

Chemistry simulations for IPCC AR5

Jean-François Lamarque (NCAR)

Collaborators: P. Cameron-Smith (LLNL), P. Hess
(Cornell), D. Kinnison (NCAR), M. Prather (UCI),
F. Vitt (NCAR) and many others

Chemistry plans for AR5

- Datasets for CCSM Track1 (20th century and future)
 - Ozone (troposphere and stratosphere)
 - Aerosols
 - Nitrogen and aerosol deposition
- Datasets for CCSM Track5 (20th century and future)
 - Emissions
 - Oxidants
- Interactive chemistry
 - Superfast chemistry in Track1: 20th century
 - Stratosphere/troposphere chemistry (comparison with WACCM): 20th century
 - Tropospheric chemistry for decadal projections

Status

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CAM-only simulations

- CAM3.5
 - 1.9x2.5x26L (≈ 40 km)
 - CCSM3 SSTs
 - Historical: 1870-2000
 - RCP2.6: Commitment
 - RCP4.5: B1
 - RCP8.5: A2
 - Interactive chemistry (troposphere and stratosphere) and bulk aerosols
 - Long-lived (ODSs, CH₄, H₂, N₂O, CO₂) concentrations set at surface; everything else as emissions
 - Monthly output
 - Identical version used for CCMval (extensive evaluation against high-top models, see Th PM session)

SO₂ emissions

Historical Trend - IPCC AR5 SO₂ Emissions (Tg/yr)

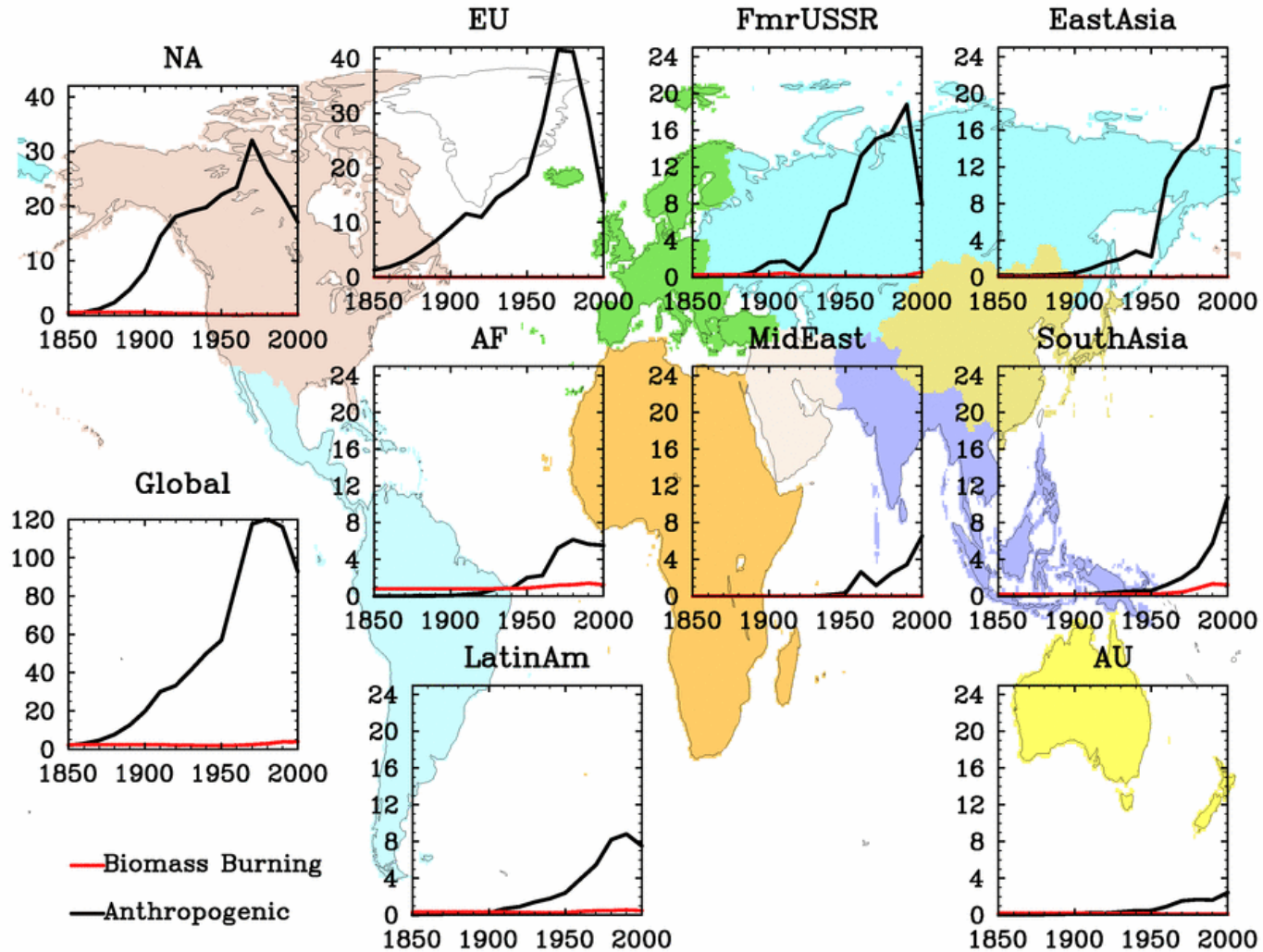
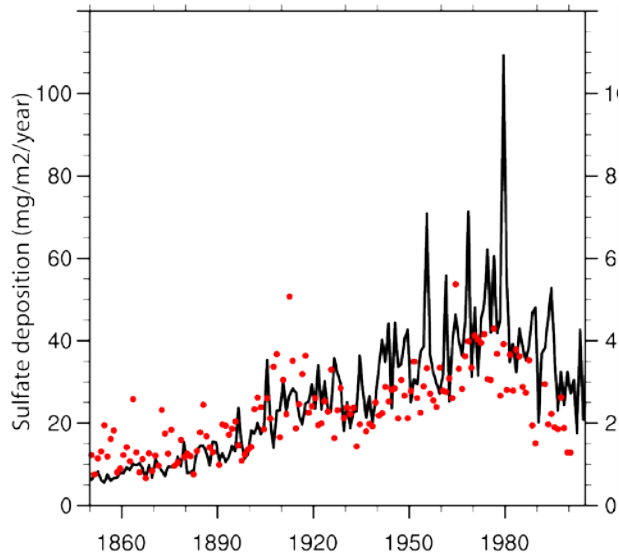


