

Pelagic *Sargassum* in the Atlantic Ocean: What happened in the past 25 years?

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With many coauthors and collaborators

NOCCG seminar,
March 25, 2026

Photo credit:
David Freestone

Outline

I. What, why, and how

II. What happened and why

III. Now what

Sargassum – what is it?



"Encountered weed …in some places so thick that it actually held back the ships…"

Columbus 20th September 1492

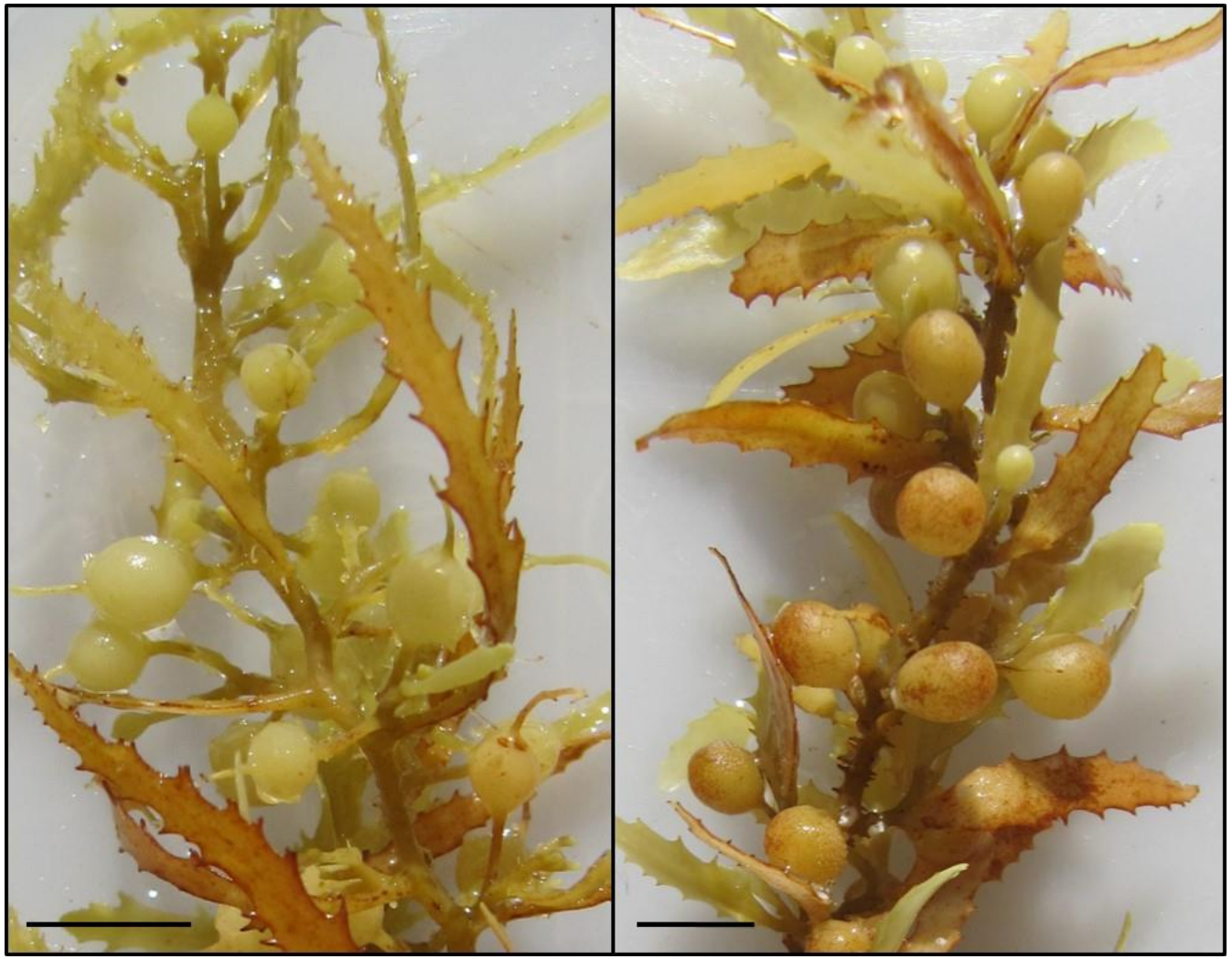


Portuguese sailors thought these air-filled bladders resembled one type of grape, "sarga", and therefore named this plant "sargazo", and in English it is *Sargassum*

Slide courtesy of Dr. David Freestone

Sargassum – what is it?

Spines on air bladders, blades are long and narrow



No spines on air bladders, blades are short and wide

***S. natans* I (left) and *S. fluitans* III (right)**
(courtesy of Hazel Oxenford)

Why – the good

- **Nursery/Feeding area:** eggs/juveniles of >80 fish species occur in *Sargassum*
- ***Sargassum* Endemics:** 145 invertebrate species live in association with *Sargassum*











Photo courtesy of JP Roula

Why – the bad and the ugly

A beach nuisance

- Smells bad, attracts insects, clogs water intake
- Smother turtle nesting sites, causing turtle and fish mortality
- Negative impact on tourism and economy (billion $ along east coast of Florida, Jin et al., 2025)
- Hazardous for human health and coastal habitats (seagrasses, corals, mangroves)

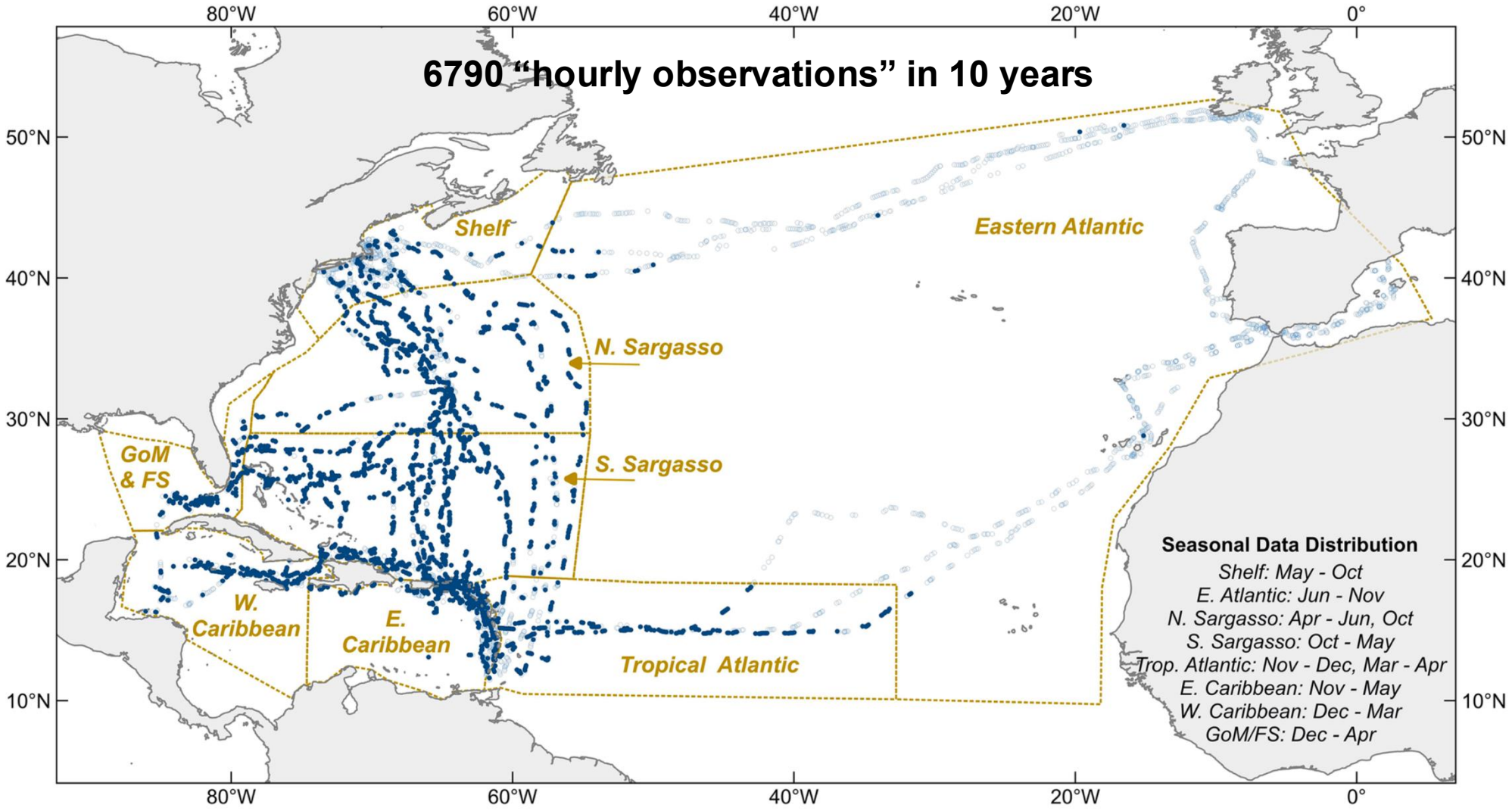


Orange Beach, Alabama, June 2022,
(video credit: Sandy Hill)



How –*Sargassum* sampling in the field

2011 – 2020 ship-based sampling by the Sea Education Association (Goodwin et al., 2022)

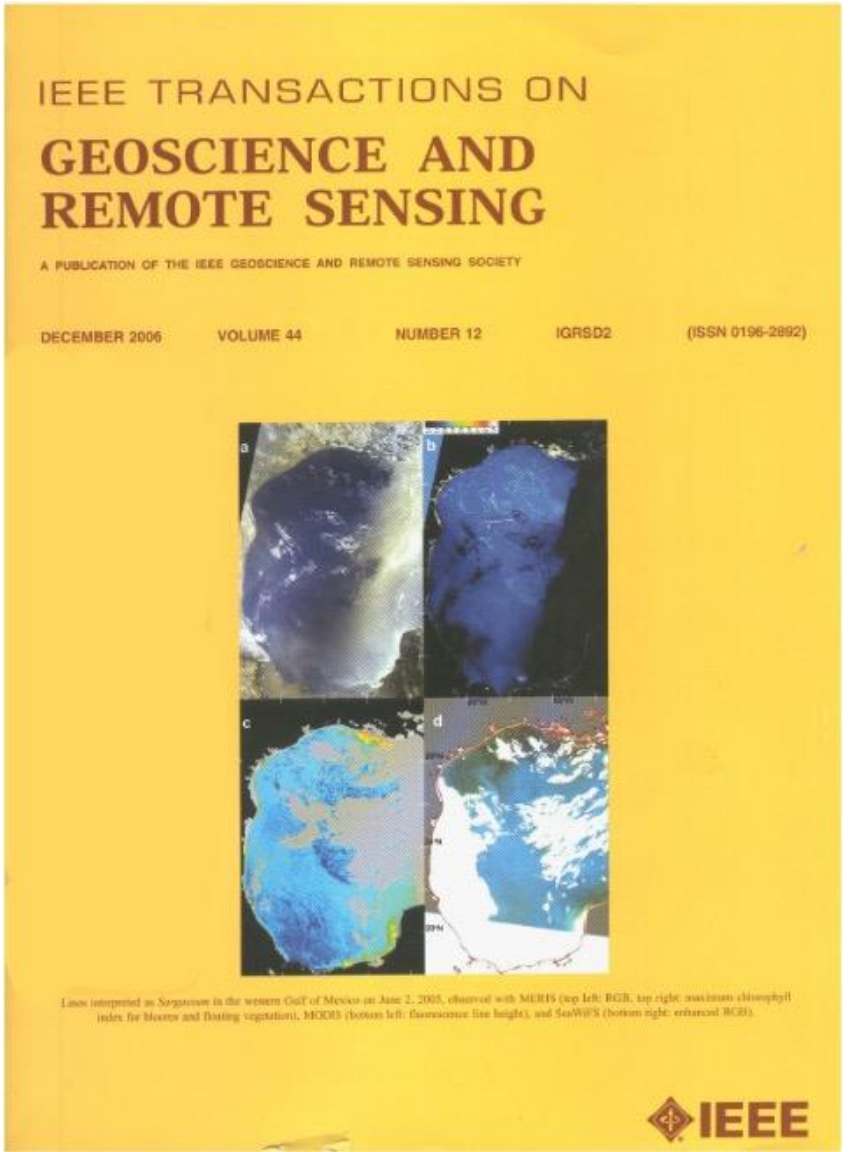


How – mapping *Sargassum* from space



Jim Gower's
Proof of concept

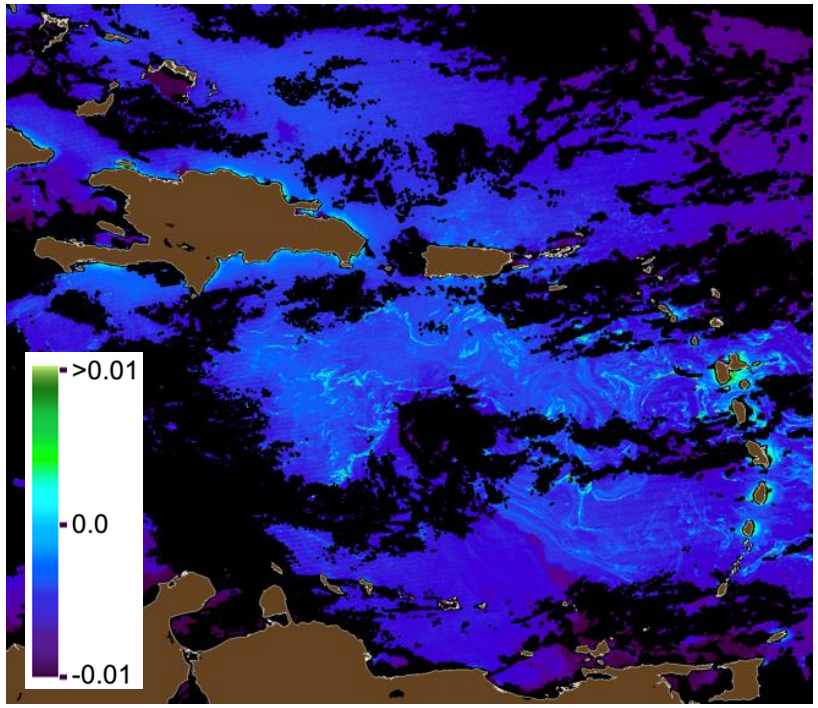
Gower et al. (2006)



