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Climatological analysis of drought over northwest India during the year 1979

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ABSTRACT. Though the seasonal rainfall exceeded 700 mm in many a place of northwest India, during the year 1979, drought conditions prevailed over the entire region causing water stress conditions to all rainfed agricultural crops. A climatological analysis has been attempted to examine the incidence of drought, spread and its dissipation.

1. Introduction

The onset of southwest monsoon was delayed by about 15 days during the year 1979 over northwest India. Devastating floods occurred in parts of Rajasthan and Gujarat States during the months of July and August respectively. Inspite of the heavy rainfall occurrence, drought conditions also prevailed over the entire region causing water stress conditions to agricultural crops. The drought situation was peculiar by itself, as floods and droughts — the two faces of the same coin occurred within the same season which is a very rare phenomenon in these arid regions.

A climatological analysis of the drought situation was attempted in this paper for examining the origin, spread and dissipation of the drought. Also the water balance diagrams were examined where floods and droughts occurred and the water deficit pattern was studied for those regions where drought conditions prevailed during the entire monsoon season.

2. Methodology

The climatic and the year 1979 water balances were computed for all the meteorological stations using the book-keeping procedure of Thornthwaite & Mather (1955) and the potential evapotranspiration required for the water balance computations was estimated using Penman's (1948) equation. The departures aridity indices I_a (percentage ratio of annual water deficit to annual potential evapotranspiration) for the year 1979 from the climatic normal value were computed and plotted for the four monsoon months, *i.e.*, June to September, over the region (Fig. 1). The drought-free area (*negative* departures) is shown as dotted and in the drought affected area isolines of the departures were drawn for examining the intensity of the drought.

3. Results and discussion

An examination of the Fig. 1 reveals that during the month of June, except eastern and southern parts, drought conditions prevailed over the region, but with a mild intensity, the departure of I_a being only 15 per cent and the core was situated in northern parts around Ganganagar. By July, the drought had spread over the entire region except Punjab and central Rajasthan, and it was concentrated in Gujarat with two cores situated around Kutch and Surat regions indicating severe drought conditions in Gujarat during this period. However, floods occurred in central Rajasthan during the same period.

During August, the drought moved eastward concentrating in northern Rajasthan, Haryana

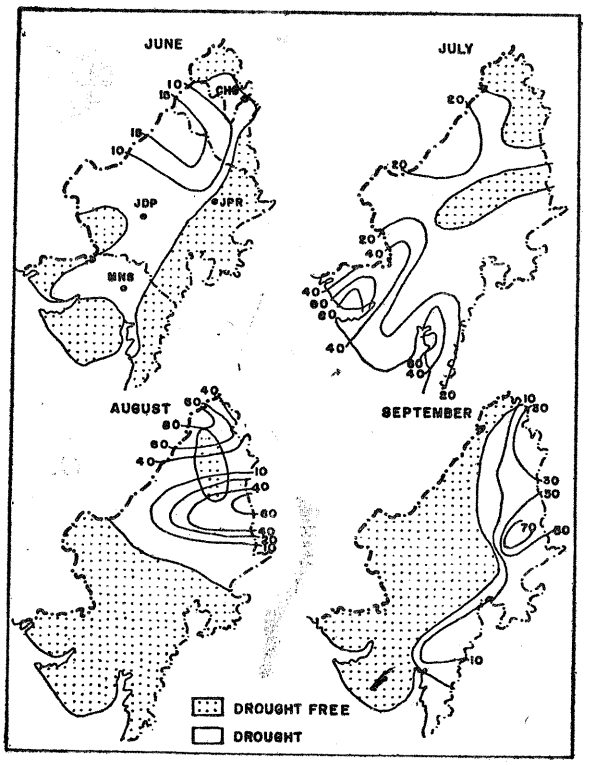

Fig. 1. Drought analysis by water budget technique for the year 1979 over northwest India

TABLE 1

Water deficit pattern in some representative regions of Gujarat, Rajasthan, Haryana and Punjab States

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
						Bhavnagar (Gujarat)						
Normal	90	114	170	200	234	0	0	0	18	86	90	85
1979	93	116	173	209	244	32	92	0	17	79	0	26
						Ganganagar (Rajasthan)						
Normal	26	51	104	158	210	201	171	102	125	114	61	36
1979	34	65	115	165	217	247	232	119	115	116	57	40
						Haryana						
Normal	4	10	68	125	176	135	0	0	0	20	28	15
1979	0	0	64	126	151	155	0	25	60	79	50	25
						Punjab						
Normal	3	18	71	125	177	151	0	0	12	66	43	15
1979	7	0	40	128	101	151	0	105	56	99	41	28

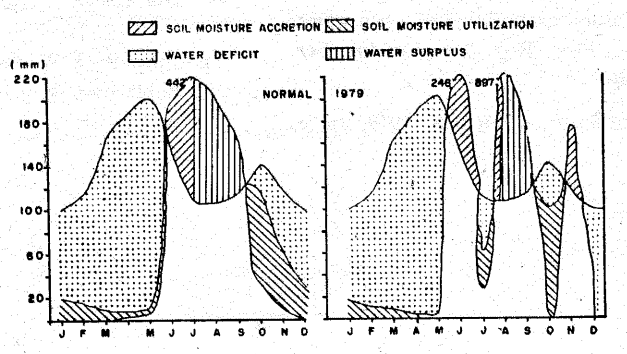

Fig. 2. Water balance diagrams of a typical region (Surat) where floods as well as droughts occurred during 1979

excluding a small pocket around Hissar and Punjab and two cores of drought existed around Delhi and Gurdaspur. By September the drought situation almost dissipated and confined to only eastern most parts of the region and the core was situated around Jaipur.

The above analysis confirms the incidence of drought pattern in arid regions as reported earlier by Rama Krishna and Sastri (1979) according to which the drought originates in the northern or northeastern parts, spreads towards south or southwest and dissipates with an easterly movement.

As mentioned earlier in some parts of the region floods and droughts occurred during the same season. As a typical example, the climatic and the 1979 water balance diagrams for Surat are shown in Fig. 2. From a comparison of the two water balance diagrams it can be visualised the extent of drought during July and also occurrence of floods during August due to heavy rainfall of 897 mm.

Drought prevailed in most of the regions of northwest except southern Gujarat and central Rajasthan and the water deficit pattern in some representative regions of northwest India is shown in Table 1. The deficit conditions occurred right from June onwards in Gujarat and Rajasthan regions and in the two northern States, *i.e.*, Haryana and Punjab the deficit conditions occurred from August onwards.

4. Conclusion

The analysis of the incidence of drought over northwest India brought out two important findings. Firstly, the pattern of the incidence of drought confirms the earlier findings. Secondly, the drought situation during the year 1979 is peculiar by itself, and is incomparable with other drought situations, as drought conditions prevailed in some of the regions even with a seasonal rainfall of greater than 700 mm.

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