CELEBRATING 20 YEARS
OF SUSTAINED MARINE OBSERVING

IMOS
Integrated Marine Observing System

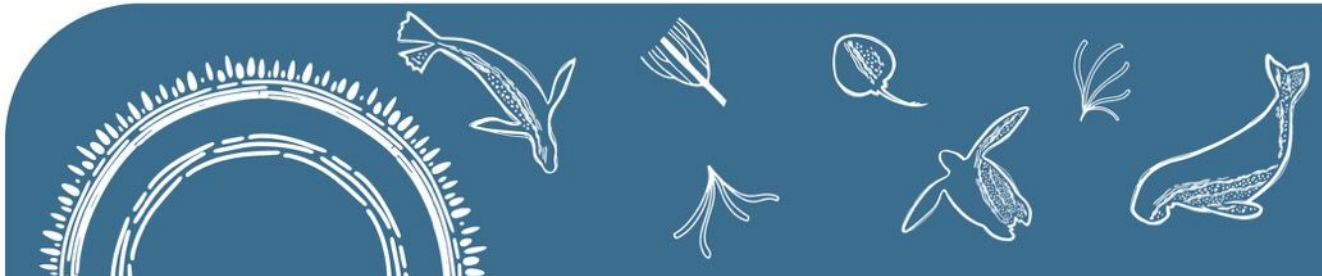
IMOS Ocean Colour

Retrospective 2006-2026

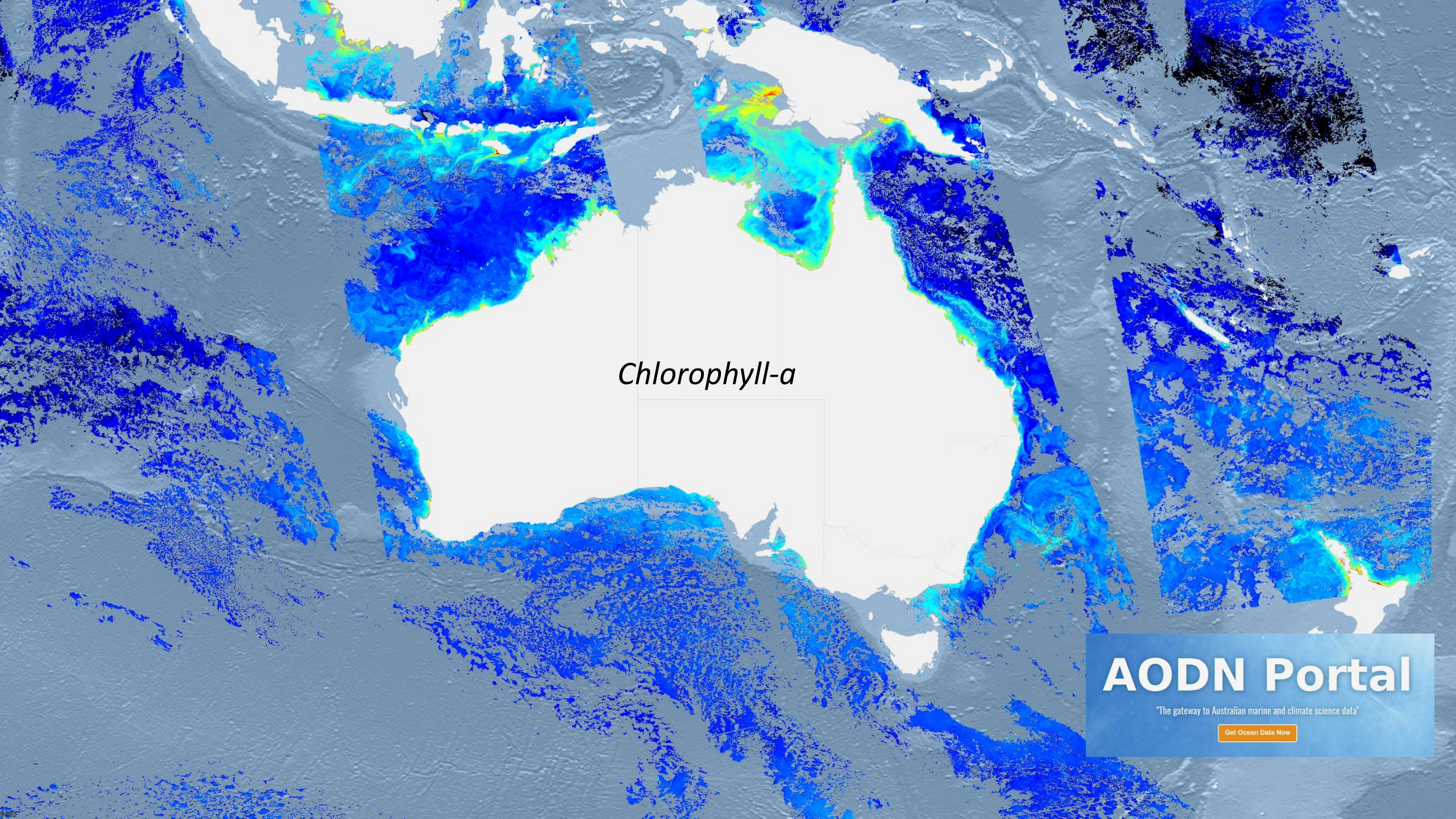
Thomas Schroeder, David Antoine, Elisabeth Brewer, Tim Burrell, Tess Canto, David Barker, Edward King, Jenny Lovell, Jordan Marano, Tenneal Maskell, Juliet Morris, Tim Hogarty, Albertina Dias, Yi Qin, and Roger Scott

CSIRO

Curtin University



IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe, and recognise them as Australia's first marine scientists and carers of sea Country. We pay our respects to Aboriginal and Torres Strait Islander peoples past and present.


Chlorophyll-a
AODN Portal
"The gateway to Australian marine and climate science data"
Get Ocean Data Now

IMOS Satellite Ocean Colour Sub-facility Cal/Val

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

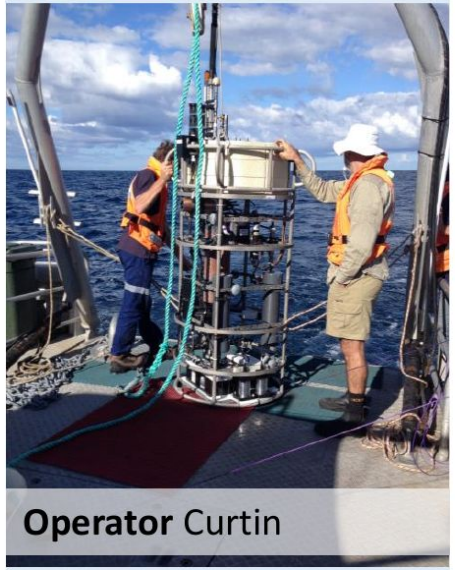
Validation and production of satellite Ocean Colour products for the wider Austral-Asian region

Lucinda Jetty Coastal Observatory (LJCO)
Fixed Platform, QLD

Operator CSIRO

Observations
Above-water radiometry
In-water optics
Biogeochemical samples

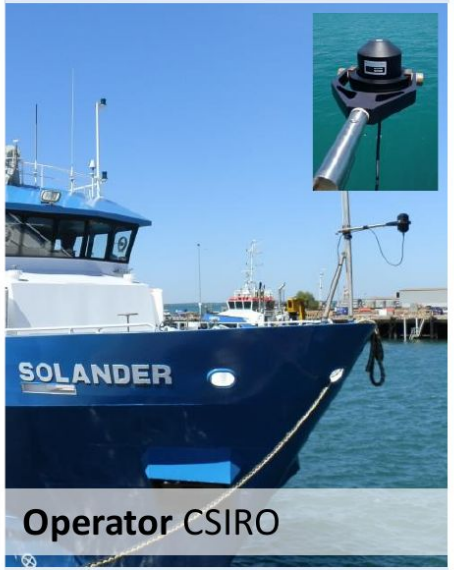
Rottnest Island NRS
Profiler, MarONet
Bio-optical sampling, WA



