Tidal Propagation And Amplification In The Bransfield Strait, Antarctica: An Unstructured Grid Ocean Modelling Study

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A tide model is established to study tidal dynamics in Bransfield Strait and its adjacent seas in Antarctica. The limited coverage of point-based sea level observations has prompted for an alternative approach through high-resolution numerical modelling to advance the knowledge of tides in this region. This allows the coverage of extensive spatial and temporal information and fills the gaps which are not covered by point observations. The propagation and amplification of tides over complex bathymetric terrains were modelled for an austral summer month using the multiscale unstructured grid, finite-volume coastal ocean model FVCOM. Tidal harmonic analysis was performed to obtain estimates for amplitudes and phases of the tidal constituents ($M_2$, $S_2$, $K_1$ and $O_1$) were constructed for Bransfield Strait and the region around the northern Antarctic Peninsula. Sea level data from tide gauges were obtained and used for the quality assessment of the model results based on two statistical parameters, namely Willmott’s index of agreement $D$ and the bias index. The tidal regime is mixed, predominantly semi-diurnal at Capitan Prat Base, Dallmann and Esperanza; and the dominant tidal constituents for all the three locations are $M_2$ and $K_1$. In general, tides propagate from the Weddell Sea, enter Bransfield Strait and move further southwestward. The findings help to understand the physical processes of tides and serve as a basis for further modelling studies and analyses which include hydrodynamics, bed erosion characteristics and water transport time scales estimation.

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