



Committee on Earth Observation Satellites

# Volcano Demonstrator Update

Mike Poland (USGS)

Susanna Ebmeier (University of Leeds)

and many others

WG Disasters 19 (Cordoba, Argentina)

17–19 April 2023



# SUMMARY

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## 1) Eruption/Unrest response

- Shiveluch
- Ambae
- Merapi
- Alaska (Aniakchak, Edgecumbe, Great Sitkin)

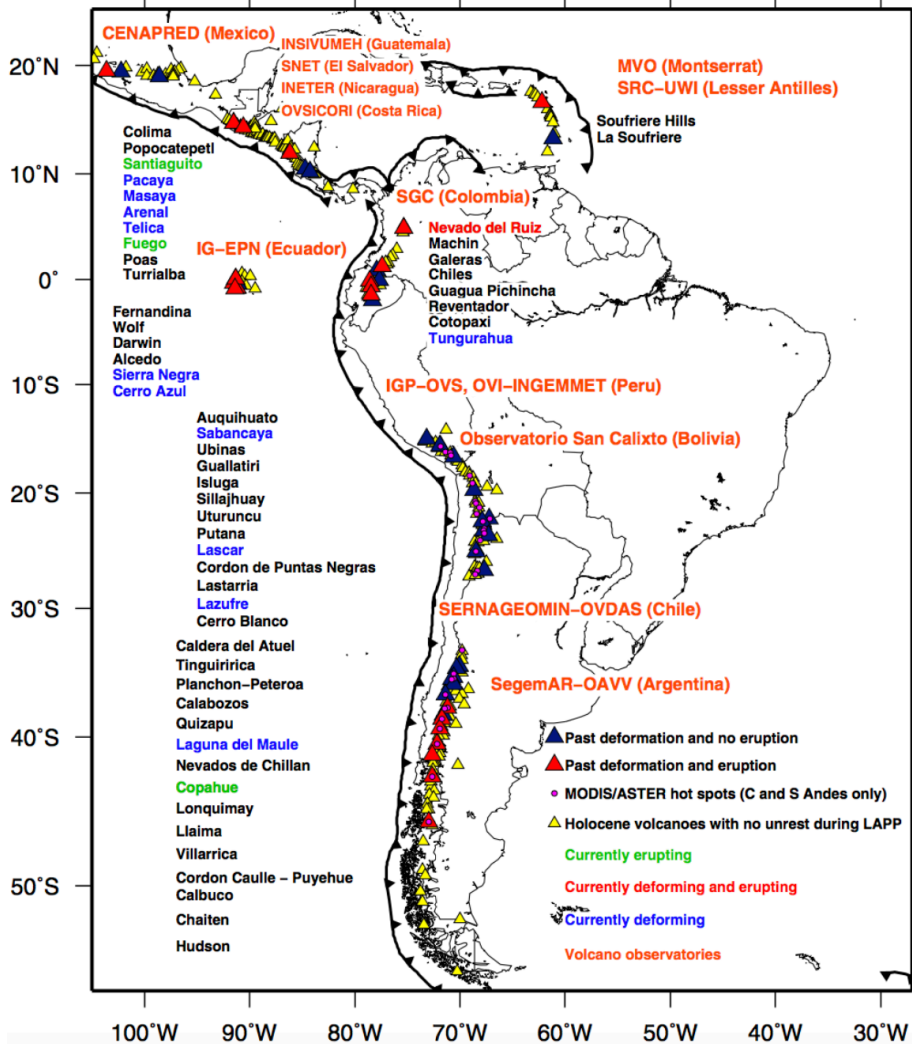
## 2) Powell Center report

## 3) Building a Sustainable “International Virtual Volcano Observatory”

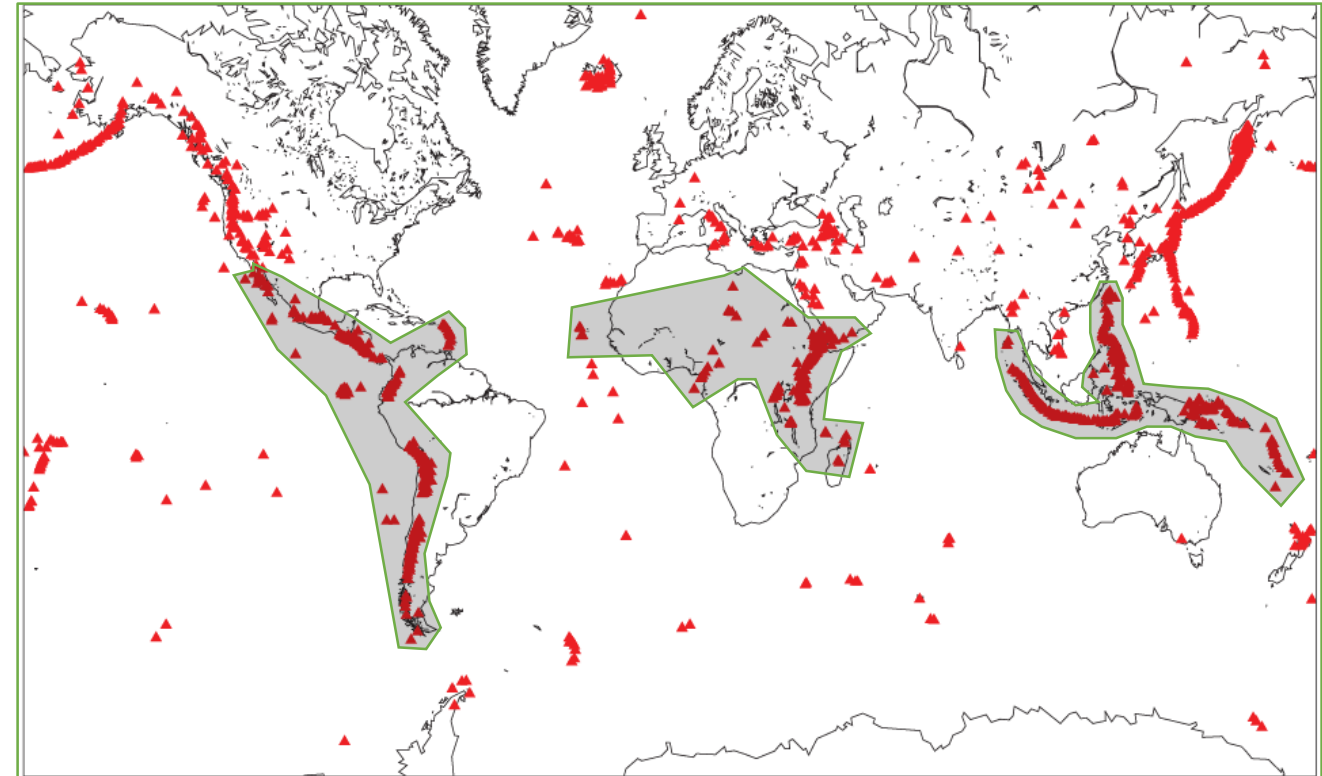


# WG Disasters: Volcano project history

## Pilot (2014–2017)



## Demonstrator (2019–)



Long term goal: to demonstrate the necessity and viability of international coordination of satellite tasking for volcano monitoring

# Volcano Demonstrator



Cornell University

Latin America:

**Matt Pritchard**

Cornell University



University of  
**BRISTOL**

Africa:

**Juliet Biggs**

University of Bristol



**東京大学**  
THE UNIVERSITY OF TOKYO

SE Asia:

