

AH Episodes

An Episode is a set of time-correlated geophysical, technological and other relevant geodata that relates comprehensively anthropogenic seismicity to its industrial cause. In other words, an Episode is a set of data related to a common industrial process, and that are intended to be analysed together in order to better understand this process, its environment and consequences. Clearly, the episode data may also be used separately to compare different processes and create tools for their analysis and prediction.

By the end of 2023, **42 AH Episodes** are integrated in the EPISODES Platform

Navigating to AH Episodes

The data provided by the EPISODES Platform can be browsed in two ways: by episode to which they are connected or by searching by the data individual properties. By choosing the first mode, you will be able to learn more about the context in which the data were gathered and see compound visualisations, while the second, might be more suited if you are searching for a particular data file e.g. for your computations.

AH Episodes

To browse the data by episodes, go to the *AH Episodes* tab within the EPISODES Platform (see *Figure 1*) or use the direct link: <https://EpisodesPlatform.eu/#episodes>. You will be presented with a list of all the available episodes, which can additionally be filtered by their *Project association* or *Impacting factor* (filters marked with (1) in *Figure 1* and displayed in detail in *Figure 2*). Each episode on the list is represented with a logo, containing a pictogram of its impacting factor and approximate location, description and most important properties. Clicking on the episode logo or name will take you to the detailed description of the chosen episode (see the next section). The episodes can be also displayed on the map (with the same filtering rules) with the switch marked with (3) in *Figure 1*, where the episode name is available on hovering, and the episode details can be accessed by clicking on the chosen location (see *Figure 3*).

To switch to the individual data discovery (describe further in [this section](#)), use the *Go to Advanced data search* button (marked with (2) in *Figure 1*).

The screenshot displays the EPISODES Platform interface. At the top, there are tabs for 'AH EPISODES' and 'APPLICATIONS'. Below the tabs, there are filters for 'Project association' and 'Impacting factor', both marked with a red circle and the number 1. A 'Go to Advanced data search' button is marked with a red circle and the number 2. Below the filters, there is a 'Show:' section with a 'LIST' button (marked with a red circle and the number 3) and a 'MAP' button. The main content area shows a list of episodes, each with a logo, a title, a description, and a list of associated organizations. The episodes listed are:

- GRONINGEN FIELD: conventional hydrocarbon production**: The Groningen gas field is a giant natural gas field located near Slochteren in Groningen province in the northeastern part of the Netherlands. Discovered in 1959, it is the largest natural gas field in Europe and the tenth-largest in the world. Episode integrated in the framework of: SHEER project. Shale gas Exploration and Exploitation induced Risks project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 640896.
- GROSS SCHOENEBECK: geothermal energy production experiment**: A deep injection well and a doublet of production wells were established in this area reaching the reservoir rocks like red bed sandstone and andesitic volcanic rock at the 4200m depth. Injection performed from 9th to 14th August 2007 was used for repeated stimulation treatments to investigate scenarios of enhancing productivity of thermal fluid recovery from the underground. A total amount of 13.000 m³ of water was injected. The maximum injection well-head pressure reached 58.6 MPa. Episode integrated in the framework of: IS-EPOS project: Digital Research Space of Induced Seismicity for EPOS Purposes No. POIG.02.03.00-14-090/13
- LACQ GAS FIELD: conventional hydrocarbon extraction**: The episode is related to a seismic swarm that developed contemporary to and in the vicinity of a deep conventional gas extraction, Lacq gas Field, Aquitaine, France. Onset of Lacq gas field production is 1958, when the first local M2 event occurred in 1969. Since this time, hundreds of shallow, small to moderate earthquakes (Mmax=4) have occurred near the Lacq deep gas field. These earthquakes are clearly separated from tectonic seismicity occurring in the Pyrenees, 25 km to the southwest. The induced seismicity began when the reservoir pressure had declined by 30 MPa. Repeated leveling over the field shows localized subsidence reaching a maximum of 60 mm in 1989. Episode data are (i) regional seismicity catalogue on the 1962-2009 period, local catalogue 1975-1995 period, respectively; (ii) yearly production volume, 1958-2016; (iii) yearly reservoir pressure drop, 1958-2016; (iv) yearly injected volume, 1958-2016.
- LAI CHAU: water reservoir**: Seismic activity linked to Lai Chau hydropower plant and the reservoir containing backed up water of Da river (Black river) in northwestern Vietnam. Construction started on 5 January 2011, reservoir impoundment started in June 2015 with the first turbine put into operation in 2016. The area of the reservoir is considered as tectonically active with known earthquakes in the past. During the period from September 2014 to May 2015, network of seismological stations in broad Lai Chau region recorded nearly 40 earthquakes M 1.1 to 4.0. Three of them occurred directly in Lai Chau hydro reservoir area (October 19 and 21, 2014 M2.5 and November 26, 2014 M2.0). The reservoir filling started in June 2015. The water level varies between 205 and 280 m a.s.l. During the period from October 2014 to October 2015, network of seismological stations in wide Lai Chau area recorded nearly 60 earthquakes with M1.0 to 4.0. Several of them were located a radius of 6-20 km from Lai Chau dam.
- LGCD: regional seismicity and ground motion associating underground hard rock mining**: Seismicity induced by underground copper ore exploitation in mines located in the Legnica-Głogów Copper District (LGCD), southwestern Poland. Mines use a room and pillar exploitation system at the level from 0.6 to 1.3 km below surface. Episode LGCD contains only seismic events recorded inside the seismic network.

Figure 1. List of the available episodes with most important elements marked.

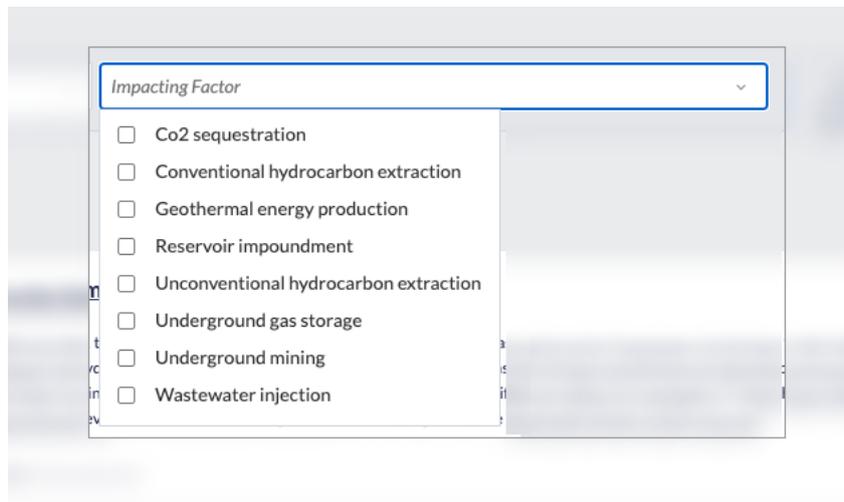


Figure 2. Details of one of the episodes filter - *Impacting Factor*.

