Geophysical Research Abstracts
Vol. 20, EGU2018-4014, 2018
EGU General Assembly 2018

A new constraint on parameter beta of Haverkamp's model for 1D water infiltration

Laurent Lassabatere (1), David Moret-Fernández (2), Rafael Angulo-Jaramillo (1), Simone Di Prima (3), Massimo Iovino (4), and Vincenzo Bagarello (4)

(1) ENTPE, University of Lyon LEHNA UMR 5023 CNRS ENTPE UCBL, Vaulx en Velin, France (laurent.lassabatere@entpe.fr), (2) Departamento de Suelo y Agua, Estación Experimental de Aula Dei, Consejo Superior de Investigaciones Científicas (CSIC), PO Box 13034, 50080 Zaragoza, Spain., (3) Agricultural Department, University of Sassari, Viale Italia, 39, 07100 Sassari, Italy, (4) Dipartimento di Scienze Agrarie, Alimentari e Forestali, Università di Palermo, Viale delle Scienze 90128, Palermo, Italy

Water infiltration into the soils is one of the major components of the water cycle. Several studies have investigated the quantification of water infiltration into soils, considering at first homogeneous soil columns (Haverkamp et al., 1994). Haverkamp's implicit model was designed for modelling water infiltration into 1D soil columns and then extended to 3D for axisymmetric problems like infiltrometers. Haverkamp et al. (1994) also defined explicit approximate expansions for an easier computation of the transient and steady states. However, the proposed model and related expansions involve a shape parameter beta that is fixed by default at 0.6 in spite of any appropriate justification. The analytical procedure established by Haverkamp for this model requires that beta < 1. However, this constraint is never considered. Besides, several numerical studies have focused on the optimization of this parameter by fitting numerically generated data and proved that beta had to be optimized as a function of soil texture and had to be over unity for certain types of soils. If not, the analytical model was not able to mimic the concavity of the numerical cumulative infiltration curves accurately (Lassabatere et al., 2009). In this investigation, we use the scaled versions defined by Lassabatere et al. (2009) of Haverkamp's model and related expansions to propose a sensitivity analysis as a function of parameter beta. The sensitivity analysis shows that beta may be over unity but must remain < 2, under all circumstances. If this constraint is not considered, the analytical models suffer from significant inconsistencies regarding the physics of water infiltration in soils and must not be used.

Haverkamp R, Ross PJ, Smettem KRJ, Parlange JY (1994) 3-Dimensional analysis of infiltration from the disc Infiltrometer .2. Physically-based infiltration equation. Water Resour Res 30:2931–2935.

Lassabatere, L., Angulo-Jaramillo, R., Soria-Ugalde, J.M., Simunek, J. Haverkamp, R. 2009. Numerical evaluation of a set of analytical infiltration equations. Water Resour. Res.