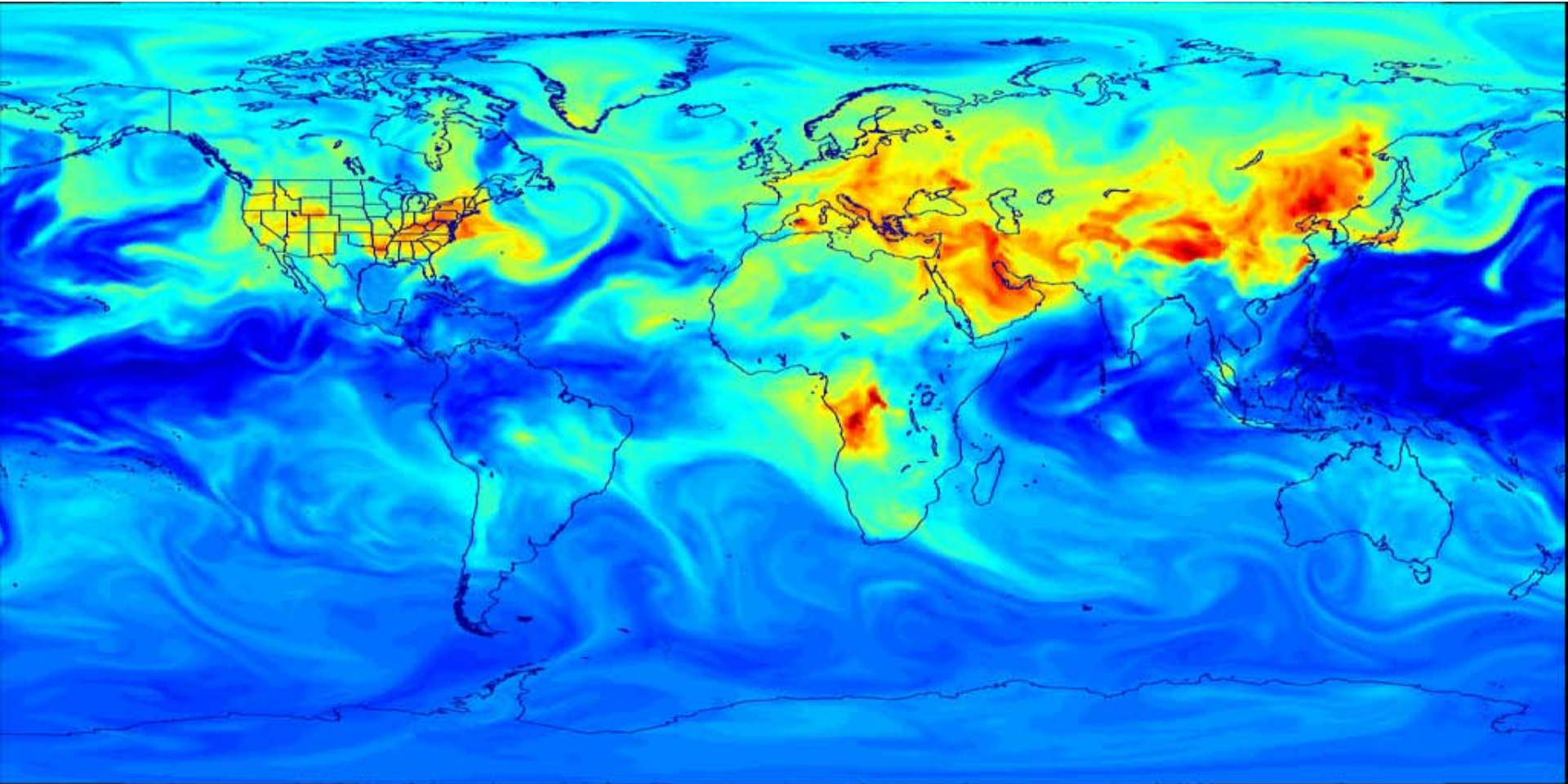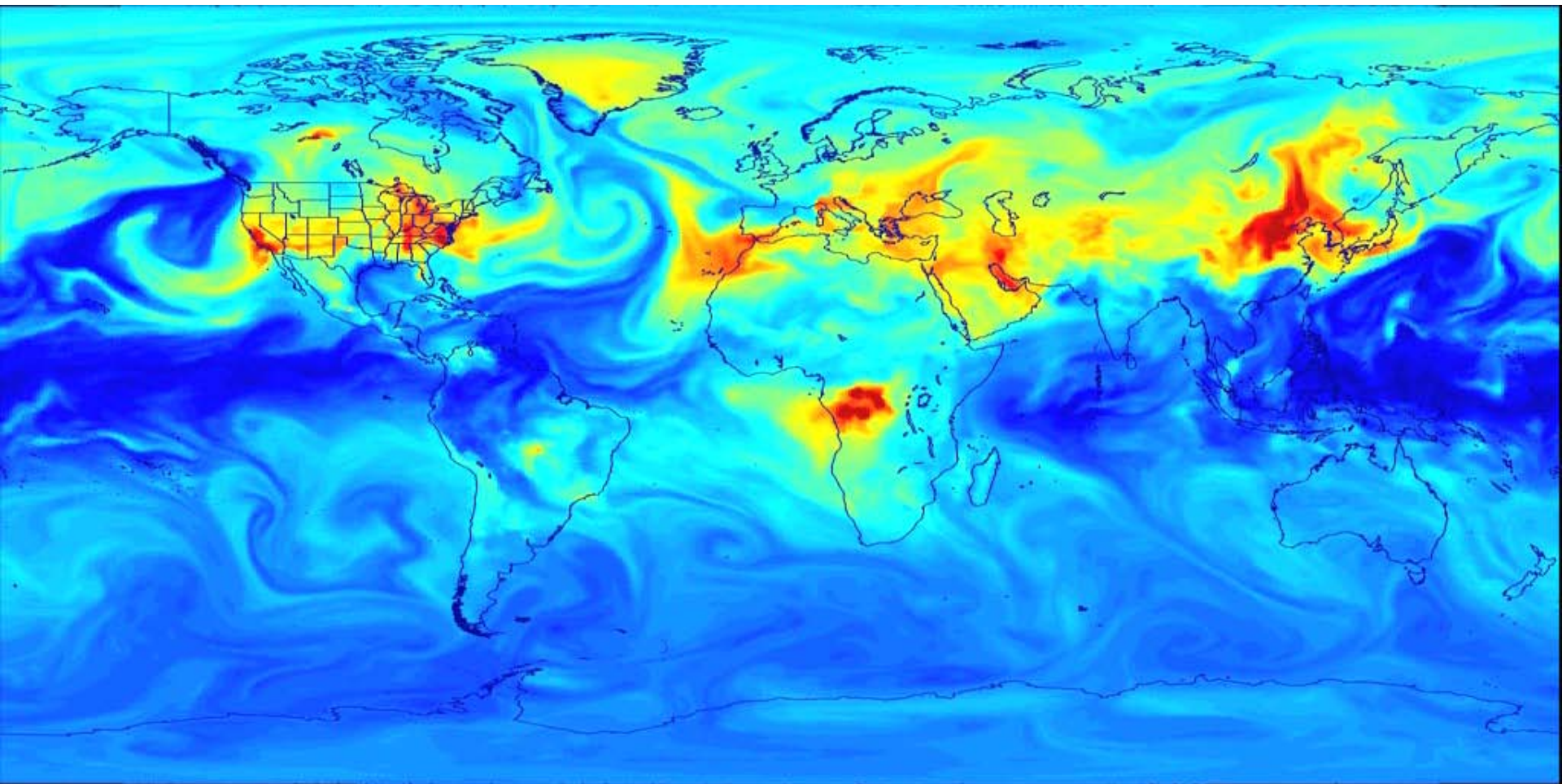# High Resolution CAM-Chem

