CZ-NEC

Revision of the Czech National Earthquake Catalogue

Part 1
PARAMETER ASSESSMENT

WP 2 – Action 2.5

ΣIGMA2

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Executive summary

CZ-NEC (**CZ**ech **N**ational **E**arthquake **C**atalogue) is a scientific product which makes available data on earthquakes in the Czech Republic and in its surroundings. During the work on the catalogue, the CZ NEC team accepted the challenge to prepare an earthquake catalogue for the entire Bohemian Massif. This expansion of the area of interest has already required the invitation of seismologists and creators of earthquake catalogues from neighboring countries, especially from Austria and Germany. Due to this expansion, the work on the catalogue had to be divided into two phases.

This report contains the results of three years of work on phase I. Phase II. should follow this phase and will be built primarily on working with German colleagues.

CZ-NEC is made openly available; therefore, it will be published also on the Internet. The web presentation of the catalogue is based on the Midop and ArcGis Online software. Converting CZ NEC catalogue to the web environment will allow continuous updating and improvement of the catalogue, both in the form of adding of newly occurring events and reviewing and reassessment of historical earthquakes. The CZ NEC team has gathered a very rich archive of sources, as monastic annals, chronicles, old prints, newspaper reports and newer publications on earthquakes, which will also be made available to serious researchers interested in continuing work on the CZ NEC.

The CZ NEC report is divided into four text parts, the fifth part is a web presentation. The text parts are as follows:

PART 1 Parameter Assessment

PART 2 Source Management

PART 3 Historical Earthquake Catalogue

PART 4 Catalogue of the Instrumentally Recorded Earthquakes

Part 1 provides basic information on approaches to revising catalogues, to working with sources and discussing historical entries, and to parameterizing individual recognized earthquakes. It also describes the format of the Catalogue of historical earthquakes and the Catalogue of instrumentally recorded events. The last chapter provides information about the web presentation.

Part 2 is devoted to the sources of information that were used in the discussion of individual entries in catalogues. The list contains almost 1000 references divided into several blocks (libraries), which are stored in a digital archive in full-text form. Access to the digital archive must be regulated due to copyright relating to certain prints.

Part 3 contains a tabular form of the Catalogue of Historical Earthquakes, including an explanatory commentary on the individual columns of the table and a graphic presentation. Part 3 also contains a set of so-called Event Sheets. These sheets are the cornerstone of the Catalogue of Historical Earthquakes, as they provide a detailed discussion of each of entry, including a complete list of sources related to the entry.

A special item of the Catalogue of Historical Earthquakes is the Catalogue of Prehistoric Earthquakes, resp. catalogue of places with observed geological records of past earthquakes.

Part 4 contains a tabular form of the Catalogue of Instrumentally Recorded Earthquakes, including an explanatory commentary on the individual columns of the table and a graphic presentation. This part presents earthquakes from the period 1953 - 2018. These events are divided into 4 separate tables:

Catalogue of instrumentally recorded tectonic earthquakes for the period 1953 - 1999;

Catalogue of instrumentally recorded tectonic earthquakes for the period 2000 - 2018;

Catalogue of instrumentally recorded induced events for the period 1953 - 1999;

Catalogue of instrumentally recorded induced events for the period 2000 - 2018.

The website has not been launched yet; however, it will be created on the basis of **Midop** software. The CZ NEC website will include all parts of the CZ NEC (Catalogue of Prehistoric Earthquakes, Catalogue of Historical Earthquakes and Catalogue of Instrumentally Recorded Earthquakes).

The basis of the web presentation will be tables of individual catalogues, which will contain a list of all booked events in the CZ NEC. By clicking on the line of each event, it will be possible to open a window with more detailed information and a link to the relevant Event Sheet, if it has been compiled. In the next window, it will be possible to display IDPs (table and map) that relate to a given earthquake.

ArcGIS Online then offers the ability to display individual catalogues on a synoptic map, freely combine individual catalogues, and create graphical outputs.

The main advantage of this web form of the CZ NEC will be its openness for further adding new events and re-evaluating the historical ones, without the need to update the printed editions of the CZ NEC.

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Contents

TERMS OF USE

CZ-NEC (**CZ**ech **N**ational **E**arthquake **C**atalogue) is a scientific product released by Czech team involved in the SIGMA2 project that required few years of work and makes available data on earthquakes in the Czech Republic and in its surroundings.

CZ-NEC is made openly available via website, but the website is not running yet.

CZ-NEC can be used for non-profit scientific purposes only, and the source must always be cited. Any commercial and profit use is explicitly forbidden without a prior agreement with the sponsor – CEZ, a.s.

Citation

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PREFACE

More than sixty years ago, in 1958, the first comprehensive earthquake catalogue was published in the former Czechoslovak Republic (see [401]).

This work was created by the Geophysical Institute of the Czechoslovak Academy of Sciences during 1952-1956, under the leadership of Vít Kárník (* October 5, 1926 - † January 31, 1994 / see left), head of the Department of Seismology. Together with Vít Kárník, Emanuel Michal (* July 14, 1894 - † April 18, 1968), an emeritus seismologist, geologist and publicist, and Alexander Molnár, a seismologist working at the Geophysical Laboratory of the Slovak Academy of Sciences, worked on the catalogue.

The catalogue was prepared in a very similar format to Sieberg's German earthquake catalogue from 1940 (see [237]) and was written in German. Although this catalogue was not developed as a parametric catalogue, for a long period it was the only comprehensive overview of the earthquakes in Czechoslovakia.

It is a work that deserves admiration and recognition, especially considering that it originated in a time without the personal computers, Internet, digital library registers and digitized books and, on top of that, on the background of a politically divided Europe of the 1950s.

23 years later, the Institute of Geophysics published a sequel of the Czechoslovak earthquake catalogue, this time for the period 1957 – 1980 (see [501]). The catalogue was prepared by Vít Kárník and Dana Procházková from the Geophysical Institute of the Czechoslovak Academy of Sciences and Ivan Brouček from the Geophysical Institute of the Slovak Academy of Sciences. The catalogue was prepared in a similar way to the previous one, but in English.

After 1980, parametric earthquake catalogues were being worked on, mainly due to the development of nuclear power industry in Czechoslovakia and the need to assess the seismic hazard. Many activities in the field of seismic hazard assessment were carried out by employees of the Geophysical Institute of the Czechoslovak Academy of Sciences, initially by Vít Kárník, then by Dana Procházková, Zdeňka Schenková and Vladimír Schenk. Some of the catalogs were published (see e.g. [522]), but some remained only as unpublished manuscripts used solely by their authors.

In the late 1990s, the issue of seismic hazard assessment was shifted to the nuclear power plant operator (ČEZ, a.s.) and its Technical Support Organizations as Institute of Rock Structure and Mechanics of the Czech Academy of Sciences, Energoprůzkum Praha and Institute of Physics of the Earth, Masaryk University, Brno. As part of this evaluation compiled catalogues of earthquakes were produced, such as the Compiled earthquake catalogue for the regions of Czech nuclear power plants kept by I. Prachař from 2003. Furthermore, local earthquake catalogues for the vicinity of the Temelín and Dukovany NPPs (see ([566] and [567]) were created and catalogues of micro earthquake recorded by the seismic networks of Temelín (ETE) and later also Dukovany (EDU) were compiled. All these reports were produced as unpublished manuscripts and were used only for the purposes of ČEZ, a.s.

1 BASIS

1.1 MOTIVATION

After the accident at the Fukushima Daiichi nuclear power plant in March 2011 the world community has made great efforts to improve the safety of nuclear power plants. In the field of seismic hazard assessment, a few methodological approaches to assess seismic hazard have been improved. Projects and activities, such as BestPSHANI, SIGMA-1 or IAEA Meetings, certainly contributed to this effort and their results were later reflected in the new IAEA standards. In parallel with these projects supported by nuclear plant operators, the development of so-called Eurocodes, including Eurocode 8 dedicated to Seismic Design of Buildings, was underway. A few projects (e.g. GSHAP, SHARE) have been implemented, which have also brought many new insights into European continent's seismicity and methods of assessing it on a pan-European harmonized scale.

Also, ČEZ a.s. actively proceeded to improve the seismic hazard assessment of Czech nuclear power plants Dukovany and Temelín. In order to achieve this goal, it was necessary to adapt the Czech nuclear legislation and to absorb new approaches and methods arising from international cooperation.

The first task was ensured by the national regulatory body, the State Office for Nuclear Safety, by amending of the Atomic Act (Act No. 263/2016 Coll.) and by amending of subordinate decrees (Decree No. 378/2016 Coll. on siting of a nuclear installation and Decree No. 329/2017 Coll. on requirements for a design of a installation).

The second task, that the nuclear power plant operator (ČEZ a.s.) took care of, was somewhat more difficult. The operator and its TSOs have faced the challenge to assess sites with low seismicity, where it has been sometimes difficult to apply new approaches introduced into IAEA practice, which were primarily developed for areas with high seismicity.

It pointed to the need to start working on modifying new approaches and SHA procedures that would better suit the nature of low seismicity areas and that would be applicable in our situation as well. Simultaneously, it was necessary to improve the input data bases, particularly with regard to better capture the epistemic uncertainties. To meet these needs and strengthen harmonization of Czech approaches with international practice, this was the main motivation for the establishment of a working team and its involvement in the SIGMA2 project.

One of the urgent needs was to ensure a well-developed parametric national earthquake catalogue comparable to other modern national catalogues or similar European compilations (as e.g. CENEC or SHEEC catalogues). To achieve this, it was necessary to revise the above-mentioned Kárník's catalogues and to complete the catalogue of the instrumentally recorded earthquakes to the present day.

1.2 KÁRNÍK'S CATALOGUES

1.2.1 Kárník – Michal - Molnár (1958) Catalogue

The first Kárník's earthquake catalogue from 1958 (see [401]) provides a short chronicle of earthquakes that originated in Czechoslovakia territory or propagated into this area in the period 460-1956. Kárník notes in the introduction of his work that he included in the catalogue for the years 460-1894 "*also such earthquakes, which could probably spread to the territory of today's Czechoslovakia or whose epicenter lies in the Bohemian Massif*".

The individual entries, which are numbered, provide more or less detailed information about each earthquake. The minimum record size includes the year (and month, day and time in CET, as the case may be), brief characteristics of the earthquake and the source from which it was drawn. If more information was available, the record contains the following additional items: macroseismic area (makroseismische Gebiet - MG), epicentral area (Herdgebiet - HG), geographic coordinates of the macroseismic epicenter, focal depth h in km, maximum intensity I_0 (in Mercalli–Cancani–Sieberg scale), radius of macroseismic area rn in km, magnitude (only for earthquakes of the 20th century, M_I - calculated from I_0, M - calculated from amplitudes and periods of seismic waves), area of territory P in km^2 which was shaken. Some records of stronger or better described earthquakes also contain a list of IDPs (Intensity Data Points).

References were indicated by numbers in square brackets that corresponded to bullets in the reference list. Kárník's catalogue also contains a separate list of Observation Data Points (analogy to the IDPs), which states: the name of the municipality, its latitude and longitude, and the earthquake number associated with the municipality.

1.2.2 Kárník – Procházková – Brouček (1981) Catalogue

The second Kárník's catalogue, covering the period 1957-1980, was arranged in the same form as the first one. Every event is defined by the basic parameters: date, origin time (GMT), geographical coordinates of the epicenter, depth of epicenter *h* in km, epicentral intensity I_0, magnitude determined from macroseismic data $M_I = f(I_0, h)$ or $M_I = f(I_0)$, instrumentally determined magnitude *M*, radii of isoseismals; exceptionally, the other focal parameters are added.

The macroseismic reports appended to the Bulletins of the Czechoslovak Seismological Stations were the main source of this catalogue. Epicenter and IDPs were determined mainly based on questionnaires or other reports using the MSK-64 (Medvěděv-Sponheuer-Kárník-1964) macroseismic scale. Isoseismic maps are added to the records of many events. The catalogue contains not only events originated on the territory of Czechoslovakia, but also those which originated in the vicinity and whose effects were observed in Czechoslovakia. But the list of IDPs similar to that in the first catalogue was not compiled.

1.2.3 Graphic presentation of Kárník's catalogues

Kárník's catalogues with the addition of some Austrian and Hungarian earthquakes were presented by the Geophysical Institute of the Czechoslovak Academy of Sciences on a poster in 1979. The compilation was prepared by Zdeňka Schenková, Vít Kárník and Vladimír Schenk (see Fig. 1).

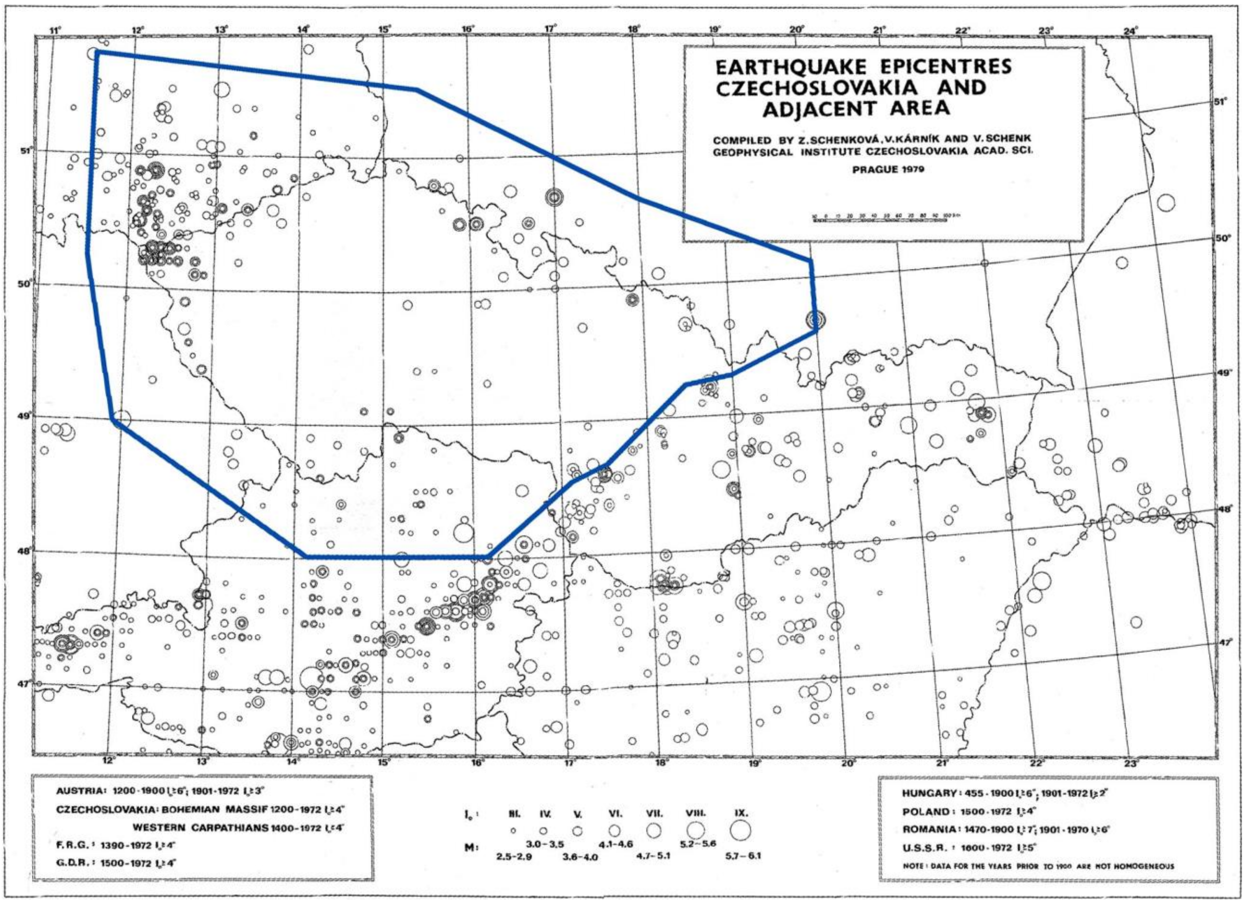


Fig. 1: Original graphic presentation of Kárník's catalogues and other macroseismic data from 1979. The blue line represents the CZ-NEC polygon.

1.3 OTHER SOURCE CATALOGUES

When the plan for revision of Kárník's catalogs was being prepared, it was decided, in addition to the review of Kárník's entries, to check the earthquakes lying in the CZ-NEC polygon, which are included in other earthquake catalogues for neighboring states. It was necessary to devote a large portion of the revision work to two pan-European compilations - CENEC ([503] and SHEEC ([506]), as well as the German catalogue of G. LEYDECKER ([509]). The contributions of the Polish catalogue ([526], ([550]) and the Austrian data (e.g. [505]) were not so extensive.

1.3.1 German catalogue of G. Leydecker ([509])

In most events, the German catalogue overlaps with the Kárník's one (see Kárník's catalogue from 1958 - [401]). There may be differences in some parameters of the earthquakes and there are also other interpretations of some events from the German-Czech borderland (see NEUNHÖFER, 2018 - [532]). It therefore seemed reasonable to capture these differences also in CZ-NEC. In order to best meet this challenge, cooperation with Diethelm Kaiser from BGR has been agreed on a joint revision of the catalogue for the Czech-German border region. Fig. 2 shows a graphic presentation of the Leydecker's earthquake catalogue for Germany and adjacent areas ([509]).

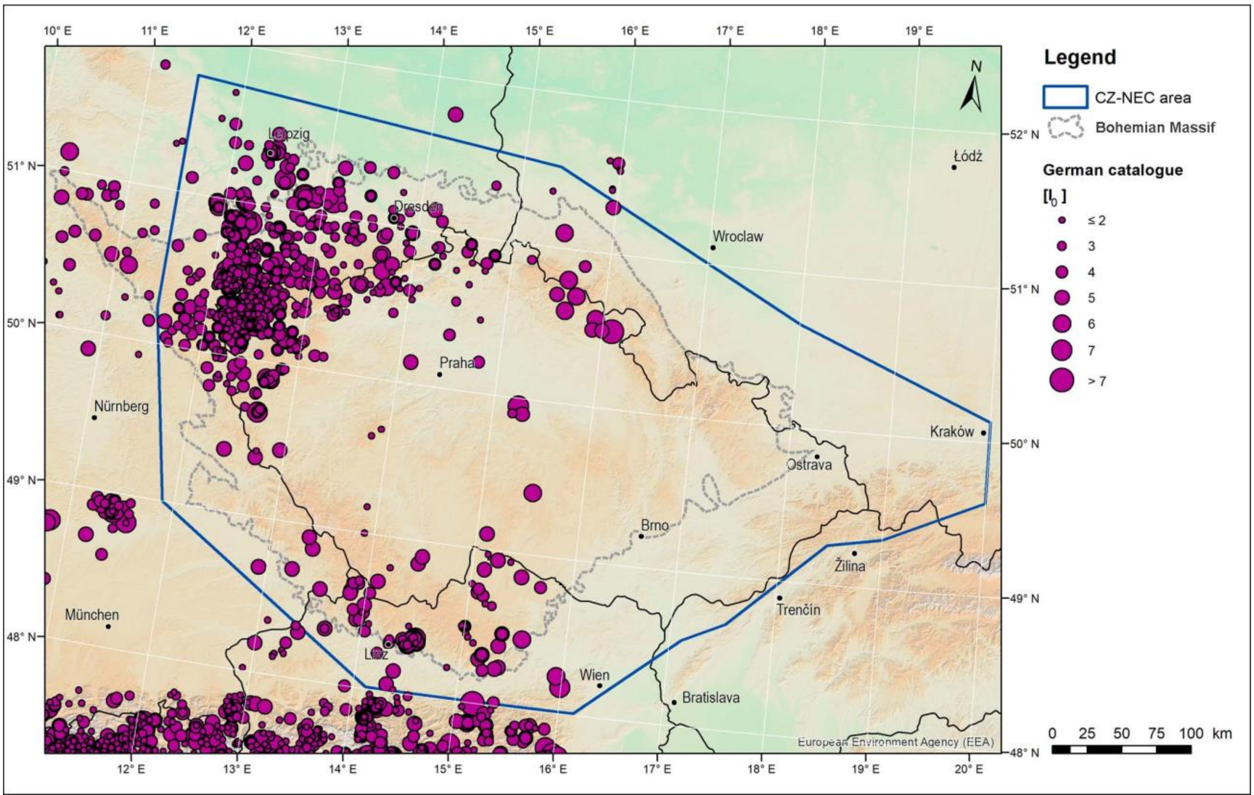


Fig. 2: Graphic presentation of the Earthquake catalogue for Germany and adjacent areas ([509]) in the CZ-NEC polygon.

1.3.2 Pan-European compilations

In the last two decades, several compilations of the pan-European earthquake catalogue have been created as part of several major scientific projects (e.g. SHEEC, CENEC). Unfortunately, Czech seismologists did not participate in these projects, and so these compilations included unverified data on earthquakes from the Bohemian Massif. For this reason, the entries in these catalogues, that fall within the CZ-NEC polygon, were also revised similarly to Kárník's catalogues (see Appendices 7.1 and 7.2), regardless of whether entries were mentioned by Vít Kárník. Graphic presentation of these catalogues is shown on Fig. 3 and Fig. 4.

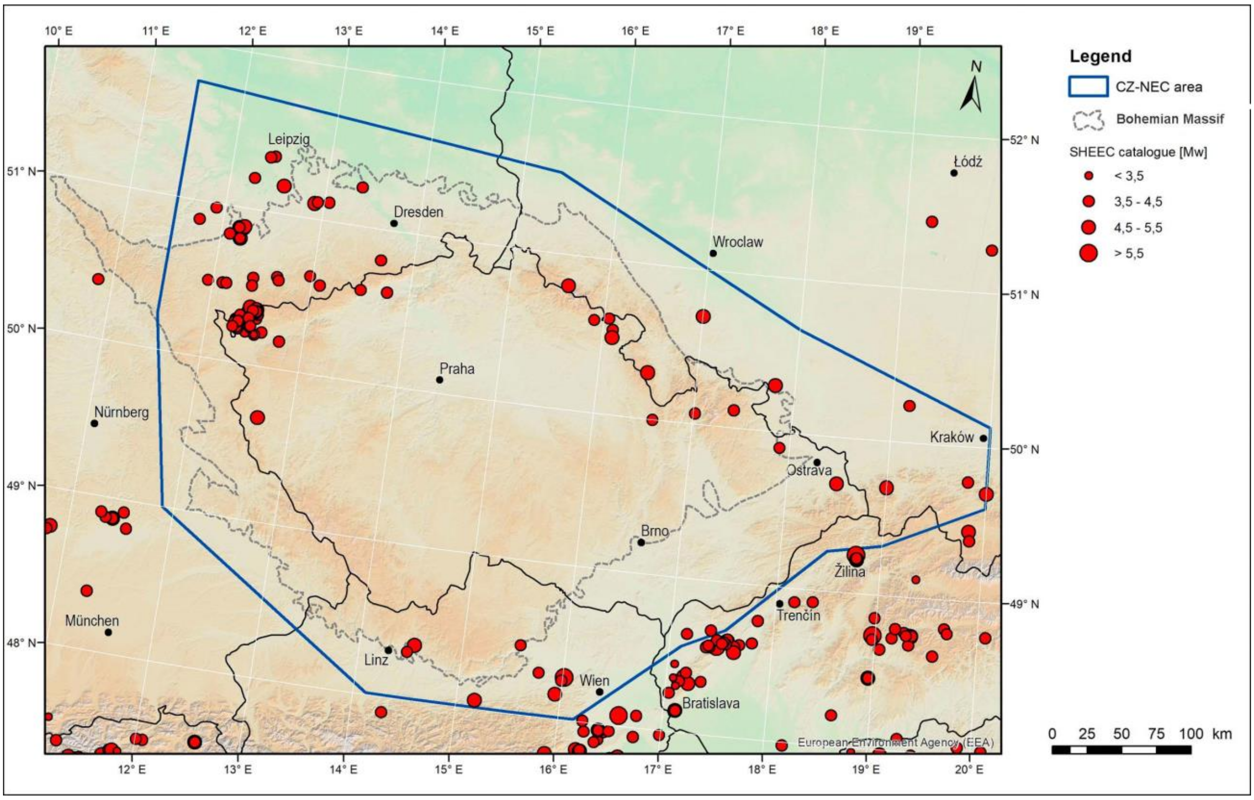


Fig. 3: Graphic presentation of the SHEEC catalogue ([506]) in the CZ-NEC polygon.

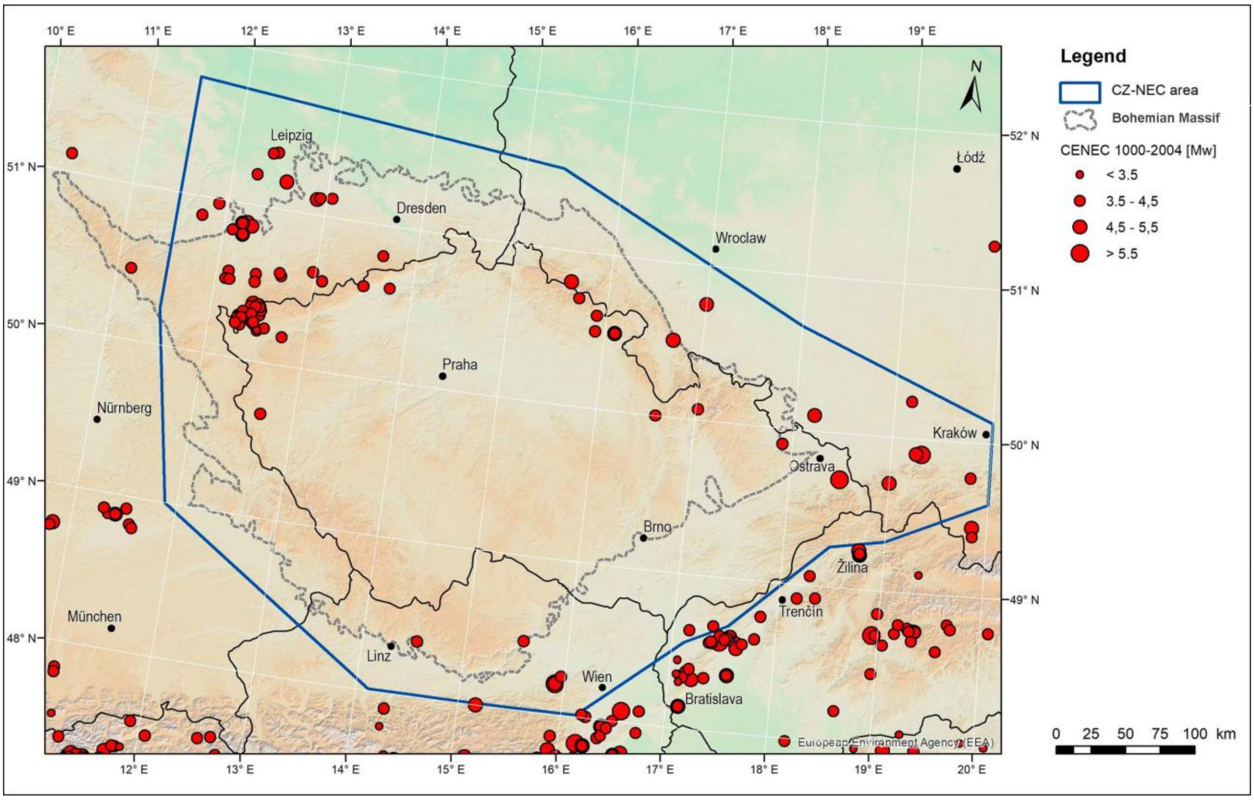


Fig. 4: Graphic presentation of the CENEC catalogue ([503]) in the CZ-NEC polygon.

These compilations have a relatively high minimum magnitude threshold, Mw (min) = 3.5 (see [503] or [506]). With the exception of Germany and the West Bohemian swarm area, it was not necessary to revise many events from the SHEEC catalogue - [506] (see Fig. 3). A very similar picture is provided by the slightly older CENEC catalogue - [503] (see Fig. 4). Earthquakes with epicenters in Austria and Germany were revised in collaboration with colleagues from BGR (Diethelm Kaiser) and ZAMG (Christa Hammerl).

1.4 APPROACH

The absence of a parametric earthquake catalogue was the main challenge for which a solution was sought. It was clear that the use of pan-European compilations was not possible, as these compiled catalogues had minimal magnitude set too high, so that they were basically unusable for assessing the seismicity of the Bohemian Massif in the required "resolution". Furthermore, these compilations did not solve the inaccuracies of Kárník's catalogues.

The presence of a series of vague records ("earthquake in Bohemia and everywhere else") and evidently questionable events (e.g. windstorms, thunderstorms and the associated shaking) were considered a priority to be addressed, i.e. to separate fake and doubtful events from tectonic events with a high probability that they have occurred.

We did not seem so important to extensively reassess intensities that were determined by V. Kárník, his associates, or his successors, if we did not find a serious reason to do it. On the other hand, converting Kárník's catalogues to a parametric national catalogue was also one of the important goals of our work. It was possible to use the papers of Dana Procházková, which contain very valuable data. It is possible to name e.g. the Atlas of Isoseismal Maps (see [413]) that provides an evaluation of many stronger earthquakes from Central European territory. Dana Procházková also published a few other keynote papers that could be used to parameterize earthquakes. It should be mentioned e.g. the analysis of source areas in the Bohemian Massif, including a statistical evaluation of the occurrence of earthquakes in them (see [522]); parameters of earthquakes originated in Central and Eastern Europe (see [414]) or attenuation of macroseismic effects of earthquakes (see [R004]).

It was also necessary to consider the events that had an epicenter on the Czech-German border area or in some areas of the Czech-Austrian border region. In these cases, it was important to ensure that there were no events in the cross-border seismic source zones that were assessed in different ways. We tackled this challenge by including a step of harmonization and cooperation with colleagues from Germany and Austria in our plan.

The conversion of the chronical Kárník's catalogues to the parametric catalogue and its completion of missing earthquakes and events after 1980, including earthquake parameterization, required very time-consuming work with sources as well as finding suitable formulas to convert macroseismic intensity to moment magnitude. Therefore, some issues remained open, such as the revision of very large seismic swarms in West Bohemia/Vogtland region or the use of more IDPs processing methods in case of stronger earthquakes.

1.5 AREA OF INTEREST

Since the CZ-NEC is primarily designed for the evaluation of seismic hazard, it was necessary to consider the area of interest so that the revised catalogue would cover the area in which the seismic source zone of the Bohemian Massif could be delimited. Therefore, it has been defined the CZ-NEC polygon (see Fig. 5), which extends beyond the borders of the Czech Republic. In order to avoid complications, especially with the sorting of events, a rectangle defined by longitudes and latitudes has been used during catalogue processing. This rectangle extends between 48° N and 52° N and 10° E and 20° E.

The decision on the shape of the CZ-NEC polygon was based primarily on geological aspects. There have also been considered previously used models of areal source zones (see MÁLEK ET AL., 2018 - [R006] or GRÜNTHAL ET AL., 2018 - [R007]).

The basis for the definition of the CZ-NEC polygon was the outline of the surface occurrence of the Bohemian Massif as it is described in the Czech geological literature (see e.g. [360]) and as it is shown on the Geological map of Europe 1 : 5 000 000 (see [359]). It was also necessary to consider some shallowly covered parts of the Bohemian Massif, especially on the border with the Western Carpathian arc.

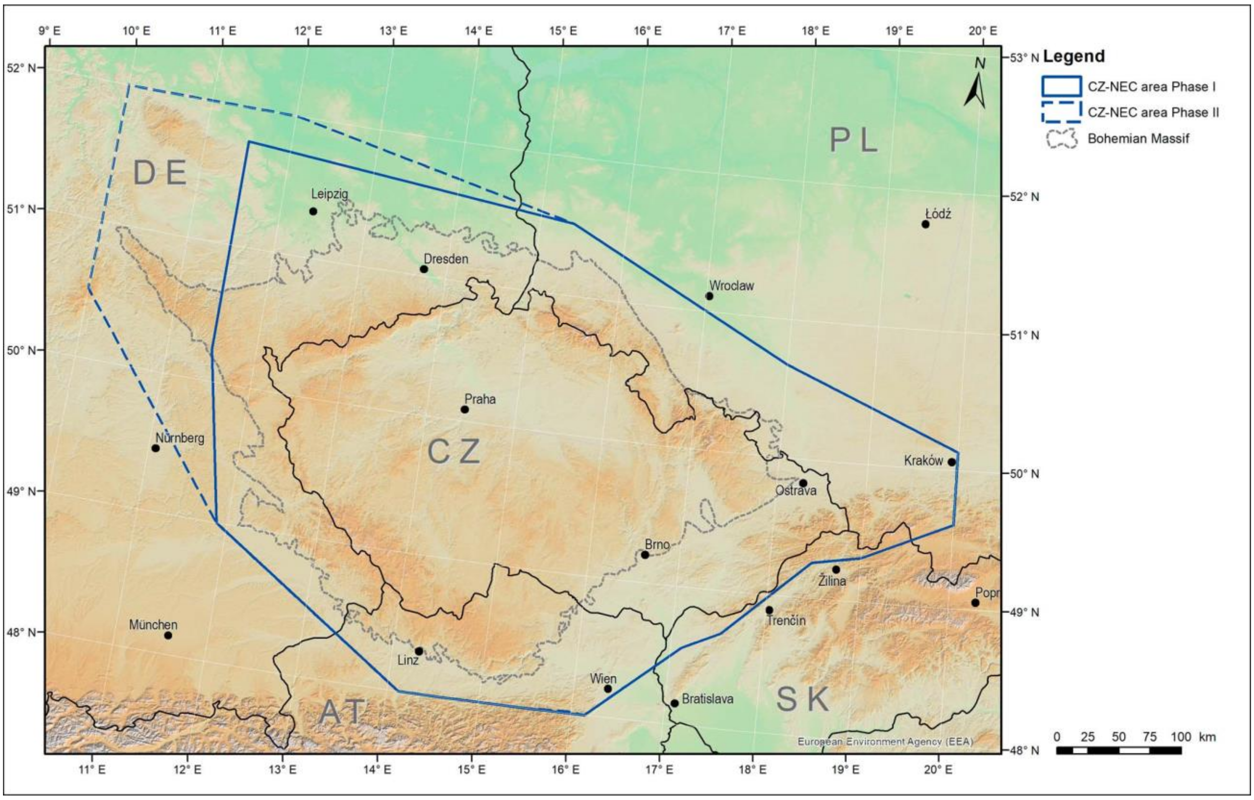


Fig. 5: Displaying the CZ-NEC areas of interest on the topographic map of Central Europe.

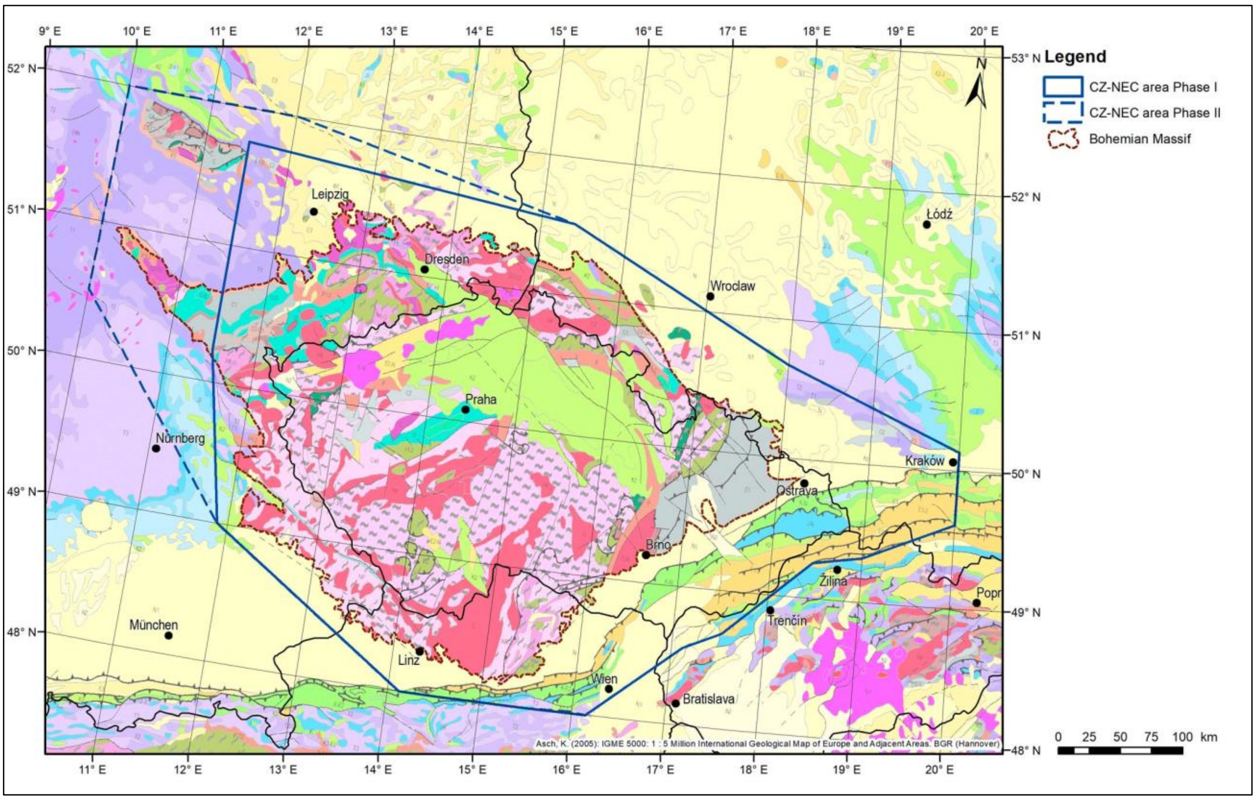


Fig. 6: Displaying the CZ-NEC areas of interest on the Geological map of Central Europe ([359]).

Therefore, in the southeast, the boundary of the CZ-NEC polygon was led along the boundary of the "Peripienian Lineament" fault zone (see e.g. [R006]). In the south, the existence of the South Bohemian Basement Spur, which is covered by Molasse and the Flysch-Helvetic zone, is assumed (see [361]). This Spur extends to the north-western border of the very active seismic source zones of the Mur-Mürz fault system and the Vienna Basin transform fault system. The southwest border of the CZ-NEC polygon was laid along the surface boundary of the Bohemian Massif to envelop the epicenters of weak earthquakes related to the Bohemian Massif (see Fig. 6).

In the west, the decision on the boundary of the CZ-NEC polygon was divided into two phases due to the narrow spur of the Thuringian Forest, which extends relatively deep into German territory (see Fig. 6). In the first phase, the events east of the 11.5 meridian (the boundary of the CZ-NEC Phase I polygon) were revised by the forces of the CZ-NEC team with the contribution of German colleagues. In the second phase, data from the German catalogue for events between 10 and 11.5 meridians will be taken over as soon as they are revised by German colleagues.

In response to the delimitation of the Vogtland-Leipzig source zone (see [R007]), running from the Czech Republic's border to Leipzig, the CZ-NEC polygon was extended to the northwest so that this zone was included in the CZ-NEC as a whole. The occurrence of a cluster of instrumentally recorded earthquakes in this zone (see Fig. 20) proved the justification for this expansion of the CZ-NEC polygon towards the northwest. Then the wedge of the Saxony zone with the Elbe fault system also had to be included in the CZ-NEC polygon (see Fig. 6).

In the north, the boundary of the CZ-NEC polygon envelopes the surface occurrences of granitoids of the Bohemian Massif. And in the northeast, the uncovered and covered part of the Moravian-Silesian block is included in the CZ-NEC polygon as well as the Brunovistulicum covered by the flysch nappes of the Carpathians (see Fig. 6).

The CZ-NEC polygon is decisive for the revision of the earthquake catalogue. Only events that had an epicenter inside the polygon were reviewed and included in a tabular form of the CZ-NEC catalogues.

1.6 RESEARCH PLAN

Work on the CZ-NEC catalogue took 3 years, from 06/2017 to 11/2020, and the work was divided into several stages:

1) **Preparatory works** that included digitization of the Kárník's catalogues, excerption of events (records) with the declared or likely epicenters on the Czech Republic territory and its close surroundings, as well as establishing of the Source Management.
2) **Collection of data sources** that includes downloading digital sources or data mining in archives and libraries, their scanning, creating a digital archive, and maintaining a list of sources (Part 2 - Source Management).
3) **Revision of historical earthquake entries** that included translating reports about earthquakes and their analysis, compiling so-called Event Sheets, discussing the credibility of sources and deciding on entry category: Catalogue row / FAKE / FELT-DISTANT EVENT / DOUBTFUL / SEE.
4) **Parameterization of historical (pre-instrumental) events** that includes determining the date and time of the event, its coordinate (longitude and latitude) of the epicenter, estimating the macroseismic intensity and magnitude, estimating the depth of the epicenter and determining the number of intensity data points (IDP).
5) **Compilation of a catalogue of instrumentally recorded events**, including induced events.
6) **Converting events to a table**, including a Fake event table.
7) **Harmonization of the CZ-NEC catalogue** with the catalogues of neighboring countries, especially Germany and Austria. And including preparatory works for the inclusion of CZ-NEC catalogue in the SHEEC one.
8) **Setting of the web application** based on MIDOP and ArcGIS Online, which will allow editing and supplementing the CZ-NEC catalogue.

2 DETERMINING THE SCOPE OF THE REVISION

The first step in the revision of the Kárník's macroseismic catalogue was to convert the printed text into a digital form that could be processed using a spreadsheet editor. OCR-converted text was subdivided into columns so that the event number, year, month, day, time, and event description were placed in separate columns. In this way, data from both Kárník's catalogues were prepared for further processing.

2.1 SORTING OF ENTRIES

Kárník's catalogue from 1958 contains 911 entries and the other from 1981 another 88 ones. Both catalogs recorded various events, e.g., local events with epicenter in the Czech Republic (in the present-day Czech Republic), in Slovakia and also beyond the borders of Czechoslovakia, as well as strong distant earthquakes that could have been felt in Czechoslovakia.

Performing this step required, for the most part, manual checking of individual records, at first using keywords like: Böhmen (Westböhmen, Ostböhmen, Nordböhmen, Südböhmen), Böhmerwald, Riesengebirge, Mähren, Gesenke, Schlesien, Sachsen, Vogtland, Erzgebirge and more. In the case of the 1958 catalogue, German variants of names had to be used, in the second case English ones. The use of keywords was only partially successful, so a manual check-by-case had to be deployed. Only in this way it was possible to exclude distant events, as the keywords were used to indicate where the earthquake was felt. On the other hand, it was necessary to add some events in the list, if they mentioned a place name from the Czech Republic that was not used as a sorting name. Conservatively, events from Saxony and Thuringia were included in the list, although later it turned out that they lie outside the CZ-NEC polygon.

The result of this step was a table indicating the events to be revised (see Fig. 7).

KMM	YYYY	MM	DD	hh	mm	ss	Lat.	Long.	H	I0	Mi	TEXT	CZ-NEC
K-001	460											„Zu Nürnberg wie auch fast in ganzem Deutschland ist ein erschrökliches Erdbeben gewesen" (siehe auch „Einleitung"). [237]	
K-002	471											Ein zerstörendes Erdbeben in Wien von grossen Gebäudeschäden begleitet. [76]	
K-003	768											?, Erdbeben in „ganz Bajoarien" [76].	Y
K-004	786											„Erdbeben in Teutschland, besonders in Bayern, in den letzten Monaten des Jahres", [21] wahrgenommen in Regensburg, wahrscheinlicher Herd im Alpengebiet [98, 114, 213].	Y
K-005	819											Erdbeben in Johunnum (in Westböhmen?), Dauer 28 Tage, Grosse Gebäudeschäden und Schrecken unter der Bevölkerung Böhmens [86, 285] (siehe auch „Einleitung").	Y
K-006	823											Ein Erdbeben in Sachsen bei Meissen, in Thüringen und in der Altmark [237]. „Bei dem Aarensee (Arendsee) in Ostsachsen erhob sich die Erde auf eine Meile und machte einen Wall in iner Nacht" [22, 98, 175].	Y
K-007	827											oder 828, Zerstores Erdbeben in Sachsen [234]	Y
K-008	867	10	8									Ausgebreitetes Erdbeben in Deutschland, genannt sind Lindau, Fulda, Melk, Worms und Mainz [76, 147, 237, 262].	Y
K-009	997											Ein Erdbeben in Mitteldeutschland, gemeldet aus Magdeburg, der Altmark und Sachsen [22,76, 98, 278].	Y

Fig. 7: Sorted events to be revised (Y = Yes) in the CZ-NEC column.

A complete table of events that have been revised, including comparative events from the Leydecker (2016) - [509], CENEC - [503] and SHEEC - [506] catalogues, is available at the hyperlink:

Kárník_CAT_For Review.xlsx

This table provides simple statistics showing the scope of revision of Kárník's catalogues. In the digitized version of Kárník's catalogs, the columns show the parameters of the inserted earthquakes, which were converted from text paragraphs to a table. The last column labeled CZ-NEC determines the type of event in terms of revision. The letter "Y" and a green highlight indicate events from Kárník's catalogues that have been revised. The letter "F" and ocher highlighting indicate events from Kárník's catalogues, which represent distant earthquakes (events outside the CZ-NEC polygon) that were felt in the Czech Republic. This marks the events for which entries are available in our source database. Empty cells without highlighting indicate earthquakes outside the CZ-NEC polygon, especially from Slovakia, which have not been revised. Of the 999 lines covering the period 460 - 1980/11/06, 64 earthquakes were felt, 586 events were revised, and the remaining 349 events were excluded from the revision. The felt earthquakes are also listed in the third sheet of the above-mentioned Excel spreadsheet. The second sheet shows a cross-comparison of Kárník's catalogues with the German catalogue of Leydecker (2016) - [509], CENEC - [503] and SHEEC - [506] catalogues.

2.2 COLLECTING SOURCES

When developing a catalogue revision approach, it was decided that all sources that KÁRNÍK ET AL. (1958; 1981) cites in References will be checked. It was also decided to study the notes on individual events prepared by E. Michal (see [181]), which are stored in the archives of the Geophysical Institute of the Czech Academy of Sciences (IG CAS). During the work on the catalogue, there was also no resignation of searching for “new” sources and going through Internet and library registers.

For this purpose, the Source Management Book and a special folder for storing files on the ftp server of the Institute of Physics of the Earth were established. This provided access to sources for all employees involved in work on the catalogue.

