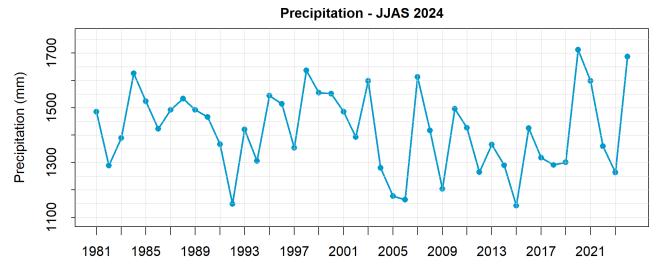


Figure 5: Seasonal total precipitation of Monsoon season from 1981 to 2024 at 91 stations (average of monthly total precipitation sum at stations having long term data).



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## **Maximum Temperature**

Northern part of the country recorded seasonal maximum temperature less than 9°C while southern plain recorded above 33°C during Monsoon season (Figure 6). Most parts of the country recorded above normal maximum temperature while a few parts across the country recorded near-normal to below normal maximum temperature (Figure 7).

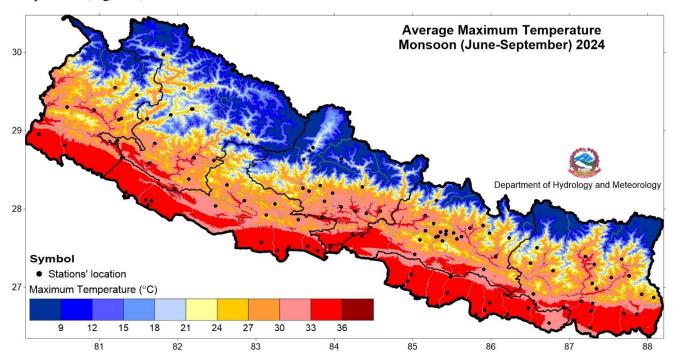


Figure 6: Maximum Temperature in Monsoon 2024.

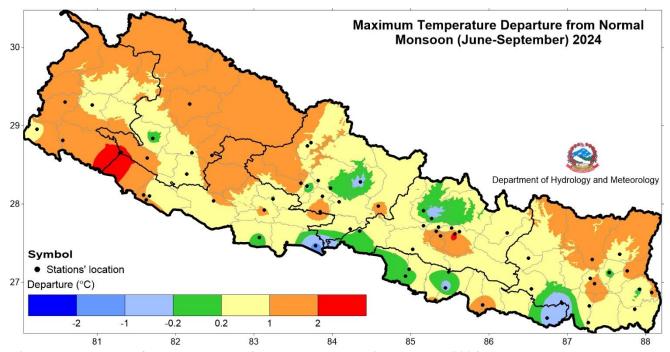


Figure 7: Departure from normal maximum temperature in Monsoon 2024.



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Birgunj station and Humde station recorded the highest and lowest seasonal maximum temperature of 35.7°C and 19.1°C respectively. Similarly, the highest seasonal anomaly of 2.5°C was recorded at Chisapani (Karnali) station and the lowest of -1.3°C was recorded at Semari station (Annex 1). The highest daily maximum temperature of 44.6°C was recorded at Nepalgunj (Reg.Off.) station on 13<sup>th</sup> June while the lowest daily maximum temperature of 10.0°C was recorded at Humde Station on 27<sup>th</sup> September. Some of the stations broke the previous record of highest maximum temperature in this Monsoon. The country averaged maximum temperature of monsoon 2024 was the second highest since 1981 (Figure 8).

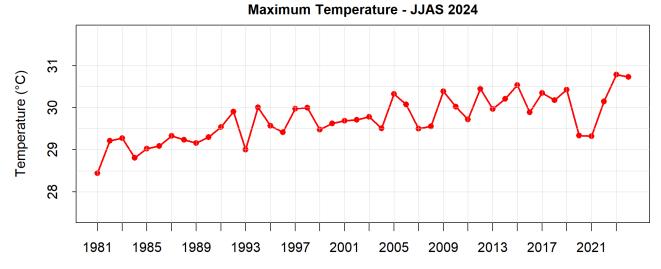


Figure 8: Seasonal average maximum temperature of Monsoon season from 1981 to 2024 at 56 stations (average of seasonal average maximum temperature at stations having long term data).

