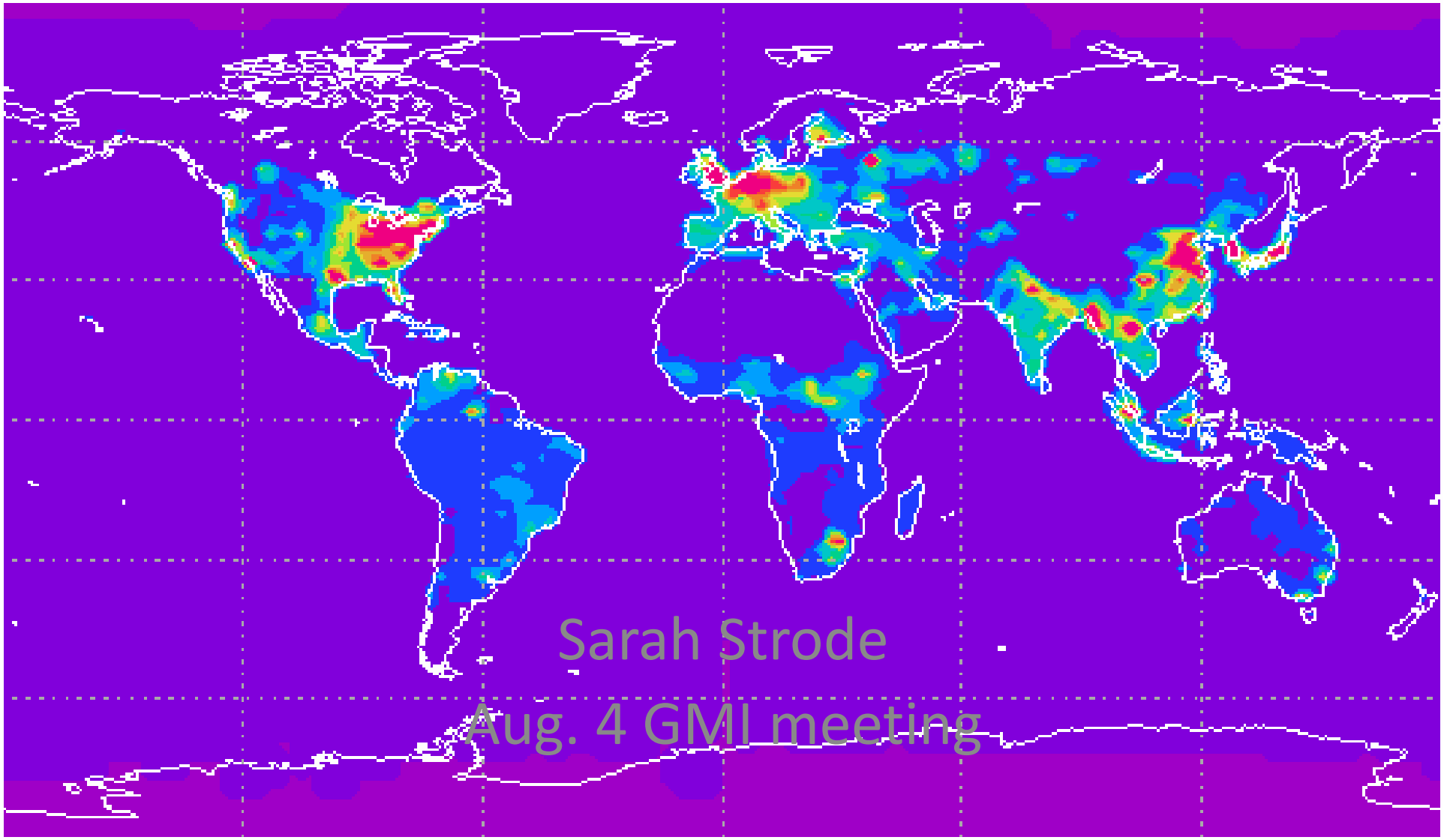
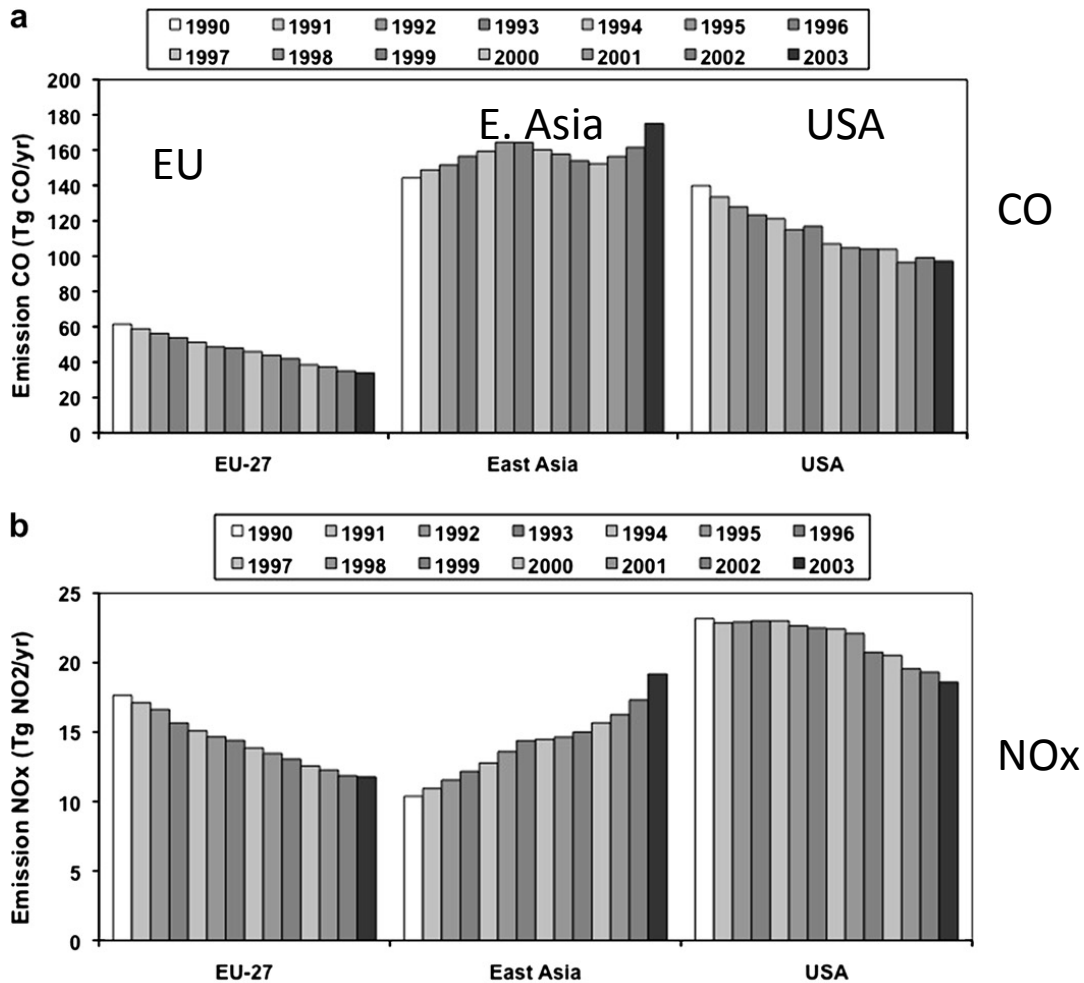
Historic Emission Options for Hindcast Simulation



