Geophysical Research Abstracts
Vol. 16, EGU2014-182-1, 2014
EGU General Assembly 2014

Understanding the spatial structure of peat permeability around natural pipes in blanket peatlands

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We present the results of a detailed investigation of fine-scale variations in the permeability or hydraulic conductivity (K) of the peat around a natural pipe in a blanket peatland. Both vertical K and horizontal K ranged over seven orders of magnitude over scales of decimetres. K was found to be more variable than indicated by previous research. This finding has important implications for the approaches currently employed to investigate peatland hydrological processes, and the parameterisation of models used to simulate these complex ecohydrological systems.

We also observed considerable spatial structuring in K. Lateral K parallel to the pipe was significantly greater than lateral K perpendicular to the pipe. Critically, a wedge of poorly-humified, high-permeability peat was present directly above the pipe, forming a hydrological connection between the peatland surface and the perennially-flowing pipe. These observations advance our mechanistic understanding of pipeflow generation in peatlands.

We also attempted to investigate K across the pipe-peat interface to test for a hypothesised low-K skin; however, this was precluded by sample length dependency, which suggests that it is inappropriate to compare K measurements between peat samples of different lengths.

Overall, we argue that high resolution work such as this is required for the development of more accurate perceptual models of peatland hydrological systems.

Cunliffe, A. M., A. J. Baird, and J. Holden (2013), Hydrological hotspots in blanket peatlands: Spatial variation in peat permeability around a natural soil pipe, Water Resources Research, Vol.49, doi:10.1002/wrcr.20435.