Marine Heat Waves case study: NOAA Coral Reef Watch

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[1] *NOAA Coral Reef Watch*

EUMETSAT series of short courses: Warming oceans: using satellites to monitor sea surface temperature, ocean heat content and marine heatwaves; 07.202

Marine Heatwaves and SST Anomalies

NOAA Coral Reef Watch has been producing and using sea surface temperature (SST) anomaly products for the past 23 years.

Although their main purpose is to aid with the management of coral reefs world wide, many other managers, scientists and users have found other uses:

- Harvesting seaweed
- Onset of migration of various whale species
- Identifying when organisms are stressed on reefs for drug prospecting

Marine Heatwaves and SST Anomalies

Marine Heatwaves (MHW) are based on Sea Surface Temperature (SST) Anomalies

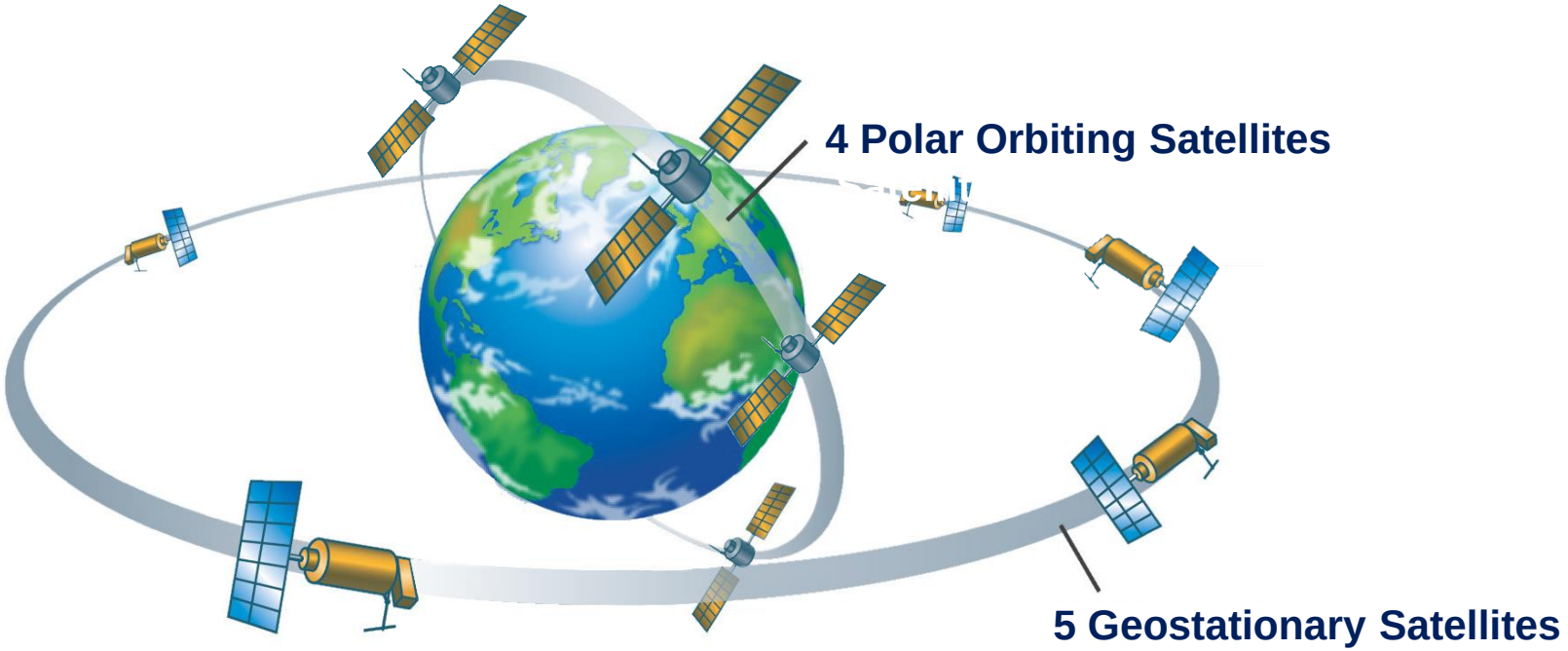
SST Anomalies are the difference between the daily SST and a climatological value

- Daily/seasonally varying climatologies
  Used mostly for characterising the physical environment
  (e.g. MHW, ENSO indices, etc)
- Static climatologies
  Used mostly for the prediction of biological phenomena
  (e.g. Coral Bleaching, onset of migration, etc)