How – mapping *Sargassum* from space

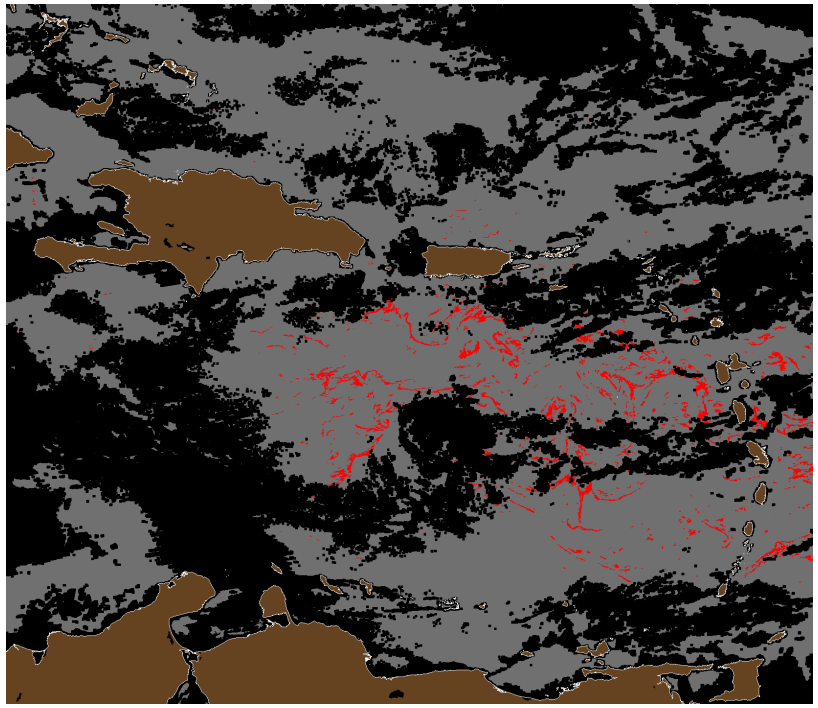
Methodology has matured over the last 20 years

1. Is there something?



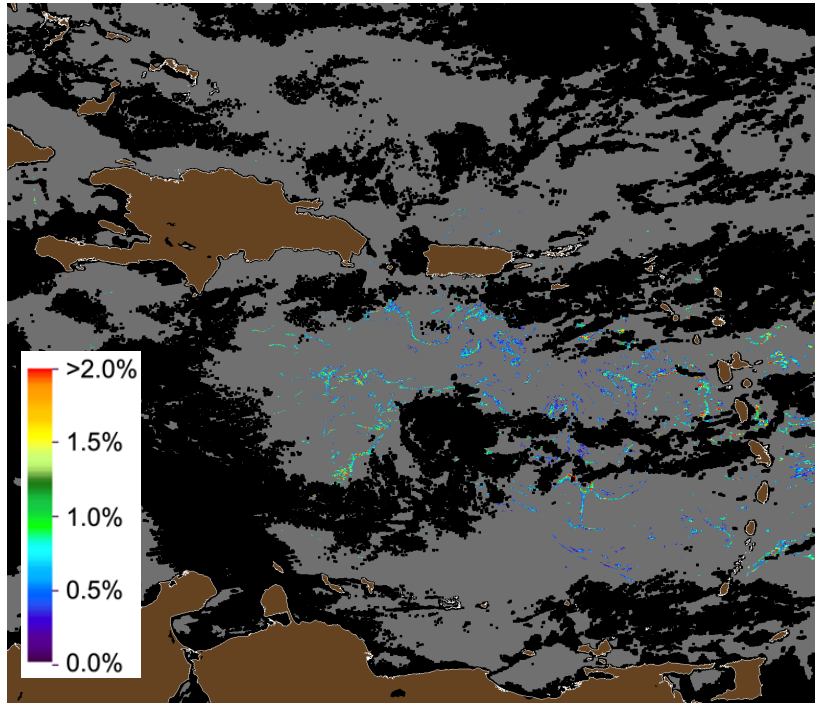
Data product type 1:
Quicklook images

2. Extraction and spectral discrimination



Data product type 2:
Presence/absence images

3. How much?

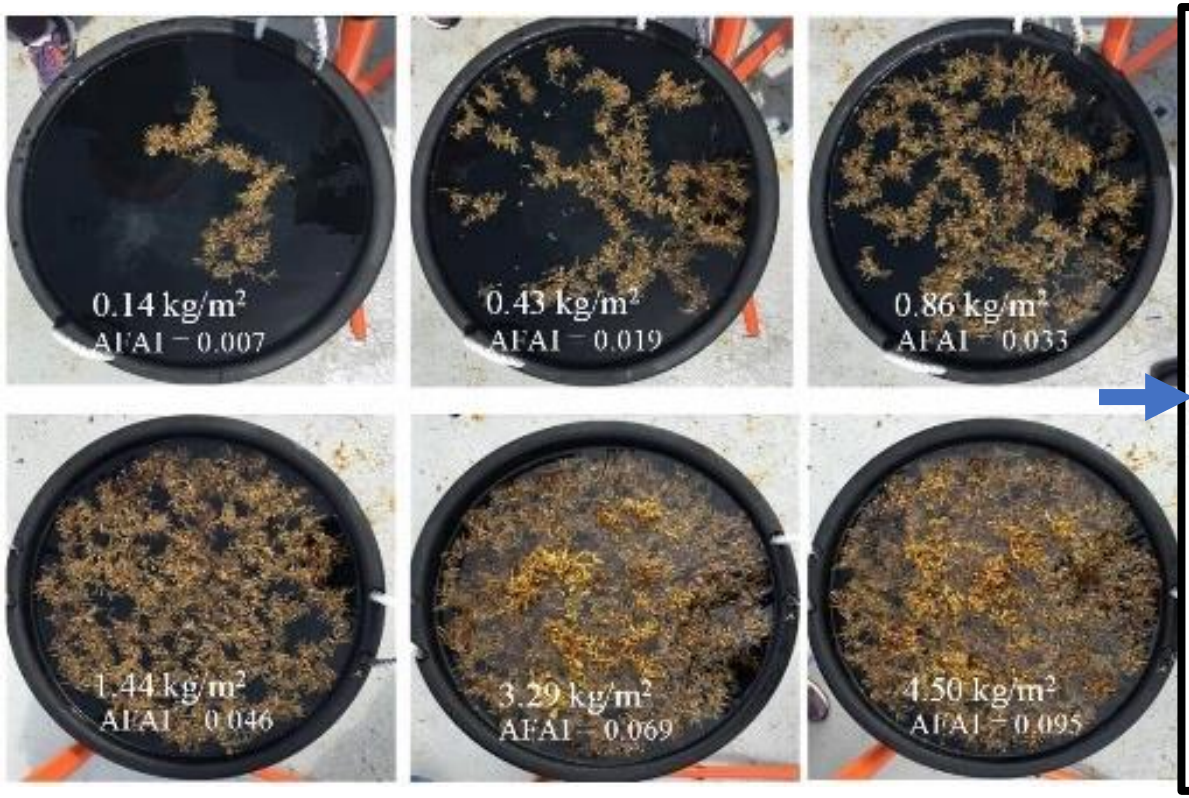


Data product type 3:
% cover for each pixel

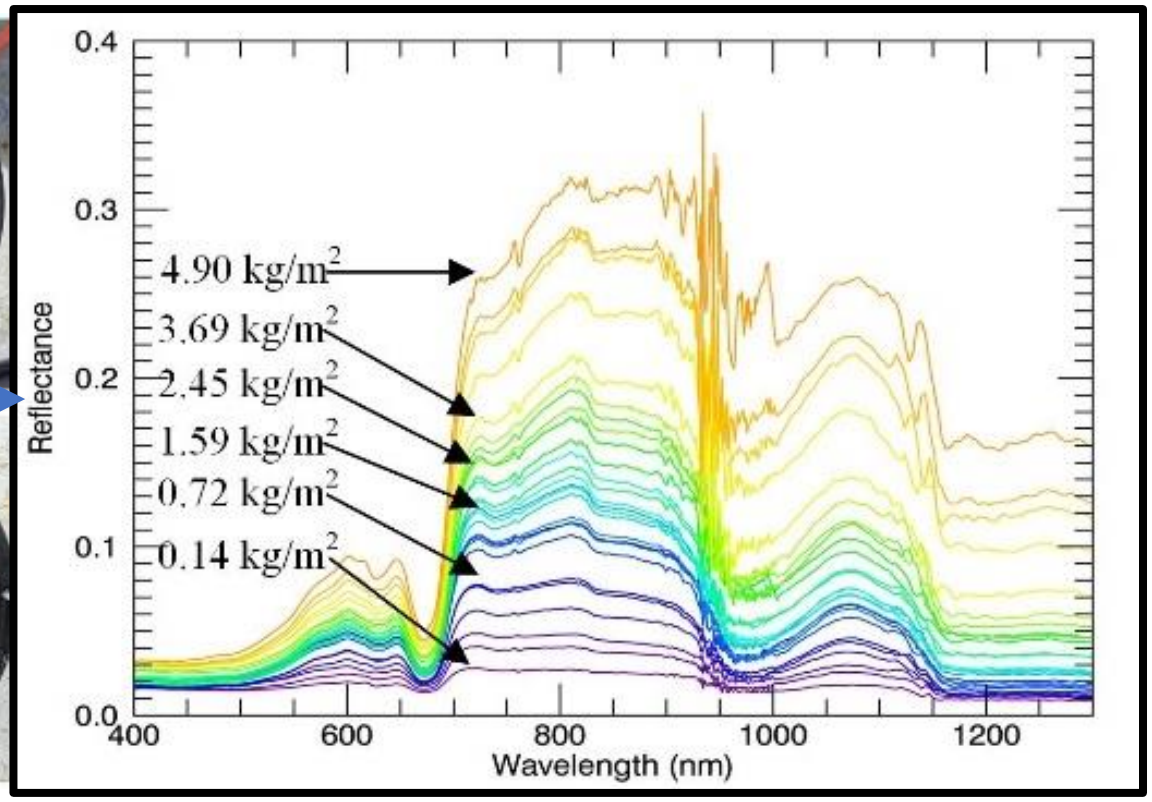
Hu *et al.*, 2025

How – calibration using lab and field measurements

Controlled experiment

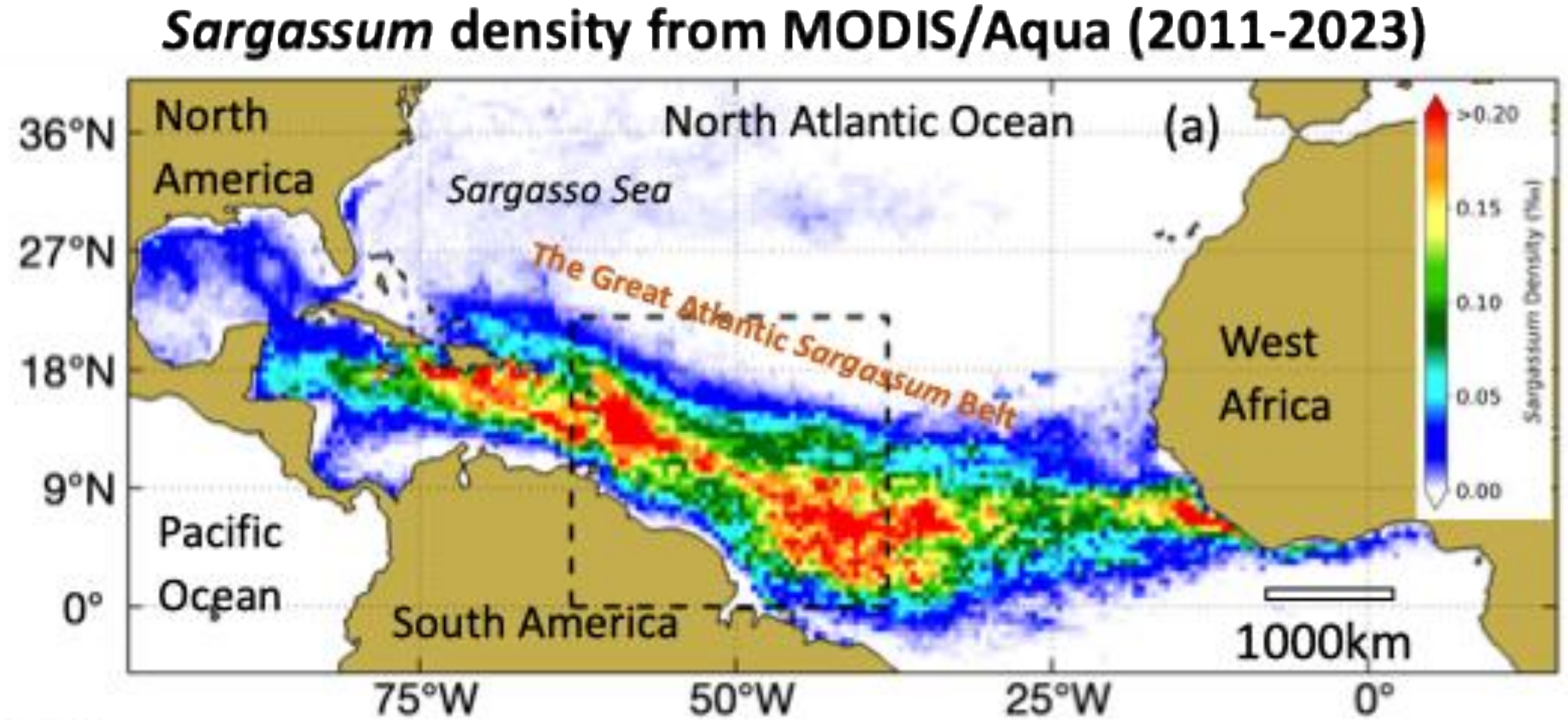


Field experiment



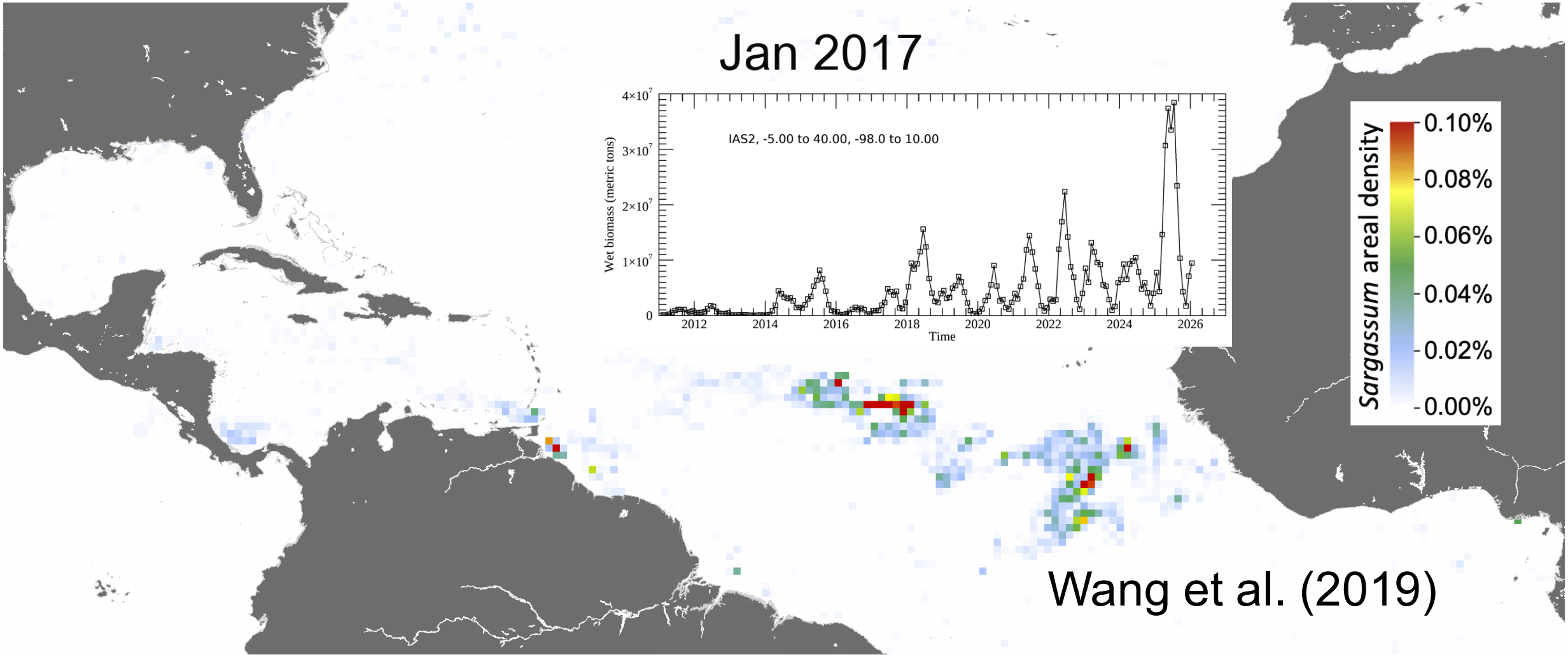
Wang *et al.*, 2018

Sargassum – the large picture from space



From Qi et al. (2026)

