

**OBSERVING SUBSYSTEM**

**FIXED PLATFORMS**

**FIXED PLATFORMS**

	<b>Automated Meteo Stations</b>	<b>Multipurpose buoys -Coastal data buoy</b>	<b>Automated stream flow/water quality station</b>	<b>Profiling - Diagnostic Nearshore Water Quality Monitoring Stations</b>	<b>Other - Redeployable Sea Floor Current/Wave monitoring instrument array</b>
<p><b>Fixed Platforms</b></p> <ul style="list-style-type: none"> <li>· Single purpose buoys</li> <li>· Shore Stations</li> <li>· Offshore platforms</li> <li>· Multipurpose buoys</li> <li>· Profiling</li> <li>· Other</li> </ul> <p><i>Provide a brief description for each of the platform types - Descriptor: (e.g. Single Purpose Buoy: water quality or Single purpose buoy: waves or Multipurpose buoy: coastal, etc.)</i></p>	<p>Install a new weather station in the central mountain range of Puerto Rico.</p> <p>Sustain and enhance CARICOOS Weather Stations.</p>	<p>Meteocean data systems in coastal ocean waters and constrained approaches to critical ports</p>	<p>Stream gauges</p>	<p>Eco sensor ensembles to be deployed aboard data buoys and bottom platforms</p>	<p>Acoustic Doppler Current Profilers Pressure Sensors</p>
<p><b>Theme Issues Addressed</b></p> <p><i>Directly link to all issues addressed in the previous section</i></p>	<p>All Thematic Issues</p>	<p>1.1,1.2,1.3,1.5,2.1,2.4</p>	<p>2.1,2.3</p>	<p>3.1,3.2,3.3,4.1</p>	<p>1.1,1.4,1.5,2.1,2.2,2.3,3.1,3.2,3.2</p>
<p><b>Variables Observed and Resolution (Spatial, Temporal, Accuracy) Requirements</b></p> <p><i>List the variables that are required to fulfill themes. This can be a estimate of what is expected (e.g., Water Temperature: 1, 10, 50 m; hourly for 10 mins @1Hz; 0.1°C)</i></p>	<p>Meteorological: wind and wind gust speed and direction, atmospheric pressure, relative humidity, air temperature (every 10 mins at 10 m)</p>	<p>Physical: waves height, wave period, wave direction, current profiles, water temperature (every hour)</p> <p>Meteorological: wind speed, wind direction, air temperature, barometric pressure (every hour)</p>	<p>Physical: Discharge (cu. ft./sec), sea surface height (every hour; at surface)</p>	<p>Physical: temperature, pressure and conductivity (every 30 minutes) Chemical: pH, DO, pCO2, colored dissolved organic matter fluorescence, turbidity, chlorophyll fluorescence. (every 30 minutes)</p>	<p>Physical: temperature, pressure, currents at depth (@ 0.1 m), surface waves, sea surface height, water levels (every 30 minutes) Geological: Suspended sediments, turbidity (every 30 minutes)</p>
<p><b>Sensors (and number)</b></p> <p><i>For example: surface current meters (10), CTDs (5), ADCPs (5), etc (e.g., CTD: 3) IF POSSIBLE PROVIDE LINK TO SENSOR URL. THIS WILL ASSIST COST ESTIMATORS</i></p>	<p>RM Young 5103, Custom, Sensiron SHT-75, Sensiron SHT-75</p>	<p>Nortek Aquadopp Zcell SeaBird SBE 37SM RM Young anemometers Gill windsonic sensor GPS TRIAxYS wave sensor UME wave sensors</p>	<p>As per USGS specs</p>	<p>SeaBird Deep SeapHOx, ECO Triplet</p>	<p>Water column pressure ( 0-50 psia, 0.01% full scale) Wave pressure sensors Nortek ADCP Signature</p>

