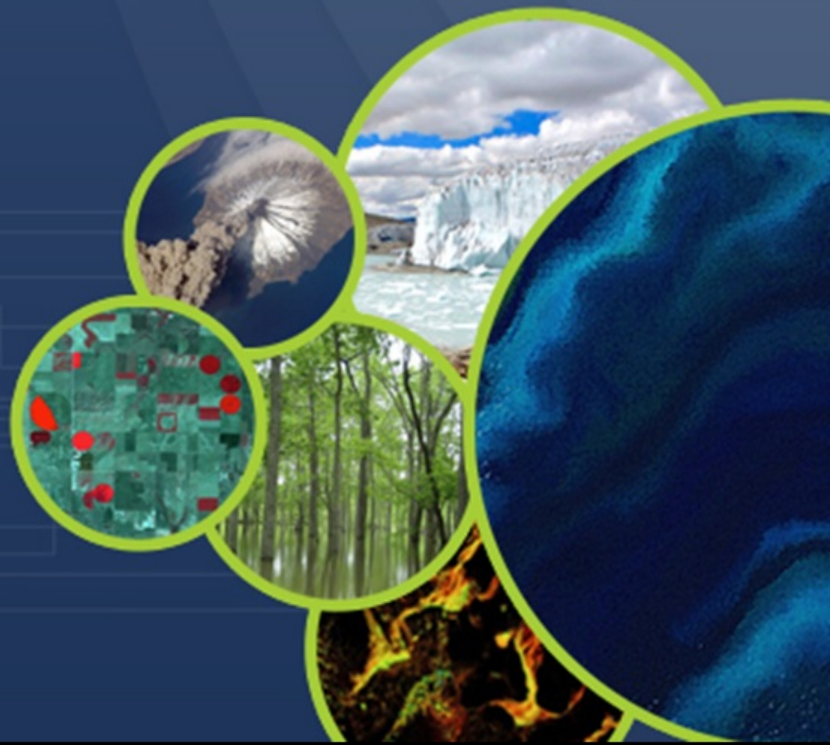
Committee on Earth Observation Satellites

Landslide Pilot Working Group Presentation

March 5 - 7, 2019
Athens, Greece



Co-leads of landslide pilot

Dr. Dalia Kirschbaum, NASA Goddard Space Flight Center, Maryland, USA

Dr. Jonathan Godt, Landslide Hazards Coordinator, U.S. Geological Survey, Colorado, USA

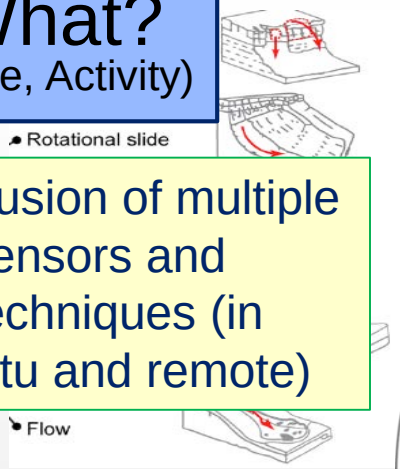
Dr. Jean-Philippe Malet, School and Observatory of Earth Sciences, University of Strasbourg, France

Dr. Sigrid Roessner, GFZ German Research Centre for Geosciences, Germany

Integration of satellite platforms for understanding landslides

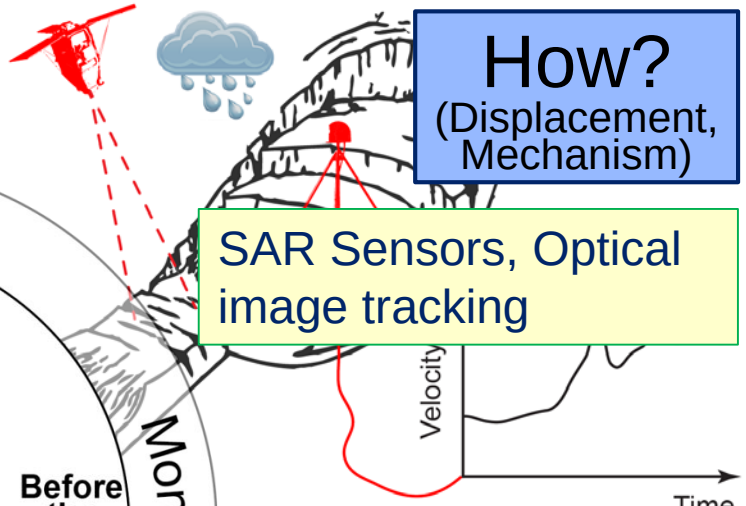
What?
(Type, Activity)

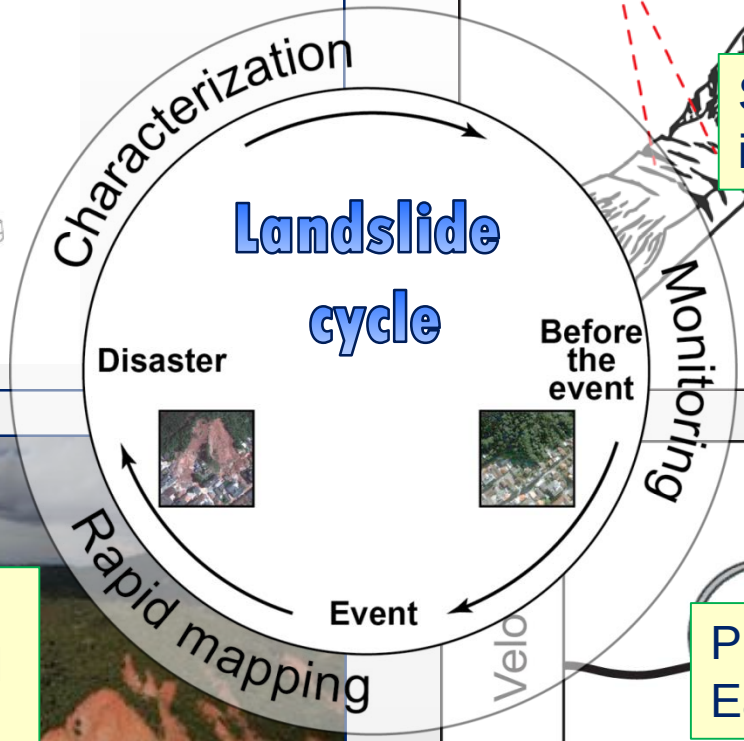
Fusion of multiple sensors and techniques (in situ and remote)



How?
(Displacement, Mechanism)

SAR Sensors, Optical image tracking

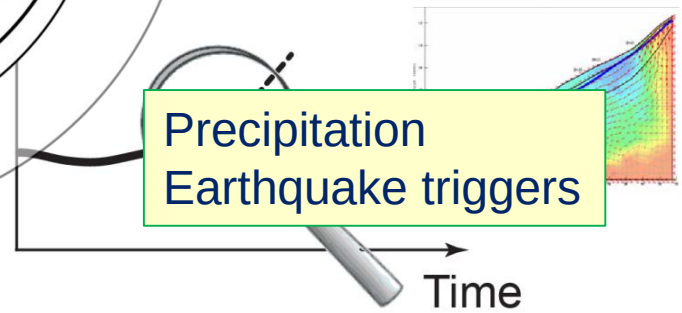




Optical data, Citizen Science and Inventory sharing

Where?
(Location)

Precipitation
Earthquake triggers



When?
(Forecast)

Landslides in multi-hazard environments

Earthquakes **Major triggers** **Hydrometeorologic extremes (e.g. typhoon)**

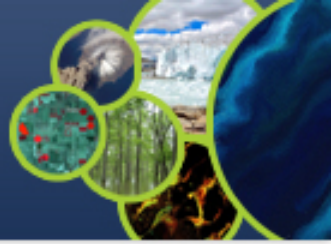
New Zealand: 2016 (7.8Mw) ca. 6,000 landslides
Nepal: 2015 (7.8Mw) ca. 20,000 landslides

Nepal: Bhote Koshi (drone image month after EQ)

Taiwan: 2009 Typhoon Morakot: ca. 20,000 landslides

Taiwan: photos before and after

Landslides Pilot: Main Goals



To demonstrate the **effective exploitation** of Earth observations (EO) data and technologies to **detect, map and monitor landslides and landslide prone hillsides**, in different physiographic and climatic regions.

To apply satellite EO across the **cycle of landslide disaster risk management**, including preparedness, situational awareness, response and recovery with a distinct multi-hazard focus on cascading impacts and risks.

Pilot Objectives

A. **Establish effective practices** for merging different Earth Observation data (e.g. optical and radar) to better monitor and map landslide activity over time and space.

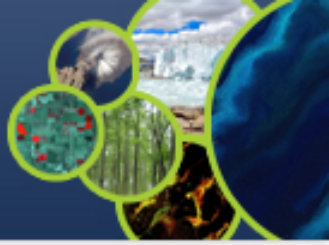
B. Demonstrate how landslide products, models, and services can **support disaster risk management** for multi-hazard and cascading landslide events.

C. **Engage and partner with data brokers and end users** to understand requirements and user expectations and get feedback through the activities described in objectives 1-2.

Regional study areas and leads

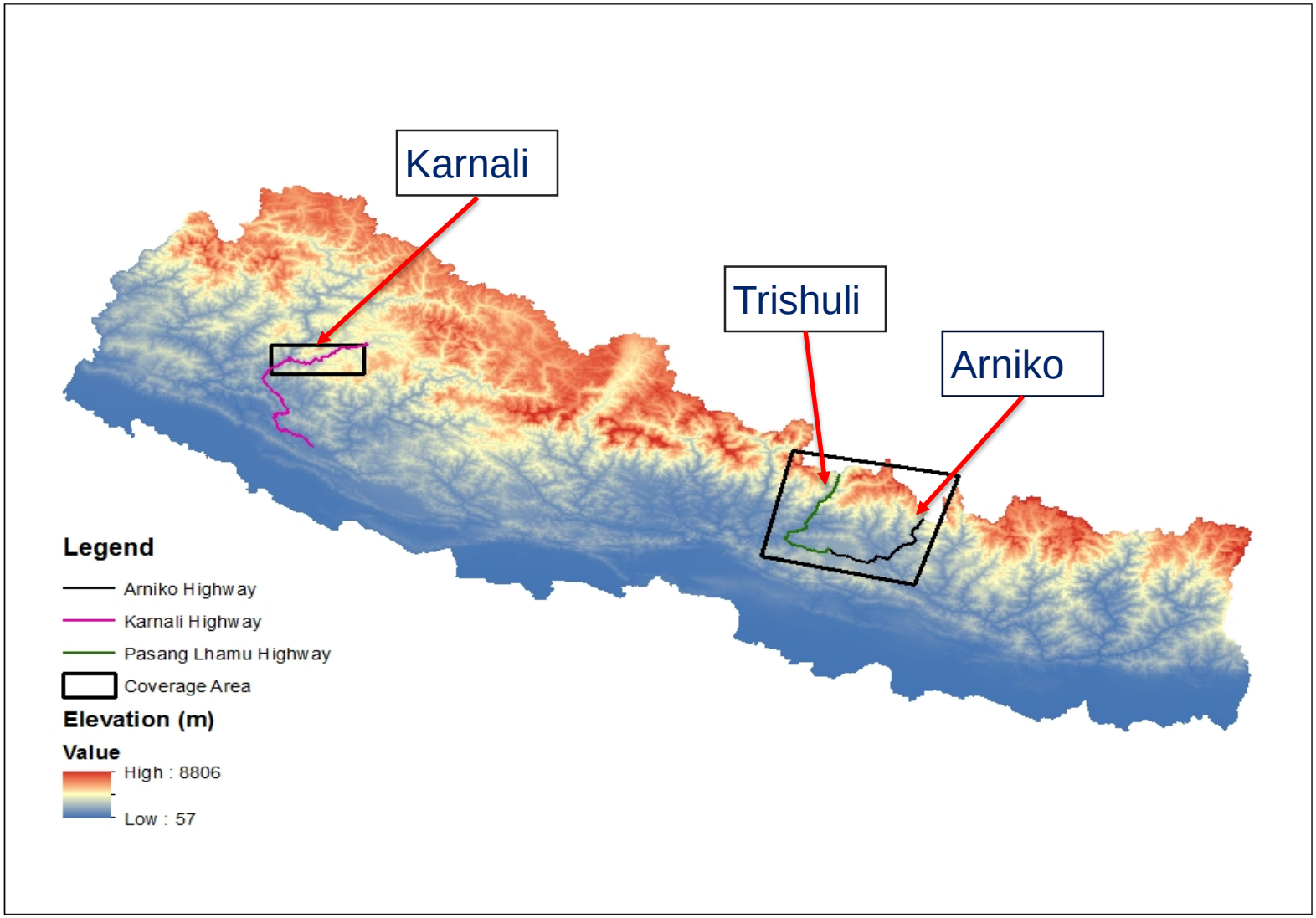
Region	Regional Point of Contact
Nepal	Nick Rosser, Sigrid Roessner, Dalia Kirschbaum
Pacific Northwest, US	Jonathan Godt, Dalia Kirschbaum
Eastern Africa	*Olivier Dewitte*
Caribbean (Cuba/Lesser Antilles)	*Georgina Bennett, Jean-Philippe Malet*
China	*Zeng-Guang Zhou*

How data will be exploited



Geographic Area	Products	Value Added Partners
Nepal	Landslide monitoring and deformation analysis, multi-temporal landslide inventories, magnitude-frequency analysis of landslide occurrence, multi-temporal landslide hazard analysis	ICIMOD, Nepal Govt. Ministries, World Bank, Red Cross, US Army Corp of Engineers
Pacific Northwest, US	Landslide monitoring and deformation mapping, historical analysis and multi-temporal mapping	Washington and Oregon Departments of Transportation, National Parks Service, National Forest Service, FEMA, USGS
Eastern Africa	Deformational monitoring of slow moving landslides, delineation of hazard areas	City managers, university partnerships
China	Technologies of spatial-temporal detection of landslides; Spatial-temporal mapping of earthquake-induced landslides	IMHE/CAS (Institute of Mountain Hazards and Environment, Chinese Academy of Sciences).
Haiti and Lesser Antilles	Multi-temporal landslide maps, Landslide monitoring and deformation mapping Methodological developments for automated processing of time series (GEP platform, other calculation). Frequency-magnitude relationships with triggers. Haiti and Lesser Volcanic Arc	CNES (Kal-Haiti), CNIGS, CIAT and UEH (Haiti) Permanent Risk Observatory of Guadeloupe and Martinique

Nepal data request areas



PNW data request areas


Orientale
Lake Albert
Uganda Eastern
Ruwenzori Mountains
Western
Central
Kampala
Busia
Kakamega
Bukavu
Lake Victoria
Mitumba Mountains
Rwanda
Mara
Kagera
Democratic Republic of the Congo
Mwanza
Shinyanga
Bujumbura
Burundi
Kigoma
Tabora
Tanzania
US Dept of State Geographer
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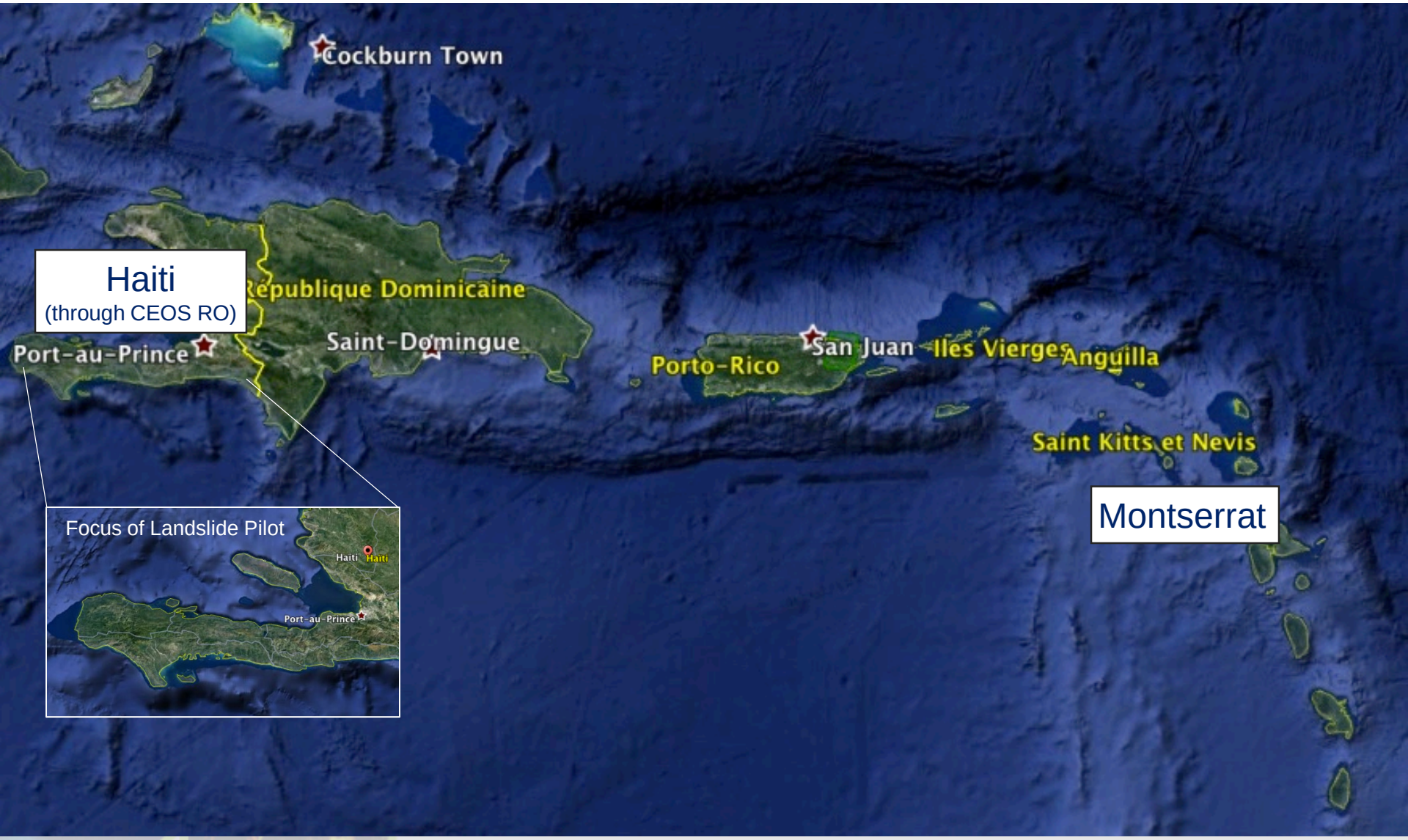
Image Landsat / Copernicus
Google Earth

Caribbean data request area



DLR/TerraSAR-X

Total quota: Decided by DLR upon review of the proposal

Ordered:

1. Nepal: Acquisition in Arniko study area of Nepal. Trishuli not feasible.
2. PNW: Not possible
3. East Africa: Not possible

Status: Acquisition ongoing for Arniko and data hosted in DLR ftp.

CSA/Radarsat-2

Quota available:

1. Nepal: 30 tasking, 30 archived

2. PNW: 30 archived

Status: No request received

ASI/COSMO-SkyMed

Total quota: 300 images/year

Ordered:

Nepal: Trishuli (72 asc/72 des), 2015 earthquake data also available but with permission from ASI

PNW: Wenatchee (30 asc/ 30 des), Cascade (30 asc/30 des).

East Africa: Bukavu (42 asc/42 des) (possible extension through volcano pilot)

Status: Acquired data hosted in ASI ftp (need for a central repository

CNES - Pleiades/SPOT

Pleiades

Total quota: 40000 km^2 for the life of the project.

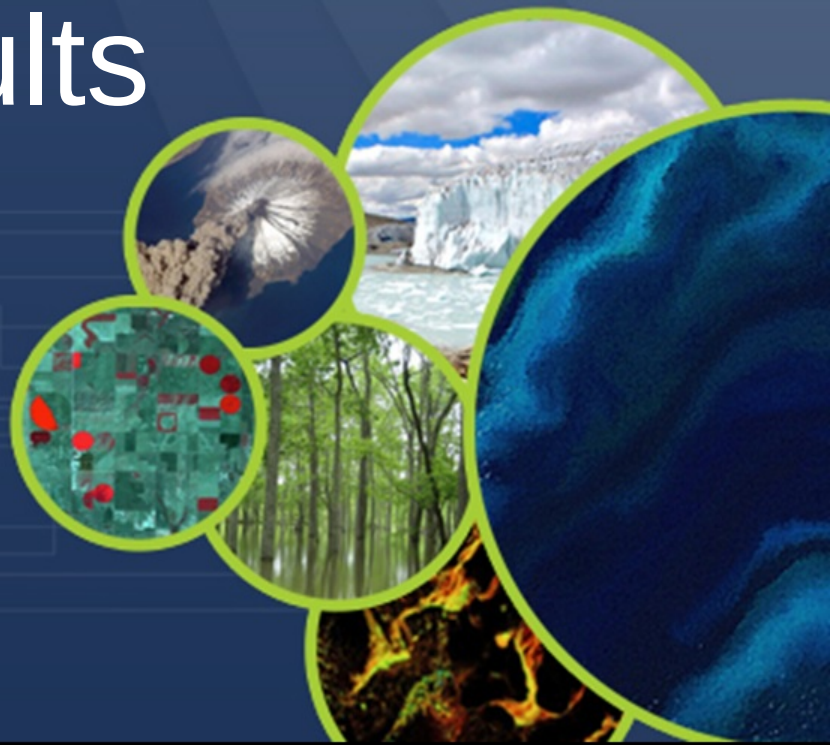
Ordered:

1. Nepal: Karnali (22242 km^2), Arniko (300 km^2)
2. PNW: Eel river (6605 km^2), Southern Oregon Coast (1535 km^2)
3. Caribbean: Montserrat (56 km^2, 2018) + new request 2019

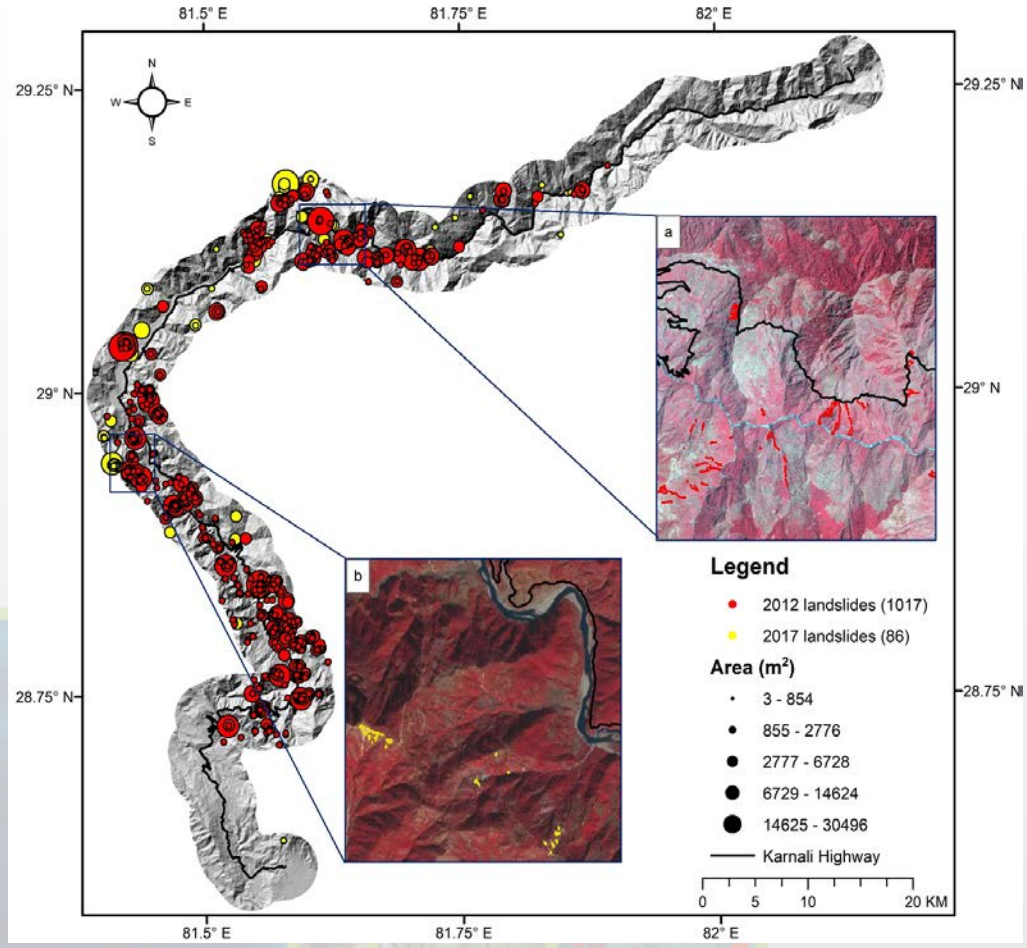
Status: data delivered directly to requestor.

