# Impact of AMOC shutdown on Australian precipitation

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## *Context*

- The strength of the Atlantic meridional overturning circulation (AMOC) varied significantly during the last glacial period[1]. Particularly, the AMOC could have been shutdown during Heinrich events as a result of iceberg discharges into the North Atlantic Ocean[2].
- The AMOC will weaken over the coming century[3,4].
- The impact of an AMOC shutdown on Australian precipitation is unclear. Here we assess the impact of an AMOC shutdown under pre-industrial and last interglacial boundary conditions.

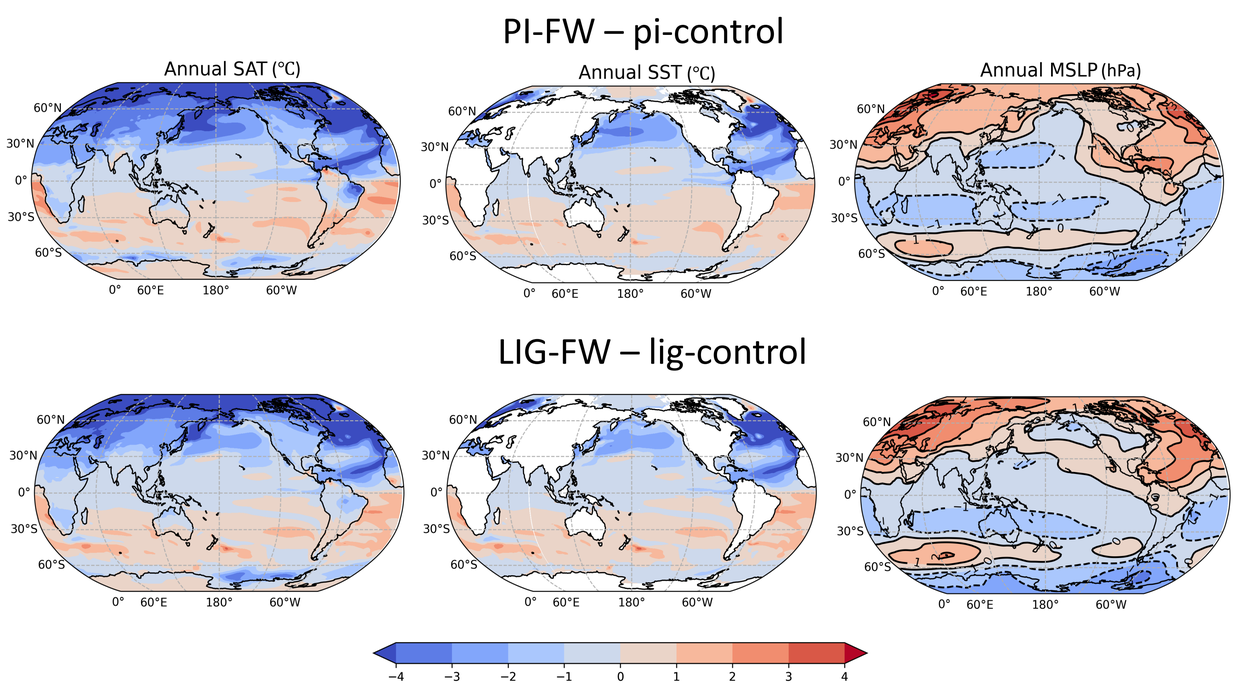
## *Experimental design*

- Model used: ACCESS_ESM1.5
- Boundary conditions: Orbital parameters and GHGs corresponding to pre-industrial (PI) and last interglacial (LIG) .

