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Long term stabilised carbon as product of physical protection

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In order to simulate long term dynamics most models have implemented a long term stabilised (LTS) pool (often called inert) with a pool size that is soil specific and independent from management activities and climatic conditions. Chemical and physical carbon stabilisation in soil proceeds simultaneously. If the physical effects are not explicitly modelled the long term stabilization has to be described by means of pools having a higher chemical stability shifting functionality from physical to chemical effects. This leads to the consequence that those pools become conceptual and are empirically determinable only.

Because a number of experimental results suggest that all carbon in soil is decomposable we hypothesise that the stabilisation of soil organic matter is a result of its location at places with low biological activity. Basing on this hypothesis a new modelling approach (CIPS: Carbon turnover In Pore Space) has been developed, where the carbon turnover is described for micro, meso and macro pores with different turnover activities as a result of water filling of the pore space. The pore classes used in the model are marked by wilting point, field capacity and pore volume. The CIPS model was parameterised using a dataset from the long term experiment in Bad Lauchstädt, Germany and validated for a number of European long term experiments. Because all applications proved that the turnover in space of micro pores was very low it seems reasonably to consider the carbon located in this pore space as long term stabilized. Assuming the total organic carbon equally spread over the inner soil surface it is possible to calculate the part associated with micro pores as an indicator for the amount of long term stabilized carbon.

This hypothesis has been compared with other approaches deriving the LTS-pools size from soil texture and another model that estimates the LTS pool just as part of the total amount of organic matter. Using more than 380 datasets from long term experiments all over Europe the representation of carbon dynamics with the CCB model was much better when the size of the LTS pool was estimated as part of the total organic matter comparing to texture based approaches. These results show that the long term stabilisation of carbon in soil to a great extent is a result of physical protections.