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IMOS Integrated Marine Observing System

THE UNIVERSITY OF WESTERN AUSTRALIA | Oceans Institute

Observations of extreme events on the continental shelf regions of Australia using ocean gliders

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Australian Institute of Marine Science

IUGC2024

INTERNATIONAL UNDERWATER GLIDER CONFERENCE 2024

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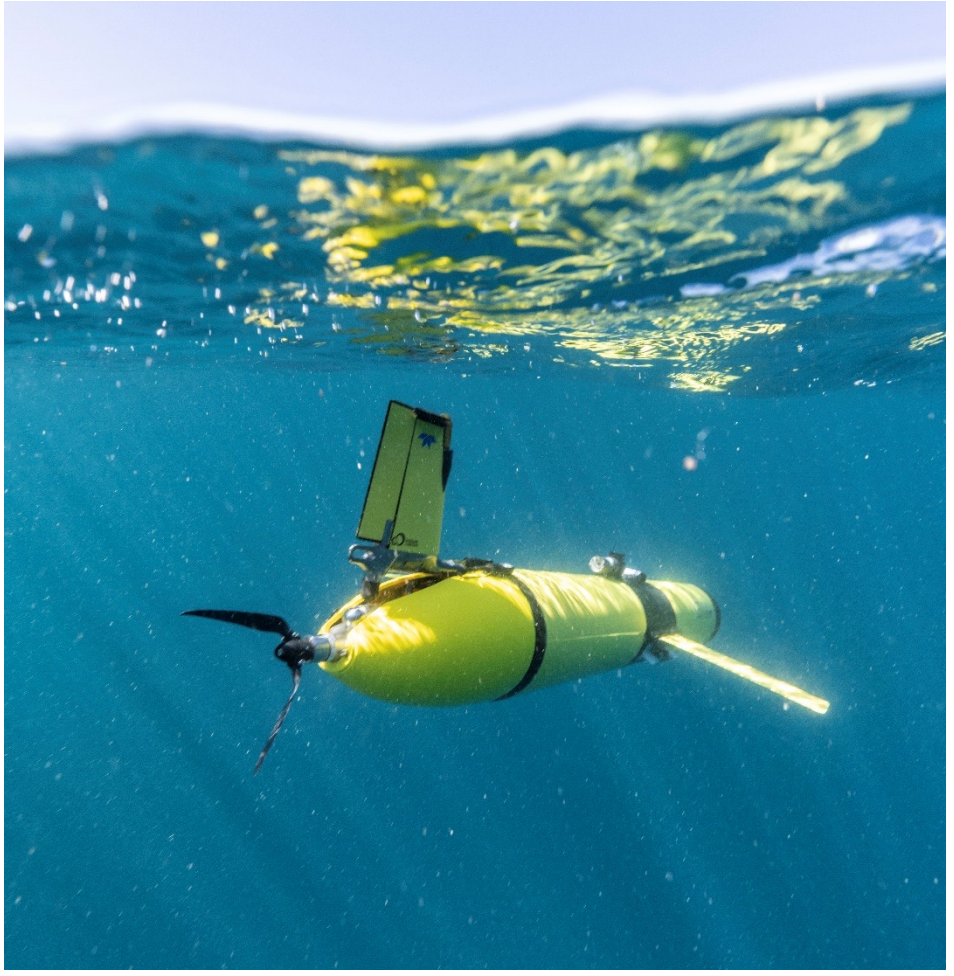
Coastal Oceanography

Acknowledgements

IMOS
Integrated Marine Observing System

UWA Ocean Glider Team:
Dennis Stanley
Paul Thomson
Mun Woo
Sarath Wijeratne

IMOS Event based sampling Steering Committee:



IMOS Integrated Marine Observing System

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A multi-disciplinary, multi-institutional approach to enhance the observation and understanding of the oceans around Australia

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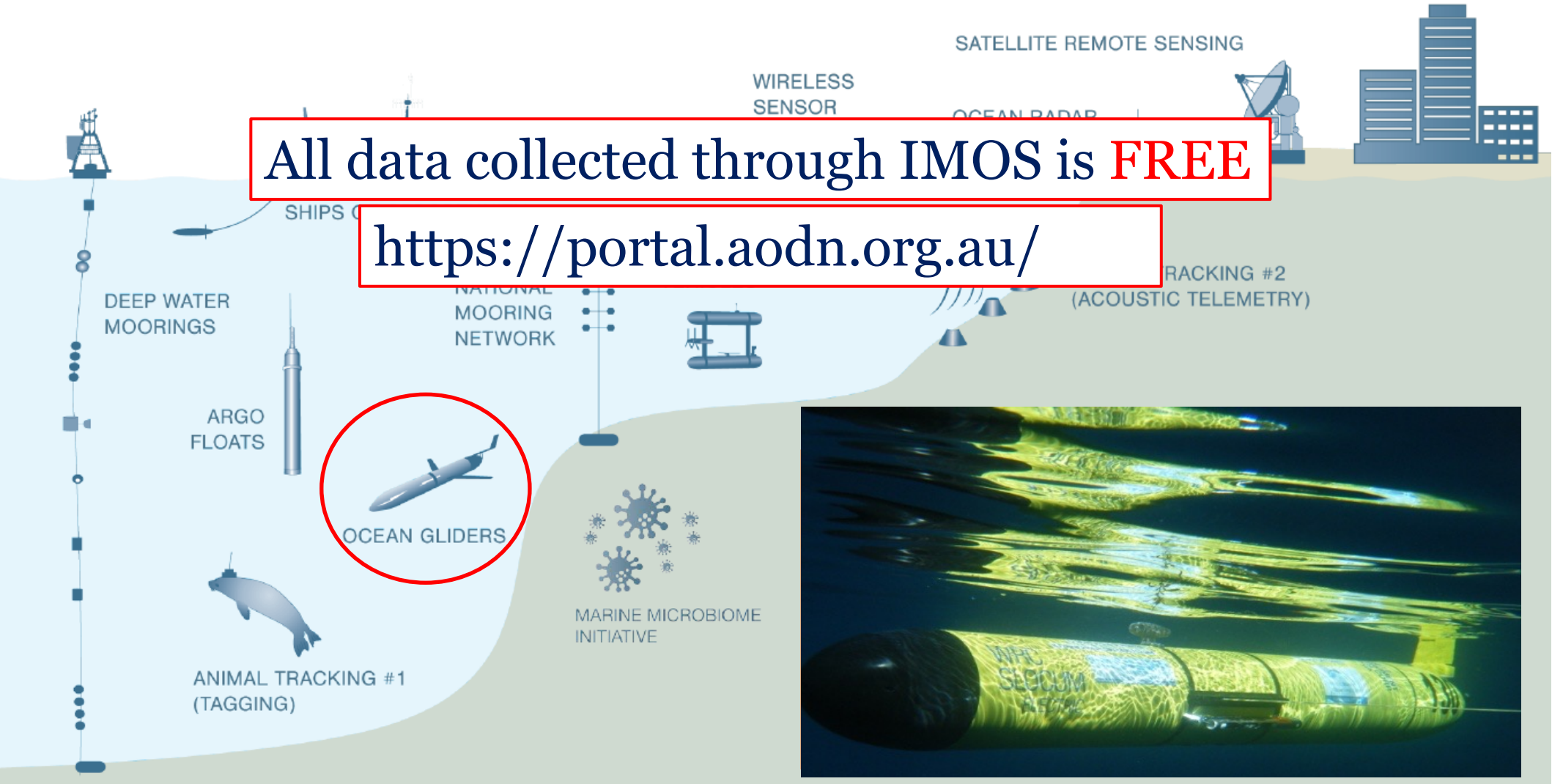
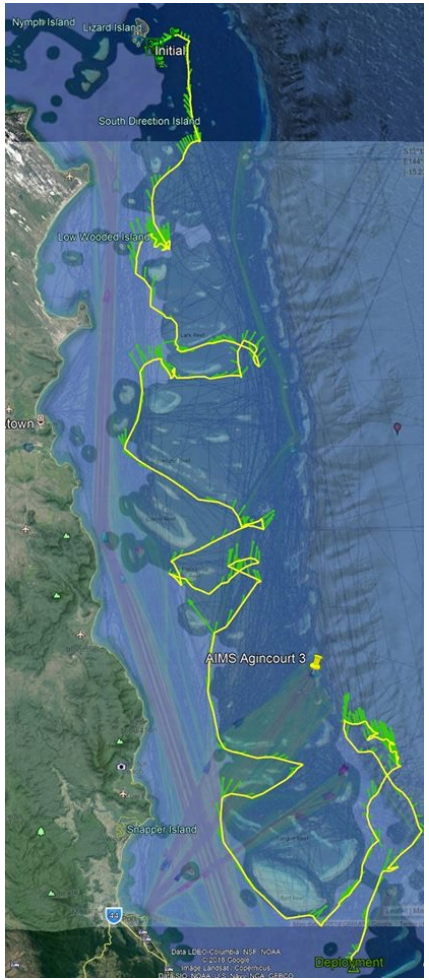
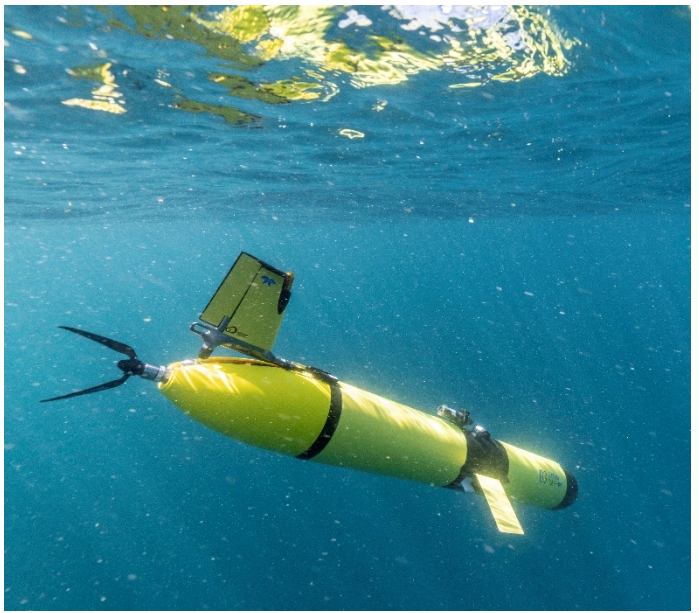
Overarching goal: 'sustained' observations

The Integrated Marine Observing System ++ AUSTRALIAN OCEAN DATA NETWORK



Glider deployments





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2009-2024

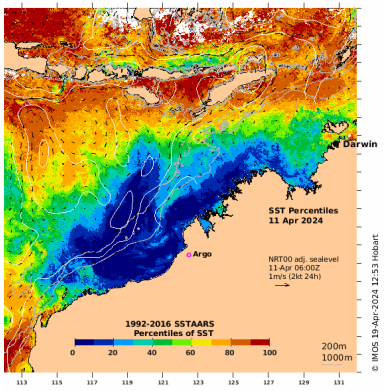
9289 glider days (> 25 years)

