

Quiz 1: Model the seismicity rate as a function of magnitude according to the catalogue *Synthetic catalogue.xlsx*

The synthetic catalog distributed the earthquake in the square region (figure 1):

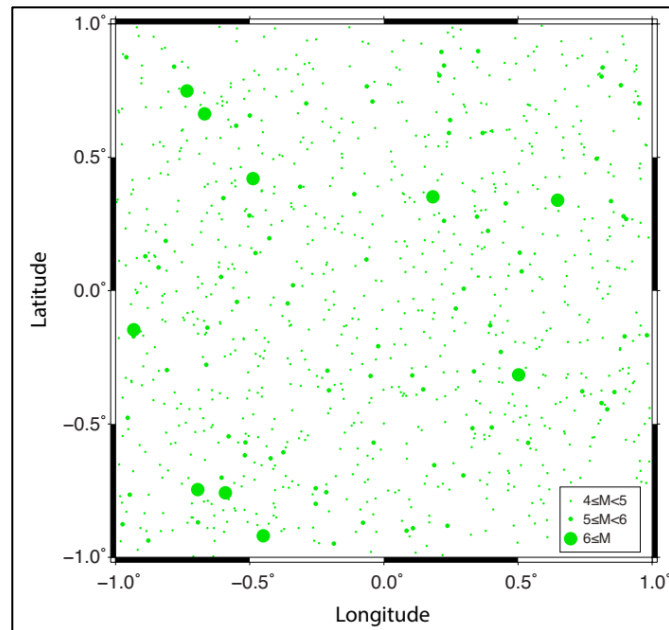


Figure 1: The earthquake epicenter of synthetic catalog

To process this earthquake, first of all, I made the data statistic by count the number of events for each specific magnitude.

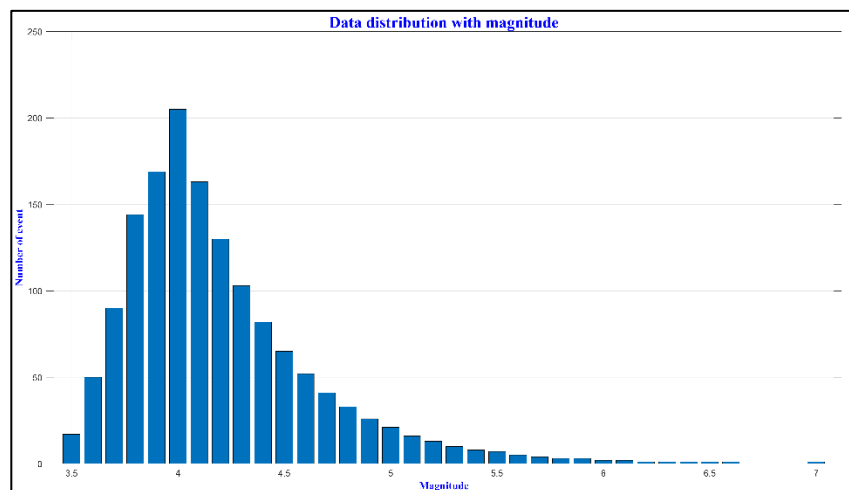


Figure 2: Distribution of earthquake with specific magnitude

The seismicity rate model calculated from the formula based on origin catalog and data sorted-out from the input catalog in range 4~6.4 is represented in figure 3 – left and right, respectively.

