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Simulating heavy rainfall events for parameterizing a first application of the physically based soil erosion model EROSION3D in South Africa

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Soil erosion is a frequently tackled field of research and plays a major role in land degradation. Representing a discontinuous process soil loss is strongly determined by single events, which leads to high demands on modelling approaches.

Here we present a first application of the physically-based soil erosion model EROSION3D in a South African setting within the framework of the project SALDi (South African Land Degradation Monitor). Parameterization of the model requires intensive field work in accordance to land use and management patterns, soil types and topography. The experimental determination of physical and hydrological processes for selected sites allows for an improvement of the modelling results. Thus, rainfall and runoff simulation campaigns were carried out on various sites with a 3 x 1 m² mobile rainfall simulator. Additionally, UAV and TLS surveying, soil sampling, laboratory analysis and digital soil mapping complemented the approach. The created datasets are firstly handled in EROSION2D to calibrate soil erosivity and hydraulic conductivity and then introduced to EROSION3D for including land use, precipitation, elevation, multi-layered soil properties, organic carbon content and additional model input parameters.

The modelling procedure was applied within the boundaries of a research catchment close to Ladybrand in the Free State for first test runs. Furthermore, the same approach showed distinct differences on a conventionally tilled field vs. a conservational approach. An upscaling to larger catchments will then be carried out in basins with protected soils within Kruger National Park to directly compare them to results from intensively cultivated agricultural sites adjacent to the park boundaries.