Committee on Earth Observation Satellites

Geohazard Supersites and Natural Laboratories (GEO-GSNL)

Stefano Salvi (GEO-GSNL & INGV)

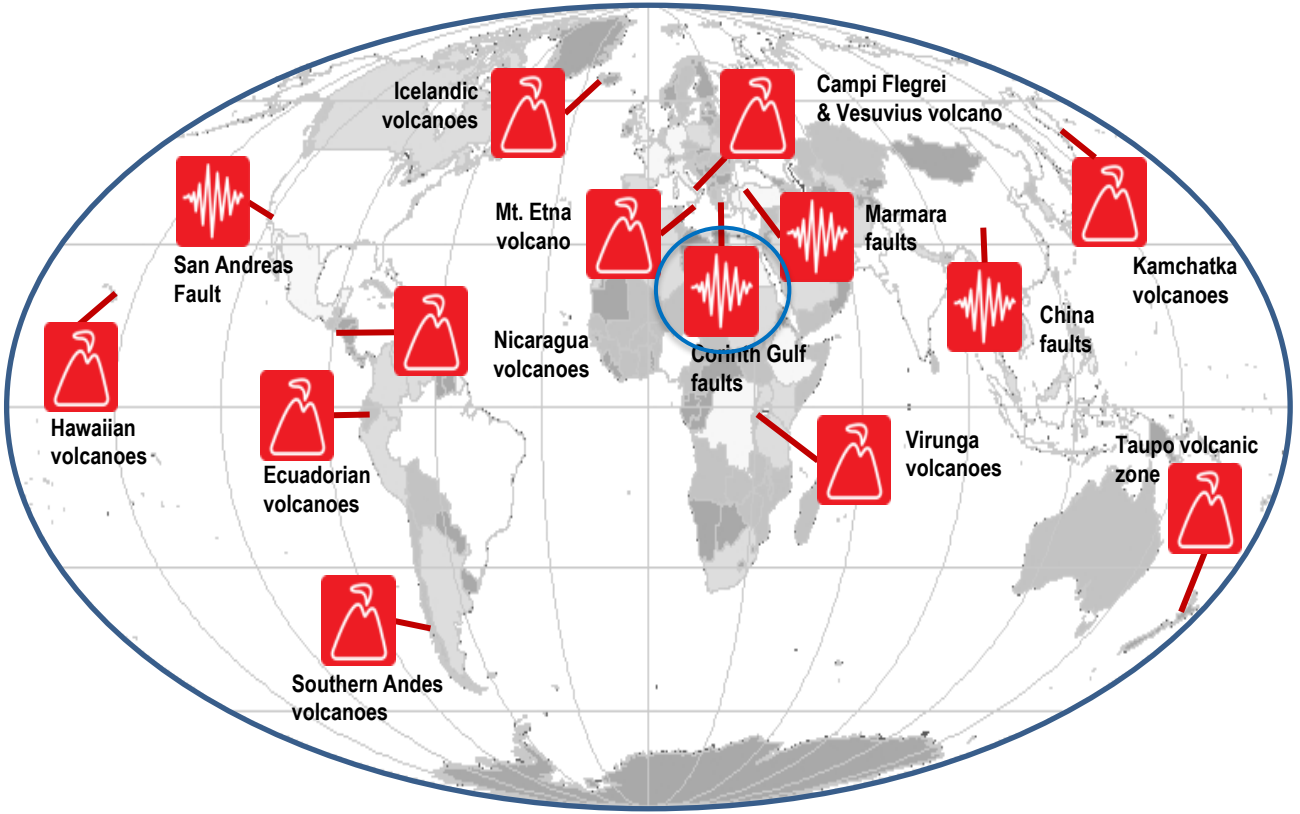
WG Disasters 17 (virtual)
15, 16, and 17 March 2022

Status of Supersites

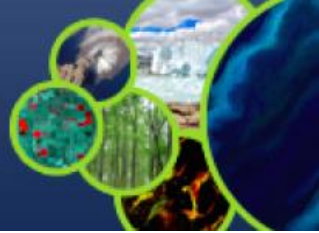
GSNL is now a network of 14 Supersites

13 are supported by CEOS

Support to Enceladus Supersite withdrawn in April 2021 due to no use of quotas.



