CARICOOS joint effort to understand ocean acidification and climate variability in the Caribbean

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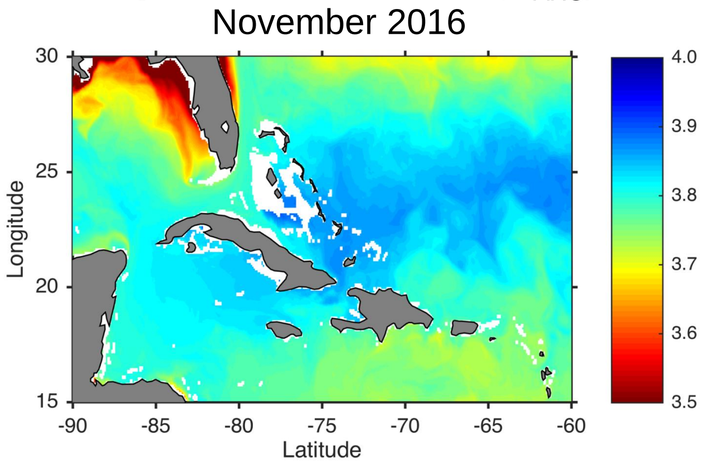
Goal

A key component of CARICOOS mission is to monitor, understand and predict changes in ocean and coasts and inform decision makers in the Caribbean region. Ocean acidification (OA) represents one such change, unfolding in direct response to increasing atmospheric carbon dioxide (CO_2) concentrations. To this end, CARICOOS, several federal agencies, the UPR-Mayaguez and the University of New Hampshire have joined efforts to monitor OA and climate variability in the Caribbean region. The aim of these efforts are to work together on a mission to improve our understanding of how OA impacts the ecosystem and the biogeochemical and physical processes controlling the carbonate dynamics in near-shore areas using different monitoring tools. This aids NOAA's National Coral Reef Monitoring Program efforts to establish baselines and track changes in both carbonate chemistry and the associated ecological impacts of OA and support NOAA's progress towards achieving a holistic understanding of the ecosystem respond to OA and climate.

From space observations to → Buoy to → In-situ

A satellite-based OA model by NOAA's Coral Reef Conservation Program

Surface seawater aragonite saturation state (Ω_{ARG}) November 2016



$\Omega_{ARG} > 4$ Healthy coral

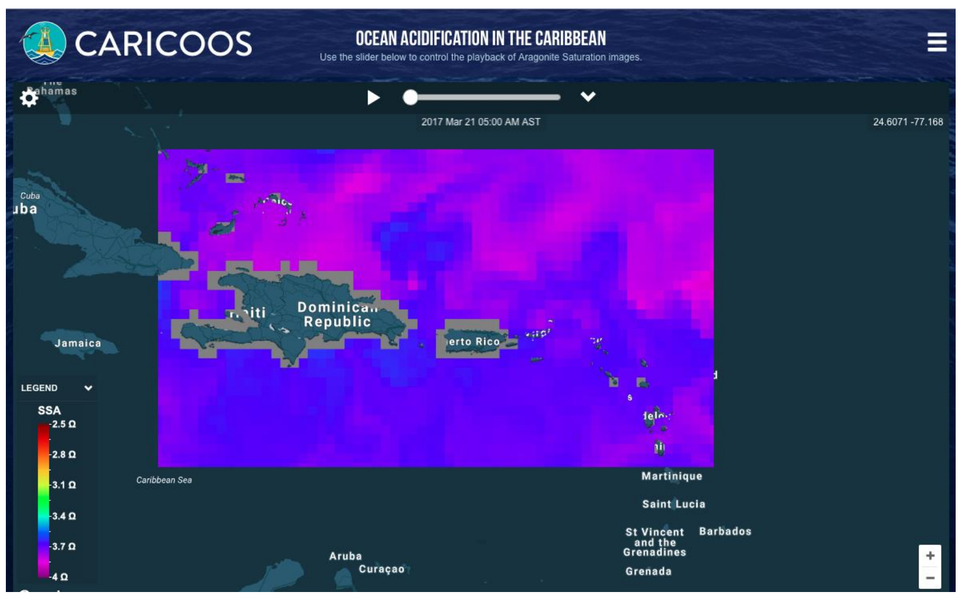
$\Omega_{ARG} < 3$ Stress coral

This model reveals considerable spatial and seasonal variability. As Ω decreases, it becomes more difficult for marine calcifying organisms to build their skeletons out of calcium carbonate, resulting in slower growth rates.