The Source Management Book is part of the project output as part 2. Links to sources are divided in the book as follows:

[001] - [304]	References mentioned by KÁRNÍK ET AL. (1958) - closed list.
[305] - [363]	Support sources & maps and auxiliary web sites.
[401] - [437]	References mentioned by KÁRNÍK ET AL. (1981) - closed list.
[440] - [456]	Online data (earthquake bulletins etc.).
[501] - [595]	Printed catalogues and studies on seismicity.
[600] - [1007]	Printed sources.
Appendix	List of digital registers

The sources were either downloaded from the Internet, mainly from the servers listed in the Appendix, or scanned in the libraries or archives that hold them. They were then uploaded to the ftp server of the Institute of Physics of the Earth.

3 METHODS OF DETERMINATION OF EARTHQUAKE PARAMETERS

Methods for determining parameters in the case of macroseismic earthquakes and earthquakes recorded by instruments are described separately. A somewhat specific group is formed by historical earthquakes, which have been preserved in the geological record, and historical earthquakes, whose parameters are determined by the analysis of archaeological sites. Since the geological record of the prehistoric earthquake was discovered also in the Bohemian Massif, this third group is also described in CZ-NEC (see Chap. 4.1).

3.1 PARAMETRIZATION OF HISTORICAL EARTHQUAKES

Parameterization of historical earthquakes is carried out on the basis of a two-stage procedure. The first step contains an evaluation of macroseismic data, which were successfully extracted from historical sources – chronicles, books, papers etc. Only **time**, approximate location and **macroseismic intensity** in the form of feelings of direct observers of earthquakes and earthquake damage to buildings can be derived directly from historical sources. Early instrumental records may also be available, but only from the beginning of the 20th century to the end of the 1970s.

In the second step, appropriate data processing such as calculations or deductive interpretations must be used in order to obtain more accurate **location of the earthquake epicenter**, **macroseismic intensity in the epicenter**, its **depth** and earthquake **magnitude.**

The following text describes the approach to the parameterization of historical earthquakes, which was used in the compilation of CZ-NEC. This approach includes both deductive interpretation and computer processing of macroseismic data. The decision as to whether an earthquake actually happened, its time, the determination of macroseismic data points (MDPs) and the intensity of the earthquake observed in them can only be done on the basis of a deductive interpretation of the information revealed in the sources. In contrast, determining the depth of the epicenter and the magnitude of an earthquake can only be done using some computational procedure. Both approaches can be used to locate the epicenter and macroseismic intensity in the epicenter. The choice of an appropriate procedure was usually based on the interpreter's experience, as well as on the amount and quality of available macroseismic data.

3.1.1 Deductive approach

The activities of the first step represent the most responsible part of the work on the catalogue of historical earthquakes. However, this step is very important, as its purpose is to select the events that actually happened and to separate them from fakes, doubtful events or other natural phenomena with a cause other than an earthquake. The results of this step are, of course, burdened by a great deal of subjectivism. The result is therefore one of the possible interpretations and it is useful from time to time to return to the interpretation of especially strong earthquakes.

The deductive approach is mainly based on very careful work with the sources and information they contain. That is why great care has been taken to gather as many sources as possible (see Part 2). The processing of sources then run through the so-called "Event Sheets", where all the information that could be extracted from the sources was recorded, as well as our observations, interpretations and conclusions that we made on the basis of this information.

3.1.1.1 Event Sheets

The event sheets had following fixed content:

Event sheet header (event number, date of the event)
1 Record type in the CZ-NEC
2 Text taken from Kárník's catalogue and list of all reference codes.
3 Full text references (summary of available unabridged information).
4 Discussion of knowledge and evaluation of the credibility of sources. Determining the type of event.
5 List of references.

Event sheet header

The event sheet header contained the event number that was taken from the KÁRNÍK ET AL. (1958) catalogue. If an event was found that Kárník does not mention the previous event number was supplemented by an extension **a, b**, and so on. The date was also taken from the KÁRNÍK ET AL. (1958) catalogue unless it was wrong. For events included in the catalogue, the correct date is given.

1. Record type

To show the type of record already on the title page of the sheet, the chapter "CZ-NEC record" has been placed under the header. It can be selected from the following options: **Catalogue row / FAKE / FELT-DISTANT EVENT / DOUBTFUL / SEE…**

2. Kárník's catalogue reference

In this chapter a short table is presented in which the first line gives an unabridged description of the earthquake taken from Kárník's catalogue, including the date and time. The second line lists the source codes quoted by Kárník. The third line shows the codes of the newly acquired sources.

3. Full text references

This chapter provides clippings from each source in the original language and translations of these passages into English. This approach was consistently chosen for older earthquakes, approximately until the end of the 17th century. For newer events, the combined approach was chosen. Both clippings and extracts from the text, when they were multi-page publications, were used. The clippings were used in order to make the original text available to eventual followers. The clippings and their translations were linked by an accompanying and explanatory text in many cases.

The following types of sources were used if they would be divided in terms of origin and form:

1) Manuscrips - handwritten text from that time

   This type of sources was not very common. Manuscripts were studied only in cases where their transcription into printed form was not available. Manuscripts were written in Latin or in old forms of German and Czech and added to this by Kurrent (Kurrent is an old form of German-language handwriting based on late medieval cursive writing). The cracking of these texts was very difficult and time consuming and often required the help of archivists to be read.

2) Transcriptions of early medieval texts

   Early medieval texts, especially monastic chronicles from the Carolingian era and the first centuries of the new millennium, have been preserved in the form of manuscripts written in Latin. Since the mid-19th century, these texts have been made available through editions of historical sources such as: Monumenta Germaniæ Historica [MGH], Monumenta historica Bohemiæ or Monumenta Poloniæ historica (Pomniki dziejowe Polski). In these editions, which are freely available for download on the Internet, transcripts of manuscripts in the original language (in Latin) are published and very often the texts are accompanied by valuable notes and explanations. On various web sites (see e.g. https://www.wikipedia.org/, http://www.manuscriptorium.com/cs, https://www.geschichtsquellen.de/index.html or https://referenceworks.brillonline.com/browse/encyclopedia-of-the-medieval-chronicle) it is then possible to find information about the time in which the original manuscripts were written and about the authors of these texts. Such information was very useful for assessing the credibility and authenticity of records.

3) Early Printed Books (≈ 1450 – 1800)

   Early printed books form a large group of sources. It is a very varied collection of sources that includes chronicles (e.g. Hajek's Kronyka Czeska from 1541 - [086-1]), various books on strange phenomena and signs (such as Lycosthenes, 1557. Prodigiorum ac ostentorum chronicon - [654-1]), various calendars or books about earthquakes (e.g., Beuther, 1601. Compendium Terraemotuum - [022]). In some books, references were made to older sources, which made it possible to gradually work towards sources close to the earthquake. On the other hand, these books were full of inaccuracies and errors, and it was necessary to carefully consider their credibility. An example of this is Hájek's Chronicle of Bohemia, which was critically reviewed by Gelasius Dobner in 1761-1782 (see [058]).

The processing of these sources has been made more difficult by writing in old forms of German (in some places very garbled language) or Czech and added to this they were printed by Schwabacher. German-written texts were sometimes difficult to translate due to the use of regional or local dialects and so it was necessary to use specialized dictionaries, general (see e.g. [DWG] - Das Deutsche Wörterbuch von Jacob Grimm und Wilhelm Grimm: https://www.dwds.de/wb/) or e.g. mining. Similarly, old Czech texts were translated using a specialized dictionary (see [WV] - The Web Vocabulary to learn historical Czech: https://vokabular.ujc.cas.cz/informace.aspx?t=ridics-en&o=ovokabulari).

These texts, although converted by OCR, could not be used for automated data mining. On the one hand, reading letters written by Schwabacher did not work very well, and on the other hand, many words were used to denote an earthquake, often garbled. At least 4 terms were used in Latin only: terraemotu, terraemotus, Terrae motus, Terre motu(s). In German, a number of curious garbled words of »Erdbeben« were found: Erdbidmẽ, Erdbidem, Erdbidmen, Erdbiden, Erdbide, Erdbidm, Erdpiden, Erdbibe, Erdbibem, … or its synonyms as Erdstoß, Erderschütterungen, Erdschütterung. Old Czech used the word »Zemietřesenij« and in Polish it is written as »trzęsienie ziemi«.

When these texts were translated into English, there was an effort to preserve the original composition of the text. In some cases, this was difficult to maintain, as the originals were written in old language forms of German or Czech. It was considered important to preserve the content accuracy of the message, sometimes at the expense of the grammatical purity of the translation.

4) Printed Books after 1800

Printed books after 1800 are another very large group of sources. Two types of resources should be highlighted: the chronicles of the cities and the books about earthquakes that were the predecessors of the earthquake catalogues, as well as the articles on individual events. The quality of these sources varied. If they described events of that time, they were a relatively credible source. Much worse quality was observed when they described long-past events without citing sources. Many earthquake catalogues thus contained a few erroneous and unsubstantiated information.

5) Newspapers and journals

The first newspaper articles on earthquakes appeared as early as during the second half of the 18th century. Reports found in them were used as additional source of information in deciding whether it was indeed an earthquake or another, such as a meteorological phenomenon, or to specify the date or area of observation. Digitalized resources were used, especially on the Czech portal www.digitalniknihovna.cz/ or on the server of the Austrian National Library http://anno.onb.ac.at/ - AustriaN Newspapers Online. Newer newspapers, in the Czech digital library since 1918, in the Austrian since 1949, are subject to copyright law, so they are not available online on the Internet and the relevant information had to be found directly in libraries. As today, older newspaper articles should be used with caution. Some articles were misinterpreted by a later author, and in such cases, the opportunity to see the original newspaper article helped to correct identification where the earthquake was observed, for example.

Earthquake observations published in various scientific journals were a welcome source of information, as they often provided detailed information on observations in individual municipalities (see e.g. [292] or [254]).

6) Chronicles, letters and other written reports on earthquake observations stored in archives and museums.

Many written records of earthquake observations are hidden in archives and museums. Only a small fraction has been found and published by archivists or researchers working with archival collections ([561] or [624]). Some reports, such as municipal chronicles or registries, could be traced through the digitization of archival collections.

7) Reports on earthquake observation stored in the Macroseismic archive (see [008] and [404]) of the IG CAS.

The Geophysical Institute of the Czech Academy of Sciences (IG CAS) is a direct successor to the State Institute of Geophysics founded in 1920. Since this year, the Institute has been collecting all macroseismic questionnaires and reports from citizens about earthquake observation. These documents cannot be taken out of the institute, but the opportunity to inspect and copy them was very helpful.

Some earthquakes, especially the medieval ones, have been described in many sources; in those of that time and gradually, entries appeared in younger and younger sources and were also included in the first chronicle catalogues. In this chapter, the task was not only to find the so-called primary source, but also to identify other independent sources. This task was very closely related to the verification of the credibility of sources described below. In some cases, this scrum of independent sources and various, more or less faithful younger copies was unraveled using a genealogical tree of sources.

4. Discussion

The primary purpose of the discussion was to decide on the **type of record**. It was crucial to recognize the records of earthquakes that really occurred from the fake one. If the sources described the earthquake plausibly (i.e., the earthquake was most likely to happen), then an effort was made to gather as much information as possible about the time, location, and macroseismic intensity of the earthquake, as well as about as many IDPs as possible. Huge efforts were also needed to verify the credibility of sources.

As already indicated above, the approach to the discussion was also different when considering records of earthquakes from the Early Medieval to Early Modern Period or records of events from the 18th to the 20th centuries. Although much of the knowledge mentioned above also applies to more recent earthquakes. Date errors, misspellings, or misinterpretations, such as poor translation, often occur in secondary sources as well as the appropriation of earthquakes observed elsewhere or the overestimation of observations. Phenomena of different origin - tornadoes, windstorms, landslides, meteorites - were sometimes confused with earthquakes. Thanks to the existing catalogues (AHEAD, Austrian and German catalogue), it was possible to pair some local observations with strong regional earthquakes. It is always necessary to try to find the primary source from which later authors took information. It is a bit easier in the last century because many authors mentioned it. Most of the 20th century earthquakes were also well documented and analyzed. However, the origin of some events has not been clarified and many remain without parameters.

Finally, the type of entry is always determined at the end of the discussion. This type is then written in the event sheet header. The purpose was to identify earthquakes to be included in the CZ-NEC.

If it is decided that the discussed event will be included in CZ-NEC, then all earthquake parameters that could be derived from sources are recorded in the table, including information on key sources or source catalogue. Remote events, as well as events erroneously falling within the CZ-NEC polygon, are recorded in the table of “recognized” earthquakes. The form of both tables is the same.

5. References

This chapter lists all the sources that were used to compile the Event sheet. The reference codes correspond to the codes used in Part 2 - Source Management.

3.1.1.2 Deduction of earthquake parameters from sources

Determining the time

Determining the time at which the earthquake occurred is a little complicated only for medieval earthquakes, especially those that occurred before the end of the 17th century.

The seemingly simple determination of the **year** can be complicated by the fact that the author used »**Year After Creation**« (Anno Mundi). This calendar was used e.g. by twelfth-century Byzantine historian Georgius <Cedrenus> in »Sive Historio Ab Exordio mundi ad Isacium Comnenum usque Compendium« (printed in 1566 - [766]) or by German Protestant pastor and theologian Leonhard Krentzheim (1532-1598) in his »Chronologia« from 1577 (see [779]). This calendar was combined with indiction cycles (An indiction is any of the years in a 15-year cycle used to date medieval documents throughout Europe, both East and West [W]). These sources were very useful in the discussion of the 11th century earthquakes that was supposed to be in Bohemia. Fortunately, it was determined that these authors used the Byzantine calendar (see [CY]), so it was possible to pair these earthquakes with the earthquakes that occurred in Byzantium and the Middle East.

The **date** was expressed in early medieval sources using a lunar (Roman) calendar that counted inclusively forward to the next one of three principal days (Kalends, Nones and Ides) within each month (see [315]).

When determining the date, it was necessary to consider the transition from the Julian calendar to the Gregorian calendar, too. This was actual after 1582, when Pope Gregory XIII. issued the bull *Inter gravissimas* to correct the inaccuracy of the leap years of the Julian calendar. The difficulty in determining the date was due to the gradual introduction of this correction by countries in the coming years. In the Catholic countries of the Holy Roman Empire (including the Archduchy of Austria) this change took place as early as 1582, in the Bohemian Kingdom in 1584, exceptionally in 1588 in Kadaň, but in the Protestant countries of the Holy Roman Empire the calendar changed only in 1700. In the books of some Czech Protestant clergy (e.g. Havel Žalanský-Phaëthon - [303]) one can find the use of the Julian calendar even at the beginning of the 17th century.

A very common way of determining the date, which is used in medieval books, is to determine the day according to the *proprium de sanctis* (a calendar containing the feasts of the saints that are tied to a specific date) or according to time relationship to the Christian festivals (Easter, Pentecost, Birth of Jesus Christ etc.).

The counting of **time** in the Early and High Middle Ages was also very complicated. In monastic chronicles, time is counted depending on Canonical hours (see [CH]). Canonical hours mark the divisions of the day in terms of periods of fixed prayer at regular intervals.

Many records, however, only describe time by daytime, such as at noon, at evening, and at night. Sometimes specific hours are given in Latin texts, where parts of the day are called "horae" (see e.g. [327]). For the time to be precisely determined, the text must state whether it was day or night. Because the so-called Roman time consisted of 12 hours by day and 12 hours by night and counting always started at sunset and sunrise, respectively. This counting of time remained until the 13th, somewhere until the 14th century, when mechanical clocks began to appear ([327]).

On mechanical clocks the time was counted in two ways, on the whole clock face (1 - 24 hours) or on the half of the clock face (2 x 1-12 hours). In Bohemia, the first method, the so-called Czech clock, was used until the half of the 17th century. The first Czech hour always came after sunset. But that meant that the beginning of the first Czech hour changed during the year (i.e. between 4 p.m. and 8 p.m. with quarter-hour division). According to German hours, the day began at midnight. For more details see [327].

Despite some complications with time conversion, time can be more or less accurately determined, although not always as a complete detail. With respect to compatibility with other catalogues, time is given in Coordinated Universal Time (UTC). The time offset from UTC to local, Central European Time (CET) can be written as UTC+01:00.

Determining the macroseismic intensity

As stated in Chap. 1.2.1, KÁRNÍK ET AL. (1958) expressed macroseismic intensity in the Mercalli–Cancani–Sieberg scale if the numeric value is specified. In a later catalogue, Kárník et al. (1981), the MSK-64 scale is used, too (see Chap. 1.2.2). This scale (MSK-64) was also used by D. Procházková to express macroseismic intensity in her publications (see e.g. [413] and [414]), which have been used by authors of CZ-NEC. The MSK-64 scale is used essentially up to now, although officially the EMS-98 scale applies. This may be because there are no differences in MSK values and EMS values ([R015]), if the MSK values were correctly assigned (cf. [R008] and [R017]).

Estimation of macroseismic intensity in the IDPs

Macroseismic intensity for IDPs in the form of feelings of direct observers of earthquakes and earthquake damage to buildings can be derived directly from historical sources. The numerical value of the intensity (in integers) is then determined by comparison with the macroseismic intensity scale, that is usual in the region.

It is not always easy to do this. It is especially very complicated to do this for most medieval earthquakes. This is mainly because the descriptions of the earthquake manifestations that appear in medieval sources are of poor quality and certainty. R. Musson ([R012]) wrote that it is necessary to ask two questions when evaluating the intensity of an earthquake based on historical records:

- → how well one can trust that the value is a true reflection of what really happened? = Quality.
- → how well the data fits the scale? = Certainty.

In a slightly modified form, these questions were used by W. Brüstle ([R016]) in the guidance on how to assess macroseismic intensity for IDPs according to EMS-98 scale in SW Germany. His questions are as follows:

- → how well do the data fit what happened? = Quality.
- → how well do the data fit a degree of the scale? = Precision.

Estimation of macroseismic intensity of medieval earthquakes in the IDPs

As the experience with sources of medieval and early modern earthquakes in the Bohemian Massif shows, these sources are, with some exceptions, essentially lacking information value. It can be sensed that the quality of the information increases with the intensity of the earthquake described. Especially when damages are described, many details can be found. Of course, these damages are described in somewhat different terms than those on the macroseismic scales and so one can have a problem with precision. Descriptions also improve as time goes by, especially when the first macroseismic scales appeared.

The problem of missing information and its poor quality was solved by W. Brüstle ([R016]) by developing a **flag** system. Thus, he uses flags instead of intensities and distinguishes between felt flags and damage flags. He assigns flags with a certain phrase, which then corresponds to the numerical value of intensity in the EMS-98 scale. A similar approach was used in the compilation of the Italian earthquake catalogue CPTI15 to describe intensities with large uncertainties (see [527-3]). They call them „Non-conventional descriptive codes“.

Brüstle’s Guideline was primarily useful for evaluating earthquakes from the 17th to 19th centuries. In their descriptions could be found close phrases, as W. Brüstle using in his “flags”. The felt flags (see [R016]) or SF/F/HF codes (see [527-3]) were mainly used, as earthquakes with some damage rarely occurred in the Bohemian Massive.

For earthquakes before the 16th century, it was necessary to deal with some other pitfalls. Primarily, it was necessary to create a tool to evaluate the effects of an earthquake based on such words as horrible, petrifying, terrible, i.e. words that were used by a medieval man. And how to translate these words into today's macroseismic intensity scale.

It was almost impossible to find the exact transfer key, but it should be remembered that medieval descriptions have often exaggerated the true manifestations of the earthquake. In these texts are often found the phrase: “*There was a terrible earthquake ... it caused fear and horror ... but fortunately, it didn’t bring any damage*”.

Such an expression can be interpreted as follows. On that place, the earthquake was actually felt. But since it was believed that every earthquake is a manifestation of God's wrath, in the minds of men it was automatically associated with something they feared, something terrible. But the earthquake was not entirely negligible, because people thought it necessary to record it. Such an earthquake would probably be rated today as having an intensity of 4°-5° MSK-64 (EMS-98). Compare Brüstle’s felt flag 2 (strongly felt) - [R016].

Estimation of macroseismic intensity of recent historical earthquakes in the IDPs

If records of recent historical earthquakes are evaluated, i.e. earthquakes from the 19th century up to the digitally instrumental period, it is possible to observe a considerable refinement of the description of how the earthquakes manifested itself.

At the turn of the 19th and 20th centuries, the first specialized publications on earthquakes appeared. The territory of the former Austro-Hungarian Monarchy was monitored by the "Kaiserlichen Akademie der Wissenschaften" which began publishing the so-called “Mittheilungen der Erdbeben-Kommission” in 1897 (see [001] and also [002]). These specialized articles on significant earthquakes and the annual reports on recorded earthquakes in the monarchy were an important source of information about earthquakes and their manifestations (including intensity).

At that time, the system of macroseismic questionnaires began to apply. At first on the basis of correspondents from the ranks of teachers and other publicly active persons, later also with the involvement of the general public and using pre-prepared forms (see [008] and [404]).

Estimation of epicentral intensity

Since it is likely that there will be no observation at the epicenter itself, especially in the case of medieval earthquakes, it is necessary to find some way to derive the intensity at the epicenter. It should be noted that this issue is also closely related to the issue of epicenter location, which is described below.

The basic condition for estimating epicentral intensity is a data set of parameterized IDPs. Thus, the points for which the localization is known (and can be written in the form of coordinates) and where it was possible to estimate the intensity in the form of a number, as a minimum (see [R008]).

Determining the earthquake epicenter and epicentral intensity

A pure deductive approach was preferred in cases where the epicenter and epicentral intensity were determined for medieval earthquakes and earthquakes from early modern times.

Ideas and approaches

This method has proved to be much more effective than numerical procedures, especially in cases where earthquakes have been discussed about which there was little information or where there were many doubts about what the sources actually say. It was these doubts, as well as our interpretation of very often poor information, that we tried to record in the Event Sheets.

Therefore, the clippings were also supplemented with a few notes and explanations. The purpose of these comments and numerous footnotes was to provide, together with the message, more detailed information about the author of the text, the period and geographical context, and the perception of the circumstances in which the earthquake occurred by people of that time. Understanding this historical and religious context was very important, especially for the discussion of such earthquakes. Because it was the earthquake that caused the horror of a medieval man, as well as comets, meteorites, storms, locusts, floods or plague. Earthquakes, as well as other disasters were perceived as a manifestation of the wrath of God and were therefore the subject of a series of books on strange phenomena and signs (prodigia in Latin), as well as preaching in churches. Therefore, in these books we find little information about the manifestations and effects of the earthquake, because preachers were more concerned with the lesson and moral admonition for faithful people.

We would not be able to develop these considerations without the kind and collegial help of a number of historians, archivists and employees of regional archives and museums, who willingly provided us with consultations.

The deductive approach also emerged to be necessary because an area of low seismicity was evaluated, where strong earthquakes are rare. Sometimes, even for stronger earthquakes, only one IDP was available. It was also uncertain whether this place was where the earthquake was felt or whether it was the place where it was recorded (like a monastery), because no one was able to do it closer.

These circumstances, and many others, had to be considered when determining the time, location and intensity of the earthquake, as well as the credibility of the source was checked. It is difficult to present a very clear manual on how to do this task. Experience and historical overview certainly play an essential role. But also, some degree of subjectivity is present.

Although the circumstances under which medieval sources were created were at least somewhat understood, it nevertheless proved necessary to verify the credibility of such sources.

Undoubtedly, the most credible sources are eyewitness statements and sources from that time. If an author writes: “*when I was there or there, I experienced an earthquake*”, it can be believed that he had experienced an event (but it may still be unclear whether it was really an earthquake). Therefore, great care was taken to determine when the message was written and who wrote them.

It is not always possible to reveal the source of that time and there is nothing else than to use a slightly younger source. Of course, such sources are valuable, but some pitfalls that accompany their use must be considered:

- Swelling of message. A brief report swells for more details as time goes by and as it is passed on and on. The manifestations and consequences are escalated as the report is copied by next author.
- Adding more disasters. The message, that originally spoke of a windstorm, is enriched by an earthquake or an earthquake and a plague in the next copy. Very often, windstorms and thunder were also spontaneously associated with the earthquake.
- Distortion of message. The message that the houses were shaking during a thunder will appear later as a report of miserable weather and earthquake.
- Appropriation of earthquakes. The laconic message "*This year was a strong earthquake*" was taken over to another chronicle and in it, the word “here” is added to this sentence.
- Distant earthquakes. It may seem relatively easier to distinguish the strong distant earthquake that was felt from the weaker local event. But it is when the "parent" earthquake can be identified. Sometimes, however, these earthquakes are not even known in the countries where they occurred, and national earthquake catalogues do not list them. There is a suspicion that many earthquakes that have been felt in Moravia, are related to the Eastern Alps earthquakes, but they have not yet been recognized.

In general, the credibility of the sources decreases depending on the time delay with which the message was reported (*it was said that there was a strong earthquake* ... and is meant hundreds of years ago). But not all messages that were reported with a time delay should be rejected. If the original sources are well cited, these reports can also be credible. For some sources, it is possible to rely on how historians evaluate the credibility of the source (an example may be the problematic Hájek's Chronicle ([086] and its criticism written by Gelasius Dobner - [058]). A simple check can also be carried out by us when comparing the accuracy of other information in the message, especially the timing or whether the historical events and acts of prominent persons correspond to the historical knowledge.

The lessons learned from the above experience can be summarized in three simple principles: going as far as possible to the original sources of that time / considering each word in the message and checking other information unrelated to the earthquake / empathize with the thinking of the medieval man and his work.

The approach taken in creating the historical part of CZ-NEC builds on the same or very similar ideas as Brüstle’s Guideline and on Italian system of Non-conventional codes.

<u>Procedures used</u>

It is very difficult to find a universal method to determine epicenter and/or epicentral intensity in cases when only one or a few MDPs are available. After all, it is common practice for catalogue creators to find their own way (cf. [R011]).

There were most cases where very little data was available when CZ-NEC was compiled, and it was clear that the computational procedures are essentially not applicable. In such cases, a pure deductive approach was used in CZ-NEC. As described above, this approach is based primarily on a thorough analysis of the information that provides the sources and consideration of all the earthquake-related circumstances. However, if one would like to be strictly professionally correct, one could not dare to set an epicenter and/or epicentral intensity for most of the medieval earthquakes. Despite all the uncertainties, an attempt should be made to estimate the epicenter, if the data allows at least a little. When we interpreted such earthquakes, it was important to us to carefully consider all pros and cons and also to decide whether we can dare to determine the location of the epicenter and I_0.

This attempt was made within the CZ-NEC in a few cases of relatively stronger (meant in terms of the Bohemian Massif) medieval earthquakes. There was an effort to capture possible infrequent moderate and large earthquakes that can rarely occur in intra-plate regions, where no or insignificant seismicity is observed today (see e.g. [R001]).

Interpretation of such earthquakes, and indeed many weaker ones, has many pitfalls. Of course, the lack of reliable IDPs is a significant complication. Much more important is the fact that it is often not clear what the particular IDP actually represents. It should be considered that in the Early Middle Ages the places where the mention of earthquakes could be registered (monasteries, centers of power, important mining centers) were relatively distant from one to another. There is therefore no certainty that the place of registration is also the place where the earthquake was felt with a given intensity. It should also be considered that the monasteries were in lively contact with each other, often across orders, as shown by nearly identical records in monastic annals, although these monasteries were quite far apart. It is almost certain erroneous if one places the epicenter halfway between such IDPs or places it at the point where the earthquake was recorded. Unfortunately, even such cases can be seen in some catalogues.

For weaker earthquakes but only a single IDP is very often available. Simply because the earthquake was not felt at a greater distance, or it was so weak that there was no compulsion to record it. Such situations are solved by some catalogue-makers by automatically placing the epicenter in areas where today's seismicity is concentrated, or at the nearest fault. Sometimes this approach can be used, but it should not be the rule. It should be borne in mind that by using the approach described above, the epicenter could be pushed away from the correct location. If one dares to do it, it should be well thought out and substantiated and be made transparent.

However, for some events, determining the epicenter has not been possible with every effort. These events are marked as "**Without the ability to location"** in the Event sheets.

Considering the above, we must reconcile with the fact that epicenter position and epicentral intensity of medieval earthquakes are sometimes very rough estimates.

3.1.1.3 Computational procedures for determining earthquake parameters

Beside deductive approach, a number of computational procedures were available, which were used by Kárník and his co-workers and successors. To determine the epicenter, epicentral intensity, and depth they used isoseismal maps (see [413]) that were developed within the KAPG project (i.e. project of the Commission of the Academies of Socialistic Countries for Planetary Geophysical Research). The basis for the construction of isoseismal maps of earthquakes with epicenters on the territory of former Czechoslovakia was the parameters of IDPs, as reported in earthquake catalogues KÁRNÍK ET AL. (1958) - [401] and KÁRNÍK ET AL. (1981) - [501]. Of course, isoseismal maps of the events for which data was not sufficient are missing in this set. The formulas of KÖVESLIGETHY (1907) - [R018] and of BLAKE (1941) - [R019] were used for determining the epicentral intensities, focal depths and absorption coefficients by PROCHÁZKOVÁ AND DUDEK (1980) - (see [414]). In the same way also proceeded G. Leydecker creating German earthquake catalogue (see [509]).

Although MUSSON AND CECIĆ (2011) - [R008] warn against a certain subjectivity which is reflected in creation of the isoseismal maps and suggest other procedures of the direct use of the IDPs distribution (see e.g. [R002] or [R003]), this approach was used in CZ-NEC. We thought so that isoseismal maps created by D. Procházková are still very valuable today and they are well acceptable, at least at this stage of the revision of Kárník's catalogues. Unfortunately, no evaluations of uncertainties are available, so it was always necessary to confront these maps with information obtained from sources. It is also necessary to mention one newer method of rendering isoseismal maps published by the Czech seismologist Zdeňka Šenková, who describes the plotting of isoseismals using the Kriging method (see SCHENKOVÁ ET AL., 2007 - [R005]).

In many cases, our predecessors processed IDPs into an isoseismal map and this map then they used to determine the epicenter. This procedure represents the classic method how to solve this issue. The contemporary literature describes a number of rules on how to find an epicenter (see overview in [R011] or [R003]). PROCHÁZKOVÁ AND DUDEK (1980) - (see [414]) used a definition, according to which the macroseismic epicenter is "*the center of gravity of the isoseismals with the highest intensity*". Usually, however, several approaches are used by the evaluators, the most appropriate one being usually chosen depending on the circumstances and knowledge of the earthquake area (cf. [R008]).

Determining the earthquake epicenter and epicentral intensity

When compiling CZ-NEC, we preferred, if possible, the use of the results of the work of our predecessors. We used this approach when there was any reason why older data should not be accepted. Otherwise, the resulting determination of epicenter coordinates and/or epicentral intensity had to be corrected depending on the performed interpretation of information from sources.

Earthquakes whose magnitude is higher than the minimum magnitude threshold used in the SHEEC catalogue are likely to be re-evaluated by some of the more recently used methods before they are offered to SHEEC.

Part of estimating macroseismic intensity, whether or not isoseismals rendering is used, is the presentation of intensity data of individual IDPs or epicenter. The above mentioned KAPG project used different proportions of small, monochrome circles (see [413]), as shown in Fig. 8.

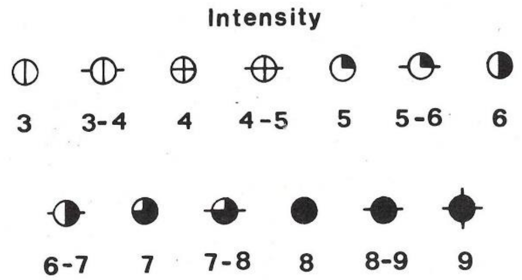


Fig. 8: Intensity symbols used in the KAPG project (see [413]).

A newer, colorful set has been created within the EC Project NERIES Networking Activity 4 and it was intended for covering as much as possible the intensity ranges used in Europe. It is also used by AHEAD (European Archive of Historical EArthquake Data) – see Fig. 9.

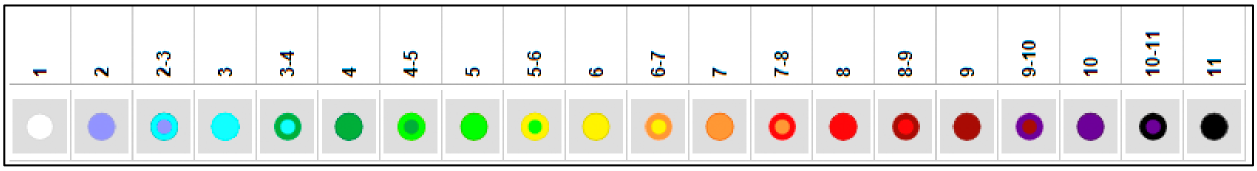


Fig. 9: Intensity symbols used by AHEAD.

Both sets of symbols were used in CZ-NEC. KAPG symbols, if isoseismal maps have been taken over from [413], resp. AHEAD symbols, if isoseismal maps were created within CZ-NEC.

Depth

Depth, or the position of the hypocenter, is a very important parameter, too. There are various methods for estimating depth from intensity data, which are essentially derived from the work of KÖVESLIGETHY (1906) - [R020]. MUSSON AND JIMÉNEZ (2008) - [R003] noted that this method is appropriate for use with small earthquakes because it assumes that source dimensions are insubstantial. In contrast, they consider that the method is not suitable for large surface-rupturing earthquakes. There are only a few earthquakes that are known to have surface rupture or could be strong enough to do so, in the CZ-NEC polygon.

<u>Traditional Czech approach</u>

This issue was also solved by V. Kárník and his colleagues in former Czechoslovakia. The formulas of KÖVESLIGETHY (1907) - [R018] and of BLAKE (1941) - [R019] were used for determining focal depths and absorption coefficients by them (see e.g. [414]).

PROCHÁZKOVÁ AND DUDEK (1980) - (see [414]) processed 309 historical earthquakes with epicenters in Central and Eastern Europe from the period 1443 - 1976 and for these earthquakes they determined in addition to the coordinates of the epicenter and I_0 also the depth and parameters of α (anelastic attenuation coefficient) and k (scaling constant). Many of them had an epicenter in the CZ-NEC polygon and therefore this data can be used for comparison.

In addition to the evaluation of many earthquakes, publication [414] also includes evaluation of a number of focal regions in terms of average depths, α and k parameter ranges and radii of isoseismals depending on azimuth. A larger set of focal regions were processed by D. Procházková two years later (see PROCHÁZKOVÁ, 1982 - [R004]). These results are also very useful (see Table 1) because they call attention to a possible approach by determining focal depths for individual regions.

Table 1: The average depths of the focal regions related to CZ-NEC (the number of isoseismals used is given in brackets, if indicated by the source). Taken from the publications [414] and [R004].

Name of the Focal region	Average depth in km / mean value of α / k D. Procházková - [414]	Average depth in km D. Procházková - [R004]
Ore (Krušné) and Fichtel Mountains (Smrčiny)	7 (146) / -0.0018 / 2.9	
Environs of Kraslice		5
Environs of Komořany	9 (3) / -0.002 / 2.9	9
Giant Mountains (Krkonoše) Hronov-Poříčí	7 (6) / 0.0054 / 3.3	7
Bohemian Forest (Český Les) South of the Bohemian Massif	5 (1) / 0.002 / 3.0	
Environs of Opava	6 (9) / 0.003 / 3.1	6
Environs of Strzelin	8 (1) / 0.008 / 3.4	8
High Ash Mountains (Hrubý Jeseník)	10 (1) / 0.004 / 3.1	10
Western Beskids (Beskydy) Mountains	20 (2) / 0.003 / 3.4	10
Eastern Beskids (Beskydy) Mountains	20 (1) / 0.001 / 3.1	20

German approach

G. LEYDECKER [509] used the same method as D. Procházková to estimate focal depths for earthquakes in the German earthquake catalogue from isoseismal radii using the formulation of SPONHEUER (1960) - [R034] of Köveslighety's equation. For the use in probabilistic seismic hazard analyses he introduced the concept of "characteristic focal depth in a focal region". G. Leydecker used a set of 65 instrumentally recorded earthquakes with specified local magnitude (4.5 ≤ M ≤ 7.1) and depth (< 3 km). He used such a procedure that the energies were calculated using the formula $\log_{10}E = 1.5{*}Ms + 11.4$ (see [R021], resp. [R022], p. 366) for the earthquakes in individual focal region and added up according to the focal depth. Table 2 shows the Leydecker's values for focal regions related to CZ-NEC.

Table 2: The characteristic depths of the focal regions related to CZ-NEC taken from [509].

Name of the Focal region	Characteristic depth in km G. Leydecker - [509]
Central part of the Bohemian Massif	5
Vogtland	10
Central Saxony	10
Bohemian Forest (Český Les)	5

CZ-NEC approach

The values of the characteristic depth in the focal regions, which were published in sources [414], [R004] and [509], were compared with the map of the distribution of focal depths for instrumentally recorded earthquakes from 2000-2018 (see Fig. 10). A similar picture showed the evaluation of instrumental events from the 1950-1999 period, but the number events was significantly less (see Fig. 11). The new data allows for more precise specification of focal regions with different characteristic focal depths (see Table 3).

Table 3: Focal depth statistics by focal regions.

Region	Number of events	Median [km]	Range [km]
(1) Auerbach-Leipzig zone, Germany	509	6 / 15	4-6 / 13-15
(2) Kraslice – Nový Kostel - Vogtland	12 510	9	9-11
(3) Bohemian Forest	81	9	8-12
(4) Southern part of the Bohemian Massif	298	6	4-9
(5) Nord-East Moravia	245	16	15-17

Focal depth statistics showed that for some regions the characteristic depths were determined very similarly by previous authors, but for some focal regions large deviations were found (see also Fig. 12).

The depths in the Auerbach (Vogtland) - Leipzig zone appear to have a bimodal distribution with peaks at 6 and 15 km (see Fig. 10, Region 1). A good match between older estimate in [509] and new data was shown in the zone Kraslice - Nový Kostel – Vogtland (see Fig. 10, Region 2), where the median of depths lies at 9 km and a depth of 7-14 km was recorded in 95% of cases.

In other regions, however, it is not possible to compare new data with Procházková's or Leydecker's data, because these authors worked with much smaller data sets (see e.g. Table 1). PROCHÁZKOVÁ ([414]) estimated average depths in some regions even from isoseismal maps of one or only a few events.

In the region of the Bohemian Forest (see Fig. 10, Region 3) the hypocenters are laid at a depth of 9 km. The focal depths appear to be in range between 8 - 13 km. In the south of the Bohemian Massif (see Fig. 10, Region 4). The hypocenters are mostly located at a depth of 6 km, but the range is relatively wide 4-9 km in this region. In the north-eastern region of the Bohemian Massif, in the Upper Morava Valley, Jeseníky Mts. and in the Odra Highlands, greater focal depths in a narrow range of 15-17 km were observed (see Fig. 10, Region 5).

It is very difficult to interpret the focal depths in the Hronov region (see Fig. 10, Region 6). Data show both very shallow earthquakes, which cluster around Hronov, and isolated deep events in the foothills of the Giant Mountains. In this region, however, it is necessary to consider a large error in determining the depth due to the small number of seismic stations and their poor spatial distribution.

The data given below show the distribution of focal depths in the Bohemian Massif and also make it possible to define sub-regions with different focal depths. The results of this analysis will certainly be very useful in defining areal seismic source zones. If the focal depth of individual historical earthquakes is determined, these data can only be used as indicative values. It is necessary to accept that it is not be possible to determine the focal depths for all historical earthquakes, but only for stronger events, where a larger number of IDPs is available. In such cases, it was reasonable to follow the procedures outlined in the source [414].

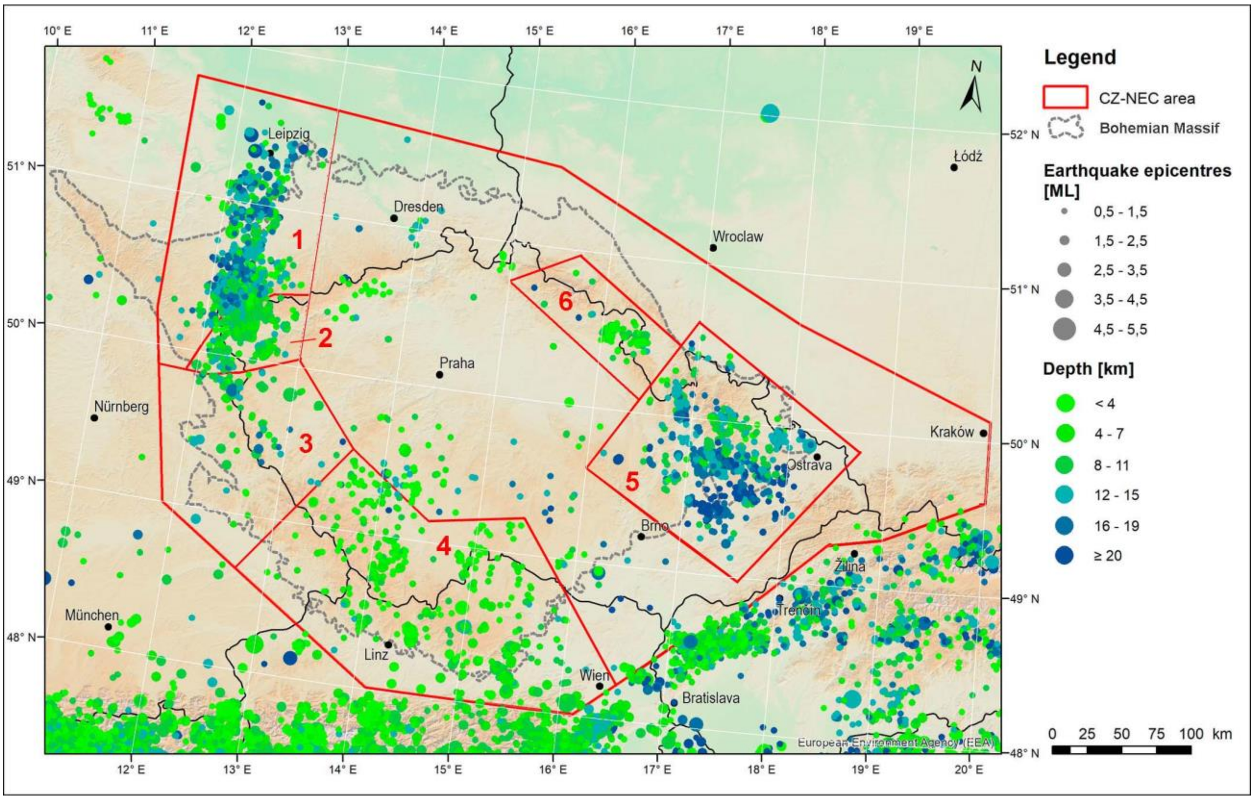


Fig. 10: Distribution of focal depths in the CZ-NEC polygon according to the depth data of instrumentally recorded earthquakes from 2000-2018.

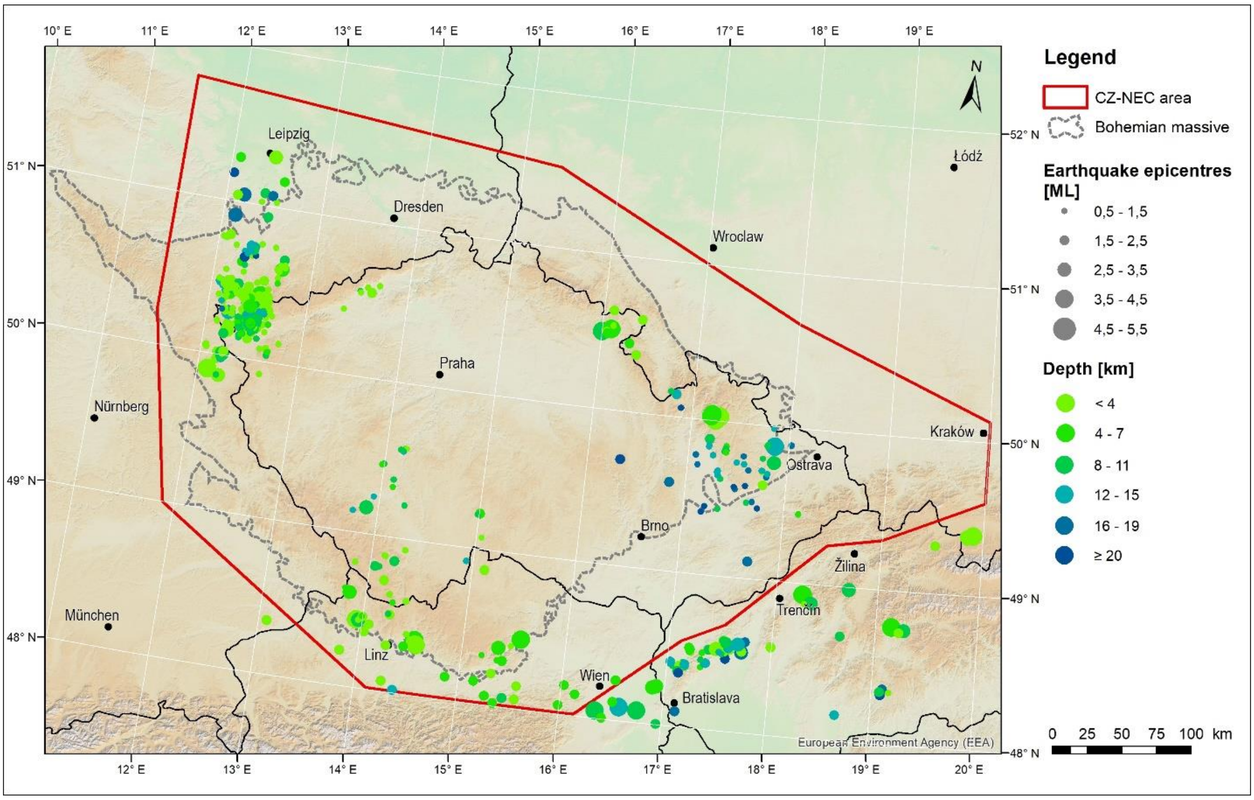


Fig. 11: Distribution of focal depths in the CZ-NEC polygon according to the depth data of instrumentally recorded earthquakes from 1950-1999.

