Carbon monoxide in the GMI models

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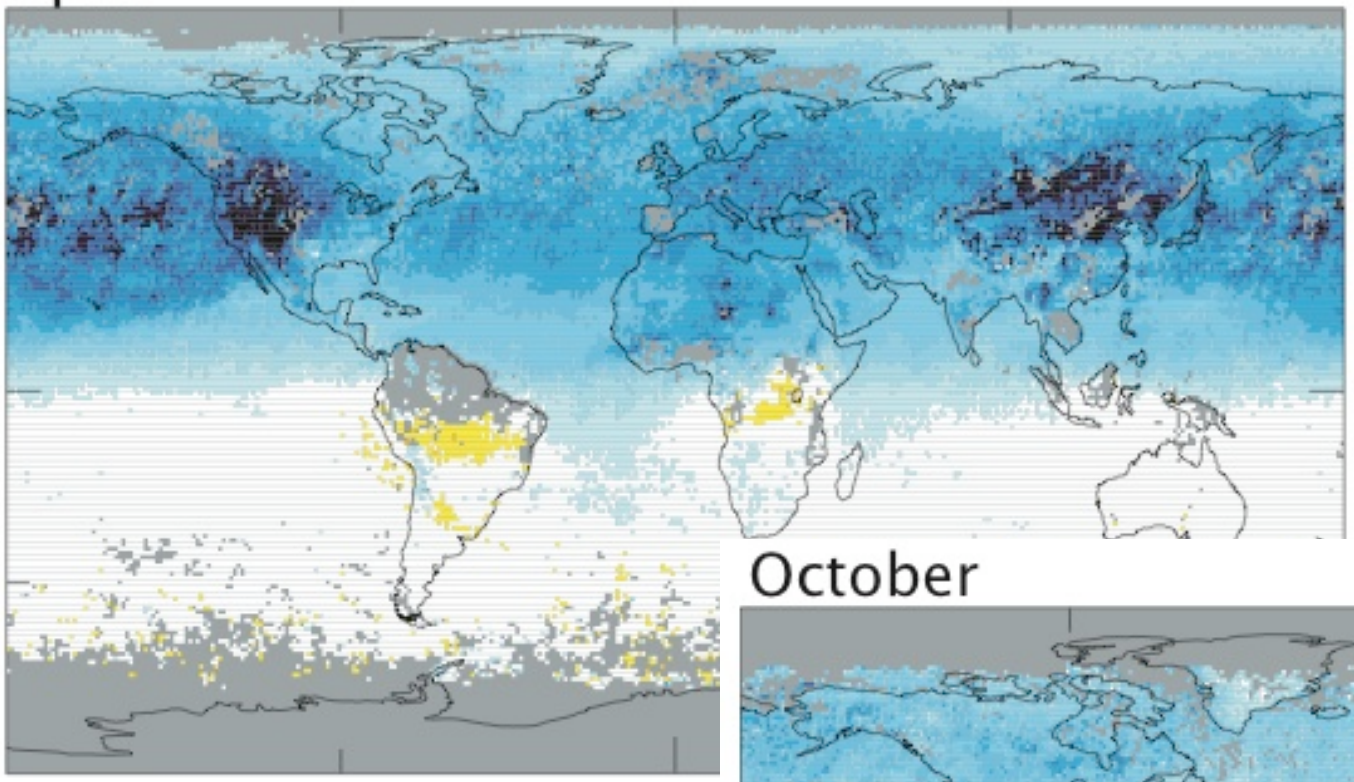
Carbon monoxide

- Mid-range lifetime (~1 month), transported regionally but not globally well-mixed
- Many model datasets (26 in recent IPCC AR4 simulations).
- One of the best observed trace-gases
  - satellite coverage with vertical profile information
  - space-based observations back to 1980s
  - long-term surface data

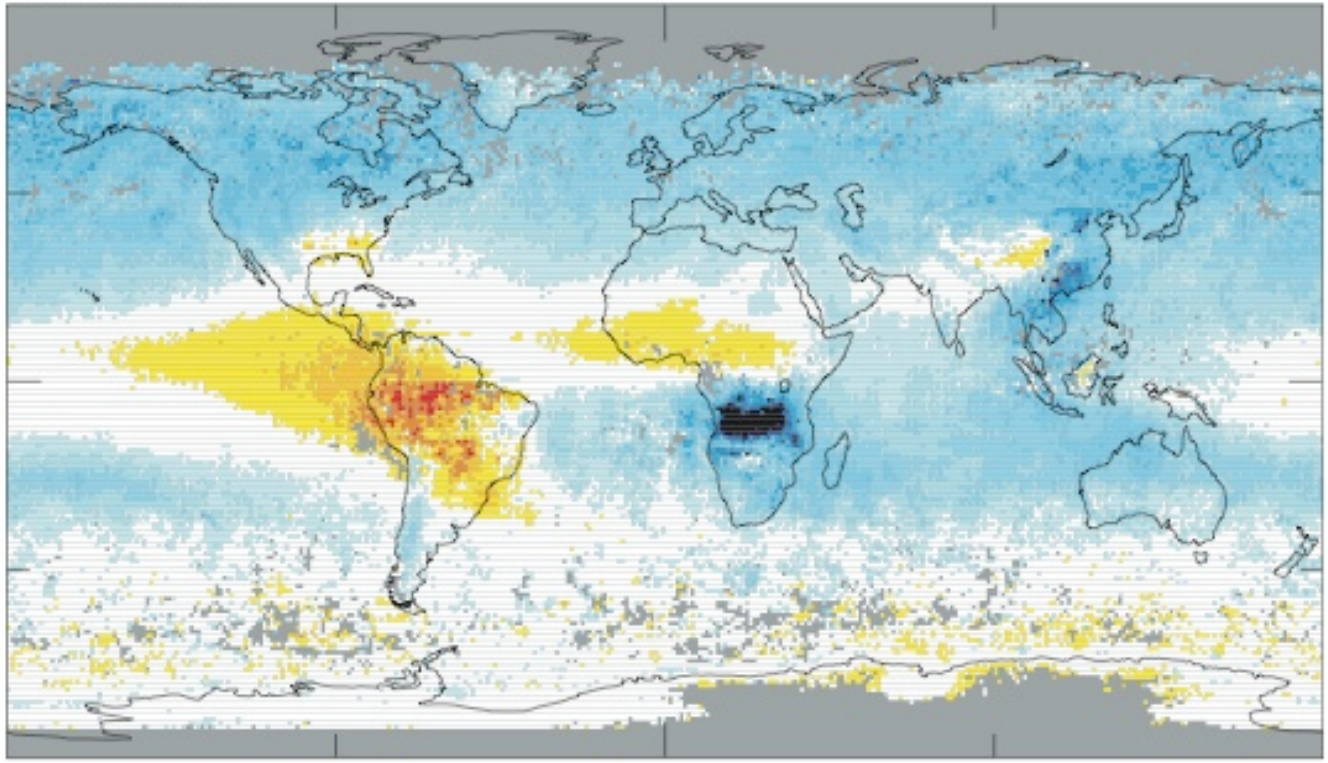
IPCC studies of carbon monoxide

- IIASA/EDGAR3.2 2000 emissions (AR4)
- Previous simulations with GISS composition-climate model using:
  - GEIA emissions
  - EDGAR 1995 emissions
  - GFED 2000-2001 biomass burning emissions
- Methane prescribed
- NMVOCs suggested from TAR

