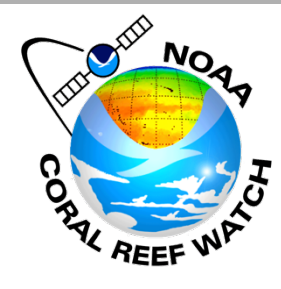


NOAA Coral Reef Watch: High Resolution Coral Bleaching Products for Monitoring Coral Bleaching

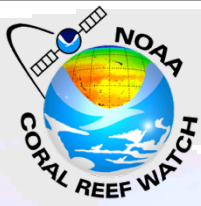
Dr. C. Mark Eakin

NOAA Coral Reef Watch

<http://coralreefwatch.noaa.gov>



2015 Coral Bleaching: American Samoa



December 2014

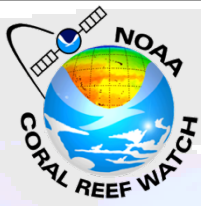


XL CATLIN
SEAVIEW™
SURVEY

<http://coralreefwatch.noaa.gov>



2015 Coral Bleaching: American Samoa



February 2015

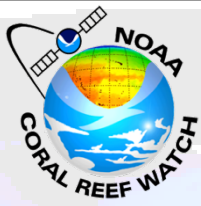


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<http://coralreefwatch.noaa.gov>



2015 Coral Bleaching: American Samoa

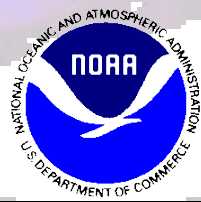


August 2015



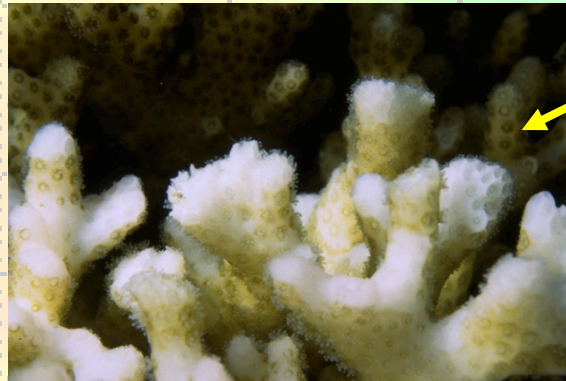
XL CATLIN
SEAVIEW™
SURVEY

<http://coralreefwatch.noaa.gov>

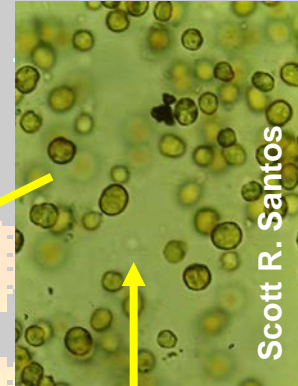


What is Coral Bleaching?

- 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

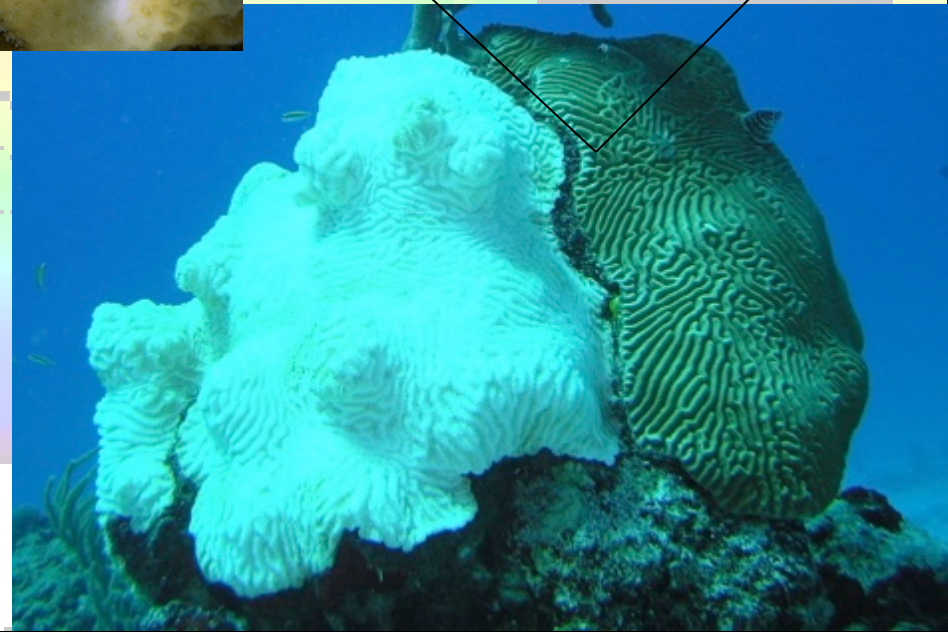


zooxanthellae



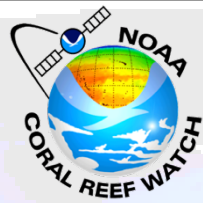
Scott R. Santos

Symbiotic algae



Coral Reef Watch

5-km Satellite-Based Products



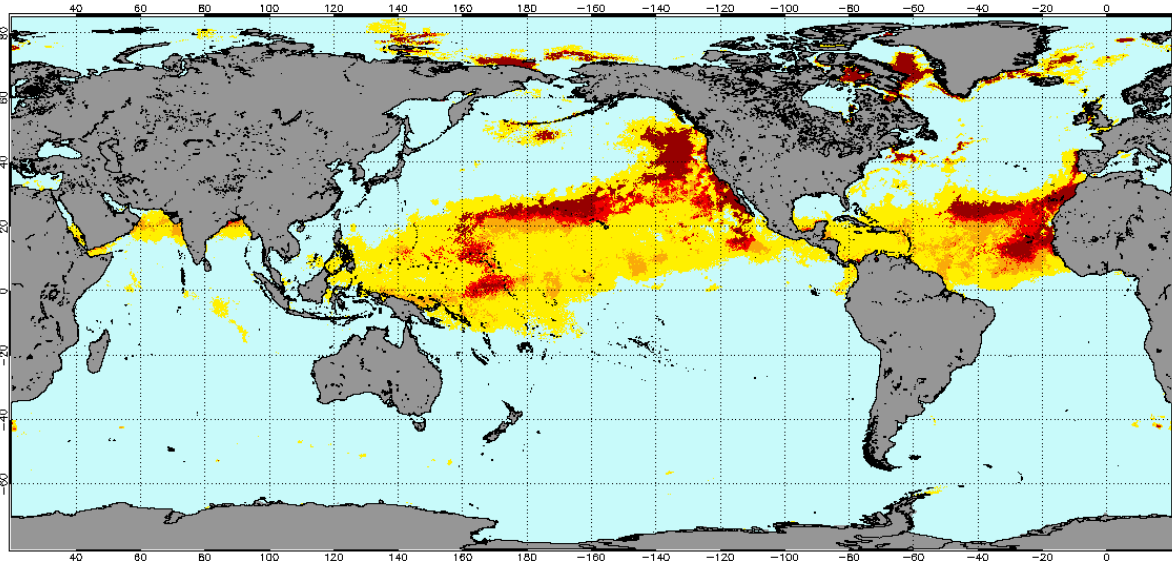
NOAA Coral Reef Watch Daily 5-km Blended Geo-Polar Nighttime Sea Surface Temperature 17 Oct 2014

