



Estimation of damage and human losses due to earthquakes worldwide – QLARM strategy and experience

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Within the framework of the IMRPOVE project, we are constructing our second-generation loss estimation tool QLARM (earthQuake Loss Assessment for Response and Mitigation). At the same time, we are upgrading the input data to be used in real-time and scenario mode. The software and databases will be open to all scientific users. The estimates include: (1) total number of fatalities and injured, (2) casualties by settlement, (3) percent of buildings in five damage grades in each settlement, (4) a map showing mean damage by settlement, and (5) functionality of large medical facilities. We present here our strategy and progress so far in constructing and calibrating the new tool. The QLARM worldwide database of the elements-at-risk consists of point and discrete city models with the following parameters: (1) Soil amplification factors; (2) distribution of building stock and population into vulnerability classes of the European Macroseismic Scale (EMS-98); (3) most recent population numbers by settlement or district; (4) information regarding medical facilities where available. We calculate the seismic demand in terms of (a) macroseismic (seismic intensity) or (b) instrumental (PGA) parameters. Attenuation relationships predicting both parameters will be used for different regions worldwide, considering the tectonic regime and wave propagation characteristics. We estimate damage and losses using: (i) vulnerability models pertinent to EMS-98 vulnerability classes; (ii) building collapse rates pertinent to different regions worldwide; and, (iii) casualty matrices pertinent to EMS-98 vulnerability classes. We also provide approximate estimates for the functionality of large medical facilities considering their structural, non-structural damage and loss-of-function of the medical equipment and installations. We calibrate the QLARM database and the loss estimation tool using macroseismic observations and information regarding damage and human losses from past earthquakes. Our focus is on developing countries, where only approximate information exists on building stock and population and therefore we started validation and calibration of our tool in the following countries: Algeria, Peru, Iran and Pakistan. We proposed that the QLARM software and database may be tested by others and compared with other similar tools. We believe that some of the features of QLARM may serve as a base for further development within the worldwide Global Earthquake Model project (GEM).