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The factors affecting the rate of large earthquakes on Japanese inland faults

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This research aims to assess the strength of the relationship between seismological variables and the rate of large earthquakes occurring along Japanese mainland faults. We define a large earthquake as having magnitude greater than five and consider all faults within the National Institute of Advanced Industrial Science and Technology catalog. To estimate the effects of the seismological variables, we use a recent extension to the Cox proportional hazards model. The simple Cox proportional hazards model examines the strength of the relationship between covariates and the rate of the event. The recent extension allows for events to reoccur multiple times, and uses this extra knowledge of recurrences to obtain improved estimates of effect size. Here we use this extended Cox proportional hazards model to determine which seismic variables most affect the rate of large earthquakes, considering all known recurrences of large earthquakes along a fault. We find that the general seismicity rate along a fault, inclusive of all small earthquakes, affects the rate of large earthquakes occurring along the same fault. That is, seismic rate increases risk of a large earthquake along a fault. We present plots showing the hazard rates along individual faults over time and highlight the change in hazard rate prior to a large earthquake. We hope to make a predictive model using this information and submit the model to the Japan CSEP initiative.

Keywords: Earthquake Prediction, Japanese Active Faults, Cox Proportional Hazards Model