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Synthetic aperture sonar imaging of simple finite targets near a sediment-water interface

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Synthetic aperture sonar (SAS) is used often to detect targets that are either proud or buried below a sandy sediment interface where the nominal grazing angle of incidence from the SAS to the point above a buried target is below the critical grazing angle. A numerical model for scattering from simple targets in a shallow water environment will be described, and can be used to generate pings suitable for SAS processing. For buried targets, the model includes reverberation from the rough seafloor, penetration through the interface, target scattering, and propagation back to the SAS. The reverberation and penetration components are derived from first order perturbation theory where small-scale roughness and superimposed ripple can be accommodated. For proud targets, the simulations include the scattering from the target where interaction with the seafloor is included through simple acoustic ray models. The interaction of the target with an incident field is based on a free field scattering model. Simulations will be compared to both benchmark problems and measurements over a frequency range of 10-30 kHz. These comparisons further support sediment ripple structure as the dominant mechanism for subcritical penetration in this frequency range. [Work supported by the US Office of Naval Research.]