

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	Janiszewski et al., 2020
							Local body-wave tomography	No	
							Ambient noise tomography	No	
							dv/v	No but feasible	
							Other	-	Ps-P Tomography (Portner et al., 2020)
Augustine (313010)	80%	80%		2006 CE			Receiver functions	No	
							Local body-wave tomography	No	
							Ambient noise tomography	No	
							dv/v	No	
							Other	-	

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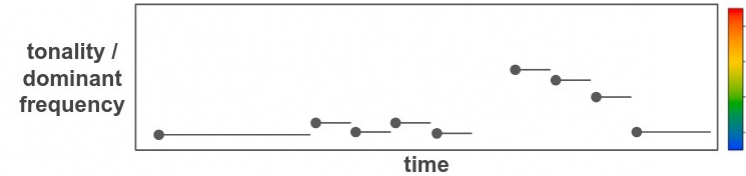
Current status: ???

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?

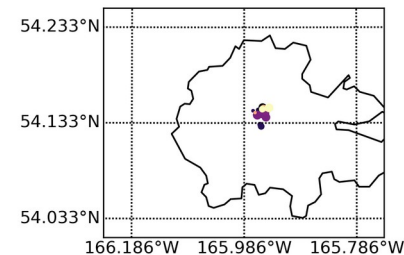
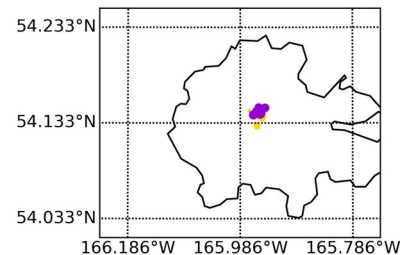
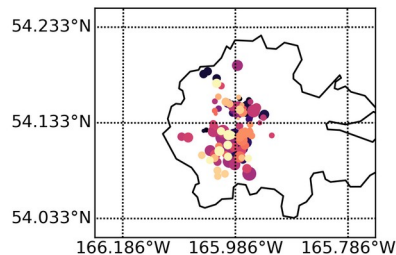
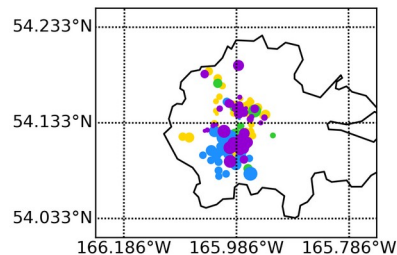
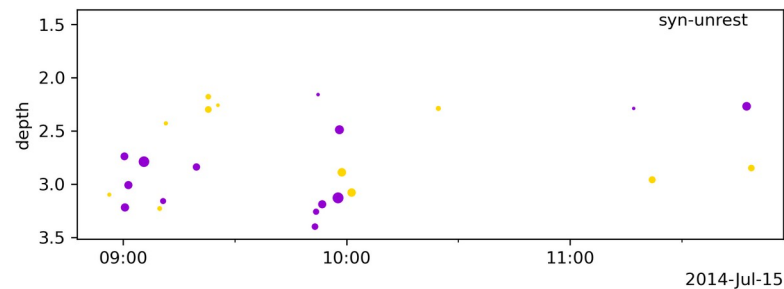
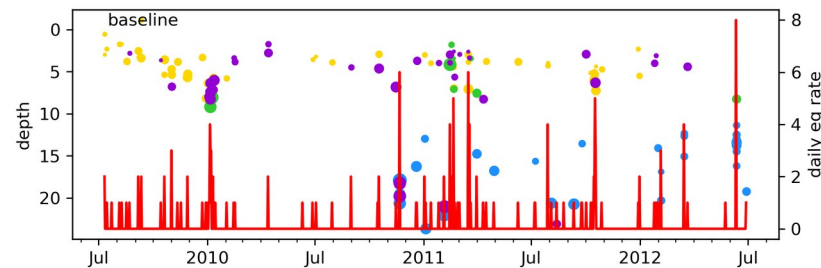
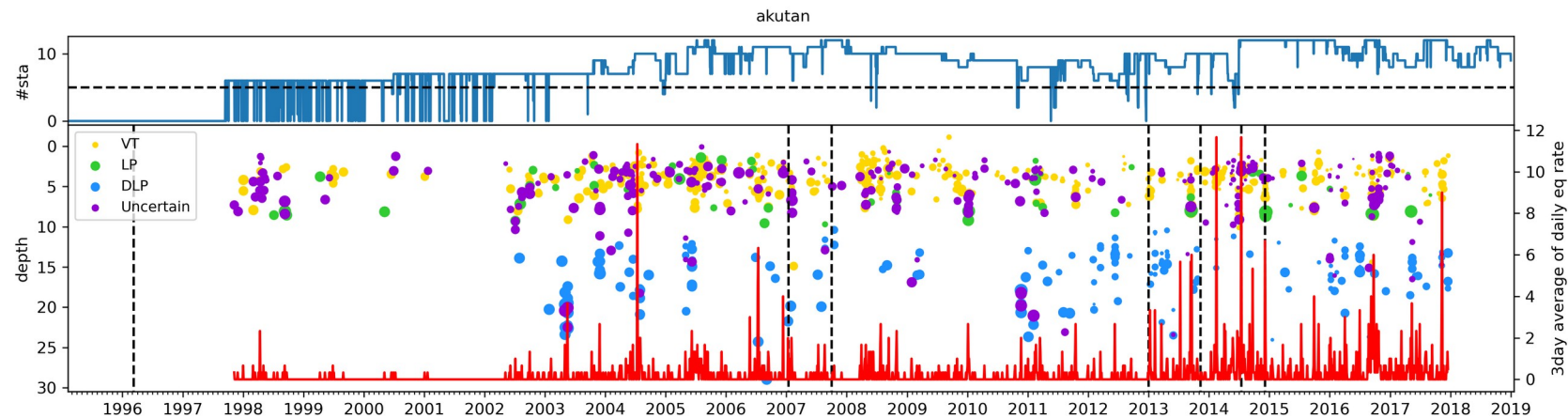
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Preliminary workflow to pull EQ catalogs associated with particular volcanoes, classify by frequency content, and calculate some statistics for specified time periods (“baseline” vs “unrest”). The group compiled documented unrest periods from AVO catalogs.



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 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