Marine heatwaves:
What's happening and what can we expect?

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IMAS/CMS Special Online Webinar Series
Monday 11 December 2023, online briefing

The Long Hot Summer: Getting Ahead of the Heatwave
Hot seas ahead: current and projected ocean and coastal conditions for Tasmania

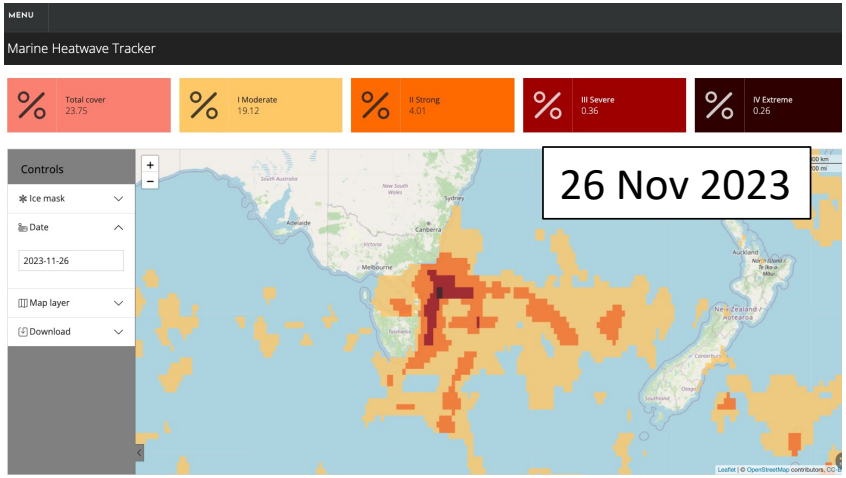
climate extremes
ARC centre of excellence

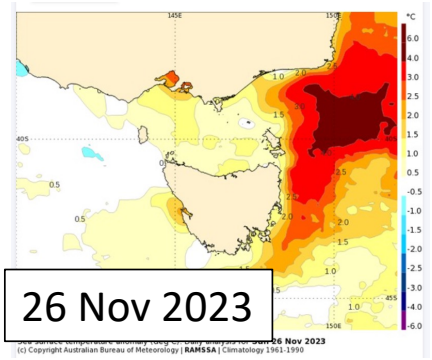
Climate Systems
National Environmental Science Program

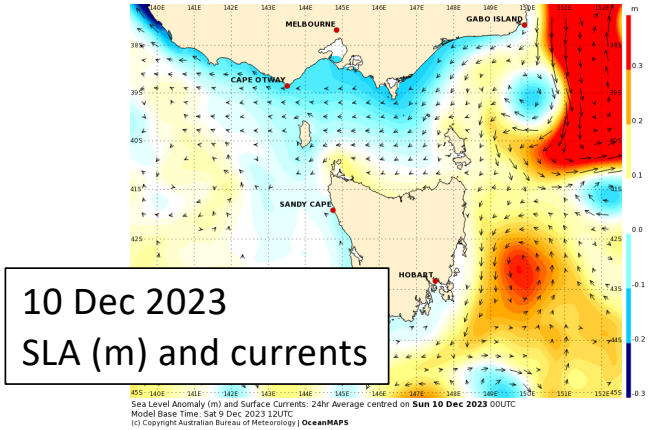
UNIVERSITY of TASMANIA | IMAS
INSTITUTE FOR MARINE & ANTARCTIC STUDIES

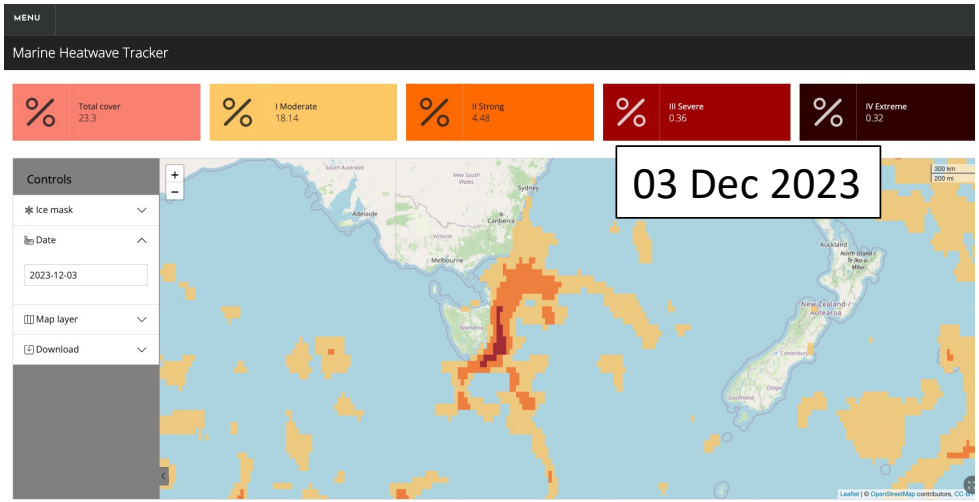
What's happening now?

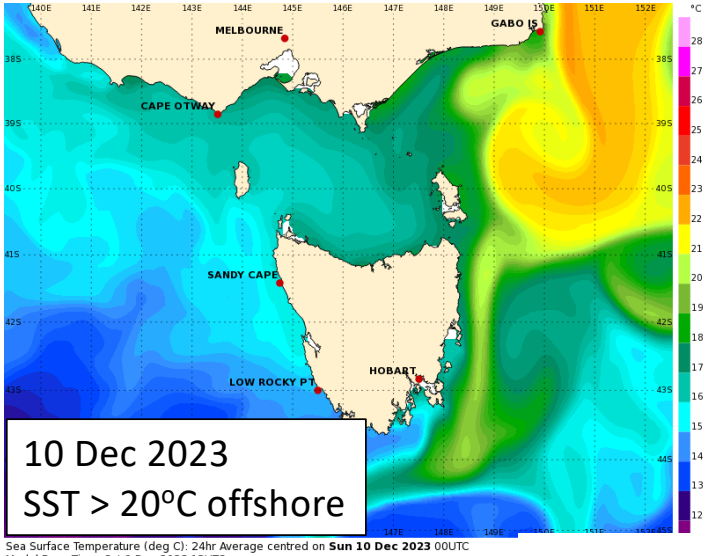
SST 20-21ºC east of Tasmania. Severe MHW conditions offshore.





