

M8 earthquakes in Kanto likely triggered by large events off eastern Japan between Sanriku and the Boso Peninsula

IMOTO, Masajiro^{1*}, FUJIWARA, Hiroyuki¹, ENESCU, Bogdan¹

¹NIED

Only the 1923 and 1703 earthquakes in the Kanto region, central Japan, are widely accepted as M8-class earthquakes that were caused by the relative motion between the Philippine Sea Plate (PH) and the North American Plate (NA) along the Sagami trough. These two events followed M8 earthquakes along the Japan Trench ? where the Pacific Plate (PA) is subducting beneath NA ? in 1896 and 1677, respectively. Assuming a Brownian passage time model based on historical earthquake data, we have simulated earthquake sequences to determine whether these Kanto events were observed just by chance following the Japan Trench megathrust earthquakes. It is not conclusive but probable, at a significance level of 95%, that this historical evidence was not observed by chance. Thus, we assume that a large earthquake along the Japan Trench can trigger an M8 earthquake along the Sagami trough. This triggering could be interpreted as follows. First, we assume that the stress regimes in the Kanto area and along the Japan Trench are mainly governed by the relative motion between NA and PA. Beneath the Kanto area, the relative motion between NA and PA is decomposed into two components along the directions of relative motion between NA and PH, and PH and PA, respectively. If motion between PH and PA could take place, the accumulated stress may be partially released and at the same time the orientation of the resultant stress may be rotated toward a direction compatible with the relative motion direction between NA and PH. Therefore, an M8 Kanto earthquake becomes more probable than before. This interpretation could be confirmed by a Coulomb failure stress analysis, where the resultant stresses are examined based on the fault geometry of the 1923 Kanto earthquake, after a large presumed relative movement between PH and PA beneath the Kanto area due to the 2011 Tohoku earthquake (M9.0) along the Japan Trench.

Keywords: M8 earthquakes in Kanto, 2011 Tohoku earthquake, Triggering, Brownian passage time model, Monte Carlo method, Coulomb failure stress analysis