Geophysical Research Abstracts
Vol. 17, EGU2015-867, 2015
EGU General Assembly 2015

Spatial and temporal variation in dissolved organic carbon composition in a peaty catchment draining a windfarm

Ying Zheng (1), Susan Waldron (1), and Hugh Flowers (2)

(1) School of Geographical and Earth Sciences, University of Glasgow, Glasgow, United Kingdom, G12 8QQ, (2) School of Chemistry, University of Glasgow, Glasgow, United Kingdom, G12 8QQ

Peatlands are an important terrestrial carbon reserve and a principal source of dissolved organic carbon (DOC) to the fluvial environment (Wallage et al. 2006). Recently it has been observed that DOC concentrations [DOC] in surface waters have increased in Europe and North America (Monteith et al. 2007). This has been attributed primarily to reduced acid deposition. However, land use change can also release C from peat soils. A significant land use change in Scotland is hosting windfarms. Whether windfarm construction causes such impacts has been a research focus, particularly considering fluvial losses, but usually assessing if there are changes in DOC concentration rather than composition. Our study area is a peaty catchment that hosts wind turbines, has peat restoration activities and forest felling and is drained by two streams. We are using UV-visible and fluorescence spectrophotometry to assess if there are differences between the two steams or temporal changes in DOC composition. We will present data from samples collected since February 2014. The parameters we are focusing on are SUVA254, E4/E6 and E2/E4 ratios as these are indicators of DOC aromaticity, humic acid (HA): fulvic acid (FA) ratio and the proportion of humic substances in DOC (Weishaar, 2003; Spencer et al. 2007; Graham et al. 2012). To assess these we have measured UV-visible absorbance spectra from 200 nm to 800 nm. Meanwhile sample fluorescence emission and excitation matrix (EEM) will be applied with the PARAFAC model to obtain more information about the variations in humic substances in this catchment.

Our current analysis indicates spatial differences not only in DOC concentration but also in composition. For example, the mainstem draining the windfarm area had a smaller [DOC] but higher E4/E6 and lower E2/E4 ratio values than the tributary draining an area of felled forestry. This may be indicative of more HAs in the mainstem DOC. Seasonal variations have also been observed. Both streams had high [DOC] in summer and autumn compared to spring. While E2/E4 ratios were steady in both streams, a more variable E4/E6 ratio in the mainstem may suggest DOC composition changed more over time than in the tributary which had a relatively stable E4/E6 ratio. [DOC] fell in both streams during the summer drought period but a corresponding fall in SUVA254 in the mainstem but not the tributary is further evidence of differences in DOC composition between the two streams. Such spatial and temporal understanding is needed to understand if, and how, land use influences the composition of the DOC exported.

References:

Graham M. C. et al. 2012. Processes controlling manganese distributions and associations in organic-rich freshwater aquatic systems: The example of Loch Bradan, Scotland. Science of the Total Environment, 424, 239-250.

Monteith D. et al. 2007. Dissolved organic carbon trends resulting from changes in atmospheric chemistry. Nature,450, 537–540.

Spencer R.G.M, Bolton L. and Baker A. 2007. Freeze/thaw and pH effects on freshwater dissolved organic matter fluorescence and absorbance properties from a number of UK locations.Water Research, 41 (13):2941–2950.

Wallage Z.E., Holden, J. and McDonald, A.T. 2006. Drain blocking: An effective treatment for reducing dissolved organic carbon loss and water discolouration in a drained peatland. Science of the total environment, 367, 811-821.

Weishaar J.L. et al. 2003. Evaluation of specific ultraviolet absorbance as an indicator of the chemical composition and reactivity of dissolved organic carbon. Environmental Science & Technology 37(20): 4702–4708.