USGS
science for a changing world

National Volcano Early Warning and Monitoring System: Advisory Committee Meeting

June 3 – 4, 2026: Day 1

Main Interior Building

Washington, DC

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

USGS
science for a changing world

2025 NVEWSAC Report Review & Vote for Approval

Leif Karlstrom

University of Oregon

Jenn Wade

National Science Foundation

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

NVEWSAC: National Volcano Early Warning System Advisory Committee 2025 Annual Report for approval

NVEWSAC meeting: July 29-30, 2025
Subcommittee meetings: December 3 and 4, 2025

- Status of NVEWS at USGS Volcano Observatories

- Heard from all volcano observatory SICs (Scientists In Charge) about NVEWS-related instrumentation and planning, as well as gaps and challenges.

- NVEWS Full Implementation and phasing

- *The Committee's primary recommendation is that the NVEWS program be fully implemented.* The Committee noted that the watch office and grants program components of NVEWS have been authorized but not appropriated funds.

- Subcommittee Meetings

- December 3, 2025: distributed/hydrothermal hazards
- December 4, 2025: USGS volcano threat level reassessment

NVEWSAC Recommendations following the three 2025 meetings:

1. Develop public-facing documents (e.g., ‘glossary of events’) that explain volcanic hazards and possible impacts in the specific area with historical context. Particularly needed in the SW region.

2. Develop documents accessible to the research community (White papers or reports) that outline key areas where academic research can aid NVEWS + any potential grant program.

3. Develop USGS Scenarios (prior examples include those from the SAFER group and current FEMA efforts in Region 10) around less well understood (e.g., hydrothermal) hazards.

4. The NVEWSAC would benefit from a member who is a social scientist, given potential challenges for public communication with the hazard reassessment and engagement with private and public entities tasked with communicating volcanic hazards.

5. The NVEWSAC would benefit from a tribal representative, given discussions about redefining volcanic fields in the ongoing Threat Level Reassessment.

6. NVEWSAC still needs representation from DOD, USFWS, and Wyoming Survey (DOE is unknown/pending). This list assumes that new NVEWSAC nominees are approved.

USGS
science for a changing world

State of the USGS Volcano Hazards Program

Gari Mayberry

Volcano Hazards Program Coordinator

DOI/USGS/Natural Hazards Mission Area

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

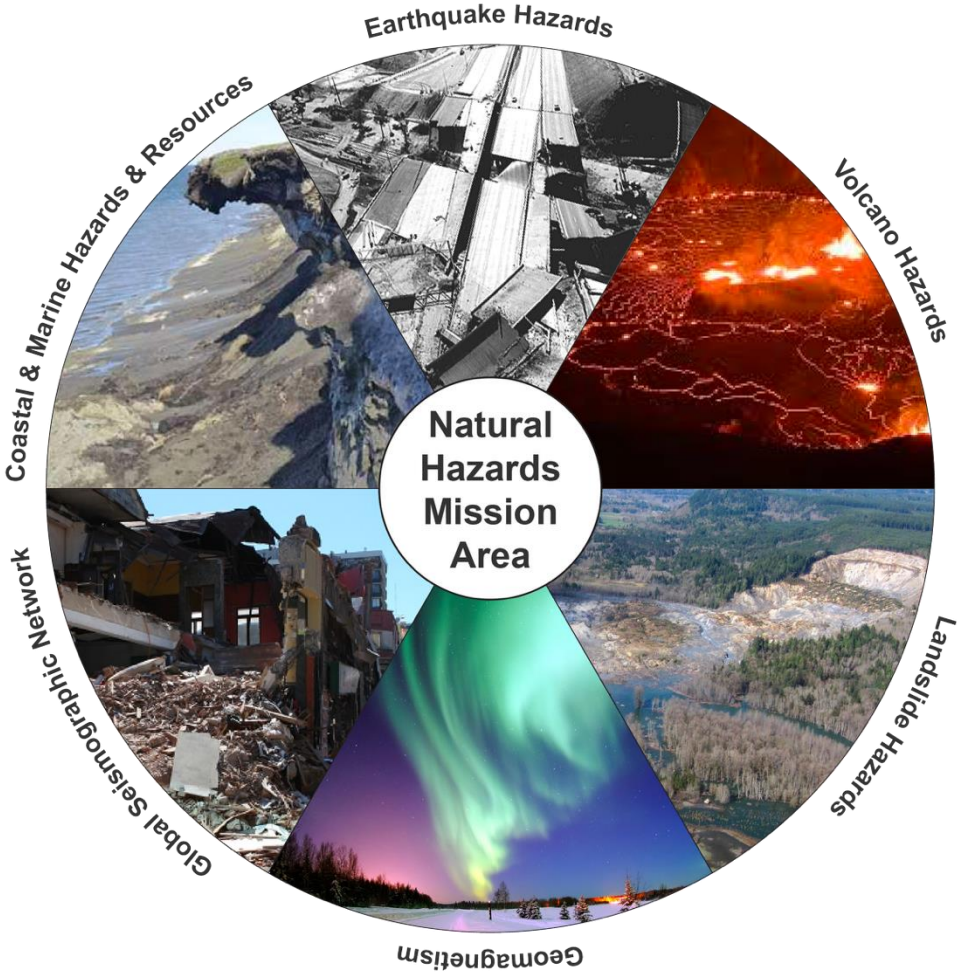
USGS Mission and Vision

The **USGS mission** is to monitor, analyze and predict current and evolving dynamics of complex human and natural Earth system interactions and to deliver actionable information at scales and timeframes relevant to decision makers.

Vision Statement: Lead the Nation in 21st-century integrated research, assessments, and prediction of natural resources and processes to meet society's needs.

USGS

- **Direct responsibility for six programs:**
  - Coastal/Marine Hazards & Resources
  - Earthquake Hazards
  - Geomagnetism
  - Global Seismographic Network
  - Landslide Hazards
  - Volcano Hazards



USGS

The mission of the U.S. Geological Survey Volcano Hazards Program is to enhance public safety and minimize social and economic disruption from eruptions by delivering effective forecasts, warnings, and information of volcano hazards based on scientific understanding of volcanic processes.

BY THE NUMBERS

57

Number of very high or high threat volcanoes that could directly impact nearby communities

7.7B

Pounds of air cargo at risk of disruption due to volcanic ash from Alaska eruptions each year

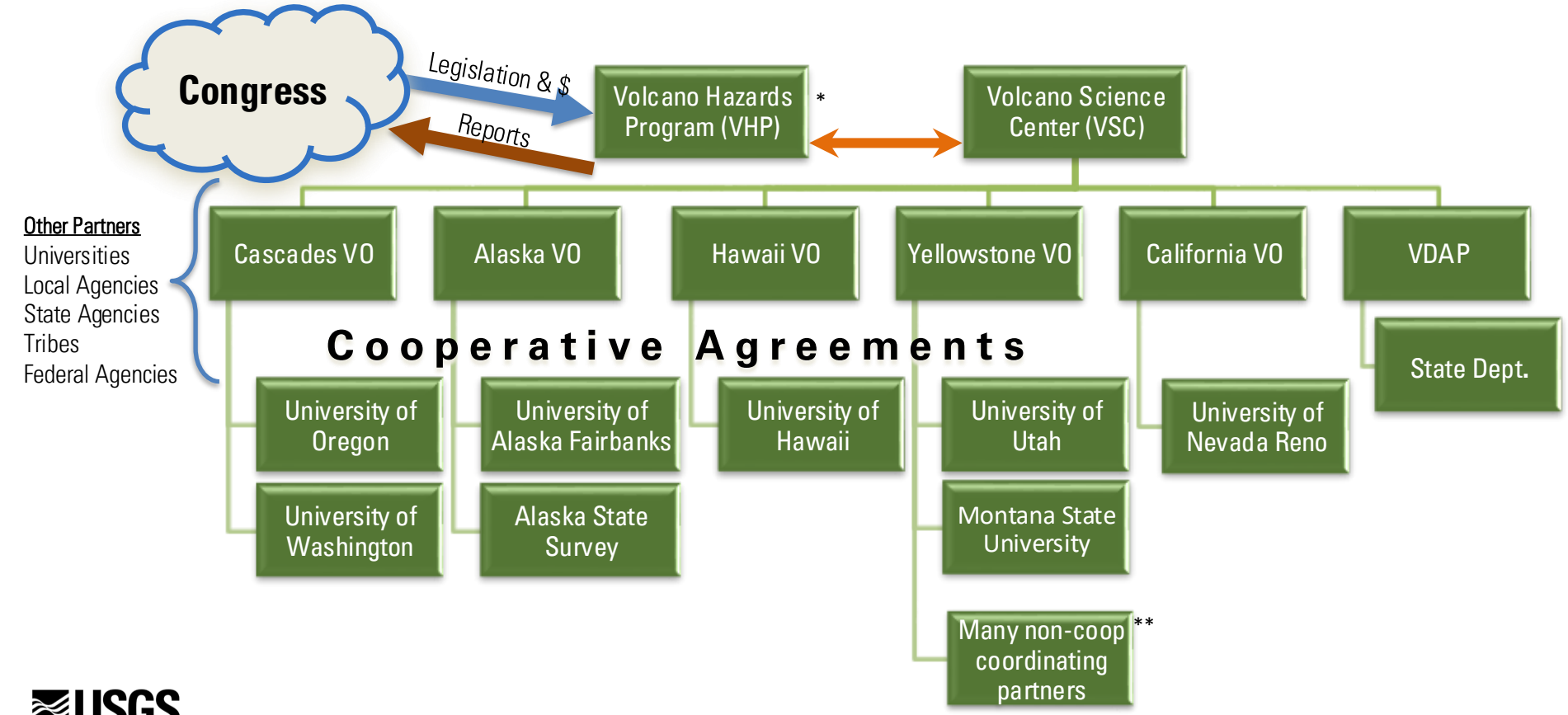
U.S. VOLCANOES
Number of active volcanoes in the United States and its territories
170

AVIATION NOTIFICATIONS
Number of Volcano Observatory Notices for Aviation (VONA) issued for aircraft during 2025
51

VOLCANO LOCATIONS
Number of U.S. states and territories that have active volcanoes
14

U.S. ERUPTIONS
Number of eruptions in the United States since 1980
148

USGS



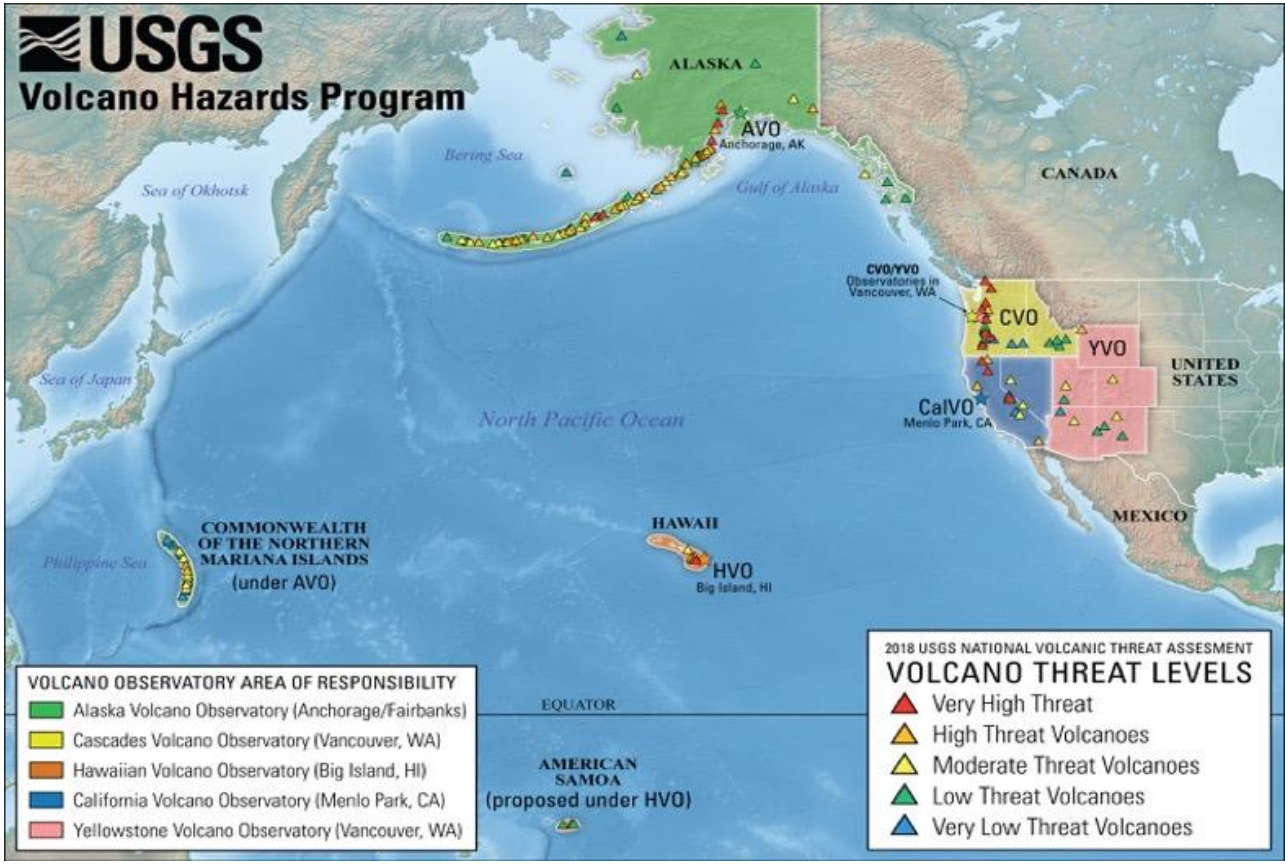
USGS

*The VHP also provides small amounts of funds to other USGS science centers.

** Other YVO partners are National Park Service, EarthScope, Montana State University, University of Wyoming, and State Geologic Surveys of Wyoming, Montana, and Idaho

Volcano Observatories

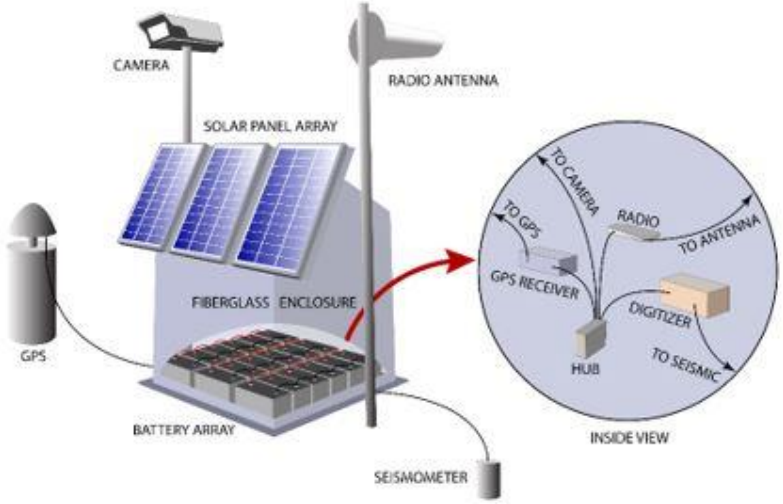
- Alaska (AVO)- AK, CNMI
- Hawaiian (HVO)- HI, Am Samoa
- Cascades (CVO)- WA, OR, ID
- California (CalVO)- CA, NV
- Yellowstone (YVO)- WY, MT, CO, UT, AZ, NM
- *International Volcano Disaster Assistance Program (VDAP)*



USGS

National Volcano Early Warning and Monitoring System (NVEWS)

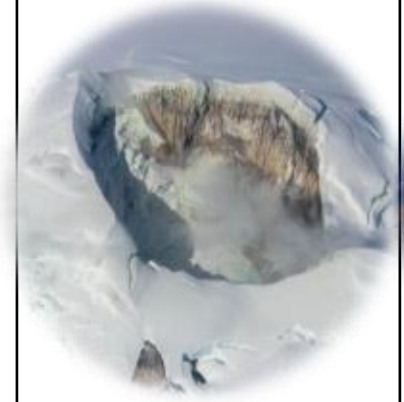
- March 2019- Title V of the John Dingell Jr. Conservation, Management, and Recreation Act (P.L. 116-9)
- U.S. volcanoes monitored commensurate with the threats they pose
- U.S. volcano observatories will be an interoperable system
- National Volcano Information Service (NVIS) will aggregate and distribute real-time monitoring data from all observatories
- A Watch Office will provide 24/7 continuity of operations
- Authorizes an external grants program to support research in volcano monitoring science and technology
- Establishes an interagency advisory committee (DOE, DOD, FAA, NOAA, FEMA, NASA, NIST, NSF, volcano science community)
- S.3533, Volcanic Ash and Fumes Act of 2022- Incorporates capacity/expertise of NOAA into NVEWS



USGS

FY25 Volcano Activity

Mount Spur
March 2024 – Aug 20, 2025



- Stalled intrusion
- Greater than 3,000 total earthquakes
- 6 cm radial motion
- Melting at summit
- Multi-gas at Crater Peak
- Stood up an OVERT

Mount Adams
September 2024

- 9 located earthquakes (~20 times background)
- Installed 3 temporary stations
- Highlighted challenges of an under-monitored volcano awakening

Kīlauea
Dec 23, 2024 – present

- 48 episodes—major data surge (mapping, gas/lava chemistry, thermal & video)
- Large plumes (up to 15k ft) prompting VAN/VONA notices
- Tephra hazards impede infrastructure and fieldwork

Mount Rainier
Jul 8 – 14, 2025

- 1000 earthquakes (largest M 2.4)
- Peak event rate ~40/hour
- No deformation of other precursory activity.
- Most significant since monitoring began in 1987.

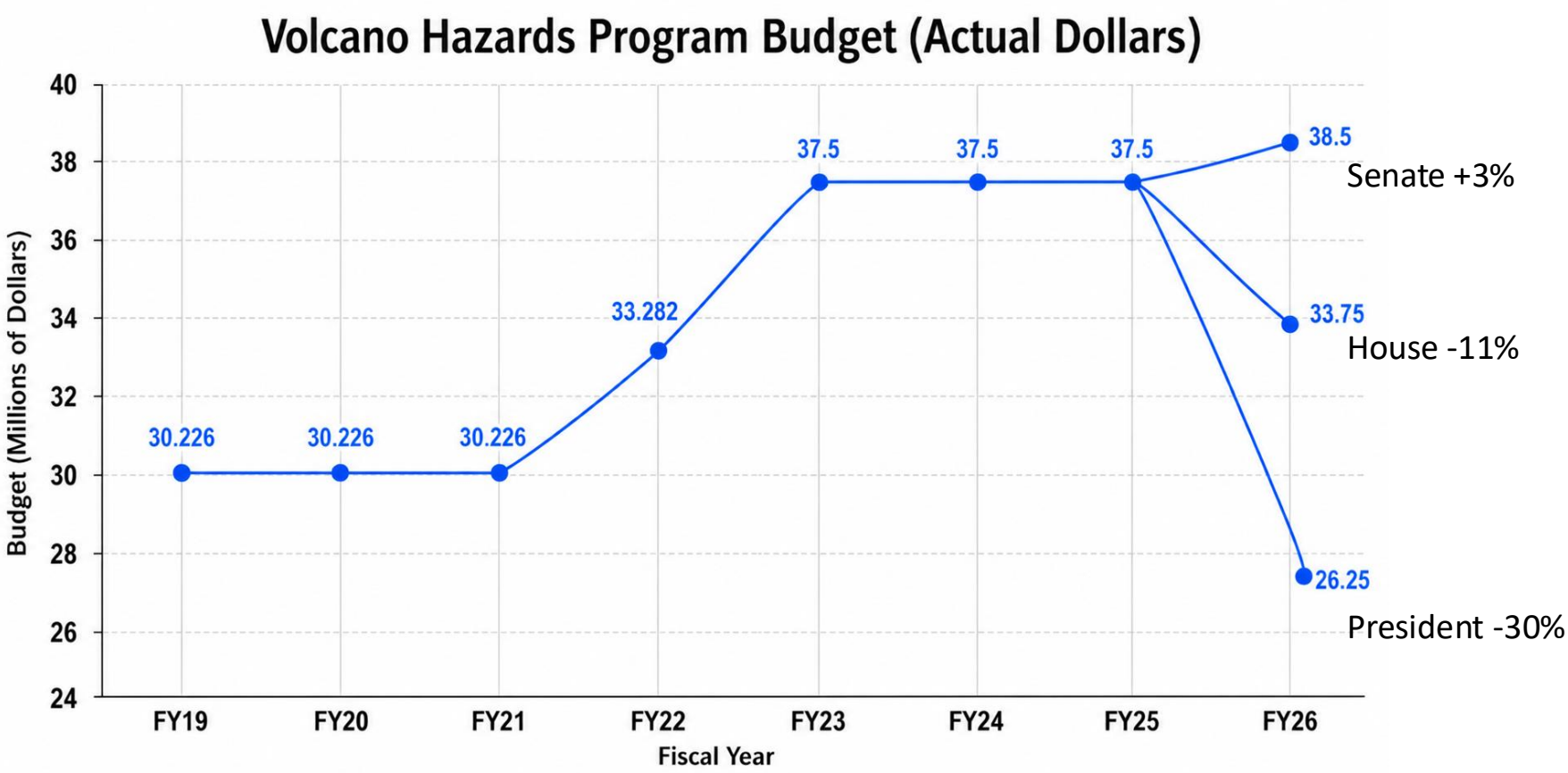
USGS

FY25 Volcano Activity

Kilauea

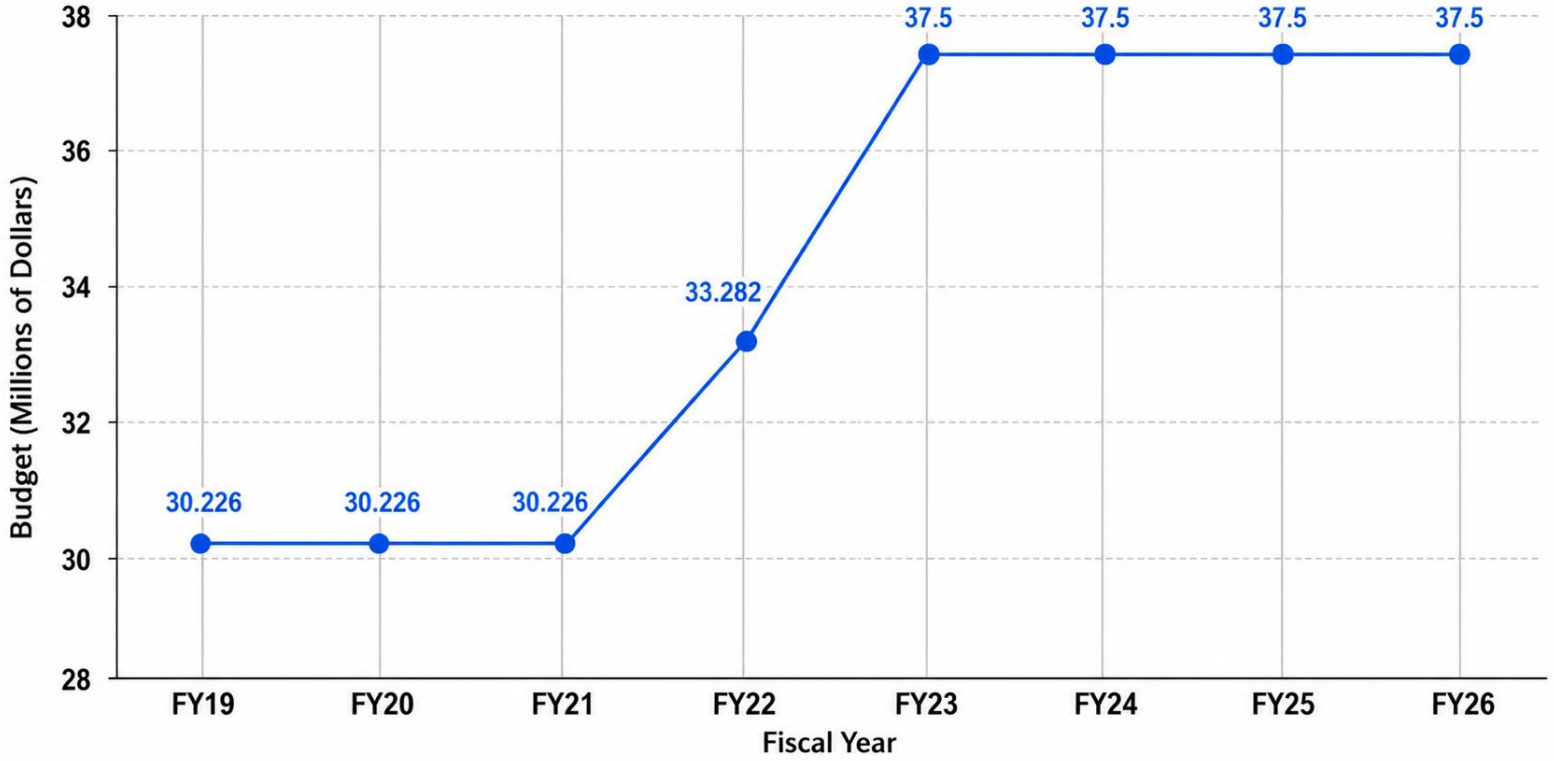
- As of this week, episode 48 broke the record for the most fountaining episodes ever recorded at Kilauea
- [Volcano Watch Article]

USGS


Volcano Hazards Program Budget (Actual Dollars)
Budget (Millions of Dollars)
40
38
36
34
32
30
28
26
24
30.226
30.226
30.226
33.282
37.5
37.5
37.5
38.5
33.75
26.25
FY19
FY20
FY21
FY22
FY23
FY24
FY25
FY26
Fiscal Year
Senate +3%
House -11%
President -30%

USGS

Volcano Hazards Program Budget (Actual Dollars)

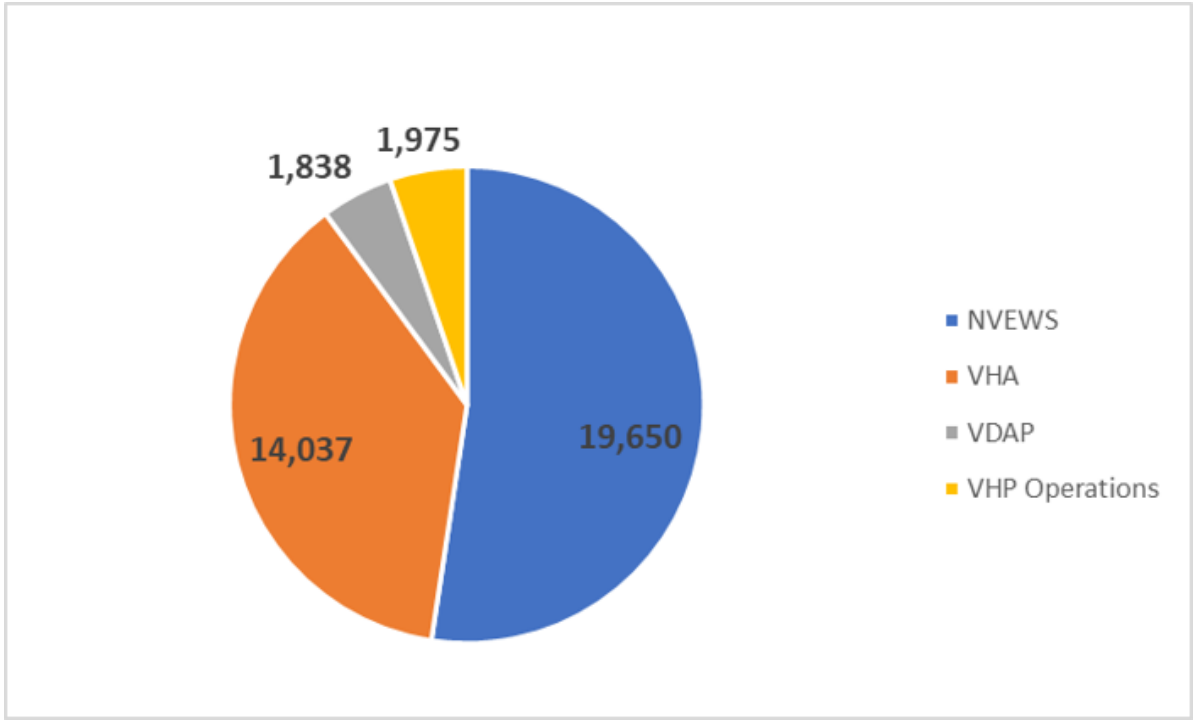


USGS

19	30,266	$1.54 mill NVEWS + $4.145 mill Lahar Detection
20	30,266	No NVEWS specific language
21	30,266	No NVEWS specific language
22	33,282	$3M NVEWS, $770K hazard assessments, $766K fixed costs
23	37.5	$2.591M NVEWS, $750K hazard assessment, $877K fixed costs
24	37.5	No NVEWS specific language
25	37.5	CR- No NVEWS specific language
26	37.5	No NVEWS specific language

USGS

FY25 Funding Breakdown ($37.5 mill)



USGS

FY27 Budget Outlook

Activity: Natural Hazards[1]

(Dollars in Thousands)

Activity/Sub Activity/Program Element/Budget Element	2025 Actual Budget Authority	2025 Actual *FTE*	2026 Enacted Budget Authority	2026 Enacted *FTE*	2027 Request Fixed Costs (+/-)	2027 Request Internal Transfers (+/-)	2027 Request Program Changes ($)	2027 Request *Program Changes FTE (+/-)*	2027 Request Budget Authority	2027 Request *FTE*	Change from 2026 Enacted	(percent reduction) -%
Natural Hazards												
Earthquake Hazards	92,651	*254*	94,901	*241*	-30	-	-32,220	*-7*	62,651	*234*	-32,250	33
Volcano Hazards	37,500	*155*	37,500	*146*	-17	-	-7,983	*-6*	29,500	*140*	-8,000	21
Landslide Hazards	14,432	*62*	14,532	*61*	-6	-	-3,094	*-5*	11,432	*56*	-3,100	21
Global Seismographic Network	7,000	*9*	7,000	*9*	-	-	-3,500	-	3,500	*9*	-3,500	50
Geomagnetism	5,198	*15*	5,198	*14*	-	-	-1,000	-	4,198	*14*	-1,000	19
Coastal/Marine Hazards and Resources	39,345	*193*	41,000	*169*	-19	-2,510	-13,226	*-37*	25,245	*132*	-15,755	38
Total, Natural Hazards	**196,126**	***688***	**200,131**	***640***	**-72**	**-2,510**	**-61,023**	***-55***	**136,526**	***585***	**-63,605**	32

[1] Table does not include supplemental funding.

