# Recording earthquakes for tomographic imaging of the mantle beneath the South Pacific by autonomous MERMAID floats

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Every 6.25 days on average, data are returned from a mobile array of freely floating diving instruments, named MERMAID for Mobile Earthquake Recording in Marine Areas by Independent Divers, launched in French Polynesia in late 2018. Overall 50 MERMAIDs were deployed over a number of cruises (GEOAZUR, GENAVIR, IFREMER, JAMSTEC, SUSTECH) in this vast and understudied oceanic province as part of the collaborative South Pacific Plume Imaging and Modeling (SPPIM) project, under the aegis of the international EarthScope-Oceans consortium founded in 2016. Our objective is the hydroacoustic recording, from within the oceanic water column, of the seismic wavefield generated by earthquakes worldwide, and the nearly real-time transmission by satellite of these data, collected above and in the periphery of the South Pacific Superswell. This region, characterized by anomalously elevated oceanic crust and myriad seamounts, is believed to be the surface expression of deeply rooted mantle upwellings. Tomographically imaging Earth's mantle under the South Pacific with data from these novel instruments requires a careful examination of the earthquake-to-MERMAID travel times of the high-frequency $P$-wave detections within the windows selected for reporting by the discrimination algorithms on board. Our workflow picks the relevant arrivals, matches them to known earthquakes in global (e.g., CMT) earthquake catalogs, calculates their travel-time residuals with respect to global seismic reference models, characterizes their quality, and estimates their uncertainty. The lifespan of an individual MERMAID is five years. The utility for seismic tomography of MERMAID data quality is demonstrated by comparison against "traditional" land seismometers and Raspberry Shake sensors, using waveforms recovered from instrumented island stations in the geographic neighborhood of our floats. Our growing database of automatically accumulating 200–250 s long triggered segments contains a treasure trove for geophysicists—also for those interested in seismology beyond $P$-wave tomography. Equipped with two-way communication capabilities, MERMAID can furthermore entertain requests to deliver data from its one-year buffer, e.g., to study later-arriving seismic phases and also $T$-waves.

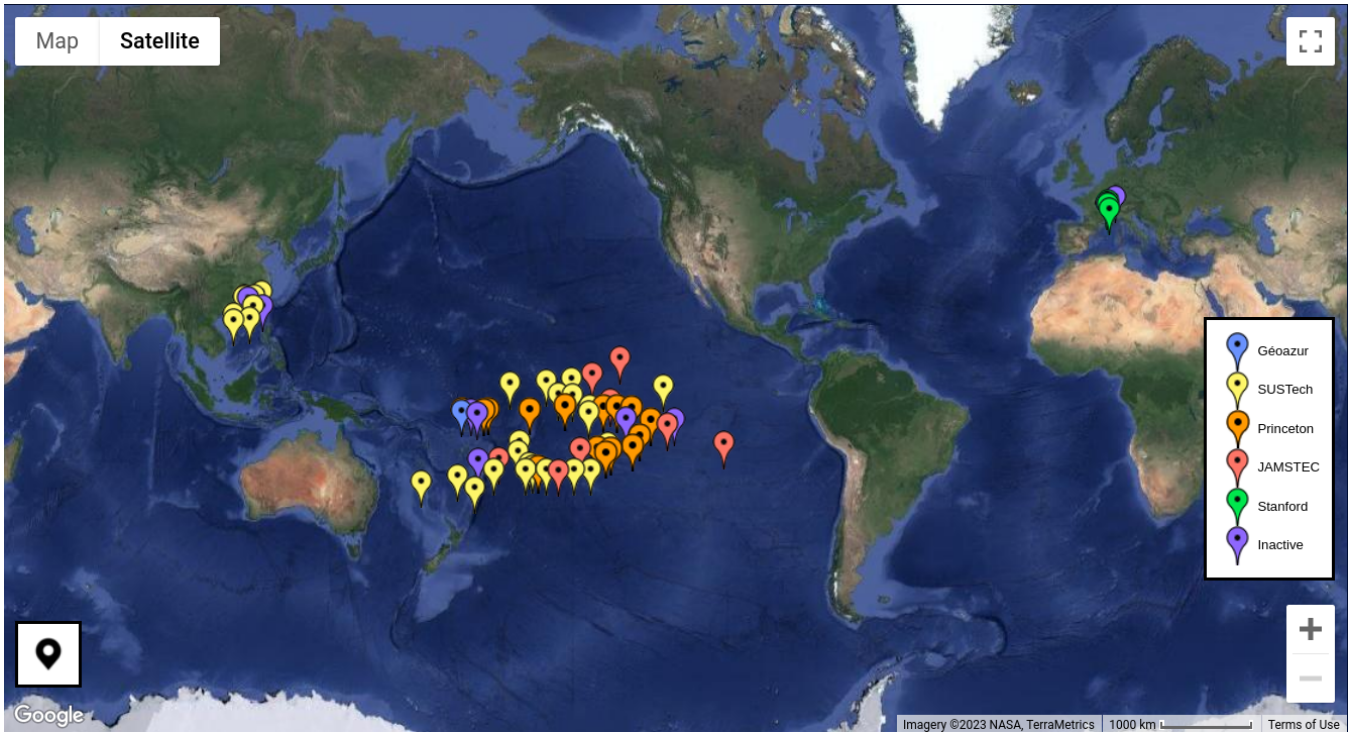


Figure 1: *Current global* MERMAID *fleet, as of 10 March 2023.* `http://www.earthscopeoceans.org`