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RESEARCH ARTICLE

TREND ANALYSIS OF VARIABILITY IN WEATHER PARAMETERS USING SIMPLE LINEAR REGRESSION (SLR) METHOD IN DIFFERENT WATER REGIMES IN CUDDALORE DISTRICT OF TAMIL NADU

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ABSTRACT

The overall objective of this study is to analysis the impact of climate change on weather variability in different water using regimes in Cuddalore district, Tamil Nadu. Climate has a vital role on biosphere of the earth. A very slight change in the climate will lead to a major change in plant and animal life. For example, some crops will not tolerate even a minute variation in temperature. In India for the past four decades (1969-2005), surface temperature has increased by 0.3 °C or by 0.08 °C per decade. The study shows the general observation made in the minimum and maximum temperature no observable trend was noticed in the period of 15 years from 2001 - 2015 but the decline in relative humidity was quite explicit. The trend in rain fall also did not exhibit any significant increase or decrease over the years it was concluded that the duration of analysis for the weather parameters to absorb any significant climatic variation should be long enough to recognize any observable trend over the years.

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INTRODUCTION

The agricultural sector has a multiplier effect on any nation's socio-economic and industrial fabric because of the multifunctional nature of the sector (Ogen, 2007). It has the potential to be the industrial and economic springboard from which the country's development can take off (Stewart, 2000). This sector remains the main source of livelihood for most rural communities in developing countries in general. Climate has a vital role on biosphere of the earth. A very slight change in the climate will lead to a major change in plant and animal life. For example, some crops will not tolerate even a minute variation in temperature. Climate change could seriously threaten production levels required to feed the burgeoning population. Phenomenon of warming across the globe along with other falling consequences in the form of shift in rainfall pattern, melting of ice, rise in sea level etc. is getting accepted by the world community. The long-range climate change has been observed worldwide and also the changes in food production and productivity of individual crop. This change is slow in nature and caused some area to lose their traditional crops and to go for alternative crops.

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Further it leads to shifting of cropping pattern and cropping season. The productivity of an individual crop has been changed resulting in variation in total production of the food grains. The impacts of climate change are likely to be severe for the countries like India that have limited arable land but heavy dependence on agriculture (Mendelsohn *et al.,* 2006; Stern, 2006; Nelson *et al.,* 2009) and also have poor technological and financial capabilities for mitigation and adaptation to climate change. In India, the agricultural sector despite a significant decline in its share in national income (<15% in 2010-11 from 37% in 1970-71), remains an important segment of the economy because of its strategic importance to food security, employment generation and poverty alleviation. The sector still engages about 54 per cent of the country's workforce. In the past four decades (1969-2005), India's surface temperature has increased by 0.3 °C or by 0.08 °C per decade.

In recent years, the climate change has been accompanied by increased incidence of natural calamities such as droughts, floods, cyclones and heat waves (Goswami *et al.,* 2006). Such extreme events can cause a drastic decline in the agricultural output, exacerbating the problems of food insecurity and rural poverty. The threat that climate changes pose to agricultural production does not only cover the area of crop husbandry but also includes livestock and in fact the total agricultural sector.

African farmers also depend on livestock for income, food and animal products Nin, Ehui, (Benin 2007). Climate can affect livestock both directly and indirectly (Adams *et al.,* 1999; Manning and Nobrew 2001). Direct effects of climate variables such as air, temperature, humidity, wind speed and other climate factors influence animal performance such as growth, milk production, wool production and reproduction. Climate can also affect the quantity and quality of feed stuffs such as pasture, forage, and grain and also the severity and distribution of livestock diseases and parasite (Niggol and Mendelsohn 2008). Hence the totality of agricultural sector is considered by examining agricultural productivity.

Design of the study

The present study was conducted to analyse and statistically measure the variability in climatic factor of the selected blocks in Cuddalore district, Tamil Nadu. The daily data set of weatherparameterfor the period from 2001-2015 were collected from the Indian Meteorological Division (IMD), Chennai.

The weather parameters analyzed in this study are:

X1 Maximum Temperature (^{0}C)
X2 Minimum Temperature (^{0}C)
X3 Relative Humidity (Per cent)
X4 Rain fall (mm)

Trend analysis is performed by fitting the simple regression equation separately for each parameter over years for the period 2001-2015. The data were then input into the Microsoft Excel software V 2010 in a spread sheet for the time series analysis. To determine the trend component of the data, a simplelinearregression(SLR) was run, using the deseasonalized data as the response (Y) and the t, values (t=1,…t=15) as the independent (t) variables respectively. The expected equation, which yielded the trend component, is the traditional Y= a+bx, where a, is the intercept on the Y-axis and b, is the slope, known as the linear regression (best fit) equation.