The Great Atlantic *Sargassum* Belt



Wang et al. (2019)

The Great Atlantic *Sargassum* Belt

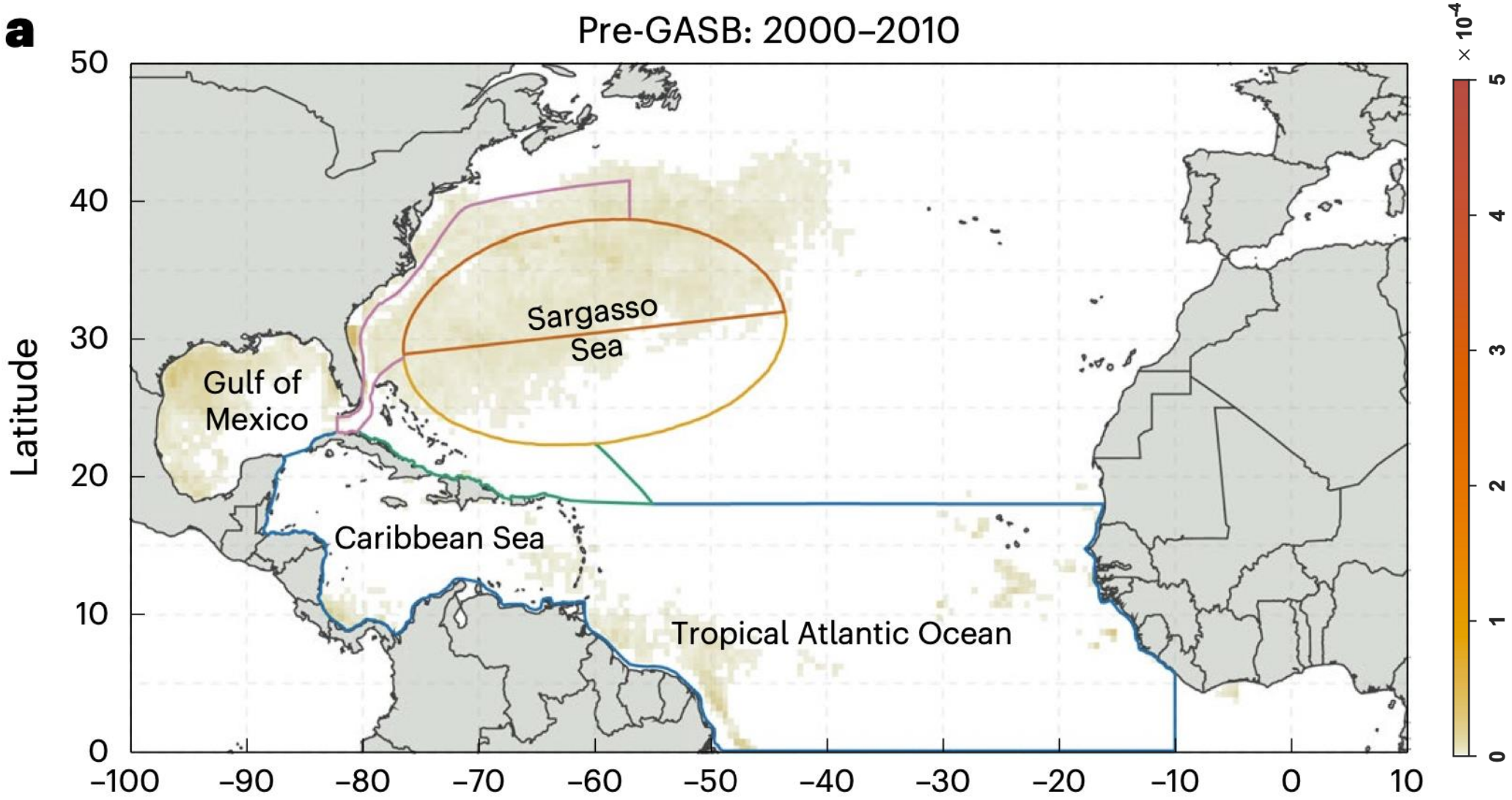




Credit: Chantale Begin (USF) during an international rowing race across the Atlantic

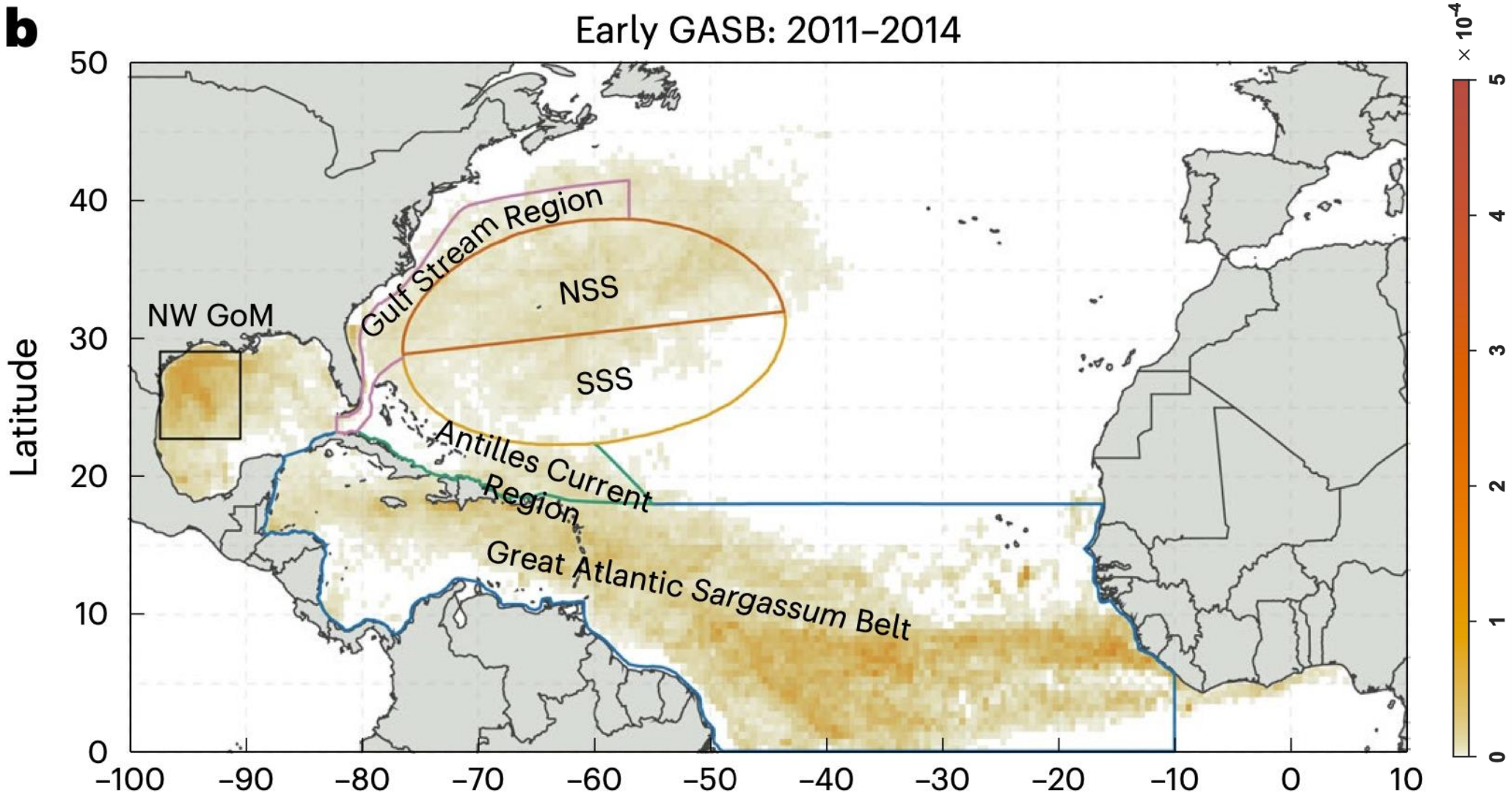
What happened in the past 25 years? Why?

The historical “norm”



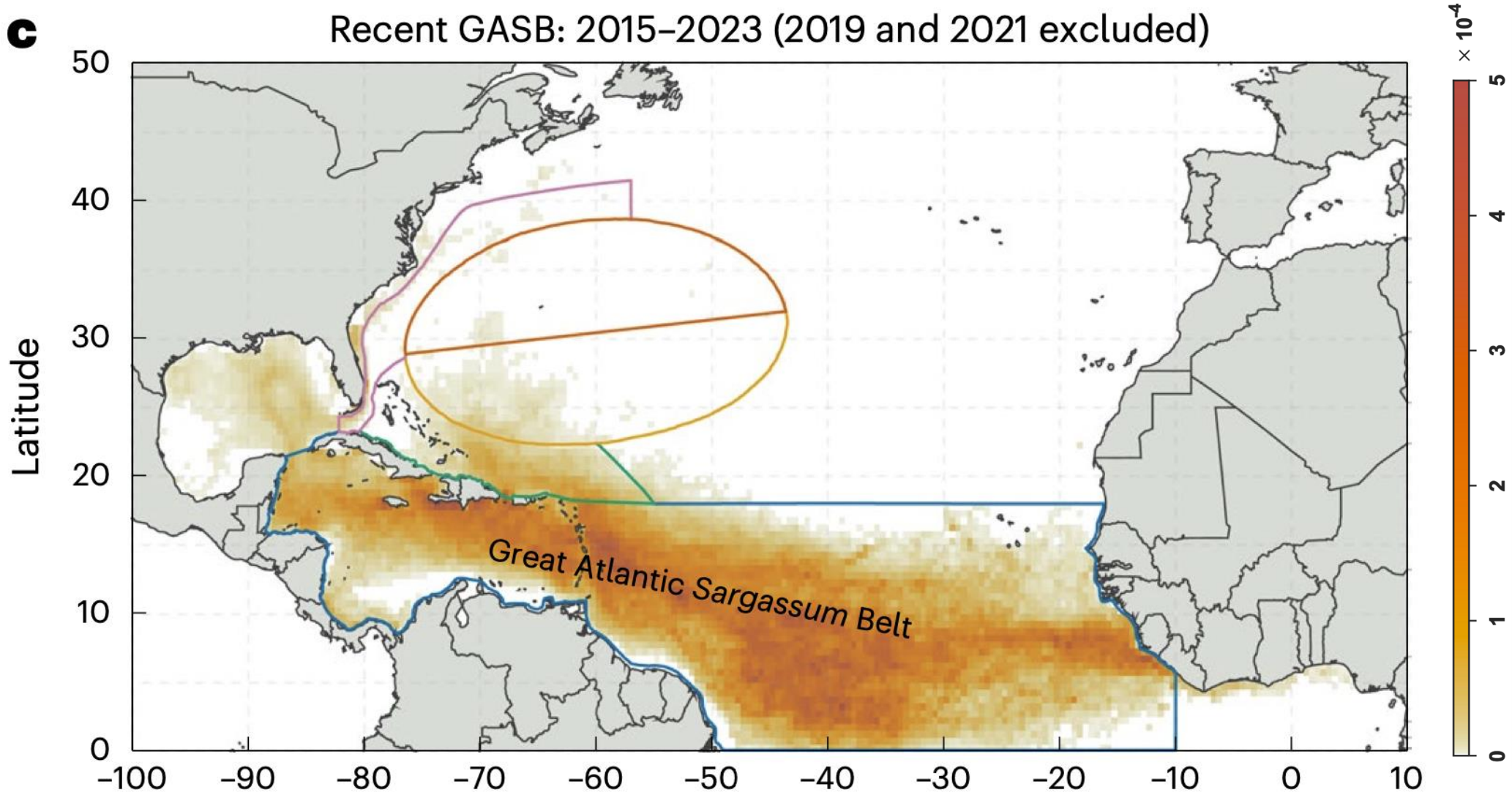
From Zhang et al. (2025)

The emergent GASB, starting 2011



From Zhang et al. (2025)

