Winter conditions alter the character and reactivity of dissolved organic carbon at the soil-stream interface

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2013

Panneer Selvam B (oral), H Laudon and M Berggren. 2013. Winter conditions alter the character and reactivity of dissolved organic carbon at the soil-stream interface. *ASLO 2013 Aquatic Sciences Meeting: Learning for the Future*, presented on February 18, 2013, in New Orleans, Louisiana, USA

ABSTRACT

Dissolved organic carbon (DOC) is a major driver of greenhouse gas evasion from inland waters and its concentrations have systematically increased in northern aquatic systems in recent years. Studies have revealed that longer and colder winters result in higher DOC concentrations in boreal riparian soils and in streams during the subsequent spring and summer. However, little is known about the climate change influence on the character of DOC and on its reactivity. We conducted a study of riparian soils in northern Sweden, involving three different experimental plot-scale treatments: less soil frost (insulated), more soil frost (exposed; snow removal) and control. To understand the DOC character and reactivity, soil solution samples were analyzed using fluorescence parallel factor modeling, specific UV absorbance, plus bio- and photo-degradation experiments. DOC from soils with reduced frost had distinct chemical properties and was less biologically reactive compared to DOC from the other soils. Our study suggests that change in climate to milder winters not only leads to lower DOC export, but also to lowered reactivity of the DOC that is exported from shallow riparian soils.