Long-Range Transport Work Group Update

Buffalo NY
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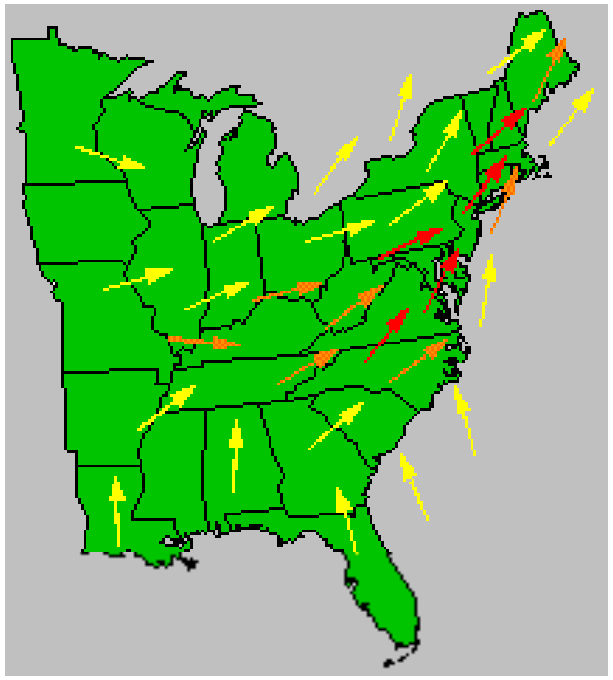
Debra Baker
Maryland Department
of the Environment

MDE

Long-Range Transport Work Group

- Created by OTC Modeling Committee in June
- **Charge**: Assess the ability of the CMAQ air quality model to accurately simulate long-range transport (LRT) of ozone, particulate matter, and their precursors, over the eastern United States
- **Importance to SIP Modeling**
  - Accurately simulate the effects of control strategies: local vs. regional
  - Reasonably estimate "significant contribution" from or to other states [§ 110(a)(2)(D)(i)]

Starting Questions



- Does CMAQ have performance problems related to long-range transport and vertical mixing?
- If so, what are the underlying causes?
- What can be done to increase the accuracy of CMAQ long-range transport simulations?
- What is the impact of this model weakness on SIP modeling outputs?

Past Assessments of CMAQ & LRT

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ATMOSPHERIC ENVIRONMENT

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Dynamic evaluation of regional air quality models: Assessing changes in O_3 stemming from changes in emissions and meteorology

Alice B. Gilliland[a,*,1], Christian Hogrefe[b], Robert W. Pinder[a,1], James M. Godowitch[a,1], Kristen L. Foley[a,1], S.T. Rao[a,1]

[a]*Atmospheric Sciences Modeling Division, Air Resources Laboratory, National Oceanic and Atmospheric Administration, Research Triangle Park, NC 27711, USA*

[b]*Atmospheric Sciences Research Center, University at Albany, 251 Fuller Road, Albany, NY 12203, USA*

