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Biogeochemistry of the Tana estuary and delta (northern Kenya)

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Given the importance of the tropics in the global riverine export of organic and inorganic carbon, the lack of data on the magnitude of carbon fluxes and transformations in river systems and estuaries along the entire east African coastline represents one of the many gaps in our knowledge on carbon dynamics in the tropical coastal zone. The estuarine mixing zone of the Tana river (the largest river system in Kenya) and an extensive deltaic area just south of the estuary were sampled for a variety of physico-chemical and biogeochemical parameters in April 2004, with a focus on identifying the distribution, sources, and biogeochemical processing of organic and inorganic carbon. The undersaturation of $O_2$and high pCO_2, as well as the non-conservative nature of DIC and δ^{13}C-DIC suggest a strongly heterotrophic nature of the 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, in the delta occasional respiration/photosynthesis values close to 1 and relatively low δ^{18}O values in the dissolved O_2 pool indicate that the pelagic system as such is not consistently strongly heterotrophic. This could suggest that water colomn signatures of O_2 saturation levels, $pCO_2$and related parameters result from a strong interaction with the benthic compartment and/or the large intertidal areas as proposed earlier for estuarine marshes. Under such a scenario, the respiratory activity (oxic and anoxic) in the sediments and in the overlying water column during inundation of the intertidal areas leaves a marked signature on the water column geochemistry in the tidal creeks, where local conditions (higher wind speed and water mixing) are more favorable for gas exchange with the atmosphere. The Tana river showed high suspended matter and organic carbon loads, exceeding currently cited estimates for the east African conti-

nent. This suggests that carbon export to the Indian Ocean from the African continent could well be underestimated. Moreover, stable isotope data indicate that a major fraction of the organic carbon transported by the Tana river is derived from C4 vegetation -which could have implications for the marine sedimentary record in this region- and that mineralization in the large tidal delta is sustained by roughly equal contributions from mangrove and C4 inputs.