April



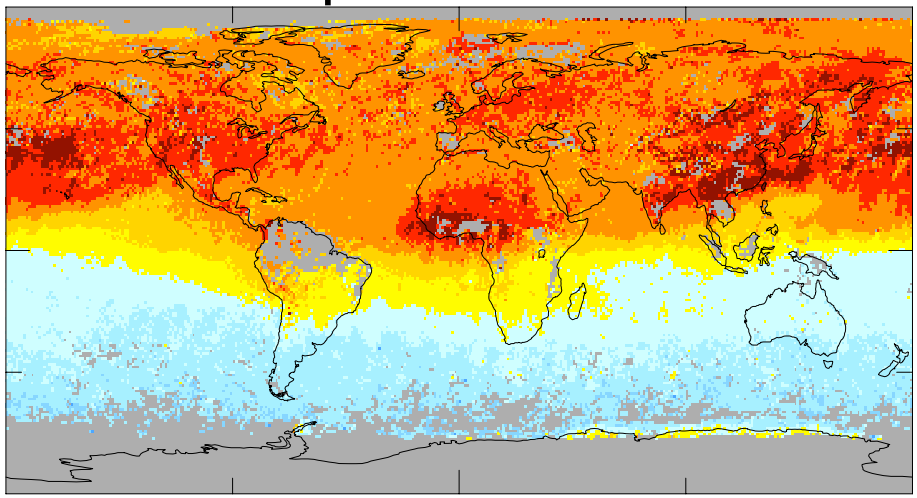
October



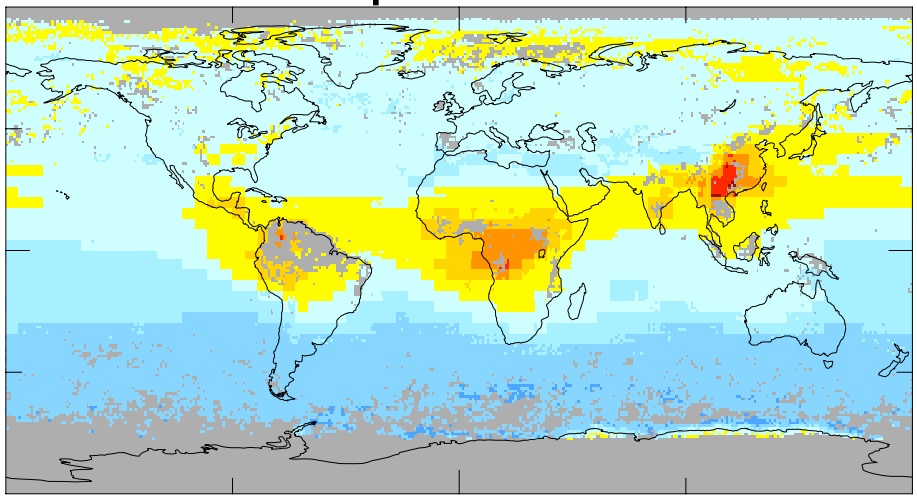
Multi-model CO vs MOPITT (broad 500 hPa retrieval level)

GMI CO vs MOPITT (broad 500 hPa ret. level)

