

The extraction of seismicity acceleration by time-to-failure analysis in Chubu District (part 2)

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Some examples of seismicity acceleration prior to large events have been reported [e.g. Bufe and Varnes(1993), Yamaoka et al (1999)]. It is found that seismicity acceleration is well approximated with power law time-to-failure function.

Power law is then applied to extracting some examples of seismicity acceleration. The object of this study is predicting the epicenters and the occurrence times of future large events before they occur under the assumption of their occurrence. It is important to extract not only some ongoing examples but also past examples of seismicity acceleration in order to consider the possibility of future earthquake occurrence.

In this study, the extraction of past examples of seismicity acceleration, which has not been tried, is attempted.

DATA

Hypocenter catalog of JMA (1978/01/01-2001/10/01)

Depth 0-20km

Cut-off magnitude = 2.5

Minimum magnitude of considered mainshock = 5.0

ANALYSIS

- (1) Some aftershock clusters are removed by SLC (Single-Link Clustering) method (Frohlich and Davis, 1990).
- (2) The calculation of cumulative Benioff strain using the data in a space-time window.
- (3) The optimization by power law and linear function. If RMS (root mean square) value by power law is less than that by linear function, seismicity is regarded as being accelerated.
- (4) (2), (3) is iterated by changing the space-time window.
- (5) A candidate for the epicenter of large event is determined by the Intersecting Circle Method (Yang et al., 2001).

RESULT AND DISCUSSION

Seismicity acceleration is extracted around Hamamatsu-Kakegawa area prior to not only the end of 2000 but also 1986-1987 although no large event occurred in 1987.

Kimata (2001) suggested that slow slip events in the Tokai Region occurred at least three times in the past, 1981 and 1987 and 2001 in the Tokai Region, although the event in 2001 continues now. The extracted seismicity acceleration prior to 1987 might therefore be reflected by the slow slip event in 1987. It is possible that the acceleration prior to the end of 2000 is also reflected by the ongoing Tokai event since April 2001. It is difficult to discuss the existence of seismicity acceleration prior to 1981 because the data before 1978 is too worse in quality.

If the Tokai event in 2001 ends up in a slow slip event, it could be said that the seismicity acceleration in this region tends to be followed by a slow slip event. In this case, it follows that failure in terms of time-to-failure analysis can be slow slip, which is one of some failure modes.

CONCLUSION

The seismicity acceleration in the Tokai Region prior to 1987 and the end of 2000 seems to be followed by the slow slip event in 1987 and the Tokai event in 2001, respectively. This indicates that failure in terms of time-to-failure analysis could be slow slip and, in the case of the 2001 event, probably preslip.