

Land- atmosphere exchange of carbon dioxide in a high Arctic fen: importance of wintertime fluxes.

Global warming is predicted to have a major impact on the ecosystems over the polar latitudes including the Arctic region which is thought to be especially sensitive to changes in climate. So far, the research studying greenhouse gases in the Arctic has primarily been focused on the short and intense growing season when carbon flux is mostly driven by plants and soil microorganisms. Regarding winter time little is known about what factors that influence the carbon flux between the land and the atmosphere (Net Ecosystem Exchange, NEE) and how big impact it has on the annual carbon budget.

This study investigated the importance of wintertime CO₂ fluxes (Net ecosystem exchange; NEE) on a net annual exchange basis and which environmental variables that affected CO₂ flux during wintertime. If seasonality (i.e. early winter, dark winter, late winter) affected relationships between carbon flux and the driving variables was also examined. The study was based on two years of data (August 2012- October 2014) from an eddy covariance tower on the fen in Zackenberg, Greenland. It was found that winter time flux in the year 2012/2013 was 67.6 g C m⁻² (emission of CO₂ to the atmosphere) and for the year 2013/2014 the winter time flux was 31.4 g C m⁻².

The early winter time (September -7th of November) was the winter season where the strongest relationship between environmental variables and NEE was seen for both years. Here NEE increased exponentially with air temperature and soil temperature (-10 cm) but the relationship was strongest with air temperature. Air temperature, PAR, soil temperature and snow depth were factors that affected CO₂ flux during wintertime but no clear relationship could be seen with snow temperature. Seasonality clearly had an impact on the relationship between carbon flux and the driving variables.

In this study only a few environmental variables were tested and to be able to cover the complete pictures of what factors that affect NEE more studies have to be done, for example of soil and snow temperatures at more depth, water table depth, thaw depth, day of snowmelt and air pressure. A longer time series would also have been valuable but it is certain that winter time carbon flux is important when making an annual carbon budget in the Arctic.

Keywords: geography, physical geography, ecosystem analysis, NEE, eddy covariance, Arctic, CO₂, wintertime flux, Zackenberg

Supervisor: **Magnus Lund**

Master degree project 30 credits in Physical Geography and Ecosystem Analysis, 2015

Department of Physical Geography and Ecosystem Science, Lund University. Student thesis series INES nr 332