

DARK SIDE OF REMOTE SENSING

**InSAR time series: the SBAS/PSI
time series approach to study
landslide movements**

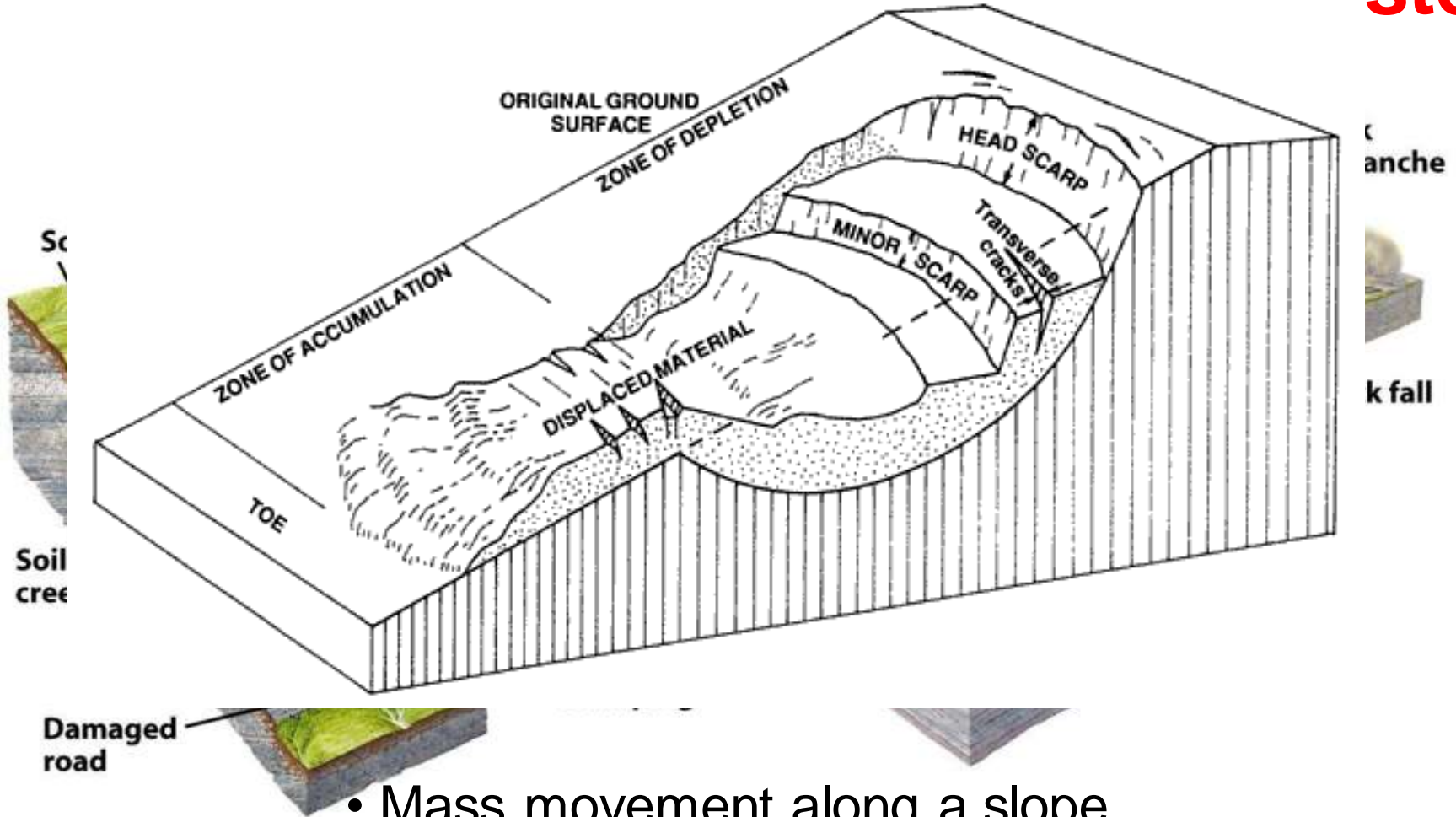
Adriano Nobile

E. Monsieurs, O. Dewitte, N. D'Oreye, J.C. Maki Mateso, F. Kervyn