RESULT AND DISCUSSION

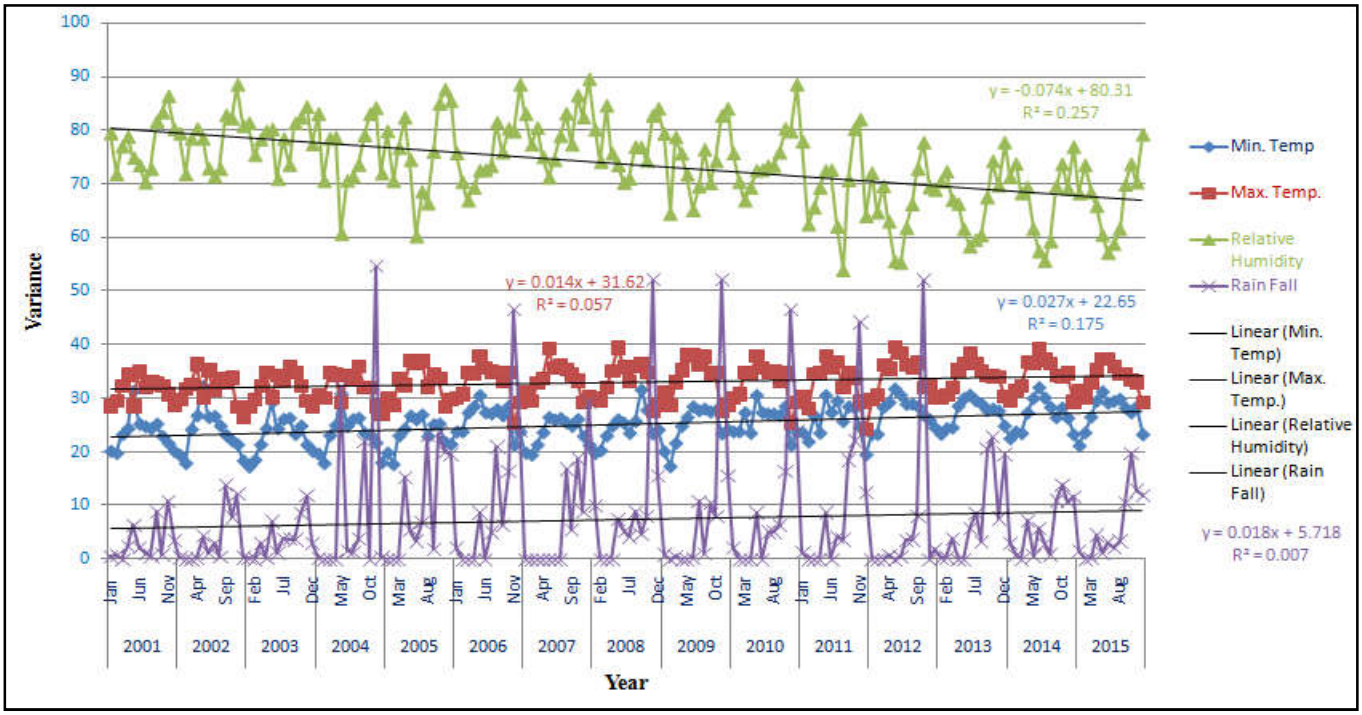
Trend Analysis on Weather Variability in Selected Block (2001-2015)

The analysis on weather parameters to absorb the changes and variations over a period of 15 years was performed and the results are discussed below. The weather parameters such as maximum and minimum temperature, relative humidity and rainfall were considered as variables for analysis. The monthly data recorded the parameter were obtained from the secondary source viz., Indian Meteorology Division, Chennai. The visual observation of the trend line in figure-1 showed that the maximum and minimum temperature and rainfall had revealed a positive trend and the relative humidity showed a negative trend. The inverse relationship between the temperature and relative humidity was as per the apriori expectations. The magnititude of trend co-efficient on this parameter showed that therewasanobservableincreasing trend in minimum temperature which increased by 0.03^{o}C similar the relative humidity exhibited a decreasing trend of 0.07 per cent every month over the time period but not significant R^2 value. Though the maximum temperature and rainfall exhibited a positive trend those observations might not be considered significant due to the poor R^2 values.

