

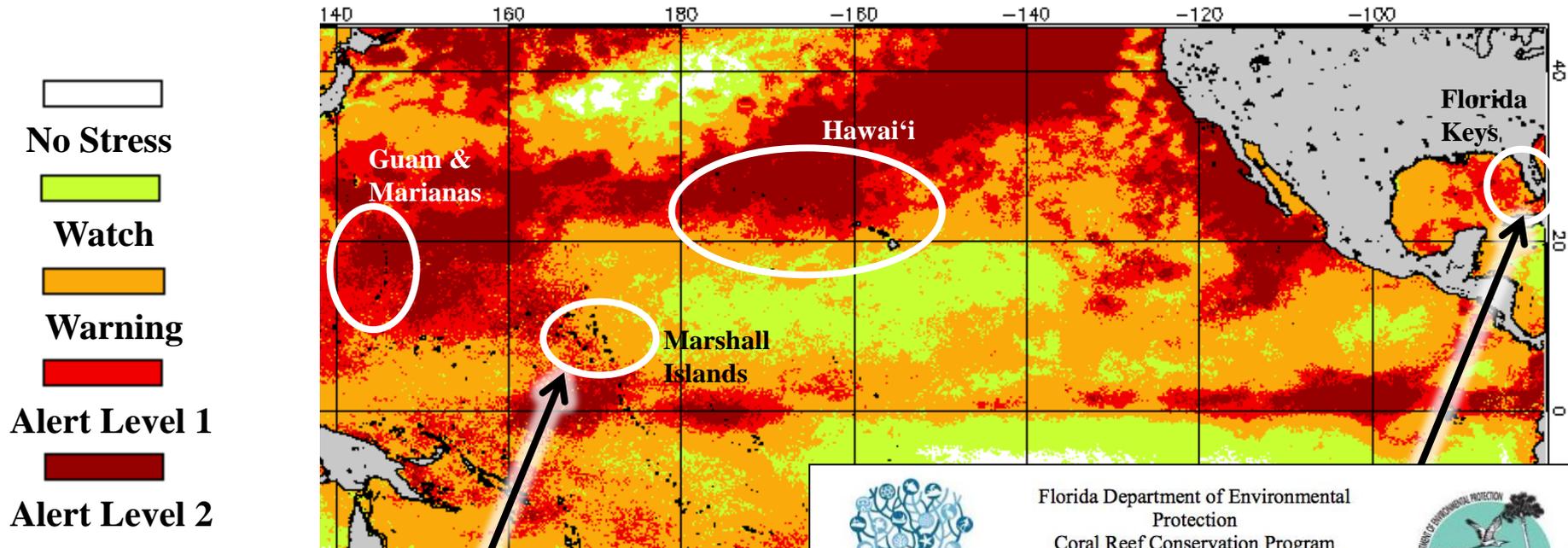
Ocean Acidification and Coral Reefs



2014 Severe Bleaching

Start of 3rd Global Event?

NOAA Coral Reef Watch Annual Maximum Satellite Coral Bleaching Alert Area 2014





Florida Department of Environmental Protection
Coral Reef Conservation Program
SEAFAN BleachWatch Program
Current Conditions Report #20140902
September 2, 2014



Summary: Based on climate predictions and field observations, the threat for mass coral bleaching in southeast Florida, between Miami-Dade and Martin counties is currently **HIGH**.

Environmental Monitoring

The latest CRW experimental 5 kilometer (km) Daily Coral Bleaching Alert Area (Figure 1) indicates that southeast Florida is presently experiencing a moderate to high level of thermal stress, with an Alert Level 1 or Bleaching Warning present throughout the region. This indicates that bleaching is likely in southeast Florida and additional alerts are possible if current conditions continue or worsen.

