

Southeast Coastal Ocean Observing Regional Association (SECOORA): Supporting Resilient Ecosystems, Communities and Economies

Program Performance Report

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1) Progress and Accomplishments

Goal 1: Continue SECOORA’s region-wide governance and communication structure to engage users and stakeholders in coastal observing science

Milestone A: Maintain governance and management for the RA and RCOOS

Activities	Status
Effectively manage grants and contracts	Ongoing.
Ensure SECOORA’s operational & governance structure enables us to achieve our vision	Ongoing. The SECOORA Membership Re-envisioning Committee met monthly from December 2017 through April 2018. The committee agreed on a Matrix of Membership Benefits, drafted a potential Student Membership Program and the 1 st Year Implementation Schedule.
Maintain effective communication with US IOOS and the IOOS Association	Ongoing. Highlights this period include meetings in DC between IOOS Association and NOAA leadership Jan. 31 – Feb. 1; participating in the IOOS Spring meeting March 5-8 in DC; and monthly IOOS Program Office and RA Director calls.
Expand and diversify funding.	Ongoing. SECOORA submitted an LOI to the Curtis & Edith Munson Foundation on 4/6/18. Proposed activities include working with FACT to re-establish acoustic stations in South Florida that were damaged during Hurricane Irma. SECOORA met its \$50,000 fundraising goal to establish the Vembu Subramanian Ocean Scholars Award. The award opportunity announcement was issued, and SECOORA’s Education and

Activities	Status
	Outreach committee selected the first awardee, Laura McGee, who was announced on May 23 at the SECOORA Annual meeting.
Update and maintain SECOORA's RCOOS Plan	In January 2018, SECOORA Board of Directors decided that instead of having a large SECOORA RCOOS Plan that includes details on all of the SECOORA operational components, SECOORA would have a series of smaller, platform specific plans that are easier to keep up-to-date and can be tailored based on user and stakeholder needs. SECOORA has drafted the Moorings Plan and Glider Plan. The SECOORA RCOOS manager is leading the plan writing teams. Each plan will provide sufficient detail to outline SECOORA use of the assets and future expansion for the assets. Our revision timeline for all of these plans is every 5 years. Note that the HFR and Data Management Plans have already been developed.

Milestone B: Engage users and other stakeholders to prioritize investments. Ongoing

Activities	Status
Improve web-based information system and web presence	Although outreach activities have increased, there was a 52% decrease in website sessions (32,579 to 16,806) due to the fact that highly visited pages, such as the Marine Weather Portal, are not currently being counted as part of SECOORA's website sessions although they were previously. SECOORA hired Second Creek Consulting, LLC in May to help with Google AdWords and a Google Analytics review. SECOORA newsletters, stories and videos can be accessed via website , Facebook and Twitter .
Identify and promote opportunities for non-members to engage in SECOORA activities and initiatives	SECOORA's Annual meeting was hosted in Charleston, South Carolina, May 22-24. The theme of the meeting was the Blue Economy. Three panels discussed different aspects of the Blue Economy – offshore resources, fisheries management, and local South Carolina economic perspectives. Additionally, SECOORA hosted a public forum titled Extreme Events, the Blue Economy, and Ocean Observations on the evening of May 23. A meeting overview, presentations, and materials are available: http://secoora.org/annual-meeting-2018/ . Over the three days, 81 people participated in the meeting, 36 from non-member organizations. Click here to read the highlights story.
Implement an effective outreach strategy	SECOORA continues to implement an outreach strategy based on both the SECOORA Strategic Plan and Fundraising Strategy. Primary marketing and outreach mechanisms are e-newsletters, e-mails, social-media and the website. From 12/1/17 to 5/31/18, we increased our subscription to the newsletter by 21, from 835 to 856; Facebook "likes" have grown 2% (from 388 to 396); and, Twitter "followers" have grown 11% (482 to 536). SECOORA shared approximately 75 Facebook posts and 147 Twitter "tweets", referring a combined 339 sessions to the SECOORA website. During this period, 18 stories were published on the website (www.secoora.org/news). Additionally, we released our 2017 Annual Report (link) and four state rack cards (link to: Florida , Georgia , South Carolina , and North Carolina). The FACT Network website, developed by SECOORA, will be released in June 2018. SECOORA is continuing the Coastal Observing in your Community webinar series. During the reporting period, 4 webinars were hosted. Members and non-members presented and attended each webinar. A combined 248 people registered, and each webinar was recorded and archived for future viewing.
Support citizen science opportunities	SECOORA is promoted the "What's you Water Level?" app through the Coastal Observing in your Community webinar series (12/19/17). The app was developed by Christine Buckel, NOAA NCCOS. The water level reporting app collects and aggregates reports of observed water levels submitted through citizen scientists. 34 people from around the region and NOAA Sentinel Site Cooperative members attended the webinar.

Activities	Status
Engage students in problem solving using ocean observing data	<ul style="list-style-type: none"> • The first Vembu Subramanian Ocean Scholar, Laura McGee, proposed <i>Determining Hurricane-Induced CO2 Flux in the South Atlantic Bight</i>. Laura is a graduate student at NC State University and her advisor is Dr. Ruoying He. • The SECOORA Data Challenge opportunity was issued. Due to a low response rate, it was decided that the Education and Outreach committee will review the announcement and potentially re-advertise the Data Challenge in August 2018. • In February, 25 undergraduate students from the University of South Florida St. Petersburg reviewed the SECOORA Data Portal. The students were guided through a series of exercises on the portal and provided feedback on the ease of use. • In April two groups of undergraduate students from USF were learned about the importance of water quality and meteorological data collected by coastal ocean observing systems. The students participated in a field trip to the USF COMPS Clam Bayou station in Florida. This is a partnership between YSI Xylem, SECOORA, and USF COMPS. Over 200 students have been taught through this partnership since it began in 2014.
Coordination of SOCAN activities	<p>SOCAN Coordinator Leslie Wickes continues to engage stakeholders within the region and nationally. Wickes is now the U.S. Southeast lead for the Ocean Acidification Information Exchange and co-led a National Water Quality Monitoring Council webinar with Dr. Cai (University of Delaware) titled, <i>Coastal acidification: moving from a global problem to a coastal water quality issue</i>. There were 140 participants on the webinar. Two story maps are available for stakeholders: SOCAN Priorities for acidification monitoring and Coastal acidification: moving from a global problem to a coastal water-quality issue.</p> <p>SOCAN materials such as the NC Stakeholder Workshop report and the monthly newsletters are available on the SOCAN resources page. Wickes led a SOCAN Executive Committee meeting on 1/10/2018 and hosted four Science Working Group calls this reporting period (2/6/18, 3/12/18, 4/27/18, 5/31/1). Wickes authored and submitted to EOS, <i>SOCAN: Mobilizing a regional acidification network to address a global problem</i>. The paper has been accepted and is currently in revision.</p> <p>In progress: 1) Wickes, in coordination with Axiom Data Science is updating the SOCAN website. 2) A Georgia/South Carolina stakeholder workshop will be held in July 2018. 3) Wickes is coordinating with the East Coast Ocean Acidification team on nearshore sampling for their summer cruise (July, dates TBD). 4) Wickes is working with Sharing Ocean Acidification Resources for Communicators and Educators (SOARCE) to schedule a SOCAN webinar this summer.</p> <p>The SOCAN web portal is under development by Axiom Data Science. Ingestion, data processing, and preliminary visualization of 55 datasets associated with cruise surveys were prepared for ingestion and visualization on the web portal. The prototype SOCAN website and the portal are available.</p>
Animal Telemetry Workshop (Joint SECOORA, CariCOOS, and US IOOS)	Complete (3/28-29/17). Access here .

Milestone C: Maintain and Operate DMAC (SECOORA and Axiom Data Science, LLC): Ongoing.

