

CONVERSE

Converging on Eruption Science with Equity



Townhall: The CONVERSE Center: Converging on Eruption Science with Equity

Date and Time: Tuesday, 12 December 2023: 18:30 – 19:30 PST

Location: Moscone Center, Room 2004 – West

Presenters:

Tobias Fischer, UNM – Introduction to CONVERSE

Barbara Bruno, U of Hawaii – Education and Outreach Activities

Bailee Zinzer, U of Idaho and Jonathan Gates, U of Washington – The CONVERSE Eruption Building Scenario (CESBI)

Tina Neal, USGS Volcano Science Center – CONVERSE and USGS

Paul Lundgren, NASA JPL – CONVERSE and NASA

Reception:

Date and Time: Tuesday, 12 December 2023: 19:30 – 21:30 PST

Location: InterContinental on 888 Howard Street; Cathedral Hill Room (4th floor). A 3 min walk from Moscone West.

Please see this website for info and the opportunity to leave comments for discussion during both events. <https://conversecenter.org/agu-2023-town-hall/>



CONVERSE – a community network for the scientific response to volcanic eruptions

RCN 2019 – 2022 : Focus on coordinating the collaboration of non-observatory scientists with USGS - Observatory scientists to collect multidisciplinary data/samples during eruptions

2022 – 2024: Track 1 NSF Geohazards Catalyst Center

Converging on Eruption Science with Equity

Focus on: - USGS collaboration/coordination as in RCN
- facilitate participation of US scientists in non-US eruptions (potentially globally)



A working mission statement

The CONVERSE center focusses on the science and hazards of volcanic eruptions

The center's goal is to advance our ability to anticipate the onset, size, duration, form and hazards of volcanic eruptions

The center has **three pillars**:

Science: the transformative research in processes that lead to volcanic eruptions and their hazards. The technology and coordination that allows the community to carry out the research.

Workforce development and diversification: Making significant headway towards solving the diversity gap in the geosciences and providing multi-disciplinary, advanced and technologically driven training for the workforce of the future.

Community engagement: Connecting and communicating research and education to the broader community of scientists and beyond

CONVERSE Team of Principals

Tobias Fischer (PI)

Bruce Houghton (co-PI)

Einat Lev

Kari Cooper

Greg Waite

Christelle Wauthier

Michael Manga

Karl Kim

Mike Lindell

Barbara Bruno

Yolanda Lin

Matthew Fricke

Su Zhang (program manager)

USGS Representation:

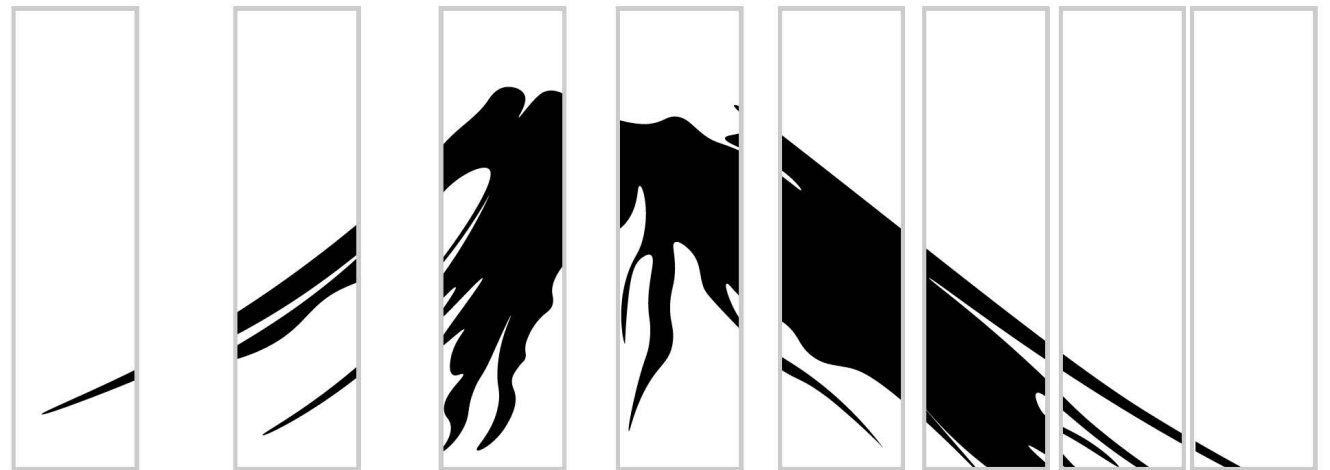
Seth Moran and Michelle Coombs

NASA Representation:

Grace Bato and Paul Lundgren

C O N V E R S E

Converging on Eruption Science with Equity



CONVERSE Disciplinary Task Forces

<i>Discipline</i>	<i>Lead</i>	<i>USGS Rep</i>	<i>Member</i>	<i>Member</i>	<i>Member</i>	<i>Member</i>	<i>Member</i>
Social Science	Michael Lindell	Sara McBride	Catherine Depari	Carson MacPherson-Krutsky	Jeanette Sutton	David Johnston	
Data Management	Ben Andrews	Emily M-B	Connor Bacon	Su Zhang	Kerstin Lehnert		
Geophysics (s, d, infrasound)	Greg Waite	Wes Thelen	Kathleen McKee	Christelle Wauthier	Noel Barstow	Ronni Grapenthin	
Gas	Tobias Fischer	Peter Kelly	Alessandro Aiuppa	Simon Carn	Maarten DeMoor		
Mineral Clocks/Rates	Tom Shea	Kendra Lynn	Megan Newcombe	Madison Myers	Teresa Ubide		
Modelling	Helge Gonnermann	Kyle Anderson	Josh Crozier	Sylvain Charbonnier	Chiara Montagna		
Rapid Geochemistry/Sampling	Kari Cooper	Matt Loewen	Ben Andrews	Cheryl Gansecki	Penny Wieser		
Rapid Impacts/Damage	Karl Kim	David Damby	Mike Vorce	Eric Yamashita	Su Zhang	Yolanda Lin	
Remote Sensing	Rob Wright	Hannah Dietterich	Mary Bato	Paul Lungren	Simon Carn	Matt Pritchard	Ben Phillips
UAV/UAS	Brett Carr	Angie Diefenbach	Einat Lev	Mel Rodgers			
Eruption Documentation	Bruce Houghton	Matt Patrick	Jacopo Taddeucci	Erika Radder			

The CONVERSE Center: CONverging on Volcanic ERUption Science with Equity



Since 2019	2022	2023	2024	2025	2026	2027 - 2029
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	Community Growth, Equity, Opportunity, Security					
	Community Engagement & Feedback					
Science Challenges	<i>Identify:</i> Key science goals <i>Catalog:</i> Laboratory / cyber / models / databases needs to address science goals			<i>Implement:</i> Major science projects meeting 3 Grand Challenges from NAS (2017). Support development of lab, technology, databases and modelling capabilities		
Eruption response	<i>Define:</i> Structure for rapid eruption response <i>Identify:</i> New hardware essential for response			<i>Implement:</i> Hardware, software, logistical support for rapid response to new eruptions		
Collaborators and Partners	<i>Run:</i> workshops/meetings/seminars <i>Seek:</i> new external funding partnerships			<i>Implement & support:</i> New funding partnerships, Long-term exchanges & lab visits & joint science activities		
Strategic Planning	<i>Define:</i> org. structure, roles, sustainability plan			<i>Implement, review, revise & support:</i> Governance structure, org. chart, MOUs, partnerships		
Community Engagement	<i>Implement:</i> 2 regional SACs, 2 scenario exercises, best practices documents <i>Develop:</i> Educational plans			<i>Support:</i> More complex scenarios with models, outreach, new curricula, engagement of international partners		

