Examining the causes of a devastating debris flow

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Storm-triggered landslides cause loss of life, property damage, and landscape alterations. For instance, the remnants of Hurricane Camille in 1969 caused 109 deaths in central Virginia, after 600 mm of rain fell in mountainous terrain in 6 hours. More recently, on 8 August 2010, a rainstorm-induced landslide devastated the Chinese county of Zhouqu, causing more than 1000 deaths. A new modeling study by Ren, published by *Geophysical Research Letters*, examines the multiple factors, both natural and human caused, that came together to produce this event. The triad of storm-triggered landslides is geological condition, surface loading and vegetation roots, and extreme precipitation.

Extreme precipitation can be explained by three factors: low-level moisture buildup, conditional instability, and a lifting mechanism. When several factors (e.g., El Niño years, hurricane remnants, lifting mechanisms (e.g., orography, cold fronts, jets, and differential heating from land cover contrast), and weather pattern phase-lock) work in synergy in a region, extreme precipitation may occur.

Using a multiple-phase scalable and extensible geofluid model, the author considered geological features of the region, as well as an earthquake, drought, deforestation, and topsoil erosion before the triggering storm. Previously, drought conditions created cracks and crevices in the surface; these cracks and crevices were deepened by the 2008 M7.9 Wenchuan earthquake.

Another key factor in setting up the conditions for the landslide was human-induced deforestation and topsoil erosion, the study found. The results "underscore the urgency for a high priority program of re-vegetation of Zhouqu County, without which the region will remain exposed to future disastrous, progressive bulking type landslides," the author reports.

More information: Ren, D. (2014), The devastating Zhouqu storm-triggered debris flow of August 2010: Likely causes and possible trends in a future warming climate, *J. Geophys. Res. Atmos.*, 119, 3643-3662, DOI: 10.1002/2013JD020881

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