Geophysical Research Abstracts
Vol. 12, EGU2010-9169, 2010
EGU General Assembly 2010

Trends in CO_2 exchange over a deciduous forest based on continuous eddy covariance mesurements over 14 years

Kim Pilegaard (1), Andreas Ibrom (1), and Ebba Dellwik (2)

(1) Risø DTU, Biosystems Division, Roskilde, Denmark (kipi@risoe.dtu.dk, +45 4677 4101), (2) Risø DTU, Wind Energy Division, Roskilde, Denmark

The CO_2 exchange was measured by eddy covariance technique over a Danish mature beech forest (Sorø) continuously from June 1996 to December 2009. The results show a significant increase in annual net ecosystem exchange (NEE) of 30 g C m^{-2} y^{-1}. Estimates of ecosystem respiration (RE) and gross ecosystem exchange (GEE) were derived from NEE. The trend in RE (-8 g C m^{-2} y^{-1}) was not significant, but there was a significant increase in GEE (22 g C m^{-2} y^{-1}). An analysis of the seasonal changes in NEE showed that the carbon uptake period (CUP), i.e. the period with net uptake increased significantly by 1.7 d y^{-1}, whereas the period with leaves on the trees (LP) stayed constant. Light response curves for NEE revealed that the assimilation capacity of the forest at maximum ambient light (F_∞) increased significantly by 0.7 μmol m^{-2} s^{-1} per year, whereas there was no significant trend in the apparent quantum yield.

Trends in the explaining variables were examined. No significant trends could be found in temperature, light or precipitation, whereas there was a significant increase in global atmospheric CO_2 concentration (1.9 ppmv y^{-1}).

Simulation of the NEE data from the Sorø forest by the model MAESTRA showed that the increase in CO_2 could only explain a small part of the increased uptake capacity of the forest. A much larger part could be explained by an increase in N-content of the leaves. Such an increase is not yet documented. In general the deposition of atmospheric N has decreased, but the forest is already N-saturated and the availability of N in the soil might have increased due to climate change. Other possibilities for explaining the observed trends are discussed.