NOAA Coral Reef Watch Daily 5-km Blended Geo-Polar Nighttime SST Anomaly 17 Oct 2014

NOAA Coral Reef Watch Daily 5-km Geo-Polar Blended Night-Only HotSpots 17 Oct 2014

NOAA Coral Reef Watch Daily 5-km Geo-Polar Blended Night-Only Degree Heating Weeks 17 Oct 2014

NOAA Coral Reef Watch Daily 5-km Geo-Polar Blended Night-Only Bleaching Alert Area 7d Max 17 Oct 2014

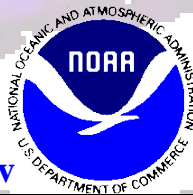


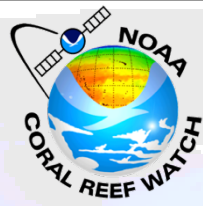
Coral – specific

Bleaching Alert Area



<http://coralreefwatch.noaa.gov>





Coral Reef Watch: Product Comparison

5 km Geostationary-Polar Blend

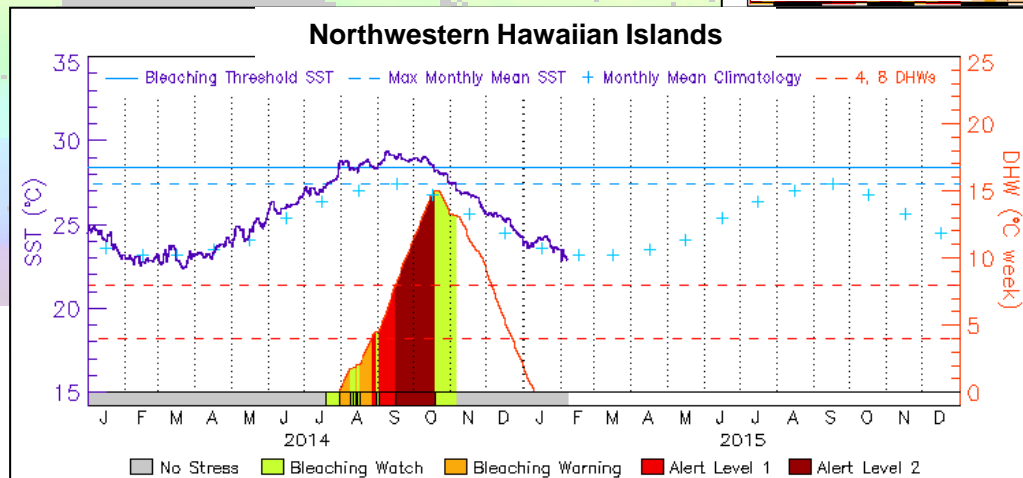
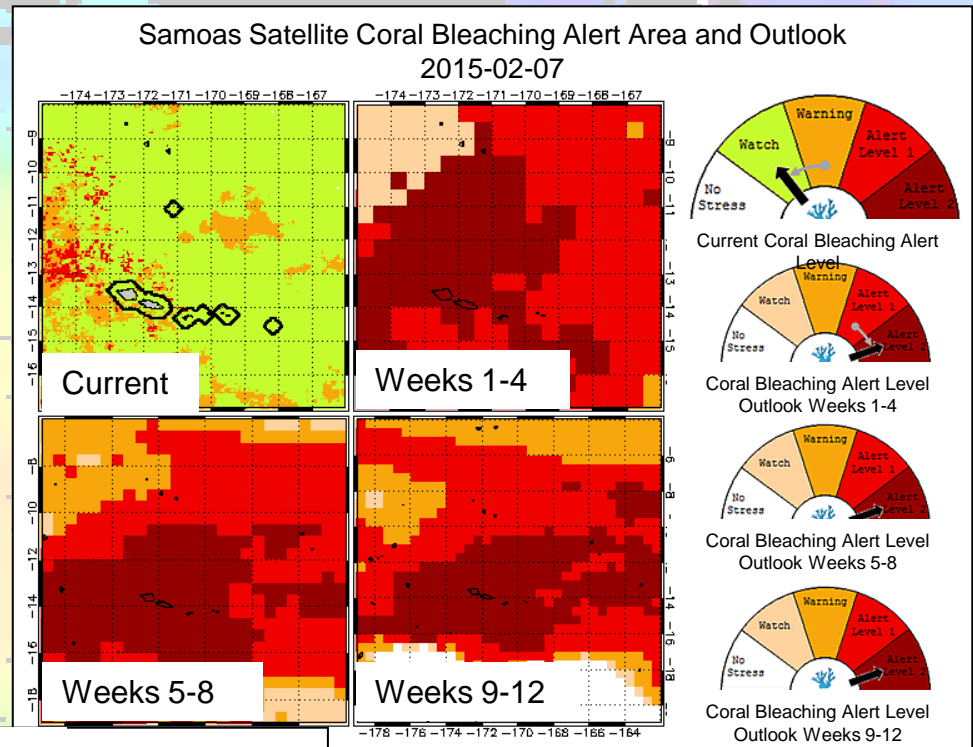
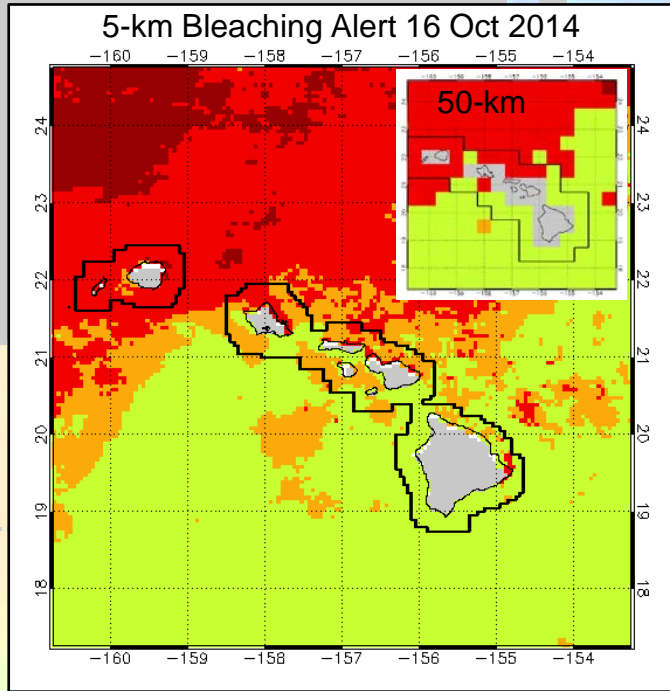
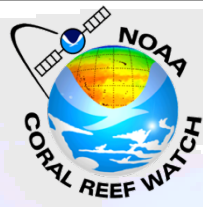
- **Climatology:** 22 year, 4 km (Pathfinder AVHRR)
- **Data:**
 - 5 km Operational Blended, night only
 - Polar-orbiters (2, including SNPP) + Geostationary (4)
 - Up to 50 scenes/day

50 km Polar-only (Operational)

- **Climatology:** 7 year, 50 km (AVHRR)
- **Data:**
 - 50 km Operational, night only
 - Polar-orbiter (1)
 - Max 1 scene/day



