

Transformative Ocean Observing for Hurricane Forecasting, Readiness, and Response in the Caribbean Tropical Storm Corridor

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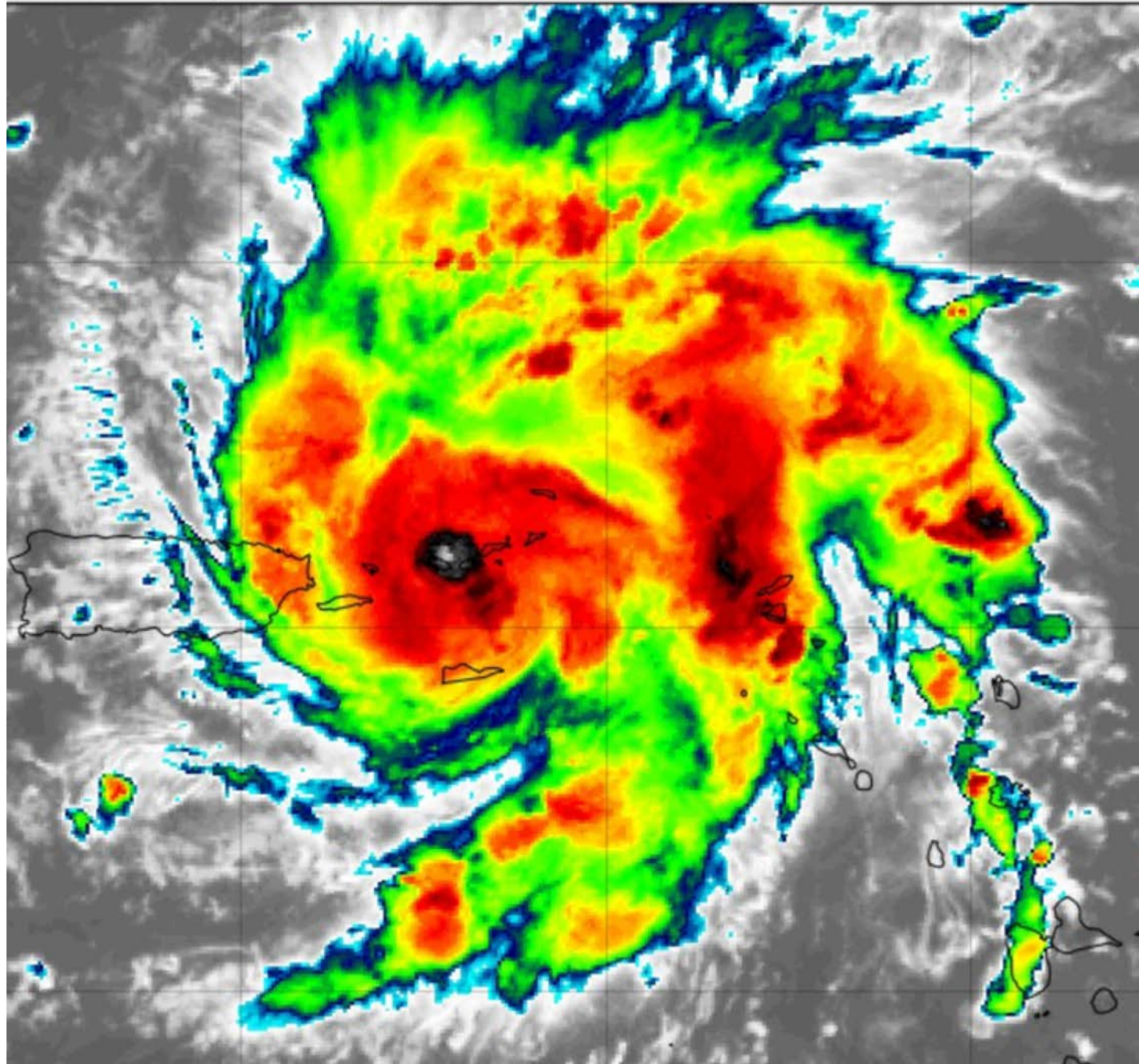
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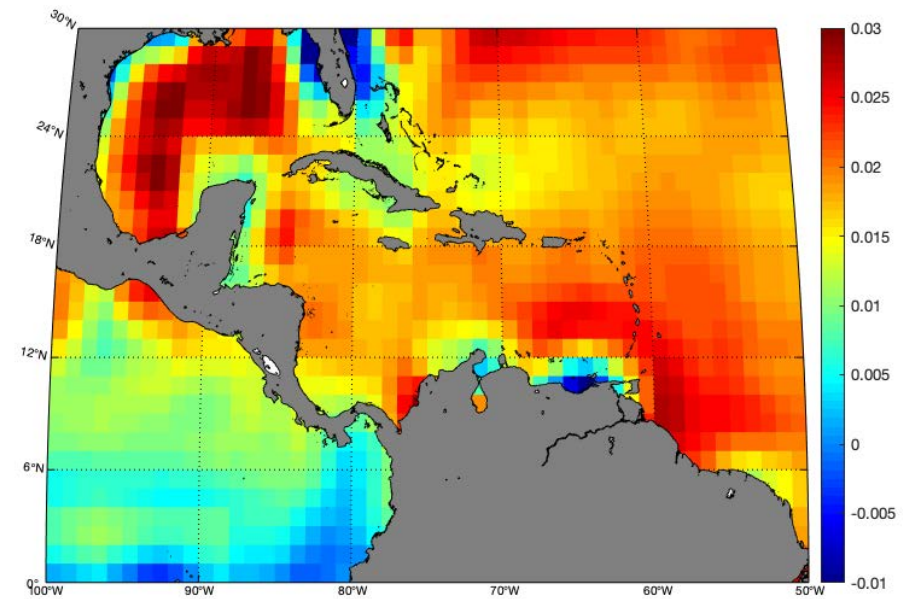
Annual US economic losses from hurricane-related damage is \$112B year over the last 3 years alone - and climbing - with 1095 deaths / year. Initial results indicate that hurricane intensity forecasts can be improved with expanded and sustained ocean data collection and utilization along the hurricane path.

