

Overview of initial CoastRI investments

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CoastRI

Research Infrastructure connecting land and sea

Coastal Research Infrastructure (CoastRI) is an initiative of the National Collaborative Research Infrastructure Strategy (NCRIS)



The Coastal Challenge



Melbourne storm surge, Sept 24
Source: Dr Ben Hague (BOM)



Great Ocean Road

Inverloch beach erosion worsens after 'huge' storms and high tides

9NEWS



Staged Process



STAGE 1:

- Initial, multi-year investments (2023-2027)
- Nationwide consultation

STAGE 2:

- Development of program description
- Implementation of CoastRI

A consortium of NCRIS capabilities is working to **establish national-scale coastal research infrastructure**



Initial Funding (2023-27)

Proposals identified as immediate needs for the coastal zone - \$38M investment.

1

COASTAL OCEAN MODELING COMMONS: (ACCESS-NRI, AusScope, NCI)

- establishing a coastal ocean modelling commons in partnership with the University of New South Wales (UNSW).
- enhancing Australian ice sheet modelling capacities

2

COASTAL WAVES AND ESTUARINE CONDITIONS: (IMOS)

- establish observing platforms will provide baseline data to understand conditions and trends in key coastal areas.

3

IMPROVING THE AVAILABILITY OF COASTAL MARINE BIODIVERSITY DATA: (ALA)

- quantify hotspots and gaps in open-access datasets of coastal marine biodiversity with an initial focus on fish.

MONITORING SEA LEVEL IMPACTS ON COASTAL ECOSYSTEM RESILIENCE: (TERN, AuScope)

- OzSET network
- integration of remote sensing combined with LiDAR to provide information about wetland vegetation characteristic.

4

PLANET RESEARCH DATA COMMONS: (ARDC)

- infrastructure for environmental prediction, trusted data spaces, models, storage, synthesis activities, indigenous data, and data sharing between sectors.
- data and modelling platforms for research & decision making

5

UNDERGROUND INFRASTRUCTURE IN CRITICAL COASTAL AREAS: (AURIN)

- access to currently unavailable and hard-to-get urban infrastructure data assets, such as subterranean utilities

6

SHORELINE OBSERVING: (AuScope, TERN, IMOS)

- Establish drone and fixed camera/LIDAR infrastructure
- innovative citizen science and outreach components, providing complimentary, low-cost observations and critical community engagement.

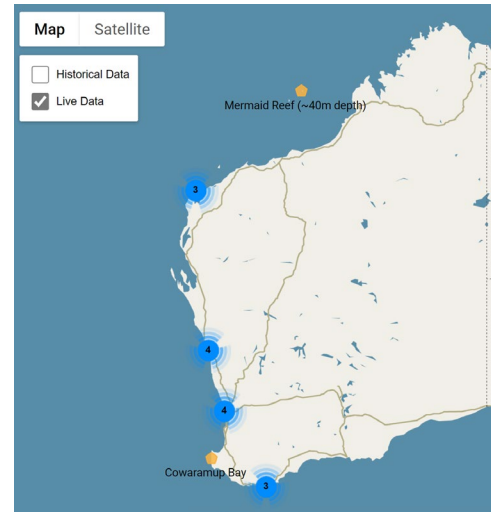
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Developing a national coastal wave buoy network

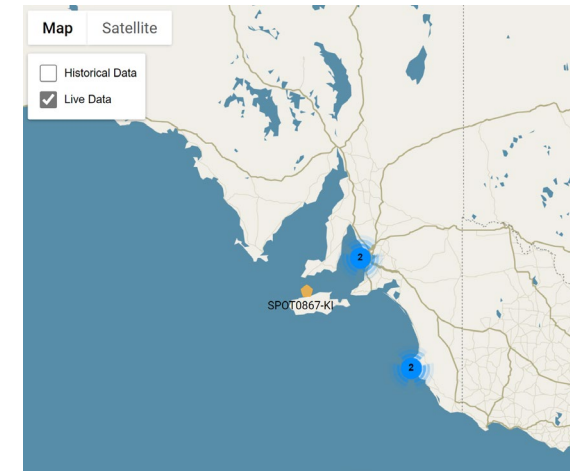
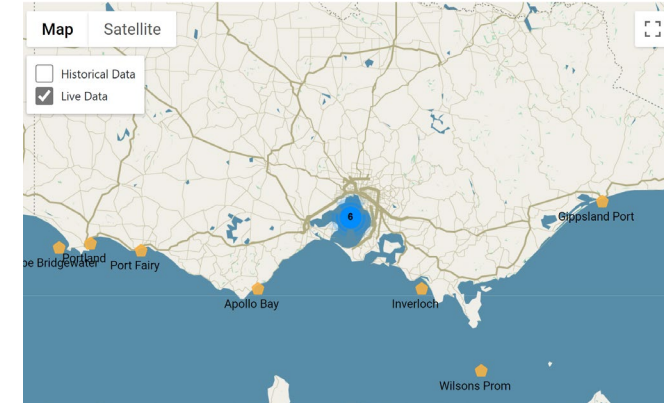
Building on a foundation of regional networks

- Research organisation operated
 - Vulnerable to uncertain funding, research project grants, etc.
 - Predominantly deployed in nearshore regions
 - Initially driven by research needs, but lots of recreational and industry uptake
 - Development of NRT websites for data access

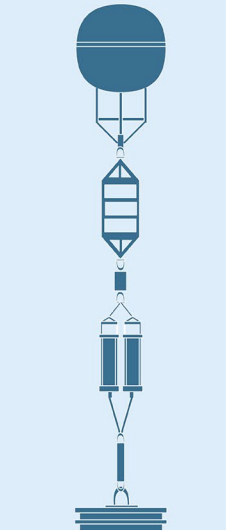
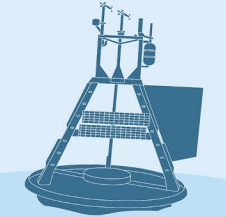
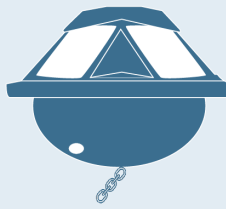
Wawaves.org (UWA)



Vicwaves.com.au (DU)

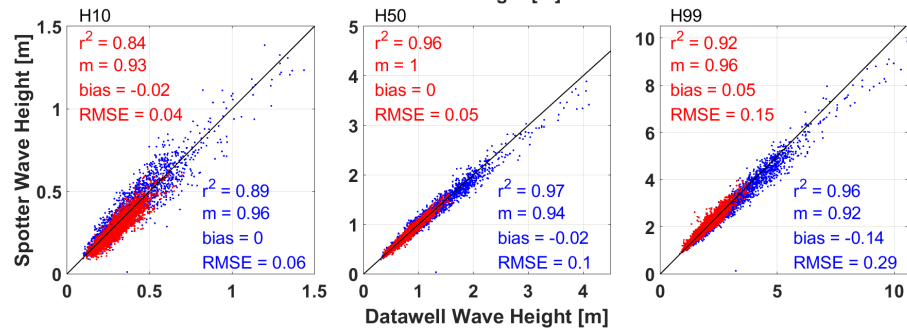
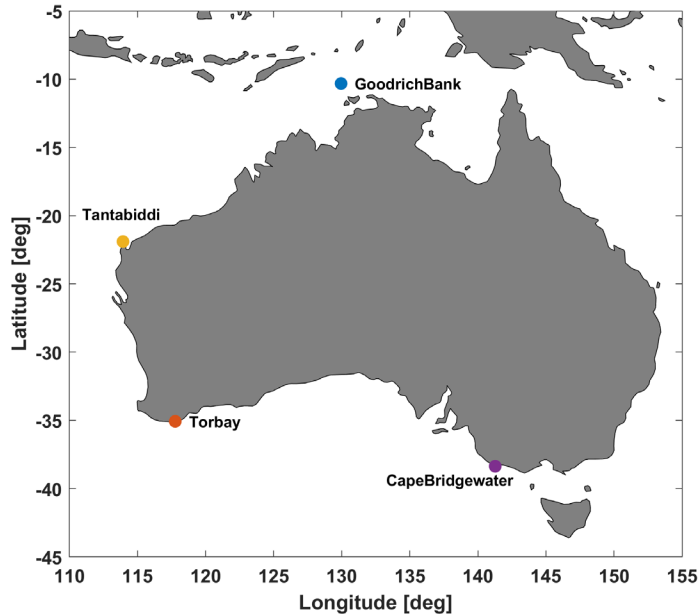


Sawaves.org (Flinders/SARDI)



IMOS - Technology proving around Australia

IMOS New Tech Proving: (2019-2021)

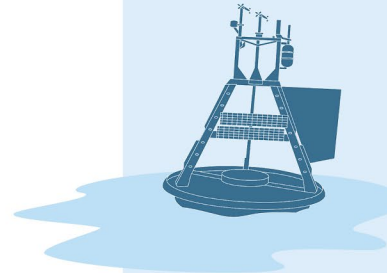


Hansen et al. (in prep)

Australian Wave Buoy Operations and Data Management Guidelines

Australian Research Data Commons - Australian Data Partnerships:
Development of a National Infrastructure for in-situ wave observations

Jointly prepared by:
A/Prof Jeff Hansen (University of Western Australia)
Dr Mike Kinsela (University of Newcastle, NSW Department of Planning & Environment)



