Geophysical Research Abstracts
Vol. 16, EGU2014-1880, 2014
EGU General Assembly 2014

Mid-Lithospheric boundary below oceans from seismic surface waves

Jean-Paul Montagner (1), Gael Burgos (1), Eric Beucler (2), Yann Capdeville (2), and Antoine Mocquet (2)
(1) Institut de Physique du Globe de Paris, Departement de sismologie, Paris, France (jpm@ipgp.fr), (2) Université Nantes, L.P.G., France

The nature of LithosphereAsthenosphere boundary (LAB) is controversial according to different types of observations. Using a massive dataset of surface wave dispersions in a broad frequency range (15300s), we have developed a 3D tomographic model (1st order perturbation theory) of the upper mantle at the global scale.
It is used to derive maps of LAB from the resolved elastic parameters. The key effects of shallow layers and anisotropy are taken into account in the inversion process. We investigate LAB distributions primarily below oceans according to three different proxies which corresponds to the base of the lithosphere from the vertically polarized shear velocity variation at depth, from the changes in orientation of the fast axis of azimuthal anisotropy and from the maximum of the gradient of the radial anisotropy positive anomaly. The LAB depth determinations of the different proxies are consistent for the different oceanic regions. The estimations of the LAB depth based on the shear velocity proxy increase from thin (20 km) lithosphere in the ridges to thick (120-130 km) old ocean lithosphere. LAB depths inferred from azimuthal anisotropy proxy show deeper values for the increasing oceanic lithosphere (130-135 km). The radial anisotropy proxy presents a very fast increase of the LAB depth from the ridges, from 50 km to older ocean where it reaches a remarkable monotonic sub horizontal profile (70-80 km).

The results present two types of pattern of the age of oceanic lithosphere evolution with the LAB depth. The shear velocity and azimuthal anisotropy proxies show age dependent profiles in agreement with thermal plate models while the LAB based on radial anisotropy is characterized by a shallower depth, defining a sub horizontal interface (mid-lithospheric boundary) with a very small age dependence for all three main oceans (Pacific, Atlantic and Indian). These different patterns raise questions about the nature of the LAB in the oceanic regions, and of the formation of oceanic plates.