Statistical trend, homogeneity and stationarity analysis of annual rainfall for Amaravati - Andhra Pradesh

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Abstract: The present study aims to find trends, Homogeneity and stationarity of gauged rainfall stations located in and around the capital city of Andhra Pradesh, Amaravati. Amaravati is in developing stage where the need for trend analysis of precipitation and study of rainfall stationarity is high for the water resources development and management. Thirty years (1985-2014) of annual precipitation data from 17 gauged stations are considered for the study. The analysis is based on the parametric linear regression analysis and non-parametric methods such as Mann–Kendall trend test and Sen's slope method (Cooley,2017). Homogeneity of rainfall series is calculated by SNHT (Standard Normal Homogeneity Test), Pettitt's test, Buishand's test and Von Neumann's test (Jana'2017; Taxak,2014). Stationarity and non-stationarity of time series are determined using Kwiatkowski– Phillips–Schmidt–Shin (KPSS), Dickey-Fuller (ADF) and Phillips-Perron (PP) methods (Yilmaz,2014).

Trend analysis is performed for 95% confidence interval using Mann-Kendall trend test and magnitude is calculated using Sen's slope analysis. Mann-Kendall statistical properties of the annual average rainfall time series result are obtained. 47% of the station has a positive trend, in which the significant trend detected at Vijayawada urban ($Z= 1.74$, $P_{Two\ tailed}=0.087$). Insignificance negative trend is found at 7 stations. Sen's slope values vary from -1.233(at Kanchikacherala) to 1.744 (Vijayawada Urban). Parametric linear regression analysis of annual rainfall displayed a 53% positive trend and 30% showed a negative trend. Medikonduru, Thullur, Phirangipuram, Prathipadu and Kanchikacherala rainfall stations did not show any trend while carrying out by linear regression analysis. Pettitt's test showed Homogeneity in the all annual rainfall series. SNHT and Buishand's test showed heterogeneity at Pedakurapadu and Vijayawada urban where the change point found in the year 2009 and 2007 respectively. Von Neumann's test showed heterogeneity at Amaravati station and Penamaluru. ADF test and PP test showed stationarity at 90% of annual rainfall. 76% of annual time series showed stationarity using KPSS test.

The results of this study will help in the decision making and planning of water resources management and development at Amaravati. Variability and trends of rainfall and streamflow are useful for planning studies, hydrological modelling and climate change impacts assessment for Amaravati.

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