



## Structure of dissolved organic matter across 500 boreal lakes analyzed by fluorescence spectroscopy

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Dissolved organic carbon (DOC) in boreal lakes is largely comprised of organic compounds of terrestrial origin at various stages of decomposition. Optical metrics can provide information on the aromatic content and origin of DOC which furthermore provides insights into the biological reactivity of DOC.

In this study, we interpret the fluorescence and absorbance characteristics of DOC in over 500 lakes across the Swedish boreal landscape, and relate established optical metrics of aromaticity (specific absorbance, fluorescence index) and levels of degradation (humification index and freshness index) to lake water chemistry, land cover, and climate variables. The lakes are distributed along the full length of Sweden, from latitude 55° to 70° N, providing a unique opportunity to explore several naturally occurring gradients, including for example, mean annual temperature, altitude, wetland cover, nutrient levels, and weathering of base cations from differing bedrock geology.

In addition to common optical metrics, we used parallel factor analysis (PARAFAC) and identified 6 fluorescence components which were then related to water chemistry, climate and land cover. With the aid of multivariate approaches including partial least squares and principle components analysis we found an overlying influence of latitude and altitude on DOC concentration and several optical DOC measures. Specific fluorescence components were found to be linked to pH, nutrient concentrations, and coverage of wetlands in the catchment areas. Results of this study allow us to test specific hypotheses from previous studies, such as the influence of agriculture and altitude on protein-like fluorescence, relative to humic-like fluorescence. This study expands upon our general understanding of landscape controls and lake chemistry on the structure and reactivity of boreal lake DOC.