The Hawaiian PLUME Experiment

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Hawaii is thought to be the textbook hotspot that is fed by a stationary, deep-rooted mantle plume as proposed by Wilson and Morgan in the 1960s and 70s. Yet, very little is known about the underlying geodynamical processes and their implications to geophysical observables such as seismic travel time data. Even constraints on the most basic features of the plume such as the spatial location of its conduit, the dimensions of its head and its extent into the lower mantle have been elusive. The cause for the bathymetric swell downstream also is still under heavy debate. One major problem has been that seismic observables have not been available on a required scale because taking measurements has been restricted to land-based stations. Until very recently, it has not been technically feasible to deploy autonomous seismic broad-band equipment on the ocean floor, for long time intervals.

The PLUME experiment, launched in January 2005, is one of the first OBS (ocean bottom seismometer) experiments, that deployed an extensive array of seismometers for one year, the time deemed necessary to collect meaningful seismic datasets. PLUME is also the first U.S. experiment that deployed true seismic broad-band sensors (Guralp CMG-3T) that are also used in high-quality permanent global observatories on land.

The first of two PLUME deployments was recovered in January 2006. Of the 35 instruments that were deployment in 2005, we lost just 3 instruments. Timing is uncertain for 2 more instruments because of prematurely failing batteries. This leaves an extremely rich dataset of 30 3-component seismograms plus differential pressure records. Data analysis has just begun but we can already discern interesting anomalies in our record sections that will help us to constrain the spatial extent of the proposed mantle plume and the cause of the bathymetric swell.