Correlations at the global scale and retrieval of the deep seismic phases in presence of reverberations, coda waves and ambient noise.

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It was observed that cross-correlation of continuous broadband records allows the retrieval of body waves at teleseismic distances. Numerous deep seismic phases can be identified. The continuous motion at the surface of the Earth comprises low-amplitude background noise associated with ocean–crust interactions, and waves from earthquakes of different magnitudes and their coda associated with reverberation and/or scattering. It has been shown from representation theorems that, for sources acting at the free surface, the cross-correlation cannot be identified directly as the Green function. We analyzed the contributions of earthquakes and ambient noise for long and short periods. Specifically, we compare the correlation of long codas after strong earthquakes with those of the quietest days. In the long period range (25-100 s), several phases that propagate in the deep Earth are observed in the correlations of the signals recorded after earthquakes, with some of these phases showing non-physical polarization or amplitude. At the same time, the global section of correlations shows a series of spurious branches. These features are reproduced with synthetic correlations. A stack of the quietest days of the year shows that body waves are still present, with relative amplitudes that are closer to those expected for the actual Earth response and that the strong spurious arrivals disappear. When considering shorter periods (5-10 s), the reconstruction of the deep phases is not affected by the earthquake coda, due the dominance of scattering over reverberation at short periods. We present applications of noise correlations to problems of imaging of the deep structures.