

# Forecasts of Pelagic *Sargassum* Blooms and Transports in the Intra-Americas Sea and Tropical Atlantic: Improving a Prototype Decision-making Tool

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Collaborators and partners: Brian Barnes, Mengqiu Wang, Brian Lapointe, Amy Sinuda, Jean-Philippe Maréchal, Jim Franks, Sargasso Sea Commission, Seakeepers.....

NASA Biodiversity and Ecological Forecasting Team Meeting, Apr 24-26, 2018,  
Embassy Suites by Hilton Washington DC Convention Center  
Washington, DC

# What *Sargassum*?

*Sargassum fluitans*



*Sargassum natans*



Photo credit: Amy Sinuda of Sea Education Association

# The Good and the Bad



Photo courtesy: Tracey Villareal (U. Texas)

- *Sargassum* provide food and shade to many animals (fish, young turtles, shrimp, crab, etc.) and serves as an important ecosystem habitat, and it also supports sand dunes and shoreline stabilization
- “The golden floating rainforest of the Atlantic Ocean” (The Sargasso Sea Alliance)

# The Good and the Bad



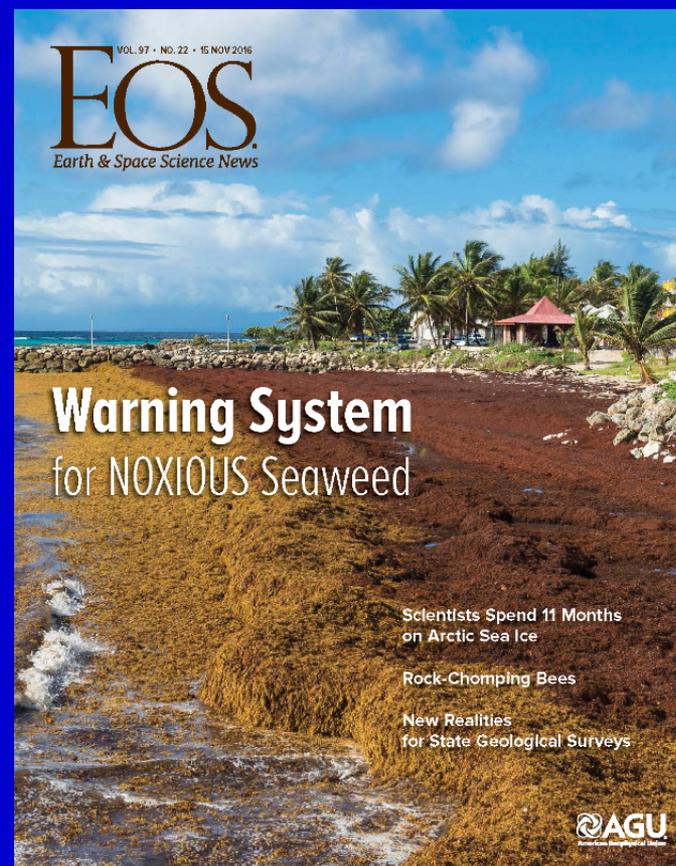
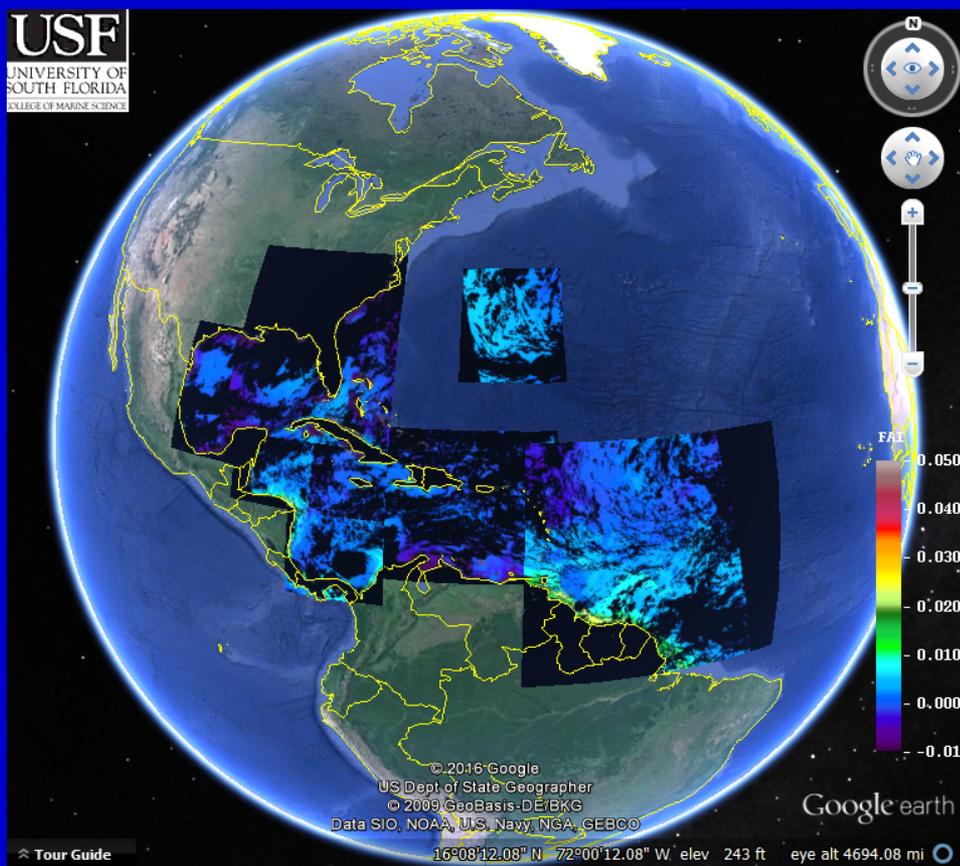
*Sargassum* beaching in the Caribbean (photo courtesy of Jean-Philippe Maréchal)

