GEOTROP

GEOmorphic hazards and compound events in a changing TROPical East Africa

DURATION
1/09/2022 – 1/12/2025

BUDGET
249 772 €

PROJECT DESCRIPTION

CONTEXT AND OBJECTIVES

Landslides and flash floods are geomorphic hazards (GH) that often result from a combination of interacting processes across multiple spatial and temporal scales. GH events are linked to climate drivers (e.g., rainfall intensity) and land drivers (e.g., vegetation patterns). Land transformation such as deforestation has impacts on GH events and climate change will alter many drivers.

The tropics are environments where GH are under-researched. In mountainous regions, high population densities with high societal vulnerability are common and frequently on the rise. GH events disproportionately impact these regions. In the future, the frequency and/or impacts of GH events will be more severe; not only due to, for example, climate change and deforestation, but also due to population growth and increased exposure to disasters.

In many instances, landslides and flash floods occur very quickly. They co-occur and interact, leading to events with more severe impacts. The combination of processes (climate drivers and/or hazards) leading to a significant impact is referred to as a 'compound event'. Although many GH can be assumed to be compound events, the understanding, analysis, quantification and prediction of such events is still in its infancy, especially at a regional level.

The GEOTROP project aims to assess the role of land transformation and climate change on the occurrence of compound events in tropical East Africa.

The specific objectives (SO) are:

- SO1: To develop an unprecedented spatio-temporal regional inventory of GH events;
- SO2: To understand the spatial distribution of the GH events in the landscape, and to assess the role of land transformation on their occurrence;
- SO3: To uncover the interplay of multiple land and climate drivers in triggering GH compound events;
- SO4: To project the future evolution of GH compound events so that future hazard and risk hotspots can be identified.

GEOTROP also aims to strengthen capacities of African institutions involved in disaster risk reduction.

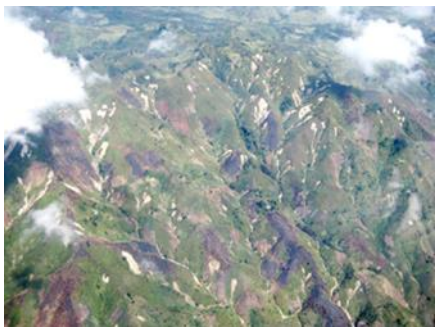

Figure 1. Landslides triggered by an intense thunderstorm over the deforested hillslopes of Kalehe (DR Congo)

GEOTROP

Figure 2. Flash flood triggered by an intense thunderstorm in the region of Kalehe (DR Congo)

STUDY AREA

The study area (Area of Interest- AOI) of GEOTROP is the western branch of the East African Rift; a mountainous region characterized by a large range of tropical climates and environmental conditions. Alongside a natural landscape diversity, this AOI is characterized by an alternation of contrasted pristine and highly human-transformed landscapes. The deep understanding of the AOI is a key for the achievement of the project, constituting the ideal location for our research with:

- A global hotspot of GH due to particularly favorable environmental conditions
- A strong north – south climate gradient associated with the Inter-Tropical Convergence Zone (ITCZ) dynamics and influenced by climate oscillations that contribute to a frequent succession of extreme dry and wet periods
- A hotspot of climate change with projected changes in both temperature and mean and extreme rainfall patterns
- Uncontrolled urbanization and deforestation
- A high population density that is on the rise, high vulnerability, and a strong societal need of climate and hazard process understanding at the border between six countries
- A unique long-term expertise in the region at the RMCA and its partners

METHODOLOGY

In GEOTROP satellite remote sensing approaches will allow to obtain high accuracy constraints on the timing and location of GH events over this large region through the combined use of radar and optical remote sensing. The spatio-temporal analysis of the detected GH events will be done with Earth observation measurements and by using harmonized climate and LULC change scenario models. GEOTROP relies on high performance computing and cloud-computing infrastructures to process these very large datasets. Information from citizens will be used for validating the methods and improving the processes characterization.

POTENTIAL IMPACT AND EXPECTED RESULTS

This project will improve our understanding of natural hazards in the context of global change in under-researched climates. It is innovative for developing better hazard zonation and DRR strategies in the region, and also for understanding the evolution of the landscapes and its dangers in general. The project combines innovative tools and approaches in Earth observation and climate science for working on unprecedented large regional scales.

CONTACT INFORMATION

Coordinator

Olivier Dewitte
Royal Museum for Central Africa (RMCA)
Department of Earth Sciences
olivier.dewitte@africamuseum.be

Partners

François Kervyn de Meerendré
Royal Museum for Central Africa (RMCA)
Department of Earth Sciences
francois.kervyn@africamuseum.be

Wim Thiery
Vrije Universiteit België (VUB)
Department of Hydrology and Hydraulic Engineering
wim.thiery@vub.be

International Partners

Nicolas d'Oreye
National Museum of Natural History & European Center For Geodynamics and Seismology
Department of Geophysics/Astrophysics history of Luxembourg
ndo@ecgs.lu

Jean-Philippe Malet
École & observatoire des sciences de la Terre
Centre national de la recherche scientifique
Active Deformation Group
jeanphilippe.malet@unistra.fr

Jakob Zscheischler
Helmholtz Centre for Environmental Research – UFZ
Computational Hydrosystems
jakob.zscheischler@ufz.de

LINKS

https://georiska.africamuseum.be/en/activities/geotrop