Ocean-acoustic studies of near-surface and near-bottom soliton packets.

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Abstract

Over the last several years we have performed joint oceanographic and acoustic studies in the Strait of Messina, Gulf of Gioia, Yellow Sea, Winter Primer, and ASIAEX areas. Solitary internal waves have different characteristics in the different study areas. They propagate off shelf in the Yellow Sea and on shelf in the Winter Primer. Solitary waves of depression that peak in the pycnocline near the surface propagate away from the shore (off the shelf), and the less noticed solitary waves of elevation formed around the shelf break propagate toward shore near the shelf bottom.

A fully nonhydrostatic, 2.5-dimensional oceanographic model developed by Lamb (1994) was used to perform the oceanographic simulations. This model uses terrain following coordinates, and is forced by the semidiurnal tidal velocity. The resulting soltiary wave simulations are adjusted until they agree with observations and the structure of the simulated solitary wave packets compare favorably with the measured data, both in period and amplitude. Acoustical field calculations are performed using a high-fidelity ocean acoustic simulation model along the path of solitary wave packet propagation by coupling with the sound speed derived from the oceanographic simulations. The joint oceanographic and acoustic simulations indicates a complex interaction between the oceanographic and acoustic fields that can result in anomalous loses and enhancements in acoustical energy. This can occur over particular spatial and temporal bands at certain acoustic frequencies. The acoustical modes are calculated and the loss mechanisms are analyzed. [Work supported by ONR/NRL.]