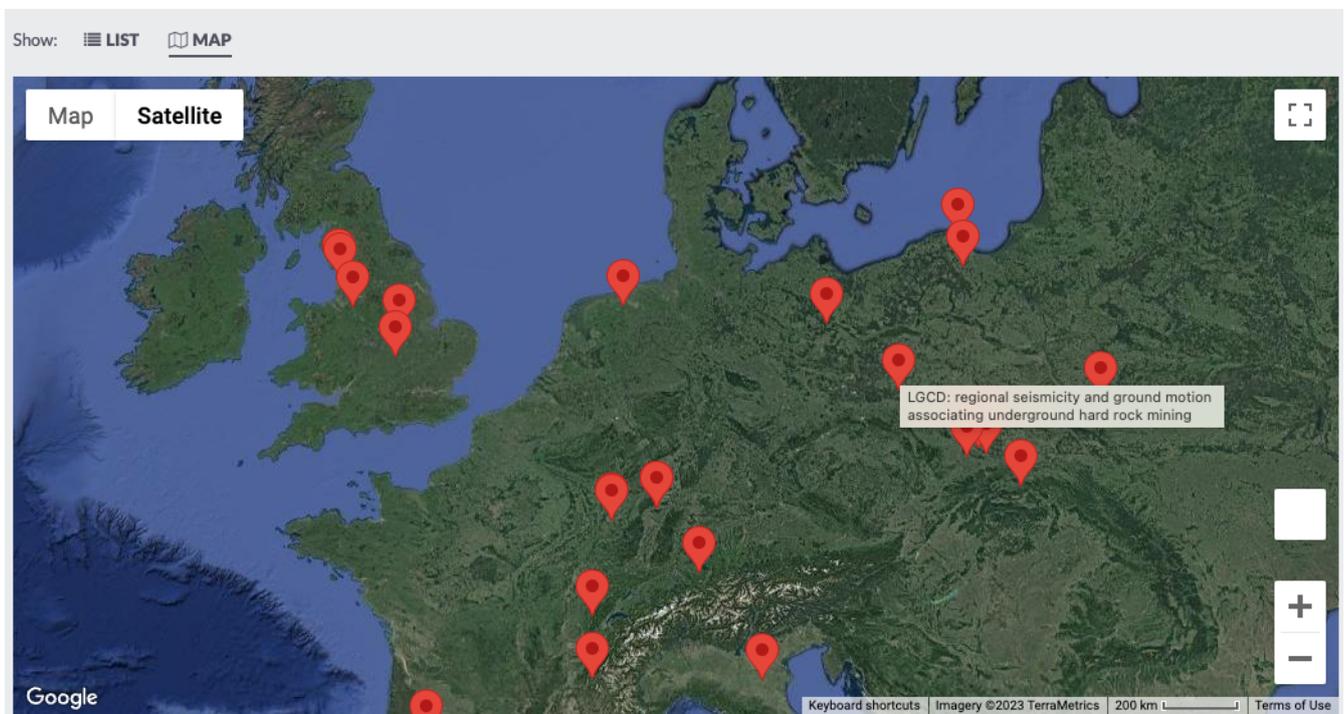


Figure 3. Episodes displayed on the map, with one of the locations hovered

Episode details

After choosing one of the episode, its full details are available (see *Figure 4*) they are:

- The episode code name and full name (marked with (1) in *Figure 4*);
- Full description of the location and context of the data collection (marked with (2) in *Figure 4*), containing also information on how the data from the episode should be cited, and licence (marked with (3) in *Figure 4*);
- Description of the data contained within the episode, divided into categories (marked with (2) in *Figure 4*) and types within a category - if the relevant type of data is available on the EPISODES Platform (which is the case for most of the data), the listing provides also a link, either directly to the data file, or to a pre-filled [data search](#) where all the files of the selected type from the selected episode are presented. The link might also lead to additional resources available outside of the EPISODES Platform;
- Additional actions (marked with (5) in *Figure 4*):
 - *All data related to this episode* will open [the data search](#) listing all the data contained in the chosen episode
 - *Available visualizations* will show a menu of visualizations showing combined data representative for the episode
 - *See more information in Document Repository* will take you to the [Document Repository](#) to the page containing materials related to the chosen episode
- Owner of the data (marked with (6) in *Figure 4*)
- Additional information and a picture representative to the chosen episode (marked with (7) in *Figure 4*).

Episode: LGCD 1

LGCD: regional seismicity and ground motion associating underground hard rock mining

Description 2

Seismicity induced by underground copper ore exploitation in mines located in the Legnica-Glogow Copper District (LGCD), southwestern Poland. Mines use a room and pillar exploitation system at the level from 0.6 to 1.3 km below surface. Episode LGCD contains only seismic events recorded inside the seismic network.

Episode integrated in the framework of:
 • IS-EPOS project, Digital Research Space of Induced Seismicity for EPOS Purposes No. POIG.02.03.00-14-090/13

If you use data from this episode in a publication, then you must cite the data source as follows:
 IS EPOS (2017), Episode: LGCD, <https://episodesplatform.eu/#episode:LGCD>, doi:10.25171/InstGeophys_PAS_ISEPOS-2017-006 3

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Status details

Impacting factor:	Underground mining
Region:	Poland, Legnica-Glogow Copper District
Project association:	IS-EPOS 7

Data 4

DATA RELEVANT FOR THE CONSIDERED HAZARDS

SEISMIC

- [Catalog](#) Catalog since 10/12/2013, some 75 events a month, magnitude range Mw: 0.9 to 4.0
- [Event Related Accelerograms](#) Ground motion waveforms available since August 2015
- [Event Related Waveforms](#) Event related waveforms available since 10/12/2013
- [Ground Motion Catalog](#) Two ground motion catalogues:
 1) Part 1 of Ground Motion Catalog - 16 005 events from 19/08/2015 to 30/12/2019
 2) Part 2 of Ground Motion Catalog - 2 047 events from 01/01/2020 to 30/04/2021
- [Ground Motion Network](#) Network for ground motion monitoring equipped with 10 free-field surface triaxial accelerometers GeoSIG AC-73
- Parts of continuous waveforms for specific dates and stations are available through 'Waveform download tool' in Applications
- [Seismic Network](#) Depending on period of observation, number of seismic stations varied from 6 to 17. The network is equipped with short period stations: Lennartz 3D Lite, 1 s; Geosig VE-53-BB, 5 s-160 Hz. The acquisition system allows to record the signals with dynamic range > 120 dB using sampling rate 100 Hz. Average distance between stations: 5.8 km

INDUSTRIAL

- [Mine Area](#) The area of mining fields in LGCD
- [Shoreline](#) Shoreline of the nearby ore flotation waste repository Zelazny Most

GEODATA

- [Velocity Model](#) Seismic velocity layered model to 10 km depth with Vp, Vs, density and attenuation factors for each layer
- [Geological map](#) Link to the geological map of the LGCD site

ALL DATA RELATED TO THIS EPISODE

AVAILABLE VISUALIZATIONS 5

[See more information in Document Repository](#)

Figure 4. View of a sample episode details with most important elements marked.

Some of the episodes may contain restricted or partly restricted data. In such case, the episode is marked with a label as marked with (1) in Figure 5 (a similar label is also displayed within the episodes list next to the episode name). In case of any restriction, its conditions are described within the episode data section (marked with (2) in Figure 5). If you meet the specified condition (in the presented example this is an academia affiliation, it might be also a project or team membership), apply for the respective affiliation in your user profile view (see this guide for more details) or log in, if you already have the required affiliations. The restricted data are not available as links - they are inactive (see marking (2) in Figure 5). Note, that in the provided example some data types are available as links (public) and some are inactive (restricted).

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Figure 5. View of a sample episode with partly restricted access.

Specific Episode visualizations

For most of the episodes, the most representative data sets are presented together as a visualization - in form of a map view (e.g. Seismic Network, mining area, reservoir shoreline) or graph charts (e.g. velocity model, mining front advance, injection rate). The most important and common visualizations will be described in the next subsections.

Integrated Episode Data Visualization

The map view - like data can be combined and demonstrated in a single map by selecting the 'Integrated Episode data visualization' from the 'Available Visualizations' menu (Field 5, Figure 3). Seismic events (red circles), network of seismic stations (green triangles) and various episode-related data can be shown/hidden by setting/removing a tick in the small boxes shown in the top of Figure 4.1. The visualization is offered for every episode containing a Catalog, Seismic Network or other data that can be visualized on the map.

