Net community metabolism of Caribbean Coral Reef systems derived from NOA-ON time-series stations

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Increase in atmospheric CO_2 has caused an increase in ocean acidification

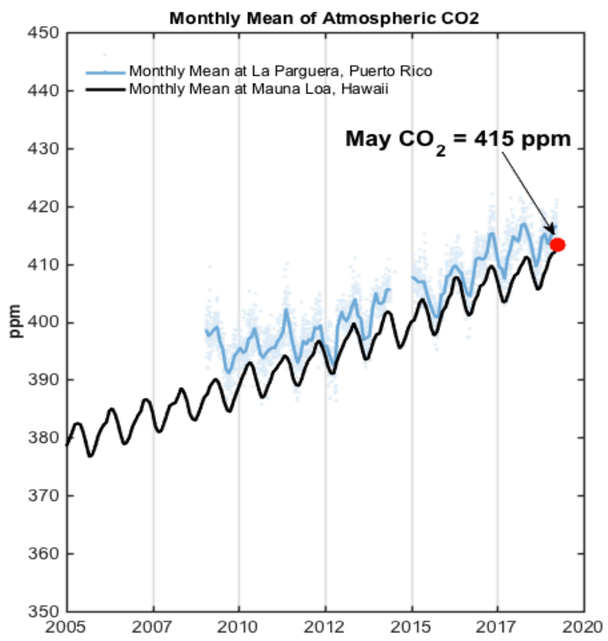
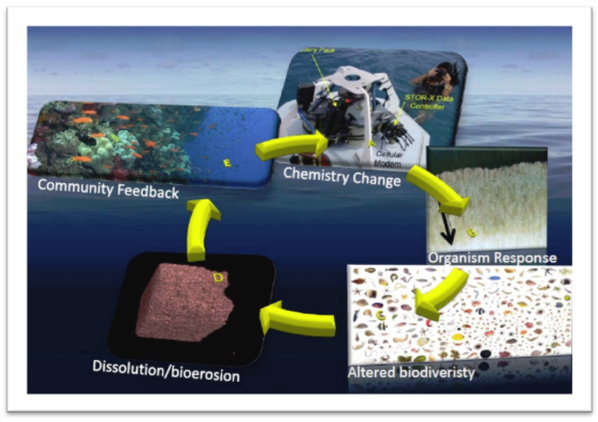


Fig. 1: CO2 concentration in Air

GOA-ON Goal 2: Improve our understanding of ecosystems response to ocean acidification



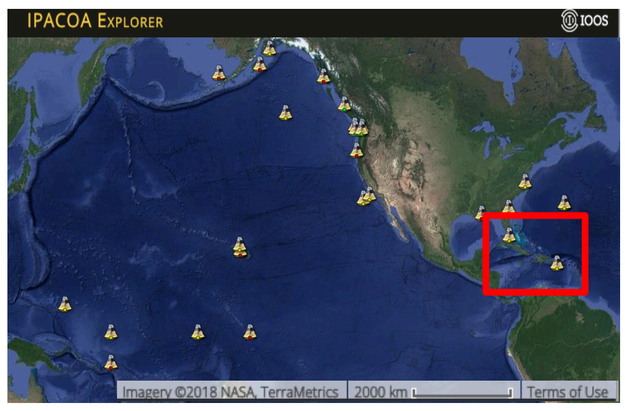


Fig. 2: Global Ocean Acidification Observing Network – GOA-ON Caribbean Region include two buoys located in Puerto Rico & Florida

Monitoring the Chemical Change in Coral Reefs

Fig.3: MapCO2 buoy

The MapCO_2 buoys provides measurements of CO_2 in the air and seawater, pH, temperature, and salinity every 3 hours.

A primary concern with respect to coral reef ecosystems is coral health and their ability to precipitate calcium carbonate.

Community & Environmental Feedbacks

Fig.4: Biogeochemical processes affecting the carbonate chemistry

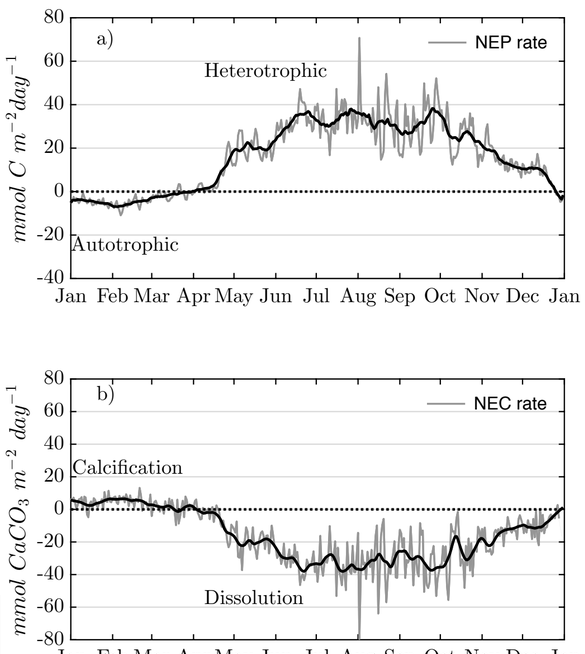
	Alk	DIC	pCO_2	pH	$[HCO_3^-]$	$[CO_3^{2-}]$	comments
increase in atmospheric CO_2	no change	↑	↑	↓	↑	↓	causes $CaCO_3$ dissolution
photosynthesis	(+)	↓	↓	↑	↓	↑	nitrate uptake slight effect on alkalinity
respiration	(-)	↑	↑	↓	↑	↓	nitrate release slight effect on alkalinity
calcification	↓	↓	↑	↓	↓	↓	usually coupled with photosynth or respiration
$CaCO_3$ dissolution	↑	↑	↓	↑	↑	↑	affected by respiration

