Geophysical Research Abstracts
Vol. 18, EGU2016-13894, 2016
EGU General Assembly 2016

Controls on the dynamics of dissolved organic matter in boreal lakes

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The reactivity of dissolved organic matter (DOM) strongly influences the biogeochemical cycling of key nutrients including carbon and nitrogen. Dissolved organic nitrogen (DON) comprises a small, yet functionally important, fraction of total DOM in boreal lakes. This pool of DON can influence the fate of total DOM by catalyzing microbial degradation pathways, or alternatively being less reactive to photo-degradation. Upon mineralization, it may also constitute an important nutrient for planktonic primary producers. By examining the optical and detailed molecular characteristics of DOM from several hundred lakes spanning a 13 degree latitude gradient across Sweden, we found that the molecular composition of DOM was influenced primarily by the water residence time of lakes, followed by mean annual temperature, which spanned from -6.1 to 6.5 degrees C, from north to south, respectively. Land cover across Sweden is typical of the boreal zone, being comprised of primarily forest and wetland cover; however, at this large spatial scale, land cover did not influence the molecular composition of DOM. We discuss how these results provide insight into predicting the relative influence of climatic, hydrological and catchment characteristics on the fate of DOM under a changing climate. In particular, we explore how DON constituents play a pivotal role in the overall chemical diversity of DOM and how this diversity ultimately drives its reactivity or persistence through freshwaters.