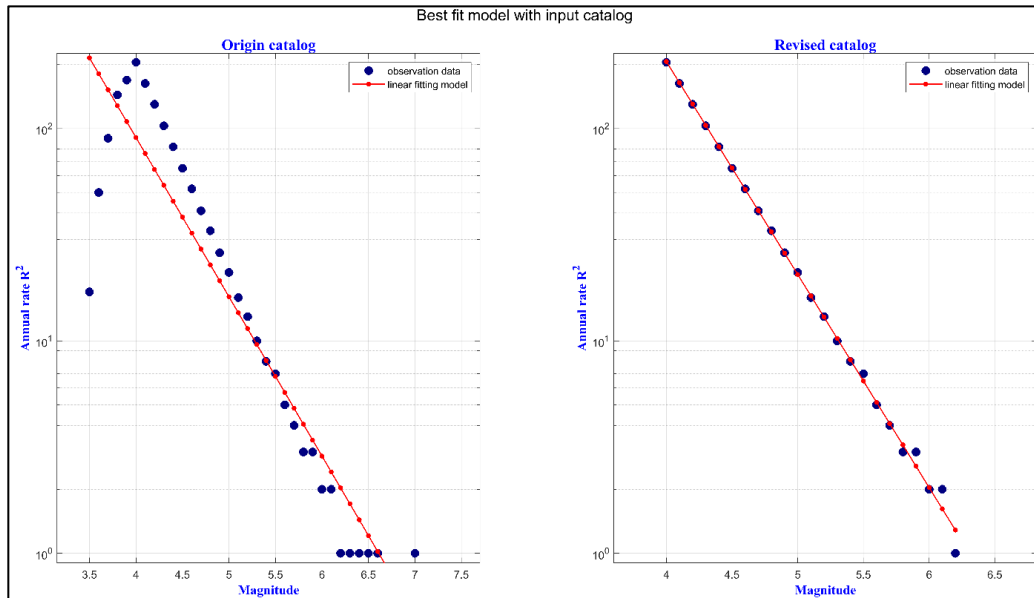


Figure 3: Seismicity rate model from (left) origin catalog; (right) sorted-out catalog from magnitude range 4 ~ 6.4.

The blue dots represent the seismic annual rate of each magnitude, while the red straight-dot line represented the best-fit model estimated by the linear regression method.

Quiz 2: Model the seismicity rate as a function of magnitude within 50 km from NCU.

- Which catalog should be accessed?
- ‘CWB catalog (1900-2016).xlsx’ in the shared folder
- What magnitude range should be considered?
- Which period should be implemented?
- Which catalog should be accessed?

According to the 2020-10-06 class discussion, the best catalog for 50km around NCU is the CWB catalog (Chinese version), which included the reviewed events and confirm historical earthquake events.

- ‘CWB catalog (1900-2016).xlsx’

The origin catalog contained 686279 events in the Taiwan region in the period from 1900 to 2016. To select the catalog within 50km in radius from NCU the following step used:

+ Pick the NCU location on map (using location in Google map with the latitude = 24.967694, and longitude = 121.195037),

+ Select the radius 50 km from the NCU location: The Haversinian formula had been used to convert latitude and longitude into the distance of kilometer; Then the location with the distance, which less than 50 km away from NCU location had been selected (figure 4). At the end of the input catalog selection, 13489 events from 1900 to 2016 had been selected,

+ The statistical analysis for extracted catalog to choose the period and magnitude range,

+ Sorted-out by time,

+ Sorted-out by magnitude,

+ Final seismicity rate model calculation.

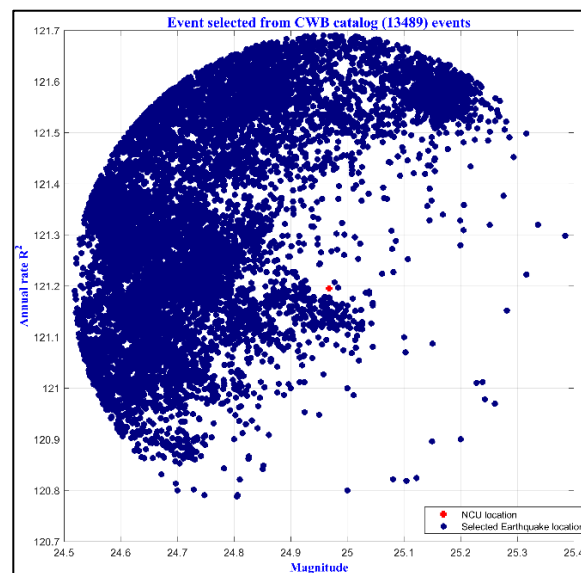


Figure 4: Seismicity at 50km in radius from NCU location. The red dot denotes the NCU location while the blue dots denote the event location from 1900 to 2016.

The events distributed with the time, it's an obvious show that, most events recorded from duration to 1973 to 2016, which may correspond with the period of seismic monitoring in Taiwan region. Therefore, the period from 1973 to 2016 had been selected to sorted-out the catalog. Then, the catalog in this duration is used to further implementation (figure 5).