## **Minimum Temperature**

The minimum temperature in the Terai remained above 24°C, reaching over 27°C in some areas (Figure 9). Most parts of the country recorded above normal minimum temperature while the northern part of Gandaki Province and isolated part over Bagamati Province and Sudurpaschim Province recorded near-normal to below normal temperature (Figure 10).

Birgunj station and Humde station recorded the highest and lowest seasonal minimum temperature of 27.6°C and 9.8°C respectively. Similarly, the highest seasonal anomaly of 2.7°C was recorded at Chainpur (East) station and the lowest anomaly of -2.2°C was recorded at Tikapur station (Annex 1). The highest daily minimum temperature of 31.8°C was recorded at Khajura station on 19<sup>th</sup> June while the lowest daily minimum temperature of 0.5°C was recorded at Humde station on 28<sup>th</sup> September. The country's average minimum temperature in Monsoon 2024 was the highest since 1981 (Figure 11).



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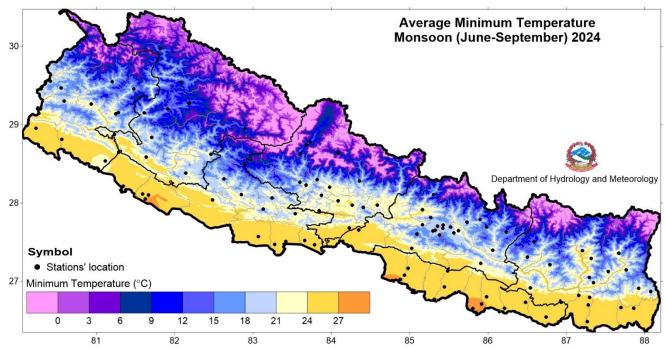


Figure 9: Minimum Temperature in Monsoon 2024.

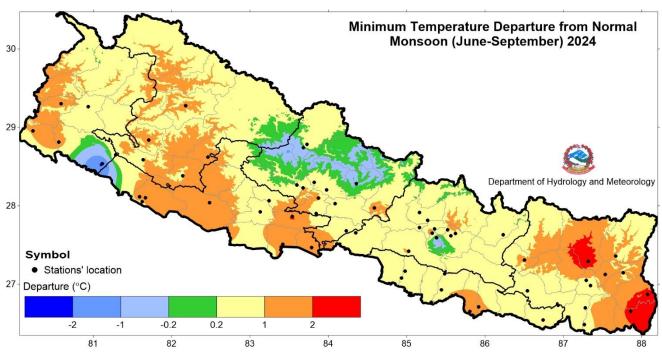


Figure 10: Departure from normal minimum temperature in Monsoon 2024.



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## Ministry of Energy, Water Resource and Irrigation Department of Hydrology and Meteorology Climate Division (Climate Analysis Section)

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## Minimum Temperature - JJAS 2024

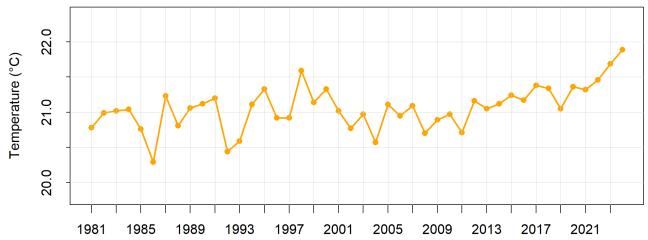


Figure 11: Seasonal average minimum temperature of Monsoon season from 1981 to 2024 at 52 stations (average of seasonal average minimum temperature at stations having long term data).

## **Heavy Precipitation Events**

## 1. Heavy Precipitation event in Kanchanpur District on 8th July 2024

An unpredictably heavy precipitation in southwestern part of Sudurpaschim Province (Kanchanpur district) was observed on 8<sup>th</sup> July 2024. The 24-hour accumulated precipitation recorded at 8:45 A.M. on July 8 at Dodhara Precipitation station was 624.0mm, Hanuman Nagar station was 573.6mm and Sundarpur station was 555.8mm (Figure 12). Hourly precipitation of 10 minutes moving sum of 3 stations at Sundarpur, Hanuman Nagar and Dodhara rainfall stations which shows peak precipitation of 102.0 mm in Hanuman nagar which was observed between 07/07/2024 22:05:00 and 07/07/2024 23:05:00 (Figure 13).

