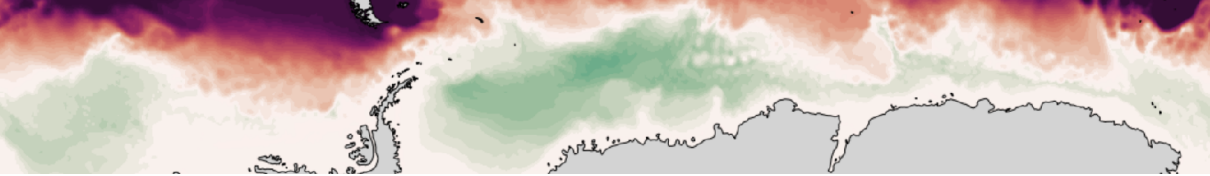

Preliminary analysis of the Ross and Weddell Gyres in ACCESS-OM2

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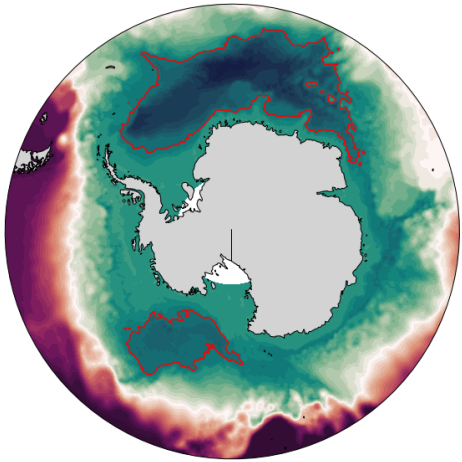
Background

- **Cyclonic** gyres predominantly **wind driven** and **topographically steered**
- Connected to **deep water formation** and **poleward heat transport**
- **Very undersampled**
- Weddell gyre transport estimates: **30 - 100 Sv**
- Ross gyre transport estimates: **8 - 50 Sv**
- Strong seasonal variability with a stronger (weaker) gyre during winter (summer)
- Variability related to climate modes, such as ENSO, SAM and ASL (Amundsen Sea Low)



Objectives

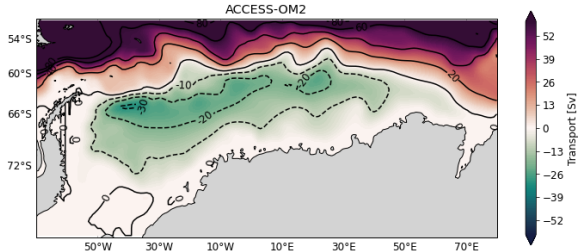
1. Study how the gyres "look" in ACCESS-OM2
2. Assess the model's ability to reproduce observed features

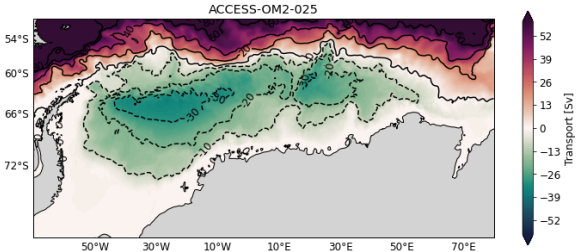
Data:

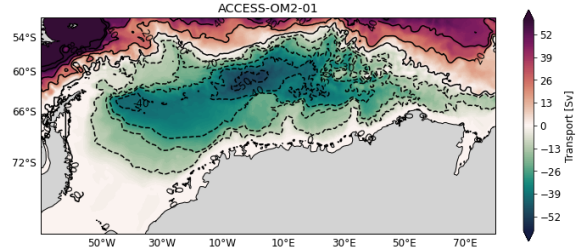
- **ACCESS-OM2**: **1**$^\circ$ resolution interannual forcing experiment. Last forcing cycle, years **1958 to 2018**.
- **ACCESS-OM2-025**: **0.25**$^\circ$ resolution interannual forcing experiment. Last forcing cycle, years **1958 to 2018**.
- **ACCESS-OM2-01**: **0.1**$^\circ$ resolution interannual forcing experiment, years **1985 to 2018**.

