

# MARINE ENVIRONMENTAL MONITORING (GREAT BARRIER REEF, AUSTRALIA)

## SUMMARY

### Title

eReefs

### Service

Marine environmental monitoring

### End users

Government agencies, reef managers, policymakers, researchers, industry, local communities

### Intermediate users

- Queensland and Australian governments (Reef Report Card)
- Integrated Marine Observing System

### Application(s)

- Marine ecosystem monitoring through Marine Water Quality Dashboard and ReefTemp tools
- Climate impact monitoring and assessment
- Adaptation to climate change

### Models used

Water optical property models for deriving in-water optical properties and concentrations of optically active constituents from satellite imagery

### Climate data records used

- SST
- Ocean colour (chlorophyll levels, suspended sediments, dissolved organic matter)

### Satellite observations used

- MODIS daytime cloud-free VIS/NIR imagery (1x1km) (for ocean colour)
- AVHRR cloud-free imagery (2x2 km) on board NOAA-18, -19 (for SST)

### Agencies that produce records

- Bureau of Meteorology as implementing agency, in conjunction with CSIRO, Australian Institute of Marine Science, Great Barrier Reef Foundation and the Queensland Government
- NASA (MODIS), NOAA (AVHRR)

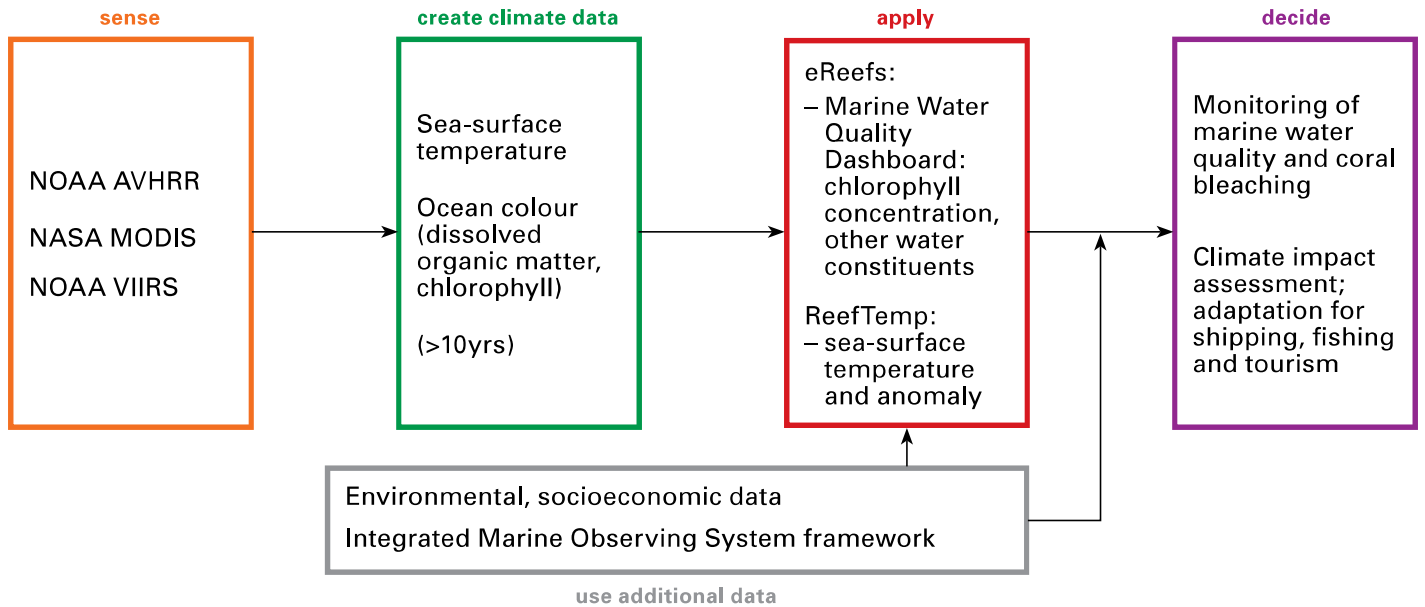
### Sustainability of service (demonstration or ongoing)

eReefs commenced in 2012 and is a five year project; it is expected to successfully move to a fully operational information and modelling system



*Hardy Reef on the Great Barrier Reef,  
Australia*

## INFORMATION FLOW



## DESCRIPTION

The eReefs project is a collaboration that contributes to the protection and preservation of the iconic Great Barrier Reef. A number of threats, including water quality, climate change, shipping, fishing and coastal development have the potential to detract from the Reef's natural, cultural and economic value. It combines government commitment to Reef protection and science innovation and operation with contributions from leading Australian businesses. Using the latest technologies to collate data and leading-edge integrated modelling, eReefs produces powerful visualisation, communication and reporting tools.