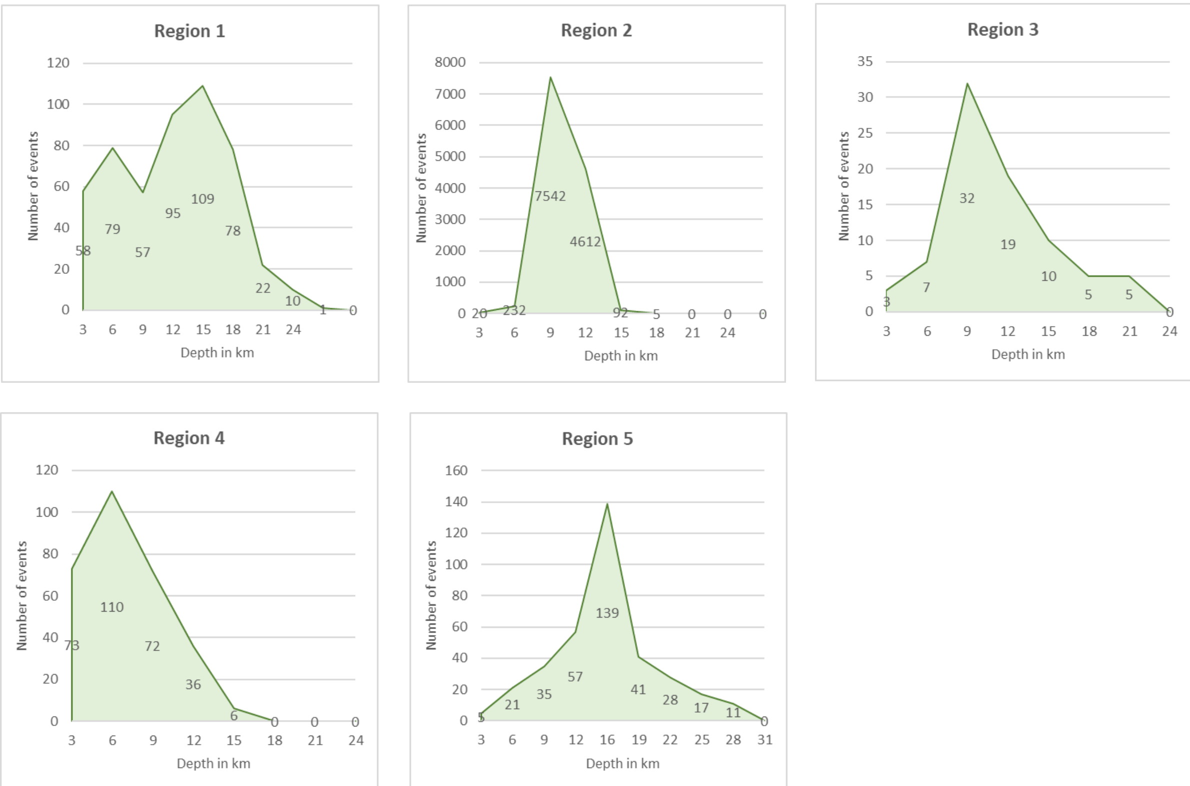


Fig. 12: Depth distribution graphs in selected regions. See map in Fig. 10.

Magnitude

The magnitude value, or specifically the moment magnitude Mw, is one of the key parameters of any earthquake catalogue in terms of usability for seismic hazard assessment. Magnitude cannot be read from macroseismic records, so it must be calculated. Standard conversion formulas can be written in the following general form:

$M = f(I_0; h),$ [1]

where *M* represents macroseismic magnitude M_I or local magnitude ML or any other magnitude type, I_0 is the macroseismic epicentral intensity and *h* is the focal depth. Conversion to Mw is possible either by using the relationship between M_I / ML and Mw or by directly calculating Mw from the value of the macroseismic intensity I_0.

CZ-NEC is based on the Mw enumeration, but a separate column of the CZ-NEC table indicates the initial magnitude value and type of magnitude or whether magnitude Mw was derived directly from intensity. An empty cell indicates that the value Mw has been adopted from other catalogues or publications. As such cases are rare, a historical overview of the magnitude determination procedures used by the main source catalogues is attached below.

Determination of magnitude in the main source catalogues

As the events that are simultaneously listed in the German and Austrian catalogues have been revised, German and Austrian approaches to determining magnitude are also discussed.

Kárník's catalogues

In the regional catalogues for the former Czechoslovakia (KÁRNÍK ET AL., 1958 - [401]) and (KÁRNÍK ET AL., 1981 - [501]), the magnitude, designated M_I, was determined from macroseismic intensities using a general formula which was adapted for the Bohemian Massif and Western Carpathians:

$M_I = 0.55 \cdot I_0 + 0.95$ or [2]

$M_I = 0.55 \cdot I_0 + 0.93 \cdot \log(h) + 0.14$ (if h was known) [3]

In his another work KÁRNÍK (1968) - [R023] introduced the following formula for the area of the Bohemian Massif and adjacent Poland territory:

$M_I = 0.65 \cdot I_0 + 0.5$ [4]

German catalogues

GRÜNTHAL, 1988 - [508], when compiling a catalogue for the territory of the former GDR, used also the conversion of macroseismic intensity to determine macroseismic magnitude (Mk), if magnitude data were not available in the source. For that he used the following formula according to KÁRNÍK (1968) - [R023]:

$Mk = 0.63 \cdot I_0 + 0.5$ [5]

He justified the choice of this formula in such a way, that the magnitude value, especially for weaker earthquakes, calculated according to KÁRNÍK'S (1968) formula with considering the hypocenter depth:

$Mk = 0.5 \cdot I_0 + \log(h) + 0.35$ (for h in km) [6]

was higher by 0.8 to 1.3 units of magnitude, as the evaluation of a series of data from 1985 to 1986 showed. However, GRÜNTHAL (1988) had in mind local magnitude ML when referring to data from 1985 to 1986. But it is not clear what the relationship between Mk and ML is.

LEYDECKER (2011) - [509] provides values up to 4 different magnitude types in the German earthquake catalogue: ML – local magnitude, in most cases instrumentally determined; MW – few values determined from instrumental data by observatories and agencies, 57 values computed from isoseismal radii using the formulas of JOHNSTON (1996) [R026]; MK – macroseismic magnitude adopted from other observatories based on its own formula MK = f(I_0, h); MS – surface wave magnitude in a few cases. It appears that the catalogue was designed so that in most cases magnitude is only listed if it was enumerated in the source catalogue. Local magnitude values are almost completely provided only from the more advanced instrumental era since approximately 1980.

LEYDECKER (2011) - [509] mentions in the explanatory notes to his catalogue 4 regression relationships from three different authors that were published within three years (2000-2003). For completeness, all formulas published by LEYDECKER (2011) are mentioned below:

1. GUTDEUTSCH ET AL (2000) - [R024] determined the following formula for range depths up to a maximum of 100 km using linear regression on 370 earthquakes form the earthquake catalogue of Europe and the Mediterranean (KÁRNÍK, 1996 - [R035]):

   $$ML = -4/3 + 2/3 \cdot I_0 + 2 \log (h) \qquad [7]$$

   and the preferred orthogonal regression:

   $$ML = 0.129 + 0.302 \cdot I_0 + 2.48 \log (h),\ \sigma (ML) = \pm 0.31 \qquad [8]$$

2. RUDLOFF & LEYDECKER (2002) derived, based on statistical processing of 270 earthquakes with $4.0 \le I_0 \le 7.5$; $h \ge 3$ km, the following formula:

   $$ML = -0.154 + 0.636 \cdot I_0 + 0.555 \log (h),\ \sigma (ML) = \pm 0.4 \qquad [9]$$

3. GRÜNTHAL & WAHLSTROM (2003) - [504] developed the following formula:

   $$ML = 0.74 (\pm 0.05) \cdot I_0 + 0.78 (\pm 0.23) \log (h) - 0.87 (\pm 0.36) \qquad [10]$$

Leydecker (2011) notes that values in the upper intensity range for ML, derived using formula *[9]*, are too small compared to *[7], [8]* and *[10].*

Austrian catalogues

First, it should be noted that the older as well as newer Austrian catalogues are mainly focused on the Alpine earthquakes in terms of determining magnitude. The same applies to the Slovak catalogues, which record West Carpathian earthquakes. It can be said that in Austria no special formula is used to determine magnitude with epicenter in the Austrian part of the Bohemian Massif.

The SHEBALIN (1958) - [R025] formula was first used for assessment of the Alpine earthquakes. In the catalogue [505], this relationship was checked by comparing it with newer relationships evaluating the extent of the felt area (see FRANKEL, 1994 - [R028]; JOHNSTON, 1996 - [R026]; KAISER ET AL., 2002 - [R027]). A comparison especially with [R027] relation between intensity, depth of epicenter and magnitude led to an agreement of the estimated magnitudes within 0.2 magnitude units in the relevant range of focal depth (see HAMMERL AND LENHARDT, 2013 - [505]).

CZ-NEC approach

The CZ-NEC approach distinguishes cases where magnitude is derived from macroseismic intensity from cases where magnitude ML is available from instrumental measurements.

Estimation of macroseismic magnitude (MI)

KÁRNÍK ET AL. (1958) - [401] determined the intensity, possibly also macroseismic magnitude, only for selected, especially stronger and younger earthquakes. These values were also revised in CZ-NEC. Thus, revised macroseismic intensity values are available; that it is possible to derive the values of macroseismic magnitude M_I. It was decided to use relationships with focal depths *[2]* and *[3]*, because the focal depth was also revised and the characteristic depths are available for all regions in the Bohemian Massif, both in the Czech Republic (+ Poland and Austria) and in Germany. These magnitudes are considered informative only. They are written in a separate column of the CZ-NEC table, along with other data extracted from the sources, and are primarily used to document the parameter history of each event.

Local magnitude values (ML)

Instrumentally recorded earthquakes are described primarily by local magnitude ML in the CZ-NEC catalogue. These values were compiled from source catalogues or bulletins, but some were detected directly by stations operated by the Institute of Physics of the Earth.

Despite the different methods of local magnitude calculation, the differences between individual catalogues used were mostly up to 0.3, max. 0.5 unit of magnitude ML. Slightly larger were ZAMG magnitudes (up to 0.8 in some cases). The IPE magnitudes were preferred in such cases, if any (see end of the Chapter 0).

Enumeration of moment magnitude (Mw)

Since CZ-NEC is based on quantifying of moment magnitude, priority attention was paid to derive Mw as accurately as possible from macroseismic data. There were two ways to do this. The first method was based on double counting, i.e. first converting the intensity to a macroseismic (M_I) or local magnitude (ML) using region-specific relationships (see above) and then converting that magnitudes, again using region-specific relationships (see e.g. [504]), to Mw. The second method was based on direct calculation of Mw, using a more general relationship, directly from the macroseismic intensity.

In the case of conversion of macroseismic intensity to moment magnitude Mw, the second method was generally chosen to prevent the introduction of another deviation resulting from double conversion. The site-specific relationships may be more accurate, but on the other hand, it is necessary to consider the conversion from intensity itself, when the intensity is a discrete value with a step of maximum 0.5 units. To this uncertainty is then added another one resulting from the conversion between magnitude types.

In this context, the opinion of GRÜNTHAL AND WAHLSTROM (2003) - [504], who suggest magnitude calculated from relations [2] and [3] from the Bohemian Massif and the Western Carpathians to be considered Mw, can be accepted, i.e.:

$$M_I = Mw \qquad [11]$$

If only macroseismic intensity values are available, the formula to derive magnitude is offered in form:

$$Mw = 1.2\ (\pm\ 1.6) + 0.32\ (\pm 0.52) \cdot I_0 + 0.03\ (\pm 0.04) \cdot I_0^2 \qquad [12]$$

GRÜNTHAL AND WAHLSTROM (2003) - [504] used a set of 110 European earthquakes from period 1911 – 1992, for which they had a seismic moment (M_0) value, to derive this formula.

In the preparation of the CENEC catalogue (see GRÜNTHAL, WAHLSTRÖM, STROMEYER, 2009 - [502], [503]), new regression relationships were processed and their confidence limits in relation to various source data (catalogues) was also assessed. A chi-square regression of Mw on I_0 and h was performed for the 41 selected events and yields up following formula:

$$Mw = 0.667 \cdot I_0 + 0.30 \log(h) - 0.10,\ \sigma = 0.31 \ldots 0.37 \qquad [13]$$

The obtained relation is valid in the applied ranges of I_0 and h (5° – 9.5°, resp. 6 – 22 km).

In cases where focal depth was not specified, the formula was modified, based on 41 earthquake data, to a form omitting depth such as:

$$Mw = 0.682 \cdot I_0 + 0.16,\ \sigma = 0.32 \ldots 0.36 \qquad [14]$$

From the Czech Republic, the authors of [502] had only seven data points above the given parameter thresholds (data of Zdenka Schenková, 1993 and Jan Zedník, 2005). All data with and without *h*, respectively, fell within the 95% confidence limits. In the case of German data, the 182 data points with *h* were all within the 95% confidence limits and the 90 data points without *h*, 99% of which were within the 95% confidence limits.

Finally, the relationships developed in the preparation of the SHEEC catalogue (see STUCCHI ET AL., 2013 - [506]) should also be mentioned. In this catalogue, Europe is divided into 5 regions. The CZ-NEC polygon falls entirely into the SCR (Stable continental region). By way of comparison, the Central Europe region in the sense of publication [502] is also mentioned in this publication ([506]). Based on only 26 earthquakes, the equation:

$$Mw = 0.655 \cdot I_0 + 0.528,\ \sigma = 0.25 \qquad [15]$$

is offered, valid for the macroseismic intensity range 4.8 - 8.0 and Mw magnitude range 3.6 - 5.6.

If a local magnitude value is available, then, of course, the first method, i.e. ML to Mw conversion, is used. For this purpose, the following relationship may be used:

*Mw = 0.67 (± 0.11) + 0.56 (± 0.08) * ML + 0.046 (± 0.013) * ML²,* *[16]*

which was derived by chi-square maximum likelihood regression based on 164 earthquakes set from Central Europe with original seismic moment data by GRÜNTHAL AND WAHLSTROM (2003) - [504].

Discussion of relationships to determine moment magnitude Mw

When determining the moment magnitude, it is necessary to consider one specificity of the Bohemian Massif, which is the prevailing occurrence of earthquakes with low intensities. The relationships above are tested for intensity ranges between 5° and 8°. But such values reach very few events in the Bohemian Massif. Weaker events that could be statistically processed are concentrated only in the region of Kraslice - Nový Kostel - Vogtland. However, this is a region with earthquake swarms, and it is unclear whether this region could represent the entire Bohemian Massif.

The issue of estimating the moment magnitudes (Mw) of a small earthquake was addressed by MUNAFÒ ET AL. (2016) - [R029]. The authors used a data set of 1191 well-relocated small earthquakes in the range of 0 ≤ ML ≤ 3.8 from the zone of the Alto Tiberina fault in Italy, which was recorded between 2010 – 2014. The result of the data set processing was a regression relationship between Mw and ML, which takes the form of:

*Mw = ⅔ * ML + 1.15* *[17]*

When the course of curves according to formulas *[16]* and *[17]* are compared (see Fig. 13), a different slope of the lines is apparent. If both formulas should be respected, it is possible to use an interconnected formula developed by the CZ-NEC team, which has the following form:

*Mw = 1.34 + 0.417 * ML + 0.049 * ML²* *[18]*

This polynomial curve fits very well on both parent curves, excluding the junction point around ML = 4, where the deviation is about 0.2 units magnitude.

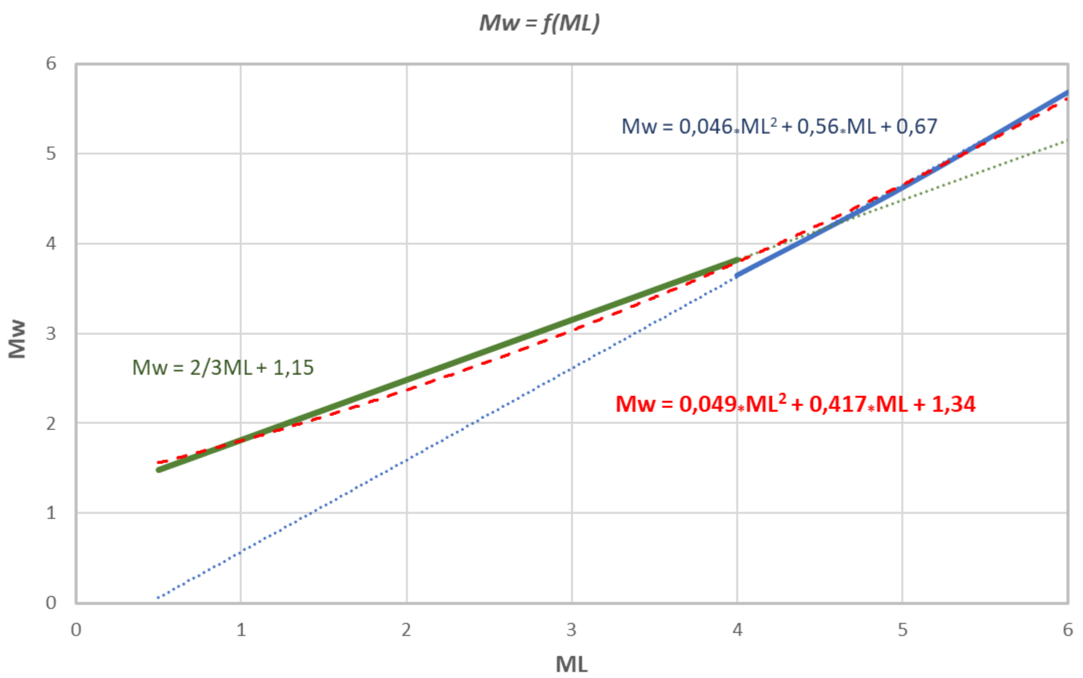


Fig. 13: Comparison of curves of Mw = f(ML) according to formulas [16] and [17].

It seems reasonable to use this formula in all cases where the credible value of ML is available, i.e. approximately since 1950. This formula should work very well for events after ca. 1990, since ML values are more precise.

In cases where ML is not available, one of the functions *Mw = f (I₀; ± h)* must be selected. Many of these are shown in the graph (see Fig. 14). But the question remains whether they are useful for deriving Mw magnitude of earthquakes with low intensity (2° - 5° MSK-64/EMS-98).

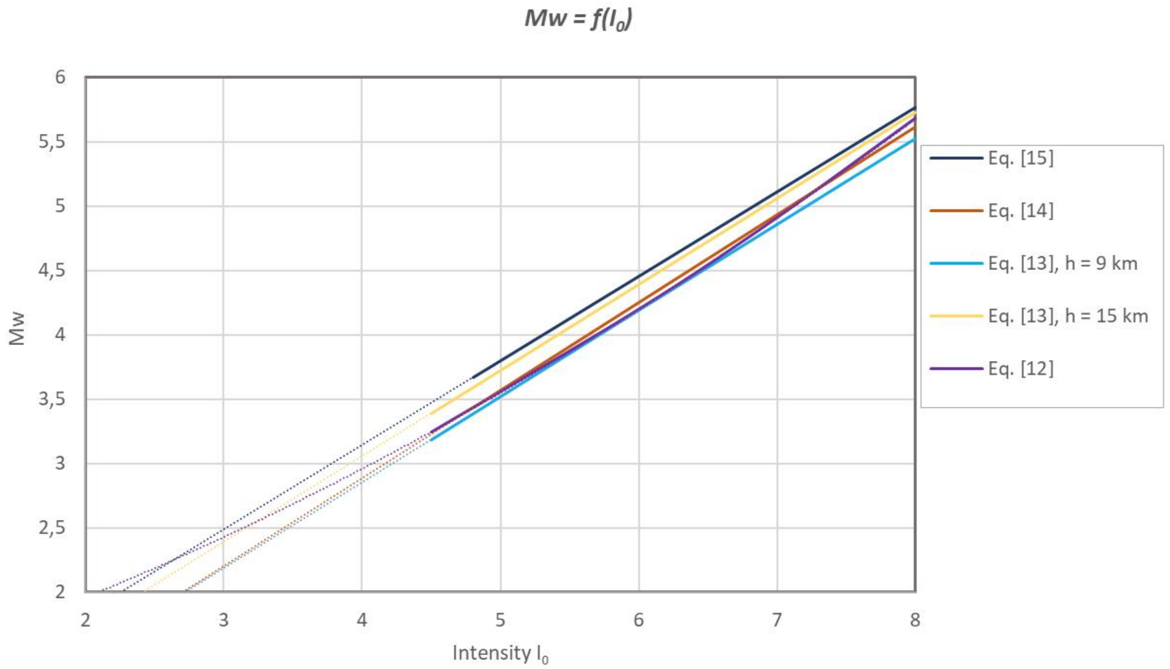


Fig. 14: Comparison of selected curves of function Mw = f (I_0; ± h).

It is probably not possible to give preference to some of them, i.e. it is necessary to proceed selectively. In principle, if they were lengthened to lower intensity values, they would give a value of Mw with a maximum deviation of 0.3 units of magnitude for I_0 = III° (MSK-64/EMS 98). In order to reduce this inaccuracy, some rules have been established on how to determine the Mw magnitude in CZ NEC:

- If focal depth can be reliably determined, the functions *Mw = f (I_0; h)* should be preferred.
- If a trustworthy Kárník's M_I value is available, it should be adopted as Mw according to relation *[11]*.
- In the remaining cases, there is nothing left but to use a formula without depth. It is a difficult decision, but it seems that formula *[15]* should be a last option.
- If ML value is available as well as macroseismic intensity, it is better to choose function *Mw = f (ML)*.

In the CZ-NEC, the value of Mw was derived for the macro-earthquakes using the known region-specific relationships *Mw = f (I_0; ± h)* or *Mw = M_I* mentioned above. These relationships are used in the Central European region and, although they are based on relatively small data sets from the Bohemian Massif and adjacent Germany (compared to more seismically active regions), their use is associated with intuitive acceptable inaccuracy. Regarding ML values, we see a great challenge for the future to harmonize the derivation of ML values for the earthquakes in the Bohemian Massif from instrumental records by the seismic services of the Czech Republic, Germany and Austria.

3.1.1.4 Logic tree of deductive approach

The previous text provides a large number of ideas, approaches and possible solutions that we generated during the work on the catalogue of historical earthquakes. It was difficult to organize text in any way in order to achieve a clear and easy-to-understand narrative. Therefore, the following logic tree has been attached, in which we try to capture our ideas and approaches, as well as all the pitfalls that the creator of the catalogue of historical earthquakes may encounter. The presented logic tree thus somewhat represents the deductive approach, which we very often used when compiling CZ-NEC.

Define the territory for which the catalogue of historical earthquakes is to be compiled.

↓

Search for available earthquake catalogues covering this territory.

↓

Create a list of events to be revised. Establish Event Sheets for each event.

↓

Gather sources. Follow the references in sources if there are and go to the past as much as possible. Look for the primary source.

↓

Discuss and compare the information found. Get information that is useful for deciding whether an earthquake or other natural event is being described.

↓

Verify the trustworthiness of sources. Check the other information in the entries to see if they correspond to the events as they actually happened. Try to get more information about the author of the entry, the time in which he lived and worked, as well as about the historical and social circumstances that existed at that time.

↓

Decide if the sources really describe an earthquake. Separate earthquakes from other natural events, which you then add to the list of fakes.

Earthquake catalogue ◆ **Fake list**

↓

Search records of earthquake for information about earthquake parameters such as date, time, observation sites (MDPs), and information useful for estimating earthquake intensity at observation sites.

↓

Analyze these data carefully, look for discrepancies in the messages, consider what calendars were used at that time, how time was determined, and how the borders of empires, states, and regions changed over time.

↓

Define IDPs and choose the way in which the coordinates of the epicenter and the epicentral intensity of the earthquake can be reasonably derived. Choose the procedure by which the depth of the epicenter and the magnitude of the earthquake can be reasonably determined.

↓

Deal with the uncertainties and carefully document how the individual parameters were determined or from what source they were taken.

3.2 PARAMETRIZATION OF INSTRUMENTALLY RECORDED EARTHQUAKES

Parameters of instrumentally recorded earthquakes are obtained by analysis of seismograms and their further processing. The procedures described below are used by Czech seismological institutions and with small differences also in abroad institutions, from which bulletins were taken into the CZ-NEC.

Various interactive software packages are used to display and further analyze digitally recorded data. At the Institute of Physics of the Earth, Masaryk University, Brno (IPE) collected digital observational material has been analyzed by means of the graphical program package *Geotool* (HENSON AND COYNE, 1993 - [R030]). Routine analysis of digital recordings at the Institute of Geophysics of the Czech Academy of Sciences, Prague (IG) has been performed by the *SeismicHandler* (STAMMLER, 1993 - [R031]). Seismic records from individual stations are not processed separately, but as a rule the records from stations forming the network are analyzed together. Thanks to data sharing, additional stations are used in particular cases. The basic analysis of seismic records begins with the detection of seismic event. The following step is the most accurate **picking of the arrival times** of seismic waves, in case of local earthquakes mostly Pg and Sg phases. This is facilitated by various digital data processing methods such as filtering, rotation, cross-correlation, polarization, particle motion, and others.

Arrival times at the stations can then be used to determine the hypocenter coordinates (latitude, longitude and depth) and the time of occurrence of the event (origin time). Various **location procedures** are utilized – mostly iterative methods using tables of travel time or velocity models, grid search, also master event or double-difference methods. The *LocSat* program (BRATT AND BACHE, 1988 - [R032]) is used in both institutes, by IPE Brno and by IG Prague. Special software *HYPO3D* (FIRBAS AND WERL, 1988 - [R030]) based on *HYPO71* with detailed velocity models is used for location of events recorded by local networks operated by IPE Brno, locations being refined using the master event method. *NonLinLoc* (http://alomax.free.fr/nlloc/), master event or double-difference method is used to improve locations of local network WBNET, provided by IG Prague.

The epicenter determined, and particularly the depth, cannot be considered as the exact location due to **various errors** (namely in the arrival time observations and differences between the model and the real Earth). Station distribution in space also affects the accuracy of location. In some cases, these various inaccuracies may result in an apparently linear distribution of the focal points of individual epicenters on the map, even if they actually come from the same focus.

Before particular quake is included in the earthquake bulletin, it is necessary to check whether the event is of **tectonic or artificial origin**. This requires excellent knowledge of the area under investigation, the location of the blasting sites (quarries, buildings, military areas) or places with induced event occurrences (mines, drilling).

The relative size of an earthquake is characterized by its **magnitude.** The local magnitude ML ("Richter magnitude") is the most commonly used in the local and regional scales. It is based on measurement of the maximum ground motion displacement recorded by seismograph. Since current stations measure not displacement, but velocity, the maximum amplitude and period recalculated via calibration curves are used as inputs to displacement conversion or various formulas for ML calculation. A different methodology for reading the maximum amplitude is also used across institutions, e.g. maximum amplitude in the vertical component, the greater value of two horizontal components or the maximum value of the vector sum of both horizontal components. The network magnitude is also calculated in different ways in various institutions – arithmetical mean of individual station magnitudes, the highest value of the station values, or median.

The results of the data processing are usually presented in the form of catalogues and bulletins. The **catalogues of recorded earthquakes** contain origin time, coordinates of hypocenter (latitude, longitude and depth), magnitude, mostly also a name of origin area and macroseismic intensity in the case of felt earthquake. In addition to the above items, the bulletins also contain location errors and list of all seismic phase arrivals with their parameters (time, amplitude, period, station magnitude and some others depending on the format).

Macroseismic intensities (EMS-98) of felt earthquakes reported by Czech institutes are based on macroseismic questionnaires evaluation. People who felt an earthquake can fill a questionnaire on page https://www.ig.cas.cz/makroseismicky-dotaznik/ or phone or send an e-mail or a letter to IG Prague or IPE Brno. The observations obtained are available to both institutes and are evaluated by one of them, mostly according to the focus position. However, the authors of some catalogues also calculate it for instrumentally recorded earthquakes whose observations were not reported, such as the Austrian catalogue [505]. If the intensity from this source was taken into the CZ-NEC catalogue, it was marked with the letter c – counted.

4 CZ-NEC DATA SETS

CZ-NEC consists of three data sets (catalogues) - a catalogue of prehistoric earthquakes, a catalogue of historical earthquakes and a catalogue of instrumentally recorded earthquakes.

4.1 CATALOGUE OF PREHISTORIC EARTHQUAKES

This catalogue was included in CZ-NEC mainly due to its anticipated use for the seismic hazard assessment of nuclear power plants in the Czech Republic. IAEA standards, inter alia, require the establishment and maintenance of a catalogue of prehistoric earthquakes (see IAEA Standard SSG-9, par. 3.24).

To date, three places with a geological record of a strong earthquake, which could be causally connected with the course of a particular fault and its Mw magnitude could be derived, are known from the CZ NEC polygon or just beyond the border of the CZ-NEC polygon (see Table 4 and Fig. 15). One of them falls into the category of historical earthquakes because the age of the geological record lies in the time span covered by CZ-NEC. Of course, this earthquake was given the greatest attention.

Table 4: Records of prehistoric earthquakes

	Locality / Key references	Lat.	Long.	M_w	Causative fault	Time span of displacements
1	Kopanina (Western Bohemia) / [536]	50,204	12,461	6,5	Mariánské Lázně Fault	792-1020 AD
2	Bílá Voda (North-Eastern Bohemia) / [573]	50,439	16,907	6,3	Sudetic Marginal Fault	≈> 11 000 years
3	Siehdichfür Farm (Vienna basin, Austria) / [571], [572].	48,291	16,678	7,0	Markgrafneusiedl Fault	≈ 14 000 years**)

***) Five events in the time span 104 ky to 14 ky. ([571], [572]).*

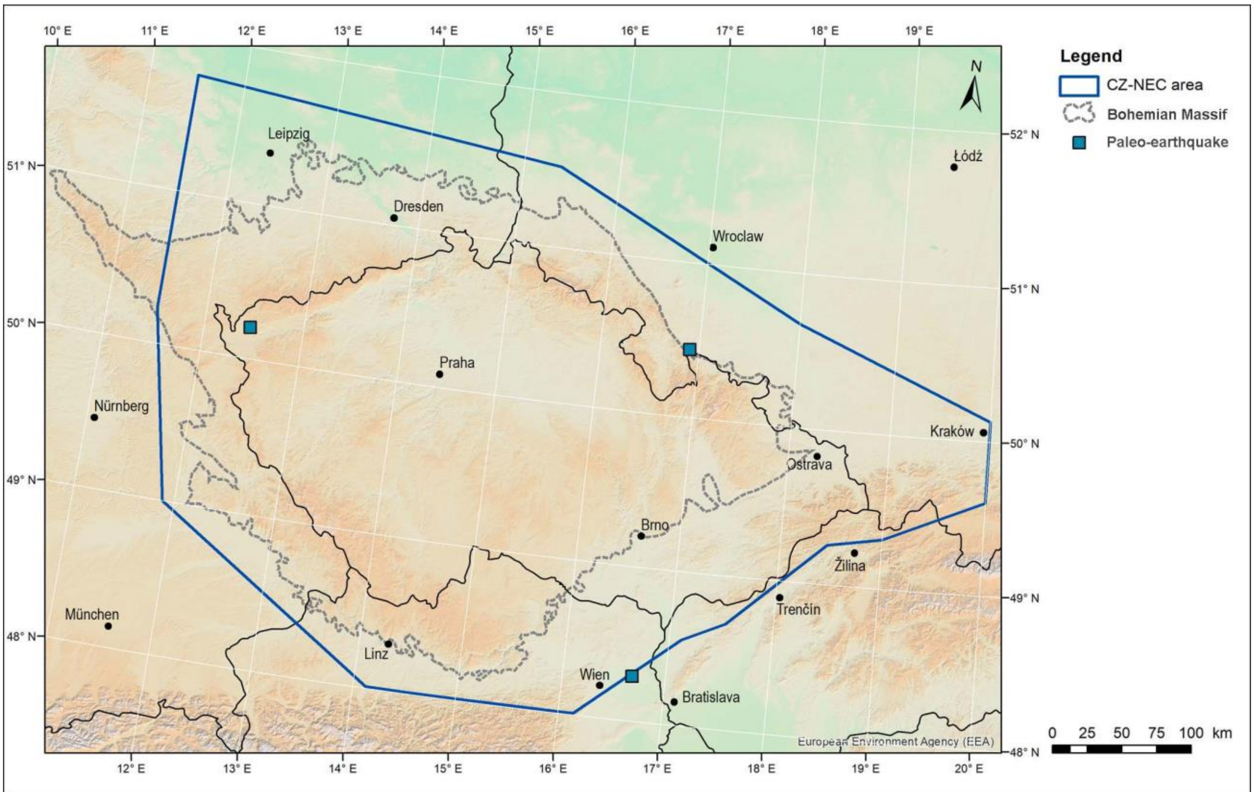


Fig. 15: Locations with findings of geological records of paleo-earthquakes in the CZ-NEC polygon.

4.2 HISTORICAL EARTHQUAKE CATALOGUE

The catalogue of historical (macroseismic) earthquakes CZ-NEC covers the period from 768 to the present. The period from 768 to 1020 was added to the catalogue mainly because of the need to cover the time span in which the paleo-earthquake occurred in West Bohemia. Since 1950 the catalogue of historical earthquakes overlaps with the catalogue of instrumentally recorded earthquakes. The catalogue of historical earthquakes, however, adopted only those events that were felt by men.

The catalogue of historical earthquakes is based on Mw magnitude to ensure its direct usability for seismic hazard assessment. For this reason, it also extends beyond the borders of the Czech Republic and covers the entire Bohemian Massif, even though it is considered the **CZ**ech **N**ational **E**arthquake **C**atalogue (CZ-NEC).

4.2.1 Foreshocks and Aftershocks

If earthquake catalogues are used to assess seismic hazard, foreshocks and aftershocks must be removed before being processed using the Gutenberg-Richter law. Therefore, some catalogues do not mention these foreshocks and aftershocks at all. But they are entered in CZ-NEC. The fact that the entry represents a major shock, foreshock or aftershock is recorded in the "Type of Event" column.

4.2.2 Completeness of the CZ-NEC

The completeness of the catalogue was another important issue that was solved within the CZ-NEC compilation, especially with regard to future use for seismic hazard assessment. For the needs of PSHA, it will be necessary to address the issue of completeness of the catalogue in more detail.

If one looks at the annual frequencies of occurrence of macro-earthquakes in the CZ-NEC polygon for the period 768-1980 (see Fig. 16), it turns out that before 1700, earthquakes were recorded at random, both strong earthquakes, especially distant ones, and local events with epicenters near major centers. The first earthquake is recorded in 1269.

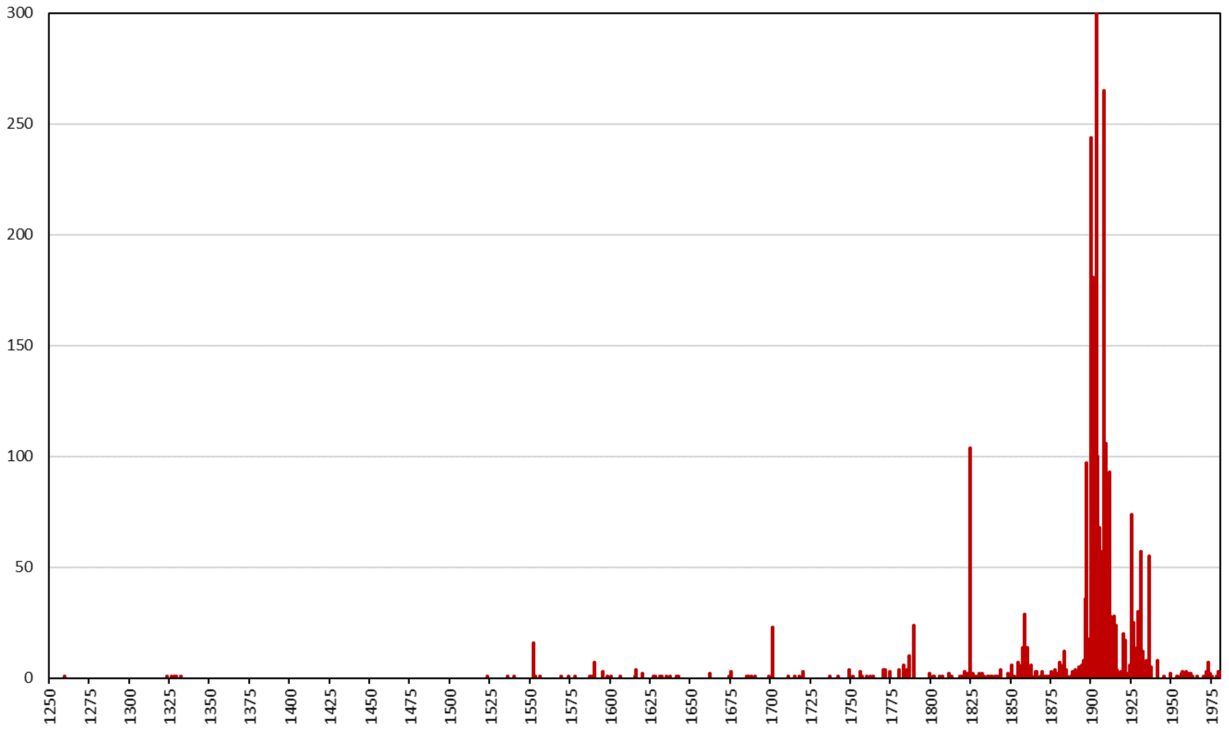


Fig. 16: Diagram of the annual frequencies of occurrence of macro-earthquakes in the CZ-NEC polygon for the period 1250-1980.

The diagram shows very significantly, as a sharp increase in the number of earthquakes per year, the fact that the CZ-NEC polygon includes the source area of West Bohemia - Vogtland, which is characterized by the occurrence of earthquake swarms. The most tremors (924) were recorded in 1903. Prior to 1896, major earthquake swarms in this area were observed in 1552, 1701, 1824, 1789 and 1824. A swarm of 68 earthquakes was also observed near Litschau (AT) in 1854-1860.

The number of records is usually also affected by social causes. This is very evident in the decline of records during World War II. Shortly after the war, however, this "drop-out" in the records returned to the level before war. But the decrease in the number of earthquakes did not appear during the World War I., which was caused by increased seismic activity as well as the good work of the Austro-Hungarian seismic service during the war.

The completeness of the catalogue has so far been estimated on the basis of the results of the work of our predecessors and our own experience in evaluating the seismic hazard of Czech nuclear facilities (see [R006], Table 5). In the cited work, the assessment of completeness was performed by statistical analysis of the catalogue used at that time, using the SHEEC approach (see [506]).

Table 5: Completeness of the CZ-NEC macroseismic earthquake catalogue

Magnitude (Mw)	Year of completeness
≥ 3.9	1890
≥ 4.4	1880
≥ 4.9	1780
≥ 5.4	1750
≥ 5.9	1700
≥ 6.4	1500

4.2.3 Reliability of Kárník's catalogues

As part of the revision of Kárník's catalogues, the reliability of Kárník's catalogues (see [401] and [501]) was also assessed. It was clear to us that the reliability of the catalogue would gradually increase as time shifted towards today. We also rightly assumed that due to data gaps, the reliability in determining medieval earthquakes would be very low. Alexandre (1990) - [510] found that the vast majority of principal European catalogues contain more than 50% of fake earthquakes for the period 400-1260. Therefore, we considered it correct to divide the time span that Kárník's catalogue covered (460 -1956) into at least two parts, the part that listed medieval earthquakes and earthquakes from early modern times, and the remaining part until 1956. We laid the border in 1699.

Exactly accurate statistics were not processed, because we did not revise the complete catalogue, but only a certain selection of events. Distant earthquakes (outside the CZ-NEC polygon) were excluded, including those felt in the Czech Republic. And also all Slovak, Hungarian and East Polish earthquakes. Some events, on the other hand, have been added because they were found in other catalogues or they were newly discovered in sources.

In the first group of medieval and early modern earthquakes from the period 768-1699, 129 events were evaluated and 72 of them were fake earthquakes. The error rate was 56%, i.e. Kárník's chronicle catalogue does not differ in any way from the catalogues mentioned by Alexandre (1990) - [510]. Another 14 earthquakes falling into the period 768-1699 were added to the CZ-NEC by adopting them from the German catalogues (see [508], [509], [532]) or from the catalogue for Lower Austria (see [505]).

From 1700 to 1980, a total of 493 entries from both Kárník's catalogues were revised, which as a result fall into the CZ-NEC polygon. Of course, apparently distant earthquakes have been excluded. Of these 493 records, 311 were identified as earthquakes, 176 as fakes or questionable events and 6 as induced, mining earthquakes (Kladno, Příbram, Ostrava regions). Thus, there were a total of about 36% erroneous or questionable items.

However, the error rate gradually decreased towards today. In the 18th century, half of the 70 events evaluated were mistaken for earthquakes. In the 19th century, the percentage of erroneous events dropped to 38% (i.e. 73 errors out of 190 entries) and in the period 1900-1980 68 fakes plus 6 induced earthquakes out of the total number of 233 evaluated events, i.e. 29%, were recorded.

4.2.4 Graphic presentation of the CZ-NEC – Historical earthquake catalogue

The results of the revision of Kárník's catalogues (see [401] and [501]) are graphically presented in Fig. 17. The map of epicenters of historical earthquakes was compiled on the basis of table CZ-NEC-Table_30122020.xlsx. This table shows historical earthquakes from the period 768-1980, the epicenters of which fall into the CZ-NEC polygon. It should be noted that the first event, which is registered in the catalogue, did not happen until 1259. However, events have been screened since 768, because records of earthquakes that were proven by paleo-seismological research in West Bohemia, which according to dating occurred between 790-1020, were searched. For now, however, without success, and so this event is still only kept in the catalogue of prehistoric earthquakes.

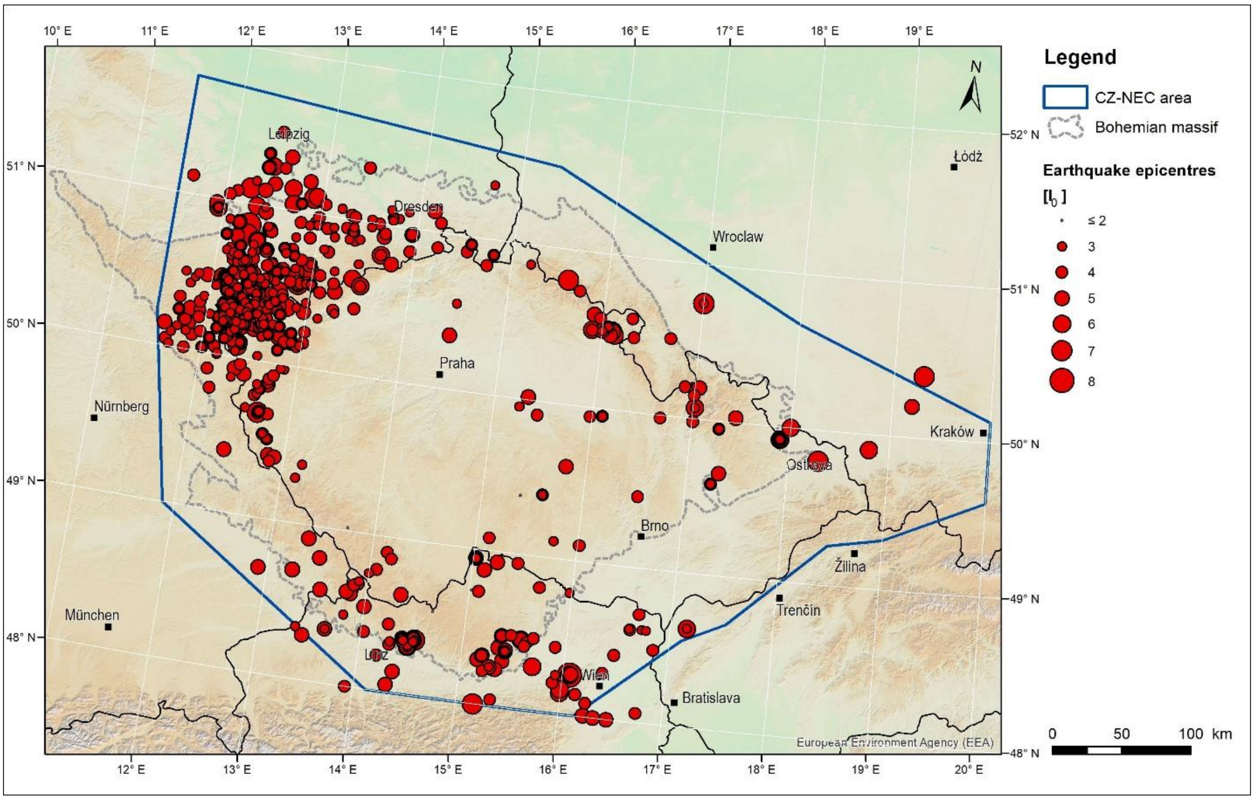
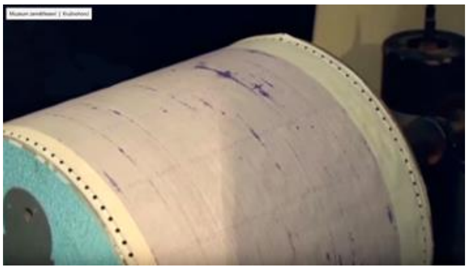


Fig. 17: Graphic presentation of the CZ-NEC Historical earthquake catalogue covering data from the time period 768 – 1980 (revised Kárník's catalogues).

4.3 INSTRUMENTAL EARTHQUAKE CATALOGUE

Main goal of this part of the project was to collect relevant data concerning the instrumentally recorded earthquakes originated in focal zones that input into the seismic hazard assessment. Available data acquired by seismological institutions involved in permanent seismological monitoring of the area comprising the Czech Republic and its close surroundings have been collected. They were merged, compared and revised.

4.3.1 Seismic stations on the territory of the Czech Republic



First seismometers on the Czech territory were installed early in the last century - in Příbram (1903-1905), in Cheb (1908-1954), and in Prague (1924-1954) (see KOZÁK AND PLEŠINGER, 2003 - [569-1] and [569-2]). These stations were able to record mostly strong regional and teleseismic earthquakes.

Fig. 18: One of the first seismographs – view of rotating cylinder of paper. Source: Geophysical Museum - seismic exposition, Skalná in Western Bohemia. Illustrative photo.

The monitoring of moderate local and regional earthquakes was made possible by more modern instruments operated by the Institute of Geophysics, Czech Academy of Sciences, Prague in Průhonice (PRU) since 1957 and Kašperské Hory (KHC) since 1961 (see KOLÁŘ, 2020 - [570]). Both stations were equipped with a digitizer in the 1970s. The earthquake location using only these two stations was quite problematic. In addition, only parametric data from some foreign stations could be used.

Catalogues and bulletins containing regional events recorded by those stations are available on the web page http://www.czechgeo.cz/en/article/default/seismic-data-portal since 1976.