EO data



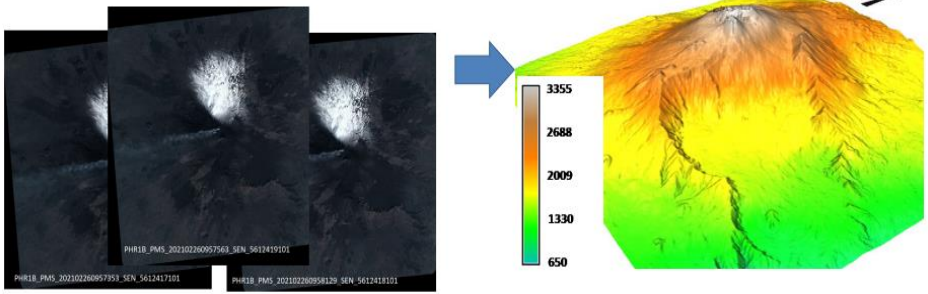
- Pleiades stereo/tristereo data continue to be much requested, especially over volcanoes, during and after eruptions, to calculate the volume of emitted products.
- SAOCOM L-band data acquired and processed by the Hawaii Supersite on the Kilauea caldera, further requests are likely in the next future
- PRISMA time series are accumulated over several Supersites, we expect to see results in the next 1-2 years
- CSK and TSX data continue to be important SAR assets, although Sentinel 1 is the most widely used for ground deformation

We are very grateful to all the Agencies and the people who are making this happen

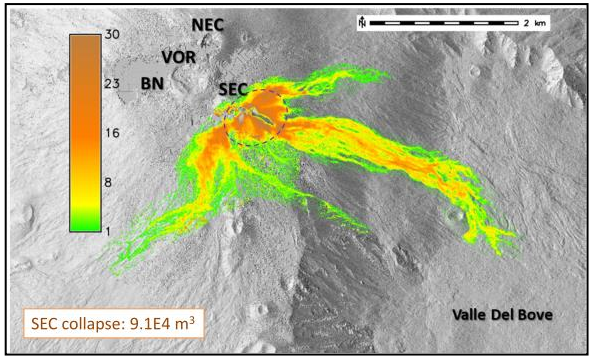
Pléiades

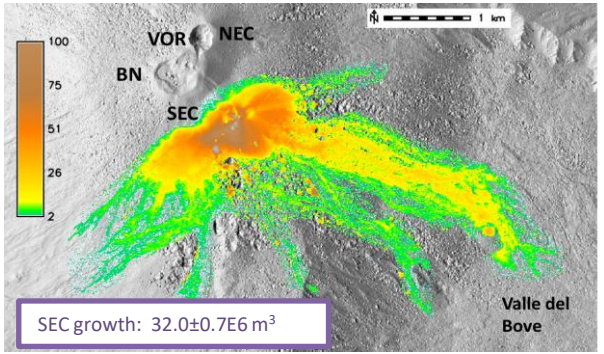
Surface changes due to 2020-2021 Etna eruption

A cloud-free Pléiades triplet was acquired over Mt Etna on February 26, 2021. The 3D processing of the tri-stereo Pléiades imagery is performed using the free and open source MicMac (Multi-images Correspondances, Méthodes Automatiques de Corrélation) photogrammetric library developed by the French IGN (Institut Géographique National).



