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Dissolved Organic Carbon concentrations response to extreme climate events during snow melt

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Extreme weather and climate events are predicted to increase in both frequency and severity in the near future, which could have detrimental consequences for water quality in northern latitudes. Specifically, episodes of extreme temperature and/or precipitation have the potential to alter key processes that regulate the production and transport of solutes, like dissolved organic carbon (DOC), from soils to streams. Here we use 23 years of data from an intensively studied research catchment in northern Sweden to ask how extreme antecedent climate events influence DOC concentration during snowmelt. Specifically, we used multivariate partial least square (PLS) analysis to assess how different climate extremes observed during summer, autumn, and winter seasons affect the magnitude of DOC concentration observed during the subsequent spring flood. Analysis of climate data showed that almost every year provides some combination of extreme conditions in terms of intensity, duration, or frequency of temperature and/or rainfall. However, in terms of DOC responses to these events, variation in peak concentrations were most closely related to cold winter conditions, winter precipitation (snow) and temperature during the previous autumn. Specifically, years with most severe frost and icing during winter, but low winter precipitation and warmer autumns, showed the highest peaks in concentrations. In contrast, the lowest DOC peak concentrations were observed in years that following colder autumns and high winter precipitation. While this research highlights the importance of winter climate for influencing the DOC concentration during the spring, it also points to the importance of lag effects from preceding seasons on the DOC response during the snow melt season.