Geophysical Research Abstracts
Vol. 13, EGU2011-692, 2011
EGU General Assembly 2011

The lowermost mantle beneath Bering Sea – P wave study and inversion for mineralogy of D"

Stefanie Hempel (1), Christine Thomas (1), and Razvan Caracas (2)

(1) Institute of Geophysics, University of Münster, Germany (stefanie.hempel@uni-muenster.de), (2) Ecole Normale Supèrieur e de Lyon, France

Seismic array data are used to study a region of approximately 45x30 degrees beneath the eastern Bering Sea. We use P and S wave reflections off the core-mantle-boundary (CMB) and D" reflector with source-receiver combinations spanning a distance range from 60 to 85 degrees. Twenty Japanese and east Russian earthquakes of magnitudes from 5.7 to 7.3 were recorded by several seismic networks and arrays in western Canada and the western United States, often at temporary stations of the Earthscope project (US-Array). Array methods such as vespagrams or slowness-backazimuth analysis are used to determine travel time differences, slowness and backazimuth of P, PdP and PcP. Comparing amplitudes, waveforms and polarities of processed data with synthetic seismograms, we aim to determine the thickness of the reflector and the impedance contrast between lower mantle and D" layer.

The western part of our studied region shows a clear existence of a sharp D" reflector with steep sides and a velocity gradient of about 90km. The central area lacks D" reflections and further east weak signals of PdP are detected. Strong topography variations within a short lateral range could cause annihilated or weakened reflected signals. The observed lateral variations in P reflector depths correlate with results of former S wave studies in this region, indicating a very heterogeneous lowermost mantle beneath the Bering Sea.

Different models exist to explain these phenomena: an upwelling of warm material above the CMB, transition from an upwelling to a downwelling, or an accumulation of old subducted MORB material, in combination with a phase transition from perovskite to post-perovskite or a chemically isolated amount of material with different iron content than the average mantle. To get a better handle on the different possibilities, we use locally modelled 1D-velocity profiles fitting the observations and invert them for mineralogy. We use first-principle calculations of elastic parameters for different mantle materials like perovskite and post-perovskite of different compositions, thereby estimating the possible mineralogical compositions of the lowermost mantle in the region.