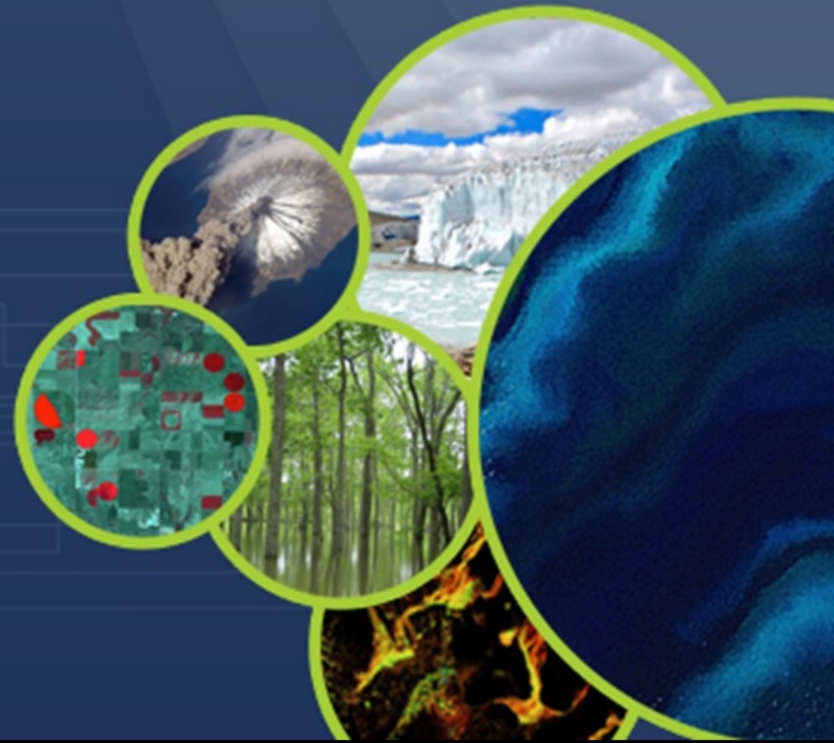


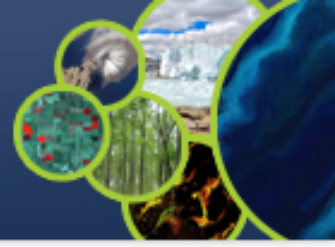


Committee on Earth Observation Satellites

Landslide Pilot Working Group Presentation

March 14th, 2018





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



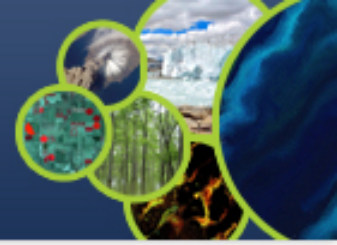
Dr. Jonathan Godt, Landslide Hazards Coordinator, U.S. Geological Survey, Colorado, USA



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



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



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

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



Credits: K. Cook

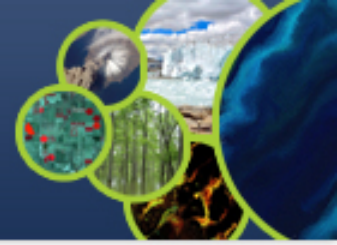
Nepal: Bhote Koshi (drone image 1 month after EQ)



Credits: Tsou Univ. Kyoto

Taiwan: photographs before and after

Integration of satellite platforms for understanding landslides



What?
(Type, Activity)

Rotational slide



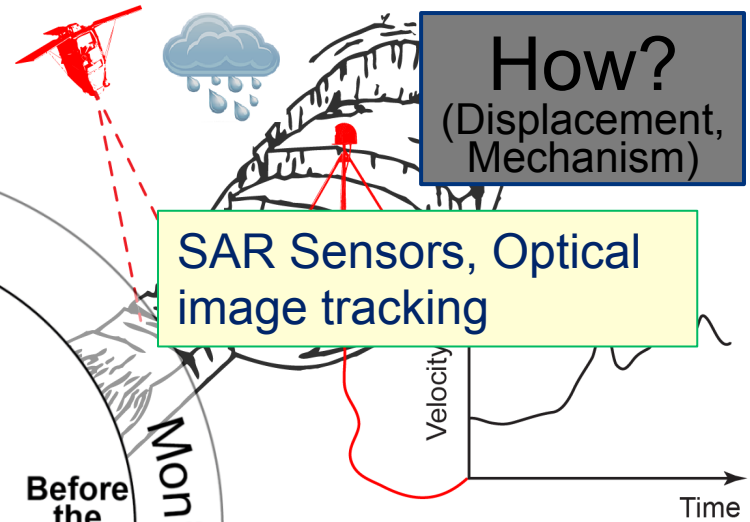
Fusion of multiple sensors and techniques (in situ and remote)

