Spatial variation in coda Q in the northeastern Niigata-Kobe Tectonic Zone

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We focus on a high strain rate zone called Niigata-Kobe Tectonic Zone (Sagiya et al., 2000) to understand a stress accumulation process of source fault. Jin and Aki (2005) showed that low coda Q for 1-2 Hz and 2-4 Hz frequency bands corresponded spatially to the high strain rate zone. Hiramatsu et al. (2013) and Tsuji and Hiramatsu (2014) suggested that the cause of the high strain rate zone was attributed to the high deformation rate below the brittle-ductile transition zone in the crust along the Atotsugawa fault zone and around the Nobi fault zone. This study investigates details of the spatial distribution of coda Q in the northeastern Niigata-Kobe Tectonic Zone and discusses a relationship to the high strain rate zone.

We analyze 1196 events during the period January 2012–October 2014 in the northeastern Niigata-Kobe Tectonic Zone. Those magnitudes are greater than 2.0 and the depths shallower than 30 km. We use seismic waveforms recorded at stations of three national universities, Japan Meteorological Agency, and Hi-net data. For each station, we select events of which epicentral distances are within 30 km for the analysis of coda Q.

We recognize three different patterns of the spatial distribution of coda Q. To compare the spatial distribution of coda Q with that of differential strain rate in the same period, middle frequency bands (4-8 Hz and 8-16 Hz) shows more significant negative correlation than low frequency bands (1-2 Hz, 2-4 Hz).[YH1] Positive correlations are found between the perturbation of the S-wave velocity (Nakajima and Hasegawa, 2007) at 25 km depth and coda Q at low frequency bands, and between the perturbation of the S-wave velocity at 10 km depth and coda Q at middle frequency bands.

In the northeastern Niigata-Kobe Tectonic Zone, these facts imply that the spatial distribution of coda Q at low frequency bands reflects mainly the heterogeneity of the lower crust and that at middle frequency bands mainly the heterogeneity of the upper crust. The spatial distribution of coda Q at middle frequency bands is related dominantly to the concentrated high strain rate. Therefore, in the northeastern Niigata-Kobe Tectonic Zone, it is because Niigata plane is sedimentary basin that the deformation rate in the upper crust is high, so that we observe high strain rate. However, the 2011 Touhoku earthquake have provided a large change in strain rate in this study area. We need to investigate the spatial distribution of coda Q before the earthquake.

Keywords: Niigata-Kobe Tectonic Zone, coda Q, differential strain rate, S-wave velocity

