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High-resolution photogrammetric methods for nested parameterization and validation of a physical-based soil erosion model

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Soil erosion is one of the most prominent environmental problems of major interest to a vast field of research. Due to the complexity, variability and discontinuity of erosional processes, erosion model approaches are non-transferable to different spatial and temporal scales.

The objective of our project is the across-scale modelling of soil erosion, using photogrammetric measurements and optimization methods as well as physical based model approaches. Present process-based models are only valid for the observation scale they are parametrized and validated for. In the observed reality phenomena therefore occur, which are not or only to some extent reproducible by complex model concepts (e.g. development of rills or concentrated runoff within driving lanes). We present the synergetic combination of a physically described model with highly redundant observations from photogrammetric data processing. This enables both the validation of the erosion model EROSION-3D as well as the optimization of its parameters and potentially advancement of the mathematical process description. The photogrammetric observations (RGB and thermal) offer the opportunity of a temporal and spatial differentiated process assessment (splash, sheet and rill erosion, as well as deposition and transport). To this purpose, the acquisition of the respective operating processes and contributing factors, will be nested defined at three different scales (micro plot, single slope and catchment scale) on two sites (loess soil and residual soil).

Flexible cross-scale applicable photogrammetric methods, considering 3D reconstruction and flow measurement, combined with physical-based methods of soil erosion modelling shall enable a better and reliable understanding of soil erosion processes on various spatial and temporal observation scales. Consequently, the implementation of the adjusted model is aimed for to enable a cross-scale description and validation of scale-dependent processes (e.g. discrete consideration of thin sheet flow and rill genesis) to offer new perspectives on both interconnectivity of sediment transport and relationship between event frequency and magnitude.