primary changes responses (+), (-) minor responses

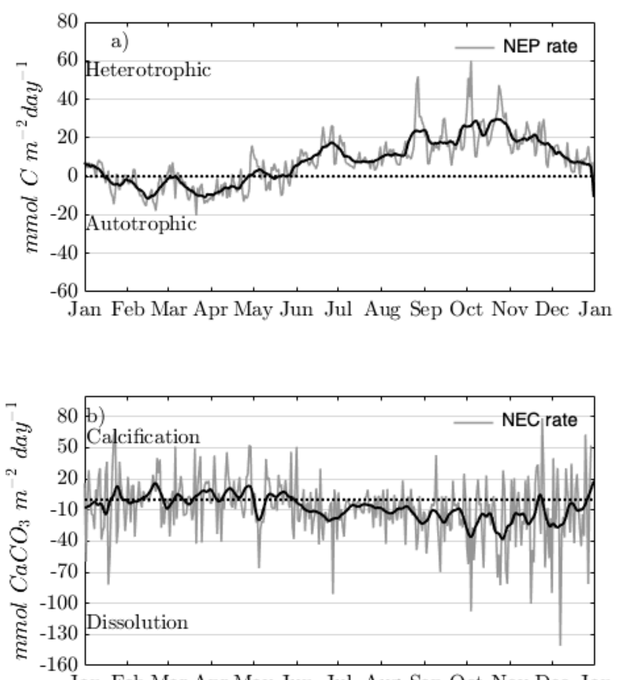
EPOCA/BIOACID/CalMarO/OCB training workshop - *Best practices in ocean acidification research* Ulf Riebesell

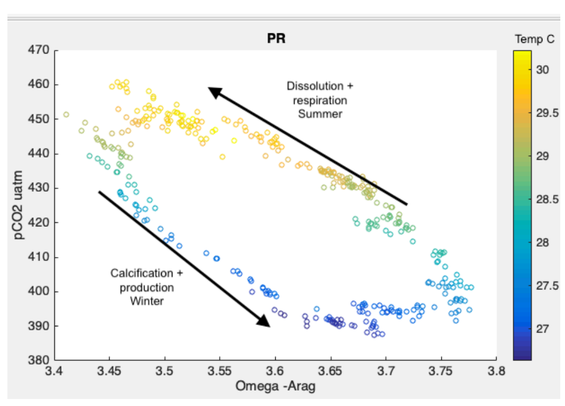
Metabolic Rates

Puerto Rico – La Parguera



Florida – Cheeca Rocks





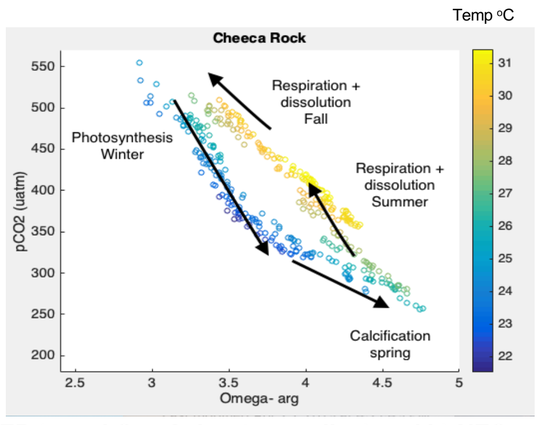


Fig.5: Annual composites based on daily averages of modeled a) NEP (mmol C m-2 day-1; gray line) and b) NEC rates (mmol CaCO3 m-2 day-1; gray line). Seawater pCO2 vs Ωarag and seawater temperature (color bar) for La Parguera, PR and the Cheeca Rocks, Florida.

Remarks:

- Tropical Caribbean reef ecosystems are likely exhibiting periods of net dissolution during the summer time.
- The dissolution and heterotrophic events overlapped with the beginning of the shellfish spawning period.
- The annual carbonate dissolution rate in both studied sites ranged between -0.5 to -0.62 kg CaCO3 m^{-2} yr^{-1}.
- The increase of temperature increases the respiration and dissolution rates and the pCO2 over the summer months.
- Autonomous capabilities of buoyed operational systems such as these can be used to detect metabolic processes sensitive to ocean acidification.