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Soliton-like internal waves on a shelf: processes of their generation

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The paper focuses on the topic of study processes of internal soliton-like waves generation in the shelf zone of the seas. Review will be done on the basis of our own 35-year experience in internal wave field observations in the seas of the former Soviet Union. We carried out long-term internal wave measurements in the following geographical points: the Caspian, Black, White, Barents, Pechora Seas, the Sea of Japan, and Pacific Ocean coast of Kamchatka. In the measurements we used different techniques. Early observations prevailed contact measurement methods based on using line temperature sensors. In recent years, replaced by remote sensing through the use ADCP and satellite radar observations. The measurements were made both as from stationary platforms on the shelves and with the towed vessels and moored sensors. It is well known that the most widespread mechanism for the generation of internal waves on shelf is associated with tidal phenomena. More precisely with the transformation of the barotropic tide into baroclinic one with following disintegration of tidal internal wave into the trains of solitons. Many examples of this mechanism exist in literature. We present a few examples of intense internal soliton-like waves, associated with tidal currents from observations in the Sea of Japan, the Barents and White Seas, as well as on the Pacific Kamchatka shelf. Special case will be shown on observation the new mechanism of internal waves generation due to the collision of flows on a shelf. Another interesting example is connected with generation train of breaking internal waves due to Kelvin-Helmholtz instability in coastal waters of the Sea of Japan. Investigations in non-tidal seas like the Caspian and Black Sea gave us possibility to reveal set processes responsible for internal waves generation not connected with tide. We observed generation of internal solitons from long seiche internal waves entering the shelf and from inertial internal waves approaching coastal zone. The generation of internal solitons by moving local fronts of up and down welling origin was observed in coastal zone after effect of strong wind. It was revealed that intrusions of freshened and warm waters propagated above thermocline produces intense internal waves (an observation on the wide shallow shelf of the Black Sea). One more new mechanism of internal wave generation was observed during propagation on shelf coastal sub-mesoscale anticyclonic eddy. Train of intense internal waves was registered in the periphery of the eddy. In the paper detail presentation of all observed cases of processes responsible for internal soliton generations will be done. The work was partially supported by Russian Foundation for Basic Research, project № 13-05-01106 and № 15-52-40012.