Ψ_B(barotropic stream function) defined as the meridional integral of the zonal, depth integrated transport starting from the Antarctica.

Weddell Gyre: mean Ψ_B

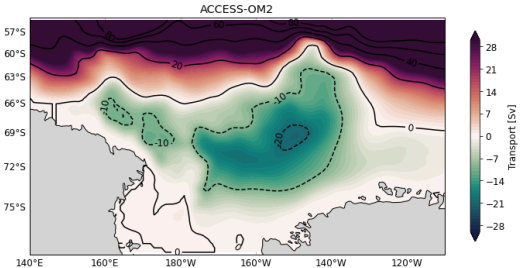


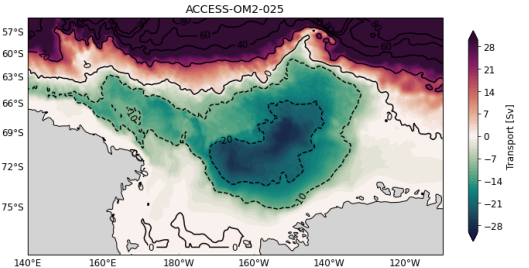


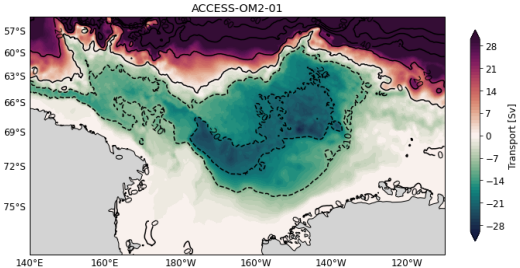


- Gyre intensity and area increase with resolution and the flow becomes more unstable.
- In ACCESS-OM2-01 the gyre does not show a "double lobe" circulation or a defined eastern boundary.

