The Rainfall Activity and Temperatures Distribution Over KPK during the Monsoon Season (July to September) 2009

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Abstract

In this report, changes in the rainfall activity, minimum, maximum and mean temperatures have been studied on monthly as well as on seasonal basis during the monsoon season (July-September) 2009 in Khyber Pakhtunkhwa (KPK) Province of Pakistan. The data was collected from 12 meteorological observatories located in KPK. By comparing the monthly data of rainfall, minimum, maximum and mean temperatures for the monsoon months of the year 2009 with the climatic normal values of 1971-2000, it has been found that the rainfall was moderately below normal during the months of July and August. It was slightly below normal during September. As a whole, it remained moderately below normal during the monsoon season across the region due to the prevailing El Nino phenomenon in the Pacific Ocean. Consequently, scanty rainfall distribution during the season resulted in a bad crop conditions.

The minimum temperature remained normal during the monsoon season throughout the region. The maximum temperature remained slightly above normal during the months of July and August and remained normal during the month of September. As a whole, it remained slightly above normal throughout the season across the region. Consequently, the mean temperature remained normal during the study period across the region.

Introduction

The Southwest summer monsoon in Pakistan occurs from July through September. The southern deserted areas of the country heat up considerably during the hot summer months. As a result, seasonal\heat lows develop over arid land areas of Balochistan and adjoining areas of the country during warmer months. The moisture-laden currents from the Indian Ocean winds on reaching the southernmost point of the Indian Peninsula become divided into two parts: the Arabian Sea Branch and the Bay of Bengal Branch. They rush into the subcontinent due to the wind circulation over the region. These winds, rich in moisture, are drawn towards the Himalayas, bringing heavy rainfall to the subcontinent. The Himalayas act like a high wall, blocking the winds from passing into Central Asia, thus forcing them to rise. With the gain in altitude of the clouds, the temperature drops and precipitation occurs.

The Arabian Sea Branch of the monsoon first hits the Western Ghats of the coastal state of Kerala, India. This branch of the monsoon moves northwards along the Western Ghats with precipitation on coastal areas. The eastern areas of the Western Ghats do not receive much rain from this monsoon system as the wind does not cross the area.

The Bay of Bengal Branch of monsoon flows over the Bay of Bengal heading towards North-East India and Bengal, picking up more moisture from the Bay of Bengal. The winds arrive at the Eastern Himalayas with large amounts of rain. After the arrival at the Eastern Himalayas, the wind turns toward the west, traveling over the Indo-Gangatic Plain.

The study has been conducted regarding the analysis of rainfall, minimum, maximum and mean temperature data for the monsoon season 2009. The data was collected from the 12 stations of meteorological observing network of Pakistan Meteorological Department (Chitral, Drosh, Dir, Saidu Sharif, Balakot, Kakul, Cherat, Peshawar, Kohat, Parachinar, Bannu and D.I.Khan) located in the KPK Province. The climatic normal value for Bannu meteorological observatory was calculated on the basis of available data for 13 years (1997-2009).

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Methods & Materials

Sea surface temperatures anomaly (ºC) was shown in Table 1. Mean monthly rainfall, minimum, maximum and mean temperatures data (Tables 2, 3, 4 & 5) for the months July through September from all observatories, situated in KPK was collected and used for the analysis. Percentage departures of the rainfall and departures of minimum, maximum and mean temperatures were calculated for each month due to prevailing El Nino phenomena in the Pacific Ocean, as well as for the season as a whole and the changes in the parameters were shown graphically.

Results and Discussion

Monthly Features of Rainfall and Temperature Distribution

July 2009

During the month, weak El Nino phenomenon was present across the equatorial tropical Pacific Ocean. Monthly sea surface temperatures (SST) departures ranged from +0.5 °C to +1.5 °C across the equatorial Pacific Ocean, with the largest anomalies in the eastern half of the basin (Figure 1). Consistent with this warmness, all of the Nino-region SST indices were between +0.6 °C to +1.0 °C throughout the month (Table 1).

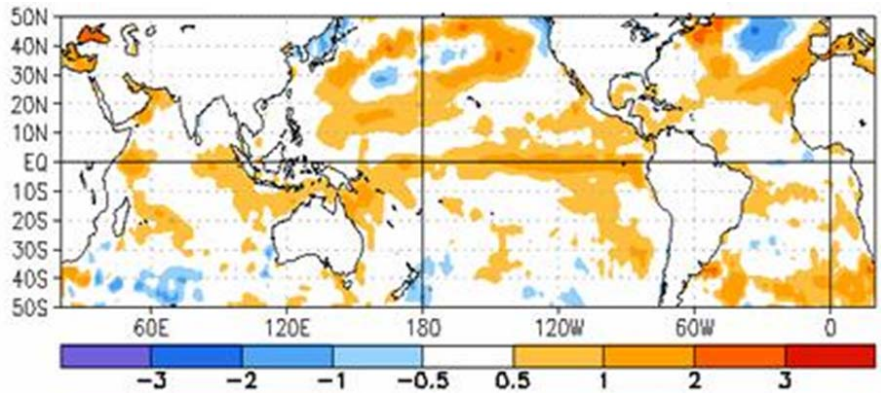

Figure 1: Sea Surface Temperature Anomaly (ºC) (Source: Climate Prediction Centre, NOAA)

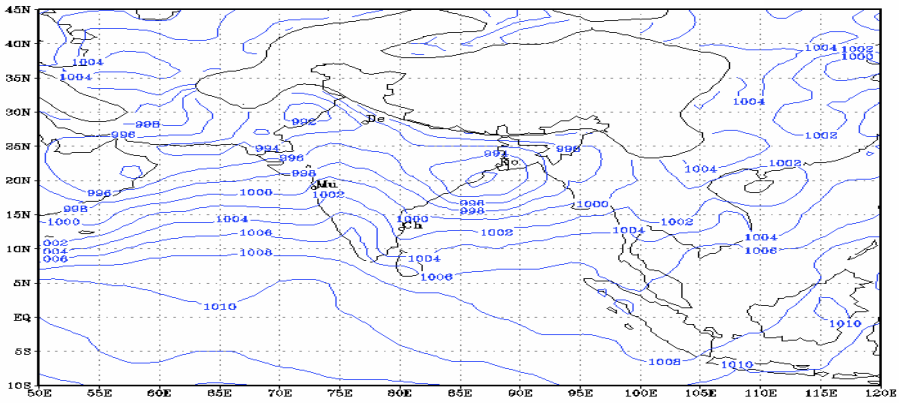

Figure 2: MSLP (in hpa) Analysis 12 UTC of 13 July 2009 source: RSMC (IMD) New Delhi

Due to the negative impact of El Nino's phenomenon, the rainfall was in moderate excess at one meteorological observing station (Parachinar); slightly excess at one station (D.I.Khan); normal at two stations (Chitral and Cherat); moderate deficit at one station (Kakul) and large deficit at seven stations (Drosh, Dir, Saidu Sharif, Balakot, Peshawar, Kohat and Bannu).As a whole, the rainfall was moderately below normal across the region during the month. According to the synoptic situation at 12 UTC on 13th July, 2009, moist currents in shallow layers penetrated into the north eastern parts of the region due to the monsoon low formed over the south Punjab (Figure 2) and caused moderate to heavy rainfall at a few places over the area. The heaviest amount of rainfall was recorded 48.0 mm on 14th July, 2009 at D.I.Khan. Figure 3 shows normal and actual whereas Figure 4 illustrates percentage departures from the normal.

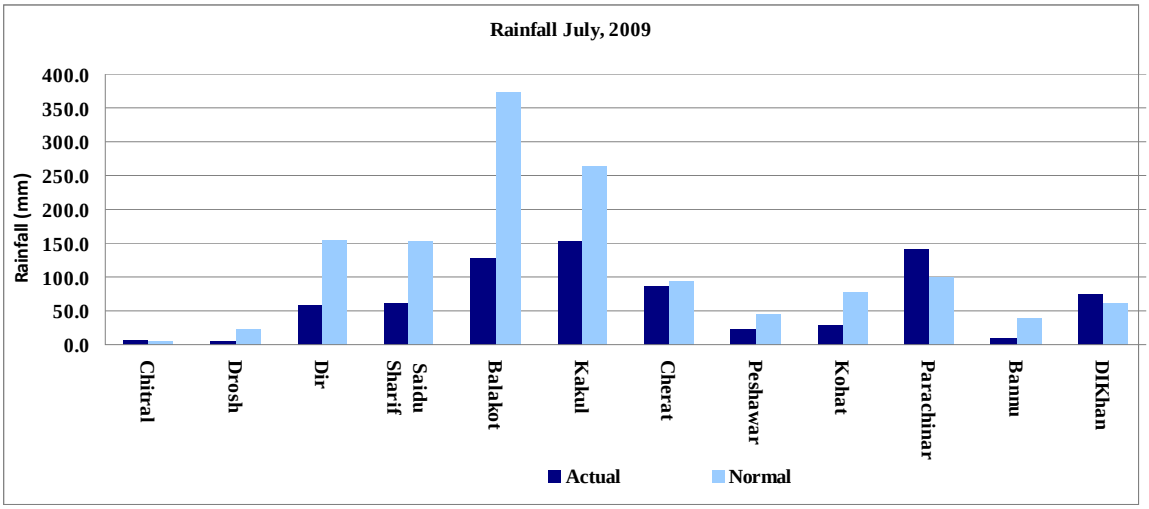

Figure 3: Actual vs Normal Rainfall, July 2009.

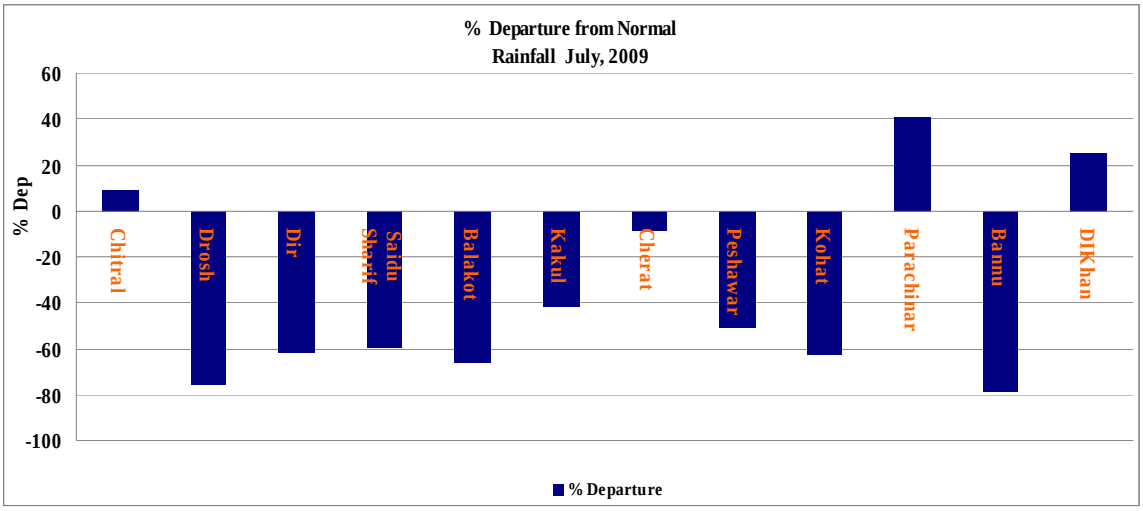

Figure 4: % Departure, Rainfall Jul 2009

August 2009

During the month, weak El Niño phenomenon continued, as sea surface temperature (SST) remained above-average across the equatorial Pacific Ocean (Figure 5). Consistent with this warmness, the monthly values of the Niño-region SST indices were between +0.8 °C to +1.0 °C (Table 1)

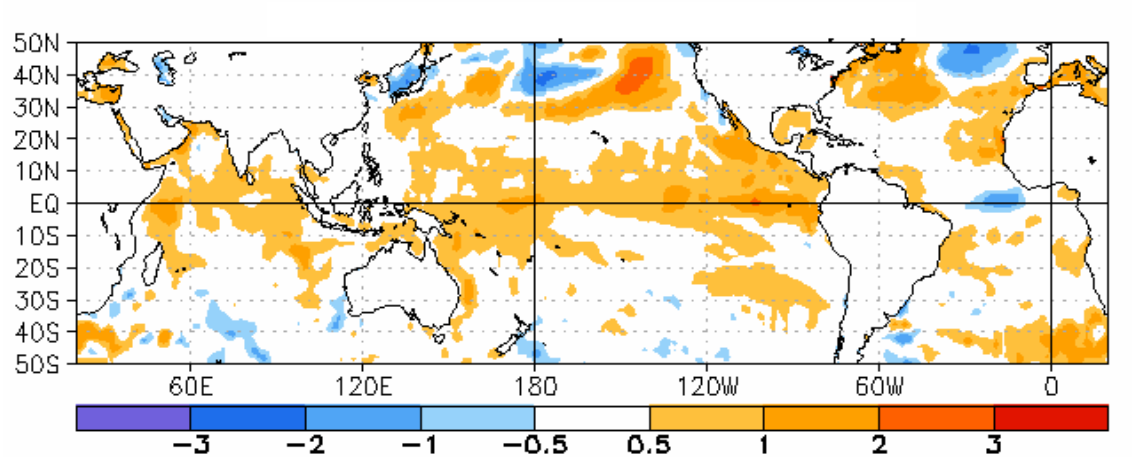

Figure 5: Sea Surface Temperature Anomaly (ºC) (Source: Climate Prediction Centre, NOAA)

