

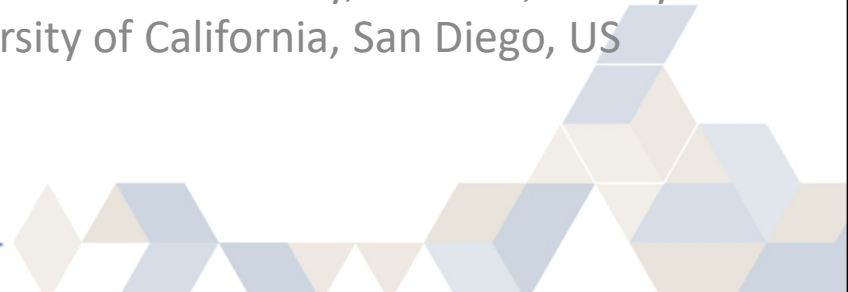
Investigation of Mechanical and Thermal Wind Sensitivity on the Mesoscale Eddies in the Southern Ocean

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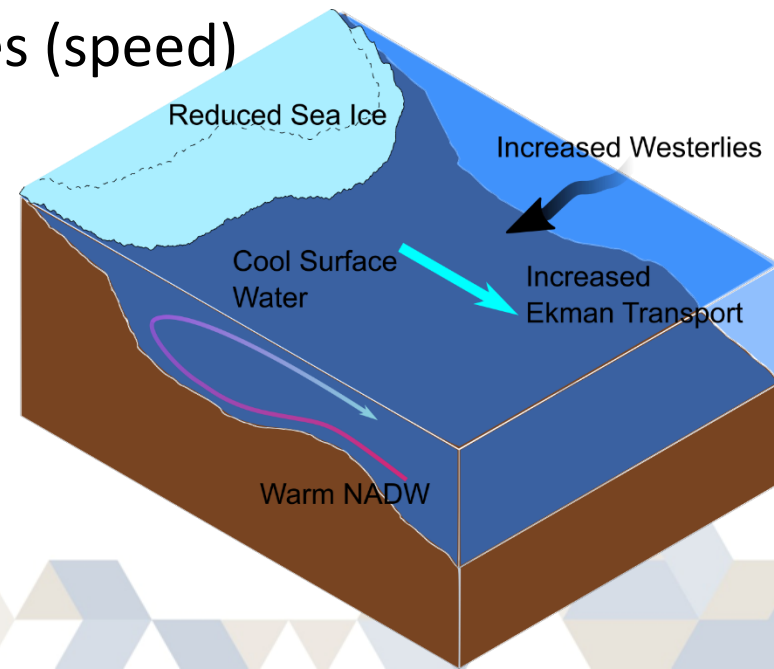
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Motivation

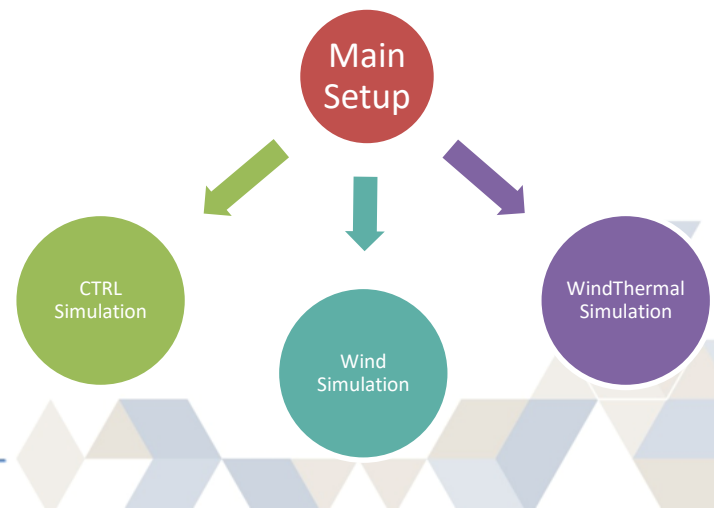
- Understanding difference between wind speed vs. wind stress increase on the Southern Ocean Dynamics
- Investigate the effect of increasing Westerlies in Southern Ocean
- Compare the sensitivity of the dynamics to
 - Only mechanical wind changes (stress)
 - Mechanical + Thermal Wind Changes (speed)