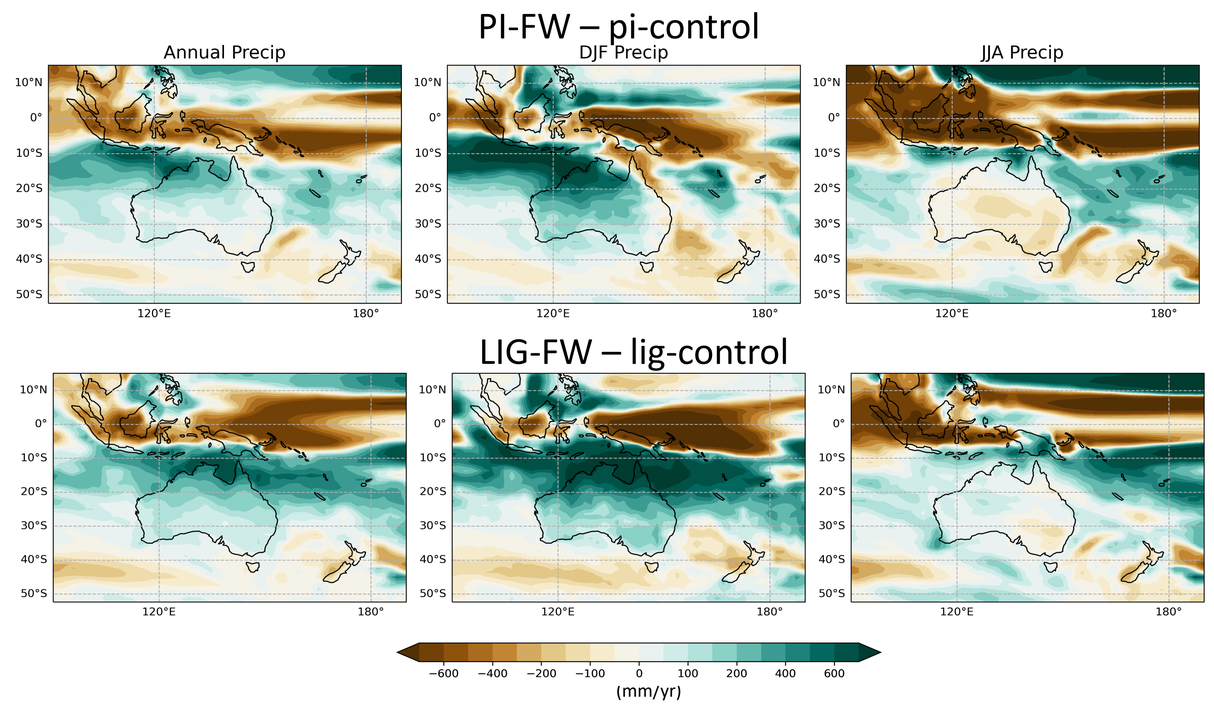
- Freshwater experiments: 0.4 Sv of freshwater added into the North Atlantic under LIG and PI boundary conditions (LIG-FW, PI-FW)
- AMOC collapse is referred to the point when AMOC strength is <5 Sv in both LIG-FW and PI-FW

## *Climatic impact of an AMOC shutdown*

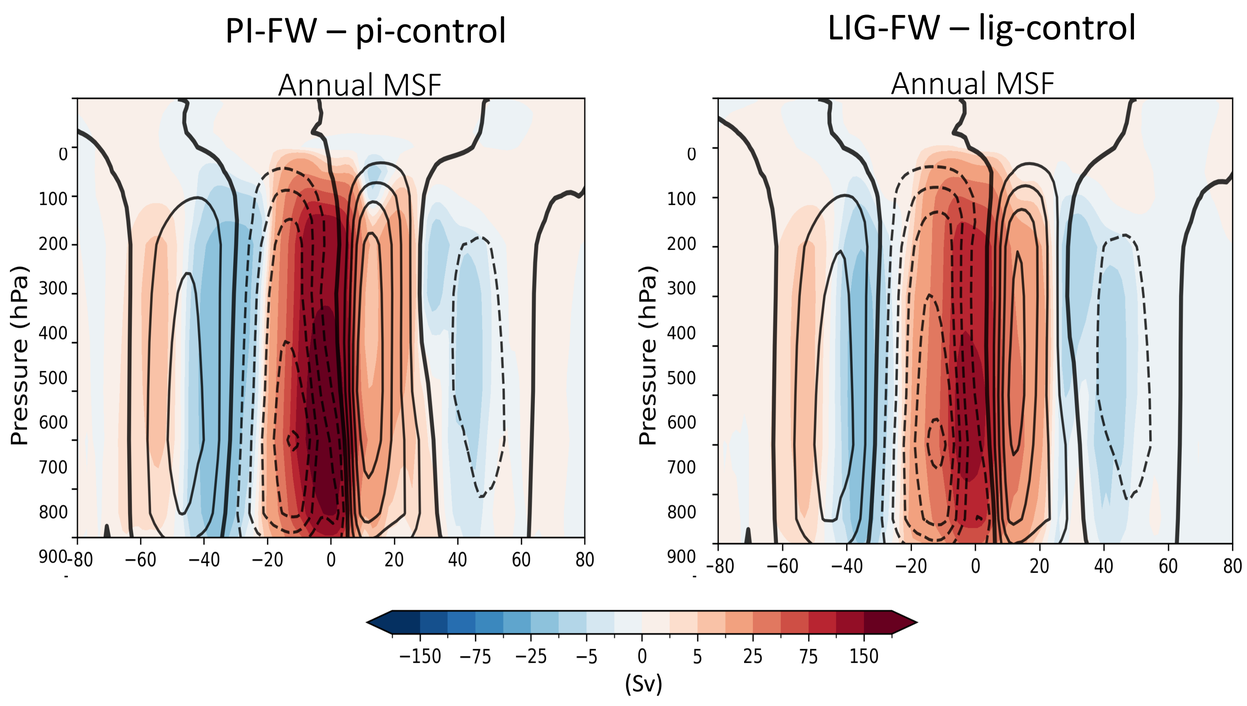
- **Air temperature, SST and MSLP anomalies**



