

Modeling Support for NOMADSS, SOAS and SENEX

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And others



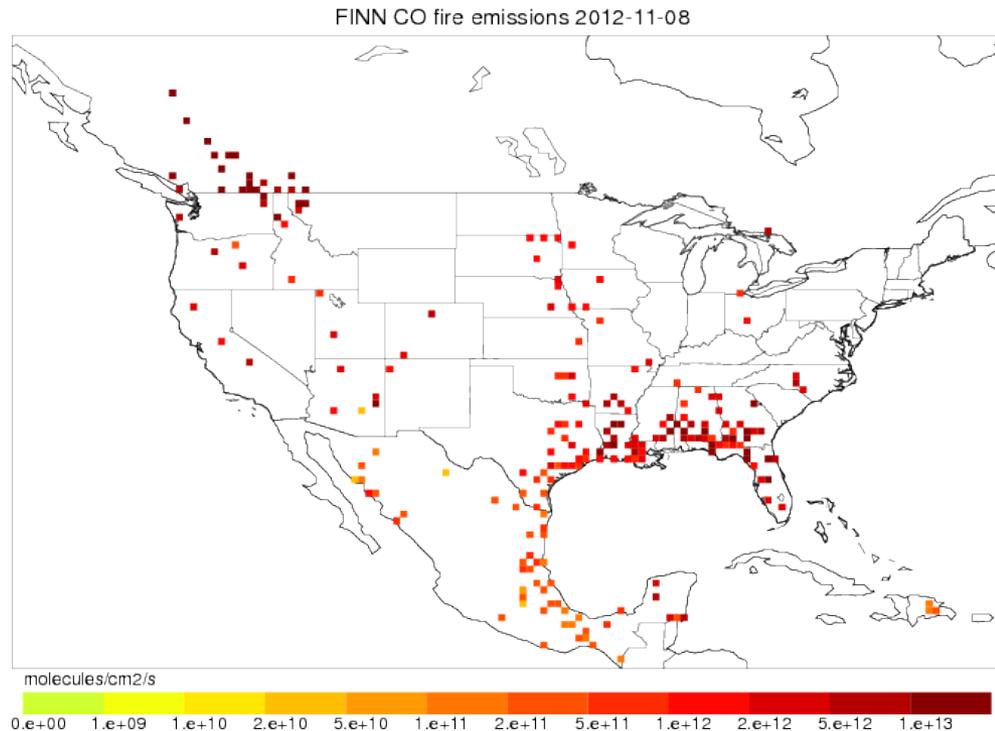
NCAR



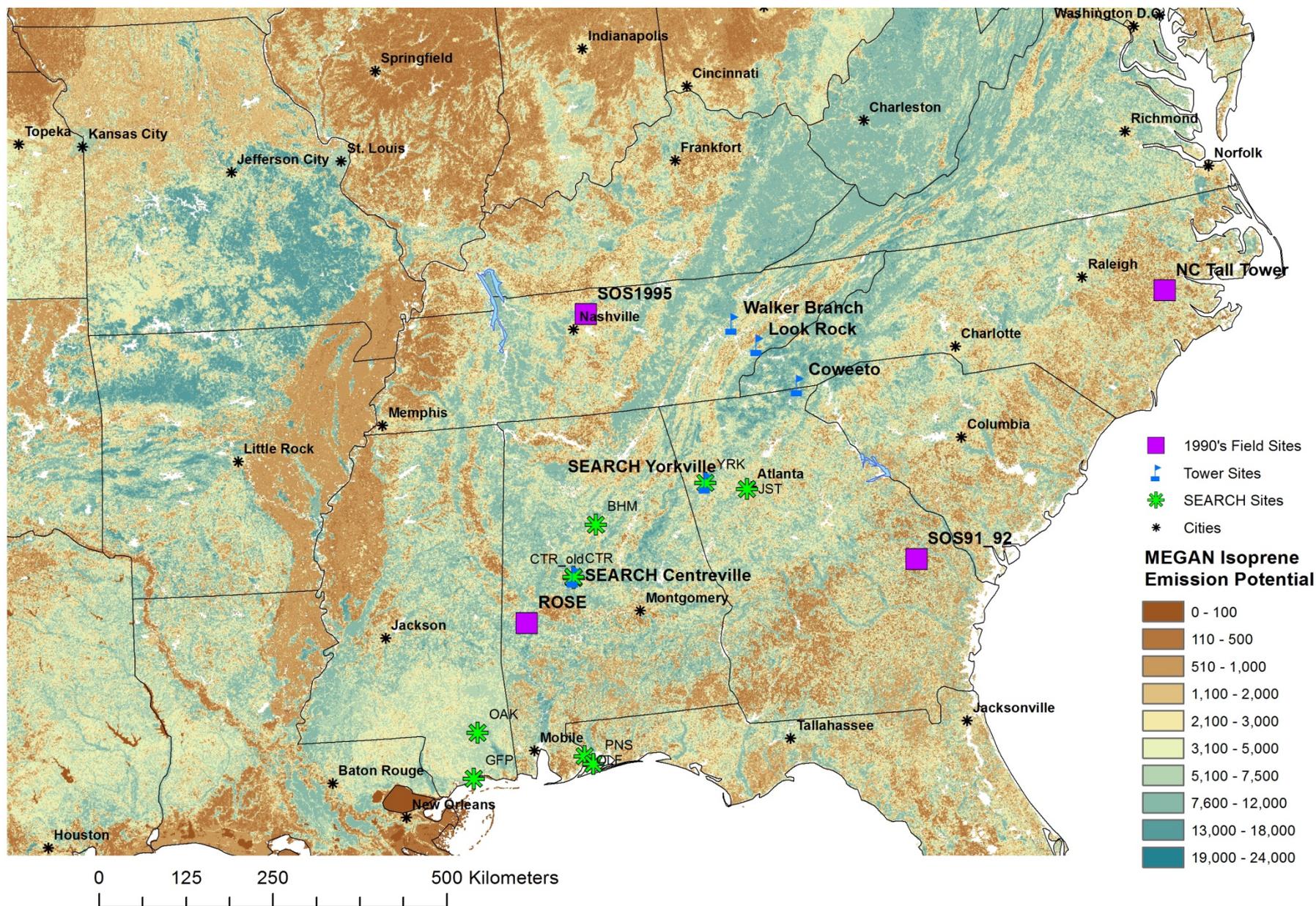
Fire Emissions: Fire INventory from NCAR (FINN)

Christine Wiedinmyer (ACD/NCAR)

- Daily fire emissions of trace gases and particles
 - Can include Hg emissions if requested
 - FINN is run in real-time based on MODIS Rapid Response fire counts
- <http://www.acd.ucar.edu/acresp/forecast/fire-emissions.shtml>
- Plots and data files available for forecasts and hindcasts



MEGAN: biogenic emissions model – offline and online in MOZART, CAM-chem/CLM, WRF-chem



Chemistry Satellite Observations

Louisa Emmons and NCAR/ACD Satellite group

Retrievals produced by NCAR/ACD:

