A Simpler Chemistry Mechanism for Climate Simulations

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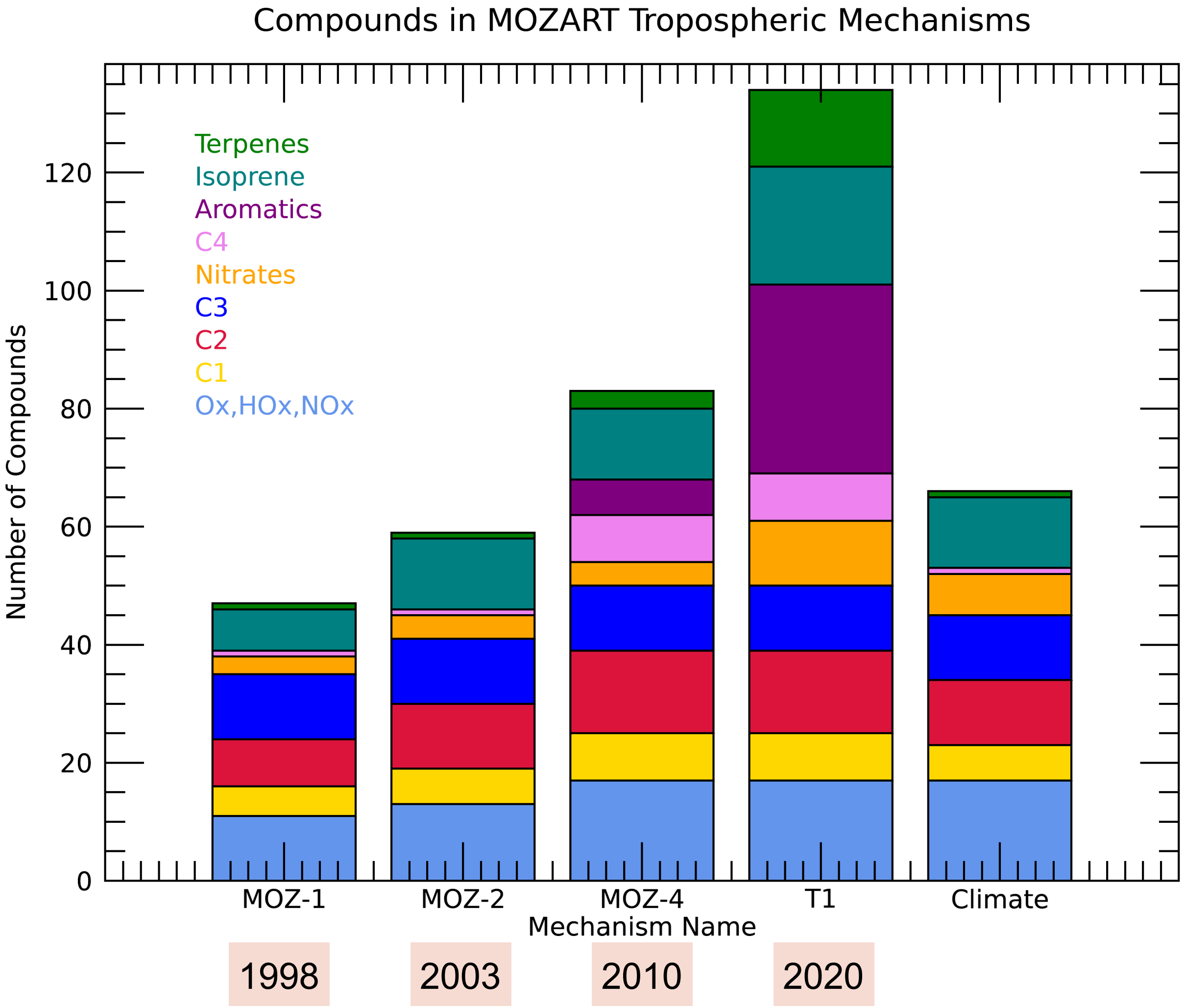
MOZART Family of Chemical Mechanisms



- Increasing complexity as computing power increases
- The MOZART-Climate mechanism is comparable to MOZART-2 (Horowitz et al., 2003)
- Similar mechanism used in GFDL AM4 (Horowitz et al., 2019)
- MOZART-Climate not optimal for air quality studies, but should appropriately simulate oxidants and aerosols for chemistry-climate studies and for creating specified oxidants for CAM

MOZART-Climate Chemistry Mechanism

MOZART-TS1

- **231** total compounds
  - 42 not transported
- Comprehensive stratospheric chemistry
- Full sulfur chemistry

