Geophysical Research Abstracts,
Vol. 11, EGU2009-1769, 2009
EGU General Assembly 2009

The role of pipes in carbon transfer in and from peatlands

J. Holden (1), R.P. Smart (1), P.J. Chapman (1), A.J. Baird (1), and M.F. Billett (2)

(1) University of Leeds, School of Geography, Leeds LS2 9JT, United Kingdom (j.holden@leeds.ac.uk, +44 113 343-3308),
(2) Centre for Ecology and Hydrology Edinburgh, Bush Estate, Penicuik, Midlothian, EH26 0QB, UK.

Natural pipes are tunnels or conduits for water within soils and are often greater than 10 cm in diameter. Such natural pipes have been reported in most types of northern peatlands and have been observed to play an important role in water transfers within peat systems. However, until now no-one has studied carbon exports from natural pipe waters in deep peats. Pipes form complex undulating networks within the peat profile and may, under differing flow conditions, combine both water and carbon from various depths within the peat. Research has shown that environmental change in peatlands can lead to increased pipe formation. Pipes may therefore release greater amounts of carbon from deep within the peat to the aquatic and atmospheric systems in response to climate change. We studied a blanket peatland in northern England where dissolved, gaseous and particulate carbon fluxes were monitored. The mean annual dissolved organic carbon (DOC) flux from the site is 218 kg ha-1 yr-1. Of the 88 pipes found in this catchment, 8 representative pipes and the catchment outlet were monitored routinely and during rainfall events. Pipe and stream waters were analysed for DOC, particulate organic carbon (POC), pH, conductivity, CO2 and CH4 with analysis of base cations and major anions on storm samples. Flow was also measured at these points. Deep and shallow pipes respond rapidly to rainfall inputs demonstrating strong connectivity with the peat surface. However, pipes also transported water from deeper layers of the peat. While many perennially flowing pipes respond quickly to rainfall events, pH and cation data show they also appear to obtain waters from deep peat layers and underlying mineral strata and thereby connect deep matrix and near-surface/overland flow. This mix of different sources of water results in highly variable concentrations of DOC and dissolved CO2 and CH4 within pipe water. Results to date show that 20 to 30% of the flow recorded at the catchment outlet can be accounted for by pipe flow, 53% of DOC and 200% of the exported POC in the stream is produced by the pipes (not all of the POC leaving the pipes makes its way to the stream, some of it is held in storage). Mean values of DOC for individual pipes range from 23.1 to 43.8 mg L-1 and mean POC concentrations vary from 0.64 to 6.38 mg L-1. Episodic pulses of POC from pipe outlets are common during storm events suggesting failures of pipe walls and flushing of debris from the internal system.Work that is underway to understand more about the sources of carbon being released from pipe networks using a dual isotopic approach (C14 and delta13C) will be outlined.