Operator Curtin

Observations
In-water radiometry
In-water optics

DALEC on AIMS RV Solander
En-route Radiometry, AU



Operator CSIRO

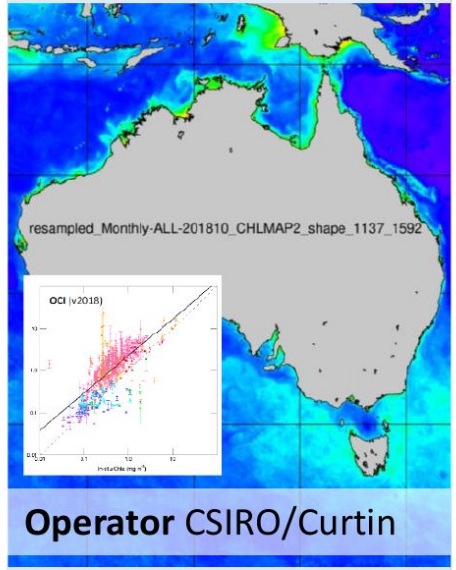
Observations
Above-water radiometry

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

Products
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

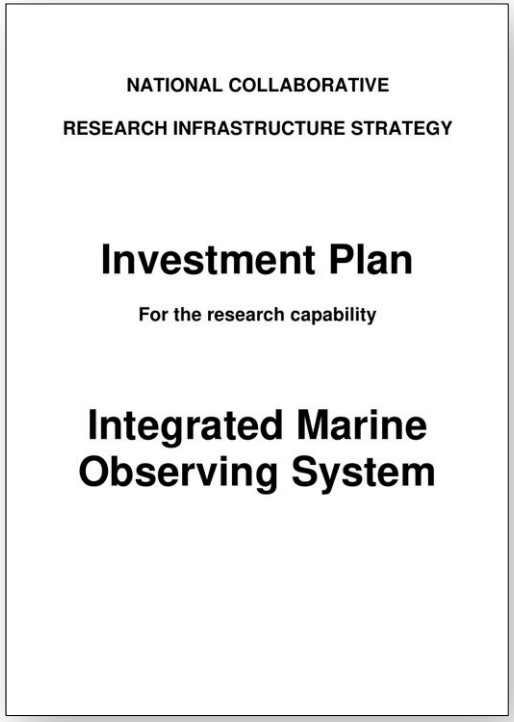
In a nutshell

"The Ocean Colour Sub-facility
colllects in-situ marine observations that enable the
production and delivery of regionally validated ocean colour products for a
wide range of national and international stakeholders
(research community, public, government and international Space Agencies)"

How did it all start?

- **Oct 2006** IMOS Investment Plan submitted – accepted May 2007

  Satellite Colour Calibration/Validation (6g) under Australian Ocean Mooring Network
  $0.5M to establish and equip 2 sites – co-located with Long Term Reference Stations



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IMOS Integrated Marine Observing System

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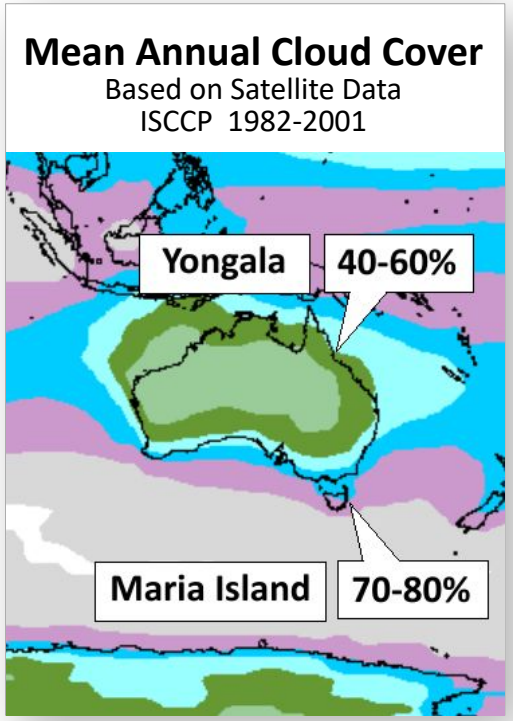

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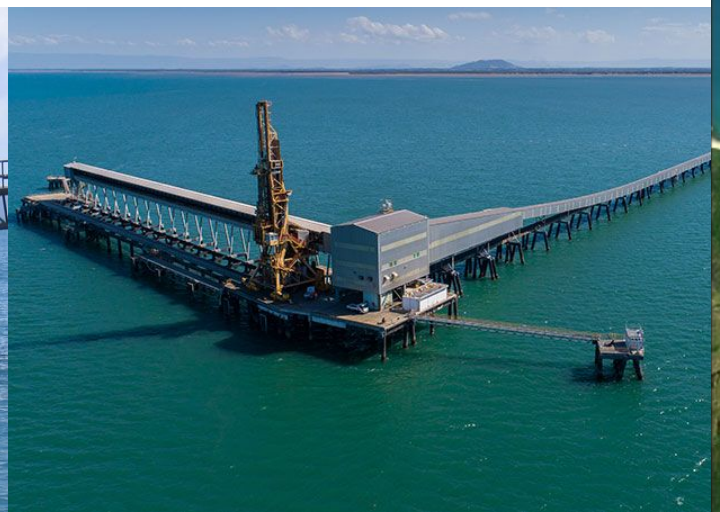

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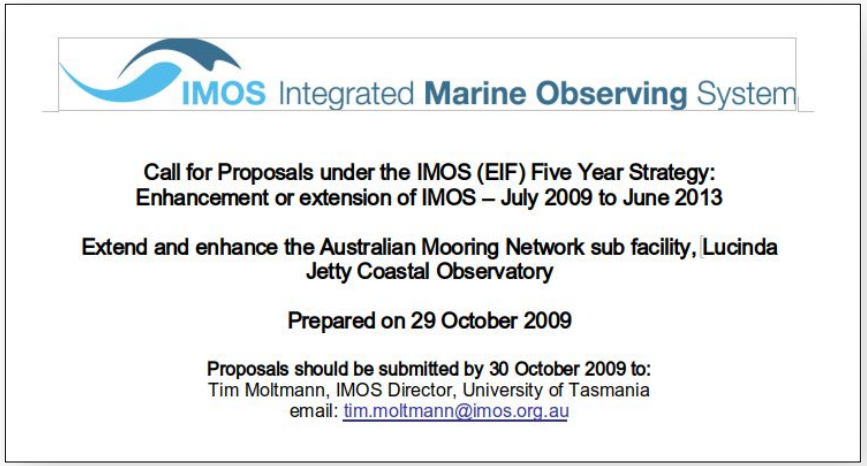
- **Oct 2009** Installation of the **IMOS Lucinda Jetty Coastal Observatory**

Ocean Colour enhancement/extension 2009-13

- **Oct 2009** IMOS 5-Year Strategy 2009-13 proposal submitted
- Redeveloped early 2010 to incorporate board recommendations better alignment with Bluewater and Climate Nodes.
- New activities proposed. Almost similar to today's structure.



IMOS Integrated Marine Observing System

Call for Proposals under the IMOS (EIF) Five Year Strategy:
Enhancement or extension of IMOS – July 2009 to June 2013

Extend and enhance the Australian Mooring Network sub facility, Lucinda Jetty Coastal Observatory

Prepared on 29 October 2009

Proposals should be submitted by 30 October 2009 to:
Tim Moltmann, IMOS Director, University of Tasmania
email: tim.moltmann@imos.org.au

Lucinda Jetty Coastal Observatory

1) Bio-optical Database for Australian waters (new)
2) Regionally validated Ocean Colour products (new)
3) DALEC (shipborne radiometry) (new)

} Sub-Facilities

11d SRS Ocean Colour

National Reference Station Bio-optics (new)
Discontinued 2016/17 due to unresolvable technical issues