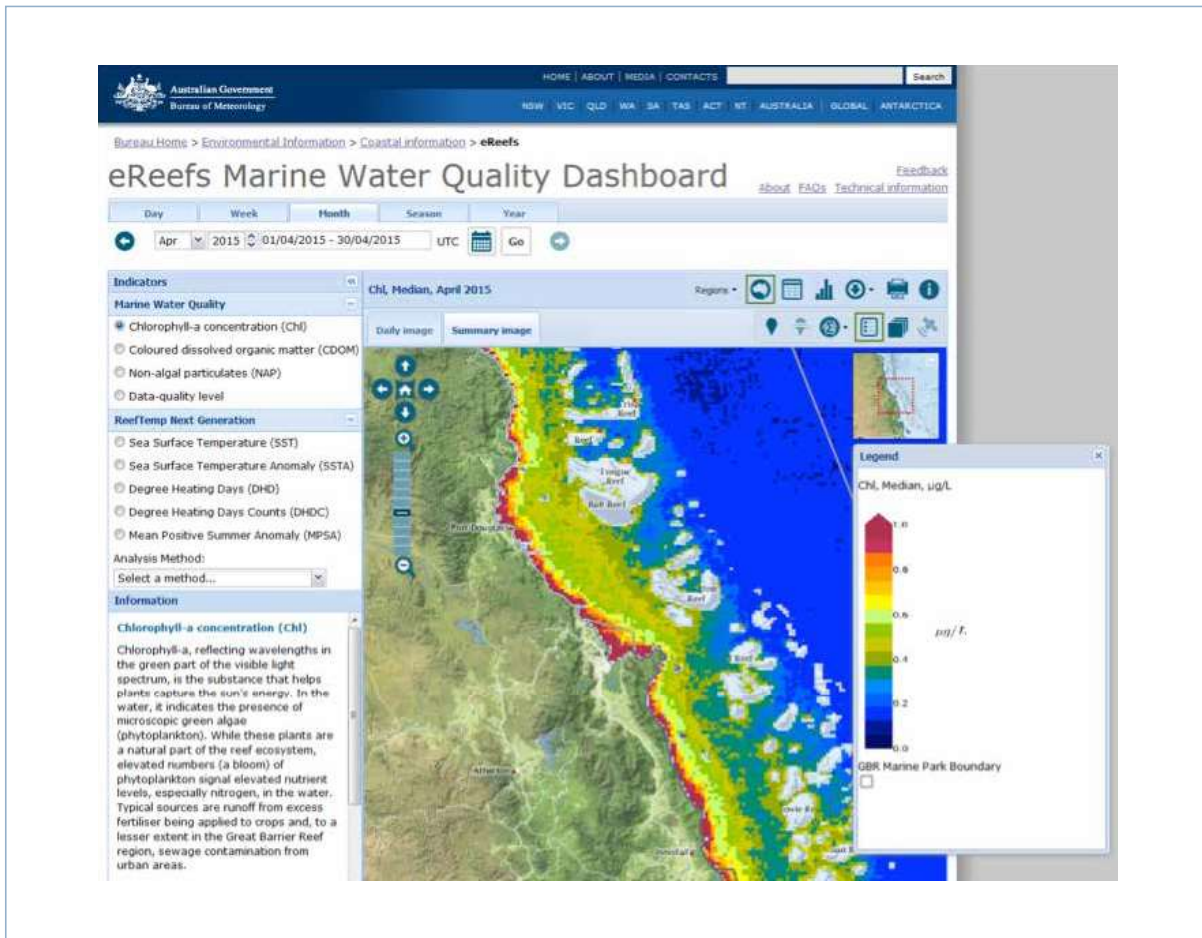
The Marine Water Quality Dashboard (Figure 1) is a tool designed to access and visualize a range of water-quality indicators, including near real-time data, more than ten years of records of sea-surface temperatures, chlorophyll levels, sediments and dissolved organic matter derived from ocean-colour observations for the entire Great Barrier Reef. Data from the Dashboard can be displayed in various formats including maps, tables and charts. Users are able to download data for further analysis and interpretation.

Using data captured through satellite remote-sensing, water quality indicators help to determine the type and amount of matter in the water and consequently, how much light is available in the water. The amount of light in the water, and concentrations of chlorophyll and sediments can assist in managing sea grass beds and the production of large algae, which may compete with coral for space.

These indicators are important to monitor as they can have a great impact on the state and health of the Great Barrier Reef ecosystem.

ReefTemp Next Generation is a high-resolution mapping product that provides information on coral bleaching risk for the Great Barrier Reef region. Bleaching is a stress response of coral in unfavourable conditions. High ocean temperatures are the primary cause of mass coral bleaching events. Coral mortality appears to increase with the intensity of the bleaching event; intensity is determined by how much and for how long temperatures remain above the maximum mean summer temperatures. With future climate change projections indicating increased frequency and severity of mass coral bleaching events, ReefTemp improves our ability to monitor heat stress on the Great Barrier Reef.