From the FY27 President's Budget

USGS

FY27 Budget Outlook

Summary of Program Budget Changes Table: Volcano Hazards Program

Dollars in Thousands ($000)

Natural Hazards	2027 Request Change	FTE Change
Volcano Hazards Program		
National Volcano Early Warning System (NVEWS)	-2,000	+0
Volcanic Hazard Assessments	-5,983	-6
TOTAL Program Changes	**-7,983**	**-6**

From the FY27 President's Budget

USGS

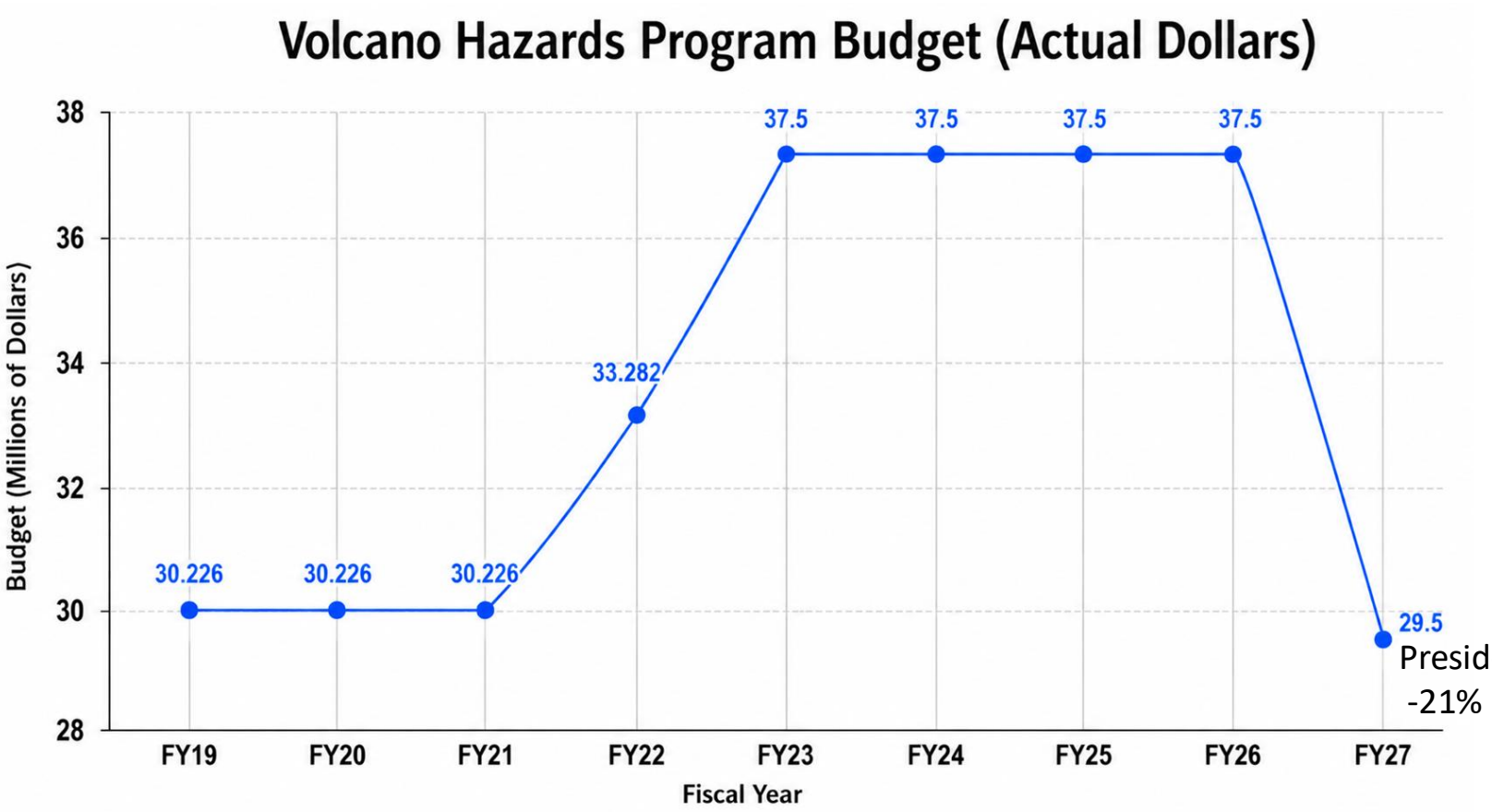
FY27 Budget Outlook

COMPARATIVE STATEMENT OF NEW BUDGET (OBLIGATIONAL) AUTHORITY FOR 2026
AND BUDGET REQUESTS AND AMOUNTS RECOMMENDED IN THE BILL FOR 2027
(Amounts in thousands)

	FY 2026 Enacted	FY 2027 Request	Bill	Bill vs. Enacted	Bill vs. Request
Natural Hazards:					
Earthquake hazards	94,901	62,651	94,901	---	+32,250
Volcano hazards	37,500	29,500	29,500	-8,000	---
Landslide hazards	14,532	11,432	13,532	-1,000	+2,100
Global seismographic network	7,000	3,500	6,230	-770	+2,730
Geomagnetism	5,198	4,198	4,626	-572	+428
Coastal/Marine hazards and resources	41,000	25,245	37,251	-3,749	+12,006
Subtotal	200,131	136,526	186,040	-14,091	+49,514

From the FY27 Draft House DOI Appropriations Report

USGS



President's Budget
-21%

USGS

Advancing Adminstration Priorities

Relevant Executive Orders

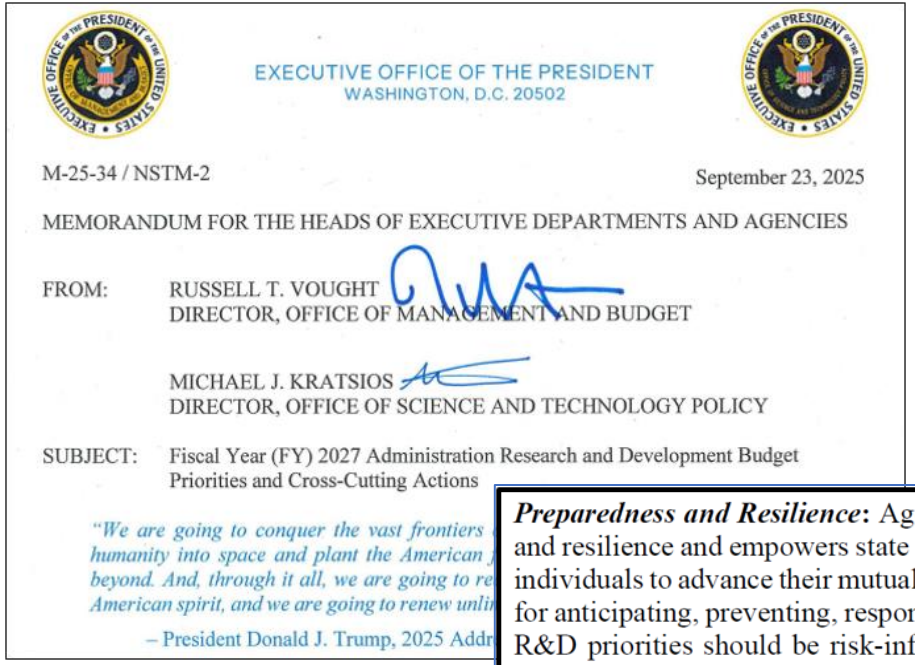
- E.O. 14239: Achieving Efficiency Through State and Local Preparedness
- E.O. 14153: Unleashing Alaska's Extraordinary Resource Potential
  - Secretary's Order 3422: Unleashing Alaska's Extraordinary Resource Potential
- E.O. 14154: Unleashing American Energy; Department of the Interior
  - Secretary's Order 3418: Unleashing American Energy
- E.O. 14272: Ensuring National Security and Economic Resilience through Section 232 Actions on Processed Critical Minerals and Derivative Products

Relevant Secretarial Priorities

- Priority 1: Energy production and delivery for current and future needs
- Priority 4: Safety and protections for our people, property, and resources
- Priority 5: Recreational and traditional use of lands and waters
- Priority 8: Service to communities that rely on Interior's capacity for science, data, and technologies
- Priority 9: Delivery of information, ease of doing business, public and other engagements

USGS

Advancing Adminstration Priorities



EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20502

M-25-34 / NSTM-2

September 23, 2025

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: RUSSELL T. VOUGHT
DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET

MICHAEL J. KRATSIOS
DIRECTOR, OFFICE OF SCIENCE AND TECHNOLOGY POLICY

SUBJECT: Fiscal Year (FY) 2027 Administration Research and Development Budget Priorities and Cross-Cutting Actions

"We are going to conquer the vast frontiers humanity into space and plant the American beyond. And, through it all, we are going to re American spirit, and we are going to renew unli

– President Donald J. Trump, 2025 Addr

***Preparedness and Resilience*:** Agencies should invest in R&D that improves the Nation's safety and resilience and empowers state and local governments and communities, the private sector, and individuals to advance their mutual preparedness. This should include R&D to enhance capabilities for anticipating, preventing, responding to, and recovering from threats and natural disasters. Such R&D priorities should be risk-informed and encompass, as appropriate, integrative approaches across threat and hazard domains, including cyber and electromagnetic attacks on critical infrastructure, supply chain weaknesses, power grid vulnerabilities resiliency, airspace threats, biological threats, severe terrestrial and space weather, and other geophysical hazards. Agencies should prioritize R&D for cybersecurity resilience, to ensure the Nation is prepared with post-quantum cryptography to defend against future threats. Additionally, agencies should explore novel datasets and identify opportunities to leverage AI applications to enable improved resilience.

USGS

NVEWS Reauthorization

- Passed by the House on Dec 15, 2025
- Senate Amendment (referred to Committee on Energy and Natural Resources)

"(F) IMPLEMENTATION COMMITTEE.—The Secretary shall establish an implementation committee that shall—

"(i) include representatives of—

"(I) each State agency or designee of a State agency subject to a cooperative agreement entered into under subparagraph (C);

"(II) institutions of higher education; and

"(III) each volcano observatory described in paragraph (1)(B)(i); and

"(ii) be responsible for providing to the Secretary recommended requirements, implementation steps, and performance standards for the System.".

- Add Secretary coordination with Chief of the Forest Service
- Senate- increase length from 5 to 10 years (2023-2033), increase funding authorized to appropriate from $55-75 million
- House- 2026-2030, $55 million, NOAA $470K/year

USGS

NVEWSAC- Non-federal

Leif Karlstrom, **University of Oregon (Co-Chair)**

Brian Terbush, **Washington State Emergency Management**

Yvette LaDuke, **California Governor's Office of Emergency Services**

Erin Campbell, **Wyoming State Survey**

Nelia Dunbar, **New Mexico Bureau of Geology**

Casey Hanell, **Washington Department of Natural Resources**

Michael Manga, **University of California, Berkeley**

Christy Till, **Arizona State University**

Matthew Pritchard, **Cornell University**

USGS

NVEWSAC- Federal

Douglas Howard, **NOAA - NESDIS STAR (Co-Chair)**

Lauren Boyd, **Department of Energy**

Stephen Dornbos, **Department of Defense**

Ariel Stein, **NOAA - Office of Oceanic and Atmospheric Research**

Steven McCabe, **National Institute of Standards and Technology**

Jennifer Wade, **National Science Foundation (Co-Chair)**

Jeffery Williams, **Fish and Wildlife Service, Alaska**

Ben Phillips, **NASA**

Karen Shelton-Mur, **Federal Aviation Administration**

Wade Witmer, **Federal Emergency Management Agency**

USGS

Pending Actions (from last meeting)

- Continue NVEWS buildout- funding levels impact implementation
- Hiring a monitoring and evaluation specialist
- 24 x 7 watch capabilities
- External grant
- Building tribal relationships

USGS

Future Plans (from last meeting)

- Several unknowns for the Volcano Hazards Program, including NVEWS in FY25-27 (budget, hiring, future staffing)
- Staffing shortages will likely continue- prioritization is necessary
- Focus on geothermal energy and critical minerals applications
- Increase Tribal engagement
- Some monitoring and evaluation expertise to tap into
- Expand partnerships (Earthquake and Landslide Hazard Programs, geothermal, federal and non-federal partners)

USGS

Priorities

- Strategic development of NVEWS and NVIS
  - Focus on very-high and high threat volcanoes

- Hiring critical staff

- Completing several volcano hazard assessments
  - Volcano Hazard Assessment Project- streamlined communication products

- Addressing geothermal resource and critical minerals work
  - Created a new VHP Geothermal Project

- Increase engagement in the SW

USGS

Overview of volcanism and hazards in the southwest

- General description of distributed volcanism and eruption styles
- Broad overviews of each volcanic field that might be site of a future eruption
- Some of the hazards that could result from a SW USA DVF eruption, including the potential for cascading hazards (like a lava flow blocking a river), and how they might impact various areas (lava blocking highways, ash closing airspace, etc.)
- (Possible) Monitoring options -currently rely on regional seismic and InSAR for detection, and would then focus work once some anomaly was recognized
- Others?

.

BREAK

USGS

Reports from NVEWSAC Members

USGS
science for a changing world

VHP Monitoring and Evaluation Process Update

Wendy Stovall

Volcano Hazards Program Associate Coordinator

DOI/USGS/Natural Hazards Mission Area

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

Monitoring and Evaluation
VHP & Office of Risk and Resilience

Heartland Consulting, Contract

Geraldine O'Mahony – M&E specialist

Tim Hoheneder – Survey & data specialist

<u>Two projects</u>

- **Develop a VHP Monitoring and Evaluation plan**
- **Assess effectiveness of USGS volcano hazard notification**

USGS

Monitoring and Evaluation
VHP & Office of Risk and Resilience

- Assess and improve VHP monitoring and evaluation across program, services, and products.
- Create a comprehensive M&E plan with clear evaluation methods.
- Evaluate use and effectiveness of volcano notifications to strengthen impact-based decision-making.
- Deliver phased findings and a final M&E plan with actionable recommendations.

USGS

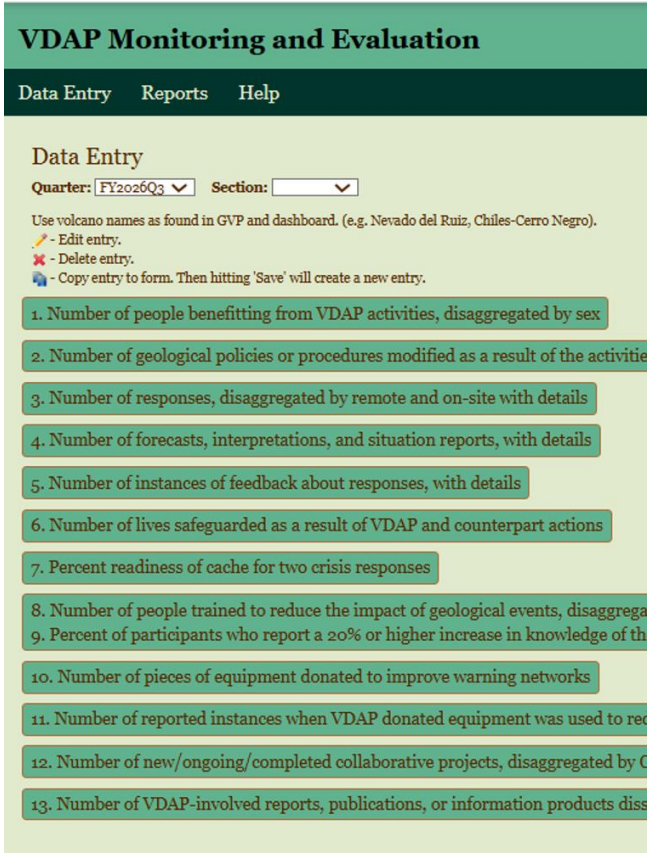
VHP Monitoring and Evaluation Plan

Why M&E for VHP?

- Monitoring: collect/review outputs & progress over time
- Evaluation: examine effectiveness & impacts
- Result: tell out story & refine strategy

M&E will assess how well monitoring, research, communication, preparedness, and response efforts reduce volcanic risk while strengthening partnerships, demonstrating public value, and improving hazard communication and risk-reduction strategies.

FY27 – planned contract for database development



USGS

VHP Monitoring and Evaluation Plan

VHP Draft Objectives

1. *Improve the quantity and quality of monitoring networks at U.S. volcanoes to match their threat rankings by implementing NVEWS, ensuring early detection of unrest and accurate and timely alerts as foundational inputs to VHP's mission to assess hazards and issue warnings to reduce loss of life and property.*

2. *Conduct research that advances knowledge of volcanic systems and hazards through innovative studies, thereby improving hazard assessment and forecasting capabilities.*

3. *Deliver outreach to stakeholders to support community preparedness through planning, coordination, and training, ensuring that both technical and non-technical communities have adequate awareness and understanding of volcanic hazards, enabling effective interpretation and use of VHP warnings and hazard assessments.*

4. *Increase observatories' capacity to maintain operational effectiveness through inter-operational preparatory actions and reliable responses during volcanic crises.*

USGS

VHP Monitoring and Evaluation Plan

VHP Draft Objectives & Potential Measures

1. *Ensure U.S. volcanoes are appropriately monitored to reduce loss of life and property*
    - Monitoring stations installed or upgraded, post unrest-event evaluations.
2. *Research to support monitoring, volcanic hazard assessment, and forecasting abilities*
    - Publications, hazard assessment components, implementation of research-derived tools or models, partners incorporating research into operational plans or decision frameworks.
3. *Support community preparedness for volcanic hazards*
    - Outreach events, communication products, stakeholder meetings, response plans, exercises w/ partners, VNS subscribers, hazard notifications, social media engagement.
4. *Ensure observatory operational effectiveness for volcanic crises*
    - Internal exercises, event-trees developed/exercised, cross-observatory (discipline) meetings, staff training (including safety), lessons incorporated from after-action reports, operational volcano response plans developed and implemented, cross-observatory cooperator outputs.

USGS

VHP Monitoring and Evaluation Plan

Cooperators and other Partners

- Partners as beneficiaries and advocates
- VHP Funds work that feed M&E measures
- VHP-specific NOFO would formalize and standardize reporting requirements for all external assistance

University of Utah Seismograph Stations
THE UNIVERSITY OF UTAH

UAF UNIVERSITY OF ALASKA FAIRBANKS

UNIVERSITY OF HAWAI'I
MĀLAMALAMA
UA MAU KE EA O KA ʻĀINA I KA PONO
1907

STATE OF ALASKA
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

USGS

University of Nevada, Reno

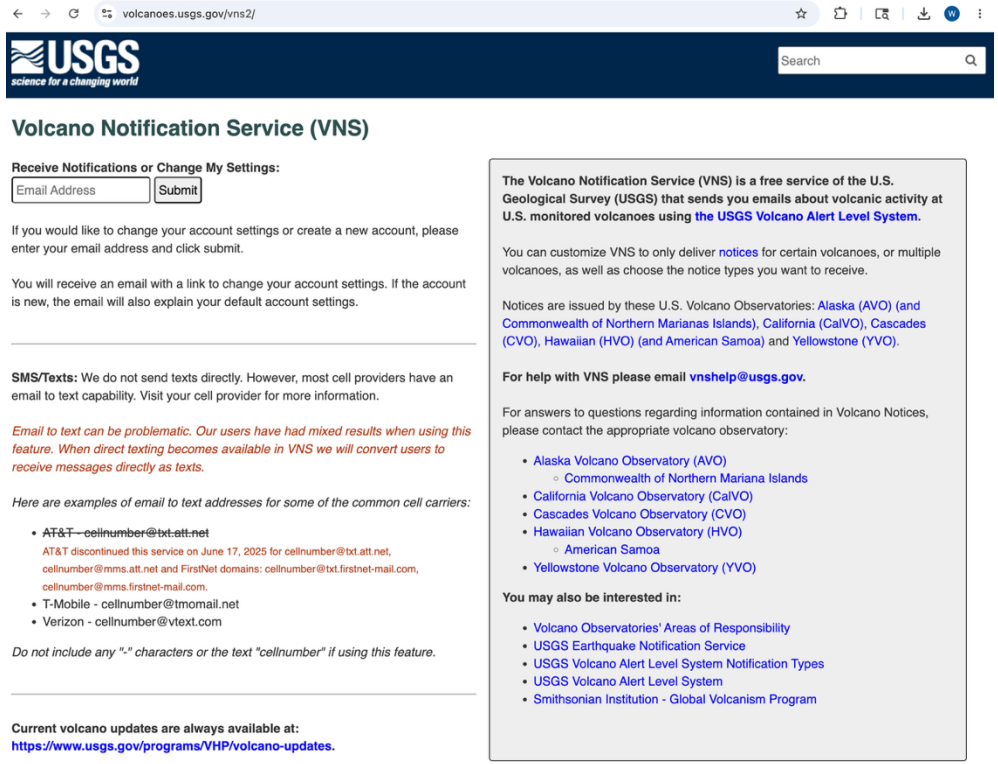
W UNIVERSITY of WASHINGTON

MONTANA STATE UNIVERSITY

Volcano Hazard Notification Assessment

Volcano Notification Service Analysis

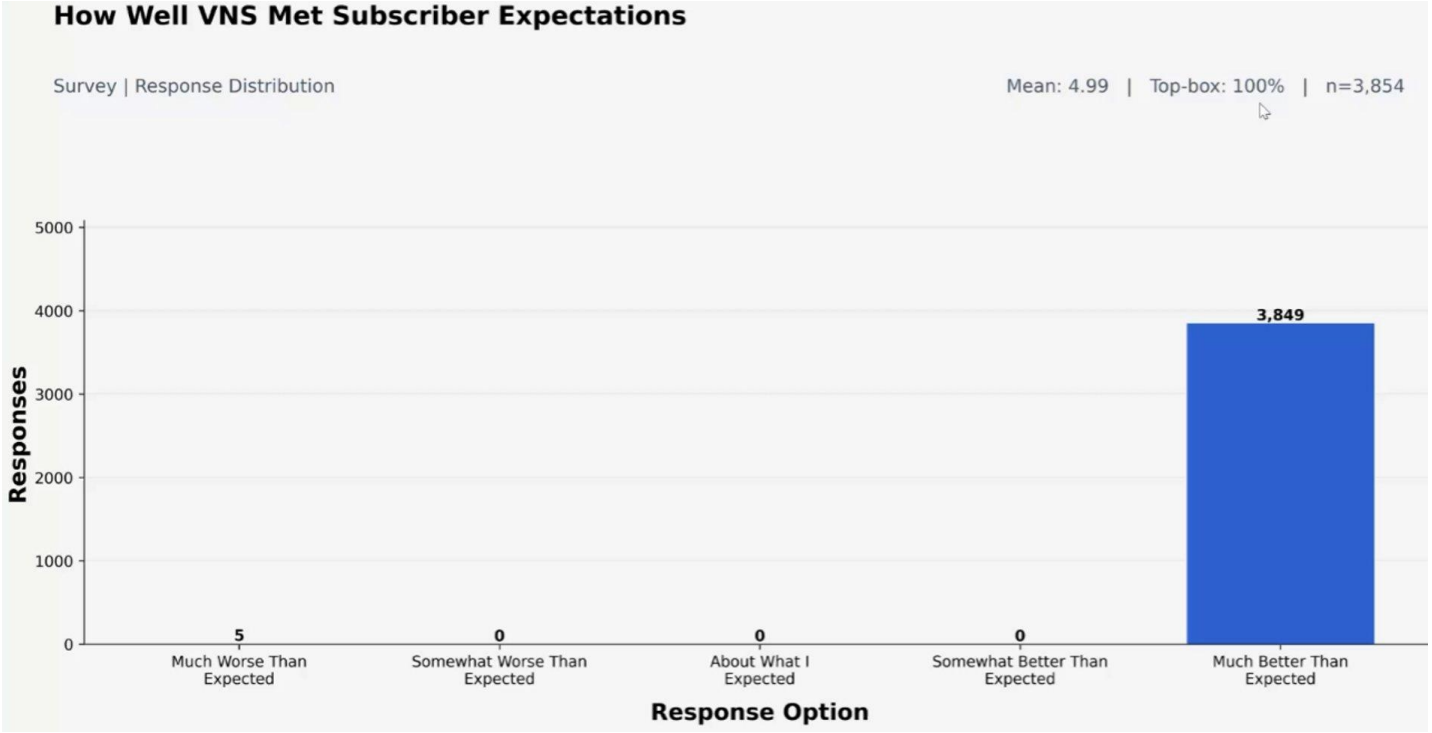
- ***Survey to >50K subscribers***
- ***14% response rate***



USGS

Volcano Hazard Notification Assessment

Preliminary Results

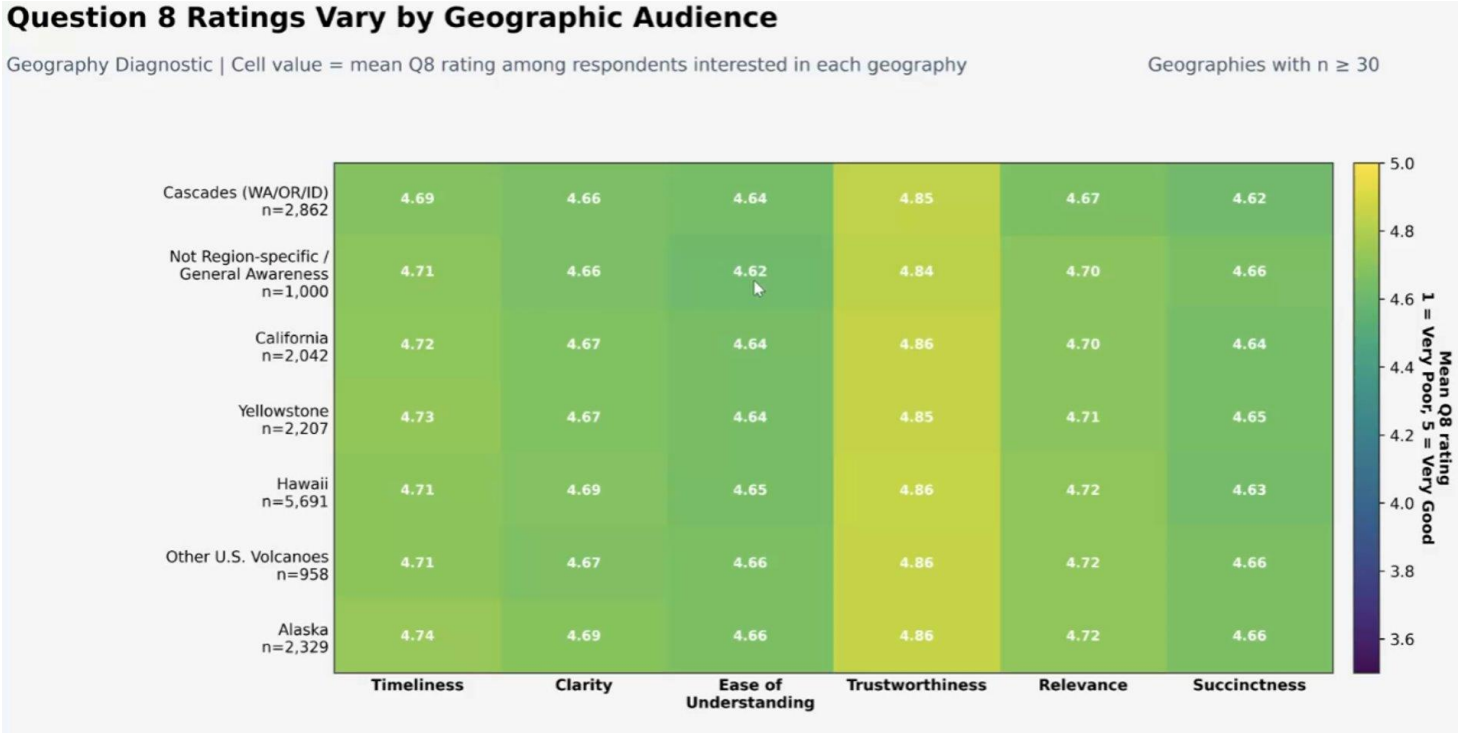


USGS

Volcano Hazard Notification Assessment

Preliminary Results

"No change, please."
- many responses



USGS

VHP Monitoring and Evaluation

Questions for the Committee

- What do you think about VHP developing an M&E Plan?
- Should cooperators be required to report on information pertaining to NVEWS in a way that is consistent with M&E?
- Does the committee have recommendations on whether—and in what ways—we should share information about the VHP M&E plan, the process used to develop it, or the results of the VNS survey?

USGS


LUNCH
Return 1:15 PM
USGS

USGS
science for a changing world

State of the USGS Volcano Science Center

Jacob Lowenstern

Volcano Science Center Acting Director

DOI/USGS/Alaska Region

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

Volcano Science Center Overview

NVEWSAC

Jake Lowenstern

Acting VSC Director

Washington, DC

June 3, 2026

Summary of Talk

- About the Center
- Recent Issues
- Science Highlights

Money Stuff: VSC Funding (net funding)

	FY26 Funding (Millions)
VHP Salary	20.3
VHP OE	2.0
State/VDAP	5.2
ERP	0.19
EHP	0.04
LHP	1.63
CMGP	0.06
NCGMP	0.19

All VSC Staff

including admin

	VSC
AVO	29
CalVO	31
CVO	64
HVO	26
Lakewood, CO	1
Woods Hole, MA	1
Washington, DC	1
Total	153

Staff funded by VHP = 138: FTE = 112

16 admin + management: Remaining are split Ops-RGE

Last year at 163,
Jan 1, 2025 at 177

CoPilot's conception of a USGS Volcanologist

Staff: Major Deficits

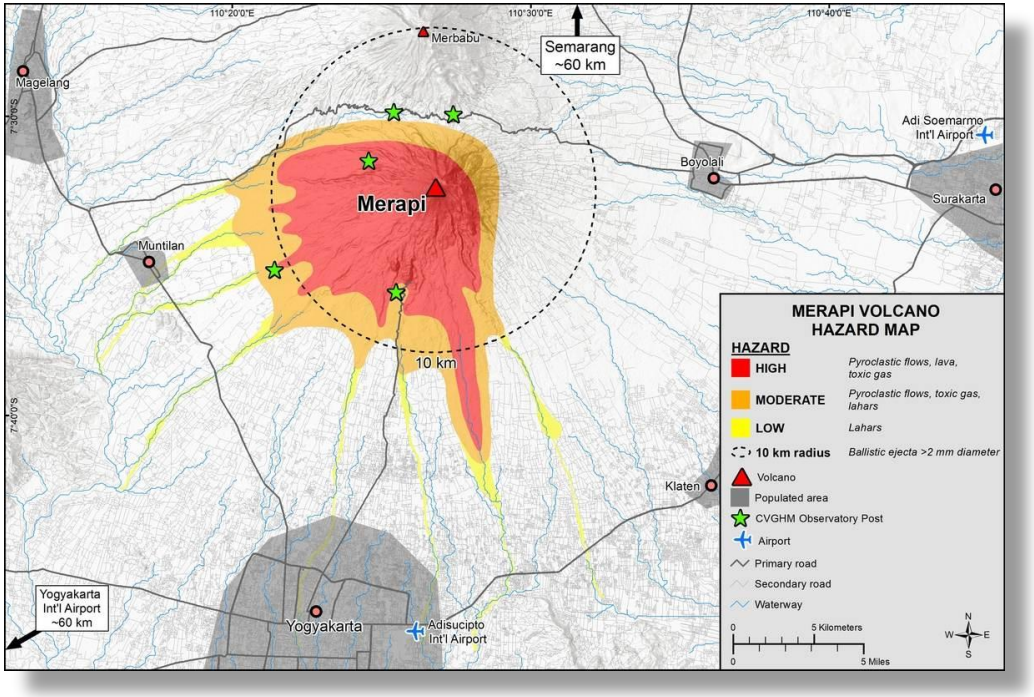
- Hydrology (lahars, volcanic sediments, field mapping of surficial deposits).
- GIS/Cartography/Map Design/Geodatabases
- CalVO has a gap in geologic mapping
- Geodesy (HVO, plus overall)
- FEIT/IT holes and term expirations w/ existing CRITICAL hiring request.
- Outreach/web/communications: None at AVO. CalVO and YVO by RGE. CVO is overcommitted. No one is really in charge.
- VDAP: Binationals & DVAR.

Kliuchevskoi Volcano: October 1994

Issues to be aware of

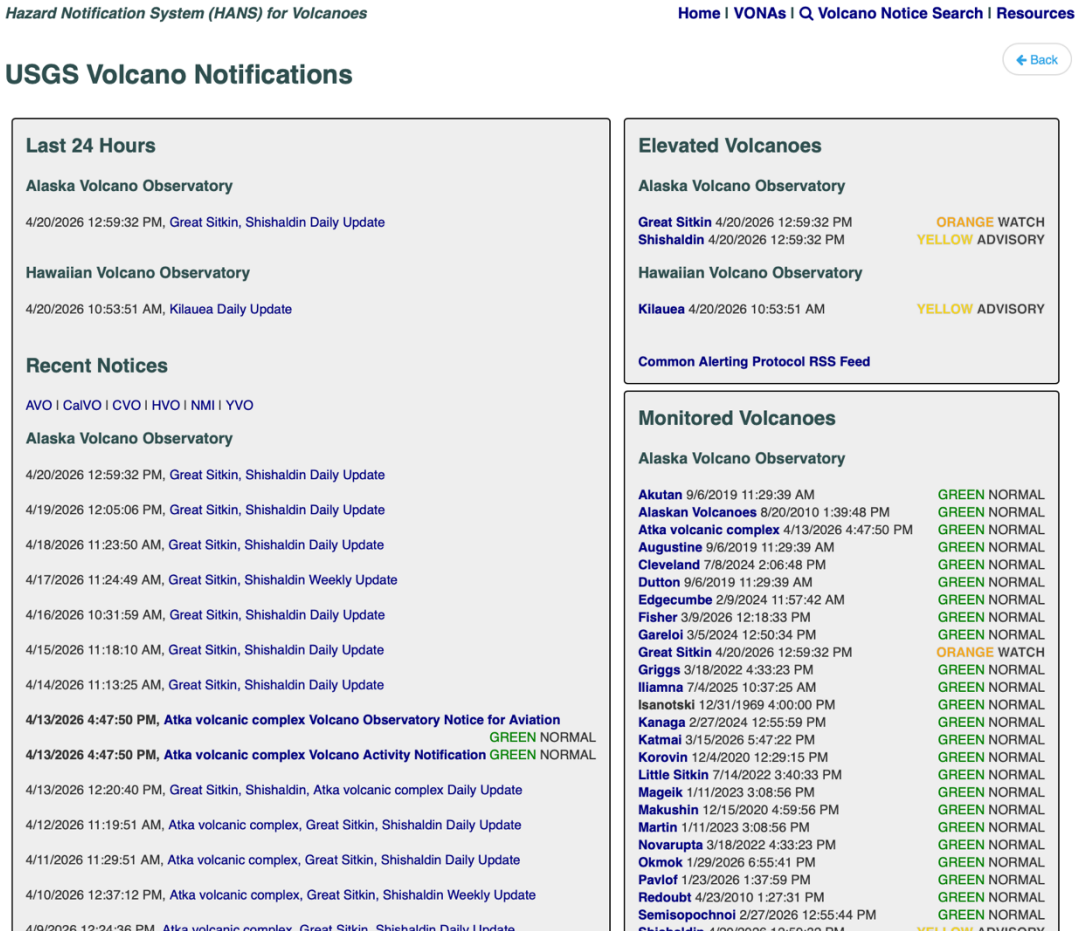
- Hiring: Freeze still on.
- Consolidation.
- Challenging to get permission for supervisory changes, 120-day promotions, changes in organizational location.
- Facilities (to be discussed)
- Purchasing (credit cards) restrictions are slowly regularizing. Travel cards too.
- Interagency agreements, cooperative agreements, etc. receive additional scrutiny.