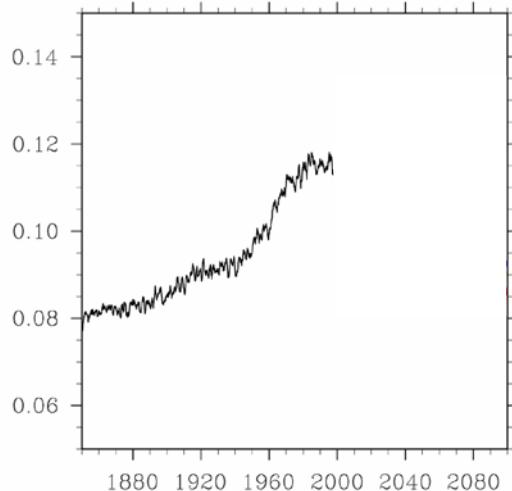
Figure from V. Naik (GFDL)

Results: Aerosols

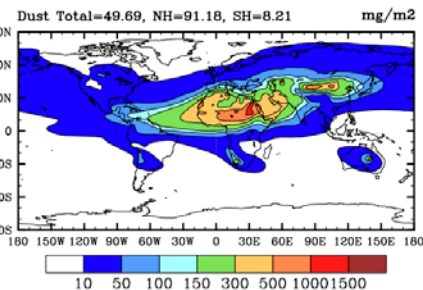
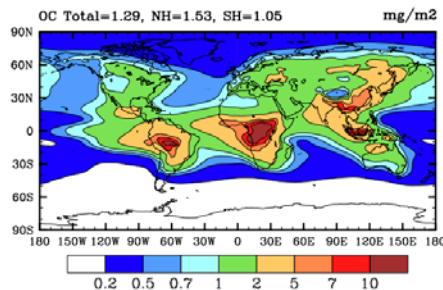
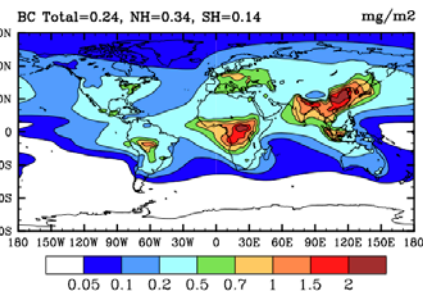
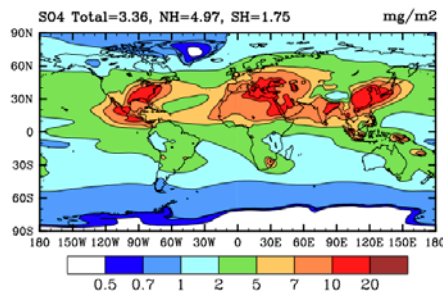
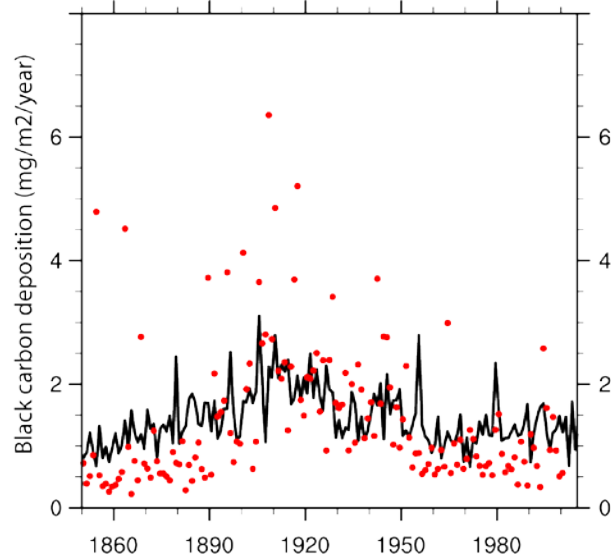
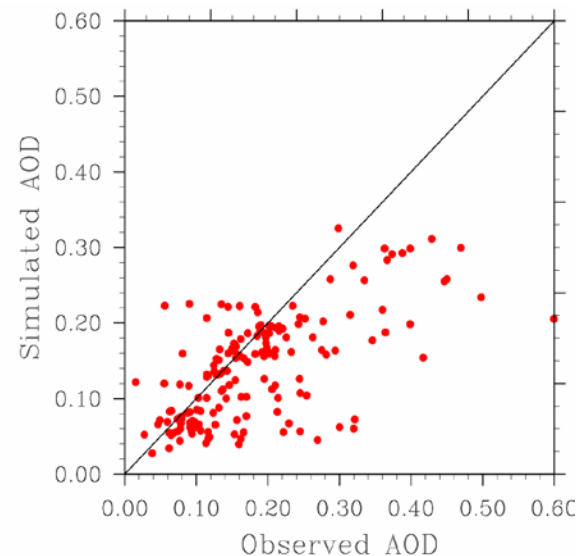
Deposition at D4, Greenland



Global mean AOD



Comparison w/ AERONET (N. Mahowald)



u), plotted by V. Naik (Vnaik@prosa.gov) Fri Jan 15 15:06:21 EST 2010

NO emissions

Historical Trend - IPCC AR5 NO Emissions (Tg/yr)