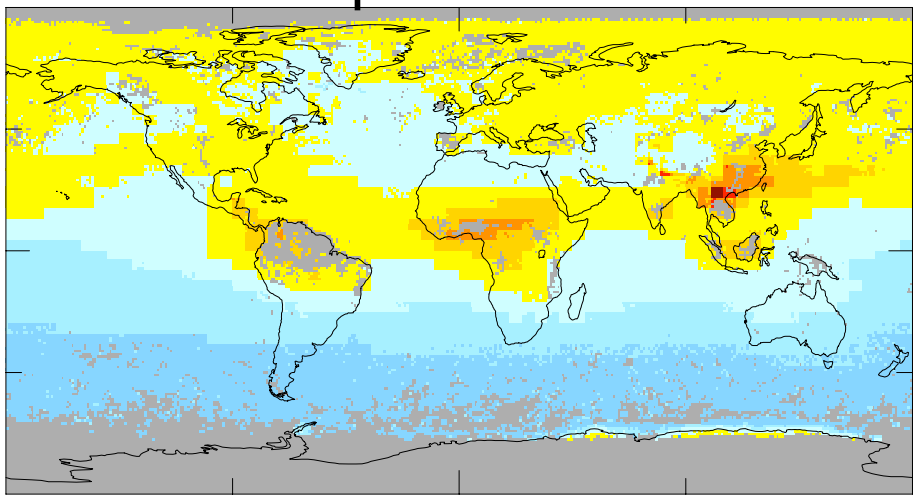
MOPITT April 2000



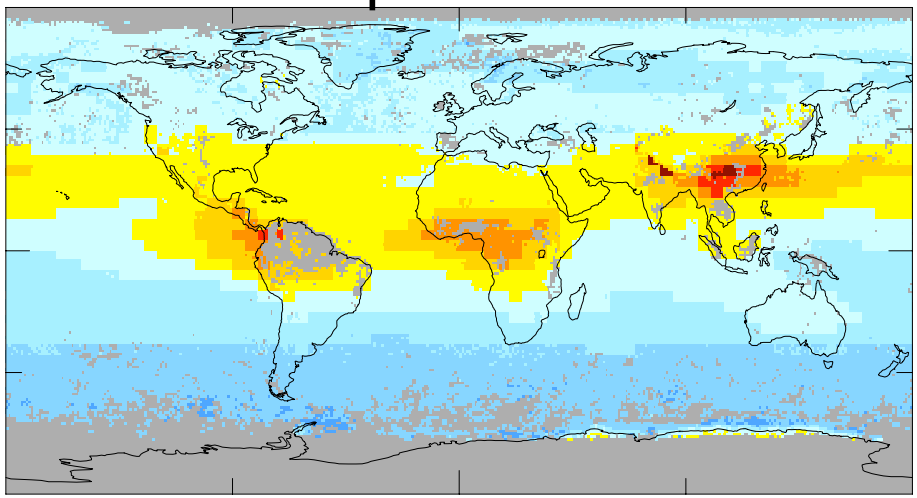
GMI-CCM April 2000

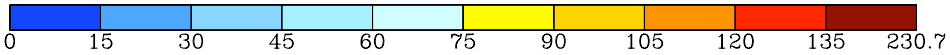


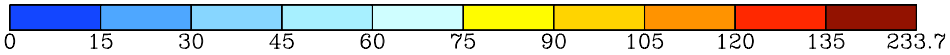
GMI-DAO April 2000



GMI-GISS April 2000

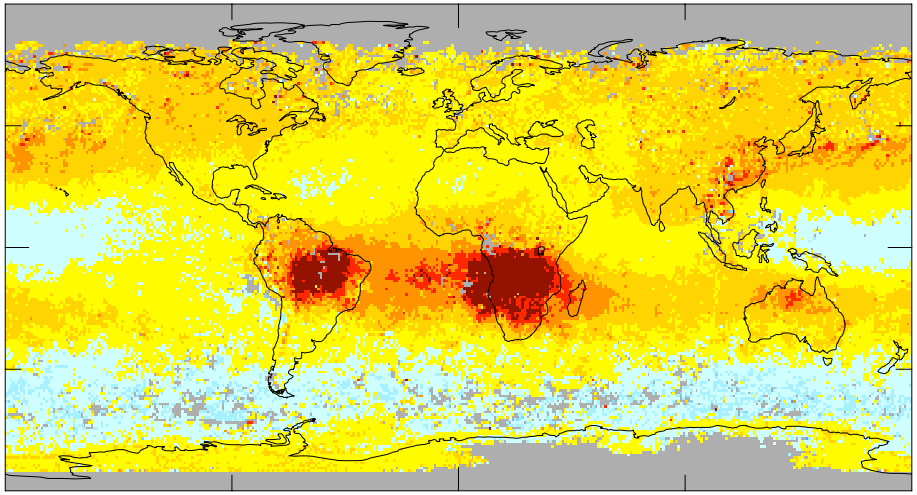




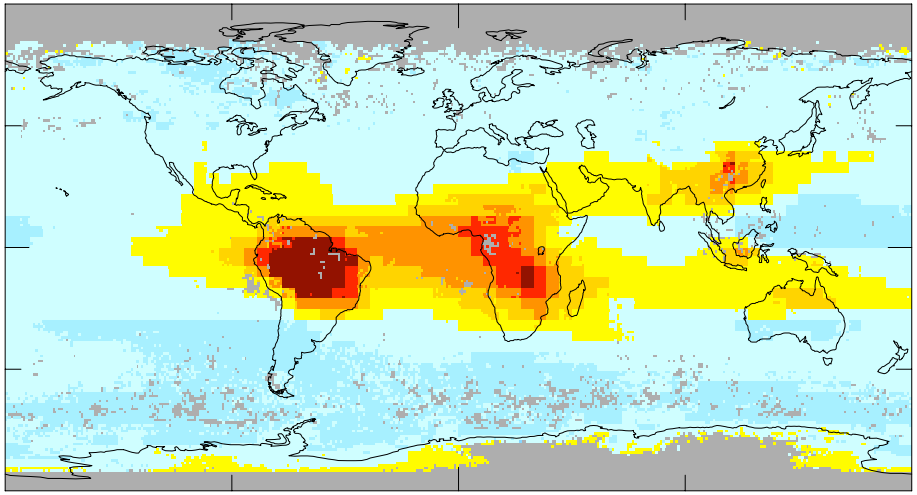