Landslides Processes

Easter



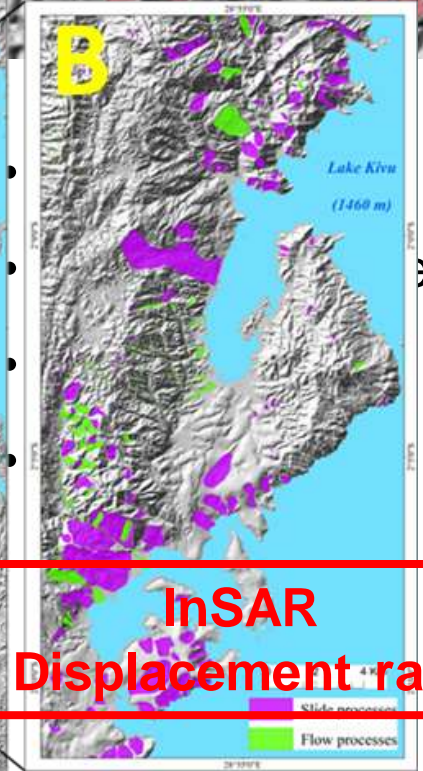
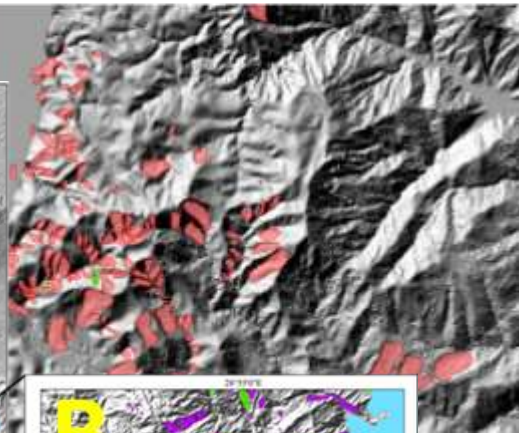
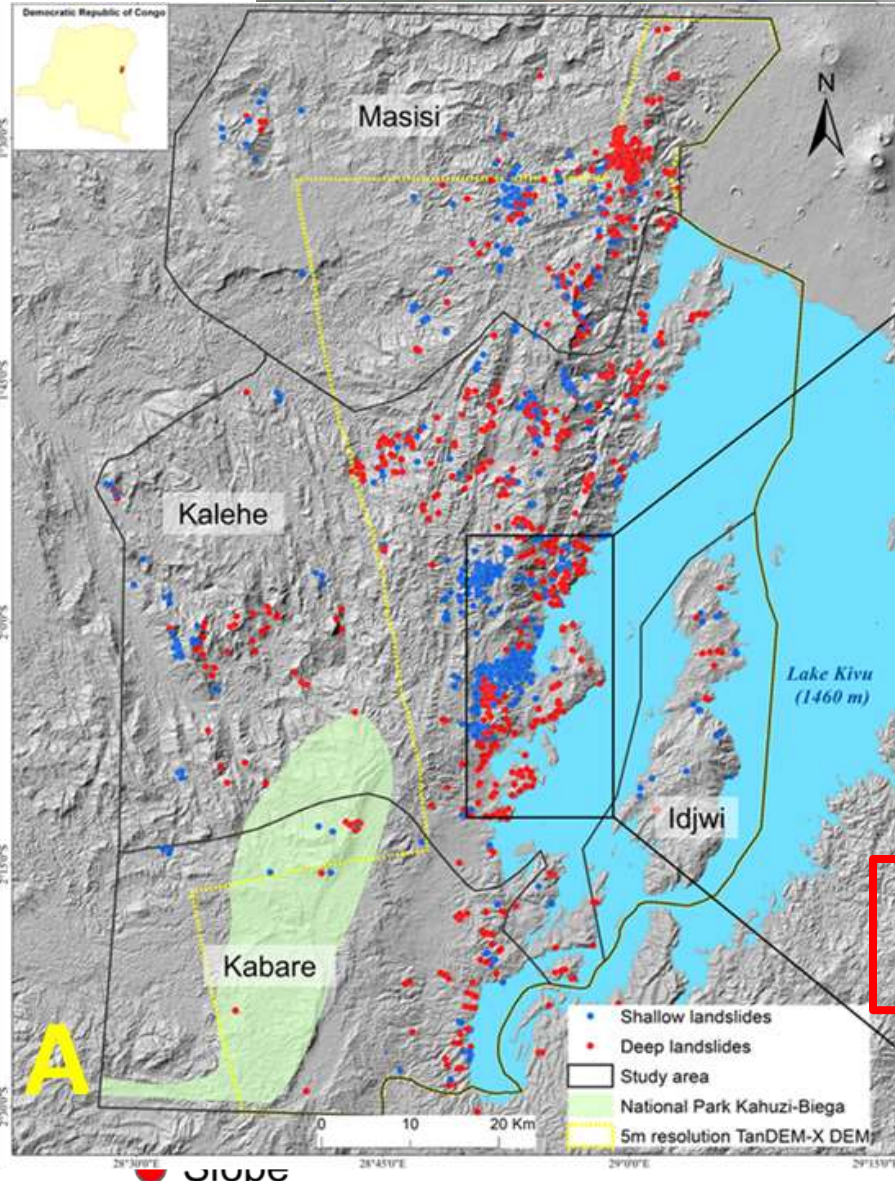
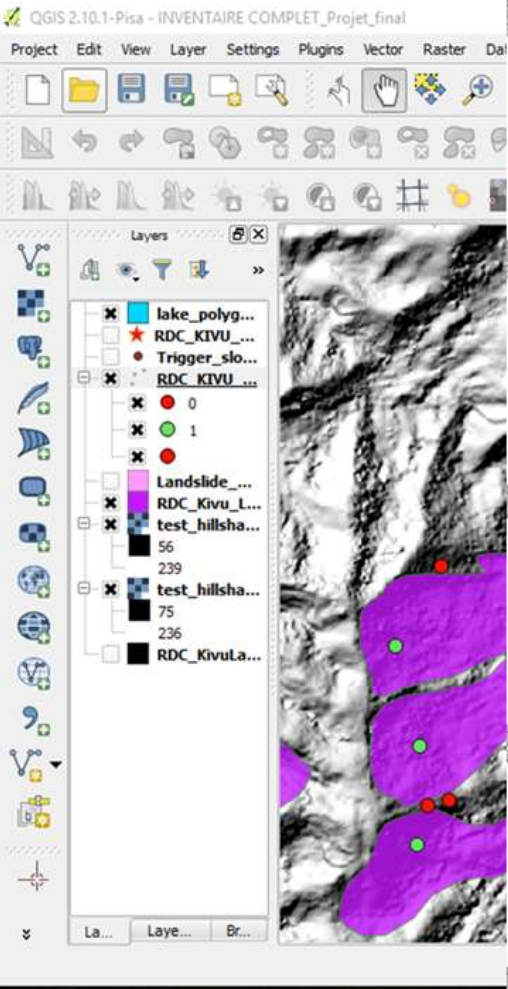
Slower