**Yosuke Aoki**

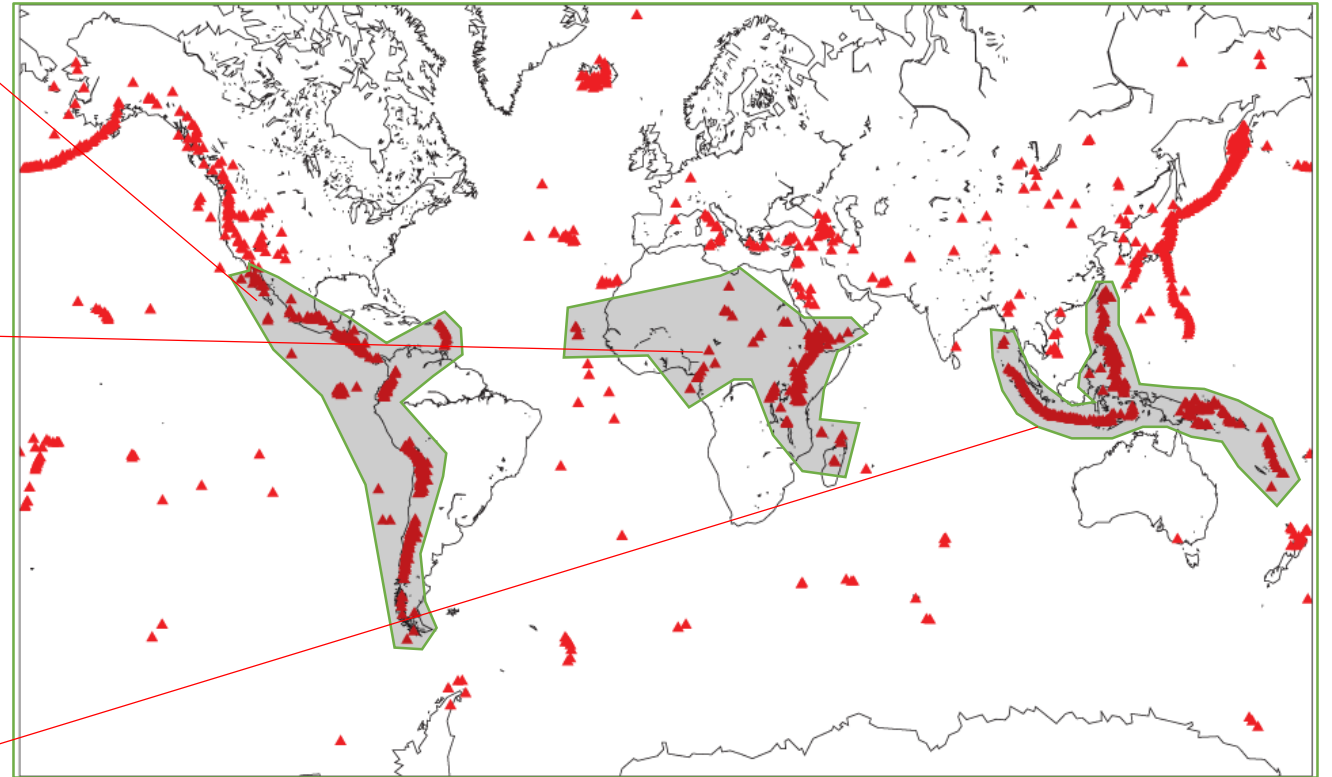
University of Tokyo



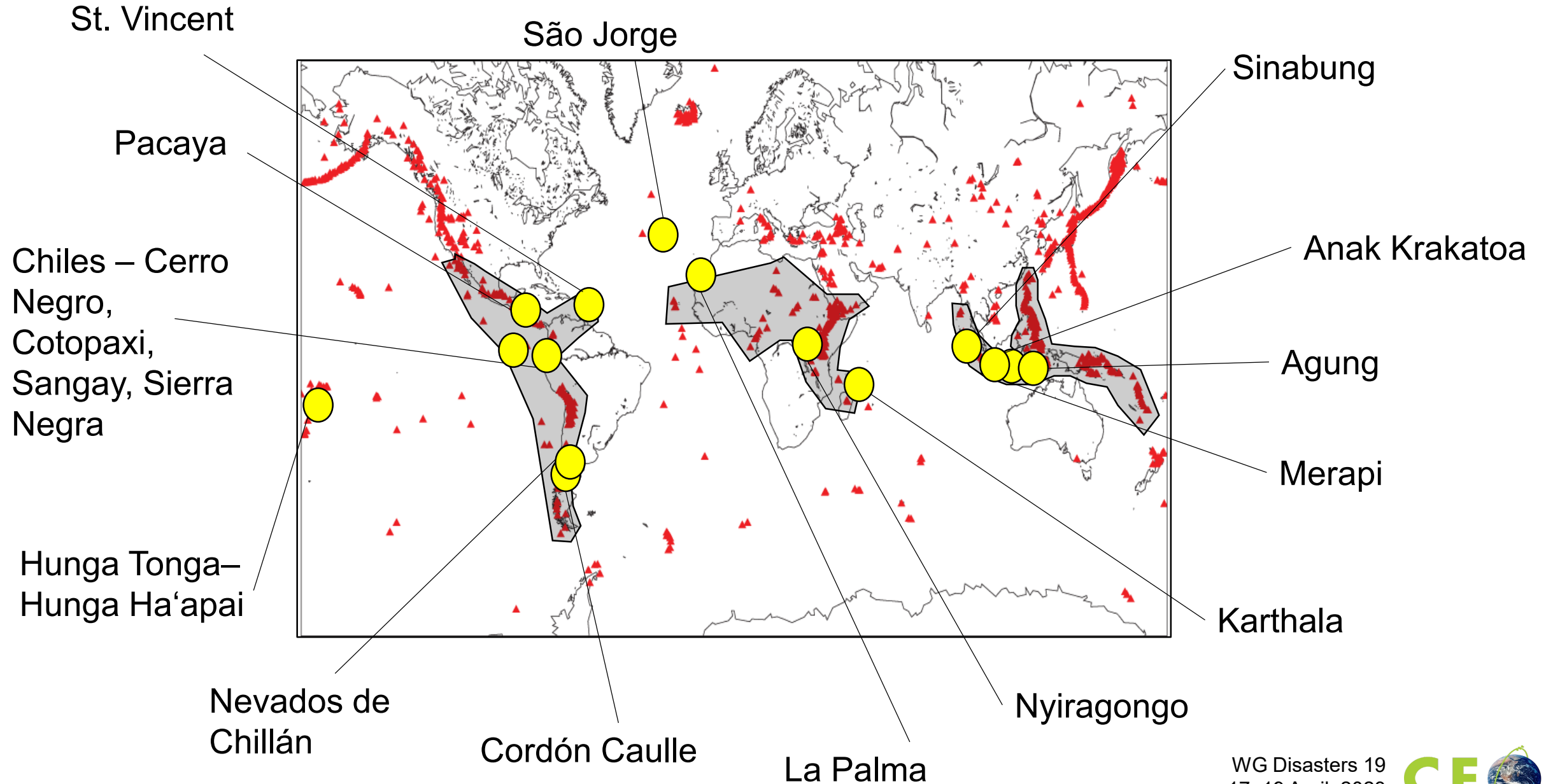
**Ian Hamling**

GNS New Zealand

## Demonstrator (2019 -)



# Demonstrator response, monitoring, research (2019-2023)

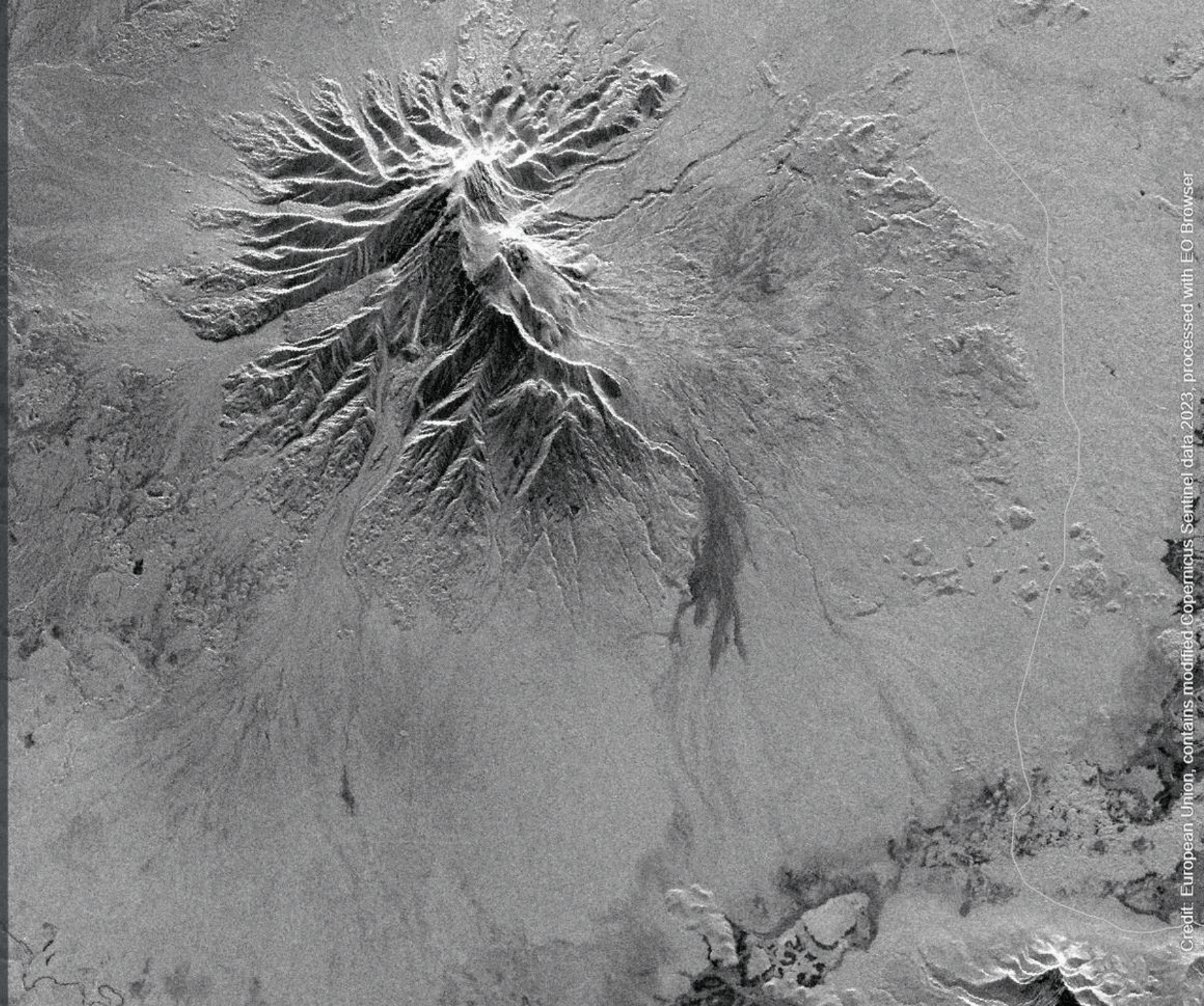