MOZART-Climate

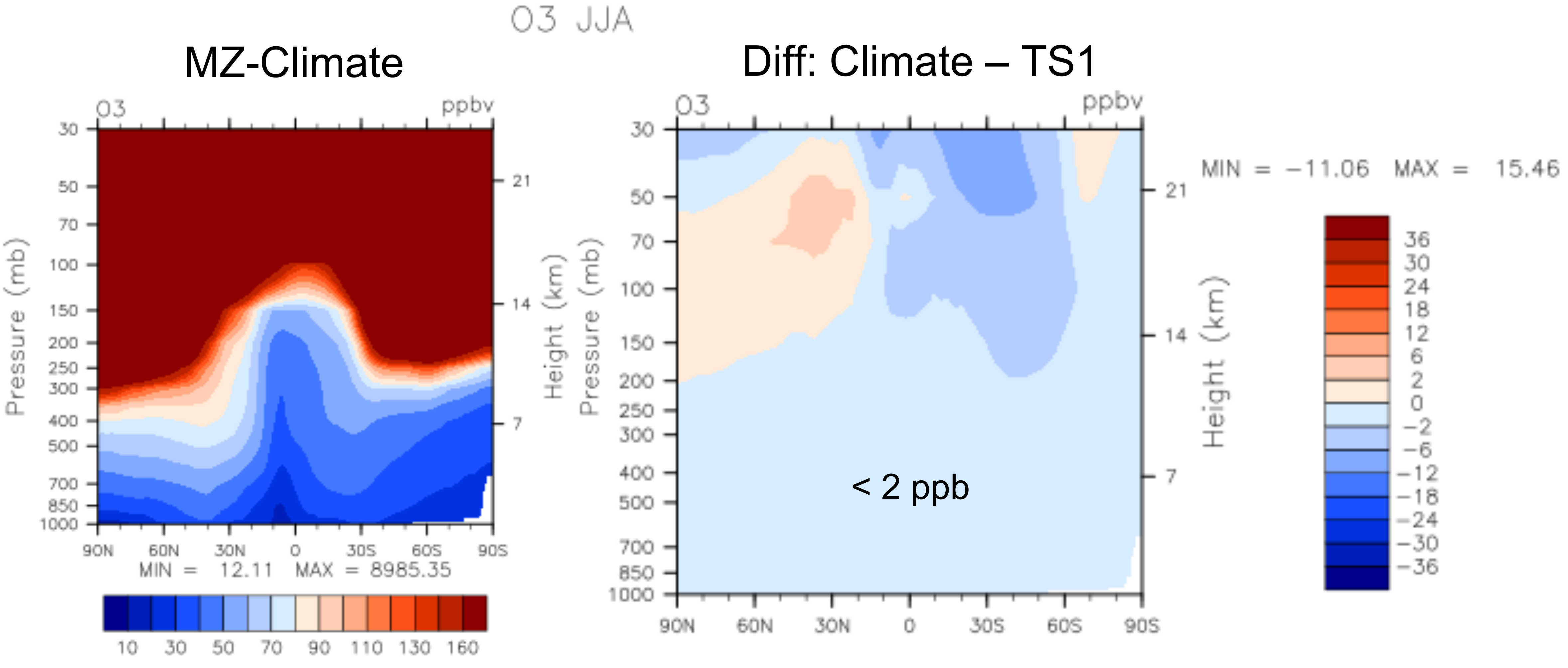
- **141** total compounds
  - 15 not transported
- Comprehensive stratospheric chemistry, but without odd F
- Full sulfur chemistry
- Simpler chemistry for hydrocarbons C>3

Tropospheric budgets

- Aerosols and oxidants very similar in both complete and simpler mechanisms

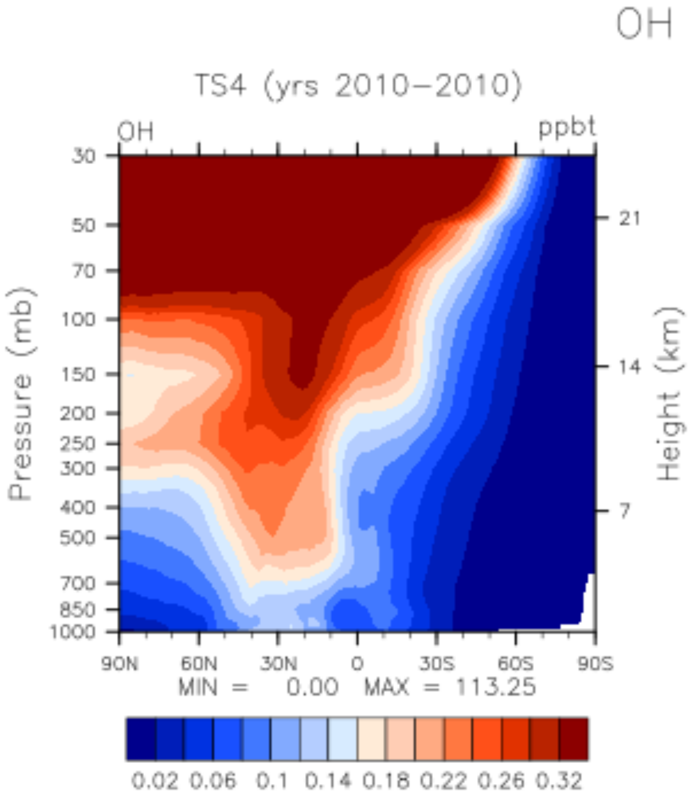
	MOZART-Climate	MOZART-TS1
Ozone (Tg)	335	341
CO (Tg)	269	266
Methane (Tg)	4198	4195
Methane lifetime (years)	7.0	6.9
POM (TgC)	0.61	0.65
SOA (TgC)	0.76	0.71
BC (TgC)	0.11	0.12
SO4 (TgS)	0.50	0.73