**FIXED PLATFORMS**

<b>Geographic cover / Location and number of buoys:</b> <ul style="list-style-type: none"> <li>· Deep water/open ocean,</li> <li>· Slope,</li> <li>· Shelf (includes outer-shelf, mid-shelf, inner shelf),</li> <li>· Coastal (nearshore, beaches, coastal),</li> <li>· Inland (estuaries, rivers)</li> <li>· Other – describe</li> </ul>	Currently: 18 coastal stations Planned: 1 inland	Currently: 5 GoMOOS type and 2 Waverider MK2. Planned: Small buoys/Current Profilers	Inland	Shelf	Deployed as needed for validation experiments and incident response
<b>Operational Requirements</b> <ul style="list-style-type: none"> <li>· Deployment / Operations (boats, etc)</li> <li>· Maintenance (# of service trips/year)</li> <li>· Personnel (# of FTEs)</li> <li>· Replacement needs (spare parts, redundant systems)</li> <li>· Other</li> </ul>	Deployment and maintenance contracted to WeatheFlow Inc. and CARICOOS Technician (0.1 FTE)  Replacement needs: Batteries, sensors, cables	Maintenance and data managed by University of Maine  Recovery and deployment services are contracted	Deployment and maintenance by USGS	Boat for deployment and recovery of the sensor package Maintenance every 6 months Personnel: 0.25 FTE Replacement needs: Batteries, cables, O-rings	Small boat and scuba diver team Maintenance: As required Personnel: 0.25 FTE Replacement needs: Batteries, cables, O-rings
<b>Development Needs</b> <i>If necessary, describe development efforts required for advancing, operationalizing or refining each of the identified issues.</i>	None	None	None	None	None

**Synthesis Table for Cost Estimation**

Observing Platform	Number of NEW stations	Capital Cost	O&M (sensors spares/repair)	FTEs	
WeatherFlow Meteo stations	1	\$ 5,000	\$ 2,500	0.1	
CODAR SeaSonde Units	5	\$ 750,000	75000 per unit	0.5	
Small buoys (or ATON systems)	3	Buoys: \$300,000 (ATONs: \$150,000)	\$35,000 per sensor	0.5	
Stream gauges	6	\$ 300,000	\$16,000 per sensor	-	
Eco sensor ensembles	4	\$ 300,000	\$8,000 per sensor ensemble	0.5	
Acoustic Doppler Current Profilers	3	\$ 105,000	\$3,000 per sensor	0.2	
Pressure sensors	3	\$ 15,000	\$250 per sensor	0.2	
Redeployable instrument array		\$ 75,000	\$ 60,000	0.2	
Diagnostic monitoring stations		\$ 85,000	\$ 5,000	0.25	