Main Activities so far

Disciplinary workshops July 2019 – March 2020

Mount Hood Virtual Eruption Scenario (Nov. 2020) – SAC concept

Distributed Volcanic Field Eruption Scenario (4 weeks, Feb 2022)

80 participants

Kīlauea Eruption coordination of science with HVO Dec 2020 – May 2021

9 proposals submitted

Maunaloa Eruption coordination of science with HVO Nov. 2022

11 proposals submitted

Kīlauea Eruption coordination of science with HVO Jan. 2023

CSBI – Eruption Scenario Building Institute July 2023

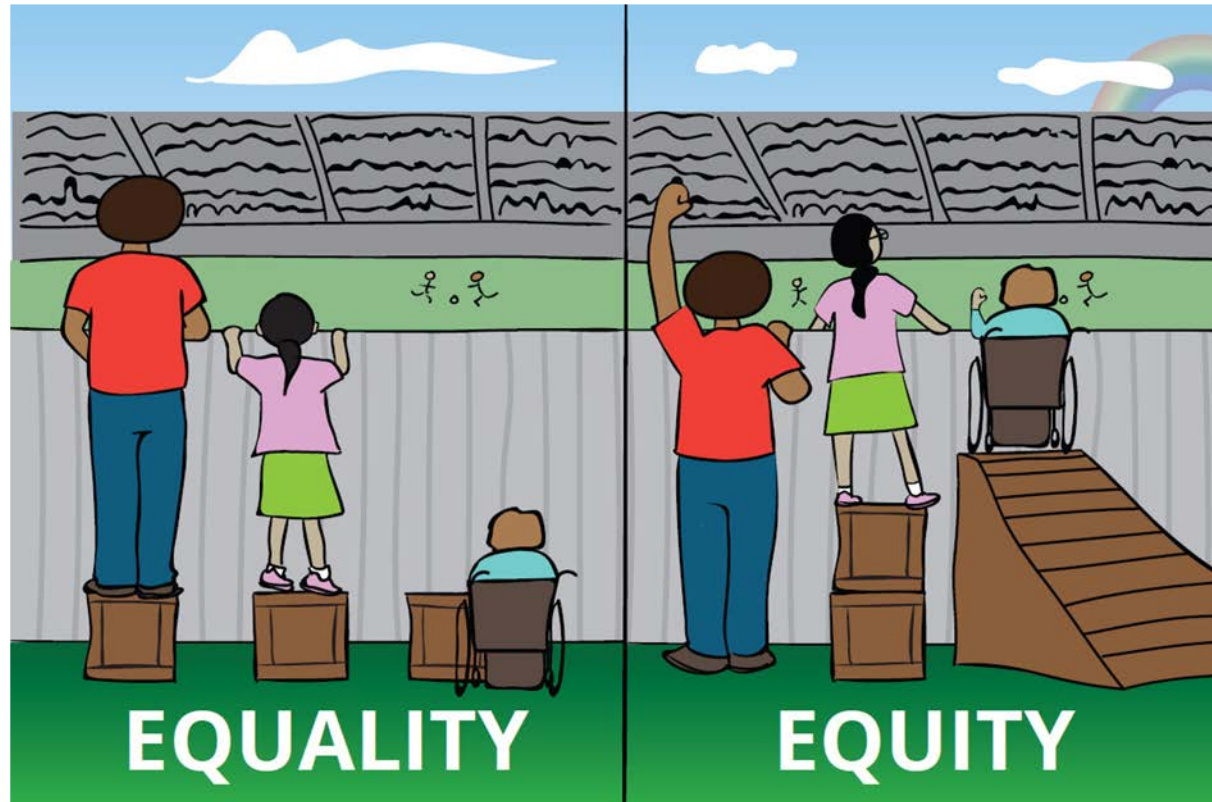
Volcanoes have done things that we cannot yet
imagine (Kari Cooper, this morning)

