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Long-range propagation and associated variability of internal tides in the South China Sea

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The variability of internal tides during their generation and long-range propagation in the South China Sea (SCS) is investigated by driving a high-resolution numerical model. The present study clarifies the notably different processes of generation, propagation and dissipation between diurnal and semidiurnal internal tides. Internal tides in the SCS originate from multiple source sites, among which the Luzon Strait is dominant, and contributes approximately 90% and 74% of the baroclinic energy for M2 and K1, respectively. To the west of the Luzon Strait, local generation of K1 internal tides inside the SCS is more energetic than the M2 tides. Diurnal and semidiurnal internal tides from the Luzon Strait radiate into the SCS in a north-south asymmetry but with different patterns because of the complex two-ridge system. The tidal beams can travel across the deep basin and finally arrive at the Vietnam coast and Nansha Island more than 1000-1500 km away. During propagation, M2 internal tides maintain a southwestward direction, whereas K1 exhibit complicated wave fields because of the superposition of waves from local sources and island scattering effects. After significant dissipation within the Luzon Strait, the remaining energy travels into the SCS and reduces by more than 90% over a distance of $\sim$1000 km. Inside the SCS, the K1 internal tides with long crests and flat beam angles are more influenced by seafloor topographical features and thus undergo apparent dissipation along the entire path, whereas the prominent dissipation of M2 internal tides only occurs after their arrival at Zhongsha Island.