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RESEARCH ARTICLE

IMPACT OF CLIMATE CHANGE ON MONSOON ONSETOVER TAMIL NADU

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ABSTRACT

"Timely sowing results in half the production" is an important quote of rainfed agriculture and preparedness for that depends on how accurately we predict the monsoon. Rainfall is highly variable in both temporal and spatial dimension. The dependency of rainfall forecast can be increased by using higher resolution rainfall data in both space and time. The existing pre-monsoon sowing week of Tamil Nadu was calculated long back at Agro Climatic Zone level and which is only seven for entire Tamil Nadu state. In order to ascertain the impact of changing climate on the onset of monsoon, an attempt has been made at Tamil Nadu Agricultural University under UGC sponsored scheme "Revalidating premon soon sowing week with higher resolution for changing climate of Tamil Nadu". To identify the shift in the rainy season and for fixing the pre-monsoon sowing week at block level, observed rainfall over the period from 1951 to 2010 has been utilized. Daily rainfall observed at 18 TNAU research stations, 47 locations from State Ground and Surface Water Data Centre and 700 locations from district level State Documentation department were utilized in this study. As these observed records are available only for the period from 1970-2011, the APHRODITE's gridded data sets of daily rainfall was utilized to fill the gaps from 1951 and also used the PET data sets from CRU-TS 3.1 monthly climatology for the present analysis. The agro-climatic variable viz., the length of growing period and pre-monsoon sowing week were estimated using Jeevananda Reddy's 14-week moving average technique. To predict the shift over the 60 years period, four period analyses were made for each of the 30 years from 1951 leaving a decade behind for the subsequent analysis. The differences in the onset have been observed over these periods in Tamil Nadu and are more pronounced by an earlier onset in southern districts and delayed in coastal part of Tamil Nadu where North East Monsoon is the case.

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INTRODUCTION

Most of the districts in Tamil Nadu are receiving maximum amount of rainfall during north east monsoon, except Kanyakumari, Coimbatore, Dharmapuri, Krishnagiri and Nilgiris districts, where both South West Monsoon (SWM) and North East Monsoon (NEM) are giving rain. In general, the rainfed agriculture land preparation of Tamil Nadu starts from 2nd week of September which is end of SWM and a month before NEM. The North East Monsoon (NEM) also known as "post-monsoon" or "retreating south west monsoon" or "winter monsoon" is the major rainfall activity over south peninsular India. The NEM strikes Tamil Nadu during October to December which is accounting for about 48% of the annual rainfall. Coastal districts of the TN get nearly 60% of the annual rainfall and the interior districts get about 40-50% of the annual rainfall from NEM (IMD, 1973).

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Tamil Nadu is the only sub-division of the Indian union which receives more rainfall in the NEM season than in the South West Monsoon (SWM). The rainfall during NEM is due to the formation of trough of low, cyclonic circulation, easterly waves, low pressure area, depression and cyclonic storm over Bay of Bengal. North East Monsoon is associated with cyclonic storms causing wide spread damage to property. The NEM strongly influences the agricultural production over peninsular India and Sri Lanka; the onset, variability and predictability of NEM has paramount socioeconomic impacts over these regions. Large arable land, dearth of rivers, thickly populated peasants who depends on rain fed farming everything aggravates their thirst for rain. To quench the thirst the NEM begins in the coast of Tamil Nadu first and advances inward even though the wind comes from north.

The onset date of NE monsoon over Southern Peninsular is a matter of pivotal interest to the people of Tamil Nadu because they are in the leeward side of Western Ghats during the southwest monsoon.

It is difficult to find a trend in onset date of NEM. The increase in rainfall activity over Andhra-Tamil Nadu coasts which takes place sometime around middle of October is generally considered as the "setting in of Northeast Monsoon". Normal date of onset of the northeast monsoon is around 20th October with a deviation of about a week on either side.

Raj (1992) defines the onset of northeast monsoon over southern peninsular India based on the synoptic features. Later studies suggest that the onset of NE monsoon in India is calculated as the day on which central Tamil Nadu receives rain more than 50 mm (Raj, 2011). Charlotte *et al.* (2012) defined the onset of NE monsoon as the first occurrence of broad scale wet conditions with a minimum sustenance of 3-4 days in conjunction with easterly wind conditions. The NEM exhibits significant interannual and decadal variability (Sreekala *et al*., 2012). George *et al*. (2011) recently investigated the role of local and remote meteorological variables in deciding the occurrence of strong and weak phases of the NEM rainfall on the basis of its interannual variation over peninsular India. Surface air temperature is one of the factors that influence monsoon variability (Raj, 1998).

