



Spatial and temporal drivers of dissolved organic matter in high alpine lakes of Sierra Nevada, Spain

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Spatial and temporal variations in dissolved organic carbon (DOC) concentrations and dissolved organic matter (DOM) optical properties (absorption and fluorescence) were measured in clear lakes above treeline in the Sierra Nevada Mountains, Spain and potential external (precipitation, evaporation, and atmospheric deposition) and internal (bacterial abundance, bacterial production, chlorophyll a, and catchment vegetation) drivers of DOM patterns were assessed. At the spatial scale, bacterial products were found to be important sources of colored DOM (CDOM) in eleven lakes of the Sierra Nevada, whereas no measurable control over DOC concentration or DOM optical properties by microbial activity was observed over time. At the temporal scale, water soluble organic carbon (WSOC) in atmospheric dust deposition and evaporation were found to have an important influence on DOM in two Sierra Nevada lakes studied during the ice-free periods of 2000 – 2002. DOC concentration and absorption coefficient at 320 nm were well correlated over the spatial scale ($R^2 = 0.86$; $p < 0.01$), but poorly correlated for the time series, indicating seasonal and interannual variability in external factors and a differential response to these drivers by DOM optical properties and

DOC concentrations. At the continental scale, higher mean DOC concentrations and more color in lakes of the Sierra Nevada than in lakes of the Pyrenees and Alps may be due to a combination of higher bacterial activity under higher mean temperatures, more extreme evaporation, and greater atmospheric dust deposition.