Modeling of spatially distributed infiltration in the Iraqi Western Desert

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Abstract

Infiltration process tends to be one of the most essential elements of the hydrological cycle. Comprehensive and thorough information on soil infiltration in both temporal and spatial territories can support maintaining environmental and hydrological development. Traditional methods to measure soil infiltration are costly, time-consuming, and their facility to regain the spatial and temporal inconsistency, particularly in large scale areas. In this context, remote sensing is capable of providing meaningful information for counting preliminary soil infiltration on various spatial scales via spectral reflectance variability. The present study aims at developing a mathematical model to determine the spatially distributed infiltration using artificial neural networks (ANN) combined with geographical information system (GIS), remote sensing (RS), and field infiltration measurements using a double ring infiltrometer in the Wadi Al-Ratga in the Iraqi western desert. The performance of the proposed model was assessed both qualitatively and quantitatively by comparing the results measured against estimated infiltration rate values for each sample. The distribution of estimated infiltration rate values in dry season varies from 56 to 215 mm/h while the distribution of estimated IR values in wet season varies from 12 to 27 mm/h. The results indicate a good agreement between estimated and measured infiltration (R2 = 0.8443, mean absolute percent error (MAPE) = 0.0996, root mean square error (RMSE) = 16.8 mm/h, and relative error (RE) less than 20%). Therefore, this comparative method plays for a considerable role in detecting and mapping soil infiltration by providing timely, fast, reparative, and relatively cheap data