2aA05. Coastal front tomography in the Haro Strait experiment: High resolution ray-based techniques. Max Deffenbaugh, Henrik Schmidt (MIT, Cambridge, MA 02139), and Mark Johnson (Hoods Hole Oceanograph. Inst., Woods Hole, MA 02543)

The coastal environment presents some unique challenges for ray-based acoustic tomography. The need to resolve travel time effects of environmental changes over smaller distance scales pushes the experiment designer toward higher frequencies, but higher frequency signals are more susceptible to unmodelled features of the environment like surface and bottom roughness and micro-structure within the water column. At Haro Strait, it was found that these unmodelled features of the environment had a greater overall impact on the received acoustic signal than did the features of interest. Two techniques proved useful in improving the environmental estimates under these conditions. The first technique was a matched filtering of the received signal which emphasized those parts of the signal most sensitive to the environmental features of interest and least sensitive to unmodelled features of the environment. The second technique was adaptive repositioning of one of the tomography sources, made possible by mounting the source on an AUV. Tomographic resolution is dependent on the source/receiver geometry, and by repositioning a source, resolution can be conserved as inversion features of interest. The improved resolution offered by these techniques is shown in the data from Haro Strait. [Work supported by ONR.]


During the summer of 1995, a multi-institutional study called Shallow Water Acoustics in a Random Medium (SWARM) was conducted in the mid-Atlantic Bight continental shelf region off the coast of New Jersey. Environmental and acoustic sensors were deployed as part of SWARM to measure and characterize the nonlinear internal waves and their impact on the spatial and temporal coherence of the acoustic transmissions. As part of the environmental monitoring network, two bottom-mounted, upward-looking acoustic Doppler current profilers (ADCPs) were deployed. As oceanographic, modal, time-series analysis of the ADCP data reveals that large-amplitude, nonlinear, internal wave packets were generated at multiple sites near the shelfbreak; the generation mechanism was consistent with the lee-wave hypothesis of generation; the propagation characteristics were in good agreement with nonlinear soliton theory; and the power spectral density was spatially varying and changed markedly during the passage of these nonlinear waves. Based on these observations, a canonical model of the induced sound-speed perturbations was developed. Using a coupled normal-mode propagation model, the temporal and spatial vertical structures of the sound field were subsequently calculated for comparison to data obtained by a vertical line array. [Work supported by ONR.]