D9

9:05

2aAO5. Coastal front tomography in the Haro Strait experiment: High resolution ray-based techniques. Max Deffenbaugh, Henrik Schmidt (MIT, Cambridge, MA 02139), and Mark Johnson (Woods 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 unmodeled features of the environment like surface and bottom roughness and micro-structure within the water column. At Haro Strait, it was found that these unmodeled 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 unmodeled 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 concentrated at emerging features of interest. The improved resolution offered by these techniques is shown in the data from Haro Strait. [Work supported by ONR.]

9:20

2aAO6. Horizontal refraction tomography with mode interaction. A. G. Voronovich and E. C. Shang (NOAA/Environ. Technol. Lab./CIRES, Univ. of Colorado, 325 Broadway, Boulder, CO 80303)

Measurements of horizontal refraction angles associated with horizontal refraction of different acoustic modes can be used for inferring 3-D ocean inner structure [A. G. Voronovich and E. C. Shang, J. Acoust. Soc. Am. **98**, 2708–2716 (1995)]. Numerical simulations demonstrated that the corresponding inversion scheme works very well for adiabatic propagation. It was also shown that the nonadiabatic case can be incorporated into the inversion scheme when mode interactions can be approximately accounted for by modifying local values of propagation constants of modes. In the present investigation, mode interaction is taken into account in a much more realistic "$N\times 2$-D" approximation (only relatively weak azimuth coupling is neglected). A new exact algorithm was used for the calculation of mode interactions in the plane of propagation. Numerical simulations showed that in many cases, the effect of mode interactions on horizontal refraction is rather weak and can be taken into account by rapidly converging iterative procedure. The results of tomography reconstruction of mesoscale inhomogeneities typical for the Pacific are demonstrated. [Work supported by ONR.]

9:35

2aAO7. Observations, characterizations, and acoustic effects of nonlinear internal waves on the Mid-Atlantic Bight continental shelf. Ching-Sang Chiu (Code OC/Ci, Dept. of Oceanogr., Naval Postgrad. School, Monterey, CA 93943), James F. Lynch (Woods Hole Oceanograph. Inst., Woods Hole, MA), Marshall Orr (Naval Res. Labs., Washington, DC), Donald W. Taube, and Seng L. Ng (Naval Postgrad. School, Monterey, CA 93943)

During the summer of 1995, a multi-institutional field 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-moored, upward-looking acoustic Doppler current profilers(ADCPs) were deployed. An 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 vertical structures of the sound field were subsequently calculated for comparison to data obtained by a vertical line array. [Work supported by ONR.]

9:50

2aAO8. Acoustic wave internal wave interaction experiment in the Yellow Sea. Renhe Zhang, Guoliang Jin, L. Y. Lei (Inst. of Acoust., Chinese Acad. of Sci., Beijing, China), Zijun Gan (South China Sea Inst. of Oceanology, Guangzhou, China), Ji-Xun Zhou, Peter H. Rogers, George S. McCall II, James S. Martin (Georgia Tech, Atlanta, GA 30332), Gary W. Caille, Duane C. Tate (Georgia Tech Res. Inst., Atlanta, GA 30332), Peter H. Dahl, and Robert C. Spindel (Univ. of Washington, Seattle, WA 98105)

Simultaneous observations of internal wave activity and acoustic wave propagation in 70 m water in the Yellow Sea were made in the late summer of 1996. The objective of the experiment was to validate the predicated modal coupling and resulting fluctuations and alterations in propagation loss induced by shallow-water internal waves. Propagation over distances up to 50 km (using narrow- and broadband sources over the frequency range of 50 Hz to 6 kHz) was measured with moored and suspended arrays which spanned the water column. Internal wave activity was monitored using several thermistor chains. Details of the experiment and preliminary data will be presented. [Work supported by ONR and the Chinese Academy of Sciences.]

10:05 10:15 Break

10:15

2aAO9. Internal tide impact measured by acoustic tomography experiment. Yann Stephan, Xavier Demoulin (EPSHOM/CMO, BP 426, F-29275 Brest, France), Sergio Jesus (Univ. do Algarve, UCEH, P-8000 Faro, Portugal), Emanuel Ferreira Coelho (Inst. Hidrografico, P-1296 Lisboa, Portugal), and Michael B. Porter (New Jersey Inst. of Technol., Newark, NJ 07102)

The INTIMATE (internal tide impact measured by acoustic tomography experiment) project is devoted to the study of internal tides by use of acoustic tomography schemes. The first exploratory experiment was carried out in June 1996 on the continental shelf off the coast of Portugal using a towed broadband acoustic source (500–800 Hz) and a four-hydrophone vertical array. Acoustic data were collected for 5 days, including legs where the source ship was moving and legs with the ship on station. Intensive environmental surveys (XBT, CDT, bottom and hull-mounted ADCP, thermistor chain, bathymetry, geoacoustic characteristics of the sediments) were also conducted. The purpose of the presentation is to give the preliminary results of acoustic data processing and to evaluate the impact of internal tides on the acoustic propagation in a shallow water environment. Future works will deal with inversions in terms of sound speed and geoacoustic parameter estimation. [Work supported by SHOM-IH-UAL. The hydrophones array was provided by the SACLANT Undersea Research Center, La Spezia, Italy.]

10:30

2aAO10. The coupled mode parabolic equation. Ahmad T. Abawi,[a] W. A. Kuperman (Scripps Inst. of Oceanogr., La Jolla, CA), and Michael D. Collins (Naval Res. Lab., Washington, DC 20375)

An additional term has been incorporated into the adiabatic mode parabolic equation (AMPE) to account for mode coupling. The coupled mode parabolic equation (CMPE) involves the solution of coupled horizontal wave equations for the mode coefficients. The numerical solution may be obtained efficiently using the splitting method. The first step is identical to the numerical solution of the AMPE. The second step involves Crank-

Honolulu, Hawaii