Southern Ocean Model Setup

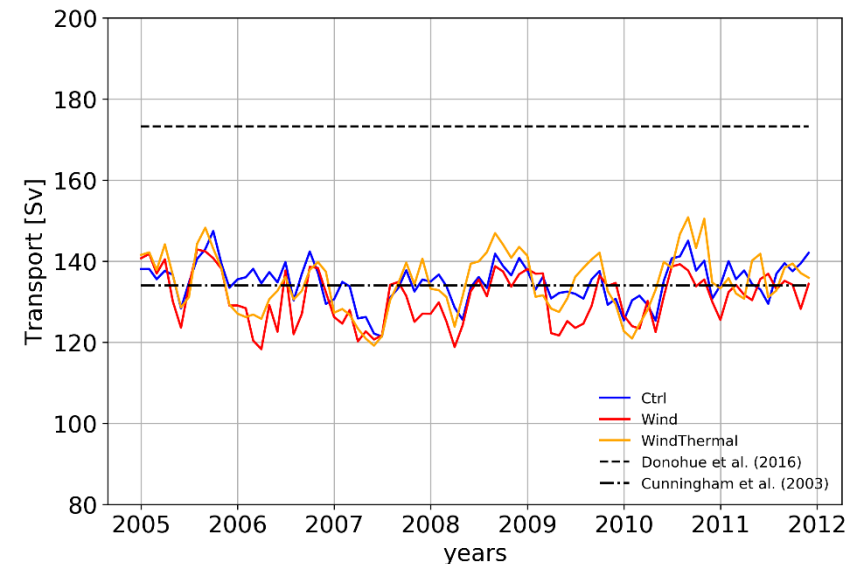
- High-Res ($1/12^\circ$ - 4320 x 1260) Southern Ocean
- MITgcm (Ocean + Sea Ice) Coupled
- ECMWF ERA-5 Atmospheric Re-Analysis

- Wind Simulation: 1.5 times wind stress increase
- WindThermal Simulation: 1.2247 times wind speed increase (mechanical + thermal)



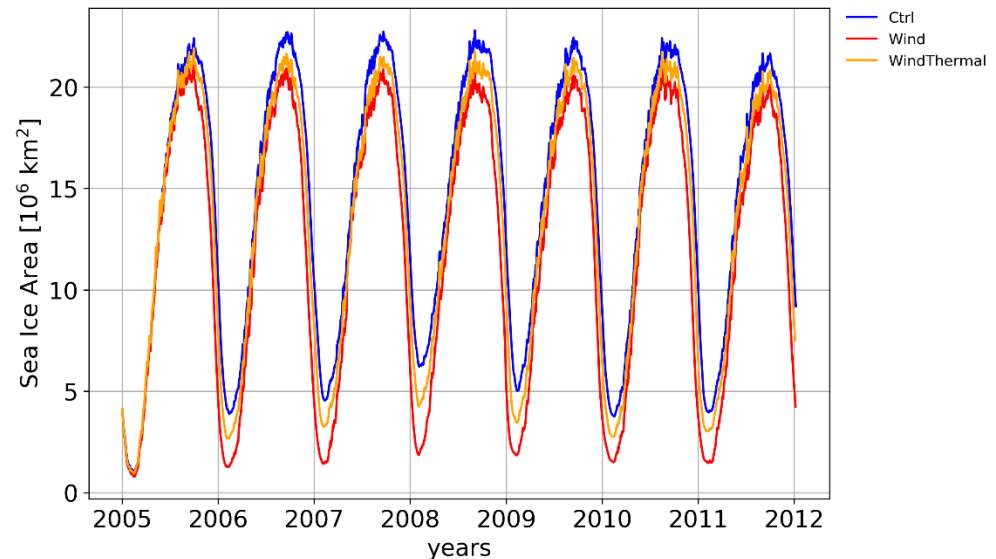
Drake Passage Transport

- Drake Transport in comparable range
- Increased transport with mechanical and thermal (WindThermal) compared to mechanical only (Wind)



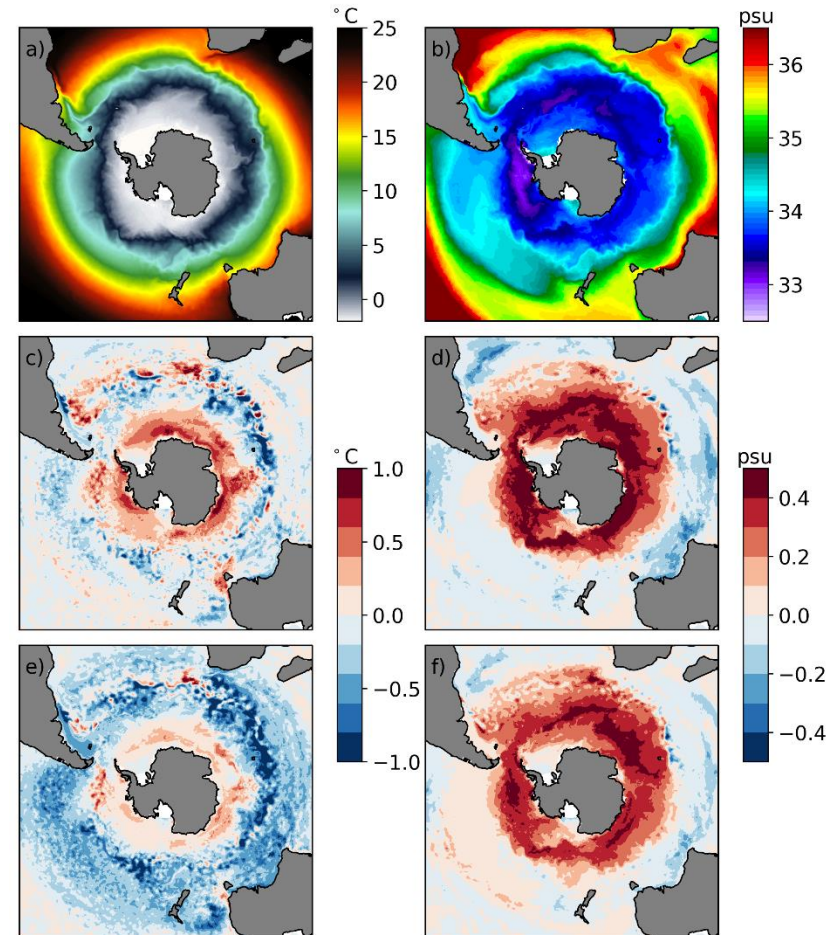
Sea Ice Variability

- Both Wind and WindThermal show reduced Sea Ice coverage
- Increased NADW (warmer) upwelling prevents further Sea Ice formation



