CMAS Conference Overview

Byeong-Uk Kim
Georgia EPD – Air Protection Branch
VISTAS2 Air Quality Modeling Lead

2014 EPA Region 4 Modelers Workshop
November 3, 2014 – Atlanta, GA

CMAS Sessions

- Model Development
- Sensitivity of Air Quality Models to Meteorological Inputs
- Model Evaluation and Analysis
- Global/Regional Modeling Applications
- Emissions Inventories, Models, and Processes
- Air Quality Measurements and Observational Studies
- Fine Scale Modeling and Single Source Assessments
- Energy and Climate

https://www.cmascenter.org/conference/2014/agenda.cfm

Model Development

chaired by:

Talat Odman (Georgia Tech) and Shawn Roselle (U.S. EPA)

The Community Multiscale Air Quality (CMAQ) Model: Updates and Future Development

Jonathan Pleim
and
EPA CMAQ Development Team

Atmospheric Modeling and Analysis Division

UK-US Atmospheric Modeling & Analysis Meeting
20-24 October, 2014

New CMAQ releases

- The latest publically available model is CMAQv5.0.2
  - Released early 2014, included:
    - Updates to base model
    - Instrumented models
    - Community contributions
    - Updates to 2-way WRF-CMAQ model
- Next model is CMAQv5.1
  - To be released in October 2015, includes:
    - Science updates
    - Revised code structure for faster execution
    - Improved physics and data assimilation in WRF
    - Improved 2-way coupled WRF-CMAQ
- Plans for Next Generation AQ model (user forum)

Improvements to the characterization of organic nitrogen chemistry and deposition in CMAQ

Donna B. Schwede[1], Deborah Luecken[1], John Walker[2], George Pouliot[1], Wyat Appel[1], James Kelly[3], Kirk Baker[3]

[1]National Exposure Research Lab, US EPA, RTP, NC
[2]National Risk Management Laboratory, US EPA, RTP, NC
[3]Office of Air Quality Planning and Standards, US EPA, RTP, NC

Summary

- Understanding of chemistry and emissions of organic N is a rapidly growing field, but there is still much to learn and improve in the modeling
- Organic N is an important component of the nitrogen budget, but has been historically underpredicted
- Recent changes to the organic N treatment in CMAQ have resulted in improved model performance
- Additional comparisons with measurements are needed

Continued improvements of air quality forecasting through emission adjustments using surface and satellite data

Yongtao Hu[1], M. Talat Odman[1], Michael E. Chang[2] and Armistead G. Russell[1]

[1]School of Civil & Environmental Engineering,
[2]Brook Byers Institute of Sustainable Systems
Georgia Institute of Technology

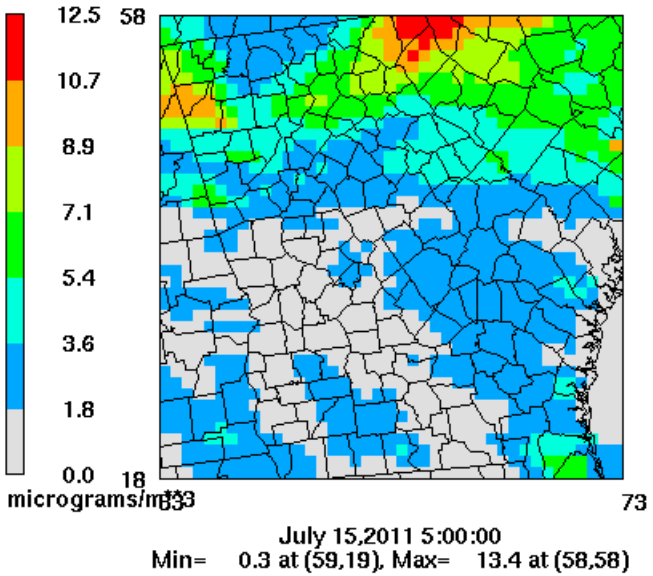
With thanks to Pius Lee and the NOAA ARL Forecasting Team

13th Annual CMAS Conference, October 27th, 2014

$PM_{2.5}$ Forecasting Performance of week2: Jul. 13-19, 2011

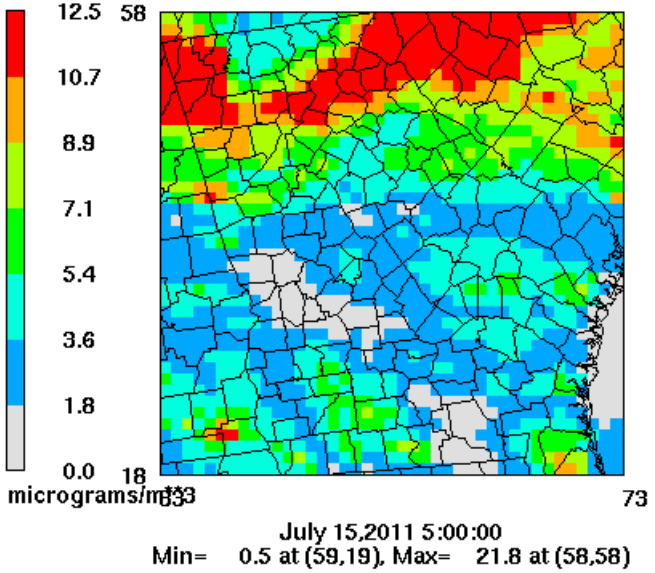
without emissions adjustments

Jul. 15, 2011 $PM_{2.5}$ Concentration



with emissions adjustments

Jul.15, 2011 $PM_{2.5}$ Concentration



	Obs (ug/m3)	Sim (ug/m3)	NFE	NFB
Jul. 15, 2011	11.35	3.85	94%	-94%
Emis adjusted		7.23	50%	-40%
Jul. 13-19, 2011	14.39	8.67	54%	-44%
Emis adjusted		14.92	44%	7%

Sensitivity of Air Quality Models to Meteorological Inputs

chaired by:

Aijun Xiu (UNC-Chapel Hill)

