Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

SSS01-13 Room:104 Time:May 25 13:45-14:10

Possibility of the use of seismicity data for monitoring spatiotemporal slip variation on a plate interface

KATO, Naoyuki[1*], KATSUMATA, Kei[2]

[1]Earthquake Research Institute, University of Tokyo, [2]Institute of Seismology and Volcanology, Hokkaido University

During an interseismic period of large interplate earthquakes, stresses on and around the plate interface are expected to be varied by evolution of aseismic sliding. Numerical simulations on the basis of a rate- and state-dependent friction law indicate that aseismic sliding gradually propagates updip on the seismogenic plate interface due to stress concentration generated by deep continuous stable sliding. The characteristics of propagating aseismic sliding such as the amplitude and propagation speed depend on frictional properties (Kato and Seno, 2003). Since a large earthquake that breaks the entire seismogenic plate interface nucleates near the front of the aseismic sliding zone, monitoring of aseismic sliding may be useful for forecasting the earthquake. The propagating aseismic sliding increases shear stress ahead of the aseismic sliding zone and relaxes stress around the slipped zone. This stress variation may affect seismic activity. For example, the numerical simulations suggest that seismic quiescence precedes the occurrence of a large interplate earthquake a few months to a few years (Kato et al., 1997). Propagating aseismic sliding also influences crustal deformation, which can be monitored by geodetic observations such as Global Positioning System and strainmeters. However, the simulation results suggest that the amplitudes of abnormal crustal deformation are small except for that caused by possible preseismic sliding immediately before earthquake occurrence. In contrast, the amplitudes of stress changes may be larger than 0.01 MPa, which is thought to be large enough to affect seismic activity. The simulation results also suggest that seismic activity may be affected by episodic aseismic slip events, which may be useful for detecting aseismic slip events (Kato and Hirasawa, 1999). Using a homogeneous earthquake catalog, Katsumata (2011) found that seismic quiescence appeared for about five years before the 2003 Tokachi-oki earthquake (Mw=8.3), along the Kuril trench. He evaluated stress changes due to aseismic sliding on a deeper part of plate boundary to compare them with the focal mechanisms of earthquakes in the quiescent regions. This observation is consistent with the numerical simulation. We will report some other examples of changes in seismic activity, which may be caused by stress variation due to aseismic sliding. We emphasize the importance of homogeneous earthquake catalogs and focal mechanisms of affected earthquakes for detecting stress changes and comparison between observations and model predictions.

References

Kato, N., and T. Hirasawa (1999), Pure Appl. Geophys., 155, 425-442.
Kato, N., and T. Seno (2003), Earth Planet. Sci. Lett., 210, 53-63.
Kato, N., M. Ohtake, and T. Hirasawa (1997), Pure Appl. Geophys., 150, 249-267.
Katsumata, K. (2011), J. Geophys. Res., 116, B10307.

Keywords: earthquake cycle, seismic quiescence, friction, aseismic sliding