Influence of Mantle Structures on Measurements of Anisotropy in the Inner Core

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The seismological exploration of the Earth’s inner core has revealed some structural complexities such as seismic anisotropy and hemispherical separation. Investigating the travel times of PKP waves from at least two different ray paths, a polar and an equatorial one, is one of the commonly used methods to probe the inner core’s anisotropy. Since the waves are traversing anomalous structures in the lowermost mantle before entering the core, these heterogeneities have to be taken into account when investigating anisotropy in the inner core.

In this study we use data from an equatorial path with events from Indonesia recorded in Morocco and a nearly polar one with earthquakes in New Zealand recorded in England. The two waves used in our study, PKPdf and PKPab, both propagate through mantle and outer core and PKPab additionally traverses the inner core. Within this work, we do not only analyse the travel times of the waves but rather investigate their deviations from the originally assumed path along with their incidence angle. This is done with the methods of array seismology, mainly its two parameters slowness and backazimuth.

The results of this study reveal opposite deviations of slowness and backazimuth of the polar in contrast to the equatorial path. While the polar waves travel shallower and closer to North, the equatorial waves propagate deeper and farther from North than predicted by ak135. Additionally we observe hemispherical differences between waves that sample the eastern and the ones that sample the western hemisphere for both ray paths, PKPdf and PKPab, which leads us to the assumption that the deviations are not caused by the inner core but are rather due to mantle structures.