

Southeast Coastal Ocean Observing Regional Association (SECOORA): Hurricane Ian Supplemental Repairs

Disaster Relief Supplemental Act (DRSA) - Repair and Replacement of Observing Assets, Real Property, and Equipment in the Gulf of Mexico, Southeast, and Caribbean Regions Non-competitive Request for Applications (RFA) - NOAA-NOS-IOOS-2024-2008259 Disaster Relief Supplemental Appropriations Act, 2023

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Background/Introduction:

SECOORA is part of the US Integrated Ocean Observing System (IOOS®). Its footprint covers both the eastern Gulf of Mexico (GOM) and the South Atlantic Bight (SAB), which are connected by the Loop Current- Florida Current- Gulf Stream continuum. Our members include a cross-section of regional interests from private industry, academia, non-governmental organizations and state and federal government. SECOORA integrates observations, models, data management and outreach to sustain and advance an end-to-end, regional coastal ocean observing system (RCOOS) responsive to societal needs. An information management system transforms and delivers value-added products and services consistent with priorities identified through stakeholder needs assessments. SECOORA emphasizes coordinating a multidisciplinary suite of coastal ocean observations with numerical models so that societally important phenomena may be described, understood and ultimately predicted via applications of best science practices. This work provides foundational observing, modeling, and data management capabilities to predict and support preparedness to changing conditions, thus enabling resiliency.

US IOOS recognizes the importance of the coasts and ocean for their economic and ecosystem services values. SECOORA is a region where hurricane landfalls are prevalent. The region is also a major tourist destination and a commercial and recreational fishing hub. Through performance, SECOORA has demonstrated both a vision and accomplishments toward meeting the US IOOS goal of societally relevant applied science. SECOORA sustains RCOOS assets consisting of High Frequency Radars (HFR), coastal buoys, subsurface bottom moorings, gliders, and coastal water level stations. These observational components inform and support models across multiple scales and applications. SECOORA works closely with our funded PIs across the four-state region of North Carolina, South Carolina, Georgia, and Florida to maintain our operational assets. These observing assets are critical to coastal communities, mariners, and ports, as they report vital information, such as sea state and wind speed, during tropical storms and hurricanes.

2022 Hurricane Ian Damage

SECOORA supported assets, specifically HFR, water level stations, surface buoys and subsurface moorings in Florida, South Carolina, and North Carolina were damaged during the passage of Hurricane Ian. Hurricane Ian crossed the path of two surface buoys and two subsurface moorings in the Gulf of Mexico on September 28 as a Category 5 Hurricane. It made landfall on the southwest coast of Florida where it then damaged the HFRs located in Venice, FL and destroyed the HFR in Naples, FL. Additionally, water level sensors in Captiva, FL and Sanibel, FL were also destroyed. The storm crossed Florida, and entered the Atlantic Ocean, finally making a second US landfall on September 30 as a category 1 storm near Georgetown, SC. The HFR located in Georgetown, SC was damaged and two buoys off the coast of South Carolina and one buoy off the coast of North Carolina sustained damages. Repairs are needed to bring these stations back into full operation. This critical infrastructure informs us as to whether our ocean 'highways' are safe for work and recreation. Without data, our ability to forecast and respond to future disasters in our region will be significantly impacted.

Objective 1: Hurricane Ian Repairs – High Frequency Radar

HFR provides real-time information on the speed and direction of ocean surface currents over a large coverage area. Four (4) SECOORA supported HFRs were damaged during Hurricane Ian. The specific HFR that were damaged include: Naples CODAR, originally installed in 4/20/05, Venice CODAR, originally installed 4/27/04, Venice WERA, originally installed 6/13/10, and Georgetown WERA, originally installed 2010. All four HFR were originally deployed with Office of Naval Research (ONR) funding.

