NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)

NOAA Coral Reef Watch Bleaching Outlook for 2010

Dr. C. Mark Eakin,

Reef Resilience Webinar

September 9, 2010

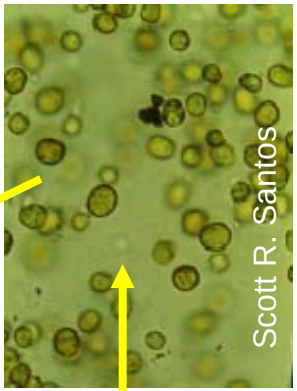
NOAA CORAL REEF CONSERVATION PROGRAM

Coral Reef Watch website: http://coralreefwatch.noaa.gov/

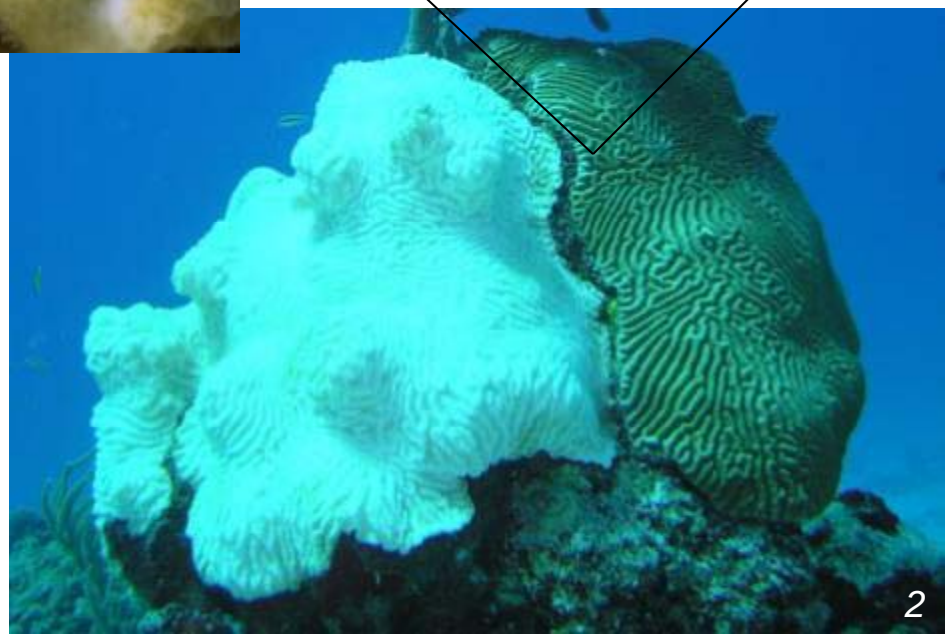
What is Bleaching?

- Most of corals' food comes from photosynthesis
- Corals can "bleach" due to stress
- Corals exposed to high temperatures and/or high light become stressed
- Corals eject their algae; coral appears "bleached"
- If stress is mild or brief, corals recover, otherwise they die

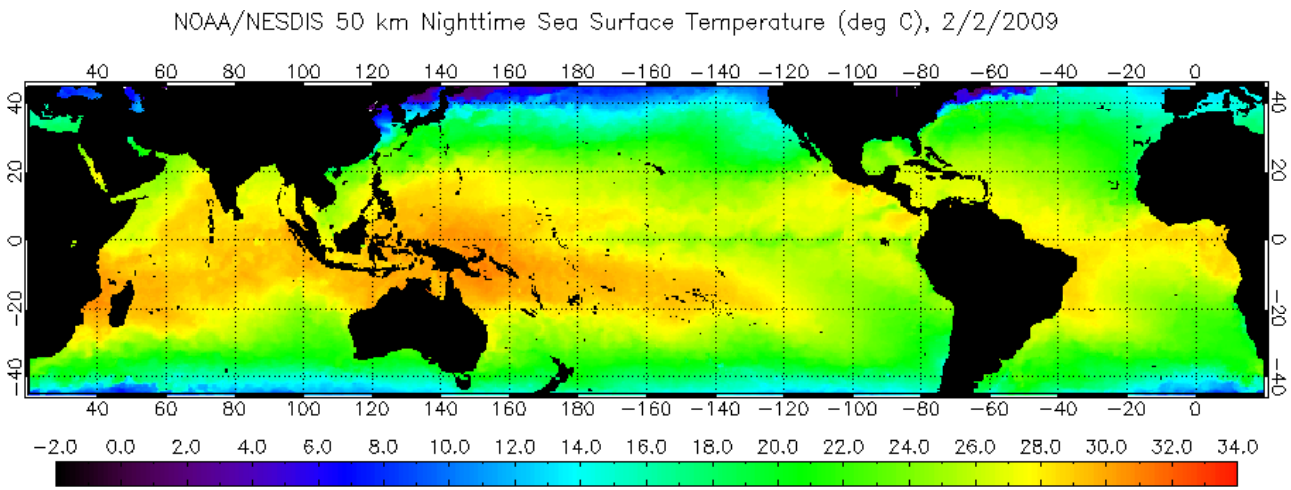
zooxanthellae



Symbiotic algae



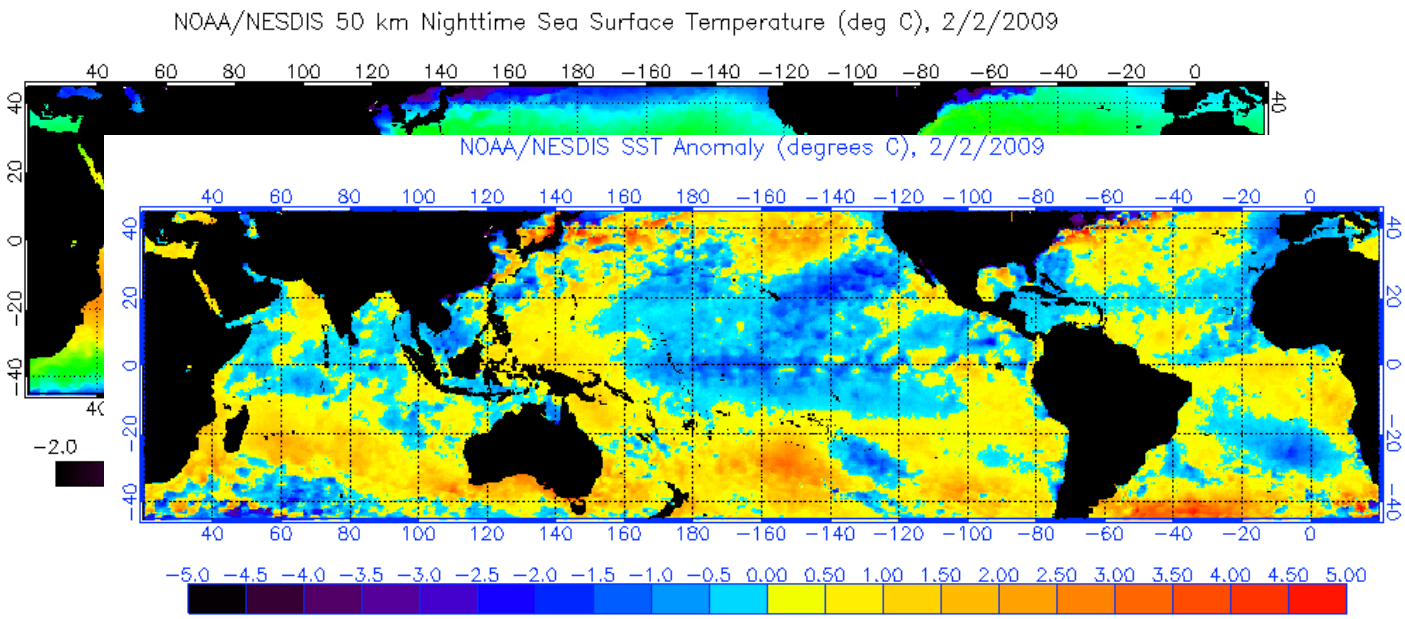
Coral Reef Watch
Satellite-Based Products



50km Nighttime Sea Surface Temperature (SST)

http://coralreefwatch.noaa.gov

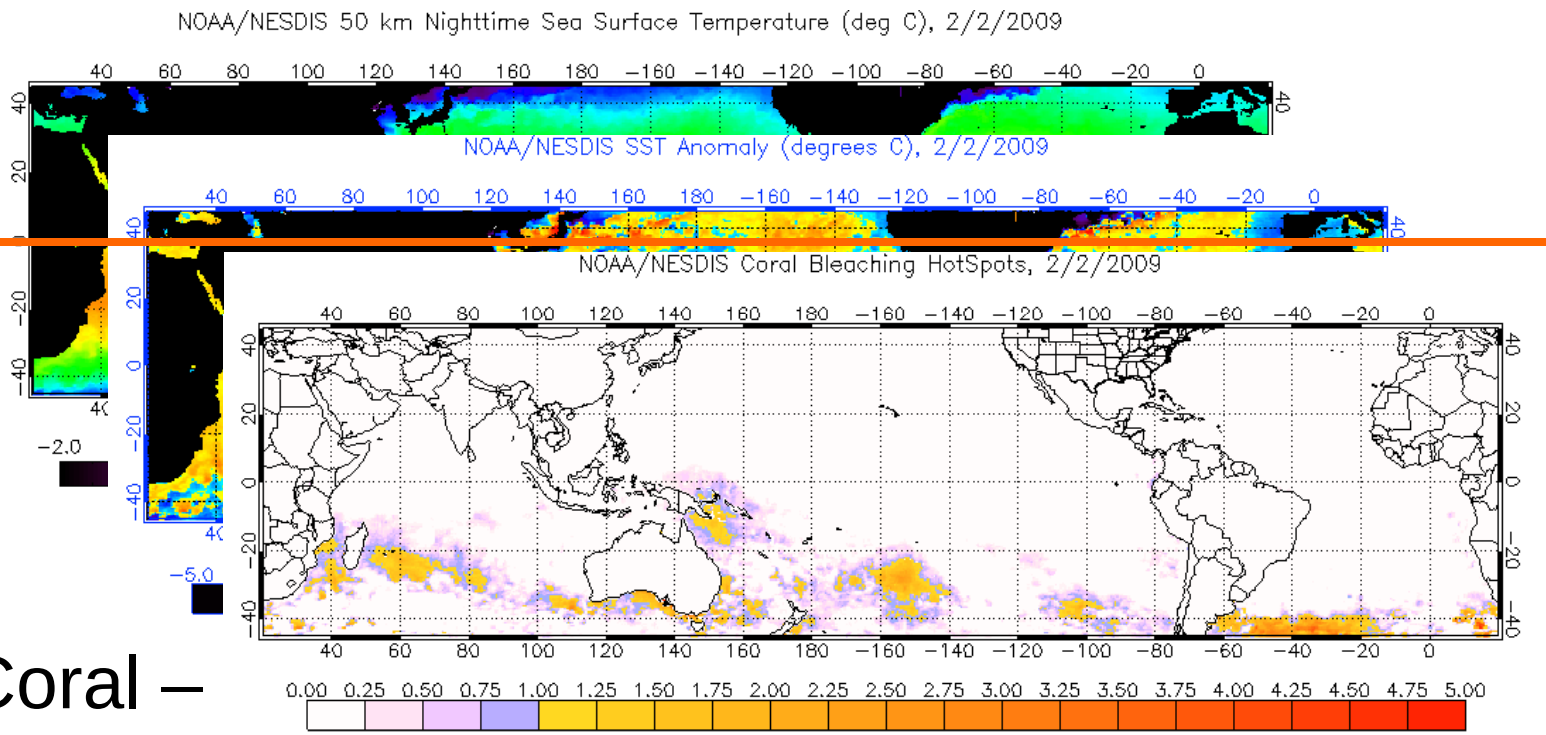
Coral Reef Watch
Satellite-Based Products



