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IMPLICATIONS OF DIFFUSIVE WAVE CASCADING PLANE SIMULATIONS FOR THE STUDY OF SURFACE WATER - GROUNDWATER INTERACTION WITH A 3-D FULLY-INTEGRATED CATCHMENT MODEL

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Summary. The study of hydrological responses and interactions within coupled surface water - groundwater systems at catchment scales gave rise to the development of 3-D fully-integrated, physically-based models solving the diffusive wave equation coupled to the Richards' equation for variably-saturated flow. As their typical temporal and spatial resolution requirements are high, such models demand very long computation times.

Looking for computationally efficient alternatives to these types of models (to which we will refer as the geometrically realistic model below) we investigated the usability of a simplified watershed model, the so-called equivalent diffusive wave cascading plane for parameter studies. The simplified model allows considerable savings in computation time while it keeps important model processes, certain geometric characteristics, and material properties of the catchment. Despite the geometric simplification the fully coupled system of surface water and subsurface water flow equations are solved within the diffusive wave cascading plane.

We use the cascading plane to study the sensitivities of different catchment controlling factors (e.g. roughness coefficient, saturated hydraulic conductivity) and soil hydraulic functions (e.g. air-entry pressure, pore-size factor) on the hydrological response at the Lerma river basin a tributary to the Ebro River, Spain.

The comparison with the calibrated geometrically realistic model indicates that the diffusive wave cascading plane has the potential to identify meaningful parameter ranges and sensitivity rankings that may be transferred from the simplified model to the realistic one at the benefit of reduced computation times