HFR Environmental Compliance (NEPA): The ongoing maintenance and operation of the Naples CODAR HFR, Venice CODAR HFR, Venice WERA HFR, and Georgetown WERA HFR was incorporated into the SECOORA ocean observing system as part of NOAA award number NA16NOS0120028. The NEPA Memorandum for the Record for NA16NOS0120028 was signed on 3/16/2016 by the IOOS Program Office (Carl Gouldman on behalf of Zdenka Willis). This memorandum specifically included the approval to continue operation of existing HFR in the SECOORA region, which includes the HFR located in Naples, FL, both HFRs in Venice, FL, and the Georgetown, SC HFR. The Memorandum stated that “IOOS determined that this activity (i.e. HFR) is categorically excluded from further NEPA analysis”. Furthermore, all four HFR were reviewed again as part of SECOORA’s current IOOS award, NA21NOS0120097, and the HFR within the region were included in the Categorical Exclusion E3. See Memorandum for the Record for NA21NOS0120097 signed on 05/03/2022 by Krisa M. Arzayus, Deputy Director, US IOOS. All HFR activities related to deployment, operations, and maintenance of assets identified in Objective 1 have been previously reviewed and approved for NEPA compliance. Note that repairing assets damaged from storms, vandalism, or other causes is part of the ongoing maintenance and operation of these systems.

A breakdown of each station including Ian damages and required repairs are listed below

- University of South Florida (USF), Lead PI Cliff Merz, Naples HFR, 5.265 MHz CODAR: The Naples CODAR HFR is located at Loudermilk Park within the City of Naples, FL. The HFR operating system is located inside of the park concession stand and the Transmit (Tx) and Receive (Rx) antenna and cables are located near the beach. Hurricane strength winds and a 6.5-foot-high storm surge completely flooded the concession stand and washed away much of the beach. The Naples HFR operating equipment (computers, radar, A/C units) inside of the concession stand and the exterior equipment (antenna and cables) were destroyed. USF will purchase a new HFR system from CODAR to replace the Naples HFR.
- USF, Lead PI Cliff Merz, Venice HFR, 5.265 MHz CODAR: High water and winds were experienced at the Venice site, damaging the CODAR Tx and Rx antenna. New long-range Tx and Rx antenna (1 each) will be purchased from CODAR and installed at this site.
- USF, Lead PI Cliff Merz, Venice HFR, 13.5 MHz WERA: High water and winds were experienced at the Venice site, causing significant sand erosion which exposed the Rx and Tx WERA system cables and damaged the Rx and Tx antennas. Repairs to the site include the replacement of the 4 Tx antenna and 12 Rx antenna. The antenna will then be tuned once reinstalled and the system evaluated by Helzel (WERA manufacturer).
- University of South Carolina (UofSC), Lead PI George Voulgaris, Georgetown HFR, 5.262 MHz WERA: During Hurricane Ian, 55 mph sustained winds were recorded in Georgetown SC. Winds pushed a 3-to-6-foot storm surge onshore inundating the Georgetown HFR installation and flooding the base station shed that houses the electronic equipment. Specific damages include destruction of the floor inside the shed, flooding of the WERA electrical system leading to corrosion, and flooding of the UPS and Power Amplifier. Sustained high humidity environment inside the shed lead to compromised and reduced operational ability of the WERA Frequency Control Rack requiring its replacement. Due to the age of the damaged equipment, its replacement will require updating of peripherals as to ensure compatibility with the new parts. In the field, the Tx array was destroyed, requiring the purchase of a new Tx antenna array. The connections to the Rx array active antennas were submerged in saltwater for extended period and due to corrosion, all of the Rx antennas will need to be replaced.

Objective 2: Hurricane Ian Repairs - Coastal Real-time Buoys and Subsurface Non Real-time moorings

Buoys moored in our coastal and offshore waters hold a variety of real-time sensors. Two SECOORA members (USF and the University of North Carolina Wilmington (UNCW)) operate the buoys and moorings damaged by Hurricane Ian. These sensors measure conditions such as wind speed, gust and direction, air temperature, water temperature, and wave height. Weather models, such as those operated by the NOAA National Weather Service, assimilate data from these sensors. Two (2) USF real-time buoys, C13 and C22, and 4 UNCW real-time buoys, CHR60, CHR60Wave, SUN2, and SUN2Wave sustained damages. Two non real-time, seafloor moorings operated by USF, C11 and C15, were also damaged during Hurricane Ian. Seafloor sensors provide valuable information about water column currents and seafloor water temperature and salinity. All activities related to deployment, operations, and maintenance of buoy and non real-time assets identified in Objective 2 have been previously reviewed and approved for NEPA compliance. Note that fixing assets damaged from storms, vessel strikes, or other causes is part of the ongoing maintenance and operation of these systems.