Ozone zonal mean - JJA

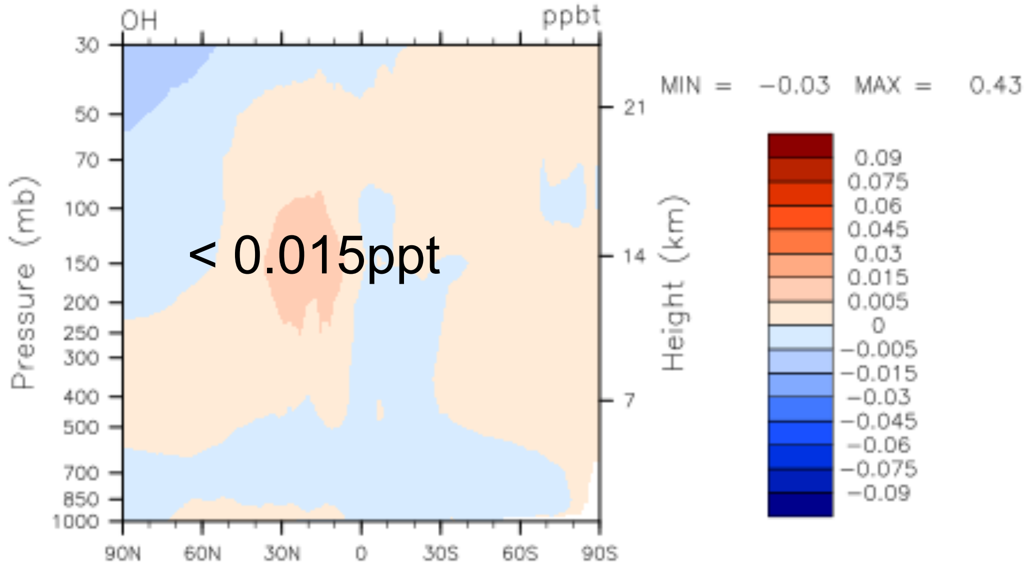


OH zonal mean - JJA

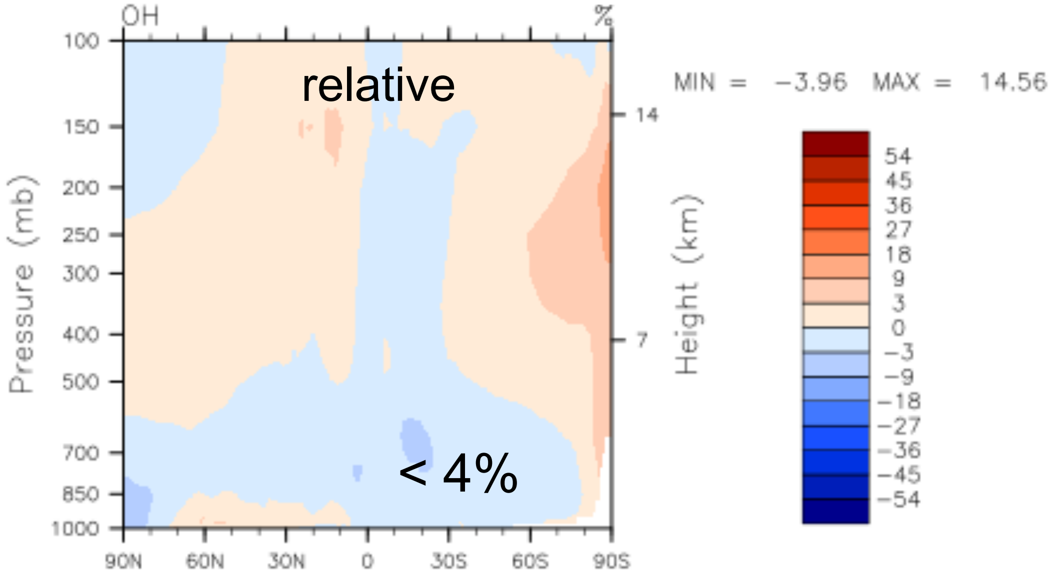
MZ-Climate



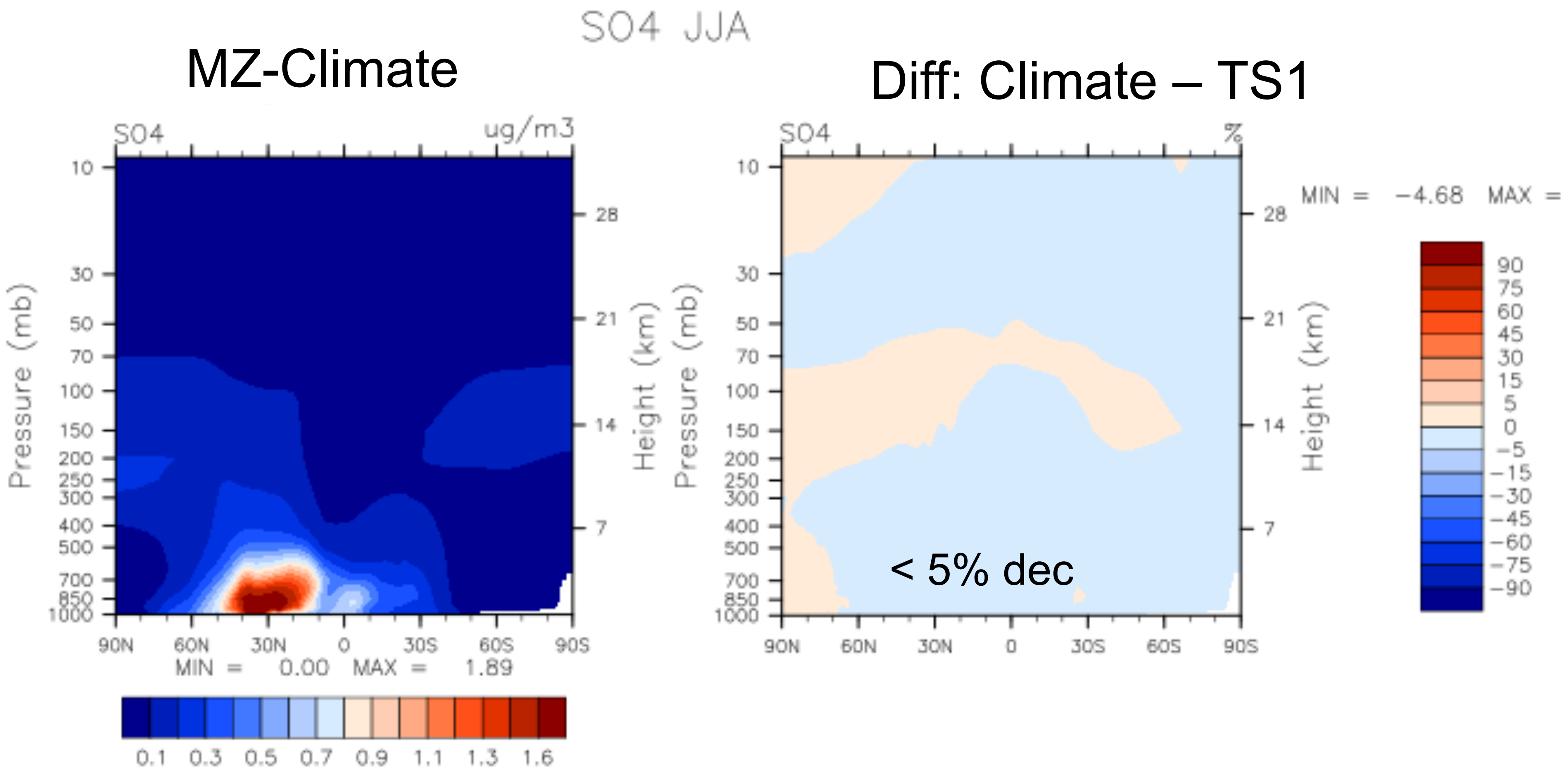
