Geophysical Research Abstracts
Vol. 12, EGU2010-6970, 2010
EGU General Assembly 2010

The effect of decreased atmospheric sulphur deposition on soil dissolved organic carbon concentration and quality

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Increasing concentrations of dissolved organic carbon (DOC) has been observed in aquatic systems throughout the Northern Hemisphere the last decades. The reduction in sulphur deposition has been identified as one of the major mechanisms behind this trend, where several reports show correlations between DOC and sulphur concentrations in surface waters. The reasoning is that as sulphur deposition decreases, pH in soil increase and ionic strength decrease thereby making DOC more soluble and mobile. With a more mobile DOC, the transport of DOC from the terrestrial to the aquatic system will increase. However, most of these conclusions are based solely on monitoring data that generally only include the period of decreasing sulphur deposition, and little experimental evidence exist. In this study we wanted to test the effect of sulphur deposition on the concentration and quality of the DOC in soil water. This was done in a field experiment with artificial precipitation of 12 50*50 cm plots in a boreal-nemoral forest. There was one low and one high sulphate treatment and the soil water was collected every second week using zero-tension lysimeters placed just below the O-horizon and analyzed for both quantitative and qualitative DOC variables. The experiment lasted 2 years.

After about one year the low acid treatment had significantly higher absorbance at a wavelength of 420 nm, while DOC concentration did not differ between the low and the high acid treatment. Rather than the expected increase in DOC concentration in the low acid treatment, a change in DOC quality was observed as characterized by absorbance, fluorescence and high performance size exclusion chromatography. DOC in the low acid treatment tended to be more aromatic and of greater molecular weight.

A change in DOC quality will affect the fate of the DOC as it moves through the terrestrial and into the aquatic system. The susceptibility of DOC to photooxidation, biodegradation and flocculation may be greatly altered and ultimately affect the turnover of organic carbon.