# From the Ocean to the Cloud
# Now and the Future

## Using the Australian Ocean Data Network

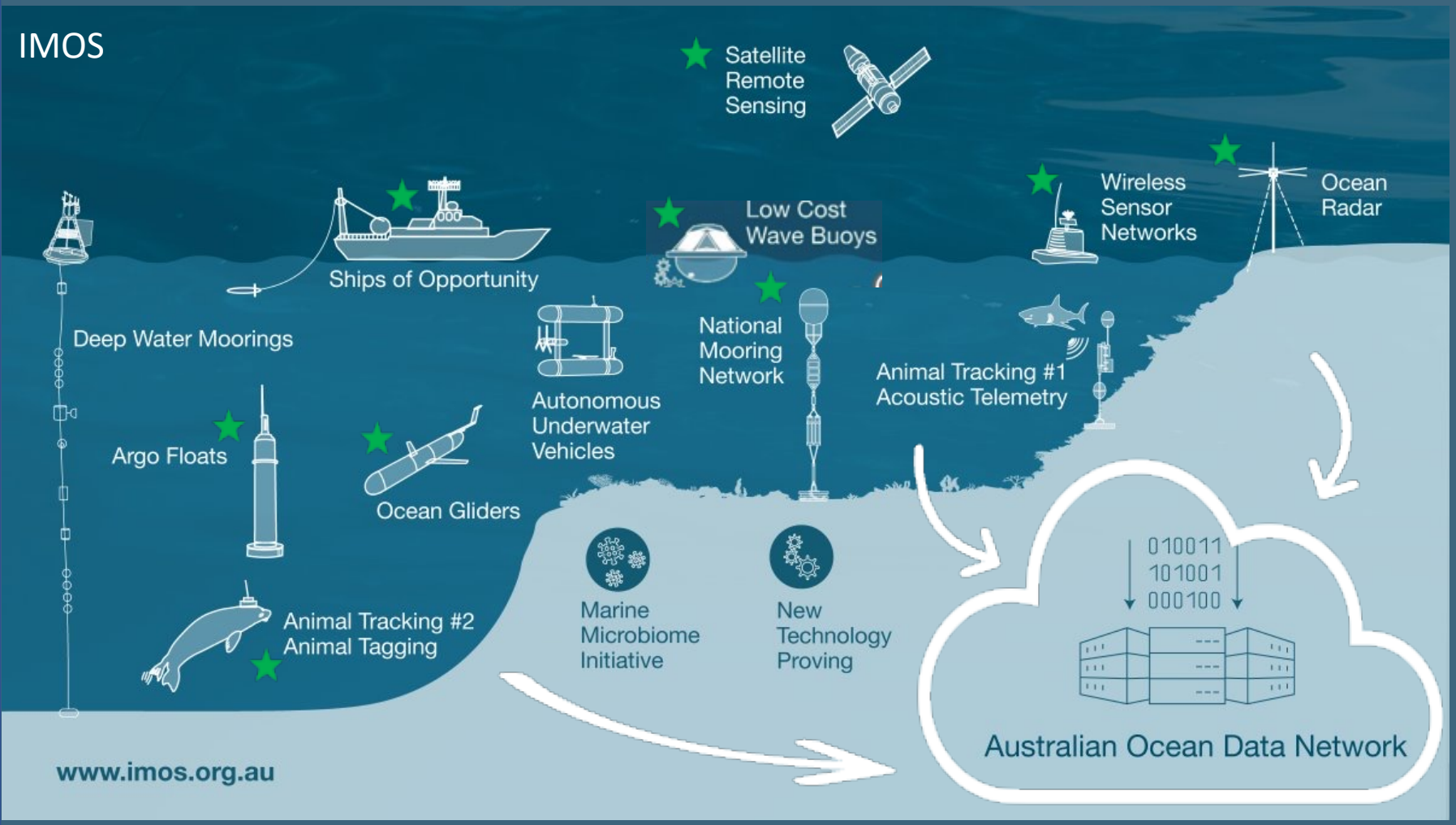
Mark Rehbein
Director, Australian Ocean Data Network

IMOS
Integrated **Marine Observing** System

*IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe and recognise their unique connection to land and sea. We pay our respects to Aboriginal and Torres Strait Islander peoples past and present.*

