# Long-term trends

Jean-François Lamarque (NCAR)

Collaborators: D. Shindell (GISS), J. McConnell (DRI), J. Orlando and G. Tyndall (NCAR)

CAM-only simulations

- CAM3.5
  - 1.9x2.5x26L (≈ 40 km)
  - CCSM3 SSTs
  - Interactive chemistry (troposphere and stratosphere) and bulk aerosols
  - Long-lived (ODSs, CH_4, H_2, N_2O, CO_2) concentrations set at surface; everything else as emissions
  - Monthly output
  - Identical version used for CCMval
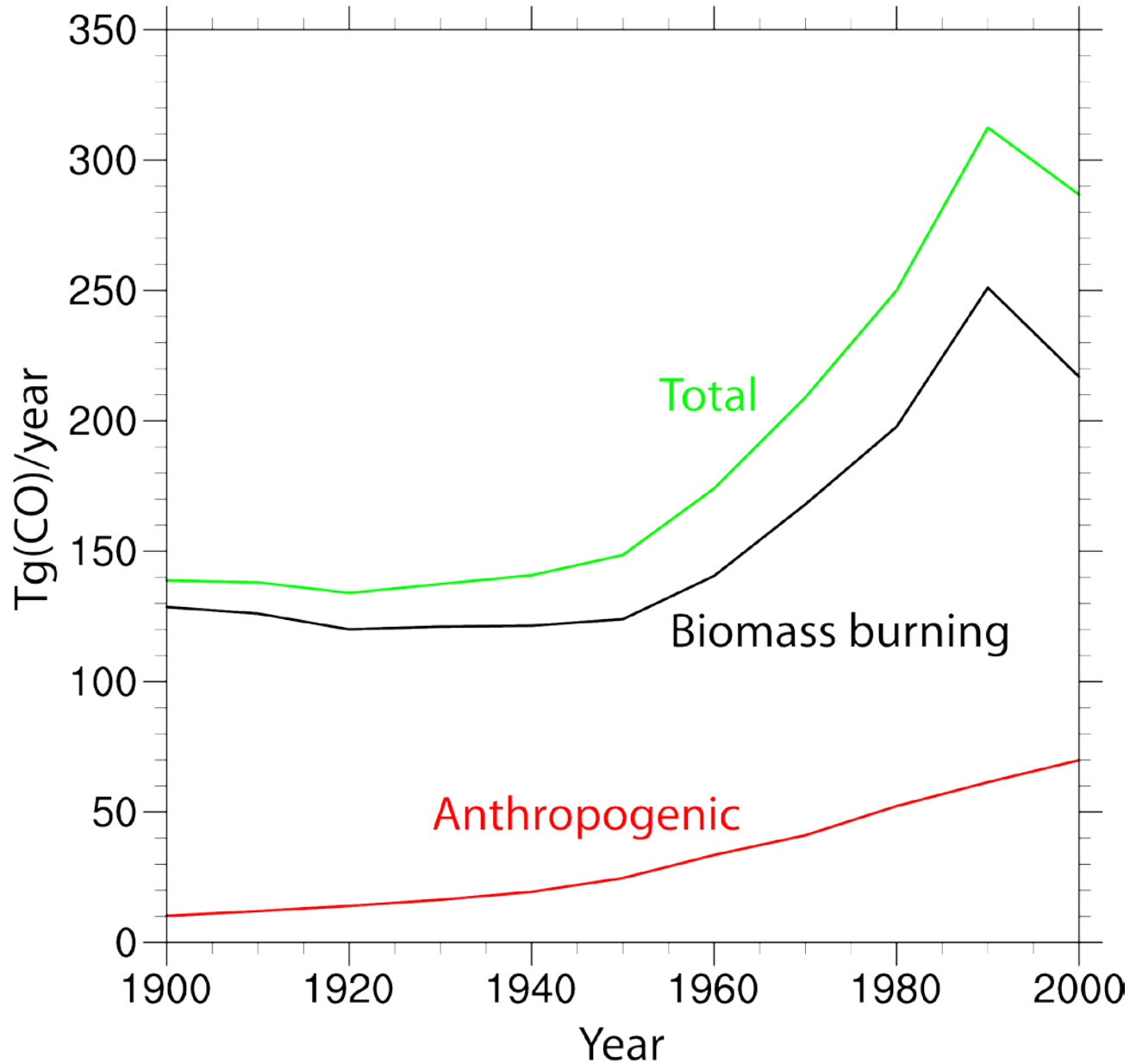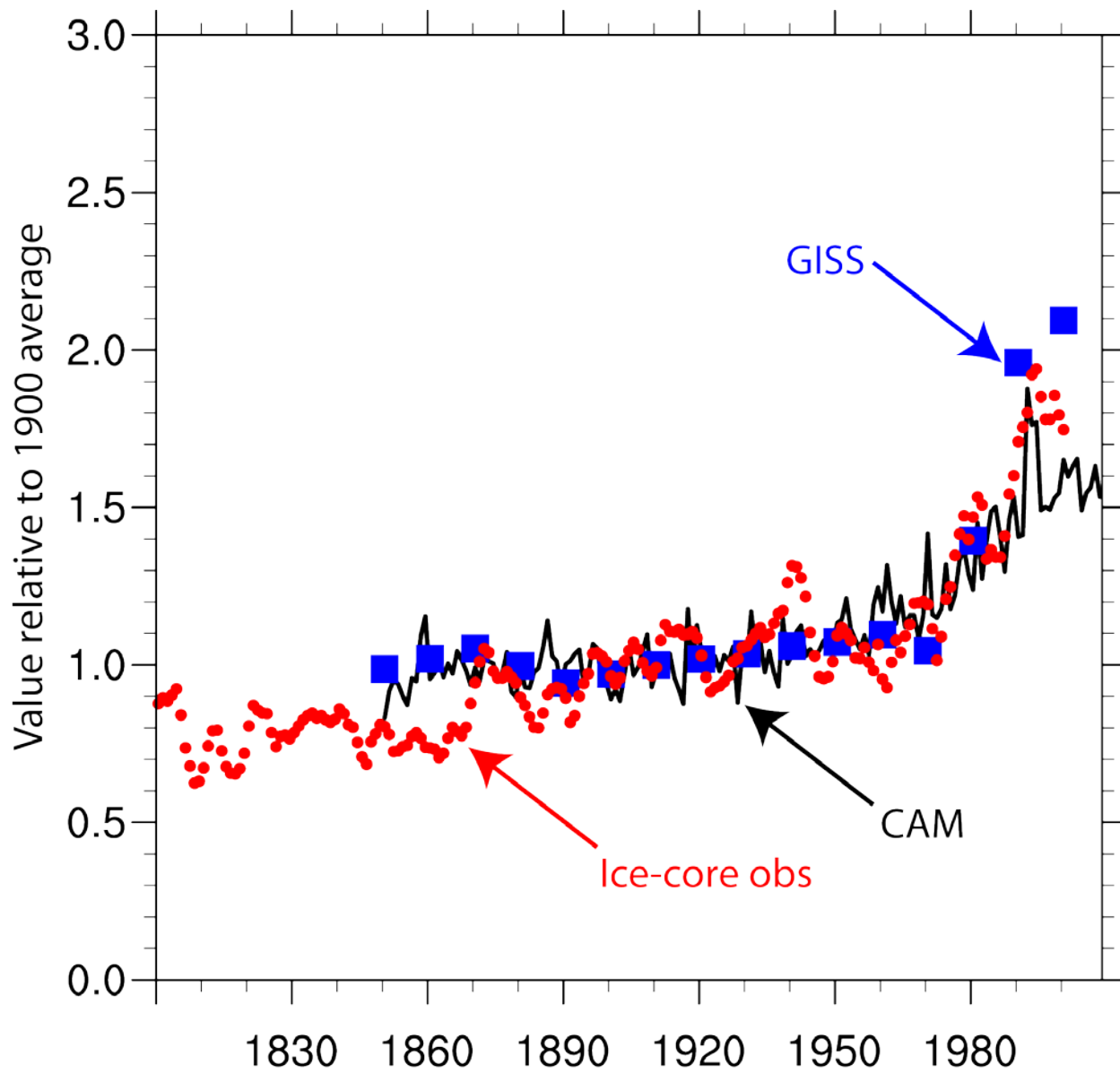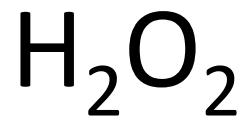 - IPCC emissions

