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Interactions between soil structure and Soil organic matter turnover

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Soil structure has a strong impact on SOM turnover. Experiments of STRONG ET AL. (2004) and the recently developed CIPS model, detailed described in KUKA ET AL. (2007) , demonstrates this very successful. The partition of the total pore space into micro, meso- and macropores and the subsequent distribution of specific microbial activity to these classes proofed to be very useful to understand long term dynamics without sophistic assumptions like an inert pool. The CIPS model has recently been integrated in the CANDY model in order to perform more complex scenario simulations.

It is well known that SOM has an impact on soil structure. A new submodel in CANDY has been developed in order to simulate these effects also. In this context we consider as structural indicators field capacity, permanent wilting point and total porevolume because these are used to control the soil water dynamics in the CANDY model and also as proxies to identify the pore space classes in CIPS. The main driver of soil structure changes is pore volume depending on the ratio of bulk density to particle density which are both dependent on SOM. FCAP and PWP can be calculated using the pedotransfer function of RAWLS and BRACKENSIEK (1985) if pore volume is known. Particle density is calculated using the approach of RÜHLMANN ET AL. (2006) depending on SOM content and a site specific value for the density of mineral particles.

Bulk density is of course a more dynamic variable as it is changed by a number of processes. The model considers impacts from management activities that may increase

(overdrive) or decrease (tillage) soil compaction as well as from natural processes like freezing and rainfall.

Soil tillage effects and subsequent re-compaction are described following the approaches of SCHAAF(1998) whereas the technical compaction caused by machinery is modelled according to RÜCKNAGEL(2007). Both approaches make use of a site specific standard bulk density that is modelled as function of SOM content following the approach of RÜHLMANN and KÖRSCHENS (2008). This way the bulk density is no longer a constant value but a soil state variable depending on management, climate and SOM.

The effect of dynamical physical soil parameters was modelled with the CANDY_CIPS model two different managed plots of the ‘Static Fertilization experiment’ Bad Lauchstaedt. In addition to modelling undisturbed soil samples were collected to investigate the pore structure. The soil samples were measured using a X-ray micro-CT scanner to get a 3-dimensional image of the pore-solid interface.