Geophysical Research Abstracts
Vol. 13, EGU2011-3050, 2011
EGU General Assembly 2011

Partitioning of micrometeorological measurements of NEE through the use of leaf level measurements and coupled stomatal and photosynthesis modeling

Rasmus Jensen, Mathias Herbst, Rasmus Ringgaard, Thomas Friborg, and Henrik Soegaard
Department of Geography and Geology, University of Copenhagen, Oester Voldgade 10, DK-1350 Copenhagen K

The eddy covariance technique is widely used to estimate fluxes of greenhouse gasses (GHG) from many different surface types. The advantage of this type of measurements is that it is possible to quantify fluxes and budgets of carbon dioxide, water vapour (and other trace gasses) on canopy scale, i.e. the net ecosystem exchange (NEE) between vegetation and atmosphere. However the exchange is controlled by several biochemical and biophysical processes. To partition the components of the NEE and to link the measured fluxes to ecosystem functions and processes mathematical models must be used. This also allows us to evaluate the sensitivity of individual components in NEE to different variation in prevailing climatic condition, thus increase the ability to predict future fluxes in response to a changing climate.

In the present study eddy covariance measurements of carbon dioxide from an agricultural site (winter barley) in Western Denmark is compared to modeled estimates of net photosynthesis and soil respiration. The photosynthesis model applied in this study is a biochemical model (Farquhar et al., 1980) and is coupled to a semi-empirical stomatal conductance model (Ball et al., 1987). The parameterization of the model is done by estimating photosynthetic capacity from leaf-chamber photosynthesis measurements (LI-6400, LI-COR Inc.) in the field and scaled by measured leaf area index (LAI) measured in the field and estimated by remote sensing (green leaf area index, GLAI). Here we show that the parameterized coupled stomatal and photosynthesis model in combination with measured and modeled soil respiration with confidence can be used to partition the components in NEE as measured by eddy covariance.

Ball, J.T., Woodrow, I.E., Berry, J.A., 1987. A model predicting stomatal conductance and its contribution to the control of photosynthesis under different environmental conditions. In: Biggins, J. (Ed.), Progress in Photosynthesis Research. Nijhoff, Dodrecht, pp. 221–225.

Farquhar, G.D., von Caemmerer, S., Berry, J., 1980. A biochemical model of photosynthetic CO2 assimilation in leaves of C3 species. Planta 149, 78–90.