Volcanoes will do things that we cannot yet
imagine



Converging on Eruption Science with **Equity** (CONVERSE) Education and Equity

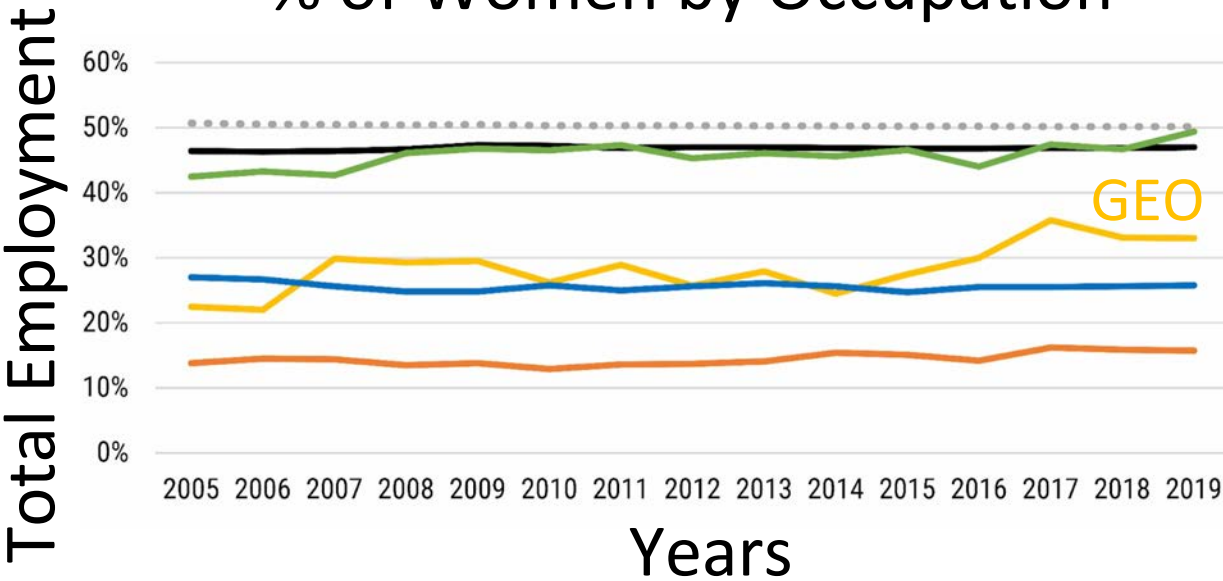
Barbara Bruno & Yolanda Lin



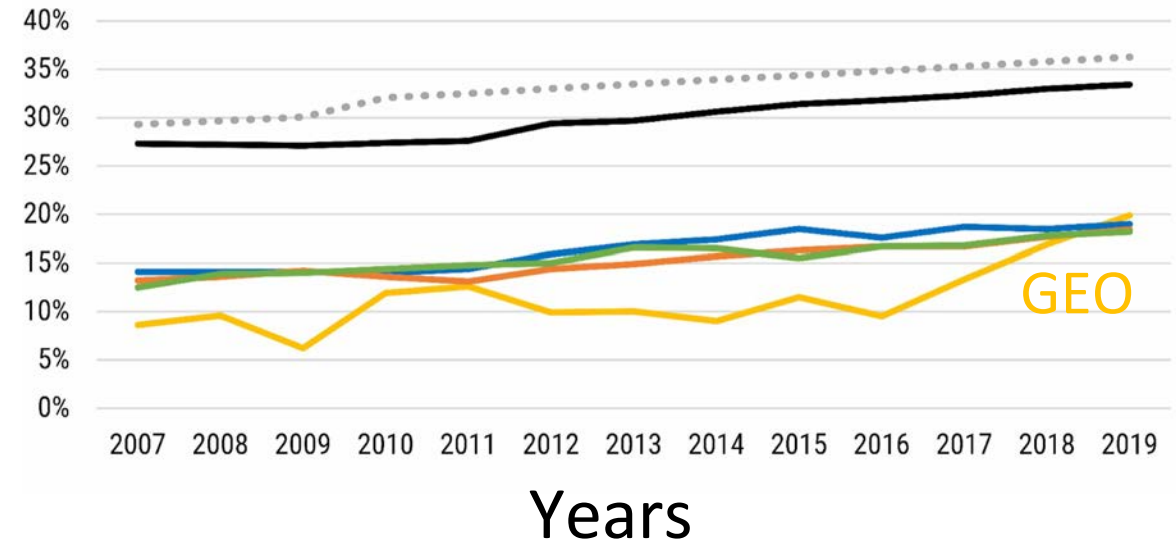
[Interaction Institute for Social Change. Artist: Angus Maguire]

U.S. Workforce

% of Women by Occupation



% of Underrepresented Minorities by Occupation



- All Occupations
- Computer and math
- Life, physical, and social science
- Environmental scientists and geoscientists
- Architecture and engineering
- U.S. population, 18 to 64 years

[AGI, based on data derived from US Census Bureau and US Bureau of Labor Statistics]

Why such lack of geoscience diversity? (e.g., gender, racial, socio-economic)

Possible explanations

- Limited exposure to Earth sciences in public schools
- Geoscience careers & career pathways not well known
- Association with outdoor activities (not always safe spaces)
- Construction worker stigma (not a real profession)



[Kids.brittanica.com](https://kids.brittanica.com)



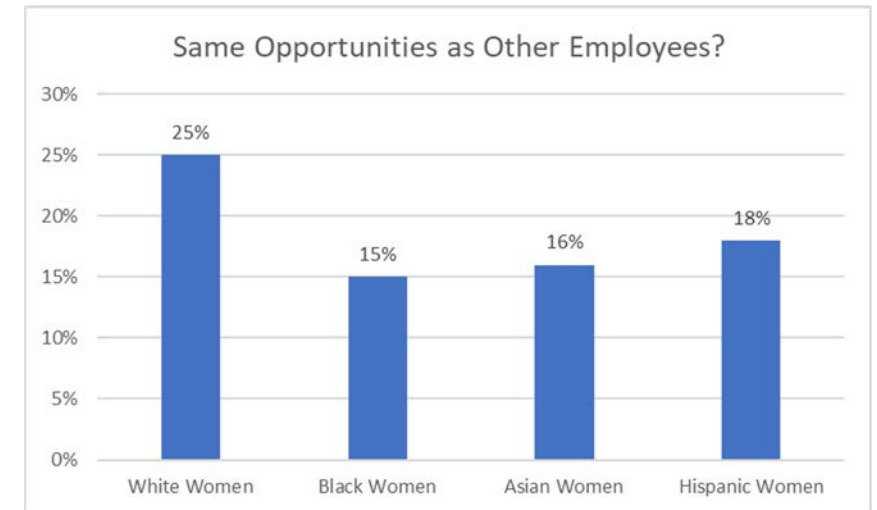
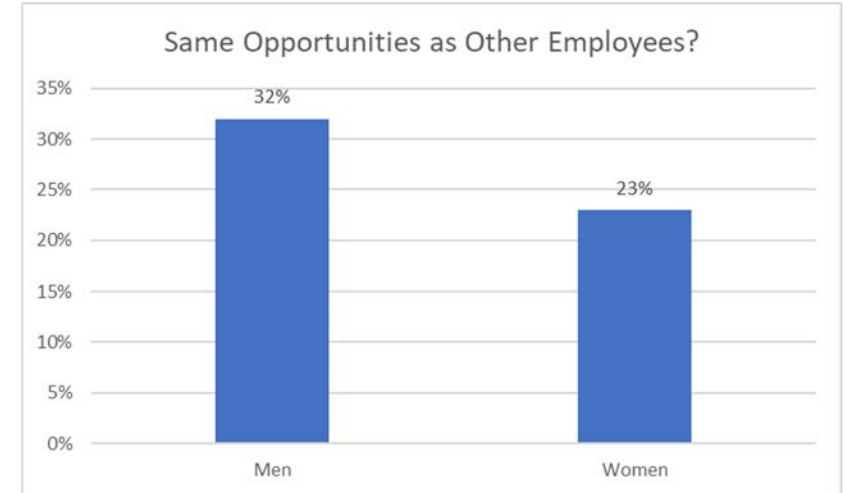
<https://www.becomeopedia.com/geologist/>

[e.g., Bernard & Cooperdock, 2018; Guitard, 2018]

Disparate professional experiences

Women and/or Minorities in Academia

- Higher service load
- Higher levels of burnout
- Less access to resources / space
- Less likely to agree they have same opportunities as other employees



[e.g., [Inside Higher Ed, 2022](#); [MIT 1999 equity study](#); [Scripps 2023 self-study](#)]

CONVERSE Equity Goals

- Equity embedded throughout CONVERSE policies and practices
- Shared equity leadership
- Education & training rooted in inclusive, equitable practices
- Continuous evaluation

