Geophysical Research Abstracts
Vol. 15, EGU2013-7950, 2013
EGU General Assembly 2013

Vegetation, soil property and climatic controls over pore water dissolved organic carbon concentrations in a blanket peatland hosting a wind farm

Alona Armstrong (1), Susan Waldron (1), Jeanette Whitaker (2), and Nick Ostle (2)

(1) University of Glasgow, Geographical and Earth Sciences, Glasgow, (alona.armstrong@glasgow.ac.uk), (2) Centre for Ecology and Hydrology, Lancaster University, Lancaster.

Rising dissolved organic carbon concentrations ([DOC]) in surface waters have prompted much research to elucidate the cause(s). Given that increases in [DOC] may indicate a destabalisation of carbon stores, increase water treatment costs and affect rates of primary production and respiration in aquatic ecosystems, identifying the causes of the increase is important. Research has demonstrated that [DOC] in peatlands are influenced by vegetation, soil property and climatic controls, including water table height, temperature and plant functional type (PFT). In this paper we present data from Black Law Wind Farm, Scotland, where we examined the effect of a predicted wind turbine-induced microclimatic gradient and PFT on pore water [DOC]. Moreover, we determined the role of vegetation, soil property and climatic variables as predictors of the variation in [DOC].

We measured [DOC] at 48 plots within Black Law Wind Farm at monthly intervals from May 2011 to April 2012. Four sampling sites were located along a predicted wind turbine-induced microclimatic gradient. At each site four blocks were established each with plots in areas dominated by mosses, sedges and shrubs. Plant biomass and PFT (vegetation factors); soil moisture, water table height, peat depth, C content, nitrogen (N) content and C:N (soil properties); and soil temperature and photosynthetically active radiation (PAR) (climatic variables) were measured. An analysis of variance (ANOVA) model based on the microclimatic gradient site, season, site*season and PFT*season explained 55 % of the variation in [DOC]. [DOC] generally increased along the predicted microclimatic gradient and increased from winter through to autumn. A parsimonious ANOVA model using the vegetation, soil property and climatic explanatory data explained 53 % of the variation in [DOC].

Published studies (Baidya Roy and Traiteur 2010; Zhou, Tian et al. 2012) and preliminary results from this study suggest that a wind turbine-induced microclimatic effect may exist. Consequently, given that the climatic variables, factors influenced by changes in the climate, and their interactions affect [DOC] fluxes, the operational effects of wind farms on peatland ecosystems may need to be taken into account when considering their full life cycle carbon budget.

Baidya Roy, S. and J. J. Traiteur (2010). Impacts of wind farms on surface air temperatures, Proceedings of the National Academy of Sciences, 109: 15679-15684.
Limpens, J. et al. (2008). Peatlands and the carbon cycle: from local processes to global implications – a synthesis, Biogeosciences, 5(5): 1475-1491.
Zhou, L., et al. (2012). Impacts of wind farms on land surface temperature, Nature Climate Change, 2: 539-543.