Excessive *Sargassum* beaching is bad

- Smells bad, attracts insects,
- Smother turtle nesting sites
- Cause sea turtle and fish mortality
- Negative impact on tourism and economy
- Requires physical removal

# Satellite-based near real-time *Sargassum* Watch System (SaWS)

<http://optics.marine.usf.edu/projects/SaWS.html>



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The screenshot displays a web browser window with the URL [optics.marine.usf.edu/projects/SaWS.html](http://optics.marine.usf.edu/projects/SaWS.html). The page title is "Satellite-based Sargassum Watch System (SaWS)".

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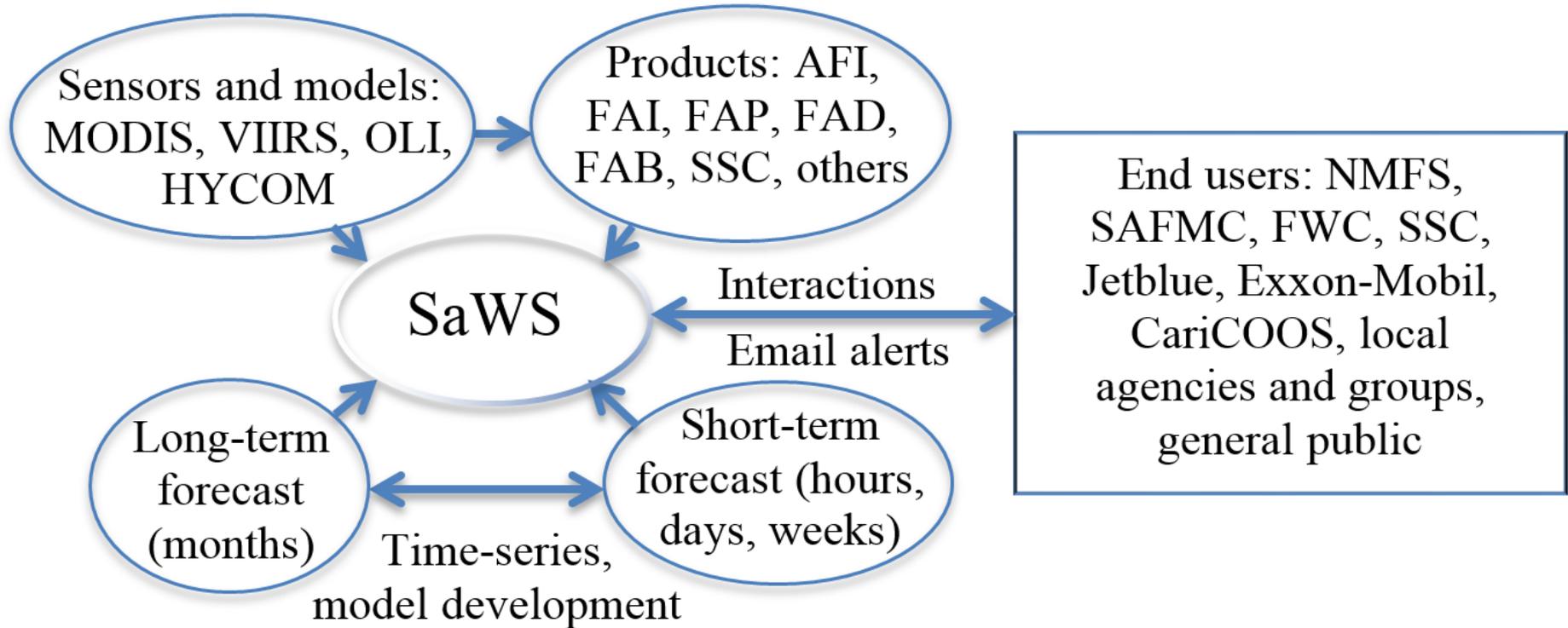
- What is SaWS?
- How Sargassum is Monitored
- Where the Images are Found
- Integration of Ocean Currents
- Photo Gallery
- References