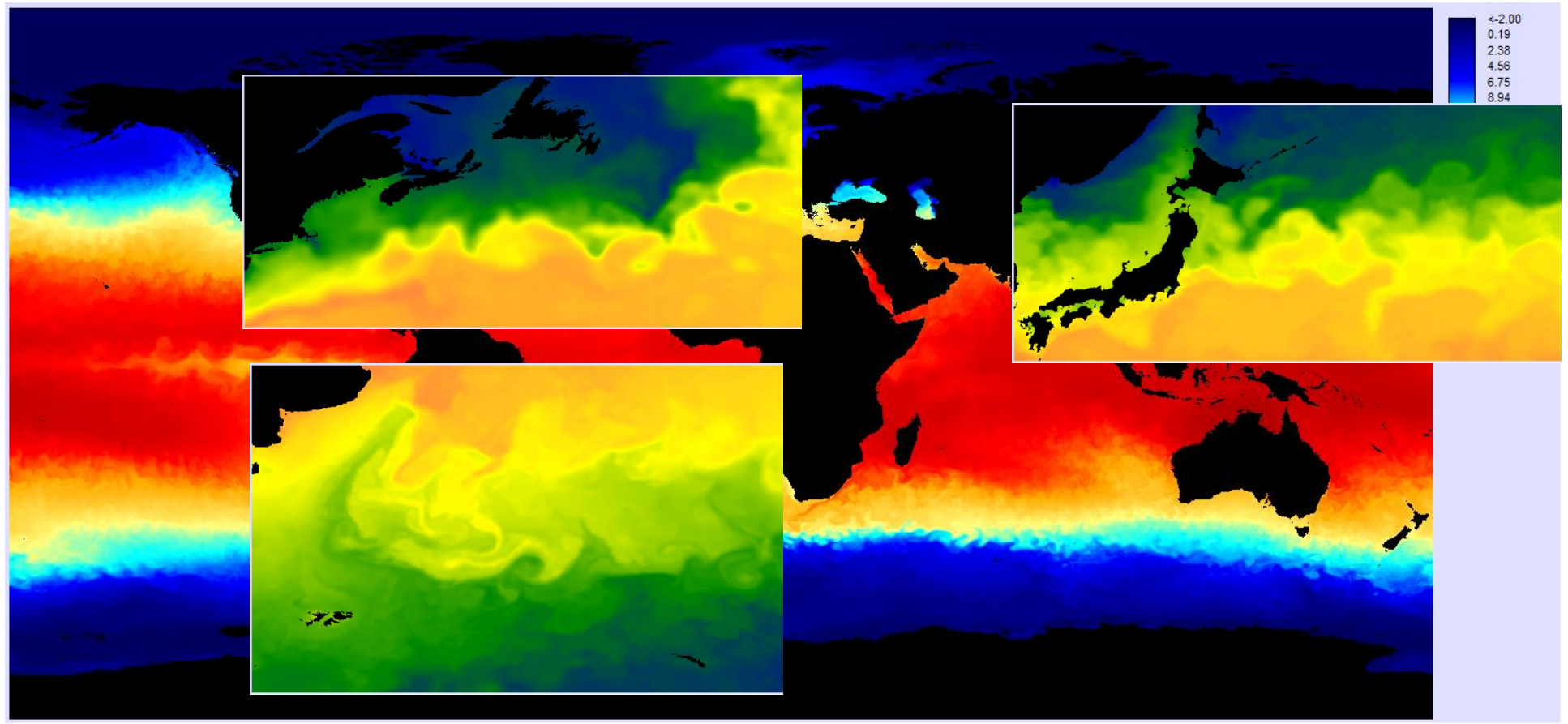
NOAA Coral Reef Watch (CRW) produce and use both types of Anomalies

CRW developed their own SST product called CoralTemp

- Gap-free
- Daily SST from 1st January, 1985 to present
- Night-only data
- Consistent product from end to end
- Currently use 5 Geostationary and 4 Polar orbiting satellites
- Between 52 and 76 observations per night

