

# Australian OC activities

Mark Baird, Tim Malthus

Contributions from: Janet Anstee, David Antoine, David Blondeau-Patissier, Nagur Cherukuru, Arnold Dekker, Lachlan McKinna, Marites Magno-Canto, Barbara Robson, Thomas Schroeder

# Continued IMOS/NCRIS Funding for Ocean Colour until 2027



## IMOS Satellite Ocean Colour Sub-facility Cal/Val

Co-leads: Thomas Schroeder (CSIRO), David Antoine (Curtin University)



Curtin University

### Validation and production of satellite Ocean Colour products for the wider Austral-Asian region

**Lucinda Jetty Coastal Observatory (LJCO)**  
Fixed Platform, QLD

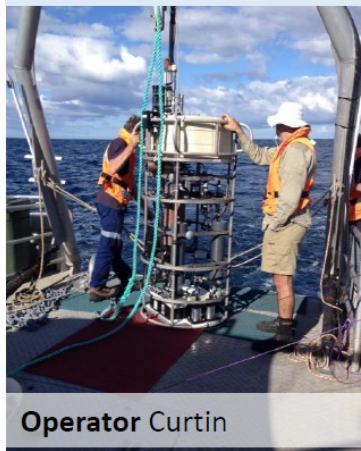


**Operator** CSIRO

**Observations**

Above-water radiometry  
In-water optics  
Biogeochemical samples

**Rottnest Island Thetis (RITS)**  
Profiler Mooring, WA

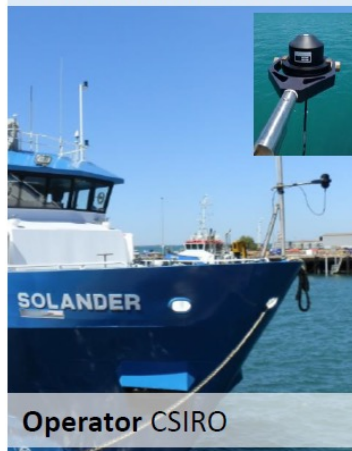


**Operator** Curtin

**Observations**

In-water radiometry  
In-water optics

**DALEC on AIMS RV Solander**  
En-route Radiometry, AU

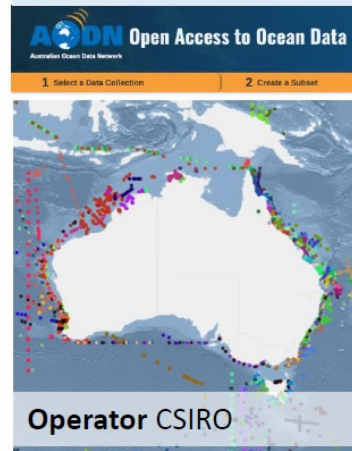


**Operator** CSIRO

**Observations**

Above-water radiometry

**Bio-optical database (BODB)**  
Data Collection, AU

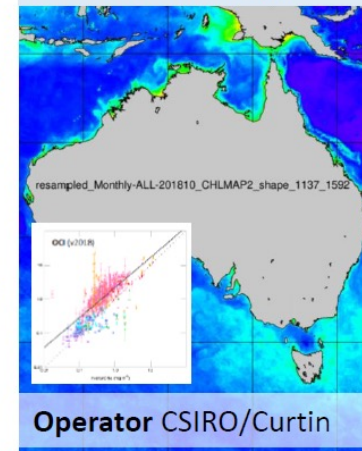


**Operator** CSIRO

**Observations**

Biogeochemical samples (Pigments, TSS, CDOM)  
In-water optics

**Production & validation of OCR data**  
Data Repositories, AU



**Operator** CSIRO/Curtin

**Observations**

Level 2, 3 products  
Sentinel-3 OLCI, VIIRS  
SNPP NOAA20, MODIS-A

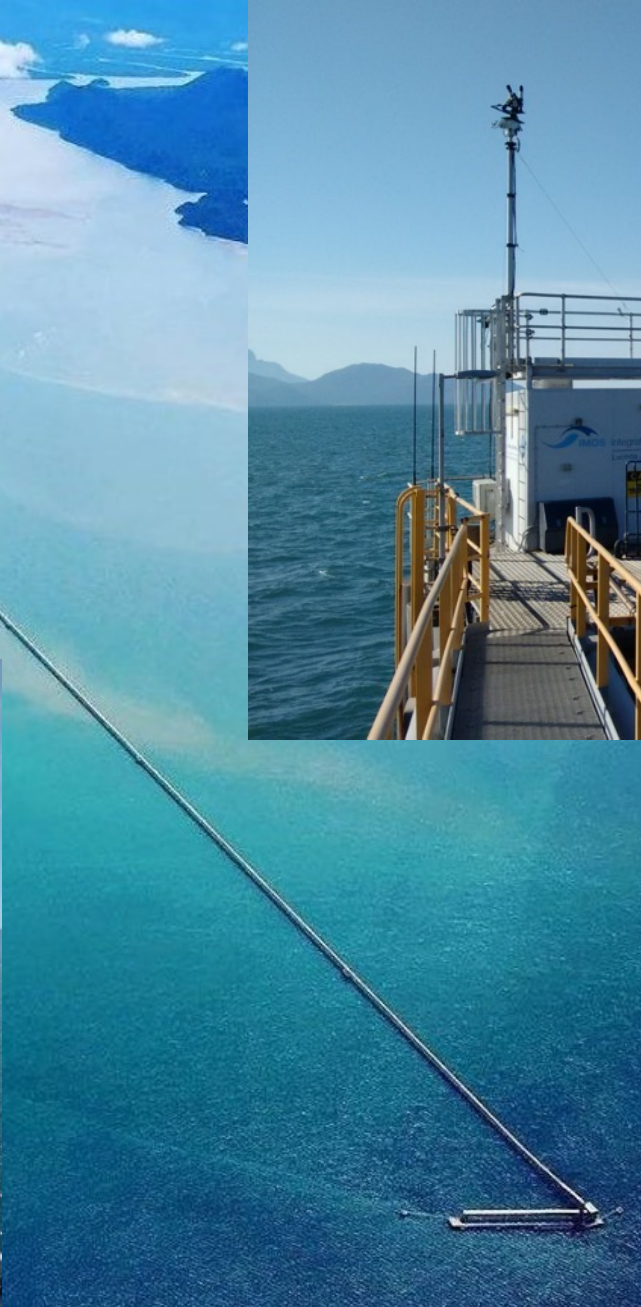
### National & International Engagement & Collaborations

eReefs, Digital Earth Australia, BoM, GBRMPA, AIMS, AquaWatch Australia, QLD Government, IMOS Community of Practice & RTT  
NASA AERONET-OC, NASA SeaBASS, Sentinel-3 Validation Team OC, EnMAP, FRM4SOC, Copernicus CVS, IOCCG, wider research community

