Enhancing Australia's network of coastal wave observations using low cost wave buoys

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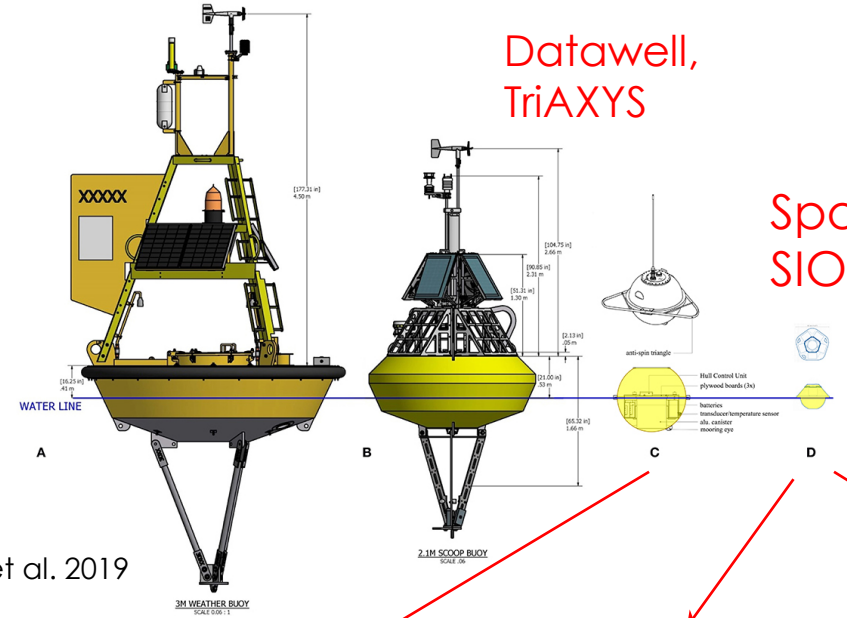
BOM Annual R&D Workshop 2020

In situ wave measurements (buoys)

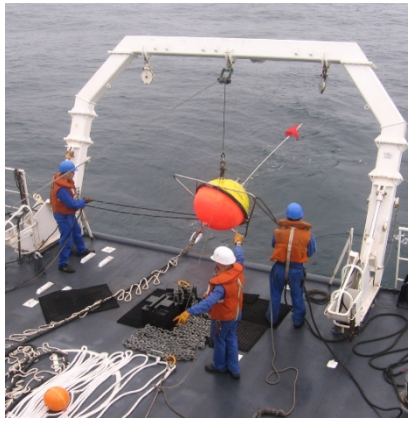
- Conventional wave buoys (e.g. Datawell, TriAXYS)
  - ✓ $70-100K AUD
  - ✓ ~200 kg (require mid-size vessels for deployment)
- Emerging low cost wave buoy technology
  - ✓ ~$7K AUD (Spotter)
  - ✓ ~5 kg



Arduin et al. 2019

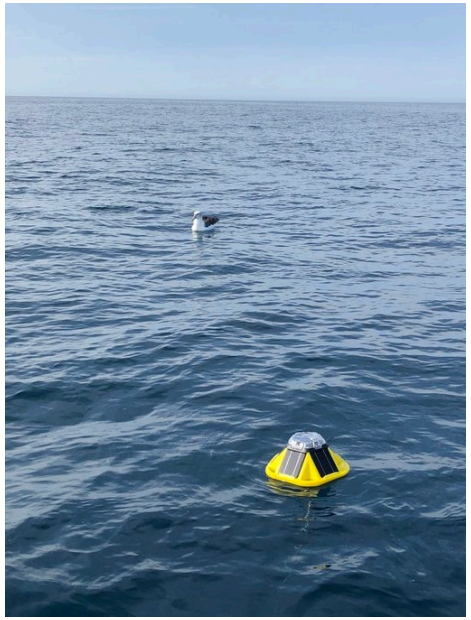
Datawell, TriAXYS

Spotter, SIO, etc.



IMOS New Tech Proving (NTP) project (2019-2021)

- Spotter (Sofar Ocean Technology)
- Originally developed for drifting applications (US ONR funding)
- $4500 USD (~$7K AUD)
- Small (~40 cm diameter) and lightweight (5 kg)
- GPS-based wave measurement approach
- Near-real-time data transmission (Iridium)
- Other similar buoys (e.g. Scripps)



Evidence the hardware can measure wave motions as effectively as conventional buoys. But open questions….

✓ Mooring effects for low-mass wave buoys (extreme waves, surface currents, windage)?
✓ Durability and longevity for operational networks (hardware, fouling, etc.)

Project aims

1. How well do these low-cost wave buoys perform in moored applications over a wide range of wave conditions (including extremes), wind conditions, and surface currents?
2. How reliable is this technology for the long-term deployments required for observational programs?
3. How does this technology perform in drifting applications relative to traditional moored applications?