Activities	Status
IOOS DMAC standards compliance	Ongoing. Responsible contractor: Axiom Data Science, LLC. SECOORA follows the IOOS recommended standards-based services and requirements to ingest, manage, and provide access to all our funded data streams (in-situ, remotely sensed and numerical models). See portal.secoora.org . Improvements over this period include:

Activities	Status
and implementation of Data Management, Products, and Services	<ul style="list-style-type: none"> • Maintain IOOS compliant services and applications for integration with national products: <ul style="list-style-type: none"> ○ Upgraded THREDDS to 4.6.10 - http://thredds.secoora.org ○ Upgraded ERDDAP to 1.80 - http://erddap.secoora.org ○ Updated SECOORA ISO WAF - https://thredds.secoora.org/iso • Made programmatic improvements to operationalize the ERDDAP API instance for external users and systems to interact with real-time SECOORA data served through the HPC cache. This API emulates the SOS style requests/response services in addition to several higher-level methods which allow users to access summary analytics and advanced packaging of data for downloading. • Developed and documented a test ERDDAP API instance for external users and systems to programmatically interact with real-time SECOORA data served through the HPC cache. This API emulates the SOS style requests/response services in addition to several higher-level methods which allow users to access summary analytics and advanced packaging of data for downloading. • Set-up an ingestion pathway for USF moorings and models via a new version of their THREDDS server. • Maintained submission of 66 sensor feeds to NCEI for long-term preservation. • Maintained the SECOORA Glider System. Progress was made in collaboration with SECOORA, IOOS, and Rutgers towards resolving issues with submitting the corrected delayed mode data to the DAC. Eleven glider deployments are now available through the SECOORA portal. • Submitted 2 new gliders missions to the IOOS Glider DAC (pelagia-20180401T0000 and bass-20180301T0000). • Provided technical support to USF and UNCW for authoring ISO 19115-standard metadata using the Research Workspace. • Axiom staff participated in the IOOS DMAC meeting hosted May 21-23, 2018.
Maintenance of DMAC infrastructure (hardware and software)	Ongoing. Responsible contractor: Axiom Data Science, LLC. Axiom ensured that the SECOORA data system was secure and monitored and provided technical support to address system problems.
Establishment and release of new SECOORA Portal	<p>Ongoing. Responsible contractor: Axiom Data Science, LLC.</p> <ul style="list-style-type: none"> • Developed a proof-of-concept visualization for Harbor Branch wave glider data and made enhancements relative to feedback (here) . This task also included data programming support to extract geographical position for visualizations. • In April 2018, the upgraded SECOORA data portal was made operational and replaced the earlier version. http://portal.secoora.org • In April 2018, the redesigned v2 sensor system was integrated into the back-end portal systems for improved handling of in-situ data ingestion. The full-integration of the v2 sensor system will facilitate management of multiple overlapping time-series data generations (e.g. raw data, provider QCed data, revised data) and include support for QARTOD checks. The new system will be designed to make the addition of new sensor datasets, and maintenance of existing sensor datasets, much less cumbersome. The current system will continue running until full integration of the new system is complete (December 2018). • Axiom led a data workshop on May 24 as part of the SECOORA Annual Meeting. Approximately 30 people participated in the workshop and provided feedback on the new data portal. Additionally, a survey was sent to participants after the workshop to gather additional suggestions for improvements on the portal.
Address 10 requirements per NOAA IOOS Contribute Data Page	SECOORA, with Axiom Data Science, is working towards meeting all 10 data management and core capabilities requirements for contributing data to NOAA IOOS

Activities	Status
	https://ioos.noaa.gov/data/contribute-data/ . See Appendix A for detailed responses for each requirement.

Goal 2: Maintain existing core observation investments in the region

Milestone A: Maintain HF Radars distributed throughout the region: Ongoing.

Institution/Contractor	Status
University of South Florida (USF) (Weisberg, Merz)- Support four CODAR radar arrays on the West Florida Shelf	<p>USF continues to operate and maintain 3 CODAR system HF Radar sites (Naples, Venice and Redington Shores) and 2 WERA HF Radar sites (Venice and Ft. DeSoto Park) which overlook the USF mooring array. The planned fourth CODAR has not been deployed and parts for this fourth station are being used as spares for existing CODARs.</p> <p>Proposed Effort: A proposal was submitted to the NASEM-GRP Loop Current Dynamics Request for Applications. The proposal effort includes the deployment of 3 CODAR HFR systems in south Florida. One in the Dry Tortugas (Fort Jefferson and the lower Florida Keys (1 new site each at Key West and Marathon). SECOORA is a funded partner in the proposal and if funded will directly augment our SECOORA work on the West Florida Shelf, as well as expand SECOORA stakeholder engagement into the lower Florida Keys/Tortugas region.</p>
University of Georgia (UGA), Skidaway Institute of Oceanography (SkIO) (Savidge) - Support two WERA radar arrays on St. Catherine's and Jekyll Island, GA	<p>The SkIO WERA on St. Catherine's continues to provide HFR data to SECOORA and the national HFRnet archive. The Jekyll Island site has not been redeployed post Irma and Maria. The RX and TX antennas and cables were destroyed, and the deployment site is too eroded to re-establish the WERA in the same location. PI Savidge worked with the Jekyll Island Authority to identify a less erosion prone site to the north of the current location. Permits are currently under review by the Georgia Department of Natural Resources. Once permits are granted, they will be shared with the IOOS office, along with a site map, and other details required for NEPA compliance.</p> <p>NSF PEACH Project: The NSF sponsored WERA installations at Cape Hatteras, NC are providing high quality radial data, which is currently being provided to Seim's SECOORA team at UNC-CH, for combining with the Hatteras CODAR. QC/QA and automation scripting was developed over the past 6 months and handed off to Sara Haines at UNC-CH to improve upon. She is now providing hourly maps of the combined product at http://nccoos.org/ (click on "platforms" and then "HF Radar"). WERA radial data that have been smoothed in time and space to match the CODAR sampling are also being provided to Hugh Roarty at Rutgers.</p>
University of Miami (Shay) - Support three WERA radar arrays at Crandon, Virginia Key and Dania Beach	<p>UM has repaired 1 of 3 WERA which were severely damaged due to Hurricane Irma. UM has repaired the HFR installation at the US Navy Test Facility at Dania Beach (Transmits at 12.7 MHz). Repairs included laying new cables and moving computer systems inside of a Navy building to provide them with extra protection. This site became operational again in March 2018.</p> <p>UM is in the process of acquiring hold harmless agreements at Virginia Key and Crandon Park sites prior to redeploying HF radar instrumentation that was extensively damaged due to Irma. In addition, Dade County Water and Sewage Department requests a fence be installed around the facility housing the radar and computer as part of our agreement. Supplemental funding is needed before fence installation can be completed.</p> <p>UM has submitted an application to the Florida Department of Environmental Protection for an HF radar site in Northern Key Largo. This site will support WERA in a direction-finding mode. Once the permit is approved, a copy will be forward to SECOORA/IOOS.</p>
University of NC - Chapel Hill (UNC-CH) (Seim) - Support three CODAR	<p>UNC-CH operates CORE, HATY, and DUCK. Note that one of the NSF-funded PEACH project WERA systems belonging to SkIO (PI Savidge) is co-located with HATY and is sharing communications infrastructure. DUCK sustained a lightning strike in early May that damaged</p>

