Geophysical Research Abstracts
Vol. 15, EGU2013-7754, 2013
EGU General Assembly 2013

A decade of continuous NEE measurements at a Scottish peatland

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Eddy-covariance measurements of carbon dioxide (CO_2) fluxes have been running continuously at the Auchencorth Moss peatland site in Scotland (55o47'32N, 3o14'35W, 267 m a.s.l.) since the spring of 2002 which makes this study one of the longest ones to date on a peatland system. Auchencorth Moss is a low-lying, ombrotrophic peatland situated ca. 20 km south-west of Edinburgh. Peat depth ranges from <0.5 m to >0.5 m and the site has a mean annual precipitation of 1155 mm. The open moorland site has an extensive uniform fetch of blanket bog to the south, west and north. The vegetation present within the flux measurement footprint comprises mixed grass species, heather and substantial areas of moss species (Sphagnum spp. and Polytrichum spp.).

The eddy-covariance system consists of a Licor 7000 closed-path infrared gas analyser operating at 10 Hz for the simultaneous measurement of carbon dioxide and water vapour and of a Gill Windmaster Pro ultrasonic anemometer, operating at 20 Hz, and mounted atop a 3 m mast. The effective measurement height is 3.5 m with a vertical separation of 20 cm between the anemometer and the inlet of the sampling line. Air is sampled at 20 litres per minute through a 40 m long Dekabon line (internal diameter 4 mm). In addition to eddy-covariance measurements, the site is equipped with a weather station, soil temperature measurements, total solar radiation and photosynthetically active radiation (PAR) sensors, a tipping bucket for rainfall and, since April 2007, water table depth has been recorded at half-hourly interval.

On an annual basis, the peatland at Auchencorth Moss has consistently been a net sink of CO_2 in the study period 2002-2012 with a mean net ecosystem exchange (NEE) of - 69.1 $\pm$ 33.6 g C-CO_2 m-2 yr-1. This value is at the high end of other recent studies as is the inter-annual range of NEE (-31.4 to -135.9 g C-CO_2 m-2 yr-1). Inter-annual variations in NEE are significant and strongly correlated to the length of the growing seasons whilst seasonal variations in both NEE and ecosystem respiration are largely driven by air temperature. Monthly and seasonal mean air temperatures during the 2002-2012 study period were very similar to 50-year means, whilst rainfall for that decade was on average higher. Potential effects of rainfall or water table height on NEE and respiration could not be separated from air temperature which appeared to be the strongest control. We conclude by discussing the 10 year NEE dataset in the context of future changes to our climate and the likely scenarios for peatland NEE fluxes.