WEATHER IN PAKISTAN
MONSOON SEASON (July-September 2003)

Akhlaq Jameel*, Arif Mahmood* & S. Anzar Ali Jafri*

Introduction

Monsoon rain commenced over the country during first week of July. Heavy to very heavy rain occurred in the country particularly in Sindh and Balochistan during a number of days in July and August and on a few days in September. Due to these devastating rains, number of cities particularly the interiors of Sindh and Balochistan were badly affected. At least 180 people were killed and more than 700000 people were affected, more than 100000 houses were damaged, thousands of acres of standing crops in flood-hit areas were destroyed. Thousands of cattle and livestock were also killed. Severe heat wave/heat wave conditions also prevailed over some parts of Balochistan and Southern parts of Sindh during few days in the season. A number of westerly low pressure waves continued to pass across northern and central parts of the country during the monsoon season. A monsoon depression was formed over Northwest Bay of Bengal which later moved towards Lower Sindh and North Arabian Sea and finally dissipated over there during last week of July. Under its influence heavy rains occurred in Sindh, South Balochistan and at a few places in Southern areas of the Punjab.

Seasonal rainfall (July-September)

Seasonal rainfall out of 56 meteorological observing stations in the whole country was in large excess in 23, moderate excess in 5, slight excess in 10, normal in 5, slight deficit in 4, moderate deficit in 7 and in large deficit in 2.

Rainfall was in large excess in Gupis, Bunji, Astor, Kohat, Peshawar, Sialkot, Shorekot, Bahawalnagar, Khanpur, Quetta, Dalbandin, Sibbi, Kalat, Pasni, Moenjodaro, Jacobabad, Rohri, Nawabshah, Hyderabad, Badin, Chhor, Karachi (A/P) and Karachi (Masroor), moderate excess in Skardu, Cherat, D.I.Khan, Zhob and Jiwani, slight excess in Gilgit, Parachinar, Chitral, Drosh, Risalpur, Mianwali, Multan, Bahawalpur, Khuzdar and Padidan, Normal in Saidu Sharif, Balakot, Chaklala, Jhelum and Faisalabad, slight deficit in Chilas, Kotli, Kakul and Lahore(PBO), moderate deficit in Muzaffarabad, Garhi Dupatta, Dir, Murree, Sargodha, Bar khan and Panjgur and in large deficit in Lahore(A/P) and Nokkundi. The principal amounts of rainfall (mm) during the month of July,

* Pakistan Meteorological Department

August and September 2003 are given in Table-5. Seasonal station- wise percentage rainfall departures are given in Fig. 1 and percentage departures in Table.1, Whereas province-wise graphic representation of rainfall is given in Fig. 2.

Significant Features Month Wise:

July

Weather and associated synoptic features

Details of weather systems formed during the month are given in Table 2. Rain/thundershowers occurred almost at all the places on 11– 14 days in Hazara, Rawalpindi, Gujranwala, Zhob, Hyderabad and Karachi divisions, on 7 – 9 days in Lahore, Sukkur and Mirpurkhas divisions, on 4 – 6 days in FATA, Malakand, Kohat, Peshawar, Sargodha, Bahawalpur, Faisalabad, Kalat, Mekran and Larkana divisions, on 1-3 days in Bannu, D.I.Khan, Multan, D.G.Khan and Sibbi divisions.

Rain/thunderstorms with a few duststorms in plains also occurred at a few places on 12 – 15 days in Malakand and Kalat divisions, on 7-10 days in Peshawar, Rawalpindi, Gujranwala, Bahawalpur, Quetta, Mekran and Sukkur divisions, on 4 - 6 days in FATA, Hazara, Faisalabad, Larkana and Hyderabad divisions, on 1-3 days in Bannu, Kohat, D.I.Khan, Sargodha, Lahore, Multan, D.G. Khan, Zhob, Sibbi, Mirpurkhas and Karachi divisions.

Rainfall distribution

The rainfall was in large excess in 24 meteorological observing stations (Gupis,

Kohat, Peshawar, Risalpur, Cherat, Sialkot, Shorekot, Khanpur, Quetta, Dalbandin, Sibbi, Kalat, Khuzdar, Pasni, Jiwani, Jacobabad, Rohri, Nawabshah, Padidan, Hyderabad, Badin, Chhor, Karachi (A/P) and Karachi (Masroor); moderate excess in 3 meteorological observing stations (Mianwali, Bahawalnagar and Moenjodaro); slight excess in 2 meteorological observing stations (Lahore(PBO) and Zhob); normal in 9 meteorological observing stations (Gilgit, Astor,

Kotli, Kakul, Chaklala, Jhelum, Sargodha, Bahawalpur and Panjgur); slight deficit in 3 meteorological observing stations (Muzaffarabad, Garhi Dupatta and D.I.Khan); moderate deficit in 7 meteorological observing stations (Skardu, Bunji, Parachinar, Balakot, Murree, Lahore(A/P) and Multan) and in large deficit in 8 meteorological observing stations (Chilas, Chitral, Dir, Drosh, Saidu Sharif, Faisalabad, Nokkundi and Barkhan). The principal amounts of rainfall(mm) during the month are given in Table-5.

