

COCONet EAR 1042906/9 Quarterly Report

December 1, 2014 – February 28, 2015 (FY2015-Q2)

SUMMARY

This quarterly report covers COCONet project (EAR-1042906/EAR-1042909) activities for the time period from September 1, 2014 to February 28, 2015. COCONet is a Collaborative Research project between UNAVCO (EAR-1042906) and University Corporation for Atmospheric Research (UCAR) (EAR-1042909) awarded on September 14, 2010. The project is under the direction of M. Meghan Miller, as PI, with Co-PIs, Karl Feaux, Glen Mattioli, and Guoquan Wang. Dr. Glen Mattioli is acting as Project Director in his role as Director of Geodetic Infrastructure at UNAVCO and Dr. John Braun is the UCAR PI.

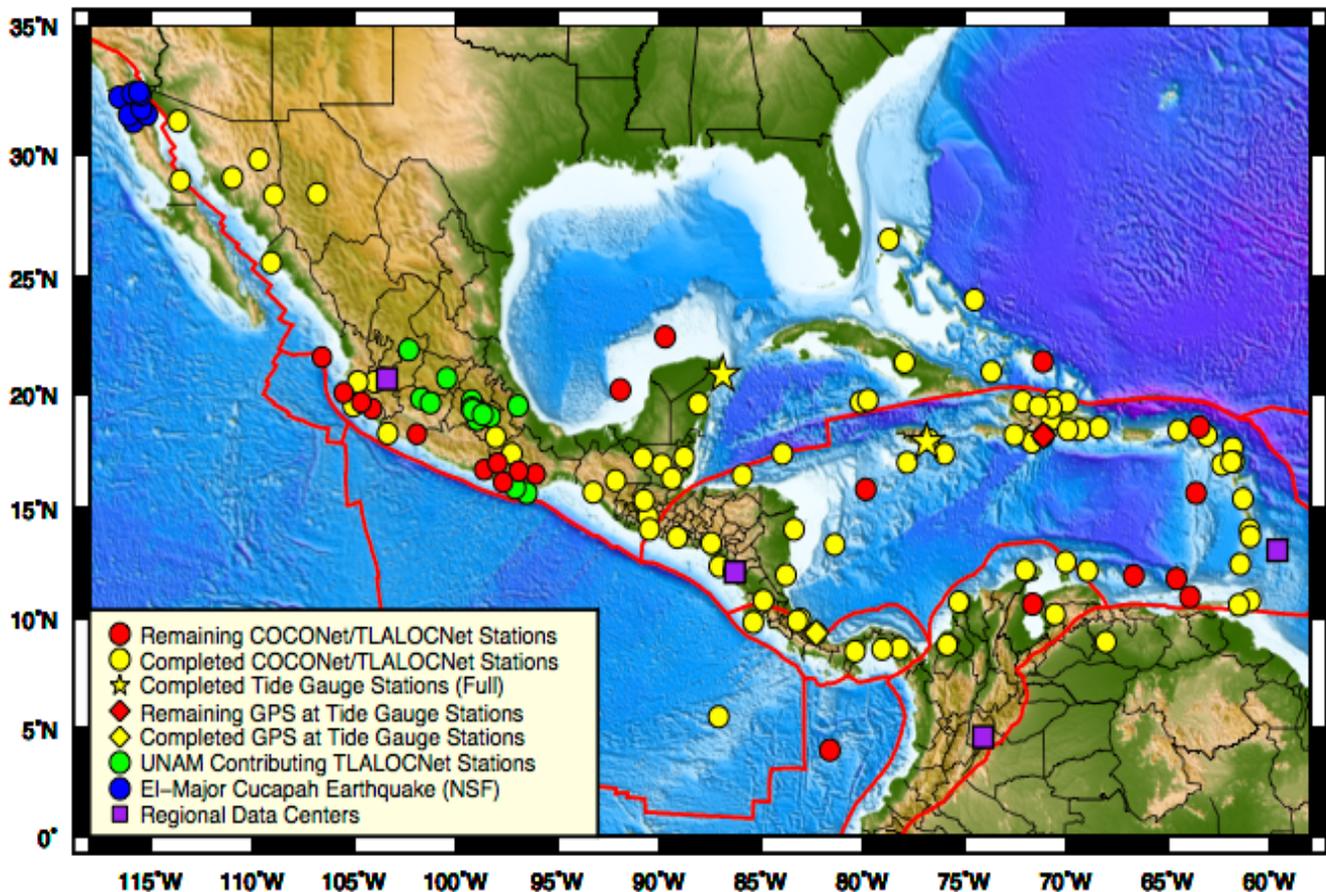


Figure 1. The current COCONet and TLALOCNet siting plan. Yellow dots represent the 71 completed COCONet stations (new and refurbished) and 13 completed stations from the TLALOCNet network. Red dots represent the 12 remaining planned COCONet stations (new and refurbished) and 12 planned TLALOCNet stations. The stars represent the proposed tide gauge locations (with 2 additional GPS sites per location). The diamonds represent existing tide gauge stations where 1 GPS stations will be added to constrain the motion of the pier. The existing “contributing” GPS stations (n=61+), which either already or are soon to be delivering data to the COCONet archive, are not shown in this map.