After 1990, more permanent stations were gradually added. In 2018, the Czech Regional Seismic Network (CRSN) consisted of twenty broadband stations and other local networks and stations were also in operation. The CRSN stations are listed in the following Table 6.

Table 6: The Czech Regional Seismic Network.

Station	Code	Lat. [°N]	Lon. [°E]	Operator	Open
Praha	**PRA**	50.0692	14.4277	CU	1924
Průhonice	**PRU**	49.9883	14.5417	IG	1957
Kašperské Hory	**KHC**	49.1309	13.5782	IG	1961
Ostrava/Krásné Pole	**OKC**	49.8346	18.1399	TU/IGN/IG	1983
Nový Kostel	**NKC**	50.2331	12.4479	IG	1987
Vranov	**VRAC**	49.3084	16.5933	IPE	1991
Dobruška/Polom	**DPC**	50.3502	16.3222	IG/VGHMÚř	1992
Moravský Beroun	**MORC**	49.7768	17.5425	IPE/ZAMG/GEOFON	1994
Moravský Krumlov	**KRUC**	49.0619	16.3952	IPE/ZAMG	1995
Velká Javorina	**JAVC**	48.8591	17.6707	IPE/ZAMG	1995
Úpice	**UPC**	50.5074	16.0121	IG	2001
Hora Sv. Kateřiny	**HSKC**	50.6072	13.4317	IG	2002
Panská Ves	**PVCC**	50.5282	14.5689	IG	2003
Třešť	**TREC**	49.2948	15.4871	IG	2005
Ostaš	**OSTC**	50.5565	16.2156	IRSM	2005
Králíky	**KRLC**	50.0966	16.8341	IG	2008
Chvaleč	**CHVC**	50.5881	16.0547	IRSM	2009
Pecný	**GOPC**	49.9141	14.7870	VUTGK/CU	2010
Příbram	**PBCC**	49.6857	13.9956	IG	2011-2016
Český Krumlov	**CKRC**	48.8199	14.3096	IRSM	2013
Zvíkov	**ZVC**	49.4389	14.1923	IG	2016

List of operators:

IG - Institute of Geophysics, Czech Academy of Sciences, Prague
VGHMÚř - Military Geographical and Hydrometeorological Office, Dobruška
CU - Charles University, Prague
IPE - Institute of Physics of the Earth, Masaryk University, Brno
ZAMG - Zentralanstalt für Meteorologie und Geodynamik, Vienna, Austria
GEOFON - GEOFON Program GFZ, Potsdam, Germany
TU - Technical University, Ostrava
IGN - Institute of Geonics, Czech Academy of Sciences, Ostrava
IRSM - Institute of Rock Structure and Mechanics, Czech Academy of Sciences, Prague
VUTGK - Research Institute of Geodesy, Topography and Cartography, Zdiby

Some important regions were or are being also observed by local networks. First digital seismic network in the Czech Republic monitored the planned NPP site in the northeastern part of the Czech Republic in 1984 - 1987. It was operated by Geofyzika Brno, a predecessor of IPE. In the 1986, the first stations of the WEBNET network (IG) began to study seismic activity in West Bohemia. It is the most active seismic region in the Czech Republic, and it is known for the occurrence of earthquake swarms. In 1991 - 2008, this area was also monitored by the KRASNET network operated by IPE. The seismic network around the Temelín NPP was put into operation by IPE in 1991 and the Dukovany NPP network in 2014, also by IPE. Since 1996 the stations in northeastern part of the Czech Republic have been gradually built to monitor natural seismicity in the region. This MONET group now consists of more than 20 stations jointly operated by IPE, IGN, IG, and IRSM. Several other local stations connected to various projects complement the above-mentioned stations and networks. Special seismic networks monitor some other objects (coal mine, gas storage) but their data are not available. See Fig. 19.

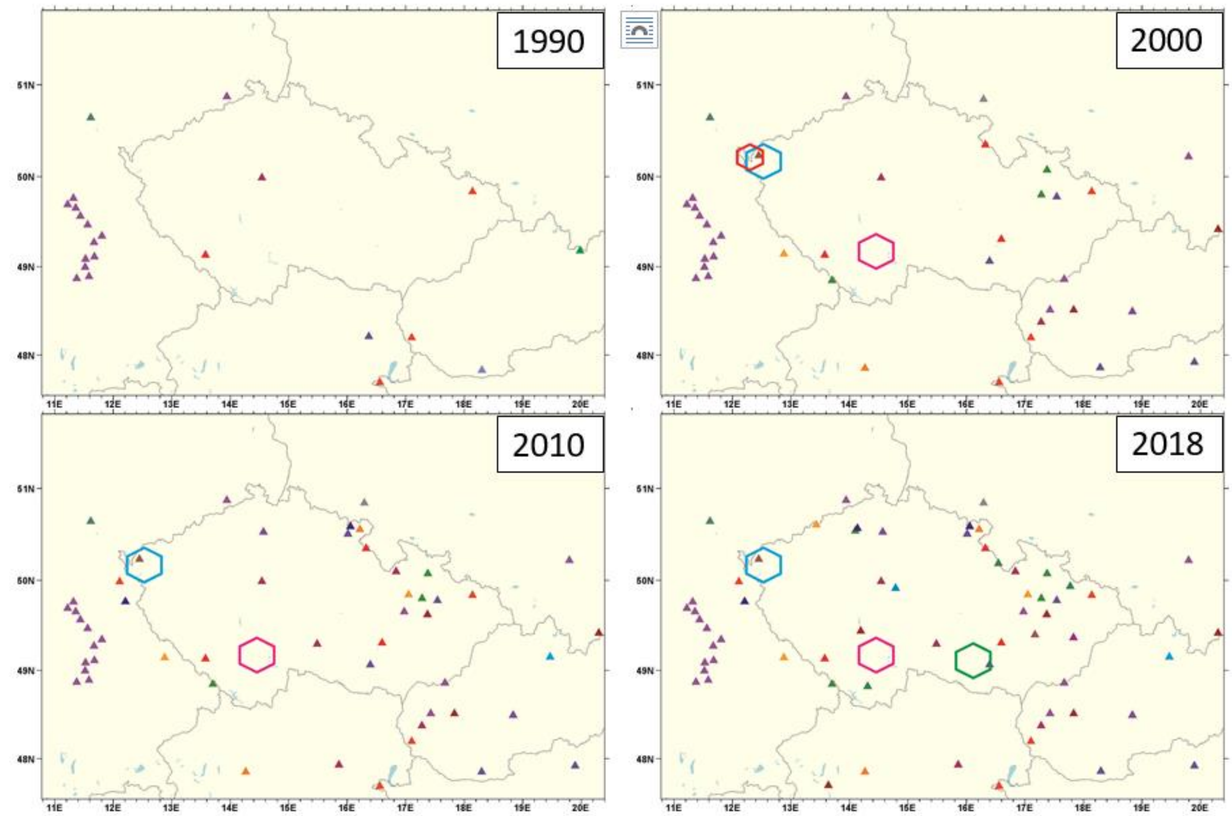


Fig. 19: An increase in the number of permanent seismic stations and their distribution on the territory of the Czech Republic by 2018. Triangle – station, hexagon – network. Only those stations in other countries that were used to revise CZ-NEC events are shown.

4.3.2 Available seismic bulletins and catalogues

Data for compilation of the instrumental catalogue have been adopted from all available sources in the Czech Republic and in neighboring states to ensure the best coverage of the area of interest. All used sources are listed in the following Table 7.

Table 7: List of used catalogues and bulletins.

CZECH REPUBLIC	
Geophysical Institute of Geophysics, Czech Academy of Sciences, Praha:	
GFU	Catalogs of regional seismic events (1976 - 2018) http://www.czechgeo.cz/gfu-catalog/ *It uses location from other sources (ISC, EMSC, NEIC-ED, NEUNH,...) in some cases*
WBNET	Local network West Bohemia (2000-2018) https://www.ig.cas.cz/vyzkum-a-vyuka/observatore/lokalni-seismicka-sit-webnet/katalogy-webnet/
PROCH	Procházková 1993: Catalogue of earthquakes. Procházková 1994: Earthquakes in the Jeseníky Mts. in 1986.
Institute of Physics of the Earth, Masaryk University, Brno:	
BLA	Local network Blahutovice, NE Czech Republic (1985-1987)
JABO	Local J.Bohunice NPP network (1987 - 1991)
ETE	Local Temelín NPP network (1991 - 2018)
KRASNET	Local network West Bohemia (1991 - 2008)
MONET	Local network NE Czech Republic (1996 - 2018)
IPEC	Broadband IPE stations (2000 - 2018)
EDU	Local Dukovany NPP network (2014 - 2018)
Some events were correlated with **bulletins of Institute of Geonics AS CR, Ostrava**	
GERMANY	
LEY2016	Leydecker: Erdbebekatalog für Deutschland, version 2016 (1950-2008)
SXNET	Sachsennetz, Universität Leipzig (2001 – 2018), http://linap6.geo.uni-leipzig.de/sxweb/
UniJena	Thüringer Seismologisches Netz, Universität Jena (2017-2018) http://www.geophysik.uni-jena.de/Einrichtungen+_+Labore/Th%C3%BCringer+Seismologisches+Netz/Erdbeben.html
BAY	Erdbebendienst Bayern, Universität München (2001 – 2018), https://www.erdbeben-in-bayern.de/aktuelle-beben/
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover https://www.bgr.bund.de/DE/Themen/Erdbeben-Gefaehrdungsanalysen/Seismologie/Seismologie/Erdbebenauswertung/Erdbebenkataloge/Kataloge_Bulletins/kataloge_bulletins_node.html
AUSTRIA	
BullZAMG	Zentralanstalt für Meteorologie und Geodynamik, Wien http://www.isc.ac.uk/iscbulletin/collected/reports/
H_L_2013	HAMMERL, CH., LENHARDT, W.A., 2013. Erdbeben in Niederösterreich von 1000 bis 2009 n. Chr. [505] https://www.zobodat.at/pdf/AbhGeolBA_67_0001-0297.pdf
ACORN	Catalogue of Alpine Carpathian On-line Research Network (project ZAMG + IPE)
WL	Wolfgang Lenhardt´s personal catalogue
SLOVAKIA	
SEK	Local Jaslovské Bohunice NPP network, Progseis (2000 - 2018)
SAV	Catalogue of Department of Seismology, Slovak Academy of Sciences, Bratislava
BRA	Printed Bulletin of the Slovak seismographic stations, 1978 - 1988, Bratislava

	HUNGARY
GEORISK	GeoRisk, Budapest http://www.georisk.hu/
	POLAND
	catalogues are not available
WAR	GUTERCH ET AL. 2005: Earthquakes recorded in Poland along the Pieniny Klippen Belt, Western Carpathians - [521]
	INTERNATIONAL
ISC	**Bulletin of International Seismological Centre** (*for some earthquakes*) http://isc-mirror.iris.washington.edu/iscbulletin/search/catalogue/
NEIC	**National Earthquake Information Center, USGS** (*for some earthquakes*) ftp://hazards.cr.usgs.gov/NEICPDE/isf2.0/

4.3.3 Approach to compilation of instrumental catalogue

Catalogues or bulletins provided by the above-mentioned sources were converted into unified data format in the form MS Excel ® sheets. Events with epicenter in the rectangle 48,0°N – 51,5°N and 11,5°E – 20,5°E were selected. They were merged into annual catalogues and sorted in time order.

A manual analysis "event-by-event" followed. In case of concurrent occurrence of event in more sources, one record was appointed as the preferred one (P) and the others were retained as auxiliary ones (A). These auxiliary locations are not listed in the resulting catalogue.

Local network locations were preferred. For areas outside the local networks mostly locations from the national catalogues were used (i.e. the preferred location of the earthquake from the Austrian territory was taken from the Austrian bulletin), but that was not always the rule. In some cases, preference was given to locations where a greater number of arrivals or smaller azimuthal gap were known or expected.

At the same time suspicious events (possible blasts, mislocations) or incorrectly determined events (incorrect location, missing magnitude) were appraised. All doubtful events were then revised. Many earthquakes were newly located or identified because it was now possible to obtain waveforms that were previously unavailable or with delay during that processing. Hundreds of waveforms were obtained either from the IPE archives (data since 1991) or thanks to web forms provided by IG Prague at http://silo.ig.cas.cz/wdrm/wdrm_index.php (data since 2000) or by BGR Hannover https://www.szgrf.bgr.de/waveforms.html (some data even since 1970). That made it possible to improve identification or location or to determine the magnitude for hundreds of earthquakes.

Much of the suspicious events were shocks falling within the normal working hours of quarries or localized to the regions where induced shocks occur. Possible blasts were compared with lists of blasts collected in IPE, IG, or ISC database. It turned out that just blasts are quite problematic. It is necessary that all potential earthquakes be verified carefully in order to exclude accidental blasts (originated in quarries, in the framework of construction works, ammunition disposal etc.). Such a thorough cross-check is often omitted. 70 – 150 blasts misidentified as earthquake were found per year in acquired data. On the other hand, it also turned out that (not negligible) number of quakes of natural origin was probably falsely associated to blasts not being incorporated into catalogues.

Note to West Bohemia/Vogtland region: This very active seismic area on the Czech-German border with numerous and long-lasting earthquake swarms has been monitored by several local networks – WBNET (IG), KRASNET (IPE), Sachsennetz (University Leipzig), and Thüringer Netz (University Jena). But one cannot say that the catalogue of one of these networks is more complete than the others. These catalogues were more or less detailed at different times, probably depending on the analyst and on the amount of shocks in the swarm. Several earthquakes with magnitude about 2.0 were not even included in any of these catalogs and had to be taken from the regional catalogue or newly located.

More than 70.000 records were acquired in total for the period 1950 – 2018. A large portion are very weak earthquakes from the West Bohemia/Vogtland region and the auxiliary events. Several thousand events were identified as blasts, false locations of distant earthquakes or weak induced events from coal districts in the Ostrava or Upper Silesia in Poland and from the Lubin mine in Poland north of Legnica. These non-tectonic events were excluded from the catalogue. Tens of probably weak earthquakes have not been included in the catalogue because of missing magnitude or accurate location.

4.3.4 Resulting instrumental catalogue

The instrumental part of the CZ-NEC has been compiled for the period 1950 – 2018. Since the 1950s, the first instrumentally recorded earthquakes appeared in German and Austrian bulletins, digital instrumental bulletins of Czech provenance are available since 1976.

The quality of the instrumental catalogue up to 2000 is affected by a low number of stations in the Central European Region and also by the fact that sharing of the records was very limited or impossible. Number of available seismic stations plays a crucial role in quality of identification of seismic events and their location. Digital data were initially used only by the institutions operating the station. Only some parametric data was exchanged between institutions. In addition to a small number of seismic stations, the lack of storage capacity influenced the quality of the data analyze. Digital data from stations was not stored in a continuous mode, but in the so-called trigger mode – only short sections of the signal selected by a special algorithm were recorded. This made it impossible in many cases to correctly identify the event (frequent confusion Sn for Pg arrival). Also, some shocks were not recorded at all because of the trigger algorithm settings or increased noise at the station.

1350 earthquakes were collected from the time period 1950 – 1999. About 90 % earthquakes from that time originated in the seismic swarm region West Bohemia/Vogtland. The location quality of most of remaining earthquakes from other parts of the territory is low due to small number of seismic stations. In the late 1990s, data began to be stored continuously and since about 2000, waveforms began to be shared. This, together with the increase in the number of stations, significantly improved the quality of data analysis and location accuracy. It was therefore decided to divide the catalogue into two parts, 1950 - 1999 and 2000 – 2018. The quality of the locations and the completeness of the older part of the catalogue up to 1999 is so low that the older part serves only as the supplement of the macroseismic catalogue. The instrumental CZ-NEC contains data from the time period 2000 – 2018.

As a lower threshold of magnitude, a value of 0.5 was set in order to complete catalogue. Weaker events being omitted. The final catalogue 2000 – 2018 supposedly contains all events with magnitude 1.5 and larger for the area enclosed by the polygon. Earthquakes with magnitude range 0.5 - 1.5 may not have been detected in some areas, especially in the first few years of that period.

Most catalogues used for the compilation do not mention a location error. For the period 2000-2018, according to the results of IPE locations, it has been estimated ranging from hundreds of meters inside local networks to several kilometers in places with fewer stations, depth errors being slightly higher. An even greater location error should be considered for older earthquakes and earthquakes with a focus in places with a sparse distribution of stations.

Induced events in the Czech Republic and its surroundings are frequent and mostly they are much stronger than natural earthquakes. Therefore, they were not completely excluded from the catalogue but some of them from the time period 2000 – 2018 were included in a separate sheet. The „induced events" sheet contains ML ≥ 0.5 events from mine Kladno and gas storage Příbram (central part of the Czech Republic) and the strongest events from mining areas in Ostrava (CZ, ML ≥ 2.5), Lubin (PL, ML ≥ 3.5), Upper Silesia (PL, ML ≥ 3.0), Belchatów (PL, ML ≥ 3.0), and some events from Germany.

The earthquakes that were felt between 1950 and 2018 are included both in the instrumental catalogue and in the macroseismic earthquake catalogue (see Fig. 21). Induced earthquakes from this time period are also listed in the CZ-NEC catalogue (see Fig. 22).

4.3.5 Graphic presentation of the CZ-NEC – Instrumental catalogue

A graphic presentation of both parts of the instrumental catalogue is shown in Fig. 20. Only earthquakes whose epicenters lie within the CZ-NEC polygon were included in the tabular part of the catalogue.

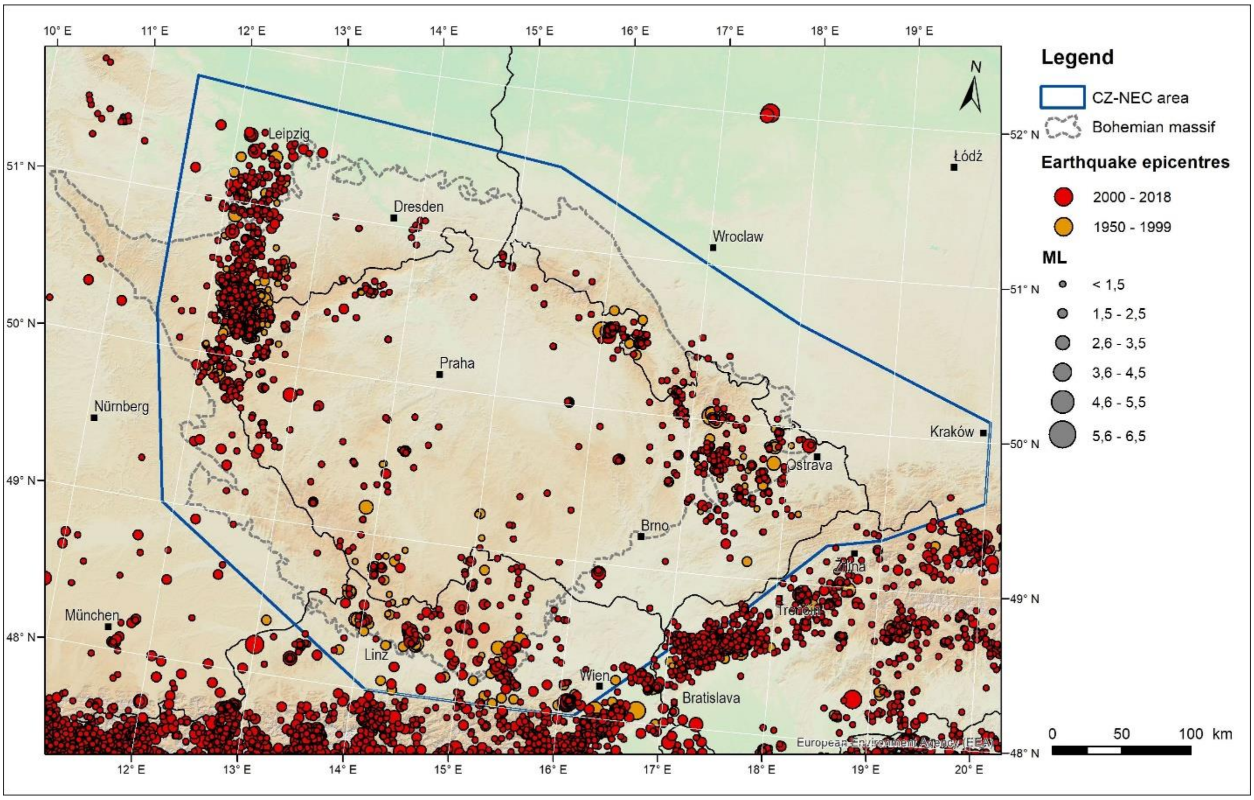


Fig. 20: Graphic presentation of both parts of the instrumental catalogue CZ NEC.

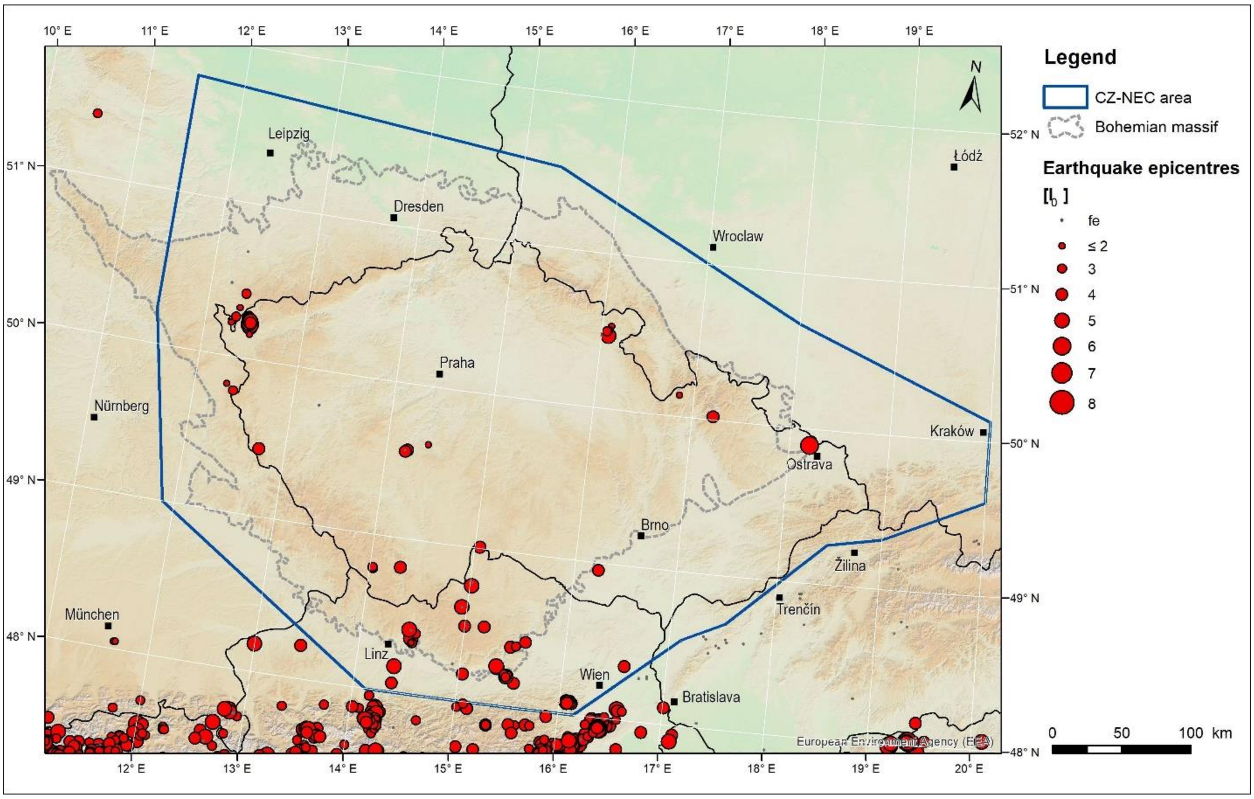


Fig. 21: Graphic presentation of the macroseismic data from the period 1950-2018.

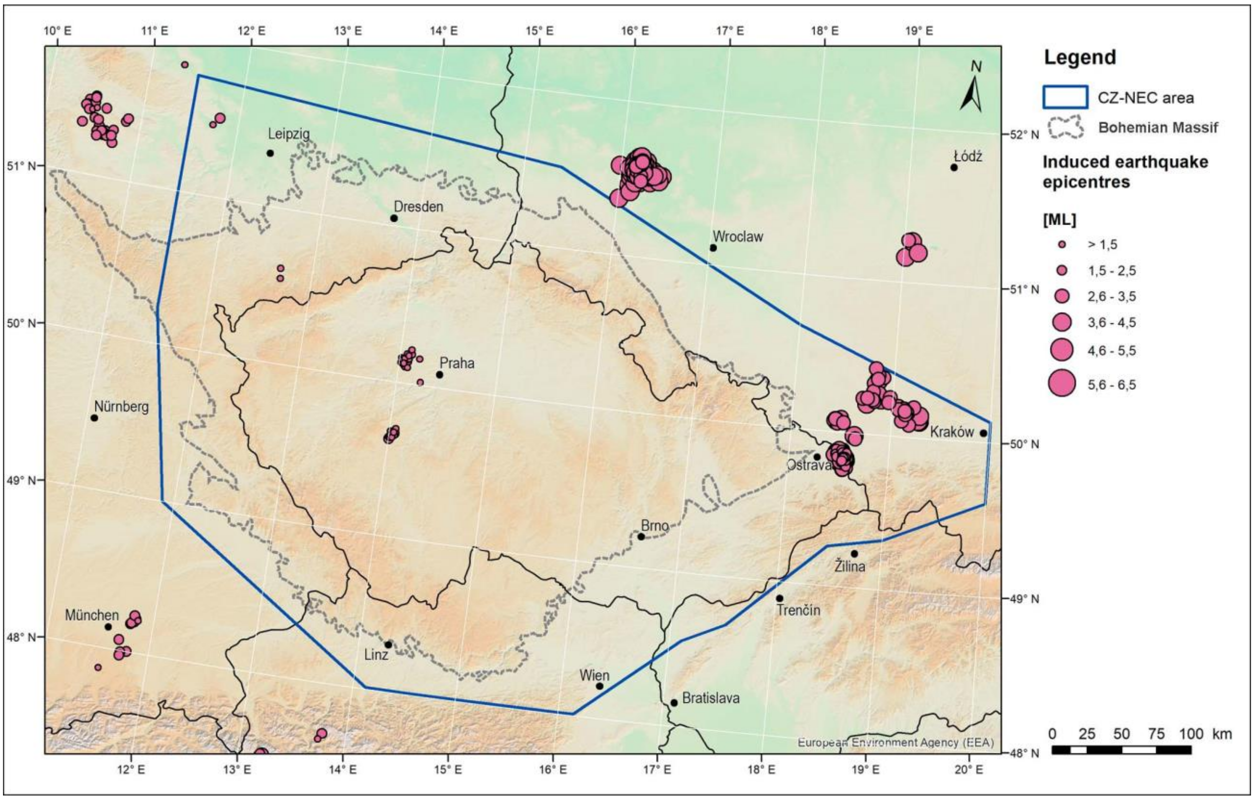


Fig. 22: Graphic presentation of induced earthquakes from 1950-2018.

5 ON-LINE PRESENTATION

CZ-NEC is made openly available on the Internet.

Software midop (see LOCATI AND CASSERA, 2010 - [455]) was chosen as the basis for web presentation of CZ-NEC catalogue. MIDOP is an initiative related to the European Archive of Historical Earthquake Data (AHEAD) and it is available for free to any institution or individual interested. This software allows to archive, process and present seismological data. MIDOP is also a good tool for easily transforming macroseismic intensity data tables into interactive maps, which is a planned extension of CZ-NEC activities.

The CZ-NEC website will be managed by the Institute of Physics of the Earth, Masaryk University, Brno, both update and archiving of older versions. It will be available during 2021.

The graphical presentation of the CZ NEC catalogue was prepared in the form of an interactive map based on **ArcGIS Online** https://www.esri.com/en-us/arcgis/products/arcgis-online/overview, which is a part of the Esri Geospatial Cloud.

An interactive map »CZ-NEC Map« based on ArcGIS Online is not yet available.

In this tool, it will be possible to freely combine the following CZ-NEC datasets and other geo-data in the CZ-NEC polygon and its surroundings:

Earthquake Data:

1. Paleo-earthquakes
2. Historical macro-earthquakes (768 – 2018)
3. Instrumentally recorded tectonic earthquakes (1950 – 2018)
4. Instrumentally recorded induced events (1950 – 2018)
5. Distant earthquakes felt in the Czech Republic (350 – 2018)
6. SHEEC catalogue (1000-2006) within the area of interest
7. CENEC catalogue (1000-2004) within the area of interest
8. LEYDECKER, G. (2016) - Events within the CZ NEC polygon (800 - 1980)

GEO-Data:

a) CZ-NEC polygon
b) Area of interest 48°N – 52°N and 10°E – 20°E
c) Bohemian Massif contour
d) ESRI Topographic Map
e) ESRI Relief Map
f) European Geological Map IGME 5000

The CZ-NEC online presentation will be made available during 2021.

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[MGH] **Monumenta Germaniæ Historica –** *https://www.dmgh.de/*

[W] **Free encyclopedia**: https://www.wikipedia.org/

[WV] **The Web Vocabulary to learn historical Czech:** https://vokabular.ujc.cas.cz/informace.aspx?t=ridics-en&o=ovokabulari

7 APPENDICES

7.1 CENEC CATALOGUE

Table 8: List of CENEC earthquakes falling into the CZ NEC polygon

Year	Mo	Day	h	min	Lat.	Long	depth	Intensity	Mw	Ref
1259	1	31			49,9	19,25		7	5	Pag
1326	0	0			50,8	12,2		6,5	4,6	Gru
1332	2	12			50,8	12,2		5,5	3,8	Gru
1366	5	24			51,12	10,33		5,5	3,8	GruRA
1409	8	24			52,1	11,4		6	4,2	GM95
1540	6	26	19		51,1	12,9		6,5	4,6	Gru
1552	3	6			50,58	13,08		6	4,2	Gru
1552	4	20	9		50,57	12,66		5,5	3,8	Gru
1553	8	17	19	30	51,1	12,9		6,5	4,6	GF98
1562	2	10			50,5	16,7		7	5	GLM
1568	7	26			51,12	13,05		5,5	3,8	Gru
1578	4	27	11		50,88	12,23		7	5	Gru05
1590	9	15	17		48,2	15,91	4	8	5,3	ZAMG
1590	9	15	23	50	48,2	15,91	4	9	6,2	ZAMG
1598	12	16	7		50,87	12,18		6,5	4,6	Gru
1616	12	18	18		51,2	12,25		5,5	3,8	FG96
1695	4	18			50,97	11,91		5,5	3,8	Gru
1701	3	27	15		50,59	12,64		5,5	3,8	Gru
1701	4	8	0	30	50,59	12,64		5,5	3,8	Gru
1711	10	25	19	15	51,18	12,56		6,5	4,6	Gru
1720	7	1	17		50,56	12,4		6	4,2	Gru
1751	7	31			50,8	15,6		6,5	4,6	GLM
1770	11	4	1		50,25	12,43		5,5	3,8	Gru
1771	1	6	16		50,25	12,43		6	4,2	Gru
1774	1	26	23		50,1	18,2		7	5	GLM
1784	3	20			50,6	13,77		5,5	3,8	Gru
1785	8	22	7		49,7	19	16	6,5	4,7	GLM
1786	2	13	23		50	16,6		5,5	3,8	CAS
1786	2	27	4		49,7	18,5	40	7,5	5,8	CAS
1786	12	3	17		49,9	19,3	35	7,5	5,7	GLM
1789	8	26	9	30	50,55	12,12		6	4,2	Gru
1799	12	11	14	45	50,5	16,1		6	4,2	CAS
1811	12	12	20		50,63	12,97	7	5,5	3,7	Gru
1824	1	13	13		50,33	12,51		5,5	3,8	Gru
1824	1	19	16	30	50,22	12,57	9	5,5	3,8	Gru
1829	6	3	0		50,7	15,7		6	4,2	GLM
1837	2	8	6		50,24	19,17		5,5	3,8	GLM
1847	4	7	19	30	50,46	11,14	17	6	4,3	NG95
1850	7	15	2	45	50,18	12,76		5,5	3,8	Gru
1852	11	15	22	30	48,64	17,16		6	4,3	Lab
1857	6	7	15	7	50,82	12,09	12	5,5	3,8	Gru
1872	3	6	15	55	50,86	12,28	12	7	5	GS01
1873	1	3	18		48,25	15,96	4	6,5	4,1	ZAMG
1875	11	23	0	45	50,5	12,14	5	5,5	3,7	Gru
1877	10	5	4	30	50,8	13,66	5	5,5	3,7	Gru
1883	1	31	13	43	50,5	15,9	6	6,5	4,5	CAS
1883	10	20	22	30	50,87	12,18	13	5,5	3,9	Gru
1888	12	26	0	12	50,51	12,4	9	5,5	3,8	Gru

Year	Mo	Day	h	min	Lat.	Long	depth	Intensity	Mw	Ref
1895	6	11	9	27	50,75	17	8	6,5	4,6	GLM
1896	5	16	20	50	50,5	12,1		6	4,2	Gru
1896	11	3	21	10	50,59	13,5	11	5,5	3,8	Gru
1897	10	25	21		50,35	12,4	9	5,5	3,8	Gru
1897	10	29	19	45	50,35	12,48	8	6	4,2	Gru
1897	11	7	4	45	50,3	12,5		6	4,2	Gru
1897	11	7	4	58	50,35	12,48	8	6,5	4,6	Gru
1897	11	17	6	30	50,22	12,32	9	6	4,2	Gru
1897	11	17	7	43	50,22	12,32	9	5,5	3,8	Gru
1900	7	25	18	40	50,35	12,45	5	5,5	3,7	Gru
1901	1	10	2	30	50,5	16,1	15	7	5,1	CAS
1902	11	26	12	15	49,67	12,67	5	6,5	4,5	Gru
1903	2	21	21	9	50,34	12,47	5	6	4,1	Gru
1903	2	23	5	31	50,3	12,42	7	5,5	3,7	Gru
1903	2	25	23	11	50,27	12,33	7	6	4,1	Gru
1903	3	5	0	50	50,31	12,33	12	5,5	3,8	Gru
1903	3	5	20	37	50,37	12,42	10	6,5	4,6	Gru
1903	3	5	20	55	50,37	12,42	10	6,5	4,6	Gru
1903	3	6	1	13	50,26	12,28	9	5,5	3,8	Gru
1903	3	6	4	57	50,34	12,47	14	6	4,3	Gru
1903	3	6	12	59	50,27	12,33		5,5	3,8	Gru
1903	3	6	19	11	50,26	12,28	16	5,5	3,9	Gru
1903	3	7	5	0	50,37	12,48	10	5,5	3,8	Gru
1903	3	8	6	22	50,35	12,5	8	5,5	3,8	Gru
1903	4	27	16	8	50,27	12,29	5	6	4,1	Gru
1904	10	12	3		48,68	17,39		6	4,3	Lab
1905	8	17	3	21	51,35	12,38	10	5,5	3,8	Gru
1908	10	21	14	4	50,27	12,32	10	5,5	3,8	Gru
1908	10	21	20	39	50,28	12,29	10	6	4,2	Gru
1908	10	22	21	42	50,35	12,49	9	5,5	3,8	Gru
1908	11	3	12	1	50,23	12,27	8	5,5	3,8	Gru
1908	11	3	13	24	50,23	12,31	10	6	4,2	Gru
1908	11	3	17	21	50,34	12,47	10	6,5	4,6	Gru
1908	11	4	3	32	50,36	12,49	6	6	4,1	Gru
1908	11	4	10	55	50,34	12,47	9	6,5	4,6	Gru
1908	11	4	13	10	50,34	12,47	9	6,5	4,6	Gru
1908	11	4	20	41	50,28	12,37	14	6	4,3	Gru
1908	11	6	4	35	50,34	12,47	14	6,5	4,7	Gru
1908	12	19	5	3	51,11	12,93	14	5,5	3,9	Gru
1914	6	27	1	44	51,36	12,43	8	6	4,2	Gru
1926	1	28	16	57	50,88	11,76	4	6	4	Gru
1931	4	12	21	25	49,9	17,9	10	6	3,9	CAS
1935	7	24	23	18	50,07	17,02	8	5,5	3,8	KMM57
1959	2	17	1	54	48,45	15,56	4	6	3,7	ZAMG
1963	11	3	0	27	50,6	15,9		5,5	3,6	CAS
1972	6	17	9	3	48,36	14,53	4	6,5	4,1	ZAMG
1985	12	21	10	16	50,2	12,5	10	6,5	4,5	SchP
1985	12	24	0	4	50,24	12,45	9	5,5	3,7	GruRA
1986	1	20	23	38	50,24	12,45	9	6,5	3,9	Gru91
1986	1	23	2	21	50,25	12,45	9	5,5	3,6	GruRA
2000	11	6	22	7	50,2	12,5	10	4,5	3,5	GFU
2004	12	2	18	25	49,77	19,81	10	5	3,8	GRF

7.2 SHEEC CATALOGUE

Table 9: List of SHEEC earthquakes falling into the CZ NEC polygon – period 1000-1899

Year	Mo	Da	Ho	Mi	Lat.	Long.	H	epi_I_0	Mw	Ax
1127	4	13			48,694	13,851		4,5	3,48	Ratisbonne, Göttweig
1259	1	31			50,114	17,405		4,5	4,14	Moravie
1326	0				50,8	12,2		6,5	4,79	Gera
1332	2	12			50,8	12,2		5,5	4,13	Gera
1366	5	24			50,8	12,2		7,5	5,44	Gera
1540	6	26	19		51,1	12,9		6,5	4,79	N.-Sachsen
1552	3	6			50,58	13,08		6	4,46	Annaberg-Buchholz
1552	4	20	9		50,57	12,66		5,5	4,13	Schneeberg
1553	8	17	19	30	51,25	13,365		5	4,34	Torgau
1562	2	10			50,3	16,5	5	6,5	4,79	Klodzko
1568	7	26			51,12	13,05		5,5	4,13	Meissen/Rochlitz
1578	4	27	11		50,88	12,23		6,5	4,79	Gera
1590	9	15	23	50	48,275	16,014	8	8,5	6,06	Niederroesterreich
1590	9	15			48,265	15,988		0	0	Neulengbach
1598	12	16	7		50,87	12,18		6,5	4,79	Gera
1616	12	18			51,2	12,25		5,5	3,8	Leipzig
1695	4	18			50,97	11,91		5,5	4,13	Jena Stadtroda
1701	3	27	15		50,59	12,64		5,5	4,13	Schneeberg
1701	4	8	0	30	50,59	12,64		5,5	4,13	Schneeberg
1711	10	25	19	15	51,18	12,56		6,5	4,79	N.-Sachsen
1720	7	1	17		50,56	12,4		6	4,46	Auerbach
1751	7	31			50,8	15,6	5	7	5,11	Karkonosze Mts.
1770	11	4	1		50,25	12,43		5,5	4,13	Kraslice
1771	1	6	16		50,25	12,43		6	4,46	Kraslice
1774	1	26			50,3	17,8	16	7	5,11	Silesia
1784	3	20			50,6	13,77		5,5	4,13	Ohre-Gräben
1785	8	22	7		49,7	19		6,5	4,79	Western Carpathians
1786	2	13	23		50	16,6		5,5	3,8	[Northern Moravia]
1786	2	27	4		49,7	18,5		7,5	5,44	Silesia
1786	12	3	17		49,7	20		7,5	5,44	S Cracow
1789	8	26	9	30	50,499	11,951		5	4,19	Plauen
1799	12	11	14	45	50,55	16,1	1	6	4,46	Czechoslovakia
1811	12	12	20		50,63	12,97	7	5,5	4,13	Annaberg-Buchholz
1824	1	13	13		50,33	12,51		5,5	4,13	Kraslice
1824	1	19	16	30	50,22	12,57		5,5	4,13	Sokolov
1829	6	3			50,6	15,6	1	4	3,14	Karkonosze Mts.
1837	2	8	6		50,24	19,17		5,5	3,8	[Katowice]
1847	4	7	19	30	50,378	10,851		5,5	4,45	Thuringia
1850	7	15	2	45	50,18	12,76		5,5	4,13	Sokolov
1852	11	15	22	30	48,64	17,16		6	4,46	Pernek – Modra
1857	6	7	15	7	50,82	12,09	12	5,5	4,13	Gera
1872	3	6			50,869	12,222		7	5,3	Central Germany
1873	1	3	19		48,16	15,945	4	6,5	4,74	Himmelhof
1875	6	12	23	40	48,253	15,99	9	5,5	4,45	Grabensee
1875	11	23	0	45	50,5	12,14	5	5,5	4,13	Plauen
1876	7	17	13	17	48,059	15,178	4	7,5	5,42	Scheibbs
1877	10	5	4	30	50,8	13,66	5	5,5	4,13	E.-Erzgebirge
1883	1	31	14	43	50,62	16,05	9	6	4,46	Czechoslovakia
1883	10	20	22	30	50,87	12,18	13	5,5	4,13	Gera
1888	12	26	0	12	50,51	12,4	9	5,5	4,13	Auerbach
1895	1	28	21	59	48,285	15,765	8	5	4,1	Grabensee
1895	6	11	9	27	50,7	17	9	7	5,11	Lower Silesia
1896	5	16	20	50	50,5	12,1		6	4,46	Plauen

Year	Mo	Da	Ho	Mi	Lat.	Long.	H	epi_I0	Mw	Ax
1896	11	3	21		50,59	13,5	11	5,5	4,13	Erzgebirge
1897	10	25	21		50,35	12,4	9	5,5	4,13	Oberes Vogtland
1897	10	29	19	45	50,32	12,484		6	4,66	Kraslice
1897	11	7	4	45	50,3	12,5		6	4,46	Kraslice
1897	11	7	4	58	50,359	12,49		6	4,56	Kraslice
1897	11	17	6	30	50,209	12,406		5,5	4,36	Oberes Vogtland/Skalná
1897	11	17	7	43	50,22	12,32	9	5,5	4,13	Oberes Vogtland/Skalná

Table 10: List of SHEEC earthquakes falling into the CZ NEC polygon – period 1900-2006

Year	Mo	Da	Ho	Mi	Sec	Lat.	Long.	H	epi_I0	Mw	Ref
1900	7	25	18	40		50,35	12,45	5	5,5	3,7	Gru
1900	9	28	8	15		48,31	14,47		5,5	3,8	ZAMG
1901	1	10	2	30		50,5	16,1	15	7	5,1	CAS
1902	11	26	12	15		49,67	12,67		6,5	4,6	Gru
1903	2	21	21	9	6	50,34	12,47	5	6	4,1	Gru
1903	2	23	5	31	47	50,3	12,42	7	5,5	3,7	Gru
1903	2	25	23	11	58	50,27	12,33	7	6	4,1	Gru
1903	3	5	0	50	18	50,31	12,33	12	5,5	3,8	Gru
1903	3	5	20	37	6	50,37	12,42	1	6,5	4,6	Gru
1903	3	5	20	55	32	50,37	12,42	1	6,5	4,6	Gru
1903	3	6	1	13	10	50,26	12,28	9	5,5	3,8	Gru
1903	3	6	4	57	29	50,34	12,47	14	6	4,3	Gru
1903	3	6	12	59	45	50,27	12,33		5,5	3,8	Gru
1903	3	6	19	11	14	50,26	12,28	16	5,5	3,9	Gru
1903	3	7	5	0	51	50,37	12,48	1	5,5	3,8	Gru
1903	3	8	6	22	32	50,35	12,5	8	5,5	3,8	Gru
1903	4	27	16	8	4	50,27	12,29	5	6	4,1	Gru
1904	10	12	3	0		48,68	17,39		6	4,3	Lab
1905	8	17	3	21		51,35	12,38	1	5,5	3,8	Gru
1908	10	21	14	4	9	50,27	12,32	1	5,5	3,8	Gru
1908	10	21	20	39	27	50,28	12,29	1	6	4,2	Gru
1908	10	22	21	42	36	50,35	12,49	9	5,5	3,8	Gru
1908	11	3	12	1	48	50,23	12,27	8	5,5	3,8	Gru
1908	11	3	13	24	42	50,23	12,31	1	6	4,2	Gru
1908	11	3	17	21	17	50,34	12,47	1	6,5	4,6	Gru
1908	11	4	3	32	51	50,36	12,49	6	6	4,1	Gru
1908	11	4	10	55	57	50,34	12,47	9	6,5	4,6	Gru
1908	11	4	13	10		50,34	12,47	9	6,5	4,6	Gru
1908	11	4	20	41	38	50,28	12,37	14	6	4,3	Gru
1908	11	6	4	35	53	50,34	12,47	14	6,5	4,7	Gru
1908	12	19	5	3	51	51,11	12,93	14	5,5	3,9	Gru
1914	6	27	1	44	50	51,36	12,43	8	6	4,2	Gru
1926	1	28	16	57	39	50,88	11,76		6	4,2	Gru
1931	4	12	21	25		49,9	17,9	1	6	3,9	CAS
1935	7	24	23	18	18	50,07	17,02	8	5,5	3,8	KMM57
1959	2	17	1	54		48,45	15,56	4	6	3,7	ZAMG09L
1963	11	3	0	27		50,6	15,9		5,5	3,6	CAS
1972	6	17	9	3		48,36	14,53		6,5	4,6	ZAMG09L
1985	12	21	10	16		50,2	12,5	1	6,5	4,5	SchP
1985	12	24	0	4		50,24	12,45	9	5,5	3,7	GruRA
1986	1	20	23	38		50,24	12,45	9	6,5	3,9	Gru91
1986	1	23	2	21	58,29	50,25	12,45	9	5,5	3,6	GruRA
2000	11	6	22	7	20	50,2	12,5	1	4,5	3,5	GFU
2004	12	2	18	25	42,04	49,77	19,81	1	0	3,8	GRF

Revision of the Czech National Earthquake Catalogue

Part 2
SOURCES MANAGEMENT

WP 2 – Action 2.5

Citation:

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Legend: ⊗ = Not available.