2014-5: New Coral Reef Watch 5-km Product Suite for Coral Bleaching

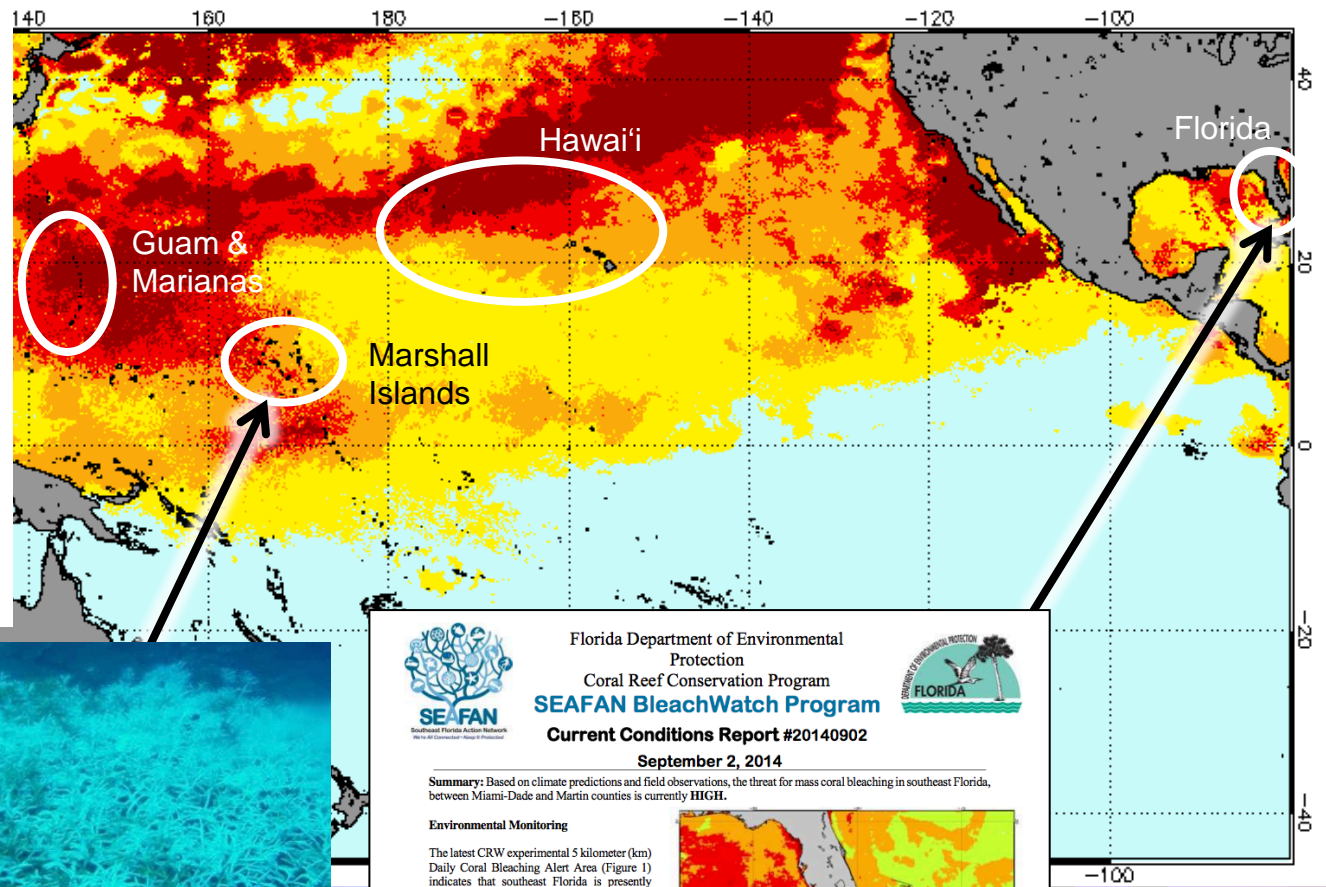



<http://coralreefwatch.noaa.gov>



Global Bleaching: Last Half of 2014

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.

NOAA's Bleaching Hotspot Map compares current SST to the maximum monthly mean, which is the average temperature during the

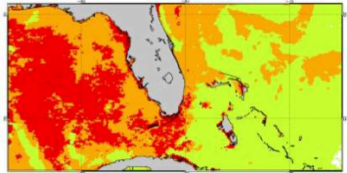
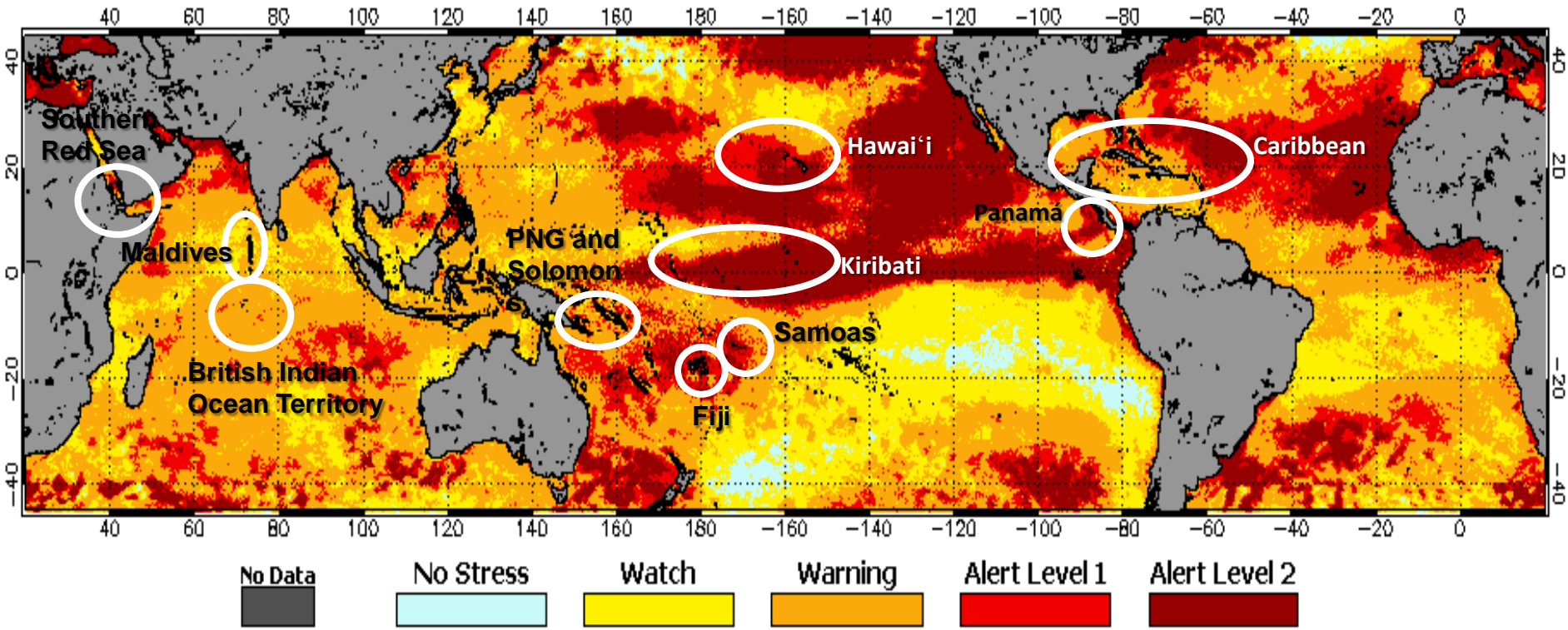


