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P and S wave attenuation tomography of the Southwest Japan arc

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We determined the first high-resolution P- and S-wave attenuation (Qp and Qs) tomography of the crust and upper mantle under the entire Nankai subduction zone from the Nankai Trough to the Japan Sea using a large number of high-quality t∗data measured from P- and S-wave spectra of local earthquakes. The suboceanic earthquakes used in this study were relocated precisely using sP depth phases and ocean-bottom-seismometer data. The overall pattern of the obtained Q models is similar to that of velocity models of the study region. Our present results show that high-Q (i.e. weak attenuation) anomalies in the upper crust generally correspond to plutonic rocks widely exposed in the Nankai arc. Some of the low-Q (i.e. strong attenuation) anomalies in the upper crust along the Pacific coast are associated with the Cretaceous-Cenozoic accretionary wedge. Obvious low-Q anomalies exist in the crust under the active arc volcanoes. Most of the large inland crustal earthquakes are located in or around the low-Q zones in the crust. The subducting Philippine Sea slab is imaged clearly as a landward dipping high-Q zone. Prominent low-Q anomalies are revealed in the mantle wedge under the volcanic front and back-arc area, which reflect the source zone of arc magmatism caused by slab dehydration and corner flow in the mantle wedge. Significant low-Q anomalies exist in the fore-arc mantle wedge, which reflects a highly hydrated and serpentinized fore-arc mantle wedge due to abundant fluids released from dehydration of the young and warm Philippine Sea slab.

Keywords: Southwest Japan, subduction zone, Seismic attenuation, slab, fluids