

The CARICOOS Operational Wave Modeling System

Investigator:

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LONG-TERM GOALS

Develop accurate, high-resolution operational wave models and wave-prediction products with the goal of enhancing available information that supports decision-making by stakeholders in the maritime sector.

MILESTONES / OBJECTIVES

The following table includes the wave modeling milestones / tasks as included in the FY16 scope of work, and their current status.

MILESTONE / TASK	Q1	Q2	Q3	Q4	Original Completion Date	Status
Improve wave, current and circulation modeling for ports in the region					May 2017	On-Track
Continue operation of the Yabucoa Port Metocean observation and prediction system					May 2017	On-Track
Implement a new version of the CARICOOS sea state point forecast online interface with integrated wave height maps					May 2017	Complete (October 2016)
Develop an online product to provide along-track sea state forecasts (waves, wind) for popular shipping and boating routes in the region					May 2017	On Track
Maintain and enhance the operational CARICOOS - Sea Grant Nearshore Breaker Model					May 2017	On Track
Continue and enhance SWAN modeling					May 2017	On Track

MILESTONE / TASK	Q1	Q2	Q3	Q4	Original Completion Date	Status
Explore operational implementation of unstructured SWAN					May 2017	On Track

These objectives do not include Dr. Canals' duties as CARICOOS Technical Director.

WORK COMPLETED

1. Improve wave, current and circulation modeling for ports in the region

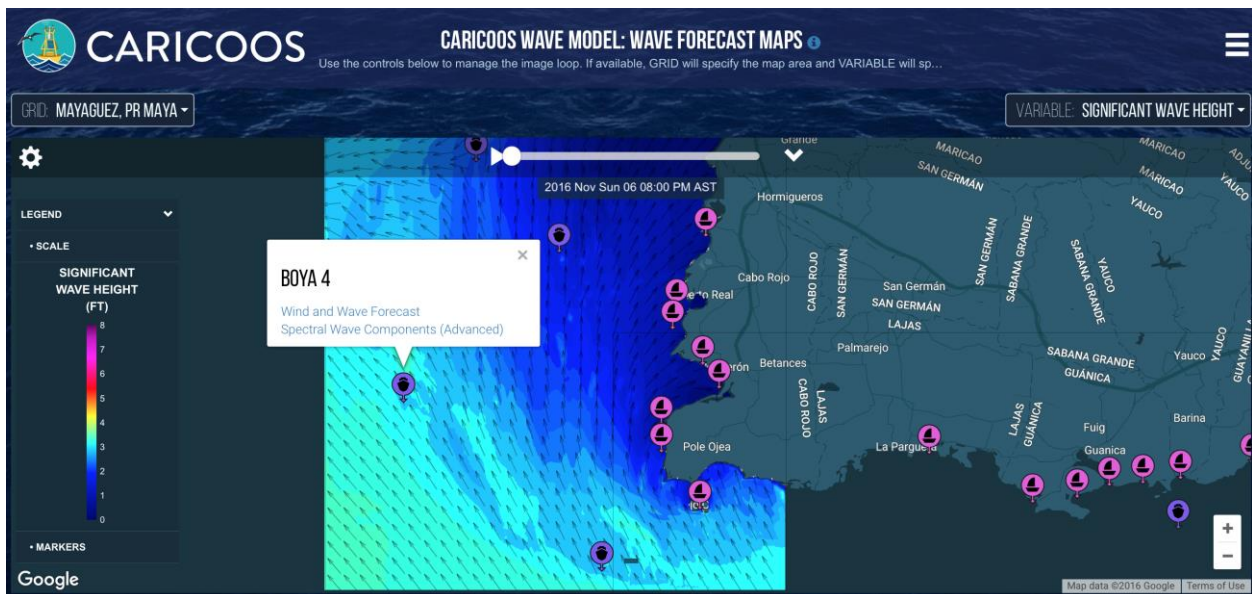
Improved spatial resolution of the CARICOOS Nearshore Wave Model (CNWM) at several grids with important ports (see 6 below).

2. Continue operation of the Yabucoa Port Metocean observation and prediction system

The Yabucoa operational wave model has run successfully since its release in April 2016.

3. Implement a new version of the CARICOOS sea state point forecast online interface with integrated wave height maps

A new interface for the CNWM was conceived and developed in collaboration with Candela Creative Group (CARICOOS contractors). This new interface combines high-resolution graphics with transparent backgrounds and the Google Maps API to allow stakeholders to zoom in to nearshore areas and exploit the full resolution of the CNWM. Point forecasts can be visualized on top of the wave contour plots, as shown below:



4. Develop an online product to provide along-track sea state forecasts (waves, wind) for popular shipping and boating routes in the region

