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Frequency-dependent source locations of Earth's hum

Laura Ermert, Korbinian Sager, Christian Boehm, and Andreas Fichtner
ETH Zurich, Institute of Geophysics, D-ERDW, Zurich, Switzerland (laura.ermert@erdw.ethz.ch)

The Earth's hum has been studied under various aspects, such as its origin and its usability for global tomography. Its oceanic, seasonally varying origin has been established by several studies. However, improved seismological constraints on its global excitation pattern are still needed for comparison to modeling and as a basis for ambient noise waveform tomography at global scale.

Previous inversions for the source distribution of the hum, including our own, have focused on long periods around 200 seconds. We now aim to extend the frequency range of hum source inversion, thereby also studying methodological aspects of frequency-dependent ambient noise source inversion.

The noise source inversion method we use honors finite-frequency wave propagation and 3-D heterogeneous Earth structure. Previously, we chose one frequency band for inversion, enforcing a flat spectrum across this frequency band. Now, we include a number of frequency domain tapers with internally flat spectrum that can be weighted independently, thus resulting in a variable spectrum. To avoid inversion artifacts, all frequency bands are jointly inverted, thus also reducing modeling cost.

With higher frequencies included, we reassess the influence of different approaches of noise processing. Even 'light' processing used to retrieve improved signal-to-noise means that our resulting models show effective sources rather than a purely physical quantity. This has to be taken into account both for interpretation and future use in ambient noise waveform tomography.

First results from our frequency-dependent inversion of seasonal hum data show a noise source distribution with marked variations throughout the three chosen frequency bands.