SST Anomaly

http://coralreefwatch.noaa.gov

Coral Reef Watch
Satellite-Based Products

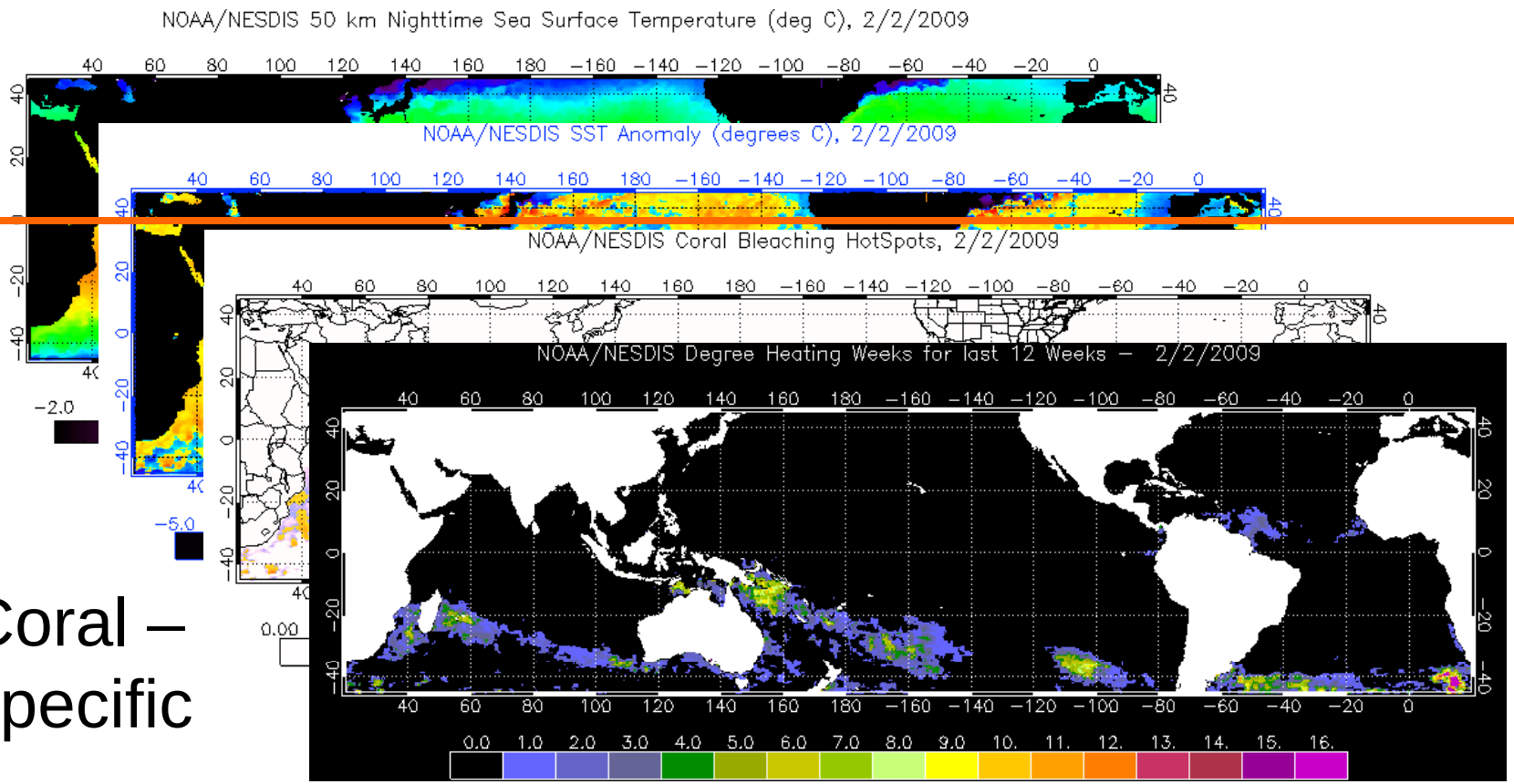


Coral – specific

HotSpot

http://coralreefwatch.noaa.gov

Coral Reef Watch
Satellite-Based Products

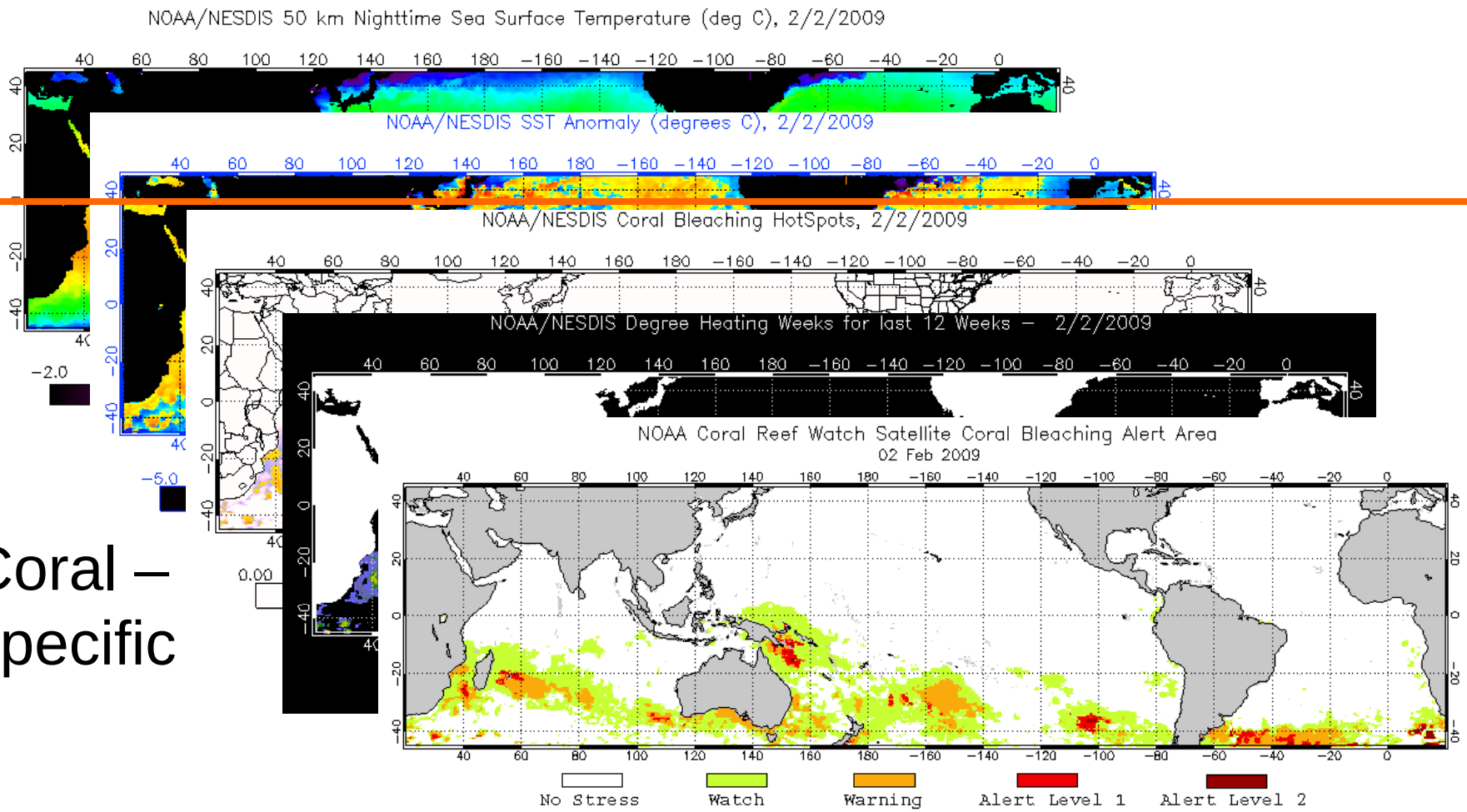


Coral – specific

Degree Heating Week

http://coralreefwatch.noaa.gov

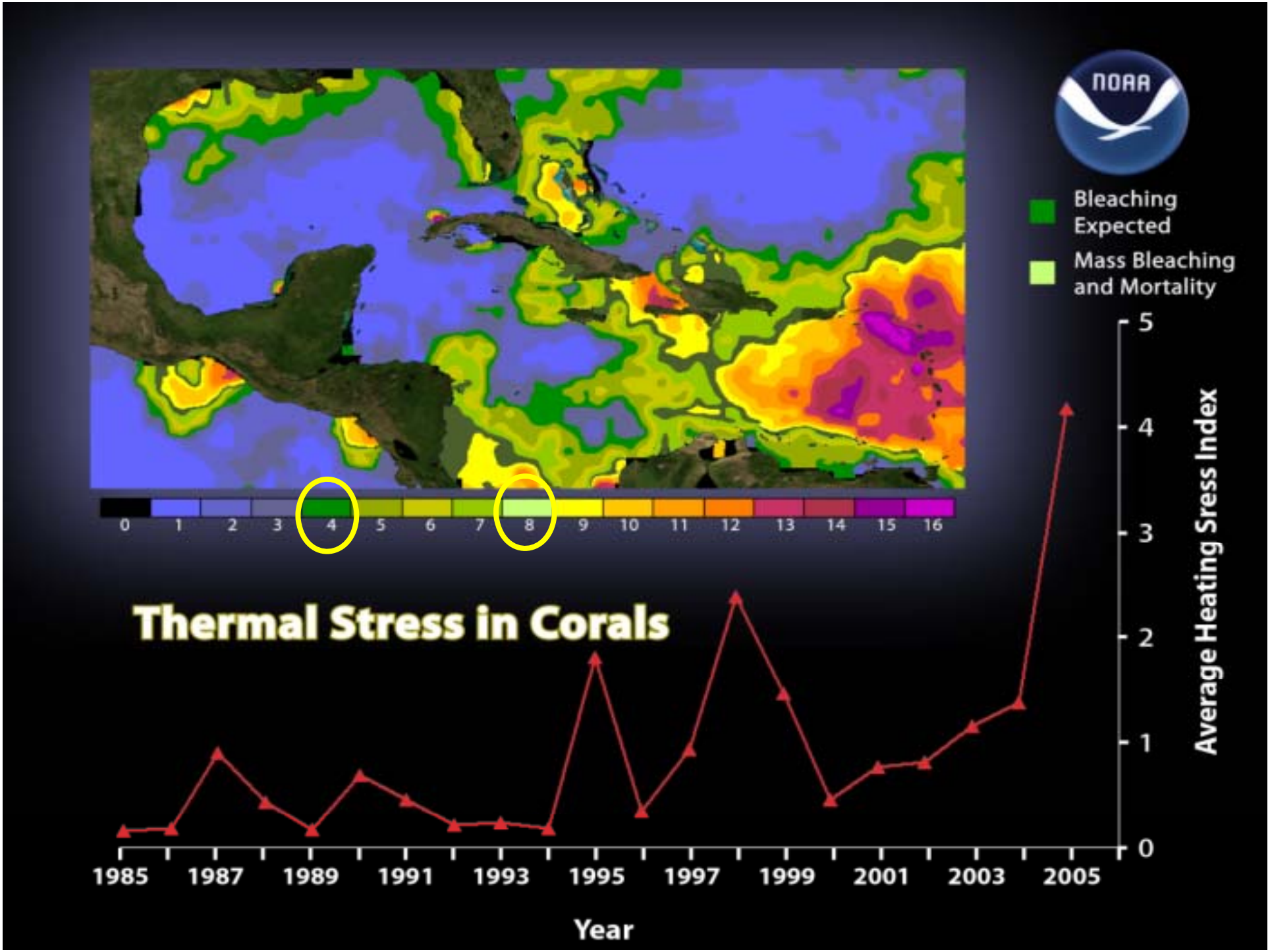
Coral Reef Watch
Satellite-Based Products