OBSERVING SUBSYSTEM					
<b>MOBILE PLATFORMS</b>	<b>Mobile Platforms</b>				
	<b>Observing platform-Mobile Name</b> (e.g. Glider: water quality or Glider: Coastal or ...) Provide a brief narrative for each of the platform types.	<b>Gliders: Caribbean Time Series</b>	<b>Ships: Event Sampling</b>	<b>AUV for Benthic Survey</b>	<b>Nearshore Bathymetric Surveys</b>
		Seaglider underwater vehicles (AUVs) for repeat transects off north and south coasts of the region for upper ocean heat content and ROMS-HYCOM validation and assimilation	Event-based ship sampling for regional oceanographic processes, satellite imagery and model validation, and water quality (HABs, outfalls, stormwater, hazardous spills)	Remote Environmental Monitoring Units (REMUS) autonomous underwater vehicle	Coastal surveying system (PWC CSS)
	<b>Theme Issues Addressed</b> Directly link to all issues addressed in the previous section (e.g., Marine Operations: SAROPS, ...)	4.1	2.1,2.3,3.1,3.2,3.3,4.1,4.2	2.1,3.1,3.2,3.3	1.1,1.5,2.1,2.3
	<b>Variables Observed and Resolution (Spatial, Temporal, Accuracy) Requirements</b> (e.g., Water Temperature: 1, 10, 50 m; hourly for 10 mins @1Hz; 0.1°C)	Physical: temperature, salinity (from surface to 1,000 m) Chemical: dissolved oxygen, chlorophyll, conductivity (from surface to 1,000 m)	Variables to be measured include profiles of SSS, SST, DO, Chl a, Beam attenuation, pH, TA, LADCP-currents	Benthic Community Composition (reflectance, imagery)	Geological: bathymetry, sea floor properties
	<b>Sensors (and number)</b>	Seaglider AUV	CTD Rosette	Biological: benthic habitats Geological: Bathymetry, bottom character, AUV_video, benthic reflectance	Jetski GPS RTK Multibeam Sonar
	<b>Geographic cover / Location and number:</b>	Deep water/open ocean: NE Caribbean Sea & Western Tropical Atlantic	NE Caribbean Sea & Western Tropical Atlantic	Shelf and Coastal	Coastal
	<b>Operational Requirements:</b> <ul style="list-style-type: none"> <li>· Deployment / Operations</li> <li>· Maintenance</li> <li>· Personnel</li> <li>· Replacement needs</li> <li>· Other</li> </ul>	Maintenance, operation and data management will be performed by CARICOOS personnel (0.5 FTE) Contract boat services Replacement needs: Batteries, ARGO tag, O-rings, anodes, spare sensors	Contract boat services or UPR-Mayaguez Marine Science Department vessels  Sampling will be performed by CARICOOS technicians (0.25 FTE)  Replacement parts: water sample bottles, CTD	Maintenance, operation and data management will be performed by CARICOOS personnel (0.5 FTE) Contract boat services Replacement needs: Batteries, ARGO tag, O-rings, anodes, spare sensors	Operations will be performed locally by UPRM Center for Applied Ocean Science and Engineering personnel
	<b>Development Needs</b> If necessary, describe development efforts required for advancing, operationalizing or refining each of the identified issues.	-	-	-	-
	<b>Synthesis Table for Cost Estimation</b>				
<b>Observing Platform</b>	<b>Capitol Costs</b>	<b>O&amp;M Costs</b>	<b>FTEs</b>		
<b>Seaglider AUV (2 deployments per month)</b>	-	\$60,000 per year	0.40		
<b>Platform: Research vessel</b>	-	\$45,000 per year	0.25		
<b>Platform REMUS AUV</b>	\$200,000 per equipment	\$60,000 per year	0.25		
<b>PWC (jetski)</b>		\$10,000 per year	0.25		

OBSERVING SUBSYSTEM			
REMOTE SENSING PLATFORMS	Remote Sensing Platforms		
	<b>Remote Sensing: Land-based, satellite-based and other</b>	<b>Land-Based: High Frequency Radar (HFR) Systems</b> <i>Network of high-frequency radar stations along the coast of Puerto Rico and in St. Thomas, US Virgin Islands to measure ocean surface currents.</i>	<b>Satellite-based: Remotely-sensed derived parameters</b> <i>Satellites: MERIS, MODIS, GOES, SST (AVHRR, AMRS), IKONOS imagery, TOPEX, POSEIDON, Aquarius</i>
	<b>Theme Issues Addressed</b>		
	<b>1. Marine Operations</b>		
	1.1 Safety	x	
	1.2 Search and Rescue and Rapid Response	x	x
	1.3 Spill Response	x	x
	1.4 Offshore Energy	x	x
	1.5 Port and Harbor Operations	x	
	<b>2. Coastal Hazards</b>		
	2.1 Hazard and disaster information		x
	2.2 Address beach water quality issues		x
	2.3 Coastal inundation		x
	2.4 Improve local weather forecast		x
<b>3. Coastal Resources</b>			
3.1 Ecosystem health		x	
3.2 Coastal ecosystem threats		x	
3.3 Sustainable fisheries		x	
<b>4. Climate Variability</b>			
4.1 Climate trends and variation in ocean properties	x	x	
4.2 National and global datasets			
<b>5. Integrated Products</b>	x	x	
<b>Variables Observed and Resolution (Spatial, Temporal, Accuracy) Requirements</b> (e.g., Surface Currents: Hourly vector maps at 6 km spatial resolution across the continental shelf for the entire region)	Surface Currents: Hourly vector maps at 2 km spatial resolution out to 70 nautical miles	Parameters/variables: water quality, chlorophyll, ocean color, floating algae index, sea surface temperature	
<b>Sensors (and number) (e.g., CTD: 3)</b>	Five CODAR SeaSonde Unit 13 MHz <a href="http://www.codar.com/">http://www.codar.com/</a>	USF Optical Oceanographic Laboratory ( <a href="https://optics.marine.usf.edu/cgibin/optics_data?roi=ECARIB&amp;current=1">https://optics.marine.usf.edu/cgibin/optics_data?roi=ECARIB&amp;current=1</a> )  NOAA CoastWatch: ( <a href="https://coastwatch.pfeg.noaa.gov/">https://coastwatch.pfeg.noaa.gov/</a> )  GOES MSG Daily Sea Surface Temperature	
<b>Geographic cover / Location and number:</b>	Coastal and Shelf Puerto Rico and US Virgin Islands waters	Deep water, slope, shelf and coastal Puerto Rico and US Virgin Islands waters	
<b>Operational Requirements:</b> · Deployment / Operations · Maintenance · Personnel · Replacement needs · Other	Maintenance and installation is conducted by CARICOOS technicians (0.5 FTE) Replacement needs: Cables, connectors, backup batteries, electronics, antennas, whips, computers, A/Cs	-	
<b>Development Needs</b> If necessary, describe development efforts required for advancing, operationalizing or refining each of the identified issues.	Hardening and modernize current CARICOOS HFR stations	-	
Synthesis Table for Cost Estimation			
Observing Platform	Sensors (#)	Capital Cost	O&M Cost (including FTEs)
Platform A- HF Radar	5	\$ 750,000	\$75,000 per unit
Platform B - Satellited-derived data	-	-	\$30,000 to maintain and enhance products

