Geophysical Research Abstracts, Vol. 7, 05200, 2005
SRef-ID: 1607-7962/gra/EGU05-A-05200

A fast, simplified three-dimensional saturated-unsaturated lateral flow numerical simulation model for hydrological modeling at watershed scale

Z. Saâdi (1), S. Debionne (2), P. Viallet (2), D. de Condappa (1), I. Braud (1), R. Haverkamp (1)

(1) Laboratoire d'étude des Transferts en Hydrologie et Environnement, LTHE (UMR 5564, CNRS, INPG, UJF, IRD), BP 53X, 38041, Grenoble, Cedex 9, France, (2) Hydrowide, BP 53X, 38041, Grenoble, France (zakaria.saadi@hmg.inpg.fr)

We present a new, fast and simplified 3D numerical saturated-unsaturated simulation model developed in the framework of the hydrological modeling system POWER (**P**lanner **O**riented **W**atershed modeling system for **E**nvironmental **R**esponses). It is based on a one-dimensional implicit finite volume numerical scheme of the Richards flow equation, combined with a 2D explicit saturated-unsaturated lateral flux scheme entering through imbedded sink/source terms. Water flow is simulated by considering vertical and lateral soil heterogeneity and scale factors of the soil structure parameters distributed at the watershed scale. For the special case of a 2D flow domain, the results are compared with the numerical finite element solution of HYDRUS-2D considering flow domain geometries with successive sand and clay soil layers, or successive sand and clay soil columns. The numerical scheme is conservative with negligible mass balance errors. No problems of convergence and stability have been observed. Whereas the volumetric water contents and pressure heads at different points of the flow domain are calculated satisfactory, the soil water fluxes during drainage and infiltration are simulated very accurately. The 2D user mode of the scheme is faster than HYDRUS-2D involving little CPU time for long periods of calculation.