

Seasonal Evolution of 21st Century Atmospheric Circulation Trends in the Southern Hemisphere: Mechanisms and Uncertainties

40-member coupled model ensemble (CCSM3)
A1B SRES GHG Forcing and Ozone recovery
2000-2061

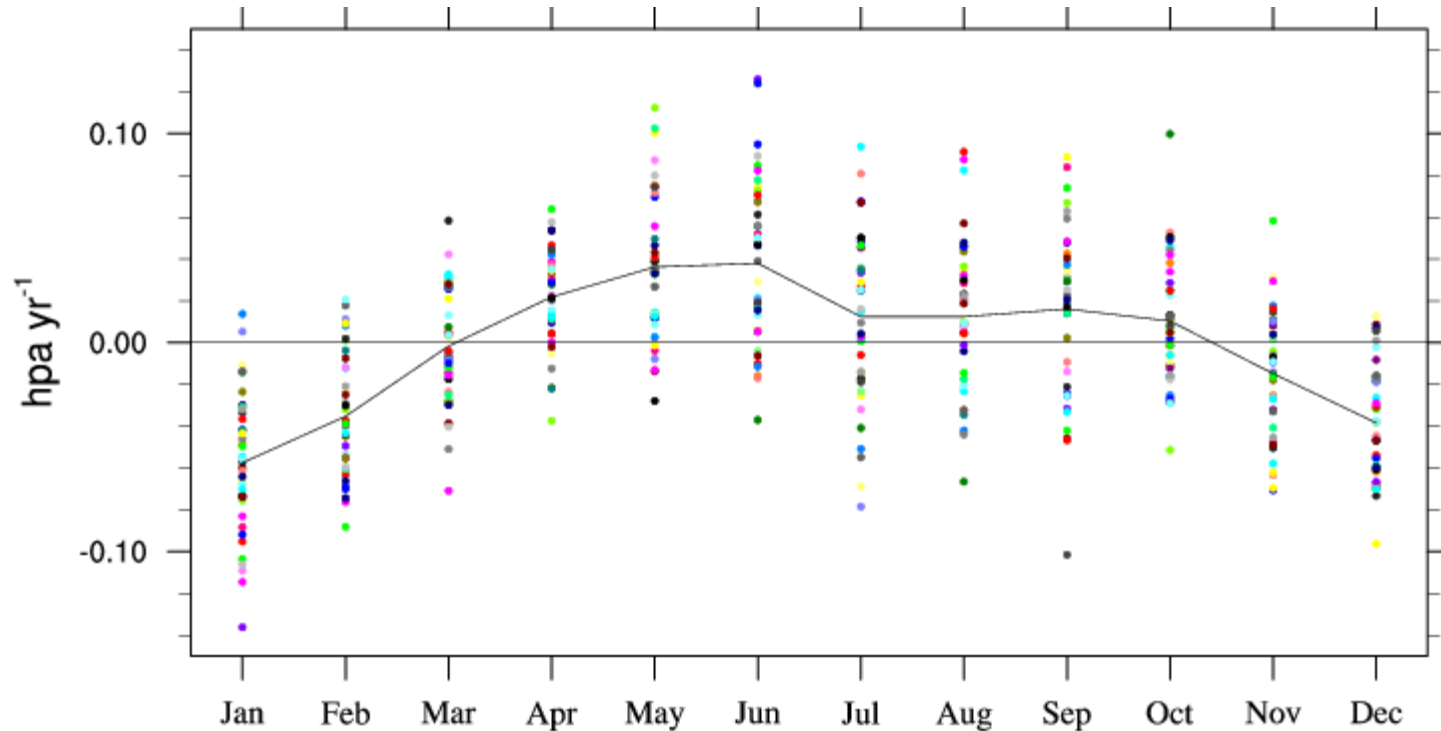
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Supervisors :

Clara Deser (NCAR/CAS)

Christophe Cassou (CNRS)