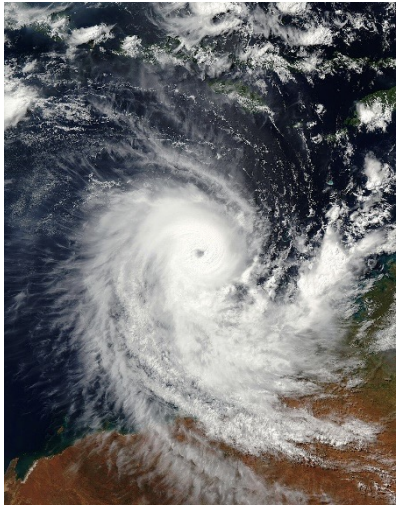
201152 km

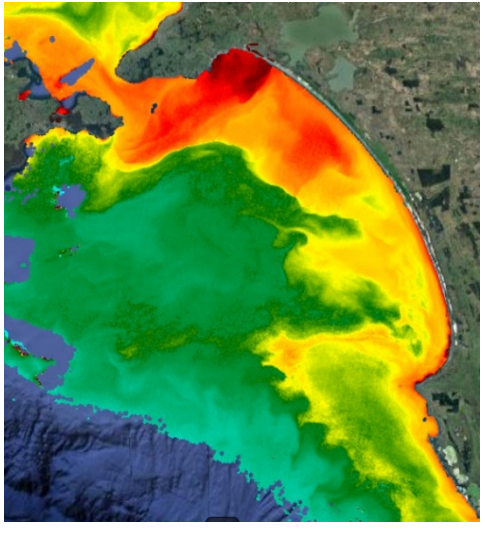
Sampling of extreme events

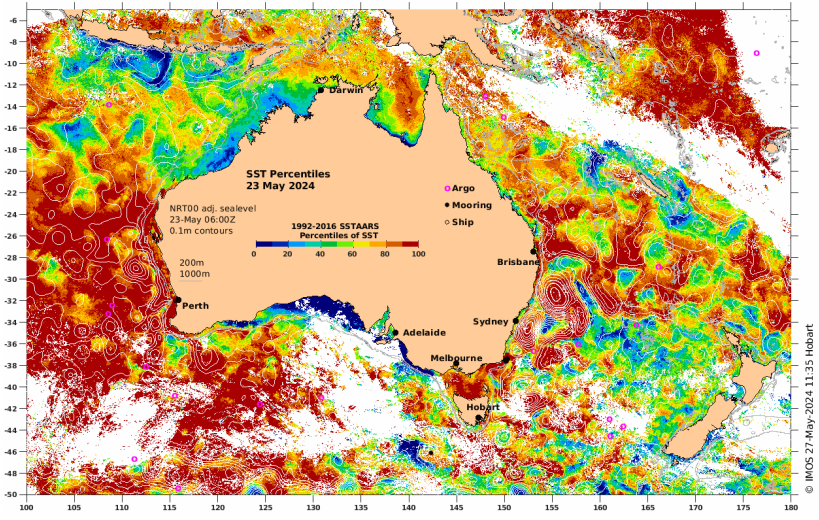
Within prediction time scale for glider deployment

- Marine heatwaves and cold spells
- (Ex-) Tropical cyclones, severe storms, east coast lows
- River plumes and coastal discharge



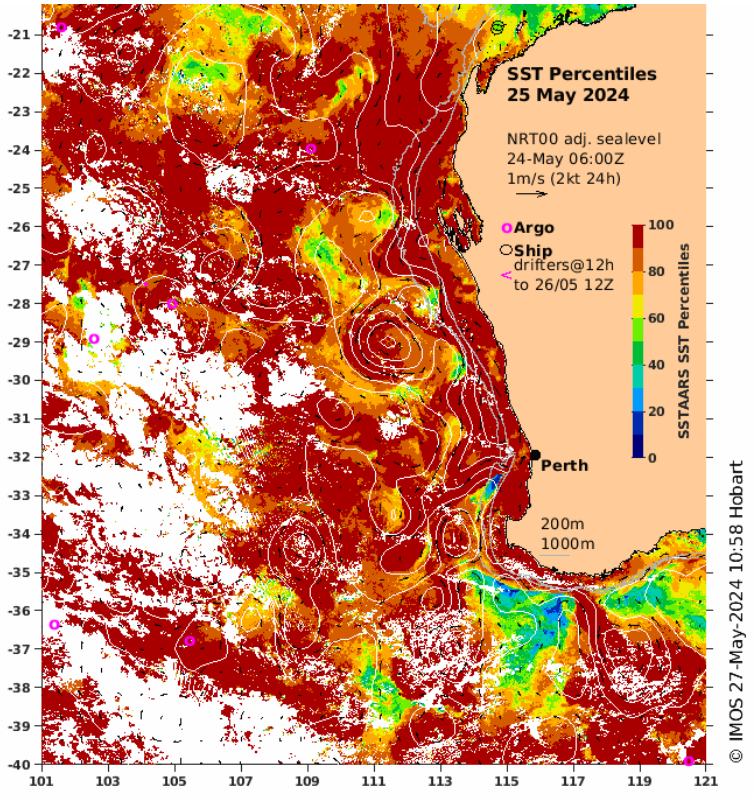






Sampling of extreme events

25 May 2024
1d L3S Percentiles, 1992-2016 clim period



http://oceancurrent.imos.org.au/product.php

Identify extreme events by monitoring existing data sources and tools:

- IMOS OceanCurrent – temperature anomalies and percentiles,
- BoM RAMSSA SST (regional SST product),
- BoM ACCESS-S1 (seasonal outlook), BoM OceanMAPS (operational short-term forecast),
- Near real time temperature observations
- Other products: NOAA Coral Reef Watch, Marine heatwave tracker (www.marineheatwaves.org/tracker.html),

Collate, review and evaluate evidence and indicators**:**

- assess the likelihood of events and geographic regions to be impacted.

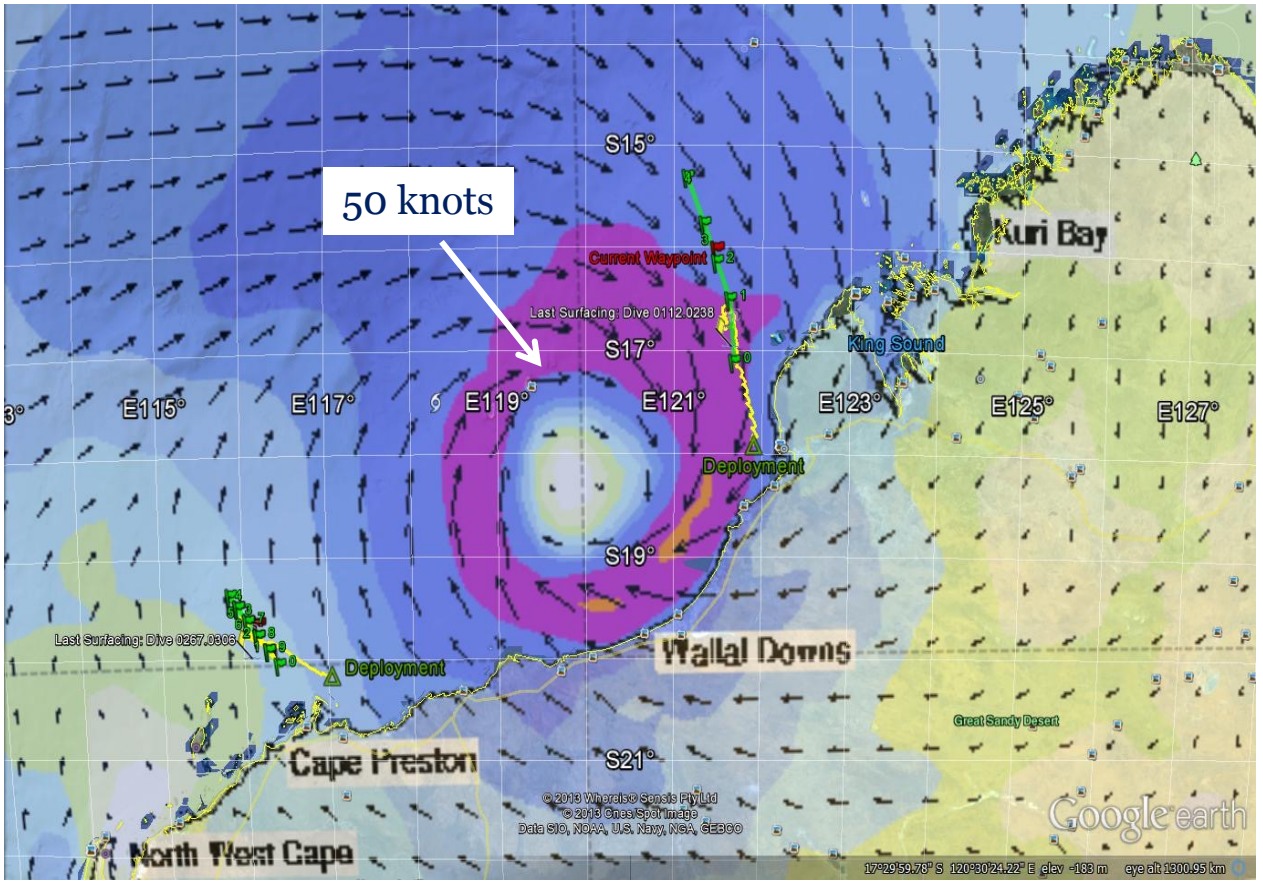
Develop a deployment plan:

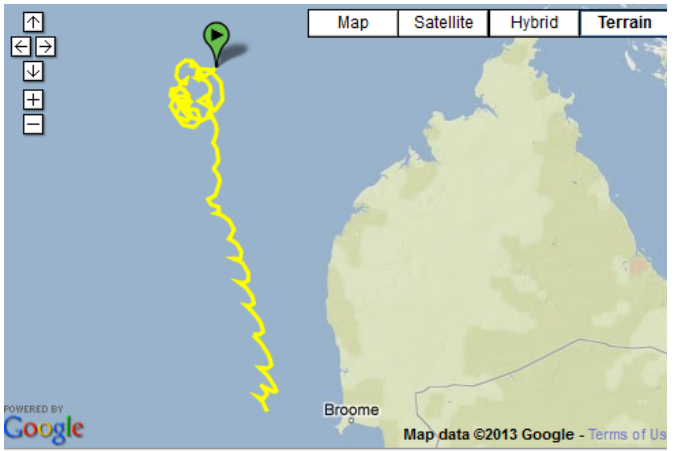
- the geographic location and timing of sequential deployments,
- capture phases of development, maintenance and deterioration.

Prioritise deployment locations based on criteria including:

- scientific novelty of the extreme event,
- predicted impacts including ecological consequences,
- the availability of supporting meteorological and oceanographic observations and ocean models.

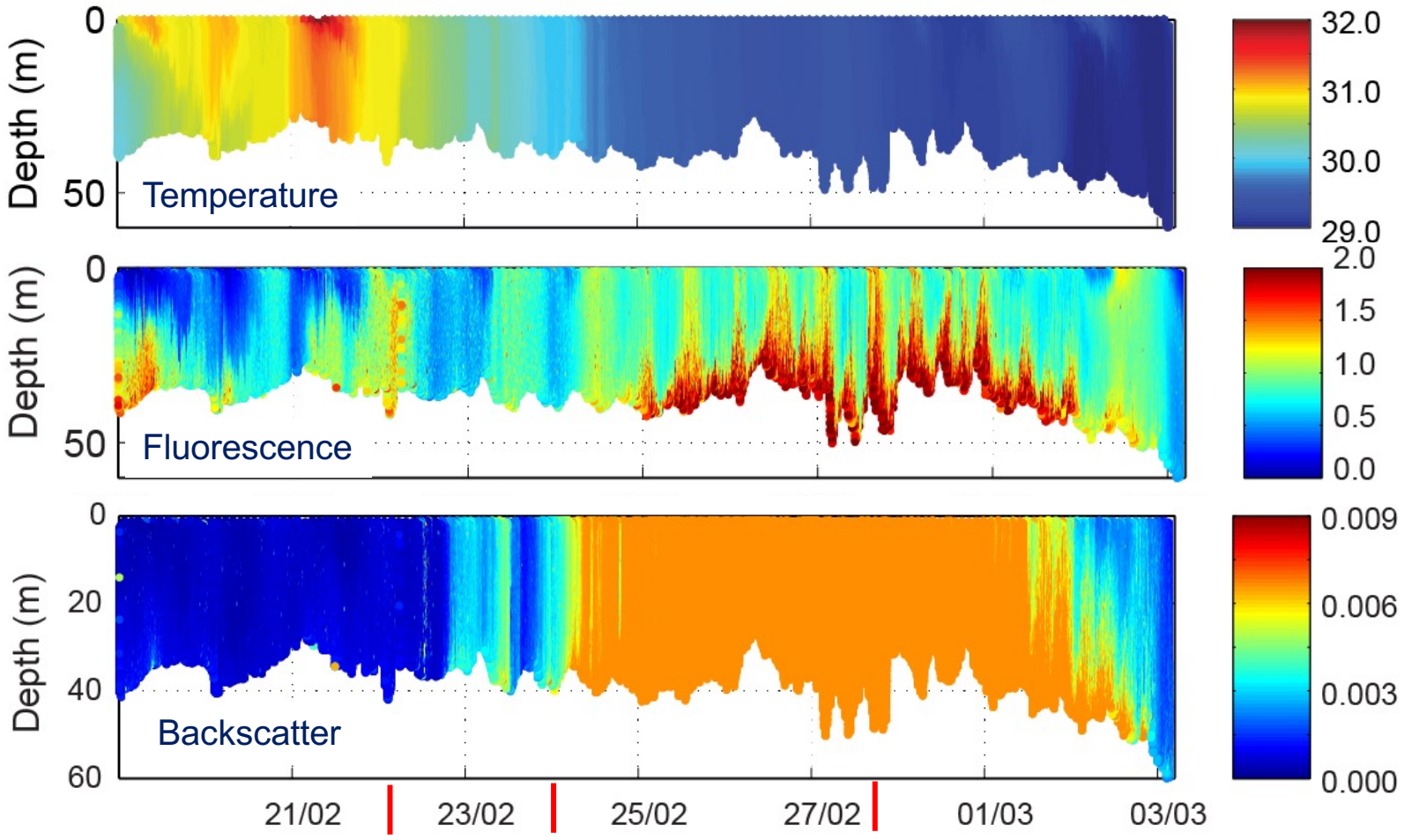
Slocum: TC Rusty





Maximum predicted H_s = 6.5m

TC Rusty: Kimberley Transect



Temperature anomalies (2010-2011)