Rainfall Seasonal Pattern of the Selected Block (2001-2015)

The monsoon season conventionally described in Tamil Nadu where January and February are considered as winter season, March, AprilandMay months are considered as summer season, June to September months were considered as south west monsoon, October to December months were considered as northeast monsoon. As per this convention the rainfall data over a period of 15 years was split up in to above 4 seasons and plotted in a linear graph. It could be observed from the seasonal rainfall analysis that the north east was the predominant season which accounted for 58 per cent (Figure - 2) of total annual

Fig-1. Trend in Rain Fall (Year 2001 - 2015)



Fig–2. Rain fall Seasonal Pattern (2001-2015)

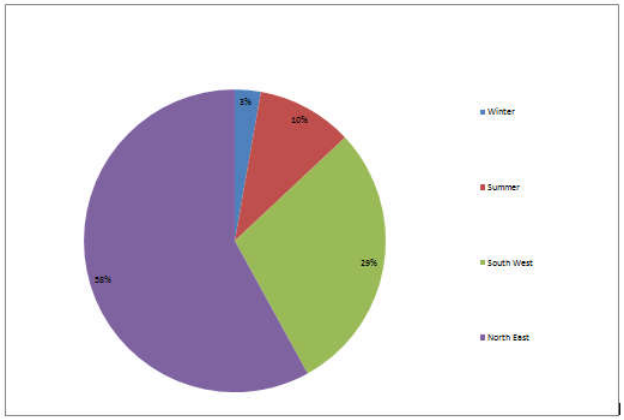


Fig-3. Rainfall Seasonal Pattern of the Selected Block (2001-2015)

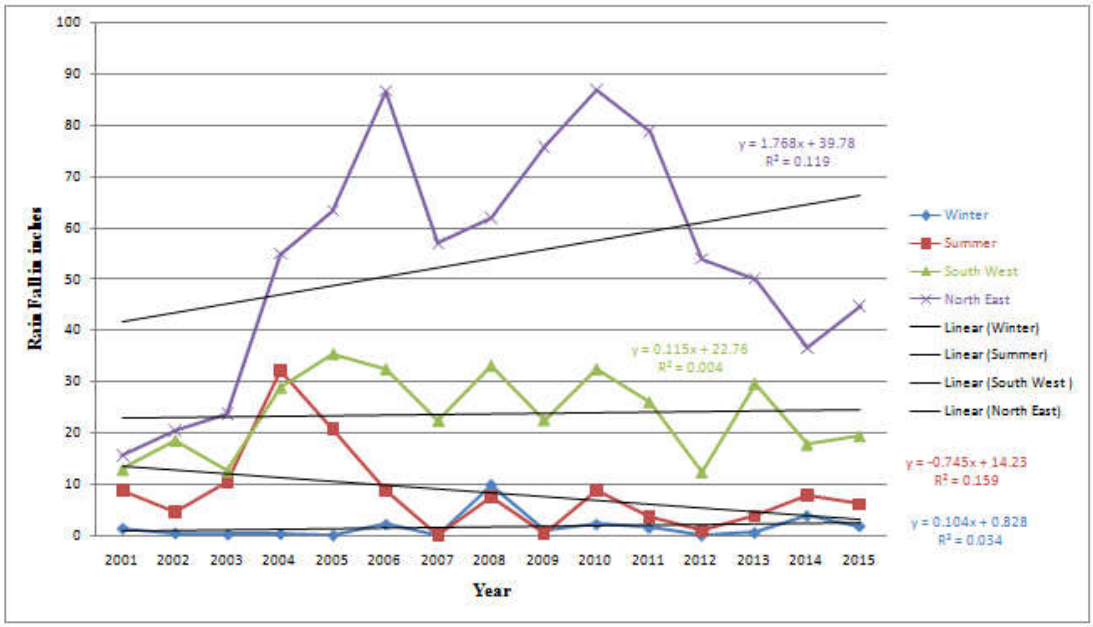
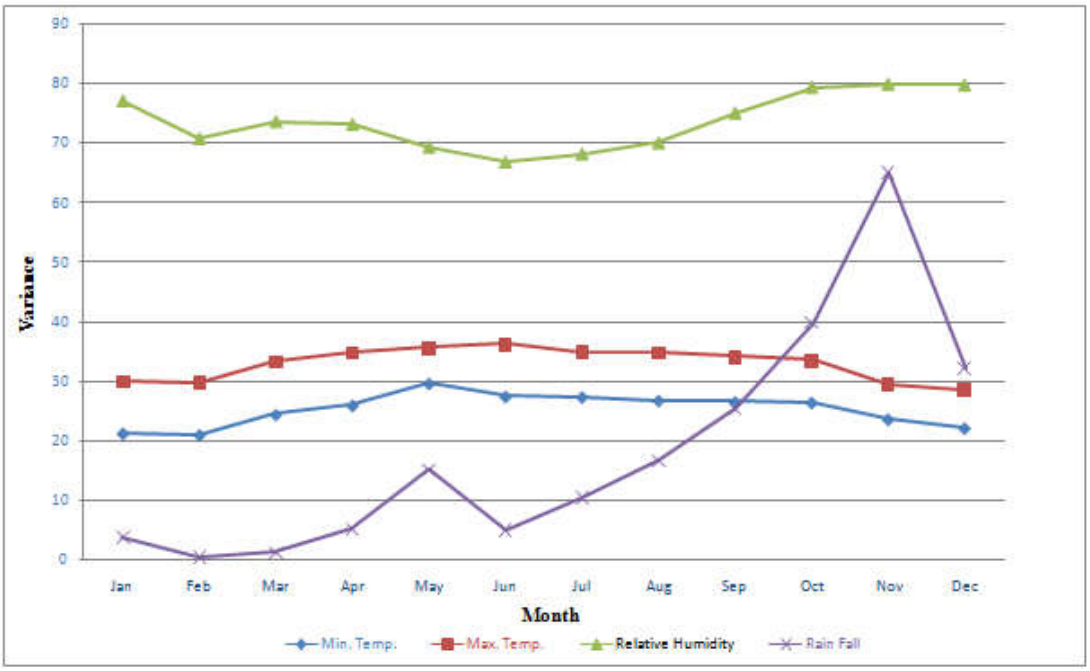


