On Optimizing Joint Inversion of Constrained Geophysical Datasets

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We implemented a joint inversion least-squares (LSQ) algorithm to characterize 1D earth structure using geophysical datasets with two different optimization methods: truncated singular value decomposition (TSVD), and primal-dual interior-point (PDIP). We used receiver function and surface wave dispersion velocity observations, and created a framework to incorporate other datasets. An improvement in the final outcome (1D shear velocity model) is expected by providing better physical constraints than using just one single dataset. The TSVD and PDIP methods solved a regularized unconstrained and an inherent regularized constrained minimization problems, respectively. Both techniques include bounds into the layered shear velocities. A numerical experimentation was conducted with synthetic data, and the PDID method's solution seems to be more robust in terms of satisfying geophysical constraints, accuracy, and efficiency than the TSVD approach.