

# Diversity of seismic signals in volcanic systems

Hannah Mark, Diana Roman, John Power, Darren Tan, Elizabeth Alzate, Conor Bacon, Yuly Rave, Jackie Caplan-Auerbach, Kathleen McKee, Ya-Li Lizik, Xiaotao Yang, Carlos Cardona, Craig Gabrielson, John Lyons, etc etc etc

# May 2025 status

- Deep dive on DLPs
- Distinguishing VT vs surface process signals (landslide, avalanche)
  - Seismo-matrix
  - Tremor catalog framework
  - Non-eruptive unrest

# Seismo-matrix: led by Conor

- Collect information on availability of seismic catalogs, imaging, and velocity models per volcano
- Combine with (known) eruptive history, level of instrumentation
- Cross-reference with other “matrices” discussed at the workshop

Volcano	Goal	Published knowledge	Knowledge gap	Last Eruption	Seismic Catalogue	Earthquake classes (optional)	Imaging		
							Category	Status	Notes
Cleveland (311240)	80%	53%	27%	2020 CE	1 AVO catalogue Power et al., 2021	-	Receiver functions	Yes	-
							Local body-wave tomography	No	-
							Ambient noise tomography	No	-
							dv/v	No but feasible	-
							Other	-	Ps-P Tomography (Portner et al., 2020)
							Receiver functions	No	-
Augustine (313010)	80%	80%	80%	2006 CE		-	Local body-wave tomography	No	-
							Ambient noise tomography	No	-
							dv/v	No	-
							Other	-	

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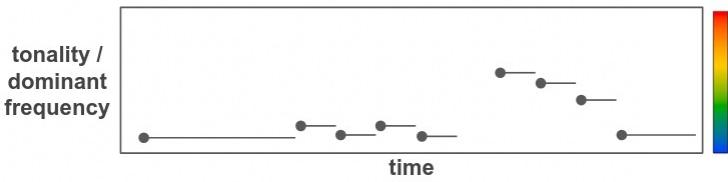
## Current status: ???

Some progress was made during and just after the workshop, but Conor then moved to Norway! If there is interest in working on this, we can contact Conor to check on status and see if he still has interest/capacity.

# TremCat: led by Darren

**Vision:** create a framework for systematic documentation and research into tremor, similar to what exists for volcanic earthquake catalogs.

Python-based user-friendly data/metadata container  
plus tools for data visualization →



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**Current status: in progress!**

Darren has basically built a working prototype and has presented it to a few groups of volcanologists, with positive reception.

Further development waiting until Darren comes across a really good use-case (i.e. a high-quality tremor catalog).

Note that this is an archiving framework, not a tool for tremor detection.

# Unrest: led by Hannah

**Initial idea:** build on Cameron et al. 2018 looking at color code changes, focused on unrest that subsides without eruption (green→yellow→green). Compile info and see what we find.

**Subsequent meetings:** what are common features of unrest episodes that make it into AVO reports? What is the implied working definition of “unrest” and what does it mean?