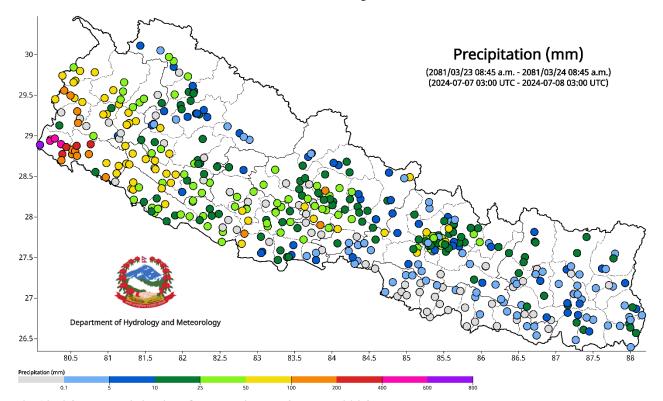


Fig 12: 24 hr. Precipitation Observation on 8th July 2024.



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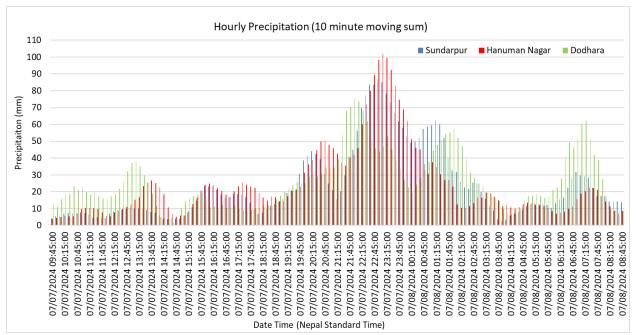


Fig 13: Hourly Precipitation at Sundarpur, Hanuman Nagar and Dodhara Stations from 8:45 A.M. July 7 2024 to 8:45 A.M. July 8 2024

## 2. Extreme Precipitation event of 27-29 September 2024

The three-day accumulated precipitation from 26 September 08:45 AM to 29 September 08:45 AM shows heavy to extremely heavy rainfall in Koshi Province, Madhesh Province, Bagmati Province, the southern part of Gandaki Province, and the eastern part of Lumbini Province while light to moderate precipitation was recorded across rest of the country (Figure 14). Meteorological stations at Daman, Chandragadhi, Dedhgaun, Naikap, Kechana, and Khopasi reported accumulated precipitation over 400 mm for the period. A total of 183 stations recorded more than 50 mm of precipitation.

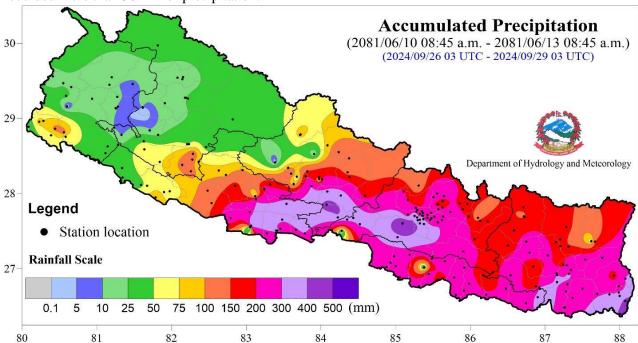


Figure 14: Three-day accumulated precipitation measured at 8:45 AM on 29 September 2024



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## Historical record break

In this Monsoon, several stations broke the previous record of extremes of temperature and precipitation (Table 1 & 2).

Table 1: List of stations breaking the ever-recorded highest daily maximum temperature.

