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Investigation of Mangrove Area Effects on Hydrodynamic Conditions of a Tidal Dominant Strait Near the Strait of Hormuz

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Abstract : This paper aims to evaluate the main role of mangroves forests on the unique hydrodynamic characteristics of the Khuran Strait (KS) in the Persian Gulf. Investigation of hydrodynamic conditions of KS is vital to predict and estimate sedimentation and erosion all over the protected areas north of Qeshm Island. KS (or Tang-e-Khuran) is located between Qeshm Island and the Iranian mother land and has a minimum width of approximately two kilometers. Hydrodynamics of the strait is dominated by strong tidal currents of up to 2 m/s. The bathymetry of the area is dynamic and complicated as 1) strong currents do exist in the area which lead to seemingly sand dune movements in the middle and southern parts of the strait, and 2) existence a vast area with mangrove coverage next to the narrowest part of the strait. This is why ordinary modeling schemes with normal mesh resolutions are not capable for high accuracy estimations of current fields in the KS. A comprehensive set of measurements were carried out with several components, to investigate the hydrodynamics and morpho-dynamics of the study area, including 1) vertical current profiling at six stations, 2) directional wave measurements at four stations, 3) water level measurements at six stations, 4) wind measurements at one station, and 5) sediment grab sampling at 100 locations. Additionally, a set of periodic hydrographic surveys was included in the program. The numerical simulation was carried out by using Delft3D – Flow Module. Model calibration was done by comparing water levels and depth averaged velocity of currents against available observational data. The results clearly indicate that observed data and simulations only fit together if a realistic perspective of the mangrove area is well captured by the model bathymetry data. Generating unstructured grid by using RGFGRID and QUICKIN, the flow model was driven with water level time-series at open boundaries. Adopting the available field data, the key role of mangrove area on the hydrodynamics of the study area can be studied. The results show that including the accurate geometry of the mangrove area and consideration of its sponge-like behavior are the key aspects through which a realistic current field can be simulated in the KS.

Keywords : Khuran Strait, Persian Gulf, tide, current, Delft3D
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