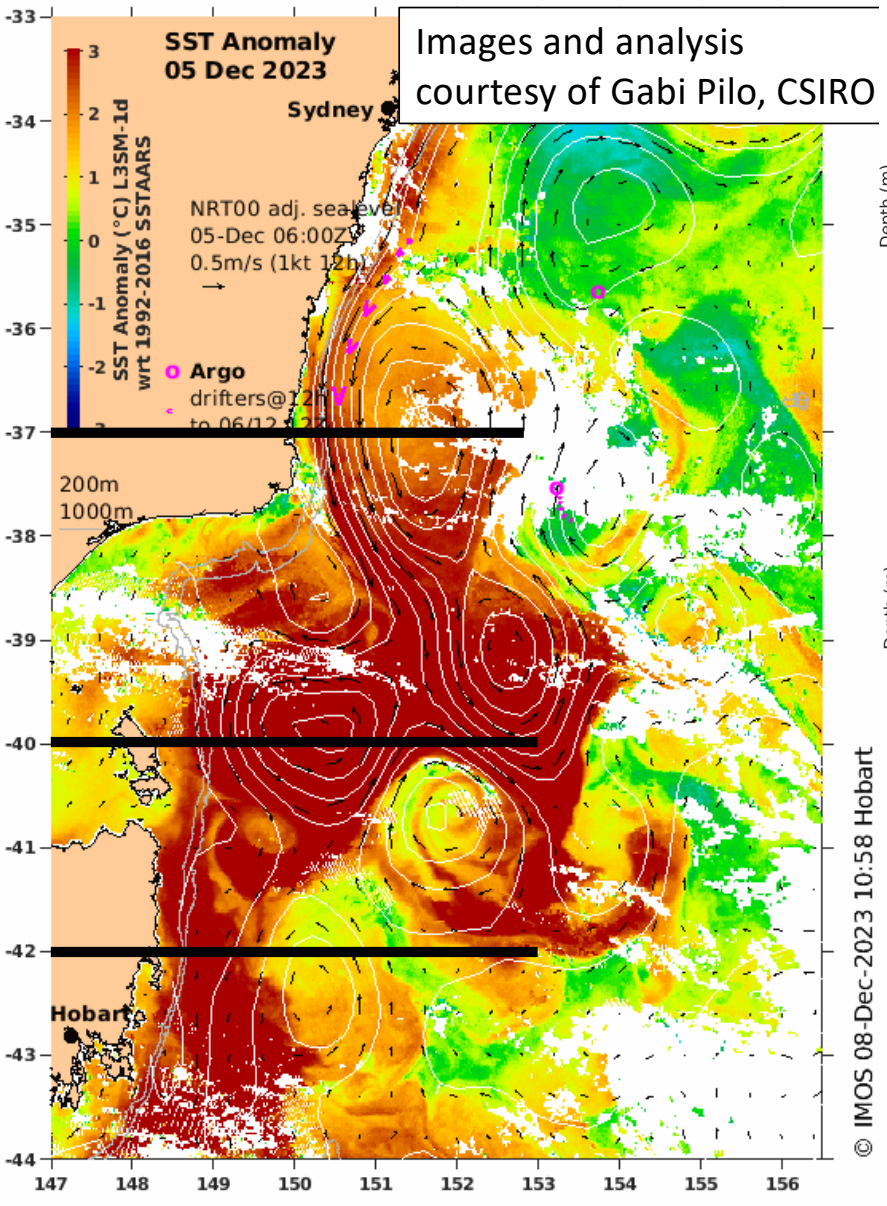




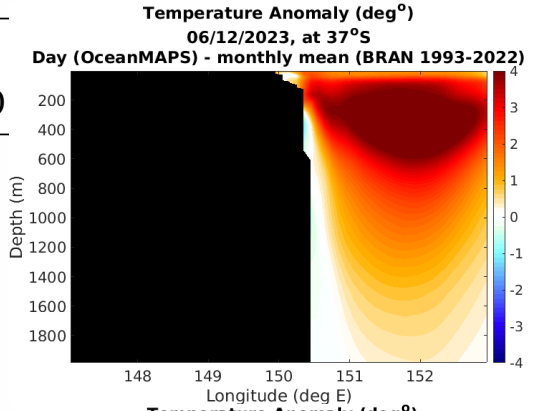


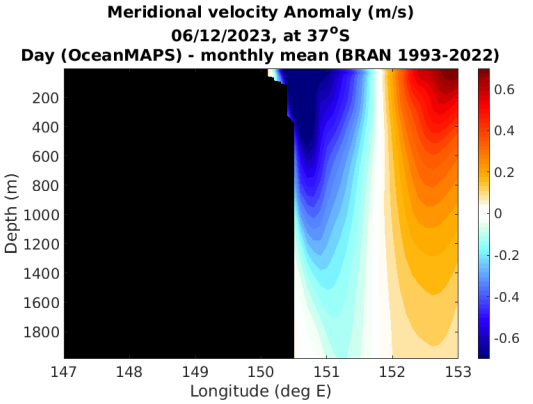
https://www.marineheatwaves.org/tracker.html

OceanMAPS

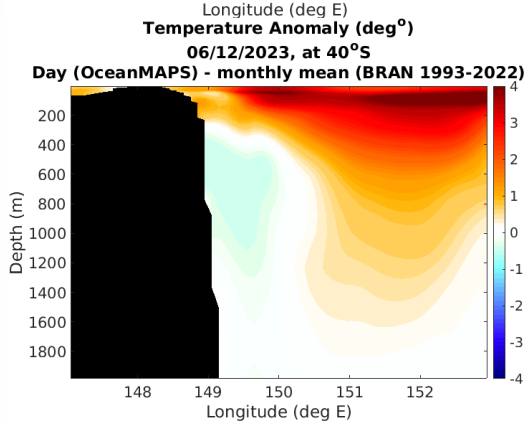


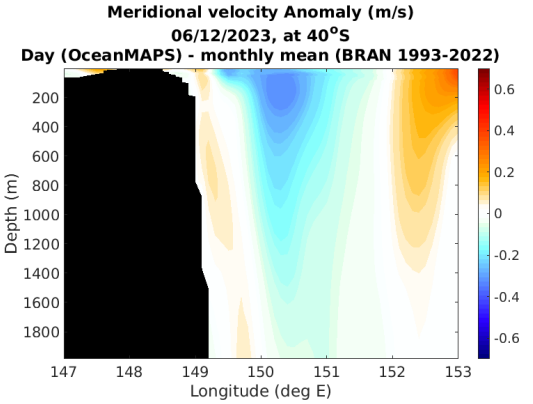
Images and analysis courtesy of Gabi Pilo, CSIRO