CONVERSE educational highlights

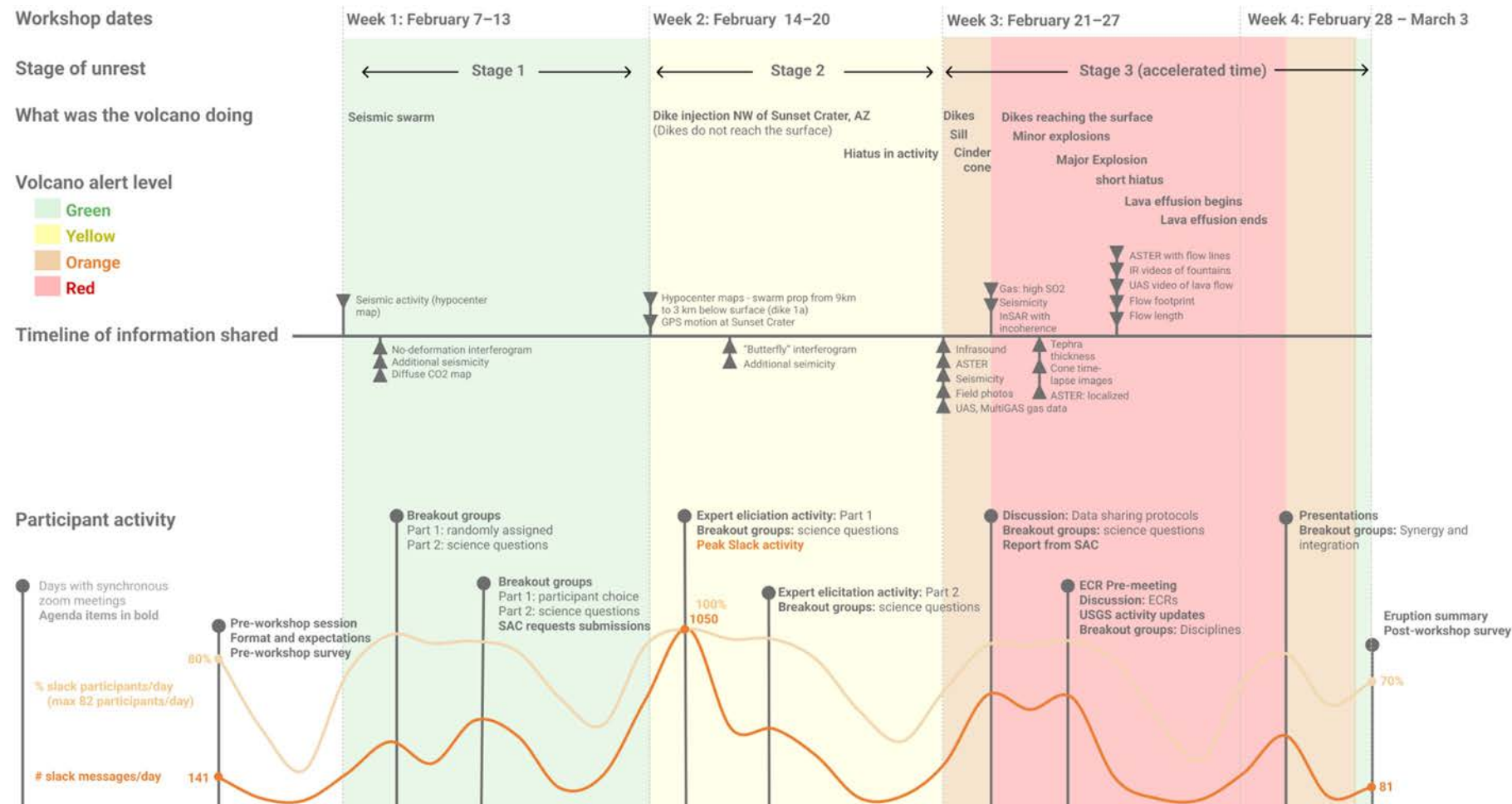
Scenario exercises

- Mt Hood exercise (2020)
- San Francisco Volcanic Field exercise (2022)

Training workshops and seminars

- CONVERSE webinar learning series (2023)
- CONVERSE Scenario Building Institute (2023), which included FEMA-certified Volcano Crisis Awareness course

SFVF Scenario Exercise (Feb-Mar 2022)



Read more: Lin, Lev, Mukerji, Fischer, Connor, Stovall, Poland, Iezzi, Wauthier, Gonzalez-Santana, Wright, Wolf, and Kasali (2023). Lessons Learned from the 2022 CONVERSE Monogenetic Volcanism Response Scenario Exercise, *Volcanica*

CONVERSE Webinar Learning Series

Advancing Science During Volcanic Crises

Organizers: Fischer, Lev, Houghton, Zhang



Spring 2023 Converse Webinar Series

Feb 7	Dr. Sæmundur Halldórsson (University of Iceland). Magmatic Shifts during the Fagradalsfjall Eruption.
Feb 28	Dr. Karl Kim (University of Hawai'i, Mānoa). Volcanoes, Hazards, Evacuation and Preparedness.
Mar 21	Dr. Kendra Lynn (Hawai'i Volcano Observatory). Recent Eruptions at Mauna Loa and Kīlauea Volcanoes.
Apr 11	Dr. Samantha Tramontano (City University of New York). Observations from the Recent La Cumbre Vieja Eruption.



CONVERSE Webinar Learning Series

Advancing Science During Volcanic Crises

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Fall 2023 Converse Webinar Series

Sep 19	Dr. Thor Thordarson (University of Iceland). Observing, Monitoring and Documenting the Three Eruptions of the 2021-23 Fagradalsfjall Fires and Its consequences.
Oct 17	Dr. Michelle Coombs (Alaska Volcano Observatory). Responding to Alaska's Numerous Eruptions.
Nov 14	Dr. Valentin Troll (Uppsala University) The 2021 La Palma Eruption, Canary Islands; Eruptive Phenomena, Magma Plumbing, and Societal Consequences

Plans for 2024: Continue this webinar series. Also launch a new webinar series of talks given by ECRs – Nominations and Self-nominations wanted!

CONVERSE Scenario Building Institute (CSBI)

Organizers: Fischer, Lev, Houghton, Lin, Hushman, Zhang

1 week in-person workshop (July 2023) to develop a scenario for the science response to the run-up to and eruption of an arc volcano.

Included a one-day FEMA-certified “Volcanic Hazards Awareness” Course (which we plan to regularly deliver in future years to students & professionals)

CONVERSE supported travel to Albuquerque, lodging on campus, meals, and a \$500 stipend for 17 participants.

Positive feedback from participants and student leaders helped identify needs and interest for future institutes





CONVERSE Scenario Building Institute (CSBI)

University of New Mexico

July 2023





Schedule

- Monday:
 - Introduction to CONVERSE
 - FEMA training course on volcano crises



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- Wednesday-Friday:
 - Brief from each group
 - Worked in our groups until mid afternoon
 - Daily report on zoom with experts from the site



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- Saturday:
 - Valles Caldera Field Trip

Overall Objective of the Workshop

Create data for an eruption scenario reflective of the current base levels produced by volcano X

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Volcano X Info

- Large glacier on the summit
- Prone to lahars
- Surrounding communities are in built in hazard zones
- Smaller frequent eruption ~ VEI 2
- Historic large eruptions (VEI 4-5)

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Scenario Outline

- 4 Phases
 - Pre-Unrest
 - Period of normal background levels
 - Unrest
 - Magma chamber mixing, dome emplacement, increase in seismic activity, and gas build up
 - Eruption
 - VEI 4 Eruption
 - Post Eruption
 - Lahar Hazard Map

Building The Scenario

- Participants created the data from scratch to simulate a VEI 4 scenario.
- **Geodesy**
 - Created GNSS and InSAR time series leading up to the eruption to simulate realistic timelines for magma transport and volcanic deformation.
- **Petrology**
 - Determined necessary bulk composition and reasonable melt to crystal ratios.
- **Volcanic gas/plume/hazards**
 - Simulated gas emissions, ash fallout, PDCs, lahars, and plume dynamics with weather and historical data incorporated for realism.
- **Seismology**
 - Produced seismic catalogs for lead up, eruptive phase, and post eruption. Included LP and VT data.



Skills built during workshop

- Gave participants practice in coordination and collaboration across multiple disciplines.
 - Provided participants moments to help teach peers and to gain a deeper understanding of volcanic processes.
- Built participant's science communication skills.
 - Daily updates on what each group was working on.
- Introduce participants to the complexities of mounting a scientific response to an eruption.



