

Recurrence intervals of large earthquakes along the northern margin of the Philippine Sea plate

Masataka Ando[1]; Akira Sangawa[2]

[1] RCSV, Science, Nagoya Univ.; [2] Active Fault Research Center,GSJ/AIST

Along the northern margin of the Philippine Sea plate between 132°E and 138°E, large subduction earthquakes have occurred repeatedly with intervals of one hundred to several hundred years. These events generated strong ground motions equivalent to seismic intensities 6 to 7 in JMA scale, 10 to 11 in MM scale, and caused extensive tsunamis over western Honshu.

In the region of west Honshu the continuous GPS monitoring has demonstrated that the plate interface is nearly fully coupled along all this plate boundary. This implies that most of the Philippine-Eurasia plate motion in this region is likely to be released by earthquakes. The recurrence intervals are different between the western and eastern parts of the plate margin. Along the Nankai trough between 132°E and 138°E, large earthquakes have been well documented on historical records and can be traced back to 648 A.D. The average recurrence interval is about 100 years. On the contrary, along the Sagami trough between 139°E and 142°E, great earthquakes occurred in 1923 (M7.9) and 1703 (M8.6) located about 50 km southwest of the Tokyo. For this area, only three or four events have been identified in the past 1,000 years, suggesting possible recurrence intervals of 200 to 500 years. The inferences from recurrence intervals are therefore particularly important in assessing seismic hazard for these areas.

Thus, it is important to know what controls the recurrence intervals of large earthquakes in this particular region. The oceanic plate subducting along the Nankai trough comprises an oceanic plate created by a backarc spreading 15-25Ma. On the contrary the plate subducting along the Sagami trough comprises an island-arc crust of a thickness 25km. It is usually considered that the more buoyant plate resists subduction and causes higher frictional stresses along the Philippine Sea plate that would eventually lead to longer intervals of large earthquakes. If this hypothesis is applied to the Suruga trough between 138.0°E and 138.7°E where an island-arc structure is being subducted, a large earthquake is anticipated to occur soon since no earthquake has occurred since 1854 unless its recurrence interval is much longer than the calculated average recurrence interval.