
COCONet EAR 1042906 Yearly Report

September 2010 - June 2011

SUMMARY

This yearly report covers project activities for EAR-1042906/EAR-1042909 for the time period September 2010 - June 2011. The COCONet grant was awarded to UNAVCO on September 14, 2010 and a collaborative grant (EAR-1042909) awarded to J. Braun, University Corporation for Atmospheric Research. The project is under the direction of M. Meghan Miller, Eric Calais, Guoquan Wang, Michael Jackson, and John Braun.



Figure 1. Cover of the COCONet Workshop: Community Science, Station Siting, and Capacity Building

This is a highly collaborative project involving a broad swath of researchers in both science and hazards and monitoring, geomatics professionals, and agencies with the goal of advancing the understanding of and continue to develop the regional capacity for hazard identification and risk mitigation across the Caribbean. This project will strengthen and complement existing large-scale, state-of-the-art geodetic and meteorological infrastructure in the Caribbean. A strengthened monitoring network will provide the observational backbone for a broad range of Earth and atmospheric science investigations and enable research on process-oriented science questions with direct relevance to geohazards. The observational infrastructure will serve as a regional platform for more focused topical geophysics studies by members of an international community of scientists. Related observations, instrumentation, and analyses from other groups such as the seismological community and those working on long-term or tsunami-related sea-level change will complement the geodetic observations that come directly

from COCONet. The infrastructure will also serve as a platform for international partnerships for science and societal applications.

The majority of efforts during this reporting period include convening a community station siting and planning meeting and initiation of station reconnaissance activities and the planning for a more focused Network Operators Meeting in late June 2011. Other activities that occurred this quarter include providing supplemental budget material for augmenting young investigator and foreign participant support for the community meeting, refining the COCONet budget to meet NSF funding requirements, drafting criteria for a competitive receiver procurement, establishing financial and schedule tracking, and creating a hiring plan for staffing COCONet. UNAVCO engineering personnel have performed site reconnaissance at 17 locations in 11 different countries, submitted land use permits for 9 sites, had three permits accepted with one of the most logistically difficult stations built on Cocos Island. Education and outreach efforts include hosting of a Caribbean student for the RESESS program and the creation of numerous handouts and support materials.

MAJOR RESEARCH AND EDUCATION ACTIVITIES OF THE PROJECT

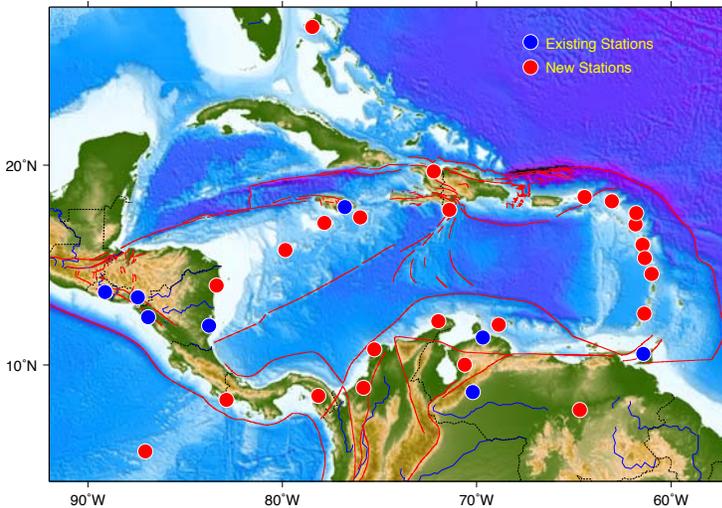


Figure 2. Station siting plan formulated during the Puerto Rico COCONet workshop entitled COCONet Workshop: Community Science, Station Siting, and Capacity Building

COCONet Workshop

A majority of the effort this quarter was devoted to the inception, planning, and attending the COCONet Workshop: Community Science, Station Siting, and Capacity Building (see <http://www.unavco.org/community/meetings-events/2011/coconet/coconet.html>) (Figure 1). The Community Science, Station Siting, and Capacity Building meeting was held February 3-4, 2011 in Puerto Rico to:

a) revise the GPS station siting plan in light of science goals and existing open-data GPS infrastructure; b) develop a mechanism for ongoing science oversight; c) define capacity building activities and funding mechanisms, including development of the scientific and technical capacity of the international and in-country community conducting research in the Caribbean; and d) ensure the project operated in a climate of free and open access to COCONet geodetic data.