Louisa Emmons - NCAR

Francis Vitt, Xiaoyan Jiang, Simone Tilmes, Jean-Francois Lamarque

Ozone – 0-2 km avg - June 13-22, 2008

CAM-chem - 0.47° x 0.63°
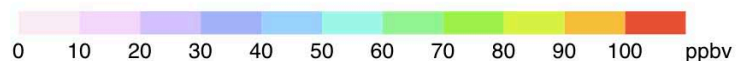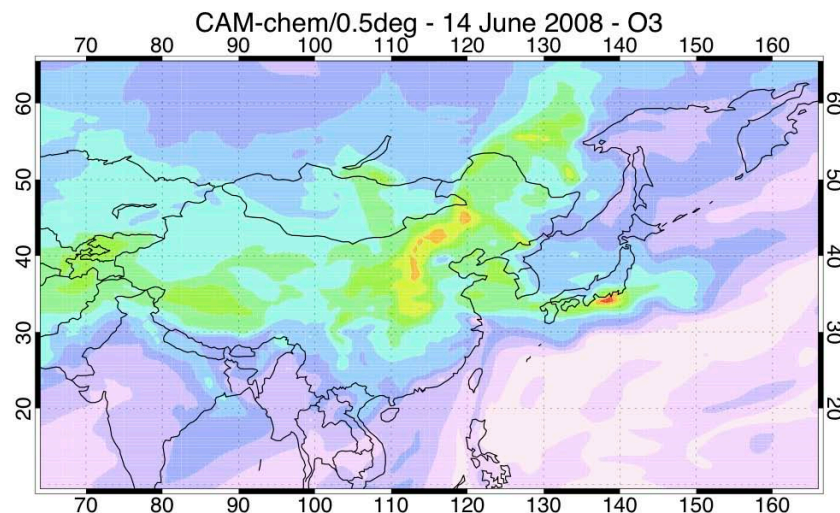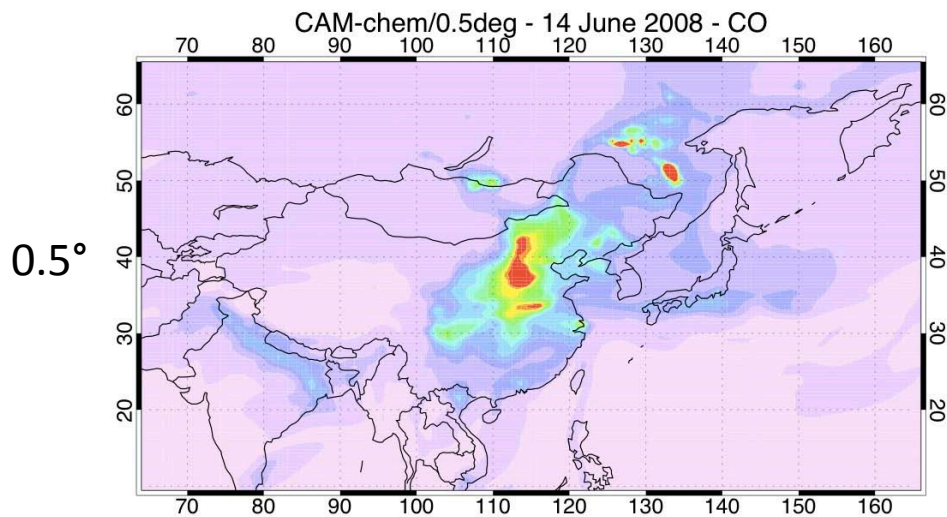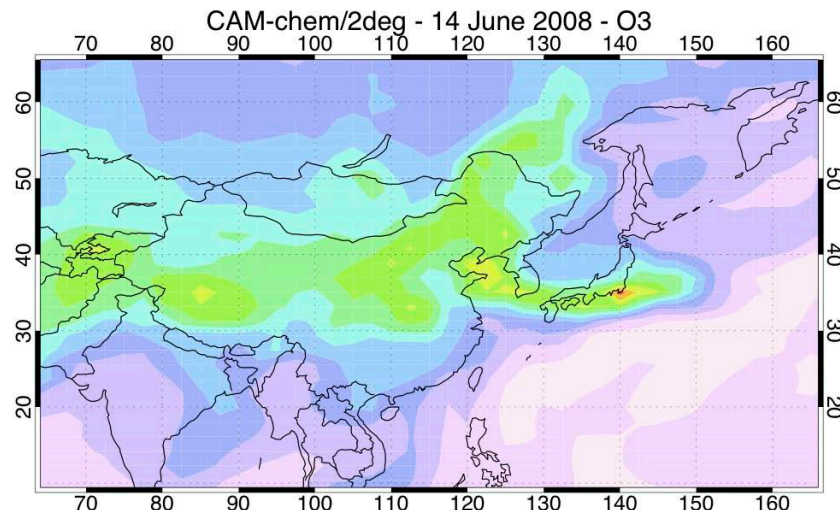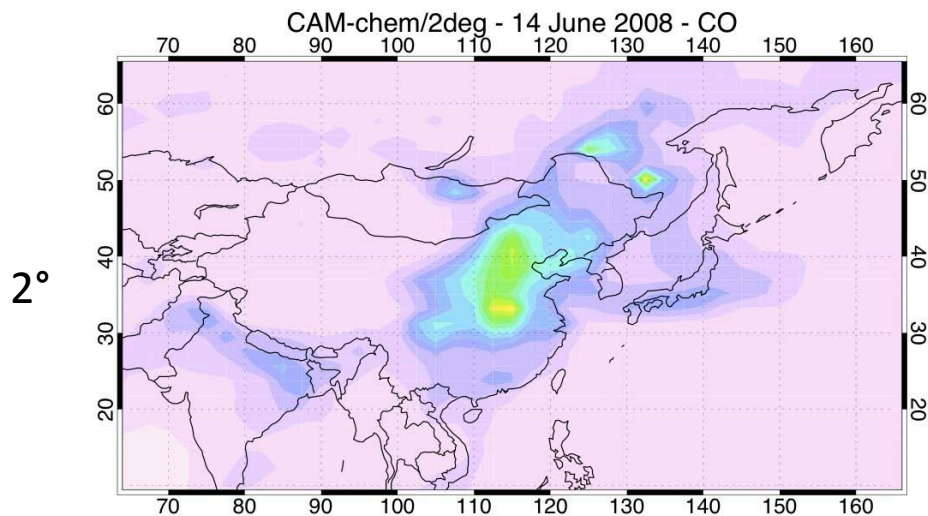
Animation by Tim Scheitlin, CISL