Valles Caldera

- Real life magma degassing!
- Exposed participants to gas sampling and CO₂ monitoring.
- Showed the effects of volcanic eruptions on geomorphology.
- Showed effects of magma degassing on local hydrology.



Thank you to CONVERSE for providing an opportunity to meet peers in volcano science and form strong connections across multiple disciplines and between many organizations!



... next up Tina Neal USGS



Narrowing the Latency Gap for Volcano Science and Response through Aerospace-based datasets

M. Grace Bato and Paul Lundgren



Jet Propulsion Laboratory
California Institute of Technology

Outline

- **ARIA & OPERA Projects: Analysis-Ready Data for Everyone**
- **Beyond Satellite Radar Data**
- **UAVSAR: NASA's Airborne Asset for Eruption Response**
- **Future NASA Missions**
 - Surface Biology and Geology (SBG)
 - Surface Topography and Vegetation (STV)
 - Surface Deformation and Change (SDC)

ARIA & OPERA Projects: Analysis-Ready Data for Everyone

Providing Analysis-Ready Data (ARD) in a timely fashion is crucial for monitoring and for disaster response and recovery efforts.



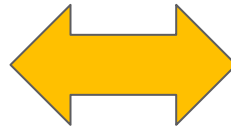
Jet Propulsion Laboratory
California Institute of Technology



Advanced Rapid Imaging and Analysis Project

Research and Disaster Response

- Primarily supported by research grants through ROSES program
- Agile to disaster response and scientific research



OPERA

Observational Products for End-Users from Remote Sensing Analysis Project

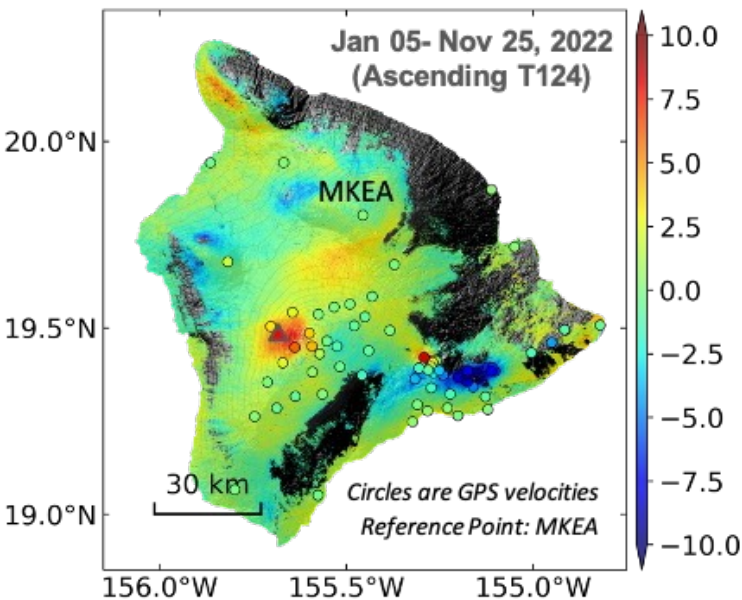
Production of Analysis Ready Products

- Project level funding with formal Program requirements for producing products
- No urgent response requirement.

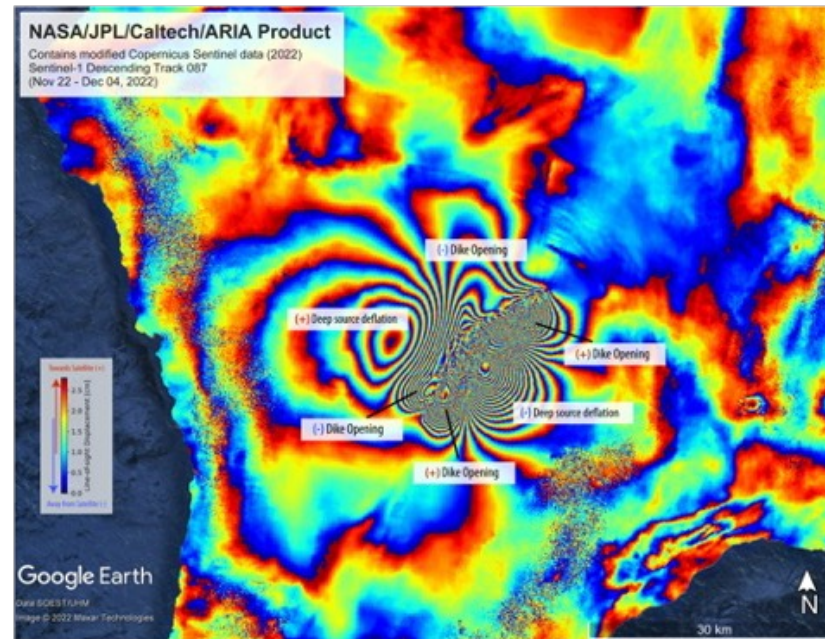
Example Disaster Response Products during an Eruption

2022 Mauna Loa Eruption, Hawaii, USA

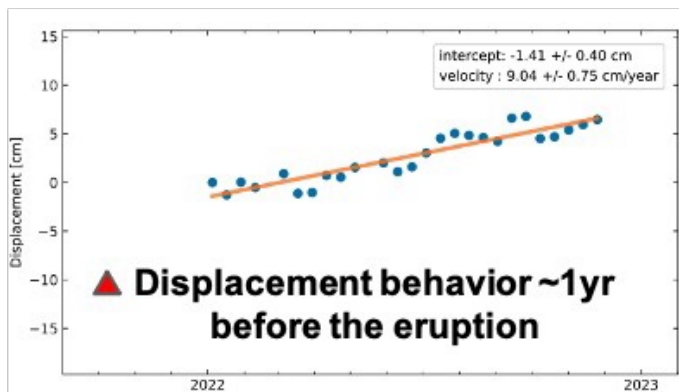
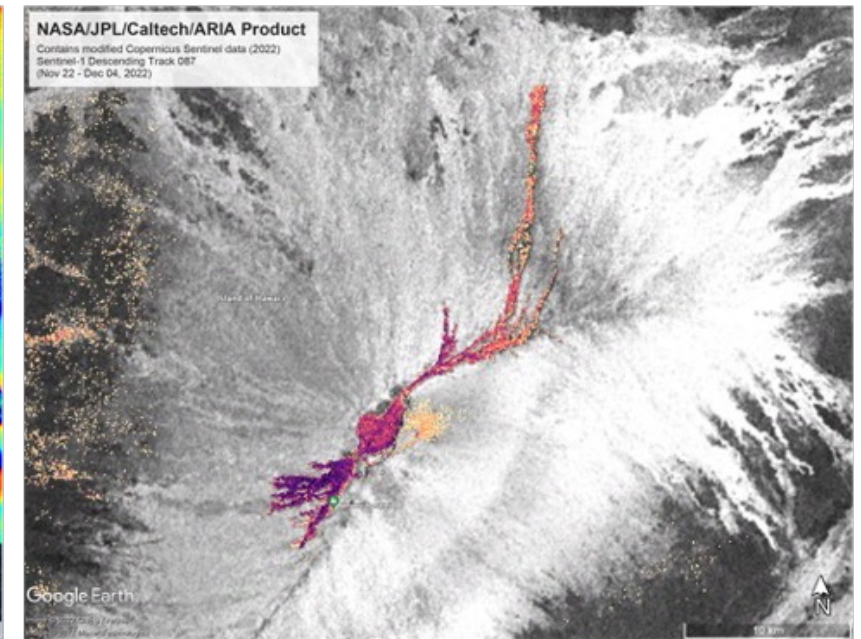
Pre-eruption LOS Velocity Map