NASA Air Quality Applied Sciences Team

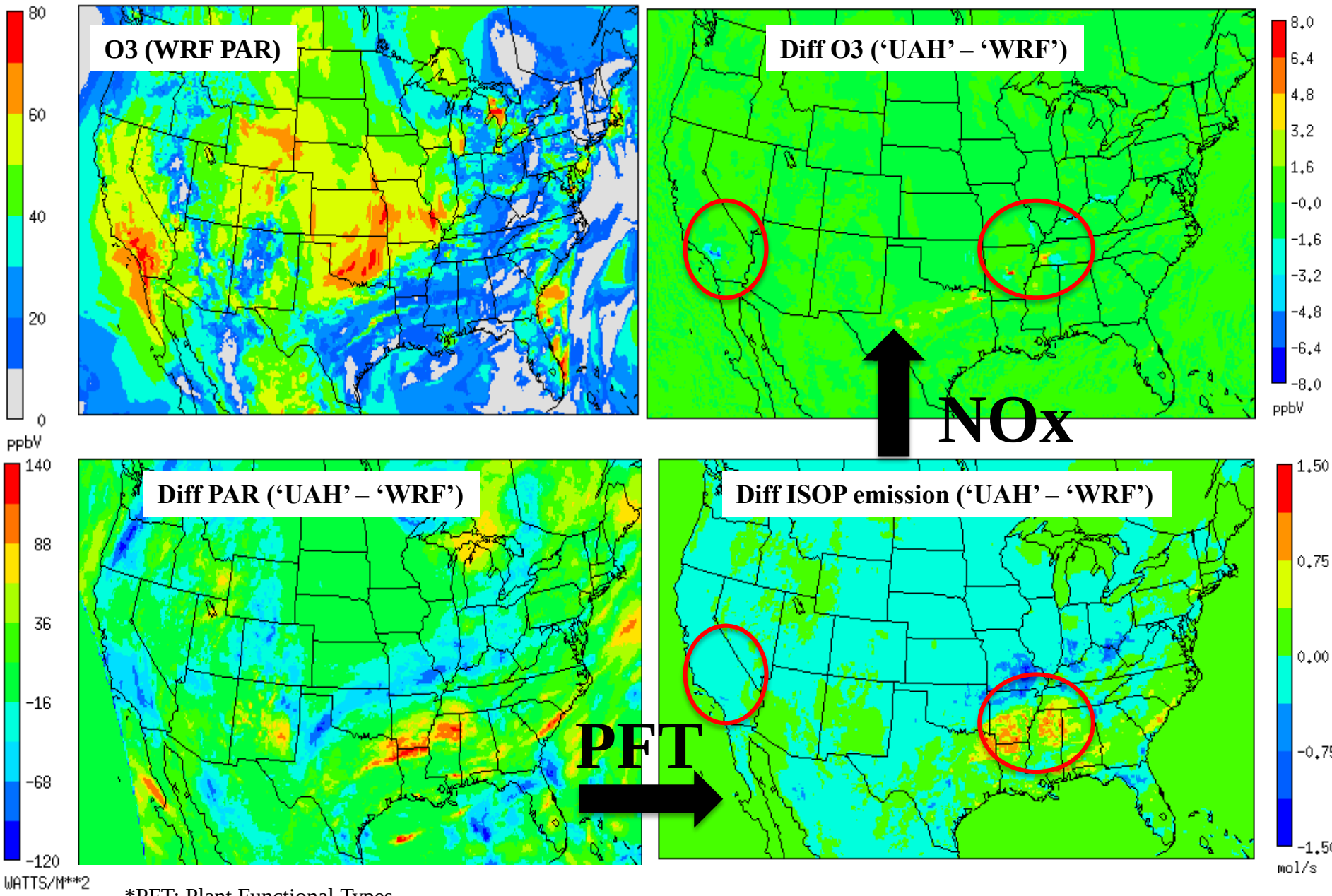
Earth Science Serving Air Quality Management Needs

Probing the impact of biogenic emission estimates on air quality modeling using satellite Photosynthetically Active Radiation (PAR)

Rui Zhang[1], Daniel S. Cohan[1], Arastoo Pour Biazar[2], and Erin Chavez-Figueroa[1]

([1]Rice University, [2]University of Alabama in Huntsville)

Response for daily max 8-hr average O3 concentrations



*PFT: Plant Functional Types

Model Evaluation and Analysis

chaired by:

Heather Simon and Wyat Appel (US EPA)

Estimating Empirical Sensitivities of Air Pollutants to Emissions Using Statistical Modeling

Lucas Henneman, David Lavoué, Heather Holmes, Howard Chang, KJ Liao, Jim Mulholland, Armistead Russell

Georgia Institute of Technology
Atlanta, GA

Summary

- Annual ozone distributions have decreased in width due to emissions controls
- Controls have had little effect on median ozone concentrations
- Statistical modeling can produce sensitivities that are comparable with CMAQ-DDM
- Impact of reducing NO_x emissions has decreased as the distribution of ozone has shrunk

Global/Regional Modeling Applications

chaired by:

Prakash Karamchandani (Environ) and Arastoo Biazar (University of Huntsville)

