10:30

AA4. Space-time measurement of oceanic motions from a range-gated Doppler sonar. R. Pinkel and F. N. Spiess (Marine Physical Laboratory, Scripps Institution of Oceanography, La Jolla, CA 92093)

A narrow-beam, 90-kHz Doppler sonar is being developed for the measurement of currents in the upper ocean. Transmitted sound is back scattered by the plankton and/or density structure in the sea. The Doppler shift of the return is proportional to the long-beam component of the drift velocity of the scatterers. Remote sensing of oceanic motions in this manner offers several advantages to the oceanographer. In particular, flow-speed information is available over great ranges. Kilometer-scale features in the sea can be monitored without recourse to expensive moored arrays of mechanical current meters. Preliminary tests of an 87.5-kHz system were conducted from the Research Platform FLIP during May 1975. Using 100-msec simple pulses, the signal/noise ratio was favorable out to a range of ~400 m. Comparisons between spectra of the remotely measured currents and those from a conventional current meter are encouraging. The system is currently being modified to permit transmission of frequency encoded signals. In this manner it is hoped to increase the useful range of the system to ~1 km while improving resolution to ~10 m.

Contributed Papers

11:00

AA5. Observations of oceanic fine structure. G. T. Kaye (Marine Physical Laboratory, Scripps Institution of Oceanography, University of California, San Diego, CA 92132)

SCAR, an acronym for SCattering ARray, is a large-aperture planar hydrophone array with sound source that has been used to observe the backscattering of sound by fine structure in the oceanic water column in the frequency range of 3.5–20 kHz. The signals are clipped and 1024 samples of phase for each of 128 hydrophone channels are recorded. Time delays and phase shifts for each range step are computed for two modes: returns due to specular reflection from density layering and returns due to point scatterers in the water column. Beamforming of the data provide a side-by-side display of the two outputs. Distinct differences between modes and between the amplitude information output of the signal before clipping can be noted. The depth distribution of the density layering correlates with XBT temperature profiles taken concurrently. Future signal processing will include multibeam computations, so that density layers tilted by internal wave action will still be observable. [This research is supported by the Defense Advanced Research Projects Agency.]

11:12

AA6. Acoustic sensing of ocean processes. W. Jobst and J. Clark (Institute for Acoustical Research, Miami Division of Palisades Geophysical Institute, Miami, FL 33130)

It is shown that acoustic ray paths between a fixed source and fixed receiver act as continuous lines of environmental sensors. For an axial ray, the phase response is identical to that of an unshaded line array steered perpendicular to the direction of acoustic transmission. The axial-ray response to the internal-wave continuum and to internal tides are calculated, and it is shown how acoustics can be used to map ocean processes. The phase response for nonaxial rays is estimated using a ray trace program with the speed of sound variable as a function of range and time.

11:24

AA7. Acoustic phase processing for sensing ocean parameters. S. L. Adams and W. J. Jobst (Institute for Acoustical Research, Miami, FL 33130)

The received phase of a transmitted acoustic continuous wave (cw) signal has been shown to provide a measure of ocean parameters along the propagation path. This paper contains a review of the problems encountered in measuring phase and considerations for designing a phase estimation algorithm. The algorithm must consider the characteristics of the phase process, the noise, and especially the problem of multipath fades. Spectral analysis of the phase process must be done with care because of the large fraction of energy concentrated at the low (semidiurnal and below) frequencies. An analysis of quantization error in the measurement of phase and estimation of the phase spectrum is presented. [Work supported by ONR, Code 222.]

11:36

AA8. Backscatter measurements using side-looking sonar. C. D. Lowenstein (Marine Physical Laboratory, Scripps Institution of Oceanography, San Diego, CA 92132)

Signals from a 110-kHz side-looking sonar have been digitally processed in real time to remove the variations due to small-scale vehicle motions and transducer beam pattern. The residual signals can be used to measure the backscattering coefficient of the ocean bottom at grazing angles from 45° down to 6°. The system is calibrated by use of a cross-frequency reference transponder. Data have been gathered in several areas of the Eastern Pacific and in the North Atlantic. [Work supported by U.S. Navy.]