Flow



How?
(Displacement, Mechanism)

SAR Sensors, Optical image tracking



Characterization

Monitoring

Disaster

Before the event

Event

Rapid mapping

Precipitation
Earthquake triggers

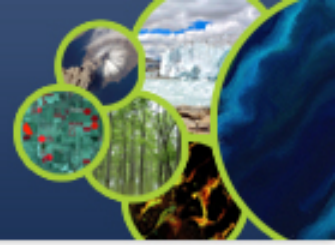
Optical data,
Citizen Science and
Inventory sharing

Where?
(Location)

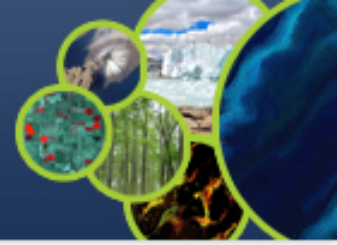


When?
(Forecast)

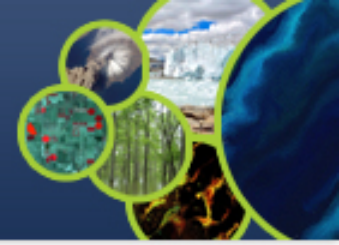




<i>Region</i>	<i>Regional Point of Contact</i>
Nepal	Nick Rosser, Sigrid Roessner, Dalia Kirschbaum
Pacific Northwest, US	Jonathan Godt, Dalia Kirschbaum
Central Eastern Africa	Olivier Dewitte, Jean-Philippe Malet
Caribbean (Cuba/Lesser Antilles)	Jean-Philippe Malet, Georgina Bennett
China	Zeng-Guang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

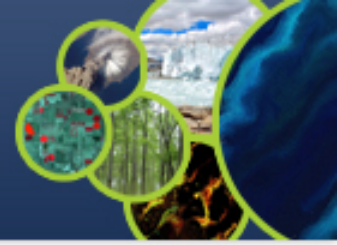


Geographic Area	Products	Value Added Partners
Nepal	Landslide monitoring and deformation analysis, multi-temporal landslide inventories, magnitude-frequency analysis of landslide occurrence, multi-temporal landslide hazard analysis	ICIMOD, Nepal Govt. Ministries, World Bank, Red Cross, US Army Corp of 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, multi-temporal landslide inventory, susceptibility and hazard analysis	Local African Universities and research centres (DRC, Burundi, Rwanda, Uganda), North and South Kivu Civil protection, Bukavu City hall
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 Link with CEOS RO
Indonesia	<i>In development</i>	