USF, Lead PI Yongang Liu, C13 and C22 real-time buoys: Both C13 and C22 are deployed on the West Florida Shelf. Buoy C13, deployed 09/01/1999, is located approximately 60 nm north-northwest of Naples, FL in 50 meters (165 ft) of water. C13 was originally deployed through ONR funding. Buoy C22, deployed 06/27/2019, is located approximately 110 nm south-southwest of Naples, FL in 70 meters (230 ft) of water. C22 was deployed through funding provided by the National Academies of Sciences, Engineering, and Medicine (NASEM). The ongoing maintenance and operation of the C13 buoy was incorporated into the SECOORA ocean observing system as part of NOAA award number NA16NOS0120028. The NEPA Memorandum for the Record for NA16NOS0120028 was signed on 3/16/2016 by the IOOS Program Office (Carl Gouldman on behalf of Zdenka Willis). This memorandum specifically included the approval to continue operation of in situ stations on the West Florida Shelf, including the C13 buoy. The Memorandum stated that “IOOS determined that these activities (i.e. Moorings, Stations, Buoys and Fixed Arrays) are categorically excluded from further NEPA analysis”. Furthermore, C13 was again reviewed and C22 underwent review as part of SECOORA’s current IOOS award, NA21NOS0120097, and the Moorings/Buoys within the region were included in the Categorical Exclusion E3. See Memorandum for the Record for NA21NOS0120097 signed on 05/03/2022 by Krisa M. Arzayus, Deputy Director, US IOOS. Note that fixing assets damaged from storms, vessel strikes, or other causes is part of the ongoing maintenance and operation of these systems.

Both C13 and C22 sustained damage to the above water and below water sensors and buoy structures during the passage of Hurricane Ian. Specific damages and required repairs include:

- Power systems (solar panels, charge controller, batteries and cabling) were damaged beyond repair and will have to be replaced.
- Surface sensors, including wind, relative humidity, air temperature and barometric pressure were damaged and must be replaced.
- Surface lights on the buoy towers, surface hardware (signs, radar reflectors), satellite beacons and antennas all sustained damage and need replacement.
- Below water sensors, including Acoustic Doppler Current Profilers (ADCPs) stopped recording shortly after the storm passed due to damages; Conductivity and Temperature sensors (CTDs) were all damaged. ADCPs and CTDs will have to be replaced.

Both stations will be re-deployed at the existing, US Coast Guard PATON approved and permitted station locations. USF will secure time on small vessels and larger research vessels to re-deploy C13 and C22.

USF, Lead PI Yongang Liu, C11 and C15 non real-time subsurface moorings: C11 and C15 are non real-time, bottom mounted stations. Both moorings are located northwest of Fort Myers, FL. C15 is

deployed in 10 meters (33 ft) of water and C11 is deployed in 20 meters (66 ft) of water. These stations use trawl resistant frames with ADCPs and CTD sensors inside the frames. Both sites were originally deployed with ONR funding on 7/13/1998. The ongoing maintenance and operation of C11 and C15 was incorporated into the SECOORA ocean observing system as part of NOAA award number NA16NOS0120028. The NEPA Memorandum for the Record for NA16NOS0120028 was signed on 3/16/2016 by the IOOS Program Office (Carl Gouldman on behalf of Zdenka Willis). This memorandum specifically included the approval to continue operation of in situ stations on the West Florida Shelf. The Memorandum stated that "IOOS determined that these activities (i.e. Moorings, Stations, Buoys and Fixed Arrays) are categorically excluded from further NEPA analysis". Furthermore, C11 and C15 were again reviewed as part of SECOORA's current IOOS award, NA21NOS0120097, and the Moorings/Buoys within the region were included in the Categorical Exclusion E3. See Memorandum for the Record for NA21NOS0120097 signed on 05/03/2022 by Krisa M. Arzayus, Deputy Director, US IOOS. Note that fixing assets damaged from storms, vessel strikes, or other causes is part of the ongoing maintenance and operation of these systems.

