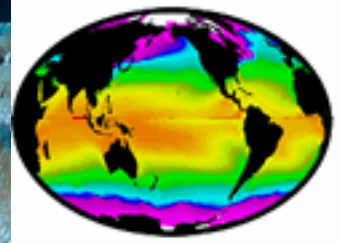
GHRSST Coral Heat Stress Task Team User Requirements

Co-Chairs
William Skirving, Jonathan Mittaz, Craig Steinberg



GHRSST
GROUP FOR HIGH RESOLUTION SEA SURFACE TEMPERATURE

20 Years
NOAA CORAL REEF WATCH

University of Reading

AUSTRALIAN INSTITUTE OF MARINE SCIENCE

GHRSST Coral Heat Stress Task Team

Co-Chairs:

William Skirving	NOAA Coral Reef Watch
Jonathan Mittaz	University of Reading
Craig Steinberg	Australian Institute of Marine Science

Task Team Members:

Derek Manzello	NOAA Coral Reef Watch
Blake Spady	NOAA Coral Reef Watch
Gang Liu	NOAA Coral Reef Watch
Andy Harris	NOAA
Eileen Maturi	NOAA
Neal Cantin	Australian Institute of Marine Science
Christopher Merchant	University of Reading
Simon Good	Met Office
Mark Worsfold	Met Office
Simon Donner	University of British Columbia
Claire Spillman	Bureau of Meteorology
Robert Johnson	Bureau of Meteorology
Helen Beggs	Bureau of Meteorology
Ove Hoegh-Guldberg	University of Queensland