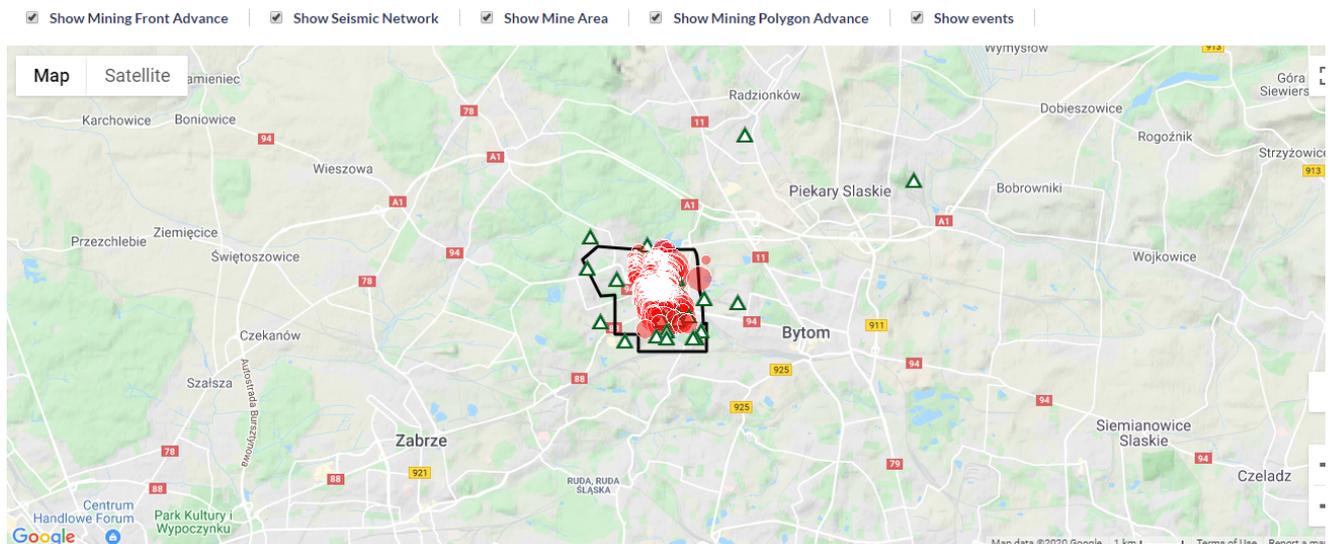


Figure 4.1. Example of combined "Integrated Episode data visualization" for Bobrek Mine episode.

Production data with Seismic Activity (For Particular AH Episodes)

In these visualizations the technological activity (either reservoir water level or wellhead pressure) is plotted in the same diagram with the histogram of the seismic activity. There are options for both parameters as shown in [Figure 4.2](#) (top left corner). The step and time unit (hours, days or weeks) of the seismic activity can be selected for the histograms of seismicity (blue panel).

The zooming (in the X-axis) can be performed in two ways: First by selecting a predefined time unit, shown after 'Zoom' field (blue panel), among 1 month, 3 months, 6 months, YTD (i.e. from the beginning of the current year up to date), 1 year and all (i.e. the entire period). The second is to interactively zoom in/out the X-axis on the lower frame (shown in the red box in [Figure 4.2](#)). The User has just to click on the small rectangles at the left and right of the shaded panel and drag them to either direction in order to select the time period he/she wishes. The selected period can be shifted towards left/right by either dragging the cursor after clicking into the shaded part, or by using the small arrows at the left and right bottom corner of the lower frame (depicted by the red box in [Figure 9](#)). In any case the starting and ending date of the chosen period is noted in the screen (green box in [Figure 9](#)). Each one of the plotted parameters can be hidden or shown by clicking on the legend, found at the very bottom of [Figure 4.2](#).

The visualization is available for episodes containing a Catalog and production data with timestamps - e.g. Water Level/Injection Rate/Wellhead pressure.



Figure 4.2. Water level/Wellhead pressure with seismic activity plot.

3-D Visualizations

This is a 3-D integrated visualization tool which provides an interactive spatial and temporal representation of the seismicity evolution in the AH Episodes and its connection with the production data (e.g. mining front advance, wellhead pressure etc) as demonstrated in [Figure 4.3](#). The instructions for applying rotation and zoom in the Figure are shown in the top left corner of [Figure 4.3](#). The seismicity can be shown as a video /animation by using the tools available in Field 1, [Figure 4.3](#). From right to left, the symbols correspond to: Play video forward, jump to the next time point, pause video, jump to the previous time point, play video backwards. The progress of the video is indicated by the black dot moving along the grey bar, found just below the "Date" text, at the top of [Figure 4.3](#). The objects manager (Field 2, [Figure 4.3](#)) can be used at any time in order to hide/show selected objects on the screen such as the injection wells, the seismic events, the stations of the seismic network, the surface map and the map scale, with respect to the selected episode. Field 3 in [Figure 4.3](#) show a color scale to interpret the seismic events depicted in terms of their size (magnitude). Finally the User may change the velocity model view in the illustration from Vp to Vs and vice versa by clicking on the "Change velocity model to Vs" button, as shown in Field 4, [Figure 4.3](#).

The visualization is available to episodes: Bobrek, Czorsztyn, Gross-Schoenebeck, LGCD, USCB and Song Tranh.

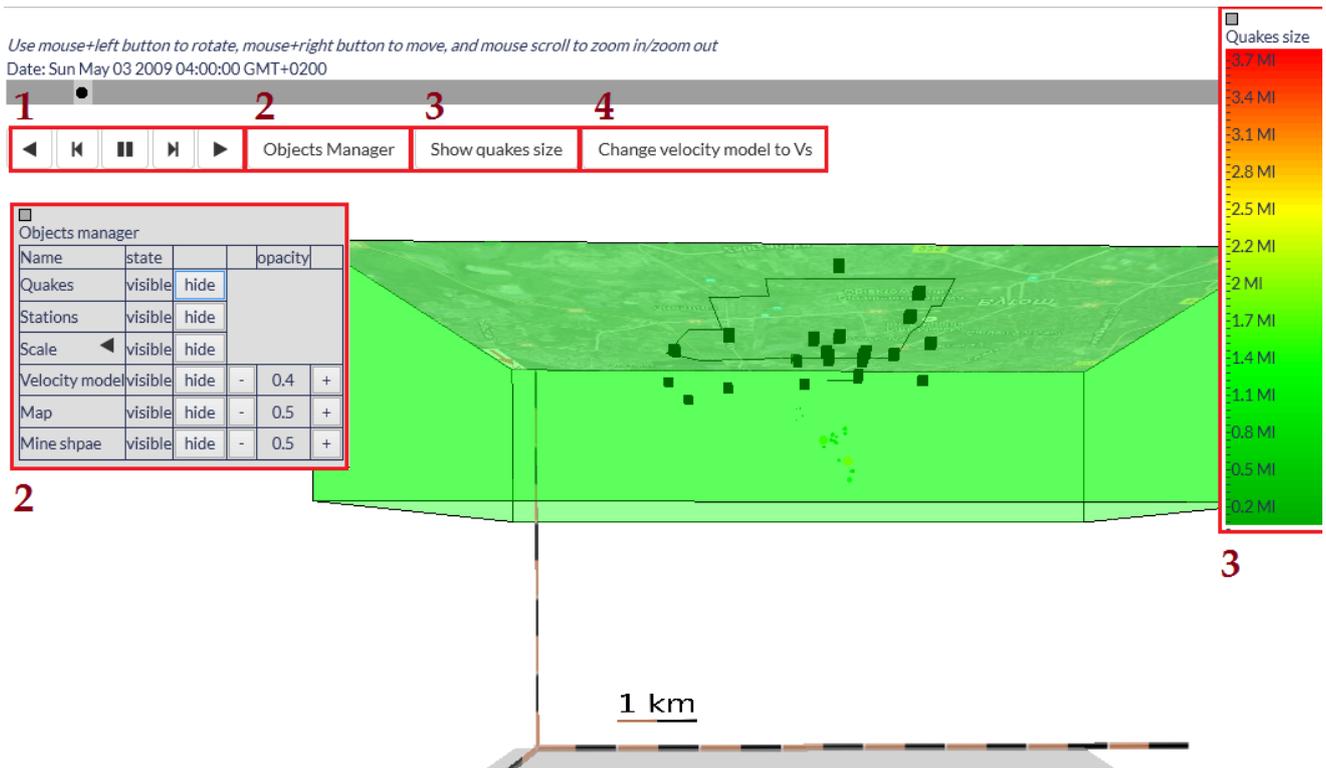


Figure 4.3. 3D seismicity visualization.