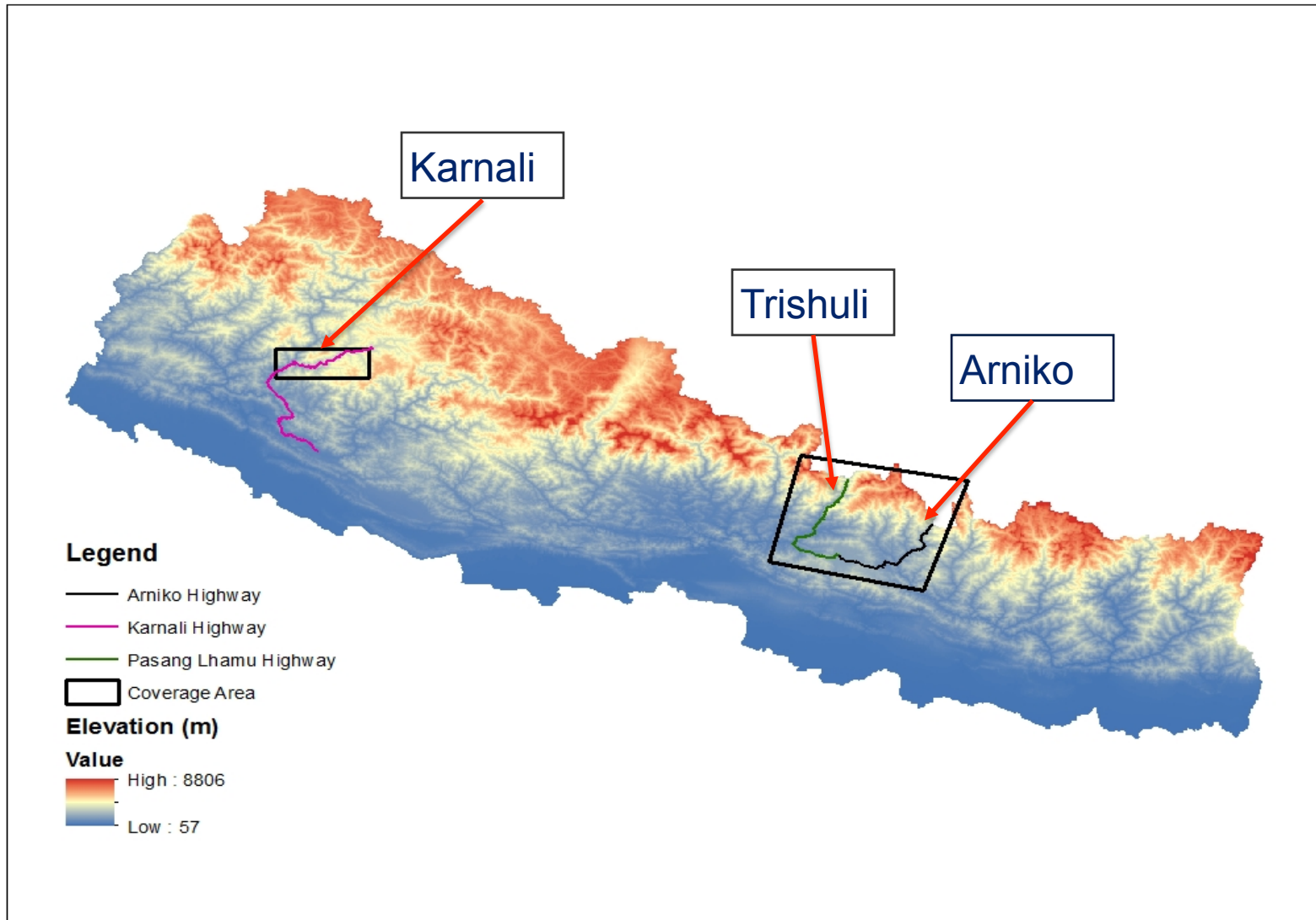
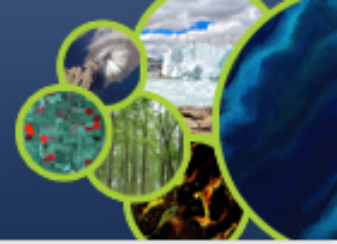
	Total quota	Nepal		Pacific Northwest	
	All years	New	Archived	New	Archived
SPOT (archive only)	Not (presently) available		60		60
Pléiades	100	25	25	25	25
Radarsat-2	110		60		50
Cosmo Sky-Med	?	150	150	100	50
TerraSAR-X (StripMap)	?	100	all archived datasets	50	
TerraSAR-X (Spotlight)	?	100			
ALOS-2 / PALSAR-2		100	50	100	

