The Importance of Reprocessing and Blending in Coral Bleaching Products:

No satellite is an island, and history is key to understanding the present

C. Mark Eakin
the NOAA Coral Reef Watch Team
and extended partners

Acknowledgements

- Funding provided by:
  - NASA Applied Sciences Program
  - NOAA
    - Coral Reef Conservation Program
    - JPSS Proving Ground Program

Coral Bleaching: Impact of Climate Change

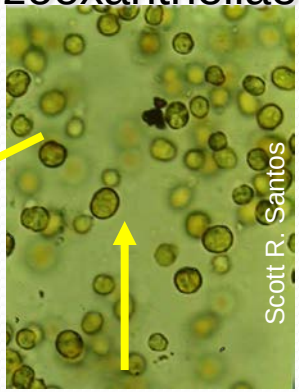
- Most of corals' food comes from photosynthesis

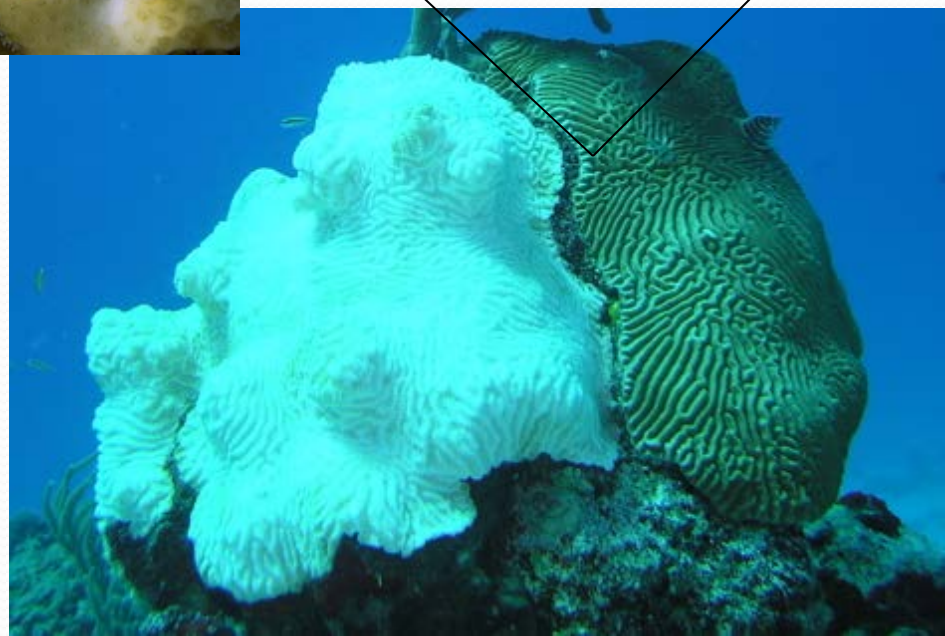
- Corals exposed to high temperatures and/or high light become stressed

- Corals eject their algae; coral appears "bleached

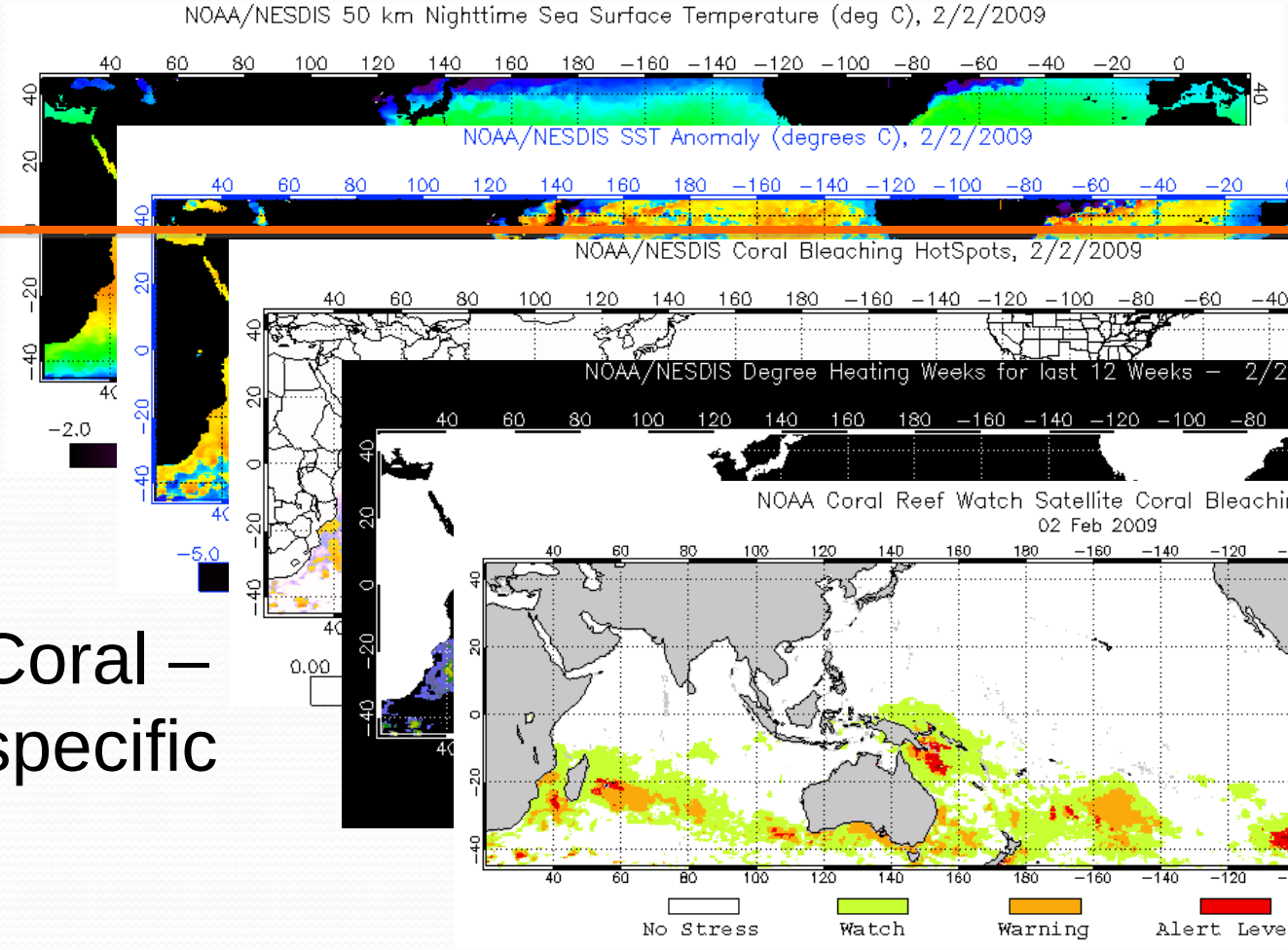
- If stress is mild or brief, corals recover, otherwise they die

