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Carbon turnover in pore spaces - CIPS model approach

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The CIPS (Carbon turnover In Pore Spaces) model has been developed to overcome the constraints of conceptual pools and to get a better insight into the nature of carbon stabilization in soil (KUKA, 2007). This pure carbon turnover model was implemented in CANDY (CArbon and Nitrogen Dynamics) model system (Franko, 1995).
The CIPS model did overcome the empirical pools taking into account soil structure effects. It is based on quality driven primary stabilisation mechanism (recalcitrance of SOM) and process driven secondary stabilisation mechanism (place of turnover) of SOM in soil. In addition to the division of SOM in the qualitative pools on the basis of chemical measurability, a dependence of the turnover conditions from the location of SOM in pore space is implemented taking into account different turnover conditions in the particular pore space and the accessibility for microbial biomass. The main assumption of the CIPS model is that the biological activity is not evenly distributed through the whole pore space. The pore space classes - micro, meso and macro pores - used in the model are marked by wilting point, field capacity and pore volume as a first approach. Because of the poor aeration in the micro pores they show very low biological activity leading to a strong protection of the carbon localized in this pore space. The biological active time (BAT) concept of the CANDY model was adapted to the CIPS model in order to calculate the distribution of biological activity for each pore space class. The reduction functions of the turnover active time concept of CANDY model, related to soil temperature, soil moisture, soil texture, relative air volume and distance to the soil surface are multiplied by the step width of calendar time producing the transformed time step as total BAT (BATtot). The calculated BATtot corresponds to the time that would be required under optimal conditions in the laboratory to perform the same turnover result as under the given suboptimal conditions.
The qualitative pools in CIPS model are fresh organic matter (FOM), microbial biomass (AOM), dissolved organic matter (DOM) and residue organic matter (ROM) which are measurable. FOM pool is split in a soluble (S), labile (L) and resistant (R) part. The FOML and FOMR are only available for the AOM pool in meso or macro pores, because it is assumed that micro pores are too small for these organic matter particles. The FOMS directly feeds the DOM pool, that itself is available to all pore space classes providing a vehicle for matter exchange between them
Beside a validation of the CIPS model for long term experiments representing a wide range of soils and site conditions shows that the conceptual pool of inert SOM was an empirical representation of to the amount of carbon situated in micro pores.

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