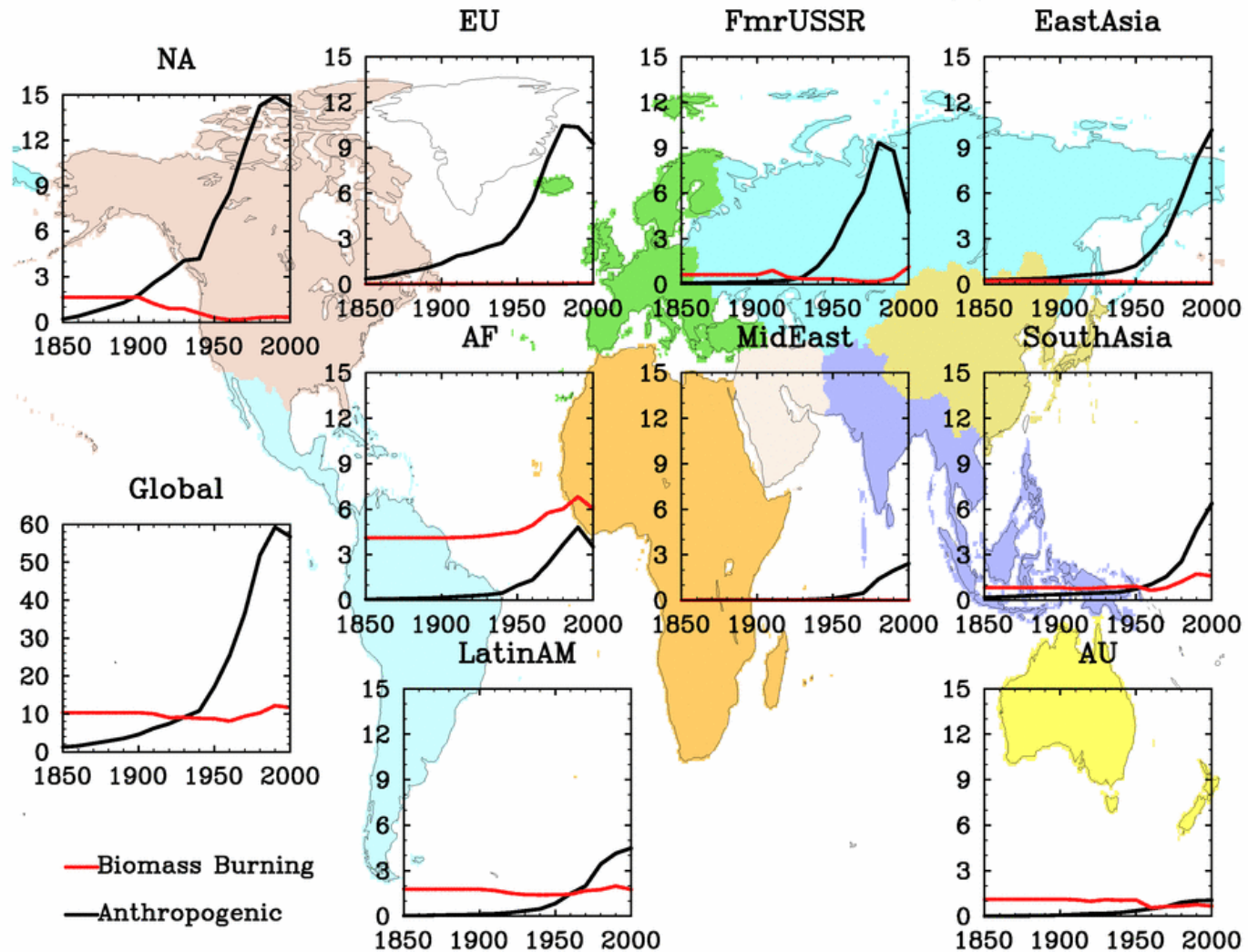
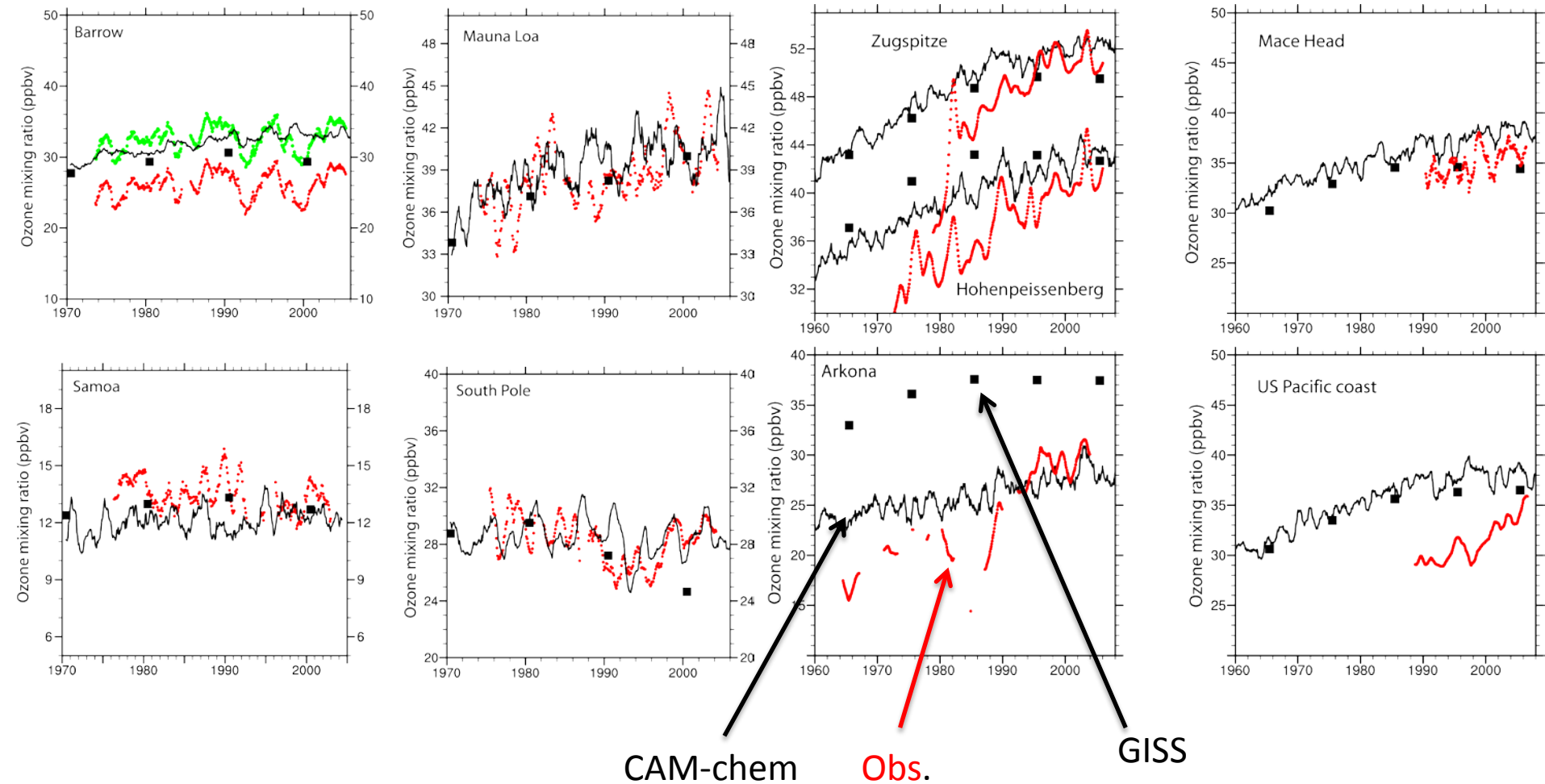