Southern Annular Mode Monthly Trends 2000-2061



Dots: Individual Ensemble Members

Line: Ensemble Mean

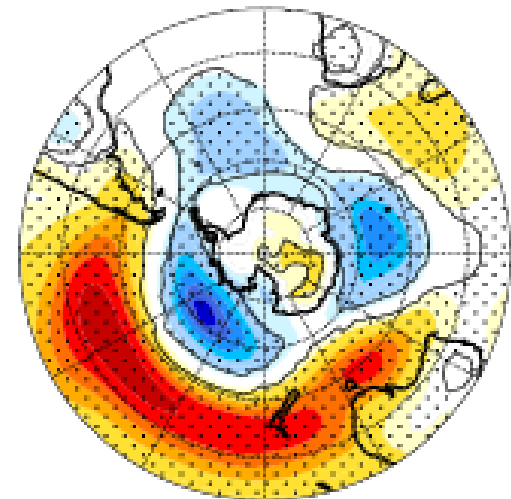
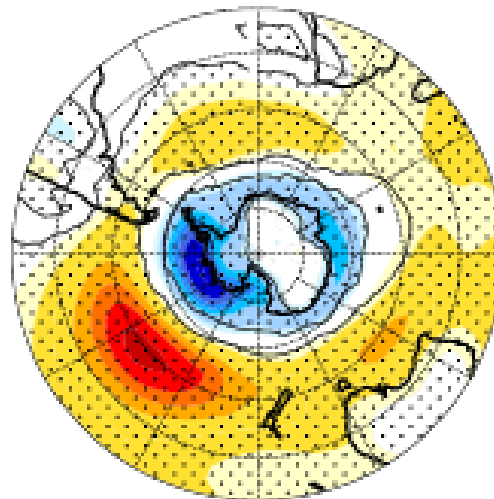
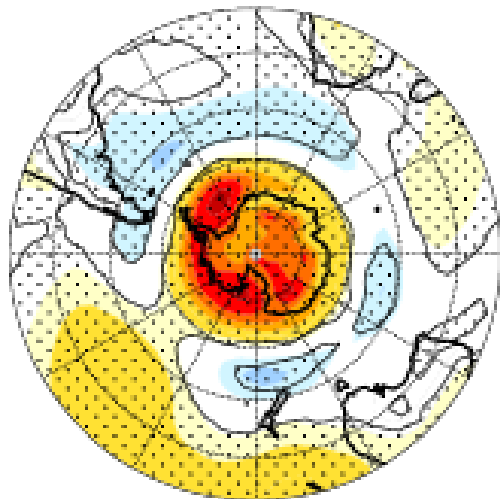
See also Son et al. (2009)

Ensemble Mean Sea Level Pressure Trends 2000-2061

Nov-Feb

Mar-Jun

Jul-Oct



hpa 10yr⁻¹

Stippling indicates ensemble mean trend is statistically significant at the 5% confidence level relative to the spread of the 40 individual trends

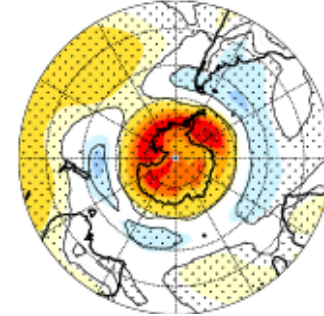
Ensemble Mean Trends: Contributing Factors

