Multidisciplinary Simulation, Estimation, and Assimilation Systems

Seminar Series

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Sources of baroclinic tidal energy in the Gaoping Submarine Canyon off southwestern Taiwan

Abstract: A three-dimensional model driven by tidal constituents O_1, K_1, M_2 and S_2 was adopted to evaluate the sources of baroclinic tidal energy in the Gaoping Submarine Canyon (GPSC) off southwestern Taiwan. The model domain covered the probable primary generation sites, including the Luzon Strait (LS) and the southeastern Taiwan Strait (TS). The simulated baroclinic tides agreed with the observations of tidal current velocity, isotherm vertical displacement, and baroclinic tidal energy flux (F_{bc}) in the GPSC. The depth-integrated, seven-day-averaged F_{bc} computed from the model result was 2.2 kW m^{-1} in the GPSC, and the corresponding area-integrated F_{bc} reached 189.4 MW. The results obtained from the model suggest that the baroclinic tides lead to strong turbulent mixing near the canyon head with a vertical diffusivity of 3.5×10^{-3} m^2 s^{-1}. Baroclinic tidal energy in the GPSC is mainly generated on the western ridge in the LS and on the steep topography in the southeastern TS. The local generation of baroclinic energy only accounts for 4.4% of the total value. The other 95.6% of the baroclinic tidal energy is remotely generated at the LS and the southeastern TS of which 31.9% and 8.8% are directly emanated, respectively, into the GPSC. The northwestward and southeastward baroclinic energy beams radiating from the LS and the southeastern TS, respectively, meet each other and form internal partial standing tides outside the GPSC. The transverse baroclinic energy from the internal partial standing tides accounts for the remaining 54.9% of the baroclinic tidal energy in the GPSC.

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