		O					
S.N.	Station Name	District	Record break maximum	Previous highest maximum temperature(°C)/Date			
		District	temperature (°C)/Date				
1	Diktel	Khotang	30.2/2024-07-27	30.0/2012-05-15			
2	Dhankuta	Dhankuta	34.0/2024-09-23	33.7/2022-07-15			
3	Kanyam Tea Estate	Ilam	30.5/2024-09-21	30.0/2023-06-03			
4	Darchula	Darchula	40.0/2024-06-15	39.5/2015-06-10			
5	Patan	Baitadi	39.0/2024-06-08	35.5/2019-06-15			
6	Chainpur	Bajhang	37.6/2024-06-15	36.5/2012-06-15			
7	Jumla	Jumla	32.0/2024-06-14	31.9/1990-06-25			
8	Rara	Mugu	32.0/2024-09-19	30.1/2001-10-06			
9	Changu Narayan	Bhaktapur	35.4/2024-06-10	33.6/2015-06-06			
10	Baglung	Baglung	39.5/2024-06-12	39.2/1994-05-04			

Table 2: List of stations breaking the ever-recorded highest daily precipitation.

S.N.	Station Name	District	Record break daily	Previous highest
	Station Name	District	precipitation (mm)/Date	precipitation(mm)/Date
1	Sandhikharka	Arghakhanchi	196.6/2024-09-28	166.0/2021-06-16
2	Nangkhel	Bhaktapur	194.5/2024-09-28	191.5/2002-07-23
3	Govindabasti	Chitwan	264.0/2024-09-28	196.0/2024-07-19
4	Gajuri	Dhading	261.2/2024-09-28	131.3/2021-07-02
5	Chandragadi Airport	Jhapa	256.0/2024-09-28	188.2/2022-06-28
6	Panipokhari	Kathmandu	206.6/2024-09-28	198.0/1971-06-14
7	Kathmandu Airport	Kathmandu	239.7/2024-09-28	177.0/2002-07-23
8	Buddhanilakantha	Kathmandu	178.3/2024-09-28	159.0/2002-07-23
9	Jitpurphedhi	Kathmandu	178.3/2024-09-28	128.2/2019-07-07
10	Nagarjun	Kathmandu	205.4/2024-09-28	147.5/2014-09-13
11	Khopasi	Kavrepalanchok	331.6/2024-09-28	276.9/2015-09-03
12	Panchkhal	Kavrepalanchok	232.5/2024-09-28	145.0/1999-10-21
13	Dhulikhel	Kavrepalanchok	224.6/2024-09-28	220.0/2002-07-23
14	Godavari	Lalitpur	311.6/2024-09-28	225.2/2002-07-23
15	Khumaltar	Lalitpur	294.4/2024-09-28	136.0/2022-08-10
16	Tikathali	Lalitpur	264.0/2024-09-28	207.0/2002-07-23
17	Khokana	Lalitpur	297.3/2024-09-28	249.2/2002-07-23
18	Chapagaun	Lalitpur	323.5/2024-09-28	200.5/2002-07-23
19	Daman	Makwanpur	410.0/2024-09-28	373.2/1993-07-20
20	Humde	Manang	84.2/2024-09-28	64.7/2022-10-07
21	Kakani	Nuwakot	169.2/2024-09-28	161.0/1972-07-28
22	Baldyanggadi	Palpa	252.0/2024-09-28	90.4/2012-09-16
23	Phidim	Panchthar	172.0/2024-09-28	148.9/2021-10-20
24	Baunepati	Sindhupalchok	190.6/2024-09-28	137.5/1978-07-16
25	Sakhar at Tanahun	Tanahun	214.0/2024-09-28	173.2/2020-07-21
26	Khairini Tar	Tanahun	252.3/2024-09-28	241.9/1983-07-17



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## Annex 1: Seasonal precipitation and temperature data of Monsoon 2024