Institution/Contractor	Status
radar arrays on the Outer Banks of NC	<p>receiver, transmit, and transmit antenna units operated in collaboration with John's Hopkins University. The strike lead to a weeklong outage. The radar was returned to operation after the UNC-CH transmit and receive units were re-installed at the site.</p> <p>NSF PEACH Project: The nested CODAR/WERA radars provide combined radial vectors from both types of systems and fill in coverage in Raleigh Bay that was previously unavailable from the CODAR systems alone. The surface currents provide the PEACH project with essential information about the convergence of shelf waters off Hatteras, NC and the influence of the Gulf Stream on the cross- shelf transport that results. Ten in-water current sensors will provide a rich source of validation data for the radar network when they are recovered in November, 2018.</p>
University of South Carolina (Voulgaris) - Support two WERA arrays on Fort Caswell, NC (CSW) and Georgetown, SC (GTN)	<p>The operation of CSW and GTN continued without significant down time during this reporting period. Areas around Georgetown, SC that did not require modification for sea turtle nesting in prior years, were modified for this season's nesting. The GTN site was visited in May to adapt 3 antenna sites for sea turtle nesting. Guy wire and radial attachment points were elevated 0.75m above ground to prevent entanglement with turtles. The CSW site was visited in May 2018 to re-position guy wire and radial attachment points that were exposed due to beach front erosion during a heavy rain event on 4/15/18. This site may continue to have issues with erosion at the transmission array due to scheduled beach re-nourishment west of the location, as well as east across the Cape Fear river mouth on Bald Head Island. A detailed beach profile has been conducted and vigilant monitoring of the dunes will occur. If required, the transmission array could be re-located slightly west of the current location, but still inside of Fort Caswell.</p> <p>Research/Testing: In collaboration with the University of North Carolina at Wilmington (UNCW), the USF team conducted an <i>in-situ</i> evaluation of the HFR velocities using ADCP data from an instrument deployed in the footprint of the HFR. Analysis suggests that the differences between the ADCP and HF radar velocities are due to Stoke's drift being included in the HFR measurement and not vertical current shear. Additionally, combining traditional WERA beamforming with CODAR's implementation of the MUSIC algorithm is showing promise to identify inaccurate beamformed surface current measurements. These results were presented at 2018 Ocean Sciences and a paper is currently in preparation.</p> <p>Regarding HF radar ocean wave measurements, calibration of both radar sites was performed using the ADCP data provided by UNCW and two wave buoys (Frying Pan Shoals #41013, Wilmington Harbor #41108). Initial analysis shows good agreement of significant wave height between HFR wave measurements and the <i>in-situ</i> wave measurements. This work was presented at 2018 Ocean Sciences and is currently in preparation for journal submission.</p>

Milestone B: Maintain in-situ stations along the Carolina and West Florida Shelf (WFS) coasts:

Ongoing.

Institution/Contractor	Status
USF (Weisberg) - Coastal Ocean Monitoring and Prediction System (COMPS) moorings	<p>Operations: Three real time surface moorings (C10, C12 and C13) and two non-real-time subsurface (C11 and C15) moorings are operated by USF. Real-time data are shared with SECOORA and NOAA's NDBC. Additionally, USF personnel are working with Axiom to generate metadata and share historic data for C11 and C15. This data will be made available via the SECOORA data portal.</p> <p>C13 has been non-operational during this reporting period due to damage from Hurricane Irma. USF received a NASEM-GRP Irma damage award, which enabled the mooring team to purchase replacement parts. A new C13 system is now scheduled to be deployed in June 2018. Once the old station is recovered, USF will be able to determine if the ADCP continued to record data</p>

Institution/Contractor	Status																																																
	<p>internally. If so, the ADCP data will provide valuable current and wave data collected during the passage of Irma.</p> <p>USF has MCATS deployed at the surface (1 m) and sub-surface (5 m, 10 m, 15 m). The MCAT collects water depth, temperature, salinity, and specific conductivity data. The sub-surface MCATs at C10 and C12 have been non-operational since Irma due to the inductive cables separating during the passage of the storm.</p> <table border="1" data-bbox="597 445 1312 850"> <thead> <tr> <th></th> <th>C10</th> <th>C12</th> <th>C13</th> </tr> </thead> <tbody> <tr> <td>Air Temperature</td> <td>0%</td> <td>0%</td> <td>0%</td> </tr> <tr> <td>Barometric Pressure</td> <td>94%*</td> <td>0%</td> <td>0%</td> </tr> <tr> <td>Wind Speed, Gust, Direction</td> <td>94%</td> <td>99%</td> <td>0%</td> </tr> <tr> <td>Relative Humidity</td> <td>0%</td> <td>0%</td> <td>0%</td> </tr> <tr> <td>Short Wave Radiation</td> <td>99%</td> <td>N/A</td> <td>0%</td> </tr> <tr> <td>Long Wave Radiation</td> <td>99%</td> <td>N/A</td> <td>0%</td> </tr> <tr> <td>Surface Salinity</td> <td>94%</td> <td>99%</td> <td>0%</td> </tr> <tr> <td>Surface Water Temperature</td> <td>94%</td> <td>99%</td> <td>0%</td> </tr> <tr> <td>Subsurface Water Temperature</td> <td>0%</td> <td>0%</td> <td>0%</td> </tr> <tr> <td>Subsurface Salinity</td> <td>0%</td> <td>0%</td> <td>0%</td> </tr> <tr> <td>Currents (ADCP)</td> <td>90%</td> <td>97%</td> <td>0%</td> </tr> </tbody> </table> <p>*Data is suspect</p> <p>Research: Real time data and model simulations for the West Florida Shelf: http://ocgweb.marine.usf.edu; and, the red tide tracking forecasts (joint project with FWRI): http://ocgweb.marine.usf.edu/hab_tracking/HAB_trajectories.html. Additionally, the automated, daily nowcast/forecast Tampa Bay Coastal Ocean Model (TBCOM), which nests into the West Florida Coastal Ocean Model (WFCOM), is available to the public: http://ocgweb.marine.usf.edu/~tbn/index.html.</p>		C10	C12	C13	Air Temperature	0%	0%	0%	Barometric Pressure	94%*	0%	0%	Wind Speed, Gust, Direction	94%	99%	0%	Relative Humidity	0%	0%	0%	Short Wave Radiation	99%	N/A	0%	Long Wave Radiation	99%	N/A	0%	Surface Salinity	94%	99%	0%	Surface Water Temperature	94%	99%	0%	Subsurface Water Temperature	0%	0%	0%	Subsurface Salinity	0%	0%	0%	Currents (ADCP)	90%	97%	0%
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<p>USF (Luther) - Coastal tidal & meteorological stations</p>	<p>Operations: Sites collecting water level and surface meteorological parameters are Big Carlos Pass, Clam Bayou, Fred Howard Park, Aripeka, and Shell Point. Additionally, the Clam Bayou site collects a suite of water quality parameters and the Big Carlos Pass site collects water temperature/salinity and fish acoustic data in collaboration with Jim Locascio at Mote Marine Lab. Data from Big Carlos Pass is only shared with SECOORA. Axiom Data Science will begin sending data to NDBC in the next reporting period. Aripeka (ARPF1) did not report any data to the SECOORA or NDBC websites from 1/9/18 – 5/9/18. This was due to a script to push the data to both SECOORA and NDBC being broken. The data is available on the COMPS website.</p> <p>The Clam Bayou site is maintained in close collaboration with YSI/Xylem. Engineers from YSI/Xylem, led by Curt Butler, visit the site every 4 to 6 weeks to clean and recalibrate the water quality sensors. Scientists from USF/CMS, FWRI, and USGS collect in situ water samples for lab analysis at the same time for additional calibration of the instrumental record.</p> <p>Research/Testing: PI Luther is working with the Tampa Bay Estuary Program, US Fish and Wildlife Service, and the Tampa Port Authority to analyze Automatic Identification System (AIS; https://www.navcen.uscg.gov/?pageName=AISworks) vessel tracking data to estimate the impacts of ship wakes on critical marine habitat in Tampa Bay. The project team is mining the AIS data for other Maritime Domain Awareness applications, such as identification of optimal vessel transit windows and automated anomaly detection, in collaboration with the port authority, the Tampa Bay Pilots, and ARES Security (http://aressecuritycorp.com/news/florida-ports). Real-time products being developed will be incorporated into the CommandBridge vessel traffic system.</p>																																																