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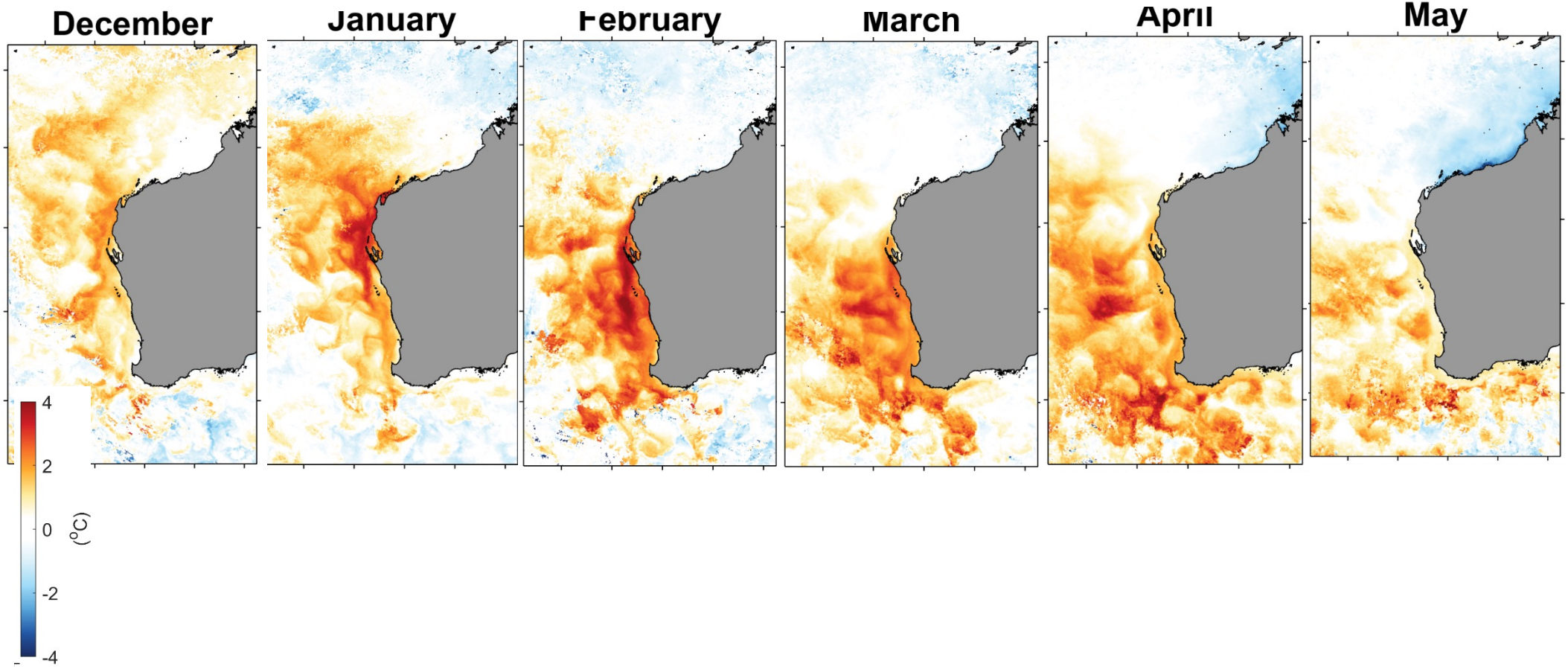

Ningaloo Nino: Feb 2011

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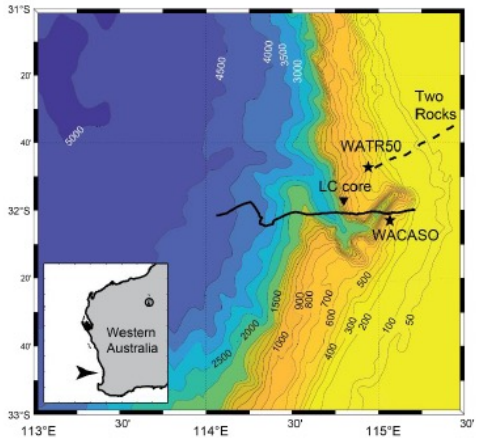
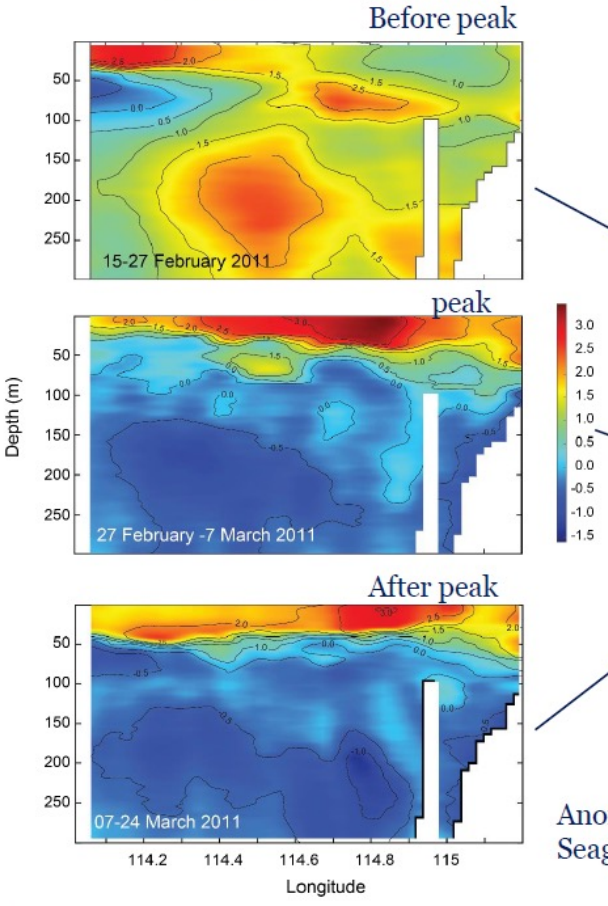
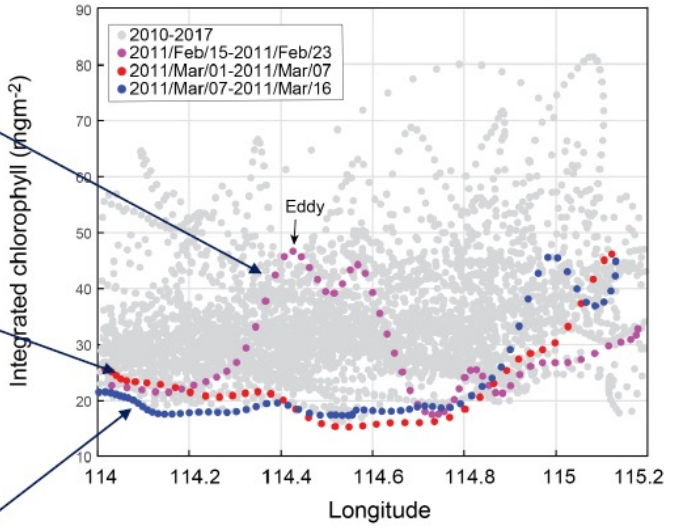
Seaglider Tracks



Temperature anomaly



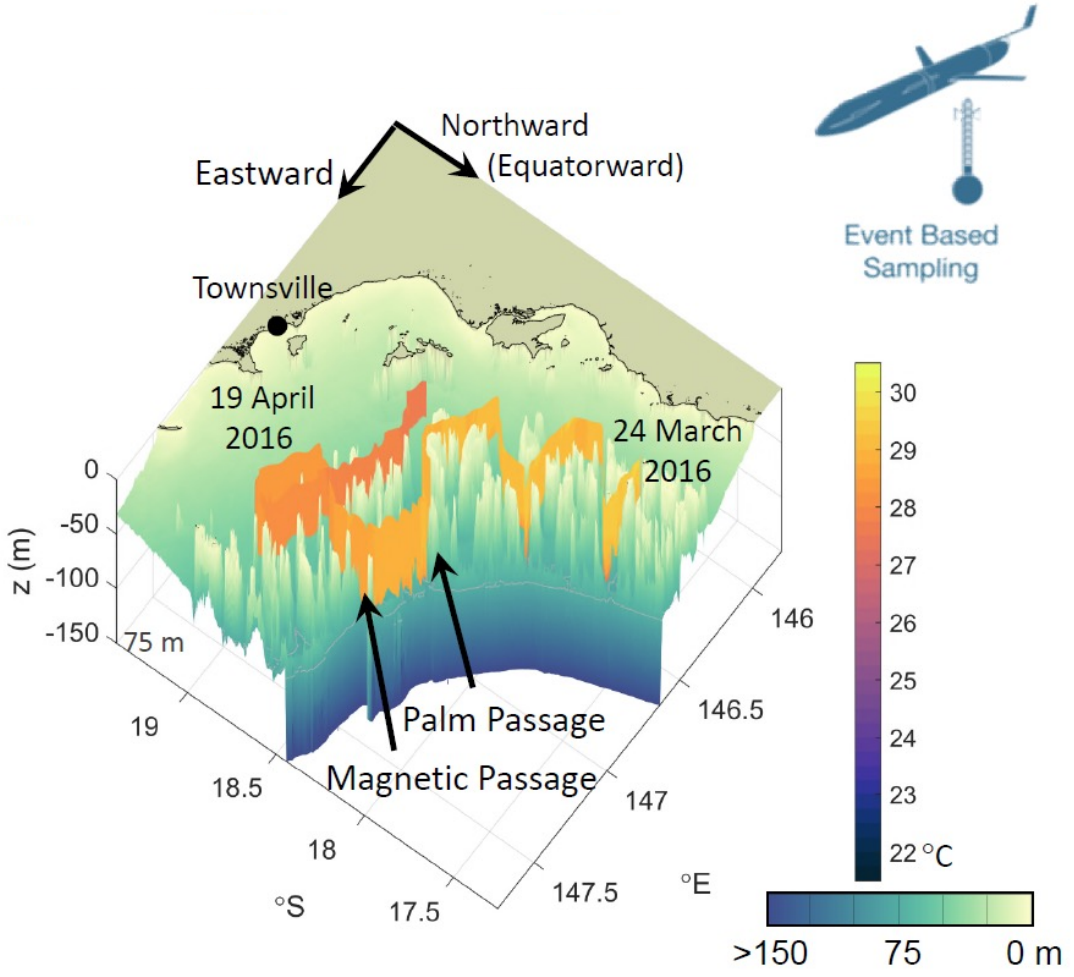
Lowest integrated chlorophyll over 8 years of measurements



