



Advancing Coastal Intelligence in the US Caribbean: Surface Currents

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Performance Period: June 1, 2020 – November 30, 2020

LONG-TERM GOALS

Rutgers University Center for Ocean Observing Leadership (RUCOOL) is a global leader in High-Frequency radar (HFR) network implementation and management. Through this proposal, RUCOOL looks to assist CariCOOS in the expansion and operation of their HFR network. The US Coast Guard has identified the ocean surface current data from the five existing HFR stations as an important resource for their search and rescue activities. The real-time surface current information improves the decision-making capabilities during critical lifesaving search and rescue missions.

The HFR network is part of the observational sensor subsystem for CariCOOS. The other subsystem for CariCOOS is a modeling and forecast component. The subsystem is comprised of wave, storm surge, wind and ocean circulation models. The ocean circulation model is based upon the Regional Ocean Modeling System (ROMS). The goal of this proposal is to compare the surface current measurements of the HF radar network with the output of the circulation model and test the capability of the other models to assimilate the measured ocean surface current data.

MILESTONES / OBJECTIVES

No.	Deliverable	Delivery Date	Status
1	Deliver paper on latest improvements of Sargassum tracking method at OCEANS 2020 virtual meeting	Oct 31, 2020	Complete
2	Evaluate the NOAA Maximum Chlorophyll Index product in comparison to the USF AFAI product for estimating Sargassum around Puerto Rico and the Virgin Islands	Dec 31, 2020	Complete
3	Develop a validation method of the Sargassum Tracker for beaching events	Feb 15, 2021	On Schedule
4	Evaluate if the CARICOOS FVCOM surface current product outperforms the AMSEAS model product for beaching events and/or coastal circulation.	Mar 15, 2021	On Schedule
5	Attend CARICOOS General Assembly	Apr 2021	TBD



WORK COMPLETED

- Presented paper on latest development of Sargassum Tracker at MTS/IEEE OCEANS Conference entitled “Integration of Additional Products into the Sargassum Seaweed Tracker”
- The HFR network underperformed during this progress period due to comms equipment issues at FARO and a prolonged power outage at MABO primarily resulting from Tropical Storm Laura. The radial data availability over the progress period is provided in Figure 1 and the total vector availability is given in Figure 2. The total vector drop in mid July to mid August correlates with the vacant radial vector field from sites FARO and MABO. The FARO radial data could not be pushed to the CARICOOS AWS platform during that time gap, however that data was manually transferred to the AWS at the end of the progress period. We are working with the National Network to transfer the data now and have it integrated into the totals for the archives.
- We computed monthly mean total vector maps, radial vector maps and radial vector coverage maps. Only the total vector map for November 2020 (Figure 3) is presented in the progress report. The other maps are available upon request.
- Operated drifter code to validate AMSEAS model for 169 of the 183 days in the progress period. A time series map of drifter separation between HF radar drifters and AMSEAS drifters is presented in Figure 4. The gaps in the time series are due to lack of coverage from the radar network. It should also be noted that the radar network could only sustain trajectories for 24 hours on a few occasions. The radar sites CDDO and MABO experience the largest drops in coverage at night.
- Generated daily maps of AFAI and MCI satellite products from June 1 to December 1, 2020. We identified 13 instances where there were MCI values above 0.06 to indicate the presence of floating algae (Figure 5).
- We identified a sargassum beaching event on May 2, 2020. We used this as a test case to compare the AMSEAS currents with the FVCOM currents (Figure 6). This beaching event coincided with one of the MCI instances that we identified which bodes well for utilizing the MCI product as a proxy for Sargassum. This beaching event was discussed in my presentation at the Biloxi OCEANS meeting.
- We obtained Sargassum beaching event data for 2019 from the website <http://sargassummonitoring.com> . We will analyze the drifter data sets from 2019 to see if the model currents explained the beaching events.