} **6f** ANMN National Reference Stations

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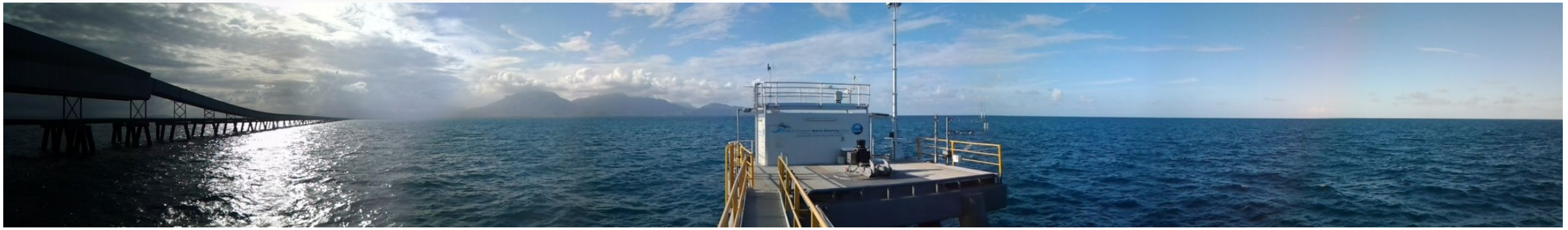
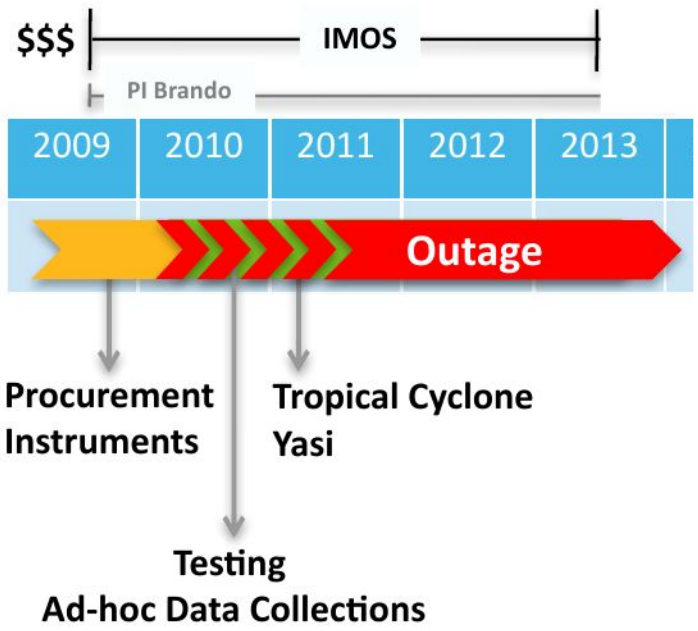
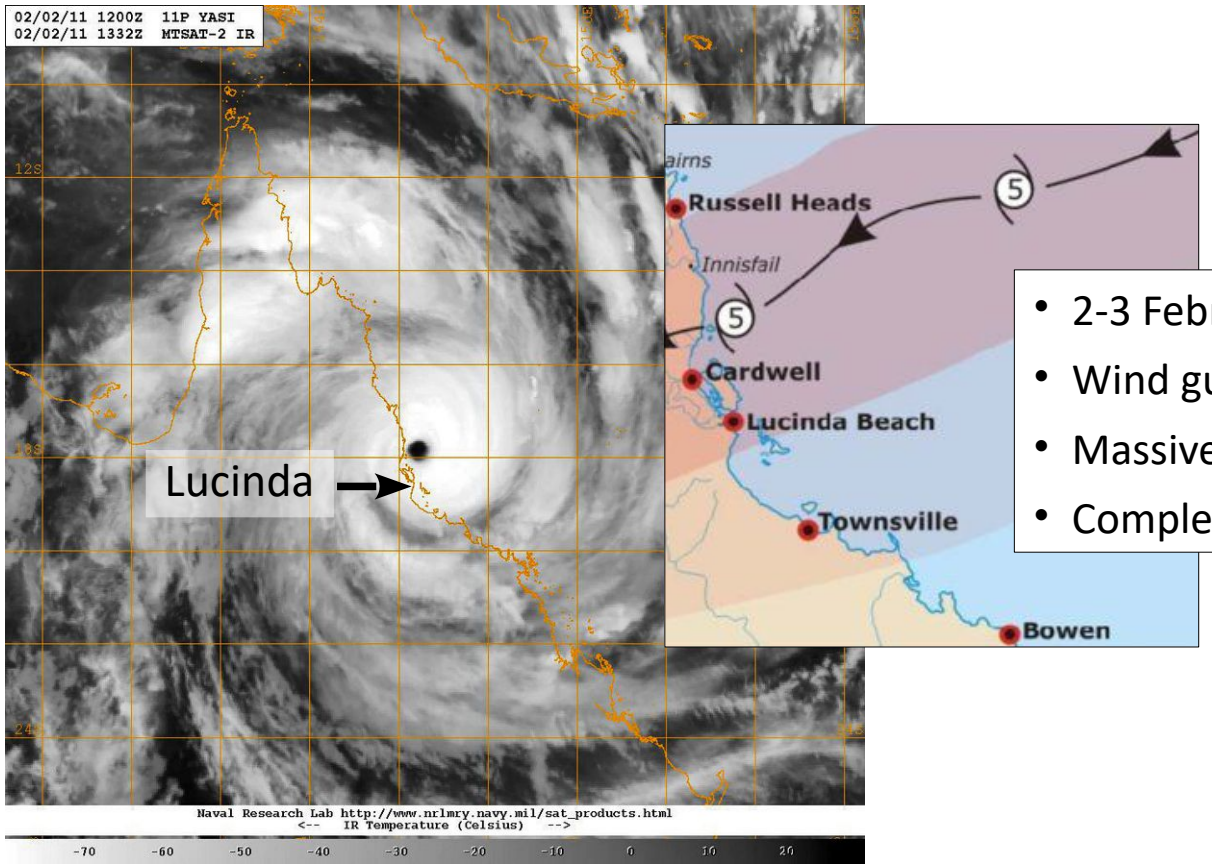
IMOS Integrated Marine Observing System

Lucinda Jetty Coastal Observatory – Challenging early years







- 2-3 February 2011
- Wind gusts up to 185 km/h
- Massive tidal swell
- Complete loss of the enclosure

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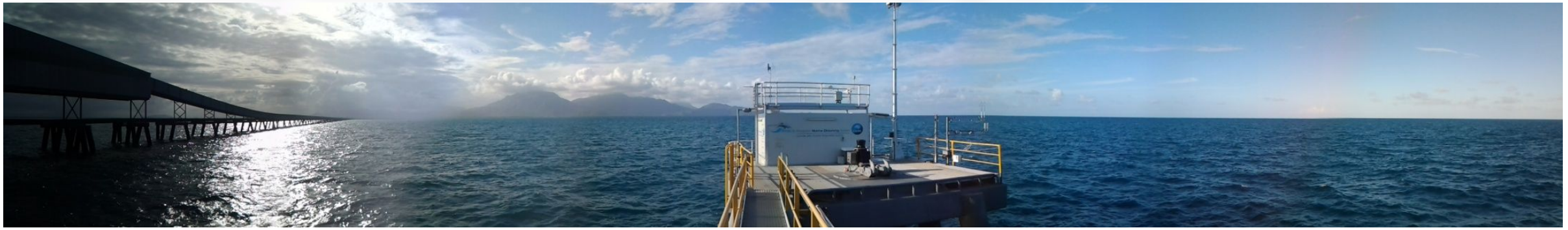
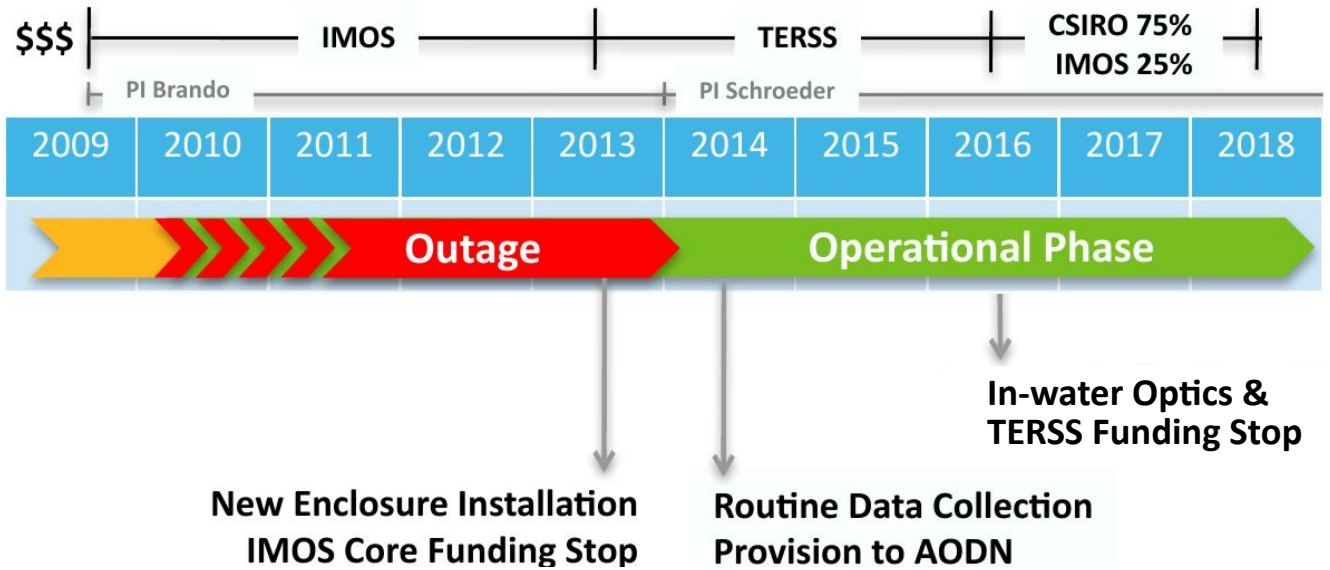
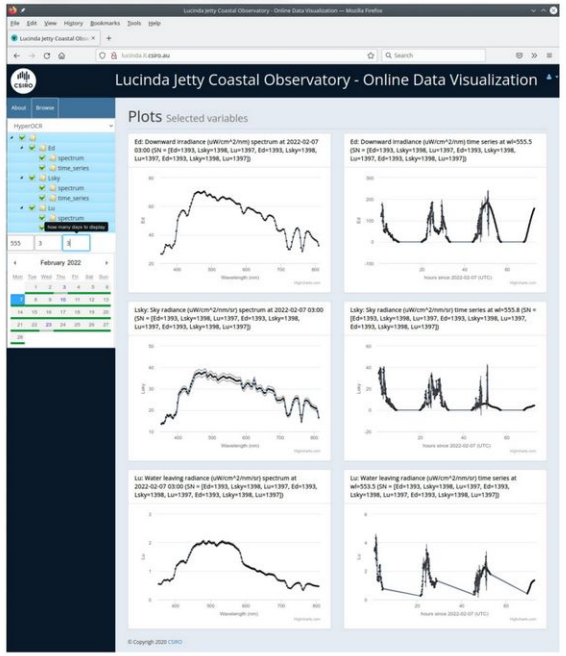
Lucinda Jetty Coastal Observatory – Challenging early years