CO at Mace Head
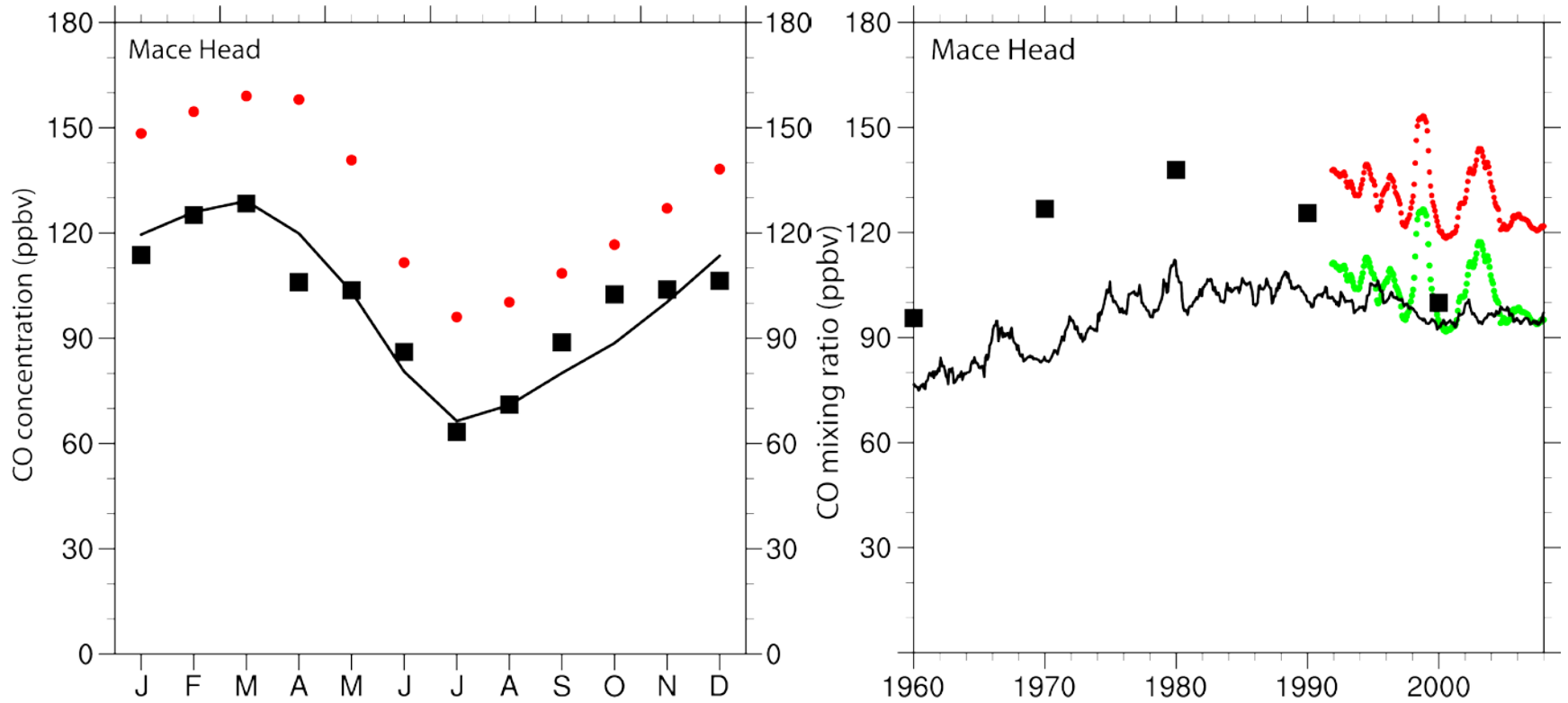
Ice-core record

- West Antarctica
- Several collection sites
- Spans several hundreds to thousands of years
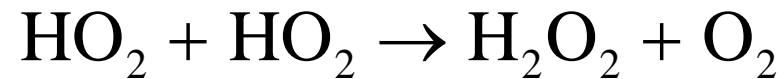- BC, non-sea salt sulfate,
- H_2O_2

