



Reanalysis of the chemical composition of the troposphere for the period 1980-2005 using the chemistry aerosol general circulation model ECHAM5-HAMMOZ

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OBJECTIVES

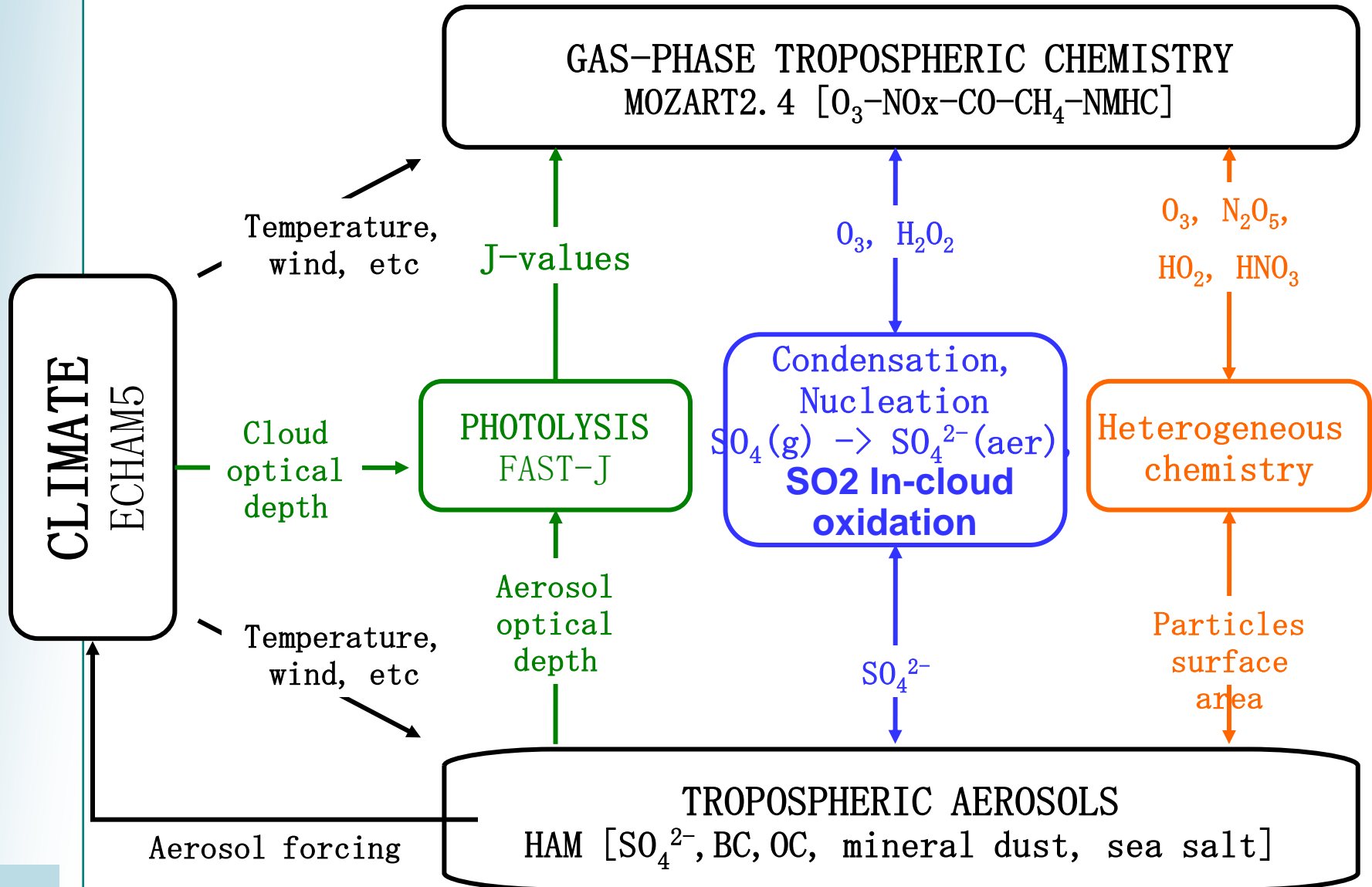


- ❑ Long term simulation of aerosols and chemical composition of the troposphere with a comprehensive chemistry-aerosol-general circulation model (ECHAM5-HAMMOZ, Pozzoli et al., JGR, 2008)
- ❑ Understand and assess the impact of trace gas-aerosol interactions on the global chemical composition of the troposphere (comparison with the results from the RETRO project)
- ❑ Understand past trends of trace gas and aerosol distributions and concentrations
- ❑ Evaluate the efficiency of the strategies adopted in the past to reduce air pollution