Integrated GIS data

This visualization allows User to integrate GIS data into an interactive base map plot (Figure 4.4). The User can introduce to the plot fault segments, operating edges in mining seems, seismic events ans network and front advance.

The visualization is available only for episode Bobrek.

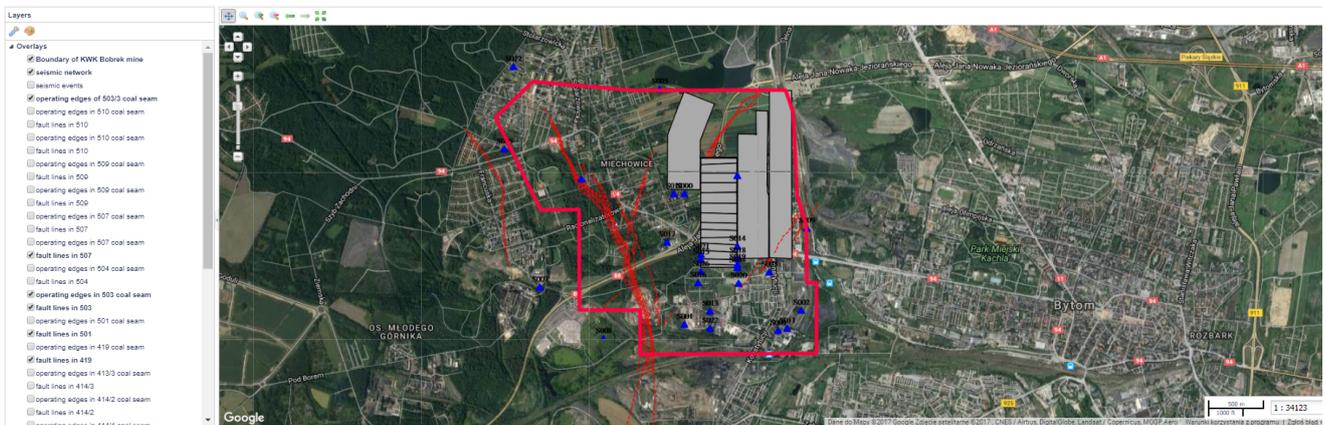


Figure 4.4. Integrated GIS data in an example for Bobrek mine.

Specific Episode data

Additional options are available for some specific kinds of data (e.g. Catalog), they will be described in detail in the next subsections.

Seismic Catalog (Catalog)

EPOS Thematic Core Service Anthropogenic Hazards

Seismic catalog contains various important information as demonstrated in Figure 5 and subsequent figures (Figure 5.1-5.8). The User may upload the catalog data in the workspace by selecting 'Actions' (blue tab, right top corner of Figure 5) and then 'Add to workspace' either as a link (following the updates in the dataset) or as a copy. In both cases the file can be moved in a particular location (folder) in the User's workspace. Information on the file can also be displayed on the screen and the data can be downloaded in .mat format. A short summary of the catalog is provided, containing the number of events, time period that the Episode covers, depth range of seismicity and magnitude range of the events. Next to the summary, there are some action tabs (Field 1, Figure 5) including (with respect to the AH Episode) Show Catalog, Seismic Activity Plot, 3D Event Distribution, Events in Local Coordinates, Benioff Plot etc. The attributes of the catalog are displayed below 'Data' Section, and they comprise the Name of the attribute, a brief description, the minimum and maximum values and the number of valid values (i.e. values that exist, not NaNs). The 'PLOTS' tab gives the chance to perform 1-D plot, histogram, cumulative histogram and reversed cumulative histogram. The tabs in Field 3, give the chance of performing various 1-D, 2-D and 3-D plots, 2-D histograms and seismic activity plots together with selected parameters. Some of the actions available to be chosen from menus displayed as Fields 1, 2 and 3, Figure 5 are described in the the following paragraphs.

The screenshot shows the 'Catalog, LGCD' interface. At the top right, there is an 'ACTIONS' button. Below it, a 'Summary' section contains a table with the following data:

NUMBER OF EVENTS:	TIME RANGE:	DEPTH RANGE:	MW RANGE:
4808	2013 Dec 10 to 2019 Apr 30	0.000 to 1.637	0.9 to 3.8

To the right of the summary, there is a red box labeled '1' containing an 'ACTION LIST' dropdown menu with options: 'CATALOG PREVIEW', 'Mw', and '3-D EVENTS DISTRIBUTION'. Below the summary is a 'Data' section with a table of attributes:

Name	Description	Minimum value	Maximum value	Number of valid values
ID	Event ID	N/A	N/A	4808
Time	Event origin time	2013 Dec 10 03:56:12.9	2019 Apr 30 23:24:50.8	4808
Lat	Latitude [deg]	51.4330	51.5748	4808
Long	Longitude [deg]	16.0061	16.2122	4808

To the right of the data table, there is a red box labeled '2' containing a 'PLOTS' dropdown menu. Below the data table is a 'PLOTS' configuration panel (Field 3) with a red border. It includes a 'Seismic activity plot with:' section where 'Latitude' is selected. There are also 'X axis:' and 'Y axis:' dropdowns with 'Time' and 'Lat' selected respectively. A 'PLOT' button is at the bottom.

Figure 5. Example of seismic catalog and available handling options.

- **Catalog Preview** (from Actions List, field 1, Figure 5): Detailed information on the attributes of every event in the seismic catalog is demonstrated (Figure 5.1). These data appear as pop-up windows and are shown in pages, each one containing 20 rows. The User can proceed to the following or previous pages by clicking the left-right arrows shown in the bottom left part of Figure 5.1. The events can be sorted in ascending/descending row according to any parameter, by clicking at one of the parameters headers. Searching and filtering of the catalog is also provided (red field, Figure 5.1).