IMOS National Coastal Wave Buoy Facility



Steering Committee

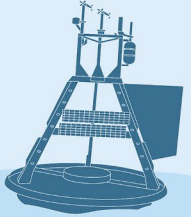
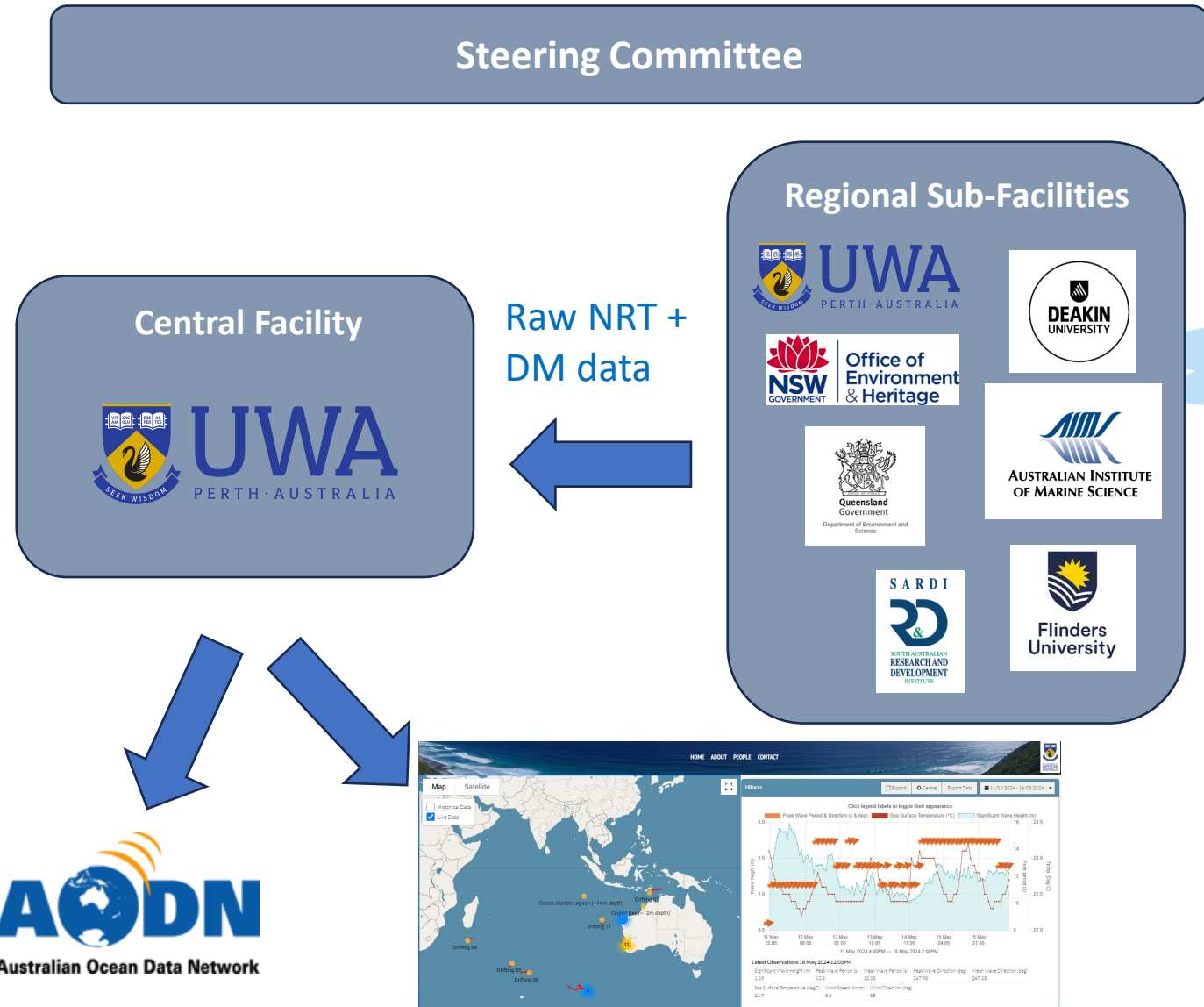
- Includes representatives from regions + IMOS/AODN + Federal agencies (BoM, CSIRO, AIMS)
- Determined standards for site selection, data collection, data processing standards and display

Central facility

- Consists of Facility Manager and Data Officer
- Lead coordination of the national program, including data processing

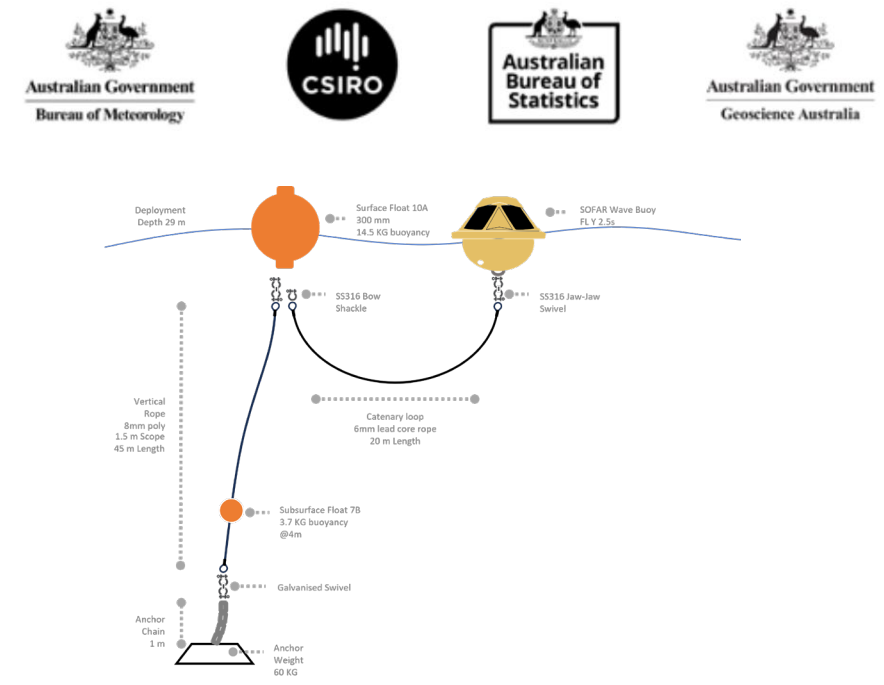
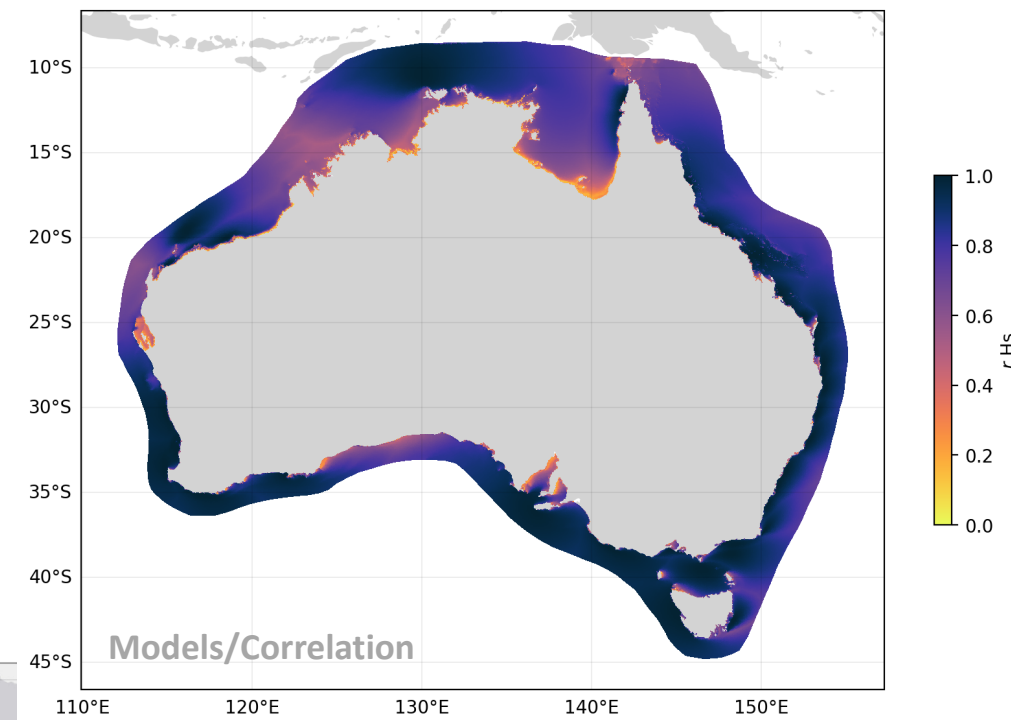
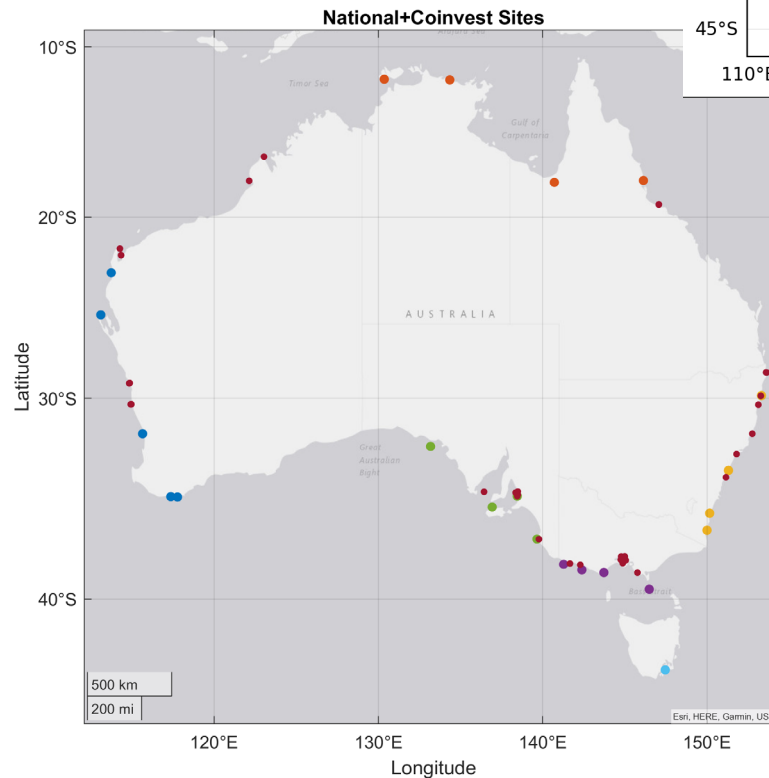
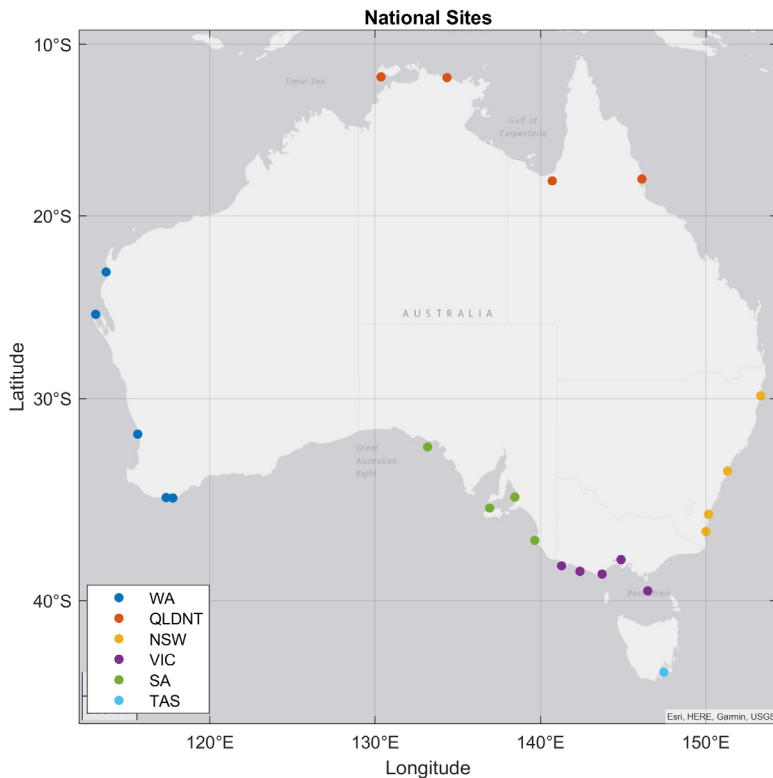
Regional sub-facilities