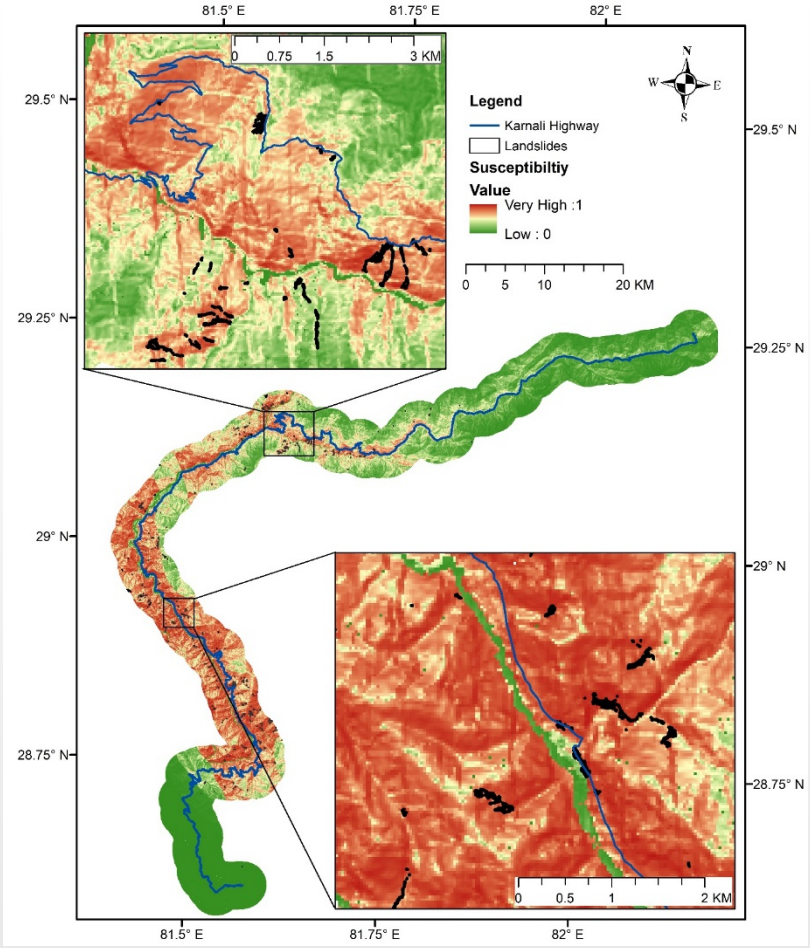
Quota of 6000 km2 available in Landslide Pilot (status on March 2019)

Nepal Study Sites: Preliminary Results



Landslide and susceptibility mapping along the Karnali highway, Nepal

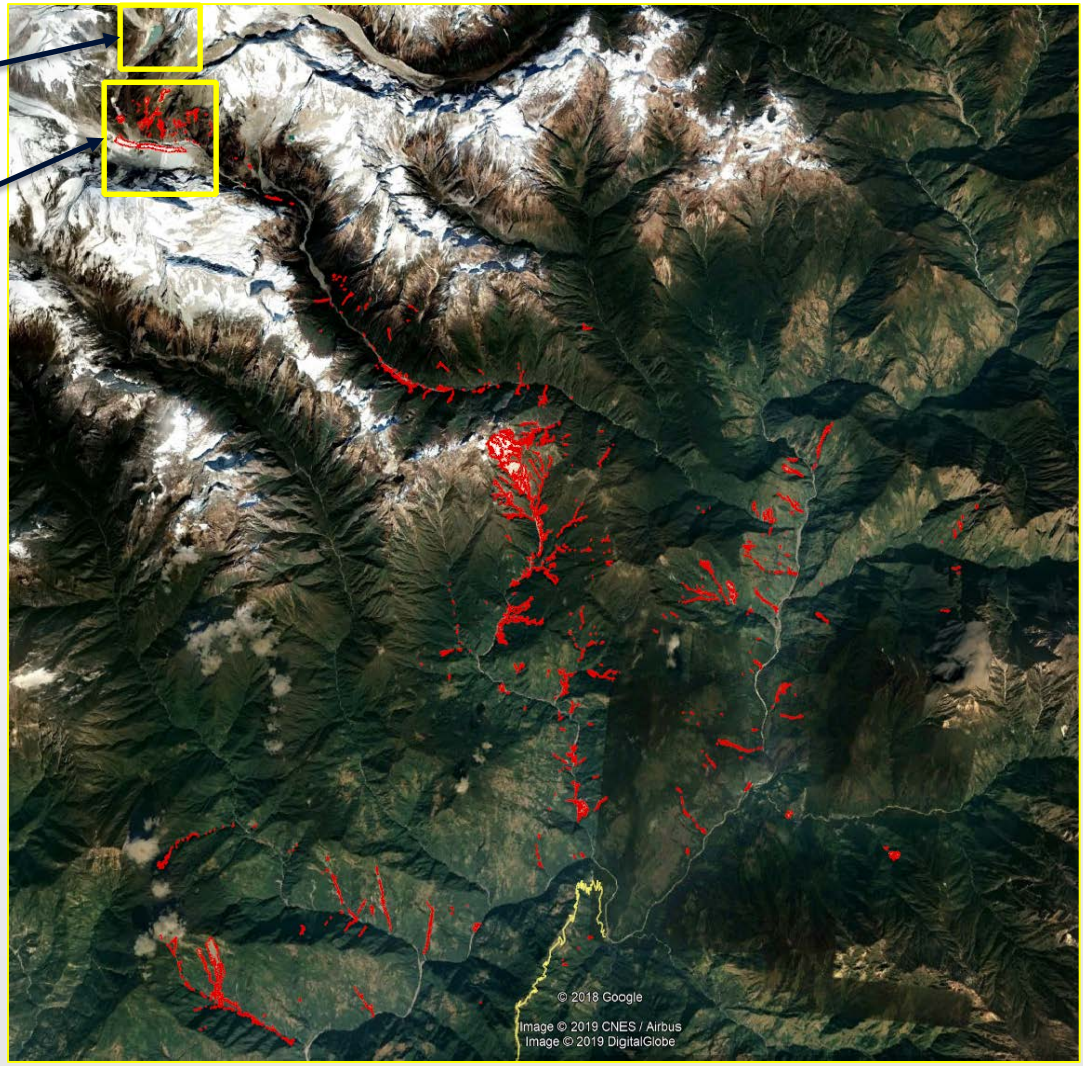




47.28% of area lie in a low susceptibility zone whereas 36.60% of study area lie in high susceptibility zone

Pukar Amatya (NASA/USRA), Dalia Kirschbaum (NASA)

Landslide mapping in Barun region, Nepal



1056 landslides were mapped dow nstream of Upper and Lower Barun glacial lakes for a study highlighting effective use of remote sensing dat a for examining cascading hazard i n High Mountain Asia.

Pukar Amatya (NASA/USRA), Dalia Kirschbaum (NASA)

Landslide mapping using medium-resolution Sentinel-2 Optical Data

- Test of ALADIM algorithm for automated landslide mapping for Nepal – Creation of pre-, post-monsoon landslide inventories

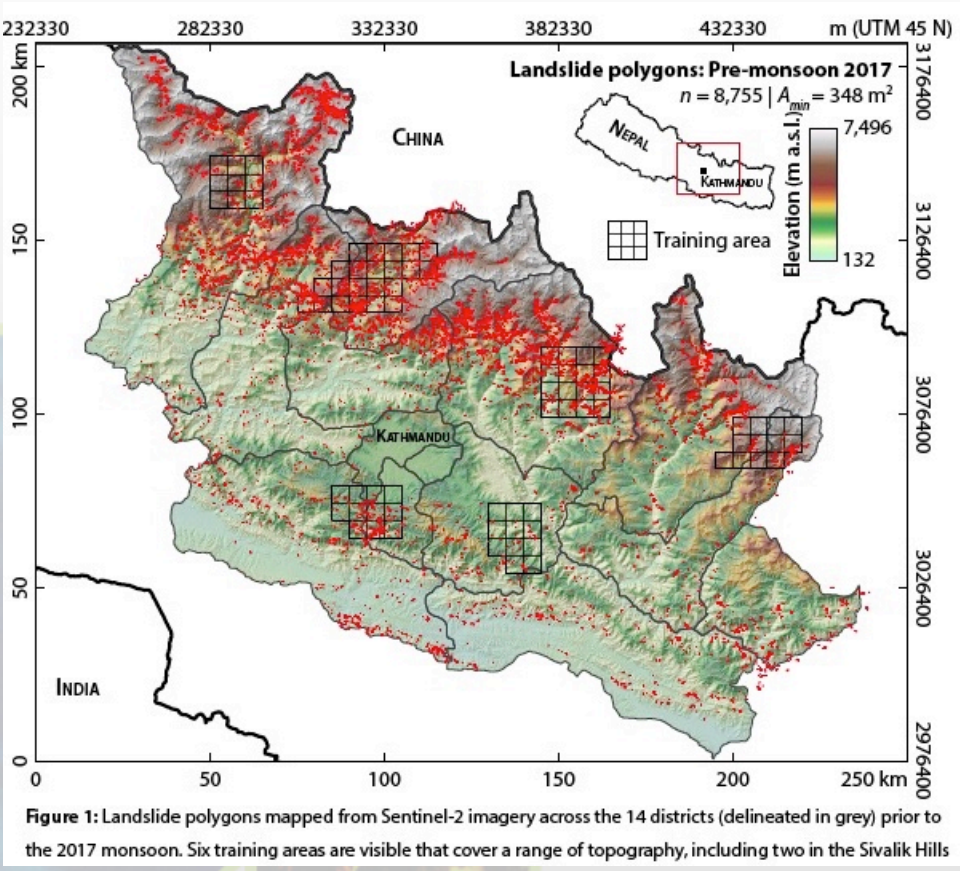


Figure 1: Landslide polygons mapped from Sentinel-2 imagery across the 14 districts (delineated in grey) prior to the 2017 monsoon. Six training areas are visible that cover a range of topography, including two in the Sivalik Hills

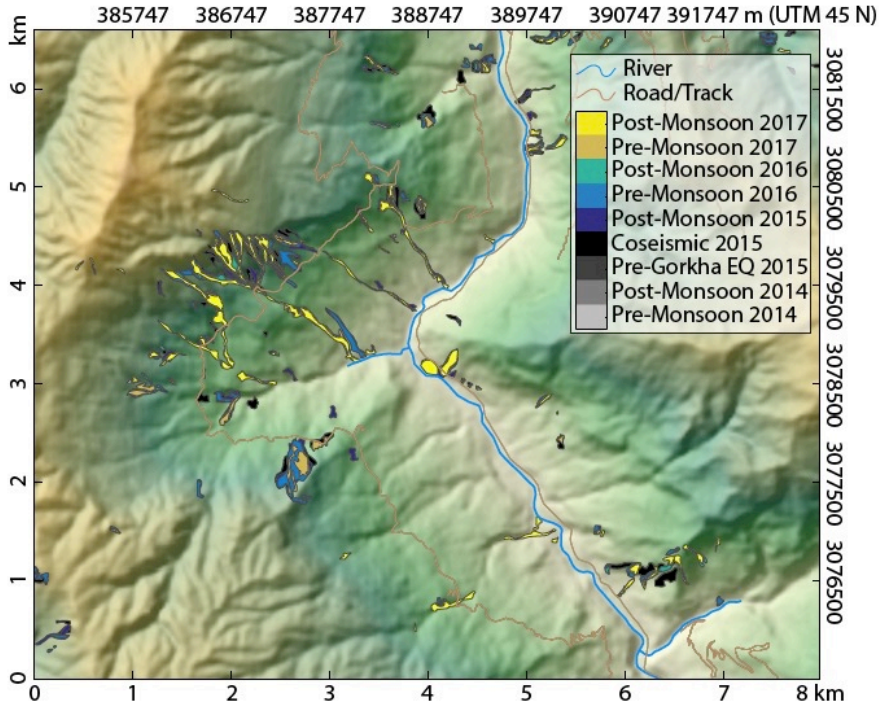
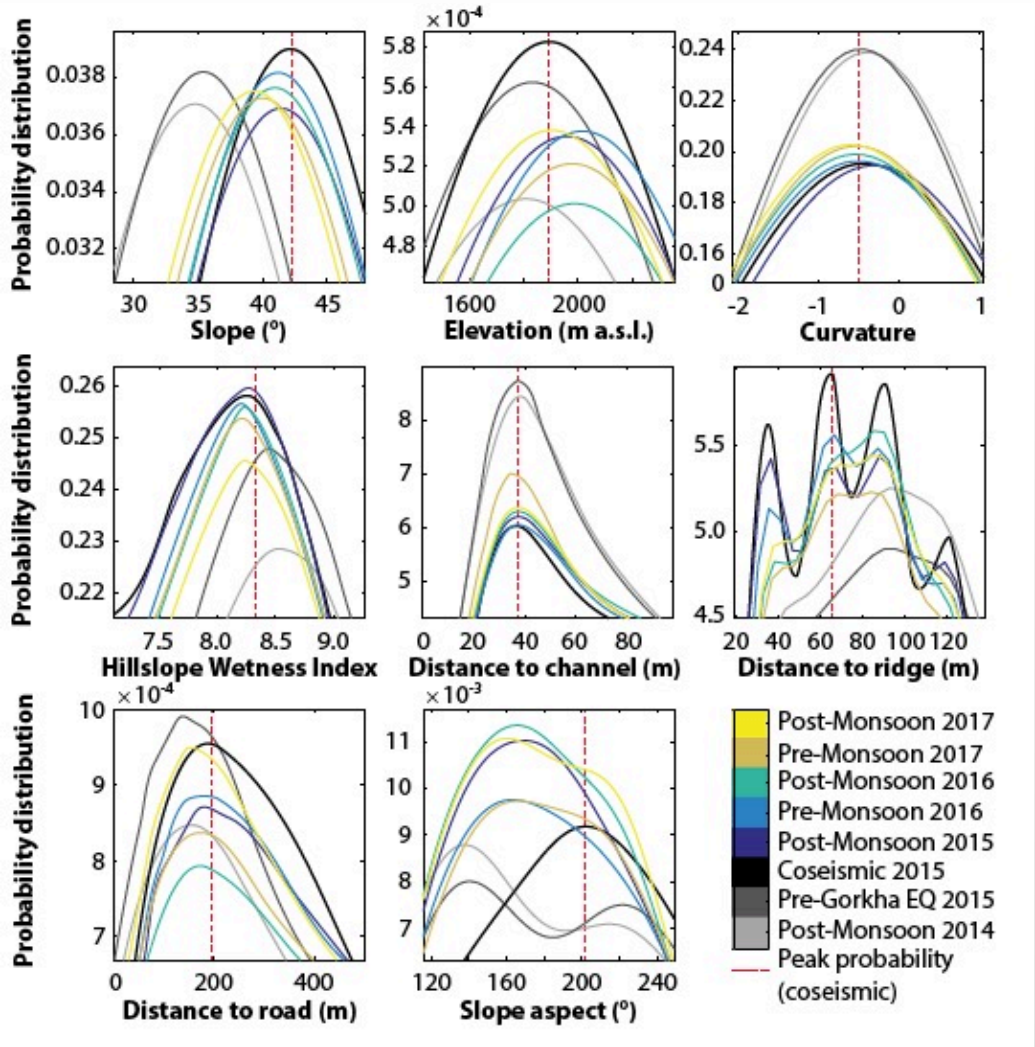


Figure 2: Extract of landslide polygons pre- and post-earthquake. All landslides (new and existing) are mapped independently for each epoch, enabling changes in individual landslide geometry and style to be identified through time. A frequent observation is the conversion of coseismic landslides to debris flows.

EGU2018: J. Williams / N. Rosser (U. Durham)
J.-P. Malet (EOST)

Landslide mapping using medium-resolution Sentinel-2 Optical Data

- Pre-, post-monsoon landslide topographic statistics



Topographic distributions of new landslide cells (which can originate from both new and existing landslides) through time.

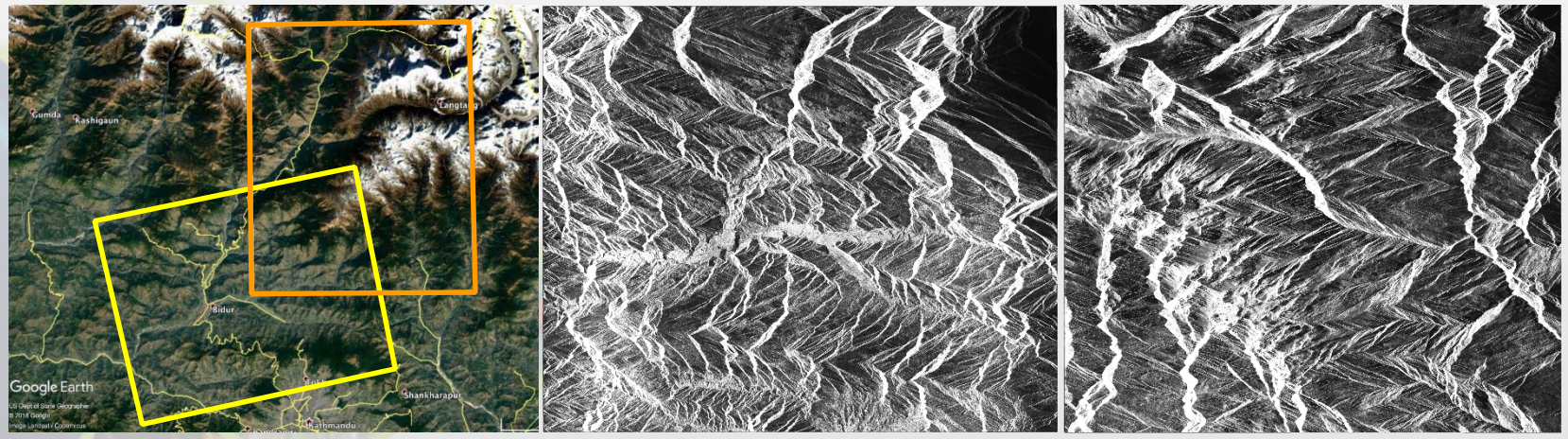
The 2015 Nepal earthquakes triggered landslides that were closer to the riidgelines, at higher slopes, and at higher elevations than rainfall-induced landslides from previous years.

A progression towards pre-EQ distributions appears to be ongoing in terms of slope and distance to channel/ridge. The latter reflects the extension of coseismic failures downslope (increasing runout length) with each monsoon.

EGU2018: J. Williams / N. Rosser (U. Durham)
J.-P. Malet (EOST)

Landslide mapping by Radar Data

- ***Difficulties*** **and opportunities of exploring landslides over HiMAT**
  - Mountainous areas with the high topographic relief result in distortions in SAR imagery: shadow, foreshortening, layover
  - High temporal decorrelation, especially in the wet seasons.
  - Lack of precise and high resolution topographic data (DEM)
  - Difficulties of maintaining the consistent signal with short wavelength (X-band) SAR: COSMO-SkyMed, TerrSAR-X/TanDEM-X, etc.
  - Small landslide outcrops and vegetation cover.
    - ***The window of opportunity is narrow!!***

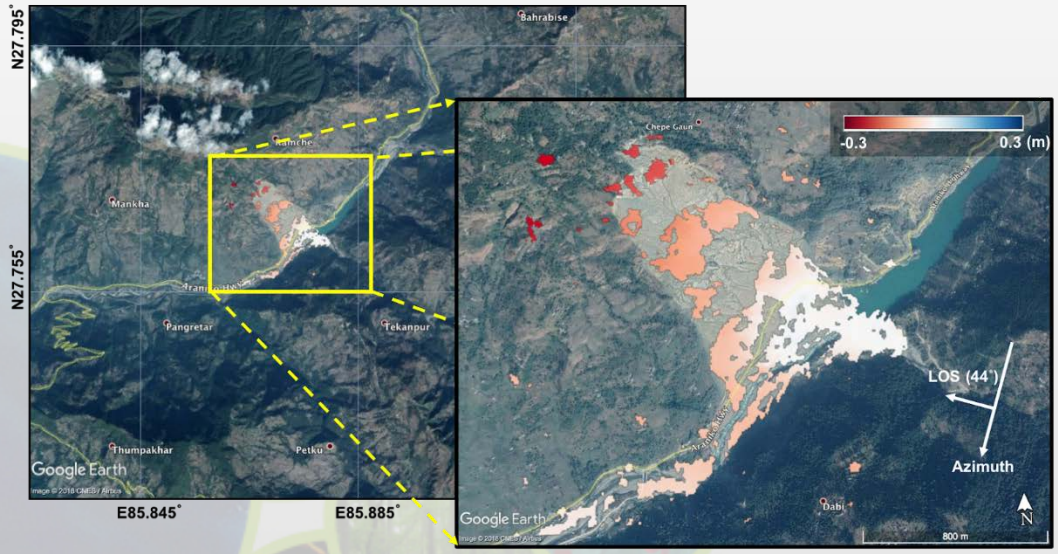


Example of COSMO-SkyMed SAR imagery over Trishuli, Nepal

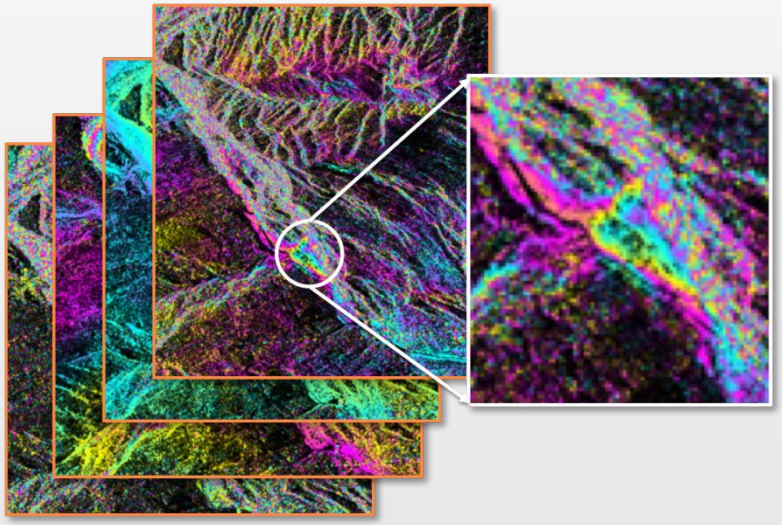
MinJeong Jo, NASA/USRA

Landslide mapping by Radar Data

- **Difficulties and *opportunities* of exploring landslides over HiMAT**
  - Possibilities of X-band SAR for the analysis of slow-moving landslide
    - Short revisit intervals (4d, 8d, 11d, etc)
    - Observable size of a landslide outcrop (≳1km)
    - Short perpendicular baselines of InSAR pairs
    - Multi-temporal analysis of InSAR measurements to suppress unwanted errors



Multi-temporal analysis (SBAS) of COSMO-SkyMed InSAR data

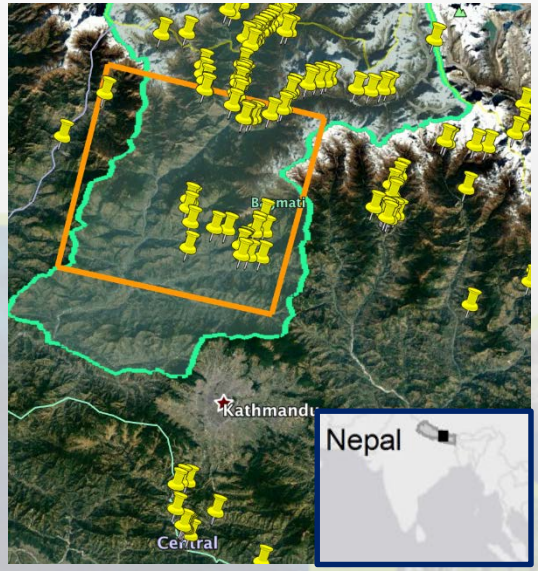


InSAR observations over the Ariniko highway, Nepal, with TerraSAR-X data (2018-2019). 11 days of revisit intervals. <100m baselines.