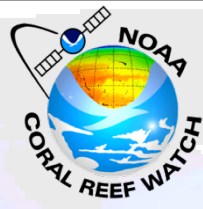
Figure 1. NOAA CRW Experimental Daily 5 km Blended Geo-Polar Nighttime Blended Bleaching Alert Area, August 31, 2014

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

Global Bleaching: 2015

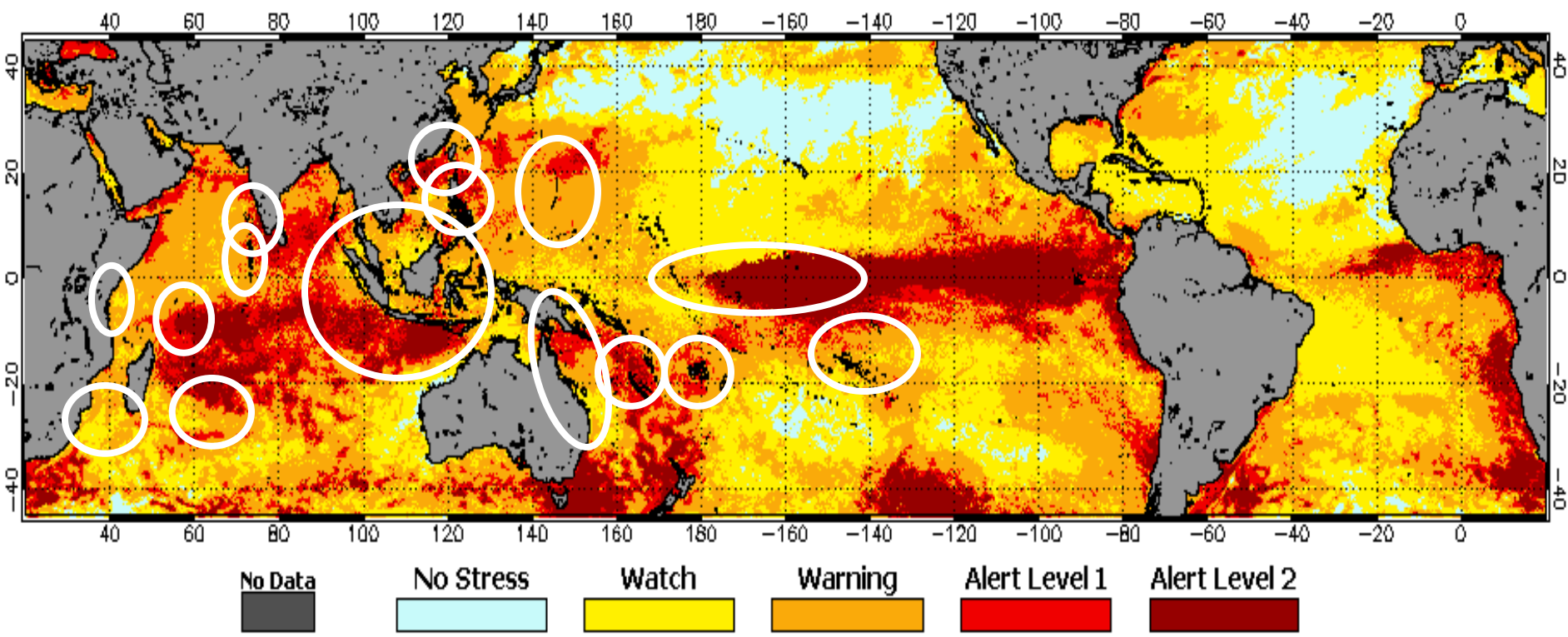
NOAA Coral Reef Watch Annual Maximum Satellite Coral Bleaching Alert Area 2015





Global Bleaching: First Half of 2016

NOAA Coral Reef Watch Maximum Satellite Coral Bleaching Alert Area 1 Jan – 31 July 2016



- | | | | |
|-----------------------|----------------------|---------------------|-------------------------|
| | Western India | Taiwan | Guam/CNMI |
| Seychelles | Maldives | Vietnam | Kiribati |
| Kenya/Tanzania | Réunion | Thailand | New Caledonia |
| Mozambique | Indonesia | Philippines | Fiji |
| Madagascar | Mauritius | E. Australia | French Polynesia |

Great Barrier Reef Bleaching: 2016



Justin Marshall, Coral Watch



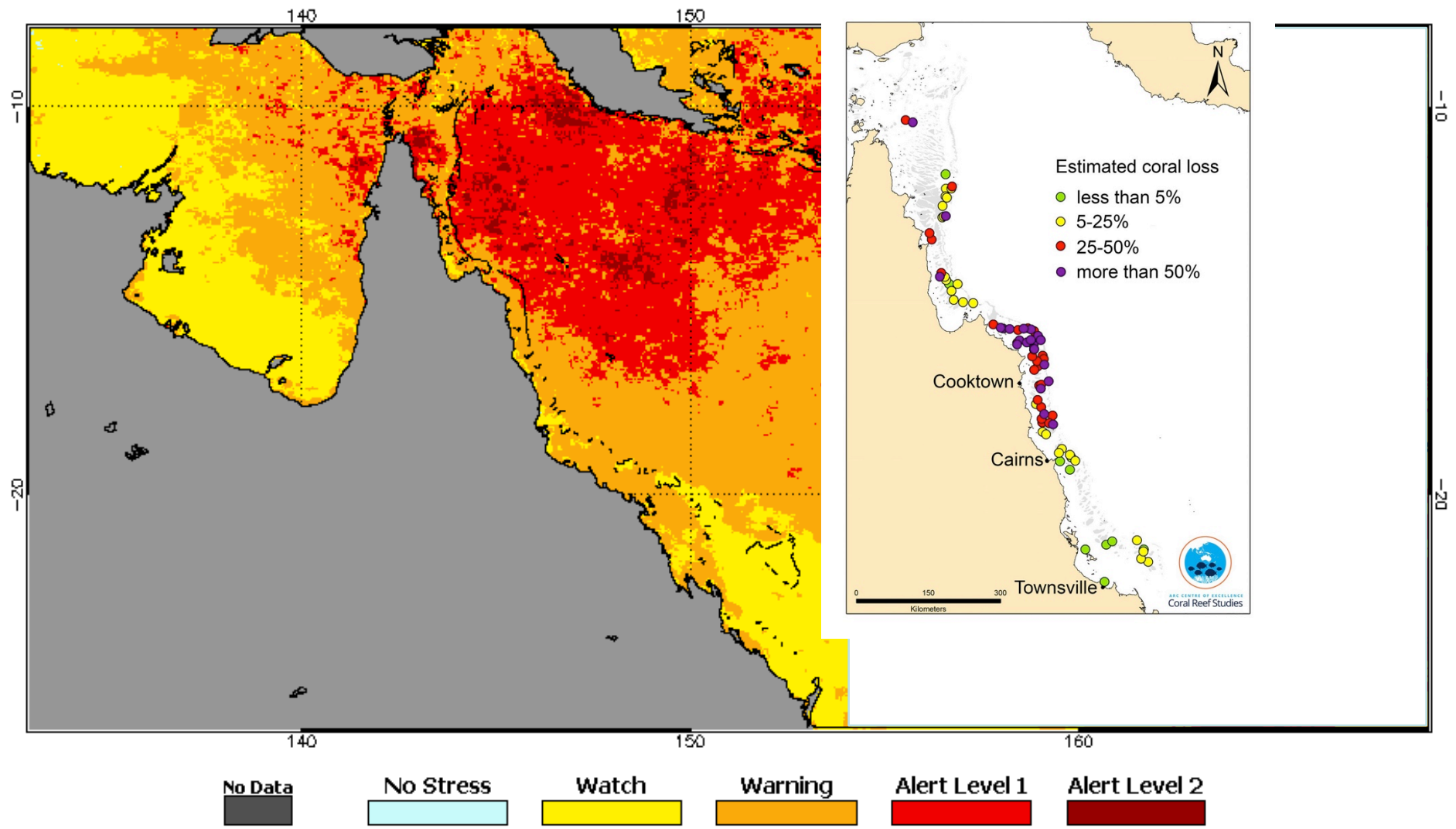
Lizard Island Mortality: 2016



The lack of fish was an indication that there was “complete ecosystem collapse”
Justin Marshall, Univ. of Queensland
The Guardian 21 July 2016