The screenshot shows the 'Catalog contents' pop-up window. It has a search bar at the top with a 'SEARCH' button and a 'Switch to advanced filtering' link. The table below contains 20 rows of event data:

No.	ID	Time	Lat [deg]	Long [deg]	Depth [km]	Elevation [km]	MO [Nm]	Mw	MTrr [Nm]	MTss [Nm]	MTee [Nm]	MTrs [Nm]	MTre [Nm]	MTerr [Nm]	ISO [%]	CLVD [%]	DC [%]	StrikeA [deg]	DipA [deg]	RakeA [deg]	StrikeB [deg]	DipB [deg]	Ra [deg]
1	LGCD_CIBIS_208640	2013 Dec 10 03:56:12.9	51.5269	16.1418	0.800	-0.720	2.24E+11	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	LGCD_CIBIS_207575	2013 Dec 10 06:23:30.4	51.4778	16.1101	1.000	-0.920	3.83E+13	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	LGCD_CIBIS_208642	2013 Dec 10 06:25:30.6	51.4835	16.1132	0.400	-0.320	2.08E+12	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	LGCD_CIBIS_208643	2013 Dec 10 07:47:55.9	51.5261	16.1370	1.000	-0.920	5.01E+13	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	LGCD_CIBIS_208644	2013 Dec 10 16:46:22.6	51.5388	16.1392	1.000	-0.920	1.58E+11	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	LGCD_CIBIS_208646	2013 Dec 11 04:36:10.3	51.5032	16.1322	0.500	-0.420	2.88E+11	1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	LGCD_CIBIS_208647	2013 Dec 11 04:54:40.8	51.5381	16.1370	0.800	-0.720	9.17E+11	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	LGCD_CIBIS_208648	2013 Dec 11 07:13:25.7	51.5257	16.1085	0.800	-0.720	2.11E+11	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	LGCD_CIBIS_208650	2013 Dec 11 12:31:36.2	51.5477	16.1104	0.800	-0.720	9.52E+11	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	LGCD_CIBIS_208654	2013 Dec 13 01:29:03.0	51.5442	16.1327	1.000	-0.920	4.22E+11	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	LGCD_CIBIS_208655	2013 Dec 13 04:56:49.8	51.5304	16.1431	1.000	-0.920	3.55E+11	1.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	LGCD_CIBIS_208657	2013 Dec 13 13:04:27.9	51.5447	16.1132	0.800	-0.720	6.49E+11	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	LGCD_CIBIS_208659	2013 Dec 14 00:13:57.1	51.5246	16.1337	0.800	-0.720	1.94E+11	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	LGCD_CIBIS_208660	2013 Dec 14 01:41:31.4	51.5092	16.1280	0.700	-0.620	3.98E+10	1.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	LGCD_CIBIS_208661	2013 Dec 14 02:45:25.4	51.5288	16.1300	0.800	-0.720	1.26E+11	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	LGCD_CIBIS_208662	2013 Dec 14 05:02:55.5	51.5326	16.0987	0.800	-0.720	6.17E+11	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	LGCD_CIBIS_208664	2013 Dec 14 16:57:44.7	51.5439	16.1062	0.800	-0.720	7.08E+11	1.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	LGCD_CIBIS_208665	2013 Dec 14 20:48:16.9	51.5407	16.1422	0.600	-0.520	4.60E+11	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	LGCD_CIBIS_208666	2013 Dec 14 21:10:05.9	51.4831	16.1114	0.600	-0.520	1.35E+11	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	LGCD_CIBIS_208667	2013 Dec 14 22:32:36.4	51.5013	16.1279	0.700	-0.620	9.72E+10	1.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

At the bottom of the table, there are navigation arrows and the text '1-20 of 4,808'.

Figure 5.1. Catalog contents.

- **Histogram** (from *Actions List*, field 2, [Figure 5](#)): This option shows the histogram of the selected parameter ([Figure 5.2](#)). Zooming in/out and linear/logarithmic scale of the y-axis and selection of step (bin width) are available.

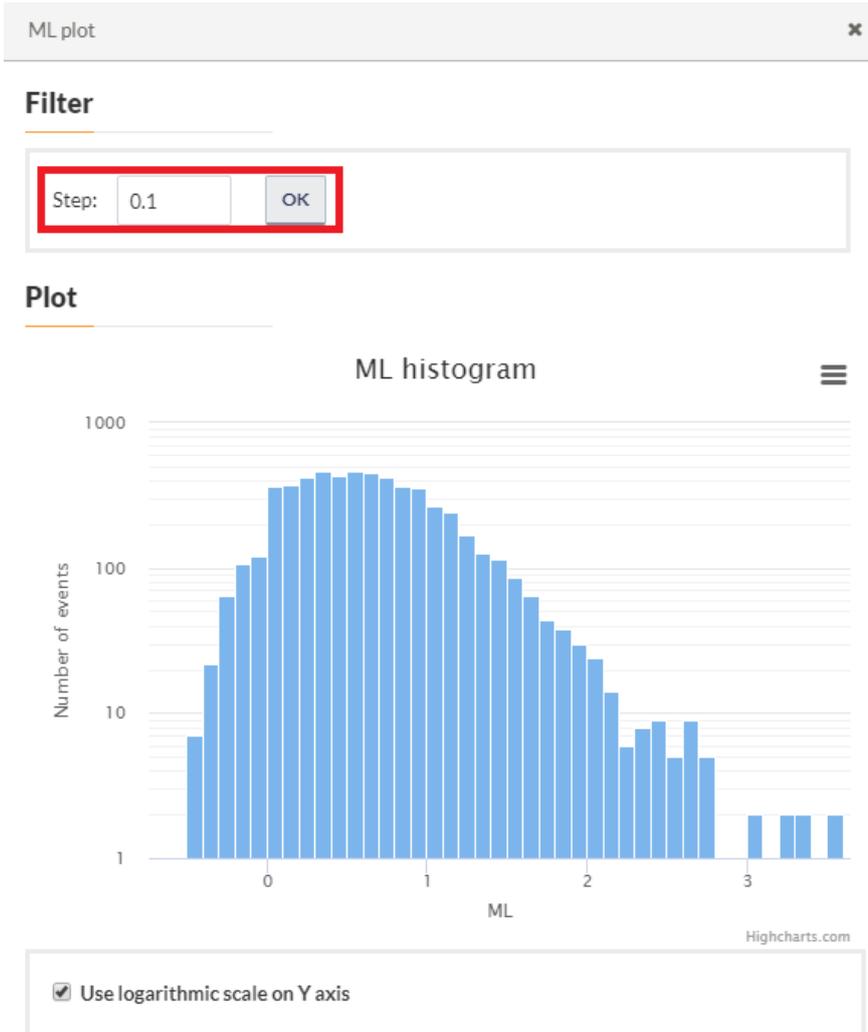


Figure 5.2. Histogram of magnitudes.

- **3D events distribution** (from *Actions List*, field 2, [Figure 5](#)): 3D spatial distribution of the events foci (longitude,latitude,depth), as circles with size proportional to the event magnitude ([Figure 5.3](#)). Rotation of the plot is possible after clicking and dragging the cursor through the plot area. The focal coordinates of each event are depicted when the cursor is pointing on a circle.