ECHAM5-HAMMOZ





- Simulate the period 1980–2005 with ECHAM5–HAMMOZ
- T42: $\sim 2.8^\circ \times 2.8^\circ$
- 31 vertical levels from surface to 10 hPa.
- Nudging, ERA40 reanalysis data



EMISSIONS (1980-2000)



ANTHRO

GAS

CO, NO_x, NMHC, VOC – RETRO
(monthly emissions)
SO₂ – T. Diehl, article in preparation
(yearly emissions)
NO_x – Aircraft Emissions [Grewe,
2002] (3D monthly emissions)

AEROSOL

BC, OC – T. Diehl, article in
preparation (yearly emissions)
Sulfate from ship traffic – T. Diehl
Sulfate as 2.5% of SO₂ emissions

FIRES

CO, NO_x, NMHC, VOC, SO₂ –
RETRO (3D monthly emissions)

BC, OC – RETRO
(3D monthly emissions)

NATURAL

Biogenic (terpenes, isoprenes, ...),
MEGAN [Guenther, 2006]
SO₂ volcanic emissions (AEROCOM)
DMS Marine/Terrestrial (AEROCOM)
NO_x Lightning, [Grewe, 2001]

Mineral dust interactive scheme
[Tegen, 2002; Cheng, 2008]
Sea salt interactive scheme [Schulz,
2004]
OC Biogenic [Guenther, 1995]



- ❑ Biomass burning: The Global Fire Emissions Database version 2 (GFEDv2) covering the period 1997–2006
- ❑ Anthropogenic: **under compilation!**

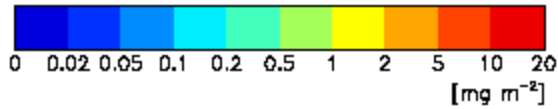
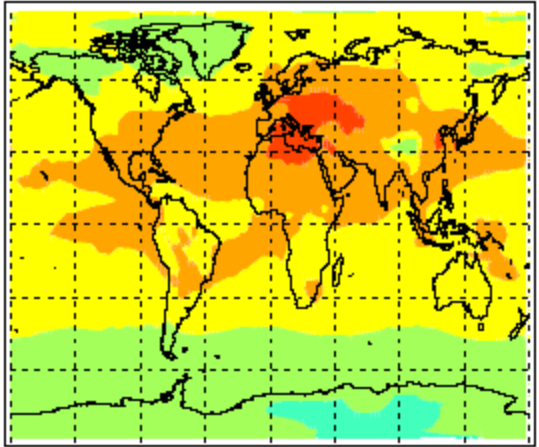
Derive trends of CO, NO_x, SO₂ and VOC emissions for the period 2001–2005 over US (EPA), Europe (EMEP) and Asia (REAS)

In the other regions the anthropogenic emissions will be kept constant (year 2000)

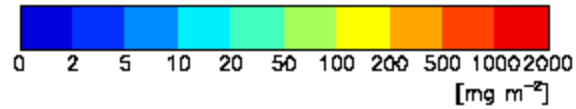
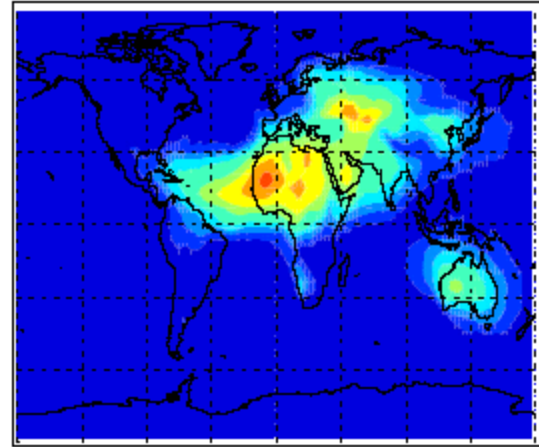