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[017] **Beckovský, Jan František, 1700.** Poselkyně Starých Přjběhůw Czeských, Aneb Kronyka Czeska: Od prwnjho do nynĕgssý Země České Přjchozu Dwauch Knjžat Charwátských Čzecha y Lecha Wlastnjch Bratřj Až do Stiastného Panowánj Cýsaře Ržjmského, Krále Čzeského, etc. Ferdynanda Prwnjho Wždycky Wjtěze Slawného k Rozmnoženj Obecného Dobrého, k Zwelebenj Gazyka Čzeského, A k Prospěchu Bližnjho ; Djl Prwnj, W němž se někteřj Cyzý Přjběhowé nacházegj, kteřj k Domácým přináležegjce od njch se odcyzyti nemohli / Od Kněze Jana Beckowskýho Křjžownjka s Čžerwenau Hwězdou na Swětlo wydaná. *1052 s., 2°, W Králowském Starém Městě Pražském: v Jana Karla Geřábka, 1700.*

[018] **Belar, Albin, 1899.** Graslitzer Erschütterungen vom Jahre 1824. *Sitzungsberichte des Deutschen Naturwissenschaftlich-Medicinischen Vereins für Böhmen "Lotos"* in Prag, *Jg. 1899, Neue Folge XIX. Band, 153-158, Prag, 1899.*

[019] **Belar, Albin, 1905.** Nichtbeeinflussung der Karlsbader Thermen durch das Lisaboner Erdbeben. *Die Erdbebenwarte, Jg. IV, 1904/05, Nr. 10,11,12, 211-212, Laibach, 1905.*

[020] **Berger, A., 1880-1881.** Zur Leidensgeschichte des Böhmerwaldes. *Mittheilungen des Vereins für Geschichte der Deutschen in Böhmen, Jg. 19, č. 2, str. 89-106. Prag, 1880-1881.*

[021] **Bernhertz, Michael, 1616.** Terraemotus Das ist: Ein gründlicher Bericht von den Erdbeben was dieselbige seyen, auß was Ursach dieselbigen entstehen, und zu welchem ende sie geschehen: Auß göttlicher Schrifft, und der Philosophorum meynung zusammen gezogen, und allen Menschen zu trewer warnung fürgestelt. Sampt einem Register vnd ordentlicher Erzehlung aller fürnembster Erdbeben, so viel in Historien auffgezeichnet zu finden. *112 s., Wagenmann, Nürnberg, 1616.*

[022] **Beuther, Johann Michael, 1601.** Compendium Terraemotuum. Das ist, Kurtzer Begriff, vnd Gründtliche verzeichnuß, Aller vnnd jeder Erdbidemen, die sich von zeit der allein seligmachenden Geburt JEsu Christi vnsers Erlösers vnd Heilandes, bßs auff jetzige 1601. Jahre, hin vnd wider in der gantzen Melz erhebr vnd zugerragen haben, So viel deren beydes in Kirchen: vnd andern glaubwürdigen Historien verfasset vnd auffgezeichnet befunden werden: Aus erheblichem anlaß dess Jungst verschienen 8. tag Septemb. Morgends frue zu 2. vhren gewesenen, vnd so wol im gantzen H. Reich, als anderen nechst vmgelegenen Rationen, vermerckten erschröcklichen Erdbidems, Mäniglichen zur notwendigen betrachtung, was von Erdbidemen zuhalten, fleissig zusammen gezogen, vnd in offentlichen Truck bestellet / Durch Johann Michael Beuthern der Rechten Doctorn Dagstulischer Freyhernschafft-Raht, vnnd Advocaten zu Hagenaw. *40 pp.; 4°, Lazarus Zetzner Buchhändler, Straßburg, 1601. (ABA001[0NK ČR Praha] -- sign. 15 F 000096).*

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[024] **Bohomolec, Jan, 1770.** Prognostyk Zły czy Dobry Komety Roku 1769 y 1770 Albo Natura y Koniec Komet: z Przydatkiem Opisania krotkiego obrotow Niebios y Reiestru tak Komet, iako też przypadkow znacznieyszych od potopu świata aż do tego roku. *255 pp., 8°, W Drukarni J. K. Mci y Rzeczypospolitey w Kollegium Soc. Jesu. Warszawa, 1770.*

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[027] **Bouška, Jan, 1940.** O dynamických účincích východoalpských zemětřesení na území Velké Prahy. *Publikace Geofysikálního ústavu v Praze, Spec. práce č. I, 9 s., Geofysikální ústav, Praha, 1940.*

[028] **Bretholz, Berthold, 1911.** Geschichte der Stadt Brünn, Hrsg. vom Deutschen Vereine für die Geschichte Mährens und Schlesiens. *1. Band, bis 1411, 443 s., Druck von Rudolf M. Rohrer, Brünn, 1911.*

[029-1] **Březan, Václav, 1847.** Wácslawa Březana Žiwot Wiléma z Rosenberka. *Spisů musejních č. XXIV, 327 s., w kommissí u Kronbergra a Řiwnáče, Praha, 1847. (str. 292)*

[029-2] **Březan, Václav, 1880.** Vácslawa Březana Život Petra Voka z Rosenberka. *Spisů musejních č. 151, 297 s., v kommissí knihkupectví Frant. Řivnáče, Praha, 1880. (str. 127-133)*

[030] **Bruncvík Miletínský, Václav, 1607.** Kázanij o Země třesenij / kteréž se stalo Létha ďobijhagijcýho 1606. we Cžtwrtek / w Ochtáb S° Ondřege neyprwněgssýho / z důstogných Legatůw / a Aposstolůw Syna Božijho / Pána a Spasytele nasseho Gežijsse Krysta. Složené ochotně a připsané wděčně: Slowutné a wysoce wzáctné Opatrnosti Gehomilosti Cýsařske Panu Rychtaři / a Panu Purgmistru / y Panům Senatorům Města Wysokého Meytha / Panům Deffensorum / Patronům / a Ochrancům swým / pro a skrze wijru a známost Syna Božijho Pana Gezu Krysta / dobrotiwě a laskawě přijzniwým / ec. Od Kněze Wáclawa Bruncwika Miletinskeho / ec. Léta 1607. *27 s., 16°, Wytisstěno w Městě Litomyssli Andres Graudenc, 1607. (Strahov monastery library, Prague -- sign. FK IV 71 přív.).*

[031] ⊗ **Bruncvík, Zachariáš, 1615.** Kázaní o hrozném zemětřesení w kraji Bechynském i jinde stalém. *38 s., 8°, Daniel Karolides z Karlsberka, w Praze 1615.* **NOT AVAILABLE**. *See List of Czech and Slovak Early Printed Books, ID number K01327.*

N.R. *It relates to the earthquake of 1615, February 20, in Austria.*

[032] **Bruncvík Miletínský, Václav, 1615.** Kázanij o hrozném a děsytedlném Země třesenj / Léta přítomného 1615, Unora dne 19. w Kragi Práchenskem / y ginde stalém / až y Zázracých té nocy na Obloze Nebeské spatřených / gak z Slowa Božího / tak učenj Theologů / fizyků / a Mathematyků sebrané / a činěné w Městě Prachaticích. W Neděli Prwnj po Dewjtnjku. Od Kněze Zacharyásse Bruncwjka Nowopražského / Děkana w Městě Prachaticých. *8°, Wytisstěné w Nowém Městě Pražském / u Danyele Karla z Karlsspergka. 1615. Library of the Czech Academy of Sciences, Sign. Th 12.*

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[034] **Lindner, Obrist von, 1801.** Erdbeben in Schlesien 1799. **Buch, Leopold von, 1801.** Nachricht von diesem Erdbeben. *Der Gesellschaft Naturforschender Freunde zu Berlin, Neuere Schriften Jg. III, 180-194, Berlin, 1801.*

[035] **Calagio, Andrea M., 1590.** Terrae motus Passim in Silesia XV. Sept. Anno MDLXXXX media nocte, ter, citra incommodum: Alibi vero gentium frequentius & longius, non fine ingenti damno animadversus, Seculo huic fecuro & profano utcunq; inculcatus. *Gorlici Ambrosius Fritsch exudebat., Vratislav, Anno MDXC.*

[036] **Neuböck, Johann Caspar, 1591.** Zwo catholische Predigen. Gehalten zu Wienn in Österreich / in offentlichen bersamblungen zum gemeinen Gebett / wider die schröckliche Erdtbiden, so sich Anno 1590 den 15. September / und nachmals vilfeltig erzeigt haben. Durch Den hochwirdigen / in Gott Vattern und Herrn / Herrn Johann Casparn Bischoffen zu Wienn / Rȯm: *Anno clↄ. lↄ. xci.*

[037] **Anonym, (Cerroni, J.P.), 1742.** Geschichte der königlichen Stadt Iglau. *Manuscript Cerroni II. 170, In: Moravský zemský archiv Brno, G 12 – Cerroniho sbírka, inv. č. 282, Cerroni II, č. 170.*

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[039] **Commenda, Hans, 1907**. Erdbeben und Erdbebennachrichten aus Oberösterreich. *Petermanns geographische Mitteilungen XLI Bd., 1900. Abgedruckt auch in die Erdbebenwarte Jg. VI. 1906/07, Laibach 1907.*

[040] ⊗ **Conrad, V., 1928.** Das Schwadorfer Beben vom 8. Oktober 1927. *Gerlands Beiträge zur Geophysik, Bd. 20, 240-277, Leipzig, 1928. **N.R.** It relates to the earthquake of 1927, October 8, in Austria.*

[041] **Kosmas, 1110–1125.** Cosmae ecclesiae Pragensis decani Chronicon Bohemorum …. Accedubt eiusdem Cosmae continuatores. *In: Scriptorus rerum Bohemicarum, Tomus I, 498 s., Pragae 1783.*

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[043] **Credner, Hermann, 1877.** Das Dippoldiswalder Erdbeben vom 5. Oktober 1877, *Zeitschrift für die gesamten Naturwissenschaften, Band L, Neue Folge, 275-287, Berlin, 1877.*

[044] **Credner, Hermann, 1884.** Die erzgebirgisch-vogtländischen Erdbeben während der Jahre 1878 bis Anfang 1884. *Zeitschrift für Naturwissenschaften, Bd. LVII (1884), 2-29, Halle a. S., 1884.*

[045] **Credner, Hermann, 1889.** Das vogtländische Erdbeben vom 26. December 1888. Mit einer Übersichtskarte auf Tafel III. *Berichte über die Verhandlungen der Königlich Sächsischen Gesellschaft der Wissenschaften zu Leipzig. Mathematisch-Physische Klasse. 41. Band, 76-85, Leipzig, 1889.*

[046] **Credner, Hermann, 1898.** Die sächsischen Erdbeben während der Jahre 1889 bis 1897 insbesondere das sächsisch-böhmische Erdbeben vom 24. October bis 29. November 1897. *Abhandlungen der Sächsischen Akademie der Wissenschaften zu Leipzig, Mathematisch-Naturwissenschaftliche Klasse, Bd. XXIV, 317-397, Leipzig, 1898.*

[047] **Credner, Hermann, 1900.** Die seismischen Erscheinungen im Königreiche Sachsen während der Jahre 1898 und 1899 bis zum Mai 1900. *Berichte über die Verhandlungen der Königlich Sächsischen Gesellschaft der Wissenschaften zu Leipzig. Mathematisch-Physische Klasse, 52. Band, 37-42, Leipzig, 1900.*

[048] **Credner, Hermann, 1900.** Die vogtländischen Erdbebenschwärme während des Juli und des August 1900. *Berichte über die Verhandlungen der Königlich Sächsischen Gesellschaft der Wissenschaften zu Leipzig. Mathematisch-Physische Klasse, 52. Band, 153-177, Leipzig, 1900.*

[049] **Credner, Hermann, 1902.** Die vogtländischen Erderschütterungen in dem Zeitraume vom September 1900 bis zum März 1902, insbesondere die Erdbebenschwärme im Frühjahr und Sommer 1901. *Berichte über die Verhandlungen der Königlich Sächsischen Gesellschaft der Wissenschaften zu Leipzig. Mathematisch-Physische Klasse, LIV. Band, 74-90, Leipzig, 1902.*

[050] **Credner, Hermann, 1904.** Der vogtländische Erdbebenschwarm vom 13. Februar bis 18. Mai 1903 und seine Registrierung durch das Wiechertsche Pendelseismometer in Leipzig. *Abhandlungen der Sächsischen Akademie der Wissenschaften zu Leipzig, Mathematisch-Naturwissenschaftliche Klasse, Bd. XXVIII, N°. VI, 421-530, Leipzig, 1904.*

[051] **Credner, Hermann, 1907.** Die sächsischen Erdbeben während der Jahre 1904 bis 1906. *Berichte über die Verhandlungen der Königlich Sächsischen Gesellschaft der Wissenschaften zu Leipzig. Mathematisch-Physische Klasse, 59. Bd., s. 333-355, Leipzig, 1907.*

[052-1] **Anonym, 17s0.** Prawdiwý hrozný Přjbech o pře-vkrutném Země třesenj / Léta 1755. dne 1. Listopadu / a to skoro celého tak welkeho Slawného Města Lyzabonu w Portugalu, y Královské Rezydency. Wssem w Piseň uwedeny / ó Okolnjch Měst a Krágin sskod trpěgicy k Polepsse – nj a k Vstrnuti wydaný. *4 s., Předně w Praze a nynj w Litomyssly 17s0. Library of the National Museum in Prague, Old print room, Sign. 27 C 27.*

[052-2] **Anonym, 1756.** Píseň k Ustrnutí Všem věrným křesťanům, kterak tohoto léta 1755, Dne 1. Listopádu v Zemi Portugalské, Skrze Země Třesení, Hlavní Město Lyzabona Y Jiné okolní Města Z Božího Dopuštění Škodu trpěli, Vytištěná v Holomoucy Roku 1756. In: **Beneš, Bohuslav, 1970.** Světská kramářská píseň: příspěvek k poetice pololidové poezie. *Opera Universitatis Purkynienae Brunensis facultas philosophica – Svazek 150, 273 s. + Příloha,Univerzita J.E. Purkyně v Brně, Filozofická fakulta, Brno, 1970. (Str. 170).*

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[054] **Dathe, Ernst., 1897.** Das schlesisch-sudetische Erdbeben vom 11. Juni 1895. *Abhandlungen der Königlich Preussischen Geologischen Landesanstalt, Neue Folge, Heft 22, 1-329, Berlin. 1897.*

[055] **Dathe, Ernst., 1898.** Bemerkungen zum schlesisch-sudetischen Erdbeben vom 11. Juni 1895. Jahresbericht der Schlesischen Gesellschaft für Vaterländische Cultur, II. Abtheilung. Naturwissenschaftliche Section, 7-22, Breslau, 1898.

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[113] **Freher, Marquard, 1602**. Rerum bohemicarum antiqui scriptores aliqvot insignes, partim hactenvs incogniti. Qui gentis originem & progressum, variasq[ue] regni vices, & Regum aliquorum vitam resq[ue] gestas peculiariter, Hußitarum deniq[ue] sectae historiam & profeßionem litteris tradiderunt / Ex bibliotheca C. V. MARQVARDI FREHERI, Consiliarii Palatini. Accedunt seorsim IOH. DVBRAVII EPISCOPI OLOMVCENSIS, Historiæ Bohemicæ Commentarii, longe emendatiores & auctiores. Omnia cum Indicibus rerum & verborum memorabilium amplißimis. III. Chronica Aulæ Regiæ, cœnobii eo nominee in Bohemia: De Iohanne Rege Bohemiæ & sub eo in regno, nec non in Germania actis, ab anno MCCCXVII. usque ad annum MCCCXXXIII.

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[201] **Peter von Zittau, Otto von Zittau (Žitavský, Petr; Žitavský, Ota) 1339.** Kronika zbraslavská = Chronicon Aulæ Regiæ, *1-337, In: Fontes Rerum Bohemicarum, Tom. IV., Chronicon Aulæ Regiæ. – Excerpta de diversis chronicis additis quibusdam Aulæ Regiæ memorabilibus. – Chronicon Francisci Pragensis. – Chronicon Benesii de Weitmil. Prameny dějin českých vydané z nadání Palackého péčí „Spolku historického v Praze” pořádáním Josefa Emlera. Praha 1884.*

[202] **Petrak, Eduard Rudolf, 1883.** Das jüngste Erdbeben im Riesengebirge. Das Riesengebirge im Wort und Bild: Fachblatt für die Gesammtkunde des Riesengebirges und der angrenzenden Gebiete, III. Jg., č. z 1.7. 1883, 36-41.

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[207] **Scriptorum Rerum Bohemicarum:** Tomus III. Annales patrio sermone scripti vulgo Pulkavae et Benessii de Horowic chronicorum continuatores anonymi. *524 s., Cura et impensis regiæ Societatis Scientiarum Bohemicæ. Pragæ 1829.*

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[210] **Rasch, Johannes, 1591.** Erdbidem Chronic Nach art eines Calenders, sambt einem kurtzen bericht vn[d] Catalogo Autorum. Darin[n] allerley Erdbiden vnd Erdklüfften, vor Christi Geburt 1569. vnd souil deren biß auff diß 1591. Jar her beschrieben: Diese seyen von jnnerlichem Erdrich herauß, oder vom Himmel heras, von Lufft, Wind, vnd Wetter verursacht, Darauß zusehen vnd zulernen, was destro tröstlicher sich menniglich darnach zurichten hat / Durch Johann Raschen in Wien also zusammen gebracht vnd an tag geben. *40 s., 4°, Gedruckt zu München: bey Adam Berg, 1591.*

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[253] **Špaček, Josef, 1933.** Les tremblements de Terre dans la région frontière Silésie-Moravie. *Publications du Bureau central séismologique international. Série B. Monographies, Fascicule № 4, 74-90, Nogent-le-Rotrou, 1933.*

[254] **Špaček, Josef, 1932.** K zemětřesení ve Slezsku (s mapkou). *Vesmír, Jg. X, 1932, Nr. 5, s. 132-134.*

[255] **Štefan, Václav, 1605.** LIBELLUS DE METEORIS. To gest: Knjžka w njž se kratjčce o Vkazých a rozličných hnutjch w Powětřij wypisuge / a z Pjsem swatých wyswětluge / Wydaná od K. Wácsĺawa Ssteffana Teplického / Služebnjka Slowa Božjho na Horách Kuttnách. *8°,Wytisstěna w Starém Městě Pražském / v Danyele Sedlčanského. Léta Páně M.DC.V.*

[256-1] **Štefan, Václav, 1615.** De terrae motu. To gest: O Země třesenj / kteréž se stalo na Horách Kuttnách, Kaňku, a wssudy w tom wůkolj: Též y na Morawě w některých mijstech / ec. Léta Páně 1615. 20. dne Vnora w Pátek po Neděli Dewjtnjk, při hodině 10. Ráno / ec. Kázanj včiněné w Neděli následugjcý[= 22. února] od K. Wácslawa Sstěffana / Děkana na Horách Kuttnách. Wytisstěné w Starém Městě Pražském v Matěge Pardubského. Léta 1615. *8°, Knihovna Husova domu (Praha, Česko) -- sign. 1 C 10 přív. = I T 80 přív. (KHD Sbírka rukopisů a starých tisků Ústředního archivu Českobratrské církve evangelické v Praze).*

[256-2] **Michal, Emanuel, 1961.** Neznámý tisk Václava Štefana o zemětřesení roku 1615. *Strojopis, opis článku In: Sborník pro dějiny přírodnich věd a techniky = Acta historiae rerum naturalium nec non technicarum, Roč. 6, 229-239, ČSAV, Praha, 1961./ Geofyzikální ústav AV ČR, Archiv V. Kárníka, S 1362.*

[256-3] **Michal, Emanuel, 1961.** Neznámý tisk Václava Štefana o zemětřesení roku 1615. *Sborník pro dějiny přírodnich věd a techniky = Acta historiae rerum naturalium nec non technicarum, Roč. 6, 229-239, ČSAV, Praha, 1961.*

[258] **Tesák Mošovský, Jiří, 1613.** Tonitrua & Tempestates. To gest Spis o strassliwém Powětřj, častém hřjmánj, a hrozném hromobitij: kteréž roku tohoto přijtomného 1613. w Králowstwj tomto Czeském, wewssech téměř kragich na wssechny strany, pro hřijchy a neprawosti nasse, bylo welmi zhusta s welkau nebohých lidij sskodau slycháno y wijdáno / sprostničce dle Pijsem Swatých sebraný a wydaný: Od Kněze Giřijka Tesáka Mossowského, Faráře SwatoHasstalského, a Swato-Křjžského. Léta Páně DeVs Certe sVperbls seMper reslstIt. *70 pp., 8°, Wytisstěný w Starém Městě Pražském: V Matěge Pardubského, 1613, ABA001[NK ČR Praha] -- sign. 54 K 006786.*

[259] **Těšínský kalendář na rok 1922.** Adamus, Al., Přehled dějin Těšínska až do r. 1653. *Slezská Ostrava: Slezská Matice osvěty lidové na Těšínsku a Hlučínsku, (1921-1947), 81-97, lex. 8°.*

[260] **Schneider, Daniel, 1723.** Theatri Europæi Neunzehender Theil. Oder Außführlich fortgeführte Friedens- und Kriegs-Beschreibung. Und was mehr Von denck- und merckwürdigsten Geschichten in Europa, vornemlich aber, in Hoch- und Nieder-Teutschland: ... auch einige in der übrigen Welt-Theilen: zu Wasser und Lande, vom 1710ten Jahr, biß zu Außgang des 1712ten vorgegangen und sich begeben haben: Alles auß vertraulich communicirten Schrifften, ... zusammen getragen und beschrieben. Wie auch Mit unterschiedlicher Potentaten und berühmter Krieges-Helden Bildnüssen, danebenst auch mit denen vornehmsten Kriegs-Actionen; ... mit annehmlichen Kupffern gezieret, und verleget Durch Weyland Carl Gustav. Merians Seel. Erben. *XIX. Theil, 1585 pp. Gedruckt bey Anton Heinscheidt, Frankfurt am Mayn 1723.*

[261-1] **Tomek, Wácslaw Wladiwoj, 1875.** Dějepis města Prahy. Díl III. *s. 503, W kommissí u Františka Řiwnáče, W Praze, 1875.*

[261-2] **Tomek, Wácslaw Wladiwoj, 1901.** Dějepis města Prahy. Díl XII. *s. 341, W kommissí u Františka Řiwnáče, W Praze, 1901.*

[262] **Toperczer, Max; Trapp, Erich, 1950.** Ein Beitrag zur Erdbebengeographie Österreichs, nebst Erdbebenkatalog 1904-1948 und Chronik der Starkbeben. *Mitteilungen der Erdbeben-Komission, N. F., Nr. 65, 59 s. Wien, 1950.*

[263] **Trimmer, L., ????.** Sammlung gemischter Nachrichten von vergangenen und jetzigen Zeiten von Glück und Unglück fällen nebst …. 1816 bis 1822. *MS, Zweiter Teil, s. 292-293, State Regional Archives in Třeboň, Sign. A23.*

[264] **Uhlig, Viktor, 1901**. Bericht über die seismischen Ereignisse des Jahres 1900 in den deutschen Gebieten Böhmens. *Mittheilungen der Erdbeben-Kommission der kaiserlichen Akademie der Wissenschaften in Wien, Neue Folge, No. III., s. 1-55, Kaiserlichen Akademie der Wissenschaften in Wien, Wien, 1901.*

[265] **Ulke, K., 1830.** Gesammelte Nachrichten von Frankenstein und dessen Umgegend. *Nr. 66, von 10. April 1830, Frankenstein 1830.*

[266] **Anonym (F. Sturm?), 1902.** Historische Beben in Schlesien. *Erdbebenwarte, I. Jahrgang, 1901/02, Nr. 9 und 10, Laibach, 4. Februar 1902, s. 117-118, Laibach, 1902.*

[267] **Anonym, 1590.** Ein kurtzer Bericht Von dem sehr grossen vnd erschrecklichen Erdbeben dieses j[e]tzige 1590. Jar den 15. Septem. geschehen/ durchs gantze Königreich Böhemb / Mehren / Osterreich / vnd sonderlich in der … Stadt Wien ... | Hiebey auch newe Zeitung auß Wien. *17 p., Gedruckt zu Franckfurt an der Oder, 1590.*

[268] ⊗ **Anonym, 1598.** Beschreibung von dem grossen Erdbeben zu Wien, und verschiedenen herumliegenden Orten, Wien 1598. **NOT FOUND.** *(See Věstník České akademie věd a umění, Svazek 50, s. 30, ČSAV, 1941).* **N.R.** It relates to the earthquake of 1590, September 15, in Austria (Neulengbach).

[269] ⊗ **Anonym, 1590.** Von dem erschröcklichen grossen vnd sehr schedlichen Erdbeben so dieses jetzt lauffende 1590. Jahr, den 15. Septemb. geschehen in dem Ertzhertzogthumb Osterreich, sonderlich aber in ... Wien vnd vmbliegenden Ortern vnd Flecken ... ; Erstlich Gedruckt zu Wien. M. D. LXXXX. *Verfügbar in ÖNB Sammlung von Handschriften und alten Drucken Rara - http://data.onb.ac.at/rec/AC00951187.* **N.R.** It relates to the earthquake of 1590, September 15, in Austria (Neulengbach).

[270] **Anonym, 1620.** "Ungenannt: Kázáni o třeseni neb pohnutí země a podivném v oblacích hučení, 1620 (siehe 188)". *See [206].*

[271] **Anonym, 158?.**De Terræ Motu. O země Třesení a Rozjímání pobožné.

[272] **Anonym, 1591?.** Nowiny nessťastné z Hory Gutny / Kteréž se staly den sstiedrého wečera (:z dopusstěnij Božijho:) nynij při koncy Roku[15]90. Prwnij / O ohni kterýž se stal w Sobotu před čtwrtau Neděli Adwentnij. Druhá / O zbořenij dwau Sstijtů z domu Pana Zykmunda Steysska / též v Hory Gutny. Při tom o zmordowaných lidech / gichž se nasslo / w počtu gedenmecytma osob / kteřijž od země třesenij / a od týchž Sstijtů zahynuli / a mnozý y raněni odtud zdobeywáni. Kdo bude bedliwě čijsti / wsseho se wijcegij dočte. *4°,[V Praze] Jan Filoxenes Gitčijnský wytlačil[1591?].*

[273] ⊗ **Anonym, 1763.** Žalostiwá Pjseň O hrozném Země Třesenj, w Králowstwj Vherském w Městě Komárna (!), w Rádu, a giných Městech až k vstrnutj, z Pjsně se lépeg wyrozumj... *Píseň; 1763;[IV] ll. 16°, National museum library, sign. 27 H 67. Index of Czech and Slovak Early Printed Books published between years 1501-1800, ID: K12785.* ***N.R.*** It relates to the earthquake of 1763, June 28, (Komárno - Slowakia).

[274] **Anonym, 1590?.** Spis Kratjčkey. O hrozném Země Třesenj / kteréž Létha tohoto M.D.Lxxxx w Sobothu na Neděli XI. po Swaté Trogi[cy][w] této nássý České Zemi / w Morawě Rakausých / a ginde Pan[Bůh] Wssemohaucý z obzwl̂ásstnjho hněwu swého / aby lidj w hřjssjch opl̂ýwagjcý k pokánj prawému přiwedl̂ / dopustiti ráčil̂. A to l̂askawé geho nápomenutj /[které w] sobě nesl̂o / nepřestanemeli nep[rawostj] poněkud se tuto vkáze. *Strahov monastery – sign. FR I 18 přív. (torso)*

[275] **Hanuš Lanškrounský, Jiří, z Kronenfeldu, 1596.** Prawdiwé a kratičké wypsánij O Zázračnopodiwném skutku Páně / kterýž se stal w Kragi Chrudimském blijž Wysokého Meyta / Léta giž pominulého eč. XCV°. w Sobotu na Neděli Stědrého dne / předcházegjcý památku Narozenj Pána Gezu Krysta / ginák xxiij° Dne Měsýce Prasynce. *4°, 5 fol., Wytisstěno w Starém Městě Pražském / u Danyele Sedlčanského. Léta Páně: 1596. Lobkowicz library, Roudnice nad Labem, Czech Republic, sign. III Ib 12 přív. 41.*

[276] **The same as [225]**

[277] **Anonym, 176?.** Zeitgenossische Zeitungen über das Erdbeben vom 27. Februar 1768 in Wien. *State Regional Archives in Třeboň, MS, Sign. IB 4E 24a.* **N.R.** It relates to the earthquake of 1768, February 27, in Austria (Brunn am Steifeld).

[278] **Unglücks-Chronica** vieler grausamer und erschrecklicher Erdbeben. *Gedruckt bey Thomas von Wiering, Hamburg [ca. 1695].*

[279] **Vacek, František, 1884.** Paměti královského města Velvar / sestavil a vysvětluje František Vacek.*386 s., Nákladem spisovatelovým a písmem i v komissi knihtiskárny Hohlička a Sieverse. V Praze, 1884.*

[280] **Vavák, František J., 1916.** Paměti Františka J. Vaváka, souseda a rychtáře Milčického z let 1770 až 1816. *Kniha třetí (Rok 1791-1801, část II (1795-1797), III/2, 111 s., Praha, 1916; s. 44.*

[281A] **See [117]**

[281B] **V.L., 1850**. Směs. *Včela, 1850, Nr. 40., p. 166.*

[282-1] **Adam z Veleslavína, Daniel, 1578.** Kalendář Hystorycský: To gest Krátké poznamenánij wssech dnuow gednohokaždého Mesýce přes celý Rok: k nimžto přidány gsau některé paměti hodně Historiae, o rozličných přijhodách a proměnách yak Národůw giných a zemij w Swětě tak také a obzwlásstně Národu a Králowstwij Czeského z hodnowěrných Kronyk od M. Danyele Adama Pražského s pilnostij sebrany. *378 s., Vytisstěný w Starém Městě Pražském v Giřijho Melantrycha z Awentýnu a M. Danyele Adama Pražského, 1578.*

[282-2] **Adam z Veleslavína, Daniel, 1590.** Kalendař Hystorycky: Krátké a Summownj poznamenánj wssechněch dnůw gednohokaždého Měsýce, přes celý Rok: K nimžto s doloženjm Let, buďto od Stwořenj Swěta, aneb od Narozenj Božjho, přidány gsau wjry a paměti hodné Historyae, o rozličných proměnách a přjhodách, sstiastných y nesstiastných, weselých y smutných, obecných y osobnjch, yak w giných Národech a zemjch, tak obzwlásstně w slawném Národu a Králowstwj Českém, zběhlých: Napřed položeny gsau Genealogiae, aneb Tabule Rodůw welikomocných Knjžat a Králůw, kteřjž od začátku až do těchto časůw na České zemi kralowali: Gest y mnohých giných Rodůw Králowských a Knjžetcých mjsty swými w Kalendáři dotknuto, kteřjž nynj w Europě w Ržjssi panugj: Indices k tomu a Registra dostatečná napřed y nazad se na[gdau]: To wssecko znowa rozssjřeno, a k ljbosti těm, gessto celých Historij a obssjrných Kronyk mjti, aneb pro přjčiny

čjsti nemohau (wssak s vkázanjm, kdeby wjce hledati a nagjti měli) / s pilnostj sebráno, wytisstěno a wydáno, pracý a nákladem M. Danyele Adama z Weleslawjna. *636 s., 6°, Wytlačeno w Starém městě Pražském: v M. Danyele Adama z Weleslawijna, 1590.*

[283] **Veselský, Petr Miloslav, 1867.** Královské horní město Hora Kutná: úplný děje- a místopis. Díl první: Od počátku města až do roku 1424. Díl druhý: Od roku 1424 až do roku 1500. Díl třetí: Děje od roku 1501 až do roku 1600. Nový tisk: 264 s., *Vydavatelství a nakladatelství Martin Bartoš - Kuttna, Kutná Hora, 2008.*

[284-1] **Vlastivěda moravská.** II. Místopis. Díl II., Brněnský kraj. Klobucký okres. Napsal Karel Jar. Bukovanský. 159 s., Nákladem Musejního spolku v Brně. V Brně 1909.

[284-2] **Vlastivěda moravská.** II. Místopis. Díl II., Hradištský kraj. Kroměřížský okres. I. Část. Napsal František Václav Peřinka, Nákladem Musejního spolku v Brně. V Brně 1911.

[285] **Vogt, Maururius, 1729.** Boemia, et Moravia subterranea, Autore R.P. Mauritio Vogt s.o. cist. Plassij Professo. Anno 1729 conscripta. *380 s., Nationalmuseum in Praha, sign. VI.D.10.*

[286] **Vogler, G.H. Otto, 1857.** Untersuchungen über das Phänomen der Erdbeben in der Schweiz, seine Geschichte, seine Äußerungsweise, seinen Zusammenhang mit anderen Phänomenen und mit den petrographischen und geotektonischen Verhältnissen des Bodens, und seine Bedeutung für die Physiologie des Erdorganismus. I. Theil, Chronik der Erdbeben in der Schweiz. *Justus Perthes, Gotha, 1857.*

[287] **Weck, Anton, 1680.** Der Chur-Fürstlichen Sächsischen weitberuffenen Residentz- und Haupt-Vestung Dresden Beschreib: und Vorstellung: Auf der Churfürstlichen Herrschaft gnädigstes Belieben in Vier Abtheilungen verfaßet, mit Grund: und anderen Abrißen, auch bewehrten Documenten erläutert. *700 s., In Verlegung Johann Hoffmans, Nürnberg 1680.*

[288] **Weindrich, Martin, 1591.** Commentativncvla de Terrae Motv: Pronunciata / A Martino Weindrichio Professore Physices in Gymnasio Vratisl. *42 s., Vratislaviae in officina typographica Georgii Baumanni, I., MDXCI.*

[289] **Woldřich J. N., 1897.** Předběžná zpráva o zemětřesení v Pošumaví ze dne 5. ledna 1897. Rozpravy České akademie císaře Františka Josefa pro vědy, slovesnost a umění. Třída II, Mathematicko-přírodnická, Jg. VI, No. 2, 1897, 1- 6.

[290] **Woldřich, J. N., 1899.** Zpráva o podzemní detonaci z Mělníka v Čechách dne 8. dubna 1898. Rozpravy České akademie císaře Františka Josefa pro vědy, slovesnost a umění. Třída II, Mathematicko-přírodnická, Jg. VIII, No. 7, 1-18, 1899.

[291] **Woldřich, J. N., 1898.** Bericht über die unterirdische Detonation von Melnik in Böhmen von 8. April 1898. Sitzungsberichte der kaiserlichen Akademie der Wissenschaften in Wien. Mathematisch-Naturwissenschaftliche Classe, Bd. 107 (1898), Heft X, Abtheilung I., Mittheilungen der Erdbeben-Commission der kaiserlichen Akademie der Wissenschaften in Wien, No. IX, 1179-1207, Wien, 1898.

[292] **Woldřich, J. N., 1901.** Zemětřesení v severovýchodních Čechách ze dne 10. ledna 1901. Rozpravy České akademie císaře Františka Josefa pro vědy, slovesnost a umění. Třída II, Mathematicko-přírodnická. Jg. X, No. 25, 1-32, 1901.

[293] **Woldřich, J. N., 1901.** Das nordostböhmische Erdbeben vom 10. Jänner 1901. Mittheilungen der Erdbeben-Commission der kaiserlichen Akademie der Wissenschaften in Wien, Neue Folge, No. VI, 1-35, Wien 1901.

[294] **Woldřich, Jan Nepomuk, 1902.** Všeobecná geologie se zvláštním zřetelem na země koruny České. *Bd. II, s. 136-155, Praha, 1902.*

[295] **Woldřich, Jan Nepomuk, 1897.** Sdělení o zemětřesení krušnohorských z 25. až 29. října 1897. *Věstník České akademie císaře Františka Josefa pro vědy, slovesnost a umění, Jg. VI, 1897, č. 8, 449-451.*

[296] **Woerle, Hans, 1900.** Das Erschütterungsbezirk des grossen Erdbebens zu Lissabon; ein Beitrag zur Geschichte des Erdbeben. *Münchener Geographische Studien, herausgegeben von Siegmund Günther, 8. Stück, 1-148, München, 1900.*

[297] **Zátopek, Alois, 1937.** Zemětřesení v severní části Země Moravskoslezské 24. července 1935. Makroseismická studie ze Státního geofysikálního ústavu v Praze, 1939, s. 1-19, Státní geologický ústav Československé republiky, Praha, 1937.

[298] **Zátopek, Alois, 1940.** Zemětřesná pozorováni na Slovensku a býv. Podkarpatské Rusi 1923-1938. = Erdbebenbeobachtungen in der Slowakei und in eheim. Karpatenrussland 1923-1938 = Obserations des tremblements de terre en Slovaquie et ancienne Russie Subcarpathique 1923-1938. *Zvláštní otis publikace Geofysikálního ústavu v Praze, Spec. práce č. 2, 79 s., Praha, 1940.*

[299] **Zátopek, Alois, 1948.** Šíření východoalpských zemětřesení českým masivem. *Publikace Čs. státního geofysikálního ústavu. Speciální práce; Čís. 3, 1-69, Praha, 1948.*

[300] **Zátopek, Alois, 1956.** Seismická charakteristika Československa. *Sborník Česko-slovenské společnosti zeměpisné, Sv. 61, Ročník 1956, č. 2, 81-92, Praha 1956.*

[301] **Zeibig, Hartmann Joseph, 1851.** Die kleine Klosterneuburger Chronik: (1322 bis 1428). Zugleich N.J. der "Monumenta Claustroncoburgensia". *Aus d. 3. u. 4. Hft. d. VII. Bds. 1. Jahrg. 1851 des Archivs für Kunde oesterreich. Geschichtsquellen, Wien 1851.*

[302] **Zoellner, A., 1908.** Die Erdbeben im Fichtelgebirg und ihre Ursache. *Selber Tagblatt 39, Nr. 250, 23. Oktober 1908.*

[303] **Žalanský-Phaëthon, Havel, 1620.** O Sedmi Ranách Božjch těžkých a welikých, které mezy ginými Wálku Českau předessly a hlásaly, a které správem Prodromi a Classica, totiž, Předchůdcowé a Hlasatelé wálky České slauti mohau Traktátů Sedm: I. o Hřjmánj a Hromobitj. II. o Powodnjch. III. o Země třesenj. IV. o Bauřliwém Powětřj. V. o Suchu. VI. o Drahu a Hladu. VII. o Wálce, Metle Božj neytěžssj, a smutném nepohodlj gegjm / Sepsaných od Kněze Hawla Žalanského, Služebnjka Božjho Slowa v S° Gilgj w Starém Městě Pražském. *172 pp.; 8°, Wytisstěno w Nowém Městě Pražském: v Danyele Karla z Karlspergka, 1620. ABA001[NK ČR Praha] -- sign. 54 K 010807/adl.2.*

[304] **Želízko, Jan Vratislav, 1928.** Některé poznámky k zemětřesení v Pošumaví a sousedních územích 25. července 1927. *Věstník Státního geologického ústavu ČSR, Roč. IV. 1928, Nr. 1, 40-48, Praha, 1928.*

1.2 SUPPORTING SOURCES & MAPS

[305-1] **Jungmann, Josef Jakub, 1849.** Josefa Jungmanna Historie literatury české: Aneb: Saustawný přehled spisů českých s krátkau historií národu, oswícení a jazyka. *772 s., Nákladem Českého museum číslo XXXII., W kommissí kněhkupectwí F. Řiwnáče, Praha, 1849.*

[305-2] **Jungmann, Josef Jakub, 1869.** Dodavky a doplňky k Jungmannově Historii literatury české. Sestavil I.J. Hanuš. I. První a druhé oddělení literatury české. *771 s., Nákladem Českého museum číslo XCIL., W kommissí kněhkupectwí F. Řiwnáče, Praha, 1849.*

[306] **Koniáš, Antonín, 1770.** Index Bohemicorum Librorum Prohibitorum, Et Corrigendorum Ordine Alphabeti Digestus, Reverendissimi, Celsissimi S. R. I. Principis Domini Domini Antonii Petri Dei Gratia, Et Sedis Apostolicae Archi-Episcopi Pragensis Jussu Collectus, Atque Editus. *316 s., Typis Joannis Caroli Hraba, Inclyti Bohemiae Regni D.D. Statuum Typographi, Vetero-Pragæ 1770.*

[307] **Old maps.**

[307-1] **Mappa Králowstwí Českého, 1847.** Topographisch-statistische Post und Strassen-karte des Königreiches Boehmen nach den besten vorhandenen Quellen von Johann Loth, 1847.

[307-2] **Blaeu, Juan, 1659.** Geographia Blaviana. *Atlas: Bohemia (p. 213); Ducatus Breslanus (p. 206); Comitatus Glatz (p. 205); Silesia inferior (p. 203); Silesia Ducatus (p. 202); Moravia Marchionatus (p. 201); Arciducatus Austriæ superiors (p. 199, 200); Saltzburg Archiepiscopatus (p. 217); Bavaria Ducatus (p. 218, 219); Voigtland (p. 221); Misnia Marchionatus (p. 222); Thuringia Landgraviatus (p. 223); Lusatia superior (p. 227); Saxonia (p. 228, 232). Amsterdam, 1659.*

[307-3] **Criginger, Jan, 1609.** Regni Bohemiae Descriptio. *Map of Bohemia dated 1590 (reedition 1609).*

[307-4] **Claudian, Mikulas, 1518.** *Map of Bohemia made by Mikulas Claudian in 1518.*

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[318-2] **Map:** Central Europe during the short-term existence of Imre Thököly's Principality of Upper Hungary. - Habsburg and Ottoman territories, including Habsburg Kingdom of Hungary (Royal Hungary) and Habsburg Croatia, Ottoman vassal states (Wallachia, Moldavia, Transylvania, Principality of Upper Hungary (existed between 1682-1685), Montenegro, Ragusa) and Ottoman eyalets. The Ottoman expansion was asked by prince Imre Thököly in Upper Hungary (centered in present-day Slovakia) against the Habsburgs. The Ottoman Rule in Upper Hungary lasted only for 3 months. *Panonian,* https://commons.wikimedia.org/wiki/File:Central_europe_1683.png

[318-3] **Map:** Română: Regatul Ungariei(background) in Ridicarea topografică iozefină, 1782-1785. Kingdom_of_Hunagry_background_Josephinische_Landesaufnahme_1782-1785.jpg, *Asybaris01,* https://commons.wikimedia.org/wiki/File:Kingdom_of_Hunagry_background_Josephinische_Landesaufnahme_1782-1785.jpg

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et chartae geographicae cum Poloniae, Prussiae, Masouiae, Russiae[et]c. tum etiam Lithuaniae, Livoniae et Moscouiae, aeneis formis expressae, Cum indice rerum memorabilium locupletissimo. *846 s., Coloniæ Agrippinæ, In Officina Birckmannica Ssmptibus Arnoldi Mylii, 1589.*

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[672] **Dusburg, Petri, 1679.** Petri de Dusburg, Ordinis Teutonici Sacerdotis, Chronicon Prussiæ, in quo Ordinis Teutonici Origo. nec non res ad ejusdem Ordinis magistris ab an. MCCXXVI. usque ad an. MCCCXXVI. in Prussia gestæ exponuntur, cum incerti auctoris Continuatione usque ad annum MCCCCXXXV. Accesserunt his præter notas in Dusburgensem privilegia quædam Prussi antiquitùs concessa, item Dissertationes XIX. antiquitates Prussicas complexa. Auctore et collectore Christophoro Hartknoch, Passenheim. Prusso. *942 s., Francofurti et Lipsiæ, Sumtibus Martini Hallervordii, Bibl. Regiom. Pruss., Typis Johannis Nisi, Jenæ, MDCLXXIX.*

[673] **Eckstorm, Heinrich, 1620.** Historiae Terræ Motuum complurium, & praecipuè ejus, quo Plura oppidum nuper miserè obrutum & convulsum est; Quibus eorum caußae, species, effectus, praesagia, fines, signa, accidentia & remedia ostenduntur & explicantur: Inspersâ de Terræmotibus dissertatione, cum appendice Locurum quorundam semper ardentium, Specuum mirabilium. Ex sacrarum literarum monumentis, & optimæ notæ & fidei tàm antiquis quàm recentibus Scriptoribus excerptæ, studio & operâ M. Henrichi Eckstormii P.C. in Monasterio VValkenredensi Prioris & Parochi. *234 s., Typis heredum Iacobi Lvci, Helmæstadi, 1620.*

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[675] **Keckermann, Bartholomäus, 1611.** Contemplatio Gemina, Prior, ex generali Physica De Loco; Altera, ex speciali De Terræmotu; Potissimum illo stupendo, qui fuit Anno 1601, meste Septembri. Scripta à Bartholomæo Keckermanno, & nunc tertiò edita. *248 s., Apud Guilielmum Antonium, Hanoviæ. 1611.*

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[681-2] **Těšínský kalendář 1923.** Dějepisný kalendář. *s. 9, 17, 25.*

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& in Scriptores Introductionem pramisit Christ. Godofred. Hoffmannus, J.U.D. & in Acad Lips. Juris Naturæ & Gentium Professor. *Sv. 1, 468 s., 4°,: Sumpt. Davidis Richteri, Bibliopolae, Lipsiae & Budissae, 1719.*

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[699] **Augsburgische Ordinari Postzeitung** von Staats-, gelehrten, historisch- u. ökonomischen Neuigkeiten. *1770-10-27, čís. 258.*

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[701] **Kronika fary Bruzovice 1506-1936.** *Farní úřad Bruzovice, Zemský archiv Opava, inv. č. 32, Sign. Vli, str, 298.*

[702] **Stalmach, P. 1858.** Z Cieszyna. Trzęsienie ziemi, ... *Gwiazdka Cieszyńska, No. 4, d. 23.1. 1858, p. 32.*

[703] **Anonym, 1601.** Zwo warhafftige newe zeitung: Die erste/ von dem erschrecklichen Erdbide[m]/ so den 8. September durch das gantz Teutschland ergangen/ auch wie in selbiger zeit 2. Stätt und etlich Flecken in Türckey versuncken. Im Thon: Hilff Gott das mirs gelinge / Die ander/ von der Statt Willißaw im Schweitzerland wie alda Fewr. vom Himmel gefallen / und die Statt an dreyen orten angezündet / geschehen dieses 1601. Jahrs. Im Thon/ Ewiger Vatter im Himmelreich. 8 s., Gedruckt bey Hans Schrötter, Basel, 1601.

