

The Moon's age corresponding to the earthquakes occurred beneath the Tokyo metropolitan area in the past 400 years

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[1] none

1 Introduction

There have been discussions on the relation between the occurrence of earthquakes and the Moon's age. No conclusion has been reached yet. (Utsu, 1999) On the other hand, a recent report shows that the Earth tides can be a trigger of earthquakes. (Cochran, Vidale and Tanaka, 2004) The objective of this report is to study the occurrence of earthquakes beneath the Tokyo Metropolitan area in light of the Moon's age.

2 Data set

Earthquakes causing damage have occurred everywhere in the Kanto district. However, those occurring in such areas surrounding Tokyo as Gunma Pref., Tochigi Pref., Ibaragi Pref., the western part of Saitama Pref., that of Kanagawa Pref. and off the coast of Boso Peninsula will not cause heavy damage to the central Tokyo even if they are M7 level ones because of the distance. In addition, there have been huge earthquakes at the M8 level in Sagami Trough. However, considering the interval of earthquakes occurred in the past in this area, it is highly unlikely that a huge earthquake will happen in the near future.

For the above reasons, the data examined in this report are of earthquakes of M4.5 and greater that occurred in the area surrounding Tokyo Bay, stretching 80km from east to west and 70km from north to south, during the period from June 1615 to July 2005. The data were collected from the database prepared by the Meteorological Agency. The major earthquakes in the data set include the 1855 Ansei Edo Earthquake (M6.9) and the 1894 Meiji Tokyo Earthquake (M7.0). The earthquakes examined totaled 182, 32 out of which are of M5.5 and greater and 150 are smaller than M5.5.

3 Results

(Date) Although the dates that earthquakes of M4.5 and greater occurred do not show clear dependency on the Moon's age, those of earthquakes of M5.5 and greater show clear dependency. Occurrence tends to increase around the new Moon, the first quarter, the full Moon and the third quarter. The average number of occurrence is $(32/29.5=)$ approximately 1.0. However, they occurred more than twice at 29 to 2 days (meaning the Moon's age, hereinafter) around the new Moon, at 8 days in the first quarter, at 14 to 15 and 17 days around the full Moon, at 20 and 24 days in the third quarter. Especially occurrence increases around the new Moon period. The 1855 Ansei Edo Earthquake, one of the largest earthquakes in history occurred at 1.7 days in the new Moon period. In addition, the 1894 Meiji Tokyo Earthquake occurred at 16.3 days of the full Moon and the 1649 Keian Edo Earthquake occurred at 19.8 days of the third quarter. On the other hand, no M5.5 class earthquakes occurred at 5 to 6, 9 to 13, 18 to 19, 21 to 22 and 26 to 27 days.

(Time) The time of occurrence is not random but affected. During the new Moon period and the full Moon period, earthquakes occurred from 9 to 17 o'clock and from 22 to 6 next morning. On the other hand, in the first and the third quarter periods, they occurred from 7 to 8 o'clock, 12 to 13 and 18 to 1.

(Location) The location of occurrence is affected by the Moon's age.

4 Summary

When the survey is set to such big earthquakes as those of M5.5 and greater that occurred within a small area, an influence of the Moon's age is observed in the date, time and location of occurrence. It is believed that such an influence exists because the direction of slips of the faults in the selected area is limited and earthquakes occurred by receiving the external forces of the Moon and the Sun from the directions specified by the Moon's age.

As for M5.5 class earthquakes occurred in the Tokyo metropolitan area show a tendency in the date, time and location of occurrence according to the Moon's age. Details are shown above.

5 Reference

Tokuji Utsu, 1999, General remarks of the seismic activity, University of Tokyo Press, 494-496

Cochran, E.S., J.E. Vidale and S. Tanaka, 2004, Earth tides can trigger shallow thrust fault earthquakes, Science, 306, 1164-1166