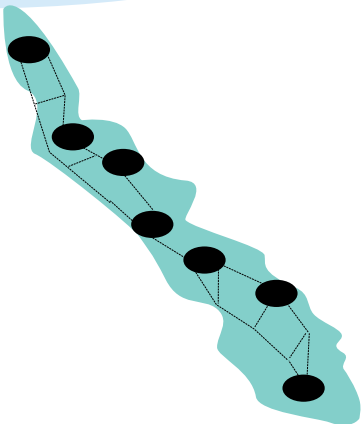
IMOS Integrated **Marine Observing** System

FACILITY 9: Facility for Automated Intelligent Monitoring of Marine Systems (FAIMMS)

The Great Barrier Reef (GBR) is the largest coral reef system in the world, with over 2,900 individual reefs and 900 islands. It is an iconic system having UNESCO World Heritage status; it supports a diverse ecosystem high in biodiversity and generates one billion dollars annually in revenue from tourism and fishing.The GBR is suffering a range of stresses including from tourist activities, overfishing, terrestrial run-off. It also suffers from warm water events (causing coral bleaching) and ocean acidification (caused by increases in CO_2 in the ocean). The FAIMMS network provides the real time environmental data to better understand how reefs react and respond to changing environmental conditions.



The FAIMMS sensor network technology

Sensor networks are a leading edge technology that is used to provide spatially dense bio-physical measurements in real-time. The term 'sensor network' refers to an array of small, interconnected wireless sensors that collectively stream observational data to a central data aggregation point. The system is 'smart' in that sensors can adaptively sample; that is change how they monitor based on the conditions they measure.

The FAIMMS network consists of buoys and platforms on which the sensors are attached; and a wireless network that transmits the data back to a base station which then forwards the data to the main data centre. The design allows other groups to 'plug-in' to the infrastructure lowering the cost of deploying new sensors on the reef. Supporting new sensors and sensor applications is a core goal of FAIMMS.

Figure 1. Satellite (MODIS) image of the Great Barrier Reef (Image AIMS / NASA).

The FAIMMS data

The FAIMMS facility is installing sensor networks at seven sites along the GBR. These are Heron and One Tree islands in the south, Orpheus Island in the central region, Lizard Island in the north and Davies, Myrmidon and Rib reefs in the central area. The island deployments are supported by the Tropical Marine Network made up of the research stations on each of the islands.

The initial deployments include buoys and fixed poles that are deployed with a thermistor/ pressure sensor, and a thermistor string which gives a vertical profile of temperature. The resulting data is collected every ten minutes giving high definition measurements of variables from a range of locations and depths. Figure 2 shows temperature data from the lagoons of Heron and One Tree islands for September-October 2008, Figure 3 shows data from One Tree Island at the time of Cyclone Hamish showing a drop in pressure, rise in wind speed and mixing of the lagoon waters.

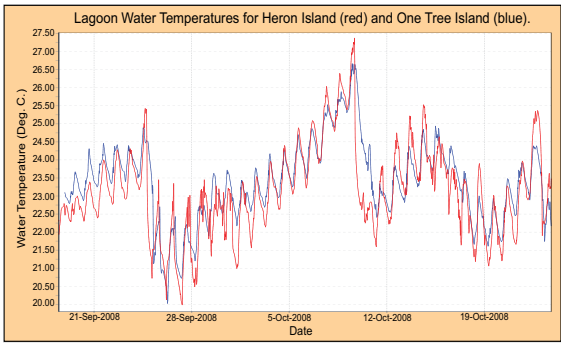


Figure 2. Data from Heron Island (red) and One Tree Island (blue) showing a 'saw-tooth' pattern of temperatures in the lagoons of both reefs. Note how closely the temperature on the two reefs track each other.

Applications of FAIMMS data

The FAIMMS data provides spatially dense observations of the physical conditions around the reef in real time. As communications with sensors are bi directional, sampling frequency can be automatically adjusted according to prevailing conditions,

or by land based control systems. This gives a system wide picture of the response of the reef to changes in physical conditions. Data on the broad scale oceanographic variability is provided by the IMOS Argo Australia and Ships of Opportunity facilities. In addition the sensor network is complemented by mooring, ocean radar and satellite data which gives insight into how large scale processes impact individual reefs and even particular areas within the reefs. The data allows us to model how predicted large scale changes, such as changes in temperature, will impact the reefs of the GBR.

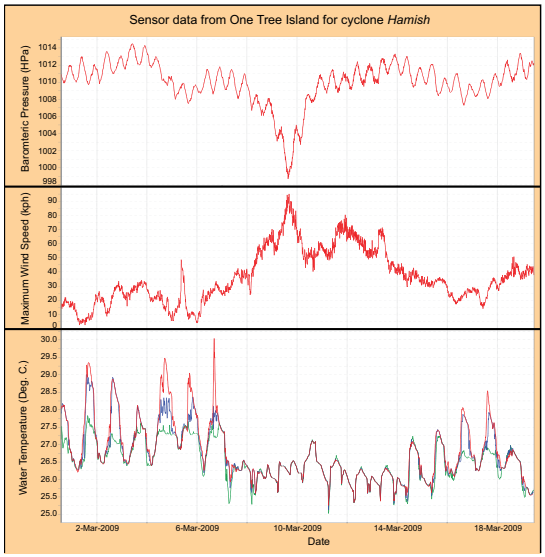


Figure 3. Data from One Tree Island showing the impact of Cyclone Hamish. Barometric pressure (top graph) drops, wind speed (middle graph) rises and a water column that shows marked stratification (bottom graph - red line is surface temperature, blue line is the middle of the water column, green line is bottom temperature) becomes well mixed.

Focus and priorities

1. to provide the real-time data to better monitor, measure and understand the interaction of heat and light in coral bleaching and the long term impact of changes in the ocean systems that impact the GBR.
2. to measure how oceanic processes link into within-reef processes and so to understand the impact of oceanic events and changes on the productivity and functioning of GBR ecosystems.
3. to provide the infrastructure, including reef based platforms, communications and data systems, to facilitate a broader range of reef observational activities.

Partners

- Australian Institute of Marine Science
- Queensland State Government
- Queensland Cyber Infrastructure Foundation
- Tropical Marine Network (James Cook University, University of Sydney, University of Queensland, Australian Museum)
- The University of Melbourne

www.imos.org.au

IMOS Integrated Marine Observing System

An Australian Government Initiative
National Collaborative Research Infrastructure Strategy

More information

IMOS Facility for Automated Intelligent Monitoring of Marine Systems
http://imos.org.au/faimms.html

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