[704] **Höfer von Heimholt, Hans, 1880.** Die Erdbeben Kärntens und deren stosslinien. Mit 3 Kartenskizzen. *1-90, Aus der Kaiserlichköniglichen hof- und staatsdruckerei, in commission bei Karl Gerold's sohn, Wien, 1880.*

[705] **Pertz, Georg Heinrich, 1891.** Scriptores Rerum Germanicarum in usum scholarum ex Monumentis Germaniæ historicis recusi. MGH-SRG-VII : Annales Fuldenses sive Annales Regni Francorum orientalis. Accedunt Annales Fuldenses Antiquissimi.*, 152 s., Impensis bibliopolii Hahniani, Hannoverae, 1891.*

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[707] **Collenuccio, Pandolfo, 1539.** Compendio Delle Historie Del Regno di Napoli Composto da Messer Pandolpho Colllenutio iu risconsulto in Pesaro. *408 s., In Venetia. MDXXXIX.*

[708] **Höfler, Karl Adolf Constantin von, 1865.** Geschichtschreiber der husitischen Bewegung in Böhmen. Theil II. *In.: Fontes rerum Austriacarum. 1. Abth., Scriptores, VI. Band., 843 p., Wien, 1865.*

[709] **Pertz, Georg Heinrich, 1839.** Monumenta Germaniae Historica, inde ab anno Christi quingentesimo usque ad annum millesimum et quingentesimum. Scriptorum, Tomus III (V). *920 p., Impensis bibliopolii Aulici Hahniani, Hannoverae, MDCCCXXXVIIII.*

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[711] **Spangenberg, Cyriacus, 1572.** Mansfeldische Chronica, der erste Theil: von Erschaffung und Austheilung der Welt, und insonderheit von der Graveschafft Mansfelt, und den alten und ersten Deutschen Königen und Fürsten, der Schwaben und Marckmannen, Cherucken, Francken und Sachsen: und von gemeinen polittischen und weltlichen hendeln, so sich in Friede oder Kriegsleufften in dieser Landart, Sachsen, Thüringen und am Hartz, auch etwan anderswo zugetragen, dabey dieser Landart, Oberkeiten oder Unterthanen mit gewesen Durch M. Cyriacum Spangenberg. *1006 p., Andreas Petri, Eisleben, 1572.*

[712] **Drož, Bedřich, 1903.** Dějiny kláštera a města Žďáru na Moravě. s 32 vyobrazeními. *211 s., nákladem vlastním. Tiskem Jos. Jahody v Mor. Budějovicích, 1903*

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herschafften, vnnd sonderlich mit den vornemsten Stadten in Deutschladnt, Aus da seindt die Seestadte vnd hensestadte Lobliches vnd dechwirdiges zugetragen, von iaren zu iaren. Aus vielen Galubwirdigen, allerley Nationen vnnd Landern, Chronicis Auch aus berren Vhrtunden vnd vielen alten Monumentis, zusammen Colligiret, vnd mit Bildernis der alten Neidnischen Abgotter: Der gleichen mit vieler Stadte Brustbilder Wapen vnd andern Figuren gezieret bis auss diese ziet Continuiret vnd volstracter etc. Der gleichen im Druck zwor niemals aus gangen. Mit einem volkommenden vnd richtigem Register versasset vnd beschrieben etc. durch M. Johannem Pomarium. *826 p., Gedruckt zu Wittenbergk Durch Zacharias Krafft, 1588.*

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[715-2] **Nauclerus, Johannes; Surius, Laurentius, 1564.** Tomvs Secvndvs Chronicon D. Iohannis Navcleri Praepositi Tvbingensis, svccinctìm compræhendentium res memorabiles seculorum omnium ac gentium, ab initio mu[n]di vsq[ue] ad annum Christi nati M.CCCCC. Ob magnitudinem sui & usum Lectoris per Tomos & paragraphos lepidè nunc primùm recèns distinctorum. *767 s., Coliniæ apud Hæredes Iohannis Quentel & Geruuinum Calenius, anno Christi nati M.D.LXIIII.*

[715-3] **Nauclerus, Johannes; Amsdorff, Nicolaus von, 1545.** Ein kurtzer außzug, ausz der Cronica Naucleri, wie vntrewlich, aigenwillig vnd betrüglich die Bäpste zu Ro[m] mit den Rhömischen Kaysern Beuorab Teütsches nam[m]ens und bluts, gehandelt haben. *135 s., Otmar, Augsburg M.D.XXXXV.*

[716] **Oefele, Andreas Felix von, 1763.** Rerum Boicarum scriptores: nusquam antehac editi quibus vicinarum quoque gentium nec non Germaniæ universæ historiæ ex monumentis genuinis historicis et diplomaticis plurimum illustrantur: ex membranis & chartis vetustis collegit, descripsit ac monitis præviis indiceque copiosissimo instruxit atque edidit instruxit atque edidit Andreas Felix Oefelius Monacensis, Tomus I. *834 p., Sumptibus Ignatii Adami & Francisci Antonii Veith, Augustæ Vindelicorum, Anno MDCCLXIII.*

[717] **Heimburg von, Heinrich, 1242-????.** Annales Heinrici Heimburgensis. Dalimili Bohemiae chronicon: Annales Heinrici Heimburgensis; Vita Karoli IV Imperatoris; Sermones post mortem Karoli IV Imperatoris per Johannem, Archiepiscopum Pragensem, et Mag. Adalbertum Ranconis de Ericinio facti; Johannis Neplachonis, abbatis opatovicensis, Chronicon; Johannis de Marignola Chronicon. *305-321, In: Prameny dějin českých - Fontes rerum Bohemicarum, red. Josef Emler, 634 s., Nadání Františka Palackého, Praha, 1882.*

[718-1] **Fabricius, Georg, 1597.** Georgii Fabricii Chemnicensis Rerum misnicarum libri VII. Electorum Saxoniæ lib. I. Marchionum Misnensium lib. I. Annalium urbis Misnae lib. III. Siffrigi Misnensis presbyteri epitomes lib. II. *314 p., Typis Tobiæ Steinmanni: Impensis Henningi Grosii civis & Bibliopolæ Lipsensis, Ienæ, Anno M.D.XCVII.*

[718-2] **Fabricius, Georg, 1569.** Georgii Fabricii Chemnicensis Rerum misnicarum libri VII. Electorum Saxoniæ lib. I. Marchionum Misnensium lib. I. Annalium urbis Misnae lib. III. Siffrigi Misnensis Presbyteri epitomes lib. II. *352 p., Curante Ernesto Voegelino, Lipsiæ, 1569.*

[719] **Freher, Marquard, 1600.** Germanicarum rerum scriptores aliquot insignes, hactenus incogniti. Qui gesta sub Regibus & Imperatoribus Teutonicis, iam inde à Karolo M. vsq; ad Fridericum III. Imp. perpetua ferè serie, suis quique seculis, litteris mandatas pesteritati reliquerunt, Tomus unus. Nunc primum editus, ex bibliotheca Marquardi Freheri consiliarii Palatini, auctorum catalogus, qui hoc volumine continentur, post nuncupatoriam apparebit. Cum indice rerum & verborum in primis memorabilium copiosissimo. *466 s, Index, Appendix 34 s., Wechel, Andreas Erben & Marne, Claude, Libreria impressa dei duchi di Urbino apud heredes Andreae Wecheli, Claudium Marnium & Ioannem Aubrium, Francofurti, M.DC.*

[720-1] **Mencke, Johann Burchard, 1728.** Scriptores rerum Germanicarum, praecipue Saxonicarum, in quibus scripta et monumenta illustria, pleraque hactenus inedita tum ad historiam Germaniae generatim, tum speciatim Saxoniae sup. Misniae, Thuringiae et Varisciae spectantia, vel nunc primum in lucem protrahuntur, vel cum codicibus mss. collate notulis illustrantur ex sua bibliotheca aliisque editis Io. Burchardus Menckenius. *Tomus I. cum figuris Aeneis. 2132 s., Impensis Ioannis Christiani Martini, Lipsiæ, Anno M.DCC XXVIII.*

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[795] **Pertz, Georg Heinrich, 1868.** Monumenta Germaniae Historica, inde ab anno Christi quingentesimo usque ad annum millesimum et quingentesimum. Scriptorum. Tomus XX. *850 s., Impensis Bibliopolii Aulici Hahniani, Hannoverae, 1868.*

[796] **Baumann, Franz Ludwig Fränkel-Herzberg, 1888.** Monumenta Germaniae Historica, inde ab anno Christi quingentesimo usque ad annum millesimum et quingentesimum. Necrologia Germaniae. Tomus I. *798 s., Apud Weidmannos, Berolini, 1888.*

[797] **Mommsen, Theodor, 1892.** Monumenta Germaniae Historica, inde ab anno Christi quingentesimo usque ad annum millesimum et quingentesimum. Auctorum Antiquissimorum Tomus IX, Chroniva minora saec. IV.V.VI.VII., Volumen I. *756 s., Apud Weidmannos, Berolini, 1892.*

[798] **Mommsen, Theodor, 1882.** Monumenta Germaniae Historica, inde ab anno Christi quingentesimo usque ad annum millesimum et quingentesimum. Auctorum Antiquissimorum Tomus V, Pars prior, Iordanis Romana et Getica. *200 s., Apud Weidmannos, Berolini, 1882.*

[799] **Grünewald, Moritz, 1829.** Die Mießner Chronik. Von Erbauung der Stadt, bis zum Jahre 1588. Nebst einem Anhang. Erster Theil. *407 s., gedruckt bei L.G. Rothe, Hayn, 1829.*

[800] **Schmidt, Friedrich 1599.** Thüringische Chronik, oder Geschichtbuch von allerhand denkwürdigen Sachen, Thaten und Händeln, so sich in Thüringen bis 1599 zugetragen, durch Friedrich Schmidtei revidirt und continuirt durch Joh. Langen, Mühlhausen. *212 s. und Register, Andreas Hantzsch, 1599.*

[801] **Leibniz, Gottfried Wilhelm, 1710.** Scriptorum Brunsvicensia illustrantium tomus secundus. *1143 s., Sumtibus Nicolai Foersteri, Bibliopolæ Aulici, Hannoverae, 1710.*

[802] **Peinlich, Richard, 1877/1878.** Geschichte der Pest in Steiermark. *I./II. Band, 559/652 s., Druck und Verlag der Vereins-Buchdruckerei, Graz, 1877/1878.*

[803] **Pellegrino, Camillo, 1643.** Historia principum langobardorum Quae continet antiqua aliquot Opuscula de rebus Langobardorum Beneventanæ olim Provinciæ quae modo regnum ferè est Neapolitanum. *Ex Typographia Francisci Sauij, Neapoli Anno Sal. MDCXLIII.*

[804-1] **Rivander, Zacharias, 1596.** Düringische Chronica: Von Vrsprung vnd Herkom[m]en der Düringer Auch allen furnembsten Geschichten vnd Thaten ... Von jren Königen Wenn die Königliche Regierung bey jnen auffgehöret: Von jren Landgrauen sonderlich ... Wie die Landgraffschafft Düringen an die Marggrauen zu Meissen komen .. *512 s.,*

[804-2] **Rivander, Zacharias, 1581.** Düringische Chronica: … *durch Johan Spieß, 1581.*

[805] **Linzbauer, Xaver Ferencz, 1852.** Codex Sanitario-Medicinalis Hungariae. *Tomus I., 898 s., Typis Caesareo-Regiae Scientiarum Universitatis, Budae, 1852.*

[806-1] **Zacharias, Theobald, 1621.** Hussiten-Krieg: Darinnen begriffen / Das Leben / die Lehr / der Todt M. Johannis HussI, auch wie derselbe von den Böhmen / besonders Johann Zischka / ist gerochen / und seine Lehr hernacher inn dem Königreich erhalten worden. *322 s., Gedruckt und verlegt durch Simon Halbmayer. Nürnberg / M.DC.XXI.*

[806-2] **Zacharias, Theobald, 1621.** Hussiten-Krieges Ander Theil / Darinnen begriffen / Was sich bey der Regierung Käysers Sigismundi / Käysers Alberti / und dann Königs Ladislai / von dem 1436. biß auff das 1458 Jahr / im Land zu Böheim in Fried und Unfried begeben. *228 s., Gedruckt und verlegt durch Simon Halbmayer. Nürnberg / M.DC.XXI.*

[806-3] **Zacharias, Theobald, 1621.** Hussiten-Krieges Dritter und Letzter Theil / Darinnen begriffen / was sich bey der Regierung König Girschicks, König Waldislai, unnd König Ludovici / von dem 1458 biß auff das 1517 Jahr / im Land zu Böheim in Friend und Unfriend begeben. *179 s. / Gedruckt und verlegt durch Simon Halbmayer. Nürnberg / M.DC.XXI.*

[807-1] **Limmer, Karl August, 1825.** Entwurf einer urkundlichen Geschichte des gesammten Voigtlandes. Erster Band. *s. 1-305, Auf patriotische Subscriptionen gedruckt mit Albrecht`schen Schriften. Gera. 1825.*

[807-2] **Limmer, Karl August, 1826.** Entwurf einer urkundlichen Geschichte des gesammten Voigtlandes. Zweyter Band. *s. 306-646, Auf patriotische Subscriptionen gedruckt mit Albrecht`schen Schriften. Gera. 1826.*

[807-3] **Limmer, Karl August, 1827.** Entwurf einer urkundlichen Geschichte des gesammten Voigtlandes. Dritter Band. *s. 647-960, Auf patriotische Subscriptionen gedruckt mit Albrecht`schen Schriften. Gera. 1827.*

[807-4] **Limmer, Karl August, 1828.** Entwurf einer urkundlichen Geschichte des gesammten Voigtlandes. Vierter Band. *s. 961-1309, Auf patriotische Subscriptionen gedruckt mit Albrecht`schen Schriften. Gera. 1828.*

[808] **Nausea, Friedrich, 1532.** Frederici Navseæ Blancicampiani, Eximmi LL. doctoris, inclytæ ecclesiæ Moguntinæ àsacris Concionibus eminetiss. Libri Mirabilium Septem. *s. 961-1309, Coloniæ apud Petrum Quentell. Anno M.D.XXXII.*

[809-1] **Lorenz, Christian Gottlob, 1856.** Die Stadt Grimma im Königreiche Sachsen, historisch beschrieben. Siebentes Heft. Mit einem Stahlstich. *768 s., Dyk`sche Buchhandlung. Leipzig, 1856.*

[809-2] **Lorenz, Christian Gottlob, 1856.** Die Stadt Grimma im Königreiche Sachsen, historisch beschrieben. Schlußheft. *1644 s., Dyk`sche Buchhandlung. Leipzig, 1856.*

[810] **Francke, Heinrich Gottlieb, 1753.** Leisnigker Chronica, oder Beschreibung der sehr alten Stadt Leisnigk: Nach ihrer Lage, Gegend, Benennung, alten Einwohnern, Ursprung und Erbauung, Kirchen und andern gemeinen Gebäuden, Gottesdienst, Nahrung, und Bequemlichkeit, Regenten und Beamten; Ingleichen was so wohl in Kriegs- als Friedens Zeiten daselbst und in der umliegenden Legend, auch sonst hin und wieder sich denkwürdiges begeben hat. Und so dann ist besonders beygefügt eine gleichmäßige Beschreibung / oder Chronica der benachbarten Stadt Loldiß. *652 s., Zum Druck aber gefertiger und verlegt von Johann Kamprad, Leisn. Misn. 1753.*

[811-1] **Franck, Sebastian, 1539.** Germania: Von des gantzen Teütschlands / aller Teutschen völcker herkom[m]en, Namen / Håndeln, Gůten vnd bösen Thaten / Reden / Råtchen/ Kriegen / Sigen / Riderlagen / Stiffcungen. Durch Sebastian Francken / von Wŏrd. *402 fol., Merz, Anno M.D.XXXIX.*

[811-2] **Franck, Sebastian, 1555.** Chronica zeitbuch unnd Geschichtbibel von anbegyn biß in diß gegenwertig M.D.LV. Jar verlengt: Darinn bede Gottes unnd der Welt lauff, händel, art, wort, werck,thun, lassen, kriegen, wesen und leben ersehen und begriffen wirt. .... Die ander Chronica ... der Keyser Jarbuch, oder die neüw Welt. *266 fol. Apiarius, 1555*

[812] **Agricola, Georg, 1544.** In.: Lehmann, Ernst, 1807. Georg Agrikola's Mineralogische Schriften. Zweyter Theil. Von den Eigenschaften der Körper, die aus dem Innern der Erde auf die Oberfläche hervordringen. (De natura aeorum, quae effluunt ex terra.). *260 s., bey Craz und Gerlach, Freyberg, 1807.*

[813] **Fincelius [Fincel, Finke], Hiob, 1559.** Der ander Teil Wunderzeichen. Gründlich Verzeuchnis schrecklicher Wunderzeichen unnd Geschichten, so innerhalb viertzig Jaren sich begeben haben durch Jobum Fincelium,. *414 s., Gedruckt zu Leipzig / durch Jacobum Berwald / M.D.LIX.*

[814] **Heine, Samuel Gottlieb; Graun, Caspar Heinrich, 1719.** Historische beschreibung der alten stadt und grafschafft Rochlitz in Meissen. *427 s., Verlegts Johann Christian Martini, Leipzig, 1719.*

[815] **Sturm, Ludwig, 1888.** Geschichte der Stadt Goldberg in Schlesien. *1007 s., Im Selbstverlage des Verfassers, Goldberg, 1888.*

[816-1] **Rivander, Zacharias, 1602.** Fest Chronica: Darinnen viel außerlesene / denckwirdige historien oder Geschicht / die sich auff die Feyer und Sontage zugetragen / in der Erklerung der darauff geordenten Euangelien nach gelegenheit nützlich einzuführen. Der erste Theil. Von den gewöhnlichen oder sonsten der zeit halben bekandten Festagen / colligiret und zusammen bracht / Durch Zachariam Rivandrum. *D., 258 s., Anno M.DC.II.*

[816-2] **Rivander, Zacharias, 1591.** Fest Chronica: Darinnen viel außerlesene / denckwirdige Historien oder Geschicht / die sich auff die Feyer und Sontage zugetragen /in der Erklerung / der darauff geordenten Euangelien / nach gelegenheit nützlich einzuführen. Der ander Theil. Von den gewöhnlichen Sontagen, durchs gantze Jahr uber / Colligiret und zusammen bracht / Durch Zachariam Rivandrum. *D., 206 s., Im Jahr M.D.XCI.*

[817] **Meltzer, Christian, 1716.** Historia Schneebergensis renovata, das ist: erneuerte Stadt⸗ und Berg⸗Chronica, der im Ober⸗Ertz⸗Gebürge des belobten Meißens gelegenen Wohl ⸗ldbl. Freyen Berg⸗Stadt Schneeberg, … von Christian Meltzern / Phil. M. und p.t. Pastore der Kirchen zu S. Catharienberg im Buchholz. *1369 s., druckt und verlegts Heinrich Fulde / Schneeberg / Anno 1716.*

[818] **Saur, Abraham, 1594.** Calendarium Historicum, das ist Ein besondere tägliche Hauß vnd Kirchen-Chronika : darinn Sum[m]arischer weise, auff einen jeden Tag, Monat, u. Jahr etliche besondere Nam vnd warhafftige Geschichte, schreckliche Miracul, lustige Exempel, merckliche Beyspiel, mancherley Ankunfft, seltzame Veränderung / Glůck unf Anglůck/ ... *656 s. und Register, Gedruckt zu Franckfurt am Mayn / durch Nicolaum Basseum, M.D.XCIIII.*

[819-1] **Möller, Andreas, 1653.** Theatrum Freibergense Chronicum: Beschreibung der alten löblichen BergHauptStadt Freyberg in Meissen. Darinnen des reichen herrlichen Silber⸗Bergwercks / und der Stadt uhrsprung / Gelegenheit / Gebäwde / Privilegia / Regenten und Beampten / so wol in Geistlichen als Weltlichen und Berg Stande verzeichnet zu befinden / ... von Andr. Mollero Pegavio, Philos. & Med.D. *507 s., Druck und verlegts Georg Beuther / Feybergk Im Jahr Christi 1653.*

[819-2] **Möller, Andreas, 1653.** Theatrum Freibergense Chronici Pars Posterior, Beschreibung der alten löblichen BergHauptStadt Freyberg in Meissen / Ander Buch / Darinnen ordentliche Annales und Jahrverzeichnüsse vieler denckwürdigen Sachen und Geschichten zu finden, welche sich im Lande zu Meissen / und absonderlich in und bey der Stadt Freybergk bißher innerhalb fünffhundert Jahren ereignet und begeben / ... Von Andr. Mollero Pegavio, Philos. & Med.Doct. *707 s., Druck und verlegts Georg Beuther / Feybergk Im Jahr Christi 1653.*

[820] **Meltzer, Christian, 1684.** Bergkläufftige Beschreibung Der Churfürstl. Sächß. freyen und Meißnischen Ober. Erz. Gebirge löbl. Bergk⸗Stadt Schneebergk / ... / von Christian Melzern / Wolckensteinensi. *788 s., Gedruckt zu Schneebergk bey Christian Pfüßnern / und zu finden bey Sebastian Meißnern / Buchbinern daselbst /deme es der Auctor übergeben / Anno 1684.*

[821] **Mathesius, Johannes, 1571.** Sarepta / Darinn von allerley Bergkwerck vnd Metallen / Was ir engenschafft und natur / und wie sie zu nutß und gut gemacht / guter bericht gegeben. Mit tröstlicher vnd lehrhaffter erklerung aller sprüch / so in heiliger Schrifft von Metall reden / Unnd wie der heilig Seift inn Metallen unnd Bergarbeit die Artickel unsers Christlichen glaubens Fürgebildet. Sampt der Jochimsthalischen kurtzen Chronicken. Durch M. Johann Mathesium Pfarzer in S, Jochimsthal / selber für seinem seligen ende versertigt. *237 fol. und Chronica, Gedruckt zu Nürnberg bey Dietrich Gerlatz. M.D.LXXI.*

[822] **Stichart, Franz Otto, 1841**. Chronik der Stadt Werdau. *269 s., bei Carl Heinr. Reclam, Leipzig, 1841.*

[823] **Remp, Adam, 1587**. Calendarium Saxonicum. Kurtz Jerzeichniß / allerley Gedenckwirdigen Historien / so in dem Hochlȯblichsten Chur uň Fůrstlichen Hause zu Sachsen. Durch M. Adamum Remp. *365 s., M.D.LXXXVII.*

[824] **Hermann, Christian, 1698.** Mittweidisches Denckmahl Das ist / Beschreibung der Stadt Mittweida In Meissen / Nach dero Nahmen und Ursprung / Situation und Bequemligkeit / Geist- und Weltlichen Gebäuden / Religions und Policeywesen / Kirch⸗ und Schuldienern / Bürgermeistern und Rathmannen. Von M. Christiano Hermannen Mitvveidensi. *690 p., Druckts und verlegts Conrad Stössel, Chemnitz, 1698.*

[825] **Vulpius, Johann, 1704.** Franckenbergæ commoditas, Das ist: Der Chur⸗Fürstl. Sächß. Ober-Meißnischen Löblichen Ammts-Stadt Franckenberg Gelegenheit / ... / durch Johannem Vulpium, Sals.Misn.N.P.C. der Geschichts⸗Kund Befließenen. *40 s., bey Johann Christian Wohlfart / Weissenfels / Anno 1704.*

[826] **Vogel, Johann Jacob, 1714.** Leipzigisches Geschicht⸗buch oder Annales, Das ist: Jahr⸗ und Tage⸗bücher Der Weltberühmten Königl. und Churfürstlichen Sächsischen Kauff⸗ und handels⸗Stadt Leipzig, In welchen die meisten merckwürdigsten geschichte und geschehene veränderungen, die in und bey belobter stadt und gegend, bey des in Geistl. als Weltl. Sachen, so wohl in Friedens⸗als Krieges⸗Zeiten, von Anno 661. nach Christi geburth an, biss in das 1714. Jahr, von Tage zu Tage sich begeben haben, enthalten sind, alle zum theil aus glaubwürdigen alten und neuen, bey des gedruckten als geschriebenen chronicken, bewahrten historicis, uhralten urkunden und documenten, zum theil auch aus eigener erfahrung mit nicht geringer mühe aus angebohrner liebe zusammen getragen und in richtige ordnung verfasset, auch mit dienlichen marginalien und einen benöthigten register erläutert von m. Johann Jacob Vogeln, von Leipzig. *1077 s., Verlegt von Friedrich Lanckischens sel. Erben, Leipzig, 1714.*

[827] **Heidenreich, Tobias, 1635.** Leipzigische Chronicke / Und zum Theil Historische Beschrebung der fürnehmen / und weitberühmbten Stadt Leipzig. Durch Tobiam Heydenreich Lipsiensem, bey der Rechte Doctorn. *Zu Leipzig gedruckt Bey und in Verlegung Gregorii Ritzschens.*

[828] **Bode, Friedrich, 1865.** Chronik der Stadt Rochlitz und Umgegend. *158 s., Verlag von Friedrich Bode. Rochlitz, 1865.*

[829] **Krentzheim, Leonhard, 1577.** Chronologia, Das ist / Gründtliche vnd fleissige JahrRechnung / Sammpt verzeichnung der fürnemsten Geschichten / Verenderungen und Zufell / so sich beyde in Kirchen und WeltRegimenten zugetragen haben / zu jeder Zeit / Von anfang der Welt / biß auff unsere / Beyde aus heiliger Göttlicher Schrifft / und andern glaubwirdigen und bewerten Historien / so wol aus dem Calculo Astronomico genommen / und trewlich zusammen gezogen. Durch Leohard Krenßheim / von Iphofen im Franckenlandt / ietziger zeit Pfarherr zu S. Peter und Paul in Ligniß / und desselben Fürstenthumbs Superattendent. *538 fol. und Register, Gedruckt zu Gőrlitz / Durch Ambrosium Fritsch. 1577.*

[830] **Simon, Jeremias, 1696.** Eilenburgische Chronica / Oder Beschreibung Der sehr alten Burg, Schlosses und Stadt Eilenburg / Aus vielen alten und neuen bewehrten Autoribus, wie auch andern glaubwürdigen Schrifften und Archiven nebenst eigener Erfahrung / zusammen getragen und zum Druck geliefert Von M. Jeremias Simon / Kåyserl. gekr. Poëten und Pfarrern zu Limehna. *836 s., Leipzig / In Verlegung Friedrich Lanckischens Erben / Im Jahr 1696. s. 585; 1578 – s.*

[831] **Anonym, 1558.** Warhafftige Geschicht, eines grawsamen Wetters. Geschehen zu Burgkchonna in Thüringen / den Dienstag nach Vocem Jocunditatis. Anno Domini M.D.LVIII. *8.s. (Staats- und Stadtbibliothek Augsburg).* ***N.R.*** *It relates to the earthquake of 1558, May 17, in Gera, Germany.*

[832] **Herzog, Emil, 1845.** Chronik der Kreistadt Zwickau. Zweiter Theil. Jahresgeschichte. *937 s., Druck und Verlag von R. Zückler, Zwickau, 1845.*

[833] **Limmer, Karl, 1831.** Entwurf einer Urkundlich ⸗ Pragmatischen Geschichte des gesammten Pleisnerlandes. Zweiter Band. 1036 s. und *76 s. Register, Im Verlag Bei Friedrich Weber, Ronneburg, 1831.*

[834] **Simon, Ernst Friedrich Wilhelm, 1821.** Kurze historisch-geographisch-topographische Nachrichten von den vornehmsten Denkwürdigkeiten der bis zum Schluß des Jahres 1819 Königl. Sächsischen Amtsäßigen, vom Jahr 1820 an aber als schriftsäßig zu behandelnden Berg-Stadt Zschopau im erzgebürgischen Kreise. *428 s., Dresden, 1821.*

[835] **Leipziger Tageblatt, 1812.** Neuerliches Erdbeben in Sachsen. *Leipziger Tageblatt No. 232. Mittwochs den 19. August 1812, 924-927.*

[836] **Schmidt, Tobias, 1656.** Chronici Cygnei Pars Posterior. Oder Zwickauischer Chronicken Anderer Theil / In sich begreiffend Jahr⸗Verzeichnisse / oder Register / in welchen ordentlich nach einander zu finden / was sich bey der Stadt Zwickau / auch sonsten hin und her in der Nachtbarschafft / im Oster⸗ und Meißner⸗ Lande über die Neundhalbhundere Jahr / Denckwürdiges begeben und zugetragen. Durch M. Tobiam Schmidten von Zwickau / Dienern am Wort Gottes daselbst. *732 s., Gedruckt bey Melchior Söpnern / Zwickau / Anno 1656.*

[837] **Potěšil, F.K., 1927-1928.** Zemětřesení v naší krajině. *Krajem Pernštýnův: vlastivědný sborník školního okresu pardubického. Ročník VIII, č. 9, 1927-1928, s. 132-133, Pardubice, 1927-1928.*

[838-1] **Vrbka, Anton, 1902.** Chronik der Stadt Znaim. *144 s., Verlag des „Znaimer Landlehrerver", In Commision bei Fournier & Haberler, Znaim, 1902.*

[838-2] **Vrbka, Anton, 1927.** Gedenkbuch der Stadt Znaim. *s. 330 (Erdbeben), Verlag: A. Bartosch, Nikolsburg, 1927.*

[839] **Vincentius <Bellovacensis>, 1483.** Speculum historiale. *Nürnberg, 1483.*

[840] **Jenisch, Paulus, 1605.** Annaebergae Misniae urbis historia in duos libros digesta. Accessit de incendio, ad XXVII April anno 1604 immaniter in urbe grassante commonefactio. Authore Pavlo Ienisio Annæbergensi, M. *374 p., Imprimebat Hieronymus Schütz, Dresdæ, anno M.DC.V.*

[841] **Erich, Adolar, 1611.** Gülichische Chronic Darinnen der Vhralten Hochlöblichen[n] Grafen[n], Marggrafen[n] vn[n]d Hertzogen von der Marck, Gülich, Cleve, Bergen etc. Ankunfft, Genealogi, Stam[m] vnd Geschlechtregister, Außbreitung, Succcssion [sic!], Verrenderung, fürnembliche thaten zu Friedes vnd Kriegszeiten, neben des Nider Reingeländes, Item der Städte, auch angrentzenden Provintzen vnd Lande, vhralten vnd newen merckwürdigen Geschichten, in 7. vnterschiedlichen Büchern ördentlich beschrieben, und biß in das 1610. Jahr continuirt werden. Mit sampt beygefügter Geographischer Landes Chart der Fürstenthümer Gülich, [et]c. Auß aller Hand alten vnd newen Monumenten, Historien, vnd Chronicbüchern mit fleiß auffgesucht vnd zusammen getragen / Durch Adelarium Erichium. *592 s., In verlegun Jacob Apels / und Thomæ Schürers Buschf. in Leipzig, M.DC.XI.*

[842] **Simon, B., 1909.** Scriptores Rerum Germanicarum in usum scholarum ex Monumentis Germaniae Historicis separatim editi. MGH-SRG-XII: Annales Xantenses et Annales Vedastini. *96 s., Impensis Bibliopolii Hahniani, Hannoverae et Lipsiae, 1909.*

[843] **Horn, Wilhelm, 1843.** Zur Charakterisirung der Stadt Erfurt. Ein medicinisch-statistischer Beitrag. *444 p., Gedruckt bei J.I. Uckermann. Erfurt, 1843.*

[844] **Rauch, Adrian, 1743.** Rerum Austriacarum Scriptores (Anonymi Chronicon Austriacum). Volumen II. *563 s., Apud Josephum Stamel. Vindobonæ, M.DCC.XCIII.*

[845] **Pez, Hieronymus, 1721.** Scriptores rerum Austriacarum veteres ac genuini, quotquot ex Austriæ vicinarumque provinciarum bibliothecis et tabulariis, decumano labore perlustratis, aut primum in lucem Vindicari, aut ex Mss. codicibus auctiores et emendattiores edi potuerunt. Tomus I. Veterum Austiæ marchionum et ducum stirpis Babenbergensis. *124 s., Sumptibus Joh. Frid. Gleditschii B. Filli, Lipsiæ, Anno M DCC XXI.*

[846] **Jacobi, H., 1885.** Zur Geschichte der Erdbeben im westlichen Erzgebirge. *Mitteilungen Wissenschaftlichen Vereins für Schneeberg und Umgebung. 2. Heft, 14-22, 104-106, Schneeberg, April 1885.*

[847] **Zeno, Franz, 1771.** Untersuchung des bey Wessel und Reindlitz unweit Aussig zum Anfange des gegenwärtigen Jahrs 1770 sich eireigneten heftigen Erdbeben sammt der Entscheidung der Wahrschleilichen Ursache desselben. *Neue physikalische Belustigungen. Zweyter Band, erste Abteilung, s. 3-80. Prag, 1771.*

[848] **Jirasek, Johann, 1785.** Mineralogische Nachrichten von der Gegend von Sobrusan, eine halbe Stunde von Dux entlegen. *Abhandlungen der Böhmischen Gesellschaft der Wissenschaften, auf das Jahr 1785, s. 123-129, Prag, 1785.*

[849] **Cotte, M., 1807**. Suite du Tableau Chronologique. *Journal de Physique, de Chimie et d´histoire naturelle et der Arts, vol. LXV, s. 250-264, 329-364, Paris.*

[850-1] **Cantor, Johann Chrysostomus, 1804.** Geschichte der merkwürdigsten Naturbegebenheiten auf unserer Erde von Christi Geburt bis auf gegenwärtige Zeiten. I. Band. *453 s., bey J.C.D. Ginner, Koburg und Leipzig, 1804.*

[850-2] **Cantor, Johann Chrysostomus, 1804.** Geschichte der merkwürdigsten Naturbegebenheiten auf unserer Erde von Christi Geburt bis auf gegenwärtige Zeiten. II. Band. *447 s., bey J.C.D. Ginner, Koburg und Leipzig, 1804.*

[850-3] **Cantor, Johann Chrysostomus, 1805.** Geschichte der merkwürdigsten Naturbegebenheiten auf unserer Erde von Christi Geburt bis auf gegenwärtige Zeiten. III. Band. *309 s., in der Sinner´schen Buchhandlungen, Koburg und Leipzig, 1805.*

[851] **Michal, Emanuel, 1807**. K zemětřesné katastrofě dne 5. dubna 1789 u Pilníkova. *Acta Musei Reginaehradecensis. Serie A, Scientiae naturales, s. 125-134. Muzeum východních Čech, Hradec Králové.*

[852] **Arnold, Georgius; Jenisch, Paulus, 1812.** Chronicon Annaebergense continuatum. Durch M. Georgium Arnoldum, Cizensem. *292 s., Register, Reprint - bey Friedrich Wilhelm Ludwig Hasper, Annaberg, 1812.*

[853] **Albinus, Petrus, 1590.** Meißnische Land und Berg⸗Chronica / In welcher ein vollnstendige description des Landes / so zwischen der Elbe, Sala vnd Südödischen Behmischen gebirgen gelegen / So wol der dorinnen begriffenen auch anderer Bergwercken, sampt zugehörigen Metall vn[d] Metallar beschreibungen. Gestellet durch Petrum Albinum. *449 s., Dreßden / Im 1590. Jar.*

[854] **Vulpius, Johann, 1704.** Crimmitzschaviæ celebritas, Das ist: Der alten Meißnisch-Ertzgebirgischen Pleißen-Stadt Crimmitzschau Löblichkeit. *36 s., bey Johann Christian Wohlfart / Weissenfels / Anno 1704.*

[855] **Göpfert, Gottlieb, 1794.** Aeltere und neuere Geschichte des Pleißengrundes. Oder: Geschichte und Beschreibung der Städte Crimmitzschau und Werdau, mit den in dasiger Gegend an der Pleiße befindlichen Rittergüthern und Dorfschaften. *456 s., bey Friedrich Gottlob Höfer, Zwickau, 1794.*

[856] **Köhler, Friedrich Wilhelm, 1781.** Historische Nachrichten von der chursächsischen alten freyen Bergstadt Wolkenstein im meißnischen Obererzgebürge. *283 s., Register, bey Friedrich Gottlob Fuldens, Schneeberg, 1781.*

[857] **Garcaeus, Johannes, 1568.** Meteorologia Conscripta a Iohanne Garcæo Pastore ecclesiæ Dei in noua arce Brennonis. Additæ sunt tabellæ, quae totam meteororum doctrinam complectuntur, Et exempla historica sacra & prophana, multorum seculorum, quibus haec materia scholasticorum causa illustrata est. *936 s., Ioh. Georgii à Werdenstein, Vvitebergæ Anno M.D.LXVIII.*

[858-1] **Sigebertus, <Gemblacensis>, 1513.** Sigeberti Gemblacensis cœnobitæ Chronicon ab anno 381 ad 1113 cum insertionibus ex historia Galfridi &additionibus Roberti abbatis Montis centū & tres sequētes ānos cōplectibus promouēte egregio patre D.G. Paruo / doctore theologo / cōsessore regio: nunc primū in lucem emissum. *164 fol., Paris, 1513.*

[858-2] **Sigebertus, <Gemblacensis>, 1608.** Chronicon Sigeberti Gemblacensis Monachi. *263 s., Apid Hieronymus Verdussen, Antveroiæ, Anno M.DC.VIII.*

[859] **Grafen von Sternberg, Johann, 1786.** Versuch einer Geschichte der ungarischen Erdbeben. *Abhandlungen der Böhmischen Gesellschaft der Wissenschaften auf das Jahr 1786. nebst der Geschichte derselben. Mit Kupfern. 492 s., (s. 1-8), In der Waltherischen Hofbuchhandlung, Prag und Dresden, 1786.*

[860-1] **Szentiványi, Martin, 1702.** Curiosiora Et Selectiora Variarum Scientiarum Miscellanea. Autore R.P. Martino Szentivany. Decadis tertiæ Pars prima. *141 s., Typis Academicis, per Joannem Andream Hôrmann. Tyrnaviæ, M.D.C.C.II.*

[860-2] **Szentiványi, Martin, 1709.** Curiosiora Et Selectiora Variarum Scientiarum Miscellanea. Autore R.P. Martino Szentivany. Decadis tertiæ Pars secunda. *784 s., Typis Academicis, Tyrnaviæ, M.DCCIXI.*

[861] **Albertus, <Stadensis>, 1587.** Chronicon Alberti, Abbatis Stadensis, a condito orbe usque ad auctoris aetatem, id est, annum Iesu Christi M.CC.LVI. deductum, & nunc primum evulgatum. Quod opere cum aliis in partibus vetus historia, inprimis vero res Germanicae illustrantur, tum Saxoniae & Metropol. Crancianæ fundamenta aperiuntur. *500 s., Excudebat Iacobus Lucius, Helmæstadii, Anno M.D.LXXXVII.*

[862] **Perrey, Alexis, 1847.** Mémoire sur les tremblements de terre dans le bassin du Rhin. *Volume 19, 4th Edition, Académie Royale de Belgique, 113 p., Hayez, 1847.*

[863] **Bertrand, Elie M., 1757.** Memoires historiques et physiques sur les tremblemens de terre. *326 s., Chez Pierre Gosse, Junior, Libraire de S.A.R., Alahaye, M.DCC.LVII.*

[864] **Journal de Genève, 1855.** Le tremblement de terre. *Nº 182, Vendredi 3 Août 1855, s. 1.*

[865] **Petrak, E.E., 1882.** Beiträge zur Klimatologie des Riesengebirges. *Das Riesengebirge in „Wort und Bild“, 2. Jahrgang, 5. u. 6. Heft, s. 80-94, Marschendorf, 1., Dezember 1882. Lausitz*

[866] **Demuth, Josef, 1901.** Der politische Bezirk Trautenau: Gerichtsbezirke: Trautenau, Marschendorf, Schatzlar und Eipel. *608 s., Verlag des Trautenauer Bezirkslehrer-Vereins, 1901.*

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[868] **Hermannus (Augiensis), Aemilian Ussermann, Bernoldus (Constantiensis), Otto (de Sancto Blasio), 1792.** Chronicon: Ex Inedito Hucusque Codice Augiensi, Unacum Eius Vita Et Continuatione A Bertholdo eius discipulo scripta. Praemittuntur Varia Anecdota. Subiicitur Chronicon Petershusanum Ineditum. *514 s., In: Monumentorum Res Alemannicas Illustrantium. Tomus II - et ultimus. Typis San-Blasianis, 1792.*

[869] **Noeggerath, Jakob, 1870.** Die Erdbeben im Rheingebiet in den Jahren 1868, 1869 und 1870, beschrieben von Dr. Jakob Noeggerath, K. Berghauptmann a. D. und Professor der Mineralogie und Bergwerkswissenschaften. *132 s., (Separatabdruck aus dem XXVII. Jahrgange der Verhandlungen des Naturh. Vereins für Rheinland u. Westphalen.), In Commission bei Ma Cohen & Sohn, Bonn, 1870.*

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[872] **Marci de Kalt, 1358-1373.** Chronicon Pictum Vindobonense - Kepes Kronika - Cronica Pictata de la Viena. *The Chronicon Pictum is a medieval illustrated chronicle from the Kingdom of Hungary from the second half of fourteenth century. The chronicle was written by Márk Kálti (lat. Marci de Kalt) shortly after the year 1358, with the last of the illuminations being finished between 1370 and 1373. The chronicle was given by the Hungarian king Louis I to the French king Charles V, when the daughter of Louis, Catherine, was engaged to Charles's son Louis I, Duke of Orléans.*

[873] **Cordus, Valerius, 1561.** In hoc volumine continentur Valerii Cordi Simesusij Annotationes in Pedacij Dioscoridis Anazarbei de Medica materia libros V. longe aliæ quam ante hac sut euulgatæ. 301 s., Argentorati excudebat Iosias Rihelius. Anno M.D.LXI.

[874-1] **Cornelius Tacitus, [Lipsius, Justus, 1598].** C. Cornelii Taciti Opera quæ exstant. I. Lipsius quintùm recensuit. Seorsim excusi Commentarii meliores pleniorésque, cum curis secundis. *1224 s., ex Officina Plantiniana apud Franciscum Raphelengium, cIɔIɔ.IIc.*

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[874-3] **Cornelius Tacitus.** P. CORNELI TACITI ANNALIVM LIBER TERTIVS DECIMVS. http://www.thelatinlibrary.com/tacitus/tac.ann13.shtml

[874-4] **Cornelius Tacitus, [Gordon, Thomas, 1728].** The Annals of Tacitus. *Vol. I., Part II., translated by T. Gordon, R. Gunne, Dublin, 1728.*

[874-5] **Cornelius Tacitus, [1514].** P. Cornelii Taciti Libri quinque nouiter inuenti atque cum reliquis eius operibus editi. Ne quis intra decennium presens opus possit alicubi impune imprimere aut impressum vendere grauissimis edictis cautum est.

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[875] **Clüver, Philipp, 1616.** Philippi Clüverii Germaniæ antiquæ Libri tres. Adjectæ sunt Vindelicia et Noricum, ejusdem auctoris, Lugduni Batavorum. *869 s., Apud Ludovicum Elzevirium, Anno cIɔIɔcXVI.*

[876-1] **Strobelberger, Johann Stephan, 1733.** D. Johann Stephan Strobelbergers, Kayserl. Baad-Medici & c. Kurtze Unterweisung, Wie man nemblich Des Kaysers Carols-Baads sich recht zu gebrauchen, und dabey in währender Baad-Cur, guter Diaet sich befleissigen solle. *33 s., gedruckt bey Johann Augustin Orwansky, Eger, 1733.*

[876-2] **Strobelberger, Johann Stephan, 1621.** Galliæ Politicæ Medicæ Descriptio, De qualitatibus Regni Gallici, Academiis, Urbibus, Fluviis, Aquis medicatis, plantisque differens. *300 s., Typis & sumptibus Johan. Beithmanni, Jenæ, 1621.*

[877] **Anonymus, 1724.** Curiosa Naturae Arcana Inclyti Regni Boëmiæ, Et Appertinentium Provinciarum Moraviæ, Et Silesiæ Dissertationibus, Et Quaestionibus Philosophicis indagata; Admixtis Thesibus Ex Universa Aristotelis Philosophia, Quam In Alma, Cæsarea, Rediáque Universitate Carolo-Ferdinandea Pragensi. *185 s., Typis Universitatis, 1724. (p. 120).*

[878] **Nöggerath, Jacob, 1824.** Das Gebirge in Rheinland-Westphalen nach mineralogischem und chemischem Bezuge. Herausgegeben von Dr. Jakob Nöggerath. *Dritter Band. Mit drei illuminirten und zwei schwarzen Stein- und einer Kupfertafel. 291 s., bei Eduard Weber, Bonn, 1824.*

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[880] **von Mering, Fried. Ev.; Reischert, Ludwig, 1838.** Zur Geschichte der Stadt Köln am Rhein. Von ihrer Fründung bis zur Gegenwart, nach handschriftlichen Quellen und den besten gedruckten Hülfsmitteln bearbeitet. Erster Band. *384 s., Druck und Verlag von Joh. Wilh. Dietz, Köln, 1838.*

[881] **Wirtz, Karl, 2009.** Erdbrand bei Köln von Rektor Karl Wirtz, Eschweiler. *Online http://www.heimat-geschichtsverein-nideggen.de/aduatuka/2009/917erdbrand.html*

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[883] **Hermann, Amandus, 1700.** Capistranus triumphans, seu Historia fundamentalis de sancto Joanne Capistrano, ordinis minorum insigni regularis observantiæ propagatore. *840 s., apud Balthasarem Joachimum Endterum, Coloniæ, An. MDCC.*

[884] **Merwürdige physikalische Chronik aus Bayern.** *Der Aufmerksame (Beilage zur Grätzer Zeitung), No. 14, Mittwoch, den 1. Februar 1826, A. Leykam's Erben, Graz, 1826.*

[885] **Pertz, Georg Heinrich, 1861.** Monumenta Germaniae Historica, inde ab anno Christi quingentesimo usque ad annum millesimum et quingentesimum. Scriptores Rerum Germanicarum, Nova Series, Tomus IX., Tietmari Merseburgensis episcopi Chronicon. *631 s., Berolini apud Weidmannos, Berlin, 1935.*

[886] **Anonym, 1218–1761.** Chronica domus fratrum ordinis Praedicatorum Olomutii. Origo, antiquitas notabilio résque Casus unacum serie Superiorum, prout ex antiquis fragmentis colligi poterant, Conventus S. Michäelis Arch⸗Angeli Olomucensis Montis Juliani FF. Ordinis Prædicatorum laconicè descripta. *Archive Olomouc, Regional Archives in Opava.*

[887] **Meerstein, Modertus, 1675.** Archivum Conventus Olomucensis ad S. Bernardium F.F. Min. Refor: Provia Böemiæ. *Archive Olomouc, Regional Archives in Opava.*

[888] **Fritsche, Marcus, 1555.** Meteororum, hoc est, impressionum aerearum et mirabilium naturæ operum, loci fere omnes, Methodo Dialectica conscripti, & singulari quadam cura diligentiáq; in cum ordinem digesti ac distributi, A.M. Marco Frytschio Laubano Hexapolensi: Lusaciæ superioris alumno. Item: Catalogus prodigiorum atque ostentorum (etc.). *180 s., Ioannis Montani, & Ulrici Neuber. Noribergæ, Anno 1555.*

[889] **Bittner von, Alexander, 1874.** Beiträge zur Kenntniss des Erdbebens von Belluno vom 29. Juni 1873. *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. mathematisch-naturwissenschaftliche Classe, LXIX. Band. Zweite Abtheilung. 541-637.*

[890] **Sabellico, Marco Antonio, 1670.** M. Antoni Coccii Sabellici Historiae Rerum Venetiarum Ab Urbe Condita Libri XXXIII. In IV. Decades Distributi. Qui quidem nunc demum ad Probatißimorum Exemplarium fidem correcti, ac notis Marginalibus locupletati, novam veluti rerum gestarum imaginem Lectori exhibere poterunt. Accederunt ejusdem Authoris libros singulos Epitomæ, nec non in fine Index Rerum Memorabilium copiosus. 661 s., Sumptibus Joannis König, Excudebat Jacobus Werenfels, Basileæ, Anno clɔ Iɔc Lxx.