  - Mass bleaching covers 100-1000 kms





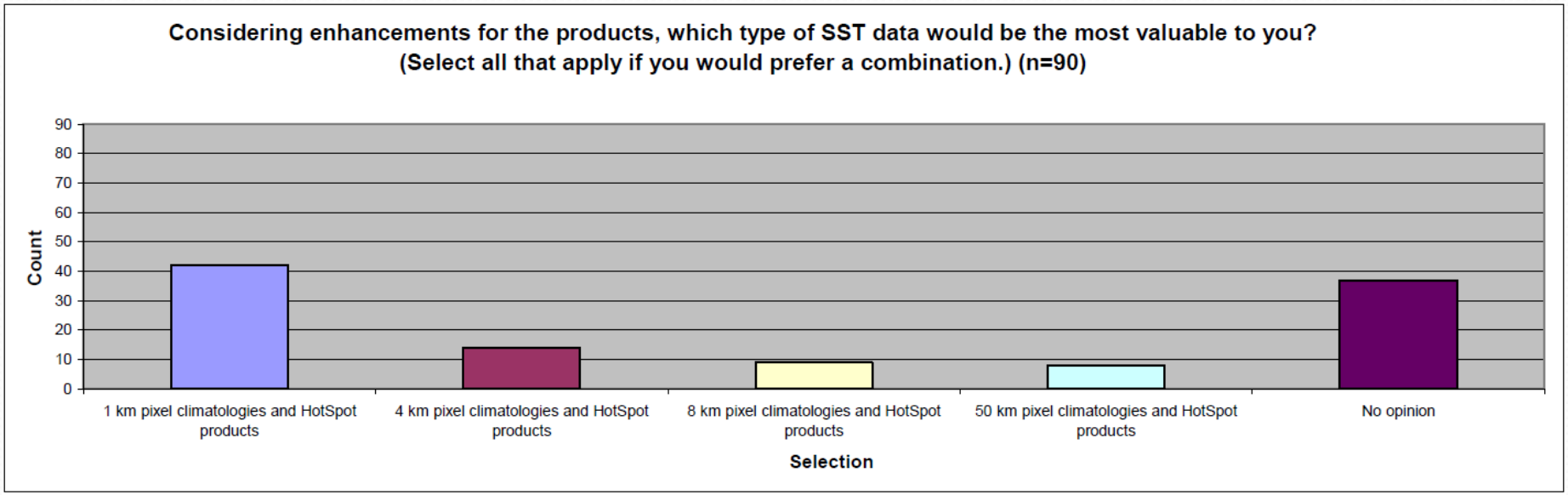
Coral Reef Watch
Satellite-Based Products



Coral – specific

Bleaching Alert Areas

User surveys (S. Lynds / CIRES)



Users are interested in higher spatial resolution products

50-km Resolution Operational Global CRW Products based on:

- Climatology: legacy RSMAS AVHRR climatology 1985-1993, omitting 1991-2

- Data: 50-km Operational Nighttime AVHRR (gap-filled)
  - Polar-orbiter
  - 1 scene/day

http://coralreefwatch.noaa.gov/

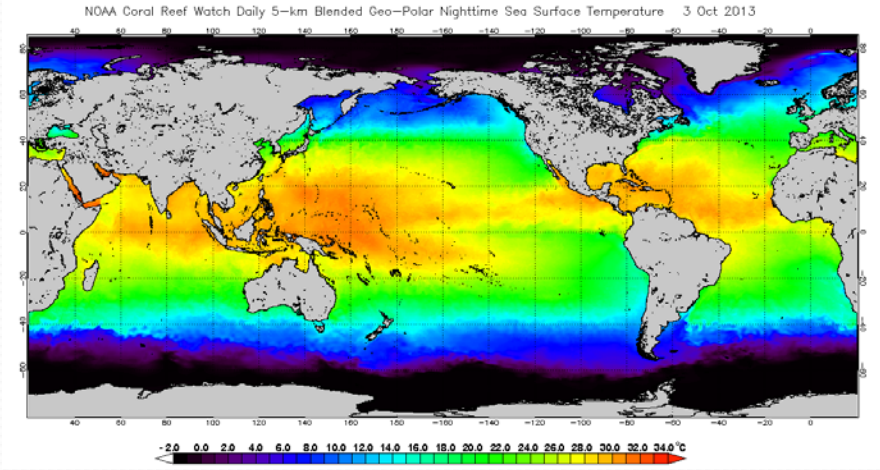
5-km Resolution Global CRW Products based on:

- Climatology: 4-km AVHRR Global Pathfinder – completed April 2014
- Data: 5-km Operational Blended
  - Polar-orbiters + Geostationary (4)
  - Up to 28-100 scenes/day
  - 5th geostationary coming

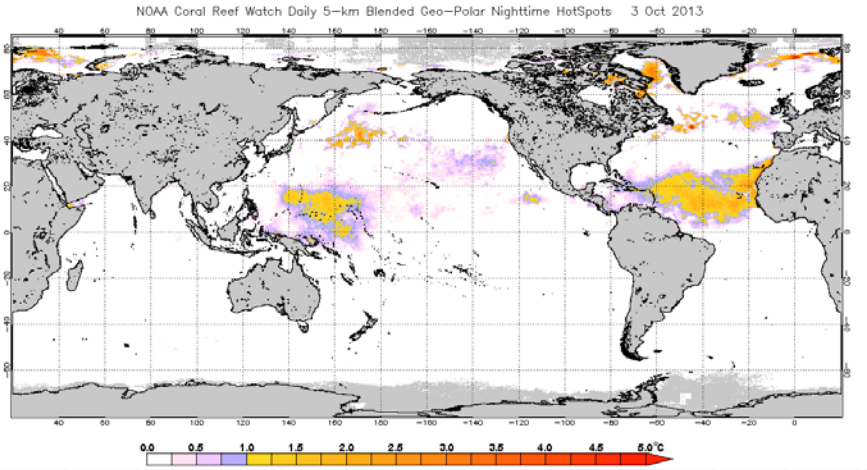
http://coralreefwatch.noaa.gov/satellite/bleaching5km/index.php

