

9:30

4aUW6. Analysis of sound propagation data taken in the East China Sea. Zhaohui Peng, Ji-xun Zhou (Inst. of Acoust., Chinese Acad. of Sci., Beijing 100080, PROC and School of Mech. Eng., Georgia Inst. of Technol., Atlanta, GA 30332, zpeng@sununo.me.gatech.edu), Renhe Zhang (Inst. of Acoust., Chinese Acad. of Sci., Beijing 100080, PROC), and Peter H. Dahl (Univ. of Washington, Seattle, WA 98105)

As a part of the Asian Seas International Acoustic Experiment (ASIAEX2001), sound propagation data from wideband (explosive) sources were recorded in the East China Sea by using a 32-element suspended array. The propagation was measured as a function of range in two perpendicular tracks (one up to 60 km) and as a function of azimuth for a fixed range of 30 km. Supporting environmental data, obtained from a 17-element thermister chain, XBT, and CTD, showed very complex variation in the water column. In this paper, transmission loss (TL) as a function of range, frequency and azimuth is briefly introduced. Seabottom acoustic parameters such as density, velocity, and attenuation are inverted from the sound propagation data. Then, these parameters plus internal wave data are used as inputs to PE and normal-mode codes qualitatively to explain observed strong fluctuations in sound propagation. The inversion techniques used for estimating seabottom parameters, including spatial mode filtering and dispersion analysis, are also discussed. [Work supported by the National Natural Science Foundation of China and ONR.]

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4aUW7. A comparison of East China Sea low frequency bottom scattering strength determinations. P. G. Cable, R. Gibson, (BBN Technologies, 1300 N. 17th St., Arlington, VA 22209), Y. Dorfman (BBN Technologies, Cambridge, MA 02138) D. P. Knobles, T. W. Yudichak Univ. of Texas, Austin, TX 78713-8029), R. Zhang, Z. Peng, F. Li, Z. Li (Chinese Acad. of Sci., Beijing, PROC), P. H. Dahl (Univ of Washington, Seattle, WA 98105) J. H. Miller, and G. R. Potty (Univ. of Rhode Island, Kingston, RI 02881)

Low frequency shallow water bottom scattering strength determinations conventionally involve accounting for the two-way transmission from source to scattering region to receiver and correcting for the size of the contributing bottom scattering area. Experiment uncertainties in transmission loss, bottom homogeneity and isotropy, contributions from volume, and ocean surface backscatter, can all contaminate the accuracy and robustness of such determinations. Bottom scattering strengths were determined in octave bands from 50–800 Hz reverberation data using Institute of Acoustics sources and the receiving array on Shi-Yan III and from transmission data obtained on the APL-UW/URI receiving array on R/V Melville during East China Sea ASIAEX in 2001. Seabed geoacoustic parameters were inferred from the forward data, which were then used to model transmission and extract scattering strength from the reverberation data. The ASIAEX scattering strengths were compared with other measurements of bottom scattering strength derived from previously obtained East China Sea broadband data sets. The separate bottom scattering strength determinations, though obtained at different times and East China Sea sites, and by different methods, are very close. The experimental sensitivity of these measurements will be described and implications regarding the robustness of the results to seasonal variability and geographic change discussed. [Work supported by ONR.]

10:00–10:15 Break

10:15

4aUW8. Spatial coherence of signals forward scattered from the sea surface in the East China Sea. Peter H. Dahl, Christian J. Eggen, and Russell D. Light (Appl. Phys. Lab., Univ. of Washington, Seattle, WA 98105)

Measurements of sea surface forward scattering, wind speed, and directional wave spectra made in 100 m of water in the East China Sea are discussed. The experiment was part of the Asian Seas International Acoustics Experiment (ASIAEX) conducted in the spring of 2001. Signals were

received at ranges near 500 m on 2 vertical line arrays that were collocated but separated in depth by 25 m. Estimates of the vertical spatial coherence along these arrays as a function of frequency, path geometry, and sea surface environmental conditions are compared with a model for spatial coherence. The model is based on identifying the probability density function that describes vertical angular spread at the receiver position. An alternative approach utilizing the van Cittert–Zernike theorem from statistical optics is shown to give equivalent results. Both approaches require computation of the sea surface bistatic cross section, done here with the small slope approximation. Forward scattering from the sea surface represents an important channel through which sound energy is transmitted, and spatial coherence determines in part the performance of imaging and communication systems that utilize the sea surface bounce path.

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4aUW9. Time- and space-varying interference patterns of broadband acoustic field sampled by drifting buoys during ENVERSE 97 experiments. Jean-Pierre Hermand (Royal Netherlands Naval College, Postbus 10000, 1780 CA Den Helder, The Netherlands, jhermand@ulb.ac.be), Serge Scevenels (Université Libre de Bruxelles, B-1050 Brussels, Belgium), and Frans G. J. Absil (Royal Netherlands Naval College, 1780 CA Den Helder, The Netherlands)

During the winter of 1997 SACLANTCEN deployed a fixed controlled sound source, a vertical receive array, and drifting hydrophone buoys in a complex coastal environment on the western Sicilian shelf (ENVERSE 97). The acoustic impulse response of the medium was measured in a broad frequency band as a function of range and azimuth from the source, using repeated, large time-bandwidth-product FM transmissions and DGPS positioning. This paper investigates the combined effects of water column and bottom variability upon the space-frequency distribution of the sound-field intensity. The time and space dependence of extracted features such as patterns of field extrema are analyzed and related to the observed environmental conditions. In particular, perturbations of acoustic field invariants are detected and shown to be well correlated with the range-dependent bottom properties and the time-varying ocean sound speed and current fields. Preliminary modeling (C-SNAP) results obtained from concurrent oceanographic and geophysical ground-truth data (ENVERSE 98) are compared to the acoustic measurements to determine their sensitivity to various environmental parameters. [Work supported by the Royal Netherlands Navy.]

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4aUW10. Temporal resolutions of time-reversal and passive-phase conjugation for underwater acoustic communications. I. Stationary source and receivers in a dynamic shallow-water environment. T. C. Yang (Naval Res. Lab., Code 7120, Washington, DC 20375)

Multipath arrivals cause interference between transmitted symbols and hence, symbol errors in underwater acoustic communications. A time-reversal mirror uses the ocean to combine the multipath arrivals and can be used for underwater acoustic communications. Passive-phase conjugation uses the received data of a probe signal to deconvolve the channel transfer function and thereby removes the multipath effects. In this paper, we study the following temporal resolutions of a time-reversal or passive-phase conjugation process as applied to underwater acoustic communications: (1) the time resolution or the pulse width of a backpropagated, time-compressed pulse as compared with the original transmitted pulse; (2) the effectiveness of temporal focusing as measured by the peak-to-sidelobe ratio of the backpropagated or phase-conjugated pulse; both pulse elongation and sidelobe leakages are causes of intersymbol interference and bit errors for communications; (3) the duration of temporal focusing or the temporal coherence time of the underwater acoustic channel; and