Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

SSS01-03 会場:102B 時間:5 月 24 日 14:45-15:00

関東地方における2011年東北地方太平洋沖地震による静的クーロン応力変化と地震活動度変化の相関性
Correlation between Coulomb stress imparted by the 2011 Tohoku-Oki earthquake and seismicity rate change in Kanto, Japan

石辺 岳男[1*] ; 佐竹 健治[1] ; 酒井 慎一[1] ; 島崎 邦彦[1] ; 鶴岡 弘[1] ; 横田 裕輔[2] ; 中川 茂樹[1] ; 平田 直[1]
ISHIBE, Takeo[1*] ; SATAKE, Kenji[1] ; SAKAI, Shin'ichi[1] ; SHIMAZAKI, Kunihiko[1] ; TSURUOKA, Hiroshi[1] ; YOKOTA, Yusuke[2] ; NAKAGAWA, Shigeki[1] ; HIRATA, Naoshi[1]

[1] 東京大学地震研究所, [2] 海上保安庁海洋情報部
[1]Earthquake Research Institute, the University of Tokyo, [2]Japan Coast Guard, Hydrographic and oceanographic department

We show that the seismicity rate increase in the Kanto region around Tokyo following the 2011 Tohoku-Oki earthquake (*M*w9.0) was well correlated with the static increases in the Coulomb failure function (ΔCFF) transferred from the Tohoku-Oki earthquake sequence. Because earthquakes in the Kanto region exhibit various focal mechanisms, the receiver faults for the ΔCFF were assumed to be reliable focal mechanism solutions of ˜3,000 earthquakes compiled from three networks (F-net, JMA network, and MeSO-net).

The histograms of ΔCFF showed that more events in the postseismic period had positive ΔCFF values than those in the preseismic period (2008 April 1 - 2011 March 10). Among the 928 receiver faults showing the significant ΔCFF with absolute values ≥ 0.1 bars in the preseismic period, 717 receiver faults (77.3 %) indicated positive ΔCFF. On the contrary, 1,334 (88.2 %) out of 1,513 receiver faults indicated positive ΔCFF in the postseismic period. We confirmed that the result is similar for the longer preseismic period, between 1997 October 1 and 2011 March 10.

To test the significance of the difference in the distribution of ΔCFF between preseismic and postseismic periods, we used a Monte Carlo method with bootstrap resampling. As a result, the ratio of positive ΔCFF randomly resampled from ΔCFF values in the preseismic period never exceeded 83.1%, even after 10,000 iterations. This supports the findings of Toda & Stein [2013]; however, our calculation is more reliable than theirs because we used a much larger number of focal mechanisms compiled from the three networks. It also proves that the static stress changes transferred from the Tohoku-Oki earthquake sequence are responsible for the changes in the seismicity rate in the Kanto region.

Earthquakes of focal mechanisms with positive ΔCFF values drastically increased, while those with negative ΔCFFs showed no obvious changes except for immediately after the mainshock. This fault-dependent seismicity rate change strongly supports the contribution of the Coulomb stress transferred from the Tohoku-Oki sequence to the seismicity rate change in the Kanto region. Immediately following the mainshock, earthquakes of all types of focal mechanisms were activated, but the increased seismicity rate of earthquakes with negative ΔCFFs returned to the background level within a few months. This suggests that there might be other contributing factors to the seismicity rate change such as dynamic stress triggering or pore-fluid pressure changes.

Acknowledgements
This study was supported by the Special project for reducing vulnerability for urban mega earthquake disasters from the Ministry of Education, Culture, Sports, Science and Technology of Japan.

キーワード: 2011 年東北地方太平洋沖地震, 地震活動度変化, 関東地方, 静的クーロン応力変化
Keywords: 2011 Tohoku-Oki earthquake, Seismicity rate change, Static changes in the Coulomb failure function, Kanto region