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Combined inversion of mid-frequency propagation and reverberation sonar data

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Sonar performance predictions in shallow-water regions are strongly dependent on a good knowledge of the geoacoustic and scattering properties of the seabed. The bottom properties are probably the most difficult parameters to determine, but inversion of measured acoustic data to infer the geoacoustic and scattering properties is a feasible technique. One of these techniques relies on inverting: (1) propagation data to estimate local bottom properties and (2) long-range reverberation data providing effective bottom properties over larger areas. A matched-field inversion approach is applied to propagation and reverberation data received on a towed horizontal array during the BASE'04 experiment conducted on the Malta Plateau, Mediterranean Sea. A total of 30 transmissions along a 10-km track were used to capture eventual range-dependent bottom properties. The inversion algorithm is composed of efficient prediction tools which can provide environmental parameter estimates within tactical time frames for in-situ sonar performance predictions. The experimental set-up mimics a mid-frequency active sonar system using only the suite of sensors available on the vessel towing the sonar system; also known as the through-the-sensor technique. The impact on sonar performance utilizing the environmental characterization approach is shown for various experimental scenarios and seasons.
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