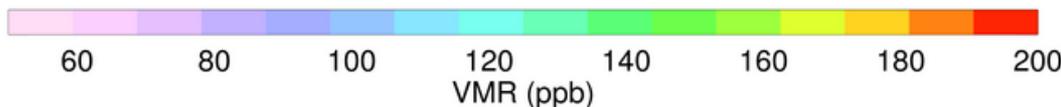
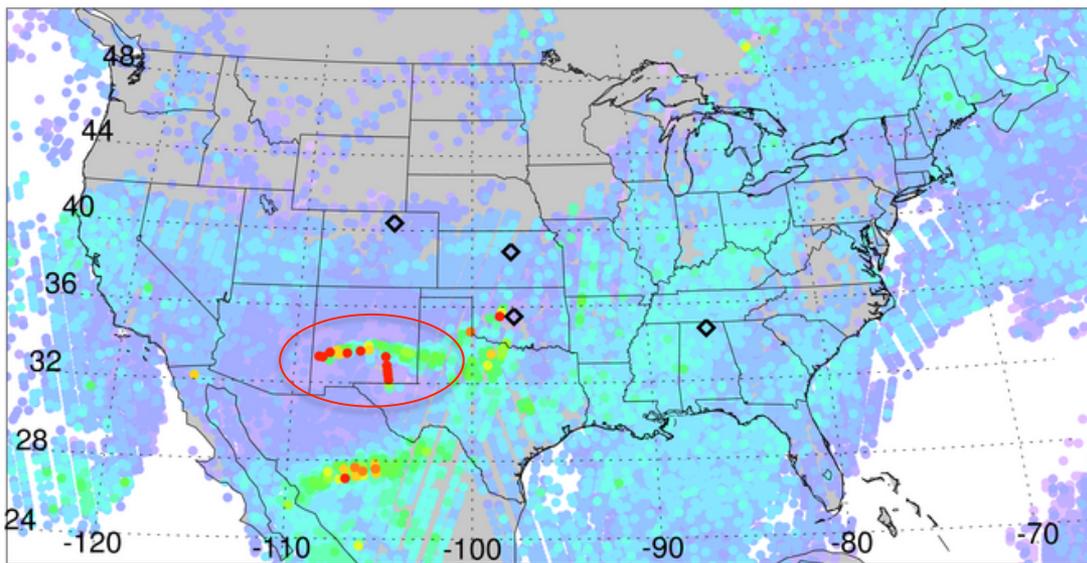
- MOPITT CO – available within a day of overpass
- IASI CO – about 2-day delay, global coverage 2x/day

Helpful for showing influence of western US fires and pollution transport

NCAR/FORLI

IASI CO Total Column Effective VMR

24 May 2012

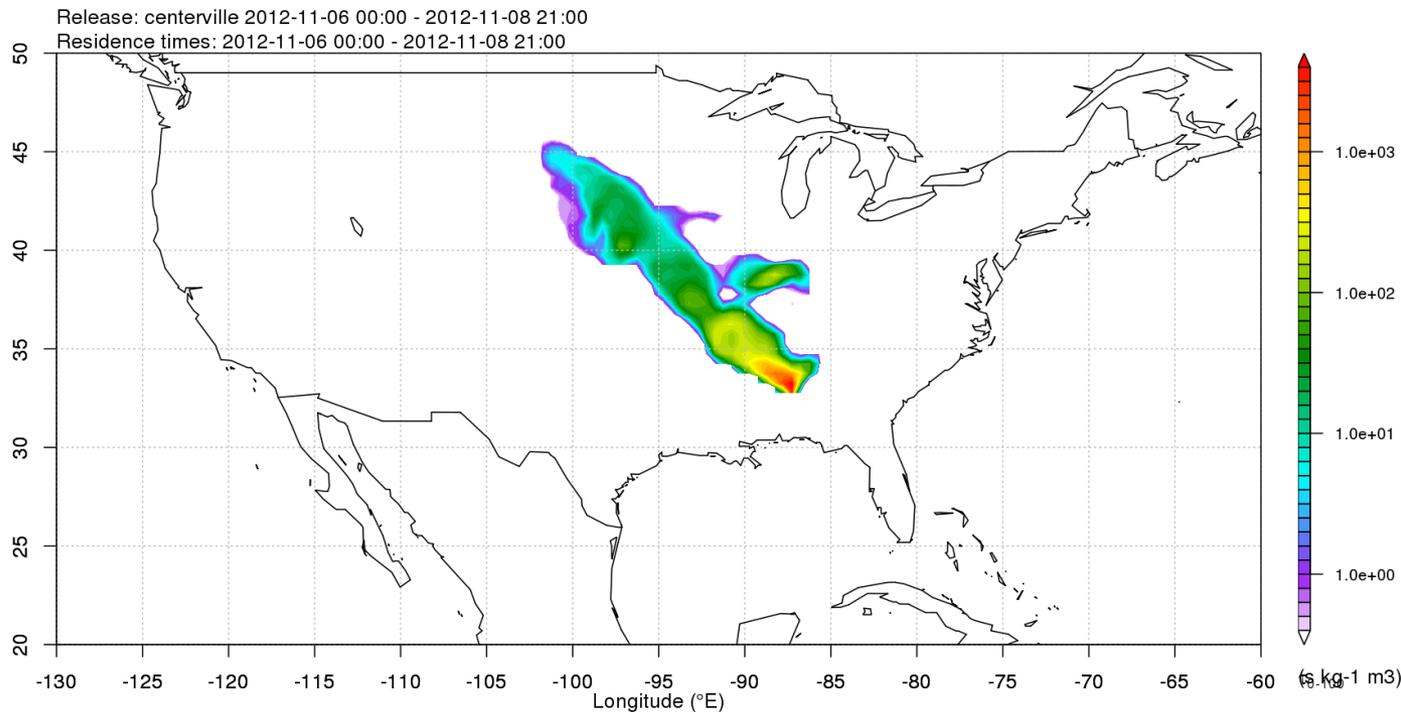


May 2012:
CO and smoke from the NM Whitewater-Baldy Fire, as well as fires in northern Mexico, were carried to SE U.S.

