

GEOMorphic hazards and compound events in a changing TROPical East Africa

GEOTROP

ABSTRACT

Flash floods occur worldwide. Triggered by intense rainfall spanning only a few hours, they frequently occur together with landslides. These landslides can deliver hillslope material to the river system, leading to amplified and devastating impacts. Landslides and flash floods are influenced by the daily to monthly variations in rainfall that precondition the landscape and change their likelihood of occurrence. The co-occurrence, interaction, and the preconditioning effect of rainfall reflects the compounding nature of these hazards. The tropics provide favourable conditions for their occurrence, with inequalities and challenging socioeconomic conditions often increasing their impact. Understanding their occurrence is therefore essential but require long-term datasets that are usually unavailable in these regions. In this project, we aim to better understand current and future spatial and temporal patterns of co-occurring landslide and flash flood events in the tropics and the effect of preconditioning rainfall in this process. To do this, we focus on the western branch of the East African Rift (WEAR). We developed two complementary remote sensing methodologies that allow for the spatio-temporal detection of landslide and flash flood events in the challenging data-scarce conditions of the tropics. Through these methodologies we have identified more than a hundred new co-occurring landslide and landslide and flash flood events in the WEAR. Our results suggest that preconditioning rainfall plays a central role in understanding their occurrence, along with land use and land cover and landscape geological history. We discuss that pessimistic future rainfall, population and land use scenarios could increase these co-occurring events and have a larger impact due to increase demographic pressures. This research offers new information and tools relevant to a region that is commonly underrepresented in global studies, and that can serve as a foundation for further landslide and flash flood research.

Keywords: Compound events, Landslide, Flash floods, Preconditioning rainfall, Remote sensing.