CAM3 SST

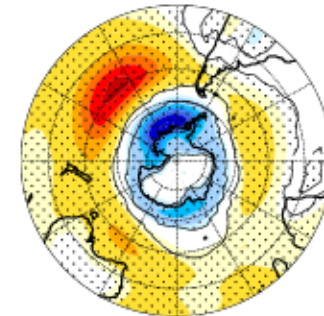
CAM3 GHG

CAM3 O₃

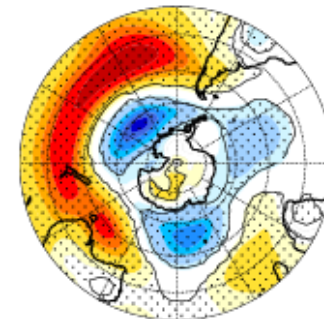
CCSM3



Nov-Feb



Mar-Jun

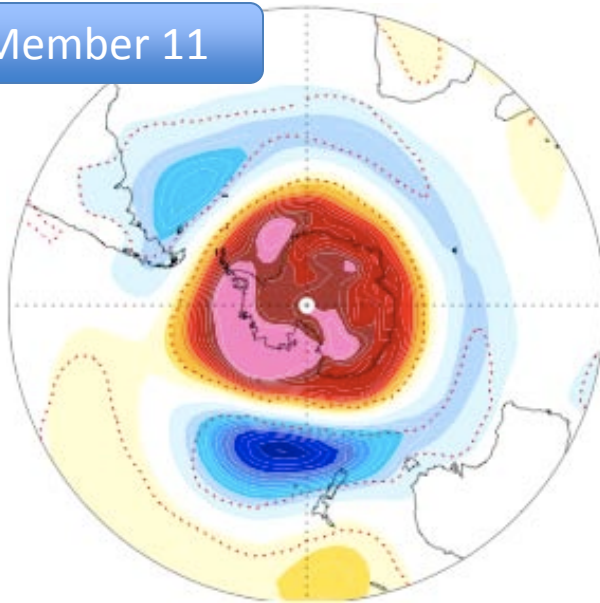


Jul-Sep

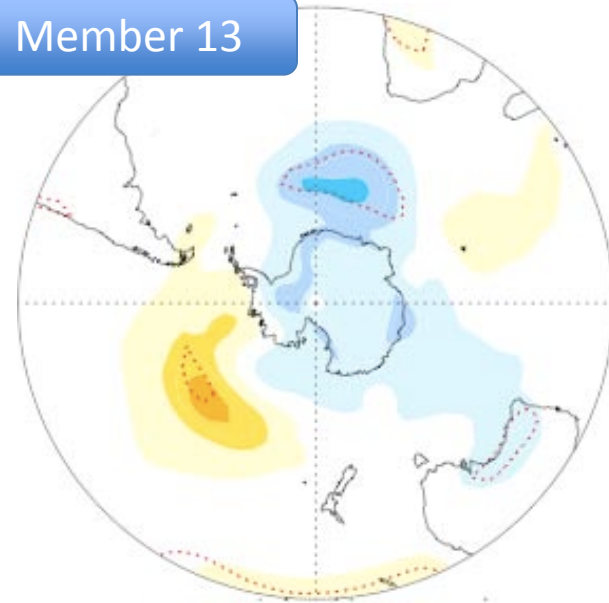
Trend Uncertainties

Nov-Feb Sea Level Pressure Trends 2000-2061

Member 11



Member 13



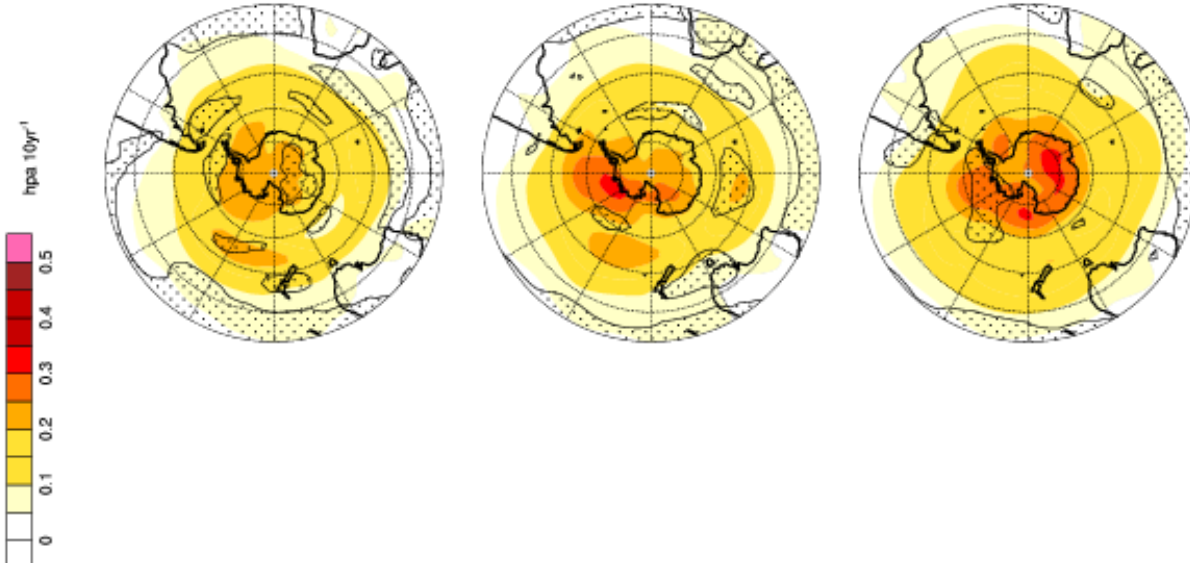
Why so different?