5 km – Resolution, Global Coral Thermal Stress Products – Now Live

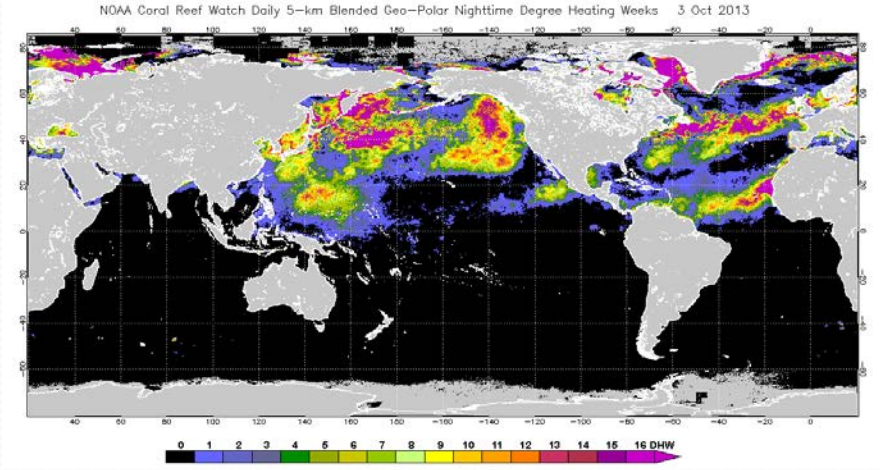
Based on NOAA Operational GOES-POES SST, 10/03/13



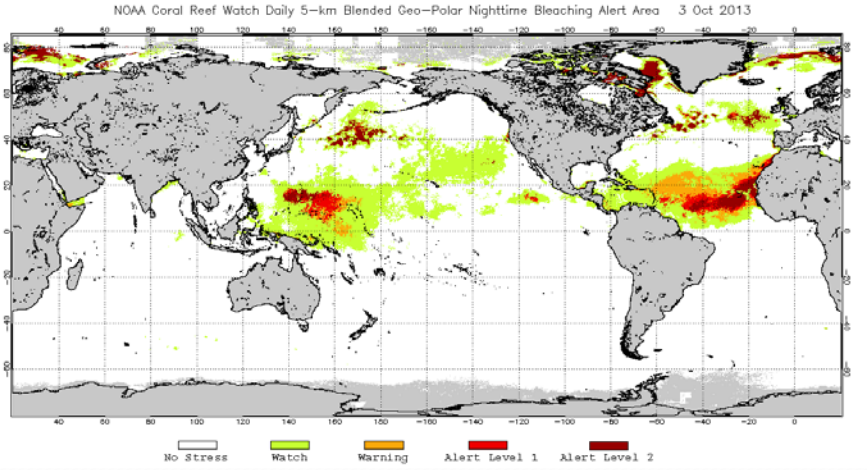
SST



HotSpot



DHW

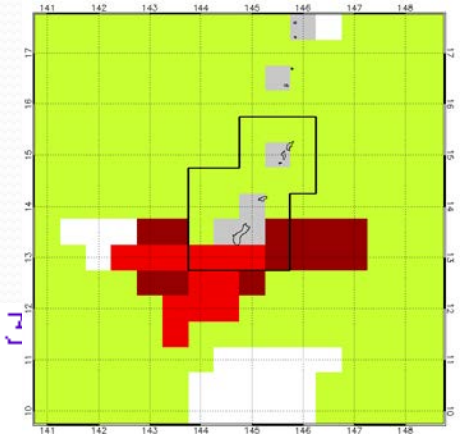


Bleaching Alert Areas

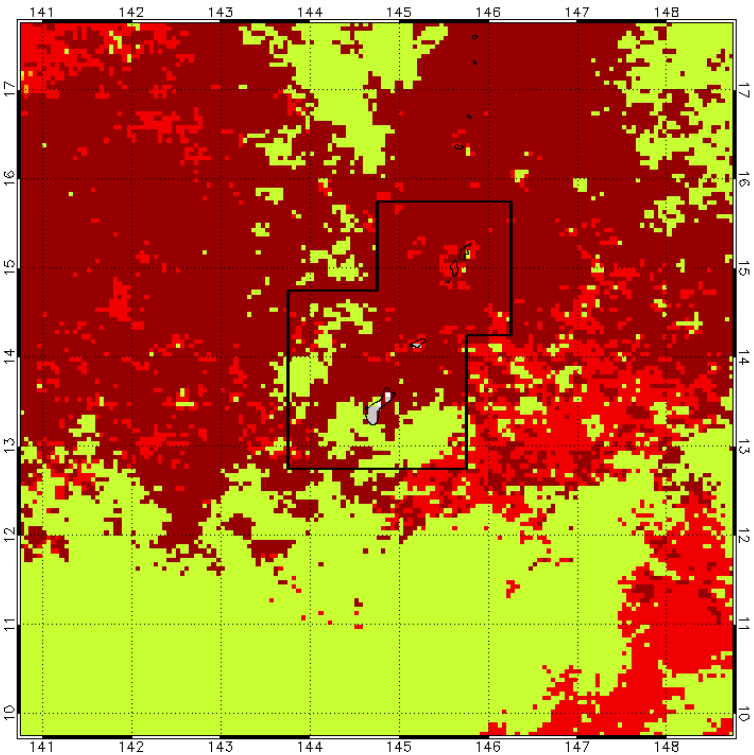
http://coralreefwatch.noaa.gov/satellite/bleaching5km/index.php