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University of North Carolina - Wilmington (UNCW) (Leonard) - Coastal Ocean Research and Monitoring Program (CORMP) mooring network	<p>Operations: UNCW continues to operate 9 moorings in NC and SC coastal waters. Moorings performed consistently well throughout the progress report period. The FRP2, CAP2 and SUN2 buoys were successfully swapped during the Long Bay maintenance cruise (4/17-4/19/18). Additional platform maintenance included: 1) Redeployment of repaired SUN2WAVE on 1/30/18. The new mooring included an improved inductive loop, housed in rubber cable and filled with a urethane rubber to reduce chafing and absorb shock; and, 2) Turnaround ILM2WAVE (CDIP #150, NDBC 41110) on 3/09/18.</p> <p>Buoy statistics for 12/1/17 – 5/31/18 are below. Note that ILM2 and LEJ3 have co-located WaveRider buoys (i.e. 2 moorings on station) that provide spectral wave data and water temperature. SUN2 has a co-located acoustic system (comprised of an ADCP and Nemo) to provide wave data and surface and bottom water currents (2 moorings on station).</p> <table border="1" data-bbox="451 604 1459 877"> <thead> <tr> <th></th> <th>ILM2</th> <th>ILM3</th> <th>LEJ3</th> <th>SUN2</th> <th>CAP2</th> <th>FRP2</th> </tr> </thead> <tbody> <tr> <td>Air Temperature</td> <td>98%</td> <td>99%</td> <td>99%</td> <td>99%</td> <td>98%</td> <td>98%</td> </tr> <tr> <td>Air Pressure</td> <td>98%</td> <td>99%</td> <td>99%</td> <td>99%</td> <td>98%</td> <td>98%</td> </tr> <tr> <td>Wind Speed, Gust, Direction</td> <td>98%</td> <td>99%</td> <td>99%</td> <td>99%</td> <td>98%</td> <td>98%</td> </tr> <tr> <td>Salinity</td> <td>98%</td> <td>87%</td> <td>98%</td> <td>63%</td> <td>90%</td> <td>98%</td> </tr> <tr> <td>Surface Water Temperature</td> <td>98%</td> <td>87%</td> <td>98%</td> <td>63%</td> <td>90%</td> <td>98%</td> </tr> <tr> <td>Waves</td> <td>99%</td> <td>NA</td> <td>99%</td> <td>60%</td> <td>NA</td> <td>N/A</td> </tr> <tr> <td>Currents</td> <td>N/A</td> <td>N/A</td> <td>N/A</td> <td>60%</td> <td>N/A</td> <td>N/A</td> </tr> </tbody> </table> <p><i>Discussion of Low Buoy Statistics:</i></p> <p>SUN2 WAVE (waves and currents provided by an ADCP): This failed 10/20/17 and the entire bottom mounted system (ADCP, housing, cables, etc.) was recovered for repair. The system was redeployed on 1/30/18 and has worked well since that time. The low performance statistics reflect the period the buoy was out of water.</p> <p>SUN2 and ILM3: Salinity and Water Temperature performance statistics for these platforms are due to power issues. At both stations, batteries supplying power to the SBE-16CTDs failed prior to their anticipated lifetime. Technicians identified the cause of the failure; however, onsite repairs were delayed by combination of weather and availability of a third boat operator/diver.</p> <p>Data Management: In partnership with Second Creek Consulting, CORMP has developed a tool to aggregate and report quality control flags, using NOAA QARTOD standards, for the real-time sensors deployed on each CORMP platform. Technicians receive automated e-mail daily reports for the previous 24 hours. Technicians then use data quality dashboard to review flagged data and adjust the quality roll-up flags. The quality flags remain with the data and are even incorporated into the visualization tools on CORMP.org.</p> <p>Research/Testing: CORMP continues to assist the FACT Network partners (SERC, Florida Wildlife Commission and Georgia DNR) by placing VEMCO acoustic receivers on the three Onslow Bay buoys and the OB27 bottom frame. New batteries were received in early May and the next 6-month maintenance is scheduled for June 2018. Following maintenance, CORMP will forward data to the FACT partners. On May 15, 2018, CORMP staff also assisted the Ft. Fisher aquarium in locating VEMCO acoustic receivers deployed on artificial reefs for an effort focusing on the tracking of shark movement in Onslow Bay.</p>		ILM2	ILM3	LEJ3	SUN2	CAP2	FRP2	Air Temperature	98%	99%	99%	99%	98%	98%	Air Pressure	98%	99%	99%	99%	98%	98%	Wind Speed, Gust, Direction	98%	99%	99%	99%	98%	98%	Salinity	98%	87%	98%	63%	90%	98%	Surface Water Temperature	98%	87%	98%	63%	90%	98%	Waves	99%	NA	99%	60%	NA	N/A	Currents	N/A	N/A	N/A	60%	N/A	N/A
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Milestone C: Maintain the sensors on NOAA GRNMS buoy: Ongoing.

Institution/Contractor	Status
UGA (Noakes) and University of Delaware (UDEL) (Cai) - Support to	<p>Operations (UGA): For the reporting period, the MAPCO2 has been operational 100% of the time. The Seabird providing additional water quality parameters mounted under the buoy did fail in late December 2017. A replacement Seabird was obtained in late February but has not</p>

Institution/Contractor	Status
NOAA's Ocean Acidification Program NDBC Gray's Reef National Marine Sanctuary (GRNMS) NDBC ID #41008 buoy	<p>been installed due to rough sea conditions. At this time, a visit to the GRNMS buoy is scheduled for late summer to replace the MAPCO2 system which includes the electronics package, battery pack, equilibrator, iridium antenna and spare gas.</p> <p>During December 2017, 6 water samples were collected for bulk sample analysis. Each sample was immediately spiked with HgCl₂ and put on ice. The samples were kept cold until shipment by FedEx to the University of Delaware for analysis. UDEL team members processed the water samples for dissolved inorganic carbon (DIC) and total alkalinity (TA).</p> <p>Research: A Georgia Southern University graduate student has been engaged to apply the GRNMS ocean acidification data in a research project relating <i>Oculina</i> coral growth to carbon dioxide concentrations. The project is in the early stages of development and, depending on funding, will start July 2018.</p>

Goal 3: Begin to address geographic gaps in observations

Milestone A: Establish a regional glider observatory in the South Atlantic Bight (SAB): Ongoing.

Institution/Contractor	Status
UGA SkIO (Edwards) North Carolina State University (NCSU, (He) UNC-CH (Seim) USF (Lembke) Georgia Institute of Technology (Zhang)	<p>Operations: The SECOORA regional glider observatory is a collective effort among five institutions, which jointly conducted 3 deployments. Two of these deployments were mapping missions cut short due to age-related equipment failure within the first two weeks. The third deployment, which lasted 25 days, took place at GRNMS. This deployment was coordinated with an externally funded fisheries project and the glider collected passive acoustic data along with physical oceanographic variables while deployed. This was also a shakedown mission for a G1 glider made available to SkIO from UNCW through 2021.</p> <p>Hardware issues on the glider fleet have been addressed for the short term, and a new G3 is on order for SkIO/UGA. Finally, the team has been working with SECOORA administration on the development of a build-out plan for future operations. This plan highlights the need for new gliders as the current fleet is ageing and maintenance costs are steadily increasing.</p> <p>PIs Edwards and Lembke presented a summary of recent and planned SECOORA glider observatory efforts to the Florida Atlantic Coast Telemetry (FACT) members at the December FACT meeting in Tequesta, FL. This had led to increased communications between the glider and FACT teams and identification of partnering opportunities.</p> <p>Research/Testing: UNC-CH has implemented data post-processing routines that correct for thermal lag and other issues that cause spiking in salinity and oxygen data and are working on automating this process so that delayed mode submission of QA/QC data is easier. Georgia Tech and SkIO have developed new path planning and path-following routines that will take advantage of HF radar data to optimize waypoint generation.</p> <p>Edwards led a UG2 webinar in January on lessons learned for hardening of glider operations centers after SkIO's hurricane evacuation during Hurricane Irma. During the reporting period, SECOORA glider observatory efforts have resulted in one journal publication and four conference papers.</p>

Milestone B: Install a new coastal water quality and meteorological station in Charleston Harbor, SC: Ongoing.

