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Sounding the Inner Core with Ambient Seismic Noise Correlations

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Cross-correlation (or interferometry) of seismic noise is a well known method to observe the propagation of surface waves between pairs of sensors without involving transient sources. These observed surface waves are routinely used to depict high-resolution image of the crust and upper mantle, or mapping the velocity changes associated with tectonic events. Recent works highlight observation of body waves that propagate at various scales of the Earth. Here we focus on the detection of body waves at teleseismic distances using a one-year continuous data recorded at global distributed broadband stations. We first show that body waves emerge from cross-correlation of continuous records in the 5s to 100s period band. Then we demonstrate that these reconstructed phases can be used as a complement to earthquake data for imaging the inner core structure using a long period PKIKPPKIKP. Our main result is to recover the inner core anisotropy pattern by comparing polar and equatorial travel time. Finally we discuss the large potential of improvement of such method (number and locations of receivers, frequency band, velocity changes), but also eventual measurement biases introduced by uneven distribution of sources.