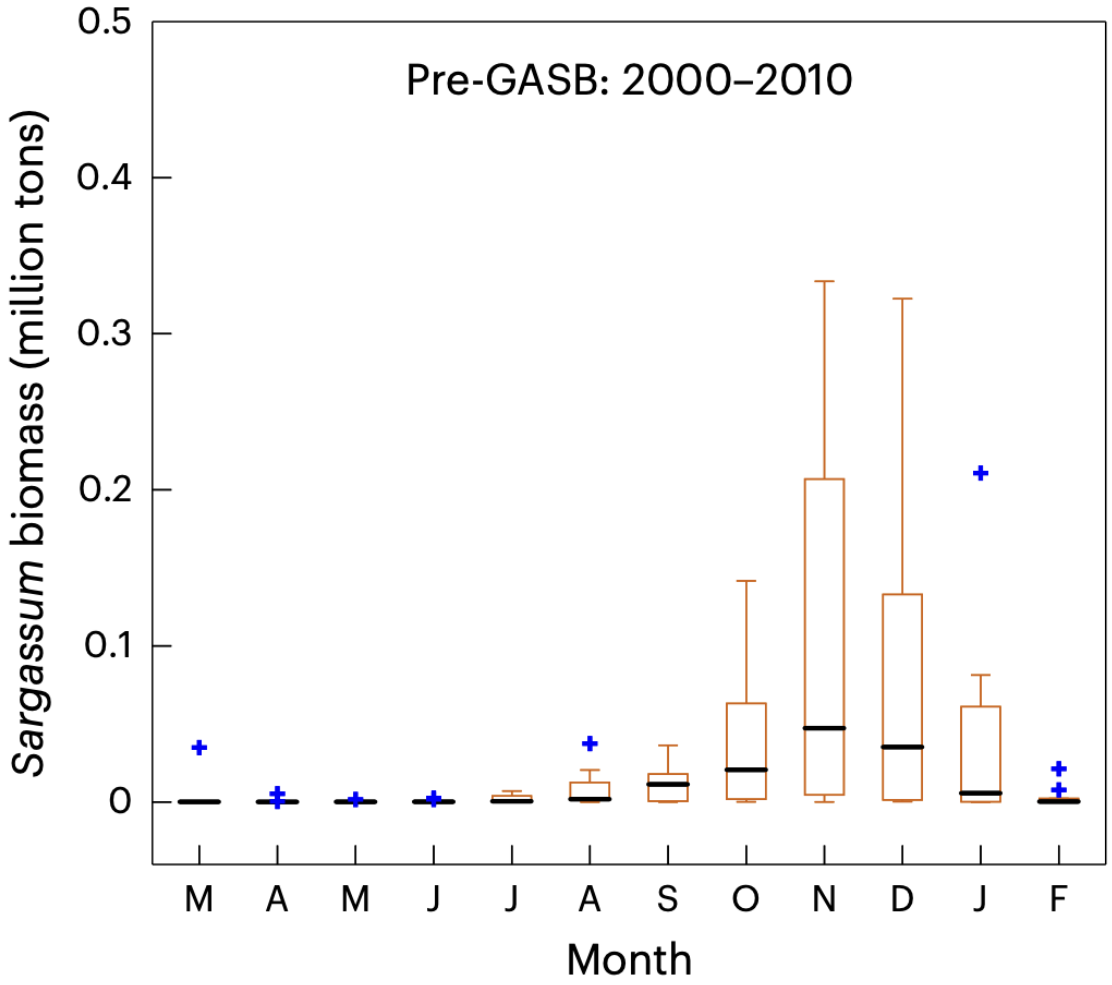
The decline in the north SS, starting 2015

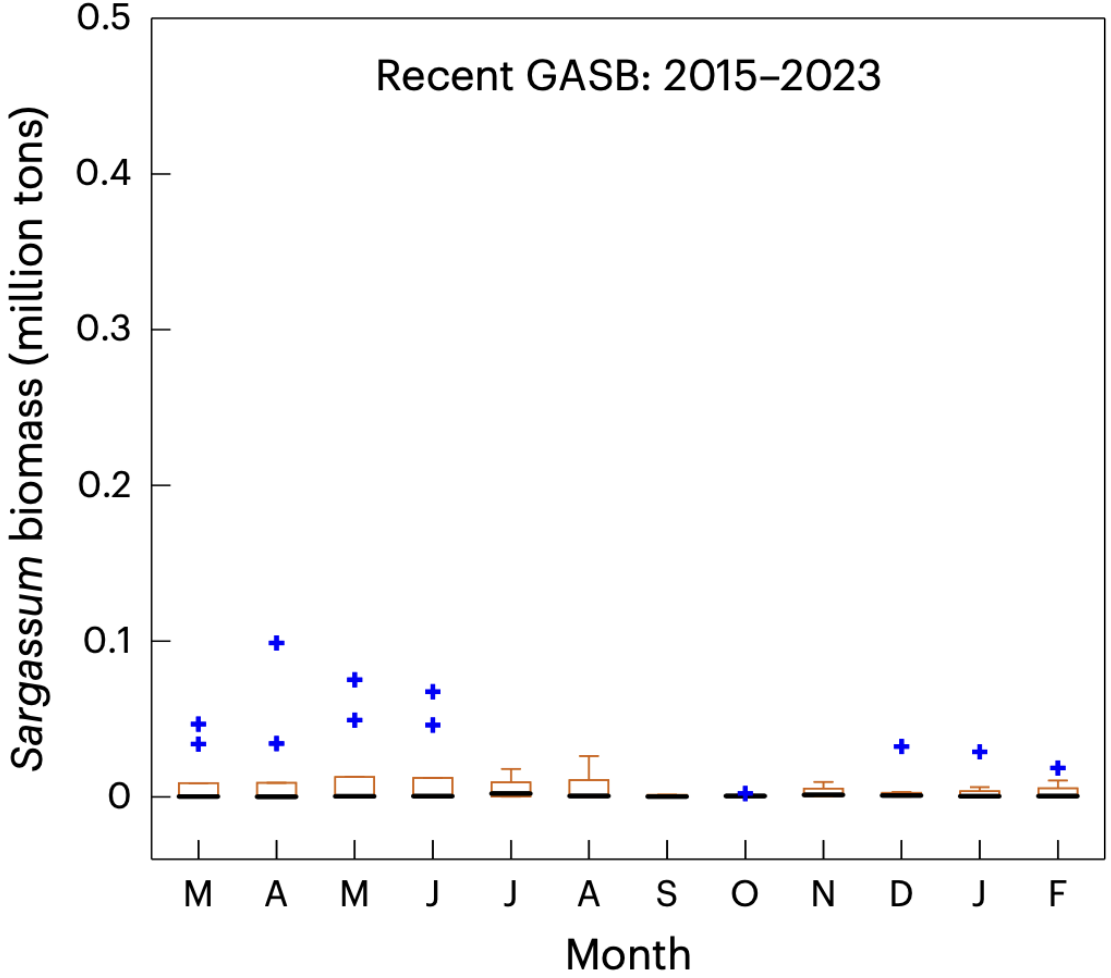


From Zhang et al. (2025)

The changes in *Sargassum* seasonality

North Sargasso Sea



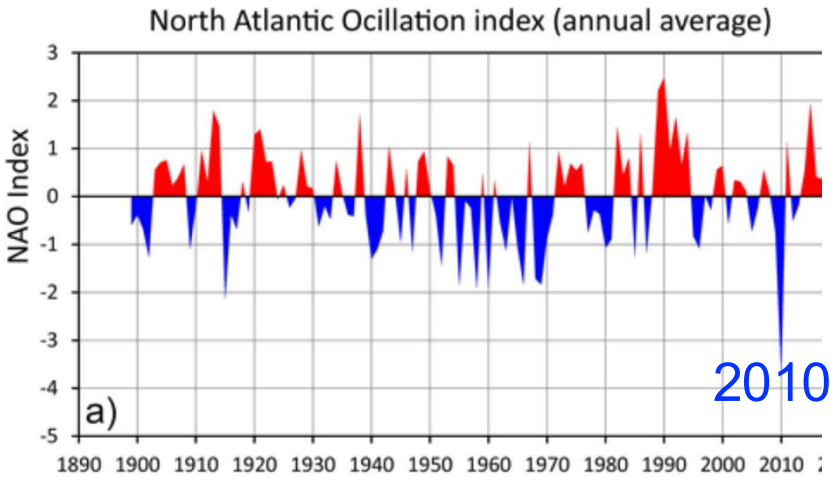


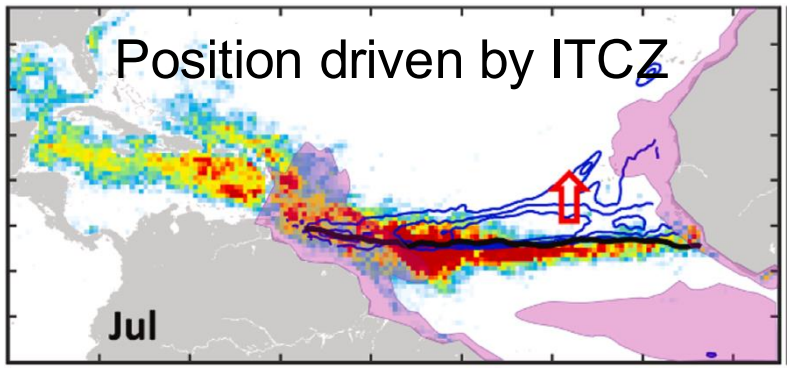
From Zhang et al. (2025)

Why – what initiated the GASB in 2011?

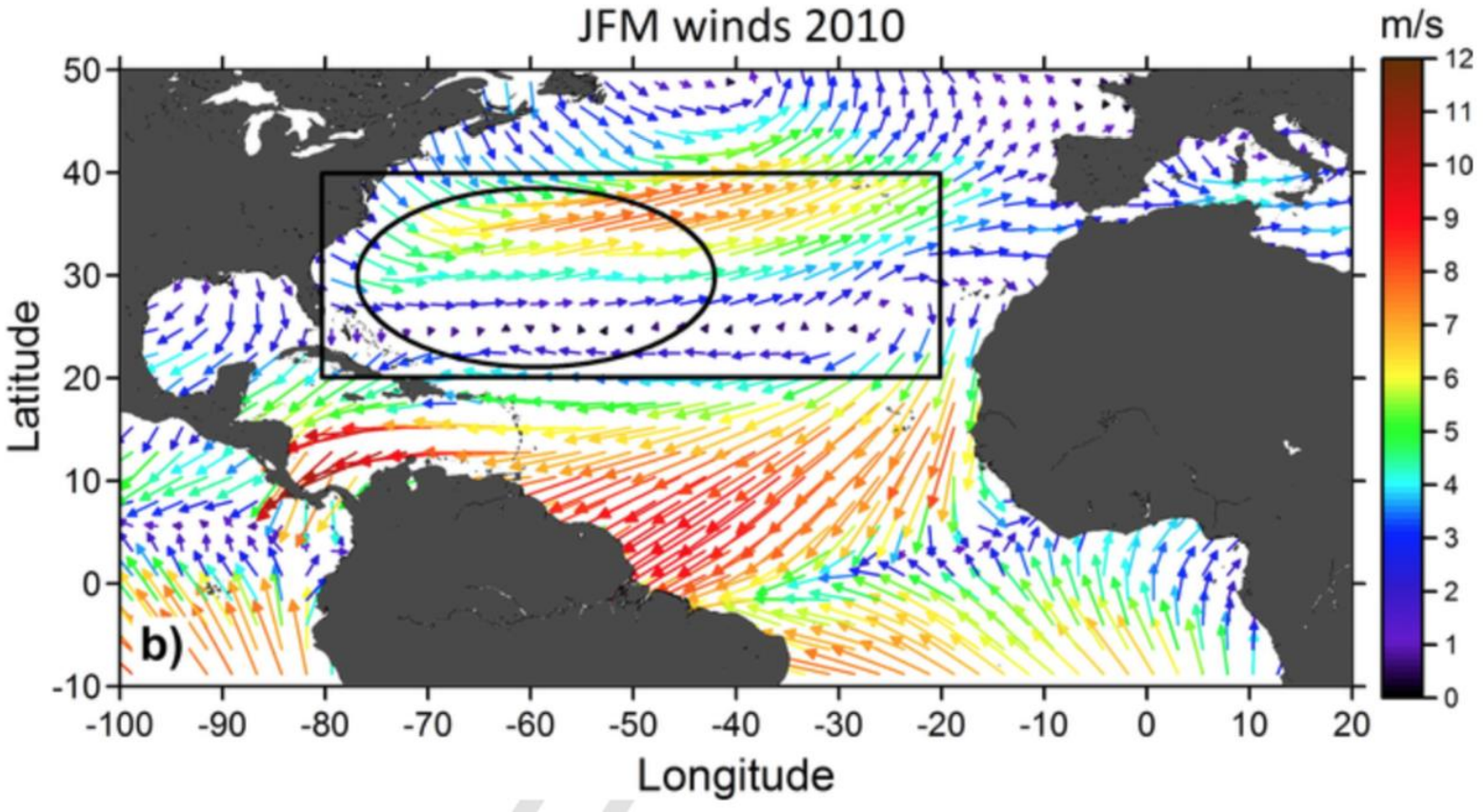
Hypothesis: long-distance transport to initialize the first year of 2011

In 2010, abnormal winds and currents brought *Sargassum* to the tropics





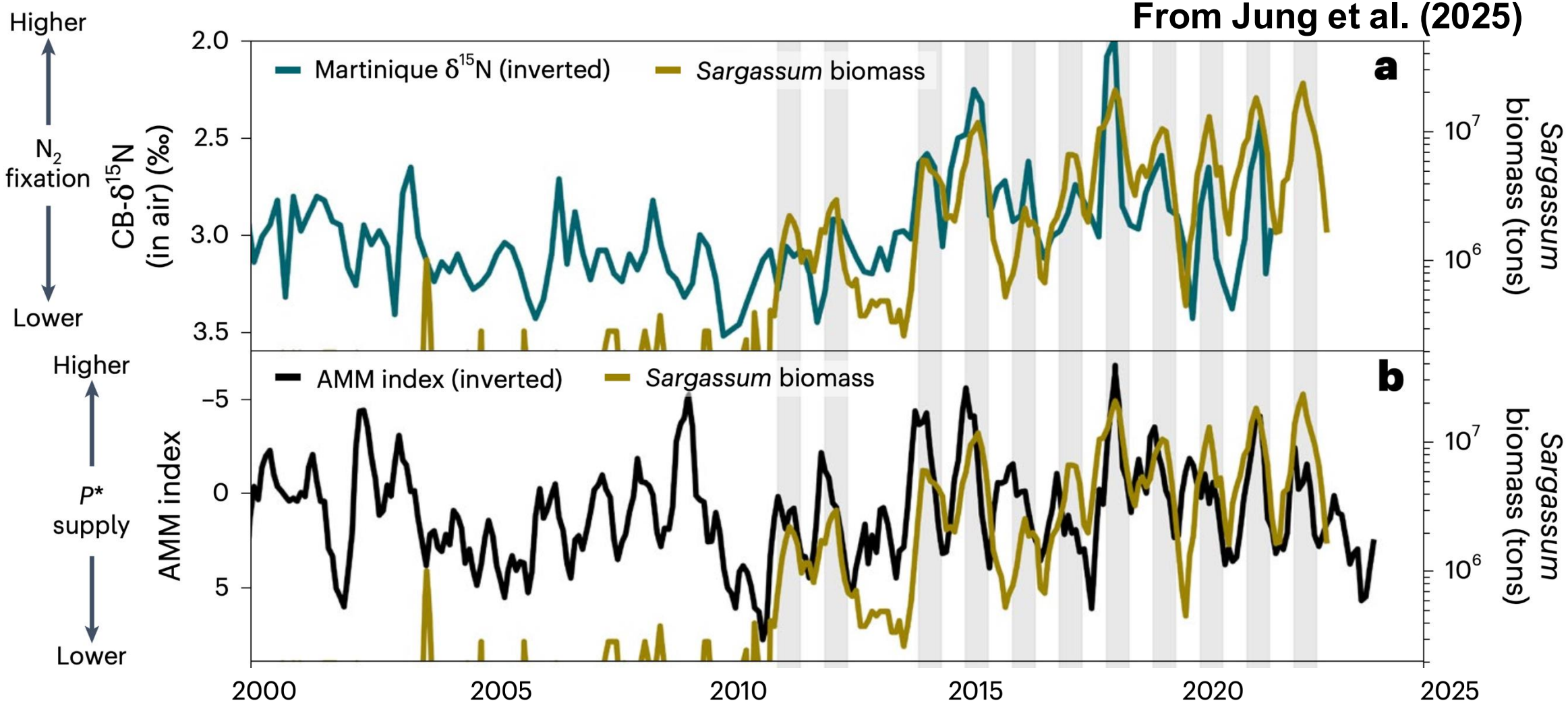
From Johns et al. (2020)



Why – what maintained the GASB after 2011?

