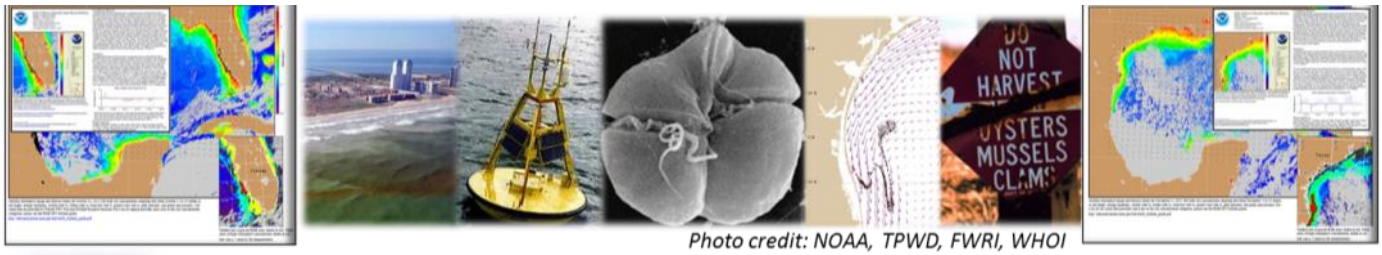


Photo credit: NOAA, TPWD, FWRI, WHOI

Issue 8 June 2014

# NOAA HAB-OFS Newsletter

Welcome to the NOAA HAB-OFS Quarterly Newsletter. We are always happy to hear from you so please send your topic suggestions, questions, comments and feedback to hab@noaa.gov.

## In this issue:



## New Satellite Imagery Ensemble Products to Enhance HAB Detection

In order to make improvements to the Gulf of Mexico Harmful Algal Bloom Operational Forecast System (GOMX HAB-OFS), the team works closely with partners to evaluate new data sources and enhancements to existing data products and forecasting tools. Satellite ocean color imagery is a key component of the HAB-OFS analysis because it is used for the early detection of *Karenia brevis* blooms in the Gulf of Mexico, as well as bloom transport and intensification forecast verification. The HAB-OFS team has been examining algorithms that recent research has indicated may improve *K. brevis* bloom detection in satellite imagery.

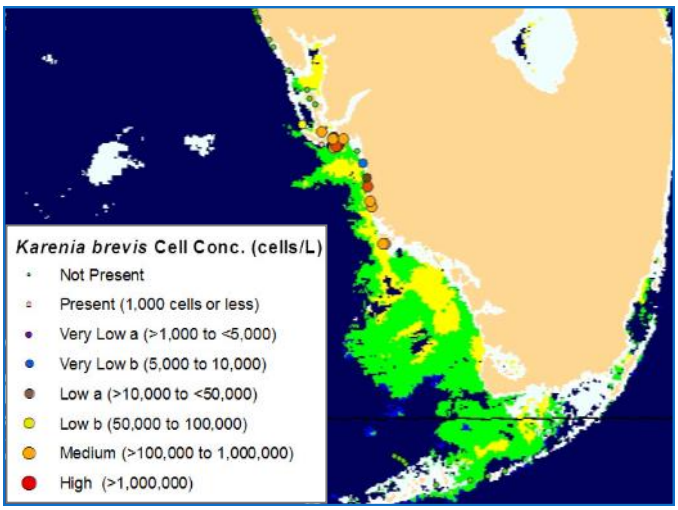


***Figure 1.*** *In the image above, pixels are highlighted by the ensemble algorithm products as follows: BLUE=chlorophyll anomaly only, GREEN=spectral shape 490nm + chlorophyll anomaly, TURQUOISE=backscatter ratio $b_{bp}$ + chlorophyll anomaly, and YELLOW=spectral shape 490nm+backscatter ratio $b_{bp}$ + chlorophyll anomaly.*

The primary source of ocean color imagery currently used by the HAB-OFS is derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) Aqua satellite, provided by NOAA's CoastWatch Program. To assist with *K. brevis* bloom identification, MODIS imagery is processed using a chlorophyll algorithm that highlights areas of anomalously high chlorophyll by comparing daily real-time chlorophyll to a 60 day running mean ending two weeks prior to the present (Stumpf, et al., 2003). Since *K. brevis* blooms tend to be mono-specific once they are established, the chlorophyll anomaly product is an effective tool for identifying regions of high chlorophyll created by the blooms. Yet, the chlorophyll anomaly product is not specific to *K. brevis* and may also highlight areas of high chlorophyll created by blooms of non-toxic phytoplankton species. These false alarms are especially problematic during the *K. brevis* offseason when non-toxic phytoplankton blooms are common and in the Florida Bay and Florida Keys region where the imagery is less reliable at distinguishing between algal blooms and the resuspension of benthic chlorophyll. To refine *K. brevis* detection, Tomlinson et al. (2009) recommended an ensemble approach that combined the currently used chlorophyll anomaly with algorithms that targeted specific properties of *K.* brevis blooms. One of the algorithms selected accounts for the relative particulate backscatter of blooms (Cannizzaro et al. 2008) and the other looks at how *K. brevis* blooms change the spectral shape characteristics in the blue wavelengths (at 490 nm) (Tomlinson et al. 2009).

Recently, to determine their effectiveness for operational use, the HAB-OFS evaluated the ensemble imagery products that combine the chlorophyll anomaly, backscatter ratio, and spectral shape at 490 nm. A comparative analysis of the current chlorophyll anomaly product and the ensemble products was performed on a sample set of images from the southwest Florida coast between April 2010 and December 2013. Through the overlay of *K. brevis* water samples, imagery was evaluated to compare how well the ensemble products performed at bloom detection.