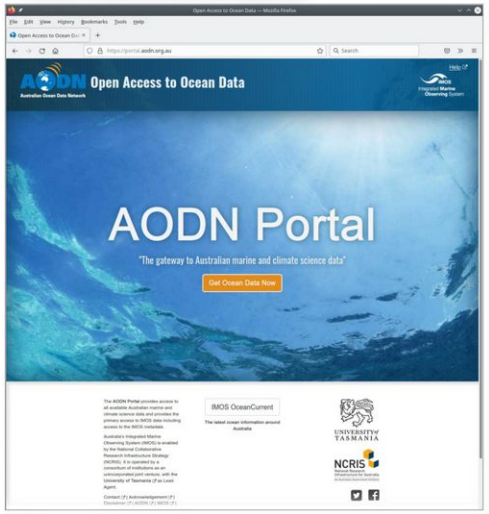
Online Data Visualization

https://lucinda.it.csiro.au



Data access via AODN

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



TERSS: Tasmanian Earth Resources Satellite Station, X-band ground station, decommissioned in 2014

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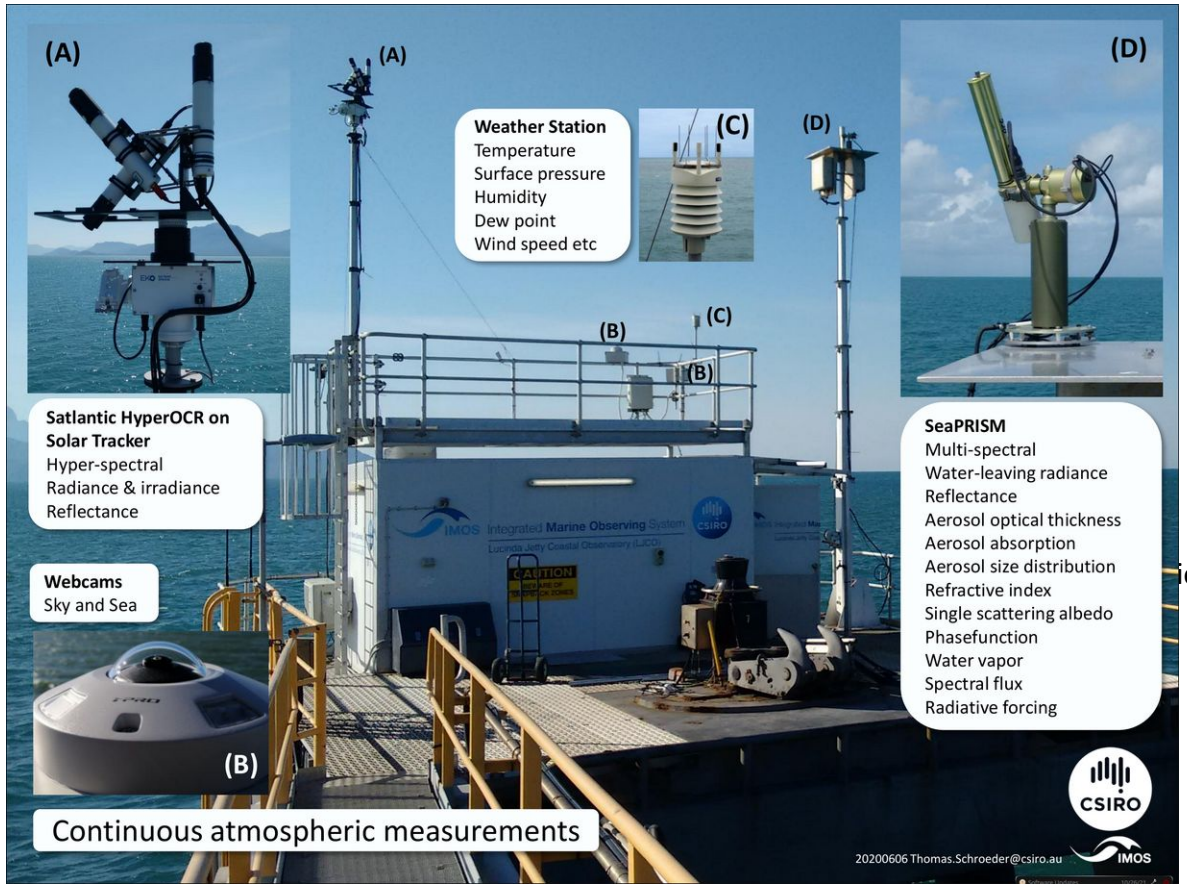
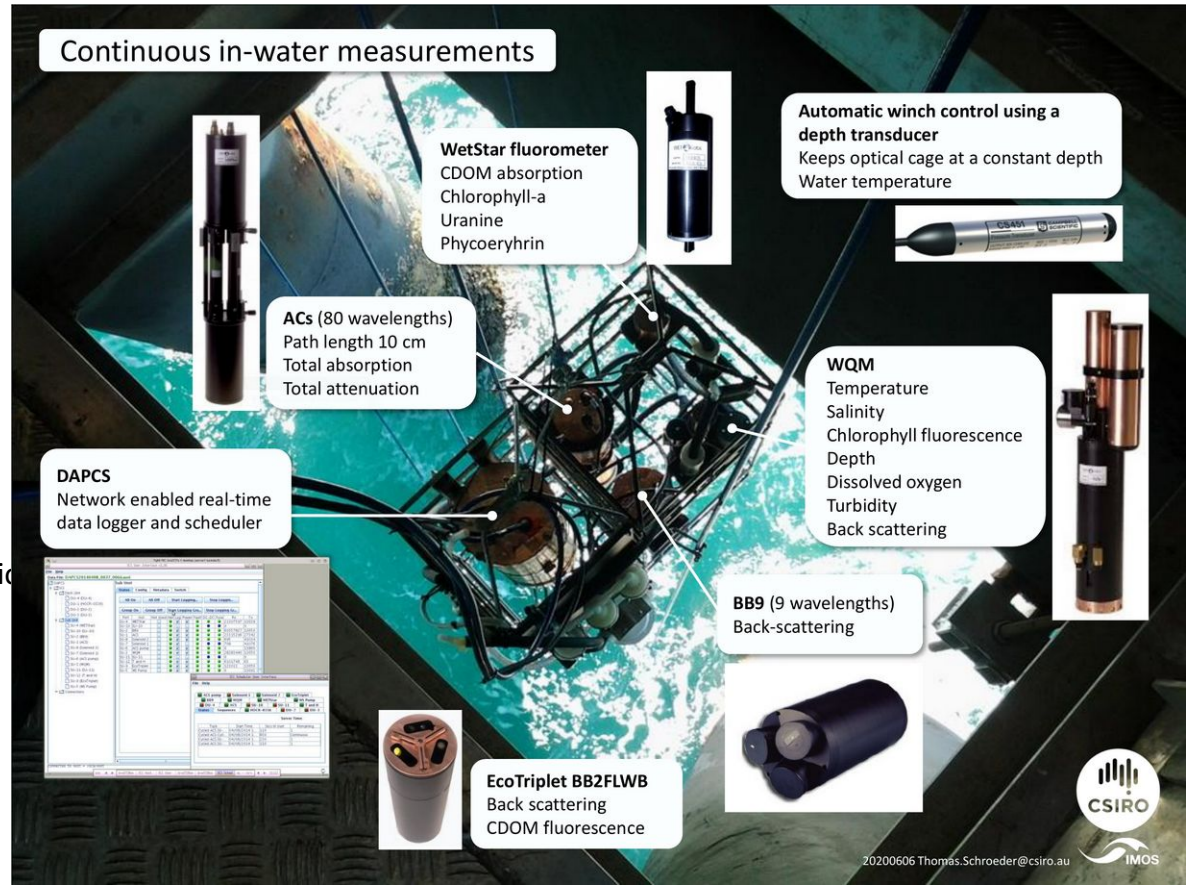
Lucinda Jetty Coastal Observatory



