

## Correlation between Coulomb stress imparted by the 2011 Tohoku-Oki earthquake and seismicity rate change in Kanto, Japan

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We show that the seismicity rate increase in the Kanto region around Tokyo following the 2011 Tohoku-Oki earthquake ( $M_w$ 9.0) was well correlated with the static increases in the Coulomb failure function ( $\Delta CFF$ ) transferred from the Tohoku-Oki earthquake sequence. Because earthquakes in the Kanto region exhibit various focal mechanisms, the receiver faults for the  $\Delta CFF$  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  $\Delta CFF$  showed that more events in the postseismic period had positive  $\Delta CFF$  values than those in the preseismic period (2008 April 1 - 2011 March 10). Among the 928 receiver faults showing the significant  $\Delta CFF$  with absolute values  $\geq 0.1$  bars in the preseismic period, 717 receiver faults (77.3 %) indicated positive  $\Delta CFF$ . On the contrary, 1,334 (88.2 %) out of 1,513 receiver faults indicated positive  $\Delta CFF$  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  $\Delta CFF$  between preseismic and postseismic periods, we used a Monte Carlo method with bootstrap resampling. As a result, the ratio of positive  $\Delta CFF$  randomly resampled from  $\Delta CFF$  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  $\Delta CFF$  values drastically increased, while those with negative  $\Delta CFF$ s 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  $\Delta CFF$ s 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.

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Keywords: 2011 Tohoku-Oki earthquake, Seismicity rate change, Static changes in the Coulomb failure function, Kanto region