Volcano Hazards Assessment Project (VHAP)



- Successor to NextGen Hazards Assessment Initiative.
- Project Chief is Michelle Coombs.
- Provides strong direction for the “Pilot Projects.”
- Enables Steering Committee to formalize best practices.
- Source of funds outside of VOs.
- Can supervise future hires needed to implement products (e.g., GIS, cartography).

Hazard Notifications System (HANS)



Hazard Notification System (HANS) for Volcanoes

Home | VONAs | Volcano Notice Search | Resources

Back

USGS Volcano Notifications

Last 24 Hours

Alaska Volcano Observatory

4/20/2026 12:59:32 PM, Great Sitkin, Shishaldin Daily Update

Hawaiian Volcano Observatory

4/20/2026 10:53:51 AM, Kilauea Daily Update

Recent Notices

AVO | CalVO | CVO | HVO | NMI | YVO

Alaska Volcano Observatory

4/20/2026 12:59:32 PM, Great Sitkin, Shishaldin Daily Update

4/19/2026 12:05:06 PM, Great Sitkin, Shishaldin Daily Update

4/18/2026 11:23:50 AM, Great Sitkin, Shishaldin Daily Update

4/17/2026 11:24:49 AM, Great Sitkin, Shishaldin Weekly Update

4/16/2026 10:31:59 AM, Great Sitkin, Shishaldin Daily Update

4/15/2026 11:18:10 AM, Great Sitkin, Shishaldin Daily Update

4/14/2026 11:13:25 AM, Great Sitkin, Shishaldin Daily Update

4/13/2026 4:47:50 PM, Atka volcanic complex Volcano Observatory Notice for Aviation GREEN NORMAL

4/13/2026 4:47:50 PM, Atka volcanic complex Volcano Activity Notification GREEN NORMAL

4/13/2026 12:20:40 PM, Great Sitkin, Shishaldin, Atka volcanic complex Daily Update

4/12/2026 11:19:51 AM, Atka volcanic complex, Great Sitkin, Shishaldin Daily Update

4/11/2026 11:29:51 AM, Atka volcanic complex, Great Sitkin, Shishaldin Daily Update

4/10/2026 12:37:12 PM, Atka volcanic complex, Great Sitkin, Shishaldin Weekly Update

Elevated Volcanoes

Alaska Volcano Observatory

Great Sitkin 4/20/2026 12:59:32 PM — ORANGE WATCH
Shishaldin 4/20/2026 12:59:32 PM — YELLOW ADVISORY

Hawaiian Volcano Observatory

Kilauea 4/20/2026 10:53:51 AM — YELLOW ADVISORY

Common Alerting Protocol RSS Feed

Monitored Volcanoes

Alaska Volcano Observatory

Akutan 9/6/2019 11:29:39 AM	GREEN NORMAL
Alaskan Volcanoes 8/20/2010 1:39:48 PM	GREEN NORMAL
Atka volcanic complex 4/13/2026 4:47:50 PM	GREEN NORMAL
Augustine 9/6/2019 11:29:39 AM	GREEN NORMAL
Cleveland 7/8/2024 2:06:48 PM	GREEN NORMAL
Dutton 9/6/2019 11:29:39 AM	GREEN NORMAL
Edgecumbe 2/9/2024 11:57:42 AM	GREEN NORMAL
Fisher 3/9/2026 12:18:33 PM	GREEN NORMAL
Gareloi 3/5/2024 12:50:34 PM	GREEN NORMAL
Great Sitkin 4/20/2026 12:59:32 PM	ORANGE WATCH
Griggs 3/18/2022 4:33:23 PM	GREEN NORMAL
Iliamna 7/4/2025 10:37:25 AM	GREEN NORMAL
Isanotski 12/31/1969 4:00:00 PM	GREEN NORMAL
Kanaga 2/27/2024 12:55:59 PM	GREEN NORMAL
Katmai 3/15/2026 5:47:22 PM	GREEN NORMAL
Korovin 12/4/2020 12:29:15 PM	GREEN NORMAL
Little Sitkin 7/14/2022 3:40:33 PM	GREEN NORMAL
Mageik 1/11/2023 3:08:56 PM	GREEN NORMAL
Makushin 12/15/2020 4:59:56 PM	GREEN NORMAL
Martin 1/11/2023 3:08:56 PM	GREEN NORMAL
Novarupta 3/18/2022 4:33:23 PM	GREEN NORMAL
Okmok 1/29/2026 6:55:41 PM	GREEN NORMAL
Pavlof 1/23/2026 1:37:59 PM	GREEN NORMAL
Redoubt 4/23/2010 1:27:31 PM	GREEN NORMAL
Semisopochnoi 2/27/2026 12:55:44 PM	GREEN NORMAL

- Releasing new VONA format
- HVO was first volcano observatory in the world to issue a VONA in the new format at RED!
- Alert Format
  - Synopsis will automatically lead each notification.
  - Synopsis now increasing to 280 characters.
- VONAs now can be released without triggering VAN.
- First NWS Ashfall advisory.
- Looking forward to seeing the recommendations from the VHP contractor.

Facilities

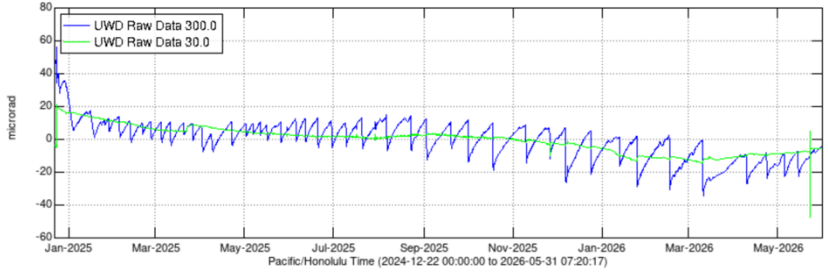
- Major new facilities to be run by VSC.
- Lots of unknowns in terms of available funding through facility budget.
- Unclear what other federal staff could/should be invited.
- Unique costs associated with building maintenance.
- No permissions yet to hire support staff.
- Also need facilities support for Moffett (combined with other science centers who operate out of there).

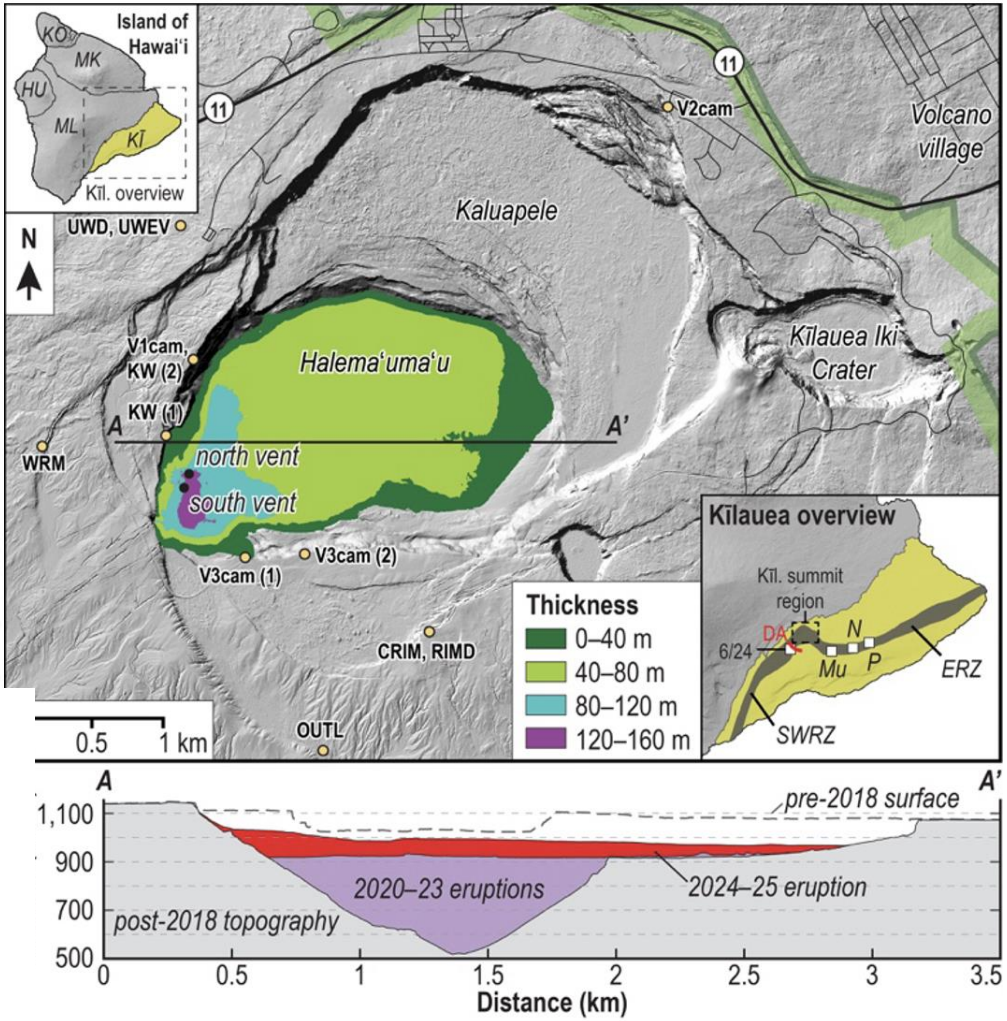
Science Highlights

- Just finished Episode 48.
- Started on Dec. 23, 2024 (527 days)

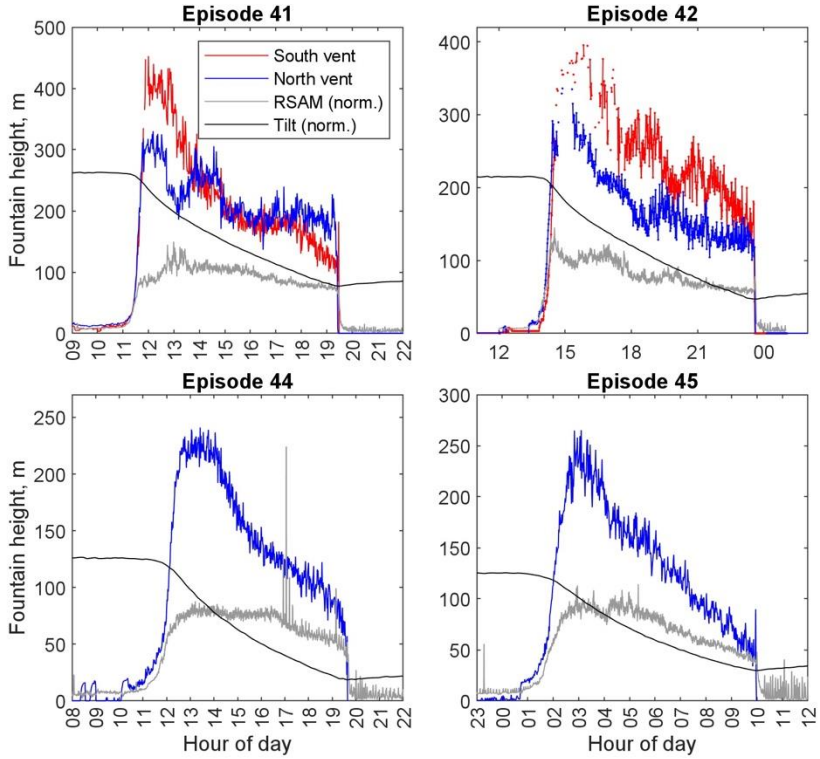
On average, an eruption every 11 days

- Eruptions can be forecast with tilt (and other parameters)
- RSAM tracks overflows.





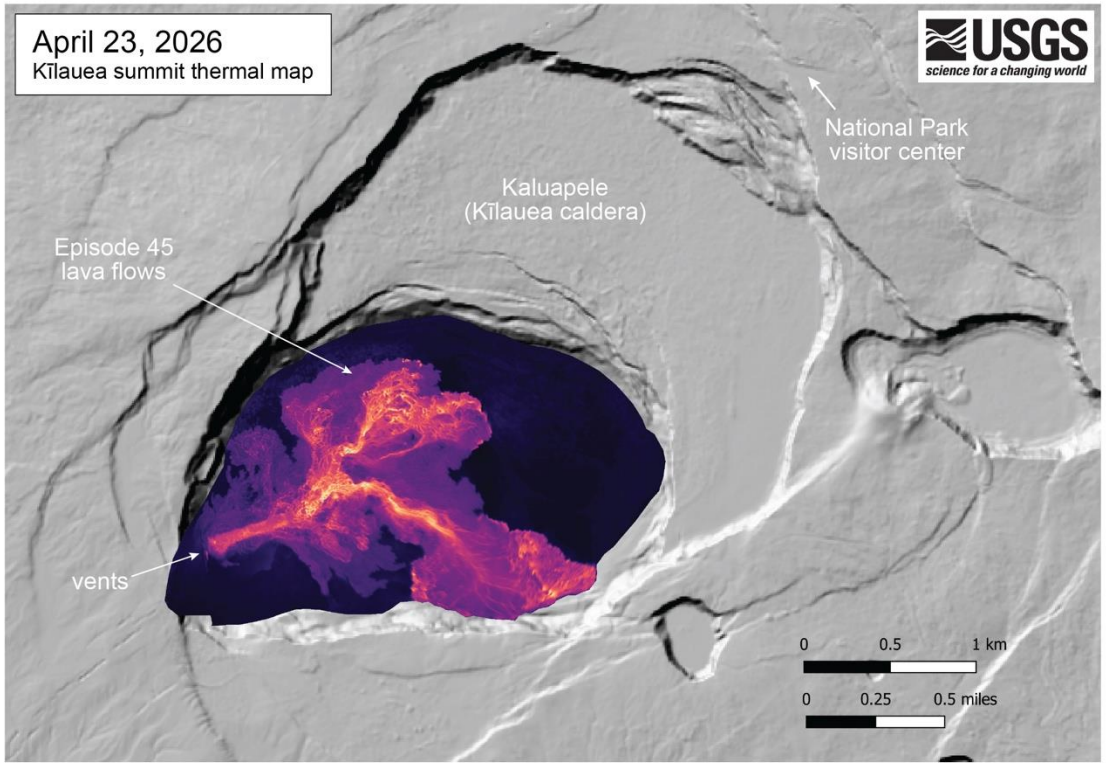
Science Highlights



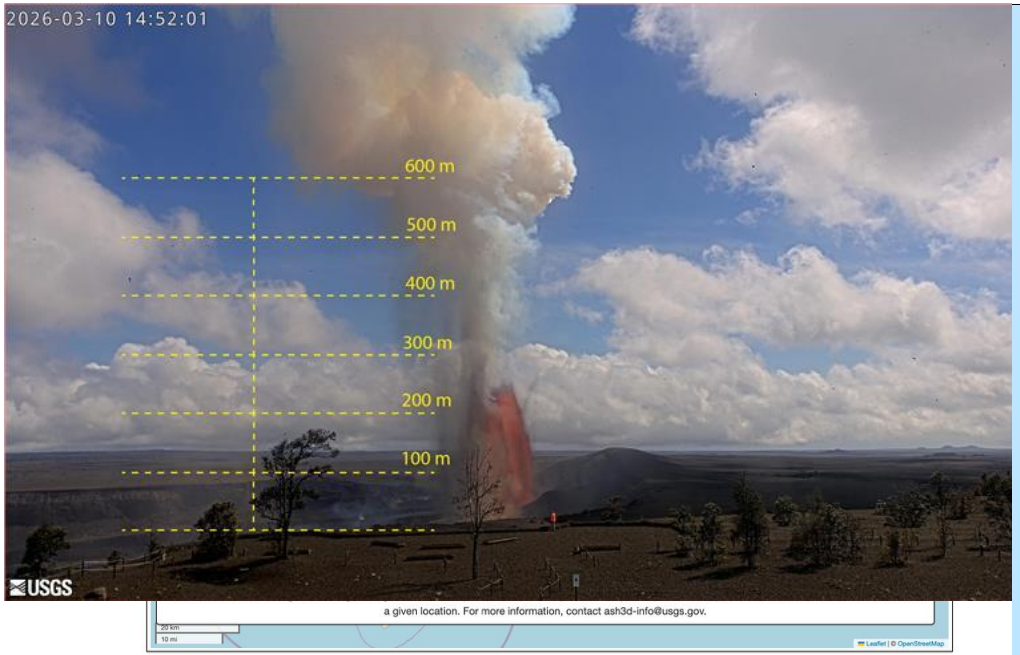
- Tilt and tilt slope allow for quantification of mass discharge rate and total mass erupted.

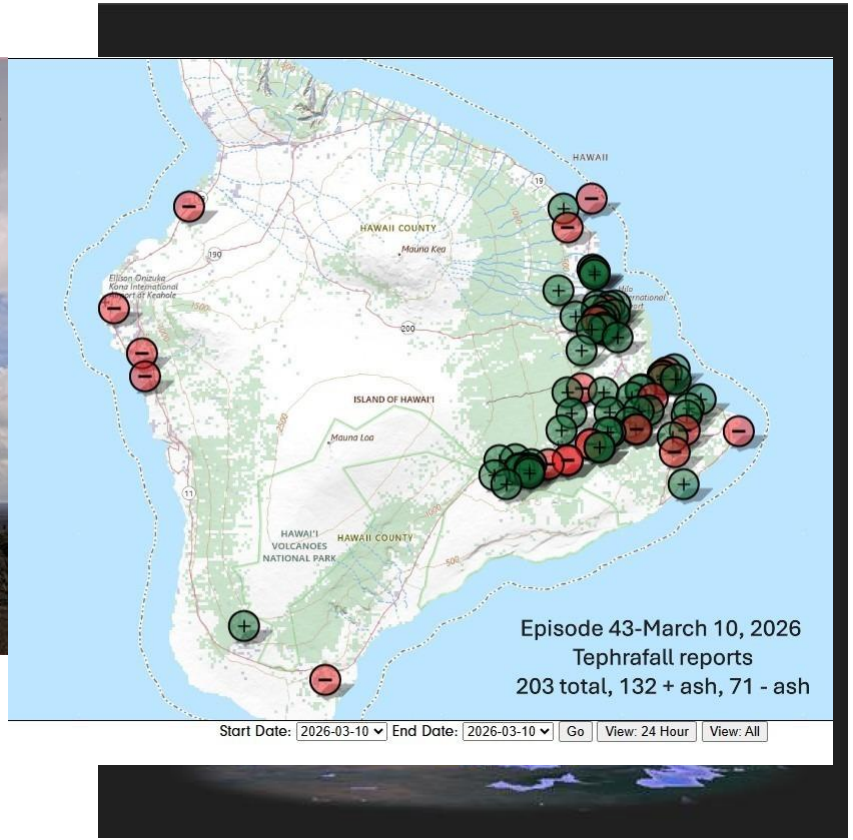
Science Highlights

- Stitched together from multiple helicopter-based FLIR images.
- Shows Episode 45 coverage.

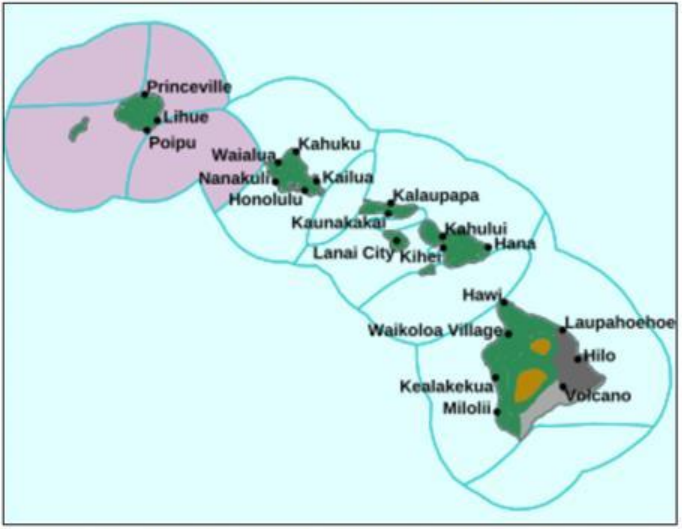


Science Highlights





Click a location below for detailed forecast.



Watches, Warnings & Advisories

Zoom Out

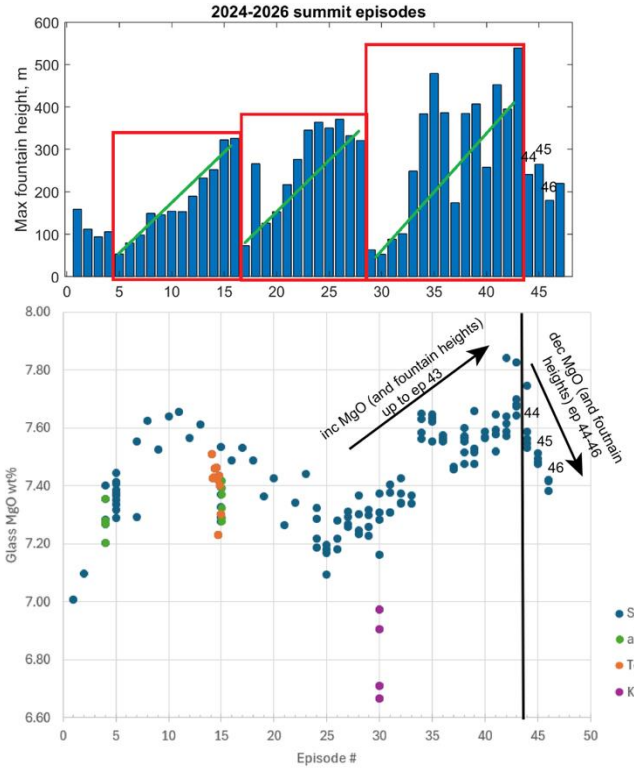
- Ashfall Warning
- Ashfall Advisory
- Small Craft Advisory
- Flood Watch
- High Wind Watch
- Special Weather Statement

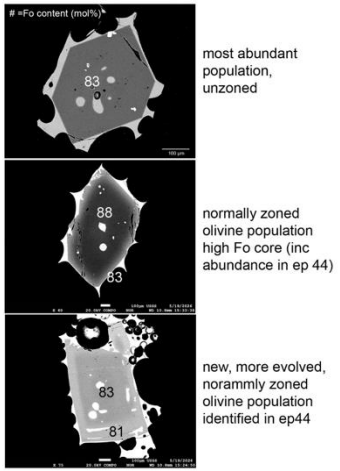
Last Map Update: Tue, Mar 10, 2026 at 1:36:19 pm HST

```
National Weather Service Honolulu HI
130 PM HST Tue Mar 10 2026

HIZ053-110300-
/O.CAN.PHFO.AF.W.0002.000000T0000Z-260311T0300Z/
/O.NEW.PHFO.AF.Y.0005.260310T2330Z-260311T0300Z/
Big Island East-
130 PM HST Tue Mar 10 2026

...ASHFALL ADVISORY IN EFFECT UNTIL 5 PM THIS AFTERNOON NORTH AND
EAST OF VOLCANOES NATIONAL PARK, INCLUDING MOUNTAIN VIEW, GLENWOOD,
KEAAU AND HILO...

* WHAT...Kilauea is undergoing a minor eruption where the public
  will be affected by a limited hazard extent such as less than
```

Science Highlights

- Cycles in fountain height.
- Changes in glass chemistry
- New, more-evolved crystals when eruptions drop in volume.





Science Highlights

Yellowstone

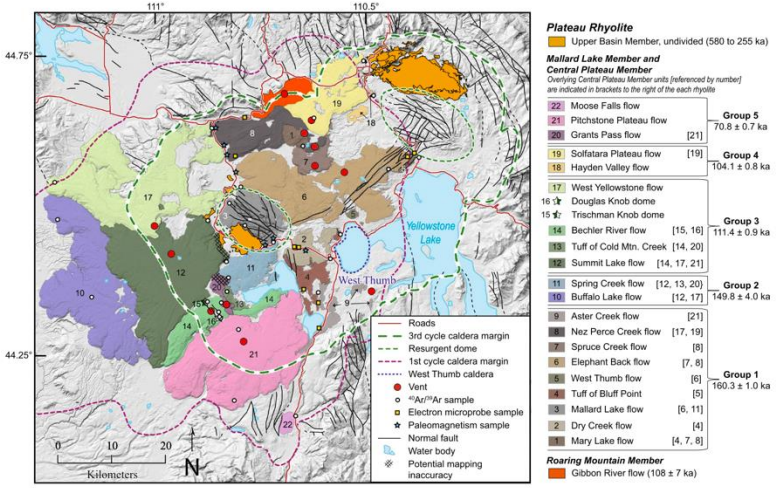
Bulletin of Volcanology (2023) 85:55
https://doi.org/10.1007/s00445-023-01665-w

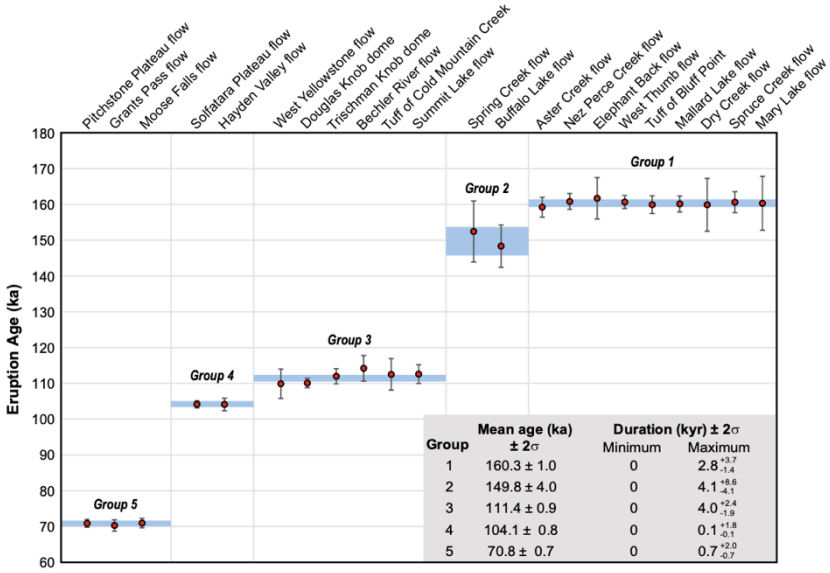
RESEARCH ARTICLE

Spatio-temporal clustering of post-caldera eruptions at Yellowstone caldera: implications for volcanic hazards and pre-eruptive magma reservoir configuration

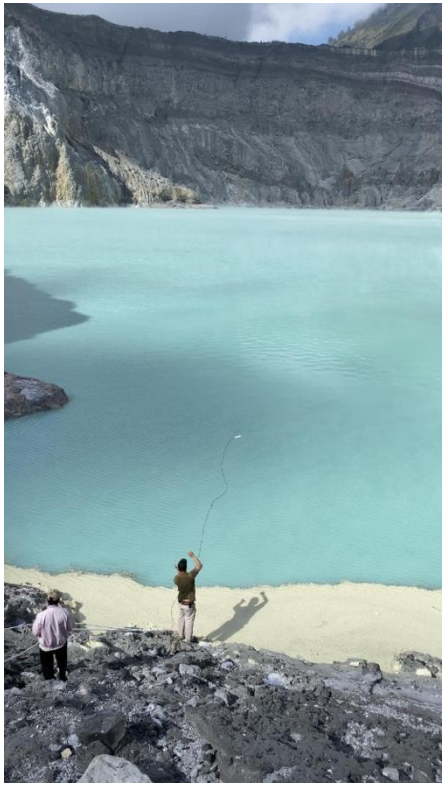
Mark E. Stelten[1] · Nicole Thomas[1] · Anthony Pivarunas[1] · Duane Champion[1]

Received: 3 February 2023 / Accepted: 11 August 2023 / Published online: 12 September 2023





Monitoring Lakes



Ijen: Eastern Java

Table 2. Chemical compatibility of sensor-cover assembly and cable materials

Component	Material	Expected Chemical Compatibility	Expected Performance in Kawah Ijen Lake	Notes
Sensor Cover	PTFE Teflon	Excellent	Safe choices for continuous immersion. Very low chemical attack expected even in hot mixed mineral acids.	Minimal degradation expected; mechanical creep possible (loosening of threaded connection to gland connector) but not chemical failure.
Gland connector	PVDF (Polyvinylidene fluoride)	Excellent to Very Good	Very strong resistance to acidic oxidizing environments and hot mineral acids. Common industrial choice for aggressive acid service.	Slight long-term surface aging possible in ultra-low-pH mixed-acid environments, but generally highly suitable.
Gland connector O-ring and gland seal	FKM Rubber (Viton fluoroelastomer)	Good to Very Good	Better acid resistance than most elastomers.	Gradual hardening and permeation possible in hot concentrated acid brines.
Temperature sensor cable jacket	Santoprene (TPV thermoplastic vulcanizate)	Fair/Unknown	Good compatibility with dilute sulfuric acid (10%) alone, but uncertain long-term durabilty in mixed-acid volcanic lake chemistry.	Swelling, embrittlement, softening, and loss of mechanical properties over time in strong acids.

All chemical compatibility data from: https://pumpport.com/en/chemical-compatibility-chart/

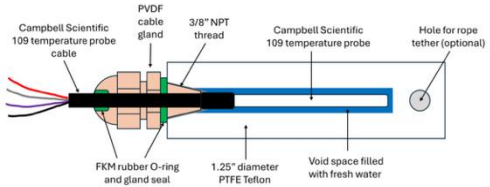


Figure 6. Cartoon cross section schematic of temperature sensor cover. Not drawn accurately to scale.

Daily Volcano Activity Report (VDAP)

Semeru (Indonesia) | Continuing eruption *Cite this Report*

Semeru
Sunda Volcanic Arc

The Center for Volcanology and Geological Hazard/Pusat Vulkanologi dan Mitigasi Bencana Geologi (CVGHM/PVMBG) reported that the eruption continued at Semeru on 28 May 2026 (local). There were 73 explosions reported, with plumes rising to a maximum of 1,500 m (4,921 ft) above the vent. Seismicity related to pyroclastic density currents was recorded 1 times. The alert level remained at "Level 3 - Standby" (on a 4-level scale). Activity also included: seismically detected pyroclastic density current(s) (PDCs).

Observatory Alert Level: "Level 3 - Standby" (on a 4-level scale)
Aviation Alert Level: unavailable or not collected

Source: Center for Volcanology and Geological Hazard/Pusat Vulkanologi dan Mitigasi Bencana Geologi (CVGHM/PVMBG)

Underlying database includes:
Seismic Events
Alert Level Changes
Explosions
Plume Heights
Gas Release
Potential for many other attributes

Remote Sensing Copy to Clipboard

Volcano	Country	Report Time	Sender	Summary	Attachments
Central Bismarck ...	Papua New Guinea	2026-05-27T21:09...	griswold@usgs.gov	View	View Image View Image
Central Bismarck ...	Papua New Guinea	2026-05-22T16:51...	rwessels@usgs.gov	View	View Image View Image View Image

VAA List

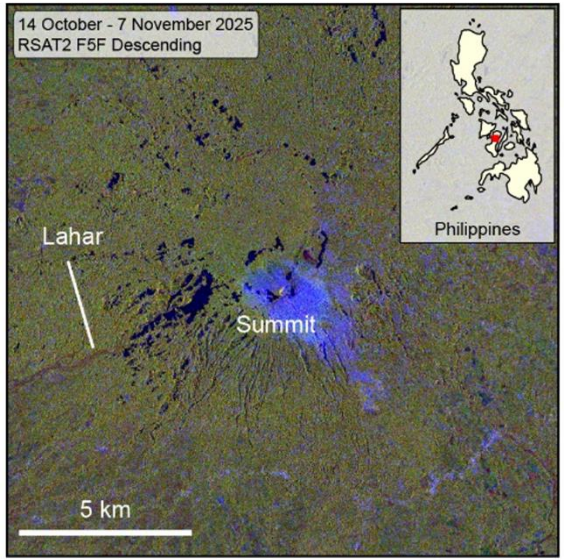
Volcano	Location	Report Time	Aviation Code	Height At Sea Level	Raw Text
Aira	Tokyo	2026-05-22T05:5...		5486	View
Purace	Washington	2026-05-24T04:12...			View
Sangay - Ecuador	Washington	2026-05-25T06:2...			View

Science Highlights

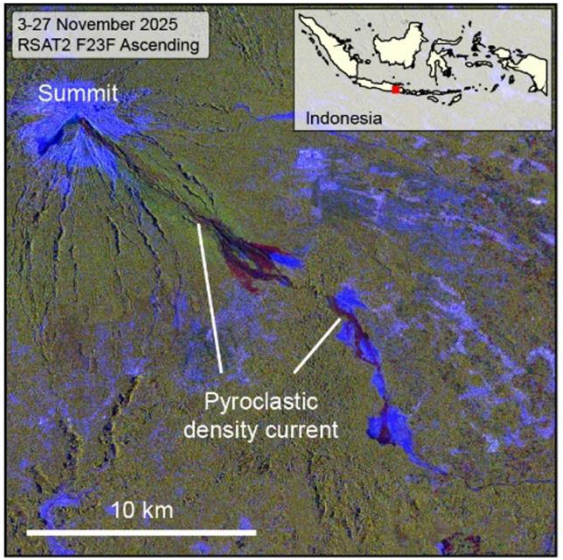
International

Cross-polarized SAR analysis: VFM Operationalizing Poland (2022)

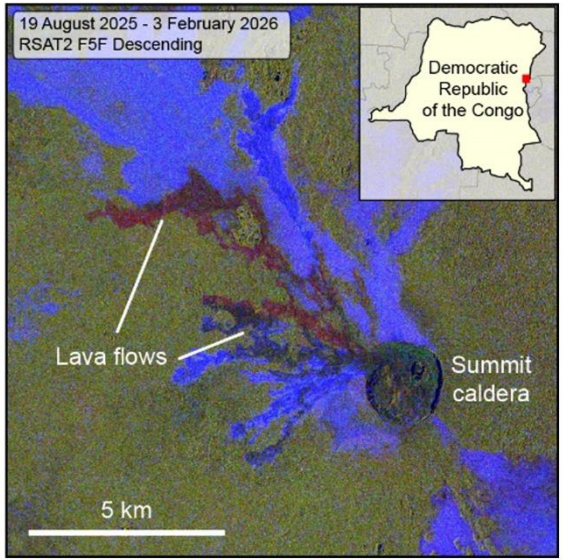
Kanlaon



Semeru



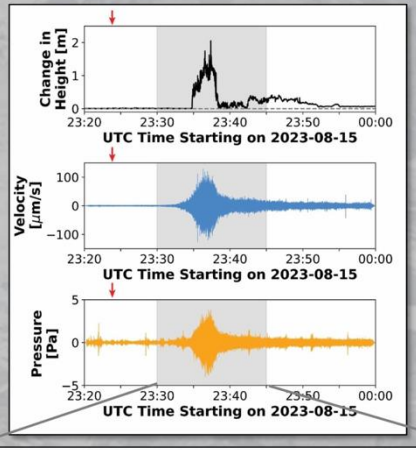
Nyamulagira



Science Highlights (RLDS)

Field Scale: New Technology

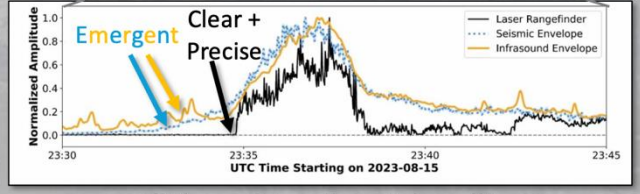
Laser rangefinder as an alternative to tripwires



Laser Rangefinder

Seismic

Infrasound



[Iezzi et al., 2024]

All three datasets match well!

