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Improved Temporal Resolution of Ambient Seismic Noise Monitoring without the Green's Function

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Ambient noise crosscorrelations have been used on several occasions to monitor temporal variations in seismic velocity. In particular, Brenguier et al. (Science, 2008) find coseismic and postseismic velocity changes around a fault zone in Parkfield, California. In this study, and in others, it was initially assumed that a correct reconstruction of the Green's function is as necessary for temporal monitoring as it is for imaging. We show through laboratory experiments that a stable waveform reconstruction is sufficient to retrieve relative temporal variations. Armed with this knowledge, we revisit the data from Parkfield.

One way to obtain a stable waveform, with an acceptable signal to noise ratio, is to average the correlations over a long period of time. However, for the application to monitoring one wants the possibility of following short-term variations. How can we resolve this conflict and improve temporal resolution without sacrificing SNR?

We show that by applying an adaptive filter (Baig et al, J. Geophys. Res., 2009) to the Parkfield dataset the temporal resolution can be increased from 30 days up to 1 day. With this, we show that the velocity drop observed is coseismic with the Parkfield earthquake.