# From the Ocean to the Cloud!

## Access to freely and openly accessible data

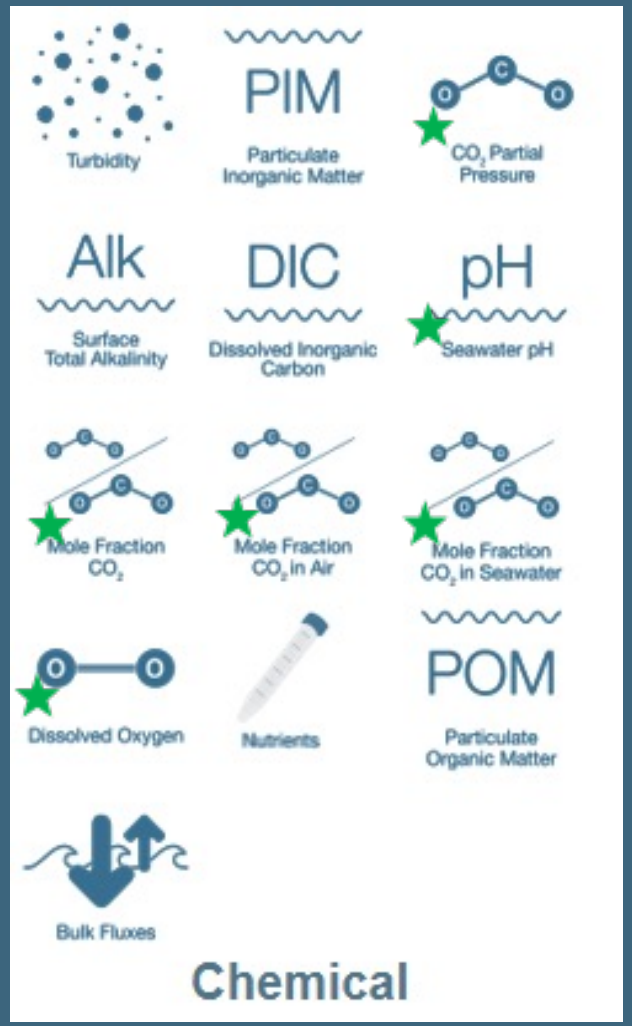


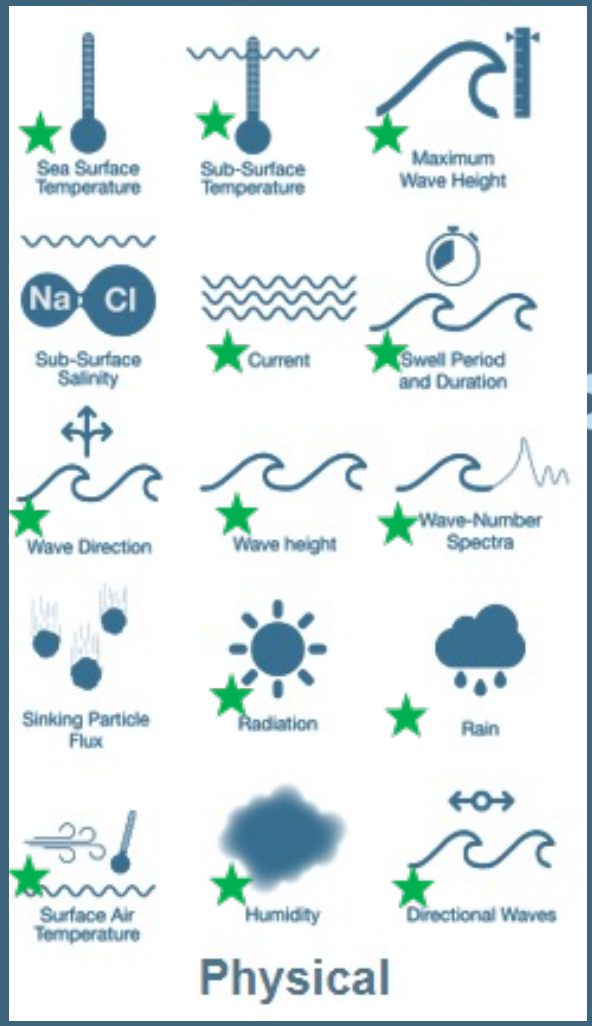

Partner Data

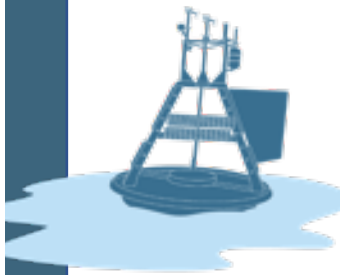
★ = near real time component

IMOS Integrated Marine Observing System

# A Diverse Range of Data

IMOS Integrated **Marine Observing** System

★ = near real time component

# Bluewater & Climate

## Spatial coverage

All IMOS data is openly and freely available on the IMOS Australian Ocean Data Network (AODN):

portal.aodn.org.au

SATELLITE REMOTE SENSING PRODUCTS

SEA LEVEL ANOMALY | OCEAN COLOUR | SEA SURFACE TEMPERATURE

### IMOS' SUSTAINED OCEAN OBSERVING INFRASTRUCTURE

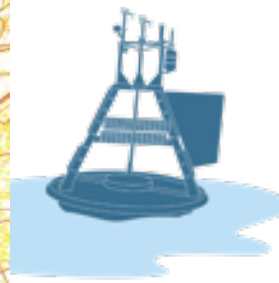
**ANIMAL TAGGING**
Seals are fitted with satellite data loggers that collect valuable oceanographic measurements in regions inaccessible to researchers, that validate oceanographic models and provide information on seal behaviour.

**ARGO FLOATS**
IMOS manages Australia's contribution to the global Argo Array. Deploying regular, ice and biogeochemical Argo floats, Argo Australis is the second largest contributor to this international program.

**SATELLITE CALIBRATION**
The Lucinda Jetty in QLD collects optical measurements to support satellite ocean colour calibration. Buoys located in the Bass Strait TAS measure sea surface height, providing the only Southern Hemisphere calibration site.

**DEEP WATER MOORING**
The IMOS Southern Ocean Time Series Observatory monitors long term trends in weather and climate in the Southern Ocean.

**SHIPS OF OPPORTUNITY**
Australia benefits from a combination of commercial and research vessels used to collect a wide range of oceanographic measurements including;
- Biogeochemical Sensors
- Sea Surface Temperature
- Expendable Bathtythermographs
- Continuous Plankton Recorders
- Air-Sea Fluxes



### IMOS DATA STREAMS CONTRIBUTE TO

REGIONAL OCEAN MODELS | WEATHER FORECASTING | CLIMATOLOGIES | OPERATIONAL OCEAN FORECASTS | ENVIRONMENTAL ASSESSMENTS AND OUTLOOKS

https://imos.org.au/nodes/nodes/bluewaterclimate

# Northern Territory

## Spatial coverage

### SHIPS OF OPPORTUNITY
The Northern Territory benefits from a combination of commercial and research vessels used to collect a wide range of oceanographic measurements.
'———' indicates Ships Of Opportunity observations.

### MARINE MICROPLASTICS
Monitoring of Marine Microplastics as part of our New Technology Proving Facility identifies potential sources, fate and impacts of microplastics in the marine environment.

### NATIONAL MOORING NETWORK
A national network of moorings that monitor environmental conditions in Australia's coastal waters.

### WAVE BUOY
A wave buoy deployed north of the Tiwi Islands provide valuable real-time information on wave data used to validate wave, weather and climate models.

### LOW-COST WAVE BUOYS
Low-Cost Wave Buoys deployed as part of our New Technology Proving Facility, are being trialled to lower the cost of collecting wave observations.

OTHER NATIONALLY OPERATED INFRASTRUCTURE IN NORTHERN TERRITORY INCLUDES:

ARGO FLOATS

SATELLITE REMOTE SENSING PRODUCTS

IMOS is part of Australia's National Collaborative Research Infrastructure Strategy (NCRIS). Research infrastructure refers to the facilities, equipment, resources, and skilled workforce that underpin cutting-edge research and innovation in Australia. Researchers across many institutions can access the infrastructure, ensuring equitable and common access across the country, from our regions to our cities.

Principal participants include the Bureau of Meteorology, Australian Institute of Marine Science (AIMS) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

All IMOS data is openly and freely available on the IMOS Australian Ocean Data Network (AODN):

portal.aodn.org.au

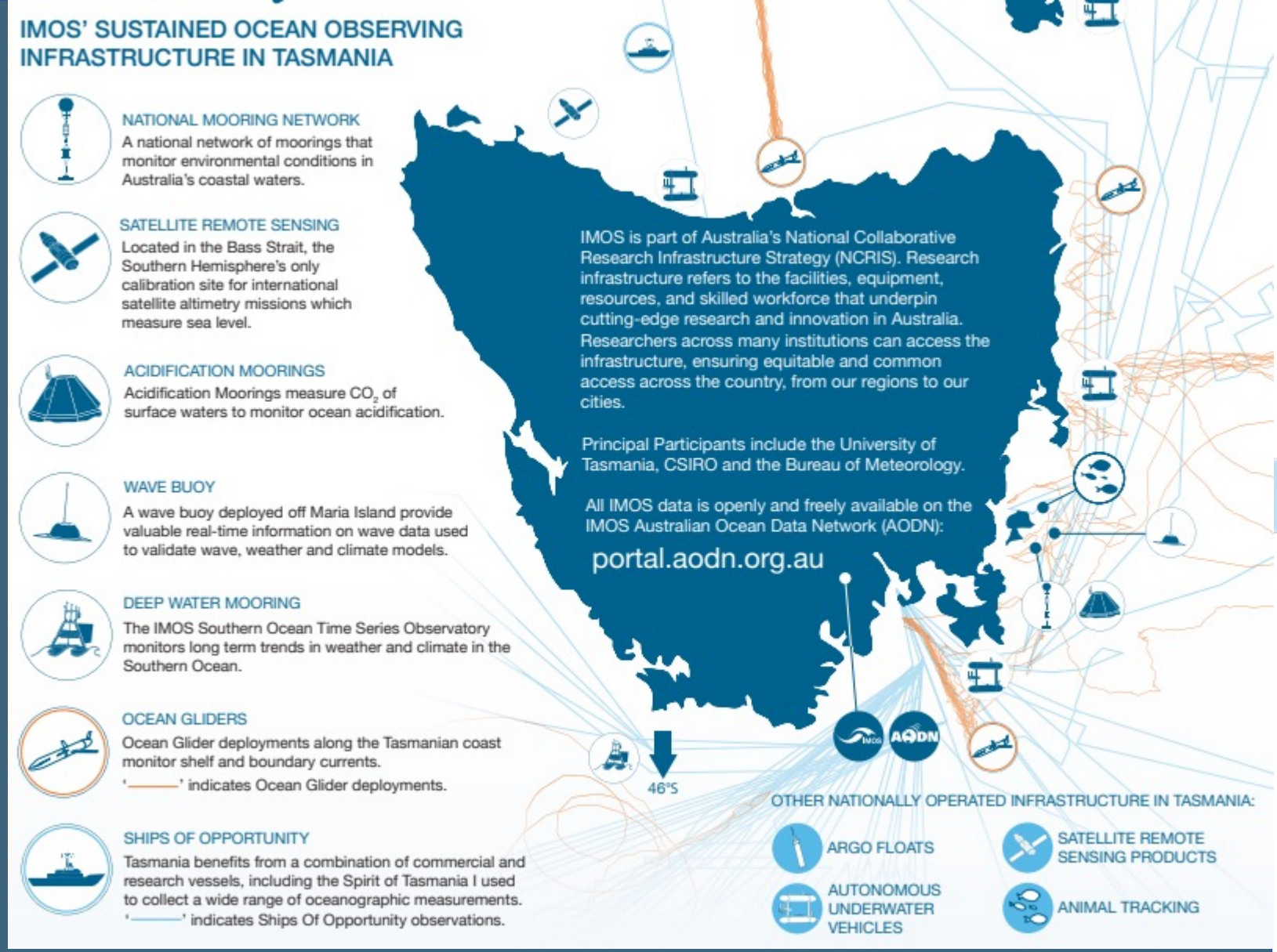
**THE NORTHERN TERRITORY MARINE SCIENCE COMMUNITY HAS USED IMOS OBSERVATIONS TO PRODUCE:**

