Scale matters: contrasting hillslope and catchment scale calibration results for sediment fluxes using the LAPSUS-D model

Rens Masselink[1], Arnaud J.A.M. Temme[2], João Pedro Nunes[1,3], Saskia D. Keesstra[1]
[1]Wageningen University, [2]Kansas State University, [3]University of Aveiro

Soil erosion, especially in agricultural areas, is associated with negative onsite and offsite effects. To mitigate these negative effects, we need to better model sediment sources and their connectivity to sinks. We calibrated the LAPSUS-D model to multiple spatial scales to try and better reproduce hydrological and sediment connectivity in the agricultural catchment of 'Latxaga' in Northern Spain. The catchment has a humid sub-Mediterranean climate, clayey soils and main crops are cereals. The model was calibrated for hydrology with 3 parameters: infiltration, throughflow and soil depth. In a second step, the model was calibrated for sediment discharge at the outlet using three hydrological parameterisations optimised for: hillslope scale, catchment scale, and the combined dataset.
Results of the hydrology calibration showed that the optimum catchment model parameters were almost opposite to those of the hillslope, indicating different dominant hydrological processes. The calibrated sediment transport models produced satisfactory model results for all three optimizations. The hillslope-optimized model proved to be the most robust model. Only the hillslope-optimized model managed to reproduce the observed spatial patterns of erosion, albeit with too high quantities for erosion.
Results show that traditional ways of calibrating erosion models at the outlet to determine sediment dynamics within the catchment do not necessarily give satisfactory results. Furthermore, it is necessary to have measurements of water and sediment fluxes at multiple scales in order to verify the model results. Therefore, to gain sensible outputs it is important to know if the model correctly simulates the relevant processes at different scales, and the connectivity between these scales.