Changing emissions

- Regional changes in anthropogenic emissions:
  - increases in Asia
  - decreases in Europe & N. America

1990-2003 Emission trends

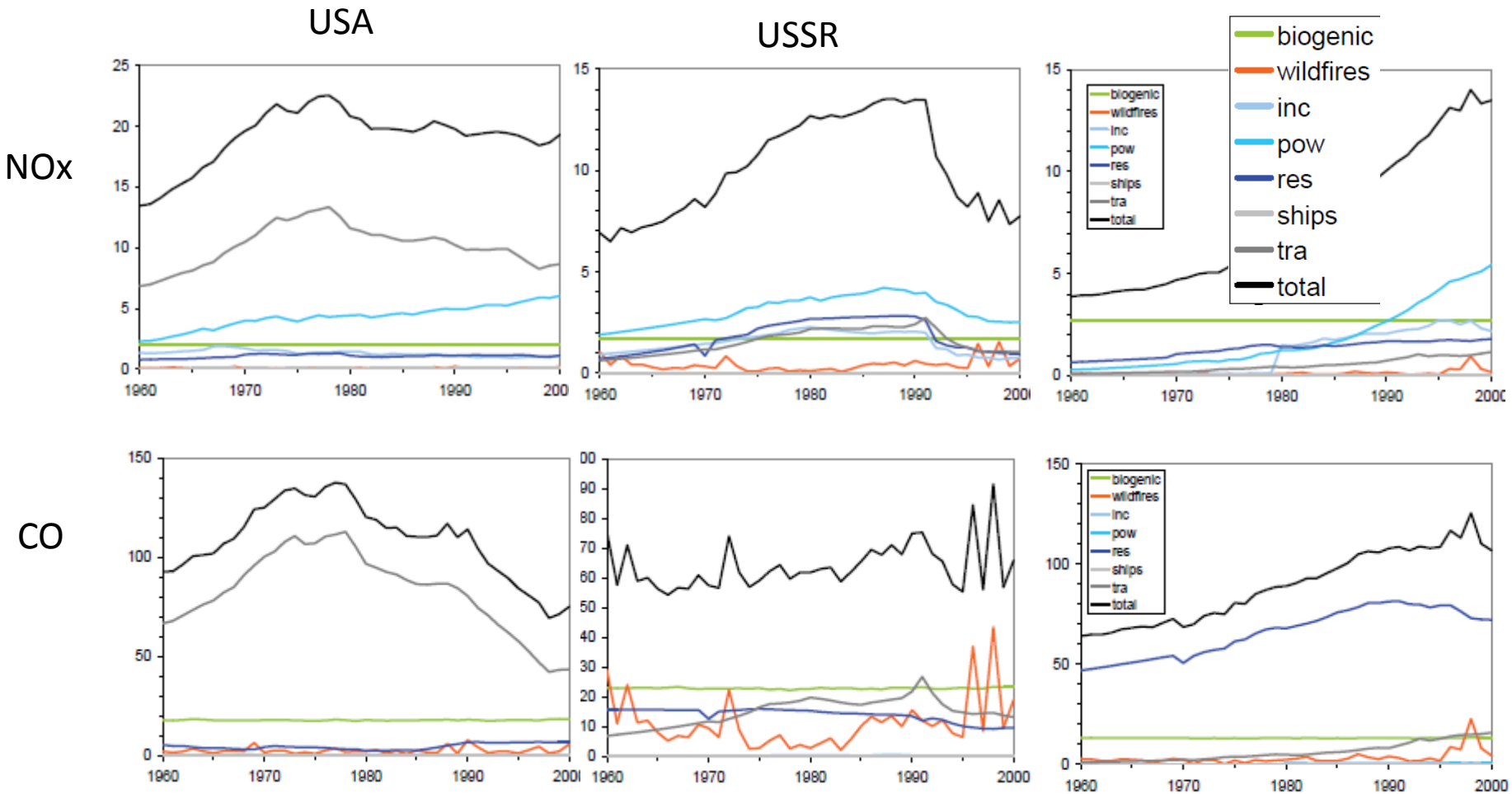


CO

NOx

Monks et al. 2009

Trends by region and sector

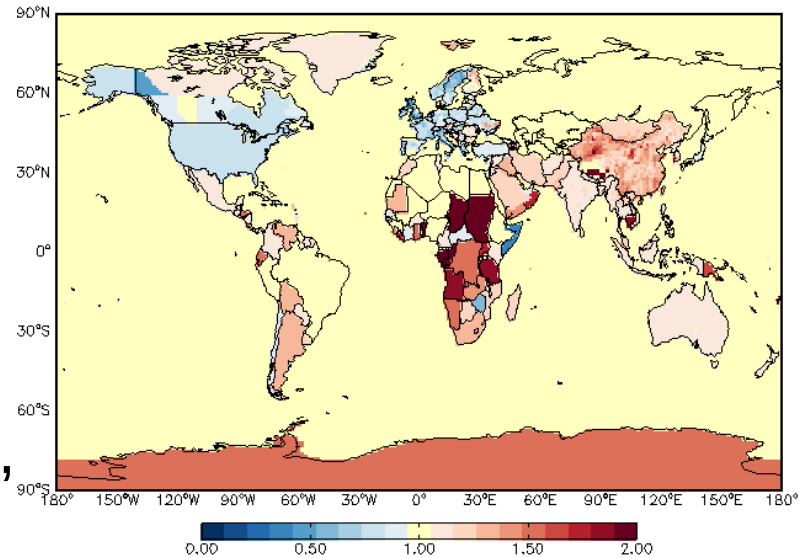


