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Simulating surface and subsurface water flow for a headwater catchment in the Eifel National Park, Germany.

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The system of equations governing water flow and solute transport is highly non-linear. Moreover at the soil surface, boundary condition changes rapidly and irregularly. Therefore, the equations describing hydrological processes are usually solved by numerical methods.
This work is part of the Transregio-SFB 32 (TR32) research project with the title “Pattern in Soil-Vegetation-Atmosphere Systems: Monitoring, Modelling, and Data Assimilation”. The TR32 works on exchange processes among soil, vegetation and the adjacent atmospheric boundary layer.A fully-integrated surface-subsurface flow model is applied to the Wüstebach basin which is a tributary to the Erkensruhr river, Germany, with a catchment size of about 27 ha. This catchment is part of the new Eifel National Park. The catchment is well characterized and monitored. The simulation of surface/subsurface flow and the interaction between these domains are studied here with the three-dimensional finite-element code HydroGeoSphere (Therrien et al., 2007).
With increasing computer power, process-based models that use grids to discretize space have become popular. For such models, the simulation results depend on both grid cell size and on the time step length used in the model. The choice of the space and time resolution results from a subjective balance between acceptable accuracy and such as calculation time and use of hard-disk space.
In this study the effect of grid cell size and time step length on model results is studied. The results show that before model calibration a choice for a certain grid cell size and a certain time step length has to be made.

References:
Therrien, R.; McLaren, R.G.; Sudicky, E.A.; Panday, S.M. (2007). HydroGeoSphere; A three-dimensional numerical model describing fully-integrated subsurface and surface flow and solute transport: User manual, 362 pp.