Figure from V. Naik (GFDL)

Results: Surface ozone



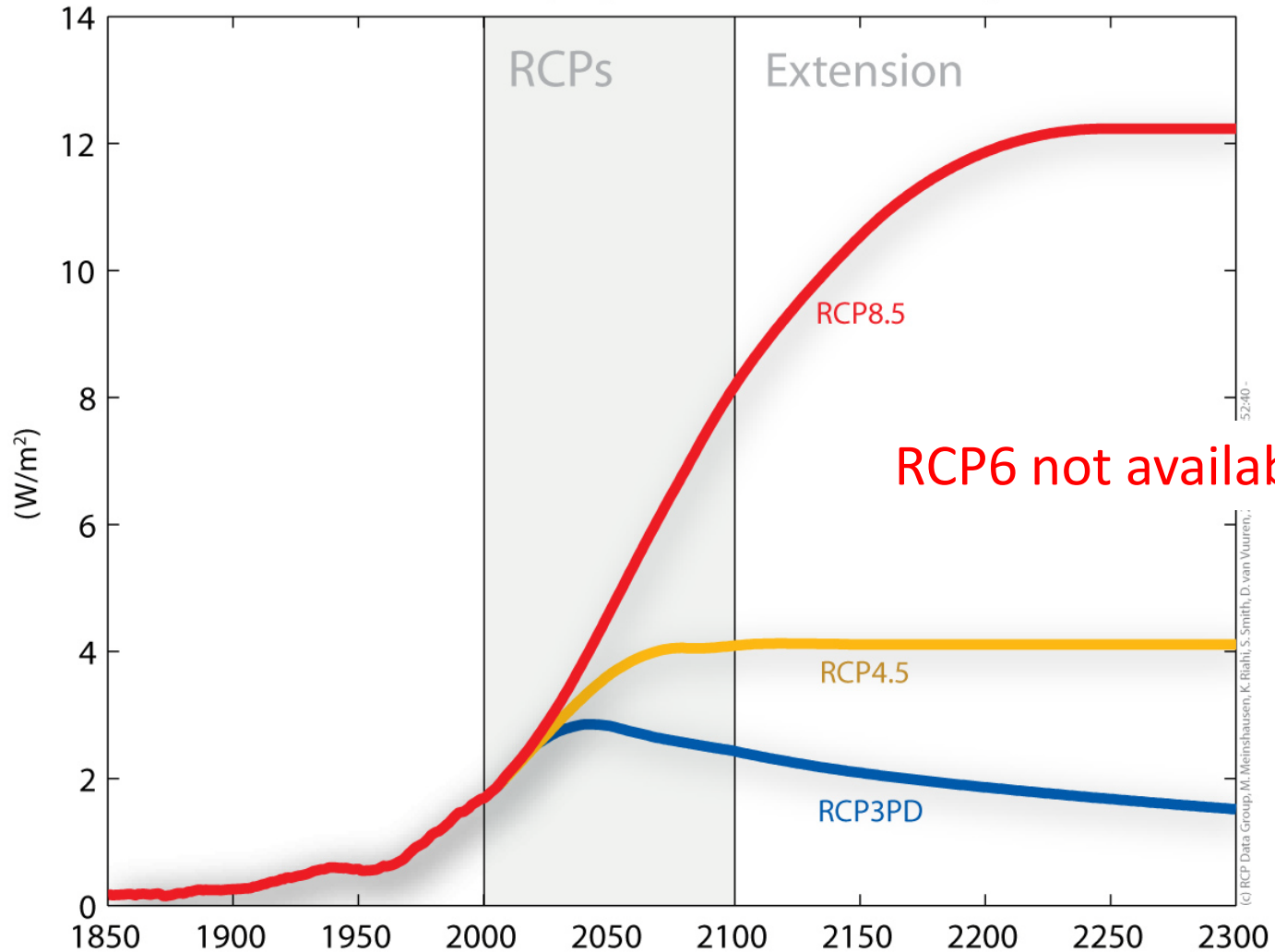
CAM-chem

Obs.