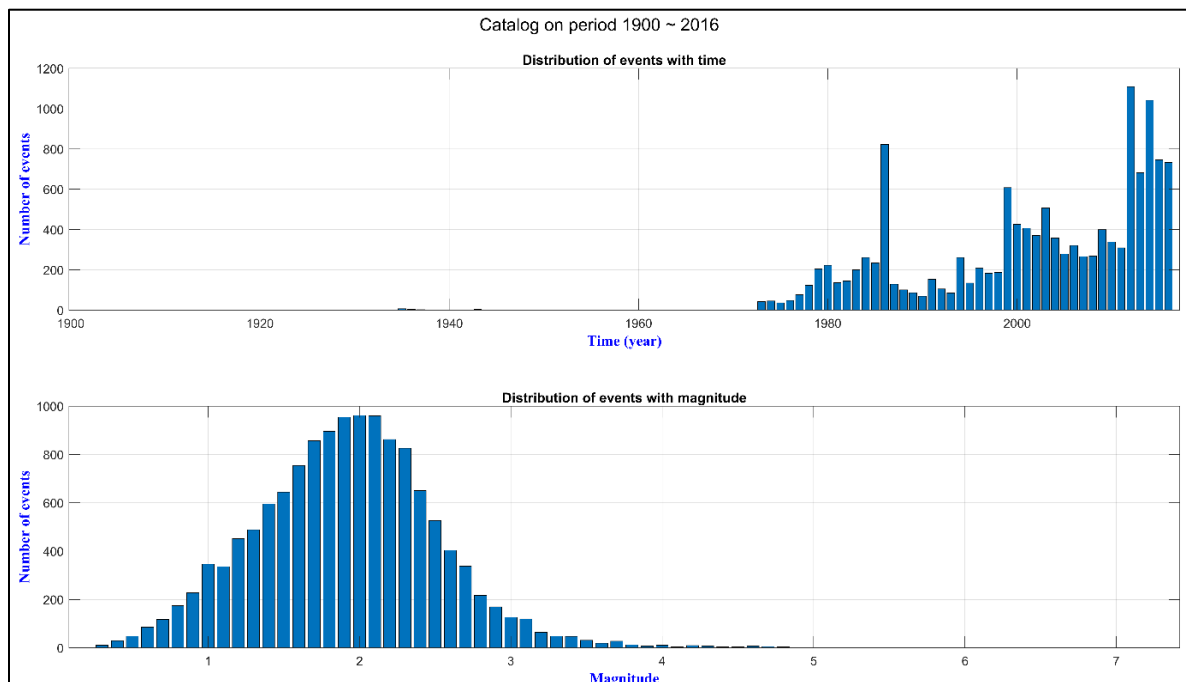


Figure 5: The statistical analysis of the seismicity catalog 50 km around NCU.

(Upper panel) distribution of event with time; (lower panel) distribution of events with magnitude.

On the other hand, the distribution of the events with the magnitude shown the shape similar with the Probability Density Function, with the middle located at magnitude = 2 of input catalog and catalog sorted-out from (1973-2006) with total 13489 and 13415 events (figure 5, figure 6), respectively. To estimate the seismic rate model, the second sorted-out with magnitude range from 2 to 5 was applied to the sorted-out in

the time range catalog. Finally, 5441 events were used to calculate the seismic rate from the NCU region (figure 7).

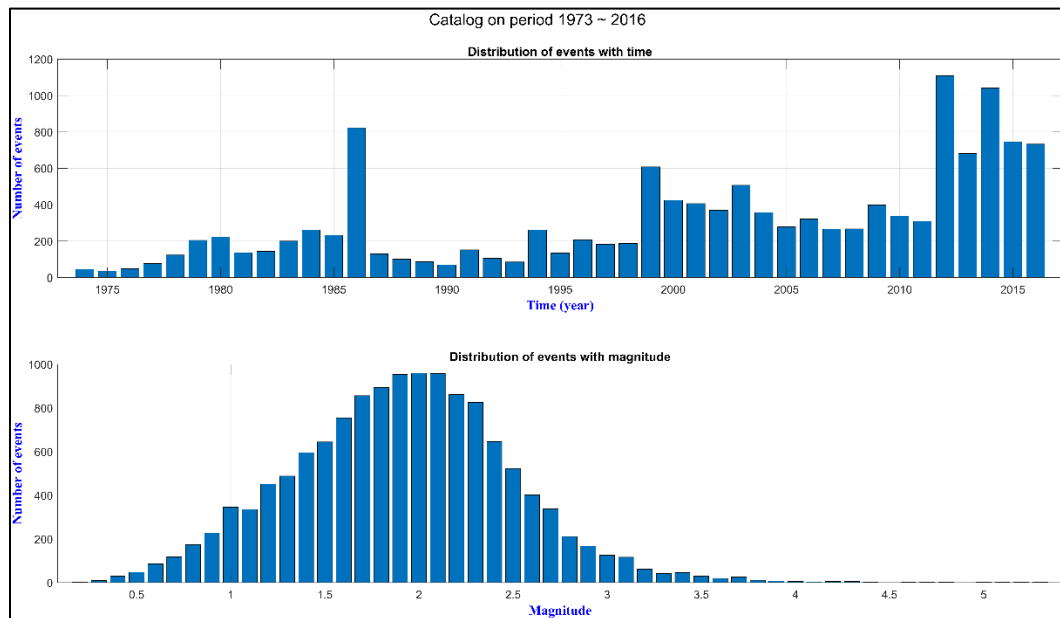


Figure 6: The statistical analysis of the seismicity catalog 50 km around NCU, catalog sorted-out the year range.

