ASSESSING EMS98 MACROSEISMIC INTENSITY TO A SEISMIC SEQUENCE: THE CASE OF THE 1984 ABRUZZO-LATIUM EARTHQUAKES

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The Parametric Catalogue of Italian Earthquakes counts many seismic sequences for which mainshock and aftershocks intensities were assessed. On the basis of our experience acquired on direct macroseismic field surveys and on historical seismology studies, we wondered how such assessments were actually reliable. During the study of the 1984 Abruzzo-Latium sequence we tried to tackle this issue.

On 7 May 1984 a Mw 5.9 earthquake occurred in an area at the border of Latium, Abruzzo and Molise regions (central-southern Italy). Largely felt in central and southern Italy, the shock was the beginning of a sequence lasted several months (Rovida *et al.,* 2016). The mainshock, which caused widespread moderate damage, was followed few days later (11 May) by a strong aftershock (Mw 5.5) that, in some cases, worsened the damage. In the frame of the revision of the 1984 seismic sequence, according to the EMS98 (Grünthal, 1998), we faced the problem of interpreting effects caused by multiple shocks occurred in a short period of time. In the present work we propose an unconventional approach to assess macroseismic intensity related to seismic sequences.

The reference source of the 1984 earthquakes acknowledged by the Parametric Catalogue of Italian Earthquakes (Rovida *et al.,* 2016) is Guidoboni *et al.* (2007), which made a synthesis of the data in Mercalli-Cancani-Sieberg (MCS) scale, mainly coming from two macroseismic surveys performed during the sequence. The authors distinguished the effects caused by the two shocks and assessed MCS intensity values for the 7 May and 11 May shocks. To perform the reappraisal of this sequence, the Guidoboni *et al.* (2007) dataset was analysed, integrated with new accounts coming from original ING (Istituto Nazionale di Geofisica) macroseismic questionnaires (in Medvedev Sponheuer Karnik, MSK64 scale) as well as information from press reports. The gathered information were interpreted according to EMS98, identifying and extracting from descriptive pictures of the effects, the quantitative elements necessary for the evaluation of EMS98 intensities (percentages of buildings for the different typologies and damage degrees). In order to perform this kind of assessment we assumed that the building stock of the localities affected by the 1984 earthquakes was well represented by typologies A, B and C of the EMS98, and that these typologies may be identified to the corresponding A, B and C of the MSK scale.

The operation, even though quite challenging, was accomplished effortless for the mainshock but regarding the 11 May event we had to manage with very vague descriptions like “general worsening of preexisting damage” or “new cracks occurred”: this kind of information are not useful to quantify the effects in terms of EMS98.

Starting from the characteristics of the available information, we believe that it is uncorrect to isolate the macroseismic effects of multiple damaging earthquakes occurring in a short time period. In fact, it is not known how the seismic vulnerability of buildings already damaged by previous earthquakes may vary (Mouyiannou *et al.,* 2014). Similarly, we cannot quantify the damage evolution in terms of intensity degree, due to the superimposition of the effects.

To interpret the data related to the 11 May shock, an unconventional way of interpreting macroseismic data for this seismic sequence has been conceived: we assessed the intensity value only for those localities for which the effects of the shaking were absolutely referred to that event, otherwise we declined to assign the intensity value. This was the case of 156 localities damaged during the first shock for which it was not possible either to estimate the change of buildings vulnerability or to quantify the worsening of the damage evolution. The result is a reliable macroseismic field, but incomplete in the epicentral area; to fill this partial but faithful reconstruction of the second shock, an overall picture of the aggregated effects

observed at the end of the seismic sequence was supplied, assigning the intensity degree for all localities.

Our approach is inspired by the common experience in interpreting historical seismic sequences. In fact in these cases the only available info are usually global descriptions of the observed effects from which it is not possible to distinguish those caused by each shock. This approach, although cannot allow to deduce any information on source parameters (magnitude, location, fault dimention), can be useful to compare historical events occurred in the same area. However, due to the relevance and the frequency of cases encountered in literature, we strongly suggest that the issue of seismic sequences intensity assessment should be faced within the seismological community, in order to reach a shared answer to this matter.

References

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