Numerical Modeling of Earthquake Triggering
Due to Erosion Unloading in Central Taiwan

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Central Taiwan is a seismic active region that also experiences frequent landslides and typhoons with large amounts of precipitation. In this study, we analyze stress changes induced by erosional mass unloading and evaluate their contribution to earthquake triggering in Central Taiwan. We calculated Coulomb stress changes due to erosional unloading at hypocenters of large earthquakes with $M_L \geq 6.0$ in Central Taiwan using a 3D elastic finite element model (Figure 1). The erosional unloading was estimated from published interpolated erosional rates of fluvial suspended sediment observations from 1970 to 1999 (Dadson et al., 2003). The failure stress changes calculated based on decadal-scale erosion rates at hypocenters were within the range of 80 – 140 (bar/yr $\times 1e^{-5}$). For comparison, they are significantly higher than stress changes calculated for the triggering of the New Madrid earthquakes due to erosion (20 – 25) (bar/yr $\times 1e^{-5}$). Our preliminary results indicate that long-term erosional unloading imposes long-term stress triggering effects (around 100 years or even longer) on the nucleation of the studied six mainshocks. We also began exploring potential seismic triggering of two $M_L \geq 6.0$ mainshocks that occurred in central Taiwan within one year after the super wet 2009 Morokat Typhoon (~3 meter of rain within 4 days) hit the area. In this study we use estimated erosion rates derived by integrating sediment flux before and after Typhoon Morokat, which are applied to our 3D finite element model. Uncertainties in the estimated erosion rates and their consequent impact on stress changes related to earthquakes triggering will also be discussed.

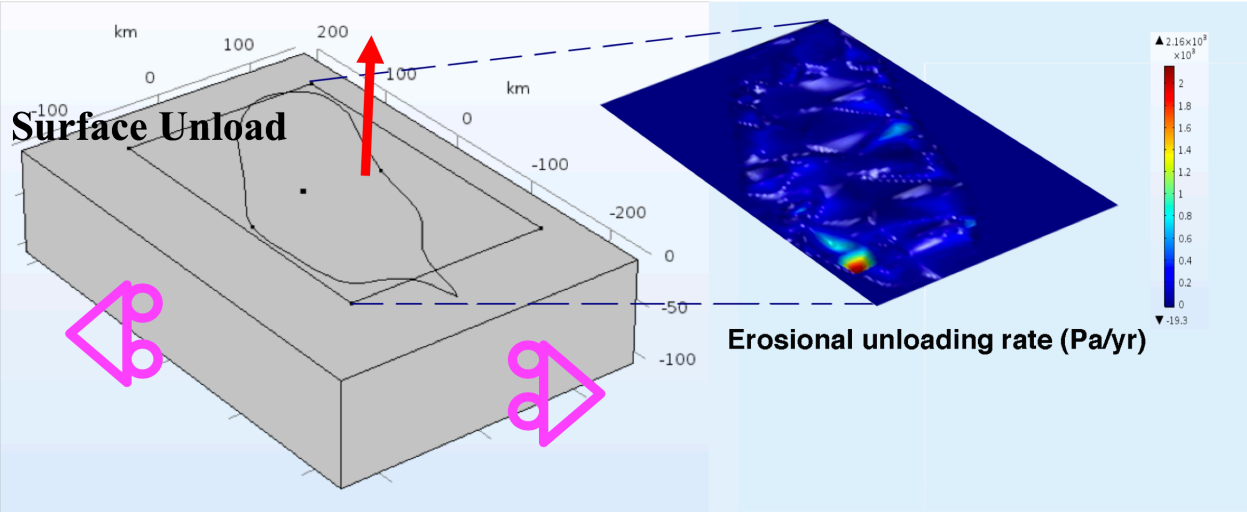

Figure 1. 3D Elastic Finite Element Modeling Structure.