CARICOOS

CARIBBEAN COASTAL OCEAN OBSERVING SYSTEM

MAJOR OUTCOMES

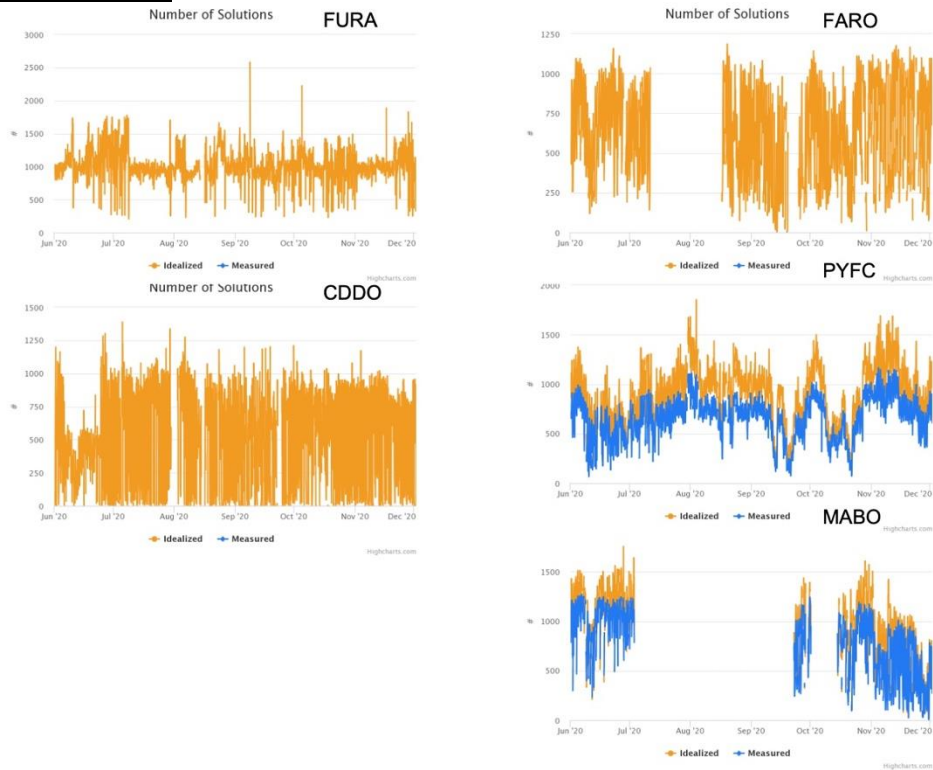
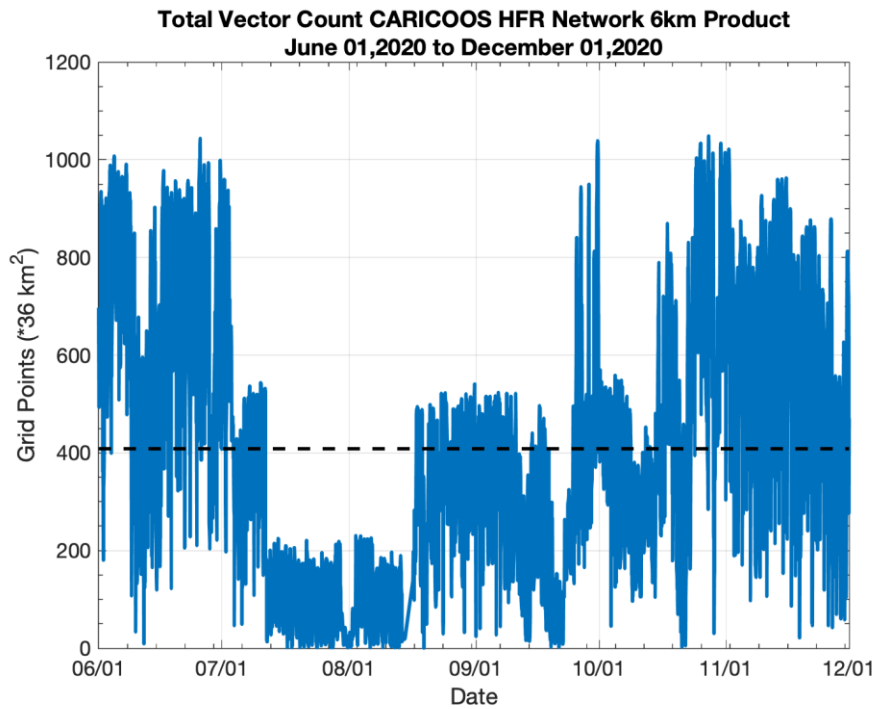


Figure 1: Ideal (orange) and measured (blue) radial data availability of the 5 HF radar stations in Puerto Rico on the National Network servers for June 1, 2020 to December 1, 2020.



:/03/20 CARICOOS_6km_Total_Vector_Count_20200601_00001.png / time_series_from_05_NN.nc_vector_count.m

Figure 2: Time series of 6 km total vector coverage. The dashed black line represents the mean coverage for the progress period which equates to approximately 14,400 km².