**Contacts:**

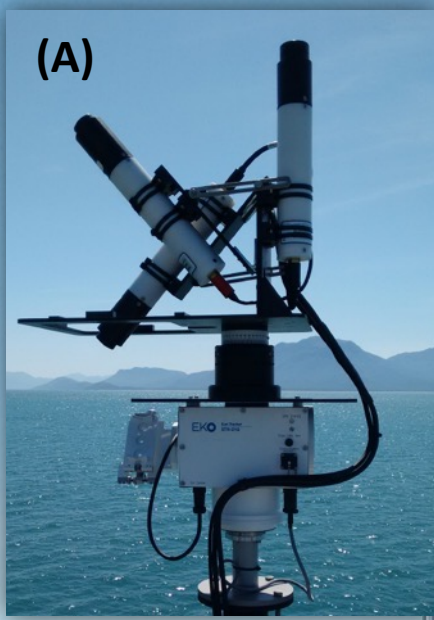
Thomas.Schroeder@csiro.au

David.Antoine@curtin.edu.au



# IMOS Lucinda Jetty Coastal Observatory (LJCO)

PI/Contact: [Thomas.Schroeder@csiro.au](mailto:Thomas.Schroeder@csiro.au)

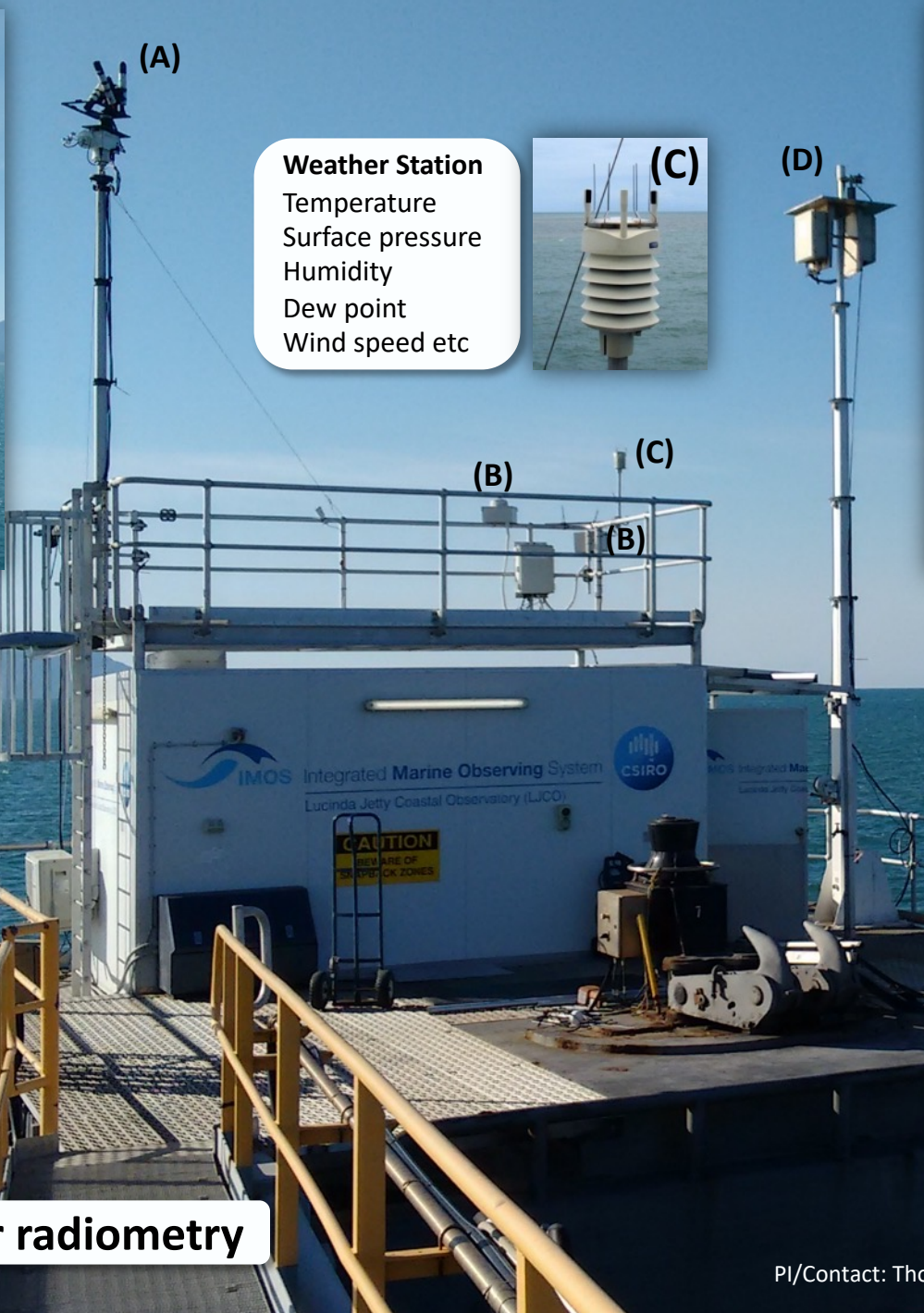


**Satlantic HyperOCR on Solar Tracker**  
Hyper-spectral  
Radiance & irradiance  
Reflectance

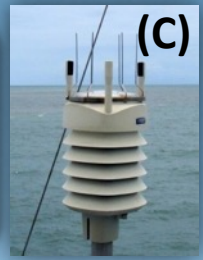
**Webcams**  
Sky and Sea



**LJCO above water radiometry**



**Weather Station**  
Temperature  
Surface pressure  
Humidity  
Dew point  
Wind speed etc



**SeaPRISM**  
Multi-spectral  
Water-leaving radiance  
Reflectance  
Aerosol optical thickness  
Aerosol absorption  
Aerosol size distribution  
Refractive index  
Single scattering albedo  
Phasefunction  
Water vapor  
Spectral flux  
Radiative forcing

## Continued support of national & international programs and activities:

eReefs,

Digital Earth Australia,

Great Barrier Reef Marine Park Authority,

Australian Bureau of Meteorology,

Australian Institute of Marine Science,

AquaWatch Australia,

Queensland Government,

**DLR/AWI EnMAP validation,**

**CNR-IREA PRISMA validation,**

ESA/EUMETSAT,

Sentinel-3 Validation Team Ocean Colour,

IOCCG WG on atmospheric correction,

Copernicus CVS,

SeaBASS (NASA),

and the wider OC research community.

