Geophysical Research Abstracts
Vol. 12, EGU2010-9139, 2010
EGU General Assembly 2010

P′P′ and PP precursor observations of the 660km seismic discontinuity

Elizabeth Day and Arwen Deuss

Bullard Laboratories, Department of Earth Sciences, University of Cambridge, Cambridge, United Kingdom
(ead33@cam.ac.uk)

Precursors to surface reflected seismic phases, such as PP, are a powerful seismological tool with which we can characterise seismic discontinuities in the mantle transition zone (MTZ). The nature of the 660km seismic discontinuity (the '660') is of particular interest, as its properties as a chemical and/or mechanical boundary govern the behaviour of the mantle as a whole. Observations of the 660km discontinuity in precursors to the compressional phases PP and P′P′ have been difficult to reconcile. Short period P′P′ almost invariably detects a single narrow reflector around 660km depth, whereas a reflection from the '660' is much harder to observe with long and short period PP. Long period PP precursors intermittently detect single and double reflectors at the base of the MTZ, between depths of 640km and 720km. The complexity of observations of the 660km discontinuity in long period PP precursors has been attributed to additional phase transitions in the non-olivine components of the mantle, particularly the garnet system.

By comparing PP and P′P′ precursor data at long and short periods in the same region we improve our understanding of the differences in the '660' observations of the different data types. Each precursor has unique sensitivities, with short period P′P′ being able to resolve relatively small scale structures and narrow transitions, whereas long period PP is sensitive to broader features and wide impedance jumps. This study concentrates on regions with different tectonic settings and contrasting observations of the 660km discontinuity in long period PP precursor studies. We investigate differences between each study area and local variations in the depth and width of mantle transitions within each region. Comparing the observations from the PP and P′P′ precursor data with the predictions of synthetic seismograms, and combining these results with mineral physics models allows us to further constrain the properties of this complex region of the Earth's mantle.