



## The Italian Catalogue of Earthquake Environmental Effects

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Earthquake Environmental Effects (EEE), including all phenomena generated by a seismic event in the natural environment, have been included in the macroseismic intensity assessment since the very beginning, in order to define the highest degrees of the intensity scales (e.g., Ferrari Postpischl, 1979; Sieberg, 1912; 1932). They can be categorized in primary effects, i.e. the surface expression of the seismogenic source, and secondary effects, mostly induced by the vibratory ground motion. Their use for intensity assessment has been brought into line with the other intensity diagnostics and formalized by the ESI 2007 scale, since it will provide an added value to traditional intensity evaluations being applicable also in not inhabited areas and not afflicted by saturation even for the greatest earthquakes.

The Italian Catalogue of EEE is a contribute to the INQUA Project #0811 - A Global Catalogue and Mapping of Earthquake Environmental Effects activities (<http://www.eeecatalog.sinanet.apat.it/login.php>). It takes advantage from the great amount of available data on EEEs induced by Italian earthquakes. For each event, we have assessed ESI epicentral and local intensities based on EEE data and traced isoseismal contours, similarly to traditional isoseismal maps. This procedure has allowed an objective comparison in terms of intensity, for events occurred in different areas and/or in different periods.

In particular the Italian catalogue, still under implementation, collects:

a) *modern events*: for large seismic events ( $M > 5.5$ ) occurred since '80s, a systematic description and mapping of EEEs is available, thanks to ad hoc geological field surveys, often integrated by remote sensing data. Of course these are the best records in terms of completeness, reliability and resolution. ESI intensity assessments are consistent with instrumental magnitudes and in quite good agreement with MCS damage based intensity evaluations.

b) *historical earthquakes*: the Italian historical seismic catalogues record information for events occurred over a time window larger than two millennia. For some earthquakes historical sources report EEE data in very good detail, allowing to depict ESI isoseismal contours based on a quite complete scenario of ground effects which may be used as an helpful tool for the identification of seismogenic source. For some other earthquakes the EEE scenario is far to be complete: nevertheless, the characteristics and size of the available EEE allow to assess a minimum intensity value through the ESI scale, that may significantly differ from traditional damage based intensity assessments.

c) *paleoearthquakes*: especially in the last three decades, paleoseismic studies have been conducted in the most active sector of the Italian territory mostly along normal capable faults. The catalogue collects surface faulting data in terms of local vertical offsets. This is a very helpful information for a minimum ESI intensity assessment, similarly to magnitude empirical estimates. For seismic hazard assessment, the most relevant added value of the EEE catalogue is the possibility to objectively compare earthquake intensities in a particular area over a 103-104 yrs time window. For example, the characteristics and size of a few EEEs induced by the February 2, 1703, seismic event affecting the area of L'Aquila are significantly larger than any ground effect surveyed in 2009, in agreement with available paleoseismic data (Blumetti, 1995; Moro et al., 2002). Similarly, in the Fucino area the size of coseismic surface ruptures induced by the January 13, 1915, event is comparable with local vertical offsets triggered by other two historical and several early to mid-Holocene events (Michetti et al., 1996; Pantosti et al., 1996; Galadini et al., 1999), suggesting that it can be considered the maximum expected earthquake in the area.