**29** JOURNAL ARTICLES **28** REPORTS **14** PROJECTS **24** DATA PRODUCTS

https://imos.org.au/nodes/nodes/northern-territory

# Tasmania

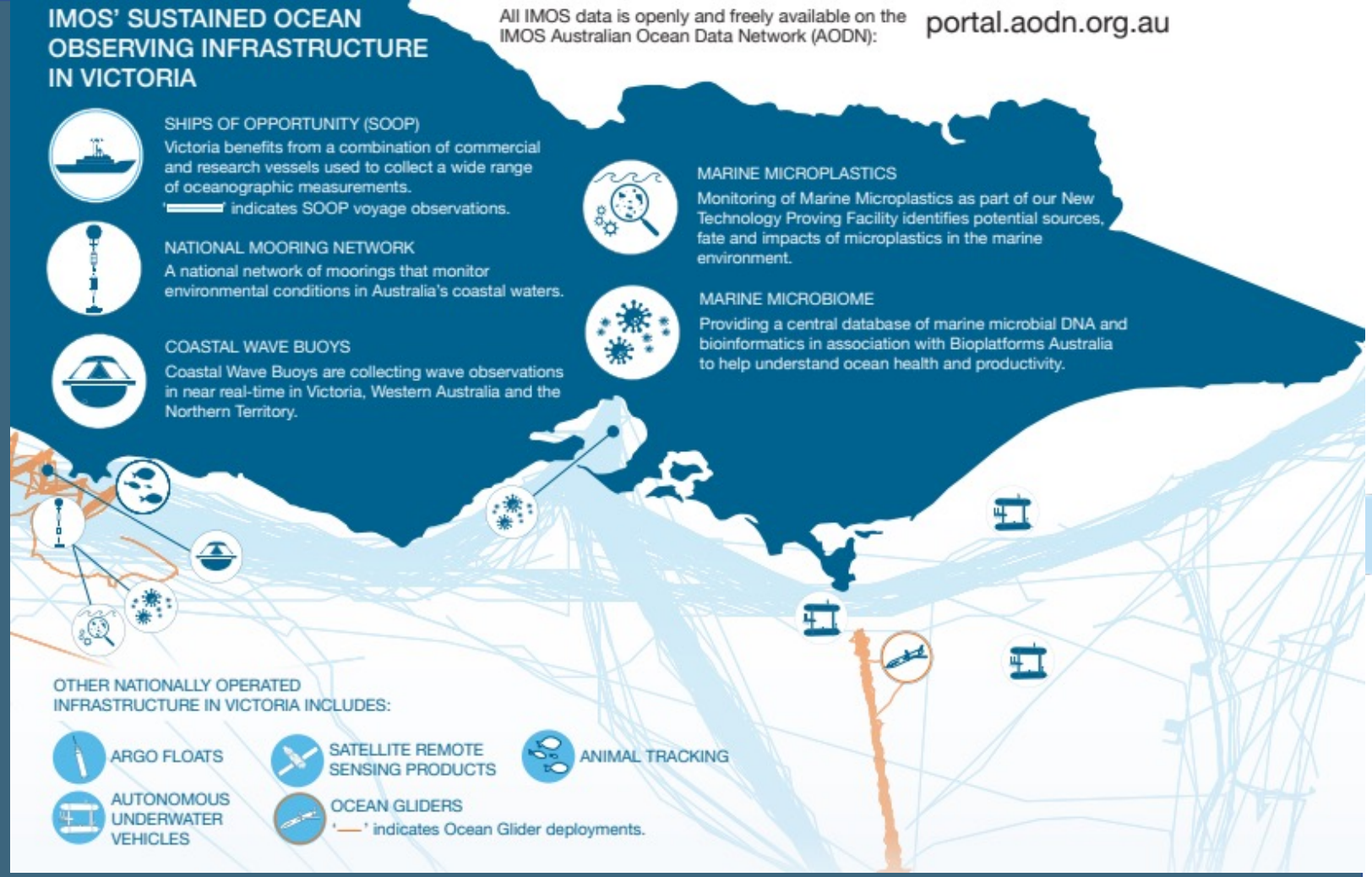
## Spatial coverage



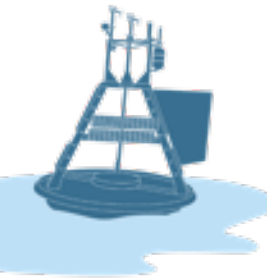

https://imos.org.au/nodes/nodes/tasmania

# Victoria

## Spatial coverage




https://imos.org.au/nodes/nodes/vicimos



IMOS Integrated Marine Observing System

# South Australia

## Spatial coverage


https://imos.org.au/nodes/nodes/saimos

IMOS Integrated Marine Observing System

# New South Wales

## Spatial coverage

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The Sydney Institute of Marine Science is a principal participant to the unincorporated joint venture. The data collected by IMOS has been used by all major Universities in New South Wales including, University of New South Wales, University of Sydney, Macquarie University and University of Technology Sydney.

All IMOS data is openly and freely available on the IMOS Australian Ocean Data Network (AODN):

portal.aodn.org.au

### IMOS' SUSTAINED OCEAN OBSERVING INFRASTRUCTURE IN NEW SOUTH WALES

**SHIPS OF OPPORTUNITY (SOOP)**
New South Wales benefits from a combination of commercial and research vessels used to collect a wide range of oceanographic measurements.
'———' indicates of SOOP voyage observations.

**NATIONAL MOORING NETWORK**
A national network of moorings that monitor environmental conditions in Australia's coastal waters.

**OCEAN RADAR**
New South Wales benefits from Ocean Radar which contributes to biological systems research, ocean modelling and ocean circulation.

**ANIMAL TRACKING**
New South Wales benefits from a national acoustic animal tracking network which can track priority species along the coast.

**OCEAN GLIDERS**
Ocean Glider deployments along the New South Wales coast monitor shelf and boundary currents.
'———' indicates Ocean Glider deployments.

**AUTONOMOUS UNDERWATER VEHICLES**
AUVs collect precisely navigated time series of benthic imagery.

OTHER NATIONALLY OPERATED INFRASTRUCTURE IN NEW SOUTH WALES INCLUDES:

ARGO FLOATS

SATELLITE REMOTE SENSING PRODUCTS

MARINE MICROBIOME

https://imos.org.au/nodes/nodes/nswimos

# Queensland

## Spatial coverage






https://imos.org.au/nodes/nodes/qimos

# Western Australia

## Spatial coverage

### IMOS' SUSTAINED OCEAN OBSERVING INFRASTRUCTURE IN WESTERN AUSTRALIA

**SHIPS OF OPPORTUNITY**
WA benefits from a combination of commercial and research vessels used to collect a wide range of oceanographic measurements.
'——' indicates of Ships Of Opportunity voyage data.

