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S-to-P receiver function imaging of the 0 – 40 My old Atlantic Plate from the PI-LAB experiment

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The concept of the lithosphere-asthenosphere system is well defined as the rheological boundary between the rigid lithosphere that transfers coherently with the weaker asthenosphere. A better understanding of this transition, the lithosphere-asthenosphere boundary (LAB), is essential as it may have implications for the driving forces of plate tectonics and mantle dynamics. Ocean lithosphere is the ideal place to study this plate transition.
The Passive Imaging of the Lithosphere-Asthenosphere Boundary (PI-LAB) was designed to better characterize and understand the lithosphere-asthenosphere boundary of the oceanic plate at a range of resolutions. We deployed 39 broadband ocean bottom seismometers (OBS) and 39 ocean bottom magnetotellurics (OBMT) on 0 – 80 My seafloor at the mid-Atlantic Ridge near the Chain fracture zone from March 2016 – March 2017.
In this study, we use S-to-P receiver functions to image the discontinuity structure. We use teleseismic earthquakes recorded by our stations with magnitude >5.8Mw from epicentral distance of 545 – 90 degrees. We image a $\sim$7 km thick oceanic Moho across our study region. We image a negative discontinuity, likely the lithosphere-asthenosphere boundary, which deepensthickens progressively away from the western ridge segment from 30 to 80 km beneath 0 to 40 My old lithosphere. Although thinning of this phase below the eastern ridge segment is not prominent. We do not observe much shallowing of this phase below the eastern ridge segment. However, we observe a weaker shallow positive phase close to the eastern ridge segment along the transform boundary. The depths are consistent with thermally controlled thickening with age. However, Although compositional variation is expected, the lithosphere-asthenosphere transition is not likely defined by composition alone which would likely result in a constant depth discontinuity at $\sim$60 km depth. the amplitude and sharpness of the phasesanomaly we observe also suggests melt may be present at the base of the lithosphere.