Research Report
Earthquake Research Institute, University of Tokyo
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General Description of Work:
I was a guest scientist at the Earthquake Research Institute (ERI) of the University of Tokyo from May 16, 2023 to June 1, 2023 in order to collaborate with Dr. Mie Ichihara and her colleagues. During this brief visit we discussed strategies for remote volcano monitoring based on our shared interest and experience in studying seismic and infrasonic data from eruptions, including the 2022 eruption of Hunga Tonga-Hunga Ha'apai volcano. On May 19, I presented a talk at ERI titled 'Operational Eruption Forecasting: New Directions in VDAP Seismology'. In this talk I described common challenges that we face in eruption forecasting and several recent research projects of the USGS VDAP seismologists that address some of the challenges. I attended the 2023 Japan Geophysical Union meeting May 21-26.

Research Project:
My research is focused on improving volcanic eruption forecasting and monitoring strategies. In the USGS-USAID Volcano Disaster Assistance Program (VDAP), we frequently assist international partner organizations in designing geophysical networks and analysis strategies for eruption detection and monitoring, often for newly active or poorly monitored volcanic systems. My work at ERI was focused specifically on strategies for remote monitoring of unmonitored volcanoes. Thousands of remote volcanoes around the globe have the potential to erupt catastrophically, yet they lack local monitoring networks due to geographical, logistical, and financial limitations. The problem is particularly acute for island volcanoes. Although satellite volcano monitoring strategies are advancing rapidly, the detection of seismic precursors remains critical to successful eruption forecasting.

Recent studies employ new techniques to track seismicity at volcanoes remotely with surprising precision. For example, Kinter et al. (2022) retrospectively detected earthquake precursors to the VEI 6 eruption of Hunga Tonga-Hunga Ha'apai volcano using seismic stations located more than 700 km distant. Concurrently, other studies have used simple but effective techniques to detect low-amplitude subtle seismic signals that are precursors to eruption (*Ichihara et al., 2023*). Together these types of techniques could be more widely and consistently applied to monitor remote volcanoes more effectively. To do so efficiently however requires international coordination and data standards.

visiting scientists, and Dr. Ichihara's students, particularly Victoria Craig. Finally I would like to thank Yoko from the International Program office of ERI for graciously coordinating my visit.

References:
Kintner, J. A., Yeck, W. L., Earle, P. S., Prejean, S., & Pesicek, J. D. (2022). High-Precision Characterization of Seismicity from the 2022 Hunga Tonga-Hunga Ha'apai Volcanic Eruption. *Seismological Research Letters*.

Ichihara, M., Ohminato, T., Konstantinou, K. I., Yamakawa, K., Watanabe, A., & Takeo, M. (2023). Seismic background level (SBL) growth can reveal slowly developing long-term eruption precursors. *Scientific reports*, *13*(1), 5954.