Observing marine climate extremes beneath the surface: Integrating autonomous ocean observations in south-eastern Australia

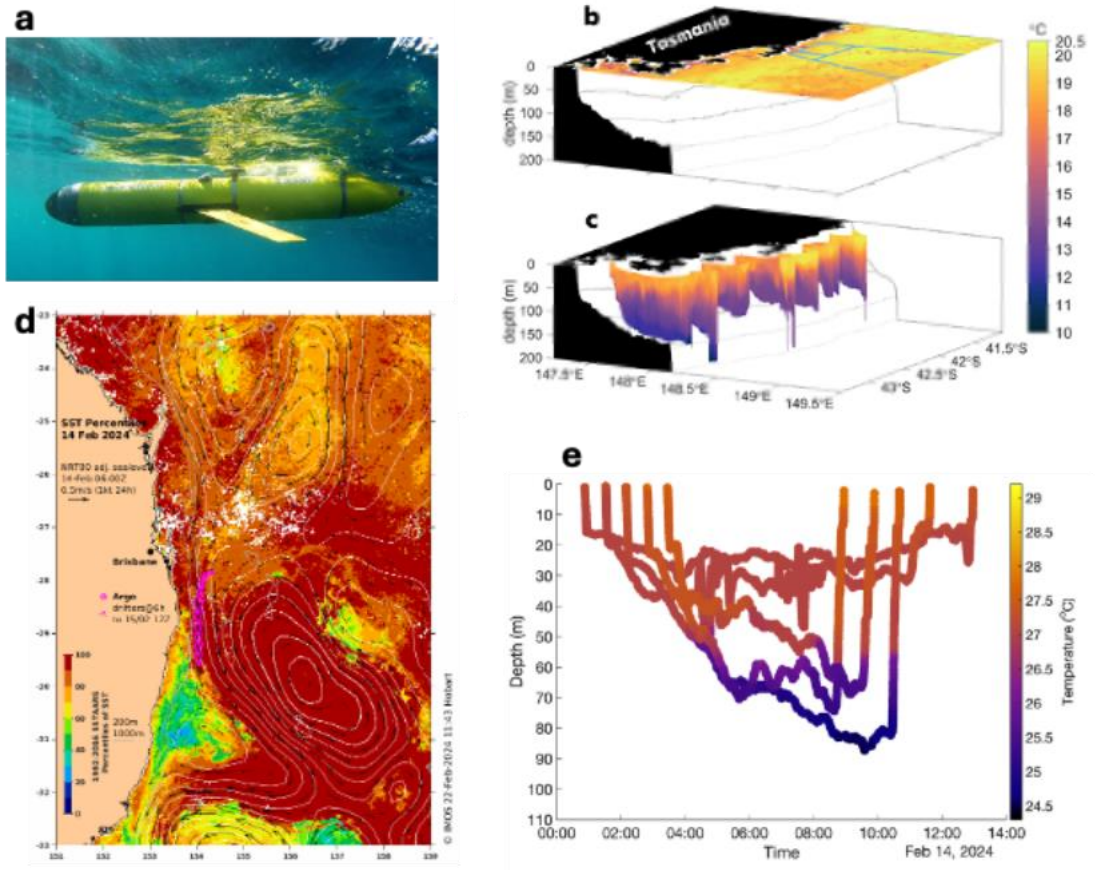


Fig. 1: (a) Glider during deployment, (b) Sea Surface temperature during glider deployment, (c) temperature sampled by glider, (d) Sea Surface temperature during a Marine Heat Wave (14 February 2024) and (e) FishSOOP data sampled in this period.

Brief description of the Project

The coastal ocean of south-eastern Australia is one of the world's most dynamic marine environments and a recognised hotspot of ocean warming. Recent years have seen unprecedented marine heatwaves, cold-spells and extreme rainfall events that have dramatically altered coastal ocean conditions. While satellites provide an excellent view of

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surface variability, many of these events extend throughout the water column, and yet their subsurface evolution and impacts remain poorly understood.

Since 2008, the Integrated Marine Observing System (IMOS) has maintained one of Australia's longest-running autonomous underwater glider observing programs, with regular cross-shelf deployments off the New South Wales coast providing high-resolution measurements of temperature, salinity and biogeochemical properties throughout the water column. The Fishing Ships of Opportunity (FishSOOP) program has complemented these observations by collecting subsurface temperature measurements around Australia since 2021. Together, these observing systems provide a unique opportunity to investigate how marine extremes evolve beneath the ocean surface.

This research project will synthesise long-term IMOS glider observations with FishSOOP measurements to characterise recent subsurface variability and extremes across the south-eastern Australian continental shelf. The candidate will investigate the three-dimensional structure, evolution and spatial extent of these events, providing new insights into the physical processes driving coastal variability. The project will advance Australia's coastal ocean observing capability and improve our understanding of marine climate extremes, with outcomes that can support ecosystem management, fisheries and climate adaptation.

Skills you will learn

- Processing and quality control of large oceanographic datasets
- Analysis of long-term oceanographic observations from autonomous underwater gliders
- Integration and synthesis observational data from multiple platforms
- Characterisation of marine heatwaves, cold-spells, and coastal freshening events
- Time-series and statistical analysis of oceanographic observations
- Scientific programming using Python
- Ocean data visualisation and communication
- Opportunities to participate in oceanographic fieldwork, including glider deployments

Background / interest needed

We welcome applicants with backgrounds in oceanography, marine science, environmental science, physics, mathematics, engineering, or related disciplines.
The ideal candidate will have:

- An interest in physical oceanography and climate variability
- Experience with scientific programming
- Good quantitative and analytical skills
- An enthusiasm for collaborative research

Supervisors

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