A 1-meter spatial resolution digital elevation model was produced



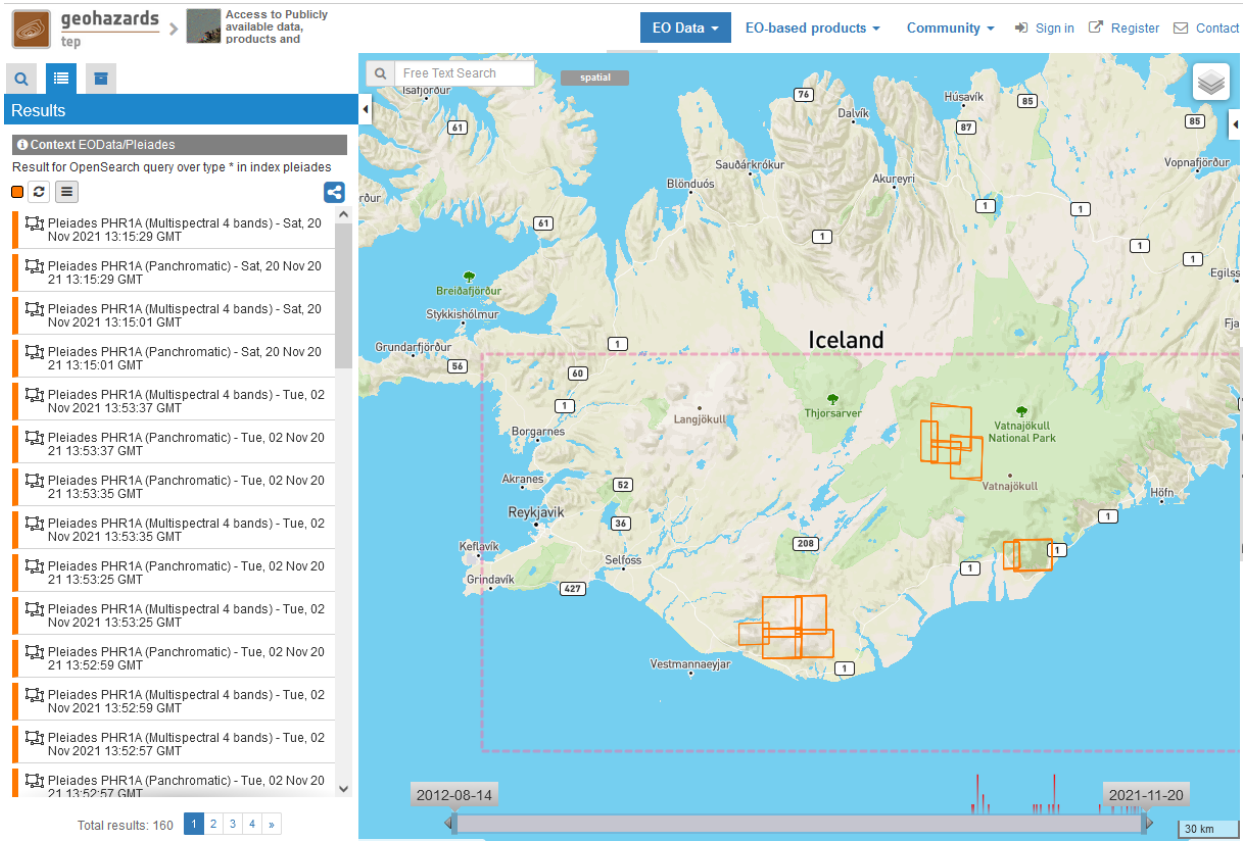


Morphological changes related to December 2020 – February 2021 eruptive activity at the South East Crater (SEC). Above: Production or the DEM from tristereo image.
Right: Maps of the morphological changes due to crater collapse and lava flows emplacement. Upper image: from Dec 2020-Feb2021; Lower image: from Dec 2020 to 25 July2021

Results by G. Ganci

Pléiades

- All Plèiades data acquired over the Supersites are now available through the Geohazardf Exploitation Platform (GEP).
- To access the data, users have to contact the Supersite Coordinator and sign the CNES license agreement



Thanks to ESA and TerraDue company

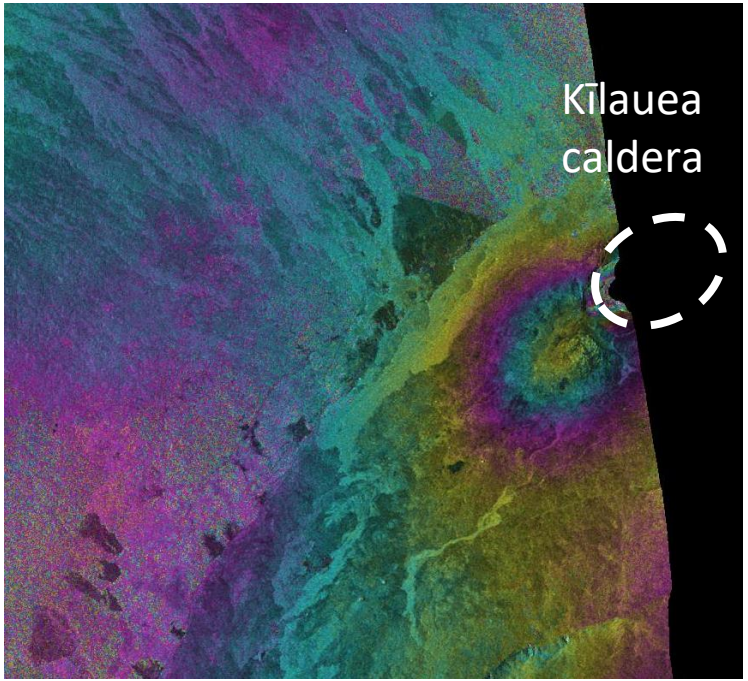
SAOCOM

2021 eruptive activity in Kilauea

SAOCOM interferogram
May 13, 2021 – January 11, 2022

Coverage: Kīlauea Volcano Southwest Rift Zone
The signal just west of the summit of Kīlauea Volcano shows line-of-sight inflation (about 20 cm) occurred as a result of the onset of eruptive activity in September 2021.