Hurricane Dorian forms

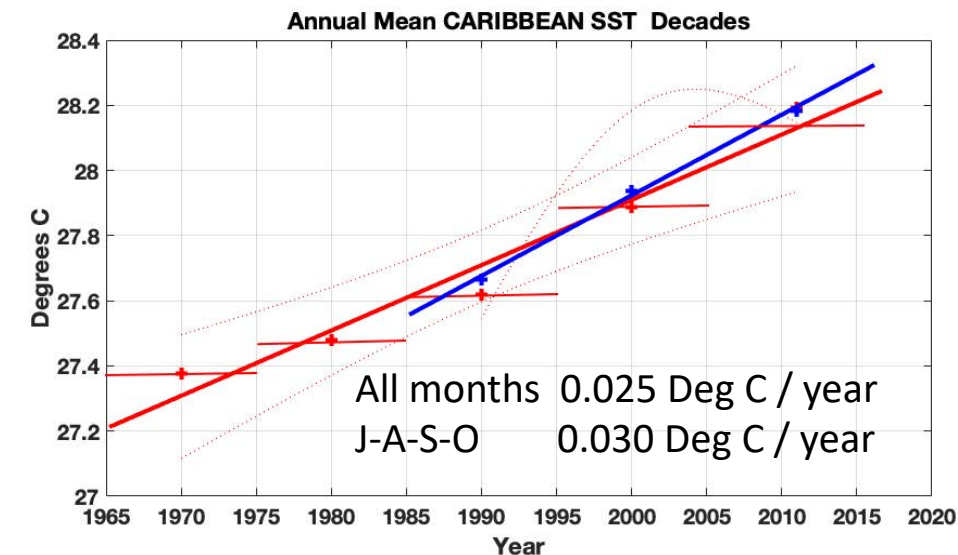
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The upper ocean in the Western Tropical Atlantic tropical storm corridor – including the Caribbean Sea – is highly under-sampled and climatologically warming. Regionally varying Essential Ocean Features impacting hurricane dynamics include fresh water upper ocean layers, mesoscale eddies, high sea surface temperature and Upper Ocean Heat Content values, and inflows from the Subtropical and Equatorial Atlantic. There are long-term warming trends in Sea Surface Temperature... →