Standard Deviation of 62-yr Trends

Nov-Feb

Mar-Jun

Jul-Oct



40-member CCSM3

*160-“member” CAM3
10,000 yr control*

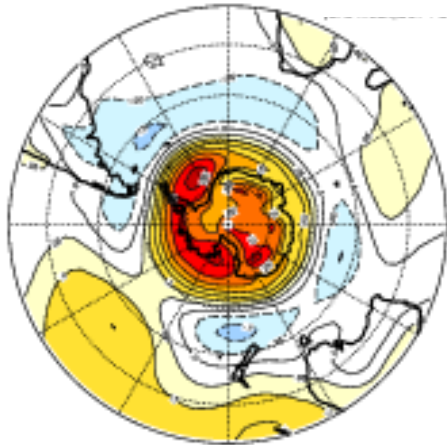
Lack of stippling indicates standard deviations are not significantly different between CCSM3 and CAM3 control integration

(i.e., spread in CCSM3 trends is consistent with internal atmospheric variability or “noise”)

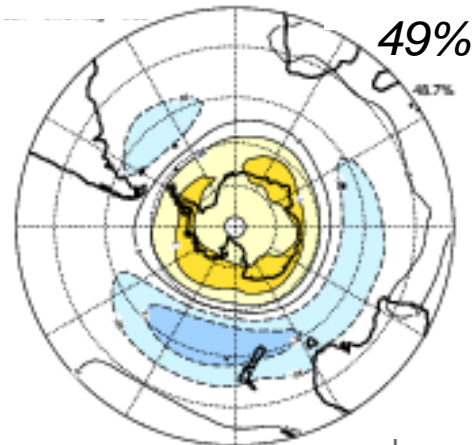
EOF Decomposition of SLP Trends

Example for November-February; similar results for other 2 seasons

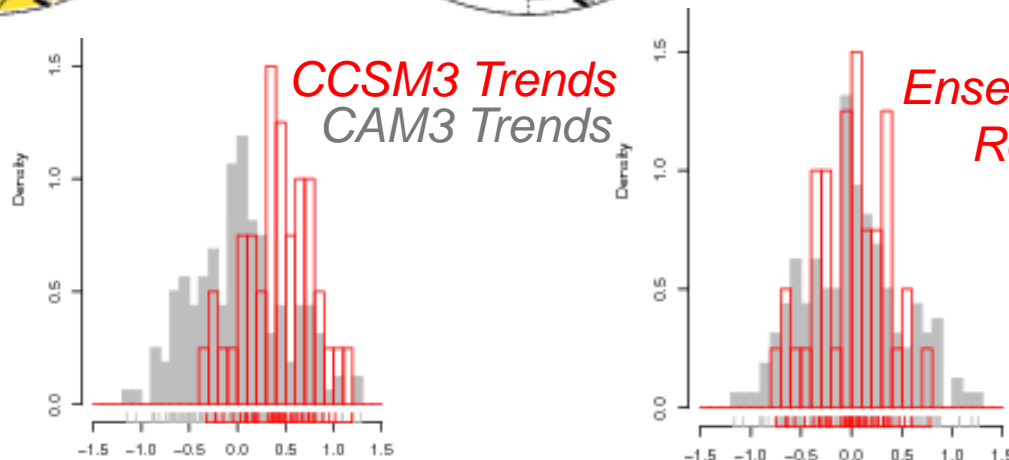
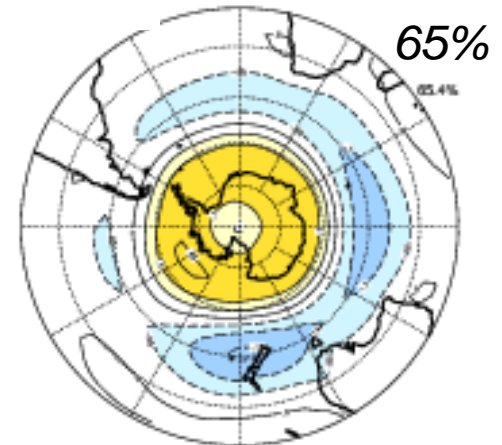
Ensemble Mean
Trend