As part of the community station siting and planning meeting, 32 locations (Figure 2) were identified as first priority stations for new infrastructure (red dots in figure above) or refurbishment (blue dots). Identification of these stations by Caribbean community partners was critical to getting the project started and keeping it on the three year schedule for full implementation. During the meeting a number of Caribbean and NSF network operators came forward with a request that the PI's and NSF consider refurbishing some existing stations with new receivers and antennas to make them viable for COCONet science. The PI's believe this can be worked into the budget if savings are realized in equipment procurements. The English, French, and Spanish versions of the workshop report can be found at <http://www.unavco.org/community/meetings-events/2011/coconet/agenda.html>.

A second siting meeting of Caribbean network operators will be held at the end of June, 2011. The purpose of this meeting will be to report to the community on progress to date and to finalize the station siting plan. Other topics to be discussed include ideas for partnership and funding regional data archiving and processing centers in the Caribbean, funding and hosting of a COCONet community website, and discussions of opportunities for additional collaborations and meetings.

Field Operations

Field engineering efforts are moving forward with two full time engineers hired who are performing field siting and reconnaissance activities, land use permitting, and field installations. Field crews are working to the installation plan put forward as part of the siting meeting held in Puerto Rico and UNAVCO engineering personnel have performed site reconnaissance at 17 locations in 11 different countries, submitted land use permits for 9 sites, had three permits accepted with one of the most logistically difficult stations built on Cocos Island (Figure 3). Field engineers have spent 114 days in the field doing GPS reconnaissance, permitting, and installations during this performance period and have visited all of the major geographic areas outside of Colombia and Venezuela. Some of the field activity highlights are provided below and summarized in Table 1 and future planned work is presented in Appendix 1. A site at the Freeport International Airport on Grand Bahama was located and UNAVCO is currently in the process of reviewing a station MOU. An excellent station location was found for a short drilled braced monument near the airport in Curacao. Other activities for the performance period are shown in the table below.



Figure 3. Station CN32, the first newly constructed COCONet site located at the Cocos Island National Park, Costa Rica

Table 1. Current COCONet reconnaissance and siting activity

	Cumulative	Since Last Quarter	Notes
Station Sitings	26	6	
Station Recons	18	6	Virgin Gorda, Bluefields, Puerto Cabezas, Penenome, La Palma
Permits Submitted	10	1	Virgin Gorda
Permits Accepted	4	3	Grand Bahama, Curacao, Cocos Island
Stations Installed	1	1	Cocos Island
Metadata Submitted	1	1	Cocos Island
Data Flow	1	1	Cocos Island
Maintenance Visits	0	0	
One Month Projection	Recons: 3, Permits Submit: 3, Installs: 0		

The first official COCONet station was installed by UNAVCO on Cocos Island in May of 2011 (Figure 3). At the Puerto Rico meeting this station was deemed critical to the science of the Caribbean because it is one of the only available locations for GPS that can be used to constrain the motion of the Cocos plate. The site was located near the dormitories of the Cocos Island National Park. Data are relayed from the station to the park headquarters and transmitted by VSAT back to UNAVCO in Boulder. A station homepage for CN32 and the will be available to the public shortly.

Data Activities

Of the 82 existing Caribbean GPS stations we have identified for possible adoption into the COCONet data framework, 50 are already contributing data to the UNAVCO archive and are operating under the same open data policy that will apply to COCONet. Even though we do not know how many UNAVCO-archived stations will eventually contribute to the COCONet velocity field, we assume that a significant number will be included and have selected a small subset of these stations to use for building out and testing the initial design of the COCONet data infrastructure. A process for integration of these existing stations will be discussed with the project PI's, NSF sponsors, and community members. This subset includes PBO station P780 in Puerto Rico, which is the template for new COCONet stations whose data will flow through the PBO dataflow system, and a number of stations from the CORS, GGN and CARIBE networks to serve as proxies for existing stations whose data will flow via different pathways to UNAVCO. We are also using six stations from the PRVINet network in Puerto Rico and the Virgin Islands to prototype and test our realtime streaming capabilities for COCONet stations.

