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Investigation of upper mantle seismic discontinuities through a profile from Western Sahara to Greenland

Morvarid Saki (1), Christine Thomas (2), Stuart Nippress (3,4)

(1) Institute of Geophysics, University of Muenster, Germany (msaki_01@uni-muenster.de), (2) Institute of Geophysics, University of Muenster, Germany (tine@earth.uni-muenster.de), (3) School of Environmental Science, University of Liverpool, UK (nippress@liverpool.ac.uk), (4) AWE Blacknest, UK

The structure of mantle transition zone that is bound by two seismic discontinuities at depths near 410 and 660 km provides important constrains on models of mantle composition and dynamic. Underside reflections of PP and SS seismic waves from these discontinuities arrive as precursors to the PP and SS phases. Their travel time is indicative of the depths of the reflectors. Dense coverage in both oceanic and continental regions, allows us to obtain the variations of the depth to the reflectors. In this study we map the topography of the transition zone discontinuities through a profile from Western Sahara to Greenland. We have used several source-receiver combinations in order to find a large number of bouncepoints of the underside reflected PP and SS waves and their precursors along the profile. We analyzed over 1500 records from events with Mw >6. Array seismology methods e.g., vespagrams, slowness-backazimuth analysis were applied to stack the seismic traces and enhance their signal-to-noise ratio. The stacks show reflections from the transition zone discontinuities at 410, 520 and 660 km and we measure the differential travel times between the precursors and the PP and SS arrivals in each event. Based on preliminary results, we have a deeper 410 km discontinuity beneath Canaries and Azores compared with the surroundings regions. For 660 km discontinuity we have found fewer reflections which are more scattered than in the case of reflections of the 410 km discontinuity. Due to the opposite sign of the Clapeyron slope of the phase changes of Olivine to Spinel and Spinel to Pervoskite located at these two discontinuities, we would expect to have a thinner transition zone comparing with the normal state in case of intersection of a mantle plume. It is also possible that the base of the transition zone in upwellings is dominated by the Majorite-Pervoskite transition which would lead to a deeper discontinuity depth. Reflection points for the Greenland region show good quality data and indicating almost normal depths for upper mantle seismic discontinuities. Interestingly we have a noticeable number of events with good quality of PP and SS phases but no detectable precursors. The absence of precursors needs further detailed investigation to understand the state of the mantle in those regions.