

Regional Ground Motion Scaling

On the ground of simple tectonic/geologic considerations, but also keeping in mind the distribution of high quality digital seismic network on the Italian territories, at the beginning of this project we formulated a regionalization of the Italian region into sub “homogeneous” areas from the point of view of crustal wave propagation. For each subregion the characteristics of excitation and regional propagation of seismic waves were investigated using recordings from the background seismicity.

We compiled very large data sets of digital recordings of ground velocity and ground acceleration, corrected for the instrument response and stored in SAC format (ground velocity in m/s). Whenever possible, strong-ground motion accelerograms from large events were also collected and made part of the datasets. Datasets typically contain several thousand waveforms, and in many cases tens of thousand ones.

For each region, a separate study was carried out. The Apennines, that were initially described as a “homogeneous” region, was subsequently subdivided into smaller subregions, as is described in the following paragraph. The “homogeneous regions are the following:

1. the Apennines: at the very beginning of this project, a single study was performed for the entire mountain chain (see the attached paper by Malagnini et al., 2000; the database was the collection of three individual sets of seismograms from three transects installed between 1994 and 1996. As new digital data become available, a subdivision of the Apennines into homogeneous subregions was performed: Northern Apennines (Garfagnana-Lunigiana, data base from the seismic network run by the University of Genova, see attached draft by Morasca et al., 2004); Central Apennines: Abruzzo seismic network, run by the Servizio Sismico Nazionale, and portable networks deployed by INGV; MedNet instruments yielded data from the strongest events;
2. Northwestern Italy, seismometric database collected by the Regional Digital Seismic Network of Northwestern Italy, run by University of Genova; MedNet station BNI yielded waveforms for the strongest events (see attached draft by Morasca et al., 2004);
3. Northeastern Italy, seismometric database collected by the Friuli-Venezia Giulia Seismic Network; this database was integrated with all the available strong-motion records from the seismic sequence of 1976-1977 (Mw 6.5 was the largest magnitude included); MedNet station TRI yielded the recordings of recent large earthquakes (see attached paper by Malagnini et al., 2002);
4. Eastern Sicily, database collected by the ex-Poseidon seismic network, run by INGV; the database was integrated by waveforms recorded by some stations of the regional MedNet network (see attached paper by Scognamiglio et al. 2004).

For each region we produced tables of parameters to define the excitation/attenuation of the ground motion (to describe the functional form of the geometrical spreading function and of the crustal attenuation parameter $Q(f)$). Tables of peak ground motion (PGA) used for the compilation of the national hazard map were also produced.

As a final product of interest for the Civil Protection, the tables of peak ground motion were used to compute the national hazard map (see the attached appendix done for the “Gruppo di Lavoro per la redazione della mappa di pericolosità sismica”). Similar tables were computed for a number of quantities of engineering interest (PGA, PGV, PSA, PSV).

The predicted goals included the ground motion scaling of the Southern Apennines. No suitable digital datasets were available until now, so we could not achieve this goal.

During the last three years we developed the technique initially used by Malagnini et al. (2000), and the paper by Malagnini et al. (2002) describes the latest version of this methodology. Herrmann and Malagnini (2004, see the attached draft) investigated the details of the ground motion scaling functional forms and interpreted these features in terms of effects of the crustal structure on regional wave propagation.

References/Attachments

- Herrmann, R. B. and L. Malagnini (2004). Interpretation of High Frequency Ground Motion from Regional Seismic Network Observations, Bull. Seism. Soc. Am. (submitted).
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- Malagnini, L., Akinci, A., Herrmann, R. B., Pino, N. A. , and L. Scognamiglio (2002). Characteristics of the ground motion in northeastern Italy. Bull. Seism. Soc. Am., 92, 6, 2186- 2204.
- Malagnini, L., Herrmann, R.B., and M. Di Bona (2000). Ground motion scaling in the Apennines (Italy). Bull. Seism. Soc. Am.,90, 1062-1081.
- Morasca, P., L. Malagnini, A. Akinci, and R.B. Herrmann (2004). Ground motion scaling in the Western Alps, Bull. Seism. Soc. Am. (submitted).
- Scognamiglio L., Malagnini, L., A. Akinci (2004). Ground Motion scaling in Eastern Sicily (Italy). Bull. Seism. Soc. Am. (submitted), 2004.