Project 5

2D Nonlinear Traveltime Tomography for Layered Models

Solve a first-arrival traveltime tomography problem for layered earth model with sharp layer interfaces. Model mesh is in the same fashion for GLI method or delay-time. But this approach solves a nonlinear inversion problem with model regularization applied.

Development: implement a 2D wavefront tracer for the mesh system, and implement inversion using the wavefront tracer. Test with synthetics and real data, compare with delay-time and grid-based traveltime tomography.

Model: \( s(nx,nlayer) \), \( xmod(nx,nlayer) \), \( zmod(nx,nlayer) \), \( d(nx,nlayer) \)
Raypath storage: \( ipath(nx*nlayer) \), backward tracking
   For a point \( ij0 \), \( ij1=ipath(ij0) \), previous point on the same ray. If \( ipath(ij)=0 \), pointing to source from \( ij \).
Sources: \( sx(ns) \), \( sz(ns) \)
Receivers: \( rx(mr,ns) \), \( rz(mr,ns) \)

Source Codes Offered:
2D grid based wavefront tracer: fwd.f
Conjugate gradient inversion: tomo2d_inv.f
Other utility codes: read_geom.f, C wrapper