MinJeong Jo, NASA/USRA

Landslide mapping using SAR Sentinel-1 data

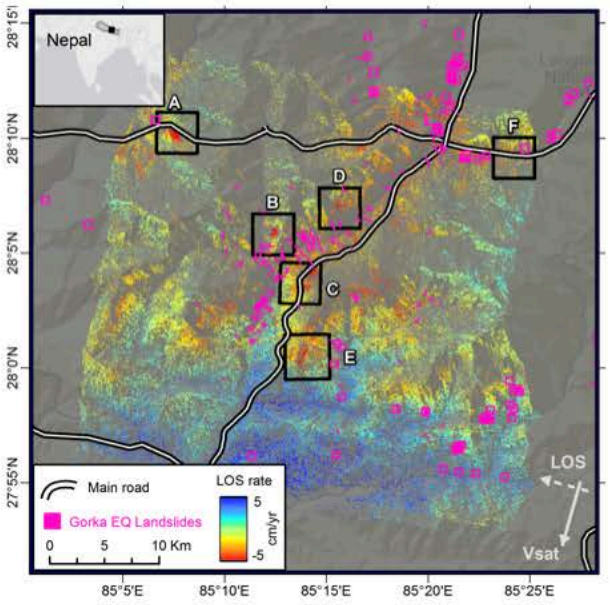
- Using multi-temporal SAR overpasses this work seeks to determine the feasibility of using Sentinel-1 data for identifying landslide movement within the Trishuli basin
- Field surveys provided by the Univ. of Durham helped to corroborate or explain our observations with the SAR data

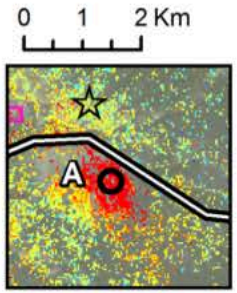


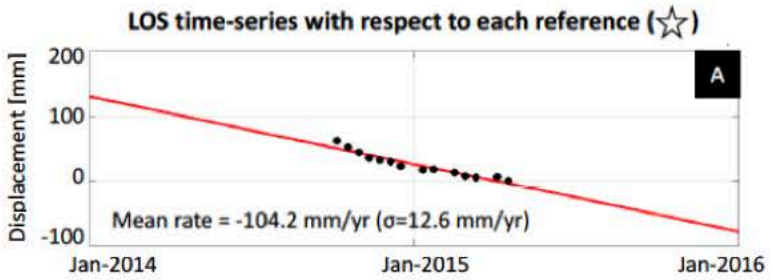
Improved understanding on causes & correlation with physical processes requires dense spatio-temporal landslide catalogues

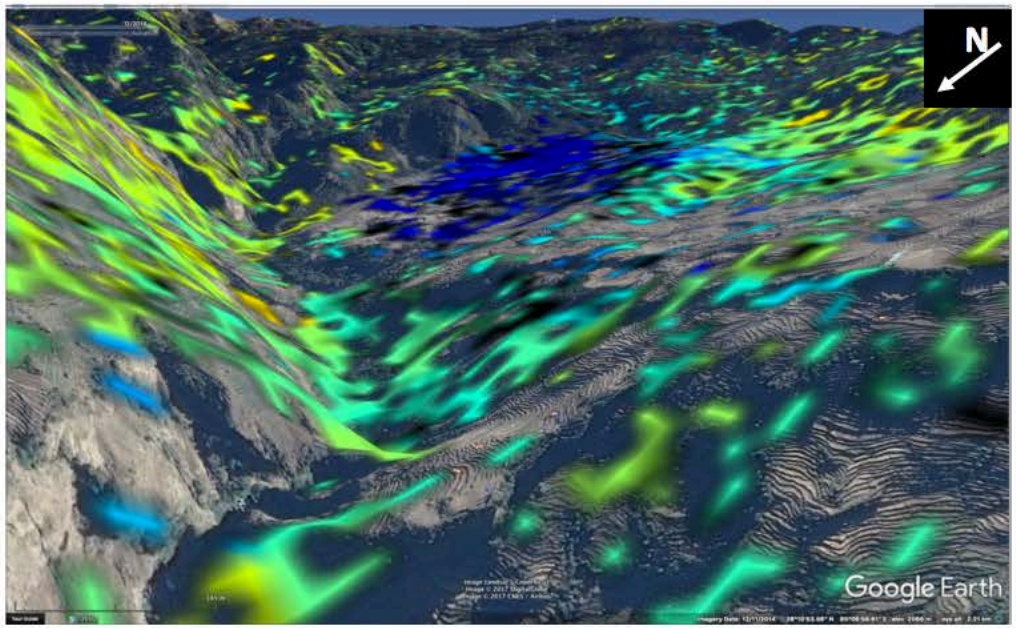
D. Bekaert et al., NASA/JPL

Line of Site time series change using Sentinel-1 data

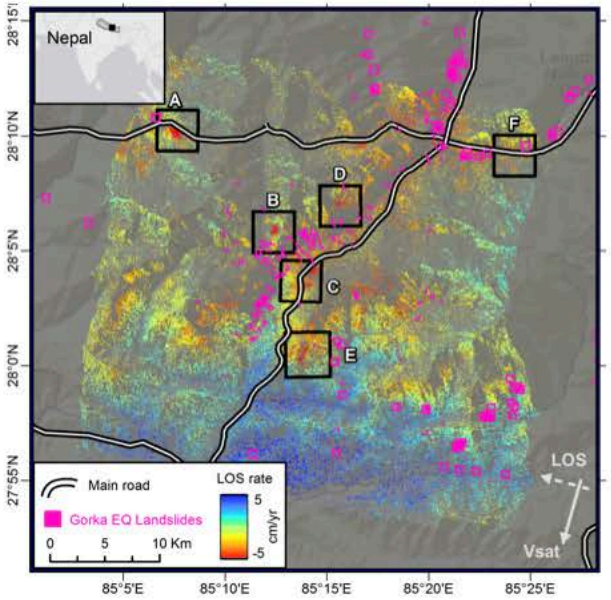


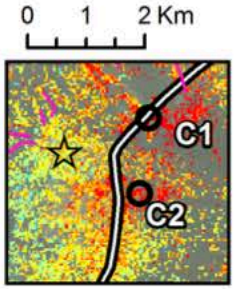


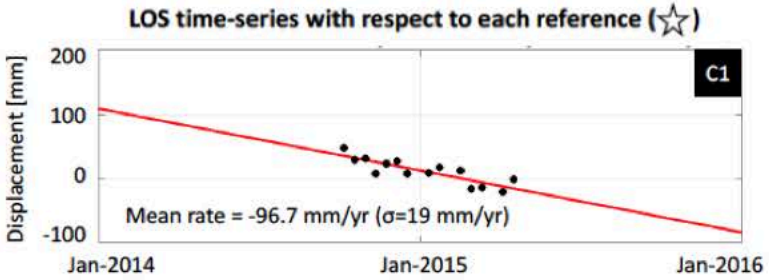


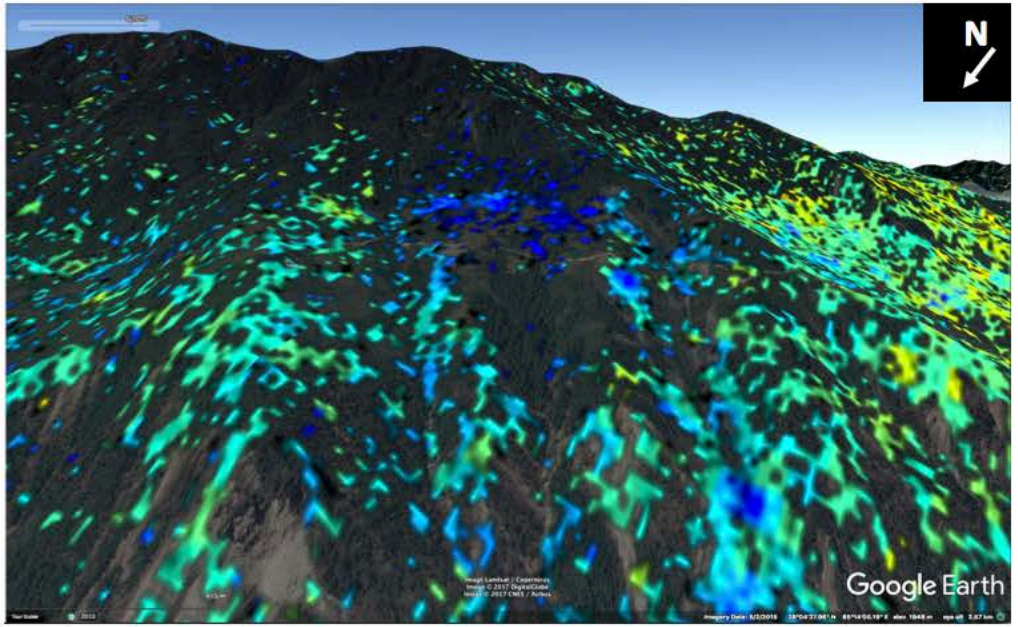


Study area C within Trishuli

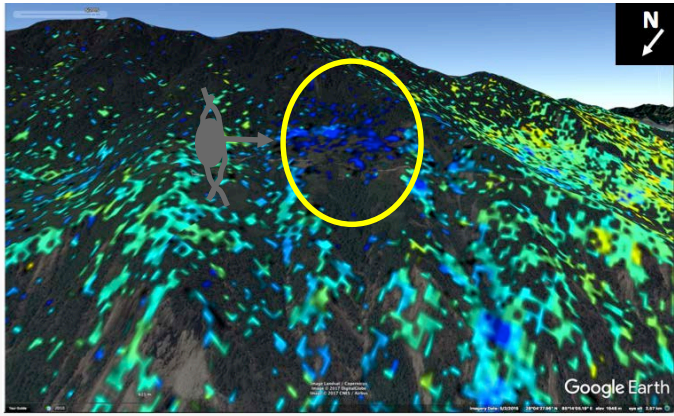




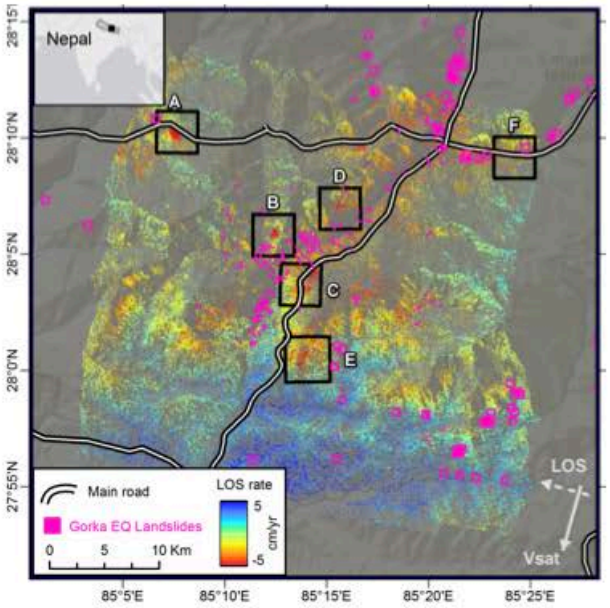


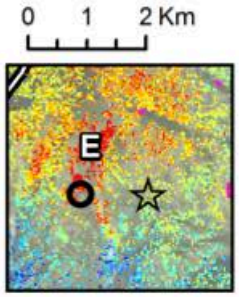


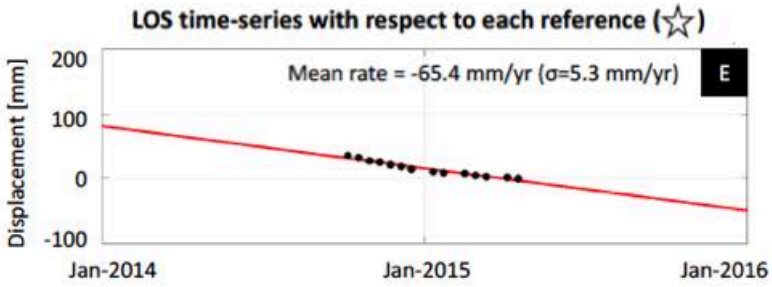
Study area C within Trishuli

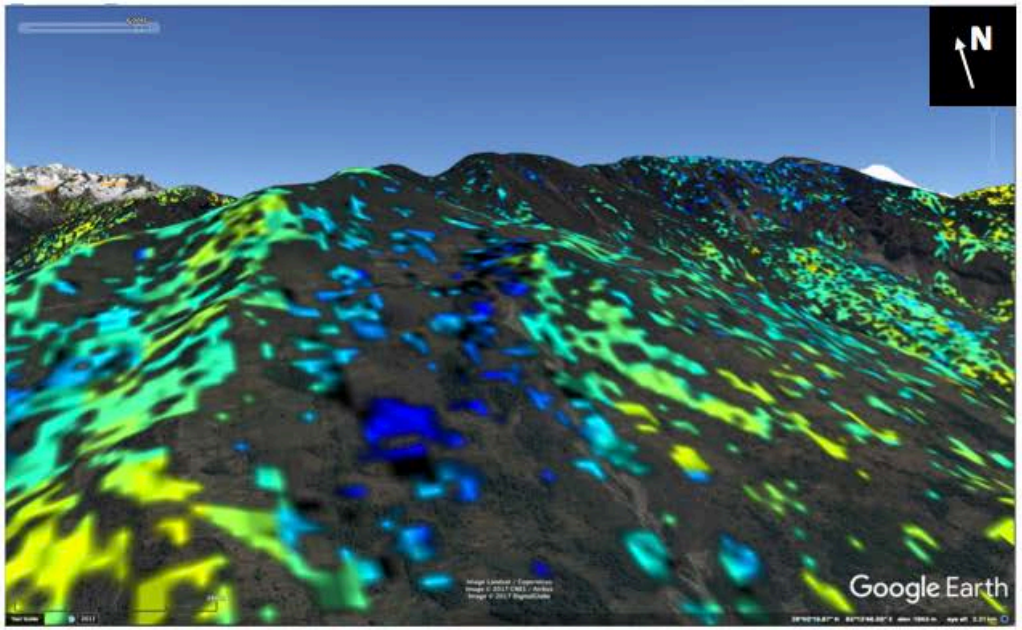


Study area E

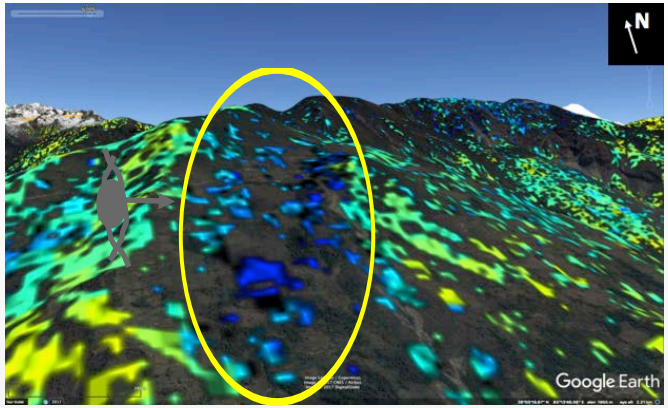








Work in Progress!



Work in Progress!

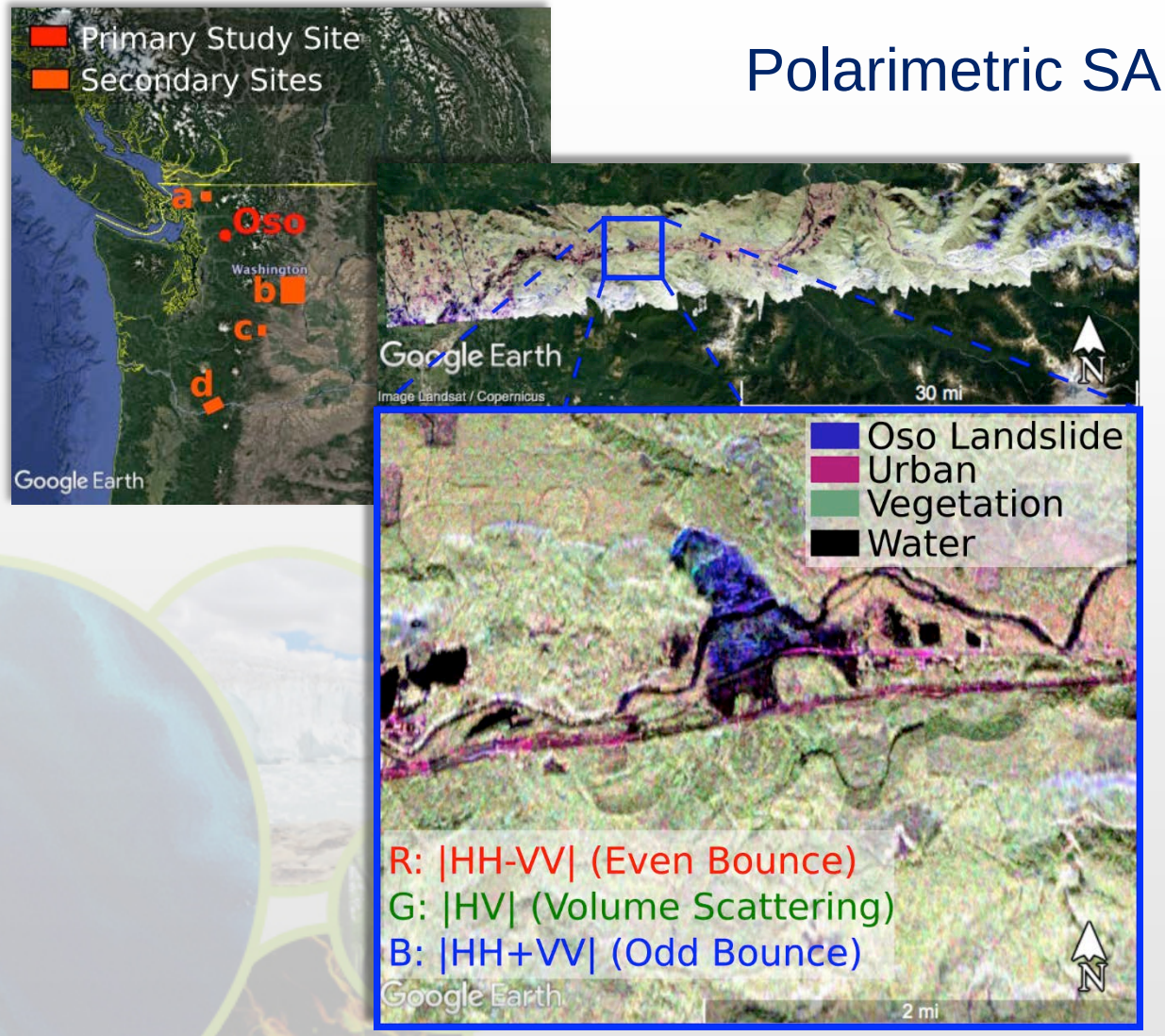
Summary

- SAR data can be used in a variety of ways to map landslides
- Detection success rate for SAR strongly related to:
  - Sensor resolution
  - Landslide orientation vs satellite acquisition geometry
  - Scattering changed from snow, precip, vegetation
- There is not a one-fit all SAR technique towards landslide mapping
  - Fast moving landslides
  - Slow moving landslides
  - Critical failure landslides
- Time-series InSAR capable of mapping slowly moving slides
  - Local detector successfully applied on regional processing to identity slowly moving landslide area's from superimposed noise sources

Pacific Northwest Study Site: Preliminary Results

Landslide mapping by Radar Data

Polarimetric SAR (PolSAR) Approach



Landslide scar was detected for ***Oso Landslide*** in WA using AirMOSS airborne SAR data.

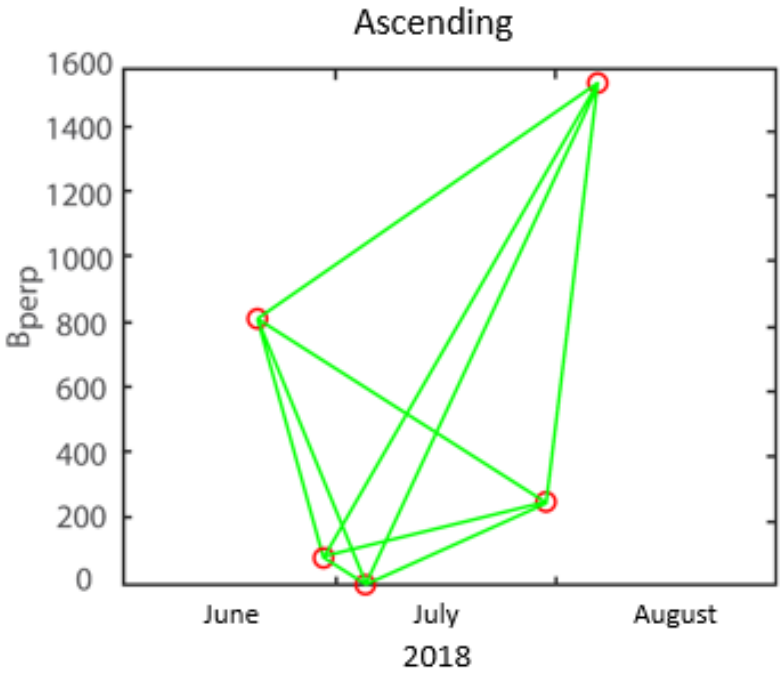
The area in blue show single bounce dominant scattering mechanisms, highlighting the Oso Landslide area.