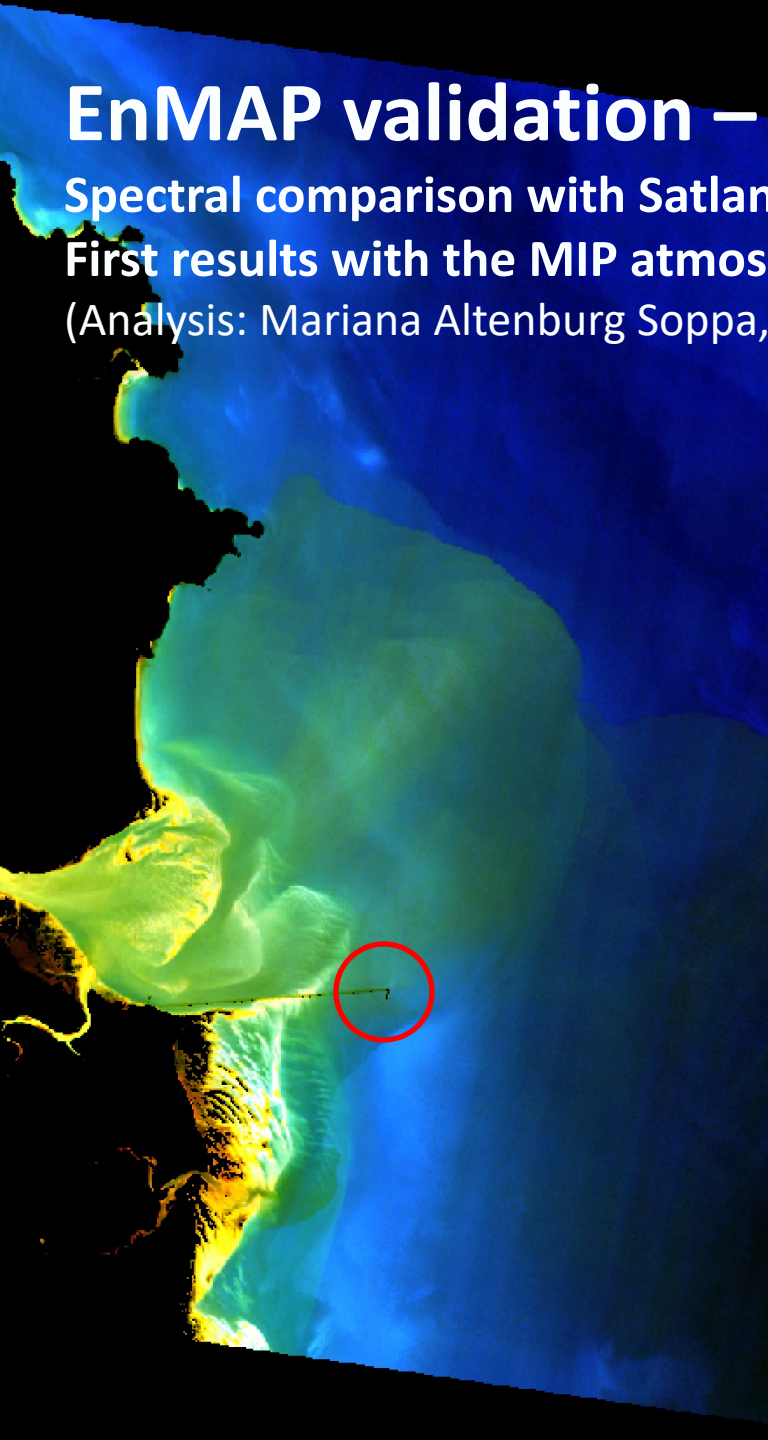


# EnMAP validation – Lucinda

Spectral comparison with Satlantic HyperOCR, 20 May 2023

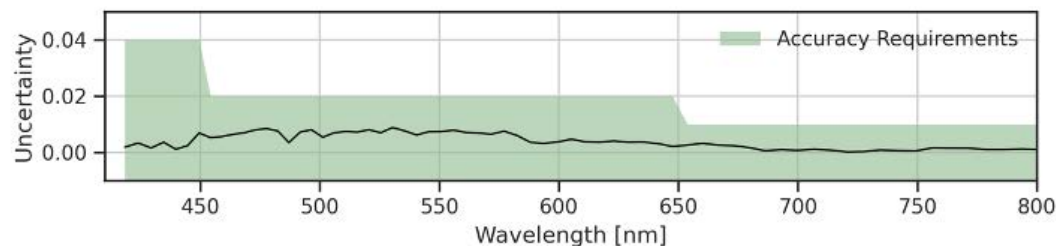
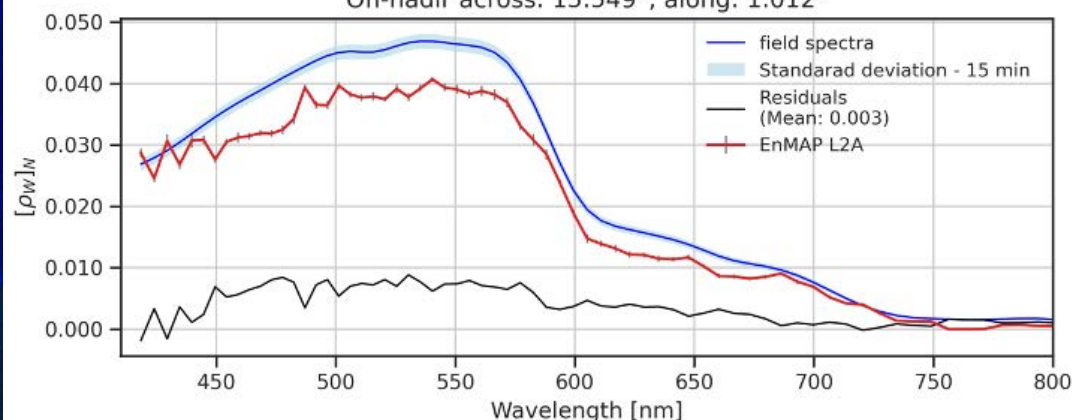
First results with the MIP atmospheric correction provided by AWI

(Analysis: Mariana Altenburg Soppa, AWI)



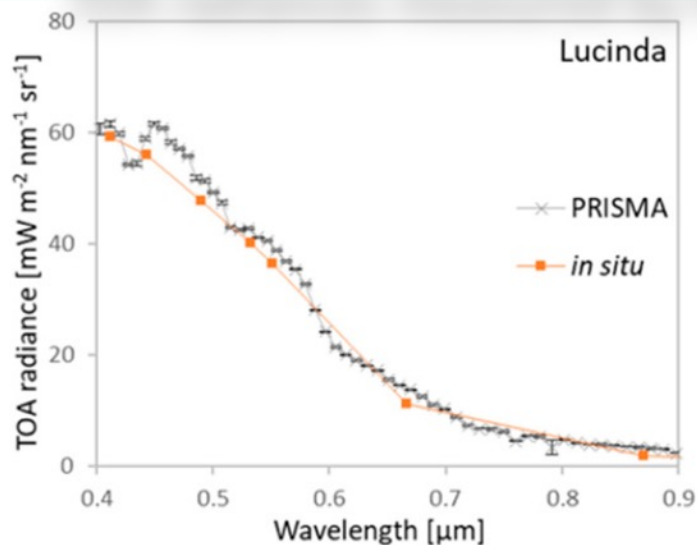
Spectral Comparison Lucinda (May 20, 2023)

Off-nadir across: 15.549°, along: 1.012°



# PRISMA validation - Lucinda

TOA radiances measured by PRISMA and simulated with 6SV (labelled as in-situ).



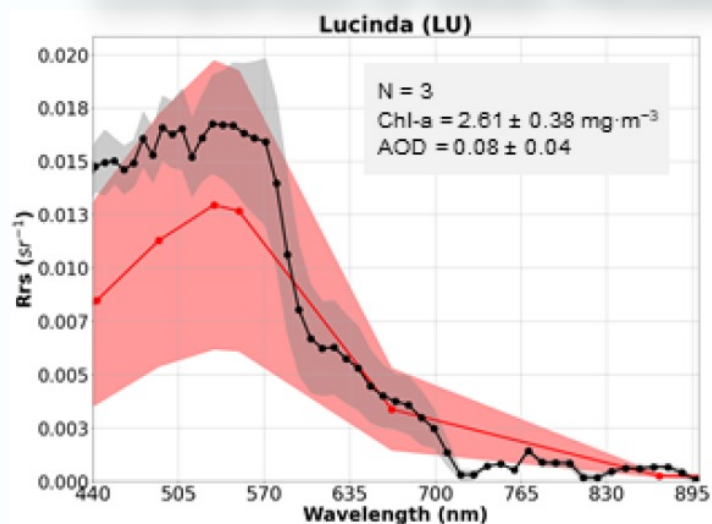
Technical Note

## First Evaluation of PRISMA Level 1 Data for Water Applications

Claudia Giardino <sup>1,\*</sup>, Mariano Bresciani <sup>1</sup>, Federica Braga <sup>2</sup>, Alice Fabbretto <sup>1,3</sup>, Nicola Ghirardi <sup>1</sup>, Monica Pepe <sup>1</sup>, Marco Gianinetto <sup>1,3</sup>, Roberto Colombo <sup>4</sup>, Sergio Cogliati <sup>4</sup>, Semhar Ghebrehiwot <sup>5</sup>, Marnix Laanen <sup>5</sup>, Steef Peters <sup>5</sup>, Thomas Schroeder <sup>6</sup>, Javier A. Concha <sup>7</sup> and Vittorio E. Brando <sup>7</sup>

<https://doi.org/10.3390/s20164553>

Comparison of mean PRISMA L2d (grey) and Lucinda AERONET-OC Rrs data (red).