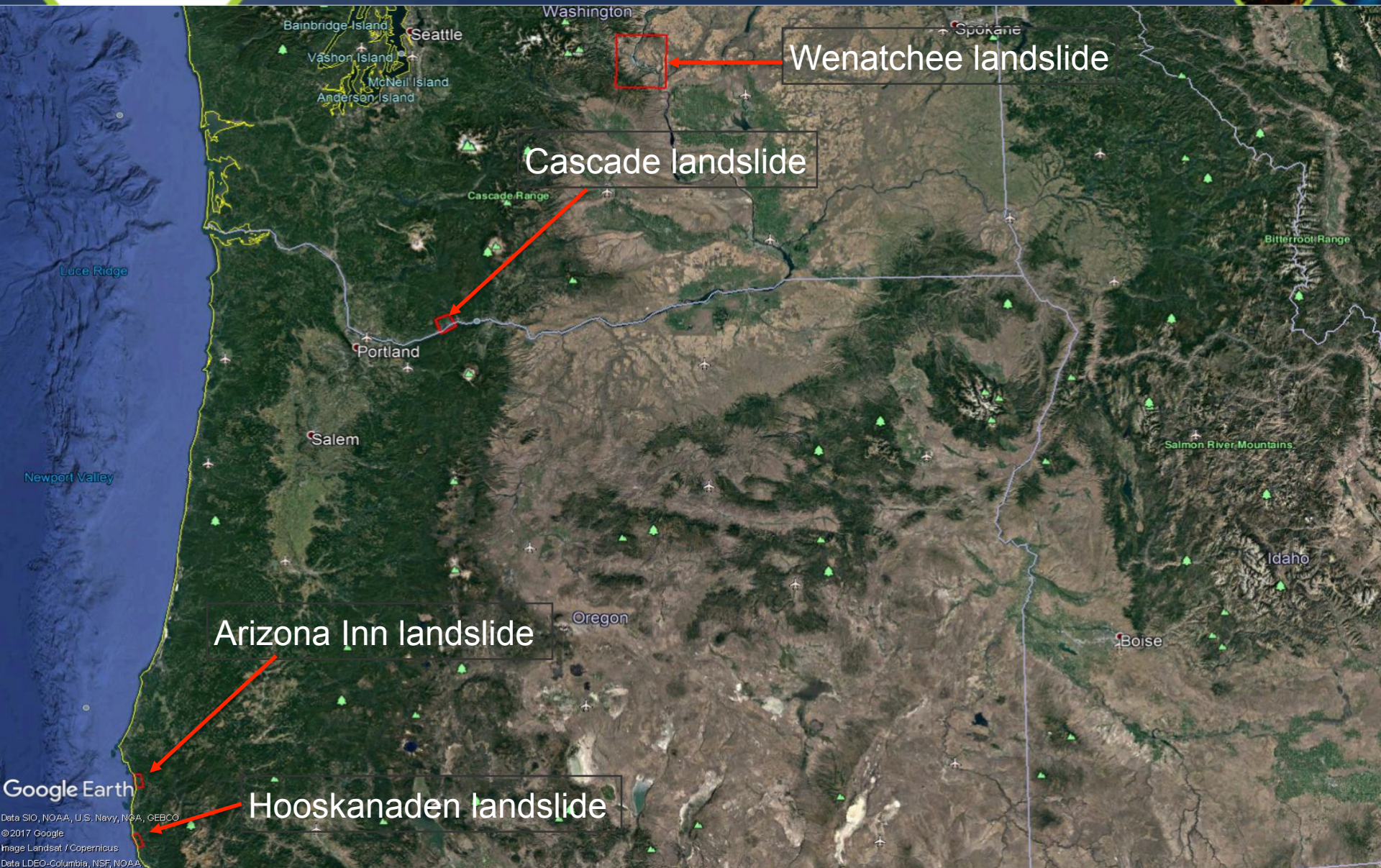
Imagery Requested and Received (1 March 2018)

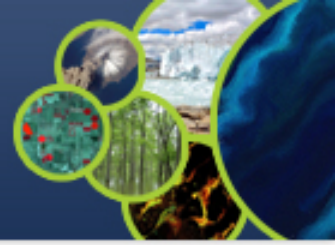


Satellite	Total quota	Nepal			PNW		
		Requested		Received	Requested		Received
		Archived	Tasking		Archived	Tasking	
Radarsat-2	90	no request	no request		no request	no request	
Cosmo Sky-Med		70	180			40	
TerraSAR-X			280		120	152	
Pléiades	40000 sq. km	19322 sq. km. received with 20678 sq. km. remaining					
SPOT 6/7	Depends on GEOSUD	10					

