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Long-term patterns in dissolved organic carbon in boreal lakes: the role of incident radiation, precipitation, air temperature, southern oscillation and acid deposition

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Abstract. Both lake-specific (e.g. pH) and regional (e.g. precipitation) factors affect DOC concentration and pattern. Using annual DOC concentration in nine boreal lakes in the ice-free season, the potential influences of five regional factors, air temperature, precipitation, SO₄ deposition, solar radiation (photosynthetically active radiation, or PAR) and the southern oscillation index (SOI) have been explored through multiple regression. Mean solar radiation, winter precipitation and summer precipitation explained 59% of the variation in the mean DOC concentration ($F_{3,17} = 8.29$, $p = 0.0013$). Solar radiation and winter precipitation were correlated, negatively, while summer precipitation was correlated, positively, with DOC concentration. Because these relationships were based on only 21 years of data (1978 to 1998), the significance of the parameters in the regression model was evaluated with a randomisation test. This re-analysis indicated that summer precipitation did not contribute significantly to the regression model ($p_{\text{rand}} = 0.183$). The final multiple regression explained 50% of the variation in DOC ($F_{2,18} = 9.33$, $p_{\text{rand}} = 0.002$) based on solar radiation and winter precipitation. These results suggest that solar radiation and winter precipitation have a significant role in determining long-term DOC concentration in boreal lakes.

Keywords: dissolved-organic-carbon, lakes, climate, solar-radiation, precipitation, acid-precipitation, Precambrian-Shield-Ontario

[Final Revised Paper](#) (PDF, 606 KB)

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