Approach

- Benchmark the “performance” of these low-cost wave buoys against Datawell and TriAXYs buoys
- Assess mooring effects and improve designs
- Test sites in WA, Vic and NT (wide range of different wave climates, wind conditions, surface currents, etc.)
- Develop QA/QC approaches for wave buoy measurements (including spectral data) and integration into AODN

Coastal wave buoy network and test sites

◯ = Test Sites

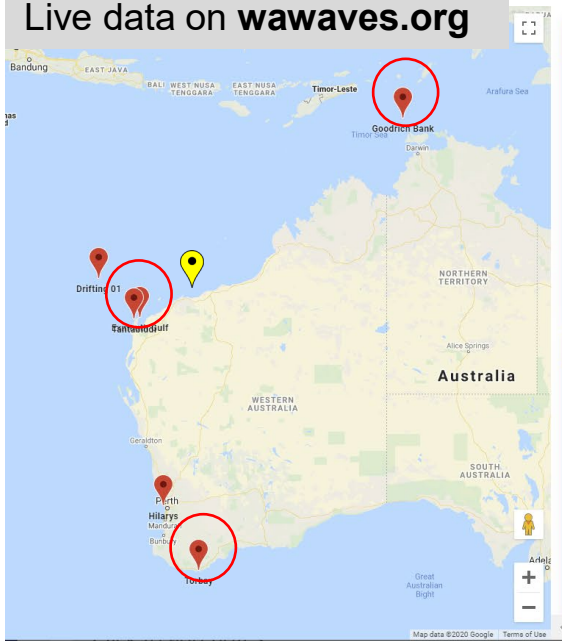
IMOS Integrated Marine Observing System

THE UNIVERSITY OF WESTERN AUSTRALIA

WA and NT test sites

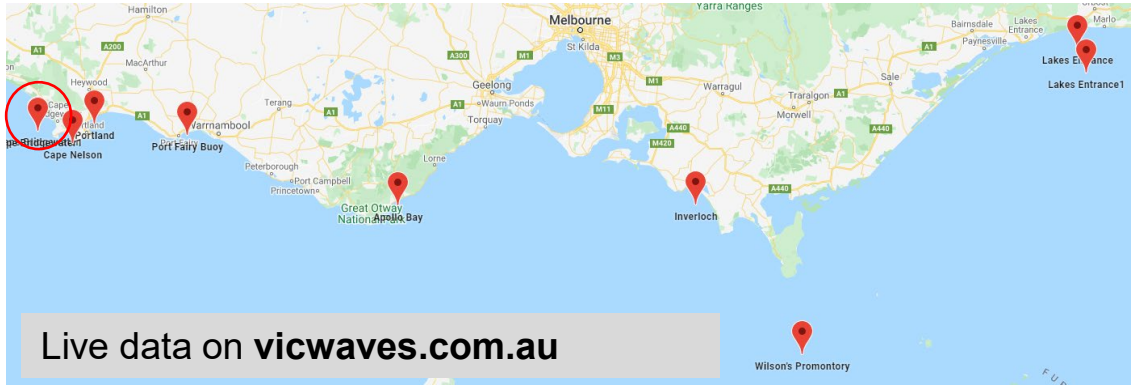
- WA: Albany and Ningaloo (w/ UWA and DoT Datawells)
- NT: Goodrich Bank (w/ IMOS TriAXYS)
- Real-time data at **wawaves.org**

Live data on **wawaves.org**



Victoria

- Cape Bridgewater (w/ TriAXYS)
- Real-time data at **vicwaves.com.au**



Live data on **vicwaves.com.au**

Trialling different mooring designs (Examples)