GMI CO vs MOPITT (broad 500 hPa ret. level)

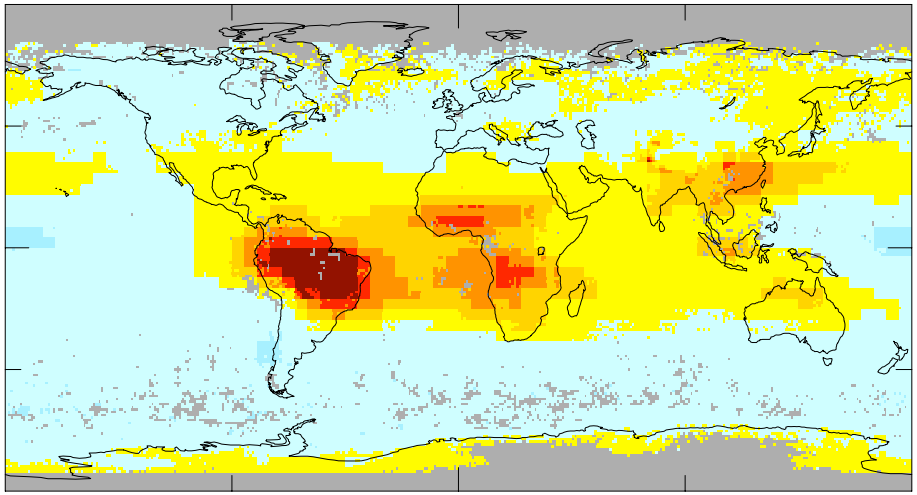
MOPITT October 2000



GMI-CCM October 2000



GMI-DAO October 2000



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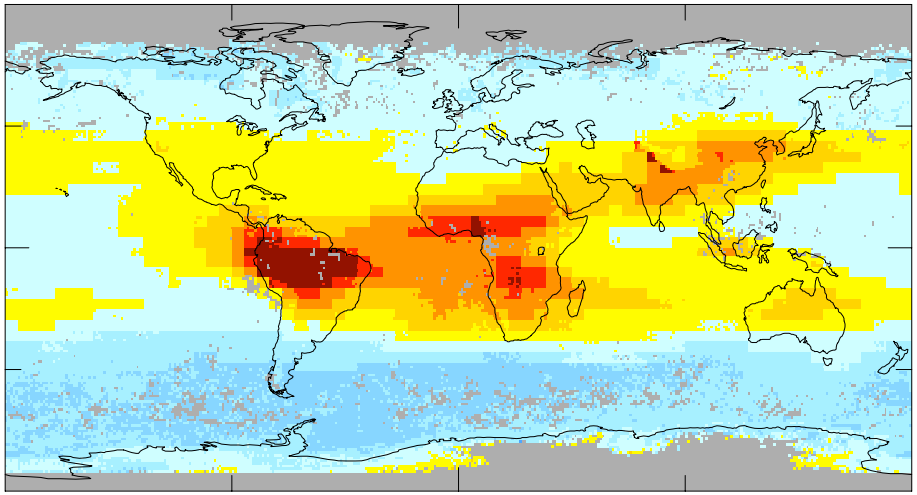
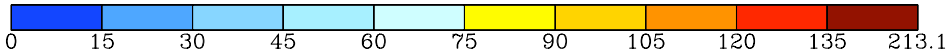
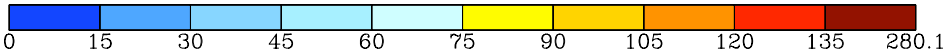
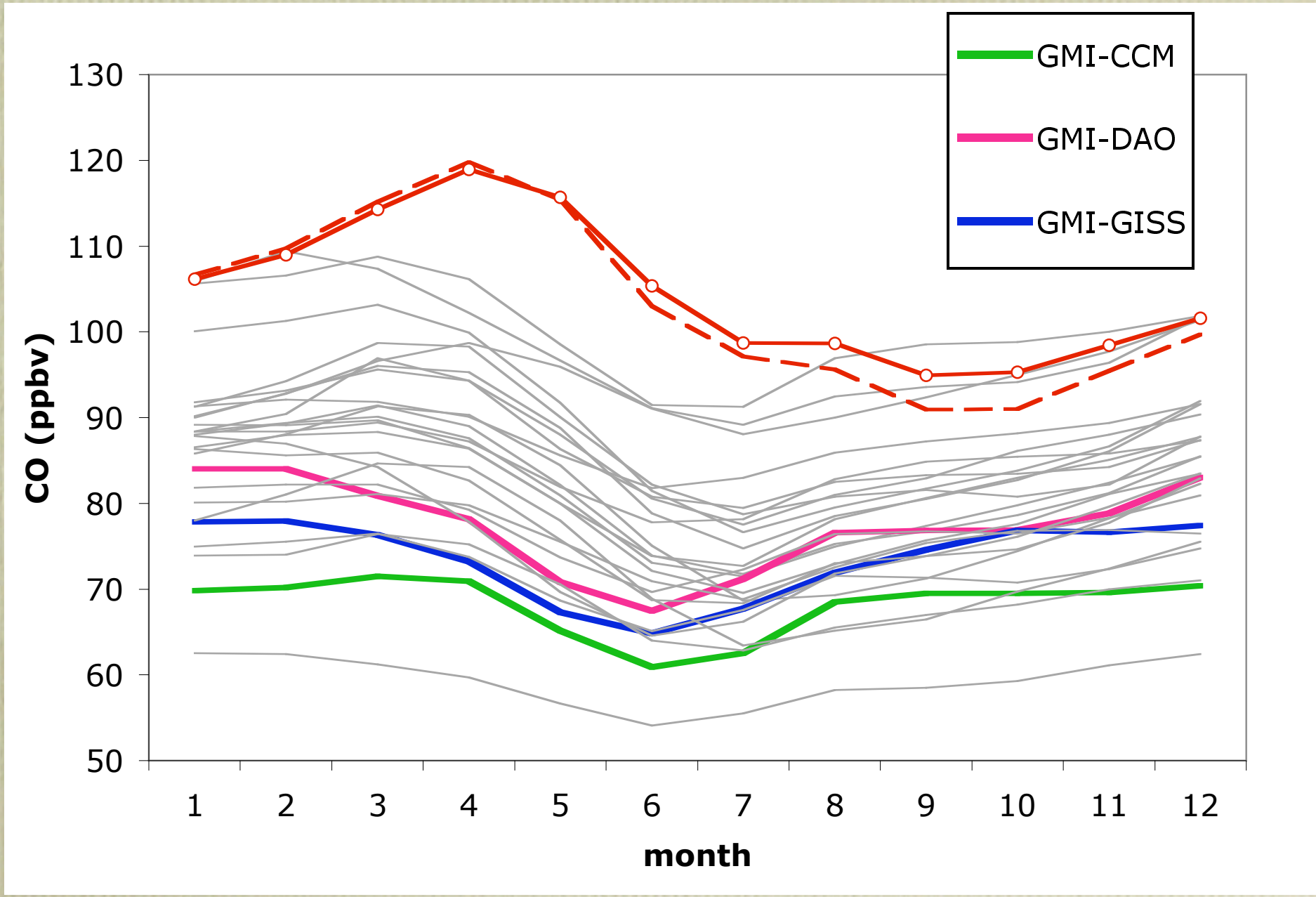


