Estimation of near-source Q and its temporal varaiation associated with pore pressure change: a case study of the Yamagata-Fukushima border swarm

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Existence of fluids in the crust is key to understanding the occurrence of earthquakes because it affects the fault strength. Given that fluids are intensely distributed in fault zones, anelastic attenuation of seismic waves may be locally high in these regions. The present study examined near-source attenuation in the focal region of the intense swarm activity in the Yamagata-Fukushima border region of Japan by a new simple approach. This earthquake swarm exhibits a distinctive migration behavior of hypocenters similar to fluid-injection induced seismicity and was estimated to be caused by the pore pressure change. Near-source attenuation was estimated by examining the decay of amplitude ratios of nearby earthquake pairs with travel time differences. The obtained *Q-1* was high during the initial ~50 days (with a median value of 0.040 for 2-4 Hz), and significantly decreased to become almost constant for the later period (with a median value of 0.011). This pattern is similar to those independently obtained for background seismicity rate, b-value, stress drop, and fault strength. These patterns can be explained in a consistent manner by the hypothesis that the swarm in question was triggered by fluid movement following the 2011 Tohoku-Oki earthquake, and the source and seismicity characteristics were also affected by this temporal change in pore pressure. Attenuation was high near the earthquake sources than that in the surrounding crust in the initial period of the swarm, indicating the importance of considering the near-source attenuation to correctly estimate the source-effect of an earthquake.

Keywords: attenuation, fluid, swarm

