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Dynamics and energetics of nonlinear internal wave around a double-canyon system

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The continental shelf/slope northeastern Taiwan is a 'hotspot' of nonlinear internal wave (NLIW). The complex spatial pattern of NLIW indicates the complexity of the source and the background conditions. In this talk, we investigated the dynamic and energetics of the internal tide (IT) and NLIW around this region based on a 3D high resolution nonhydrostatic numerical model. Special attention is paid on the role of two main topographic features-the Mien-Hua Canyon and the North Mien-Hua Canyon, which are the energetic sources for ITs and NLIW.

The complex IT field is excited by the double-Canyon system and the rotary tidal current. ITs from different sources and formation time interference with each other further strengthen the complexity. The area-integrated energy flux divergence (the area-integrated dissipation rate) is ~0.45GW (~0.28GW) and ~0.26 GW (~0.17 GW) over the Mien-Hua Canyon and the North Mien-Hua Canyon, respectively. Along with the energetic internal tides, large-amplitude NLIW and trains are also generated over the continental shelf and slope region. The amplitude of the NLIW can reach to about 30 m on the continental slope with a water depth of 130 m and shows similar spatial complexity, which is consistent with in situ and satellite observations. Further analysis shows that the dominant generation mechanism of the NLIW belongs to the mixed tidal-lee wave regime. In addition, the dynamic processes can be significantly modulated by the Kuroshio. With the present of Kuroshio, the energy flux of the M2 internal tide shows a distinct gyre pattern and strengthens over the double canyon system, which is more close to the mooring observations and previous study.

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