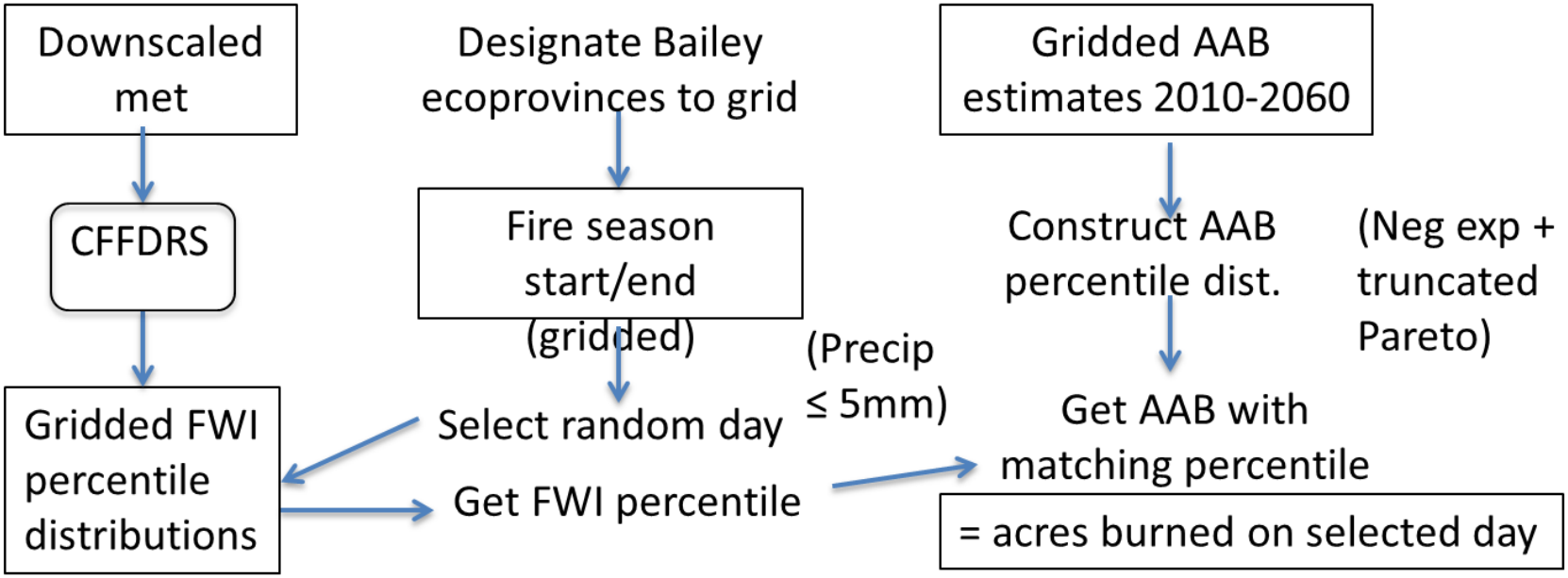
Causes and Consequences of Climate Change: Wildfire Emissions and Their Air Quality Impacts in the Southeastern U.S.

U. Shankar[1], J. Prestemon[2], A. Xiu[1], K. Talgo[1], B. H. Baek[1], M. Omary[1], and D. Yang[1]

[1]UNC Institute for the Environment
[2]USDA Forest Service

Daily Acre Burned Estimates: Fire Scenario Builder

- FSB: a stochastic model that estimates daily gridded areas burned needed to calculate daily fire emissions in the fuel consumption model, e.g., CONSUME
  - Assumes one fire per grid cell in a given fire season
  - Percentile of acres burned on a given day in fire season assumed to match that of the Fire Weather Index on that day



McKenzie, D., S. M O'Neill, N. K. Larkin, and R. A. Norheim, 2006: Integrating models to predict regional haze from wildland fire, *Ecological Modelling, 199*, 278-288.

Conclusions and Future Work

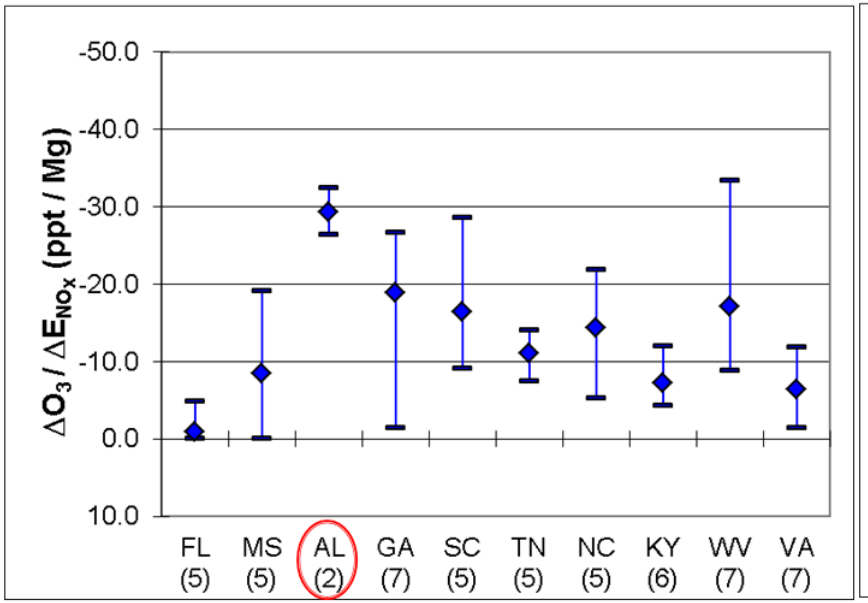
- Human role is critical in Southeastern wildfires
- Preliminary finding: AAB spatial distributions appear lower for dynamically derived vs. statistically derived met in future climate regimes – possible effect of precip?
- AQ results similar for 2010 from the two methods; slightly better PM performance from the dynamical method vs. statistical
  - Higher PM and O_3 than the NEI benchmark; needs investigation
- This project provides methods and data for
  - dynamic fire emissions estimates to examine fires in future climate regimes
  - supporting ongoing work funded by the Bureau of Land Management under its Joint Fire Sciences Program
    - considers effects of dynamic vegetation -> fuel loads change 2006-2050
    - 12-member ensemble of WRF model simulations: current and future modeling periods, high and low fire years, RCP4.5 and RCP8.5 scenarios in future years

Talat Odman and Yongtao Hu, Georgia Tech
Zac Adelman, Mohammad Omary and Uma Shankar, UNC
James Boylan and Byeong-Uk Kim, Georgia DNR

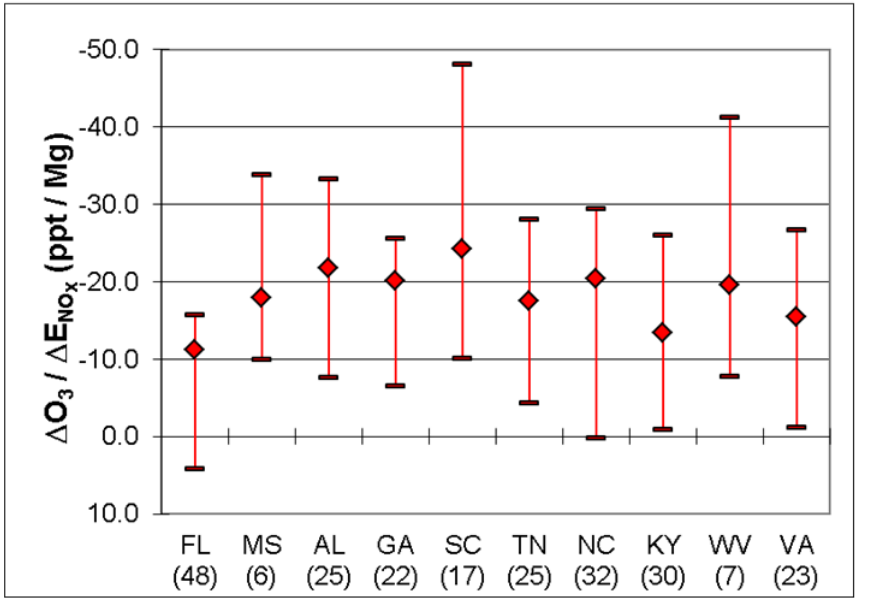
Ozone Sensitivities to NO_x and VOC Emissions in Southeastern US: Projections for 2018 and a Look Back at 2009