- Responsible for deployment and on-going maintenance of national sites
- Delivery of data (delayed mode) to central facility for post-processing and delivery to AODN



IMOS - Site selection

- **Models/Correlation** analyses to understand **areas of uncertainty** to inform site selection
- Asked the regional operators to prioritise sites based on **observational gaps, research priorities, stakeholder/end-user needs**
- 23 national sites selected from **regional priorities**
- 30 sites **co-invested** data (more coming)



IMOS - Developing a coastal mooring capability

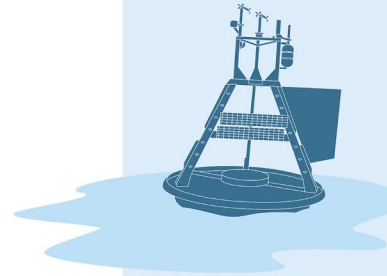
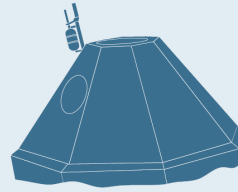
Consultation - need for nationally-coordinated coastal & estuarine WQ observations

Estuarine and Coastal Water Quality Observation Needs:

- Parameters of interest: salinity, temperature, currents, waves, chlorophyll, turbidity
- Water level data from estuaries
- Need to understand storm surge and predict its effects

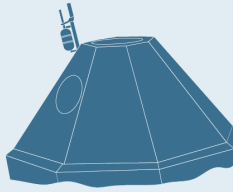
Estuarine and Coastal Water Quality Data/Modelling Needs:

- Aggregated, accessible data → **NEAR REAL TIME DATA**
- Standardised processes along the entire observation value chain
- Estuarine models to predict wave runup and inundation, especially in urban and low-lying areas
- Models to identify where hazard lines are for land use planning



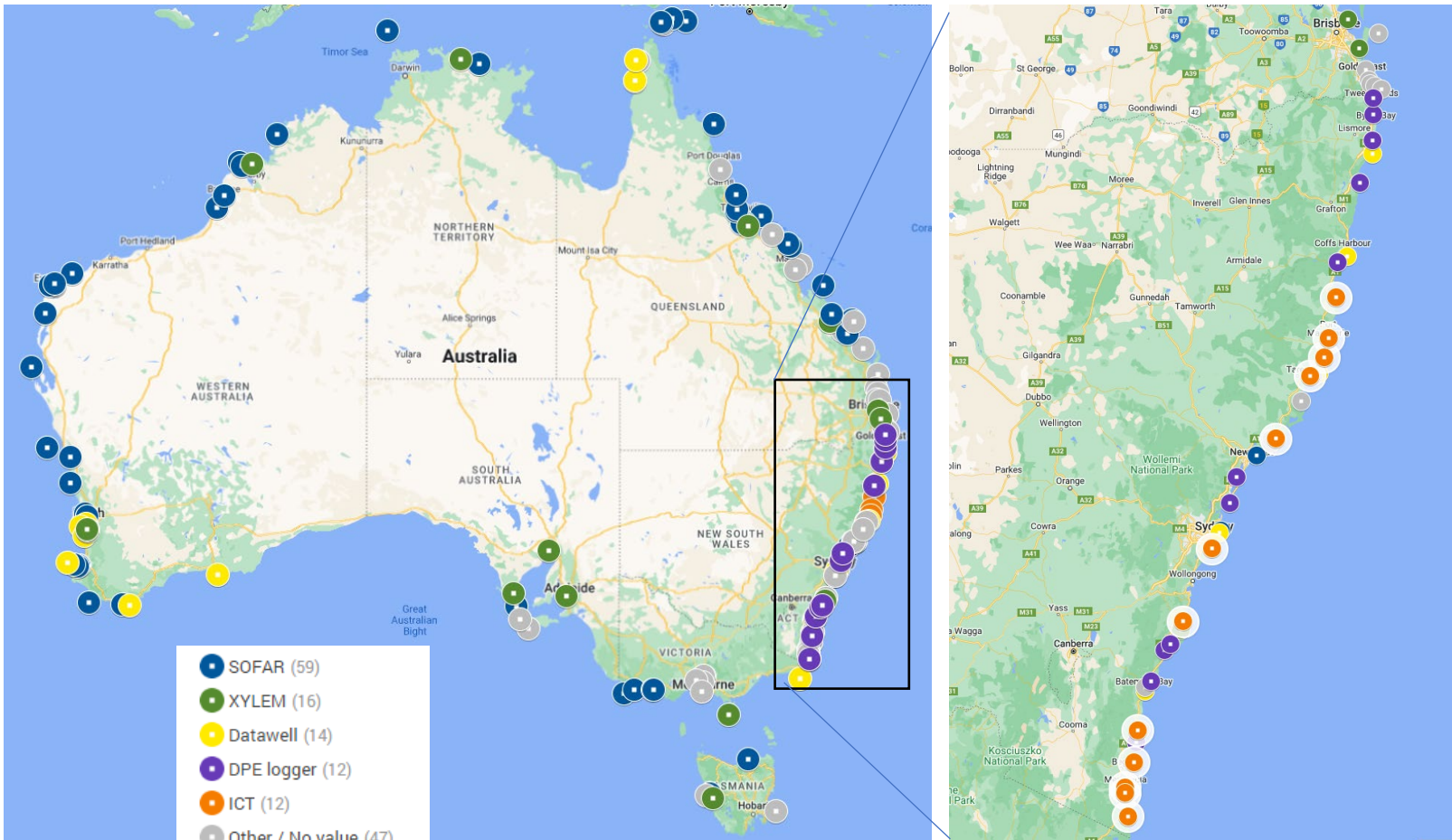
IMOS - Mapping of current locations/manufacturers

Building on a foundation of existing infrastructure and regional networks



Challenges

- Lack of information on the web/private data
 - Monitoring Type
 - Buoy locations
 - Buoy capabilities
- Fragmented Information
- Different Data Standards

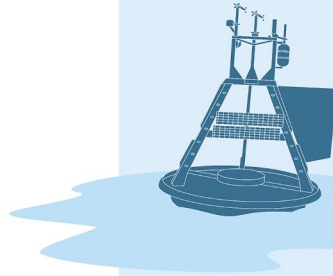
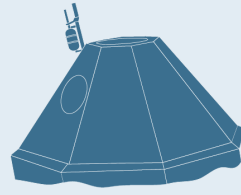


Avoid duplication and more fragmentation:

Importance of mapping current observations/capabilities and aggregating existing data.