UNAVCO data personnel met three times over the report period to plan the COCONet data system. The foundations of this system will be the UNAVCO Data Center's data archiving system, the metadata management systems of both the Data Center, the Plate Boundary Observatory, and the data processing centers and Analysis Center Coordinator for the Plate Boundary Observatory. Specifically, all COCONet station data and IGS site logs will reside on common UNAVCO data servers together with data from all other stations in the UNAVCO archives, freely accessible to all users via anonymous FTP. Many users – especially those just beginning to use the data – will benefit from a graphical user interface to aid in data discovery and access, and we will employ UNAVCO's Data Archive Interface (DAI, <http://facility.unavco.org/data/dai2/app/dai2.html#>) to fill this role. Specifically, all COCONet stations will receive a network code to identify them as such, and links to the DAI from the COCONet web site or other access points will be configured to present the user a default interface with all the COCONet stations preloaded. In the longer term, UNAVCO is investigating a proposal for the development of a stand-alone data archiving/access software package that could be used by interested Caribbean institutions to allow them to host COCONet data locally. This is an important component of the COCONet mandate for building regional partnerships, and we are hopeful that this initiative will move forward.

The PBO analysis centers and the analysis center coordinator have discussed a framework for processing COCONet position time series and network velocities, which is ready to be implemented as soon as a back bone of existing stations can be identified.

DESCRIBE THE MAJOR FINDINGS RESULTING FROM THESE ACTIVITIES.

This project has just gotten underway and there are currently no major findings or results from our activities.

DESCRIBE THE OPPORTUNITIES FOR TRAINING, DEVELOPMENT AND MENTORING PROVIDED BY YOUR PROJECT

This project provides the opportunity to collaborate and provide technology transfer in terms of GPS station installation practices and data flow and processing to numerous investigators in the Caribbean. To date these activities are in the incipient stages and will increase as our field and data activities increase. The project is planning a workshop for teaching field operations and maintenance to our Caribbean collaborators.

DESCRIBE OUTREACH ACTIVITIES YOUR PROJECT HAS UNDERTAKEN.

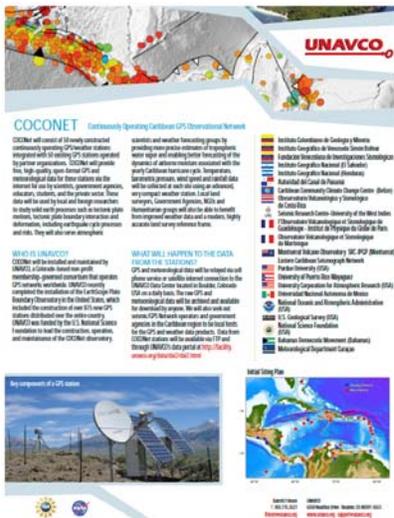


Figure 4. COCONet one-page handout for land-owners and Caribbean partners.

and begun exploration of funding for: building a community portal to allow effective sharing information about communication, locations, contact information, data availability, educational resources, partnerships and other topics of mutual interest; development of regional COCONet data centers which provide access, products, and instrument pools for regional campaign studies; and establishment of international internships and summer schools for undergraduate students at locations in the Caribbean region. These ideas and options will come forward at the up-coming siting workshop.

UNAVCO has produced preliminary outreach materials (flyers, Figure 4) for use in siting discussions with local partners. We have surveyed regional partners, particularly those that currently operate Caribbean-focussed websites, as potential partners for a

Participants at the COCONet Workshop agreed that COCONet should serve as a focal point for leveraging regional infrastructure, enhancing international research collaboration, and augmenting international partnerships. The participants recommended activities in four areas: additional scientific opportunities beyond the geodetic and atmospheric sciences; efforts to enhance collaborative acquisition, sharing and analysis of data; strategies to nurture a new generation of researchers; and efforts to share scientific outcomes and processes with non-scientific stakeholders, including teachers, emergency managers, policy and decision makers, professionals (e.g. surveyors), and other public constituencies.