NO_x Emission Sensitivity Trends

VISTAS 2009



SEMAP 2018



Normalized ozone sensitivities to the home state's NO_x emissions per day
Diamonds denote the average of each state's sites while bars mark the range.
The number of sites is in parenthesis

Conclusions

- Atlanta, GA is the only area in the SESARM states with a projected 2018 ozone DVF > 75 ppb.
- Anthropogenic NO_x emission reductions are much more effective at reducing ozone compared to anthropogenic VOC emission reductions in SESARM states.
  - Some sites in Florida and some coastal sites in other states (e.g., AL, GA, VA) show comparable benefits from VOC and NO_x reductions.

Conclusions (continued)

- Ozone is becoming more sensitivities to NO_x emissions in Southeastern US, except for Alabama.
  - In 2018, ozone will decrease more compared to 2009, per ton of NO_x reduced.
  - Alabama's 2009 sensitivity included only 2 sites (vs. 25 sites in 2018).
- This is probably due to CB05 (vs CBIV) chemistry, differences in the numbers of days/sites, and/or decreasing NO_x emissions
- Average sensitivities of Southeastern States relative to each other remained almost the same.
  - South Carolina passed Georgia and Alabama in terms of ozone decrease per ton of NO_x reduced.

Emissions Inventories, Models, and Processes

chaired by:

Marc Houyoux (US EPA) and
Michael Barna (NPS)

Updates to EPA's 2011 Emissions Modeling Platform

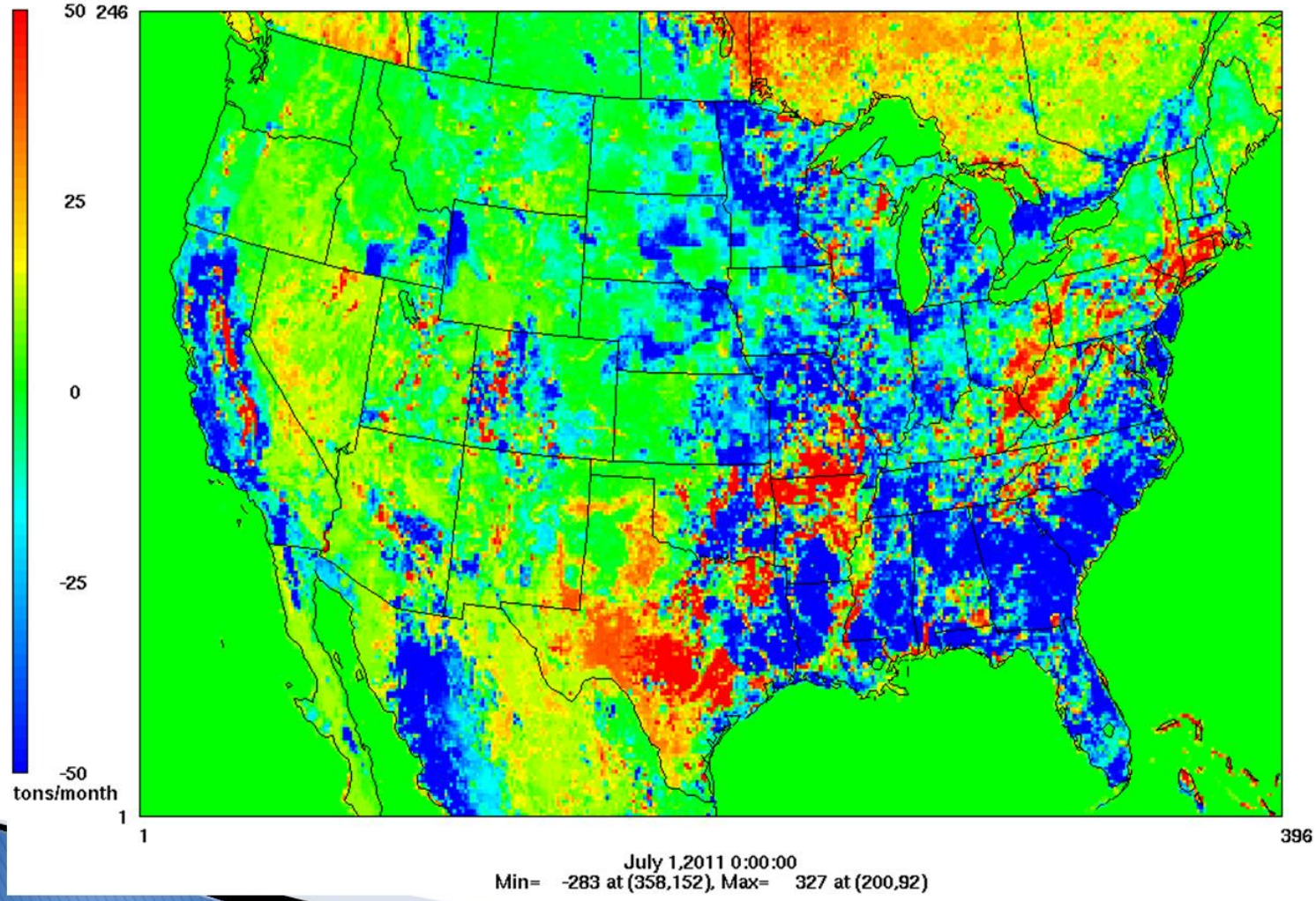
October 29, 2014

Alison Eyth, Alexis Zubrow, Rich Mason
EPA Office of Air Quality Planning and Standards
Emission Inventory and Analysis Group