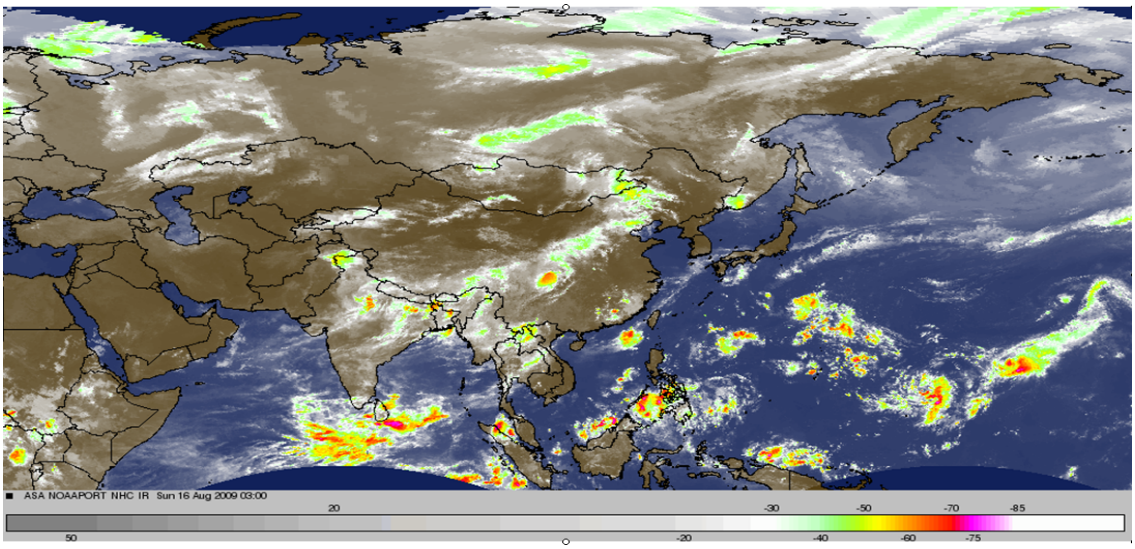

Figure 6: Satellite pictures depicts the monsoon weather system

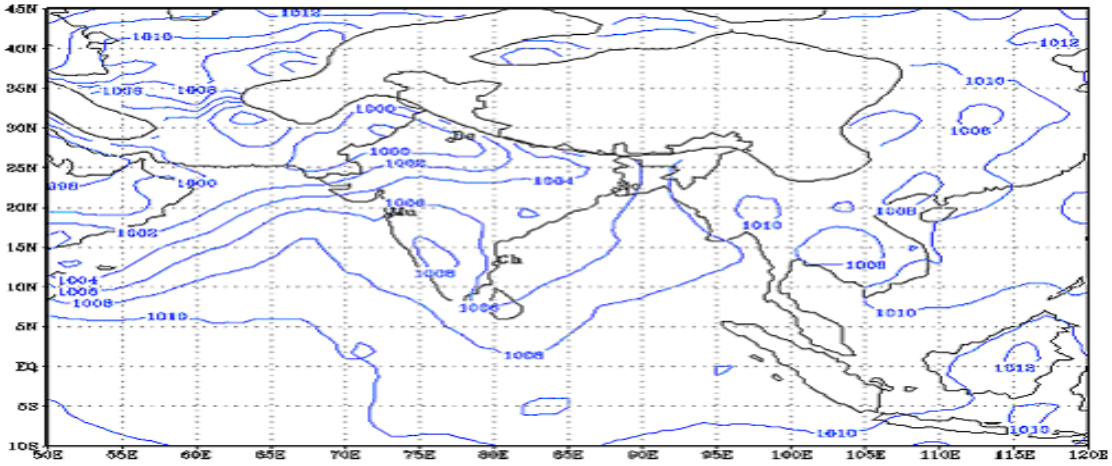

Figure 7: MSLP (in hpa) Analysis at 00 UTC of 16 Aug 2009 source: RSMC (IMD) New Delhi

The rainfall was normal at three stations (Parachinar, Bannu and D.I.Khan); slight deficit at two stations (Saidu Sharif and Balakot); moderate deficit at two stations (Kakul and Peshawar) and in large deficit at five stations (Chitral, Drosh, Dir, Cherat and Kohat). As a whole, the rainfall was moderately below normal throughout the region during the month in association with the El Nino's negative impact, According to the synoptic situation, monsoon trough along the foothills of Himalayas has become active and due to the passage of westerly wave over the upper parts of the country, scattered thundershowers occurred across the northeastern parts of the region. The heaviest amount of rainfall was recorded 65.0 mm on 16th August, 2009 at Kakul. Satellite picture also depicts the monsoon weather system affecting the area (Figure 6 & 7). Figure 8 shows normal and actual whereas Figure 9 illustrates percentage departures from the normal.

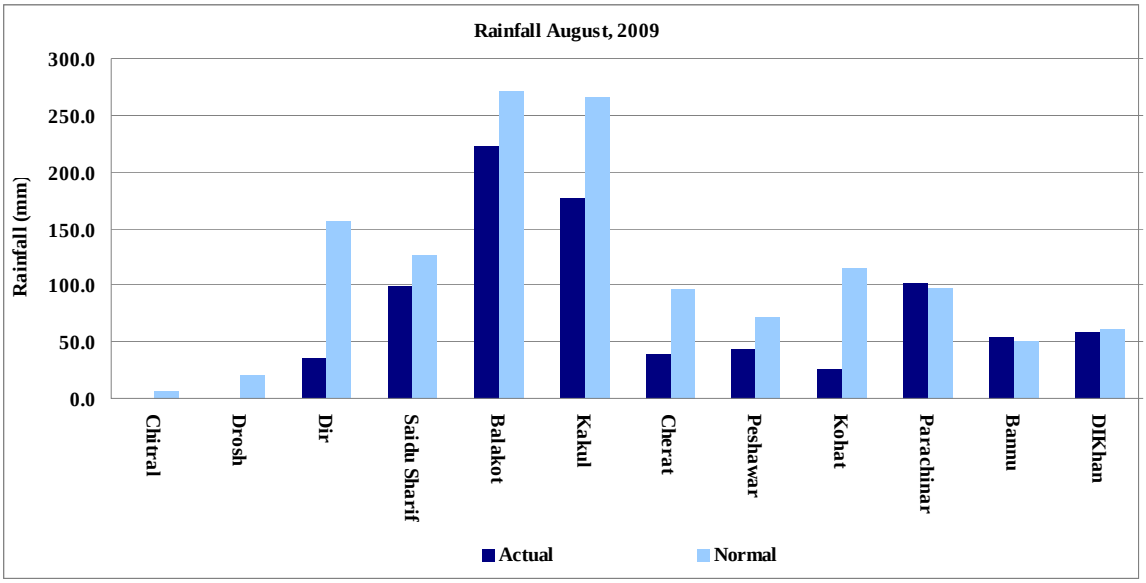

Figure 8: Actual vs Normal Rainfall , Aug 2009

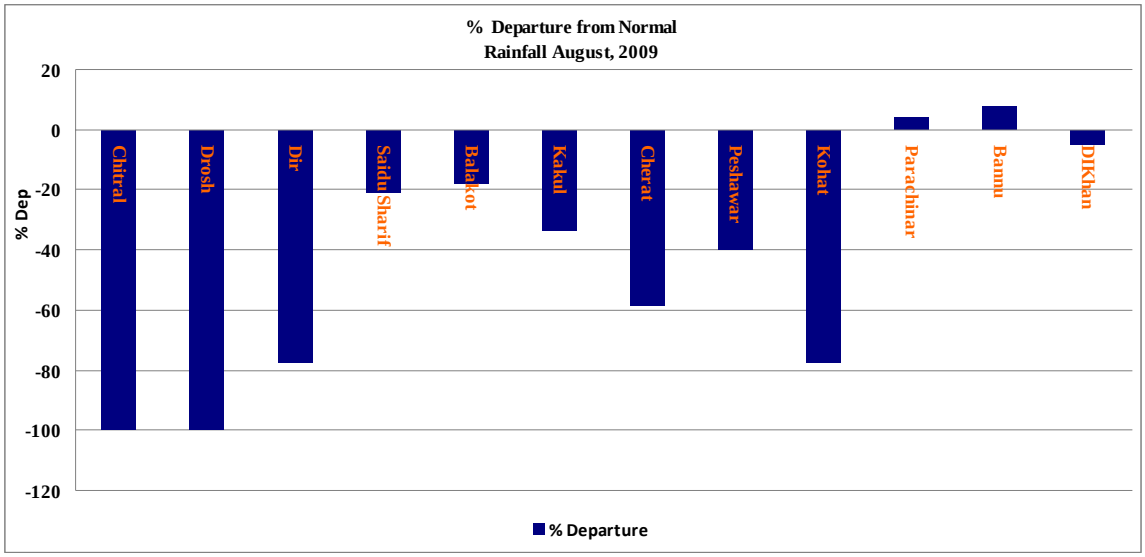

Figure 9: % Departure, Rainfall Aug 2009

September 2009

During September, weak El Niño phenomenon continued, as sea surface temperature (SST) anomalies remained above average across much of the equatorial Pacific Ocean (Figure 10). Consequently, all of the Niño-region SST indices were about +0.8 °C throughout the month, except for the Niño 1+2 index, which dropped to +0.3 °C during the month (Table 1).

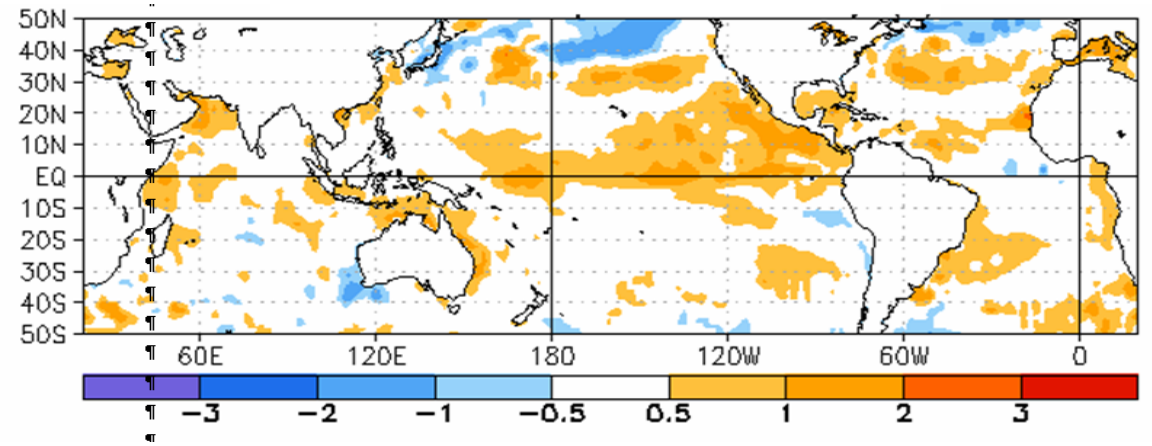

Figure 10: Sea Surface Temperature Anomaly (ºC) (Source: Climate Prediction Centre, NOAA)

In connection with the El Nino phenomenon, rainfall activity across the region was in large excess at two meteorological stations (Parachinar and D.I.Khan); normal at one station (Saidu Sharif); slight deficit at two stations (Drosh and Bannu); moderate deficit at five stations (Chitral, Balakot, Cherat, Peshawar and Kohat) and in large deficit at two stations (Dir and Kakul). As a whole, the rainfall was slightly below normal during the month throughout the region. According to the meteorological analysis at 00 UTC on 02nd September, 2009, of 925 & 500 hpa depict (Figure 11 a & b) a strong westerly wave from the west and monsoon currents approached from Arabian Sea and Bay of Bengal approached the region and entered the country from north east direction. Due to the interaction between these two systems, it caused widespread thunderstorm and rainfall in the province. Figure 11(c) shows the track of the westerly system. The heaviest amount of rainfall was recorded 90.2 mm on 3rd September at Parachinar. Figure 12 shows normal and actual, whereas Figure 13 illustrates percentage departures from the normal.