CAM-chem configuration

- CAM-4

- MOZART-4 chemistry, bulk aerosols

- 0.47° x 0.63°

- GEOS-5 specified dynamics (56 levels)

- Not with new MEGAN
  (waiting for land IC files)

- 2008 – ARCTAS-POLMIP emissions

Daily averages for June 14, 2008

Peak values are higher over source regions

CO   Ozone

CAM-chem/2deg - 14 June 2008 - CO

CAM-chem/2deg - 14 June 2008 - O3

2°

CAM-chem/0.5deg - 14 June 2008 - CO

CAM-chem/0.5deg - 14 June 2008 - O3

0.5°

0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 ppbv

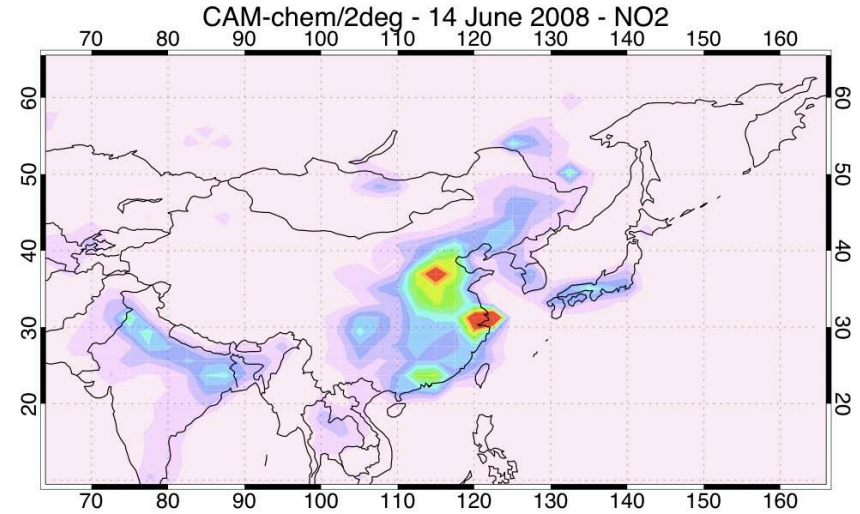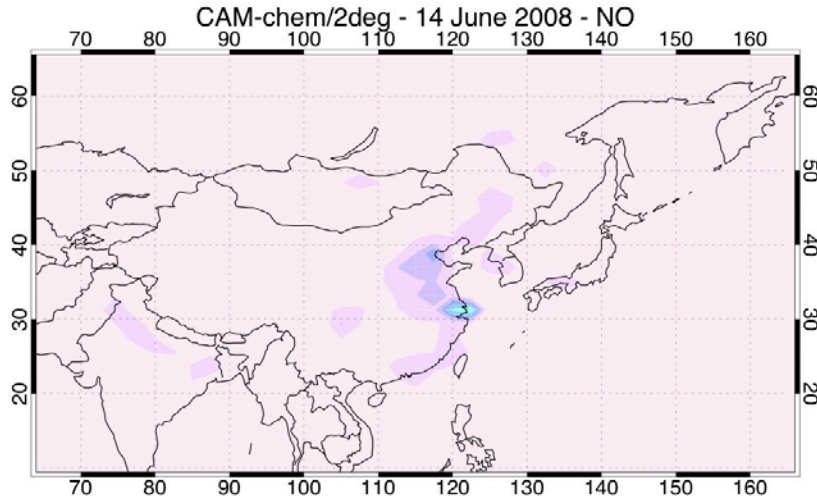0   10   20   30   40   50   60   70   80   90   100   ppbv

Cities are much more pronounced in fine resolution

NO

NO2

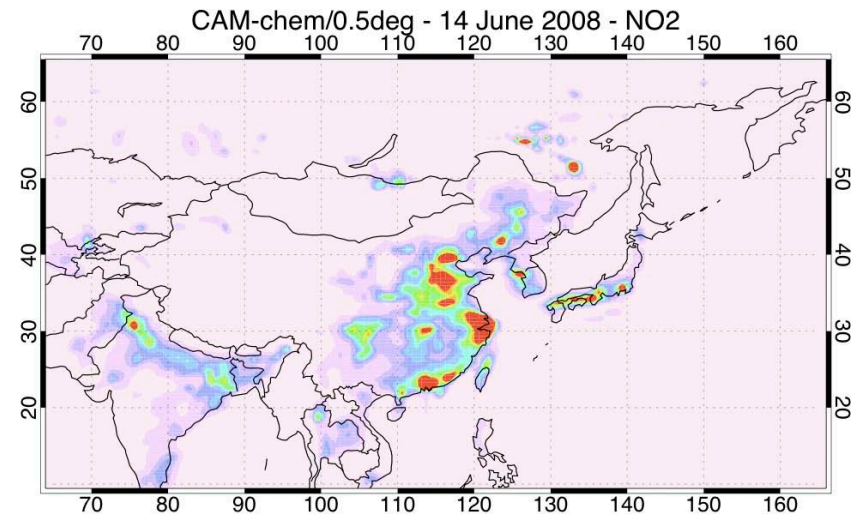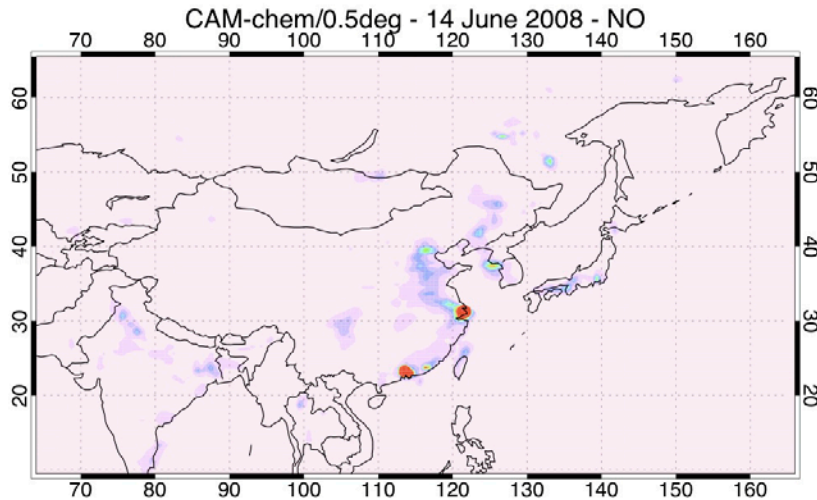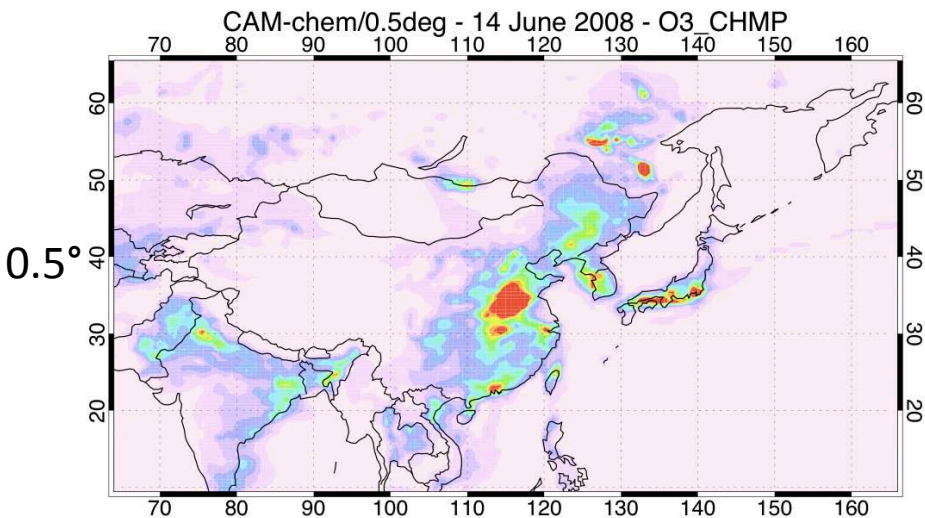2°