Major Changes to Onroad

- New Source Category Codes map closely to MOVES
- Speciation now done in MOVES (see Sontag/Zubrow for more information)
- More representative counties for Con. US (284 vs 163)
- Improved spatial surrogates
  - extended idling locations (truck stops)
  - urban/rural unrestricted roads
  - off-network short/long haul trucks
  - bus stops
- Improved temporal profiles
  - 2012 Vehicle Travel Information System (VTRIS)
  - Reported traffic count data to the Federal Highway Administration (FHWA)
  - Varies by state, HPMS vehicle (10, 20, 30, …) and road type
  - Distinct hourly / diurnal profiles for weekdays/Sat/Sunday
  - Day of the week profiles (i.e. Monday vs Tuesday vs …)

July ISOP Difference BEIS 3.6 – BEIS 3.14



2011 Emissions Modeling Platform Development: Steps and Timing

Item	Timeframe
2011 runs based with new platform	November-December 2014
Release 2025 O3 NAAQS data (2011v1)	December, 2014
Develop Future Year Projections	November-December 2014
Future Year Runs	Starting January 2015

- EPA posts emissions modeling platform inventories and other data on the CHIEF Emissions Modeling Clearinghouse: http://www.epa.gov/ttn/chief/emch

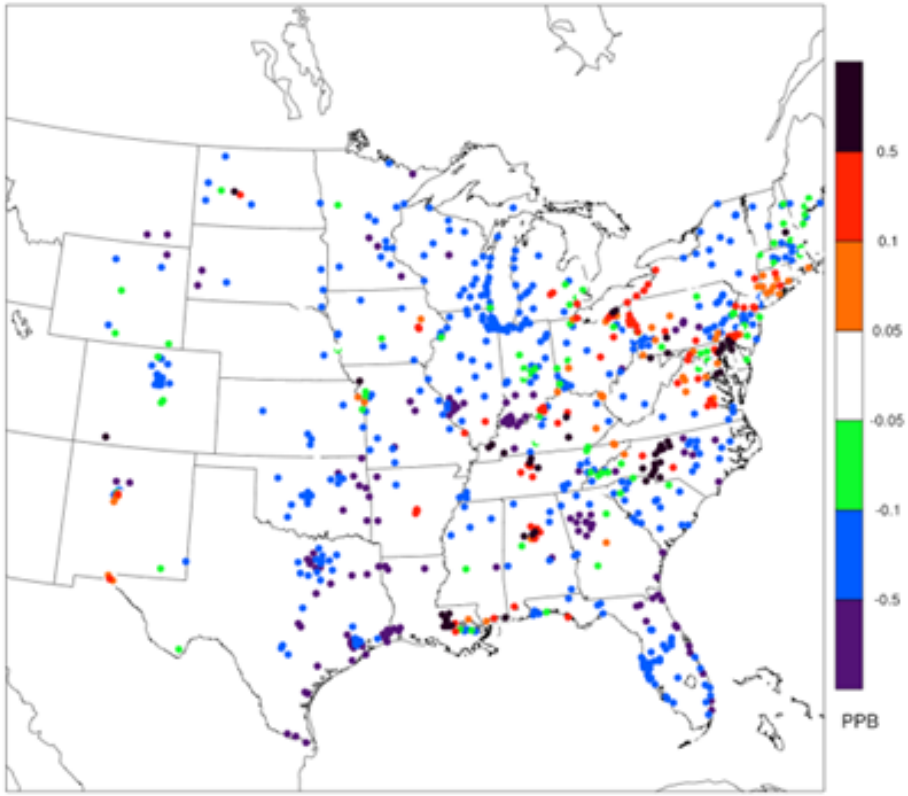
Emissions and Photochemical Modeling of Future Electric Generation

Mark Janssen, Alexander Cohan

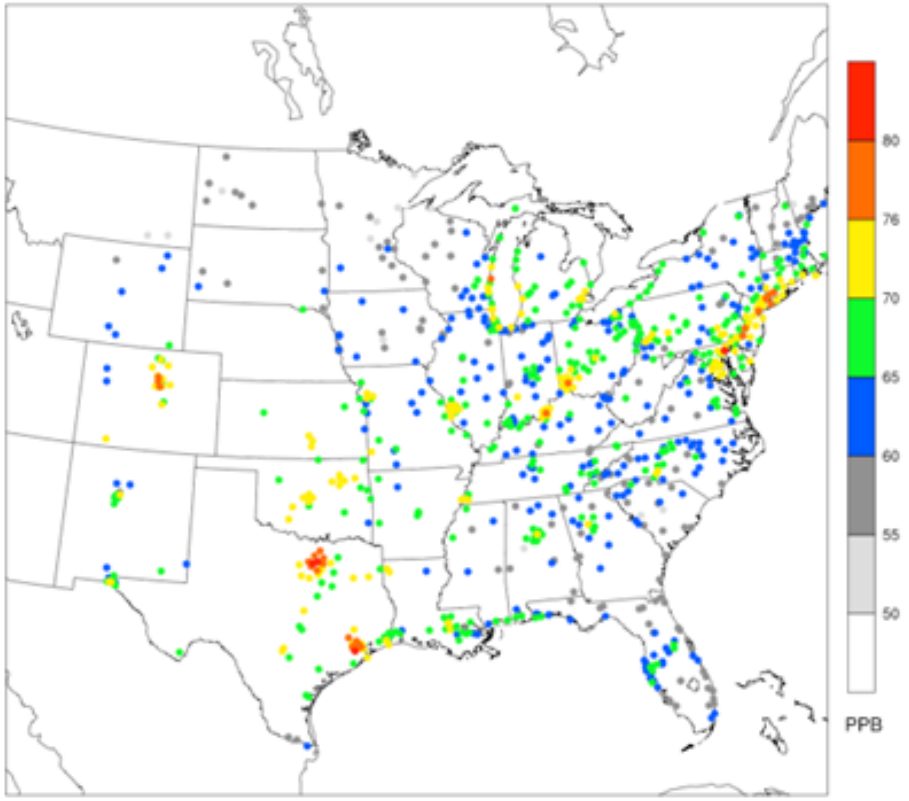
10/29/14

Modeled Attainment Test (MATS)