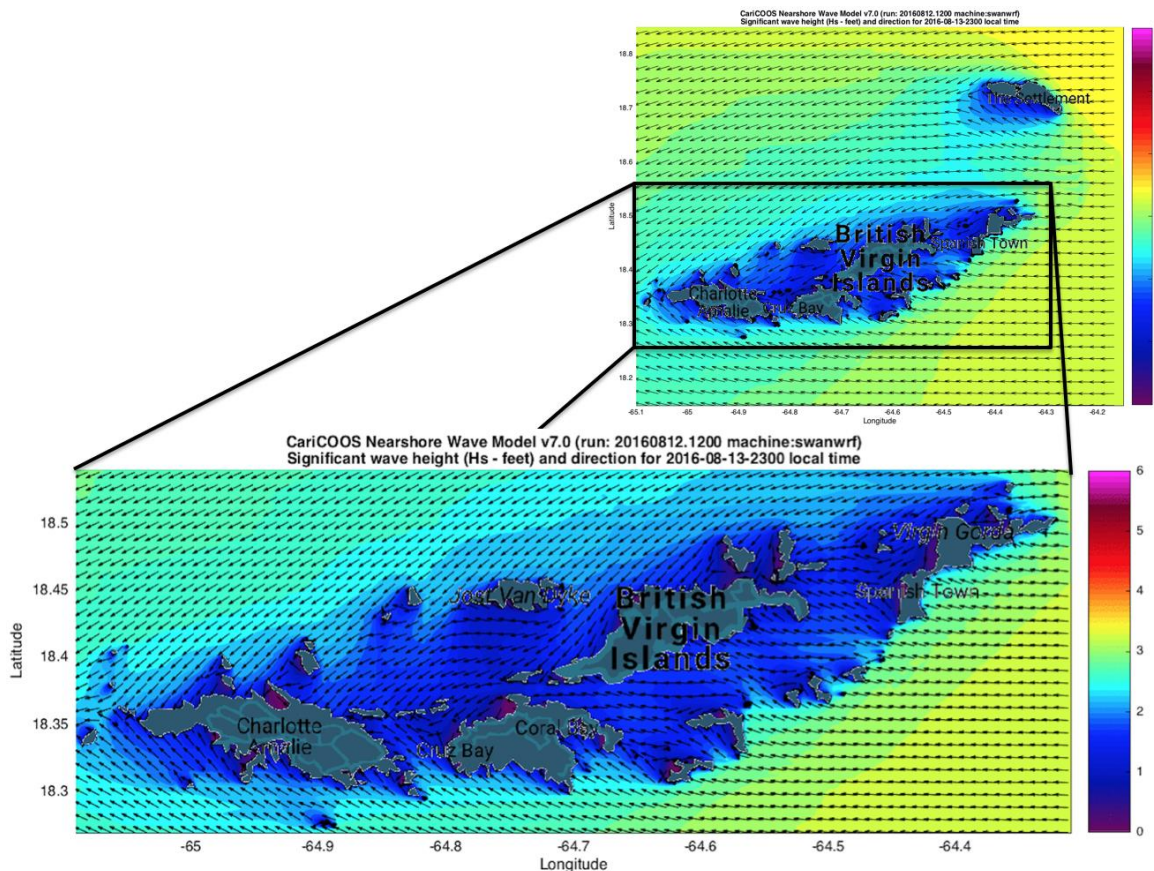
This task is under development and a beta version should be ready for the 2017 CARICOOS General Assembly.