**Two Sargassum Species**

The main content area features a photograph titled "Two Sargassum Species". The image shows a person wearing a light-colored, short-sleeved button-down shirt, holding two large, dense clumps of Sargassum seaweed. The seaweed on the left is bright yellow, while the one on the right is a mix of yellow and reddish-orange. The background is a clear blue ocean.

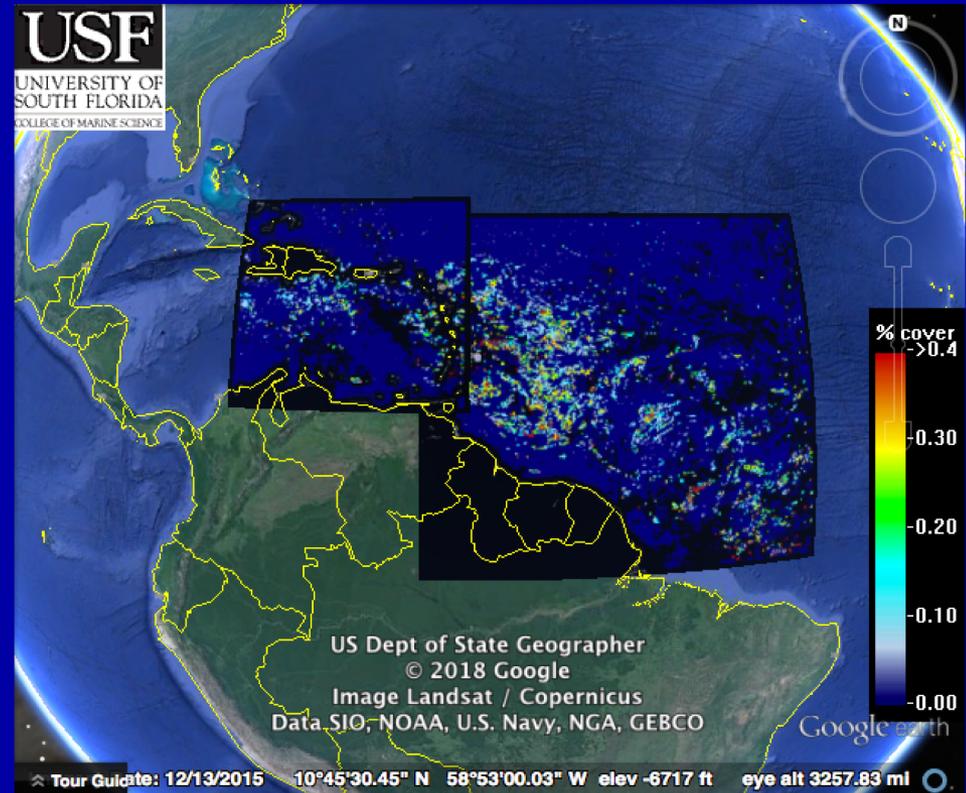
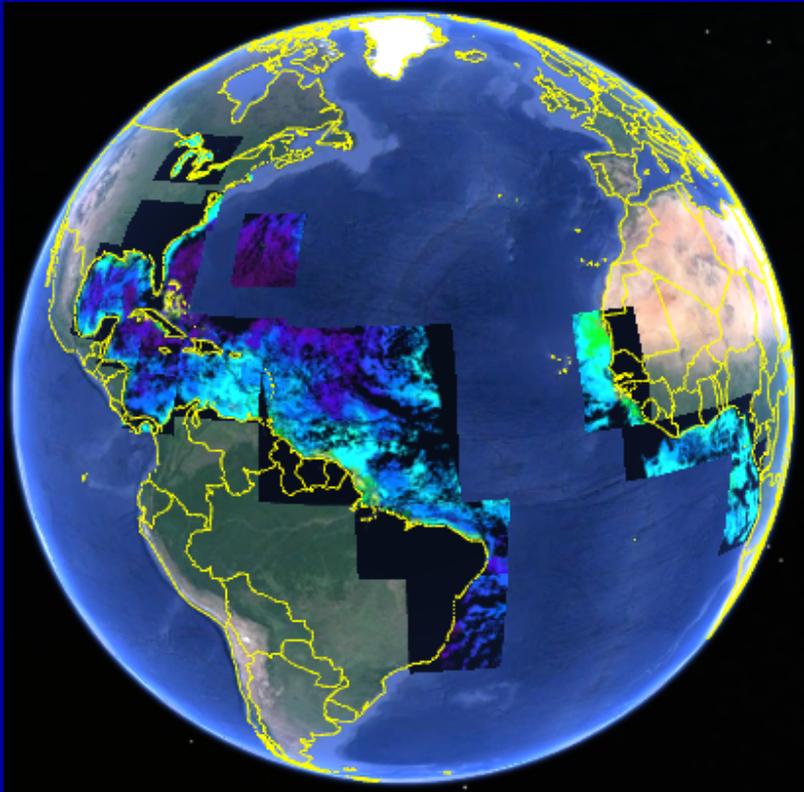
# Project goals: Improve SaWS and its operational use