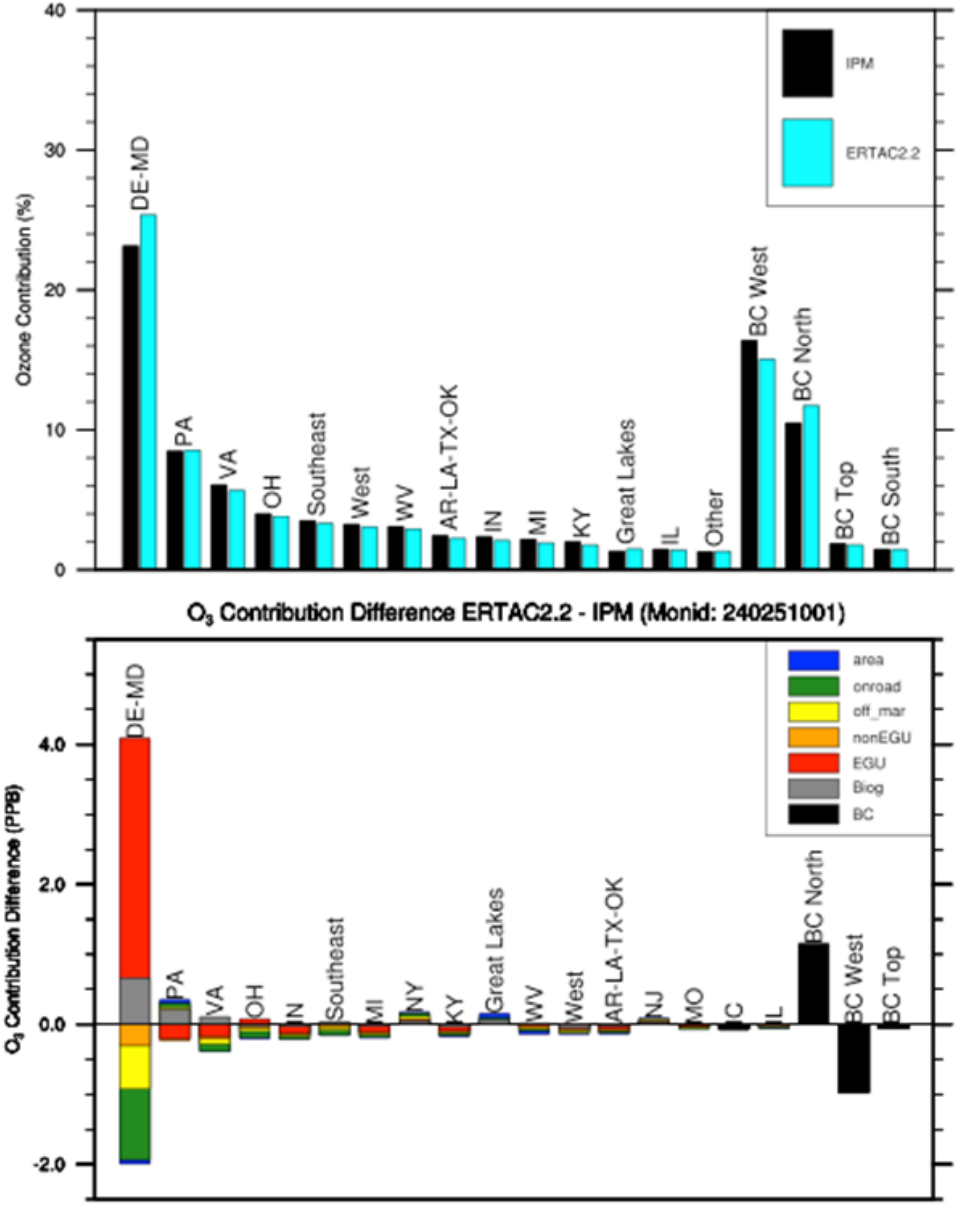
ERTAC - IPM



ERTAC



Edgewood, MD



75 ppb O_3 threshold

Air Quality Measurement and Observational Studies

chaired by:

Pius Lee and Daniel Tong (NOAA)

Comprehensive comparisons of NAQFC surface and column NO_2 with satellites, surface, and field campaign measurements during 2009-2014

Hyun Cheol Kim [1,2], Pius Lee [1], Li Pan [1,2], Laura Judd [3], Daniel Tong [1,2], Youhua Tang [1,2], Tianfeong Chai [1,2], Barry Lefer[3], and Ivanka Stajner [4]

[1] NOAA/Air Resources Laboratory, College Park, MD
[2] UMD/Cooperative Institute for Climate and Satellites, College Park, MD
[3] University of Houston, Dept. of Earth and Atmospheric Sciences, Houston, TX
[4] NOAA/National Weather Service, Silver Spring, MD

NO_2 trends over CONUS (2000-2014)

- Declining trends of surface and column NO_2 has been observed from surface AQS, satellites, and CEM NO_x emission monitoring
- Model could not reproduce continuous changes, but was improved by emission update and model configuration change.
- Change of met driver and system configuration (LBCs, dry deposition, minimum PBL height) had a large impact on simulated NO_2 concentrations