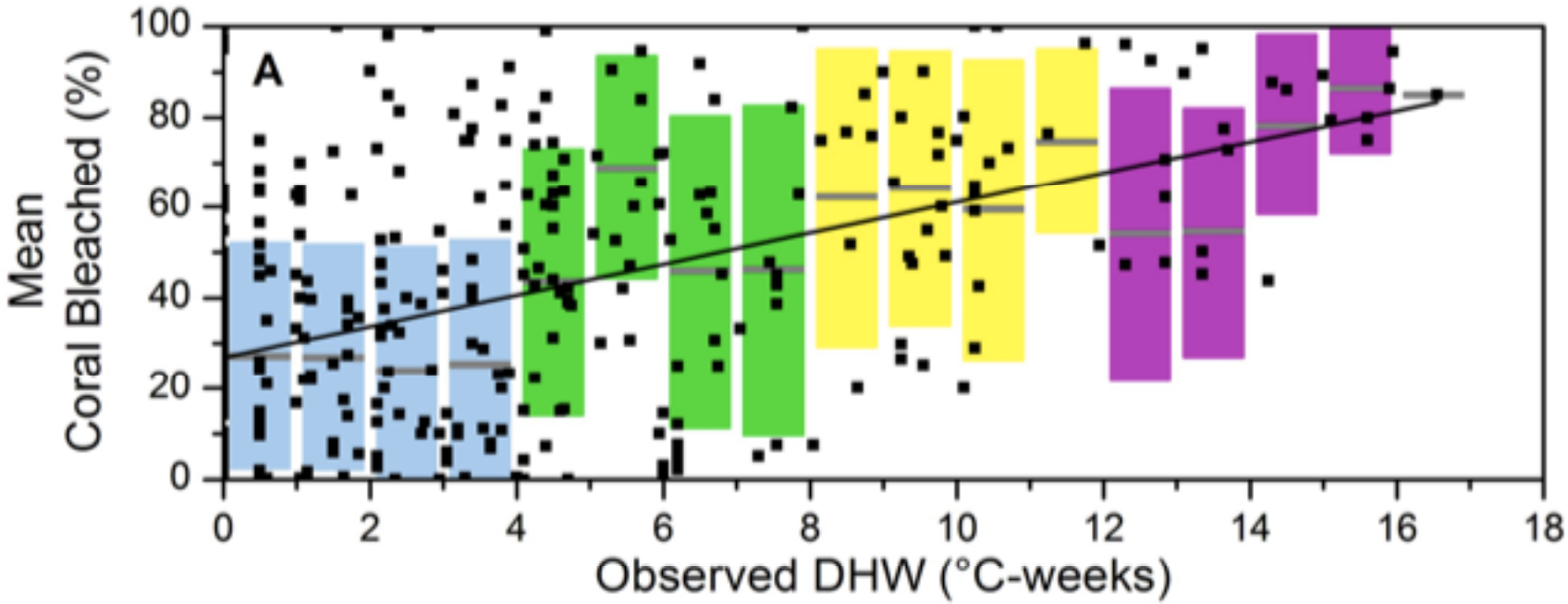
Coral – specific

Bleaching Alert Areas

http://coralreefwatch.noaa.gov

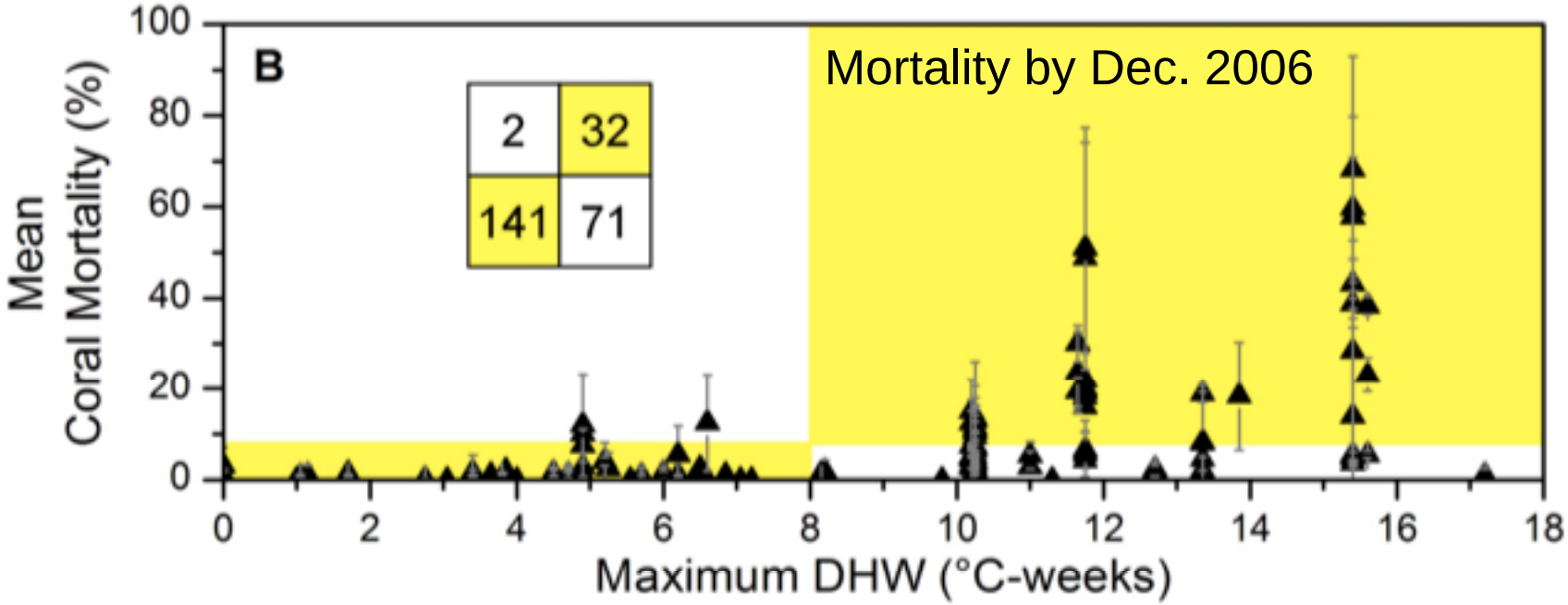

NOAA
Bleaching Expected
Mass Bleaching and Mortality
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Thermal Stress in Corals
Average Heating Sress Index
0 1 2 3 4 5
1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005
Year

2005 Bleaching & Mortality in Caribbean



Eakin et al. (accepted, PLoS One)

2005 Bleaching & Mortality in Caribbean



Eakin et al. (accepted, PLoS One)