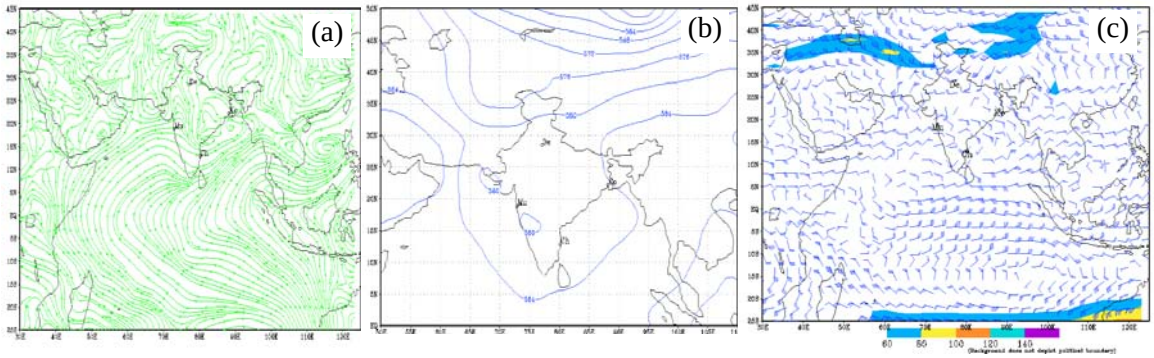

Figure 11: (a) 925 hpa Analysis at 00 UTC of 02 Sep 2009 wind (kt) **(b)** 500 hpa Analysis at 00 UTC of 03 Sep 2009 contour source: RSMC (IMD) New Delhi **(c)** 300 hpa Analysis at 00 UTC of 03 Sep 2009 wind (kt) source: RSMC (IMD) New Delhi showing the passage of jet stream over the region

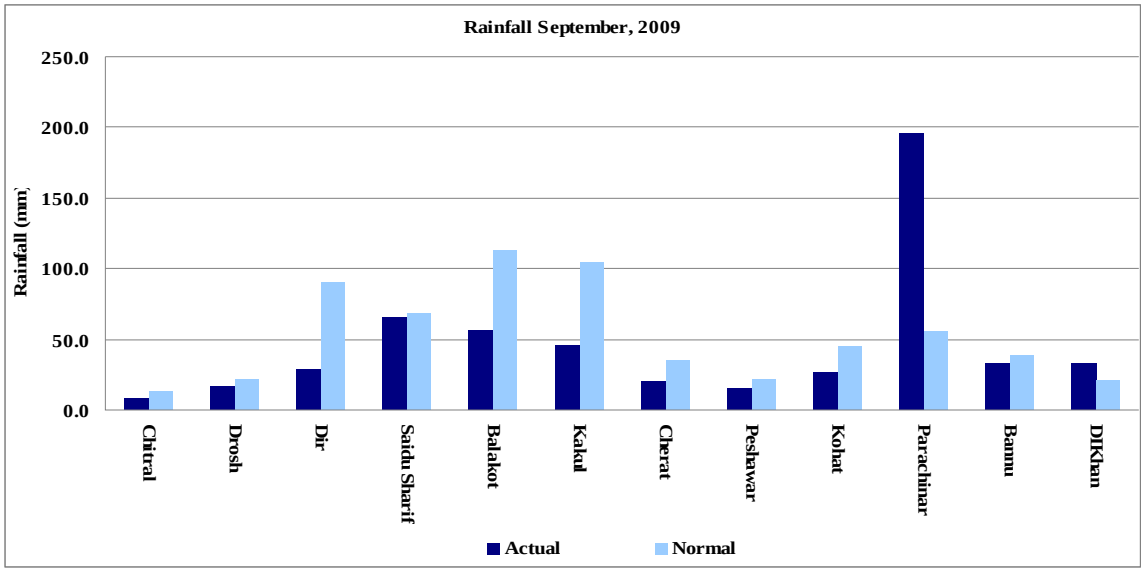

Figure 12: Actual vs Normal Rainfall, Sep 2009

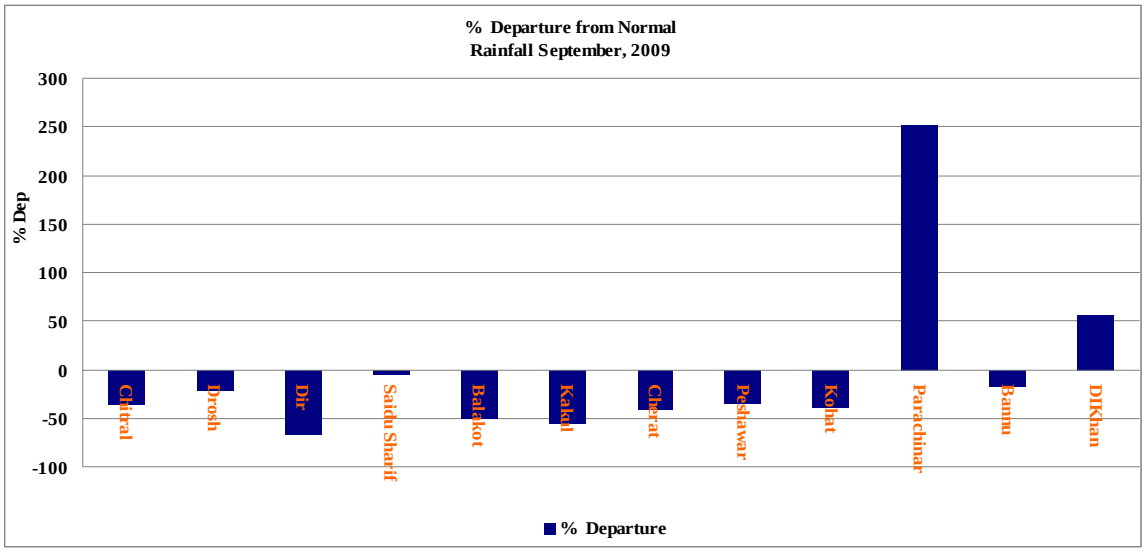

Figure 13: % Departure Rainfall, Sep 2009

Seasonal Rainfall (July-September, 2009)

During the season, rainfall was in large excess at one meteorological observing station (Parachinar); slight excess at one station (D.I.Khan); moderate deficit at seven stations (Chitral, Saidu Sharif, Balakot, Kakul, Cherat, Peshawar and Bannu) and in large deficit at three stations (Drosh, Dir and Kohat). As a whole, Precipitation was moderately below normal by 35 % over the region during the monsoon season. The heaviest amount of rainfall was recorded 487.0 mm at Parachinar during the season. The mean monthly rainfall data with normal and percentage departures from the normal are shown in Figures 14 & 15.

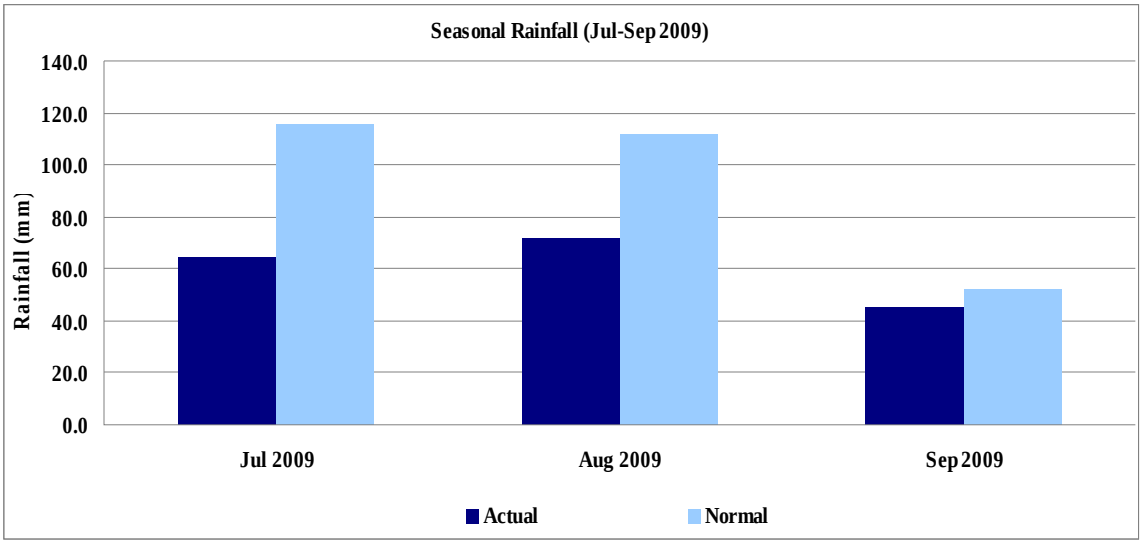

Figure 14: Seasonal Rainfall Actual vs Normal

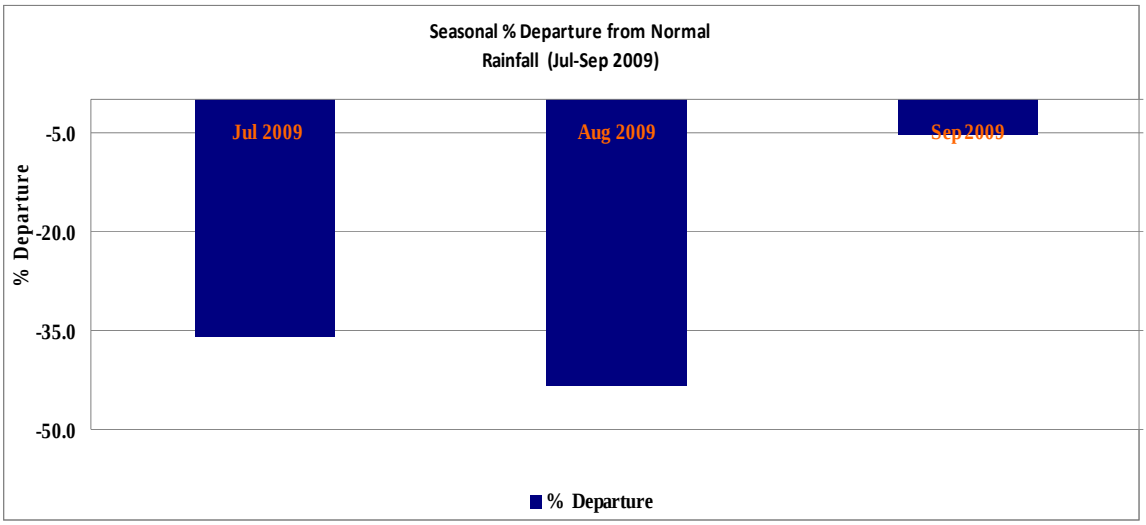

Figure 15: Seasonal Rainfall % Departure

Monthly features of Minimum Temperature Distribution

July 2009

During the month, minimum temperature remained slightly below normal at three stations (Chitral, Drosh and Dir); normal at eleven stations (Saidu Sharif, Balakot, Kakul, Cherat, Peshawar, Kohat and D.I.Khan) and slightly above normal at two stations (Parachinar and Bannu). As a whole, it remained normal almost at all places of the region during the month. The month's lowest minimum temperature was 11.5° C recorded at Dir on 5th July, 2009. Figure 16 shows normal & actual, whereas Figure 17 illustrates departures from the normal.