Anomaly calculated using 2010-2017 Seaglider data

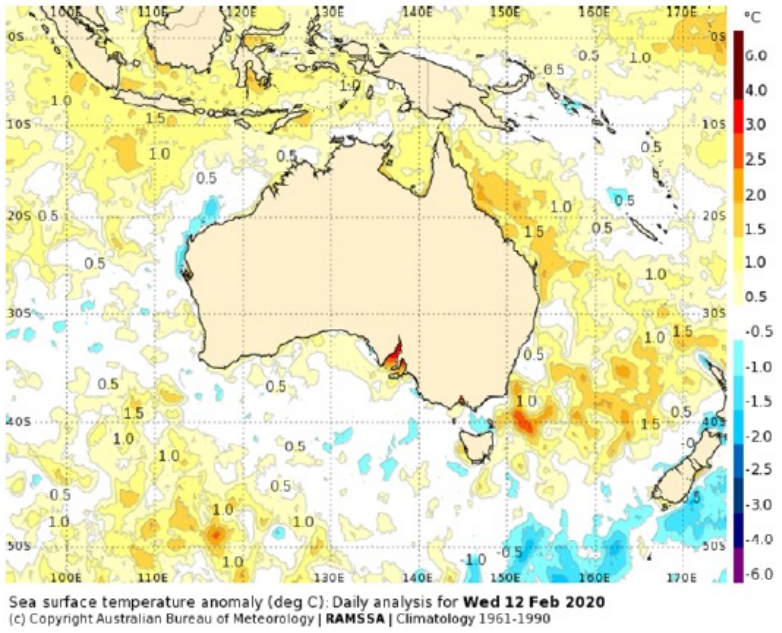
Fengyao Jin, Chari Pattiaratchi, Paul Thomson

Great Barrier Reef: March 2016



Evaluating marine heatwave conditions

SST Anomaly
12 Feb 2020

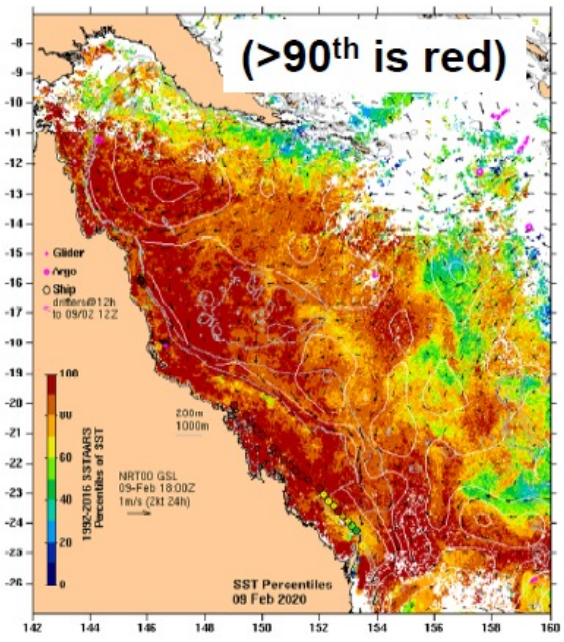


Sea surface temperature anomaly (deg C): Daily analysis for **Wed 12 Feb 2020**
(c) Copyright Australian Bureau of Meteorology | **RAMSSA** | Climatology 1961-1990

RAMSSA – Reynolds SST climatology (1961-1990)

http://www.bom.gov.au/marine/sst.shtml

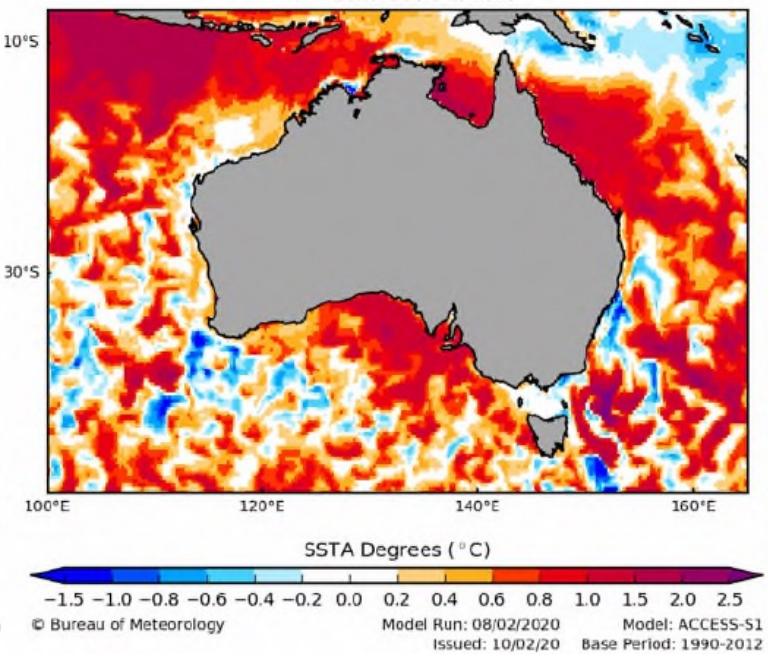
SST Percentiles
9 Feb 2020



IMOS 3-day night Multi-sensor L3S percentiles, using the SSTAARS climatology (1992-2016)

http://oceancurrent.imos.org.au/

SST Anomaly outlook
8 – 22 Feb 2020



BoM ACCESS-S1 seasonal outlook, Issued 10 Feb 2020

http://www.bom.gov.au/oceanography/oceantemp/sst-outlook-map.shtml

Great Barrier Reef: Jan-March 2020

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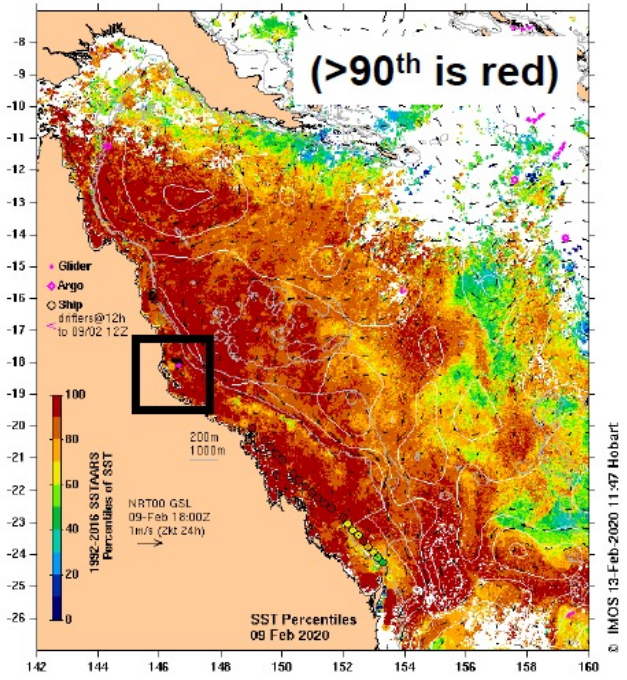
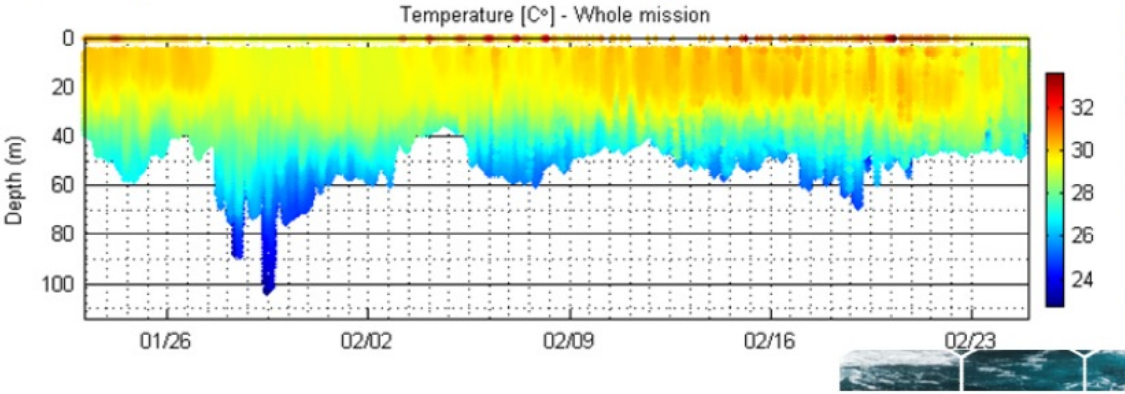
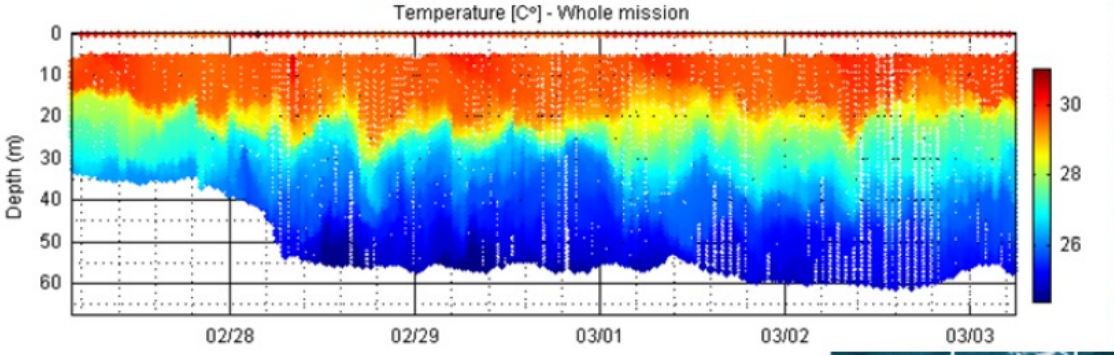
SST Percentiles - 9 Feb 2020