[891] **Pock, Johann Joseph, 1740.** Güldener Denckring göttlicher Allmacht und menschlicher Thaten, welche sich begeben von Anfang der Welt durch die bißher etliche tausend verfiossene Jahre / biß auf jetzt lauffende Zeit; Von Johann Joseph Pockh / Zwey und zwantzigster Theil. *1161 s. und Register, Gedruckt und verlegt von Johann Jacob Lotters, Augspurg, An. 1740.*

[892] **Letopisy žďárské.** *In: Fontes Rerum Bohemicarum, Tom II., Cosmæ chronicon Boemorum cum continuatoribus. 570 s., 519-557, Nákladem Musea království Českého. V komissí kněhkupectví: Dr. Grégr a Ferd. Dattel. V Praze 1874.*

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[894] **Naruszewicz, Adam Stanisław, 1803.** Adama Naruszewicza, Historya Narodu Polskiego, od początku chrzesciaństwa. Panowanie Piastów. Tom V. *591 s., Edycya Tadeusza Mostowskiego, w Warszawie 1803.*

[895] **Stumpf, Johannes, 1548.** Gemeiner loblicher Eydgnoschafft Stetten, Landen vnd Völckeren Chronick wirdiger thaaten beschreybung: Hierin[n] wirt auch die gelegenheit der gantzen Europe, Item ein kurtzuergriffne Chronica Germanie oder Teutschlands, in sonders aber ein fleyssige histori vnd ordenliche beschreybung Gallie oder Franckreich fürgestellt/…./ Durch Johann Stumpffen beschreiben/und in XIII. bůcher abgeteilt ist. *664 s., Gedruckt Zürych in der Eydgnoschafft bey Christoffel Froschouer, MDXLVIII.*

[896] **Birnhard, Johann, 1613.** Newe vollkommene Thüringische Chronica Das ist: Geschicht und Zeitbuch aller namhafftigsten Historien Sachen und Handlungen von der Geburt und Menschwerdung unsers einigen Erlösers und Seligmachers Jesu Christi an biß auff diß gegenwertige M.DC.XIII. Jahr vollzogen: Darinnen alle Händel, Stifftung und erbawung der meisten und fürnembsten Städte, Kirchen, Clöster, Schlösser, Flecken und Dörffer, im gantzen Thüringer Lande, wenn, wo, durch wen, und worumb sie gebawet: … Durch Johannem Binhardum. *551 s., Bey vnd in verlegung Nicol vnd Christoff Nerlichen, Leipzig.*

[897] **Nowý Kalendář Hospodářský na rok přestupnij 1844**, wydaný od cis. král. wlastenecké hospodářské Společnosti w králowstwj Českém. *Kronika powětrnosti s zwlásstním ohledem na Čechy. p. 20-25, Wytisstěn a k dostánj u Synů Bohumila Háze, na Starém městě, w klássteře sv. Anny, číslo 211.*

[898] **Pelzl, František Martin, 1817.** Geschichte der Böhmen, von den ältesten bis auf die neuesten Zeiten. Zweyter Theil. Vierte fortgesetzte Auflage. *s. 531-1076, im Verlage des k.k. privil. Zeitungs⸗ und Intelligenz⸗ Comptoirs. Prag, 1817.*

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[901] **Zopff, Johann Caspar, 1692.** Reußische Gerauische Stadt- und Land-Chronica, darinnen enthalten viel denckwürdige Sachen / betreffend nicht allein die Stadt Gera / sondern auch das gantze Voigt⸗ und Reussen⸗Land. *456 s., Verlegts Christoph Wohlfart Buchhåndler, Leipzig Ann. M DCLXCII.*

[902] **Chronica** Darinnen auff das kürtzest werden begriffen, die Namhafftigsten Geschichten, so sich vnder allen Kaysern, Von der geburt Christi, biß auf das M.D.XXXVIII Jar verlaffen haben. *192 p., Philipp Ulhart, Augspurg, 1538.*

[903] **The Gentleman's magazine.** Vol. 57 part 1, 1787, pp. 174-175. *Printed by F. Jeffries, etc., London, 1731-1907.*

[904-1] **Bange, Johann, 1599.** Thüringische Chronick oder Geschichtbuch, Von allerhand denckwürdigen Sachen, Thaten vnd Händeln, so sich fürnemlich in Thüringer Landschafft vnd dessen angräntzenden ... orten, von dero Welt anfang biß auff gegenwertige Zeit, vnd das nochwehrende Neun vnd Neunzigste Jahr, begeben vnd zugetragen: … *424 s., durch Andream Hantzsch, Mülhausen, 1599.*

[904-2] **Bange, Johann, 1600.** Newe Cronick oder Geschichtbuch / Von allerhand denckwürdigen Sachen, Thaten vnd Händeln, so sich fürnemlich in Hessen und Thüringer Landschafft vnd dessen angräntzenden von der Hessen- und Thüringer Landschafft vnd dessen angräntzenden / so wol auch andern weil abgelegenen Orten / von dero Welt anfang bi auff das 1599 Jahr nach Christi Geburt begeben und zugetragen… *424 s., Mülhausen, Anno 1600.*

[905] **Természettudományi közlöny** havi folyóirat a közérdekű ismeretek terjesztésére. A pestis hazánkban. *XXIX. Kötet.,1897. Május, 333. Füzet, s. 256-257.*

[906] **Fuhrmann, Mathia, 1738.** Alt⸗ und Neues Wien, Oder Dieser Kayserlich⸗ und Ertz⸗Lands⸗Fůrstlichen Residentz⸗Stadt Chronologisch⸗ und Historische Beschreibung Von derselben vermuthlichen Ursprung an biß auf die neuen Zeiten. Erster Theil. Aus verschiedenen bewehrten Auctoribus, und anderen sicheren Nachrichten, zusammen getragen ... von P. Mathia Fuhrmann. *720 s., Joh. Joh. Ignatz Heninger, Wien, 1738.*

[907] **Kircher, Conrad, 1594.** Zehen Predigen von erschröcklichen Erdbidemen. *247 s., Durch Leonhart Reinmichel / Gedruckt zu Laugingen / 1594.*

[908] **Annales Silesiae** ab A. 1049 ad A. 1491 iussu magistratus Wratislaviensis A. **1514** conscripti. *Biblioteka Cyfrowa Uniwersytetu Wroclawskiego. Mf. 41495.*

[909] **Tesák Mošovský, Jiří, 1607.** [Stella Nova & Cometae To gest: Křestianské a pobožné též y s Pijsmy swatými srownalé Wyswětlenij co hrozného, a strassliwého, y oplakánij hodného, wssechny Kométy, a yacýkoliw na Nebeské Obloze kdekoliw Vkazowé, předzwěstugj, a s sebau přinássegji když se koliw od Lidj spatřugj a wjdagj / W Městě Hradcy Králowé nad Labem w 2. Neděli Adwentnj Léta tohoto 1607. z Cžástky w hlawnijm Kostele kázané a k těmto časům w nichžto VpřlMost gest řlDká Ctnost wydané: Od Kněze Giřijka Tesáka Mossowského wýss Města poznamenaného přednijho Zpráwce Cýrkewnjho], *[69] listů ; 8°, 1607.*

[910] **Alsted, Johann Heinrich, 1649.** Joan. Henrici Alstedii Scientiarum Omnium Encyclopædiæ Tomus Quartus. Complectens huius Operis Partem Septimam. Cuius contenta sequens folium indicabit. *430 s., Sumptibus Ioannis Antonii Huguetan Filij, & Marci Antonii Ravaud viâ Mercatoriâ ad insigne Sphæræ. Lugduni, M.DC.XLIX.*

[911] **Minsberg, Ferdinand, 1834.** Geschichtliche Darstellung der merkwürdigsten Ereignisse in der Fürstenthums Stadt Neisse. *392 s., Druck und Verlag von Wangenfield, Neisse, 1834.*

[912] **Pertz, Georg Heinrich, 1878.** Scriptores Rerum Germanicarum in usum scholarum ex Monumentis Germaniæ historicis recusi. MGH-SRG-VIII: Annales Hildesheimenses*, 69 s., Impensis bibliopolii Hahniani, Hannoverae, 1878.*

[913] **Pertz, Georg Heinrich, 1894.** Scriptores Rerum Germanicarum in usum scholarum ex Monumentis Germaniæ historicis recusi. MGH-SRG-XXXVIII: Lamperti monachi Hersfeldensis Opera, *491 s., Impensis bibliopolii Hahniani, Hannoverae, 1894.*

[914] **Kornhuber, G. Andreas, 1858.** Das Erdbeben vom 15. Jänner 1858: besonders rücksichtlich seiner Verbreitung in Ungarn. *Verhandlungen des Vereins für Natur- und Heilkunde zu Presburg, 3 (1858), s. 23-54.*

[915] **Schmidt, J., 1858.** Nachrichten über das Erdbeben am 15, Jänner in Ollmütz. *Mittheilungen der Kaiserlichj-Königlichen Geographischen Gesellschaft. 2 (1858), s. 53-54, Wien.* Online https://www.biodiversitylibrary.org/item/43112#page/93/mode/1up

[916] **Olczak, Tadeusz, 1966.** Sur la région épicentrale et la profondeur d´un foyer séismique du 3 XII 1786 dans les Carpathes occidentales polonaises. *Acta Geophysica Polonica, Vol, XIV, nr. 1, s. 61-72, Warszawa.*

[917] **Panáček, Jaroslav, 2016.** Kronika města České Lípy mistra Hanse Kriescheho. *Litoměřice: Státní oblastní archiv v Litoměřicích, 2016. Edice a studie Státního oblastního archivu v Litoměřicích. ISBN 978-80-904381-6-3.*

[918] **Hofmeister, Adolf, 1919.** Weissenburger Aufzeichnungen vom Ende des 8. und Anfang des 9. Jahrhunderts. *401-421. Zeitschrift für die Geschichte des Oberrheins, Neue Folge. Band XXXIV. Heidelberg, 1919.*

[919] **Wolfart, Karl, 1909.** Geschichte der Stadt Lindau im Bodensee: Im Auftrag der Stadtgemeinde unter Mitwirkung von Fr. Joetze, H. Loewe, Th. Stettner, u.a, Bd. 2. *470 s., J.T. Stettner, Lindau, 1909.*

[920] **Heußler, Leonhard, 1591.** Speculum terrae motus, Das ist: Erd-Bidems-Spiegel. Darauß mennigklich zu sehen: Was davon zu halten sey / Nemlich sie bedeuten Gottes Zorn und straffungen / auch sonst vilfeltiges Creutz, Unglůck / Noth und Elend. *46 s., Anno M.D.XCI.*

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[R014] **Allen, T.I., 2019.** Seismic hazard estimation in stable continental regions: challenges and opportunities. *2019 Pacific Conference on Earthquake Engineering and Annual NZSEE Conference, Paper 392, 1-17.*

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[R018] **Kövesligethy, Radó, 1907.** Seismischer Starkegrad und Intensität der Beben. *Gerlands Beiträge zur Geophysik, Vol. 8, 363-366.*

[R019] **Blake, Archie, 1941.** On the estimation of focal depth from macroseismic data. *Bulletin of the Seismological Society of America (1941), 31, (3): 225–231.*

[R020] **Kövesligethy, Radó, 1906.** A makroseismikus rengések feldolgozása. *Mathematikai és Természettudományi Értesítő, 24. kötet, 1906, 349-368.*

[R021-1] **Gutenberg, B.; Richter, C. F., 1942.** Earthquake magnitude, intensity, energy, and acceleration (Second Paper). *Bulletin of the Seismological Society of America, 32 (3): 163–191*.

[R021-2] **Gutenberg, B.; Richter, C. F., 1956.** Earthquake magnitude, intensity, energy, and acceleration (Second Paper). *Bulletin of the Seismological Society of America, 46 (2): 105–145*.

[R022] **Richter, Charles F., 1958.** Elementary Seismology. *768 pp.*, *W. H. Freeman, 1958.*

[R023] **Kárník, V., 1968.** Seismicity of the European area. Part 1. Academia, Praha.

[R024] **Gutdeutsch, Rolf; Kaiser, Diethelm; Jentzsch, Gerhard, 2002.** Estimation of earthquake magnitudes from epicentral intensities and other focal parameters in Central and Southern Europe. *Geophysical Journal International, Volume 151, Issue 3, December 2002, Pages 824–834, https://doi.org/10.1046/j.1365-246X.2002.01804.x*

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[R026] **Johnston, A.C., 1996.** Seismic moment assessment of earthquakes in stable continental regions – II. Historical seismicity. *Geophys. J. Int., 125, 639– 678, London.*

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[R028] **Frankel, Arthur, 1994.** Implications of felt area-magnitude relations for earthquake scaling and the average frequency of perceptible ground motion. *Bull. Seism. Soc. Amer., 84/2, 462–465, Washington.*

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[R031] **Stammler, Klaus, 1993:** Seismic-Handler - Programmable multichannel data handler for interactive and automatic processing of seismological analyses. *Comput. Geosci.*, *19(2), 135-140.*

[R032] **Bratt, S.R.T.C.; Bache, C.T., 1988.** Location estimation using regional array data. *Bulletin of the Seismological Society of America, 78,780-798.*

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[R034] **Sponheuer, W., 1960.** Methoden zur Herdtiefenbestimmung in der Makroseismik. *Freiberger Forschungshefte C88, S.1-117.*

[R035] **Kárník, V., 1996.** Seismicity of Europe and the Mediterranean. *28 pp. + map and catalogue, Geophysical Institute of the Academy of Sciences of the Czech Republic, Praha.*

3.5 SEARCHED SOURCES

[S01] **Unger, W., 1960.** Erdbeben im Ergebirge. *Glückauf, Bd. 7 (1960), Nr. 5, s. 90-93.*

[S02] **????, 1829.** Chronik der Erdbeben. *Mährischer Wanderer, Bd. ??, 1829, s. 59-69.*

Mährischer **Wanderer**
Brünn : K.J. Jurende, 1809-1859
BOA001 [Moravská zemská knihovna Brno] -- sign. 3-0004.232
Roky: 1809-59
Svazky: 1-48

[S03] **????, 1895.** Das mittelschlesische Erdbeben vom 11. Juni 1895. *Schlesische Zeitung, 1895, No. 415.*

[S04] **Kögler, Joseph, 1993.** Die Chroniken der Grafschaft Glatz, Bd. 2, Die Pfarrei- und Stadtchroniken von Glatz - Habelschwerdt - Reinerz mit dem zugehöreigen Dörfern. …….

Hlavní záhlaví	Kögler, Joseph
Název	**Die Chroniken der Grafschaft Glatz**. Band 2, **Die** Pfarrei- und Stadtchroniken von **Glatz** - Habelschwerdt - Reinerz mit dem zugehöreigen Dörfern / Joseph Kögler ; neu bearb. und hrsg. von Dieter Pohl
Nakl. údaje	Modautal: Pohl, 1993
Popis (rozsah)	350 s.: obr., fotogr.
Ve fondu	ABD005 [PedF UK - knihovna Praha]

[S05] **????, 1890.** ……………. *Erzgebirgs-Zeitung, Bd. 11 (1890), s. …...*

Název	**Erzgebirgs-Zeitung** : Organ der Touristen-Vereine des böhmischen Erz- und Mittelgebirges
Nakl. údaje	Teplice : C. Weigend, 1880-1943
Popis (rozsah)	64 sv.
Ve fondu	ABA001 [NK ČR Praha] -- sign. 19 F 391 Roky: 1888-1943

4 LIBRARY SERVERS AND WEB SITES

4.1 LIBRARY SERVERS

Czech libraries

https://www.nkp.cz/
http://kramerius.nkp.cz/kramerius/Welcome.do
http://www.digitalniknihovna.cz/mzk/
http://www.nm.cz/Katalogy-a-databaze/
http://www.manuscriptorium.com/apps/index.php#search
http://knihovna.nacr.cz/
http://librinostri.catholica.cz/
http://cms.flu.cas.cz/cz.html
https://old.techlib.cz/cs/262-vpk

German libraries

https://www.digitale-sammlungen.de/?c=digitale_sammlungen
https://www.ub.uni-leipzig.de/forschungsbibliothek/digitale-sammlungen/
https://digital.slub-dresden.de/kollektionen/
http://digital.staatsbibliothek-berlin.de/
https://opacplus.bsb-muenchen.de/metaopac/start.do?SearchType=2

Austrian libraries

https://www.onb.ac.at/digitale-bibliothek-kataloge/
http://www.wienbibliothek.at/bestaende-sammlungen/digitale-sammlungen
https://www.obvsg.at/kataloge/kataloge-wien/

Other European libraries

http://www.oszk.hu/en
https://www.arcanum.hu/en/
https://www.bn.org.pl/en/digital-resources/
http://gallica.bnf.fr

Digi-libraries

https://archive.org/details/googlebooks
https://books.google.cz/

https://www.biodiversitylibrary.org/subject/Germany#/titles
https://www.biodiversitylibrary.org/item/108478#page/17/mode/1up
https://www.biodiversitylibrary.org/item/31090#page/9/mode/1up
https://www.biodiversitylibrary.org/page/7208262#page/34/mode/1up
https://de.wikisource.org/wiki/Bayerische_Akademie_der_Wissenschaften
https://www.biodiversitylibrary.org/bibliography/50438#/summary

https://de.wikisource.org/wiki/Sitzungsberichte_der_Kaiserlichen_Akademie_der_Wissenschaften_in_Wien_%E2%80%93_mathematisch-naturwissenschaftliche_Classe

https://de.wikisource.org/wiki/Sitzungsberichte_der_Kaiserlichen_Akademie_der_Wissenschaften_in_Wien_%E2%80%93_mathematisch-naturwissenschaftliche_Classe/Inhalt

www.dmgh.de/de/fs1/search/query.html?contextSort=sortKey&contextType=scan&contextOrder=descending&sort=score&order=desc&hl=false&fulltext=terrae+motus&start=0&rows=10

4.2 AUXILIARY WEB SITES

[MGH] **Monumenta Germaniæ Historica –** *https://www.dmgh.de/*

MGH-SS-1 Annales et chronica aevi Carolini [724]
MGH-SS-2 Scriptores rerum Sangallensium. Annales aevi Carolini [768]
MGH-SS-3 Annales, chronica et historiae aevi Saxonici [709]
MGH-SS-4 Annales, chronica et historiae aevi Carolini et Saxonici [772]
MGH-SS-5 Annales et chronica aevi Salici [782]
MGH-SS-6 Annales et chronica aevi Salici [758]
MGH-SS-9 Chronica et annales aevi Salici [006]
MGH-SS-10 Annales et chronica aevi Salici. Vitae aevi Carolini et Saxonici [793]
MGH-SS-13 Supplementa tomorum I-XII, pars I [656]
MGH-SS-16 Annales aevi Suevici [770]
MGH-SS-17 Annales aevi Suevici [745]
MGH-SS-19 Annales aevi Suevici [676]
MGH-SS-20 Supplementa tomorum I, V, VI, XII. Chronica aevi Suevici [795]
MGH-SS-26 Francogallicarum scriptoribus [792]
MGH-SS-29 Ex rerum Polonicarum scriptoribus saec. XII. et XIII. [794]
MGH-SS-30.1 Supplementa tomorum XVI-XXV [870-1]
MGH-SS-30.2 Supplementa tomorum I-XV [870-2]
MGH-SS-37 Die Reichschronik des Annalista Saxo [771]
MGH-SS-44 Heinrici de Heimburg annales [745]
MGH-SRG-4 Annales Altahenses Maiores [661]
MGH-SRG-6 Annales Regni Francorum 741-829 [767]
MGH-SRG-7 Annales Fuldenses, Annales Regni Francorum orientalis [705]
MGH-SRG-8 Annales Hildesheimenses [912]
MGH-SRG-11 Annales Poloniae [658]
MGH-SRG-12 Annales Xantenses et Annales Vedastini [842]
MGH-SRG-19 Bayerische Chroniken des 14. Jahrhunderts [777]
MGH-SRG-38 Lamperti monachi Hersfeldensis Opera [913]
MGH-SRG-42 Monumenta Erphesfurtensia saec. XII. XIII. XIV. [774]
MGH-SRG-72 Annales Quedlinburgenses [927]
MGH-SRG-NS-13 Thomas Ebendorfer, Chronica Austriae [778]
MGH-Necr. 6-1 Necrologia Germaniae [796]
MGH-AA-9 Chroniva minora saec. IV.V.VI.VII., [797]
MGH-AA-5 Iordanis Romana et Getica [798]

[CA] **Calendar:** http://lieberknecht.de/~prg/calendar.htm

[CY] **Calendar years:** https://kalendar.beda.cz/ruzne-letopocty

[DWG] **Das Deutsche Wörterbuch von Jacob Grimm und Wilhelm Grimm:** https://www.dwds.de/wb/

[E] **Encyclopedia of the Medieval Chronicle.**

[EDC] **Quick Easter Date Calculator**: http://www.csgnetwork.com/easter2calc.html

[F] **Folio:** https://cs.wikipedia.org/wiki/Folio

[CH] **Canonical hours:** https://en.wikipedia.org/wiki/Canonical_hours

[JDC] **Julian Day and Civil Date Calculator**: https://core2.gsfc.nasa.gov/time/julian.html

[JGC] **Converting between Julian and Gregorian Calendar in One Step:** https://stevemorse.org/jcal/julian.html

[JPL] **JPL Small-Body Database Browser:** https://ssd.jpl.nasa.gov/sbdb.cgi?sstr=Halley;orb=1

[LC] **Lunar calendar:** https://planetcalc.com/540/

[LCD] **Latine-Czech dictionary – online**: *http://psalvet.sweb.cz/slovnik.html*

[MAP] **Map server:** *http://www.maproom.org/c/index.php*

[R] **Das Repertorium "Geschichtsquellen des deutschen Mittelalters"**: The repertory "Historical sources of the German Middle Ages" is a bibliographical and source-based reference work on a digital basis to the narrative historical sources of the medieval German Empire for the period of about 750 to 1500. https://www.geschichtsquellen.de/index.html

[SE] **NASA - Solar Eclipse Search Engine:** https://eclipse.gsfc.nasa.gov/SEsearch/SEsearch.php

[W] **Free encyclopedia**: https://www.wikipedia.org/

[WBN] **Wörterbuchnetz:** http://www.woerterbuchnetz.de/cgi-bin/WBNetz/setupStartSeite.tcl

[WV] **The Web Vocabulary to learn historical Czech:** https://vokabular.ujc.cas.cz/informace.aspx?t=ridics-en&o=ovokabulari

CZ-NEC

Revision of the Czech National Earthquake Catalogue

Part 3
HISTORICAL EARTHQUAKE CATALOGUE

WP 2 – Action 2.5

ΣIGMA2

Citation:

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Contents

1 INTRODUCTION

The catalogue of historical (macroseismic) earthquakes CZ-NEC covers the period from 768 to the present. The period from 768 to 1020 was added to the catalogue mainly because of the need to cover the time span in which the paleo-earthquake occurred in West Bohemia. Since 1950 the catalogue of historical earthquakes overlaps with the catalogue of instrumentally recorded earthquakes. The catalogue of historical earthquakes, however, adopted only those events that were felt by men.

2 CZ NEC HISTORICAL CATALOGUE FORMAT

The set of parameters that are determined for each event included in CZ-NEC was inspired by the SHEEC catalogue (see [506]). This decision was taken because it is envisaged that CZ-NEC will be offered for inclusion in the next SHEEC update. That is, to ensure easier compatibility. Therefore, the table designed for CZ-NEC contains the following parameters (columns):

Parameter code	**Parameter name**	**Type of value**
No.	Event number	Integer
No-ES	Number in Kárník´s catalogue	Integer ± suffix
Year/Mo/Da	Date	Integer/Integer/Integer
Ho/Mi/Sc	Time	Integer/Integer/Dec. Number
Ax	Epicentral area – geographical name	Text
C	Country code	Text
Reg	Epicentral region – for all events it is eq. SCR	Text
Lat. / Long.	Coordinates of the epicenter	Dec. Number - °N / °E
TEpi	Method of deriving the epicenter	Text
TU	Source or method used to determine uncertainty	Text
H	Depth in km	Integer
TH	Source or method used to determine uncertainty	Text
I_0	Epicentral intensity	Roman numerals
TI_0	Source from which the value was taken or method	Text
Mw	Moment magnitude	Dec. Number
TMw	Source or method used to determine	Text
Type	Type of event	Text
Note	Clarifying note	Text
MW_{OR}	Original MW magnitude	Dec. Number
TMW_{OR}	Source of MW magnitude	Text
MM_{OR}	Original MM magnitude	Dec. Number
TMM_{OR}	Source of MM magnitude	Text
ML_{OR}	Original ML magnitude	Dec. Number
TML_{OR}	Source of ML magnitude	Text

In order of transparency of the catalogue, the important parameters are supplemented by information on the source or method used. There was a great effort to extract as much information from the original sources as possible. Parameters of other events, especially those with epicenter outside the Czech Republic, were taken from earthquake catalogues of neighboring countries. However, at least a simplified review was carried out for these events or the event was consulted with colleagues from that country. The methods used to derive some parameters were chosen regarding the applicability of these methods in areas with low seismicity (with limited possibilities to using statistics) or for evaluating sets with very small numbers of IDPs.

Our next priority was to best harmonize the CZ-NEC catalogue with the catalogues of our neighbors, especially Germany and Austria. The Bohemian Massif, whose seismicity is the subject of evaluation, also extends to the border areas of these countries, as well as the assumed seismic source zones and faults.

Event number

The »Event number« represents the unique identifier of a catalogue entry respecting the chronological order of the earthquakes.

Number in Kárník´s catalogue

Since CZ-NEC represents a revision of Kárník's catalogues, the original earthquake numbers listed in KÁRNÍK ET AL. (1958) catalogue (see [401]) are preserved. This means that some numbers on the list are missing. On the other hand, the CZ-NEC catalogue contains events that Kárník did not mention. If the event does not have an event number assigned to it by Kárník, the nearest lower Kárník's number and suffix A, B, C, etc. are used.

Origin Date

The **Year / Mo / Da** codes mean Year / Month / Day. All years are referred to as AD years (Anno Domini), i.e. they denote the year since the birth of Christ. The Julian and Gregorian calendars are not differentiated, but before 1582 all dates are listed in the Julian calendar. In the transition period, about 1582-1700, dates may occur in both calendars.

Origin Time

The **Ho** / **Mi** / **Sc** codes mean Hour / Minute / Second. Hour are given in Coordinated Universal Time (UTC). The time offset from UTC to local, Central European Time (CET) can be written as UTC+01:00.

All times given in other time counting systems (canonical hours, Czech or German hours) were converted to UTC if possible. Only those times that can be represented by a single number are listed in the catalogue table. The time specified by the time range or part of the day is specified only in the Event sheet and the space in the Catalogue table remains vacant.

Epicentral Area

The epicenter area (**Ax**) is a conventional geographical indication that can be recognized on the map. Names of settlements, mountain ranges and small regions can be used. If the event was taken from another catalogue, the original name of the epicentral area is usually used.

Country Code

The country code specifies the previous determination of the epicenter area. The following codes are introduced: CZ – Czech Republic; DE – Germany; AT – Austria; SK – Slovakia; PL – Poland (resp. state codes according to https://abbreviations.yourdictionary.com/articles/abbreviations-european-union.html).

Epicentral Region

The delimitation of the epicenter region (**Reg**) may seem formal. However, it indicates that the Bohemian Massif is located in a stable continental region (SCR) according to the SHEEC approach. It also indicates which models could be used for I_0 > Mw conversion.

Epicenter

The epicentral location (**Lat.** / **Long.**) is given in decimal degrees of °N (Latitude) and °E (Longitude).

The **TEpi** column then specifies how the epicenter coordinates were derived. This column can contain the following codes: »SEC« - taken from the source catalogue (The source catalogue is specified in the Event sheet); »DED« - deduced from the source information (The primary source is specified in the Event sheet); »IDP« - processing of IDPs (The procedure used is specified in the Event sheet); »WAL« - Without the ability to location (In this case, without specifying coordinate values).

Uncertainty in the determination of epicenter coordinates is discussed only in the Events Sheets. If the coordinates of the epicenter are adopted from another catalogue and if the source catalogue expresses epicentral uncertainty in any way, the reference number of the source catalogue is entered in the **TU** column. When values resulting from the IDPs processing, the code »DPP« is entered in the TU column. In the remaining cases, e.g. due to a small number of IDPs, there is no other option than to estimate uncertainty, then the code »EJ« is entered in the TU column.

Depth

Depth value (**H**) is expressed in km as an integer.

Uncertainty in the determination of focal depth (**HUnc**) is expressed in km. Then the source or method used to determine uncertainty is given in the next column (**TH**). If the source catalogue expresses focal depth with value in km, this value is entered in the HUnc column and the code of the source catalogue is entered in the TH column. When value represents characteristic focal depth, then the code »CH« is entered in the TH column.

Macroseismic intensity

Intensity value (**I_0**) is expressed as an integer entered as roman numerals or as a range of two integer values. EMS-98 or MSK-64 scales are used.

Then the source of the intensity value is given in the next column (**TI_0**) in form of reference number in square brackets. When macroseismic intensity was determined by the authors of CZ-NEC, then the code »CT« is entered in the TI_0 column.

Magnitude

Moment magnitude (**Mw**) is expressed as a decimal number.

Number of formulae used to determine Mw is given in the next column (**TMw**).

$Mw = M_l = 0.55 \cdot I_0 + 0.95$ [1]
$Mw = M_l = 0.55 \cdot I_0 + 0.93 \cdot \log(h) + 0.14$ [2]
$Mw = 1.2\ (\pm 1.6) + 0.32\ (\pm 0.52) \cdot I_0 + 0.03\ (\pm 0.04) \cdot I_0^2$ [3]
$Mw = 0.667 \cdot I_0 + 0.30 \log(h) – 0.10.\ \sigma = 0.31 \ldots 0.37$ [4]
$Mw = 0.682 \cdot I_0 + 0.16.\ \sigma = 0.32 \ldots 0.36$ [5]
$Mw = 0.655 \cdot I_0 + 0.528.\ \sigma = 0.25$ [6]
$Mw = 0.67\ (\pm 0.11) + 0.56\ (\pm 0.08) \cdot ML + 0.046\ (\pm 0.013) \cdot ML^2$ [7]
$Mw = ⅔ \cdot ML + 1.15$ [8]
$Mw = 1.34 + 0.417 \cdot ML + 0.049 \cdot ML^2$ [9]

If the Mw value has been adopted from another catalogue (source), the reference number is entered in the TMw column.

If the formula allows to determine uncertainty or the source gives it, this value is entered in the **MwUnc** column, otherwise, the cell remains empty.

Type of event

Type of event is indicated by one of the following codes: **T** – tectonic; **T/m** – main shock; **T/f** – foreshock; **T/a** – aftershock; **C** – collapse earthquake; **U** – uncertain, the induced event cannot be excluded.

Note

Links to additional notes may be entered in this column. This column also records cases where the evaluation of the event is incomplete. By the end of 2020, for example, some manuscripts could not be read, or some key sources were not available due to administrative barriers.

Additional information about the type of magnitude.

If other magnitude values are available, then these values are entered in the **M_{OR}** column. The next column of TM_{OR} records the type of magnitude (Mw, MM and ML) and the reference number of the source catalogue.

3 CZ-NEC HISTORICAL CATALOGUE

3.1 CZ-NEC TABLE

The results of the revision of Kárník's catalogues (see [401] and [501]) were listed in table CZ-NEC-Table_30122020.xlsx. The table shows historical earthquakes from the period 768-1980, the epicenters of which fall into the CZ-NEC polygon.

The source data for the following graphic presentation of the catalogue of historical earthquakes are taken from the table:

CZ-NEC-Table_30122020.xlsx

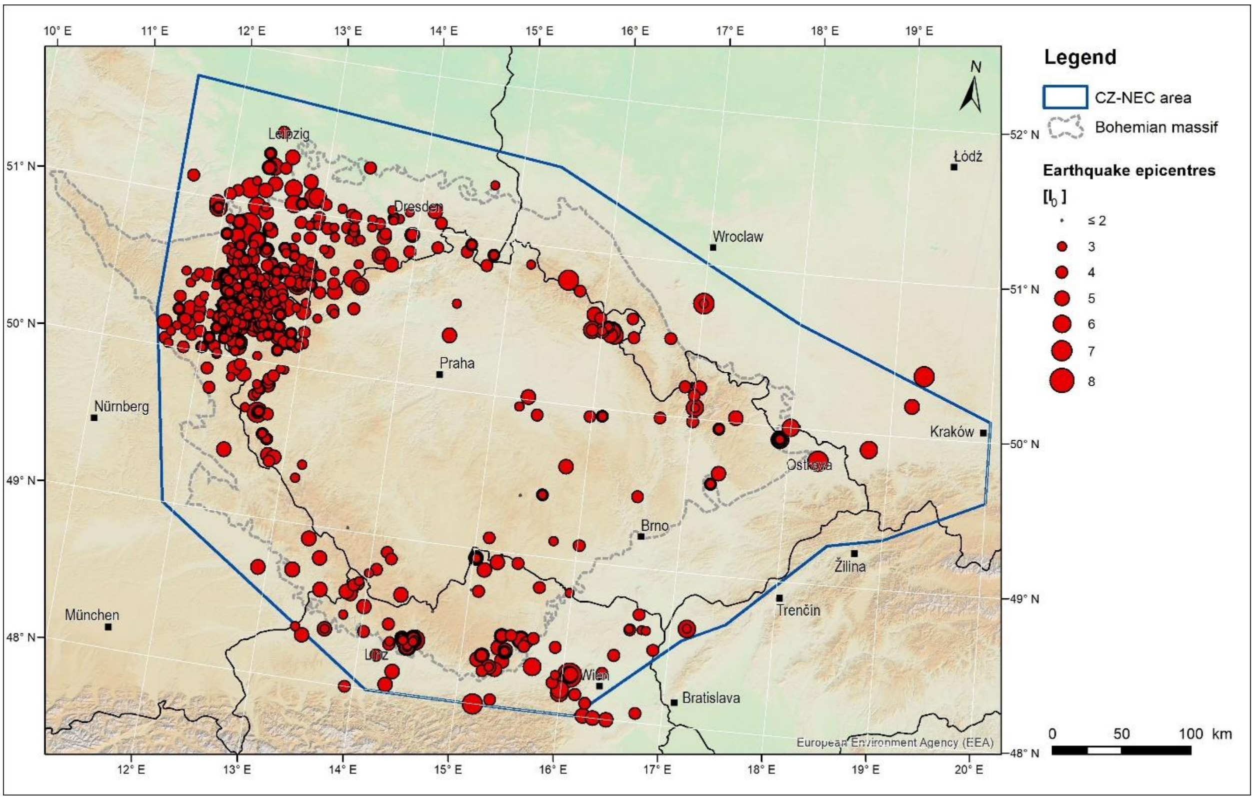

Fig. 1: Graphic presentation of the CZ-NEC Historical earthquake catalogue covering data from the time period 768 – 1980 (revised Kárník's catalogues).

3.2 EVENT SHEETS

Each record in Kárník's catalogues, as well as earthquake records revealed by the CZ NEC team, has a separate Event Sheet, where all relevant information related to this event are recorded. The key is especially the list of all available sources (in many cases with clippings in the original wording and language) and the discussion of the event, including the decision whether it is a fake or an earthquake that happened.

The complete set of Event Sheets is attached. Due to the size, the Event Sheets file is divided into 14 *.pdf files.

768-999.pdf

1000-1099.pdf

1100-1199.pdf

1200-1299.pdf

1300-1399.pdf

1400-1499.pdf

1500-1599.pdf

1600-1699.pdf

1700_1749.pdf

1750_1799.pdf

1800_1849.pdf

1850_1899.pdf

1900_1949.pdf

1950_1980.pdf

4 FAKE, DOUBTFUL AND INCORRECTLY ASSIGN EVENTS

This table lists both the earthquakes that were found to be false or very doubtful and earthquakes, which were incorrectly located.

Fakes: Mostly these are events that mention Kárník's catalogues, but there are also events found in other sources (see numbers with suffix). Events were classified as fake either when a phenomenon other than an earthquake was recognized or when the data was unreliable, poor or confused. The classification was made by the authors of the CZ NEC catalogue. In the "Reference" column there is a link to the source if the event has already been disputed before us and we agreed.

Incorrectly Assign Events: In several cases, earthquakes were incorrectly located, and their epicenter was laid in the Bohemian Massif. Usually it was a medieval earthquake and the sources reported "earthquake in Bohemia (Saxony, Moravia, Poland)". Very often it is said that the earthquake was "throughout the country" ("in all country"). An analysis of the sources showed that the earthquake actually happened, but its epicenter was not in the Bohemian Massif and could not even be felt in this region. The assignment of recognized earthquakes was made by CZ-NEC authors. The reference shows a reference catalogue (source).

Table of Fake, doubtful and incorrectly assign events

En KMM	Year	Mo	Da	Ho	Mi	Kárník's text	Recognized cause/event	I_0	Ref.
3	768					Earthquakes in "All of Bajoaria"	Treviso / IT	VIII-IX	[543]
4	786					Earthquakes in Germany, especially in Bavaria. …	Vesuvius eruption, [305]		[510]
N.L.	787					Various cities in Germany felt an earthquake ([076-1])	lack of reliable sources		[510]
5	819					Earthquake in Johunnum (in western Bohemia?)	confusion of places		[510]
6	823					Earthquake in Saxony near Meissen, in Thuringia and in the Altmark	Aachen / DE	VII	[509]
7	827/828					Destructive earthquake in Saxony	windstorm in Germany		
N.L.	841					An earthquake in the area of today's Kayna and Zeitz in Thuringia ([237])	lack of reliable sources		[510]
N.L.	849	2	18			Not listed. Terrae motus magnus ([076-1])	Remiremont / FR	VIII	[547]
8	867	10	9			Earthquake spread in Germany	Reichenau??? / DE	?	[510]
N.L.	868					A terrible earthquake at various locations is reported from Kayna near Zeitz in Thuringia ([237])	lack of reliable sources, comet? [006], [724]		[510], [532]
9	997					An earthquake in central Germany, reported from Magdeburg, the Altmark and Saxony	false year, should be 998, meteorite fall, [339]		[510]
10	998	7				A terrible earthquake in Slavošov (CZ)	Harz Mts.??? / DE	?	[510]
11	1000	3	29			"but almost all over Europe"	Saint-Amand / FR	IV-V	[510]
12	1008	5				A great earthquake in Bavaria	lack of reliable sources		[510]
13	1011					Great earthquake on the rim of the Giant Mountains, which in some places, including Landeshut, caused minor damage to buildings	no historical source		[510]
14	1014	11	18			An earthquake in Silesia and Poland	confusion of dates		[510]
15	1016					An earthquake in Poland, Kraków is given	confusion of information		[510]

En KMM	Year	Mo	Da	Ho	Mi	Kárník's text	Recognized cause/event	I_0	Ref.
17	1032	8	13			An earthquake in Saxony	Istanbul / TR	VI-VII	[506], [530]
18	1034	2	17			An earthquake in Poland, Hungary and Bohemia	probably reminiscence of the Middle East earthquakes 1033-1034, [539]		[510]
19	1036	11				Allegedly destructive quake in Praha, lasting 3 days, felt all over Bohemia, very questionable	unreliable source		[401]
20	1040	12	25			An earthquake coming from Hungary to Poland and Bohemia	probably reminiscence of the Smyrna earthquake 1040/02/02, [546]		[510]
21	1044					An earthquake in Poland, Hungary and Bohemia	no historical source		
24	1068					Great earthquake across Germany and Moravia on the last day of February	no historical source		[510]
25	1071					Earthquake damage to many towns in Bohemia, very questionable	unreliable source		[401]
26	1088	5	11			Allegedly destructive earthquake in Saxony	Mainz / DE	IV-V	[510]
27	1092	6	26			Strong earthquake in Jeseníky Mts. and in Silesia	Hungary/Slovakia	VIII	[506], [510]
29	1170	4	1			A particularly strong earthquake in Hungary (Western Carpathians), which was also felt in Poland, Bohemia, Styria, Switzerland in Kiev	Frusinate-Ceccano Sicily[2)] / IT	VIII	[527-1]
36	1203					A great earthquake that moved with houses and mountains, especially with the "Slánská hora" (Central Bohemia). Very questionable	probably reminiscence of the Lungau earthquake 1201 05 04, [506]		[401]
37	1212					An earthquake swarm lasting 6 months in Bavaria	no historical source		[510]
38	1230					Earthquake in Bohemia	Vrancea[3)] / RO	VIII-IX	[506]
39	1256	12	30			Earthquake in Bohemia	misapprehension of the source		[510]
40	1258	2	7			Powerful earthquake in Poland, shaken Bohemia,	false date, should be 1259/ 01/31		[510]
45	1298	11	30			A strong earthquake in Bohemia	Rieti[4)] / IT	IX-X	[527-1]
46	1303	8	8			An earthquake in Poland with an epicenter probably in the Kraków area	Crete / GR	XI?	[546]
N.L.	1318	8	5			Great earthquake in Brno ([091])	misprint in [091], should be 1328/08/04		
47	1322	2	12			Earthquake in the Meissen county and in Thuringia	misprint in [022], should be 1332/02/12		
48	1322	6	6			An earthquake in almost all of Germany	lack of reliable sources		
51	1329	1	15			A great earthquake in Jihlava (Moravia)	record error of [083], should be 1348/01/25		
54	1346					Spreading a devastating earthquake in many places in Thuringia	confused records, should be 1348/01/25		
56	1348	6	23			A strong thunderstorm was accompanied by a short earthquake that destroyed many houses and mines in Kutná Hora (Central Bohemia)	A storm and heavy rain, collapse of some water-logged houses		
57	1356					An earthquake felt in Moravia (Moravian Jeseníky Mts.) and in Silesia	Basel[4)] / CH	IX	[506]

En KMM	Year	Mo	Da	Ho	Mi	Kárník's text	Recognized cause/event	I_0	Ref.
58	1358					Powerful earthquake in Moravia (felt in the Moravian Jeseníky Mts. and near Brno), in Silesia and Poland	confusion for the years 1258 or 1348		
59	1366	6	3			A cruel thunder and lightning arose in the cities of Prague … many buildings fell from the earthquake and the cruel wind	shaking due to windstorm shocks		
60	1372	6	1			Destructive earthquake in Sundgau, damage in Basel, it was felt in southern and western Germany, Lorraine, Upper Bavaria and Wroclaw, perhaps also in the Moravian Jeseníky Mts.	Plaine de Haute - Alsace / FR	VII	[453]
62	1380					"A strong earthquake in many places in Bohemia in winter"	Elbasan / AL	VII	[533]
65	1433					A powerful earthquake in Silesia, felt in Wrocław and up to Vienna (Lower Austria)	probably confusion with an earthquake of 1443/06/05		
66	1434	5	29			An earthquake in Bohemia	no historical source		
67	1440					A great earthquake in Moravia	traditional confusion with earthquake of 1443/06/05		
72	1456	12	5			1456, June 1, earthquake in Bohemia	Molise / IT	XI	[527-2]
74	1469					An earthquake in Bohemia	lack of reliable sources		
75	1483					An earthquake in Brieg (Silesia)	a single listing with a long interval from the event		
76	1495	4				An earthquake in Olomouc (Storm?) (Moravia)	cruel storm, lightning		[401]
77	1496	7	23			An earthquake at Neisse in Silesia	lack of reliable sources		
78	1505					An earthquake in Erzgebirge	confusion with an earthquake in Bologna	VII	[527-2]
81	1513	8	17			An earthquake near Meissen	confusion with the "Torgau" earthquake in 1553		
83	1517	1	13			A terrible earthquake in Bohemia	lack of reliable sources		
86	1522					An earthquake swarm in Vogtland	doubtful - lack of reliable sources		
87	1528					Earthquakes in Poland, Hungary and Moravia, allegedly felt in Olomouc	apparently confused with another earthquake		
94	1552	3	6			Fichtel Mts., Ore Mountains and Lusatian Mts., epicenter in Freiberg, Jáchymov	wrong date		
N.L.	1552	5	10			Zwickau ([836])	wrong date		
97	1556	1	24			An earthquake in Fichtel Mts., Bohemia and Bavarian Forest	confusion with a distant earthquake (Illiria)	X	[591]
103	1562	2	10			An earthquake in the Kladsko region	thunderstorm		
104	1568	7	26			An earthquake in the Meissen region and Thuringia	windstorm		
107	1572	1	22			An earthquake in Fichtel Mts., Selb, Hof, Bayreuth	lack of reliable sources		
109	1580					An earthquake in Kutná Hora (Bohemia)	wrong date, should be 1588		
111	1582					An earthquake terrified people in Bohemia, Moravia and Austria	wrong date; confusion with distant earthquake in Schwadorf	VI	[505]
N.L.	1587	2	12			An earthquake in N-Sachsen ([508])	lack of reliable sources		
N.L.	1587	5	4			An earthquake in Zwickau ([508])	confusion in dates		