Linking temperature characteristics to measures of bleaching response severity has revealed that multiple heat stress indices allow for a better estimate of bleaching risk than any single measure. ReefTemp indices include SST, SST anomaly (+SST), Degree Heating Days (DHD) and Heating Rate. DHD are a measure of the accumulation of heat stress, while Heating Rate represents the rate of accumulation of heat stress. The combination of indices used has provided consistent and effective estimates of bleaching risk during recent bleaching events in the Great Barrier Reef Marine Park (Figure 2).



**Figure 1. Marine Water Quality Dashboard displaying a monthly composite image of chlorophyll-a concentration, an important indicator of the presence of green algae (phytoplankton) in the Great Barrier Reef region (April 2015)**

The eReefs project started in 2012 and is being implemented in three phases over five years. Phase one focuses on delivering the building blocks for the project. Monitoring, modelling and visualization platforms form the basis of eReefs: they enable the delivery of primary datasets and information to reef managers, scientific researchers and the broader public. A key deliverable of phase one was the release of the Marine Water Quality Dashboard and ReefTemp Next Generation products.

Phase two of the project comprises extending the capabilities established in phase one, including the application of VIIRS spectral data to replace MODIS Aqua. Secondary products and services will be developed in consultation with various end users. Phase three will incorporate the transition to a fully integrated operational information and modelling system. The eReefs project will deliver:

- Expanded and improved monitoring data through the application of the latest measurement technologies

and data delivery tools, such as mobile and internet applications;

- A suite of new and integrated models across paddock, catchment, estuary, Reef lagoon and ocean;
- A framework to research the impact of multiple factors such as temperature, nutrients, turbidity and pH, and to communicate the results of that research to those who will be affected;
- An interactive visual picture of the Reef and its component parts, accessible to all;
- Public science initiatives to engage the broader community on the health of the Reef;
- Targeted communication products to allow the public to interact with and learn about the Reef, and to contribute monitoring information.

IMOS 14-day Mosaic: SST Anomaly  
3 February 2015 GBR region

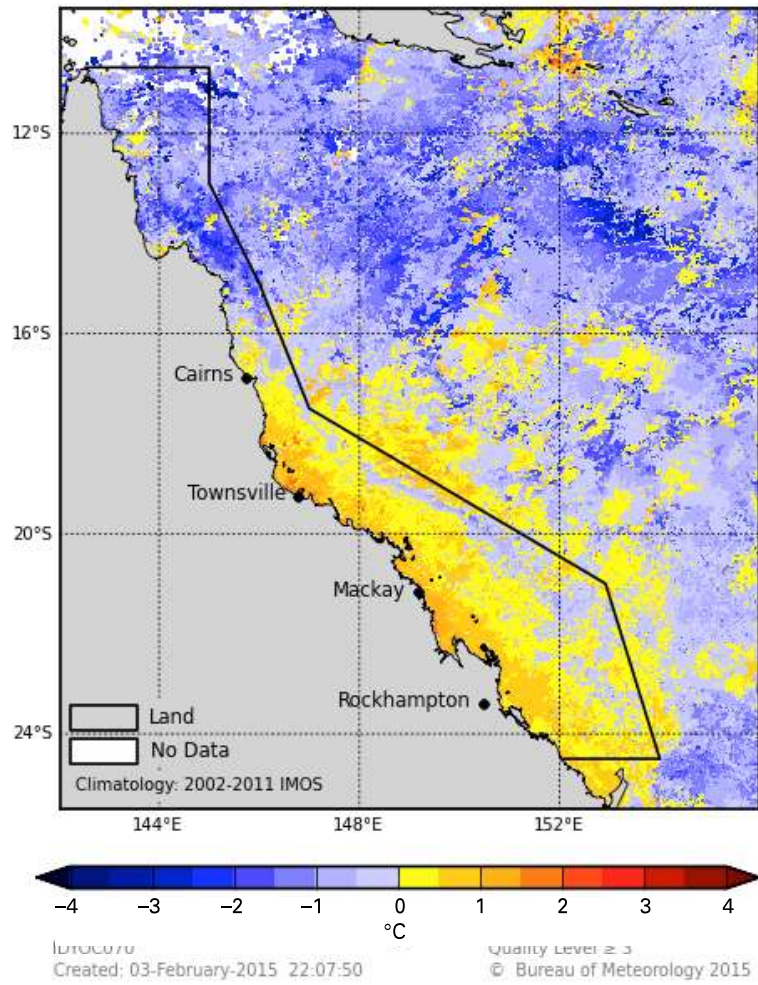


Figure 2. Example of an SST anomaly map for the Great Barrier Reef region obtained through the ReefTemp Next Generation system (<http://www.bom.gov.au/environment/activities/reeftemp/reeftemp.shtml>)