Geophysical Research Abstracts, Vol. 9, 01287, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01287

0.1 Internal wave generation and breaking in the coastal zone of sea

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Nonlinear shallow-water equations were used for numeric modeling of internal wave generation and transformation in the coastal ocean. The calculations have shown that over the continental slope near the shelf boundary internal tides with high amplitudes are generated periodically and short high-frequency internal waves (IW) are generated permanently. While propagating over the shelf, the primary short waves are damping, and internal tide is generating bores, hydraulic jumps and packets of secondary short IW due to nonlinear interactions and thermocline shoaling. The enhancement of mixing associated with propagation of internal waves in a horizontally-inhomogeneous thermocline was estimated using theoretical results of Navrotsky (1999) and numeric modeling of internal wave generation with parameters corresponding to their typical values in the explored shelf zone (Navrotsky et al., 2003). These theoretical results are in good correspondence with towed and moored measurements of internal waves carried out during several years in the coastal zone of the Sea of Japan, Peter the Great Bay (Navrotsky et al., 2004).

To understand the IW effects close to shore, special measurements of temperature fluctuations at 10 levels in the near-bottom thermocline were conducted in the same region in August-September 2006. It was found that periods of high-frequency temperature fluctuations, caused by short IW and turbulence, were alternating with periods of such fluctuations absence. The period of the alternation was close to semidiurnal internal tide in the time of light winds, but was longer when strong wind and wind induced mixing were observed.

The sharp change of temperature fluctuation regime indicates that processes of destruction and reconstruction of steady structure in the near-bottom thermocline are going on mainly due to advection of warm near-shore water (in this case a quasi homogenous layer with high temperature from surface to bottom appears) or cold deep water (restoration of stratification). The results obtained are helpfully for physical process understanding as well as for boundary conditions formulation in the ongoing calculations, which permit us to model IW destruction with periodic eddies formation and subsequent mixing.

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