

Estimation of Coverage Ratio of Descriptive Catalogue of Disaster Earthquakes in Japan for Large Shallow Inland Earthquakes

Heitaro Kaneda[1]

[1] Earth and Planetary Sci., Kyoto Univ

I extract inland earthquakes from descriptive catalogue of disaster earthquakes in Japan and make distinction between shallow ($D \leq 20\text{km}$) and deep ($D > 20\text{km}$) ones. From analysis of shallow inland earthquakes in the 19th and 20th century, I show that magnitude distributions of both centuries are almost the same. By applying the result to the past, I also estimate centennial coverage ratio of the catalogue for large shallow inland earthquakes ($M \geq 6.5$). Consequently, coverage ratios during and after the 17th century are more than 70%, while ratios during and before the 16th century are generally less than 20%. We have to take into consideration this conclusion in presuming causative faults for historical earthquakes from results of trench excavations.

1) INTRODUCTION

We presume causative faults for historical earthquakes by checking results of trench excavations with descriptive catalogue of disaster earthquakes in Japan (Usami, 1996). However, there is no quantitative evaluation on coverage for the catalogue. As it may be foundation for presuming causative faults for historical earthquakes, I attempt quantitative evaluation on coverage of the catalogue for large shallow inland earthquakes.

2) EXTRACTION OF INLAND EARTHQUAKES

At first, I extract inland earthquakes from the catalogue (796 earthquakes). However, earthquakes in Hokkaido and volcanic earthquakes are out of extraction. I refer to the earthquake, an epicenter of which locates in and near (within 10km) land as inland earthquake. I recognize 399 inland earthquakes.

3) EXTRACTION OF SHALLOW INLAND EARTHQUAKES

Secondly, I extract shallow earthquakes from inland earthquakes. I refer to the earthquake, hypocenter depth of which is equal to or less than 20km as shallow earthquake. As we have no depth data for the majority of earthquakes before 1926, I distinguish shallow earthquakes by the following method.

Since damage of a deep earthquake is generally small for its magnitude, I make a diagram that shows maximum JMA intensity- magnitude distribution for 153 earthquakes after 1891 for which we have depth data. We can recognize shallow earthquake area, deep earthquake area and mixed area of both in the diagram. I extract shallow earthquakes by applying the diagram to the earthquakes of no depth data. For earthquakes in the mixed area, I make decision based on location in the mixed area, damage distribution, regional seismic characteristic and recent similar earthquakes. I recognize 308 shallow inland earthquakes.

4) EXTRACTION OF LARGE SHALLOW INLAND EARTHQUAKES

Thirdly, I extract large earthquakes that have possibility of accompanying surface ruptures from shallow inland earthquakes. Although minimum magnitude of earthquake with surface rupture in Japan is 6.8, I refer to the earthquake, magnitude of which is equal to or more than 6.5 as large earthquake, for magnitude before 1868 is largely estimated by 0.5. I recognize 107 large shallow inland earthquakes.

5) ON PROSPERITY AND DECAY OF SEISMICITY

We know prosperity and decay of seismicity of various time and space scale. To avoid influence of it, I analyze in the largest area (Pan-Japan without Hokkaido) by 100 years that is nearly the same as recurrence interval of large earthquakes at Nankai trough and Japan trench, which should have large influence on seismicity of inland Japan.

Recurrence curves for shallow inland earthquakes in the 19th and 20th century show that both curves for $M=6-7$ are nearly along the same line. Thus, number- magnitude distributions in both centuries should be almost the same. I estimate the Gutenberg and Richter's formula as $\text{Log}N=(6.17-6.29)-0.750M$ and evaluate the coverage of the catalogue by applying this result to the past.

6) RESULTS AND DISCUSSIONS

Centennial number of large shallow inland earthquakes in Japan without Hokkaido is estimated 19.7~26.0 based on the G-R's formula. I estimate centennial coverage ratio of the catalogue for large shallow inland earthquakes based on this analysis.

The ratios during and after the 17th century are larger than 70%, while these during and before the 16th century are generally less than 20%. Therefore, we can say that large shallow inland earthquakes during and after the 17th century are mainly covered in the catalogue, while these during and before the 16th century are mostly uncovered. Thus, during and before the 16th century, many large shallow inland earthquakes that are underestimated or remain no historical description should exist. We have to take into consideration this conclusion in presuming causative faults for historical earthquakes from

results of trench excavations.

(REFERENCES)

Usami (1996): Descriptive Catalogue of Disaster Earthquakes in Japan, 493p, Univ. Tokyo Press.