Ross Gyre: mean Ψ_B

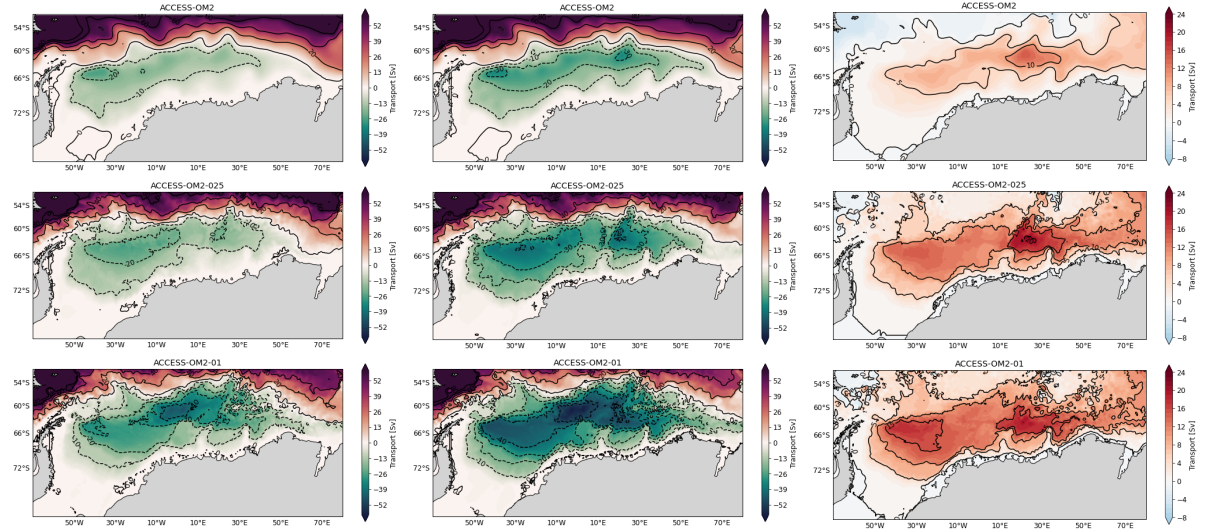






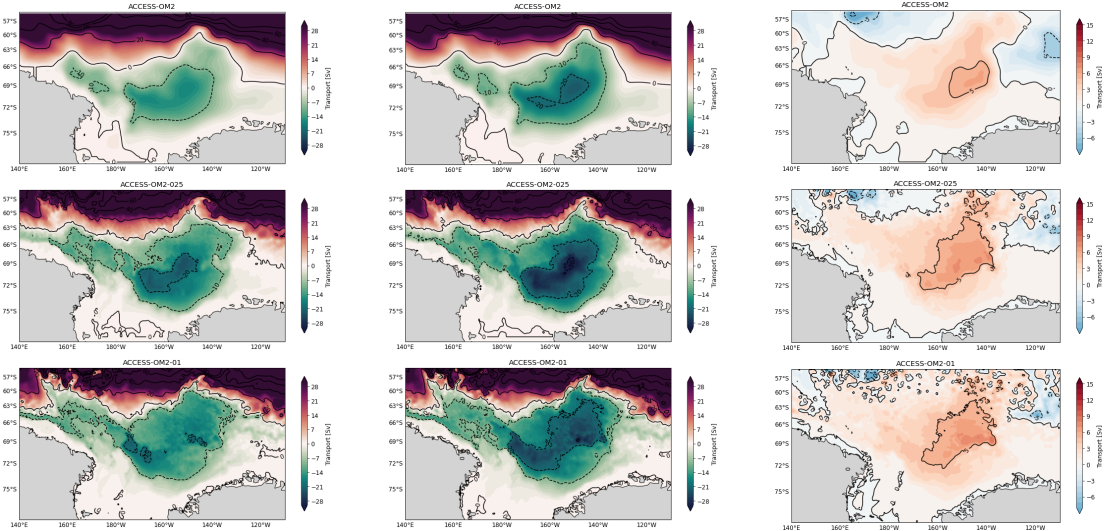
- Position and region of highest intensity does not vary among resolutions.
- ACCESS-OM2 presents the weakest and smaller gyre.
- The area and intensity in ACCESS-OM2-025 and ACCESS-OM2-01 is similar.

