PREDICTING RAINFALL SPATIAL VARIABILITY USING GEOSTATISTICAL ESTIMATION

A. D. Bello, A. A. Shuaibu and A. B. Usman

1Department of Hydraulics and Hydrology, Faculty of Civil Engineering University Technology, Malaysia, Skudai, Johor Bahru, Malaysia.
2Department of Civil Engineering, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.
3Department of Water Resources and Environmental Engineering, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.

Corresponding Author: email: abdulshub4@gmail.com, Phone: +2348035360921

ABSTRACT
The most relevant climate data used in hydrological studies is rainfall, but spatial extent of actual rainfall events are poorly presented using gauge observations that are often sparse and of poor quality. For an accurate presentation of the hydrology of a Skudai watershed, geostatistical techniques are developed for mapping the rainfall distribution using the elevation data derived from a Digital Elevation Model (DEM) and mean annual rainfall data of 5 rain gauges stations extended over 287.44 km² of the watershed. The interpolation between the point gauges and elevation points are computed using ordinary Co-Kriging (OCK) and Ordinary Kriging (OK) methods. A semivariogram model generated using OCK method with an $R^2$ value of 0.89 and OK method of an $R^2$ value of 0.91 are used to predict the unknown rainfall depth for each elevation points. The cross-validation statistics of semivariogram model result shows a 0.53 KRMSE value for OCK and 0.74 for OK algorithms. In other to evaluate effectiveness of the OK and OCK methods in estimating rainfall in the watershed, IDW method was used to estimate the rainfall distribution of the study area. The maximum $R^2$ and RMSE values obtained are 0.38 and 0.54 respectively. Comparing the result of the two methods it confirmed that geostatistical estimation as the most suitable method of spatial interpolation to predict the most probable rainfall depths in the Skudai watershed.