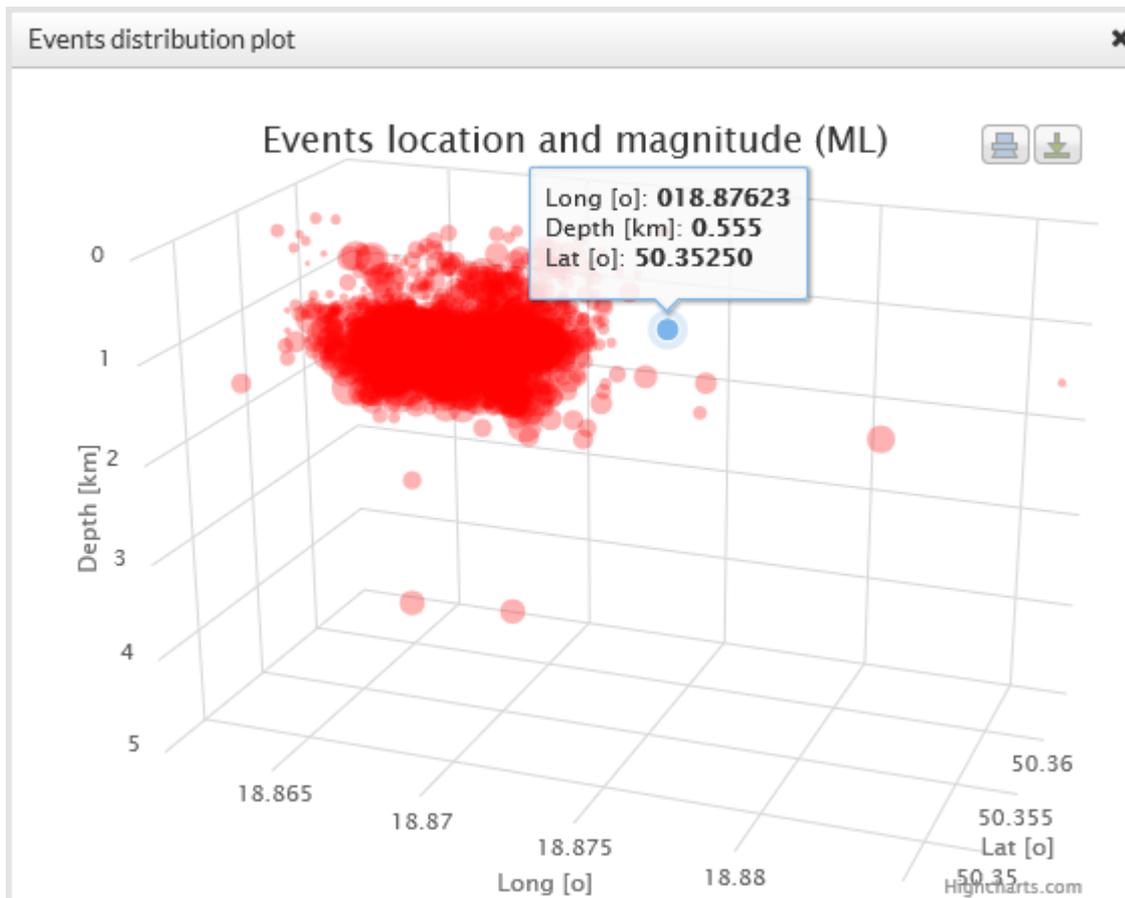


Figure p3. Events location and magnitude 3D plot.

- **Benioff plot** (from Actions List, field 1, Figure 5): A Benioff plot (square root of energy against time) can be created for those catalogs which include information on seismic energy released by the seismic events (Figure 5.4). Zooming in/out and linear/logarithmic scale of the y-axis are available.

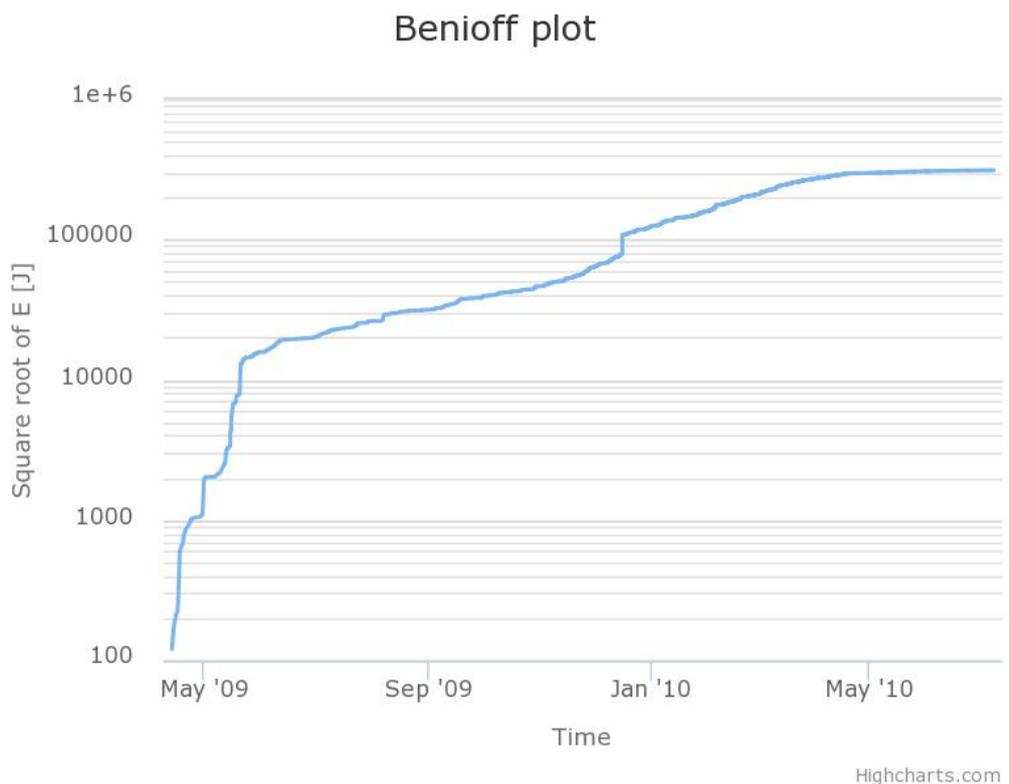


Figure 5.4. Benloff plot.

- **Events in local coordinates** (from *Actions List*, field 1, [Figure 5](#)): This option generates 2-D plot of the epicentral coordinates of the seismic events ([Figure 5.5](#)) in local (cartesian) coordinate system (when those are available). Zooming in/out option is available for this figure.

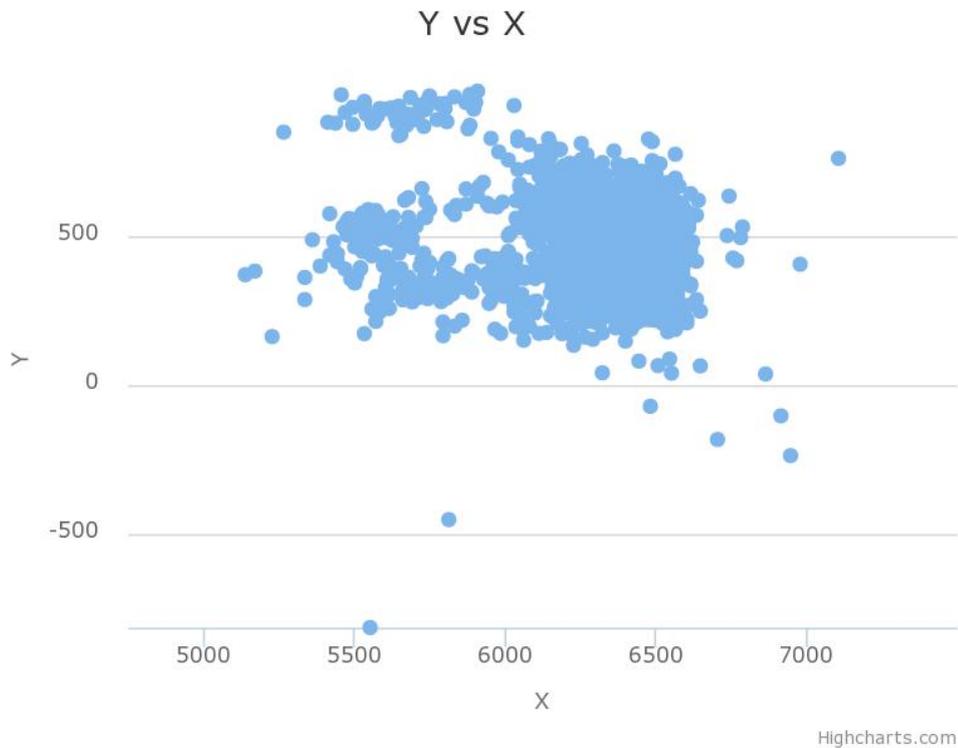


Figure 5.5. Events in local coordinates plot.

Additional plotting options are available by clicking on the gear icon shown in Field 2 of [Figure 5](#) (right hand side). These options include histograms (interval, cumulative and reversed cumulative histograms) and 1-D plots. Zooming in/out and linear/logarithmic scale of the y-axis are available. Moreover, in histograms the bar step can be modified and in 1-D plots the chart type can be switched among column, scatter, spline and line.

