velocities and tends to focus in time and depth forming intense arrivals especially at the depth of the transmitted. A second group of surface reflected bottom reflected (SRBR) modes produce arrivals that fan out in time. Coastal areas inside western boundary currents have exceptionally variable sound speed fields owing to dynamical effects such as meanders, shelf waves, eddies, coastal upwelling and energetic internal waves and tides. Sound speed fluctuations are observed to be an order greater than the deep ocean. Very large changes in mean sound speed profiles and extreme gradients occur at subinertial periods. Also, potential energy of the internal wave field varies with the same longer periods as do statistical properties of observed acoustic signals.

8:35

3aUW3. Modeling the interaction of acoustic and internal wave fields in shallow-water environments. Steven Finette (Acoust. Div., Naval Res. Lab., Washington, DC 20375)

Over the past decade, there has been considerable interest in the effect of solitary wave packets on the acoustic field. This talk will present an overview of modeling efforts to describe the interaction of these internal gravity waves with acoustic field propagation in shallow-water waveguides. The emphasis will be on the interaction of solitary wave packets with low-frequency acoustic fields propagating in a continental shelf/slope environment. Topics to be discussed will include both adiabatic and mode-coupling effects, differences between 2-D and 3-D propagation, as well as the influence of wave packets on horizontal array beamforming. Most research to date involves solitary wave propagation over flat bathymetry, but does not address the generation of internal tides over variable bathymetry and their subsequent evolution into wave packets. In this regard, recent nonlinear fluid dynamic simulations of both the generation and propagation of internal tides and wave packets are illustrated and their influence on acoustic propagation briefly addressed. [Work supported by ONR.]

8:55

3aUW4. Rapid fluctuations of the channel impulse response at midfrequencies in shallow water. W. S. Hodgkiss, W. A. Kuperman, and D. E. Ensberg (Marine Physical Lab., Scripps Inst. of Oceanogr., La Jolla, CA 92093-0701, wsh@mpl.ucsd.edu)

A fixed source, fixed receiving array experiment was carried out to measure the stability of forward transmissions in shallow water ($\sim$100 m deep) over a 6 km forward propagation path off San Diego, CA. The source was moored 6 m above the seafloor and the 12 aperture, 64-element vertical receiving array was deployed with the lowest element 4 m off the bottom. The source transmissions of interest here are the 2 kHz bandwidth, 1 s duration FM chirps which were transmitted continuously for 5 min at a time and have been matched filtered to yield the channel impulse response. In addition to CTDs taken in the region between the source and receiving array, a thermistor string at the receiving array site provided measurements of water column temperature fluctuations. The time-evolving structure of the channel impulse response clearly shows significant, environmentally induced fluctuations which also are evident in an arrival angle vs travel time spatial decomposition at the array. [Work supported by ONR.]

Contributed Papers

9:15

3aUW5. High frequency sonar variability in littoral environments: Irregular particles and bubbles. Simon D. Richards (QinetiQ, Winfrith Technol. Ctr., Dorchester, Dorset DT2 8XJ, UK), Timothy G. Leighton, and Paul R. White (Univ. of Southampton, Highfield, Southampton SO17 1BJ, UK)

Littoral environments may be characterized by high concentrations of suspended particles. Such suspensions contribute to attenuation through visco-inertial absorption and scattering and may therefore be partially responsible for the observed variability in high frequency sonar performance in littoral environments. Microbubbles which are prevalent in littoral waters also contribute to volume attenuation through radiation, viscous and thermal damping and cause dispersion. The attenuation due to a polydisperse suspension of particles with depth-dependent concentration has been included in a sonar model. The effects of a depth-dependent, polydisperse population of microbubbles on attenuation, sound speed and volume reverberation are also included. Marine suspensions are characterized by nonspherical particles, often plate-like clay particles. Measurements of absorption in dilute suspensions of nonspherical particles have shown disagreement with predictions of spherical particle models. These measurements have been reanalyzed using three techniques for particle sizing: laser diffraction, gravitational sedimentation, and centrifugal sedimentation, highlighting the difficulty of characterizing polydisperse suspensions of irregular particles. The measurements have been compared with predictions of a model for suspensions of oblate spheroids. Excellent agreement is obtained between this model and the measurements for kaolin particles, without requiring any *a priori* knowledge of the measurements.

9:30

3aUW6. Sediment tomography in the East China Sea: Compressional wave speed and attenuation inversions from Airy phase dispersion measurements and time series correlation. Colin Lazauski, James Miller, Gopu Potty, Chuen-Song Chen (Dept. of Ocean Eng., Univ. of Rhode Island, Narragansett, RI 02882), and Peter Dahl (Univ. of Washington, Seattle, WA 98105)

This paper discusses ongoing data analysis results from the acoustic bottom interaction experiment conducted in May–June 2001 in the East China Sea as part of the Asian Seas International Acoustics Experiment (ASIAEX-2001). Using time-frequency scalograms of broadband signals, the modal arrivals and group speed minimums (Airy Phase) of several modes are clearly observed. The structure of the Airy Phase signal is used to match the dispersion curves which forms the basis of this inversion technique. Utilizing the Airy Phase group speed minimums and corresponding pressure amplitudes of each observable mode, the sediment compressional wave speed and attenuation as a function of depth are derived. The group speed minimum for each mode provides additional information on the compressional wave speed in the modal sediment depth penetration interval. To refine the sediment parameters, synthetic and measured time series are correlated for goodness of fit and used in the inversion process. The synthetic time series is generated from the scalogram values corresponding to the times and frequencies of the calculated dispersion curves. Inverted speeds and estimated modal penetration depths are then used to develop the sediment profile. The estimated resolution is dependent on the number and frequency span of the observable modes. Estimated sediment properties from several areas are presented with verification from coring results. [Work supported by ONR.]