

CARICOOS: Enhancing Coastal Intelligence in the US Caribbean

Program Performance Report



CARICOOS

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Project title: CARICOOS: Enhancing Coastal Intelligence in the US Caribbean

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Recipient Institution: University of Puerto Rico at Mayaguez

Principal Investigator: Julio M. Morell (julio.morell@upr.edu)

Address: University of Puerto Rico at Mayaguez

Department of Marine Sciences

Magueyes Island, La Parguera, Lajas Puerto Rico

Postal address: PO Box 3446 Lajas, PR 00667-3446

Phone number: 787-899-2048 ext. 255; 787-450-0139 (cel)

Fax: 787-899-2564

Program Officer: Regina Evans, 301-427-2422, regina.evans@noaa.gov

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I. Performance Progress Report

The progress of activities scheduled for the first semester of the current year under the “CARICOOS: Enhancing Coastal Intelligence in the US Caribbean” cooperative agreement was interrupted and severely delayed by the direct impact of Hurricanes Irma and Maria to the CARICOOS region on mid-September. Operations at the University of Puerto Rico-Mayaguez, which provides essential administrative and operational support to CARICOOS, ceased for six weeks due to major infrastructure damage. To date not all facilities, including most of CARICOOS’s, are fully operational. Investigators, administrative personnel and student have been temporarily relocated. The University of the Virgin Islands suffered extensive damage. Furthermore, the prolonged recovery of vital infrastructure in the region has hindered resumption of daily operations to pre-hurricane levels.

With the exception of the HF Radar network, whose main components were removed from all stations, the U of Virgin Islands-owned data buoy deployed west of St. Thomas which was severely damaged by Hurricane Irma and several meteo stations (see CARICOOS system status report below), observational assets continued in operation through the events collecting an unique data-set part of which are included in reports by the NWS San Juan WFO (SAN JUAN WFO REPORT), OCOVI (OCOVI_SUMMARY) and others.

As detailed below, the disruption of activities resulted in the postponement of several milestones to the upcoming semester. The hurricane impact also provoked the implementation of additional activities in response to the hurricane events. These include measures for the recovery of the observing system such as damage assessments, submission of a supplemental funding request, engagement of pertinent subawardees and contractors and a data recovery effort.

In addition, CARICOOS has undertaken several tasks towards supporting and informing stakeholders in the aftermath of the hurricanes. Among others, CARICOOS is providing technical expertise and presentations to community forums and the ongoing redaction of informative products towards improved understanding by the general coastal community of particular hurricane expressions driving the impact to their sector. CARICOOS also responded to a call from USCG RIO Ponce office to assist with the identification of underwater obstructions in the Port of Ponce navigational channel and dockage area required before opening the port to major ships part of the hurricane relief effort. Furthermore, CARICOOS will be providing “in kind” support for an NSF funded initiative led by Patricia Chardón, CARICOOS Technical Coordinator, entitled “Hurricane Maria Rapid Response: Field Observations of Post-storm Beach Recovery Dynamics in Rincon, Puerto Rico”.

Although system recovery efforts are underway these will be limited by the need for additional funding for: the acquisition of a replacement for the St. Thomas buoy and various sensors/instruments and meteo stations in need of calibration/repair/replacement, contracting the repositioning of all buoys and replacing their anchors and for the refurbishment of four HF Radar stations (replacement of non-removable infrastructure and replacement of electronic that were removed from stations but got wet due to damage to the building where these were stored) . A cost estimate for the above totals \$878,000.

a. Status of CARICOOS after Hurricanes Irma / Maria

A preliminary assessment of CARICOOS assets was performed to evaluate their condition and current operational status after the catastrophic impacts of Hurricanes Irma and Maria on Puerto Rico the US Virgin Islands. The extreme metocean conditions generated during the storm significantly damaged several of CARICOOS assets.

BUOYS

- All buoys moved at least 100 meters from their original station locations.
- St. John buoy, during Hurricane Irma, moved approximately 680 m from station position.
- The USVI EPSCOR St. Thomas buoy was severely damaged (unrepairable) during Hurricane Irma.
- The mooring of the Rincon wave buoy failed during Hurricane Maria and the buoy went adrift. Fortunately, the NOAA ship THOMAS JEFFERSON successfully recovered the drifting buoy east the Turks and Caicos Islands on Monday, October 9.
- A physical inspection of the CARICOOS Ponce buoy was performed and it was observed that the buoy anchor was flipped upside down. The anchor will have to be replaced.
- Direct inspections of the Vieques, San Juan and St. John buoys have been scheduled for January 2018. Solar panels and anchors will need to be replaced in all buoys.
- The Ponce and St. John buoys are having issues with cellphone service due to H. Maria and the unstable nature of cell phone service in the area.
- The Ponce buoy is having issues with the Microstrain wave sensor, the sensor will likely have to be replaced.
- The San Juan buoy lost one of its wind sensors.