## CARICOOS MODELING & ANALYSIS SUBSYSTEM

### MODEL REQUIREMENTS

Model Name	SWAN	WRF	FVCOM	Breaker Height Statistical Forecast	CMS FLOW / ROMS	Compound Flooding	HYCOM / ROMS / RTOFS	AMSEAS
<b>Type of Model</b>	Wave model	Atmospheric	Coastal Ocean Circulation	Breaker heights estimates based on beach-specific predictions from the CARICOOS Wave Model and adjusted based on analytical and empirical equations	Sediment transport	Inundation (storm surge + wave runup + wave overtopping + runoff)	Circulation	Circulation
<b>Geographic Domain</b>	PR / USVI	PR / USVI	PR / USVI	Beaches of PR / USVI region	Specific locations in PR / USVI	Atlantic Ocean / Caribbean Sea	Atlantic Ocean / Caribbean Sea	Atlantic Ocean / Caribbean Sea
<b>Themes/Issues Addressed</b>	1.1,1.2,1.3,1.4,1.5,2.1,3.3,4.1	1.1,1.2,1.3,1.4,1.5,2.1,3.3,4.1	1.1,1.2,1.3,1.4,1.5,2.1,3.3,4.1	1.1,1.2,1.3,1.4,1.5,2.1	1.5 Other: coastal erosion, harbor entrance shoaling	1.1, 1.2, 2.1, 2.3, 4.1	1.1, 1.2, 1.3, 1.4, 2.1, 3.1, 3.5, 4.1	1.1, 1.2, 1.3, 1.4, 2.1, 3.1, 3.5, 4.1
<b>Important Variables to be modeled</b>	Physical: wave height, wave period, wave direction, wind speed, wind direction	Atmospheric: wind speed, wind direction, air temperature, barometric pressure	Physical: Surface currents, currents at depth, temperature, salinity (in 2D and 3D)	Physical: breaker height, surface waves	Geological and physical: Surface currents, sediment transport / morphology change, surface waves	Physical: wave setup, storm surge, storm induced currents precipitation, runoff	Physical: sea surface temperature, salinity, currents (all in 3D)	Physical: sea surface temperature, salinity, currents (all in 3D)
<b>Spatial (horizontal and vertical requirements)</b>	Tens of meters	Hundreds of meters	Tens of meters	Meters	Tens of meters	Tens of meters	Hundreds of meters	3 km
<b>Temporal</b>	hours	hours	hours	hours	hours - days - months	hours	hours	hours
<b>Computing infrastructure, including redundancy of operations</b>	AWS High Performance Computing Services and Local Server with 64 processors	AWS High Performance Computing Services and Local Server with 32 processors	AWS High Performance Computing Services and Local Server with 64 processors	AWS High Performance Computing Services and Local Server with 64 processors	32 processors	128 processors	128 processors	N/A
<b>Personnel (FTEs/year)</b>	0.25	0.25	0.25	0.25	0.5	1	0.5	0.1

