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UCI2001: The Updated Catalogue of Italy

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Abstract

A new updated earthquake catalogue for the Italian territory, named UCI2001, is described here; it consists of an updated and revised version of the CCI1996 catalogue (Peresan et al., 1997). The revision essentially corresponds to the incorporation of data from the NEIC (National Earthquake Information Centre) and ALPOR (Catalogo delle Alpi Orientali) catalogues, while the updating is performed using the NEIC Preliminary Determinations of Epicenters since 1986.

A brief overview of the catalogues used for the monitoring of seismicity in the Italian area is provided, together with the essential information about the structure of the UCI2001 catalogue and a description of its format.

Introduction

The Updated Catalogue of Italy, UCI2001, is a catalogue compiled to permit the routine monitoring of seismicity, for earthquake prediction purposes, in the Italian area.

The intermediate-term medium-range prediction algorithms, namely CN (Keilis-Borok and Rotwain, 1990) and M8 (Keilis-Borok and Kossobokov, 1990), require an input catalogue as complete and homogeneous as possible over the monitored region. Besides, the catalogue must be updated rapidly enough to permit to issue predictions in advance. The analysis of seismicity by the algorithm CN is carried on every two months, and every six months by the algorithm M8 (every year predictions are issued on January, 1 and July, 1); hence, the data must be available with a time delay not larger than a couple of weeks.

In principle, the regional catalogues of earthquakes should provide the most appropriate data set for predictions, since they are expected to be more complete than the global ones. An high completeness level would be especially important when attempting predictions in relatively low magnitude ranges, as it happens in the case of Italy, or when trying to reduce the space-time uncertainty of predictions (e.g by the Mendocino Scenario algorithm, Keilis-Borok, 1996). However, the ING bulletins compiled at the Istituto Nazionale di Geofisica e Vulcanologia, which were used to update the Italian catalogue since 1980, resulted to be biased by a relevant

underestimation of the local magnitudes (Peresan et al., 2000), starting approximately in 1987. This prevents their use for the routine monitoring of seismicity and makes it necessary to update the Italian catalogue with a different data set, thus leading us to compile the UCI2001 catalogue.

Overview of catalogue evolution

The Italian catalogue of earthquakes is the result of several subsequent revisions and different stages characterised its compilation. The data set initially used for intermediate-term medium-range prediction purposes was obtained by Keilis-Borok et al. (1990) integrating the catalogues ENEL and ING (see Caputo, 2000 and references therein) with the events reported by the CSEM (European-Mediterranean Data File 1976-1988, Strasbourg 1989).

In a second step the ENEL+CSEM data have been replaced by the PFG catalogue (Progetto Finalizzato Geodinamica; Postpischl, 1985), resulting from the integration and revision of the data available for the Italian territory. Thus, the PFGING catalogue (Costa et al., 1995) was assembled updating the PFG catalogue (time interval: 1000-1979) with the ING bulletins (available for the time interval 1980- July 1997).

Later on, the Current Catalogue of Italy CCI1996 (Peresan et al., 1997) was issued, which consists of a revised version of the PFGING catalog, incorporating the information provided by the ISC bulletins (International Seismological Centre; 1976-1990) and by the CFT catalogue ("Catalogo dei Forti Terremoti in Italia dal 461 a. C. al 1980"; Boschi et al., 1995). The revision has been performed at first on the basis of information from ISC bulletins, 1976-1990, in order to correct depth, magnitude and obvious errors in coordinates determinations. After that the origin time, coordinates and intensities were corrected according to the CFT estimations in the time period 1000-1980. The use of the CFT allowed correcting 237 events, eliminating 19 events, and introducing two new events in the catalog.

All of the aforementioned catalogues cover an area that, toward to the North, it's fairly incomplete for the seismicity monitoring of the Italian territory, mainly due to the presence of many different political borders across the Alpine arc. The spatial heterogeneity of the data over the Italian area, especially near its boundaries, can exert

negative influence on prediction results. The problem was solved by Costa et al., (1996) filling the gap with data contained in two other catalogs, namely NEIC (National Earthquake Information Center. Golden, CO) and ALPOR (Catalogo delle Alpi Orientali; Osservatorio Geofisico Sperimentale, Trieste, Italy. 1987).

