4 MAY 2023

A heavy toll from landslides and floods in Rwanda and Uganda

Posted by Dave Petley

A heavy toll from landslides and floods in Rwanda and Uganda

Heavy rainfall in recent days has caused extensive flooding and large numbers of landslides in Rwanda and Uganda. Worst hit has been Rwanda, where the toll is reported to be at least 129 people. The majority of the losses have occurred in Northern and Western Provinces, primarily in the districts of Ngororero (23 fatalities), Rubavu, Nyabihu (17 fatalities), Rutsiro (26 fatalities) and Karongi (16 fatalities) in Western Province. It is unclear as to the exact location of the landslides, but The New Times reports that four people were killed in a landslide in Rugerero sector, Rubavu district, whilst a further four people were critically injured.

This tweet appears to show landslides triggered by the rainfall, which fell on 2 and 3 May 2023:

Mohamed A
@MohamedHachi99 · **Follow**

I am deeply sadned that more than 130 lost their lives due to the landslide and floods caused by heavy rains hit at night in Northern and Western provinces in Rwanda.

9 MAY 2023

The deadly mud and debris flows around Lake Kivu in the Democratic Republic of Congo

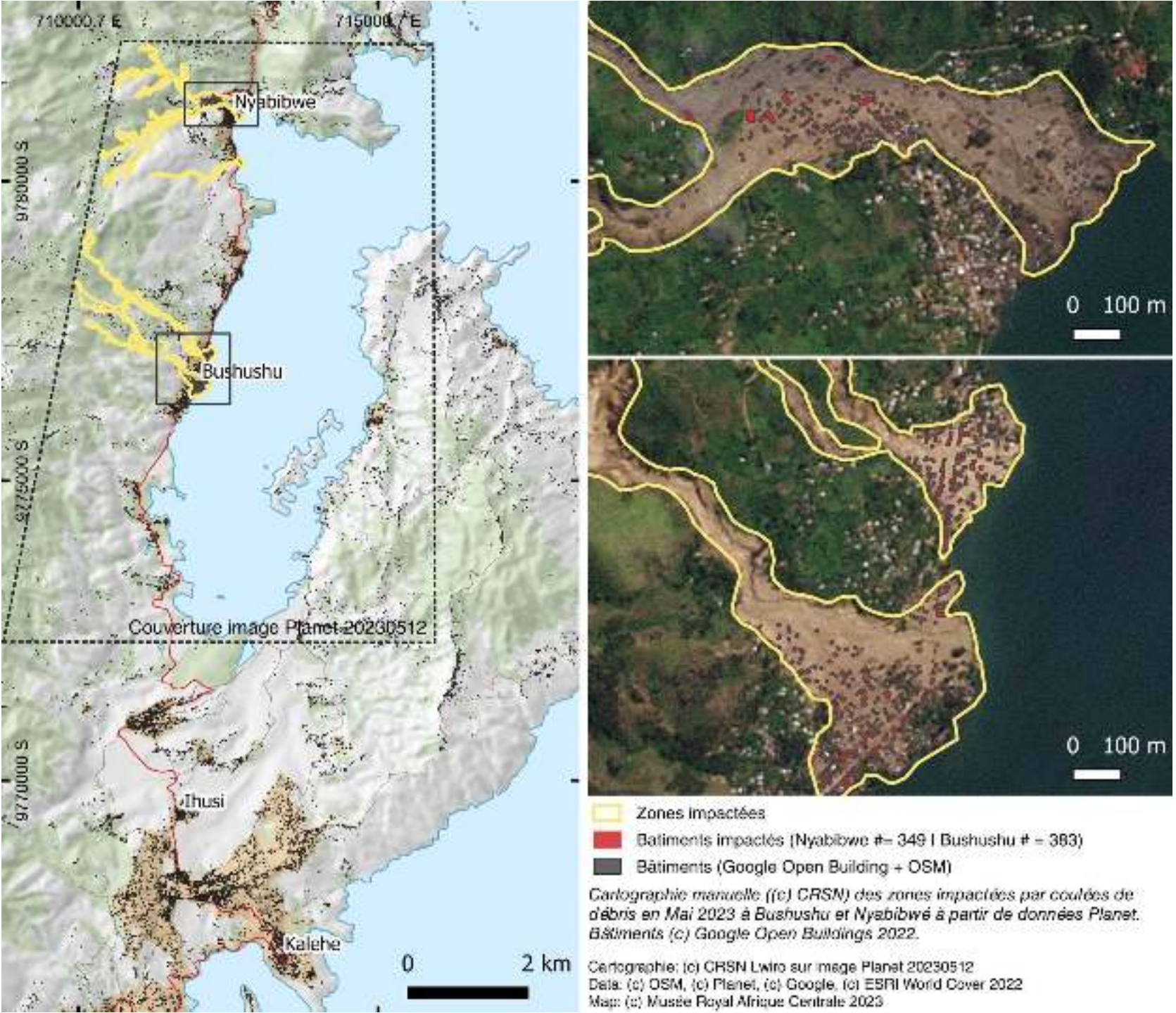
Posted by Dave Petley

The deadly mud and debris flows around Lake Kivu in the Democratic Republic of Congo

On Thursday 4 May 2023, intense rainfall triggered a series of deadly mud and debris flows around Lake Kivu in the Democratic Republic of Congo (DRC). At the time of writing the number of people killed is known to be at least 401, although this might still increase. As such, this is the worst landslide disaster of 2023 to date.

The events are reported to have destroyed the villages of Bushushu and Nyamukubi, although reports also indicate that the villages of Luzira and Chabondo were impacted too. However, there is often some complexity in the determination of the names of the places affected these types of events.

Planet has captured a set of satellite images that capture the scale of the disaster. This image, dated 8 May 2023, shows multiple channelised mud and debris flows originating on the slopes above Lake Kivu. Many of the houses are built on the debris fans from previous events, and have been over-run by this disaster. The location of this site is [-2.019, 28.905].:-



Zones impactées

Batiments impactés (Nyabibwe #= 349 I Bushushu # = 383)

Bâtiments (Google Open Building + OSM)

Cartographie manuelle ((c) CRSN) des zones impactées par coulées de débris en Mai 2023 à Bushushu et Nyabibwé à partir de données Planet. Bâtiments (c) Google Open Buildings 2022.

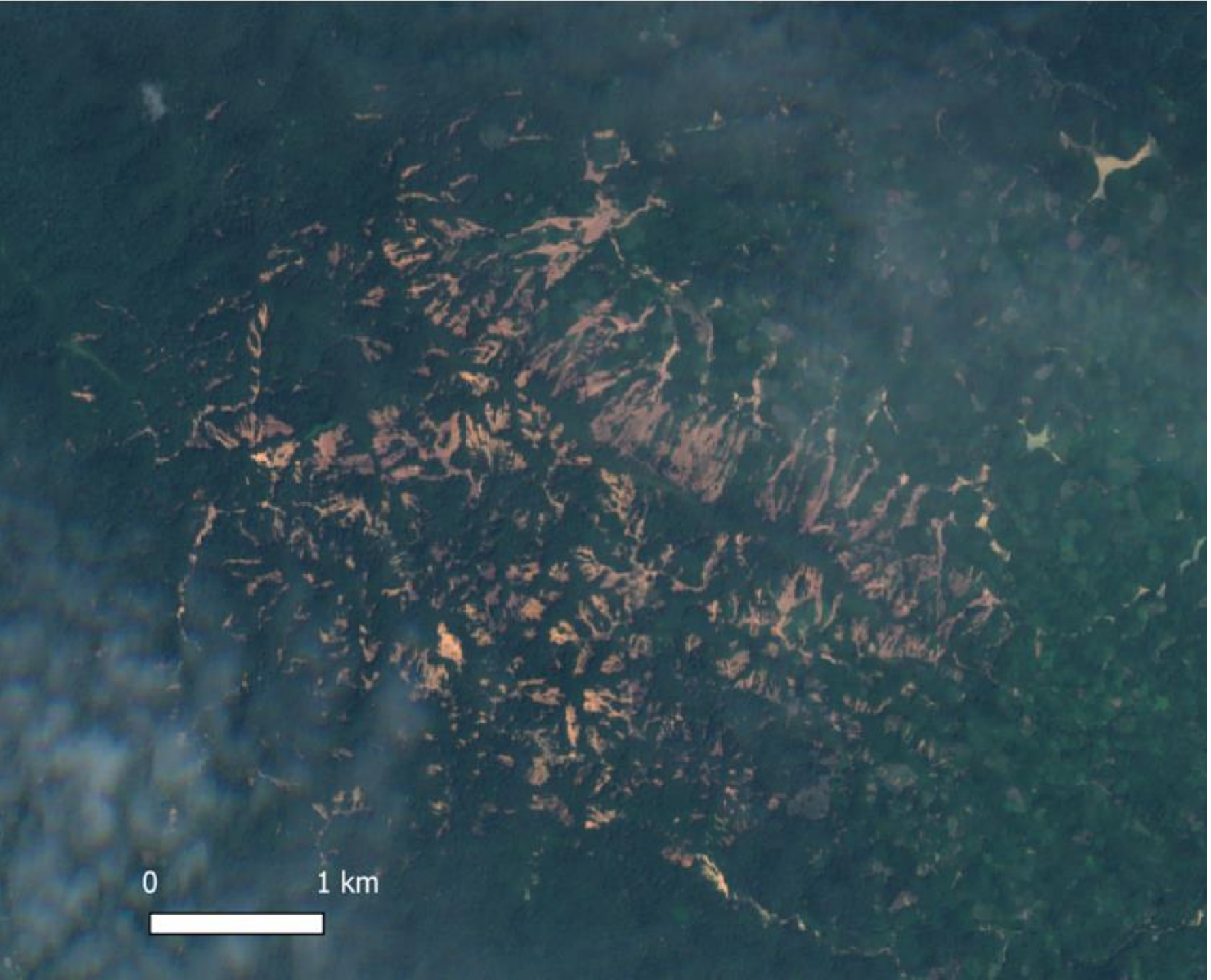
Cartographie: (c) CRSN Lwiro sur image Planet 20230512
Data: (c) OSM, (c) Planet, (c) Google, (c) ESRI World Cover 2022
Map: (c) Musée Royal Afrique Centrale 2023

