Geophysical Research Abstracts
Vol. 21, EGU2019-5917, 2019
EGU General Assembly 2019

When informal urban activities increase the likelihood of landslides?

Elisa Bozzolan, Elizabeth Holcombe , Thorsten Wagener , and Elisa Bozzolan
University of Bristol, Civil engineering, Bristol, United Kingdom (eb16029@bristol.ac.uk)

The combination of a rapid and unplanned urban development can significantly affect landslide occurrences in the humid tropics, where rainfall events of high intensity and duration are the dominant trigger. However, the attention of current landslide hazard studies is largely focused on natural slope processes, excluding the role of urbanisation on slope stability. The aim of our study is to understand the relative influence of urbanisation features on local slope stability in order to target local engineering actions for landslide risk reduction.
We use the software CHASM (Combined Hydrology and Stability Model) to diagnose which combinations of natural and urban factors lead to slope failure in Saint Lucia (Caribbean). CHASM is a physically based model which combines soil hydrology and slope stability assessment, and Saint Lucia represents a typical data-scarce and resource-limited location in the humid tropics, in which informal constructions of houses has led to increased landslide risk. Instead of relying on existing records, which are generally lacking or very incomplete for landslides, plausible ranges of preparatory (such as slope, cohesion, friction angles), triggering (rainfall) and aggravating factors (i.e. the informal urban activities considered: house density and house water network management) are defined for this location, and possible combinations of these factors are sampled from. The resulting combinations define the characteristics of thousands of typical slopes that can be found in the study site, which are analysed with CHASM. The influence of informal urban features on site hydrology and stability mechanisms is evaluated and then implemented in denser urban contexts, characteristic of unplanned settlements. The results of CHASM can be generalised, defining critical thresholds which separate stable and unstable conditions considering both natural factors and the degree of urbanisation. Once the triggers are understood, possible mitigation strategies can be evaluated. The ability to define local urban rainfall threshold for landslide slope stability, also considering the urban factor, helps the decision-making process to prioritize the areas of interest and locally define the main causes of instability, natural and/or urban. The independence of the method from the landslide records, coupled with a possible local adaptation, facilitates the transferability of the results to other urbanised or urbanising areas.