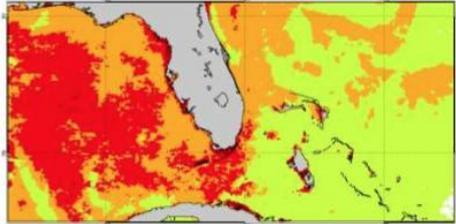
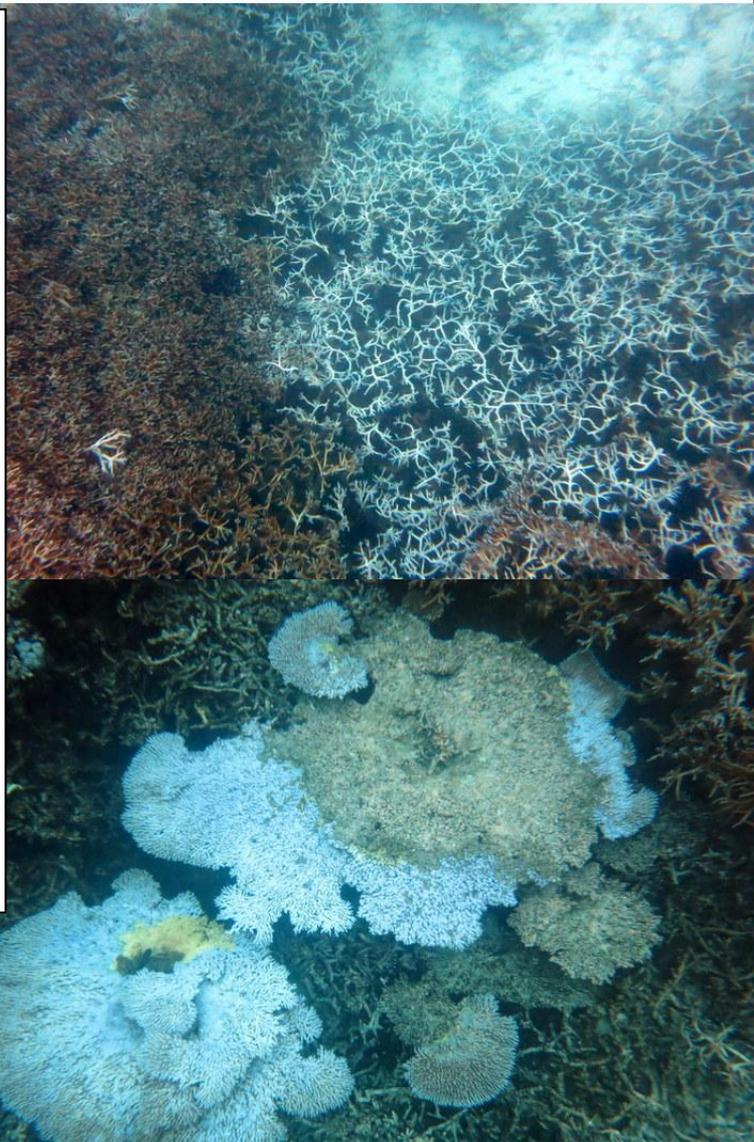