Technical Note

## Assessing the Accuracy of PRISMA Standard Reflectance Products in Globally Distributed Aquatic Sites

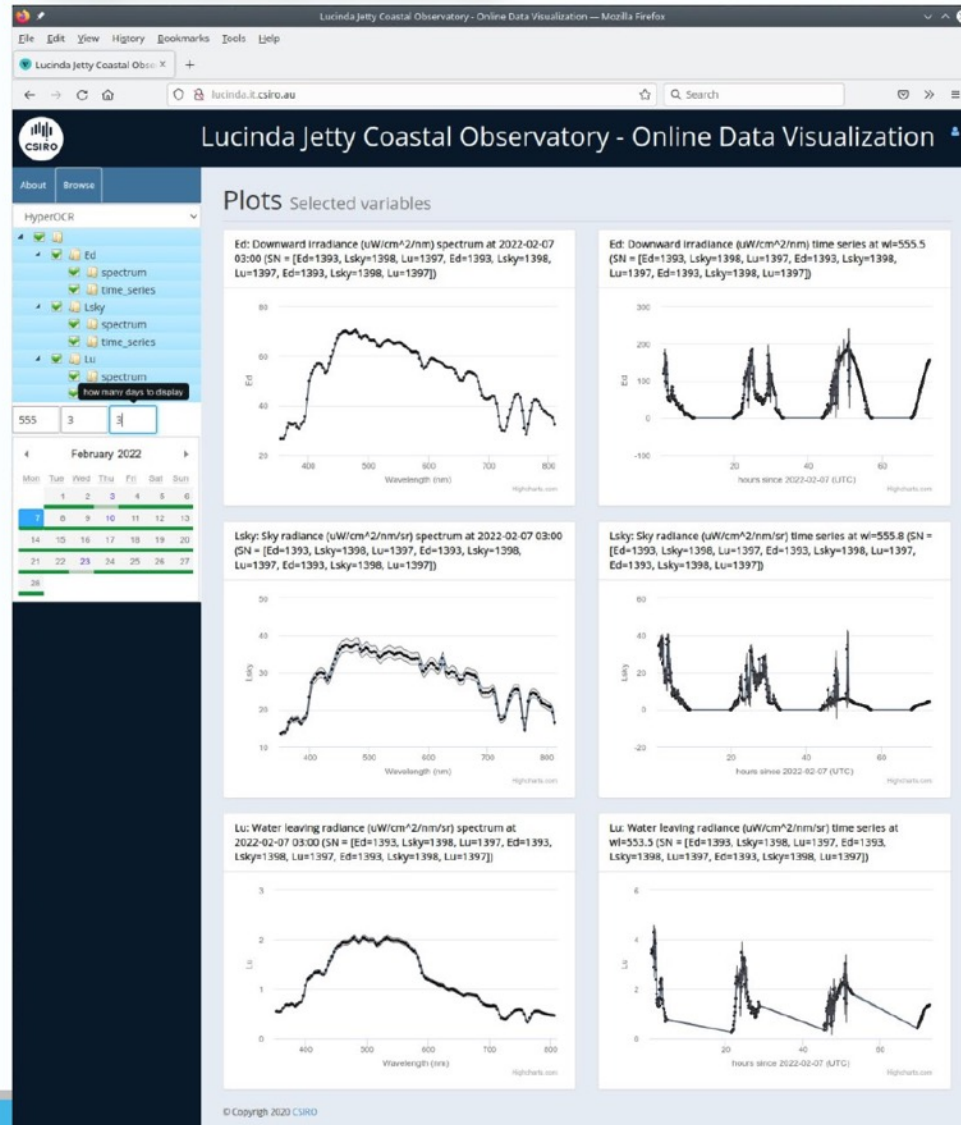
Andrea Pellegrino <sup>1,\*</sup>, Alice Fabbretto <sup>1,2</sup>, Mariano Bresciani <sup>1</sup>, Thainara Munhoz Alexandre de Lima <sup>3</sup>, Federica Braga <sup>4</sup>, Nima Pahlevan <sup>5,6</sup>, Vittorio Ernesto Brando <sup>7</sup>, Susanne Kratzer <sup>8</sup>, Marco Gianinetto <sup>9</sup> and Claudia Giardino <sup>1</sup>