GISS

Radiative forcing for RCPs

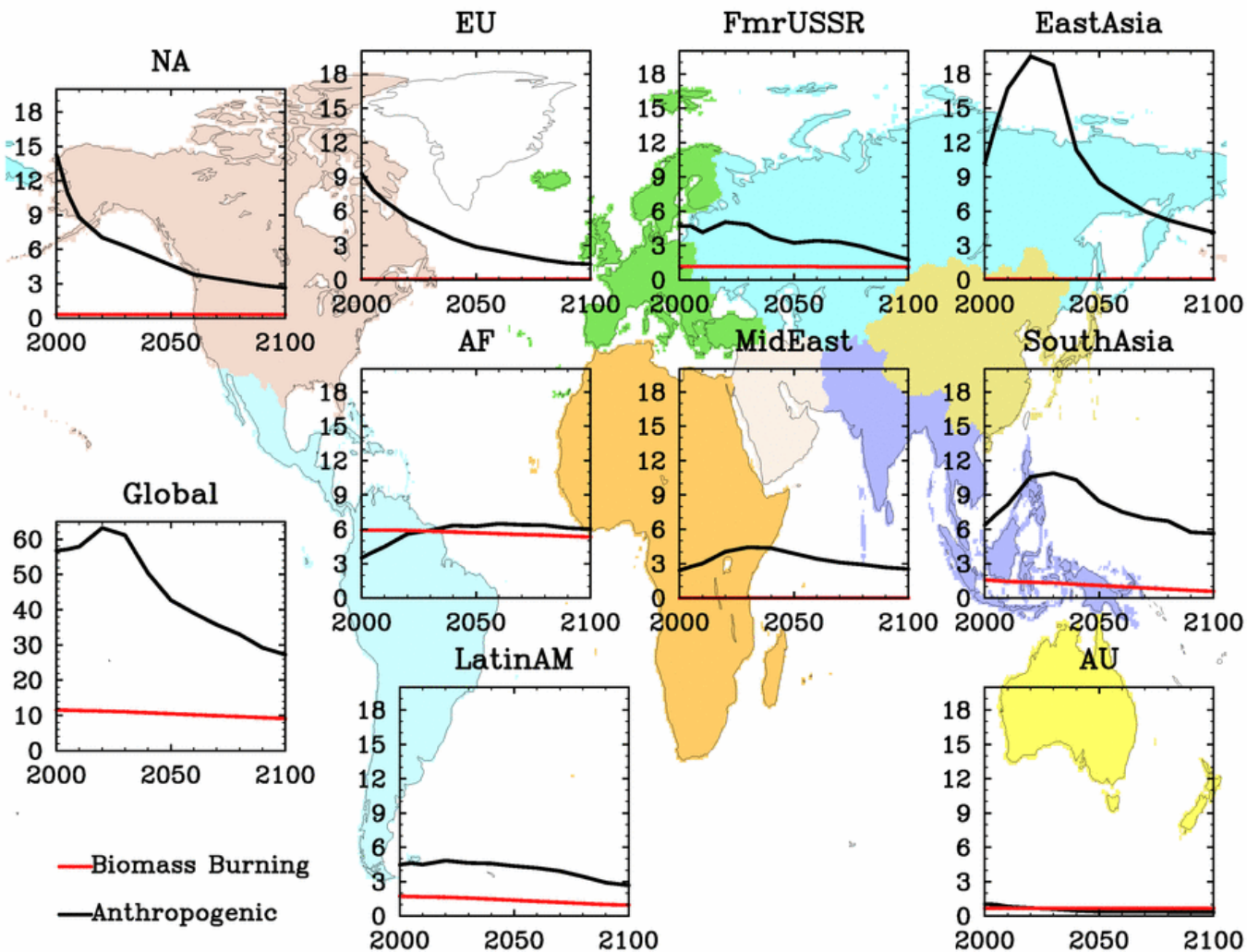
Global Mean Total Anthropogenic Radiative Forcing



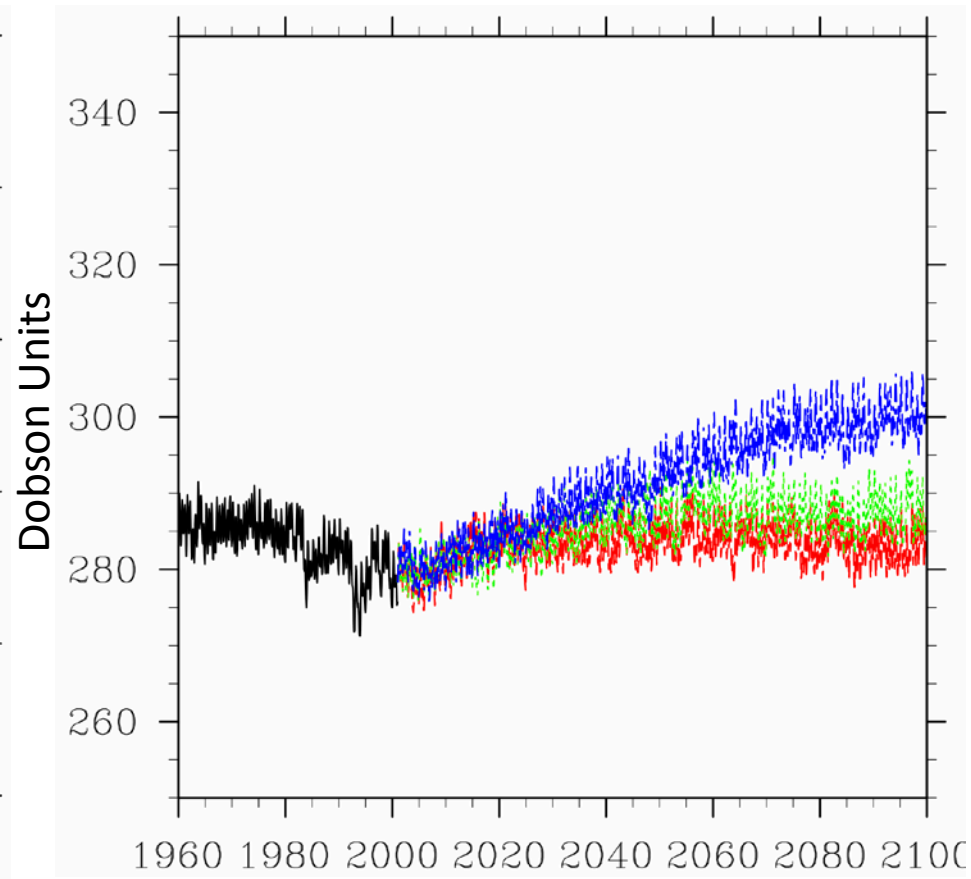
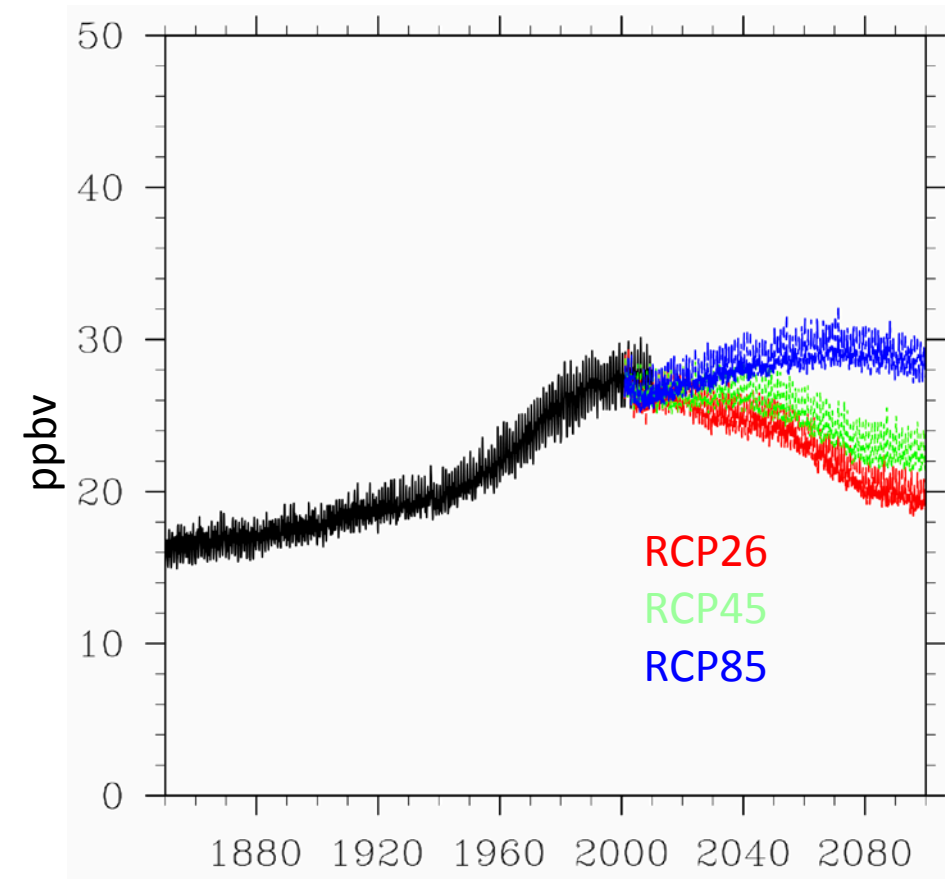
From M. Meinshausen (Potsdam)

