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Constraints on thermal and compositional structure of the lithospheric mantle from long-period seismic waveforms

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Long-period seismic waveforms provide a robust constraint on shear-velocity structure of the upper mantle. Although several global Vs models of the top 300 km of the mantle have been constructed, their meaning in terms of temperature and composition are still unclear.
In order to assess the physical properties of continental lithosphere, we are going to analyze three-component broadband seismograms to obtain a physically-constrained 3-D tomographic model. After collecting and processing a dataset of about 14000 seismic traces, we identify the wave-packets due to surface waves and overtones using an automated procedure (Flexwin, Maggi et al., 2007). We made sure that the data selected have the most uniform global coverage possible. Forward synthetic seismograms have been computed with a normal-mode summation approach and based on a 1-D Earth model (Cammarano et al., 2005). We are now proceeding to build a 3-D low-resolution (degree 12) model. We are using a normal-mode perturbation approach to compute the sensitivity kernels (Li and Romanowicz 2006), but starting our inversion from several 1-D starting models. This way we avoid to be trapped in local minima. Our starting models are related to given temperature and compositional average profiles of the upper mantle. Radial anisotropy is either kept fixed and equal to PREM (Dziewonski and Anderson, 1981) or modeled as an independent parameter and classical linear crustal corrections using are implemented. Misfits between real and synthetic data are computed by using a time-frequency criteria (Kristekova et al., 2009). In spite of the low resolution, our preliminary models allow us to infer deviations from reference thermo-chemical upper mantle structure.