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The lithosphere-asthenosphere boundary observed with USArray receiver functions and comparison with other regions

R. Kind, P. Kumar, X. Yuan, J. Mechie, F. Sodoudi, and B. Heit
GFZ Potsdam, Potsdam, Germany (kind@gfz-potsdam.de)

The dense deployment of seismic stations so far in the western half of the United States within the USArray project provides the opportunity to study in greater detail the structure of the lithosphere-asthenosphere system. We use the S receiver function technique for this purpose which has higher resolution than surface wave tomography, is sensitive to seismic discontinuities and has no problems with multiples like P receiver functions. Only two major discontinuities are observed in the entire area down to about 300km depth. These are the crust-mantle boundary (Moho) and a negative boundary which we correlate with the lithosphere-asthenosphere boundary (LAB) since a low velocity zone is the classical definition of the seismic observation of the asthenosphere by Gutenberg (1926). Our S receiver function LAB is at a depth of 70-80km in large parts of westernmost North America. East of the Rocky Mountains its depth is generally between 90 and 110km. Regions with LAB depths down to about 140km occur in a stretch from northern Texas over the Colorado Plateau to the Columbia Basalts. These observations agree well with tomography results in the westernmost USA and at the east coast. However, in the central cratonic part of the USA the tomography LAB is near 200km depth. At this depth no discontinuity is seen in the S receiver functions. The negative signal near 100km depth in the central part of the USA is interpreted by Yuan and Romanowicz (2010) or Lekic and Romanowicz (2011) as a recently discovered mid lithospheric discontinuity (MLD). A solution for the discrepancy between receiver function imaging and surface wave tomography is not yet obvious and requires more high resolution studies at other cratons before a general solution may be found. Our results agree well with petrophysical models of increased water content in the asthenosphere, which predict a sharp and shallow LAB also in continents (Mierdel et al. 2007). We are comparing our results from North America with other regions (South Africa, South America, Europe).