

EFFECTS OF TIDAL AND RIVER DISCHARGE FORCINGS ON TIDAL PROPAGATION ALONG THE GUADIANA ESTUARY

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Abstract: This study presents the outputs of a new hydrodynamic model of the Guadiana Estuary, situated in southwest region of the Iberian Peninsula. The numerical model, in 2D barotropic mode, has been forced by tides at the ocean side and by freshwater at the upstream boundary of the domain. It has been validated using water level and current observations at several locations along the estuary. Different scenarios with variable tidal forcing and freshwater discharge have been analysed in order to assess the influence of each external agent on the along-channel hydrodynamics. The model reproduces the expected asymmetries between rising-falling tide and flood-ebb flow durations, with falling tide being longer than rising tide and ebb tide flows lasting longer than flood tide ones. These asymmetries increase with fresh water discharge, showing a trade-off between bottom friction and the freshwater inputs at the estuary's head. The asymmetry related to the tidal currents (ebb-flood) increases faster than the one of sea level (rising-falling), which agrees with the prismatic morphology of the estuary. From a discharge above 200 m³/s, friction dominates over the tidal amplification caused by the convergence of the estuary, with any tidal forcing. For high freshwater regime, the estuary develops a point where flood currents are arrested and do not progress further upstream. For a given tidal forcing, the location of this point moves downstream as the discharge increases. Thus, the regime and variability of freshwater inputs at the estuary's head (strongly regulated by an upstream dam) is the forcing man-made.

Keywords: Guadiana Estuary; MOHID model; tidal propagation; tidal asymmetries.