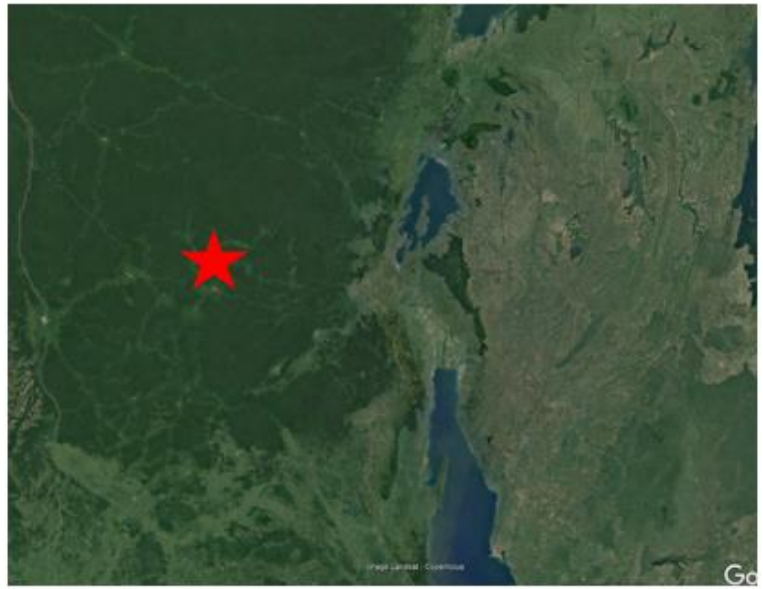
AFRICA museum

Landslide and flash flood event of May 4th in DR Congo

Manual mapping, field investigation

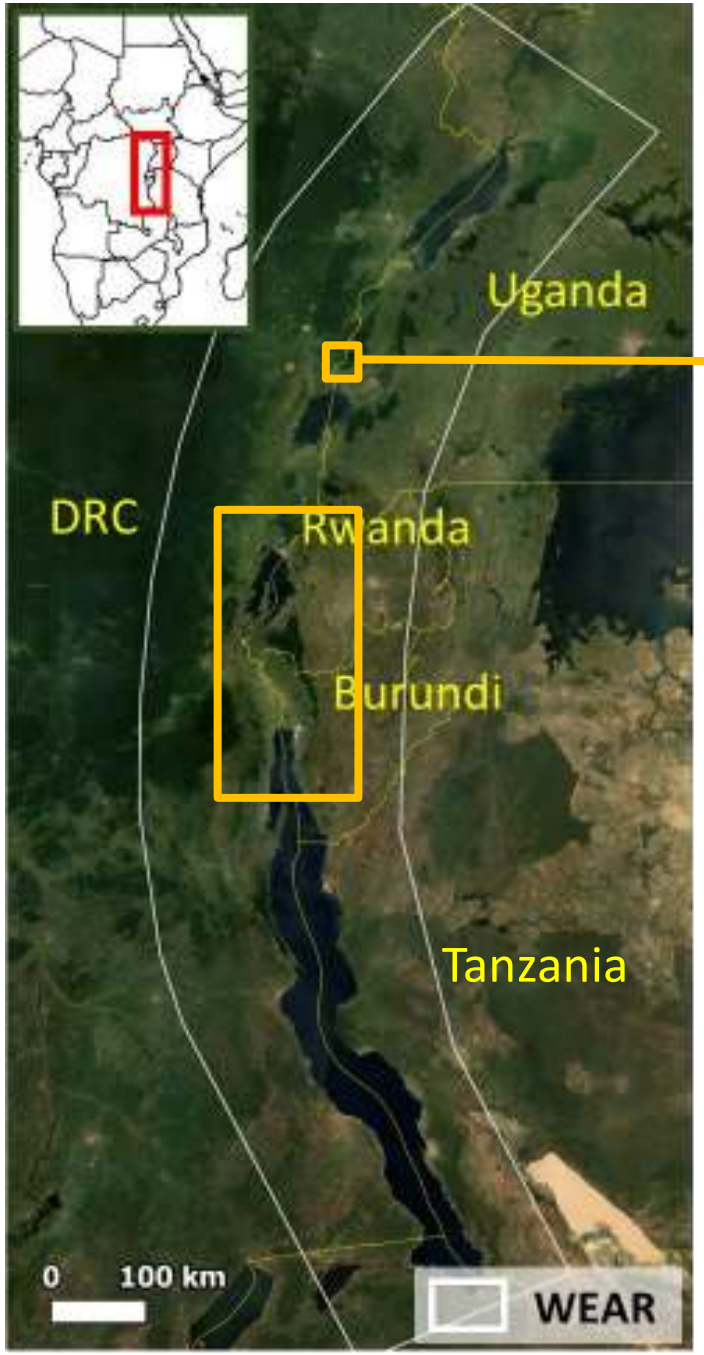
Role of human activities

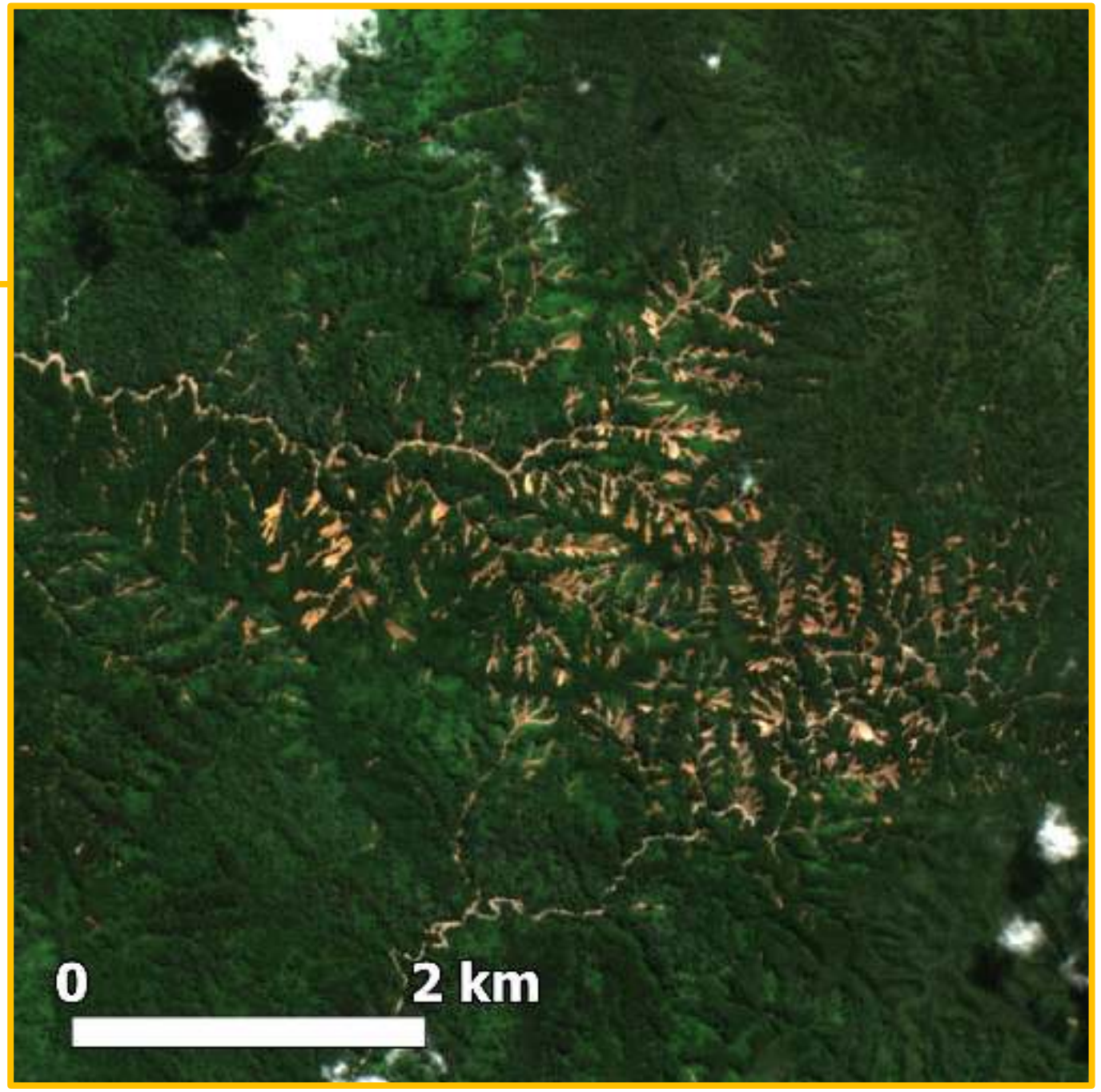


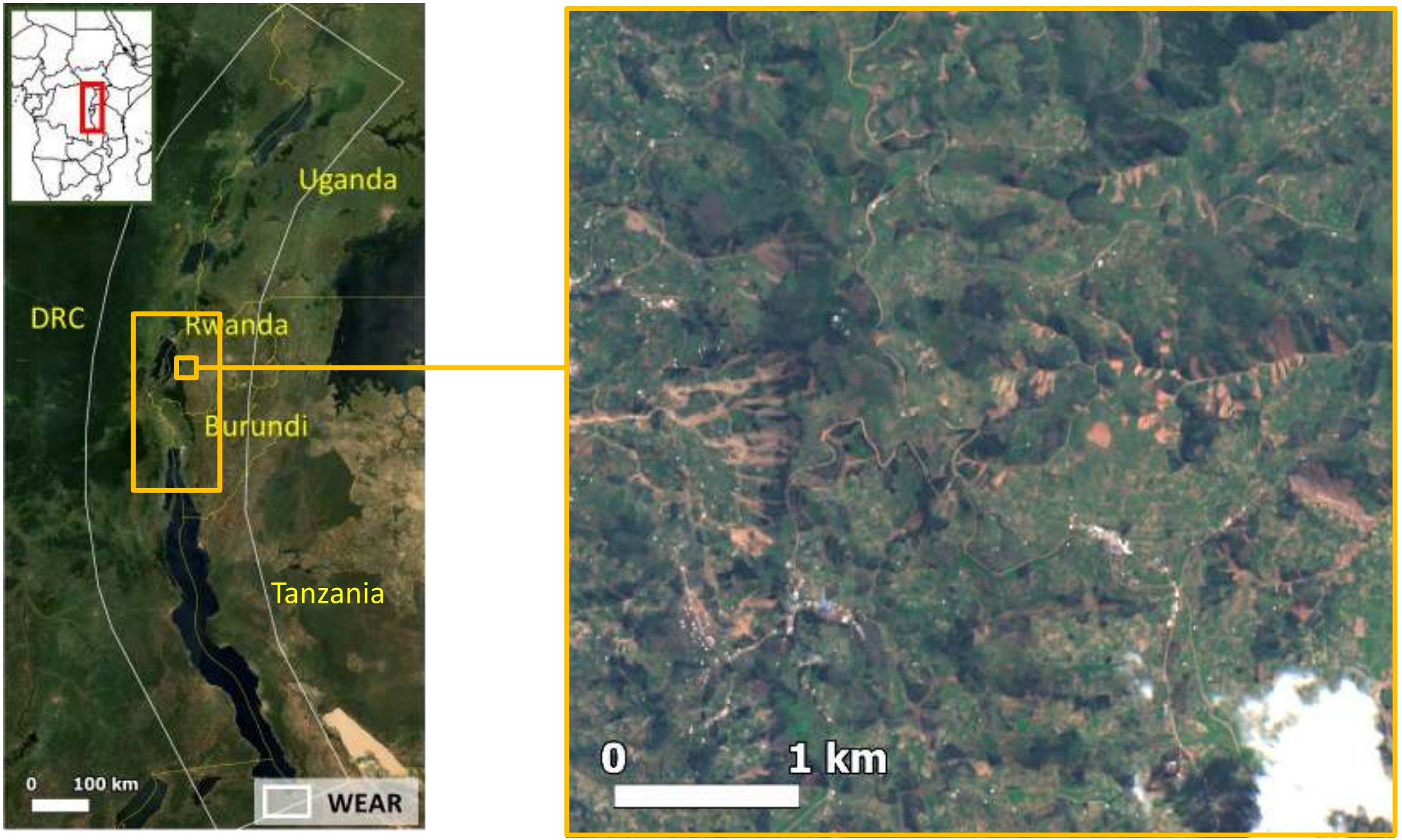


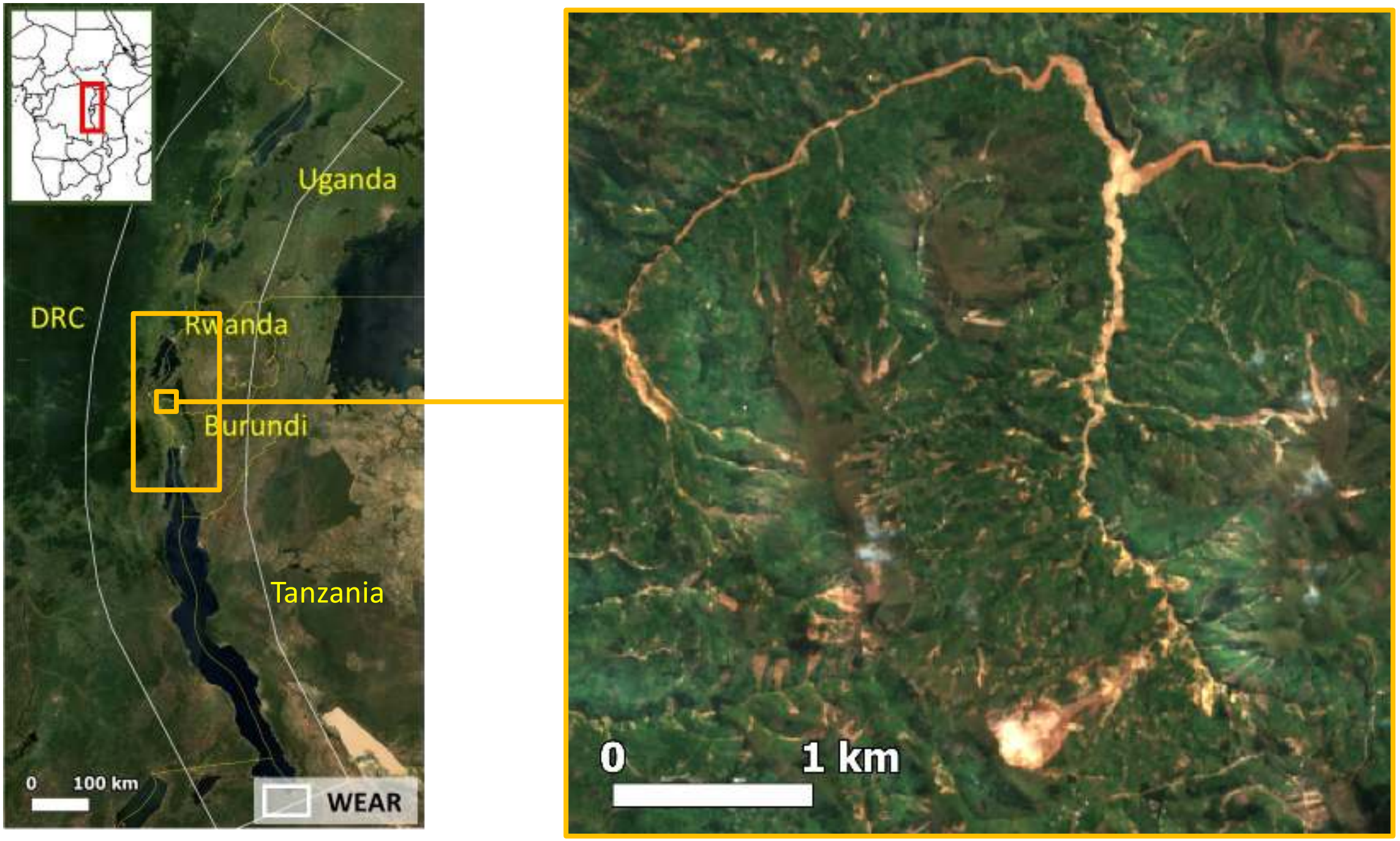
Landslide and flash flood event in Nov 2020 in DR Congo

