

Australia's ACCESS-CM2 climate model with a higher-resolution ocean-sea ice component (1/4°)

Wilma Huneke^{1,2}, Andy Hogg^{1,2,3}, Martin Dix^{3,4}, Dave Bi⁴
 ANU, CLEX, ACCESS-NRI, CSIRO

Our coupled model permits the ocean mesoscale.
 Could it be the tool to answer your next research question?

1 Why coupled modelling?

- Ocean-atmosphere interaction is an important component of the Earth's climate system
- Coupled models directly simulate
 - heat and freshwater fluxes
 - momentum transfer

2 What is new?

Improvement of Australia's ACCESS-CM2 coupled model to have a **higher ocean resolution** (0.25° instead of 1°) that allows eddies (ocean mesoscale) to be resolved across most of the globe.

3 Why ocean resolution matters

- Ocean can force the atmosphere: warmer SST result in higher winds, important near large SST gradients (fronts).
- Ocean mesoscale affects large-scale decadal modes of variability.

Resolving the ocean mesoscale improves the representation of low-frequency variability in a climate model.

4 ACCESS-CM2-025 performance

Comparison of 0.25° and 1° coupled models (CM2-025 and CM2-1) to the ocean-only models (OM2-025, OM2-1) with a prescribed repeat-year atmospheric forcing.

Key takeaways:

- Trend in SST (spin-up) in both coupled models, driven by Southern Ocean
- Large DP transport in CM2-025, too low in ocean-only models
- Unrealistically strong multidecadal variability due to excessive North Atlantic convection, dominates global SST
- Spurious convection could be mitigated by improving eddy parameterisation in high latitudes (ongoing testing)
- Negligible changes in the ENSO representation

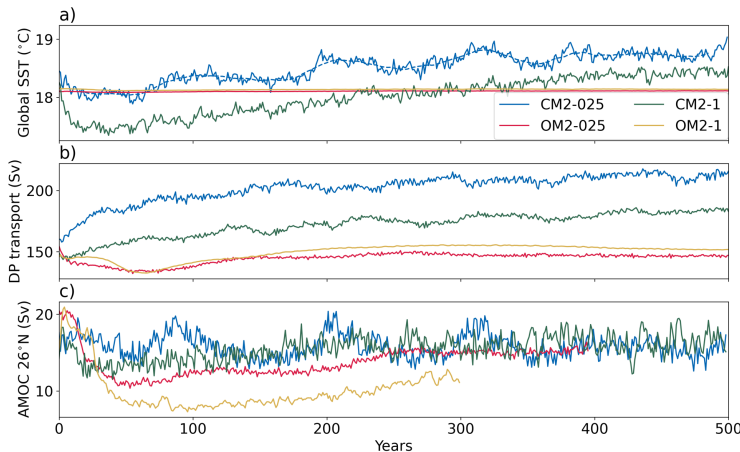


Figure 1: Time series of annually averaged a) sea surface temperature, b) Drake Passage transport, c) Atlantic Meridional Overturning Circulation.

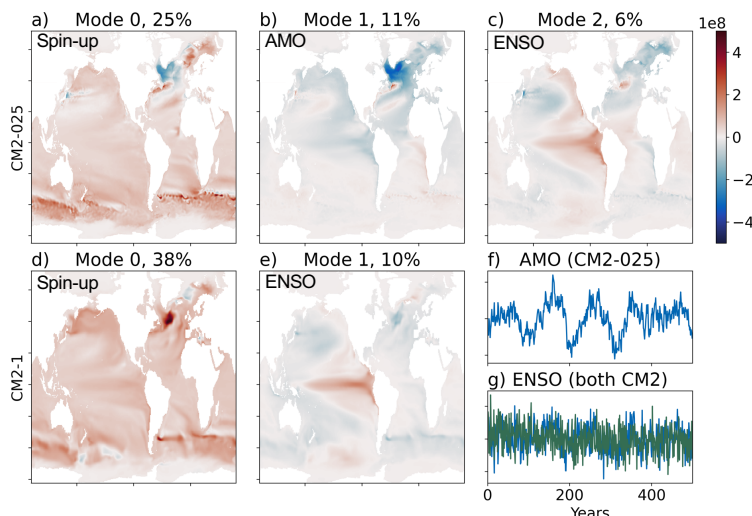


Figure 2: Spatial structure of a global empirical orthogonal function (EOF) analysis of the upper ocean heat content (0-50m) for the (a-c) 0.25° and (d-e) 1° coupled models. Panels f) and g) show selected principal component time series of the corresponding EOF.

ACCESS-CM2-025

Model components:

- Ocean: MOM5 (0.25°)
- Sea ice: CICE5 (0.25°)
- Atmosphere: UKMO UM (N96, 1°)
- Land: CABLE (1°)

Cost:

- 12.5 kSU/model yr
- 4.3 yr/walltime day

Simulation: 500 yr present day