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Validation of Erosion 3D in Lower Saxony – Comparison between modelled soil erosion events and results of a long term monitoring project

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Since 2000 water erosion has been surveyed on 400 ha arable land in three different regions of Lower Saxony (Mosimann et al. 2009). The results of this long-term survey are used for the validation of the soil erosion models such as USLE and Erosion 3D. The validation of the physically-based model Erosion 3D (Schmidt & Werner 2000) is possible because the survey analyses the effects (soil loss, sediment yield, deposition on site) of single thunder storm events and also maps major factors of soil erosion (soil, crop, tillage).
A 12.5 m Raster DEM was used to model the soil erosion events.Rainfalldata was acquired from climate stations. Soil and landuse parameters were derived from the “Parameterkatalog Sachsen”(Michael et al. 1996).
During thirteen years of monitoring, high intensity storms fell less frequently than expected. High intensity rainfalls with a return period of five or ten years usually occurred during periods of maximum plant cover.Winter events were ruled out because dataon snow melt and rainfallwere not measured. The validation is therefore restricted to 80 events.
The validation consists of three parts. The first part compares the spatial distribution of the mapped soil erosion with the model results. The second part calculates the difference in the amount of redistributed soil. The third part analyses off-site effects such as sediment yield and pollution of water bodies.
The validation shows that the overall result of erosion 3D is quite good. Spatial hotspots of soil erosion and of off-site effects are predicted correctly in most cases. However, quantitative comparison is more problematic, because the mapping allows only the quantification of rillerosion and not of sheet erosion. So as a rule,the predicted soil loss is higher than the mapped. The prediction of rill development is also problematic. While the model is capable of predicting rills in thalwegs, the modelling of erosion in tractor tracks and headlands is more complicated. In order to obtain better results, the DEM needs a higher resolution, and soil and landuse parameters have to been optimized in tractor tracks and headlands (higher bulk density, less coverage). Other models like LINERO (Bug &Mosimann 2012) can help to get an overview over the location of erosion forms and the soil loss due to rill erosion.

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