Central GBR glider: 23 Jan – 25 Feb 2020

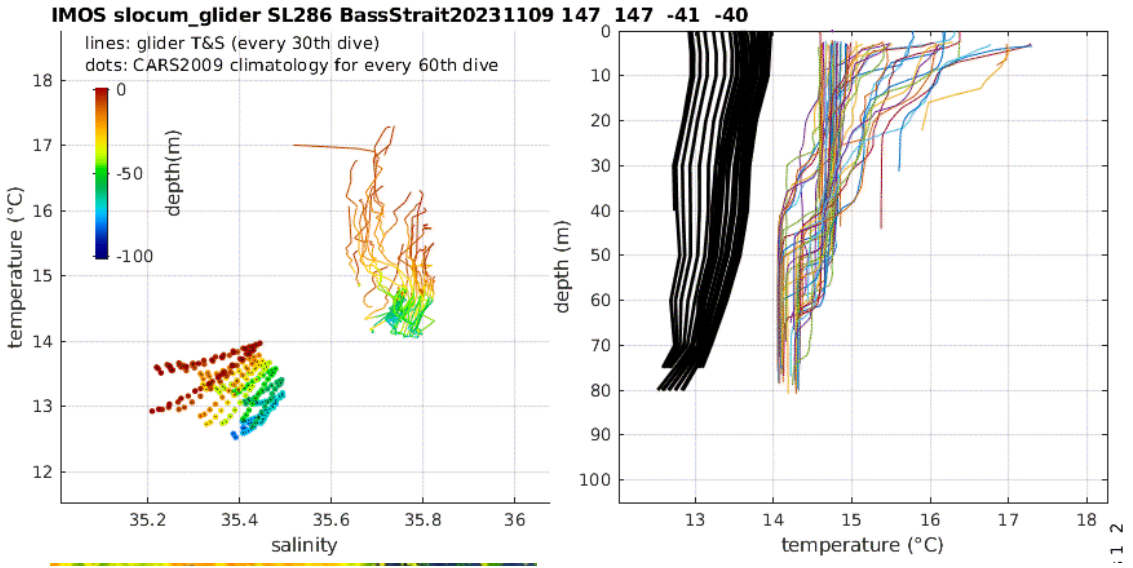


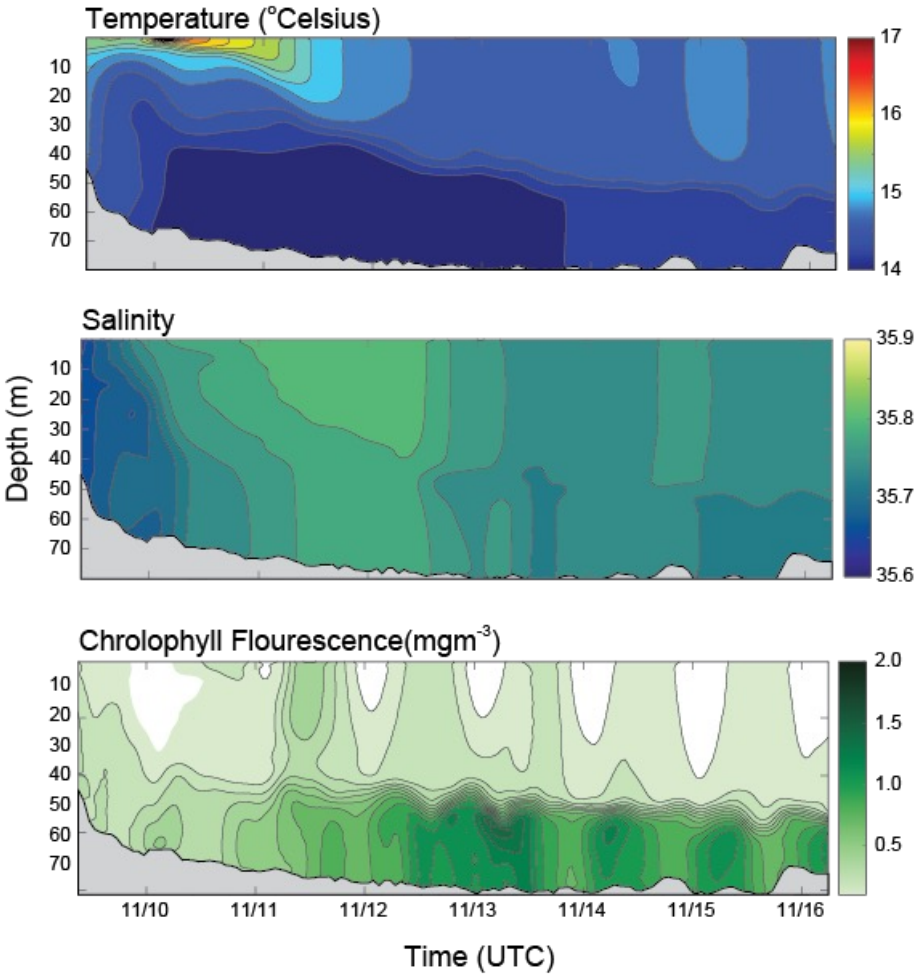
Event Based Sampling #1 for 2020: 27 Feb – 27 March 2020



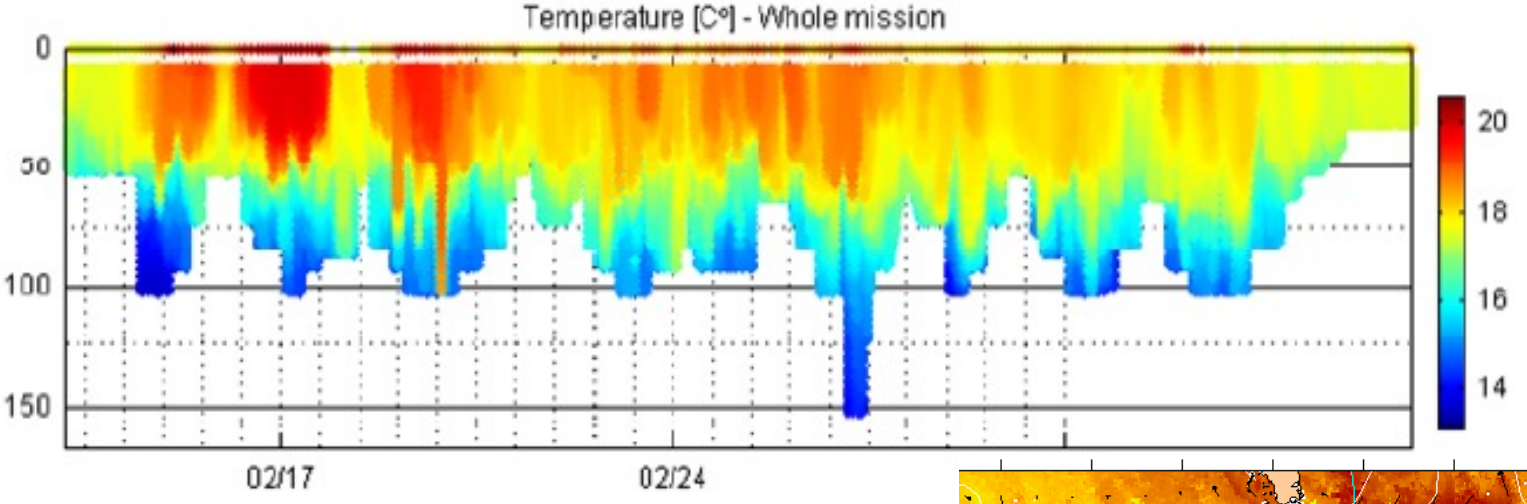
Note change in colour axis and vertical scale.

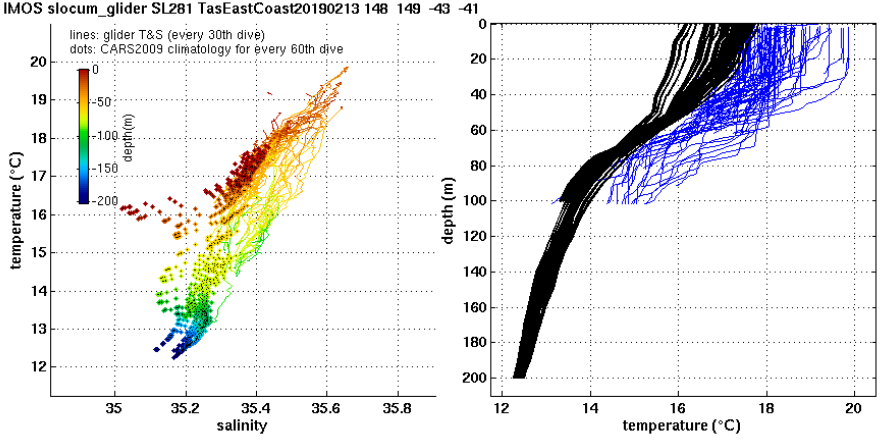
Bass Strait: Nov 2023

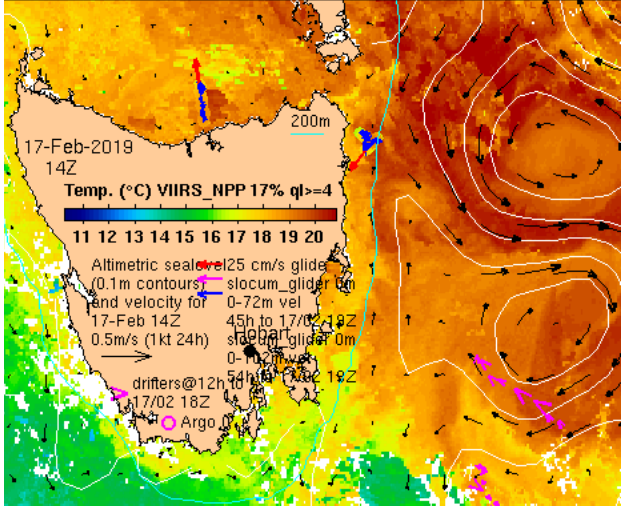




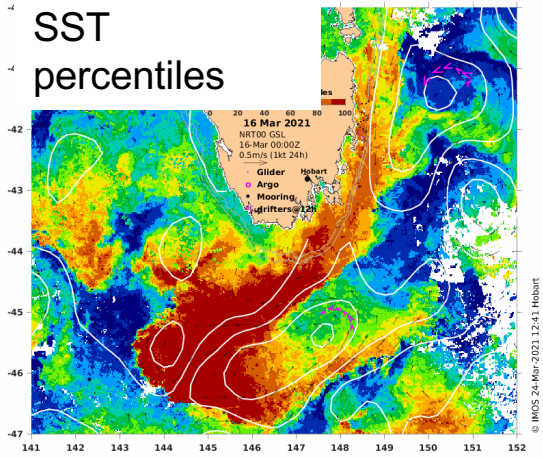
East Tasmania: Feb 2019

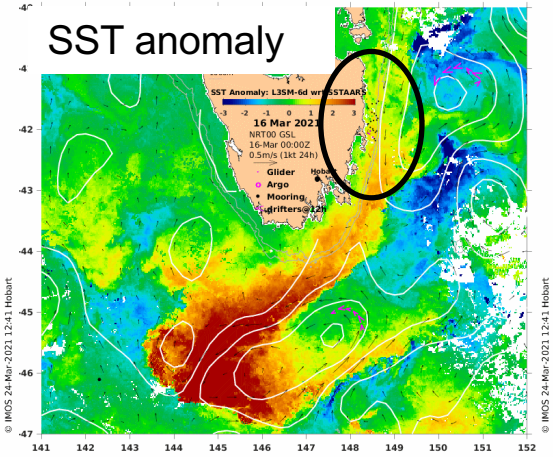




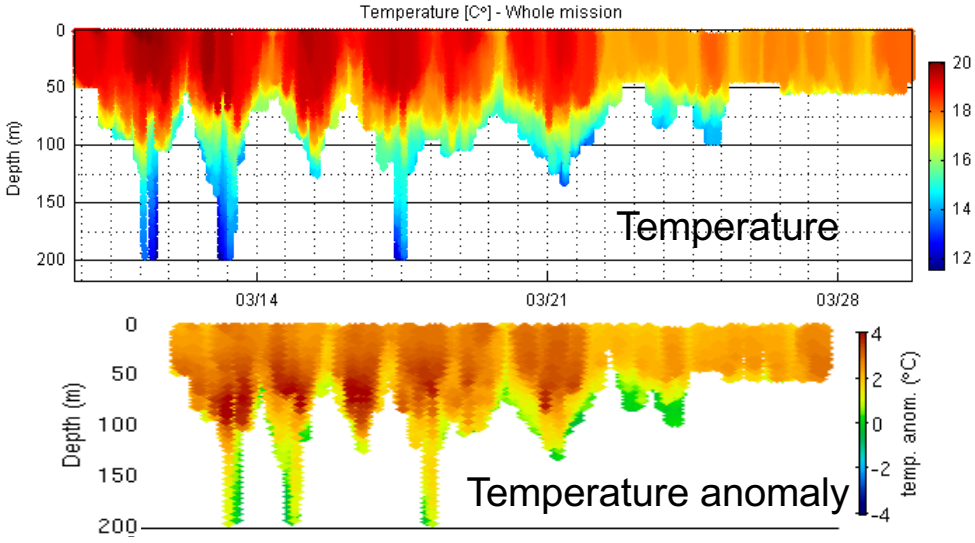


East Tasmania: March 2021





The glider sampled waters off eastern Tasmania, where SST was 1-2 deg C warmer than usual,