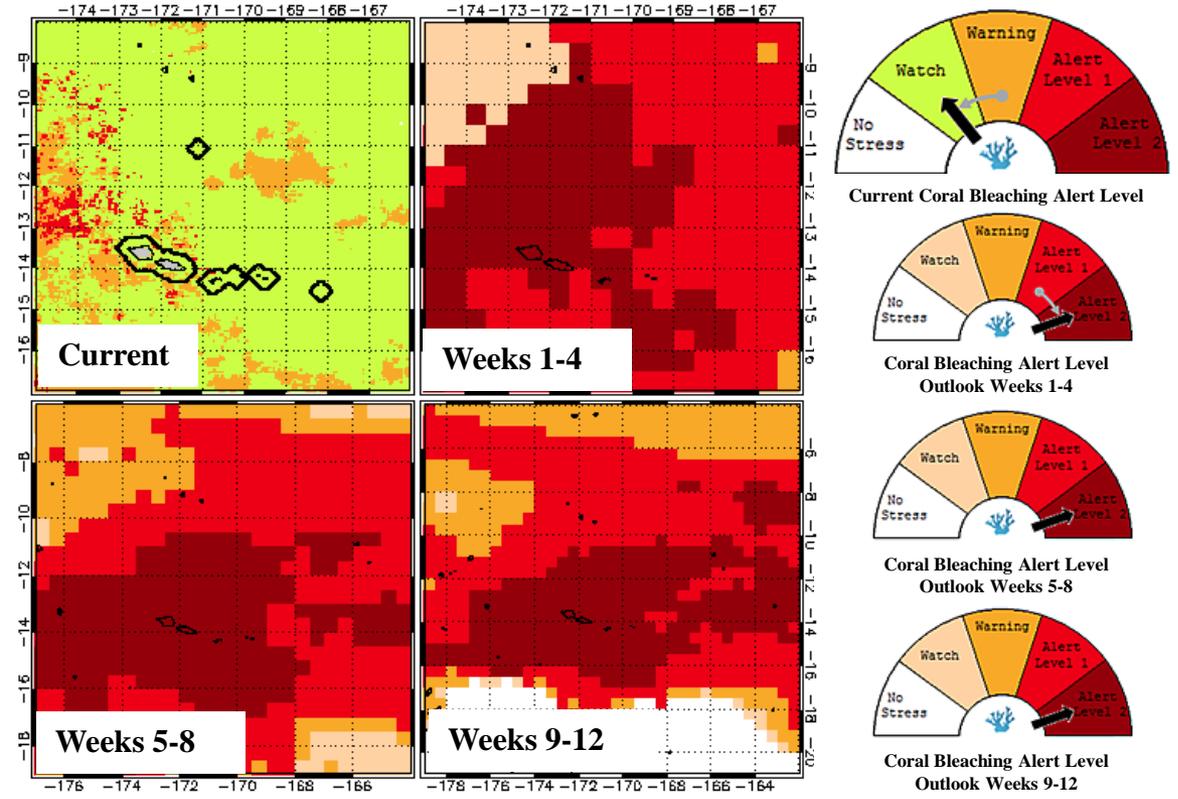


