APPLICATION OF AN UPDATED ATMOSPHERIC MODEL TO EXPLORE INFRASOUND PROPAGATION OF EXPLOSIVE ERUPTIONS IN ALASKA

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Alaska's over 50 historically active volcanoes span 2,500 kilometers, and their eruptions pose great threats to the aviation industry and local populations. This makes both prompt observations of explosion onsets and changes in intensity a necessity. Alaskan volcanoes are predominantly monitored by local seismic networks in the best case, and augmented by remote observations including satellite imagery and infrasound arrays. Infrasound is an important tool for monitoring in locations such as Alaska where volcanoes are both numerous and remote. Due to relatively weak attenuation in the atmosphere at these low frequencies and strong ducts in the atmosphere, infrasound can propagate hundreds to thousands of kilometers under suitable conditions and be detected by infrasound sensors, either at an array or on single sensors. However, long-range infrasound propagation is greatly affected by winds and temperature gradients in the atmosphere. To accurately constrain volcanic source information and understand the long-range propagation, a detailed characterization of the spatial and temporal variability of the atmosphere is vital.

We present results from the recently published study by *Iezzi et al. (2018),* which applies a reanalysis model constructed to accurately characterize the atmosphere and model long-range infrasound propagation from volcanic eruptions in Alaska (Schwaiger et al., in review). Alaska Volcano Observatory Ground-to-Space (AVO-G2S) is an open source atmospheric reconstruction model similar to that of *Drob et al. (2003)* that smoothly characterizes atmospheric conditions using multiple numerical weather prediction models and reanalysis products as well as empirical models for the upper atmosphere (Schwaiger et al., in review). We select a number of case studies to examine recent eruptions of Alaskan volcanoes, including the two most recent eruptions of Pavlof Volcano and two typical explosions from Cleveland Volcano. See Figure 1 for volcano and station locations, where propagation distances between Cleveland and Pavlof volcanoes to the DLL infrasound array are 992 and 460 km, respectively. Our findings reiterate that variable atmospheric conditions play a vital role in the propagation of infrasound, and constraining these conditions using modeling techniques similar to those outlined in this study is important for long-range infrasound signal interpretations.

Using a combination of array processing, celerity, and propagation modeling in Alaska can help differentiate between propagation paths and refine interpretations of infrasound detections at long-range, as shown by *Iezzi et al, (2018)*. AVO-G2S atmospheric reconstruction and subsequent infrasound modeling was used in near real-time for the 2016 eruption of Pavlof Volcano and 2016-2017 eruption of Bogoslof Volcano. Future work will implement the high temporal and spatial resolution atmospheric modeling automatically every 12 hours for volcanoes of elevated activity to aid real-time volcano monitoring efforts internally by the Alaska Volcano Observatory.

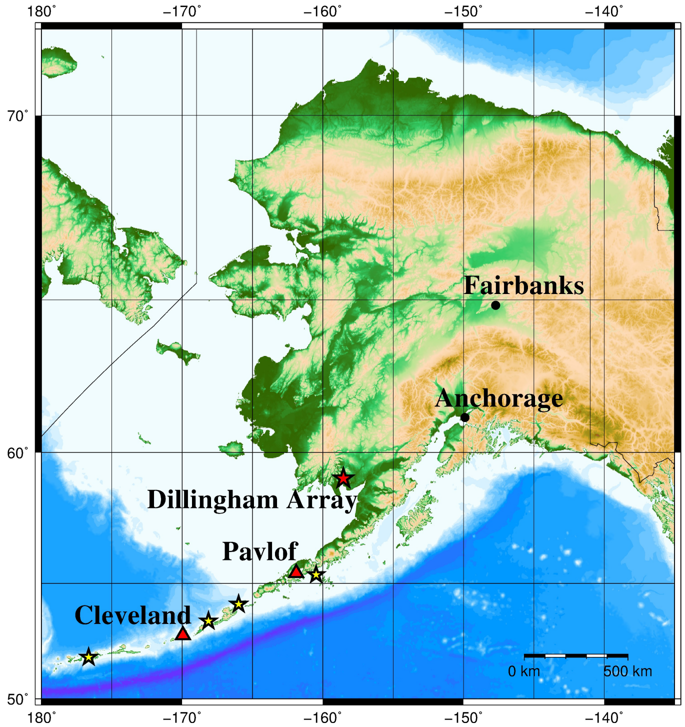

Figure 1: Image from (Iezzi et al., 2018). Map of Alaska and infrasound arrays and volcanoes discussed in this manuscript. Pavlof and Cleveland volcanoes are shown with red triangles and the Dillingham (DLL) infrasound array as a red star. Other infrasound arrays maintained by AVO are shown by yellow stars. The propagation distance from Cleveland to DLL is ~990 km and Pavlof to DLL is ~460 km.

References:

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