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Spatial and temporal characterization of dissolved organic matter in bog water based on spectroscopic properties: the effects of humification

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To study the effects of climate change on organic matter (MO) degradation here we propose a fast and simple method based on UV/Vis fluorescence analysis, a spectroscopic technique which exploits the intrinsic capacity of OM to absorb and to emit light at specific wavelengths within the range of the electromagnetic spectrum. This technique allows collecting structural and functional data rapidly, reliably and cheaply making it highly precious for routine and long-term studies.
The effect of temperature on the degree of peat degradation as detected in dissolved OM was investigated through the analysis of near surface water (pore water) and deeper water (groundwater) in four Swiss bogs sampled on monthly basis from June to October 2010. The four bogs were located at different altitude (from about 500 m up to 1900 m a.s.l.) so as to simulate a natural gradient of increasing peat soil temperature.
Three-dimensional UV/Vis fluorescence measurements were acquired over the ranges 250-500 and 280- 550 nm for excitation and emission wavelengths, respectively. Besides visual analysis, 3D spectra were used to determine several qualitative indicators including the fluorescence index (FI), the index of humification (HIX) and aging index (IA/IC, where IA is the peak intensity of the fulvic like compound and IC is the peak intensity of the fulvic like compound). In addition, concentration of dissolved organic carbon (DOC) was also periodically determined.
Our preliminary results showed that DOM is mainly plant-derived in all the bogs and for both kinds of bog water. However, in pore water collected in October (last sampling month) an increase of microbial-derived compounds was observed for all sites except at the lowest altitude bog. The value of HIX in pore water tended to increase with time reaching a maximum in September-October. This trend was almost absent in groundwater samples. HIX in porewater showed that DOM is more humified at the end of the season for all the bogs, which is not visible in groundwater. Seasonal concentration of DOC showed an increase at the top of the plant growing season indicating a primary contribution of plant rhizodeposition.
Our preliminary results indicate the existence of spatial and temporal trend in the quality of DOM in relation to plant and microbial activity along the study period and in relation to the age of DOM.