NOAA/NESDIS/STAR GHRSST Sea Surface Temperature Products

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OPERATIONAL SST PRODUCTS (GHRSST- GDS-2)

Geostationary SST Products L2

GOES-13
GOES-15
MTSAT-2
MSG-3

Blended SST Analysis Products L4

GEO-Polar Blended SST Analysis 5-km Day/Night
GEO-Polar Blended SST Analysis 5-km Nighttime

Physical Retrieval Methodology

- Sea Surface Temperatures generated by physical retrieval methodology

  - MTLS (Modified Total Least Squares) works better than other physically based retrievals (e.g. OEM*) in our case
  - Improves retrievals when compared to regression, particularly for GOES
  - Reduces regional biases and scatter compared to the current operational regression-based retrieval

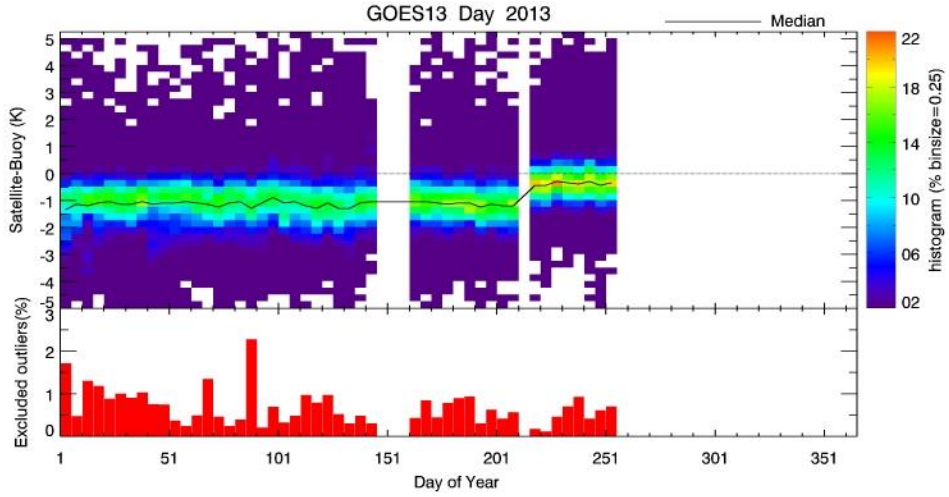
*Optimal Estimation Method (OEM)

Recent update to Geo-SST

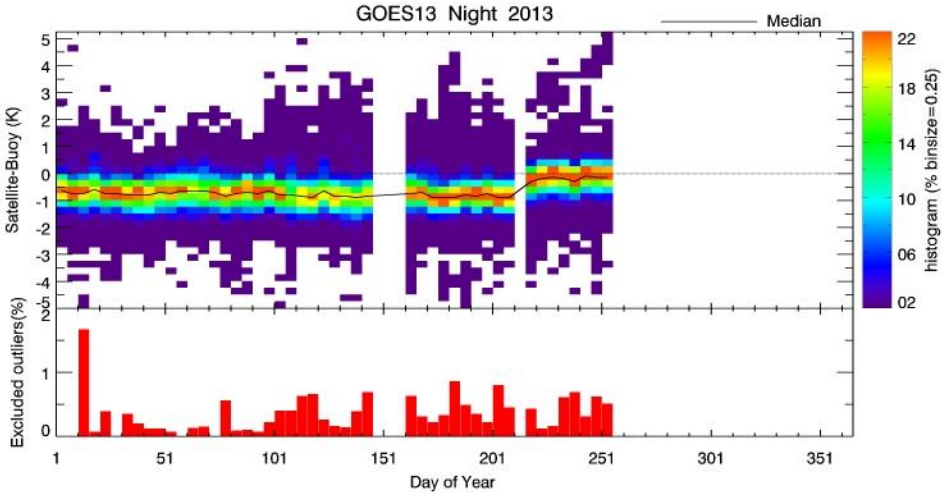
- Physical retrieval based on Modified Total Least Squares
- Improved bias and scatter *cf.* previous regression-based SST retrieval

GOES-13

Daytime



Nighttime



Recent update to Geo-SST

- Physical retrieval based on Modified Total Least Squares
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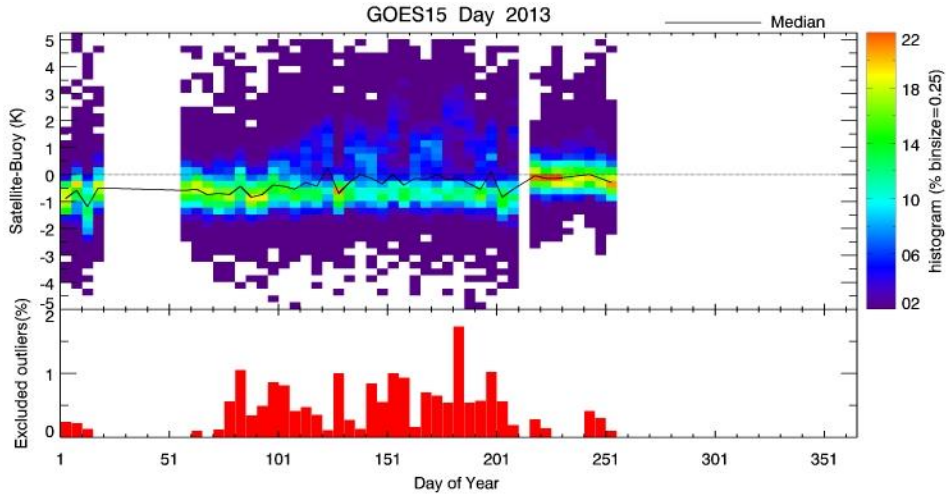
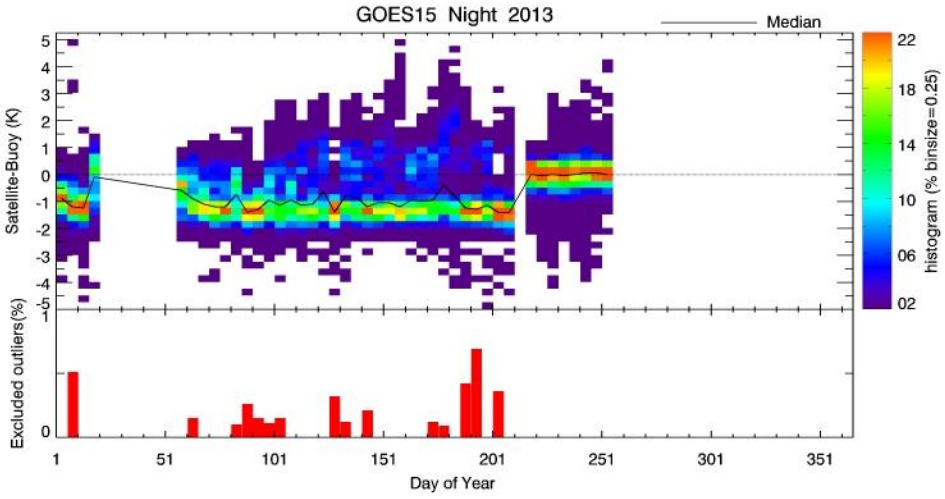
GOES-15



Daytime



Nighttime

Geostationary Improvements

- Radiative Transfer Improvements
  - Input increased resolution NCEP fields
    - Currently use 26 levels
    - 16 more levels
  - Input aerosol product
    - Currently using climatology for testing
    - Climatology will be replaced by an operational 3D aerosol product (once available)
- Improvements to Bayesian Cloud Mask
  - Satellite specific Probability Density Functions (PDF) will be generated
- Matchup data available in NetCDF format
  - Over 1000 variables!

