Antarctic surface signature of ozone depletion

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2x20-years simulations:

- LMDZ with imposed climatological SST
- 144x142x39 levels (resolved stratosphere)
Seasonal differences

Temperature (60°-90° S)

Zonal wind (50-70° S)

- Max anomalies in Nov-Dec (stratosphere)
- Dec-Feb (surface)
Circulation response: poleward jet shift projects strongly on the SAM

- EOF 1, intraseasonal variability
- Mean impact of ozone depletion
Surface temperature:
Antarctic cooling

Precipitation (in %):
Southern Ocean dipole
Antarctic drying
Comparison with impacts of the SAM: Surface temperature

- Total response
- SAM-related (computed from month-to-month regression)

- Good reconstruction over Antarctica
Temperature spatial structure

Total ozone depletion impact

Reconstruction from SAM
Surface heat fluxes

- Cooling driven by downward IR
- Partial compensation by solar and sensible
- Direct ozone impact over Antarctica
Comparison with impacts of the SAM: Precipitation

- Total response
- SAM-related (computed from month-to-month regression)

- Good reconstruction in mid-latitudes
- Missing (50%) share of Antarctic precipitation
Precipitation spatial structure:

Total ozone depletion impact

Reconstruction from SAM

- About half the amplitude missing
Ozone depletion impacts
(SAM-related part removed)

Water vapor (color, g/kg)

Meridional wind (contours)

➢ Surface drying driven by downslope winds?
Conclusions:

• Response to ozone depletion follows « classic » pattern

• Over Antarctica, surface cooling and drying (including relative humidity)

• Response well explained by jet shift in mid-latitudes

• Additional direct radiative effects over Antarctica

• Drying: surface winds caused by radiative cooling?

Thank You!
Surface net shortwave fluxes

- Clear sky due to ozone
- Large impact of cloud cover
Surface circulation

Differences in temperature (color), 10-m wind (contours)