through customized data products and short-term long-term forecasts



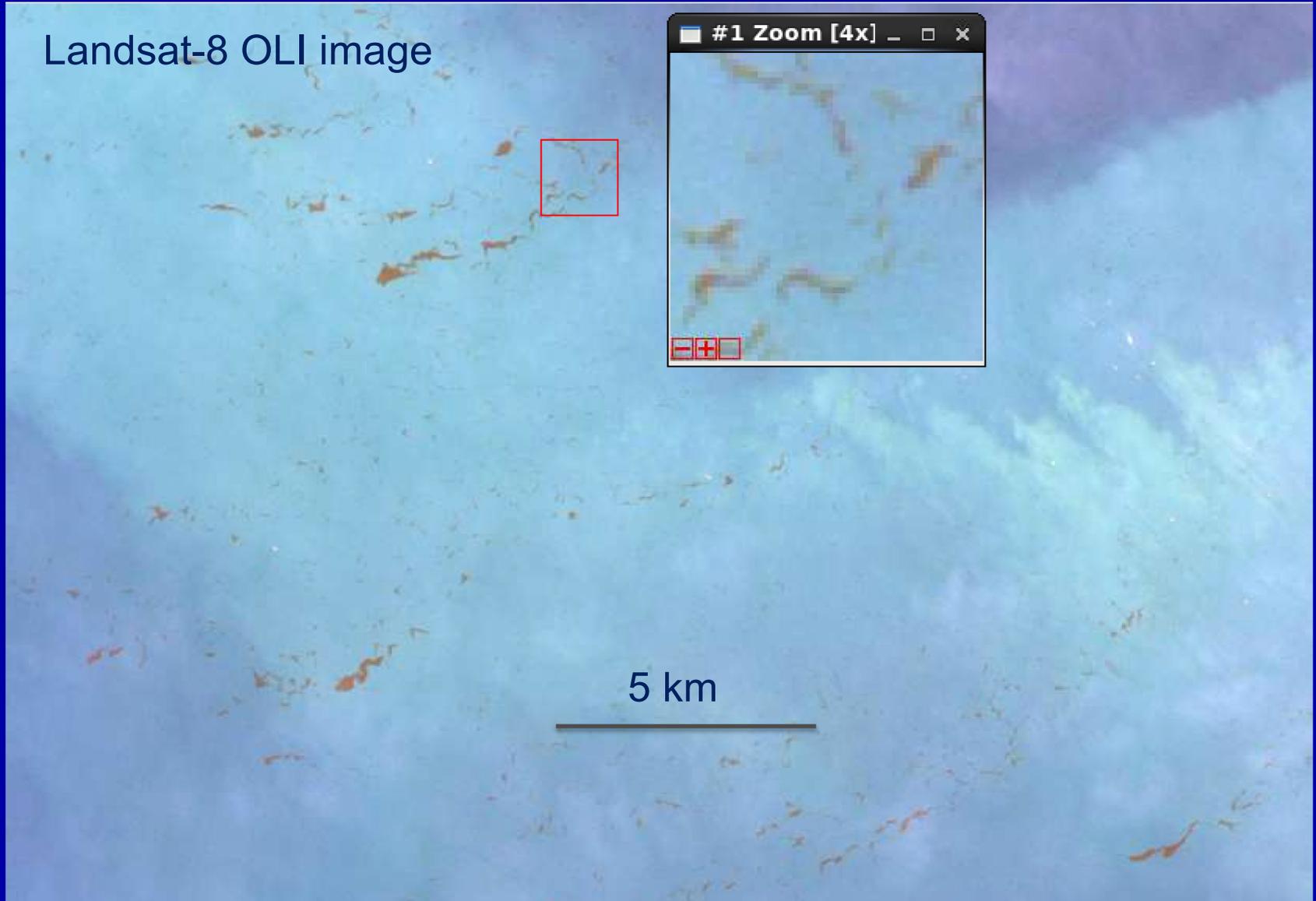
# Achievements to date: improved online tools