# Shiveluch, Kamchatka, Russia

April 1-13, 2023

Sentinel-1

2023-04-01 00:00 - 2023-04-01 23:59, Sentinel-1 AWS-IW-VVH, VV - decibel gamma0

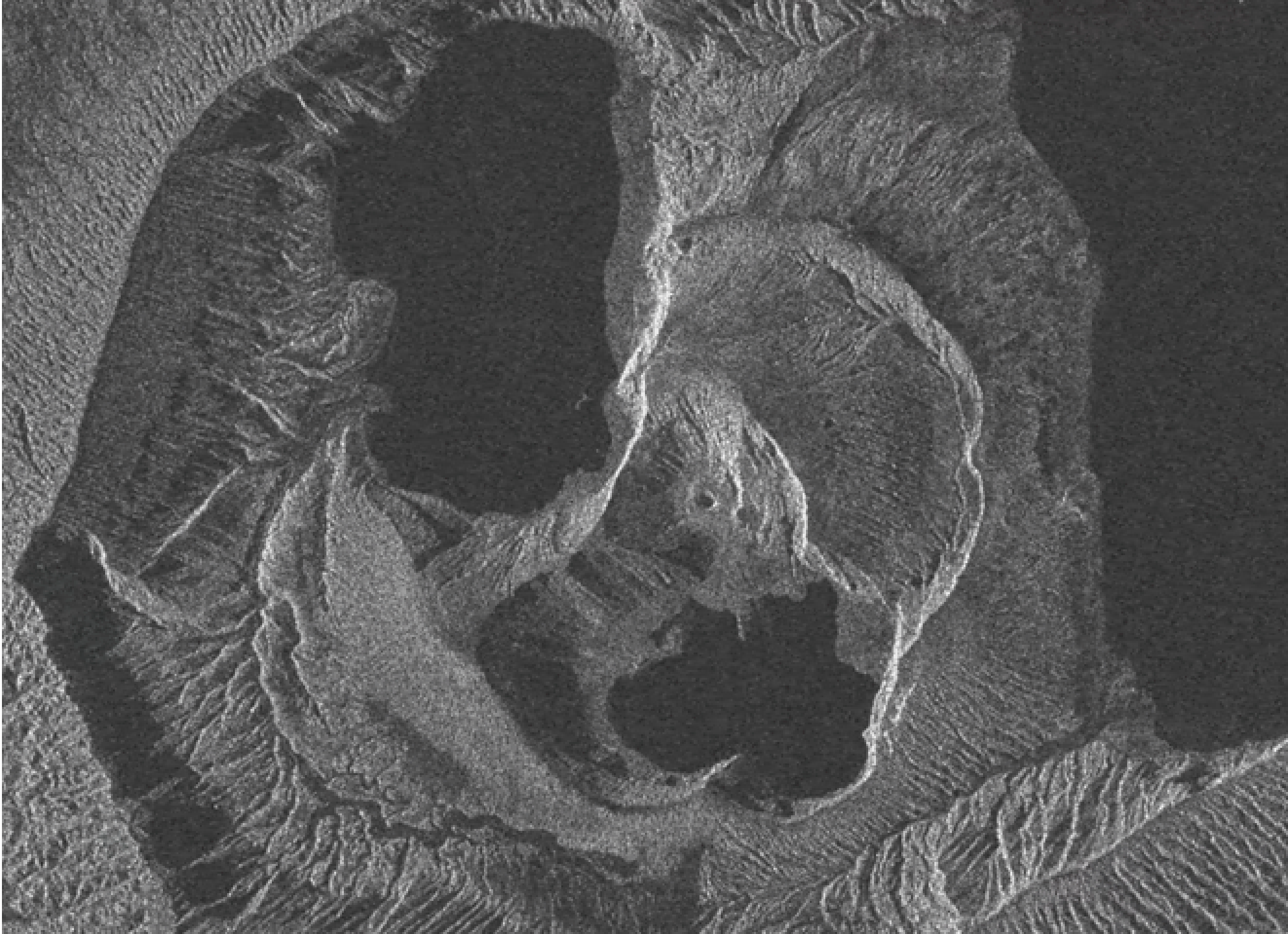


Ambae,  
Vanuatu

January 28 –  