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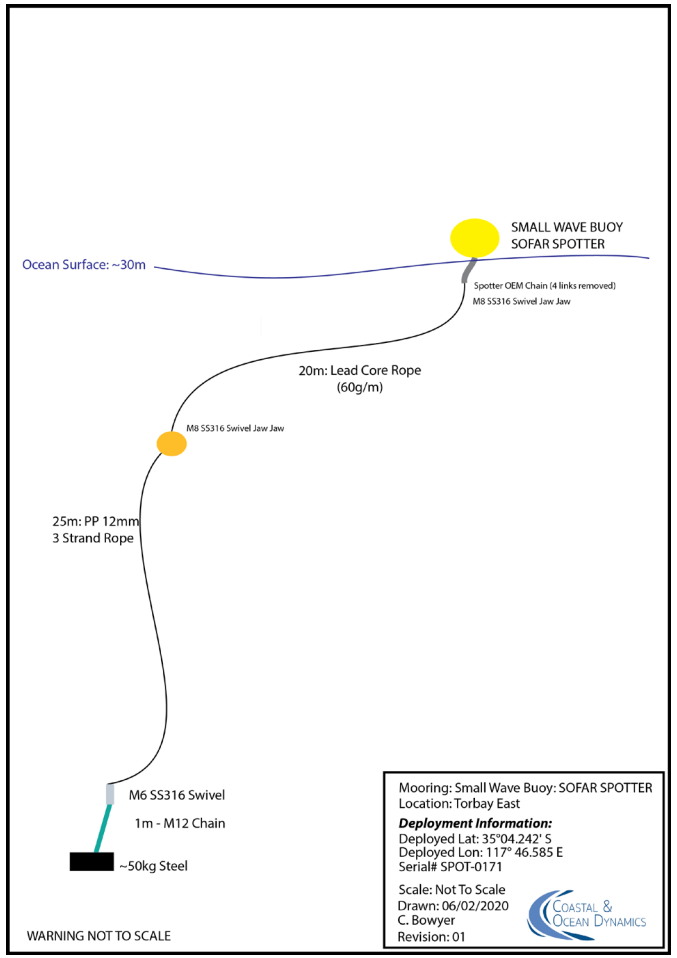
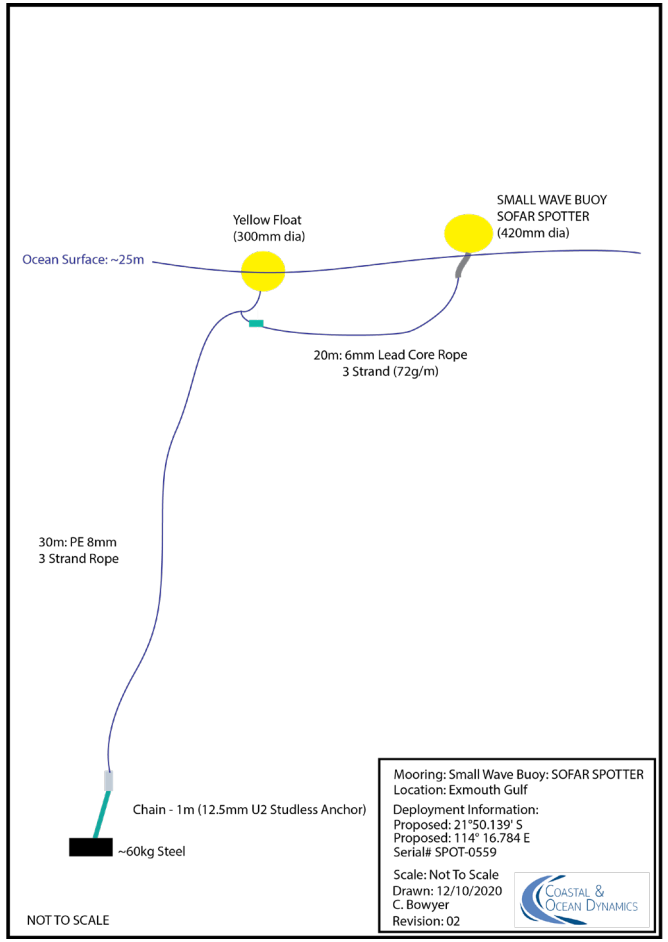
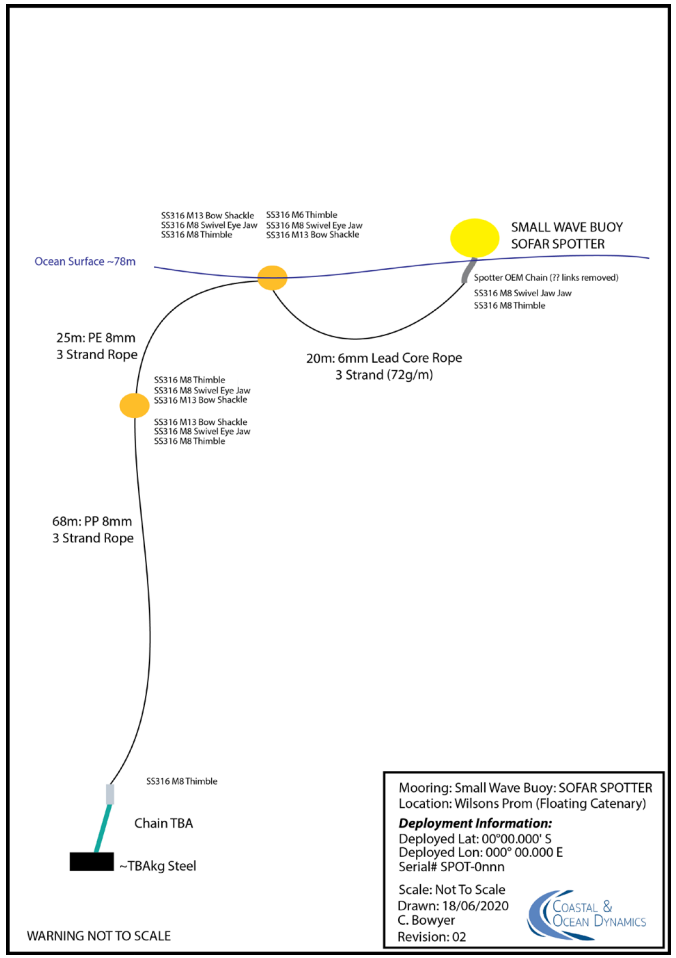
Mooring #1