Figure 1. NOAA CRW Experimental Daily 5 km Blended Geo-Polar Nighttime Blended Bleaching Alert Area; August 31, 2014
<http://coralreefwatch.noaa.gov/satellite/bleaching5km/index.php>

2015: American Samoa Bleaching

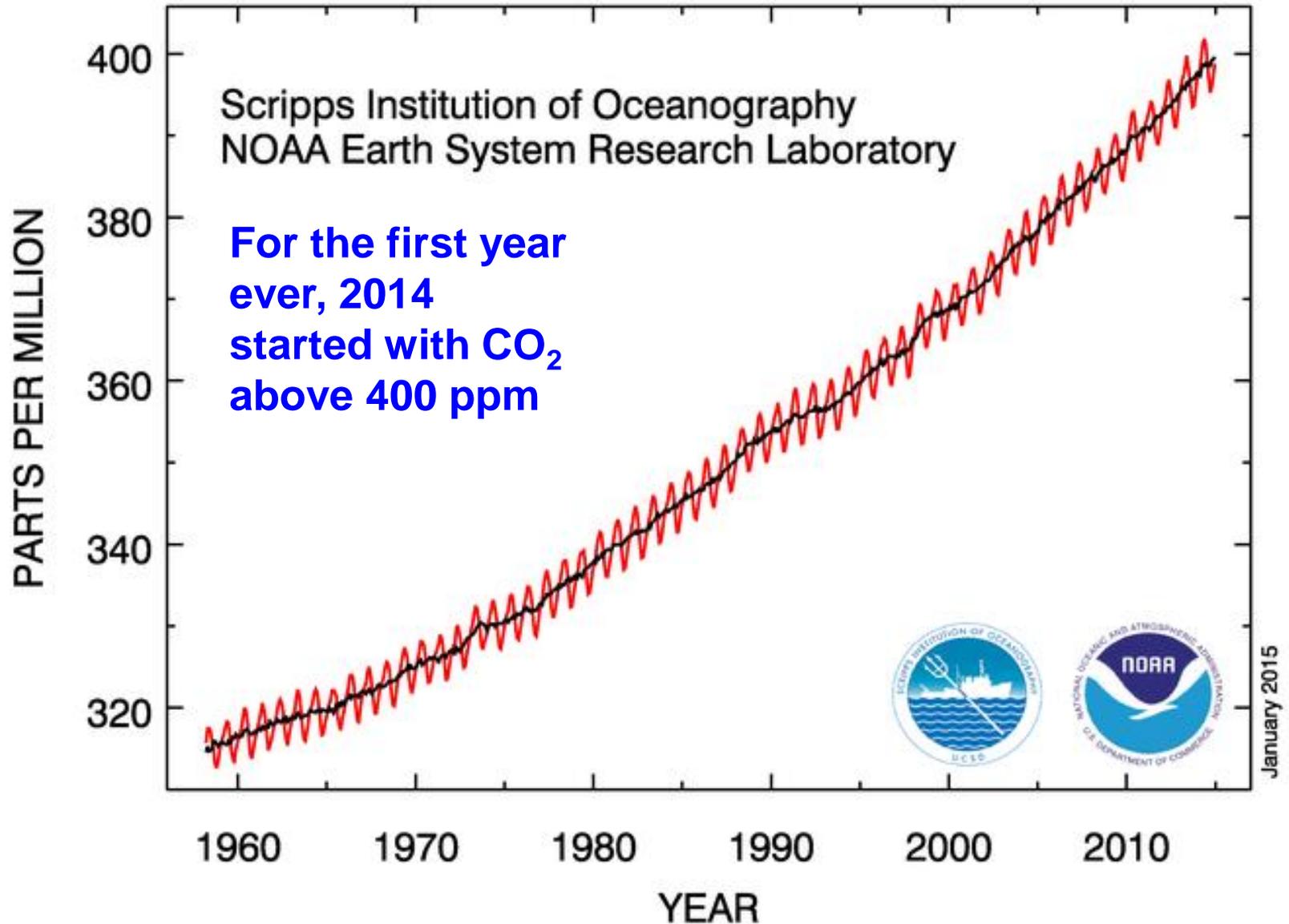
Samoas Satellite Coral Bleaching Alert Area and Outlook
2015-02-07



