Effect of Antecedent Conditions on Prediction of Pore-Water Pressure Using Artificial Neural Networks

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Received: October 9, 2011 Accepted: December 26, 2011 Published: Feburary 1, 2012
doi:10.5539/mas.v6n2p6 URL: http://dx.doi.org/10.5539/mas.v6n2p6

Abstract

The effect of antecedent conditions on the prediction of soil pore-water pressure (PWP) using Artificial Neural Network (ANN) was evaluated using a multilayer feed forward (MLFF) type ANN model. The Scaled Conjugate Gradient (SCG) training algorithm was used for training the ANN. Time series data of rainfall and PWP was used for training and testing the ANN model. In the training stage, time series of rainfall was used as input data in one model whereas, rainfall and pore water pressure with some antecedent conditions was used in second model and corresponding time series of PWP was used as the target output. In the testing stage, data from a different time period was used as input and the corresponding time series of pore-water pressure was predicted. The performance of the model was evaluated using statistical measures of root mean square error (RMSE) and coefficient of determination (R^2). The results of the model prediction revealed that when antecedent conditions (past rainfall and past pore-water pressures) are included in the model input data, the prediction accuracy improves significantly.

Keywords: Antecedent, Artificial Neural Network, Pore-water Pressure, Prediction, Rainfall

1. Introduction

Variations in soil pore-water pressure (PWP) due to rainfall are known to exhibit highly non-linear and complex relationship. This is due to the spatial and temporal variability of precipitation, evaporation pattern and soil properties. The knowledge of PWP is very important in the determination of strength and effective stress of a soil. Excessive PWP increase is known to cause slope failures in areas susceptible to landslide. To arrive at effective remedial and design strategies against slope failure it is necessary to know the PWP changes due to rainfall.