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Constraining relationships between rainfall and landsliding with satellite derived rainfall measurements and landslide inventories.

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In mountainous and hilly regions, landslides are an important source of damage and fatalities. Landsliding correlates with extreme rainfall events and may increase with climate change.
Still, how precipitation drives landsliding at regional scales is poorly understood quantitatively in part because constraining simultaneously landsliding and rainfall across large areas is challenging.
By combining optical images acquired from satellite observation platforms and rainfall measurements from satellite constellations we are building a database of landslide events caused by with single storm events. We present results from storm-induced landslides from Brazil, Taiwan, Micronesia, Central America, Europe and the USA. We present scaling laws between rainfall metrics derived by satellites (total rainfall, mean intensity, antecedent rainfall, ...) and statistical descriptors of landslide events (total area and volume, size distribution, mean runout, ...). Total rainfall seems to be the most important parameter driving non-linearly the increase in total landslide number, and area and volume. The maximum size of bedrock landslides correlates with the total number of landslides, and thus with total rainfall, within the limits of available topographic relief. In contrast, the power-law scaling exponent of the size distribution, controlling the relative abundance of small and large landslides, appears rather independent of the rainfall metrics (intensity, duration and total rainfall). These scaling laws seem to explain both the intra-storm pattern of landsliding, at the scale of satellite rainfall measurements (∼25kmx25km), and the different impacts observed for various storms.
Where possible, we evaluate the limits of standard rainfall products (TRMM, GPM, GSMaP) by comparing them to in-situ data. Then we discuss how slope distribution and other geomorphic factors (lithology, soil presence,...) modulate these scaling laws. Such scaling laws at the basin scale and based only on a-priori information (topography, lithology, . . .) and rainfall metrics available from meteorological forecast may allow to better anticipate and mitigates landsliding associated with extreme rainfall events.