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Observation of nonlinear internal waves in the Shallow Water 2006 experiment and interference of low-frequency sound waves in the long-range propagation

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Results of observations of trains of nonlinear internal waves (NIW) on continental shelf are presented, obtained in the experiment Shallow Water 2006 (SW06) carried out in mid July-mid September of 2006 off the cost of New Jersey. Detail description of the experiment is presented in [1,2]. The core of measurement suite of the SW06 experiment was an array of 62 acoustical and physical oceanographic mooring, deployed in "T" geometry with the stem of the "T" stretching 30 km along shelf at the 80 m isobath, and the top of the "T" stretching 50 km across shelf from 500 m isobath to 60 m isobath. During almost three weeks of work about 50 events of appearance of NIW were registered by the ship's radar and thermistors chains. In given talk authors submit preliminary analysis of behavior of NIW in shelf zone of the ocean. Directivity of NOW, velocity of propagation, amplitudes and evolution of trains, and curvature of wave fronts are gathered as a result of processing of 50 events. It is shown that width of angular diagram of directivity is about 15 deg, curvature of wave front about 20 km and velocity about 0.6-0.8 m/s. In this experiment propagation of low frequency sound waves (200-400 Hz) on long distances (about 25-30 km) in different direction was studied. Authors present results of observation of propagation of sound signals received by vertical and horizontal line arrays (VHLA), when acoustic track is directed approximately parallel to the costal line, or wave front of moving NIW. In this case effects of horizontal refraction play important role in sound propagation, leading to significant spatial and temporal variations both of amplitude and phase of received signals. It is shown that interference pattern at VHLA can be explained by reflection/refraction of horizontal rays radiated by the source and coming to receiver. In this case the so called multipath propagation takes place and the corresponding interference pattern. It is shown as well that parameters of moving interference fringes at the VHLA correspond to parameters of moving front of NIW (direction of propagation, velocity and amplitude). Results of theoretical modeling are presented and discussed as well.

1. Newhall, A., N., Duda, T., F., Von der Heydt, K., J.D.Irish, J.N.Kemp, S.A.Lerner et al Acoustic and oceanographic observations and configuration information for the WHOI moorings from the SW06 experiment. Technical report WHOI 2007-004
2. J.Lynch, D.Tang Overview of shallow water 2006 , Journal of the Acoust. Soc Am., Vol.124, N3, 2008, EL-63-65