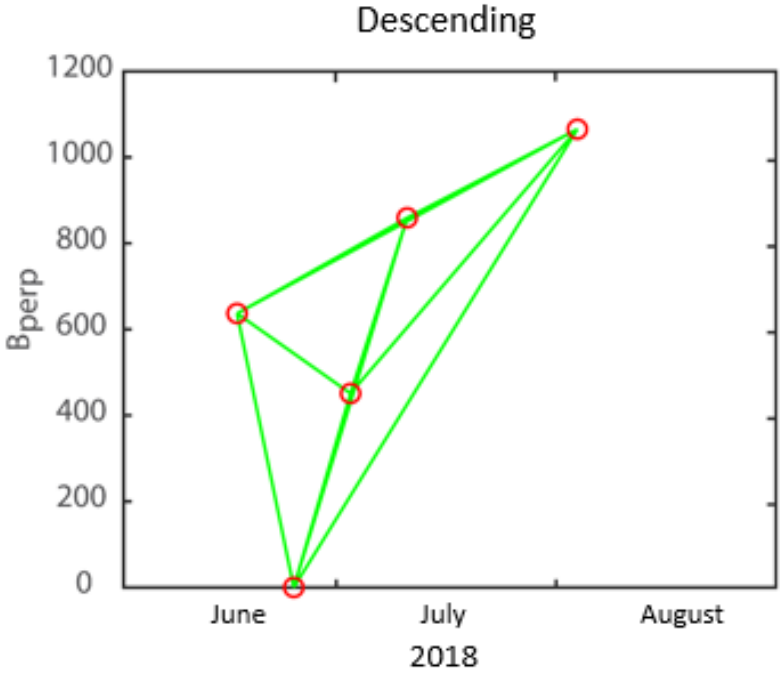
Credit: MinJeong Jo (NASA/USRA)

Preliminary results over Cascade Landslide, PNW

COSMO-SkyMed Data Processing over Cascade Landslide Complex

- Available data
  - 5 scenes from ascending track (20180621 - 20180808)
  - 5 scenes from descending track (20180617 - 20180804)

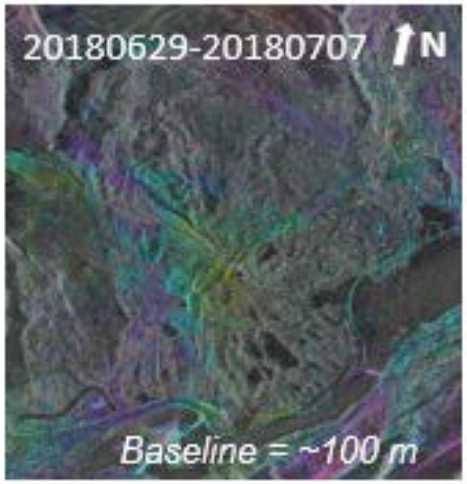


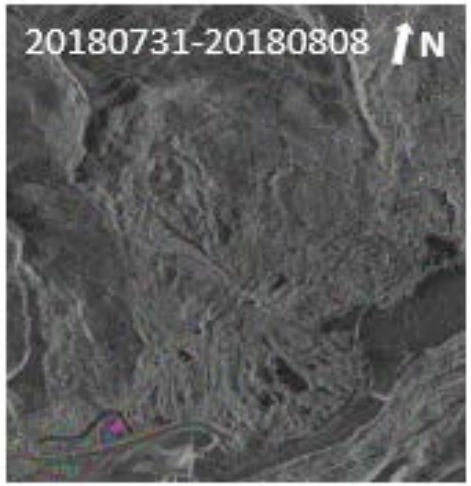


Credit: Zhong Lu, Southern Methodist University

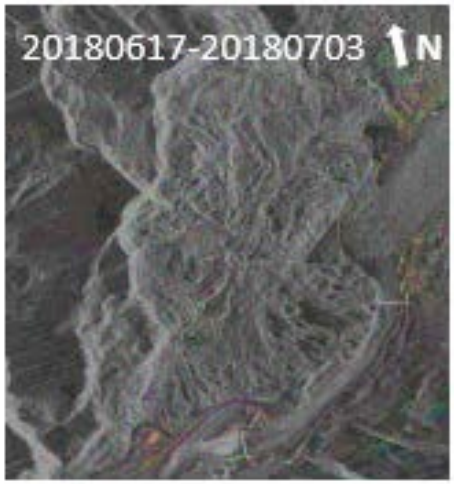
Preliminary results over Cascade Landslide, PNW

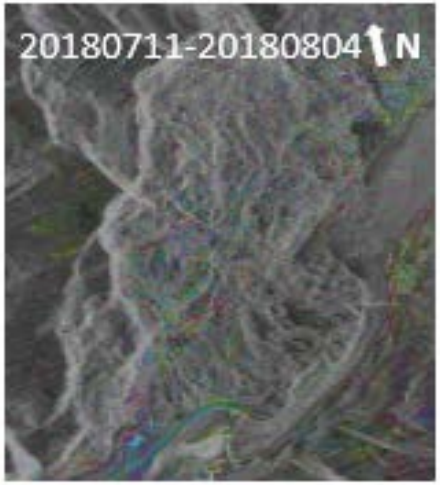
Preliminary results





Ascending track





Descending track

Credit: Zhong Lu, Southern Methodist University

Preliminary results over Cascade Landslide, PNW

- Problems

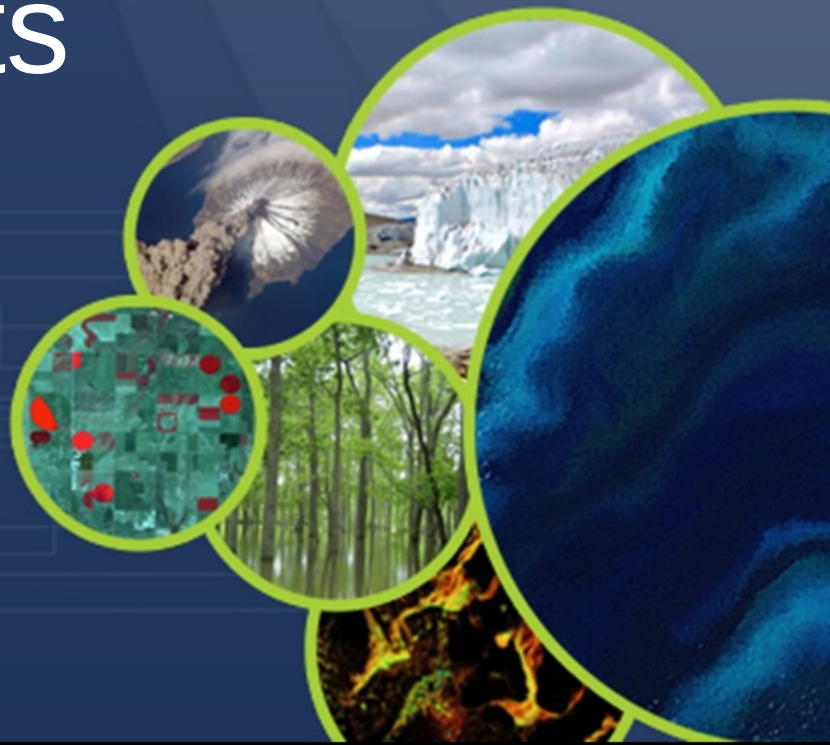
  (1) Large spatial baselines and vegetation in the target region cause severe decorrelation of X-band COSMO-SkyMed InSAR images.
  (2) Limited SAR acquisitions prevent us from conducting PSInSAR anlaysis on stable scatters

- What's next?

  (1) We need more COSMO-SkyMed data covering Cascade Landslide Complex to run PSInSAR analysis: about 30 images per track.
  (2) Particularly, we would like more images during Nov 2018 and March 2019, the season of peak landslide movement/activity.

Data request was extended till December 2018.

Africa Study Site: Preliminary Results



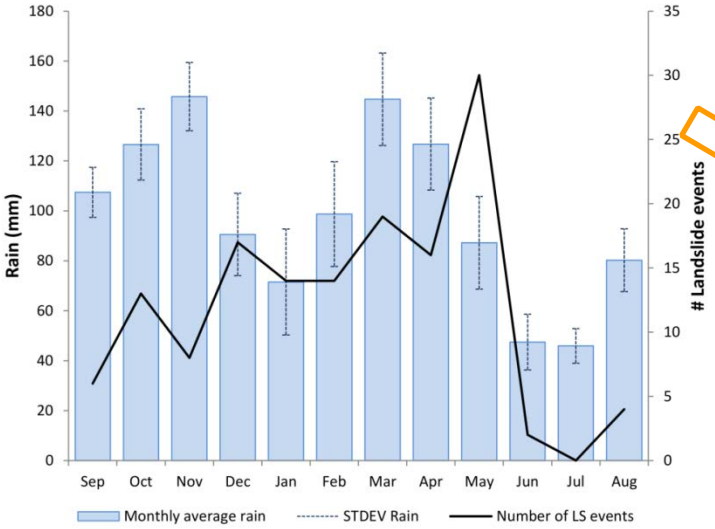
CEOS Landslide Pilot – East African Rift

Olivier Dewitte, Arthur Depicker, Antoine Dille, Elise Monsieurs

Royal Museum for Central Africa, Department of Earth Sciences, Tervuren, Belgium

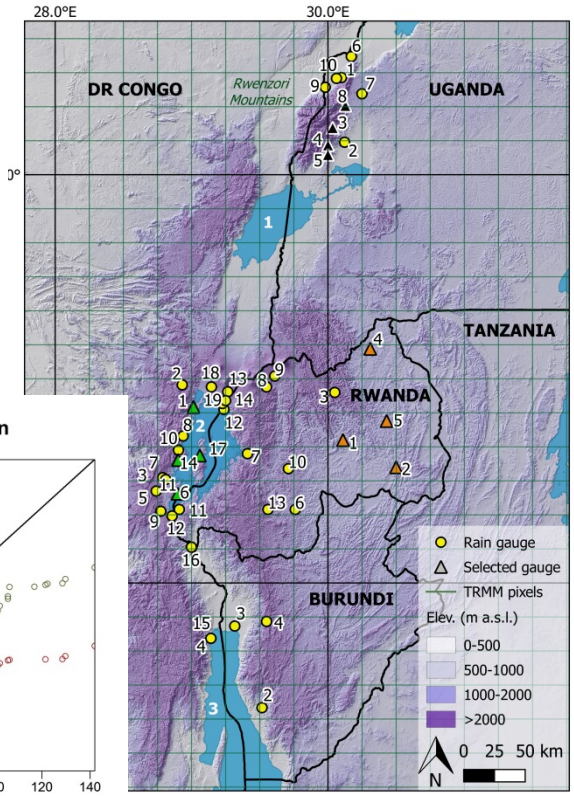
Regional landslide rainfall thresholds

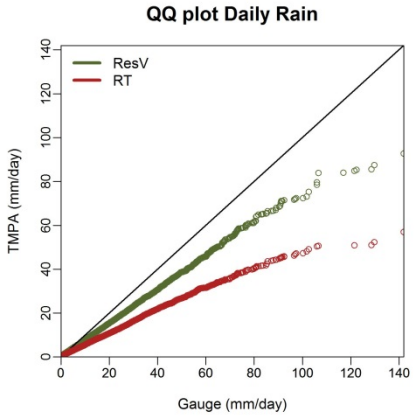
Step 1: landslide data collection



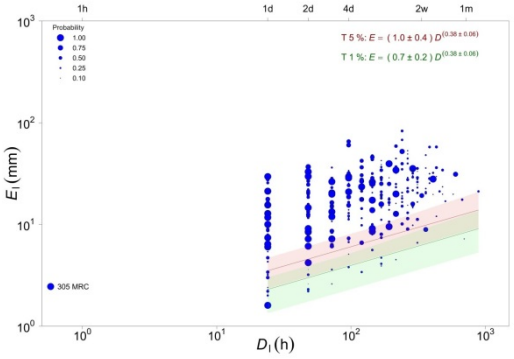
Monsieurs et al., 2018. Landslides.

Step 2: TRMM and GPM derived products validation





Step 3: Landslide thresholds (next slides)



Monsieurs et al., 2018. Journal of Hydrometeorology.

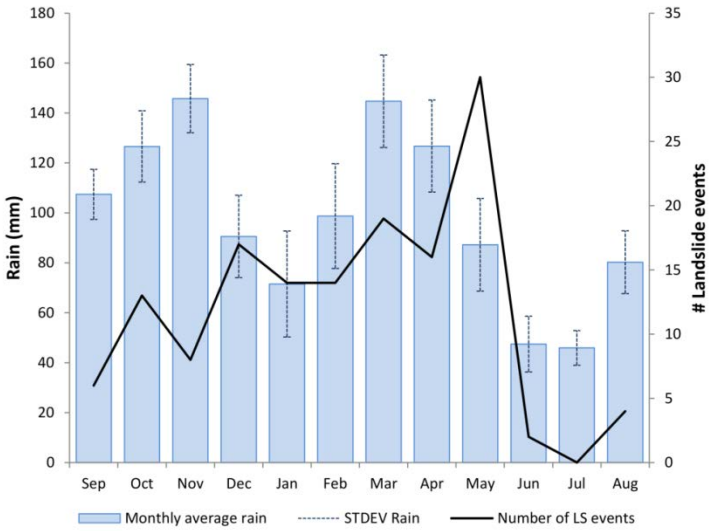
Rainfall thresholds for landslides: Trigger – Cause conceptual framework

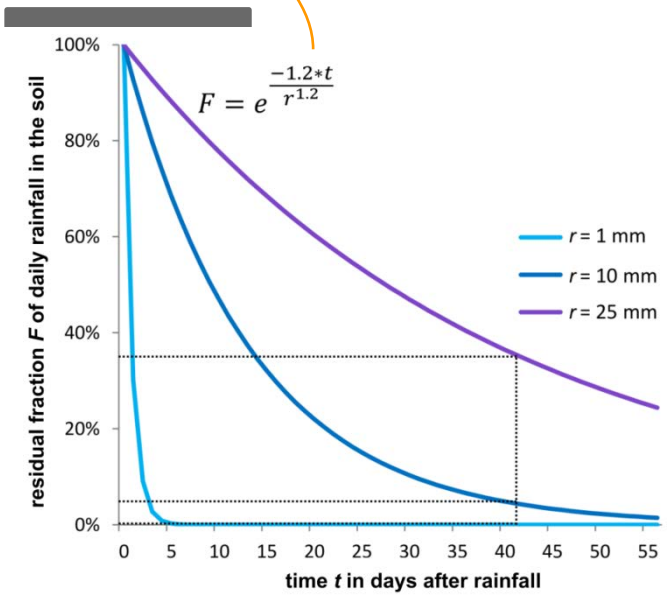
Trigger: TMPA-based antecedent rainfall index

$$AR_i = \sum_{k=i}^{i-n} e^{\frac{-a*(t_i - t_k)}{r_k^b}} * r_k$$

n

a, b

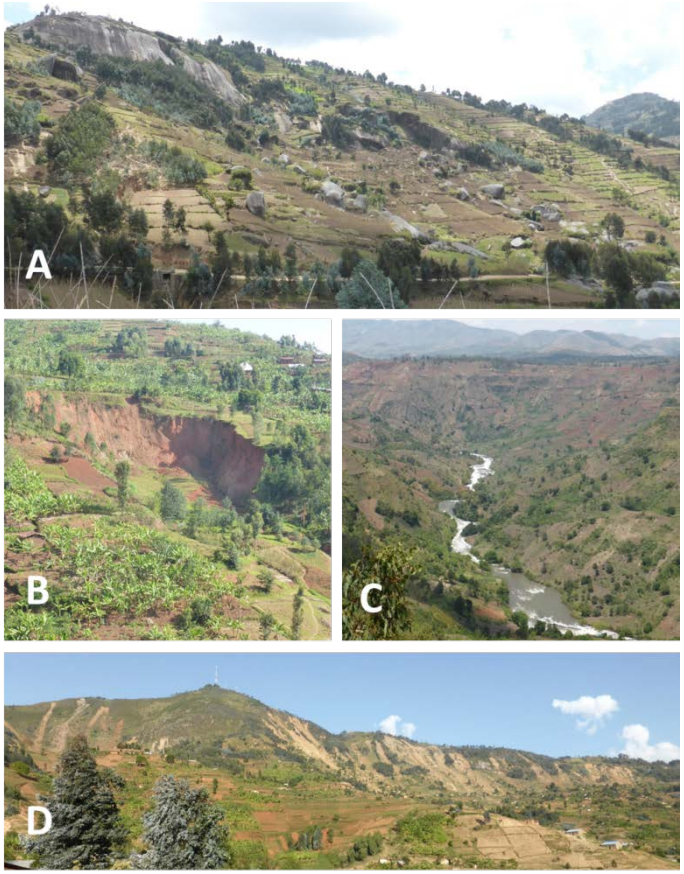


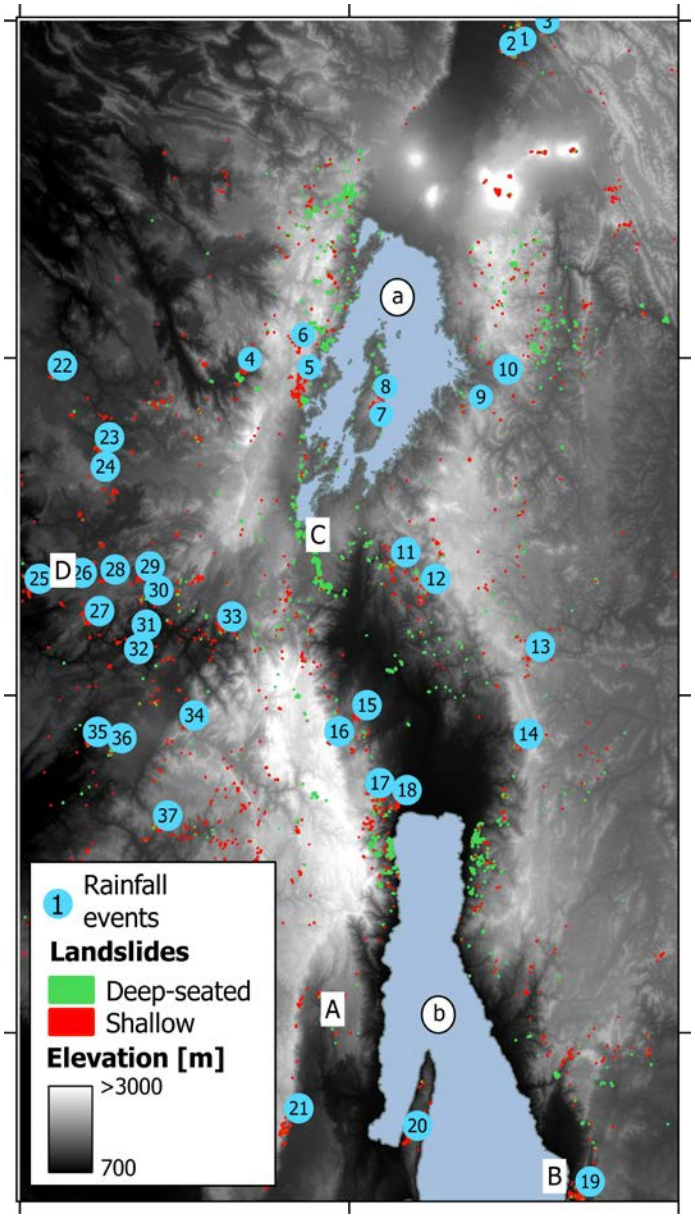


Regional landslide susceptibility assessment

Step 1: regional inventory

- **Compiled from Google Earth (visual analysis)**
- **Field-validated in target regions**

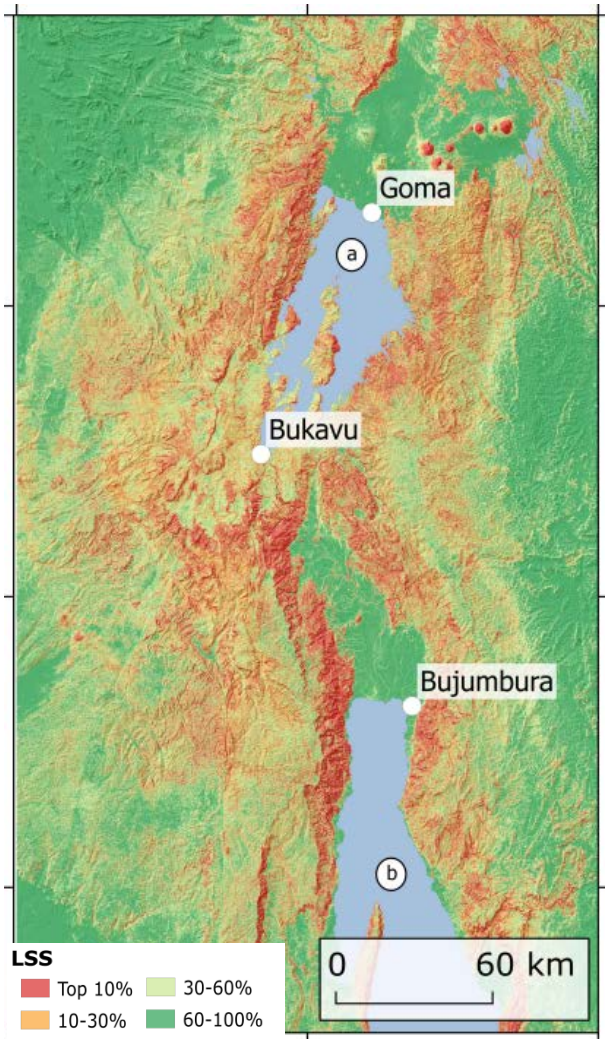




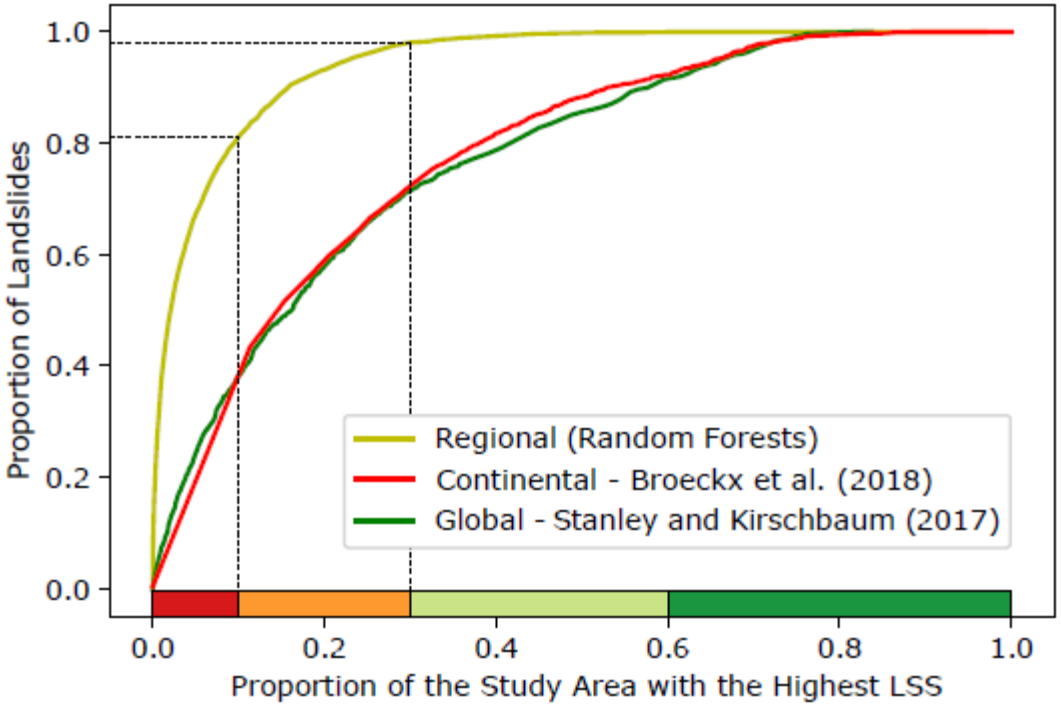
Depicker et al., submitted.