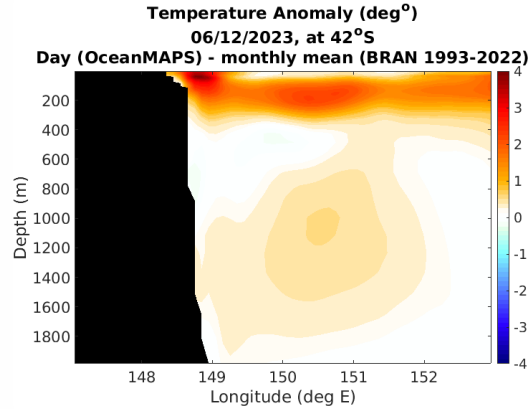


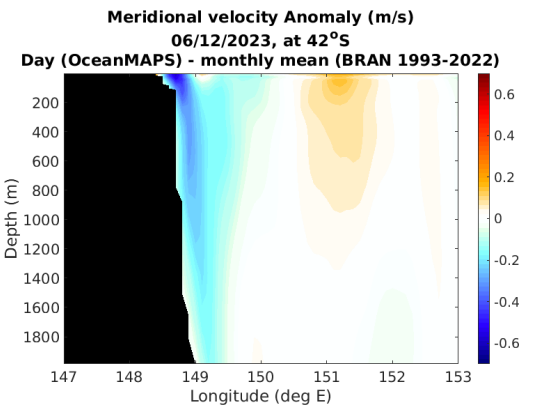
37°S





40°S



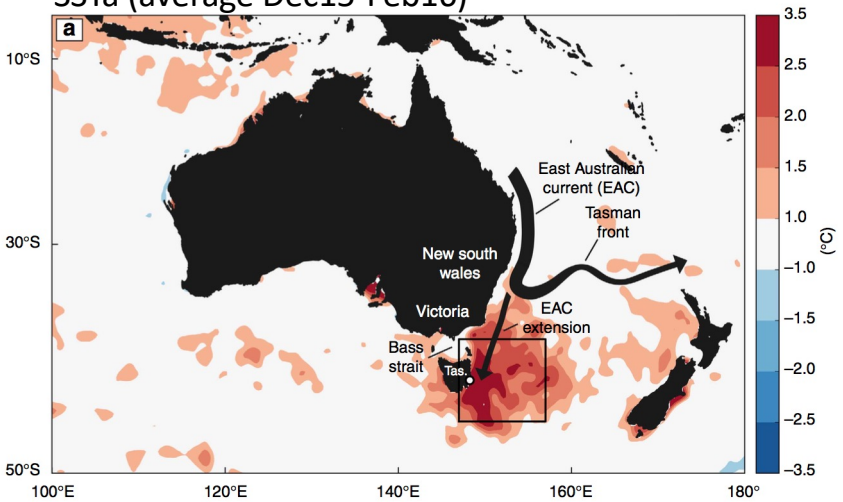


42°S

What have we seen before and what have we learned?

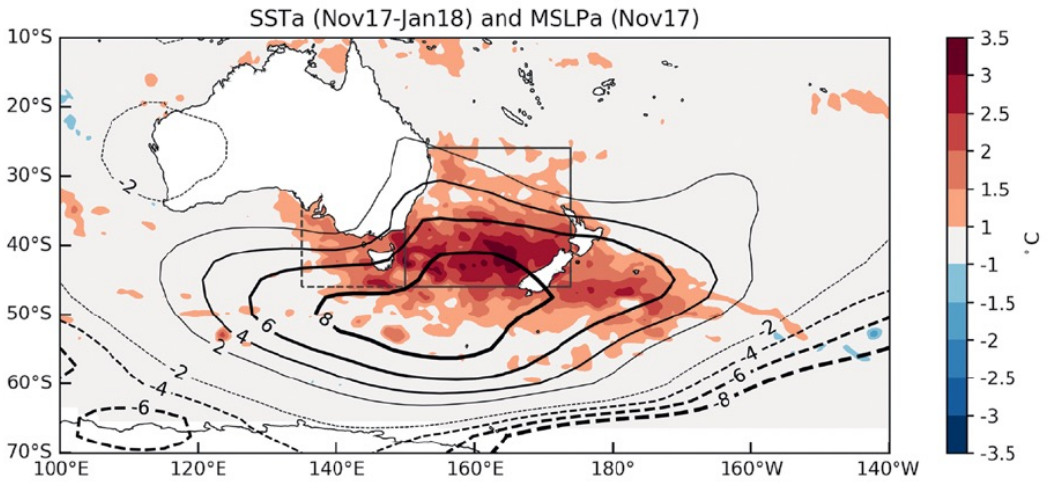
2015/16 Tasman Sea marine heatwave

SSTa (average Dec15-Feb16)



Oliver et al. (2017)

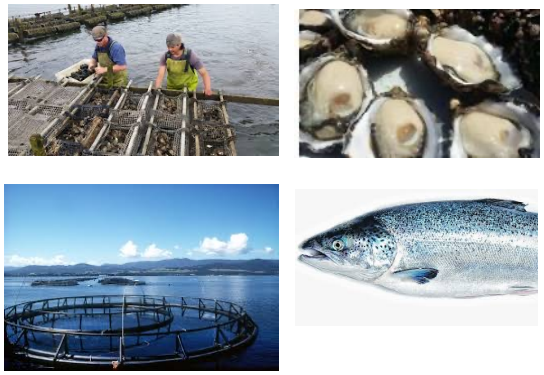
2017/18 Tasman Sea marine heatwave



Perkins-Kirkpatrick et al. (2019)

- Narrower horizontal spatial scale
- Relatively deep to >200 m depth
- Long duration 251 days (>8 mths!)

