The estimation of coda wave attenuation in the northern Kinki district, southwestern Japan

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Microearthquake activity that does not spread along active faults occurs continuously in the northern Kinki district, in particular to the north of the Arima–Takatsuki Tectonic Line (Iio., 1996). Also, an existence of an S-wave reflector in the lower crust in this district is confirmed (Katao, 1994). From the results of an S-wave reflection analysis and a receiver function analysis using data from the dense seismic observation network (Manten observation network), it is estimated that this reflector has a thin structure with a low seismic wave velocity, and it is thought that the reflector was formed by the existence of fluid in the fault zone extending to the lower crust (Katoh et al., 2019). However, no direct results have been reported indicating the presence of fluid.

The purpose of this study is to clarify the existence of fluid and the seismic activity associated with it by applying different coda analyzing methods to derive attenuation parameters. In this study, we used waveforms over M1.5 recorded by the Manten observation network between 2009 and 2013.

First, assuming the Single Isotropic Scattering model (Sato., 1997), Q_C, which is the decay rate of the code wave, is determined for 1-2, 2-4, 4-8, 8-16, 16-32 Hz frequency bands, and we approximated a two-dimensional distribution of Q_C by distributing the Qc value estimated for each waveform along a two-dimensional ray-path. Q_C is an important parameter that describes the state of the crust and is thought to be related to seismic activity (Hiramatsu et al., 2013). However, Q_C is a parameter that reflects both effects of a scattering attenuation (Q_{SC}) due to random heterogeneous structures and an intrinsic attenuation (Q_I) due to inelasticity. With Q_C only, it is not possible to specify whether the main cause of the attenuation is due to Q_{SC} or Q_I.

Therefore, we conducted the Multiple Lapse Time Window Analysis (Fehler et al., 1992). This method can estimate Q_{SC} and Q_I by comparing observed seismic energy densities with theoretical seismic energy densities obtained by the approximate solution of the radiative transfer equation (Paasschens., 1997). The two-dimensional distribution of Q_{SC} and Q_I was obtained by these values of each waveform along a two-dimensional ray-paths in the same way as Q_C. From these results, it is possible to specify whether the main cause of the attenuation is due to Q_{SC} or Q_I.

In this presentation, we will discuss the existence of fluid and the seismic activity associated with fluid from the two-dimensional distribution of Q_C, Q_{SC}, and Q_I obtained from the above methods.

Keywords: coda wave, attenuation

