Intensity and coseismic surface rupture parameters

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Magnitude quantifies the size of an earthquake by interpreting a seismogram, while Intensity is an empiric classification of earthquake effects on humans, buildings and natural environment. In order to use historical information for engineering applications, Intensity values are commonly converted in Magnitude values by means of empirical linear relationships.

Many authors have obtained log-linear correlation between earthquake magnitude and surface rupture parameters. So, an analogous relationship should be expected between the latter and intensity.

To this end a database containing more than 300 earthquakes, distributed worldwide, has been constructed: the SURFIN (SURface Faulting and INtensity) database. Each earthquake is described by date, epicentral area (country and locality), latitude and longitude, slip type, focal depth, magnitude (Me, Ms), intensity (MM), surface rupture length and maximum displacement. When available, intensity maps have been also collected and surface areas of selected intensity degrees computed.

The analysis of the whole dataset has highlighted the presence of many earthquakes with supposedly anomalous intensity because too divergent to those generally estimated for the earthquakes with similar evidence of surface faulting and magnitude.

In fact, nowadays there is a strong tendency to focus solely on building-related effects. So, to overcome the shortcomings of this approach in scarcely populated to deserted areas, and in the highest intensity degrees (X to XII), where there is saturation of damage to buildings, the INQUA environmental scale has been developed, based only on coseismic environmental effects.

The analysis made possible through SURFIN has allowed to select the earthquakes that present intensity values compatible with their faulting parameters and magnitude.

All the screened earthquake data have been correlated to develop empirical relationships among intensity, surface rupture length, maximum displacement and surface areas for given intensity degrees.