

Attenuation structure beneath the Tokai region, Central Japan using a spectral ratio method

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Slow earthquakes including Low frequency earthquake(LFE), Low frequency tremor, and Long term slow slip(LTSS) were reported in the central part of the Tokai district, central Japan. Slip rate and slip direction of LTSS were estimated by geodetic data. Slow earthquakes were suggested that they occurred by high-pressure fluid by analyzing the seismic velocity and the seismic attenuation. A Q_p/Q_s value is reported to be a sensitive and important indicator of water-saturation condition by experimental study. To clarify the spatial variation of physical properties in this region, we developed a new spectral analysis method and applied it to the waveform spectra for estimation of a seismic attenuation structure. In the shallow depths from the surface to 15 km, we found that there is a relatively low Q_p/Q_s and high Q_s zone in the west side of Median Tectonic Line(MTL) whereas there is a relatively high Q_p/Q_s and low Q_s zone in the east side of MTL. In lower crust of the land plate at depths of 15km to 25km low Q_p/Q_s and high Q_s zone exists just above the region where large slip rates were observed during the LTSS between 2001 and 2005. On the contrary, the region just beneath the large slip zone has high Q_p/Q_s and low Q_s . Comparing our result with a Q_p and a seismic velocity structure derived from travel time tomography, we found the low Q_p/Q_s and high Q_s zone approximately coincides with a zone of relatively high Q_p and high velocity. Otherwise the zone of relatively high Q_p/Q_s and low Q_s corresponds to a zone of low Q_p , low velocity, and high VP/VS. A high Q_p/Q_s , low Q_s , low Q_p , low velocity, and high VP/VS can be interpreted as the zone which involves high-pressure fluid. Probably the low Q_p/Q_s and high Q_s zone above the large slip zone works as a cap rock and prevent the fluid from moving upward, and then the fluid pressure becomes high and it affects the occurrence of slow slip in this region.

Keywords: Attenuation structure, spectral ratio method, Q value, Tokai region, Slow slip