



A modelling framework for spatially temporally explicit simulation of soil-landscape dynamics: the mARM3D model

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The description of soil properties in hydrological and geomorphological models is typically extremely simplistic. This is a known limitation as the effect of soil properties on landscape processes is spatially and temporally complex. The reasons for the simplistic conceptualization of soil in distributed models vary, but are mostly due to (1) lack of quantitative and distributed soil data and (2) uncertainties in the role of soil properties in landscape processes.

In order to address these issues we have developed a new soil-landscape modelling framework called mARM3D. The mARM3D model explicitly calculates three-dimensional soil evolution as a function of both pedon and surface processes. In order to overcome the immense computational requirements for this interaction, mARM3D is based on a novel algorithm which couples physically-based equations and transition matrices. The computational efficiency of mARM3D allows for long-term (100,000s years) and large-scale (1000s pixels and 10s profile layers) simulations.

Here the modelling concept will be briefly described followed by a description of a case-study. This case-study examines the effect of spatial and temporal erosion-weathering dynamics on soil properties (depth, soil grading) distribution.