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Extreme precipitation and high-impact landslides

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It is well known that extreme or prolonged rainfall is the dominant trigger of landslides; however, there remain large uncertainties in characterizing the distribution of these hazards and meteorological triggers at the global scale. Researchers have evaluated the spatiotemporal distribution of extreme rainfall and landslides at local and regional scale primarily using in situ data, yet few studies have mapped rainfall-triggered landslide distribution globally due to the dearth of landslide data and consistent precipitation information. This research uses a newly developed Global Landslide Catalog (GLC) and a 13-year satellite-based precipitation record from Tropical Rainfall Measuring Mission (TRMM) data. For the first time, these two unique products provide the foundation to quantitatively evaluate the co-occurence of precipitation and rainfall-triggered landslides globally.

The GLC, available from 2007 to the present, contains information on reported rainfall-triggered landslide events around the world using online media reports, disaster databases, etc. When evaluating this database, we observed that 2010 had a large number of high-impact landslide events relative to previous years. This study considers how variations in extreme and prolonged satellite-based rainfall are related to the distribution of landslides over the same time scales for three active landslide areas: Central America, the Himalayan Arc, and central-eastern China. Several test statistics confirm that TRMM rainfall generally scales with the observed increase in landslide reports and fatal events for 2010 and previous years over each region. These findings suggest that the co-occurrence of satellite precipitation and landslide reports may serve as a valuable indicator for characterizing the spatiotemporal distribution of landslide-prone areas in order to establish a global rainfall-triggered landslide climatology. This research also considers the sources for this extreme rainfall, citing teleconnections from ENSO as likely contributors to regional precipitation variability. This work demonstrates the potential for using satellite-based precipitation estimates to identify potentially active landslide areas at the global scale in order to improve landslide cataloging and quantify landslide triggering at daily, monthly and yearly time scales.