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Forecasting performances of hybrid ANN-SARIMA, Grey and SARIMA models for monthly rainfall data

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As a real world practice, rainfall data has a seasonal trend with short term as well as long term oscillations. Therefore monthly rainfall forecasting plays an important role in miscellaneous fields today; it is especially considered the most important climatic element that influences agriculture, to manage daily human activities. The main objective of this current study is to find a model to efficiently forecast monthly rainfall in Nuwara Eliya, Sri Lanka in the long term and short term. The study was carried under the two main phases. In the first phase, an Artificial Neural Network (ANN) and Seasonal Autoregressive Integrated Moving Average Model (SARIMA) based new hybrid model is introduced to forecast monthly rainfall data, considering twelve years in the period 2006-2017, representing two divisional secretaries' rainfall stations, namely, Ginigathhena and Alupolla. In the second phase, Grey (1, 1) with the proposed hybrid approach is implemented to predict rainfall, using 24 month observations from January 2016 to December 2017. The minimum values of Akaike's information criterion, Schwarz's Bayesian information criterion, and Hannan Quinn criterion results suggested that, SARIMA(1,0,0)(1,1,2)_[12] and SARIMA(2,0,0)(0,1,1)_[12] models are more suitable for forecasting rainfall in Ginigathhena and Alupolla stations respectively. The model accuracy testing results suggested that new proposed SARIMA-ANN hybrid method (Mean Absolute Percentage Error (0.4037 (SARIMA-ANN) < 1.1414(SARIMA))) always gives the best result. However, in a short term manner GM(1,1) always gives a better result than proposed new SARIMA-ANN hybrid model. The results confirmed that, the proposed model is more suitable for modeling and forecasting rainfall data under complex behaviors such as uncertainty, seasonality, and high fluctuations. Furthermore, the proposed hybrid model is appropriated to predict the monthly rainfall for the upcoming years to assist decision makers to establish priorities for water demand, storage, distribution, and cultivation.

Keywords: Grey model, SARIMA, ANN-SARIMA, hybrid model

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