**NATIONAL MOORING NETWORK**
A national network of moorings that monitor environmental conditions in Australia's coastal waters.

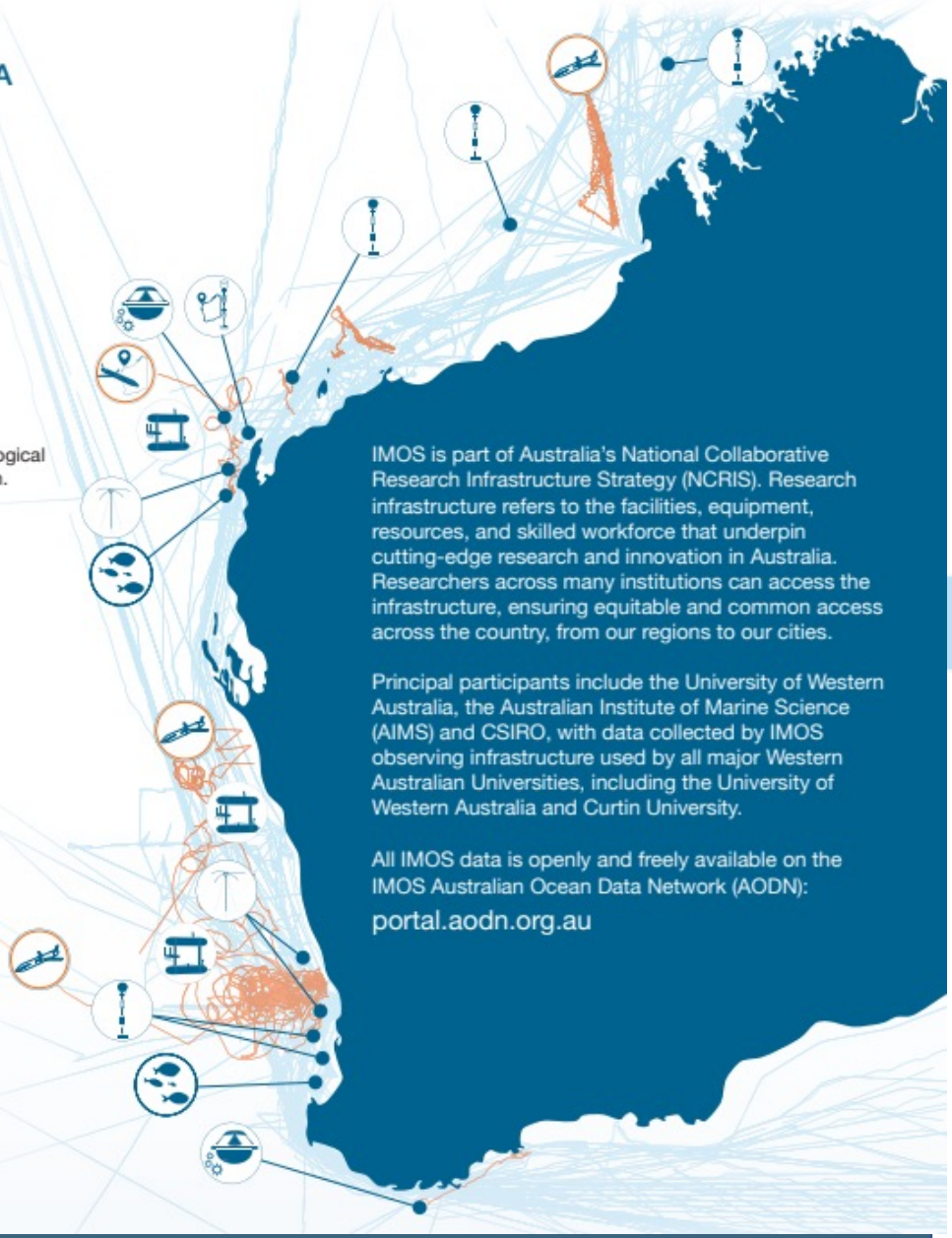
**OCEAN RADAR**
WA benefits from Ocean Radar which contributes to biological systems research, ocean modelling and ocean circulation.

**OCEAN GLIDERS**
Ocean Glider deployments along the WA coast monitor shelf and boundary currents.
'——' indicates Ocean Glider deployment data.

**NEW TECHNOLOGY PROVING**
WA is the home of our Low-Cost Wave Buoy New Technology Proving Facility at the UWA Great Southern Marine Research Facility, being trialled to lower the cost of collecting wave observations.

**WESTERN AUSTRALIA STATE GOVERNMENT CO-INVESTED INFRASTRUCTURE:**
- NINGALOO MOORING
- ONSLOW GLIDERS

**OTHER NATIONALLY OPERATED INFRASTRUCTURE IN WESTERN AUSTRALIA INCLUDES:**
- ARGO FLOATS
- SATELLITE REMOTE SENSING PRODUCTS
- AUTONOMOUS UNDERWATER VEHICLES
- ANIMAL TRACKING



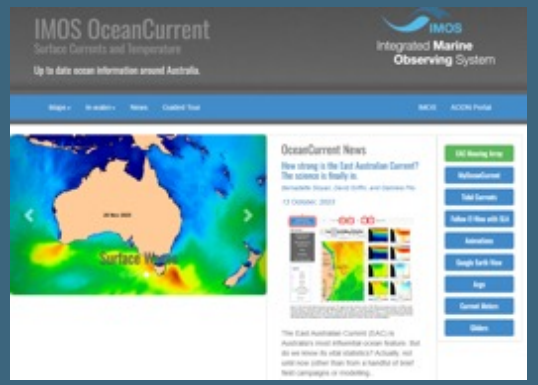
IMOS is part of Australia's National Collaborative Research Infrastructure Strategy (NCRIS). Research infrastructure refers to the facilities, equipment, resources, and skilled workforce that underpin cutting-edge research and innovation in Australia. Researchers across many institutions can access the infrastructure, ensuring equitable and common access across the country, from our regions to our cities.

Principal participants include the University of Western Australia, the Australian Institute of Marine Science (AIMS) and CSIRO, with data collected by IMOS observing infrastructure used by all major Western Australian Universities, including the University of Western Australia and Curtin University.