- Mass movement along a slope
- Several triggering sources

Cause damage to people, buildings and infrastructure

Satellite images

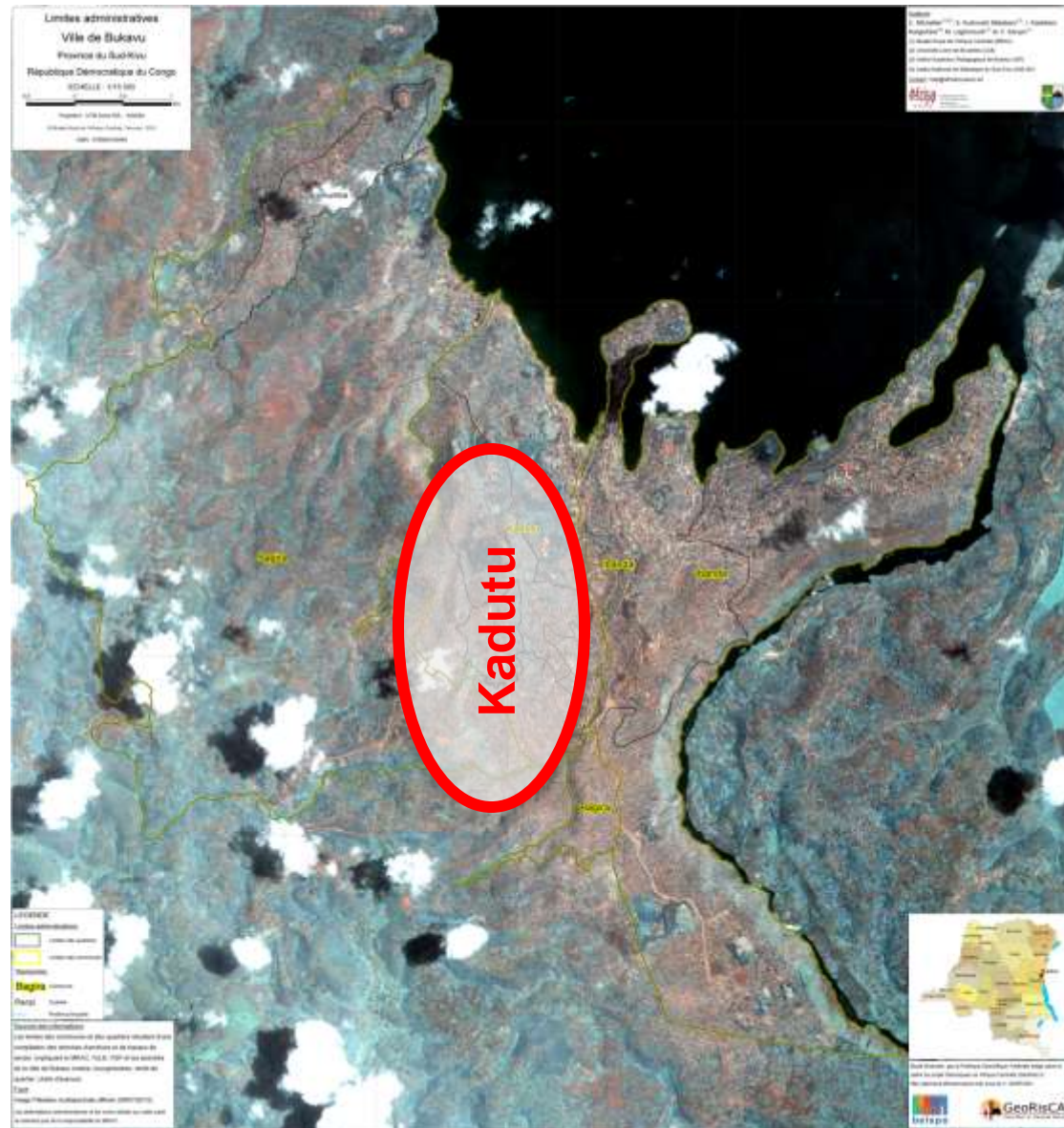
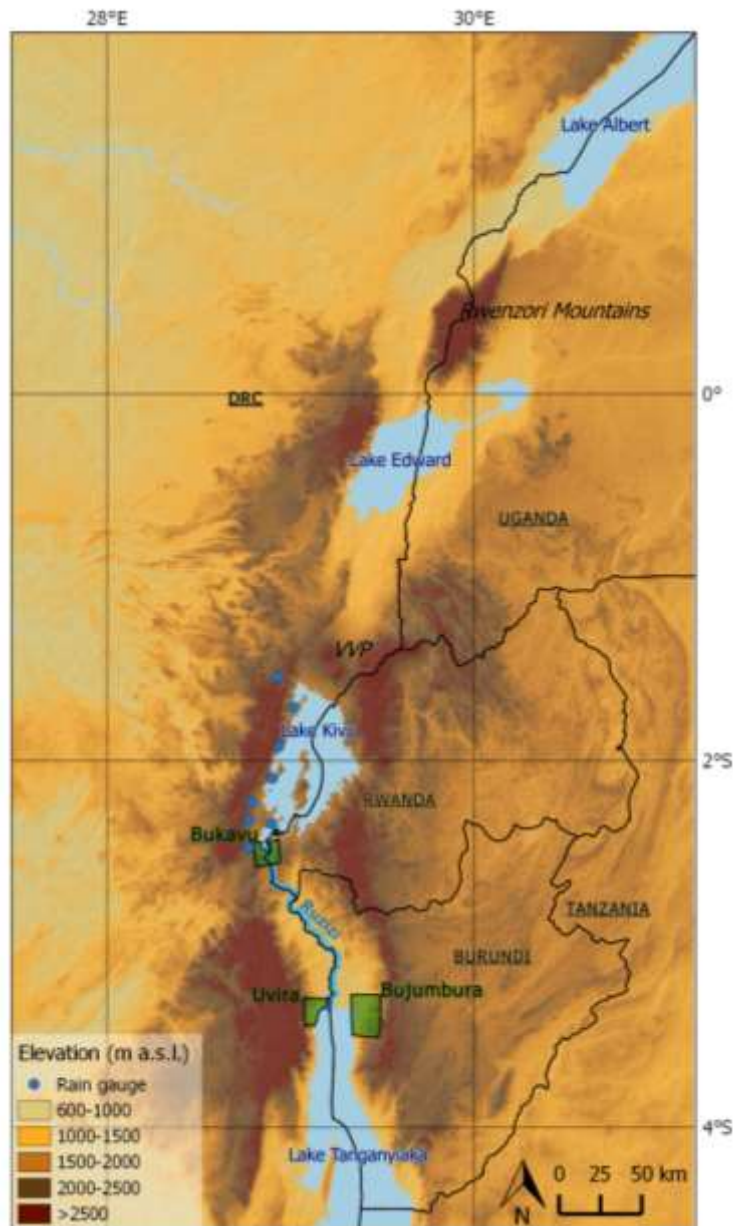
LS Catalogues



