Seismic activity before and after a large earthquake in seismicity cycle

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After a large earthquake at an inland active fault, it is usually recognized the following seismicity cycle that the aftershock activity continues for a long time and then the next seismic sequence will start after it [Toda, 2002]. According to Toda [2002], the following tendencies are found from the sequences of recent micro and moderate sized earthquake activity on a fault.

1) Seismic activity is high along the active faults which have moved within about the past 150 years, and in areas where earthquakes (M is 6 or more) have recently been recorded.

2) Seismic activity is generally low for faults on which the most recent event has been hundreds of years or more before.

3) When the lapsed time from the most recent event is close to or larger than the recurrence time, seismic activity is comparatively or locally high.

It is shown that the seismic activity along a fault after a big earthquake is classifiable into an aftershock term, calm term and preparatory term [Mogi, 1985]. These results show that periodicity is recognized in the seismic activity including microearthquakes, and that the recurrence time between two succeeding large earthquakes can be considered as one unit of the cycle. Generally, the cycle of the large earthquakes on inland active faults is very long, e.g. one thousand of years to tens of thousands of years, and, there is large variation in the duration of a cycle between various faults. Furthermore, during the observation period of modern seismology which is about a hundred years, the observational result is available only for a small portion of an entire activity cycle, except faults with extremely short recurrence time.

Many active faults are currently situated in different stages of their earthquake cycles. As there is large variation in the scale and recurrence time of a fault, we develop corrections for these factors, and a clear correlation is recognized between the lapsed rate from a large earthquake and the present seismic activity [Itaba and Watanabe,2005]. Using our methodology, we can identify how the present seismicity fits in the earthquake cycle. It is thought that the seismic activity of some faults shifts to a preparatory stage before a large earthquake. If the lapsed rate is found to be a large portion of the earthquake cycle and also in a preparatory stage, the seismic activity may increase. Based on this idea, it may be useful to detect the shift to preparatory stage or to calm stage before a large earthquake in the seismicity pattern. Thus, this study contributes to the overall understanding of the seismicity cycle which will contribute to the ongoing efforts in earthquake prediction and disaster mitigation.

In this investigation, the examples of the seismic activity in the seismicity cycle before and after an actual large earthquake are introduced.