NO emissions

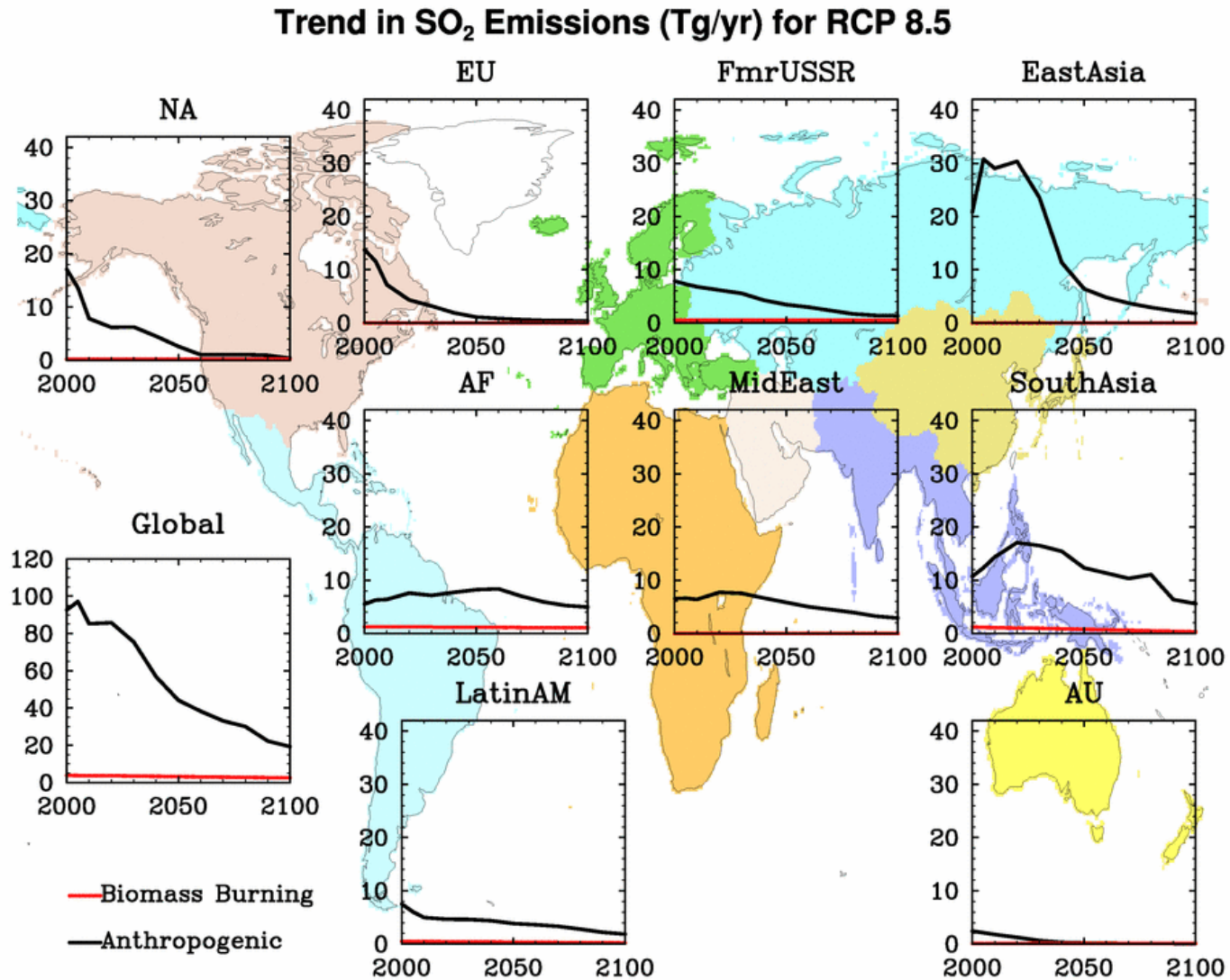
Trend in NO Emissions (Tg/yr) for RCP 8.5