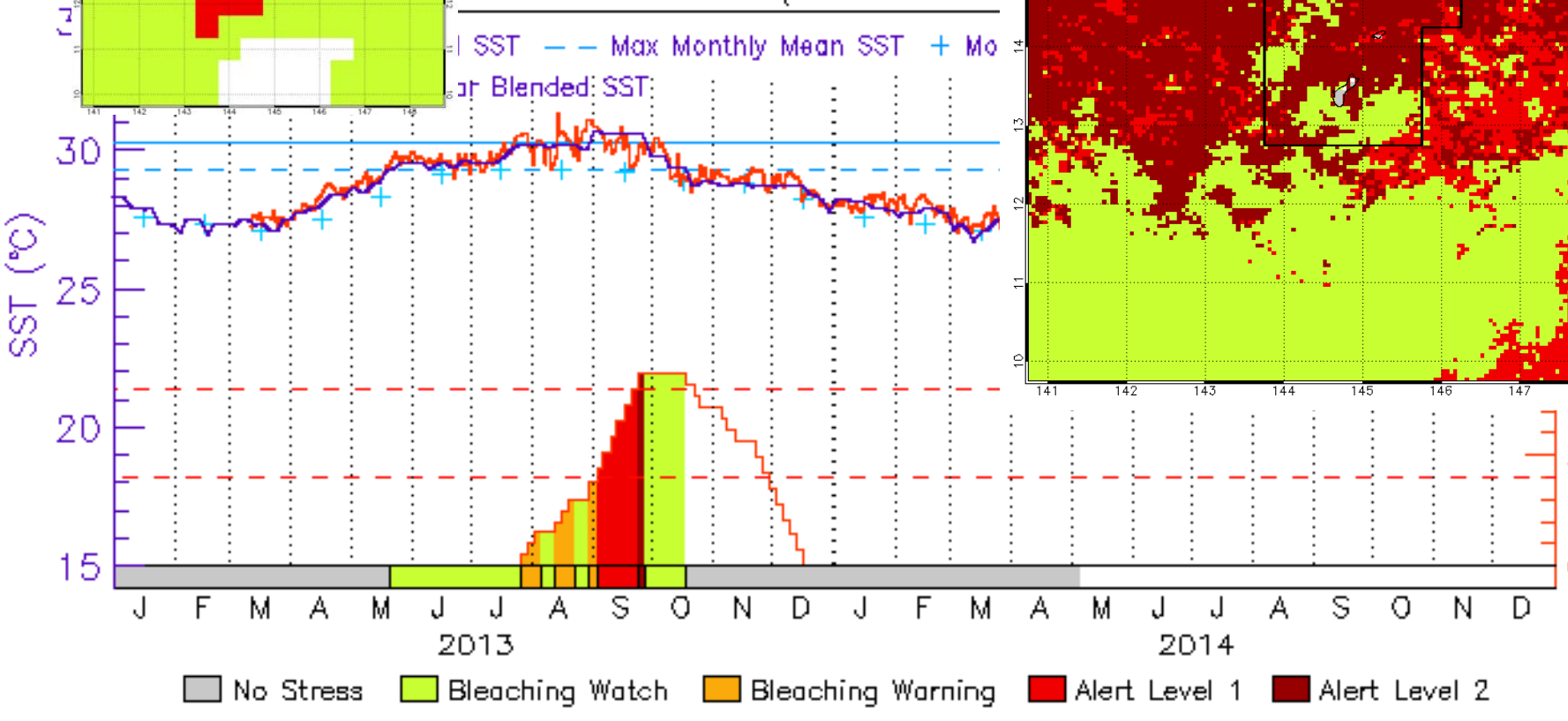
Prototype Regional Alert Products for Guam and Marianas Islands

