EGU21-14339, updated on 18 Jan 2022
https://doi.org/10.5194/egusphere-egu21-14339
EGU General Assembly 2021

Data overhaul Models? – Temporal and spatial high resolution assessment techniques for across-scale calibration, parameterization and validation of physically-based soil erosion models

Lea Epple[1], Andreas Kaiser[2], Marcus Schindewolf[3], and Anette Eltner[4]
[1]Friedrich-Schiller-University Jena, Geography, Physical Geography, Jena, Germany
[2]Technical University Dresden, Photogrammetry and Remote Sensing, Photogrammetry, Dresden, Germany
[3]Thuringian State Institute of Agriculture, Jena, Germany
[4]District Administration Siegen-Wittgenstein, Siegen, Germany

Soil erosion as a major environmental challenge, plays a central role in land degradation. Accurate erosion rates assessment and information on erosion, deposition and on occurring processes are important to support soil protection and recovery strategies.

Due to the complexity, variability and discontinuity of erosional processes, model approaches to predict soil erosion are non-transferable to different temporal and spatial scales. Present process-based models are only valid for the particular observation scale which they were parameterized and validated for. In reality processes occur (e.g. spontaneous rill initiation) which are only to some extent reproducible, resulting in an incomplete process description. While model parameterization in the past was limited by the availability and resolution of data, constant development of data assessment technologies help overcome these confines. Time and cost in collecting data decreases, computing power is constantly expended and both the temporal and spatial resolution offer new possibilities on new scales.

Addressing the issue 'data overhaul models' we present a unique experimental setup, including flow velocity, erosion and deposition measurements at nested temporal and spatial scales, acquired using high resolution photogrammetric data (RGB and thermal) and structure from motion techniques. At the micro plot scale (3 m^2), we perform rainfall simulations, monitored with up to eleven cameras. Using time lapse intervals of 10-20 seconds processes of pool formation and aggregate breakdown are observed. At the hillslope scale (60 m^2), we installed a permanent setup – three rigs at three slope positions at four meter height, each equipped with five synchronized RGB cameras, a RGB video-camera and a low cost thermal camera. To capture changes in soil surface during rainfall events, time lapse images are triggered by a low-cost rain gauge. Soil surface changes at the small catchment scale (4 ha) are measured by taking UAV-images before and after rainfall events. These observations are used as parameterization, calibration and validation for modelled soil surface changes and erosion fluxes, using Erosion3D and FullSWOF.

The continuous development and improvement of soil erosion assessment techniques leads to spatially and temporally highly resolved information on different scales. Eventually the adjustment of the erosion models can enable a cross-scale description and validation of scale-dependent processes, offering new perspectives on both interconnectivity of sediment transport and the relationship between event frequency and magnitude.