CARICOOS

CARIBBEAN COASTAL OCEAN OBSERVING SYSTEM

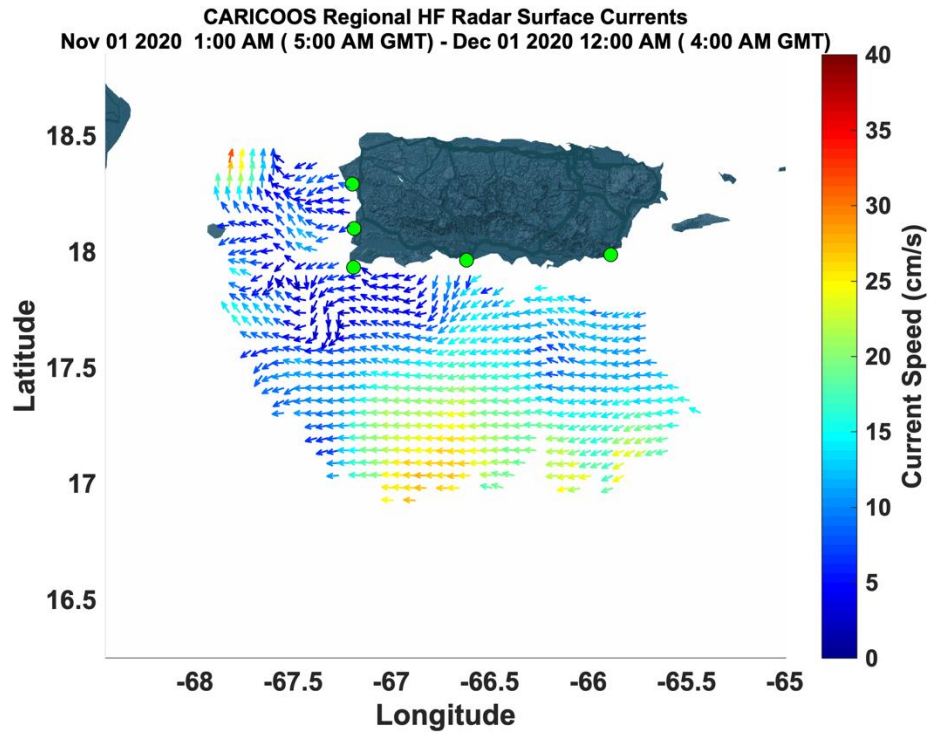


Figure 3: Monthly mean total vector map for November 2020. The map requires 40% data coverage to plot a vector as a quality control measure.

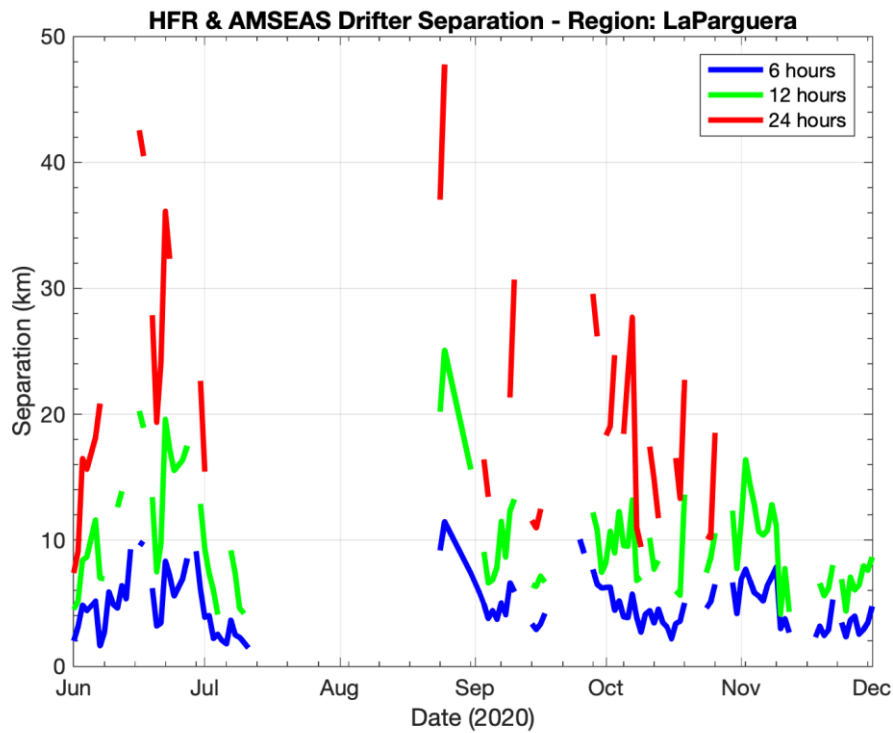


Figure 4: Average separation between the 169 virtual trajectories from HFR and AMSEAS after 6 (blue), 12 (green) and 24 hours (red) for the La Parguera sub region. The simulations were generated from June to December 2020.

