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Stochastic simulations of sediment connectivity using random forests

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Modelling sediment connectivity, i.e. determining sediment sources, sinks and pathways has often been done by applying spatially explicit models to catchments and calibrating those models using data obtained at a catchment outlet. This means that modelled locations of sediment sources, sinks and pathways are directly derived from the input data of the model (especially the digital elevation model) and the calibration parameters. On the other hand, measured sediment transport data, e.g. from erosion plots or sediment tracers (e.g. Be7, Cs137, Rare earth oxides) is often only available from small plots or hillslopes. Extrapolation of these measured values often lead to an overestimation of erosion at catchment scale. There is a need to link both the small scale erosion/deposition measurements with large scale catchment scale sediment yield.
In this study we propose using random forests (RF) for multivariable regression for determining to which extent certain variables influence sediment transport. The independent variables for the RF are derivatives of a high-resolution digital elevation model and vegetation parameters and the independent variables are sediment erosion and deposition data. For the erosion and deposition data we use sediment tracers (rare-earth oxides) applied at a single hillslope in the winter of 2014/2015. Subsequently, we will do stochastic simulations (e.g. sequential Gaussian simulation) for the entire catchment using the RF output and its residuals. These simulations will then be compared to the total suspended sediment output at the catchment outlet. This way, we hope to get a better view of both sediment yield at the catchment scale and locations of sediment sources, sinks and pathways.