

Green-Ampt approximations: a comprehensive analysis

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ABSTRACT

Green-Ampt (GA) model and its modifications are widely used for simulating infiltration process. Several explicit approximate solutions to the implicit GA model have been developed with varying degree of accuracy. In this study, performance of nine explicit approximations to the GA model is compared with the implicit GA model using the published data for broad range of soil classes and infiltration time. The explicit GA models considered are Li et al. (1976) (LI), Stone et al. (1994) (ST), Salvucci and Entekhabi (1994) (SE), Parlange et al. (2002) (PA), Barry et al. (2005) (BA), Swammee et al. (2012) (SW), Ali et al. (2013) (AL), Almedeij and Esen (2014) (AE), and Vatankhah (2015) (VA). Six statistical indicators, e.g., percent relative error, maximum absolute percent relative error, average absolute percent relative errors, percent bias, index of agreement, and Nash-Sutcliffe efficiency are used for assessing model performance. Models are ranked based on the overall performance index (OPI). The BA model is found to be the most accurate model followed by the PA and VA models for variety of soil classes and infiltration periods. The SW, SE, AE, and ST model also performed comparatively better. Based on the overall performance index, accuracy of the explicit models is ranked as BA > PA > VA > SW > SE > AE > ST > AL > LI. Results of this study will be helpful in selection of accurate and simple explicit approximate GA models for solving variety of hydrological problems.

Keywords: Green-Ampt; Implicit equation; Explicit equation; Infiltration, Overall performance index.