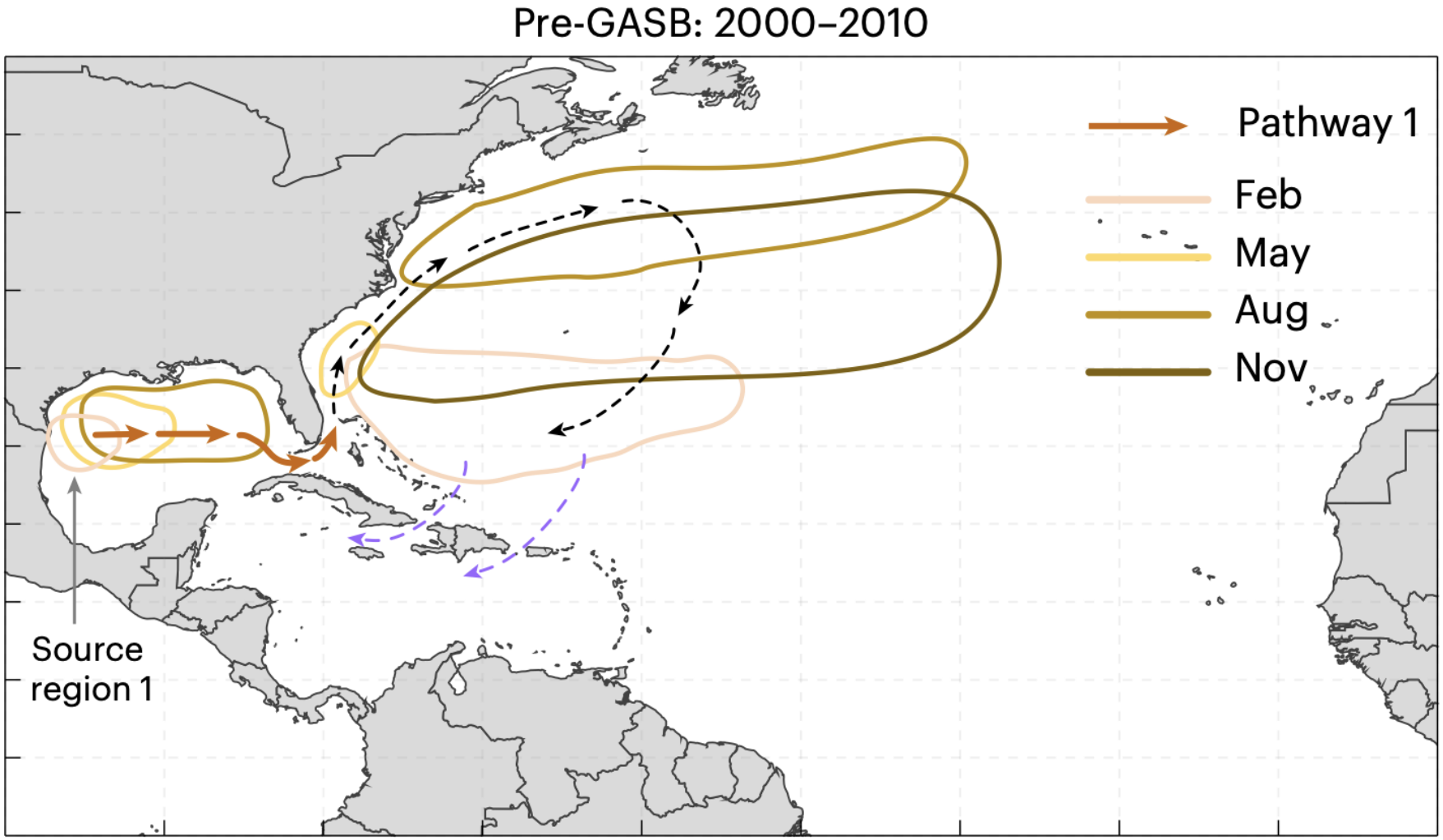
Ocean mixing/upwelling fuels the plant in subsequent years

From Jung et al. (2025)



Why – what caused the decline in the north SS?

Hypothesis: changes in transport pathways and ocean temperature

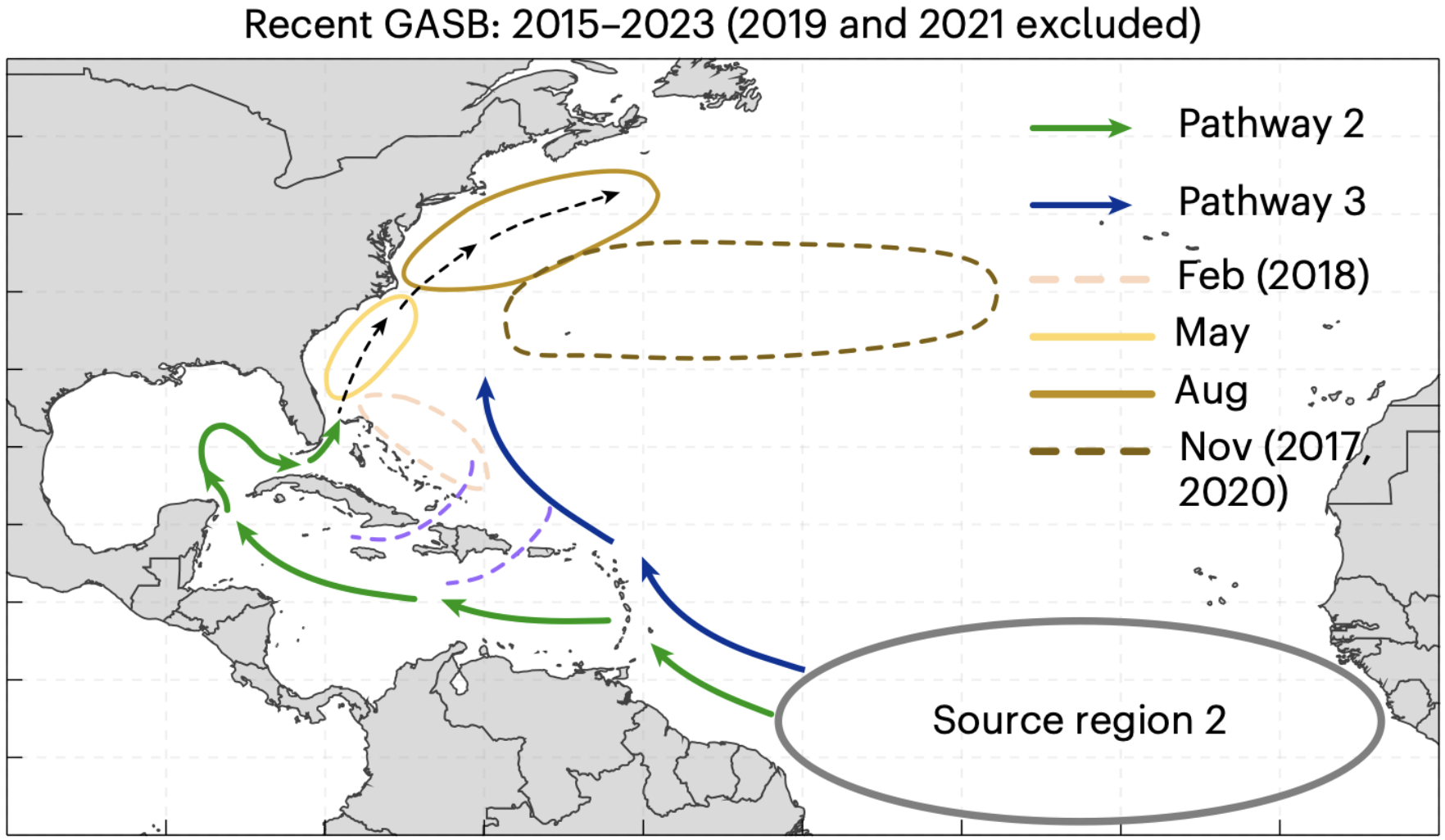


From Zhang et al. (2025)

Sargassum optimal growth: 23 – 28°C

Why – what caused the decline in the north SS?

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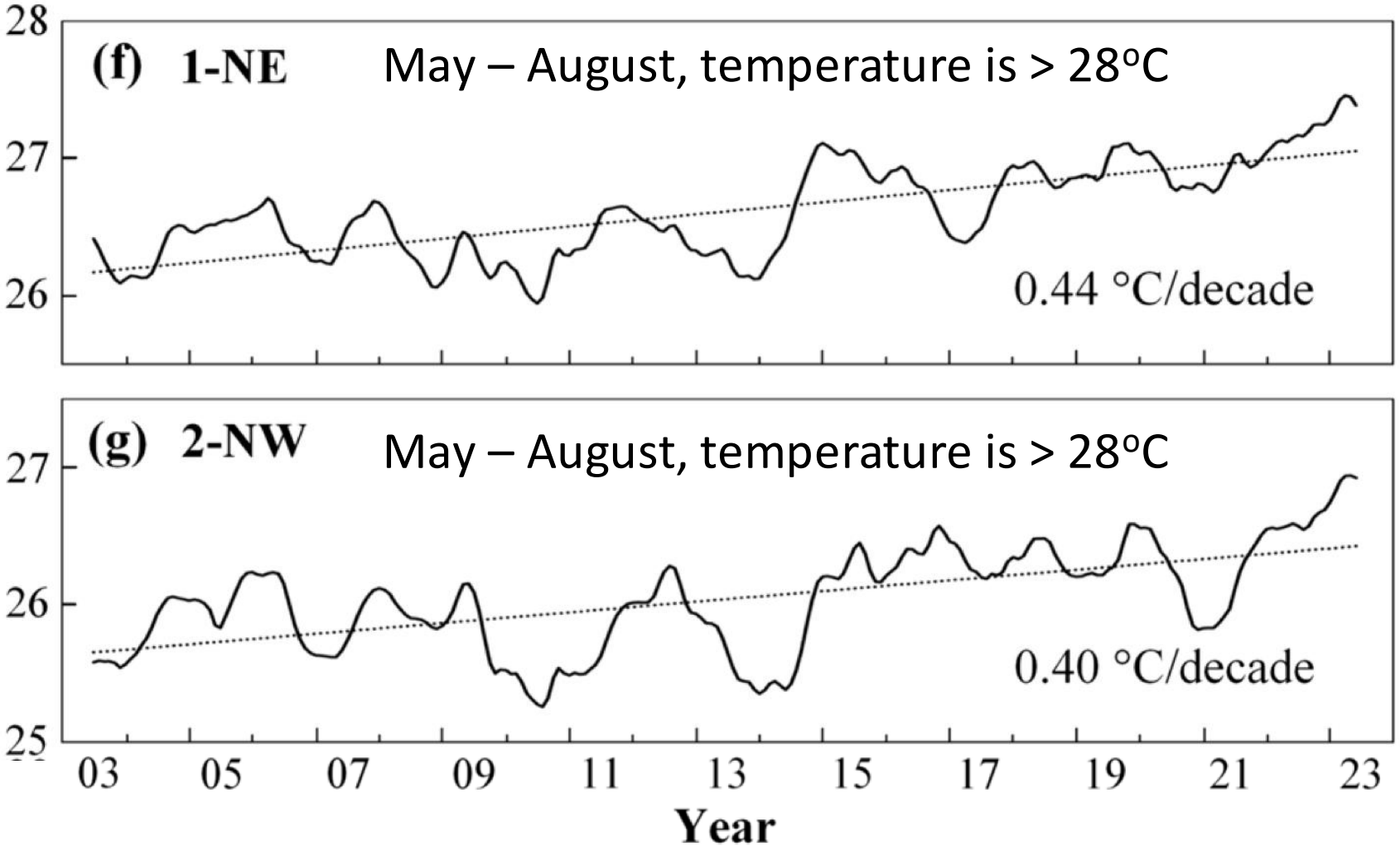


From Zhang et al. (2025)

Sargassum optimal growth: 23 – 28°C

Why – what caused the decline in the north SS?

