Prediction of slow-slip events by quiescent periods of deep low-frequency tremor

Akio Katsumata[1]; Noriko Kamaya[2]

[1] Meteorological College, JMA; [2] JMA

Deep low-frequency tremors along the strike of the subducting Philippine plate show intermittent activation. Obara and Hirose (2003) detected slow-slip events (SSE) and simultaneous activation of deep low-frequency tremor in western Ehime. We investigated quiescent periods between tremor-active periods and its relationship to slow-slip events based on the unified seismic catalog produced by the JMA. The lengths of quiescent periods are usually almost stable. But they sometimes show gradual reductions and extensions.

A slow-slip event was detected by the GEONET around the Bungo channel from August to October, 2003. During the period, deep low-frequency tremor had been active in the region, and quiescent periods had been kept short. One and half months prior to the SSE, shortening of the quiescent periods seems to have started in the eastern part of the tremor-active region near Bungo channel. They reduced from usual level of 10-30 days to several days. After the SSE, gradual extension of the quiescent periods was also observed.

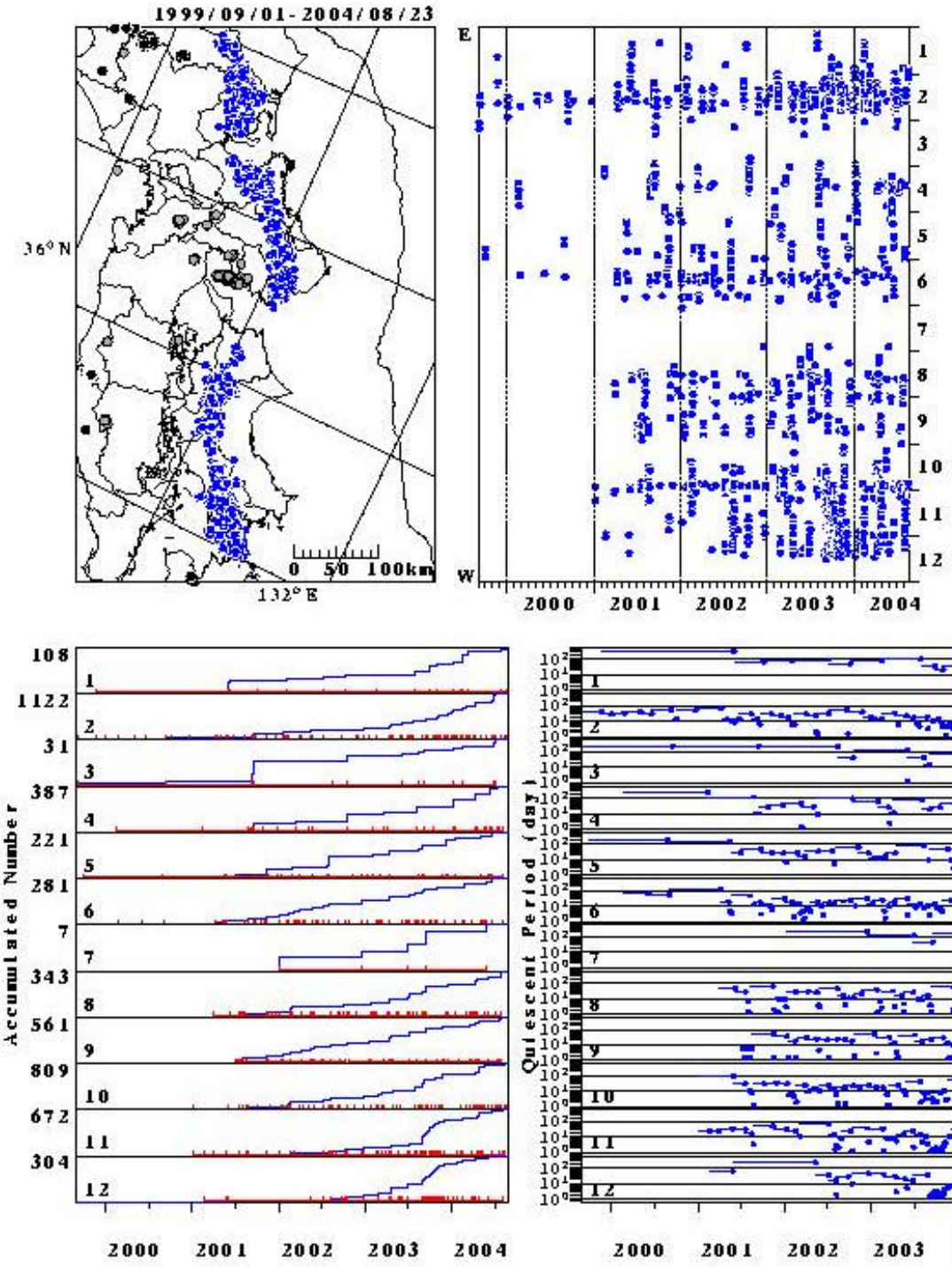
Obara and Hirose (2003) reported occurrence of SSE in the western Ehime in Jan. 2001, Aug. 2001, Feb. 2002 and Aug. 2002. Reductions of the quiescent periods were observed about one month prior to the SSE in Aug. 2001, Feb. 2002 and Aug. 2002. The periods of about one month is longer than the SSE duration of several days.

Similar quiescent period reductions were observed in Mar. 2003, May 2003, Apr. 2004, Aug. 2004 in the western Shikoku, in Jul. 2001, Jan. 2002, May 2002, Sep. 2002, May 2003, Sep. 2003, Apr. 2004 in the eastern Shikoku, in Jun. 2001, Nov. 2001, Mar. 2002, Mar. 2003, Nov. 2003, May 2004 in the Kii Peninsula. The case in Apr. 2004, simultaneous changes of the quiescent periods occurred in the whole area of Shikoku.

A long-duration SSE has been observed in the Tokai area since 2000. Ishigaki et al. (2004) pointed out activation of tremor generation which was simultaneous with relatively fast slip-velocity of the SSE in 2003. Quiescent periods had been short from Sep. 2003 to May 2004. Shortening started around Apr. 2003. Whereas the change of the quiescent periods may not have coincided with the speeding up of SSE, it would be noticeable that the tremor-active period and the high-speed SSE period was overlapped.

Many of SSE in the southwest Japan accompany reduction of quiescent periods about a month prior to the slip. This means that these SSE are possible to be predicted.

We used seismic data from the National Research Institute for Earth Science and Disaster Prevention, University of Tokyo, Nagoya University, Kyoto University, Kochi University, Kyushu University, the National Institute of Advanced Industrial Science and Technology, Shizuoka prefectural government, the Japan Marine Science and Technology Center, and the Japan Meteorological Agency.


1999/09/01-2004/08/23
36° N
132° E
0 50 100km
E
W
2000
2001
2002
2003
2004
Accumulated Number
108
1122
31
387
221
281
7
343
561
809
672
304
Quiescent Period (day)