Co-eruptive Displacement Map showing how much the ground deformed due to the eruption



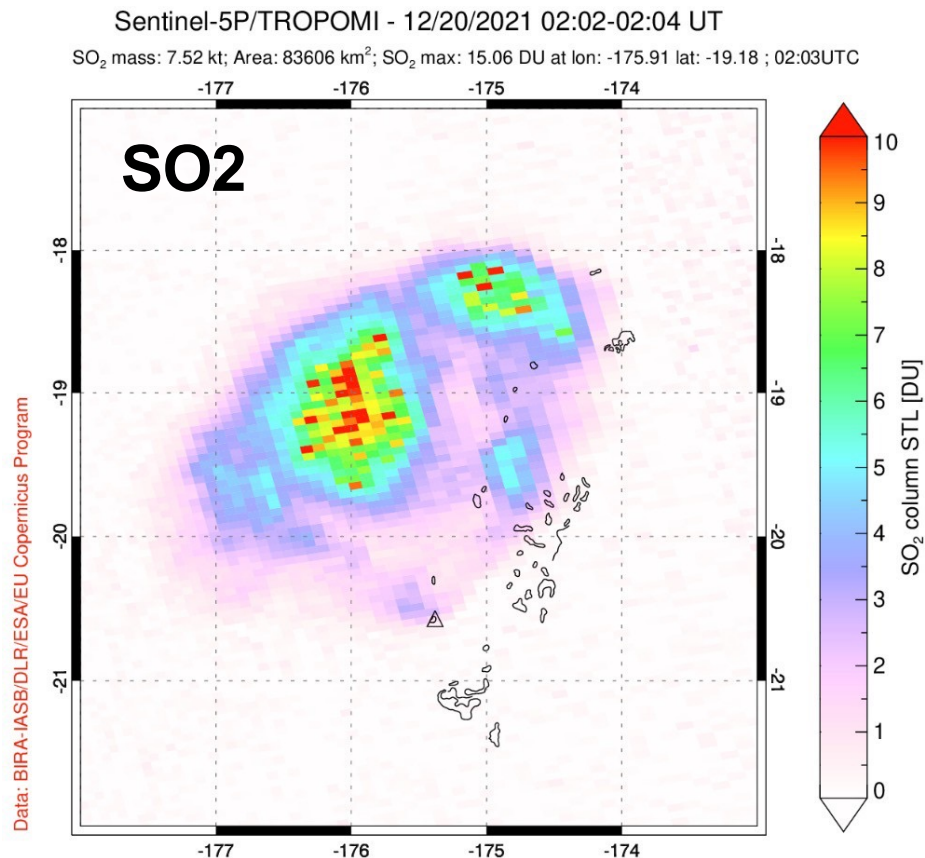
Lava Flow Emplacement Map generated by analyzing the coherence change before and after the eruption



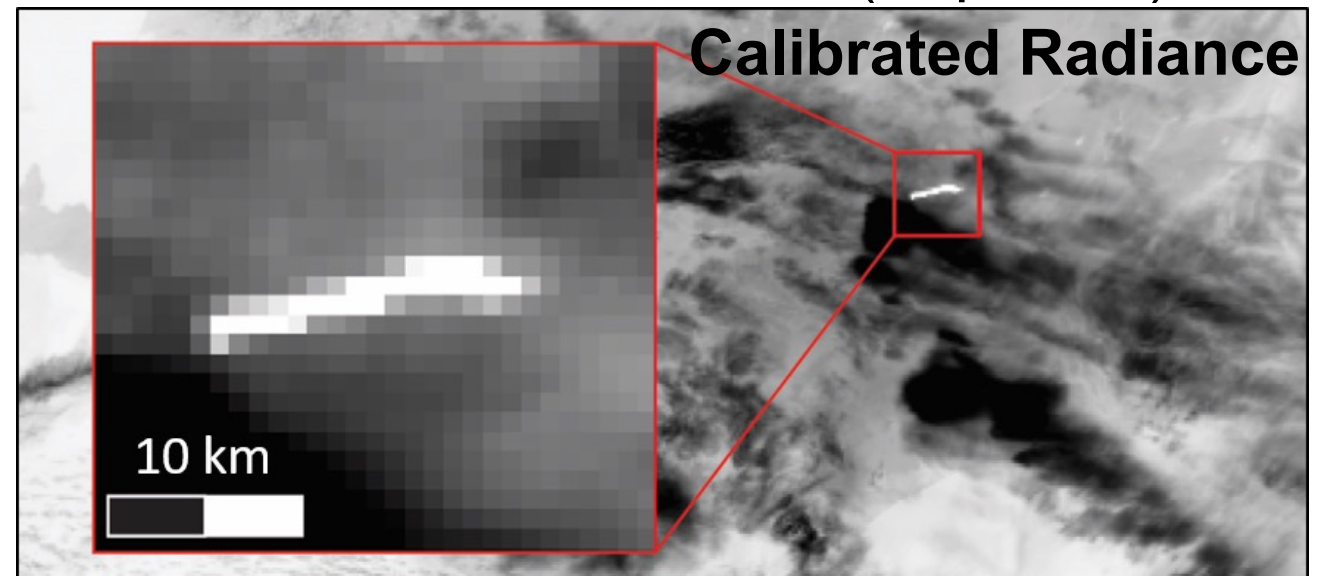
We produced various disaster response products to support in decision-making during an ongoing volcanic unrest/eruption. Example above is for the Nov-Dec 2022 eruption of Mauna Loa volcano in Hawaii.

Beyond Satellite Radar Data

Hunga Tonga – Hunga Ha'apai



Iceland's Holohraun volcano (Sep 2014)