1. Coverage expanded to South America and West Africa
2. Added VIIRS data products
3. Added new Floating Algae Density (FAD) product

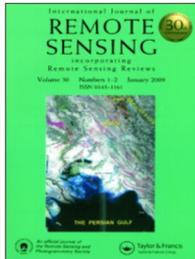


# Achievements to date: improved online tools

Landsat-8 OLI image



# Achievements to date: Publications



## On the continuity of quantifying floating algae of the Central West Atlantic between MODIS and VIIRS

Mengqiu Wang & Chuanmin Hu



ELSEVIER

## Remote Sensing Applications: Society and Environment

journal homepage: [www.elsevier.com/locate/rsase](http://www.elsevier.com/locate/rsase)

A simple, fast, and reliable method to predict Sargassum washing ashore in the Lesser Antilles

Jean-Philippe Maréchal<sup>a,\*</sup>, Claire Hellio<sup>b</sup>, Chuanmin Hu<sup>c</sup>

## Geophysical Research Letters

### RESEARCH LETTER

10.1002/2017GL072932

#### Key Points:

- *Sargassum* blooms in the Caribbean Sea lag those in the Central West Atlantic, as determined from MODIS 2000–2016 observations

## Predicting *Sargassum* blooms in the Caribbean Sea from MODIS observations

Mengqiu Wang<sup>1</sup>  and Chuanmin Hu<sup>1</sup> 

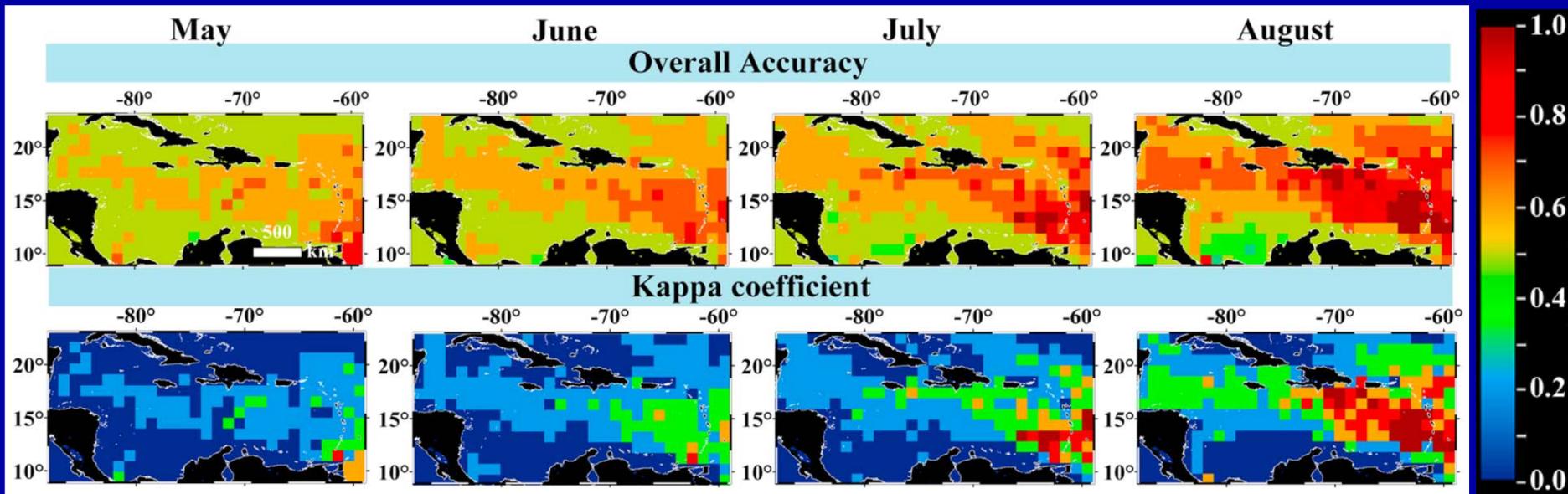
<sup>1</sup>College of Marine Science, University of South Florida, St. Petersburg, Florida, USA

# Prediction based on physical transport



# Prediction based on physical transport

Prediction: if a bloom occurs in the central West Atlantic in February, there will be major blooms in the Caribbean in May - August



From Wang and Hu (2017, GRL)