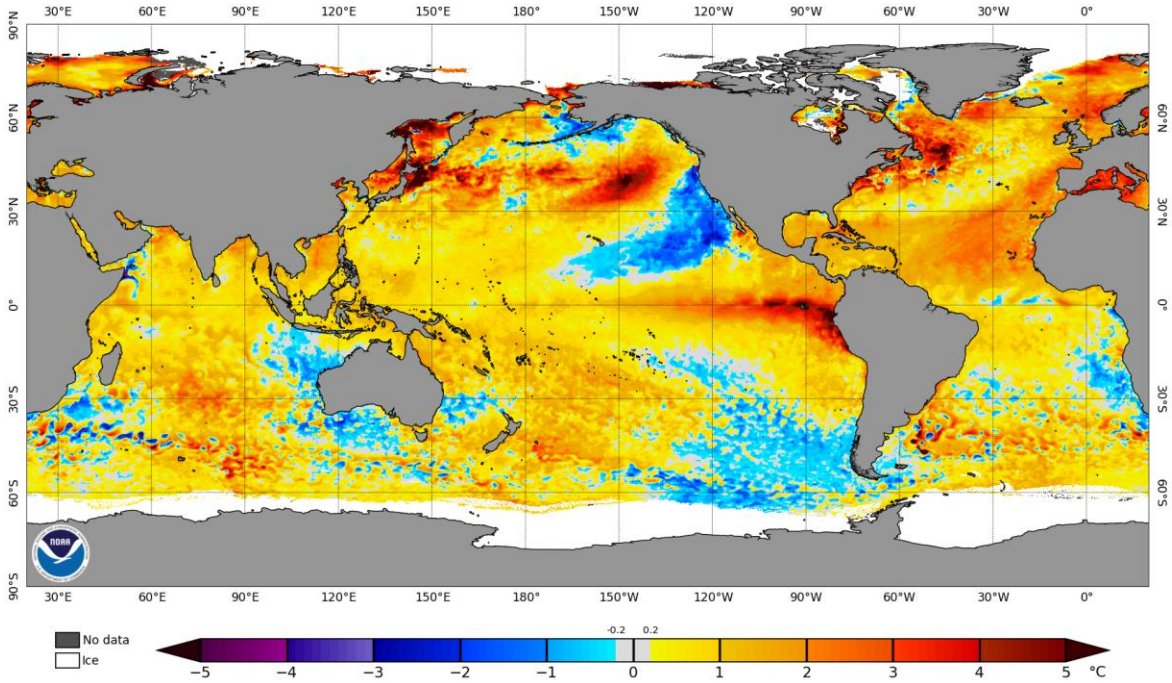


CoralTemp SST example

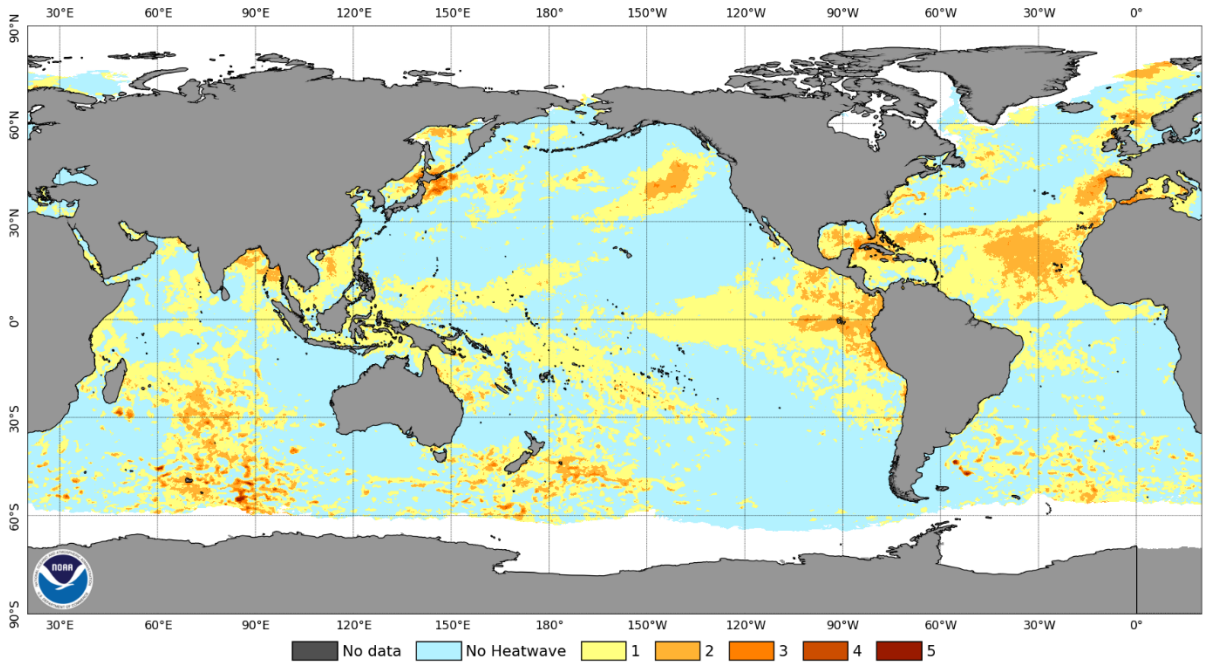


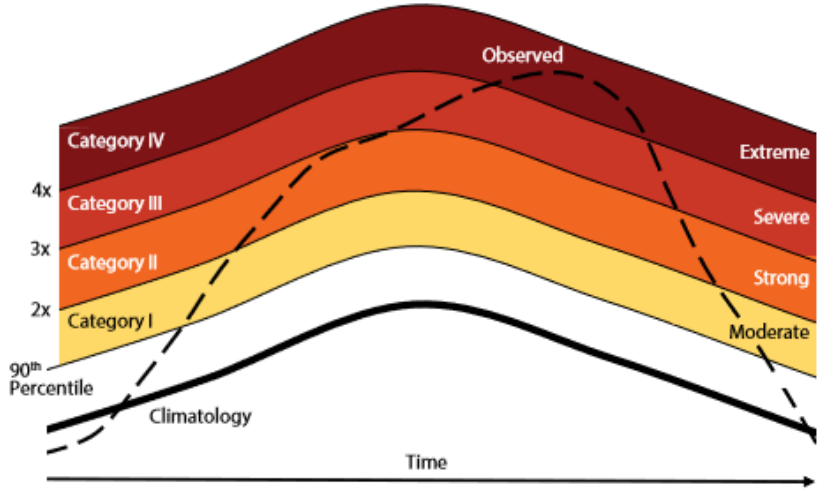
SST Anomaly and Marine Heatwaves

NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 12 Jul 2023