Table 1: Station wise rainfall (mm) for each month and season as a whole (July – September 2003)

		July			August			September			Season		
		Actual (mm)	Normal (mm)	Dep % (mm)	Actual (mm)	Normal (mm)	Dep% (mm)	Actual (mm)	Normal (mm)	Dep% (mm)	Actual (mm)	Normal (mm)	Dep% (mm)
1	Gupis	22	11	100	65	16	306	72	9	700	159	36	342
2	Gilgit	15	16	-6	9	15	-40	18	7	157	42	38	11
3	Skardu	6	9	-33	12	11	9	22	7	214	40	27	48
4	Bunji	9	15	-40	21	18	17	64	9	611	94	42	124
5	Chilas	0	12	-100	5	12	-58	19	3	533	24	27	-11
6	Astor	23	21	9	29	23	26	81	19	326	133	63	111
7	Muzaffar-abad	264	328	-19	111	249	-55	125	108	16	500	685	-27
8	Garhi Dupatta	231	276	-16	139	253	-45	89	111	-20	459	640	-28
9	Kotli	254	283	-10	200	291	-31	123	95	29	577	669	-14
10	Parachinar	74	105	-29	120	98	-22	116	51	127	310	254	22
11	Chitral	0	6	-100	1	7	-86	25	8	213	26	21	24
12	Dir	41	146	-72	76	160	-53	138	82	68	255	388	-34
13	Drosh	6	22	-73	55	22	150	21	22	-5	82	66	24
14	Saidu Sharif	67	146	-54	142	143	-1	104	57	82	313	346	-9
15	Kakul	285	258	10	159	261	-39	105	97	8	549	616	-11

Table 1: Station wise rainfall (mm) for each month and season as a whole (July – September 2003)

		July			August			September			Season		
		Actual (mm)	Normal (mm)	Dep % (mm)	Actual (mm)	Normal (mm)	Dep% (mm)	Actual (mm)	Normal (mm)	Dep% (mm)	Actual (mm)	Normal (mm)	Dep% (mm)
16	Balakot	225	359	-37	267	293	-9	248	101	145	740	753	-2
17	Kohat	210	70	200	181	111	63	107	40	167	498	221	125
18	Peshawar	156	42	271	114	68	68	111	18	517	381	128	198
19	Risalpur	180	113	59	123	126	-2	42	40	5	345	279	24
20	Cherat	139	91	53	70	97	-28	78	35	123	287	223	29
21	D.I.Khan	46	61	-25	82	57	44	57	18	217	185	136	36
22	Chaklala	267	267	0	261	310	-16	217	98	121	745	675	10
23	Murree	196	340	-42	196	326	-40	135	147	-8	527	813	-35
24	Jhelum	226	237	-5	245	221	11	88	78	13	559	536	4
25	Sialkot	617	293	111	452	259	75	137	104	32	1206	656	84
26	Mianwali	128	99	29	113	105	8	53	48	10	294	252	17
27	Sargodha	102	108	-5	56	129	-57	30	26	15	188	263	-29
28	Faisalabad	47	115	-59	135	90	50	42	29	45	224	234	-4
29	Shorekot	181	103	76	52	6	767	0	25	-100	233	134	74
30	Lahore (P.B.O)	252	202	25	109	164	-33	16	61	-74	377	427	-12
31	Lahore A/P	115	218	-47	63	173	-63	46	66	-30	224	457	-51

Table 1: Station wise rainfall (mm) for each month and season as a whole (July – September 2003)

		July			August			September			Season		
		Actual (mm)	Normal (mm)	Dep % (mm)	Actual (mm)	Normal (mm)	Dep% (mm)	Actual (mm)	Normal (mm)	Dep% (mm)	Actual (mm)	Normal (mm)	Dep% (mm)
32	Multan	35	61	-43	71	33	115	17	11	55	123	105	17
33	Bahawal-pur	52	53	-2	81	43	88	1	12	-92	134	108	24
34	Bahawal-Nagar	113	81	39	69	34	103	73	9	711	255	124	106
35	Khanpur	85	27	215	148	23	543	0	15	-100	233	65	258
36	Quetta	46	13	254	0	12	-100	0	0	0	46	25	84
37	Dalbandin	87	4	2075	0	1	-100	0	0	0	87	5	1640
38	Nokkundi	0	1	-100	0	1	-100	0	0	0	0	2	-100
39	Zhob	59	49	20	87	59	47	7	11	-36	153	119	29
40	Barkhan	39	100	-61	103	88	17	14	46	-69	156	234	-33
41	Sibbi	61	36	69	51	30	70	14	8	75	126	74	70
42	Kalat	68	12	467	0	10	-100	0	2	-100	68	24	183
43	Khuzdar	112	45	149	21	57	-63	0	6	-100	133	108	23
44	Panjgur	25	25	0	0	9	-100	0	1	-100	25	35	-29
45	Pasni	48	6	700	0	12	-100	0	1	-100	48	19	153
46	Jiwani	15	8	87	3	4	-25	0	0	0	18	12	50
47	Moenjo-	69	48	44	75	25	200	3	4	-25	147	77	91