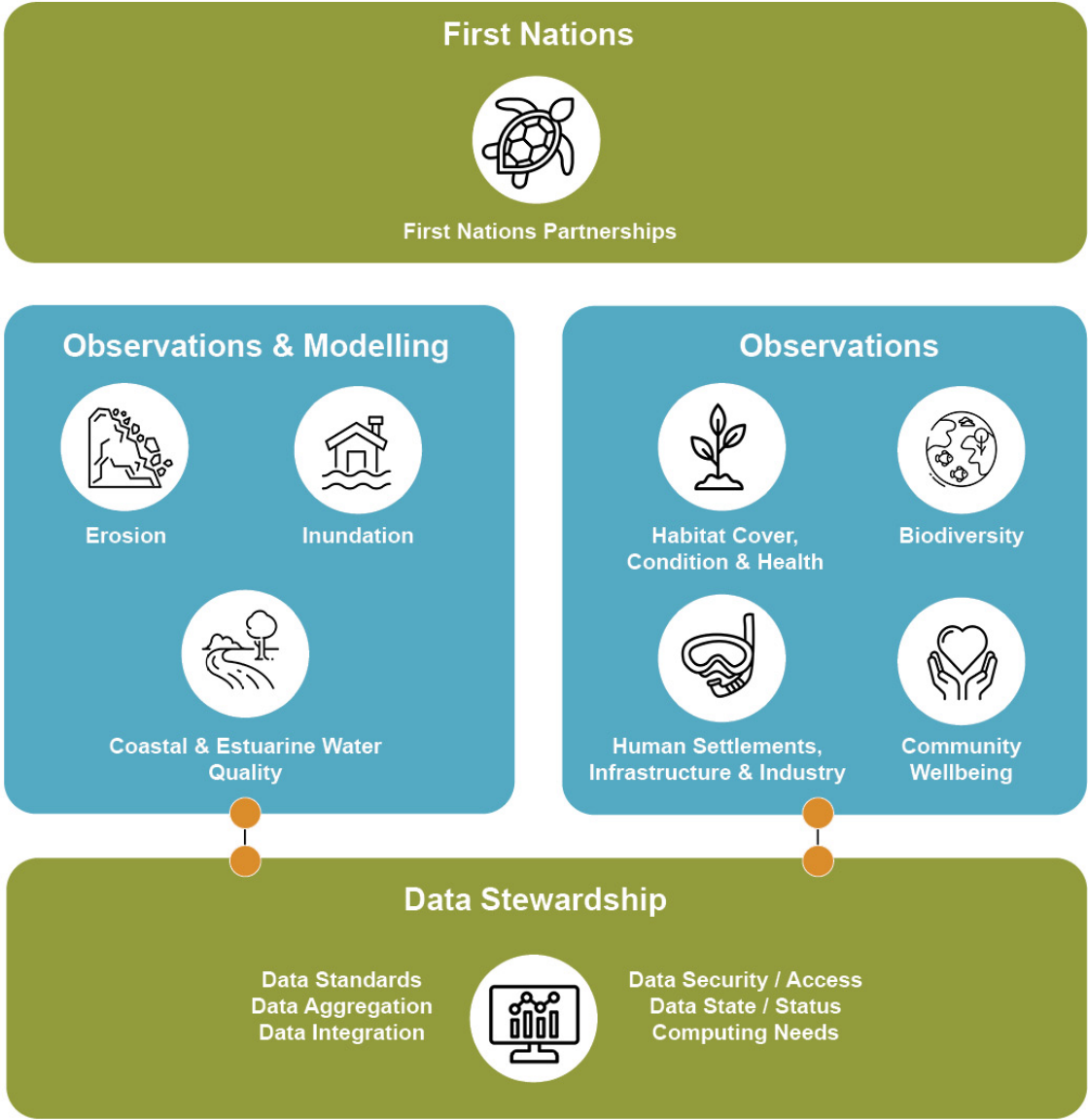
IMOS – EOI Facility lead and regional support

- **Identifying Priority Sites (new/value-adding):**
 - Addressing **observational gaps**
 - Recognizing **historically significant** sites
 - Considering **stakeholder/end-user needs**, including FN perspectives/priorities
 - Ensuring **FN permissions and engagement**
 - Aligning with national and regional **strategic priorities**
 - Assessing potential for **co-investment** opportunities
 - Evaluating **ease of access for operators** and long-term feasibility
- **Identifying Equipment/Platforms/Sensors for cohesive national approach:**
 - Consensus on **key parameters**
- **Establishing national data standards and workflows**
- **Establishing nationally consistent QA/QC protocols**
- **Establishing national guidelines for the operation of Coastal Moorings**



CoastRI Elements

	Theme	Activity type	IMOS elements
WP1.1	Erosion	Observation	· wave buoy +· buoy sensors, drones
WP1.2		Data	· wave buoy data + new sensor data
WP2.1	Inundation	Observation	· estuarine water level · wave buoy smart moorings · climate tide gauge · GNSS buoys [supported by sensor mooring in EWQ]
WP2.2		Data	· wave data covered above · tide, mooring and other new data streams
WP3.1	Coastal water quality	Observation	· sensor mooring · 'manual' water sampling [supported by wave buoy in erosion]
WP3.2		Data	· sensor data + manual WQ data
WP4.1	Estuarine water quality	Observation	· sensor mooring · 'manual' water sampling [supported by wave buoy in inundation]
WP4.2		Data	· sensor data + manual WQ data
WP5.1	Biodiversity	Observation	· eDNA sampling/processing, drones
WP9	Communication/Coordination		· staff · workshops + travel
WP10.1	First Nations	Observation	TBD
WP10.2		Data	TBD



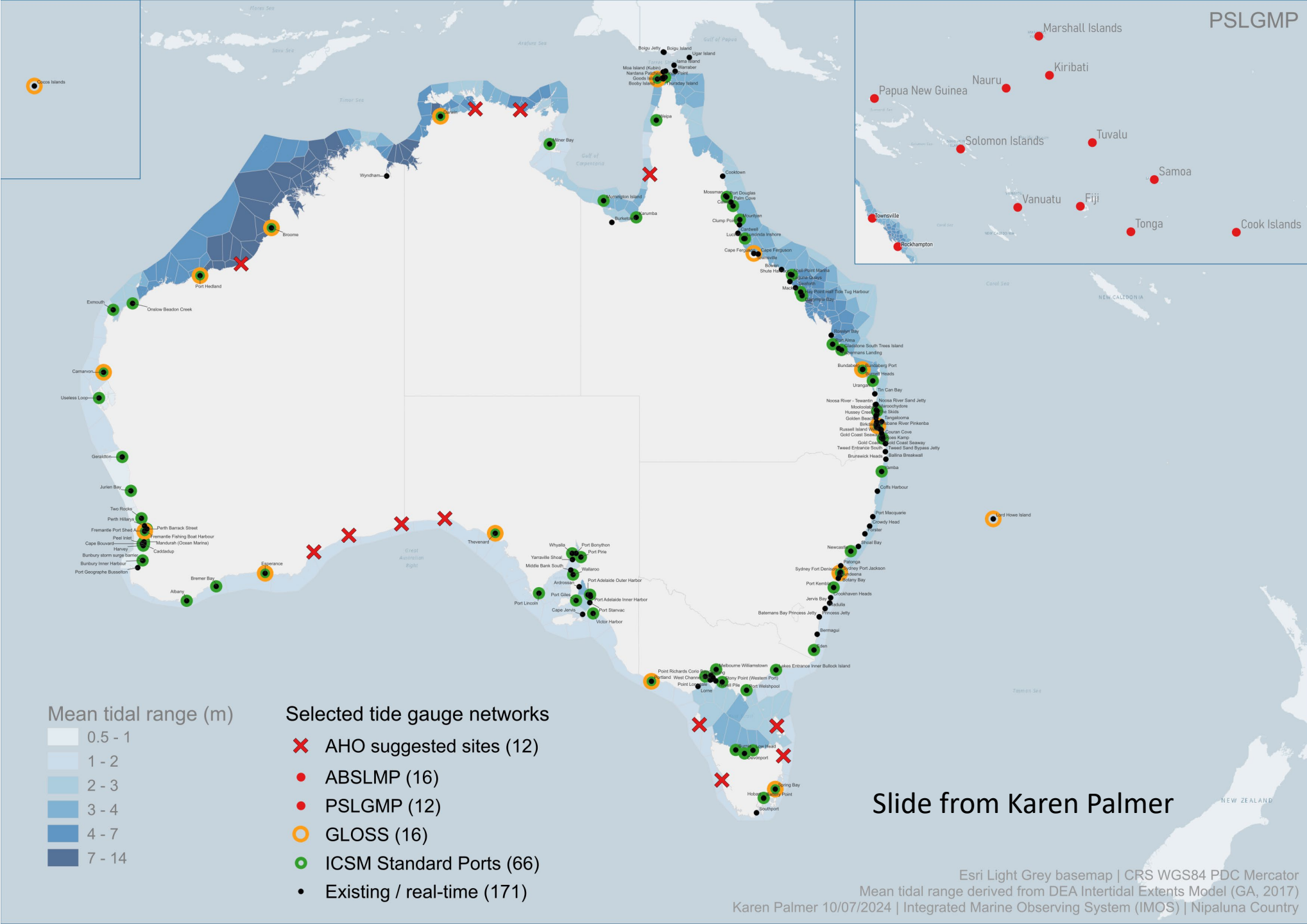
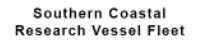
CoastRI WP 2: Inundation



WP	NCRIS CAPABILITY	ACTIVITIES
2.1 Observations	AuScope, IMOS, SCRV, TERN	<ul style="list-style-type: none"> GNSS, Coastline Monitoring Water Level, Wave Buoy Smart Moorings, Tide Gauge, GNSS buoys Surface Elevation Tables (SET)
2.2 Data	ARDC, AuScope IMOS TERN	<ul style="list-style-type: none"> Tide Data Aggregation GNSS Mooring Data, Tide Data SET Data, Habitat Condition
2.3 Modelling	Access-NRI, NCI	Storage, Computing, Modelling Commons (ANCOMS)



Observations: estuary water level stations, GNSS upgrades including INSAR reflectors, smart wave buoys moorings), Climate tide gauge upgrades and leveling, Near coastal GNSS Buoys, Surface elevation tables **Data** tide data aggregation and compute, managing new data streams and storage.