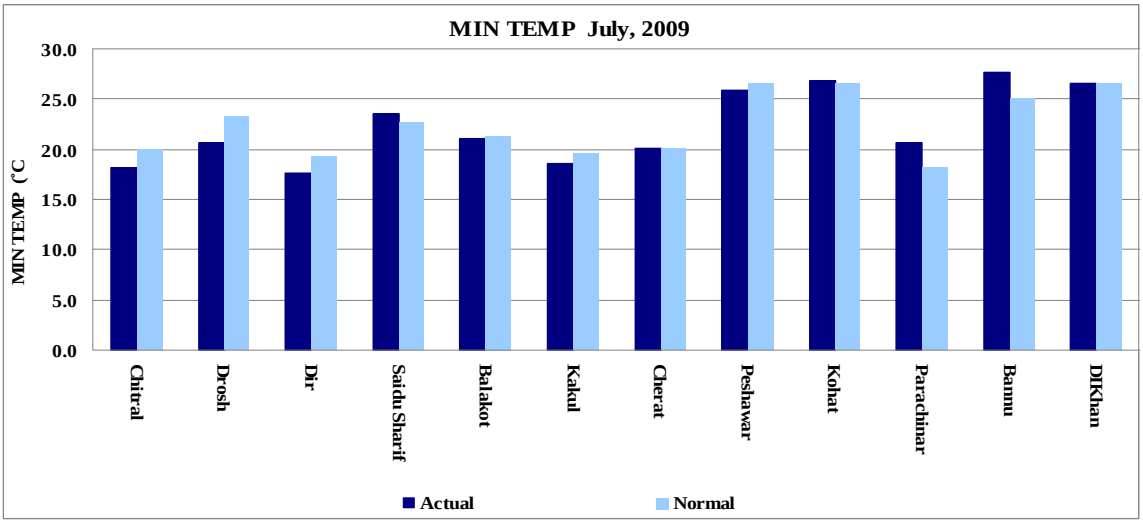

Figure 16: Actual vs Normal Min Temp, Jul 2009

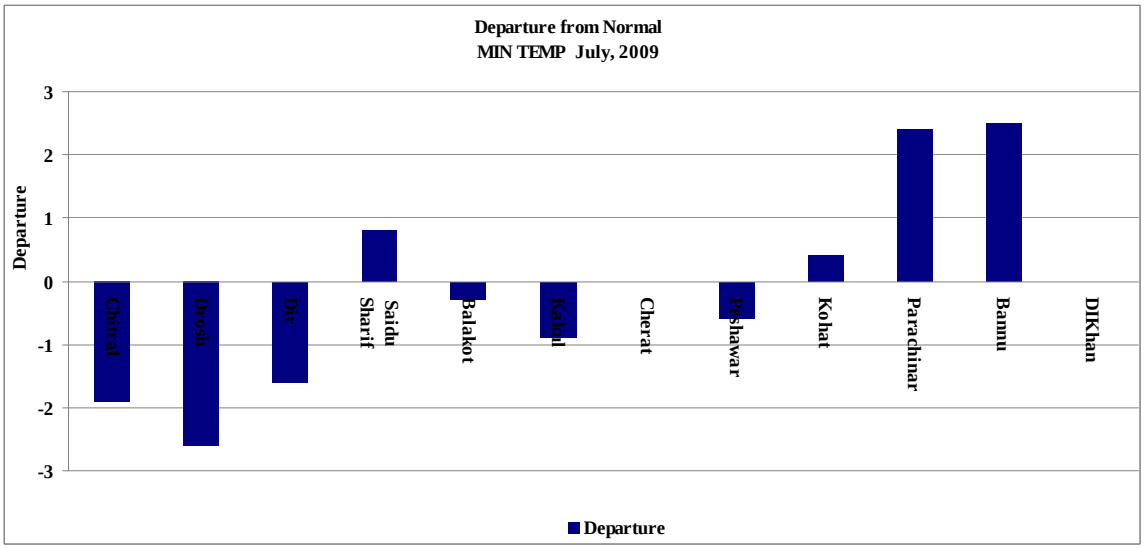

Figure 17: Departure from Min. Temp. Jul 2009

August 2009

During the month, minimum temperature remained slightly below normal at one station (Drosh); normal at seven stations (Chitral, Saidu Sharif, Balakot, Kakul, Cherat, Peshawar and D.I.Khan); slightly above normal at two stations (Dir and Kohat) and appreciably above normal at two stations (Parachinar and Bannu). As a whole, it remained normal almost at all places of the region during the month. The month's lowest minimum temperature was 14.0 °C recorded at Chitral and Kakul on 23rd & 22nd August, 2009 respectively.

Figure 18 shows normal & actual, whereas Figure 19 illustrates departures from the normal.

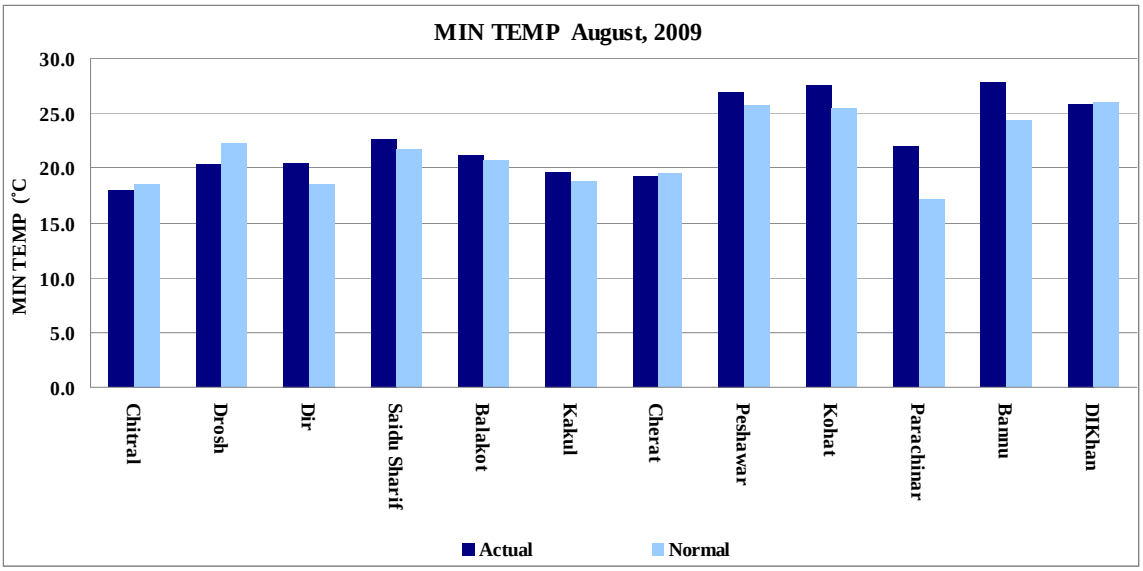

Figure 18: Actual VS Normal, Min. Temp. Aug 2009

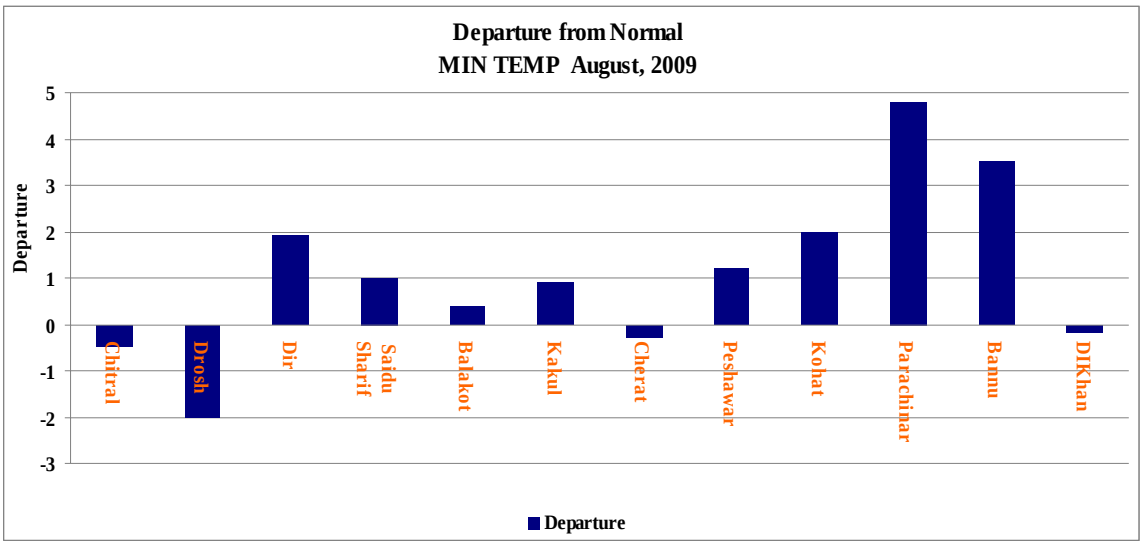

Figure 19: Departure from Min Temp Aug 2009

September 2009

During the month, minimum temperature remained slightly below normal at one station (Drosh); normal at ten stations (Chitral, Dir, Saidu Sharif, Balakot, Kakul, Cherat, Peshawar, Kohat, Bannu and D.I.Khan), and slightly above normal at one station (Parachinar). As a whole, it remained normal at a number of places across the region during the month. The month's lowest minimum temperature was recorded 8.0°C at Chitral on 10th September, 2009.

Figure 20 shows normal & actual, whereas Figure 21 illustrates departures from the normal.

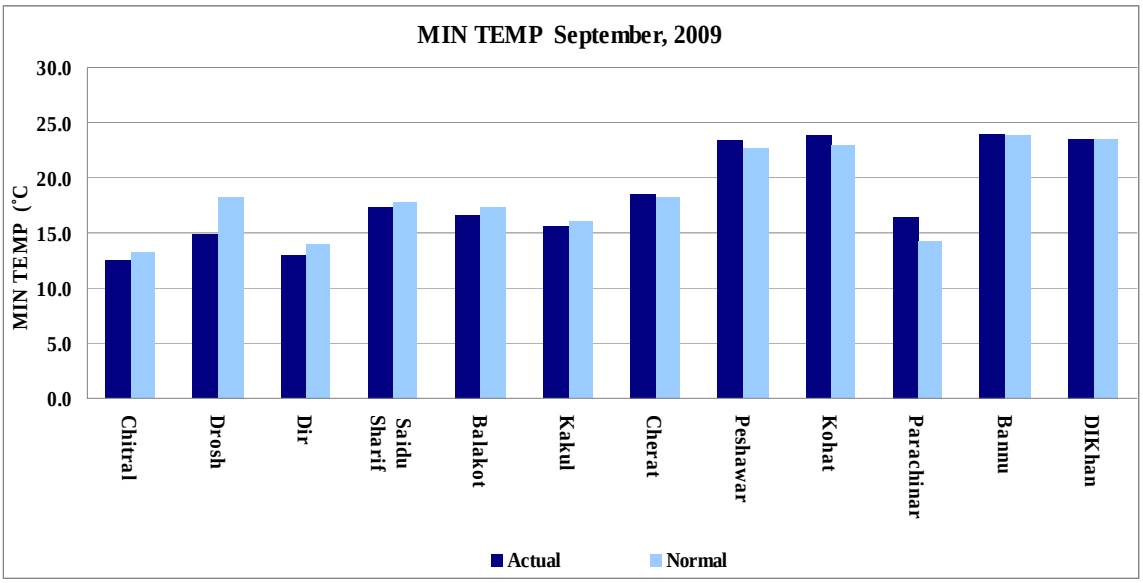

Figure 20: Actual vs Normal Min Temp Sep 2009

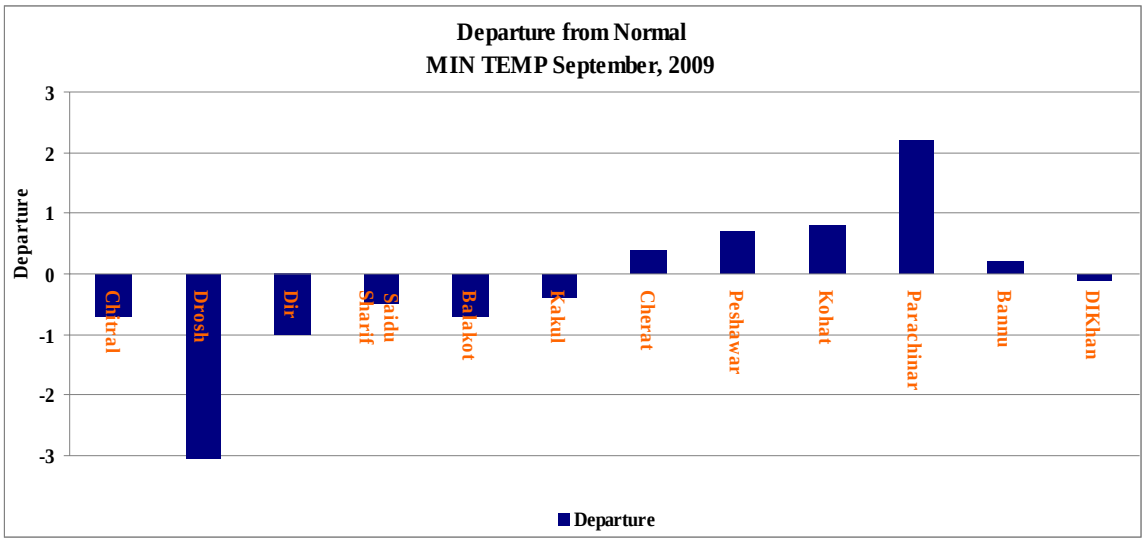

Figure 21: Departure from Min. Temp Sep 2009

Seasonal Minimum Temperature (July-September, 2009)

During the season, minimum temperature remained slightly below normal at one station (Drosh); normal at nine stations (Chitral, Dir, Saidu Sharif, Balakot, Kakul, Cherat, Peshawar, Kohat and D.I.Khan) and slightly below normal at two stations (Parachinar and Bannu). As a whole, it remained normal almost at all places across the region during the season.

The season's lowest minimum temperature was 11.5° C recorded at Dir on 5th July, 2009. Mean monthly minimum temperatures with normal & departures are shown in Figures 22 & 23.

