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On estimation of scattering coefficient and intrinsic absorption from spatial distribution of seismic energy (3)

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It is possible to separately estimate the scattering coefficient and intrinsic absorption in the lithosphere by interpreting the observed spatiotemporal distribution of high-frequency seismic wave energy by the radiative transfer theory (RTT). One of such an estimation method is the multiple lapse-time window method (Fehler et al., 1992; Hoshiba, 1993), in which the seismic wave energy respectively observed at different positions is integrated using multiple time windows and then its spatial variation is to be interpreted by the RTT. We recently proposed another method to estimate the scattering coefficient and intrinsic absorption (Saito et al., 2013, Abst. Seism. Soc. J. Fall Meet.). In this method, the seismic wave energy respectively observed at different times is integrated using multiple space windows to obtain “apparent energy” , whose temporal variation is to be interpreted by the RTT. We applied the method to the Hi-net records of an earthquake in the Chugoku region, Japan, and thus estimated the scattering coefficient as ~ 0.002 km^{-1} and the intrinsic Q^{-1} as ~ 0.0075 for 1 - 2 Hz S waves in the southwestern Japan (Saito et al., 2014, Abst. Seism. Soc. J. Fall Meet.). However, the observed apparent energy showed complex temporal fluctuations, which could not be fully reproduced in the synthesis by the RTT.

We infer that this inconsistency is largely attributed to the inappropriate choice of the 1-D S-wave velocity structure model used for computing the RTT solutions. We thus adopted an average 1-D S-wave velocity structure model for the Chugoku and Shikoku regions, which was produced on the basis of the 3-D seismic wave velocity structure model of Matsubara and Obara (2011). We also fixed the extents of the space windows in contrast to our previous analysis, in which the windows expanded proportional to the expansion of the direct wave front. We confirmed that these changes largely improved the agreement between the observed and synthetic apparent energy.

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Keywords: seismic wave energy, scattering, intrinsic absorption