5-km Blended SST Analysis

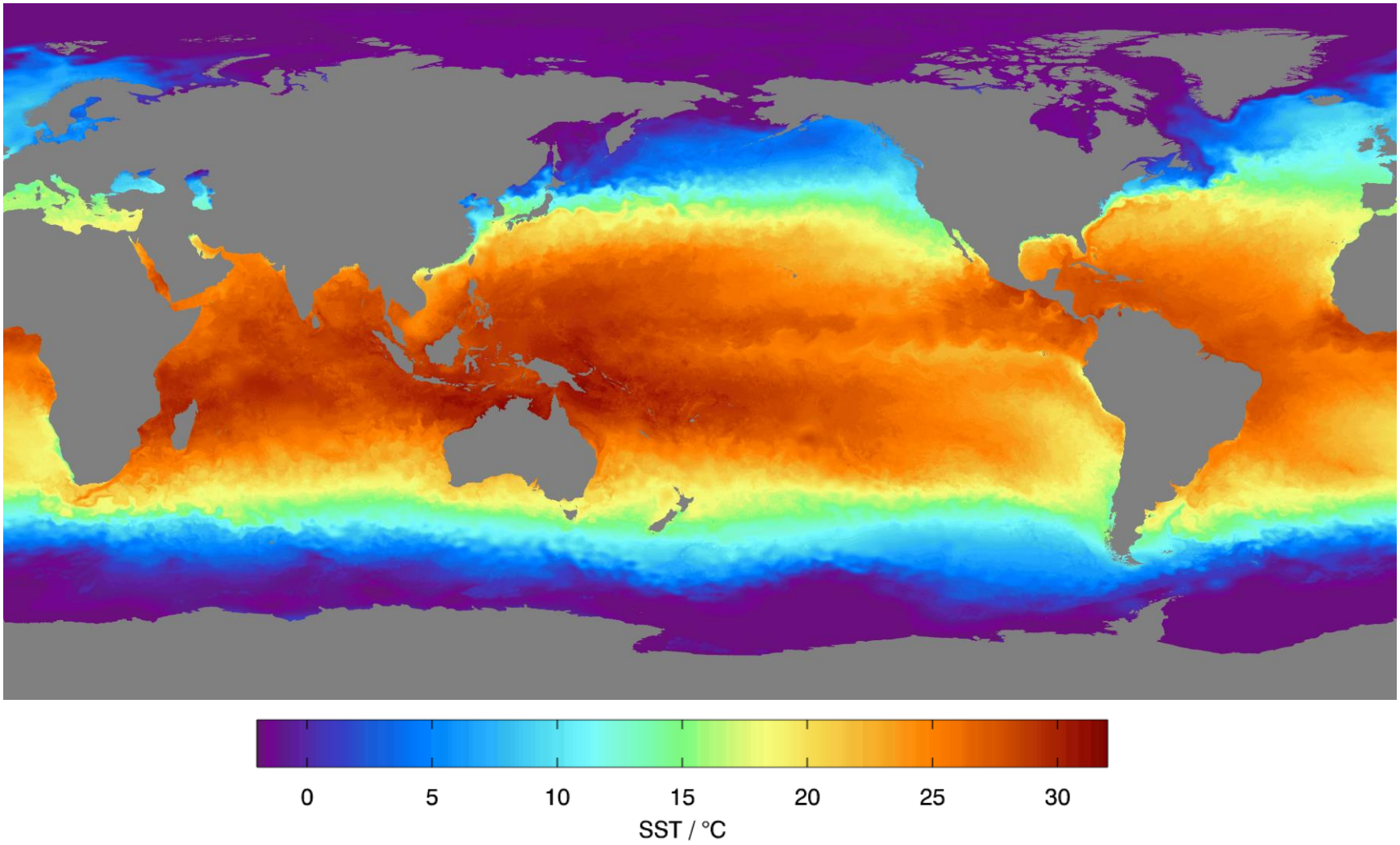
- Resolution 1/20 degree
- Data-adaptive correlation length scale
  - Analysis is performed at 3 different scales
  - Final result is interpolated from these analyses based on data density
  - **Preserves fine-scale features without introducing excessive noise**

5-km Blended SST Analysis

- **Produced daily from 24 hours (Polar & Geo-SSTs)**
  - SNPP-VIIRS, METOP-B
  - GOES-E/W Imager
  - MTSAT-2 Imager
  - Meteosat-10 SEVIRI

- **Does not use buoy data**

5-km Global Blended SST Analysis

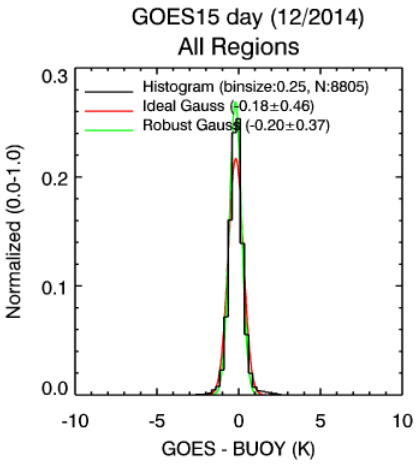


GEO-Polar Blended Improvements

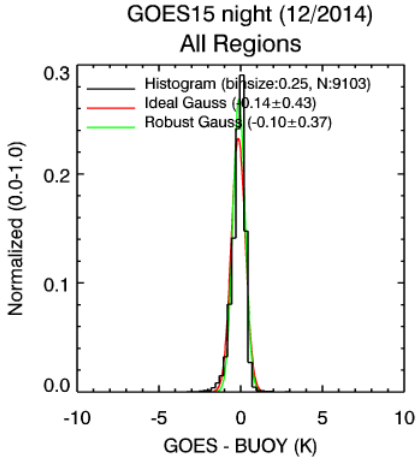
- Improved bias correction scheme (2015?)
  - Currently referenced to NCEP RTG
  - Looking forward to SLSTR to overhaul bias correction
- Inclusion of MW data (December 2015)
  - AMSR-2 SST
- Diurnally corrected product (November 2015)
  - Provide improved “foundation” SST
  - See Gary Wick’s presentation

Summary of Product Accuracy: Blended SST

GOES-15

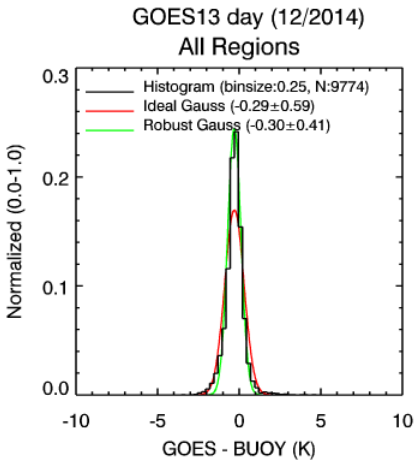


-0.18±0.46 (0.37)

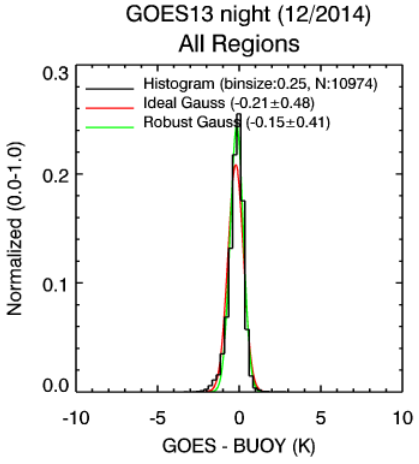


-0.14±0.43 (0.37)

GOES-13

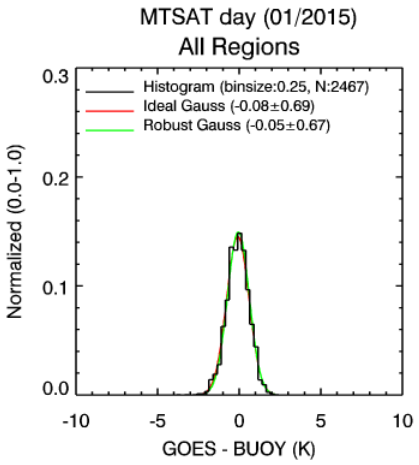


-0.29±0.59 (0.41)

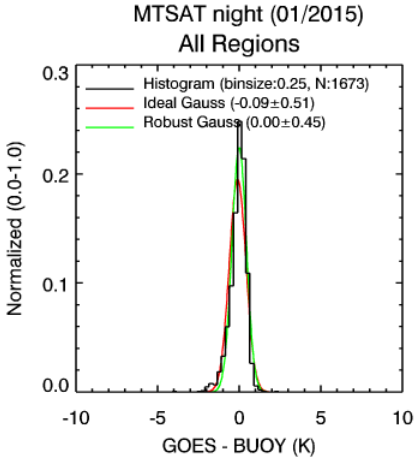


-0.21±0.48 (0.41)

MTSAT-2

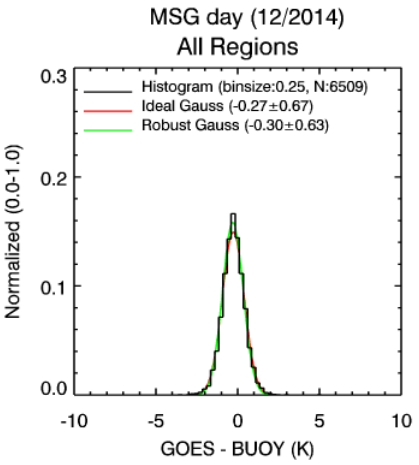


-0.08±0.69 (0.67)

