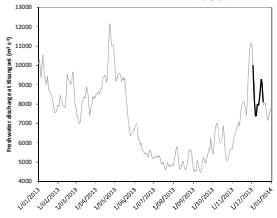
Spatial variability of inorganic and organic carbon in the Congo River during high waters (December 2013)

AV Borges[1], S Bouillon[2], T Lambert[1], C Teodoru[2], B Leporcq[3], J-P Descy[3] & F Darchambeau[1] [1]ULg [2]KULeuven [3]UNamur



We sampled the Congo River from Kisangani to Kinshasa (1700 km) between 3 and 19 December 2013, during the onset of the high-water period. The aim of the study was to describe the aquatic biogeochemistry with a particular focus on carbon (C) cycling, and greenhouse gas emissions. We sampled the middle of the main stream, and a series of tributaries.

Compared to the main stream, tributaries were generally characterized by:

- Lower temperature (forest cover)
- Lower conductivity
- Lower pH coincident with higher dissolved organic C (DOC), higher chromophoric dissolved organic matter (cDOM) (a_{350}), lower total alaklinity (TA)
- Lower total suspended matter (TSM), lower particulate organic C (POC), lower δ^{13}C-POC, lower chlorophyll *a* (Chl-*a*), higher %POC
- Lower $\%O_2$, lower $\%N_2O$, higher pCO_2, higher $\%CH_4$
- Lower NO_3^-

These patterns show that tributaries were characteristic of black waters, while the middle of the main stream was more characteristic of white waters. This can be explained by the savannah-dominated catchment upstream of Kisangani, while most of the tributaries we sampled drained humid forest. Two notable exceptions are the Kwa (Kasai) (km 1415) and Nsele (km 1605), two left bank tributaries in the lower Congo which drain savannah and correspondingly have biogeochemical characteristics of white waters.

δ^{13}C signatures of POC and DOC fall within the range expected for a dominance of C_3 vegetation with a tendency for increased C_4 contributions at the start of the transect (due to presence of savannah in the drainage basin upstream of Kisangani) and towards the end of transect with the transition of drainage basins to savannah.

In the mainstream Congo, most variables show distinct longitudinal patterns with :

- a decrease of conductivity, pH, $\%O_2$, POC, TSM, δ^{13}C-POC, TA, δ^{13}C-DIC, NO_3^{2-}
- an increase of temperature, %POC, DOC, pCO_2, a_{350}

These patterns can be explained the combination of :

- deposition of TSM and POC inputs below Kisangani
- degradation from km 0 to km 400 of riverine OC downstream of Kisangani (decrease of $\%O_2$, δ^{13}C-DIC, increase of pCO_2)
- dilution of mainstream Congo waters by black water lateral inputs

Other variables show a more complex pattern. Chl-a and primary production increase on the stretch from km 400 to km 1400, and then drop (following TSM patterns). $\%N_2O$ shows a maximum around km 300 and increases again in the last 300 km.