Institution/Contractor	Status																
South Carolina Department of Natural Resources (Sanger)	<p>The Charleston Harbor water quality monitoring site collected data for specific conductivity, salinity, temperature, dissolved oxygen, pH, turbidity, depth, and chlorophyll fluorescence during the reporting period. The station was instrumented and began data collection in non-real time on 11/1/17. Chlorophyll fluorescence measurements did not begin until February 2018. The fluorescence of dissolved organic matter (FDOM, a proxy for total dissolved organic carbon) probe has not been added to the instrument due to concerns about probe performance by colleagues from the North Inlet-Winyah Bay National Estuarine Research Reserve (NERR). The site has received approval from the NERR Data Management Committee to be considered a secondary NERR System-wide Monitoring Program (SWMP) water quality monitoring location for the ACE Basin NERR. The telemetry equipment was installed, and the site became real-time April 2, 2018. The attainment of NERRS SWMP secondary status and telemetry equipment installation has allowed the data to be visualized in real-time on the NERRS Centralized Data Management Office website (http://nerrsdata.org) and mobile web app (http://nerrsdata/mobile/). Additionally, the station is available on the SECOORA data portal: https://portal.secoora.org/?#metadata/75585/station.</p> <p>Statistics for data collected April 2 to May 31, 2018.</p> <table border="1" data-bbox="597 831 1138 1108"> <thead> <tr> <th></th> <th>CH</th> </tr> </thead> <tbody> <tr> <td>Water Temperature</td> <td>100%</td> </tr> <tr> <td>Salinity/Specific Conductivity</td> <td>100%</td> </tr> <tr> <td>Dissolved Oxygen</td> <td>100%</td> </tr> <tr> <td>pH</td> <td>98%</td> </tr> <tr> <td>Turbidity</td> <td>96%</td> </tr> <tr> <td>Chlorophyll Fluorescence</td> <td>94%</td> </tr> <tr> <td>Depth</td> <td>99%</td> </tr> </tbody> </table>		CH	Water Temperature	100%	Salinity/Specific Conductivity	100%	Dissolved Oxygen	100%	pH	98%	Turbidity	96%	Chlorophyll Fluorescence	94%	Depth	99%
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Goal 4: Continue delivery of operational model forecasts and products to serve priority users

Milestone A: Enhance and operate a Coupled Marine Environmental Assessment and Prediction System for the SE: Ongoing.

Institution/Contractor	Status
NCSU (He) - Support and enhance SABGOM model	<p>The NCSU team has been maintaining and upgrading the SABGOM and CNAPS ocean prediction systems on a 24/7 basis, providing time- and space-continuous regional marine environment predictions on a user-interactive web portal (http://omgsrv1.meas.ncsu.edu:8080/CNAPS/). The team has made progress in refining the full couplings of wave, atmosphere, and ocean circulation models. The coupled system has been used to generate: 1) regional nowcasts and forecasts of ocean circulation, waves, and marine weather; and, 2) several regional ocean hindcasts on events such as Hurricane Irma. The team has also been implementing and testing both variational data assimilation and Kalman filter methods in their regional ocean predictions. The developed prototype data assimilative modeling system will be run in pseudo-operational mode starting in Year 3. Finally, the team is working with other SECOORA PIs on model skill assessments, long-term analysis, and generation of several value-added products. For example, He has continued supporting NOAA NMFS on their fish and turtle migration and sampling study. Partners include NOAA Fisheries’ Beaufort Lab: Todd Kellison, Chris Taylor; Southeast Fisheries Science Center: Katherine Mansfield, Mandy Karnauskas.</p>

Milestone B: Operate the WFS FVCOM ocean model: Ongoing.

Institution/Contractor	Status
USF (Weisberg)	FVCOM is a prognostic, unstructured-grid, finite-volume, free-surface, 3-D primitive equation coastal ocean circulation model, and is run in a nowcast/forecast mode. The model also includes the period for Hurricane Irma in hindcast. Real time data and model simulations (including daily, automated nowcasts/forecasts for currents and particle trajectories) continue to be publicly available on the internet (http://ocgweb.marine.usf.edu and the SECOORA web site), as well as being transmitted via THREDDS server to NOAA GOODS.

Milestone C: Provide an early warning system for swimming beach and shellfish harvesting waters: Ongoing.

Institution/Contractor	Status
USC (Porter)	<p>The project team focused water quality modeling efforts in the Charleston Harbor watershed, adjacent swimming beaches, and shellfish harvesting waters. Historical datasets (rainfall, water temperature, wind, tide, salinity data, etc.) were pulled from nearby USGS and NOAA gauges, met stations, etc., and coupled with Nexrad rainfall data. These data were coupled with data collected by Charleston Waterkeeper (<i>Enterococcus</i> concentrations) to produce predictive models using multiple linear regression (MLR). Near real-time data now feed directly in to 20 daily forecast models from five study sites (Brittlebank Park, Folly Beach, and three sites along Shem Creek) in the Charleston area. In collaboration with the EPA Virtual Beach Environmental Modeling Community, the project team also started experimenting with gradient boosting machine (GBM) learning on its best and least predictive sites to discover if this tool added any value to the modeling process. Two approaches for GBM modeling are being examined: The EPA’s Virtual Beach tool and the XGBoost library.</p> <p>The project team began collecting historical and real-time water quality data for Kill Devil Hills, NC. The team is starting to process data and run MLR models on this area. Due to lack of long-term historical salinity data in the area, the project is using modeled salinity data from three models: HYCOM, Rutgers, and Copernicus. Unfortunately, none of the regional models provide easily accessed long-term historical data. Having a THREDDS server with long term, high resolution, local models would be useful for the modeling process.</p>

Milestone D: Optimize and enhance the SECOORA Marine Weather Portal (MWP): Ongoing.

Institution/Contractor	Status
UNCW (Dorton)	The MWP is hosted on the SECOORA website: http://mwp.secoora.org/ . The MWP project team (Dorton and Galvarino) visited the Mobile NWS office on March 26. The team provided an overview of SECOORA and the MWP to staff from the NWS and Gulf of Mexico Disaster Response Center. The project team also met with forecasters from the NWS Charleston office on May 21. In person meetings provide an opportunity to identify additional information/products to include on the site and identify other potential stakeholders. The meeting in Mobile led to the identification of additional real-time stations and a list of well-known marine locations to add to the MWP. Outreach products (one pagers) were developed for the Charleston NWS office to share with boaters at trade shows in which they participate.

Milestone E: Python Data Analysis Tools for Oceanographic Services: Ongoing.

Institution/Contractor	Status
Independent Contractor (Filipe Pires Alvarenga)	Activities are summarized for the three areas of work: 1. Assist in development of IOOS.us Documentation and Demonstration sub-pages

Fernandes,
Oceanographer, Brazil)

- a. Seven new notebooks were added to the gallery: *r-erddap* library tour [ioos/notebooks demos #268](#); *BagIt* usage example [ioos/notebooks demos #275](#); CSW HF-radar data query notebook [ioos/notebooks demos #128](#); an example on how to use the R libraries with *obis* and *obistools* [ioos/notebooks demos #288](#); a demonstration on how to save CF-compliant DSG files with *pocean-core* [ioos/notebooks demos #293](#); a skill score calculation for Sea Surface Height [ioos/notebooks demos #303](#); and, a skill score for Significant Wave Height [ioos/notebooks demos #282](#).
 - b. Webpage maintenance include updates to the *IFrame* displays [ioos/notebooks demos #261](#) and minor tweaks to the font size and overall look and feel of the landing code gallery landing page [ioos/notebooks demos #264](#). The Continuous Integration infrastructure was modernized to ensure all notebooks are runnable ([ioos/notebooks demos #262](#), [#265](#), [#269](#), [#271](#)). As a consequence, the IOOS environment no longer supports Python 2.7 when running a notebook example. The webpage theme was also updated to improve the user experience while navigating the site [ioos/ioos jekyll theme #27](#), [#28](#), [#274](#).
 - c. The compliance-checker notebooks required an update to reflect the new scoring system [ioos/notebooks demos #310](#). The last changes are related to the Windows version which was broken due to some R packages [ioos/notebooks demos #308](#). This resulted in a split environment without the R packages for those on Windows [ioos/notebooks demos #307](#). Some older notebooks required small corrections to account for data source changes, package updates, etc. [ioos/notebooks demos #281](#), [#295](#), and [#297](#).
 - d. The publishing mechanism was updated to jupyter tools instead of relying on external scripts, making them more robust and extensible [ioos/notebooks demos #300](#) and [#301](#). Some webpage updates worth noting are fixing broken links ([ioos/notebooks demos #278](#) and [#299](#)), improved file management ([ioos/notebooks demos #292](#)), new media links ([ioos/notebooks demos #290](#)), and testing framework ([ioos/notebooks demos #283](#)).
 - e. The IOOS conda environment was updated to accommodate new packages, like *ncv* for Windows ([ioos/notebooks demos #280](#)), and some deprecated packages were removed ([ioos/notebooks demos #291](#)), and the notebook demonstrating the *BagIt* was updated based on user comments ([ioos/notebooks demos #279](#)).
2. Support current and continue developing software packages
 - a. ERDDAP is fast becoming the canonical way to serve data, however, users still miss a Python client to help access the data so *erddapy* was created as a remedy [pyoceans/erddapy #3](#), [#4](#). The library is a lightweight URL builder for ERDDAP's many REST responses. The main difference from its R counterpart, *erddapy* does not provide any plotting functionalities or model data, leaving the user free to choose how they want to download and manipulate the data. The code base now supports quoted constraints ([pyoceans/erddapy #19](#)) and provides a URL validator ([pyoceans/erddapy #20](#)) to ensure the outputs are always valid ERDDAP URLs. The code base went through a major cleanup ([pyoceans/erddapy #21](#), [#22](#), [#24](#), [#25](#), [#28](#), and [#29](#)) to ensure code readability, clarity, and reduce the entry barrier for third party contributions. The main new features are the data export methods that allow the user to readily load the data as a pandas DataFrame or a xarray Dataset object [pyoceans/erddapy #26](#). This version also supports password protected server via requests auth options [pyoceans/erddapy #27](#).
 - b. Issued a new release for *ioos_tools*, 1.1.2 with a workaround for missing station name when reading from *pyoos* collectors ([pyoceans/ioos tools #3](#)) and a time out feature to prevent hanging on slow servers ([pyoceans/ioos tools #4](#)).
 - c. Additional software maintenance work was done on compliance-checker's Windows testing ([ioos/compliance-checker #549](#) and [#552](#)), *pocean-core* Windows continuous integration testing ([pyoceans/pocean-core #31](#) and [#33](#)), error handling and messaging ([pyoceans/pocean-core #32](#)), and some documentation cleanup ([pyoceans/pocean-core #34](#)).
 - d. In its latest release the *netcdf4-python* package factored out the *netcdf4time* submodule [Unidata/netcdf4time #25](#). That change required a number of changes to adapt key packages to use the new module, like *cf_units* [SciTools/cf_units #85](#).