HF RADARS

- CODAR electronic equipment was retrieved from all stations before the hurricane and stored in a safe place. Therefore, no data was collected during hurricane.
- There was damage to cables, connectors and several enclosures as well as severe destruction of nearby infrastructure – reinstallation of HFR sites depends on when power and communications is restored for each site and also depends on the reconstruction of the facilities in which they were located.
 - **CDDO Station** - Enclosure and antenna bases were severely damaged primarily due to storm surge.
 - **PYFC Station** - Power and communication cables were damaged due to storm surge

METEOROLOGICAL STATIONS

Nine (9) of the sixteen (16) meteorological stations are neither working nor reporting and will require being replaced. Those stations are: Yabucoa, Fajardo, Puntas-Rincon and Isla Magueyes in Puerto Rico and Two Brothers, Crown Mountain, Rupert Rock and Buck Island in the US Virgin Islands. All others will need refurbishing and recalibration.

1.1 Milestones specific to CARICOOS focus areas

MILESTONE / TASK	Expected Completion Date	Affected by Hurricanes Irma / Maria?	Status / Highlights
Support safe and efficient maritime operations			
Improve wave, current and circulation modeling for ports in the region	May 2018		Ongoing
Continue operation of the Yabucoa Port Metocean observation and prediction system	continuous	Yes	Ongoing. Model back up mid-November.
Implement an easy to use web interface to provide text-based sea state forecasts for nonscientific CARICOOS users	April 2018	No	On Track
Conduct drifter validation experiment for intercomparison between available circulation models in the region, inform USCG about results & recommendations for SAROPS	Mar 2018	Yes	Delayed, expected completion date May 2018
Minimizing impacts from coastal hazards			
Maintain and enhance the operational CARICOOS - Sea Grant Nearshore Breaker Model	continuous	Yes	On Track. Model offline between September 20 and October 26 2017
Continue to support Surfrider's BWTF efforts to monitor beach water quality in the Northwest of Puerto Rico	continuous	No	On Track
Develop a data-to-text generator for the CARICOOS Nearshore Breaker Model	Dec 2017	Yes	Delayed. New expected completion is March 2018
Develop a Beach Water Quality data-to-text generator	Dec 2017	Yes	Delayed. New expected completion is March 2018
Issuance of CARICOOS text-based forecasts	May 2018	No	On Track
Develop additional nowcasts based on weather radar information (pilot site: Crashboat Beach, Northwest Puerto Rico)	May 2018	No	On Track
Continue to maintain and upkeep CARICOOS beach water quality data products	continuous	Yes	On Track. Data flows affected in the hurricane aftermath
Include USVI beach water quality data as part of CARICOOS data products.	May 2018	Yes	Postponed until USVI resumes beach water quality monitoring
Continue collaboration with the PR EQB to serve their beach water quality data, and achieve a formal collaborative agreement through an MOU.	May 2018	No	On Track
Coastal resources: monitoring and management			

MILESTONE / TASK	Expected Completion Date	Affected by Hurricanes Irma / Maria?	Status / Highlights
Research cruise focused on assessing the spatial variability of carbonate chemistry in La Parguera	Jan 2018	No	On Track – but postponed to February 2018.
Continue R&D for implementing a Sargasso tracking and system	May 2018	No	On Track
Monitoring climate variability			
Operation of La Parguera MAP CO2 buoy, data dissemination	continuous	Yes	On Track. Buoy mooring suffered partial damage from H. Maria. CTD and pH sensors are offline, but real-time pCO2 data is available.
Deployment of NOAA-AOML Gliders SG610 and SG630 off south coast of PR and SG 635 off San Juan P.R.	July 2017	No	Complete
Retrieval and refurbishment of NOAA-AOML Gliders SG 610, SG630 and SG635	Nov 2017	No	Complete
Deployment of NOAA-AOML Gliders SG610 and SG630 off south coast of PR and SG 635 off San Juan P.R.	Feb 2018	No	On Track
Retrieval and refurbishment of NOAA-AOML Gliders SG 610, SG630 and SG635	May 2018	No	On Track

