# Reconstructing the Sea Surface Temperature And Wet-Dry Climate History of Guam

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Following the 1997-1998 El Niño, which brought to Guam one of the severest droughts in living memory, the governor and legislature of Guam committed the island to research, development, and maintenance of long-term drought planning and management. Long-term planning has received additional emphasis lately, given the economic and population growth that will accompany the relocation of thousands of US military members and families from Okinawa during the next decade-and-a-half. The *Critical Water Resources Research Needs* identified by the 2010 Guam Advisory Council, for example, now include (1) developing water budgets for Guam's surface and groundwater watersheds, (2) re-evaluation of sustainable development estimates for the island's principal aquifer, and 3) expanding and updating the rainfall database of Guam to include long-term rainfall variability. In addition, the USGS-NIWR program has encouraged research related to climatic effects on the water cycle. For long-term planning it is necessary to have a long-term record of past climatic cycles, however. Unfortunately, the historical record of El Niño-related rainfall and drought for Guam is very limited, dating back only to the end of World War II.

Climate research has shown that climate trends (e.g., rainfall, drought, sea-surface temperature) in tropical areas correlate well with chemical signatures in the annual growth layers of local corals. In Guam, it is well known that El Niño brings higher sea surface temperature and lower precipitation. Sea surface temperature, for example, which is the best index of El Niño strength, rose 4° C in the Western Pacific in 1997. Guam is fortunate to have robust coral growth in its coastal waters. In August, 2010, WERI researchers extracted a coral core of the central west coast of Guam. Analysis has already begun on this specimen by collaborators at the University of Texas, Austin, and the initial results show that it will be possible to reconstruct the past sea surface temperature history from this specimen. WERI researchers have also been collecting real-time seawater and temperature data at the sampling site since September 2009. These data will be compared with the 60-year instrumental record, which will provide a basis for interpreting the record through the past two centuries.

The immediate objective is to identify the rhythms and strengths of past El Niño events from Guam coral skeletons and correlate, and correlate them with observed conditions in the current and historical instrumental record. Guam is especially well suited for such work. Previous similar studies lack long-term *in situ* ocean environment monitoring of coral because academic facilities tend to be remote from study sites. The resources from the proposed project will enable WERI to take advantage of being able to continue ocean environmental monitoring at the coral collection sites. Moreover, WERI researchers are also collecting prehistoric climate data from stalagmites in nearby caves, which when correlated with the coral record, may provide accurate estimates of drought/rainfall cycles for the past several millennia. Ultimately, by combining the coral record with the cave record, WERI researchers and their collaborators at the University of Texas may ultimately produce a very-long-term (10s of thousands of years) record of climate history for the entire West Pacific region. Revealing these dramatic past climate cycles on Guam will allow water resource managers to more reliably predict and model the future climate trends and contribute to the preparation for drought in the future. The proposed project thus provides the seed for a very productive long-term endeavor.