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scattering and structure from teleseismic P waveforms

Subsurface heterogeneities with scale lengths on the order of the seismic wavelength scatter the seismic wavefield, transferring energy from the main arrival to the coda and generating traveltime and amplitude fluctuations. Understanding the effect of these heterogeneities on the wavefield is important for the characterization of natural and man-made seismic sources and to improve our knowledge of Earth structure. Here, we combine an energy flux model with the analysis of the incoherent coda wavefield to a dataset of over 350 teleseismic events recorded at the Pilbara, Alice Springs and Warramunga seismometer arrays in Australia. This combination allows us to determine heterogeneity (correlation length, RMS velocity fluctuations of the heterogeneities and thickness of the scattering layer) that quantify the scale and magnitude of the lithospheric heterogeneities present beneath the arrays. Our new results show similar heterogeneity structure for all three arrays, despite the fact that they are located on different geological provinces with different crustal thickness and tectonic histories. These results are the first step in the development of a technique aiming to remove the effect of the small-scale, near receiver structure from recorded wavefields, thus enabling us to improve our source characterization and more clearly image the Earth's interior.

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