FLEXPART – planned products

Christoph Knote (ACD/NCAR)

- Driven by GFS forecasts (0.5°)
- Back trajectories from all ground sites
- Forward trajectories from major pollution sources
- Back trajectories from aircraft tracks



Residence time in
0-100m of 4000
particles in back
trajectories from
Centreville



WRF-chem forecasts

Alma Hodzic, Mary Barth (ACD/NCAR)

- WRF forecasts – 4-10 km horizontal resolution over SE U.S.
- 2-day forecasts
- Full-chemistry with SOA, along with tracers



WRF/Chem model configuration for BEACHON

- Coarse domain : 36km horiz. resolution
- Fine domain : 4km horiz. resolution
- Top of domain : 10hPa
- WRF/Chem WRFV3.3 with modifications

Physics/Dynamics

- Single moment cloud physics (Lin et al., 1983)
- Convective parameterization for coarse domain
- YSU PBL parameterization with the minimum height set to 50m
- NOAA land surface model
- Rapid Radiative Transfer Model for long wave radiation
- Goddard scheme for short wave radiation
- Runge-Kutta time integration method
- Positive definite and monotonic advection for water, scalars, and chemistry species

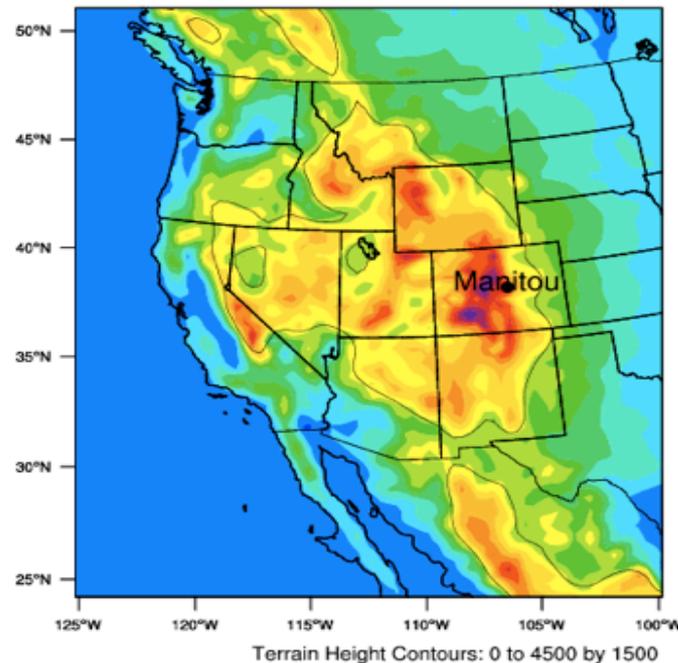
Chemistry

- SAPRC99 gas-phase chemistry
- MOSAIC aerosols - 4bins sectional approach
- Anthropogenic emissions: U.S. EPA NEI-05
- Biogenic emissions : Guenther scheme
- Photolysis rates : fastJ
- Wet deposition not included
- Dry deposition (Wesely, 1989)
- Aerosols feed back to radiation heating in meteorology

Tracers of anthropogenic emissions of CO

- for the Denver metropolitan area (tracer=1)
- for the Colorado Springs (tracer=2)
- for the Four corners area (tracer=3)
- for the Manitou local site (tracer=4)
- for the West Coast (tracer=5)

[Back to Model Results](#)





MOZART-4 driven by GEOS-5

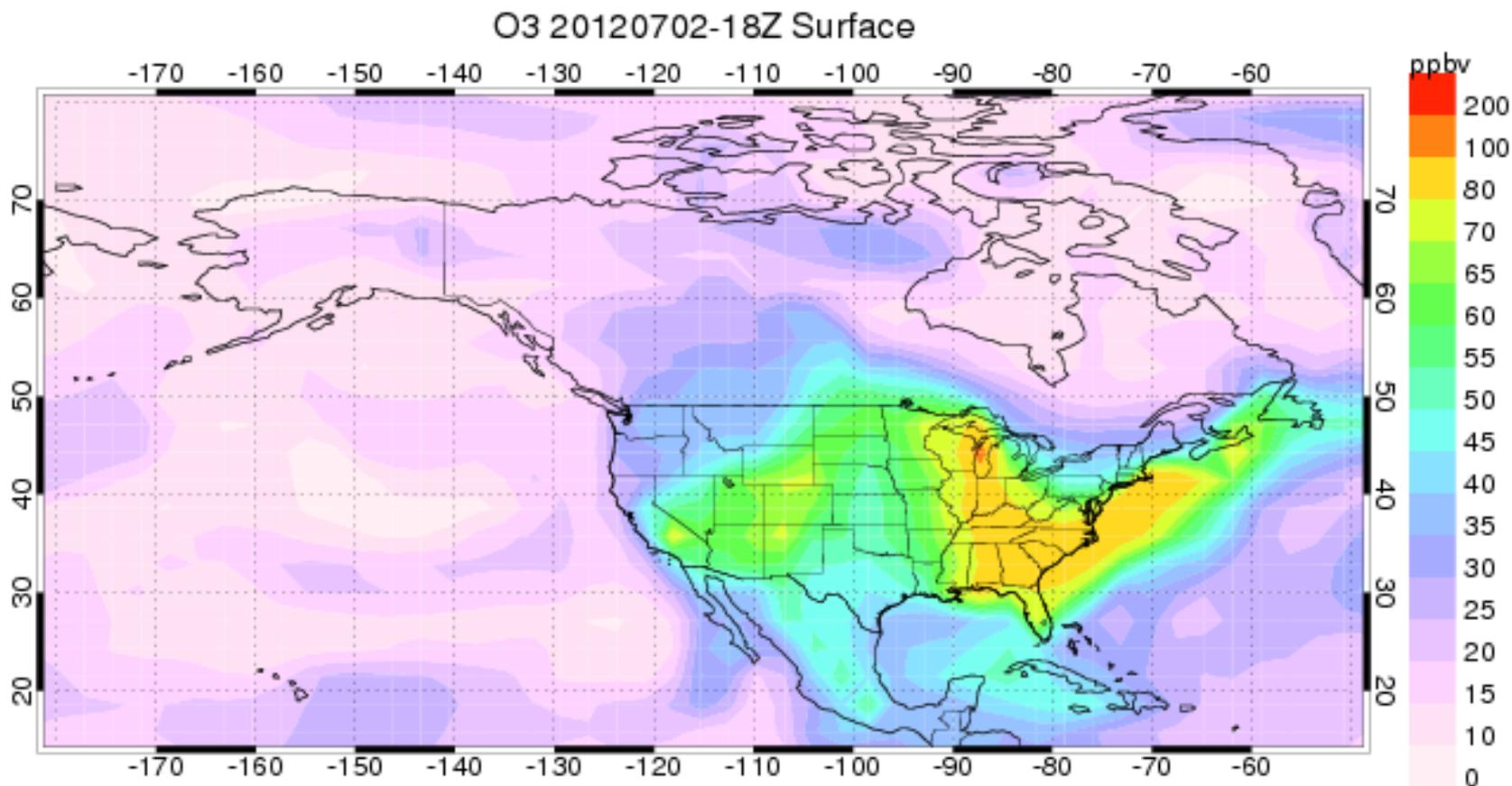
Louisa Emmons (ACD/NCAR)