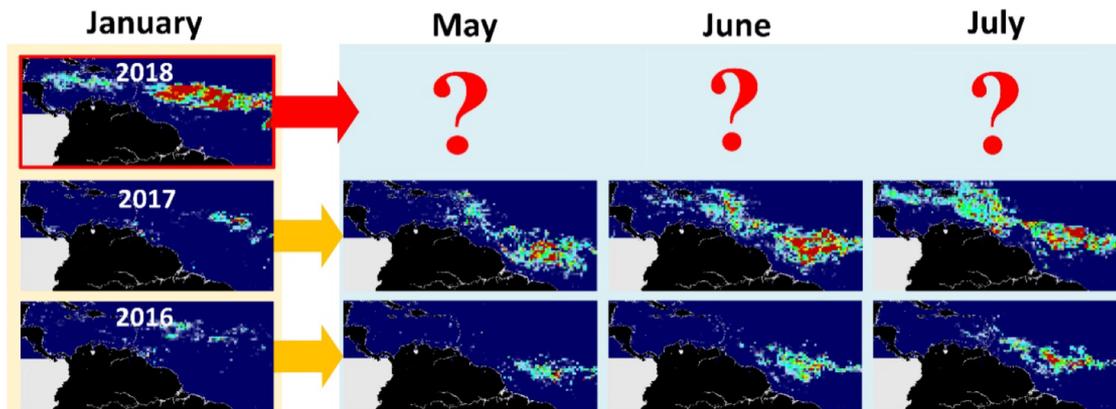
# Achievements to date: user group interactions

1. Regional workshops: 2018 French – American Workshop on *Sargassum*, Texas, January 2018,  
Blue growth and risk management workshop, St. Lucia, Jan 2018
2. Partnership with Seakeepers, Sargasso Sea Commission...
3. *Sargassum* monthly bulletins

## 2018 outlook of *Sargassum* blooms in the Caribbean Sea

February 5, 2018, by University of South Florida Optical Oceanography Lab  
(mengqiu@mail.usf.edu)

According to past experience, a winter bloom in the central West Atlantic often evolved into a major bloom in the Caribbean Sea in spring and summer. The past month of January 2018 showed the largest bloom in the central West Atlantic, as compared to the same month in history. Therefore, there is a high chance that 2018 will be another major bloom year for the Caribbean. By end of February or early March, we will have an update on this prediction. Further information can be found in: Wang, M., and C. Hu (2017), Predicting *Sargassum* blooms in the Caribbean Sea from MODIS observations, *Geophys. Res. Lett.*, 44, 3265–3273, doi:10.1002/2017GL072932.



# Achievements to date: user group interactions



## Early Warning of 'Invasions': Tracking Sargassum Seaweed via Satellite — And How Boaters Can

by Joan Corover

Starting primarily in 2011, massive quantities of pelagic (floating) sargassum seaweed, also known as sargasso, floated throughout the Caribbean, impacting marine resources, fisheries, shorelines, waterways, and tourism. Similar events have occurred since that time. The amount of observable weed has

ing through the islands need to be with gear complications plus possible steering, and plan for the safety in especially when underway at night.

Heavy mats of sargassum along the occurred on the windward coast of Barb prevent hatching sea turtles from rea Becoming proactive and keeping it location of these floating mats of se new reality for those in the Caribbean sailors alike. This sargassum issue and as one observer says, "This pro! which will ultimately adversely affect, should be working together to be pro, rather than merely reactive or in Some Caribbean island governme in Tobago, are already looking at a help cope with sargassum inund ipsters.net/2017/07/tobago-gears invasion for details).

**Satellites Spot Sargassum**  
Over the past several years, sever ties have been developing technolo! its imagery to identify the location. (See <https://eos.org/features/warnings-of-incoming-seaweed>).

While this seems simple, it has ground, or in this case sea, knowl uns of weed occur. This then allo satellite data to develop suitable app

lessened since the large influx of October 2015, however this process is cyclical and the coming season is projected to see a significant increase of this ocean-carried weed.

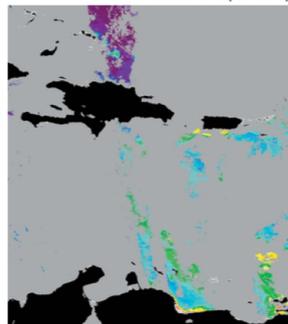
It will be during this upcoming season of 2017-18 when Caribbean governments and private citizens — including local boaters and visiting cruisers — will again need to develop procedures to address the problems that have been experienced in past "Sargasso Seasons".

The actual sargassum route and cycle are not well known, but amounts do seem to be increasing with each season's cycle; the ores for this include increasing heat and/or additional nutrients introduced into the Atlantic that create or enhance massive blooms of this foliage. Recent research also suggests that Atlantic algae responds positively to increased CO<sub>2</sub> and acidity in seawater, a major change in the former theory of slower growth.

