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Tidally-driven internal bores and solitons in the Luzon Strait and South China Sea: nonhydrostatic simulations

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The generation and propagation of internal bores and solitons in the Luzon Strait and the eastern part of the South China Sea are carried out using nonhydrostatic models. The experiments are forced by the barotropic tide passing over the sills between islands in the Luzon Strait, between Taiwan and the Philippines. The tidal forcing includes both surface elevation and barotropic currents. In order to obtain high resolution for 3-D simulations, several subregions in the area of 118E-122E and 18.5N-22.5N are used for model domains. Horizontally homogeneous density profiles, derived from climatology and CTD observations, form the initial hydrographic fields. Model resolutions vary from 50m to 1 km in the horizontal and 25m to 100m in the vertical. The primary internal wave generation regions are the sill just south of Taiwan, and the sills between islands of the Batan Group in the Strait. After some interference between the wave trains emanating from the different sills, the waves propagate across the South China Sea. Several factors that contributed to strong nonhydrostatic effects were investigated, including the horizontal-to-vertical grid ratios, the ratio of vertical grid to characteristic B-V scale height, and horizontal grid size. Signal generation was found to be most efficient for horizontal resolutions $<$ 200m. Whereas hydrostatic models describe the generation mechanisms adequately, nonhydrostatic models are needed to simulate the propagation characteristics correctly.