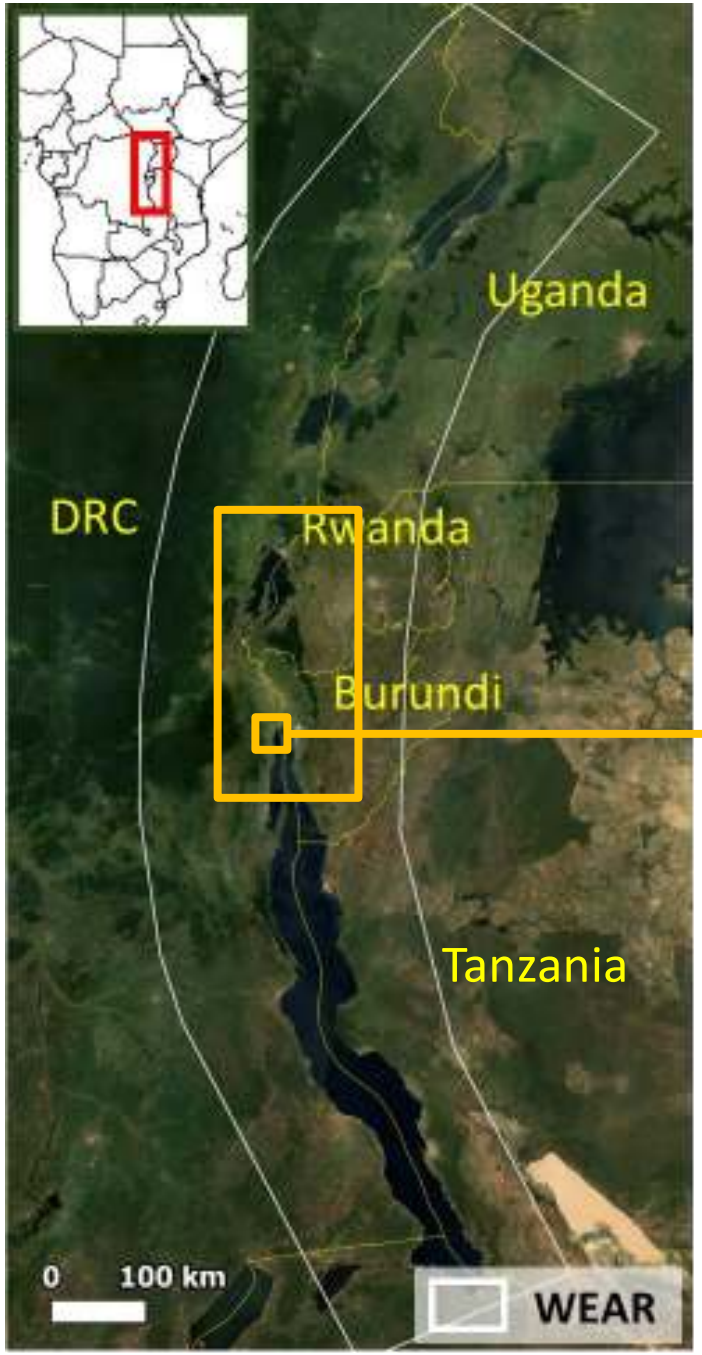
Natural environment


Uganda
DRC
Rwanda
Burundi
Tanzania
0
100 km
WEAR

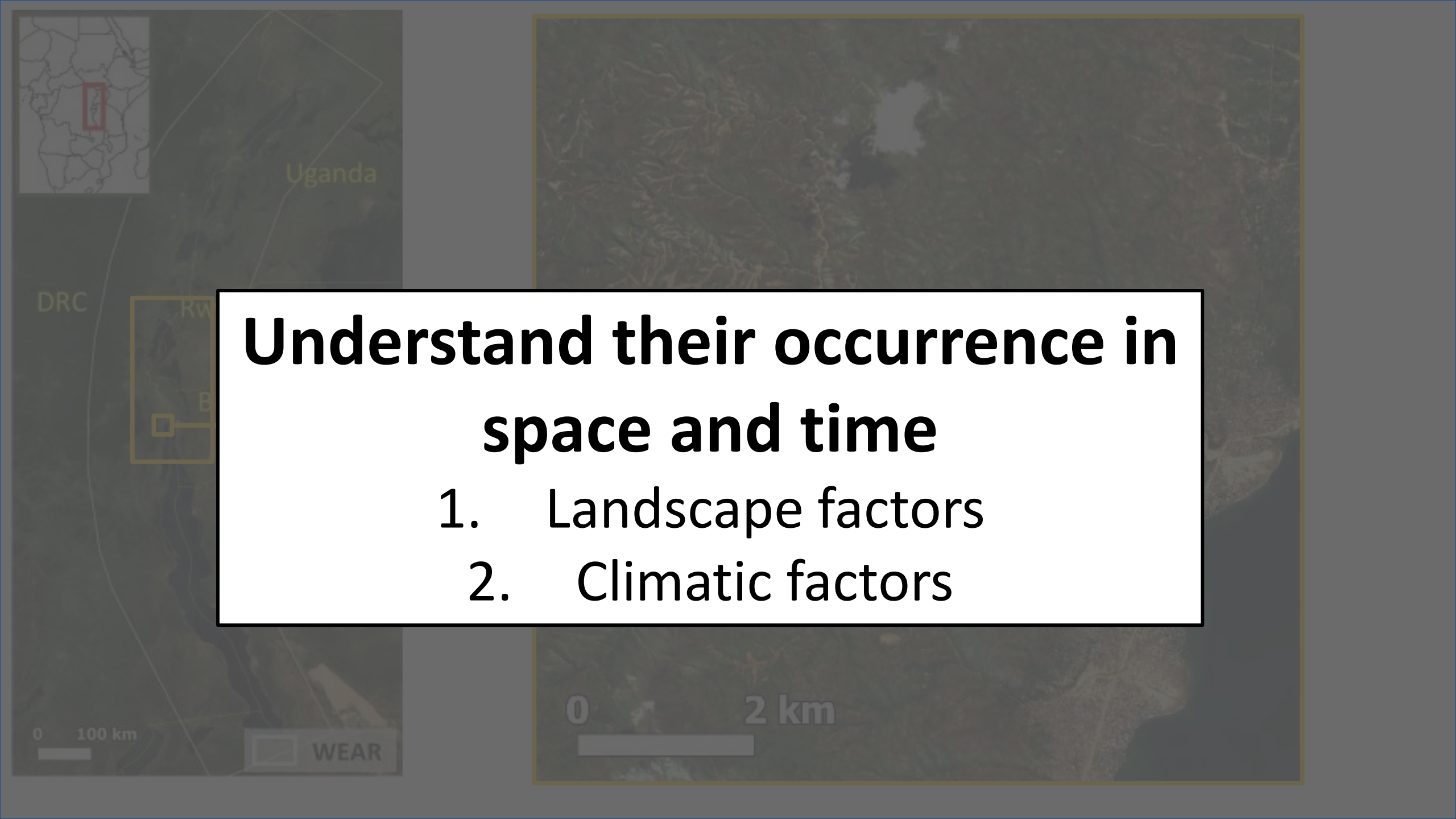

0
2 km


Uganda
DRC
Rwanda
Burundi
Tanzania
0
100 km
WEAR
0
1 km


Uganda
DRC
Rwanda
Burundi
Tanzania
0
100 km
WEAR
0
1 km


Uganda
DRC
Rwanda
Burundi
Tanzania
0
100 km
WEAR


0
2 km

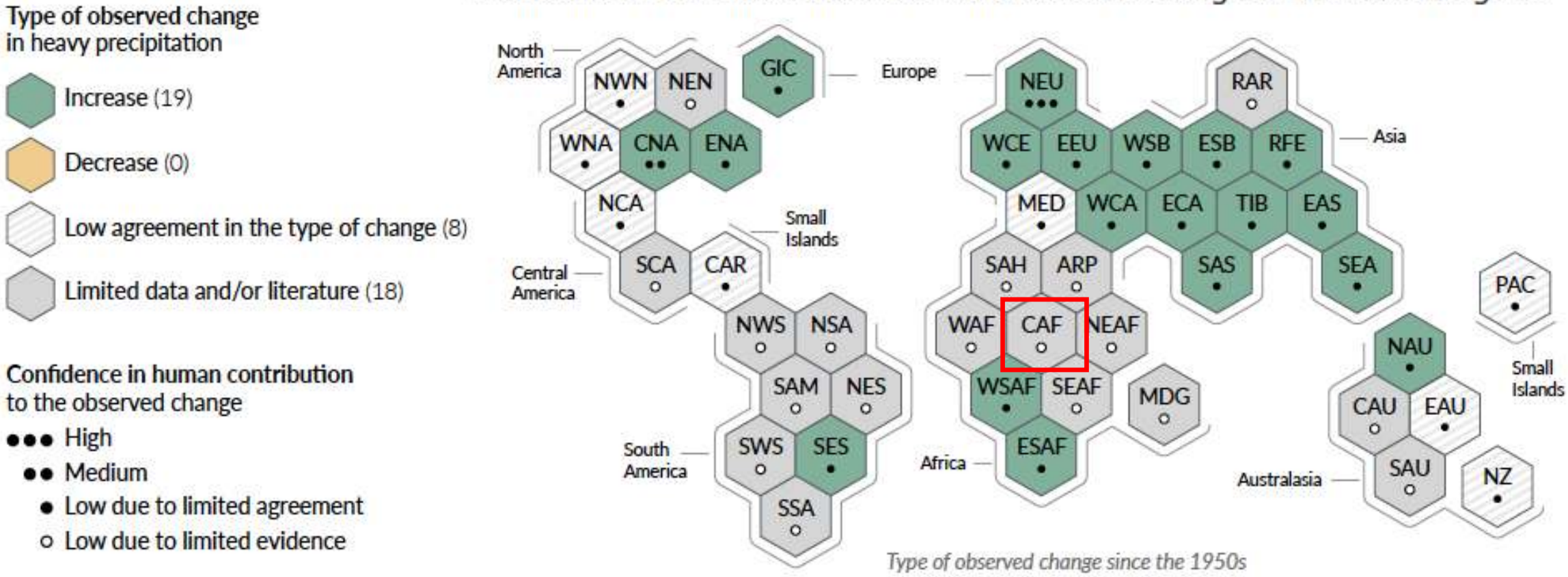


Understand their occurrence in space and time

1. Landscape factors
2. Climatic factors

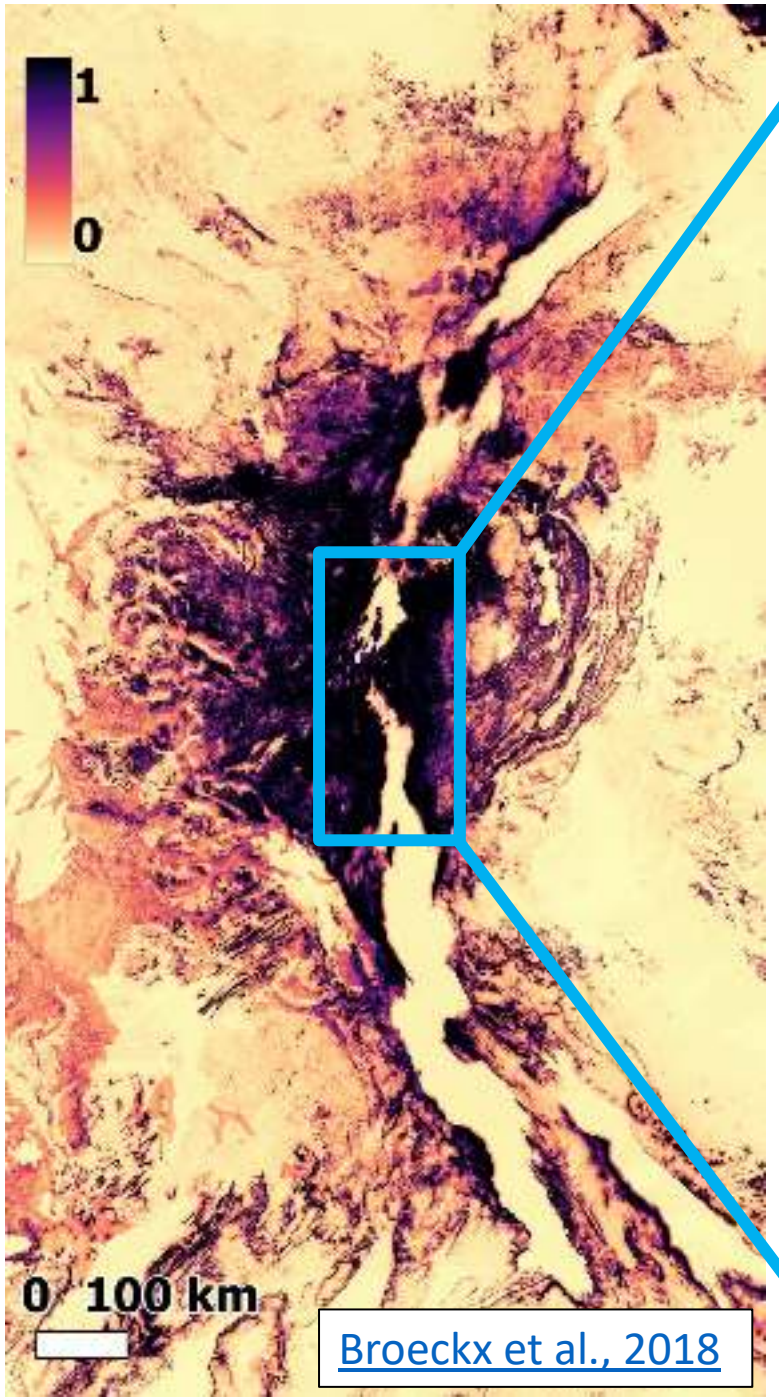
Lack of data – no time series

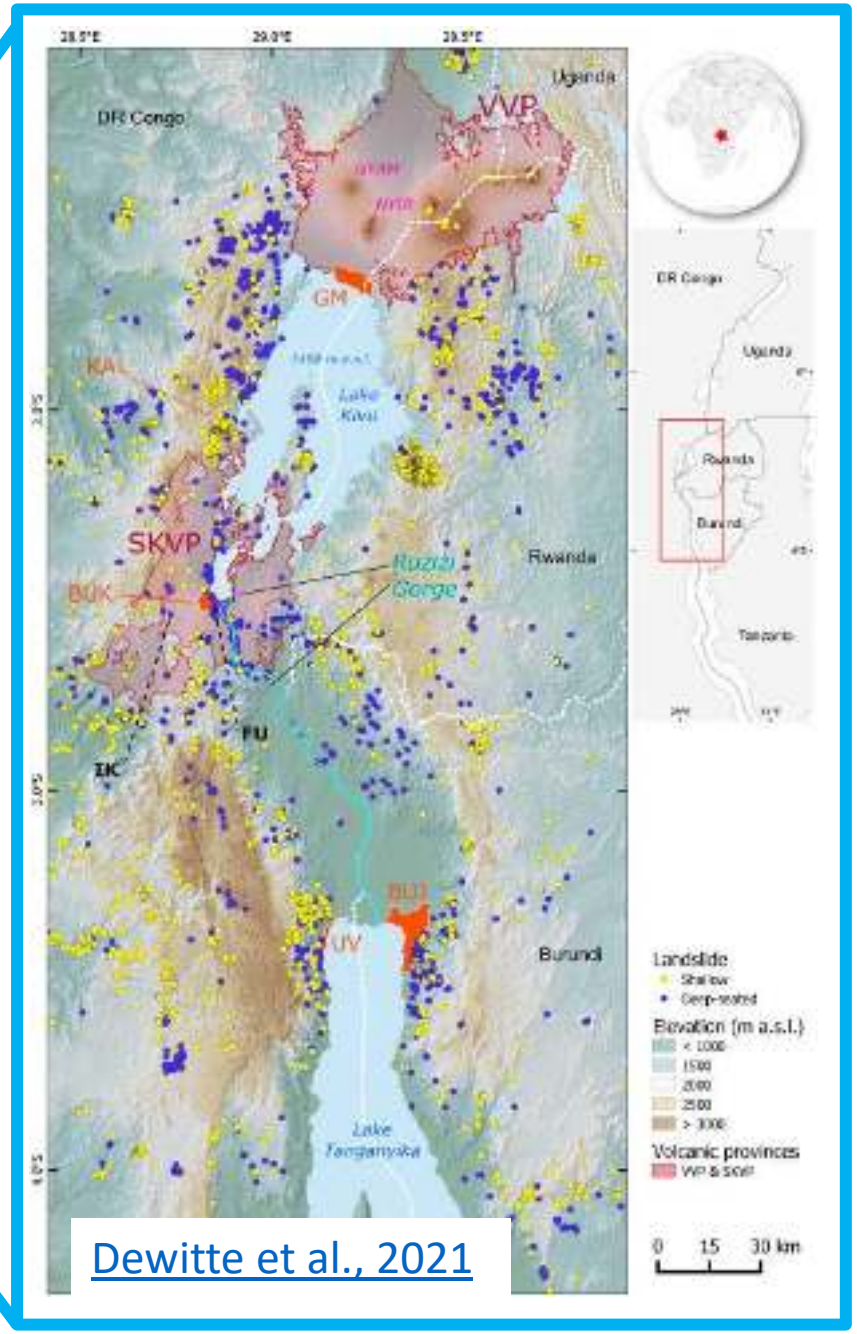
b) Synthesis of assessment of observed change in **heavy precipitation** and confidence in human contribution to the observed changes in the world's regions



Source: IPCC (2021); 6th Assessment Report


Uganda
DRC
Rwanda
Burundi
Tanzania
0 100 km
WEAR


1
0
0 100 km
Broeckx et al., 2018


DR Congo
Uganda
Rwanda
Burundi
Tanzania
VVP
GM
KA
SKVP
BUK
FU
IK
BUJ
UV
Lake Kivu
Ruzizi Gorge
Lake Tanganyika
Landslide
Elevation (m a.s.l.)
Volcanic provinces
0 15 30 km
Dewitte et al., 2021

Automatic detection of landslides and flash floods from satellite remote sensing

Olivier Dewitte[1], Axel Deijns, Nicolas d'Oreye, Jean-Philippe Malet, Wim Thiery, François Kervyn