EOF1
40 CCSM3 Trends



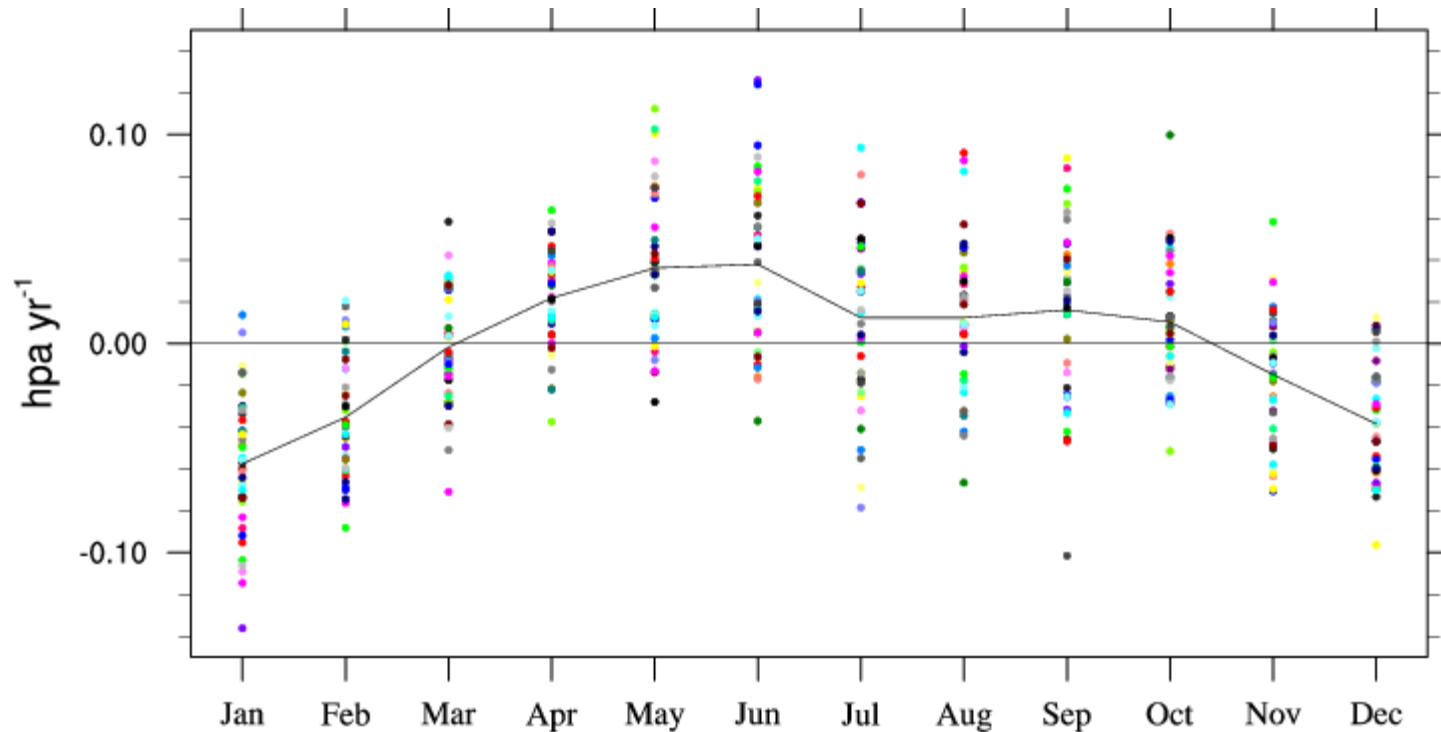
EOF1
160 CAM3 Trends



Histograms of Projections on EOF1 CAM3

Summary

Southern Annular Mode Monthly Trends 2000-2061



- 1) Ensemble mean response due to seasonally-dependent ozone (direct radiative) and GHG (indirect SST) forcing
- 2) Scatter due in large part to internal atmospheric “noise”