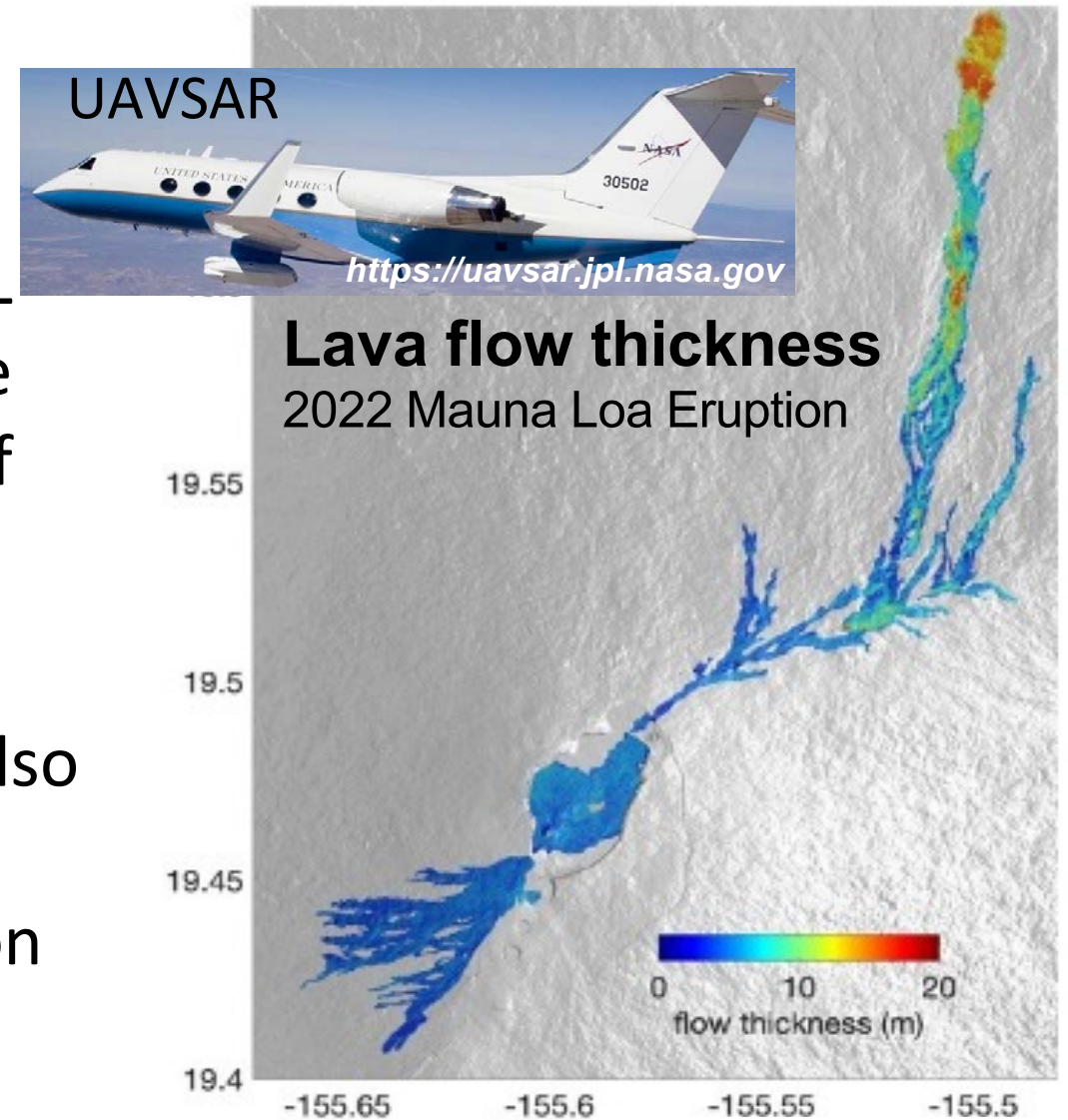
<https://www.earthdata.nasa.gov/learn/data-user-profiles/user-profile-dr-robert-wright>

Credit: Robert Wright, University of Hawai'i

S. Carn et al, *Frontiers in Earth Science* 2022

UAVSAR: NASA's Airborne Asset for Eruption Response

- The UAVSAR-Ka topographic InSAR (GLISTIN-A) is aboard the AFRC C-20 jet
- During the Mauna Loa eruption, the JPL team conducted 3 flights over the active lava flow and mapped the topography of both Mauna Loa and Kilauea volcanoes.
- SAR-Fusion Optical/SWIR cameras were also onboard to take coincident imagery for generating high resolution Digital Elevation Model (DEM) for comparison with the GLISTIN-A DEM.



Future NASA Missions

- NASA relies on the science community to identify and prioritize leading-edge scientific questions and the observations required to answer them

- Decadal Survey

- Designated observables, including:

- SDC: Surface Deformation and Change**

- Deformation measurements – InSAR*

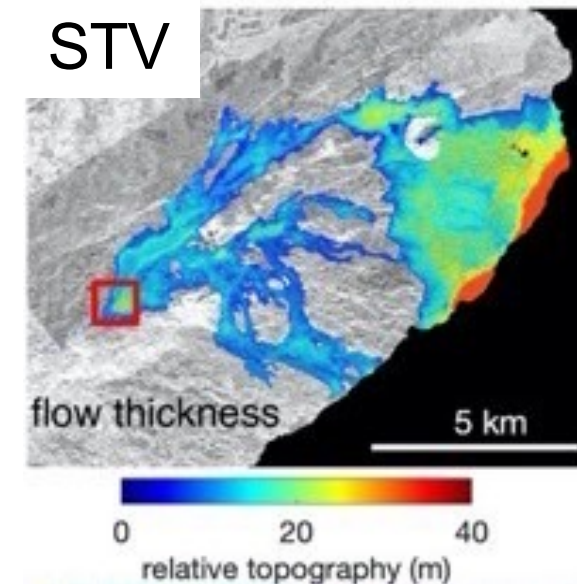
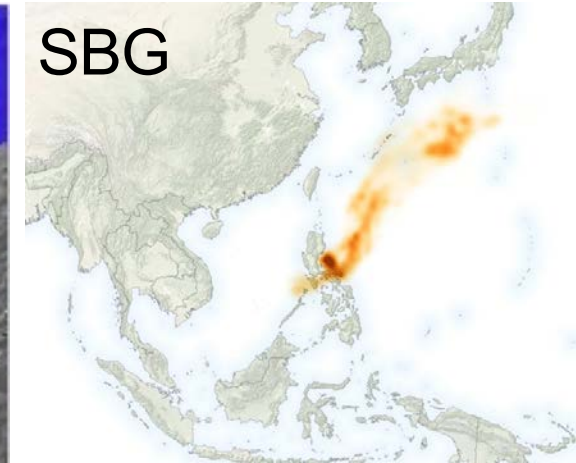
- SBG: Surface Biology and Geology**

- Gas and ash plume detection through hyperspectral visible-shortwave infrared (VSWIR) and multispectral thermal infrared (TIR) imagery*

- Incubator Program:

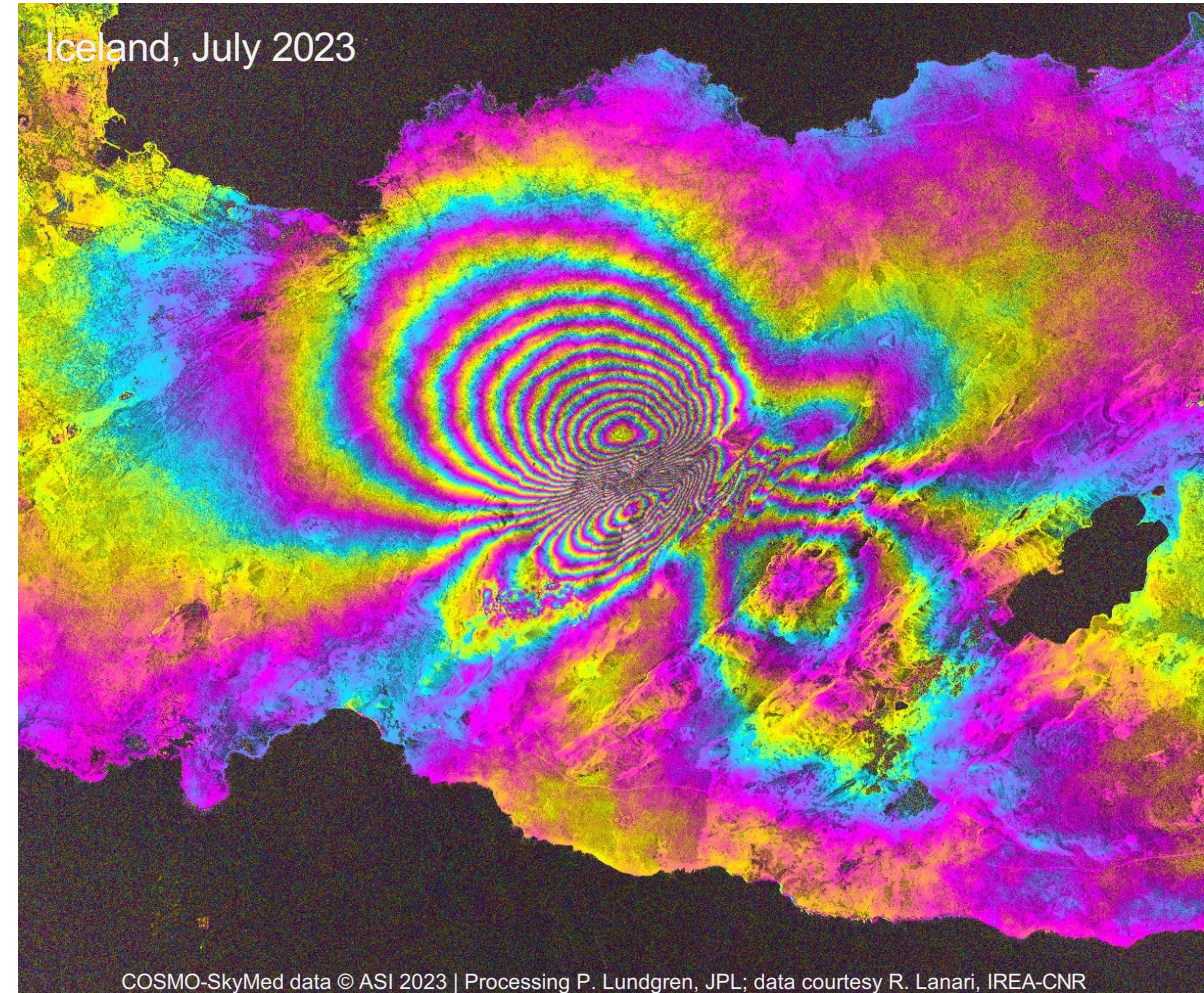
- STV: Surface Topography and Vegetation**

- High-resolution global topography change*



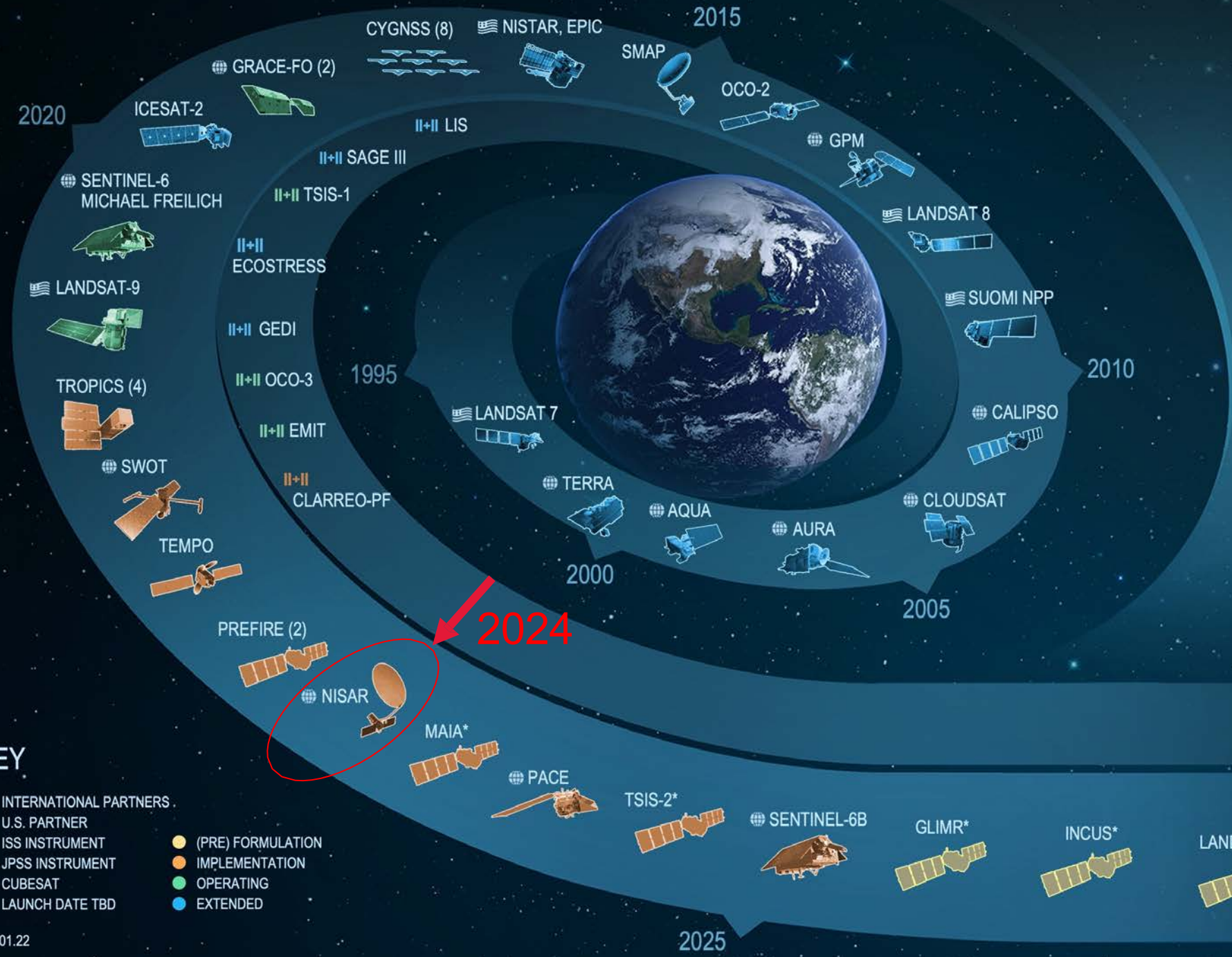
Summary

- Remote sensing data provide critical information that inform volcano response decision-making
- Working with volcano observatory and academic partners, NASA-supported processing and analysis capabilities are a critical component of CONVERSE





EARTH FLEET



INVEST/CUBESATS

- CIRIS 2023
- NACHOS 2022
- CTIM 2022
- NACHOS-2 2022
- SNOOPI* 2022
- MURI-FO* 2022
- HYTI* 2023

JPSS INSTRUMENTS

- OMPS-LIMB 2022
- LIBERA 2027
- OMPS-LIMB 2027
- OMPS-LIMB 2032

ISS INSTRUMENTS

MISSIONS

KEY

- INTERNATIONAL PARTNERS
- U.S. PARTNER
- ISS INSTRUMENT
- JPSS INSTRUMENT
- CUBESAT
- LAUNCH DATE TBD
- (PRE) FORMULATION
- IMPLEMENTATION
- OPERATING
- EXTENDED