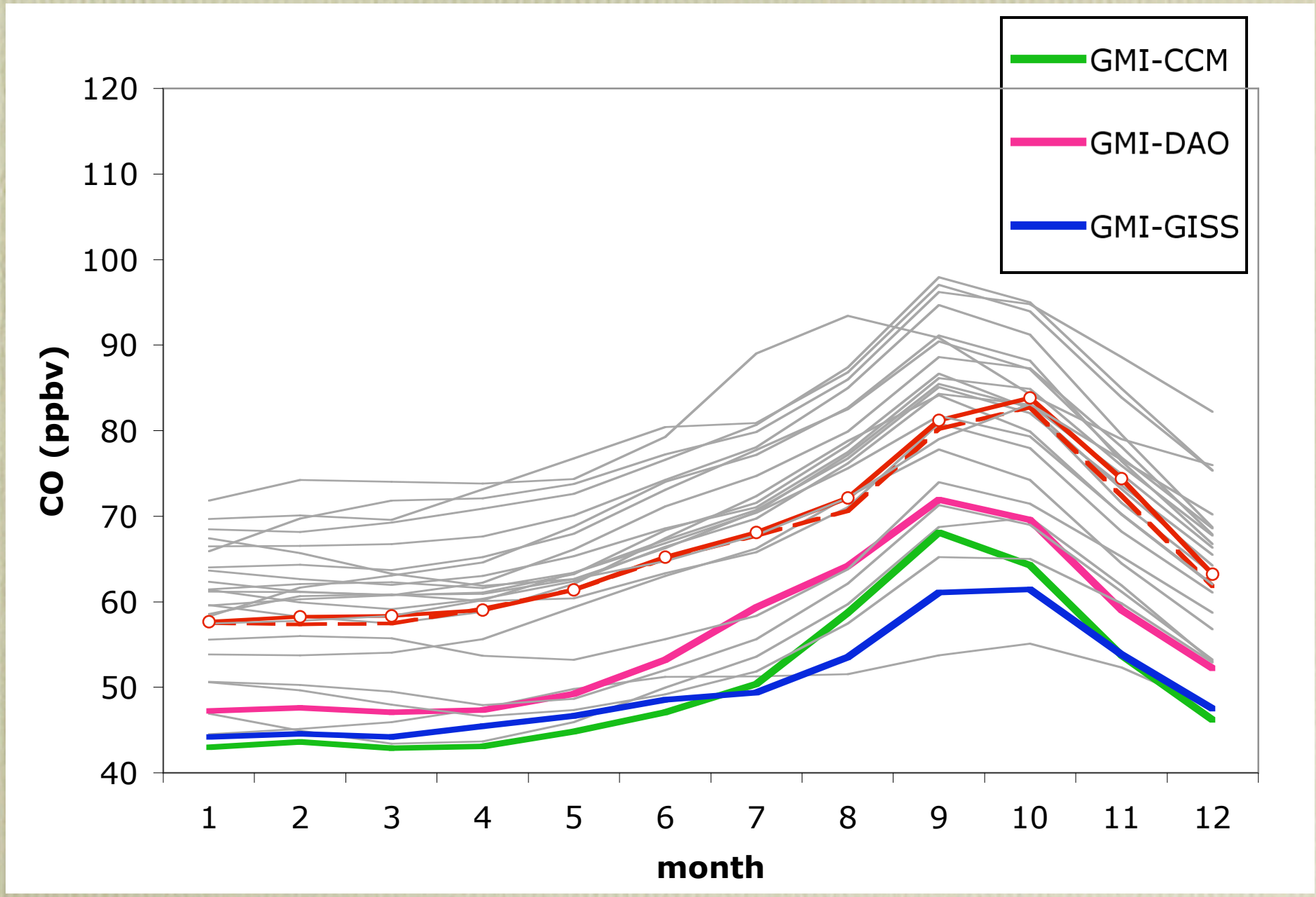




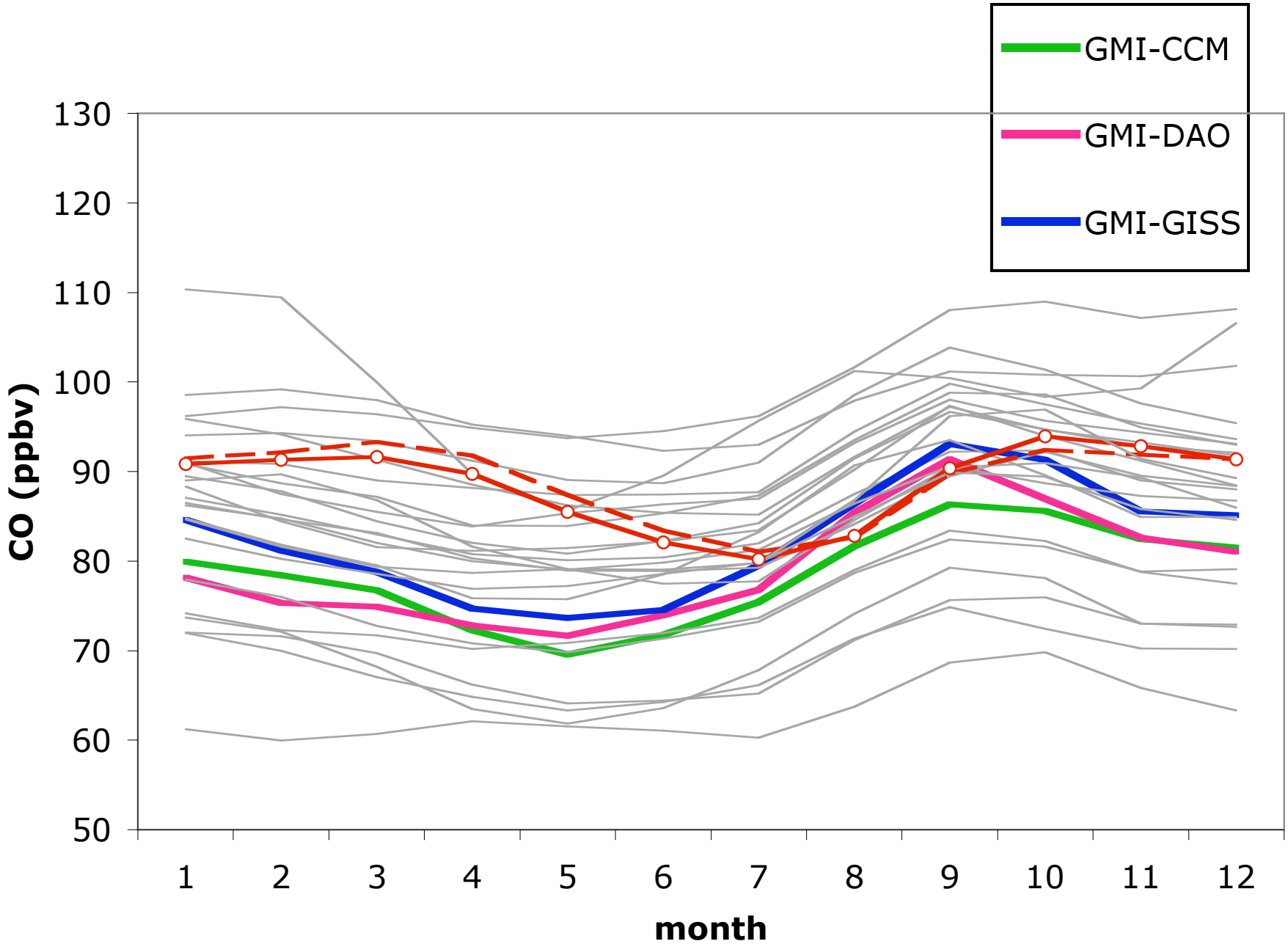
NH extratropical CO in IPCC AR4 models vs MOPITT