Weddell Gyre: summer/winter Ψ_B



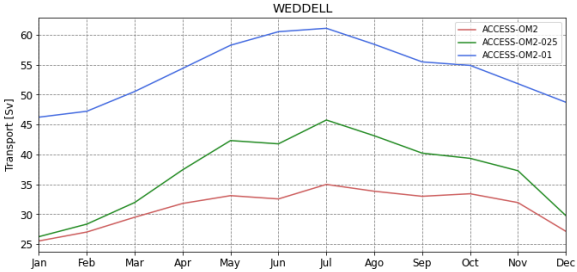
Summer | Winter | Summer - Winter

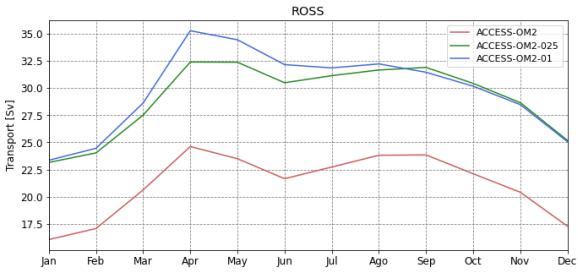
Ross Gyre: summer/winter Ψ_B



Gyre Strength: annual cycle

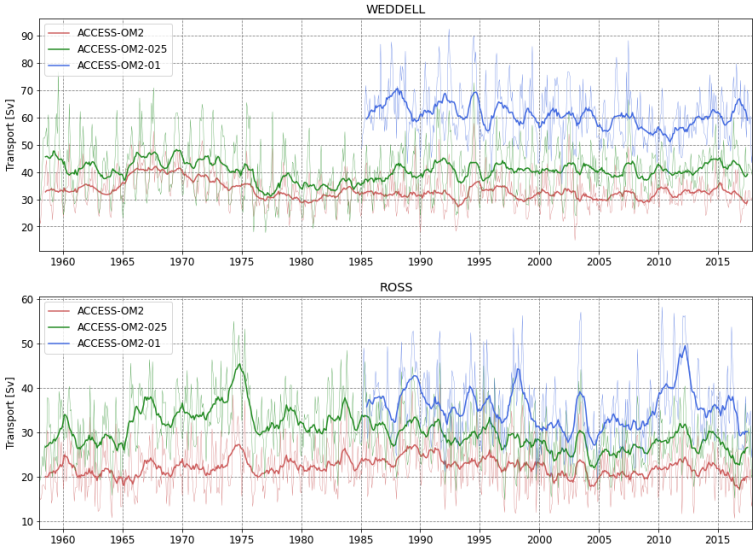
Gyre strength definition: **regional minimum** of the Ψ_B. For the Weddell Gyre, the region is bounded by [-80°S:60°S] × [60°W:30°E]. For the Ross Gyre, [-80°S:60°S] × [150°E:130°W].





- The Weddell displays a clear winter (summer) intensification (weakening) of ∼20Sv for ACCESS-OM2-025 and ACCESS-OM2-01 and ∼10Sv for ACCESS-OM2.
- The Ross shows a clear weakening in summer and hints a double peak during April and Aug-Sep with an abrupt spin-up during Feb-Mar-Apr.

Gyre Strength: time series

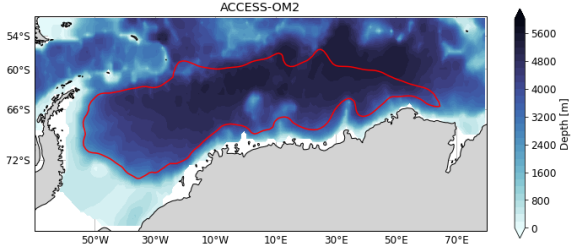


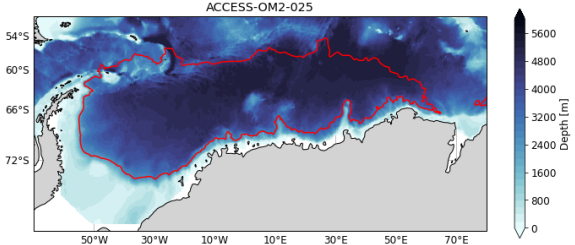
- Monthly values (thin line) and 12-month running mean (thick line)
- Gyre strength estimates are within the range reported in previous works.
- The variability is in phase among resolutions, which speaks of the influence of the forcing.

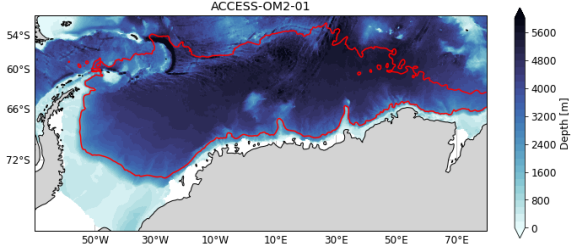
Future work

1. Continue describing the Ross and Weddell Gyre's as they appear in the model: mean characteristics, seasonal and interannual variability, connection to climate modes, etc.
2. Evaluating the model's ability to reproduce characteristics reported by observation-based works. Where the model performs well and where it does not?
3. Explore the gyre's wind/buoyancy forcing mechanisms in the interannual forcing runs.
4. Plan and run experiments to further study these mechanisms.
5. Investigate the role of these gyres in heat transport and deep water formation and how could these be related to climate change and ice-sheet melting.