Next Steps

➤ Pre-Full Program Funding:

- CoastRI website
- Implementing initial funding investments
- Workshop planning across themes
- Continue cross NCRIS, stakeholder and rights holder engagement

➤ Post-Full Program Funding:

- Adjust activities depending on funding outcome
- Workshops and annual CoastRI conferences to strengthen coordination, alignment and connection
- (inc establishment of cross NCRIS CoastRI super sites)





Australia's Integrated Marine Observing System 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.

PRINCIPAL PARTICIPANTS



SIMS is a partnership involving four universities

ASSOCIATE PARTICIPANTS



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



Designing a national coastal observation network

- Advance multi-dimensional and multi-scale observations of Australia's coastal regions at the critical land-sea interface where 85% of Australia's population live
- Using national drone and fixed monitoring infrastructure it will provide a vital bridge between satellite and ground measurements.
- NCRIS 2016 Roadmap "Expansion of IMOS into coastal and estuarine waters"
- Marine Nation 2025: Dedicated Whitepaper states a nationally-coordinated approach to sustained coastal monitoring across Australia is required.
- The Infrastructure Australia Priority List (2020) identified as a high priority the need for a coastal inundation protection plan to mitigate affects of sea level rise and flood events. **This will be reliant on high resolution, repeat and longitudinal data to guide policy and implementation.**



\$9,454,400 (NCRIS)

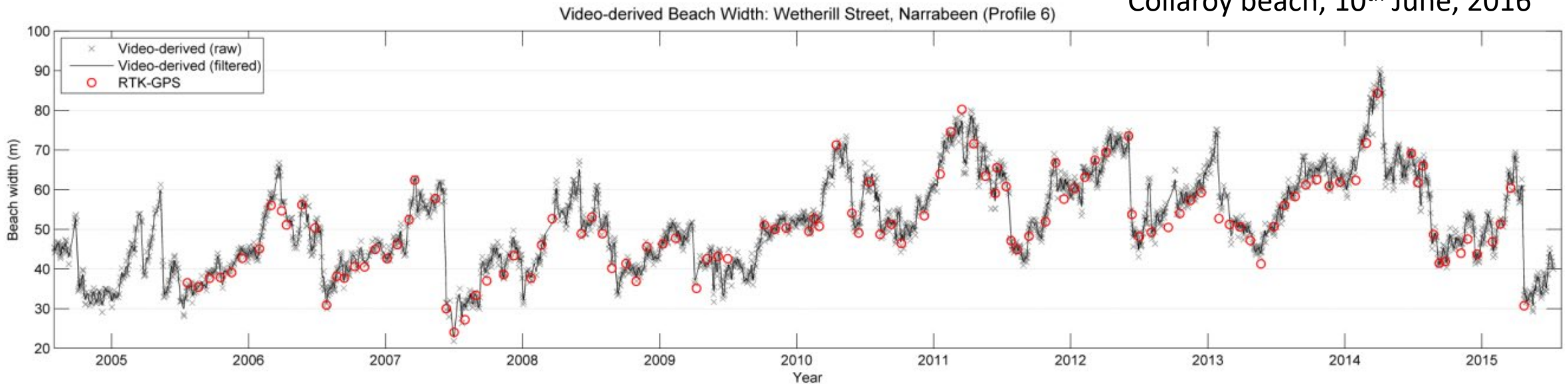
1:1 Co-invest

High-frequency coastal imaging shorelines

- Automated shoreline mapping algorithm has collected > 100,000 hourly shorelines over +15 years (August 2004 – present)
- 420,000 m³ net sand gain measured following 2016 storm
- 91 m³/m on average
- 390 m³/m in centre of beach

