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When can Empirical Green Functions be computed from Noise Cross-Correlations? Hints from different Geographical and Tectonic environments

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Noise cross-correlations are now widely used to extract Green functions between station pairs. But, do all the cross-correlations routinely computed produce successful Green Functions? What is the relationship between noise recorded in a couple of stations and the cross-correlation between them?

During the last decade, we have been involved in the deployment of several temporary dense broadband (BB) networks within the scope of both national projects and international collaborations. From 2000 to 2002, a pool of 8 BB stations continuously operated in the Azores in the scope of the Memorandum of Understanding COSEA (COordinated Seismic Experiment in the Azores). Thanks to the Project WILAS (West Iberia Lithosphere and Astenosphere Structure, PTDC/CTE-GIX/097946/2008) we temporarily increased the number of BB deployed in mainland Portugal to more than 50 (permanent + temporary) during the period 2010 – 2012. In 2011/12 a temporary pool of 12 seismometers continuously recorded BB data in the Madeira archipelago, as part of the DOCTAR (Deep Ocean Test Array Experiment) project. Project CV-PLUME (Investigation on the geometry and deep signature of the Cape Verde mantle plume, PTDC/CTE-GIN/64330/2006) covered the archipelago of Cape Verde, North Atlantic, with 40 temporary BB stations in 2007/08. Project MOZART (Mozambique African Rift Tomography, PTDC/CTE-GIX/103249/2008), covered Mozambique, East Africa, with 30 temporary BB stations in the period 2011 – 2013.

These networks, located in very distinct geographical and tectonic environments, offer an interesting opportunity to study seasonal and spatial variations of noise sources and their impact on Empirical Green functions computed from noise cross-correlation.

Seismic noise recorded at different seismic stations is evaluated by computation of the probability density functions of power spectral density (PSD) of continuous data. To assess seasonal variations of ambient noise sources in frequency content, time-series of PSD at different frequency bands have been computed.

The influence of the spatial and seasonal variation is evaluated by analysis of the one-day length cross-correlations, stacked with a 30-day moving window and with an overlap of 30 days. To inspect the effects of frequency content variations, 30-day cross-correlograms have also been computed at different frequency bands.

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