Geophysical Research Abstracts
Vol. 18, EGU2016-18512, 2016
EGU General Assembly 2016
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Different approaches for regional initialization of soil organic matter pools for modeling

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In traditional soil organic matter (SOM) compartmental pool models (e.g. Daisy), slower turnover pools (decades to centuries) are often hard to define and any information on a regional basis is generally lacking. The proportions of carbon in the slower turnover pools have implications for long-term simulations (>20 years). This study used methods developed and tested on several long-term experiments in order to extrapolate results to the regions Kraichgau and Swabian Alb in southwest Germany. A traditional size-density separation with chemical oxidation (Fractions) (Zimmermann et al., 2007) was used and compared with spectroscopic and thermo-spectroscopic methods. These included diffuse reflectance Fourier transform mid-infrared spectroscopy (DRIFT-MIRS) and pyrolysis mid-infrared spectroscopy (pyro-MIRS). These methods were applied to a regional sample set of 126 samples and later upscaled to a larger regionally extensive sample set of 1170 samples via partial least squares regression (PLSR) in order to initialize the two slow SOM pools (SOM1 and SOM2) of the Daisy SOM model. Further, geostatistics (kriging) were used to develop maps in order to compare the regional distribution of the relative sizes of the SOM1 and SOM2 pools between the different methods along with a default SOM1 and SOM2 pool initialization. Results will be used to estimate the impact of the different pool initialization methods during 20 year simulations in the Daisy soil organic matter model as implemented in the Expert-N modeling platform and scaled to the entire region.

Zimmermann, M., Leifeld, J. and Fuhrer, J.: Quantifying soil organic carbon fractions by infrared-spectroscopy, Soil Biol. Biochem., 39, 224-231, 2007.