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Broadband De-Signature for Air-Gun Arrays

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Summary

De-signature processing of broadband seismic data demands reliable signature estimation in the band 2-200 Hz. Here we discuss estimation of signatures via inversion of near-field hydrophone data. This uses a model for the propagation of energy from each source point to each hydrophone in the array, incorporating bubble motion and ghosting at the sea-surface. In the standard approach we solve for a set of notional sources, assuming a simple model for the ghost, with rough sea effects treated statistically using a frequency and angle varying reflection coefficient corresponding to the observed sea-state.

We discuss the successes of this standard approach and observed problems, specifically with predicted ghost amplitudes, that in practice leads us to parametrize the model using effective sea state parameters often larger than observer logs suggest. The physical reasons for this are linked to onset of cavitation in the water column. We then present results for an alternative approach, employing additional hydrophones, that solves directly for the down-going part of the signature without need for ghost model parametrization. We assess the quality of signatures estimated via this approach, their application to de-signature processing and examine sensitivity of this inversion to noise compared to the standard parametrized approach.

Abstract

De-signature processing of broadband seismic data demands reliable signature estimation in the band 2-200 Hz. Here we discuss estimation of signatures via inversion of near-field hydrophone data. This uses a model for the propagation of energy from each source point to each hydrophone in the array, incorporating bubble motion and ghosting at the sea-surface. In the standard approach we solve for a set of notional sources, assuming a simple model for the ghost, with rough sea effects treated statistically using a frequency and angle varying reflection coefficient corresponding to the observed sea-state.

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