InSAR
Displacement rate

● Trigger

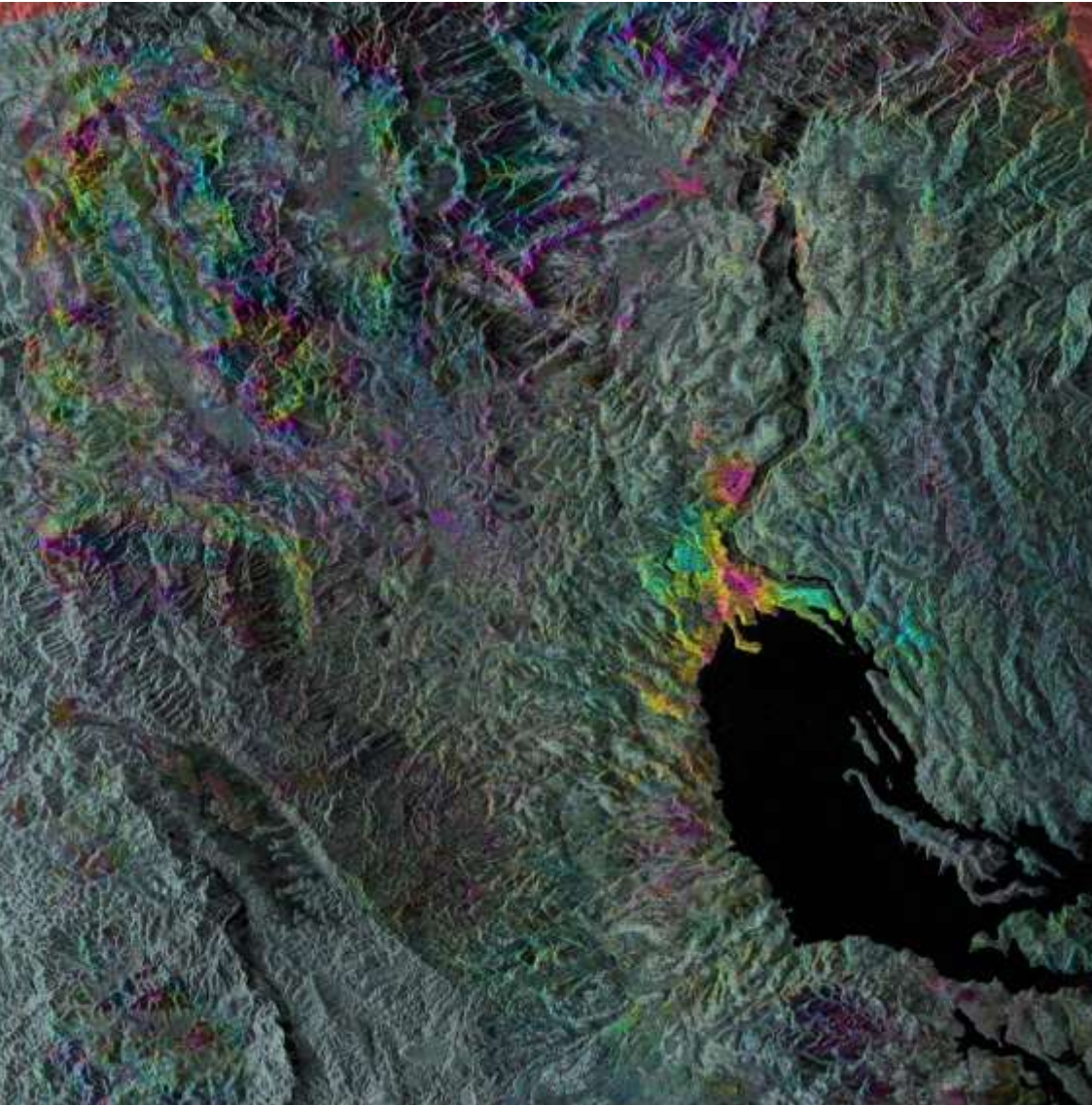
Western branch of the EARS – Bukavu



Bukavu – Kadutu



InSAR - Bukavu



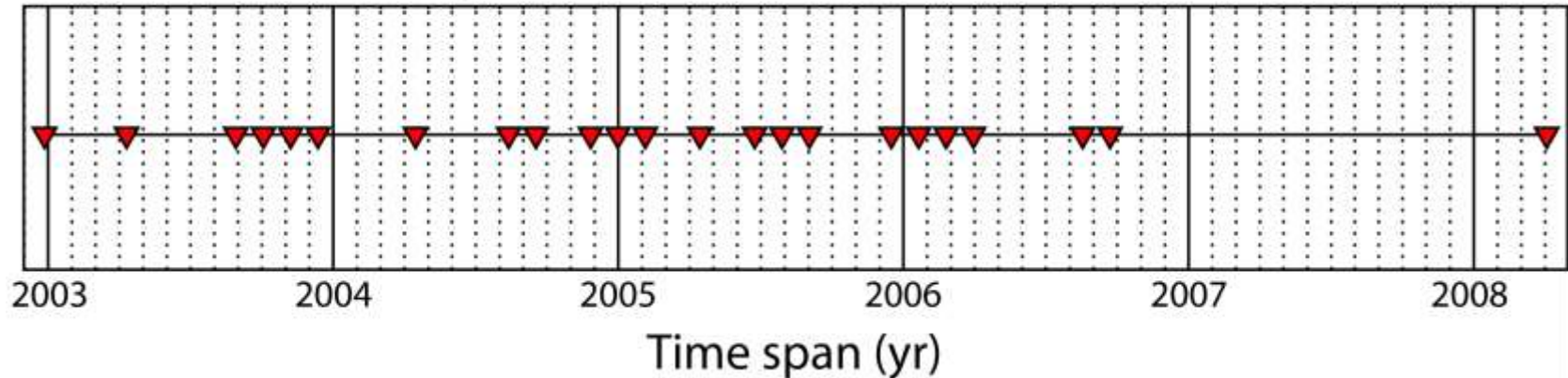
- CSK ifg 20150714-20150807
- Ascending Track
- Radar geometry

Bukavu LS:

- Inhabited area
- Movement toward East
- Displacement rate <10 cm/yr

ENVISAT Data

Temporal distribution of Envisat T228 Asc



Envisat ASAR images

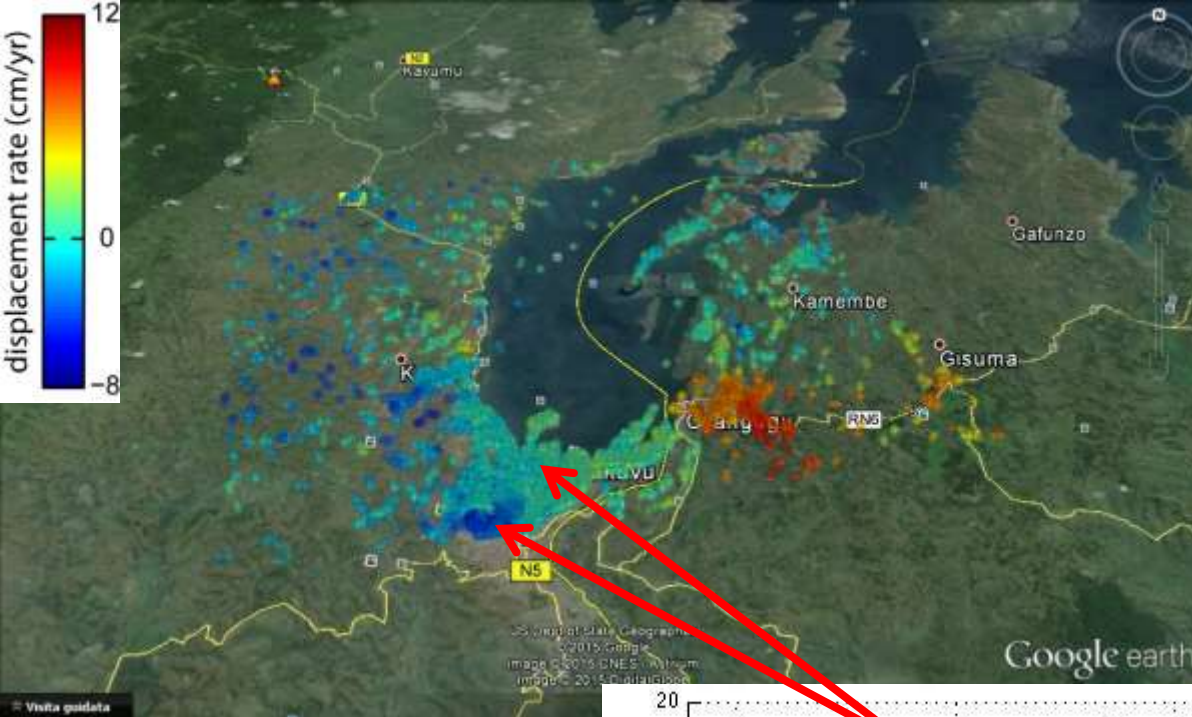
- Ascending (T228)
- Descending (T307)
- Period: end 2002 – half 2008
- Acquisition frequency unstable