This product is available at CARICOOS as part of the ecosystem and water quality program

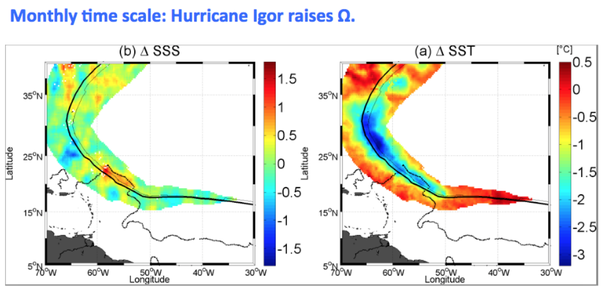
http://www.caricoos.org/oceans/observation/aragonite

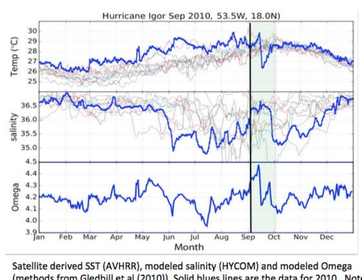
Surface Ω_{ARG} - March 21, 2017



This product allows us evaluate how extreme events, such as tropical storms affect surface Ω_{ARG}

Monthly time scale: Hurricane Igor raises Ω.





Detail from Reul at el, 2014: Surface wakes of **Hurricane Igor, September 2010**. Satellite-derived Post minus Pre-hurricane changes in (a) Sea surface Salinity (ΔSSS) and (b) Sea Surface Temperature (ΔSST) . The thick and thin curves are showing the hurricane eye track and the path of maximum winds. The dotted lines is showing the pre-hurricane plume extent. ΔSST and ΔSSS wakes were only evaluated at spatial locations around the eye track for which the wind exceeded 34 knots during the passing of the hurricane.

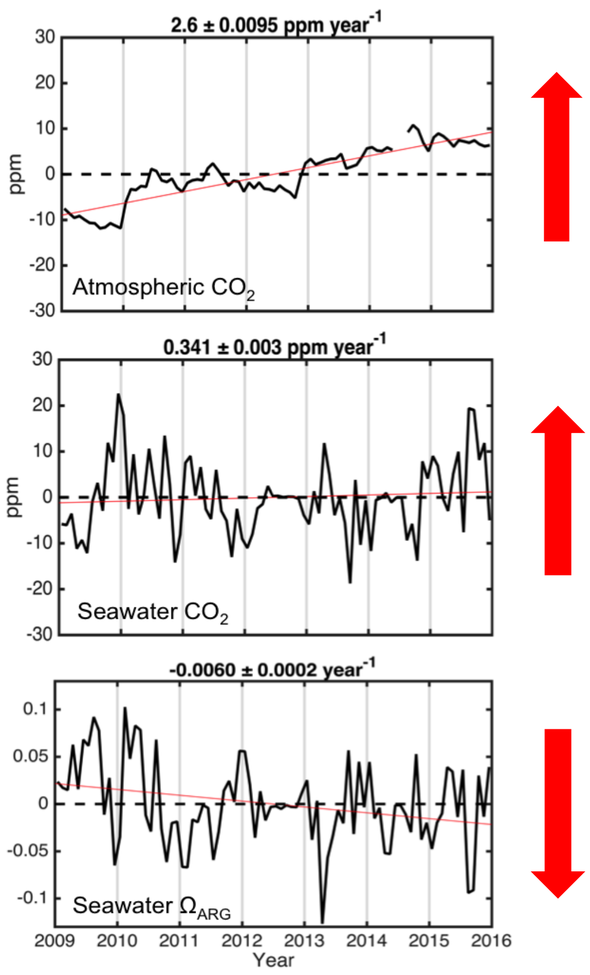
Satellite derived SST (AVHRR), modeled salinity (HYCOM) and modeled Omega (methods from Gledhill et al (2010)). Solid blues lines are the data for 2010. Note the perturbations brought on by Hurricane Igor (Sept, 2010). The recovery time for Omega ("one month) corresponds to recovery of SST and particularly, SSS.

