

High-resolution seismic velocity structure of Makushin Volcano, Alaska

F. Lanza¹, C. Thurber¹, E. Syracuse², A. Ghosh³, and J. Power⁴

¹University of Wisconsin-Madison, USA

²Los Alamos National Laboratory, USA

³University of California Riverside, USA

⁴USGS Alaska Volcano Observatory, USA

Contact: flanza@wisc.edu

Located in the eastern portion of the Alaska-Aleutian subduction zone, Makushin Volcano is among the most active volcanoes in the United States and has been classified as high threat based on eruptive history and proximity to the City of Unalaska and international air routes. Seismic imaging of its complex plumbing system has been previously attempted, but the unfavorable network geometry presented a great challenge. Here we expand on previous work in order to improve the resolution of the seismic structure beneath the volcano. We supplemented the one-sided station coverage provided by the Alaska Volcano Observatory (AVO) permanent seismic network with a set of five individual stations and three mini seismic arrays of 15 stations each. It provides us better azimuthal coverage with higher signal-to-noise ratio. Data collected during the 2015-2016 deployment show an improved event detection capability, providing us with a larger earthquake dataset. Body-wave tomography results show a complex structure with the upper 5 km of the crust dominated by both positive and negative V_p anomalies. The shallow high- V_p features possibly delineate remnant magma pathways or conduits. Low- V_p regions are found east of the caldera at approximately 6-9 km depth. This is in agreement with previous tomographic work and geodetic models, obtained using InSAR data, which had identified this region as a possible long-term source of magma. We also observe a high V_p/V_s feature extending between ~7 and 12 km depth below the caldera, possibly indicating partial melting, although the resolution is diminished at these depths. Using this new dataset and performing both body wave and ambient noise tomography, separately and jointly, we will provide a high-resolution tomographic image of Makushin volcano as well as better-constrained earthquake locations, thus enhancing AVO's monitoring and forecasting efforts.