Hypothesis: changes in transport pathways and ocean temperature



From Shi et al. (2024)

GoM warmed 4 times faster than global oceans

Now what? Continue *Sargassum* research

Between 201 …been published on the Atlantic …ding:

- *Sargassum* ph…
- The exact reas… ‘regime shift”
- The specific ro… *…assum* growth
- The fate of sink…
- The responses… …tions
- The departure…
- The different w…
- ……
- Lastly, can we…

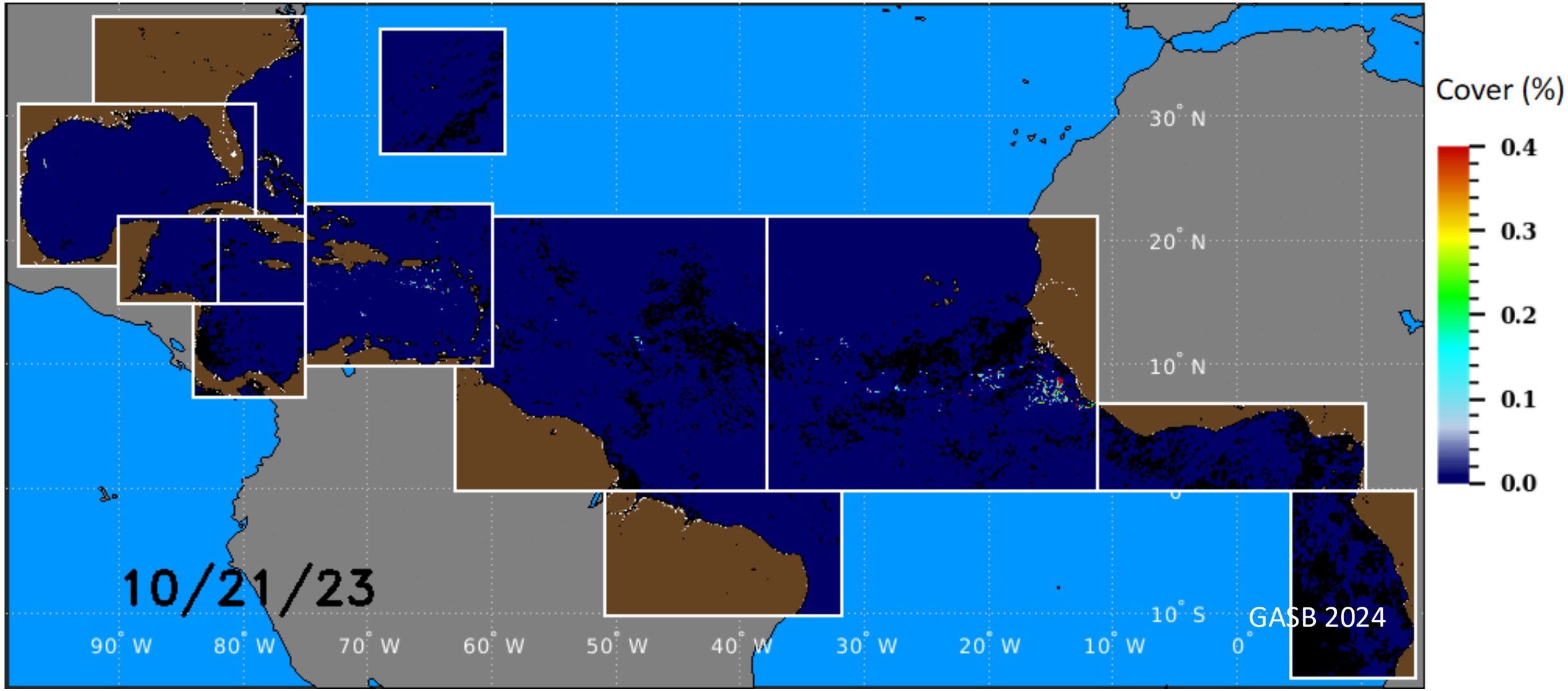


From Hatt et al. (2025)

Now what? Continue and improve SaWS

Sargassum Watch System

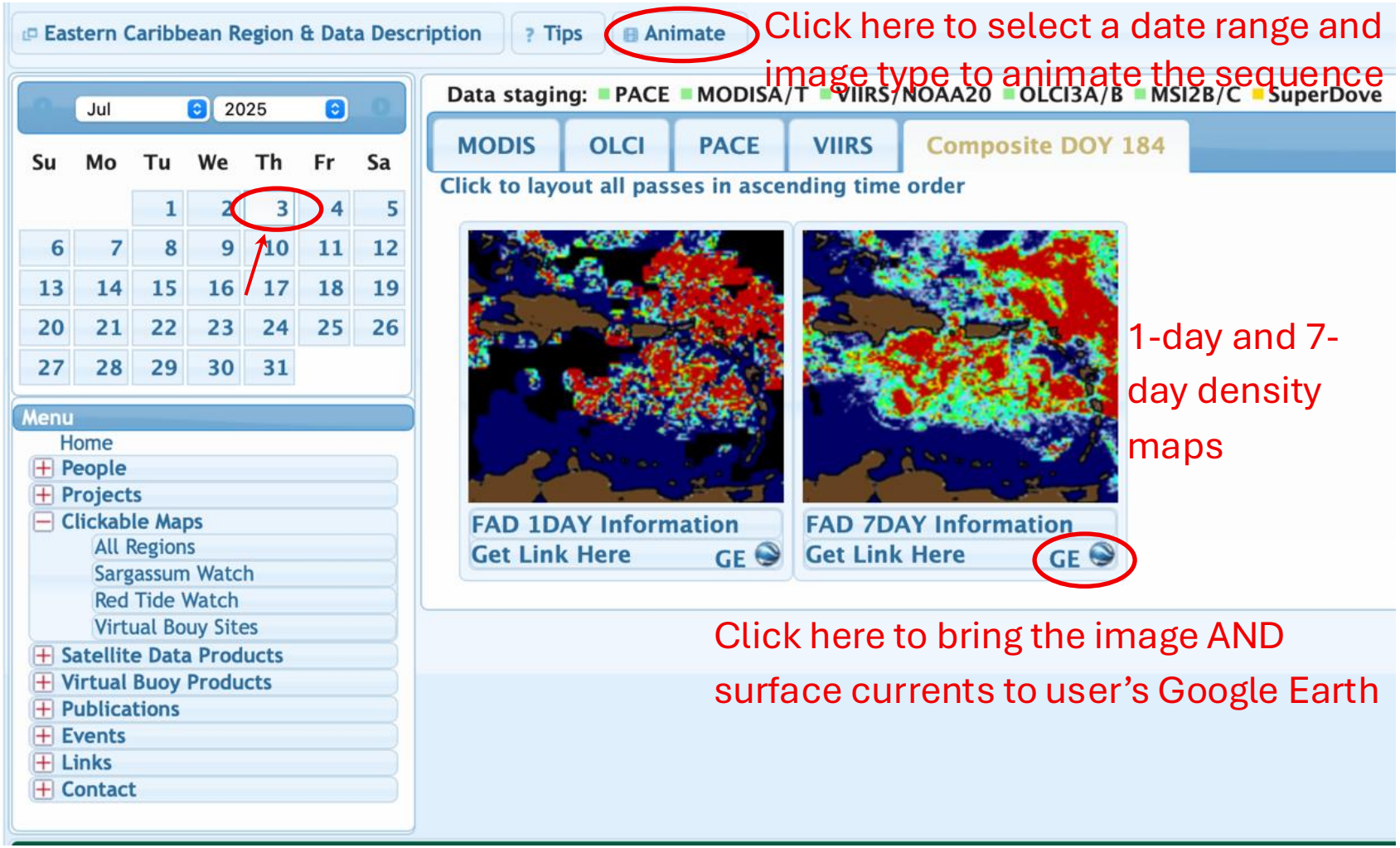
https://optics.marine.usf.edu/projects/SaWS.html

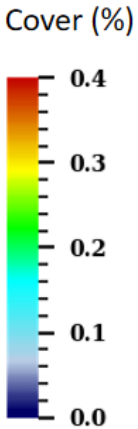


Now what? Continue and improve SaWS

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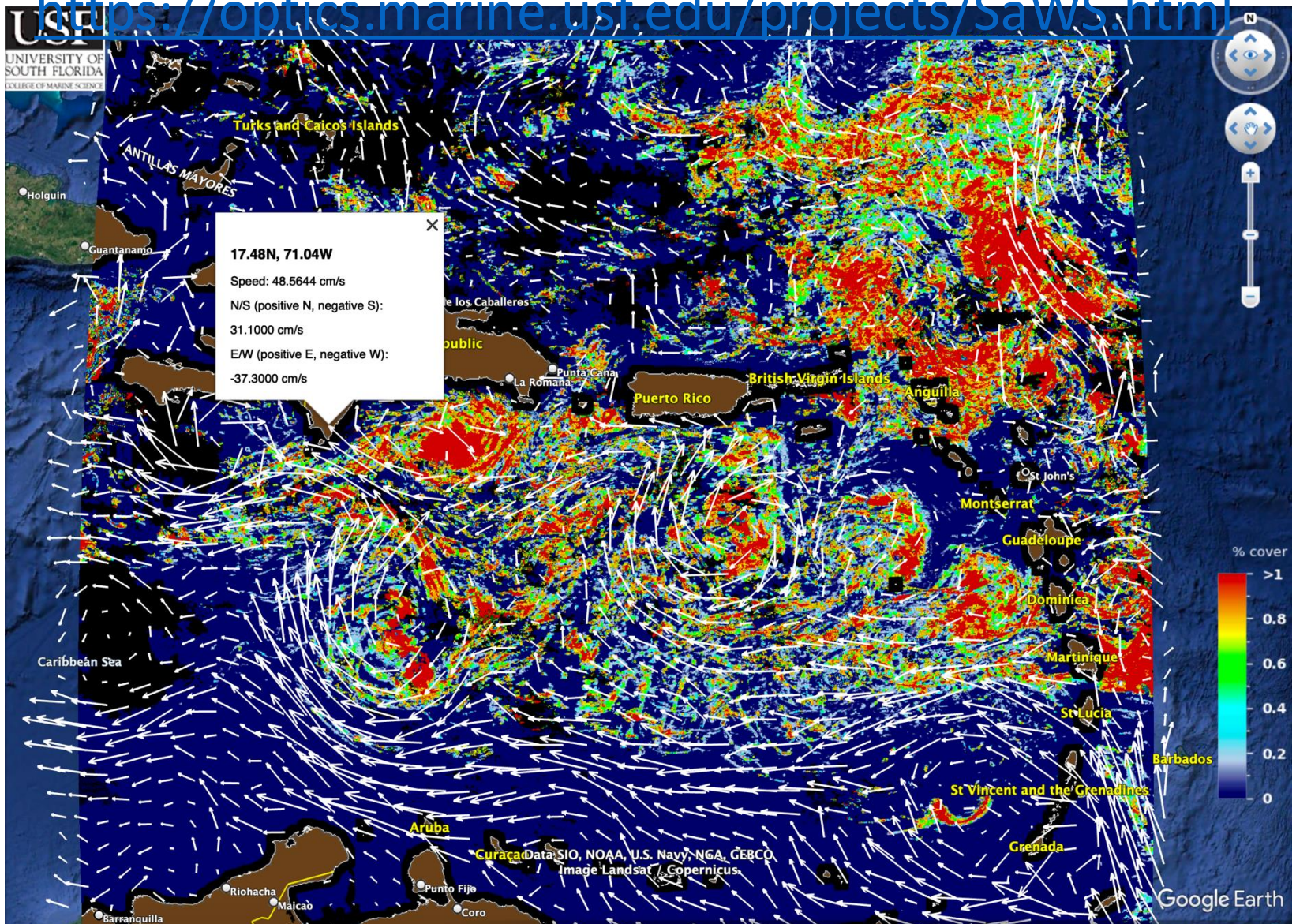




Now what? Continue and improve SaWS

Sargassum Watch System

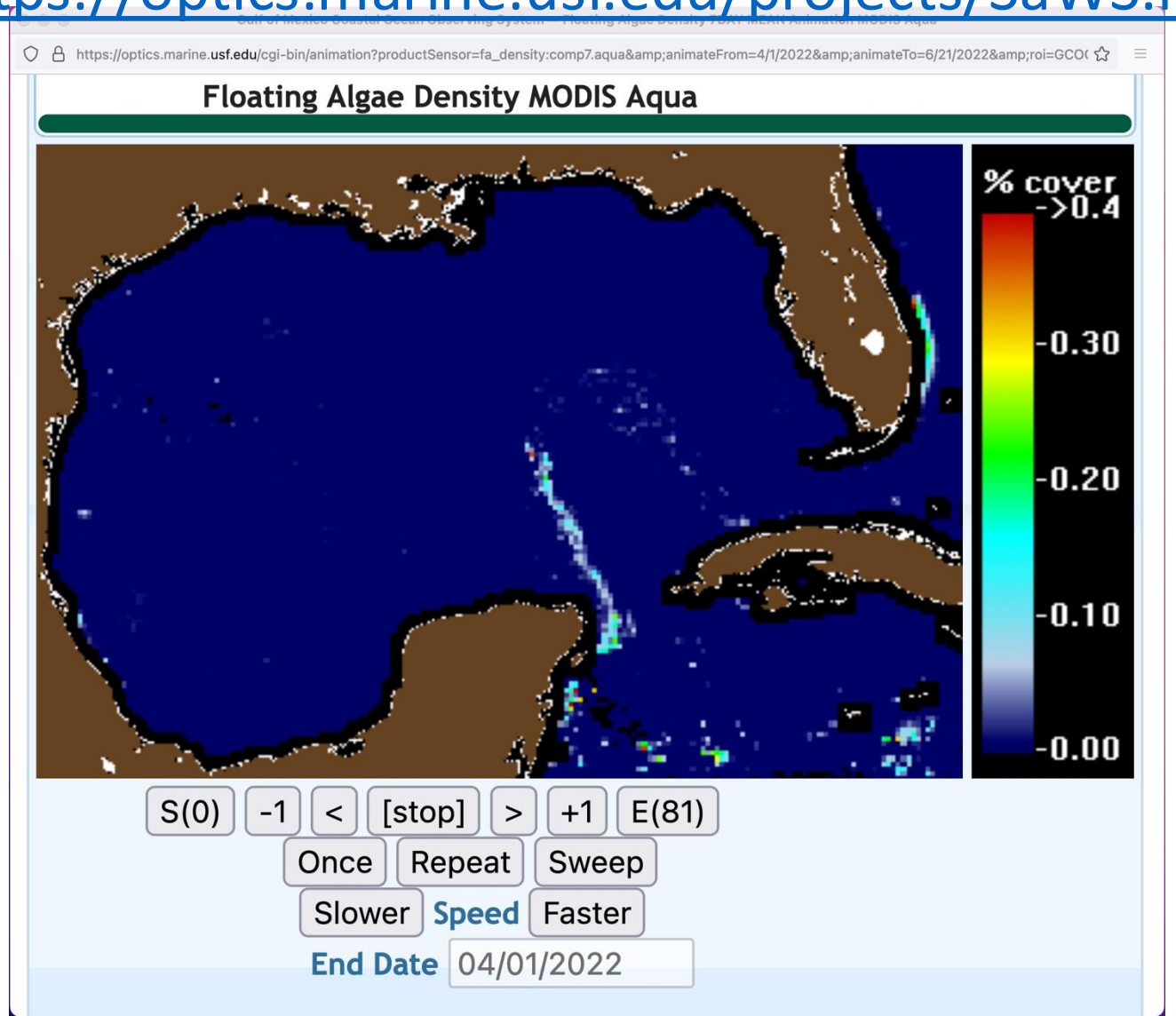
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Now what? Continue and improve SaWS

[*Sargassum* Watch System](https://optics.marine.usf.edu/projects/SaWS.html)

https://optics.marine.usf.edu/projects/SaWS.html



Monitoring, tracking, and forecasting

USF *Sargassum* bulletins

UNIVERSITY OF SOUTH FLORIDA College of MARINE SCIENCE

Outlook of 2025 *Sargassum* blooms

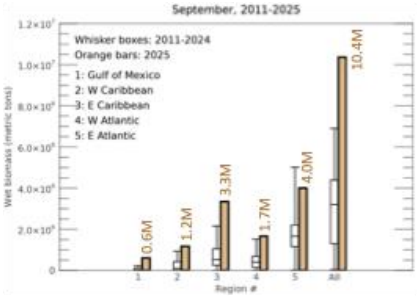
A perspective for the Caribbean Sea and Gulf of America*

September 30, 2025, by the University of South Florida Optical Oceanography Lab

(bbarnes4@usf.edu, yuyuan@usf.edu, huc@usf.edu)

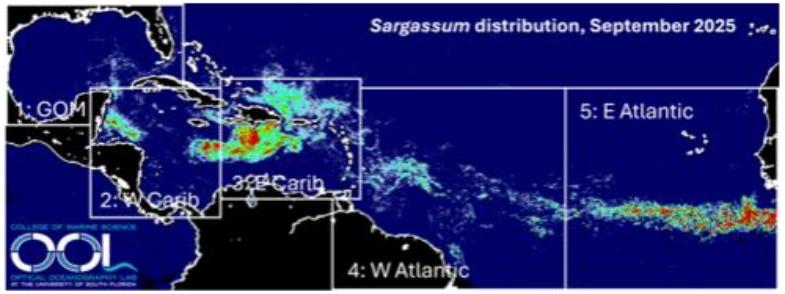
The map below shows the average *Sargassum* abundance for the month of September 2025, with warm colors representing higher abundance. The top color (red) indicates that 0.4% of the ocean surface is covered by *Sargassum*, meaning that *Sargassum* clumps and mats are scattered here and there in the location. The *Sargassum* abundance for each region is compared with historical values in the same month of 2011 – 2024 in the whisker box plot below, where horizontal bars in each vertical box indicate minimum, 25%, 50%, 75%, and maximal historical values, respectively.