[1] Royal Museum for Central Africa, Belgium

No timing information

No location information

No timing information

No location information

A regional scale problem that needs a regional scale approach

- Copernicus Sentinel-1 – *Timing*
- Copernicus Sentinel-2 – *Location*

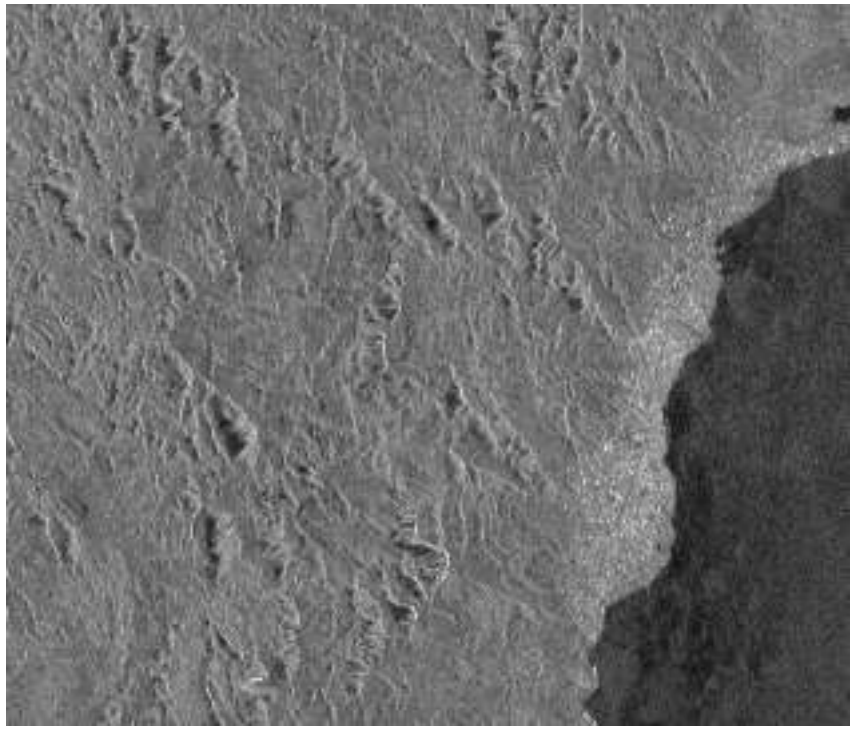
No timing information

No location information

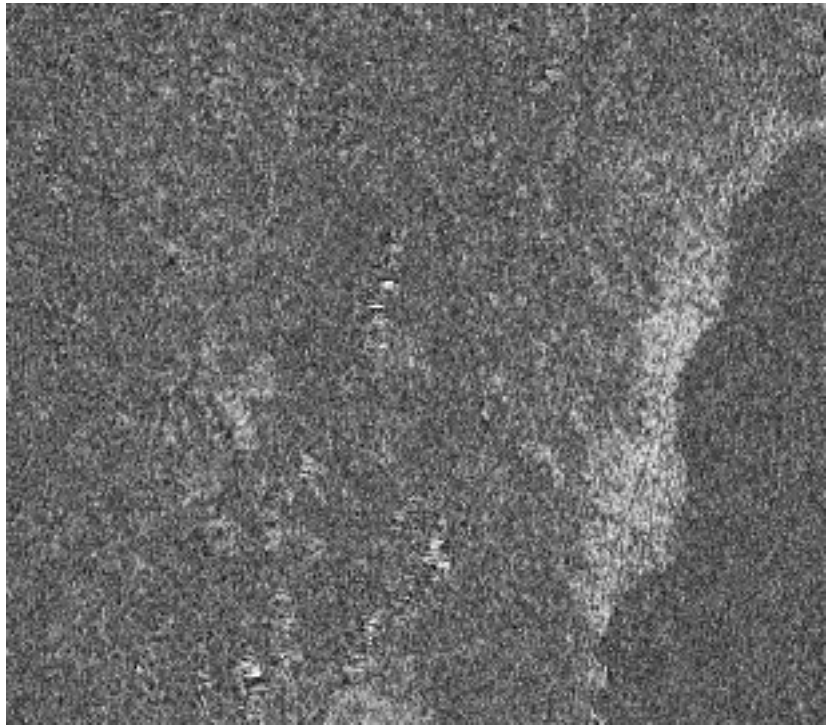
Optical vs SAR (radar) data

Sentinel -2 Optical imagery

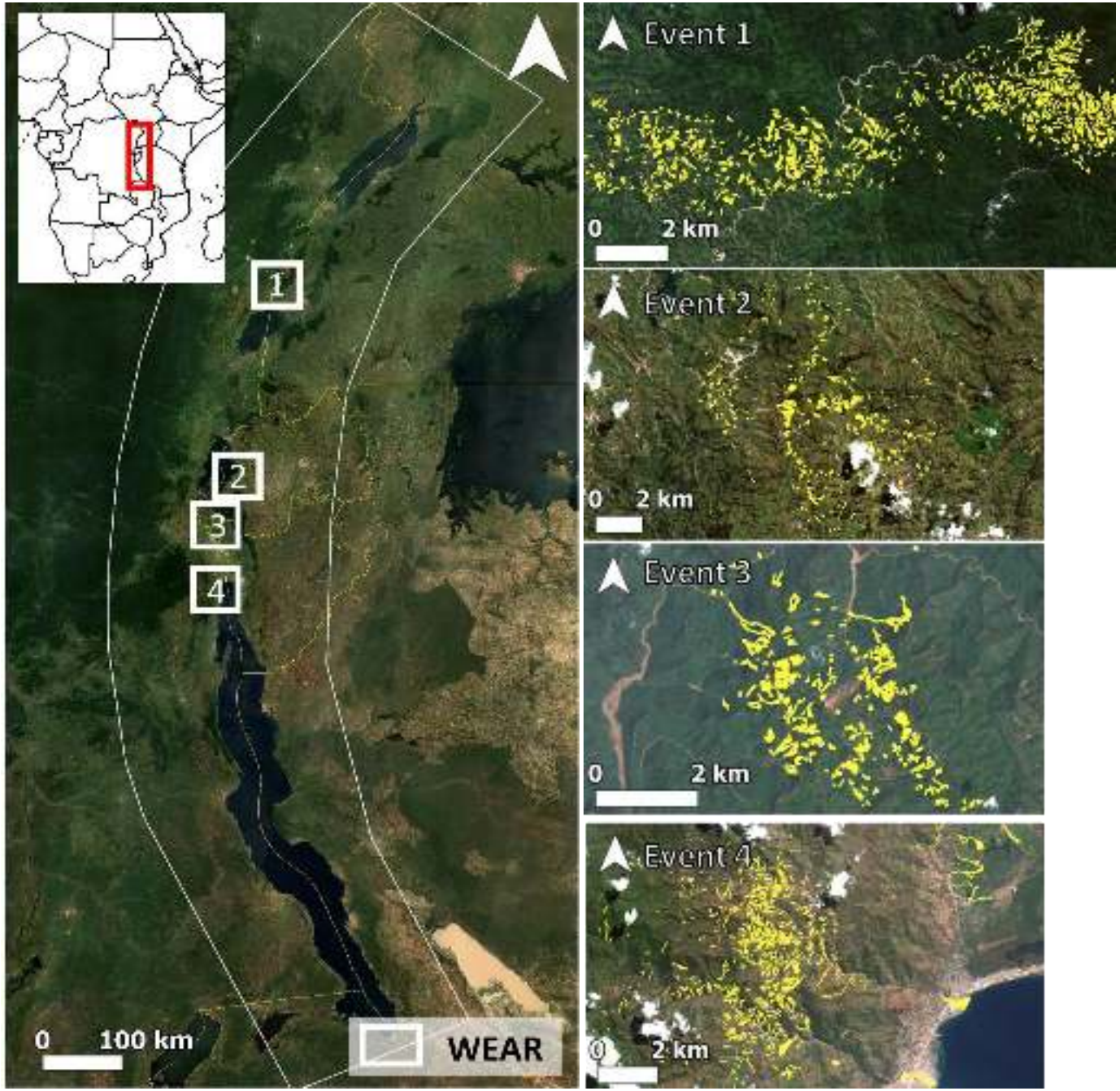
Sentinel -1 SAR Amplitude

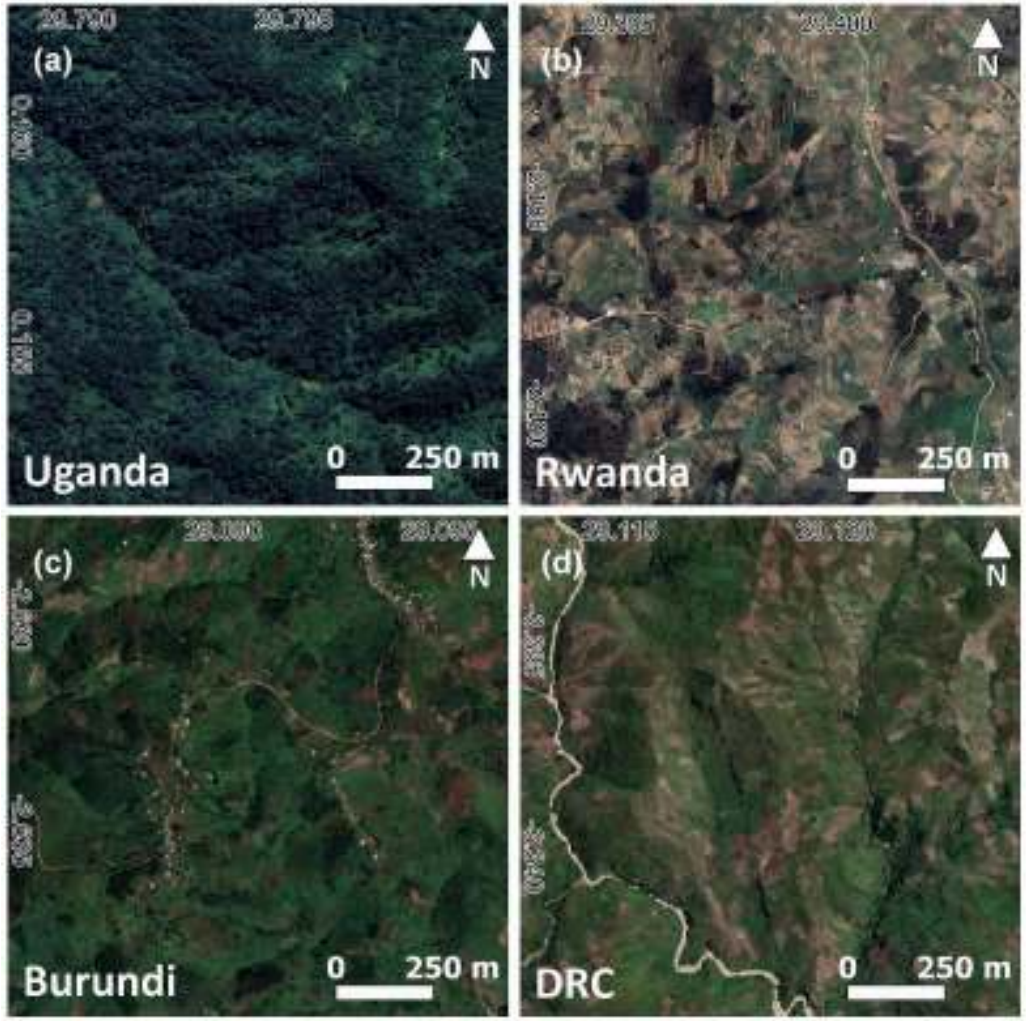


