

Abstract

This study focuses on sediment transport and exchange dynamics in the 27 km² Tana Estuary located at Kipini in the north Kenya coast. The estuary is drained by the Tana River, which contributes more than 50% of the total river discharges into the Kenyan sector of the Indian Ocean. The study involved measurement of river discharges, estuarine flood–ebb tidal discharges, total and particulate organic suspended sediment concentrations (TSSC, POSC) and fluxes, tidal water elevation, current velocities, temperature and salinity. The study was conducted between February 2001 and November 2003. The results of the study showed that the Tana River discharge ranged between 60 and 750 m³ s⁻¹. The maximum river discharges during the Southeast and Northeast monsoons were 750 and 350 m³ s⁻¹, respectively. The peak river discharges occurred in May and November. The total daily sediment load of the Tana River varied from 2796 tons day⁻¹ during the dry season to 24,322 tons day⁻¹ during the rainy season. The annual total sediment load is 6.8×10^6 tons yr⁻¹, which is, however, smaller than that before the damming of the river in the Upper Tana Basin. Because of river discharge and occurrence of a wide mangrove wetland, the estuary is mainly ebb tide dominant. The peak ebb tide currents (0.87 m s⁻¹) were 30% larger than the peak flood tide currents (0.65 m s⁻¹). During spring tide, the estuary was partially well mixed. However, in neap tide, the estuary was stratified in the middle zone. The turbidity maximum zone with TSSC > 1.5 g l⁻¹ was generated in spring tide by wave stirring of frontwater zone bed sediments and trapping of fine sediments at the toe of the salt wedge. The peak TSSC ranging from 1.5 to 5.0 g l⁻¹ occurred at low tide due to river supply of sediment and resuspension of channel bed sediments by wind waves, particularly at the last stages of ebb tide and early stages of flood tide. Due to the influx of oceanic water into the estuary at flood tide TSSC decreased to <0.2 g l⁻¹ at high tide in the frontwater zone and was larger in the backwater zones of the estuary. The estuary exports sediments at a rate ranging from 0.02 to 0.08 kg m⁻² tidal cycle⁻¹. The net export of sediments causes a net denudation of the estuary at a rate ranging from 0.08 to 0.04 mm tidal cycle⁻¹.