50-km, 3 Oct 2013

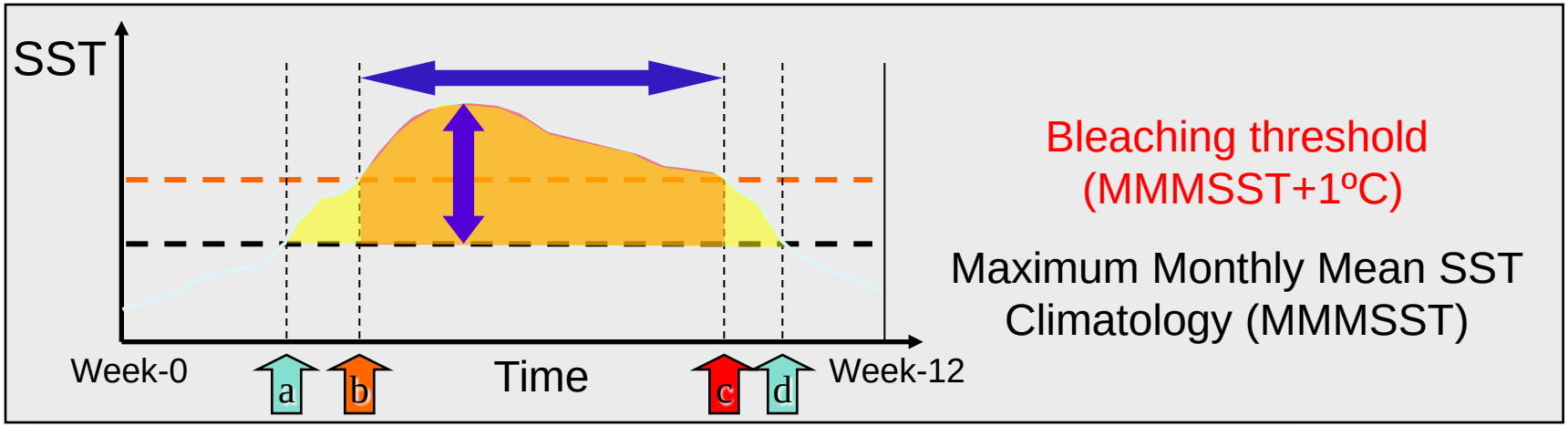


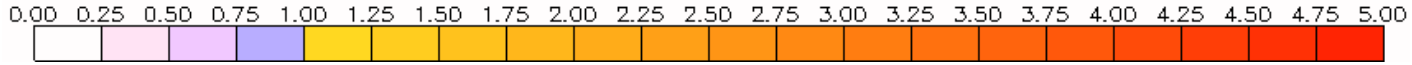
5-km Bleaching Alert 3 Oct 2013

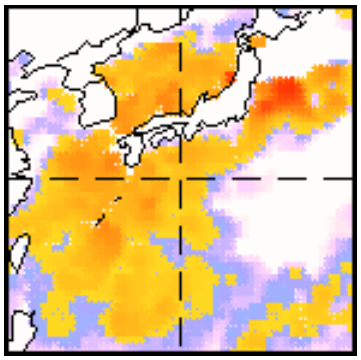




Degree Heating Week Product Algorithm

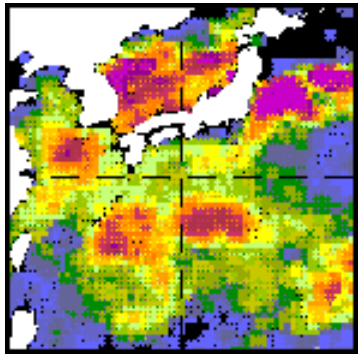






HotSpots

12 weeks
Σ(HotSpot value × duration)
≥ 1°C



Degree Heating Weeks

≥ 4 DHWs coral bleaching is expected

≥ 8 DHWs mass bleaching and mortality are expected

Need for Reprocessing: Lack of Overlap

- Climatology: 4-km nighttime AVHRR Global Pathfinder v5.2
  - January 1981 - December 2012

- Data: 5-km Operational Blended, Nighttime-only
  - available since 12 March 2013
  - day-night available since 27 March 2012
  - 11-km day-night February 2009 – October 2013

5-km Resolution Global Blended SST Reprocessing:

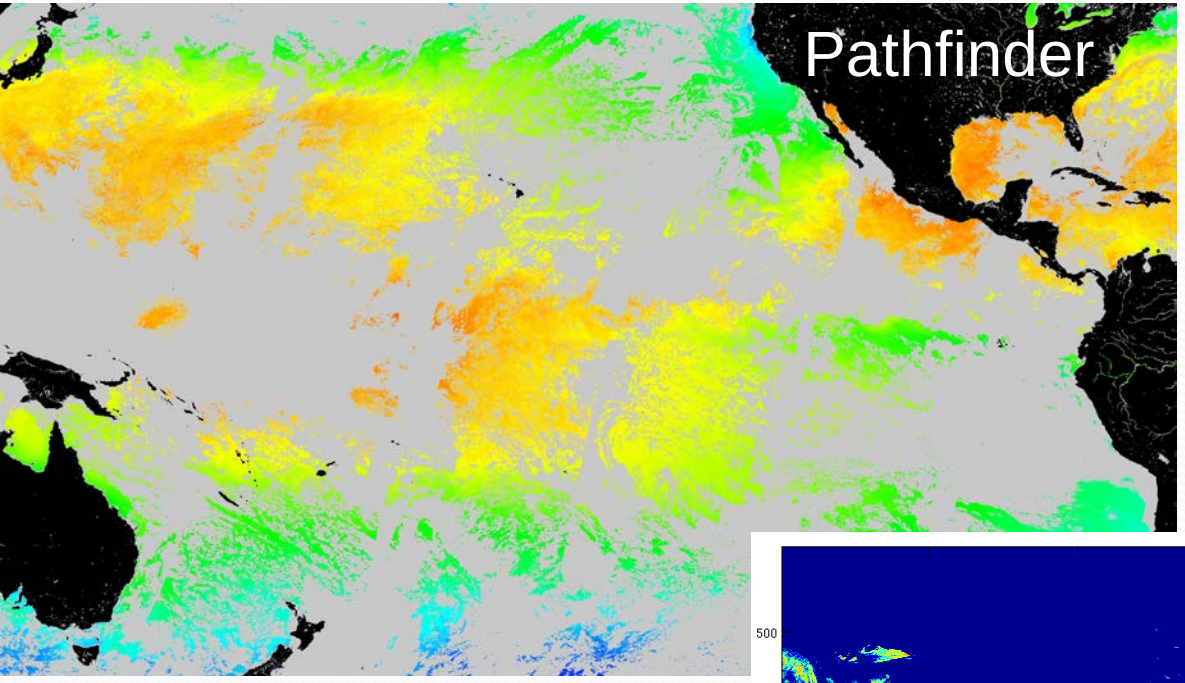
- 1st funding: 2005 – today
  - Polar satellites
  - Geo satellites & Geo-Polar Blending
  - Purpose: bias-adjust vs Pathfinder
- 2nd funding:
  - Polar satellites 1985 – today
- Seeking funding:
  - Geo satellites & Geo-Polar Blending 1994 – today
  - Purpose: provide consistent climatology and record

Why Blended?

- Data: 5-km Operational Blended
  - Polar-orbiters + Geostationary (4)
  - Up to 28-100 scenes/day
  - 5th geostationary coming

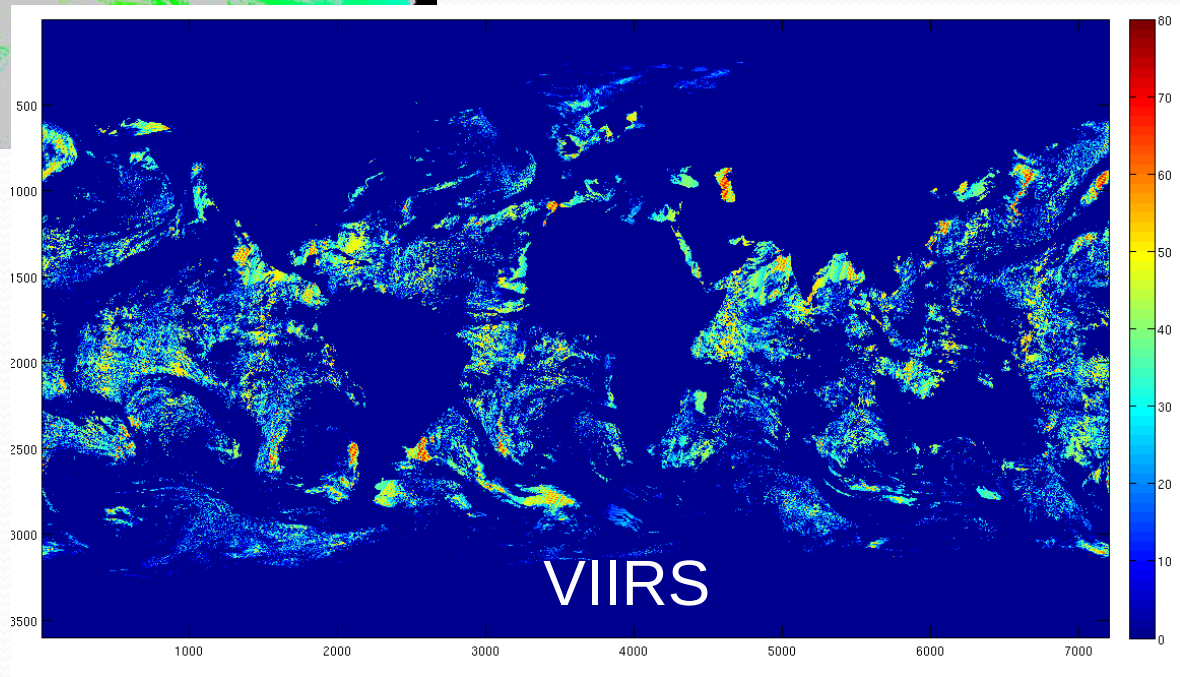
- Polar only: handful of scenes/day
  - Frequent gaps due to cloud cover and other quality issues