April 4, 2023

Ascending  
track

TerraSAR-X

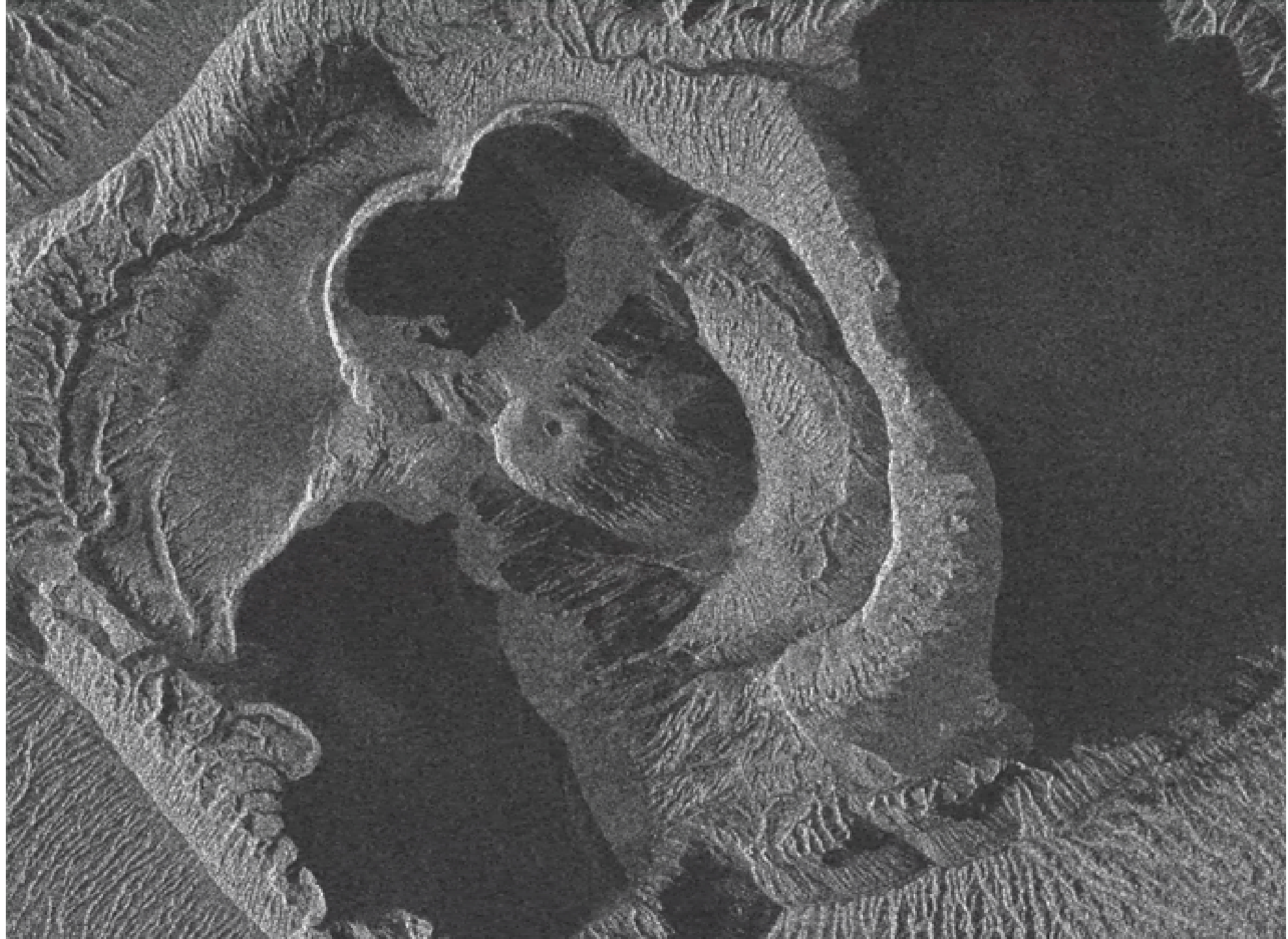


# Ambae, Vanuatu

March 3 –  
April 7, 2023

Descending  
track

TerraSAR-X

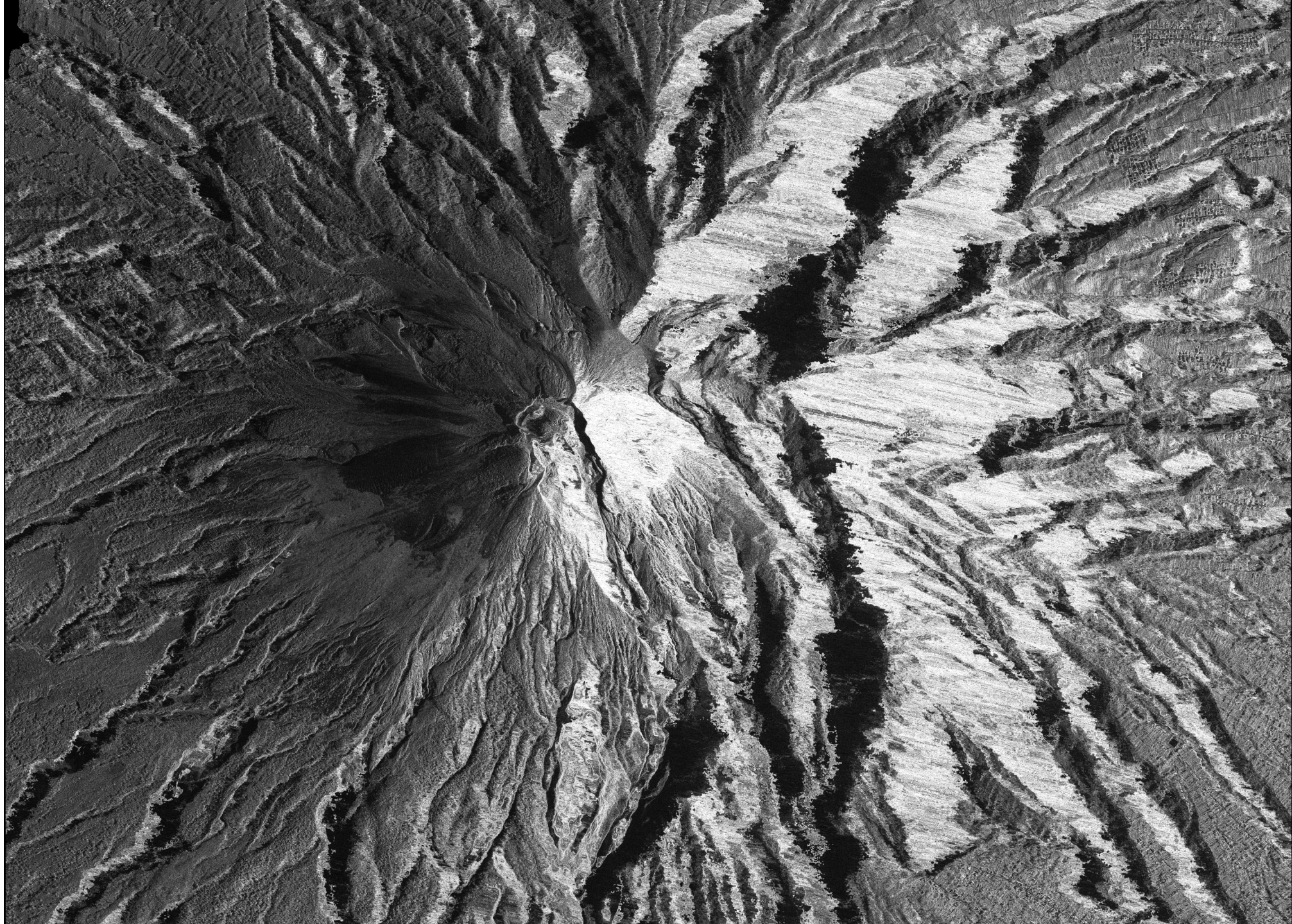




Merapi,  
Java,  
Indonesia

