Impacts of stratospheric ozone and greenhouse gas changes on the Southern Hemisphere circulation in the CCMI models

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Introduction

- Mclandress et al. (2011) shows the effects of ozone depletion (and recovery) and greenhouse gases (GHGs) on Southern Hemisphere (SH) circulation changes.
- The CCMI-1 models well represent SH-summer circulation changes in the 20th century (Son et al., 2018).

Data

Table 1. Summary of CCMI-1 experiments and their ensemble size used in this study.

Model names	Institutions	REF-C2	Sen-C2-fGHG	Sen-C2-fODS
ACCESS-CCM	U. Melbourne, CAWCR, AAD, Australia, NIWA, NZ	2	2	2
CCSRNIES-MIROC3.2	NIES, Tsukuba, Japan	1	1	1
CESM1-WACCM	NCAR, USA	3	3	3
CHASER-MIROC-ESM	Nagoya University, JAMSTEC, NIES, Japan	1	1	1
CMAM	Environment Canada, Canada	1	1	1
NIWA-UKCA	NIWA, NZ	2	2	2

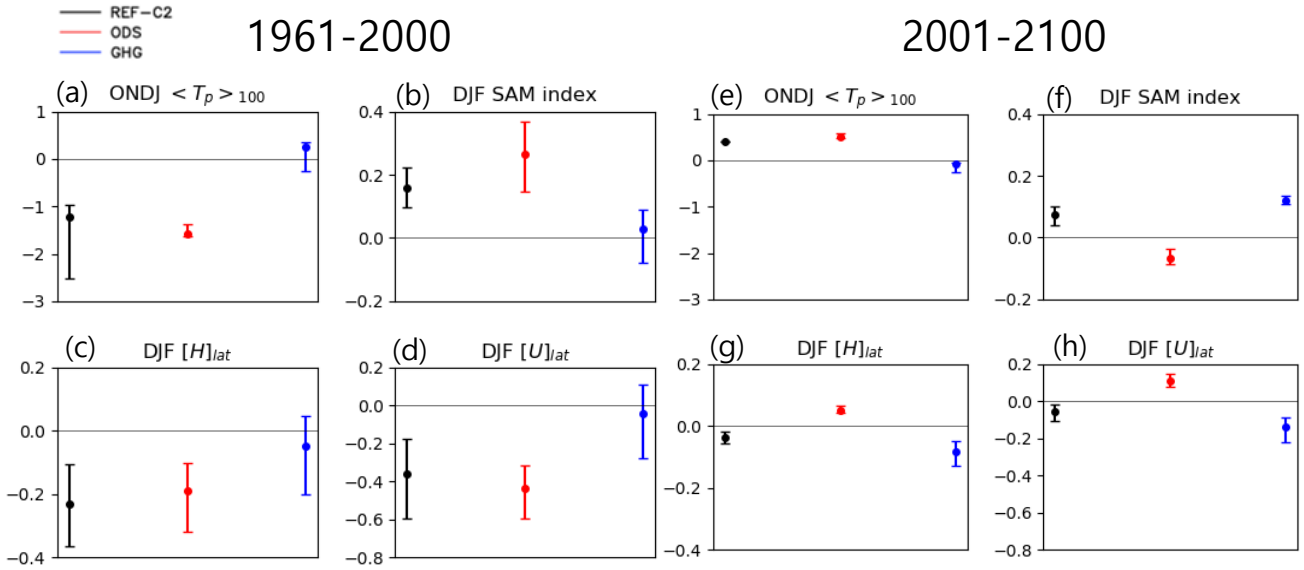

Figure 1. (a, e) The ONDJ polar temperature trend at 100 hPa for the period of (a) 1961-2000 and (e) 2001-2100. MMM trends are shown by closed circles with 5-95% confidence levels by a bootstrap method for the REF-C2 (black), ODS (red), and GHG (blue) runs. MMM values become statistically significant when the 5-95% confidence limits do not intersect the zero trend line. Others same as (a, e) but for the trends in DJF (b, f) SAM index (decade^{-1}), (c, g) Hadley cell (HC) edge (degree/decade), and (d, h) 850-hPa jet location (degree/decade), respectively.

Conclusions

- All past simulations show the poleward expansion of the HC and the poleward shift of the westerly jet accompanied by the positive trends in the SAM index.
- These trends are predicted to be weakened in the future due to the anticipated ozone recovery.