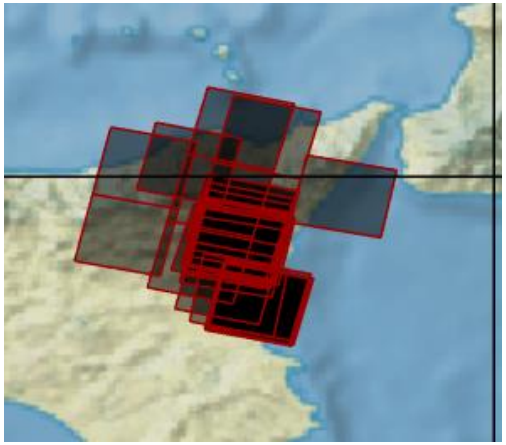
Results by M. Poland



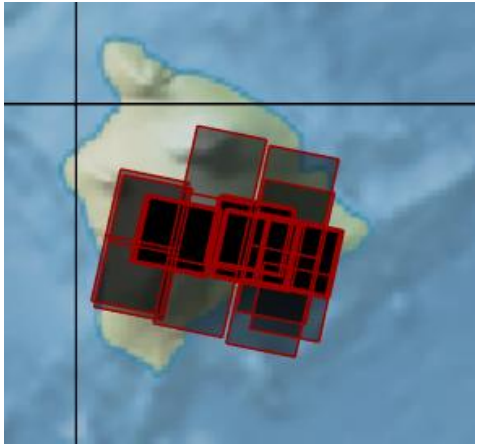
Each color cycle in this image is ~24 cm of line-of-sight displacement.

Good PRISMA data coverage over Supersites

Etna



Hawai'i

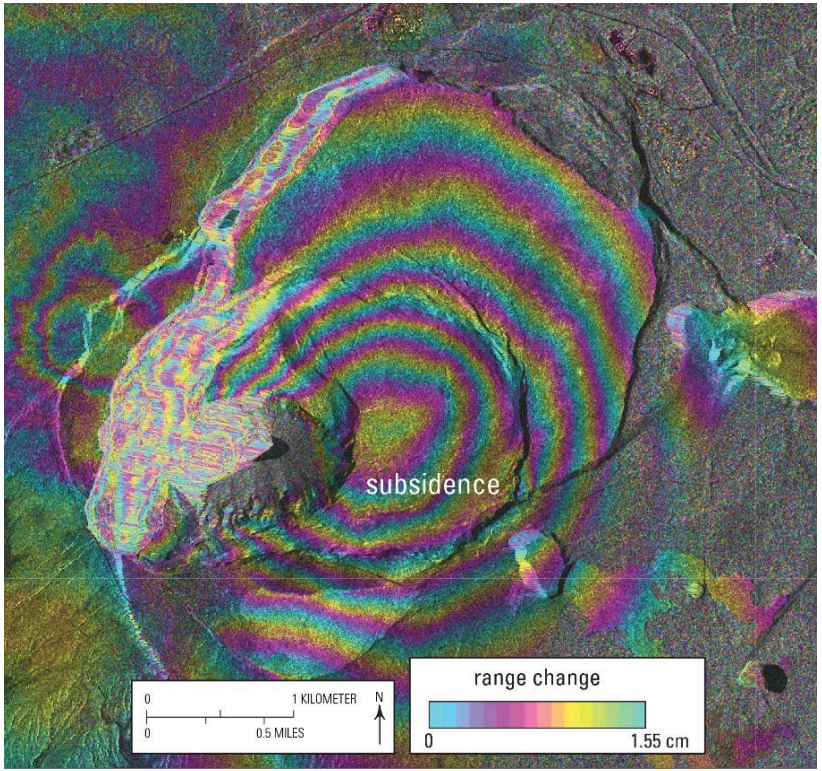


Istanbul

TerraSAR X

- **TSX data** are routinely used in the Hawai'I Supersite monitoring.
- TSX interferogram spanning the onset of the December 2020 – May 2021 eruption of Kīlauea Volcano—the first eruption following the volcano's 2018 collapse.