Emissions in SH

H₂O₂

H2O2 chemistry

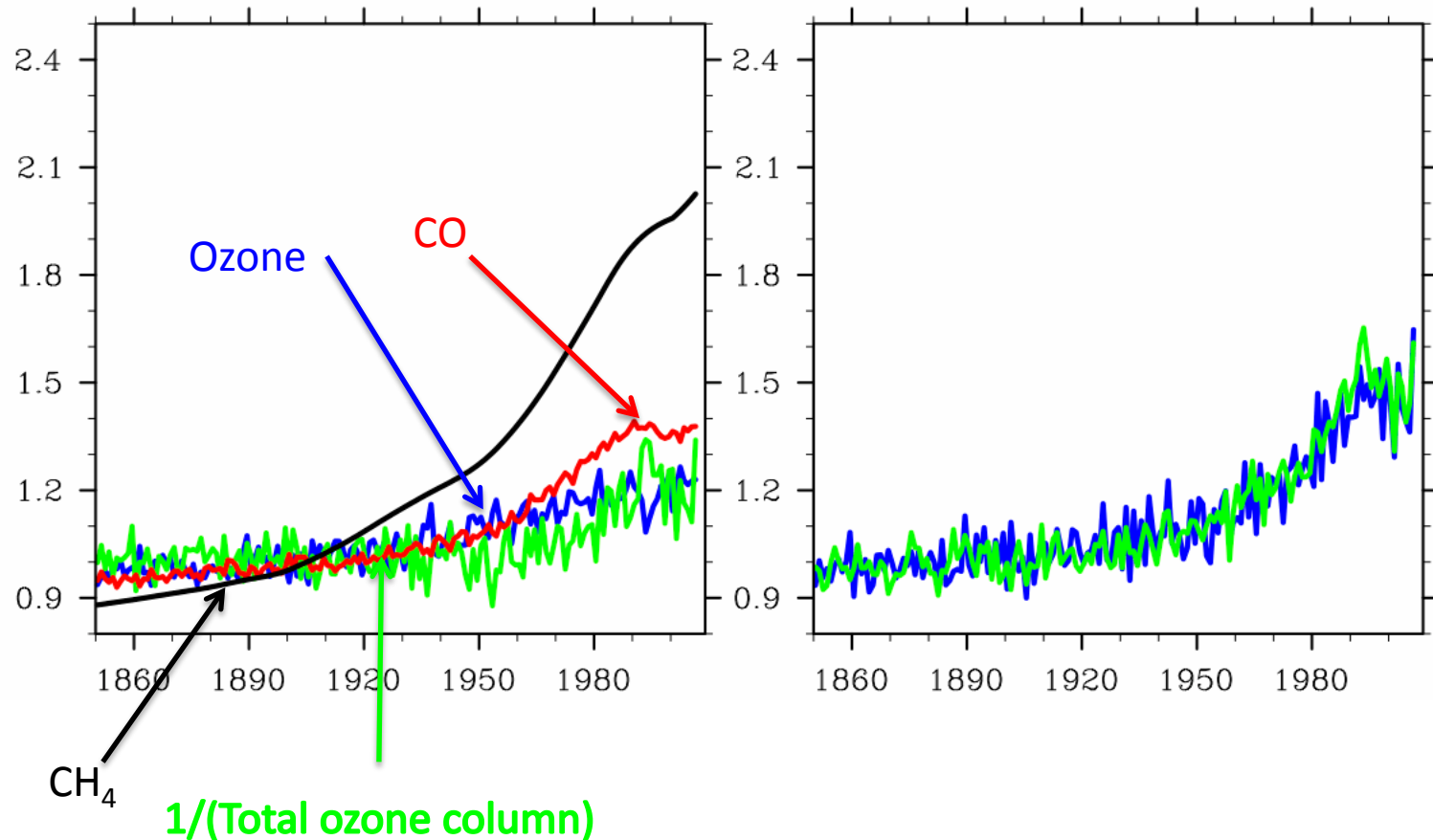- In low-NO$_x$ environment

$$[HO_2] \propto \sqrt{\{J(O^1D) \times [O_3]\}}$$