All IMOS data is openly and freely available on the IMOS Australian Ocean Data Network (AODN):
portal.aodn.org.au

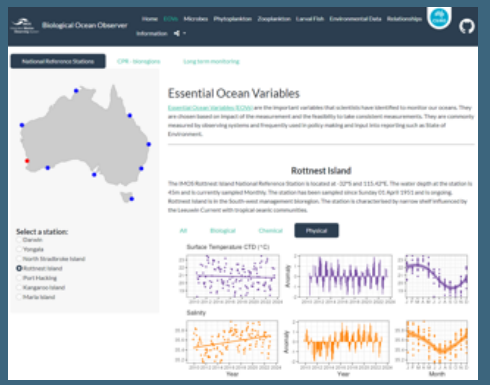
https://imos.org.au/nodes/nodes/waimos

# Visualising & Downloading IMOS Data

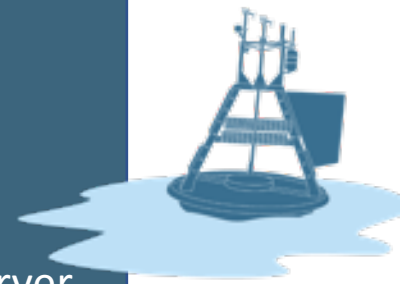



IMOS Ocean Current


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




IMOS Biological Ocean Observer



AODN Data Services

Spatial Services +
THREDDS + Cloud Files

esri

QGIS

GIS Users

R

python

Data Science Users

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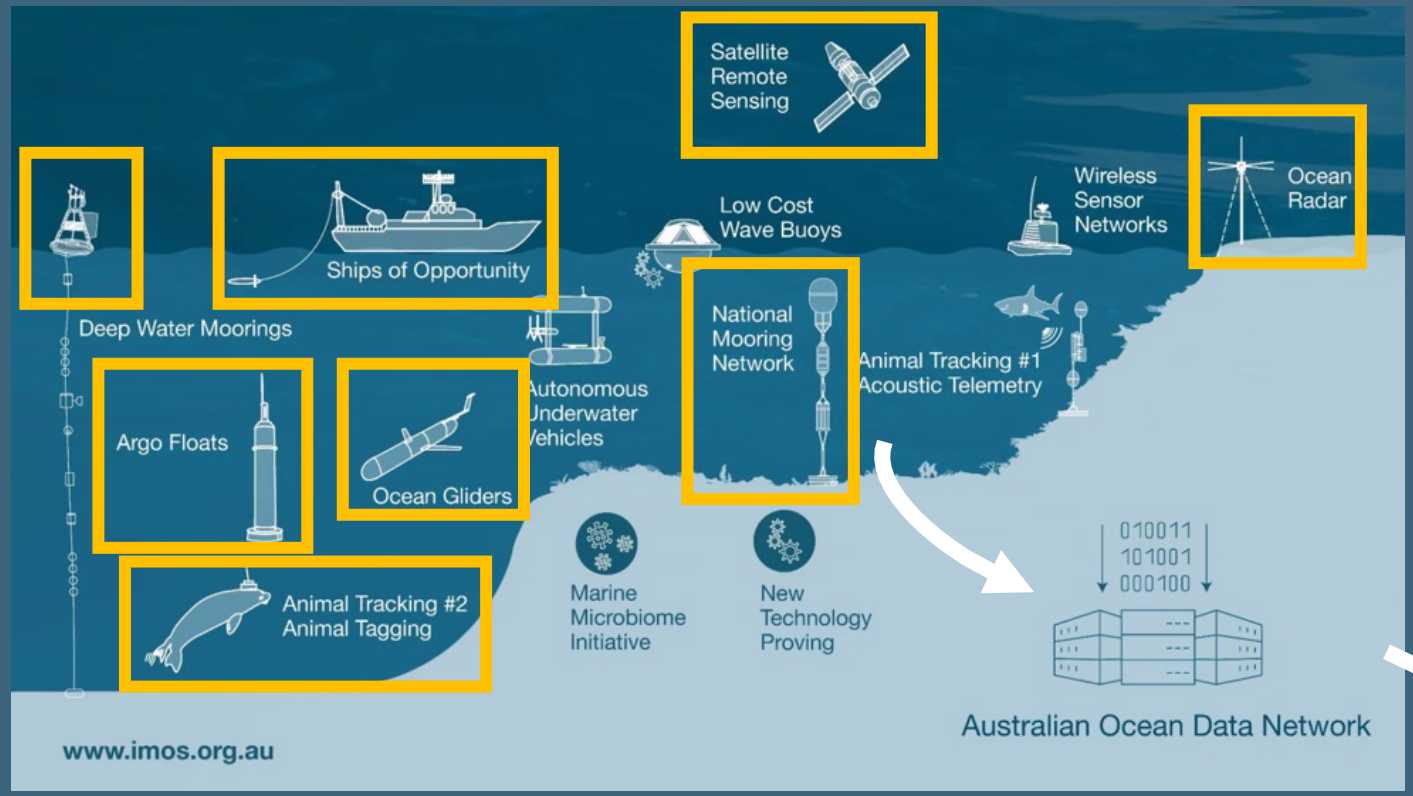
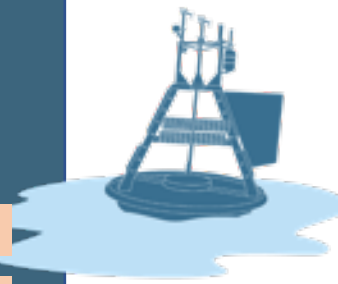
# IMOS OceanCurrent - Data Streams

