



## Stress Perturbations along Sumatra Island due to Mega-Earthquake Occurrences

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The perturbation of principle stress orientation is related to the occurrences of mega-earthquakes which altered the stress condition in the earth's crust. Therefore, fault parameters, i.e. type, orientation, and slip, are crucial to infer the variation of the crustal in-situ stress field in spatial and time. Sumatra Island has a high seismic activity due to its close location to the subduction zone between the Indo-Australian and Eurasian plates as well as the existence of the Great Sumatran Fault (GSF). According to the historical seismicity of Sumatra Island, there are three mega-earthquakes with  $M_w > 8$ : (1) 2004 Sumatra-Andaman earthquake  $M_w \sim 9.0$ , (2) 2005 Nias-Simeulue earthquake  $M_w \sim 8.6$  and (3) 2012 off the west coast of Sumatra earthquake  $M_w \sim 8.6$ . In addition, there are 797 focal mechanisms data with  $M_w > 5$  and focal depth  $< 250$  km from 1976 to 2017. This catalog was compiled from Global Centroid Moment Tensor (GCMT) and the International Seismological Centre (ISC) bulletin. Those data were used in stress inversion to retrieve the perturbation of principal stress orientations before and after the mega-earthquakes using iterative joint stress inversion method. To better understand the correlation between the variation of principal stresses and the slip of the three mega-earthquakes with  $M_w > 8$ , we model the static Coulomb stress transfer ( $\Delta CFS$ ). Our results produced remarkable changes of maximum principle stress orientation after mega-earthquakes near from the corner of Northern Sumatra Island with perturbed  $\sim 30^\circ$  and close to the NE direction of Nias Island (perturbed  $\sim 16^\circ$ ). In addition, the models of stress transfer showed good correlation between the distribution of aftershocks and increased Coulomb stress area. Judging from Coulomb Failure Stress ( $\Delta CFS$ ) models and the orientations of principle stress axes, our observations suggest that these results could be the first approach to analyse the stress level and hence, its seismic hazard potential. Following this research, a further stress modeling is planned to have a further insight on how the mechanism of the stress rotation after mega-earthquakes in the Sumatra Island.

**Keywords:** Stress estimation, Principle stress orientation, Coulomb Failure Stress