(Upper panel) distribution of event with time; (lower panel) distribution of events with magnitude.

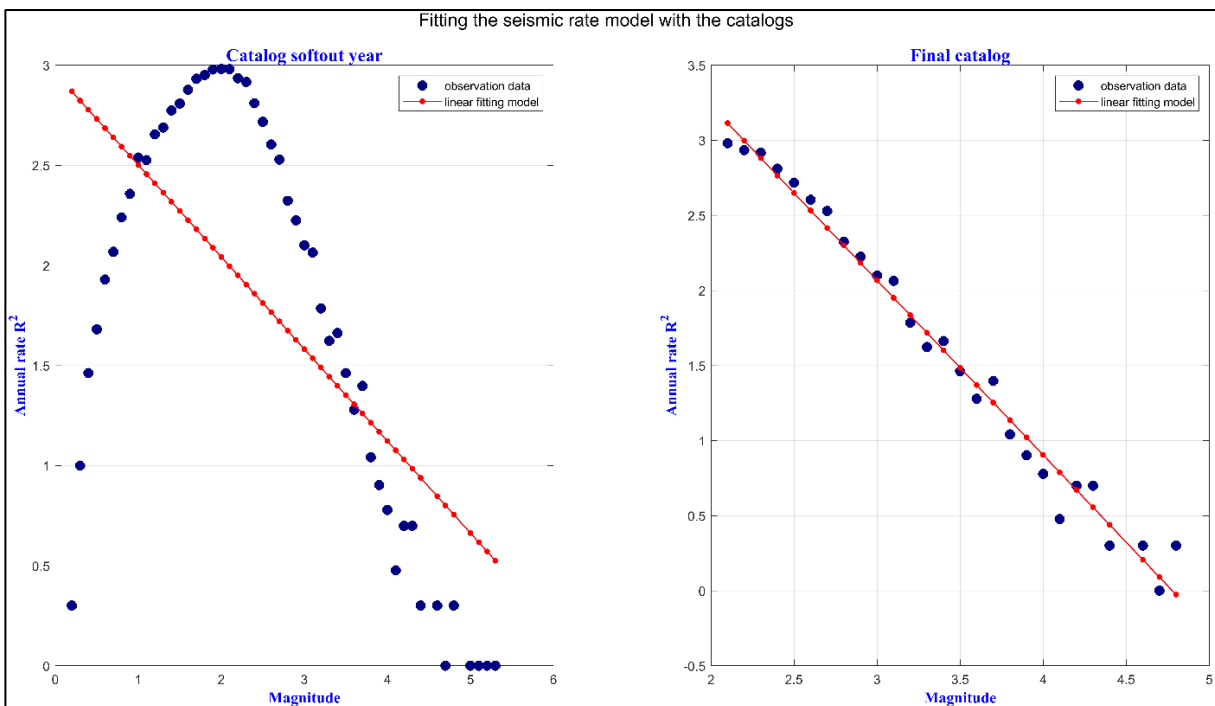


Figure 7: The seismic rate model calculated from (left) the sorted-out catalog, and (right) the final catalog. The number of events used to calculate is 13415, and 5441, respectively.

Conclusion:

Based on the selected catalog from the CWB catalog, with the period of 1973 to 2016 indicated that the seismic background on the region of 50km from NCU from tiny to light events, in which, most events magnitude range is located on the range of 1 to 4.

On the other world, the distribution of events catalog with the time quite fits with the PDF function. However, this may be caused by the method we selected the catalog or the limitation of the seismic monitoring network, which is shown the less variation of event per year in the period of 2000+, corresponded with the period of the model seismic network had been set up and operation. This is evidenced by, at the small magnitude, the number of events decreases smoothly with the decrease of the magnitude, which is incomplete recorded by the good number of stations (as usual greater than 4 stations); Therefore, the final seismic rate model calculated from the sorted-out catalog range from 2 to 5.

The code and the report also contained in:

https://github.com/havinhlong1988/H3_seismic_rate_calculation/