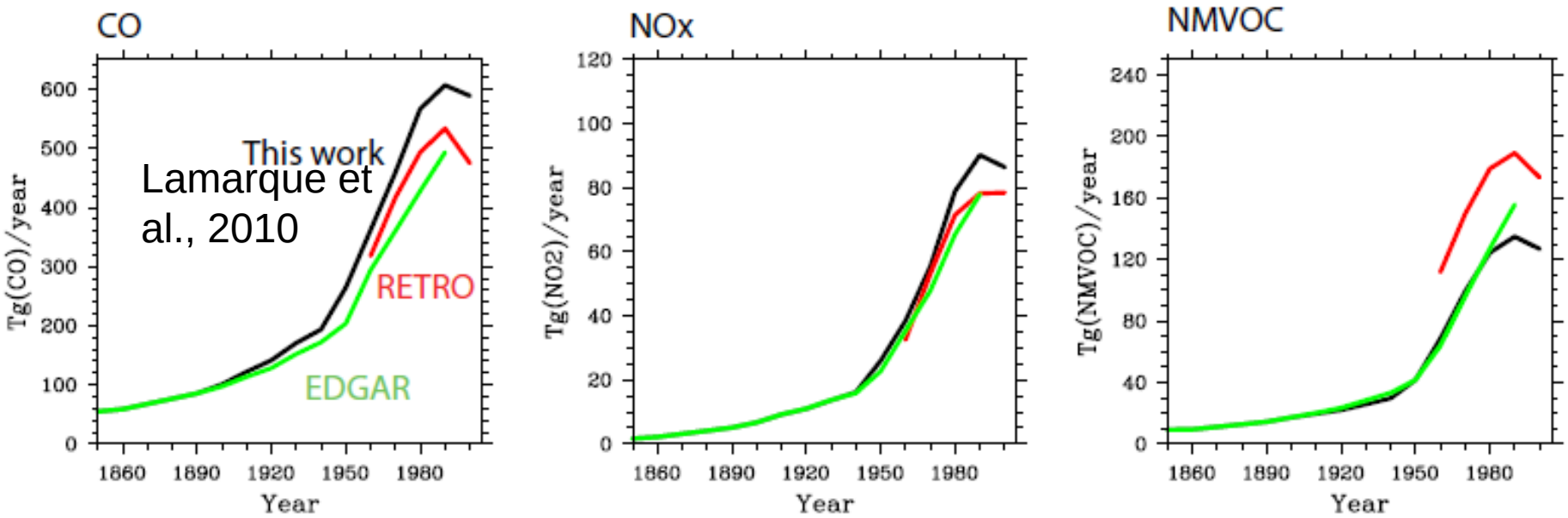
RETRO inventory (Shultz et al., 2007)

Global Anthropogenic Inventories

- Harvard Emissions (annual scaling factors, superposition of regional inventories
- EDGAR
- RETRO
- ACCMIP (Lamarque et al. 2010), decadal