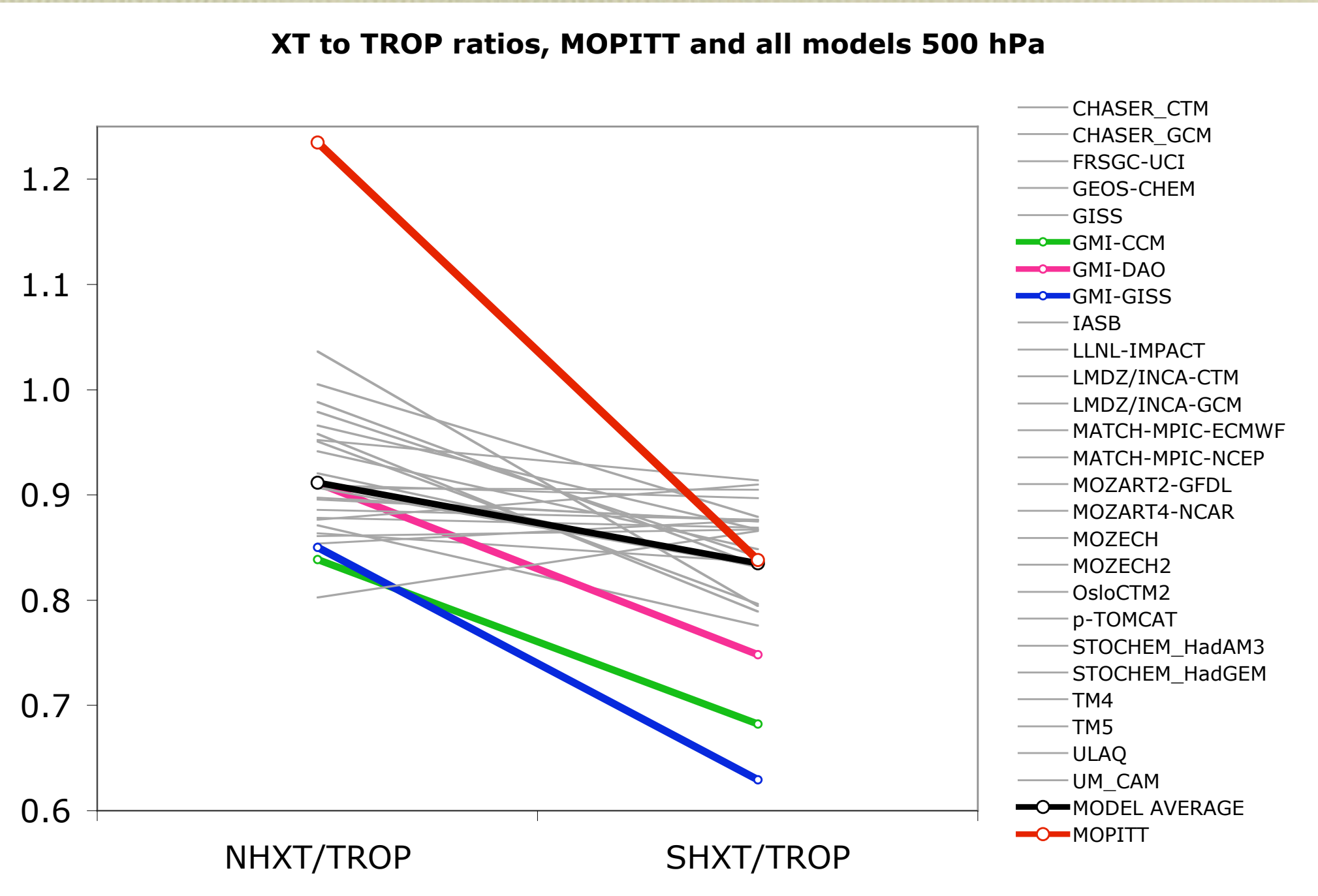


SH extratropical CO in IPCC AR4 models vs MOPITT

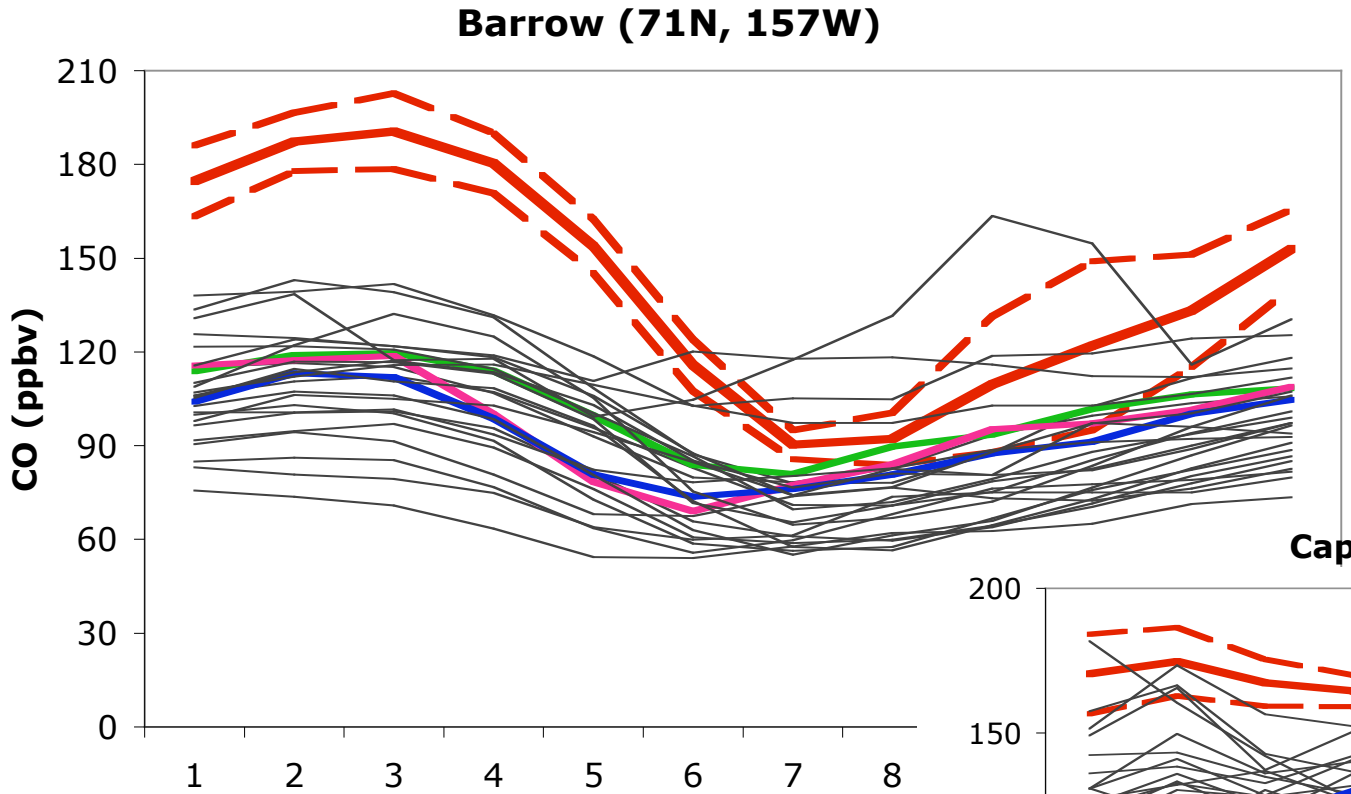


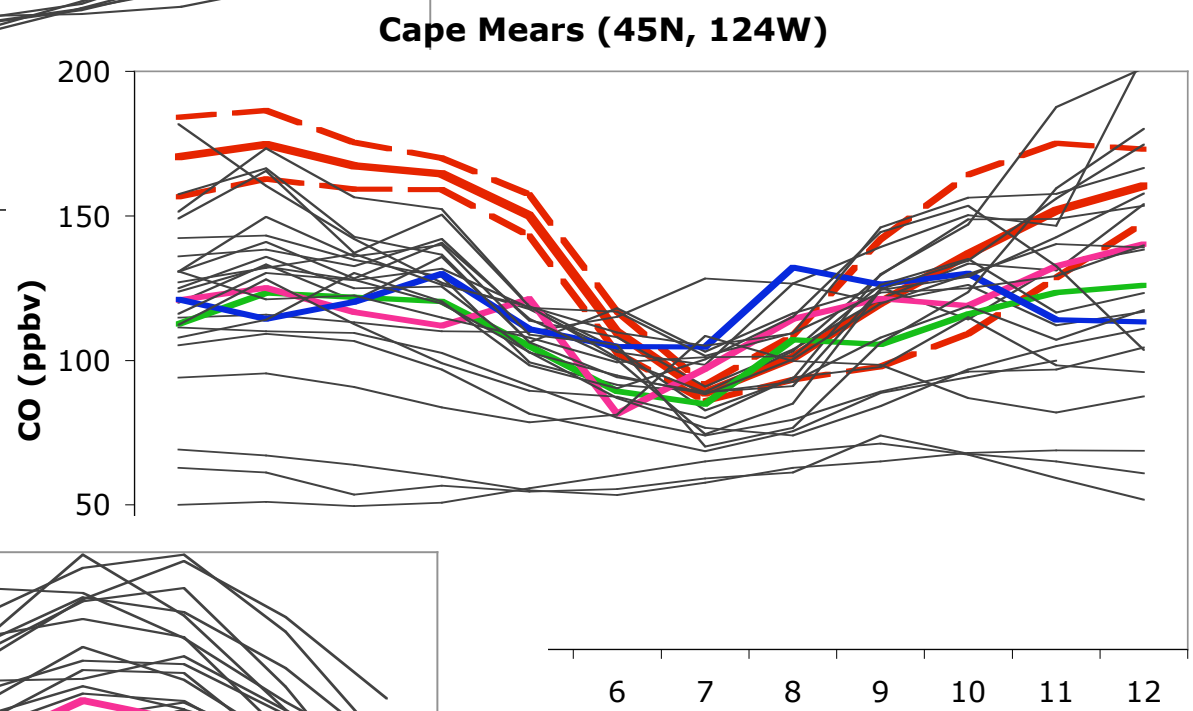
Tropical CO in IPCC AR4 models vs MOPITT

