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Validation of a physically based distributed hydrological model on the basis of sprinkling tests on conventional farmed and deep ploughed agricultural land

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Conventional intensive farming is suspected of intensifying flood danger. Compacted soils show lower infiltration capacities and their ability of water retention is reduced. However agriculture land also provides some opportunities to reduce the discharge of water.

The objective of the field experiments was to analyse how melioration methods like deep ploughing and loosening of compacted soils and sustainable cultivation methods will increase infiltration and reduce surface runoff. Soil physical data and sprinkling tests (sprinkler system by Karl & Toldrian; DVWK 1985) show that deep ploughing and loosening of compacted soils increase infiltration and temporary water retention. The positive effects of deep loosening are even 20 years later detectable (Schobel et al. 1999).

With the physically based distributed hydrological model CATFLOW (Zehe et al., 2001) the 10 x 3 m sprinkling test plots was discretized into a 2- dimentional vertical grid consisting of 10 by 10 nodes with a vertical extent of 1 m. Each element extends over the width of the test plot. Soil physical properties and initial soil moisture are taken directly from the different test plots. Especially the uncertainty of soil hydraulic conductivity is taken into account by using multiple parameter sets for each location.

The soil water dynamics are modelled using Richards Equation in the pressure based form. The hill slope module is able to simulate infiltration excess flow, saturation

excess flow and return flow.

The results suggest that with slightly modified field data (by taking into account the uncertainty of the measuring process) a high similarity between observed and simulated runoff can by achieved. These results suggest the general ability of the model to simulate/predict the influence of melioration and cultivation methods on runoff generation in agricultural landscapes.

References:

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