Harvard CO scaling factors (2006/2000)

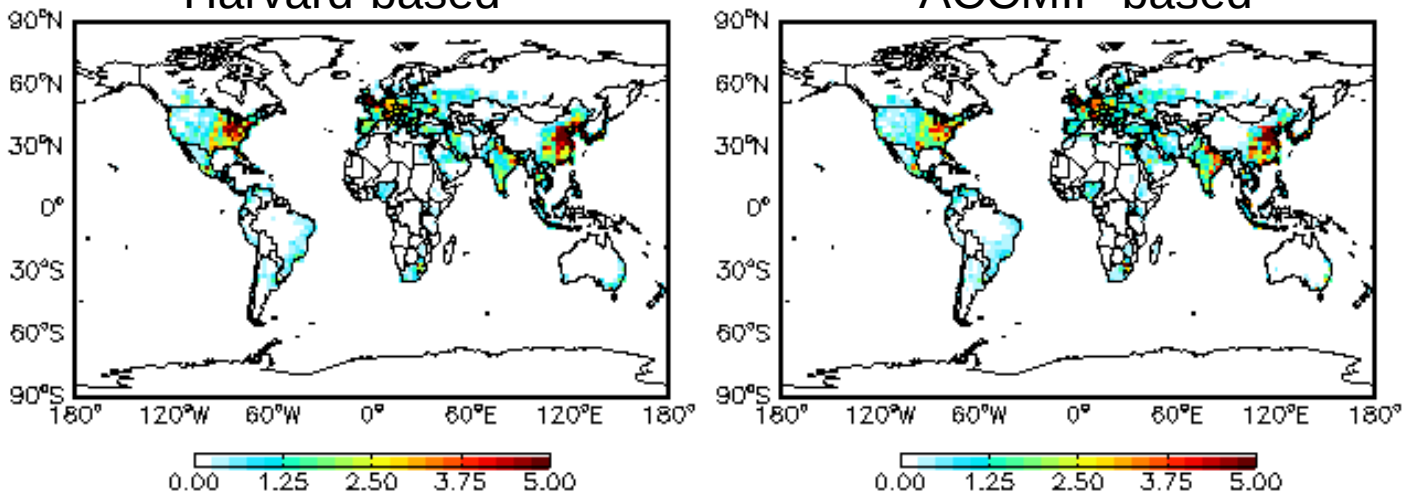




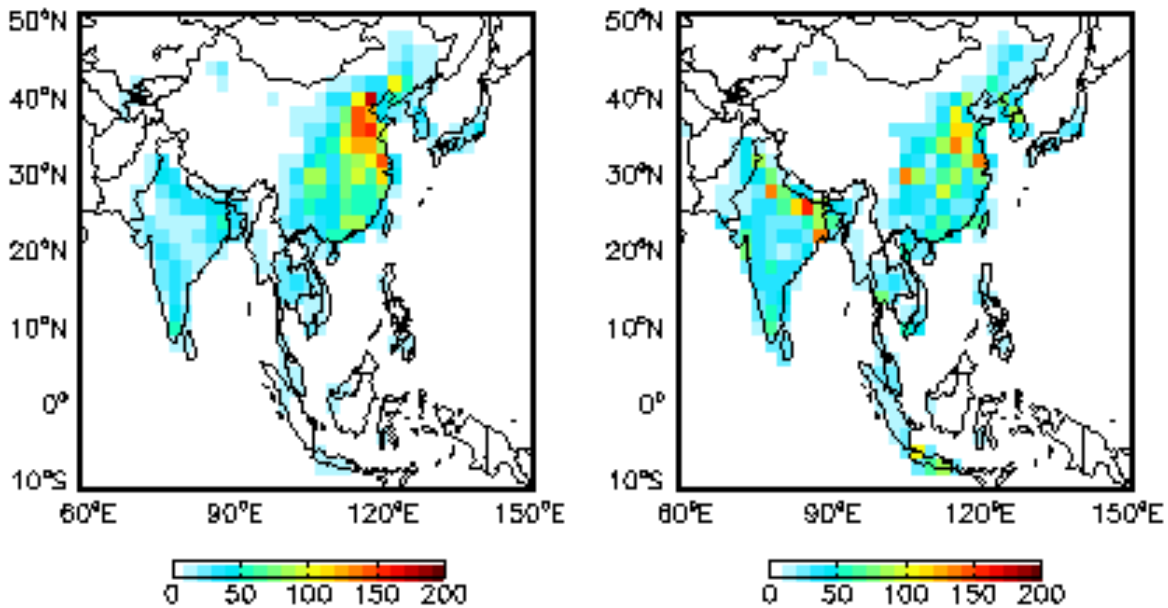
2005 Anthropogneic Emissions

Harvard-based | ACCMIP-based

NO:



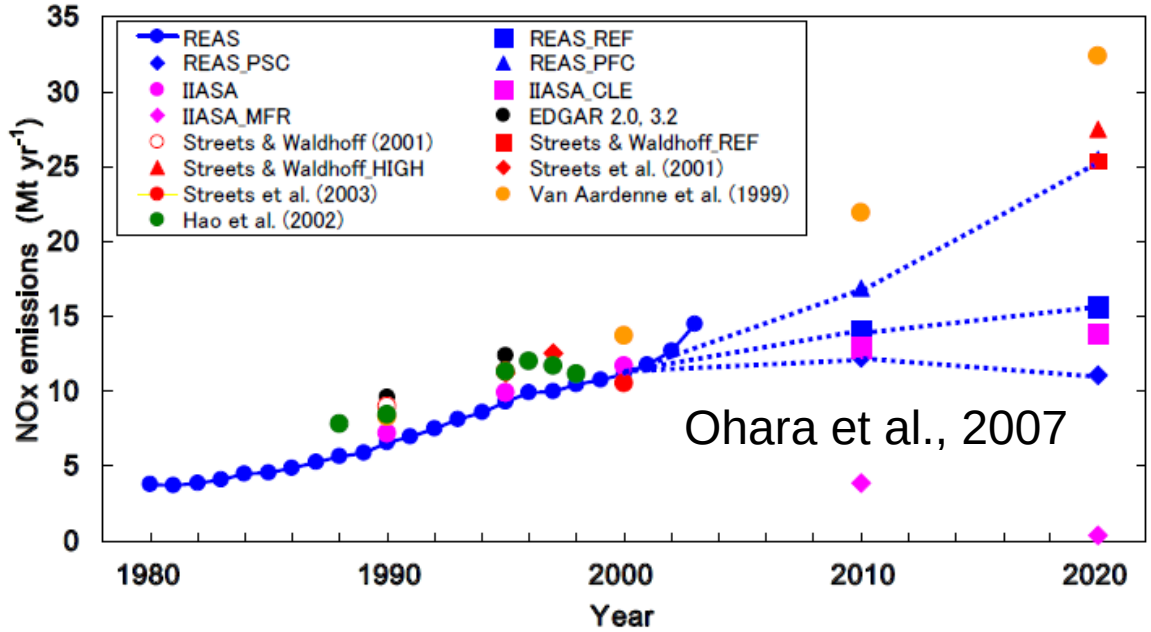
CO:



Regional Inventories

- EPA (US)
- EMEP(Europe)
- REAS, Streets, Zhang (Asia)

NOx emissions in China:



Comparison of US emissions (Lamarque et al., 2010)

