

Improving the quality of the seismic catalogue by updating outdated or preliminary reference studies: case histories

V. Castelli¹, S. Baranello¹, F. Bernardini¹, R. Camassi¹, C.H. Caracciolo¹, C. Castellano², E. Ercolani¹, S. Filosa², Laura Graziani², A. Maramai², S. Paolini³, A. Rossi², A. Tertulliani²

¹ *INGV Istituto Nazionale di Geofisica e Vulcanologia , Bologna, Italy*

² *INGV Istituto Nazionale di Geofisica e Vulcanologia, Roma, Italy*

³ *ENEA Ente per le nuove tecnologie, l'energia e l'ambiente, Roma, Italy*

The Parametric Catalogue of Italian Earthquakes CPTI15 [Rovida et al., 2022] includes 241 earthquakes whose epicentral parameters are based on studies marked AMGNDT95 [Archivio Macrosismico GNDT, 1995]. These are preliminary (or, in some cases, extremely basic) studies, that were carried out in the early 1990s by the GNDT/CNR (Gruppo Nazionale per la Difesa dai Terremoti of the Consiglio Nazionale delle Ricerche of Italy) in the frame of the “Hazard Project”, whose aim was making available the basic data required for preparing an updated hazard model, as quickly as possible and in the form of a parametric catalogue.

Those AMGNDT95 studies that we define as “preliminary” derived the epicentral parameters of each studied earthquake from a data base reconstructed starting from the bibliographic references of the PFG catalogue [Postpischl, 1985] and going back, wherever possible to their original sources, according to a procedure called “Analysis Through Catalogues” [Stucchi, 1993]. The AMGNDT95 studies that we define as ‘extremely basic’, limited themselves to parameterizing the information provided by the bibliographic references of the PFG catalogue, i.e. in most cases the Baratta [1901] earthquake compilation or the seismological bulletins of the 19th-20th centuries.

The AMGNDT95 studies remained unpublished and on paper only until the year 2017, when they were digitized within the framework of Annex B2 of the DPC-INGV 2016-2017 Convention, and made public via the ASMI platform [Rovida et al., 2017].

In the framework of the following triennial DPC-INGV Convention, an operation was then launched to update AMGNDT95 studies with revision priorities established according to the relevance of each earthquakes and to the potential margins for improving knowledge on each of them. As the operation was under way, the revision was extended to another 8 damaging earthquakes whose parameters in the CPTI15 catalogue were derived straight from the PFG

catalogue. These earthquakes had never been studied and macroseismic data were lacking for them. The CPTI15 catalogue includes several hundred records derived directly from other parametric catalogues. In most cases they are related to earthquakes outside the national borders and their parameters are taken from the seismic catalogues of neighbouring countries (Switzerland, Austria, Slovenia, and Croatia). Only 56 of them are original records derived from the PFG catalogue [Postpischl, 1985] and mainly related to instrumental aftershocks of Italian earthquakes of the first decades of the 20th century. The 8 earthquakes mentioned above can be classified, on the contrary, as major events that had never been studied probably because the extreme poverty of the available source information made it difficult to improve in the short time allotted within the “Hazard Project” frame.

A first selection of studies, related to earthquakes occurred in the 1949-1971 time window, was the subject of a communication at the 40th GNGTS conference in 2022 and was recently published [Bernardini et al., 2022]. Here we continue the presentation and discussion of the results of our work, taking into account a wider selection of AMGN95 studies related to earthquakes occurred from the 14th to the 20th century. These earthquakes belong to a very numerous category in the CPTI15 catalogue, i.e. they are damaging earthquake of moderate energy, with a very narrow base of data, often reduced to 1 or 2 intensity data only. The problem of the consistency of the information base from which to derive the epicentral parameters of earthquakes is very serious in the CPTI catalogue, which is nevertheless the result of an enormous amount of work carried out during more than thirty years of research. For instance, the current version of the catalogue, includes as many as 65 earthquakes with $M_w \geq 5.5$ ('strong earthquakes') that are documented by less than 11 intensity data points each ((or even, in about 20 cases, one intensity data point only). In the energy class $M_w \geq 4.5$, there are no less than 221 earthquakes documented by a single intensity data point only. For this reason, it is both necessary and important to improve the quality of the catalogue by producing new and better quality studies of the moderate-energy earthquakes.

The results of the work are not all equally satisfactory. Overall, the revision has improved both the consistency of the intensity data that can be used to calculate epicentral parameters, and the individual intensity estimates, thanks to the availability of original sources and testimonies that allow to considerably refine the previous assessments, based as they were on second-hand seismological compilations only.

Among the most significant results we include the exclusion from the catalogue of some earthquakes that turned out to be non-existent. One of them is the alleged Ischia earthquake of 1767, that was demonstrated to be a forgery generated by a 19th century local history which attributed the collapse of a small church to an earthquake, citing as its source an epigraph that does not mention any earthquake at all. The information of the local historian had been accepted 'on trust' by 19th century seismological compilations, and for this reason the news of this non-existent earthquake did continue to circulate - resurfacing even in recent scientific assessments and elaborations produced after the Ischian event of 21 August 2017. Now, a careful critical analysis has led to its recognition as a fake earthquake.

Last but not least, it is important to know that our revision allows public and free access to all the information retrieved for each of the studied earthquakes. All available records of macroseismic effects that were retrieved during the study were transcribed and made available to the public through the Archivio Storico Macrosismico Italiano web platform [Rovida et al., 2017]. In this way, anyone wishing to take on the study of single earthquakes or groups of earthquakes will be able to start from a base of data organized in a homogeneous and transparent manner.

References

- Archivio Macrosismico GNDT; 1995: *Studi preliminari di terremoti attraverso i repertori sismologici*. Archivio macrosismico del GNDT, Milano.
- Bernardini F., Camassi R., Castelli V., Caracciolo C. ed Ercolani E. ; 2022: *Materiali per un catalogo dei terremoti italiani: Sismicità minore del Novecento: alcuni casi tra gli anni 1949-1971*. Quaderni di Geofisica, 181, pp. 271.
- Postpischl D.; 1985: *Catalogo dei terremoti italiani dall'anno 1000 al 1980*. Progetto Finalizzato Geodinamica. Quaderni de «La Ricerca Scientifica», n.114, v.2B.
- Rovida A., Locati M., Camassi R., Lolli B., Gasperini P. e Antonucci A.; 2022: *Catalogo Parametrico dei Terremoti Italiani (CPTI15), versione 4.0*. Istituto Nazionale di Geofisica e Vulcanologia (INGV). <https://doi.org/10.13127/CPTI/CPTI15.4>
- Rovida A., Locati M., Antonucci A. e Camassi R. (eds.); 2017: *Archivio Storico Macrosismico Italiano (ASMI)*. Istituto Nazionale di Geofisica e Vulcanologia (INGV). <https://doi.org/10.13127/asmi>
- Stucchi M.; 1993: *Through catalogues and historical records: an introduction to the project "Review of Historical Seismicity in Europe"*. In: Stucchi M. (ed), Materials of the CEC project "Review of Historical Seismicity in Europe", 1, Milano, pp. 3-14.

Viviana Castelli (viviana.castelli@ingv.it)