A Bayesian seismic tomography adapted to discontinuities

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Seismic tomography is an analysis method to estimate subsurface structures of the Earth using arrival times of earthquakes. In this study, we introduce two procedures to estimate velocity structures under western North America on the basis of arrival times of P-waves.
We divide subsurfaces into meshes with different seismic velocities. We consider associations among the meshes in the estimation of velocity parameters. Velocity structures are broadly continuous but change drastically along the discontinuity such as Moho and Conrad. In addition, they change largely along the boundary between land and sea. Therefore, we first adopt Bayesian estimation with the prior distribution accommodating such information.
We second introduce a regularization to estimate behavior of velocity structures around discontinuities more sharply. We apply a network Lasso-type regularization to estimate velocity parameters. We use the regularization term which penalizes difference of velocity parameters among adjacent meshes. With this effect, similar velocities will be smoothed, on the other hand, sharp changes of velocity will be emphasized.
The resulting velocity structure can capture change points of velocities more clearly. We compare our procedure with the existing tomography through numerical studies.

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