NOAA Coral Reef Watch Daily 5km Marine Heatwave Categories (v1.0.1) 12 Jul 2023





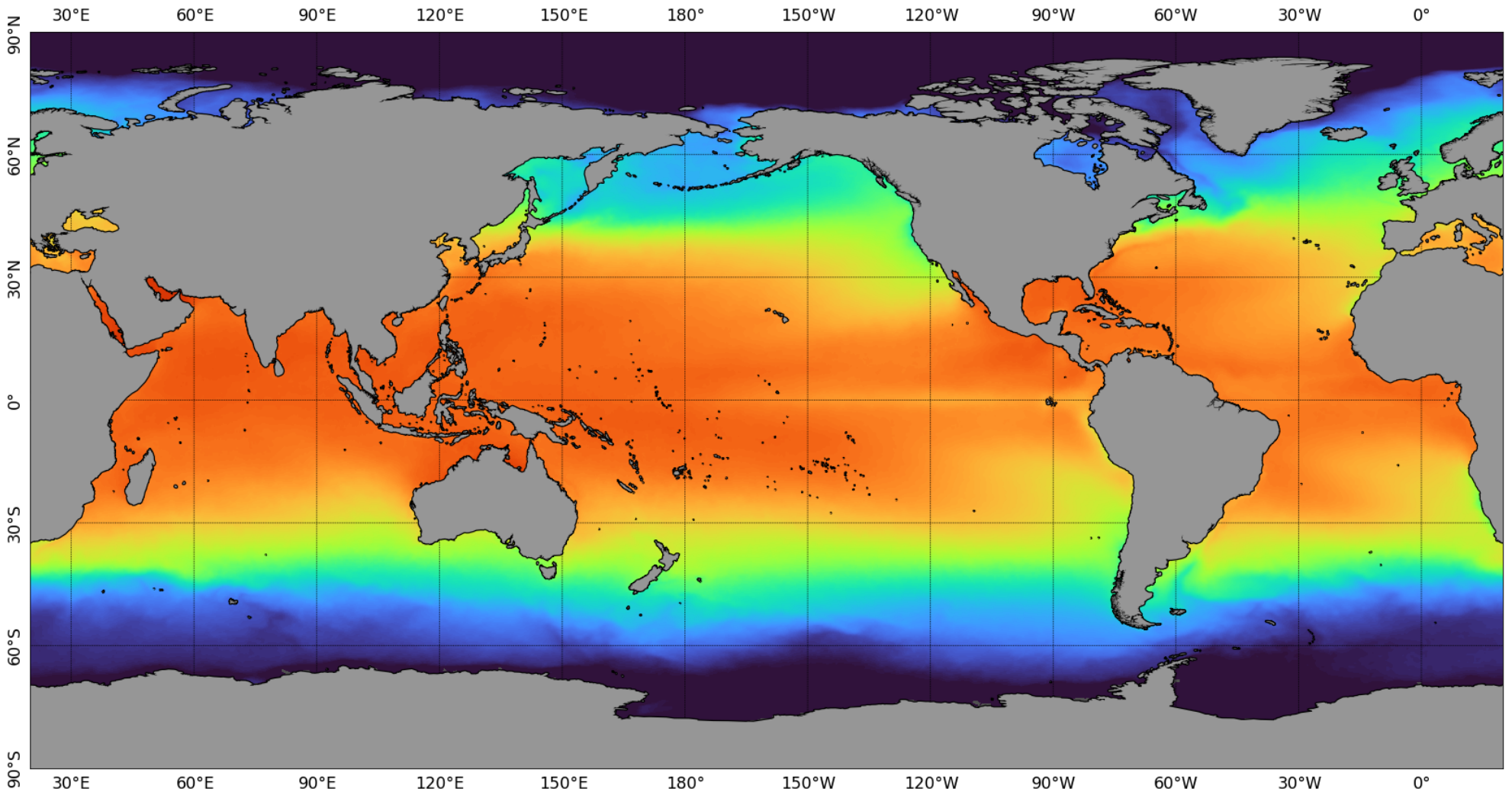
Anomalies with static climatology

Corals accumulate damage when temperatures exceed the summer-time maximum

