



Regional Earthquake Shaking and Loss Estimation

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This study, conducted under the JRA-3 component of the EU NERIES Project, develops a methodology and software (ELER) for the rapid estimation of earthquake shaking and losses in the Euro-Mediterranean region. This multi-level methodology developed together with researchers from Imperial College, NORSAR and ETH-Zurich is capable of incorporating regional variability and sources of uncertainty stemming from ground motion predictions, fault finiteness, site modifications, inventory of physical and social elements subjected to earthquake hazard and the associated vulnerability relationships. GRM Risk Management, Inc. of Istanbul serves as sub-contractor for the coding of the ELER software.

The methodology encompasses the following general steps:

1. Finding of the most likely location of the source of the earthquake using regional seismotectonic data base and basic source parameters, and if and when possible, by the estimation of fault rupture parameters from rapid inversion of data from on-line stations.
2. Estimation of the spatial distribution of selected ground motion parameters through region specific ground motion attenuation relationships and using shear wave velocity distributions.(Shake Mapping)
4. Incorporation of strong ground motion and other empirical macroseismic data for the improvement of Shake Map
5. Estimation of the losses (damage, casualty and economic) at different levels of sophistication (0, 1 and 2) that commensurate with the availability of inventory of human built environment (Loss Mapping)

Both Level 0 (similar to PAGER system of USGS) and Level 1 analyses of the ELER routine are based on obtaining intensity distributions analytically and estimating total number of casualties and their geographic distribution either using regionally adjusted intensity-casualty or magnitude-casualty correlations (Level 0) or using regional building inventory data bases (Level 1). Level 0 analysis is similar to the PAGER system being developed by USGS. For given basis source parameters the intensity distributions can be computed using: a)Regional intensity attenuation relationships, b)Intensity correlations with attenuation relationship based PGV, PGA, and Spectral Amplitudes and, c)Intensity correlations with synthetic Fourier Amplitude Spectrum. In Level 1 analysis EMS98 based building vulnerability relationships are used for regional estimates of building damage and the casualty distributions.

Results obtained from pilot applications of the Level 0 and Level 1 analysis modes of the ELER software to the 1999 M 7.4 Kocaeli, 1995 M 6.1 Dinar, and 2007 M 5.4 Bingol earthquakes in terms of ground shaking and losses are presented and comparisons with the observed losses are made.

The regional earthquake shaking and loss information is intended for dissemination in a timely manner to related agencies for the planning and coordination of the post-earthquake emergency response. However the same software can also be used for scenario earthquake loss estimation and related Monte-Carlo type simulations.