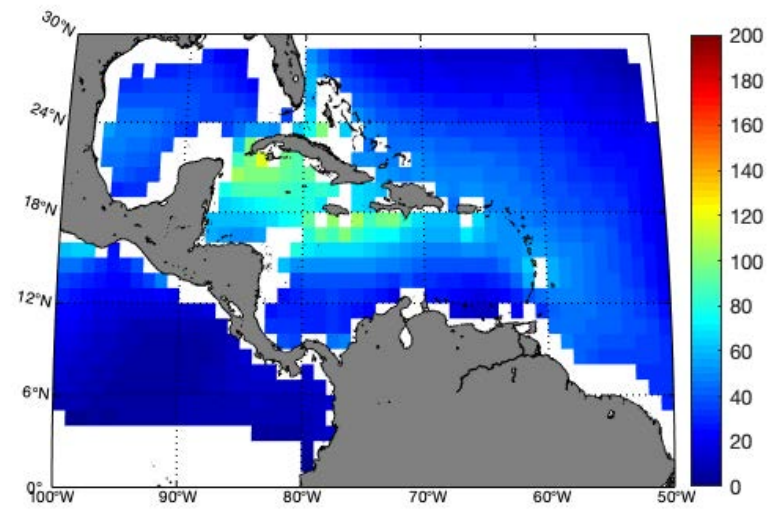
OISST V2 1981-2020 Linear Trend Deg/Year



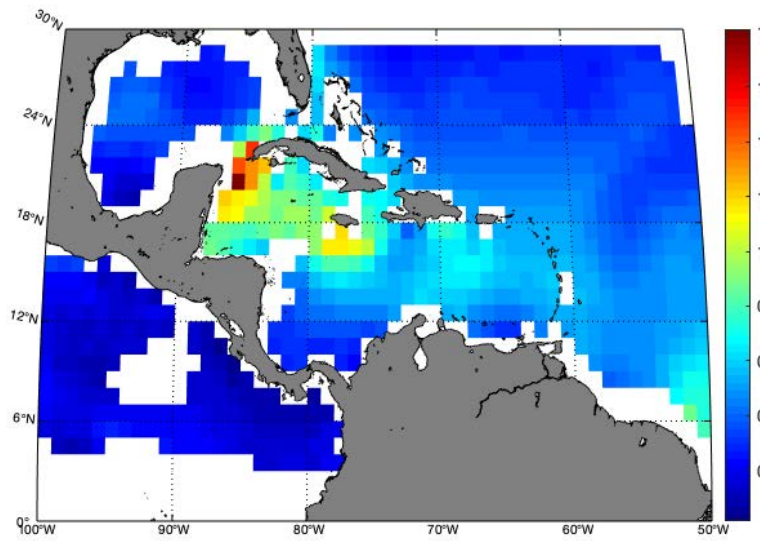
BLUE: OISST RED: WOA18

... and Upper Ocean Heat Content. Upper Ocean Heat Content estimates the thermal energy available to a tropical cyclone – vertically integrated Temperature warmer than 26° C.

