Geophysical Research Abstracts
Vol. 14, EGU2012-267, 2012
EGU General Assembly 2012

What are the mechanisms controlling carbon flux from peat soils across slopes?

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Peatlands are a globally important terrestrial carbon stock but carbon budget models need further improvement. The use of empirical observations to increase the accuracy of process based models has helped to constrain the error involved in accounting for peatland carbon balances, yet our understanding of peatland function needs to improve still further.

Hydrology and topography are important controls on the carbon balance of peatlands. The hydrology of hillslopes has been studied, with runoff mechanisms and flow pathways dependent upon the topographic position. Topslope plateau areas have been observed to promote a large degree of surface runoff, acting as a shedding area delivering water downslope. Midslopes may experience fewer saturation runoff events due to the greater hydraulic gradient, with lower water tables likely to cause subsurface throughflow that is delivered downslope at the accumulation area at the bottom of the slope. This can help to maintain higher water tables at the foot of the slope and attenuate saturation runoff events (Holden and Burt 2003).

The different hydrological mechanisms studied across the hillslope have not until recently been studied in the context of carbon cycling as well. The author has presented results elsewhere on the role that hillslope position has on carbon flux, finding that with water table drawdown observed on the midslopes, there is a concurrent increase in the rates of ecosystem respiration dependent upon the changing depth of the water table. There is also a decrease in the concentration of dissolved organic carbon concentration downslope.

This poster presents preliminary results looking to constrain the explanations for the changing levels of respiration and dissolved organic carbon content across the slope. One metre deep soil cores were taken from an intact and an eroded hillslope in the Peak District, UK, across four hillslope positions: topslope, upper midslope, lower midslope and bottomslope. The cores were analysed for bulk density, energy content using bomb calorimetry and CHNO to assess if the composition and structure of the soil substrate could explain observed changes across the slope in dissolved organic carbon content.