Abstract

The spatial–temporal variability and the behaviour of the Estuarine Turbidity Maximum (ETM) zone in the shallow, ephemeral, well-flushed Sabaki estuary located in the northern region of the Kenya coast, were studied during a period of moderate river discharge. The estuary is one of the most turbid estuaries along the coast of East Africa, characterised by high sediment input and high suspended matter (SPM) concentrations. The estuary is completely flushed after every tidal cycle and it experiences high salinity and SPM concentration gradients at high water (HW). The ETM was present at HW during periods when the river runoff was near the long-term average of 73 m^3s^{-1} and also when the river runoff was relatively low (35 m^3s^{-1}). The SPM concentrations in the ETM zone varied significantly depending on the river sediment input and phase of the semi-diurnal tide. The SPM concentrations in the ETM were on average 50% greater than those associated with river runoff. The ETM was located up-estuary during periods when river runoff was around the average and further down-estuary during periods of low river runoff, due to different sediment settling rates. There was a tendency for the accumulation of fine sediments and clay mud in a zone of low current velocities located in the lower middle region of the estuary below the freshwater–saltwater interface, causing formation of an ETM zone. The ETM was separated from the salt-limit due to the lag in time in the tidally-driven resuspension of bottom mud and subsequent tidally-driven advection of turbid water up-estuary during the flood period. The relatively low current velocities combined with high horizontal and vertical gradient in eddy diffusivity in the central region of the estuary, tended to favour rapid settling of flocculated sediments, leading to the formation of the ETM. The study concludes that rapid settling through non-turbulent pycnocline is the dominant mechanism responsible for the formation of the Sabaki estuary ETM. The study also shows that the formation of inter-tidal mudflats is related to the ETM dynamics.