2005 Bleaching & Mortality in Caribbean

Bleaching & Mortality in USVI

6 sites

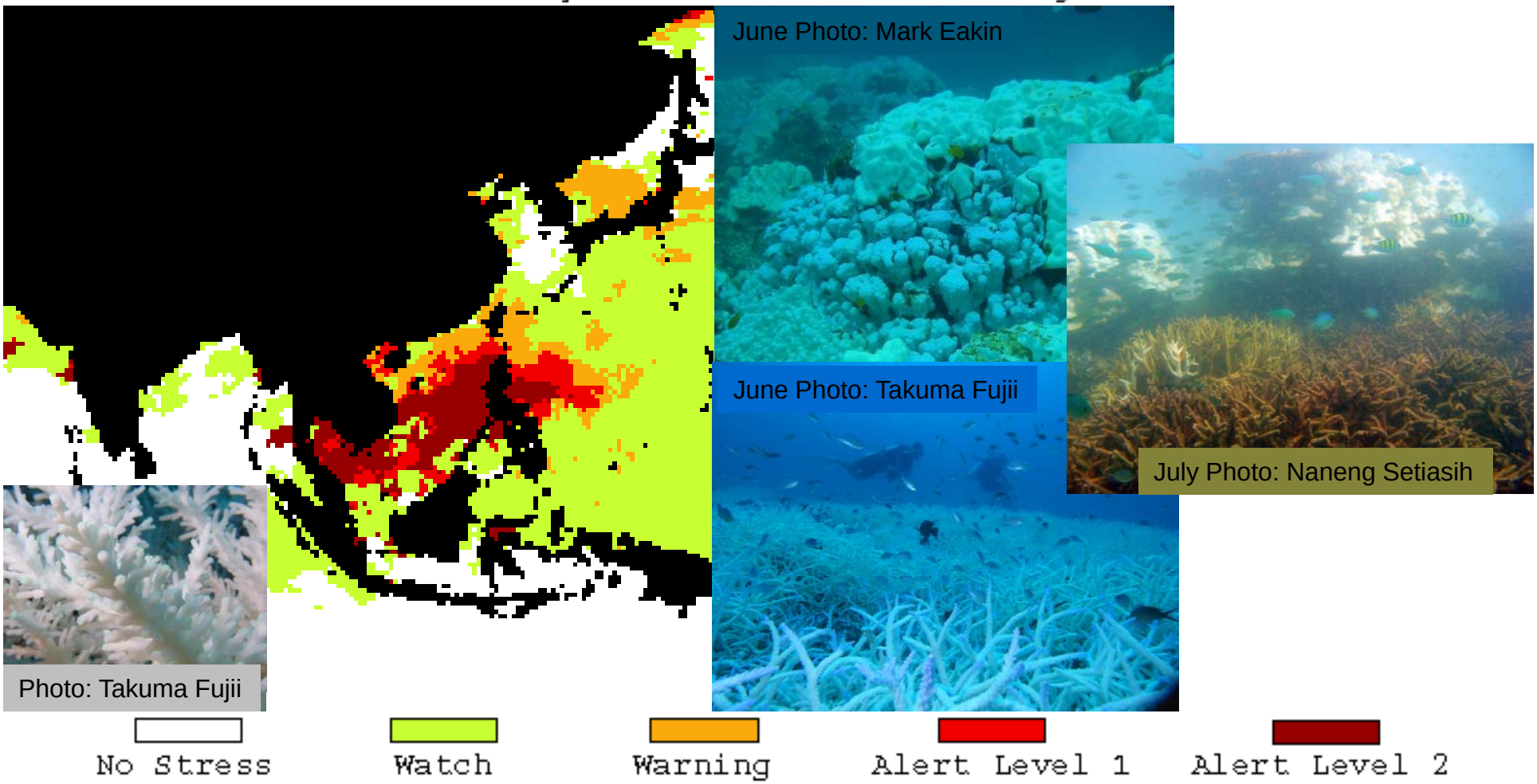
120 video transects

> 90% bleached

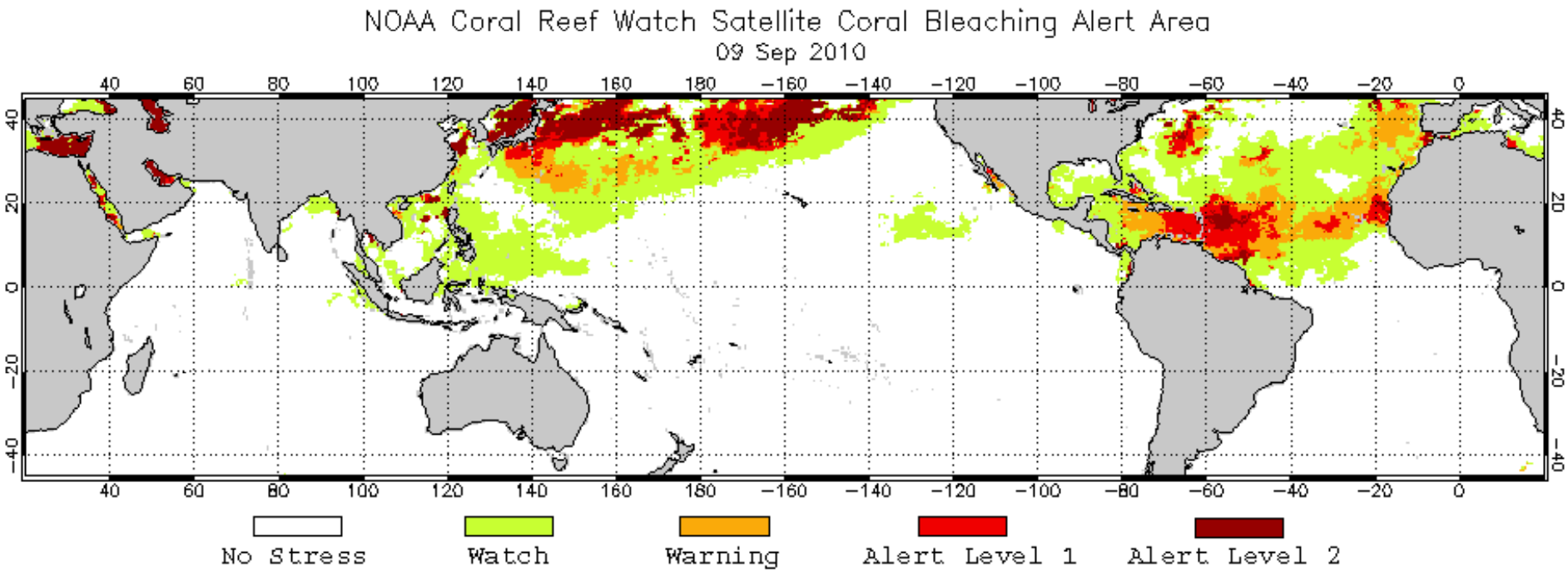
> 60% dead

Miller, et al. (2009)

2010 Southeast Asia



Current Bleaching Conditions



http://coralreefwatch.noaa.gov/satellite/baa/index.html

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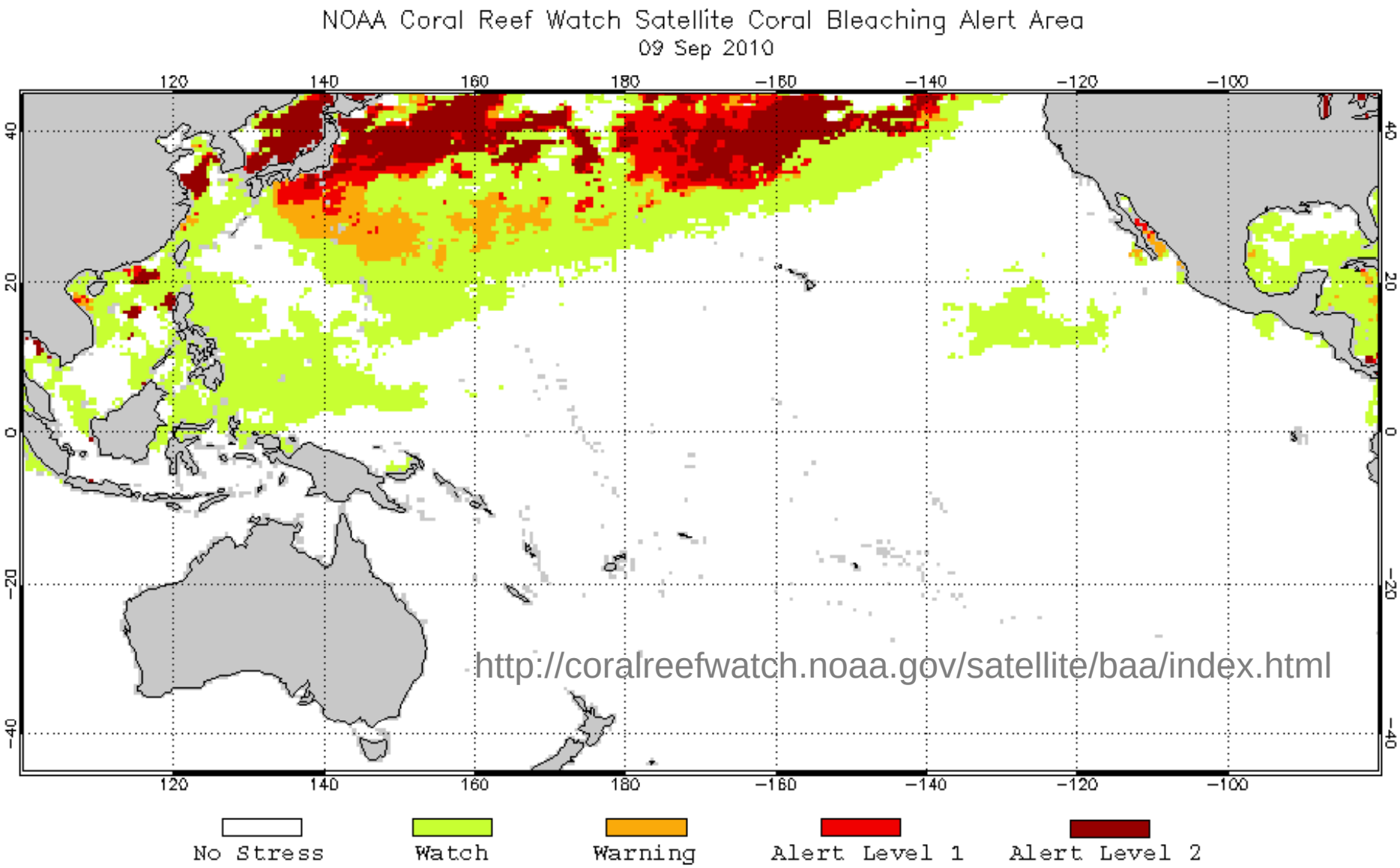
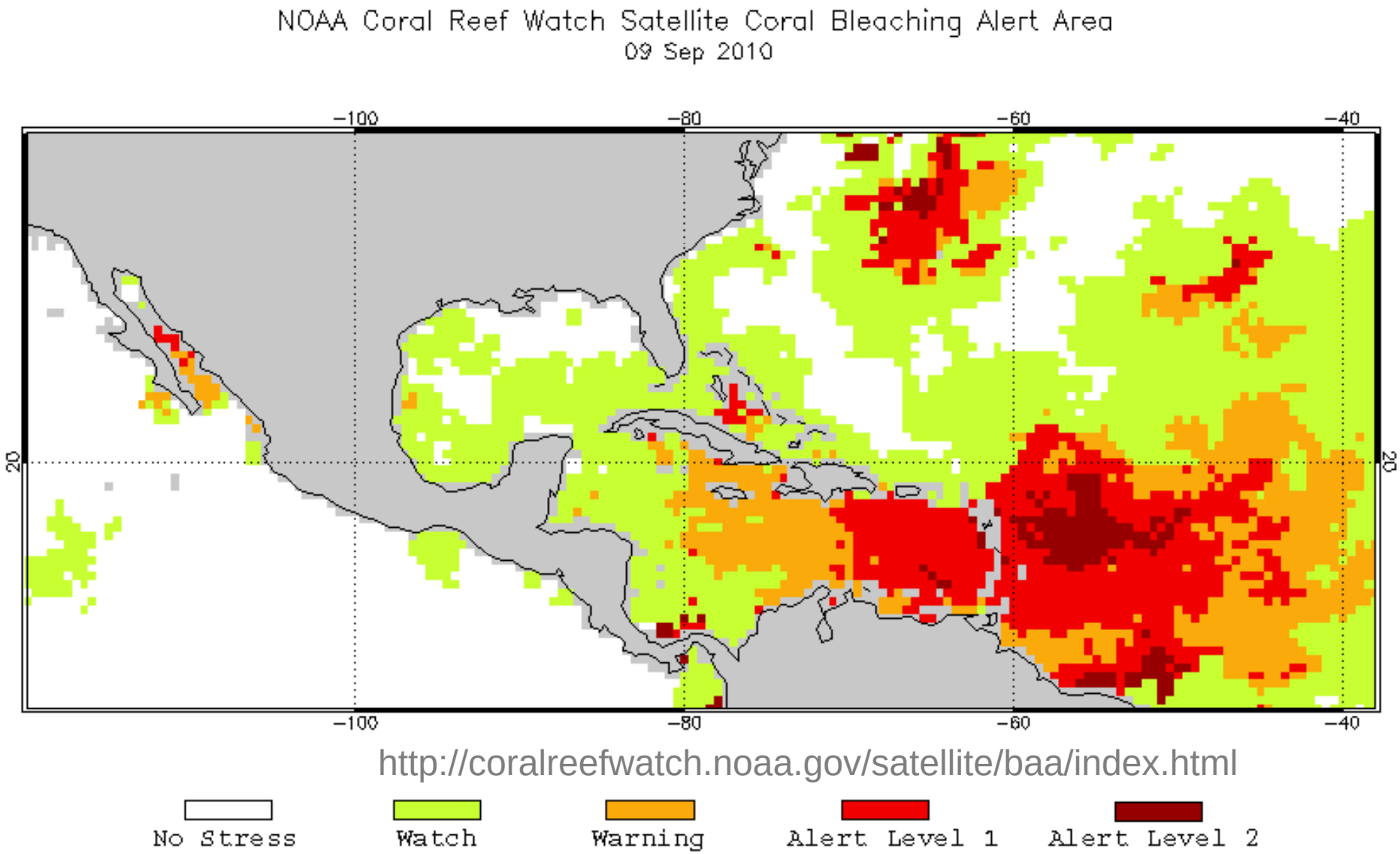