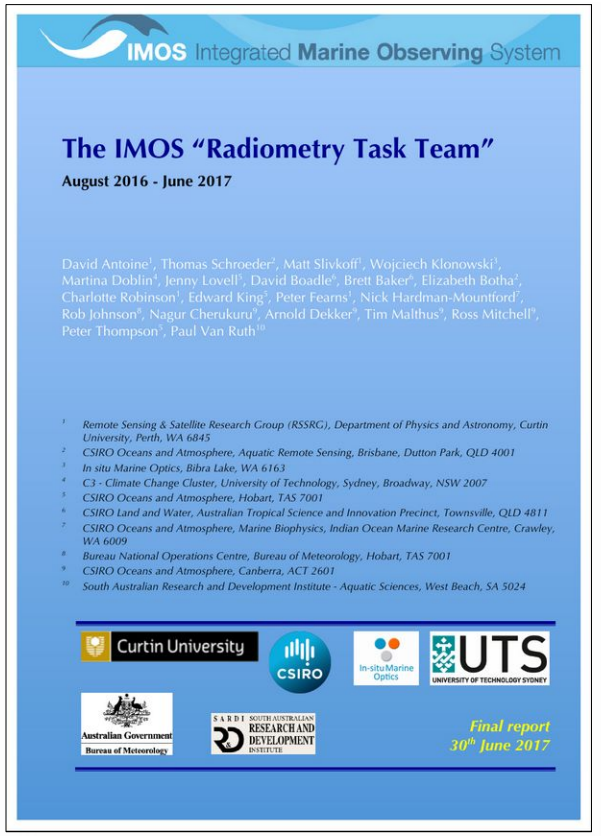


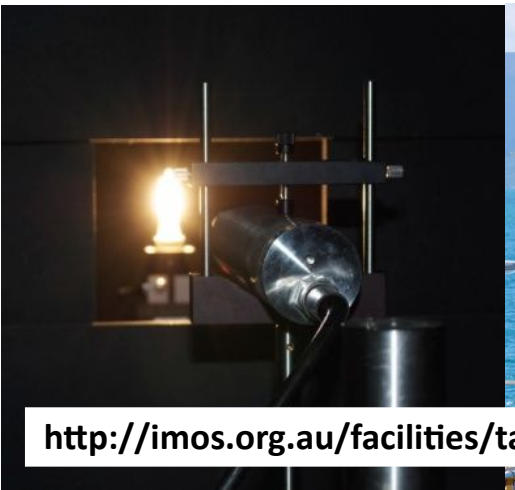
10 instrument deliver 65 data streams/products

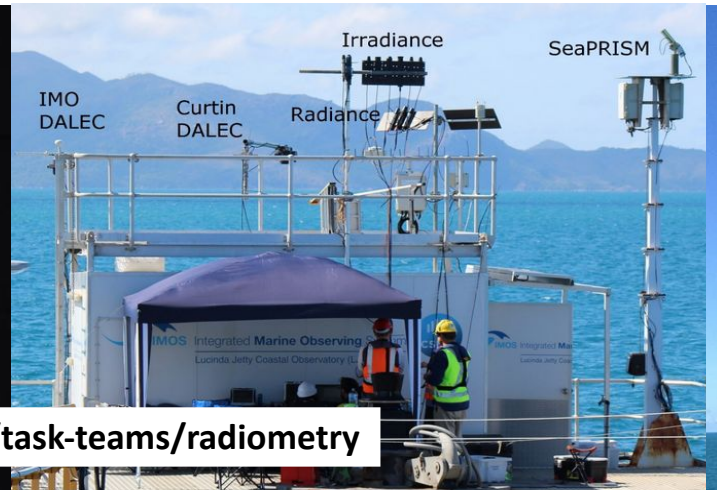
IMOS Radiometry Task Team 2016-17

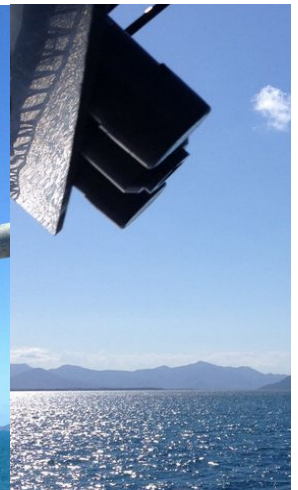
Curtin, CSIRO, UTS, BoM, SARDI, IMO

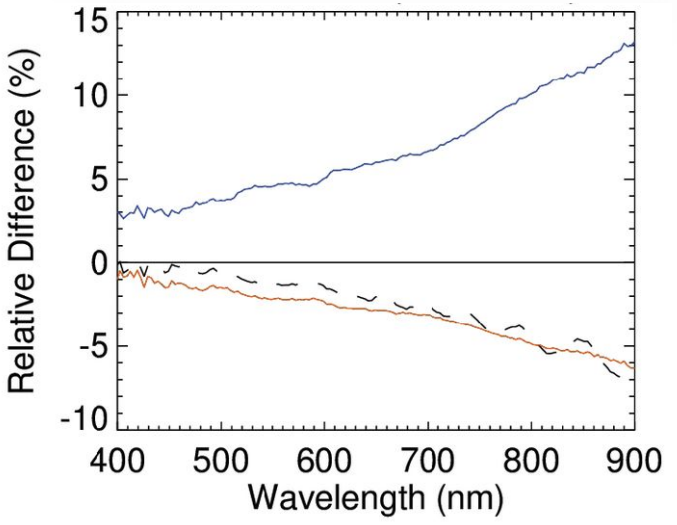
- **Objective:** Evaluate and if needed, **improve consistency of radiometric measurements** used in the IMOS and wider bio-optical community through **laboratory and field inter-comparisons**
- Sensor temperature was found to have an influence on spectral calibration coefficients magnitudes. Up to **0.56%/ C blue bands and -0.42%/ C NIR**
- **Temperature correction for DALEC now routinely implemented** by In-situ Marine Optics Temperature ramp ~15-45 C
- **List of 26 recommendations.** Provided justification for on-going support of the Lucinda Jetty Coastal Observatory.
- Continued funding for Curtin to implement specific recommendations.









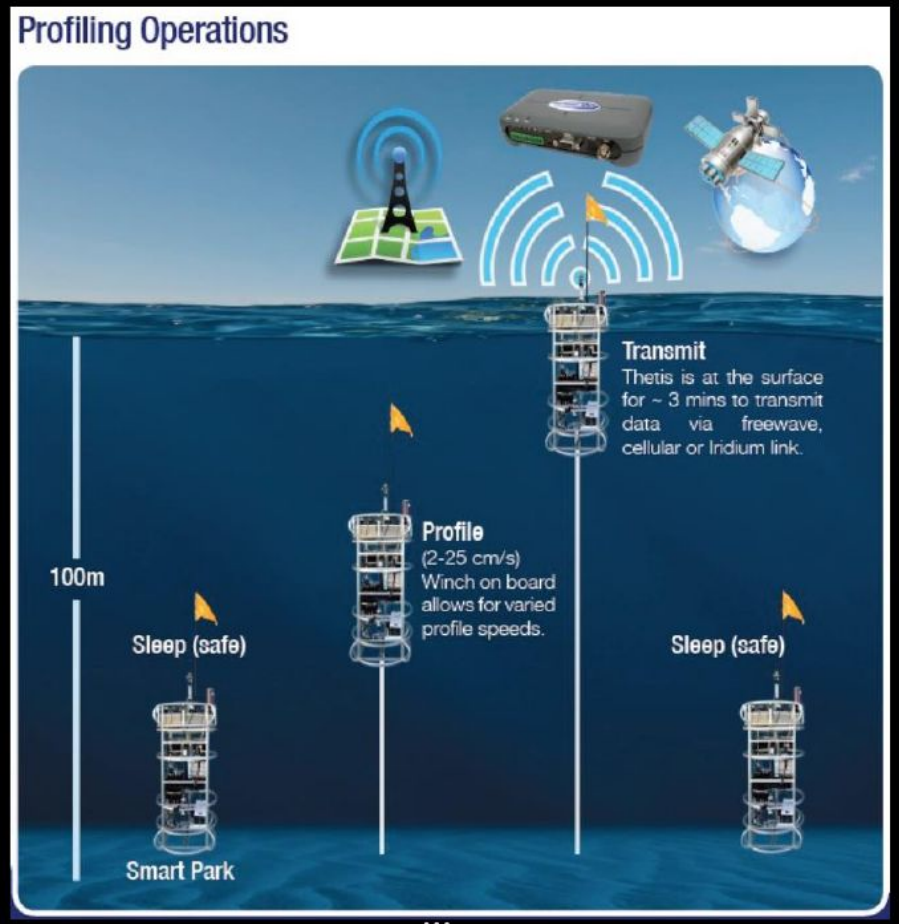


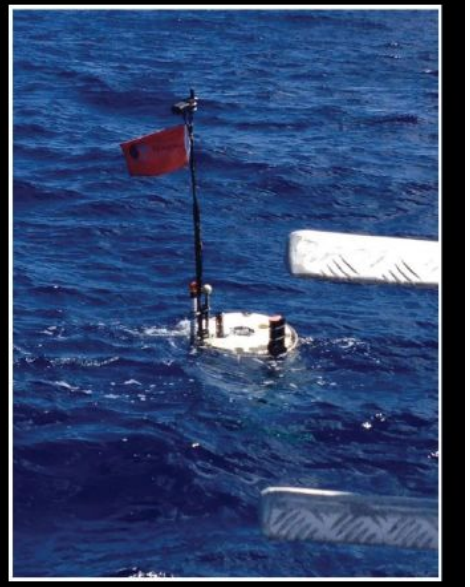
http://imos.org.au/facilities/task-teams/radiometry