$$HO_2 + HO_2 \rightarrow H_2O_2 + O_2$$

CAM-chem results

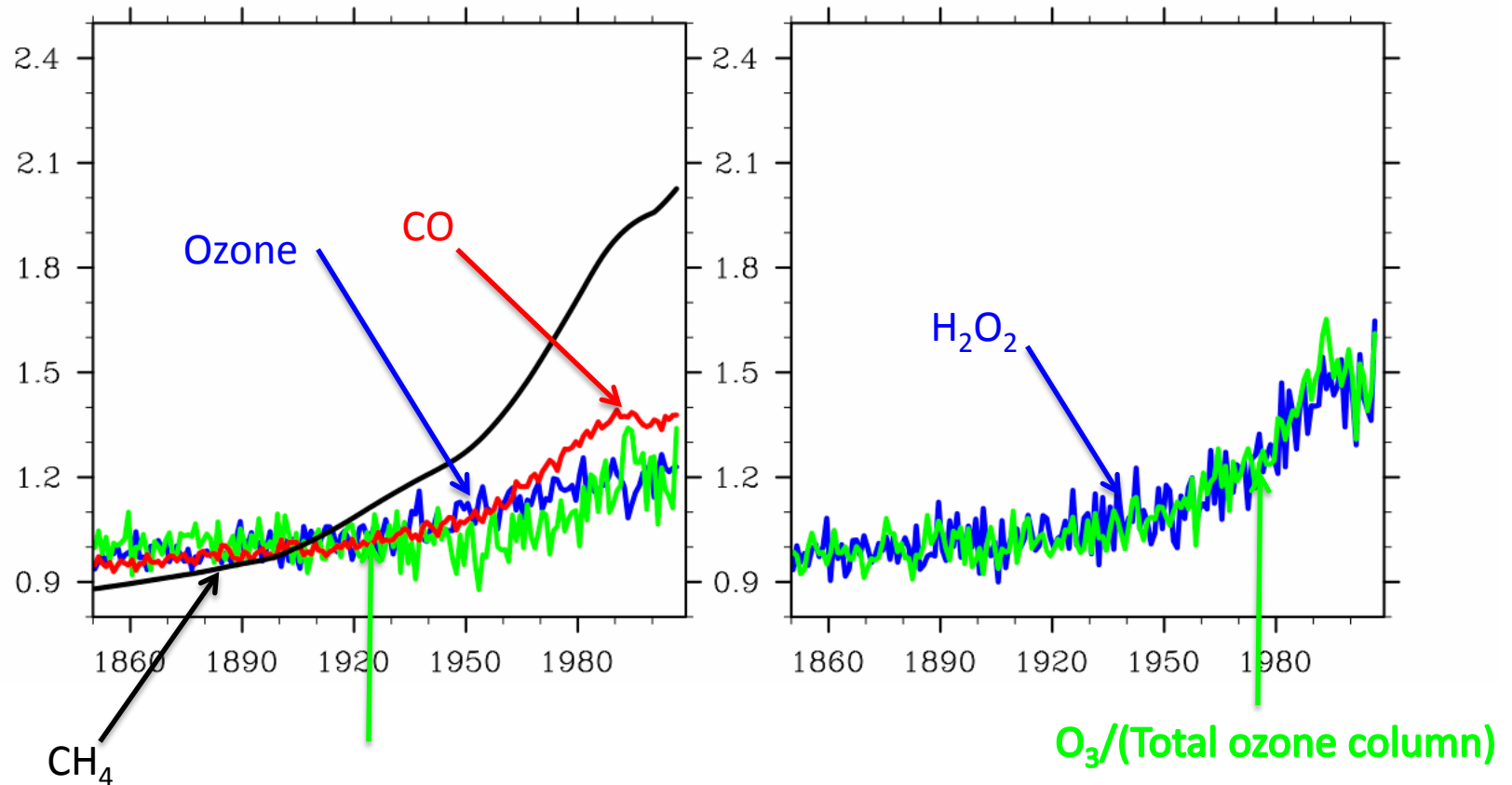## All curves normalized with 1890-1910 average

