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Short Communications

Long term variability and trends of temperatures over various time-scales at Pusa, Bihar

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Due to greenhouse effect air temperatures are increasing and the increase is expected to be 2 to 4 °C in the next 100 years. The magnitude of temperatures will vary in time and place. In view of the importance of increasing temperatures on crop productivity, local studies on temperature trends and variability, like the ones mentioned below, are necessary for agricultural decision making. Rai and Chaudhary(1998) found an increasing trend of maximum temperature in all the seasons at Raipur. Madhya Pradesh, India. Hundal and Kaur (2002) found that in Punjab, India, minimum temperature had increased by about 0.4 °C at Patiala and 1.6 °C at Ludhiana. Sarkar and Thapliyal (1988) had reported a slight warming trend during recent decades in India. A likely increase of 1°C over the central plains of India during the monsoon season (Lal *et al.,* 1995) and a greater increase in minimum temperature compared to the maximum (Lal *et al.* 1996) have been indicated.

Keeping the above in view a study was undertaken to assess the changes in maximum and minimum temperature over weekly, monthly annual and decadal periods at Pusa, Bihar, India, using historical data of the 52 year period from 1953-2004. From daily data of maximum and minimum temperatures, mean weekly, monthly and annual maximum and minimum temperatures were calculated. Mean monthly temperatures were worked out for the 5 Decades from 1955 to 2004. The results are shown in Figs. 1 and 2 and Tables 1 and 2. The variations and/or trends noted in maximum and minimum temperatures on monthly, annual and decadal basis are enumerated below.

Weekly and long period average monthly minimum temperatures showed a greater standard deviation and a higher coefficient of variation than the corresponding maximum temperatures. None of the decadal annual average maximum temperatures differed significantly from the longterm average. The decadal annual minimum temperature showed an increasing trend. The hottest and coldest maximum temperature decades were respectively 1955-64 and 1995-2004 while the coldest and hottest minimum temperature decades were 1975-84 and 1995-2004. Annual average maximum temperature had decreased at the rate of 0.008 °C in the last 50 years. However, in the year period 2001 to 2004 the maximum temperature has decreased by 0.6 to 0.9 °C. Average annual minimum temperature had increased at the rate of 0.02 °C no spurt in increase in minimum temperature in recent years is noticeable. Weekly longterm trend in weekly temperatures showed an increasing trend in maximum temperature during 45th and 46th standard meteorological week (SMW).

In global warming it had been shown that minimum temperature will increase more than the maximum. However, maximum temperature at Pusa has shown a consistently decreasing trend in contrast to the increasing trend of minimum temperature. While the increase in minimum has

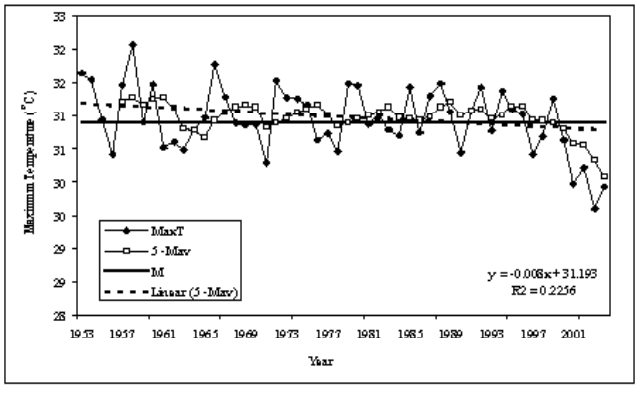

Fig. 1 : Variations in annual maximum temperature at Pusa

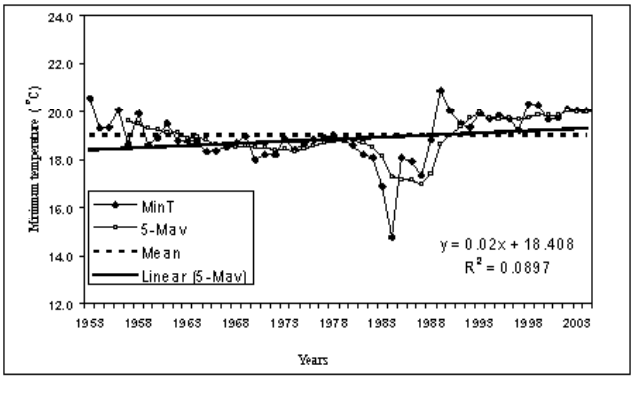

Fig. 2: Variations in mean annual minimum temperature at Pusa

Table 1: Decadal variations in average monthly maximum temperature (°C) along with their LPA and CV at Pusa