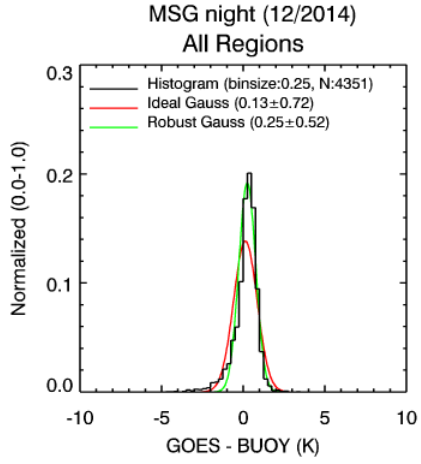


-0.09±0.51 (0.45)

Meteosat-10

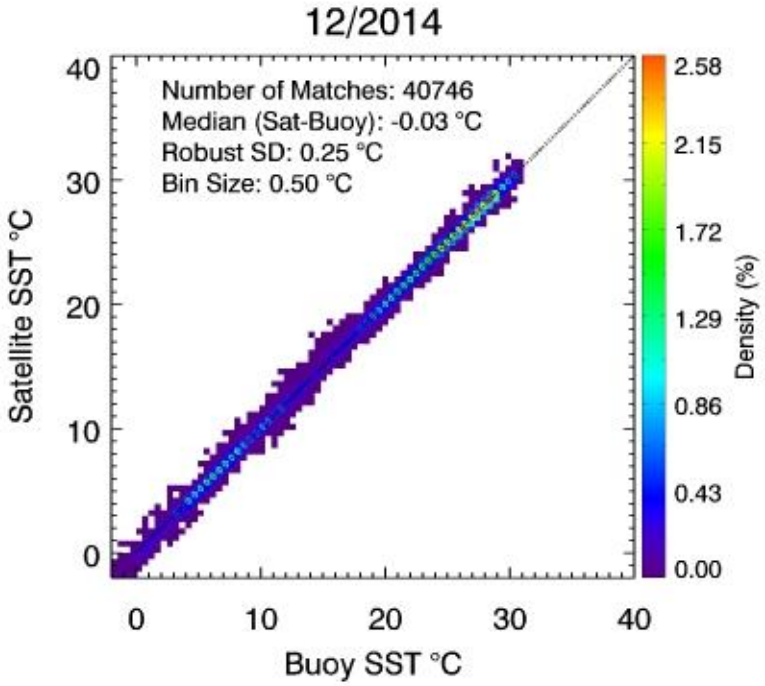


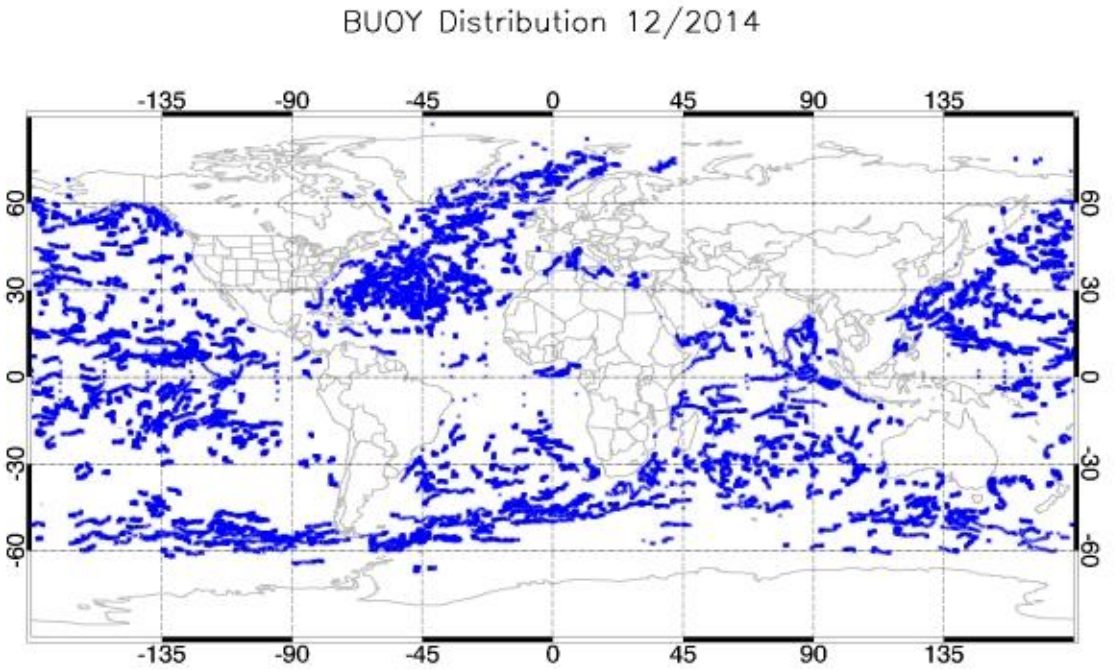
-0.27±0.67 (0.63)



0.13±0.72 (0.52)

Summary of Product Accuracy: Blended SST





Median bias (analysis – buoy) -0.03 K

Robust Standard Deviation 0.25 K

Robust Standard Deviation = (75% - 25%)/1.349

REPROCESSING GEO-POLAR BLENDED SSTs-Phase I

- Geo-Polar Blended SST Analysis

  (0.05°×0.05°) Reprocessed GHRSST-L4

  Daytime/Nighttime

  Nighttime Only

- September 2004 to Present
  - **Requires all geostationary satellite data reprocessed (~200 TB)**
  - **Requires all polar satellite data reprocessed**
- Requested by NOAA Coral Reef Watch (CRW) Users
  - **Provides ability to generate climatology for CRW products**
- BEGAN: SEPTEMBER 2014
- END: SEPTEMBER 2015

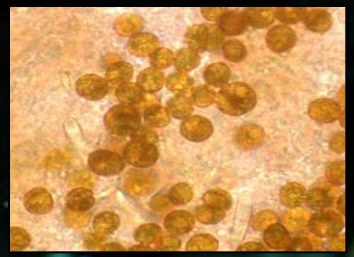
REPROCESSING GEO-POLAR BLENDED SSTs-Phase II

- Geo-Polar Blended SST Analysis
  - (0.05°×0.05°) Reprocessed GHRSST L4
  - *Daytime/Nighttime*
  - *Nighttime Only*
- 1994-September 2004
  - **Requires all geostationary satellite data reprocessed**
  - **Requires all polar satellite data reprocessed**
- Requested by NOAA Coral Reef Watch (CRW) Users
  - **Provides ability to generate climatology for CRW products**
- BEGIN: SEPTEMBER 2015
- END: SEPTEMBER 2016

APPLICATIONS OF GHRSST SST L2/L4

- Coral Reef Watch
- Marine Mammals and Fisheries
- Oceanic Heat Content
- Diurnal Warming