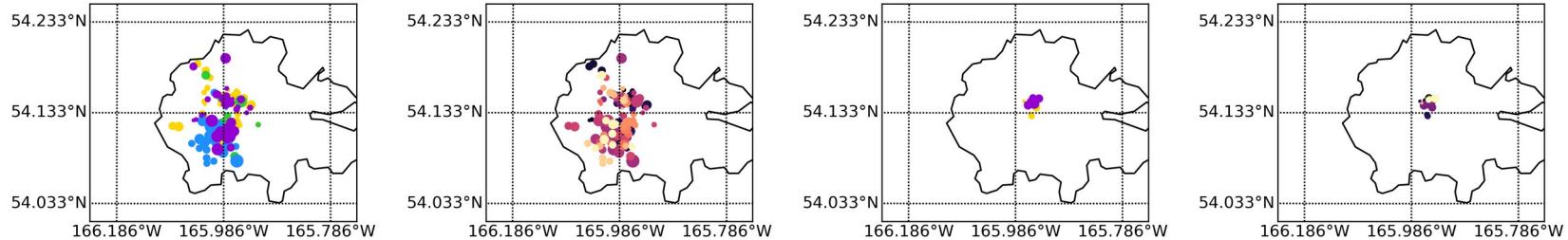
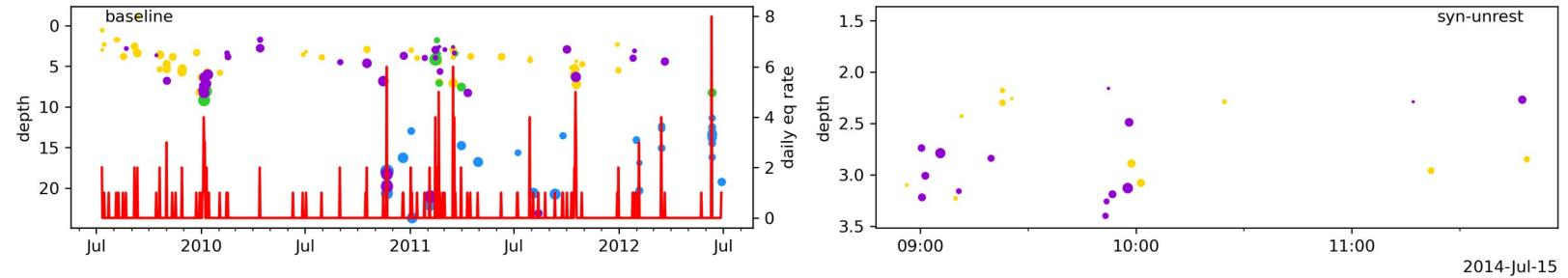
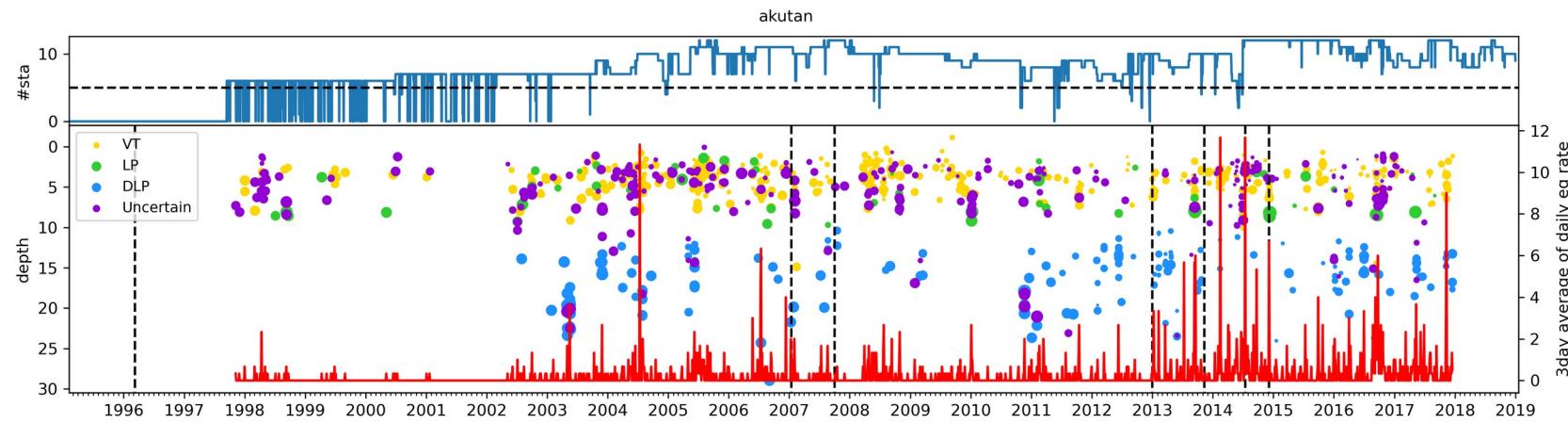
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**Current status: in progress!**

Preliminary workflow to pull EQ catalogs associated with particular volcanoes, classify by frequency content, and calculate some statistics for specified time periods (“baseline” vs “unrest”). The group compiled documented unrest periods from AVO catalogs.



base rate:  $0.14 \pm 0.62$  events per day  
 base mag:  $[-0.50, 2.60]$   $0.66 \pm 0.60$   
 base depth:  $[-1.13, 23.67]$   $7.21 \pm 5.66$  km  
 base percent VT/LP/DLP/unc:  $0.44/0.06/0.19/0.32$

unr rate:  $34.00 \pm \text{nan}$  events per day  
 unr mag:  $[-0.27, 1.47]$   $0.35 \pm 0.45$   
 unr depth:  $[1.46, 3.42]$   $2.66 \pm 0.49$  km  
 unr percent VT/LP/DLP/unc:  $0.50/0.00/0.00/0.50$

# What's next?

If you have a high-quality tremor catalog lying around, talk to Darren  
(ptan@alaska.edu)

If you want to be in the loop for group emails, contact Hannah  
(hmark@ldeo.columbia.edu)

Zoom meeting in January (date tbd) to chart a course for unrest topic