Ceaseless Tidal Zoning for Straits of Malacca using Spatial Interpolation

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SUMMARY

The Straits of Malacca is a tidally complex area with different tidal range patterns and range values, thus making standard co-tidal charts inappropriate for this region. Although tidal zoning can handle such complexities; its create discontinuity between the adjacent zones. Therefore, a different approach is needed to handle tidally complex areas effectively, while providing continuous results. Hence, a new concept 'Ceaseless Tidal Zoning (CTZ)' incorporating tidal zoning and conventional co-tidal charts was developed. In this approach, the tidal amplitude and phase fields are assumed to obey the two-dimensional (2D) Laplace Equation (LE) while the interpolation is computed by numerically solving the LE on a gridded mesh. First, the appropriate boundary condition coefficients were tested and determined by using simulated test basins. In addition, for a realistic scenario, data from ten tidal stations were selected as the known stations and another ten stations were selected as the check stations, in order to cover both sides of the Straits of Malacca. The best solutions were obtained with the boundary condition factor $a = 0.9$ for the coastline and the optimum convergence was achieved with the relaxation coefficient $r = 1.62$. A Matlab based computer application was developed to provide continuous tidal corrections for on-board bathymetric reduction based on the developed CTZ technique. The statistical results showed a 100% correlation with the check stations and also a very good correlation of over 0.8 in offshore areas with the altimetry sea surface heights. Finally, a tidal profile across the Straits of Malacca was obtained with the developed CTZ application and analysed for the discontinuity between the zones. It is shown that this approach has minimized the discontinuity of the tidal values in crossing the zones.

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