<https://doi.org/10.3390/rs15082163>



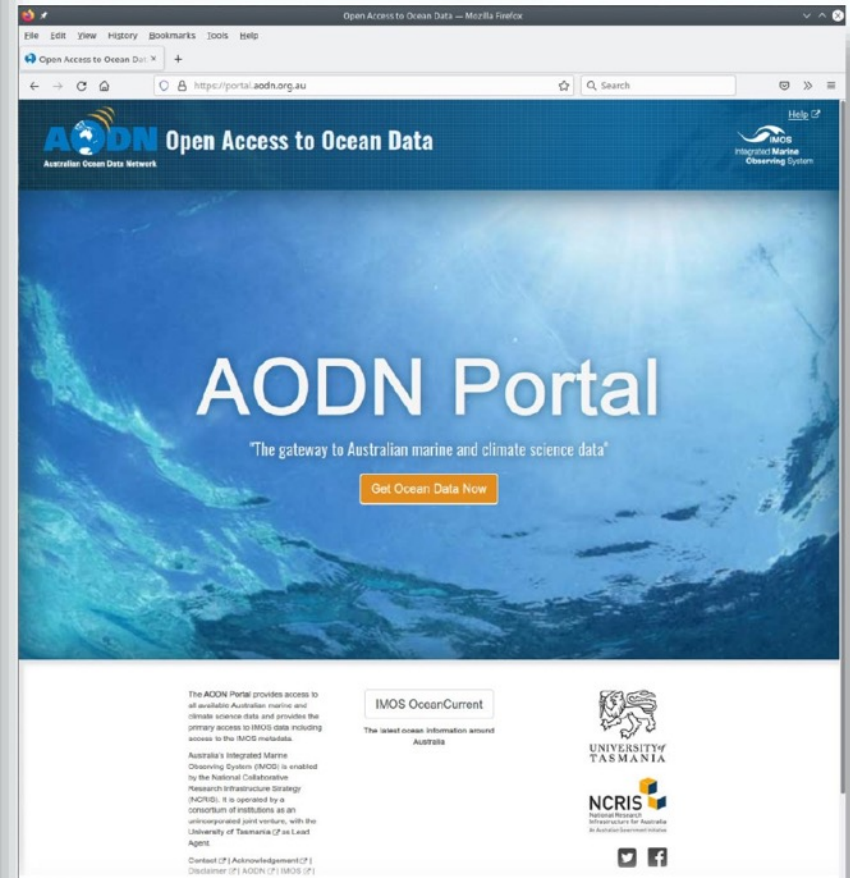
# Online Data Visualization

<https://lucinda.it.csiro.au>



# Data access via AODN

<https://portal.aodn.org.au/>



Curtin University





# Expansion of eReefs capability – Sentinel 1

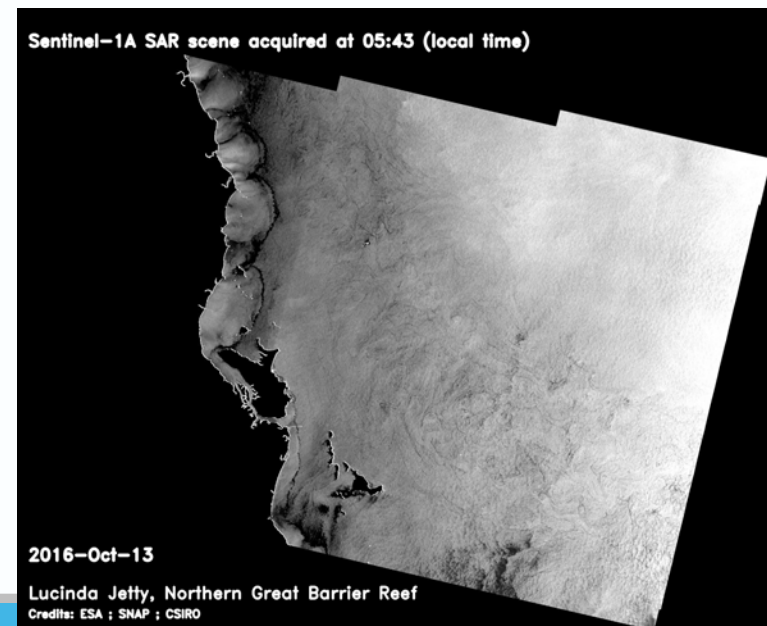
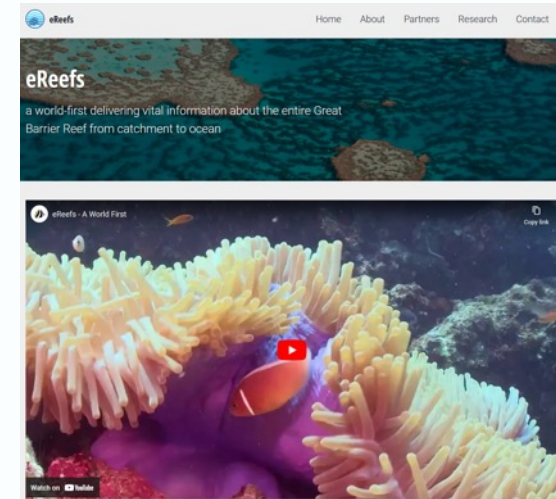
eReefs multi-agency project focused on the Great Barrier Reef

<https://www.eereefs.org.au/>

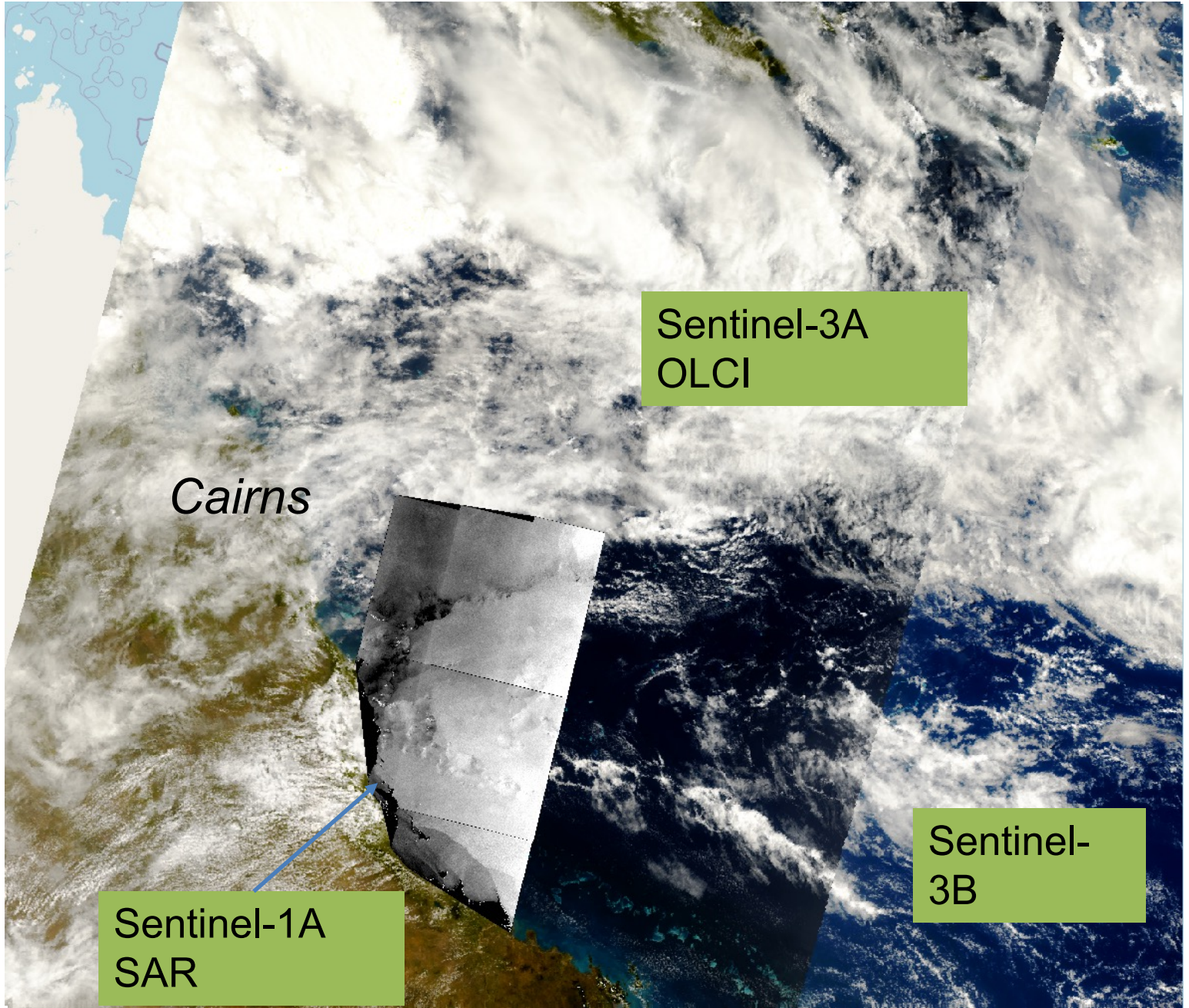
Augmented the large collection of processed Sentinel-3A/B OLCI data with 6500+ Sentinel-1A SAR images since launch