Why Blended?



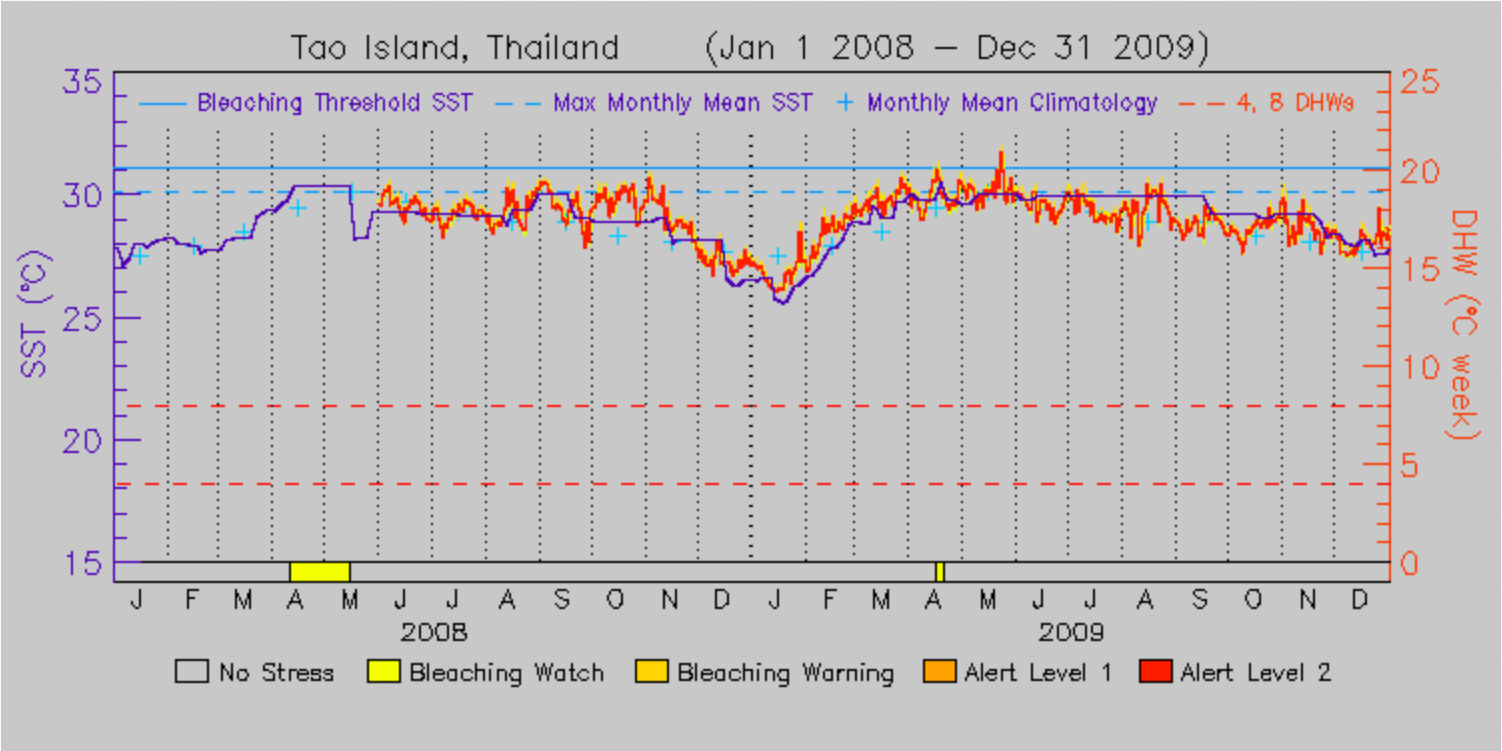
Pathfinder
35°S – 35°N:
12.6% with quality ≥ 4

90°S – 90°N:
7.8% with quality ≥ 4



Why Blended?