Months	1955-64	1965-74	1975-84	1985-94	1995-04	LPA	SD(°C)	CV(%)
Jan.	23.2(1.2)	23.4(1.7)	22.7(0.0)	23.1(0.9)	20.9(-5.1*)	22.7	1.5	6.6
Feb.	27.6(3.2*)	27.0(1.4)	26.1(-1.1)	26.6(0.3)	26.0(-1.4)	26.5	1.4	5.0
Mar.	33.6(4.3*)	32.4(0.9)	31.4(-1.4)	32.0(0.0)	31.3(-1.6)	32.0	1.5	4.8
Apr.	37.6(2.8*)	36.7(0.8)	35.7(-1.2)	36.3(0.0)	35.3(-2.1*)	36.3	1.7	4.8
May	38.0(2.4*)	37.4(1.2)	36.0(-1.6)	36.5(-0.6)	36.3(-1.0)	36.8	1.8	4.8
Jun.	35.0(0.0)	35.2(0.4)	34.9(-0.2)	35.3(0.6)	34.7(-0.6)	35.0	1.7	4.8
Jul.	32.1(-2.4*)	32.9(0.8)	32.6(-0.4)	32.7(0.0)	33.0(1.2)	32.7	0.9	2.8
Aug.	32.2(-1.5)	32.1(-2.1)	32.9(2.1*)	32.8(1.5)	32.7(1.0)	32.5	0.7	2.3
Sep.	32.4(0.0)	32.3(-0.5)	33.0(3.2*)	32.4(0.0)	32.2(-1.0)	32.4	0.7	2.2
Oct.	31.1(-1.6)	31.4(-0.6)	32.5(3.1*)	32.0(1.3)	31.6(0.0)	31.6	1.1	3.5
Nov.	28.2(-1.3)	28.2(-1.3)	28.8(1.3)	29.0(2.3)	28.5(0.0)	28.5	0.8	2.9
Dec.	24.9(1.3)	24.5(0.0)	24.6(0.3)	24.9(1.3)	23.7(-2.7*)	24.4	1.1	4.3
Mean	31.3(1.3)	31.1(0.6)	30.9(0.0)	31.1(0.6)	30.5(-1.3)	30.9	1.1	4.8
HUAN	+127.6	+51.5	-6.5	+59.9	-162.6			

**Values in parenthesis are cramer's t_k test; HUAN: Heat unit anomaly from normal;*

Table 2: Decadal mean monthly changes in minimum temperature

Months	1955-64	1965-74	1975-84	1985-94	1995-2004	LPA	SD (°C)	CV (%)
Jan.	8.7(0.6)	8.3(-0.2)	7.2(-2.4*)	8.8(0.8)	8.7(0.6)	8.4	1.8	20.9
Feb.	11.0(0.9)	9.8(-1.8)	9.4(-2.8*)	11.0(0.9)	11.4(2.0*)	10.6	1.6	15.1
Mar.	16.4(-1.6)	14.8(-2.2)	14.5(-3.0*)	16.2(1.2)	16.0(0.7)	15.7	1.5	9.7
Apr.	21.0(0.4)	20.2(-1.3)	19.5(-3.1*)	21.3(1.1)	21.6(1.8)	20.8	1.6	7.9
May	24.8(1.0)	23.8(-1.0)	21.8(-7.3*)	24.7(0.8)	25.2(1.9)	24.3	1.7	7.0
Jun.	26.3(1.6)	25.2(-0.9)	23.7(-5.6*)	25.4(-0.5)	26.6(2.4*)	25.6	1.5	6.0
Jul.	26.3(1.0)	25.1(-1.0)	23.4(-4.5*)	25.3(-0.7)	27.1(2.4*)	25.7	2.1	8.1
Aug.	25.9(0.1)	25.6(-0.3)	24.1(-2.7*)	25.7(-0.1)	27.1(2.1*)	25.8	2.3	8.2
Sep.	25.9(1.8)	25.2(0.0)	24.3(-2.3*)	24.9(-0.7)	26.1(2.3*)	25.4	1.4	5.5
Oct.	21.1(-0.2)	21.0(-0.4)	19.5(-3.3*)	21.2(0.0)	22.4(2.3*)	21.2	1.9	8.9
Nov.	13.6(-1.2)	14.1(-0.3)	12.1(-4.5*)	14.9(1.1)	15.7(2.6*)	14.3	2.0	14.0
Dec.	10.0(0.6)	8.2(-3.1)	8.3(-2.9*)	10.4(1.4)	10.9(2.4*)	9.7	1.8	17.8
Mean	19.3(0.9)	18.5(-0.6)	17.3(-8.1*)	19.1(0.3)	19.9(3.1*)	19.0	1.1	9.0
HUAN	+87.1	-176.7	-595.7	+77.4	+349.7			

**Values in parenthesis are cramer's t_k test; HUAN: Heat unit anomaly from normal;*

not accelerated in recent years the maximum has shown an accelerated decrease. The only possible explanation is that the decrease in maximum is due to increased aerosol content of air arising from pollution which appears to be on the rise in recent years. The increase in maximum temperature in the 45th and 46th SMW in place of the expected decrease in a matter of concern calling for a change in sowing time for wheat at Pusa.

REFERENCES

Rai, S.K. and Chaudhary, J.L. (1998). Trends and periodicity of temperature anomaly of Raipur district for crop planning- A Statistical approach. *Indian J. Env. Sci*., 2(2): 73-81.

Sarkar, R.P. and Thapliyal, V. (1988). Climate change and variability" *Mausam*, 39 (2): 127-138.

Hundal, S.S. and Kaur, P. (2002). Annual and seasonal climatic variability at different locations of Punjab state. *J. Agrometeorol*., 4(2): 113-125.

Hingane, L.S., Rupa Kumar, K. and Rammana Murth, Bh. V., 1985. Long term trends of surface air temperature in India. *J. Climatol*., 5:521-528.

Lal, M., Cubasch, U., Voss, R. and Waszkewitz, J. (1995). The effect of transient increase in greenhouse gases and sulphate aerosols on monsoon climate. *Curr. Sci.* 69(9): 752-763.

Lal, M., Srinivasan, G. and Cubasch, U. (1996). Implications of increasing greenhouse gases and aerosols on the diurnal temperature cycle of the Indian subcontinent. *Current Sci,*. 71(10): 746-752.

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