Research Paper Engineering

Effect of Climate Change on Crops – A Case Study of Amreli-District

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ABSTRACT

Climate change is the variation in global or regional climates over time. It reflects changes in the variability or average state of the atmosphere over time scales ranging from decades to million of years.
Now a day it is important to identify the climate change and its effect on the agriculture and environment. For better future and prediction of future it is necessary to study the climate and its parameter behaviour over a period of time.
By keeping in view the importance of climate change a study was conducted with the following objectives:
(1)To make a detailed analysis of the variability of various meteorological parameters over the region based on long term recorded data.
(2)To identify the monthly and seasonal trends of meteorological parameters such as temperature, rainfall, relative humidity, wind speed and sunshine hours.
(3)To develop model to predict the future yield of crop by correlating yield with the various meteorological parameters.
The study is conducted to evaluate the climate change over a period of time worked out at Amreli district and its impact on crop yield and crop water requirement.

Keywords :

Location of project area
The entire Gujarat is divided into the various agro-climatic zones. Amreli is located north Gujarat agro-climatic zone XIII of Gujarat state.

Geography.
Amreli is located at 21°35 N latitude, 71°12' E longitude at an altitude of 130 m above mean sea level. It is bounded on the north by the Babra Taluka and south by the savarkundla Taluka, on the west by Kunkavav Taluka and, on the east by Kunkavav Taluka . National Highway 8E passes through the district connecting it to Junagadh (92 km) and Bhavnagar (113km) districtAmreli is also connected to Ahmedabad (258 km),Vadodara (400 km), Jamnagar (193 km) and Surat (566km), Rajkot (105 km), Ankaleshwar (483 km), Vapi (633km), Gandhinagar (358 km) and Mehsana (404 km) A four-lane expressway connects the Pipavav port to National Highway 8EAlmost all the talukas of Amreli are well connected with the rail network As of 2001 India census, Amreli had a population of 1.39Million Amreli has an average literacy rate of 66.10%.

Climate.
The climate of Amreli station is semi-arid with fairly dry and hot summer. Winter is fairly cold and sets in, in the month of November and continues till the middle of February. Summer is hot and dry which commences from mid of February and ends by the month of June. May is the hottest month with mean maximum temperature around 40.08 ^{0}C. The average rainfall is 580 mm.

Soil.
The soil is representative of the soils of the region, is alluvial in origin. The texture of the soil is Mixed red and black soil. The soil is deep enough to respond well to manuring and variety of crops of the tropical and sub-tropical regions. The soil is low in organic carbon and nitrogen, medium in available phosphorus and available sulphur. Status of potassium is found medium, while micronutrient status is found sufficient. The soil reaction is slightly towards alkaline having pH 8.3.

Agriculcture.
In Amreli district cotton,Bajara and ground nut, are grown in kharif season. In rabi season wheat, gram, and jowar are grown. Especially, in summer season the bajara and ground nut are grown. In last few years there is increase in amount of rainfall which facilitate in agriculture production and various irrigation scheme.

Methodology.
General:
Climate change is the change in the meteorological parameters (such as temperatures, precipitation, relative humidity, wind etc.) from their averages or normal values or after some years the trend of meteorological parameters changes either naturally or by human intervention also.

Missing Value:
The weekly meteorological data viz. temperature, rainfall, relative humidity, sunshine hours, wind speed etc. are observed and the first step of analysis is to separate out the weekly data year wise in appropriate form.

Due to some problem or some manual problem the data gaps or missing values are indentified in data. For further analysis, it is necessary to find out the missing values in data.

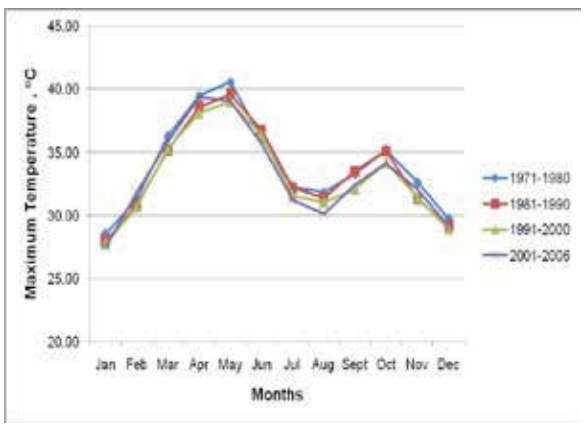
The missing values find out with the tool of SPSS 11.5 software. There are four methods available in SPSS for find the missing values are:

Series mean
Mean of nearby points
Median of nearby point
Linear interpolation
Linear trend at a points.

Result and Analysis.
General:
The analyses of meteorological parameters are carried out by different methodology like month wise and season wise. The regression analysis is done for established the relationship

between the meteorological parameters and crop yield.

