Development of an Incorporated Platform to Characterize Hydrology-Driven Landslide Hazards in Northwestern US

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The mountainous northwestern US is prone to heavy rainfall in winter, which results in hundreds of landslides, human casualties, and billions of dollars of expense to federal and state budgets for fixing railways, highways, and dams. Precipitation is a major hydrologic variable and a landslide trigger. The linkage between precipitation and landslides has been very well studied over many decades, but mainly in location-specific studies. Studies covering broad areas are typically after-the-fact assessments correlating storm intensity, topography, and landslide occurrence.

This talk highlights our new initiative funded by NASA IDS Program that aims to characterize the major hydrology-driven landslides in the northwestern US (Washington, Oregon) at a large scale with high resolution and accuracy, using radar remote sensing techniques – time-series InSAR (Interferometric Synthetic Aperture Radar) methods, TRMM (Tropical Rainfall Measuring Mission) precipitation product, and SMAP (Soil Moisture Active Passive) soil moisture. In this project, we will bring these fragmented observations and measurements to a single framework for the modeling of rapidly accelerating and slow-moving landslides. InSAR time-series displacement with dense scatterers on the slope will give an indication of landslide occurrence and help characterize the slide-body volume and basal slip surface based on geomechanical modeling. Precipitation and soil moisture sensed from space will contribute to creating hydrogeologic models with topographic features. These crucial parameters will be tracked through slope stability analysis and iterative numerical simulations, and then plugged into state-of-art landslide dynamics and run-out models.

We'll present our initial results, and the road map to accomplish this project that will ultimately enhance our understanding about the inter-relationships between topographic and geologic settings, hydrologic variables, landslide mechanisms and kinematics inferred from time-series measurements and landslide modeling on a regional scale.