

Advancing the Caribbean Coastal Ocean Observing System

Program Performance Report

Reporting Period: 12/01/2015 – 5/30/2016

Project title: Advancing the Caribbean Coastal Ocean Observing System

Award number: NA11NOS0120035

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

Program Office: NOS Integrated Ocean Observations Systems (IOOS)

Award Period: 06/01/2011 - 05/31/2016

Project Web Site: <http://www.CARICOOS.org>

1. Introduction:

In the period here reported all existing subsystems including observational and modeling capabilities as well as DMAC systems have been kept in operation. Details on system maintenance and enhancements are reported below. Selected activities per sector / focus area are included below.

1.1. Operations in ports, harbors and approaches and emergency response

Implementations of very high-resolution (VHR) wind (WRF) and wave (SWAN) models for Yabucoa Harbor, financed by Buckeye LLC, are now fully operational and made available to stakeholders through a web interface (<http://www.caricoos.org/ports/yabucoa/us>). An analogous effort is under development for the Port of San Juan and includes a hydrodynamic modelling component (FVCOM).

Observational data from CARICOOS HF Radars and drifters continues to support not only operations but also model validation for assessing the effectiveness of models available to USCG SAROPS via EDS. In March 2016, CARICOOS deployed ten drifters at varying distances off the south coast of PR. Data from these was shared with the USCG Search and Rescue lead officer John Ware at San Juan, who fed SAROPS with HF Radar data and HYCOM model output and calculated search patters for each of these. Results evidence the improvement in forecasts by utilizing HF radar data over using HYCOM

1.2. Minimizing coastal hazards

The CARICOOS Nearshore Breaker Model (NBM), developed with PR Sea Grant support and utilized by San Juan WFO as part of their operational Surf Zone Forecast, has been further validated and enhanced. The web product has drawn the attention of the public as indicated by a growing audience.

CARICOOS keeps sponsoring a pilot beach monitoring program for coliform bacteria, performed by Surfrider Foundation. MPN data on Enterococcus is reported at: <http://www.caricoos.org/map/beach-water-quality>. Results from the implementation of a probabilistic forecast model (EPA's Virtual Beach) by CARICOOS at Rincón's Public Beach in western PR is already available as an experimental product. An Enterococcus sampling in well underway at Playa Santa beach in Guanica, PR. This data will be used for the next implementation of the forecast model.

1.3. Coastal resource management

CARICOOS/AOML SEAGLIDER AUV's were deployed early in the year for the collection of surface and subsurface ocean temperature data used for seasonal hurricane forecasts. A graphical product depicting existing near and subsurface temperature and anomalies in the region using SeaGlider data has been implemented and used for documenting the subsurface extension of SST anomalies. Results indicate varying degrees of penetration of the SST anomaly below the mixed layer.

CARICOOS-NOAA Ocean Acidification Program collaboration has allowed continued operation of the MAP CO2 buoy and a discrete sampling program in collaboration with the U. of New Hampshire. A project recently financed by Sea Grant will provide for a first assessment on the impact of ocean acidification on La Parguera reef structure (non-living) and their effectiveness as coastal barriers. A parallel effort is underway for the fossilized dunes (eolianite structures) which serve as barriers for the north coast.

A project funded by the Jobos Bay National Estuarine Research Reserve is focused on sensor and discrete sample data assessment and database depuration required for trend analysis required by JOBANERR. Early results show a strong recovery of water quality in the nearshore station following cessation of agricultural activities in the immediate watershed.

1.4. Outreach and Engagement (O&E)

CARICOOS has procured presence in social media through regular publishing of focused messages informing about significant coastal "events" either observed and or forecasted by CARICOOS, periodical publication of CARICOOS news in bulletins, press releases and social media. We also have engaged stakeholders in neighbor countries such as the British Virgin Islands, the Dominican Republic and Saba, all of which have expressed interest in developing observing capabilities in their coastal waters in collaboration with CARICOOS.

1.5. Governance

The 9th CARICOOS General Assembly was held from the 27 to the 28th of April. It was well attended by members and the community in general. Fourteen presentations in an IGNITE format provided the audience with an insight on underway applied research initiatives focused on meeting regional ocean observing needs. The assembly included reports from the Chairman, Executive and Technical Directors as well as by USVI liaison and distinguished stakeholders. During the pre-Assembly

meeting the CARICOOS Board of Directors reviewed and approved funding recommendations for the Enhancing Coastal Intelligence in the US Caribbean Project starting June 1, 2016. A board election resulted in the reelection of twelve members and the addition of three new members. J. Corredor and I. Colón Carlo graciously decided to provide space for a new generation of stakeholders. For further information, see addendum.

