



Observations of mode-2 internal solitary waves on the continental shelf of northern South China Sea

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A mooring located on the shelf break of the northern South China Sea measured profiles of temperature and current velocity by thermistor chain and acoustic Doppler current profiler, respectively. Both temperature and current velocity records revealed a number of signals of mode-2 internal solitary waves (ISWs), which were seldom observed in the nature. Typically, the mode-2 ISWs show the upward/downward displacement of isotherms in the upper/lower water column, respectively. Accordingly, the displacements of isotherm induced by mode-2 ISWs were 33 ± 4 m and 28 ± 4 m in the upper and lower water column, respectively. The characteristic time scale was about 18 minutes. The vertical structure and time evolution of mode-2 ISWs were generally agree with linear theory of modal function and weak nonlinear theory of K-dV equation, respectively. In summer, mode-2 ISWs were generated by the mode-1 depressive ISW. In winter, mode-2 ISWs emerged randomly but frequently and no mode-1 ISW was observed. The generating mechanism of mode-2 ISW in summer is different than in winter. The seasonal difference could be associated with the seasonal variation of the stratification that the thermocline was deeper in winter. The thermal structure in winter was close to a hyperbolic tangent profile, which allows theoretically that a mode-2 ISW propagates along the thermocline with permanent form.