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Statistical Prediction of Seasonal Rainfall in India Vector Auto Regression (VAR) & Variance Decomposition (VDC) Model

Jyotish Prakash BASU

West Bengal State University - India, bjyotish@yahoo.com
Presenter : Jyotish Prakash Basu

Seasonal rainfall prediction has got wide range of application from agriculture management to water resource management. In an agricultural country like India, the success or failure of the crops and water scarcity in any year is always viewed with the greatest concern. A major portion of annual rainfall (about 80%) over India is received during the southwest monsoon season (June-September). This paper focuses on the connection between the scientific ability to predict climate on seasonal to inter-annual scales and the opportunity to incorporate such understanding into decisions with particular attention to issues facing water resources managers.

The objectives of the paper are three fold. First, is to forecast south west monsoon across six different regions of India by using Variance Decomposition model. Second, the paper tries to measure the variability of rainfall over 139 years across different regions of India. Third, the paper also attempts to measure inter-regions correlation matrix of rainfall.

This is an empirical paper based on data collected from secondary sources. The paper utilizes rainfall data from India's meteorological department. Data ranges from 1871 to 2010 and monthly in nature. Rainfall data are taken on six different regions of India namely Core India, North West India, North East India, Central North East India, West central India and Peninsular India from 1871 to 2010. Stationary test by Augmented Dickey Fuller test (ADF) test statistic on the south west monsoon data across different regions of India has been calculated and shows that rainfall data are stationary at level. After conforming stationary test, Vector Auto regression model (VAR) is used to estimate 14 parameters. The result of VAR showed that the previous year rainfall of Core India has positive and significant impact on the rainfall of Core India at the current period. Similarly, previous year rainfall of North West India has negative and significant impact on the rainfall of core India at the current period.

Variance Decomposition method is used for prediction of rainfall. The time horizon for prediction is 10-year (from 2010 to 2020). The prediction result shows that the rainfall for West Central India, Peninsular India, North east India and Core India will be decreasing while the rainfall prediction for Central North East India and North West India will be on the rise.

The rainfall variability across different regions of India is judged by standard deviation and the result shows that the lowest variability of rainfall is observed in Peninsular India while the highest variability is perceived in North East India. The correlation matrix of rainfall for all regions shows that there is a strong relationship of rainfall across the regions. The positive and significant value of correlation coefficient is found to be highest (0.86) between Core India rainfall and West central India rainfall while the lowest value of the correlation coefficient (0.04) is between Central North East India and North East India. This prediction model takes care for the prevention of floods and droughts.

Key words: forecasting, vector auto- regression, rainfall variability, correlation matrix, stationarity test, augmented Dickey Fuller Test (ADF).