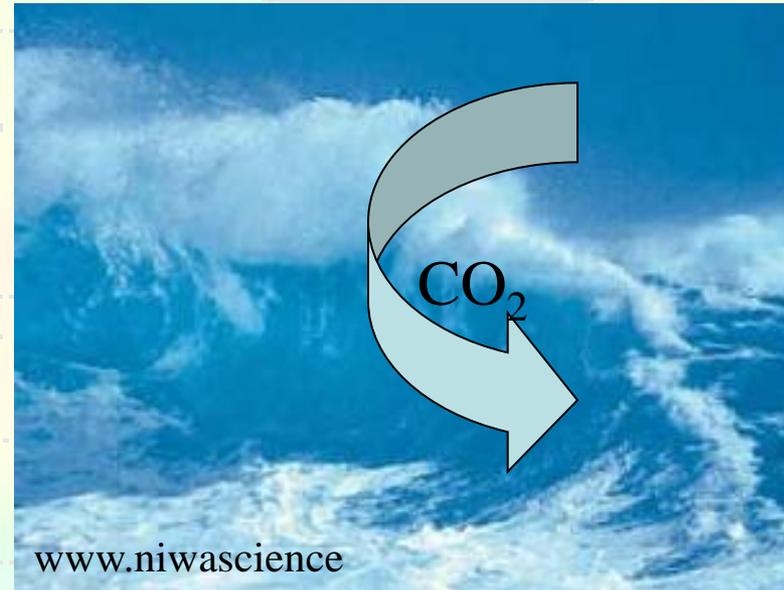
American Samoa Bleaching Feb. 2015

Global CO₂ at 400 ppm

Atmospheric CO₂ at Mauna Loa Observatory

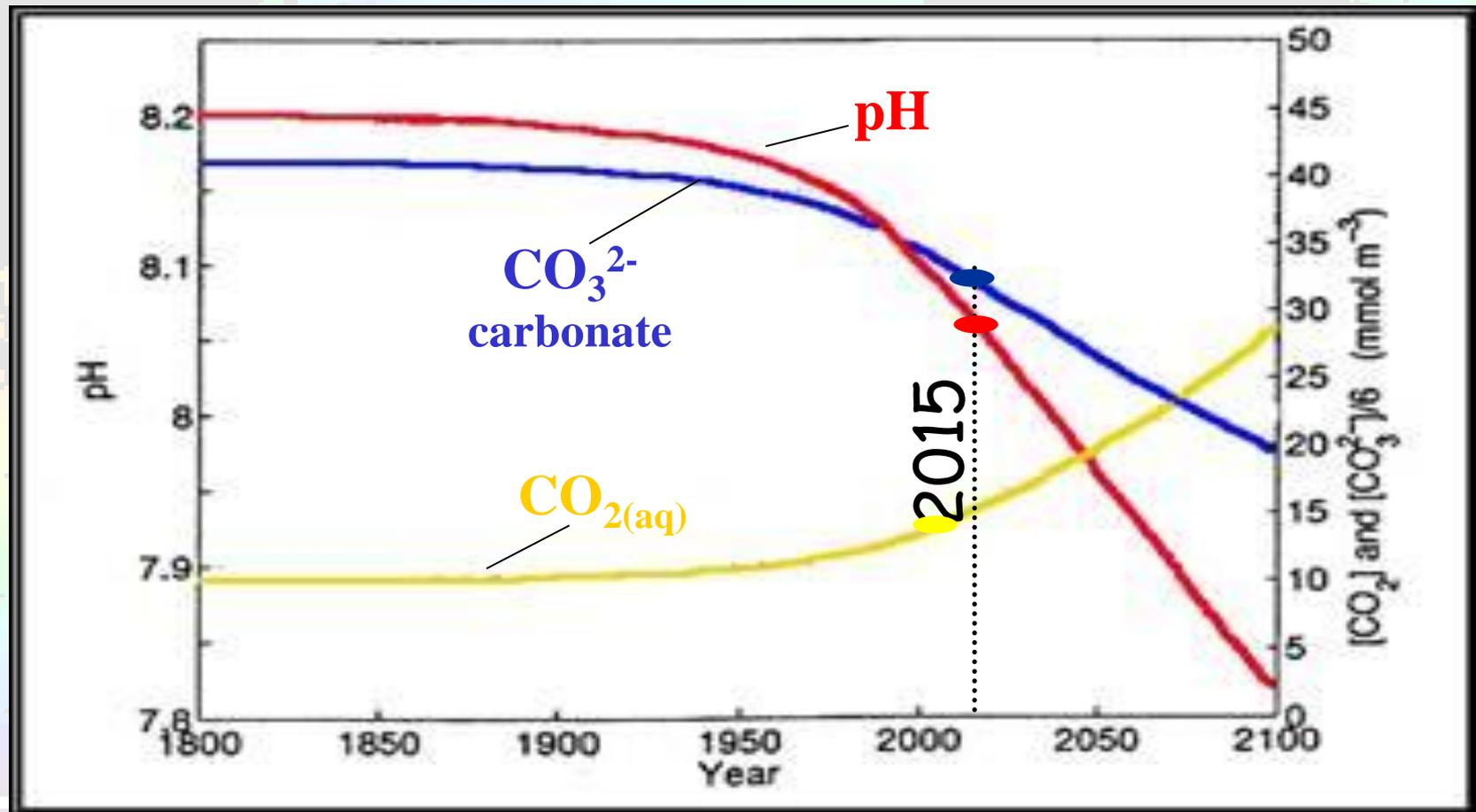


Surface Ocean Uptake of CO_2



$\approx 1/3$ of anthropogenic CO_2
taken up by the ocean each year

The Oceans and CO₂: Ocean Acidification



After Wolf-Gladrow et al., 1999

Thermal Stress Causes Mass Coral Bleaching



Thermal Stress Causes Mass Coral Bleaching



