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Temporary variable soil structure and its effect on runoff mechanism on intensively cultivated land

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Sediments and nutrients washed out from farmed catchments into rivers and reservoirs are one of the major environmental problems worldwide. Understanding the routing of the precipitated water, its pathways and residence time in the subsurface are important prerequisites for water management, flood and nutrient control.
To determine a proper linkage between the surface and subsurface processes one needs to uncover the principles and mechanisms of runoff generation. This is a considerable problem on farmed lands, where soil physical properties vary in time due to agriculture operations, vegetation and other natural processes throughout the grow season. Freshly tilled, well structured soil includes large intra aggregate preferential voids that allow fast infiltration and percolation, while compacted or even crusted soil has very limited infiltration capacity and often exhibits fast surface runoff during storm events.
Monitoring of hydrological and hydropedological conditions within plough layer has been done since 2011 on the experimental catchment Nucice, Czech Republic. Based on the first data, we have identified several rainfall-runoff events under different soil conditions that led into increased runoff in the channel. The infiltration and runoff were numerically modelled to obtain preliminary estimates of dominant runoff processes. We used a combination of physically based models S1D and HYPO. In the S1D the dual permeability approach with two coupled Richards equations is used to calculate the infiltration. Simultaneously operating HYPO code simulates a final diffusion wave to model hypodermic runoff. After a proper calibration of the model the results, will supply a basis for a more complex research including the observation and modelling of the solute and particle transport (e.g. phosphorus, nitrogen, colloids) from the farmed hillslopes and catchments.
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