Mooring #2

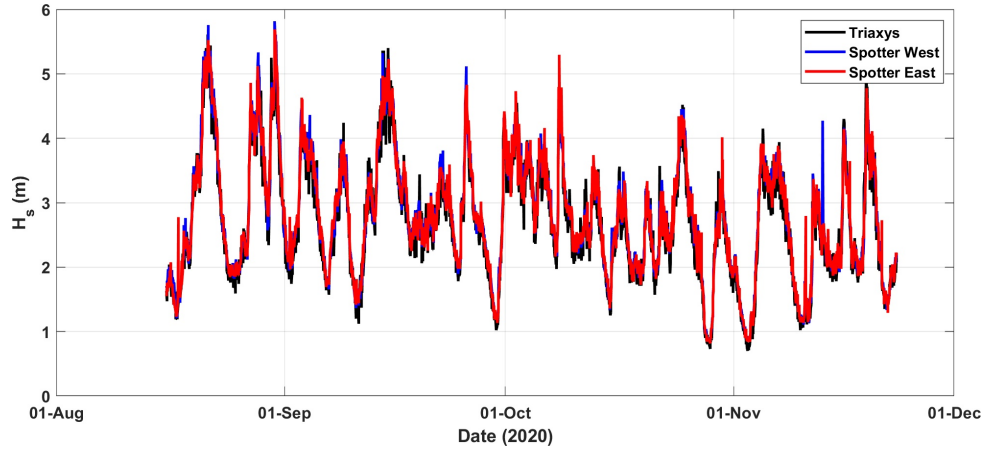


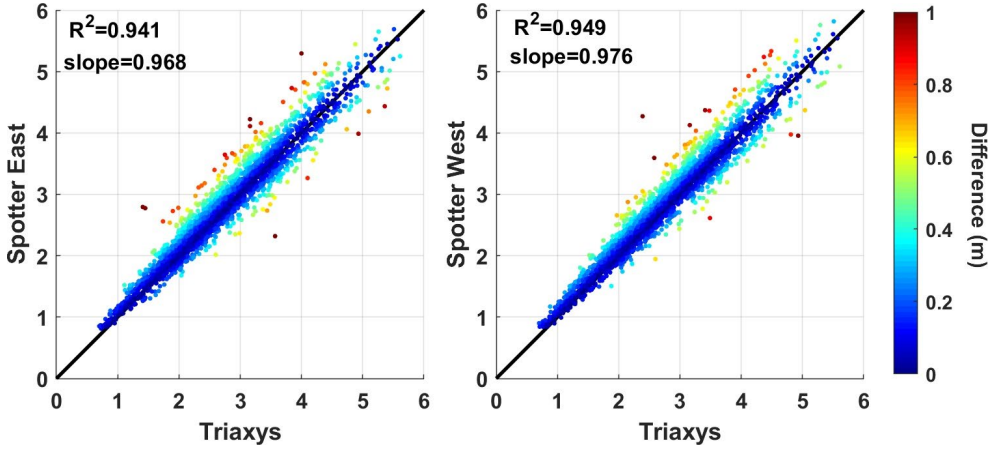
Mooring #3



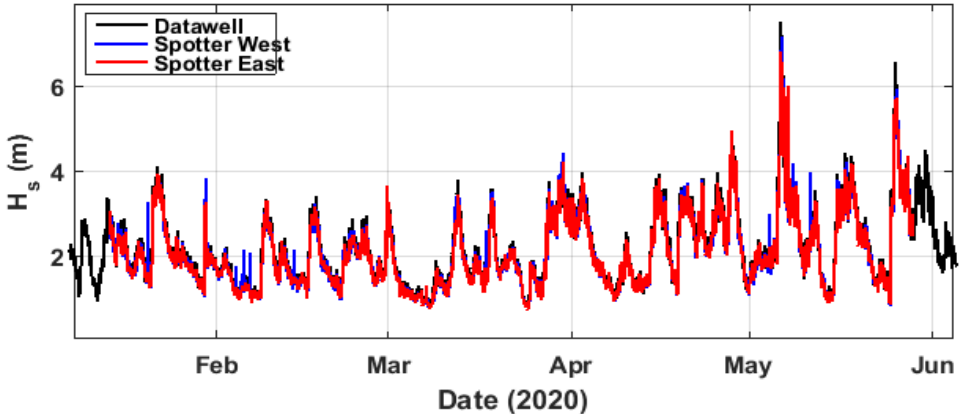
Performance evaluation

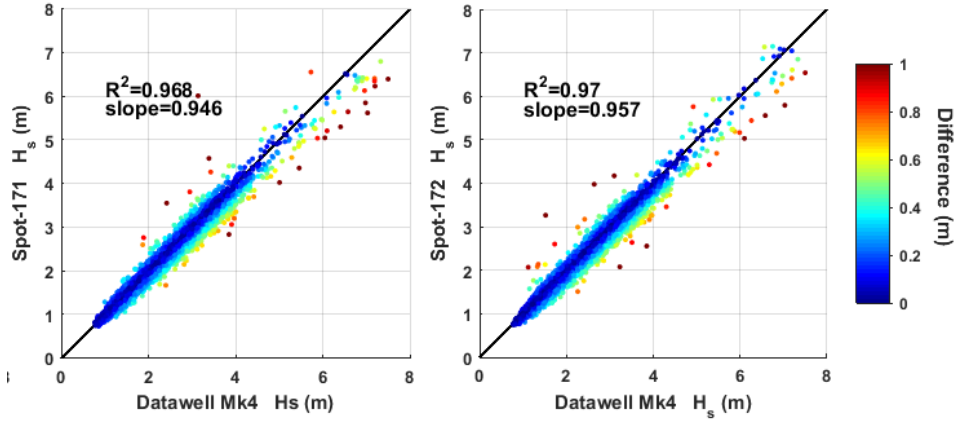
Cape Bridgewater: Spotter vs. TriAXYS