Abs. Diff: Climate – TS1



Rel. Diff: Climate – TS1



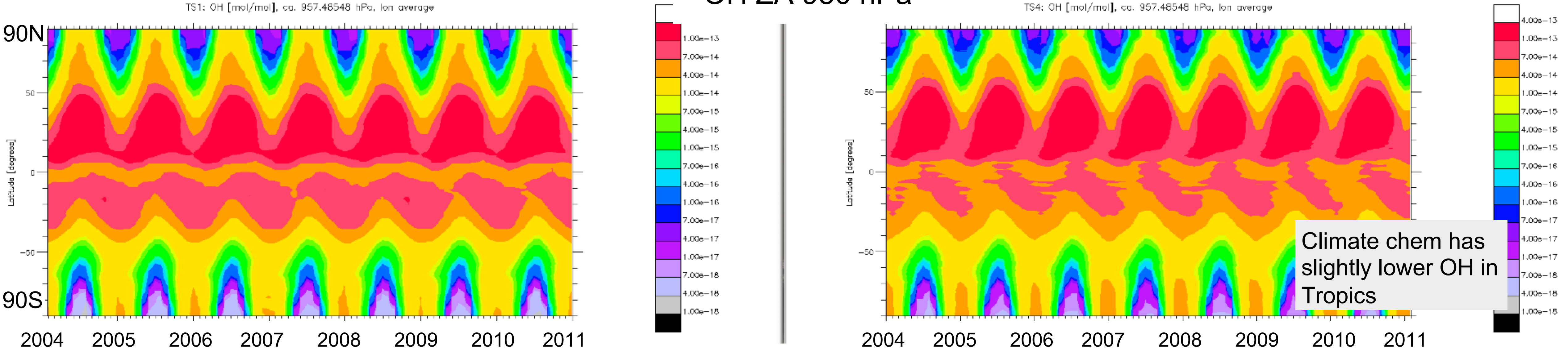
Sulfate aerosol zonal mean - JJA



TS1

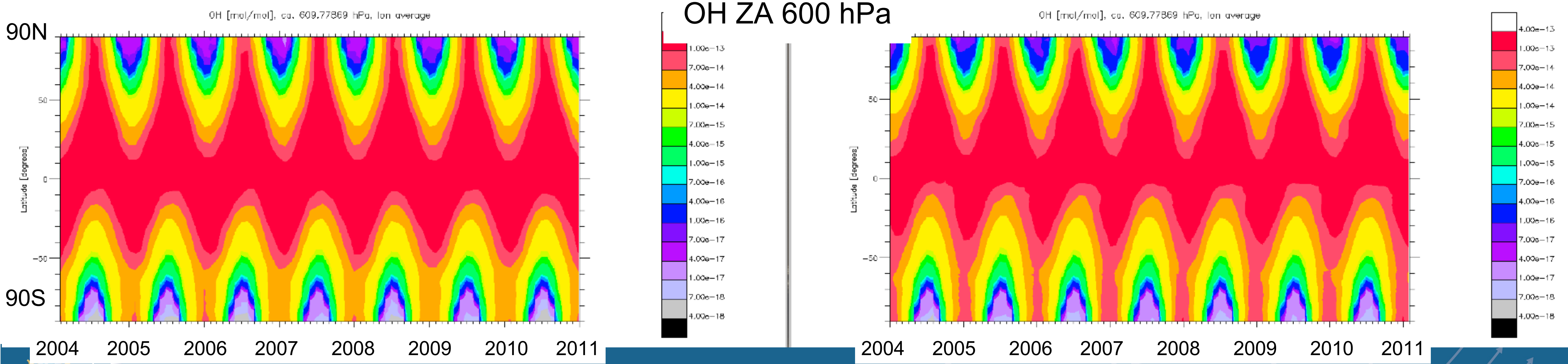
Climate Chem.

