8:55

2aAO3. Observations of acoustic scattering associated with ocean microstructure in the Arctic. Albert J. Plueddemann (Woods Hole Oceanogr. Inst., Woods Hole, MA 02543), Laurie Padman (Oregon State Univ., Corvallis, OR), Timothy P. Stanton (Naval Postgraduate School, Monterey, CA), Jeffrey T. Sherman, and Robert Pinkel (Scripps Inst. of Oceanogr., La Jolla, CA)

Observations from an Arctic ice camp on the Northwest flank of the Yermak Plateau indicate that under some conditions ocean microstructure may be detectable with "standard" acoustic instrumentation (i.e., acoustic Doppler current profilers) of moderately high frequency (150–300 kHz). The data set, collected during the Cooperative Eastern Arctic Experiment (CEAREX), includes simultaneous observations of kinetic energy dissipation rate, temperature dissipation rate, and acoustic backscatter from both 160- and 300-kHz Doppler profilers. The turbulence levels observed during CEAREX were particularly strong ($\epsilon > 10^{-7}$ W kg^{-1}) and occurred in well-defined patches. Patches in the mixed layer were not associated with backscattered intensity anomalies. However, intensity anomalies of 2 to 6 dB were found to be coincident in time and space with the patches of strong turbulence in the thermocline. The acoustic intensity anomalies were intermittent, presumably because they were detectable only above a threshold that represented the background particulate scattering level. Theoretical predictions of the acoustic intensity level based on the microstructure measurements are used to support the hypothesis that the enhanced scattering levels are due to temperature microstructure rather than variations in particulate scattering.

9:20

2aAO4. Physical oceanographic and acoustical results from the 1988–89 Greenland Sea tomography experiment. James F. Lynch (Woods Hole Oceanogr. Inst., Woods Hole, MA 02543), Peter F. Worcester (Scripps Inst. of Oceanogr., La Jolla, CA 92093), Richard Pawlowicz (WHOI), Werner Morawitz, Philip J. Sutton (SIO), and Guoliang Jin (WHOI)

Analyses of the acoustical tomography data taken in the Greenland Sea in 1988–1989, when combined with inputs from other environmental measurements made in the region, have yielded a number of insights into both the physical oceanographic and acoustical properties of that polar sea. The formation of Greenland Sea deep water (GSDW), which is of importance to the global heat engine and climate studies, was imaged tomographically, allowing us to make significant new statements about the mechanisms, rates, and amounts of GSDW formation. Studies of the late arriving acoustic energy have allowed both detailed studies of the evolution of the surface mixed layer as well as a novel acoustical study of the temporal dispersion of acoustic normal modes by that layer in the marginal ice zone. Rough surface scattering processes in ice and open water conditions, as well as ambient noise, have also been studied using the tomography data set.

9:45–10:00 Break

Contributed Papers

10:00

2aAO5. Identification and arrival time estimation of bandpass modes and rays for acoustic tomography in the Barents Sea using a vertical array. James H. Miller, Ching-Sang Chiu (Code EC/Mr, Naval Postgraduate School, Monterey, CA 93943), James F. Lynch (Woods Hole Oceanogr. Inst., Woods Hole, MA 02543), Philip McLaughlin, Christopher W. Miller (Naval Postgraduate School, Monterey, CA 93943), Keith Von Der Heydt, and John Kemp (Woods Hole Oceanogr. Inst., Woods Hole, MA 02543)

In the 1992 Barents Sea Polar Front Experiment, bandpass acoustic tomography signals centered at 224 Hz were received with very high SNR on a 16-element vertical hydrophone array at a range of 35 km from the source. The depth of the ocean varied from 120 m at the source to 280 m at the vertical array. A critical part of travel time tomography is the measurement of the arrival time of individual modes and rays. Identifying and tracking these mode and rays can be extremely difficult using a single hydrophone in coastal waters due to signal interference. A vertical array has the potential to solve these problems. An efficient signal processing scheme is described, written in MATLAB, that simultaneously (1) beamforms for the bandpass modes or rays, (2) compensates for clock drift, sampling skew, and array tilt, and (3) compresses the maximal-length, phase-encoded signal. Data are presented that show that the beamforming along with acoustic modeling provides identification of the arrivals with a high degree of confidence. Errors in measuring the arrival times are estimated to range from 2 ms for low modes to 10 ms for high angle rays making the arrivals useful for inversions. [Work supported by ONR, Code 1125AR.]

10:15

2aAO6. Modal inversion for bottom sound-speed profile in shallow Arctic waters using broadband signals. T. C. Yang (Naval Res. Lab., Washington, DC 20375) and T. Yates (Vector Res. Co., Rockville, MD 20852)

Acoustic inversion of geoacoustic properties in the ocean bottom has been investigated recently using matched-field processing. In the shallow Arctic waters, the acoustic signal may still be dominated by waterborne modes. As a consequence, the matched-field correlation may not be very sensitive to bottom sound-speed variation. It is found that in a water depth of approximately 600 m the matched-field correlation remains very high (>0.95) even with a mismatch of 50 m/s in bottom sound-speed profile. To improve the sensitivity to bottom mismatch, we include only the high-order modes in the matched-field/mode correlation. This method is investigated using a simulated broadband signal and also using SUS data received on a vertical array. The source is localized using broadband matched-field/mode processing. Short-range data are considered to maximize bottom interacting signals.

10:30

2aAO7. Broadband geoacoustic inversion in shallow Arctic water. John W. Wolf (Naval Res. Lab., Washington, DC 20375)

A broadband technique used successfully to localize acoustic sources and determine water depth and array position at a deep Pacific Ocean