Regional susceptibility assessment

Step 2: Random Forests



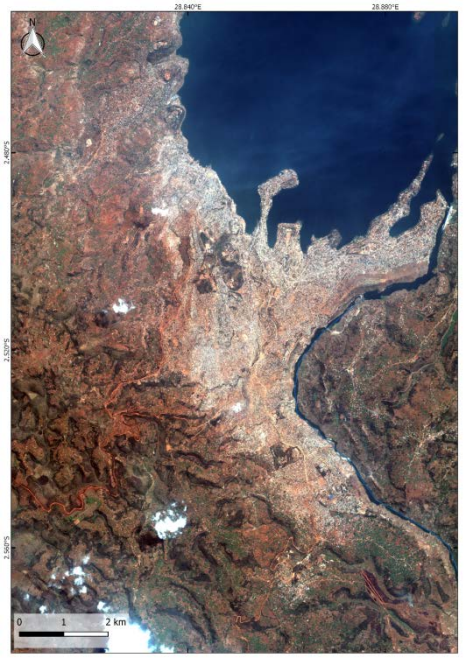
- Global/continental landslide susceptibility models lack prediction accuracy and geomorphological plausibility when compared to our regional model.
- We show that this difference in quality is driven by the use a regional landslide inventory

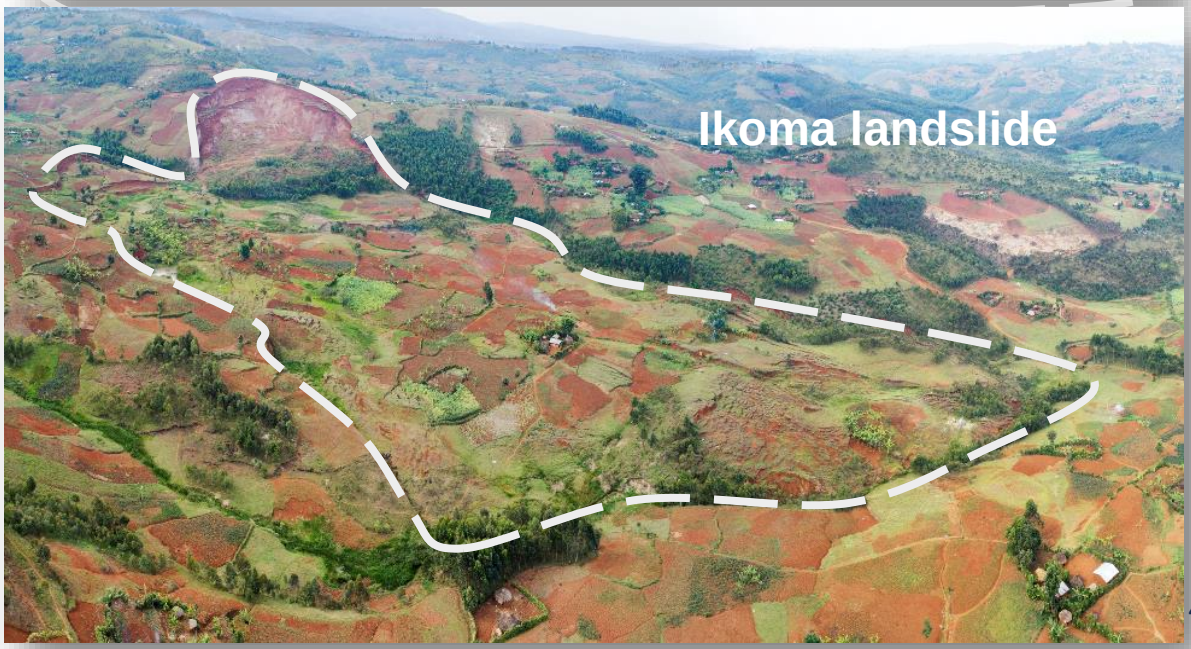


Depicker et al., submitted.

Ground deformations

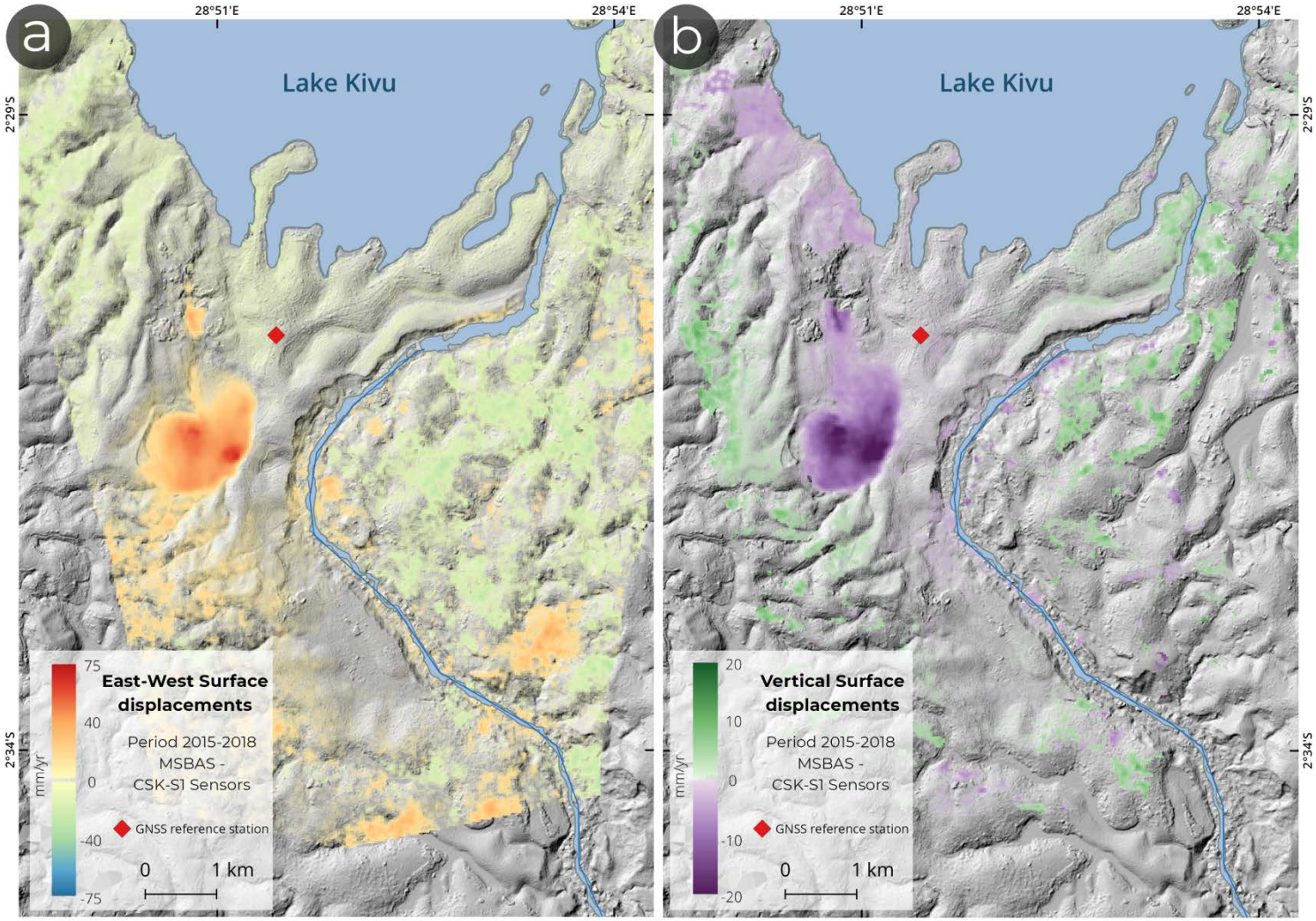
- Focus on the city of Bukavu and its surroundings





Ground deformations

CSK images are now acquired via CEOS



Next steps:

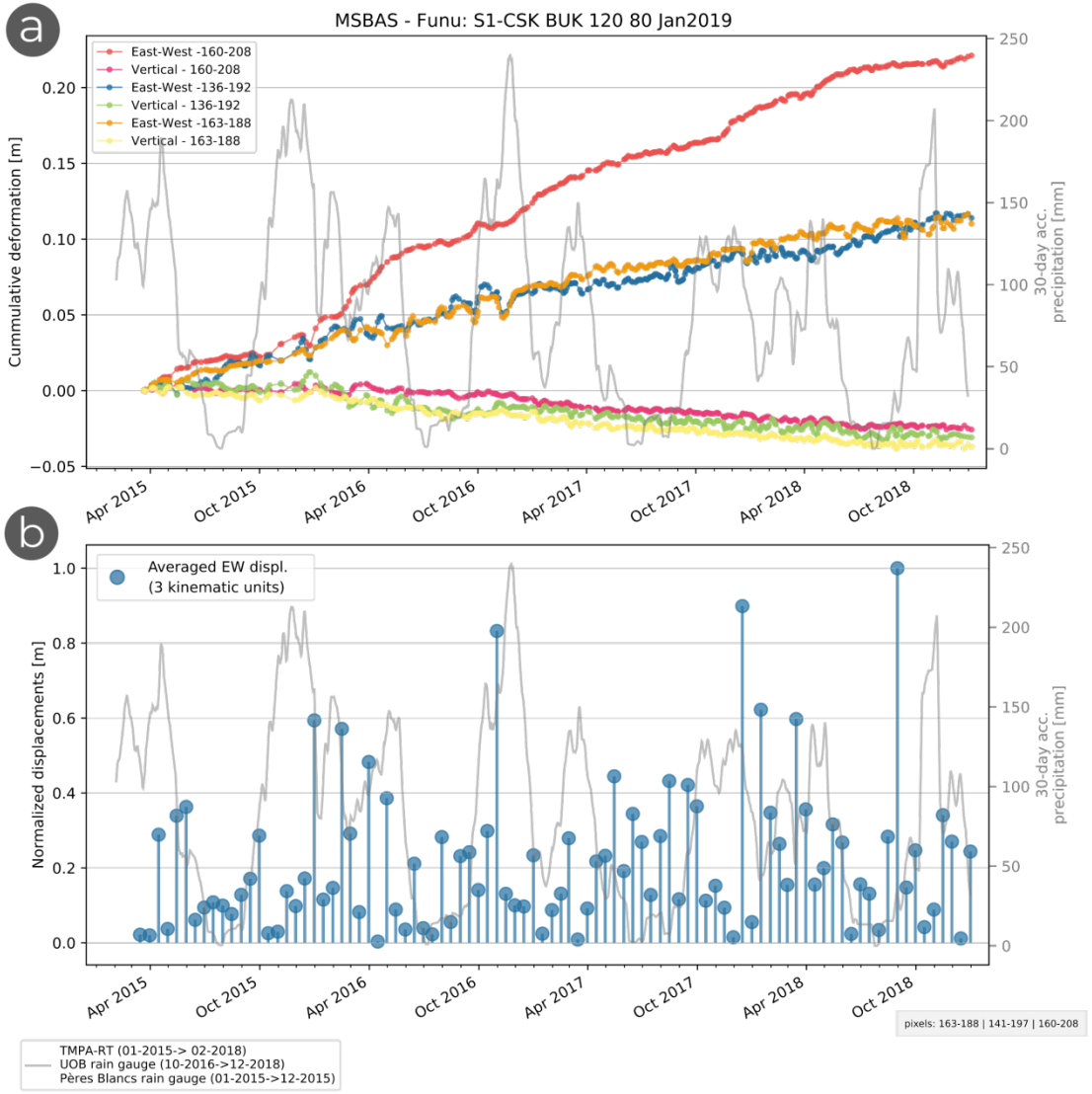
- **Image correlation with Pléiades**

Dille et al., in prep

Processing of **~500 CSK and S1 images through MSBAS processing chain**
→ **3.5 year time series**

Ground deformations

CSK images are now acquired via CEOS



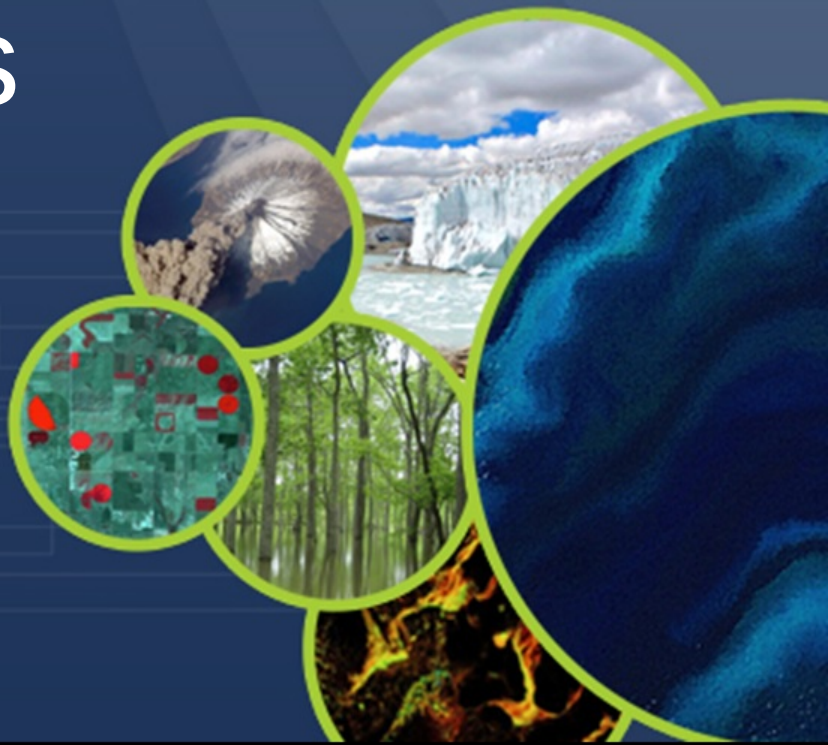
→ 3.5 year deformation time series

- Study of series of pixels situated in different morphologic zones
- Seasonal velocity variations

Dille et al., in prep

Processing of **~500 CSK and S1 images through MSBAS processing chain**
→ **3.5 year time series**

Caribbean Study Site: Preliminary Results



Post-hurricane landslide detection and mapping: Haiti

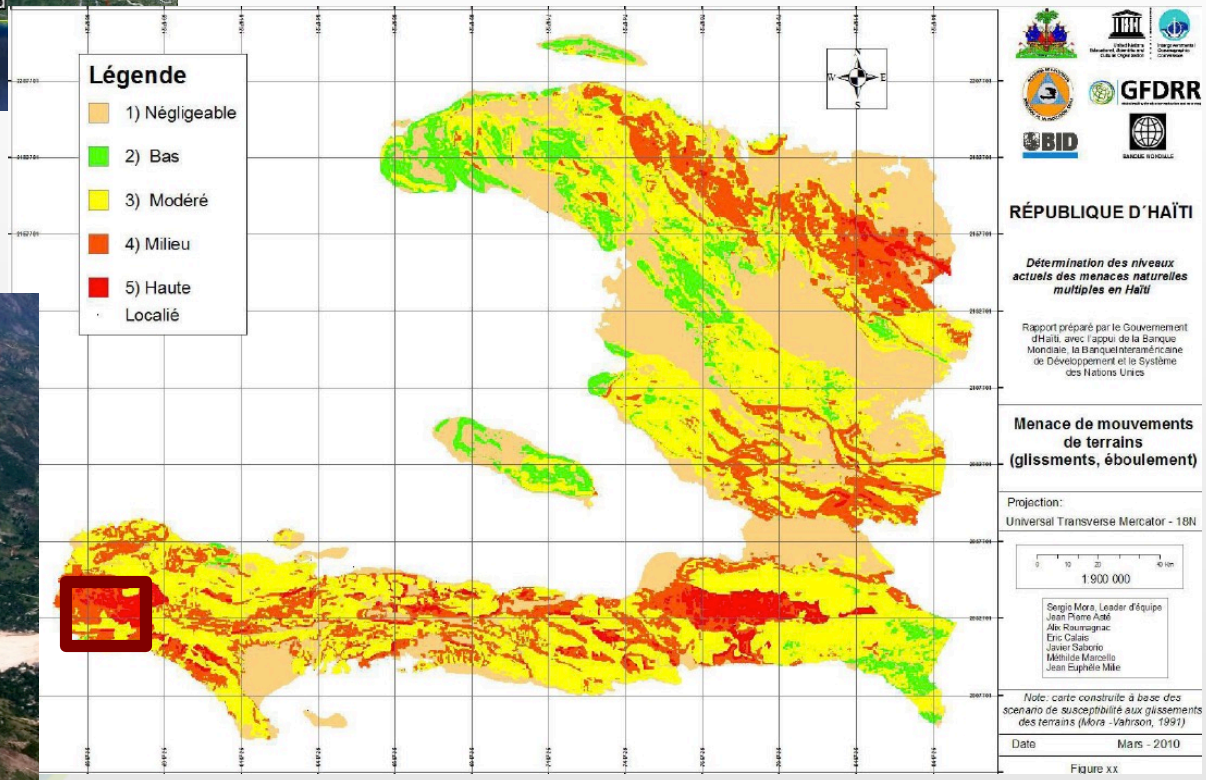
First landslide susceptibility map for the country

Topogragy = first driver of landsliding

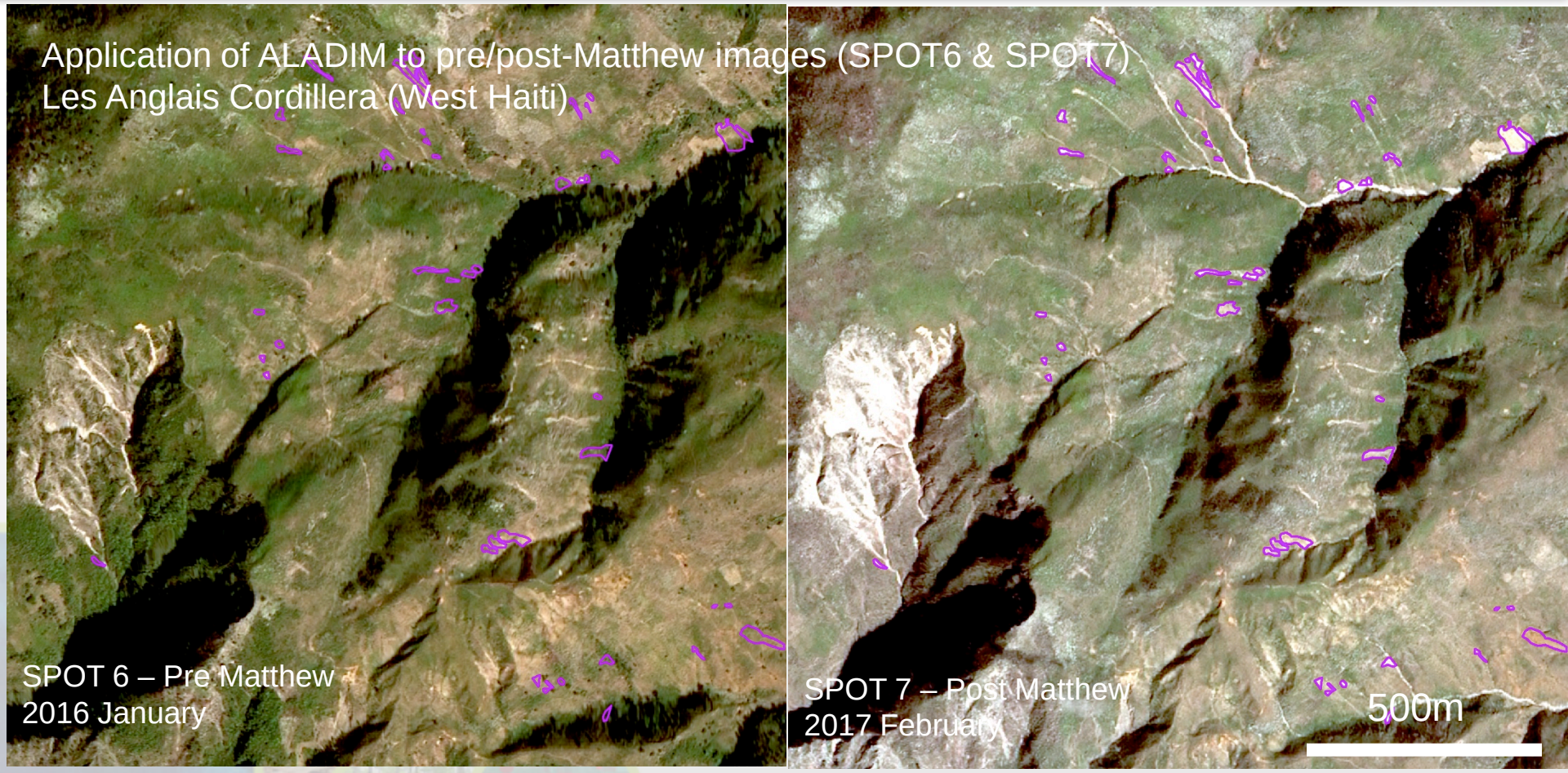
Map created without landslide information (!)