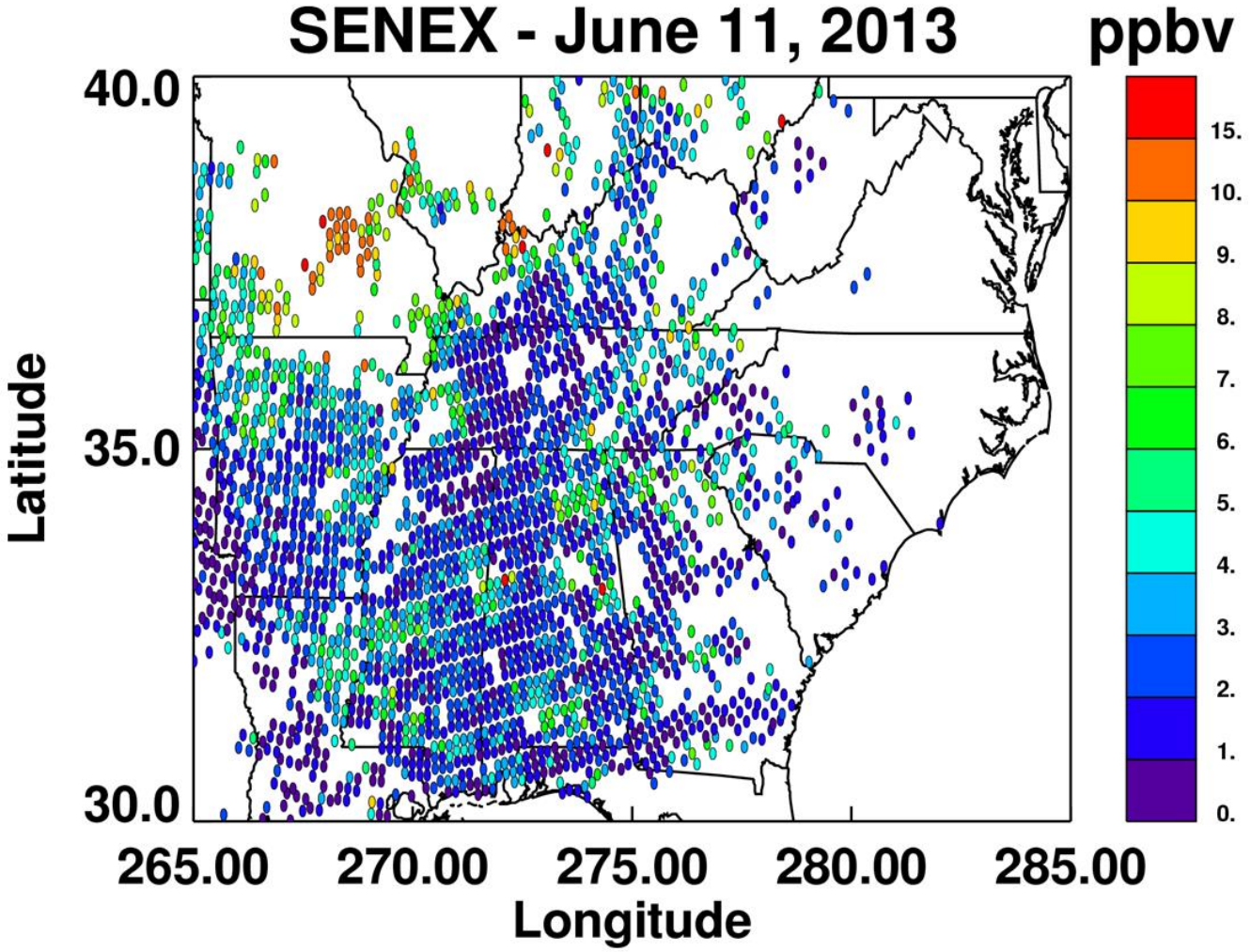
Remote Sensing of Atmospheric Ammonia from the Cross-track Infrared Sounder (CrIS): Application to Air Quality Studies in California and the Southeast US

M. J. Alvarado[1], K. E. Cady-Pereira[1], M. W. Shephard[2], J. D. Hegarty[1], C. R. Lonsdale[1], D. K. Henze[3], M. Turner[3]

[1]Atmospheric and Environmental Research
[2]Environment Canada
[3]Univerisity of Colorado - Boulder

aer
Atmospheric and Environmental Research

Application of CrIS NH_3 to SENEX



Fine Scale Modeling and Single Source Assessments

chaired by:

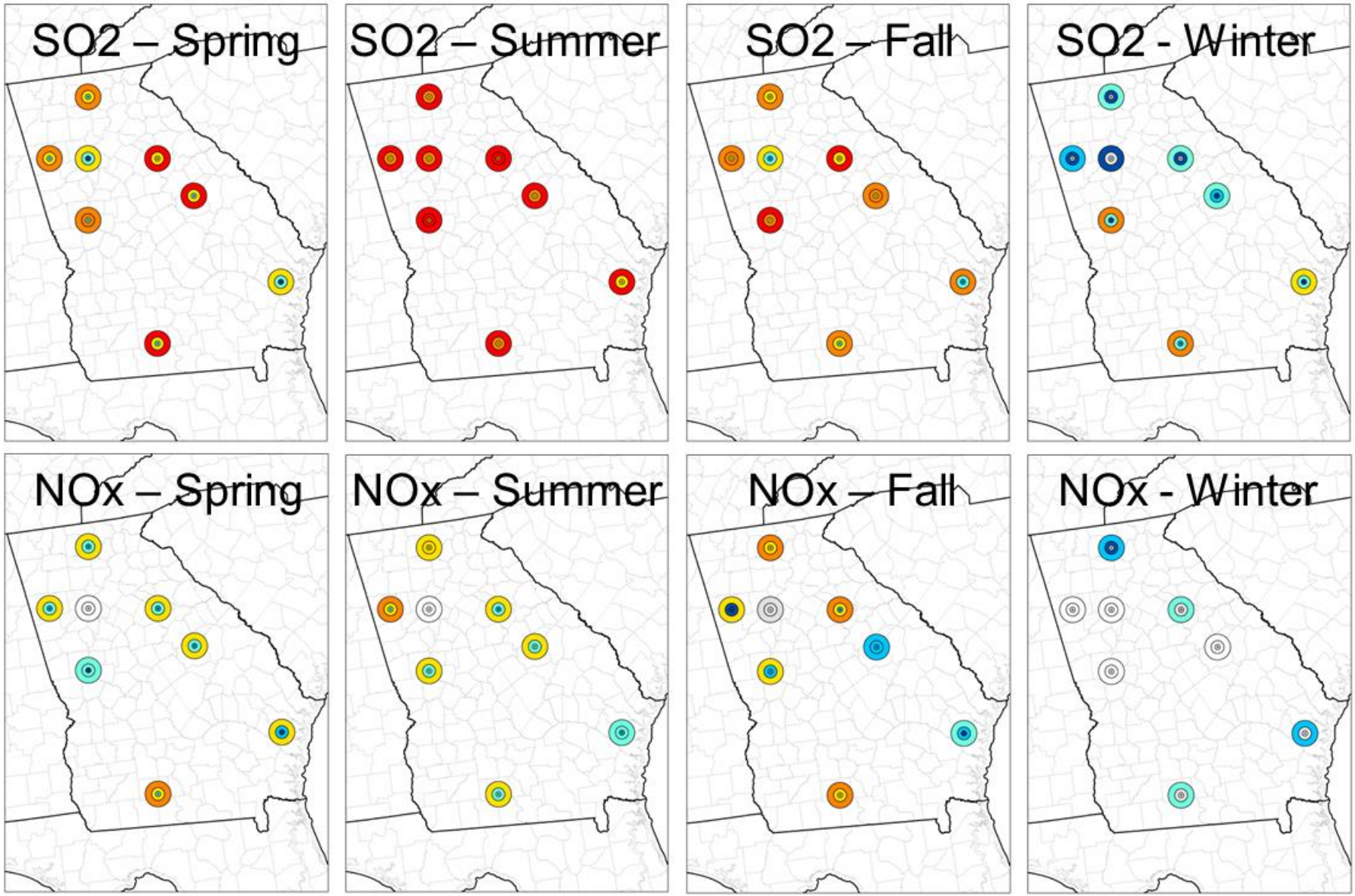
Kirk Baker (US EPA) and Sarav Arunachalam (UNC-Chapel Hill)