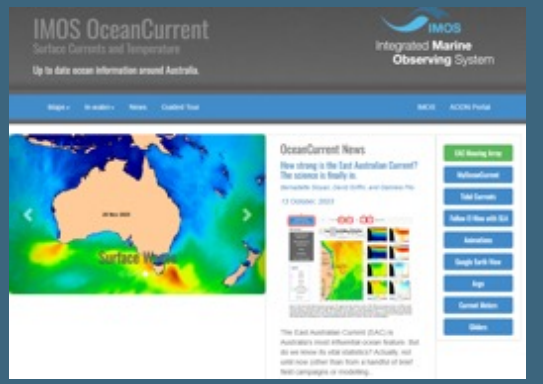



AVISO+ BOM RADAR ALTIMETER DATABASE SYSTEM RADS NOAA Bluelink Ocean Forecasting

Tide gauge data

Tide gauge data






IMOS OceanCurrent
Download Visualisations
https://oceancurrent.aodn.org.au/

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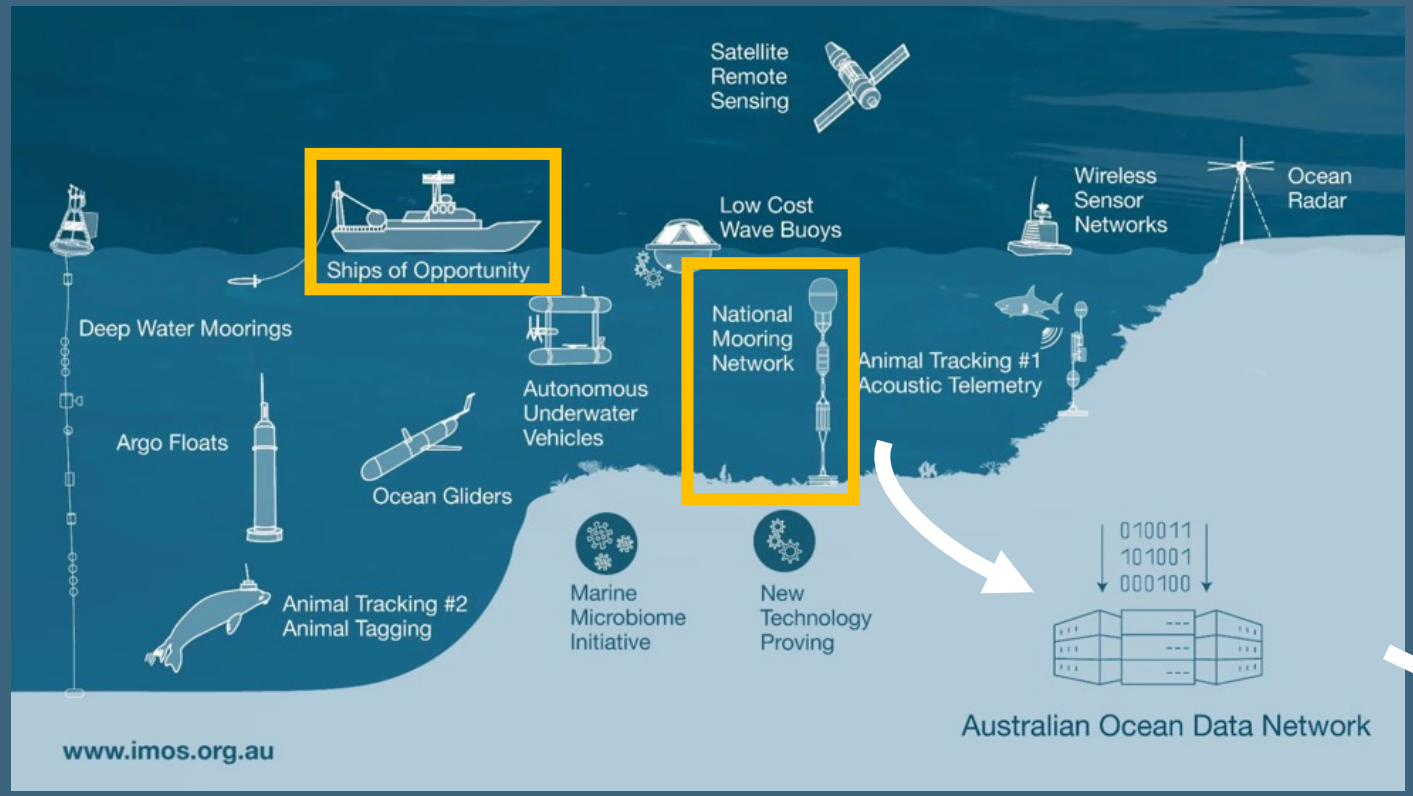
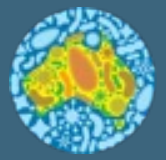
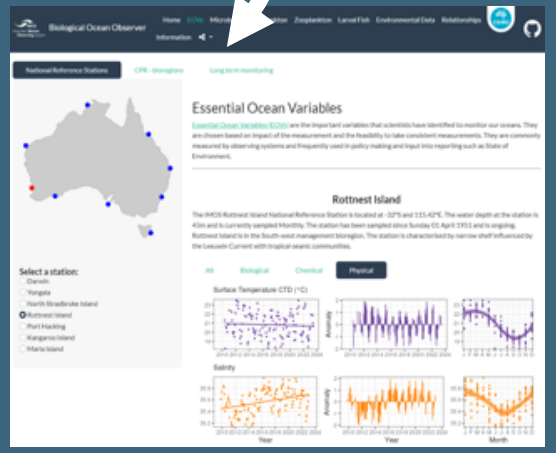
# IMOS Biological Ocean Observer - Data Streams



Australian Microbiome Initiative




IMOS Biological Ocean Observer

https://shiny.csiro.au/BioOceanObserver/

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# AODN Portal – Now and the Future

## Existing portal is 9 years old

### Now

~300 datasets

1. Select


2. Subset

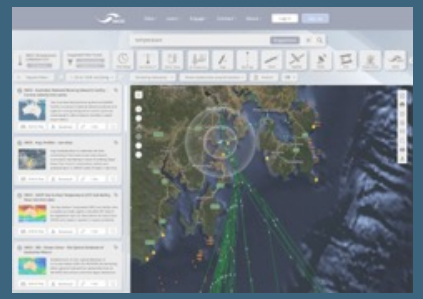

3. Download


### Future

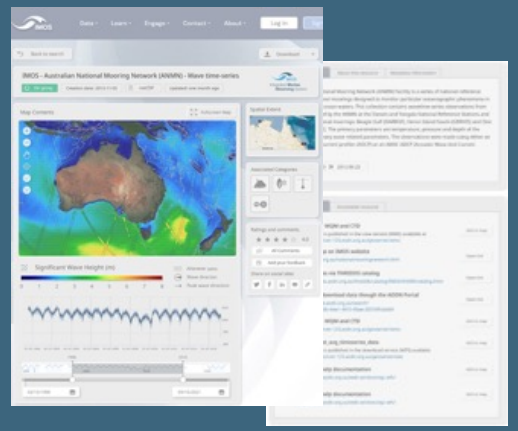
~14,000 datasets

1. Search


2. Explore



3. Assess and Download

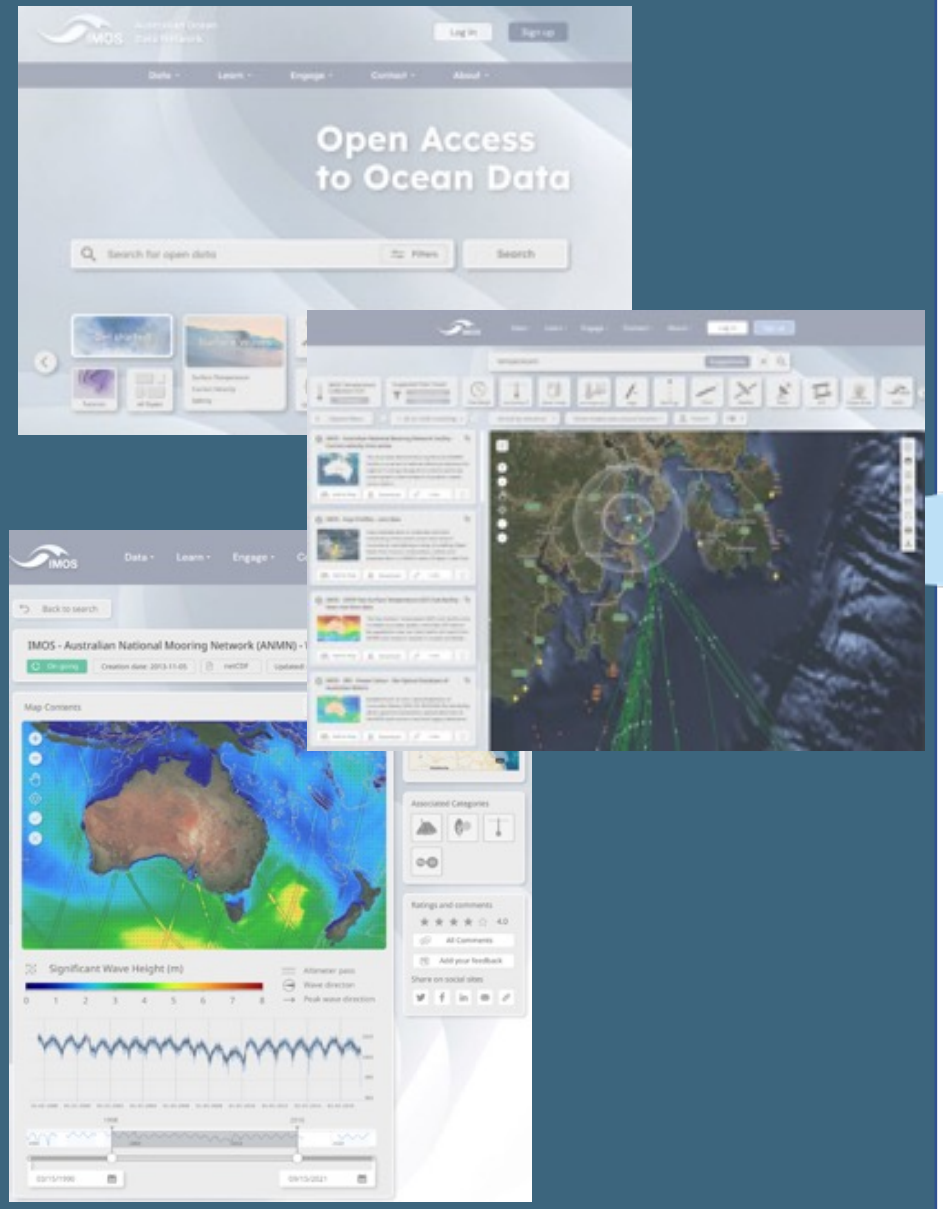


IMOS Integrated Marine Observing System

# AODN Portal Future

## Key concepts

A focus on usability, discoverability & data uptake




Easier to Find Data – not just IMOS data

- Search + interactive map-based exploration
- Inclusion of non-IMOS datasets

Easier to Use IMOS Hosted Data

- Basic data previews (gridded, timeseries, profiles)
- Data science ready - kick start guides/coding samples
- Ready to use data (pre integrated and in desired formats)
- Data subset extraction performance improvements