Current Bleaching Conditions – Operational Product



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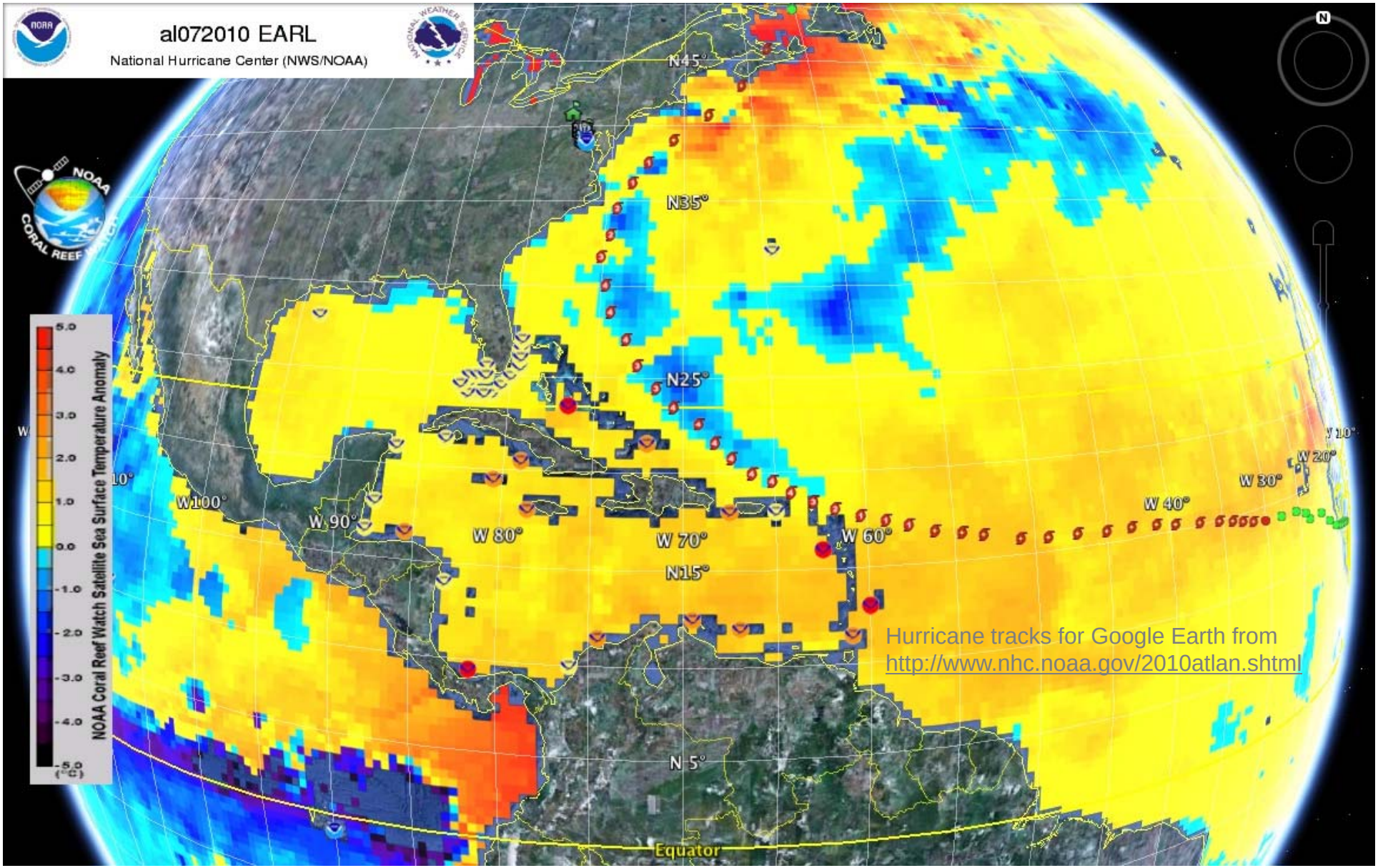

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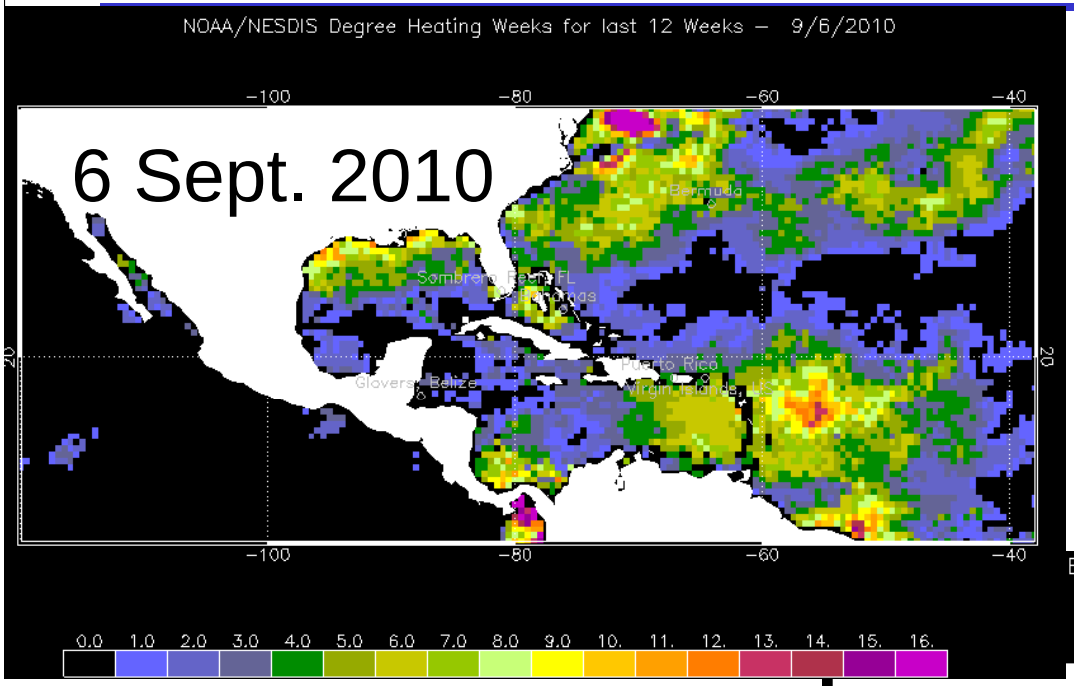
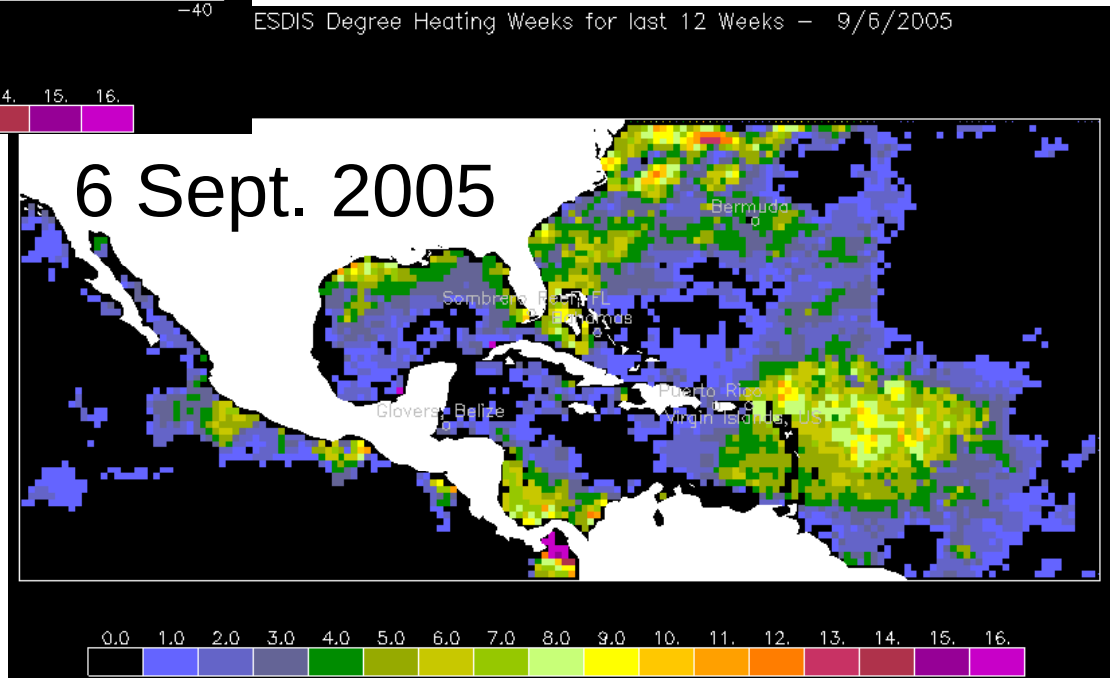


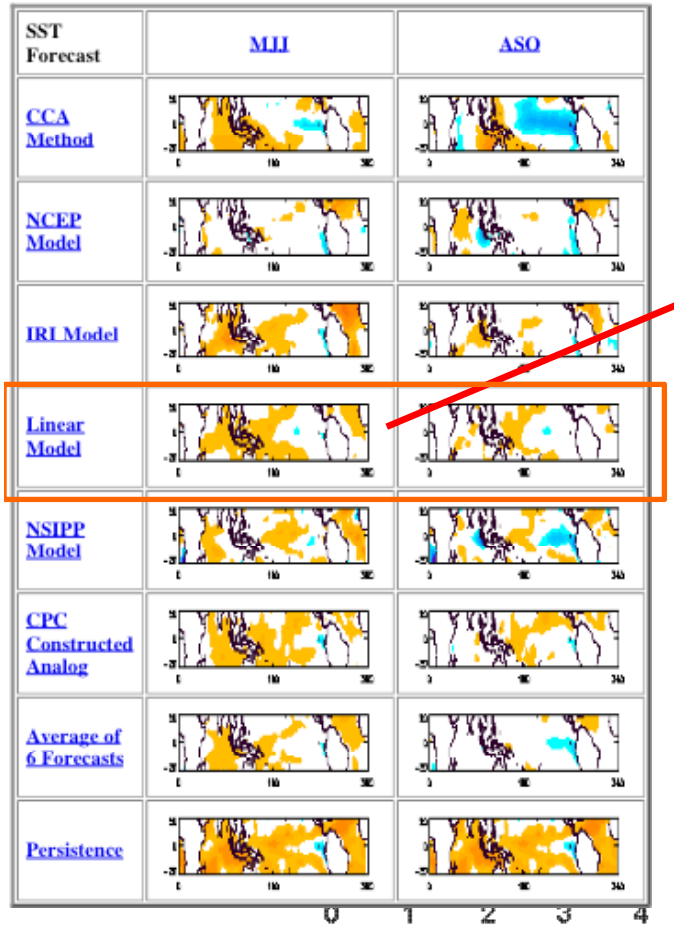
Comparison with 2005

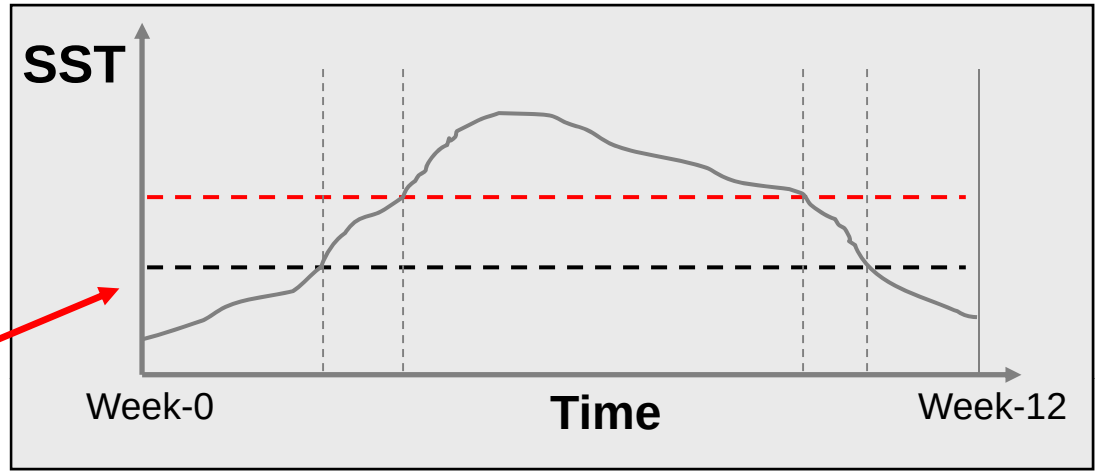


http://coralreefwatch.noaa.gov/satellite/current/products_dhw.html

Forecasting Bleaching HotSpots and Degree Heating Weeks (DHWs)