2. Progress and Accomplishments

The table below shows the original milestone / task list as submitted in the year 5 statement of work and whether each milestone was completed by May 31 2016. In March 2016 a request for a no-cost extension was submitted to IOOS. This NCE was approved by the IOOS office, which will allow CARICOOS to complete these milestones / tasks during FY16.

2.1. Observing subsystem:

Activity / Milestone	Completed by May 31 2016?	Progress
Operate and maintain the CARICOOS data buoy network including UVI's buoy.	YES	CARICOOS data buoys were retrieved in early April 2016 by Commercial Divers and refurbished by the U. Maine team. All buoys are back in operation. Refurbishment of the UVI data buoy has been postponed as to precede its relocation off the north coast of the USVI.
Operate and maintain the CARICOOS Rincón Wave Buoy	NO	Yearly maintenance of the Waverider MKIII, including buoy and mooring inspection and battery replacement is routinely performed over the summer period (after May 31) to minimize the possibility of high waves affecting the operation. This operation has been scheduled for late June 2016 (as in previous years).
Operate and maintain WeatherFlow MESONET and CARICOOS WindNet	YES	Logistics support has been provided to WeatherFlow, Inc. to maintain in operation a MESONET of fourteen hurricane-hardened weather stations located in Puerto Rico and six in the USVI. Three of these required major repairs during the period here reported. An additional new station has been deployed by WF in Culebrita, an area heavily transited by recreational vessels navigating between PR and the USVI. Two additional meteo stations maintained by CARICOOS (PTRP4 and IMG4) have also been kept in operation.

<p>Operate and Maintain CARICOOS HF Radar surface current monitoring system</p> <p>Enhance the CARICOOS HF Radar network by:</p> <ul style="list-style-type: none"> • moving the FURA antenna to Rincón Lighthouse, if the site is deemed as a feasible HFR location • rental of additional HFR unit from Rutgers and installation at site in St. Croix or alternate location is St. Croix is unsuitable. 	<p>NO (PARTIALLY COMPLETED)</p>	<p>One of the milestones during year 5 proposed the relocation of the FURA antenna to Rincón Lighthouse in order to increase northward HFR coverage in the Mona Passage. Completion of this task was delayed due to higher priority deployments of the new HFR sites at Ponce (PFYC) and Maunabo (MABO). As part of the approved no-cost extension, this task will be completed along with the deployment of a new HFR antenna in response to USCG requests for added HFR coverage in the eastern sector of the region, using unexpended funds.</p>
<p>Operate and maintain MAP CO₂ buoy and continue discrete sampling program under NOAA's Ocean Acidification program</p>	<p>NO (PARTIALLY COMPLETED)</p>	<p>A backlog in the carbonate chemistry analysis of discrete samples part of the CARICOOS OA program, due to the death of the available Alkalinity titrator requires additional time for completion. Once the analyses are finalized, UNH partners will proceed with the required data synthesis. The above issue has been mitigated through a no cost extension for the subaward granted to University of New Hampshire (PI Joe Salisbury) for sample analysis, MAP CO₂ buoy management/ maintenance and OA data synthesis. A new Alkalinity titrator has been purchased and should be delivered by the end of June.</p>
<p>Continued dissemination of remotely sensed water quality products for the region</p>	<p>YES</p>	<p>Dr. Chuanmin Hu, lead of the Optical Oceanography Laboratory at the U. of South Florida has agreed to share his suite of highly refined remotely sensed imagery-products for the Eastern Caribbean, including Chl-a, Alternate Floating Algal Index (useful for Sargasso detection) and MODIS Color Index through the CARICOOS web interface.</p>
<p>Deployment of Lagrangian drifters, both surface and SVP</p>	<p>YES</p>	<p>Six CARICOOS drifters and four AOML SVP drifters were deployed off the south coast of Puerto Rico in April 2016. Observations were utilized for numerical model validation and for assessing the impact of HF Radar data on USCG Search and Rescue Operations.</p>