PRELIMINARY RESULTS: AEROSOL BURDENS 1980

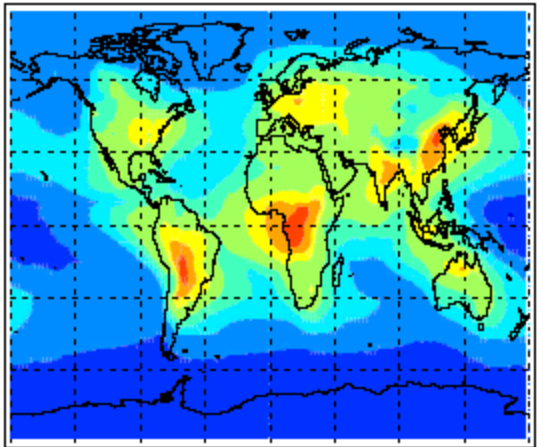
Burden of SO₄ = 0.98 Tg



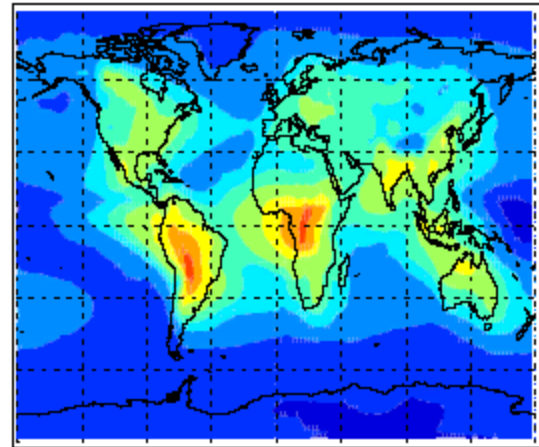
Burden of DU = 6.73 Tg



Burden of BC = 0.11 Tg



Burden of OC = 0.72 Tg

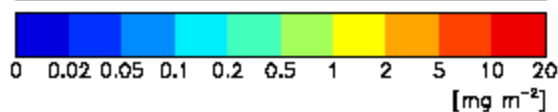
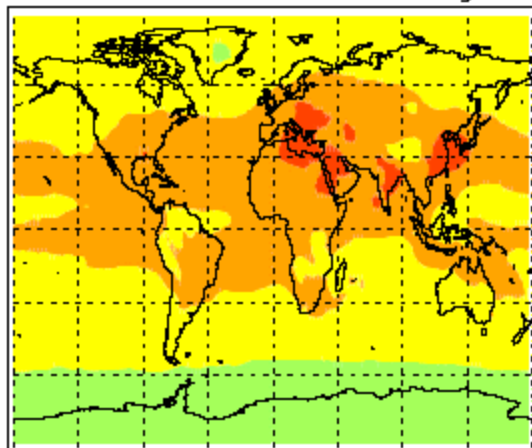




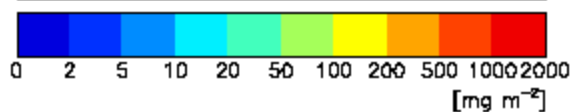
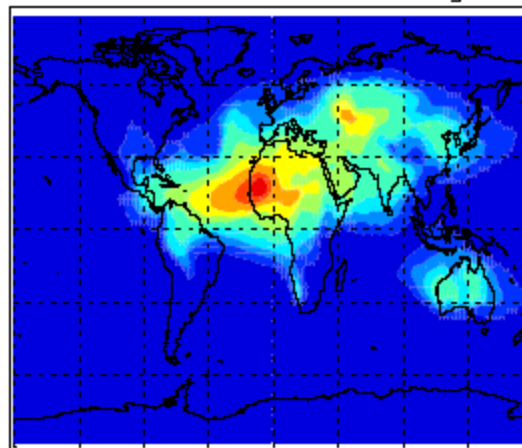
PRELIMINARY RESULTS: AEROSOL BURDENS 2000