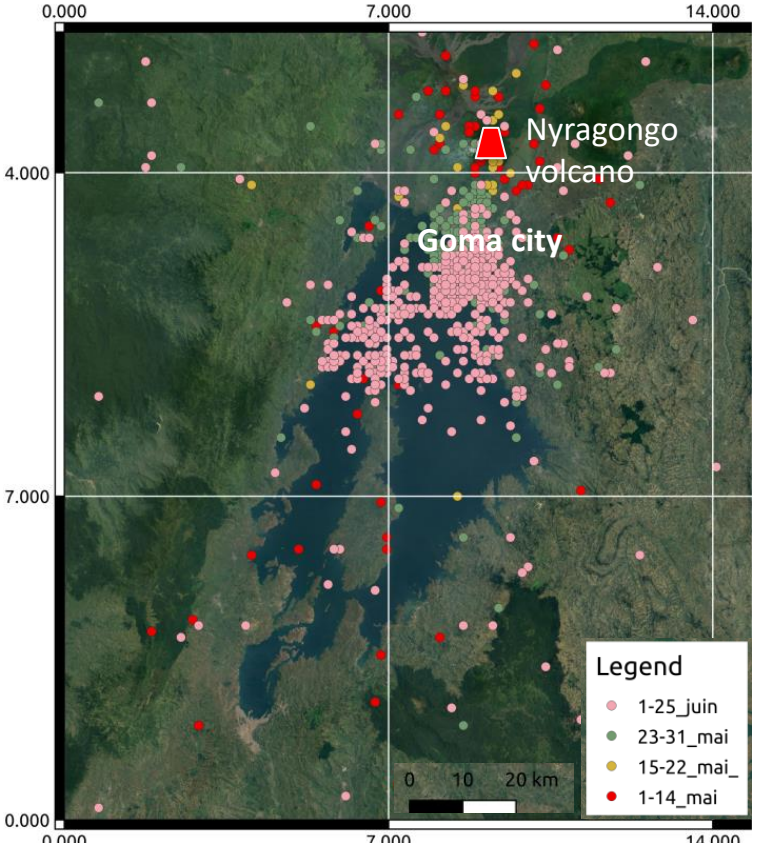
Results by M. Poland



The 2021 Nyragongo eruption-1

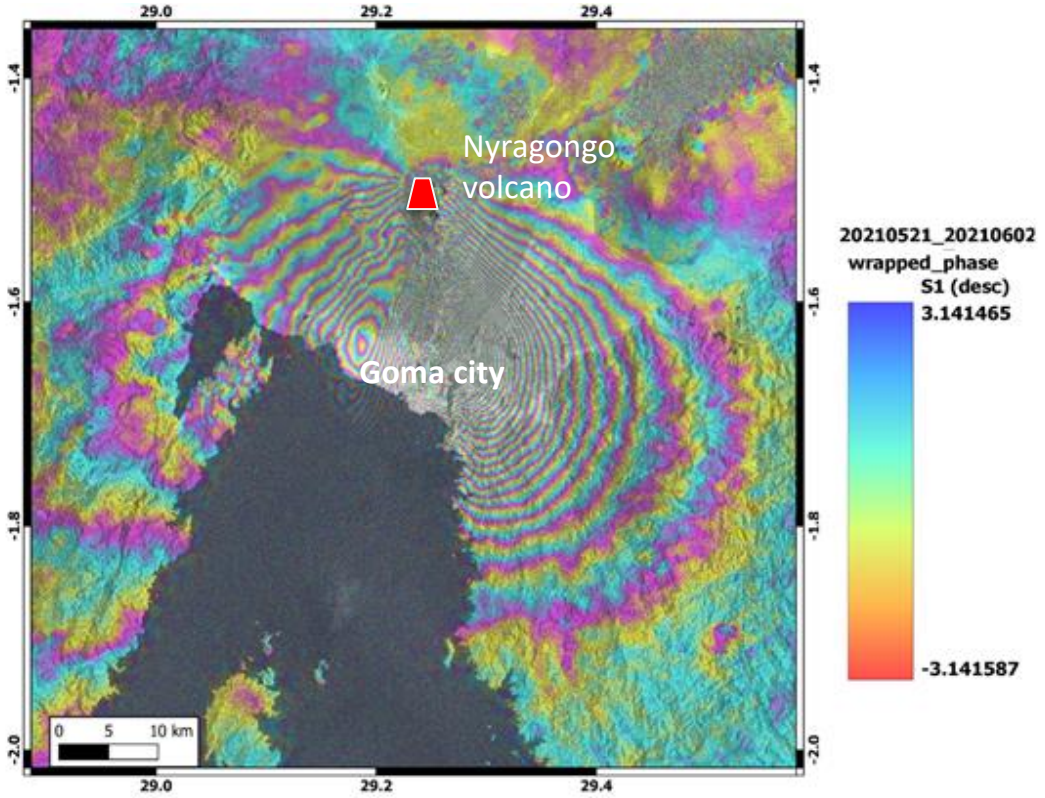
- Started May 22, 2021 (previous eruption in 2002)
- Strong lava flow and gas risks due to closeness to Goma city (1.5 M residents)
- 100s of thousands of people evacuated, final toll was 32 deaths and >1000 homes destroyed
- The Supersite community started to collaborate, facing difficult communications and less than optimal local/international coordination