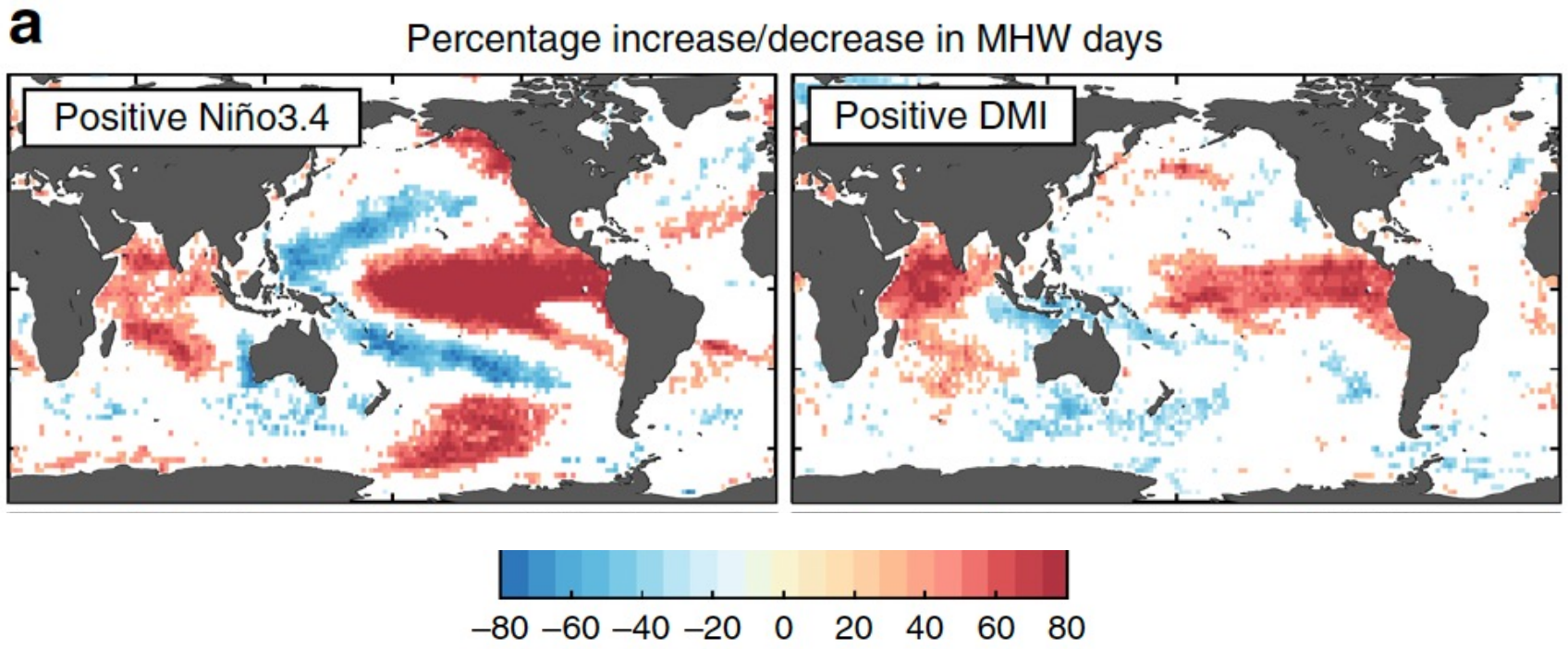
- Dominant process => **ADVECTION**



- Much broader horizontal spatial scale
- Relatively shallow to ~20 m depth
- Shorter duration (~2-3 mths)

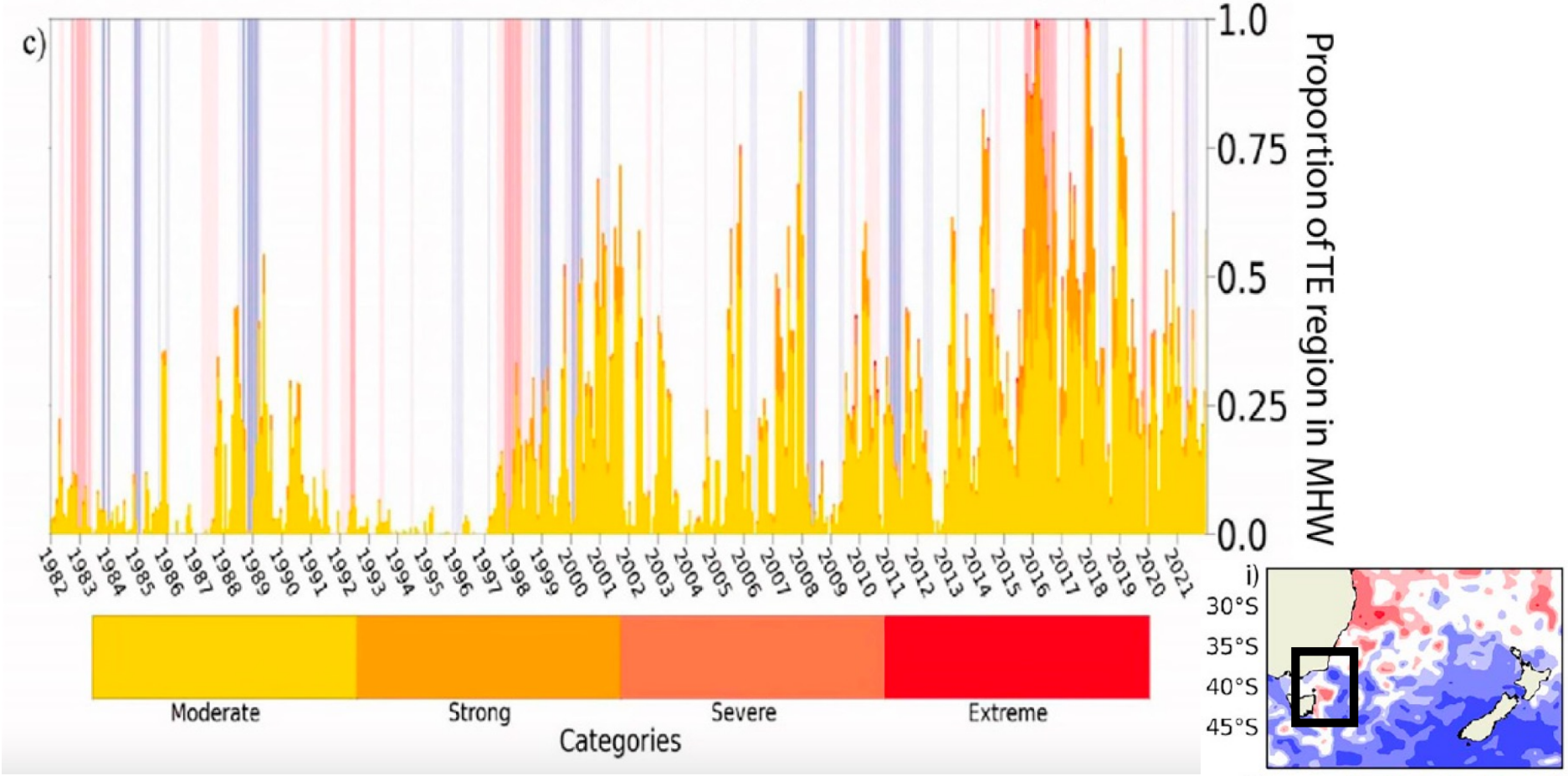
- Dominant process => **SURFACE HEAT FLUX**

Enhanced or suppressed MHW occurrence likelihoods according to climate mode phase