				Precipi	tation	Temperature			:	
									Minimum	
					Percentage of Normal (%)					
	ę	Longitude	Elevation	E E	ž	ີ	Departure form normal (°C)	Û	Departure form normal (°C)	
Station	Latitude	git	vat	Total (mm)	of ()	Average (°C)	eparture for normal (°C)	Average (°C)	eparture for normal (°C)	
	La!	uo,	3le	펻	%)	ge	ure	ıge	ure	
		1	Щ	IoI	nta	er.	at	era	art	
				,	rce	Ā	)ep	Αv	Эер	
					Pe		П		Ι	
Baglung	28.2636	83.6003	964	2060.6	126.6	33.0	1.8	21.6	0.3	
Bahrabise	27.7887	85.9000	884	2625.1	114.0	33.0	1.8	21.8	0.5	
Baitadi (Gothalapani)	29.5574	80.4132	1352	1180.1	129.3	32.6	-	19.5	-	
					122.9		-		-	
Bajura (Martadi)	29.4570	81.4804	1598	1853.1		32.0		19.8		
Bandipur	27.9418	84.4064	991	2313.5	184.1	28.5	-	17.4	-	
Bhairahawa Airport	27.5068	83.4204	108	1833.5	133.9	29.5	-	26.9	1.1	
Bhaktapur	27.6767	85.4240	1315	1559.4	147.7	34.7	0.7	20.9	-	
Bijuwar Tar	28.1035	82.8520	835	1260.4	132.5	31.0	-	22.9	-	
Biratnagar Airport	26.4840	87.2670	72	2142.4	152.6	33.1	-	26.3	0.7	
Birganj	27.0232	84.8782	67	1327.6	105.5	33.1	0.3	27.6	-	
Chainpur (East)	27.2921	87.3170	1277	1237.7	126.7	35.7	-	21.1	2.7	
Chainpur (Bajhang)	29.5459	81.2011	1405	1152.8	-	29.5	1.7	20.0	-	
Changu Narayan	27.7161	85.4268	1502	1884.8	139.8	30.1	-	19.5	-	
Chapakot	27.8999	83.8459	617	2377.6	163.8	29.9	-	23.4	0.5	
Charikot	27.6902	85.9802	2132	2686.0	150.8	34.1	1.6	16.2	-	
Chatara	26.8204	87.1592	105	2106.8	124.8	23.6	-	25.7	-	
Chaurjhari Tar	28.6540	82.2103	863	1436.3	150.8	34.6	-	-	-	
				1430.3	130.6				-	
Chautara	27.7538	85.7321	1552	- 2121.4	1040	33.3	0.8	16.6		
Chisapani (Karnali)	28.6472	81.2854	201	2131.4	104.3	29.4	-	26.1	1.0	
Dadeldhura	29.3014	80.5878	1879	1295.7	129.6	35.1	2.5	17.9	1.1	
Dailekh	28.8381	81.7085	1394	1270.8	89.4	26.6	1.7	18.2	1.0	
Damak	26.6623	87.6988	119	2269.6	121.2	29.3	-0.1	24.0	-	
Daman	27.6044	85.0920	2265	1804.4	-	33.8	-	15.0	-	
Damauli	27.9737	84.2651	347	2045.8	163.5	22.9	-	25.0	-	
