Title: Investigating the utility of infrasound arrays for lahar detection: Pilot experiment at Mount Adams, WA

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Erosional processes at volcanoes can cause large and unexpected mass wasting events. Large debris flows have occurred within the last 10,000 years at Mount Adams in the Cascade Range of the Pacific Northwest, and represent a significant hazard to communities downstream. We are conducting a pilot experiment to investigate the potential of infrasound arrays for detecting and tracking debris flows at Mount Adams. In July 2017, we deployed a 4-element ~85 m aperture infrasound array 12 km to the southwest of the summit of Mount Adams. Our array (BEAR) is located ~11 km from a likely source area -- a geologically unstable area above the Salt Creek and Cascade Creek drainages from which mass wasting is expected to occur. The infrasound acquisition system uses four Hyperion IFS-3111 infrasound sensors and a Kinemetrics Obsidian 4X digitizer. The data are transmitted via cellular modem; waveforms have been streaming continuously to UCSB and on to IRIS for the past 9 months, where any interested parties can access the data. This project is designed to provide (1) a survey of the ambient infrasound and noise environment at this relatively quiescent stratovolcano, (2) new information about geologic processes that generate infrasound at Mount Adams, and (3) proof-of-concept for a real-time streaming infrasound lahar detection and monitoring system for volcanoes. Here we use the Progressive Multi-Channel Correlation (PMCC) array processing algorithm [*Cansi*, 1995] to analyze the waveform data. PMCC estimates parameters of coherent plane waves at the array, including backazimuth, apparent velocity, signal frequency, and amplitude. These array processing results reveal near-continuous and persistent infrasound signals arriving from the direction of Mount Adams, which we hypothesize result from fluvial processes in the steeper upper portions of the Salt Creek and Cascade Creek drainages. Observed fluctuations in the detectability of these signals likely result from a combination of: (1) Variations in wind noise levels at the array, (2) changes in local infrasound propagation conditions associated with atmospheric boundary layer variability, and (3) changing flow speeds in the channel (assuming the infrasound is fluvial in origin). The array also records background coherent infrasound from the Pacific Ocean (microbaroms), as well as higher-frequency signals [20—35 Hz] likely of anthropogenic origin. To date, we have not identified any debris flow signals, which we attribute to a lack of occurrence of debris flow events. We plan to continue operating the station for several years. In addition, we plan to deploy several additional infrasound arrays during Summer 2018 for improved identification, location, and characterization of the background infrasound sources at Mount Adams.

Cansi, Y. (1995), An automatic seismic event processing for detection and location: The P.M.C.C. method, *Geophys. Res. Lett.*, 22(9), 1021–1024.

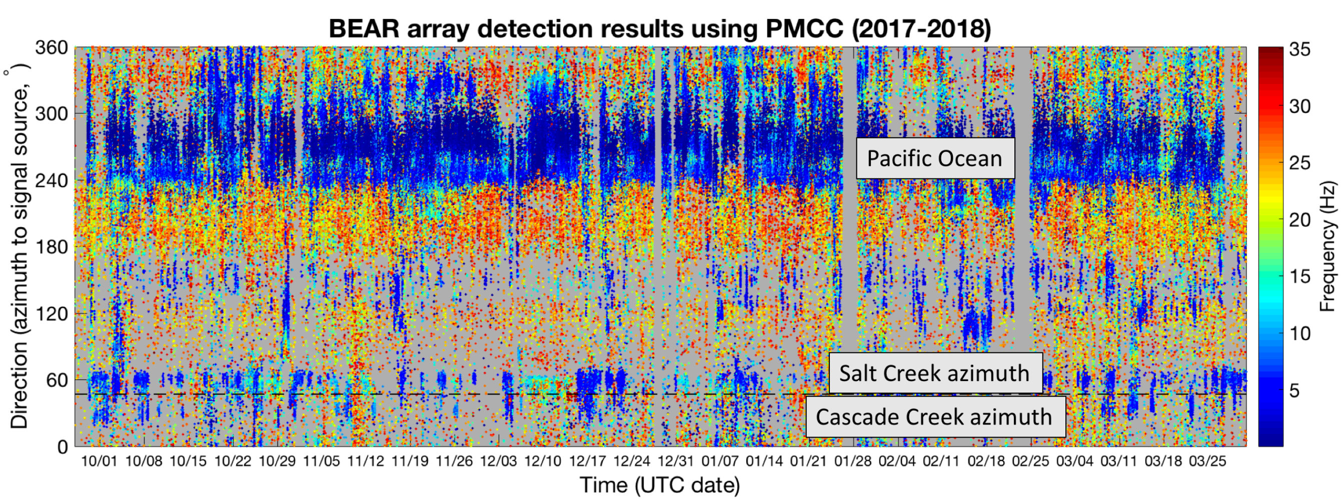

Figure: Time-series of observations by the BEAR infrasound array from October 2017-March 2018. Signal detection times (horizontal axis) are plotted against source direction azimuth (vertical axis), and color-coded by signal frequency (see right-hand color bar). We observe prominent detections from the Pacific Ocean as well as nearby Cascade Creek and Salt Creek drainages (labeled).