1.2 Milestones specific to CARICOOS subsystems

MILESTONE / TASK	Expected Completion Date	Affected by Hurricanes Irma / Maria?	Status / Highlights
Observing Subsystem			
Operate the CARICOOS data buoy network	Continuous	Yes	On-Track. Several data gaps due to communication outages.
Operate the CARICOOS HF radar network	Continuous	Yes	On-Track. Currently offline due to power and communication outages. Working on getting system back online as soon as power returns to HFR sites.
Operate the CARICOOS MESONET and WINDNET	Continuous	Yes	On-Track. Nine (9) of the sixteen (16) meteorological stations are not working nor reporting.
Quarterly inspections of CARICOOS Rincón wave buoy	May 2018	Yes	On Track. Mooring of Rincon buoy failed during H. Maria, buoy was recovered 22 days

MILESTONE / TASK	Expected Completion Date	Affected by Hurricanes Irma / Maria?	Status / Highlights
			after. Currently the buoy is at CDIP SCOOS where it is being refurbished. Buoy should be redeployed in late January 2018.
Yearly maintenance of the CARICOOS-U Maine data buoys	April 2018	Yes	On Track. Maintenance has been moved forward to an earlier date (tentative mid-January)
Yearly maintenance of the CARICOOS Rincón wave buoy	May 2018	Yes	On Track – Buoy will be redeployed in late January
Yearly maintenance of the UVI-EPSCOR St. Thomas buoy	May 2018	Yes (Hurricane Irma)	On Track. St. Thomas buoy was severely damaged during Hurricane Irma. Future status of buoy depends on hurricane supplemental funds.
Yearly maintenance of the La Parguera MAP CO ² buoy	Jan 2018	No	Delayed. Maintenance has been postponed to February 2018 due to H. Maria.
Maintenance of CARICOOS MESONET	May 2018	Yes	On Track. Stations will require refurbishment or replacement.
Maintenance of CARICOOS HF radar network	May 2018	Yes	On Track. Waiting for the power issues to be fixed.
Servicing visit to fix the issue with the external sensors installed on Vieques and St. John buoys	December 2017	Yes	Delayed. Issues will be fixed during the upcoming yearly maintenance.
Install HFR antenna in St Thomas	May 2018	Yes (Hurricane Irma)	Delayed. Postponed until the US Virgin Islands recovers from the impact of Hurricane Irma
Repair of XBRO & XWGO weather stations (WeatherFlow)	December 2017	Yes	Delayed. These and other 7 meteorological stations will be repaired by Weatherflow during the following months.
Deployment of underwater gliders in the Caribbean Sea and Atlantic Ocean	May 2018	No	On Track. Currently in maintenance, preparing for next deployment
Weekly beach pathogen monitoring	May 2018	Yes	On Track. Delayed / interrupted. Water sampling was not performed for almost 45 days due to H. Maria.
Bi-weekly water quality sampling by Surfrider Foundation.	May 2018	Yes	On Track. Water sampling was not performed for almost 23 days.
Modeling & Analysis Subsystem			

MILESTONE / TASK	Expected Completion Date	Affected by Hurricanes Irma / Maria?	Status / Highlights
Operation & maintenance of CARICOOS Nearshore Wave Model	continuous	Yes	On Track. Model offline between September 20 and October 26 2017
Migrate the CARICOOS Nearshore Wave Model to Amazon EC2 HPC instance	December 2017	Yes	Delayed. Model migration should be complete by early February 2018.
Develop new web interface to visualize CARICOOS ROMS output	December 2017	Yes	Delayed
Operation & maintenance of CARICOOS WRF (1km & 2 km resolution)	continuous	Yes	On Track. Model offline between September 20 and October 26 2017
Improvement and validation of pre-operational CARICOOS FVCOM	continuous	No	On Track
Make operational CARICOOS FVCOM available to stakeholders	April 2018	No	On Track
Develop AMSEAS / RTOFS / HYCOM web interface for model inter-comparison (FVCOM style)	December 2017	Yes	Delayed. New completion date of March 2018
DMAC Subsystem			
Fully populate CARICOOS ERDDAP with operational models (SWAN, WRF, ROMS/FVCOM)	December 2017	No	On track. SWAN has been available through ERDDAP for a while. Operational ROMS and FVCOM runs are still under development. WRF output needs to be re-written for ERDDAP compliance.
CARICOOS en español!	April 2018	No	On Track
Continue current CARICOOS DMAC and Regional DAC efforts as detailed in the SOP	May 2018	No	On Track. CARICOOS underwent a successful DMAC review by the IOOS office in June 2017
Custom text data product development in response to stakeholder needs.	May 2018	No	On Track
Entries/holdings/queries in the IOOS Registry and Catalog will be increased while achieving full compliance with IOOS DMAC metadata, file and data discovery standards and checks	May 2018	No	On Track
Attend IOOS DMAC meeting	as required	No	On Track
Continue operating DMAC and computational infrastructure	continuous	Yes	On Track. Servers located in UPRM down from Sept 20 to Oct 27.