<b>Expected Initial and Boundary conditions</b>	NMWW3 spectral data as IC's / BC's	GFS, NAM or other large scale atmospheric model	NCOM or RTOFS	CARICOOS Wave Model	Local HYCOM-ROMS & SWAN	Detailed eddy-resolving wind models, Doppler, Precipitation	Validated basin-scale Circulation Model	Global NCOM
<b>Development Needs</b>	Validation with CARICOOS oceanographic and wave data buoys	Validation with CARICOOS weather stations	Validation with CARICOOS oceanographic and wave data buoys	Validation of hazardous current intensity forecast	Validation of sediment transport rates and morphology change	As detailed in CI-Flow ( <a href="https://www.nssl.noaa.gov/projects/ciflow/">https://www.nssl.noaa.gov/projects/ciflow/</a> )	Routine validations using gliders, HF Radar stations, and drifters	Validation of slope/ outer shelf current forecast with gliders and/or HF Radar stations

### Synthesis Table for Cost Estimation

Model Name	Computing Resources	FTE	
<b>SWAN</b>	AWS High Performance Computing and Local Server with 64 processors	<b>0.25</b>	
<b>WRF</b>	AWS High Performance Computing and Local Server with 32 processors	<b>0.25</b>	
<b>FVCOM</b>	AWS High Performance Computing and Local Server with 64 processors	<b>0.25</b>	
<b>Breaker Height Statistical Forecast</b>	AWS High Performance Computing and Local Server with 64 processors	<b>0.25</b>	
<b>CMS FLOW / ROMS</b>	32 processors	<b>0.5</b>	
<b>Compound Floodings</b>	128 processors	<b>1</b>	
<b>HYCOM / ROMS / RTOFS</b>	128 processors	<b>0.5</b>	
<b>AMSEAS</b>	N/A	<b>0.1</b>	
<b>TOTAL</b>	<b>\$80k/year the AWS cloud service and local servers</b>	<b>3.1</b>	

**CARICOOS PRODUCT DEVELOPMENT SUBSYSTEM**

**PRODUCT REQUIREMENTS (for major products)**

**Synthesis Table for Cost Estimation**

<b>Product Name and Theme</b>	<b>Development Work Needed</b>	<b>Development Costs</b>	<b>Computing Resources Required</b>	<b>FTE</b>	<b>Other</b>
Upgrade and support data portal(s) and mobile applications based on user feedback	Ongoing	-	-	0.1	
Port-specific products and decision support tools	Development and implementation of port dashboard for the Port of Charlotte Amalie, St. Thomas and Port of San Juan.	\$20,000 per year until system is validated	AWS High Performance Computing Services and Local Server with 64 processors	0.25	
Simulate coastal compound flooding	Develop a data product to simulate storm surge maps combined with freshwater inundation	\$20,000 per year until system is validated	High-performance computing cluster	1.00	
Wave, ocean-thermal and current energy availability analysis	Puerto Rico Digital Ocean Energy Atlas (modeling), observations from buoys and HFR stations	\$20,000 to create the map interface	AWS High Performance Computing Services or Local Server with 128 processors		
Document changes in mangrove, seagrasses and beach dune ecosystems in response to extreme weather events, sargasso inundation and anthropogenic disturbance	Processing high-resolution remotely sensed satellite and drone imagery for coverage estimation data and obs. from 20+ virtual buoys reporting remotely-sensed derived water quality data at sites of interest for fisheries and ecosystem monitoring	\$50,000 for development and \$30,000/yr for enhancing and maintaining the product	High-performance computing cluster	0.50	
Coral Reef Ecosystem Status and Trends	Depict temporal changes in CRMP monitored reef biodiversity, coral coverage along with data on potential ecosystem threats including SST, Sargasso and others.	\$20,000 to create the map interface	Quad-core Computer	0.30	
Development and delivery of tailored products such as tool for statistical analysis of a wide range of ocean and weather variables from coastal and ocean historical data, numerical models and satellite-derived data	Refine product needs considering interested stakeholder groups	\$12,000 to create the map/figure interface	Quad-core Computer	0.50	
Expand the PR/USVI Storm Surge Atlas	Include additional maps that consider different sea level rise scenarios to the CARICOOS Storm Surge map interface	-	Quad-core Computer	0.10	
CARICOOS Particle Tracking Model	Develop the capability to simulate particle trajectories for any location in the PR/USVI domain.	Included in cost of development of associated coastal ocean models	AWS High Performance Computing Services or Local Server with 128 processors	0.25	

