LORICA: A NEW SOIL-LANDSCAPE CO-EVOLUTION FRAMEWORK

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Soils and landscapes develop in tandem. Soil development changes erodibility which affects geomorphic processes, and erosion and deposition affect soil development. This co-evolution is sometimes dominated by mainly vertical pedogenic processes, sometimes by mainly lateral geomorphic processes, but most often by both at the same time. Either way, a full understanding of the effects of land use and climate change on storage of carbon in the landscape, on geo- and pedodiversity and on agricultural productivity requires a joint consideration of landscape dynamics and soil dynamics.

We present a recently developed soil-landscape model, LORICA. The model manipulates a digital landscape (DEM), in which for every cell a user-specified number of soil layers exists. Per layer, soil properties such as the mass of various texture classes and organic matter are stored. Pedogenic processes such as bioturbation, clay translocation and weathering affect these properties within and between layers. Geomorphic processes such as water erosion and deposition, and tillage affect these properties for the top layers between different grid cells. We illustrate the interface and the working of the model with several key example outputs such as maps of soil properties, timeseries of sediment export and transects through the evolving digital landscape.

It is foreseen that the model is not only useful to visualize and evaluate pedological and geomorphological hypotheses, but also as a robust landscape-scale framework in which other processes or variables can be simulated. This could include ecological modelling of vegetation and biodiversity development and assessments of the effect of historical or future land use change on soils and landscapes.