Based on these recommendations, UNAVCO in partnerships with UCAR and IRIS has developed ideas



Figure 5. UNAVCO GPS Operations Manager Karl Feaux meeting with representatives from the University of West Indies and the National Office of Disaster Service of Barbuda and Antigua.

distributed information portal system (Figure 5).

Both UCAR and UNAVCO have recruited interns from the Caribbean region into their summer programs. One COCONet-supported intern in UNAVCO’s RESESS (Research Experience in Solid Earth Sciences for Students) program, Angel Torrens-Bonano, from University of Puerto Rico at Mayaguez, will work with UNAVCO staff to explore InSAR sensing of ground movements along the San Andreas fault system and then spend several weeks working with staff of the Southern California Earthquake Center to validate those remote measurements with in-situ GPS deployments. This training on these tools will have direct application to Caribbean geodesy.

COCONet Financial Reporting

UNAVCO has implemented an Earned Value Management (EVM) system for COCONet which provides a tool to monitor project cost and schedule activities. Our COCONet EVM system provides detailed planning for the first year of activity and will be refined for years two and three as feedback is integrated from the recent and planned workshops and experience is gained in year 1 construction and data flow activities.

For this performance period the project is has a positive cost variance with \$407K of EAR 1042906 project funds expended versus a budget of \$884k. This cost variance is driven by the late start of field work on the project while the PI’s were gathering community input at the Puerto Rico meeting and the upcoming Trinidad meeting.

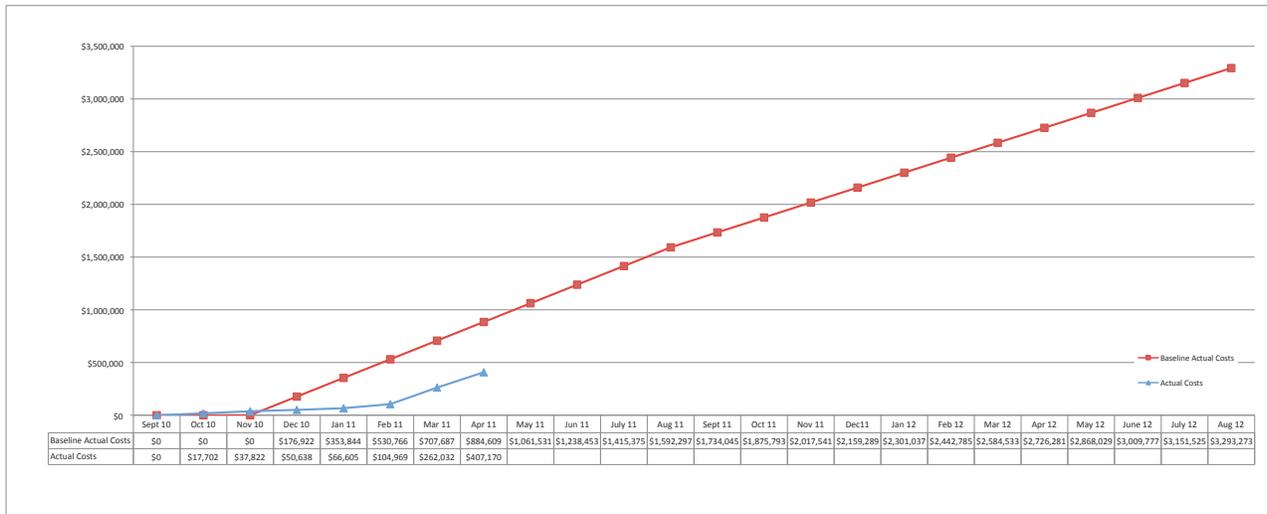


Figure X. Project actual expenditures vs. budget.

