Statics and Trace Regularization

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Abstract
The possibility of improving the regularization and datuming of seismic data is investigated by treating wavefield extrapolation as a least-squares inversion problem. Weighed, damped least-squares is then used to produce the regularized/datumed wavefield. Regularization/datuming (reg/dat) is found to be extremely costly due mainly to the computation of the Hessian so an efficient approximation is introduced. Approximation is achieved through computation of a limited number of diagonals in the operators involved.

Real- and synthetic-data examples are used to demonstrate the utility of this approach. For the synthetic data, reg/dat is demonstrated for large extrapolation distances using a highly irregular recording array. Without approximation, reg/dat returns a regularized wavefield with reduced operator-artifacts when compared to non-regularizing, generalized Phase-shift-plus-interpolation (PSPI). Approximate reg/dat returns a regularized wavefield for approximately 2-orders-of-magnitude less cost, but it is dip-limited, though in a controllable way, compared to the full method.

The Foothills Structural Dataset is used to demonstrate application to real data. These data are highly irregular in the shot coordinate and suffer from significant, near-surface effects. Approximate reg/dat is shown to return common receiver data that are superior in appearance compared to conventional datuming.