Structure of the ultra-low velocity zone in the lowermost mantle derived from core reflected phases

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Analyses of reflected seismic phases from the core-mantle boundary (CMB) enable us to constrain the fine-scale structure of the ultra-low velocity zones (ULVZ) at the base of the mantle. Large amount of data set recorded by the short-period array stations of the globally distributed International Monitoring system (IMS) and Hi-net deployed in Japan Islands allow us to investigate densely the CMB region beneath western Pacific. Clear arrivals of the postcursors to ScP are detected from several contiguous events, which from the ULVZ beneath (1) East of Philippine, (2) Kalimantan Island, and (3) East of Australia. The spatial size of each cluster is almost equal to its Fresnel zone (~200 km) of ScP, and large shear velocity contrasts and strong shear velocity heterogeneities within the layer are inferred. This favors the ULVZ involving various fractions of partial melt materials. Thermally induced rigidity variations can produce large shear velocity fluctuations relative to compositional velocities [Williams and Garnero, 1996]. However, observed compressional velocity reduction is much lower than anticipated value in the thermally induced partial melting model (~10%). Mineralogical studies suggest that such anomalous shear velocities can be best explained by the chemically distinct ULVZ model. Such compositionally distinct ULVZs might originate the mantle plumes.