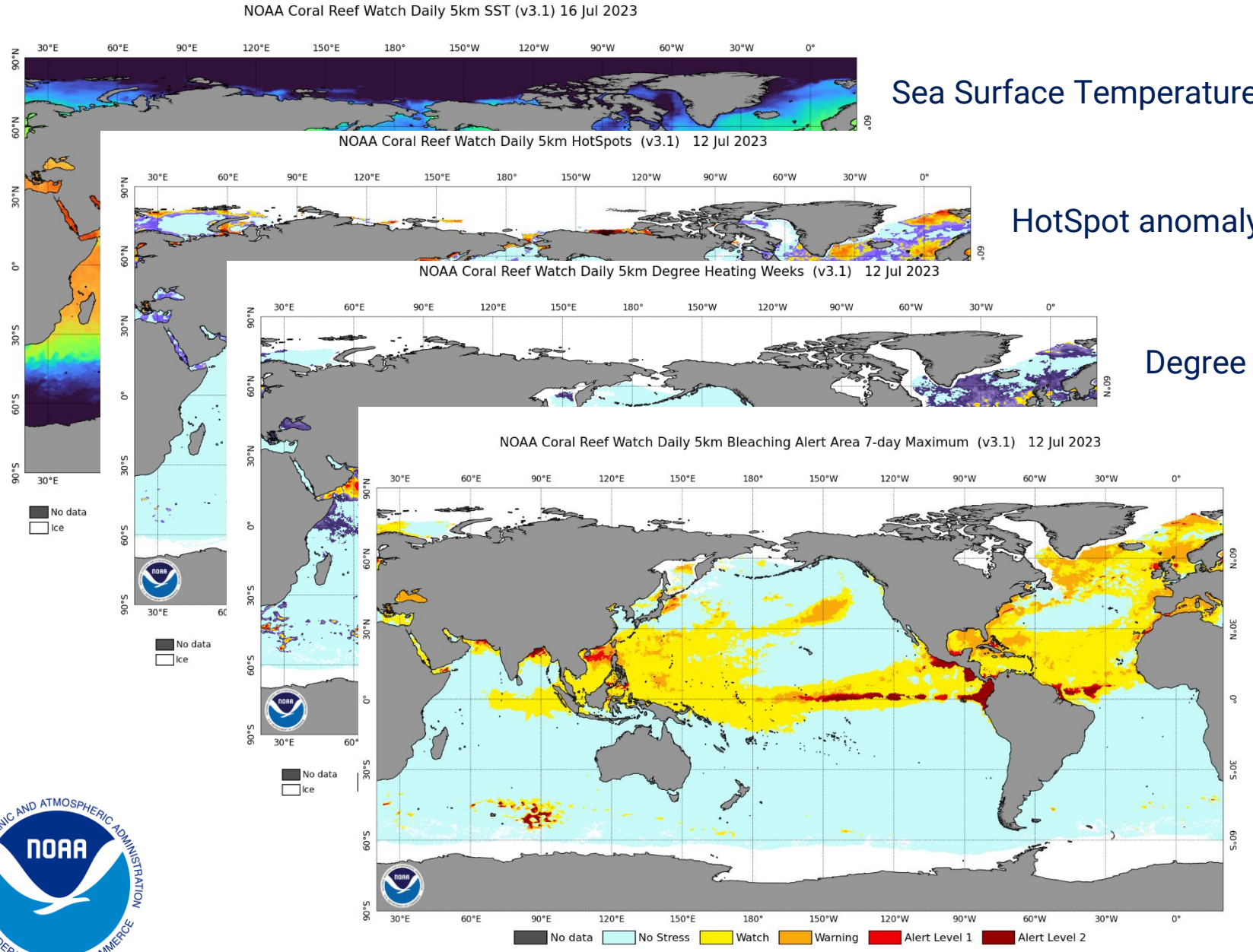
The maximum monthly mean (MMM) climatology is the maximum of monthly means from 1985 to 2012

CRW use the MMM to create a suite of heat stress metrics that are widely used to monitor coral bleaching

