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Backscattering From Scale Models of Elastic Ocean Bottoms with Power-law Roughness

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Rough surface analogs to ocean bottom interfaces with two contrasting power-law roughness spectra were fabricated from slabs of PVC. A tank experiment with a nearly monostatic geometry and transmitted signals in the band 100-300 kHz was performed, with the source and receiver positioned to produce acoustic interactions on multiple locations on the surfaces. Models of scattering strength and the received time series, using deterministic and stochastic representations of the surface, are used to verify the predicted dependence of the scattering, with emphasis on the sub-critical angle ($<$ 50 degrees grazing) region, where the predicted difference in scattering strength due to the contrast in roughness between the two fabricated surfaces is on the order of 10 dB. The numerical models employed were perturbation theory, a second-order small-slope calculation using the power-law roughness parameters, and a fourth-order small-slope calculation using the actual grid of heights as an input. The experimental effort also focused on the near-critical angle region where the predictions of the numerical models differed markedly. [Work supported by ONR and NURC.]