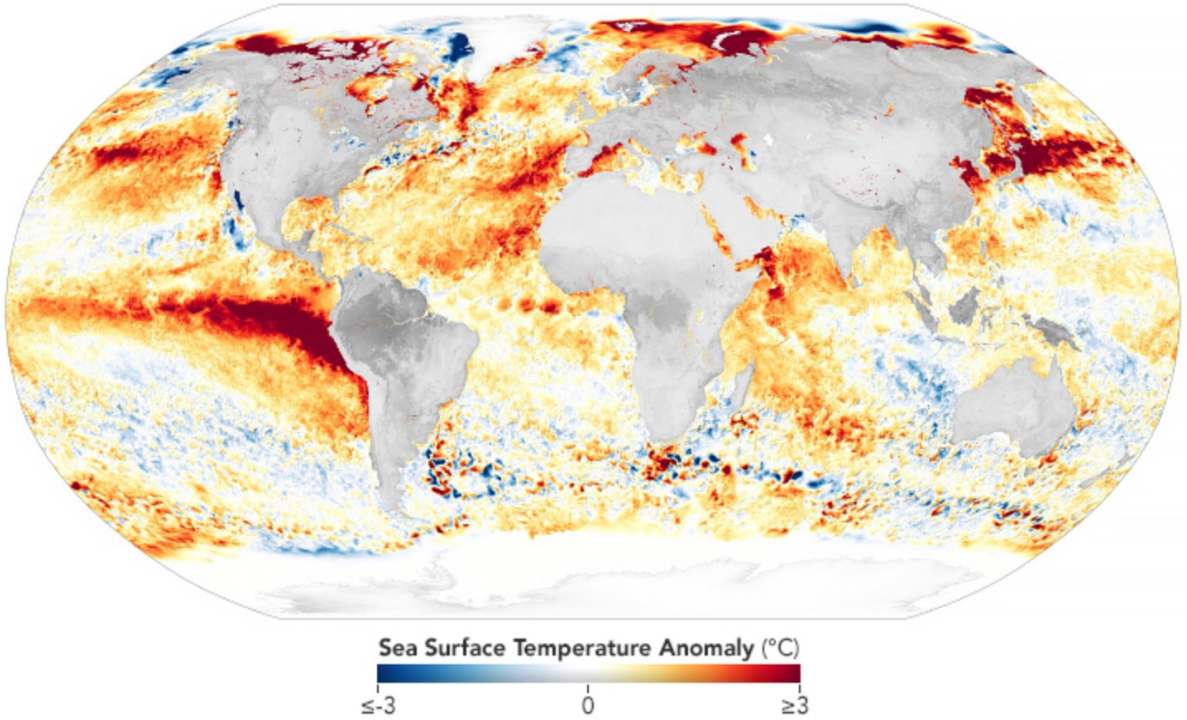
Holbrook et al. (2019), Nature Communications

Proportion of SW Tasman Sea in marine heatwave conditions 1982-2021



Gregory et al. (2023), Journal of Climate

The Ocean Has a Fever

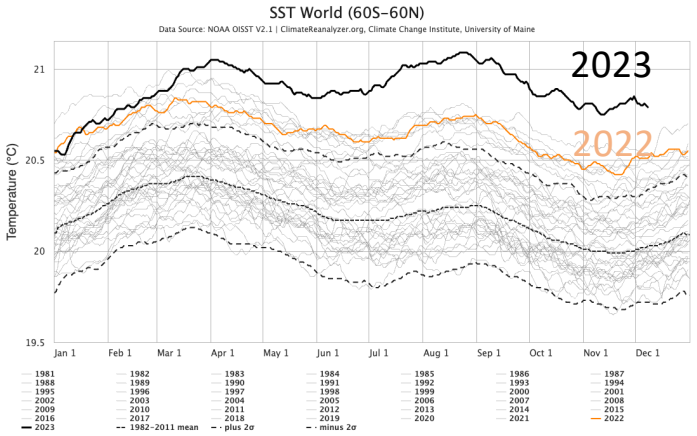


August 21, 2023

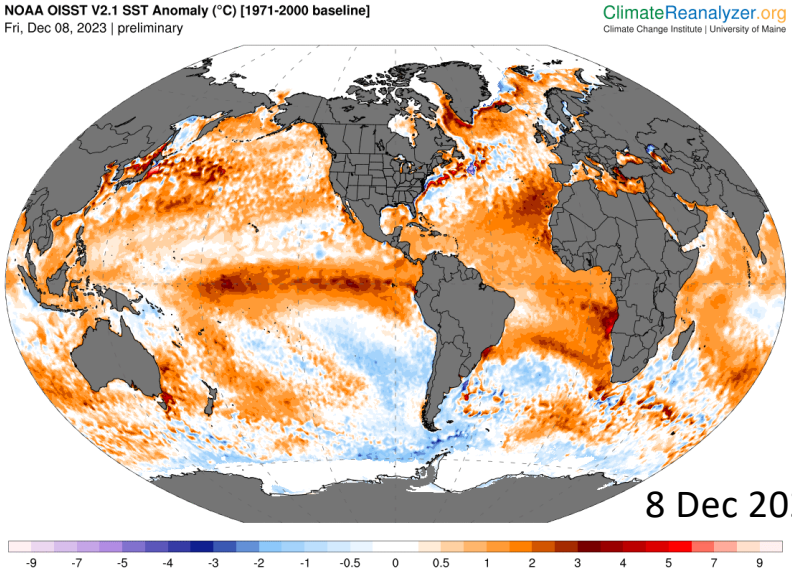
[relative to baseline average day 2003-2014]

https://earthobservatory.nasa.gov/images/151743/the-ocean-has-a-fever

Sea surface temp (°C) (60°S-60°N)