Fixed a dependency for some issues within sensorml2iso by binning pyoos and Windows testing to avoid regressions [ioos/sensorml2iso #22](#) and [#23](#). The IOOS environment was improved by adding the nco builds for Windows ([nco/nco #62](#)).

e. The compliance-checker package and its plugins, cc-plugin-glider, cc-plugin-ugrid, cc-plugin-sgrid, and cc-plugin-ncei, were not configured to test against the latest version in the continuous integration systems. That was corrected in [ioos/compliance-checker #518](#), [#533](#), [ioos/cc-plugin-ncei #41](#), [#42](#), [#43](#), [ioos/cc-plugin-glider #16](#), [ioos/cc-checker-ugrid #1](#), [cc-plugin-sgrid #1](#), [cc-plugin-ncei-feedstock #11](#). Now all downstream plugins are tested against both the stable and latest version of compliance-checker and compliance-checker also tests itself against the stable version of the plugins. This will help detect errors early and avoid bad releases when modifications in these packages cause breakages up/downstream of the dependency chain. In addition to the new tests, the CIs were updated and fixed to accommodate new dependencies, dropped Python 3.4 testing, and minor improvements to speed and code compliance tests.

f. Correct minor issues with the releases for cc-plugin-glider ([ioos/cc-plugin-glider #23](#)) and cc-plugin-ugrid ([ioos/cc-plugin-ugrid #9](#)). Adapted the compliance-checker software to work with the latest numpy and cf_units releases. A series of CI updates and fixes ([ioos/compliance-checker #552](#), [#564](#), [#580](#), [#581](#), and [583](#)) were made for the new netcdf4-python that uses an external module cftime instead of the built-in netcdf4time. The pyoos unit and integration tests, that were failing due to bit rot, were fixed and/or updated [ioos/pyoos #84](#).

g. Many PRs were issued to fix or improve packages outside of the ioos Github organization but still central to IOOS, such as: erddapy pandas version bug [pyoceans/erddapy #35](#), complete refactor of gridgeo allowing it to parse virtually any CF, UGRID, and SGRID compliant meshes ([pyoceans/gridgeo #23](#), [#24](#), [#25](#), [#27](#), [#30](#), [#31](#), [#32](#), [#33](#), [#34](#), [#37](#), and [#39](#)), ioos_tools get_surface() bug that prevented a non-compliant model from returning the surface layer [pyoceans/ioos_tools #5](#), many improvements to basemap's docs and installation procedures ([matplotlib/basemap #400](#), [#401](#), and [#402](#)), fixed Windows testing for nco ([nco/nco #82](#)), cftime ([Unidata/cftime #41](#)), and netcdf4-python ([netcdf4-python #782](#)), fixed a packaging bug on seapy ([seapy #54](#)), revived Travis-CI for sci-wms ([sci-wms/sci-wms #129](#) and [#130](#)), updated utide testing framework and updated to latest scipy version ([wesleybowman/UTide #57](#) and [#58](#)).

3. Ensure software deployment via conda-forge packages

a. Bew packages were added to conda-forge by IOOS/SECOORA requests and/or dependencies needed for the stack: *cgsn_parsers*, *cgsn_processing*, *finch*, *erddapy*, *cc-plugin-ugrid*, *geoviews*, *EarthSim*, *xesmf*, *pydensecrf*, and *jsonfield*.

b. The BioData Workshop, held Feb 8-9, required a different software environment from the standard IOOS environment provided in the IOOS Data Demonstration site. This new environment ([ioos/BioData-Training-Workshop #11](#) and [#7](#)) and the corresponding notebooks ([ioos/BioData-Training-Workshop/pull/17](#) and [#27](#)) were added to the webpage ([ioos/BioData-Training-Workshop #31](#)). In order to prepare the BioData Workshop, a huge number of R packages were added to the conda-forge channel and many more were updated, see *the conda-forge* links list in Appendix B.

Milestone F: Special Projects Ongoing

Institution/Contractor	Status
Total Water Initiative (Fathom Science, LLC)	Ongoing: Fathom Science, LLC is working to port a prototype operational ocean prediction system to the Amazon cloud computing infrastructure. Fathom Science is working closely with RPS/ASA on this project, in conjunction with several key federal partners at NOAA Center for Operational Oceanographic Products and Services (P. Burke, C. Lindley, A. Zhang), NOAA National Water Center (T. Flowers), and NOAA Coastal Survey Development Lab (E. Myers, E. Vandenameele). The effort supports NOAA's Total Water Initiative , which calls for a boundary-spanning partnership across multiple sectors to predict and deliver water information. Several documentations are being developed on how to carry out ocean model simulations in the Amazon cloud computing environment. We are also in the process of working with NC Sea Grant extension specialist, Jane Harrison, to develop an outreach effort of this project.
Data 61 & USGS (Signell)	Complete
NOS Web Camera Applications Testbed (SECOORA and Surflin)	<p>Ongoing: Surflin coordinated with SECOORA stakeholders to identify five target locations for the WebCAT project. The cameras have been deployed in Cape Hatteras, NC; Cherry Grove Pier in Myrtle Beach, SC; 40th St. Miami, FL; St. Augustine, FL; and Twin Piers in Bradenton Beach, FL. In addition, a "bonus" cam was installed at Folly Beach Pier, SC thanks to support from both SECOORA and the National Weather Service in Charleston, SC. All of the cams are now available from the SECOORA WebCAT online portal. The Surflin deliverables are now complete. The video feeds from the cams will continue to be accessible via Axiom until early 2019 unless further funding is obtained.</p> <p>WebCAT was highlighted during a Surflin presentation provided at the Global Waves Conference in Santa Cruz on March 7. A copy of the slides can be viewed here. Surflin also was invited to participate in a panel discussion at the AMS Washington Forum on April 24, where we also highlighted the WebCAT project. The relevant slides can be viewed here.</p> <p>Axiom worked with Surflin to setup a harvest program to download 10-minute video files from each SECOORA funded webcam and ingest them into the SECOORA data system. Automated the stitching of video files together and updated WEBCAT landing page to a visually more appealing interface: http://secoora.org/webcat.</p> <p>Responded to WebCAT feedback, including: Adding JSON file inventory to the root of daily files; made the additional video clips easier for users to find on the website; created a default feature for videos to start at the time closest to 10 am; and, resolved video data feed issues and documented how to download clips programmatically for analysis.</p>

2) Scope of Work

Scope of work is as described in the [Year 2 descope proposal](#).