SBAS Technique

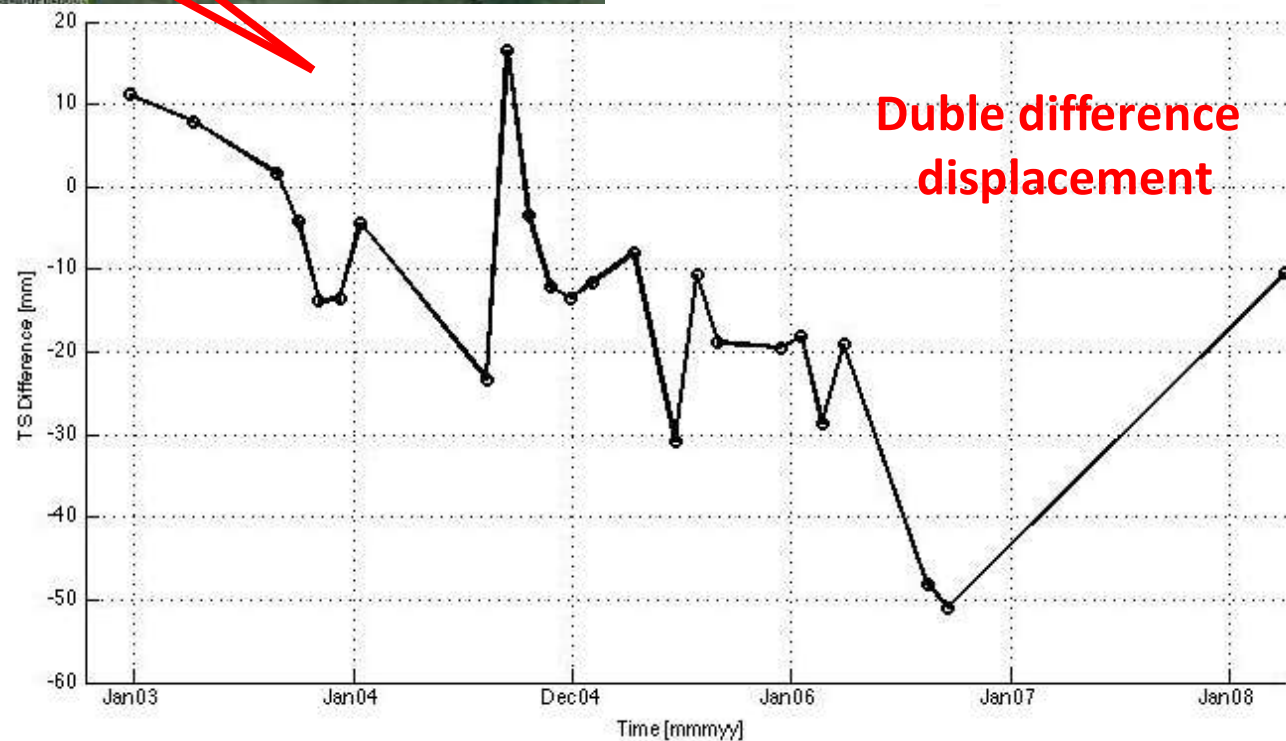
ENVISAT SBAS

Ascending Track

Movement away from the satellite

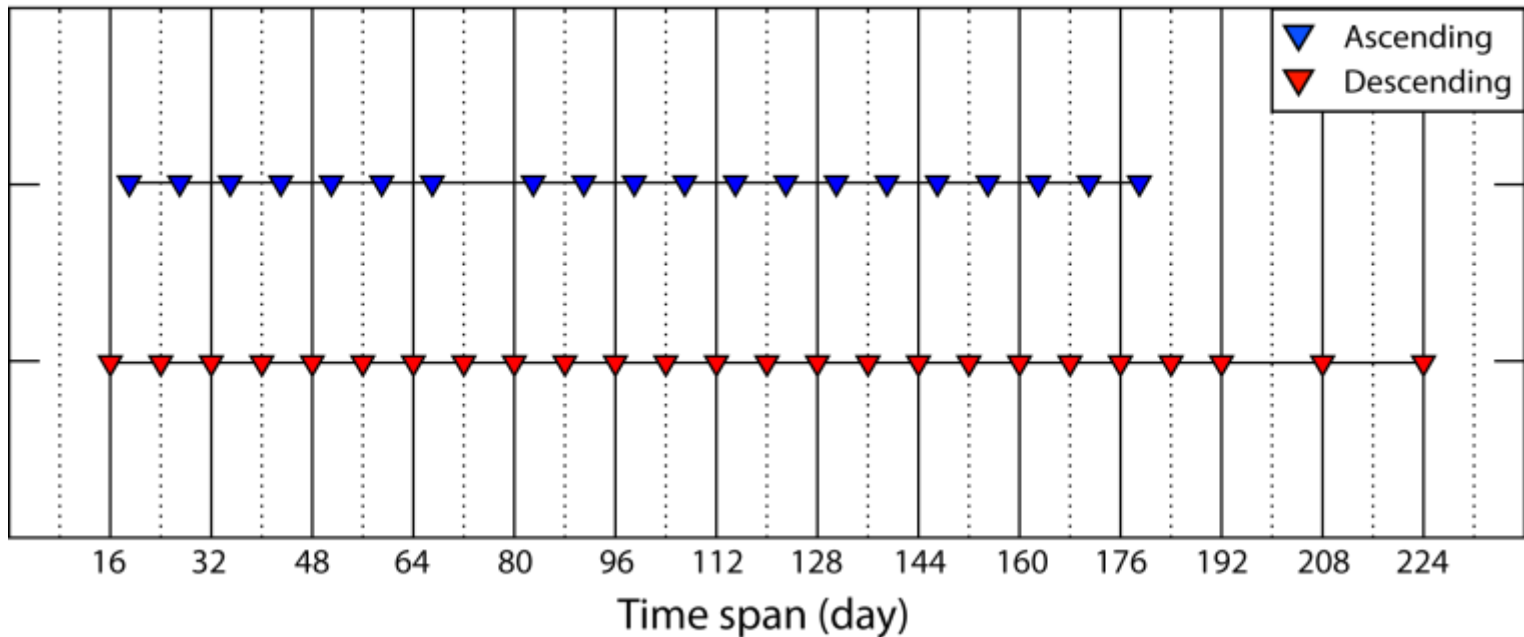


Descending Track
Movement toward the satellite



Cosmo-SkyMed Data

Temporal distribution of CSKS images



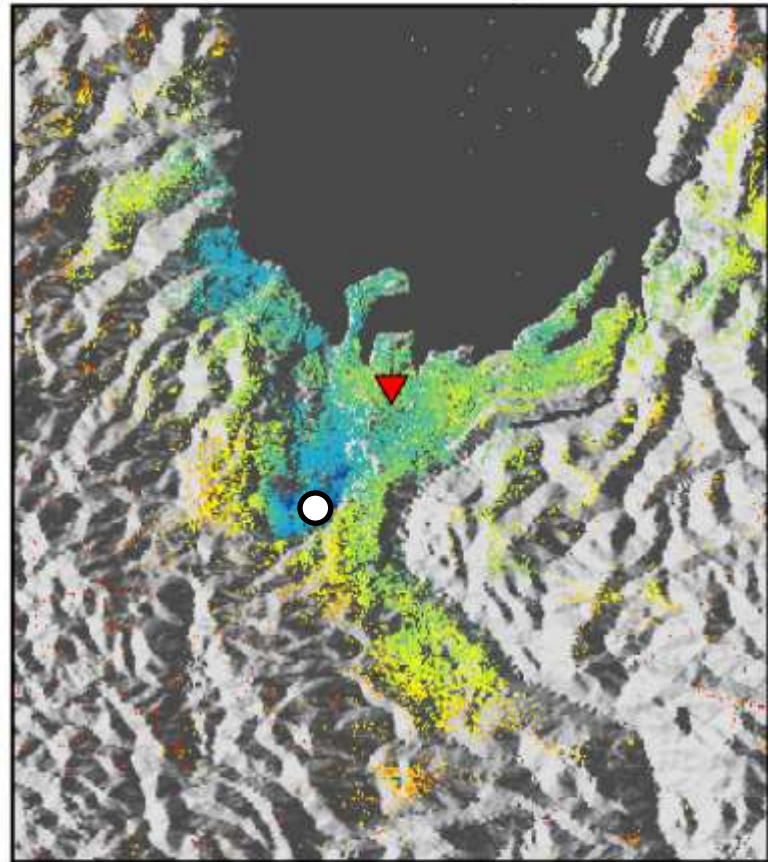
