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Joint inversion of seismic moments, attenuation parameters and site effects from the french accelerometric data.

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Spectral inversion of large sets of ground motion records have long been used either to compute source properties (magnitude, corner frequency) or to compute site effects.

In this study we propose an inversion of S-wave Fourier spectra in the frequency band 0.5-15 Hz to obtain simultaneously seismic moments, corner frequencies, anelastic and geometric attenuation parameters, as well as site effects. We use an iterative Gauss-Newton method to solve this non-linear problem.

We used three datasets composed of accelerometric records from different (seismically active) areas in France (Alps, Pyrenees, Rhine Grabben). The earthquakes have local magnitudes ranging between 3.0 and 5.5, and are recorded at distances between 15 and 200 km. We assume that the far-field displacement spectrum is the product of source, propagation and site effects. A Brune's-type source is used and attenuation is decomposed in a frequency dependent term of the form $Q=Qof^{\alpha}$ (anelastic attenuation) and a non-frequency dependent term (geometric attenuation).

The inversions give moment magnitudes which have the same correlation with local magnitudes in the three regions, and are 0.5 to 1 unit lower than local magnitudes, a result also observed by (Braunmiller, 2005). The anelastic attenuation shows a frequency dependence of the form $Qof^{0.4}$, with Qo ranging from 200 to 500 depending on the region. The geometric attenuation is approximately equal 1/R. We show that the obtained site transfer functions are similar to the results obtained, on a few sites, by the traditional site to reference ratios.

Braunmiller, J., N. Deichmann, D. Giardini, S. Wiemer, and the SED Magnitude

Working Group (2005). Homogeneous moment-magnitude calibration in Switzerland. *Bull. Seism. Soc. Am.*, 95(1) : doi: 10.1785/0120030245.