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Upscaling of chernozem fertility model to landscape

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The aim of this study is to upscale a chernozem fertility model to a territory of arable fields within a watershed. The model describes microbially-driven SOM transformations in soil granulo-densimetric fractions integrated with detailed fluid and energy transport in a soil profile with aggregate structure feedback.

To apply this model on a landscape level we use local meteodata (solar radiation, precipitation redistribution, wind speed) corrected for a certain landscape position using morphometric analysis of elevation map. Further we develop a model of water runoff with special consideration of variation in soil infiltration rates. Dependence of infiltration rate on soil physical properties is represented by regression submodel.

Monitoring setup consists of weather station, sensors installed on the top, slope and bottom of slopes facing south and north for continuous calibration of the model with soil moisture and temperature profiles that differ due to difference in insolation and snow melting.

Infiltration rate is modelled in particular representative points, that characterize groups of sites with similar weather conditions, morphologic (wetness index, insolation) and monitoring soil properties. Groups are characterized by a certain type of dependence of water infiltration on soil properties. Further wetness index is calculated considering prewetting effect on infiltration rates. The resulting model is being implemented for soil fertility monitoring and advice for management practice.