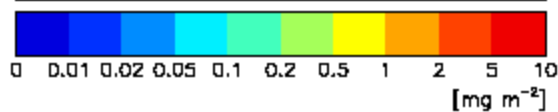
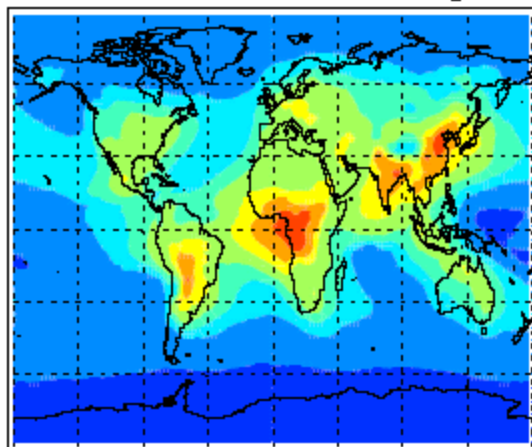
Burden of SO_4 = 1.12 Tg



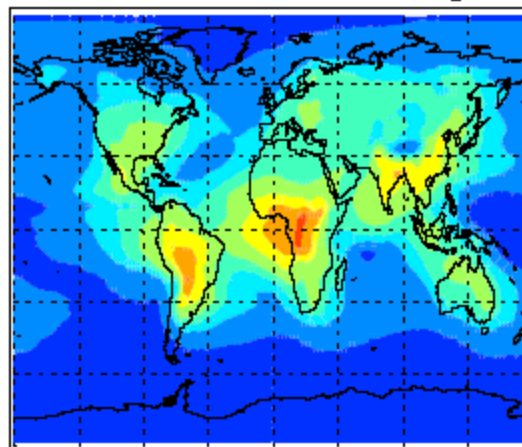
Burden of DU = 9.99 Tg



Burden of BC = 0.11 Tg

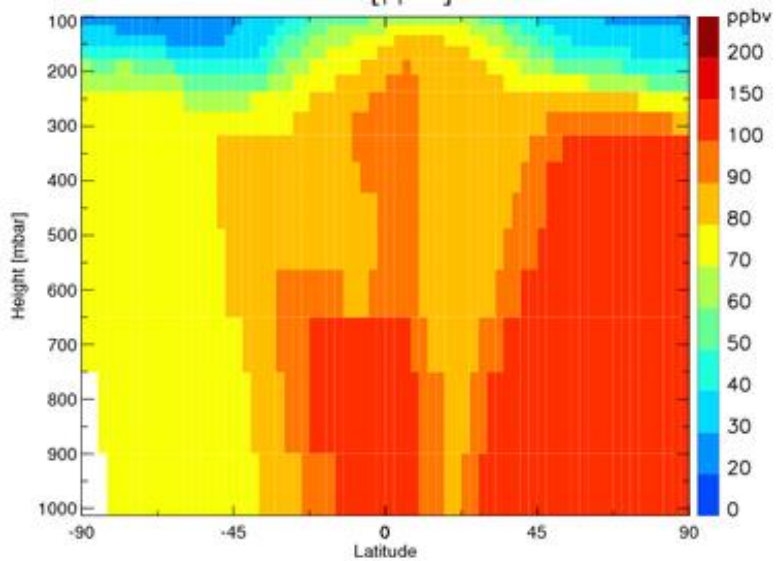


Burden of OC = 0.73 Tg

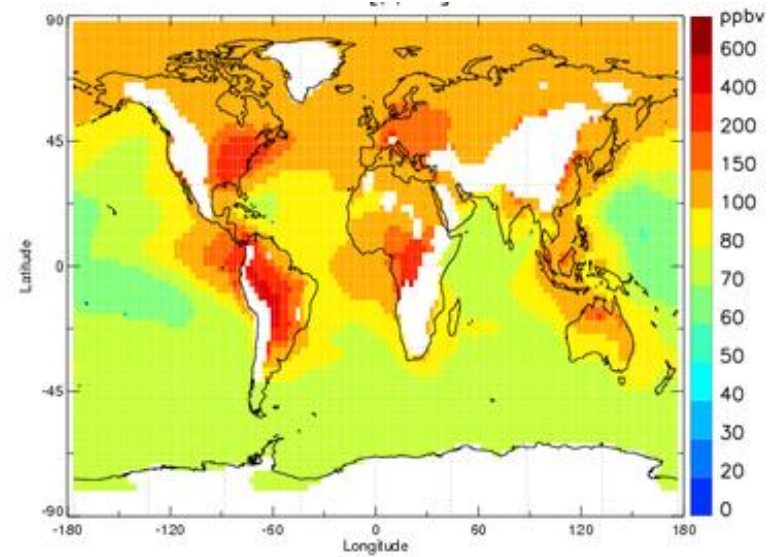


PRELIMINARY RESULTS: OZONE AND CO (1980)