0.5°

CAM-chem/2deg - 14 June 2008 - NO

CAM-chem/2deg - 14 June 2008 - NO2

CAM-chem/0.5deg - 14 June 2008 - NO

CAM-chem/0.5deg - 14 June 2008 - NO2

0.0 0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 ppbv

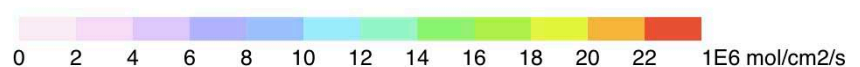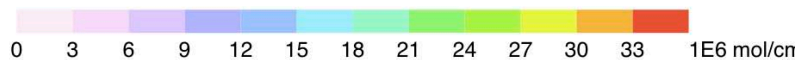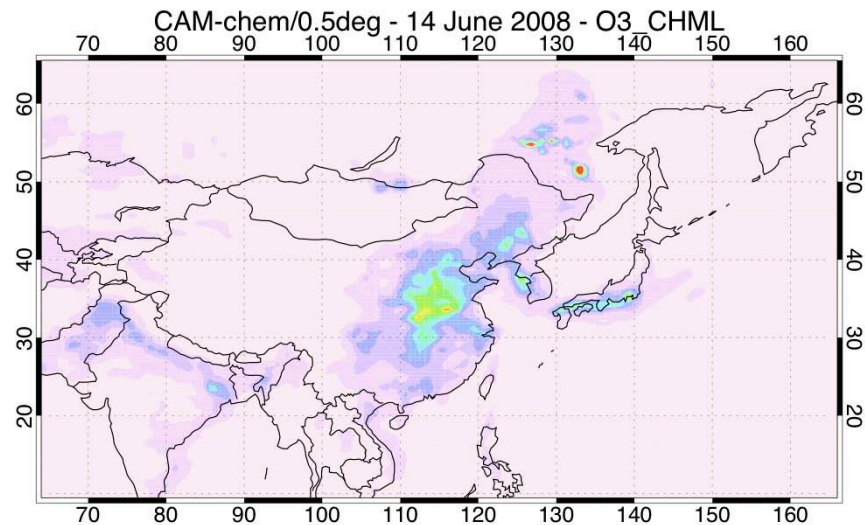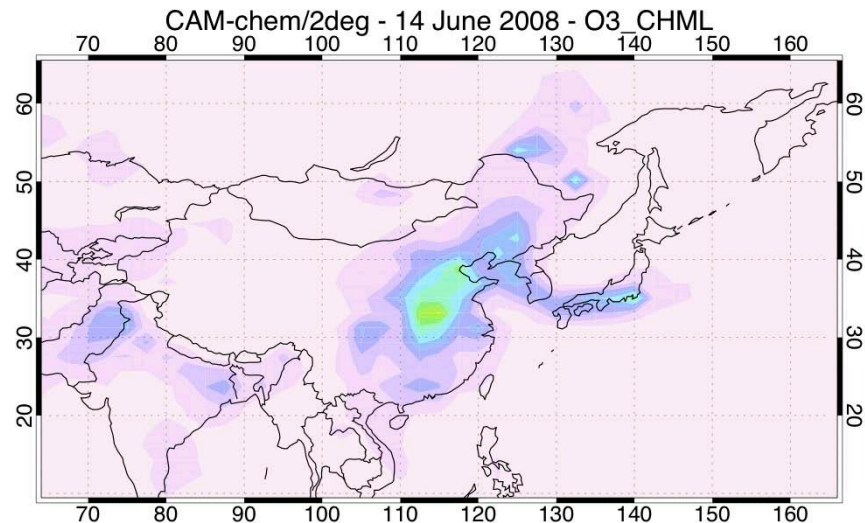0   1   2   3   4   5   6   7   8   9   10 ppbv
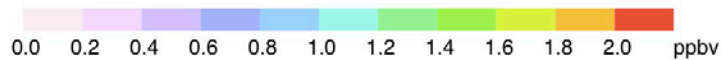
Spots of increased O3 production and loss in high resolution run over sources
Due to more concentrated NOx, affecting OH and HO2

