Geophysical Research Abstracts
Vol. 13, EGU2011-5545, 2011
EGU General Assembly 2011

Modeling soil heterotrophic respiration with an enzyme-based model: first comparison with field data and suggestions of improvements.

Pauline Buysse (1), Bernard Longdoz (2), Alain Debacq (1), and Marc Aubinet (1)

(1) University of Liege - Gblx Agro-Bio Tech, Unit of Biosystem Physics, Gembloux, Belgium (pauline.buysse@ulg.ac.be), (2) INRA, Centre INRA de Nancy, UMR1137 Ecologie et Ecophysiologie Forestières, Rue d'Amance, F-54280 Champenoux, France. (longdoz@nancy.inra.fr)

Soil heterotrophic respiration (SHR) is a fundamental process by which CO2 is produced by soil microorganisms during the process of soil organic matter (SOM) decomposition. Most actual dynamic SOM decomposition models generally describe organic carbon stock variations as functions of abiotic environmental factors (mainly temperature, soil moisture, soil texture, organic carbon quantity and quality), disregarding more complex interactions between living soil organisms and these factors.

The present study aims at getting a better understanding of the SHR process by using an enzymatic model, based on the work by Allison et al. (2010), that takes explicitly microorganism and enzyme dynamics into account. It will be applied to an agricultural site, at the field spatial scale and at the seasonal temporal scale, using an hourly time step. Simulated SHR fluxes will be compared to automatic SHR measurements performed on a half-hourly basis with a dynamic closed chamber system in root exclusion areas.

The model will first be run considering that temperature is the only environmental explicative variable, as in the original version of the model. Different propositions to improve the model will then be tested. These ones will consist in adapting the model structure to take soil water content, different scenarios of crop residue inputs and possible thermal adaptation of microorganisms into account. A sensitivity analysis will also be performed in order to assess the importance of the different parameters in the model response.

Keywords: Soil heterotrophic respiration, enzyme-based model, sensitivity analysis.

Reference:
Allison S.D., Wallenstein M.D., Bradford M.A., 2010. Soil-carbon response to warming dependent on microbial physiology. Nature Geoscience 3, 336-340.