**Point of Contact Name:** Matthew Haney

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**USGS Center:** Volcano Science Center/Alaska Volcano Observatory

**Project Title:** Comparison of seismic ambient noise and deformation data at Alaskan volcanoes

**Summary:** Magma intrusions need not trigger significant seismicity. In such cases, subtle changes in surface deformation or subsurface elastic properties may be the only indication an intrusion took place. We seek a researcher to compare two types of data sensitive to subtle changes at volcanoes in Alaska: seismic ambient noise correlations and deformation.

**Project Hypothesis or Objectives:**

The growth of high quality, digital, and broadband seismic data has led to innovative new approaches to monitoring volcanoes. Among these advances, seismic ambient noise correlations stand out for their potential of forecasting unrest without relying on the magmatic system to generate significant seismicity. This is important considering that recent eruptions of Okmok (2008) and Pavlof (2013, 2014, and 2016) were not preceded by significant long-term increases in earthquake activity. Both Okmok (2008) and Pavlof (2016) went directly from Aviation Color Code color code GREEN to RED.

Among existing methods of volcano monitoring, ground-based deformation measurements (e.g., GPS and tilt data) most closely resemble seismic ambient noise correlations in terms of their time resolution (days to weeks). The expected signals of interest at volcanoes for both data types can be difficult to isolate in the presence of noise. The primary goal of this project is to shed light on these signals by comparing seismic ambient noise correlations and deformation data side-by-side at the eight volcanoes in Alaska where both seismic and GPS data exist: Akutan, Augustine, Makushin, Redoubt, Shishaldin, Spurr, Okmok, and Westdahl. In addition to GPS data, continuous tilt measurements exist at Akutan, Westdahl, and Shishaldin. We are particularly interested if recent inflation events at Akutan Volcano, observed with GPS data, are detectable in seismic
ambient noise correlations and tilt data.

- **Duration:** Up to 12 months
- **Internship Location:** Anchorage, AK
- **Field(s) of Study:** Engineering, Geoscience
- **Applicable NSF Division:** AGS Atmospheric and Geospace Sciences, EAR Earth Sciences, DMS Mathematical Sciences, PHY Physics, ENG Engineering
- **Intern Type Preference:** Any Type of Intern
- **Keywords:** Volcano Seismology, Volcano Geodesy, Volcanic Hazards, Volcanology
- **Expected Outcome:** Results from this project will inform the Alaska Volcano Observatory on the advantages and limitations of seismic ambient noise correlations as a future monitoring tool in Alaska, through a comprehensive comparison to deformation data. A long-term goal of the project is to understand how the two types of data compare/contrast so that seismic ambient noise correlations can be interpreted within the context of typically associated deformation signals for volcanoes without GPS or tilt sensors.
- **Special skills/training Required:** The applicant will have a background in time series analysis of large geophysical data sets. Skills in computer programming (e.g., Python/ObsPy, Matlab, Fortran) are essential.
- **Duties/Responsibilities:** Although the project will be based out of the Alaska Volcano Observatory (AVO) in Anchorage, processing and interpretation of deformation data will involve collaboration with Dr. Jeff Freymueller from AVO in Fairbanks. The applicant will work within an interdisciplinary team of scientists at AVO in Anchorage striving to improve monitoring and fundamental understanding of volcanic activity in Alaska. Seismic ambient noise correlations can be computed with the freely available MSNoise software package (http://www.msnoise.org/). The applicant will be in charge of computing seismic ambient noise correlations and extracting attributes from the correlations; for example, a time series of relative seismic velocity change. It will then be the applicant’s responsibility to understand and organize existing deformation data to the point that visual and/or automated comparisons can be made between deformation and ambient noise. In collaboration with the project advisors, the applicant can propose physical models to explain the similarities or differences observed from the comparison.
Center Director Name: Thomas Murray
USGS Responsibilities: Equipment, Facilities, Mentoring, On-boarding, Background Check, Volunteer Agreement Management
Preliminary Approval: This opportunity has my Center's approval
I already have a student in mind: Reagan Cronin, University of Wisconsin Madison, EAR
David J. Miller, University of Wisconsin Madison, EAR

Comments: