Quantification of surface runoff and the redistribution of water at the soil surface due to surface runoff in flat areas

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When water accumulates at the soil surface, the excess water fills small depressions that may connect and eventually form fast flow routes to the surrounding surface waters. We hypothesise that even in flat areas like the Netherlands, surface runoff forms a significant factor of the local water balance of a rainfall event. In particular if solute fluxes are of concern, these fast flow routes may be of major importance for surface water quality. Our objective is to investigate how surface runoff develops on a flat but complex terrain in interaction with groundwater and soil moisture.

We developed an object-oriented model that accounts for filling and merging of microdepressions in a typical agricultural field surrounded by surface water. Combined with a Philip two-term infiltration equation, the model gives an insight into the development of connectivity under Hortonian infiltration conditions. We analysed various spatial organisations of microrelief and soil physical parameters.

The object-oriented model is also coupled to (1) the Simgro model that accounts for the unsaturated zone and groundwater movement and (2) the SWAP model which is a numerical solution for the Richards’ equation. Currently, we investigate the combined effect of microrelief and soil moisture conditions on the initiation and pattern of surface runoff.