Full chemistry at $1.9^\circ \times 2.5^\circ$

<http://www.acd.ucar.edu/acresp/forecast/>

5-day forecasts, hourly output, currently operational



MOZART-4 Forecast with MOPITT CO Assimilation. Plot created 2012/07/03

MOZART-4 Tracers

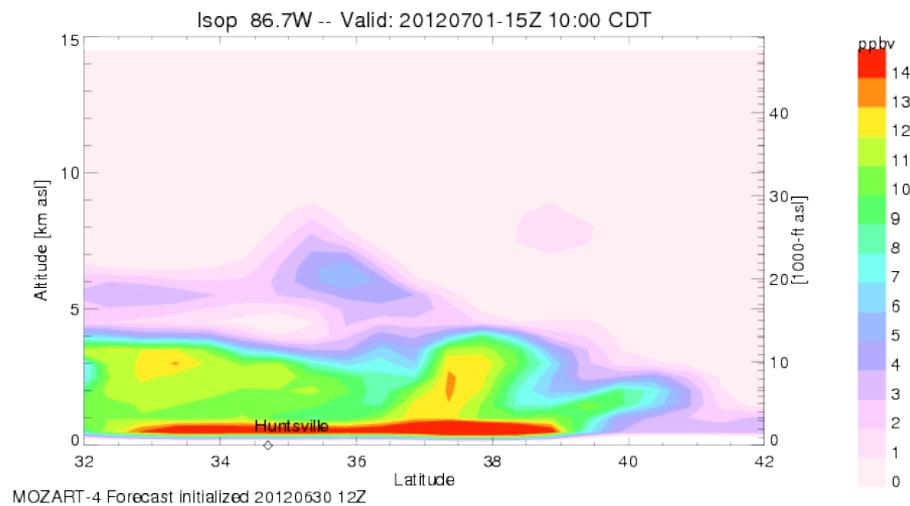
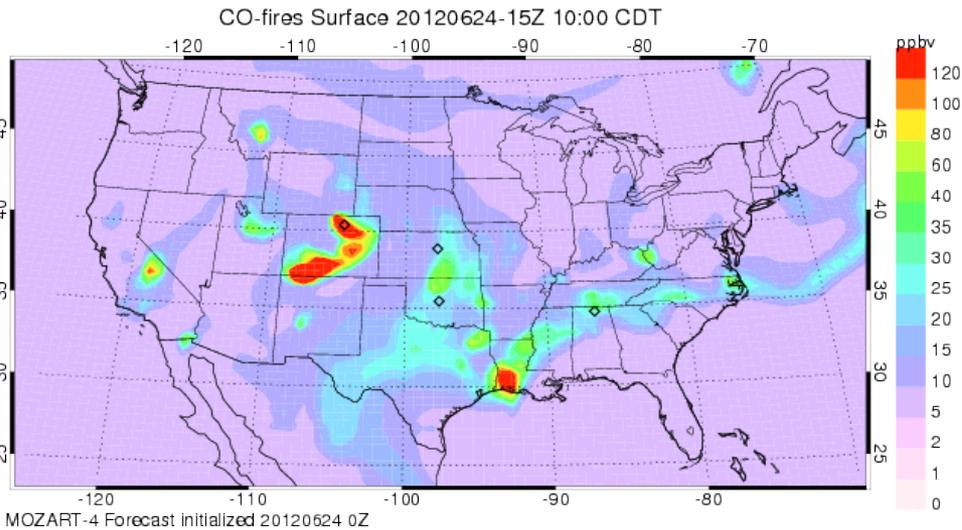


NCAR

Louisa Emmons (ACD/NCAR)

Forecasts of tracers at 0.5° horizontal resolution

- Isoprene-like tracer based on MEGAN isoprene emissions
- Anthropogenic NO_x tracer from individual cities and/or regions
- Fire CO tracer for various regions
- Similar to forecasts for DC3 (<http://www.acd.ucar.edu/acresp/dc3/>), will be run specifically for NOMADSS



GEOS-Chem and GEOS-5 during NOMADSS

Lyatt Jaeglé, Viral Shah, Yanxu Zhang

University of Washington

Department of Atmospheric Sciences, Seattle

Noelle Selin, Shaojie Song, Amanda Giang

MIT

Mission planning

Mission execution

Post-mission data analysis

GEOS-Chem chemical transport model

★ Global 3D model $2^\circ \times 2.5^\circ$ resolution, 47 vertical levels

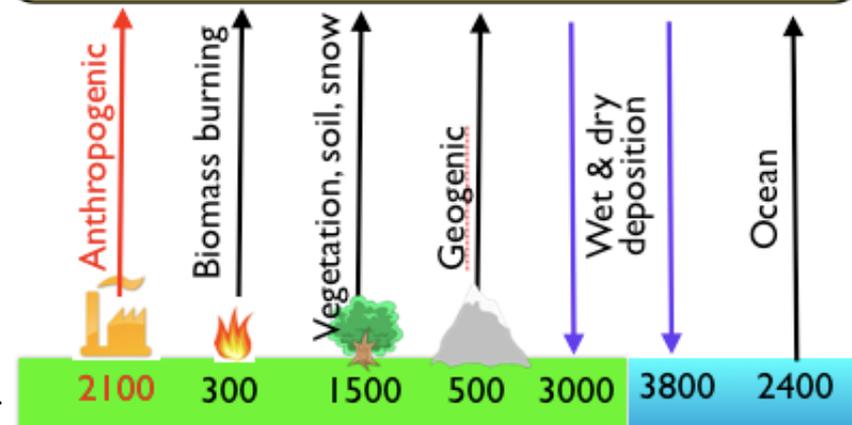
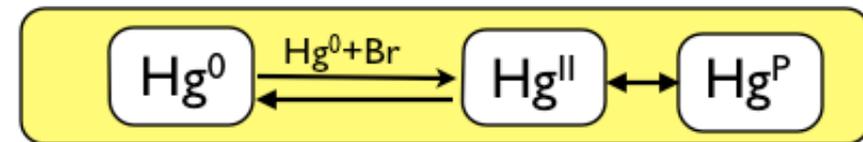
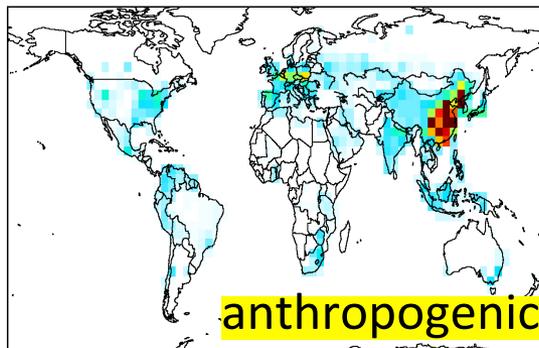
★ GEOS-5 assimilated meteorology NASA GMAO

★ Aerosol-oxidant simulation

- Oxidant chemistry: HO_x - NO_x - O_3 - VOC- BrO_x
- Aerosols: SO_4^{2-} - NH_4^+ - NO_3^- , BC, organic carbon, dust, sea salt
- Anthropogenic, vegetation (MEGAN v2.1), soils, fires, lightning

★ Mercury simulation (Selin et al., 2007; Holmes et al., 2010; Amos et al., 2012)

