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Propagation and transformation of nonlinear internal waves of tidal origin observed in the northeastern East China Sea

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Oceanic nonlinear internal waves (NLIWs) play an important role in regional circulation, biogeochemistry, energetics, vertical mixing, and underwater acoustics, causing hazards to marine engineering and submarine navigation. Mainly generated by the interaction of the barotropic tides with the bottom topography, they propagate and transform due to wave-wave interaction process. Here, we present characteristics of first two modes of NLIWs observed using high-resolution spatiotemporal data collected in a relatively flat area in the northeastern East China Sea in May 2015. Six groups of NLIWs were identified from the observations: four groups of mode-1 and two groups of mode-2. The amplitude, propagation speed, and characteristic width of mode-1 NLIWs had ranges of 4–16 m, 0.53–0.56 m s⁻¹, and 310–610 m, respectively. The mode-2 NLIWs propagate eastward slowly with a speed less than 0.37 m s⁻¹ with a comparable amplitude of 4–14 m and longer characteristic width of 540–1920 m. Intermodal interactions may take a role in the evolution of mode-1 NLIWs west of the observational area. Our results characterizing the two modes of NLIWs highlight the significance of propagation and transformation of NLIWs and their modal interactions on a broad and shallow shelf.

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