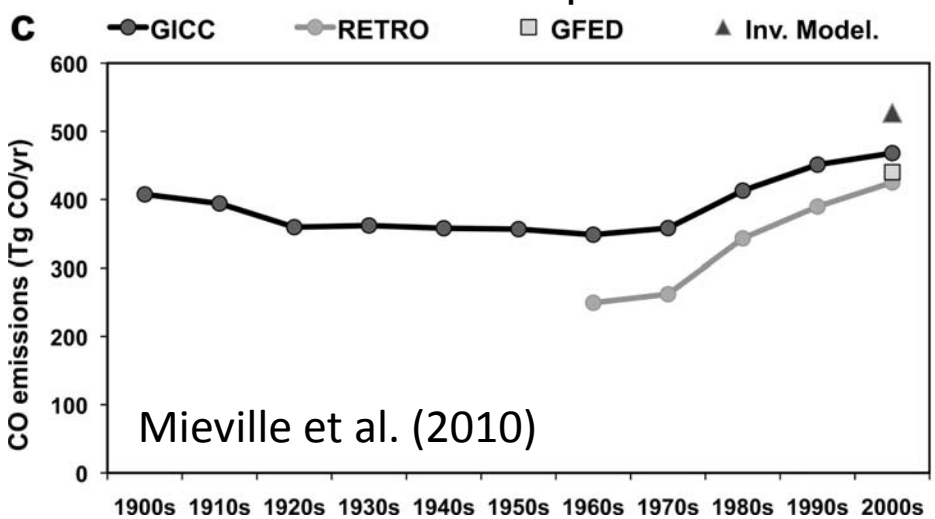
1990	CO	NOx	Total VOCs	SO2
EDGAR-HYDE	95.1	21.8	24.2	N/A
RETRO	96.4	19.1	*	N/A
EPA-2003	89.2	21.8	18.9	21.3
EPA-2006	143.6	25.2	23.1	23.1
This work	112.1	20.6	23.8	19.0

2000	CO	NOx	Total VOCs	SO2
EDGAR-HYDE	N/A	N/A	N/A	N/A
RETRO	55.7	18.5	*	N/A
EPA-2003	98.4	22.4	18.3	16.2
EPA-2006	102.4	22.3	16.9	16.3
This work	93.0	19.6	15.2	14.8

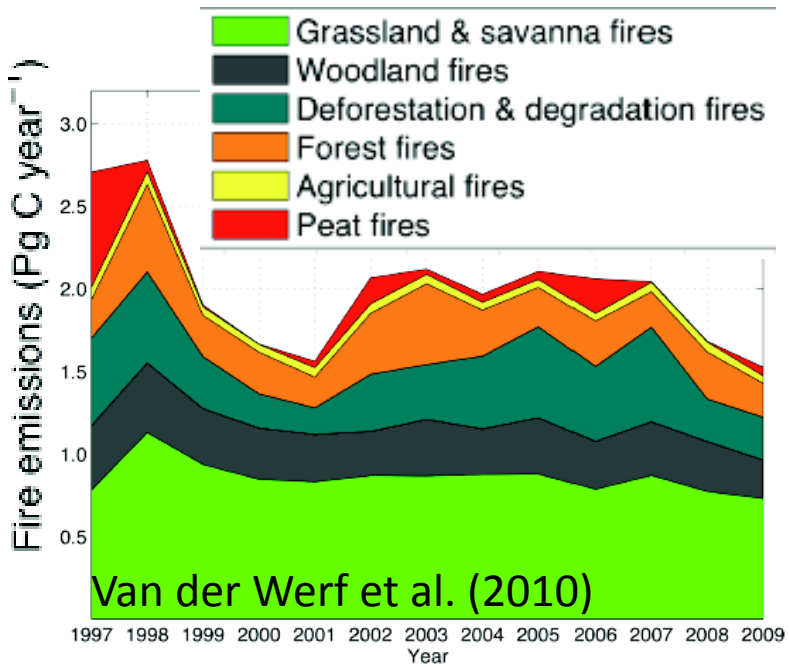
Biomass Burning

- GFEDv3 (1997-2009)
- RETRO (1960-2000)
- Duncan et al. (1979-2000)
- GICC (1900-2005, decadal until 1997)
- ACCMIP(1850-2000, decadal)

CO emission comparison



GFEDv3, 1997-2009 variability



Summary

- Time-dependent emissions available for 1980s to mid-2000s
- Several options to choose from
- Variability between inventories as well as between years --> care needed if switching between inventories between 2 years