Results from the evaluation indicated that the ensemble imagery would be a beneficial addition to the operational HAB bulletins in several ways. The ensemble products decreased false positives along the coast

*(continued from page 1)* in the region of southwest Florida where bloom initiation is most common, from approximately Tampa to Cape Romano. The ensembles also targeted the spatial extent of *K. brevis* blooms more specifically than the chlorophyll anomaly alone. The full and backscatter ensemble products reduced the over-prediction of *K. brevis* bloom presence, particularly in January to July when their formation is less common. The results of this analysis are currently being summarized in a report and with approval from CO-OPS, the goal is to incorporate the ensemble imagery products into future HAB-OFS bulletins.

**References:**

Cannizzaro, J., Carder, K., Chen, F., Heil, C., Vargo, G. (2008). A novel technique for detection of the toxic dinoflagellate *Karenia brevis* in the Gulf of Mexico from remotely sensed ocean color data. *Continental Shelf Research*, *28*, 137-158.

Stumpf, R., Culver, M., Tester, P., Tomlinson, M., Kirkpatrick, G., Pederson, B., Truby, E., Ransibrahmanakul, V., Soracco, M. (2003). Monitoring Karenia brevis blooms in the Gulf of Mexico using satellite ocean color imagery and other data. *Harmful Algae*, 147-160.

Tomlinson, M. C., Wynne, T. T., & Stumpf, R. P. (2009). An evaluation of remote sensing techniques for enhanced detection of the toxic dinoflagellate, *Karenia brevis*. *Remote Sensing of Environment*, *113*, 598-609.

## Latest HAB-OFS Website Additions: Maps of Forecast Regions

The HAB-OFS Conditions Reports provide daily forecasts of the highest potential level of respiratory irritation associated with *Karenia brevis* blooms for each forecast region. Since these forecasts are based on National Weather Service forecasted winds and available observational data, including reports of respiratory irritation and water samples collected by our partners in Florida and Texas, the HAB-OFS cannot accurately predict respiratory irritation at a particular beach. The forecast resolution is limited to 30-60km forecast regions defined and referenced by the HAB-OFS team. Now, the team is in the process of providing maps of the forecast regions on the website, with the hopes of making it easier to interpret the forecasts. It is always important to remember that levels of respiratory irritation vary locally so if a forecast is issued for a particular region, only some coastal areas with nearby bloom concentrations and specific wind and surf conditions will experience impacts. That is why the HAB-OFS also lists sources of recent, local observations on the Local Beach Conditions page.

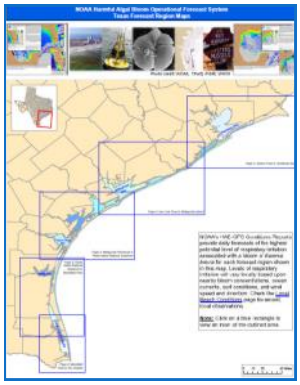

***Figure 2.*** *Click the image to go to the Texas forecast region map.*

## Innovative Tool for Improved Respiratory Irritation Forecasts

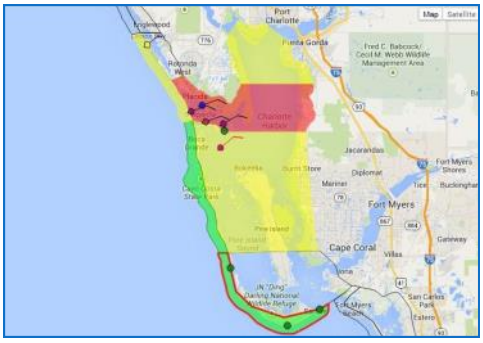


***Figure 3.*** *View of the HABIT tool internally-used to automate the respiratory irritation forecasting process. Color-coded polygons show the forecast level, K. brevis cell concentrations and wind forecasts. Analysts may modify the predicted levels based on advanced knowledge of the bloom scenario.*

The HAB-OFS team recently developed a new forecasting tool in cooperation with NOAA's Harmful Algal BloomS Observing System (HABSOS) team at the National Coastal Data Development Center (NCDDC). The Harmful Algal Bloom Impacts Tracker (HABIT), is programmed to automatically compare *Karenia brevis* cell count data (received from the HAB-OFS data providers) and wind forecasts from the National Digital Forecast Database to create an estimated level of respiratory irritation using a set of vetted Boolean rules. This automation is a major improvement in efficiency over the current mental integration methods employed by the HAB-OFS team. The HAB-OFS team will have more time to thoroughly consider special cases and subtle changes in conditions that can alter bloom dynamics and then modify the forecast levels accordingly. This in turn may also result in improved forecast accuracy. Additionally, the forecast output of HABIT will be displayed as a selectable layer on the HABSOS web map with links to the HAB-OFS website. In the future, the layer may also be added to the HAB bulletin. The first version of HABIT was developed for southwest Florida, but the Gulf Coast of Texas and other regions of Florida will be added in the near future.

**Many Thanks to our Partners and Data Providers**

**http://tidesandcurrents.noaa.gov/hab/contributors.html**

***This newsletter was written and designed by:***

NOAA/National Ocean Service

**Center for Operational Oceanographic Products and Services (CO-OPS)**

**National Center for Coastal Ocean Science (NCCOS)**

***Please send us your feedback and topic suggestions:***

Email: **hab@noaa.gov**

Web: **http://tidesandcurrents.noaa.gov/hab**

Facebook: **http://www.facebook.com/Habredtidewatchnoaagov**