CASTS TALKS

Special Program in Applied Mathematics and Applied Mechanics

Adjustment and scattering of semidiurnal Kelvin Waves on wide continental shelves

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11:00 - 12:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

In boundary areas of the World Ocean, a semidiurnal tide propagates in the form of a Kelvin wave mode trapped by the coastline. Over wide continental shelves, the semidiurnal tide is no longer a pure Kelvin wave, but attains features of a zero mode edge wave. As a result, the wave structure and the alongshore energy flux concentrate over the continental shelf and slope topography, and become very sensitive to the variations of shelf geometry. When a semidiurnal Kelvin wave encounters alongshore changes of the shelf width, its energy scatters into other wave modes, including internal waves. A particularly strong scattering occurs on wide shelves, where Kelvin wave structure undergoes significant modifications over short alongshore distances. These dynamics are studied using the Regional Ocean Modeling System (ROMS). We found that when the alongshore energy flux in the Kelvin wave mode converges on the shelf, the offshore wave radiation occurs through barotropic Poincaré wave modes, while for the divergent alongshore energy flux internal waves are generated. Under favorable conditions, more than 10% of the incident barotropic Kelvin wave energy flux can be scattered into internal waves. For the surface-intensified stratification mostly the 1st internal mode is generated, while for the uniform with depth stratification multiple internal modes are present in the form of an internal wave beam. A non-dimensional internal wave scattering parameter is derived based on the theoretical properties of a Kelvin wave mode, bottom topography and stratification. Examples in the World Ocean are briefly discussed.