A first-hand report last month from the southern Caribbean mentions, "The smell at the moment is near intolerable; the build-up has increased massively in the last week or so, and now there is too much aggregated for the tide to remove it. Furthermore, there is so much ashore already that the new influx can only sit on and in the water. The wet sargassum rots on the shore, and sea life dies on the mass floating at the shoreline".

In cases where sargassum accumulates and decomposes in large quantities, the smell of rotten eggs can occur. This is the odor of hydrogen sulfide gas, which is given off as part of natural decomposition. The US Occupational Safety and Health Administration notes that when the smell is described as "more offensive" (three to five parts per million), prolonged exposure might cause effects such as nausea, tearing of the eyes, headache and loss of sleep. Asthma sufferers may experience airway problems. Full details are at [www.osha.gov/SITC/hydrogensulfide/hazards.html](http://www.osha.gov/SITC/hydrogensulfide/hazards.html).

Sargassum also has impacts on fishing gear and motors; for example, engine cooling-water intakes get clogged and rudders jammed. Some fishers and other boaters are coming up with devices to free rudders of weed and to deflect sargassum from propellers, and are using strainers across water intakes to prevent blockage and engine overheating. Those navigat-



eral years, private "citizen scientists" have reported their sargassum to Coast Research Laboratory's (G research group headed by Jim Frank

These data are used to model the gassum in the tropical North Atlantic the Caribbean region. These data ha to determine the source of the mass research indicates a sargassum sou torial origin, rather than connecting Sea. The GCRL research conducte oceanographer colleague Dr. Don Jol

Another effort to provide a satellite tion was being developed by Dr. Chu at the University of South Florida, announce there is now an internet imagery views of sargassum, which e warning where or when this sea impact an area. While still in the de this is a huge step forward for pre weed will be and could allow count areas time to prepare. Basically, t Sargassum Watch System (SaWS) [marine.usf.edu/projects/saws.html](http://marine.usf.edu/projects/saws.html)

## Major Seaweed Invasion Underway — and What We Can Do About It

by Joan Corover

Over recent years, quantities of Sargassum, a type of seaweed commonly known as sargasso, have continued to wash up on beaches and appear in the waters of the Atlantic, the Caribbean Sea and the Gulf of Mexico. The 2015 season was the heaviest sargasso inundation on record, with the years of 2016 and 2017 showing a downturn.

Based on satellite imagery and reports from citizens, this year the impacts can be expected to be even worse. But new online tracking systems and suggestions for clean-up of affected beaches are highlighted in this article, along with ways of detecting the hydrogen sulfide gas given off by the decomposing weed and warnings on possible health impacts.

**The Gas in Sargassum**  
Since 2015, taking the risk seriously, the Government of Martinique has established an online website with updates on weed volumes and hydrogen sulfide levels, an excellent example for other islands. Two parts of hydrogen sulfide per million can cause spontaneous abortion in pregnant women; 100 PPM is deadly, according to Martinique's website, [www.aees.fr/en/content/exposure-emissions-sargassum-seaweed-washed-shore](http://www.aees.fr/en/content/exposure-emissions-sargassum-seaweed-washed-shore).

The US Occupational Safety and Health Administration states that prolonged exposure to three to five parts of hydrogen sulfide per million may cause effects such as nausea, tearing of the eyes, headaches and loss of sleep. Asthma sufferers may experience airway problems. Full details are at [www.osha.gov/SITC/hydrogensulfide/hazards.html](http://www.osha.gov/SITC/hydrogensulfide/hazards.html). Tarnishing of metals and discoloration of paint have also been reported in areas affected by a sargasso influx and the subsequent release of hydrogen sulfide. One 2015 report cited "silver tarnishing in days not months" as an illustration of how concentrated the gas is, even away from the beaches.... we lost over \$10,000 of electronic equipment solely through hydrogen sulfide damage." Another commented about the "appalling, nauseating smell, the damage to health, electronics, metals, and paint that occurred last time there was an inundation of this magnitude."

The gases in water can destroy reverse osmosis desalination systems' membranes and filters as well. Virgin Gorda lost its desalination system, located in Spanish Town, in the 2015-2016 sargasso season.

Tourism finds major problems with shorelines being fouled with off-gassing weed, sometimes with a smell strong enough to sicken beach goers.