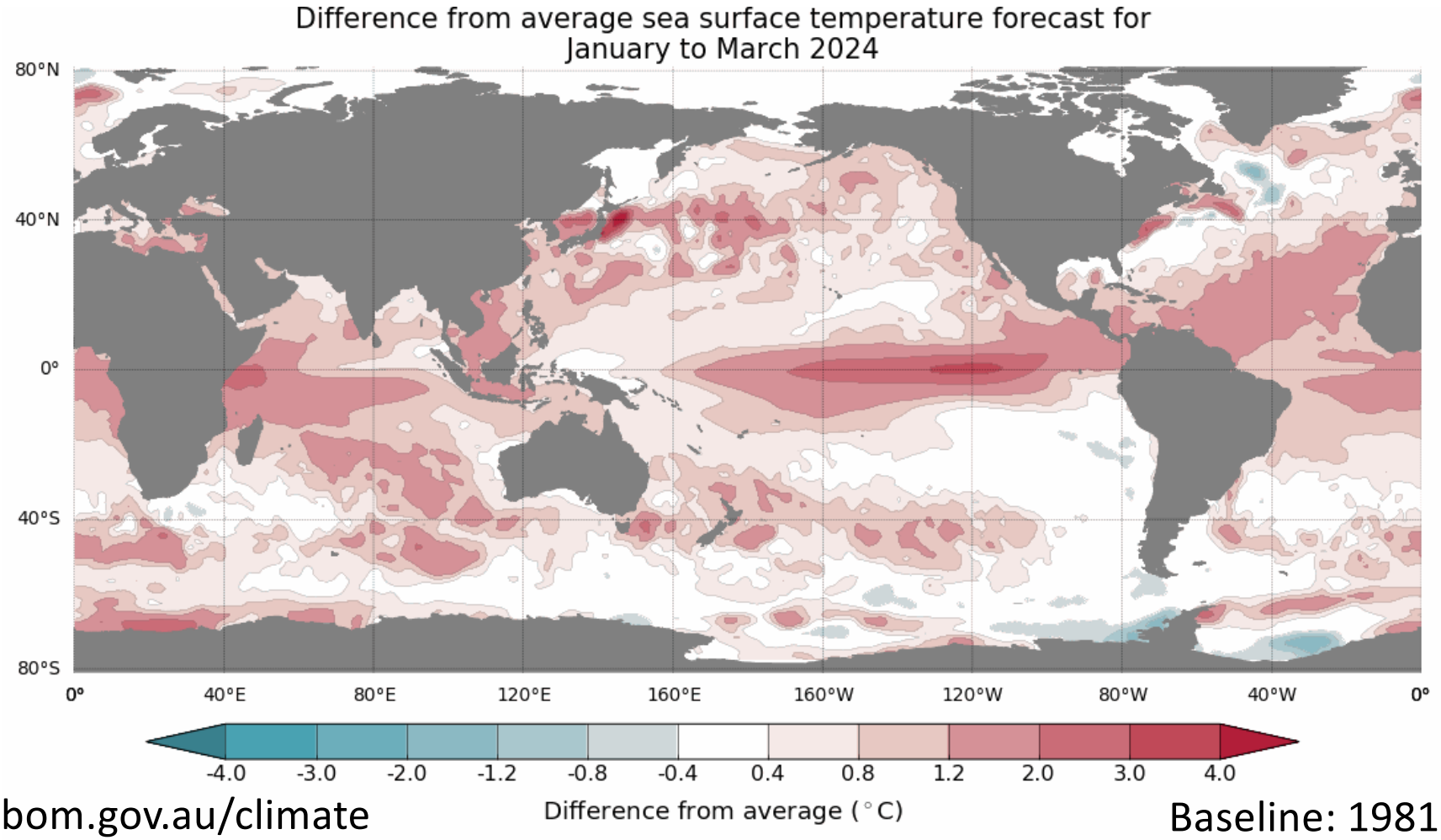


https://climatereanalyzer.org/clim/sst_daily/



8 Dec 2023

BoM Seasonal Forecast: January–March 2024



www.bom.gov.au/climate

Baseline: 1981-2018

Model: ACCESS-S2
Base period: 1981-2018

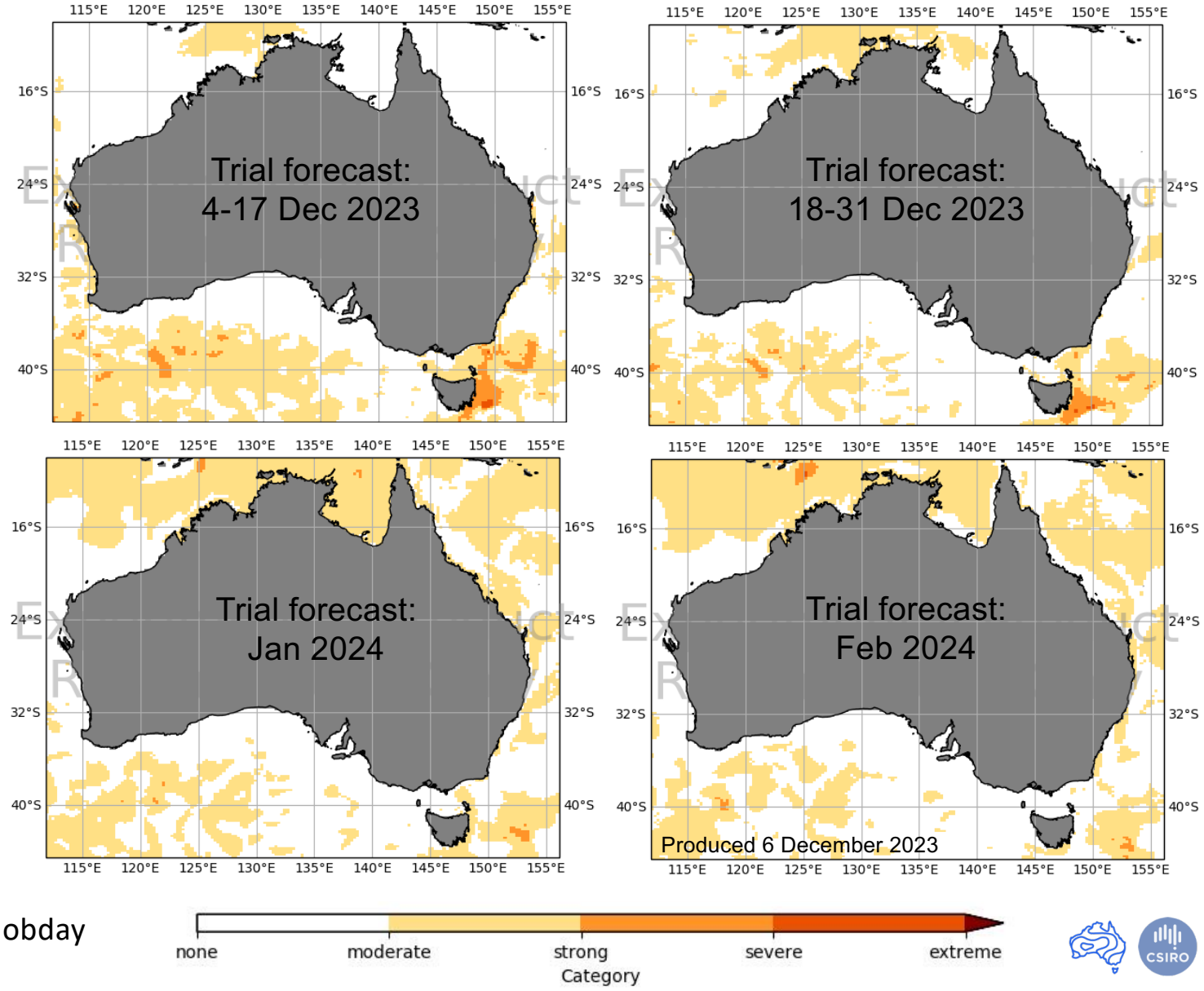
Model run: 02/12/2023
Issued: 04/12/2023

