Exploring Coral Skeletal $\delta^{18}O$ as a Tracer of Past Tropical Cyclone Thermal Wakes

Claudia Mack[1], Braddock Linsley[2], Emilie Dassié[2]

Barnard College of Columbia University[1], Lamont-Doherty Earth Observatory of Columbia University[2]

This project evaluated corals as climate proxies for tropical cyclone activity in the Southwest Pacific, a region of intense cyclone activity each year between the months of December through April. Tropical cyclones create salty, anomalously cool thermal wakes in the surface ocean mixed layer. These thermal wakes vary in impact, but depending on the strength of the storm they can cause up to a 5°C sea surface temperature cool anomaly, last 2-3 weeks, and be 200km wide (Chiang et al., 2011). Coral skeletal oxygen isotope ratios ($\delta^{18}O$) have been used as effective climate proxies to understand monthly sea water temperature and salinity variability on annual, inter-annual (El Niño Southern Oscillation) and inter-decadal time scales. In the Southwest Pacific Ocean, sea surface water $\delta^{18}O$ oscillates annually with sea surface temperature and salinity, reaching more negative values during the warm, fresh season (austral summer) and reaching more positive values during the cold, salty season (austral winter). We hypothesized that the passage of a tropical cyclone would make coral skeletal $\delta^{18}O$ higher due to the cooler and saltier conditions of the thermal wake. We targeted 1 storm in late 1999 in 3 Tonga corals and 4 storms in 2005 in a coral from Ta'u, American Samoa. All of these storms had generated significant thermal wakes in the grid cells of our coral sites based on daily SST data. We sampled the 4 *Porites lutea* corals at 0.1mm resolution and analyzed the samples in the LDEO stable isotope lab. Two of the corals showed strong signals of hurricane thermal wakes in the $\delta^{18}O$ data, and two showed faint signals. Possible explanations for this varied response to a thermal wake include differences in growth rate, physical location, and the effects of $\delta^{18}O$ depleted precipitation on the strength of a preserved skeletal $\delta^{18}O$ signal. Skeletal $\delta^{13}C$ data was also evaluated in order to see if any patterns in the data could be used to target specific years during which hurricanes occurred in the past. We also evaluated the effect of different sampling resolutions on the measured skeletal $\delta^{18}O$ response to a cyclone thermal wake.