Understanding & predicting changes in the tropical Atlantic

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Emerging technologies for public policy
Seminar 3: Impact of climate change on marine systems
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Selected themes:

- **Hurricanes** & ecosystem damage
- Climate change/variability & **Sargassum**
- Ocean currents & **Connectivity**
- **Predicting** change
- Focus on the tropics
(although marine systems are changing worldwide)
Research Story 1 - The 2017 Atlantic hurricane season

- Hurricane Irma - Category 5 hurricane
- Landfall from Caribbean to the US
- First impact in Barbuda, 6 Sept 2017

Number of Atlantic Tropical Cyclones by Category and landfall 1980 - 2017

- Major Hurricane
- Hurricane
- Tropical storms/Depressions
- Landfalling Hurricanes
We examined the oceanic circumstances around Atlantic Hurricanes in 2005, 2010 & 2017

Note the coincidence of hurricane tracks and anomalous surface warmth

Ocean warming of 2017 involved unusual ocean conditions over the eastern tropics during April, quite different from 2005 & 2010

Hallam et al. (2019) *Nature Communications*
Mexico's top Caribbean beaches hit by seaweed infestation

An infestation of a seaweed-like algae along some of Mexico's most visited Caribbean beaches has pitted the local community against the president, who has described the problem as a "minor issue".

In a long-running issue attributed by many researchers to climate change, sargassum has covered the popular white sandbanks, turning the pristine waters brown and leaving a strong odour as it decomposes, alarming residents, businesses and, obviously, tourists.

https://www.bbc.co.uk/news/world-latin-america-48756500
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Photos courtesy of Greg Scott (1), Nicole George (2), Martha Gilkes (3), Mar Burbidge (4), Andy Scholl (5), Ellie Wyatt (6)
Satellite-based Sargassum Watch System (SaWS)

https://optics.marine.usf.edu/projects/saws.html
Why has *Sargassum* proliferated across the tropical Atlantic since 2011?

1. Changing light conditions (clouds)
2. Changing stratification (heat exchange)
3. Changes in runoff (macronutrients)
4. Changes in dust fluxes (micronutrients)
5. Changing winds and surface drift
6. Changes in large-scale ocean currents

- Warmer surface water
- Weaker winds
- More solar heating
- Less cloud

Marsh & Skliris, in prep.
Points for Discussion?

- Hurricane seasons are changing in intensity & character
- Ecosystems suddenly change basin-wide - e.g. Sargassum
- We are not sure why!
- Ocean currents connect coastal environments separated by an ocean, on timescales of months-years
- Predicting change and natural cycles on a range of timescales (seasons to decades) continues to improve
- The tropics are uniquely vulnerable to extremes of heat, storms and sea level rise (reefs, low-lying SIDs)