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Characteristics of Date, Time and Lunar Phase of Giant Earthquakes for Each Subduction Zone

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There are several studies which suggest that the tidal force affects earthquake occurrence. The studies focus on earthquake precursory of Sumatra (Tanaka, 2010), non-volcanic tremor resulting from slow slip events (Nakata et al., 2008) etc. If predictions on date, lunar phase and time of giant earthquake occurrences can be narrowed for every subduction zone, it would be very effective to reduce earthquake damages. Only the giant main shock, mainly M_w 8+ earthquakes between 1900 and 2011, were investigated for each subduction zone in this study. UTC is used hereafter.

In Kuril Islands, six of the seven earthquakes occurred during Aug. 11 and Nov. 15 on lunar phase between 24.2 and 1.6 days. Earthquakes of Hokkaido in Japan near Kuril Islands occurred in a similar manner. In Tonga, four of the five earthquakes occurred during Apr. 30 to June 26. All events occurred on lunar phase between 0.8 and 6.2 days and between 5:07 and 15:26. In Chile, no clear date dependency is observed. However, four of the seven earthquakes occurred around the new moon (lunar phase between 22.1 and 1.8 days) and two occurred just before the full moon (lunar phase between 12.0 and 13.6 days). All events occurred during 16:07 to 6:34. In Peru, no clear date dependency is observed. However, three of the seven earthquakes occurred around the new moon (lunar phase between 2.2 and 3.5 days) and the rest four occurred around the full moon (lunar phase between 12.6 and 18.8 days). All events occurred during 12:08 and 23:40. In Japan, three of the six giant earthquakes occurred around the lunar phase of 6 days and the rest three occurred around the lunar phase of 20 days. Five of the six earthquakes occurred during Mar. 2 to June 15. No clear dependency was observed for earthquakes in Southeast Asia.

M_{JMA} 6+ earthquakes in Japan were investigated since there are not enough M_w 8+ earthquakes. No clear dependency between the earthquake occurrence and lunar phase was observed. However, in the case of M_{JMA} 7+ earthquake occurrence is high on lunar phase between 6 and 12 days and between 20 and 22 days. All land earthquakes occurred on lunar phase between 4 and 14 days and between 20 and 22 days.

Investigating the areas (Hokkaido, Pacific Ocean side between Aomori and Chiba, Kansai, Kyushu and Okinawa islands), the earthquakes in Hokkaido were similar to the ones in Kuril Islands. Giant earthquakes occurred on lunar phase between 20 and 0 days. Most earthquakes in Pacific Ocean along Aomori to Chiba occurred on lunar phase of about 6, 12 and 22 days. The most earthquakes in western part of Japan were on lunar phase between 9 and 21 days. Not many giant earthquakes in this area.

Investigating the seasons, most earthquakes in February to April occurred on lunar phase between 4 and 15 days. Earthquakes which occurred in May to July occurred on lunar phase between 10 and 20 days. Most giant earthquakes in August to January occurred on lunar phase between 20 and 0 days. Occurrence of the giant earthquakes was higher during winter to spring than summer to fall.

If a dangerous time zone is narrowed for each subduction zone in future, the validity will be examined based on change in the stress state of the subduction zone by tidal force. Investigation on the stress state of the whole subduction zone rather than statistical analysis for small earthquakes will be carried out since the prediction of giant main shocks is much more important than that of predict small earthquakes.

Keywords: giant earthquake, lunar phase, tidal force, subduction zone, plate

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