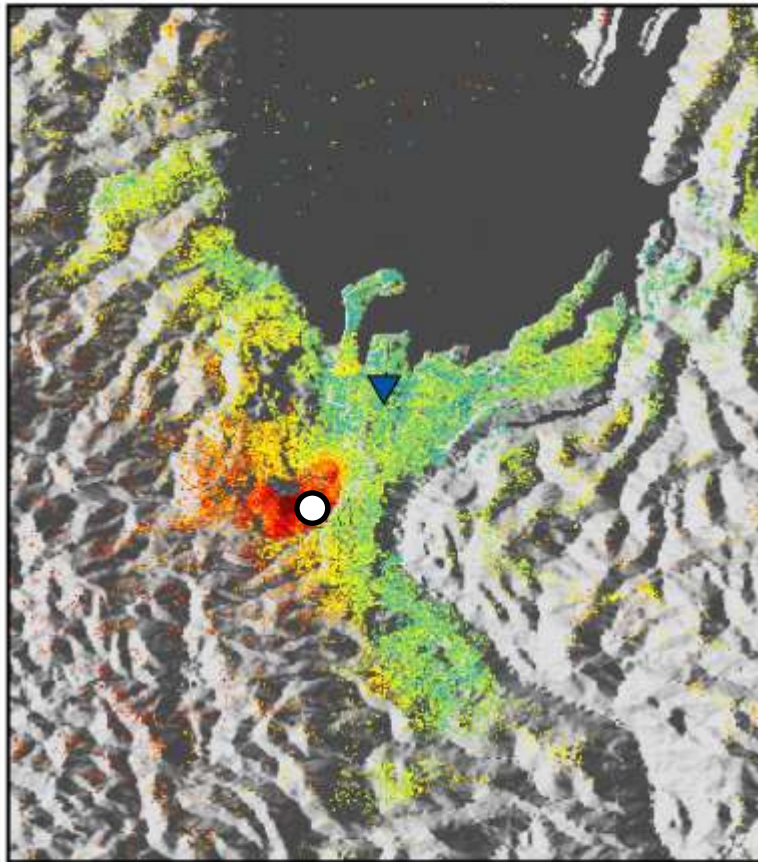
- Ascending (25 imgs – 20 used)
- Descending (25 imgs)
- Period: Mar - Oct 2015
- Acquisition frequency stable (8 days)

PS Technique

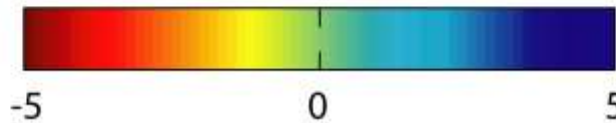
CSKS - PS

Ascending

Descending



Displacement rate (cm/yr)