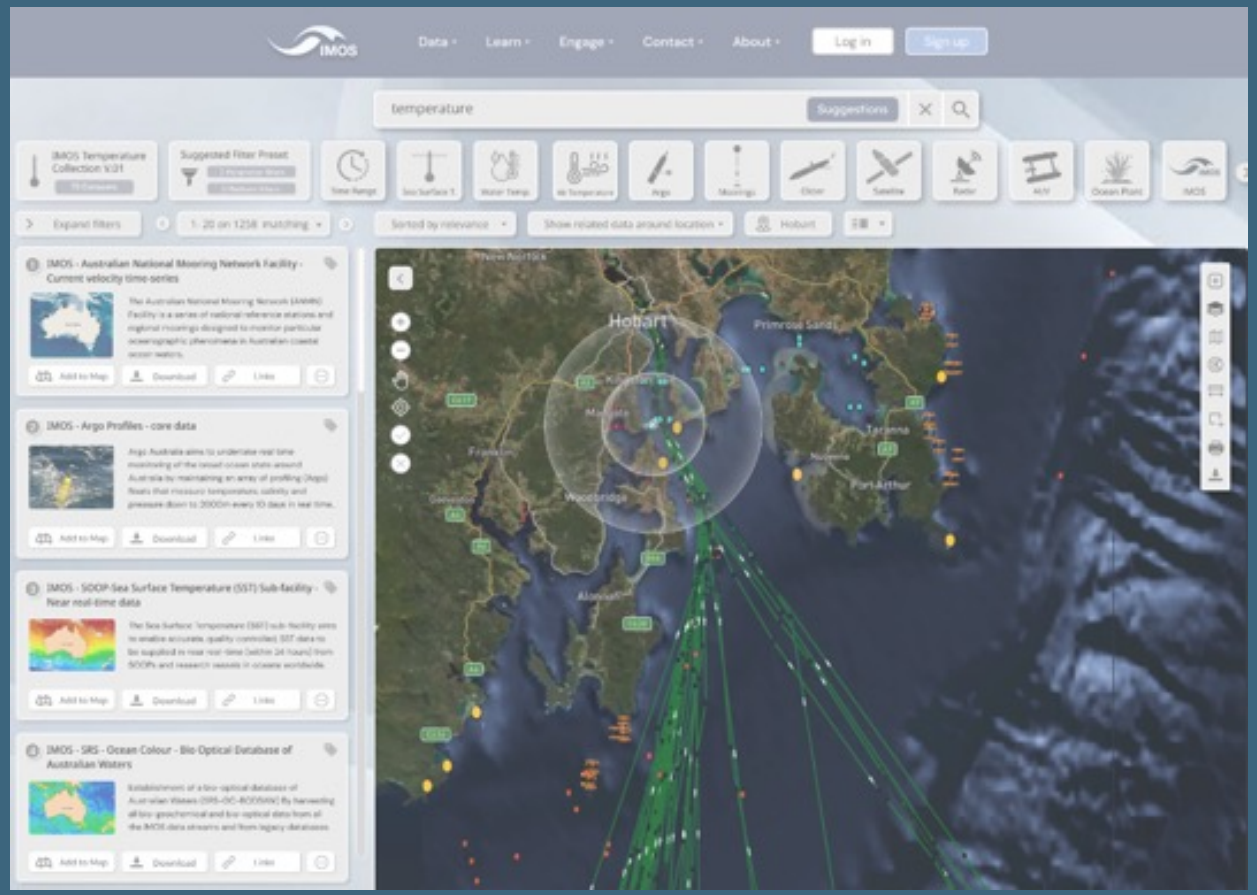
# AODN Portal Future – Initial Concepts

## A better, simple search


- Free text ‘google like’ search
- Search suggestion autocomplete
- Topic search
- Popular filters including:
  - Time period
  - Parameter