From the Supersite biennial report by C. Balagizi



The 2021 Nyragongo eruption-2

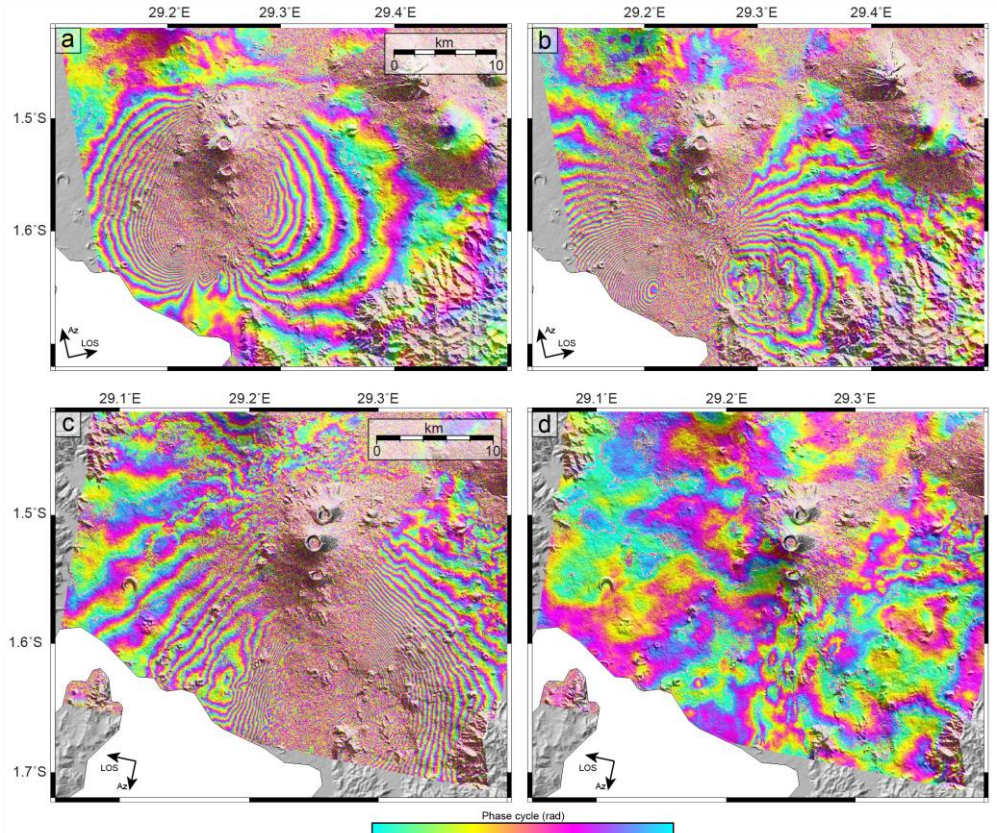
- Due to the scarcity of in situ monitoring instruments, SAR data were instrumental in providing the information feeding the situational awareness
- **Sentinel 1 data** showed a large ground deformation field linked to magma inflation along a ~N-S fracture passing underneath Goma city



From the Supersite biennial report by C. Balagizi

The 2021 Nyragongo eruption-2

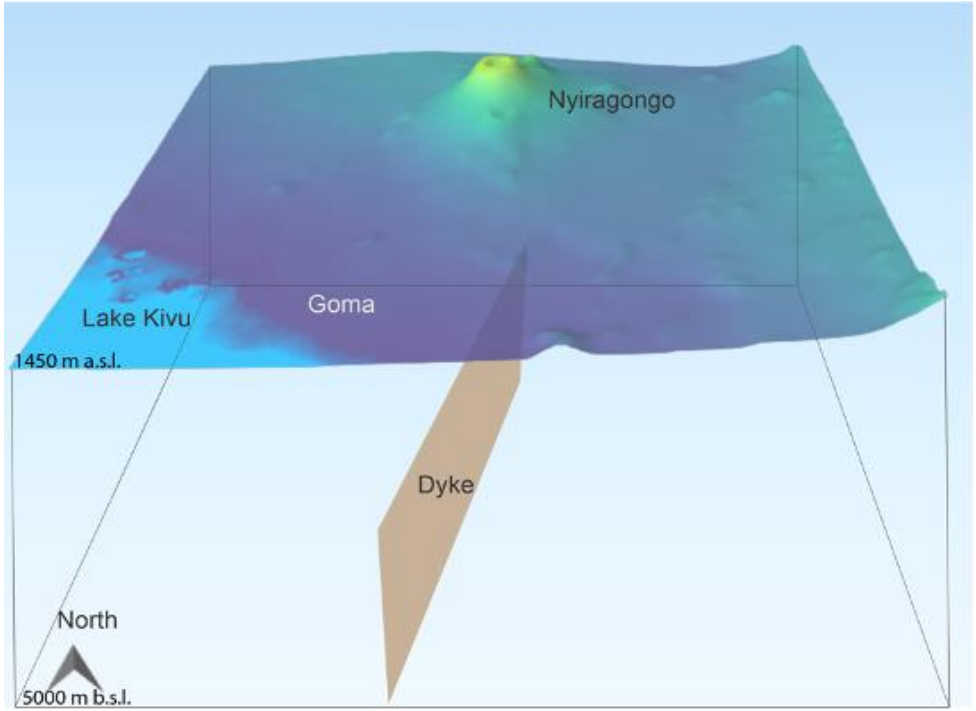
- **COSMO SkyMed data** provided high resolution images of the deformation field during the 1-month eruption period.
- The ~N-S symmetry of the inflation and its southward movement with time are evident.