Even more visualization options are available at the bottom of the screen, as shown in [Figure 5.6](#). The epicenters of the seismic events are demonstrated on a google map, which are equipped with zooming, map/satellite view, drawing of national borders and full screen mode options. The events serial numbers, their origin time and the magnitudes, are shown on the screen after the User clicks on one of the events depicted by the red circles.

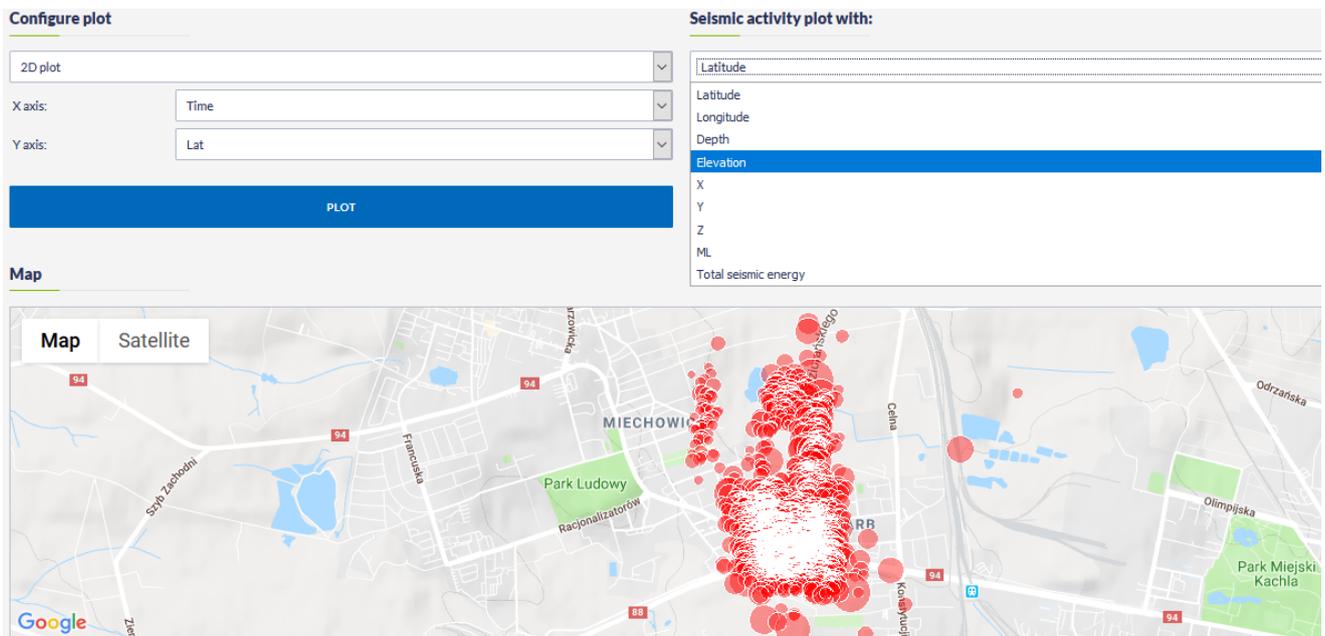


Figure 5.6. Additional plotting options

A variety of plots are available. The User can choose one of the following plot types, defining the attribute to be shown at the X, Y and Z axes:

- 1-D plot with secondary Y-axis (zooming in/out and linear/logarithmic scale of the x-axis and y-axis are available)
- 2-D plot (zooming in/out and linear/logarithmic scale of the x-axis and y-axis are available)
- 2-D plot with secondary Y-axis (zooming in/out and linear/logarithmic scale of the x-axis and y-axis are available)
- 3-D plot (rotation of the plot is possible after clicking and dragging the cursor through the plot area)
- 2-D Histogram, as shown in [Figure 5.6.2](#) (rotation of the plot is possible after clicking and dragging the cursor through the plot area).

1-D and 2-D plots - including 1-D and 2-D plots with secondary Y-axis give the user an option of choosing between linear and logarithmic scales for X and Y axes (ticking on small boxes, Field 1, [Figure 5.6.1](#)) and selection of diverse graphic views among scatter plot, spline, column and line. Plotted parameters may be hidden and re-appear by clicking at the legend (Field 2, [Figure 5.6.1](#)). By holding the cursor still onto an option or a figure element [e.g. bar in histograms or points in scatter plots], information on this option or element appears on the screen (Field 3, [Figure 5.6.1](#)). Many figures have enabled zooming options for focusing in a specified range among the values. This is achieved by clicking at a point of the figure and dragging the mouse cursor either leftwards or rightwards. Instructions are shown at the bottom of the figure as well (field 7, [Figure 5.6.1](#)). Zooming can be reset by clicking on the 'Reset Zoom' tab shown in Field 4 of [Figure 5.6.1](#). The user may save a selected figure (Field 5, [Figure 5.6.1](#)) in one or more of the following formats by clicking on the square panel: .png, .jpeg images, .pdf document or .svg vector image. Alternatively, for some figures the user can download the corresponding data and save them in .csv format in order to use it for further analysis. The figures can also be printed (also from Field 5, [Figure 5.6.1](#)).



Figure 5.6.1. Options available for generic plotting/figures.