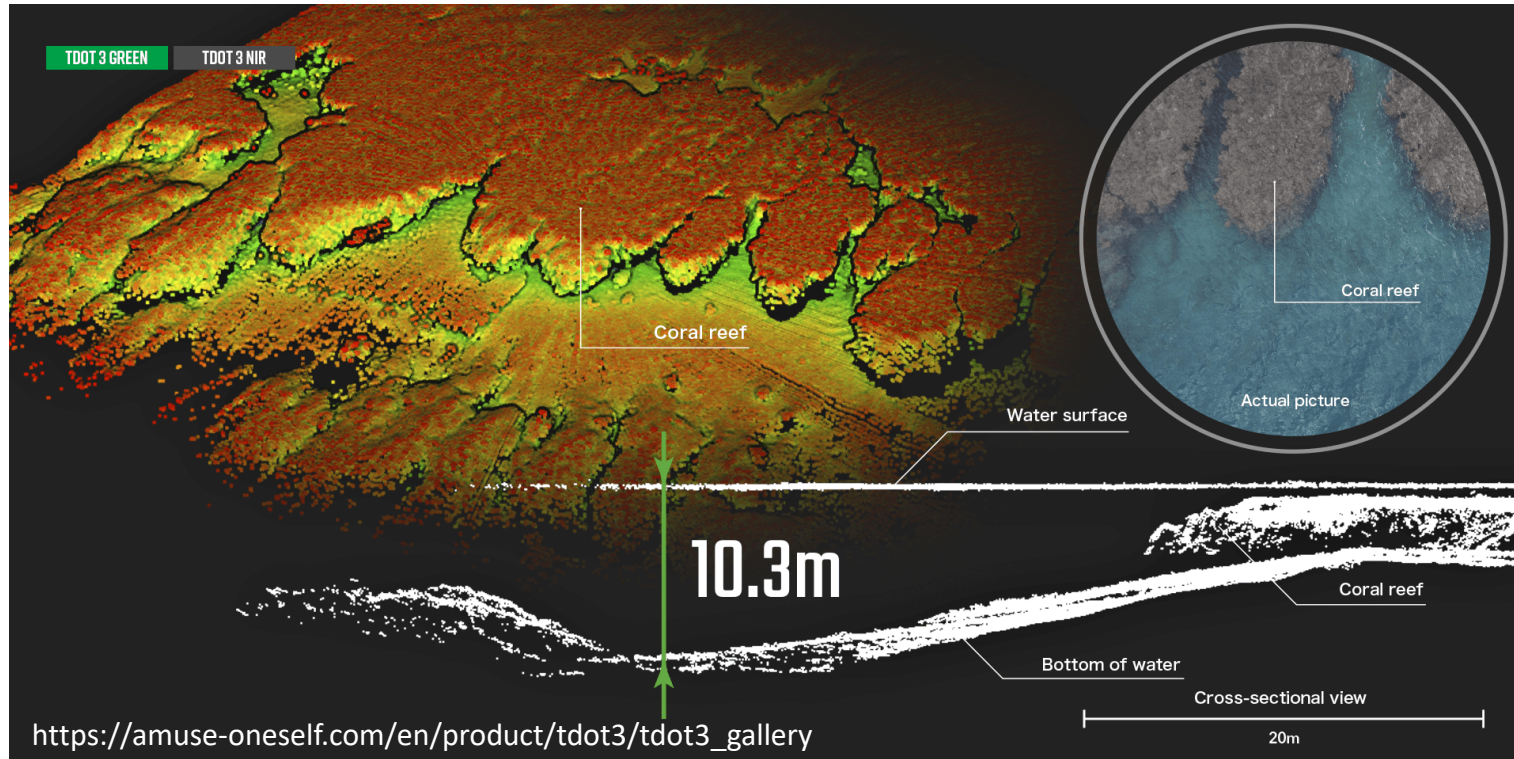


Collaroy beach, 10th June, 2016

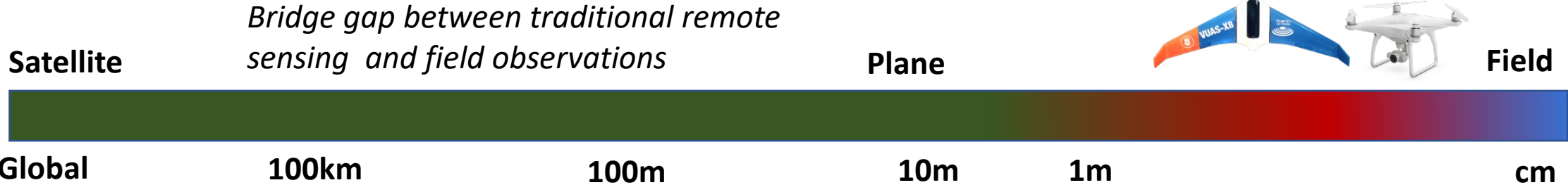
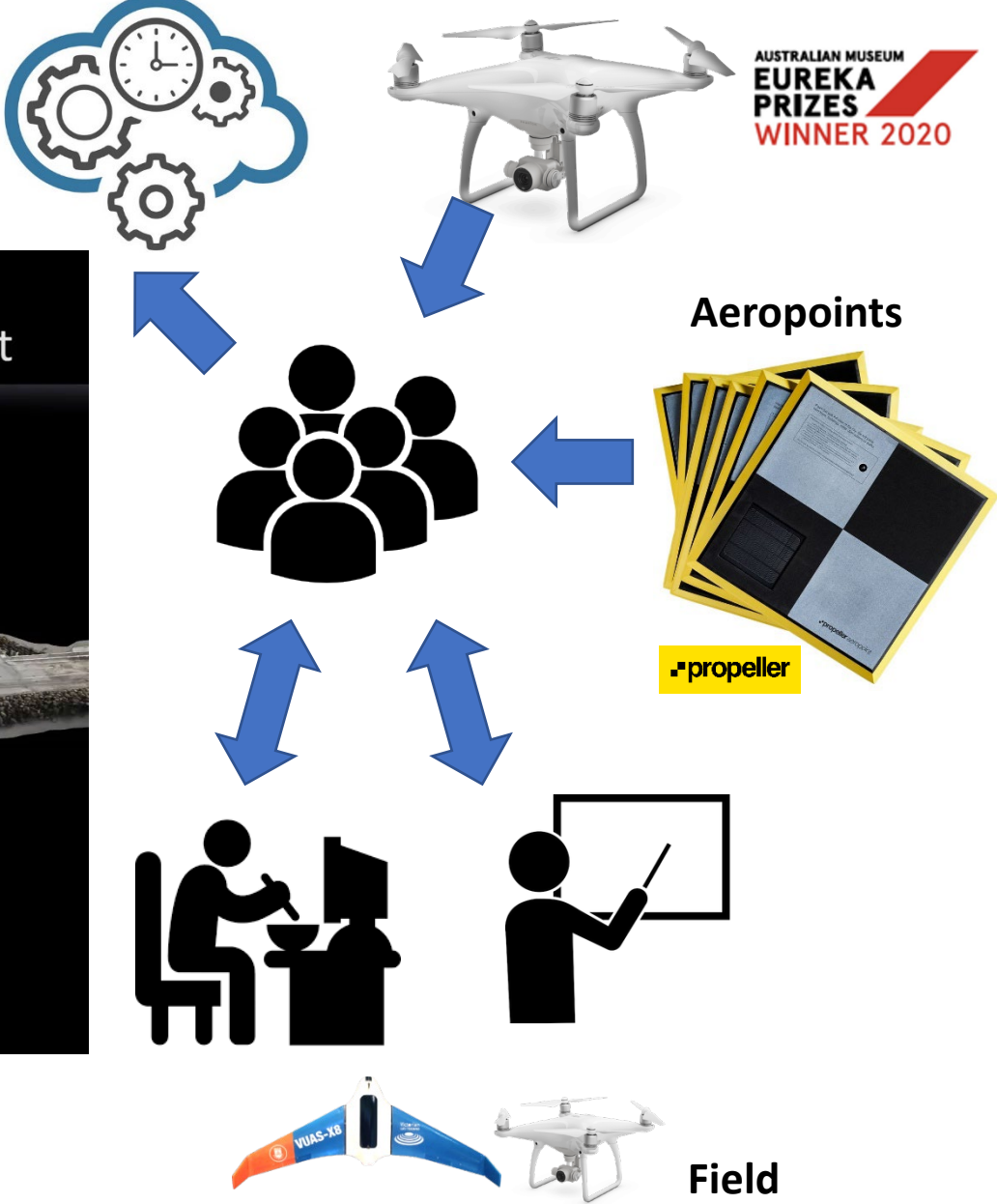


Long range drone capability

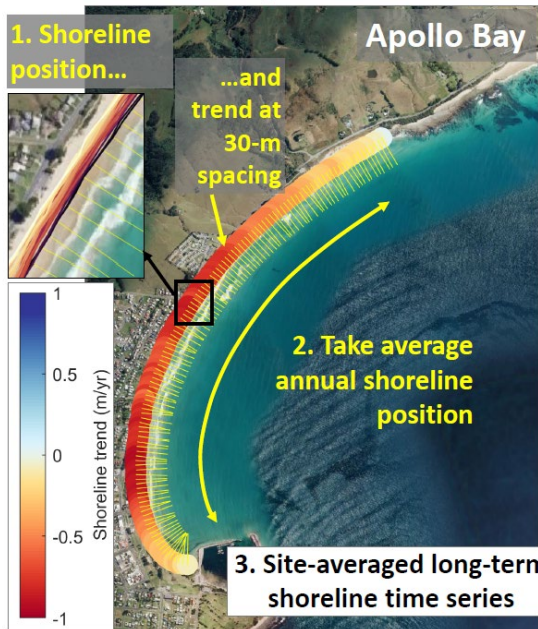
- Critical data across the land sea interface
- Improve Australia's sensor and platform capability
- Sentinel sites for coastal change (habitat, erosion)



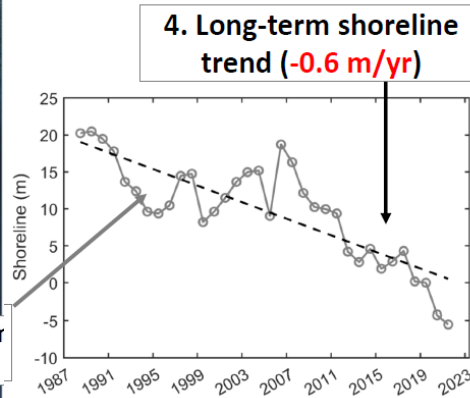
Citizen Science Drones



Shoreline trends

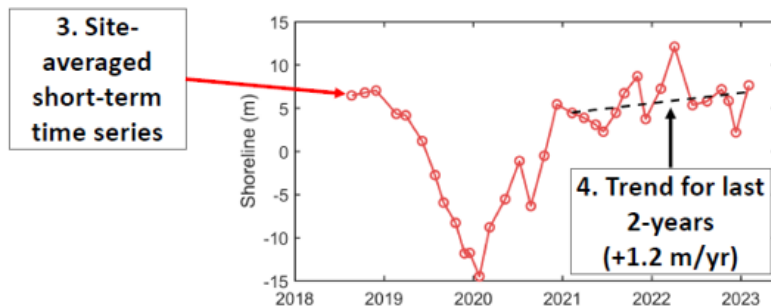
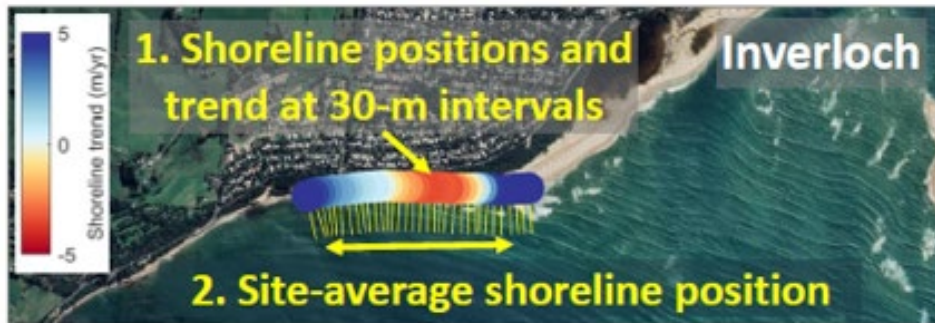
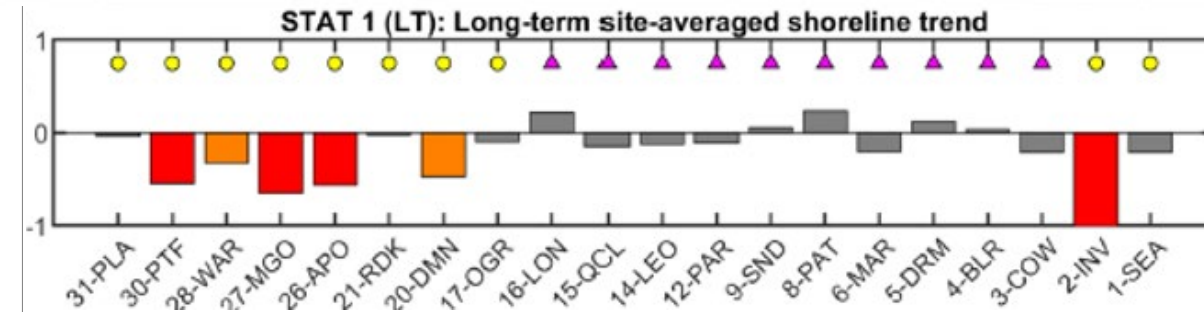


- 180 citizens, 40+ sites, 1000+ surveys with over 3,300 flights since 2018, currently >200 surveys per year



Useful for...

- Persistent erosion hotspots (map)
- Long-term shifts (time-series)
- Average sediment budget for the site (site-wide trend)



Useful for...