Fig-4. Seasonal Variation in Climate Parameter of the Selected Block (2001-2015)



rainfall followed by south west which is 29 per cent, summer showers constituted 10 per cent and almost there is no rainfall in winter. Between the monsoons the north east which accounted for a major share exhibited an increasing trend of 4.37 (cm) rainfall every year figure - 3. Though the south west monsoon had a positive trend co-efficient of 0.12 inches per year it could not be considered seriously due to its poor R^2 value and higher co-efficient values. An another important observation was that the summer showers had a decreasing trend of 0.74 inches every year and considering its substantial co-efficient values this negative trend was a matter of serious concern for the planners.

Seasonal variationinclimate parameter of the selected block (2001-2015)

The seasonal variation of the climate parameter were depicted in Figure- 4. It was observed that both minimum and maximum temperature both followed the same seasonal pattern. The mean temperature had a minimum values in the months of December, January and February, maximum values in the months of May and June. The seasonal values of the temperature parameters followed an inverted U shaped patterns from the start to end of the years. The seasonal pattern on relative humidity just exhibited an inverse relation with the temperature parameters with the U shaped seasonal curve and this relationship was quite natural as per the apriori expectation. The relative humidity was recorded minimum in the month of June and maximum in the month of October, November and December. The rainfall pattern over the months revealed that it was at maximum in the month, which coincide with the middle of the monsoon season and it was minimum and almost zero in the month of February. The rainfall pattern observed slow recovery phase from March onwards with a positive kink in May (Summer showers) and prosperity during Southwest monsoon from June to September and attained its peak in November.

Conclusion

The general observation made from the study was that in the minimum and maximum temperature no observable trend was noticed in the period of 15 years from 2001-2015 but the decline in relative humidity was quite explicit. The trend in rain fall also did not exhibit any significant increase or decrease over the years. The seasonal pattern on the rainfall showed the northeast and southwest are the major contributing monsoon of the rainfall. Between the two northeast accounted the major share of 58 percent of the total rainfall. The summer shower which was supposed to be the most productive precipitation registered a decline trend. Hence it was concluded that the duration of analysis for the weather parameters to absorb any significant climatic variation should be long enough to recognize any observable trend over the years.

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