As in previous years, the momentum of *Sargassum* decline continued in September, with total *Sargassum* amount in each of the five regions decreased. The decline was substantial in all but the East Atlantic region, with total *Sargassum* amount more than halved. Most *Sargassum* is now in the eastern Caribbean region, followed by the East Atlantic. In the Gulf of America, *Sargassum* amount decreased from 1.9M metric tons in August to 0.6 M metric tons in September, yet due to changes in ocean circulation the amount of *Sargassum* reaching the Straits of Florida increased, likely causing more inundations along the SE coast of Florida. Despite the overall declines, total *Sargassum* amount in every but the East Atlantic region still exceeded the historical record for the month of September, and inundation pressure around many Caribbean regions is still high.

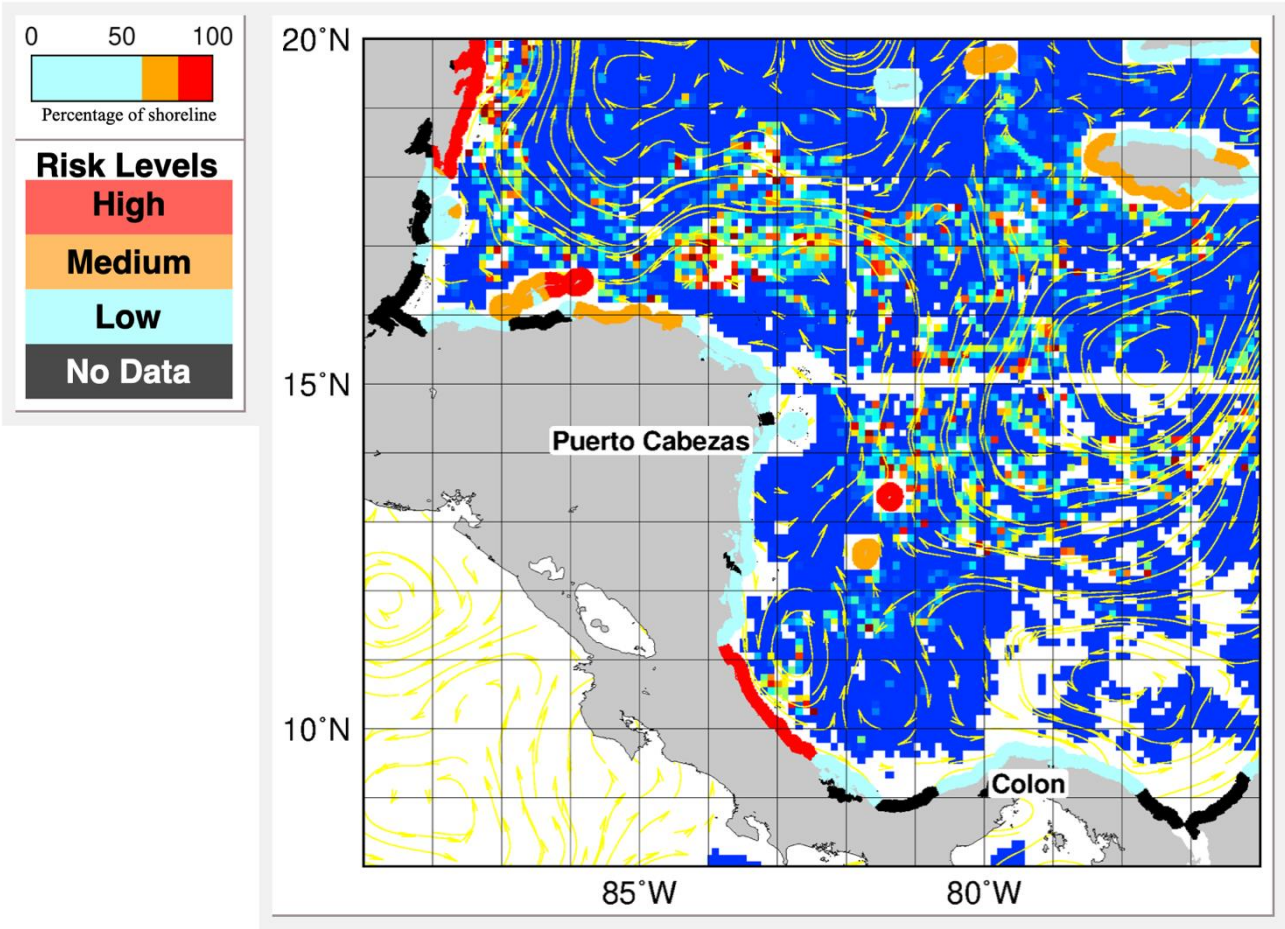


Looking ahead: Total *Sargassum* amount in all regions is likely to continue to decline, possibly reaching the annual minimum around October – November. However, because the absolute amount is still much higher than any previous September, *Sargassum* inundation of variable degrees will continue to occur, especially along the Mexican Caribbean coast and around Haiti, Dominican Republic, Puerto Rico, U.S. Virgin Islands, among others. On the other hand, whether a beach or small region receives large amount of *Sargassum* depends on local factors that are difficult to predict, including winds and ocean currents.

All previous monthly bulletins as well as daily imagery can be found under the *Sargassum* Watch System (SaWS).



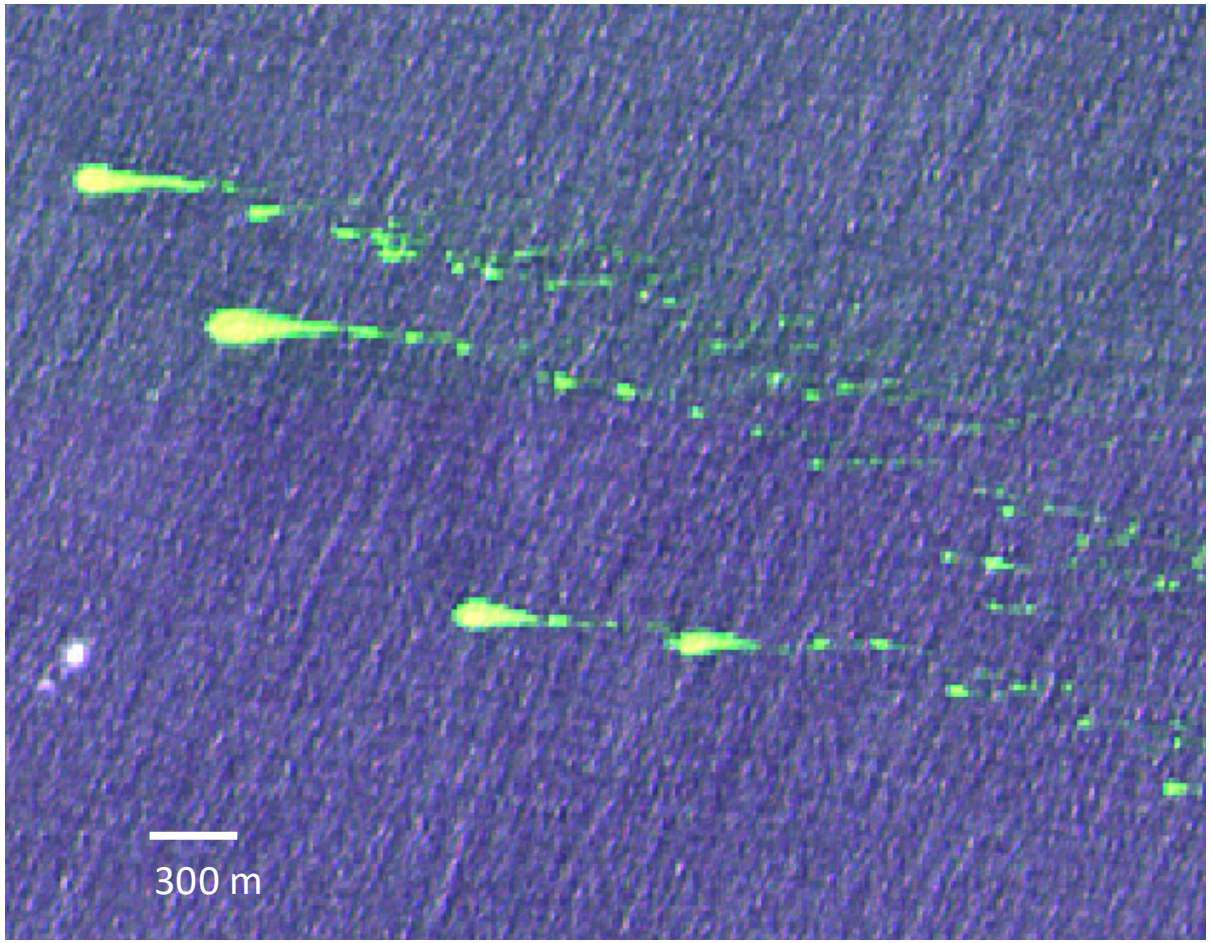
NOAA maps of *Sargassum* Inundation Risk
https://cwcgom.aoml.noaa.gov/SIR/