USGS science for a changing world

USGS
science for a changing world

NVEWS and the National Volcano Information System (NVIS) Update

Seth Moran

NVEWS Manager

DOI/USGS/Alaska Region/Volcano Science Center

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

State of NVEWS, 06/03/2026

Seth Moran – NVEWS Program Manager, VSC Deputy Director, and acting CVO SIC

Tracking completion status

09/01/2025

Volcano	Threat Level	Threat Ranking	Observatory	Network Area (km2)	Polygon dimensions (km x km or km if radius)	# Seismic sites	Target # (12-20 VHT, 6-8 HT)	Revised # of sites (overlapped for)	Revised target (overlapped for)	% Complete (overlapped for	# GNSS	Target # (16-20 VHT, 7-10 HT)	Revised # of sites (overlapped for)	Revised target (overlapped for)	% Complete (overlapped for)	# Cameras	Target #	% Complete	# Infrasound sites	Target #	% Complete	# Tilt	Target #	% Complete	# real-time gas sites	Target #	% Complete	Network completion %
Kilauea	Very High	1	HVO	1,443		38	48	38	48	79%	54	60	54	60	90%	18	21	86%	3	3	100%	10	10	100%	18	10	95%	88%
MSH	Very High	2	CVO		20	27	27	27	27	100%	24	24	24	24	100%	3	4	75%	4	6	67%	4	6	67%	2	2	100%	93%
Rainier	Very High	3	CVO		25	22	24	22	24	92%	6	9	6	9	67%	4	6	67%	12	14	86%	1	2	50%	0	0	100%	82%
Redoubt	Very High	4	AVO		20	8	10	8	10	80%	4	8	4	8	50%	3	5	60%	3	5	60%	0	0	100%	0	1	0%	62%
Shasta	Very High	5	CalVO		20	7	10	7	10	70%	7	8	7	8	88%	0	1	0%	0	2	0%	0	0	100%	0	0	100%	67%
Hood	Very High	6	CVO		20	12	12	12	12	100%	7	10	7	10	70%	2	4	50%	4	6	67%	0	0	100%	0	1	0%	76%
Three Sisters	Very High	7	CVO	1200		5	12	5	12	42%	4	8	4	8	50%	1	1	100%	0	3	0%	0	0	100%	0	0	100%	42%
Akutan	Very High	8	AVO		20	11	12	11	12	92%	12	12	12	12	100%	5	5	100%	1	6	17%	4	4	100%	0	2	0%	80%
Makushin	Very High	9	AVO		20	7	15	7	15	47%	3	8	3	8	38%	1	5	20%	3	8	38%	0	0	100%	0	4	0%	35%
Spurr	Very High	10	AVO		20	13	18	13	18	72%	4	8	4	8	50%	1	5	20%	5	9	56%	0	0	100%	1	1	100%	59%
Lassen Center	Very High	11	CalVO	3,475		7	12	7	12	58%	8	8	8	8	100%	0	1	0%	0	2	0%	0	0	100%	1	2	50%	64%
Augustine	Very High	12	AVO		20	11	15	11	15	73%	11	11	11	11	100%	2	5	40%	3	8	38%	0	0	100%	0	2	0%	66%
Newberry	Very High	13	CVO		25	13	16	13	16	81%	9	12	9	12	75%	0	1	0%	3	6	50%	0	0	100%	0	0	100%	71%
Baker	Very High	14	CVO		20	2	10	2	10	20%	0	8	0	8	0%	1	1	100%	0	4	0%	0	0	100%	0	1	0%	13%
Glacier Peak	Very High	15	CVO		20	1	8	1	8	13%	0	6	0	6	0%	0	1	0%	0	4	0%	0	0	100%	0	0	100%	5%
Mauna Loa	Very High	16	HVO	5,157		20	40	20	40	50%	34	38	34	38	89%	8	18	44%	1	3	33%	6	7	86%	2	3	67%	65%
Crater Lake	Very High	17	CVO		20	4	8	4	8	50%	4	6	4	6	67%	0	1	0%	0	4	0%	0	2	0%	0	0	100%	38%
Long Valley	Very High	18	CalVO		20	24	24	24	24	100%	23	26	23	26	88%	0	1	0%	0	0	100%	0	0	100%	0	0	100%	92%
Okmok	High	19	AVO		20	10	13	10	13	77%	8	8	8	8	100%	2	4	50%	1	7	14%	0	0	100%	0	0	100%	66%
Iliamna	High	20	AVO		20	7	8	7	8	88%	0	4	0	4	0%	2	4	50%	1	4	25%	0	0	100%	0	0	100%	50%
Yellowstone	High	21	YVO		50	48	50	48	50	96%	17	19	17	19	89%	1	1	100%	3	5	60%	5	5	100%	1	1	100%	93%
Aniakchak	High	22	AVO		20	6	10	6	10	60%	2	5	2	5	40%	1	4	25%	1	5	20%	0	0	100%	0	0	100%	42%
Hualalai	High	23	HVO	805		5	13	5	13	38%	1	3	1	3	33%	1	3	33%	0	1	0%	0	3	0%	0	1	0%	29%
Mono	High	24	CalVO		20	5	8	5	8	63%	5	8	5	8	63%	0	1	0%	0	2	0%	0	0	100%	0	0	100%	53%
Martin	High	25	AVO		20	7	8	7	8	88%	0	8	0	8	0%	2	4	50%	0	4	0%	0	0	100%	0	0	100%	38%
Mageik	High	26	AVO		20	9	9	0	0	100%	0	8	0	0	100%	2	4	50%	0	4	0%	0	0	100%	0	0	100%	44%
Trident	High	27	AVO		20	8	8	8	8	100%	0	8	0	8	0%	2	4	50%	0	4	0%	0	0	100%	0	0	100%	42%
Katmai	High	28	AVO		20	8	9	0	1	0%	0	8	0	2	0%	2	4	50%	0	4	0%	0	0	100%	0	0	100%	40%
Veniaminof	High	29	AVO		20	8	8	8	8	100%	0	4	0	4	0%	1	4	25%	3	4	75%	0	0	100%	0	0	100%	60%
Atka	High	30	AVO		20	7	8	0	0	100%	1	4	0	0	100%	1	4	25%	4	4	100%	0	0	100%	0	1	0%	62%
Korovin	High	31	AVO		20	7	8	7	8	88%	1	4	1	4	25%	1	4	25%	4	4	100%	0	0	100%	0	1	0%	62%
Shishaldin	High	32	AVO		20	6	8	6	8	75%	6	6	6	6	100%	2	4	25%	3	4	75%	3	3	100%	0	3	0%	71%
Clear Lake	High	33	CalVO	2,799		12	12	12	12	100%	2	8	2	8	25%	0	1	0%	0	2	0%	0	0	100%	0	0	100%	61%
Adams	High	34	CVO		20	2	12	2	12	17%	0	8	0	8	0%	0	1	0%	0	2	0%	0	0	100%	0	0	100%	9%
Hayes	High	35	AVO		20	0	6	0	6	0%	0	4	0	4	0%	0	1	0%	0	3	0%	0	0	100%	0	0	100%	0%
Westdahl	High	36	AVO		20	6	8	6	8	75%	7	8	7	8	88%	0	4	0%	0	4	0%	5	5	100%	0	0	100%	62%
Novarupta	High	37	AVO		20	8	8	0	0	100%	0	8	0	0	100%	2	4	50%	0	4	0%	0	0	100%	0	0	100%	42%
Churchill	High	38	AVO		20	0	8	0	8	0%	0	4	0	4	0%	0	4	0%	0	4	0%	0	0	100%	0	0	100%	0%
Kanaga	High	39	AVO		20	6	8	6	8	75%	0	4	0	4	0%	1	4	25%	1	4	25%	0	0	100%	0	0	100%	40%
Ugashik-Peulik	High	40	AVO		20	4	8	4	8	50%	0	4	0	4	0%	1	4	25%	1	4	25%	0	0	100%	0	0	100%	30%
Pavlof	High	41	AVO		20	7	8	7	8	88%	0	4	0	4	0%	4	4	100%	6	6	100%	0	0	100%	0	3	0%	68%
Mount Griggs	High	42	AVO		20	7	8	0	1	0%	0	8	0	2	0%	2	4	50%	0	4	0%	0	0	100%	0	0	100%	38%
Kaguyak	High	43	AVO		20	1	8	1	8	13%	0	8	0	8	0%	0	1	0%	0	2	0%	0	0	100%	0	0	100%	5%
Pagan	High	44	AVO/CNMI		20	0	8	0	8	0%	0	4	0	4	0%	0	2	0%	0	4	0%	0	0	100%	0	0	100%	0%
Medicine Lake	High	45	CalVO		30	4	8	4	8	50%	3	8	3	8	38%	0	0	100%	0	0	100%	0	0	100%	0	0	100%	44%
Great Sitkin	High	46	AVO		20	6	8	6	8	75%	2	4	2	4	50%	2	4	50%	1	4	25%	0	0	100%	0	0	100%	55%
Kasatochi	High	47	AVO		20	0	5	0	5	0%	0	4	0	4	0%	0	4	0%	0	3	0%	0	0	100%	0	0	100%	0%
Cleveland	High	48	AVO		20	5	8	5	8	63%	2	4	2	4	50%	1	4	25%	2	4	50%	0	0	100%	2	2	100%	55%
Moffett	High	49	AVO		20	1	8	1	8	13%	0	4	0	4	0%	0	4	0%	0	4	0%	0	0	100%	0	0	100%	5%
Seguam	High	50	AVO		20	0	8	0	8	0%	0	4	0	4	0%	0	4	0%	0	4	0%	0	0	100%	0	0	100%	0%
Fisher Caldera	High	51	AVO		20	3	8	0	1	0%	3	8	3	7	43%	0	4	0%	1	4	25%	2	2	100%	0	0	100%	35%
Snowy	High	52	AVO		20	3	8	3	8	38%	0	8	0	8	0%	2	4	50%	0	4	0%	0	0	100%	0	0	100%	21%
Fourpeaked	High	53	AVO		20	1	8	1	8	13%	0	4	0	4	0%	0	4	0%	1	4	25%	0	0	100%	0	0	100%	10%
Douglas	High	54	AVO		20	1	8	0	2	0%	0	4	0	2	0%	0	4	0%	1	4	25%	0	0	100%	0	0	100%	10%
Semisopochnoi	High	55	AVO		20	6	8	6	8	75%	0	6	0	6	0%	2	4	50%	3	4	75%	0	0	100%	0	0	100%	50%
Salton Buttes	High	56	CalVO		20	6	8	6	8	75%	9	16	9	16	56%	0	1	0%	0	2	0%	0	0	100%	0	0	100%	56%
Agrigan	High	57	AVO/CNMI		20	0	8	0	8	0%	0	4	0	4	0%	0	2	0%	0	4	0%	0	0	100%	0	0	100%	0%
Edgecumbe	Moderate(?)	58	AVO		20	4	8	4	8	50%	4	8	4	8	50%	0	4	0%	0	2	0%	0	0	100%	0	0	100%	36%
American Samoa	Low(?)	999	HVO	199	20	4	5	4	5	80%	2	2	2	2	100%	0	1	0%	0	1	0%	0	0	100%	0	0	100%	67%
Totals:						470	705	427	652	65%	289	527	288	492	59%	86	217	40%	79	240	33%	40	49	82%	27	50	54%	56%

- **Monitoring networks; how close are we to "done"?**

09/2024

# Seismic sites	Target # (12-20 VHT, 6-8 HT)	% Complete	# GNSS	Target # (16-20 VHT, 7-10 HT)	% Complete	# Cameras	Target #	% Complete	# Infrasound sites	Target #	% Complete	# Tilt	Target #	% Complete	# real-time gas sites	Target #	% Complete	Network completion %
460	704	65%	288	527	55%	86	217	40%	76	240	32%	40	49	82%	26	66	39%	**54%**

07/2025

# Seismic sites	Target # (12-20 VHT, 6-8 HT)	Revised # of sites (overlap accounted for)	Revised target (overlap accounted for)	% Complete (overlap accounted for	# GNSS	Target # (16-20 VHT, 7-10 HT)	Revised # of sites (overlap accounted for)	Revised target (overlap accounted for)	% Complete (overlap accounted for)	# Cameras	Target #	% Complete	# Infrasound sites	Target #	% Complete	# Tilt	Target #	% Complete	# real-time gas sites	Target #	% Complete	Network completion %
460	704	417	651	64%	288	527	287	492	58%	86	217	40%	76	240	32%	40	49	82%	26	50	52%	**55%**

06/2026

# Seismic sites	Target # (12-20 VHT, 6-8 HT)	Revised # of sites (overlap accounted for)	Revised target (overlap accounted for)	% Complete (overlap accounted for	# GNSS	Target # (16-20 VHT, 7-10 HT)	Revised # of sites (overlap accounted for)	Revised target (overlap accounted for)	% Complete (overlap accounted for)	# Cameras	Target #	% Complete	# Infrasound sites	Target #	% Complete	# Tilt	Target #	% Complete	# real-time gas sites	Target #	% Complete	Network completion %
477	709	434	656	66%	289	527	288	492	59%	86	217	40%	89	244	36%	40	49	82%	27	51	53%	**56%**

- **Monitoring networks; how close are we to “done”?**

2024-2026 changes (**):

- **Numerator:**
  - **19 new seismic stations (AVO, CalVO, CVO, YVO) (& 2 temporarily taken offline (Crater Lake))**
  - **1 new GNSS station**
  - **13 new infrasound stations**
  - **1 new multigas**
- **Denominator:**
  - **Target # of seismic increased by 5 (YVO)**
  - **Target # of infrasound increased by 4 (YVO)**
  - **Target # of multigas increased by 1 (YVO)**

**** NOTE: Does not include stations installed for AVO & HVO responses**

- **Monitoring networks; how close are we to "done"?**
  - **Time to completion at current pace: 44 years (2070)**
  - **But:**
    - **Most of the remaining sites will be harder to pull off (remote/ complex & expensive logistics, Wilderness/complex permitting, poor telemetry, harsh weather)**
    - **HVO network engineering group is understaffed – no capacity to install new sites**
    - **AVO & CVO engineering groups are close to maximum capacity**
    - **CalVO & YVO only have capacity to install handful of new sites/eyar**
    - **Net impact: pace of installations will be < 1% year absent new hires (so… 2100?)**

Towards automated completion tracking: VMID

Volcano						Seismic			GNSS			Cameras			Infrasound			Tilt			Real-Time Gas			
Volcano (VNUM), State	Threat Level	Threat Ranking	Observatory	Network Area (km²)	Radius or Polygon dimensions (km x km or km if radius)	# Seismic Stations	Target #	% Complete	# GNSS Stations	Target #	% Complete	# Camera Stations	Target #	% Complete	# Infrasound stations	Target #	% Complete	# Tilt Stations	Target #	% Complete	# Real-Time Gas Stations	Target #	% Complete	Network completion %
Kilauea (332010), Hawaii	Very High	1	HVO	8574.7 km²	90.5 km (w) x 94.7 km (h)	36	48	75.0%	39	60	65.0%	0	21	0.0%	3	3	100.0%	0	9	0.0%	0	19	0.0%	48.4%
Mount St. Helens (321050), Washington	Very High	2	CVO	1256.6 km²	20 km (r)	22	26	84.6%	25	24	104.2%	2	4	50.0%	4	4	66.7%	0	9	0.0%	0	19	0.0%	77.9%
Mount Rainier (321030), Washington	Very High	3	CVO	1963.5 km²	25 km (r)	33	24	137.5%	8	9	88.9%	3	6	50.0%	19	14	135.7%	0	3	0.0%	0	3	0.0%	115.5%
Redoubt (313030), Alaska	Very High	4	AVO	1256.6 km²	20 km (r)	7	10	70.0%	4	8	50.0%	0	5	0.0%	2	5	40.0%	0	3	0.0%	0	1	0.0%	44.8%
Mount Shasta (323010), California	Very High	5	CalVO	1256.6 km²	20 km (r)	6	10	60.0%	7	8	87.5%	0	1	0.0%	0	2	0.0%	0	3	0.0%	0	3	0.0%	61.9%
Mount Hood (322010), Oregon	Very High	6	CVO	1256.6 km²	20 km (r)	12	12	100.0%	8	10	80.0%	1	4	25.0%	3	6	50.0%	0	9	0.0%	0	1	0.0%	70.7%
Three Sisters (322070), Oregon	Very High	7	CVO	1802.4 km²	37.4 km (w) x 48.1 km (h)	5	12	41.7%	5	8	62.5%	0	1	0.0%	0	3	0.0%	0	9	0.0%	0	3	0.0%	41.7%
Akutan (311320), Alaska	Very High	8	AVO	1256.6 km²	20 km (r)	11	12	91.7%	12	12	100.0%	0	5	0.0%	1	5	16.7%	0	4	0.0%	0	2	0.0%	58.9%
Makushin (311310), Alaska	Very High	9	AVO	1256.6 km²	20 km (r)	7	15	46.7%	3	8	37.5%	0	5	0.0%	3	8	37.5%	0	9	0.0%	0	4	0.0%	32.0%
Spurr (313040), Alaska	Very High	10	AVO	1256.6 km²	20 km (r)	8	18	44.4%	4	8	50.0%	0	5	0.0%	3	9	33.3%	0	9	0.0%	0	1	0.0%	36.6%
Lassen Volcanic Center (323060), California	Very High	11	CalVO	3868.5 km²	84.9 km (w) x 45.6 km (h)	12	12	100.0%	6	8	75.0%	0	1	0.0%	0	2	0.0%	0	9	0.0%	0	2	0.0%	72.0%
Augustine (313010), Alaska	Very High	12	AVO	1256.6 km²	20 km (r)	11	15	73.3%	0	11	0.0%	0	5	0.0%	3	8	37.5%	0	9	0.0%	0	2	0.0%	34.1%
Newberry (322110), Oregon	Very High	13	CVO	2058.6 km²	39.7 km (w) x 51.8 km (h)	10	16	62.5%	14	12	116.7%	0	1	0.0%	3	6	50.0%	0	9	0.0%	0	3	0.0%	77.1%
Mount Baker (321010), Washington	Very High	14	CVO	1256.6 km²	20 km (r)	2	10	20.0%	0	8	0.0%	0	1	0.0%	0	4	0.0%	0	9	0.0%	0	1	0.0%	4.1%
Glacier Peak (321020), Washington	Very High	15	CVO	1256.6 km²	20 km (r)	1	8	12.5%	0	8	0.0%	0	1	0.0%	1	4	25.0%	0	9	0.0%	0	3	0.0%	10.6%
Mauna Loa (332020), Hawaii	Very High	16	HVO	14005 km²	114.2 km (w) x 122.6 km (h)	27	40	67.5%	34	38	89.5%	0	18	0.0%	2	3	66.7%	0	7	0.0%	0	3	0.0%	57.8%
Crater Lake (322160), Oregon	Very High	17	CVO	1256.6 km²	20 km (r)	3	8	37.5%	3	6	50.0%	0	1	0.0%	0	4	0.0%	0	2	0.0%	0	3	0.0%	28.6%
Long Valley Caldera (323822), California	Very High	18	CalVO	1256.6 km²	20 km (r)	26	24	108.3%	24	26	92.3%	0	1	0.0%	0	2	0.0%	0	9	0.0%	0	3	0.0%	39.0%
Okmok (311290), Alaska	High	19	AVO	1256.6 km²	20 km (r)	10	13	76.9%	8	8	100.0%	0	4	0.0%	1	7	14.3%	0	9	0.0%	0	3	0.0%	59.4%
Iliamna (313020), Alaska	High	20	AVO	1256.6 km²	20 km (r)	6	8	75.0%	0	8	0.0%	0	4	0.0%	1	4	25.0%	0	9	0.0%	0	3	0.0%	25.2%
Yellowstone (325010), Wyoming	High	21	YVO	27207.1 km²	144.8 km (w) x 187.9 km (h)	44	50	88.0%	22	19	115.8%	0	4	0.0%	1	5	20.0%	0	3	0.0%	0	3	0.0%	66.7%
Aniakchak (312090), Alaska	High	22	AVO	1256.6 km²	20 km (r)	6	10	60.0%	2	5	40.0%	0	4	0.0%	1	5	20.0%	0	3	0.0%	0	3	0.0%	37.5%
Hualalai (332040), Hawaii	High	23	HVO	2102 km²	40 km (w) x 52.5 km (h)	1	13	7.7%	1	3	33.3%	0	3	0.0%	0	3	0.0%	0	3	0.0%	0	1	0.0%	4.2%
Mono-Inyo Craters (323120), California	High	24	CalVO	2827.4 km²	30 km (r)	3	8	37.5%	12	8	150.0%	0	1	0.0%	0	2	0.0%	0	9	0.0%	0	3	0.0%	76.9%
Martin (312140), Alaska	High	25	AVO	1256.6 km²	20 km (r)	8	8	100.0%	0	8	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	33.3%
Mageik (312150), Alaska	High	26	AVO	1256.6 km²	20 km (r)	9	9	100.0%	0	8	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	36.0%
Trident (312160), Alaska	High	27	AVO	1256.6 km²	20 km (r)	8	8	100.0%	0	8	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	33.3%
Katmai (312170), Alaska	High	28	AVO	1256.6 km²	20 km (r)	6	9	66.7%	0	8	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	24.0%
Veniaminof (312070), Alaska	High	29	AVO	1256.6 km²	20 km (r)	8	8	100.0%	0	4	0.0%	0	4	0.0%	3	4	75.0%	0	9	0.0%	0	3	0.0%	55.0%
Aiha Volcanic Complex (311160), Alaska	High	30	AVO	1256.6 km²	20 km (r)	7	8	87.5%	1	4	25.0%	0	4	0.0%	4	4	100.0%	0	9	0.0%	0	1	0.0%	57.1%
Korovin volcano (311161), Alaska	High	31	AVO	1256.6 km²	20 km (r)	7	8	87.5%	1	4	25.0%	0	4	0.0%	4	4	100.0%	0	9	0.0%	0	1	0.0%	57.1%
Shishaldin (311360), Alaska	High	32	AVO	1256.6 km²	20 km (r)	6	8	75.0%	6	6	100.0%	0	4	0.0%	3	4	75.0%	0	3	0.0%	0	3	0.0%	53.6%
Clear Lake Volcanic Field (323100), California	High	33	CalVO	6887.4 km²	79 km (w) x 74.5 km (h)	16	12	133.3%	3	8	37.5%	0	1	0.0%	0	2	0.0%	0	9	0.0%	0	3	0.0%	60.6%
Mount Adams (321040), Washington	High	34	CVO	1256.6 km²	20 km (r)	3	12	25.0%	0	8	0.0%	0	1	0.0%	1	2	50.0%	0	9	0.0%	0	3	0.0%	17.4%
Hayes (313050), Alaska	High	35	AVO	1256.6 km²	20 km (r)	0	8	0.0%	0	4	0.0%	0	1	0.0%	0	3	0.0%	0	9	0.0%	0	3	0.0%	0.0%
Westdahl (311340), Alaska	High	36	AVO	1256.6 km²	20 km (r)	5	8	62.5%	6	8	75.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	37.9%
Novarupta (312180), Alaska	High	37	AVO	1256.6 km²	20 km (r)	8	8	100.0%	0	8	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	33.3%
Mount Churchill (315030), Alaska	High	38	AVO	1256.6 km²	20 km (r)	0	8	0.0%	0	4	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	0.0%
Kanaga (311110), Alaska	High	39	AVO	1256.6 km²	20 km (r)	6	8	75.0%	0	4	0.0%	0	4	0.0%	1	4	25.0%	0	9	0.0%	0	3	0.0%	25.2%
Ugashik-Peulik (312130), Alaska	High	40	AVO	1256.6 km²	20 km (r)	4	8	50.0%	0	4	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	25.0%
Pavlof (312030), Alaska	High	41	AVO	1256.6 km²	20 km (r)	6	8	75.0%	0	4	0.0%	0	4	0.0%	6	6	100.0%	0	9	0.0%	0	3	0.0%	48.0%
Griggs (312190), Alaska	High	42	AVO	1256.6 km²	20 km (r)	6	8	75.0%	0	8	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	25.0%
Kaguyak (312250), Alaska	High	43	AVO	1256.6 km²	20 km (r)	1	8	12.5%	0	8	0.0%	0	1	0.0%	0	2	0.0%	0	9	0.0%	0	3	0.0%	4.2%
Pagan (284170), Northern Mariana Islands	High	44	NMI	1256.6 km²	20 km (r)	0	8	0.0%	0	4	0.0%	0	2	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	0.0%
Medicine Lake volcano (323020), California	High	45	CalVO	2827.4 km²	30 km (r)	7	8	87.5%	3	8	37.5%	0	0	0.0%	0	0	0.0%	0	9	0.0%	0	3	0.0%	62.5%
Great Sitkin (311120), Alaska	High	46	AVO	1256.6 km²	20 km (r)	6	8	75.0%	2	4	50.0%	0	4	0.0%	1	4	25.0%	0	9	0.0%	0	3	0.0%	46.0%
Kasatochi (311130), Alaska	High	47	AVO	1256.6 km²	20 km (r)	0	5	0.0%	0	4	0.0%	0	4	0.0%	0	5	0.0%	0	9	0.0%	0	3	0.0%	0.0%
Cleveland (311240), Alaska	High	48	AVO	1256.6 km²	20 km (r)	5	8	62.5%	3	4	75.0%	0	4	0.0%	3	4	75.0%	0	9	0.0%	0	2	0.0%	50.0%
Moffett (311111), Alaska	High	49	AVO	1256.6 km²	20 km (r)	2	8	25.0%	1	4	25.0%	0	4	0.0%	1	4	25.0%	0	9	0.0%	0	3	0.0%	20.0%
Seguam (311180), Alaska	High	50	AVO	1256.6 km²	20 km (r)	0	8	0.0%	0	4	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	0.0%
Fisher (311350), Alaska	High	51	AVO	1256.6 km²	20 km (r)	1	8	12.5%	1	8	12.5%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	4.2%
Snowy Mountain (312200), Alaska	High	52	AVO	1256.6 km²	20 km (r)	3	8	37.5%	0	8	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	12.5%
Fourpeaked (312260), Alaska	High	53	AVO	1256.6 km²	20 km (r)	1	8	12.5%	0	4	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	0.0%
Douglas (312070), Alaska	High	54	AVO	1256.6 km²	20 km (r)	1	8	12.5%	0	4	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	0.0%
Semisopochnoi (311060), Alaska	High	55	AVO	1256.6 km²	20 km (r)	6	8	75.0%	0	8	0.0%	1	4	25.0%	3	4	75.0%	0	9	0.0%	0	3	0.0%	45.0%
Salton Buttes (323200), California	High	56	CalVO	1256.6 km²	20 km (r)	8	8	100.0%	7	16	43.8%	0	1	0.0%	0	2	0.0%	0	9	0.0%	0	3	0.0%	58.4%
Agrigan (284160), Northern Mariana Islands	High	57	NMI	1256.6 km²	20 km (r)	0	8	0.0%	0	4	0.0%	0	2	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	0.0%
Edgecumbe (325040), Alaska	Unknown	58	AVO	1256.6 km²	20 km (r)	4	8	50.0%	0	4	0.0%	0	4	0.0%	0	4	0.0%	0	9	0.0%	0	3	0.0%	25.0%
Totals						467	699	66.8%	279	525	53.1%	7	218	3.2%	81	239	33.9%	0	49	0.0%	0	59	0.0%	46.9%

URL: https://dev-vhptools.usgs.gov/vmid-free/#/nvews-completion-status-report

Towards automated completion tracking: VMID

	# seis		GPS	targ	cam	targ	infra	targ	tilt	targ	gas	targ	% complete
Total	467	699 66.8%	279	525 53.1%	7	216 3.2%	81	239 33.9%	0	49 0.0%	0	50 0.0 %	46.9%

Hand count – 56% complete
VMID count – 47% complete

URL: https://dev-vhptools.usgs.gov/vmid-free/#/nvews-completion-status-report

Towards automated completion tracking: VMID

Causes for celebration:

- AVO & HVO GNSS are in SIS!
- Result of big push by individuals at both VOs as well as assist from a few CVOers
- SIS now "complete" for VSC seis, infrasound, & GNSS

Reasons for hand-count vs VMID-count discrepancies:

- No "infrasound" sensor type in SIS ➔ Presently there's a kludge to search by manufacturer
- Earthscope GNSS & borehole seismic stations not in SIS (AVO, CalVO, CVO, YVO)
  ➔ Engineering a work-around, but there are still some onesie-twosie issues
- Some VSC GNSS stations are ALSO in Earthscope (CVO – leads to double-counting)
- For a few locales (e.g., Yellowstone, California), VMID polygon dimensions/centroids not providing same counts as hand-based counts (working w/ VOs to adjust polygons)
- VMID counting stations for network codes not used by VOs (CalVO, HVO)
- VMID not complete for gas, tilt, & webcams

Towards automated completion tracking: VMID

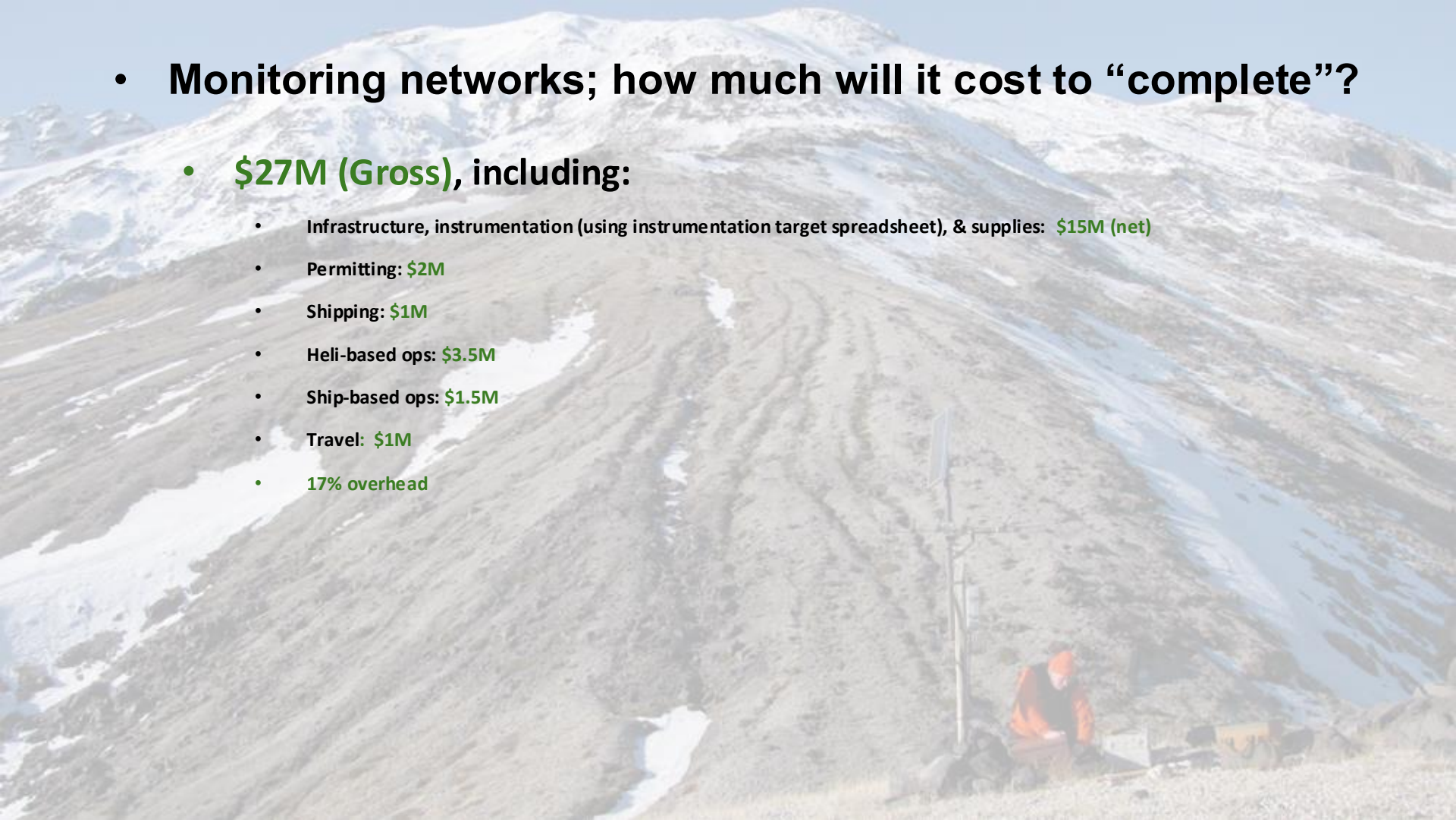
Causes for pause re: interoperability:

- Getting to this point (~2 years after I started as NVEWS PM) has taken a LOT of work by SICs, AVO/CVO/HVO staff for SIS input, and our lead programmer
- …and, we're still not quite there yet ("there" = automated accurate instrumentation tallies for VHT & HT volcanos)
- Once we get there, it will take a few years before we've actually saved ourselves time
- Reasons for challenges: each VO has its own unique constellation of partners, different constellations of network operators operating instruments at volcanoes, and different ways of doing business.
- Each difference has required development of work-arounds & manual data entry
- For other interoperability areas where a VSC-wide solution is desirable but not yet a thing (e.g., VSC-wide SOH dashboard) , this is a cautionary tale

- **Monitoring networks; how much will it cost to "complete"?**

Volcano	Seismic	GNSS	Cameras	Infrasound	Tilt	Gas	Summary Cost, infrastructure, instrumentation, supplies	Summary Cost, Permitting	Summary Cost, Shipping	Summary Cost, Helicopter Charter	Summary Cost, Marine Charter	Summary Cost, Travel	Subtotal
Kīlauea	10	6	3	0	0	1	$ 471,290.00	$ 25,000.00	$ 23,597	$ -	$ -	$ -	$ 519,887.00
MSH	0	0	1	2	2	0	$ 43,900.00	$ -	$ 3,739	$ 68,160	$ -	$ -	$ 115,799.00
Rainier	2	3	2	2	1	0	$ 155,350.00	$ 80,000.00	$ 9,554	$ 25,560	$ -	$ 5,000	$ 275,464.00
Redoubt	2	4	2	2	0	0	$ 180,040.00	$ 5,000.00	$ 11,676	$ 25,560	$ -	$ 5,000	$ 227,276.00
Shasta	3	1	1	2	0	0	$ 137,150.00	$ 120,000.00	$ 7,510	$ 25,560	$ -	$ 5,000	$ 295,220.00
Hood	1	3	2	3	0	1	$ 185,700.00	$ 40,000.00	$ 10,152	$ 17,040	$ -	$ 4,000	$ 256,892.00
Three Sisters	7	4	0	3	0	0	$ 322,850.00	$ 280,000.00	$ 17,620	$ 76,680	$ -	$ 11,000	$ 708,150.00
Akutan	1	0	0	5	0	2	$ 191,330.00	$ 2,500.00	$ 8,541	$ 51,120	$ -	$ 12,000	$ 265,491.00
Makushin	8	5	4	5	0	4	$ 649,520.00	$ 20,000.00	$ 34,335	$ 136,320	$ -	$ 23,800	$ 863,975.00
Spurr	6	4	4	5	0	0	$ 318,860.00	$ 15,000.00	$ 17,483	$ 76,680	$ -	$ -	$ 428,023.00
Lassen Center	5	0	1	2	0	1	$ 260,100.00	$ 200,000.00	$ 14,685	$ -	$ -	$ 7,000	$ 481,785.00
Augustine	4	0	3	5	0	2	$ 316,760.00	$ 10,000.00	$ 16,974	$ 51,120	$ -	$ 8,000	$ 402,854.00
Newberry	4	3	1	3	0	0	$ 201,100.00	$ 10,000.00	$ 10,218	$ -	$ -	$ 6,000	$ 227,318.00
Baker	8	8	0	4	0	1	$ 464,250.00	$ 320,000.00	$ 22,997	$ 85,200	$ -	$ 12,000	$ 904,447.00
Glacier Peak	7	6	1	4	0	0	$ 350,550.00	$ 280,000.00	$ 17,914	$ 76,680	$ -	$ 11,000	$ 736,144.00
Mauna Loa	20	4	10	2	1	1	$ 841,090.00	$ 50,000.00	$ 46,135	$ 213,000	$ -	$ 27,000	$ 1,177,225.00
Crater Lake	4	2	1	4	2	0	$ 227,300.00	$ 160,000.00	$ 13,783	$ 42,600	$ -	$ 7,000	$ 450,683.00
Long Valley	0	3	1	0	0	0	$ 89,850.00	$ -	$ 7,560	$ -	$ -	$ 1,500	$ 98,910.00
Okmok	3	0	2	6	0	0	$ 161,130.00	$ 7,500.00	$ 8,624	$ 76,680	$ 93,780	$ 17,000	$ 364,714.00
Iliamna	1	4	2	3	0	0	$ 167,940.00	$ 2,500.00	$ 11,671	$ 17,040	$ -	$ 4,000	$ 203,151.00
Yellowstone	3	3	0	3	0	0	$ 161,850.00	$ 7,500.00	$ 7,766	$ -	$ -	$ 5,000	$ 182,116.00
Aniakchak	4	3	3	4	0	0	$ 220,540.00	$ 10,000.00	$ 11,725	$ 85,200	$ -	$ 18,000	$ 345,465.00
Hualalai	8	2	2	1	3	1	$ 410,610.00	$ 20,000.00	$ 24,458	$ 85,200	$ -	$ -	$ 540,268.00
Mono	7	3	1	2	0	0	$ 308,150.00	$ 17,500.00	$ 17,484	$ -	$ -	$ 9,000	$ 352,134.00
Martin	1	8	2	4	0	0	$ 302,180.00	$ 2,500.00	$ 23,194	$ 17,040	$ -	$ 8,400	$ 353,314.00
Mageik	0	0	2	4	0	0	$ 27,800.00	$ -	$ 178	$ 42,600	$ -	$ 6,200	$ 76,778.00
Trident	0	8	2	4	0	0	$ 283,880.00	$ -	$ 23,154	$ 42,600	$ -	$ 6,200	$ 355,834.00
Katmai	1	2	2	4	0	0	$ 110,120.00	$ 2,500.00	$ 5,962	$ 17,040	$ -	$ 8,400	$ 144,022.00
Veniaminof	0	4	3	1	0	0	$ 138,740.00	$ -	$ 11,580	$ 59,640	$ -	$ 7,500	$ 217,460.00
Atka	0	0	3	0	0	1	$ 64,510.00	$ -	$ 2,844	$ 76,680	$ 104,200	$ 9,600	$ 257,834.00

- **Monitoring networks; how much will it cost to “complete”?**
  - **$27M (Gross), including:**
    - Infrastructure, instrumentation (using instrumentation target spreadsheet), & supplies: $15M (net)
    - Permitting: $2M
    - Shipping: $1M
    - Heli-based ops: $3.5M
    - Ship-based ops: $1.5M
    - Travel: $1M
    - 17% overhead



- **Monitoring networks; how much will it cost to “complete”?**
  - **NVEWS buildout estimation by VO/area:**
    - **AVO: $15.4M (gross)**
    - **CalVO: $2.0M**
    - **CVO: $3.8M**
    - **HVO: $2.6M**
    - **YVO: $0.2M (**)**
    - **CNMI: $1.4M**
    - **Samoa: $0.07M**

- **Monitoring networks; how much will it cost to "complete"?**
  - **Caveats:**
    - 2024 $$; inflation has increased costs for just about everything.
    - Doesn't include response cache equipment identified in Flinders et al. (although there is $$ for aerial surveys) – +$1-2M?
    - Doesn't include increased O&M costs of new sites (ballpark estimate of annual O&M: ~10-20% of buildout cost, or $3-5M increase annually)
    - Doesn't include increased annual telemetry costs – $1-2M annually?
    - Doesn't include staff FTE (FEIT, IT, logistics, permitting, etc.) – $3-5M annually?
    - Buildout cost: $28-$30M
    - Keeping everything working: $8-14M annually

NVEWS Threat Rescoring Tiger-Team Update

- **Met with Idaho POCs re: merging of several lava fields into a singular volcanic field ("East Snake River Plain Volcanic Field")**
  - ➔ ***Preference is to go with ESRPVF plus Crater of the Moon***
- **Met with GVP (Ed Venzke and Kadie Bennis) to review proposed additions and subtractions to list of US Holocene volcanoes**
  - ➔ ***They are in agreement with changes, need to work with them on updating volcano numbers & descriptions***
  - ➔ ***Next step: meet with VHP to review changes & plan for rollout***
- **Still needed: Finalizing exposure ratings (e.g., aviation, Park visitation) ➔ Goal for next 3 months (which is also busy field season)**
- **In-person meeting @ CVO in Oct-Nov 2026 to focus on report writing**
- **Draft of report into review by… end of 2026?**

Infrastructure and Interoperability

AI Working Group (AIWG):

Goal: guide the center's adoption of AI/GenAI tools across different use cases - programming, chat-based search.

Challenges: limited access to AI tools; limited bandwidth

Cloud Opportunities:

Goal: Migrate existing tools or develop new cloud-based applications to leverage AWS and its services.

Status: Cloud lunch-n-learn sessions are introducing many w/in VSC to Cloud use cases.

Challenges: Cost-benefit still unknown; limited bandwidth

Interoperable State of Health Project

Goal: Migrate SOH to common cloud-based platform used by all Vos

Status: Architecture is being built; feeding observatory SoH data not there yet.

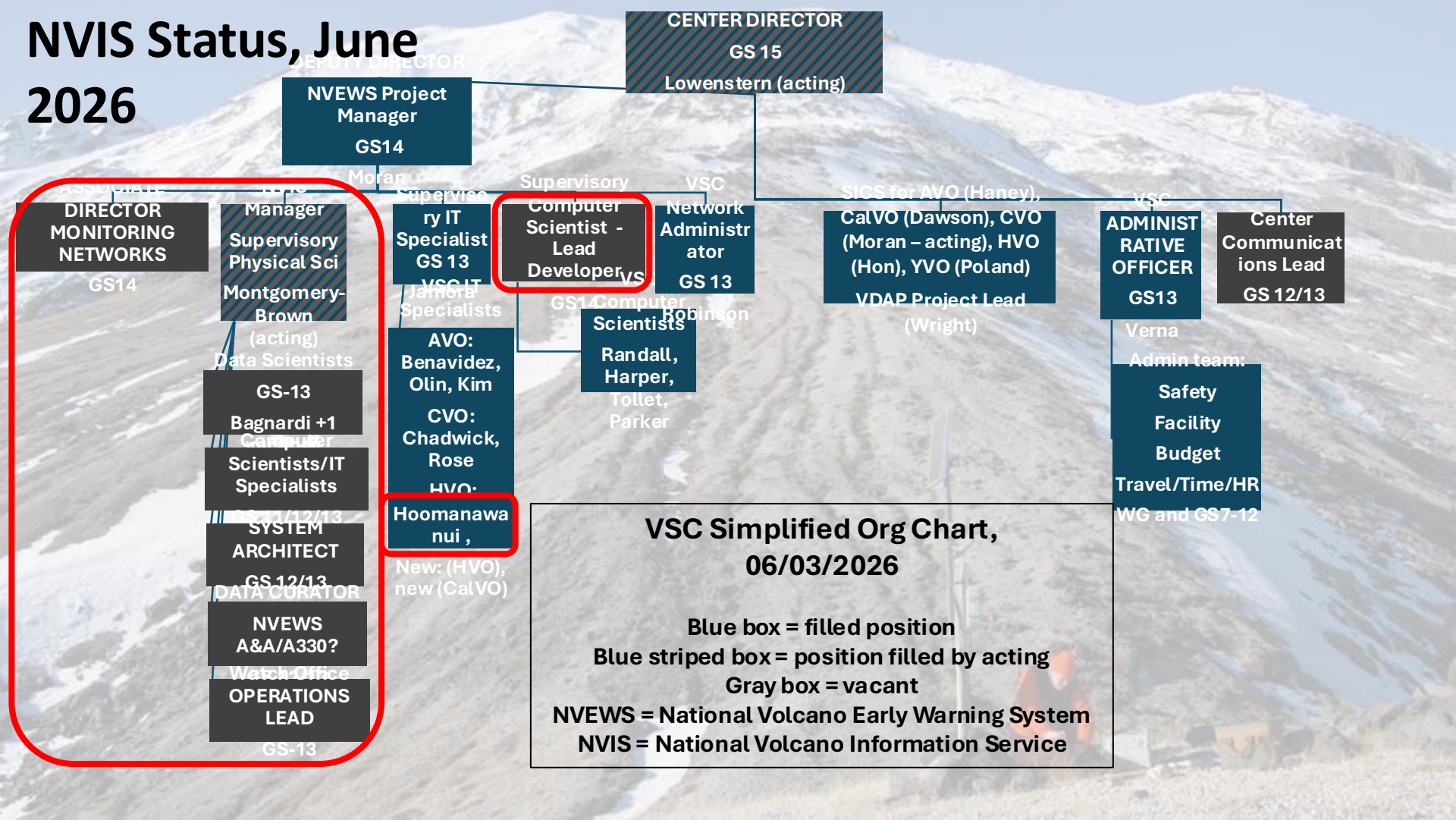
Challenge: Not enough personnel to migrate to new SoH system when operational systems already exist at each VO

Local knowledge bases

Goal: System-specific policies and procedures to enable personnel from other observatories to more readily support each other.

Challenge: Not enough people with enough time to create/revise documents

NVIS Status, June 2026



VSC Simplified Org Chart, 06/03/2026

Blue box = filled position
Blue striped box = position filled by acting
Gray box = vacant
NVEWS = National Volcano Early Warning System
NVIS = National Volcano Information Service

Image/Multimedia Management Options (Emily M-B, Harper, Randall, Tollet)

NIMS (USGS WMA)

- Collaboration continuing for webcams; not setup for field photos or videos; potential for future AI workflows.

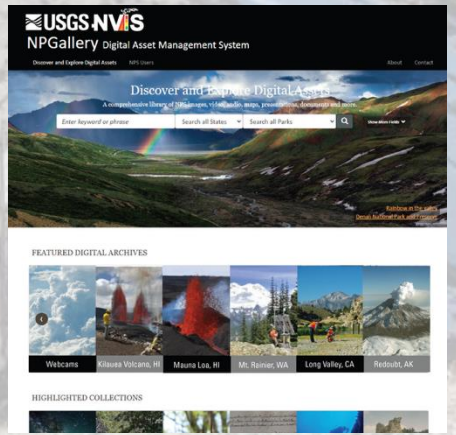
AVO Multimed

- In develop
  install, & r

Currently leaning towards a split approach: NIMS for webcams, NPGallery for field photos and other media (AVO solution too expensive)

NPGallery Digital Asset Management System

- Field and historical imagery, multimedia files
- Cloud-based, certified NARA archive supported as a DOI Enterprise Service
- Cost is TBD, but should be quite reasonable
- VSC/VHP would be a user, not a developer/maintainer; NPS willing to add the tags/groups/brandings we need,
- OCAP will also be working with NPGallery for integrating with Drupal



NVEWS -- challenges to progress

1) Understaffed – impacting network installs & maintenance, progress on NVIS
2) Equipment costs – batteries, solar panels, and anything with a hard drive & memory chip has significantly increased in cost over the last 2 years, placing increasing limits on station installs
3) Interoperability – requires concerted effort & substantial time (years) to get all VOs on same page
4) Turnover in other agencies – we're having to re-discover who our POCs are with many agencies
5) AI & the Cloud – lots of unknowns (cost, best platforms) and constraints (limited platforms, security)


Questions?

BREAK- Return 3:30p

USGS

USGS
science for a changing world

NVEWSAC Subcommittee Updates

Leif Karlstrom

University of Oregon

Jenn Wade

National Science Foundation

- **Distributed Volcanic Fields/Hydrothermal Explosions**
- **Volcano Threat Re-ranking**

Distributed Volcanism & Hydrothermal Systems

- Purpose: Introduce hydrothermal and distributed volcanic hazards and explore monitoring gaps, scientific needs, and NVEWS integration.

- Background examples included:
  - Black Diamond Pool hydrothermal explosion (July 23, 2024) as evidence of ongoing hazards.
  - Lessons from Whakaari/White Island (2019) and NZVEWS hazard scoring updates.
  - Blue Lake Crater (phreatomagmatic eruption ~3 ka) relevance to groundwater-driven hazards.
  - Distributed hazards in Auckland Volcanic Field (NZ).
  - New age constraints on monogenetic eruptions (Zimmer 2024) showing hazards may be younger and more frequent than previously thought.

- YVO region highlighted as broader than Yellowstone; includes much of the Southwest U.S. with multiple distributed volcanic centers.

Distributed Volcanism & Hydrothermal Systems

From last subcommittee meeting: Key Discussion Themes & Needs Identified

- Hydrothermal hazards need formal inclusion in NVEWS, as monitoring gaps were evident during development of response plans at YVO (e.g., Biscuit Basin explosion, 2024).

- Distributed volcanic fields underrepresented in NVEWS due to long eruptive intervals, uncertain dating, and difficulty defining hazards. Consider treating the Southwest U.S. as a single volcanic system for hazard planning.

- Committee questions centered on:
  - What distributed/hydrothermal hazards are currently overlooked?
  - What roles can academia and other agencies play in filling monitoring and research gaps?
  - How can NVEWS expand scenarios beyond traditional stratovolcano models?

- Example of monitoring expansion: incorporating lahar monitoring into Mount Rainier's network—illustrating how NVEWS could broaden its hazard scenarios.

Distributed Volcanism & Hydrothermal Systems

- Emergency management perspective stressed defining the “why”: impacts to people, infrastructure, and communities; need for clear, actionable guidance and probability context.

- Collaboration opportunities:
  - Expanded academic partnerships for dating, groundwater studies, hazard modeling, and remote fieldwork.
  - A proposed White Paper outlining needs, impacts, and research opportunities
  - Need to communicate value to USGS/DOI leadership, including economic impacts; align with broader scenario-based risk exercises (analogous to SAFER’s earthquake/atmospheric river scenarios).
  - Integration challenges: determining which fields should be part of NVEWS, monitoring cost feasibility, and how to incorporate hydrothermal systems in threat-level reporting to Congress.

Volcano Threat Level Reassessment: Overview

- Why now: Program Council initiated an update; the last threat assessment was in 2018 and the cadence is now every 5 years.
- Scope: A targeted update, not a full overhaul—aimed at revising the volcano list and refining factor definitions.
- Team & cadence: 7 members; meeting 1 hour every 2 weeks with homework; broad consultation across VSC staff and external experts.
- Methodology & data: Start from the Smithsonian database; apply methods from Ewert et al. (2005, 2018); for Alaska, use the AVO website as the definitive Holocene record; default geologic data from Global Volcano Program 2025 with documented exceptions.
- Status: Nearing completion of an updated volcano list and revised factor definitions for hazards, unrest, and exposure.

Volcano Threat Level Reassessment:

Key Proposed Changes & Discussion Highlights

- List size & composition: Proposed list is 153–158 volcanoes (pending Idaho decisions) vs 161 in 2018; expect 2–5 additions, 3 removals (re-dated to Pleistocene), 1 split, and 5–6 combinations overall.
- Regional updates — examples:
  - Alaska: Add a SE Alaska volcanic field; split Yunaska Island into two centers; combine Atka & Korovin; combine Mount Katmai & Novarupta; combine Makushin & Wide Bay cone.
  - CVO (Cascades): Create Santiam–McKenzie volcanic field (combining Blue Lake Crater, Sand Mountain Volcanic Field, Belknap Crater) → net reduction of 2 separate vents.
  - HVO/CNMI/American Samoa: Add Malumalu (submarine, Holocene) for American Samoa; no changes at HVO or CNMI.
  - CalVO: Remove Golden Trout Creek volcanic field (~55 ka, monogenetic); combine Mono–Inyo Craters with Mono Lakes Volcanic Field into Mono–Inyo Volcanic Chain.
  - YVO/Idaho options: Favor Option B—combine multiple lava fields (Black Butte, Wapi, Hells' Half Acre, North/South Robbers, Cerro Grande) into a single system.

Volcano Threat Level Reassessment:

Key Proposed Changes & Discussion Highlights

- Factor definition refinements: Clarify hazards/unrest/exposure; consolidate lahar factors; remove two exposure considerations (historical fatalities, evacuations) to avoid double-counting and align with intent of Ewert methodology.

- Analysis methods: Use kernel density polygons for distributed fields (vs fixed 30-km buffers) and a documented eruption recurrence workflow to promote consistency.

- Comms & rollout: Prepare a fact sheet; ensure cross-site consistency of published numbers; remind stakeholders that high/very high threat ≠ imminent eruption; consider a White Paper and engage State Geological Surveys; anticipate impacts to NVEWS completion stats (instrumentation/staffing).

USGS
science for a changing world

NVEWS Volcanic Ash and Fumes Act Updates

Karen Shelton-Mur

FAA

David Kochevar

NOAA

David Schneider

USGS/Alaska Volcano Observatory

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

June 3, 2026

National Volcano Early Warning System Advisory Committee – June 3-4, 2026

Karen Shelton-Mur, Federal Aviation Administration

Federal Aviation Administration

Agenda

- History of Aviation, Volcanic Ash, and International Civil Aviation Organization (ICAO) Volcanic ash activity– 1982 – present
- ICAO Volcanic Ash Advisory Centers (VAAC)
- History of ICAO Volcanic Ash Task Force, Meteorology Panel (METP) and International Aviation Volcano Watch (IAVW) Work Stream
- Vehicle Integrated Propulsion Research (VIPR) tests & Volcanic Ash Concentration Thresholds
- The role of the FAA Meteorological Authority and designated Meteorological Service Providers
- Current volcano and volcanic ash products issued by Meteorological Service Providers
- FAA/NOAA/USGS collaboration

History: Aviation, Volcanic Ash and International Civil Aviation Organization (ICAO)

- 1982: British Airways B-747 flies through volcanic ash cloud at night over Indonesia that causes all 4-engines to lose power at 37,000 feet. Plane glides to 12,000 feet before pilots restart 3-engines and make emergency landing.

Mt Redoubt, Alaska eruption Dec 14-19, 1989

Dec 15,1989: KLM Flight 867 B-747 flies through ash clouds over Mt Redoubt in Alaska and loses power to all 4-engines.

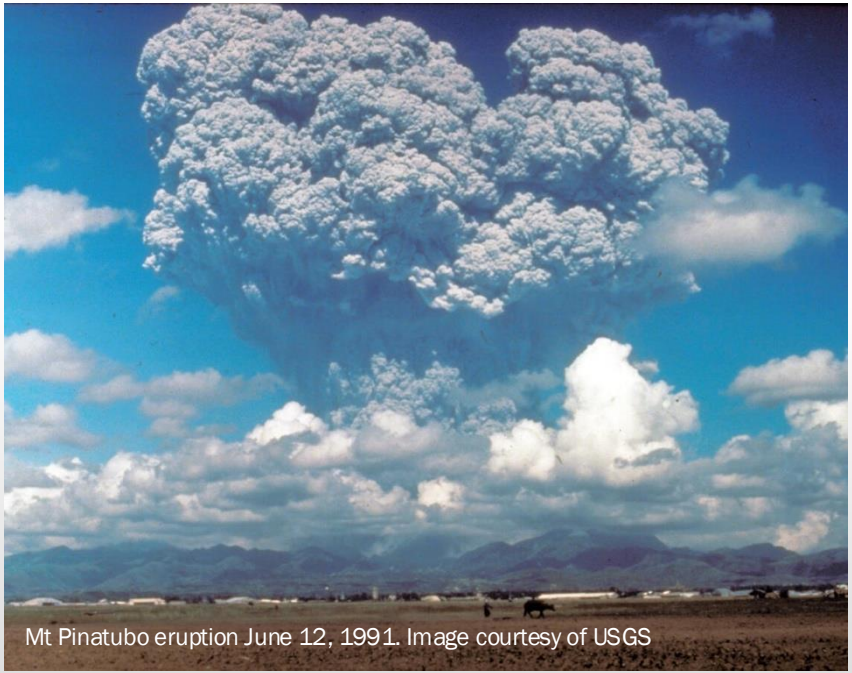
- 231 Passengers and 14 crew members on board.
- Pilots were able to restart 2-engines 8-minutes after descending to 13,000 ft.

Mt Redoubt, Alaska Dec 1989

Windshield from KLM 867 courtesy of University of Alaska, Anchorage and USGS (Dave Schneider)

Mt Pinatubo, Philippines, June 1991

- From June 12-16, 1991, eighteen encounters between aircraft and volcanic ash clouds.
- Types of encounters reported by pilots ranged from engine vibration, electrical discharge on windshield, electrical fire and SO_2 odors, nozzle and turbine damage, cockpit and cabin window abrasion.
- No accidents/fatalities but aircraft economic losses.



Mt Pinatubo eruption June 12, 1991. Image courtesy of USGS

ICAO established Volcanic Ash Advisory Centers (VAAC): 1998

1998: ICAO designates nine regional Volcanic Ash Advisory Centers (VAAC).

Two of the 9 VAACs are U.S.: Anchorage and Washington DC operated by the National Oceanic and Atmospheric Administration (NOAA) and National Weather Service (NWS).

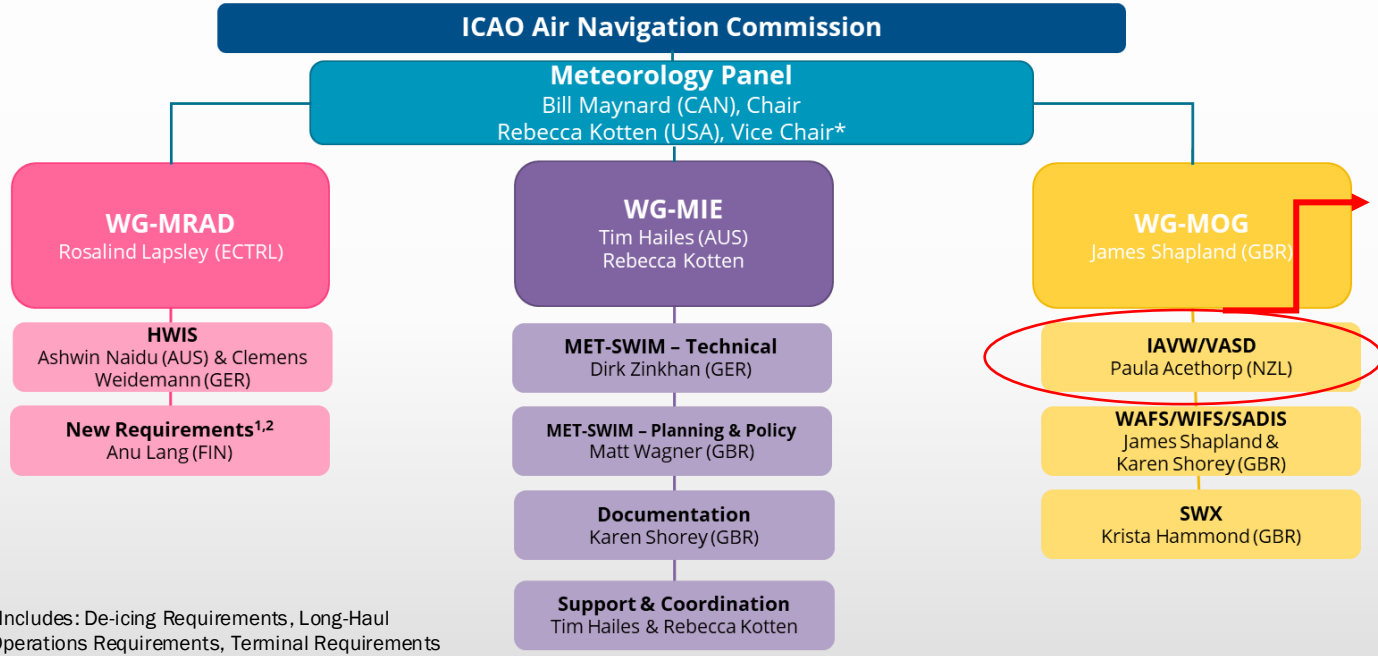
VAACs issue advisories to Meteorological Watch Offices (MWO) that issue SIGMETs (warnings) that describe the area affected by the ash cloud to aircraft and controllers. Three US MWOs are: Anchorage, Honolulu, Kansas City and operated by the NWS.

International Volcanic Ash Task Force (IVATF), and International Airways Volcano Watch (IAVW) Work Stream

- 2010: Eyjafjallajökull eruption in Iceland paralyzed aircraft operations over Europe and the North Atlantic for many days.
  - ICAO established the IVATF to urgently address the issues relevant to the Eyjafjallajökull eruption.
    - **This global Task Force from 2010 to 2012 also included FAA, NOAA, USGS, and US airlines.**
    - IVATF tasked to review guidance material, establish volcanic ash contingency plans, improve detection systems, and develop ash concentration thresholds.
      - Most tasks were completed except for the development of ash concentration thresholds.

- 2015: ICAO Meteorology Panel (METP) forms and IAVW Work Stream is established.

Current METP Structure



US Meteorology Panel (METP)
Member: Rebecca Kotten (FAA)

US Advisors to Rebecca Kotten/IAVW:

- Karen Shelton-Mur (FAA)
- Alice Crawford (NOAA)
- Jamie Kibler (NOAA/VAAC Washington)
- Al Pietrycha (NOAA)/VAAC Anchorage)
- Lora Wilson (NOAA)
- Dave Schneider (USGS)
- Amanda Hoprich (AvMET)
- Jeff Osiensky (AvMET)

[1]Includes: De-icing Requirements, Long-Haul Operations Requirements, Terminal Requirements
[2]Includes: Ice Crystal Observations, Evaluation of IWXXM Extensions, High Altitude Ice Crystals

105

Vehicle Integrated Propulsion Research (VIPR) and Volcanic Ash Concentration Thresholds

- 2011-15: VIPR engine test program (NASA, FAA,USAF, USGS, *et al*)
  - Mission was to test and determine the performance degradation of aircraft engines due to volcanic ash.
  - USGS provided expertise on the size and type of particles.
- 2020: Volcanic ash concentration thresholds, developed by Rolls Royce & proposed to the MET Panel's IAVW Work Stream.
- 2021: IAVW Work Stream developed new Quantitative Volcanic Ash Concentration product.
- Today: The IAVW Work Stream meets regularly to enhance current products and develop/improve new volcanic ash concentration forecasts.

The role of the FAA Meteorological Authority and designated Meteorological Service Providers

- From ICAO Annex 3 - *Meteorological Service for International Air Navigation:*
  - Meteorological Authority: *The entity arranging for the provision of meteorological service for international air navigation on behalf of a Contracting State and providing regulation and oversight of the meteorological service.*

- ICAO Annex 3, requires the Meteorological Authority to designate an entity (or several entities) as its Meteorological Service Providers.

FAA Requirements Process for Annex 3 Amendments

- Work in the IAVW to enhance or improve Volcanic Ash products can lead to amendments to ICAO Annex 3.
  - When amendments are approved (every few years):
    - The MET Authority (FAA) will issue a requirements letter to the MET Service Provider (NOAA/USGS) that summarizes the necessary update(s) to the product and informs the MET Service Provider of the effective date.
    - For example, the FAA issued a letter in 2024 to USGS informing them about the amendment (82) to Annex 3 to disseminate the VONA in specified data formats.

Current volcano and volcanic ash products issued by Meteorological Service Providers

- Volcano Observatory Notice for Aviation (VONA) –**USGS**
  - Five USGS Volcano Observatories issue the VONA that describes the state of the volcano including eruptions.
- Volcanic Ash Advisory (VAA) - **NOAA**
  - Two NOAA VAACs issue VAAs that provide a forecast of the location of the ash cloud through 18-hours in text or graphic form.
- Volcanic Ash SIGMET - **NOAA**
  - Three NWS MWOs issues Volcanic Ash SIGMETs, which is a warning message to pilots and controllers describing the position of the ash cloud through 6-hours.