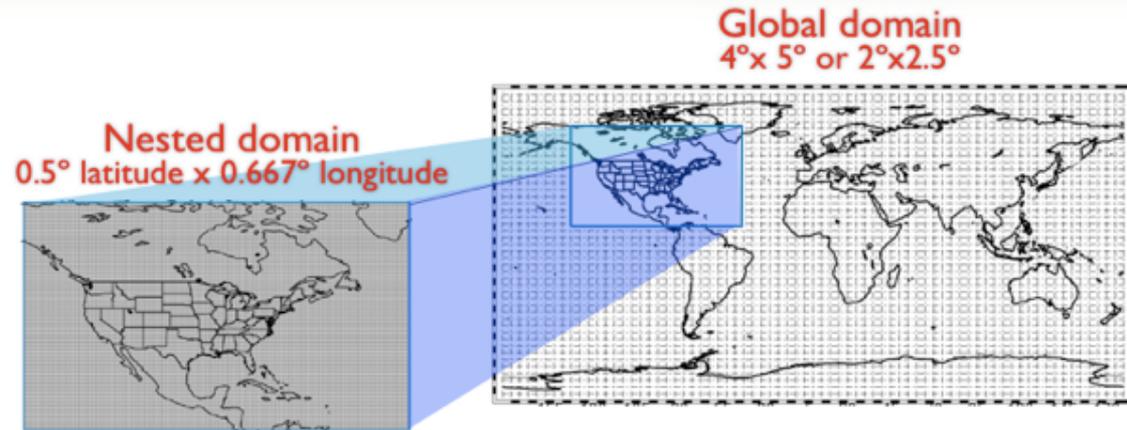
- Anthropogenic, biomass burning, gold mining
- 2-D surface ocean and 2-D soil/vegetation model
- Archived oxidants: Br or O_3/OH



Fluxes in Mg/year

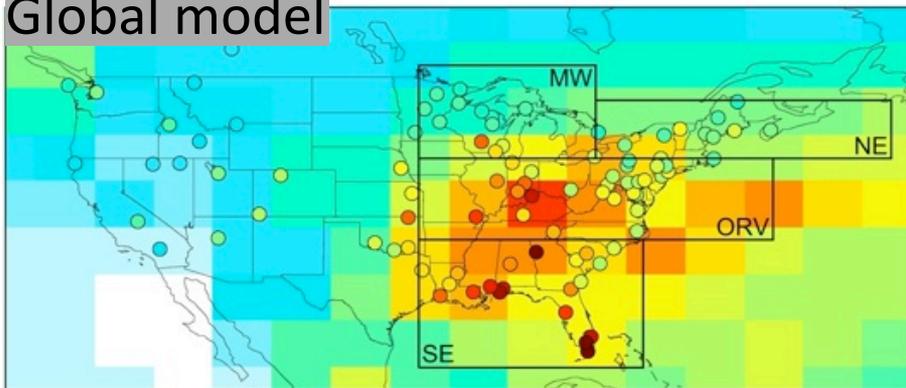
Nested-grid simulations

- 0.5° latitude x 0.667° longitude (~50 km) over N. America
- Global simulation provides boundary and initial conditions
- Same emission, chemistry, deposition, transport as global model

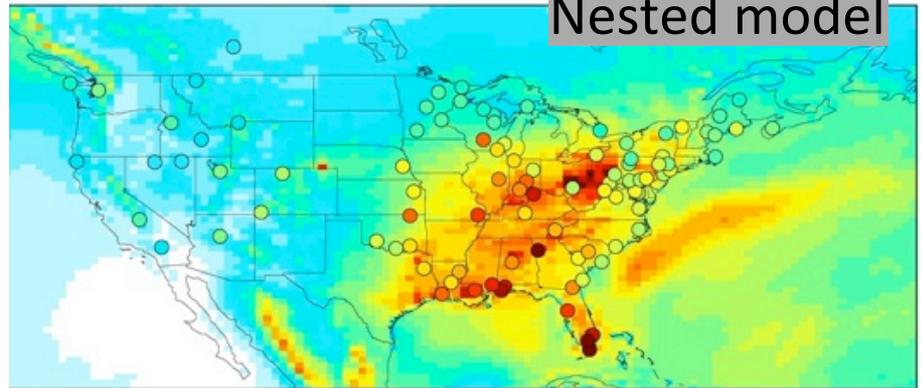


Hg wet deposition flux (2008-2009)

Global model



Nested model



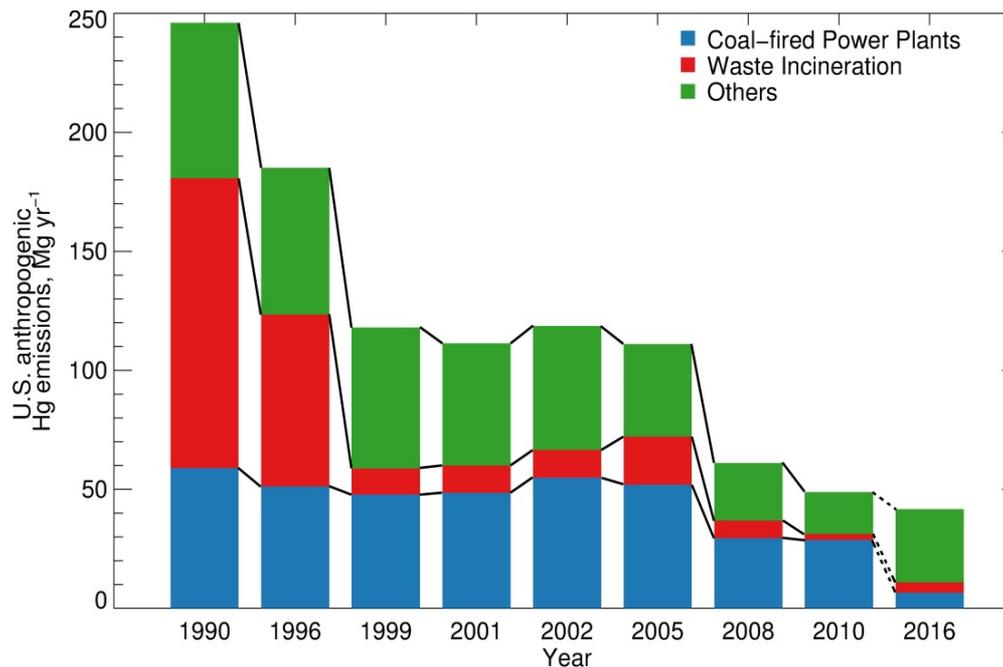
Circles = Observations from Mercury Wet Deposition Network (MDN)

0 3 7 10 14 18 $\mu\text{g m}^{-2} \text{y}^{-1}$

Zhang, Jaeglé et al. "Nested-grid simulation of mercury over N. America"
Atmos. Chem. Phys. (12), 2012.

Mission execution

- Provide analysis of NASA's GEOS-5 chemical forecasts:
 - ◆ Tracers: CO originating from different sources, O₃ and aerosol species
- Run GEOS-Chem Hg simulation in Near-Real-Time (NRT) 2-3 days after mission, providing quick comparisons to observations
- Tentative: run GEOS-Chem Hg simulation with GEOS-5 met forecasts → Hg forecasts!

