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Hydro-climatic control of stream water dissolved organic carbon (DOC) across northern catchments within the North-Watch program

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There has been an increasing interest in understanding the regulating mechanisms of surface water dissolved organic carbon (DOC) the last decade. A majority of this recent work has been based on individual well characterized research catchments or on regional synoptic datasets combined with readily available landscape and climatic variables. However, as the production and transport of DOC primarily is a function of hydro-climatic conditions a better description of catchment hydrological functioning across large geographic regions would be favorable for moving the mechanistic understanding forward. To do this we report from a first assessment of catchment DOC within the international inter-catchment comparison program North-Watch (http://www.abdn.ac.uk/northwatch/). North-Watch includes long-term research catchments ranging from northern temperate regions to the boreal and sub-arctic biomes with the aim to better understand the variable hydrological and biogeochemical responses in Northern catchments to climate change. The North-Watch catchments are located in Sweden (Krycklan), Scotland (Mharcaidh, Girnock and Strontian), the US (Sleepers River and HJ Andrews) and Canada (Catamaran, Dorset and Wolf Creek).

The annual average DOC concentration in the nine catchments investigated were directly linked to hydro-climatic influences (e.g. temperature, water storage) and landscape configuration. In general, the DOC concentration followed a parabolic shape with temperature, where the highest concentrations were found in the boreal and near boreal sites and with the lowest concentrations in the temperate and sub-arctic catchments. The between catchment variability in DOC concentration could also be explained by catchment water storage and amount of wetlands in the catchment. Whereas there is a mechanistic link between long-term climatic conditions and the areal coverage of wetlands, the total catchment storage of water is more strongly linked to topography, parent material and soil depth. The result from this analysis will serve as a conceptual framework for understanding biogeochemical response to environmental change across northern catchments. The next step in this work will be to include more detailed comparisons of the role catchment hydrological functioning for explaining the patterns and dynamics of catchment DOC of these northern watersheds.