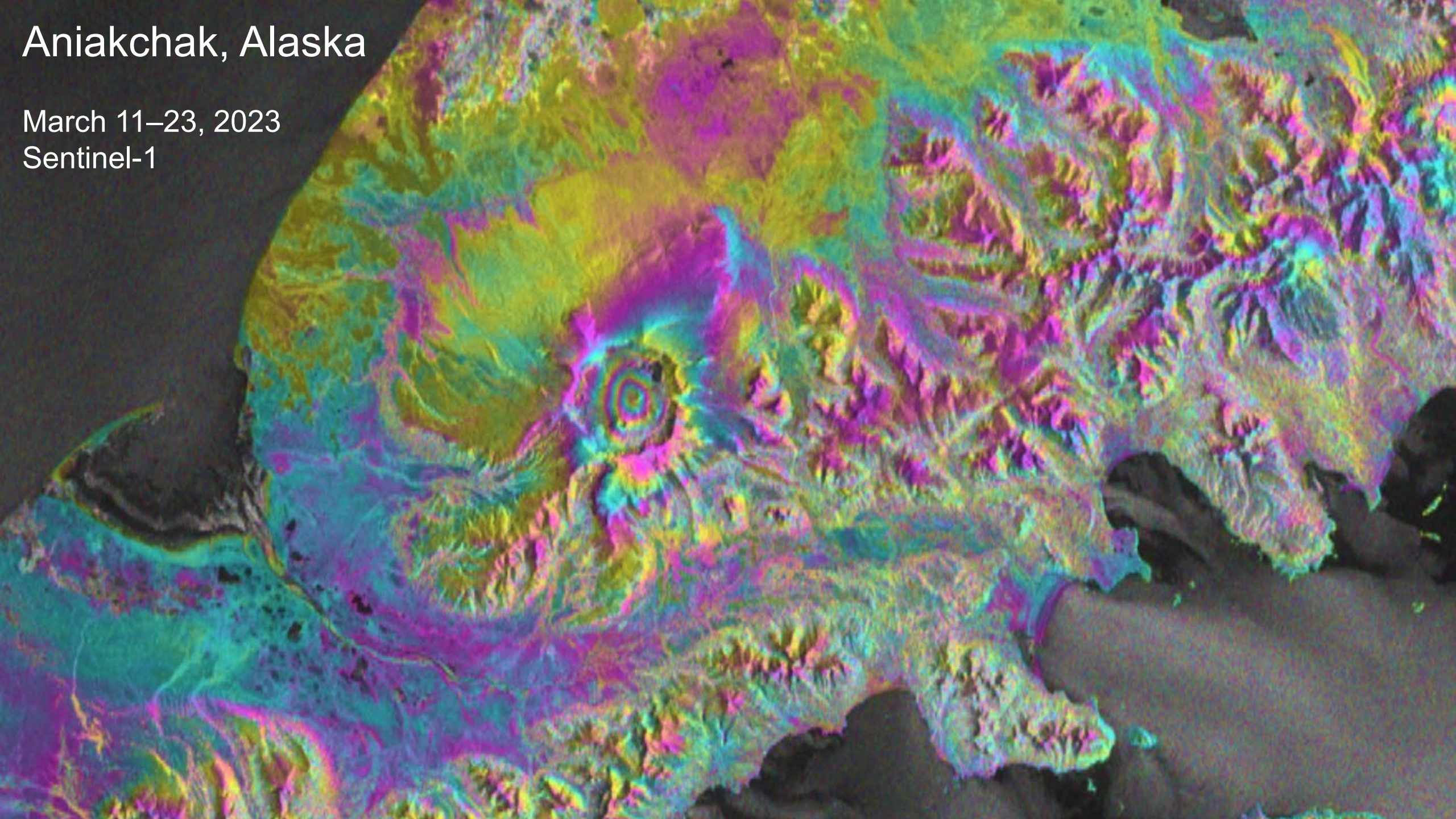
March 4–11,  
2023

Cosmo-  
Skymed



# Aniakchak, Alaska

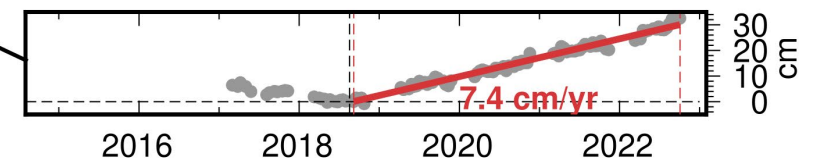
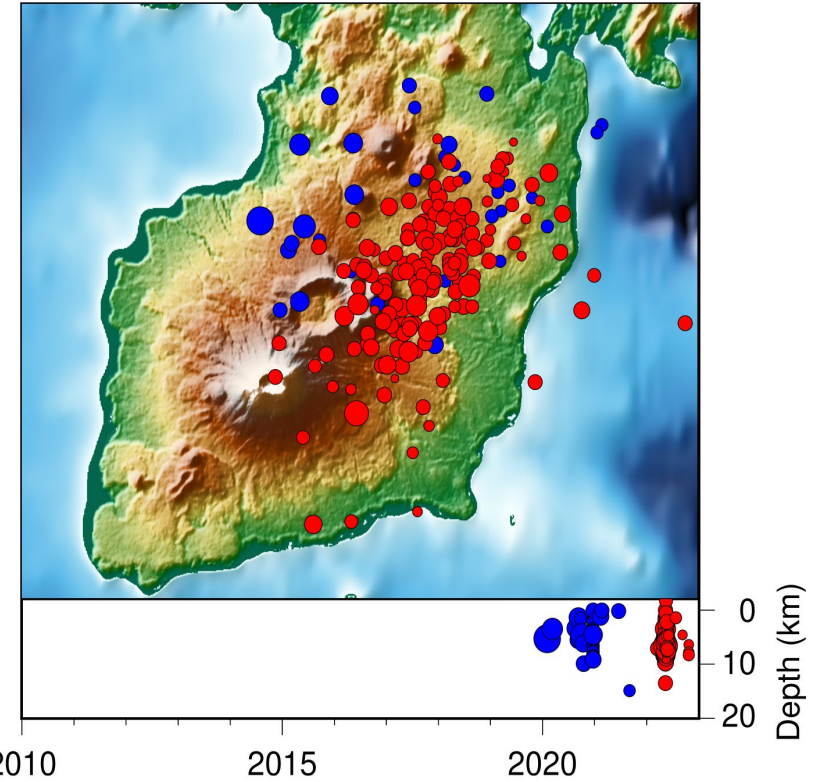
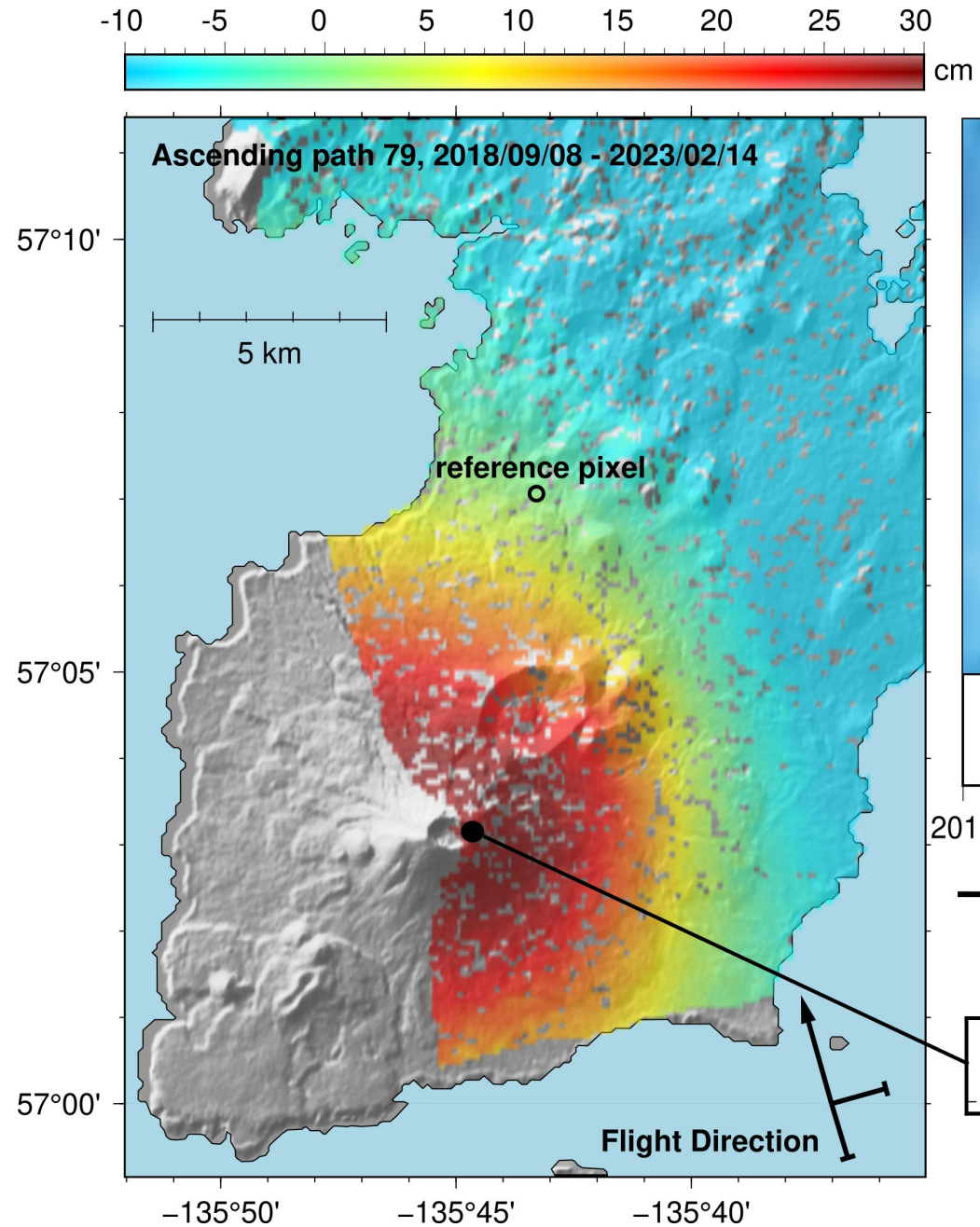
March 11–23, 2023  
Sentinel-1

