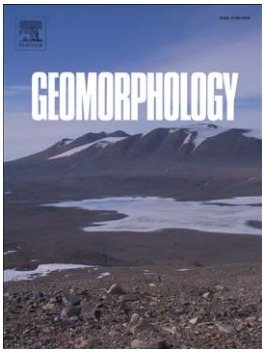

Short-term tidal asymmetry inversion in a macrotidal estuary (Beira, Mozambique)

Teodósio N.M. Nzualo, Marcos N. Gallo, Susana B. Vinzon

PII: S0169-555X(16)30889-3
DOI: doi:10.1016/j.geomorph.2018.01.029
Reference: GEOMOR 6311

To appear in: *Geomorphology*

Received date: 17 September 2016
Revised date: 10 December 2017
Accepted date: 28 January 2018

Please cite this article as: Nzualo, Teodósio N.M., Gallo, Marcos N., Vinzon, Susana B., Short-term tidal asymmetry inversion in a macrotidal estuary (Beira, Mozambique), *Geomorphology* (2018), doi:10.1016/j.geomorph.2018.01.029

Short-term tidal asymmetry inversion in a macrotidal estuary (Beira, Mozambique)

Teodósio N. M. Nzualo*; Marcos N. Gallo; Susana B. Vinzon

Coastal and Oceanographic Engineering Area, Ocean Engineering Program/COPPE,

Federal University of Rio de Janeiro, CT I100 Cx Po 68508, CEP 21949-900,

Rio de Janeiro, Brazil

***Corresponding author:** nzualo@yahoo.com.br

Keywords: tidal asymmetry**,** spring tides, neap tides, sand banks, estuarine morphology

Abstract

The distortion of the tide in estuaries, bays and coastal areas is the result of the generation of overtides due to the non-linear effects associated with friction, advection, and the finite effects of the tidal amplitude in shallow waters. The Beira estuary is classified as macrotidal, with a large ratio of S_2/M_2. Typical tides ranges from 6 m and 0.8 m, during springs and neaps tides, respectively. As a consequence of this large fortnightly tidal amplitude difference and the estuarine morphology, asymmetry inversions occur. Two types of tidal asymmetries were investigated in this paper, one considering tidal duration asymmetry (time difference between rising and falling tide) and the other, related to tidal velocity asymmetry (unequal magnitudes of flood and ebb peaks currents). In the Beira estuary when we examine the tidal duration asymmetry, flood dominance is observed during spring tide periods (negative time difference between rising and falling tide), while ebb dominance appears during neap tides (positive time difference between rising and falling tide). A 2DH hydrodynamic model was implemented to analyze this asymmetry inversion. The model was calibrated with water-level data measured at the Port of Beira and current data measured along the estuary. The model was run for different scenarios considering tidal constituents at the ocean boundary, river discharge and the morphology of the estuary. River discharge did not show significant effects on the tidal duration asymmetry. Through comparison of the scenarios, it was shown that the incoming ocean tide at the boundary has an ebb-dominant asymmetry, changing to flood-dominant only during spring tides due to the effect of shoaling and friction within the estuary. During neap tides, the propagation occurs mainly in the channels, and ebb dominance remains. The interplay between the estuary morphodynamics was thus identified and the relation between tidal duration asymmetry and tidal velocity asymmetry was observed. While fortnightly inversion in the tidal duration