

Cascadia subduction zone earthquakes and landslides: How will the hillslopes handle the big one?

The last decade has provided unexpected lessons in the enormous risks from great subduction earthquakes: Sumatra 2004, Chile 2010, and Japan 2011 were each devastating, resulting in surprising impacts distinct from shallow seismic events. Similar large-magnitude earthquakes are known to occur on the Cascadia subduction zone (CSZ), with the potential of rupturing the entire 1100 km length of the Pacific Northwest plate boundary. Coseismic landslides represent one of the greatest risks to the millions of people living along the Cascadia Subduction Zone, from northern California to southern British Columbia. Empirically derived relationships between earthquake magnitude and landsliding are well studied, and suggest a magnitude 9 earthquake is likely to trigger thousands of landslides. Because a magnitude 9 subduction earthquake is well known to have occurred just over 300 years ago, evidence of coseismic landslides triggered by this event should still be present in the landscapes of the Washington and Oregon Coasts. We are systematically hunting for these landslides through field and LiDAR mapping and are using a combination of radiocarbon dating and surface roughness analysis, a method first developed to study landslides near to the Oso 2014 disaster site, to develop more robust regional landslide chronologies. In addition, we compare our results to new probabilistic quantification of ground motions from a M9 earthquake, including uncertainties, which is a novel approach to delivering synthetic seismograms for engineering and other purposes. With these new data, we hope to better characterize how the landscape will respond to the next large subduction zone earthquake in the Pacific Northwest.