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東北日本におけるS波内部減衰構造

S-wave intrinsic absorption structure in the northeastern Japan

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Intrinsic absorption of S-wave at high frequencies (>1Hz) is one of the essential medium properties for the studies on geofluid. For precise estimation of Q^{-1}values of intrinsic absorption at high frequencies, we need to take account of apparent attenuation due to seismic wave scattering. Recent studies on stochastic interpretation of wave propagation in random media make it possible to estimate spatial distribution of random inhomogeneities. For example, Takahashi et al. (2009, GJI) estimated 3D distribution of random inhomogeneities in the northeastern Japan, and imaged strongly inhomogeneous regions beneath the Quaternary volcanoes and high seismicity region of microearthquakes. Apparent attenuation due to scattering can be evaluated numerically based on the Markov approximation for parabolic wave equation (Takahashi 2009, JPGU). This study estimates the spatial distribution of intrinsic absorption in the northeastern Japan by using aforementioned random inhomogeneity structure. At 0-20km depth in the fore-arc side, Q^{-1}values at 2-4Hz and 16-32z are estimated as 1/1000 and 1/5000, respectively. These small Q^{-1}values suggest that scattering attenuation is dominant in the crust in the fore-arc side. At deeper part (>20km) in the fore-arc side, Q^{-1}values are approximately 1/600 at 2-4Hz and 1/2500 at 16-32Hz. In the back-arc side, strong absorption tends to be imaged beneath the Quaternary volcanoes. Q^{-1} values in the strong absorption regions are approximately 1/400 at 2-4Hz and 1/1200 at 16-32Hz. Estimated Q^{-1}values at 20-40km depth is broadly consistent with the intrinsic absorption estimated by coda wave analysis (Carcole & Sato, 2010, GJI). In the northeastern Japan, melt fraction was quantitatively estimated by speculating Q^{-1}values from P-wave attenuation (Nakajima et al. 2005, EPSL). It can be expected that the intrinsic absorption structure in this study improve the melt fraction estimation in the crust and the uppermost mantle in the northeastern Japan.