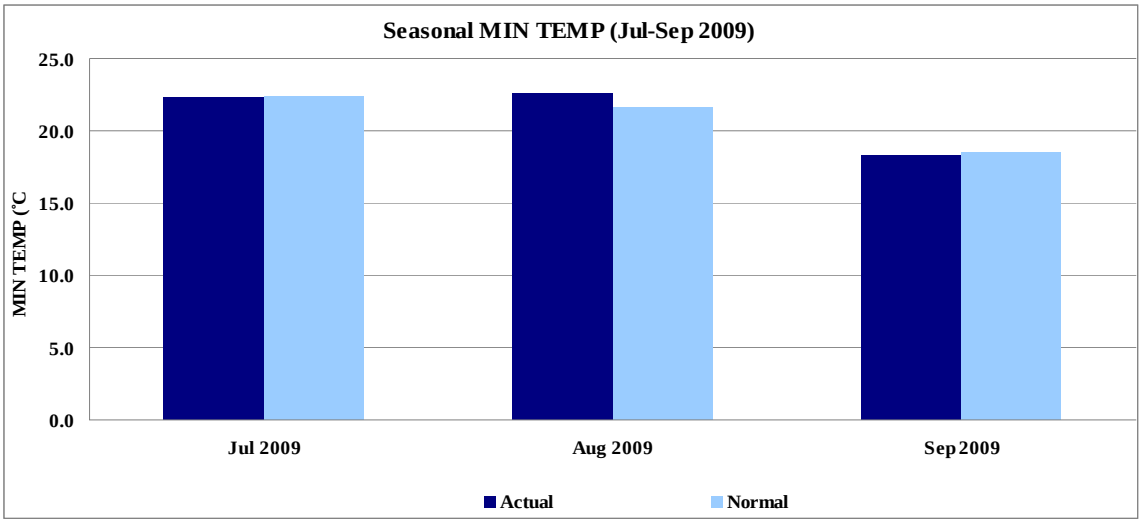

Figure 22: Seasonal Min Temp Actual vs Normal

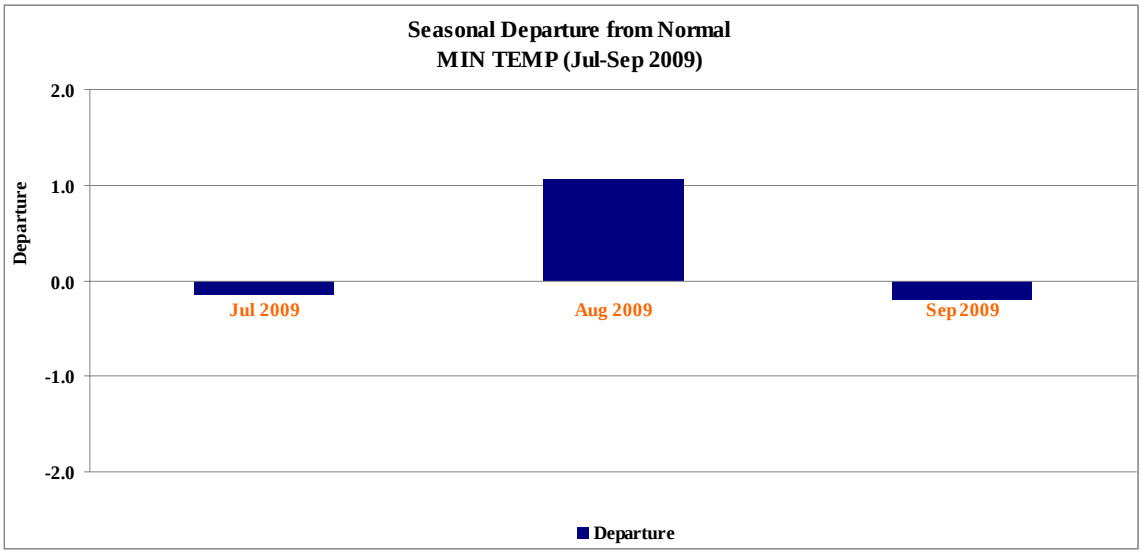

Figure 23: Seasonal Min Temp Departure

Monthly Features of Maximum Temperature Distribution

July 2009

During the month, maximum temperature remained appreciably above normal at two stations (Kakul and Cherat); slightly above normal at three stations (Dir, Saidu Sharif and Balakot) and normal at seven stations (Chitral, Drosh, Peshawar, Kohat, Parachinar, Bannu and D.I.Khan). As a whole, it remained slightly above normal during the month throughout the region. The month's highest maximum temperature was 46.8°C recorded at Bannu on 10th July, 2009.

Figure 24 shows normal & actual, whereas Figure 25 illustrates departures from the normal.

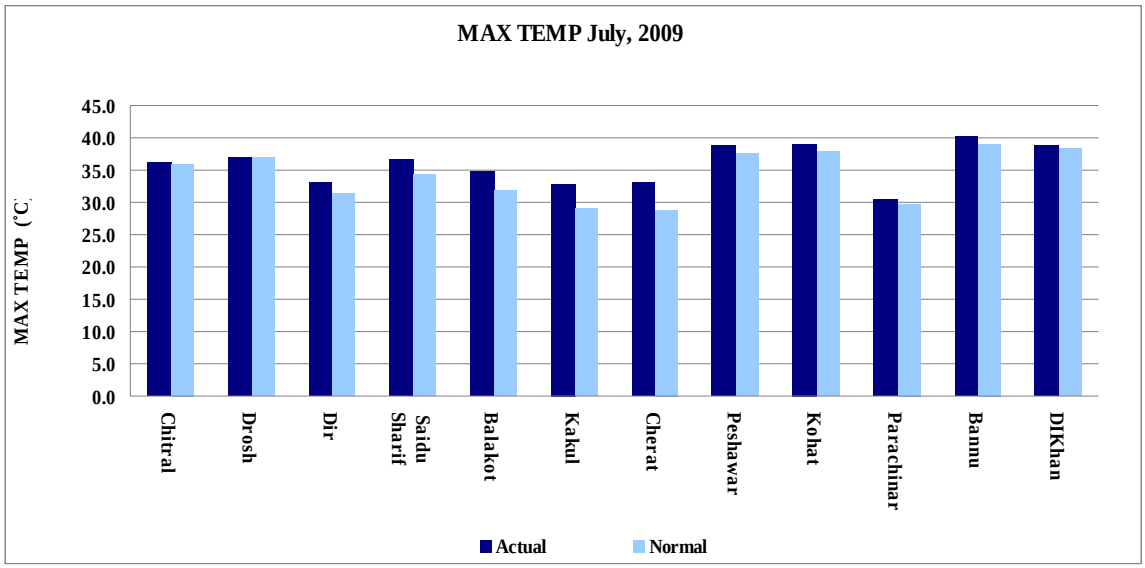

Figure 24: Actual vs Normal Max. Temp, Jul 2009

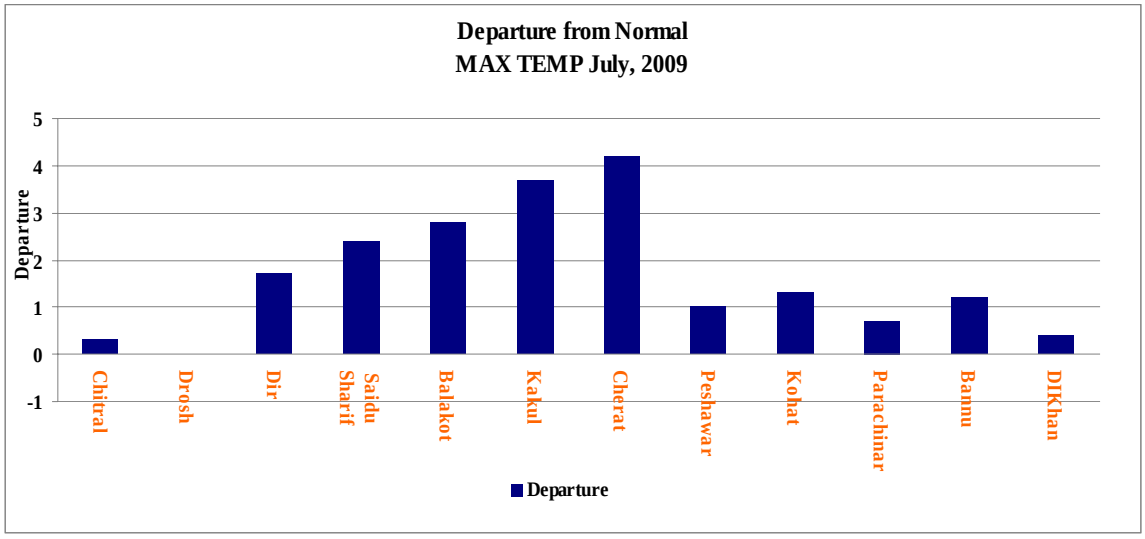

Figure 25: Departure from Max Temp, Jul 2009

August 2009

During the month, maximum temperature remained slightly above normal at eight stations (Chitral, Drosh, Dir, Saidu Sharif, Kakul, Cherat, Kohat and Parachinar); normal at four stations (Balakot, Peshawar, Bannu and D.I.Khan). As a whole, it remained slightly above normal in the area during the month. The month's highest maximum temperature was 45.0 °C recorded at Bannu on 5th August, 2009.

Figure 26 shows normal & actual, whereas Figure 27 illustrates departures from the normal.

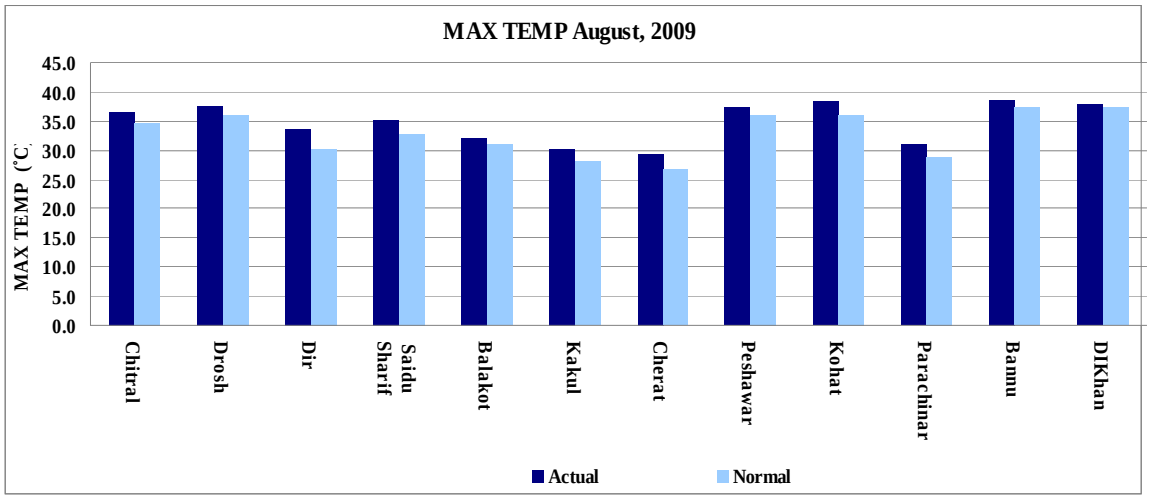

Figure 26: Actual vs Normal Max. Temp, Aug 2009

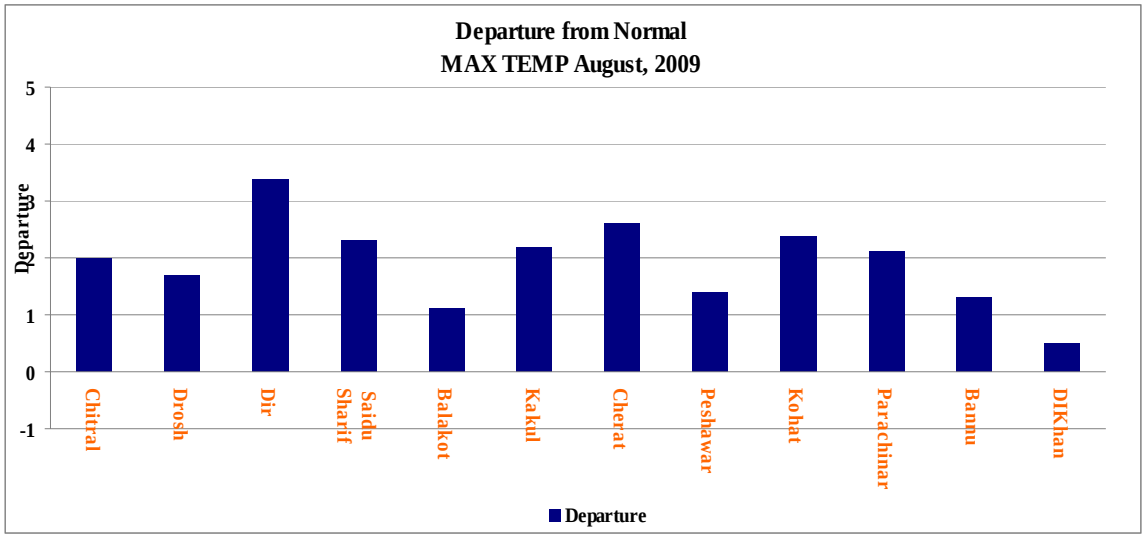

Figure 27: Departure from Max Temp, Aug 2009

September 2009

During the month, maximum temperature remained slightly above normal at four stations (Dir, Kakul, Cherat and Kohat) and normal at eight stations (Chitral, Drosh, Saidu Sharif, Balakot, Peshawar, Parachinar, Bannu and D.I.Khan). As a whole, it remained normal throughout the region during the month. The month's highest maximum temperature was recorded 41.5°C at Kohat on 25th September, 2009.