Corals live in symbiosis with algae



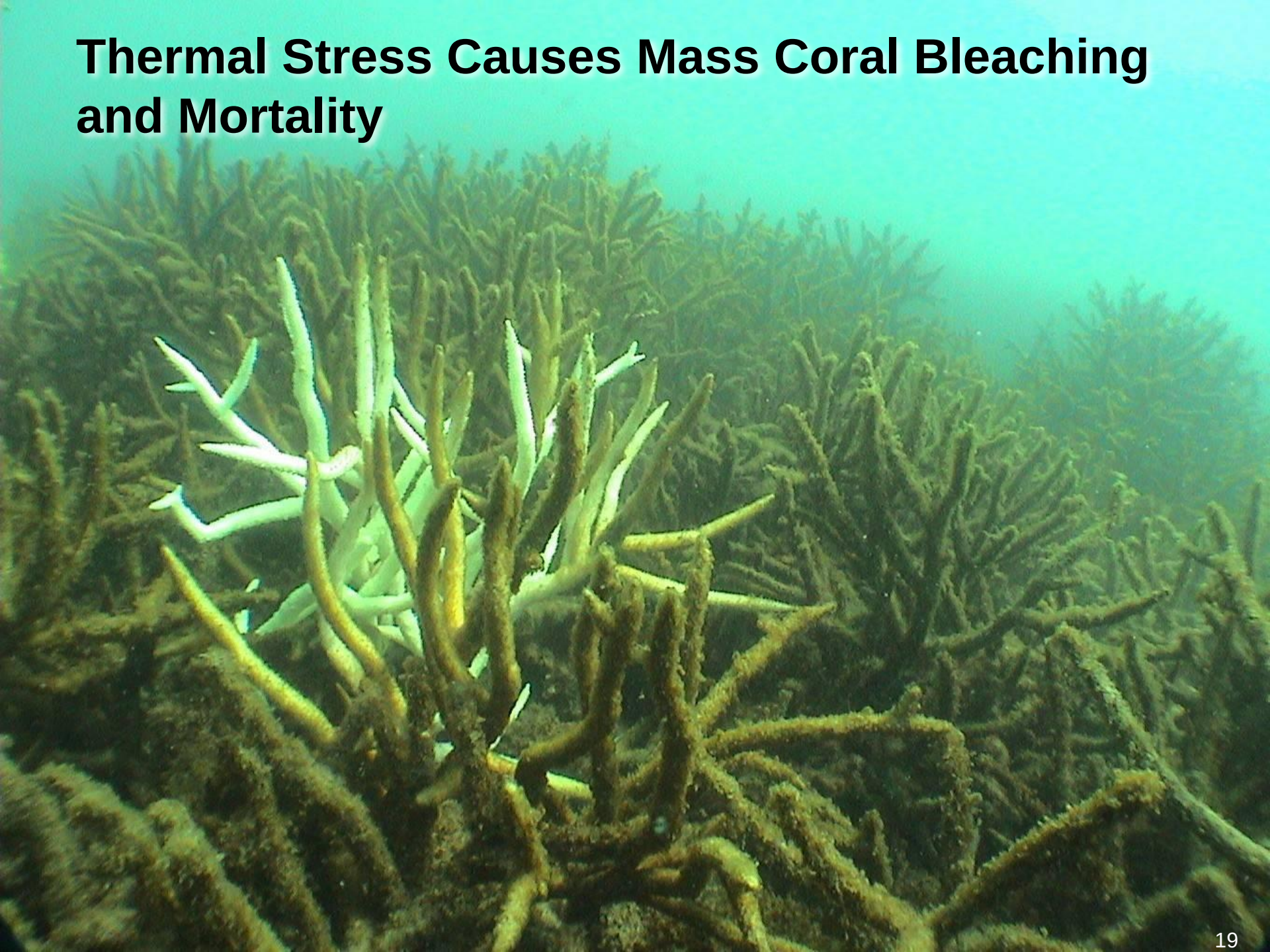
Stress

Corals release their algae

Thermal Stress Causes Mass Coral Bleaching

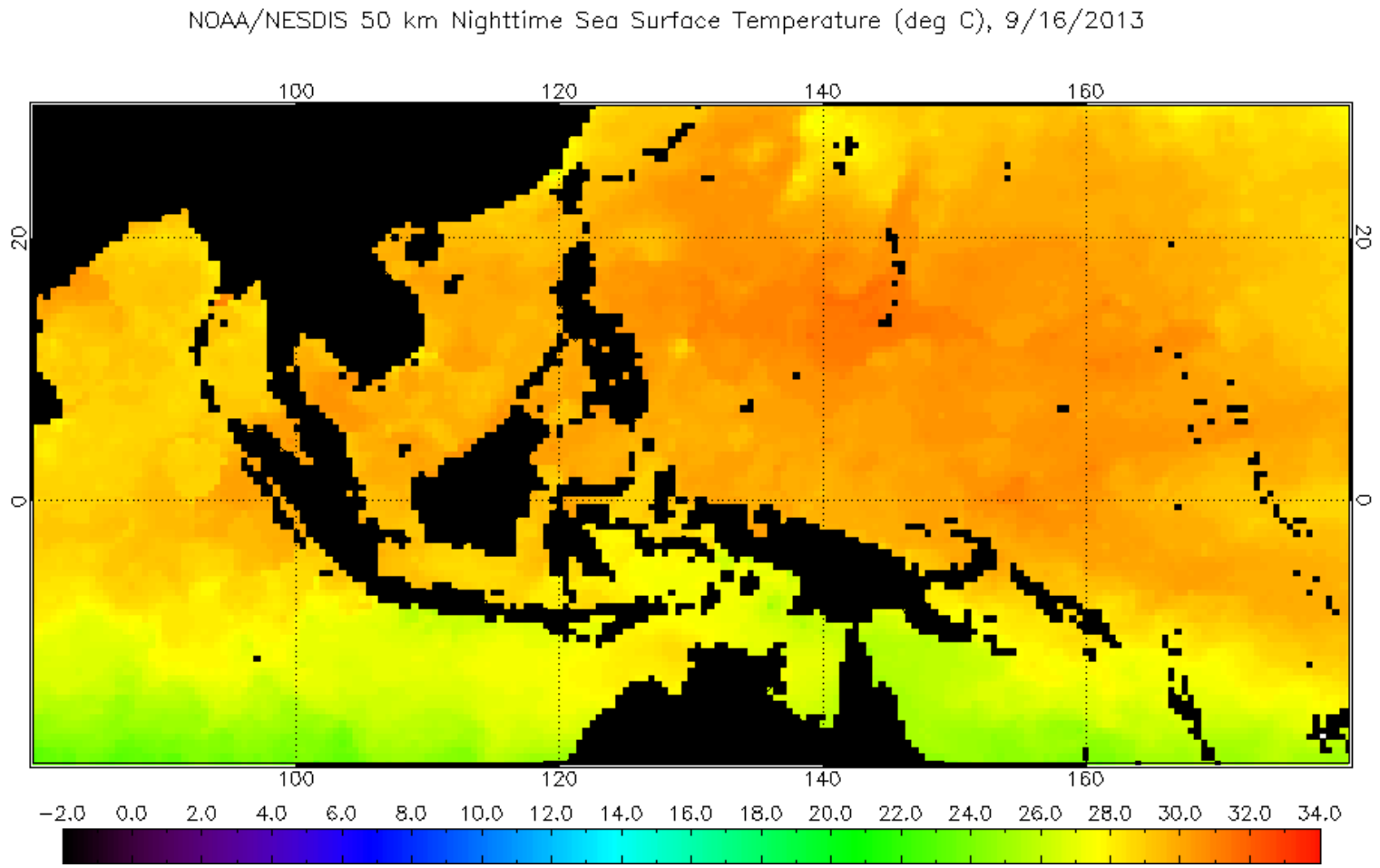
Thermal Stress Causes Mass Coral Bleaching

