Proceedings of the Institute of Acoustics

ENERGY FLUX INSIGHTS INTO EFFECTS OF A RANGE-DEPENDENT SEABED ON ACOUSTIC PROPAGATION

Charles W. Holland
The Pennsylvania State University, Applied Research Laboratory, State College, PA, USA

The ocean environment contains features of importance to acoustic propagation that vary on time scales from seconds to years and space scales from fractions of a meter to global scale. A significant body of work in the last decades has aimed at understanding the effects of water column (sound speed) variability in space and time on acoustic propagation. Much less is understood about the impact of spatial variability of the seabed boundary on propagation, which is the focus of this study. Drawing on the pioneering work of David Weston, it is shown that range-dependent propagation depends upon the geometric mean of the seabed plane-wave reflection coefficient and the arithmetic mean of the cycle distance. Thus, only the spatial probability distributions (pdfs) of the sediment properties are required; surprisingly, no information is required about the specific order, direction or spatial frequency of the seabed variability. Also, it is shown that the propagation over a range-dependent seabed tends to be controlled by the lossiest, not the hardest, sediments. In some instances, propagation over a range-dependent seabed can be calculated using range-independent sediment properties. The results have important implications for propagation modeling and prediction, geoacoustic inversion, and uncertainty estimation.