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Distribution of dissolved green-house gases (CO_2, CH4, N2O) in Lakes Edward and George: Results from the first field cruise of the HIPE project

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Inland waters (streams, rivers, lakes, reservoirs) are quantitatively important components of the global budgets of atmospheric emissions of long-lived greenhouse gases (GHGs) (CO_2, CH4, N2O). Available data indicate that a very large fraction of CO_2 and CH4 emissions from rivers and reservoirs occurs at tropical latitudes. Data on GHGs at tropical latitudes from lakes however are much more scarse, and the relative importance of emissions, in particular in Africa, remains to be determined. Large tropical lakes are net autotrophic (hence potentially sinks for atmospheric CO_2) due generally low dissolved organic carbon concentrations, seasonally near constant light and temperature conditions, and generally deep water columns favourable for export of organic matter to depth. This sharply contrasts with their much better documented temperate and boreal counterparts, usually considered as CO_2 sources to the atmosphere sustained by net heterotrophy.

Here, we report a data-set of dissolved CO_2, CH4, N2O obtained in October 2016 in Lakes Edward and George and adjacent streams and crater lakes in the frame of Belgian Science Policy (BELSPO) HIPE (Human impacts on ecosystem health and resources of Lake Edward, http://www.co2.ulg.ac.be/hipe/) project. Lake George and part of Lake Edward were sinks for atmospheric CO_2 and N2O due to high primary production and denitrification in sediments, respectively, and modest sources of CH4 to the atmosphere. Sampled rivers and streams were oversaturated in CO_2 and CH4 and close to atmospheric equilibrium with regards to N2O. Spatial variations within rivers and streams were related to elevation and vegetation characteristics on the catchments (savannah versus forest). Levels of CO_2, CH4, and N2O were within the range of those we reported in other African rivers. Crater lakes acted as sinks for atmospheric CO_2 and N2O but were extremely over-saturated in CH4, due to intense primary production sustained by cyanobacteria. These CH4 levels were much higher than what we have reported in other lakes and reservoirs elsewhere in Sub-Saharan Africa.