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Simulation of Runoff Concentration on Arable Fields and the Impact of Adapted Tillage Practises

F. Winter and M. Disse

Universität der Bundeswehr München, Institut für Wasserwesen, Lehrstuhl für Wasserwirtschaft und Ressourcenschutz, 85577 Neubiberg, Germany (florian.winter@unibw.de)

Conservational tillage can reduce runoff on arable fields. Due to crop residues remaining on the fields a seasonal constant ground cover is achieved. This additional soil cover not only decreases the drying of the topsoil but also reduces the mechanical impact of raindrops and the possibly resulting soil crust.
Further implications of the mulch layer can be observed during heavy precipitation events and occurring surface runoff. The natural roughness of the ground surface is further increased and thus the flow velocity is decreased, resulting in an enhanced ability of runoff to infiltrate into the soil (so called Runon-Infiltration).
The hydrological model system WaSiM-ETH hitherto simulates runoff concentration by a flow time grid in the catchment, which is derived from topographical features of the catchment during the preprocessing analysis. The retention of both surface runoff and interflow is modelled by a single reservoir in every discrete flow time zone until the outlet of a subcatchment is reached.
For a more detailed analysis of the flow paths in catchments of the lower mesoscale (< 1 km^2) the model was extended by a kinematic wave approach for the surface runoff concentration. This allows the simulation of small-scale variation in runoff generation and its temporal distribution in detail. Therefore the assessment of adapted tillage systems can be derived.
On singular fields of the Scheyern research farm north-west of Munich it can be shown how different crops and tillage practises can influence runoff generation and concentration during single heavy precipitation events. From the simulation of individual events in agricultural areas of the lower mesoscale hydrologically susceptible areas can be identified and the positive impact of an adapted agricultural management on runoff generation and concentration can be quantifed.