OH ZA 950 hPa



Climate chem has slightly lower OH in Tropics

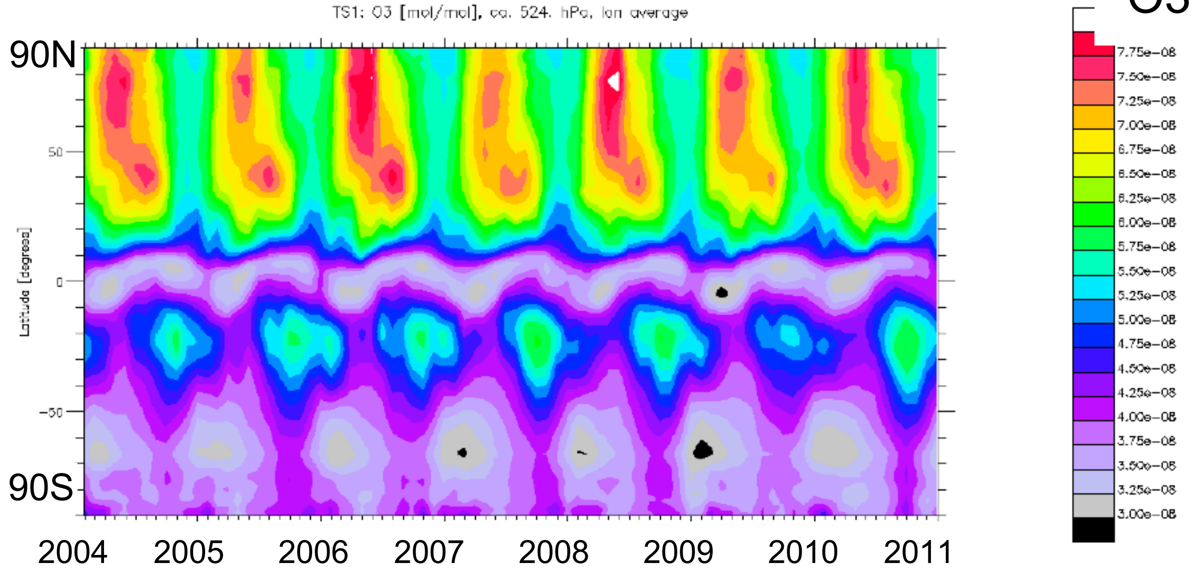
OH ZA 600 hPa

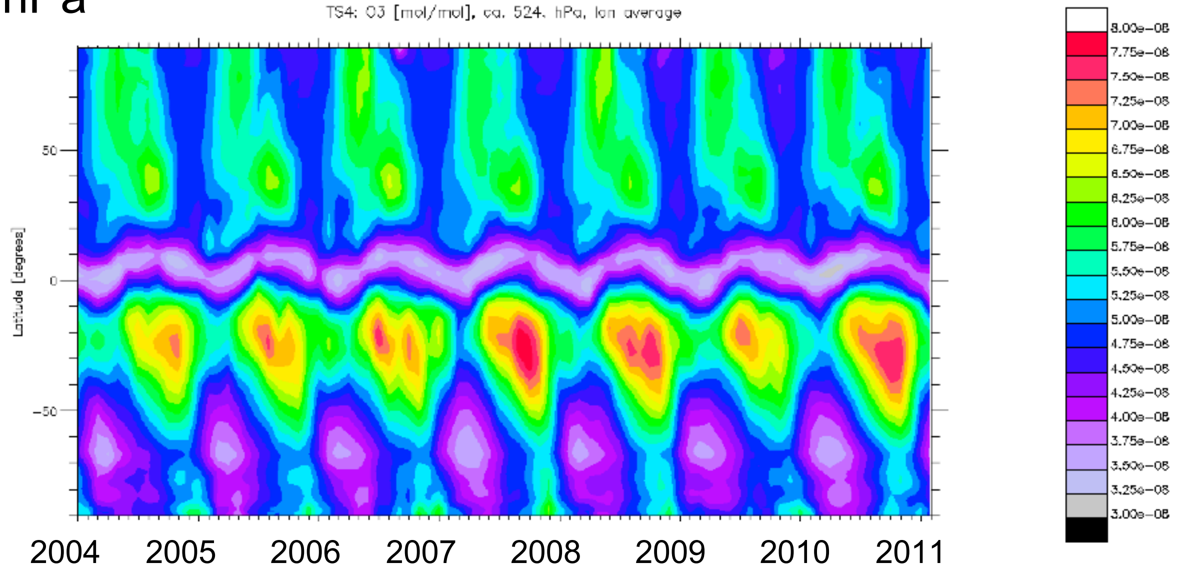


TS1

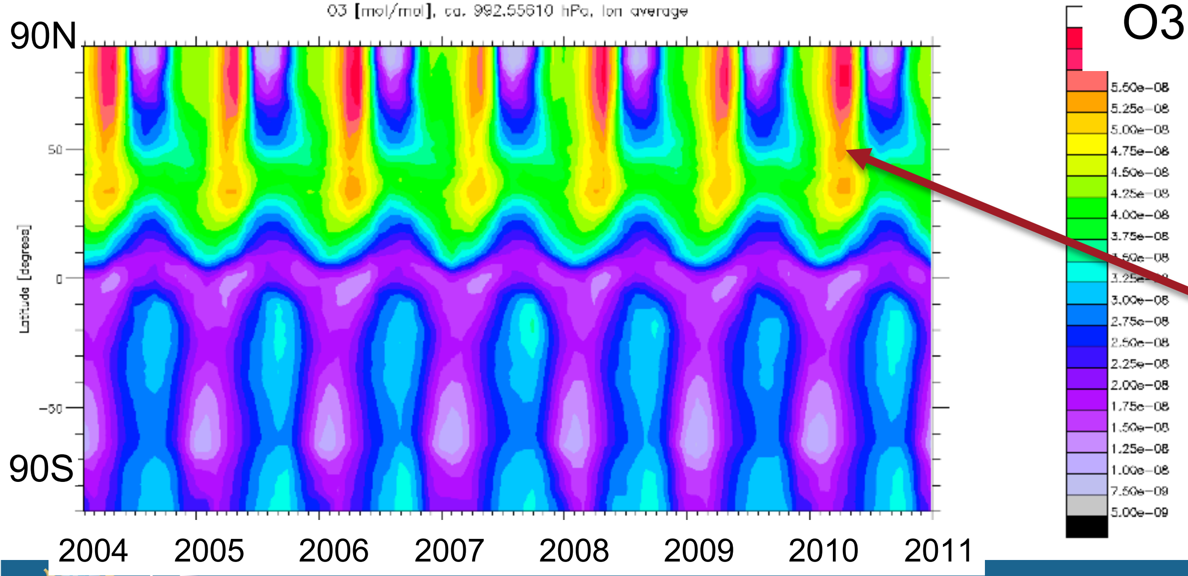
Climate Chem.