Thermal Stress Causes Mass Coral Bleaching and Mortality



Coral Reef Watch Products

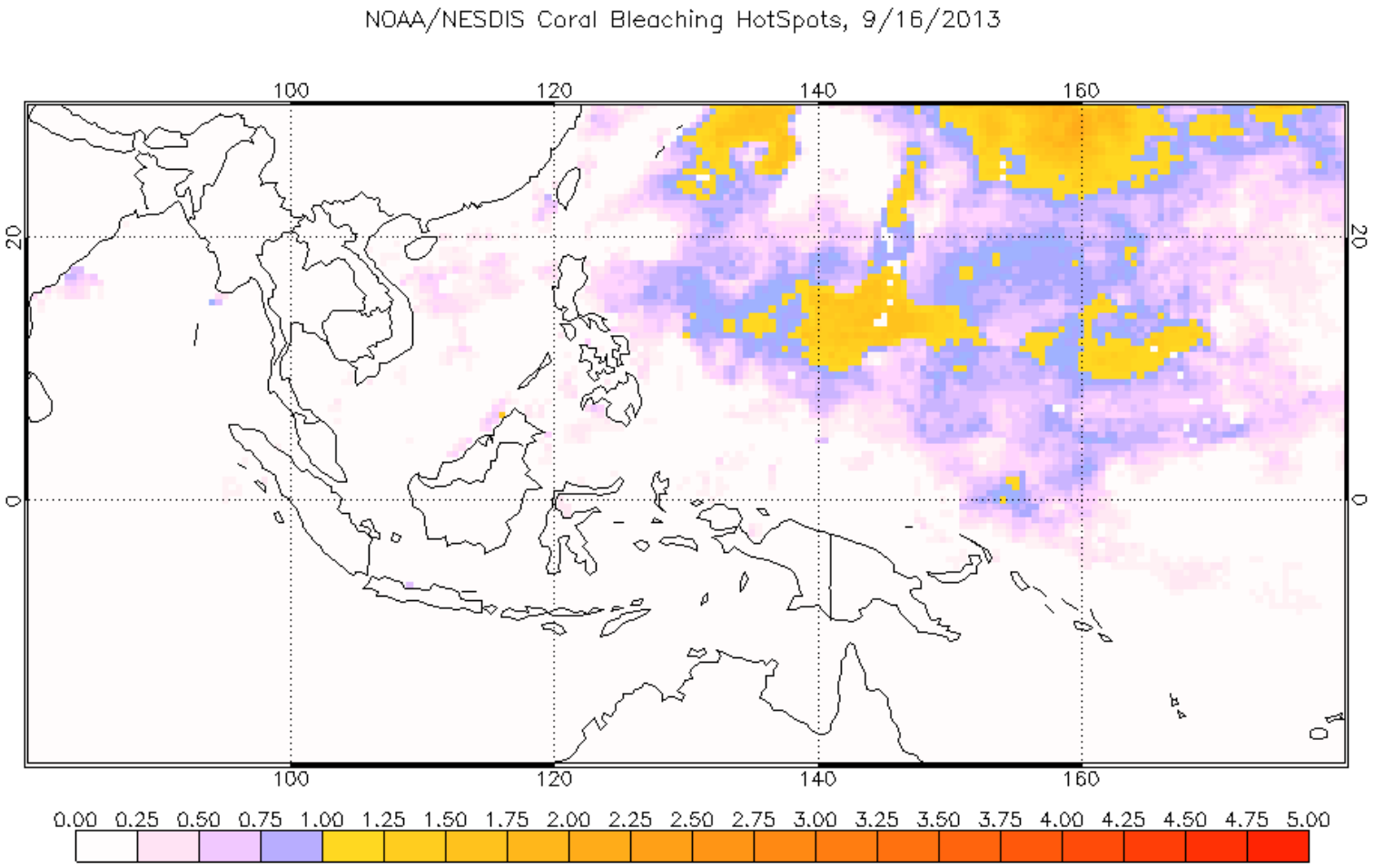
"Coral Triangle"



- **Legacy product uses 50-km AVHRR-only SST**

Coral Reef Watch Products

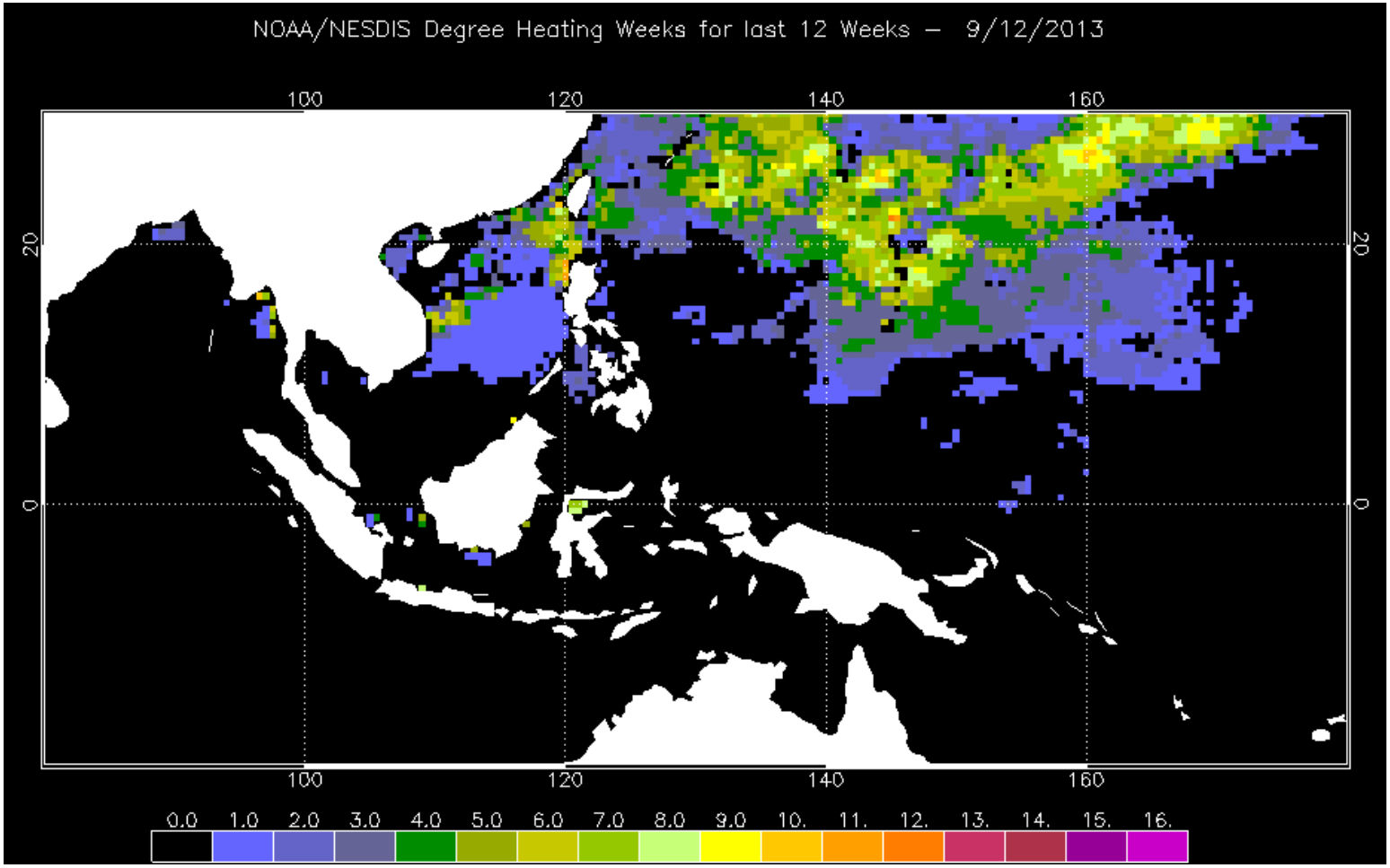
"Coral Triangle"



- **Hotspots are derived with respect to climatological threshold**

Coral Reef Watch Products

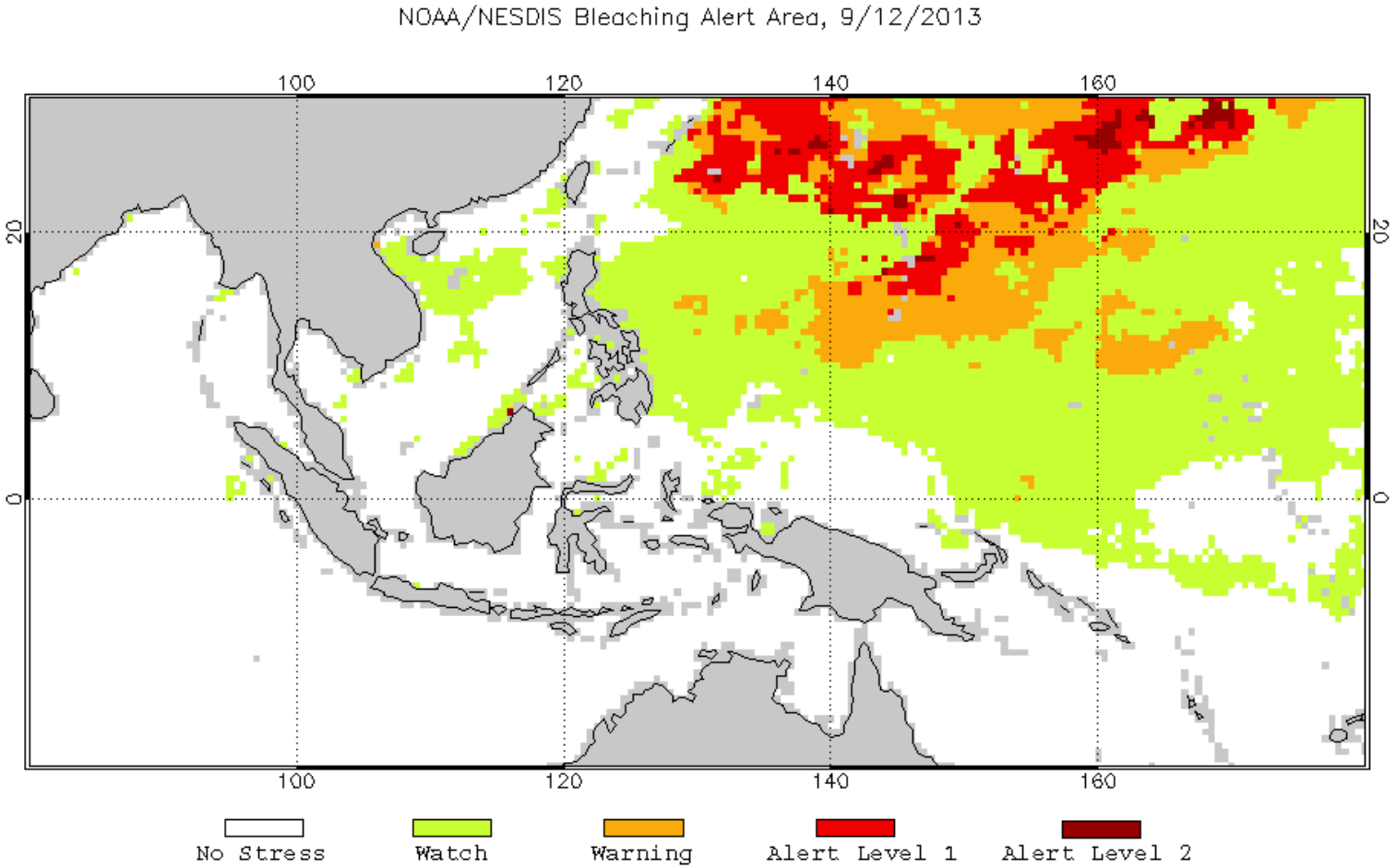
"Coral Triangle"