Rottnest Island Thetis Profiler Mooring

Autonomous in-water oceanographic profiling system

- **2017 – 2021**, oligotrophic-mesotrophic conditions, bottom depth ~60 m
- Temperature, salinity, DO, chlorophyll and CDOM fluorescence, attenuation + absorption, back scattering 470, 532, and 700 nm, upwelling radiance (nadir) downward irradiance



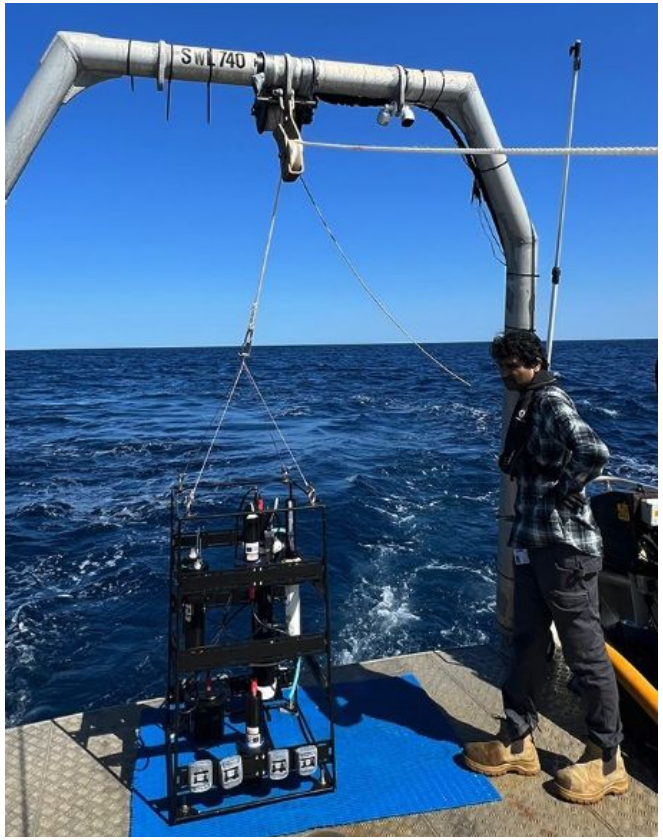


Discontinued 2023
due to ongoing technical issues

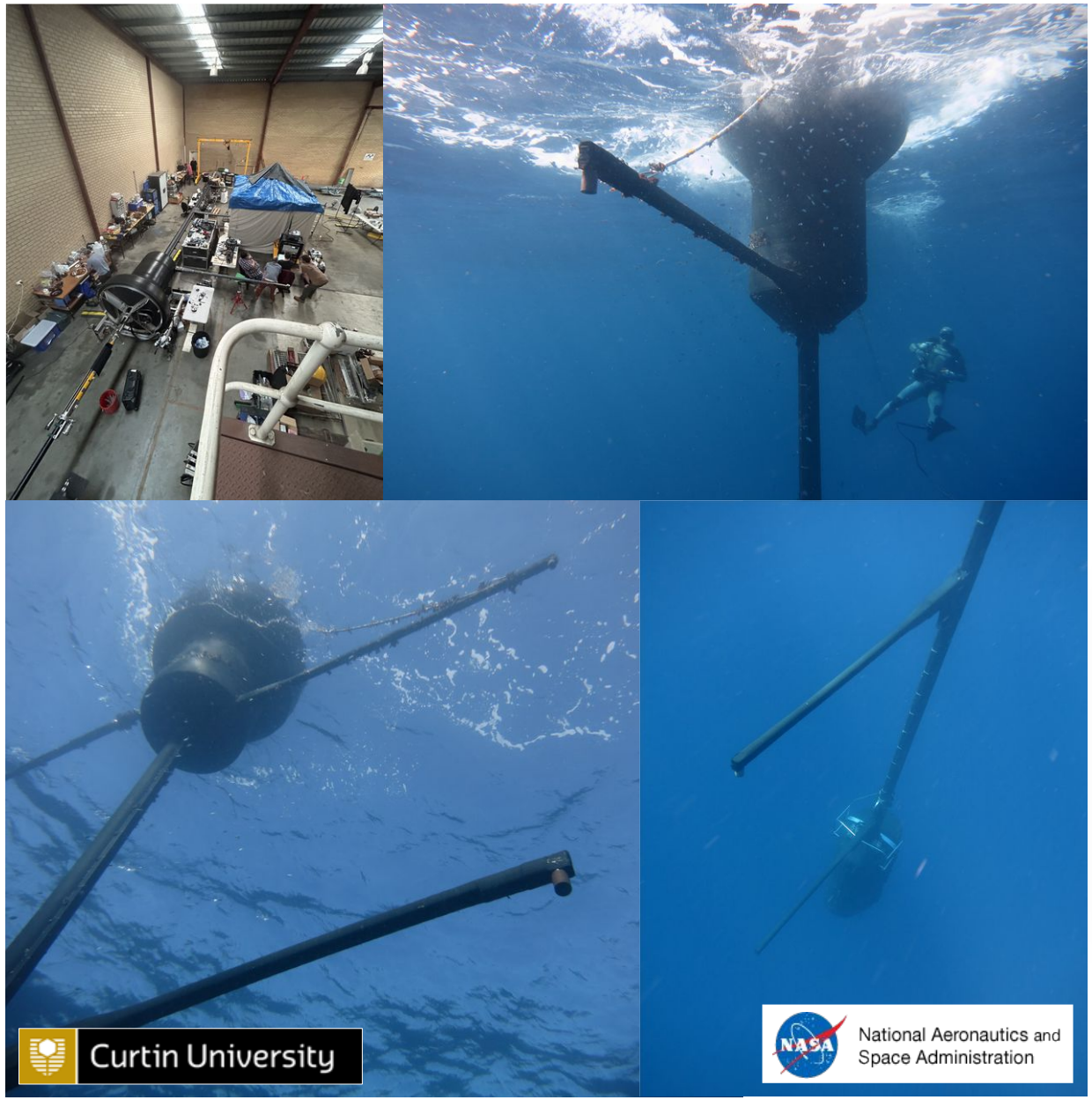
Contact:
David.Antoine@curtin.edu.au
Curtin University

Monthly bio-optical sampling at IMOS NRS

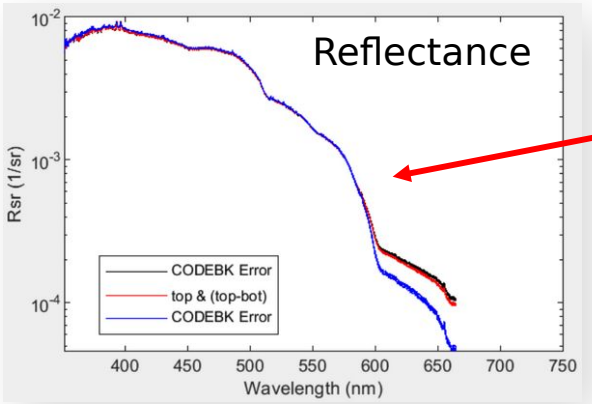
- Started March **2024**
- Hyperspectral radiometry, absorption/attenuation, multi-spectral backscattering and Chl fluorescence, plus T/S and sampling for CDOM absorption



