<u>Readme file for BC SRC Annual Seismicity Report May 2022 - May 2023 – Seismicity Catalogue</u> (Revised July 26, 2023)

This file describes the catalogue produced by the Induced Seismicity Monitoring Project (ISMP) from May 2022 - May 2023. The catalogue is provided as a CSV file, including all the events that passed the quality control measures. The quality control measures vary depending on which segment of the catalogue an event belongs to. All events in the catalogue have been reviewed by a human analyst.

Note that the catalogue contains some events from the Canadian National Seismograph Network (CNSN). The events from CNSN have fewer parameters than events determined as part of the ISMP. The missing parameters are listed as "Null" in the earthquake catalogue.

The quality control measures for each segment of the catalogue are listed below.
- CNSN
    - The latitude must be >= 55.5° N and < 60° N
    - The longitude must be >= -123.5° E and < -119.8° E
- KSMMA_working
    - The depth must be less than 8 kilometres deep
    - At least 9 phases must be used to determine the earthquake hypocentre
    - The latitude must be >= 55.6° N
- KSMMA_plus_working
    - The depth must be less than 8 kilometres deep
    - At least 14 phases must be used to determine the earthquake hypocentre
    - The latitude must be >= 55.6° N
- NORTHERN_MONT
    - There are two different sets of criteria for this area
    1.
        a. The depth must be less than 20 kilometres deep
        b. At least 8 phases must be used to determine the earthquake hypocentre
        c. The latitude must be > 56.2° N and < 60° N
        d. The longitude must >= -123.5° E and < -119.8° E
        e. The major-axis error must be less than 30000 metres
    2.
        a. The depth must be less than 20 kilometres deep
        b. At least 8 phases must be used to determine the earthquake hypocentre
        c. The latitude must be > 56.05° N and < 60° N
        d. The longitude must >= -123.5° E and < -121.3° E
        e. The major-axis error must be less than 30000 metres
- SC3
    - The depth must be less than 20 kilometres deep
    - At least 8 phases must be used to determine the earthquake hypocentre
    - The latitude must be >= 55.6° N and < 60° N
    - The longitude must >= -123.5° E and < -119.8° E
- DAWSON_antelope
    - The depth must be less than 15 kilometres deep
    - At least 4 phases must be used to determine the earthquake hypocentre
    - The latitude must be >= 55.6° N and < 56.5° N
    - The longitude must >= -122.0° E and < -119.8° E

- WORKING_cat
    - At least 4 phases must be used to determine the earthquake hypocentre
    - There are three different sets of location constraints
        - The latitude must be >= 54.0 and < 56.5, and the longitude must be >= -121.5 and < -119.8
        - The latitude must be >= 56.0 and < 60.0, and the longitude must be >= -123.0 and < -120.5
        - The latitude must be >= 51.0 and < 57.0, and the longitude must be >= -120.0 and < -113.5
- WORKING_cat_1
    - At least 4 phases must be used to determine the earthquake hypocentre
    - There are three different sets of location constraints
        - The latitude must be >= 54.0 and < 56.5, and the longitude must be >= -121.5 and < -119.8
        - The latitude must be >= 56.0 and < 60.0, and the longitude must be >= -123.0 and < -120.5
        - The latitude must be >= 51.0 and < 57.0, and the longitude must be >= -120.0 and < -113.5

The catalogue contains several columns, each describing a specific attribute of the earthquake. The meanings of these columns are listed below.
- master_id: A unique ID for each origin. Contains information on which segment of the catalogue an event belongs to
- Latitude: The earthquake hypocentre latitude, expressed in degrees North
- Longitude: The earthquake hypocentre longitude, expressed in degrees East
- Depth: The earthquake depth, expressed in kilometres
- Magnitude: calculated local magnitude
- UTC Datetime: The date and time of the earthquake. Measured in the UTC time zone
- Number of Defining Phases: The number of phases used to constrain the earthquake location
- Location Error: The root-mean square of travel-time residuals. Measured in seconds
- Majoraxis Error: The major-axis of the 68% confidence interval of the error ellipse. Expressed in metres
- Minoraxis Error: The minor-axis of the 68% confidence interval of the error ellipse. Expressed in metres
- Depth Error: An estimate of the error in the depth of the earthquake. Expressed in kilometres
- ID: A unique ID for the earthquake
- Locator: The locator algorithm used to determine the earthquake origin
- Velocity Model: The velocity model used to determine the earthquake origin
- Magnitude Type: The type of magnitude that is expressed in the Magnitude column. A value of "cml" indicates that the magnitude correction of Babaie Mahani & Kao (2019) was applied, while a value of "ML" indicates the standard Geological Survey of Canada magnitude correction was applied. In both cases this is the local magnitude
- Location Error: Describes how the location error was calculated. A value of "std_error" indicates that the standard deviation was used to calculate the location error. See http://alomax.free.fr/nlloc/ for more details
- NSTA: The number of unique stations used to calculate the earthquake origin
- Maximum Station Distance: The maximum distance between the earthquake hypocentre and the receiving stations. Expressed in degrees

- Minimum Station Distance: The minimum distance between the earthquake hypocentre and receiving stations. Expressed in degrees
- Azimuthal Gap: The maximum gap between stations where seismic phases were recorded for a given seismic event. Expressed in degrees

# References

Babaie Mahani, A., and H. Kao (2019). Accurate Determination of Local Magnitude for Earthquakes in the Western Canada Sedimentary Basin, Seismological Research Letters, Vol. 90, No. 1, p. 203-211, https://www.researchgate.net/publication/328791480_Accurate_Determination_of_Local_Magnitude_for_Earthquakes_in_the_Western_Canada_Sedimentary_Basin