

Short Communication

Trends of rainfall and temperature in Tawa canal command, Madhya Pradesh, India

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Climate is a complex phenomenon and continuously changes spatially and temporally affecting agriculture. Even with minor deviations from the normal weather, significant changes happened in the crop production and productivity. Many studies have been reported on trend analysis of rainfall and temperature in different parts of India. (Kumar and Sani 2010; Rai. *et al.* 2010; Patra *et al* 2012). But no work has been done for this region, hence this study was undertaken. The rainfall and temperature trend have been

investigated using parametric and non-parametric statistical tests for the period 1971 to 2010 data of Tawa command area of Madhya Pradesh, obtained from IMD Pune.

Rainfall characteristics and trend

The mean annual rainfall in the command is 1174.8 mm with dependable rainfall (at probability of 75%) of 989.6 mm and low coefficient of variation (27.9%). The mean annual rainfall in the region showed an insignificant declining

Table 1: Monthly, seasonal and annual rainfall characteristics and trend statistics for the period 1971-2010

Month	Mean (μ)	75% probability	Slope	t Stat	P-value	MK	Sen's Slope	Year of change
Jan	4.5	0.10	-0.04	-1.52	0.14	0.64	0.00	1993
Feb	56.6	1.10	-0.01	0.13	0.89	-0.30	0.00	1979
Mar	5.3	0.80	0.27	-0.95	0.35	1.06	0.01	2004
Apr	0.8	0.20	0.04	2.37	0.02	2.56*	0.00	2000
May	6.3	0.00	0.20	0.08	0.93	0.63	0.01	2000
Jun	169.9	57.71	-0.09	1.02	0.31	-0.62	-1.12	1981
Jul	330.9	227.63	1.43	1.47	0.15	0.41	0.68	1992
Aug	404.3	269.85	-5.55	-3.36	0.00	-1.78	-4.38	1994
Sep	200.6	78.36	2.04	-0.81	0.42	0.69	1.17	1992
Oct	26.5	0.25	0.30	0.05	0.96	0.67	0.05	1981
Nov	11.7	0.00	-0.04	-0.73	0.47	1.11	0.00	2001
Dec	8.1	0.00	0.00	0.09	0.93	-0.04	0.00	2001
Annual(Jan-Dec)	1174.9	989.57	-1.4	2.12	0.04	-0.94	-3.88	1986
Monsoon(Jun-Sep)	1105.7	896.81	-2.14	-0.50	0.62	-1.34	-5.06	1986
Winter(Oct-Feb)	56.6	20.89	0.20	-2.23	0.03	-0.17	-0.06	1990
Summer(Mar-May)	12.4	0.33	0.51	-0.66	0.51	1.50	0.07	2003

* trend at α = 0.05 level of significance; # trend at α = 0.1 level of significance

Table 2: Monthly, seasonal and annual temperature characteristics (minimum, maximum and average) and trend statistics for the period 1971-2002

Month	Mean (μ)		MK statistics		Sen's slope	
	T _{min}	T _{max}	T _{min}	T _{max}	T _{min}	T _{max}
Jan	11.7	27.1	1.05	1.44	0.01	0.03
Feb	13.6	29.9	0.71	0.89	0.02	0.02
Mar	18.3	34.9	0.02	0.02	0.00	0.00
Apr	23.2	39.2	-0.36	-0.36	-0.01	-0.01
May	26.7	40.9	0.70	0.70	0.02	0.02
Jun	25.4	36.8	0.00	0.00	0.00	0.00
Jul	23.1	30.5	0.92	0.92	0.01	0.01
Aug	22.6	28.8	1.54	1.54	0.02	0.02
Sep	22.9	30.8	1.05	1.05	0.02	0.02
Oct	18.8	32.5	1.77	1.83	0.03	0.03
Nov	14.7	29.7	1.96	2.03	0.05	0.04
Dec	11.7	27.0	1.78	2.03	0.04	0.04
Annual(Jan-Dec)	22.6	36.6	2.68	1.99	0.02	0.02
Monsoon(Jun-Sept)	31.1	42.3	1.51	1.12	0.03	0.02
Winter(Oct-Feb)	14.1	29.3	1.90	2.16	0.02	0.03
Summer(Mar-May)	22.7	38.4	0.89	0.21	0.01	0.00

trend, However, the pre-monsoon period indicated an increasing rainfall trend at 5% significance level. The monthly rainfall trend indicated that two of the four monsoon months (June and August) showed decreasing trends, whereas increasing trend was found for the months of July and September. A decreasing rainfall trend in the month of June may severely affects the initial field preparation for monsoon crops resulting in delayed sowing. (Table 1)

Temperature characteristics and trend in the command

The mean annual temperature across the Tawa command is 29.6°C with a standard deviation of 0.4°C. The temperature characteristics in the region can be summarized as extreme with intense summer and winter periods. The temperature trend in the region indicated an increasing trend excepting for the month of April (Table 2). The minimum temperature series increases more significantly than the maximum and average series. This indicates higher temperature variability between maximum and minimum temperature in the region. The increasing temperature trend in the region will require higher crop water requirement with

high evapotranspiration values. This will further increase the gap between water demand and supply in the command. The effect of higher temperature in the crop production and productivity is yet to be established in the region, but certainly an increase demand of water will further exaggerate the water stress.

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