Darchula New	29.8429	80.5388	887	2565.8	-	34.4	-	22.4	-	
Dhangadhi (Attariya)	28.8127	80.5600	184	1841.3	113.8	33.0	-	26.7	1.4	
Dhankuta	26.9832	87.3460	1192	892.8	134.5	35.3	1.5	20.7	0.5	
Dharan Bazar	26.7922	87.2978	310	2071.1	123.6	29.7	1.9	25.4	-	
Dhulikhel	27.6161	85.5655	1543	1442.5	124.7	32.9	-	18.8	0.6	
Dhunche	28.1053	85.3077	2005	1704.8	-	28.2	2.5	17.0	-	
Dhunibesi	27.7229	85.1643	991	1413.1	110.5	24.1	-	22.2	0.6	
Diktel	27.2125	86.7919	1612	1650.2	154.6	31.3	0.7	19.0	-	
Dipayal (Doti)	29.2621	80.9369	563	1168.8	153.0	25.7	-	24.2	0.8	
Dumkauli	27.6807	84.2285	183	1973.7	100.3	34.9	0.4	26.0	0.7	
Dunai	28.9507	82.8960	2098	411.0	148.9	34.4	0.4	13.7	-	
	26.6569	87.8607							2.2	
Gaida (Kankai)			107	2176.0	102.5	29.5	-	26.0		
Gaur	26.7671	85.3130	77	1035.3	100.5	33.5	0.2	25.2	0.2	
Ghorai (Dang)	28.0372	82.4842	663	1847.5	138.7	35.2	1.4	24.3	1.8	
Godavari	27.5929	85.3788	1527	1823.4	137.0	32.0	1.0	17.2	-0.6	
Gorkha (Birenchowk)	27.9714	84.5894	724	1982.9	156.7	27.2	1.2	23.3	1.2	
Gulariya	28.2128	81.3452	126	1064.8	95.3	32.1	1.3	25.6	-	
Hardinath	26.8000	85.9833	93	1612.0	-	35.4	-	26.6	-	
Hetauda N.F.I.	27.4202	85.0252	452	-	-	33.5	-	24.5	1.1	
Humde	28.6399	84.0881	3401	374.4	-	32.8	0.3	9.8	-	
Ilam Tea Estate	26.9096	87.9231	1208	1248.4	105.9	19.1	-	20.6	-	
Jajarkot	28.6990	82.2001	1236	-	-	26.2	0.1	-	-	
Jalesor	26.6522	85.8073	68	987.2	-	-	-	27.4	1.6	
Janakpur Airport	26.7097	85.9172	76	1198.0	100.2	34.2	-	27.4	1.1	
Jiri	27.6304	86.2321	1877	2153.8	107.1	34.5	1.3	16.8	0.5	
Jomsom	28.7840	83.7298	2741	284.1	179.2	24.6	0.4	13.9	1.0	
Jumla	29.2747	82.1796		503.6	94.3	23.2	0.9	15.6	1.2	
Jumla Airport	29.2740		2384	538.2	-	26.8	1.6	14.3	-	
Kakani	27.8113	85.2674	2002	2572.9	109.6	26.1	-	16.6	0.6	
			1570							
Kanyam Tea Estate	26.8681	88.0783		2521.0	109.2		-0.2	18.8	2.2	
Karmaiya	27.1330	85.4841	139	1685.9	107.2		1.2	26.3	0.4	
Kathmandu Airport	27.7038	85.3562	1337	1817.0	154.5	34.0	0.1	20.5	0.8	