Table 1: Station wise rainfall (mm) for each month and season as a whole (July – September 2003)

		July			August			September			Season		
		Actual (mm)	Normal (mm)	Dep % (mm)	Actual (mm)	Normal (mm)	Dep% (mm)	Actual (mm)	Normal (mm)	Dep% (mm)	Actual (mm)	Normal (mm)	Dep% (mm)
	daro												
48	Jacobabad	135	37	265	54	26	108	0	11	-100	189	74	155
49	Rohri	92	26	254	0	20	-100	0	10	-100	92	56	64
50	Nawab-shah	301	52	479	37	45	-18	0	10	-100	338	107	216
51	Padidan	96	42	129	9	31	-71	0	12	-100	105	85	24
52	Hyderabad	209	57	267	77	61	26	0	21	-100	286	139	106
53	Badin	303	71	327	59	90	-34	0	34	-100	362	195	86
54	Chhor	354	79	348	167	75	123	0	23	-100	521	177	194
55	Karachi (A/P)	270	85	218	10	67	-85	0	20	-100	280	172	63
56	Karachi (Masroor)	253	66	283	4	45	-91	0	23	-100	257	134	92

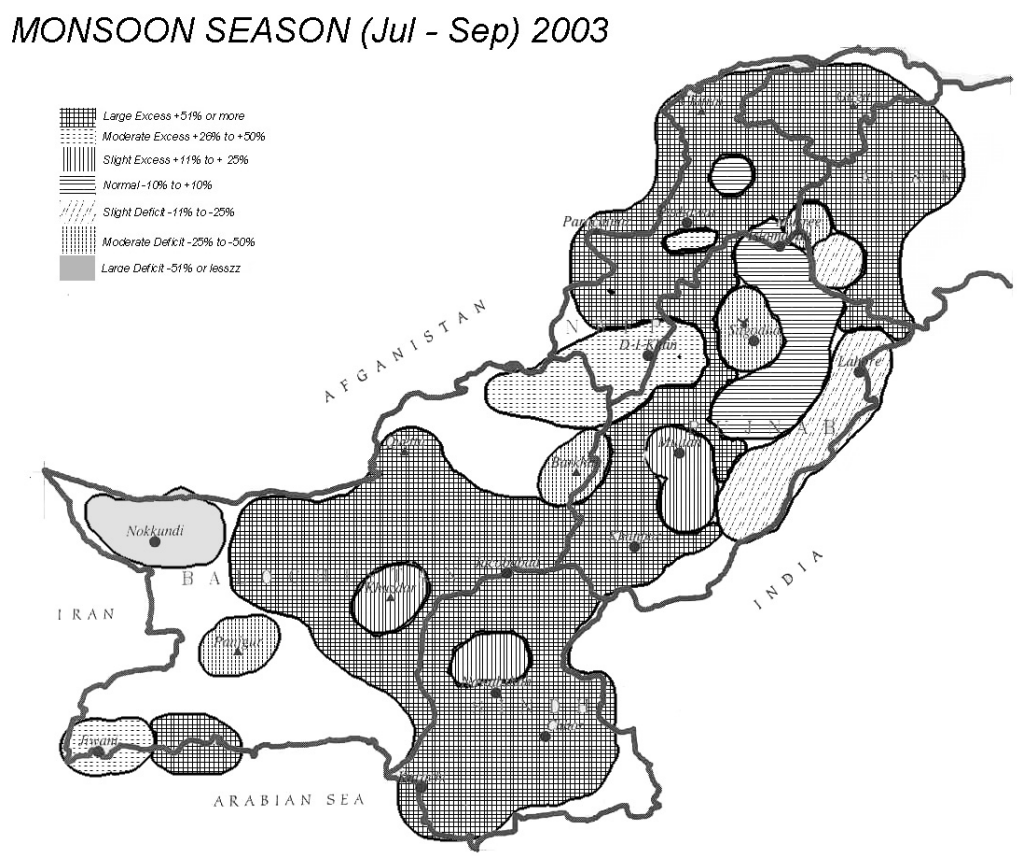

Figure: 1: Rainfall for Jul - Sep, 2003 (Normal / Departure)