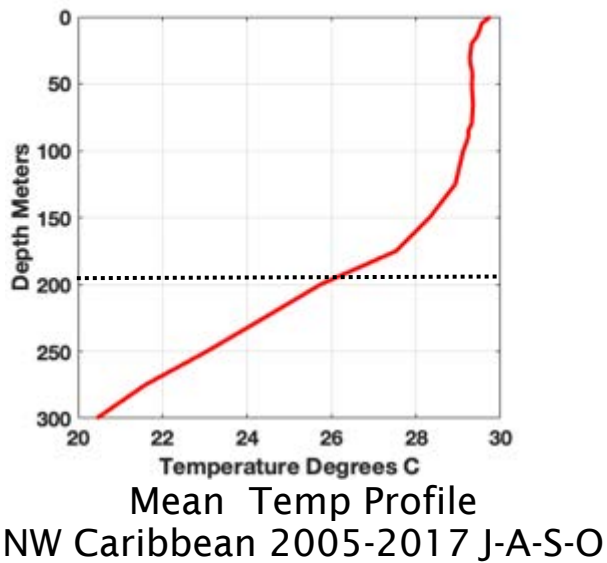
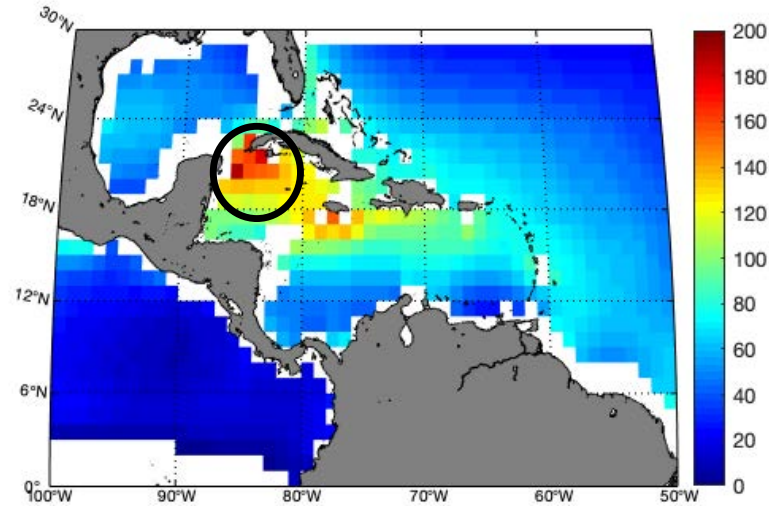
UOHC WOA18 HURR 1965 – 1974 kJ/cm²



