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On the role of near-bottom internal waves in regional background seismicity

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Breaking internal waves (IW) in seasonal thermocline are a common phenomenon in coastal ocean. The thermocline can shoal over a sloping bottom or deepen during the cold periods. In the both cases highly nonlinear IW can have the same amplitudes as near-bottom thermocline thickness or even higher.
Complex experiments were conducted in the shelf zone of the Sea of Japan to verify ideas about the role of IW in generation of background microseisms in the land-ocean transition zone. Several long-term series of measurements of water temperature fluctuations at 10 and 20 levels in the near-bottom layers 5 and 10 m thick with different bottom depth (from 10 till 22 m) were fulfilled with the help of garlands of numeric temperature sensors in the Vitiaz bay and in the open sea. Long-term measurements of pressure fluctuations close to bottom and current velocity at different levels were made near the garlands. On the ground of analysis of vertical soundings in fixed points and along spatial transects and the measured temperature fluctuations it was ascertained that in the approaching to bottom thermocline there is a range of periods of internal waves that do not break in the zone of contact of a thermocline lower boundary with bottom, but transform into quasi laminar volumes of near-bottom cold water (boluses) moving to shore. Relation of vertical and horizontal scales of such formations with periods 5-60 min is of order 1:100. Temperature fluctuations in near-bottom layers are intermittent with characteristic time scales that are close to periods and half periods of tides and inertial fluctuations at the measurements latitude. Analysis of sharp transitions between time intervals, when internal waves can propagate in a stratified bottom layer, and intervals with a mixed bottom layer has shown that hydraulic jumps can be formed at the fore and rear fronts of internal tides. Breaking of the jumps leads to generation of soliton-like high frequency waves and pressure fluctuations at the bottom (internal surf). Analysis of spectra of temperature fluctuations, caused by internal waves and boluses, as well as spectra of air pressure fluctuations and microdeformations of the earth crust shows their general similarity. But more detailed analysis of their spectral structure change in time with the help of the Hilbert-Huang method leads to the conclusion that internal surf caused by internal waves in a shoaling thermocline can be the prevailing source of background seismicity in the region.