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Assessing seasonality with air temperature, CO_2 eddy covariance measurements and CO_2 mixing ratio in northern boreal coniferous forests

T. Thum (1), T. Aalto (1), T. Laurila (1), M. Aurela (1), A. Lindroth (2), T. Vesala (3)
(1) Finnish Meteorological Institute, Global Change Research, Helsinki, Finland (2) Lund University, Lund, Sweden (3) University of Helsinki, Helsinki, Finland (tea.thum@fmi.fi)

Trends in the beginning and ending of the active period of boreal zone vegetation provide indications on how the carbon balances of the area will be affected in future. We studied four different coniferous forests located along a large latitudinal gradient, from Finnish Lapland to central Sweden. Our eddy covariance sites included Pallas/Kenttärova, Sodankylä, Hyytiälä and Norunda. We also used CO_2 mixing ratio measurements from Pallas/Sammaltunturi.

The length of the growing season was estimated from the eddy covariance measurements. We used one year of data to bind the temperature indexes and the CO_2 mixing ratio to the starting and finishing days of the active periods and used these thresholds for other years. They all worked well for the three Finnish sites during spring, but in Norunda this method did not prove to be functional. For the termination of the growing season the five day average temperature provided good estimates for the Finnish sites.

In Pallas/Sammaltunturi the CO_2 mixing ratio showed trend to earlier drop in spring time during our measuring period, 1999-2007. The same was also seen in temperature indexes. However a clear trend was not observable in ecosystem fluxes. The rise to back to the winter level of the CO_2 mixing ratio occurred nevertheless at the same time. Occasionally observed high respiration rates may enhance this autumn rise.