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Multi-site validation of a soil organic matter model based on generally available input data

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Regionalization of soil organic matter (SOM) dynamics by means of modelling is often restricted by the availability of model inputs on the used scale. Taking this into account the approach of the CANDY model (Franko et al., 1995) has been strongly simplified with a remarkable reduction of input requirements. This simplified model called Candy Carbon balance (CCB) was validated against a large number of long term datasets from arable field experiments mainly situated in Germany but also from some places in Europe altogether containing 41 sites with 65 experiments and a total number of 598 different treatments.

The required input data are:
- soil: clay content, soil classification
- climate: rainfall and air temperature as long term averages
- management: crop rotation with yields and organic amendments
- SOM: at least one initial value; more observations for validation purpose

During the calculation process the model makes use of some other soil parameters like silt content, bulk density, pore volume, field capacity and permanent wilting point. These data may be delivered by the user or if absent they will be calculated from pedotransfer functions.

If the initial information includes not only organic Carbon (Corg) but also total Nitrogen (Nt) the SOM dynamics will be modelled for both elements.

The CCB model follows the CANDY concept distributing SOM in a long term stabilized and a decomposable fraction. The long term stabilized part is calculated comparable to the CIPS model (Kuka,2005) taking the SOM in soil micro pores as highly stabilized so that its turnover can be neglected for this model application and hence will show no dynamics during simulation.

Soil texture, rainfall, irrigation amount and air temperature are used to estimate the site specific biologic activity for SOM turnover in terms of Biological Active Time (BAT). Annual yield data are transformed to the amounts of organic matter input due to cropping that together with organic amendments are the sources of SOM reproduction.

Model results for Corg and Nt have been validated against observed values. The overall result from a model application under practice related conditions shows an acceptable performance of the model. For Corg the mean difference between model and observation is MED=-0.010 and the root mean squared deviation is RMSD=0.158. In case of Nt the results are MED=-0.004 and RMSD=0.012.

Basing on this results the CCB model is considered as applicable in advisory service for arable fields on a wide range of site conditions.