To date, UNAVCO engineering personnel have performed site reconnaissance at 81 locations, submitted land use permits for 81 sites, received permits for 78 sites, and currently have 71 stations installed (Figure 1).

Key accomplishments in the last quarter were the installation of two COCONet cGPS-Met stations in Venezuela (CN39 and CN40), one station in Antigua (CN01), and the installation of the second tide gauge station at Puerto Morelos, Mexico including cGPS-Met stations TGMX and UNPM (See Field Highlight below).

A number of other planning, logistical, and data tasks were completed during the last quarter including:

- The current siting plan calls for 54 new stations, 5 new stations associated with tide gauge installations, and 24 refurbished stations (VRAI was added to the siting plan in FY2015-Q2), for a total of 83 new and refurbished stations, and at least 61 existing stations to be incorporated into the COCONet data archive.
- Seven new and refurbished cGPS-Met stations were installed in FY2015-Q2 (2 GPS-Met stations in Venezuela, one in Antigua, one GPS-Met station installed on the pier at the Bocas del Toro tide gauge station, plus two GPS instruments associated with the new tide gauge station at Puerto Morelos, Mexico. The total number of new, refurbished, or co-located stations installed to date is 71. There are 12 remaining stations to be installed as part of the COCONet installation plan.
- Maintenance work was completed at a number of stations, including:
 - Choke ring antenna were installed at five original COCONet stations.
 - Antenna LNA was upgraded at CN07 in the Dominican Republic.
 - Cellular data communications were upgraded at VRAI and VERA.
- Planned work for FY2015-Q3 includes installations at Sombrero Island, Venezuela, and Grand Turk.
- UNAVCO currently archives 119 designated COCONet cGPS stations. This group includes stations that are new, refurbished as well as contributing stations from other networks. The UNAVCO Data Archive Interface (DAI) now has two distinct groupings of COCONet sites: 1) COCONet core, which includes all the sites that UNAVCO has installed or upgraded and currently maintains; and COCONet contributing, which includes stations that UNAVCO does not operate, but have been contributed by various regional partners.
- There are currently 37 COCONet stations delivering high-rate, low-latency (1 Hz, less than 2 s) data streams in real-time via the Networked Transport of RTCM via Internet Protocol (NTRIP). This exceeds the original project goal outlined in the proposal.
- Training of Regional Data Center staff took place in Boulder December 8-10.
- A few minor changes to server software installation and configuration were completed and the servers have been shipped to Regional Data Centers.
- Including open commitments, the COCONet expenditures are now over \$5.2M through February 2015, yielding a slight budget under run to date. The cost variance (5.14%) is consistent with the schedule variance.

- COCONet Fellow Teddy Allen attended the International Conference Climate Services–4 in Montevideo, Uruguay in December 2014. He gave two presentations that focused on understanding how Caribbean farmers use climate data and on explaining how these farmers and others can access free data and tools related to climate data.
- COCONet Fellow, Hans Lechner and his colleagues at Michigan Technological University met with INSIVUMEH, CONRED, Pacaya National Park and the city of San Vicente Pacaya in Guatemala to discuss advancing continuous geodetic/seismic infrastructure in the region during a GPS field campaign to Pacaya Volcano in November 2014.
- COCONet Fellow Halldor Geirsson held a GPS training course at INETER in Managua, Nicaragua from October 6-13, 2014. The course covered basic GPS theory, collection of GPS measurements, some UNIX basics, data archiving, and data processing using GAMIT/GLOBK.
- COCONet activities were covered by the media and informed the public about research and natural hazard risks. In particular, there were multiple news stories about GPS installations in Nicaragua for research and to monitor active volcanoes. The local media in Nicaragua reported on the installation of GPS stations and the use of these and other stations for monitoring volcanic hazards in October 2014. Two stories reported in El 19 Digital include the following:
 1. Instalan Sistema de Monitoreo en Laderas del Volcan Masaya
<http://www.el19digital.com/articulos/ver/titulo:22838-instalan-sistema-de-monitoreo-en-laderas-del-volcan-masaya>
 2. Gobierno Continúa En Monitoreo Constante del San Cristobal
<http://www.el19digital.com/articulos/ver/titulo:22857-gobierno-continua-en-monitoreo-constante-del-san-cristobal>

Additional details related to COCONet field activities this quarter may be found in Table 1 below.

	Cumulative	Since Previous Quarter	Details From Current Quarter
Station Recons	81		All recons completed, except for two Gulf of Mexico stations.
Permits Submitted	81		Remaining: 2 Gulf of Mexico stations.
Permits Accepted	78		Remaining: 2 GPS stations in Venezuela, 2 Gulf of Mexico stations plus 1 new GPS instrument at existing TG station in Dominican Republic
Stations Installed New /	50 new 21 refurbished	5 new 2 refurbished	New: CN39, CN40, CN01, TGMX, TGPM

Refurbished			Refurbished: VRAI, UNPM
Maintenance Visits	50	8	

Table 1. COCONet Status: Tasks completed to date and in FY2015-Q2.