Figure 28 shows normal & actual, whereas Figure 29 illustrates departures from the normal.

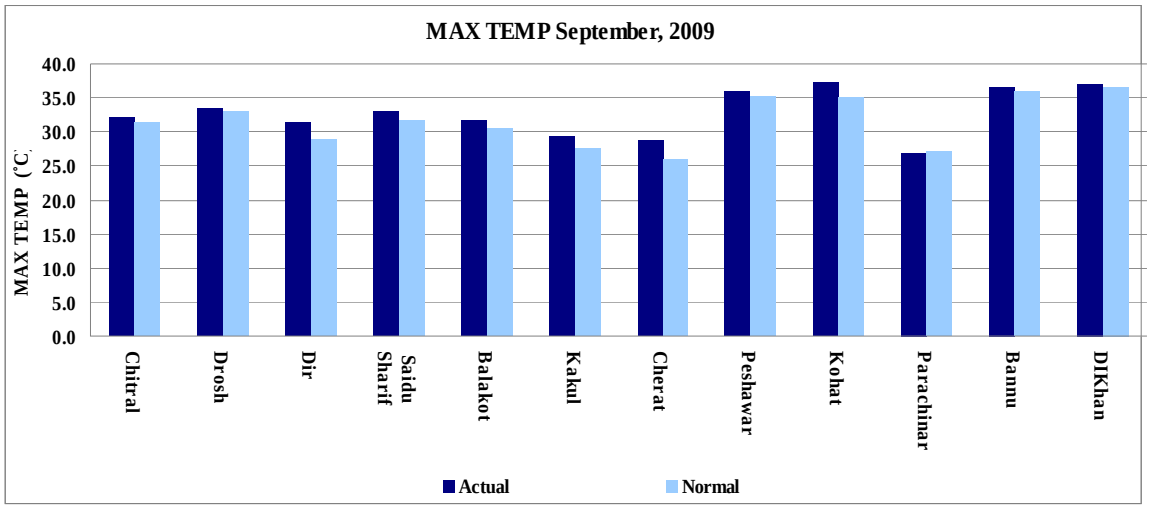

Figure 28: Actual vs Normal Max. Temp, Sep 2009

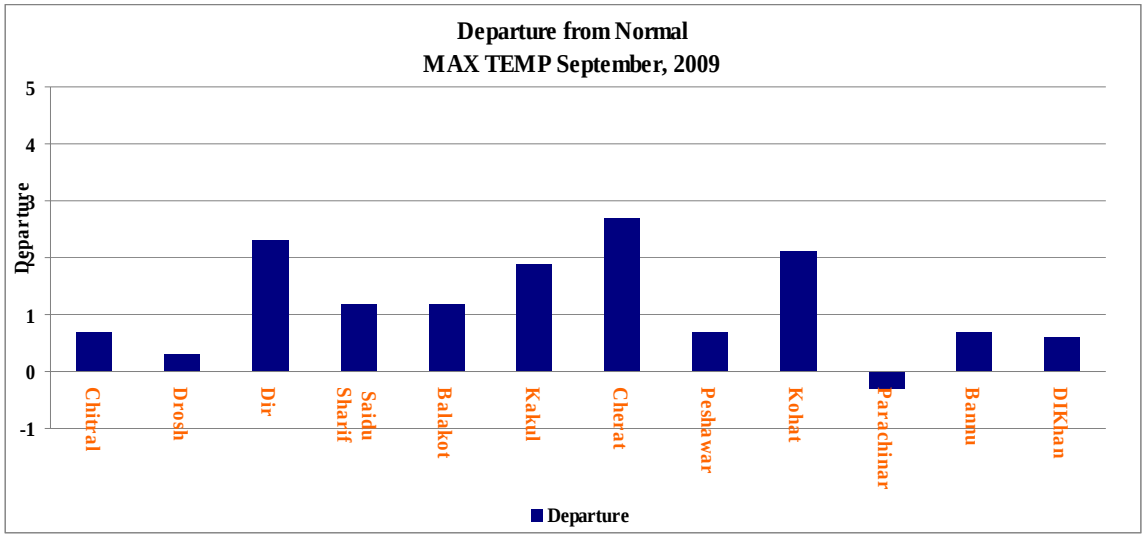

Figure 29: Departure from Max Temp, Sep 2009

Seasonal Maximum Temperature (July-September, 2009)

During the season, maximum temperature remained slightly above normal at six stations (Dir, Saidu Sharif, Balakot, Kakul, Cherat and Kohat) and normal at six stations (Chitral, Drosh, Peshawar, Parachinar, Bannu and D.I.Khan). As a whole, it remained slightly above normal across the region during the month.

The season's highest maximum temperature was 46.8 °C recorded at Bannu on 10th July, 2009. Mean monthly maximum temperatures with normal & departures are shown in Figures 30 & 31.

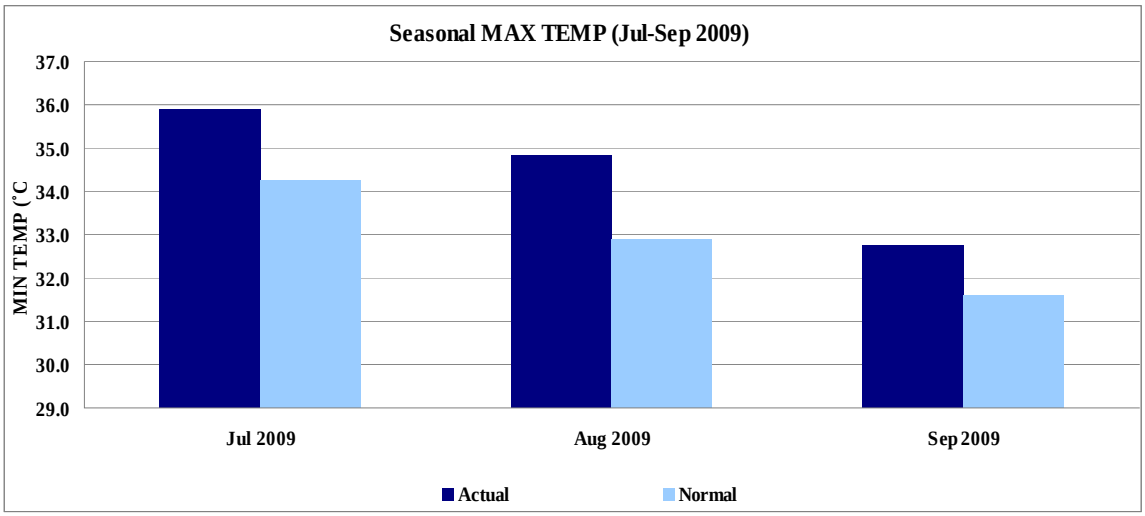

Figure 30: Seasonal Max Temp: Actual vs Normal

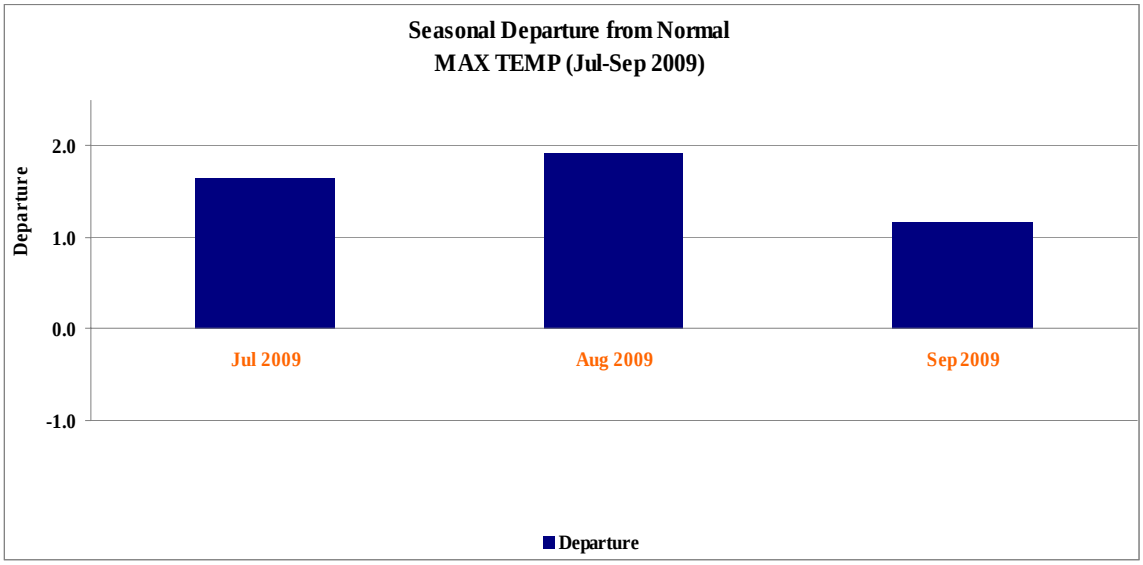

Figure 31: Departure from Seasonal Max Temp

Monthly Features of Mean Temperature Distribution:

July 2009

During the month, mean temperature remained slightly above normal at four observing stations (Saidu Sharif, Cherat, Parachinar and Bannu) and normal at eight stations (Chitral, Drosh, Dir, Balakot, Kakul, Peshawar, Kohat and D. I. Khan). As a whole, it remained normal throughout the region during the month. Figure 32 shows normal and actual whereas Figure 33 illustrates departures from the normal.

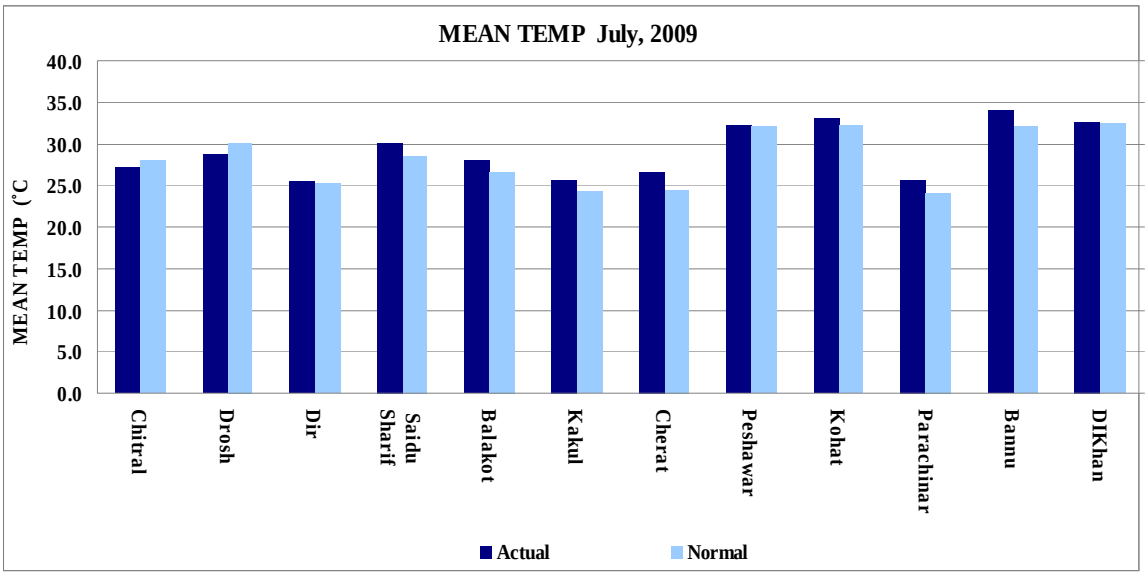

Figure 32: Actual vs Normal Mean Temp, Jul 2009

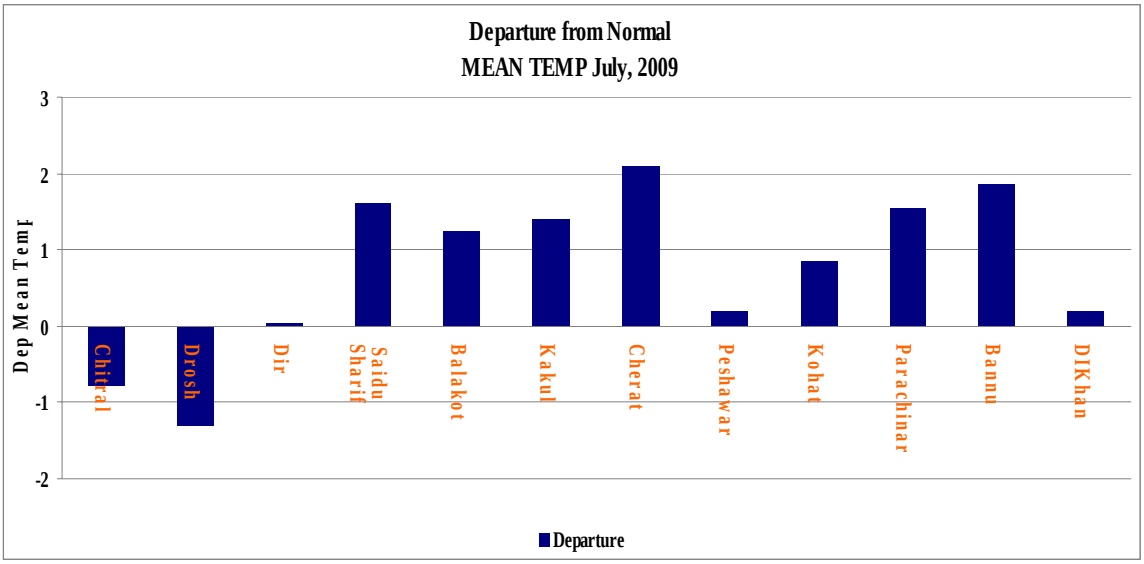

Figure 33: Departure from Mean Temp, Jul 2009

August 2009

During the month, mean temperature remained slightly above normal at six observing stations (Dir, Saidu Sharif, Kakul, Kohat, Parachinar and Bannu) and normal at six stations (Chitral, Drosh, Balakot, Cherat, Peshawar and D.I.Khan). As a whole, it remained normal throughout the region during the month. Figure 34 shows normal and actual whereas Figure 35 illustrates departures from the normal.