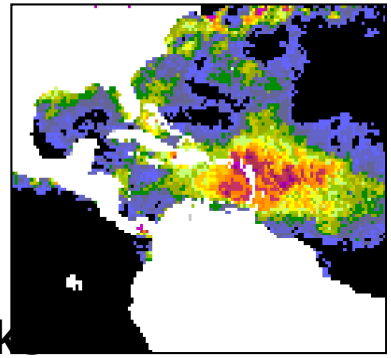
Forecasts made 1 April 2005



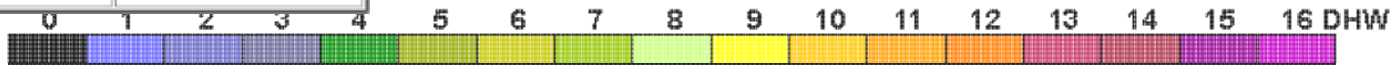


HotSpot from Forecasts

$$\sum_{\geq 1^\circ C}^{12\ \text{weeks}} (\text{HotSpot value} \times \text{duration})$$



Degree Heating Weeks



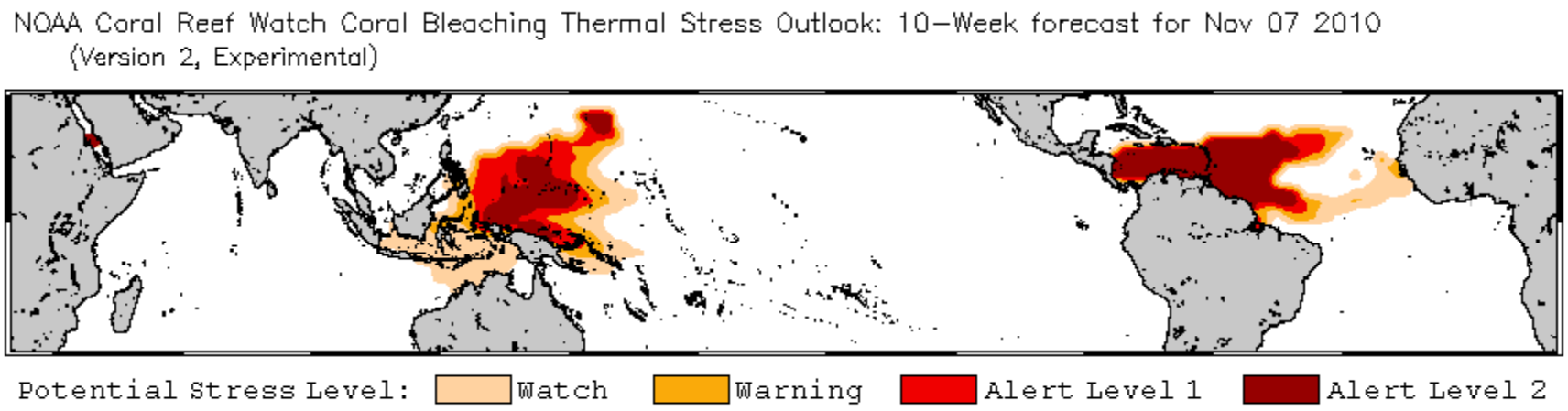
≥ 4 DHWs → coral bleaching is expected

≥ 8 DHWs → mass bleaching and mortality are expected

Seasonal Bleaching Outlook

Potential for future bleaching from SST-Forecasts

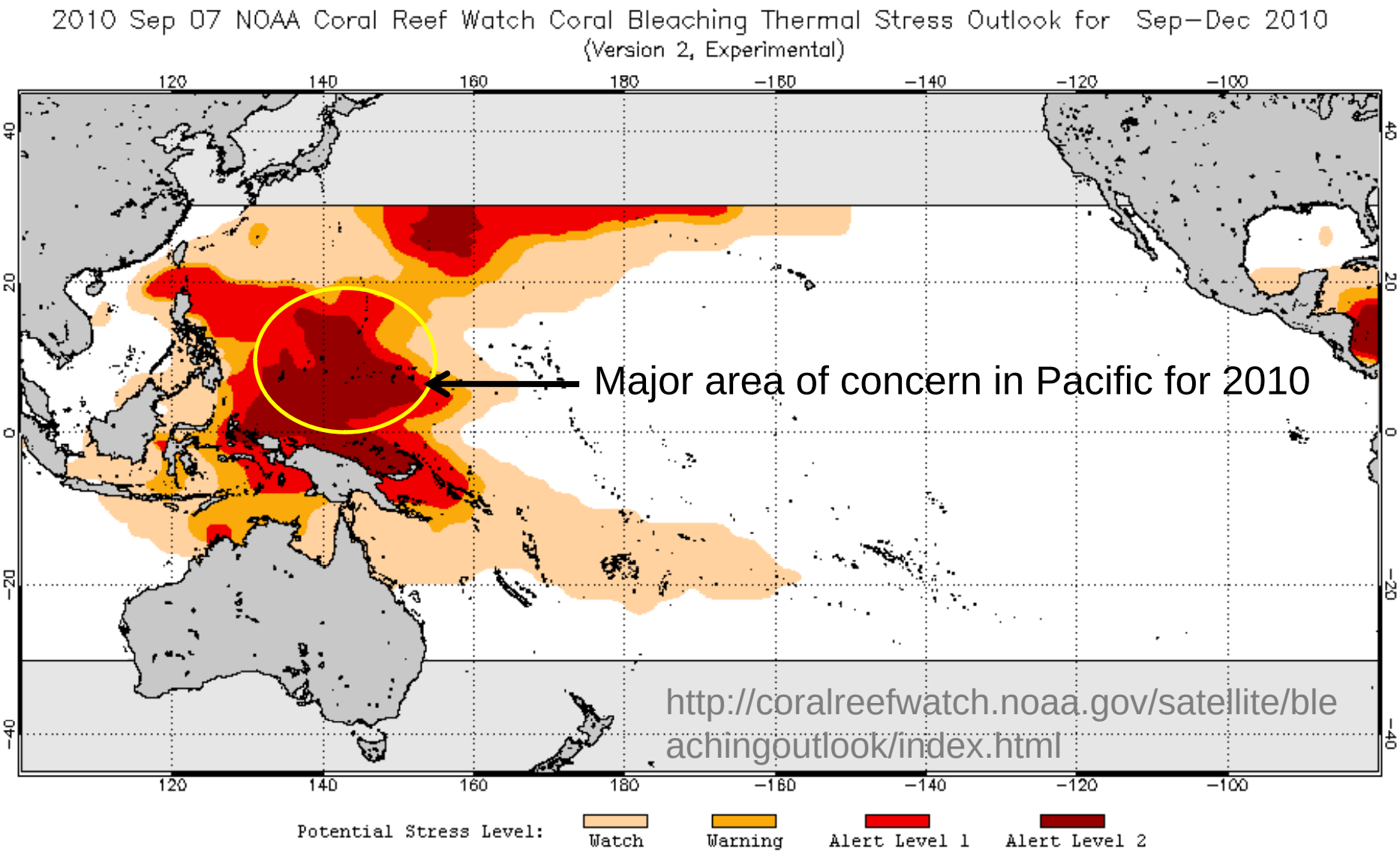
(Animation)



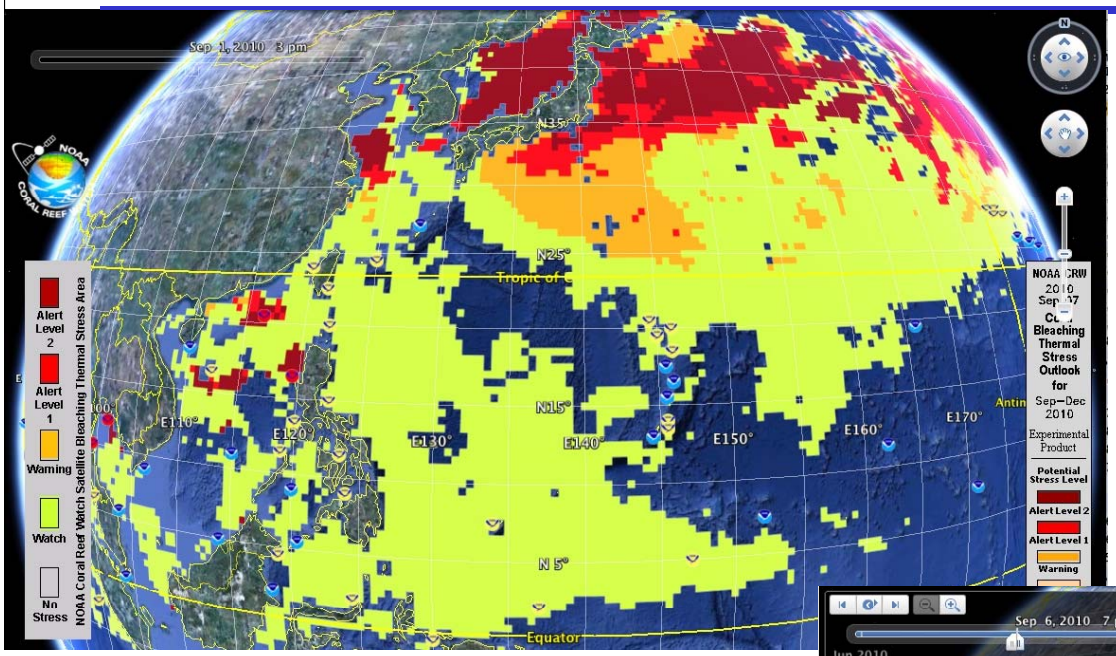
http://coralreefwatch.noaa.gov/satellite/bleachingoutlook/outlook_images_archive/animations/animation_global_obs20100829_for_2010_sep_dec.gif