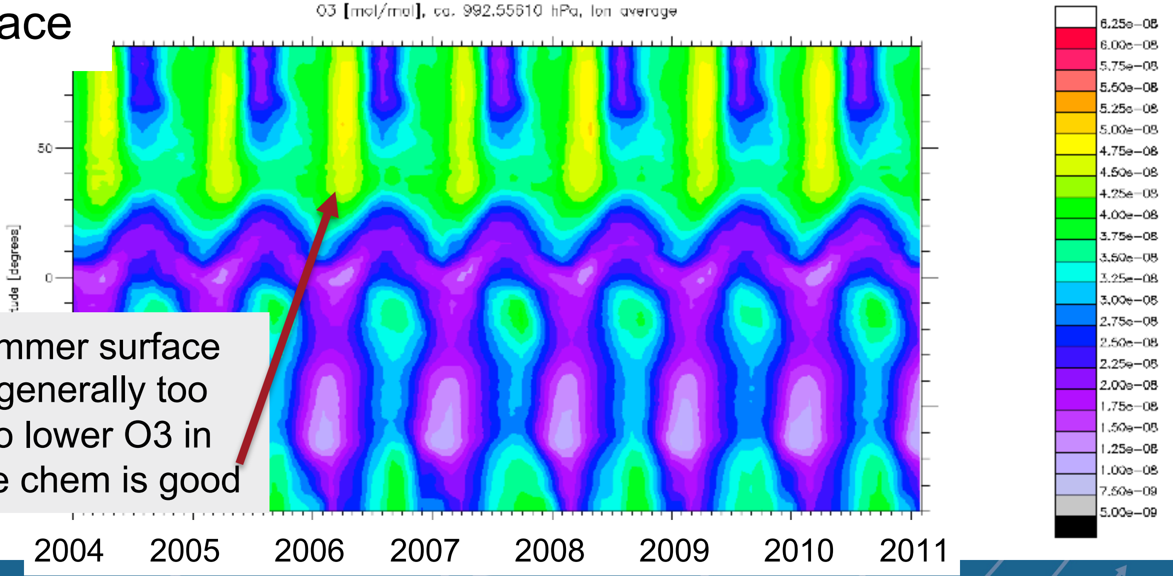
O3 ZA 500 hPa





O3 ZA Surface



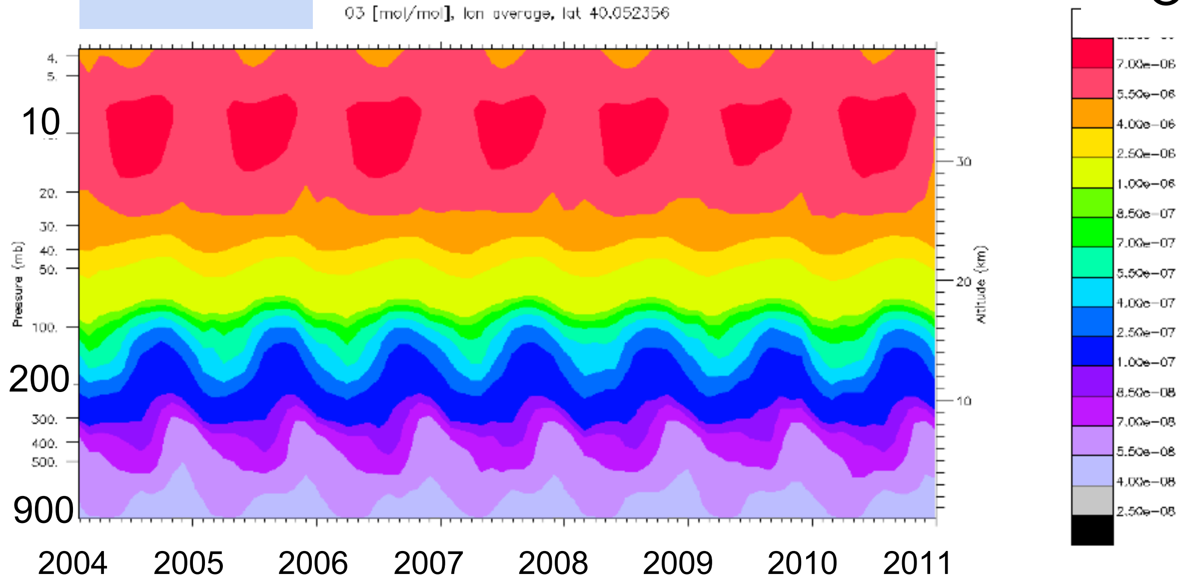


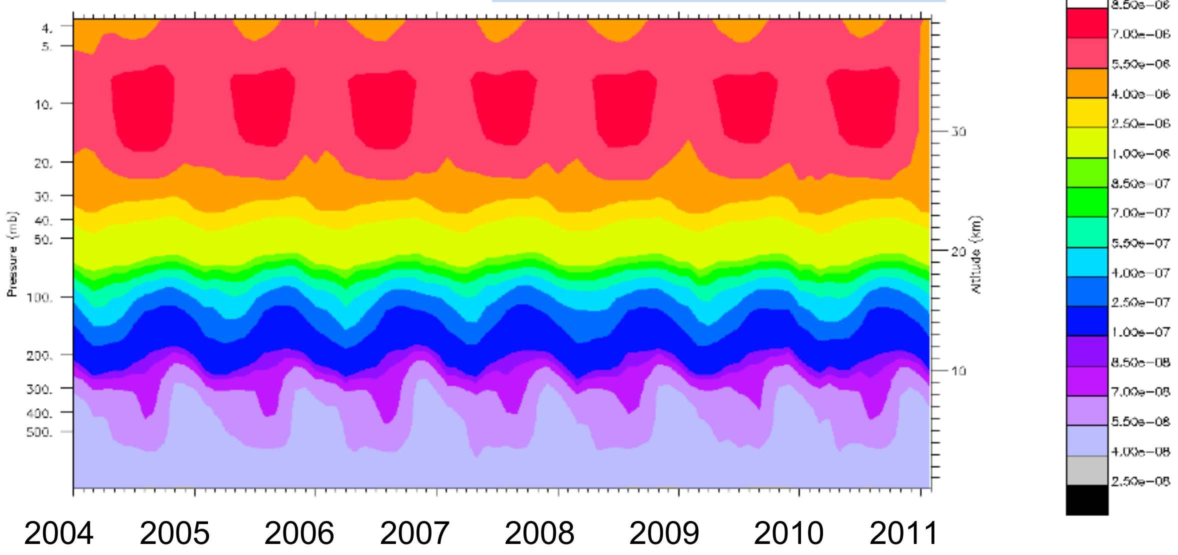
NH Summer surface ozone generally too high, so lower O3 in Climate chem is good

