Isotopic compositions and sources of organic carbon pools within the Tana River Basin, Kenya

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Rivers play an important role in the global carbon cycle, and process ~1.9 Pg C annually. Rivers do not merely transport carbon from the terrestrial to the oceanic environment, but also bury and process organic matter, typically acting as a source of CO_2 to the atmosphere. However, there are few studies which quantify carbon fluxes in tropical rivers, and data for the African continent are particularly scarce. In this study, we report the altitudinal patterns in organic carbon pools and their stable isotopic compositions in the Tana River Basin (Kenya). Samples for dissolved and particulate organic carbon, as well as soil and sediment organic carbon were collected in February 2008 (end of dry season), September-November 2009 (short rains), and June-July 2010 (end of long rains) sampling campaigns throughout the 120,000 km² Tana river basin. Furthermore, monthly data are collected at 5 sites since January 2009. A consistent downstream increase in TSM was observed during all three sampling campaigns. A consistent downstream decrease in %C and %N was observed for soil and sediment samples during all the three campaigns ($p<0.01$) except sediments samples for the 2009 wet season campaign ($p>0.05$). Both $\delta^{13}C$ soil and sediment did not exhibit clear altitudinal trends. The DOC concentration were highest during the wet season (2009) and consistently increased downstream. $\delta^{13}C$-DOC values were similar during the three campaigns and ranged overall between -27.7 and -20.9 ‰. $\delta^{13}C$-POC increased downstream ($p<0.01$), and were predominantly of terrestrial origin as reflected by generally high POC/Chl *a* ratios. TSM and %POC followed a typical inverse relationship, which substantially deviated from those used in the NEWS2 model towards the highest TSM concentration. TSM and POC delivery was highly episodic during wet season (2009 sampling campaign), and mostly mobilized at intermediate altitudes dominated by intensive agriculture. $\delta^{13}C$-POC values reflects an increasing contribution of C4-derived carbon downstream.