http://coralreefwatch.noaa.gov/satellite/bleachingoutlook/index.html

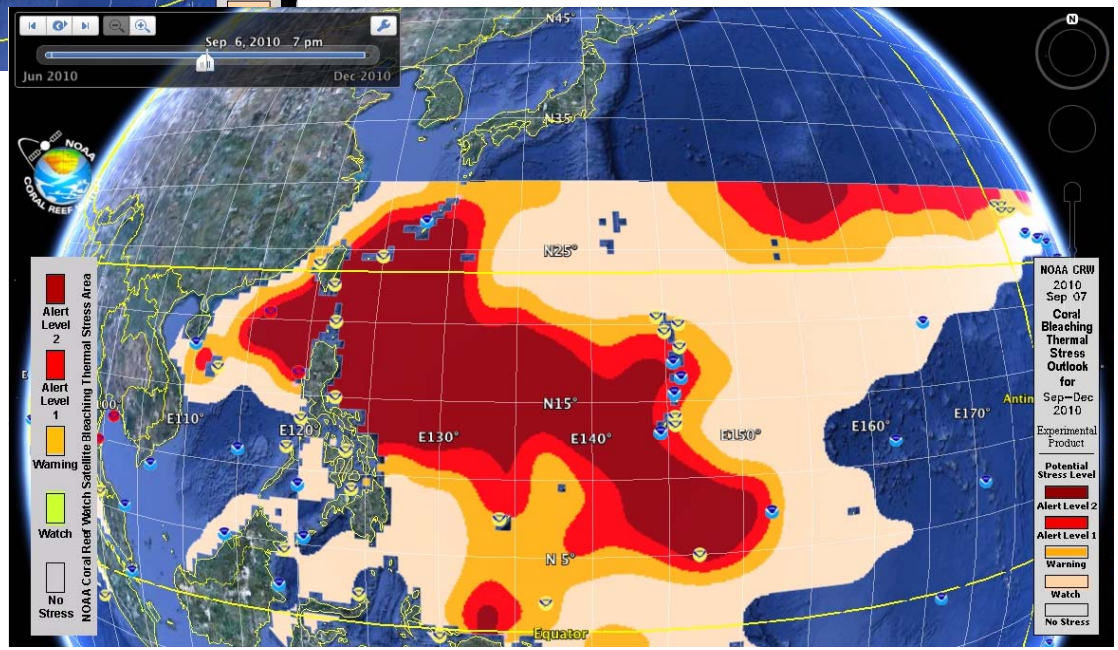
Seasonal Bleaching Outlook



Seasonal Bleaching Outlook



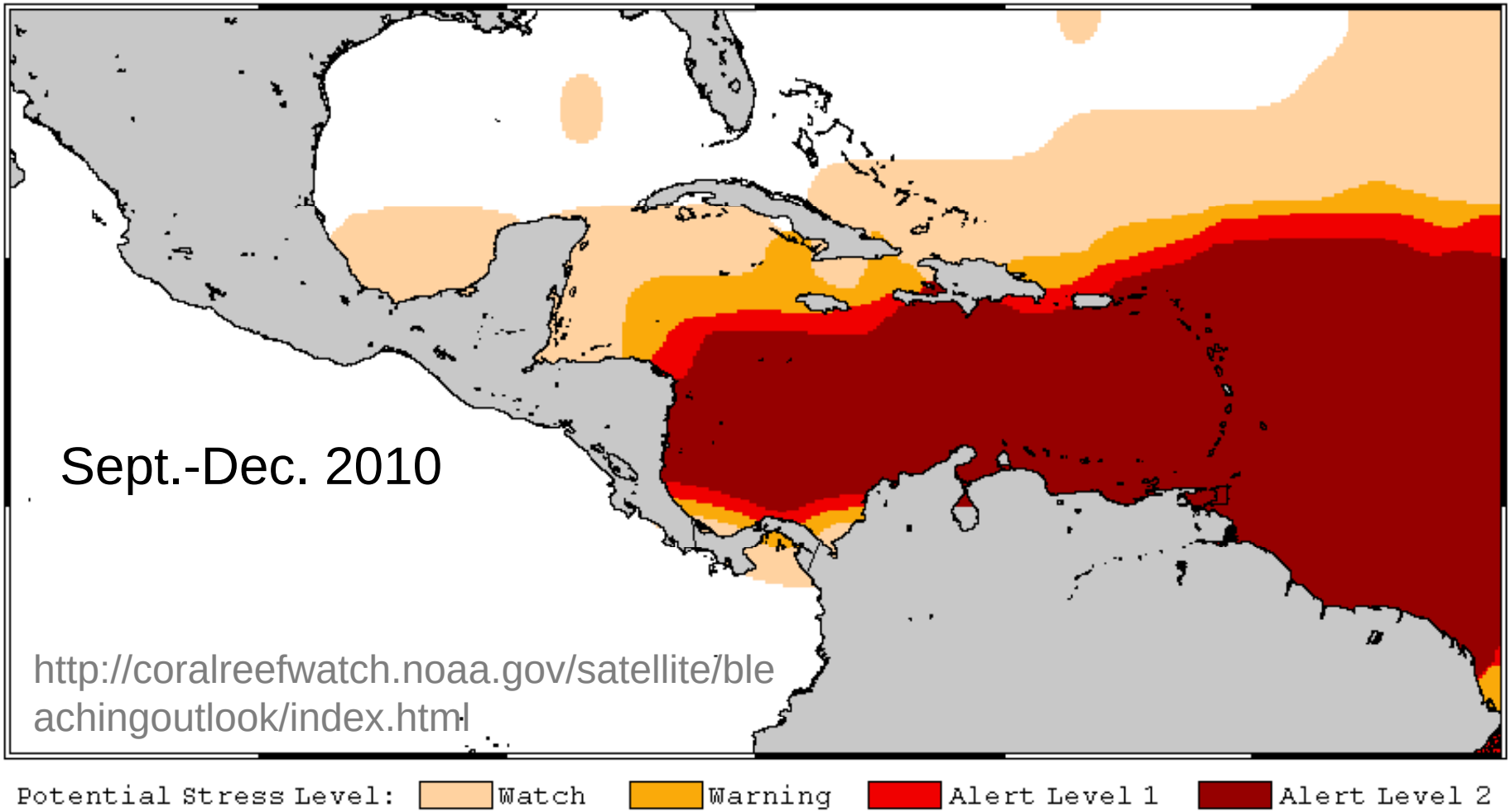
Observations to model comparison shows strong over-prediction.



Google Earth data at:
http://coralreefwatch.noaa.gov/satellite/ge/index.html

Seasonal Bleaching Outlook

2010 Sep 07 NOAA Coral Reef Watch Coral Bleaching Thermal Stress Outlook for Sep–Dec 2010
(Version 2, Experimental)



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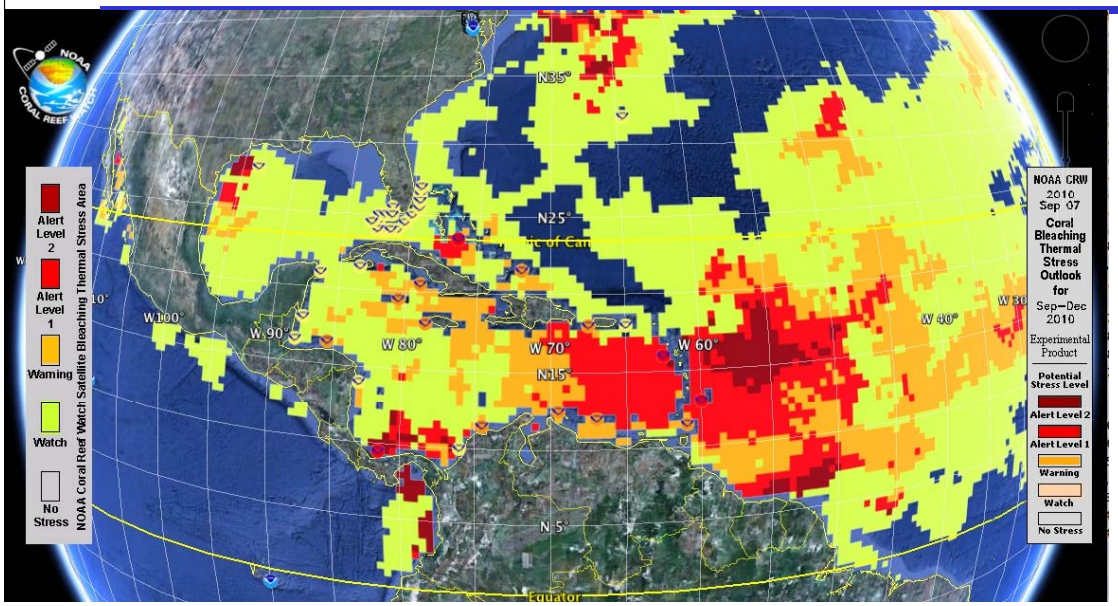
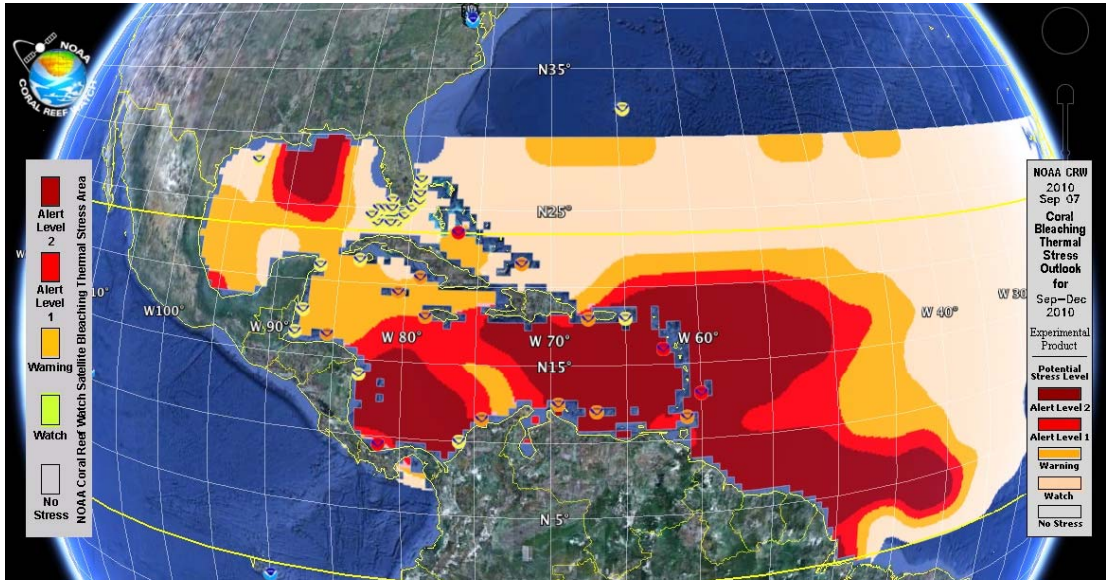


Observations to model comparison shows mild over-prediction.