Depth vs ML 2D histogram

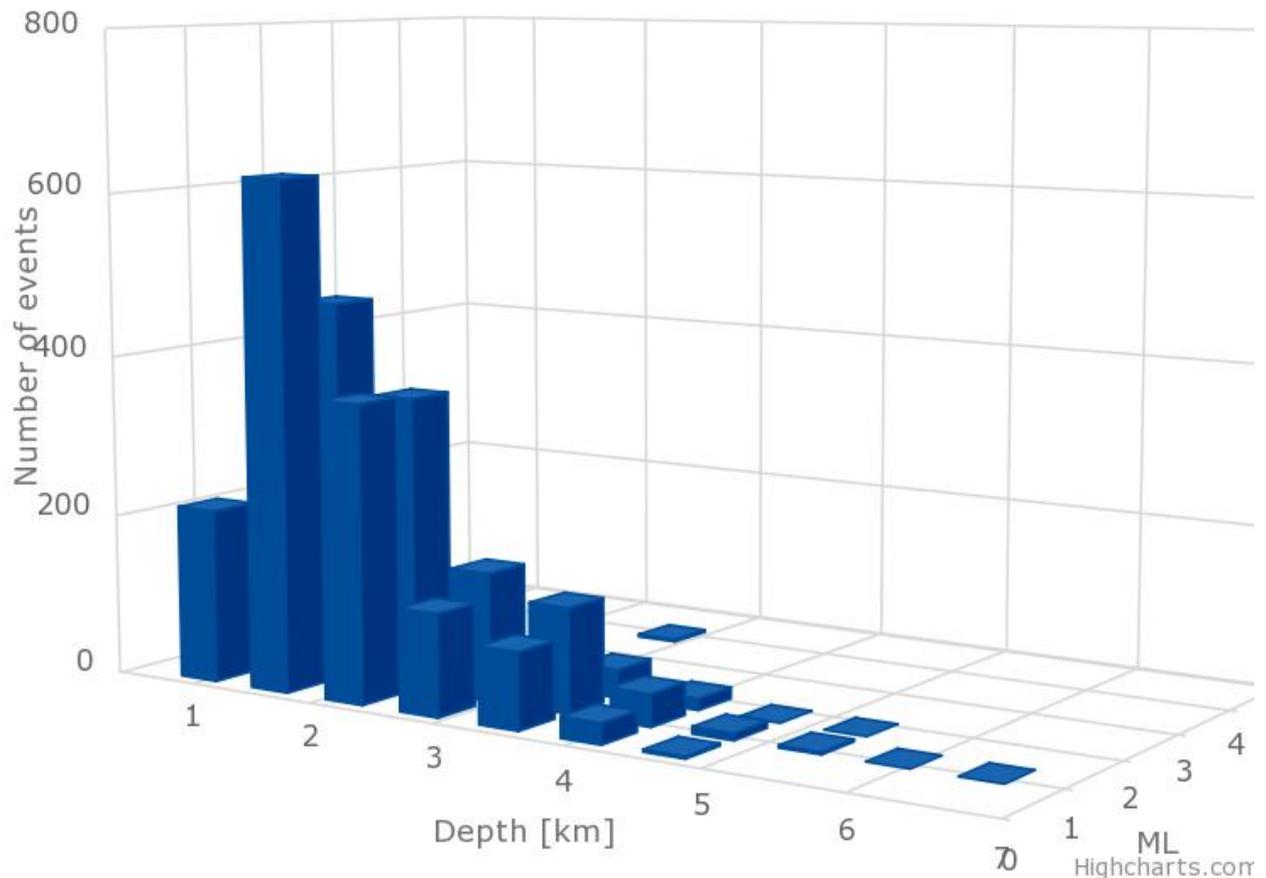
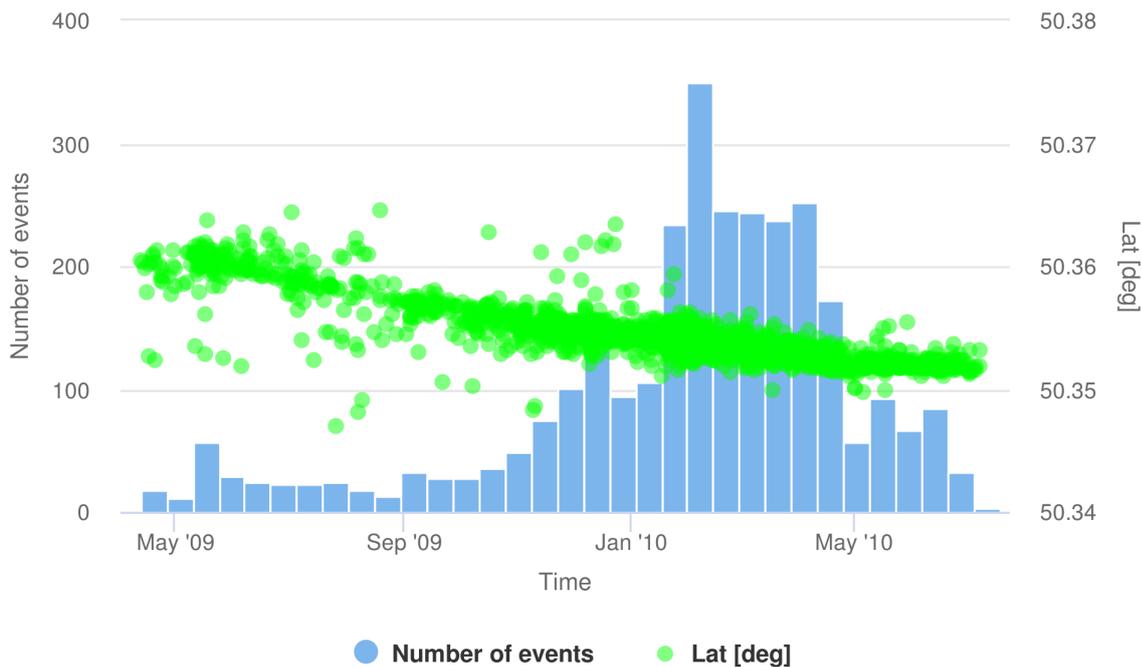


Figure 5.6.2 Depth vs local magnitude 2D histogram.

Finally, seismic activity can be plotted together with any other parameter as shown on the top right corner of [Figure 5.6](#). An example of seismic activity plotted with latitude is shown in [Figure 5.6.3](#). The time step can be set by the User. The time unit can be chosen as well among hour, day and week. These options are activated by clicking on the "OK" button. Zooming in/out and linear/logarithmic scale of the y-axis are available for this plot. The displayed chart is similar to the one displayed for the production data with seismic activity visualization (see [Figure 4.2](#)).

Seismic activity with Lat



Highcharts.com

Figure 5.6.3. Seismic activity plot with Latitude.

Advanced Data Search

This option provides an advanced data search tool, by the means of multiple data filtering, that can be accessed in two ways (see Figure 1 - 'advanced data search' and Figure 3 - 'all data related to this episode'). The following filters are available for the User (Red panel of Figure 6). The User may select one or more options by ticking the corresponding small boxes (green panel, Figure 6).

Data Search

Reservoir Impoundment |
 Episode |
 Catalog, Ray Tracing Angles, Sh |
 Country |
 Start |
 End |

Results

Name	End	Data type	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE
<input type="checkbox"/> CZORSZTYN_catalog.mat	2019 Jul 04 19:29:20	Catalog	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE
<input type="checkbox"/> CZORSZTYN_relocation_TRMLOC_catalog.mat	2016 Nov 22 22:17:03	Catalog	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE
<input type="checkbox"/> GDF_CZORSZTYN_1D_velocity_model.mat	-	Velocity Model	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE
<input type="checkbox"/> GDF_CZORSZTYN_Water_Level.mat	2017 Dec 31 00:00:00	Water Level	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE
<input type="checkbox"/> GDF_CZORSZTYN_ray_tracing_table.mat	-	Ray Tracing Angles	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE
<input type="checkbox"/> GDF_CZORSZTYN_reservoir_shoreline.mat	2013 AUG 25 11:27:24	Shoreline	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE
<input type="checkbox"/> GDF_Monteynard_shoreline.mat	1962 Apr 12 00:00:00	Shoreline	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE
<input type="checkbox"/> GDF_Monteynard_water_level.mat	1961 Sep 01 00:00:00	Water Level	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE
<input type="checkbox"/> GDF_SONG_TRANH_1D_velocity_model.mat	2011 Jan 01 00:00:00	Velocity Model	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE
<input type="checkbox"/> GDF_SONG_TRANH_Water_Level.mat	2011 Jan 01 00:00:00	Water Level	VIEW FILE	VIEW EPISODE	ADD TO WORKSPACE	MORE

ADD SELECTED TO WORKSPACE

1 2 3 4 5 -- 151

Figure 6. Data search interface.

The available filters are:

- Data Type
- Country
- Episode
- Impacting Factor

One additional filter is also provided, in which numerical data is addressed:

- Time Range: The User is requested to provide a temporal constraint for the data by entering "Start" and "End" time into the corresponding empty boxes.

After the selection of the appropriate filters, the User shall click the 'Search' button and the resulting datasets appear on the screen (Blue panel, [Figure 6](#)). In the case when too many datasets have been selected, the use of the page numbers (right bottom corner of [Figure 6](#)), provides access to the those data which are not shown in the screen. There are 4 actions the User may now attempt (blue panel of [Figure 6](#)):

1. View file: This choice will provide data features and options just as in the conventional data search described earlier in this section.
2. View Episode: This choice leads to the selected Episode main page.
3. Add to workspace: This choice is a shortcut to add the data in the workspace (see 3, below)
4. More: This choice will upload the corresponding dataset to the User's personal workspace for further processing (either as a link or copy). Alternatively the User may put a tick on one or more of the small boxes at the left side of the figure and then click on the "Add to workspace" bar, located below the table (found in [Figure 6](#)). Moreover by clicking on this icon the user may download the data or show file information on the screen ([Figure 6.1](#)).

File Information 	
File name	ESI1_Bobrek_Stations.xml
Type	Seismic Network
Format	XML
Episode	BOBREK MINE: local seismicity linked to longwall mining
Country	Poland
Region	Upper Silesia
Associated time	2009 Apr 12 21:34 - 2010 Jul 07 22:47

Figure 6.1. File information available in the results of data search application.

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