Abstract

Research into groundwater outflow and tidal circulation was undertaken in a 32 km^2 mangrove-fringed tropical creek in Kenya. The study involved measurement of the groundwater level, storage and outflow, tidal currents, salinity and temperature. The study shows that groundwater outflow in the creek occurs within the main tidal channels and is not restricted along the shoreline. Groundwater outflow is evidenced by: (1) the occurrence of vertical salinity anomalies; (2) ebb–flood tide salinity differences; (3) occurrence of groundwater in shallow wells a short distance from the mangroves; and (4) enormous groundwater recharge and storage in the Mida basin. Vertical salinity anomalies are characterized by the presence of a lens of low salinity water at the bottom water column and higher salinity at the surface. It is believed that this occurs since no major density differences develop despite vertical salinity differences of up to 1·58, possibly as a result of uniform distribution of water temperature vertically. In drought conditions, seepage reduces and hypersaline conditions (salinity in the range of 36·89 to 38·57) which mask groundwater outflow, develop in the backwater region as a result of intense evaporation and restricted circulation. The strong currents reaching 2·5 m s^{-1} occur in the frontwater zone and enhance the tidal flushing while lower currents <0·5 m s^{-1} occur in the backwater zone and promote trapping of water which thereby increase the residence time to 11 days. With flood currents being more dominant than ebb currents in the main creek channel, the seaward export of material derived from groundwater is limited.