Receiver function imaging of velocity discontinuity structure beneath the Aso volcano in the Kyushu region, southwest Japan

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The Aso volcano has experienced huge eruptions four times, which causes its caldera to grow up extremely large. Now, therefore, it is one of the largest caldera in the world. In order to find some characteristics of the structure beneath the region where such a huge eruption occurred, we tried to detect the subsurface structure with analyses of seismic waves. There have been several studies on the structure beneath the Aso caldera based on seismic tomography (Sudo and Kong, 2001) and so on. No studies, however, have tried to investigate the detailed structure by receiver function analyses. There are installed 12 seismic stations in and around the Aso caldera. We analyzed waveforms from teleseismic events with the magnitudes equal or larger than 6 during a period of 2002-2006 observed at these stations and investigated the velocity discontinuity structure in this region by receiver function analyses. The obtained results are summarized in the followings:

Result 1 : We found the Ps phases at the Moho discontinuity. Based on the velocity structure used in Sudo and Kong (2001), the depths are estimated to be 20-30 km and seem to be shallower beneath the caldera.

Result 2 : We found another Ps phases at discontinuities beneath the Moho, whose depths are about 50 km. The phases have positive amplitudes, which indicates that the velocity of seismic wave is faster beneath the discontinuity than in the shallower portion. Tomographic analysis of Wang and Zhao (2006) detected low velocity bodies beneath the Kyushu region. Our detected deeper discontinuity seems to correspond to the bottom of one of these low velocity bodies.

Result 3 : Some receiver functions have their first peaks not at the P arrival times but at some delay ones. We consider these delayed peaks indicate the existence of low seismic velocity sediments on its surface. Assuming these are Ps phase converted at the shallow discontinuity, we estimated that the thickness of the sediments is about 5 km beneath the east side of Aso Volcanological Laboratory (AVL), while 2-3 km beneath the west side. Because AVL is located at the west edge of the caldera, these observations indicate that the surface low velocity sediment beneath the inside of the caldera is thicker than that beneath the outside.