C11 and C15 both sustained damages due to sand movement caused by high wave action during the storm. Sensors and bottom frames were silted in, making recovery of the systems difficult.

- The ADCPs and CTDs at both C11 and C15 were damaged along with the C15 trawl resistant frame. New ADCPs and CTDs and a new bottom frame will be purchased and installed.

Both stations will be re-deployed at their originally approved and permitted station locations. USF will secure time on small vessels and larger research vessels to re-deploy C11 and C15.

UNCW, Lead PI Lynn Leonard, SUN2, SUN2Wave, CHR60, and CHR60Wave real-time buoys: The SUN2 buoy was originally deployed on 12/15/05 through NOAA Coastal Ocean Technology (COTS) funding and the SUN2Wave buoy was deployed 3/2012 through NOAA IOOS funding. The ongoing maintenance and operation of the SUN2 and SUN2Wave buoys was incorporated into the SECOORA ocean observing system as part of NOAA award number NA16NOS0120028. The NEPA Memorandum for the Record for NA16NOS0120028 was signed on 3/16/2016 by the IOOS Program Office (Carl Gouldman on behalf of Zdenka Willis). This memorandum specifically included the approval to continue operation of in situ stations off the Carolina coast. The Memorandum stated that "IOOS determined that these activities (i.e. Moorings, Stations, Buoys and Fixed Arrays) are categorically excluded from further NEPA analysis". Furthermore, SUN2 and SUN2Wave were again reviewed as part of SECOORA's current IOOS award, NA21NOS0120097, and the Moorings/Buoys within the region were included in the Categorical Exclusion E3. See Memorandum for the Record for NA21NOS0120097 signed on 05/03/2022 by Krisa M. Arzayus, Deputy Director, US IOOS. The CHR60 and CHR60Wave buoys were installed on 3/18/2022 as part of the current SECOORA IOOS award, NA21NOS0120097. These two buoys underwent their own NEPA/Environmental Compliance Review with the Memorandum for the Record for NA21NOS0120097 signed by Mequela Moreno on 2/3/2022, stating "based upon the above analysis, NOAA has determined that Task 1 (deployment and operation of 2 buoys off the coast of Charleston, SC) falls within IOOS PEA Page Section and numbers(s): page 1-6 to 1-7. The PEA presents a programmatic analysis of potential impacts associated with the implementation of the IOOS Office technologies and activities, including installation, operation, and maintenance. Note that fixing assets damaged from storms, vessel strikes, or other causes is part of the ongoing maintenance and operation of these systems.

Specific damages and repairs required for the UNCW buoys are described below:

- SUN2: The SBE-16 CTD onboard sustained damage to the inductive modem communications system which caused a loss of surface water temperature and salinity data. This CTD will need to

be replaced. One solar panel and power system cabling were also destroyed. The panel and cabling will be purchased and replaced.

- SUN2Wave: The Sofar spotter buoy sustained water intrusion that compromised the electronics onboard as well as damage to the buoy mooring. The buoy and mooring will need to be replaced.
- CHR60: The buoy sustained damage to one solar panel as well as the power system cabling. The panel and cabling will be purchased and replaced.
- CHR60WAVE: The Sofar spotter buoy sustained water intrusion that compromised the electronics onboard as well as damage to the buoy mooring. The buoy and mooring will need to be replaced.

All four stations will be re-deployed at the existing, US Coast Guard PATON approved and permitted station locations. UNCW will redeploy buoys during regularly scheduled buoy turnaround cruises (i.e., additional ship time is not being requested).

Objective 3: Hurricane Ian Repairs - Water Level Sensors

Four (4) water level sensors were destroyed during the passage of Hurricane Ian. All 4 sensors are operated by the American Shore and Beach Preservation Association (ASBPA) and Hohonu, Inc. The specific sensor locations are in Sanibel, FL; Captiva, FL; Oyster Landing, SC; and Georgetown, SC. Funding will be used to purchase and install four new water level sensors. All activities under Objective 3 have been previously reviewed and approved for NEPA compliance related to deployment and ongoing operation and maintenance of the systems. Fixing assets damaged from storms, vandalism, or other causes is part of the ongoing maintenance and operation of these systems.