From the Supersite biennial report by C. Balagizi

The 2021 Nyragongo eruption-3

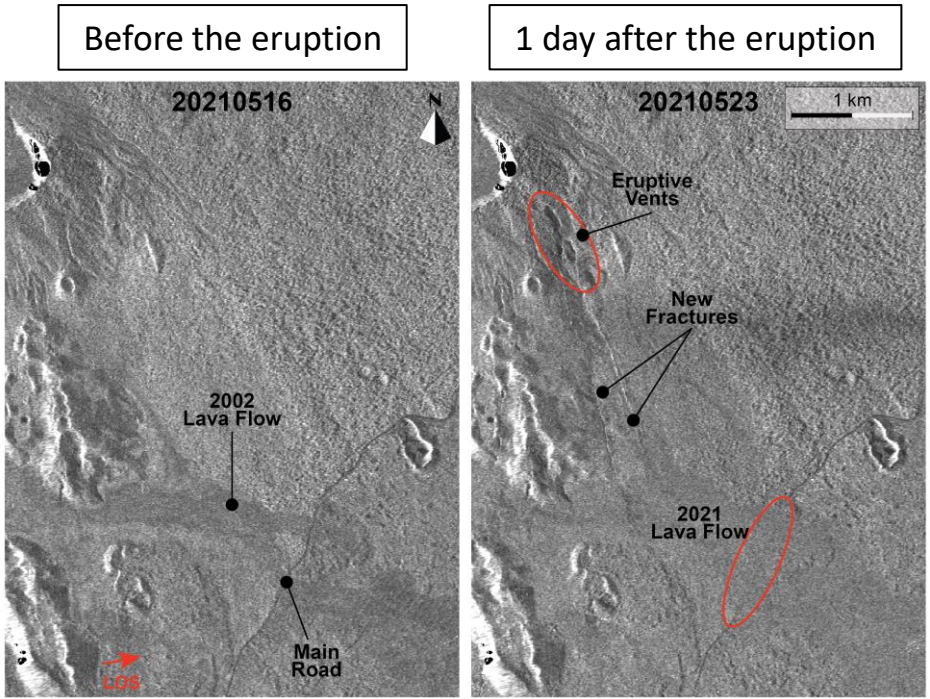
- **Inversion model** only based on SAR data.
- According to the model the magma uprising occurred mainly along a fracture (dyke) aligned with the main extension zone in the area.
- The dyke is 18 km long and 5 km wide



From the Supersite biennial report by C. Balagizi

The 2021 Nyragongo eruption-4

- **CSK amplitude images** are very useful to map the progression of the eruption, overcoming the problems caused by the cloud/gas coverage
- 5 m resolution imagery allowed to identify the new eruptive vents and fractures, and to map the impact of the lava flow over the road network.



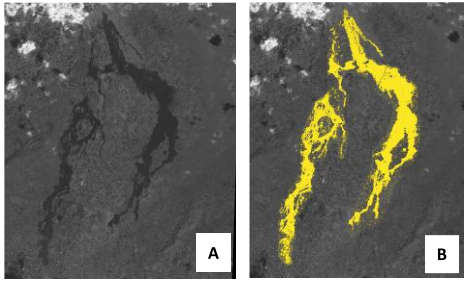
From the Supersite biennial report by C. Balagizi

The 2021 Nyragongo eruption-5

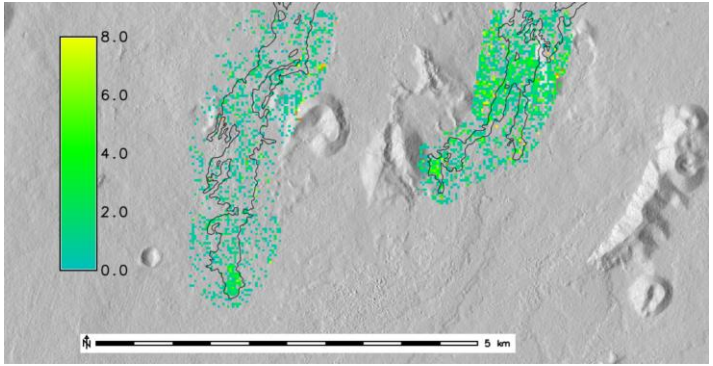
- **Pléiades imagery** (stereo and nadiral) were used for lava flow mapping and DSM generation
- From pre- and post-eruptive DSMs the calculation of lava thicknesses and total emitted lava volume has been performed
- Measured lava thicknesses were 1-3 m (very low due to peculiar magma chemistry)
- Total lava volume estimated to be 12±4 million cubic meters

From the Supersite biennial report by C. Balagizi

Accurate lava flow mapping



Lava flow thicknesses



The 2021 Nyragongo eruption-6

- **The 2021 Nyiragongo eruption** demonstrated the benefits of the Supersite, as a way to obtain EO data fundamental for volcano monitoring, and to establish the ground for an open international collaboration effort aiming to support the local response.
- Researchers from the Goma Volcano Observatory had the possibility to work with 23 researchers from 6 different countries, sharing experiences, knowledge and scientific results.