Future volcanic ash products issued by Meteorological Service Providers

- Quantitative Volcanic Ash (QVA) Concentration Information - **NOAA**
- Endorsed in 2021 by the ICAO METP.
- As of November 2025, VAACs London and Toulouse are producing QVA forecasts.
- Remaining VAACs including NOAA VAACs to begin producing QVA forecasts near future.

- QVA forecasts provide higher resolution detail than existing volcanic ash products (VAA), which allows airlines and pilots to optimize the flight path around the volcanic ash cloud.

Additional FAA/NOAA/USGS collaboration related to Volcanic Ash

Established/co-lead Volcanic Ash Coordination Group consisting of members from the FAA, USGS, and NOAA

- Established to improve and increase communication and collaboration within the US Federal Agencies related to Volcanic Ash.
- Means for IAVW members to continue to discuss requirements or policy related to Volcanic Ash services in a US focused meeting.
- Educate non-IAVW members on the activities within the workstream.
- Provide situational awareness on all things related to volcanic ash such as eruptions, exercises, stakeholder outreach and meetings/conferences.

Collaboration with USGS/NOAA to develop means to disseminate the Volcano Observatory Notice for Aviation (VONA) via the Aeronautical Fixed Service (AFS)

- The AFS is a secure network that provides information to airlines "for the safety of air navigation and for the regular, efficient and economical operation of air services.
- USGS does not have a direct connection to the AFS, so it will distribute VONAs via email to an NWS gateway, that in turn will disseminate them for international air navigation.
- Interagency group has worked through technical issues, and drafted a letter of agreement for FAA, NWS and USGS management.

111

Thank you!

For questions:
email Karen.Shelton-Mur@faa.gov

NOAA/USGS NVEWS Collaboration update

David Kochevar
Warning Coordination Meteorologist
NWS Anchorage Volcanic Ash Advisory Center

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service

Priorities from NOAA NVEWS implementation plan

Priority Group 1

Improve service on monitoring and forecasting volcanic smog (vog).

Priority Group 2

Develop/improve operational plan to warn of volcanic debris flows/lahars from eruptive and non-eruptive events.

Priority Group 3

Improve service on quantifying airborne ash hazards to aviation.

Priority Group 4

Improve service on quantifying ashfall hazards.

Priority Group 5

Improve near-real-time data sharing to improve situational awareness and operational response.

Priority Group 6

Improve service on forecasting volcanogenic tsunami and submarine eruptions.

Priority Group 7

Improve efficacy of USGS and NOAA hazard information products.

Note: Priority Number Does Not Imply Importance Ranking

Priorities from NOAA NVEWS implementation plan

Priority Group 1

Improve service on monitoring and forecasting volcanic smog (vog).

Priority Group 2

Develop/improve operational plan to warn of volcanic debris flows/lahars from eruptive and non-eruptive events.

Priority Group 3

Improve service on quantifying airborne ash hazards to aviation.

Priority Group 4

Improve service on quantifying ashfall hazards.

Priority Group 5

Improve near-real-time data sharing to improve situational awareness and operational response.

Priority Group 6

Improve service on forecasting volcanogenic tsunami and submarine eruptions.

Priority Group 7

Improve efficacy of USGS and NOAA hazard information products.

Aviation and ash related

Note: Priority Number Does Not Imply Importance Ranking


USGS Alaska Volcano Observatory

Priority Group 3: Improve service on quantifying airborne ash hazards to aviation.

Focus: Implementation of new Quantitative Volcanic Ash information service (QVA) by the Volcanic Ash Advisory Centers (VAAC).

- Ensuring QVA work done under NVEWS meets International Civil Aviation Organization (ICAO) requirements.
- Aligning research with global aviation standards, and identifying data State Volcano Observatories (SVOs) can provide for QVA.
- HYSPLIT
  - Incorporating satellite data into NOAA HYSPLIT modeling of airborne ash cloud.
- Continued USGS/NOAA involvement in ICAO Volcanic Ash working group.
- Workshops
  - ICAO Workshop for modelers, VAAC personnel, and SVOs to discuss QVA issues/needs at Buenos Aires meeting.
  - September 2025 QVA workshop at Anchorage VAAC
- Coordination with Priority 4.

Priority Group 4: Improve service on quantifying ashfall hazards

- Incorporating airborne, ground-level ashfall hazards into regional plans with NOAA/USGS/FAA.
    - Laying out agency roles and responsibilities.
- Kilauea USGS/NOAA work.
    - Incorporating Ash3D output into NWS operations (Ashfall warnings/advisories, TAF).
- USGS Ash3D Steering Committee
    - Improving coordination on Eruption Source Parameters (EPS) used in USGS/NOAA ashfall and airborne ash modeling.
    - Ensuring consistency between ashfall and airborne ash modeling.
- Establishing a USGS policy for using NWSChat/Slack for eruption response collaboration.

USGS

Priority Group 7: Improve efficacy of USGS and NOAA hazard information products.

- Identify, document, and review all NOAA/USGS current Volcanic hazard information products.
- Working to differentiate between these products and services, identify gaps, and duplication.
- USGS is supporting NOAA moving away from ashfall thresholds to NWS impact based warning products.
- Leveraging the work of the international ashfall impacts working group.
- USGS helping inform call-to-action statements in NWS ashfall products in AK and HI.

Questions?

David Kochevar
NOAA/National Weather Service
Anchorage Volcanic Ash Advisory Center
david.kochevar@noaa.gov

NVEWS Advisory Committee: USGS Volcanic Ash Activities

David Schneider, Ph.D.

Research Geophysicist

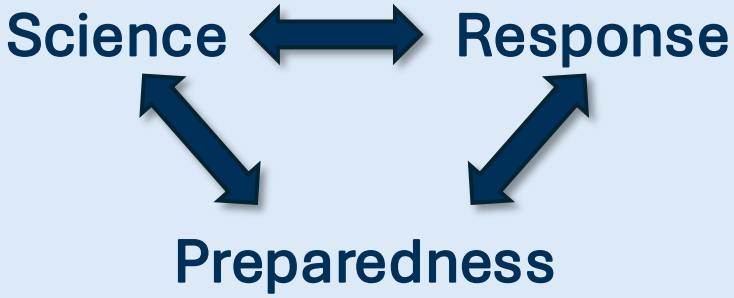
U.S. Geological Survey Alaska Volcano Observatory

Project Chief Ash Hazards, Impacts, and Risk Mitigation

NVEWS: USGS Volcanic Ash Activities

Ash Project Tasks

- Explosive Eruption Processes and Modeling
- Aviation Hazards
- Ash Impacts and Mitigation

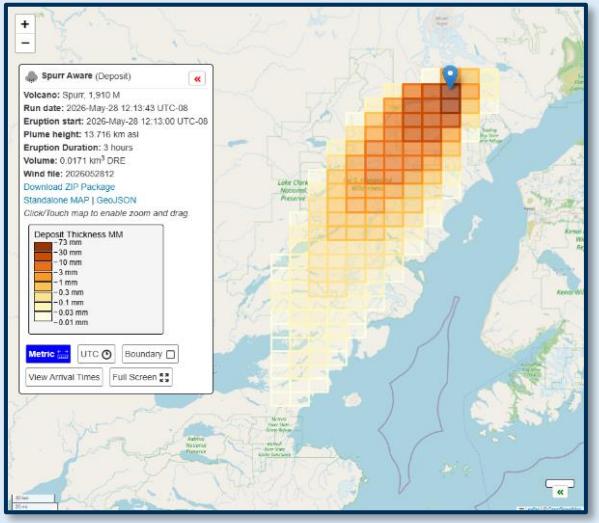


NVEWS Priorities

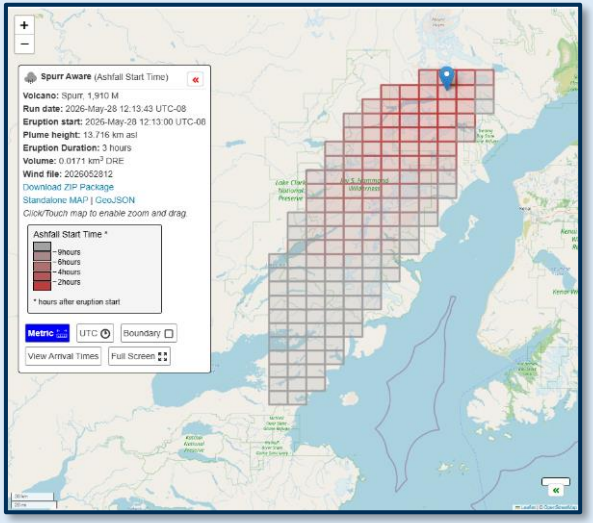
- Improve service on quantifying airborne ash hazards to aviation.
- Improve service on quantifying ashfall hazards.
- Improve efficacy of USGS and NOAA hazard information products.

Ash3d Model for Ashfall and Airborne Ash

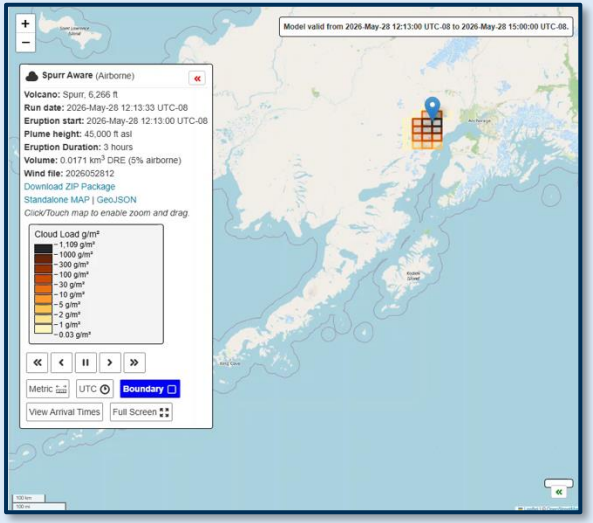
Ashfall thickness



Ashfall Start time



Cloud Mass Load

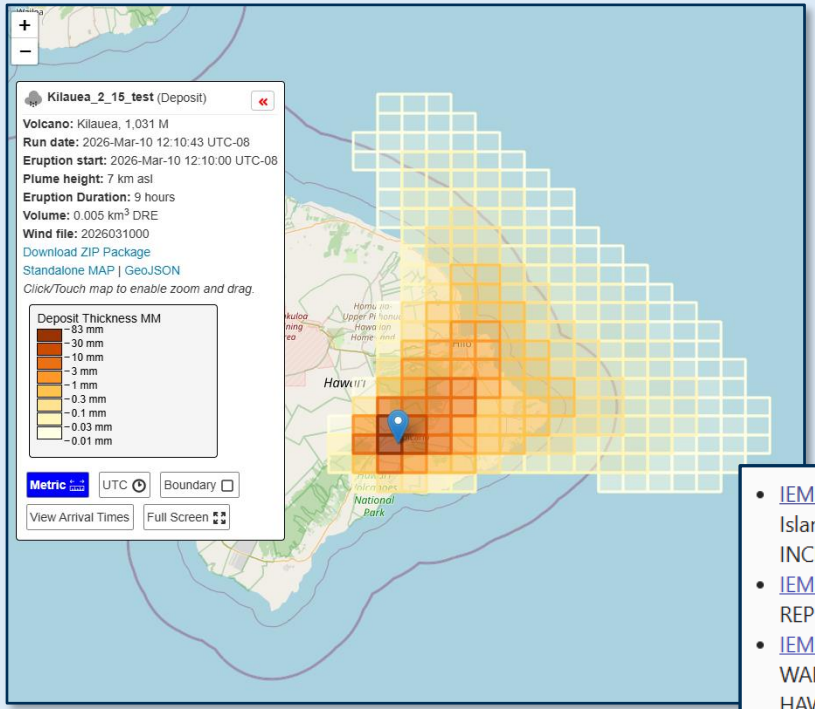


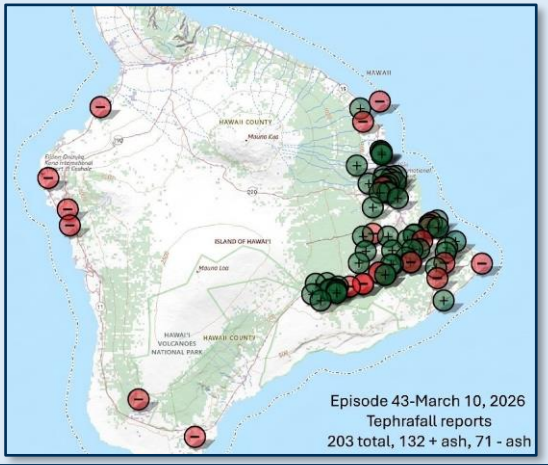
Ash3d is run twice daily for all volcanoes at elevated alert levels for awareness. During eruptions, start time and cloud altitude are updated, and results are used by NWS Forecast Offices to issue their products (Ashfall Advisory or Warnings).

Ash3d results for airborne cloud are for situational awareness. NOAA ARL runs HYSPLIT, which is used to produced VAA guidance for VAACS.

USGS

USGS and NWS Collaboration on Ashfall





Ash3d is used in Hawai'i during lava fountaining episodes.

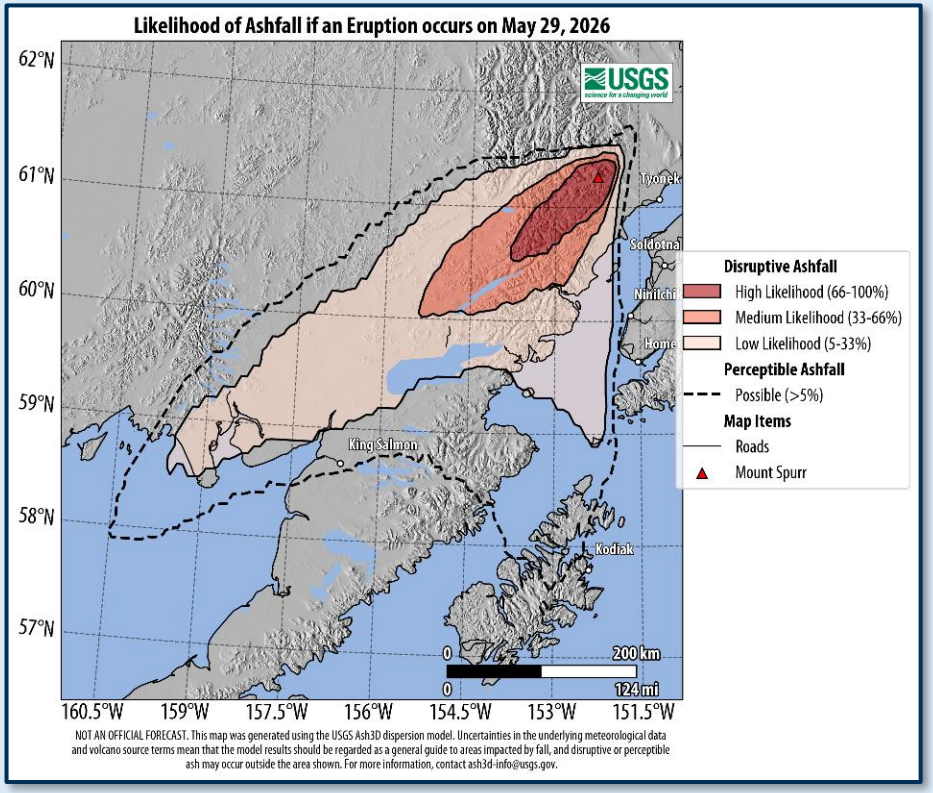
"Is Tephra Falling?" website collects citizen reports of ashfall.

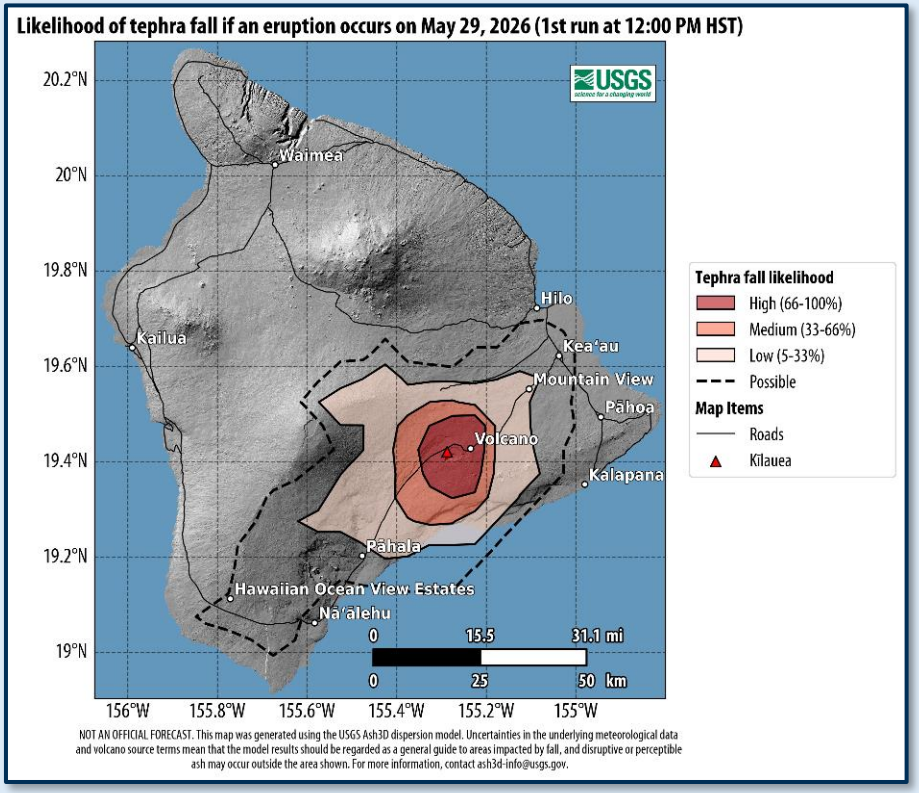
NWS Honolulu uses this guidance to issue Ashfall Advisories or Warnings.

- IEM :: NPW from NWS HFO: first ashfall advisory issued at 1040 AM Big Island Interior-Big Island Southeast-Big Island East - FOR HAWAII VOLCANOES NATIONAL PARK AND AREAS TO THE NORTH AND EAST OF THE PARK, INCLUDING THE TOWN OF VOLCANO...
- IEM :: NPW from NWS HFO: upgrade to ashfall warning at 1103 AM Big Island Interior-...ASHFALL ADVISORY REPLACED WITH ASHFALL WARNING...
- IEM :: NPW from NWS HFO: additional message at 1129 AM - Big Island Southeast-Big Island East-...ASHFALL WARNING REMAINS IN EFFECT UNTIL 5 PM THIS AFTERNOON FOR HAWAII VOLCANOES NATIONAL PARK AND AREAS TO THE NORTHEAST INCLUDING MOUNTAIN VIEW, VOLCANO, AND GLENWOOD, AND EXTENDING TO THE SOUTHEAST AND SOUTHWEST...

USGS

Ash3d Ashfall Likelihood Ensemble Model





USGS

Aviation Hazards: International Collaboration

International Civil Aviation Organization (ICAO) Working Group on Meteorological Operations Group (WG-MOG) International Airways Volcano Watch (IAVW) Work Stream

World Meteorological Organization (WMO) Advisory Group on Volcanic Science for Aviation Applications (AG-VSA)

World Organization of Volcano Observatories (WOVO)
Volcanic Ash and Aviation Hazards (VAAH) Program

USGS

Volcano Observatory Notice for Aviation

ICAO has **updated** global VONA format. These changes became a **Recommended Practice** for SVOs beginning in November 2025. The updated requirements ensure consistency, clarity, and seamless distribution across international aviation systems.

Summary of Key Updates

- A new **standardized** content and format.
- **Mandatory fields** with prescribed wording and aviation-standard abbreviations.
- Dual output format: a text bulletin and a machine-readable XML product.
- Distribution via the Aeronautical Fixed Service (AFS), in addition to current methods.

VONA – Enhanced Information

Where possible, SVOs encouraged to include ranges for eruption source parameters in the remarks sections.

- This could include variation in eruption cloud height or other factors like course-grained tephra, or significant water content.
- Supports modelling by the VAACs and issuance of probabilistic quantitative volcanic ash concentration information (QVA).

USGS

USGS VONA

NWS SIGMET

WMAK01 PAVO 031412
VONA
DTG: 20231003/1412Z
VOLCANO: SHISHALDIN 311360
PSN: N5445 W16358
AREA: ALEUTIANS
SOURCE ELEV: 9373FT AMSL
NOTICE NR: 2023/50
CURRENT COLOUR CODE: RED
PREVIOUS COLOUR CODE: ORANGE
SVO: ALASKA VOLCANO OBSERVATORY
ACT STS: ERUPTION OCCURRED
ONSET: 20231003/1350Z
DUR: ONGOING CONS
VA CLD HGT: 40000FT AMSL
HGT SOURCE: SATELLITE
MOV: S
CTC: AVO DUTY SCIENTIST, TEL +1-907-786-7497
RMK: SIG VA EM OBS IN SATELLITE AT 20231003/1350Z. VA EM EXP TO BE CONS FOR SEVERAL HR.
NXT NOTICE: A NEW VONA WILL BE ISSUED IF COND CHANGE SIGNIFICANTLY OR IF THE COLOUR CODE CHANGES

WVAK01 PAWU 232312
SIGMET
DTG: 20231003/1415Z
VAAC: ANCHORAGE
VOLCANO: SHISHALDIN 311360
PSN: N5445 W16358
AREA: ALEUTIAN ISLANDS
SUMMIT ELEV: 9374 FT (2857 M)
ADVISORY NR: 2023/050
INFO SOURCE: GOES/AVO
AVIATION COLOR CODE: RED
ERUPTION DETAILS: SECONDARY ERUPTION OCCURRED AT 1350Z.
OBS VA DTG: 03/1415Z
OBS VA CLD: SFC/FL400 N5501 W16433 - N5518 W16253 - N5355 W16218 - N5344 W16503 - N5501 W16433 MOV SSW 20KT
FCST VA CLD +6HR: 03/2015Z SFC/FL400 N5652 W15822 - N5523 W15514 - N5123 W16558 - N5427 W16652 - N5652 W15822 - N5652 W15822
FCST VA CLD +12HR: 04/0215Z NO VA EXP
FCST VA CLD +18HR: 04/0815Z NO VA EXP
RMK: LARGER SECONDARY ERUPTION OCCURRED AND WAS CONFIRMED WITH AVO. COLOR CODE UPGRADED TO RED...RV
NXT ADVISORY: WILL BE ISSUED BY 20231003/2015Z

USGS

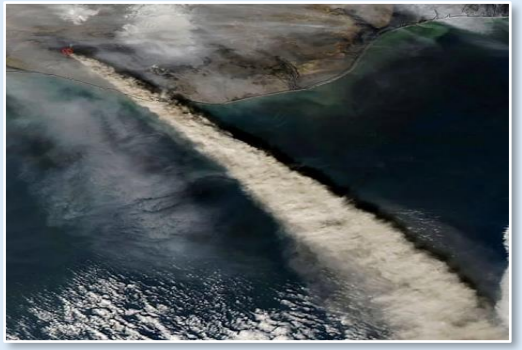
Quantitative Volcanic Ash (QVA)

A **new ICAO provision** to provide more advanced volcanic ash forecasting by regional VAACs was introduced in November 2025. It includes:

Deterministic gridded data that provides the expected ash concentration.

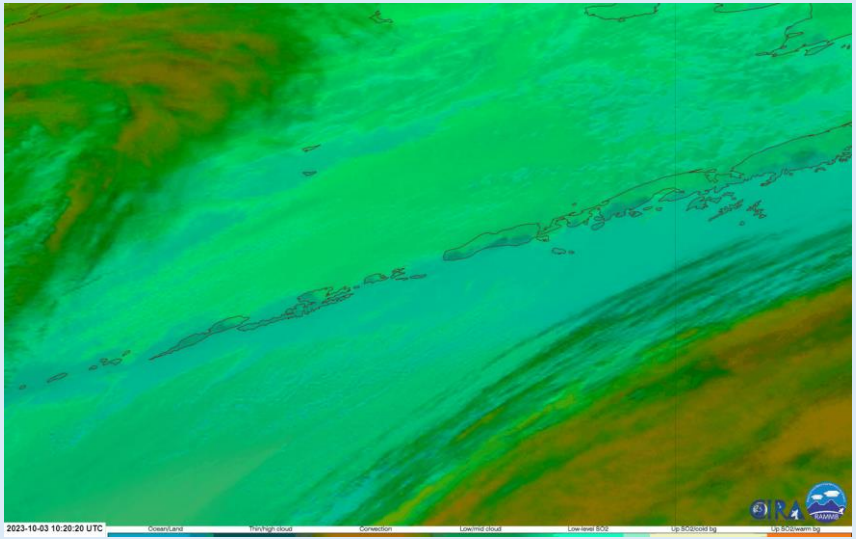
Probabilistic gridded data that gives the probability that the ash concentration these thresholds.

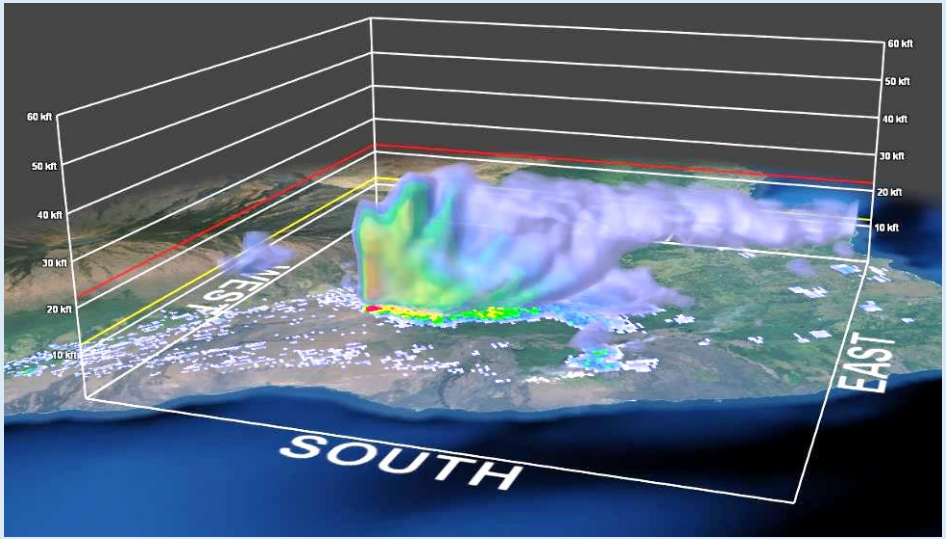
Collaboration between volcanologists, meteorologists and ash modelers is a critical part of this service provision.



USGS

Volcanic Cloud Characterization





Geostationary satellite data provide robust capabilities to distinguish volcanic ash and SO2 components in eruption clouds at temporal resolution as great as every minute.

Where available, NEXRAD radar provides detailed information on the vertical structure of eruption clouds every 6 to 10 minutes. Satellite and radar data provide situational awareness between USGS and NOAA during eruptions.

USGS

National and Regional Collaboration

Updates to Alaska, CONUS, Hawaii, and CNMI regional plans in 2026

Collaboration on Ashfall Impact Language

URGENT - WEATHER MESSAGE
National Weather Service Honolulu HI
1129 AM HST Mon Jun 1 2026

...ASHFALL ADVISORY NOW IN EFFECT UNTIL 6 PM HST THIS EVENING...

- WHAT...Kilauea is erupting lava fountains within the summit caldera. Fountaining episodes typically last less than 12 hours but ash can remain in the air longer depending on wind and weather conditions. W inds will generally be variable through 20,000 ft in elevation today, causing tephra fallout to vary in location. Tephra fall has lightened, but please remember fine ash and Pele`s hair may continue for hours after the eruption stops.

* WHERE...Big Island East and Big Island Southeast.

* WHEN...Until 6 PM HST this evening.

- IMPACTS...The public will be affected by a limited hazard extent. Varying levels of tephra, including ash, Peles hair and other lightweight pumice may fall downwind of the eruption. These small particles are eye and respiratory irritants, but will have low level impacts for most people.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Limit exposure to tephra, especially if you have respiratory sensitivities. Wear a mask, gloves, eye protection, and long clothing when clearing ashfall. Close windows and doors. Cover and disconnect water catchment systems to protect your water supply.

Submit your reports and photos of ashfall from volcanic eruptions to
the USGS Hawaiian Volcano Observatory at: Hawaiiash.science/report_form

06-01-2026 06:15 AM: USGS HVO Volcano WATCH for Kilauea continues.

The National Weather Service has issued an Ashfall Advisory for communities near the Hawaii Volcanoes National Park. Ashfall and light tephra are expected to fall in the communities North of the Park. If you live near National Park, Mountain View, or Pahoa expect ashfall and take the necessary precautions such as closing windows and doors and wearing masks, gloves, and eye protection. Cover or disconnect water catchment systems to protect your water supply.

Please drive with caution in and around the Park as there will be pedestrians and vehicles along the roadway.

You will be informed as conditions change.

This is your Hawaii County Civil Defense Agency.

For more information:
https://www.usgs.gov/volcanoes/kilauea/volcano-updates

HVO - Observatory Messages | U.S. Geological Survey

County of Hawaii Hazard Impact Map

USGS

Volcanic Ash and Gas Impacts Working Group

Authoritative guidance developed by an international team based on worldwide experience.

Website with case studies and advice for emergency managers, scientists and the public.

Posters with ashfall preparedness and mitigation advice for:

- Airport Operators
- Facilities Managers & Buildings
- Operators of Generators & HVAC Systems
- Power Plant Operators
- Power Transmission & Distribution System Operations
- Urban Cleanup Operations
- Water Supply Managers
- Wastewater Collection & Treatment Managers
- Road Network Operations

https://volcanoes.usgs.gov/volcanic_ash/

USGS

Public Comment & Closing

USGS
science for a changing world

National Volcano Early Warning and Monitoring System: Advisory Committee Meeting

June 3 – 4, 2026: Day 2

Main Interior Building

Washington, DC

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

USGS
science for a changing world

Back @ 9:30a

USGS
science for a changing world

Group Working Session I: Monitoring & Evaluation

TOPIC:

- **Monitoring & Evaluation**

Questions for the Committee:

- What do you think about VHP developing an M&E Plan?
- Should cooperators be required to report on information pertaining to NVEWS in a way that is consistent with M&E?
- Does the committee have recommendations on whether—and in what ways—we should share information about the VHP M&E plan, the process used to develop it, or the results of the VNS survey?

VHP Monitoring and Evaluation Plan

VHP Draft Objectives

1. *Improve the quantity and quality of monitoring networks at U.S. volcanoes to match their threat rankings by implementing NVEWS, ensuring early detection of unrest and accurate and timely alerts as foundational inputs to VHP's mission to assess hazards and issue warnings to reduce loss of life and property.*

2. *Conduct research that advances knowledge of volcanic systems and hazards through innovative studies, thereby improving hazard assessment and forecasting capabilities.*

3. *Deliver outreach to stakeholders to support community preparedness through planning, coordination, and training, ensuring that both technical and non-technical communities have adequate awareness and understanding of volcanic hazards, enabling effective interpretation and use of VHP warnings and hazard assessments.*

4. *Increase observatories' capacity to maintain operational effectiveness through inter-operational preparatory actions and reliable responses during volcanic crises.*

VHP Monitoring and Evaluation Plan

VHP Draft Objectives & Potential Measures

1. *Ensure U.S. volcanoes are appropriately monitored to reduce loss of life and property*

    - Monitoring stations installed or upgraded, new techniques applied to monitoring.post unrest-event evaluations.

2. *Research to support monitoring, volcanic hazard assessment, and forecasting abilities*

    - Publications, hazard assessment components, implementation of research-derived tools or models, partners incorporating research into operational plans or decision frameworks.

3. *Support community preparedness for volcanic hazards*

    - Outreach events, communication products, stakeholder meetings, response plans, exercises w/ partners, VNS subscribers, hazard notifications, social media engagement, quality of community engagement.

4. *Ensure observatory operational effectiveness for volcanic crises*

    - Internal exercises, event-trees developed/exercised, cross-observatory (discipline) meetings, staff training (including safety), lessons incorporated from after-action reports, operational volcano response plans developed and implemented, cross-observatory cooperator outputs, time 24/7 monitoring occurs, incorporation of academic & agency interactions during a crisis.

Future Plans (from last meeting)

- Several unknowns for the Volcano Hazards Program, including NVEWS in FY25-27 (budget, hiring, future staffing)
- Staffing shortages will likely continue- prioritization is necessary
- Focus on geothermal energy and critical minerals applications
- Increase Tribal engagement
- Some monitoring and evaluation expertise to tap into
- Expand partnerships (Earthquake and Landslide Hazard Programs, geothermal, federal and non-federal partners)

USGS

BREAK
Back 11a

USGS

USGS
science for a changing world

Priority Focus Area: Geothermal

Lauren Boyd

DOE

Shaul Hurwitz

USGS/California Volcano Observatory

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

U.S. DEPARTMENT of ENERGY | Hydrocarbons and Geothermal Energy Office

USGS NVEWSAC

Advisory Committee Meeting

U.S. Department of Energy
Office of Geothermal
Lauren Boyd, Director

June 4, 2026

2026 Strategic Goals and Objectives

Accelerate the discovery and development of gigawatt-scale geothermal energy and position geothermal as a competitive domestic source for reliable baseload electricity generation.

