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Processing noise records with non-linear operations to select the distribution of noise sources contributing to the correlations

Laurent Stehly (1) and Sharvan Hanasoge (2)

(1) Geoazur, Observatoire de la Côte d'Azur, Sophia Antipolis, France, (2) Department of Geoscience, Princeton University, Princeton, NJ, United States.

: It is well known that in the 10-20s period band, cross-correlations of raw noise records usually do not provide the Green function of the medium. To overcome this two strategies exist :
1) applying a non-linear operations such as a 1bit normalization to the noise records prior to computing the correlations.
2) selecting carefully the time windows used to compute correlations to discard strong earthquakes, oceanic storms or instrumental glitch.

These two strategies do not yield the same result. Using sourthern California data in the 10-20s period band, we show that correlations of 1bit and raw noise records (free from earthquake) are not sensitive to the same sources. Raw correlations see mostly local sources whereas 1bit correlations are sensitive to distant sources having strong seasonal variations.

Moreover, the azimuthal distribution of noise sources contributing to 1bit correlations exhibits abrupt changes from day to day. This is a non-linear effect induced by the 1 bit normalization which is problematic for monitoring studies.

Finally, we show it is possible to design a new non-linear operation with a free parameter allowing to move progressively from 1bit to raw correlation. It is then possible for instance 1) to use both local and distant sources when computing correlations (which is great for tomography), or 2) to diminish 1bit non-linear effects which is welcome for monitoring and attenuation studies.