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Observations of oceanic crust and mantle structures at a deep ocean seismic array in the Eastern Mid Atlantic

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In 2011, twelve ocean bottom stations (OBS) were installed approximately 100 km North of the Gloria Fault during the DOCTAR project (Deep OCean Test ARray). This fault marks the plate boundary between the Eurasian and African plate in the North Eastern Mid Atlantic. The experiment took place in water depth of 4-6 km, 800 km West of the Portuguese coast. The stations were equipped with broad band seismometers which recorded for ten months. We employ P and S receiver functions (RF) to have a closer look at the structure of crust and mantle. The ocean is a quite noisy environment, therefore the number of usable events is low (around 20) compared to RF studies on land. We use several quality criteria (e.g. signal to noise ratio, relative spike position) to select proper processing parameters for the calculation of the RF and carefully reviewed all later on used RF. Despite the low number of events, the usage of an array of OBS with an aperture of 75 km allows us to investigate deeper discontinuities (e.g. in 410 and 660 km depth) compared to single station approaches which are usually employed for OBS. Furthermore, we increase the number of usable events by applying array methods. We use move out corrected and stacked RF to have a closer look at the mantle transition zone, and estimate average depth values for the Moho, the lithosphere asthenosphere boundary (LAB) and the base of the asthenosphere. The Moho lies at depth of 7 km, the LAB at approximately 50 km and the asthenosphere has an approximated thickness of 110 km. We observe a slight increase in the time difference of the mantle discontinuity conversion times compared to PREM.
RF give just information regarding the impedance contrast at a discontinuity instead of velocities. We additionally use P wave polarization of teleseismic events to estimate absolute S velocities beneath the single stations.
All in all, we use the information gained by the RF analysis, and the analysis of the P wave polarization to construct a 1D velocity model. A comparison with synthetic RF is used to further tune the gained model.