## RESEARCH AND DEVELOPMENT

### Synthesis Table for Cost Estimation

Overall R&D Need	Associated Theme	Personnel and other costs	RA Role	Role of Others	Adoption Process
<b>Determination of stakeholder requirements needing R&amp;D</b>	Surveys, Personal Interviews, General Assembly, One-on-One meetings, Workshops	0.1 FTE; Approximately \$25k for meeting venues, travel, other costs	Gather regional information from the coordinated activities and help prioritize needs.	Input/Needs	CARICOOS Board of Directors and CARICOOS Technical Team
<b>Sponsored workshops or other forums on R&amp;D needs</b>	1) Coastal erosion 2) Coastal and ocean processes, 3) Ocean acidification 4) Assessing coastal ecosystems and their services 5) Planning and adaptation 6) Offshore energy	0.1 FTE	Facilitator	Collaboration with state municipalities, for profit & non-profit organizations, academis/research and private sector	
<b>R&amp;D Need 1</b>	Shoreline dynamics: Estimation of temporal and spatial scales for the evaluation of shoreline changes at key erosional hotspots.	0.5 FTE	Identification of high priority sites	Collaboration with Coastal Zone Management Program (CZMP)	Adoption by CZMP for baseline determinations
<b>R&amp;D Need 2</b>	Assess temporal and spatial expressions of biochemical anomalies from Sargasso inundation	0.5 FTE	Gather regional information from the coordinated activities and help prioritize needs.	Collaboration with NOAA Coral Reef Monitoring Program, Jobos Bay National Estuarine Research Reserve, Caribbean Fishery Management Council, PR Sea Grant, PR Department of Natural and Environmental Resources, PR NOAA Coastal Management Program, Sociedad Ambiente Marino, USVI Dept. of Planning and Natural Resource, Academic Researchers, Mesophotic Coral Reef Monitoring Program, Southeast Area Monitoring and Assessment Program, USVI Territorial Coral Reef Monitoring Program	
<b>R&amp;D Need 3</b>	Document changes in mangrove and benthic flora to extreme weather events and Sargasso inundation	0.5 FTE	Gather regional information from the coordinated activities and help prioritize needs.	Collaboration with NOAA Coral Reef Monitoring Program, Jobos Bay National Estuarine Research Reserve, Caribbean Fishery Management Council, PR Sea Grant, PR Department of Natural and Environmental Resources, PR NOAA Coastal Management Program, Sociedad Ambiente Marino, USVI Dept. of Planning and Natural Resource, Academic Researchers, Mesophotic Coral Reef Monitoring Program, Southeast Area Monitoring and Assessment Program, USVI Territorial Coral Reef Monitoring Program	



<p><b>R&amp;D Need 4</b></p>	<p>Implement a mesophotic reef monitoring effort</p>	<p>0.5 FTE</p>	<p>Gather regional information from the coordinated activities and help prioritize needs.</p>	<p>Collaboration with NOAA Coral Reef Monitoring Program, Jobos Bay National Estuarine Research Reserve, Caribbean Fishery Management Council, PR Sea Grant, PR Department of Natural and Environmental Resources, PR NOAA Coastal Management Program, Sociedad Ambiente Marino, USVI Dept. of Planning and Natural Resource, Academic Researchers, Mesophotic Coral Reef Monitoring Program, Southeast Area Monitoring and Assessment Program, USVI Territorial Coral Reef Monitoring Program</p>	
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**CARICOOS TRAINING AND EDUCATION SUBSYSTEM**

