The 15 January 2022 Hunga Tonga-Hunga Ha'apai Eruption as Recorded by MERMAID

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MERMAID (Mobile Earthquake Recording in Marine Areas by Independent Divers) is an autonomous diving float fitted with a hydrophone to record the mid-column hydroacoustic wavefield within the oceans. MERMAIDs record seismoacoustic signals from global earthquakes—and a variety of noises in the oceans, such as volcanic eruptions—over repeated dive cycles. The primary data targeted by MERMAID are high-frequency ($\sim$1 Hz) teleseismic P waves useful for tomographic seismology of the deep mantle. These signals are identified at depth via an onboard detection algorithm, which may trigger MERMAID to ascend to the surface (often within several hours, for large events) to transmit data segments that are roughly four minutes long. Beyond those automatically reported P-wave arrivals all the data that MERMAID deems unworthy of automatic transmission remains in its buffer, all of which remains retrievable via two-way Iridium communication, for one year.

Here we showcase one such data set, requested specifically in search of signals emanating from the 15 January 2022 eruption of Hunga Tonga-Hunga Ha'apai in the Tonga Islands. Our data are requested from our floats in the South Pacific Plume Imaging and Modeling Array (SPPIM), a large array of over 50 MERMAIDs set adrift in the South Pacific beginning in 2018 and managed by the EarthScope-Oceans Consortium (see `http://www.earthscopeoceans.org`). Our floats, at recording depths averaging 1500 m, were uniquely positioned to record the hydroacoustic signature of this large eruption. We characterize the types of signals we that are able to recover from the MERMAID buffer, assess signal amplitudes and spectra in relation to their ray paths and local bathymetry, and analyze correlations between stations to characterize wavespeeds and investigate questions concerning eruptive directionality.

Many MERMAID data and associated metadata are already available from the IRIS DMC. For more details, see `http://geoweb.princeton.edu/people/simons/earthscopeoceans/data/metadata.html`.
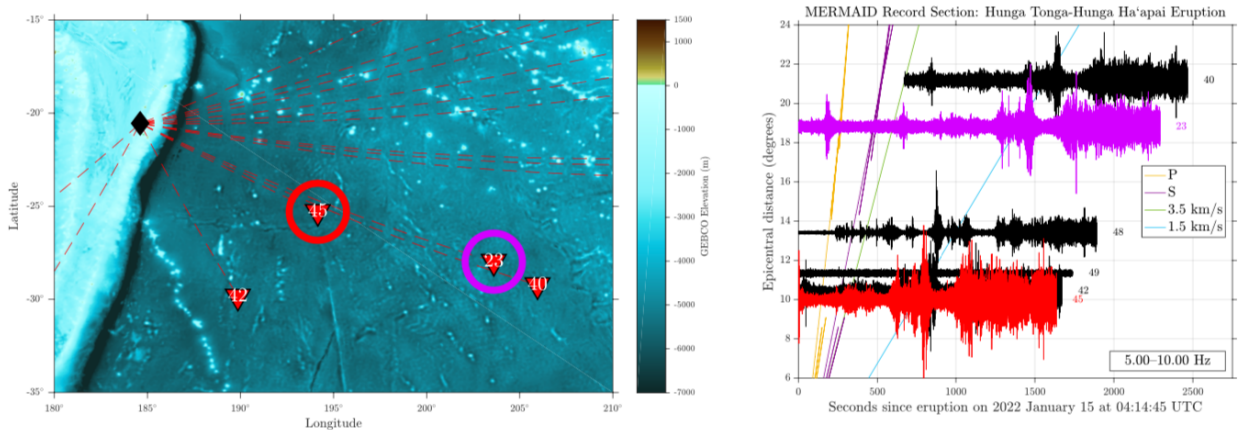

Figure 1: Signals from some of the MERMAIDs that clearly recorded the sounds of the eruption.