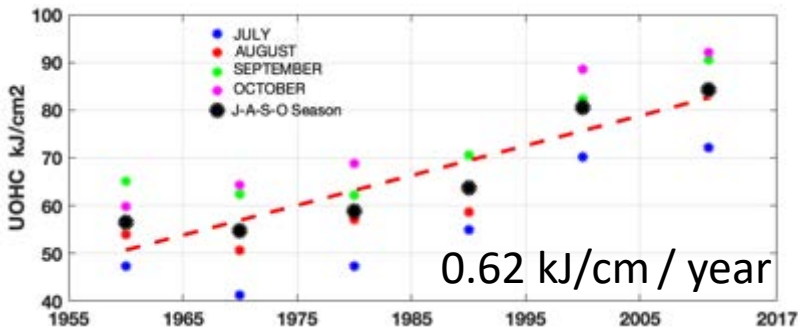
UOHC WOA18 HURR TREND kJ/cm²/year



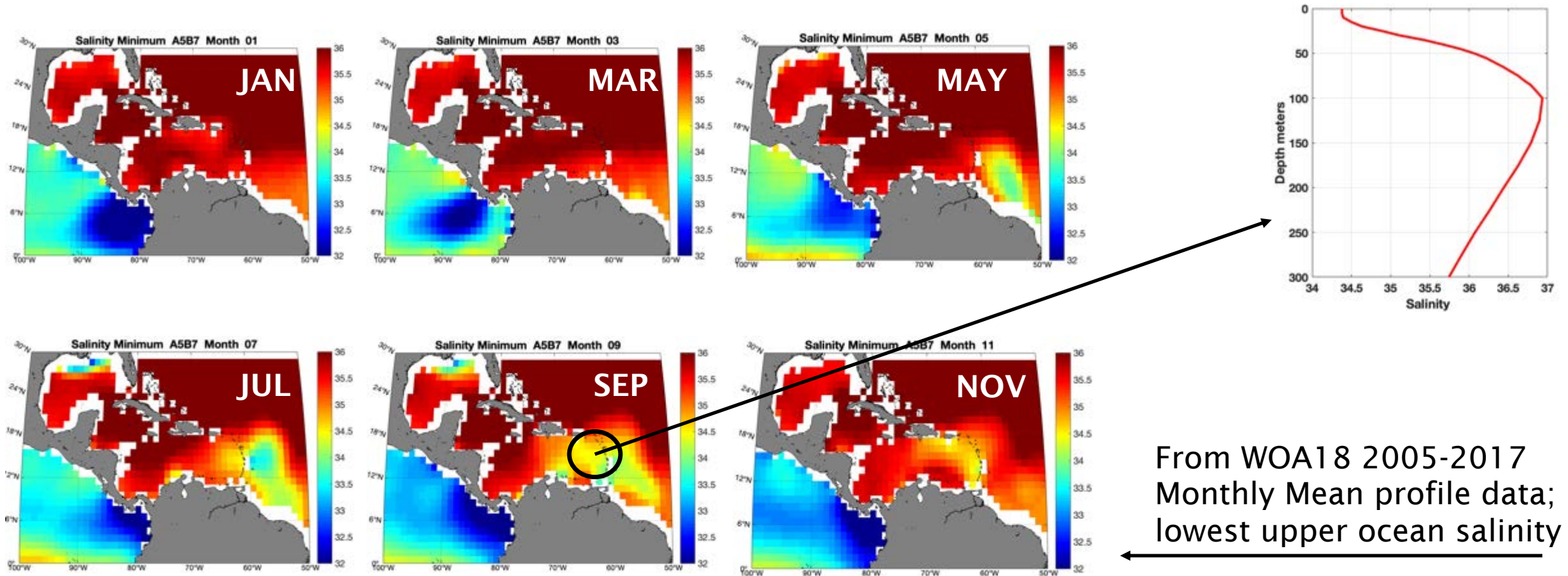
UOHC WOA18 HURR 2005 – 2017 kJ/cm²



Caribbean-wide UOHC Trend (Hurricane Season)