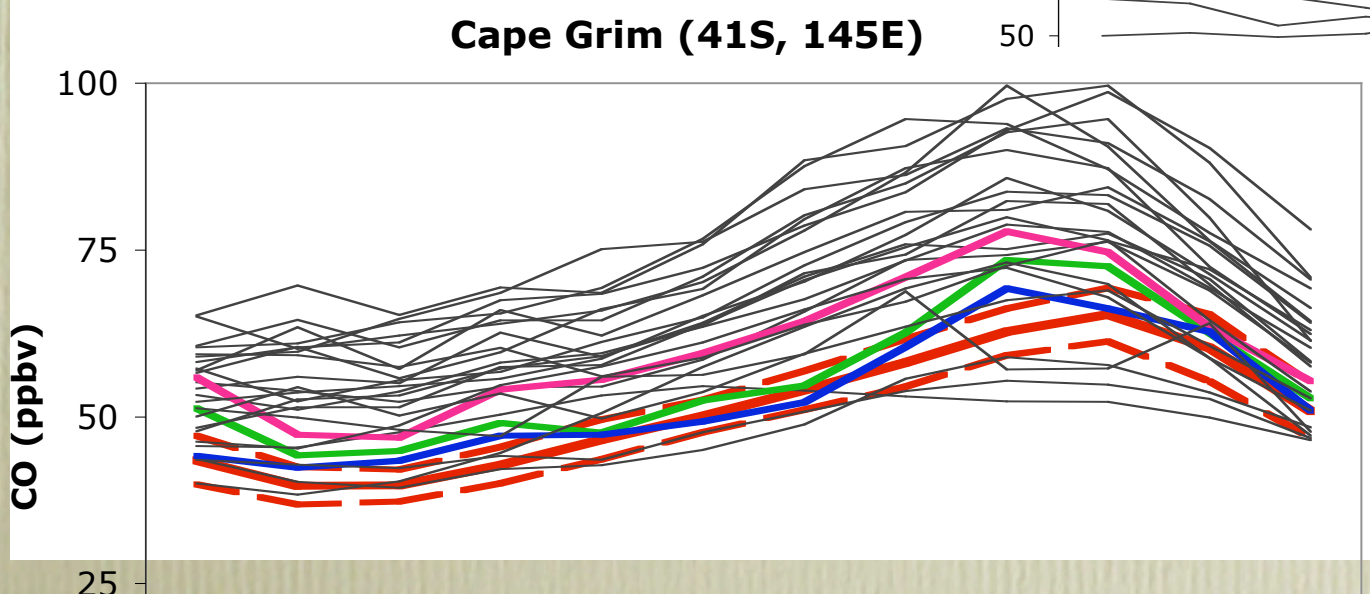



XT to TROP ratios, MOPITT and all models 500 hPa
1.2
1.1
1.0
0.9
0.8
0.7
0.6
NHXT/TROP
SHXT/TROP
CHASER_CTM
CHASER_GCM
FRSGC-UCI
GEOS-CHEM
GISS
GMI-CCM
GMI-DAO
GMI-GISS
IASB
LLNL-IMPACT
LMDZ/INCA-CTM
LMDZ/INCA-GCM
MATCH-MPIC-ECMWF
MATCH-MPIC-NCEP
MOZART2-GFDL
MOZART4-NCAR
MOZECH
MOZECH2
OsloCTM2
p-TOMCAT
STOCHEM_HadAM3
STOCHEM_HadGEM
TM4
TM5
ULAQ
UM_CAM
MODEL AVERAGE
MOPITT

