

Numbers of large earthquake interacting fault segments and large earthquake accompanied with large foreshock(2)

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For the prevention of the disaster, Japan government discussed and reported about possibilities of occurrence of the Nankai trough Earthquake at " the meeting about predictability of large earthquakes along the Nankai Trough" (CAO, 2017). Here, we reported how often large earthquakes of interaction with the fault-segment occurred in the world, and how often large earthquakes accompanied with large foreshocks in the report of CAO, following to the SSJ fall meeting.

There were 96 occurrences of over M8 earthquakes from data of ISC-GEM and USGS since 1900. The 38 succeeding earthquakes (SuEs) larger the M-1 of the preceding earthquakes (PrEs) occurred within 3 years in the regions between 50km and 500km of radii from the epicenters of the PrEs. 10 earthquakes of them occurred within 3 days. Almost of them occurred in the plate boundary (Fig.1). A lot of the SuEs were smaller than the PrEs and the 20 ones in the 38 earthquakes were differences within M0.5 (Fig.3). It shows the relationship with a main-shock and aftershocks. Some of the SuEs occurred in the adjacent areas of the aftershock regions of the PrEs.

There were 1368 occurrences of over M7 earthquakes since 1900. 56 SuEs with magnitude larger than the PrEs occurred within 3 years in the regions of 50 km of radius from the epicenter of the PrEs. 24 earthquakes occurred within 7 days. Also, almost of them occurred in the plate boundary (Fig.2). There was difference of M1.7 between the M7.3 earthquake prior to the 2001 off the Pacific coast of Tohoku Earthquake (M9.0) and the mainshock, but 48 in the 56 earthquakes were differences of within M0.5 (Fig.4).

When there is a large earthquake as the preceding earthquake, a following earthquake also seems to tend to become large (Fig.7 and 8).

Cumulative numbers of time intervals between the PrEs and SuEs indicate in the decaying way of a power law based on the Omori-Utsu formula, not Poisson (Fig.7 and 8) for both cases of the M7 and M8 classes. We divided with M7 classes and M8 classes, but both were similar in the tendency of the short time intervals relatively and tendency of same degree of magnitudes of the PrEs and SuEs.

It seems that time intervals indicate locality in the regions of the Nankai trough, Chile and the Solomon-islands and so on. Effect of the PrEs continues for a long time in the similar ways of aftershocks, but the time intervals were within 12days in the region of the Solomon-islands (Fig.9). After slip stopped once in the margin of the rupture area, stress concentration happens around the narrow boundary of an adjacent area, then next slip begins next to the early times relatively. The case of stress concentration sustained with wide area, next slip begins late. The locality of time intervals might show difference of stress concentration of the plate boundary such as above cases.

Keywords: predictability of large earthquakes along Nankai trough, earthquake interaction, Nankai trough earthquake

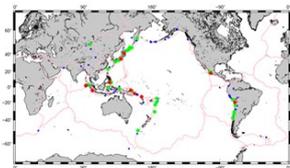


FIG.1 Epicentral distribution (ISC-GEM + USGS) of over M8 earthquakes (blue:96) from 1900. Succeeding earthquakes within 3days (red:10) and 3years(green:38). Symbols are overlaid as blue, green and red.

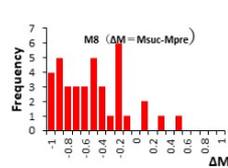


FIG.3 Magnitude differences of preceding and succeeding earthquakes for over M8. ($\Delta M = M_{suc} - M_{pre}$)

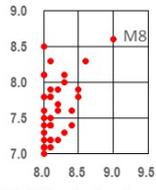


FIG.5 Magnitudes of preceding earthquakes vs succeeding earthquakes for over M8.

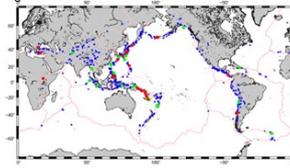


FIG.2 Epicentral distribution of over M7 earthquakes (blue:1368) from 1900. Succeeding earthquakes within 7days (red:24) and 3years(green:56). Symbols are overlaid as blue, green and red.

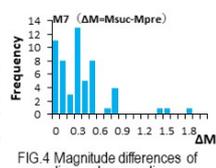


FIG.4 Magnitude differences of preceding and succeeding earthquakes for over M7. ($\Delta M = M_{suc} - M_{pre}$)

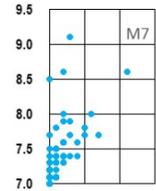


FIG.6 Magnitudes of preceding earthquakes vs succeeding earthquakes for over M7.

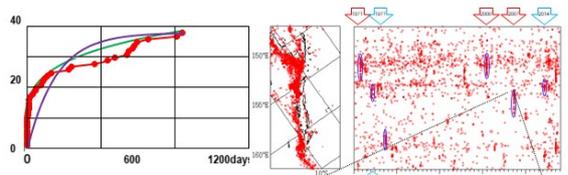


FIG.7 Cumulative numbers of time intervals of succeeding and preceding earthquakes for over M8 (red). Omori-Utsu formula (green) and poisson process (purple).

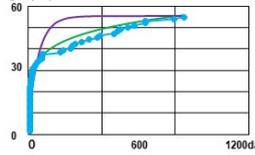


FIG.8 Cumulative numbers of time intervals of succeeding and preceding earthquakes for over M7 (blueish). Omori-Utsu formula (green) and poisson process (purple).

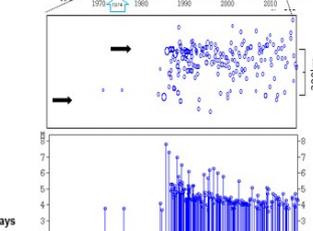


FIG.9 Epicentral distribution (up left) and space-time distribution over MB5 (ISC catalog, up right) in the region of the Solomon islands. Blue ellipses indicate the clusters of the paired earthquakes, of which intervals are within 12 days. Red and blue arrows indicate years of occurrences of M8 class and M7 classes, respectively. Seismic activity on Sep. 12, 2007 (JST). Close up of the space-time distribution (middle) and M-T diagram (down).