- Supporting resource characterization and advancing the best opportunities for development
- Driving innovations that enable development optimization of advanced materials, tools, and methods
- Investing in the revitalization of existing geothermal production
- Pursuing methods of utilizing geothermal for storage and load-following capabilities

Office of Geothermal – Research Areas

Pilots & Demonstrations

Advance geothermal innovation through pre-commercial EGS pilot deployments in new geologic and structural settings

Support and manage field activities at Utah FORGE

Improve reservoir performance for EGS and thermal cycling for thermal energy storage

Technology R&D

Improve geothermal exploration using advanced geophysical tools, AI-enabled sensing, and integrated subsurface workflows

Improve drilling speeds and materials

Increase system performance through improved power conversion

Explore opportunities to recover critical minerals from geothermal brines

Commercial Scale-Up

Enable improved permitting processes and accelerated project approvals

Manage all modeling associated with geothermal power and storage uptake, including the GDR

Assess geothermal's contributions to grid services, markets, and long-term reliability

Improve awareness and understanding of geothermal energy

DE-risking Exploration of geothermal Plays in magmatic Environments

Objective

Improve success rates for geothermal drilling in magmatic systems

Test Sites

- Hengill Volcano, Iceland
- Newberry Volcano, Oregon

Impact

Strengthens international geothermal collaboration and advances exploration for high-temperature resources

Delivered

- Validated new geophysical and geochemical exploration methods
- Developed Play Fairway Analysis for magmatic environments

2
Volcanic Test Sites

4+
Years of Research

2
International Partners

Superhot Rock Research: Unlocking Extreme Temperature Geothermal

Massive Potential

Just 1% of U.S. superhot rock (>375 °C) could generate 4.3 TW of firm, flexible power[1] — almost 4x current U.S. electricity capacity.

Technical Challenge

Existing geothermal tech isn't designed for extreme temperatures; next-gen drilling and materials are essential.

Grid Benefits

Superhot rock offers significantly more energy per unit volume, delivering reliable baseload power at lower cost.

[1] Clean Air Task Force, Mapping the potential of superhot rock geothermal. https://www.catf.us/superhot-rock/heat-mapping/

Regional Partnerships for Geothermal Data

- Aims to facilitate discovery and development of new U.S. geothermal resources through field data collection, including geophysics and exploratory drilling.
- Will support data collection for geothermal resource assessment, exploration, and development across multiple regions.
- Goal to incentivize and stimulate U.S. geothermal exploration, development, and workforce activities.

Geothermal steam rises from Pilgrim Hot Springs on the Seward Peninsula in Alaska. Credit: Dick Benoit

Hidden Systems

Play Fairway Analysis: Supported projects to advance and adapt PFA for geothermal across the U.S., resulting in regional, basin-scale maps to help quantify and reduce uncertainty for geothermal exploration.

INnovative Geothermal Exploration through Novel Investigations Of Undiscovered Systems (INGENIOUS): Discovery of commercially viable hidden systems across the Great Basin region; focus on predictive geothermal maps and a geothermal developer's playbook.

Basin & Range Investigations for Developing Geothermal Energy (BRIDGE): More detailed study of military lands in Nevada and New Mexico using airborne electromagnetic methods

36-MW Don A. Campbell Geothermal Power Plant (Ormat), a hidden system discovered during mineral exploration drilling

DOE Geothermal Data Collection Pipeline By the Numbers

4,800	Line-km of HeliTEM	**100,000+**	Feet of new exploratory drilling
800+	Magnetotelluric Stations	**30+**	Well logs
100s	Line-km of new Aeromag	**100,000+**	Acres high-res LiDAR
25+	New Data Partners	**20+ years**	Production Data

Data Access

The Geothermal Data Repository addresses the dearth of U.S. geothermal data by providing free, universal access to all OG-funded project data

- Currently houses more than 10 years' worth of project data, totaling more than **764 TB**
- **Enables research, collaboration, and transparency** by providing open access to geothermal data and information
- **Continually updated** with features that ensure data accessibility and ease of use
- **New AskGDR AI feature** enables easier data access

Downloads

216,527 in April 2026

9,681,331 Fiscal Year to Date

Thank You!

Interested in being a merit reviewer for OG projects? Email a resume or CV to DOE.Geothermal@ee.doe.gov.

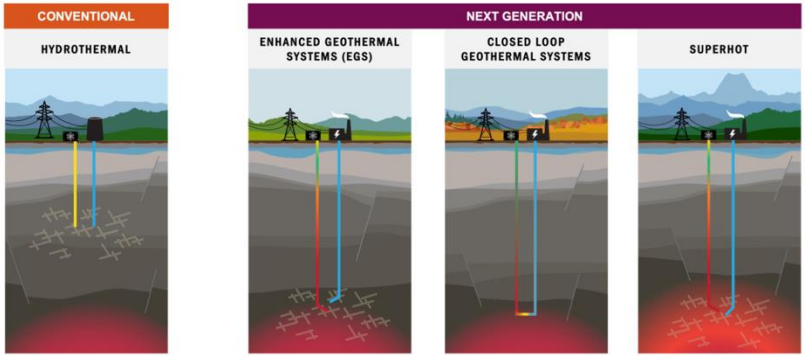
Production of geothermal energy from US volcanoes: benefits and hazards

Shaul Hurwitz - California Volcano Observatory

NVEWS Advisory Committee, 4-June-2026

Geothermal energy production

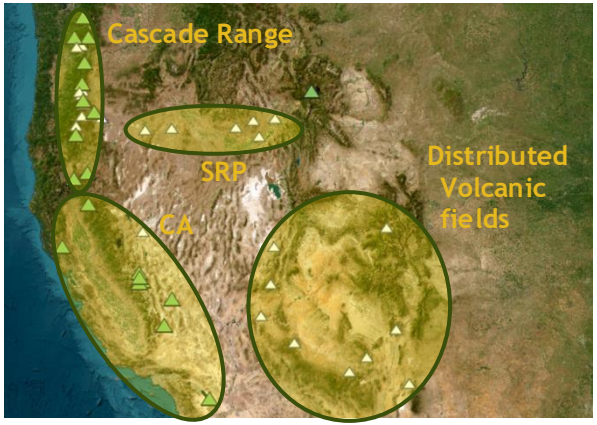
A geothermal resource requires **heat**, **water, & permeability** (natural, or induced)



Types of geothermal power plants:

- **Dry steam power stations** (only at **the Geysers**).
- **Binary cycle power stations -** use a secondary fluid with a lower boiling point than water that causes the fluid to flash and drive the turbines.
- **Enhanced Geothermal Systems (EGS)** - where rock (fracture) permeability is low. **Fluid is injected at high pressure** to open and connect pre-existing fractures (Hydraulic Stimulation).
- **Superhot** – energy production from reservoirs with Temp. >375 °C.

Not much correlation between geothermal energy production & volcanoes in the U.S.

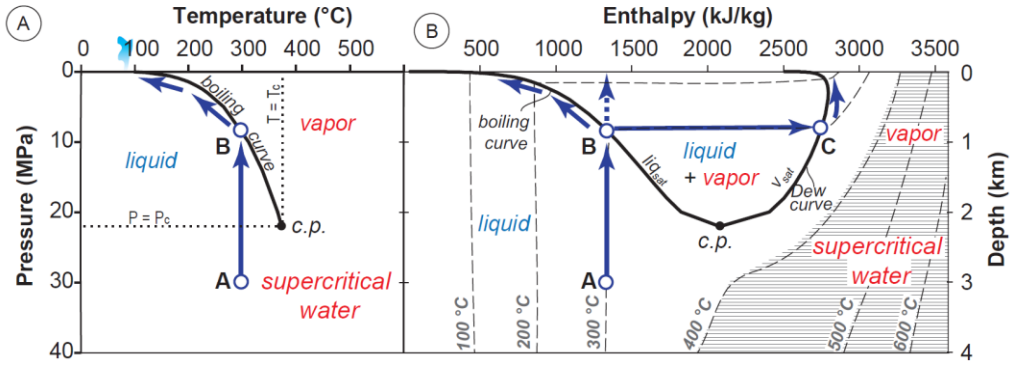


Regional Volcano Monitoring Priority

Region	Highest Priority	High Priority
Alaska	Akutan, Augustine, Makushin, Redoubt, Spurr	Aniakchak, Atka, Churchill, Cleveland, Douglas, Fisher, Fourpeaked, Great Sitkin, Griggs, Hayes, Iliamna, Kaguyak, Kanaga, Kasatochi, Katmai, Korovin, Mageik, Martin, Moffett, Novarupta, Okmok, Pavlof, Seguam, Semisopochnoi, Shishaldin, Snowy Mountain, Trident, Ugashik-Peulik, Veniaminof, Westdahl
Washington	Glacier Peak, Mount Baker, Mount Rainier, Mount St. Helens	Mount Adams
Oregon	Crater Lake, Mount Hood, Newberry, Three Sisters	
California	Lassen Volcanic Center, Long Valley, Mount Shasta	Clear Lake, Mono-Inyo Craters, Medicine Lake, Salton Buttes
Wyoming		Yellowstone
Hawaii	Kīlauea, Mauna Loa	Hualālai

- Producing power plants at two highest-, and two high-priority volcanoes.
- Drilling planned in three highest-priority volcanoes (Augustine, Makushin, Newberry)
- No geothermal plants yet in US Stratovolcanoes (Cascades, Alaska).
- Only one plant in Hawaii (PGV) and one (non-volcanic) in AK and in the SRP
- EGS in the distributed volcanic fields are prime for data centers (Fervo Energy and other companies).

Superhot fluids are targeted in volcanoes (Augustine, Newberry, Krafla)



Krafla in Iceland

KMT KRAFLA MAGMA TESTBED

A Breakthrough in Magma Energy and Science

ARPAE

About

Research Areas

SUPERHOT

Stimulate Utilization of Plentiful Energy in Rocks Through High-Temperature Original Technologies

DOE ARPA-E "The SUPERHOT program will support research and development of technologies to enable production of geothermal energy from super-hot reservoirs (>375 °C and >22 MPa)".

No superhot geothermal energy production yet.

Geothermal resources in California

California leads the U.S. in geothermal energy production (**5%-6%** of in-state electricity generation) **all from volcanic terrain**

Clear Lake Volcanic field - The Geysers, the world's largest geothermal electric power producer
Long Valley Caldera - The Casa Diablo plant
Coso - on U.S. Navy-owned land
Imperial Valley/Salton Sea – A priority area for coproduction of geothermal energy & lithium from brine

++

Medicine Lake – explored in the past but court decision voids geothermal leases on sacred tribal lands
Mono Basin - remains mostly unexplored despite the very young volcanism

By California Volcano Observatory March 1, 2022

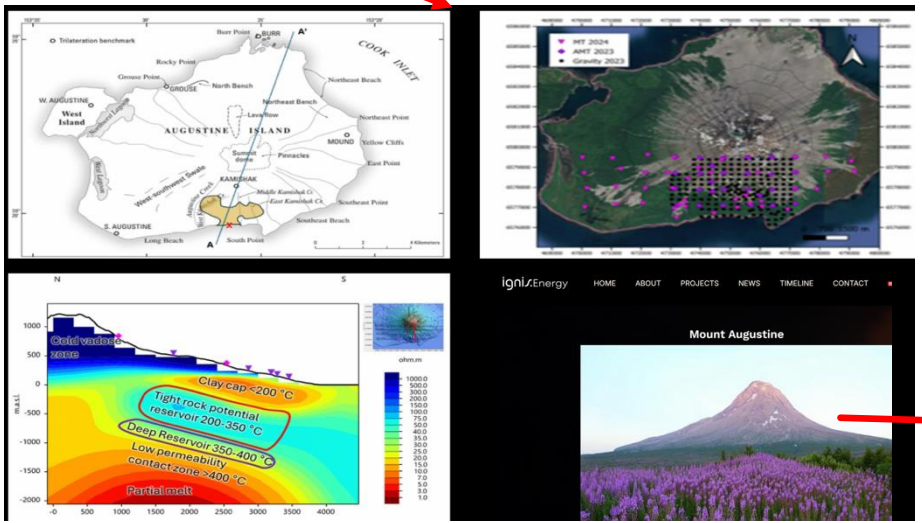
Nearly all of California's geothermal electric power generation comes from areas where eruptions occurred in the past tens thousands of years

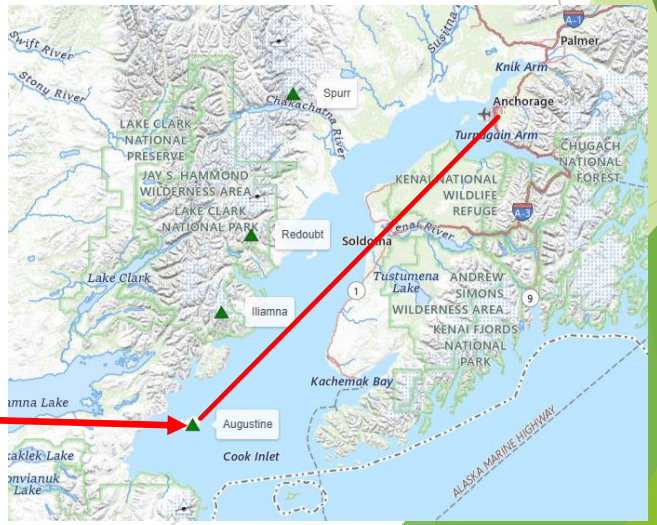
Geothermal resources in Alaska

Chena Hot Springs (~65 miles from Fairbanks) has a low-temperature geothermal resource (~165 °C) for commercial power production

Sites being explored:

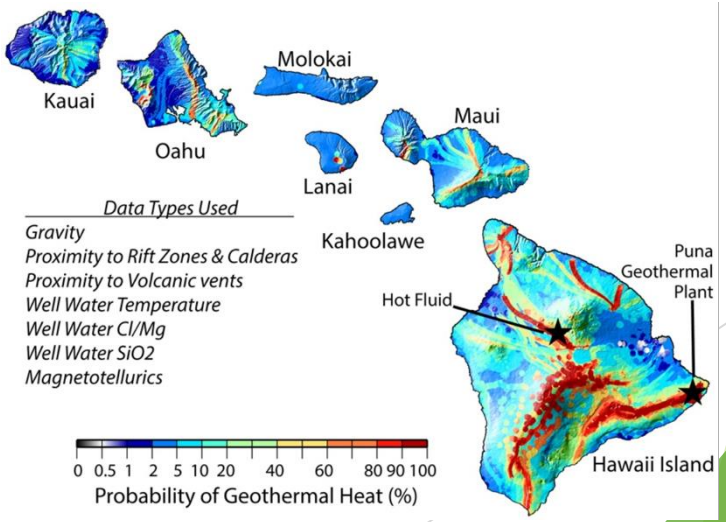
- **Pilgrim Hot Springs** (Seward Peninsula – non-volcanic)
- **Makushin** (Island of Unalaska)
- **Augustine Volcano**





Geothermal resources in Hawaii

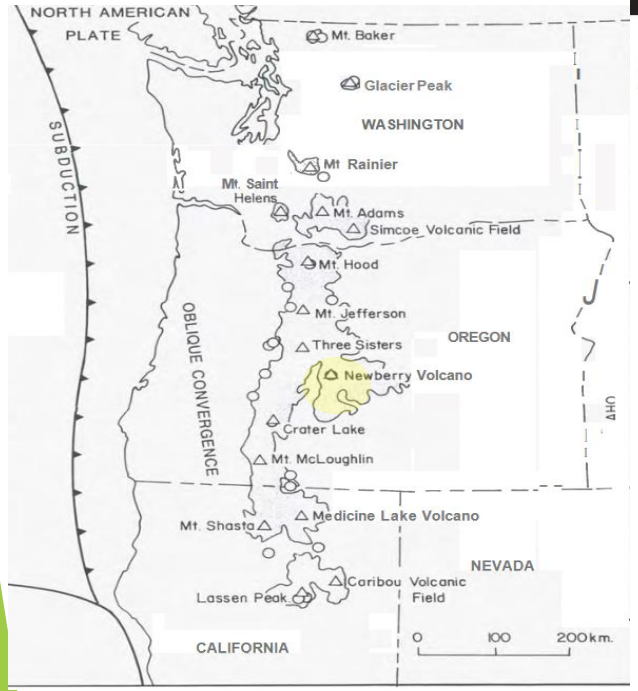
- U. Hawaii completed a play fairway analysis across the state with funding from DOE and from the state of Hawaii.
- Geothermal energy currently being produced only at Puna Geothermal Venture (PGV) in Kīlauea's Lower East Rift Zone.
- Exploratory drilling was completed in Lanai and Maui (Haleakala Volcano)
- USGS and U. Hawaii are planning to collect additional geophysical data in Maui, Mauna Loa, and/or Lanai (not final)

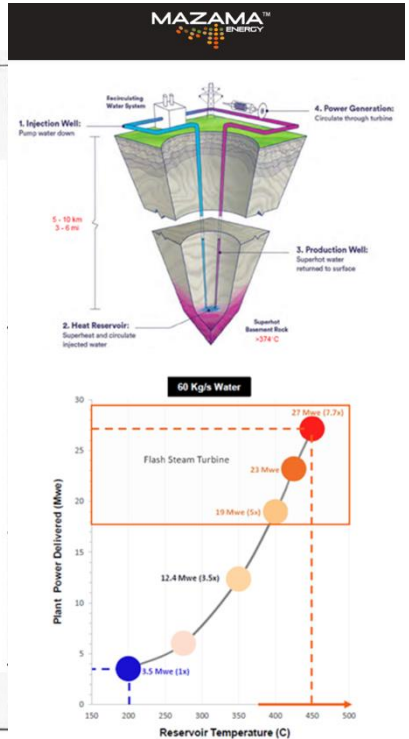


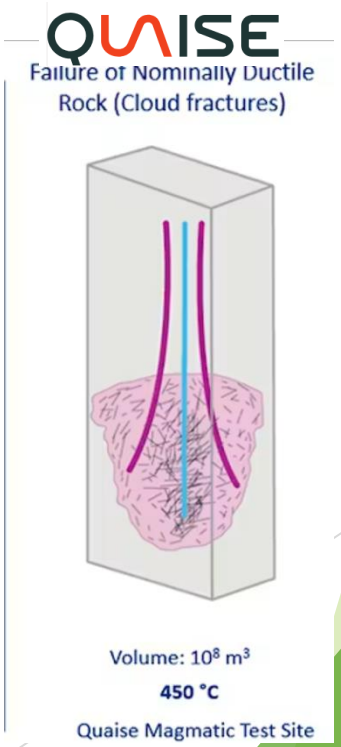
Geothermal resources in the Cascade Range

Mazama Energy, and Quaise Energy, have drilling projects in **Newberry Volcano, OR,** including EGS and plans for extracting **superhot fluids.**

USGS plans to collect additional geophysical data







Hazards associated with geothermal energy production

Hazards - lava flows

The 2018 **Kīlauea** Lower East Rift Zone eruption (HI) of covered 3 wells in Puna Geothermal Venture (PGV) power plant

At the **Svartsengi** power plant in Iceland, embankments have been built and reinforced in recent years

Hazards – induced earthquakes from EGS

RESEARCH ARTICLE | SEPTEMBER 01, 2009

Earthquakes Induced by the Stimulation of an Enhanced Geothermal System below Basel (Switzerland)

Nicholas Deichmann; Domenico Giardini

+ Author and Article Information

Seismological Research Letters (2009) 80 (5): 784–798. | https://doi.org/10.1785/gssrl.80.5.784 | Article history

RESEARCH ARTICLE | AUGUST 07, 2019

Triggering of the Pohang, Korea, Earthquake (M_w 5.5) by Enhanced Geothermal System Stimulation

William L. Ellsworth; Domenico Giardini; John Townend; Shemin Ge; Toshihiko Shimamoto

The Geysers

Quake Fears Stall Energy Extraction Project

By James Glanz

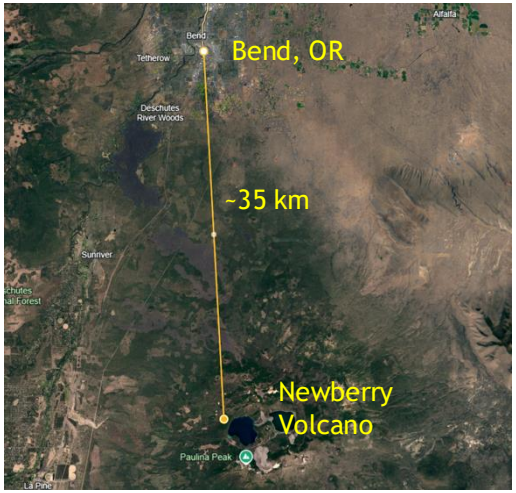
July 13, 2009 The New York Times

Small Earthquake Shakes Northern California

By William B. Davis, Madison Dong, Judson Jones, John Keefe, Joey K. Lee and Bea Malsky

Updated Nov. 29, 2025 at 1:06 a.m. E.T.

Newberry Volcano



The population of Bend, ~110,000 residents and of the metropolitan area ~268,000

Reviews of Geophysics

Review Article | Open Access

Managing Induced Seismicity Risks From Enhanced Geothermal Systems: A Good Practice Guideline

Wen Zhou, Federica Lanza, Iason Grigoratos, Ryan Schultz, Julia Cousse, Evelina Trutnevyte, Annemarie Muntendam-Bos, Stefan Wiemer

First published: 08 October 2024 | https://doi.org/10.1029/2024RG000849 | VIEW METRICS

Recommendations are provided for key technical aspects including (a) a seismic risk management framework, (b) seismic risk pre-screening, (c) comprehensive seismic hazard and risk evaluation, (d) traffic light protocol designs, (e) seismic monitoring implementation, and (f) step-by-step communication plans.

Hazards – explosions & eruptions

Declining reservoir pressures can result in hydrothermal explosions

Hydrothermal explosions can be triggered by pressure decline in a producing reservoir

Geothermal drilling has caused a volcanic eruption in Iceland (8 September 1977)

nature

Explore content | About the journal | Publish with us | Subscribe

nature > articles > article

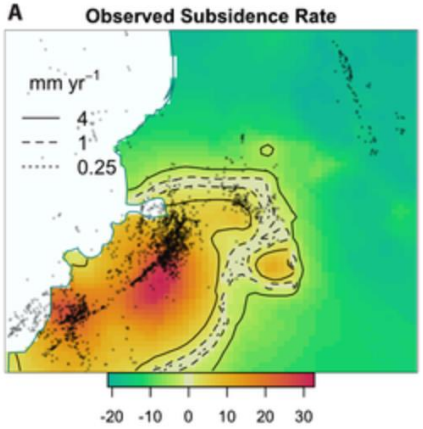
Article | Published: 01 April 1979

Volcanic eruption through a geothermal borehole at Námafjall, Iceland

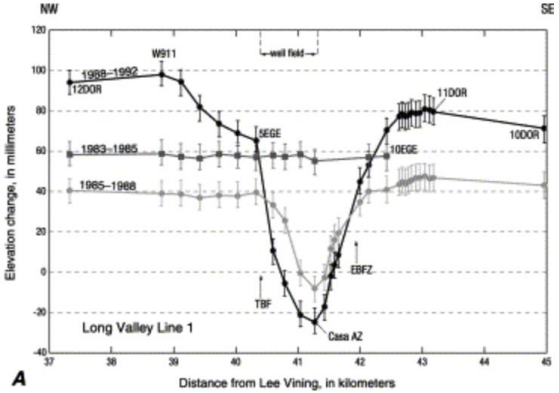
Gudrún Larsen, Karl Grönvold & Sigurdur Thorarinsson

Nature **278**, 707–710 (1979) | Cite this article

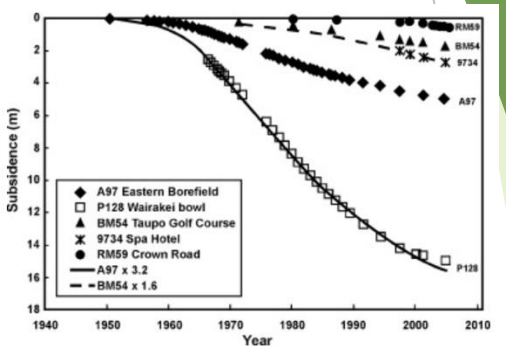
Hazards - land subsidence



Subsidence near the **Salton Sea** (2003-2010) up to 52 mmyr^{-1}
Barbour et al. (JGR 2016)



Subsidence at Casa Diablo (**Long Valley**) ~310 mm (1985-1997)
Howle et al. (JVGR, 2003)



Subsidence at **Wairakei**, New Zealand **up to ~15 m** (1950-2010).
Allis et al. (Geothermics 2009)

Into the future – what to consider

Energy Department Announces $171.5 Million To Expand U.S. Geothermal Energy


U.S. Department of the Interior

About Bureaus Media

Home › Department of the Interior Implements Emergency...

Department of the Interior Implements Emergency Permitting Procedures to Accelerate Geothermal Energy Development for National Security and Energy Independence

- Significant expansion of EGS in volcanic systems will need more seismic monitoring.

- Improved mitigation and monitoring (deformation, gas emissions, etc.,) of other hazards from geothermal drilling and energy production will be needed.

- More research and monitoring in the distributed volcanic fields for both, geothermal exploration and volcanic hazards.

- Planned drilling at Mt. Augustine (AK), Haleakalā & Mauna Loa (HI), and Newberry (OR) could provide research & monitoring opportunities.

LUNCH

Optional Mural Tour | Return 1:00 PM

USGS
science for a changing world

Other Priority Focus Areas:

Gari Mayberry
USGS/VHP

Andi Ellis
USGS/VHP

Monitoring Partnerships (AVERT, SZ4D, etc.)

Critical Minerals

Subduction Zone Science

Hazard Ready Nation

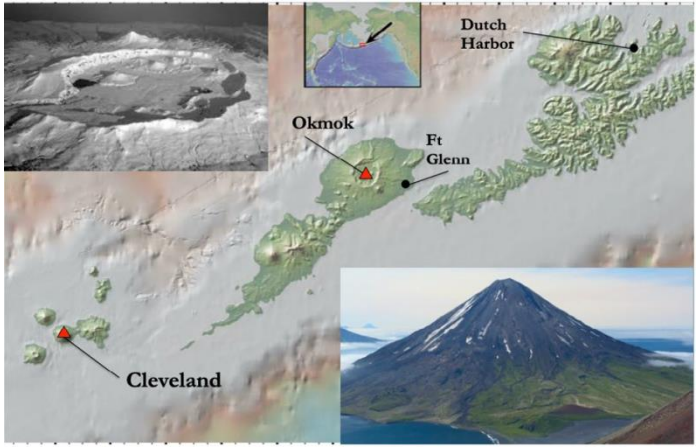
AI

Value of Information

Priority Focus Area: Monitoring Partnerships

Summary

- Anticipating Volcanic Eruptions in Real Time (AVERT), lead by the Lamont-Doherty Earth Observatory of Columbia University with funding from the Gordon and Betty Moore Foundation.
- 2019–2024, partnership with AVO to install new instrumentation on Okmok and Mount Cleveland
- Overal Goal= promote the collection of multi-sensor data on volcanoes, and provide that data openly and in near real time.



The specific goals of the AVERT-AVO partnership were:

- To install multi-sensor arrays on target volcanoes and test novel instrumentation;
- To explore satellite-based telemetry in order to provide robust real-time data;
- •To build a collaborative academic and observatory partnership.

- Over the five-year timeline, all goals were met.

LAMONT-DOHERTY EARTH OBSERVATORY
COLUMBIA CLIMATE SCHOOL

Developing an open, multi-parameter platform for real-time volcano monitoring

Browse Images EXPLORE THE DATA

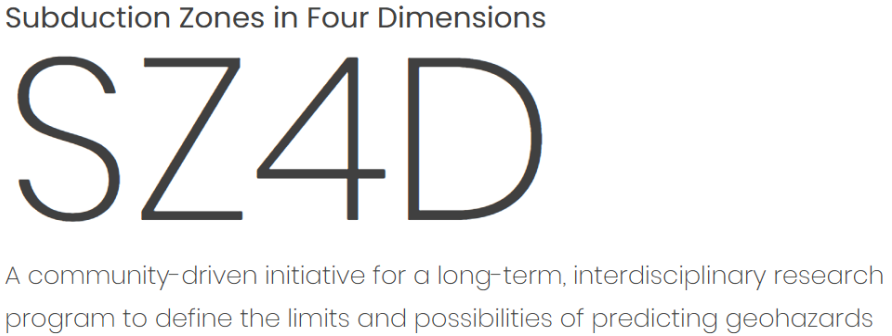
AVERT
Anticipating Volcanic Eruptions in Real-Time

USGS

Priority Focus Area: Monitoring Partnerships

The scientific community's Subduction Zone Hazards in 4D (SZ4D): A Vision Document is published in 2017 and submitted to the NSF (www.iris.edu/hq/files/workshops/2016/09/szo_16/sz4d.pdf).

- SZ4D describes big science questions, links between science and hazards, national and international partnerships, community infrastructure and capacity building, education and outreach.



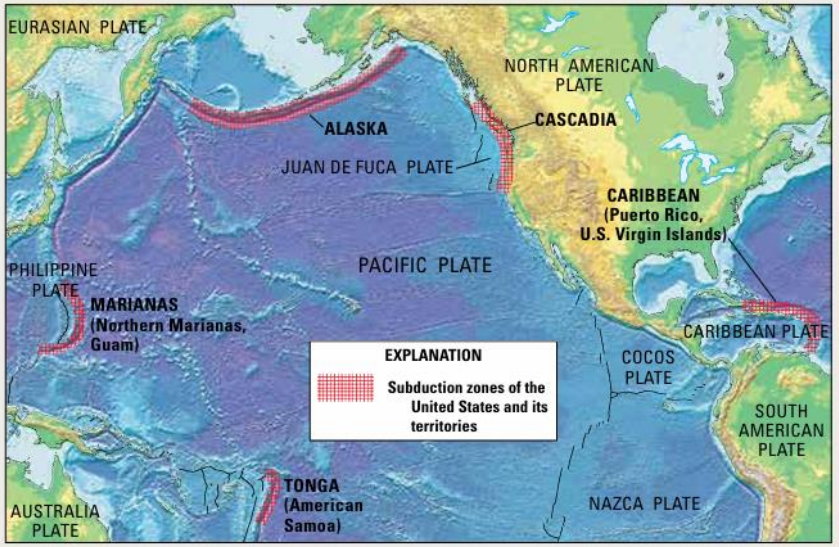
USGS

Priority Focus Area: Subduction Zone Science

USGS's Reducing Risk Where Tectonic Plates Collide – A Plan to Advance Subduction Zone Science was published in 2017 (pubs.er.usgs.gov/publication/cir1428).

The Plan:

- Lays out needs for improved basic and applied research spanning multiple USGS programs and mission areas and leveraging both existing and new partnerships.
- Focuses on: (1) advancing observations and models of subduction zone processes, (2) quantifying natural hazards and risk and (3) forecasting and situational awareness.



Map of the subduction zones that are part of the United States and its territories, which are shown in red. Subduction zones surrounding the Pacific Ocean belong to the "Ring of Fire." Modified from This Dynamic Planet (http://pubs.usgs.gov/imap/2800/).

USGS

Priority Focus Area: Subduction Zone Science

Potential products for building resilience to subduction zone hazards.

Products	Description	Scientific Input	Application
High-resolution hazard maps	Maps of expected neighborhood-scale variations in earthquake shaking and ground-failure, tsunami inundation, landslide potential, volcanic eruptions and lahars	High-resolution topography, onshore and offshore; three dimensional (3-D) models of Earth's structure; well-characterized faults, unstable slopes, active volcanoes	Building design codes, prioritized retrofitting, urban planning, and evacuation routing
Simulations	Science-based scenarios conveying hypothetical subduction zone events	Geologic field and laboratory studies, chronologies of past subduction zone events	Improved mitigation strategies
Warning systems	Advance notice of strong earthquake shaking, volcanic eruptions, tsunamis, and landslides	Multidisciplinary monitoring systems, onshore and offshore	Rapidly implemented life- and property-saving measures
New types of forecasts	Updated projections of aftershocks, landslides and ground failures, volcanic lahars and ash clouds	Rapidly acquired satellite and surface measurements	Safer, faster, and more cost-effective response and recovery
Novel assessments of cascading subduction zone events	Likelihoods of landslide-triggered tsunamis; earthquake-induced coastal land-level changes, flooding and erosion	Computer models simulating linked processes	Rapid and effective mitigation, response and recovery

USGS

Priority Focus Area: Subduction Zone Science

Priorities

- Past: Deciphering Paleoevent Timing, Sources, and Impacts along U.S. Subduction Zones,
- Present: Monitoring and Warning Systems for Subduction Zone Natural Hazards
- Future: Integrated Modeling of Natural Hazards and their Impacts.