Spatial Variability of Seasonal PM2.5 Interpollutant Trading Ratios in Georgia

James Boylan and Byeong-Uk Kim
Georgia EPD – Air Protection Branch

2014 CMAS Conference
October 29, 2014 – Chapel Hill, NC

SO_2 and NOx Offset Ratios



Energy and Climate

chaired by:

Dan Loughlin (US EPA) and Daven Henze (University of Colorado – Boulder)

RICE

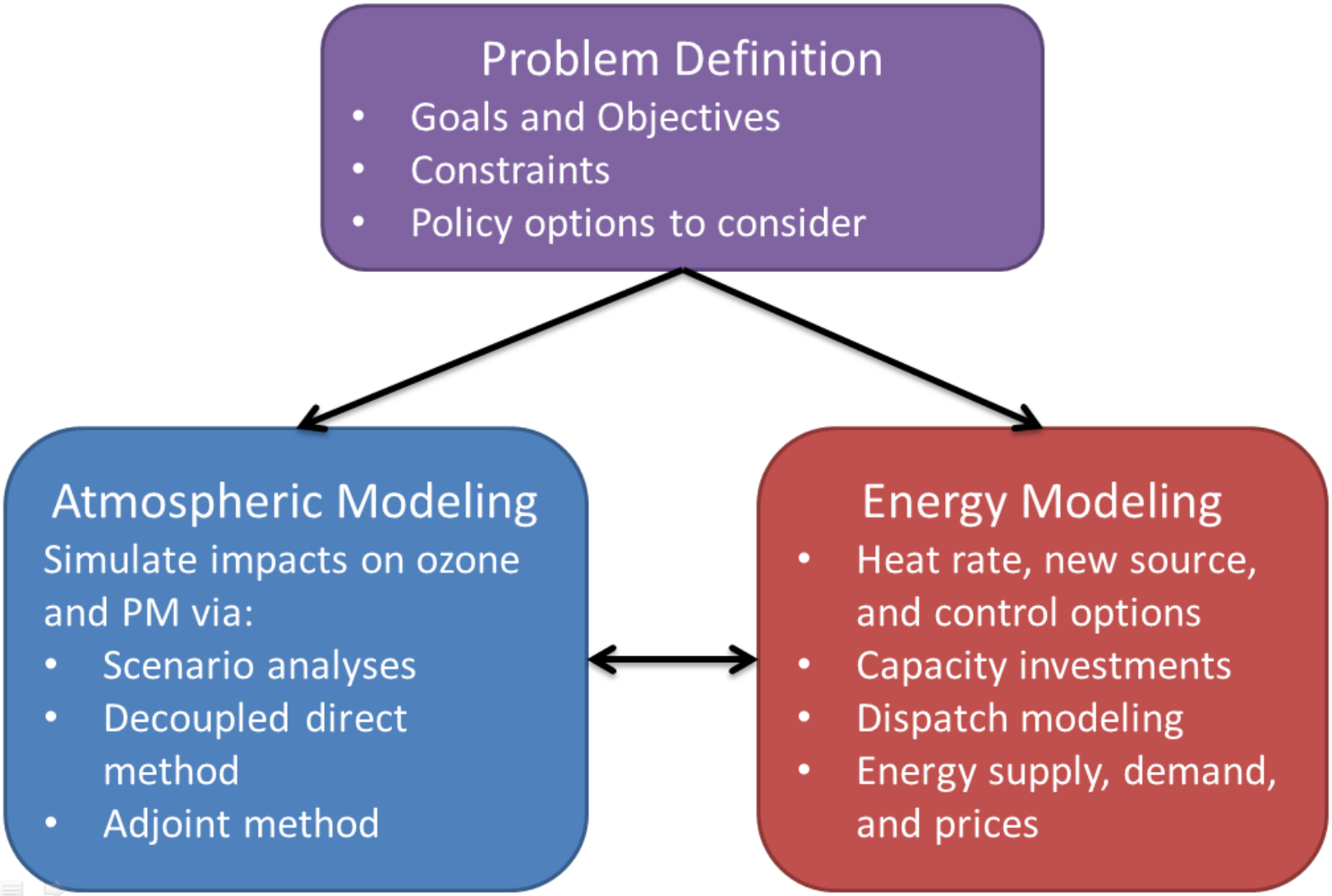
Toward the integration of air quality and climate strategies at the state level

Daniel Cohan

CMAS Conference

October 29, 2014

Integrating Clean Power Plan with NAAQS Attainment



Conclusions

- Clean Power Plan provides opportunities and challenges for achieving air quality co-benefits from CO_2 reductions
- Atmospheric models and energy systems models can inform strategy development
- Choices for how to consider AQ co-benefits in state plans for Clean Power Plan
  - Quantify impacts of Clean Power Plan approach?
  - Inform selection of Clean Power Plan approach?
  - Influence design of options?

Contact Information

Byeong-Uk Kim, Ph.D.

Georgia Department of Natural Resources
4244 International Parkway, Suite 120
Atlanta, GA 30354

Byeong.Kim@dnr.state.ga.us
404-362-2526