- **Accumulated thermal stress is predictor of bleaching risk**

Coral Reef Watch Products

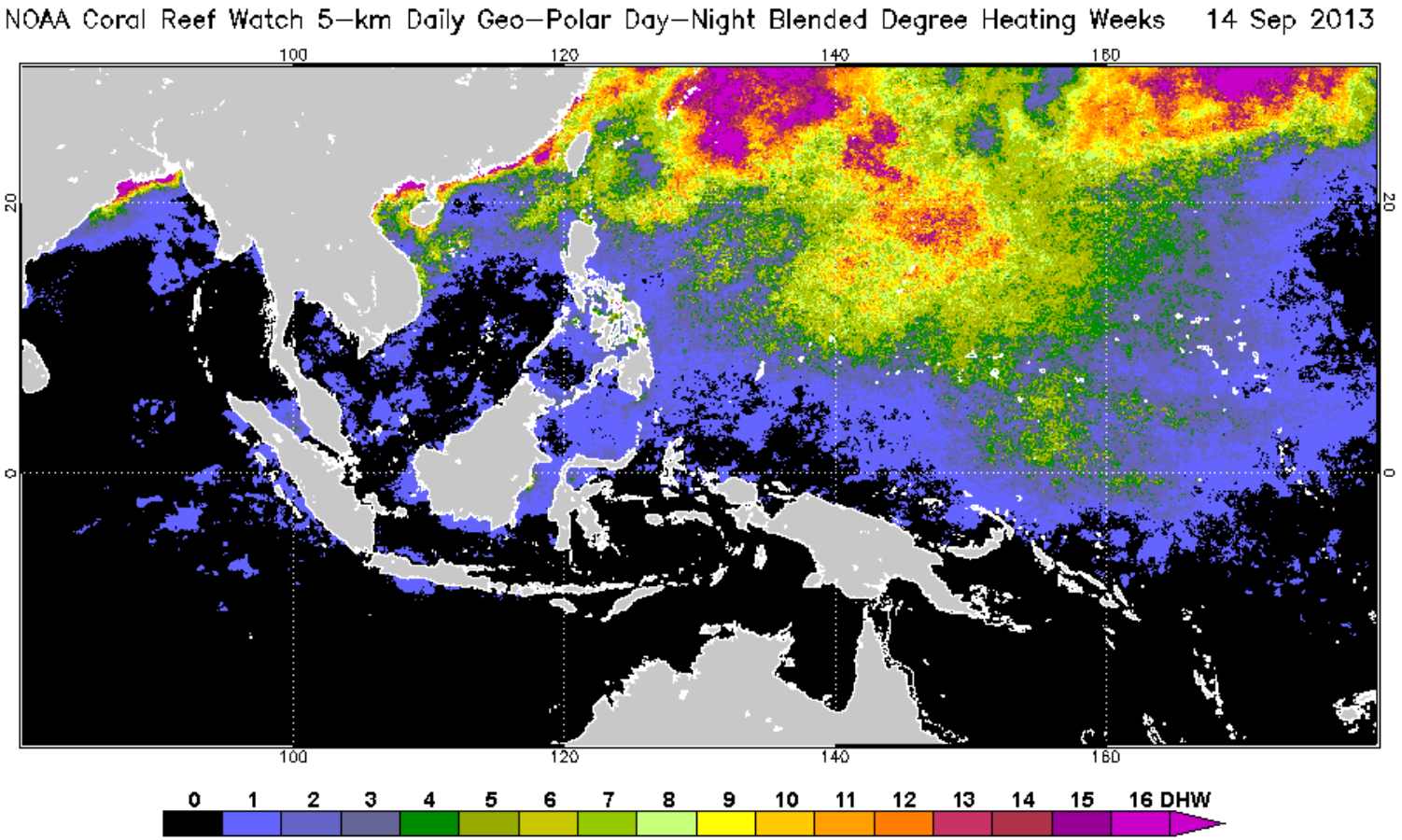
"Coral Triangle"



- **Bleaching risk alerts are issued**

CRW Products based on 5-km SST

"Coral Triangle"