Exploration of multi-sources datasets for enhanced GBR monitoring

Developed an operational oil spills detection system for GBR based on S1 SAR



29<sup>th</sup> December 2022



Sentinel-3A  
OLCI

Cairns

Sentinel-1A  
SAR

Sentinel-3B

# Dark water inland cal-val site established

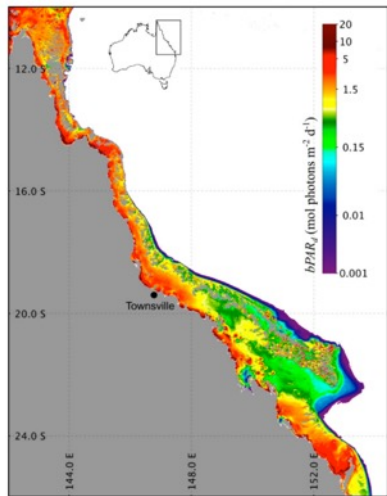
Googong Dam, 30 km SE of Canberra  
Autonomous water surface measurements  
with fortnightly in-water observations  
Aiming for FRM quality measurements  
Phase 1 deployment (end, 2023):

- TriOS Ramses  $E_d$ ,  $L_{sky}$  and  $L_w$
- Pan/tilt unit
- Weather station
- Cameras horizontal and forward-looking
- Water temperature
- Water height

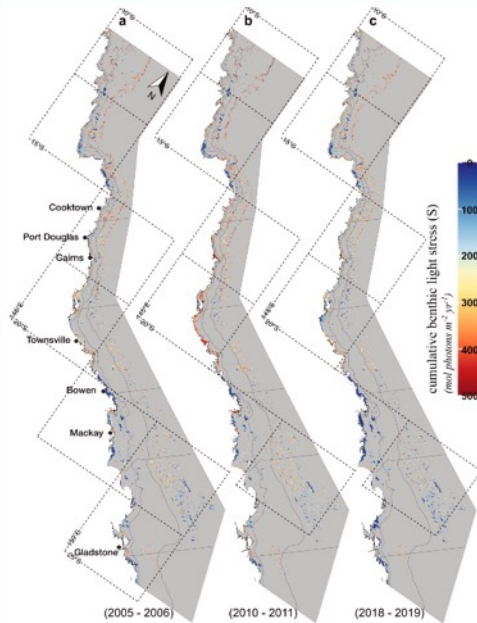
Open access



# GBR benthic light studies



Annual mean of daily integrated benthic PAR



Cumulative (annual) benthic light stress

Marine Pollution Bulletin 169 (2021) 112539



Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: [www.elsevier.com/locate/marpolbul](http://www.elsevier.com/locate/marpolbul)



## A benthic light index of water quality in the Great Barrier Reef, Australia

Marites M. Canto<sup>a,b,c,\*</sup>, Katharina E. Fabricius<sup>b,c</sup>, Murray Logan<sup>b</sup>, Stephen Lewis<sup>d</sup>, Lachlan I. W. McKinna<sup>a,c</sup>, Barbara J. Robson<sup>b,c</sup>

<sup>a</sup> College of Science and Engineering, James Cook University, Townsville, QLD 4811, Australia

<sup>b</sup> Australian Institute of Marine Science, PMB3, Townsville MC, QLD 4810, Australia

<sup>c</sup> AIMS@JCU, College of Science and Engineering, James Cook University, Townsville, QLD 4811, Australia

<sup>d</sup> Centre for Tropical Water and Aquatic Ecosystem Research, Catchment to Reef Research Group, James Cook University, Townsville, QLD 4811, Australia

\*Go2Q Pty Ltd, Sunshine Coast, QLD 4556, Australia

Research Article

Vol. 27, No. 20 | 30 Sep 2019 | OPTICS EXPRESS A1350

Optics EXPRESS

## Model for deriving benthic irradiance in the Great Barrier Reef from MODIS satellite imagery

MARITES M. MAGNO-CANTO<sup>1,2,3,\*</sup>, LACHLAN I. W. MCKINNA<sup>1,4</sup>, BARBARA J. ROBSON<sup>2,3</sup> AND KATHARINA E. FABRICIUS<sup>2,3</sup>

<sup>1</sup> College of Science and Engineering, James Cook University, Townsville, QLD 4811, Australia

<sup>2</sup> AIMS@JCU, Australian Institute of Marine Science, College of Science and Engineering, James Cook University, Townsville, QLD 4811, Australia

<sup>3</sup> Australian Institute of Marine Science, PMB3 Townsville, QLD 4810, Australia

<sup>4</sup> Go2Q Pty Ltd, Sunshine Coast, QLD, Australia

\*[marites.canto@my.jcu.edu.au](mailto:marites.canto@my.jcu.edu.au)

# AquaWatch Australia Mission



## AquaWatch Australia Mission Concept Virtual Satellite Constellation



- Remote-sensing
- In situ obs
- Simulation modelling
- AI/ML modelling
- Informatics

PREVIEW v004

Artists impression 2021



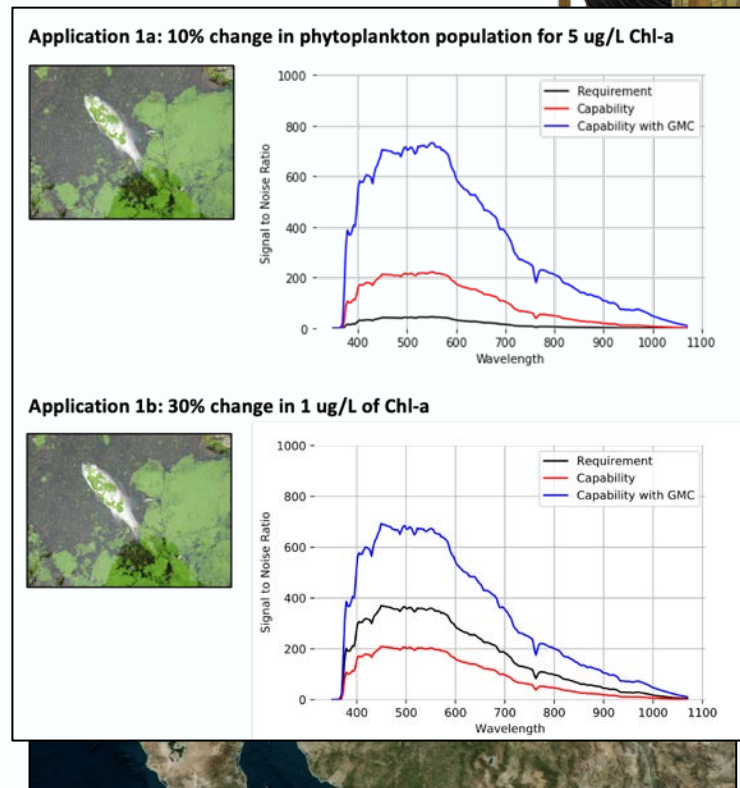
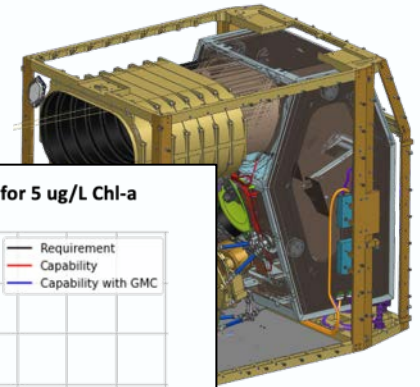
# National and global pilot sites (2021-26)