Maximum Monthly Mean (MMM) climatology



Coral Reef Watch suite of heat stress products



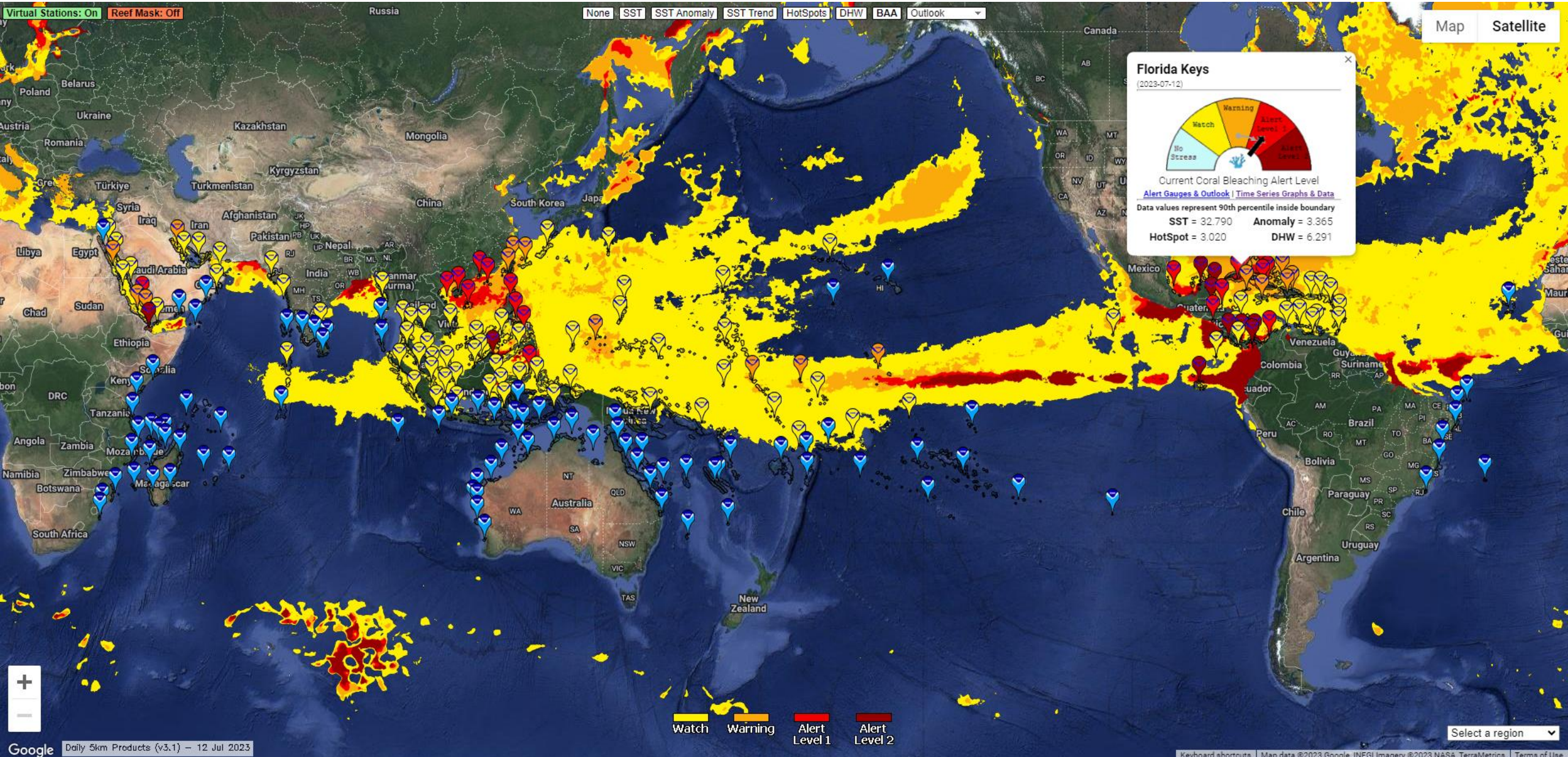
Sea Surface Temperature (SST) from CoralTemp

HotSpot anomaly (HS) - (SST-MMM)