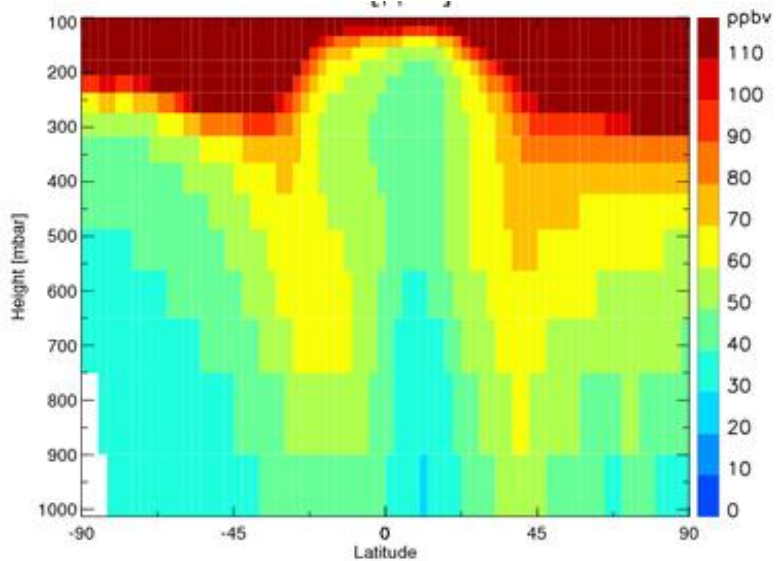
CO zonal mean (JAS)



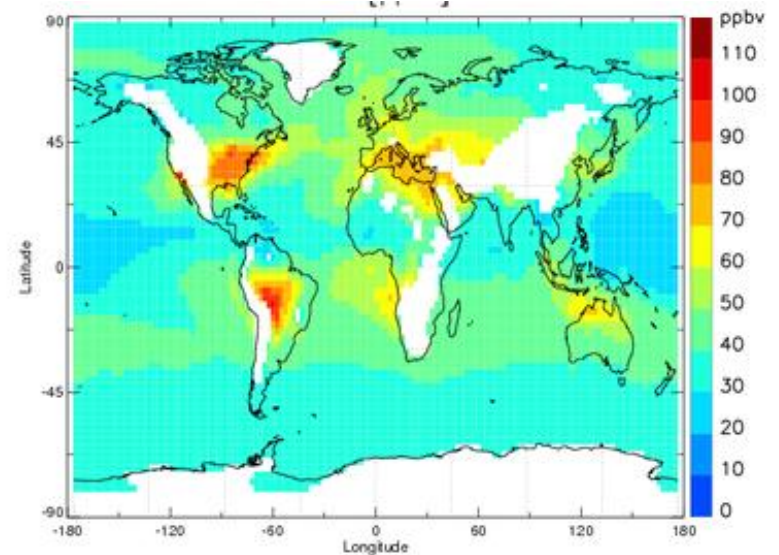
CO surface concentration (JAS)



O3 zonal mean (JAS)

