

Three-dimensional modelling of baroclinic tides in the South China Sea.

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Abstract:

The modelling of baroclinic tides generated in the Luzon Strait is carried out using the fully-nonlinear nonhydrostatic Massachusetts Institute of Technology general circulation model. The model is forced by typical for the area semidiurnal and diurnal tidal harmonics. The tidal components and typical for summer and winter density distributions were taken from tidal models and observations.

The barotropic tide interacting with supercritical bottom topography produces a complex multimodal baroclinic tidal signal radiating from the source of generation. The generated waves gradually transform into a series of large-amplitude solitary internal waves with amplitudes up to 100m and more alternating with small amplitude wave trains. The most intriguing outcome from the performed series of numerical experiments concerns a possibility of generation of second-mode solitary internal waves propagating along with solitary waves of depression towards the Chinese continental shelf. Their amplitudes and spatial characteristics were comparable with that of the first-mode solitary waves. The focus of the modelling efforts was on the investigation of the conditions of their generation (sensitivity to the topography profile, fluid stratification, tidal forcing) and their dynamics, i.e. three-dimensional characteristics, spatial and temporal variability.