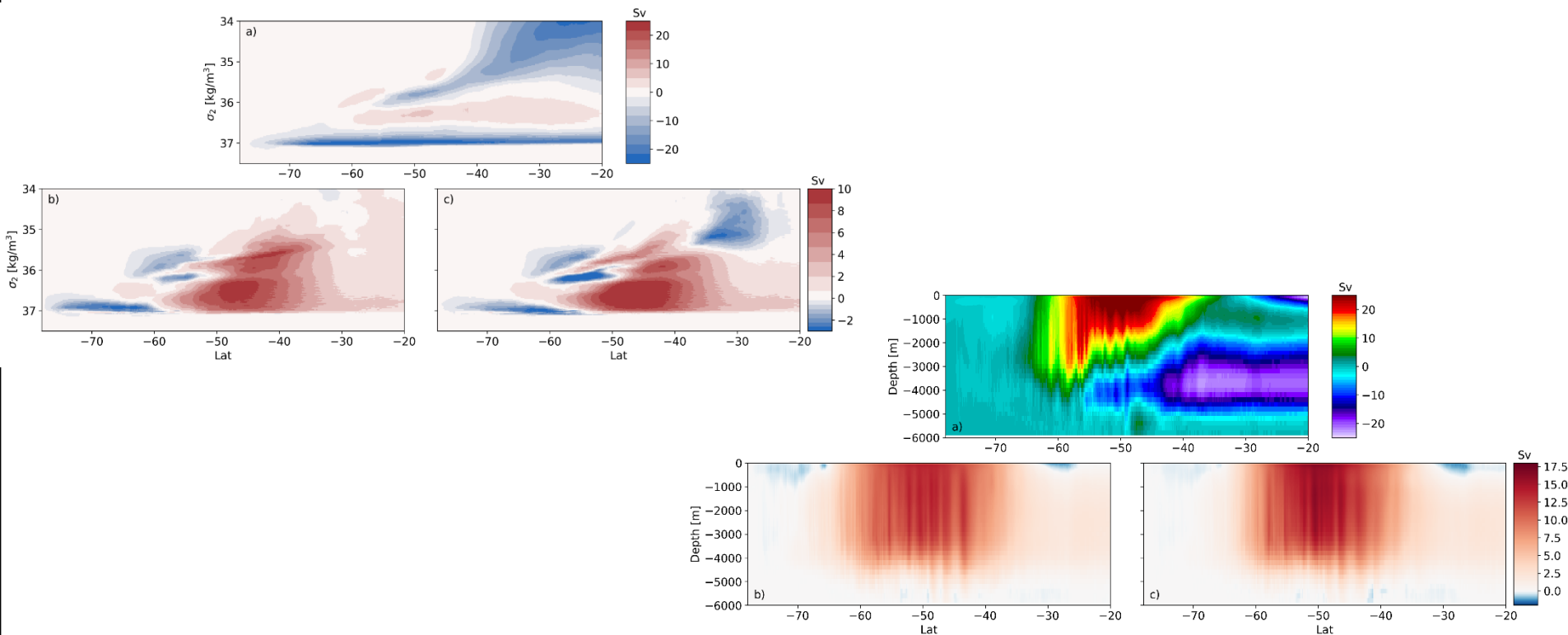
Mean SST and SSS Variability

- Strong warming near the shelf ($\sim +1$ °C)
- Strong cooling in lower latitudes (~ -1 °C)
- More warming in Wind
- Strong salinity increase (~ 0.5 PSU)
- More increase in Wind

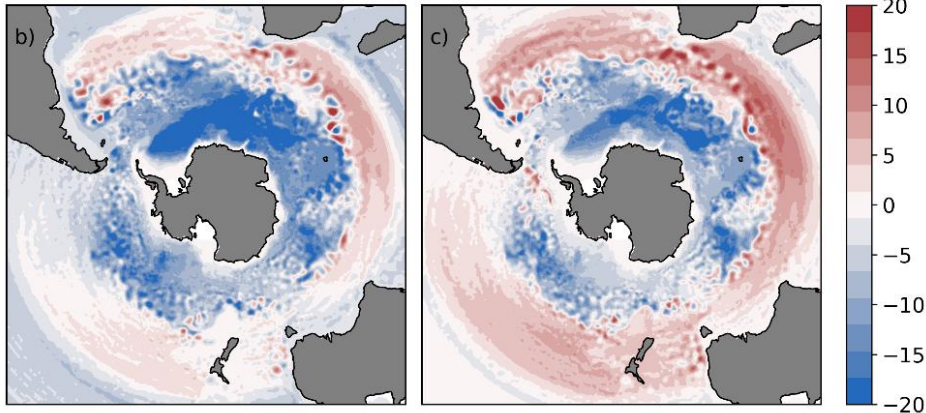
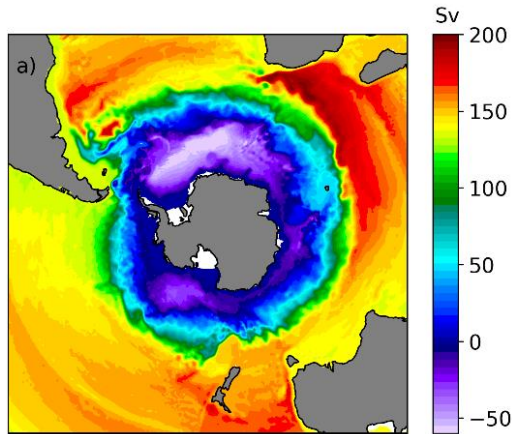


Overturning Circulation

- Increased OC at Subtropical Cell and ACC Upper Cell
WindThermal compared to Wind
- Reduced around the shelf and tropics



Surface Transport



- Strong Weakening in transport around Weddell section
- More reduction with Wind compared to WindThermal

Conclusions

- Studying increased westerlies with two different approaches;
 - wind stress (mechanical) vs. wind speed (mechanical + thermal)
- Significant changes in the surface and deep circulation
- Significant changes in SST and SSS
- Using only mechanical forcing misses thermal component of the wind effects