CSIRO-BOM MHW forecasting Project

Trial marine heatwave outlook

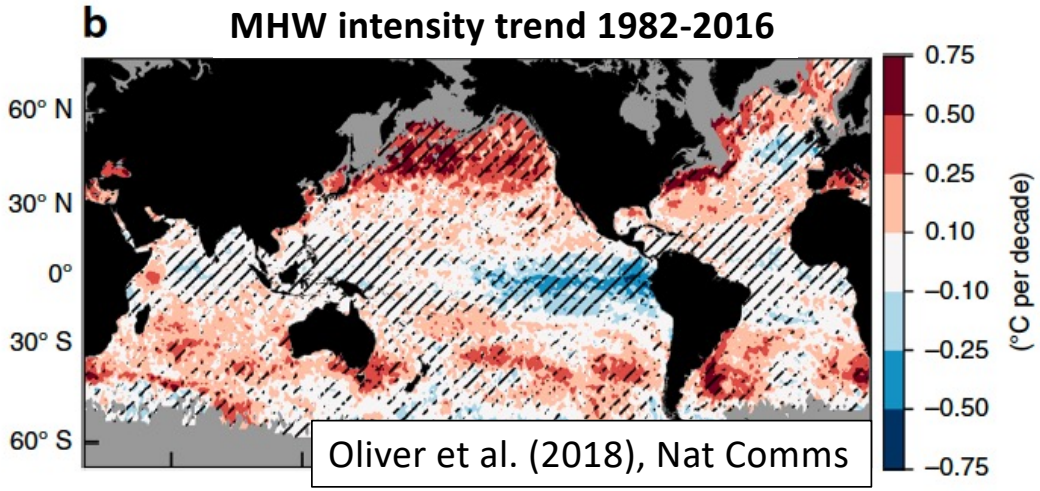
Moderate heatwave conditions forecasted to develop across northern Australia.

Strong heatwave conditions in eastern TAS for December, easing in January-February.

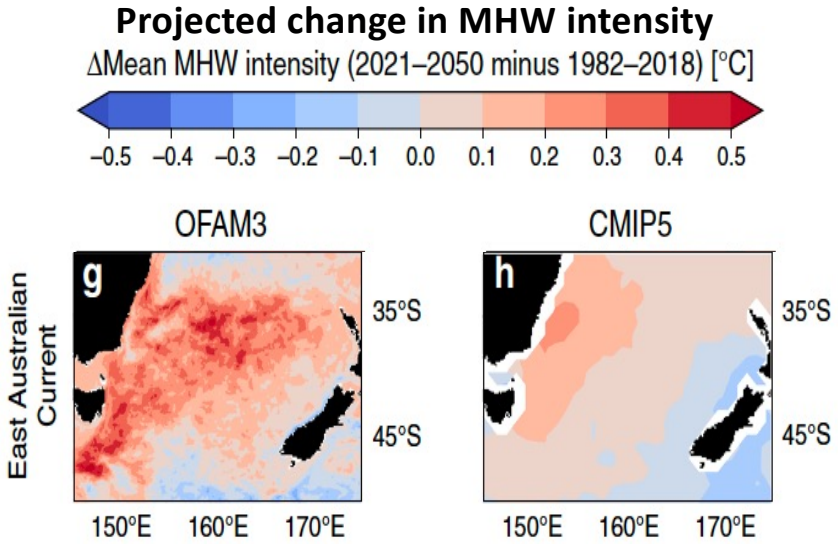


Courtesy: Claire Spillman and Alistair Hobday

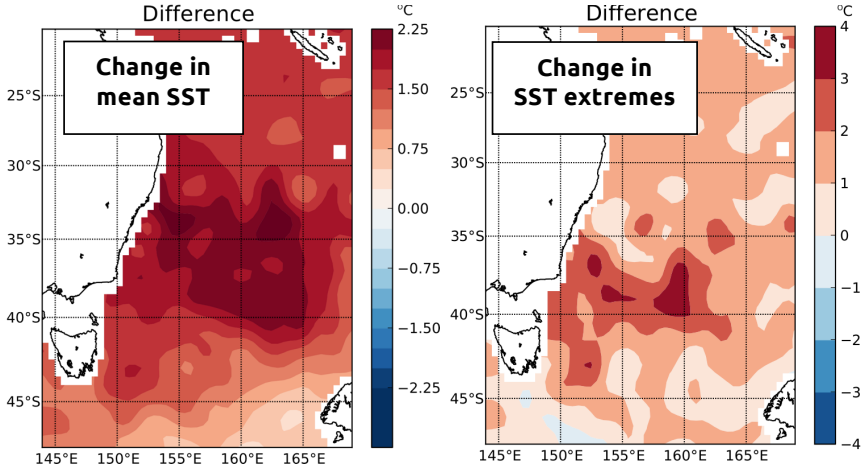
Historical marine heatwave trends and future projections