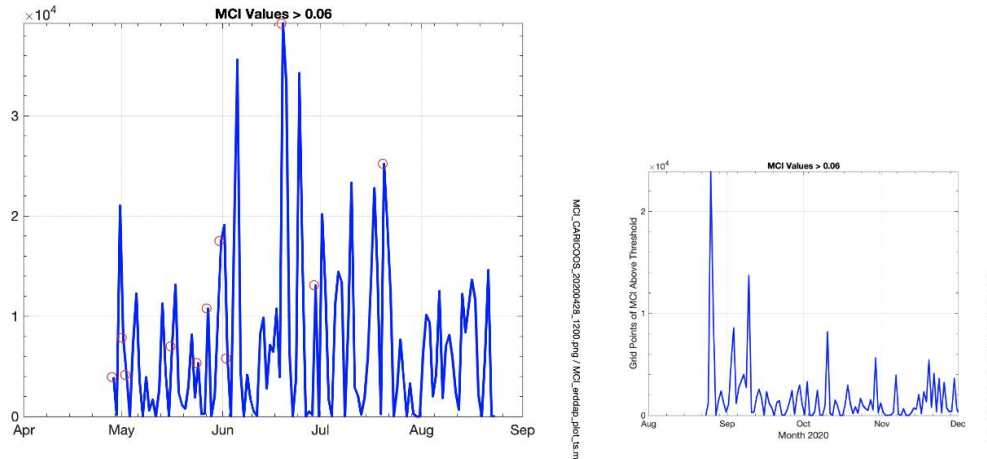


Figure 5: Time series of number of pixels above 0.06 for Maximum Chlorophyll Index (MCI) from April to August 2020 (left) and from August to December 2020 (right).

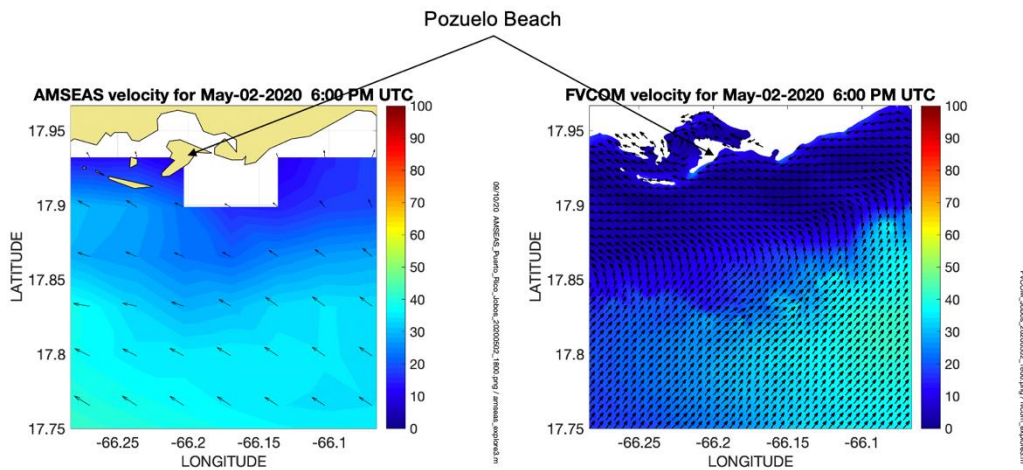


Figure 6: Map of surface currents near the time of the Sargassum beaching event on May 2, 2020. The currents from the AMSEAS model (left) and FVCOM model (right) along with a 0-100 cm/s colorbar are shown.

RELATED PROJECTS

The work being conducted here is closely aligned with the HFR surface current work being conducted within MARACOOS.

WORK PLAN FOR UPCOMING PERFORMANCE PERIOD (Dec 1, 2020 – May 31, 2021)

- We will set up a transfer of the FVCOM model output from CARICOOS to Rutgers. We will then initiate surface drifter trajectories with the FVCOM model output to compare against the HFR and AMSEAS surface drifters.
- Two new HF radar sites are expected to be installed in St. Thomas and in the San Juan Bay as part of the network expansion.

PUBLICATIONS & PRODUCTS

1. Roarty, Anarumo, Canals, Xu (2020) "Integration of Additional Products into the Sargassum Seaweed Tracker" MTS/IEEE OCEANS Biloxi Virtual