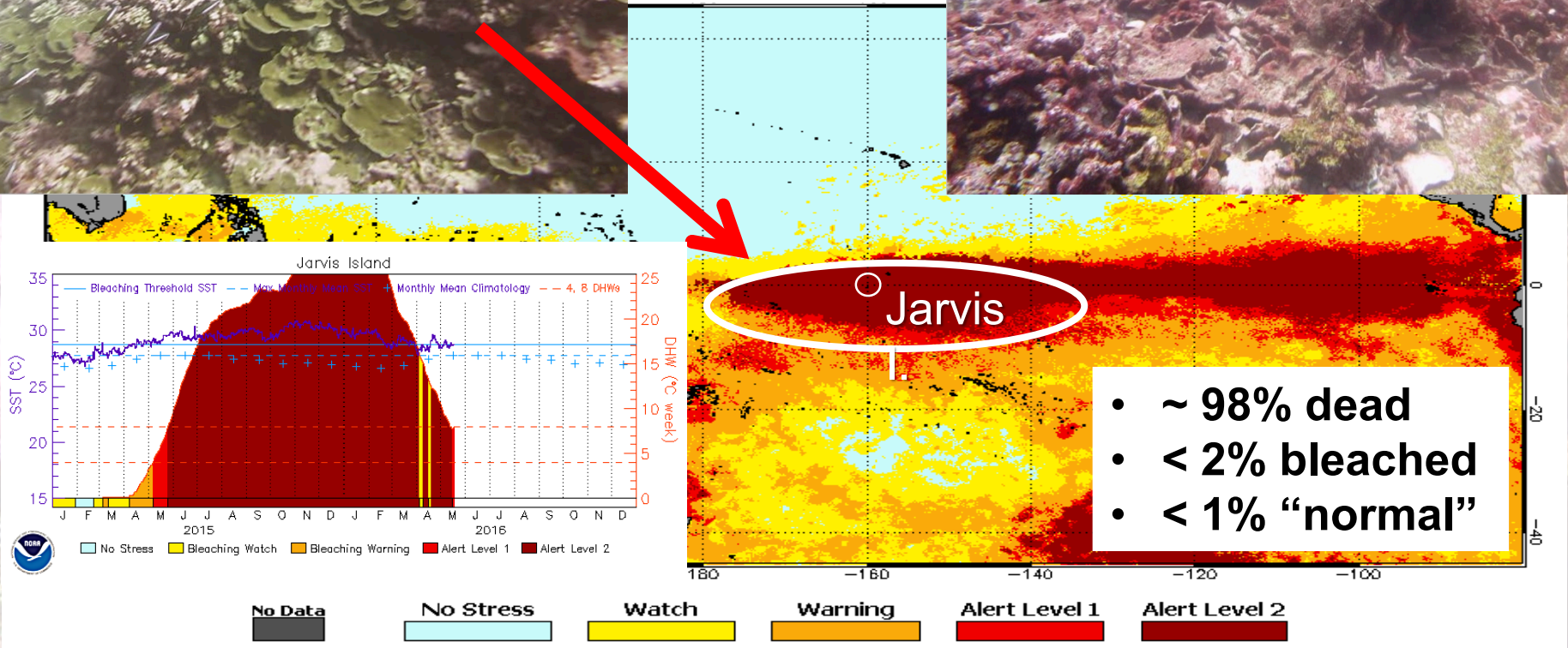
Importance of Coral Reefs

- Coral Reefs are more biodiverse than Tropical Rainforests
  - Coral Reefs cover < 1% of the world's oceans
  - Coral Reefs contain > 25% of the ocean's total species
- Coral Reefs are the number one source of new medicines
  - Surpassed tropical rainforests over a decade ago
  - Key for possible cures for cancer, arthritis, human bacterial infections, viruses, and other diseases
- Coral Reefs provide services vital to societies and industry
  - Globally between 0.5 and 1 billion people depend on healthy reefs for food, coastal protection and livelihoods
  - The value of these services is estimated to be US$10 trillion

Heat Stress and Bleaching - Jarvis Island, Central Pacific

April 2015

May 2016



The GHRSST Coral Heat Stress Task Team

The GHRSST Coral Heat Stress Task Team (TT) has been set up to provide expert advice and recommendations to the GHRSST community on the satellite SST requirements for quantifying and monitoring the effects of heat stress on coral health.

Extending the Coral Heat Stress Task Team

Other uses of SST for Coral Reef research and management

- Development of downscaling techniques for CMIP future projections
- Ecological studies and models
- Predicting and tracking disease outbreaks
- Reef restoration
  - When and where to transplant corals (i.e. where are the optimum environmental conditions for transplantation)
  - Providing realistic temperature variations for the control of nursery and experimental tanks
- Identification of likely species composition

Extending the Coral Heat Stress Task Team

Users who access satellite SST for the development of heat stress products are usually advanced users (e.g. NOAA and the BoM)

In contrast, many users from the coral community who access satellite SST for other purposes are novices when it comes to their understanding of the use of satellite SST.

Coral Reef User Community SST Requirements

- Stability through time
- Accuracy of geo-location
- Level 3 vs level 4 SST products
- Daily average vs diurnal variability
- Radiometric accuracy and spatial/temporal resolution
- Level 4 data density
- Level 4 analysis uncertainty
- Use of in situ data in the derivation of SST
- Modern SST retrievals vs historic retrievals
- Near-real-time SST vs Reprocessed SST
- Importance of temperatures above 25^{o}C
- Regional analyses
- **Preservation of Oceanographic Features**
- **A Measure of the Effective Spatial Resolution**

Level 3 vs Level 4 SST products

Need Level 4 SST products since all studies and monitoring of marine organisms that require SST require continuous (gap-free) data

Daily average vs diurnal variability

- Increase in studies of physiological response of corals to diurnal temperatures.
- Satellite products that can provide min/max or full diurnal variation over each day will be useful to the coral reef user community.

Radiometric accuracy and spatial/temporal resolution

- Accuracy of 0.2 ^{o}C per pixel per retrieval still applies

- For heat stress: SST > 25 ^{o}C
- For general Coral use: SST > 15 ^{o}C

- Spatial resolution of 0.05 degrees OK for now
  - Once diurnal variation can be used, less than 0.05 degrees is able to be used however temporal resolution would also need to be increased

Near-real time SST vs Reprocessed SST

Near-real-time and reprocessed SST used as one continuous dataset

Regional Analysis

Accuracies and uncertainties are mostly derived via global statistics these measures are more useful for the coral reef user community if they are derived using regional statistics.

Reefs are usually wholly contained within a single satellite SST pixel.

- Reef vs surrounding water temperatures often very different.
- A parameterization using bathymetry, tides, winds, solar radiation could provide an apportionment of a pixel's SST to improve the estimate of the reef temperatures.
- High resolution SST (e.g. from Landsat) would help this development
- Could be used on reprocessed SST data
- Would help improved spatial resolution of modern satellite SST to be used with reprocessed data

Preservation of oceanographic features (NEW)

Regions of upwelling, temperature fronts, currents, eddies, etc are all extremely useful to ecological studies

A Measure of the Effective Spatial Resolution (NEW)

There is a need for satellite SST providers to be transparent
With regards to the effective spatial resolution of their product.

The majority of the coral reef user community take the resolution of SST products on face value and believe that the temperatures reported are only from the pixel within which it is reported.

Each satellite SST product provided to the public should include a statement that provides a lay person with an understanding of the effective spatial and temporal resolution of the product, as well as an understanding of the sorts of conditions that can significantly degrade spatial and temporal resolution of the product.

GHRSST Coral Heat Stress Task Team

Please contact any of the co-chairs if you have questions and/or seek further information

Co-Chairs:

William Skirving
NOAA Coral Reef Watch
william.skirving@noaa.gov

Jonathan Mittaz
University of Reading
j.mittaz@reading.ac.uk

Craig Steinberg
Australian Institute of Marine Science
c.Steinberg@aims.gov.au