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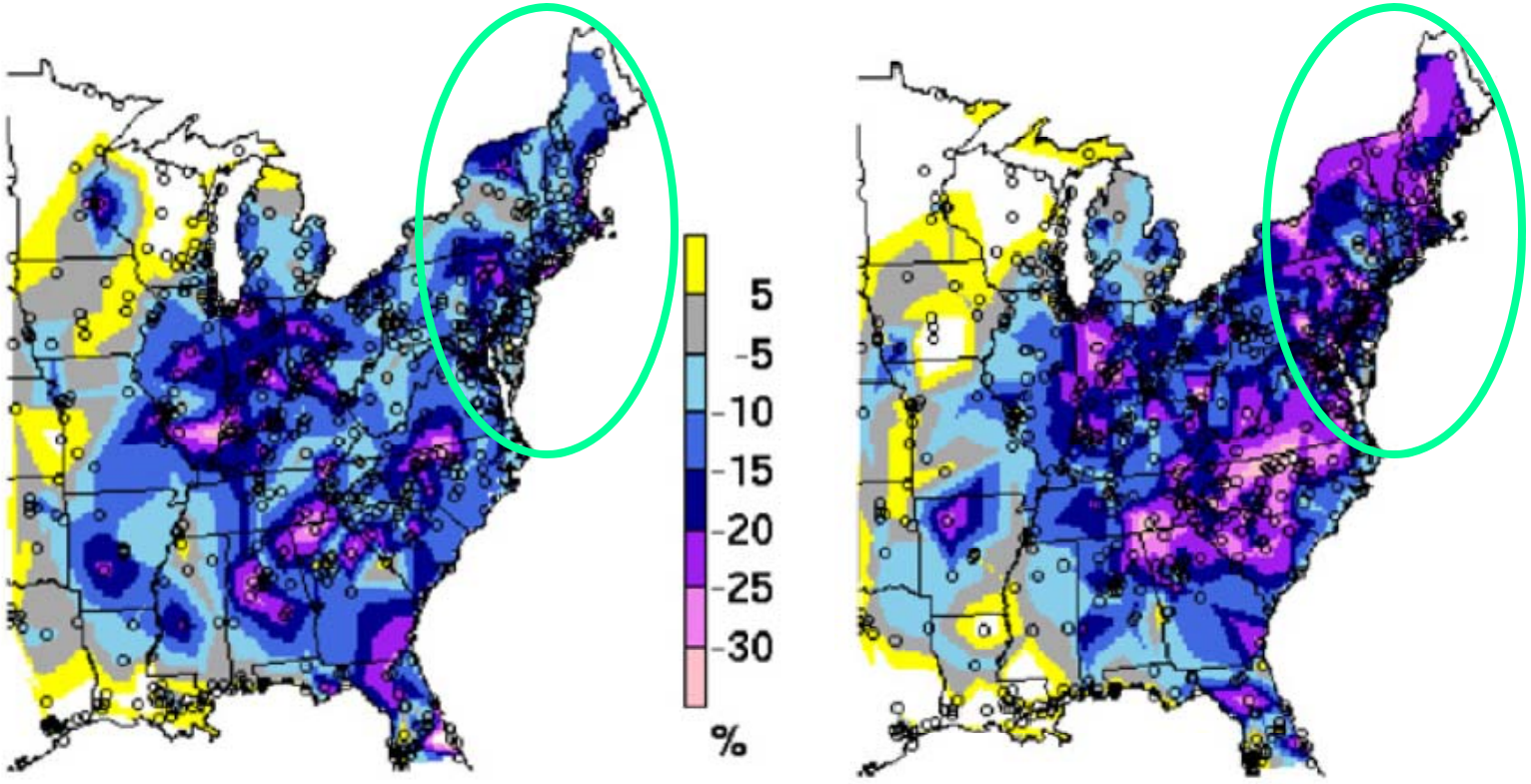
NO_x SIP Call Reductions

- Resulted in large NO_x reductions between 2002 and 2005
- Continuous Emissions Monitors Systems (CEMS) measured NO_x reductions
- Air quality monitors measured ozone concentrations
- Could CMAQ reproduce these results?