Landscape after Matthews

Major rain events



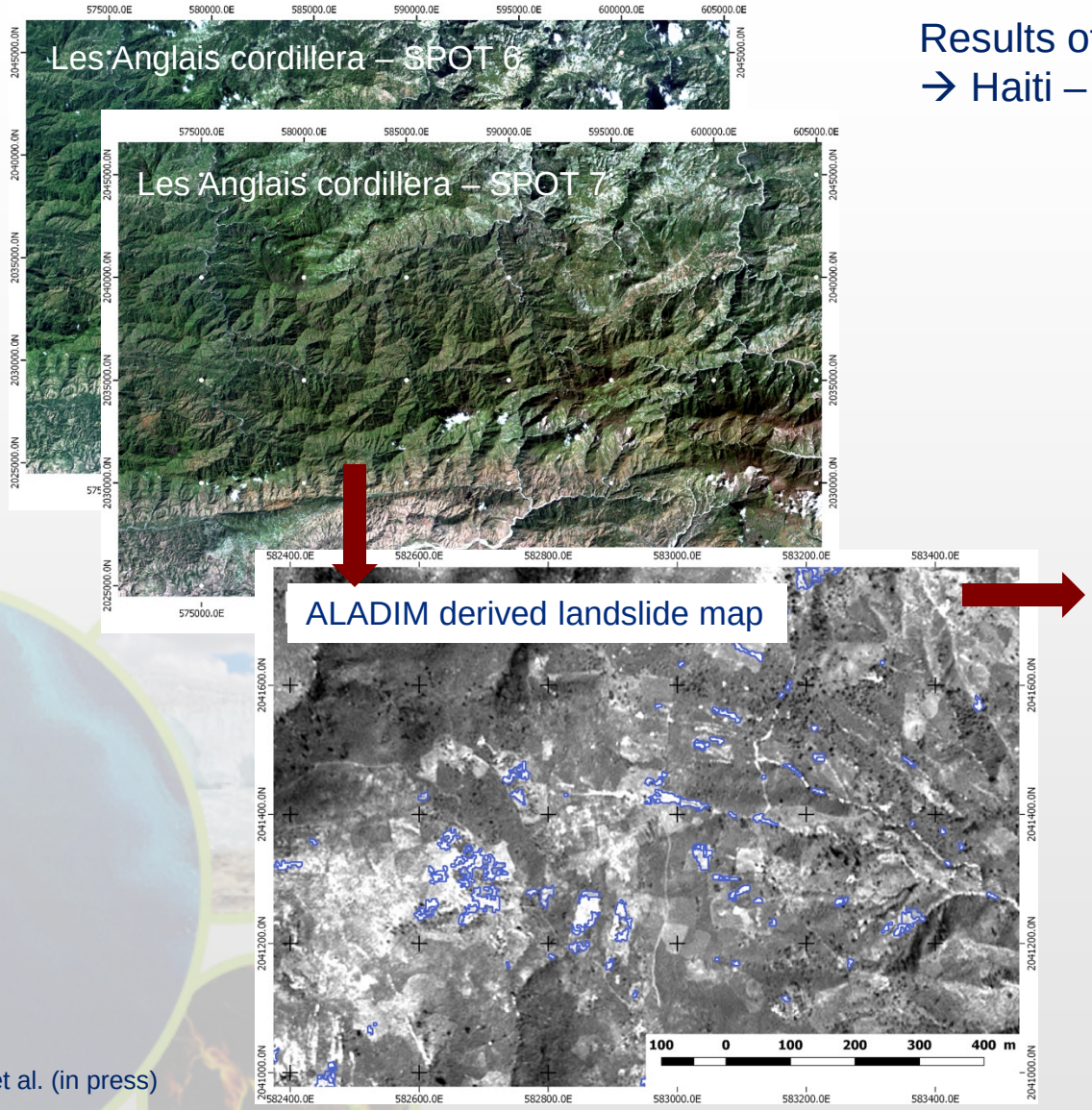
Post-hurricane landslide detection and mapping: Haiti



Channel deposits are difficult to map (they may add ~30% of affected areas)
Shadows on West and North slopes may cause underestimation of the total landsliding
Many bare soils …. Difficult for automated mapping

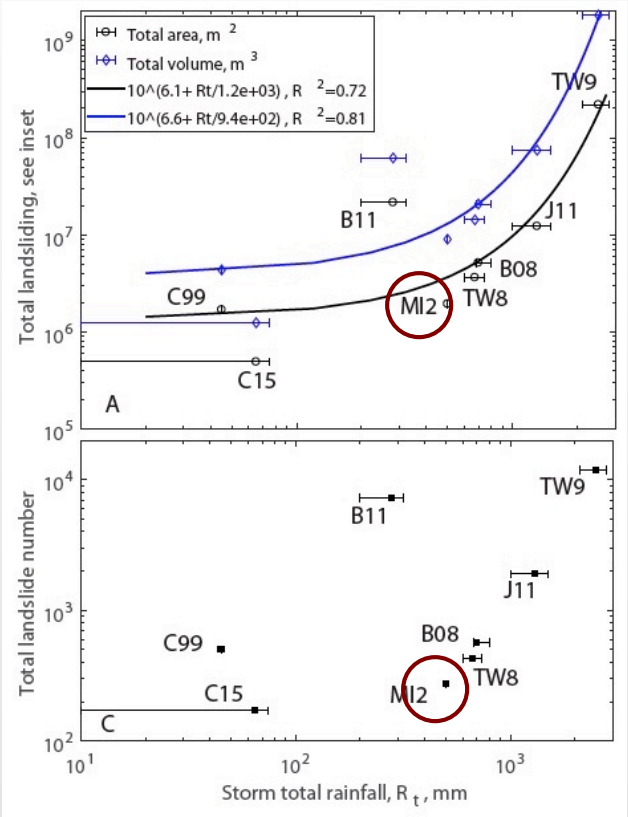
Marc et al. (2017)

Post-hurricane landslide detection and mapping: Haiti



Results of ALADIM-Caribbean:
→ Haiti – post-Matthews landslides

Landslide statistics and relation to triggers for several recent Hurricanes/Cyclons



Marc et al. (in press)

Lahar hazards in Montserrat

Quantifying and modelling lahar hazard following volcanic eruption on the island of Montserrat, West Indies

James Christie[1], Dr Georgina Bennett[1], Prof. Jenni Barclay[1], Dr Melanie Froude[2], Dr Adam Stinton[3] (1. University of East Anglia, 2. University of Sheffield, 3. Montserrat Volcano Observatory)

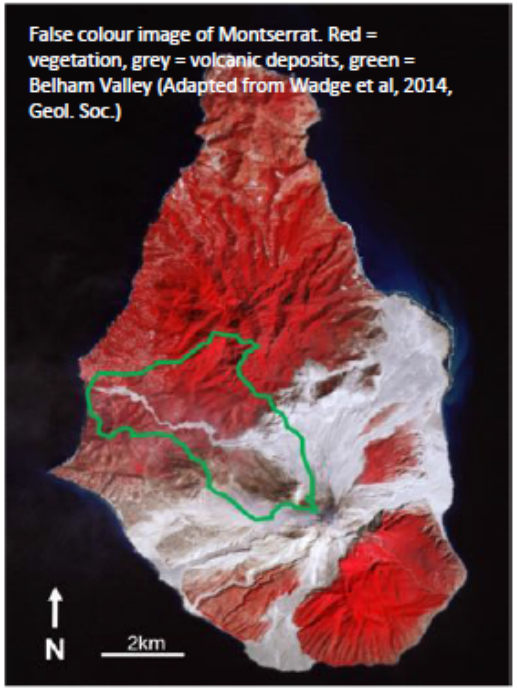
Buried church in Plymouth. Credit: J.Christie

Context:

- Eruption of Soufriere Hills Volcano, Montserrat: large quantities of loose pyroclastic material deposited in fluvial catchments around volcano.
- Tropical location: prone to intense rainfall and extreme weather events, such as the recent Hurricane Maria, which re-mobilises pyroclastic material to form hazardous **lahars**.

Primary objectives:

- Examine the geomorphic response of fluvial catchments around Soufriere Hills Volcano, Montserrat, to the eruption and deposition of large quantities of pyroclastic material.
- Quantify and simulate the evolution of lahar hazard.

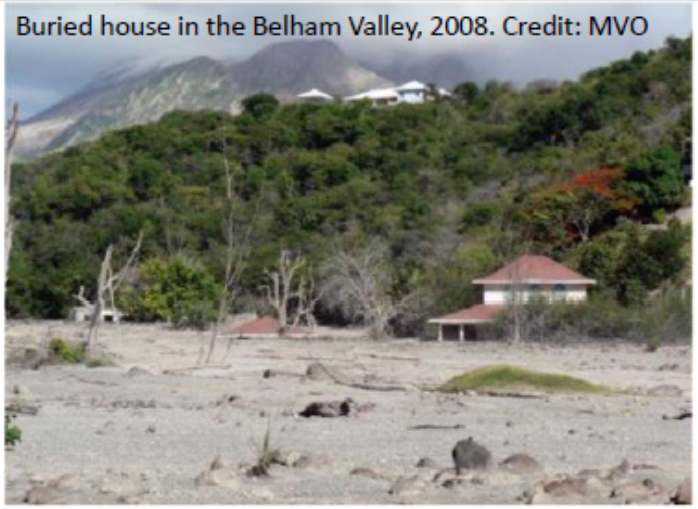


False colour image of Montserrat. Red = vegetation, grey = volcanic deposits, green = Belham Valley (Adapted from Wadge et al, 2014, Geol. Soc.)

Lahar hazards in Montserrat

Lahars in the Belham Valley: A persistent hazard.

- **OBJECTIVE**: Update lahar record.
  - 22 years of ~900 hazardous lahars so far, still a danger to this day (Barclay et al, 2007, Geol. Soc.; Jones et al, 2017, Geomorphology) .
  - **Stereo-satellite-derived** Digital Elevation Model (DEM) differencing for Geomorphic Change Detection (GCD), in combination with seismic data, will allow examination of the changing nature and behaviour of lahars through time.
- **OBJECTIVE**: Quantify impact of extreme events, such as Hurricane Maria.
  - Montserrat was struck by heavy rains during Hurricane Maria, 2017; up to 3m of observed lahar-driven channel incision in the Belham channel, destroying the river crossing.
  - GCD will allow detailed quantification of the geomorphic impacts and hazard associated with this type of extreme event.

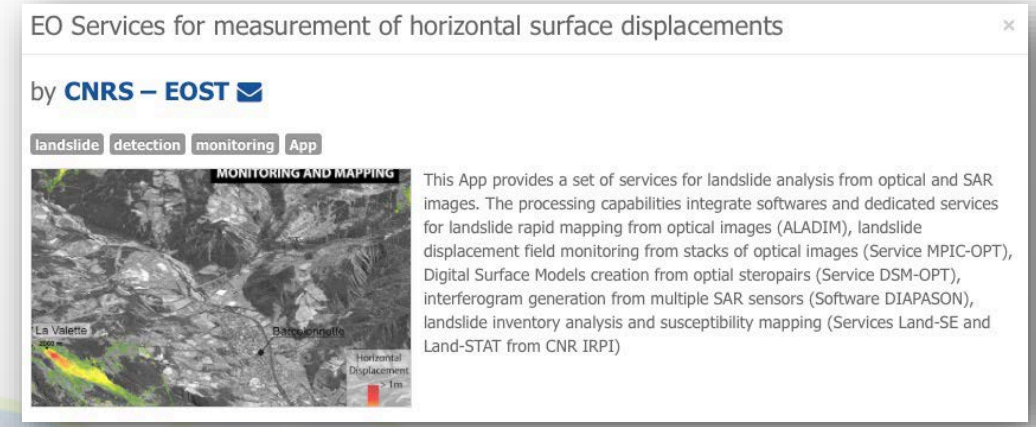


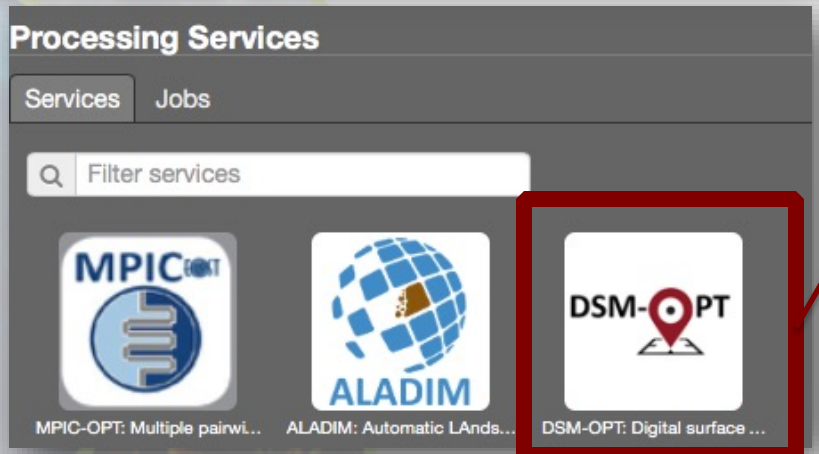
Buried house in the Belham Valley, 2008. Credit: MVO

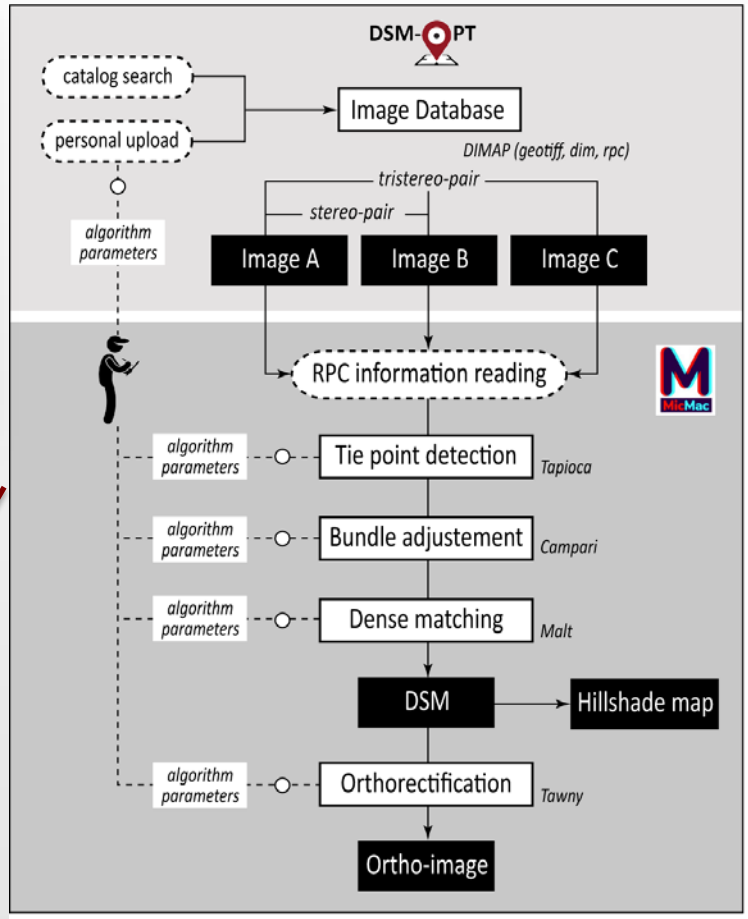
https://phys.org/news/2017-09-puerto-rico-virgin-islands-brace.html

Lahar hazards in Montserrat

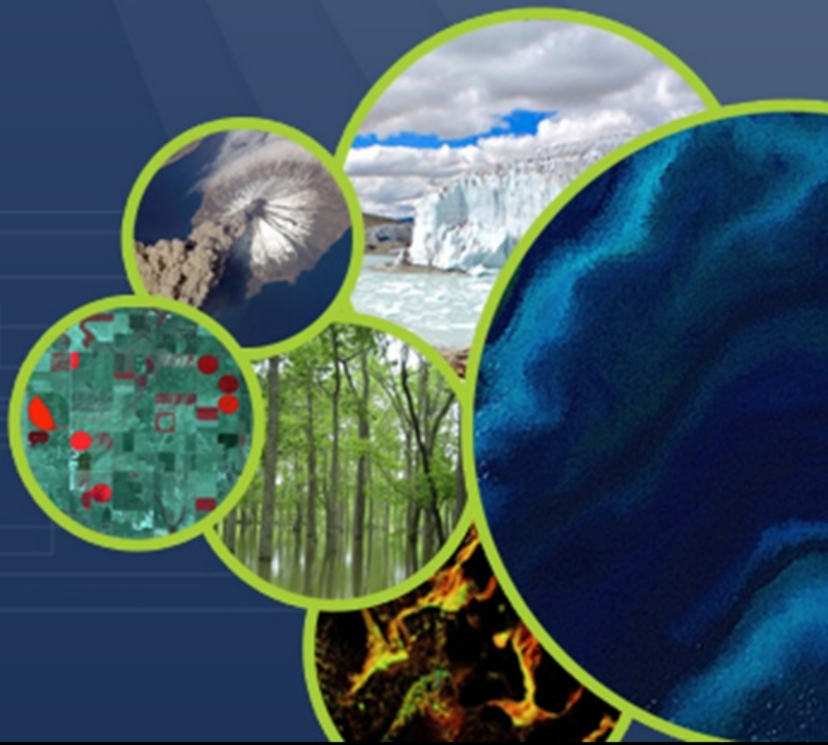
Use of DSM-OPT service on GEP for the creation of High-Resolution Digital Surface Models (HR-DSMs) and orthophotos from Pléiades stereo-images



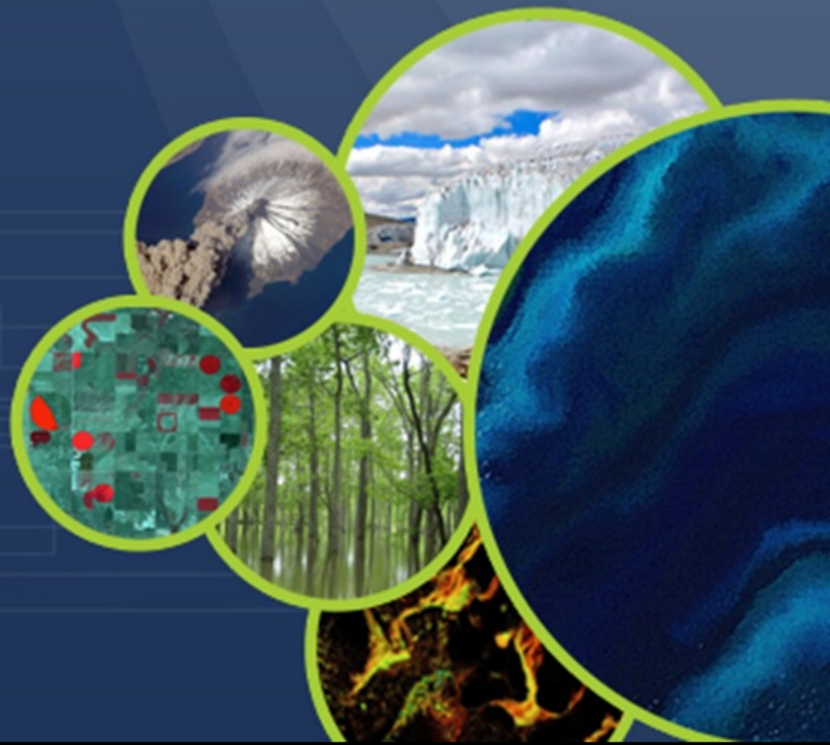




China Study Site



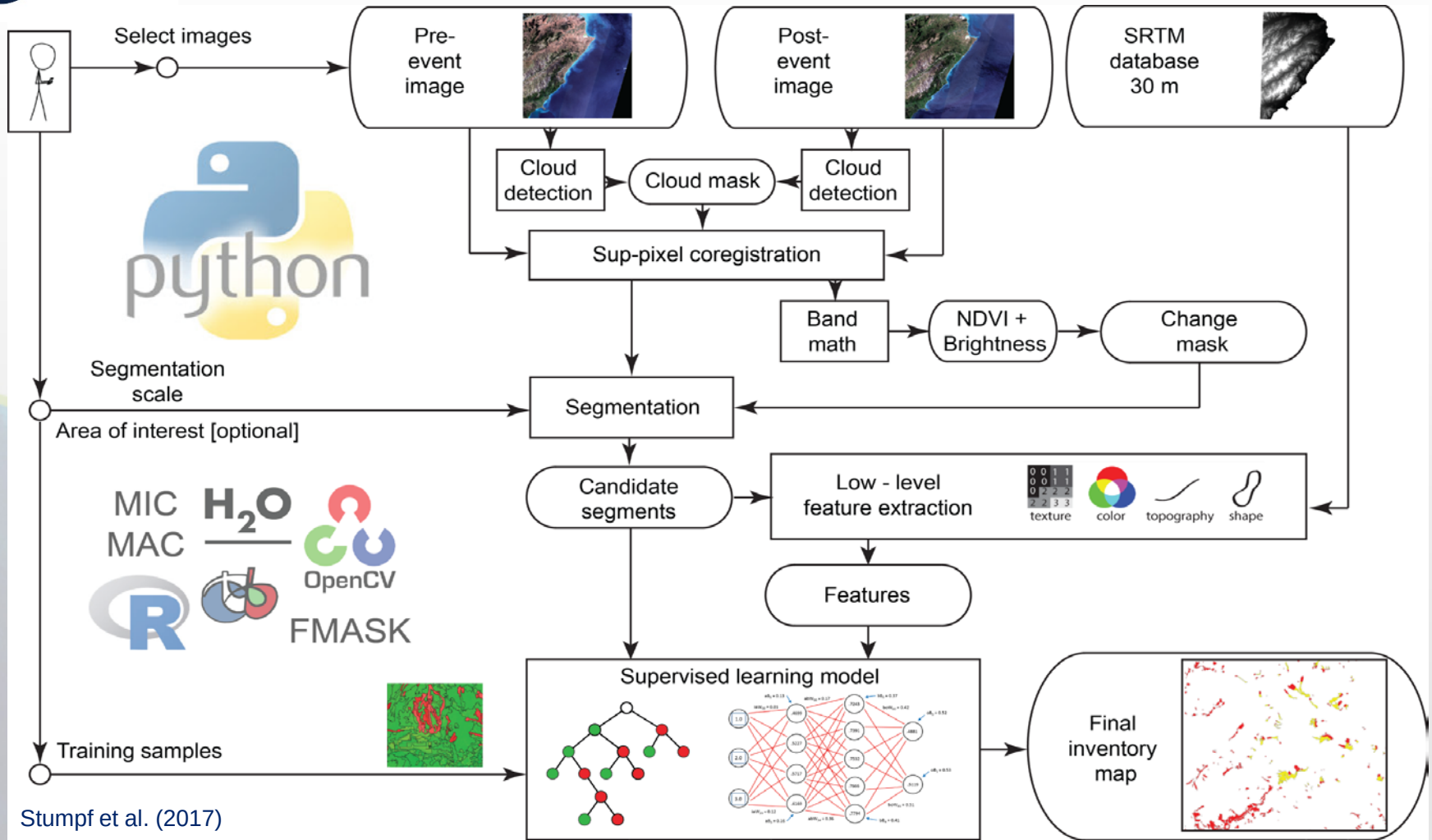
Global work



Landslide mapping using medium-resolution Sentinel-2 Optical Data

ALADIM: Automated Landslide Detection and Inventory Mapping

Image sources: S2 + VHRO ortho-images
Supervised method - Selection of image features – Random Forest classifier
HPC + cloud-based implementation (through dockerisation)



Stumpf et al. (2017)

ALADIM service available on ESA GEP
(working for S2, pending for VHRO)

geohazards tep | Site | Page | « ALADIM-S2 and... | COIN – Cohere... » | Source | TERRADUE

- Overview
- Community Portal User Guide
- Community Advanced User Guide
- Community Portal Administrator Guide
- Cloud Operations Administrator Guide
- Thematic Applications
- Processing tutorials
  - ADORE DORIS
  - ALADIM-S2 and ALADIM-VHR: Preparation of input datasets
  - **ALADIM-S2: Automatic LAndslide Detection and Inventory Mapping from multispectral S2 data**
    - Select the processin
    - Use case: Landslide mapping from S2 m
      - *Select input data*
      - *Set the processing*
      - *Run the job*

ALADIM-S2: Automatic LAndslide Detection and Inventory Mapping from multispectral S2 data

ALADIM

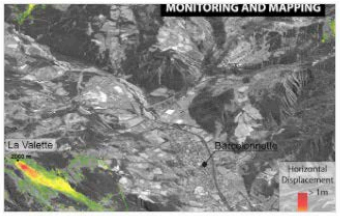
ALADIM

This service is developped by CNRS-EOST (Strasbourg, France). It allows to detect and map new landslides triggered by large forcing events (earthquake, heavy rains) from the analysis of pre- and post-event imagery, and is based on change detection methods. It allows the processing of High Resolution multispectral data (ALADIM-S2; Sentinel-2 SAFE files) and Very-High Resolution multispectral data (ALADIM-VHR; typically Pléiades and Spot 6/7). The set of pre- and post-image should be accurately co-registered in order to use the service. A training dataset of manually mapped landslides (by digitalization), the extent of the training areas, and the extent of the region of interest (ROI) should be provided as inputs (shape file-format) by the user. The outputs consist in a database of landslide polygons than can be assimilated to an Earth-Observation derived landslide inventory. ALADIM builds on the change detection methodology partially described in [1] and [2] .

EO Services for measurement of horizontal surface displacements

by **CNRS – EOST**

landslide | detection | monitoring | App



This App provides a set of services for landslide analysis from optical and SAR images. The processing capabilities integrate softwares and dedicated services for landslide rapid mapping from optical images (ALADIM), landslide displacement field monitoring from stacks of optical images (Service MPIC-OPT), Digital Surface Models creation from optial steropairs (Service DSM-OPT), interferogram generation from multiple SAR sensors (Software DIAPASON), landslide inventory analysis and susceptibility mapping (Services Land-SE and Land-STAT from CNR IRPI)

Processing Services

Services | Jobs

Filter services

MPIC-OPT: Multiple pairwi... | ALADIM: Automatic LAnds... | DSM-OPT: Digital surface ...