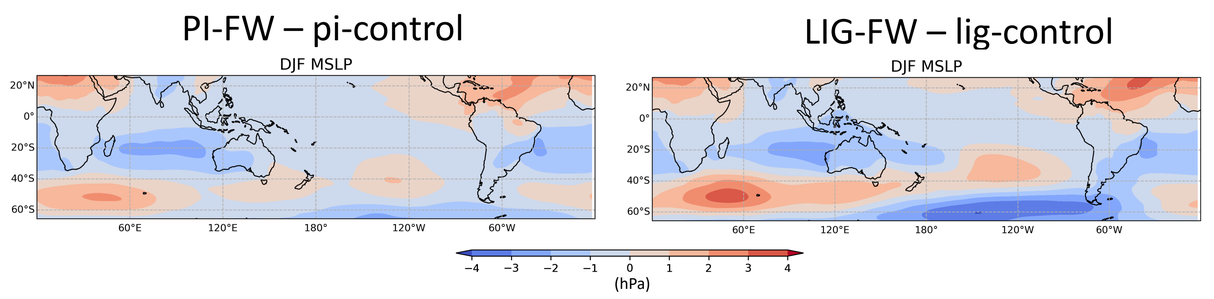

- **Australian precipitation response to AMOC shutdown**




- **Intensification of northern Hadley Cell**

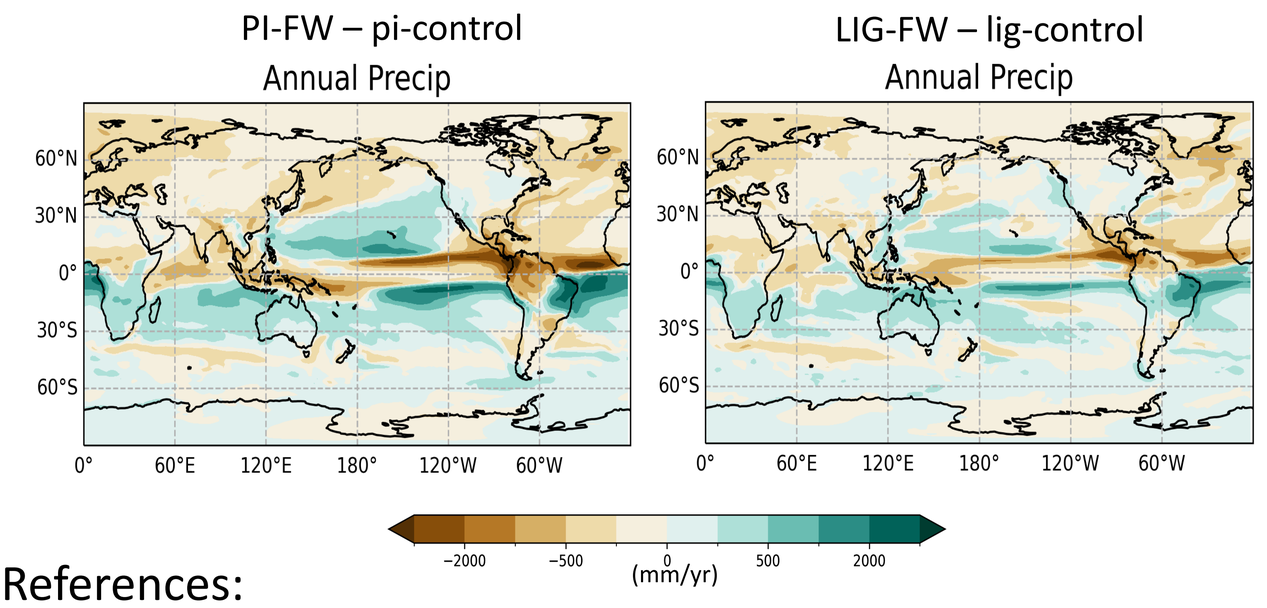



- AMOC shutdown leads to intensified DJF precipitation, particularly over Northern Australia. This could be due to the southward shift of the subtropical ridge over the Indian Ocean.
- **DJF MSLP anomalies**




- Different response under LIG and PI boundary conditions, due to northward ITCZ position at the LIG.

- **Southward shift of the ITCZ**




## *Work under progress*

- **AMOC shutdown under a glacial climate**

| Experiments | Boundary conditions |
|---|---|
| 49ka-ic | GHGs, Orbital parameters |
| 49ka-ice | 49ka-ic + ice sheet mask + vegetation |
| 49ka-XXX | 49ka-ice + ice sheet orography |
| 49ka-YYY | 49ka-XXX + FW |

## References:

1. *Rahmstorf, S., 2002. Ocean circulation and climate during the past 120,000 years. Nature, 419(6903), pp.207-214.*
2. *Menviel, L.C., Skinner, L.C., Tarasov, L. and Tzedakis, P.C., 2020. An ice–climate oscillatory framework for Dansgaard–Oeschger cycles. Nature Reviews Earth & Environment, 1(12), pp.677-693.*
3. *Caesar, L., McCarthy, G.D., Thornalley, D.J.R., Cahill, N. and Rahmstorf, S., 2021. Current Atlantic meridional overturning circulation weakest in last millennium. Nature Geoscience, 14(3), pp.118-120*
4. *Ditlevsen, P. and Ditlevsen, S., 2023. Warning of a forthcoming collapse of the Atlantic meridional overturning circulation. Nature Communications, 14(1), p.4254.*