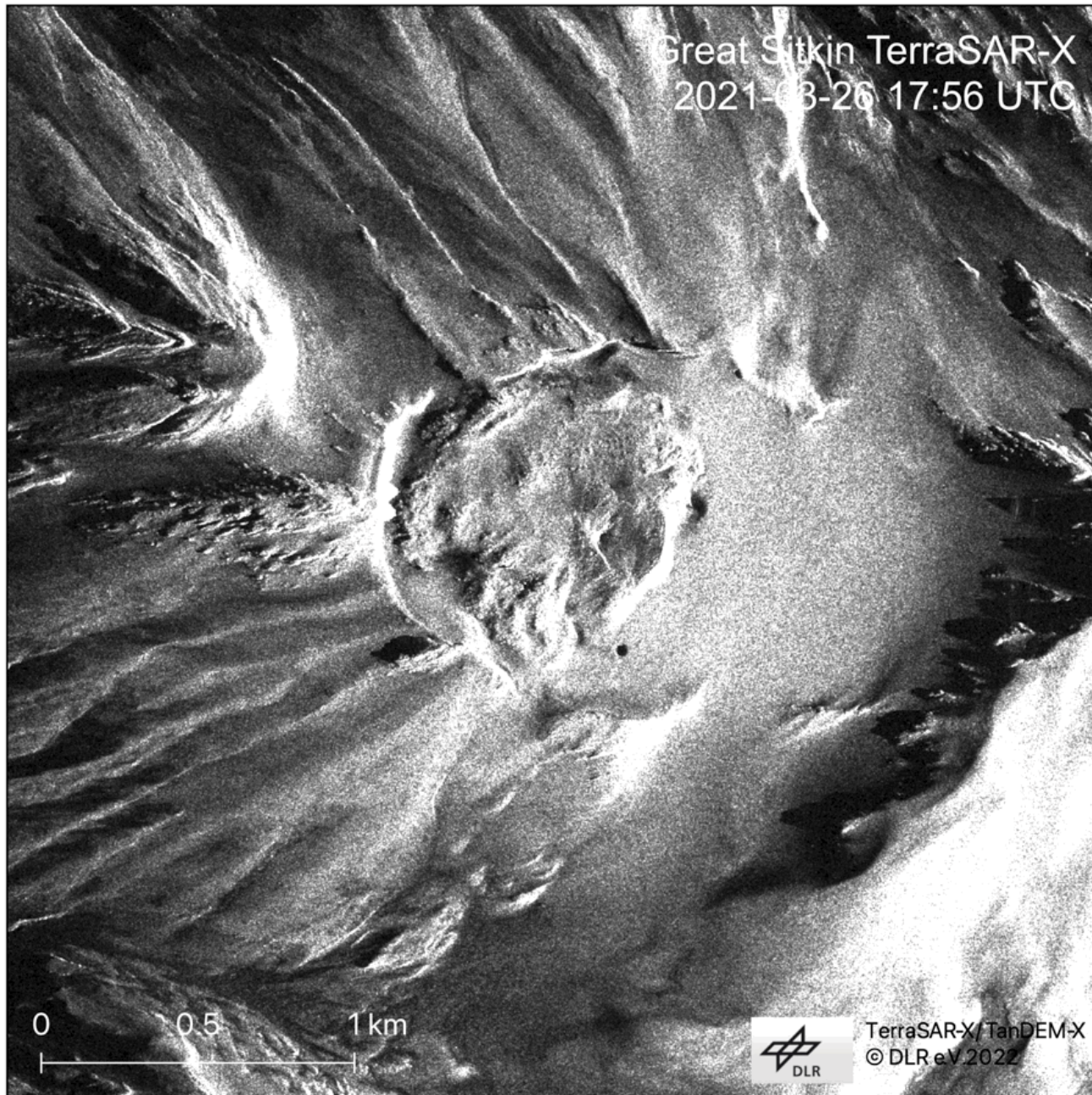


# Edgecumbe, Alaska

2018–2022

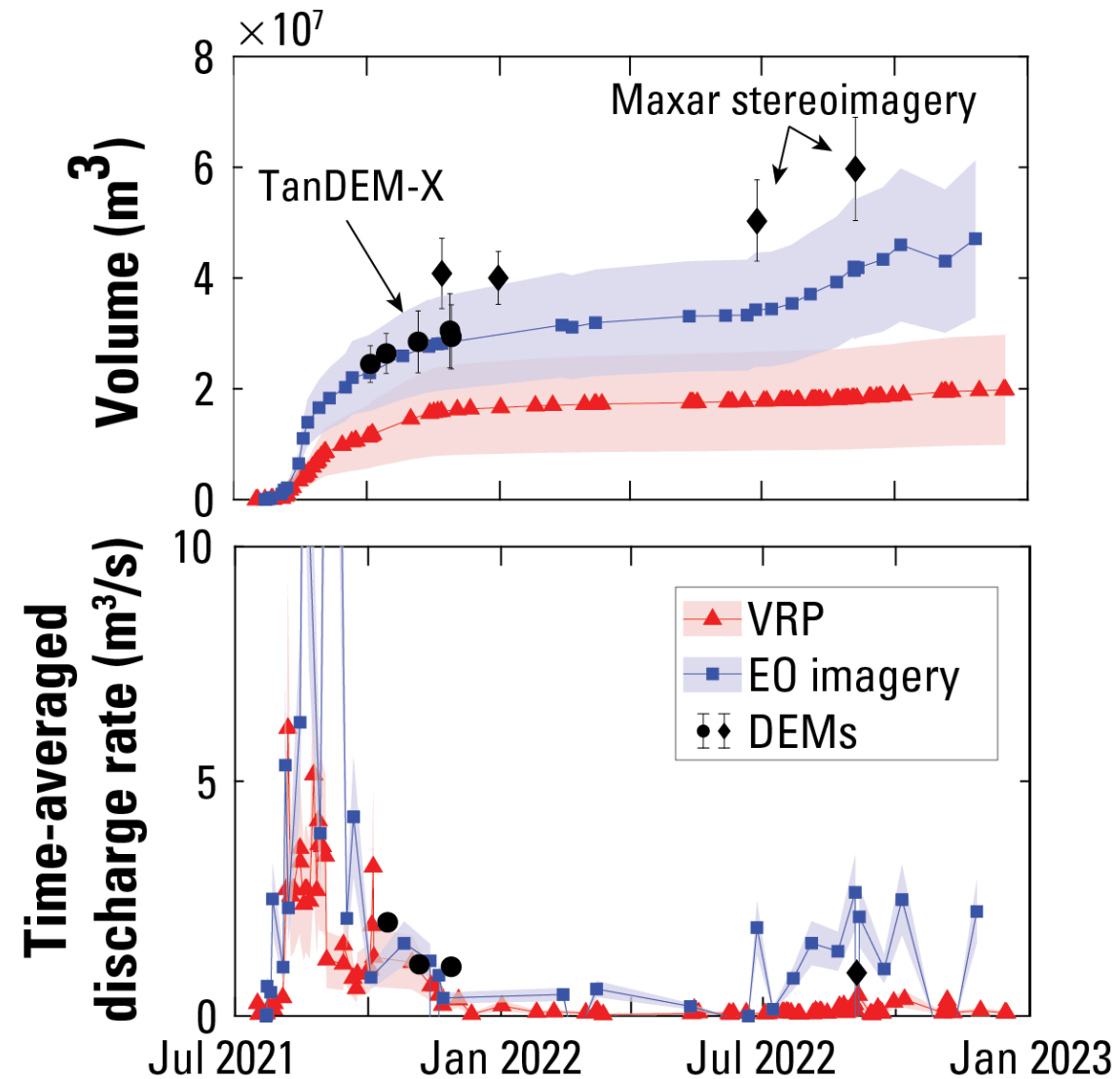
Sentinel-1





# Great Sitkin, Alaska

## TerraSAR-X



# Global Volcano