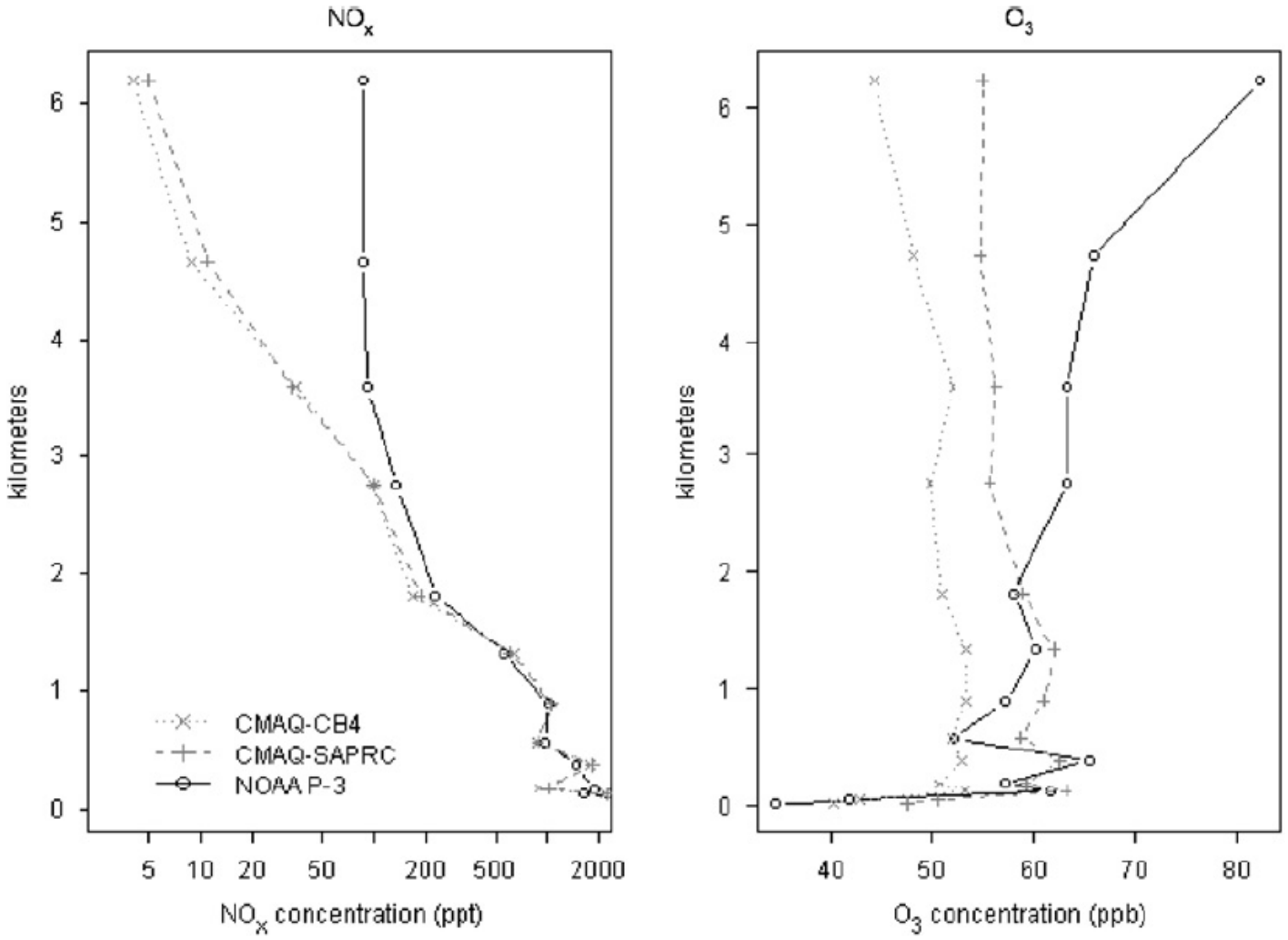
Ozone Decrease: Model vs. Observations



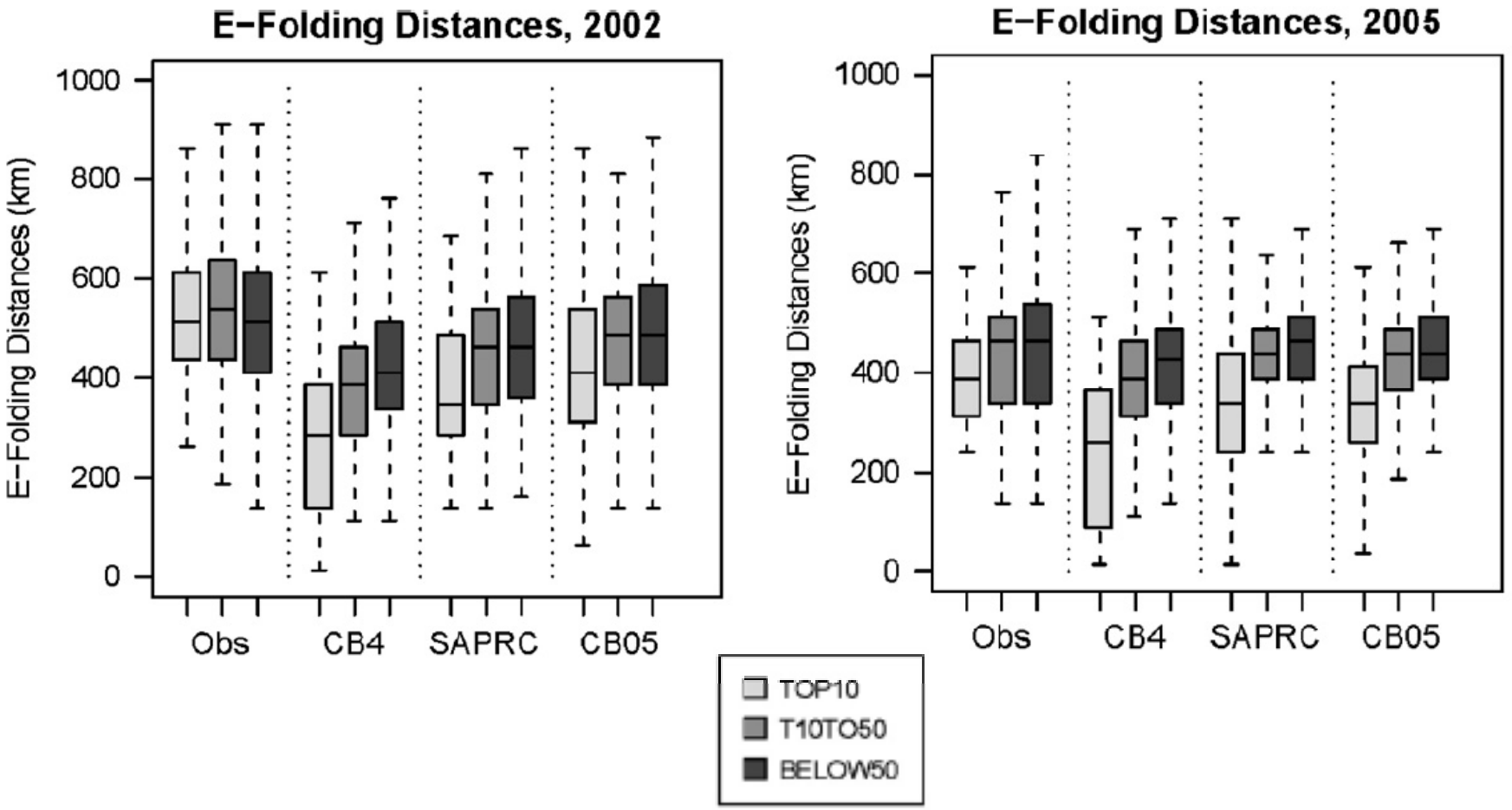
CMAQ

Observations

Vertical Profiles: O_3 Aloft Missing

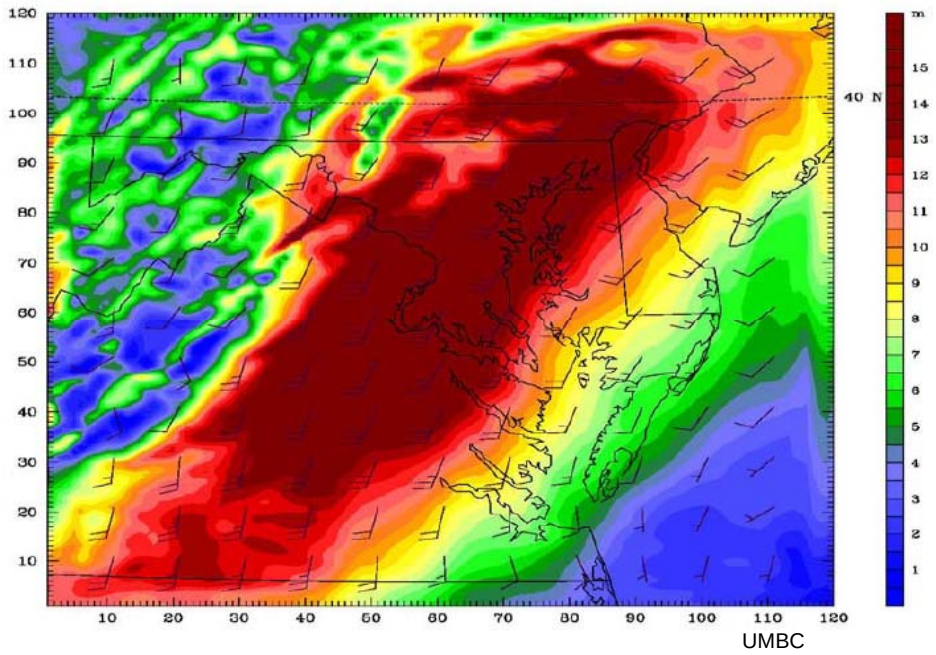


Ozone Decrease: Regional vs. Local



Potential Causes of Underprediction

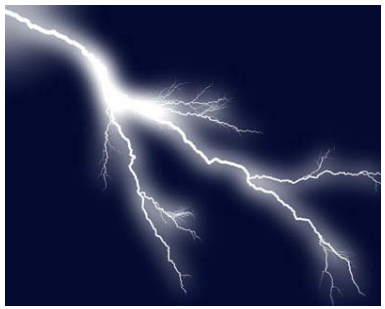
- Transport Processes
  - Vertical mixing in CMAQ
  - Winds profiles from MM5/WRF
- PBL Parameterization
  - Stable nocturnal boundary layer
  - PBL heights



Nocturnal low-level jet in WRF-ARW

Potential Causes of Underprediction

- Chemical Mechanism
  - Excessive removal of NO_x
  - Incorrect reaction rates for free troposphere
- Emission Inventories
  - Missing NO_x aloft from aircraft and lightning
  - Problems with biogenic emission simulations



LRT Work Group: Next Steps

- Use state monitoring data from aloft and the surface to assess the accuracy of CMAQ to simulate events involving long-range transport and vertical mixing.
- Identify model sensitivity tests to identify potential causes.
- Develop recommendations on model corrections and improvements for EPA.