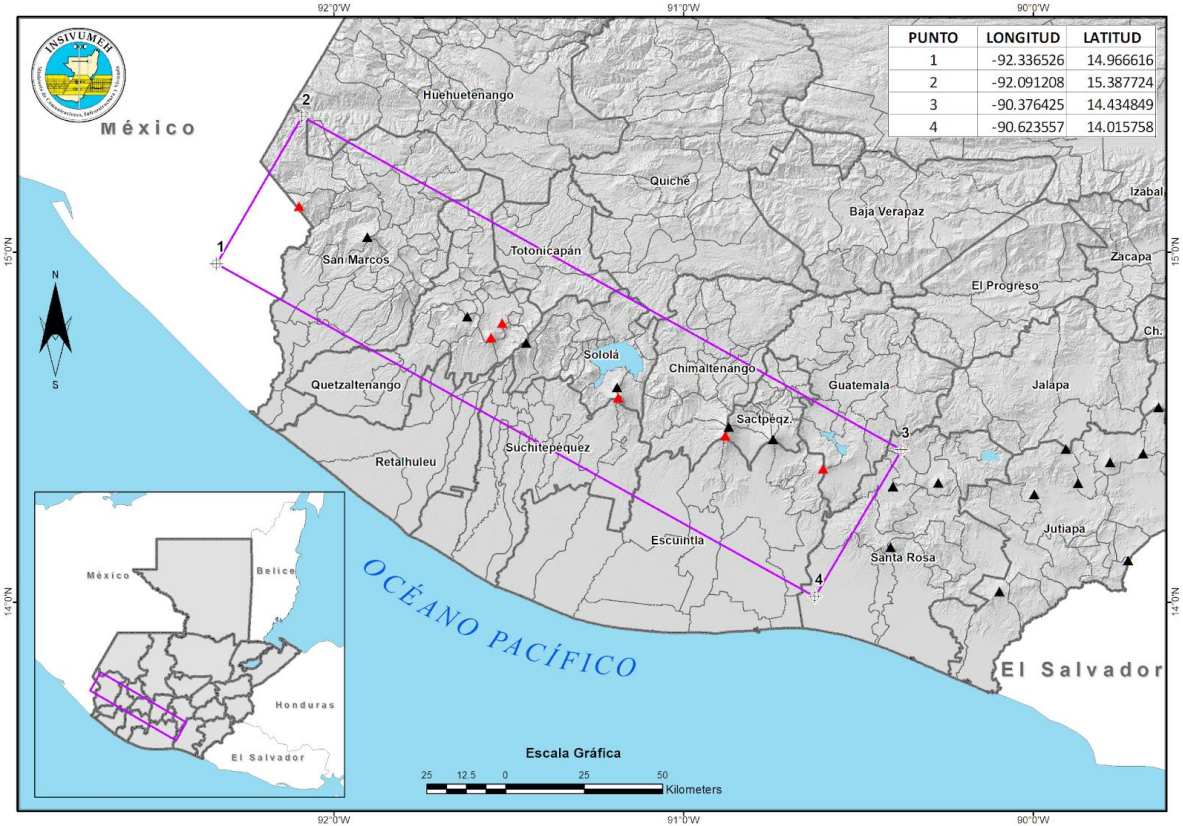
GSNL new governance 2022-2025

- After 11 years of operation as a GEO initiative, and following the growth of the Supersite network, the GSNL Scientific Advisory Committee decided it was time to establish a new governance structure.
- The new governance is operational starting March 2022, and is composed of a Steering Committee, a Management Board, and the initiative Chair.
- There are now stronger links to GEO and CEOS, and a more stringent commitment by the Supersite Coordinators
- Haris Kontoes is the liaison to the GEO DRR WG
- The WGD Chair (Pierric and then Hélène) is a member of the GSNL Steering Committee, which includes representatives from the scientific associations IAVCEI and IASPEI.
- The DCT Chair (Laura) is a member of the GSNL Management Board, which includes all the Supersite Coordinators plus two external members.
- The GSNL Chair will rotate in 2023, with a time shift of half the term of the SC members.

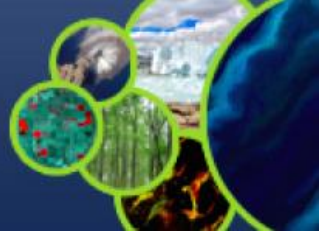
Guatemala Supersite proposal

With support from Ricardo Quiroga (NASA) the researchers at INSIVUMEH (Instituto Nacional de Sismología, Vulcanología, Meteorología e Hidrología) in Guatemala, are preparing to submit a Volcano Supersite proposal.

EO data requests could include: Sentinel 1-2, CSK, TSX, Pleiadès, Radarsat 2, ALOS 2 (SAOCOM).



For decision by CEOS DCT



Renewal of support to:

- Virunga Supersite
- Iceland Supersite
- Southern Andes Supersite

Decision if and when to re-establish support to the Enceladus Supersite