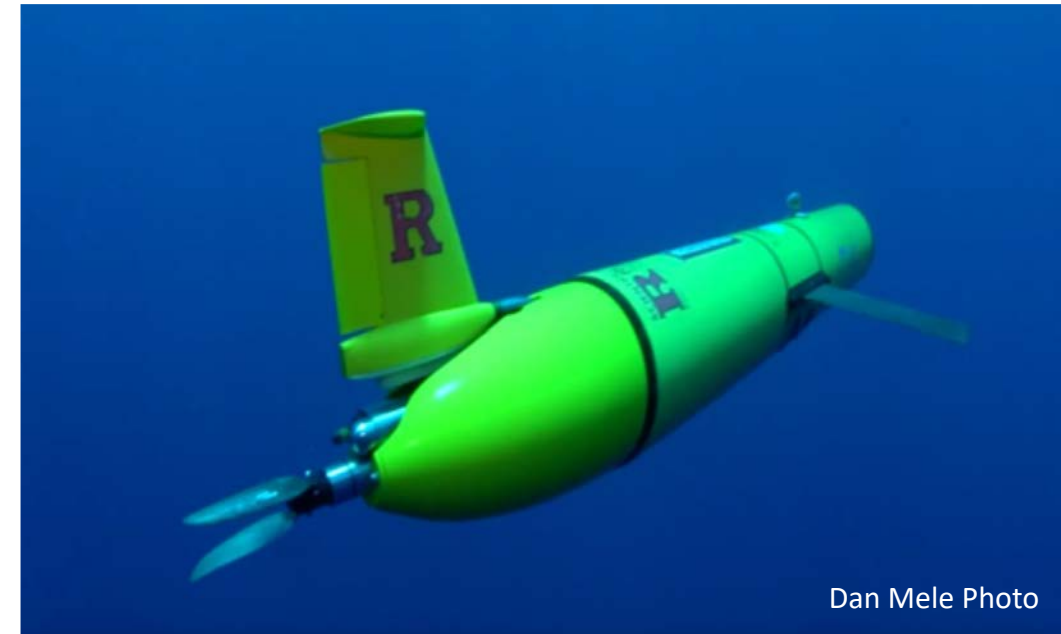
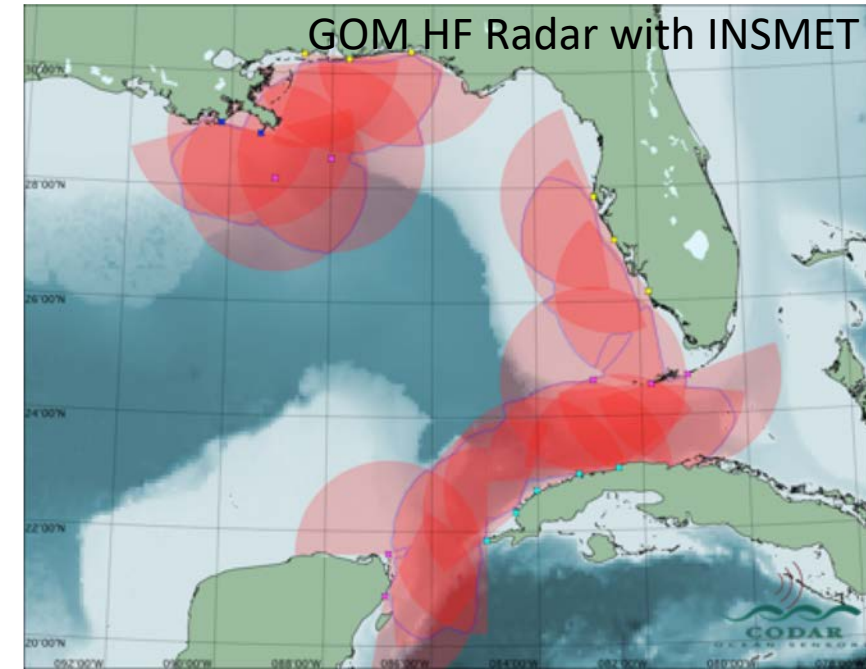


Additionally, fresh water from the south (Equatorial currents, NBC Rings, SA river outflow) spreads into the E Caribbean, peaking in hurricane season. Fresh, warm surface water is trapped above higher salinity North Atlantic water, creating a vertical upper ocean structure that can enhance hurricane intensification.