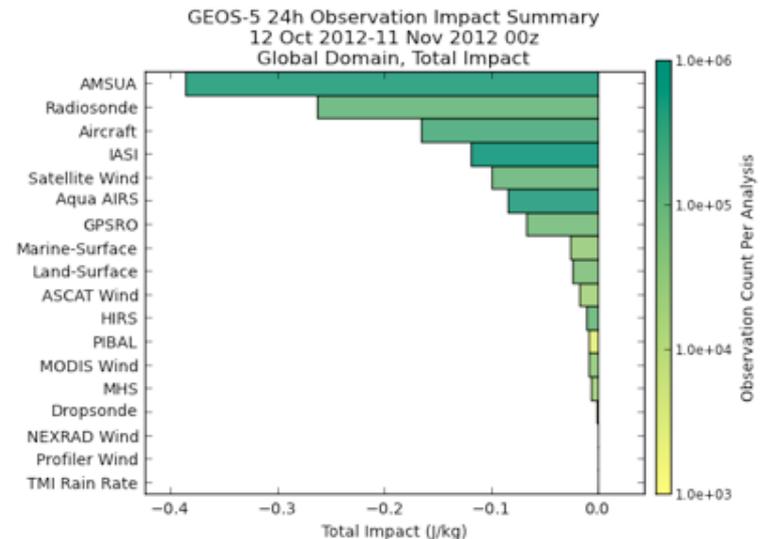
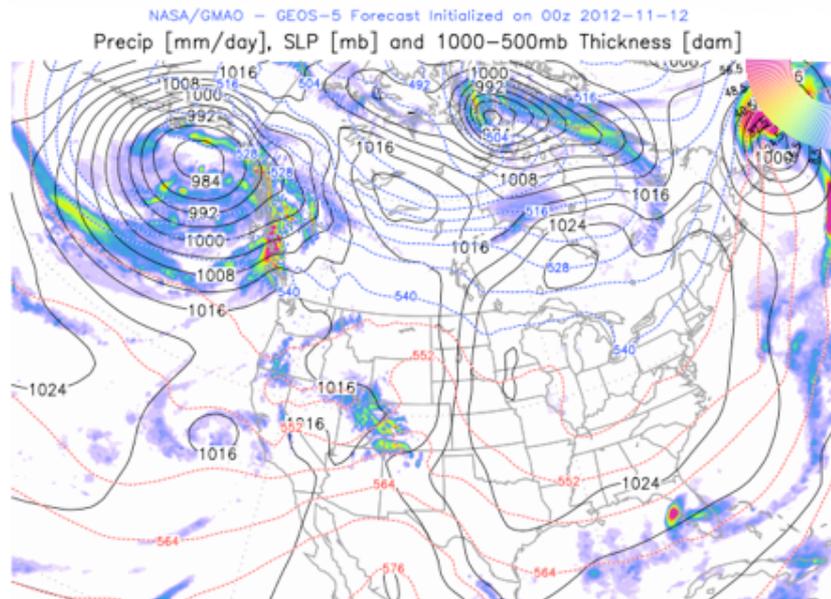


GEOS-5 chemical forecasts

NASA GSFC Code 614 and GMAO forecasts with GEOS-5 model:

- 5-days global forecasts every 12 hours. $1/2^\circ$ or $1/4^\circ$ resolution.
- Meteorology: GEOS-5 Atmospheric Data Assimilation System & GEOS-5 GCM. Winds, precip, RH, cloud cover, temp, radiation, etc...
- Ozone assimilation MLS/OMI + simple tropospheric chemistry
- Assimilation of aerosol optical thickness based on MODIS
- GEOS-5 online Aerosol/Chemistry: 20 tracers
 - ➔ Real time fire emissions from MODIS imagery and land mapping.

Forecast for today initialized on Monday (4d)



Access to GEOS-5 forecasts

- Real-time data delivery:
 - OPeNDAP server
 - Anonymous FTP
 - Web Map Server with Google Earth capabilities
 - Visualization of Chemical Weather

On-line interactive visualization for NOMADSS:

- server at UW (used for HIPPO, ARCTAS, INTEX, ITCT2K2)
- maps, cross section, animations for specific regions and tracers
- sample forecasts along planned aircraft flight track

http://acdb-ext.gsfc.nasa.gov/People/Colarco/Mission_Support/

<http://coco.atmos.washington.edu/cgi-bin/ion-p?page=hippo.ion>

Announcements

Please send bugs/comments to jaegle@atmos.washington.edu. Note that this site does not work with IE, please use another browser (Firefox, Netscape, Safari, etc...).

GSFC/Harvard GEOS-5 forecasts and assimilation products

GEOS-5 1/2 degree forecast browser:	20121111_12z (latest)	<input type="button" value="Start 1/2 degree forecast browser"/>
GEOS-5 1/4 degree forecast browser:	20121111_00z	<input type="button" value="Start 1/4 degree forecast browser"/>
GEOS-Chem Near Real Time Assimilation browser:	20121110_12z	<input type="button" value="Start NRT browser"/>

QUICKSTART GUIDE

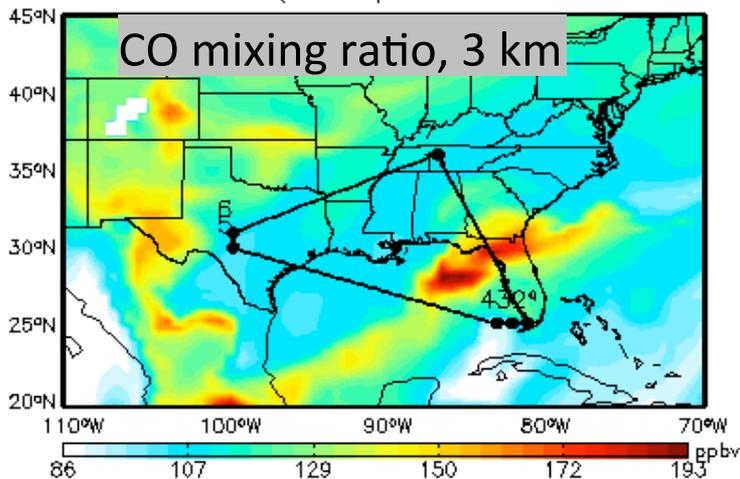
GEOS-5 forecast browser: Choose each day: a 00 GMT forecast and a 12z forecast you selected. Simply pre-calculated with the GEOS-5 chemical

Click on the forecast time in the menu in the table above and then click on "Start forecast browser". The forecast browser will allow you to view maps of the various tracers, tagged tracers, meteorological

