

Numerical simulation of infiltration and groundwater recharge using the Hydrus for Modflow package and the BEST model of soil hydraulic properties

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ABSTRACT

Groundwater recharge is a complex process, which depends on several factors, including the hydraulic properties of soils in the vadose zone. On the other hand, the rate of recharge is one of the main input data in hydrogeological models for saturated groundwater flow. Thus, there is an increasing understanding of the need for more complete representation of vadose zone processes in groundwater modeling. One of the possible approaches is to use a 1D model of water flow in the unsaturated zone coupled with 3D groundwater model for the saturated zone. Such an approach was implemented in the Hydrus for Modflow package (Seo et al. 2007), which combines two well-known and thoroughly tested modeling tools: groundwater flow simulator MODFLOW (Harbaugh 2005) and one-dimensional vadose zone simulator HYDRUS 1D (Šimůnek et al. 2016), based on the Richards equation. The Hydrus for Modflow package has been recently enhanced by implementing the BEST model of soil hydraulic properties (Lassabatere et al. 2006), which is a combination of van Genuchten – type retention function with Brooks-Corey type hydraulic conductivity function. The parameters of these functions can be divided into texture-related and structure-related and can be obtained from relatively simple lab and field tests. The method appears a promising tool for obtaining input data for vadose zone flow models. The main objective of this work is to evaluate the sensitivity of the recharge rates to the values of various parameters of the BEST model. Simulations are performed for a range of soil textural classes and plant covers, using meteorological data typical for northern Poland.

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