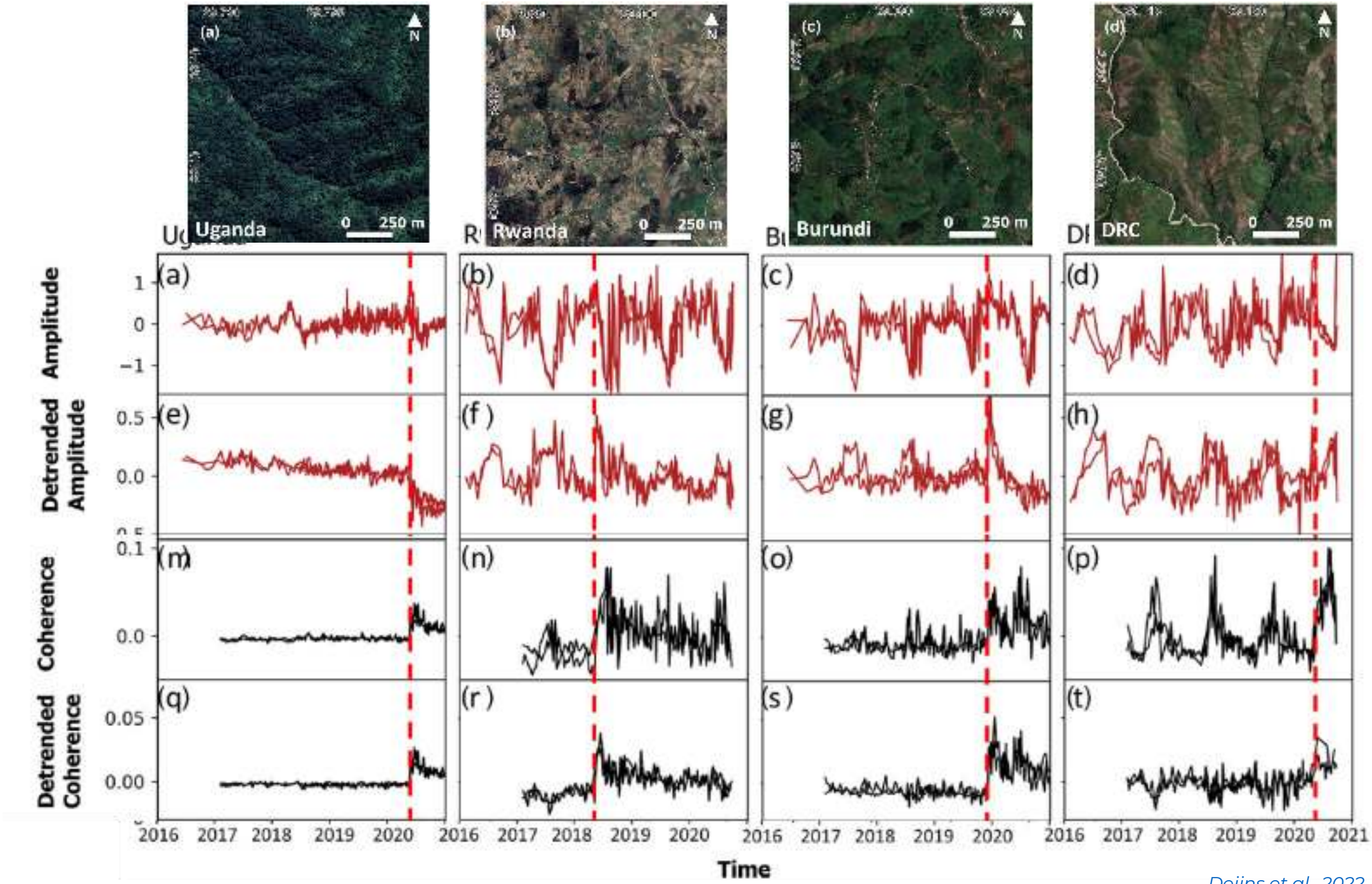
Sentinel -1 SAR Coherence



Recent events







Deijns et al., 2022. NHESS

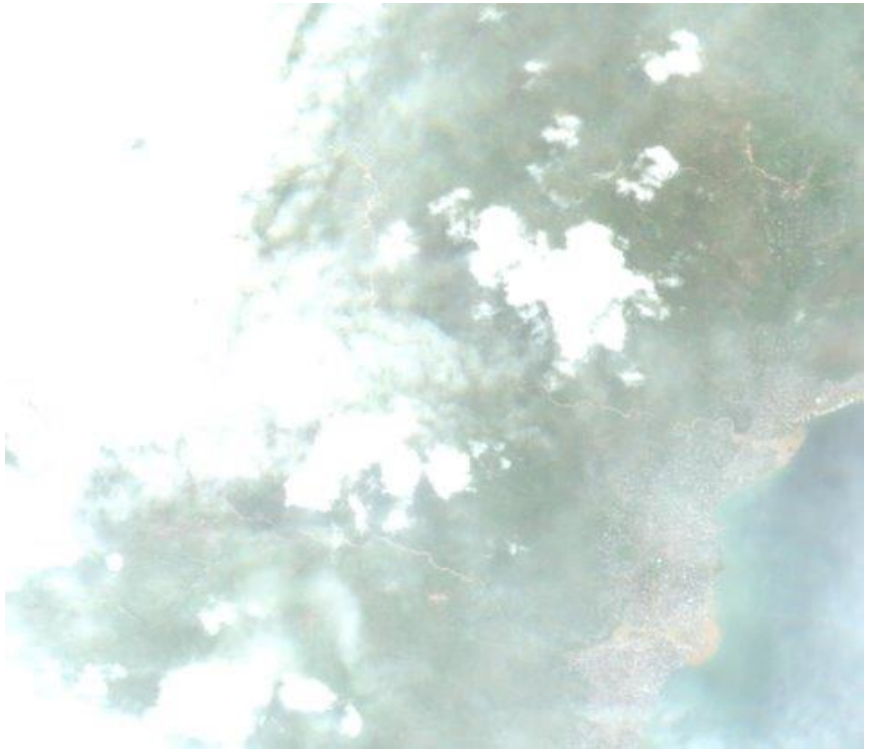
No timing information

No location information

No location information

Sentinel-2

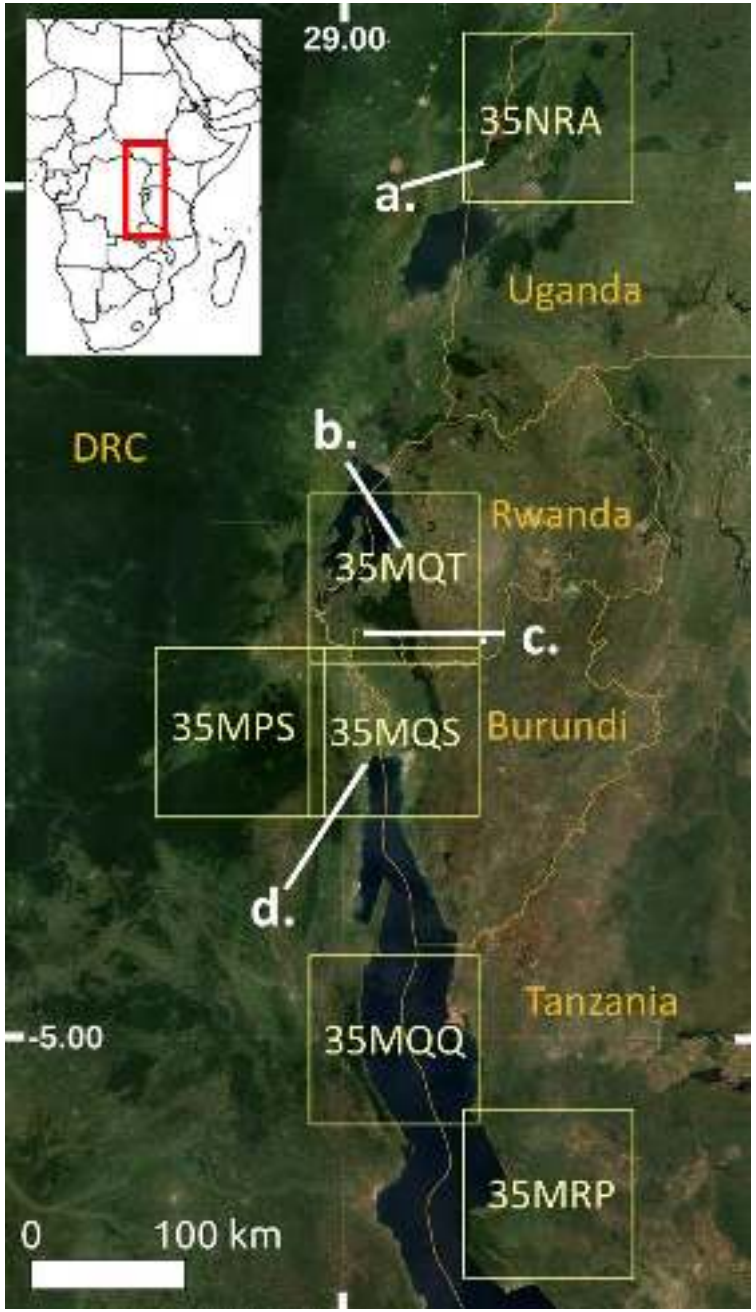
- *High spatial resolution (10m)*
- *high repeat time (5/10 days)*



- *Coverage over entire study area*
- *Consistent imagery from 2016*

- *Multi-band imagery (optical, infrared)*

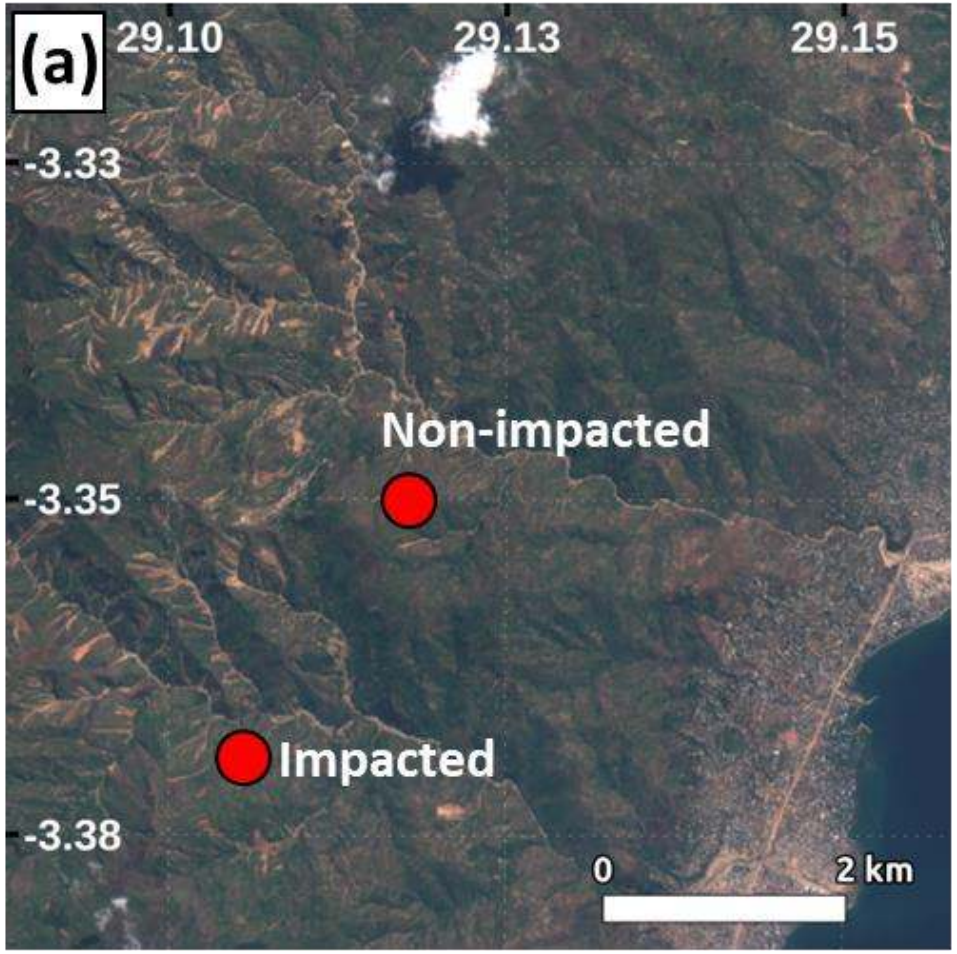
- Wide variety of landscapes
- Known GH events