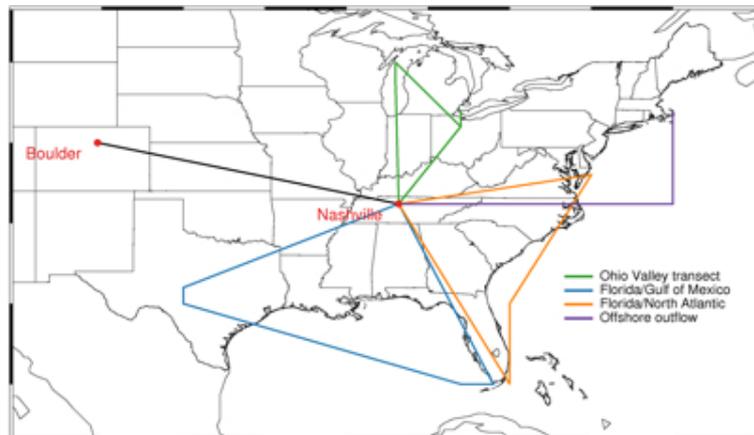
Sample forecasts along flight track

GEOS-5 forecast: 20121112_00z

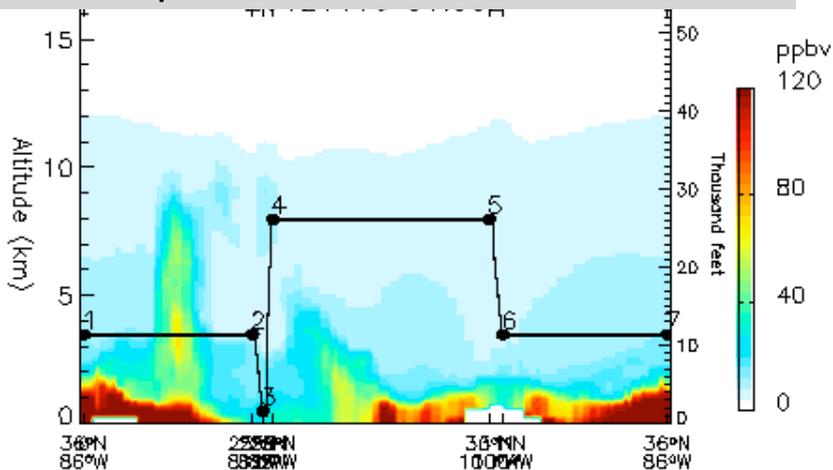
CO MIXING RATIO
700 hPa (3.0 km) 20121118 01:30Z



➔ Example: Florida/Gulf of Mexico transect and profiling



Curtain plot of N. American FF CO



HIPPO: GMAO GEOS-5 chemical forecasts
Interactive visualization
Forecast Day: 20121112_00z (latest)

GENERAL OPTIONS

Plot 1: Level/Type Day (or start day for animation) Hour Species
700 hPa (3.0 km) 20121118 01:30 CO mixing ratio

Plot 2: Level/Type Day (or end day for animation) Hour Species
Curtain Plot 20121118 01:30 CO - anthropogenic (north america)

REGION SELECTION

Plot 1 Latitude range: Minimum 20 Maximum 45
Plot 1 Longitude range: Minimum -110 Maximum -70
Plot 2 Latitude range: Minimum 15 Maximum 60 same as plot 1
Plot 2 Longitude range: Minimum -140 Maximum -60
Plot 1 value range: Minimum 0 Maximum 120 Automatic Log scale
Plot 2 value range: Minimum 0 Maximum 120 Automatic Log scale

DISPLAY AND MAP OPTIONS

Colorable: DIAL WhGYYRd Grindlines Orthographic Projection: Plot 1 Plot 2
Overplot winds: Plot 1 Plot 2 Coarse pixels Polar Projection: Plot 1 Plot 2

SATELLITE OPTIONS

AURA AQUA CALPSO CLOUDSAT TERRA Coincidence +/- (hours) 1

CURTAIN PLOT OPTIONS

Plot 1 Plot 2 Choose a flight track by date: None

Or select "None" in the above and enter latitudes, longitudes, altitudes separated by commas.
For a curtain plot, select 'Curtain Plot' in Plot/Level/Type menu.

Latitudes (N): 36.2,25.25,25.30,31,36.2
Longitudes (E): -86.8,-81,-82,-83,-100,-100,-86.8
Altitudes (km): 3.5,3.5,0.5,8.8,3.5,3.5

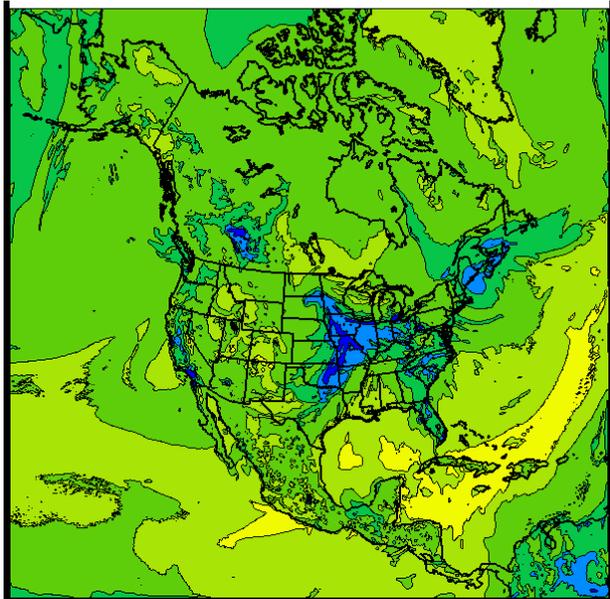
PLOT Animation Save as postscript EXIT

Other Air Quality forecasts

NOAA Rapid Refresh with Chemistry

(WRF/Chem 13km)

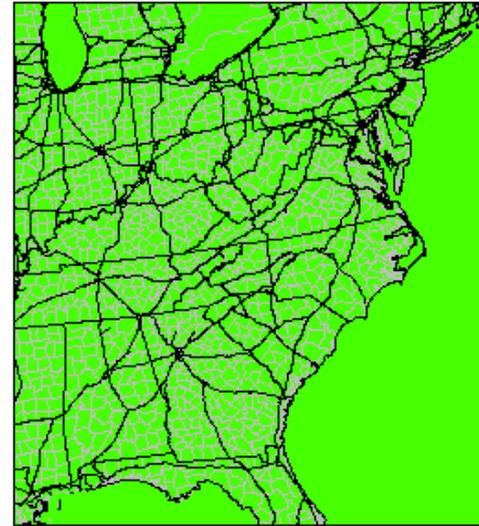
http://ruc.noaa.gov/wrf/WG11_RT/



Georgia Tech (CMAQ 4km, 12km)

Contact: Ted Russell, Talat Odman

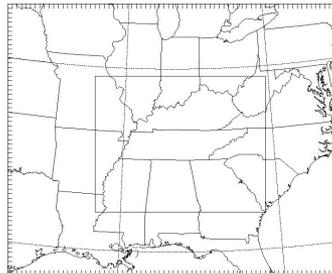
<http://forecast.ce.gatech.edu/>



TVA (WRF 9km, 27km)

Contact: Steve Mueller

sfmueller@tva.gov



NOAA RAQMS (WRF/Chem 8km)

Contact: Brad Pierce

Brad.pierce@noaa.gov

Retrospective modeling

- More than 30 groups responded to recent SOAS modeling survey, including
 - Observation-constrained box modeling
 - 1-D Canopy and PBL models
 - Large-eddy simulations
 - Lagrangian / trajectory models
 - Regional and global 3-D models
- Developing a community-based emission inventory
 - Greg Frost is developing a year 2008 inventory, available Summer 2013
 - Updates for year 2013 available in Spring 2014

Huntsville, AL observations

Mike Newchurch and Shi Kuang

Latitude 34.72 N, Longitude 86.64 W

The 915 MHz **wind lidar** and **ceilometer** measurements are usually operating here in HSV. They chase tornados and hurricanes occasionally.

