Geophysical Research Abstracts
Vol. 21, EGU2019-2403, 2019
EGU General Assembly 2019

Dissolved organic matter in a small meromictic productive soda lake: availability and molecular properties.

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Soda lakes in the Kenyan Rift Valley are considered the most productive inland waters in the world. Their huge primary production is mainly sustained by high density of planktonic cyanobacteria supported by: i) high water temperatures (typically > 20 oC); ii) high solar radiation; iii) high availability of phosphate, and; iv) enormous concentrations of dissolved inorganic carbon. In consequence, carbon cycle in these system is intense and vigorous. However, a complete view of carbon pools in soda lakes is still missing. For instance, information about quantity and quality of dissolved organic matter (DOM) is almost lacking. In this framework, this study provides the first in-depth description of quantity and properties of DOM in the water column of a small productive and meromictic soda lake of 4.5 m depth.
To constrain the origin, fate and transformation of DOM, the analysis combined: a) DOM quantification (in terms of dissolved organic carbon – DOC - and nitrogen - DON); b) bulk DOM spectroscopic measurements, and; c) detailed DOM molecular characterization through Fourier transform ion cyclotron resonance mass spectroscopy (FT-ICR-MS). Results evidenced high DOM concentrations (from 85 to 600 DOC ppm) in water column. Additionally, meromixis determines abrupt quantitative and qualitative differences between mixolimnion (from surface to 3 m depth) and monimolimnion (from 4 to 4.5 m depth). Thus, at the bottom, in contact with sediments, DOC peaked the highest concentration. Chromophoric and fluorophoric DOM that accumulated at the bottom is less aromatic, less fresh and relatively smaller in size than at mixolimnion. Additionally, FT-ICR-MS evidenced that DOM at monimolimnion is more aliphatic (high H/C ratio) and more reduced (lowest NOCS and O/C ratio values). Conversely, at mixolimnion DOM is more oxidized, more unsaturated and, in the end, with more polyphenol-like components.