T43A-4706A Constrained Multi-Objective Optimization Framework for Multiple Geophysical Data Sets

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For this work, we used a constrained optimization approach for a joint inversion least-squares (LSQ) algorithm to characterize a one-dimensional Earth structure using multiple geophysical data sets. Geophysical data sets such as receiver functions, surface wave dispersion measurements, and first arrival travel times were used for this multi-objective optimization approach for there complementary nature with the inversion process. The multiple geophysical datasets used in this study are complementary to each other because one geophysical dataset can recover the causative slowness of seismic data, one is sensitive to relative changes in S-wave velocities, and another one is found to be sensitive to absolute shear velocities between discontinuities. The complementary information provided by the datasets, also reduces the inherent ambiguity or non-uniqueness when performing inversion. Utilizing this constrained multi-objective optimization approach, several possible models can be generated and a final solution among a population of alternative solutions from the model space can be selected when using this optimization approach. This optimization scheme defines the entire solution space based from using different weights to map the Pareto Set. Through numerical and experimental testing, the Multi-Objective Optimization scheme performs inversion in a more robust, and flexible matter than inversion using a single geophysical dataset.

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