Geophysical Research Abstracts, Vol. 8, 06190, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06190

Sensitivity and uncertainty analysis for the spatially distributed hydrological simulation program SMDR to predict contributing areas for herbicide losses

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The hydrological simulation program SMDR (soil moisture distribution routing model) is a simple distributed water balance model, which predicts saturation-excess overland flow areas in a watershed. The prediction is based on an estimation of the relative saturation of the soil by accounting for infiltration, lateral water flow, percolation and evaporation of water in the soil column. These saturated areas are mainly responsible for herbicide losses from agricultural fields to surface waters. Therefore SMDR is used to predict those parts of the catchment which contribute to herbicide losses in a small agricultural catchment in Switzerland.

The model predictions are dependent on the spatially variable hydrological parameters of the catchment. The spatial subdivision is done according to the units in the soil map. Prior estimations of the hydrological parameters can be derived with pedotransfer functions from the soil properties associated with the soil and land use maps. However, such an estimation procedure leads to substantial uncertainty, which affects the prediction of the spatially distributed risk areas.

To analyse the sensitivity of the spatial prediction to the individual parameter and to quantify the overall uncertainty of the model predictions the simulation program is linked with the system analysis software tool UNCSIM. This is a computer program for statistical interference and sensitivity, identifiability and uncertainty analysis.

We will present the result of the model predictions based on the prior parameter distribution and compare them with actually measured data. The sensitivity analysis is also carried out to quantify the dependence of the spatial location and extension of the predicted risk areas on the different model parameters. This allows us to identify the parameters for which better information would be most profitable for reducing prediction uncertainty and to which degree improved parameter estimates would reduce prediction uncertainty.