Atlantic Ocean Acidification Test-bed (AOAT)

The Ma*p*CO_2 buoy at La Parguera Marine Reserve, PR.

This is part of CARICOOS efforts to establish baselines and monitor changes in both carbonate chemistry and the associated ecological impacts of ocean acidification on near-reef areas.

Current trends in air & seawater CO_2 and Ω_{ARG}



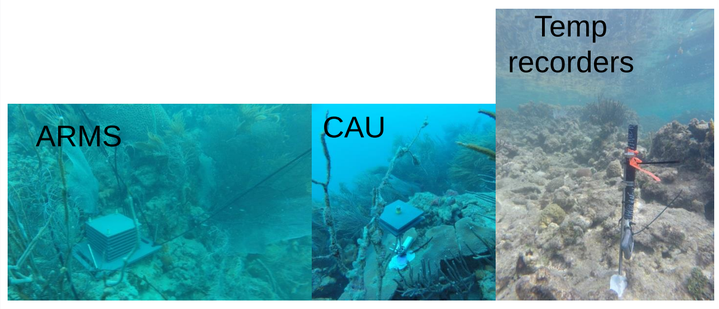
Trends analyses were performed using seasonally de-trended daily means of buoy observations.

Current atmospheric and seawater CO_2 conditions at: http://www.caricoos.org/oceans/acidification/

The Coral Reef Monitoring Network in the Atlantic

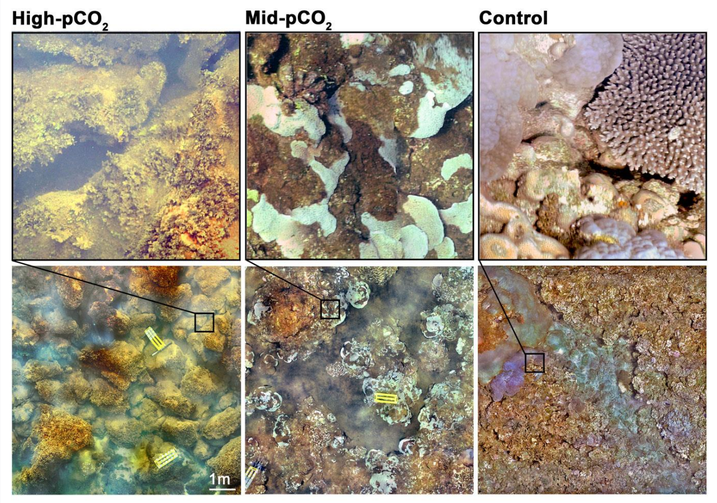
Florida, Virgin Islands, St. Croix and Puerto Rico

How climate change and OA will, and, already are, affecting the construction (coral growth, calcification) and breakdown (bioerosion, dissolution) of coral reefs and ecosystem function (e.g., biodiversity)?



CARICOOS has engaged in several efforts to understand the biological response to OA and temperature, including coral coring, deployments of Calcification Accretion Units (CAUs) and temperature recorders, computer modeling, and investigations into invertebrate biodiversity using Autonomous Reef Monitoring Structures (ARMS).

High-resolution photomosaic imagery



Benthic cover at high-*p*CO_2, mid-*p*CO_2, and control sites, showing the progression from coral-dominated to algae-dominated systems. Top images are details of the selected region in the photomosaic below.

More information at: http://www.coral.noaa.gov