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Propagation, scattering and reverberation in an ice-covered arctic ocean

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The Arctic Ocean is a unique acoustic environment due to the ice cover and the strongly upward refracting sound speed profile. A large amount of theoretical and experimental research has focused on the significance of the scattering of sound by the rough ice cover. In spite of this, a strong anomali persisted until the early 1990's in the propagation of low-frequency sound in particular, with prevailing rough-surface scattering theories incapable of explaining the frequency dependence of transmission loss observed experimentally. More recent modeling was cabable of reproducing the observed transmission losses by combining the effects of ice elasticity, rough interface scattering, and waveguide propagation [JASA,96:1783-1795,1994]. Thus, it was demonstrated that incoherent scattering into Lamb waves in the ice provided a significant loss mechanism. This mechanism itself did not explain the frequency dependence, but when incorporating the bilinear sound speed profile of the arctic ocean, it was found that the lower-order modes become disproportionately attenuated, explaining the high attenuation observed at low frequencies. The finding was later confirmed by succesfully modeling the modal losses observed in 1994 Trans-Arctic Propagation experiments, and the ability of the same model to accurately predict observed, long-range reverberation measurements [JASA,111:747-760,2001]. [Work supported by ONR]