Complex mode of data sharing
Request of the Pilot is to have one single repository (GEP would be ideal)





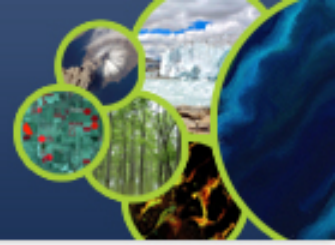


- **PI:** Sigrid Roessner

Nepal: Tasking requested and accepted for Trishuli and Arniko highways (GFZ Postdam) – No request for Karnali.

PNW: Tasking request submitted for 3 landslide areas. (Oregon State University, Southern Methodist University)

- **Status:** Data acquisition has started for Nepal. Data will be uploaded to DLR's supersite ftp server.



PI: Jean Philippe Malet

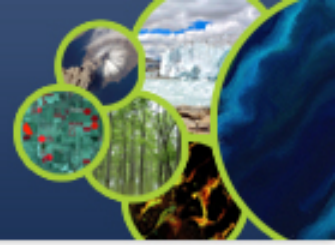
Status: Agreements have been signed and SOAR Geohazard proposal has been accepted by CSA. Access to acquisition planning tool has been established.

→ There have not been any requests from the Landslide Pilot for this data at this time.

Image Quotas:

Nepal: 30 archived, 30 tasking

PNW: 30 archived



PI: Jean Philippe Malet

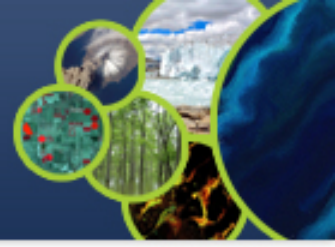
Nepal: Tasking and archived request submitted for Trishuli and Arniko highways (NASA/JPL/USRA).

PNW: Tasking request submitted for 2 landslide areas. (Oregon State University and Southern Methodist University)

Access requested to CSK imagery acquired during Nepal EQ 2015

New : Access requested for East African Rift experimental site

Status: All necessary documents have been completed and submitted to ASI. Data will be delivered to PI + on GEP.



Pléiades - PI: Jean Philippe Malet

- 40,000 sq km for the 3 years period for the Landslide Pilot (PNW + Nepal + other region).
- The first request of the Landslide Pilot, from OSU and USRA represents 2732 sq km.
- The second, from CNRS + GFZ + UDurham, represents 16590 sq km.
- Depending of the budget availability, 20678 sq km remains until 2019.

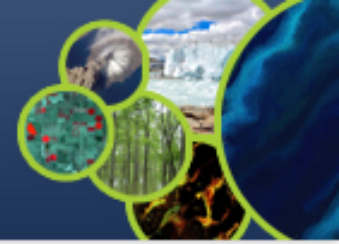
Status: Delivery of archived and tasking data on-going. Some have been delivered.

SPOT – PI: Jean Philippe Malet

Most of the image request came for SPOT 6/7 which is not available from CEOS.

Status: GEOSUD will give access to SPOT data, but our current request is too large. Some difficulties to discuss with GEOSUD.

- **Most of 2017 works on freely available data (S1, S2) and former satellite archives of the group**
- **Ongoing investigations with delivered Pléiades imagery over Nepal & PNW**
- **Waiting for SAR tasking to commence**
- **Feasibility analysis for expanding the areas of interest:**
 1. **East Africa**
 2. **Caribbean (with links to RO Pilot)**



- 2018 EGU – SMP33, “CEOS Landslide Pilot: the path forward”
Wed, 11 Apr, 12:15–13:15 / Room 2.17
- Plan to present the pilot at the UR2018 Side Meeting / Mexico
- We are awaiting data from DLR, ASI, and GEOSUD (SPOT).
- We will begin making requests for the experimental study regions (Africa, Caribbean, and possibly China) starting April 2018
- We will be discussing the potential for a joint publication across the pilot to summarize effective practices based on current and potential methods for landslide detection using remote sensing.

Thanks for your attention !

