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Frequency dependence of attenuation of the inner core beneath the NE Pacific by analyzing broadband seismic waveforms

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Understanding of the frequency dependence of the inner core attenuation is essential for constraining the physical mechanism responsible for the attenuation that may eventually help us to infer the growth process of the inner core. While Doornbos [1983] and Li and Cormier [2002] suggested a frequency dependent attenuation in the frequency band lower than 2Hz, Souriau and Roudil [1995] suggested that frequency independent attenuation in the few hundred kilometers from ICB. Recently, Souriau [2009] indicated the existence of the anisotropy in the frequency dependence of the attenuation.

In this study, we address the above issue by analyzing the broadband data (0.02 - 2 Hz) recorded by F-net in Japan for 6 events occurred in South America. We employ a nonlinear waveform inversion method based on simulated annealing (SA) [Iritani et al., 2010] with a frequency dependent attenuation filter. SA waveform inversion is the method for estimating attenuation parameters, traveltimes and amplitudes of analyzed phases according to SA algorithm, and is suitable for analyzing data for which several phases are contaminated each other. We compare waveform residuals for the cases when we assumed the frequency dependent attenuation with several different absorption bands. The preliminary results show that the residuals are generally smaller when the analyzed frequency band (0.02 - 2 Hz) is within the assumed absorption band, and tests using synthetic waveforms indicate that this is a robust feature. It suggests that a frequency independent (or weak frequency dependent) attenuation in analyzed frequency band better explains the data. The attenuation of the inner core beneath northeastern (NE) Pacific (equatorial path) appears frequency independent.

Keywords: inner core, attenuation, broadband