An Elastic Impact Model of High-Frequency Earthquake Radiation: Predictions and Observational Constraints

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Most earthquakes occur within complex fault zones containing numerous intersecting discrete strands. To approximate the complex interactions fault-zone structures must undergo to accommodate large-scale fault motion, we have proposed a stochastic elastic impact model for predicting high-frequency ground motions. Here we highlight some of the main predictions of this model, describe how the predictions differ from standard single rough-fault predictions, and point out several new observations that suggest the predictions from the elastic impact model may have merit. We show that standard seismological 'stress drop' measurements may have a very different interpretation that is unrelated to the true stress drop but instead dependent on the local geometry of the fault-zone strands. We also show that radiation patterns become more isotropic at high frequencies even in the absence of scattering, and that this behavior is consistent with the predictions of the elastic impact model. Ongoing and future work will refine the model and test it with new observational constraints.

	Cause of High-Frequency Radiation	**Focal Mechanism Frequency Dependence**
Elastic Impact Model Prediction	Size and shape of fault-zone structures - Frequency inversely related to structure length scale)	Transition from fault slip at low frequency (double couple) to impacts at high frequency (isotropic)
Relevant Observation	Fault map inferred structure size and alignment correlates with seismologically measured 'stress drop' as predicted by impact model	Focal mechanisms become more isotropic at high frequency, even when scattering is relatively small, as predicted by impact model