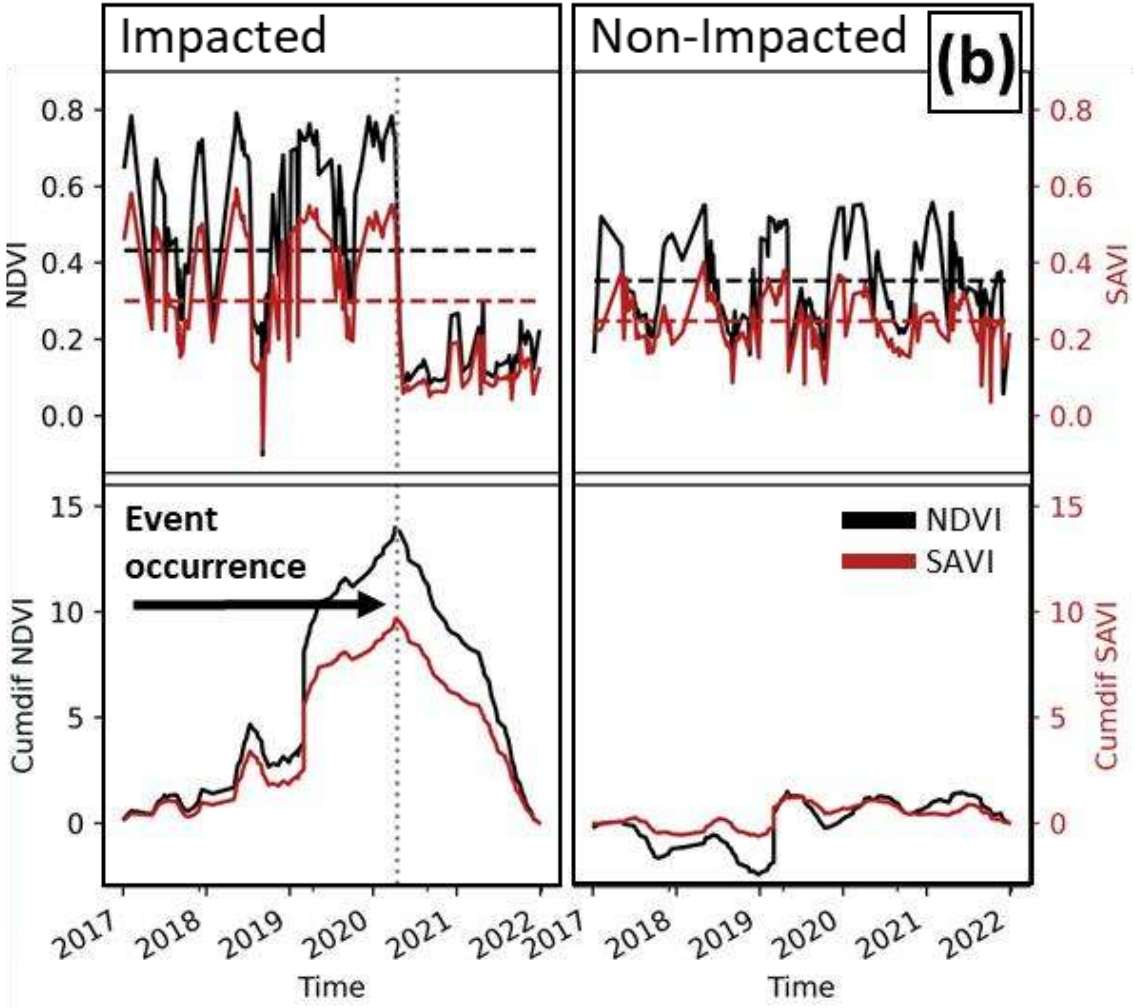


Cumulative difference from the mean

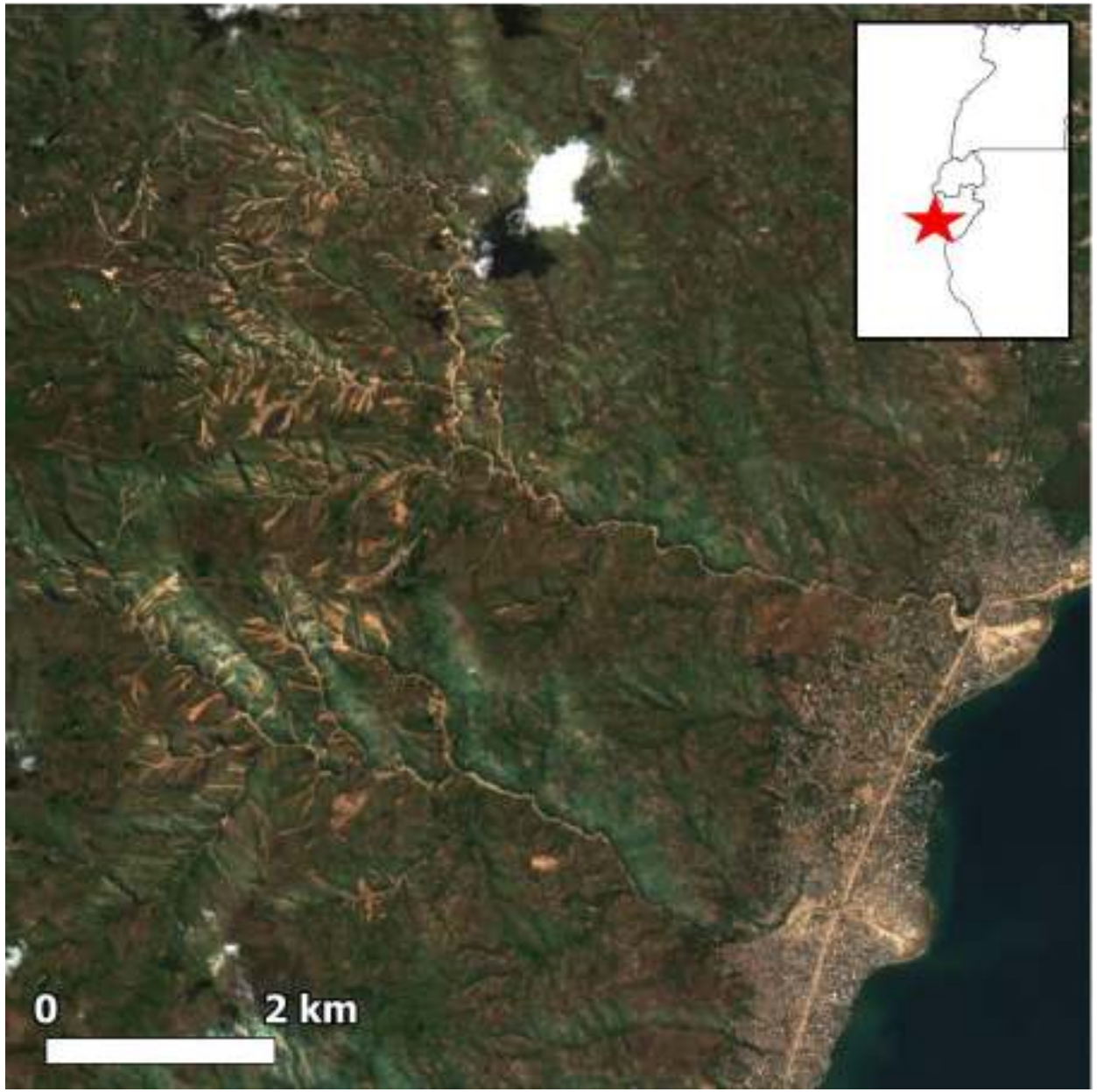
Multiple spectral indices

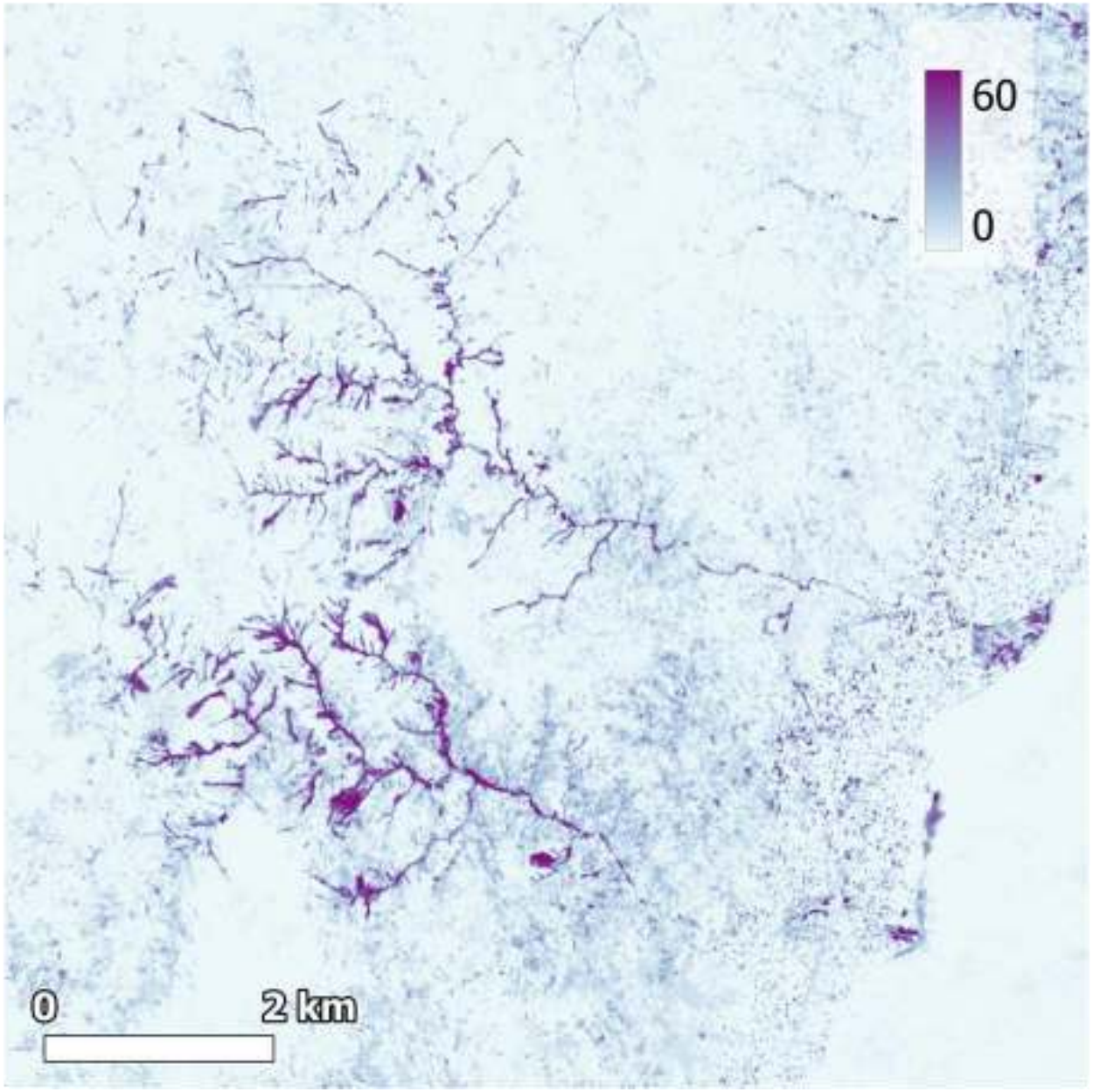
- NDVI
- BI
- SAVI
- TSAVI
- B_{RGB}
- NBR



