



Application of artificial neural network, multiple linear regression, and response surface regression models in the estimation of monthly rainfall in Northern Cyprus

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ABSTRACT

Forecasting the rainfall is one of the most important issues in the hydrological cycle. It is very challenging because is still unable to get an ideal model given its uncertain and unexpected variation. Therefore, the study reviewed previous scientific studied from 2000 to 2020 associated with predicting the rainfall in Northern Cyprus and worldwide using machine learning models or mathematical regressions. According to this review, it is evident that the response surface regression (RSR) model has not yet been considered in other studies about monthly rainfall prediction. Consequently, this paper is examined the performance of the RSR for monthly rainfall prediction and compared with the most prominent rainfall artificial model (feed-forward neural network) and multiple linear regression (MLR). In this work, geographical coordinates (latitude (L), longitude (Lo), and altitude (AL) of the location) and meteorological parameters (average temperature (AT), maximum temperature ($MaxT$), minimum temperature ($MinT$), and relative humidity (Rh)) are considered as input variables for the models. Rainfall (R) is considered as an output variable for all models. The meteorological data were collected from seven meteorological stations distributed over Northern Cyprus for a short-term period (2011–2017). The coefficient of determination (R^2), root mean squared error (RMSE), Nash–Sutcliffe efficiency (NSE), and Willmott's index of agreement (d) were used to select the best predictive model. The results demonstrate that the developed ANN model is superior in predicting the value of monthly rainfall with reported values of 0.631, 33.404, 0.625, and 0.880 for the parameters of R^2 , RMSE, NSE, and d , respectively. Additionally, the results indicate that the RSR model gave better represent the relationship between the geographical coordinates, meteorological parameters, and rainfall and produce a better prediction of the monthly rainfall compared to MLR.

Keywords: ANN; Northern Cyprus; MLR; Monthly rainfall; RSR

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