Deployment of side-looking Aquadopp at Port of Charlotte Amalie by UVI personnel	NO (PARTIALLY COMPLETED)	A Sutron weather station and a Teledyne Industries side-looking ADCP were installed in W. Gregeries channel on May of 2016. However, alignment of ADCP and transfer of data to the CariCOOS website remains to be completed. This task will be completed by UVI personnel as part of the approved no-cost extension.
--	-----------------------------	--

2.2. Modeling subsystem:

Activity / Milestone	Completed by May 31 2016?	Progress
Maintain and enhance operational high resolution WRF (weather) and SWAN (wave) model implementations	YES	<p>WRF: All CARICOOS WRF model implementations (NMMM 1 & 2 km, ARW 2.5 km) have remained operational throughout the performance period. In order to improve model predicitions of seabreeze dynamics, land boundary conditions for soil moisture and soil temperature from the 1-km resolution NASA SPoRT Real-Time LIS has been implemented on all CariCOOS WRF model versions. An improvement in model performance was observed.</p> <p>SWAN: Improvement to the CARICOOS Wave Model in FY15 include:</p> <ul style="list-style-type: none"> • Operational implementation of WRF 2KM wind forcing • Improvements to spectral grid discretization • Improvements in graphical output, including 2D and 1D spectral plots for over 200 forecast points (see the CARICOOS sea state point forecast page for details: http://www.caricoos.org/map/swan-point-forecast)
Maintain and enhance the operational CARICOOS - Sea Grant Nearshore Breaker Model	YES	A 1D spectral partitioning technique has been implemented in order to improve breaking wave height estimation using nearshore wave spectra from SWAN. A new graphical interface was developed and included in the new CARICOOS website.

<p>Continue implementation of FVCOM for San Juan Bay</p>	<p>YES</p>	<p>FVCOM has been implemented successfully for Puerto Rico and San Juan Bay by CARICOOS student Adail Rivera. Model fine-tuning and validation will continue in FY16.</p>
<p>Commence FVCOM simulations for Parguera</p>	<p>NO</p>	<p>While the regional domain and a subdomain for San Juan Harbor have already been deployed and undergoing validation, unexpected delays have precluded commencing implementation of La Parguera subdomain. The latter will support the CARICOOS ocean acidification program. Finalization of this task has been rescheduled for April 2017.</p>
<p>Evaluation of EPA's Virtual Beach as a pathogen forecasting tool for public beaches in Puerto Rico. A pilot study will be conducted for beaches in Rincón, PR to assess the feasibility of adopting EPA's Virtual Beach as a statistical tool to develop local predictive models for occurrence of beach pathogens.</p>	<p>YES</p>	<p>EPA's Virtual Beach regression algorithms were tested for Rincon Public Beach beach water quality time series. Independent variables included accumulated precipitation, wind speed and direction, wave height, period and direction, and NOAA tides, while the dependent variable was taken as the bacterial count log10 transformed. A regression model was generated for data pertaining the year 2015 and is now provided operationally every hour as CARICOOS RINCON BALNEARIO EXPERIMENTAL NOWCAST (http://www.caricoos.org/map/beach-water-quality). In general, the model is able to successfully predict exceedances 83% of the time, whereas values below the threshold are successfully predicted 63% of the time, resulting in an overall accuracy (or hit rate) of 65%. This effort has been the topic of Civil Engineering student Priscila Vargas undergraduate research, and current CARICOOS undergraduate intern Peter Rivera.</p> <p>A parallel effort to further explore the dependence of FIB with local rainfall was undertaken by graduate student Mary Carmen Acosta. The analysis shows a consistent 10% chance of exceeding the allowable limits of FIB (errors of $\pm 4\%$) for cases of no rainfall (1, 2, 3, 6, 12, 24, 48, and 72 hours without precipitation), indicating that a binary model for FIB under dry conditions can potentially be successful. Further research into a combination of VB's Multiple Linear Regression Model and a simpler binary predictor is currently ongoing. Although still at the experimental phase with further fine-tuning</p>

