Abstract

Water circulation and exchange processes in a shallow, semi-enclosed tropical bay were studied in southern Kenya (Gazi Bay) through measurements of tidal elevations, salinity, temperature, dissolved oxygen and current velocities at stations established in mangrove creeks, seagrass beds and coral reef zones. Occurrence of wide shallow entrance, lack of topographic controls (sills) and the orientation of the Bay entrance with respect to dominant tidal water circulation patterns, accounts for the high rates of exchange (60–90% of the volume per tidal cycle) between the inshore and offshore waters. High flushing rates are coupled with short residence times in the order of 3–4 h. The dominant water circulation driving force is the semi-diurnal tide, causing a strong reversing current in the mangrove creeks (0·6 ms^{-1}) and low magnitude current in the seagrass and coral reef zones (<0·30 ms^{-1}). Tidal asymmetry, characterized by stronger ebb flows than flood flows in the mangrove creeks, partly promotes the net export of organic matter to the seagrass beds. The brackish and turbid water plume in the mangrove creeks and south-western region of the Bay is trapped along the coast and in the mangrove swamp, and does not reach the coral reef. The freshwater influx via rivers and direct rainfall in the Bay accounts for a volume of 305 000 m^3, of which 20% is lost as a result of enhanced evapotranspiration, which is also responsible for a salinity maximum zone (38) in the upper region of the Bay covered by mangroves.