FIELD HIGHLIGHT: CGPS CONSTRAINED TIDE GAUGE INSTALLED IN MEXICO

A Key Contributing Station for Tsunami Early Warning and Measuring Global Sea Level Budget

In February 2015, UNAVCO engineers installed the second COCONet GPS-constrained tide gauge station in Puerto Morelos, Mexico. The installation on the Yucatan coast was another successful collaboration with UNAM, the National Autonomous University of Mexico. The multi-sensor tide gauge station was installed on a concrete pier at the UNAM Institute of Ocean and Limnology Sciences, near the small town of Puerto Morelos. Similar to the station installed last quarter in Jamaica, this station includes a Sutron Radar Level Recorder, an INW pressure sensor, Trimble NetR9 with a Trimble GNSS choke ring antenna, and a Vaisala meteorological instrument. The pier is not an ideal location in terms of sky view and multipath but will allow for a continuous positioning of the tide instruments and help convert relative tide measurements into the global reference frame for measuring global sea level. The receiver at the existing contributing COCONet station, UNPM, was modernized to a Trimble NetR9. UNPM has a 7-year time series and will provide an excellent station to constrain the pier antenna. UNAM staff will assist in long-term maintenance and operation of both the GNSS and tide instrument systems. All tide data are transmitted via GOES satellite and available at UNESCO's IOC (Intergovernmental Oceanographic Commission) tide gauge database, www.iocsealevelmonitoring.org. The tide station is called PUMO2 in the IOC archive. All GNSS and meteorological data for the GNSS station (station code: TGMX) undergo standard COCONet processing and are available at coconet.unavco.org. We are currently in the process of developing a highlight for the UNAVCO website related to this work and also providing links from the UNAVCO website to the UNESCO IOC data archive and viewer.



Figure 2. UNAVCO engineer Korey Dausz installing radar level recorder mount.

UCAR UPDATE

The UCAR/COSMIC program is participating in COCONet under support from NSF grant (EAR-1042909). UCAR/COSMIC produces continuous estimates of atmospheric precipitable water vapor (PW) using a heterogeneous network of GNSS stations, including those stations that are part of COCONet. These data are produced and distributed through the Suominet (www.suominet.ucar.edu) web portal as well as with the local data management (LDM) system.

Data from twenty-two cGPS stations were included into the analysis in Q2FY2015. This includes three COCONet stations (CN45, IND1, and VRAI), eight TLALOC stations (TNAM, TNAT, TNCM, TNHM, TNMR, TNPP, TNTB, and USMX) and 10 PBO stations (P062, P183, P309, P324, P475, CASE, KBRC, RMVJ, VTOR, and VNDP). Station KITT, in Kitt Peak, Arizona, was also added at the request of radio astronomers operating telescopes at the Cerro Tololo Inter-America Observatory. Hourly and daily estimates of PW are now available from these sites. Data from more than 500 sites across North America, Central America, and the Caribbean are now routinely analyzed to support various research applications.

Automated transmission of surface meteorology observations from COCONet were deemed suitable for distribution onto the National Weather Service (NWS) Telecommunications Operations Center (TOC) and the Global Telecommunications System (GTS) were finalized on January 7, 2015. These data are now available as NWS data stream under tag SXCA51 KWBC (<http://weather.noaa.gov/pub/data/raw/sx/sxca51.kwbc..txt>).

As reported in the 2015Q1 COCONet quarterly report, UCAR/COSMIC is reprocessing data from more than 100 cGPS stations operating in the COCONet region from 2007 through 2015. This reprocessing utilizes products from the Center for Orbit Determination in Europe (CODE) that have been recently submitted to the International GNSS Service (IGS) 2nd reprocessing effort. UCAR/COSMIC has utilized these CODE products to produce satellite clock estimates at 30 seconds intervals. Progress in this effort has been delayed this quarter. We expect this reanalysis to be completed by the end of Q2FY2015.

PROJECT CONCERNS

Venezuela: Securing two permits in Venezuela seems unlikely at this point, given the increasing unrest in civil society. This situation has resulted in an Executive Order by President Obama (<https://www.whitehouse.gov/the-press-office/2015/03/09/executive-order-declaration-national-emergency-respect-venezuela>). **Risk mitigation:** The installation of four stations in Venezuela (including the very important Aves Island site) will far exceed the expectations of many in the COCONet community when the project started. We are investigating the possibility of developing a sub-contract with our local contacts to complete the installation of the remaining instruments that are already in country. If this cannot be executed, then as a last resort, we may consider dropping the final two stations from the COCONet siting plan.

Colombia: Hector Mora, our primary partner in Colombia, has been unable to travel to the planned refurbished stations on Malpelo and Serranillo Islands. **Risk mitigation:** UNAVCO staff recommend dropping these two stations from the siting plan. This will be reviewed by the COCONet working group during their next telecon.