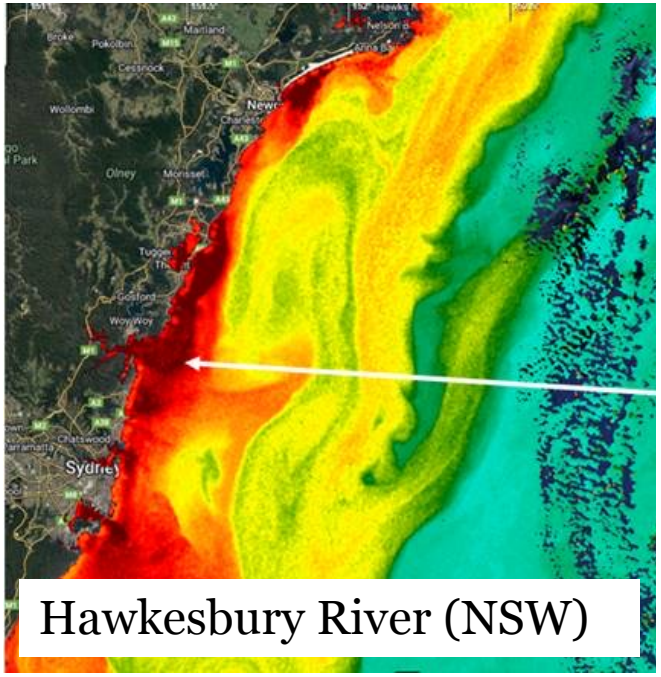


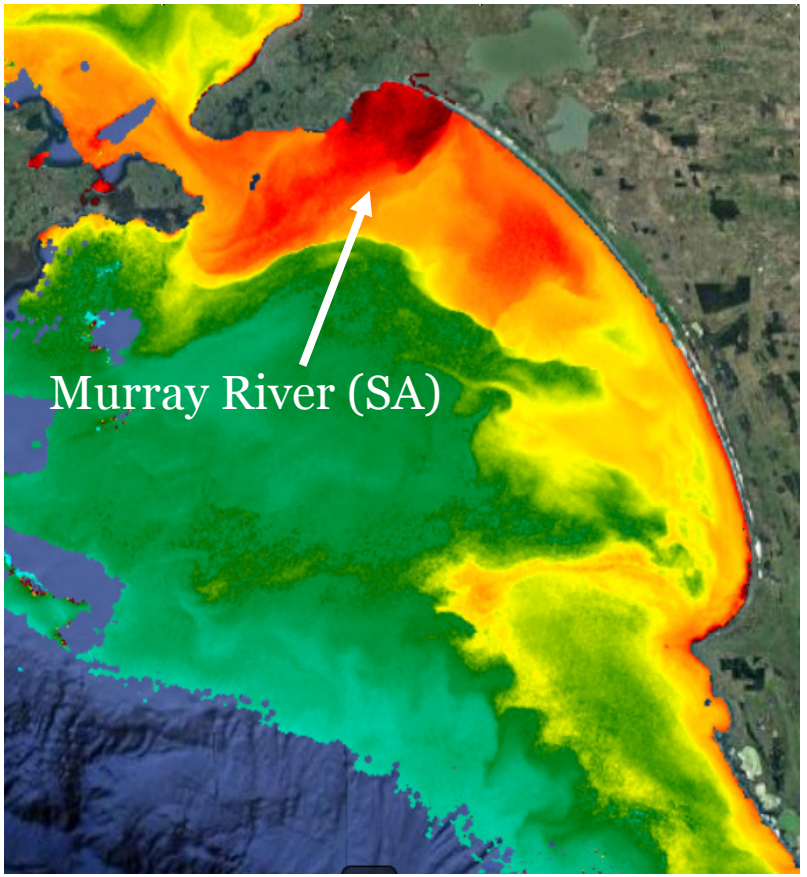
Temperature anomalies were greater at depth (reaching 4 deg C) than near the surface, as the warm water extended down between 50 to 100 m depth.

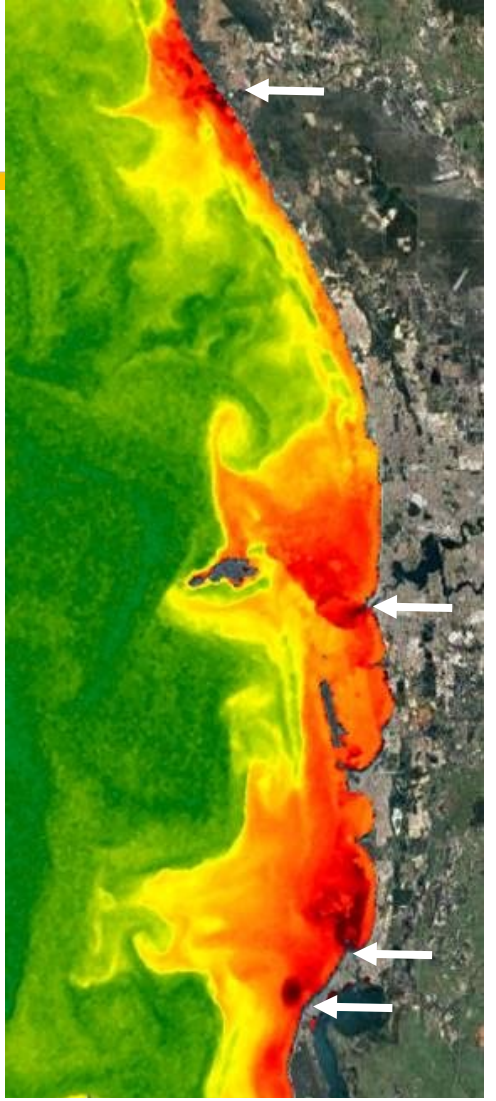
Exceptional rainfall 2021-23

- In 2021, Perth region recorded a total rainfall of 892 mm, more than 150 mm above the annual average. It was the second-wettest July on record.
- The Sydney region received highest ever daily rainfall at some stations on 7-8 April 2022 resulting in large freshwater flows into the ocean
- The 2022-23, River Murray flood event occurred between November 2022 and February 2023. This event was the largest since 1956, and the third highest flood ever recorded in South Australia