Water Level Environmental Compliance (NEPA): The SECOORA water level imitative reviewed as part of SECOORA's current IOOS award, NA21NOS0120097, and the Tide gauges and water level sensors within the region were included in the Categorical Exclusion E3. See Memorandum for the Record for NA21NOS0120097 signed on 05/03/2022 by Krisa M. Arzayus, Deputy Director, US IOOS. Additionally, SECOORA staff manage a shared Google Worksheet to track individual sensor deployment sites:

https://docs.google.com/spreadsheets/d/10KN3sdkzaUR-Kf_TbC-YI0d1mcCqWH6pvWowcQVbB8o/edit?usp=sharing. This worksheet is shared with the IOOS

Environmental Compliance Manager so the EC manager can assure that SECOORA is using ERMA to verify that potential sensor deployment locations are not conducted in areas identified in the National Historic Register. Fixing assets damaged from storms, vandalism, or other causes is part of the ongoing maintenance and operation of these systems.

Hurricane Repairs Timeline and Milestone Chart

Funding provided by the *DRSA Repair and Replacement of Observing Assets, Real Property, and Equipment in the Gulf of Mexico, Southeast, and Caribbean Regions* will be used to repair or replace existing operational observing systems damaged or destroyed by Hurricane Ian. SECOORA will set up a call with all subawardees to review the reporting requirements for this award, issue subawardee contracts, and track overall progress towards repairing assets damaged during Hurricane Ian. While each system and location will have unique needs in terms of supplies, equipment, and site access (car v/s ship), Tasks A through K, as listed in the Milestone chart (page 7), are generally applicable to all the repairs and replacements proposed. Our goal is to have all assets fully operational within 18-20 months of receipt of award. It is anticipated that some repairs/replacements, such as the water level sensors, will be completed within 12 months. However, equipment manufacturer inventory and delivery capabilities, specifically related to HFR and buoy based sensors, are beyond our control. SECOORA will

be actively working with all of our operators to effectively plan and implement all the steps necessary to complete work as soon as feasible.

SECOORA Timeline and Milestone Chart								
Tasks / Timeline	Year 1				Year 2			
	QTR 1	QTR 2	QTR 3	QTR 4	QTR 5	QTR 6	QTR 7	QTR 8
A. Meet with partners to review repair award conditions, milestones	X							
B. Issue subcontracts to partners	X							
C. Coordinate and manage subawards	X	X	X	X	X	X	X	X
D. Order supplies/equipment	X	X	X					
E. Receive supplies/equipment	X	X	X	X	X			
F. Integrate replacement sensors into overall systems (HFR, real-time buoys)			X	X	X	X		
G. Complete field-based repairs/deployments			X	X	X	X	X	
H. Verify sites are fully operational				X	X	X	X	
I. Data QA/QC by partners to assure sites are fully operational				X	X	X	X	
J. Data flowing to SECOORA/ IOOS				X	X	X	X	X
K. Progress Report submission & Final report		X		X		X		X

Data Management Plan

All the stations included in this proposal are existing SECOORA stations. The HFR operators submit data to the HFR DAC and to SECOORA. The buoy teams at UNCW and USF submit real-time buoy data to SECOORA where it is shared on the SECOORA data portal and shared, via ERDDAP services, with the NOAA National Data Buoy Center (NDBC). Non real-time mooring data are shared approximately every 6 months when seafloor sensors are swapped and the data are post processed and quality controlled. These quality-controlled data are shared via the Axiom Data Science Research Workspace and then ingested into the SECOORA data portal. Water level data are shared in real-time with SECOORA and displayed on the SECOORA data portal. The SECOORA Data Management Plan is found here:

<https://secoora.org/certification/> and Appendix F – Funded Data Stream Inventory (https://secoora.org/wp-content/uploads/2022/05/0-APPENDIX_F_FundedDataStreamsInventory.pdf) provides direct links to individual data provider data sharing plans.