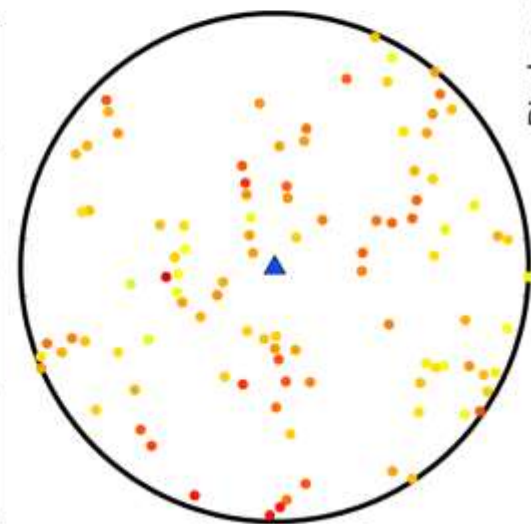
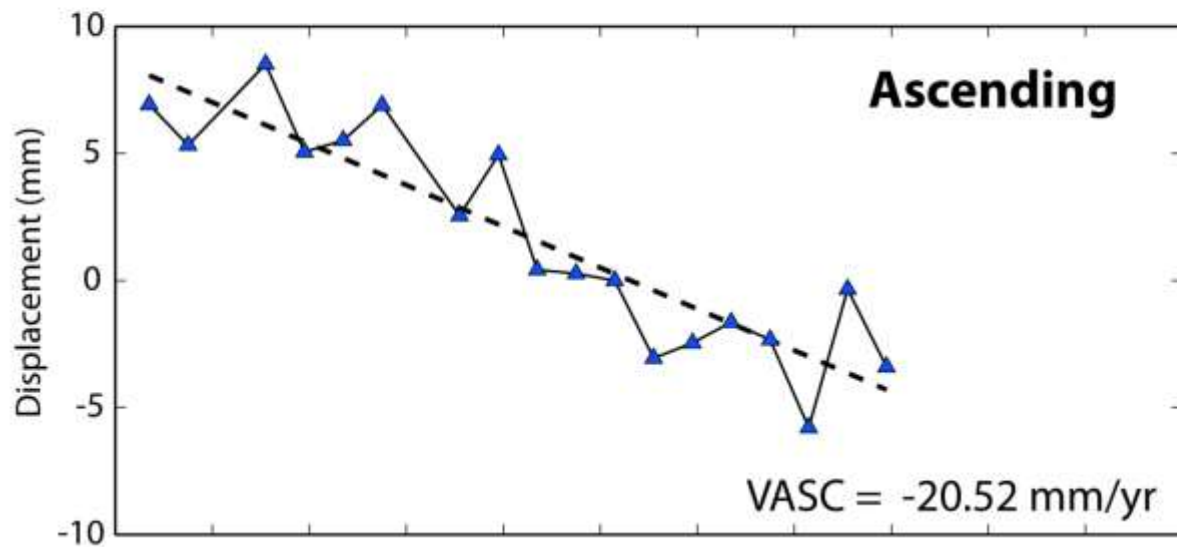
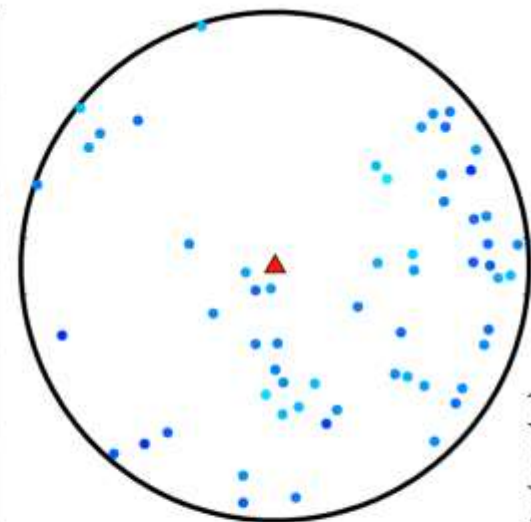
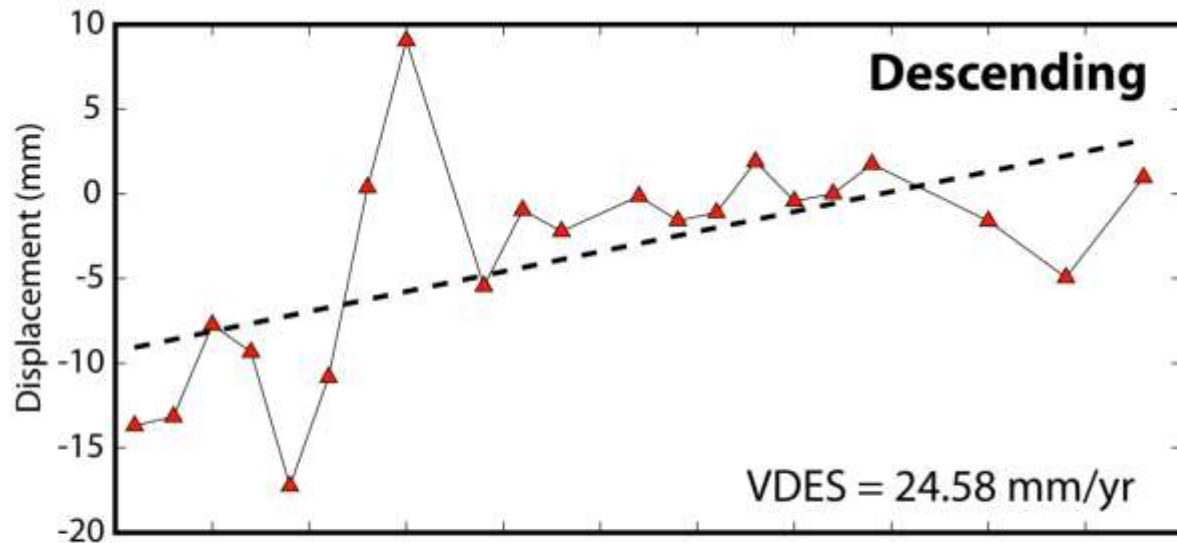
Ascending Track

Descending Track

Movement away from the Satellite

Movement toward the Satellite

CSKS - PS



Displacement rate (mm/yr)

