Global mapping of the mantle discontinuities and the geodynamical implications

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Mineral physics studies have shown that the phase changes from olivine to wadsleyite and ringwoodite to Pv + Mw are responsible for the seismological 410 and 660 km discontinuities, respectively.

In this study, we investigated the fine-scale depth variations of the 410 and 660 km discontinuities beneath the seismic stations of the Global Seismograph Network (GSN) using P-to-s converted phases. We obtained 1760 receiver functions from 444 earthquakes which occurred from 1990 to 2003 (epicentral distances of 30^o-90^o) recorded at 76 stations. A singular-value-decomposition filter is applied to the receiver functions to enhance the coherent phases and suppress the incoherent phases. To estimate the discontinuity depths, receiver functions are stacked for each station.

Our results indicate that the 410 and 660 km discontinuities are deeper around the Pacific region. The global feature of our result is the same as that of the previous results from the long-period SS wave.

It is difficult to explain all the depth changes of the mantle discontinuities in terms of temperature variation alone. It is necessary to consider other factors such as variations in water content and chemical composition.