Degree Heating Week (DHW) - accumulated HS

Alert Area (7 day max) - categorised DHW

Alternate ways to present heat stress metrics – virtual stations



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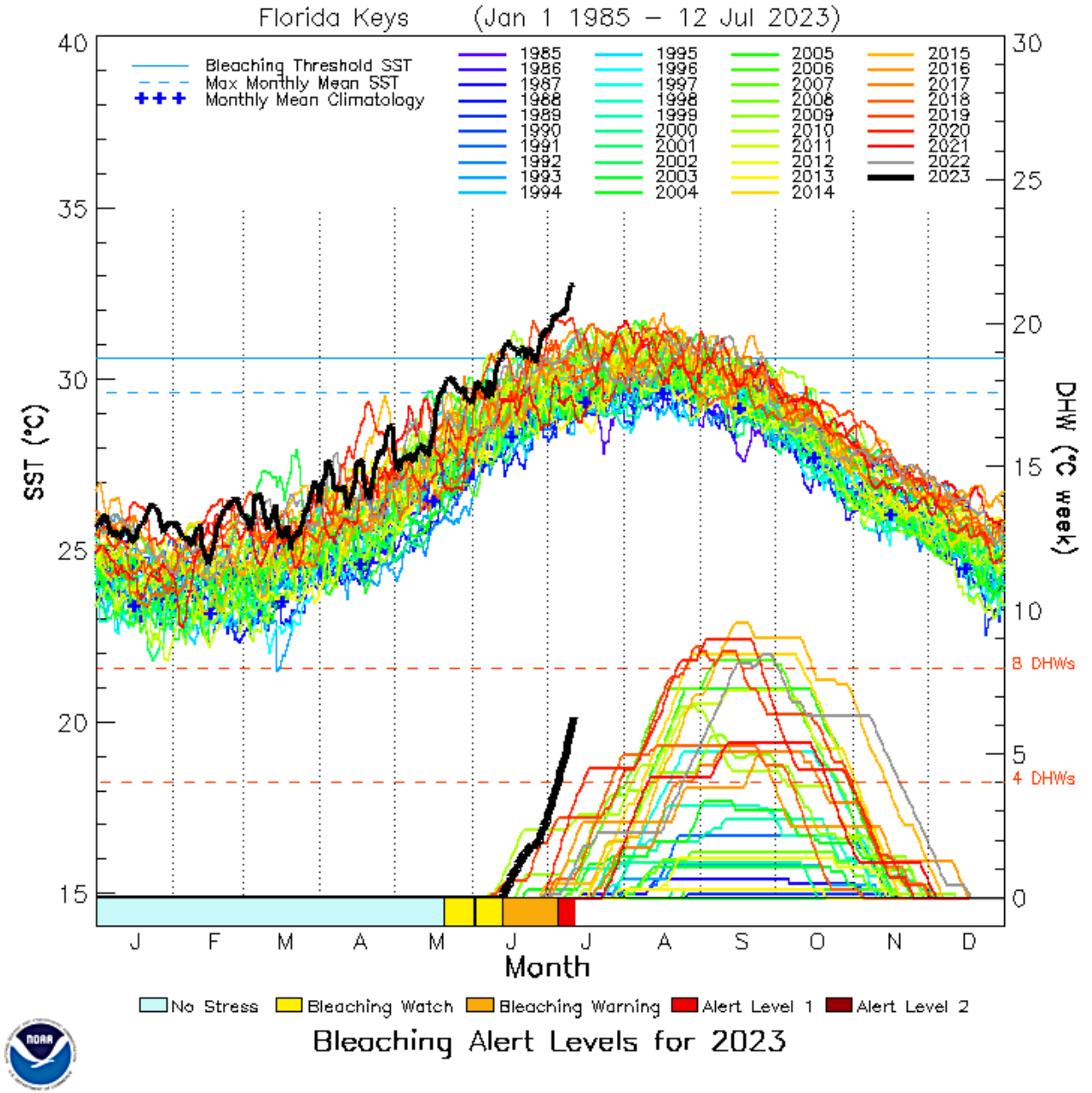
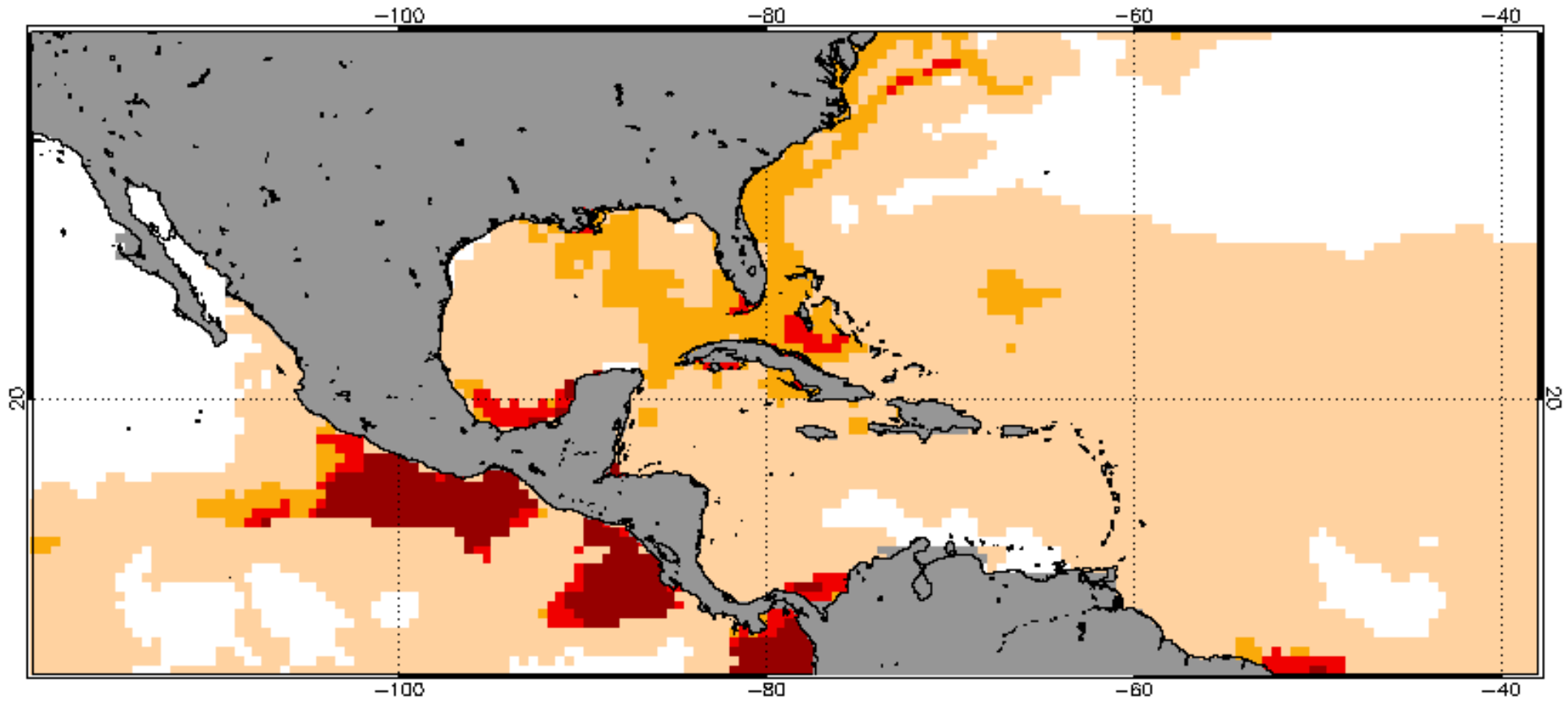