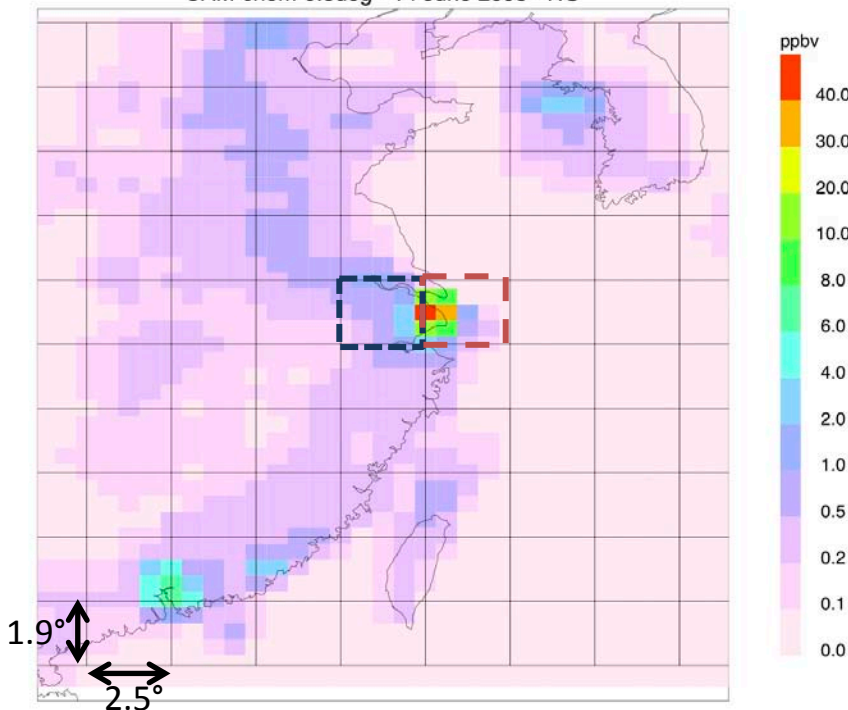### O3 production

O3 loss

2°

0.5°
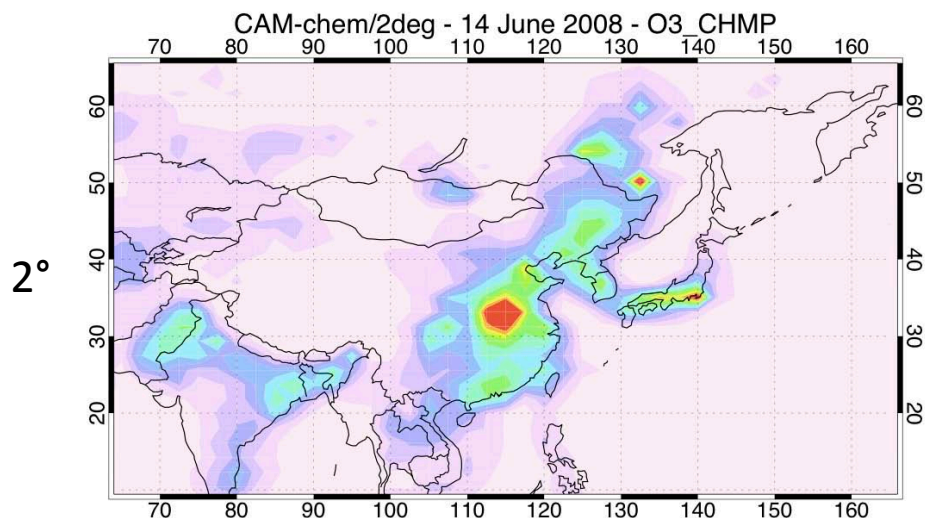
Comparison for Shanghai, China

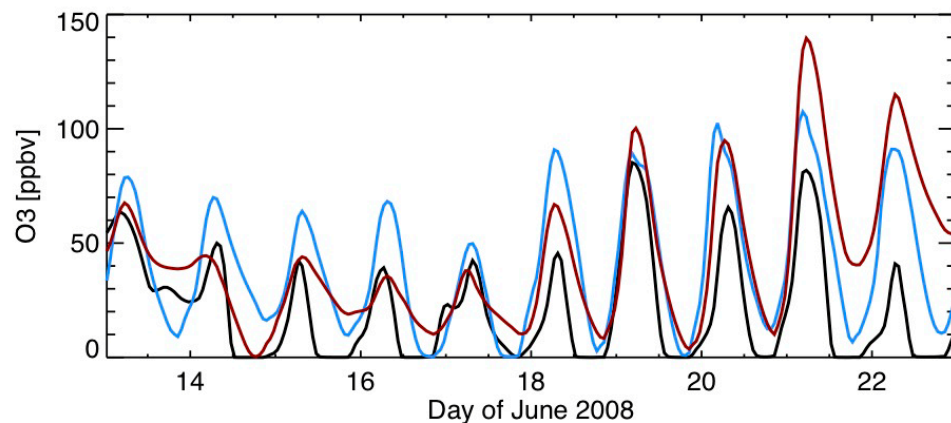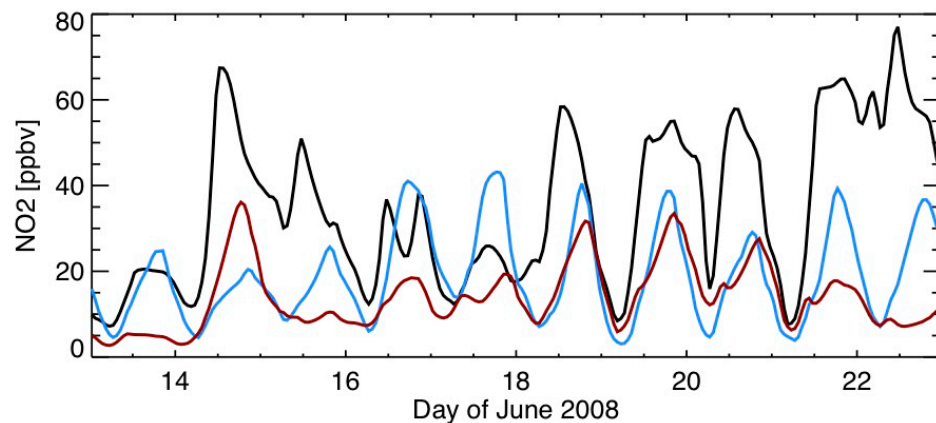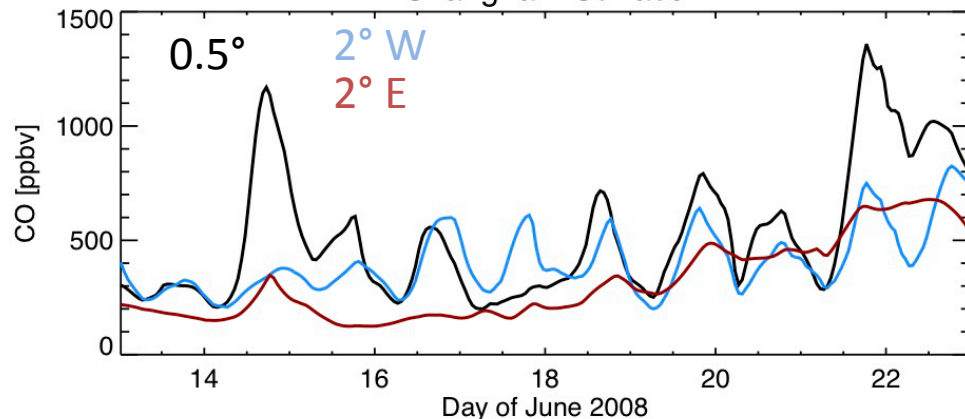Shanghai is primarily in one 0.5° grid box, but straddles two 2° boxes

Significant differences seen between 0.5° and either 2°

Eastern 2° box is mostly over ocean so has reduced O_3 deposition – doesn't go to 0 at night

