

Sediment and carbon transport in the lower Tana River (Kenya): the regulating role of floodplains

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Abstract

We estimated annual fluxes of suspended sediments and different carbon species at three sites along the lower Tana River (Kenya), based on monthly sampling between January 2009 and December 2011. Floodplains are present along large stretches of the lower Tana River. Total suspended matter (TSM), concentrations of particulate and dissolved organic and inorganic carbon (POC, DOC and DIC), as well as their stable isotope composition were determined. Both TSM (24 to 9386 mg L⁻¹) and POC (0.8 to 141.9 mg C L⁻¹) concentrations were highly variable. DOC and DIC concentrations ranged from 0.8 to 5.2 mg C L⁻¹ and 7.1 to 23.5 mg C L⁻¹, respectively, but their seasonal variations were not systematic. A strong shift in the origin of POC was observed, being dominated by C3-derived carbon (C) during dry conditions (low $\delta^{13}\text{C}_{\text{POC}}$ signatures between -28‰ and -25‰), but with significant C4 contributions during higher flow events ($\delta^{13}\text{C}_{\text{POC}}$ up to -19.5 ‰). On average, annual suspended sediment fluxes ranged from 3.1 Tg y⁻¹ to 8.7 Tg y⁻¹. Mean annual C fluxes ranged from 36.6 Gg C y⁻¹ to 104.9 Gg C y⁻¹, 6.0 Gg C y⁻¹ to 13.9 Gg C y⁻¹ and 50.6 Gg C y⁻¹ to 63.6 Gg C y⁻¹ for POC, DOC and DIC, respectively. Tana River floodplains play a critical role in regulating the transport of sediments and organic carbon as reflected by a significant reduction in the sediment, POC and DOC (ranging between 34% and 65% for the 3-year study period).