PROJECT CONCERNS

- The late start of COCONet field operations while the project was waiting for siting and existing station locations through the community meeting is a project concern. Action Plan: Work with NSF program managers, PI’s, and community representatives to re-plan project activities and year to year budgets for a successful completion.

APPENDIX 1 - SUMMARY OF STATION ACTIVITIES

Station Location	Country	Siting	Reconnaissance	Permits Submitted	Permits Accepted	Installations Refurbished	Installations New
Grand Bahama	The Bahamas	x	x	x	x		July 2011
Virgin Gorda	British Virgin Islands	x	x	x	Fall 2011		Winter 2012
Bluefields	Nicaragua	x	x	Summer 2011	Fall 2011		Winter 2012
Puerto Cabezas	Nicaragua	x	x	Summer 2011	Fall 2011		Winter 2012
Curacao	Curacao	x	x	x	x		July 2011
Cocos Island	Costa Rica	x	x	x	x		x
Penenome	Panama	x	x	Spring 2011	Summer 2011		Fall 2011
La Palma	Panama	x	x	Spring 2011	Summer 2011		Fall 2011
Anguilla	Anguilla	x	x	x	Summer 2011		Fall 2011
UWI MONA	Jamaica	x	x	x	Summer 2011		Fall 2011
Pedro Cay	Jamaica	x	x	x	Summer 2011		Fall 2011
Morant Cay	Jamaica	x	x	x	Summer 2011		Fall 2011
Saint Lucia	Saint Lucia	x	x	Summer 2011	Fall 2011		Winter 2012
Antigua	Antigua and Barbuda	x	July 2011	August 2011	Fall 2011		Winter 2012
Barbuda	Antigua and Barbuda	x	x	x	Fall 2011		Winter 2012
SSIA	El Salvador	x	x	x	x	Summer 2011	
San Lorenzo (SLOR)	El Salvador	x	x	Summer 2011	Fall 2011		Winter 2012
Carriacou	Grenada	July 2011	July 2011	August 2011	Fall 2011		Winter 2012

Station Location	Country	Siting	Reconnaissance	Permits Submitted	Permits Accepted	Installations Refurbished	Installations New
SUWI	Trinidad	July 2011	July 2011	August 2011	Fall 2011	Winter 2012	
Mapire	Venezuela	Summer 2011	Winter 2012	Spring 2012	Fall 2012		Winter 2013
El Baul	Venezuela	Summer 2011	Fall 2011	Spring 2012	Fall 2012		Winter 2013
Barinas	Venezuela	Summer 2011	Fall 2011	Spring 2012	Fall 2012		Winter 2013
Puerto Bolivar	Colombia	x	Fall 2011	Fall 2011	Winter 2012		Summer 2012
Monteria	Colombia	x	Fall 2011	Fall 2011	Winter 2012		Summer 2012
Swan Island	Honduras	x	*	*	*		*
Sarranilla	Colombia	x	Fall 2011	Winter 2012	Summer 2012		Fall 2012
Cap Haitien	Haiti	Summer 2011	Winter 2012	Spring 2012	Fall 2012		Winter 2013
St Croix	St Croix	x	x	*	*		*
Martinique	France	Summer 2011	Fall 2011	Winter 2012	Summer 2012		Winter 2013
Guadeloupe	France	Summer 2011	Fall 2011	Winter 2012	Summer 2012		Winter 2013
Dominica	Dominica	x	Summer 2011	Summer 2011	Fall 2011		Winter 2012
Cabo Rojo	Dominican Republic	x	Fall 2011	Winter 2012	Spring 2012		Summer 2012
Galerazamba	Colombia	x	Fall 2011	Fall 2011	Winter 2012		Summer 2012
CORO	Venezuela	Summer 2011	Fall 2011	Spring 2012	Fall 2012		Winter 2013
LEON	Nicaragua	x	x	Summer 2011	Fall 2011		Winter 2012
		26	18	10	4	0	1

* COCONet management is waiting for input at the COCONet siting meeting in Trinidad to determine if/when to proceed on reconnaissance for St Croix and Swan Island sites.