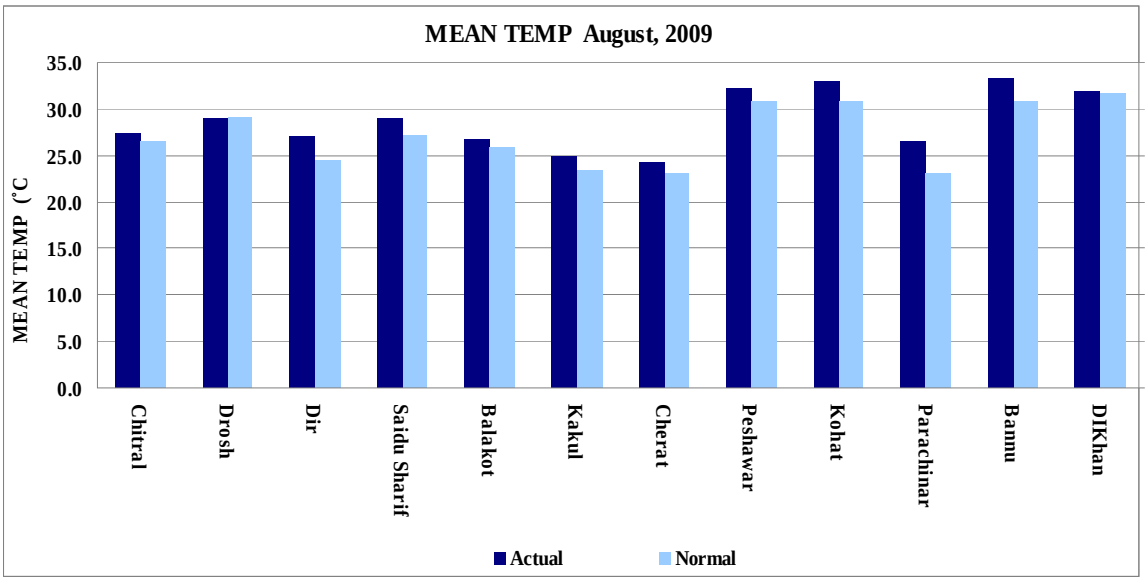

Figure 34: Actual vs Normal Mean Temp. Aug 2009

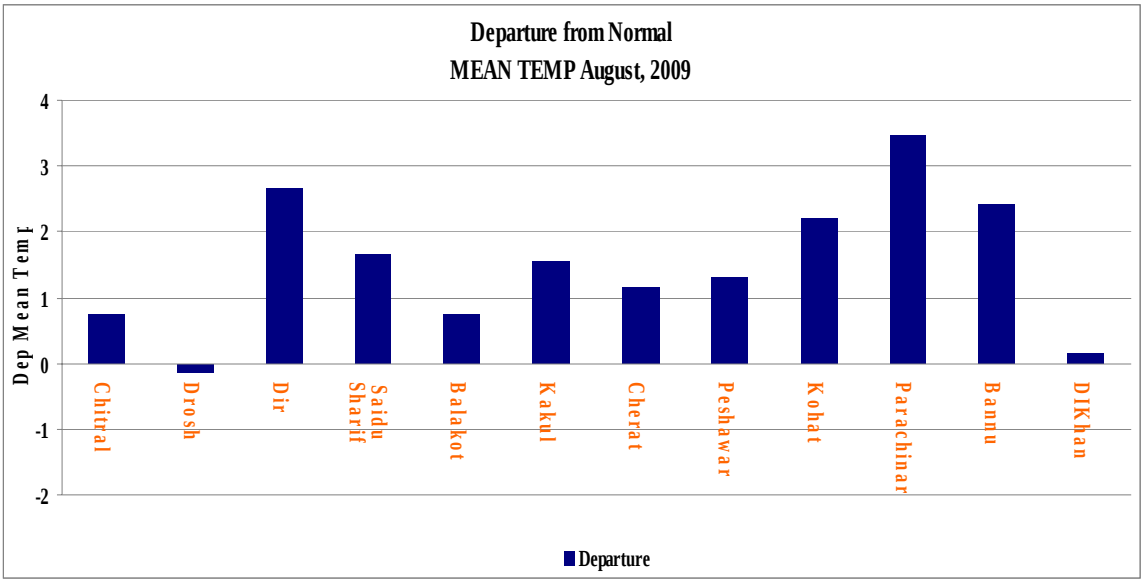

Figure 35: Departure from Mean Temp Aug 2009

September 2009

During the month, mean temperature remained normal at ten observing stations (Chitral, Dir, Saidu Sharif, Balakot, Kakul, Peshawar, Kohat, Parachinar, Bannu and D.I.Khan) and slightly below normal at two stations (Drosh and Cherat). As a whole, it remained normal throughout the region during the month. Figure 36 shows normal and actual whereas Figure 37 illustrates departures from the normal.

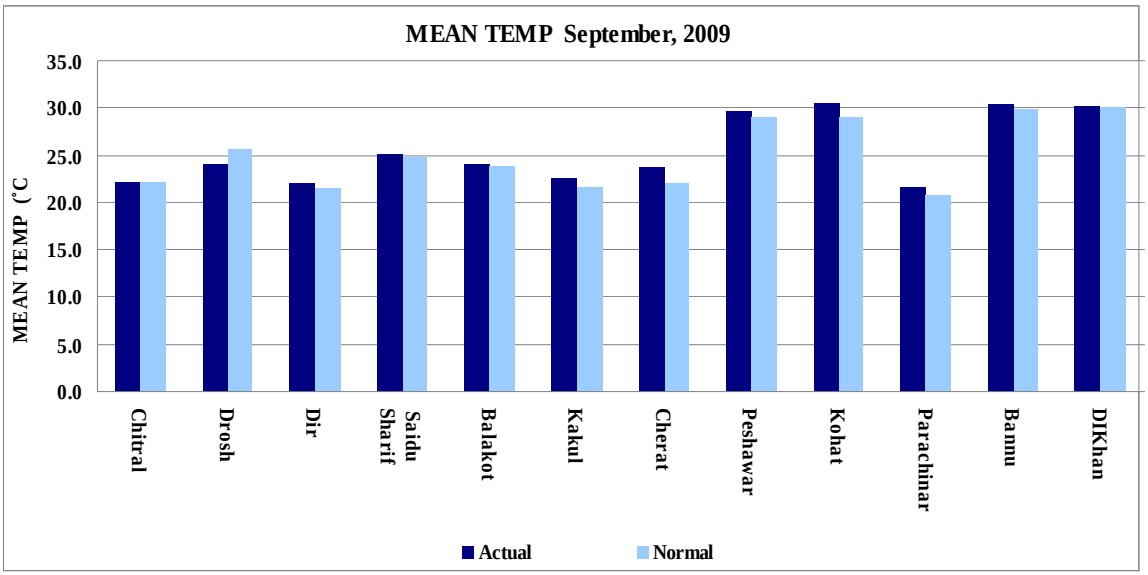

Figure 36: Actual vs Normal Mean Temp, Sep 2009

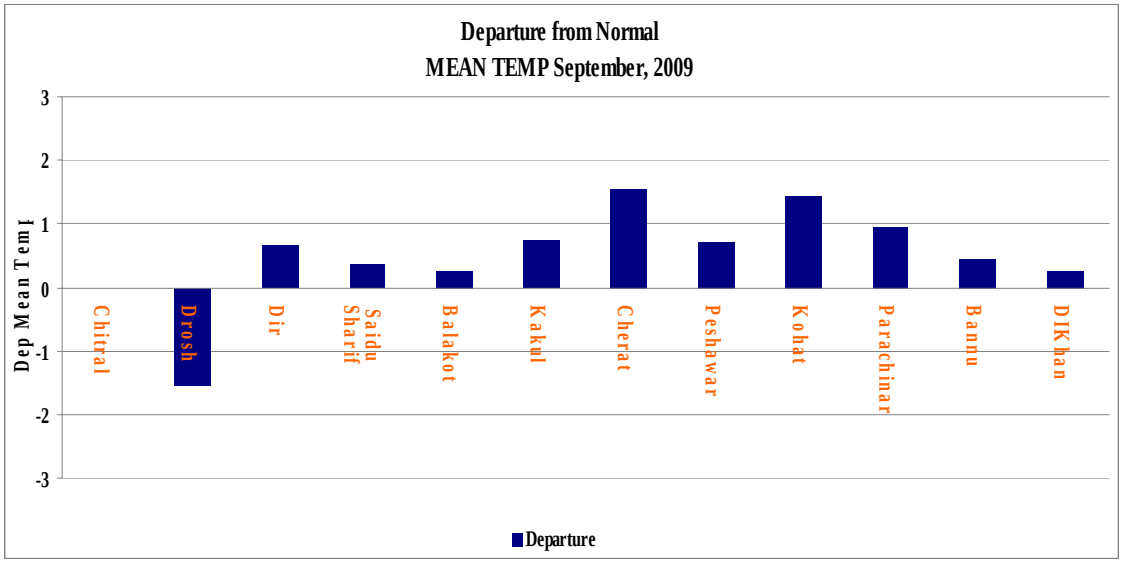

Figure 37: Departure from Mean Temp, Sep 2009

Seasonal Mean Temperature (July-September, 2009)

During the season, mean temperature remained slightly above normal at four stations (Cherat, Kohat, Parachinar and Bannu) and normal at eight observing stations (Chitral, Drosh, Dir, Saidu Sharif, Balakot, Kakul, Peshawar, and D.I.Khan). As a whole, it remained normal throughout the region during the season. Figure 38 shows normal and actual whereas Figure 39 illustrates departures from the normal.