Thermal Stress Causes Mass Coral Bleaching and Mortality



**Thermal Stress Causes Mass Coral Bleaching
and Mortality**

Ocean Acidification Eliminates Reef Structure



Future Changes in Reef Calcification

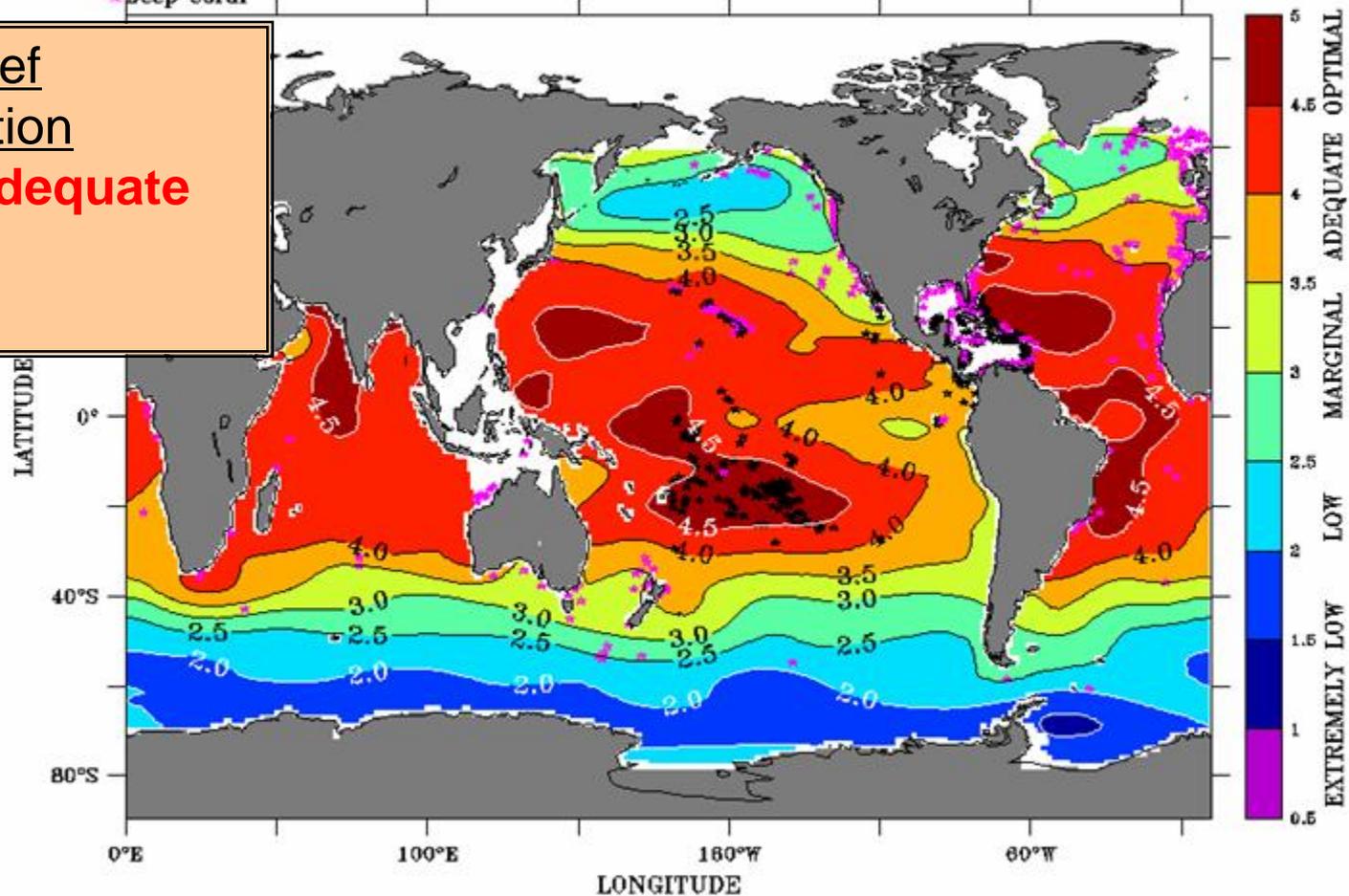
IPCC IS92a 'business-as-usual'

Aragonite Saturation Levels in 1765

* Shallow Coral
* Deep Coral

Coral Reef Calcification

- 1765 **Adequate**
- 2005
- 2100



After Feely et al (in press) with Modeled Saturation Levels from Orr et al (2005)

