

Predicting spatial distribution pattern of saturated hydraulic conductivity in research field of Sistan dam

Abstract

Saturated hydraulic conductivity is one of the important soil physical properties which is fundamental in many soil and water related sciences such as irrigation and drainage, groundwater and environment. Thus, measurement and prediction of spatial distribution pattern of saturated hydraulic conductivity is of great important. In this study, saturated hydraulic conductivity was measured in 113 locations over an agricultural research field in Sistan Dam using Guelph Permeameter (GP). Then the successful results of two-depths analysis of GP were compared with those obtained from one-depth based analyses including Richards (K_S), Laplace (K_L) and Richards regression (K_R) solutions. Geostatistics was used for spatial variability analysis and mapping of saturated hydraulic conductivity over the study area. The interpolation methods used were ordinary kriging (including logarithm transform) and inverse distance weighting. A number of 47 tests were omitted due to invalid results obtained. According to the results, two-depths analysis was mostly correlated to K_R , K_S and K_L solutions in a sequential order. Anisotropic semivariograms showed no significance difference of spatial variability of saturated hydraulic conductivity in different directions as well as no significant trend. The best semivariogram model for all methods was exponential. The cross validation results of estimating saturated hydraulic conductivity showed that both interpolation methods have similar accuracy. The RMSE and MAE of evaluating kriging were respectively 0.147 and 0.105 m/day for K_S , 0.265 and 0.189 m/day for K_L and 0.117 and 0.083 m/day for K_R . Accordingly, the highest and the lowest interpolation errors were obtained for Laplace and Richards regression solutions. Based on generated maps, the highest saturated hydraulic conductivity was observed in north and northeast of the study area. Lower amounts of saturated hydraulic conductivity were observed in south and southwest of the study region where soil texture was heavier than north regions.

Key words : Autocorrelation, Geostatistics, Guelph Permeameter, One-depth solution, Saturated hydraulic conductivity



University of Zabol

Faculty of Water and Soil

Department of Irrigation and Drainage

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Supervisors:

Dr .P. Afrasiab

Dr. M. Delbari

By:

A. A. Bozorgi

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