Monthly Decade wise Analysis
Maximum Tempracture.
The maximum temperature of July month is decrease in all decades. The maximum temperature of July during decade 1981-1990 is lower than its previous decade 1971-1980 by 0.07 ˚C. Similar way for the maximum temperature of the decade 1991-2000 is lower by 0.62 ˚C from its previous decade and in 1981- 1990. The maximum temperature of the 2001-2006 is lower by 0.37 ˚C than its previous decade 1991-2000. The maximum temperature in 2001-2006 is decreased by 0.29, 0.67, 0.37 and 0.93˚C in months of January, June, July and August from decade 1991-2000. The maximum temperature of 2001-2006 of February, March, April, May, September, October, November and December months are increasing by 1.14, 0.49, 1.29, 0.07, 0.34, 0.01, 0.69 and 0.25˚C form its pervious decade 1991-2000.



Minimum temperature
The average monthly minimum temperature during the 2001-2006 is higher than the decade 1991-2000 in January, February, April, July and October, November and December. The monthly average minimum temperature of the period 2001-2006 shows positive deviation of 0.82 ˚C from its previous decade (1991-2000) in December. The minimum temperature values during the decade 1991-2000 are higher than the decade 1981-1990 in March, May, August, September and lower in remaining months. The minimum temperature of 1991-2000 shows highest negative deviation of 1.04 ˚C from the 1981-1990 in December. During decade 1981-1990 the minimum temperature is higher than the decade 1971-1980 in January, February, March, June to December month and lower in April and May. The deviation and percentage departure during each decade compared with its previous decade are shown in table 6.8.

Table 6.8: Decade wise Monthly Average Minimum Temperature

Months	Minimum Temperature , °C				Deviation , °C			% Deviation		
	1971-1980	1981-1990	1991-2000	2001-2006	1981-1990	1991-2000	2001-2006	1981-1990	1991-2000	2001-2006
Jan	10.42	13.10	12.69	12.20	2.68	-0.41	-0.50	25.75	-3.10	-3.92
Feb	12.97	14.91	14.61	15.26	1.94	-0.30	0.65	14.98	-2.04	4.46
Mar	18.05	18.59	18.91	19.15	0.53	0.33	0.23	2.96	1.75	1.22
Apr	22.69	22.58	22.55	22.55	-0.10	-0.03	0.00	-0.45	-0.14	-0.01
May	25.90	25.44	25.79	24.96	-0.46	0.35	-0.83	-1.78	1.37	-3.21
Jun	24.83	26.60	26.09	25.60	1.76	-0.51	-0.49	7.09	-1.90	-1.86
Jul	23.94	25.37	25.25	24.63	1.43	-0.12	-0.62	5.95	-0.46	-2.46
Aug	23.53	24.57	24.63	23.92	1.04	0.05	-0.71	4.42	0.22	-2.87
Sept	23.43	23.66	23.88	24.03	0.23	0.22	0.15	0.97	0.94	0.63
Oct	21.31	21.73	21.48	21.49	0.42	-0.25	0.01	1.99	-1.17	0.04
Nov	16.63	17.34	16.85	17.34	0.71	-0.49	0.49	4.28	-2.84	2.94
Dec	12.76	14.26	13.21	14.03	1.50	-1.04	0.82	11.76	-7.31	6.17

The trend pattern of minimum temperature of the year is shown in Figure 6.67. Trendline shows that minimum temperature of the decade 2001-2006 is higher than the decade 1971-1980 in all months excepting April and May month.

Conclusion
General:
The conclusions are drawn from the results and analysis carried out by different methodology adopted like monthly, seasonal, decade wise, 24 years normal, five years moving average etc. and the model is develop to predict the yield of two crops kotton and wheat.

Maximum temperature.
The rainfall in the country is mostly confined to monsoon season and is unevenly distributed with respect to both space and time. As a result, some parts of the country are affected by frequent droughts, whereas other parts are affected by floods. Nearly one third of the country is drought prone. Water will become scarce resource in the near future, due to increasing thrust of population and increasing demands of water for various uses. Therefore, it needs no emphasis that water needs to be harnessed in a scientific and efficient manner for its optimum utilization. The monsoon flood waters need to be conserved and utilized during the period of its scarcity for drinking & industrial use, irrigation, power generation etc. The water availability and requirements in the various river basins should be assessed realistically and the requirements be met appropriately. The surplus water, if any, should be transferred to the needy areas. The National Water Policy evolved by Govt. of India in 1987 and revised in April 2002 lays emphasis on inter-basin transfer of water.

REFERENCES

[1] Al-Amin, A.Q., Filho, W.L., Kabir, M.A., Azam, M.N., Jaafar, A.H. and Kari, | F. (2011). "Climate change impacts: Prioritizing mechanism and needs for future Malaysian agriculture". International Journal of the Physical Sciences Vol. 6(7), pp. 1742–1748. | [2] Butt, T.A., McCarl, B.A., Angerer, J., Dyke, P.T. and Stuth, J.W. (2005). "The economic and food security implications of climate change in Mali". J.Climatic change, Vol. 68 No. 3: 355-378. | [3] Rao, P. G. (1993). "Climatic changes and trends over a major river basin in India." Clim. Res. (2): 215-223. | [4] Sharma, K., Bishnol, O.P., and Khichar, M.L. (2009). "Impact assessment of climatic variability on wheat and pearl millet productivity using CERES models in arid zone of Haryana." J.Agrometeorol., 12 (1): 123-127