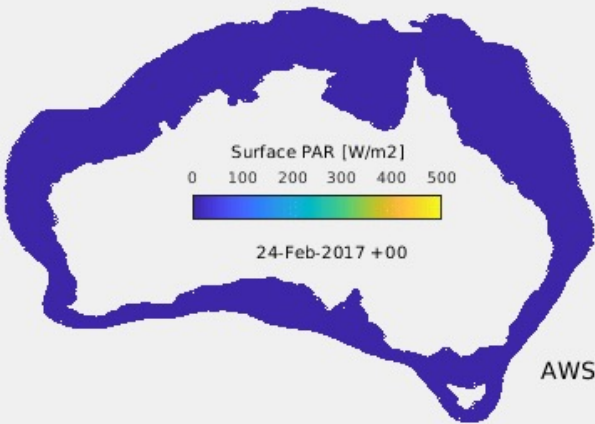
- Active
- Planning
- Expressed interest

# AquaSAT-1 Feasibility study, with NASA JPL

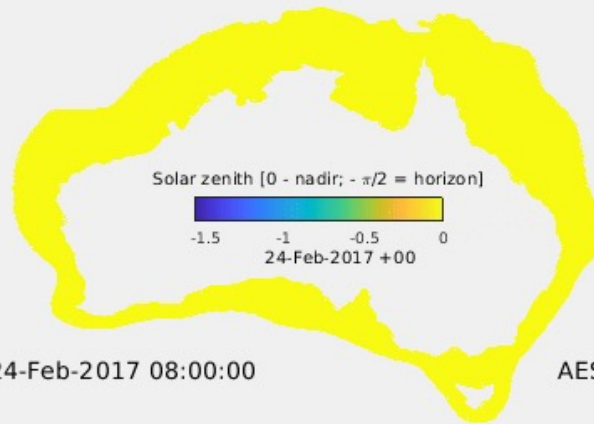
- **Orbit:** sun-synchronous, ~noon crossing time, ~400 km altitude (trade study: 600 km altitude)
- **GSD:** 18 m
- **Imaging coverage:** target sites (key lakes, rivers, estuaries, coral reefs in Australia and the US West)
- **Revisit:** 5 days with +/- 30 deg cross-track slew (not accounting for cloud cover, sunglint, target site conflicts, etc.)
- Dyson imaging spectrometer (350 to 1050 nm, 9.6 nm FWHM)



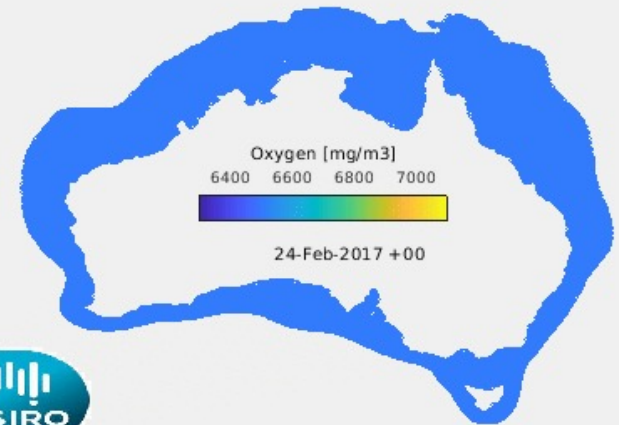
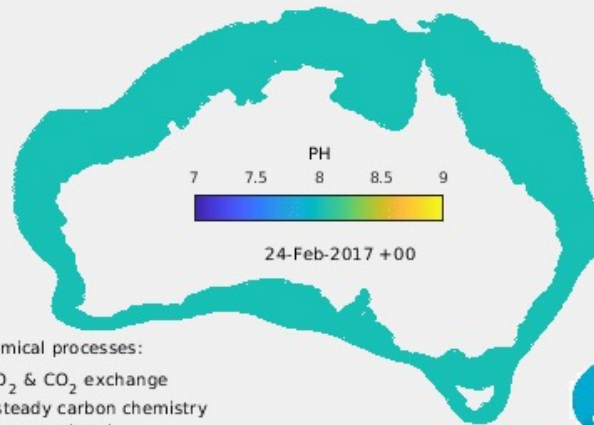
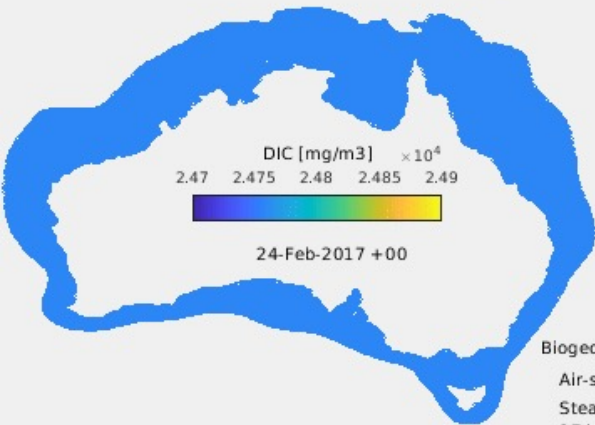
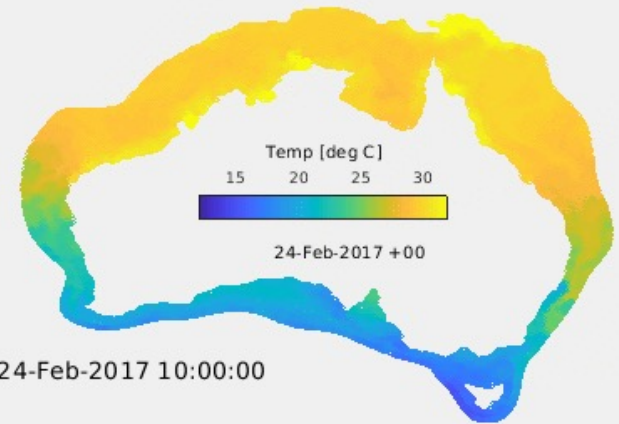
# Proposed: AquaWatch simulation modelling.



AWST 24-Feb-2017 08:00:00



AEST 24-Feb-2017 10:00:00

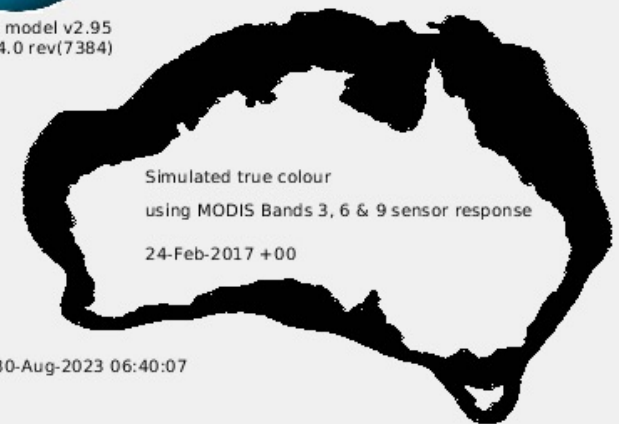
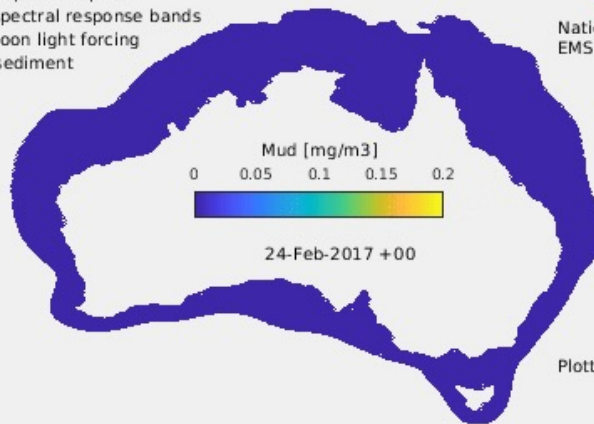
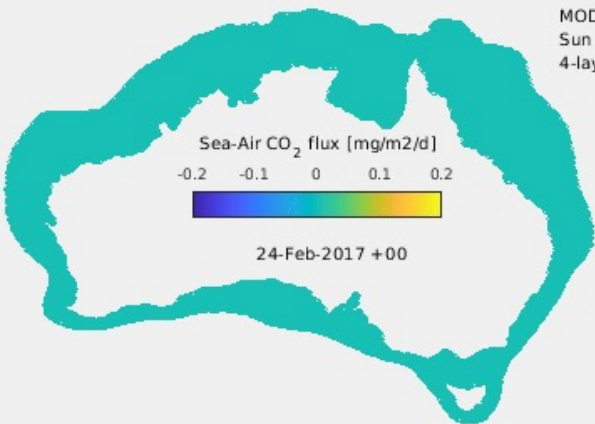


