Disintegration of the K1 internal tide in the South China Sea due to parametric subharmonic instability

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The disintegration of the equatorward-propagating K₁ internal tide in the South China Sea (SCS) by parametric subharmonic instability (PSI) at its critical latitude of 14.52ºN is investigated numerically. The multiple-source generation and long-range propagation of K₁ internal tides are successfully reproduced. Using equilibrium analysis, the internal wave field near the critical latitude is found to experience two quasi-steady states, between which the subharmonic waves develop constantly. The simulated subharmonic waves agree well with classic PSI theoretical prediction. The PSI-induced near-inertial waves are of half the K₁ frequency and dominantly high modes, the vertical scales ranging from 50 to 180 m in the upper ocean. From an energy perspective, PSI mainly occurs in the critical latitudinal zone from 13–15ºN. In this zone, the incident internal tide loses ~14% energy in the mature state of PSI. PSI triggers a mixing elevation of $O(10^{-5}–10^{-4} \text{ m}^2/\text{s})$ in the upper ocean at the critical latitude, which is several times larger than the background value. The contribution of PSI to the internal tide energy loss and associated enhanced mixing may differ regionally and is closely dependent on the intensity and duration of background internal tide. The results elucidate the far-field dissipation mechanism by PSI in connecting interior mixing with remotely generated K₁ internal tides in the Luzon Strait.