				Precipi	tation	1 Temperature			
				1		Maximum Minimu			
Station	Latitude	Longitude	Elevation	Total (mm)	Percentage of Normal (%)	Average (°C)	Departure form normal (°C)	Average (°C)	Departure form normal (°C)
Khadbari	27.3911	87.2044	1064	1459.6	-	29.7	0.7	21.7	-
Khairini Tar	28.0270	84.0866	515	2550.6	151.6	29.7	-	23.9	0.4
Khajura (Nepalganj)	28.1137	81.5903	129	1142.5	105.1	33.1	0.3	26.9	1.4
Khanchikot	27.9221	83.1298	1801	1496.4	109.6	35.5	1.3	17.6	0.3
Khokana	27.6438	85.2967	1309	1413.6	143.0	25.1	1.3	20.1	-
Khudi Bazar	28.2822	84.3564	838	2941.2	108.1	29.3	1	20.8	-0.2
Khumaltar	27.6517	85.3257	1334	1655.0	188.4	30.3	-0.5	21.0	1.3
Kushma	28.2249	83.6769	900	2568.9	120.4	29.4	1.4	22.3	1.0
Lahan	26.7327	86.4776	110	1198.0	118.0	31.0	-0.5	26.7	-
Lete	28.6327	83.6092	2490	915.6	103.1	34.2	-	14.2	-
Libang Gaun	28.3062	82.6323	1314	1350.5	109.4	21.5	-	20.8	-
Lumbini	27.4703	83.2761	95	1454.4	132.5	30.4	-	26.7	-
Lumle	28.2965	83.8179	1738	3949.1	84.7	34.4	-	18.0	0.8
Mahendra Nagar	28.9548	80.2305	197	1887.7	113.8	24.4	0.6	26.1	1.0
Mangalsen	29.1361	81.2501	1310	1409.3	135.9	34.7	0.8	20.7	-
Manma	29.1488	81.6135	1729	1251.4	-	28.9	-	18.7	-
Manthali	27.3947	86.0612	497	1056.3	150.1	26.2	-	23.7	-
Manusmara	26.9280	85.4451	90	1327.6	114.5	34.6	-	26.8	1.0
Musikot (Rukumkot)	28.6190	82.4625	1412	1898.9	107.0	33.3	-0.5	20.3	1.4
Nagarkot	27.6933	85.5209	2147	2077.5	138.7	29.8	1.5	15.9	0.8
Nagma	29.2006	81.9106	2017	380.1	81.4	22.8	0.4	17.1	-
Nepalgunj Airport	28.1006	81.6682	165	1361.5	106.7	26.1	-	26.9	1.5
Nepalgunj (Reg.Off.)	28.0520	81.6228	141	1259.9	112.3	34.9	0.6	27.1	0.8
Nuwakot	27.9150	85.1646	966	1973.0	130.3	35.7	1.8	22.1	0.6
Okhaldhunga	27.3081	86.5042	1731	1950.9	140.2	30.6	0.0	18.4	1.1
Oli Gaun (Patkani)	29.1559	81.2831	989	1236.4	-	25.3	0.3	18.9	-
Pakhribas	27.0463	87.2925	1720	1268.9	107.3	30.9	-	17.9	0.5
Panchkhal	27.6451	85.6209	857	1423.8	164.5	24.3	0.8	22.8	0.9
Parasi	27.5193	83.6622	112	1680.2	121.8	32.7	0.7	26.4	-
Parwanipur	27.0789	84.9327	87	1635.6	125.9	33.8	-	26.3	0.5
Patan new	29.4664	80.5506	1299	1070.2	-	33.4	-0.1	20.7	-
Phattepur	26.7305	86.9348	101	1596.8	106.2	-	-	25.6	0.4
Phidim (Panchther)	27.1437	87.7656	1157	1004.2	108.9	33.2	-0.9	21.8	1.0
Pokhara Airport	28.2002	83.9795	827	3246.6	106.0	30.9	1.4	22.5	0.7
Pusma Camp	28.8755	81.2327	953	1522.7	119.6	30.5	0.1	21.6	-
Rajbiraj	26.5407	86.7425	68	1833.7	155.4	29.7	-	26.3	1.0
Rampur	27.6540	84.3508	189	1786.0	106.5	32.9	-0.4	25.1	0.2
Rara	29.5401	82.0818	2989	631.6	-	33.9	0.1	12.0	-
Salleri	27.5051	86.5862	2383	1862.9	138.2	21.8	-	14.7	-
Salyan Bazar	28.3821	82.1423	1557	868.4	116.0	25.2		19.9	0.9
Semari	27.4682	83.7861	110	1783.7	113.4	28.2	0.6	26.7	1.9
Simara Airport	27.1642	84.9800	137	1590.0	105.8	34.6	-1.3	25.9	0.6
Simikot	29.9715		2993	736.3	-	33.6	0.2	12.5	-
Sindhuli Madhi	27.2281		556	2184.7	-	21.7	-	22.8	-
Siraha	26.6561	86.2117	63	1210.9	108.2	32.1	-	26.0	-
Surkhet Airport	28.5879		683	1485.3	115.3	34.0	-	23.9	1.0
Syangja	28.0988		871	2836.5	122	33.3	1.6	22.7	1.199
Tamghas	28.0636		1547	1816.8			0.9	18.9	
Tansen	27.8637	83.5387	1183	1883.1	147.8	26.5	0.1	21.3	2.082
Taplejung	27.3586	87.67	1744	1591.9	117.5		-	18.4	0.801
Tarahara	26.6987	87.2786	120	1717	112.9		0.7	26	0.954
Taulihawa	27.5711	83.0672	106	1986	167.7	33.3	0.9	26.4	-
Terhathum	27.123	87.5362	1525			33.7	0	19.1	1.306
Thakmarpha	28.7409		2655				-0.1	11.4	-0.38
Tikapur Udayapur Gadhi	28.5366			1597.9		22	0.4	22.9	-2.17
	26.9130	86.5397	469	1715.2	125.1	-	-	24.4	0.4

## *Note:*

- "mm" = millimeter; "temp" = temperature; "-" = Data Not Available.
- This summary is prepared based on the precipitation and temperature received at 112 meteorological stations during Monsoon, 2024. Out of 111 stations, 94 stations have normal precipitation data, 65 stations have normal maximum temperature data and 65 stations have normal minimum temperature data. Normal precipitation/temperature is the average of the seasonal precipitation/temperature for period of 1991-2020.