**Synthesis Table for Cost Estimation**

<b>Target audience</b>	<b>Product or Service</b>	<b>Development Costs</b>	<b>Distribution Costs</b>	<b>FTEs</b>
<b>Informal Educators</b>	1) Professional development workshops	\$2,000	\$4,000	
<b>Formal Educators (K-16)</b>	1) Professional development workshops 2) Educational module validation & distribution 3) Coastal weather presentations and educational materials	\$20,000	\$7,000	1
<b>Students (K-16)</b>	1) Development and distribution of coastal weather educational materials and products (partnership with PR SeaGrant Program)	\$10,000		
<b>Stakeholders (recreational, commercial, operations, resource management, academic community)</b>	1) Web page educational products development & maintenance 2) Public awareness campaigns (i.e. water quality, watershed protection, climate change adaptation) in partnership with NRCS, DNER 3) Training on application of CARICOOS products 4) CARICOOS Interactive Kiosk Development & presentations 5) Support for the development of a coastal and ocean engineering program at UPRM	\$20,000	\$20,000	1
<b>Managers and technical personnel local &amp; federal agencies</b>	1) Training to personnel on coastal weather topics and CARICOOS operational products	\$2,000	\$20,000	

**CARICOOS DMAC SUBSYSTEM**

**OPERATIONAL REQUIREMENTS**

<p><b>General description of DMAC operations to be compliant with IOOS Standards</b></p>	<p>Accurate and timely delivery of ocean observations and model outputs, deployment and operation of the information system components for data managements and provide the structure required for robust data exchange</p> <p><b>Services to be provided:</b></p> <ul style="list-style-type: none"> <li>- OPeNDAP Data Access Protocol (DAP) for access to gridded data and model outputs through a (NetCDF) THREDDS data server</li> <li>- Sensor Observation Service SOS for in situ observations</li> <li>- On and off site data storage and archiving submission of buoy and mesonet data to NDBC</li> <li>- Active participation in IOOS Data Management Planning and Coordination activities</li> </ul>
<p><b>Regional Data Management Enhancements</b> Describe regional data management requirements not covered by the IOOS DMAC Whitepaper (regional data portals)</p>	<p>Redundant processing and maintenance of databases Construction and dissemination of stakeholder endorsed data products Operational maintenance of web data interfaces</p>
<p><b>Maintenance Actions</b> (outline specific maintenance actions required to maintain DMAC operations)</p>	<p>IT support for routine hardware and software maintenance and upkeep</p>
<p><b>Development Needs</b> (If necessary, describe development efforts required for advancing, operationalizing or refining each of the identified issues)</p>	<p>N/A</p>

**Synthesis Table for Cost Estimation**

DMAC Needs	Computing Resources Required	FTE
IOOS-compliant DMAC	8 processors	0.5
Regional Data Management	8 processors	0.5
Maintenance	8 processors	0.5
Development Needs	0	0
<b>TOTAL</b>	<b>\$40k/year for AWS cloud service and local servers</b>	<b>1.5</b>

**CARICOOS GOVERNANCE AND MANAGEMENT SUBSYSTEM**

**Synthesis Table for Cost Estimation**

<b>Components</b>	<b>Office Space* (sf)</b>	<b>Office Equipment and Supplies</b>	<b>FTEs</b>
<b>Board and Organization Support and Management</b>	301	\$ 10,000.00	2
<b>Observing System Management</b>	1500	\$ 50,000.00	4
<b>Financial, Legal, Personnel, Management</b>	506	\$ 15,000.00	1.5
<b>Observing System Shop</b>	506	\$ 30,000.00	1

One rule of thumb is: 90 square feet per Executive; 60 sf for administrative and 15 sf per person for meeting room.