S086-018 Room: C417 Time: May 30 14:45-15:00

DSM software for computing synthetic seismograms in transversely isotropic spherically symmetric media

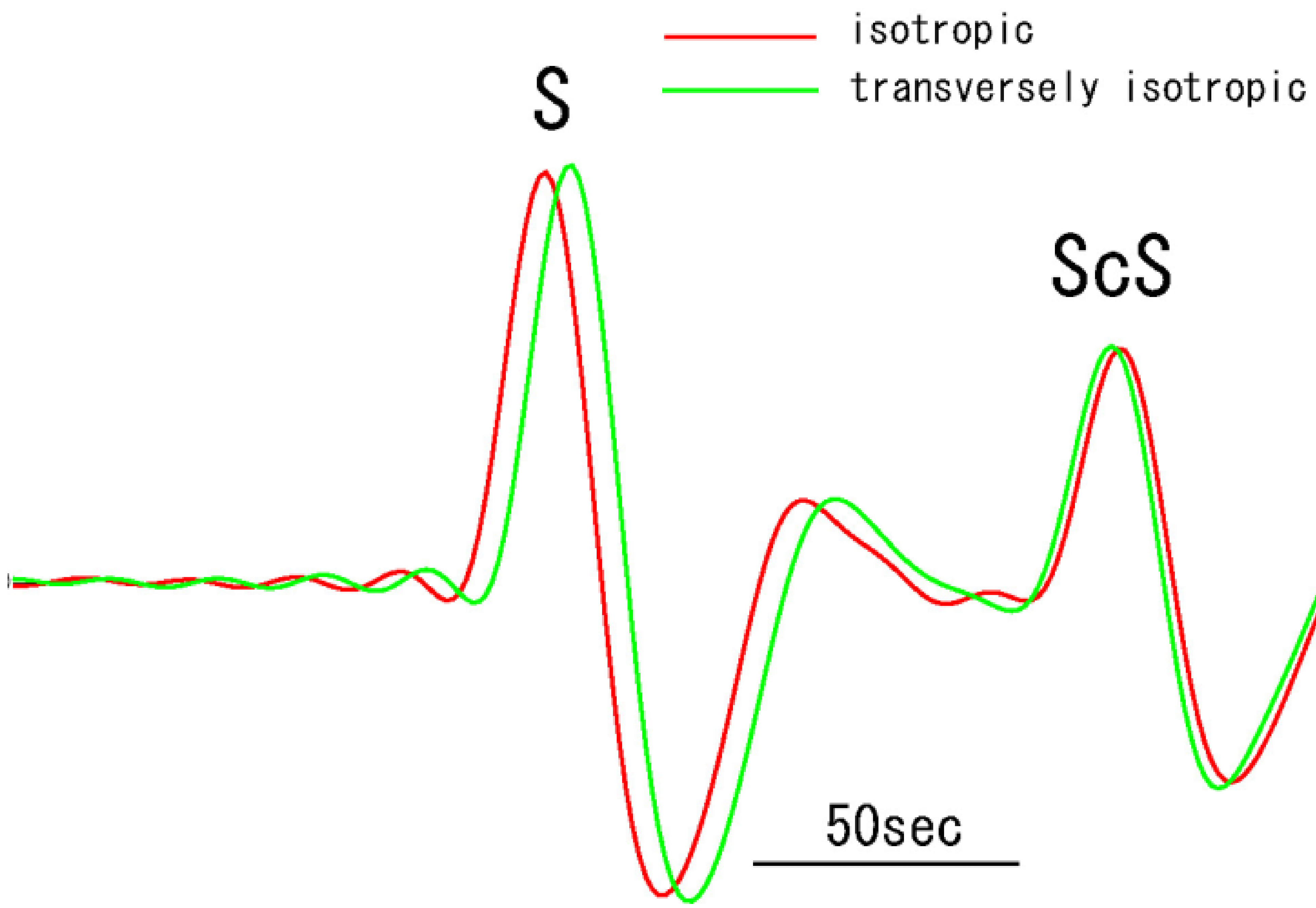
Kenji Kawai[1], Nozomu Takeuchi[2], Robert J. Geller[3]

[1] Earth and Planetary Sci, Univ. of Tokyo, [2] ERI, Univ. of Tokyo, [3] Earth and Planetary Science, Tokyo Univ

The existence of anisotropy has been suggested in many regions in the Earth. Determining the anisotropic seismic velocity of the Earth can contribute to our understanding of geodynamics and rheology. Inversion of observed seismic waveforms is a promising approach for determining the Earth's anisotropic structure, but development of computational algorithms and software for computing synthetic seismograms in anisotropic media is required. Software for computing the seismic waveforms in isotropic media based on the Direct Solution Method(DSM;Geller and Ohminato 1994, GJI) has previously been developed and used in data analysis, but DSM software for computing synthetic seismograms in anisotropic media has not yet been developed. In this study, we derive algorithms and develop software for computing synthetics in transversely isotropic spherically symmetric media. This will be extended to more general anisotropy in laterally heterogeneous media in future work.

Our derivation follows previous work for isotropic media (Geller and Takeuchi 1995, GJI; Takeuchi and Geller 2002, GJI, submitted; Takeuchi et al. 1996, GRL; Cummins et al. 1997, GJI). The displacement is represented using spherical harmonics for the lateral dependence and linear spline functions for the vertical dependence as the trial functions. The numerical operators derived using these trial functions are then replaced by optimally accurate operators. Although the number of elastic constants increases from 2 to 5, the numerical operators are identical to those for the isotropic case. Thus the bandwidth of the matrices of the coefficients for the simultaneous linear equations is unchanged from the spherically symmetric case. As the derivation of the operators does not require approximations that treat the anisotropic structure as an infinitesimal perturbation to the isotropic structure, synthetic seismograms can be calculated with the same accuracy as for isotropic media even for strongly anisotropic media.

figure: Transverse component of synthetic velocity seismograms for the toroidal (SH) wavefield. The depth of the source is 600km, and the epicentral distance is 55 degrees. The mechanism is a point moment tensor (Mrs with all other components zero) with a step function time dependence. The red line is the synthetic velocity seismogram for the isotropic model, and the green line is the synthetic velocity seismogram for a medium with 2% transverse isotropy for which the horizontal velocity is faster than the vertical.


isotropic
transversely isotropic
S
ScS
50sec