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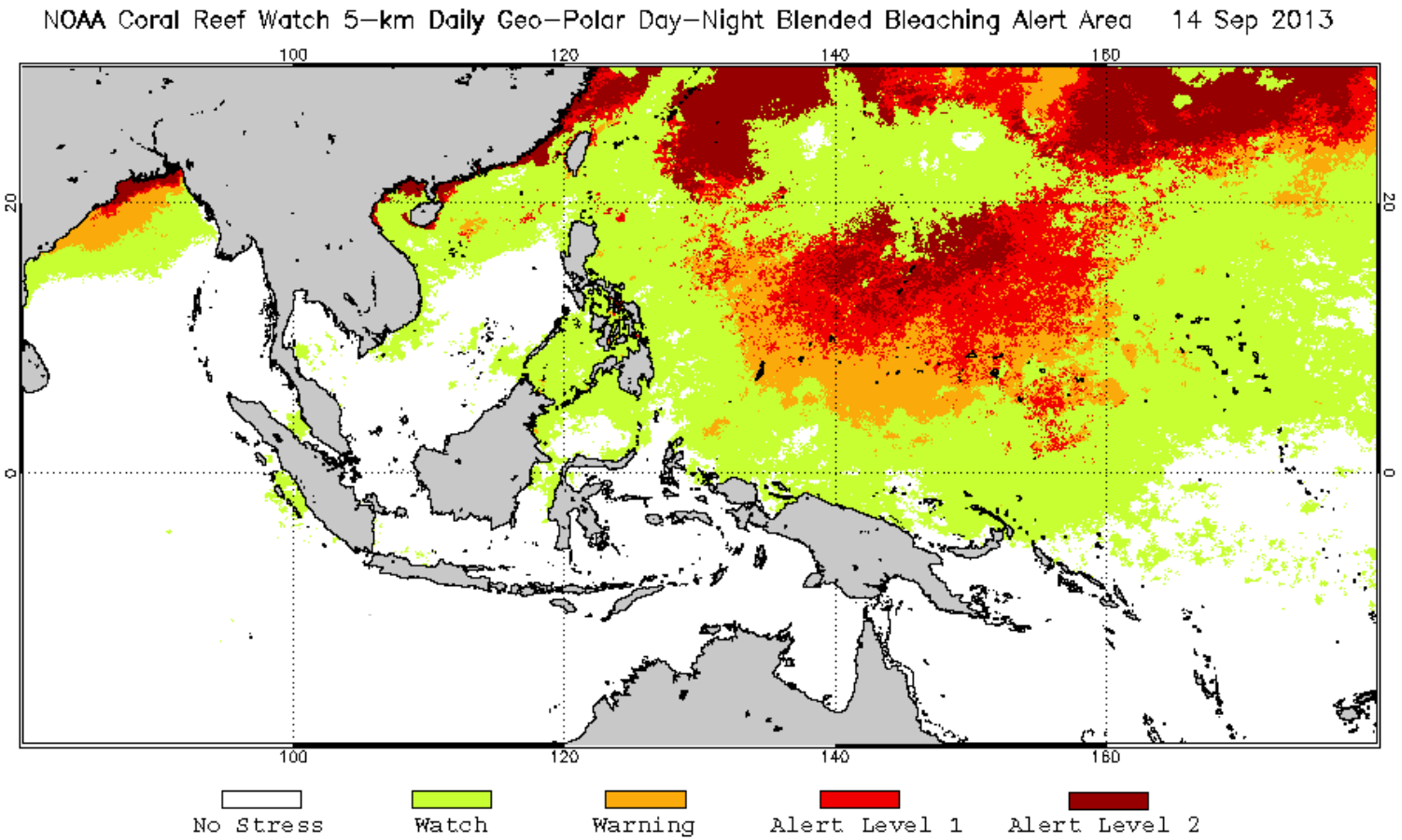
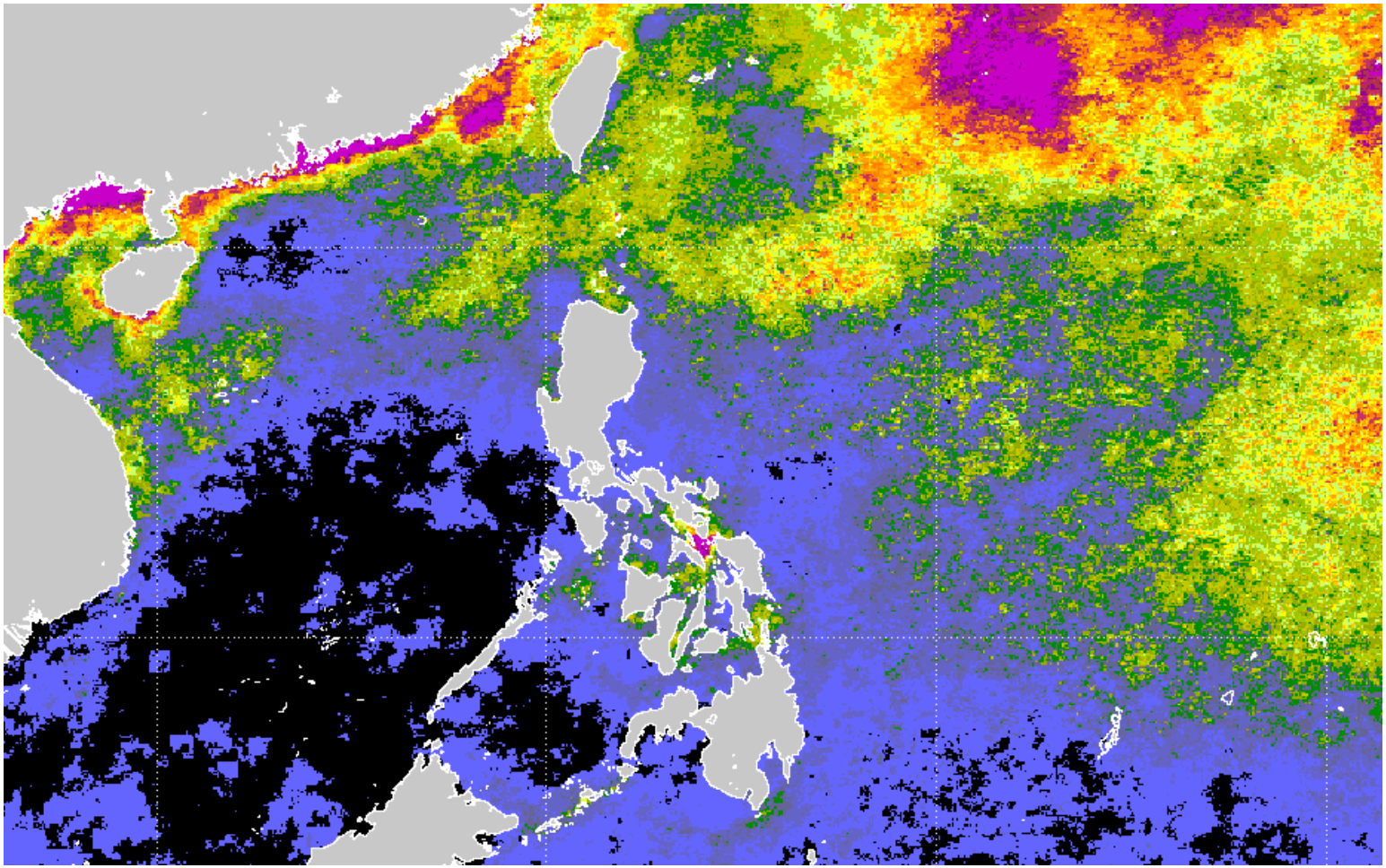


- **Strong bleaching alert for reefs in Guam & Mariana Islands – (coincided with bleaching in September 2013)**

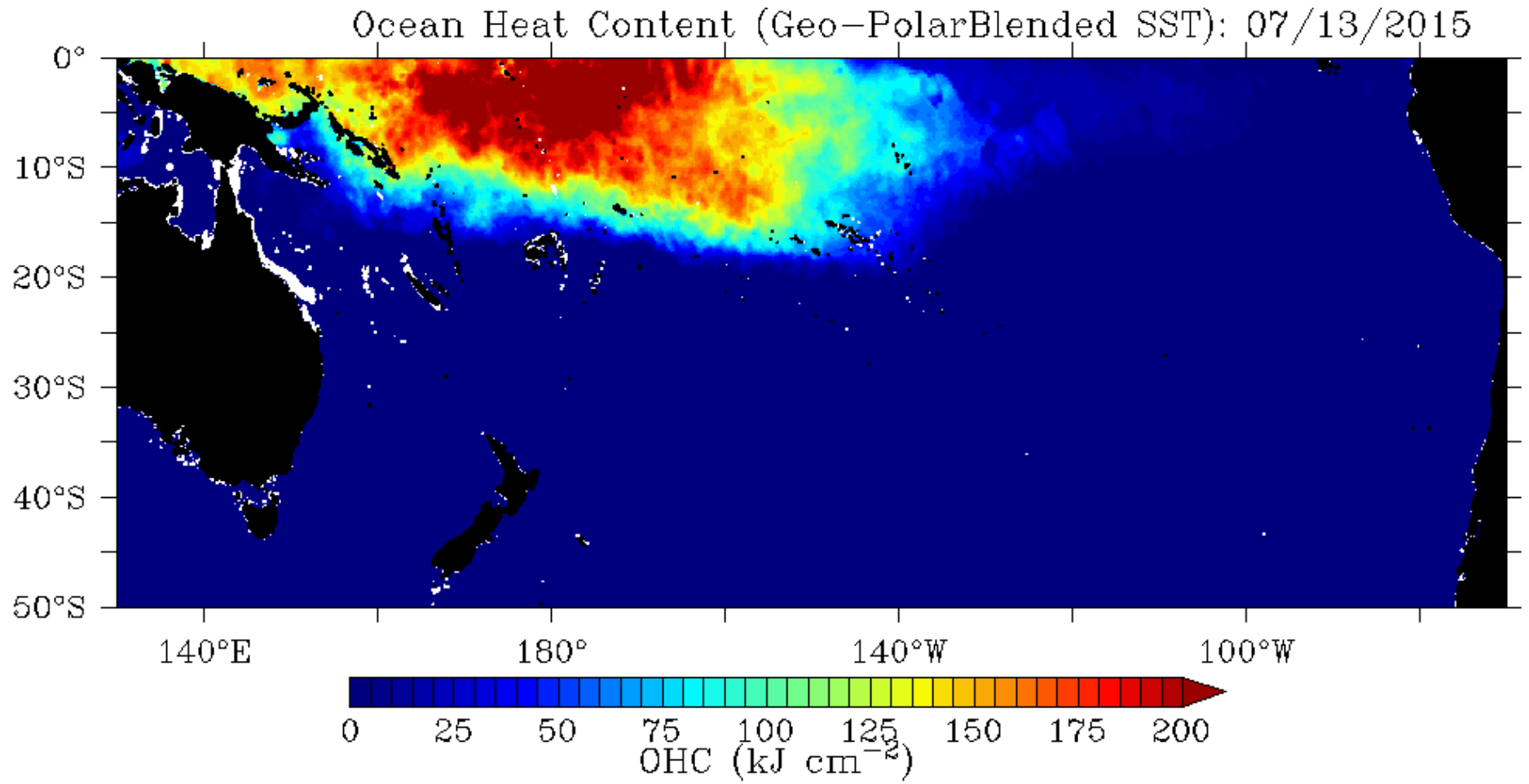
CRW Products – 5-km detail

"Coral Triangle"