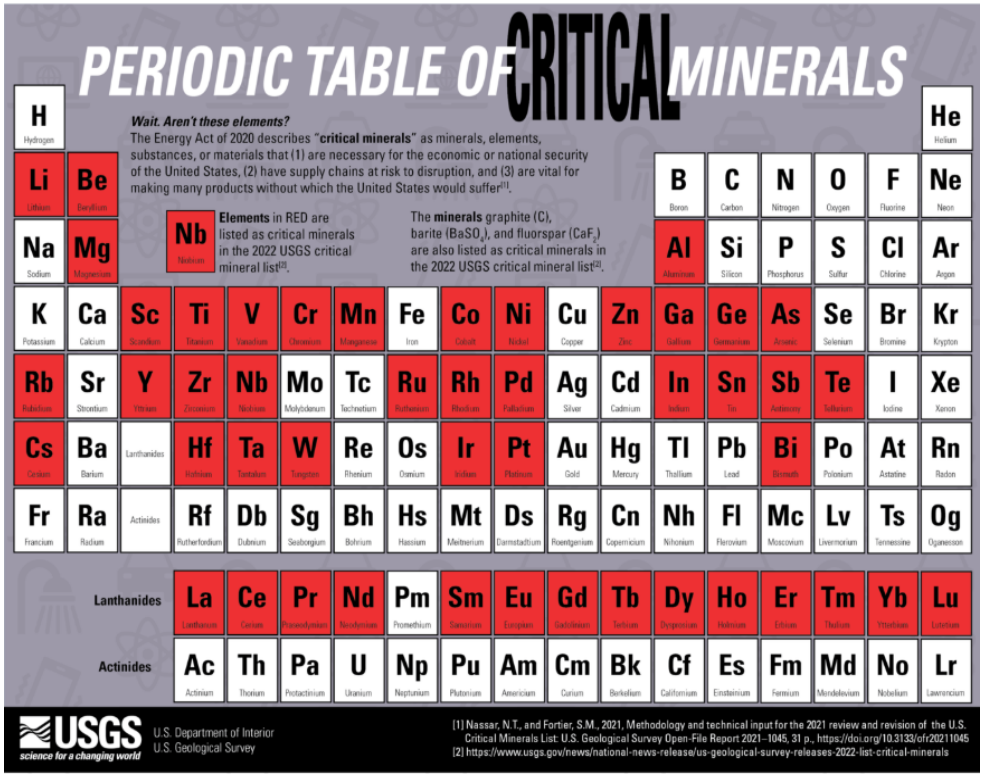
VHP Examples

- Mt Spurr, AK 2025 unrest daily Ash3d models of ashfall probability and thickness
- Ranier lahar detection and scenarios for evacuation planning
- NVEWS
- Inventory and ranking of volcano tsunami sources in Aleutian Arc
- Revision of geologic maps, e.g. Newberry Volcano

USGS

Priority Focus Area: Critical Minerals

- As defined by the Energy Act of 2020, critical minerals are non-fuel mineral resources essential to U.S. economic and national security, with supply chains vulnerable to disruption.
- The 2022 USGS list includes 50 such minerals, and a new list was published to the Federal Registrar on Aug 26th 2025
- Increased federal emphasis on mineral security through legislation, executive orders, and interagency initiatives.



Critical Minerals/Elements highlighted on periodic table. Source USGS

Priority Focus Area: Critical Minerals

- Many critical minerals are deposited or accumulated in igneous/volcanic settings.
- Knowledge of volcanic regions and processes can play a central role in better cataloguing potential critical mineral deposits.
- Volcanic systems can host metals such as copper, nickel, cobalt, lithium, chromium, tungsten, tin, lead, zinc, barite, and the rare earth elements (REEs), all of which are fundamental to advanced technology manufacturing.

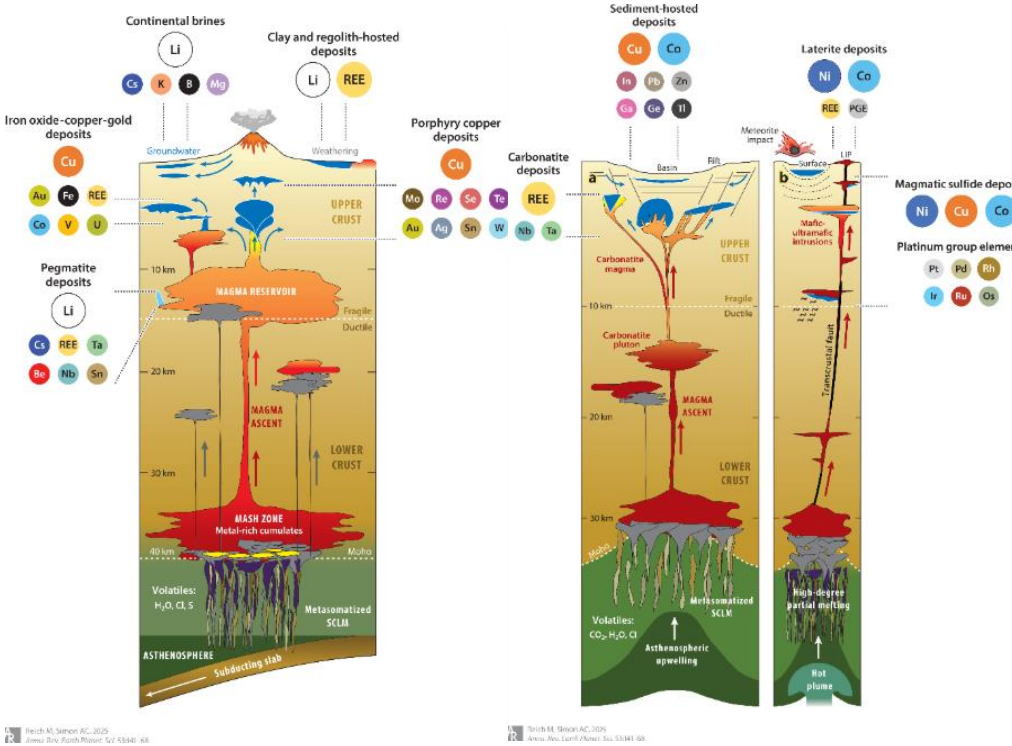


Figure from Reich and Simon (2025) showing critical mineral/element production in a convergent plate boundary (left) and extensional plate boundary and an intraplate hotspot (right).

Priority Focus Area: Critical Minerals

Expertise in igneous and hydrothermal processes positions allows VHP to play a key scientific technical role in assessing critical mineral potential and formation processes in volcanic regions and their exhumed intrusive roots.

- Investigate the sulfur cycle in magmas, a key control on the behavior of economically important metals such as copper, molybdenum, gold, and silver.
- Utilize existing infrastructure at CalVO, CVO, and AVO—including the electron probe, ion probe, SEM, isotope geochemistry labs, and experimental setups—to conduct research on volatile–metal interactions, trace element partitioning, and brine phase separation.
- Bring expertise in magmatic chlorine, copper geochemistry, and isotopic analysis of trace metals.
- Pursue collaborative studies on high-halogen volcanic systems such as Augustine, melt inclusion analyses for copper and lithium, and investigations of critical element partitioning during magmatic differentiation.
- Utilize existing chemical analyses and databases to answer statistical questions on critical minerals in magmatic systems.

USGS

Priority Focus Area: Critical Minerals

Potential activities with additional funding:

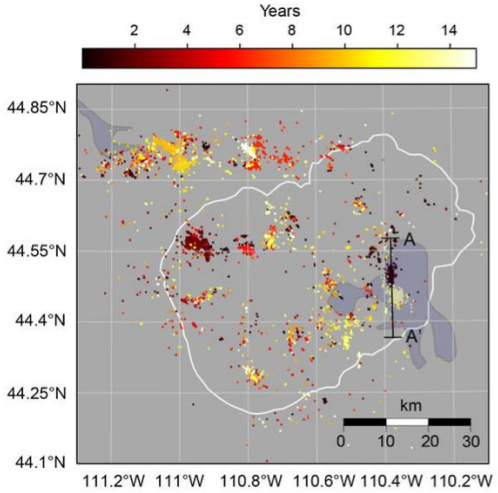
- Building formal partnerships with the USGS Minerals Program
- Leveraging shared instrumentation,
  - CalVO electron probe, USGS-Stanford ion probe, USGS laser ICP-MS facility in Denver, and SEMs at AVO and CalVO
- Pursuing DOE collaborations
- Developing cross-disciplinary projects and proposals.

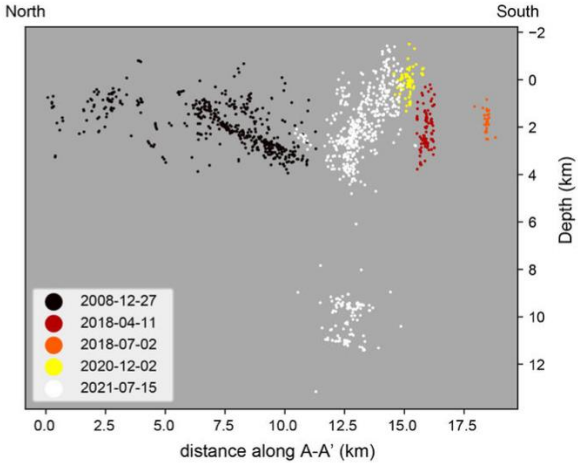
USGS

Priority Focus Area: AI

AI at Yellowstone

- New research analyzed 15 years of seismic data, from 2008 through 2022
- After computing magnitudes, the resultant earthquake catalog contained 86,276 events, more than 10 times as many as many as included in the routine earthquake catalog.
- Although individual swarms typically last days to weeks (and occasionally months), this study found that swarms separated in time by many years may occur adjacent to each other in space.
- Adjacent swarms separated by years might indicate the reactivation of dormant fluids.
- Details in YVO's [Caldera Chronicles article]





Sources/Usage: Public Domain. View Media Details

USGS

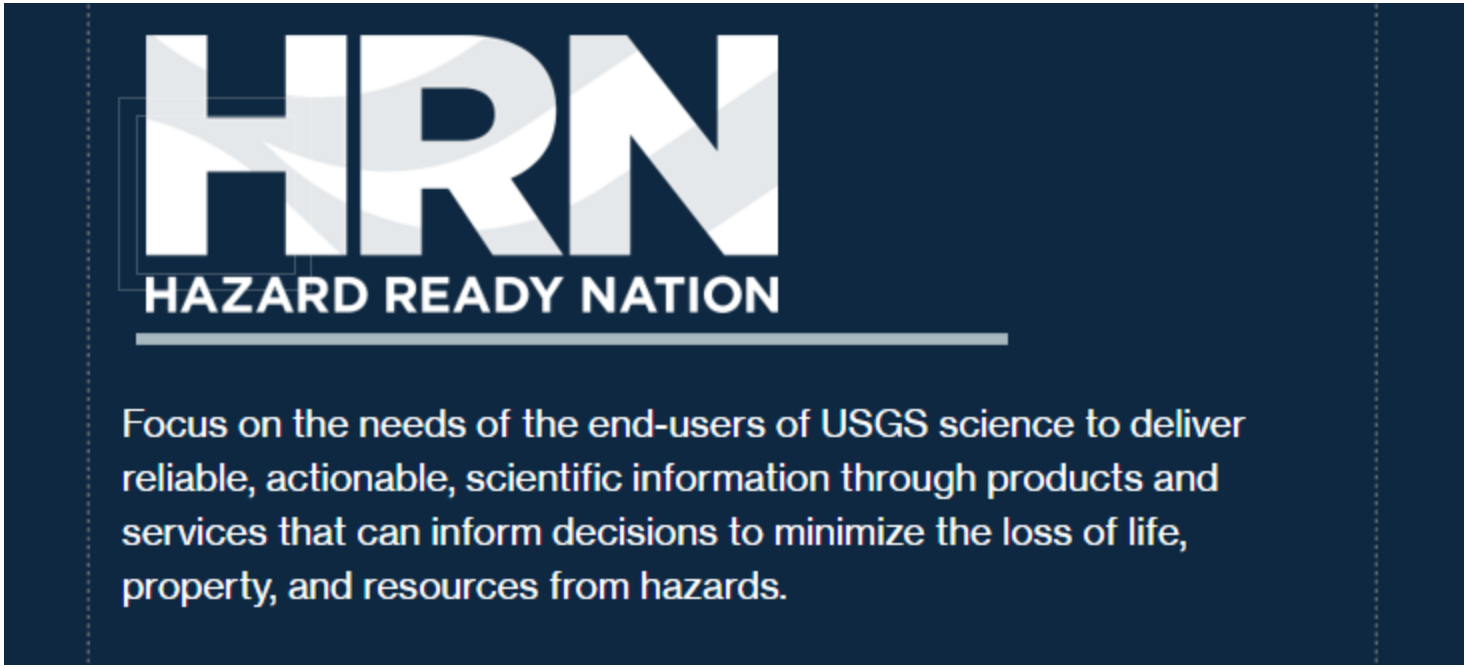
Priority Focus Area: AI

- Designing workflows to create new products volcano observatory scientists can consider alongside traditional volcano monitoring data streams (e.g., ground deformation, earthquake hypocenters)
- Developing and deploying novel tools for the evaluation of remote sensing data using AI algorithms
- Detecting long and very long-period seismic events
- Modeling volcanic systems using statistical methods, physics, machine learning, and a wide variety of data sets. These models will be used to estimate the properties of volcanic systems and to forecast future activity.
- ML approaches for INSAR analysis

AI generated

USGS

Priority Focus Area: Hazard Ready Nation



USGS

HRN
HAZARD READY NATION

Working across USGS towards a more Hazard Ready Nation by informing impact-based decision-making with scientific information

Focus USGS hazards and risk work on end-user needs

Expand USGS hazard and risk science that informs decisions to protect lives, property, and resources

Put USGS hazard and risk science to work in the form of actionable products

Prioritize consistent, collaborative, and actionable communication

WHAT IS HAZARD READY NATION?

PRIORITY 1	PRIORITY 2	PRIORITY 3	PRIORITY 4
Focus on end-user needs	Expand hazard and risk science to inform decision-making for risk reduction	Develop actionable products and services	Prioritize actionable, consistent, and end-user focused communication
• Identifying core-partners • User needs assessment • Monitoring & Evaluation • Impact analysis	• Decision support for risk management • Disaster loss and hazard exposure research • Cascading and intersecting hazard research	• Developing products and services that meet end user needs • Technology transfer • Usability • Consider enterprise technology infrastructure to integrate datasets and add efficiency	• Align USGS communication with end-user needs • Work with core partners to communicate effectively • Communicate about cascading or intersecting hazards

Priority Focus Area: Hazard Ready Nation

HRN Project themes include:

- Real-Time Monitoring and Rapid Alerts
- Scenario development
- Risk Communication
- Stakeholder Engagement and Training
- Integration of Technology and Data

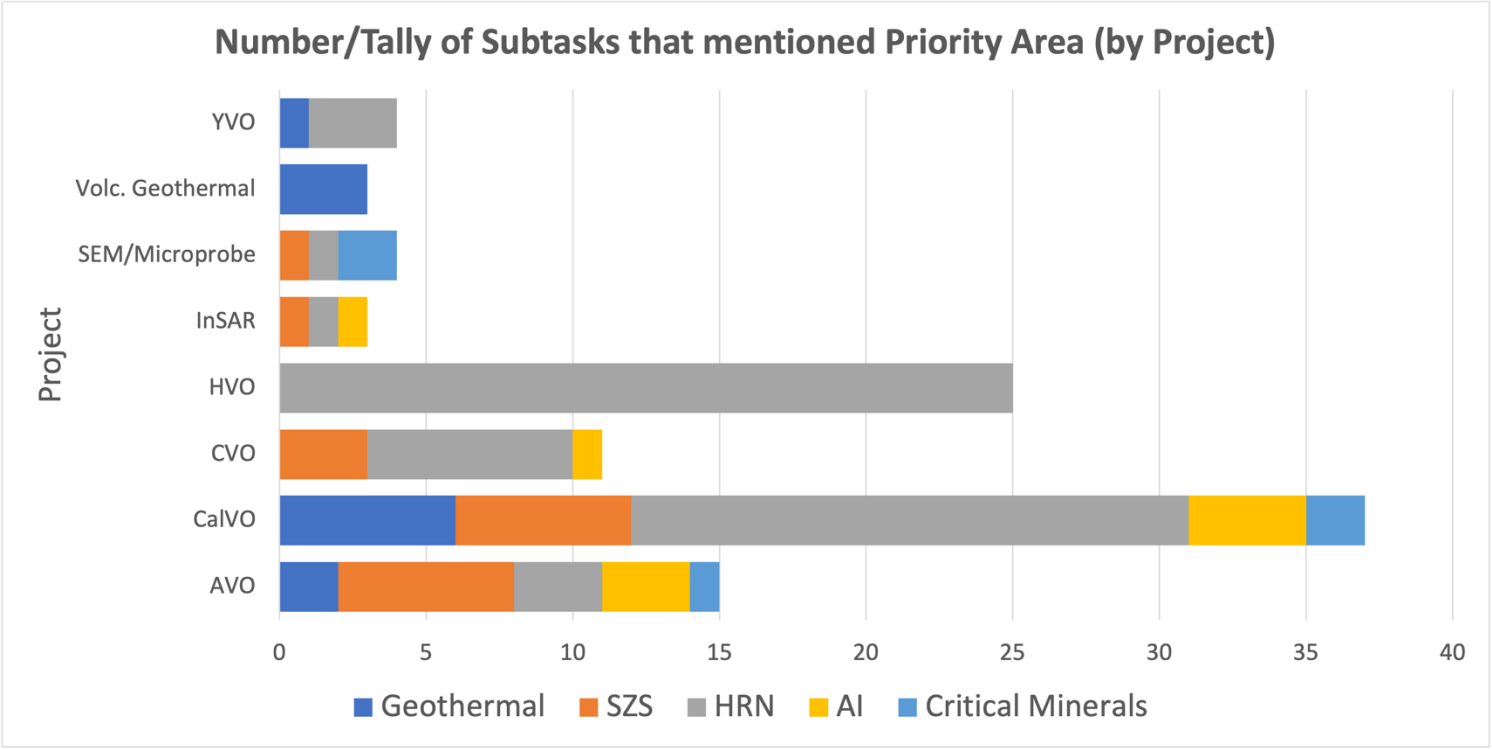
VHP Examples

- Lahar preparedness pamphlet
- "Exposure report" of distributed volcanic fields in the SW US
- Engaging with stakeholders on volcano hazard assessment preperation, pilots at Makushin, AK; Kilauea, HI; Baker, WA; Clear Lake, CA
- Geochronology, mapping, etc... to support hazard assessments
- Evaluation of volcano products

USGS

Priority Focus Areas

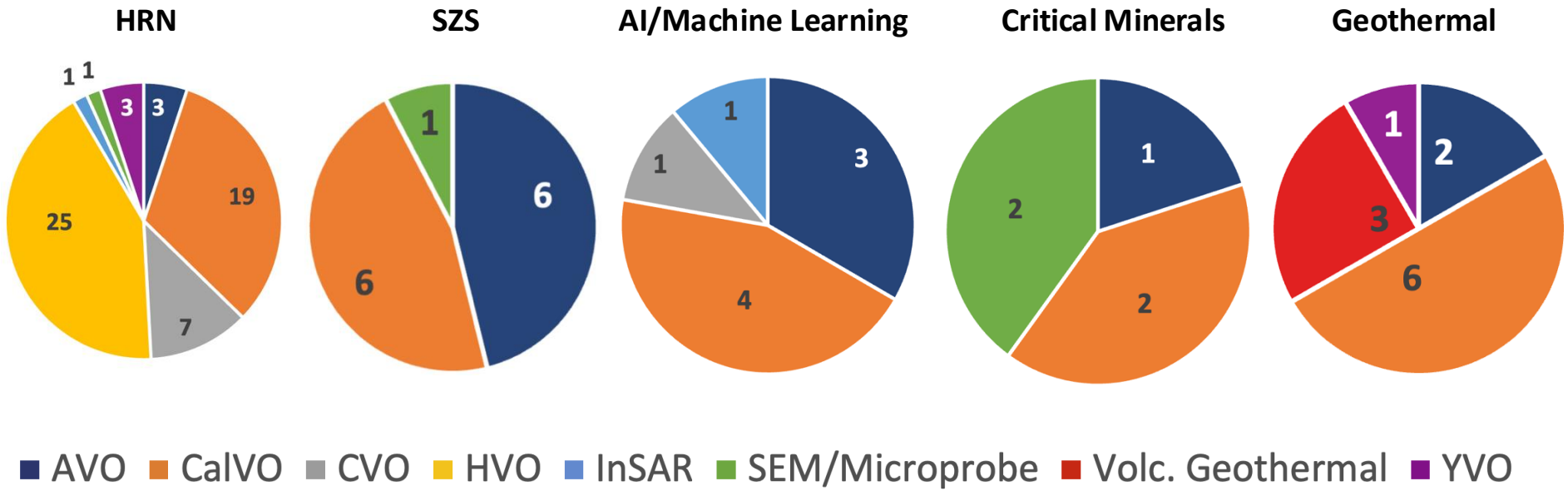
DRAFT Priority Areas by ***Subtask*** Count/Tally as reported for FY26 Projects



USGS

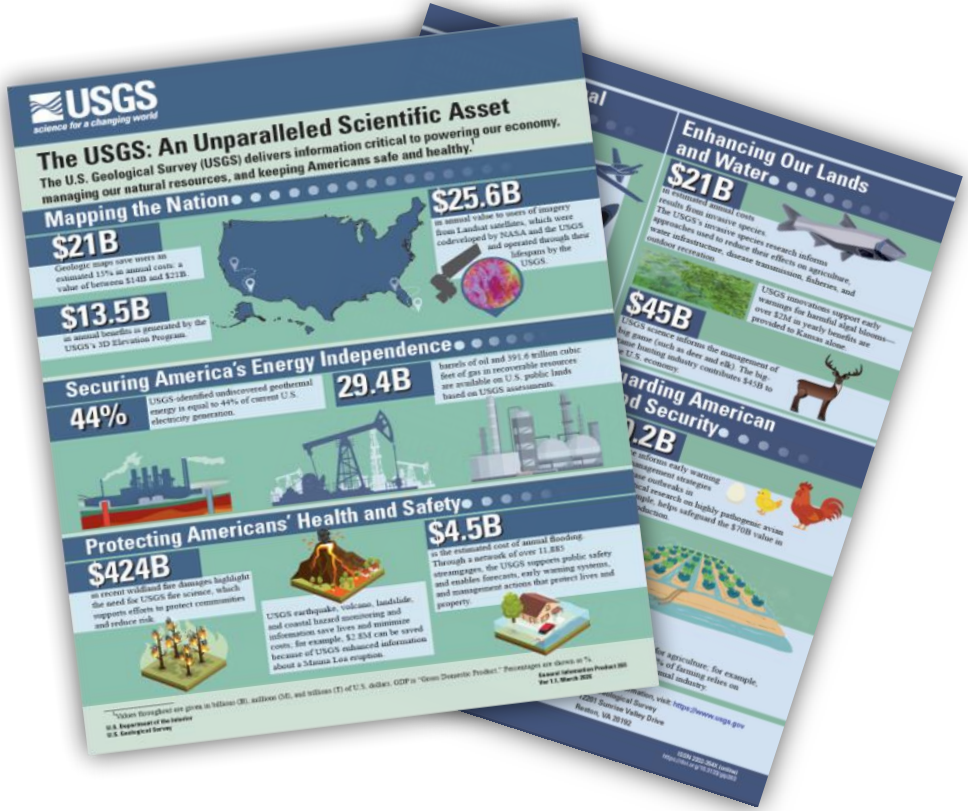
Priority Focus Areas

DRAFT Priority Areas by ***Subtask*** Count/Tally as reported for FY26 Projects



USGS

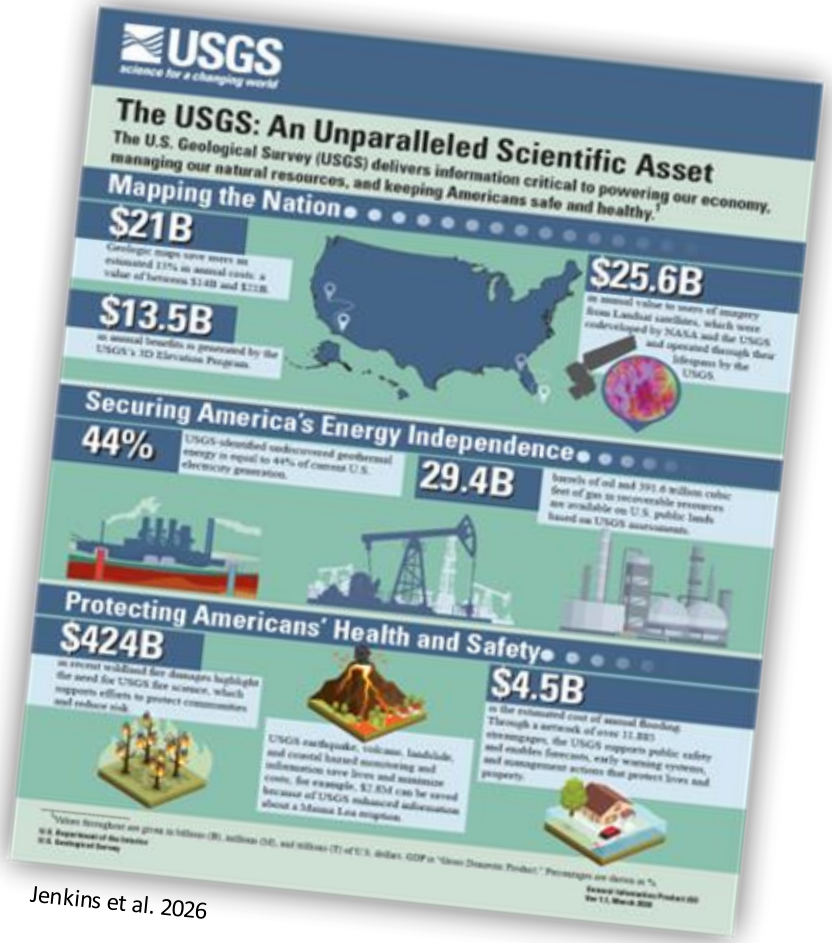
Priority Focus Area: Value of Information
"Articulating the Value of USGS Science"



USGS

VHP's VOI History

- **History (Fall 2017):**
  - Acting USGS Director commissioned the USGS Science and Decision Center (SDC) for a suite of small economic studies – Value Narratives -- from across the USGS Mission Areas.
  - Show the value of USGS products using scientific, smaller-scale specific scenario narratives instead of large broad studies
  - Vic Avery volunteered for the Natural Hazards Mission Area



Jenkins et al. 2026

USGS

Value of Information: Mauna Loa was a first project

- Used Lava Inundation Zones, extrensive interviews, decision trees, and then a specific eruption scenario to conduct a Response Quantitative Analysis

- Key outcome: *HVO information provides $2.8 Million in benefits in the event of a Mauna Loa eruption (under scenario assumptions)*

- *Jenkins, S.M., Pindilli, E.J., Applegate, D., and Reagan, R.E., 2025, USGS—An Unparalleled Scientific Asset (ver. 1.1, March 2026): U.S. Geological Survey General Information Product 263, 2 p., https://doi.org/10.3133/gip263.*

Jenkins et al. 2026

VHP's VOI Current status

- In the initial "information gathering stage”

- Planning to meet w/ *Science and Decision Center* for ideas and see what the viability is for current ideas

- Will be starting to collaborate on projects to:
  - develop and refine estimation methods
  - establish best practices to determine VOI
  - develop a study repository

GOALS:

- *Use information to validate Volcano Hazards allocations and our 'story' to Congress*

- *Inform the public and Congress about the return on investment of USGS programs (advocacy)*

USGS

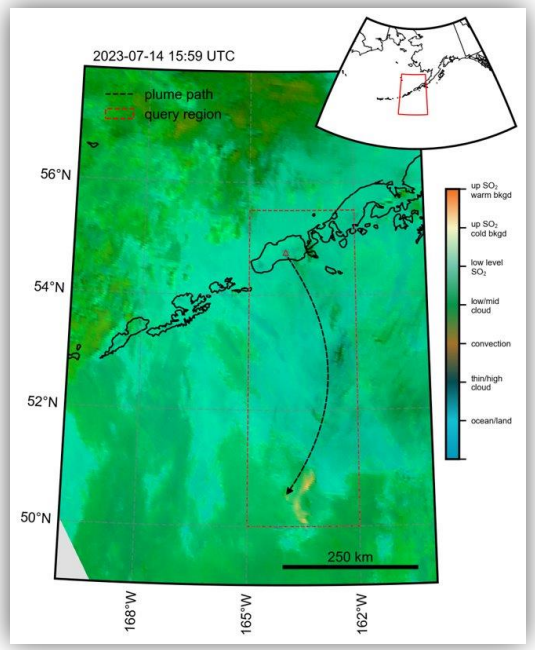
Example VOI Project from VSC

- **<u>Aviation Exposure</u>** *(Lubbers & Loewen)*: Using probabilistic assessment of aviation exposure techniques to answer :

"***For a given area of airspace near a volcano, what is the probability an aircraft is in the air at any moment in time?"***

<u>Takeaway</u>: Determining aviation exposure is no longer challenging, we just need the funds and the scope:

- 900$/month for infinite data.
- Volcano vs region based



(Lubbers & Loewen project)

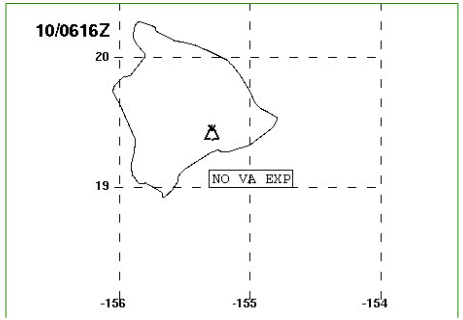
USGS science for a changing world

Example VOI Project from VSC

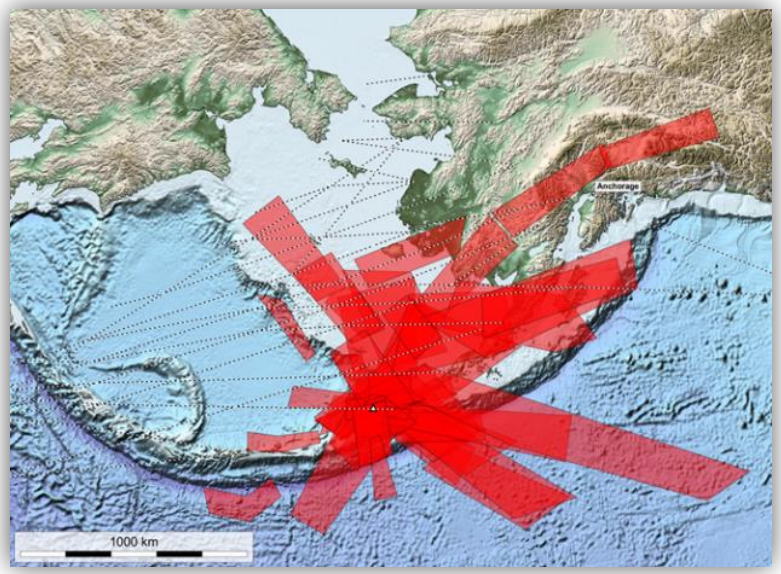
Volcanic Ash Impacts

```
FVXX24 KNES 100625
VA ADVISORY
DTG: 20260410/0625Z
VAAC: WASHINGTON
VOLCANO: KILAUEA 332010
PSN: N1925 W15517
AREA: HAWAIIAN.IS
SOURCE ELEV: 4009 FT AMSL
ADVISORY NR: 2026/016
INFO SOURCE: GOES-18. HVO. HONOLULU MWO. VONA.
WEBCAM. NWP MODELS. VOLCAT.
ERUPTION DETAILS: VA EMS HAS DISP
OBS VA DTG: 10/0616Z
OBS VA CLD: VA NOT IDENTIFIABLE FROM SATELLITE
DATA.
FCST VA CLD +6HR: 10/1230Z NO VA EXP
FCST VA CLD +12HR: 10/1830Z NO VA EXP
FCST VA CLD +18HR: 11/0030Z NO VA EXP
RMK: VA EMS HAS DISP. NO NEW EMS OBS. NO RPRTS OF
NEW EMS.  ...FISHER
NXT ADVISORY:  NO FURTHER ADVISORIES
```

Kilauea Archive



Washington VAAC Volcanic Ash Advisory from episode 44 of the Kīlauea eruption.



Initial Goals:

- **Understand the scale and impacts of hazard losses** to show long-term trends, evaluate mitigation efforts, support emergency planning, and identify research gaps.

- **Develop a national database of geophysical hazard impacts** that can capture many types of losses for each event

Other Example VOI Projects from VSC

Tourism & Public Access

- High-threat volcanoes in public lands draw major tourism that supports local and Federal economies.
- Reliable, real-time volcano information enables safe access and protects the economic value of geo-tourism.

Minerals & Geothermal Energy

- Better subsurface models reduce drilling risk, so reduced exploration uncertainty for minerals.
- Monitoring information supports safe, efficient geothermal operations, improving models of how metals and metalloids concentrate.
- Research informs emerging concepts like co-production of super-hot geothermal energy and mineral resource , informing national strategies for secure critical mineral supply.

Questions for the Committee

- *General thoughts about VHP on these priority areas*
- *Are any topics missing*
- *Thoughts about the proposed Value of Information projects or other ideas*
- *Are there any potential partners on these topics that we haven't discussed?*

USGS

BREAK
Back 2:35p

USGS

USGS
science for a changing world

Small Group Working Session II

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

Public Comment

Closing Remarks