New Halo Doppler wind lidar with scanner should be operating in a couple of months.

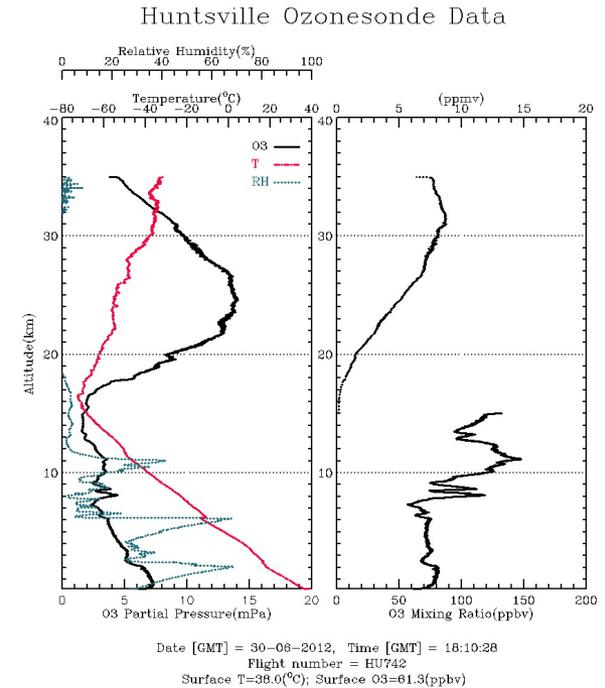
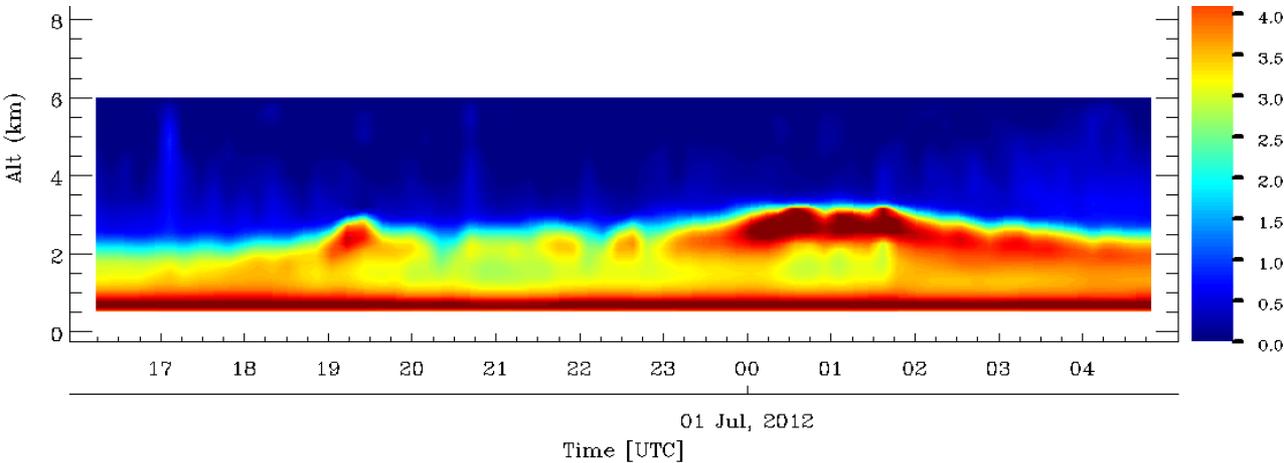
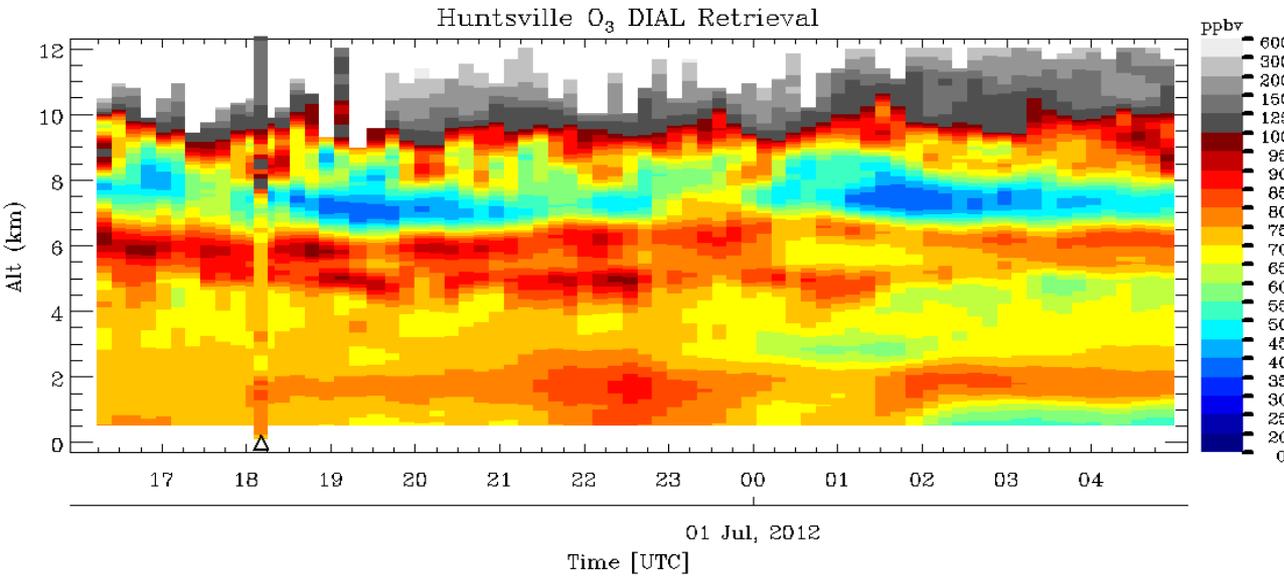
The **ozonesondes** launch every Saturday at 1330. We could fly some extra ones if someone wanted to fund it.

We can operate the **ozone/aerosol lidar** any time it is not raining. 100m to 10 or 12 km, 1-10 min integration, 30-700m vertical resolution.

Calendar of past obs: click on a date for plots.

http://nsstc.uah.edu/atmchem/lidar/DIAL_data.html

Huntsville ozone/aerosol lidar and ozonesonde June 30, 2012



Forecasting Questions for Discussion

- What species or tracers are useful?
- How far in advance?
- Multiple forecasts – how to increase the value?
- Is a meteorological forecast needed?