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Innovative satellite-based landslide risk assessment for data-poor regions

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Landslides are a globally significant natural hazard, and providing risk assessment for assets in vulnerable locations is often of primary importance. However, field-scale assessment of the geophysical parameters that determine landslide hazard can be both time and cost-intensive, which may not suit all needs. In particular, humanitarian crises often result in displacement of populations either temporarily or for longer periods, and these highly vulnerable populations may lack financial resources or technical expertise to carry out landslide risk assessment, potentially leaving them threatened by significant hazards. Simple, quickly deployable methods for landslide risk assessment using globally available satellite data could provide valuable information to stakeholders in highly vulnerable locations with transient populations.

We report on a case study of regional landslide hazard and risk associated with the region encompassing the refugee camps in southern Bangladesh. This is an area where cyclonic and monsoonal rainfall and steep slopes exacerbate the conditions for landsliding, particularly in areas that have been impacted by the rapidly expanding camps. Given the limited resources available for the humanitarian stakeholder community, there has been limited efforts to assess landslide hazard over this area. Using primarily freely-available NASA satellite data, and a novel set of machine learning methods that can flexibly incorporate other data inputs, we have produced a regional susceptibility map with an accuracy of >80% based upon a dataset of >1700 landslides mapped from Google Earth imagery. Combining this with NASA near-real time precipitation data we are able to provide near-real time hazard assessment, following the global approach of the Landslide Hazard for Situational Awareness (LHASA) model developed by Kirschbaum & Stanley (2018). This flexible hazard model can be combined either with Open Street Map data or infrastructure data provided by stakeholders to estimate either itemized or mapped exposure assessment for landslides.

While a landslide risk product based solely on satellite data will be unlikely to outperform high resolution, field measurement based estimates, our methodology provides a flexible and rapidly deployable method for data poor regions where landslide hazards may be elevated and vulnerable communities are at risk. Such an approach could be useful in other locations where short term risk-relevant decisions could benefit from coarse, regional data where no local data is available.