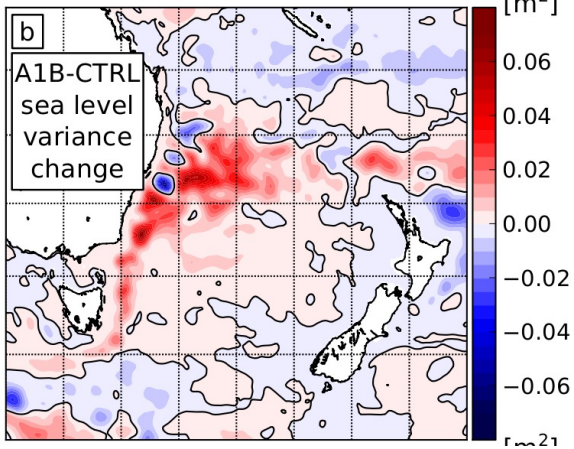
Oliver et al. (2018), Nat Comms



Hayashida et al. (2020), Nat Comms



Oliver et al. (2014), J Climate



Oliver et al. (2015), JGR Oceans

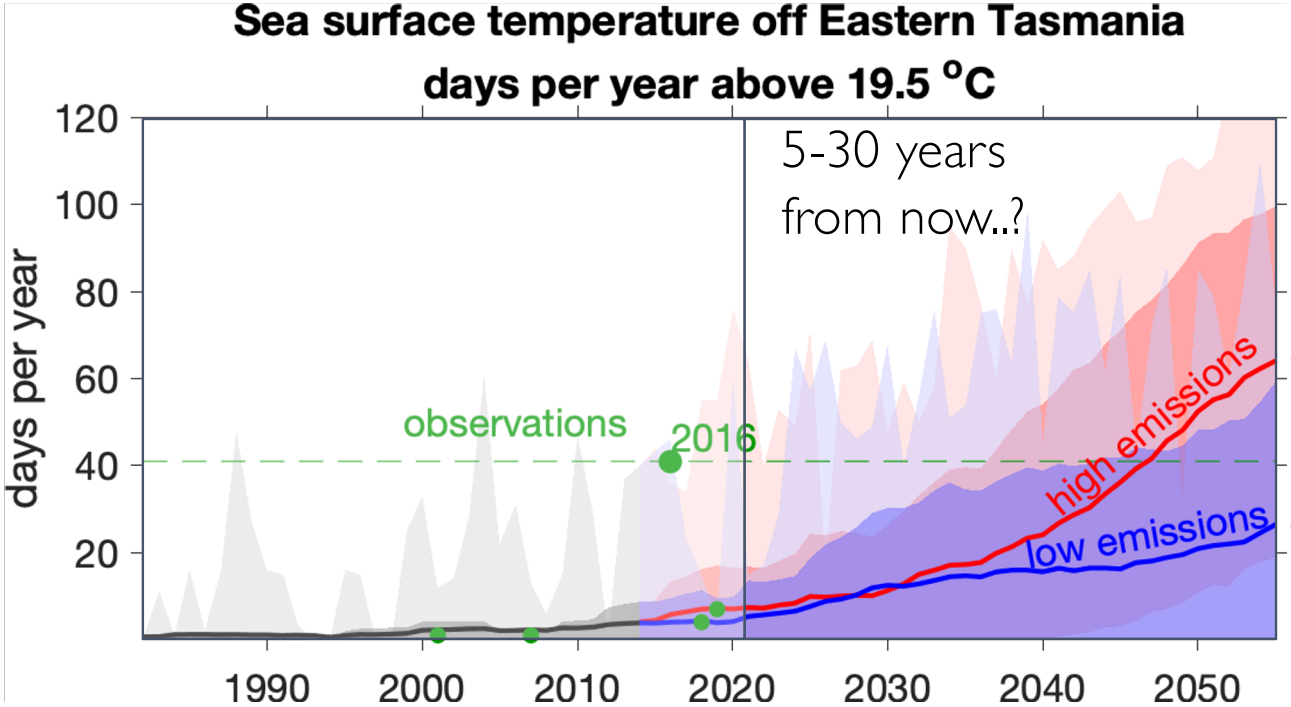
Other historical evidence

Holbrook & Bindoff (1997), J Climate

Ridgway (2007), Geophys Res Lett

Wu et al. (2012), Nature

The Future Hazard (leading to => Risk)

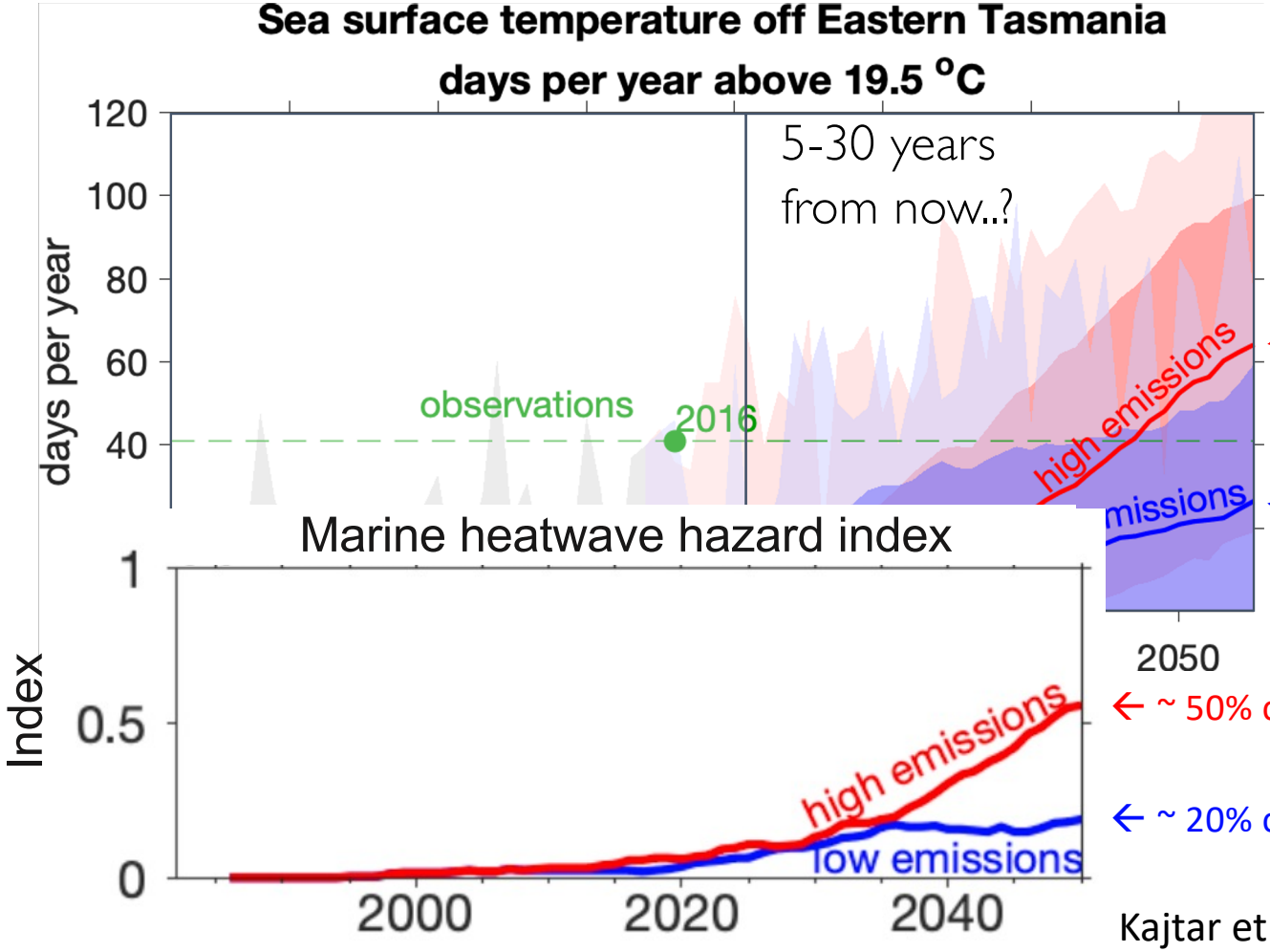


Model projections of a high greenhouse gas emissions scenario

Low greenhouse gas emissions scenario

Kajtar et al. (in review, Climatic Change)

The Future Hazard (leading to => Risk)



Model projections of a high greenhouse gas emissions scenario

Low greenhouse gas emissions scenario

← ~ 50% chance, or every 1 in 2 years

← ~ 20% chance, or every 1 in 5 years

Kajtar et al. (in review, Climatic Change)