Forecasting Meteorological Drought for a Typical Drought Affected Area in India using Stochastic Models

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SUMMARY

The Standardized Precipitation Index (SPI) is used throughout the world as a meteorological drought index to identify the duration and/or severity of drought. Early forecasting of drought is a critical issue to mitigate the adverse effects of drought of varying intensities. To address this issue, linear stochastic models, such as ARIMA and SRIMA have been used in this study. We studied ARIMA and SARIMA models to identify the most appropriate model to describe the SPI series at 3, 6, 9, 12 and 24 month time scale for the Ballary region in Southern India. Temporal characteristics of droughts based on SPI as an indicator of drought severity indicated that the region has been affected by a prolonged drought during the study period (1968–2012). Our study followed ARIMA calibration approach using time series data of SPI series for drought forecasting. The best model among different data sets has been identified using minimum Akaike Information Criteria (AIC), Schwarz-Bayesian Information Criteria (SBC) criteria along with the independency and normality criteria of the residuals. For 3-month SPI series ARIMA was observed to be appropriate while SARIMA model series is promising for the remaining SPI series. The stochastic models developed to predict drought were observed to give reasonably good results with 3 month lead time. Since drought prediction plays an important role in conservation of water resources, water storage management and mitigating drought severity, stochastic models has been observed to be the best and is recommended for drought forecasting in this region of India.

Keywords: Auto regressive integrated moving average, Drought forecasting, Linear stochastic model, Seasonal auto regressive integrated moving average, Southern India, Standardized precipitation index.