Geophysical Research Abstracts
Vol. 17, EGU2015-10529, 2015
EGU General Assembly 2015

Seismic resolution of lowermost mantle structure

Stefanie Hempel (1), Christine Thomas (1), and Tarje Nissen-Meyer (2)

(1) Institute of Geophysics, WWU Münster, Münster, Germany (stefanie.hempel@uni-muenster.de), (2) Department of Earth Sciences, University of Oxford, Oxford, United Kingdom of Great Britain

We use the axisymmetric, spherical Earth spectral elements code AxiSEM to model seismic compressional waves which sample laterally varying lowermost mantle structures. Synthetic seismograms with dominant periods between 1 and 16 seconds are computed for approximately 1500 models of D" heterogeneities varying in thickness, lateral wavelength, topographic behaviour and elastic properties. We use high-resolution array seismological stacking techniques to process the synthetic data. Our study shows, that the position of the reflector inferred from 1D backprojecting techniques as used in previous studies is overestimated with increasing inclination of the slope of the structure, whereas undulating reflectors are underestimated in height. For models with D" topography we find D" discontinuity reflections in only a small subset of stacks, but an apparent topography of the CMB. Various factors such as very thick or very thin D" layers, strong topography, convex curvature of the reflector towards the seismic source lead to invisibility of the D" reflector in most cases. Our study also reveals, that amplitude studies lead to highly ambiguous information due to the multiple dependencies of the amplitude. The thickness of seismic velocity gradients was previously underestimated, leaving wider gradients possible to be delected. Our observations in synthetic seismograms explain the intermittence of D" observations, as well as enable us to discuss accuracy of array seismological observations. Thus, seismic observations can more reliably be used to support or exclude possible mineralphysical or geodynamical interpretations.