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A McMC Method for the Inference of Radial and Azimuthal Anisotropy of the Crust and Upper Mantle from Surface-Wave Dispersion Curves

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We develop a Markov Chain Monte Carlo method for joint inversion of Rayleigh- and Love-wave dispersion curves that is able to yield robust radially and azimuthally anisotropic shear velocity profiles, with resolution to depths down to the transition zone.
The probabilistic feature of the algorithm is a powerful tool that is able to provide error assessment of the shear velocity models, quantify non-uniqueness and address the issue of data noise estimation by treating it as an unknown parameter in the inversion. In a fixed dimensional Bayesian formulation, we choose to set the number of parameters relatively high, with a more dense parametrization in the uppermost mantle in order to have a good resolution of the Litosphere-Astenosphere Boundary region.
We apply the MCMC algorithm to the inversion of surface-wave phase velocities accurately determined in broad period ranges in a few test regions.
In the Baikal-Mongolia region we invert Rayleigh- and Love- wave dispersion curves for radially anisotropic structure (Vsv,Vsh) of the crust and upper mantle. In the Tuscany region, where we have phase velocity data with good azimuthal coverage, a different implementation of the algorithm is applied that is able to resolve azimuthal anisotropy; the Rayleigh wave dispersion curves measured at different azimuths have been inverted for the Vsv structure and the depth distribution of the 2-psi azimuthal anisotropy of the region, with good resolution down to asthenospheric depths.