Geophysical Research Abstracts
Vol. 18, EGU2016-7063-1, 2016
EGU General Assembly 2016

Merging Q-theory and MEP theory to explain some geographical variations seen in Russian soil C inventory data

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Soils are as critical for understanding the ecosystem carbon cycle as plants are and here I critically evaluate some of the commonly used assumptions embedded into the soil organic matter dynamics process-based models. According to the biochemical concept (e.g. Mindermann, 1968) plant residues can be divided into liable and more recalcitrant fractions, each decomposing with a specific rate (increasing with temperature) and it is remains of recalcitrant compounds that accumulate to form soil organic matter. The application of this theory in regional to global biogeochemical models leads to conclusion that the high latitude soils stores the highest amount of carbon per square meter due to high percentage of recalcitrant compounds and low temperature. This contradicts with the Russian soil inventory data, demonstrating that within the large span of biomes present in Russia that is steepe that has the highest soil C storage. Here I take an alternative, most theoretical, viewpoint, called Q-theory (from q-quality) (Ågren and Bosatta, 1996) considering the changes in the continuous variable-the quality of the organic matter in the soil as a starting point. I then derive the novel equation for the entropy production of humification process and demonstrate how MEP theory works to explain geographical differences in soil C accumulation seen in Russian soil inventory data. Conceptually close to the work presented is a general theory of humification (Orlov, 1995) based on thermodynamic view on decomposition postulating that independently on acting factors and the soil type it is only the most thermodynamically stable components, such as humic substances, that will be produced and stored in the process of organic matter transformation

This work was supported by RFBR grants 15-05-01368