The spatial and temporal variability of the NEM rainfall over peninsular India and its association with sea surface temperature (SST) of tropical oceans are more recently studied by Nayagam *et al*. (2009). Using 131 years (1871–2001) historical dataset, Kripalani and Kumar (2004) investigated the interannual and decadal variability in the NEM rainfall and the Indian Ocean dipole mode (IODM) and depicted an increasing trend in the IODM in the warming environment. They also showed that the IODM phenomenon directly influences the NEM rainfall.

The rainfall received in Tamil Nadu during the northeast monsoon season is of great economic value. Major agricultural operations are normally undertaken during that season. It has, however, been noted that the rainfall during northeast monsoon is highly variable. Therefore, if its behavior could be predicted in advance, it would go a long way toward helping the agricultural and industrial activities of the region (Dhar and Rakhecha, 1983).

With the increasing demand for food, oilseeds and pulses, by the ever-growing human population, a desire necessity now arises to utilize the untapped rainfed dry lands effectively. Time and labour in addition to water are the main constraints for the rainfed farming, since the agricultural operation in rainfed agriculture starts with monsoon rains. The dependency of rainfall forecast can be increased by using higher resolution rainfall data in both space and time. The available date of sowing week was calculated long back at Agro Climatic Zone level and which is only seven for entire Tamil Nadu. Due course of time and change in climate, the accuracy of the predicted date is very less and more false alarms are being observed. An attempt has been made at Tamil Nadu Agricultural University under UGC sponsored scheme "Revalidating premonsoon sowing week with higher resolution for changing climate of Tamil Nadu" with the objectives of identifying shift in rainy season over the period from 1950 to 2010 and pre-monsoon sowing weeks at block level.

MATERIALS AND METHODS

Collection of rainfall data and PET

Daily rainfall data observed at 18 TNAU stations, 47 locations from State Ground and Surface Water Data Centre and 700 locations from district level State Documentation department were collected and organized. The above observed data availability is ranged from 1970-2010. The observed data are not perfect and have few errors and missing values. Hence, verification of data for the trueness and generating missing or false data was done by using TNAU weather soft.

As these observed records are available only for the period from 1970-2011, the APHORDITE's gridded data sets of daily rainfall was utilized to fill the gaps from 1951. The high-resolution 0.25 degree gridded rainfall data set for Tamil Nadu (170 locations) were downloaded from Asian Precipitation - Highly-Resolved Observational Data Integration Towards Evaluation of Water Resources at http://www.chikyu.ac.jp/precip/.