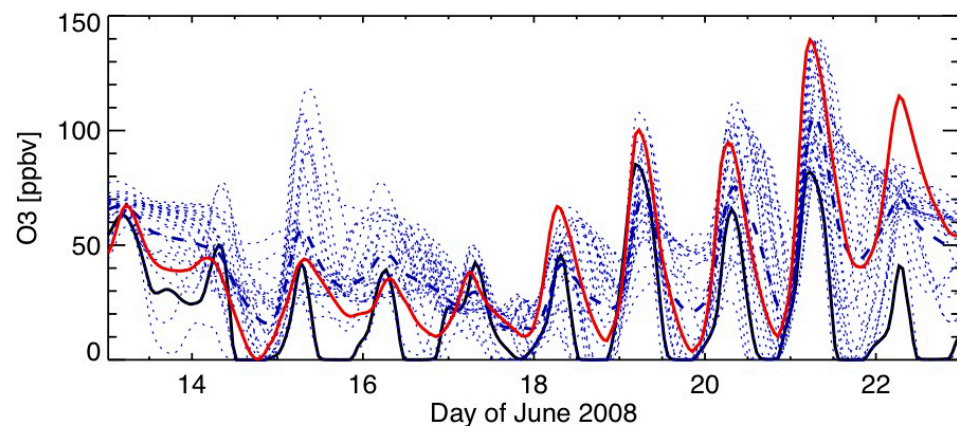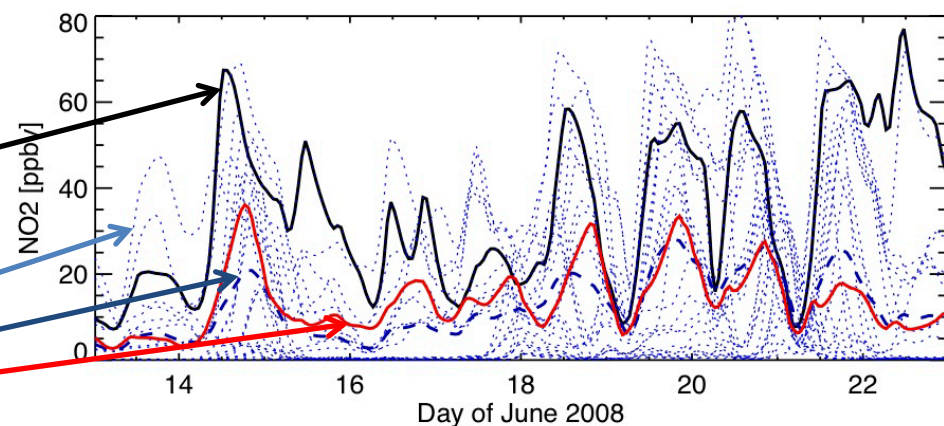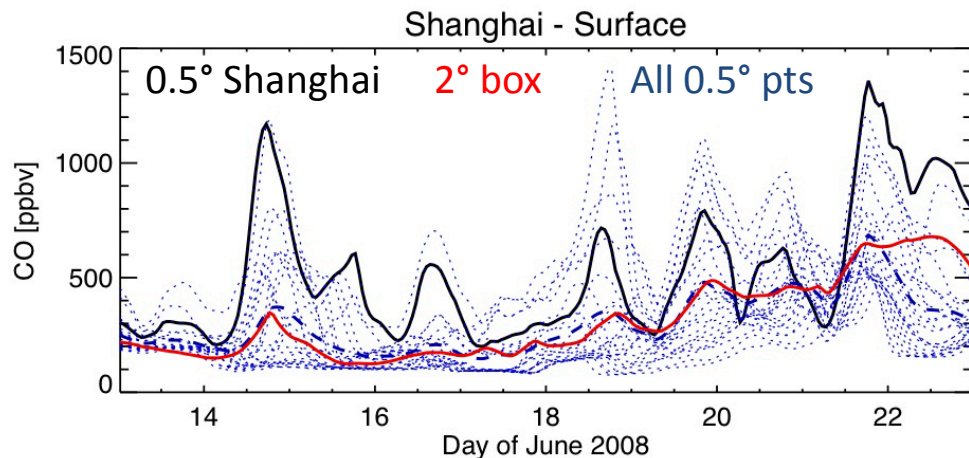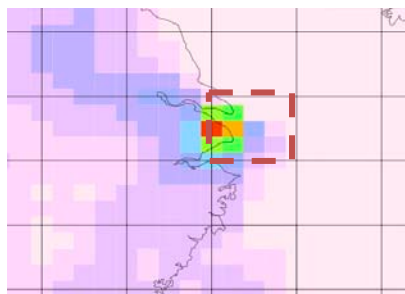
CAM-chem-0.5deg - 14 June 2008 - NO

Shanghai - Surface

Shanghai (cont.)

More emissions in eastern 2° box, but is
mostly over ocean

Wide range of values from all of the 0.5°
boxes in the 2° box

On average 2° resolution matches average
of finer resolution

But averages are very different from
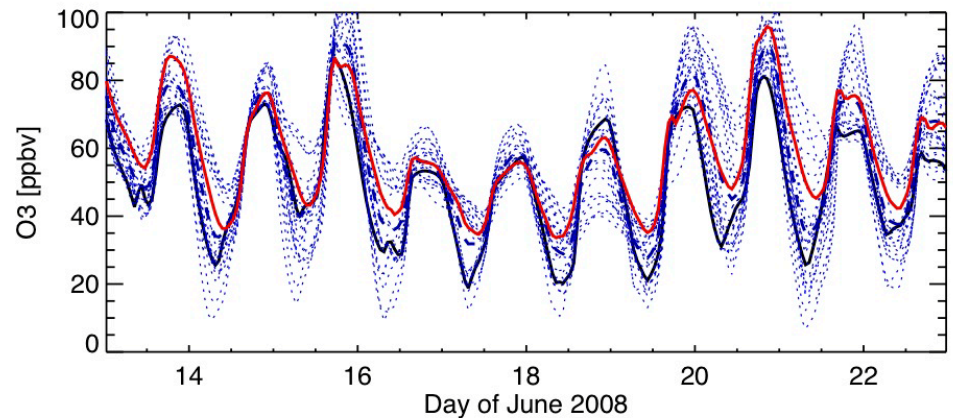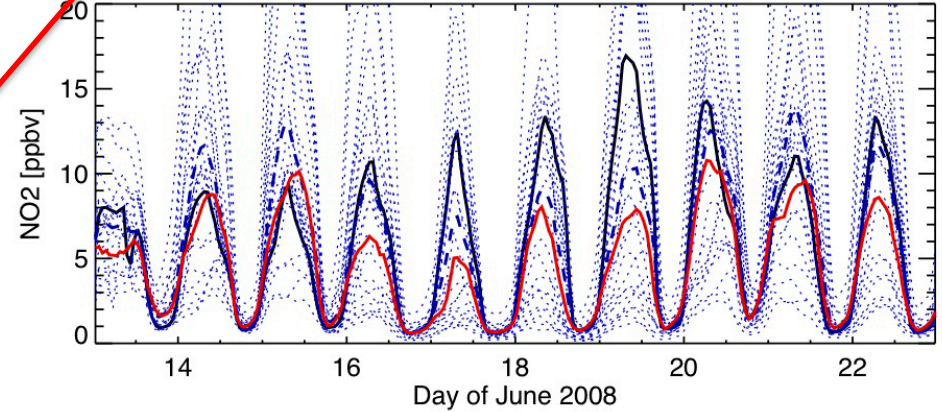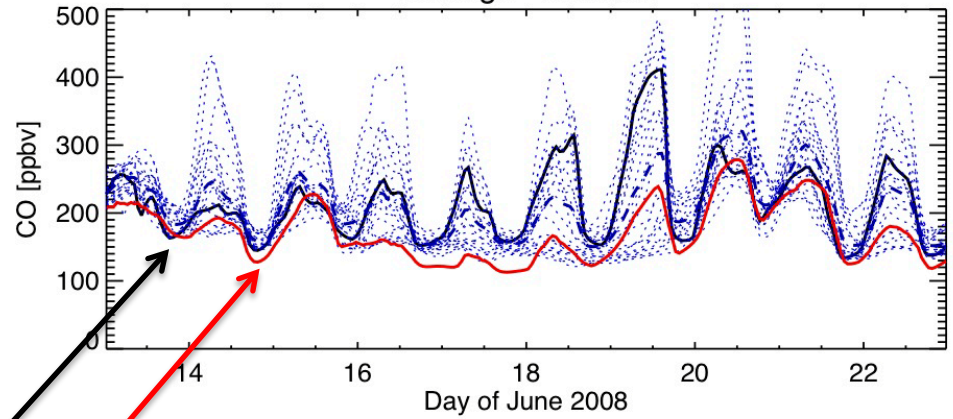Shanghai 0.5°box

