

Method for prediction of off Ibaraki M7 characteristic earthquakes based on seismicity change

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An M7 earthquake happened off Ibaraki Prefecture on 8th May, 2008, and a previous M7 earthquake happened on 23th July, 1982, 26years before the present. These two events are recognized to slip on the same asperity from analyses by Murotani(2003) and Yamanaka(2008). In this area, a series of characteristic earthquakes comprising those events in 1896, 1923, 1943, 1965 as well as above two has continued with an interval of about 20years.

NIED has started microearthquake observation around the Kanto and Tokai districts in July, 1979, and the observation has been taken over by Hi-net at present. Having an advantage of high-quality data during 30years, I examined seismicity changes possibly related to above two characteristic earthquakes. The procedure is almost same as that was introduced for the case of off Miyagi Prefecture earthquakes (Matsumura, 2006), where the seismicity change was expressed by taking a time window of ten months just prior to each event, dividing it into two successive periods, and comparing the activities between both periods.

Depicting and comparing two maps of the seismicity changes preceding the 1982 event and the 2008 event within the area ranging 35.9-36.7 and 140.5-142.21, I found that both maps very much resemble between each other, the correlation coefficient of which was $r=0.58$. I examined the temporal variation of the correlation coefficient by setting the pattern prior to the 1982 event as a reference, and by moving the window day-by-day. It is revealed that the value never exceeded $r=0.51$, excepting several or several tens of days around the characteristic earthquakes. As reported by the Tohoku University, the activities of small repeating earthquakes increased three months prior to the 2008 event. Synchronizing this, the value of r started to increase, and reached its peak of $r=0.59$ on three days before the mainshock. I thus present the following conclusions.

1. A specific pattern of the seismicity change appeared preceding the off Ibaraki characteristic earthquakes. This implies that there exists a preparatory process leading toward the characteristic events, that must be a quasi-static slip to induce the seismicity change through stress redistribution.
2. The next characteristic earthquake can be anticipated to happen around 2030. A practical prediction method for this can be proposed such that the correlation coefficient referring to 1982 and 2008 events should be monitored.
3. The concept of the preparatory process reflected in the seismicity change may be applied to other cases of the inter-plate characteristic earthquakes.