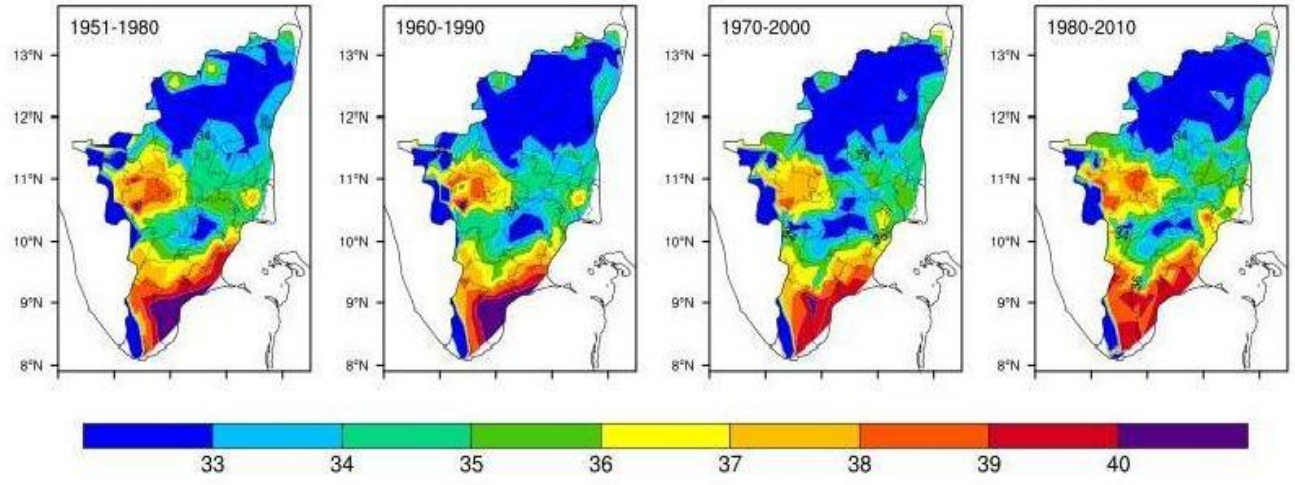

Figure 1. Monsoon onset weeks over different moving periods in Tamil Nadu

The Potential Evapo Transpiration (PET) for entire Tamil Nadu @ 0.5 degree resolution (41 locations) was downloaded from the University of East Anglia released CRU-TS 3.1 Climate Database at http://badc.nerc.ac.uk/data/cru. This new version of database covers from 1901 to 2009, globally at 0.5 degree spatial resolution on land areas. The APHRODITE's gridded data sets were used to fill the rainfall data gap from 1951 and the PET was taken from CRU-TS 3.1 Database.

Identifying shift in rainy season

The agro-climatic variable viz., the length of growing period and pre-monsoon sowing week were estimated using Jeevananda Reddy's 14-week moving average technique. To predict the shift over the 60 years period, four period analyses were made for each of the 30 years from 1951 leaving a decade behind viz., 1951-80, 1961-90, 1971-2000, 1981- 10 for the subsequent analysis. The following conditions were considered to fix the onset week.

a. Consecutive of three or more weeks should have a 14 week moving average of R/ PE ≥ 0.75 which is the optimum range for plant growth.
b. The week at the beginning of the period has a simple R/ PE value of ≥ 0.50

RESULTS AND DISCUSSION

Totally 60 years (1951-2010) of daily rainfall data are analyzed for 765 location and the results are plotted in graph (Fig. 1).The decadal analysis for identifying the shift in NEM onset clearly indicates that the onset week was shifted over these periods from 1951 to 2010. The shift has both temporal and spatial variation as like rainfall quantity. The shift observed in NEM onset was one or two weeks on either side. Depending upon the topography of the place, the shift varied widely even within the block itself. The NEM onset was two weeks earlier in southern districts of Tamil Nadu and one week earlier in north western and western parts of Tamil Nadu.

Whereas, the onset was become delayed a week at Western Ghats, North eastern and coastal regions of Tamil Nadu. In general comparing 1950, current monsoon onset was become early towards inlands and delayed near sea.

Conclusion

Shift in the North East Monsoon onset on either side have been observed in Tamil Nadu over these periods and are more pronounced by an earlier onset in southern districts and delayed along the coastal partof Tamil Nadu where North East Monsoon is the case.

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REFERENCES

Charlotte, B.V., Gibies George and Ruchith, R.D. 2012. A study on the onset date of boreal fall rainfall season of India. *IOSR J. of Engineering,* 2(7): 32-35.

Dhar, O.N. and Rakhecha P.R. 1983. Foreshadowing Northeast monsoon rainfall over Tamil Nadu, India, Monthly weather Review, 111: 109 -112.

George, G., Charlotte, B.V and Ruchith, R.D. 2011. Interannual variation of northeast monsoon rainfall over southern peninsular India. *Indian J. Geo-Mar Sci.,* 40(1):98–104.

India Met. Dept. 1973. Northeast monsoon; FMU Rep. No.IV18.4.

Kripalani, R.H and Kumar, P. 2004.Northeast monsoon rainfall variability over south peninsular India vis-á-vis the Indian Ocean dipole mode. *Int J Climatol*., 24:1267–1282.

Nayagam, L.R., Janardanan, R. and Ram Mohan, H.S. 2009.Variability and teleconnectivity of northeast monsoon rainfall over India. Glob Planet Chang 69(4):225–231.

Raj, Y.E.A. 1992. Objective determination of northeast monsoon onset dates over coastal Tamil Nadu for the period 1901-1990. Mausam, 43, 273-282.

Raj, Y.E.A. 1998. A scheme for advance prediction of northeast monsoon rainfall of Tamil Nadu; Mausam 49(2):247–254.

Raj, Y.E.A. 2011. An overview of Indian northeast monsoon. In: proc. of Seminar on Indian Northeast Monsoon – Recent Advances and Evolving Concepts (INEMREC–2011), 24-25 Feb.2011 at India Met. Dept, Chennai. Pp: 3-16

Sreekala, P.P., Rao, S.V.B. and Rajeevan, M. 2012. Northeast monsoon rainfall variability over peninsular India and its teleconnections.*Theor. Appl. Climatol.,* 108(1–2): 73–83.

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