Black line: 0.5° box at Shanghai

Blue dotted lines: All 0.5° points in 2° box

Blue thick dashed: mean of 0.5° points
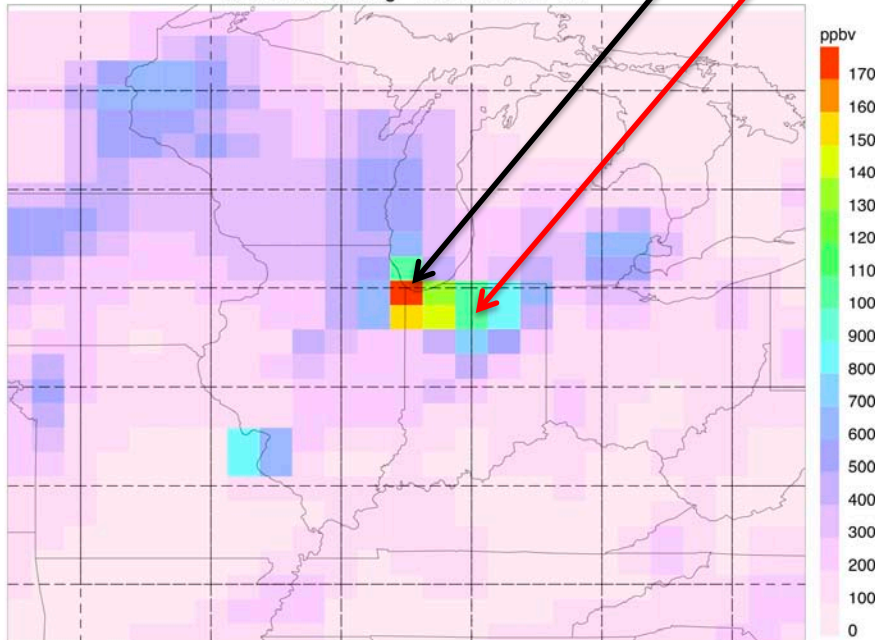
Red: 2° box (east of Shanghai)

Similarly for Chicago

Again, city is at edge of 2° box
Mean of 0.5° boxes does not match 2°
CO is significantly diluted at coarse
  resolution
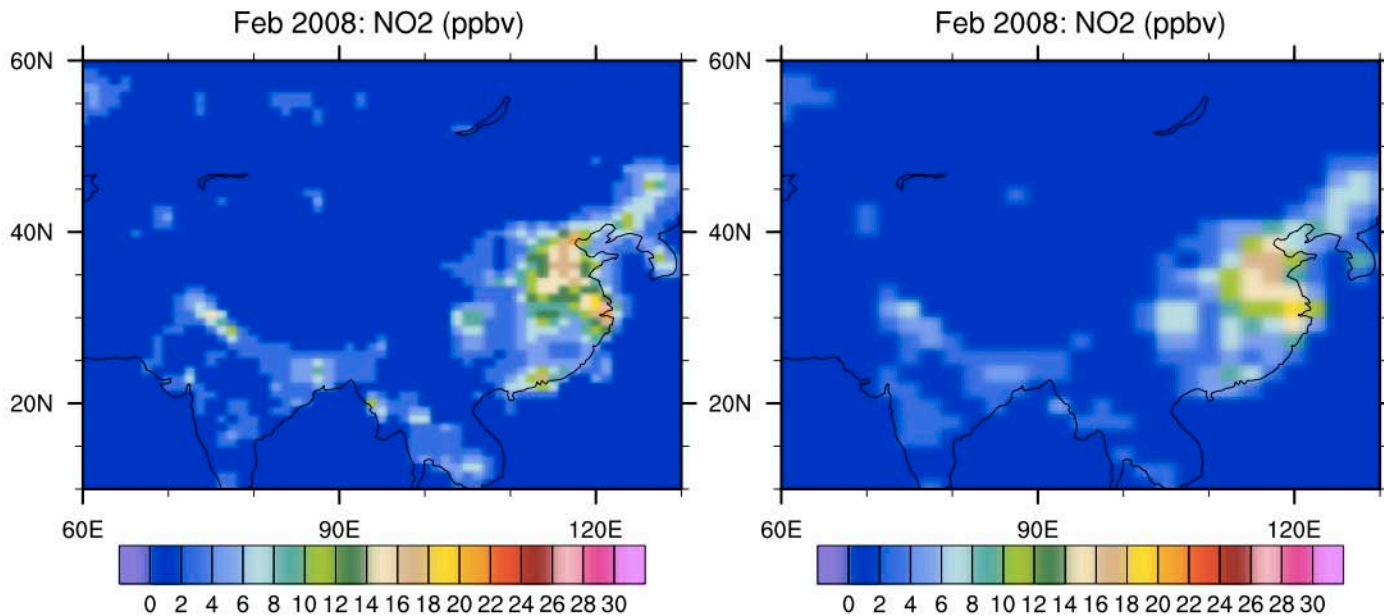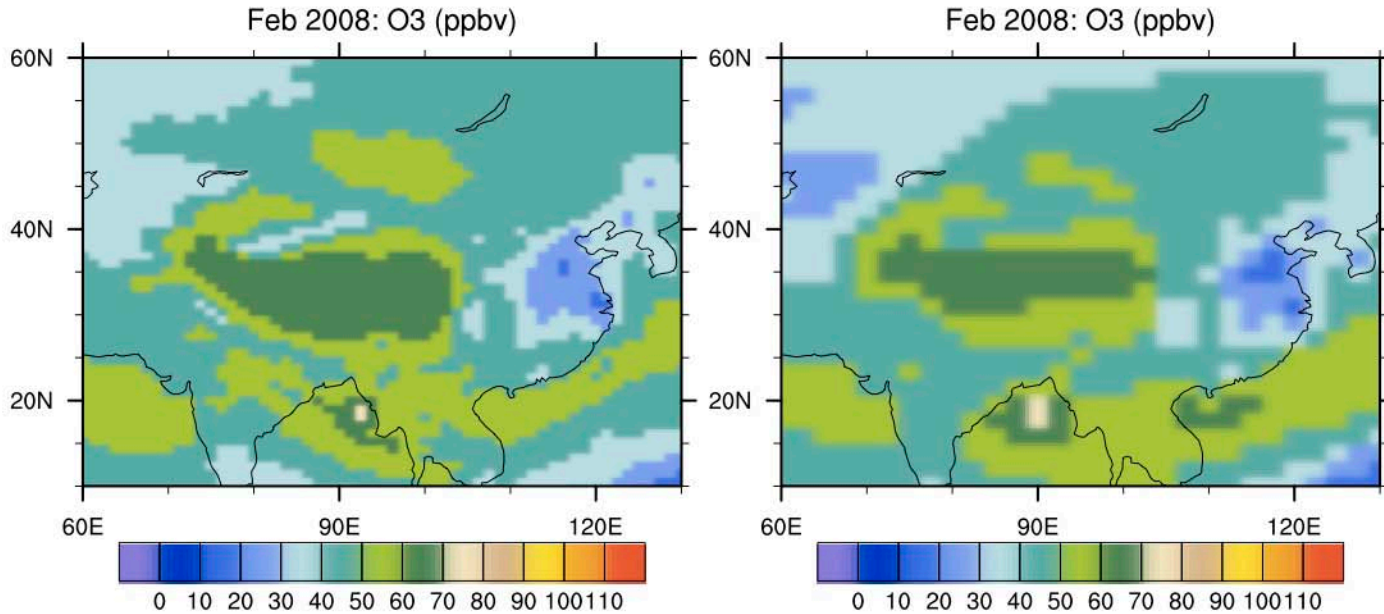NO2 is slightly less and O3 is higher

