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High resolution assessment and modelling of suspended sediment in an agricultural catchment

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Following high intensity rainfall, surface runoff and soil erosion may mobilize large amounts of pesticides from agricultural areas. To accurately assess pesticide removal from small catchments high resolution measurements are required, since typical storm events only last for several hours. As the main carrier of contaminants, suspended sediments play a key role. In a 1.8 km^2 agricultural catchment in south-west Germany continuous measurements of runoff, turbidity and suspended sediment were carried out to calibrate a catchment-scale erosion- and sediment transport model. Soils have developed from aeolian loess with a silt fraction exceeding 80%. An extensive 9 km pipe network connects terraces with gently sloping vineyards to a 2 km stream with fixed banks and channel bed. Hence in-channel erosion can be neglected and the present study area may be seen as field laboratory to investigate processes of sheet erosion at catchment scale.

During several events continuous turbidity measurements were related to suspended sediment concentrations (SSC) collected by an automatic sampler at the catchment outlet. Compared to laboratory measurements, the obtained turbidity-SSC-relation was relatively weak but more applicable to field conditions and resulted in a time series of SSC for a later model check. For modelling, the rainfall-runoff model ZIN was supplemented by a distributed erosion/sediment transport module. The USLE (Universal Soil Loss Equation) described sheet erosion depending on rainfall intensity, average slope and vegetation impacts. Existing data on sprinkling tests served for model parameterization. Sediment yields per time step and cell were transferred to the adjacent pipe or stream using a simple transfer function. Finally, inside the pipe- / channel network, the sediment wave was routed to the outlet using the Muskingum-Cunge

routing procedure. Model checks against measured runoff and SSC time series data were promising. Hence the present approach adequately described the driving processes of water and sediment dynamics and may be used as a basis to predict pesticide mobilization from intensive agriculture.