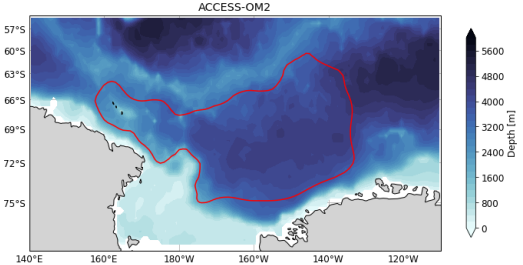
Bathymetry

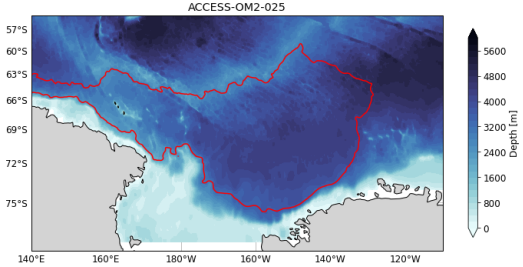

ACCESS-OM2
54°S
60°S
66°S
72°S
50°W
30°W
10°W
10°E
30°E
50°E
70°E
5600
4800
4000
3200
2400
1600
800
0
Depth [m]


ACCESS-OM2-025
54°S
60°S
66°S
72°S
50°W
30°W
10°W
10°E
30°E
50°E
70°E
5600
4800
4000
3200
2400
1600
800
0
Depth [m]


ACCESS-OM2-01
54°S
60°S
66°S
72°S
50°W
30°W
10°W
10°E
30°E
50°E
70°E
5600
4800
4000
3200
2400
1600
800
0
Depth [m]

Bathymetry


ACCESS-OM2
57°S
60°S
63°S
66°S
69°S
72°S
75°S
140°E
160°E
180°W
160°W
140°W
120°W
5600
4800
4000
3200
2400
1600
800
0
Depth [m]


ACCESS-OM2-025
57°S
60°S
63°S
66°S
69°S
72°S
75°S
140°E
160°E
180°W
160°W
140°W
120°W
5600
4800
4000
3200
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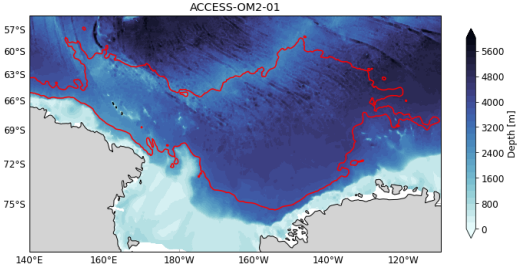
Depth [m]


ACCESS-OM2-01
57°S
60°S
63°S
66°S
69°S
72°S
75°S
140°E
160°E
180°W
160°W
140°W
120°W
5600
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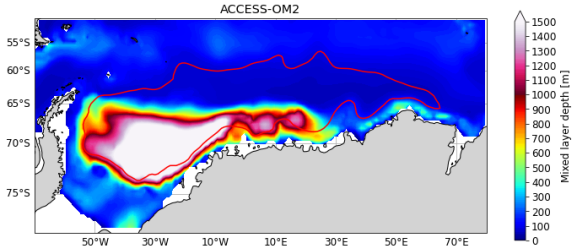
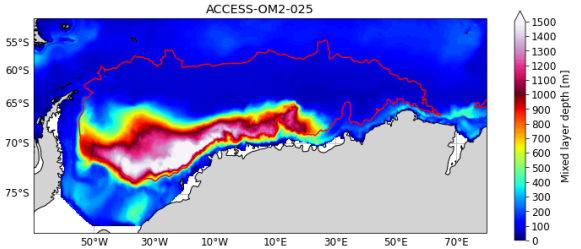
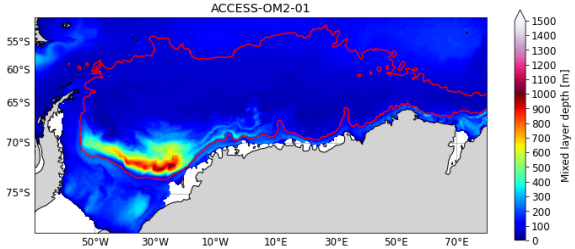
Depth [m]

Mixed layer depth







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