MILESTONE / TASK	Expected Completion Date	Affected by Hurricanes Irma / Maria?	Status / Highlights
Maintain and enhance new CARICOOS website	continuous	No	On Track
Achieve cloud-based computing and improve HPC infrastructure	Dec 2017	Yes	On Track. Migration of some model components delayed due to H. Maria.
Historic data archival	continuous	No	On Track
Education & Outreach Subsystem			
Continue O&E formal and informal activities focused on enhancing awareness and appropriate utilization of CARICOOS products and services	May 2018	Yes	On track. Some activities were postponed due to hurricanes. Several hurricane related activities have been implemented or underway
Develop and deliver products training workshops	May 2018	Yes	On track. Some activities were canceled. Will resume in the upcoming semester
Continued assessment of stakeholder/user needs	continuous	Yes	On track. Some activities postponed after the hurricanes.
Assess user needs pertaining to the development of the CARICOOS Beach App and provide support as requested	May 2018	Yes	On track. Slightly delayed after the hurricanes.
Host training workshops for teachers to facilitate interpretation of data and products and obtain essential feedback.	May 2018	No	Rescheduled for June 2018. Logistics to take place during the upcoming performance period
Host the CARICOOS summer internship program.	July 2017	No	Completed.
Continue to procure an active presence in pertinent forums, such as Harbor Safety Committees, PR Climate Change Council, UPR Sea Grant Advisory Board, JBNERRs Research Advisory Board, among others	Continuous	Yes	On track. Some activities postponed or cancelled due to the hurricanes.
Consult stakeholders via direct communication and interaction at CARICOOS General Assembly meeting	May 2018	No	On track.
Assess the effectiveness of the CARICOOS kiosk and redeploy/relocate as necessary	December 2017	Yes	Delayed due to lack of power and internet at the sites.
Continue to issue CARICOOS communications via quarterly	continuous	Yes	On track. Some issuances affected due to the hurricanes.

MILESTONE / TASK	Expected Completion Date	Affected by Hurricanes Irma / Maria?	Status / Highlights
newsletters, social media, and CARICOOS School (O&E webpage)			
Stakeholder engagement throughout the region	continuous	Yes	On track. Some activities cancelled or postponed because of the hurricanes.
Conduct Board of Directors meetings	December 2017	Yes	Delayed. Board meeting to take place January 2018.
Support CARICOOS Inc. administrative operations	continuous	No	On track.
Host annual CARICOOS General Assembly	April 2018	No	On track.

II. Scope of Work

No substantive changes to the project's SOW are anticipated except for the addition of hurricane response activities and others required for the system's reconstruction.

III. Leadership Personnel and Organizational Structure

Dr. Patricia Chardon, formerly serving as a Postdoc with CARICOOS will take a new role as the Technical Coordinator. Dr. M. Canals has stepped down as Technical Director in order to carry out new research projects that have been recently awarded to him. His percent effort will be reduced to 25%, but he will continue his functions as Co-PI and scientist, including leading the coastal numerical modeling components of CARICOOS, co-lead HFR and buoy operations with Dr. Patricia Chardon, as well as assist in new product development, stakeholder engagement, among other duties. He will also assist and provide scientific advice to CARICOOS Directors Morell and Rodriguez as required. Dr. Juan Gonzalez, modelling Postdoc, was appointed by Amec Foster Wheeler where he commenced his duties in October.

IV. Budget Analysis

Funds allotted for the 2016-2017 year totaled \$1,702,787. These have been expended with the exception of \$9,883 corresponding to salary and fringe benefits for a postdoctoral position vacated before the end of the contracted period and \$45,738 allotted to the U. of the Virgin Islands through a subaward but not invoiced for. Funds drawn-down at the end of the year totaled \$1,238,470. Funds pending drawdown total \$408,695, a delay largely resulting from the interruption in UPRM's R&D Center administrative operations arising from the impact of Hurricane Maria.

V. ENVIRONMENTAL COMPLIANCE

No activities outside those considered in the final U.S. IOOS PROGRAMMATIC ENVIRONMENTAL ASSESSMENT and found as posing no significant impact (FONSI 6/29/2016) were undertaken in the period here reported.