Darcy multi-domain approach for coupling surface-subsurface flows: application to benchmark problems

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A fully integrated coupling between surface and subsurface flows has been implemented during these last years (Weill et al., J. Hydrol., 2009). This model unifies the Richards and the diffusive wave equations into a single generalized Richards equation defined in a single domain composed of surface and subsurface subdomains. The unified equation is solved with a Picard iterative scheme in the Cast3M numerical framework (www-cast3m.cea.fr). This model has been applied successfully to 2D configurations (Abdul and Gilham, Water Resour. Res. 1984; Ogden and Watts, Water Resour. Res. 2000). It also allowed us to simulate several theoretical benchmark test cases involving the runoff production by excess saturation or by excess infiltration, and the runon-runoff processes on a heterogeneous soil (Kollet and Maxwell, Adv. Water Res. 2006; Sulis et al., Adv. Water Res. 2010, Maxwell et al., Water Resour. Res. 2014). We will present our last simulation results of benchmark problems proposed by S.J. Kollet and R.M. Maxwell during the 2nd Integrated Hydrologic Model Intercomparison Workshop which was held at the University of Bonn on June 2013: the 3D tilted V-catchment and the Super-slab case.