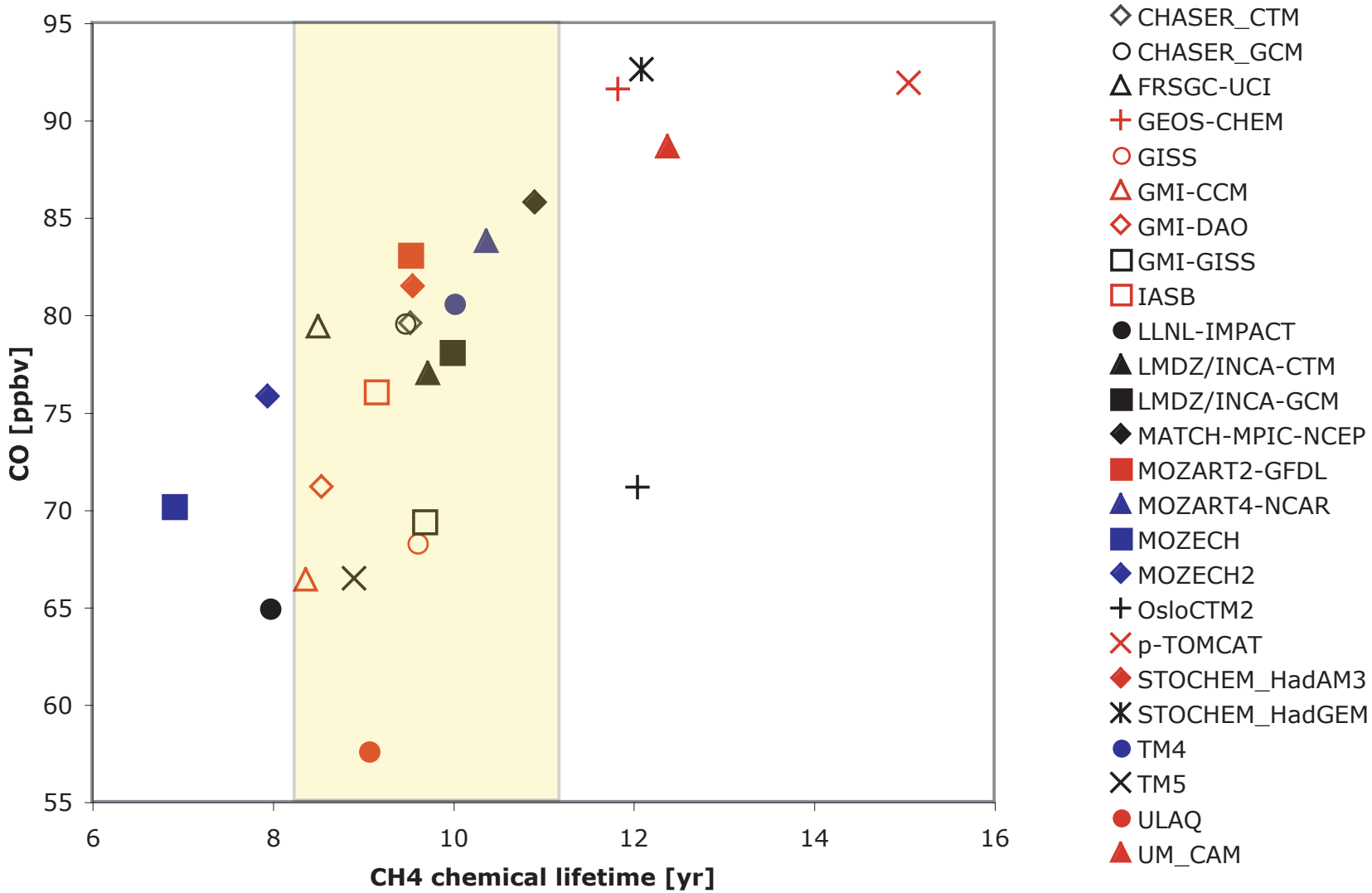
Surface data





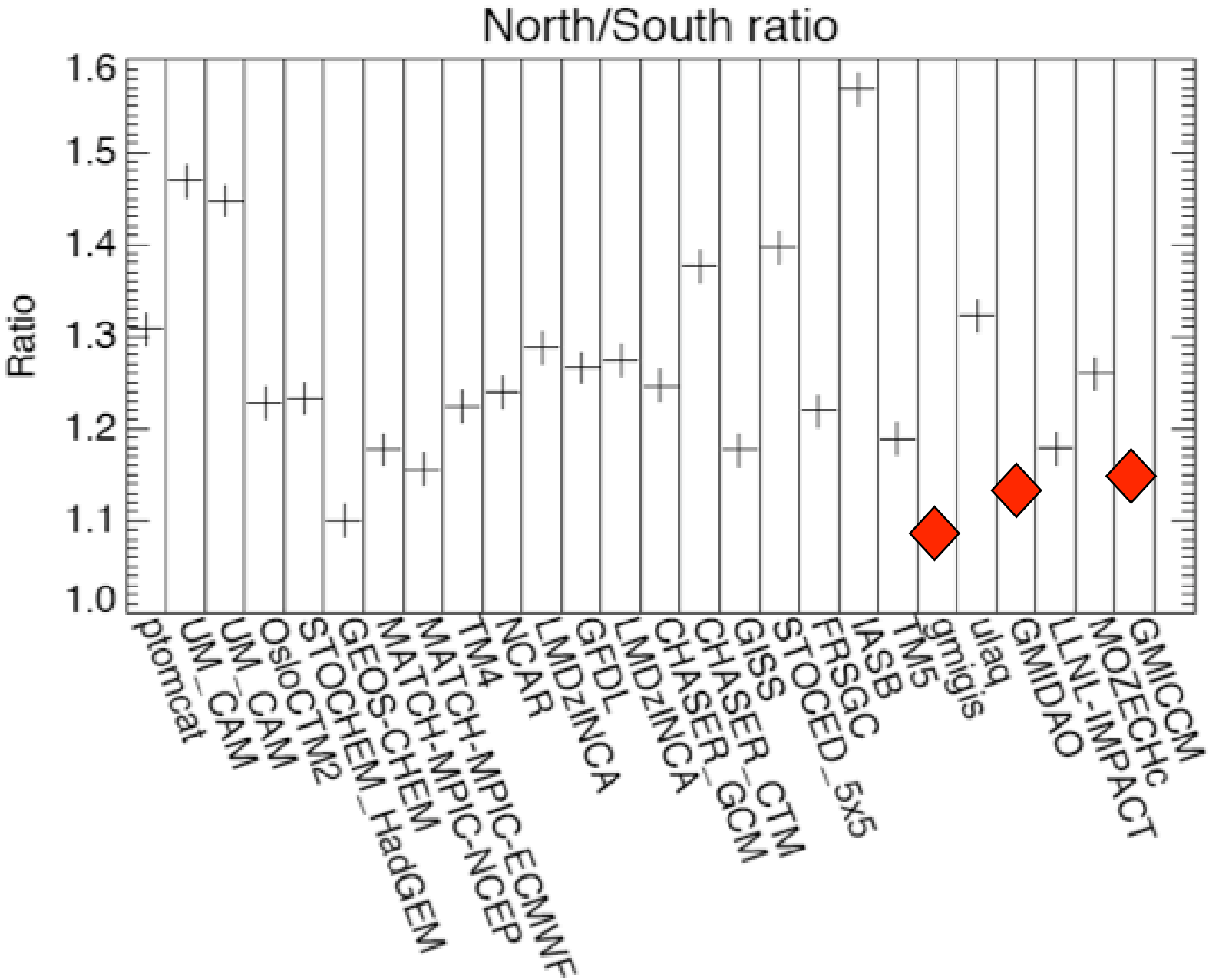


Multi-model oxidation capacity



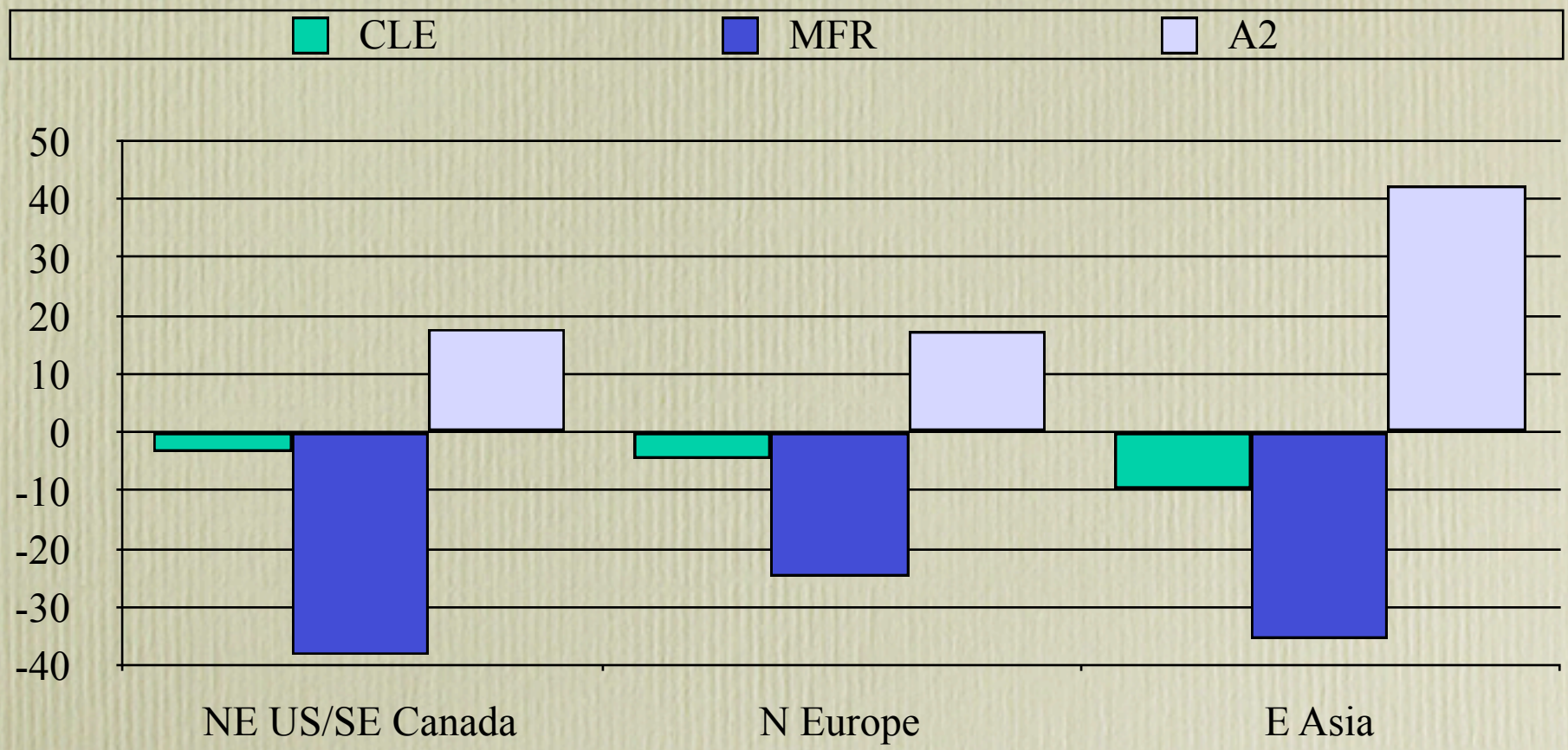
R=0.68 (all), R=0.80 (w/o 3 outliers)

Multi-model oxidation capacity



CO in 2030 simulated in IPCC AR4 models

near-surface (850 hPa)



Standard deviation 2-7 ppbv between models

Conclusions

- NH sources too small in AR4 simulations
- GMI model very low CO in SH extratropics relative to most other models and MOPITT, more SH hydroxyl than other models, especially GMI-GISS
- Spread between GMI met versions ~20%
- Influence of future emissions may be extremely large, and is quite robust