		required, this exercise proves that CARICOOS is now able to generate predictive models of beach water quality at sites where a sufficient base data exists.
Exploration of the Delft3D suite of models as a potential tool for 3D simulation of nearshore hydrodynamics and water quality	YES	This is a pilot project aimed at attempting to simulate pathogen transport in the nearshore region. The Delft3D suite of models are being implemented for the Dorado-PR area, with increased resolution at Dorado's Public Beach (~15m x 15m). Since February 2016 this is a CARICOOS-leveraged project (funded by Sea Grant) to specifically assess water quality issues at Dorado Public Beach, hence no direct financial support is being provided by IOOS-CARICOOS.
Implement the WRF-ARW wind model for improved representation of sea breeze dynamics	YES	Model has been implemented and has shown improved skills over the NMM version for prediction of sea breeze dynamics. The experimental CARICOOS WRF-ARW model setup consists of a parent domain with a horizontal resolution of 2.5 km and nested domains of 500 m horizontal resolution over the Bay of San Juan, PR and the Port of Yabucoa, PR. The model is run twice a day on cycle 00Z and 12Z and provides a 30-hour forecast. The graphical output of the CariCOOS WRF-ARW implementation is available at http://136.145.249.39/drupal/ARW .
Implement WRF wind forcing in SWAN and compare performance vs. NDFD	YES	The CARICOOS WRF model has improved SWAN wave model performance due to its increased temporal resolution vs NWS NDFD (1-hour vs 3-hour) as well as its longer high-resolution forecast period (120 hours vs 72 hours). CARICOOS SWAN is now run with CARICOOS WRF forcing in operational mode.
Further improve CARICOOS ROMS by: <ul style="list-style-type: none"> (a) Continue validation of CARICOOS-ROMS (b) Securing a technical review of the current 	NO (PARTIALLY COMPLETED)	(a) Extensive validation conducted, will continue during next year. (b) Successfully completed by Dr. John Wilkin (c) After an initial regional ROMS model implementation phase, through a subaward to U. of Texas-Dallas, model adoption for operational

<p>CARICOOS ROMS implementation by external consultant</p> <ul style="list-style-type: none"> • (c) transitioning ROMS operations from UTD to UPRM • (d) beginning 4D-VAR assimilation experiments 		<p>deployment by CARICOOS has commenced but has faced technical delays being addressed in consultation with Dr. J. Wilkin. Full transition of the model for operation by CARICOOS scientists has required further validation and model experimentation and is now scheduled for finalization in April 2017. This task requires a subaward extension to UT Dallas under the approved no-cost extension to CARICOOS.</p> <p>(d) Assimilation experiments await finalization of the model implementation and transition described above.</p>
<p>Continued participation in IOOS Coastal and Ocean Modeling Testbed for Puerto Rico and the Virgin Islands</p>	<p>YES</p>	<p>As in previous years, CARICOOS has continued to support the IOOS COMT project.</p>

2.3. Data management and dissemination subsystem:

Activity / Milestone	Completed by May 31 2016?	Progress
<p>Continued development of CARICOOS DMAC subsystem while meeting IOOS requirements</p>	<p>NO (PARTIALLY COMPLETED)</p>	<p>Foreseeable DMAC requirements include bringing NetCDF files to version CF1.6 and implementation of QARTOD procedures. Meeting these requirements demands revision of software and procedures followed for coastal buoy data by U. Maine. Additional funding will be assigned for this task and has been scheduled to be completed by May 2017. Completion of this task required a subaward extension with additional funding to U. Maine under the approved no-cost extension to CARICOOS.</p>
<p>Deployment and optimization of CARICOOS new web interface</p>	<p>NO (PARTIALLY COMPLETED)</p>	<p>The development phase of the new CARICOOS web page was extended with the purpose of constructing a new database-interface, graphical tools and content management system. These improvements will facilitate editions and additions to the web interface as new data and products are added to the CARICOOS suite as expected during the upcoming funding cycle.</p>

		Although the new website was formally released in April 2016, complete finalization of the web interface is expected to be achieved by early fall 2016.
Operate and maintain CARICOOS data streams, data products and dissemination interfaces	YES	All products and data streams have performed as expected. Several new products have been developed as part of the new CARICOOS.org.
Operate, maintain and upgrade computational infrastructure	YES	CARICOOS's computational infrastructure has performed as expected and all systems are operational. CARICOOS is now in a planning stage regarding the future of its computational infrastructure and the potential migration towards cloud computing for all operational products during the next funding cycle.
Develop new specific data products in response to stakeholder needs	YES	During this performance period CARICOOS has focused on data products for the maritime transportation and beach safety sectors. Highlights include the Yabucoa Port Metocean Prediction System (http://www.caricoos.org/ports/yabucoa/us), enhancements to the CARICOOS Breaker Prediction System (http://www.caricoos.org/map/nearshore-breaker-model), and a visualization tool for beach water quality data (http://www.caricoos.org/map/beach-water-quality).
Historic metadata archival	YES	A formal data archival plan is being crafted in collaboration with NCEI.

