Geophysical Research Abstracts
Vol. 21, EGU2019-13259, 2019
EGU General Assembly 2019

The use of connectivity on #flumefriday: Results from a large-scale erosion experiment in the Total Environmental Simulator

Martine van der Ploeg (1), Hannah Williams (2), Stuart McLelland (2), Brendan Murphy (2), Daniel Parsons (2), and Jantiene Baartman (1)

(1) Wageningen University, Environmental Sciences, Soil Physics and Land Management, Wageningen, Netherlands (martine.vanderploeg@wur.nl), (2) School of Environmental Sciences, University of Hull, Cottingham Road, Kingston-Upon-Hull, HU6 7RX, United Kingdom

Despite significant research and interventions, soil erosion by water continues to be the dominant soil threat globally. The reduction or prevention of soil erosion in catchments is complicated, because the relation between rainfall, runoff and erosion is known to be highly non-linear due to scale effects and internal dynamics, like re-deposition of previously eroded material. A possible explanation for the observed behaviour is a change in connectivity within the catchment, resulting in a sudden pulse of sediment through the landscape.
Connectivity can be used to spatially and temporally include neighbourhood effects, without the need for large parameter sets and increased prediction uncertainty as compared to spatially explicit models. Connectivity can be used to determine which spatial and temporal processes are likely to have an impact, and therefore a follow up modelling exercise can be simplified. Connectivity is a measure of the number and length of water and sediment pathways, from source to sink, in a landscape or hillslope. Changes in spatial connectivity over time, which can be the result of the intrinsic erosion and deposition processes within a catchment, may account for the non-linearity between rainfall and erosion.
Although connectivity is a straightforward concept, its application calls for detailed data on fluxes across a landscape. Testing connectivity as an explanatory factor for the effect of different sequences of rainfall events on erosion dynamics is obviously very difficult to do in real landscapes. Once one, or a particular sequence of multiple rainfall event(s) occurred, they lastingly changed the landscape, i.e. it is impossible to return to the original landscape to test another sequence of rainfall events and compare the effects.
Therefore, we setup an experiment in the Total Environmental Simulator (TES) Facility at Hull University. TES includes a large rainfall simulation and provides the opportunity to quantify rainfall-erosion processes for carefully controlled simulated environments with constrained boundary conditions. TES included spatially distributed rainfall with variable rainfall rates enabling sequences with different magnitude-frequency to be simulated. Combined with a high resolution laser scanning system surface DEMs were acquired that were then used to derive spatial connectivity indices. TES enabled monitoring internal dynamics of sediment redistribution, which is relevant from a spatial modelling perspective and is very difficult in field situations.