- Identify recent changes in behaviour across site (time series and 2-yr trendline)
 - E.g., Inverloch varied from short-term erosion (2018-2019), to accretion (2020), to stable (2021-22)

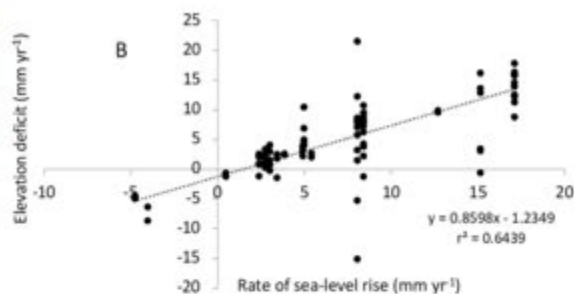
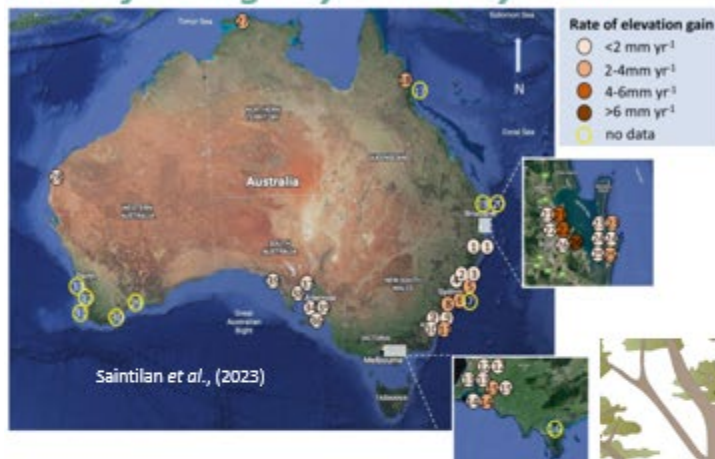


Inverloch
21 Feb 2019

propeller

OzSET: The Australian SET-MH network

initial funding July 2025-July 2027



Standardise monitoring

SOP field guide

App development



Address spatial
data gaps

New sites: Kimberley, GOC, Tasmania
new ecosystems – supratidal, seagrass



Enhance capability to undertake field work:
tech and practical support

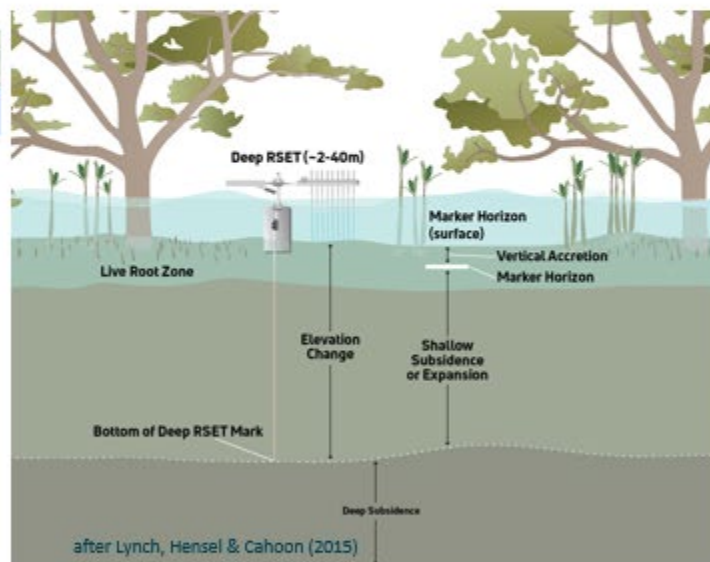


Expanding the metadata: link to LiDAR/UAV



Collaborations with other monitoring
capabilities in TERN/Coast RI

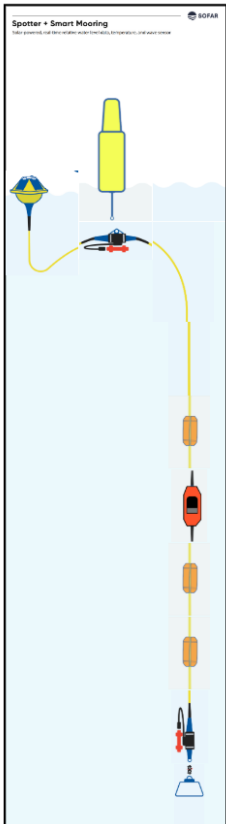
- Monitor coastal wetland respond to SLR
- Existing: 300 + (R)SETs across Australia at 32 sites
- Long term data sets (25 years at some sites)



Sofar Spotter Platform IMOS Trials

Spotter Platform: extensible ocean sensing platform delivering real-time surface and subsurface data.

IMOS Trials: Spotter with Smart Mooring systems:



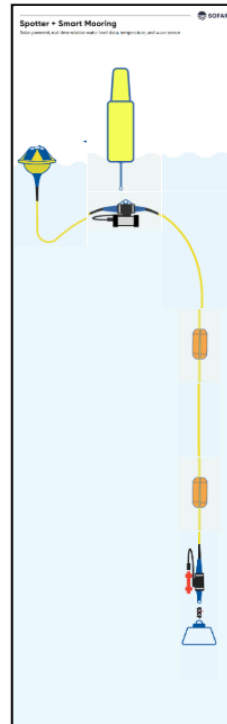
System 1. Metocean + currents + water level

Surface:

- Waves
- Wind (inferred)
- Atmospheric pressure

Subsurface:

- High-accuracy temp.
- Current speed + dir.
- High-accuracy temp. + pressure/water level



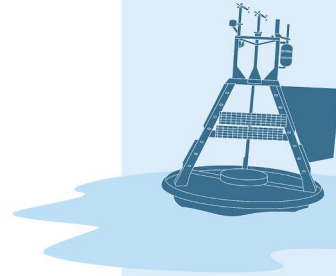
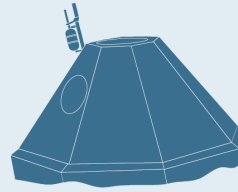
System 2. Metocean + water quality

Surface:

- Waves
- Wind (inferred)
- Atmospheric pressure

Subsurface:

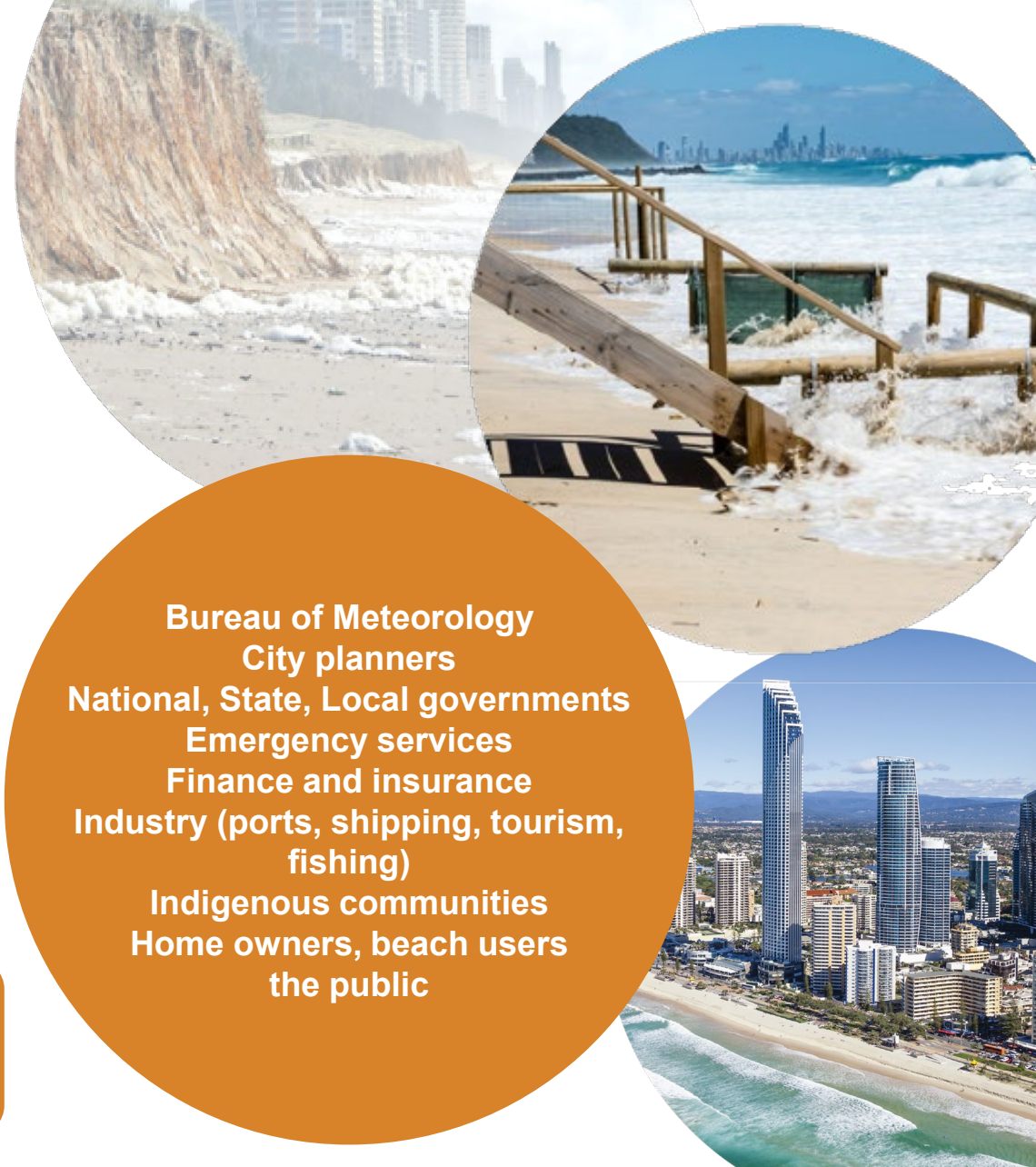
- Water quality (multiparameter EXO3)
- High-accuracy temp. + pressure/water level



