terms of KA, where K is a known wave number. Thus A is deduced by comparing Fmes and F. The most interesting advantage of this method is its independence towards attenuation. Some results are presented.

2:40

2pUW5. The extraction of a target scattering response from measurements made in a range-dependent shallow-water environment. Angie Sarkissian (Naval Res. Lab., Washington, DC 20375-5350, angie@aqua.nrl.navy.mil)

The free-field scattering response of a target may be extracted from measurements made over long ranges in a range-independent shallow-water environment by the use of vertical array of sources and vertical array of receivers. The procedure requires the generation of a low-order shallow-water mode by the source array and the extraction from the received echo at the receiver array of a low-order shallow-water mode. The algorithm is generalized to range-dependent environments where additional complications exist due to the mode coupling produced by the range dependence in the shallow-water environment, which exists in addition to the mode coupling produced by the scatterer. Results of numerical simulations are presented for a ribbed cylindrical shell with hemispherical end caps. The target scattering response is computed using the finite elements and infinite elements method, and the propagation is computed using the parabolic equations method. [Work supported by ONR.]

2:45

2pUW6. Formalism for boundary scattering in waveguides. David H. Berman (Dept. of Phys. and Astron., Univ. of Iowa, Iowa City, IA 52242, david-berman@uiowa.edu)

A natural scheme for discussing scattering in a waveguide with rough boundaries involves propagating waves from a source to the rough boundaries, followed by some form of interaction with the boundaries, followed by propagating from the boundaries to a receiver. The interaction with the boundaries is often described by a scattering amplitude whose relationship to the scattering amplitude for the same boundary located in a half-space is not entirely clear. The present work shows what this relationship is and what propagator should be used to carry the waves to and from the boundaries. These results are based on a systematic multiple-scattering analysis and provide non *ad hoc* expressions for both the scattering and the propagation parts of the problem. As an illustration, the problem of computing reverberation time histories is discussed, a problem beyond the realm of parabolic equation methods which are sometimes used to treat multiple scattering.

2:50

2pUW7. Backscattering by layered media: Modeling and comparison with data. Laurent Guillon (Lab. d'Acoust. de l'Univ. du Maine, UMR CNRS 6613, Ave. Olivier-Messiaen, BP 535, 72017 Le Mans Cedex, France, lguillon@ifremer.fr) and Xavier Lurton (Lab. d'Acoust. Sous-Marine, IFREMER, Plouzané, France)

Deep-water multibeam echosounders provide bathymetry data and acoustical images, the latter being sometimes difficult to interpret. Indeed, due to the size of the wavelength used (about 10 cm), the wave's penetration into the seafloor is not negligible and the internal geological structure of the seafloor must be taken into account in the acoustical modeling. A model for backscattering by layered media is proposed here for trying to explain the acoustical response of such geological configurations. It is based on the concept of ''equivalent input backscattering strength'' through a multilayered stratified lossy medium. Each fluid layer may feature a continuous variation in acoustical parameters (sound velocity, density, and attenuation) and generates volume backscattering. The backscattering strengths provided by the sediment finite volume and by an underlying basement are affected by various effects inside the upper layer stack : refraction, attenuation, and interferences. Synthesizing the classical approaches of backscattering (interface and volume) and transmission in layered media, this model allows one to discuss the various components and effects featured in the resultant backscattering strength. It is finally compared to acoustical data recorded in areas where some ground truth is available.

2:55

2pUW8. Measurement at low ultrasonic frequencies of absorption due to suspended particulate matter. Niven R. Brown, Timothy G. Leighton (Inst. of Sound and Vib. Res., Univ. of Southampton, Southampton SO17 1BJ, UK, nrb@isvr.soton.ac.uk), Simon D. Richards, and Tony D. Heathershaw (Defence Evaluation and Res. Agency, UK)

The visco-thermal absorption of sound by suspended particulate matter can be reliably measured using a reverberation technique. This absorption may have an adverse effect on the performance of sonars operating at low ultrasonic frequencies in coastal waters where suspensions are often present in significant concentrations. A series of experiments has been performed to study the viscous absorption by suspensions in the frequency range of 50–150 kHz by taking the difference in reverberation times of a volume of water with and without particles. Measured attenuation agrees reasonably well with that predicted by theory for concentrations above 0.5 g/l. A number of interesting phenomena have also been observed which are related to the measurement system and the turbulent flow required to keep the particulate suspended. For accurate measurement, losses at the container walls must be minimized. Although there are small losses at the surface by transmission, along with losses due to absorption in the acoustic boundary layer, the presence of bubbles and dissolved gas, and turbulence, the relative measurement gives a good assessment of the absorption by the particles. These effects are discussed and results for particulate absorption are presented.

3:00

2pUW9. Turbidity in future high-frequency sonar performance models. Simon D. Richards (Defence Evaluation and Res. Agency, UK), Niven R. Brown, and Timothy G. Leighton (Univ. of Southampton, Southampton, UK)

Current sonar performance models are incapable of accurately predicting the performance of high-frequency sonars in highly variable turbid coastal waters. There is therefore a requirement for improved models incorporating the additional effects in such environments. Turbid coastal waters are characterized by relatively high levels of suspended particulate matter, the presence of which leads to increased attenuation through viscous absorption and scattering, leading to a significant reduction in the detection range of high-frequency active sonars at moderate concentrations. The additional attenuation mechanisms have been incorporated into a propagation-loss model and the effect on detection range has been investigated. The additional attenuation processes are influenced by the ambient temperature, pressure, and salinity, and the effects of these parameters on the total attenuation in seawater containing suspended mineral particles has also been investigated. The results presented demonstrate that the effects of suspended particulate matter should be included in future high-frequency sonar performance prediction models in turbid environments. Temperature is found to be an important factor influencing the attenuation, and the local temperature should therefore be used in performance calculations. [Published with the permission of the Controller of Her Britannic Majesty's Stationery Office.]

3:05

2pUW10. Spectral diffusion of seismo-acoustic waves in shallow water. Robert I. Odom (Appl. Phys. Lab., Univ. of Washington, 1013 NE 40th St., Seattle, WA 98105) and Valerie I. Peyton (Yale Univ., P.O. Box 208109, New Haven, CT 06511)

The propagation of seismo-acoustic waves in a strongly forward scattering medium is modeled as an energy diffusion process satisfying a convection-diffusion equation in slowness space [Odom and Mercer, Geophys. J. Int. **127**, 111–124 (1996)]. No energy propagates with a slowness greater than the Stoneley/Scholte wave slowness, and therefore must sat-