3) Personnel and Organizational Structure

A current list of SECOORA Members and Board is available on our [website](#). Additionally, SECOORA personnel job descriptions and employee CVs are available on: <http://secoora.org/certification>.

4) Budget Analysis

SECOORA's March 31, 2018 financial report for Year 1 funds shows a budget balance remaining of approximately \$150k. SECOORA's March 31, 2018 financial report for Year 2 funds shows a budget balance remaining of approximately \$1.9M. We are within budget and on track with spending. SECOORA continues to receive invoices regularly from our sub-awardees and we process them at one of two bi-monthly administration meetings. All invoices are paid within forty-five days. SECOORA continues to draw from ASAP monthly. As a reminder SECOORA pays out its monthly operational costs (i.e. payroll, etc.) and then conducts the ASAP draws in the middle of the following month for both the preceding month's operation expenses and the sub-awardee invoices.

Appendix A – IOOS Data Management and Data Sharing Requirements

1. [Open Data Sharing](#)

The SECOORA Data System provides data resources in a one stop data portal, free to the public, with data assets originating from federal and state agencies, local municipalities, academic institutions, research organizations, private companies, non-profit organizations, and community observers. Real-time and near real-time data are served as soon as practical as the data become available.

SECOORA works with data providers and its data partner, Axiom Data Science, to establish and maintain freely available data streams that allow for timely ingestion, processing, and serving of data. When possible, SECOORA aims to provide real-time or near real-time (as defined in RICE IOOS Guidelines) quality assured and quality-controlled data. SECOORA adheres to data and metadata standards established by IOOS and leverages the experience and expertise of the community of data providers to improve data quality.

Status: All data currently served by the SECOORA data portal carries with it the permission to view and access and carries no privacy or ethical restrictions. Data access is defined here as being permitted to download data through the SECOORA data portal.

Challenges: Metadata for some data streams are sparse, often due to a lack of quality metadata from upstream data providers; efforts are underway to enhance metadata records and develop tools to ease and democratize metadata curation using the SECOORA Research Workspace.

2. [Data management planning and coordination](#)

Data management is an increasingly important aspect of IOOS activities. Data management plans and the coordination of activities between Regions and the IOOS Program Office ensure that data are maintained in easily accessible formats that are archived for long-term storage.

The [SECOORA Data Management Plan](#) provides the approach to the necessary implementation, describing how data are ingested, managed and distributed from the source to public dissemination.

The primary processes involved with data management and flow include data ingestion, standards and format, metadata and discovery, quality control, stewardship and preservation, access and dissemination, archival and security. SECOORA and its data management partner, Axiom Data Science, serve data to users in common machine-readable data formats and provide the feeds to the GTS with their service-oriented architecture. SECOORA works with Axiom and data providers to ensure that IOOS standard ontologies and vocabularies are being used. SECOORA strives to maintain standards-compliant metadata and provide information to the IOOS catalog. All data received and made available through the SECOORA data portal is stored in a custom infrastructure developed by Axiom. Axiom maintains onsite storage at their facilities, as well as at a redundant offsite storage location. Axiom also makes available open-source resources of software developed through a public GitHub repository.

SECOORA officially became RICE certified by NOAA in 2017. As part of this process, the SECOORA Data Management plan was completed (April 2017) and the plan will be updated routinely (minimum 5 years) as needed to meet new requirements from the IOOS DMAC.

3. [Provision of data to the Global Telecommunication System \(GTS\)](#)

SECOORA has maintained their commitment to provide data to the GTS though NDBC. In some instances, the data is flowing from the SECOORA funded data provider (i.e. UNCW, USF COMPS buoys). The Big Carlos Pass station will be submitted to NDBC directly by SECOORA. Finally, CDIP moorings within the region are reported to the GTS by the CDIP program. Challenge: SECOORA is working with PIs to determine if it would be beneficial for Axiom to take over NDBC submissions for all PIs. Right now much of the work to submit to NDBC is duplicated at each research program and bringing it under the SECOORA DMAC structure could make it more efficient.

4. [Data access services](#)

All data and products are registered in the IOOS Catalog. SECOORA offers six access points:

1. *Thematic Realtime Environmental Distributed Data Services (THREDDS)* - SECOORA provides THREDDS access points for raster (gridded) data stored in NetCDF format. Axiom upgraded THREDDS to 4.6.10 - <http://thredds.secoora.org> and updated SECOORA ISO WAF - <https://thredds.secoora.org/iso>.
2. *Open-source Project for a Network Data Access Protocol (OPeNDAP)* - SECOORA provides OPeNDAP access points for raster (gridded) and time-series data.
3. *Web Map Service (WMS)* - SECOORA provides WMS access points for point, vector, and polygon information, as well as raster (gridded) data.
4. *Web Feature Service (WFS)* - SECOORA provides WFS access points for point, vector, and polygon information, as well as time-series and raster (gridded) data.
5. *Environmental Research Division's Data Access Program (ERDDAP)* - SECOORA primarily uses this service to facilitate device-level downloads (e.g., tabular data). Axiom upgraded ERDDAP to 1.80 - <http://erddap.secoora.org>
6. *File Downloads* - SECOORA often provides data as downloadable files. These files are mostly served in the standard shared data file formats above, or in the case of project-specific data, in their native file formats.

Challenges: Large datasets and heavy usage can strain data access servers and negatively impact user experiences; Axiom and SECOORA are continually tuning and enhancing data service software and developing deployment techniques to maximize performance and stability of these services. As new data types and variables come on-line routine coordination between Axiom, SECOORA, and IOOS will be required to make them available. Currently the IOOS Glider DAC only makes available a subset of data types transmitted by the profiling gliders.

5. [Catalog registration](#)

SECOORA maintains a WAF (<https://thredds.secoora.org/iso>), which is harvested by the IOOS Catalog. All data and products are registered in the IOOS catalog.

6. [Common data formats](#)

SECOORA offers data in IOOS compliant formats through the use of ncSOS, THREDDS and ERDDAP.

SECOORA provides nearly all data in four open, standardized forms:

1. *Network Common Data Form (NetCDF)* - a self-describing, machine-independent data format that SECOORA uses primarily for raster (gridded) data. Some data stored as unstructured grids use this format as well.
2. *Comma Separated Values (CSV)* - a human-readable ASCII format that is nearly universally accepted by spreadsheet and programming languages. SECOORA uses CSV formats to allow users to download (1) time-series extractions from raster data, and (2) GIS vector and polygon information (e.g., boundaries).
3. *Shapefile* - an open geographic information system format for point, vector, and polygon data. SECOORA allows users to download shapefiles of static GIS layers such as boundaries, biologic distributions, etc.
4. *Portable Network Graphics (PNG)* - PNG is a lossless, image format provided as an alternative to shapefiles in the SECOORA catalog. PNGs are limited in use as they are pre-projected, pre-scaled, and pre-sized images of data layers. However, SECOORA provides PNG files as example WMS requests, which are useful to users who cannot access GIS services and who do not understand how to manipulate WMS requests.

7. [Metadata standards](#)

All IOOS data providers are expected to ensure relevant metadata is produced, accessible and compliant with IOOS conventions, and to participate as appropriate in the development of such conventions. Descriptive information about datasets, sensors, platforms, models, analysis methods, quality-control procedures is essential for the long-term usability and reuse of information.

SECOORA requires standards-compliant metadata for project-level data (SECOORA or IOOS-funded projects). Though SECOORA does not require specific metadata standards for ingesting other types of data, most modern data submittals are accompanied by standard ISO/FGDC metadata records. Research Workspace (RW) is being phased in within SECOORA and it will be used to assemble, store, and share data by researchers or SECOORA partners. RW provides users with a web-based interface that allows researchers to create *projects* to represent particular scientific studies or focuses of research within a

larger effort. Standard, discovery-level ISO 19115-2 and 19115-10 compliant metadata can be generated for both projects and individual datasets.

Many historical datasets come with informal metadata documentation that is variable in terms of completion and detail required by modern standards. Some data sets are only accompanied with narrative information. In these cases, SECOORA plans to work with the data provider to create more up-to-date metadata records and share the data within RW so that it can be ingested into the SECOORA data portal.

Challenge: It may be challenging to get historical data, available from non-SECOORA funded researchers, input into RW. SECOORA and Axiom staff will encourage and assist these researchers in an effort improve the likelihood of them sharing their historical data through RW. Axiom and SECOORA will do their best to make these valuable data resources available with as much documentation as possible.