ALADIM service available on ESA GEP
(working for S2, pending for VHRO)

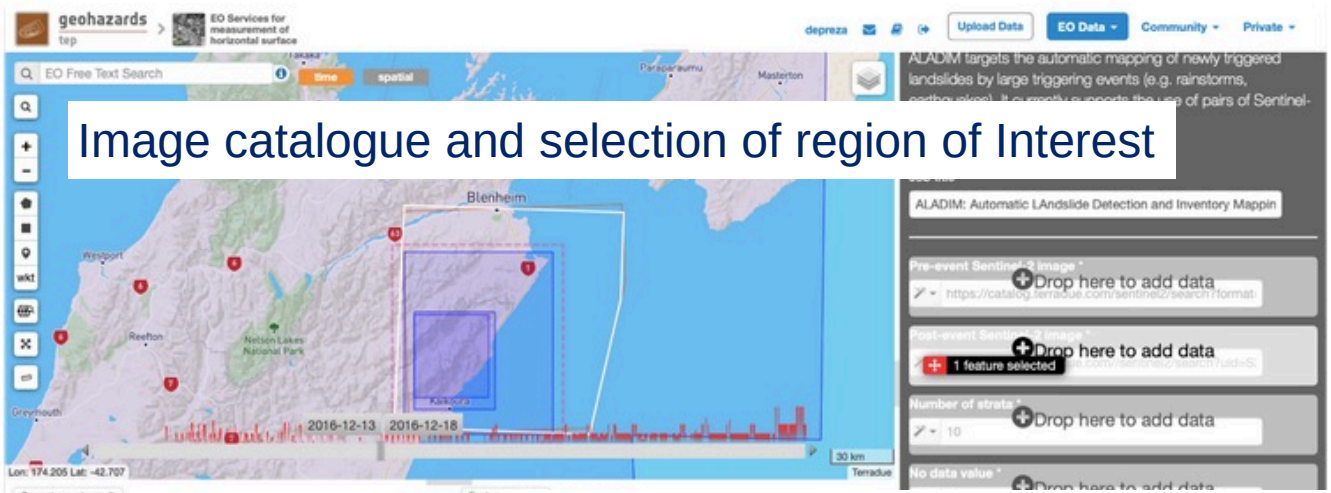
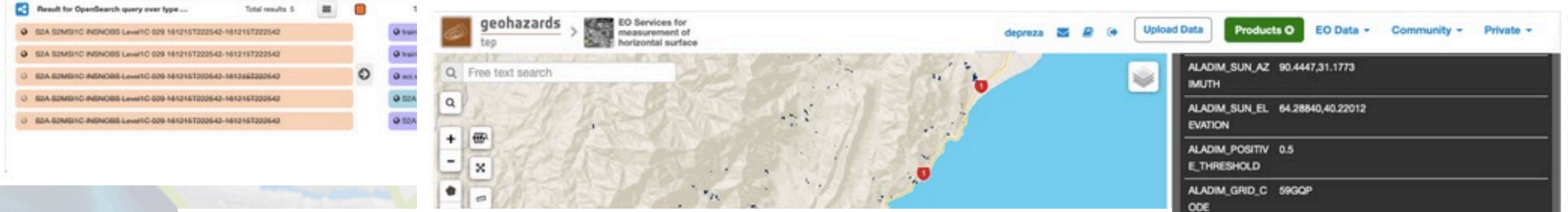
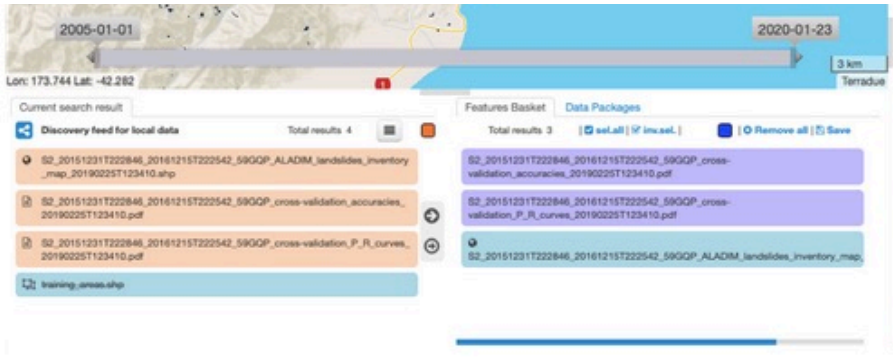


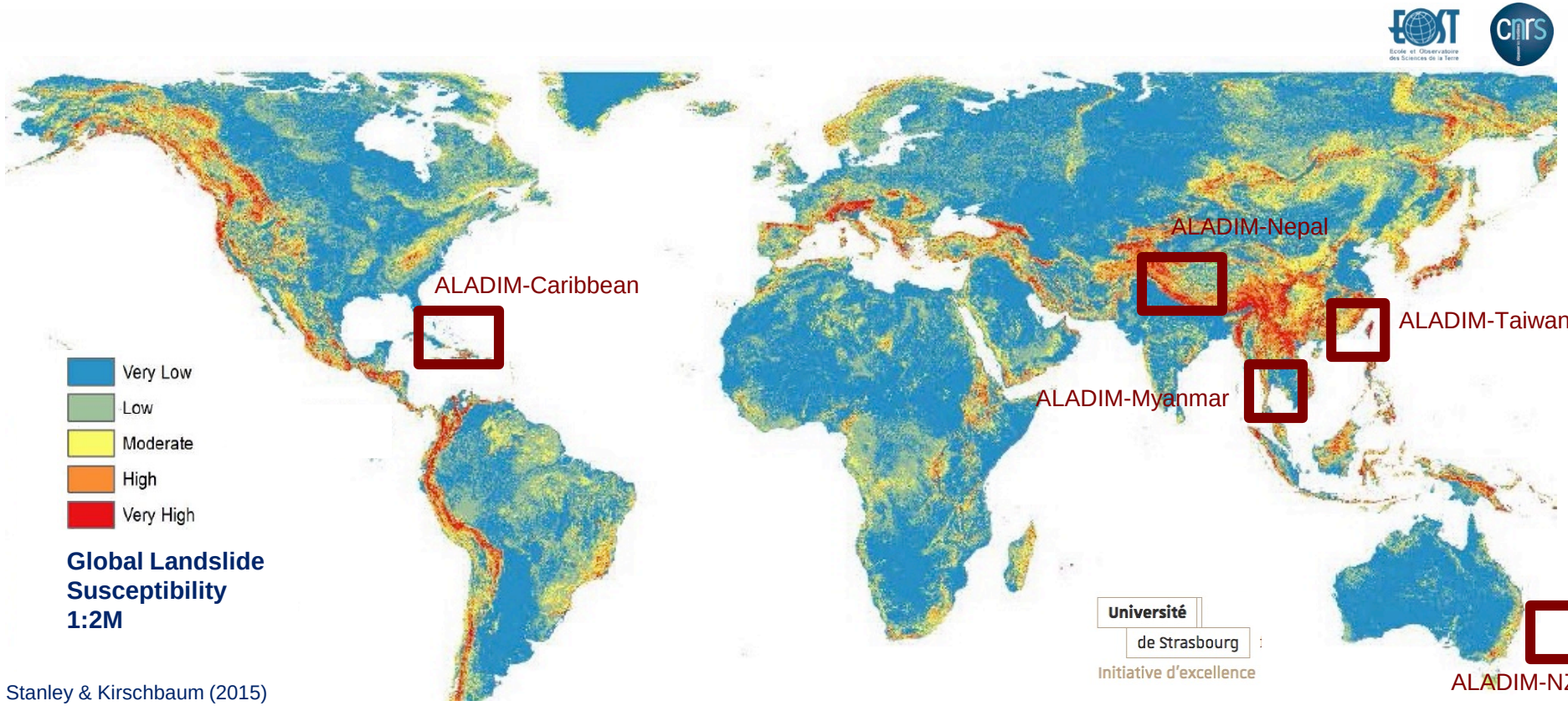
Image catalogue and selection of region of Interest



Results: polygons corresponding to possible landslides



Generalizing the creation of EO-based inventories after major triggering events



Stanley & Kirschbaum (2015)

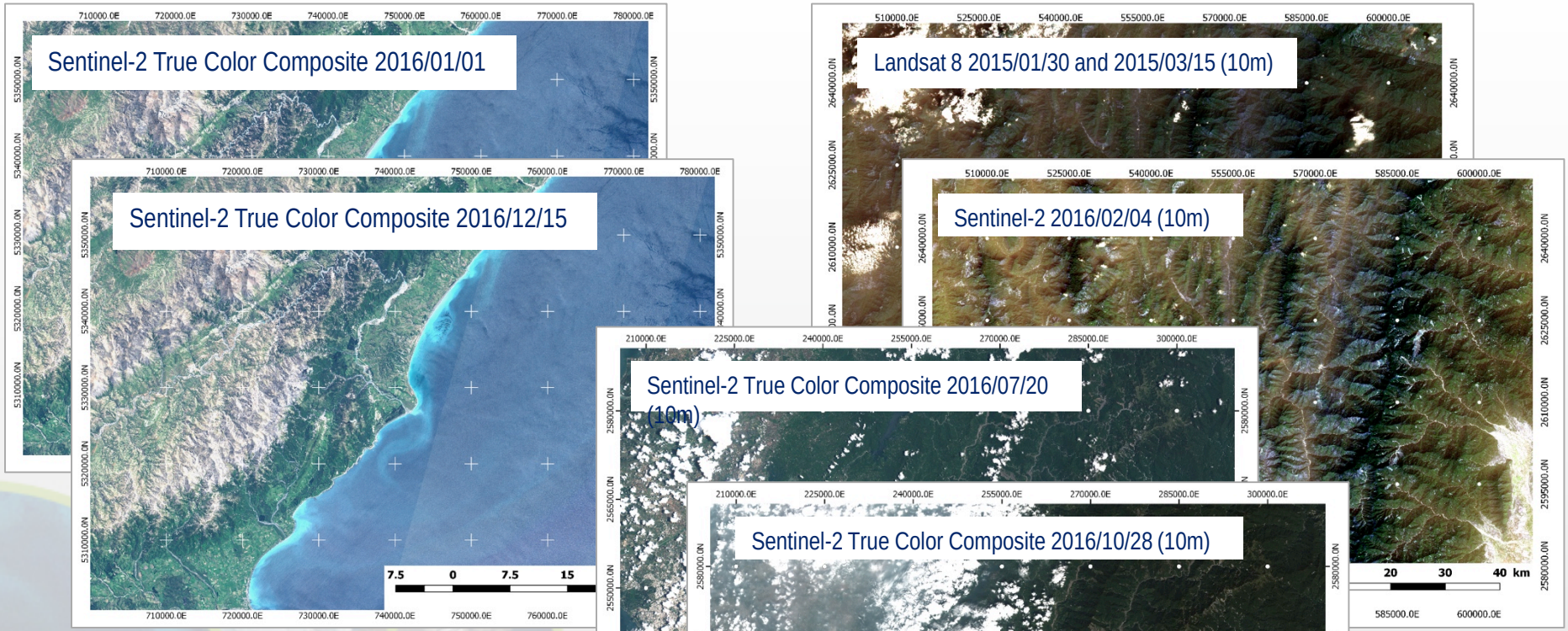
Current tests on GEP and on local cluster at Univ. Strasbourg (A^2S infrastructure)
From ALADIM to ImCLASS → fully automated processing chain combining MS and SAR data

How can this be interfaced with NASA's tool? (e.g. COOLR)

Generalizing the creation of EO-based inventories after major triggering events

New Zealand: Kaikoura ETQ - 2016

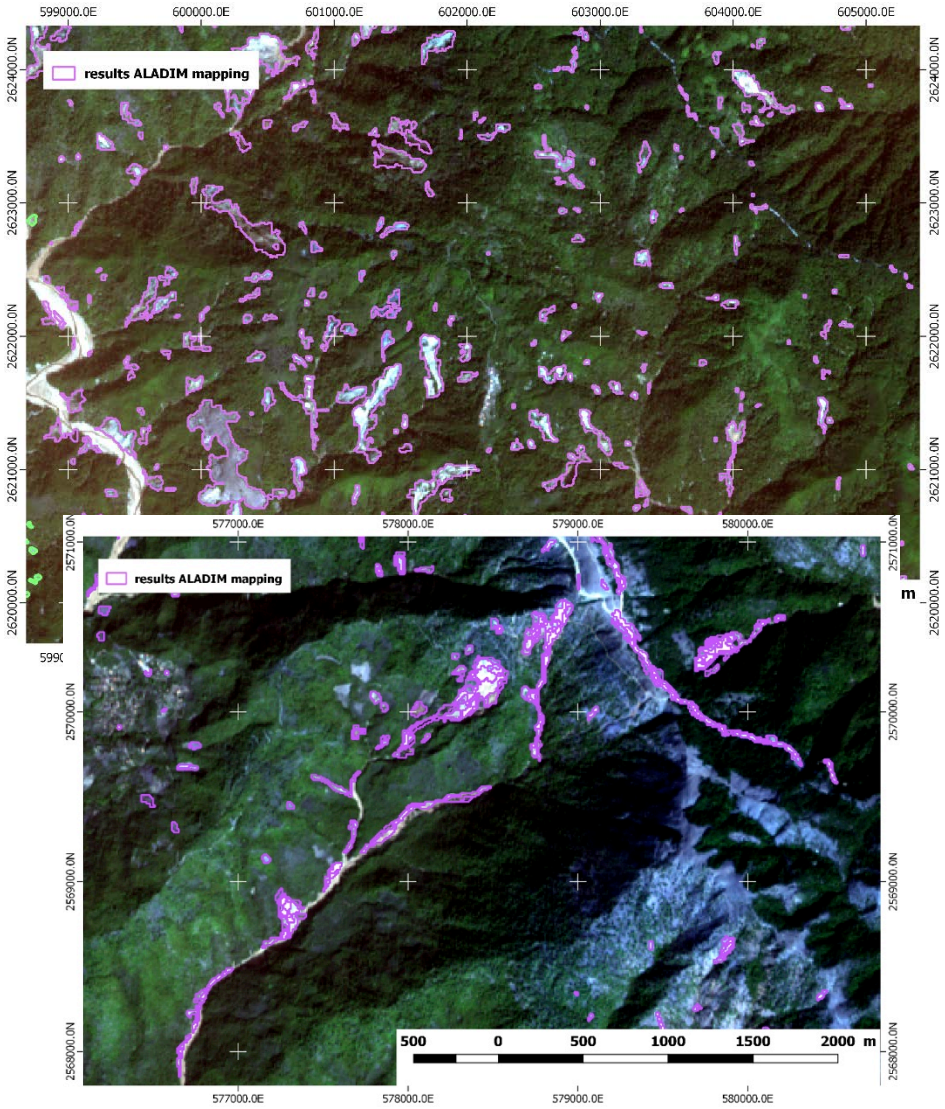
Myanmar: Cyclon Komen - 2015



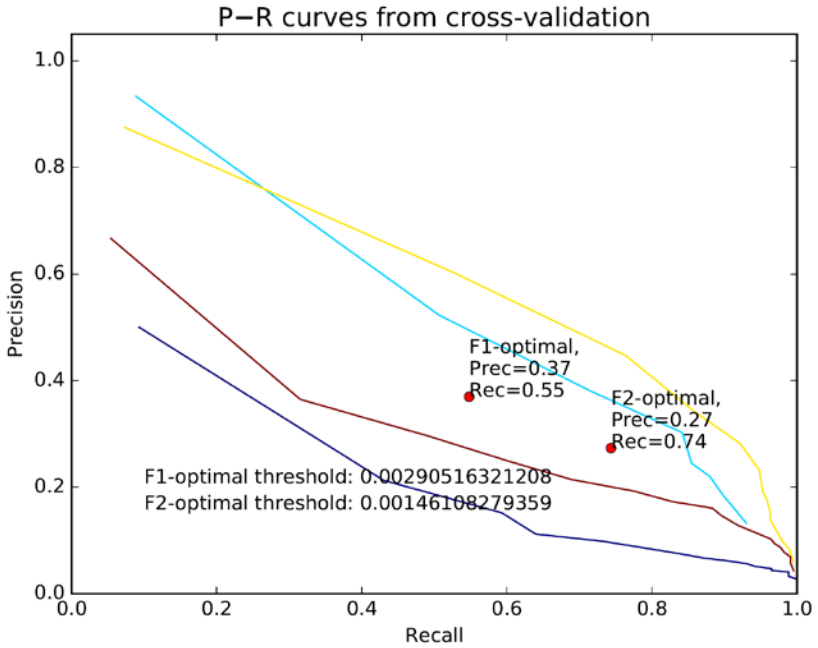
Taiwan: Typhoon Meranti - 2016

Stell et al. (2018)

Generalizing the creation of EO-based inventories after major triggering events



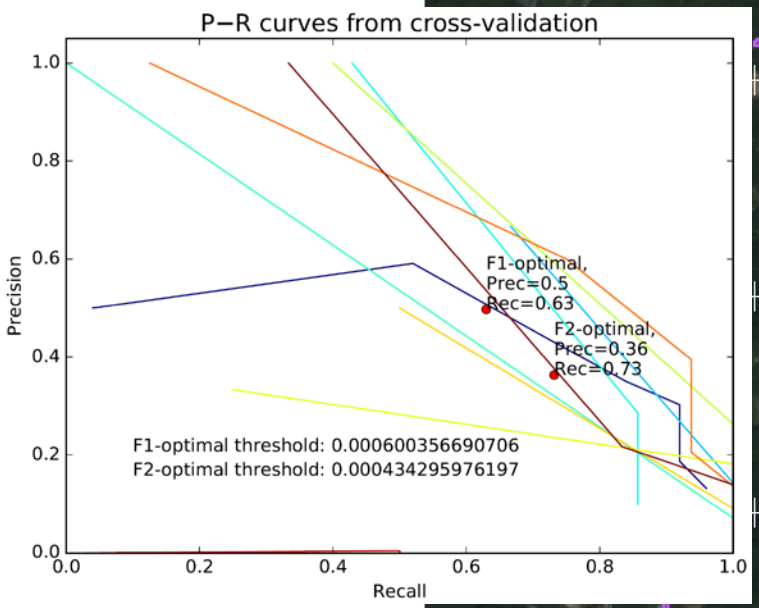
Myanmar: very good results
> 85% of mapped landslides detected by the algorithm

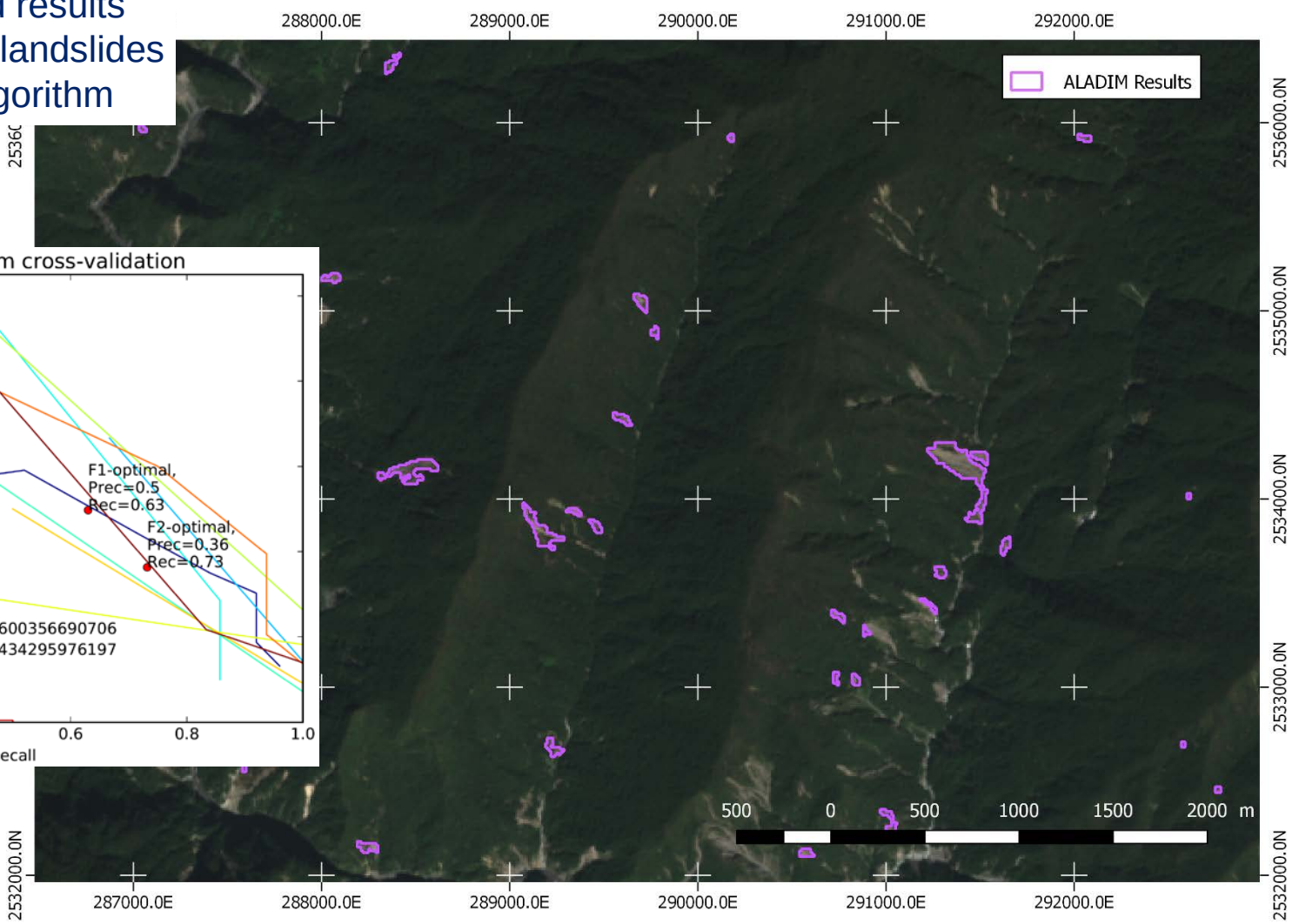


Stell et al. (2018)