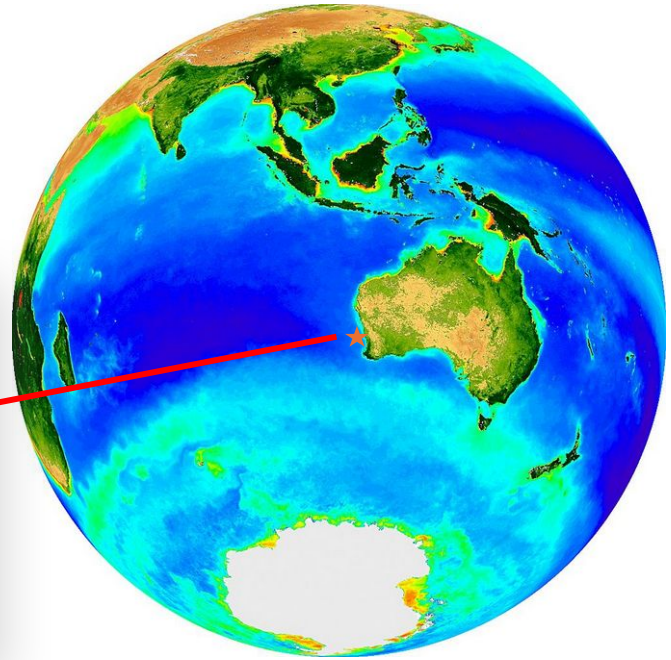
Additional support provided by IMOS for the Marine Optical Network (MarONet) buoy



Curtin University's RSSRG hosts the "Marine Optical Network" (**MarONet**), deployed 45 km off Perth, in deep clear waters. This unique equipment is the new generation "system vicarious calibration" (SVC) buoy for the NASA PACE mission



Operating since September 2024



UNIVERSITY OF MIAMI NIST SJSU

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IMOS Integrated Marine Observing System

Lucinda upgrades 2026 (external co-investment)

HYPSTAR-SR hyper-spectral radiometer funded by ESA ($150K)
SeaPRISM T-model funded by Landsat-Next USGS/GA ($250K)

(Artist impression)

Satlantic
HyperOCR

HYPSTAR-SR

SeaPRISM

CSIRO lab

AAOT, Image credit: HYPERNETS

CSIRO

IMOS

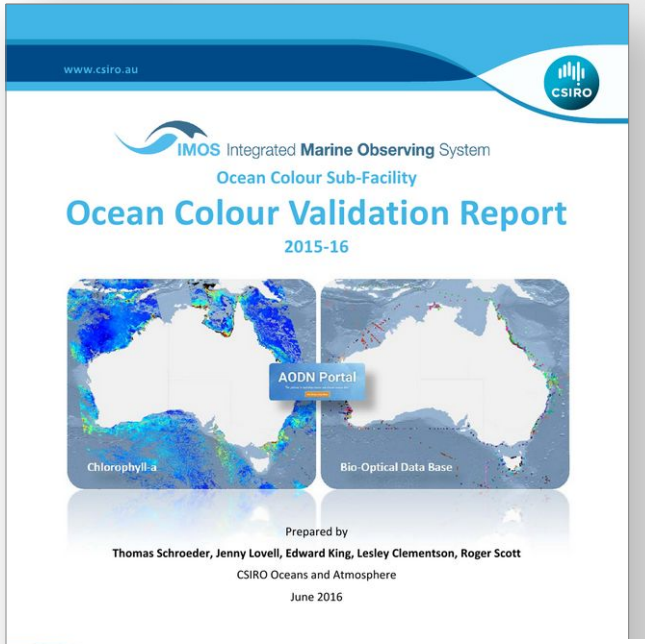
HYPERNETS

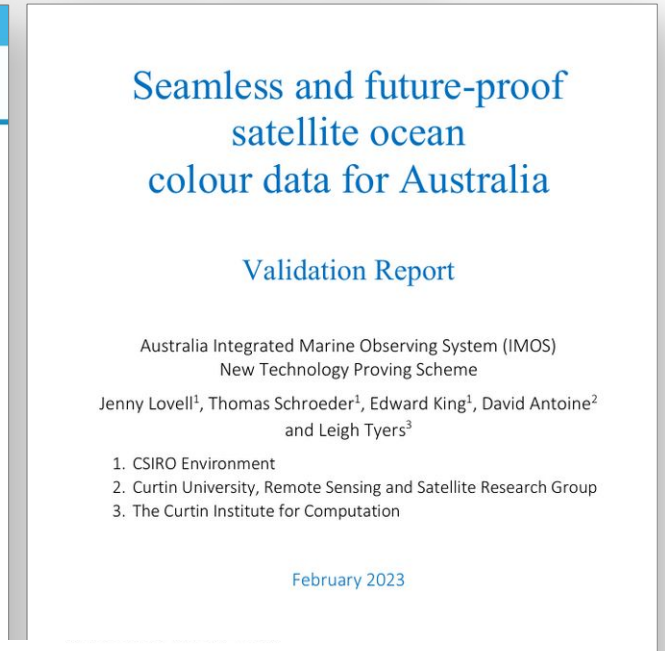
esa

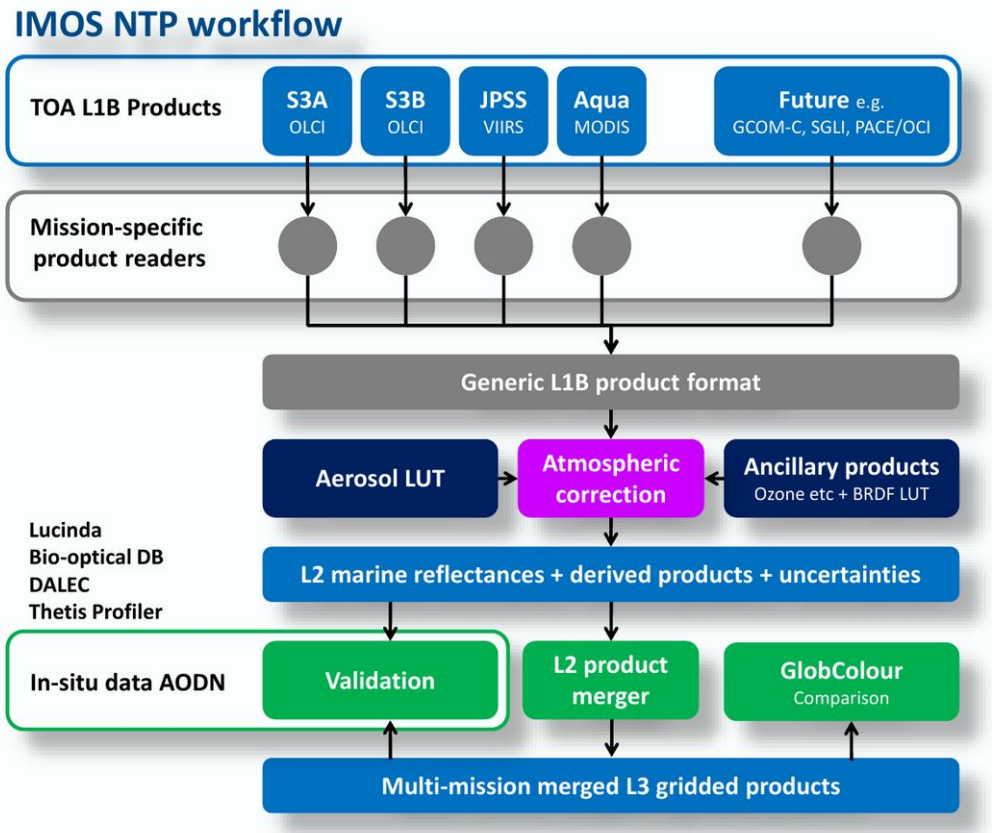
PI/Contact: Thomas.Schroeder@csiro.au

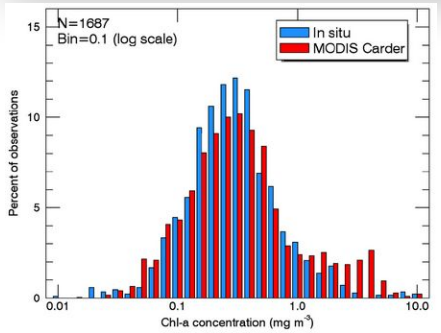
Regionally validated Ocean Colour Products

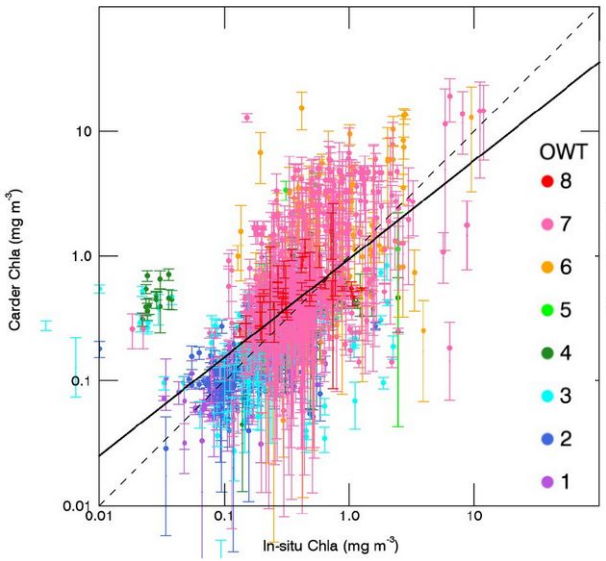
Closing the link between in-situ and satellite observations

