GROUND MOTION SCALING IN ITALY AND GERMANY

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Digest

Ground motion scaling relationships at regional distances along peninsular Italy and Germany are quantified by performing regressions over two large datasets of broadband seismograms. The Italian dataset consists of 3000 three-component seismograms, collected for 446 events that occurred along the Apennines, whereas 1350 three-component recordings were obtained for 222 events (earthquakes and chemical explosions) recorded by the German Regional Seismic Network.

Logarithms of observed ground motion amplitudes (either peak values of bandpass filtered time histories, or Fourier spectral components), are modeled as the summation of excitation, site, and propagation terms. They represent, respectively, the excitation of the ground motion at a reference distance, the distortion due to the shallow geology at the recording sites, and the effects of the geometrical spreading and anelastic attenuation. The attenuation functional is modeled as a piece-wise linear function with several nodes. Regressions are independently carried out over the mentioned terms, at a discrete set of sampling frequencies.

Regression results for the attenuation functional are very similar to the ones obtained by using a simpler coda normalization technique. In a subsequent step, the empirical estimate of the functional is parameterized using a geometrical spreading function, a frequency-dependent Q, and a distance-dependent duration for the seismic signals. Random vibration theory (RVT) is used to create a predictive model.

Results are generally given in the (0.25-5.0 Hz) frequency band, although a small subset of data was available in Italy to confirm our results in the broader (0.5-16 Hz) frequency band. Results support the idea of a low-Q crust in the Apennines ($Q(f) = 130 f^{0.10}$), implying that seismic hazard along the Apennines should be dominated by the local seismicity. Higher values of crustal Q are found in Germany, in the 0.5-16.0 Hz frequency range ($Q(f) = 400 f^{0.42}$). The different geometrical spreading functions may reflect variations in the Moho depths between the two regions.