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Biogeochemistry of the Tana estuary and delta (northern Kenya)

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ABSTRACT: The estuarine mixing zone of the Tana River (northern Kenya) and an extensive delta area just south of the estuary were sampled in April 2004 with the aim of identifying the distribution, sources, and processing of particulate and dissolved organic carbon (POC, DOC) and inorganic carbon (DIC). C4 inputs from the catchment contributed ~50% to the POC pool in the Tana River and estuary, and in the mangrove creek water column and intertidal sediments. The $\delta^{13}\text{C}$ values of DOC, however, were typically much more negative than that of POC, indicating a substantially higher contribution by C3 and/or mangrove-derived carbon in the DOC pool. The undersaturation of O_2 , high pCO_2 , and the nonconservative nature of DIC and $\delta^{13}\text{C}_{\text{DIC}}$ suggest a strongly heterotrophic water column, particularly in the freshwater part of the Tana and in the tidal creeks in the delta, where high additional inputs of organic matter were observed. However, some of these sites showed $\delta^{18}\text{O}_{\text{CO}_2}$ signatures lower than the atmospheric equilibrium (i.e., +24.2‰) indicative of significant O_2 production by photosynthesis. Therefore, the heterotrophic signature in the water column is likely the result of a strong interaction with the large intertidal areas, whereby respiratory activity in sediments and in the overlying water column during tidal inundation leave a marked signature on the water column. This is confirmed by the covariation between salinity-normalized total alkalinity and DIC, whose slope indicates an important role for anaerobic diagenetic processes. If our data are representative for other large river systems in the region, current estimates are likely to underestimate suspended matter and both inorganic and organic C fluxes to the Indian Ocean from tropical east Africa.

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