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Modelling sediment transport in agriculturally used loess catchments

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Soil erosion is a worldwide concern regarding its considerable effects on the environment. In particular surface waters are threatened by the input of nutrients and contaminants via erosion. The variation rates of sediment transport to receiving waters in space and time according to the nature of erosion and deposition processes can be determined using process-based numerical models.

Within the framework of a research project in a rural catchment the process based model CATFLOW-SED which permits the simulation of specific events as well as long term processes of water and sediment transport was developed. The underlying database results from detailed studies carried out in the Weiherbach catchment located within a loess region of Southwest Germany. For calculating the detachment rate of sediment particles from the soil matrix, an equation was developed based on the correlation of the attacking forces of rainfall and surface runoff to the erosion rate of loess soils. The amount of detached soil particles depends on the erosion resistance which characterizes the properties of the soil. On the catchment scale the variation of the erosion resistance for the homogenous loess soils mainly depends on the landuse category and the management practice.

CATFLOW-SED was validated for the database of the Weiherbach catchment at various scales (plot scale, hillslope scale, catchment scale) showing a good agreement between simulated and observed sediment loads. The sediment transport process is modeled for various grain size fractions providing the opportunity to estimate nutrient

and contaminant emissions into the surface waters.

Landscapes are characterized by specific processes and factors of influence. In regards to the limitations of field measurements, these relationships can only be examined and identified at small scale. Models provide a means of extrapolating from measurements e.g. to ungauged catchments as well as into the future. It was shown that the model CATFLOW-SED provides a means of drawing up the interrelationships within an agricultural loess catchment. On the basis of the validated model, several cause and effect studies as well as scenarios were analyzed for the Weiherbach catchment, allowing conclusions to be drawn about comparable loess areas.