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Applying a process based erosion model to assess off-site effects of soil erosion from the regional scale to the measure level

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Since soil erosion is one of the most important issues of global soil degradation, great effort was put into the application of erosion models for the assessment and prevention of on-site damages. Beside the primary impact of soil loss in decreasing soil fertility, erosion can cause significant impacts if transported sediments are entering downslope ecosystems, settlements, infrastructure or traffic routes. These off-site damages can be very costly, affect a lot of people and contaminate water-resources.

The analysis of these problems is intensified by the requirements of new legislation, such as the EU Water Framework Directive (WFD), providing new challenges for planning authorities in order to combat off-site damage.

Hence there is strong public and scientific interest in understanding the processes of sediment as well as particle attached nutrient and pollutant transport. Predicting the frequency, magnitude and extent of off-site impacts of water erosion is a necessary precondition for adequate risk assessments and mitigation measures.

Process based models are increasingly used for the simulation of soil erosion. Regarding the requirements of the WFD, these models need to deliver comparable estimates from the regional scale to the level of mitigation measures.

This study aims on the application of the process based model EROSION 3D for off-site risk assessment on different scales for the German federal state of Saxony using available geo data, data base applications and GIS-routines. Following issues were investigated:
- Where are the expected sediment deposition areas?
- Which settlements, infrastructures and traffic routes are affected by sediment fluxes?
- Which river sections are affected by sediment inputs?
- Which river sections are affected by nutrient and heavy metal inputs?

The model results identify the Saxon loess belt as highly endangered by off-site damages although hotspots can be found in the northern flatlands and the southern mountain range as well. An exemplary verification of the model results were conducted using model validation, areal pictures and field observation.

The study ended up in a user-friendly, timesaving assessment approach for the simulation of off-site damages on regional scale and measure level providing essential information for the planning of soil and water conservation measures particularly under consideration of new legislations.