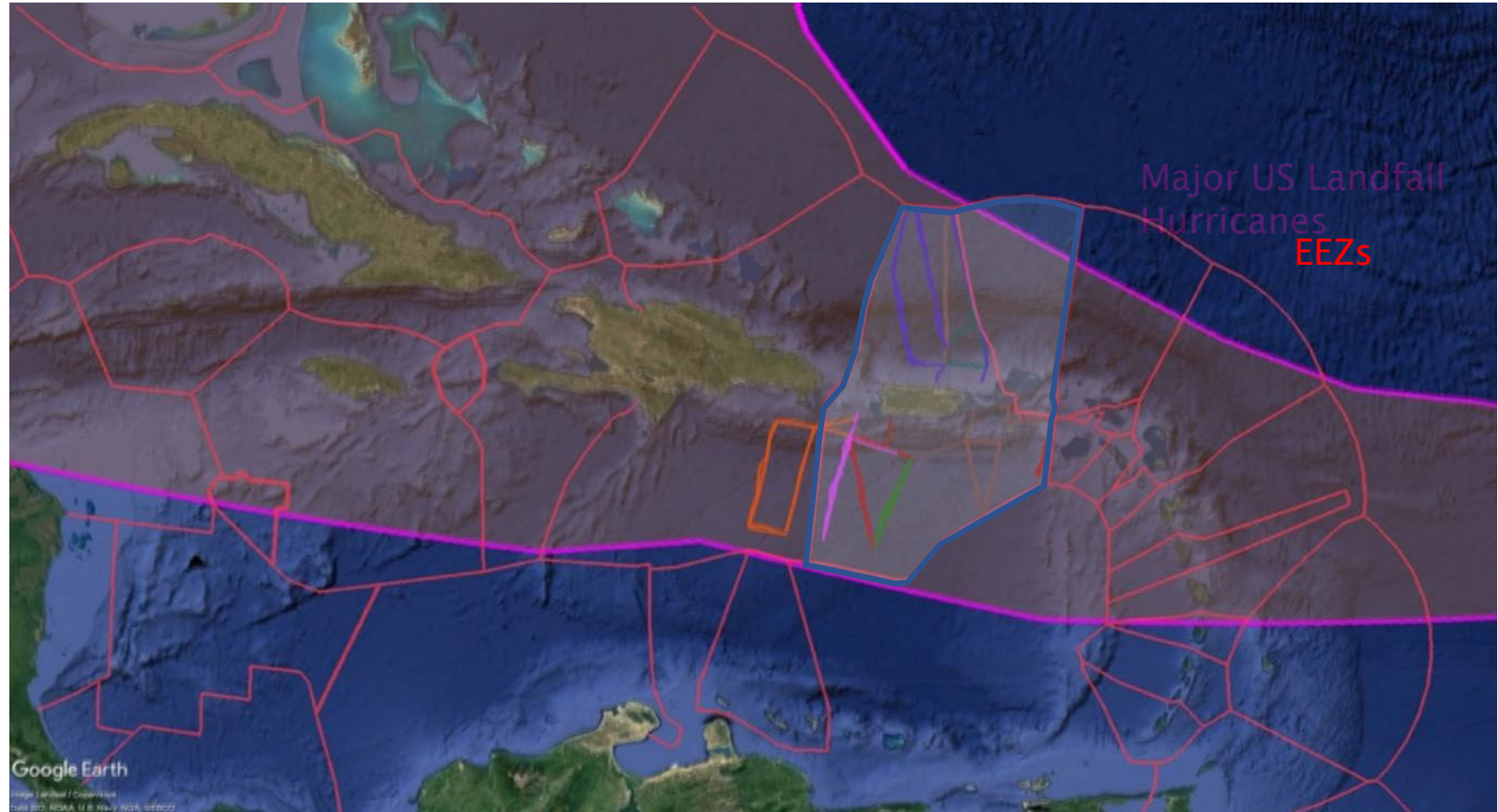


This proposed UN Decade Ocean Shot activity will build supporting physical and social infrastructure and conduct a long-term, critical-region sampling program using gliders, High Frequency Radars (HFRs), and developing technologies to provide real-time information resulting in hurricane forecast improvement.

Improved forecasts will support new generation of local storm surge / precipitation / wave and coastal impact models and guidance used to directly enhance resilience.



Through presently funded smaller scale projects, examples exist at a proof of concept scale. Examples include ongoing US and International glider missions in the region; HFRs in Puerto Rico and Mexico; and projects in cooperation with NOAA, Navy, and research interests on assimilating new data into models. The goal is to expand in scope and engage new and existing partners **into a sustained program.**



Present efforts are already stimulating ocean forecast model development, but to be transformative, this effort will:



- Strive for appropriate observation density, diversity, and utilization for a sustained, meaningful US and regional impact;
- Create a regionally distributed supporting infrastructure including operations, education, training, and workforce development;
- Engage a diverse and influential group of partners to convert forecasts to products to local action;
- Lead to a sustained, expanded, regional Ocean Observing System based on GOOS principles.