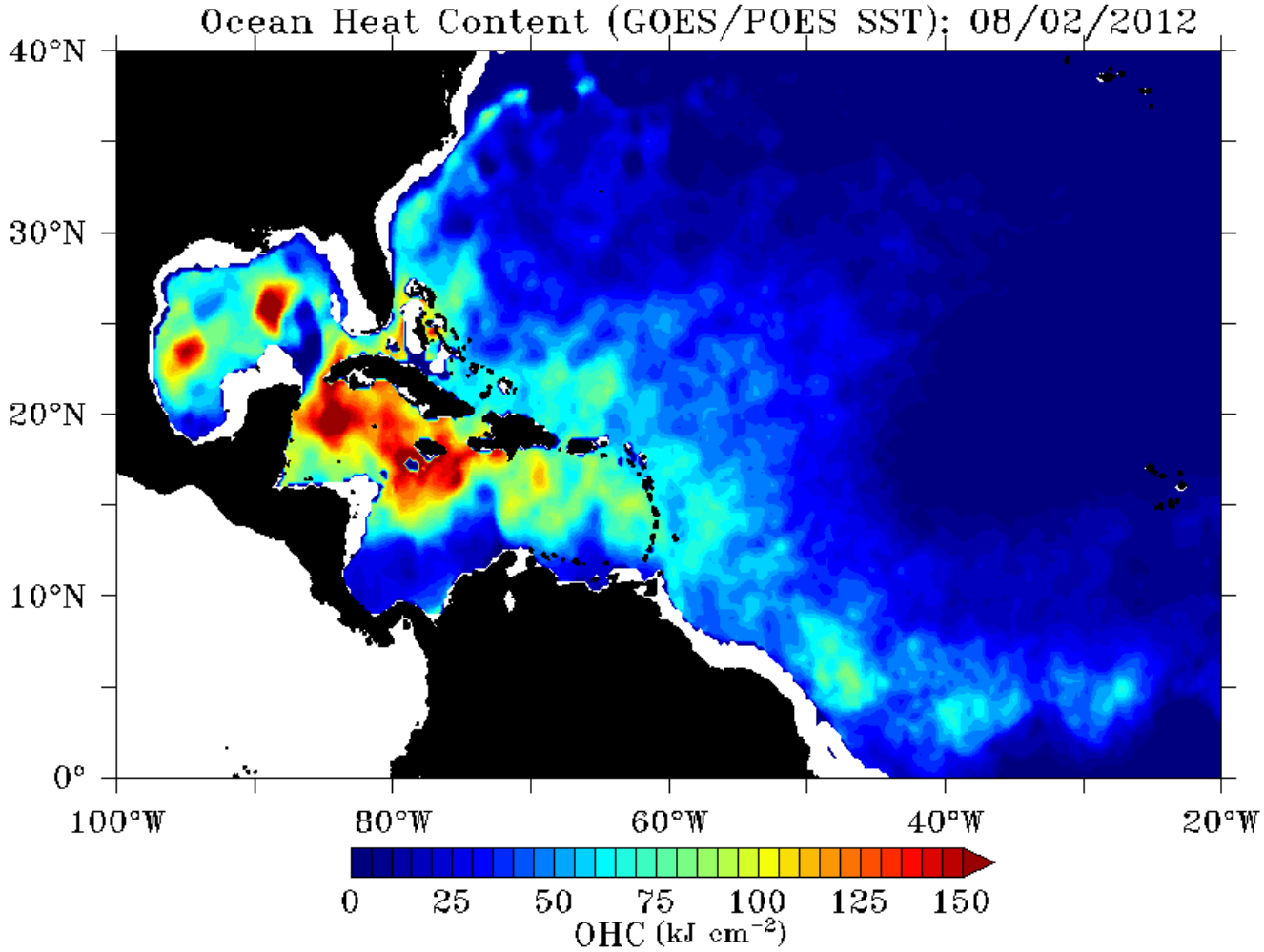


- **New analysis enables much greater precision, *e.g.* small fringing reefs**
- **However, <u>climatology is not derived from same dataset</u>**

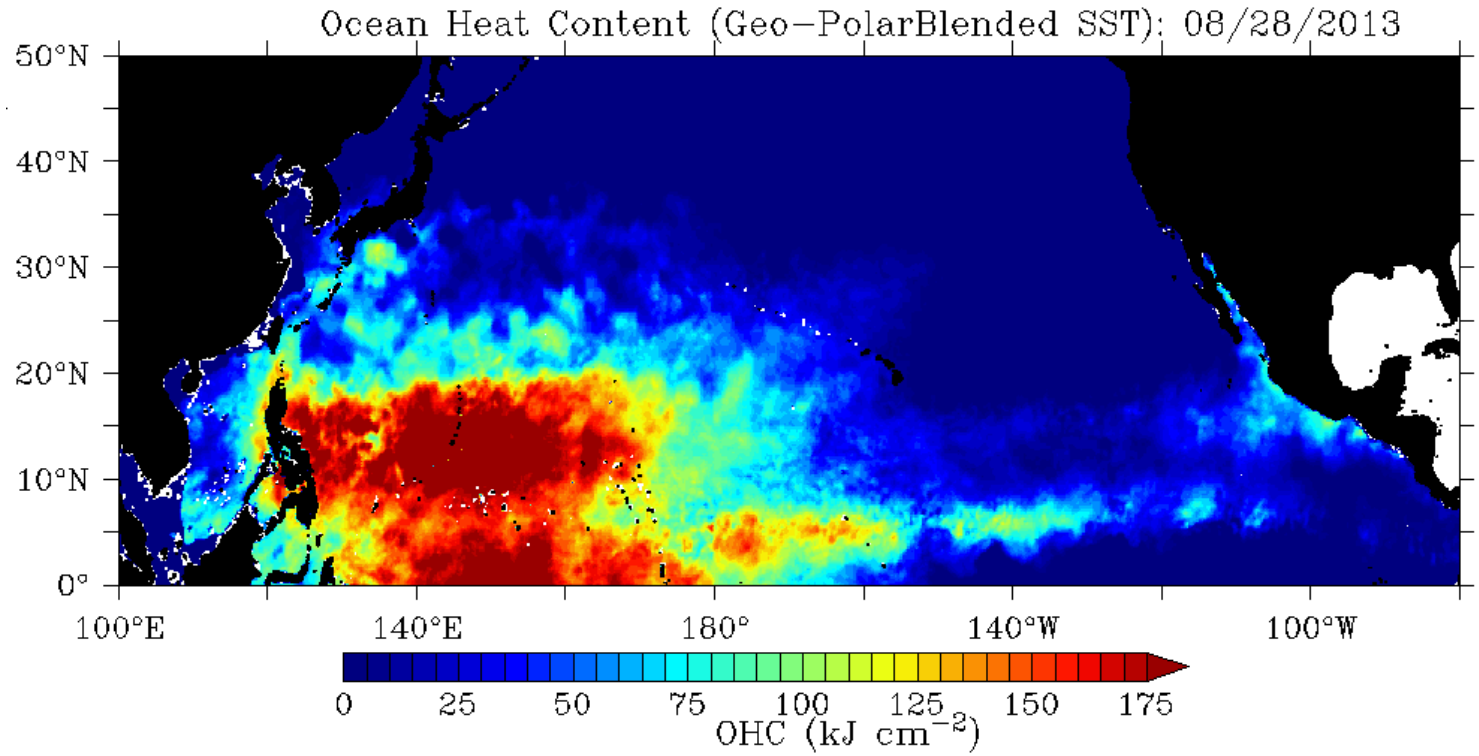
Oceanic Heat Content- South Pacific



Oceanic Heat Content- North Pacific



Oceanic Heat Content North Atlantic



SUMMARY

- GHRSST L2 Geostationary SST and blended SST Analyses products
  - Powerful data sets for studying SST
    - diurnal warming of the ocean surface
    - evolution of mesoscale features such as fronts and eddies
  - Temporal and increased data coverage for studying the
    - oceanography-Fisheries
    - meteorology-Ocean Heat Content for Hurricane Intensity
    - climate- Coral Reef Watch Products Improved for Bleaching Products
  - Reprocessing a very powerful tool for climatic studies