Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01719, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01719
EGU General Assembly 2008
© Author(s) 2008

SPICE benchmark for global tomographic methods

Y. Qin (1), Y. Capdeville (1), V. Maupin (2), J. Montagner (1), S. Lebedev (3), E. Beucler (4)

(1) IPGP, Dept. Seismologie, IPGP, 4 Place Jussieu, Paris, 75252 France, (2) University of Oslo, Dept. Geosciences, University of Oslo, PO Box 1047, Blinder, Oslo, 0316, (3) Department of Earth Sciences, Utrecht University, Budapestlaan 4, Utrecht, 3584 CD, the Netherlands, (4) Laboratoire de Planétologie et Géodynamique, Université de Nantes, BP 92205, Nantes, FRANCE

The existing global tomographic methods result in different models due to different parameterization, scale resolution and theoretical approach. In order to test how current imaging techniques are limited by approximations in theory and by the inadequacy of data quality and coverage, it is necessary to perform global-scale benchmark to understand the resolving properties of each specific imaging algorithm.

In the framework of SPICE (Seismic wave Propagation and Imaging in Complex media: a European network) project, we have decided to perform a benchmark experiment of global inversion algorithms. Firstly, a preliminary benchmark with simple isotropic model is carried out to check the feasibility in terms of acquisition geometry and numerical accuracy. Then to fully validate tomographic schemes with a challenging synthetic dataset, we constructed one complex anisotropic global model which is characterized by 21 elastic constants and include 3D heterogeneities in velocity, anisotropy (radial and azimuthal anisotropy), attenuation, density, as well as surface topography and bathymetry. The intermediate-period ($>$32s), high fidelity anisotropic modeling was performed by using state-of-the-art anisotropic anelastic modeling code, i.e., Coupled Spectral Element method (CSEM), on modern massively parallel computing resources. The benchmark dataset consists of 29 events and three-component seismograms are recorded by 256 stations. Because of the limitation of the available computing power, synthetic seismograms have minimum period of 32s and length of 10500s.

The inversion of benchmark dataset demonstrates several well-known problems of classical surface-wave tomography, such as the importance of crustal correction to recover the shallow structures, the resolution decrease with depth, smearing effect both horizontally and vertically, the inaccuracy of amplitude of isotropic S-wave velocity variation, the difficulty of retrieving the magnitude of azimuthal anisotropy, the reliability of recovering the direction of azimuthal anisotropy and so on.

The synthetic dataset can be used to validate and calibrate new processing methodologies and has been made available to the scientific community at the IPGP website (www.ipgp.jussieu.fr/∼qyl). Any group wishing to test his tomographic algorithm is encouraged to download the synthetic data.