Designed by Shahid Mahmood (Feb, 2005)

Table: 2
Detail of weather systems during July 2003

S.No	System	Period	Place of the first location	Direction of Movement	Place of dissipation	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
A) Depression						
1	Depression	26-29	Northwest Bay of Bengal and adj. areas	Northwest-wards & then Westwards	North Arabian Sea & adj. Makran coast	It was first seen as a cyclonic circulation extending up to mid-tropospheric levels over Northwest Bay of Bengal and neighbourhood on 18th July. Under its influence a low pressure area formed over Northwest Bay of Bengal and adjoining West Bengal coast on 21. Associated cyclonic circulation extended upto mid-troposphere levels and tilted southwestwards with height. It was formed on 25 morning and intensified as a depression at 0300 UTC on 26 and lay centered near Lat. 21.5° N & Long. 86.0° E. It then moved in a west northwesterly direction and lay centered at about Lat. 22.5° N & Long. 80.0° E over East Madhya Paradesh at 0300 UTC of 27. It continued to move in a west northwesterly direction and lay centered at 0300 UTC of 28 near Lat. 24.5° N & Long.

						76.0° E over East Rajasthan and adj. areas. It then moved westwards and weakened into a low pressure area at 0300 UTC of 29 over North Arabian Sea and adj. areas. It further weakened into a trough over Northwest Arabian Sea and adj. Mekran coast at 0300 UTC of 31 July.
B) Low Pressure						
1)	Low pressure upto mid-tropo-spheric level	3-8	East Arabian Sea as Mumbai coast (India)	Northwesterly direction	Lower Sindh and adjoining areas	Became a trough in lower Sindh and adjoining areas.
2)	Low pressure	11-14	Northeast Rajasthan(India)and adjoining areas	West/northwesterly direction	Southern areas of the Punjab and neighbour hood	Became less marked in southern areas of the Punjab
3)	Low pressure	16-18	Upper Sindh & adjoining southern areas of the Punjab	Stationary	Upper Sindh & adjoining Southern areas of the Punjab	Become less-marked
4)	Trough extended from seasonal low	19-20	Lower Sindh & adjoining areas	Stationary	Lower Sindh & adjoining areas	Became less-marked
5)	Low pressure	22-27	Southern areas of Punjab &	South-southwest-	Northeast Arabian sea	Moved away southwestwards

			adjoining Upper Sindh	wards		
6)	Do	29-31	Sindh & adjoining areas	Northwards & then northeastwards	NWFP & adjoining areas	Moved away north- eastwards
C) Western disturbance/eastward moving systems						
1)	Low pressure extended up to mid-trop. level	1-2	Upper NWFP & adjoining areas	Eastwards	Kashmir and adjoining areas	Moved away Northeastwards.
2)	Do	6-9	Northeast Afghanistan and adjoining areas	Eastward	Do	Do
3)	Low pressure	11-14	Upper NWFP and adjoining areas	Do	Do	Do
4)	Do	16-18	Do	Northeastwards	North of NWFP & adjoining areas	Do
5)	Do	19-21	Do	Eastwards	Kashmir of adjoining areas	Do
6)	Do	22-23	Do	Northeastwards	Northeast of Kashmir & adjoining areas	Do
7)	Trough of low	24-29	Do	Eastwards	Kashmir & adjoining areas	Do

Temperature distribution

Heat wave conditions prevailed on 4 days in Mekran division, on 1-2 days in Quetta, Bahawalpur, Sibbi and Zhob divisions. Hot day conditions prevailed on 8 days in Quetta division and on 1 day in Sargodha division. Day temperatures were appreciably to markedly above normal on 3-5 days in Malakand, Hyderabad, Mirpurkhas and Karachi divisions and on 1 day in FATA, Faisalabad and Peshawar divisions. They were appreciably to markedly below normal on 10 days in Hyderabad division, on 6-8 days in Peshawar, Bahawalpur, Gujranwala and Sukkur divisions, on 3-5 days in Lahore, Multan, Sibbi, Faisalabad, Zhob, Larkana and Mekran divisions, on 2 days in Malakand, FATA, Rawalpindi, Sibbi, Mirpurkhas and Karachi divisions. They were considerably below normal on 3-5 days in Sukkur and Larkana divisions, on 1 day in Gujranwala, Hyderabad, Sibbi, Peshawar and Zhob divisions. During the month the highest maximum temperature in plains of the country was 46.7° C recorded at Sibbi (Sibbi division) on 3 July 2003.