An inspiration for this activity was a MacArthur Foundation '100&Change' proposal

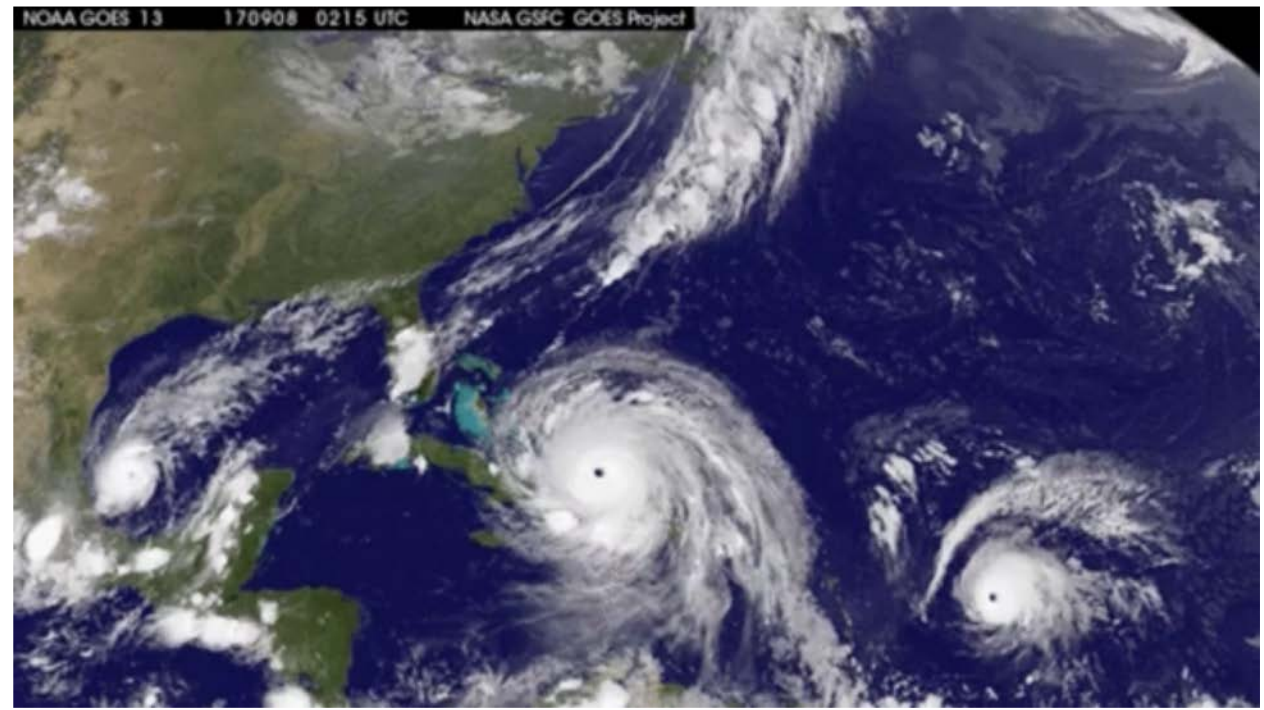
<https://macarthur100.marine.rutgers.edu>

led by Rutgers University, including TAMU and UVI.



This OceanShots project would be a component of a wider regional UN Decade Program being proposed for IOC endorsement in collaboration with **IOCARIBE**, the IOC SubCommission for the Wider Caribbean. It is our hope that by 2030 our legacy would be successful program to – in the words of the Decade Action Framework – “sustain long-term high-quality **observations** of marine and coastal environments including human interactions and deliver **forecast and decision-support tools.**”

The success of this project will depend on the merger of regional scale planning and management AND development of local level partnerships for implementation. To be **sustainable, operational, analytical, and actionable,**



capability has to exist at the multiple proposed regional system nodes. We will promote expanded education and workforce development using existing partner capabilities, and include an Ocean Observing for SIDS/Developing Economies component. Product and information delivery systems will have local interpretive support and will incorporate local knowledge and expertise.