2.4. Outreach and Education (O&E) subsystem:

Activity / Milestone	Completed by May 31 2016?	Progress
Continue O&E formal and informal activities focused on enhancing awareness and appropriate utilization of CARICOOS products and services	YES	CARICOOS wave data products and forecasts, storm surge maps, drifter data, among others, have been featured at <u>five</u> workshops through ongoing collaborations with Puerto Rico Sea Grant Program, the Sea and Learn Foundation, and the Professional College of Engineers and Land Surveyors of Puerto Rico. Aiming to promote beach safety among beachgoers, CARICOOS has participated in <u>three</u> surfing/beach festivals, where products such as the Nearshore Breaker are highly emphasized.
Continued assessment of stakeholder/user needs	YES	CARICOOS team continues to address the needs of its stakeholders through meetings with the CARICOOS Board of Directors (BOD). Two BOD meetings took place during this reporting period (August 4th, 2015 and April 27th, 2016), where Board Members had the opportunity to present and prioritize stakeholder needs to the CARICOOS team. Port pilots represent a significant portion of CARICOOS users, and are therefore engaged at each of their trimestral South Harbor Safety and Security Committee Meetings (September 11 th , 2015, December 4 th , 2015, March 11 th , 2015)
Continued engagement of the SAR community in the region	YES	CARICOOS has continued its communications with the SAR community, including participation by J. Morell in the USCG National Preparedness For Response Exercise Program (May 5 th , 2016).
Continue and enhance communication and consultation between CARICOOS, CaRA, regional programs, IOOS and IOOS Association	YES	CARICOOS team continues to participate in IOOS monthly calls (including Outreach and DMAC), IOOS annual meetings (J. Morell, S. Rodriguez-Abudo, and R. Watlington), IOOS Advisory Board meetings (M. Canals), IOOS Association Board annual meeting (J. Morell and R. Watlington), IOOS Association Board biannual calls, and other regional efforts.

<p>Provide support to CARICOOS Inc. (formerly CaRA) which will allow its development toward certification and operation as a Regional Information Coordination Entity as defined by the ICOOS Act (2009)</p>	<p>YES</p>	<p>CaRA is now CARICOOS, Inc., a non for profit organization represented by the BOD Chairman, operating on a subaward and cash-advance basis with UPRM, as described in a Memorandum of Agreement signed on April 21st, 2016. An office within UPRM premises has been allocated for CARICOOS, Inc., and a part-time Administrator (Edwin Vélez) has been operating since May 1st, 2016. Application for Certification of CARICOOS as a RICE is in its final stages, with an SOP approved by the BOD on April 27th, 2016.</p>
--	------------	---

3. Scope of work

A no-cost extension has been requested by CARICOOS and approved by the IOOS office in order to complete the remaining tasks and milestones outlined above for year 5.

4. Leadership Personnel and Organizational Structure

- No major changes

5. Budget

Total of funds awarded	\$7,614,651
Funds Drawn-down (ASAP) to date 6/29/ 2016	\$5,788,249
Funds available for approved NC Extension (May 30, 2016)	\$716,619
Total expenditures to May 31, 2016	\$6,898,032

Unexpended funds at the end of year 5 totaled \$716,619 largely corresponding to delays in contracting personnel and postdoctoral students and to under-expenditures in a subaward to USVI. These were authorized to be utilized for completion of pending milestones under a No Cost Extension approved for the project. UPRM is scheduled to request a reimbursement for expenses incurred totaling approximately \$1,110,000 dollars at the end of the current fiscal year.

Major equipment acquired during the 2015-2016 project year include an alkalinity titrator for the Ocean Acidification (\$16,950) program and two ADCP current sensors for replacing an unrepairable unit on a CARICOOS data buoy mooring (\$17,600) and one for shallow water current measurements (\$13,400) in support of model validation and ocean acidification field campaigns.

ADDENDUM

1. Projects with Regional Ocean Governance Organizations:

CARICOOS leadership is actively involved with the Puerto Rico Climate Change Council through its steering committee and its annual meeting where J. Morell, M. Canals and M. Melendez served as invited speakers (April 7th, 2016). This year the meeting included a Coastal Town Summit, which explored and discussed the risks associated with climate change faced by coastal towns in PR. Additionally, J. Morell is a member of Sea Grant's ad-hoc Board of Directors, which meets annually.