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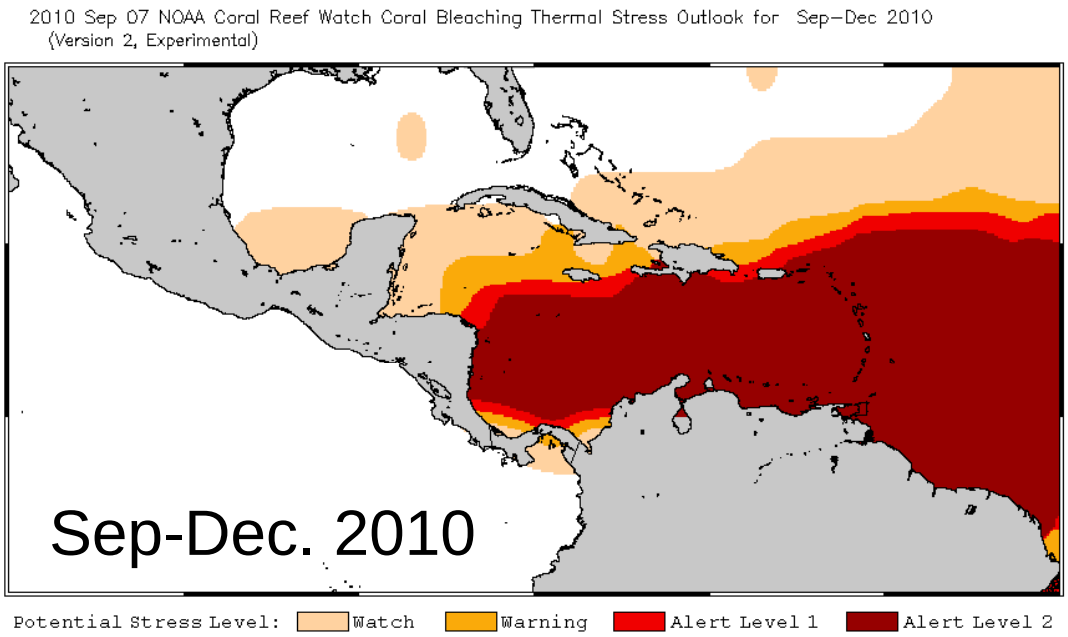
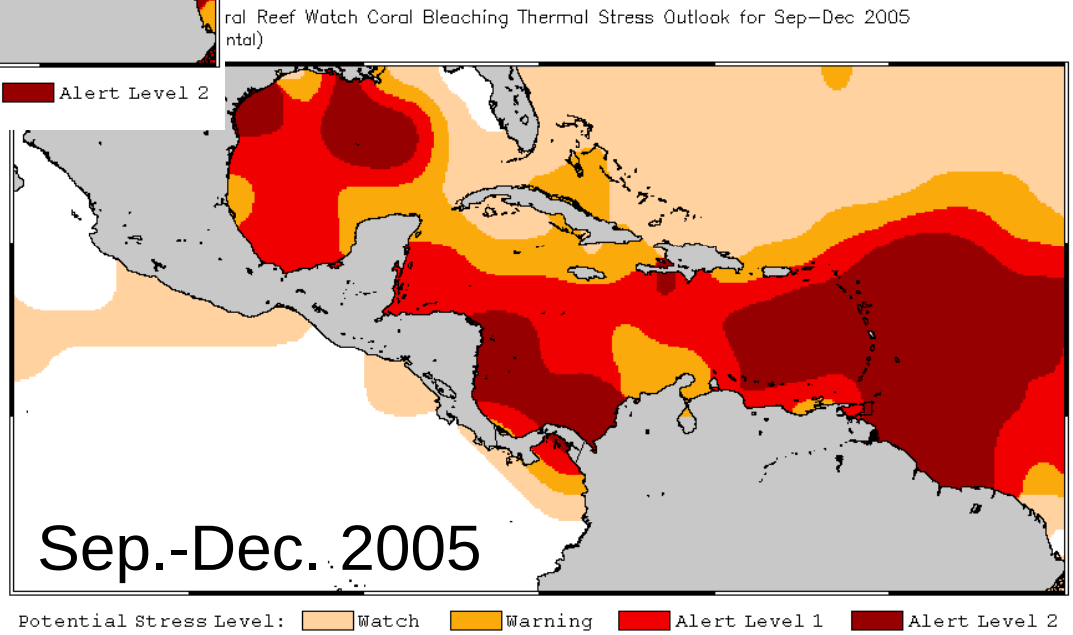
Seasonal Bleaching Outlook

Comparison with 2005

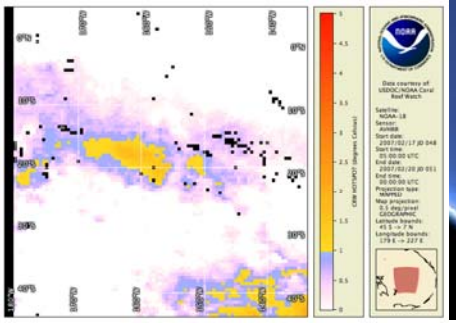


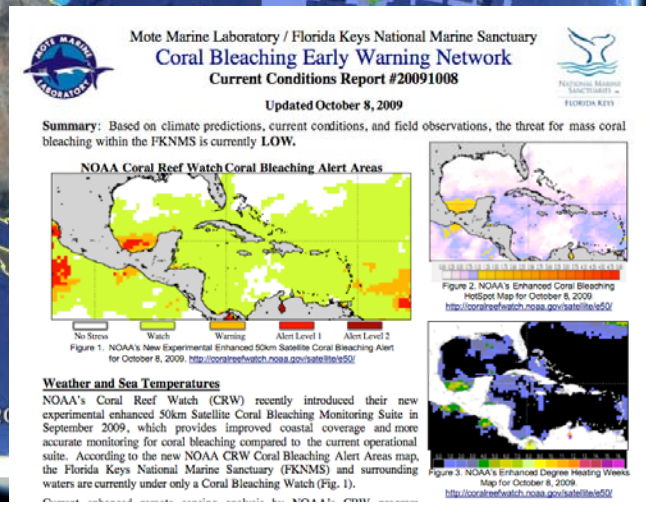


Product Delivery

Data Dissemination:

- Various Data Delivery Modes
  - Google Earth
  - HDF / CoastWatch Data Analysis Tool
  - Various image and data formats



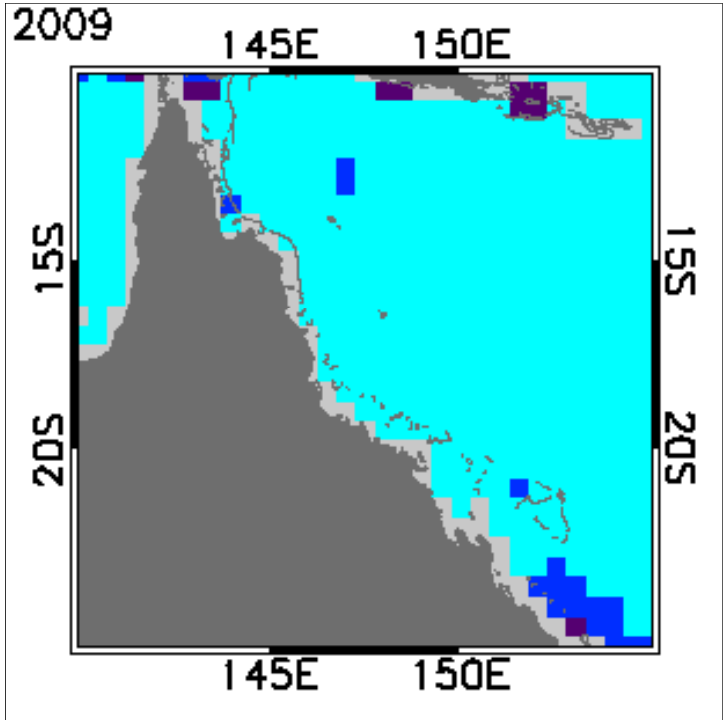


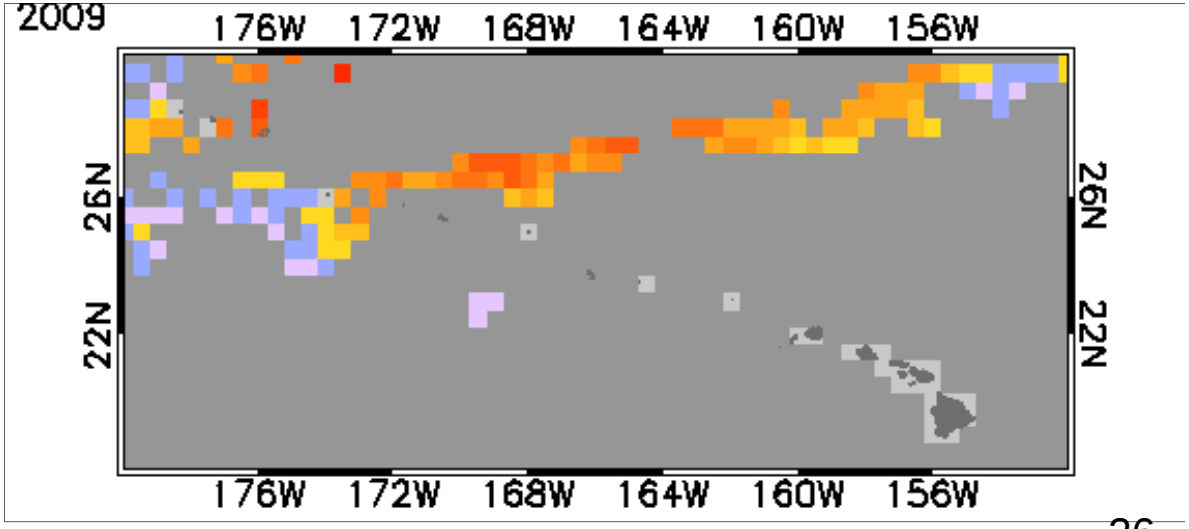
- Redistribution by Regional Users

http://coralreefwatch.noaa.gov

Coral Disease Risk Product In Development

- New experimental product to pinpoint risk of disease outbreaks
- Based on winter and summer SSTs increasing risk of certain diseases
- Publically available for the Great Barrier Reef
- Available to collaborators for Hawai'i
- GBR product description published (PLoSONE, Heron *et al*. 2010)





Bleaching Outlook for 2010

Pacific:

- Some potential for bleaching in Guam and CNMI, Palau to Chuuk
- Model currently over-predicting form observations

Caribbean:

- Major concern for bleaching across Caribbean basin
- Model output plausible and predicting higher thermal stress than 2005

Developing a bleaching/crisis response plan: Elements

- Predicting - be prepared
- Setting thresholds - when to act
- Assess ecological impacts - how/who
- Assess socio-economic impacts - how/who
- Communicate - why/who
- Management interventions - options
- Funding - uh huh
- Capacity - resources
- Support - decision-makers/stakeholders

Responsive Tasks: Assess Impacts

Ecological

- Scale
- Methods
- Response teams

Socioeconomic

Responsive Tasks: Communicate

Responsive: Management Actions

Minimize damage
Maximize recovery

Thank
You