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Application of Multisite-Multivariate CLIGEN Weather Generator in Diyala River Basin in Iraq for Climate Change Assessment.

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Abstract: Assessment and evaluation of risk analysis due to climate change impacts on water resources is of paramount importance for hydrologists and scientists. Testing a water resource system behavior under synthetic future scenarios can help us understand the system performance and suggest mitigation strategies. Such evaluation can be performed by implementing a weather generator model coupled with a hydrology model in order to study future climate scenarios for extreme events. Therefore, the main objective of this study is to develop a weather generator model with capability of producing a wide range of climate scenarios in order to assess future climate variability and its impacts on a water resources system. Herein, CLIGEN model is implemented to achieve this purpose. The proposed model contains different features including: (1) a second-order, two-state Markov chain to simulate the precipitation occurrence; (2) Wilks’ technique to produce correlated precipitation occurrences and amounts at multiple sites; (3) conserving the cross-correlation and the auto-correlation between the weather variables and the variable itself; and (4) an ability to alter the variable parameters (i.e., mean, standard deviation and coefficient of variation) to generate realistic scenarios to be used later for evaluation of climate change impacts. The developed model is applied in Diyala river basin in Iraq to demonstrate its validity for the period between 1948 to 2006. Results indicate that the proposed model preserves the statistical properties of the variables as compared to the observation properties. The proposed model also conserves the Auto-correlation of a single parameter, the spatial correlation between each variable, and the cross-correlation between the variables in each site with a good agreement with the observation characteristics. The results also show that the second-order two-state Markov chain is superior over the first-order two-state which demonstrates the importance of using higher order in dry-climate regions.

Keywords: CLIGEN weather generator; Diyala river basin; Wilks’ technique