Geophysical Research Abstracts
Vol. 18, EGU2016-13707, 2016
EGU General Assembly 2016

Exploring C-water-temperature interactions and non-linearities in soils through developments in process-based models

Fernando Esteban Moyano (1), Nadezda Vasilyeva (2), and Lorenzo Menichetti (3)

(1) Göttingen University, Bioclimatology, Göttingen, Germany (fmoyano@uni-goettingen.de), (2) Lomonosov Moscow State University, Moscow, Russia (nadezda.vasilyeva@gmail.com), (3) Agroscope, Zürich, Switzerland (ilmenichetti@gmail.com)

Soil carbon models developed over the last couple of decades are limited in their capacity to accurately predict the magnitudes and temporal variations in observed carbon fluxes and stocks. New process-based models are now emerging that attempt to address the shortcomings of their more simple, empirical counterparts. While a spectrum of ideas and hypothetical mechanisms are finding their way into new models, the addition of only a few processes known to significantly affect soil carbon (e.g. enzymatic decomposition, adsorption, Michaelis-Menten kinetics) has shown the potential to resolve a number of previous model-data discrepancies (e.g. priming, Birch effects). Through model-data validation, such models are a means of testing hypothetical mechanisms. In addition, they can lead to new insights into what soil carbon pools are and how they respond to external drivers.

In this study we develop a model of soil carbon dynamics based on enzymatic decomposition and other key features of process based models, i.e. simulation of carbon in particulate, soluble and adsorbed states, as well as enzyme and microbial components. Here we focus on understanding how moisture affects C decomposition at different levels, both directly (e.g. by limiting diffusion) or through interactions with other components. As the medium where most reactions and transport take place, water is central en every aspect of soil C dynamics.

We compare results from a number of alternative models with experimental data in order to test different processes and parameterizations. Among other observations, we try to understand: 1. typical moisture response curves and associated temporal changes, 2. moisture-temperature interactions, and 3. diffusion effects under changing C concentrations.

While the model aims at being a process based approach and at simulating fluxes at short time scales, it remains a simplified representation using the same inputs as classical soil C models, and is thus potentially applicable at the ecosystem and larger scales.