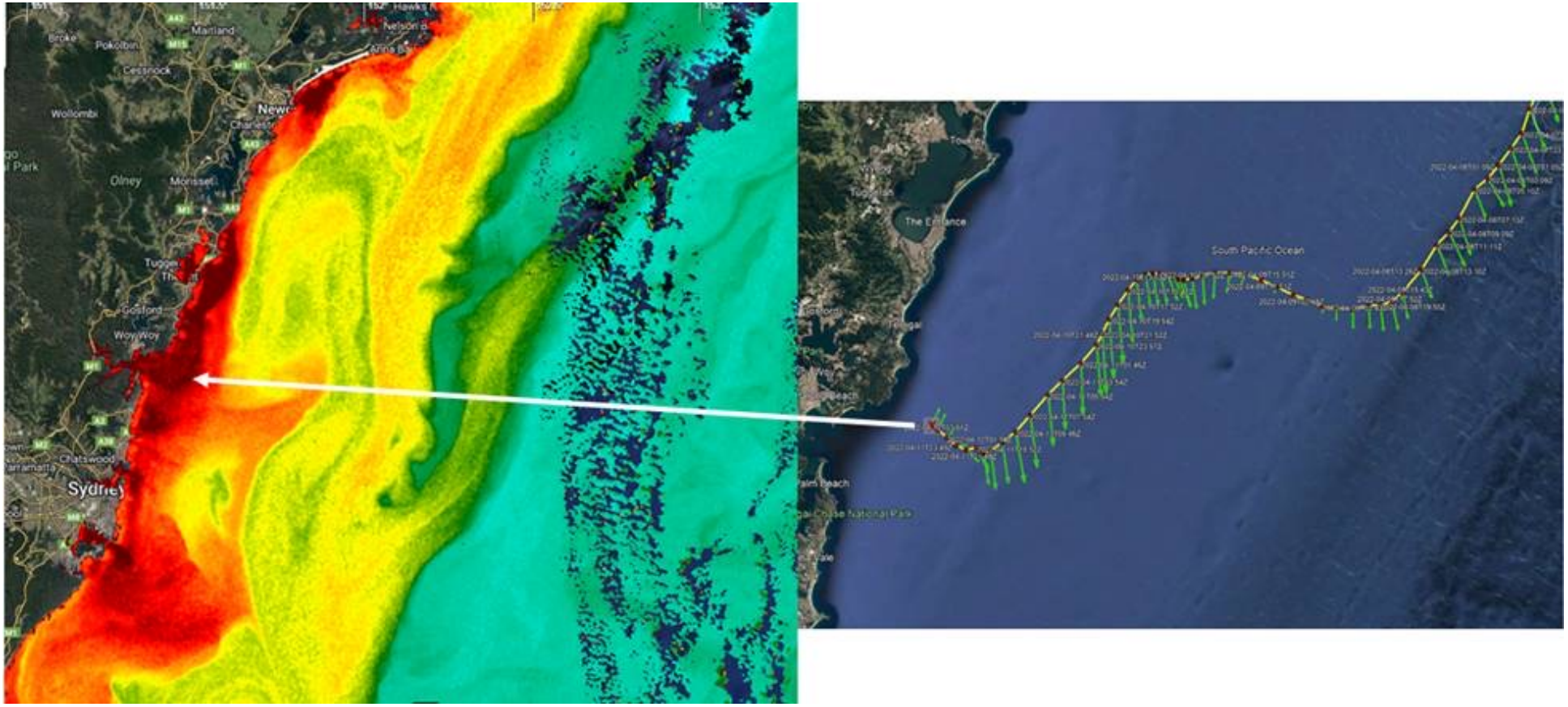
River outflows







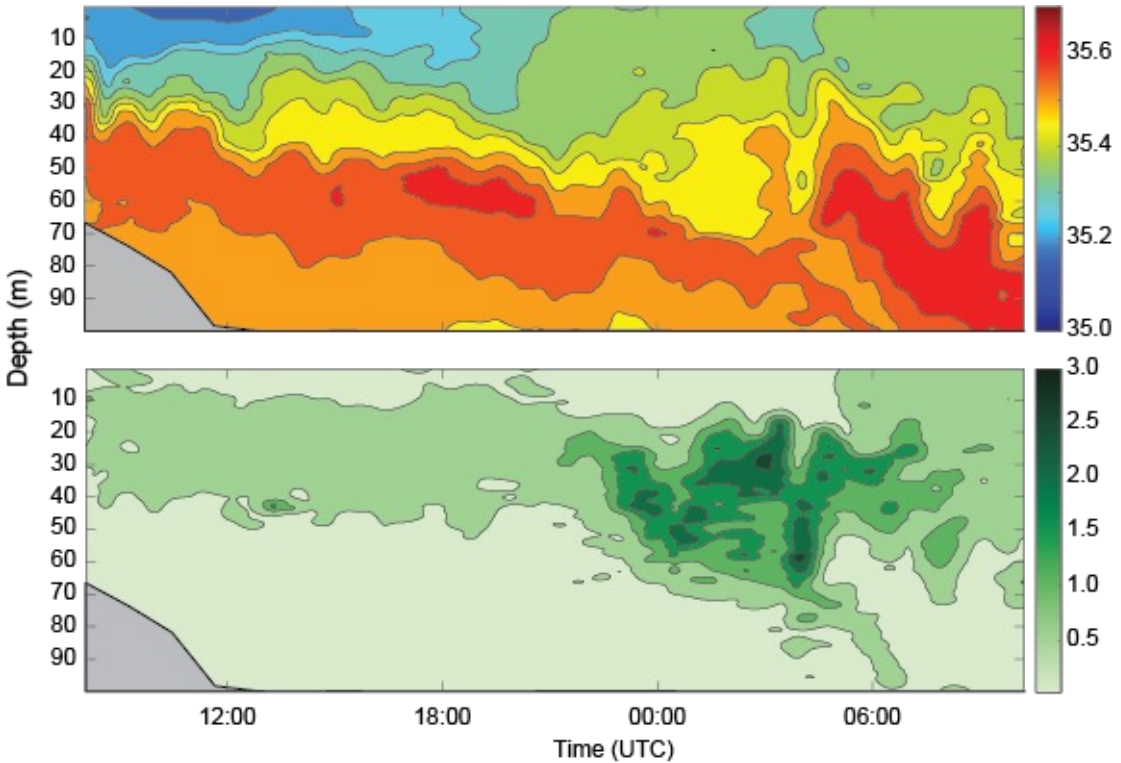
River outflows: Hawkesbury River

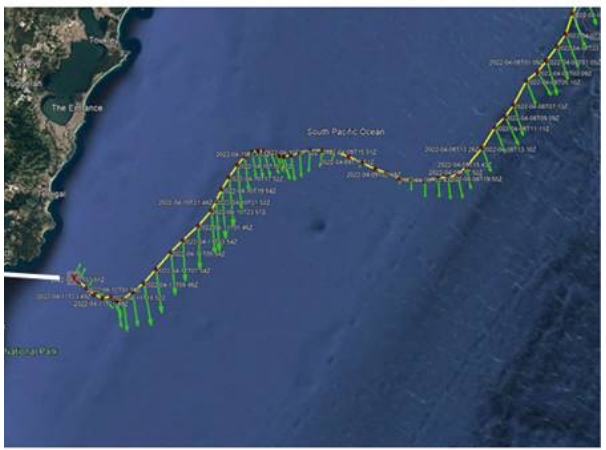


River outflows: Hawkesbury River

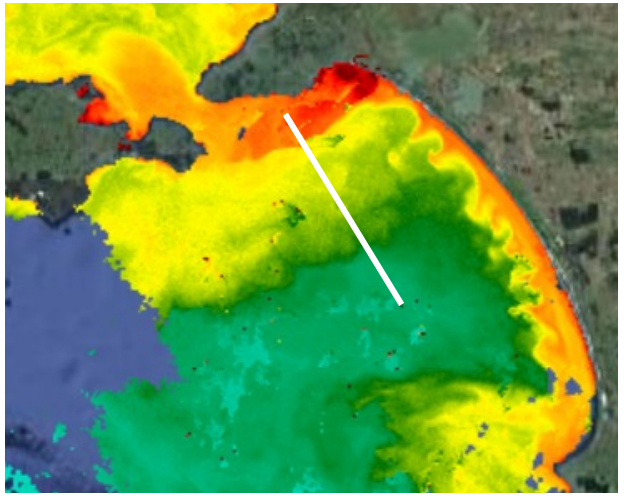
Salinity

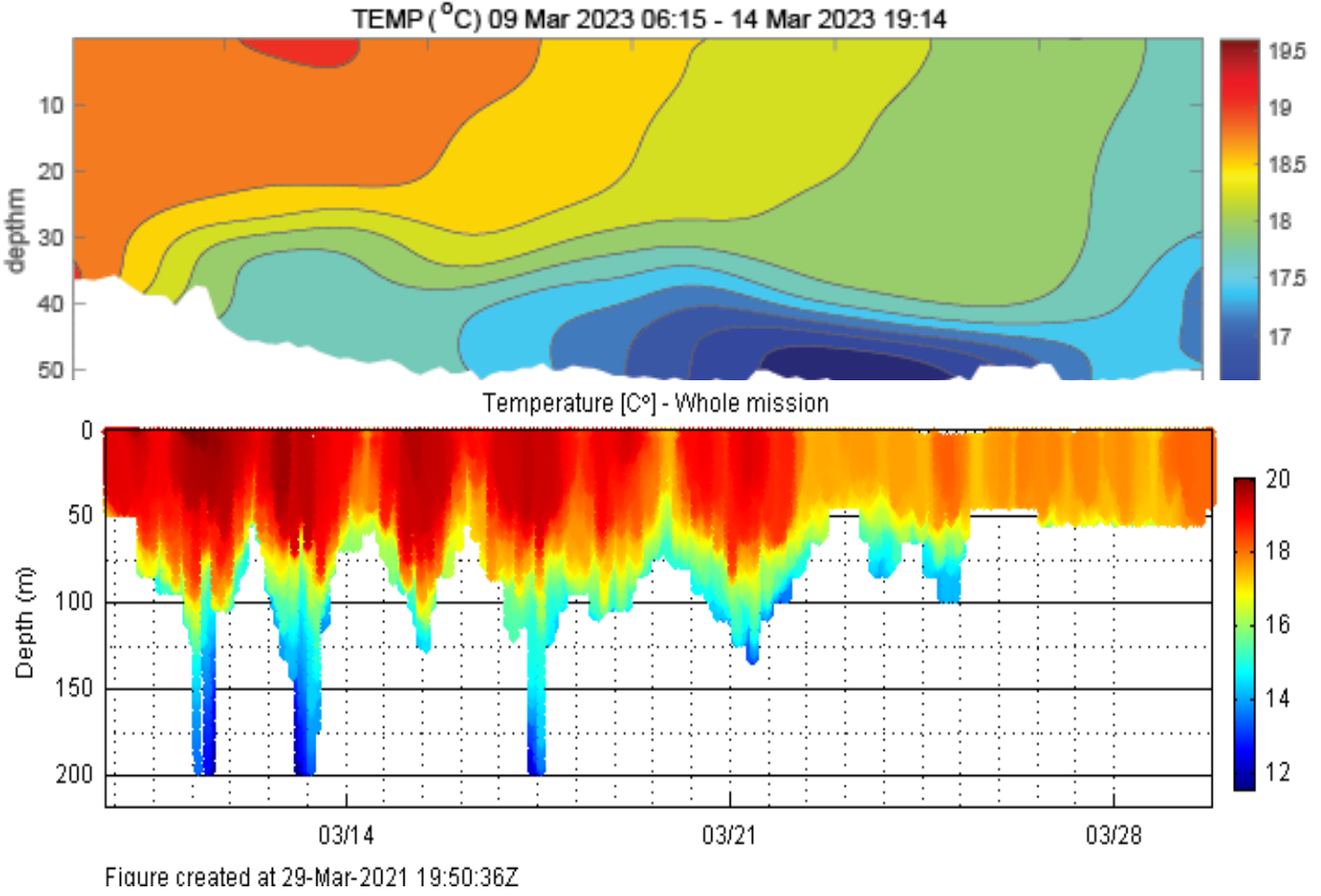
Chlorophyll



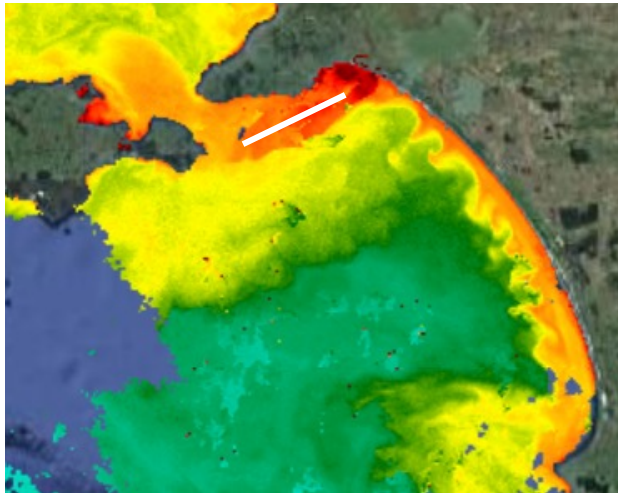


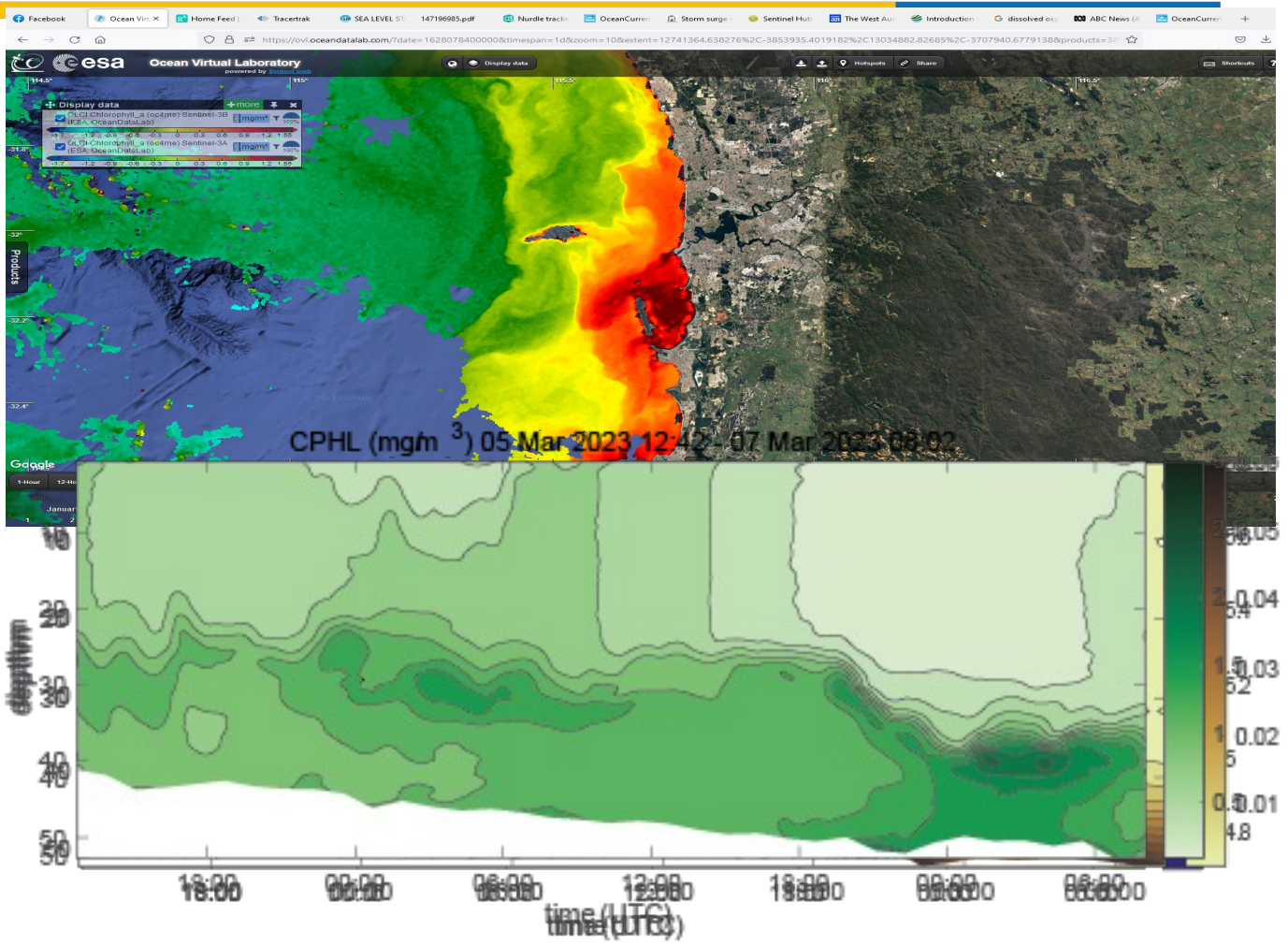
River outflows: Murray



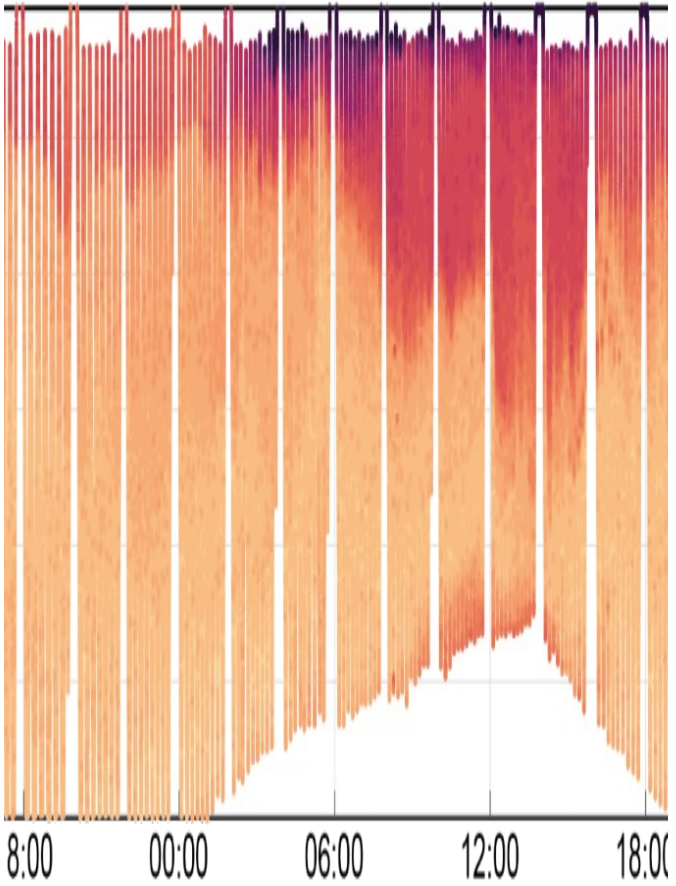


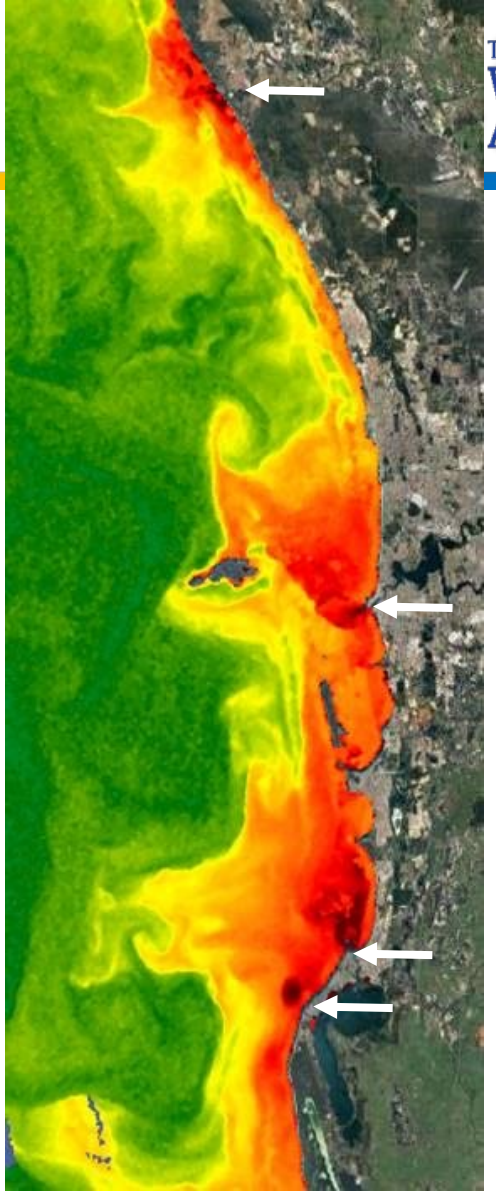
