Geophysical Research Abstracts,
Vol. 11, EGU2009-13025, 2009
EGU General Assembly 2009

A Seismic Risk Model for Europe

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A seismic risk model for Europe has been developed to assist insurers and reinsurers in assessing their financial risk posed by earthquakes. The model covers 15 countries including Italy, Portugal, Switzerland, Austria, France, and Germany. We summarize modeling methodology, focus on the seismic source model that is used to generate the stochastic event set and discuss key hazard and risk results. The earthquake risk model framework has four components: a stochastic event set, a ground-motion model including site conditions, a set of regional vulnerability curves and a financial model. Our seismic source model consists of distributed seismicity and active faults. The distributed seismicity is parameterized as area sources, covering the whole region under consideration. The modeling of distributed seismicity is based on our historical seismic catalog using a Gutenberg-Richter recurrence model. Our fault model is based on slip rates using characteristic recurrence. The complete hazard model then relies on combining this source model with a ground motion model that consists of a weighted scheme of European and global sets of attenuation equations together with a detailed site classification map for the region. The site classification map is derived from a combination of surface geology and topography. An economic exposure database for residential and commercial property was developed to derive the seismic risk in these countries. Using this exposure layer, examination of resulting hazard maps and of city-level hazard-curves gives insight to the key drivers of risk across the region. Cities examined include Rome, Milan, Lisbon, Zurich, Vienna, Marseille, Paris and London. Hazard de-aggregation allows for studying key drivers of risk. Examination of the spatial variation in the loss costs, i.e. loss per exposure unit, for residential and commercial structures gives insight into the risk model results and exposure accumulations.