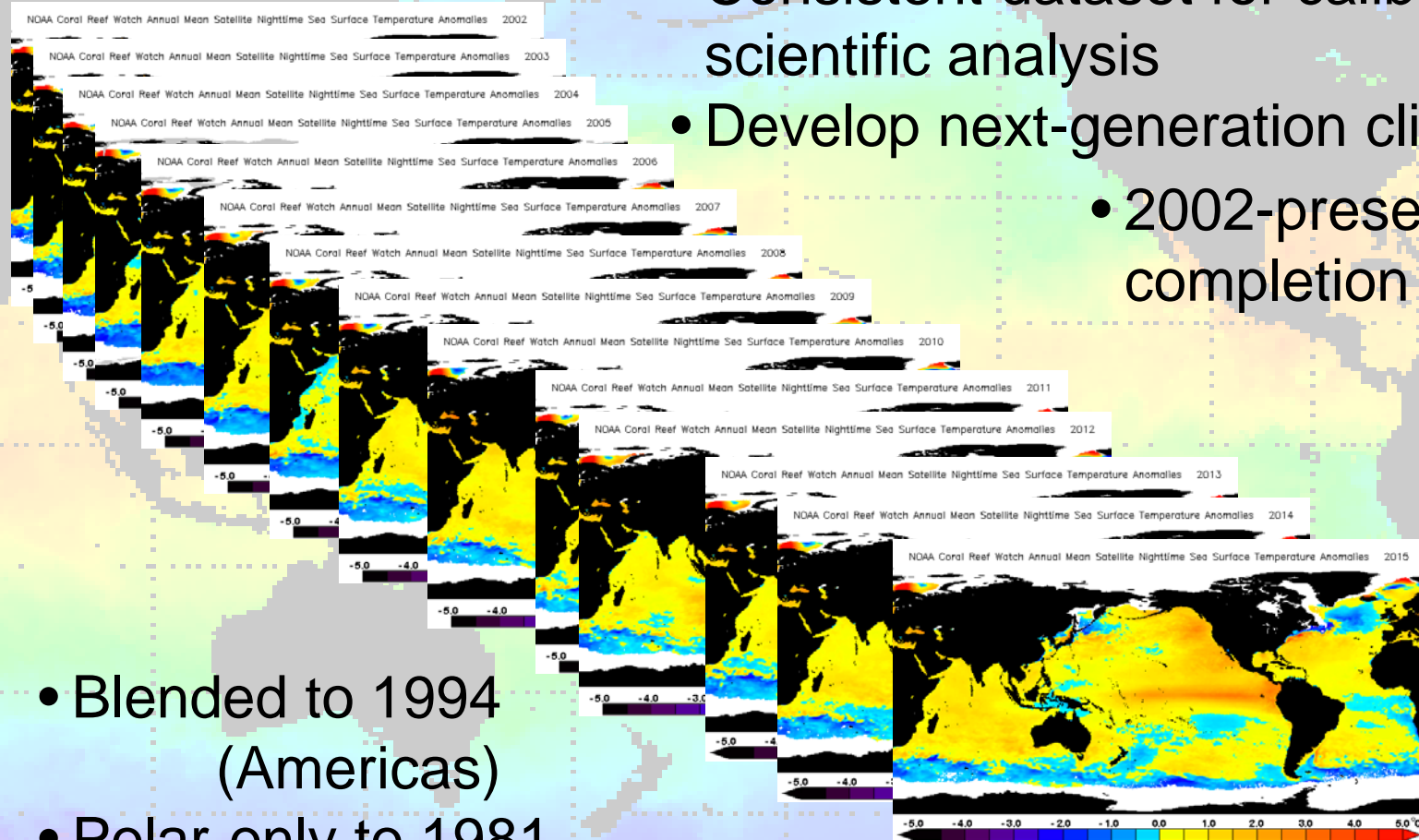
2016 Great Barrier Reef Bleaching

NOAA CRW 5-km Night-Only Bleaching Alert Area Year-to-date Maximum 06 Aug 2016



5 km Geo-Polar Reprocessing

2002



- Consistent dataset for calibration and scientific analysis
- Develop next-generation climatology
- 2002-present near completion

- Blended to 1994 (Americas)
- Polar-only to 1981
- ~974K funding

2015

June 2014-June 2016 Thermal Stress

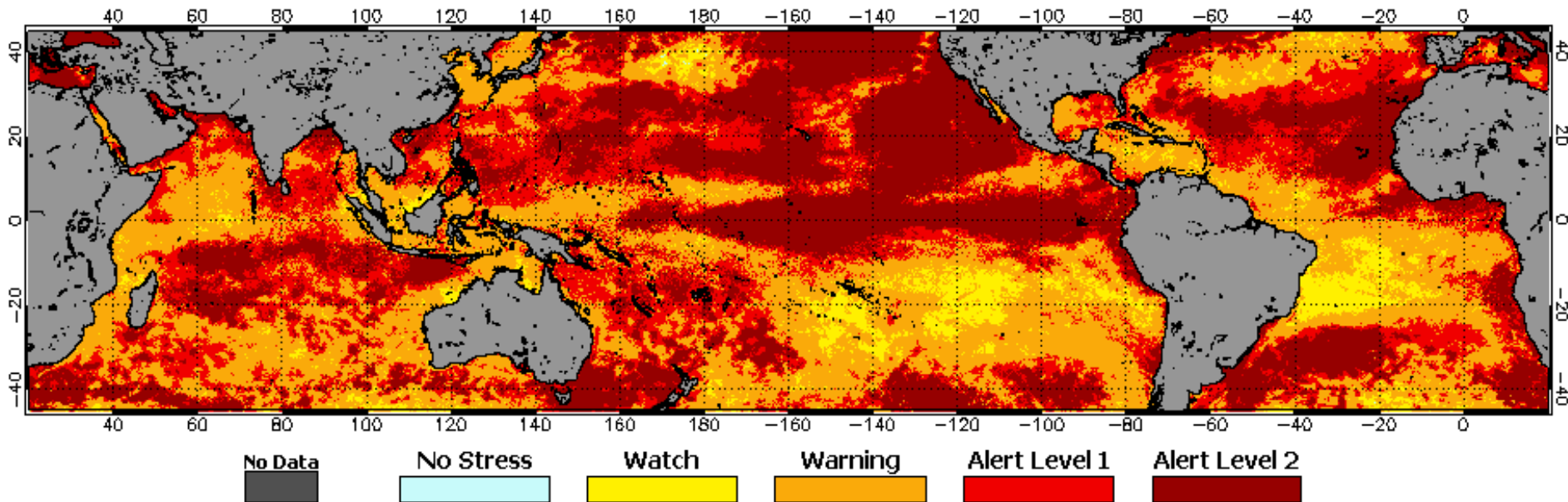
Global Reefs:

- > 40% @ Alert Level 1 or 2
- Level 2 Area > Massachusetts
- Over ½ exposed twice
- ~100% stressed

US Reefs:

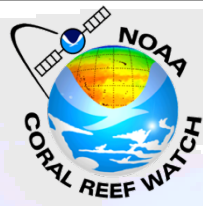
- 72% Alert Level 1 or 2
- Over ½ exposed twice
- 100% stressed

NOAA Coral Reef Watch Maximum Satellite Coral Bleaching Alert Area Jan. 2014-July 2016

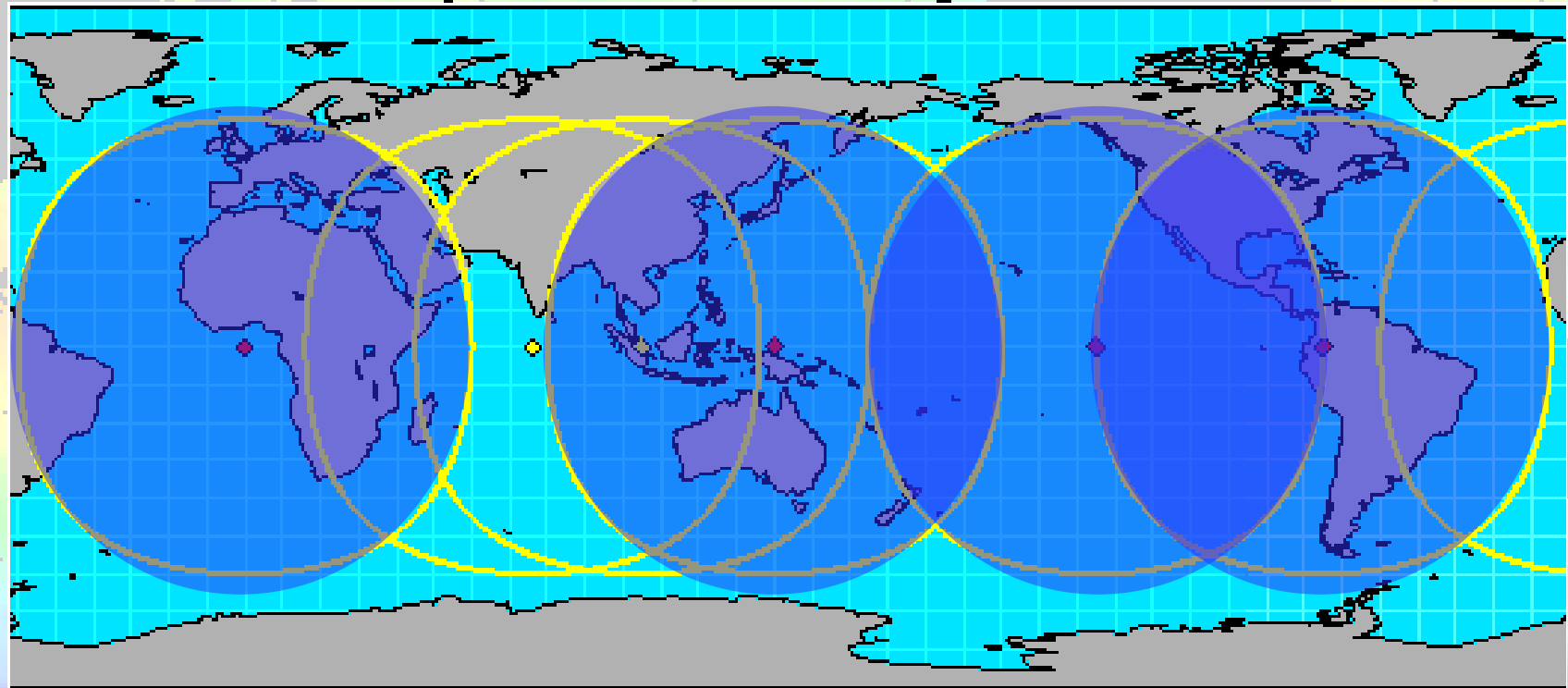


Coral Reef Watch

5-km Satellite-Based Products



Current products hindered by lack of geostationary data over Indian ocean



Meteosat



Soon
Meteosat-8



Himawari



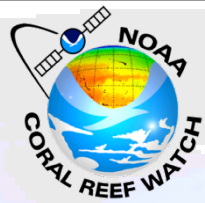
GOES-W



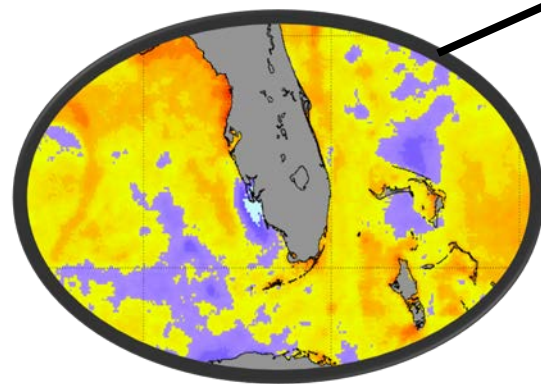
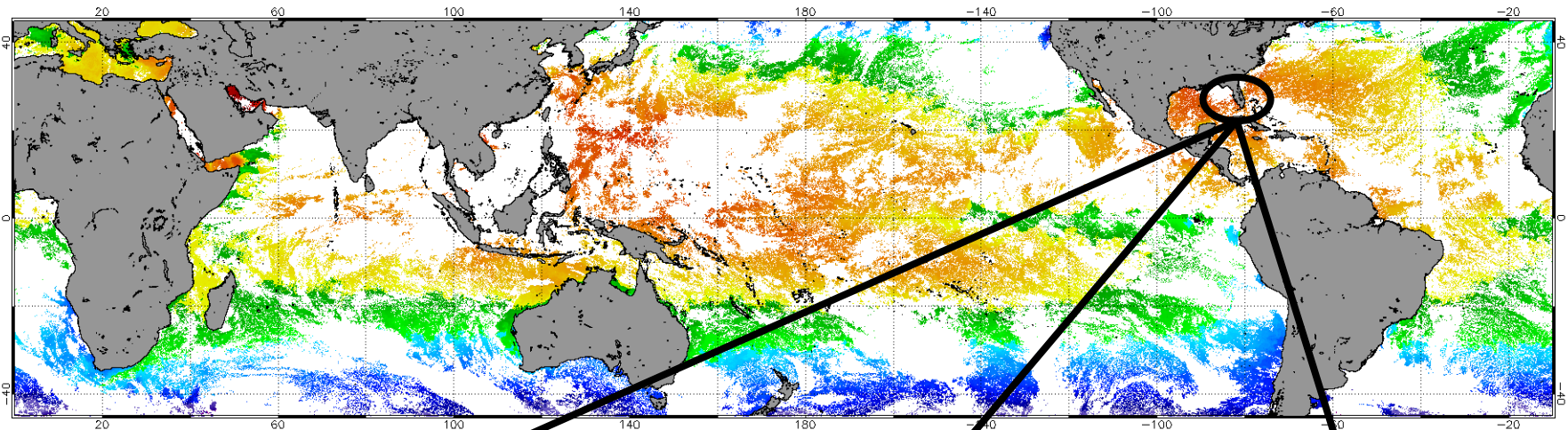
GOES-E



