Subsurface Imaging of Kīlauea using Nodal and Broadband Seismometers

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During the 2018 eruption of Kīlauea, a temporary dense array of nodal seismometers was rapidly deployed at the Lower East Rift Zone and caldera of the volcano for 33 days. The use of nodal seismometers for passive seismic imaging targets has significantly expanded over the past decade. They are primarily sensitive to a higher frequency range than broadband seismometers. However, due to their smaller size and lower cost, they are easier to deploy in larger numbers, and in sensitive or difficult to access environments, facilitating denser arrays in novel locations. Previous studies have successfully leveraged the dense deployment design to image shallow crustal features that would otherwise be aliased by the typical spacing of broadband instruments, as well as image deeper structures in equal or greater detail than broadband deployments, using receiver functions, a traditional seismic imaging technique sensitive to abrupt velocity boundaries. Here, we apply this technique to better constrain the seismic velocity structure of the Kīlauea crust. For the nodal array, we select two teleseismic earthquakes (magnitudes 6.1 and 6.4) from the deployment period based on P-wave arrival amplitude. After ground-truthing the nodal data against data from nearby broadband stations maintained by the Hawaiian Volcano Observatory, we calculated *Ps* receiver functions for each nodal and broadband station to detect velocity boundaries at the caldera and Lower East Rift Zone. Additionally, we calculated broadband receiver function stacks for magnitude 6.5 and higher events from 2009 to 2021 to provide a sparser background model of Kīlauea. This study explores the viability of seismic analysis from nodal instruments on an erupting volcano as well as lays the foundation for a future deployment of nodal seismometers over the Southwest Rift Zone of Kīlauea.

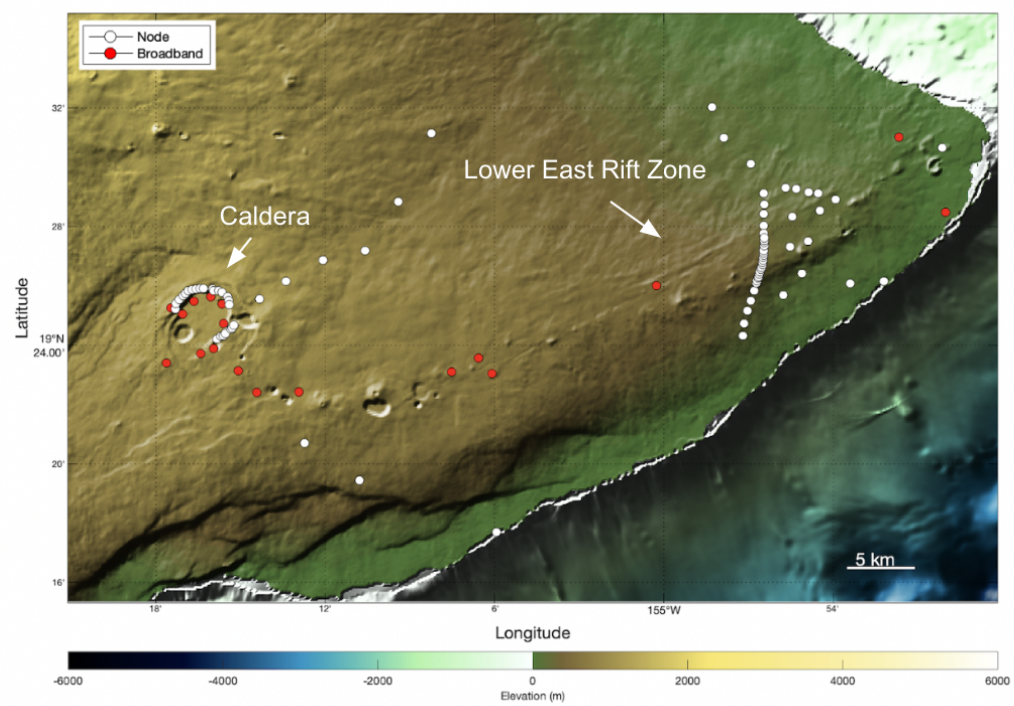

Figure 1. Nodal and broadband seismometers on Kīlauea during June and July of 2018.