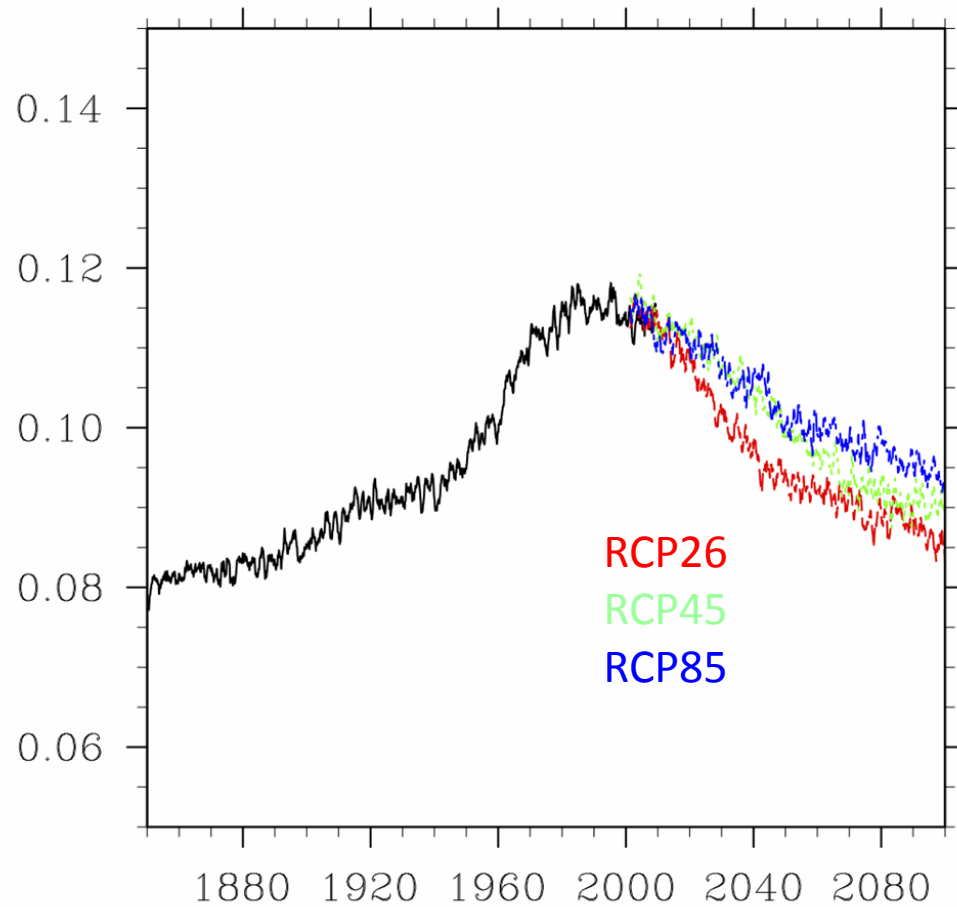
Results: Surface and Total ozone Global mean



SO₂ emissions



Aerosols: global mean AOD




Caveat: no ammonium nitrate

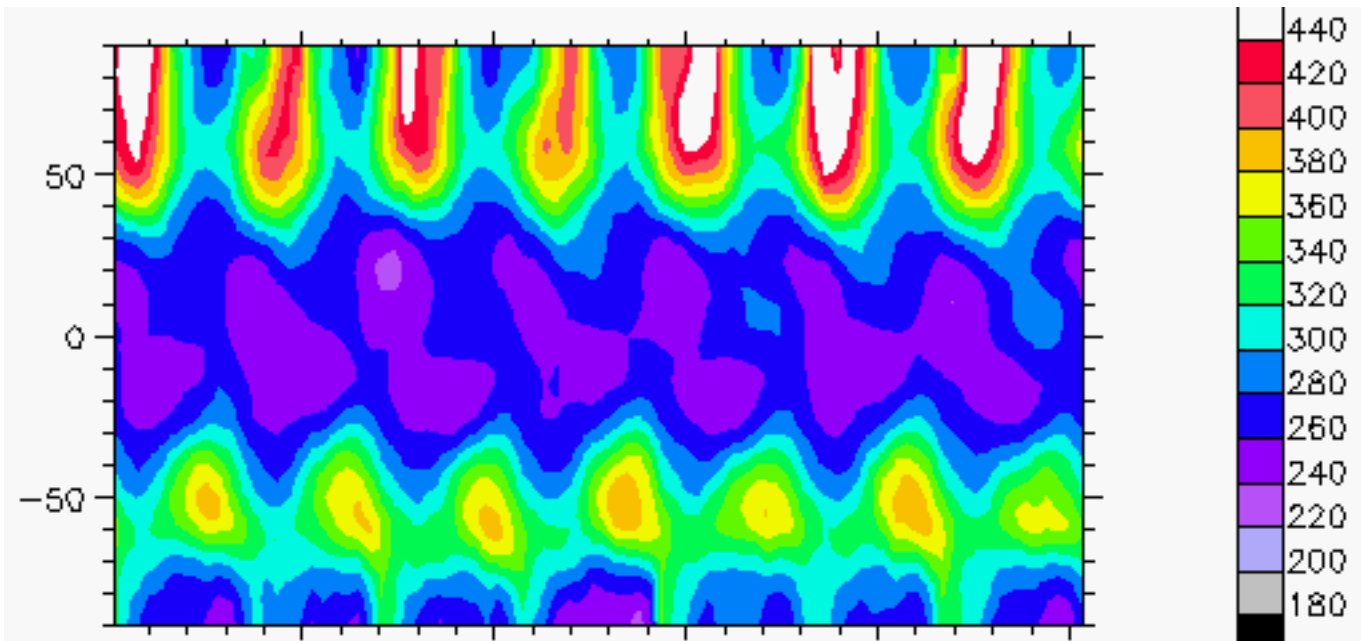
Track1 with superfast chemistry

- Track1 model setup: 0.9x1.25x26L
- Superfast tropospheric chemistry:
 - Background chemistry
 - Tested against obs. and more extensive chemistry
- Stratospheric linearized ozone chemistry (tied to CH₄, N₂O, CFCs and T) : will produce ozone hole