Albany: Spotter vs. Datawell

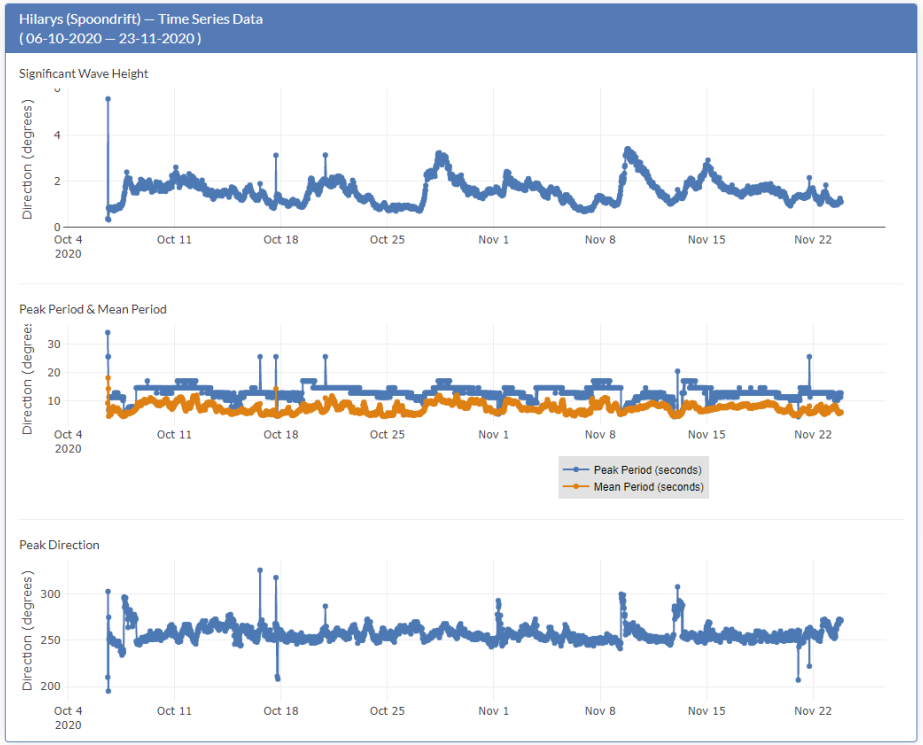


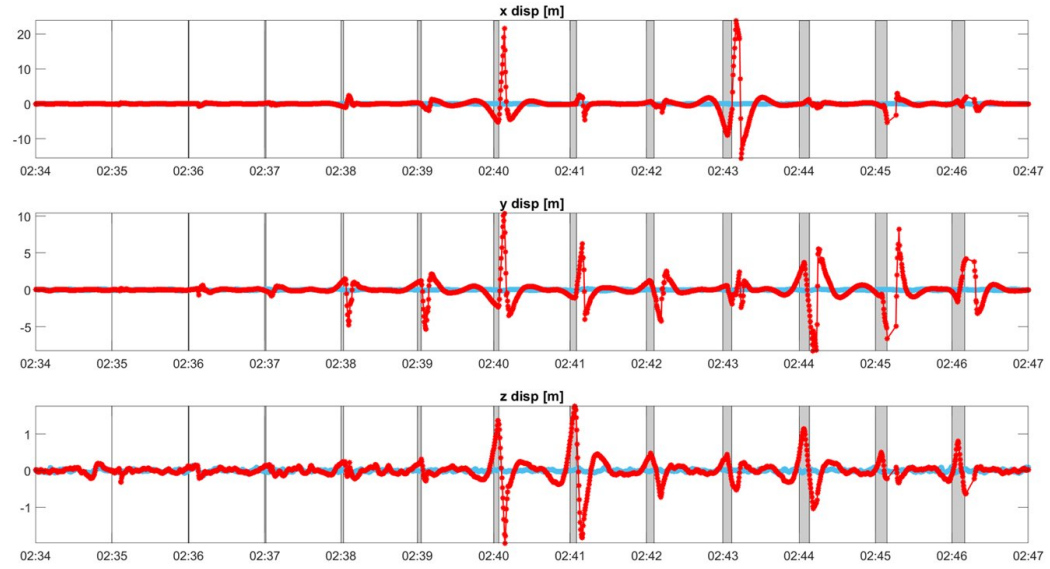


Also comparing directional spectra, time series (individual waves), etc.

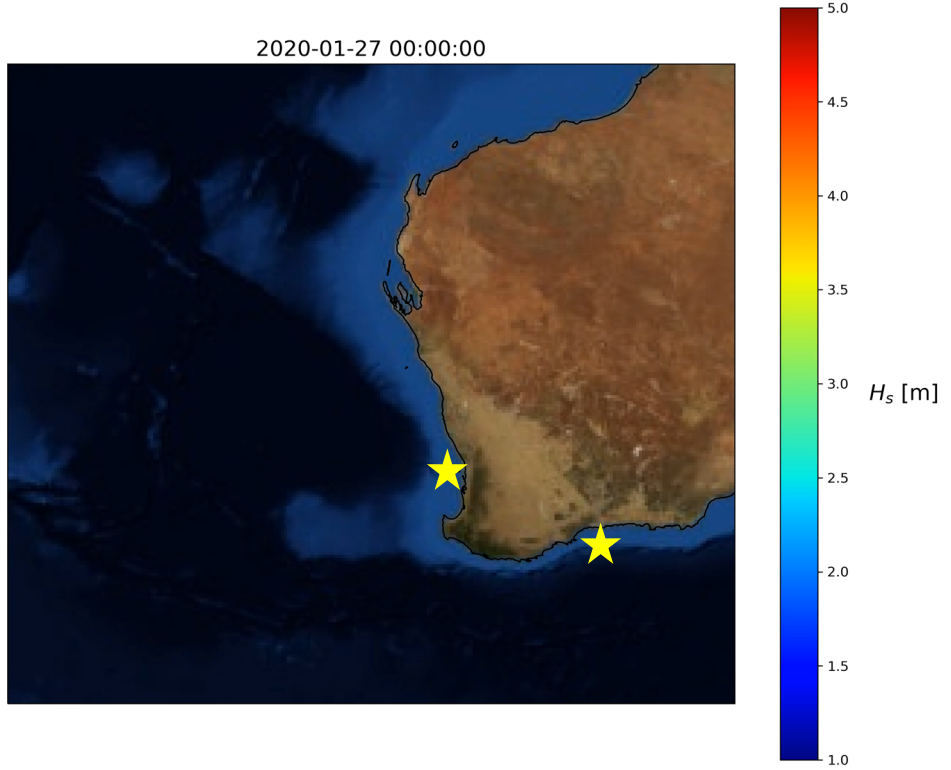
QA/QC and data workflows

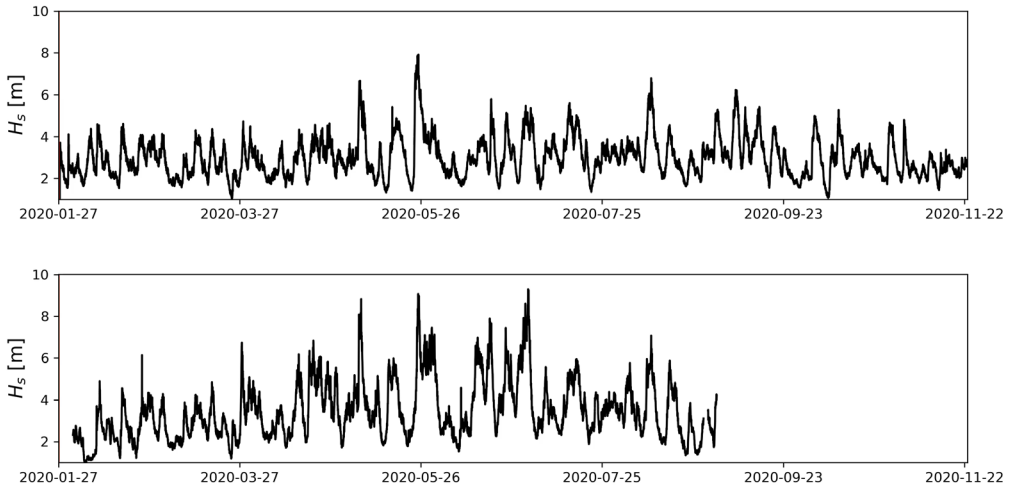
- Assessing causes of occasional bad data ‘spikes’
- Using quality control guidelines outlined in IOOS/QARTOD
- Delivery of IMOS-compliant netCDF for AODN
- Presently focusing on bulk parameters but moving to include spectral outputs, displacements