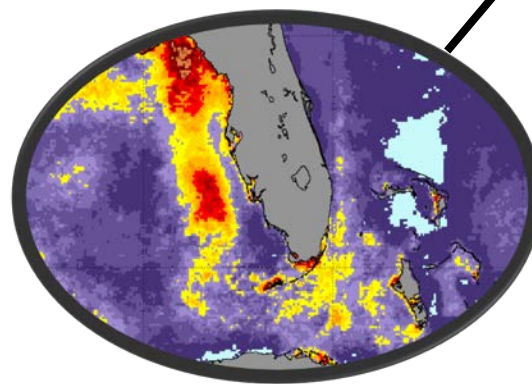
Adapting CRW algorithms for non-gap-filled 2 km VIIRS data



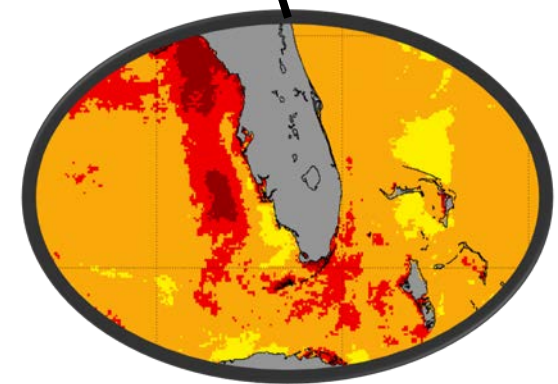
VIIRS L3C 0.02° SST for 1 August 2016



Coral Bleaching HotSpot

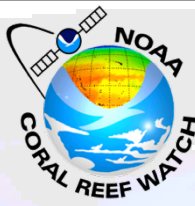


Degree Heating Week

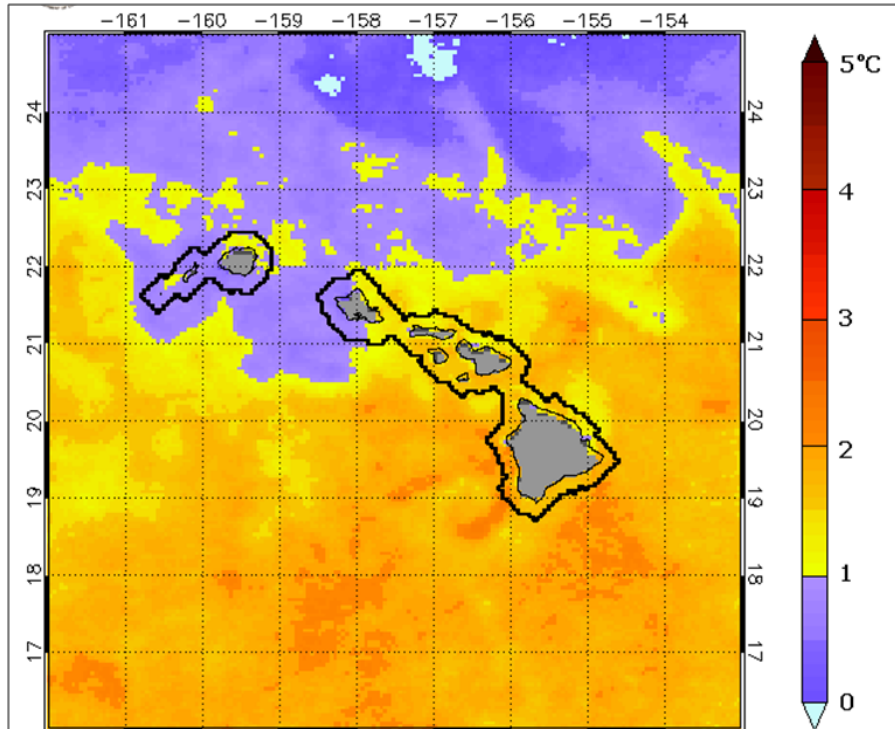


7-day Max Bleaching Alert Area

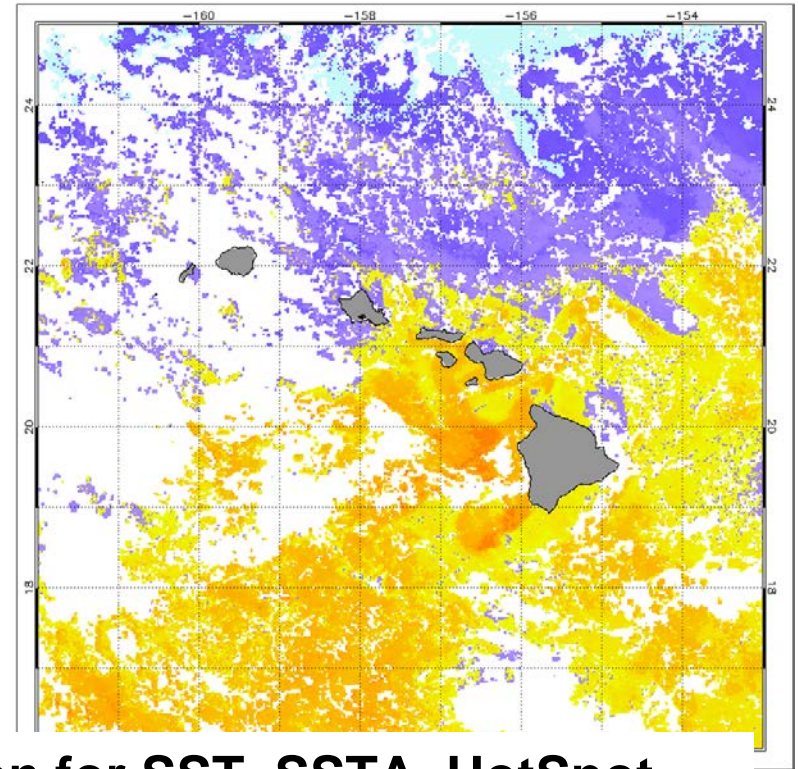
Data Gaps: 5 km Blended vs 2 km VIIRS data



Geo-Polar Blended 0.05° HotSpot
19 September 2015



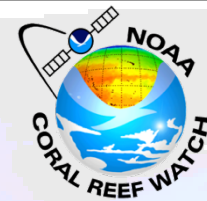
VIIRS L3C 0.02° HotSpot
19 September 2015



- 2km VIIRS provides higher resolution for SST, SSTA, HotSpot
- Data gaps complicate calculation of accumulated products like Degree Heating Weeks (DHW)
- Cooling under clouds often causes warm bias in DHW from gappy data

See poster #37, Erick Geiger

Coral Reef Watch: Future Blended Product

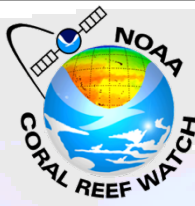


1-2 km Geostationary-Polar Blend (Planned)

