Geophysical Research Abstracts
Vol. 15, EGU2013-4532, 2013
EGU General Assembly 2013

Instrument Self-Noise and Sensor Misalignment

Andreas Gerner and Götz Bokelmann
University of Vienna, Meteorology & Geophysics, Geophysics, Vienna, Austria (andreas.gerner@univie.ac.at)

Technical improvements of seismic sensors, data loggers, computational resources and methods allow using weak seismic signals and seismic noise for studying the Earth, as it is done for example in the various applications of noise interferometry, when detecting and localizing induced seismicity, or for investigating Earth's normal modes.

As the seismic sensor is a source of noise itself, it is important to determine its self-noise and sensitivity in order to assess its suitability for a given purpose, as well as its general functionality.
One method for estimating the self-noise of seismic sensors has been proposed by Sleeman (2006), involving the correlation of seismic noise recorded by triples of collocated and coaligned sensors. Assuming that background noise is coherently recorded, the method involves the computation of auto- and cross-power spectra in order to eliminate coherent noise signals. The remaining, incoherent portion of the signal can then primarily be attributed to the noise originating from the instrument.

Even though intriguingly simple and robust the accuracy of this approach, however, is reported to strongly depend upon the precise alignment of the sensors, which is difficult to achieve in most cases. We investigate the influence of a rotation of horizontal components on apparent sensor self-noise in order to optimally correct possible misalignments, and to obtain realistic self-noise estimates. Our results show that at frequencies around 0.3 Hz a small misalignment of 0.5° leads to an error in self-noise estimation of roughly 10 dB. We can further use this technique to estimate the error in orthogonality between the seismometer's sensing axes through measurements of misalignment for each of the components separately.

Results from calculating the self-noise of 11 RefTek 151-60A "Observer" broadband seismometers enabled us to establish a self-noise model for this type of sensor. For horizontal components we found a maximum error in orthogonality of ≈0.45°, which is in good agreement with the manufacturer specifications (<0.5°).