8. [Storage and archiving](#)

SECOORA ingested data is stored in a secure, professionally managed external facility with total storage space for over 1.8 petabytes of data. Those resources are geo-replicated between Portland, OR and Providence, RI. All aggregated data is stored indefinitely beyond the life of each individual project. Real-time sensor feeds will become historical sensor feeds one-month after collection. The only assets that are not kept indefinitely in storage are webcam images.

As a federally funded program, SECOORA is required to submit data it generates to a national archive center. SECOORA is working with the National Centers for Environmental Information (NCEI) to assist with the [archival](#) of appropriate data types accepted by NCEI. SECOORA maintains an NCEI archive WAF at <http://ncei.axiomdatascience.com/secoora/> which is regularly harvested by NCEI. The bulk of the data assets managed by SECOORA are non-real-time, nonfederal assets, sometimes from small data originators, and often from distinct research projects or large, integrated ecological research programs. These data may not fall under the purview of the NCEI. Accordingly, SECOORA plans to archive these data in the DataONE network through RW.

9. [Ontologies, vocabularies, common identifiers](#)

SECOORA makes use of IOOS ontologies, vocabularies and common identifiers as needed.

10. Consideration for Long-term Operations

The SECOORA Data System hosts several integrated data management tools to ease data access, storage, and sharing by its users including the Research Workspace (RW) and its metadata editor, and the SECOORA Portal and catalog system. The SECOORA RW, the web-based data management application, will be used to assemble, store, and share data by researchers or SECOORA partners.

RW includes an integrated metadata editor to support the documentation of data and facilitate its accuracy and reuse. Content collected in the RW metadata editor uses fields from the ISO 19115 suite of standards for geospatial metadata, which is the FGDC endorsed successor to the CSDGM, extended to describe taxonomic classification for biological datasets. Standard, discovery-level ISO 19115-2 and 19115-10 compliant metadata can be generated for both projects and individual datasets.

Axiom Data Science has made significant progress redesigning the back end SECOORA Data System to implement and support QARTOD checks for real-time data. Through fall 2018, Axiom will be working to implement and display QARTOD flags to be available through the SECOORA data portal. This work will be ongoing as QARTOD manuals are further developed for additional parameters to provide the correct level of guidance for implementing appropriate QC at the regional level. SECOORA will continue working with regional data providers and experts to develop user established range tests that are specific to each sensor and its location.

Appendix B – Conda-forge links list

These are the links to the PRs adding and/or updating a package on *conda-forge*:

<https://github.com/conda-forge/staged-recipes/pull/4111>
<https://github.com/conda-forge/staged-recipes/pull/4147>
<https://github.com/conda-forge/staged-recipes/pull/4834>
<https://github.com/conda-forge/staged-recipes/pull/4841>
<https://github.com/conda-forge/staged-recipes/pull/4849>
<https://github.com/conda-forge/staged-recipes/pull/4852>
<https://github.com/conda-forge/staged-recipes/pull/5472>
<https://github.com/conda-forge/staged-recipes/pull/5473>
<https://github.com/conda-forge/staged-recipes/pull/5475>
<https://github.com/conda-forge/staged-recipes/pull/5476>
<https://github.com/conda-forge/staged-recipes/pull/5479>
<https://github.com/conda-forge/staged-recipes/pull/5858>
<https://github.com/conda-forge/compliance-checker-feedstock/pull/19>
<https://github.com/conda-forge/compliance-checker-feedstock/pull/21>
<https://github.com/conda-forge/django-feedstock/pull/47>
<https://github.com/conda-forge/django-grappelli-feedstock/pull/12>
<https://github.com/conda-forge/django-typed-models-feedstock/pull/7>
<https://github.com/conda-forge/djangorestframework-feedstock/pull/19>
<https://github.com/conda-forge/gridgeo-feedstock/pull/8>
https://github.com/conda-forge/ioos_tools-feedstock/pull/3
<https://github.com/conda-forge/jsonfield-feedstock/pull/1>
<https://github.com/conda-forge/libnetcdf-feedstock/pull/39>
<https://github.com/conda-forge/libnetcdf-feedstock/pull/40>
<https://github.com/conda-forge/libnetcdf-feedstock/pull/43>
<https://github.com/conda-forge/nco-feedstock/pull/48>
<https://github.com/conda-forge/nco-feedstock/pull/55>
<https://github.com/conda-forge/pocean-core-feedstock/pull/13>
<https://github.com/conda-forge/pysgrid-feedstock/pull/8>
<https://github.com/conda-forge/pytzdata-feedstock/pull/1>
<https://github.com/conda-forge/r-bold-feedstock/pull/1>
<https://github.com/conda-forge/r-cli-feedstock/pull/1>
<https://github.com/conda-forge/r-crayon-feedstock/pull/2>
<https://github.com/conda-forge/r-crul-feedstock/pull/1>
<https://github.com/conda-forge/r-curl-feedstock/pull/1>
<https://github.com/conda-forge/r-finch-feedstock/pull/1>
<https://github.com/conda-forge/r-geometry-feedstock/pull/1>
<https://github.com/conda-forge/r-geor-feedstock/pull/1>
<https://github.com/conda-forge/r-geor-feedstock/pull/2>
<https://github.com/conda-forge/r-gstat-feedstock/pull/1>
<https://github.com/conda-forge/r-hdf5r-feedstock/pull/1>
<https://github.com/conda-forge/r-httpuv-feedstock/pull/1>
<https://github.com/conda-forge/r-jsonlite-feedstock/pull/2>
<https://github.com/conda-forge/r-leaflet-feedstock/pull/1>
<https://github.com/conda-forge/r-lidr-feedstock/pull/1>
<https://github.com/conda-forge/r-mapedit-feedstock/pull/1>
<https://github.com/conda-forge/r-mapview-feedstock/pull/1>
<https://github.com/conda-forge/r-natserv-feedstock/pull/1>
<https://github.com/conda-forge/r-obistools-feedstock/pull/1>
<https://github.com/conda-forge/r-pillar-feedstock/pull/1>

<https://github.com/conda-forge/r-processx-feedstock/pull/1>
<https://github.com/conda-forge/r-proj4-feedstock/pull/1>
<https://github.com/conda-forge/r-randomfields-feedstock/pull/1>
<https://github.com/conda-forge/r-rgdal-feedstock/pull/8>
<https://github.com/conda-forge/r-rgeos-feedstock/pull/1>
<https://github.com/conda-forge/r-rnetcdf-feedstock/pull/1>
<https://github.com/conda-forge/r-rotl-feedstock/pull/1>
<https://github.com/conda-forge/r-rredlist-feedstock/pull/1>
<https://github.com/conda-forge/r-sf-feedstock/pull/1>
<https://github.com/conda-forge/r-solrium-feedstock/pull/1>
<https://github.com/conda-forge/r-sp-feedstock/pull/2>
<https://github.com/conda-forge/r-spacetime-feedstock/pull/1>
<https://github.com/conda-forge/r-spatstat-feedstock/pull/1>
<https://github.com/conda-forge/r-ssoap-feedstock/pull/1>
<https://github.com/conda-forge/r-taxize-feedstock/pull/1>
<https://github.com/conda-forge/r-taxizesoap-feedstock/pull/1>
<https://github.com/conda-forge/r-taxizesoap-feedstock/pull/2>
<https://github.com/conda-forge/r-tibble-feedstock/pull/2>
<https://github.com/conda-forge/r-units-feedstock/pull/1>
<https://github.com/conda-forge/r-urltools-feedstock/pull/1>
<https://github.com/conda-forge/r-webshot-feedstock/pull/1>
<https://github.com/conda-forge/r-wikidatar-feedstock/pull/1>
<https://github.com/conda-forge/r-wikitaxa-feedstock/pull/1>
<https://github.com/conda-forge/r-worms-feedstock/pull/1>
<https://github.com/conda-forge/rasterio-feedstock/pull/56>
<https://github.com/conda-forge/seapy-feedstock/pull/1>
<https://github.com/conda-forge/sensorml2iso-feedstock/pull/4>
<https://github.com/conda-forge/sensorml2iso-feedstock/pull/5>