Future Changes in Reef Calcification

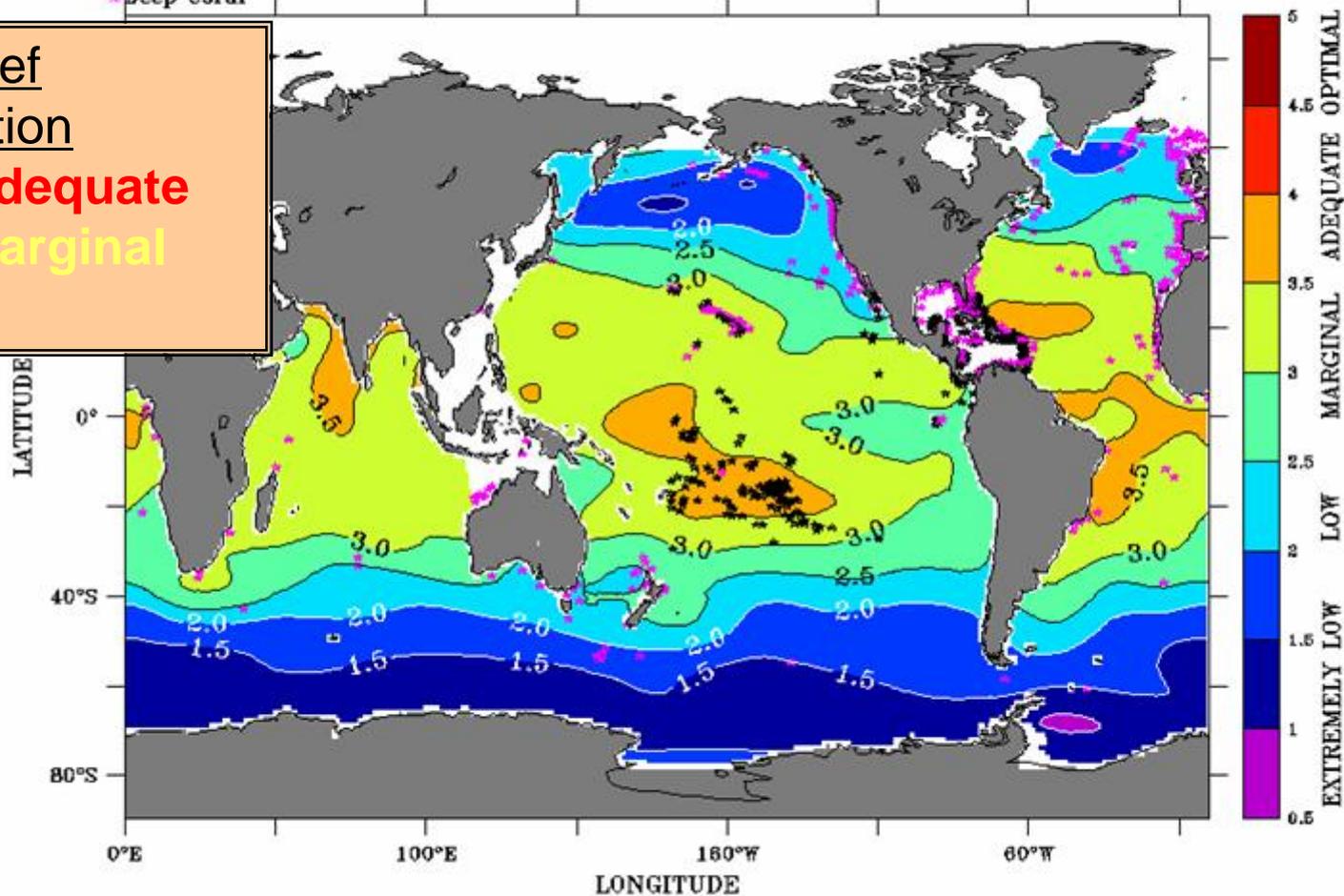
IPCC IS92a 'business-as-usual'

Aragonite Saturation Levels in 2005

* Shallow Coral
* Deep Coral

Coral Reef Calcification

- 1765 **Adequate**
- 2005 **Marginal**
- 2100



After Feely et al (in press) with Modeled Saturation Levels from Orr et al (2005)