5. Maintain and enhance the operational CARICOOS - Sea Grant Nearshore Breaker Model

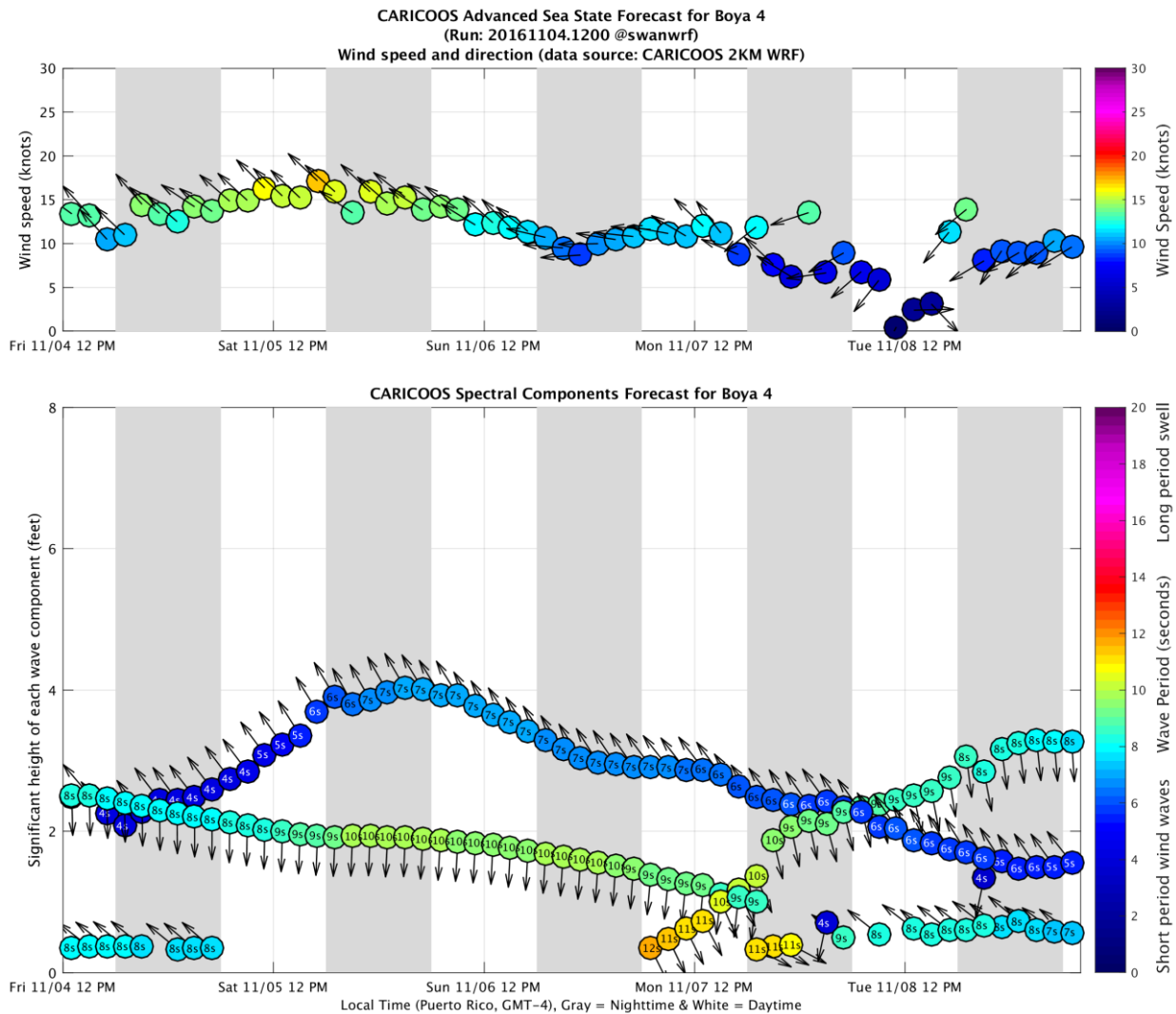
The Nearshore Breaker Model (NBM) is currently being enhanced to take advantage of the new 2D spectral partitioning capabilities included in the latest version of the CNWM. The current implementation of the NBM uses a 1D spectral partitioning technique to compute breaker heights.

6. Continue and enhance SWAN modeling

A major upgrade to the CARICOOS Nearshore Wave Model was completed in August 2016. This upgrade includes a major restructuring of some nested grids, including a new Virgin Islands Shelf (VISH) and a Virgin Islands High-Resolution (VIHR) grid, and increasing the PONCE grid to 120 meter resolution (from 240 meters). An experimental Rincon High-Resolution grid at 20 meter resolution was also added in support of several observational campaigns at the Rincon testbed site. The figure below shows the new Virgin Islands high-resolution grids:



Based on stakeholder feedback, new plots showing forecasts of individual spectral components have replaced the full 2D spectral graphics in the previous version of the CNWM. The figure below shows an example: the top plot shows wind speed and direction from CARICOOS WRF. The bottom plot shows individual wave components obtained from spectral partitioning. Colors indicate the peak wave period of each partition.



7. Explore operational implementation of unstructured SWAN

Ongoing. Both the unstructured version of SWAN and the FVCOM unstructured implementation of SWAN (FVCOM-SWAVE) are being explored to determine whether developing an unstructured version of the CNWM is cost effective and/or provides better nearshore forecasts of wave conditions.

MAJOR OUTCOMES

The most important improvement to the CNWM was the upgrade to SWAN 41.10, which for the first time has included spectral partitioning capabilities. SWAN 41.10 uses spectral partitioning algorithms (see Hanson & Phillips, 2001; Portilla et al., 2009) to decompose a 2D SWAN spectrum into individual wave components in frequency and direction space.

WORK PLAN FOR UPCOMING PERFORMANCE PERIOD (Dec. 1 – May 31 2016)

Work will focus on new products including contour plots of spatially coherent fields of spectral wave components (using 2D spectral partitioning), as well as making wave-related products more user friendly. The latter will be accomplished by providing “simple” and “advanced” graphics aimed at targeting the broad spectrum of CARICOOS stakeholders with very different levels of technical expertise.

RELATED PROJECTS

None

REFERENCES

Portilla, J., F. J. Ocampo-Torres, and J. Monbaliu 2009: Spectral Partitioning and Identification of Wind Sea and Swell, *Journal of Atmospheric and Oceanic Technology*, Volume 26, Issue 1 (January 2009), pp. 107–122.

Hanson, J.L. and O.M. Phillips, 2001: Automated Analysis of Ocean Surface Directional Wave Spectra, *Journal of Atmospheric and Oceanic Technology*, Volume 18, Issue 2 (February 2001), pp. 277–293.

RELATED PUBLICATIONS & PRODUCTS

Loefler, C., Smith, T., Canals MC, Brandt ME. Ciguatera Fish Poisoning: Regional and species specific differences in the content and concentrations of ciguatoxin identified in marketable fish of the U.S. Virgin Islands (*to be submitted*)

CARICOOS Nearshore Wave Model Version 8.0:

<http://www.caricoos.org/waves/forecast/SWAN/PRVI/hsig>