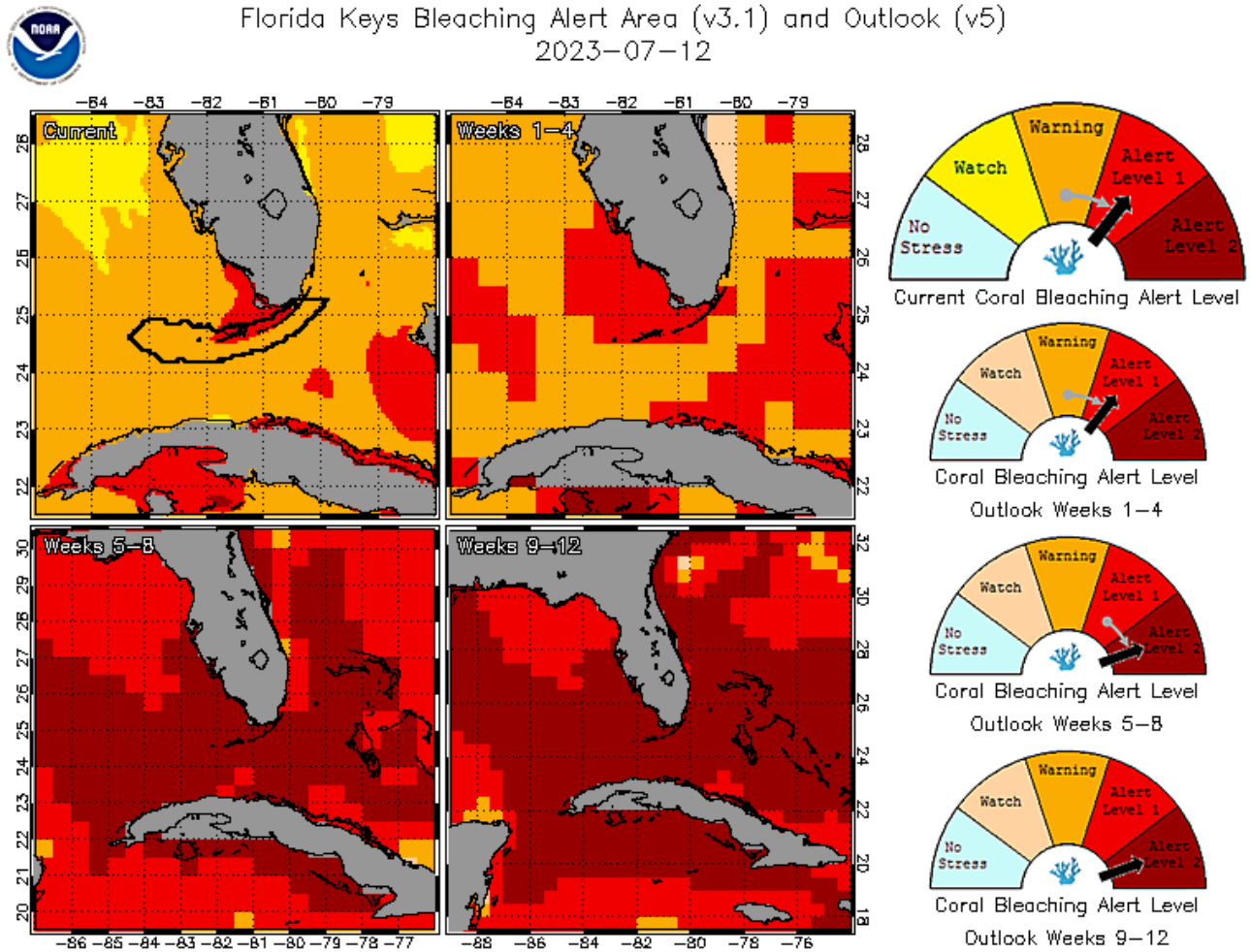
Outlook product – seasonal forecasts



Florida Keys
5 km Regional Bleaching Heat Stress Maps and Gauges (Version 3.1)

Product: SST | SST Anomaly | HotSpot | Degree Heating Week | **Bleaching Alert Area** | SST Trend

Year: < 2023 > | Month: < Jul > | Day: < 12 > | Current Date | Start Date



Current Bleaching Alert Level | 4-Week Outlook | 8-Week Outlook | 12-Week Outlook | Composite

Coral Reef Watch web site

All Coral Reef Watch data are freely available on their website

https://coralreefwatch.noaa.gov/