Disastrous weather events and associated damages

Torrential rains in Sindh and Balochistan caused widespread damage to lives, propertiesand crops. Thousands of acres of crops damage badly in different districts of Sindh and Balochistan. According to the press report more then 9000 Cattle-head had been perished in the districts of Dadu, Thatta, Tharparkar and Larkana. About 4 lac people were affected by heavy rains and floods in different districts of Sindh. More than 80 people were killed in different districts of Sindh in rain-related incidents. About 600 fishermen were reported missing along the coastal areas of Sindh and Balochistan. Heavy rain in district Sahiwal and Okara left two persons dead and six injured. Several mud houses were collapsed and flooding ruined acres of agricultural land and destroying crops.

August

Weather and associated synoptic features:-

Details of weather systems formed during the month are given in Table 3. Rain/thundershowers with a few duststorms in plains occurred almost at a number of places on 11 – 15 days in Hazara, Kohat, Rawalpindi, Gujranwala and Zhob divisions, on 7- 9 days in FATA, Malakand, Sargodha and Lahore divisions, on 3- 4 days in Bannu, Peshawar, D.I.Khan, Faisalabad, Bahawalpur, Hyderabad and Mirpurkhas divisions and on 1-2 days in Multan, Sibbi, Larkana, Sukkur and Karachi divisions. Rain/thunderstorms with a few duststorms in plains also occurred either at isolated places on 9 – 11 days in Malakand, Peshawar, Rawalpindi and Faisalabad divisions, on 4-6 days in FATA, Hazara, Bannu, Gujranwala, Lahore, Bahawalpur, Zhob, Kalat and Hyderabad

divisions, on 1-3 days in Kohat, D.I.Khan, D.G.Khan, Mekran, Sukkur and Karachi divisions.

Rainfall distribution

The rainfall was in large excess in 14 meteorological observing stations (Gupis, Drosh, Kohat, Peshawar, Sialkot, Shorekot, Multan, Bahawalpur, Bahawalnagar, Khanpur, Sibbi, Moenjodaro, Jacobabad, and Chhor); moderate excess in 5 meteorological observing stations (Astor, D.I.Khan, Faisalabad, Zhob and Hyderabad); slight excess in 4 meteorological observing stations (Bunji, Parachinar, Jhelum and Barkhan); normal in 5 meteorological observing stations (Skardu, Saidu Sharif, Balakot, Risalpur and Mianwali); slight deficit in 3 meteorological observing station (Chaklala, Jiwani and Nawabshah); moderate deficit in 8 meteorological observing stations (Gilgit, Garhi Dupatta, Kotli, Kakul, Cherat, Murree, Lahore(PBO) and Badin) and in large deficit in 17 meteorological observing stations (Chilas, Muzaffarabad, Chitral, Dir, Sargodha, Lahore(A/P), Quetta, Dalbandin, Nokkundi, Kalat, Khuzdar, Panjgur, Pasni, Rohri, Padidan, Karachi (A/P) and Karachi (Masroor). The principal amounts of rainfall (mm) during the month are given in Table-5.

Temperature distribution

Heat wave conditions prevailed on 2 days in Quetta division. Hot day conditions also prevailed on 7 days in Quetta division. Day temperatures were considerably above normal on 1 day in Mirpurkhas division. They were appreciably to markedly above normal on 1-2 days in Malakand, Sargodha, Rawalpindi, Mirpurkhas, Hyderabad and Karachi divisions. They were appreciably to markedly below normal on 3-5 days in Malakand, Lahore, Mirpurkhas, Rawalpindi, Sibbi, Gujranwala, Bahawalpur and Zhob divisions, on 1-2 days in Mekran, Hyderabad, Peshawar, FATA, D.I.Khan, Sargodha, Faisalabad, Quetta, Larkana, Sukkur and Multan divisions. During the month the highest maximum temperature in plains of the country was 46.0° C recorded at Nokkundi (Quetta division) on 1 August 2003.

Disastrous weather events and damages

Heavy rain in Sindh and Balochistan continued to cause widespread damage to lives properties and crops. According to press report more than 100 people were killed and more then 3 lac people affected and thousands of houses were damaged due to heavy rains and floods in Sindh and Balochistan. Thousands of cattle and livestock were also killed. Thousands of acres of standing crops were destroyed in flood-hit areas. Heavy rain claimed four lives in Punjab and NWFP. Several mud housed were collapsed. Thousand acres of crops were destroyed.

