Geophysical Research Abstracts
Vol. 19, EGU2017-5694, 2017
EGU General Assembly 2017

Probing the structure of the North American craton combining full waveform tomography with constraints on layering from short period converted phases.

Marco Calò (1), Corinna Roy (2), Thomas Bodin (3), Barbara Romanowicz (2,4,5)

(1) UNAM, National Autonomous University of Mexico, Institute of Geophysics, Vocanology, Mexico (calo@igeofisica.unam.mx), (2) Berkeley Seimological Laboratory, 215 McCone Hall, UC Berkeley, Berkeley CA 94720-4760, USA, (3) Univ. Lyon, Université Lyon 1, Ens de Lyon, CNRS, UMR 5276 LGL-TPE, F-69622, Villeurbanne, France, (4) Insitut de Physique du Globe de Paris (IPGP), 1 Rue Jussieu, F-75005 Paris, France, (5) College de France, 11 place Marcelin Berthelot, F-75231 Paris, France

Full waveform shear wave mantle tomography commonly uses as input either 1D, or smooth 3D models that include only the major known discontinuities and do not consider the presence of other upper mantle discontinuities in the first 200-300 km (e.g. the Mid-Lithospheric-Discontinuities and the Lithosphere-Asthenosphere-Boundary). The main reasons are 1) the difficulty of conducting stable waveform inversion down to the short periods of interest and 2) the difficulty of including poorly constrained discontinuities with strong lateral variations in depth. Yet many geophysical studies indicate the presence of such discontinuities, especially in cratonic regions. Therefore, it is important to try to include them in waveform tomographic inversions.

In this work we show the first results of full waveform tomography of the North American uppermost mantle, using the Spectral Element Method (SEM) for wavefield computations. This model is constructed using a 3D starting model that is based on the clustering analysis of a recent global radially anisotropic shear wave tomographic model (SEMUCB_WM1, French and Romanowicz, 2014). The starting model also includes lithospheric discontinuities constrained by trans-dimensional Monte Carlo modeling of short period Ps converted phases and surface wave dispersion data at about 30 sample stations across the region (Calò et al., 2016). To reduce the computation burden, the initial model is homogenized following the procedure proposed by Capdeville et al. (2013) and used as input for the SEM based tomography. The updated discontinuous model is then obtained adding the volumetric perturbations coming from the SEM based tomography to the initial 3D discontinuous one. Several iterations of this procedure can be performed until convergence.