Future Changes in Reef Calcification

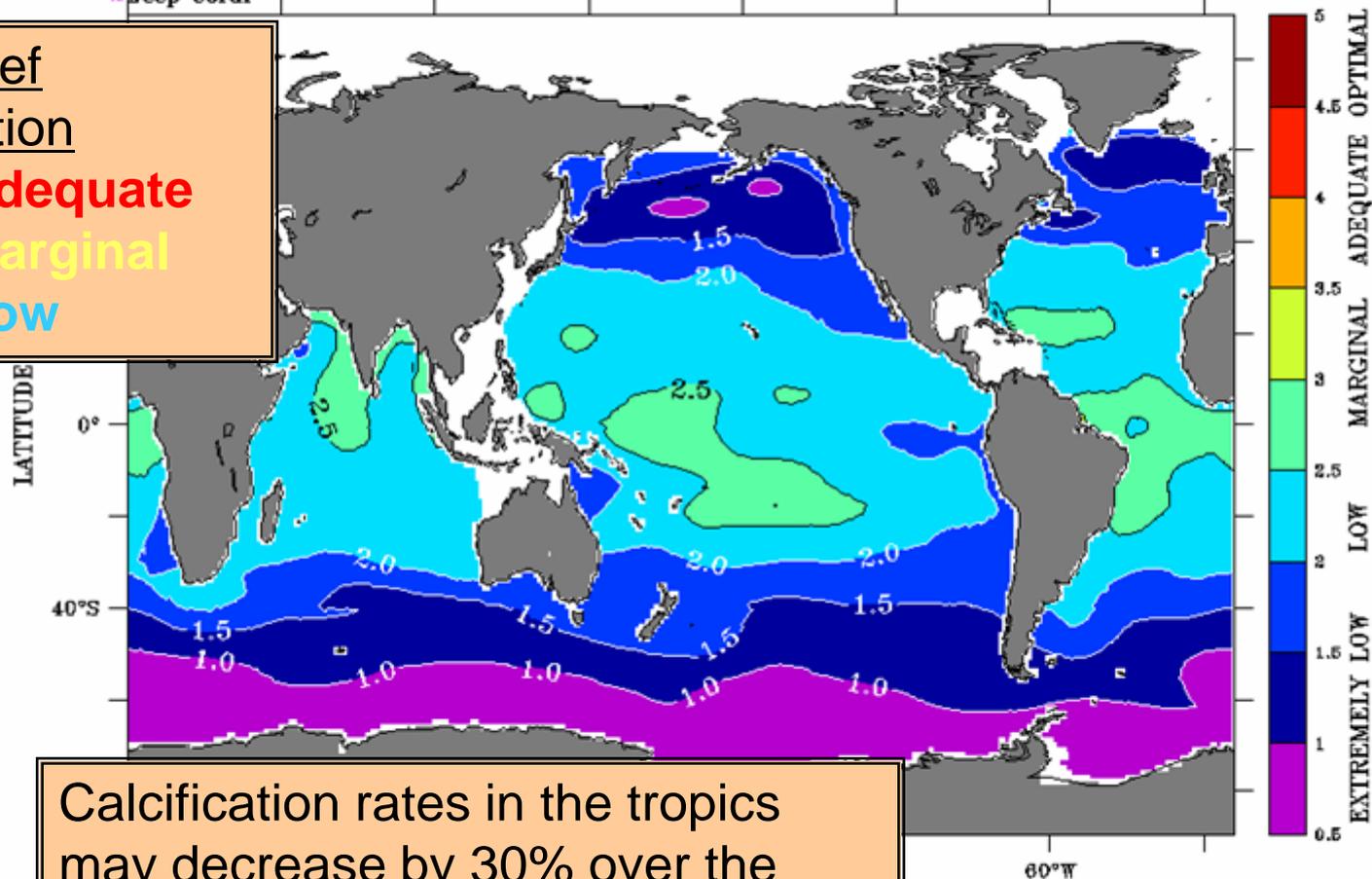
IPCC IS92a 'business-as-usual'

Aragonite Saturation Levels in 2100

* Shallow Coral
* Deep Coral

Coral Reef Calcification

- 1765 **Adequate**
- 2005 **Marginal**
- 2100 **Low**



Calcification rates in the tropics may decrease by 30% over the next century

After Feely et al (in press) with Modeled Saturation Levels from Orr et al (2005)

Ocean Acidification and Coral Reefs

- **Mark Eakin, PhD**
Coordinator, NOAA Coral Reef Watch
- **Dwight Gledhill, Phd**
Deputy Director, NOAA Ocean Acidification Program
- **Dr. Liz Whiteman, PhD**
Program Director, California Ocean Science Trust
- **Sarah Dunham**
Director, EPA Office of Atmospheric Programs
- **Kenli Kim, PhD**
Department of State, Office of Ocean and Polar Affairs

An Ocean Acidification Strategy for the US CRTF - *DRAFT*

- **Advance robust outreach on OA**
- **Enhance partnerships**
- **Support the reduction of CO₂**
- **Reduce additional coastal acidification**
- **Make coral reef ecosystems as resilient as possible in the face of OA**
- **Identify adaptation options for coral reef managers**