TABLE 3: Details of the weather system during August 2003

S. No	System	Period	Place of first location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
A)						
1)	Low Pressure	1-3	Lower Sindh & adjoining areas	Stationary	Lower Sindh & adjoining areas	Less- marked on 4
2)	Low pressure	5-7	Sindh & adjoining areas	Northeastwards	South Punjab & adj. areas	Less-marked on 8
3)	Do	20-21	East Uttar Paradesh	Westnorthwest-wards	Do	Less-marked on 22
4)	Do	22-28	West Bay of Bengal and adjoining coastal areas	Northwest-wards	Do	Less-marked on 29
B) Western disturbances/eastward moving systems						
1	Low pressure area extending upto mid-tropospheric level	1-6	Upper NWFP and adjoining areas	Eastwards	Kashmir and adjoining areas	Moved away Northeast-wards
2	Do	7-13	Do	Do	Do	Do
3	Do	14-22	North Afghanistan and adjoining NWFP	Do	Do	Do
4)	Do	27-31	Upper NWFP & adjoining areas	Do	Do	Do

September

Weather and associated synoptic features

Details of weather systems formed during the month are given in Table 4. Rain/thundershowers with a few duststorms in plains occurred almost at all the places or at a number of places on 9 – 11 days in Malakand, Hazara and Gujranwala divisions, on 5 – 7 days in FATA, Kohat, Rawalpindi and Lahore divisions, on 1 – 3 days in Bannu, Peshawar, D.I.Khan, Sargodha, Faisalabad, Multan, Zhob and Sibbi divisions. Rain/thunderstorms with duststorms in plains also occurred either at a few places or at isolated places on 8 – 11 days in Malakand and Rawalpindi divisions, on 3 – 5 days in FATA, Hazara, Lahore, Bahawalpur and Zhob divisions and on 1-2 days in Bannu, Kohat, Peshawar, D.I.Khan, Gujranwala, Sargodha, Faisalabad, D.G.Khan and Larkana divisions.

Rainfall distribution

The rainfall was in large excess in 19 meteorological observing stations (Gupis, Gilgit, Skardu, Bunji Chilas Astor, Parachinar, Chitral, Dir, Saidu Sharif, Balakot, Kohat, Peshawar, Cherat, D.I.Khan, Chaklala, Multan, Bahawalnagar and Sibbi); moderate excess in 3 meteorological observing stations (Kotli, Sialkot and Faisalabad); slight excess in 3 meteorological observing stations (Muzaffarabad, Jhelum and Sargodha); normal in 9 meteorological observing stations (Drosh, Kakul, Risalpur, Murree, Mianwali, Quetta, Dalbandin, Nokkundi and Jiwani); slight deficit in 2 meteorological observing stations (Garhi Dupatta and Moenjodaro); moderate deficit in 2 meteorological observing stations (Lahore(A/P) and Zhob) and in large deficit in 18 meteorological observing stations (Shorekot, Lahore(PBO) , Bahawalpur, Khanpur, Barkhan, Kalat, Khuzdar, Panjgur, Pasni, Jacobabad, Rohri, Nawabshah, Padidan, Hyderabad, Badin, Chhor, Karachi (A/P) and Karachi (Masroor). The principal amounts of rainfall (mm) during the month are given in Table-5.

Temperature distribution

Severe heat wave conditions prevailed on 1 day in Mekran division. Heat wave conditions prevailed on 3 days each in Quetta and Mekran divisions. Hot day conditions prevailed on 4 days in Quetta division. Day temperatures were appreciably to markedly above normal on 3 – 4 days in Malakand and Karachi divisions, on 1 day each in Sukkur, Peshawar and Mirpurkhas divisions. They were appreciably to markedly below normal on 4-6 days in FATA, D.I.Khan, Rawalpindi, Bahawalpur, Hazara, Gujranwala, Faisalabad and Quetta divisions, on 1-3 days in Lahore, Multan, Peshawar, Sargodha, Sibbi , Karachi, Zhob, Kalat,

Sukkur, Mekran and Larkana divisions. They were considerably below normal on 1-3 days in Hazara, D.I.Khan, Rawalpindi and Sargodha divisions. During the month the highest maximum temperature in plains of the country was 42.0° C recorded at Nokkundi (Quetta division) on 11 & 12 September 2003.

Disastrous weather events and damages

The gusty wind and hailstorm hit the twin cities of Rawalpindi and Islamabad at mid night on 23-09-2003. According to press report 4 person were dead, over a dozen injured and it caused large scale damage to the WAPDA installation including three Cessna planes which were parked in the hanger of Rawalpindi Flying Club. The winds blew at a speed of 100 to 167 km per hour. Dozens of stall at the art and craft fare at Rawalpindi Arts council were destroyed by the storm causing a loss of million of rupees to the stall-holders and injured several peoples.

Acknowledgement:

The authors are grateful to Mr. Nadeem Faisal, A.M, CDPC and Mr. Abu Saad Khan, Met. Asstt., Mr. Farooq Dar, Met. Asstt, Mr. Khalid Siddiqui, S.O and Mr. Muhammad Zahoor, S.O, MAC, Karachi for their help in data collection and computer work for the preparation of this document.