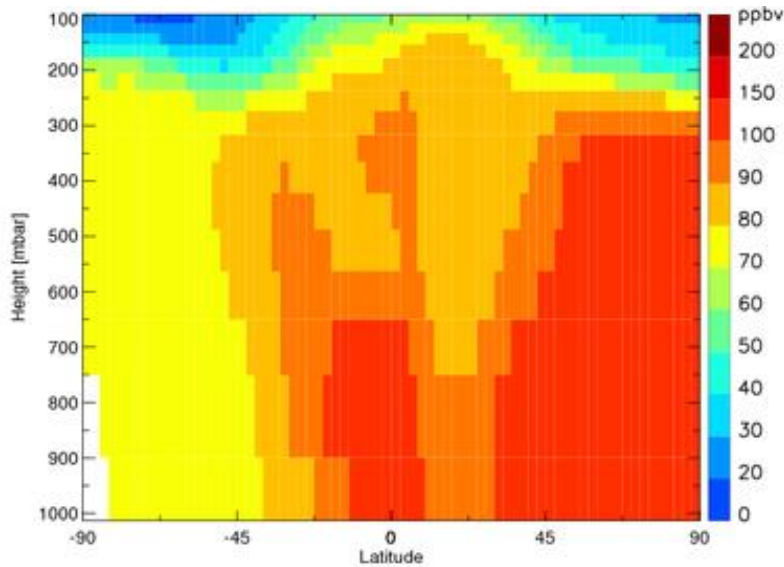


O3 surface concentration (JAS)

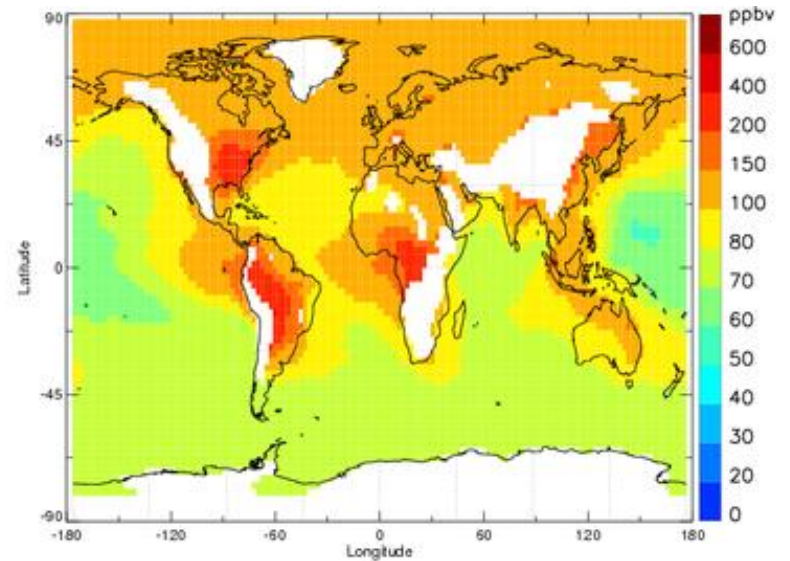


PRELIMINARY RESULTS: OZONE AND CO (2000)

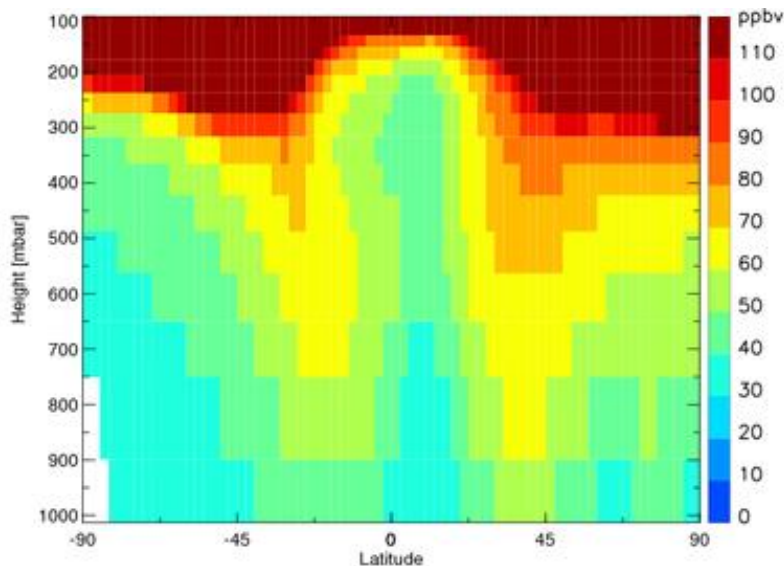
CO zonal mean (JAS)



CO surface concentration (JAS)



O3 zonal mean (JAS)



O3 surface concentration (JAS)