CAM-chem results

All curves normalized with 1890-1910 average

Ozone

CO

CH_4

H_2O_2

O_3/(Total ozone column)

TOC and H$_2$O$_2$
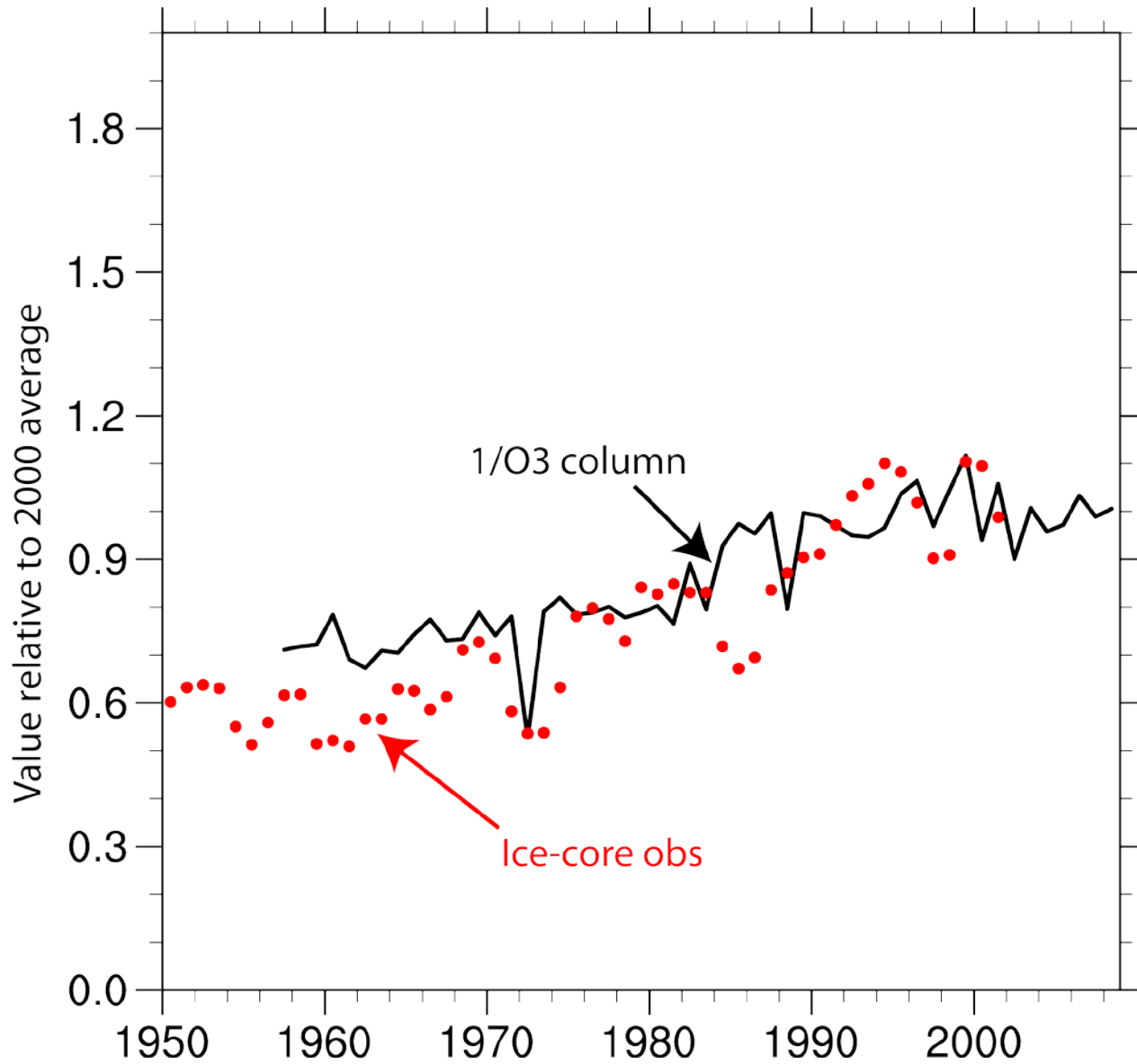
Additional studies

- CO in Greenland ice core (w/ V. Petrenko)
- Surface ozone from EPA
- Nitrogen deposition