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Hydrological controls of DOC export from Nordic headwater catchments.

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Nordic surface waters are currently much browner than during the 1980s due to drivers related to decreased acid deposition, and increased precipitation. While upward trends in concentration of DOC have been well documented, positive trends in the annual export of DOC are not as widespread. The variation in seasonality of DOC export may mask long-term trends in annual export. A large dataset of 30 natural headwater catchments from Finland, Norway, and Sweden contains more than 20 years of discharge and DOC records. We will use these data to better quantify the trends of DOC export and their relationships to seasonality and the effects of climatic changes seen over the last few decades, such as diminished snowpack, less distinct snowmelt events and increases in autumn precipitation. We will investigate both the seasonal and annual relationships between DOC concentration and discharge (C-Q) and test if they relate to time and catchment characteristics such as size, latitude, and landcover.

We explore 3 hypotheses in this data set. First, spring DOC export is decreased due to less distinct snowmelt and runoff events while autumn export of DOC is increased as a consequence of more autumn runoff. Second, we propose that catchments with a longer or more distinct snow cover period are more sensitive than catchments at lower elevation or latitude due to the length of inactivity caused by low temperatures and a more defined snowmelt runoff event. Third, we hypothesize the negative C-Q relationship in winter and spring is likely due to source limitation and dilution while hydrologic controls in summer and autumn are associated with positive C-Q relationships.

Climate change is promoting enhanced export of DOC from soils towards surface waters, leading to more carbon processed and transported along the aquatic continuum from headwaters to coast. This data set gives us an opportunity to look at a diverse set of headwater catchments in the Nordic region, an area disproportionally affected by climate change, to clarify the hydrologic components and how this will affect overall carbon transport.