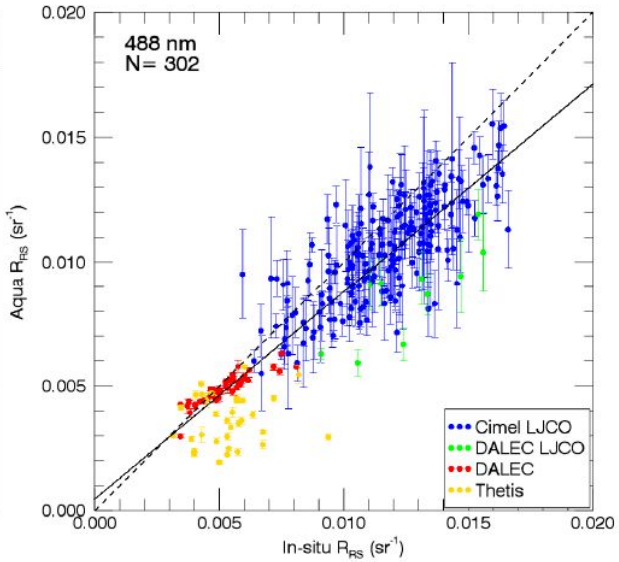


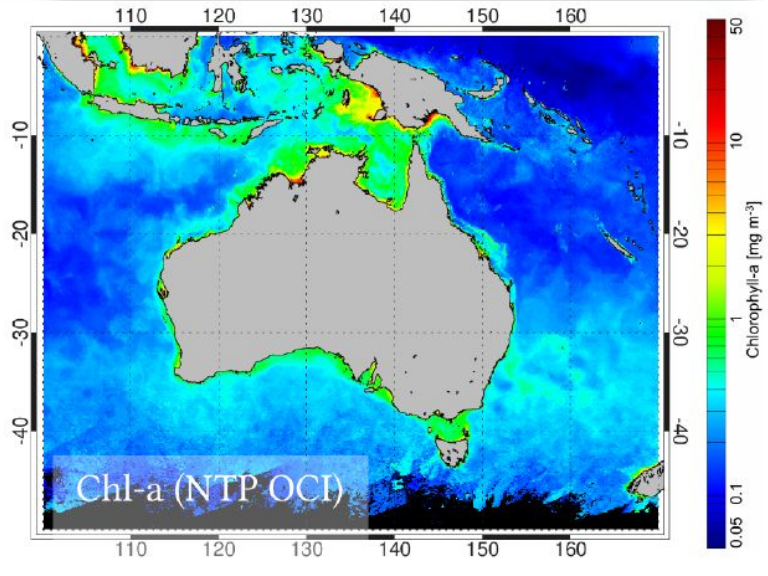












Outcomes & Impacts

- **IMOS Ocean Colour delivers world-class observations** for satellite ocean colour validation and algorithm development

Outcomes & Impacts

- **IMOS Ocean Colour delivers world-class data** for satellite ocean colour validation and algorithm development
- In-situ data and validated satellite products **support a wide range of national projects end users and stakeholders**
  - Bluelink ROAM-Biovis (partnership between Defense, BoM and CSIRO), eReefs, AquaWatch, Reef Authority, ...

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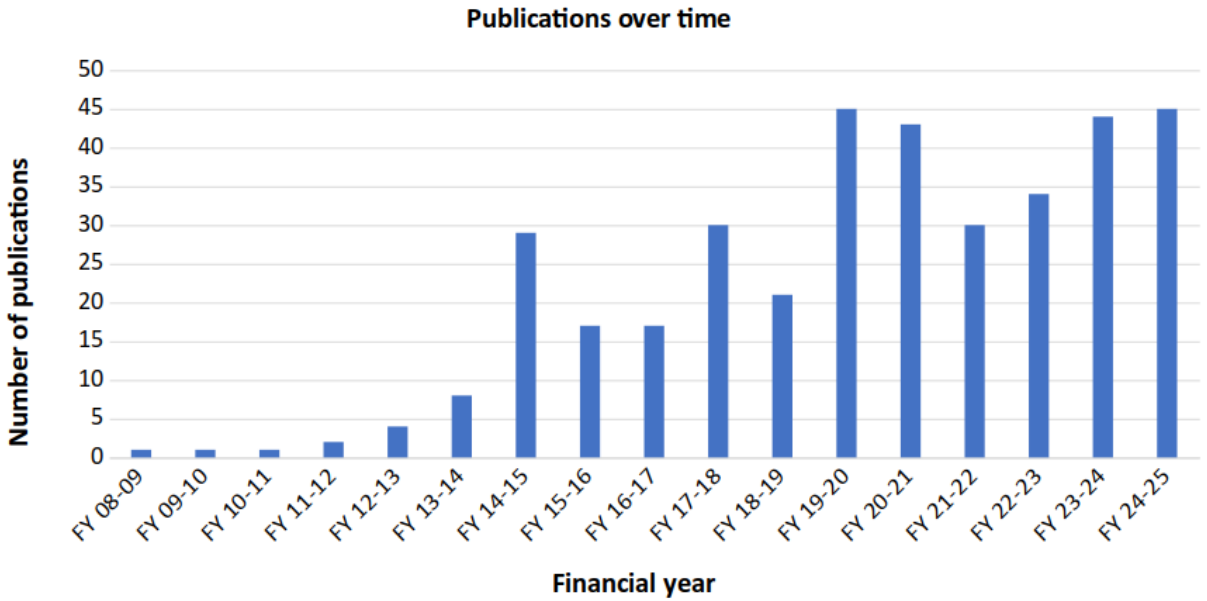
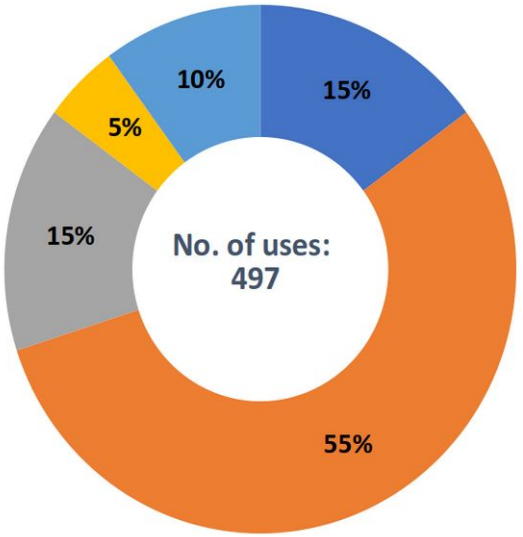
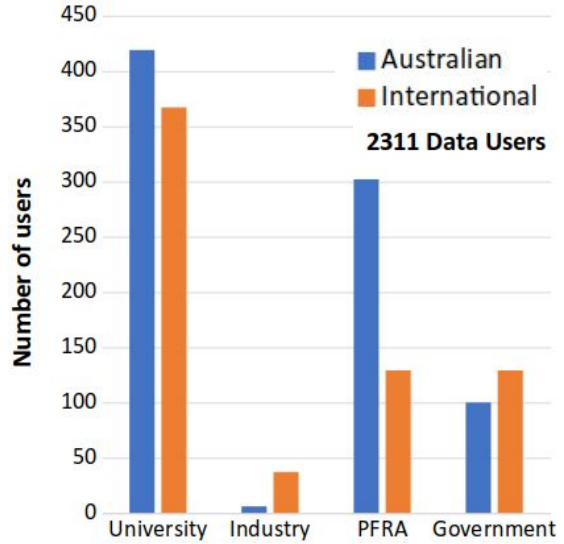




Journal articles	274
Presentations	75
Reports	74
Projects	50
Post-grad students	24



(Credit Richard Saunders)

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- **International missions and space agencies recognize our contribution** arising from:
  - Characterization of unique environments and unique geographic location (Southern Hemisphere)
  - Innovation in techniques and instrumentation
  - Commitment to long-term consistency and open data

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- **Co-investment from space agencies** for instrumentation → ESA HYPERNETS, USGS/GA Landsat-Next

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- Underpins capability to deliver **tailored products for Australian applications** and **improved quality and consistency** of observations **at a national level**

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CELEBRATING 20 YEARS
OF SUSTAINED MARINE OBSERVING

IMOS
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