論文の内容の要旨

論文題目　Depth variation of the hemispheric seismic structure of the inner core inferred from global seismic array data
(グローバルアレイデータを用いた内核不均質構造の深さ依存性)

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The Earth's inner core located at the center of the earth and is widely considered that it results from the solidification of the liquid iron of the outer core with cooling of the earth. Seismological studies have revealed complex features of the inner core such as anisotropy for the direction of the earth's rotation axis and equatorial direction, the existence of the hemispherical heterogeneities in the top 100 km for which western hemisphere has low attenuation and lower velocity and eastern hemisphere has high attenuation and faster velocity. In this paper, I focus on the hemispherical heterogeneous structure of the inner core. Although understanding of the attenuation and velocity structures is a important key to give constraint on the physical state and growth process, the depth dependent profiles of the attenuation and velocity have not been well constrained be- cause of the poor resolution due to difficulties in analyzing contaminated core phase data. In this study, I apply the waveform inversion method based on simulated anpnealing to core phase data observed by globally deployed seismic array and estimate continuous and high resolution attenuation and velocity structure in the top half of the inner core. Moreover, involving frequency dependent

attenuation model to inversion, frequency dependence of attenuation is investigated. Attenuation model is estimated by using measured attenuation parameter. Whereas measured attenuation parameters show consistent trend for the data which sample in the eastern hemisphere, for western hemisphere there is remarkable difference between the data which sample the inner core beneath Africa (W1) and beneath the north America (W2). Obtained attenuation models suggest hemispherical heterogeneities appear to be confirmed in the top 300 km. Model for the eastern hemisphere has a high attenuation zone at top 150 km and gradually decreases with depth, model for the W1 shows constant low attenuation and model for W2 represents the gradually increase from ICB and have a peak around a 200 km depth. Velocity model is obtained by using traveltime anomaly of differential traveltime between PKP(DF) and PKP(CD, BC). Measured traveltime show the consistent trend within the same hemisphere except for the data that pass through the boundary of two hemispheres. Obtained velocity structure for the eastern hemisphere and for the western hemisphere have about 1% faster and slower than reference model at the top of the inner core and reach to same velocity at 200 km depth. The results from frequency dependent attenuation analysis suggest that whereas the attenuation for the eastern hemisphere do not depend on the frequency, the attenuation for the western hemisphere show the frequency dependent attenuation. If the cause of the attenuation is considered the scattering of the seismic wave, the strongest attenuation and velocity dispersion occur when the wavelength is about the grain size. Adopting this assumption to observations, the grain size in the eastern hemisphere become larger than the western hemisphere and grain size for W2 increase with depth. By applying the waveform inversion approach, it is revealed that hemispherical heterogeneities are restricted in the top 300 km of the inner core and the existence of the heterogeneities in the western hemisphere.