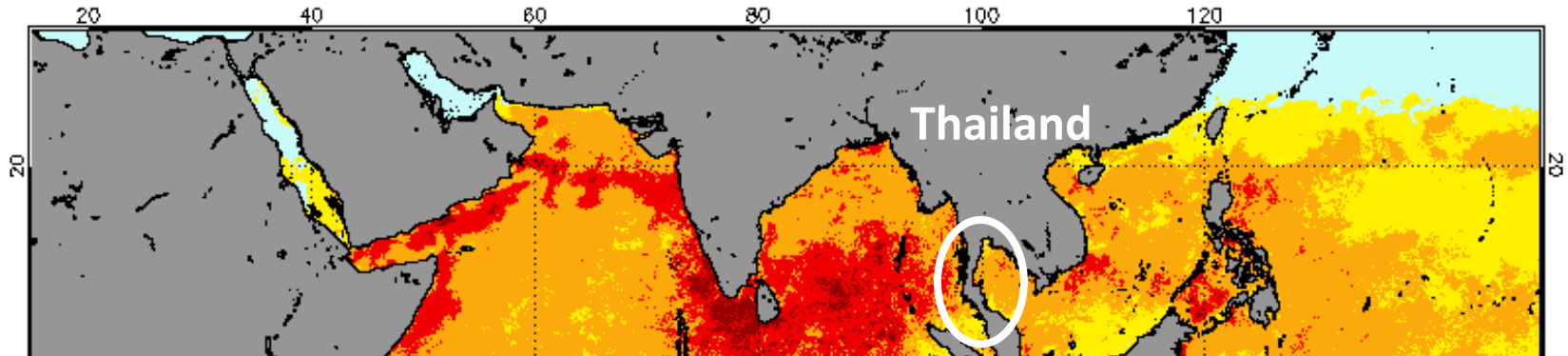
- **Data:**
 - **2 km Geostationary SST (ACSPO Himawari-8/9, GOES-R/S, MTG)**
 - **Polar-orbiters (ACSPO)**
 - **<1 km SNPP/JPSS, J1-2**
 - **1 km METOP**
 - **Up to 50 scenes/day**
 - **Options:**
 - **Native Geo resolution 2 km (NOAA Heritage GOES 4 km, MSG 5 km)**
 - **“Enhanced” Resolution < 1 km**



Management Responses: Thailand Reef Closures



NOAA Coral Reef Watch Maximum Satellite Coral Bleaching Alert Area YTD
18 June 2016



theguardian
website of the year

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[energy](#) [pollution](#) [climate change](#)

[UK](#) [world](#) [all](#)

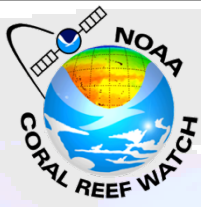
Coral

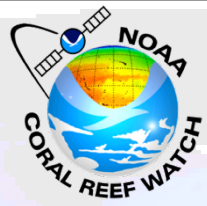
Thailand closes dive sites over coral bleaching crisis

Thursday 26 May 2016
14.11 BST

In a rare move to shun tourism profits for environmental protection, 10 popular dive sites have been shut down in a bid to slow a coral bleaching crisis

Management Responses: 2015 Hawai'i Bleaching – DAR “Ark”





Key Messages

Geo-Polar Blended data

- **Just in time for 2014-16 bleaching**
- **Higher resolution, better regional products**
- **Excellent use by scientists and resource managers**

New satellite data needs:

- **Hi-res polar needed for blended SST and coral products**
- **JPSS provides needed sub-km SST with global coverage**
- **High quality reprocessing needed for climatology**



@CoralReefWatch



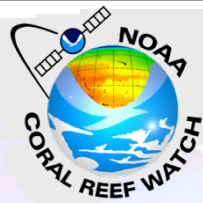
CoralReefWatch

CoralReefWatch.NOAA.Gov



NOAA Coral Reef Watch Team

<http://coralreefwatch.noaa.gov>



Mark Eakin



Jacqueline De La Cour (GST)



Gang Liu (GST)



Kyle Tirak (GST)



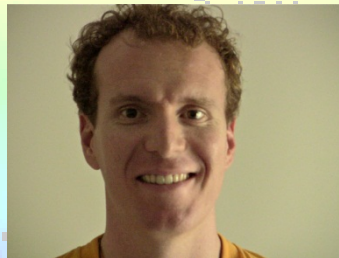
Erick Geiger (GST)



Alan Strong (GST & SRI)



William Skirving (GST & ReefSense)

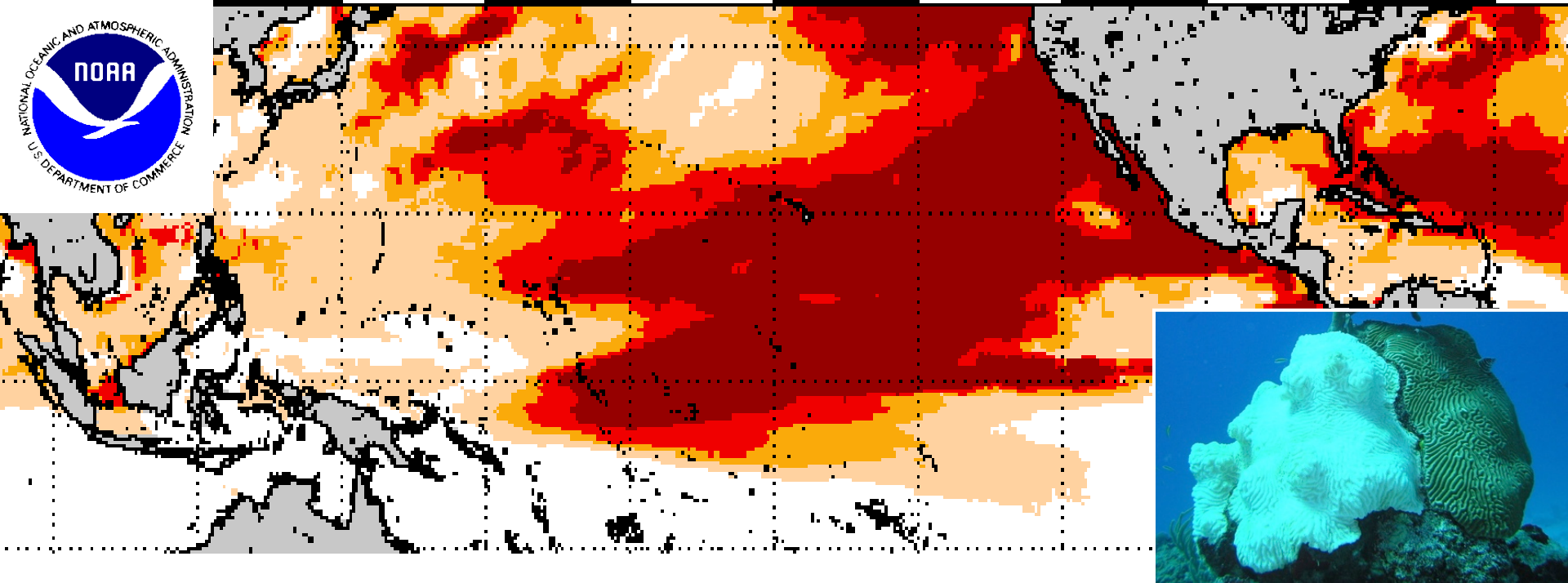
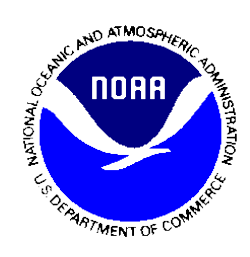


Scott Heron (GST & ReefSense)



Andrea Gomez (CCNY & NOAA-CREST)





Questions?

Dr. C. Mark Eakin
NOAA Coral Reef Watch

<http://coralreefwatch.noaa.gov>



Coral Reef Watch



@CoralReefWatch