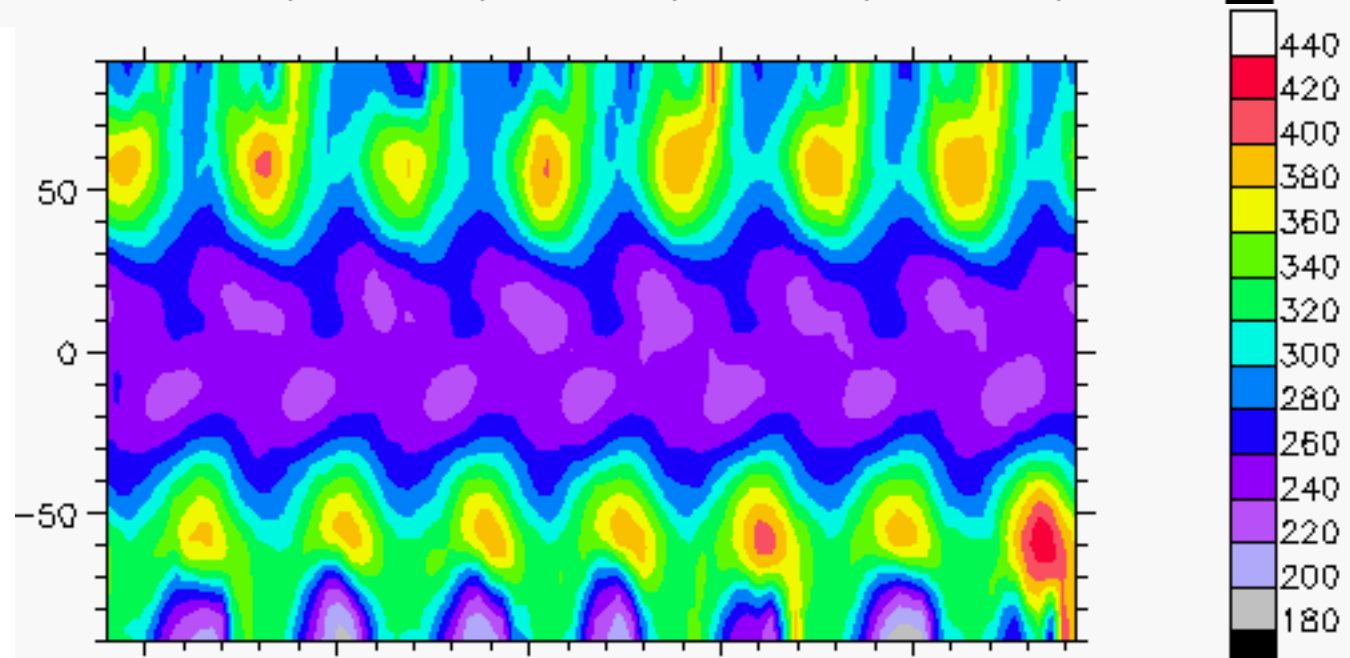
Status

- 50 years of 1850 control
 - RESTOM: -0.39 W/m^2 (T1: -0.16)
 - TS: 287.38 K (T1: 287.44 K)
 -  will need some minor tuning but no major problem identified
 - Being evaluated by other WG (atmosphere and ice)

WACCM
1950s



CCSM T1
1850s

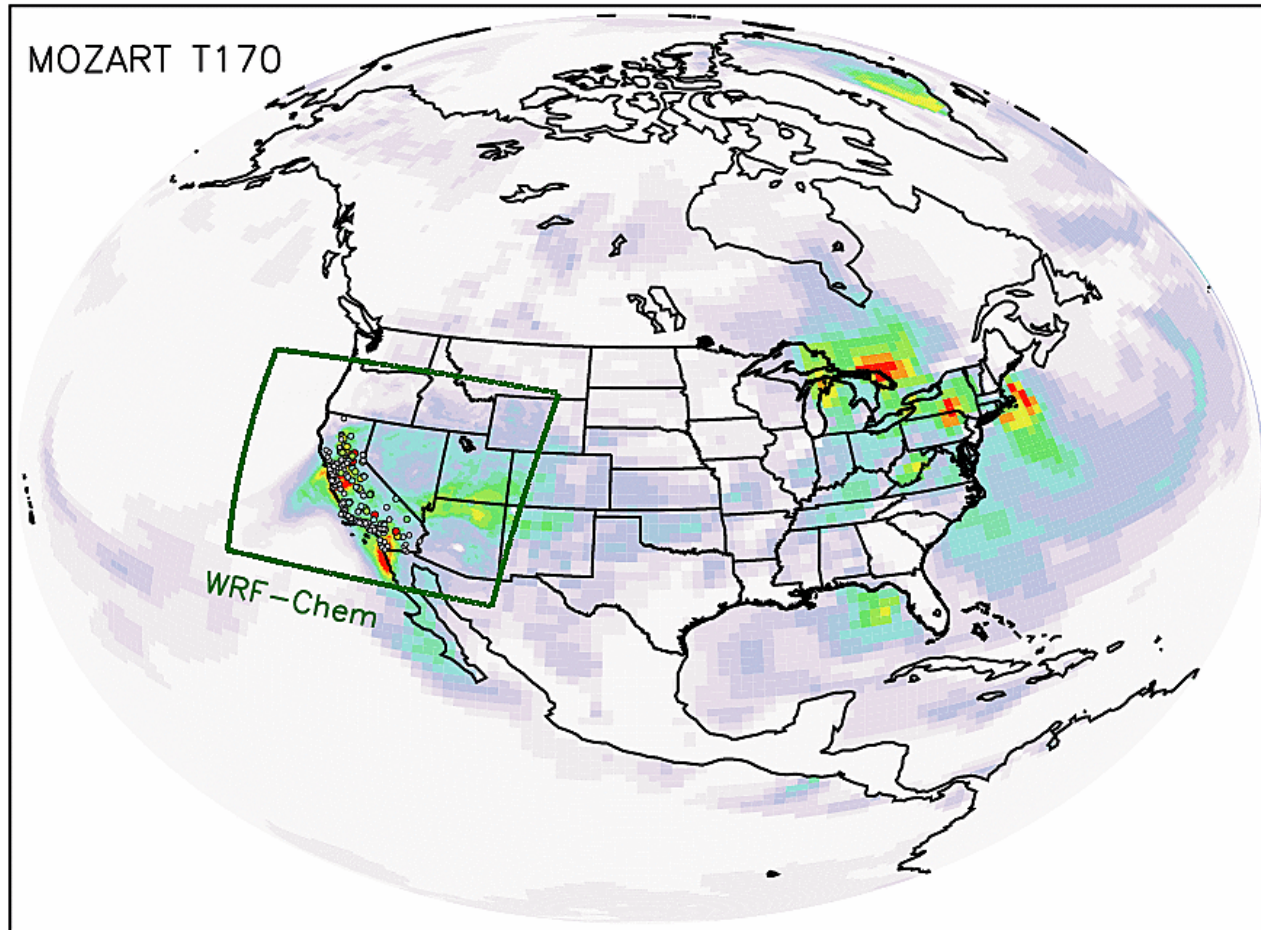


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 - Stratosphere/troposphere chemistry (comparison with WACCM): 20th century: 2-3 months
 - Tropospheric chemistry for decadal projections: 2-3 months

Chemical downscaling

20080614 4UTC



Surface O_3 (ppb)



From G. Pfister