Biogeochemical processes:

- Air-sea O<sub>2</sub> & CO<sub>2</sub> exchange
- Steady-steady carbon chemistry
- 27 band spectral optics
- MODIS spectral response bands
- Sun & Moon light forcing
- 4-layer sediment



National model v2.95  
EMS v1.4.0 rev(7384)

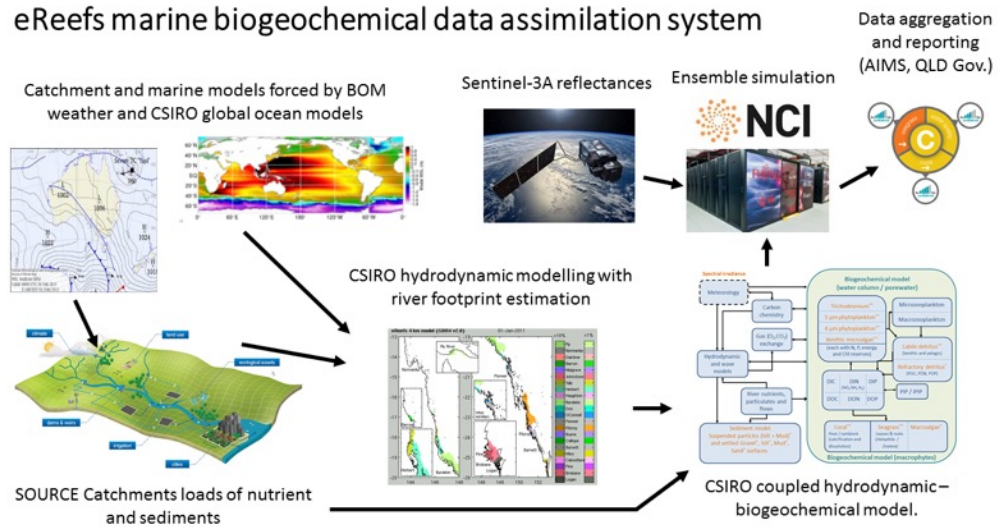


Plotted 30-Aug-2023 06:40:07





# Assimilating multi-platform, multi-band remote-sensing reflectance into a coastal biogeochemical model of the Great Barrier Reef (GBR)



Mark E. Baird<sup>1,\*</sup>, Emlyn M. Jones<sup>1</sup>, Roger Scott<sup>1</sup>, Mathieu Mongin<sup>1</sup>, Thomas Schroeder,<sup>1</sup> David Blondeau-Patissier<sup>1</sup>, Tim Malthus<sup>1</sup> + the eReefs team

<sup>1</sup>CSIRO Environment, Australia  
\*mark.baird@csiro.au

eReefs is a collaboration between



GREAT BARRIER REEF  
*foundation*

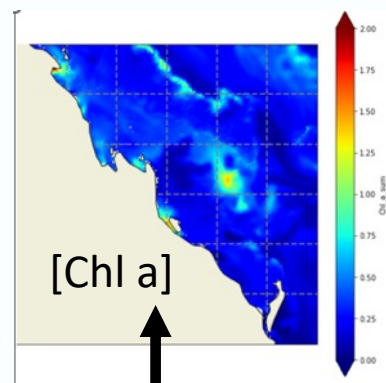
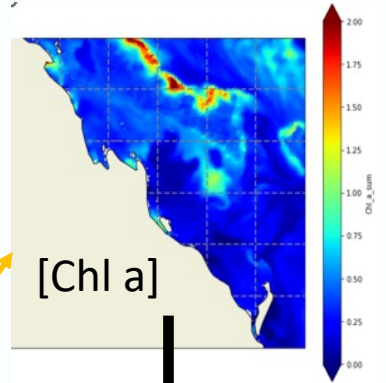
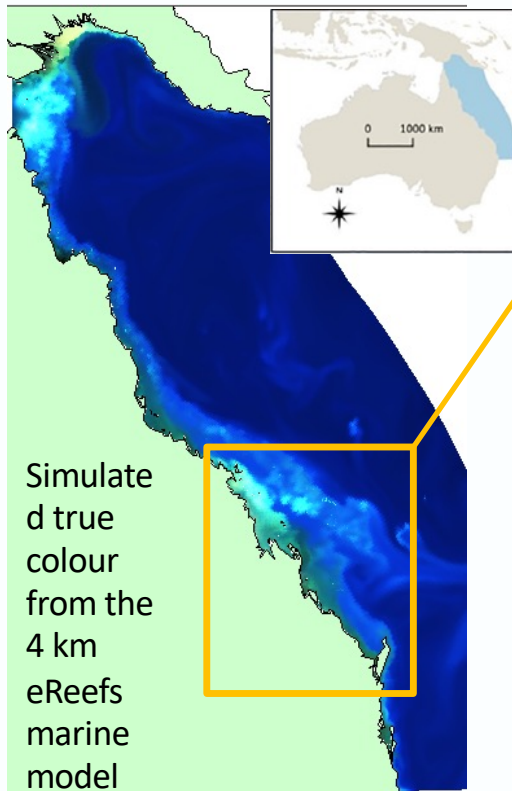


Optically – complex waters containing CDOM, microalgae, suspended sediments.

Optical model calculates remote-sensing reflectance from constituents.

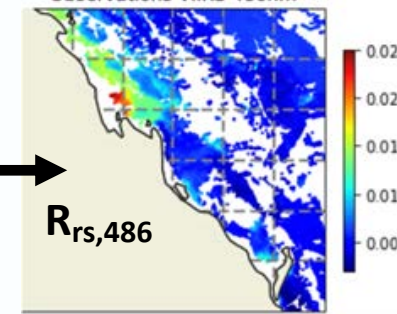
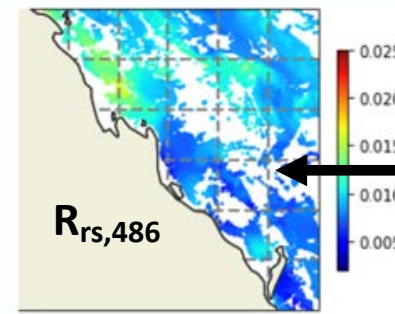
Data assimilation uses mismatch of observed and predicted  $R_{rs}$  to update constituents.

Teaser: Can the multi-platform  $R_{rs}$  observations update the different coloured constituents in the appropriate places?



Simulated  $R_{rs}$

Observed  $R_{rs}$





# Thank you

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