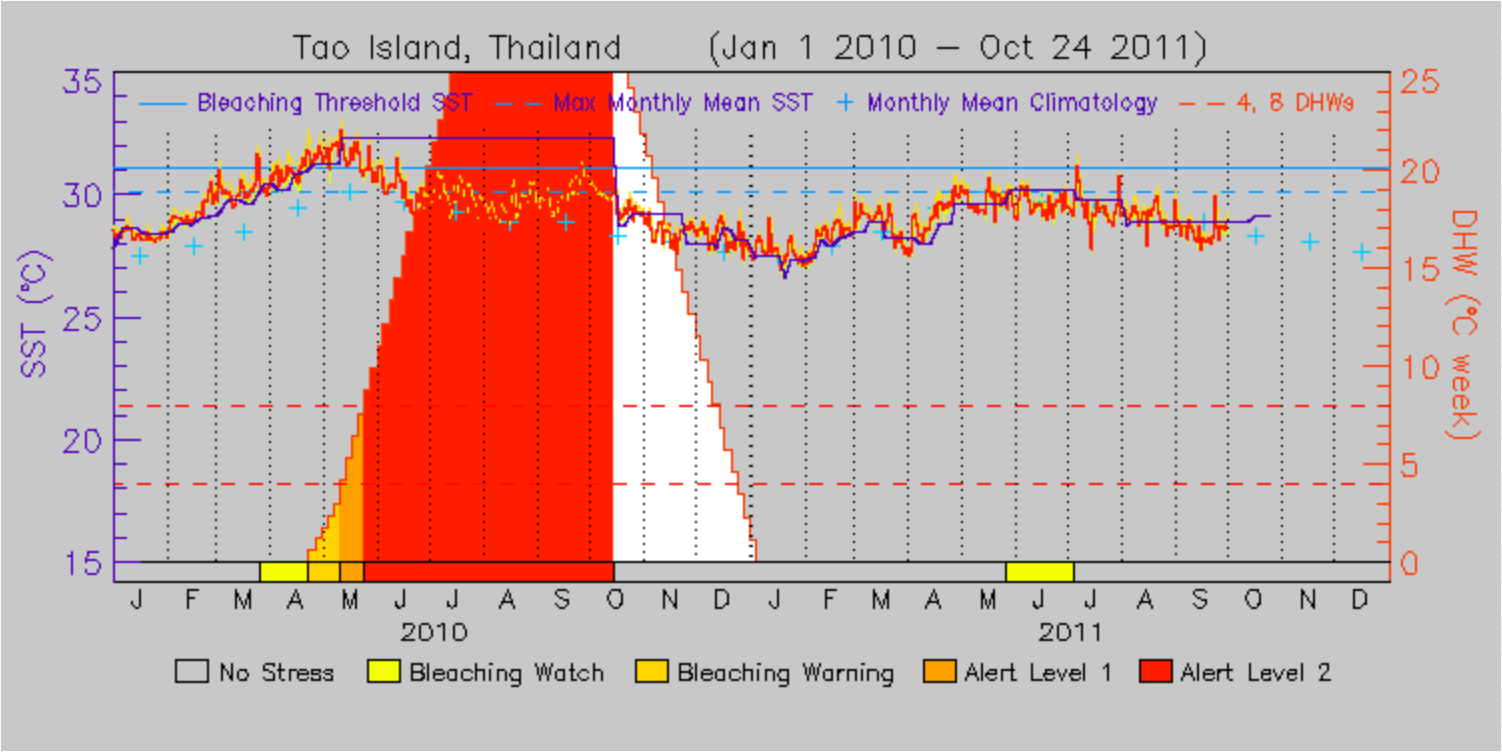
- Particular problems in cloudy regions



- Average years in Coral Triangle:
  frequent persistent cloud cover

Why Blended?

- Particular problems in cloudy regions



- 2010 in Coral Triangle:

  6-month persistent cloud cover

Why Blended?

- Next Step:

  Develop 1-km Geo-Polar blended SST analysis products for select regions

  VIIRS: 750 m

  GOES-R: 2 km

Linking science and management

- Goal: To improve our ability to alert reef managers around the world of bleaching-level stress, so they can take appropriate actions.

- In the Florida Keys, the CRW products have helped:
  - Guide Rapid Response efforts to assess reef conditions (BleachWatch)
  - Inform the public about what may be happening on the reef when corals are visibly stressed
  - Restrict access to a reef during thermal stress and disease
  - Increase confidence in management decisions

Linking science and management

Florida Department of Environmental Pr
Coral Reef Conservation Program

SEAFAN BleachWatch Pro

Current Conditions Report #201

September 4, 2013

Summary: Based on climate predictions and field observations, the threat for
Florida, between Miami-Dade and Martin County, remains **LOW**.

Environmental Monitoring

According to NOAA's Coral Reef Watch (CRW) satellite imagery products; there
southeast Florida, indicating that the region is experiencing a low level of thermal s

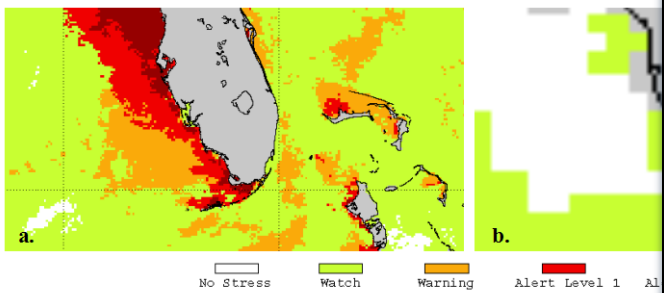


Figure 1. NOAA CRW Experimental 5 km Daily Geo-Polar Day-Night Blended Bleaching Alert
Satellite Coral Bleaching Area (b); September 2, 2013.
(a) http://coralreefwatch.noaa.gov/satellite/bleaching5km/index.html, (b) http://coralreefwatch.noaa.gov/satellite/index.php

Mote Marine Laboratory / Florida Keys National Marine Sanctuary

Coral Bleaching Early Warning Network

Current Conditions Report #20130903

Updated September 3, 2013

Summary: Based on climate predictions, current conditions, and field observations, the threat for mass coral bleaching within the FKNMS remains **LOW**.

NOAA Coral Reef Watch Coral Bleaching Alert Area
September 1, 2013 (experimental)

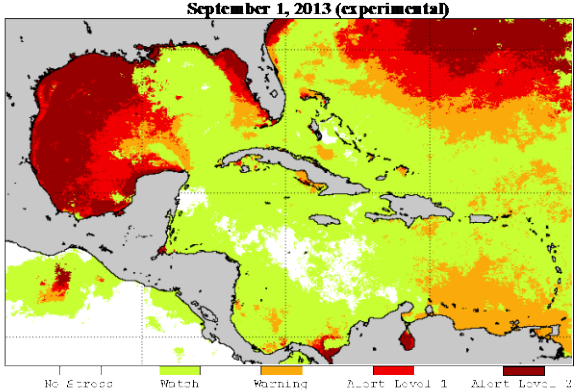


Figure 1. NOAA's 5 km Experimental Coral Bleaching Alert Areas for September 1, 2013.
http://coralreefwatch.noaa.gov/satellite/bleaching5km

Weather and Sea Temperatures

According to the latest NOAA Coral Reef Watch (CRW) experimental 5 kilometer (km) Satellite Coral Bleaching Alert Area, there is currently a bleaching watch for the Atlantic side of the Florida Keys, with the potential for bleaching warnings and alerts if temperatures in the Gulf continue to increase (Fig. 1).