As required by a recently signed Memorandum of Agreement between CARICOOS and the Department of Natural Resources, J. Capella and J. Morell continue to provide scientific advice to Jobos Bay National Estuarine Research Reserve (JoBaNERR) through a number of activities including attendance to the NERRS-IOOS Partnership Meeting (January 2016), and JoBaNERR's Management Plan meetings.

CARICOOS addresses the needs of several ocean governance organizations including the Caribbean Fishery Management Council, the Office of Coastal Zone Management, and the Puerto Rico Sea Grant Program, through their direct representation in the CARICOOS Board of Directors (BOD). Two BOD meetings took place during this reporting period (August 4th, 2015 and April 27th, 2016), where Board Members had the opportunity to present and prioritize stakeholder needs to the CARICOOS team.

CARICOOS also procures an active presence within the Caribbean Regional Response Team and its annual meeting (June 10th, 2015) where J. Morell and M. Canals provided an overview of CARICOOS products and services and opportunities for collaboration. CARICOOS leadership is also involved with the USACE/PR Coastal Initiatives: San Juan Regional Sediment Management project, a multisectorial initiative to address erosion problems in Puerto Rico (round table meeting on January 12th, 2016). Other activities include meetings to provide scientific advice to the Center for the Education on Environmental Climate Change (May 4th, 2016), and to collaborate with the Puerto Rico Environmental Quality Board on beach water quality monitoring (October 7th, 2015 and March 9th, 2016).

2. External Funding Sources:

CARICOOS has focused on developing a balanced, externally funded project portfolio that combines funding from federal agencies, state entities and private industry. Partner projects generally provide additional funds for development of new products and acquisition of additional observing assets and computational capabilities. The table below summarizes each externally-funded effort.

Effort	Source	Funding Amount	Type	Duration (years)
Improving Hurricane Predictions using Sea Gliders	NOAA-AOML	\$60,000	Direct	2
COMT Storm Surge Modeling Testbed	Southern Universities Research Association (SURA)	\$17,886	Direct	3
Models and Observations in support of UKC system	Buckeye LLC	\$124,000	Direct	1
Coastal Barriers Against Ocean Acidification	NOAA-Sea Grant	\$36,982	Direct	2
Erosion Monitoring in Rincón, PR	NOAA-Sea Grant	\$24,800	Direct	2
Hydrodynamic and Water Quality Models & In situ Biosensor	NOAA-Sea Grant	\$36,895	Direct	2
Economic Impacts of Erosion	NOAA-Sea Grant	\$24,800	Direct	2
Ocean Acidification Monitoring at La Parguera Marine Reserve	NOAA OCEAN ACIDIFICATION	\$52,000	Direct	3
Hydrodynamic Connectivity in support of MPAs	Caribbean Fishery Management Council	\$127,053	Direct	1
Exploratory System-wide Monitoring Program	Jobos Bay National Estuarine Research Reserve	\$25,200	Direct	2
High Performance Computing Resources	NSF-XSEDE	\$80,500	In-kind	1
Release time, graduate assistantships, tuition wavers*	University of Puerto Rico at Mayaguez	\$174,521	In-kind	1
TOTAL		\$784,637		

*Computed only for this performance period

3. CARICOOS Governance Board Membership:

CARICOOS' governance is overseen by a fifteen-member Board of Directors representing key stakeholder sectors. Exiting members include Dr. Jorge Corredor, Professor of Oceanography at UPRM, and Ileana Colón Carlo, former Comptroller of Puerto Rico. The new elected members are Carlos Farchette, Chairperson of the Caribbean Fisheries Management Council, Luis Torres-Meléndez, Chairman of the South Coast Harbor Safety and Security Committee, and Roberto Cortés, Head Weatherman for Telemundo Puerto Rico.

Region	Type of Governance	Distribution of Governance Board Membership								Total Number of Board Members
		Government				Non-Government			Foreign (all sectors)	
		State*	Local	Tribal	Federal	Research Institute	Industry	NGO**		
CARICOOS	MOA	2			2		6	5		15

* includes Sea Grant and territorial governments

** includes Fishery Management Councils

*** "bi-national" International Joint Commission