River outflows: Murray





River outflows: Rottnest CS





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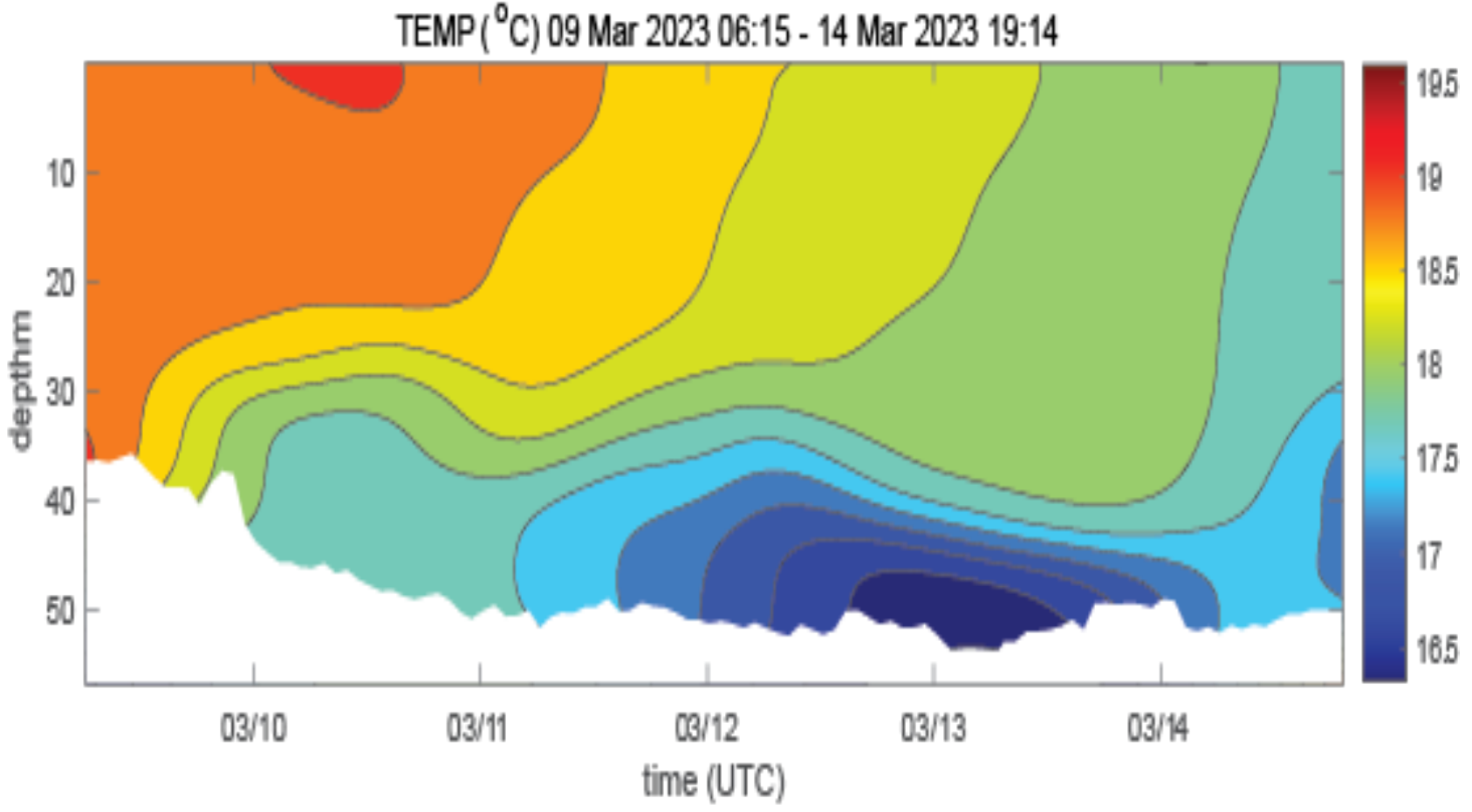
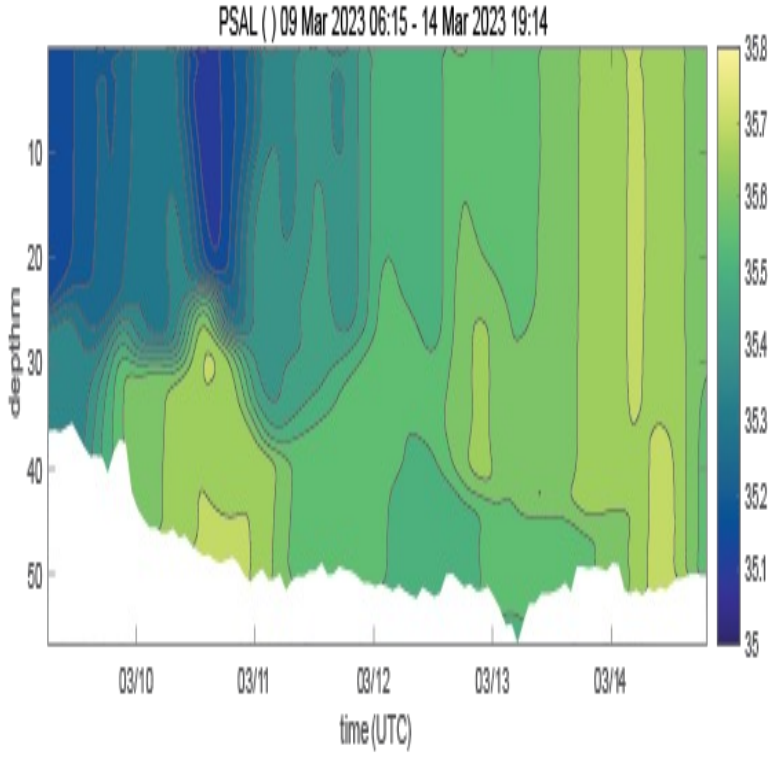
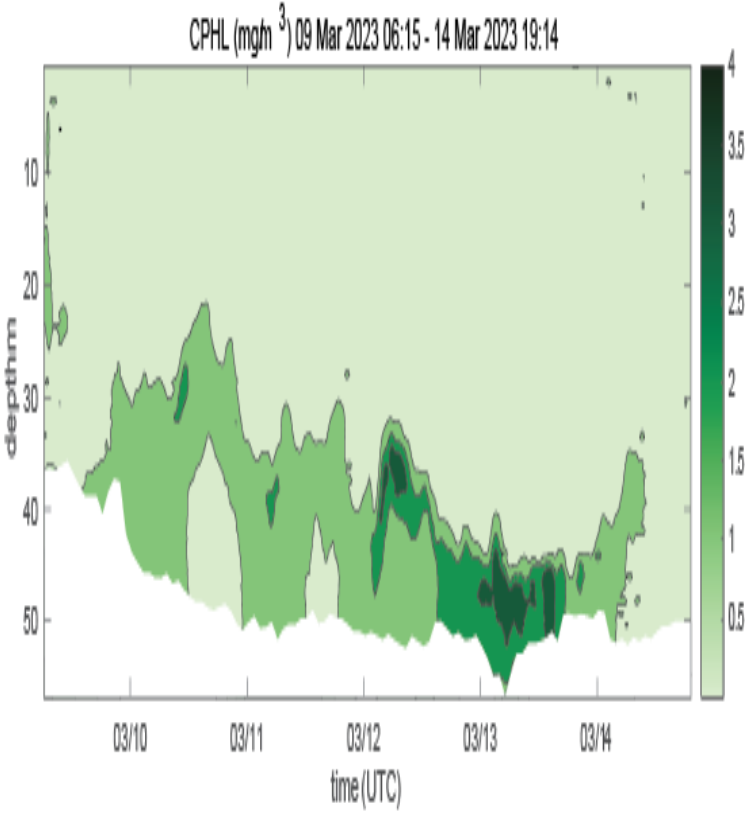
Rottnest shelf

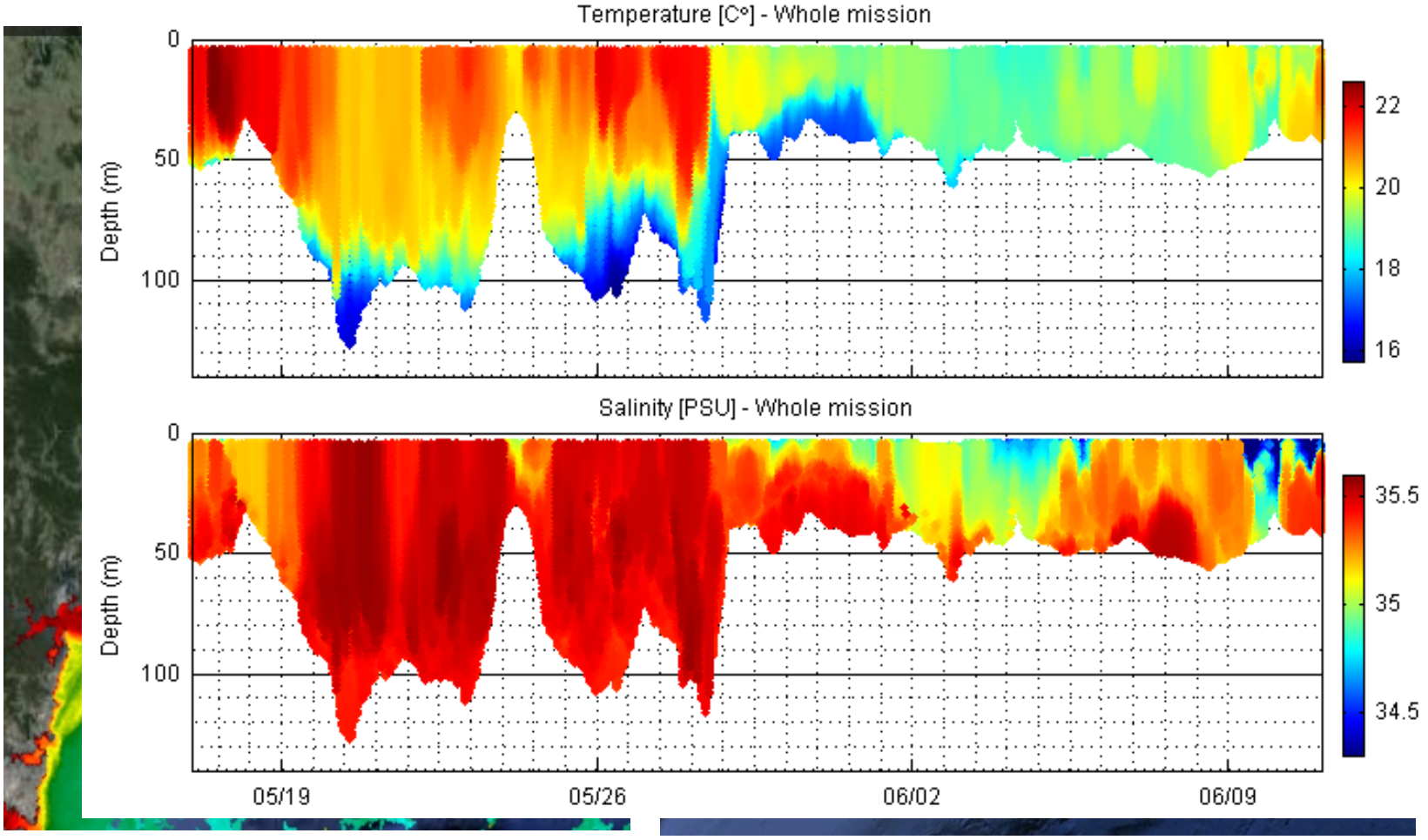


Rottnest shelf





Real time: NSW



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 Research and Development

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 the Environment and Energy Australian Antarctic Division

Deakin University