Monitoring from Space



→ THE INTERNATIONAL FORUM  
ON SATELLITE EO AND  
GEOHAZARDS

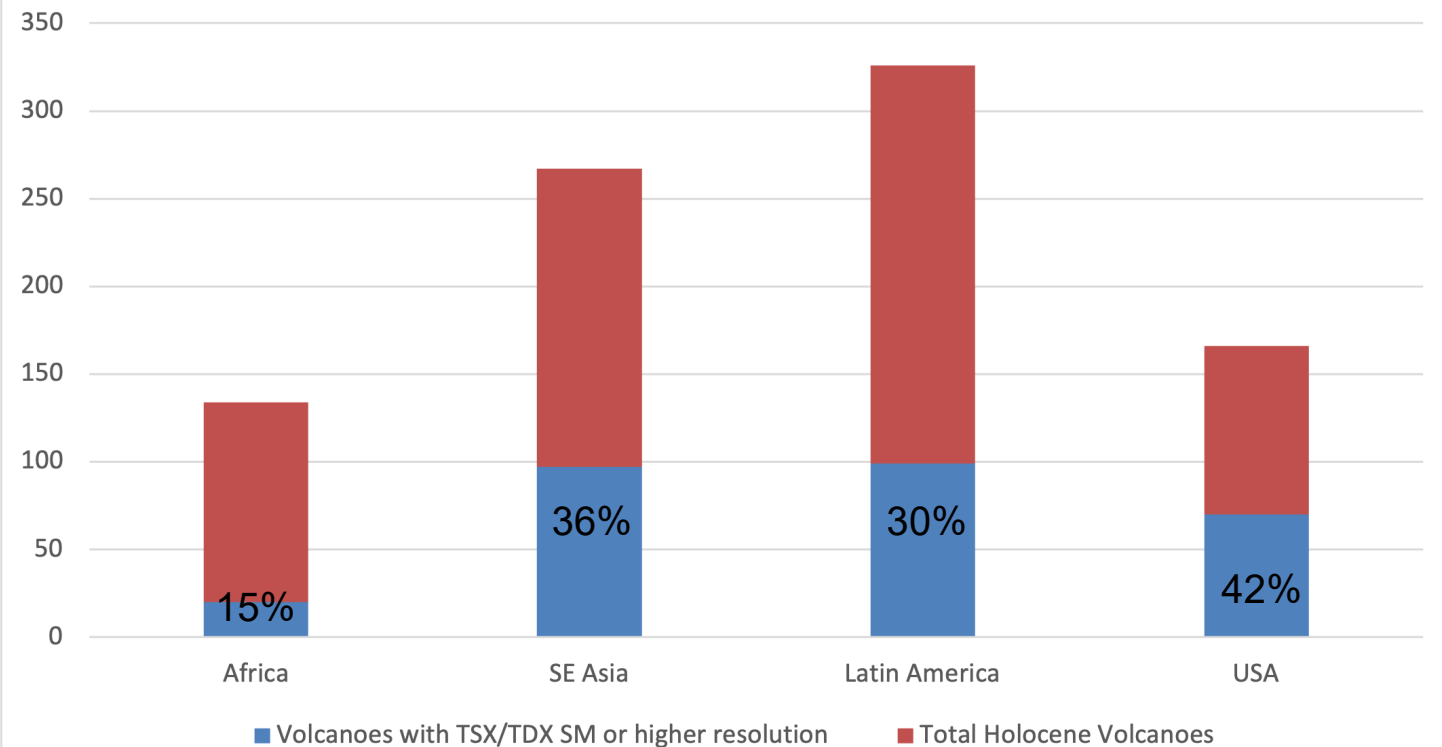
The Santorini Conference  
Santorini, Greece, 21–23 May 2012