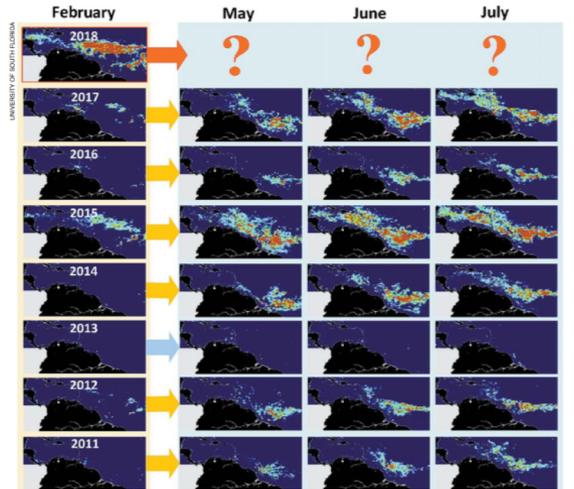
**Other Problems with Sargassum**  
Environmentalists find that nesting beaches covered with thick strands of weed trapping hatchlings and adult turtles alike, and preventing female turtles from getting onto the sand to lay their eggs. Offshore, the weed is friendlier, and fish and scallop travel and live in its strands.

However, yachting and shipping interests recognize the problems this weed causes with propeller fouling, raw-water intake blockage and loss of steerage. Boaters should also be aware that mats of sargasso accumulate debris, such as floating nylon ropes, nets and other trash.

Another concern is the potential for this seaweed to accumulate heavy metals or other toxic materials. New testing, currently in progress with the University of South Florida, is obtaining samples and processing for this type of contamination. However, as samples are just now being provided, it will take time to analyze and determine what, if any, issues there are.

**Sargasso Tracking and Prediction**  
The excessive growth of sargasso in 2018 seems grim. Researchers from the University of South Florida and NASA tell us, "The past months of January and February 2018 showed the largest bloom in the central West Atlantic, as compared to the same months in history." USF researcher Dr. Chuanmin Hu warns of the likelihood of "major beaching events this year as it is more and more becoming a reality — the total amount of sargasso we have seen in February (usually a low month) has now exceeded the maximum month of July/August of 2015."

—Continued on next page



Large blooms of sargasso in the Atlantic in February; forestell inundations in the Caribbean a few months later. February 2018 saw the largest bloom yet, and forecasters can be forewarned.

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# Summary

- A prototype SaWS has been improved, based on research and peer-reviewed papers
- Coverage extended, VIIRS added
- New product of Floating Algae Density added
- User groups expanded

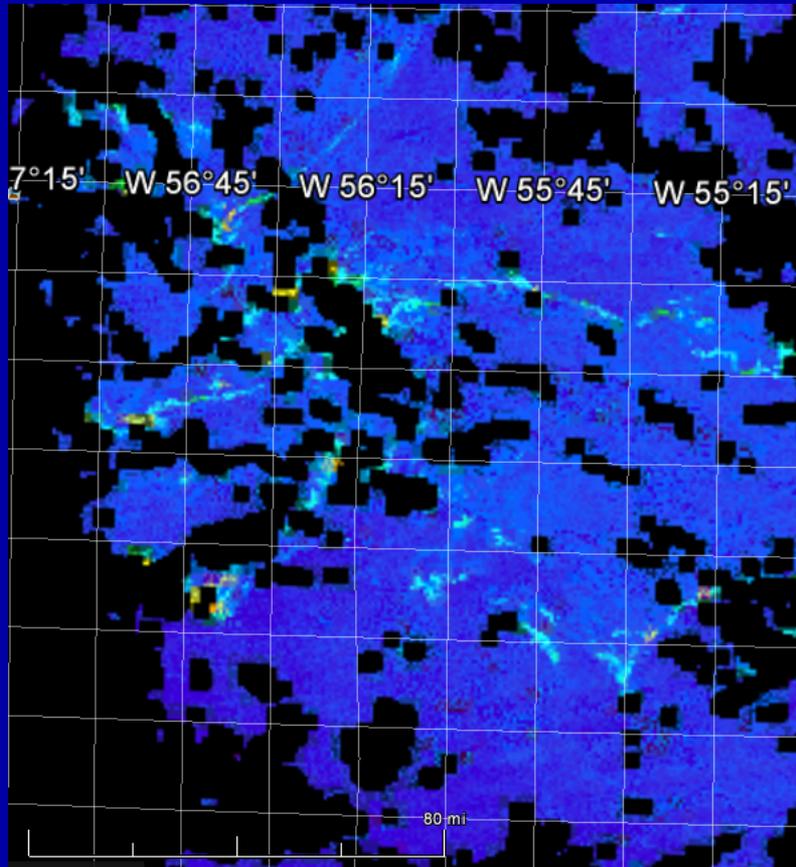
# Backup slides

1. iPhone App
2. NOAA AOML
3. CariCOOS

# Satellite-based near real-time *Sargassum* Watch System (SaWS)

<http://optics.marine.usf.edu/projects/SaWS.html>

Bring image to Google Earth



Add HYCOM surface current