The Coastal Challenge

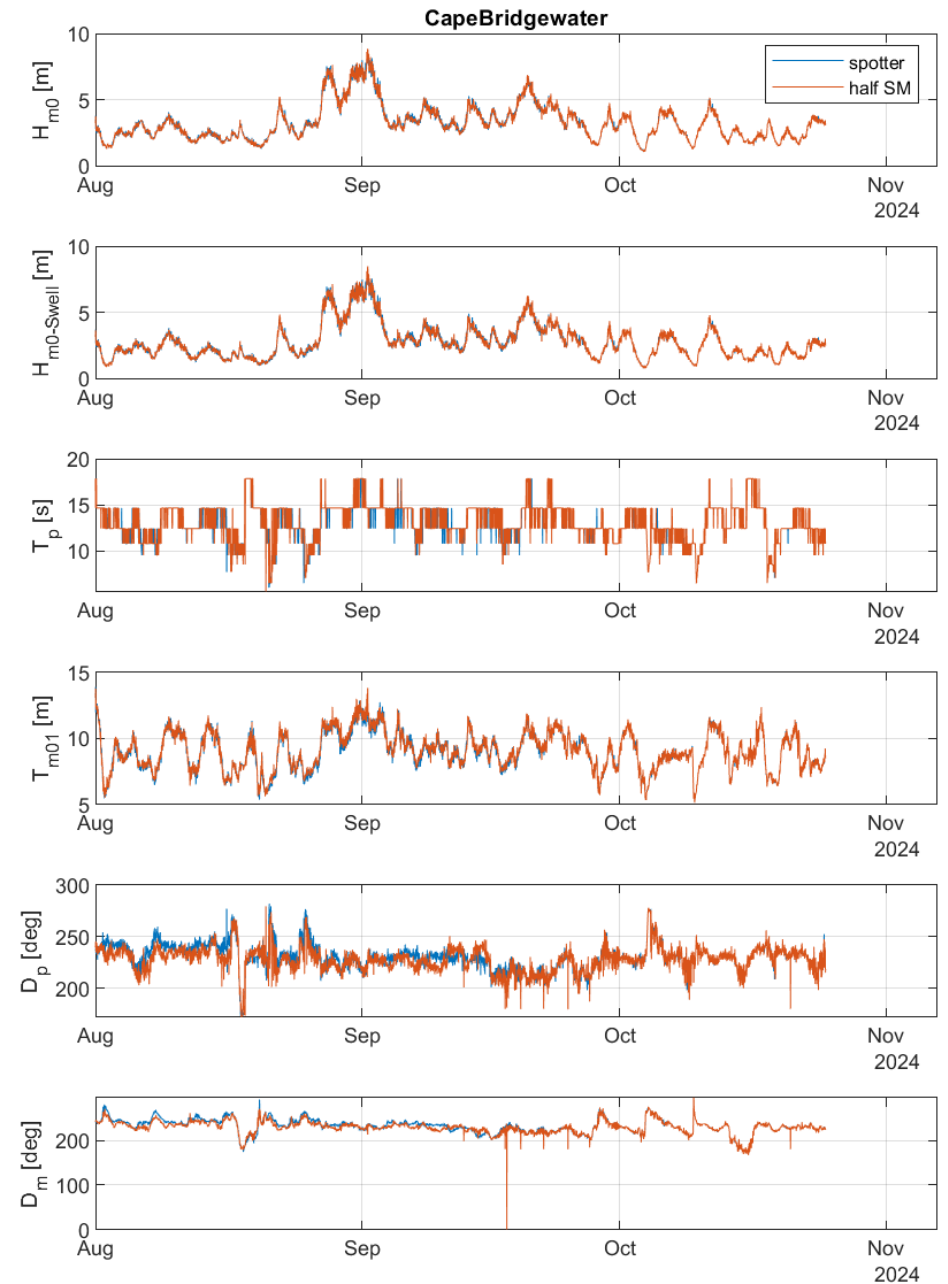
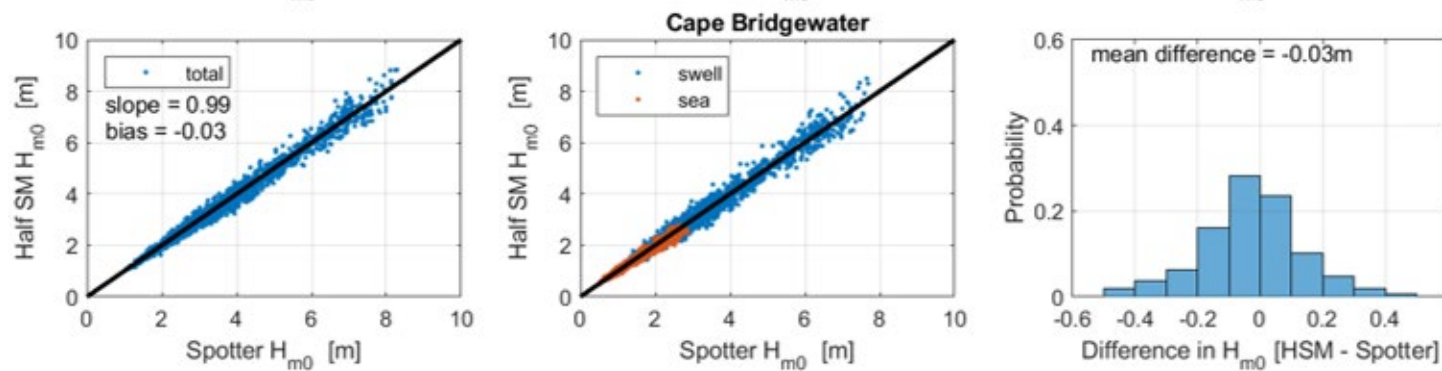
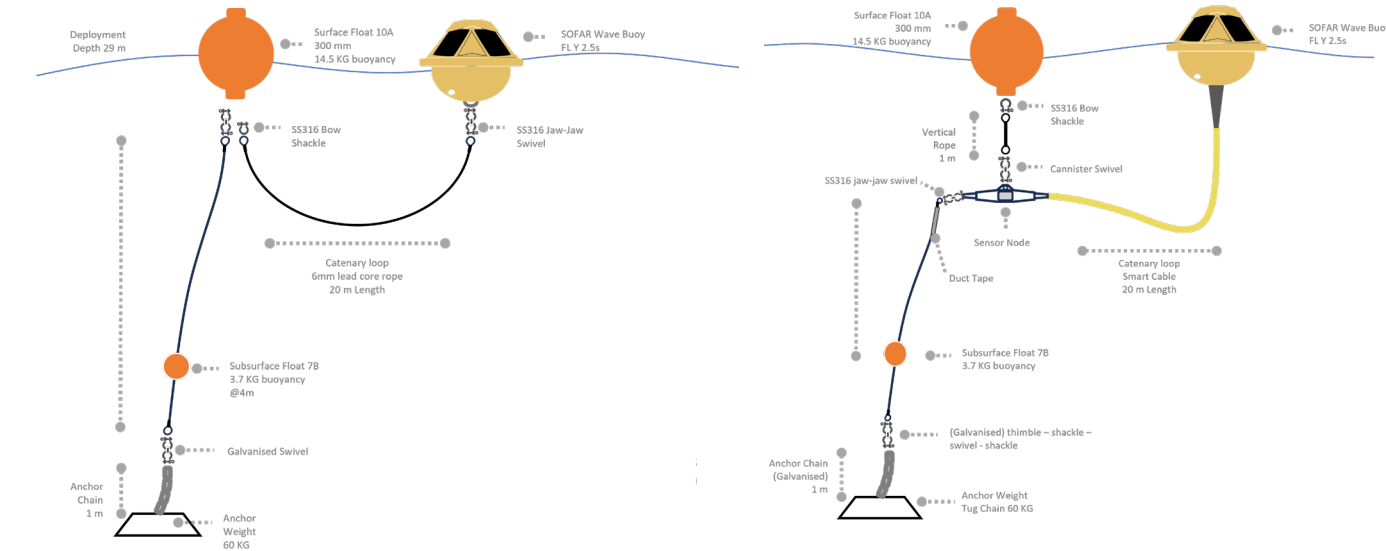
- Our climate and environments are changing at **unprecedented rates**.
- Over **50% of Australians live within 7 km of the coast** in addition to **billions of dollars of infrastructure**.
- To increase preparedness, sustainable use, and improve decision-making we **need more data to understand implications of change** to coastal areas.
- A broad suite of end-users **need data on coastal conditions and change**.

Australia lacks a national, cohesive approach to monitor, understand, predict, and adapt to these changes



Smart mooring trials

- Opportunistic testing of 'half smart moorings'
- Could enable high fidelity wave and surface temperature observations
- Spotter + RBRcoda³ temperature sensor



Recent observations – MHWs and TCs

- Varying response/impact based on relative position to TC track
- Intense heating at Coral Bay through Jan and Feb 2025 --- extensive bleaching along Ningaloo