TS1

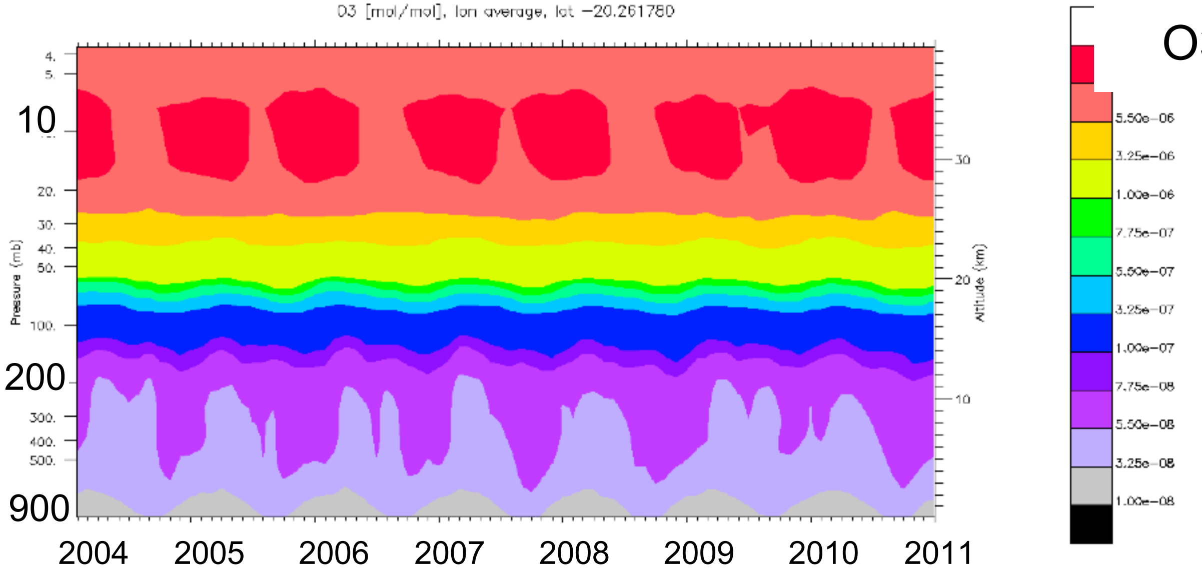
O3 ZA 40N

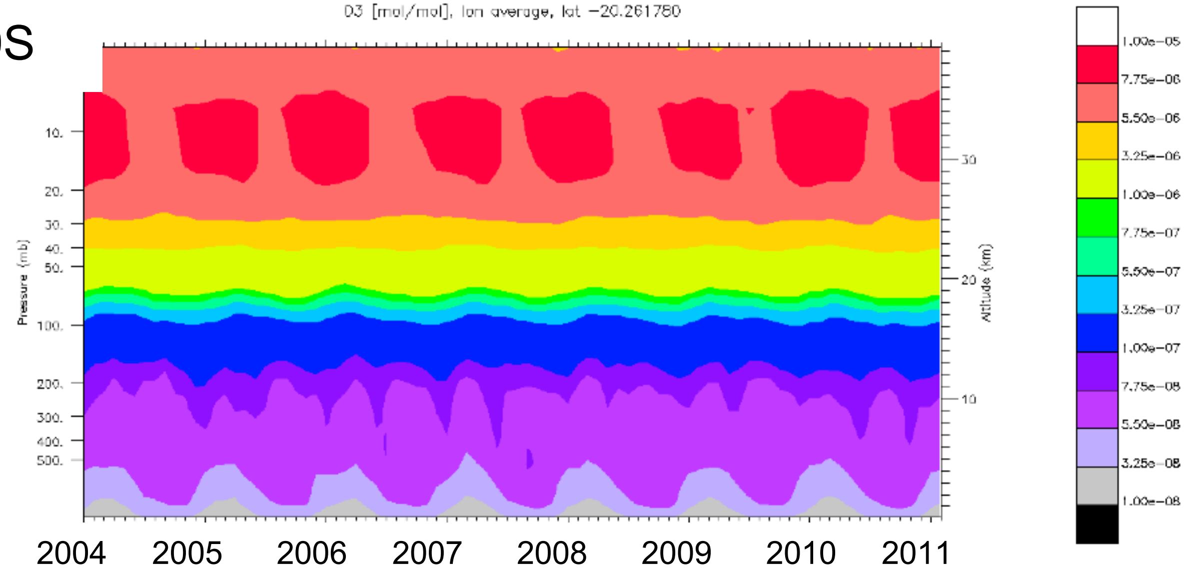
Climate Chem.