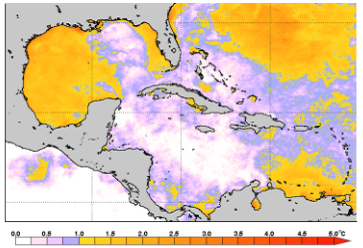


Figure 2. NOAA's Experimental 5km Coral Bleaching HotSpot Map for September 1, 2013.
http://coralreefwatch.noaa.gov/satellite/bleaching5km

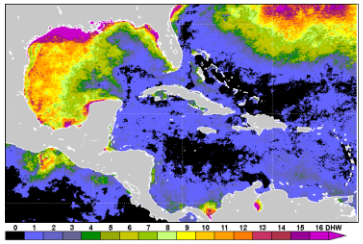


Figure 3. NOAA's Experimental 5km Degree Heating Weeks Map for September 1, 2013.
http://coralreefwatch.noaa.gov/satellite/bleaching5km

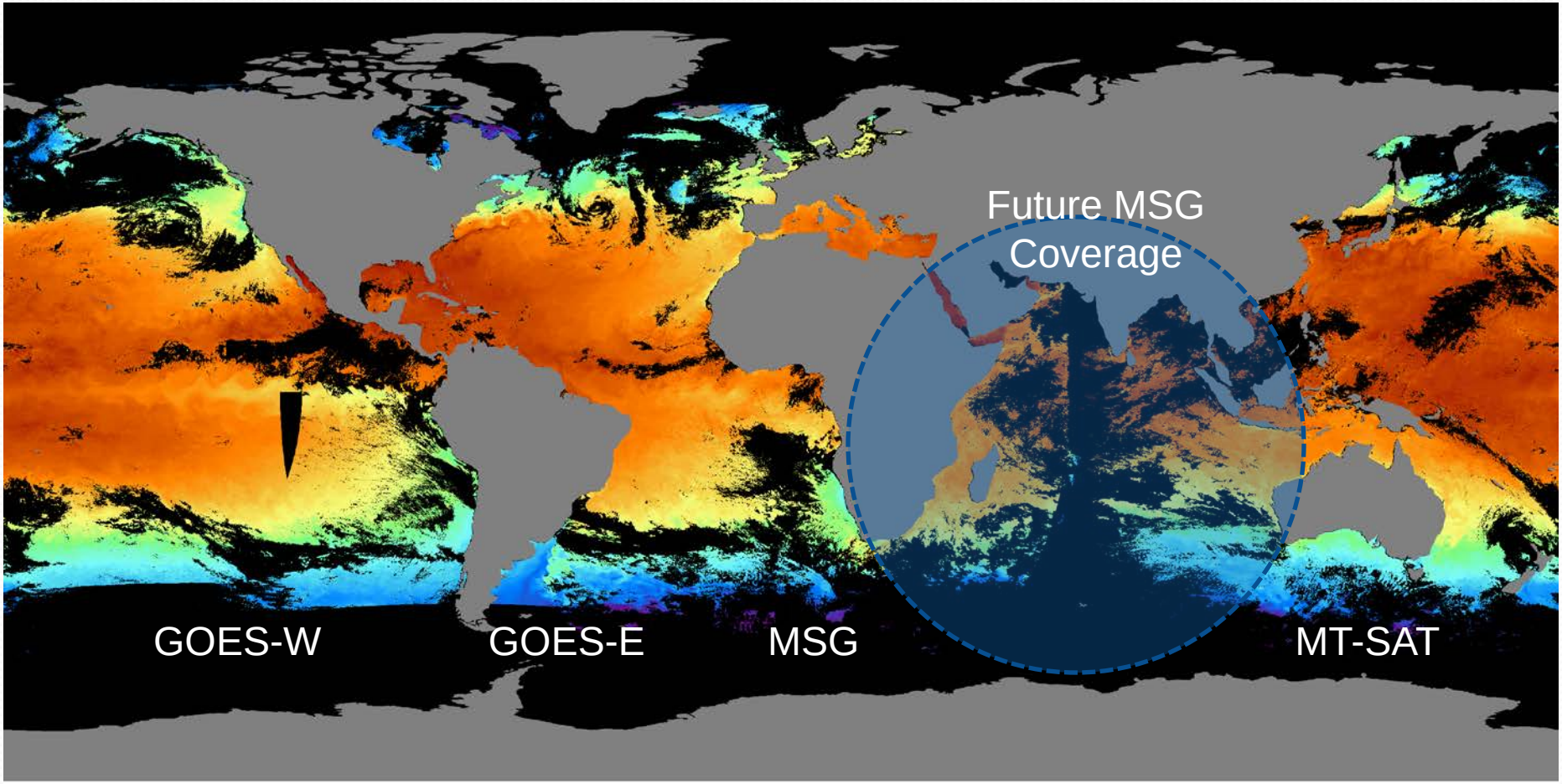
Thank You

The Importance of Reprocessing and Blending in Coral Bleaching Products:

No satellite is an island, and history is key to understanding the present

C. Mark Eakin
the NOAA Coral Reef Watch Team
and extended partners

Geostationary Sea Surface Temperature Coverage

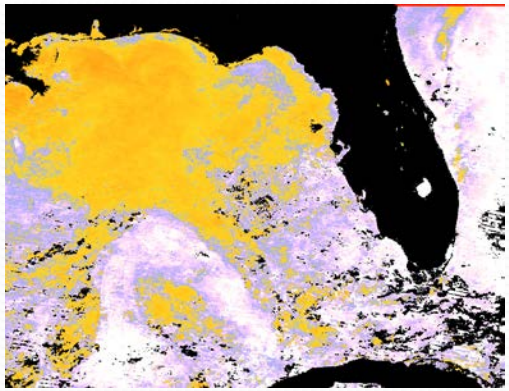


Meteosat Second Generation (**MSG**)-European Multi-Functional Transport Satellite (**MT-SAT**)-Japanese

1-km Prototype Products based on:

- 4 km AVHRR Global Pathfinder v5.2 climatology
- 1 km MODIS and AVHRR
- Note mismatch in resolution

NASA MODIS HotSpot
Climatology from Pathfinder 4km MMM



http://imars.marine.usf.edu/crw-dss/crw-dss-description