

## Comparing the annual frequencies of exceedance of observed intensities to those predicted by probabilistic seismic hazard assessments for France

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Databases of macroseismic intensities covering many centuries of earthquake history provide an attractive resource for various applications in engineering seismology and earthquake engineering, including the estimation of earthquake magnitude and the public understanding of seismic risk. Another application is to provide an independent check on the results of a probabilistic seismic hazard assessment, at least for return periods much shorter than the length of the catalogue. Intensity databases have a considerable advantage over strong-motion databases for this purpose as in Europe they generally cover periods of many centuries rather than only a few decades. They do, however, have disadvantages, such as the difficult-to-quantify but undoubtedly large uncertainties associated with intensities obtained from historical documents. In addition, intensity databases invariably only provide observations for each earthquake at locations that were specifically mentioned in a historical text concerning the effects of an earthquake at that point. This makes it difficult to reconstruct the earthquake history at a given location because generally the intensities at this location during all previous earthquakes would not be known.

To overcome this limitation of the official French macroseismic intensity database (SisFrance), a recent project, co-financed by the French Ministry of the Environment, has estimated the intensities in all communities for over a 1,000 earthquakes that occurred during the past millennium. This estimation was made using a kriging-with-a-trend technique where the attenuation of intensity with distance was controlled by the data and in which the available intensities automatically shaped the isoseismals. The procedure generally only requires three intensity points to obtain a physically-possible isoseismal map but obviously the more that are available the more accurate the maps.

From the maps for the best-documented earthquakes in the catalogue, the estimated macroseismic intensities in each French community were extracted. By ranking these intensities and computing the frequency that each level of intensity occurs, empirical hazard curves can be constructed for every location in France. The assessment of completeness must be handled with great care as well as the selection of the considered sites. It should be recognised that these curves are associated with an uncertainty that is difficult to quantify exactly because of the combined effects of various uncertainties. In this study hazard curves for a few locations with reasonably complete earthquake histories are compared to hazard curves from recent probabilistic seismic hazard assessments. The uncertainty on the conversion of peak ground acceleration to intensity is taken into account. The aim of this study is to understand how a millennium of intensity data can help discriminate between different hazard assessments in a region of low-to-moderate seismicity.