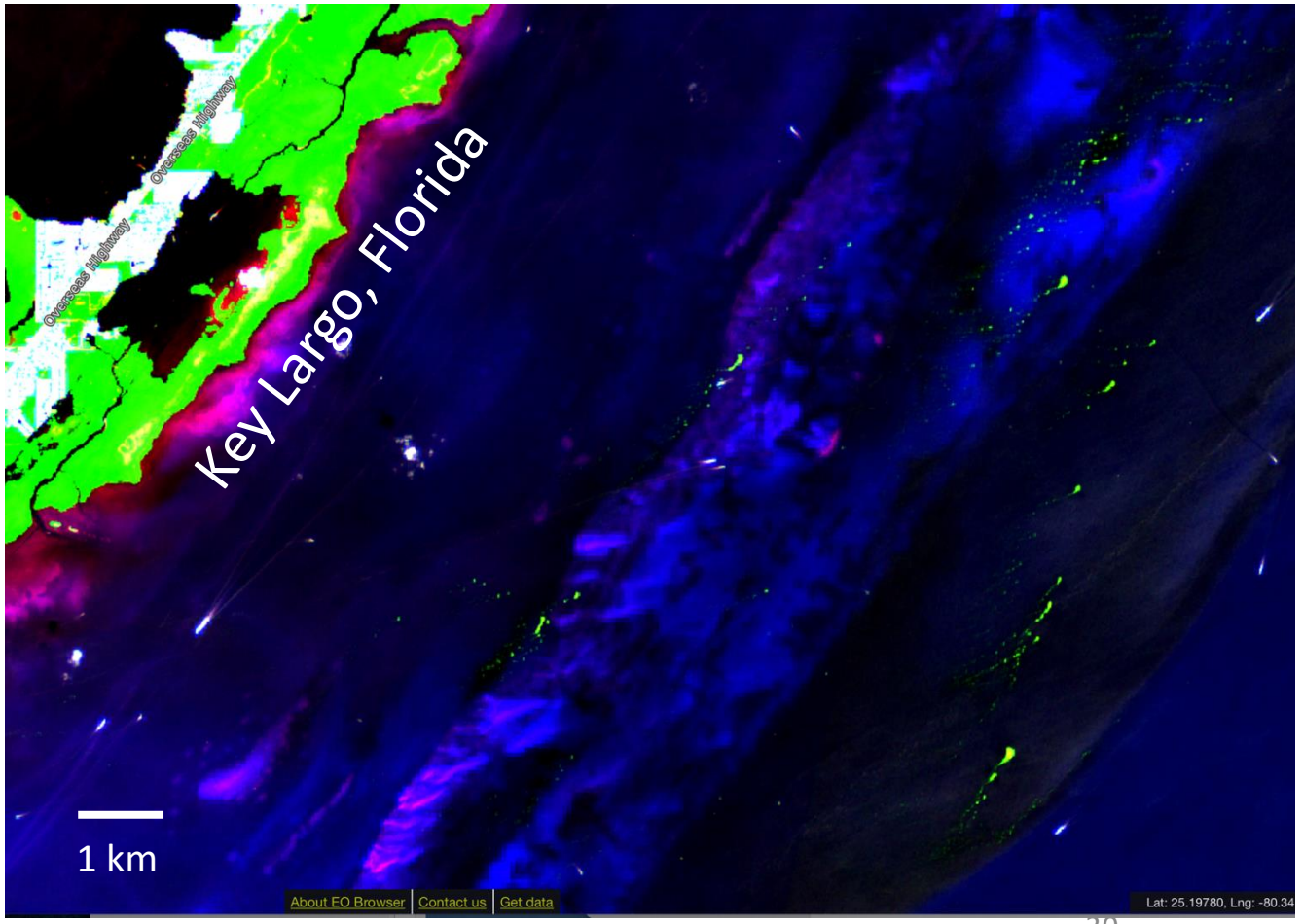
Monitoring, tracking, and forecasting

The power of high resolution

July 21, 2018, Caribbean Sea



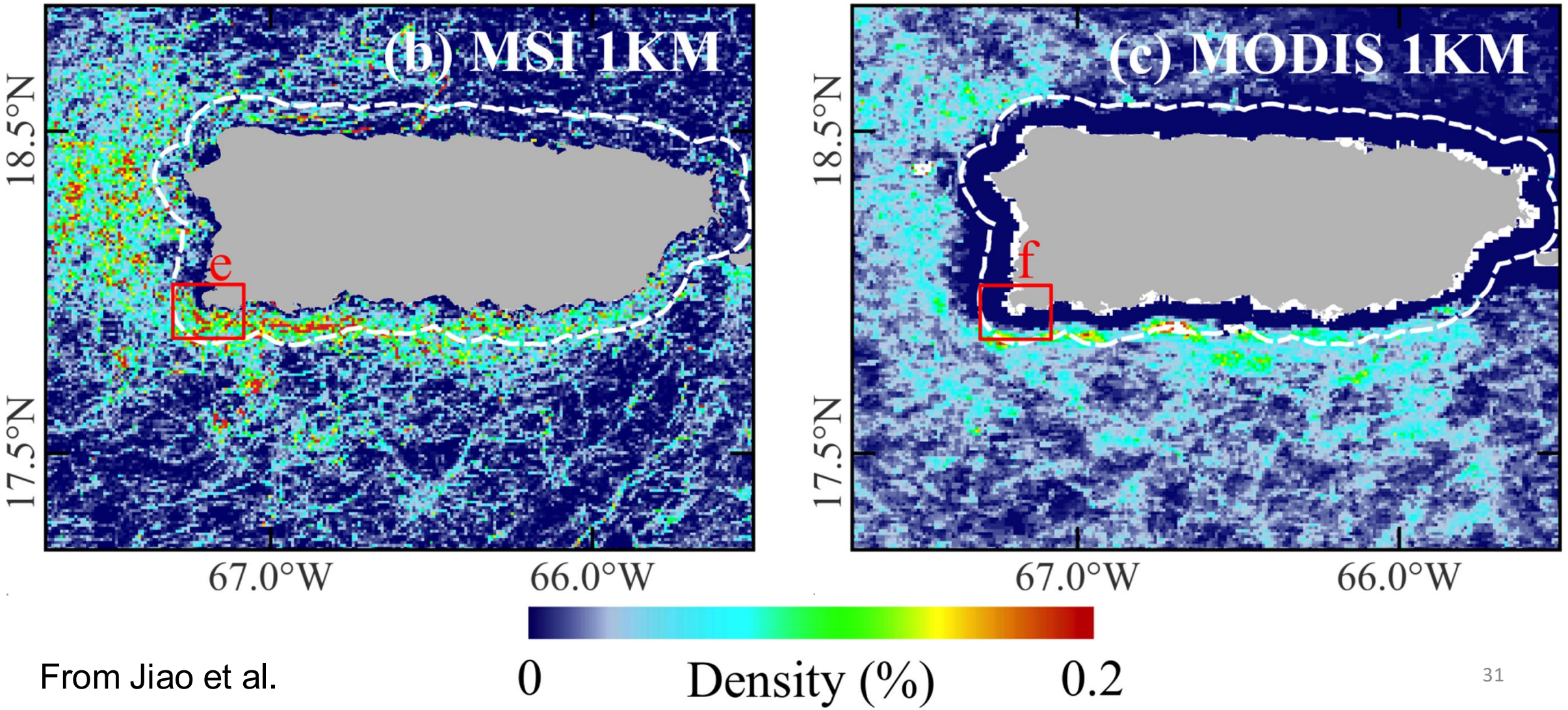
March 11, 2023, Key Largo, Florida



Monitoring, tracking, and forecasting

The power of high resolution

2023 annual mean

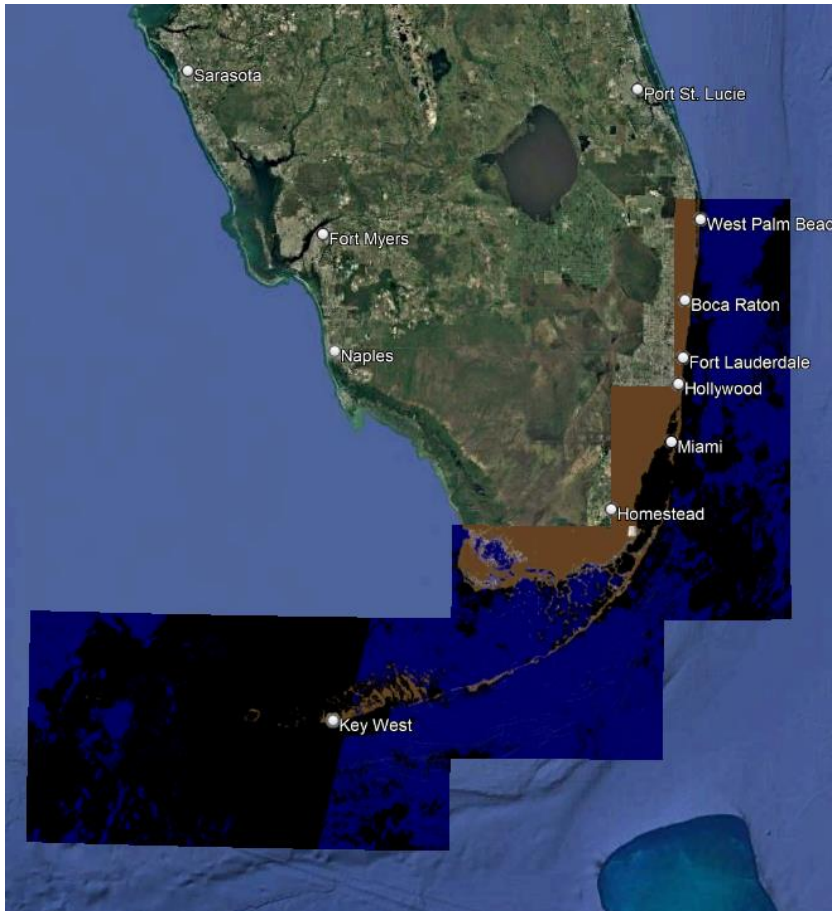


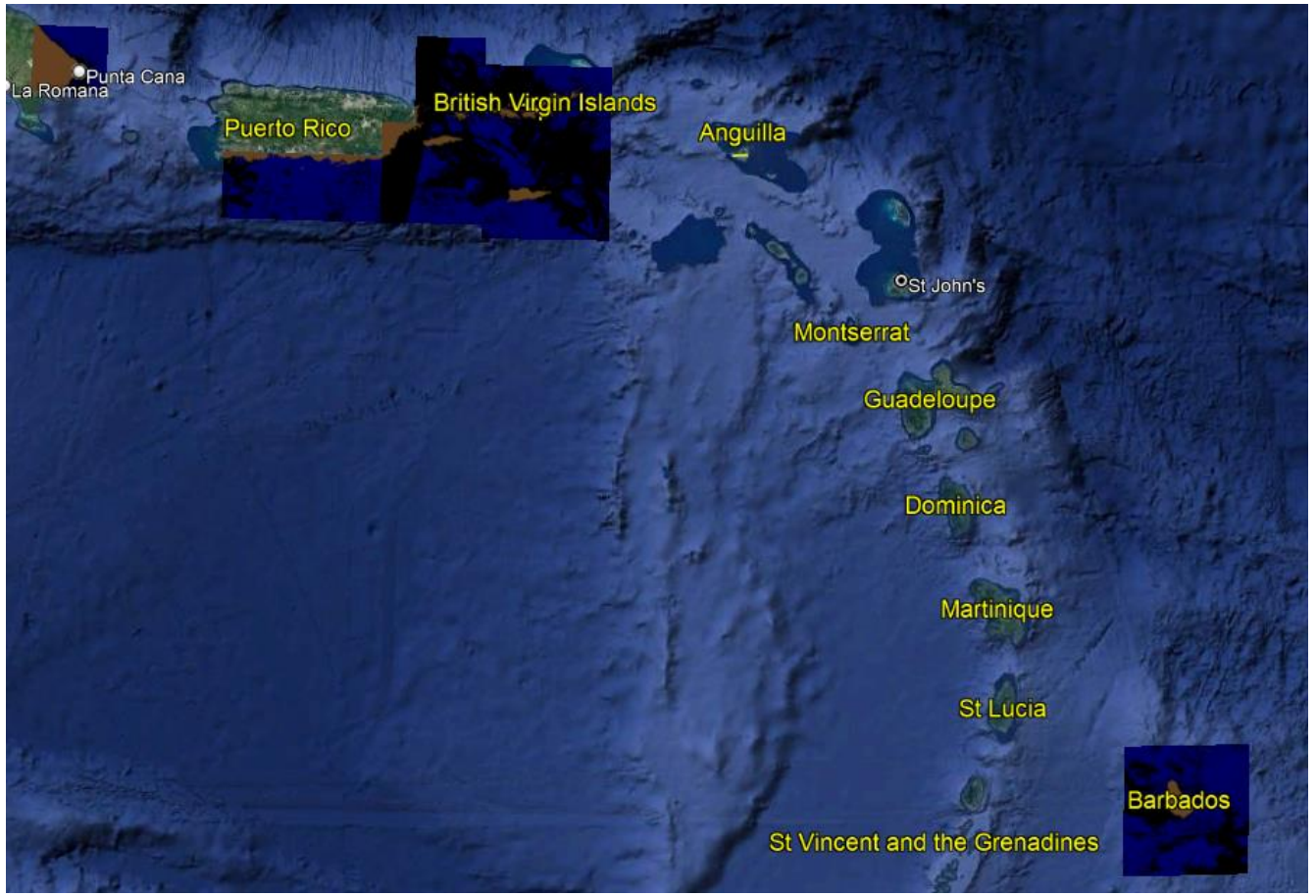
From Jiao et al.

Monitoring, tracking, and forecasting

The power of high resolution

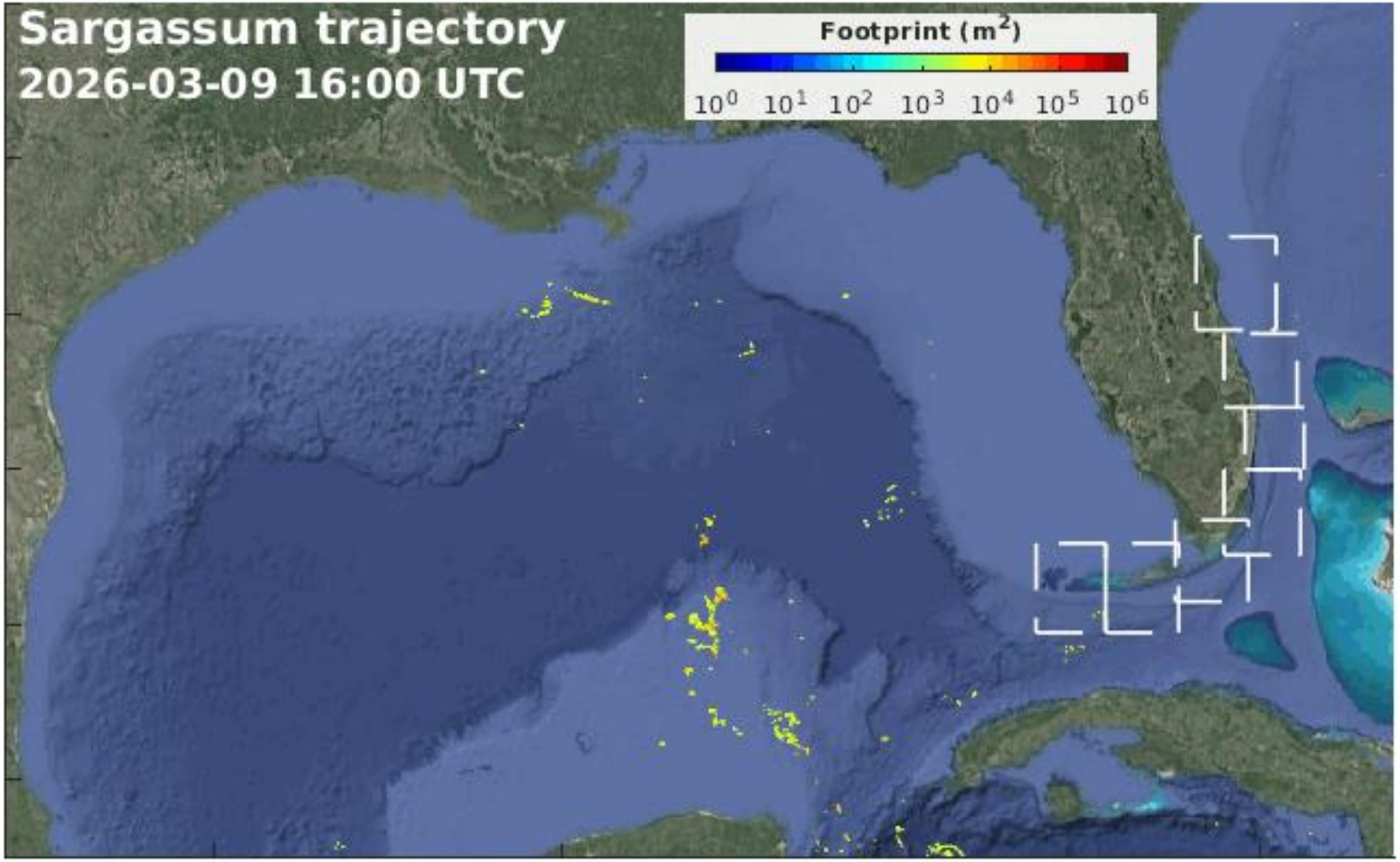
MSI implemented in SaWS for near real-time production





Monitoring, tracking, and forecasting

Operational trajectory tool, in collaboration with the USF Ocean Circulation Lab



Summary

- Satellite remote sensing provides a powerful tool in mapping, monitoring, and tracking *Sargassum* in the Atlantic Ocean: both coarse-resolution and fine-resolution sensors are useful
- Two ”tipping points” occurred in the past 25 years: the emergent GASB since 2011, and the declining *Sargassum* in the north SS since 2015. These changes led to a possible regime shift in *Sargassum* distributions: increased amount in the GASB and decreased amount in the NSS
- Both “tipping points” could be caused by climate variability: extreme negative NAO phase for the former and warming ocean for the latter
- Open-ocean upwelling appears to play a major role in supplying nutrients
- SaWS provides an online decision-support tool to serve many stakeholders
- *Sargassum* publications have increased exponentially since 2011, yet much remains to be done