50

0

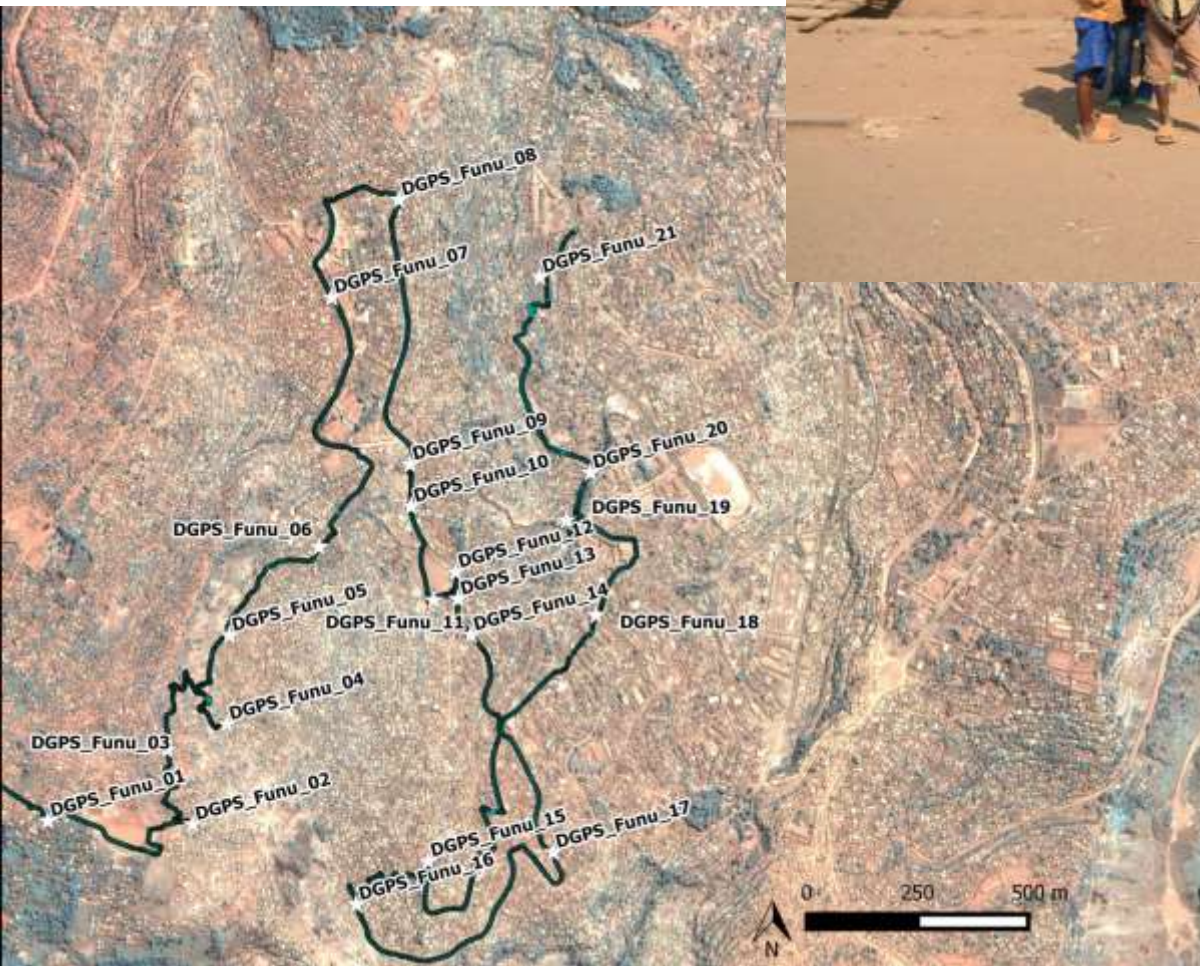
-50

Validation Field observations



- Large population density
- Few masonry buildings
- The road was asphalted in 2013

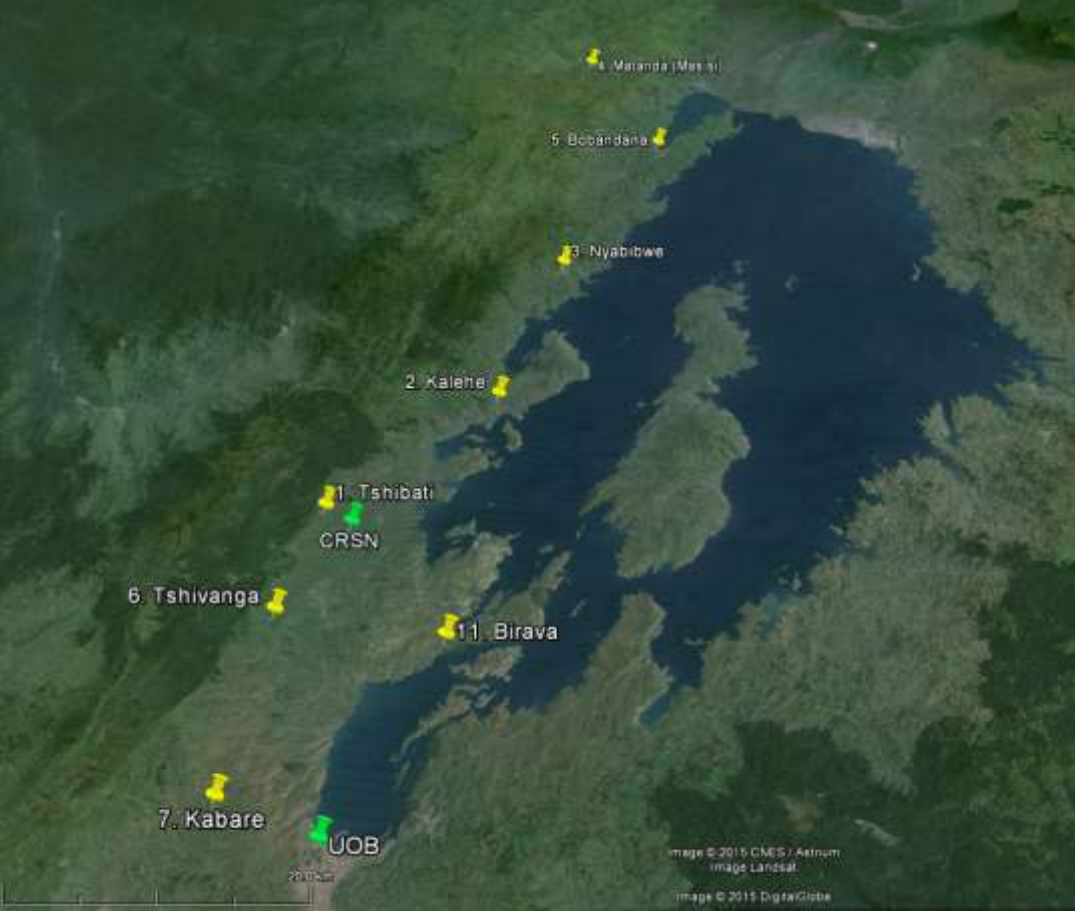
Validation GPS campaign



- 5 measurements between Aug. 2014 – Aug. 2015
- 21 benchmarks
- Next campaign in Feb.2016

Trigger mechanisms

Rainfall monitoring
11 Rain gauge installed



Kalehe



Tshibati



Birava

Discussion

Satellite images are very useful to study landslide processes:

- Localize
- Evaluate parameters (shape, size, slope angle etc)
- Evaluate displacement rate (InSAR)
- Create catalogue and hazard maps

InSAR on Bukavu Landslide suggest:

- Movement in East direction
- up to 5 cm/yr

Future works:

- 50 new CSK acquisitions (more than 1 year)
- Validation of InSAR result with field and GPS data
- Comparison between InSAR and rainfall TS



Thank you!