CAM-chem-0.5deg - 14 June 2008 - NO

0.5°

2°

CAM-chem – free-running - 2° vs 1°

Feb 2008: O3 (ppbv)

Feb 2008: O3 (ppbv)

Feb 2008: NO2 (ppbv)

Feb 2008: NO2 (ppbv)

CAM-chem – free-running - 2° vs 1°

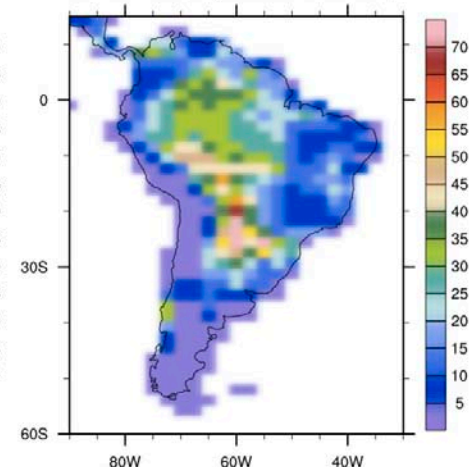Climate changes with resolution – slight changes in Temperature
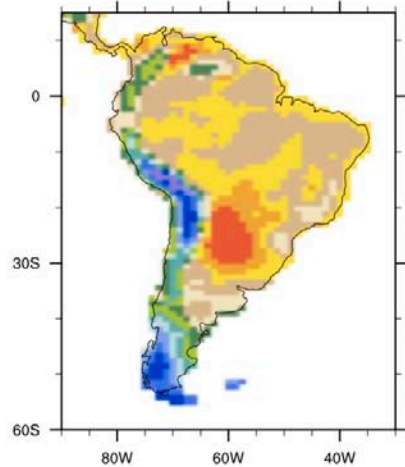Differences in LAI, Temperature and cloud cover affect biogenic emissions
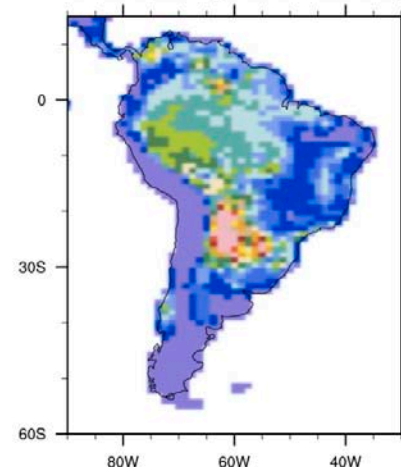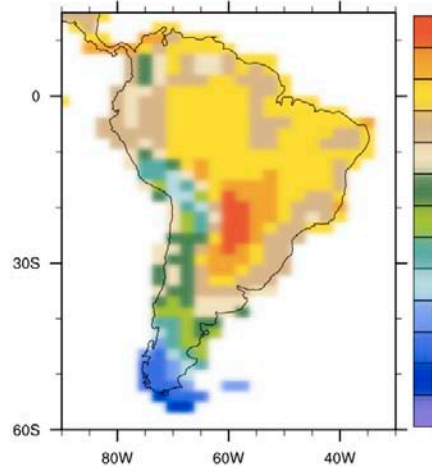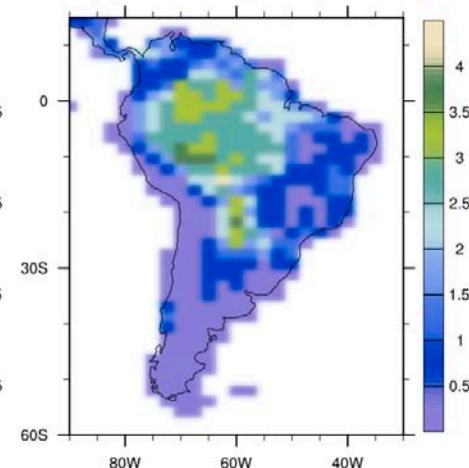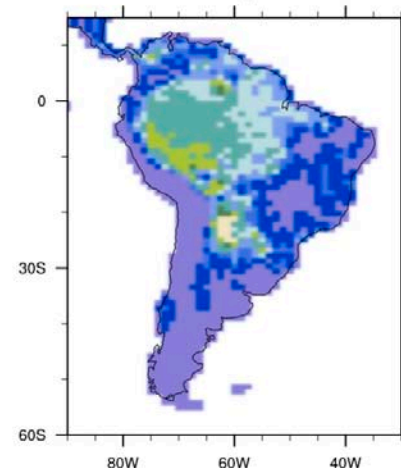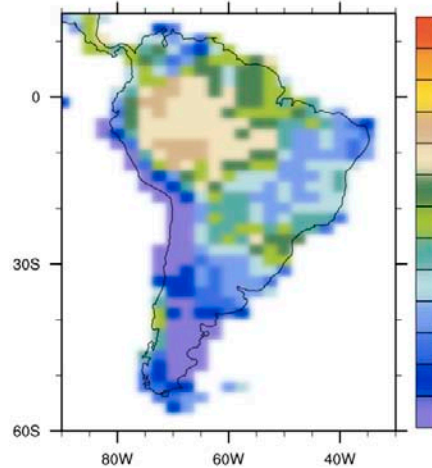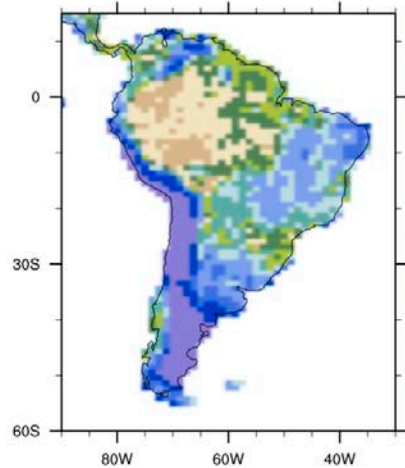
Future Work

Free-running CAM-chem at 0.5°
    Use 1° land model IC regrid to 0.5°

Specified dynamics at 0.5°
    With new online MEGAN for biogenic emissions

Compare free-running and specified dynamics to understand effects of changes in meteorology with resolution

Use for analysis of observations:
    DC3 – Thunderstorms and convective transport in US (May-Jun 2012)
    ARCTAS – fires in Canada & California; effect on long-range transport to Arctic (Apr-Jul 2008)
    Brazil – tower near Manaus (on-going)

Field campaign design of urban-biogenic interactions:
    Southeast US (SOAS)
    S. Korea