Santorini Report Goal:  
**Global background observations at 1400 volcanoes**

Thermal, Degassing, Sentinel SAR: Achieved  
Other SAR missions: Not achieved

Example: TerraSAR-X for 700 volcanoes in Latin  
America, SE Asia, Africa – only 30% covered

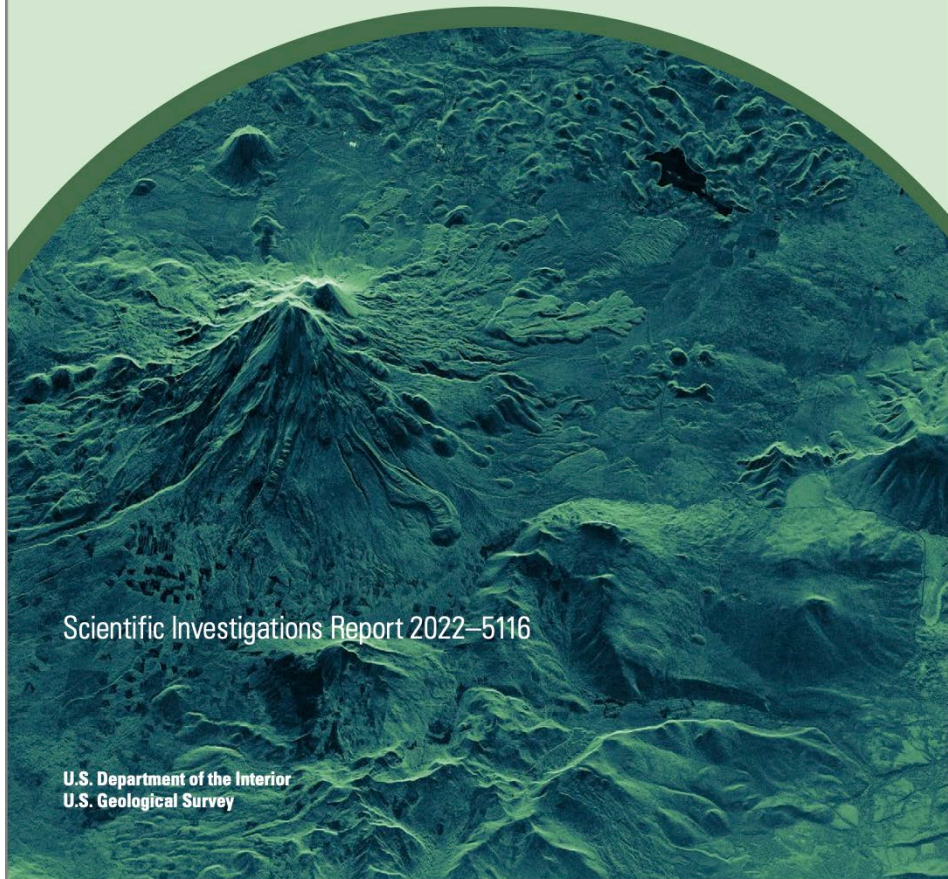
# potentially active CEOS demonstration & USA volcanoes  
with/without high spatial resolution TSX/TDX/Paz data



# Powell Center on Volcano Remote Sensing



**Optimizing Satellite Resources for the Global Assessment and Mitigation of Volcanic Hazards—Suggestions from the USGS Powell Center Volcano Remote Sensing Working Group**



Scientific Investigations Report 2022–5116

U.S. Department of the Interior  
U.S. Geological Survey

## Vision for a Global Volcano Remote Sensing Observatory:

- Global Coordination of Background Satellite Observations and Eruption Response
- Rapid Distribution of Open Data
- Communication Tools for Discussion of Satellite Volcano Data
- Data-Model Fusion for Understanding and Forecasting Volcanic Behavior
- Databases
- Building Capacity
- Leveraging Existing Efforts

# Powell Center on Volcano Remote Sensing



**Optimizing Satellite Resources for the Global Assessment and Mitigation of Volcanic Hazards—Suggestions from the USGS Powell Center Volcano Remote Sensing Working Group**

Scientific Investigations Report 2022–5116

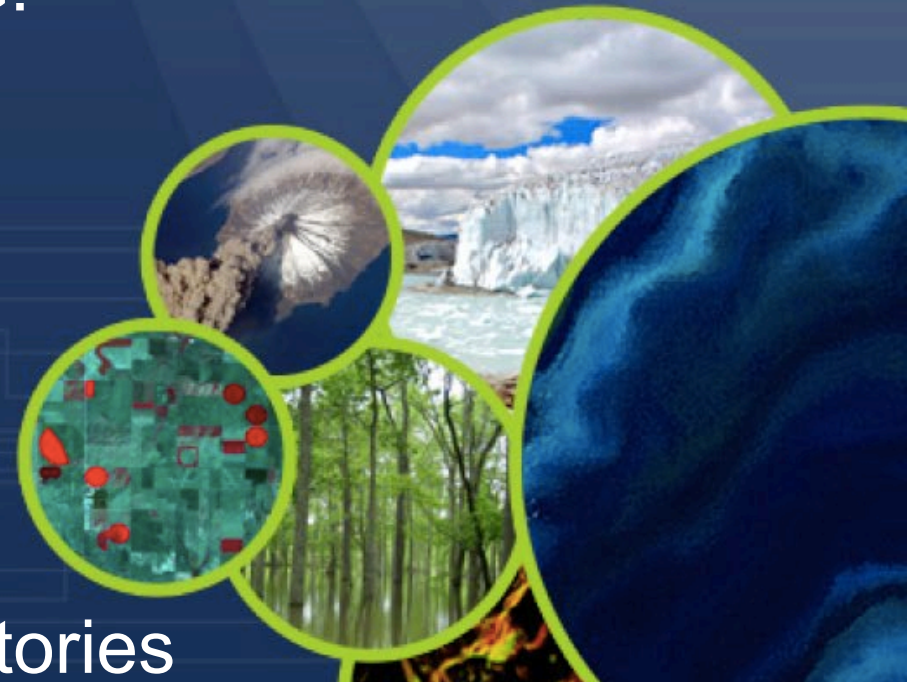
U.S. Department of the Interior  
U.S. Geological Survey

## Strategy for monitoring the world's ~1400 active volcanoes:

- Published as supplemental table by Pritchard et al., 2022 (<https://pubs.er.usgs.gov/publication/sir20225116>)
- Volcano observations classified by recent activity:
  - Weekly: 178
  - Monthly (or weekly to maintain InSAR coherence): 342
  - Quarterly: 839
- Already used by ESA to coordinate tasking

# An International Virtual Volcano Observatory

- The CEOS Volcano Pilot and Demonstrator have shown high return on investment in terms of using SAR data to track volcanic activity and aid with eruption response
- International coordination and cooperation, along the lines of the Polar Space Task Group, is vital—we need a VSTG!
- Data distribution system
  - GEP? HDDS?
  - Is the International Charter a model?
- Background tasking/monitoring are critical
- Capacity building is needed at some observatories





# IVVO — Roles and Responsibilities

- **USGS Coordinator:** Facilitate communication between observatories, scientists, and space agencies, and ensure tasking and data delivery
- **CEOS Agencies:** Provide data quotas; no cost, low latency
- **Volcano Observatories:** Merge satellite and ground-based data and produce derived hazards products
- **Academic partners:**
  - Conduct research and develop techniques
  - Capacity-building at observatories as needed
  - Train students

