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Analysis of acoustic backscattering from the ocean bottom using radiative transfer theory

Jorge Quijano and Lisa Zurk
NEAR Lab-Portland State University, 1900 SW 4th Avenue, Suite 160, Portland, OR 97201, USA

Radiative Transfer (RT) theory is a heuristic formulation for analysis of wave propagation in random media based on the principle of conservation of energy rather than on the solution of the wave equation. The theory has been applied to electromagnetics and more recently to ultrasound and seismics, and it has the advantage of being computationally tractable for complex random environments. In this paper the RT formulation is proposed for the problem of layered ocean bottom sediment with random scatterers. The volume backscattering level from tenuous media is obtained by solving the RT equation at each individual layer and by applying the corresponding reflection and transmission coefficients at the rough boundaries.
Simulations of the backscattered acoustic intensity from a finite layer with elastic spherical scatterers are presented. The results obtained from the RT equation are compared to those based on the wave equation. Single frequency steady state solutions are considered for different cases of sediment attenuation and layer thickness. The flexibility of the RT method is demonstrated by showing the individual effect of propagating longitudinal and shear waves in the elastic sediment. It is proved that the contribution of shear waves in consolidated sediments is considerable.