Generalizing the creation of EO-based inventories after major triggering events

Taiwan: very good results
> 90% of mapped landslides detected by the algorithm

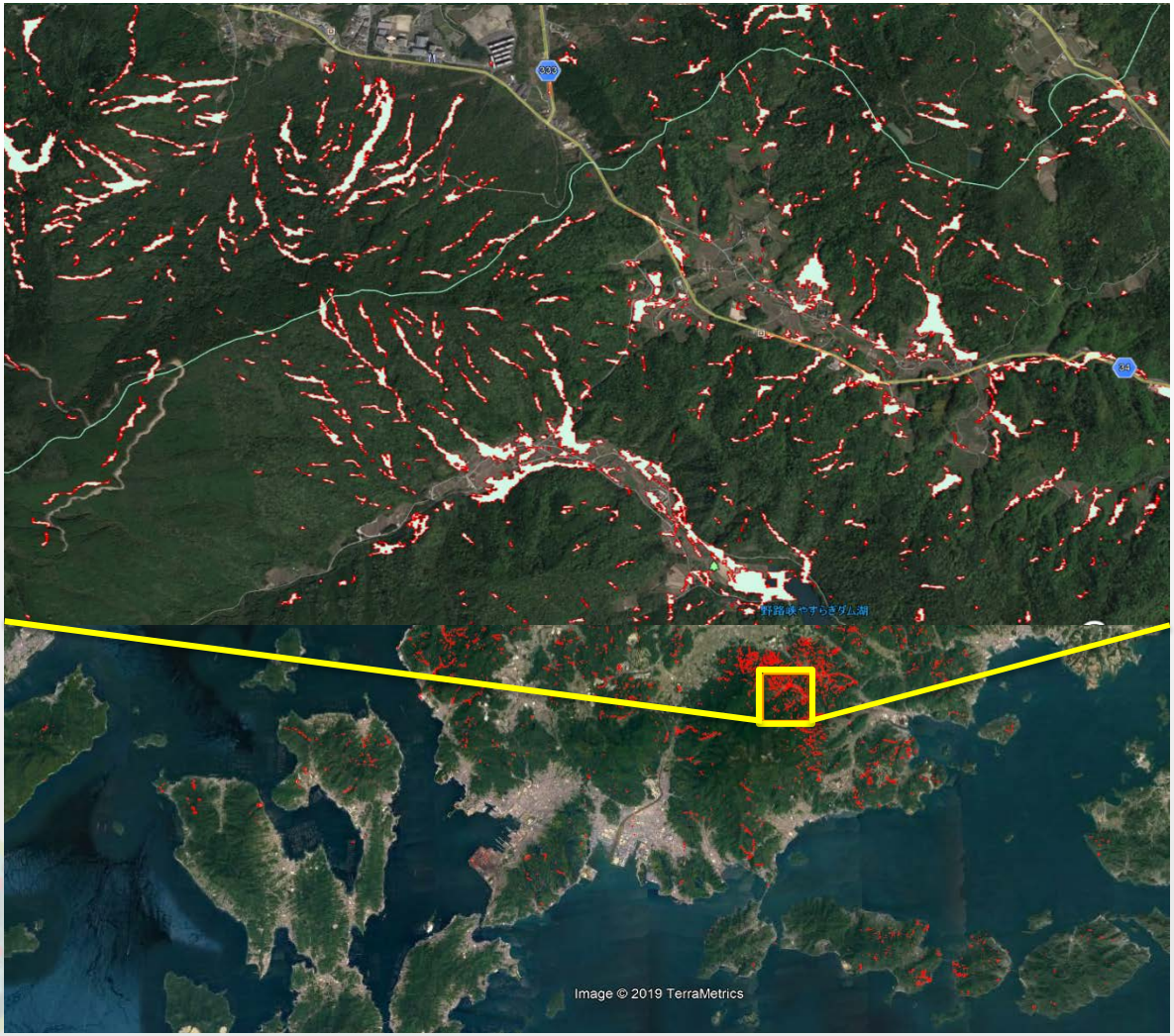




Stell et al. (2018)

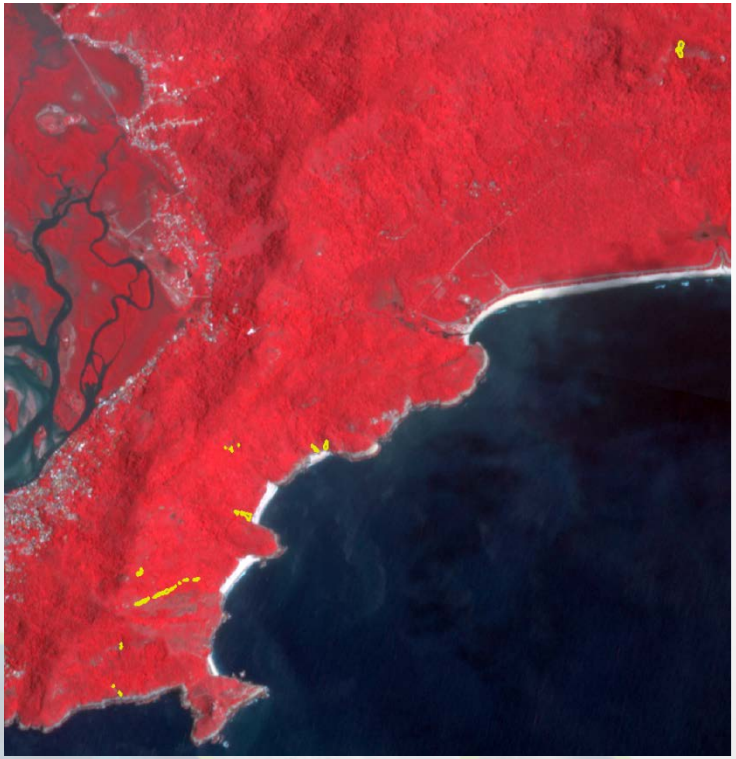
Rapid mapping effort for July 2018 rainfall event in Hiroshima, Japan

- DigitalGlobe images available in Hazard Data Distribution System (HDDS) were utilized
- About 6000 landslides were mapped in the region.



Pukar Amatya (NASA/USRA), Dalia Kirschbaum (NASA), Robert Emberson (NASA/USRA)

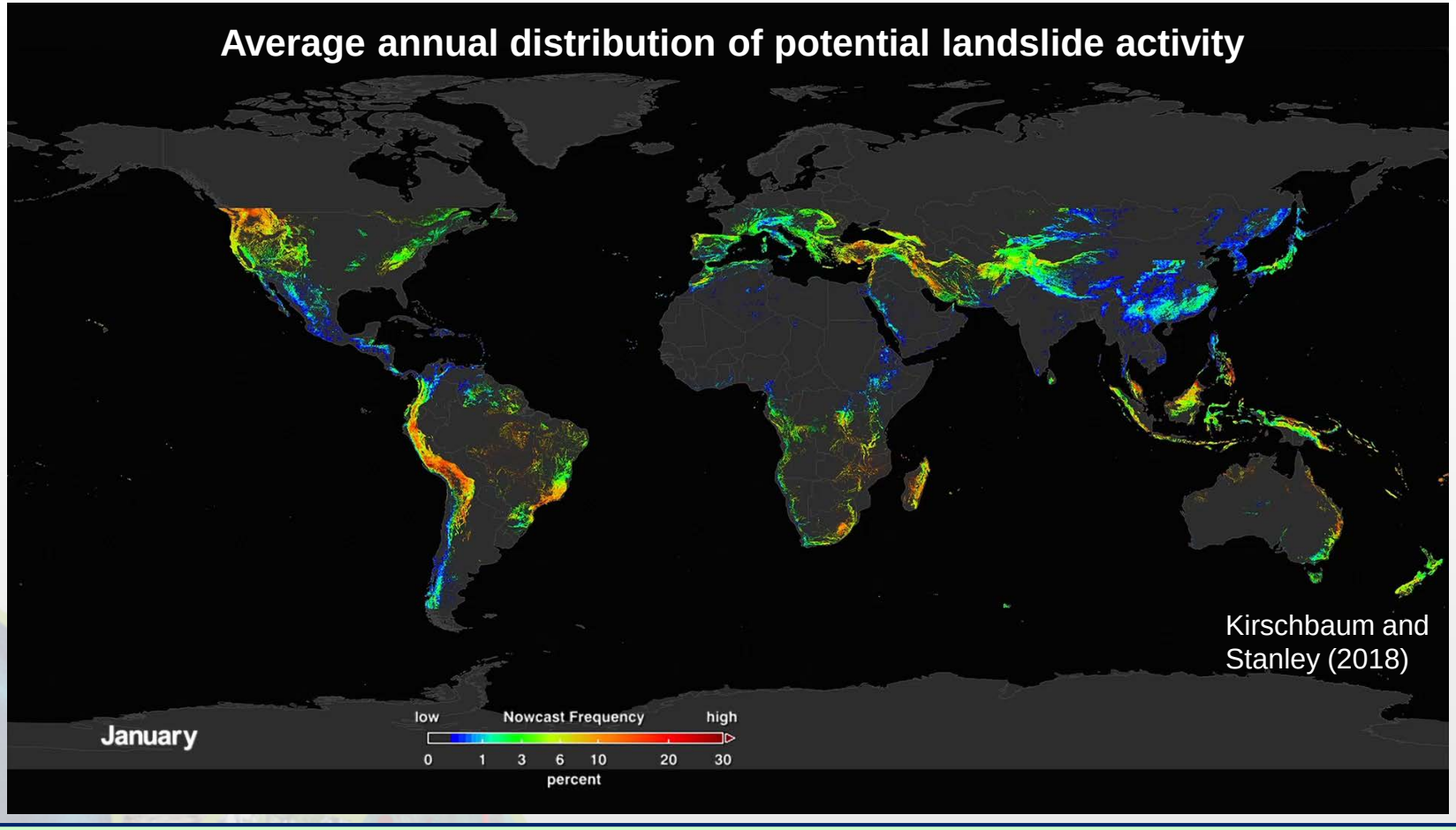
Landslide mapping for February 2019 rainfall event in Rio De Janeiro, Brazil



- Planet labs imagery were used.
- 51 landslides were mapped.

Pukar Amatya (NASA/USRA), Dalia Kirschbaum (NASA)

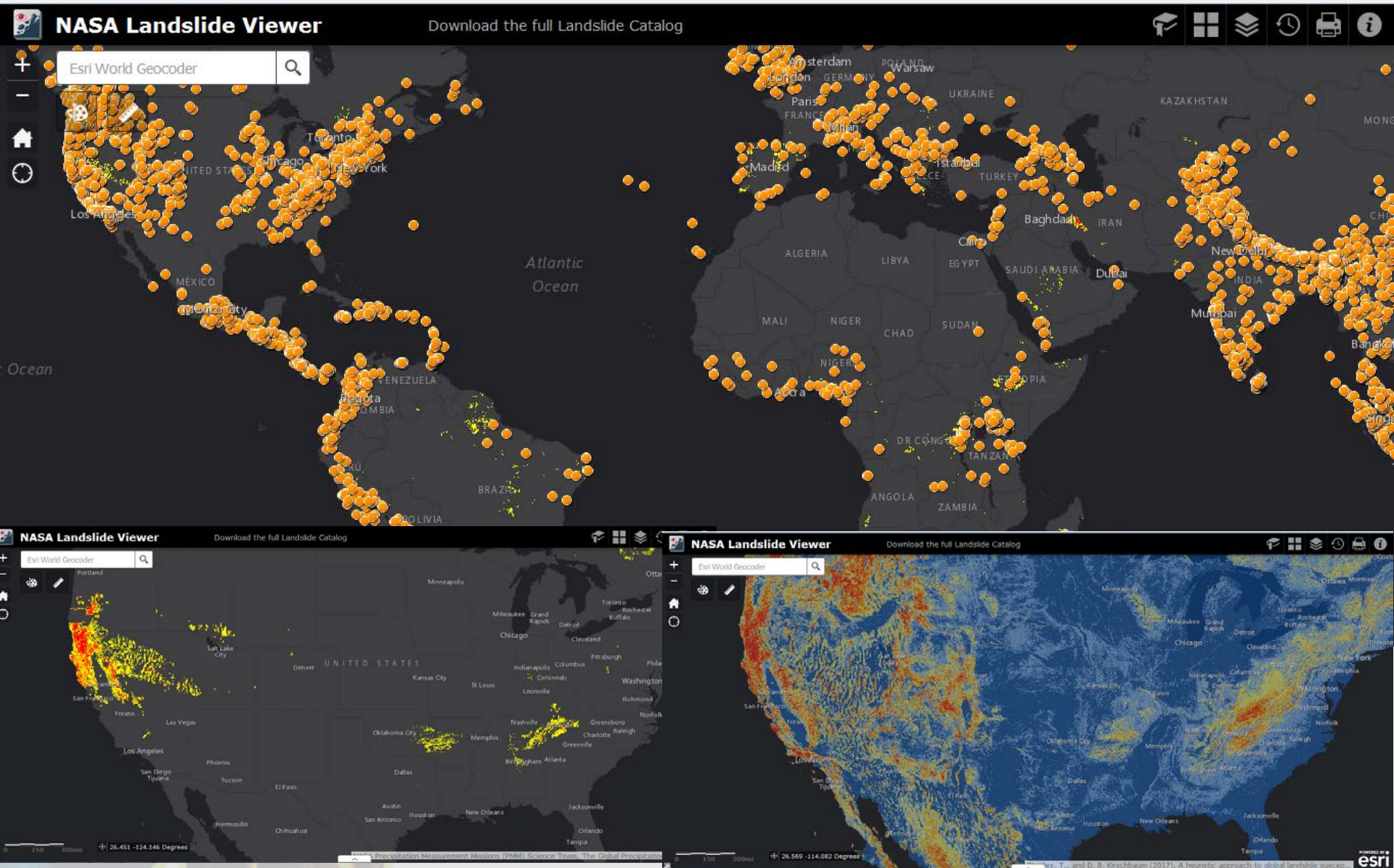
Global Landslide Modeling



A Landslide Hazard Assessment for Situational Awareness (LHASA) system provided near real-time estimates of potential landslide activity in the tropics and middle latitudes using NASA's TRMM and GPM rainfall estimates and other openly available remote sensing data. LHASA can be used as a tool to support disaster hazard and risk assessment in near real-time and is currently updated every 3 hours at https://pmm.nasa.gov/precip-apps. Landslide data can also be viewed and downloaded at: https://landslides.nasa.gov.

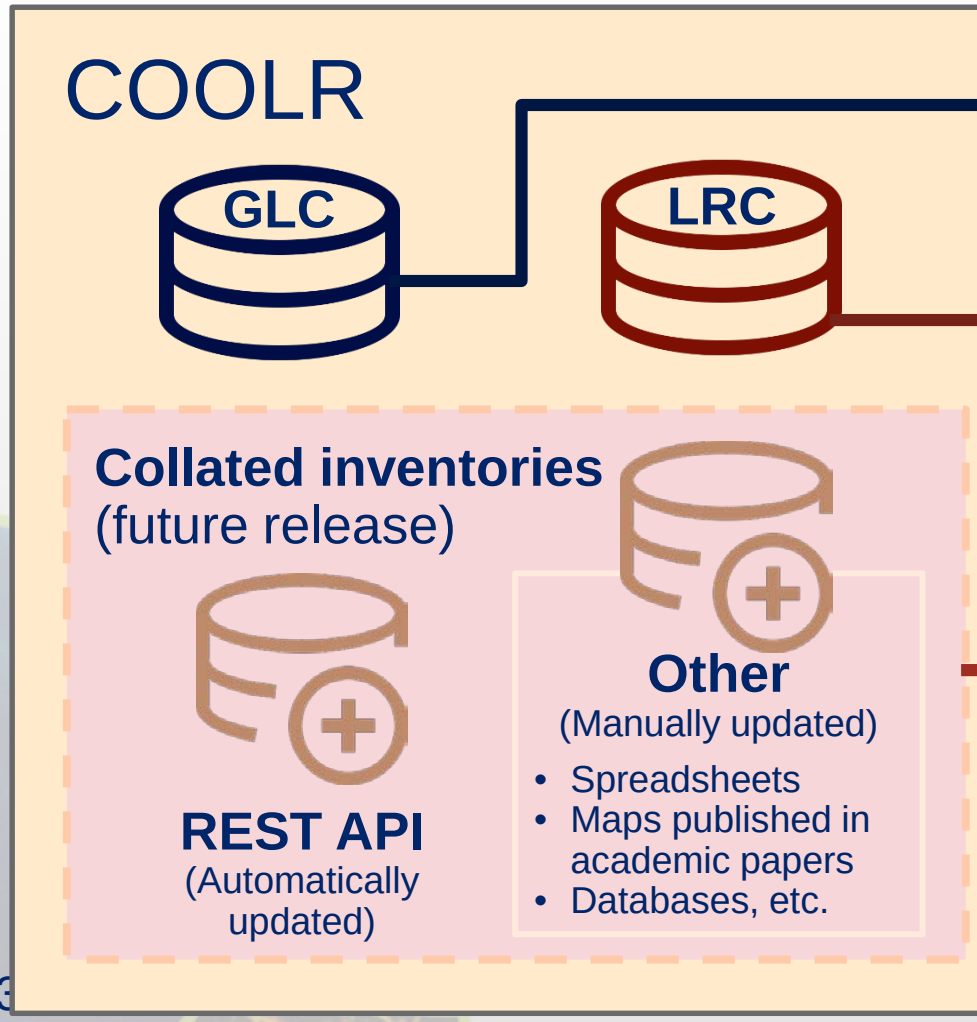
Landslide Viewer

https://landslides.nasa.gov/viewer



The Cooperative Open Online Landslide Repository (COOLR)

https://landslides.nasa.gov



Global Landslide Catalog (GLC): NASA GSFC's catalog of rainfall triggered landslide events, collected since 2007

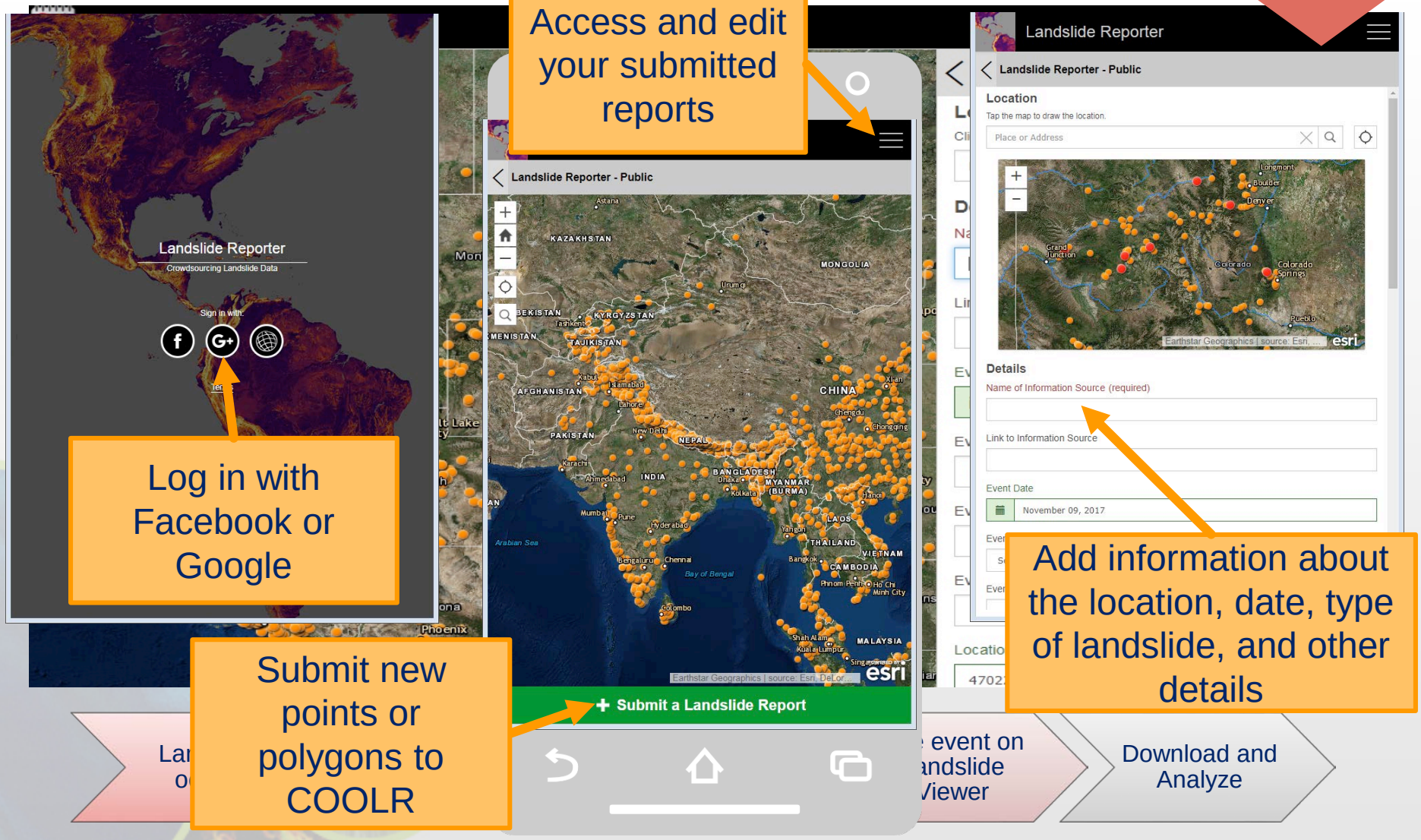
Landslide Reporter Catalog: landslide events contributed by citizen scientists

***For a future release*— Collated landslide inventories:** Landslide data from other sources will be added into COOLR

Landslide Reporter

https://landslides.nasa.gov/reporter

Use on the computer or mobile device



Access and edit your submitted reports

Log in with Facebook or Google

Submit new points or polygons to COOLR

Add information about the location, date, type of landslide, and other details

Lan… o… event on …andslide …iewer

Download and Analyze

Thematic App Landslide

jpmalet

geohazards tep

Home | Workspace | Background | Observations & Measurements | Services Catalogue | Community | EO sector Collaboration

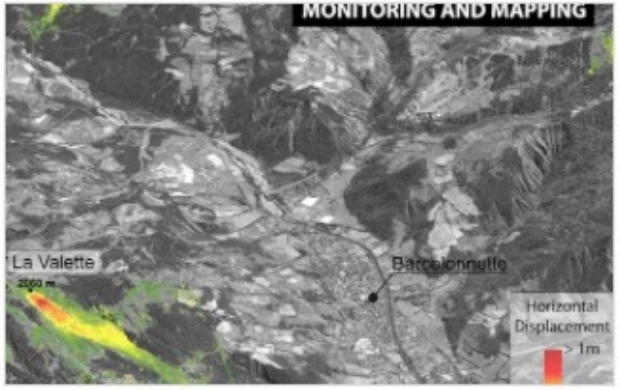
Thematic Applications

Satellite EO for landslide analysis: detection, monitoring and mapping

by **CNRS – EOST**

https://geohazards-tep-ref.terradue.com/#!thematic

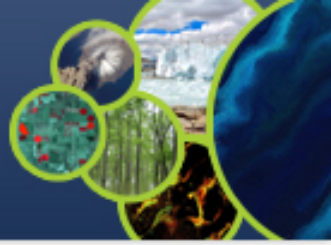
App | landslide | detection | monitoring



The App provides a set of services for landslide analysis from optical and SAR images. The processing capabilities integrate softwares and dedicated services for : - landslide rapid mapping from optical images (ALADIM), - landslide displacement field monitoring from stacks of optical images (Service MPIC-OPT), - Digital Surface Models creation from optial steropairs (Service DSM-OPT), - interferogram generation from multiple SAR sensors (Software DIAPASON), - landslide inventory analysis and susceptibility mapping (Services Land-SE and Land-STAT from CNR IRPI)

Close | Open App on the Geobrowser

Status on Key Pilot Outputs & Deliverables



1. Report on recommended practices for the combined exploitation of SAR and Optical imagery and technologies for landslide detection, mapping and monitoring". **(Objective A**)

Status: research is ongoing in the study sites to develop new methodologies for processing SAR and optical data, several papers in progress or preparation on this topic. Cosmo-Skymed Tasking over Trishuli basin will be an extremely valuable dataset to be used by the research community.

2. Report on effective methodologies and strategies for considering multi-hazard and cascading aspect of landslides through multi-temporal landslide mapping from multiple triggers (leveraging information/interactions with the volcano, flood and earthquake pilots) **(Objective A-C)**

Status: research on this effort is still in the early stages

3. Landslide event inventory and activity (monitoring) maps produced using optical and SAR imagery and technologies, and their combination, for selected case studies / geographical areas. **(Objectives B-C)**

Status: Launching of https://landslides.nasa.gov and work with the GEP have greatly expanded the potential for inventories being shared across geographic areas

4. Report on end user engagement strategies and characterize enablers, challenges, barriers to effective transfer of information, knowledge and technologies. **(Objective D)**

Status: While preliminary recommendations may be provided by the end of this pilot, we feel the deliverable will be best suited for a follow-on demonstrator phase given the current status of the research and delays in obtaining data for this effort.

Pilot Activities Summary

- Continue SAR acquisitions in different study areas of the pilot.
- Processing of SAR data acquired through the pilot and expansion of the landslide pilot involvement in the GEP
- Drafting of a joint publication across the pilot to summarize effective practices based on current and potential methods for landslide detection using remote sensing → meeting planned at EGU