The UCI2001 catalogue

Recently, a comparison of the ING Bulletins with other seismic data sources (Peresan et al., 2000) called for a further revision of the Italian catalog, evidencing the necessity to update the CCI1996 with a different data set, at least since 1986, due to relevant inhomogeneities in the reported magnitudes. Among the available data-bases we established to use the NEIC data (Preliminary Determinations of Epicentres). In fact, the NEIC catalog, analysed for the entire Italian area, appears to satisfy the general conditions required for the routine monitoring of seismicity, since it can be considered complete for magnitudes greater than 3.0, at least after 1985, and it is updated rapidly enough. A comparative analysis of the catalogues CCI1996 and NEIC permitted to determine the method of merging them together in order to obtain a rather homogeneous catalogue that covers the territory of Italy (Peresan and Rotwain, 1998). The time homogeneity of the resulting catalogue has been confirmed by a subsequent analysis of the annual number of events as a function of time (Romashkova et al., 2001).

At present an unified and updated catalogue for the analysis of the Italian seismicity, named here as UCI2001, is made available by merging CCI1996, NEIC and ALPOR data, for the period 1900-1985, and by appending to it the NEIC Preliminary Determinations of Epicentres (PDE) since 1986. The catalogue UCI2001 consists therefore of the following two main parts, covering consecutive time intervals:

- CCI1996 catalog, 1000-1985, integrated with the ALPOR and NEIC data according to Costa et al. (1996). Events from the CCI1996 are characterised by up to three magnitude estimations: the local magnitude M_L, the duration magnitude M_d and the magnitude calculated from intensities M_I. The events from ALPOR or NEIC instead, have their magnitudes assigned according to the priority $M_{ALPOR}(M_L,M_I)$ $M_{NEIC}(M_L,M_S,m_b)$, respectively.

- NEIC Preliminary Determinations of Epicentres (PDE), since 1986. This part of the catalogue may include up to four magnitude estimations for each event: the surface waves magnitude (M_S) and the body waves magnitude (m_b), both computed by NEIC, plus two values M1 and M2, that correspond to magnitudes of a different kind contributed by different agencies (mainly M_L and M_d in the Italian area).

As a consequence, the catalogue UCI2001 contains quite hetereogeneous estimations of magnitudes (see scheme in figure 1), which correspond to M_I and M_L from its beginning up to 1980, and are mainly M_L and M_d after 1981. Since there is no single magnitude scale in UCI2001 which covers the entire time considered, it is necessary to define a combined magnitude scale, before performing any analysis of the seismic flow.

The catalogue UCI2001 is used by the algorithm M8 and by CN for intermediate-term predictions in Italy. The only difference is in the way the operating magnitude is selected for the two algorithms. The M8 algorithm usually works with the maximum reported magnitude, whereas CN algorithm uses the determination selected according to a given priority order. When the priority magnitude is used it is necessary to determine the relationship between each of the magnitudes reported by CCI1996 and by NEIC (see Peresan and Rotwain, 1998), in order to preserve the homogeneity of the magnitude estimation.