O3 ZA 20S

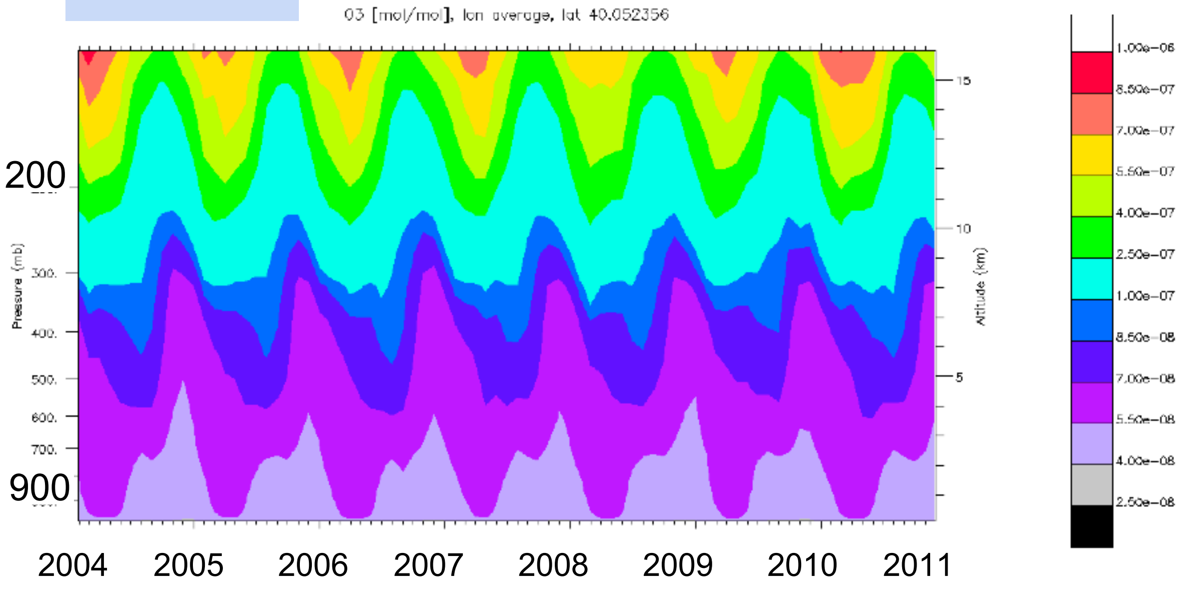


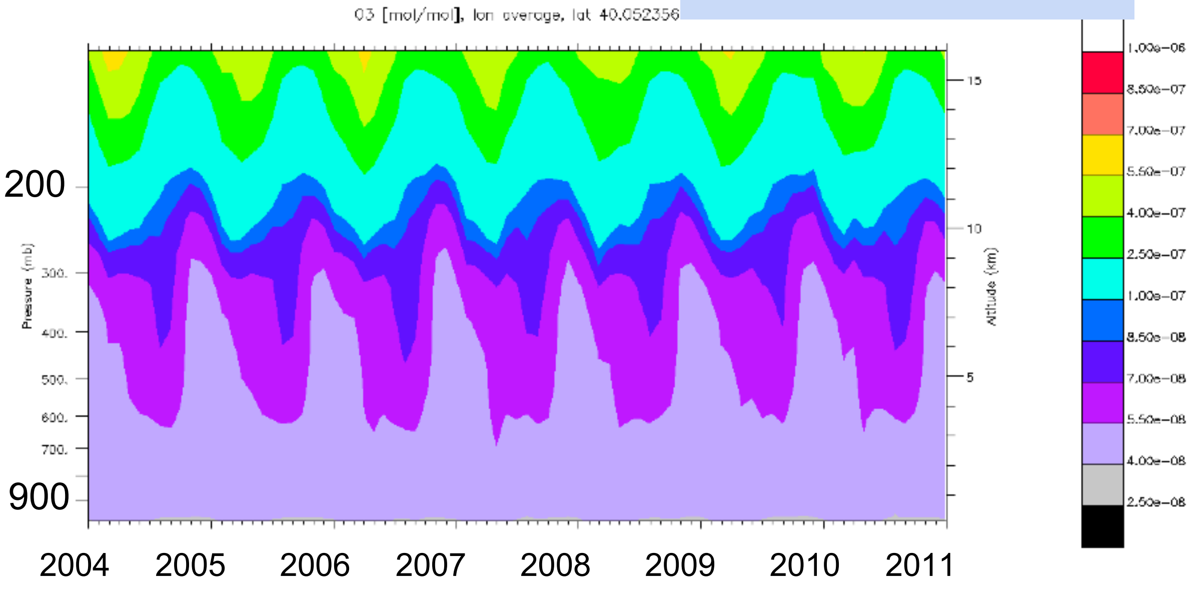


TS1

Tropospheric O3 ZA 40N

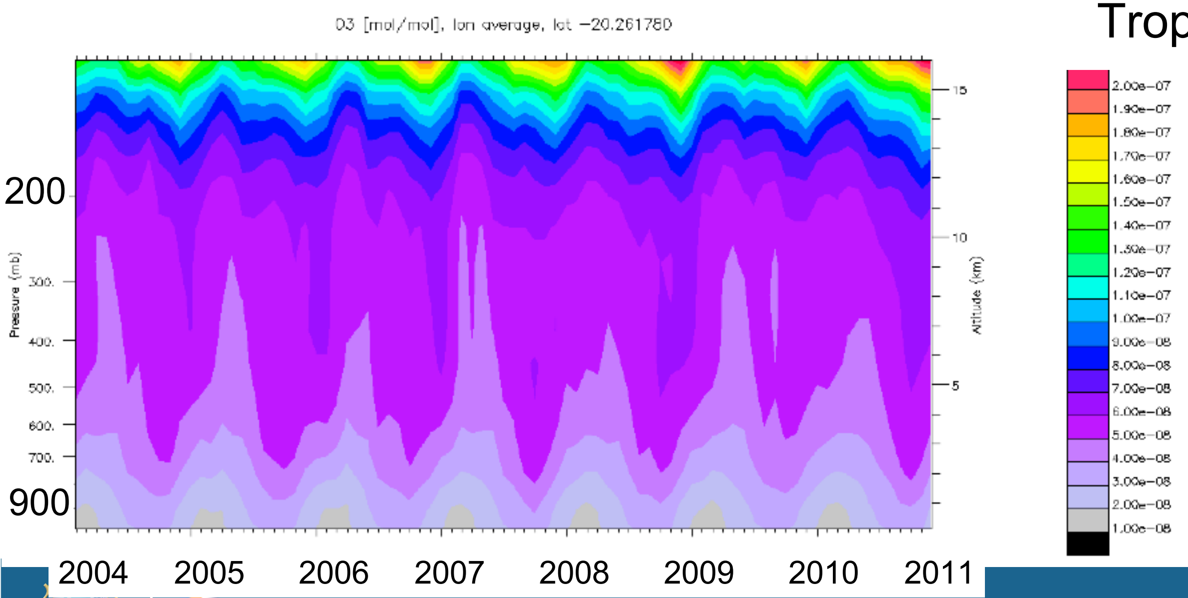
Climate Chem.

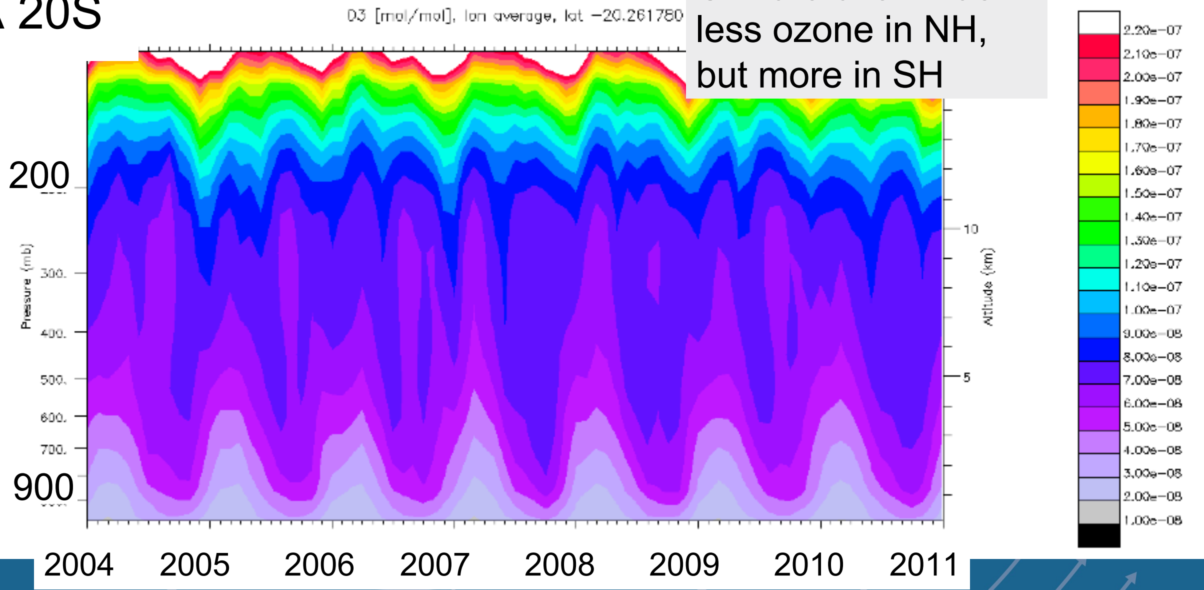




Trop. O3 ZA 20S

Climate chem has less ozone in NH, but more in SH





Summary

- The simpler "MOZART-Climate" chemistry mechanism will be ~30% cheaper/faster
- Results are appropriate for climate studies and providing oxidants for CAM simulations
- Will test in latest tag very soon