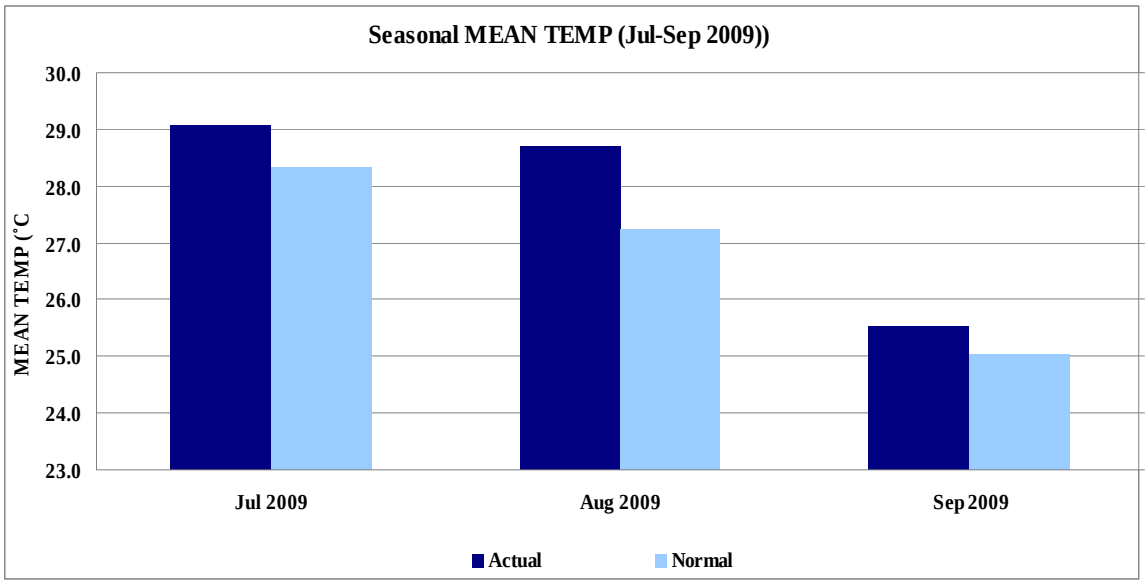

Figure 38: Seasonal Mean Temp, Actual vs Normal

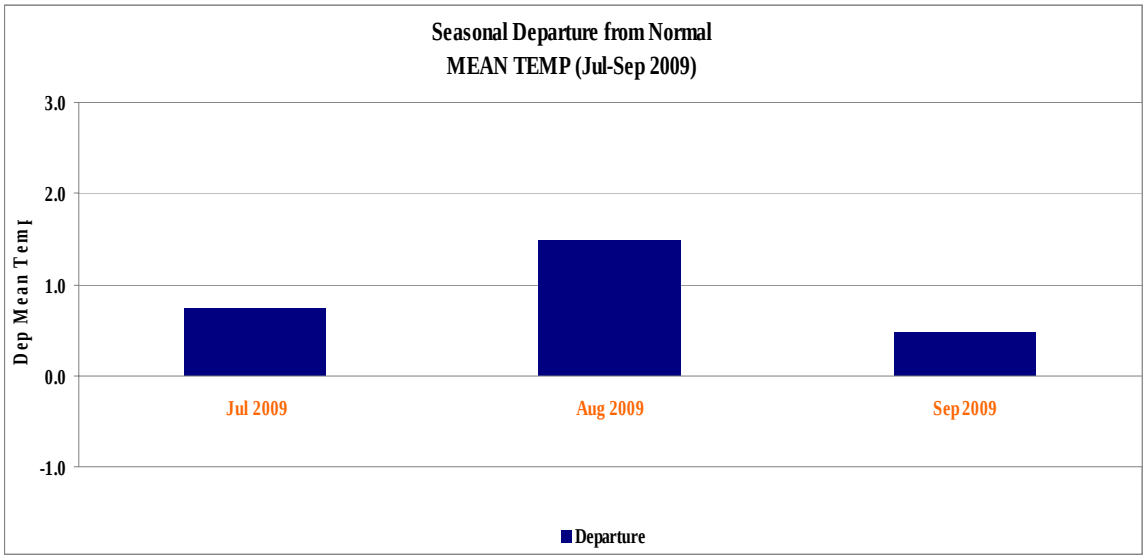

Figure 39: Departure from Seasonal Mean Temp

Conclusion

Southern Oscillation Index (SOI) plays an important role in the climate variability of the region. During summer monsoon, 2009 mainly dry weather prevailed in most parts of the region. However, sometimes, moist currents entered from the Arabian Sea through northeastern parts of the country and caused rainfall at isolated places in the region.

During the months of July and August, rainfall recorded was moderately below normal causing an increase in day temperatures and no change was found in night temperatures due to the subdued rainfall

activity over the region. Slightly below normal rainfall was recorded during September and it did not change the day as well as the night temperatures.

As a whole, KPK received moderately below normal rainfall by 35 % during the monsoon season due to the prevailing El Nino phenomenon in the Pacific Ocean. The mean temperature remained normal during the study period across the region.

Consequently, scanty rainfall distribution during the season resulted in a bad crop conditions.

Recommendations

It is recommended that further study is required to correlate the regional weather parameters in more detail with that of the global parameters for good prediction of monsoon climate condition.

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Table 1: Mean and Anomalous Sea Surface Temperature (°C) for the Most Recent 12 Months

MONTH	PACIFIC SST								ATLANTIC SST				GLOBAL	
	NINO 1+2		NINO 3		NINO 3.4		NIN0 4		N. ATL		S. ATL		TROPICS	
	0-10S		5N-5S		5N-5S		5N-5S		5N-20N		0-20S		10N-10S	
	90W-80W		150W-90W		170W-120W		160E-150W		60W-30W		30W-10E		0W-360W	
SEP 09	0.3	20.8	0.8	25.7	0.8	27.5	0.8	29.3	0.5	28.4	0.2	23.2	0.5	27.6
AUG 09	0.8	21.6	1.0	25.9	0.8	27.5	0.8	29.2	0.3	27.9	0.2	23.2	0.5	27.5
JUL 09	0.9	22.7	1.0	26.6	0.9	28.0	0.6	29.2	0.3	27.3	0.3	24.0	0.5	27.8
JUN 09	0.7	23.7	0.7	27.1	0.6	28.1	0.6	29.2	-0.1	26.6	0.5	25.3	0.5	28.3
MAY 09	0.6	24.9	0.4	27.4	0.3	28.0	0.3	29.0	-0.2	26.0	0.9	26.9	0.4	28.7
APR 09	0.5	26.0	0.0	27.4	-0.2	27.5	0.0	28.4	0.1	25.8	0.7	27.5	0.2	28.6
MAR 09	-0.1	26.4	-0.6	26.4	-0.5	26.7	-0.3	27.8	0.0	25.4	0.6	27.5	0.0	28.2
FEB 09	-0.1	26.0	-0.6	25.8	-0.7	26.0	-0.7	27.4	0.0	25.4	0.3	26.7	0.0	27.7
JAN 09	-0.2	24.3	-0.6	25.0	-1.0	25.5	-0.7	27.4	0.4	26.3	0.3	25.7	0.0	27.5
DEC 08	-0.4	22.4	-0.5	24.6	-0.7	25.7	-0.6	27.7	0.6	27.2	0.4	24.9	0.1	27.5
NOV 08	-0.2	21.5	-0.2	24.8	-0.2	26.3	-0.3	28.1	0.6	28.0	0.1	24.0	0.1	27.6
OCT 08	-0.2	20.8	-0.1	24.8	-0.3	26.3	-0.1	28.3	0.7	28.6	0.2	23.5	0.2	27.5
SEP 08	0.7	21.2	0.3	25.1	-0.2	26.5	-0.4	28.1	0.7	28.6	0.2	23.1	0.2	27.3

Table 2: Station wise Rainfall (mm) for each Month & Season as a Whole (July to September, 2009)

Stations	Jul-09			Aug-09			Sep-09			Season (Jul - Sep)		
	Actual	Normal	Dep %	Actual	Normal	Dep %	Actual	Normal	Dep %	Actual	Normal	Dep %
Chitral	6.0	5.5	9	0.0	6.6	-100	8.4	13.3	-37	14.4	25.4	-43
Drosh	5.3	22.1	-76	0.0	20.0	-100	16.9	21.8	-22	22.2	63.9	-65

Stations	Jul-09			Aug-09			Sep-09			Season (Jul - Sep)		
	Actual	Normal	Dep %	Actual	Normal	Dep %	Actual	Normal	Dep %	Actual	Normal	Dep %
Dir	59.2	154.1	-62	35.0	156.0	-78	29.0	90.6	-68	123.2	400.7	-69
Saidu Sharif	61.1	152.6	-60	99.6	125.9	-21	65.0	68.1	-5	225.7	346.6	-35
Balakot	126.4	372.0	-66	223.0	271.0	-18	56.8	113.2	-50	406.2	756.2	-46
Kakul	152.5	263.6	-42	176.6	266.5	-34	45.9	104.3	-56	375.0	634.4	-41
Cherat	85.5	93.4	-8	40.0	96.4	-59	20.0	34.5	-42	145.5	224.3	-35
Peshawar	22.5	46.1	-51	43.5	72.6	-40	14.6	22.2	-34	80.6	140.9	-43
Kohat	29.0	77.6	-63	26.0	115.2	-77	27.0	44.5	-39	82.0	237.3	-65
Parachinar	140.0	99.4	41	101.4	97.4	4	195.0	55.4	252	436.4	252.2	73
Bannu	8.0	38.1	-79	54.3	50.6	7	32.3	39.1	-17	94.6	127.8	-26
DIKhan	75.7	60.5	25	58.6	61.7	-5	32.4	20.8	56	166.7	143.0	17

Table 3: Station Wise Minimum Temperature (°C) for Each Month & Season as a Whole (July to September, 2009)

Stations	Jul-09			Aug-09			Sep-09			Season (Jul - Sep)		
	Actual	Normal	Dep	Actual	Normal	Dep	Actual	Normal	Dep	Actual	Normal	Dep
Chitral	18.1	20.0	-2	18.0	18.5	-1	12.5	13.2	-1	16.2	17.2	-1
Drosh	20.7	23.3	-3	20.3	22.3	-2	14.8	18.2	-3	18.6	21.3	-3
Dir	17.6	19.2	-2	20.4	18.5	2	12.9	13.9	-1	17.0	17.2	0
Saidu Sharif	23.5	22.7	1	22.7	21.7	1	17.3	17.8	-1	21.2	20.7	0
Balakot	21.0	21.3	0	21.1	20.7	0	16.6	17.3	-1	19.6	19.8	0
Kakul	18.6	19.5	-1	19.7	18.8	1	15.6	16.0	0	18.0	18.1	0
Cherat	20.1	20.1	0	19.2	19.5	0	18.6	18.2	0	19.3	19.3	0
Peshawar	25.9	26.5	-1	26.9	25.7	1	23.4	22.7	1	25.4	25.0	0
Kohat	26.9	26.5	0	27.5	25.5	2	23.8	23.0	1	26.1	25.0	1

Stations	Jul-09			Aug-09			Sep-09			Season (Jul - Sep)		
	Actual	Normal	Dep	Actual	Normal	Dep	Actual	Normal	Dep	Actual	Normal	Dep
Parachinar	20.6	18.2	2	22.0	17.2	5	16.5	14.3	2	19.7	16.6	3
Bannu	27.6	25.1	3	27.8	24.3	4	24.0	23.8	0	26.5	24.4	2
DIKhan	26.6	26.6	0	25.8	26.0	0	23.5	23.6	0	25.3	25.4	0

Table 4: Station Wise Maximum Temperature (°C) for Each Month & Season as a Whole (July to September, 2009)

Stations	Jul-09			Aug-09			Sep-09			Season (Jul - Sep)		
	Actual	Normal	Dep	Actual	Normal	Dep	Actual	Normal	Dep	Actual	Normal	Dep
Chitral	36.3	36.0	0	36.6	34.6	2	32.0	31.3	1	35.0	34.0	1
Drosh	36.9	36.9	0	37.6	35.9	2	33.4	33.1	0	36.0	35.3	1
Dir	33.1	31.4	2	33.7	30.3	3	31.3	29.0	2	32.7	30.2	2
Saidu Sharif	36.7	34.3	2	35.1	32.8	2	32.9	31.7	1	34.9	32.9	2
Balakot	34.8	32.0	3	32.1	31.0	1	31.7	30.5	1	32.9	31.2	2
Kakul	32.8	29.1	4	30.2	28.0	2	29.4	27.5	2	30.8	28.2	3
Cherat	33.0	28.8	4	29.3	26.7	3	28.7	26.0	3	30.3	27.2	3
Peshawar	38.7	37.7	1	37.4	36.0	1	35.9	35.2	1	37.3	36.3	1
Kohat	39.1	37.8	1	38.5	36.1	2	37.2	35.1	2	38.3	36.3	2
Parachinar	30.5	29.8	1	30.9	28.8	2	26.9	27.2	0	29.4	28.6	1
Bannu	40.2	39.0	1	38.7	37.4	1	36.7	36.0	1	38.5	37.5	1
DIKhan	38.8	38.4	0	37.8	37.3	1	37.1	36.5	1	37.9	37.4	1

Table 5: Station Wise Mean Temperature (°C) for Each Month (July to September, 2009)

Stations	Jul-09			Aug-09			Sep-09			Season (Jul - Sep)		
	MEAN	NORMAL MEAN	Dep	MEAN	NORMAL MEAN	Dep	MEAN	NORMAL MEAN	Dep	MEAN	NORMAL	Dep
Chitral	27.2	28.0	-1	27.3	26.6	1	22.3	22.3	0	25.6	25.6	0
Drosh	28.8	30.1	-1	29.0	29.0	0	24.1	25.6	-2	27.3	28.2	-1
Dir	25.4	25.2	0	27.1	24.4	3	22.1	21.4	1	24.8	23.7	1
Saidu Sharif	30.1	28.5	2	28.9	27.3	2	25.1	24.8	0	28.0	26.8	1
Balakot	27.9	26.7	1	26.6	25.8	1	24.2	23.9	0	26.2	25.5	1
Kakul	25.7	24.3	1	25.0	23.4	2	22.5	21.8	1	24.4	23.2	1
Cherat	26.6	24.5	2	24.3	23.1	1	23.7	22.1	2	24.8	23.2	2
Peshawar	32.3	32.1	0	32.2	30.8	1	29.7	29.0	1	31.4	30.6	1
Kohat	33.0	32.2	1	33.0	30.8	2	30.5	29.1	1	32.2	30.7	1
Parachinar	25.6	24.0	2	26.5	23.0	3	21.7	20.7	1	24.6	22.6	2
Bannu	33.9	32.1	2	33.3	30.9	2	30.4	29.9	0	32.5	31.0	2
DIKhan	32.7	32.5	0	31.8	31.6	0	30.3	30.1	0	31.6	31.4	0