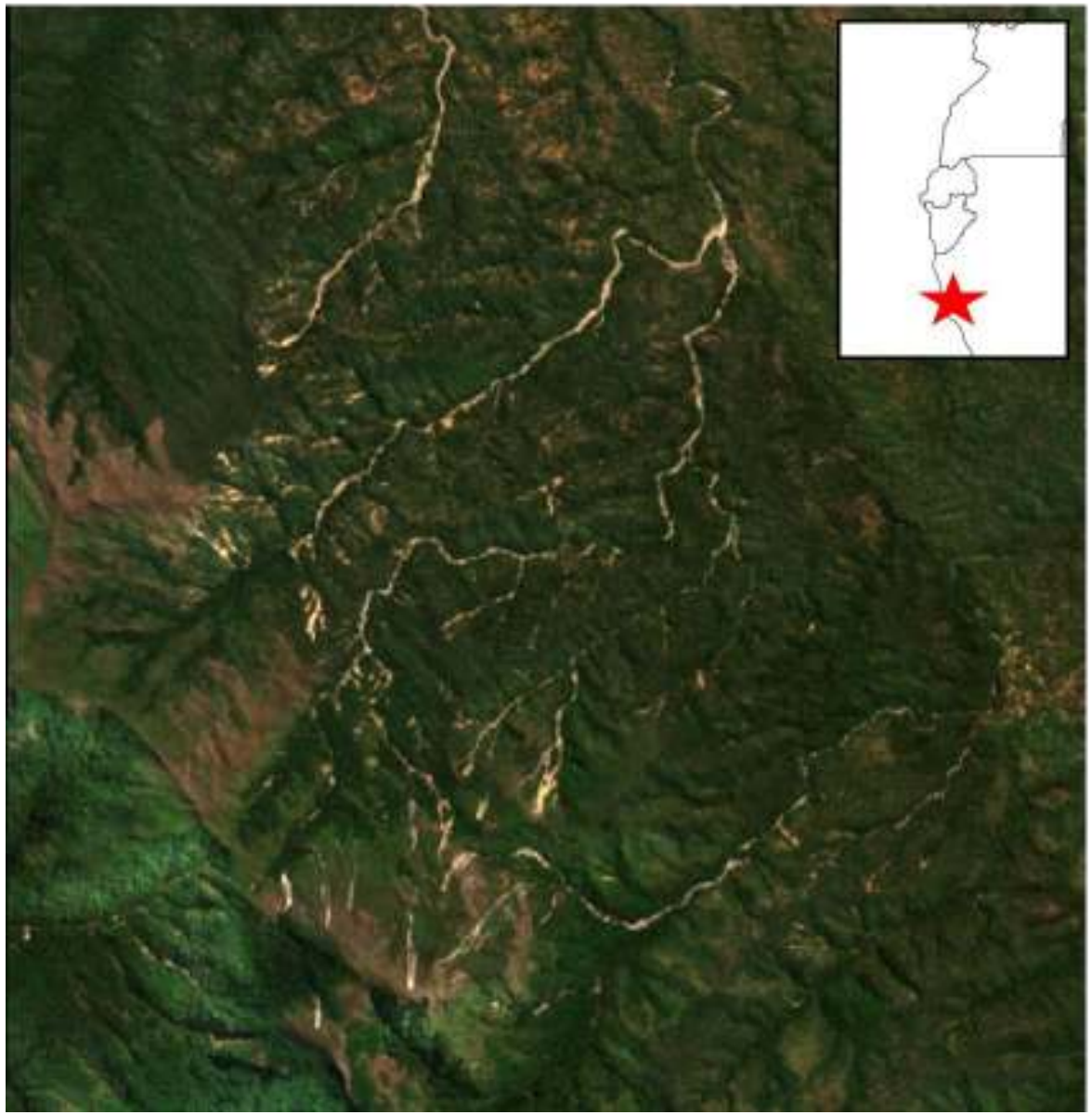


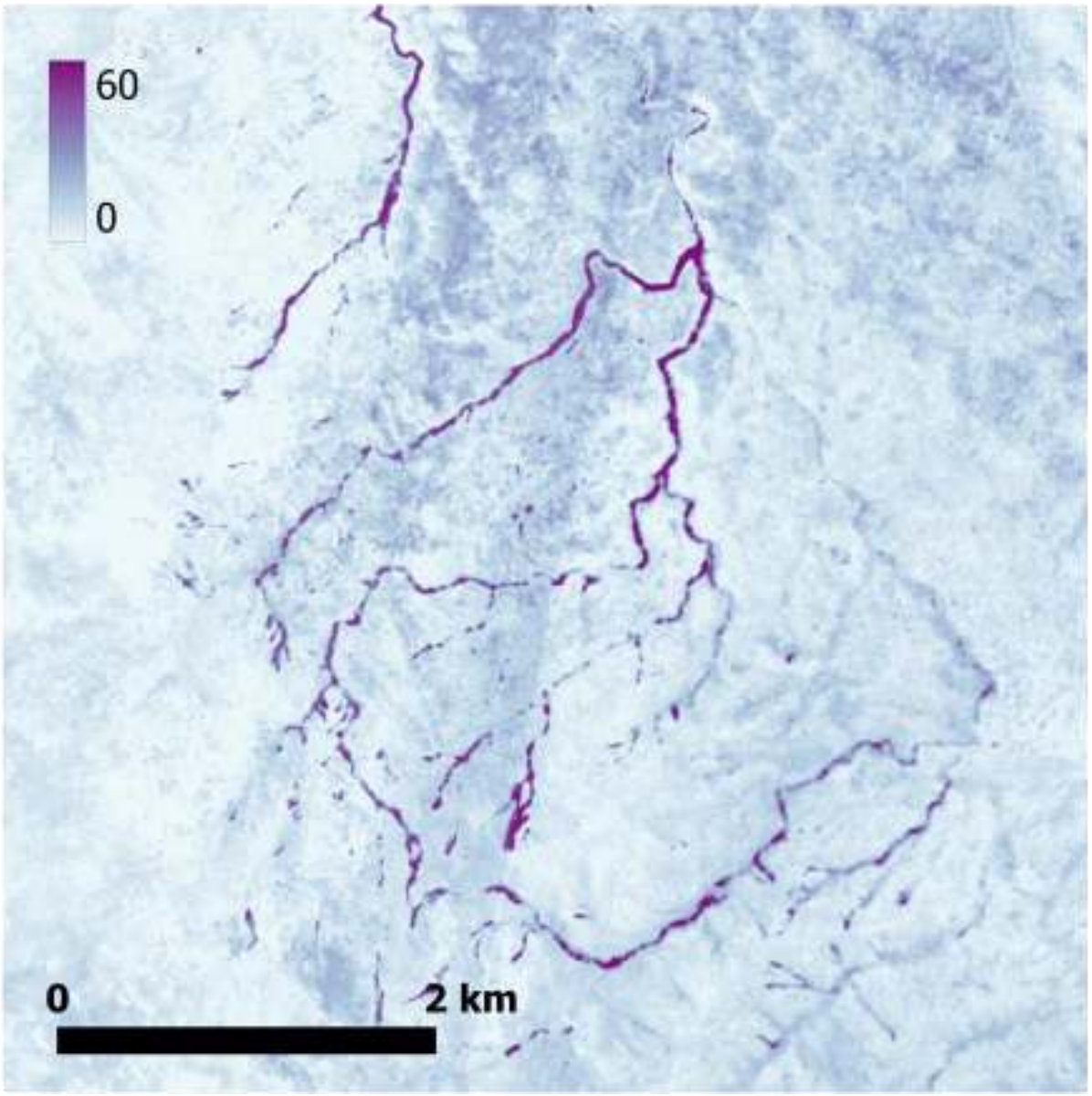
April 2020



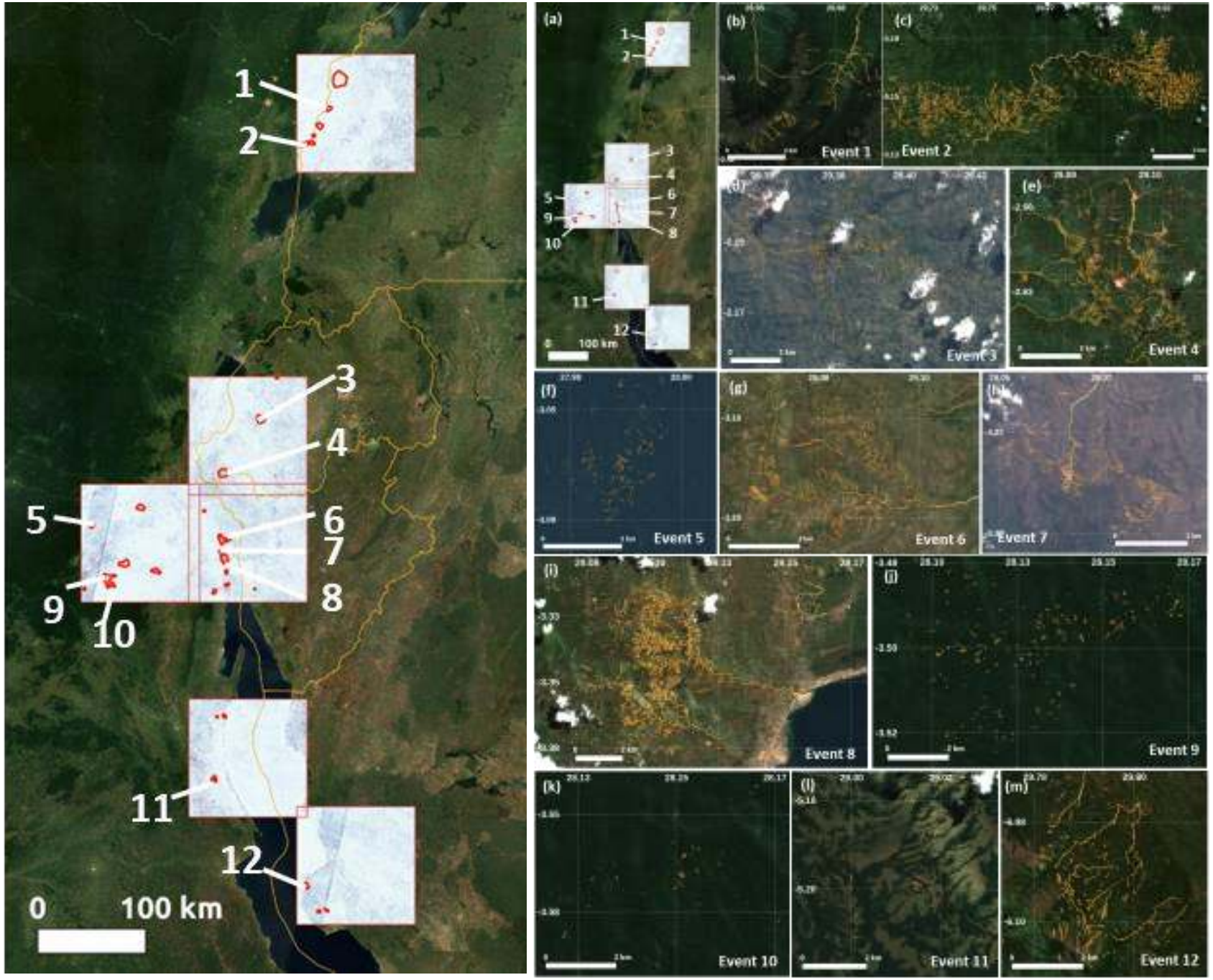


March 2021

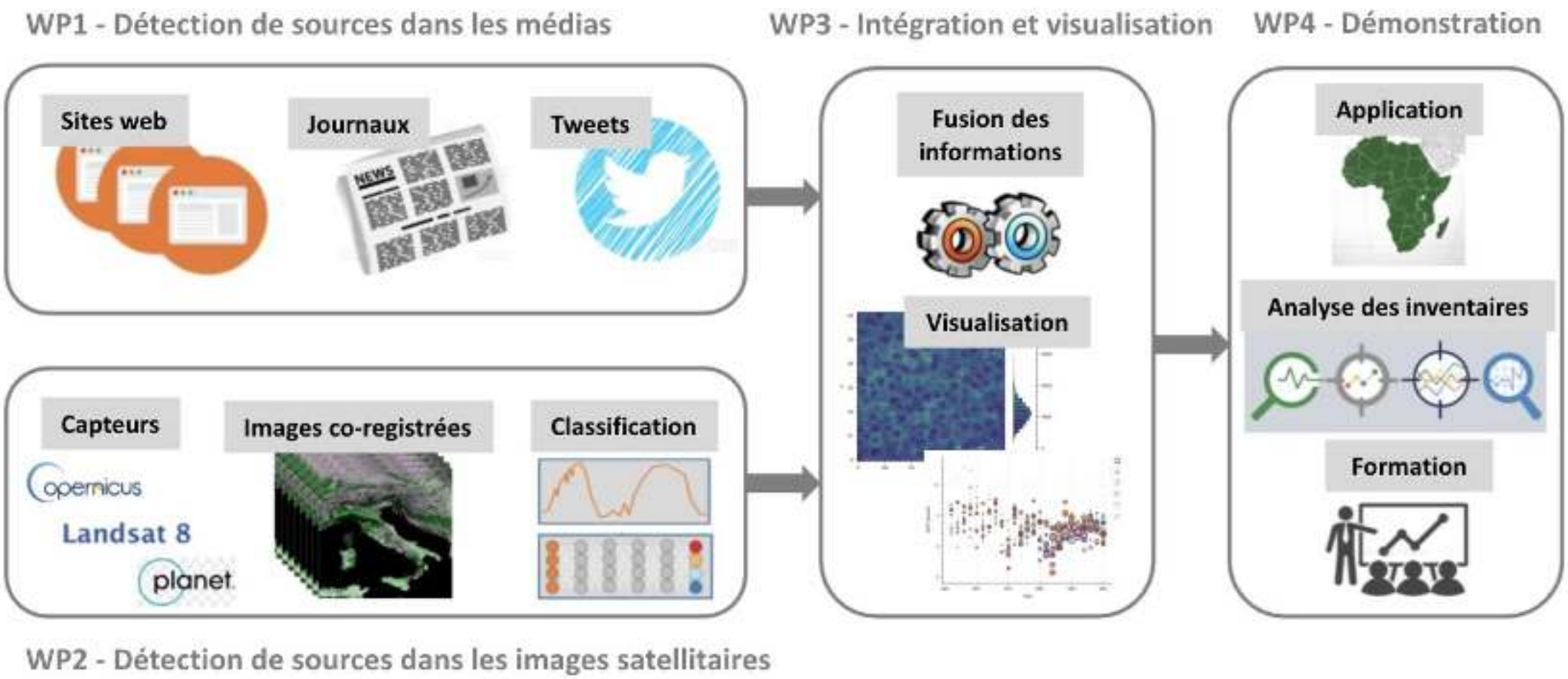




- 29 identified GH events in contrasting landscapes, and throughout the time series



Next steps – operational tools



Topics

Sustainable Development Goals

Date of acceptance
March 2022

Location
Rwanda, Eastern Africa

Steering
SCO France

Duration
24 months

Share on

GeoHaTACC

[fr]

GeoHaTACC aims to detect and inventory hydro-geological hazards in tropical environments and to document the consequences of climate change on these hazards. An operational toolbox combining various sources of information, the demonstrator is being implemented in Rwanda, an African country particularly impacted by these events, with a view to eventually being transposed to other territories.

Example of a typical landslide in Rwanda
© O. Dewitte & B. Smets, RMCA, Tervuren

> **Geo-hydrological Hazards triggered by rain in Tropical Africa: a demonstrator for Rwanda to document the effects of Climate Change**

OVERVIEW

Hydro-geological hazards (hereafter referred to as "GH"), such as mass movements and flash floods, are controlled by meteorological and climatic factors. Climate change is altering their frequency and intensity, although current evidence suggests that anthropogenic landscape changes, such as deforestation and road construction, play a major amplifying role. **Documenting these processes more comprehensively, in particular by creating inventories of well-dated and localised events, and linking them to triggers, is**

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https://www.spaceclimateobservatory.org/geohatacc

Thanks

Olivier Dewitte

olivier.dewitte@africamuseum.be

GeoRiskA

GeoRisks in Africa

https://georiska.africamuseum.be

AFRICA museum