Table 4: Details of weather system during September 2003

S.No	System	Period	Place of first location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A)	Low Pressure					
1)	Low pressure	27-30	Southern areas of the Punjab & adjoining areas	Southwards	Lower Sindh & adjoining areas	Less marked on 1 Oct.
(B) Western disturbances/Eastward moving systems						
1	Low pressure extended upto mid-tropospher-ic level	3-9	Upper NWFP and adjoining areas	Northeastwards	Kashmir and adjoining areas	Moved away Northeast-wards
2	Do	12-15	Do	Do	Do	Do
3	Do	23-29	Do	Do	Do	Do

Table 5: Principal amounts of rainfall (≥30 mm)

Date	July	August	September
(1)	(2)	(3)	(4)
1	Islamabad 52, Chaklala 48	Sialkot 86, Rawalpindi 65 & Islamabad 54	Nil
2	Nil	Kamra 33	Nil
3	Nil	Sialkot 93, Kamra 90, Jhelum 85, Risalpur 63, Rawalpindi 56, Lahore 46, Mandi Bahauddin 35 & Zhob 32	Nil
4	Chhor 33	Sialkot 162, Malam Jabba 63, Balakot 60, Parachinar 54, Murree 51, Jhang 45, Bannu 43, Saidu Sharif 35 & Mianwali 35	Islamabad 169, Kamra 105, Kotli 91, Rawalpindi 80, Peshawar 44 & Sialkot 40
5	Kotli 45 & Garhi Dupatta 37	Peshawar 45	Kohat 52 & Mianwali 32
6	Jhelum 68, D.G.Khan 50, D.I.Khan 43, Larkana 43, Murree 42, Moenjodaro 41, Kakul 41, Mianwali 40, Rawalakot 35, Kohat 32 & Nawabshah 30	Chhor 41, Nawabshah 34 & Hyderabad 32	Mandi Bahauddin 46
7	Larkana 165, Rohri 48, Garhi Dupatta 45, Muzaffarabad 38, Murree 32 & Hyderabad 31	Nil	Saidu Sharif 38
8	Dalbandin 84, Sialkot 34 & Karachi (Masroor) 32	Peshawar & Mandi Bahauddin 38 each	Bahawalnagar 43 & Faisalabad 31
9	Lasbella 77, Islamabad 56, Sialkot 48 & Chaklala 41	Kohat 66	Nil
10	Peshawar 71, Chhor 69 Bahawalnagar 66 & Kamra 50	Nil	Nil
11	Sialkot 66 & Chhor 37	Faisalabad 66	Nil

12	Nil	Nil	Nil
13	Sialkot 172, Kamra 58, Risalpur 51, Chaklala 46 & Islamabad 35	Nil	Balakot 41
14	Nil	Nil	Nil
15	Kotli 51	Nil	Nil
16	Kohat 44 & Islamabad 37	Nil	Nil
17	Sialkot 66, Karachi (A/P) 41, Jhelum 37, Karachi(Masroor) 37, Kohat 44, Padidan & Mandi Bahauddin 30 each	Nil	Nil
18	Lahore (PBO) 84, Lahore(A/P) 78, Jacobabad 50, Nawabshah 45, Khanpur 41, Hyderabad 35 & Bahawalpur 30	Kotli 33	Nil
19	Karachi (A/P) 31	Murree 92, Islamabad 61, Balakot 56, Kakul 52, Rawalpindi 42, Kamra 40, Kotli & Malam Jabba 33 each	Nil
20	Sialkot 53	Balakot 65, Jhelum 50, Kotli 43, D.I.Khan & Mianwali 42, each & Muzaffarabad 31	Nil
21	Sialkot 98, Islamabad 78, Muzaffarabad 73, Chaklala 56, Kakul 51, Rawalakot 36, Kamra & Jhelum 35 each, Kohat & Risalpur 32 each	Larkana 78, Moenjodaro 75, Jacobabad 54, Mandi Bahauddin 45, Bahawalnagar 43, Malam Jabba 40 & D.I.Khan 33	Nil
22	Jhang 63, Shorekot 45, Khuzdar 42 , Malamjaba 37, Faisalabad 36 & Balakot 32	Jhelum 67	Nil
23	Nil	Nil	Nil
24	Kotli 42	Nil	Balakot 79, Kamra 77, Rawalpindi 65, Islamabad 49, Jhelum 34 &