En KMM	Year	Mo	Da	Ho	Mi	Kárník's text	Recognized cause/event	I_0	Ref.
N.L.	1587	6	14			An earthquake in Zwickau ([508])	confusion in dates		
126	1590	12	24			Fall of the wall in Kutná Hora	structure failure		
132	1592	10	15			A tremor in Kutná Hora	apparent confusion with earthquake of 1590/09/15	VII-IX	[505]
138	1594	9	15			An earthquake in Goldenberg in Silesia	gale		
N.L.	1598					A strong earthquake in southwestern Moravia ([web Chlum municipality])	a single listing with a long interval from the event		
145	1607	11	27			An earthquake in Central Slovakia - Trenčín	apparent meteorite		
N.L.	1610	12	28			Chemitz ([532])			
146	1612	12	18			A strong thunderstorm in Bohemia allegedly accompanied by an earthquake	windstorm		
152	1619	1				A Bohemian-Moravian earthquake also shook Meissen and the surrounding area	a single listing with a long interval from the event		
163	1643	2	3			Ein grosses Gewitter bei welchem in Domažlice (Böhmerwald) „die meisten wollten ein Erdbeben verspürt haben"	windstorm		
173	1662					An earthquake was perceived in Brno (Moravia)	confusion in sources		
187	1690	11	26			A widespread earthquake in Bavaria	mishmash in calendars, probably 1690/12/04 event		
N.L.	1694	6	2			An earthquake-like phenomenon between Eibenstock and Johanngeorgenstadt ([509])	Not finished		
190	1698	2	23			An earthquake with a loud roar in Saxony (Freiberg) and in the Ore Mountains (Georgenthal) on the Bohemian border	unusual storm with lightning and thunder; location error should be Lusatian Mts. (Jiřetín pod Jedlovou)		
194	1701	4	13			1701, April 13.-27.	mistaken date, should be March		
198	1711	10	8			A local earthquake near Gera	wrong date, should be 25.10.1711		[532]
204	1720	7	17			July 17, 1720	wrong date, should be July 1.		
213	1734	12	9			An earthquake in Regensburg	a meteorite		[076-2]
214	1740	6	9			An earthquake in Brno (Moravia)	mistaken date from the source, should be 1749		
215	1745					A tremor in Chlumek	landslide		
217	1749	4	11			Earthquake in Vienna, felt in Moravia…	Wrong date, should be 9.6.1749		
221	1749	9	20			A strong earthquake in Hradčovice	unusual spontaneous ringing of the bell in the church for several nights		
222	1751	6	31			An earthquake in Giant Mountains (Krkonoše)	mistaken date or typing error, should be 31.7.1751		
223	1752					A tremor in the Bohemian Forest	strong storm		
248	1770	1	5., 6.			Strong earthquakes in NW Bohemia	landslides		
284	1784	3	20			An earthquake in West Bohemia, Duchcov	a great flood, any report of damage was not found		
290	1785	3	6			An earthquake in Western Bohemia	wrong year, should be 1786		

En KMM	Year	Mo	Da	Ho	Mi	Kárník's text	Recognized cause/event	I_0	Ref.
291	1785	3	31			An earthquake in Chomutov, W. Bohemia.	a landslide after floods		
296	1786	3				An earthquake in the Plzeň region	strong wind		
298	1786	3	10			A tremor in the Franconian Forest	strong wind		
300	1786	5	5			Strong Carpathian earthquake	confusion in sources		
302	1786	8	22			An earthquake in Moravia und Upper Silesia	wrong date, should be 1785		
303	1786	10	3			An earthquake in Těšín Silesia	Wrong date, should be 3.12.1786		
	1787	2	6			Mariánské Lázně [509]	wrong year, should be 1788		
306	1788	2	6			Two shocks in Planá	overestimated intensity		
309	1789	4	5	4		Quakes with accoustic effects in Pilníkov, NE Bohemia	a landslide		[851]
313	1789	12	11			A strong tremor in Giant Mountains (Krkonoše)	wrong year, should be 1799		
320	1796	2	6	12	15	An earthquake in Nové Hrady, S Bohemia	wrong date, should be 6.2.1784		
321	1796	2	19			Great earthquake in Bohemia	Wrong date, should be 19.2.1615		
326	1799	9 or 10				A shock in Hirschberg, also in [509]	Wrong date, should be 11.12.1799		
328	1801	12				Part of the fortress in Cheb fell	no connection with earthquake found		
332	1804	6	4			A temor in Budyšín	Mistaken date from source, there is 14.6., doubtful		
340	1809	9	2			Karlovy Vary hot spring eruption	Probably no earthquake		
342	1810	1	6			Earthquake in Bohemia	Mistaken date, felt Hung.earthquake 14.1.		
344	1811	8	2			Tremor in Kamenz, also in [509]	Wrong year, should be 1812		
	1817	11	4			Southern Bohemia [789]	Wrong date, should be 28.5.1818		
353	1820	4	16			Earthquakes near Žatec, West Bohemia	landslides		
360	1833	8				Kozolupy region	Mistaken date, should be August		
363	1823	9	9			Earth movement with thunder, Hlubčice (Silesia)	meteorite		
370	1827	1	14			Subsidence in Bílovec	landslide		
377	1833	12	18			Earth tremors with a roar in Bohemia	hurricane		
378	1834	2	2			An earthquake in Silesia	misplaced, Postojna / SI	V	[506]
384	1837	2	24			Jihlava	Wrong date, confusion in sources, probably felt Austria, 14.3.		
386	1837	3	15. - 29.			Various earthquakes	Felt Austria, 14.3.1837, confusion in sources		
407	1847	8	22			Earthquake in Bohemia	Instrumental observation of Walles earthquake in Prague		
419	1855	3	8			Earthquake in Planá (also in [509])	Wrong date, should be 8.4.1855, fake too		
420	1855	4	8			An earthquake in Planá (Bohemian Forest)	misplaced, Pfelders-Plan / IT		
427	1857	1	9			In Vienna	Mistaken year, should be 1858		
428	1857	1	15			Northwest Hungary	Mistaken year, should be 1858		
429	1857	1	28			An earthquake in Passau (Bayern)	wrong date, should be 1858		[025]

En KMM	Year	Mo	Da	Ho	Mi	Kárník's text	Recognized cause/event	I_0	Ref.
440	1858	11	28			An earthquake in Zwickau (DE)			[532]
N.L.	1865	5	16			Austria [522]	Strong storm		
475	1866	3	4			Kadaň and Chomutov	Mistaken date, should be 4.2.1866		
478	1867					Slaný	Dubious source		
507	1875	7	17			A violent earthquake in Nové Hrady (S. Bohemia)	typing error in the source [620], should be 1876		
511	1876	7	12			Český Těšín	Wrong date? Confusion in sources		
514	1877	1	5			An earthquake in Bohemian Forest.	wrong date, should be 1897		
522	1877	11	25	4		An earthquake in Glatz (Silesia)	wrong date, should be 26.11.1878		
531	1880	12	7			An earthquake in Waldenburg_Meerane.			[532]
543	1882	3	31			Strong shock in Trutnov	Wrong date, should be 1883		
544	1882	2	19			A shock in Trutnov	Wrong date, should be 1883		
545	1882	7	25			An earthquake in Chvalšiny (S Bohemia)	mistake in [147,148]		
568	1886	1	18			An earthquake in Brumovice (S. Moravia)	misplaced, should be Brunovce, Slovakia		
614	1897	4				An earthquake in Brno, Křižanov, Žďár	probably typing error, should be 1748		
618	1897	11	2			Weak earthquake in Český Krumlov (S. Bohemia)	not found in any source, probably should be 26.11.1897		
621	1897	11	26. 27.			Weak earthquake in Český Krumlov (S. Bohemia)	felt by one person only		
626	1899	7	17	22		A shock in Babí (N. Bohemia)	felt by one person only		[532]
705	1908	3	31			Svitavy 3.5°	Very doubtful		
707	1908	5	13			Čistá near Vrchlabí 4°	storm		
778	1912	8	19			Rožmitál pod Třemšínem 3°	Storm: mistaken date from source, should be 9.8.1912		
784	1913	2	10			Several places in Bohemia	Very doubtful		
824	1926	1	26			Znojmo 3°	Aurora borealis, misunderstanding the source		
827	1926	9	28			Vyšší Brod, Č. Krumlov	Felt Ternitz/AT		
830	1927	10				Želiv and its surroundings (S. Bohemia)	Misplaced – Želivsko (Moravia), felt Schwadorf / AT	VIII	[505]
856	1931	11	24	11	12	A violent tremor in South Bohemia, accompanied by a loud roar (blow, roll), Římov	fireball fragmented into several pieces		
882	1946	2	15			Brno 3.5°	One observer only		
890	1949	2	5			Dalešice 4°	One observer, very doubtful		
KPB	1973	9	20			Plzeň	Quarry blast		
KPB	1976	2	10			Rotava	Quarry blast		
KPB	1977	9	16	23	50	Blovice	Felt Italy		
KPB	1978	9	21	9		Plzeň	Quarry blast		
N.L.	1978	9	22	8	55	Teplice [509]	Quarry blast		

Notes: 1) 1065/03/27; 2) 1170/05/09; 3) 1230/05/10; 4) two events close together, 1298/11/30 and 1298/12/01, the latter was stronger; 4) 1356/10/18. N.L. – Not listed in Kárník's catalogues

5 DISTANT EARTHQUAKES FELT IN THE CZECH REPUBLIC

First table lists the more powerful earthquakes whose epicenters lies outside the CZ-NEC polygon, but these earthquakes have been felt in the Czech Republic in the period 350 - 1980. That is, there are IDPs located in the Czech Republic for these earthquakes and these IDPs are mentioned in the Kárník's catalogues ([401], [501]). Two earthquakes from the Byzantium period were added to this list, which were most likely to be felt in the territory of the Czech Republic, although there is no record of this. The list also includes 5 stronger earthquakes from Austria and one from Germany, although their epicenter lies in the CZ-NEC polygon (see bold EnKMM number). These earthquakes have not been revised by the authors of the CZ-NEC catalogue. The parameters of earthquakes given in the table were taken mainly from the SHEEC catalogue if they were mentioned there. Reference numbers of other sources are entered in the "Reference" column, as well as number of the SHEEC catalogue [506]. The position of these earthquakes is shown in the map in Fig. 2.

Second table lists earthquakes whose epicenters lies outside the CZ-NEC polygon, but these earthquakes have been felt in the Czech Republic in the period 1981 - 2018. That is, there are IDPs located in the Czech Republic for these earthquakes and these earthquakes have not been revised by the authors of the CZ-NEC catalogue withal. The source catalogue (bulletin) is marked in the Reference column. The TMw column shows the number of the formula that was used to convert e.g. ML to Mw magnitude, if the source specified another magnitude than Mw. The position of these earthquakes is shown in the map in Fig. 3.

Table of Distant strong earthquakes felt in the Czech Republic

EnKMM	Year	Mo	Da	Ho	Mi	Sc	Lat,	Long,	Ax	I_0	Mw	Reference
000A	350						48,13	16,76	Carnuntum / AT	IX	6,3	[574]
000B	455	09	07				47,24	16,62	Savaria / HU	IX	6,3	[575]
028	1117	01	03	15	15		45,309	11,023	Veronese / IT	IX	6,67	[506]
035	1201	05	04				47,224	14,377	Lungau / AT	VIII-IX	5,83	[506]
055	1348	01	25	15	30		46,579	13,540	Carinzia / AT	IX-X	6,99	[506]
070	1443	06	05				48,739	18,972	Central Slovakia / SK	VIII	5,70	[506]
080	1511	03	26	14	40		46,198	13,431	Slovenia / SI	IX-X	6,89	[506]
117	1590	06	29				48,14	15,99	Hochstrass / AT	VI	4,50	[505]
118	1590	09	15	17			48,26	16,07	Ried am Riederberg / AT	VIII	5,20	[505]
118	1590	09	15	23	50		48,26	16,07	Ried am Riederberg / AT	IX	5,75	[505]
150	1615	02	20	02	30		47,5	16,3	West Hungary / HU	VI	4,46	[506]
188	1690	12	04	14			46,633	13,880	Carinzia / AT	VIII-IX	6,56	[506]
231	1756	02	18	08			50,76	6,31	Düren / DE	VIII	5,70	[506]
239	1763	06	28	04	30		47,825	18,269	Komárno / SK	VIII-IX	5,70	[506]
244	1768	02	27	02	45		47,818	16,201	Brunn/Steinfeld / AT	VII-VIII	5,41	[506]
316	1794	02	06	13	18		47,370	15,100	Leoben / AT	VII	5,14	[506]
343	1810	01	14	17	09		47,318	18,186	Mór / HU	VIII	5,48	[506]
385	1837	03	14	16	40		47,667	15,879	Mürzzuschlad / AT	VI-VII	4,98	[506]
432	1858	01	15	19	15		49,220	18,760	Žilina / SK	VII-VIII	5,44	[506]
488	1869	10	02	23	45		50,43	7,55	Engers / Rhein / DE	VII	5,11	[506]
494	1872	03	06	15	55		50,869	12,222	Central Germany / DE	VII	5,30	[506]
496	1873	01	03	19			48,160	15,945	Himmelhof / AT	VI-VII	4,74	[506]
506	1875	06	12	23	40		48,253	15,99	Grabensee	V-VI	4,5	[506]
512	1876	07	17	13	17		48,059	15,178	Scheibbs / AT	VII-VIII	5,42	[506]
529	1880	11	09	06	33		45,910	16,110	Zagreb / HR	IX	5,99	[506]
563	1885	05	01	00	15		47,510	15,450	Kindberg / AT	VIII	5,57	[506]
607	1895	04	14	20	17		46,125	14,515	Ljubljana / SI	VIII-IX	5,93	[506]
684	1906	01	09	23	07		48,58	17,46	Dobrá Voda / SK	VIII-IX	5,7	[506]
695	1907	03	22	19	10		47,58	14,46	Admont / AT	VI	4,1	[506]
701	1908	02	19	21	11		47,94	16,74	Breitenbrunn / AT	VI-VII	4,5	[506]
754	1910	05	11	20	18		47,74	15,99	Sieding / AT	VI-VII	4,5	[506]
756	1910	07	13	08	32		47,32	10,84	Nassereith-Silz / AT	VII	4,9	[506]
764	1911	11	16	21	25	48	48,22	9,00	Ebingen / DE	VIII	5,7	[506]
797	1914	10	01	20	31		48,87	11,42	Eichstätt / DE	V	4,3	[506]
808	1915	06	02	02	33		48,87	11,42	Eichstätt / DE	VI-VI	4,7	[506]
814	1915	10	10	03	50		48,82	11,57	Kasing / DE	VII	4,5	[506]
815	1915	10	10	04	10		48,87	11,35	Hofstetten / DE	V	4,2	[506]
828	1926	09	28	15	41		47,72	16,04	Ternitz — Dunkelstein / AT	VI-VII	4,5	[506]

EnKMM	Year	Mo	Da	Ho	Mi	Sc	Lat,	Long,	Ax	I₀	Mw	Reference
829	1927	07	25	20	35		47,53	15,49	Mürztal / AT	VII	5,0	[506]
831	1927	10	08	19	49		48,07	16,58	Schwadorf / AT	VIII	5,8	[506]
834	1928	03	27	08	32		46,37	12,98	Tolmezzo / IT	IX	5,8	[506]
850	1930	10	08	00	27		47,40	10,70	Namlos / AT	VII-VIII	5,5	[506]
867	1935	06	27	17	19	30	48,04	9,47	Saulgau / DE	VII-VIII	5,4	[506]
876	1938	11	08	03	12		47,96	16,40	Ebreichsdorf / AT	VII	5,0	[506]
877	1939	09	18	00	14		47,77	15,91	Puchberg / AT	VII	5,0	[506]
906	1959	02	10	22	44	12	48,31	16,88	Baumgarten a,d, March / AT	IV-V	3,1	[501]
913	1963	12	02	06	49		47,88	16,37	Ebenfurth / AT	VI-VII	4,5	[506]
916	1964	06	30	12	29	59	47,7	15,9	Semmering / AT	V-VI	4,3	[501]
919	1964	10	27	19	46		47,8	15,9	Semmering / AT	VI-VII	5,0	[501]
924	1967	01	29	00	12		47,90	14,30	Molln / AT	VI-VII	4,4	[506]
934	1972	01	05	04	58		47,82	16,24	Wiener Neustadt / AT	VI	4,1	[506]
935	1972	04	16	10	10		47,70	16,20	Seebenstein/Pitten / AT	VII-VIII	5,1	[506]
936	1972	04	16	11	05		47,71	16,18	Seebenstein/Pitten / AT	VII-VIII	4,4	[506]
947	1976	05	06	20	00	13	46,24	13,12	Friuli / IT	IX-X	6,5	[506]
953	1976	09	11	16	35	02	46,26	13,23	Friuli / IT	-	5,6	[506]
954	1976	09	15	03	15	20	46,28	13,20	Friuli / IT	-	5,9	[506]
955	1976	09	15	09	21	19	46,30	13,17	Friuli / IT	-	6,0	[506]
959	1977	03	04	19	21	54,1	45,77	26,76	Vrancea / RO	IX	7,4	[506]
962	1977	03	24	07	32	25	51,4	16,1	Lubin (mining) / PL	V-VII	4,0	[501]
972	1978	09	03	05	08	32	48,28	9,03	Swabian Jura / DE	VII-VIII	5,1	[506]
974	1979	04	15	06	19		42,02	19,07	Bar / ME	IX-X	6,7	[506]
976	1979	08	04	22	24	4	47,75	12,85	Bad Reichenhall	V	3,6	[509]
977	1979	04	18	15	19	19,3	46,343	13,290	Friuli / IT	-	4,7	[506], [527]

Table of Distant strong earthquakes felt in the Czech Republic (1981-2018)

Year	Mo	Da	Ho	Mi	Sc	Lat,	Long,	Ax	I₀	Mw	TMw	Reference
1991	5	2	10	15	18,0	47,88	16,37	Ebenfurth / AT	V-VI	4,06	*[9]*	[505]
1992	4	13	1	20	3	51,15	5,939	Roermond / NL	VII	5,50		[509]
1996	9	11	3	36	36	51,46	11,85	Teutschenthal (rockburst) / DE	VI-VII	4,58	*[9]*	[509]
2000	7	11	2	49	47,5	47,96	16,40	Ebreichsdorf / AT	VI	4,49	*[9]*	[505]
2000	7	11	10	56	3,5	47,96	16,50	Ebreichsdorf / AT	V	4,23	*[9]*	[505]
2001	7	17	15	6	15,3	46,70	11,07	Val Venosta / IT	V-VI	4,78		[527-1]
2002	2	14	3	18	2,5	46,39	13,12	Carnia / IT	V-VI	4,67		[527-1]
2003	9	14	21	42	53,2	44,26	11,38	Appennino bolognese / IT	VI	5,24		[527-1]
2004	7	12	13	4	6,0	46,31	13,62	Lepena / SI	VI-VII	4,58	*[9]*	ARSO
2004	10	1	10	1	41,7	47,42	15,14	Leoben / AT	VI	3,90	*[9]*	ISC
2004	11	30	17	18	34,3	49,44	19,81	Podhale / PL	VII	4,23	*[9]*	ISC
2004	12	5	1	52	39	48,089	8,044	Waldkirch / DE	VI	4,8		[509]
2009	4	20	6	33	42,0	47,46	14,47	Trieben / AT	V	3,90	*[9]*	ZAMG
2009	5	7	21	27	12,8	47,58	15,69	Mürzzuschlag / AT	VI	4,06	*[9]*	ZAMG
2012	5	29	7	0	2,9	44,84	11,07	Pianura emiliana / IT	VII-VIII	5,9		[527-1]
2013	9	20	2	6	33,8	47,93	16,41	Wimpassing a,d, Leitha / AT	V-VI	3,98	*[9]*	ZAMG
2013	10	2	17	17	36,5	47,93	16,40	Wimpassing a,d, Leitha / AT	V-VI	3,98	*[9]*	ZAMG
2016	4	25	10	28	23,0	48,08	16,07	Alland / AT	V	3,98	*[9]*	ZAMG
2016	10	26	19	18	5,0	42,92	13,13	Visso / IT	-	5,9		INGV

ARSO - https://www.arso.gov.si/potresi/poro%C4%8Dila%20in%20publikacije/potresi%20v%20letu%202004.pdf
ISC - http://www.isc.ac.uk/iscbulletin/search/bulletin/
ZAMG (2009) – http://www.zamg.ac.at/geophysik/Reports/Jahrbuch/JAHRBUCH_2009-deutsch.pdf
ZAMG (2013) - http://www.zamg.ac.at/geophysik/Reports/Jahrbuch/JAHRBUCH_2013-deutsch.pdf
ZAMG (2016) - http://www.zamg.ac.at/geophysik/Reports/Jahrbuch/JAHRBUCH_2016-deutsch.pdf
INGV - http://terremoti.ingv.it/en/event/8669321

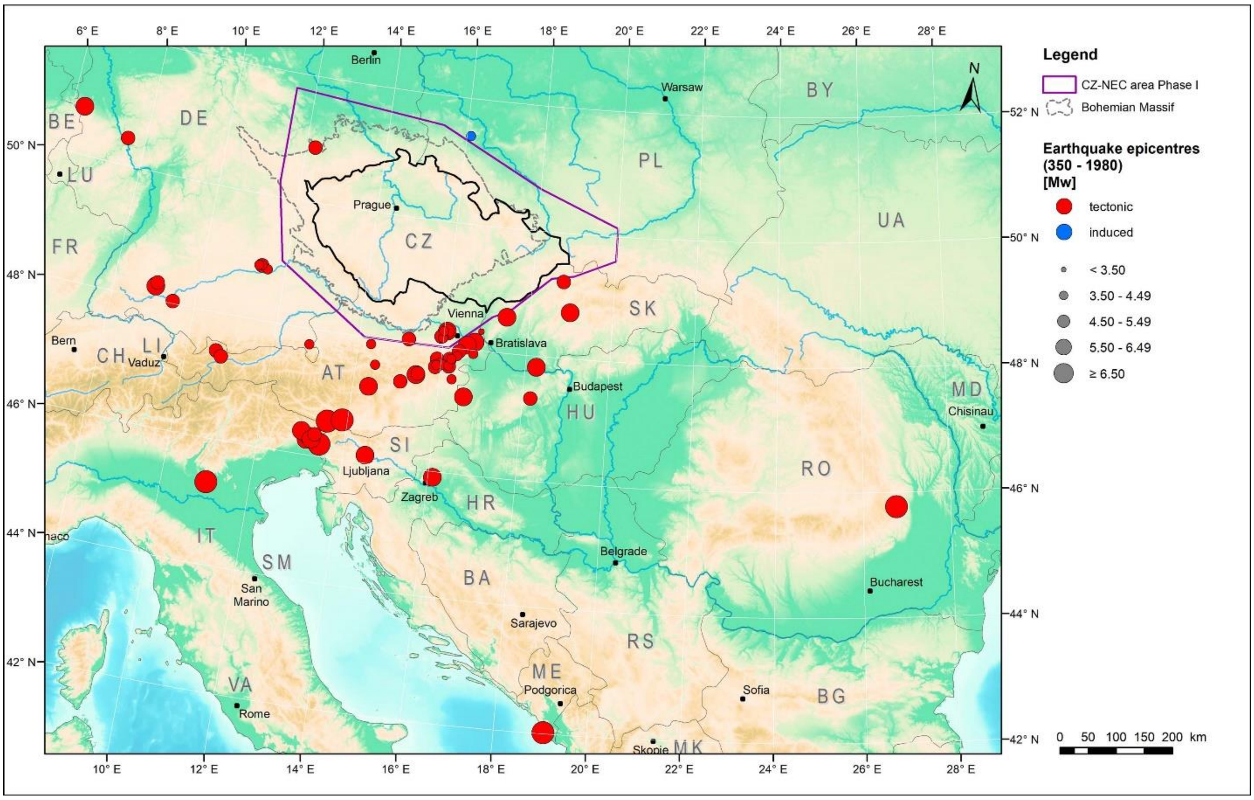

Fig. 2: Distant earthquakes felt in the Czech Republic in the period 350 – 1980 according to Kárník's catalogues.

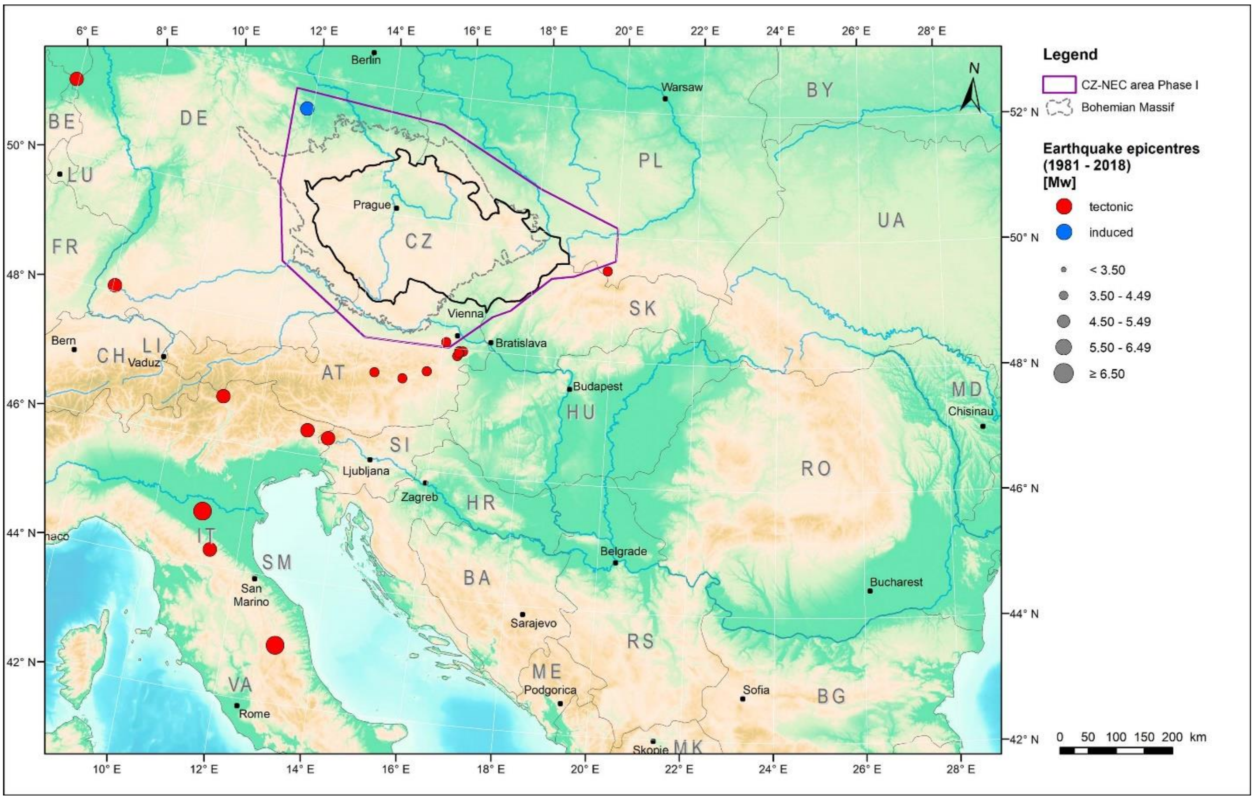

Fig. 3: Distant earthquakes felt in the Czech Republic in the period 1981-2018.

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Revision of the Czech National Earthquake Catalogue

Part 4
CATALOGUE OF THE INSTRUMENTALLY RECORDED EARTHQUAKES

WP 2 – Action 2.5

Citation:

PRACHAŘ, I., PAZDÍRKOVÁ, J., PRACHAŘOVÁ, H., PAZDÍREK, O., KRUNČÍK, L., LACHOVÁ, B., 2020. *CZ-NEC - The Revision of the Czech National Earthquake Catalogue. Version CZ-NEC_2020. Part 4. Catalogue of the instrumentally recorded earthquakes. Report No. SIGMA2-2020-D2-046/2 compiled in the framework of the SIGMA2 Project "Research and Development Program on Seismic Ground Motion". IP Consult, Prague & Institute of Physics of the Earth, Masaryk University, Brno.*

Contents

1 INTRODUCTION

The instrumental part of the CZ-NEC has been compiled for the period 1950 - 2018. The location quality and completeness of sources from the period before 2000 is low due to small number of seismic stations. It was therefore decided to divide the catalogue into two parts, 1950 - 1999 and 2000 - 2018. The older part 1950 - 1999 serves only as the supplement of the macroseismic catalogue**,** the recent one for detailed seismotectonic studies.

The final version of the CZ-NEC instrumental catalogue contains events with an epicenter inside the CZ-NEC polygon. As a lower threshold of magnitude, a value of 0.5 was set in order to complete catalogue. Weaker events being omitted. The 2000-2018 catalogue supposedly contains all events with magnitude 1.5 and larger for the area enclosed by the polygon. Earthquakes with magnitude range 0.5 - 1.5 may not have been detected in some areas, especially in the first few years of that period. In the previous period 1950-1999, even some felt earthquakes were not recorded instrumentally and the catalogue is not complete even for higher magnitudes.

2 CZ NEC INSTRUMENTAL CATALOGUE FORMAT

The instrumental catalogue is presented in the form MS Excel ® file:

CZ-NEC_instrumental_catalogue_1953-2018.xlsx

It contains two lists of earthquakes (**tectonic 2000-2018** and **tectonic 1950-1999**), two lists of induced events (**induced 2000-2018** and **induced 1950-1999**) and sheet with **explanations**.

2.1 EXPLANATION TABLE

Each event is described using the following parameters (columns):

Parameter	Explanation	Type of value
Info	Empty – the event is in only one source catalogue P – preferred location from more sources	Text
Year	Origin date	Integer
Month		Integer
Day		Integer
Hour	Origin time [UTC]	Integer
Min.		Integer
Sec.		Integer or Dec. Number
Lat [° N]	Coordinates of the epicentre	Dec. Number
Lon [° E]		Dec. Number
Depth [km]	Depth, f = fixed depth	Integer ± Text
ML	Local magnitude	Dec. Number
I_0	Epicentral intensity EMS-98 for felt earthquakes	Integer or Text
Country	Two-letter country code (ISO 3166-1 standard)	Text
Institution	Author of the source catalogue	Text
Catalogue	Source catalogue	Text

One line of the catalogue represents one earthquake. Data in individual columns are taken from the source catalogues. Individual abbreviations of catalogue authors are explained in the table below.

Parameter errors were not reported by most source catalogues; therefore, they were not included in the resulting catalogue. According to the results of IPE locations, it has been estimated ranging from hundreds of meters inside local networks to several kilometers in places with fewer stations, depth errors being slightly higher. An even greater location error should be considered for older earthquakes and earthquakes with a focus in places with a sparse distribution of stations

2.2 TABLE OF SOURCE CATALOGUES AND BULLETINS

Institute	Catalogue / Bulletin	Source
BAY	**BAY**	**Erdbebendienst Bayern, Universität München** https://www.erdbeben-in-bayern.de/erdbebendienst/erdbebenkatalog/lokalbeben-copy
BGR	**BGR**	Die Bundesanstalt für Geowissenschaften und Rohstoffe, Hannover https://www.bgr.bund.de/DE/Themen/Erdbeben-Gefaehrdungsanalysen/Seismologie/Seismologie/Erdbebenauswertung/Erdbebenkatalоge/Kataloge_Bulletins/kataloge_bulletins_node.html
IG	 **IG** **WBNET**	**Institute of Geophysics, Czech Academy of Sciences, Praha** Catalogues of regional seismic events http://www.czechgeo.cz/gfu-catalog/ Local network West Bohemia https://www.ig.cas.cz/vyzkum-a-vyuka/observatore/lokalni-seismicka-sit-webnet/katalogy-webnet/
IPE		**Institute of Physics of the Earth, Masaryk University, Brno**
	BLA **EDU** **ETE** **IPEC** **KRASNET** **MONET**	Local network Blahutovice Local Dukovany NPP network Local Temelín NPP network Broadband IPE stations + relocations in the frame of SIGMA-2 project Local network West Bohemia Local network NE Czech Republic
ISC	**ISC**	**International Seismological Centre** http://isc-mirror.iris.washington.edu/iscbulletin/search/catalogue/
LEY2016	**LEY2016**	[509] Leydecker, G., 2011. Erdbebenkatalog für Deutschland mit Randgebieten für die Jahre 800 - 2008. V. 2016.
NEIC	**NEIC**	**National Earthquake Information Center, USGS** ftp://hazards.cr.usgs.gov/NEICPDE/isf2.0/
Pro	**Pro**	[554] Procházková, Dana, 1987. Zemětřesení v ČSSR v letech 1981 – 1984.
SAV	**SAV**	**Catalogue of Department of Seismology, Slovak Academy of Sciences, Bratislava**
SXNET	**SXNET**	**Sachsennetz, Universität Leipzig** http://linap6.geo.uni-leipzig.de/sxweb/
UniJena	**UniJena**	**Thüringer Seismologisches Netz, Universität Jena** http://www.geophysik.uni-jena.de/Einrichtungen+_+Labore/Th%C3%BCringer+Seismologisches+Netz/Erdbeben.html
ZAMG	 **BullZAMG** **H_L_2013** **ACORN**	**Zentralanstalt für Meteorologie und Geodynamik, Wien** http://www.isc.ac.uk/iscbulletin/collected/reports/ [505] Hammerl, Ch., Lenhardt, W.A., 2013. Erdbeben in Niederösterreich von 1000 bis 2009 n. Chr. https://www.zobodat.at/pdf/AbhGeolBA_67_0001-0297.pdf Catalogue of Alpine Carpathian On-line Research Network (joint project ZAMG + IPE)
Zie	**Zie**	[512] Ziegert, Albrecht, 2015. Erdbebenkatalog Thüringen von 841 bis 2015.

Graphic presentation of instrumentally recorded tectonic earthquakes from 1953-1999 and 2000-2018 is in the Fig. 1 and Fig. 2.

3 INDUCED EVENTS

Induced events in the Czech Republic and its surroundings are very frequent and mostly they are much stronger than natural earthquakes. The strongest events from mining areas in Ostrava (CZ, ML ≥ 2.5), Lubin (PL, ML ≥ 3.5), Upper Silesia (PL, ML ≥ 3.0), Belchatów (PL, ML ≥ 3.0), and ML ≥ 0.5 events from mine Kladno (CZ), gas storage Příbram (CZ) and Germany are shown in the „**induced 2000-2018**" list of the CZ-NEC_instrumental_catalogue_1953-2018.xlsx. The list **"induced 1950-1999"** contains mainly events from Kladno and Příbram areas, events from Ostrava coal mine region and from Polish mining areas are not included.

Graphic presentation of instrumentally recorded induced earthquakes from 1953-1999 and 2000-2018 is in the Fig. 3 and Fig. 4.

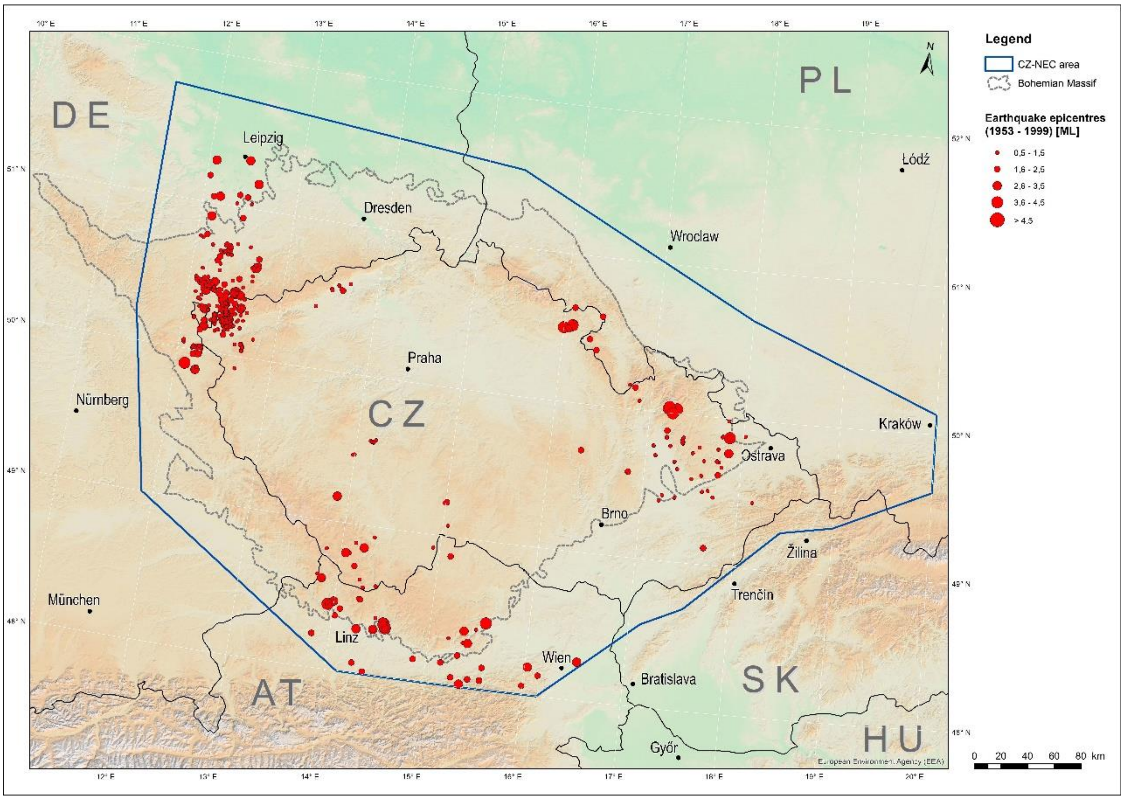

Fig. 1: Graphic presentation of the CZ NEC instrumental catalogue 1953-1999. Tectonic events.

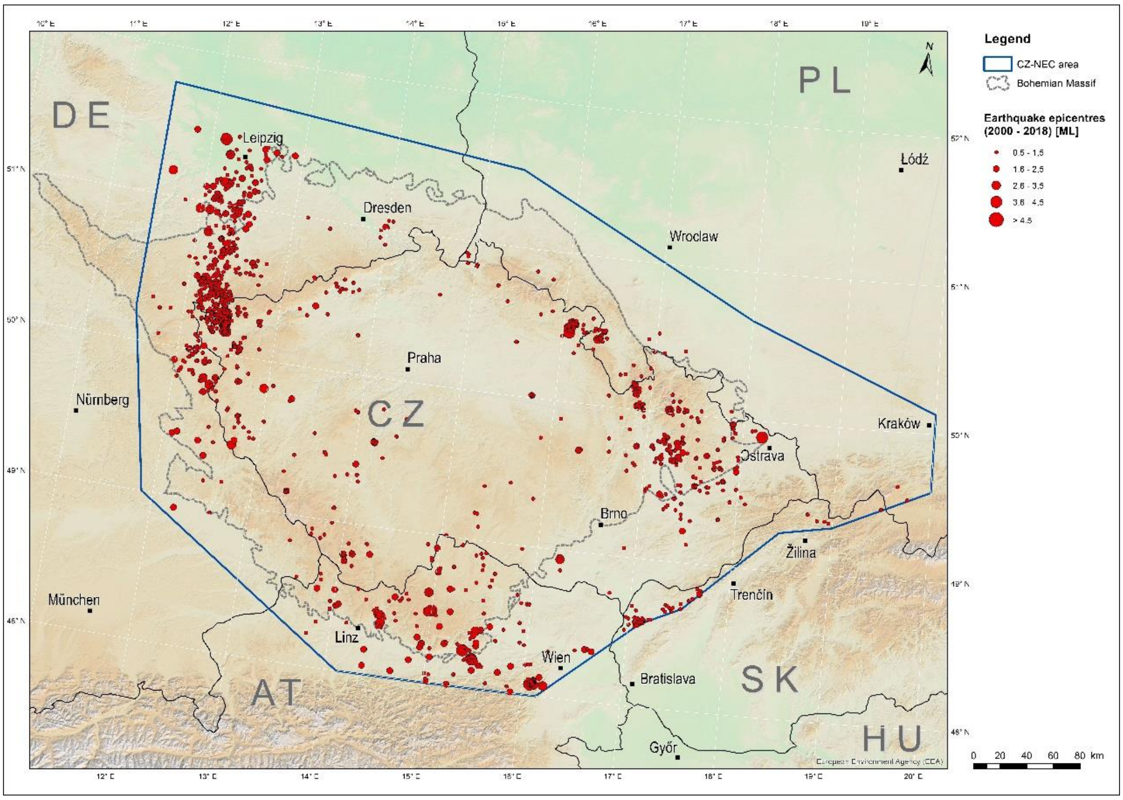

Fig. 2: Graphic presentation of the CZ NEC instrumental catalogue 2000-2018. Tectonic events.

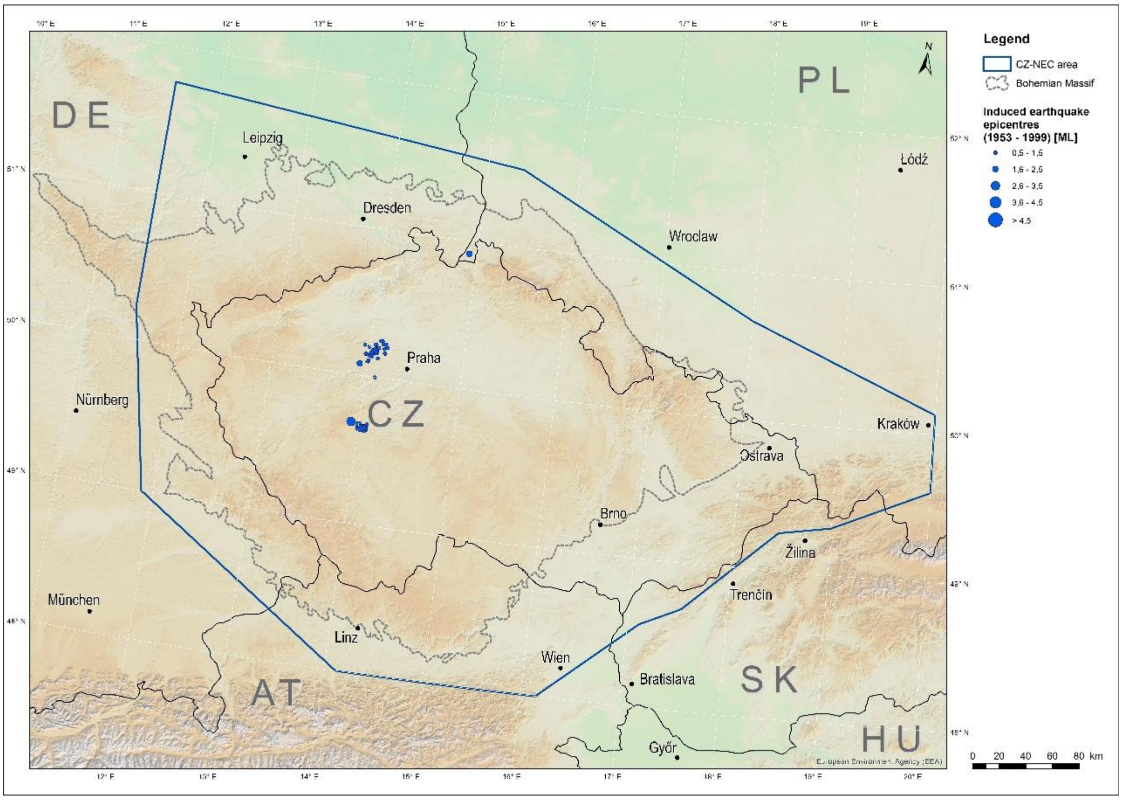

Fig. 3: Graphic presentation of the CZ NEC instrumental catalogue 1953-1999. Induced events.

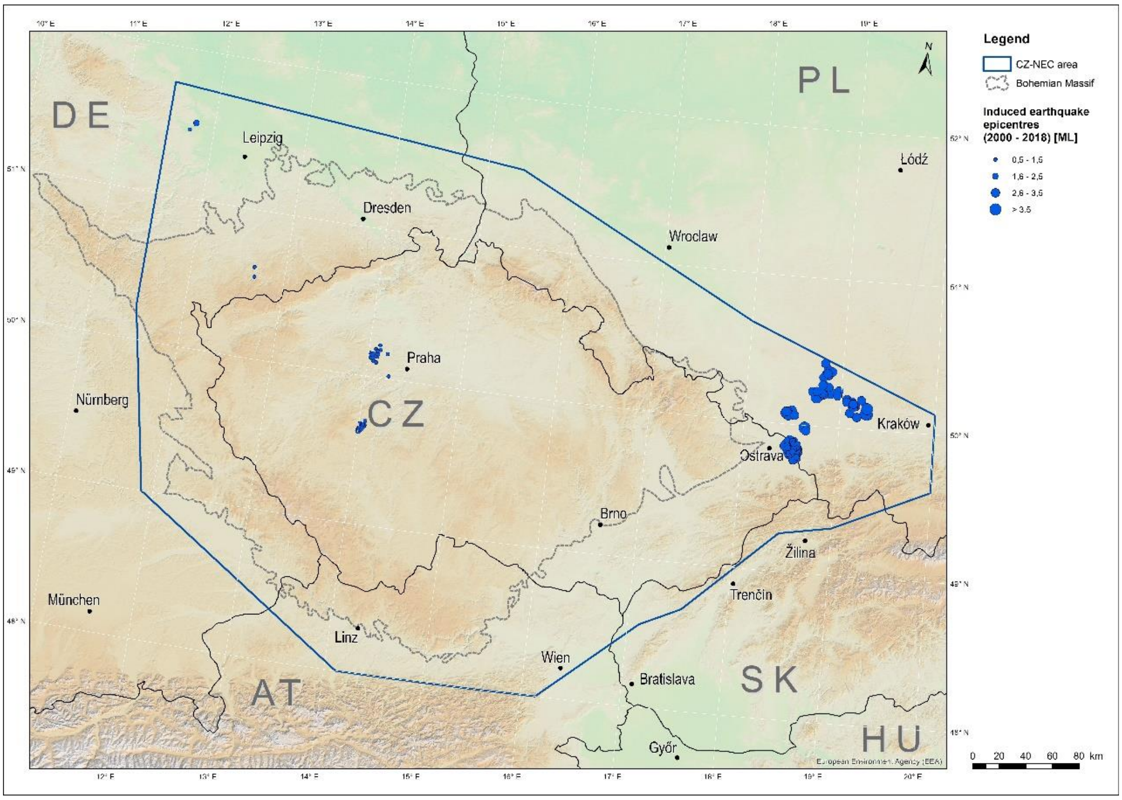

Fig. 4: Graphic presentation of the CZ NEC instrumental catalogue 2000-2018. Induced events.

4 FALSE AND POORLY DETERMINED EVENTS

Hundreds of badly determined events were not included in the final catalogue during compilation. These are mainly blasting in quarries that were considered to be earthquakes or insufficiently determined earthquakes (poor location, without magnitude). Their list is not part of this report. The reason why the event was not included in the catalogue can be ascertained by asking the author of the instrumental catalogue (jana@ipe.muni.cz).

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