EGU22-10750
https://doi.org/10.5194/egusphere-egu22-10750
EGU General Assembly 2022
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Ground motion simulations relating topographic amplification and landslide initiation during the Mw7.6 2005 Kashmir Earthquake.

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The 2005 Mw 7.6 Kashmir earthquake is the most devastating earthquake to occur along the Himalayan arc, resulting in 87,000 fatalities, 69,000 injuries, and 2.8 million people left homeless. The rupture occurred on a 30° NE dipping thrust fault and generated a ~70 km long surface rupture that concentrated much of the damage. Along with the primary hazard caused by the seismic shaking, many secondary hazards, including nearly 3,000 coseismic landslides, were initiated due to the shaking from this event. In the absence of seismic data recorded near the source of this earthquake, we attempt to understand the relationships between ground shaking and coseismic landslides by using numerical techniques to model the ground motions and topographic amplification from the Kashmir earthquake. We use the spectral element method implemented in SPECFEM3D to model kinematic rupture scenarios for the Kashmir earthquake in both high resolution and flat topography, obtaining a topographic amplification factor by comparing these simulations. We generate a range of seismic source models using the rupture generator FakeQuakes, starting with a mean slip model from the earthquake and adding stochastic variations to both static and kinematic rupture properties to produce variable rupture scenarios. The advantages of this technique, compared to calculating ground motions from one finite fault model, is that by adding stochastic variations, the source model has higher, more realistic, frequencies, and that it enables the investigation of how varying rupture properties affect topographic amplification. We calculate both peak ground velocity (PGV) and topographic amplification for each scenario and compare the average and standard deviations to locations of landslide initiation. Preliminary results from five earthquake sources shows that with changing source parameters, PGV and topographic amplification patterns remain relatively constant and that positive amplifications are concentrated at the peaks of ridges and negative amplifications are concentrated in valleys. There are no obvious relationships between the patterns of amplification and landsliding, possibly due to limitations in landslide mapping. Other causes of landslides--such as variations in lithology, distance to anthropogenic features (roads, construction), distance to faults, and distance to ridges, and rivers--will be investigated further to understand the relationships between topographic amplification and other triggers. Future work includes

combining these results with similar studies for earthquakes with different source properties and in different topographic settings to further understand the controlling factors of topographic amplification as a trigger for coseismic landslides.