Seismic Structure of the Mantle Discontinuities beneath Japan Sea and Adjacent Regions

*Juan Li[1,2], Xin Wang[3], Guangrui Guo[1,2]

1. key Laboratory of Earth and Planetary Physics, Institute of Geology and Geophysics, Chinese Academy of Sciences, China, 2. University of the Chinese Academy of Sciences, China, 3. Earth Observatory of Singapore, Nanyang Technological University, Singapore

Seismic structure of the upper mantle discontinuities is important for understanding the thermal structure, composition of the mantle, and scales of mantle circulation as well. Northwest Pacific region is one of the ideal locations to study the interaction between a subducting slab and the upper mantle discontinuities. Seismic tomography images show that beneath the Japan Sea, the subducting slab has entered the depth of 400 km and has been trapped as a stagnant slab in the MTZ. Due to the sparse distribution of seismic stations in the sea, investigation of deep mantle structure beneath the broad sea regions is very limited. In this study, we applied the long-period multiple-ScS reverberations analysis to waveforms recorded by F-net. We took advantage of the dense distribution of stations and spatial clusters of intermediate and deep earthquakes occurred beneath Okhotsk Sea, Russia and Northeast China, and conducted a common-reflection-point (CRP) stacking to the data, that allows us to map the topography of the 410-km and 660-km discontinuities beneath Japan Sea. A series of systematic synthetic experiments have been conducted to test the validity and effectiveness of the ScS reverberation method and its resolution. Detailed topography variation features of the upper mantle discontinuities are revealed beneath the Japan Sea. The associated thermal structure and underlying geodynamic implications are discussed. Our results are not only consistent for the major features of the 410 and 660 beneath the Japan islands with previous short-period seismic wave studies, but also give a more comprehensive and complete image of the topography of the upper mantle discontinuities beneath a much broader sea region.

Keywords: Mantle Transition Zone, Mantle Discontinuities, Multiple-ScS Reverberations, Northwest Pacific Subduction region, Japan Sea

