Generation of diurnal K_1 internal tide in the Luzon Strait and its influence on surface tide in the South China Sea

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Abstract

The predominance of diurnal surface tides over semidiurnal surface tides in the South China Sea (SCS) has been attributed to the near-resonance response of the former in the SCS. Recent observations further revealed vigorous internal tides in the northern SCS. Conceivably, internal tides generated in the Luzon Strait could modify the surface tide in the SCS. We use a three-dimensional tide model of the East Asian seas (Fig. 1) to address this issue (see Jan et al., 2007, for details). With a typical summertime stratification of the SCS as the initial condition, energy budget indicate that one third of the incident K_1 surface tide energy are converted to the baroclinic energy over topographic ridges in the Luzon Strait. In comparison with a global tidal model (Matsumoto et al., 2000), our numerical experiments that annihilated or reduced the K_1 internal tide in the Luzon Strait led to up to 50% amplification of the simulated K_1 surface tide in the SCS. This suggests that the baroclinic energy conversion substantially reduces the amplitude of K_1 surface tide in the SCS. The simulated phases in the SCS differ little from those calculated from Matsumoto's tide model, suggesting that the modification is primarily on the amplitude. Two-dimensional surface tidal models lack baroclinic energy conversion in the Luzon Strait; the consequent overestimation of surface K_1 tide can be reduced only through precise prescription of sea levels in the Luzon Strait or assimilation of sea level data.

References

Matsumoto, K., T. Takanezawa, and M. Ooe, 2000: Ocean tide models developed by assimilating Topex/poseidon altimeter data into hydrodynamical model: a global model and a regional model around Japan. *J. Oceanogr.*, 56, 567-581.

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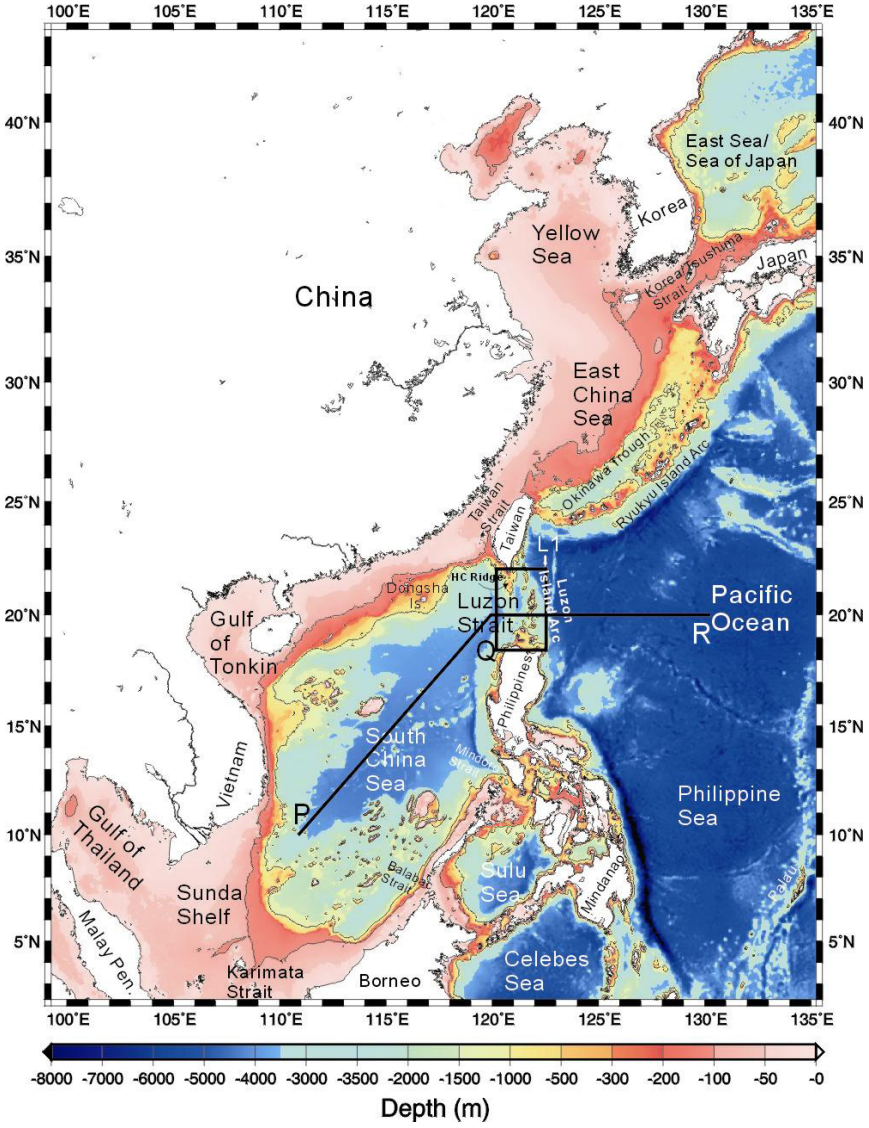

Figure 1. Bathymetry of our three-dimensional model domain, which includes the East Asian seas and northwest Pacific Ocean. HC ridge represents the Heng-Chun Ridge extended from southernmost of Taiwan Island.