Drifter trials



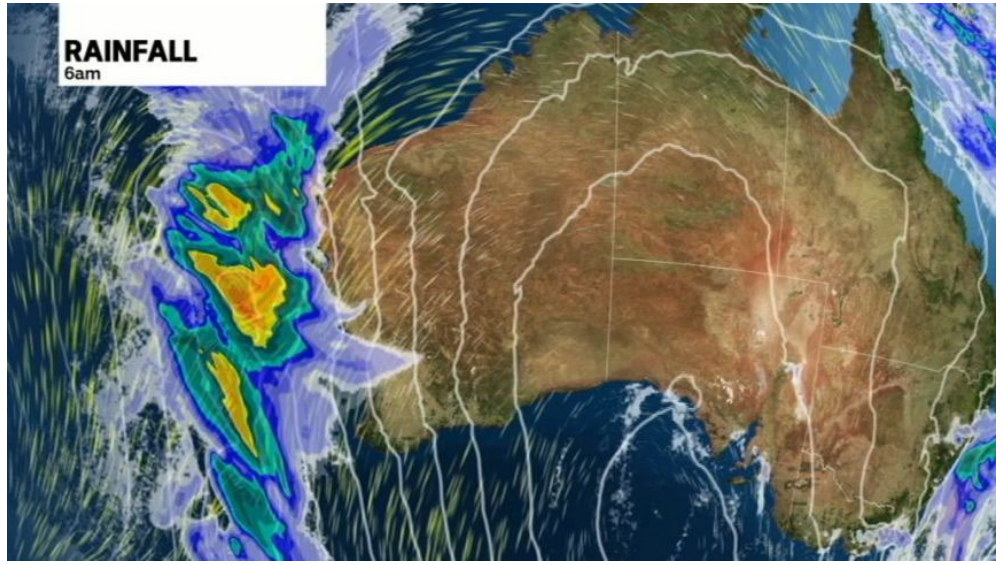


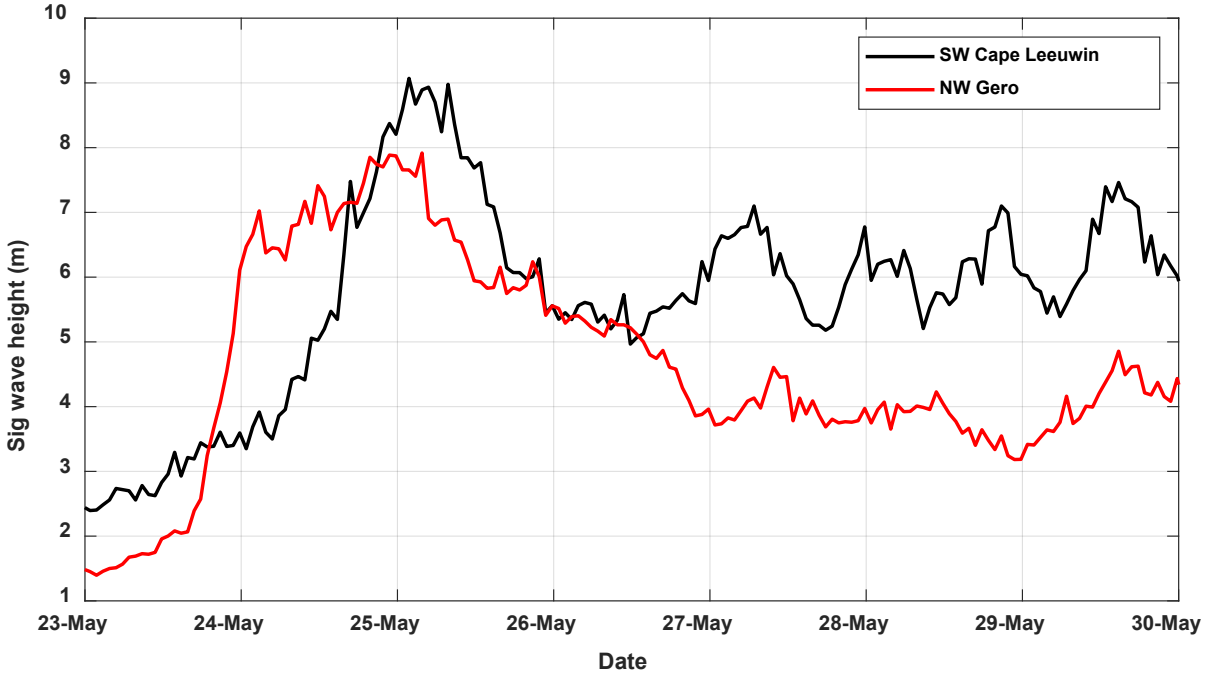
Jan 2020 **Nov 2020**

Releases off Bremer Canyon (south coast) and Perth Canyon

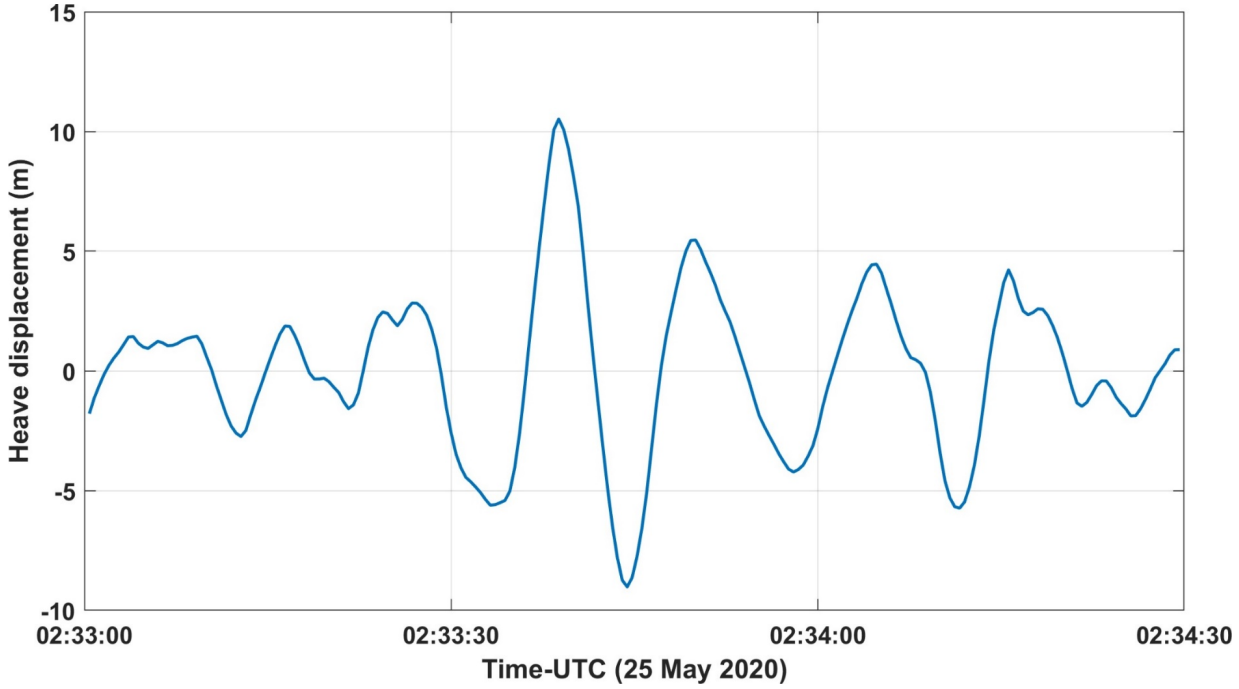
Drifting buoy trials (Ex-TC Mangga observations)

- Both drifting buoys were well positioned to record the large waves from ex-cyclone Mangga that struck WA on 25 May (~1 in 10 year event)





Max individual wave = 19.5 m



Summary

- During first year of the project, ~1 year of data from WA (Albany) and VIC sites with different moorings
- Successful drifter trials (including 11+ months data)
- New deployments in northern Australia in Nov (WA-Ningaloo Reef and NT)
- Current focus on improving QA/QC approaches and processing codes (linking with Australian waves community via FOO, etc.)
- Data delivery to AODN

Acknowledgements

Integrated Marine Observing System NTP funding, Minderoo Exmouth Research Laboratory, Carlin Bowyer, Paul Tinkler, AIMS R/V Solander crew

Enhancing wave measurements around Australia

A push for a more national approach to wave measurements, e.g.

- Forum for Operational Oceanography – Surface Waves Working Group (Hemer et. al)
- National wave research priorities (Greenslade et al. 2019 BAMS)
- Waves as priority in the IMOS Five Year Plan (2017-22) ("Enhancing IMOS to begin investing directly in the measurement of waves")

Waves engage a wide range of stakeholders and end users

- Marine industries, State and local govts, Defence, emergency service providers, general public, etc. etc.