			Muzaffarabad 33
25	Badin 63, Kohat 61, Lahore 60, Kakul 58, Balakot 50 & Peshawar 35	Chhor 57	Peshawar 65, Cherat 55, Mandi Bahauddin 52, Balakot 51, Murree & Muzaffarabad 49 each, Kakul 47, Rawalpindi 41, Dir 37, D.I.Khan 36, Jhelum & Sialkot 32 each, Garhi Dupatta 31 & Kalam 30
26	Badin 150	Chhor 55, Hyderabad 44 & Badin 31	Dir 30
27	Kakul 69, Garhi Dupatta 58 & Cherat 32	Faisalabad 40 & Lahore 39	Nil
28	Shorekot 120, Islamabad 62, Nawabshah 61, Cherat 58, Lahore 32 & Jhelum 31	Sargodha 52, Multan 50 & RahimYar Khan 40	Parachinar 60
29	Chhor 137, Lasbella 136, Karachi (A/P) 108, Karachi (Masroor) 60, Hyderabad 45, Turbat 37 & Nawabshah 35	Khanpur 125 & Malam Jabba 34	Nil
30	Lasbella 66 & Kamra 43	Kamra 46	Nil
31	Mandi Bahauddin 31	Rahim Yar Khan 62 & Bahawalpur 58	Nil

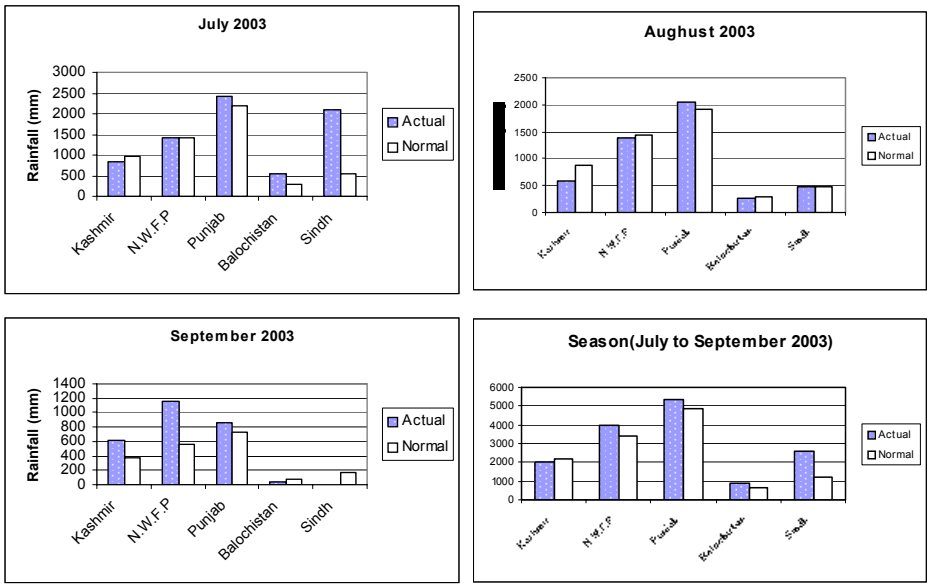

Fig. 2

Definition of the terms

Rainfall

Large excess	percentage departure from normal rainfall is + 51% or more.
Moderate excess	percentage departure from normal rainfall is + 26% to + 50%.
Slight excess	percentage departure from normal rainfall is + 11% to + 25%.
Normal	percentage departure from normal rainfall is - 10% to + 10%.
Slight deficit	percentage departure from normal rainfall is - 11% to - 25%.
Moderate deficit	percentage departure from normal rainfall is - 26% to - 50%.
Large deficit	percentage departure from normal rainfall is - 51% or less.
Almost at all	66 % or more stations of a places meteorological division reporting at least 2.5 mm rainfall.
At a number of	33 % to 66 % stations of a places meteorological division reporting at least 2.5 mm rainfall.
At a few places	33 % or less stations of a meteorological division reporting at least 2.5 mm rainfall.
Isolated places	One or two stations of a meteorological division.
Heavy rain	rainfall amount is from 44.5 mm to 88.9 mm in 24 hour
Very heavy	rainfall amount is 89.0 mm
Rainfall	rainfall or more in 24 hours.

Temperature

Severe Heat wave	Departure of maximum temperature from normal is + 8° C or more for the regions where normal max temp. is more than 40° C. Declared only when the max. temp. of a station reaches at least 40° C for plains and at least 35° C for Hilly regions.
Heat wave	Departure of max. temp. from Conditions normal is between + 4° C to + 7° C (appreciable + where the normal max. temp. is moderate)more than 40° C.
Hot day conditions	Whenever the max. temp remains 40° C or more and minimum remains 5° C or more above normal, provided, it is not satisfying the heat wave criteria.
Markedly above	Departure of max. temperature from normal is between + 6° C to + 7° C.
Appreciably	Departure of max. temperature from above normal is between + 4° C to + 5° C.
Appreciably	Departure of max. temperature from below normal is between - 4° C to - 5° C.
Markedly below	Departure of max. temperature normal from normal is between - 6° C to 7° C.
Considerably	Departure of max temperature below normal from normal is - 8° C or less.