# AODN Portal Future – Initial Concepts

## Interactive map-based exploration

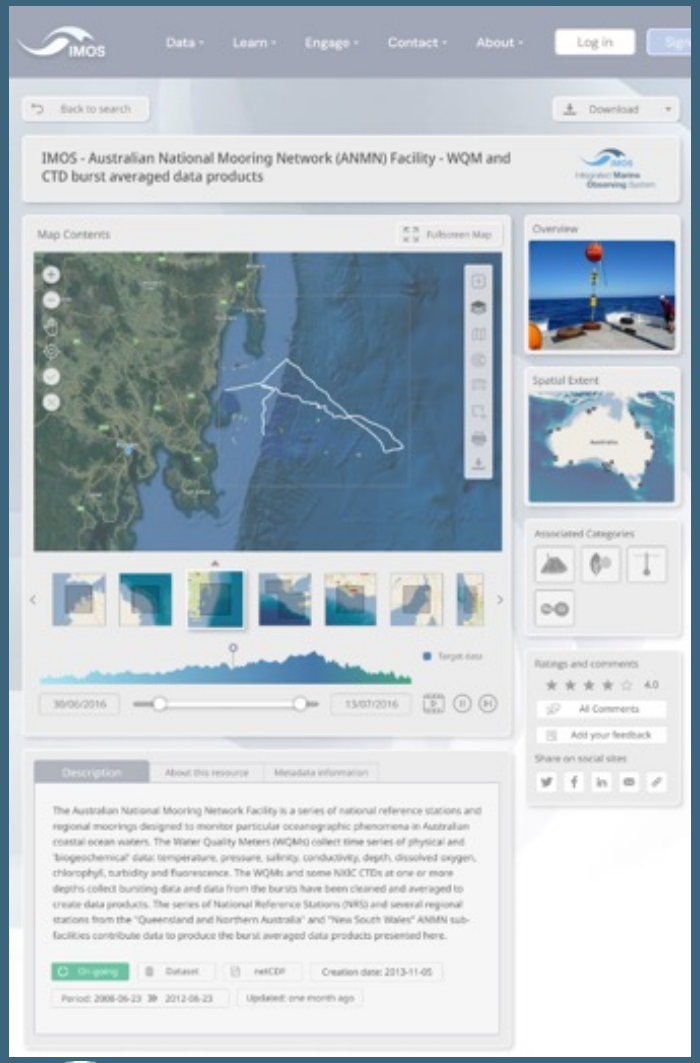


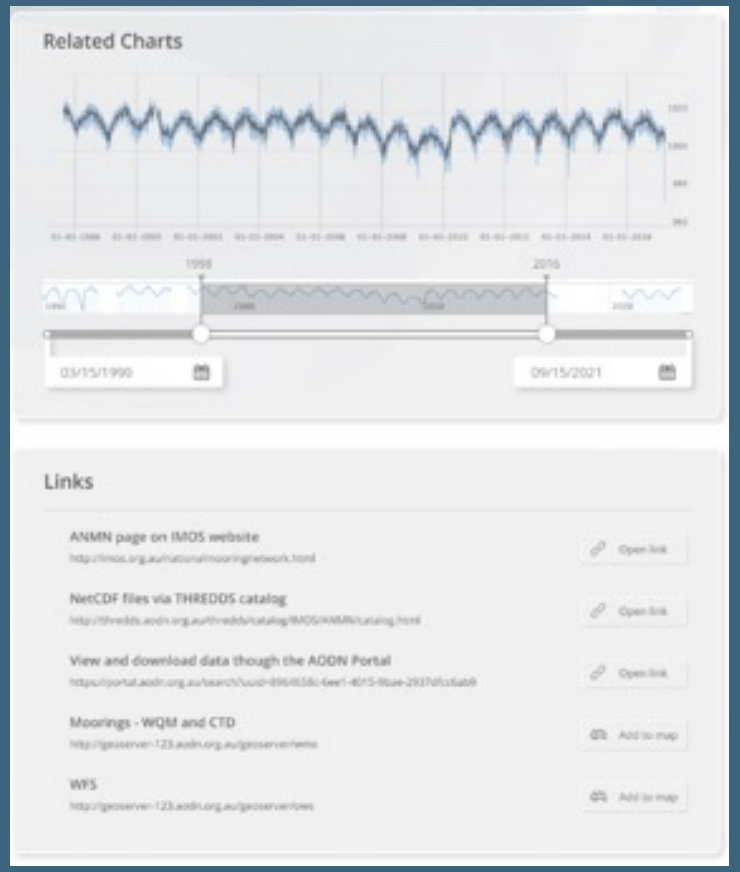

- Visualise the location of datasets
  - What is in my area of interest?
- Inclusion of non-IMOS datasets
- Dataset filter search options


IMOS Integrated Marine Observing System

# AODN Portal Future – Initial Concepts

## Dataset information – transect / profile / timeseries example




With ‘compatible’ datasets:

- Dataset details
- Data chart preview
- Subset & download
- Data services & links
- Data science kick-starter & coding samples

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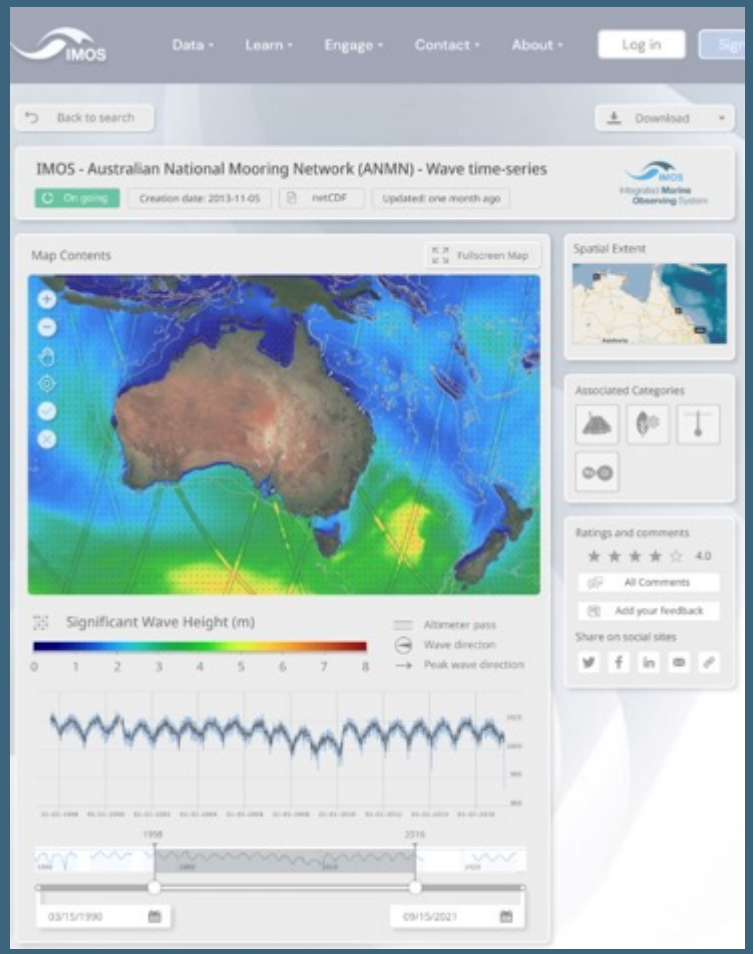
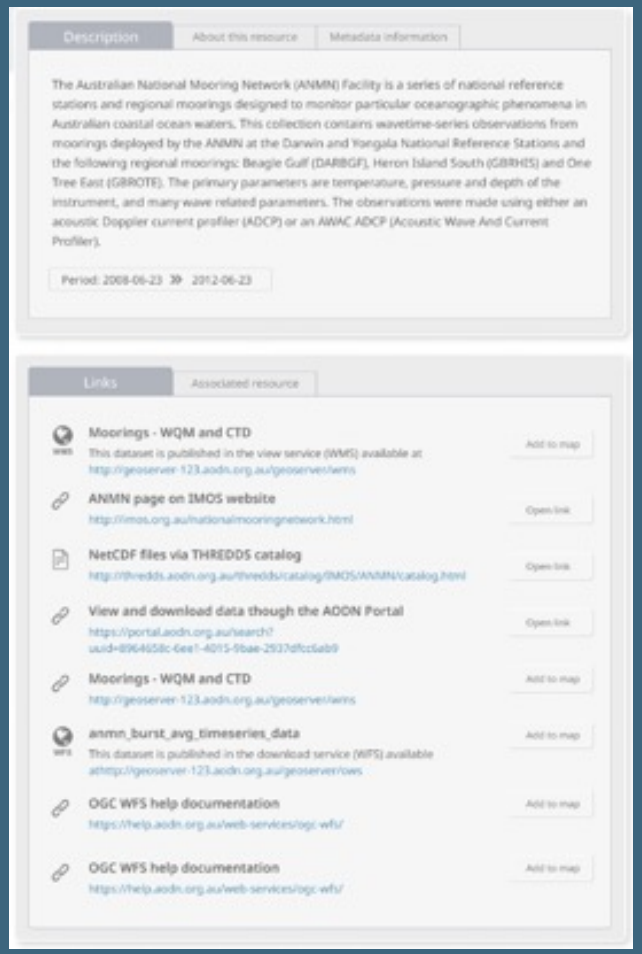
# AODN Portal Future – Initial Concepts

## Dataset information – gridded example




With ‘compatible’ datasets:

- Visualise gridded data
- Timeseries at a point
- Subset & download
- Data services & links
- Data science kick-starter & coding samples

IMOS Integrated Marine Observing System

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IMOS node info-graphics: https://imos.org.au/nodes
Biological Ocean Observer: https://shiny.csiro.au/BioOceanObserver/
Ocean Current: https://oceancurrent.aodn.org.au/
AODN Portal: https://portal.aodn.org.au/

NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

Australia's Integrated Marine Observing System (IMOS) is enabled by the National Collaborative Research Infrastructure Strategy (NCRIS). It is operated by a consortium of institutions as an unincorporated joint venture, with the University of Tasmania as Lead Agent. **www.imos.org.au**

PRINCIPAL PARTICIPANTS

UNIVERSITY of TASMANIA (Lead Agent)
Australian Government
Australian Institute of Marine Science
Australian Government Bureau of Meteorology
CSIRO
Government of South Australia
SARDI
The University of Western Australia
sims sydney institute of marine science
UTS
The University of Sydney
Macquarie University
UNSW Sydney

SIMS is a partnership involving four universities.

ASSOCIATE PARTICIPANTS

Curtin University
Australian Government Department of Climate Change, Energy, the Environment and Water Australian Antarctic Division
Australian Antarctic Program
Deakin University
The University of Melbourne

*IMOS thanks the many other organisations who partner with us, providing co-investment, funding and operational support, including investment from the Tasmanian, Western Australian and Queensland State Governments.*

*IMOS acknowledges the Traditional Custodians and Elders of the land and sea on which we work and observe and recognise their unique connection to land and sea. We pay our respects to Aboriginal and Torres Strait Islander peoples past and present.*