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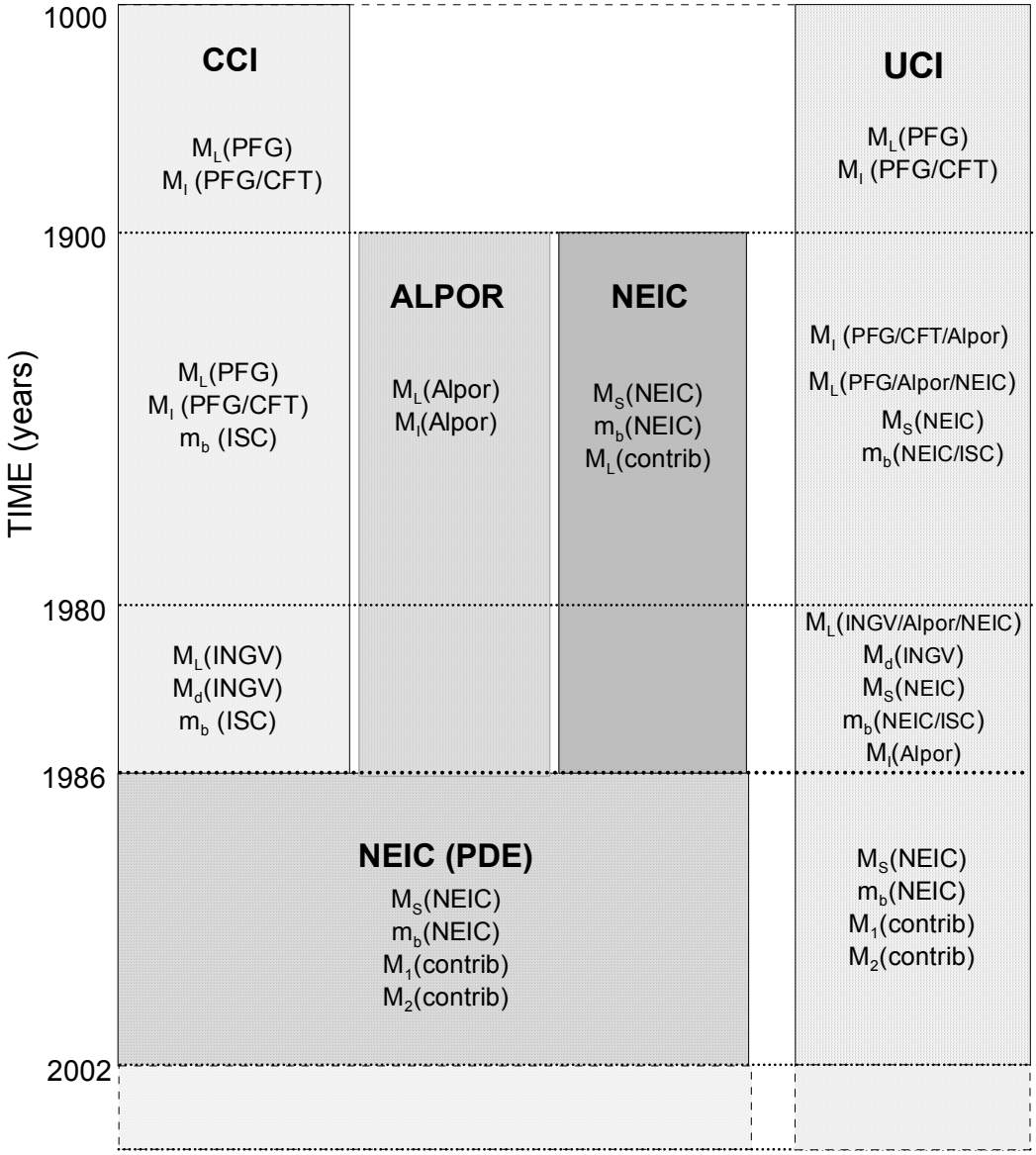

Figure 1- Schematic representation of the new catalogue. The first three columns refer to the catalogues (CCI, ALPOR and NEIC) used to compile the updated catalogue of Italy and give the magnitudes considered in each of them. The last column represents the final catalogue UCI2001: the different magnitudes reported in each time interval are given together with the source catalogue (in brackets).

Appendix: the catalogue format

Description of the catalogue

Name: UCI2001

Period: from January 1000 to April 30, 2002

Territory: Italy (formal definition of boundaries not available)

Format: 41 bytes ASCII

Format description:
year, month, day, hour, minute, seconds, latitude, longitude, depth, four magnitude estimations: M_1, M_2, M_3, M_4 (stored as positive integers), catalogue code (alphanumerical code).

Definition of magnitudes:

Catalogue Code C: Events from CCI1996 (1000-1985)

M_1: M_d average duration magnitude from ING bulletins
M_2: M_I magnitude derived from intensities
M_3: M_L local magnitude from ING bulletins
M_4: m_b body wave magnitude from ISC bulletins

Catalogue Code B: Events from ALPOR and NEIC (1900-1985)

M_1: M_{ALPOR} magnitude from the ALPOR catalogue,
selected according to the priority order: $M_{ALPOR}(M_L,M_I)$
M_2: (no value)
M_3: M_{NEIC} magnitude from the NEIC catalogue,
selected according to the priority order: $M_{NEIC}(M_L,M_S,m_b)$
M_4: (no value)

Catalogue Code A: Events from NEIC (1986-2000)

M_1: m_b body wave magnitude from NEIC
M_2: M_S surface wave magnitude from NEIC
M_3: M1 magnitude provided to NEIC by other agencies
M_4: M2 magnitude provided to NEIC by other agencies