

OTC States Modeling Plans and Issues

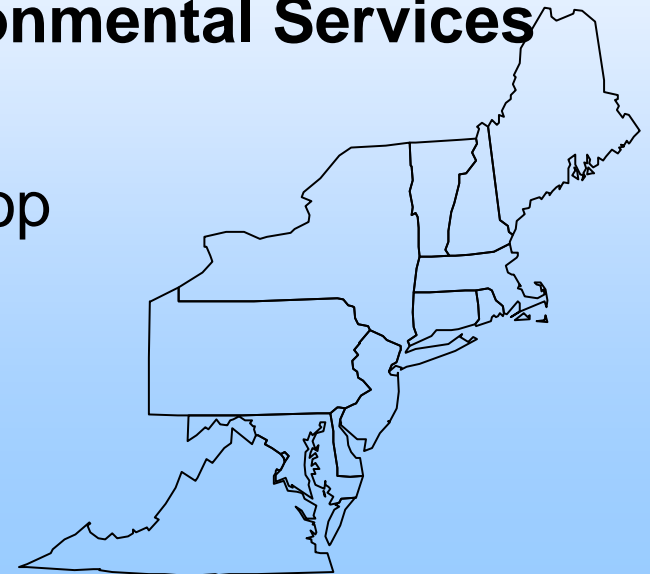
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MARAMA SIP Workshop

RTP, NC

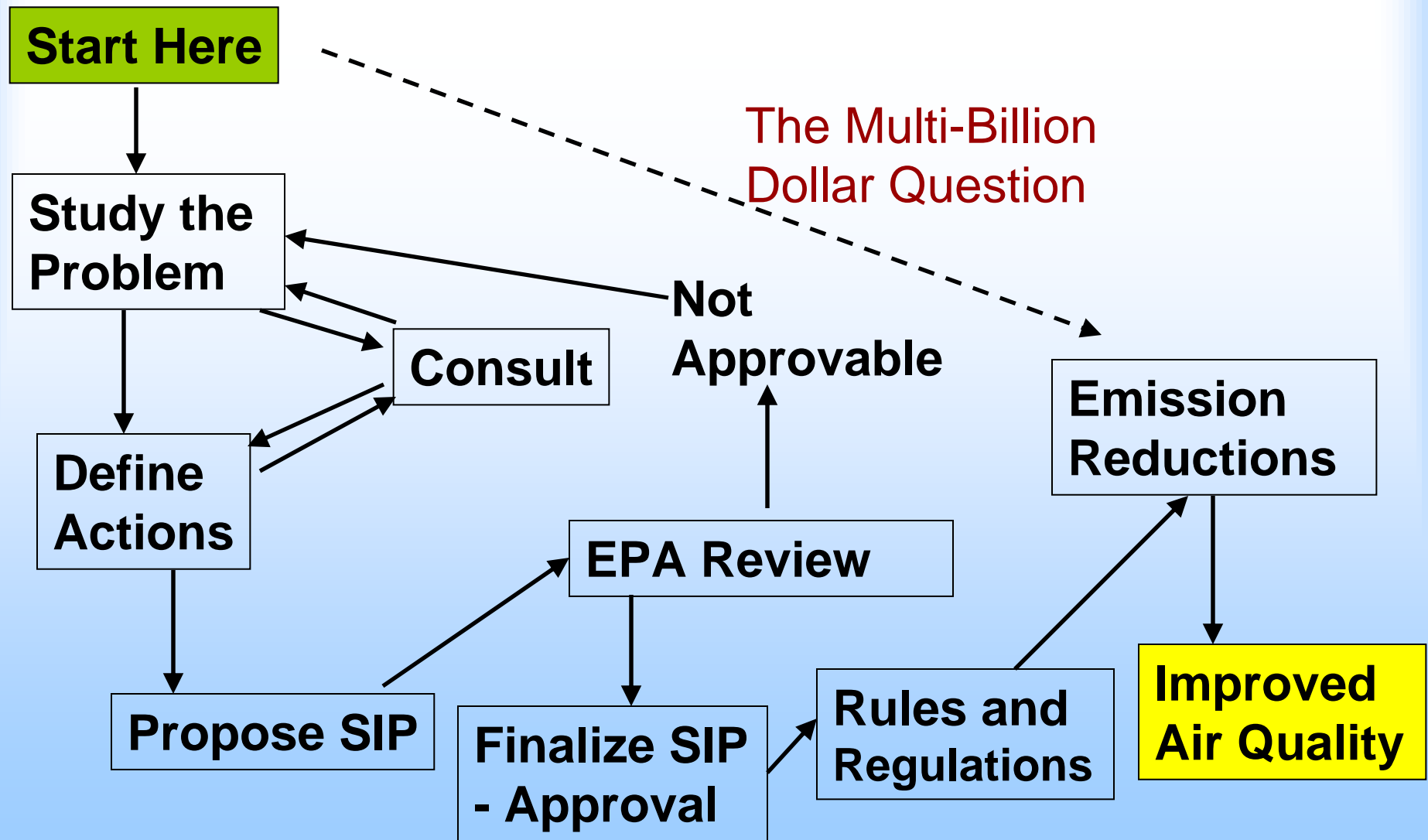
February 11, 2009



Goals

- Viable, cost effective, and equitable emission reduction SIP strategies that successfully improve air quality.
- On-time Submittals of:
 1. PM_{2.5} SIPs – 2nd Quarter of 2012
 2. Progress Report for Regional Haze – 4th Quarter of 2012
 3. Ozone SIPs – 1st Quarter of 2013

The Process

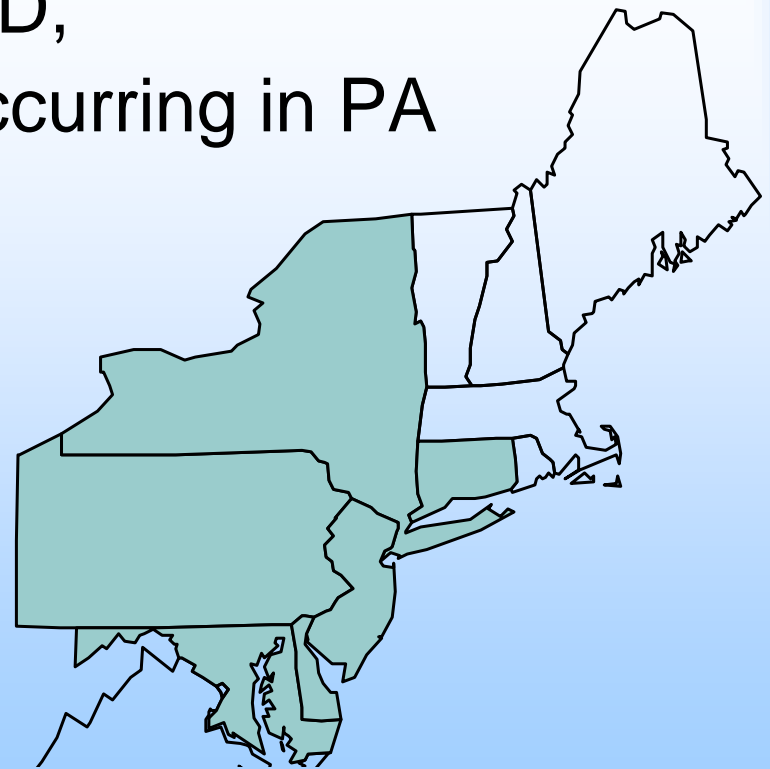


The Northeast Challenge

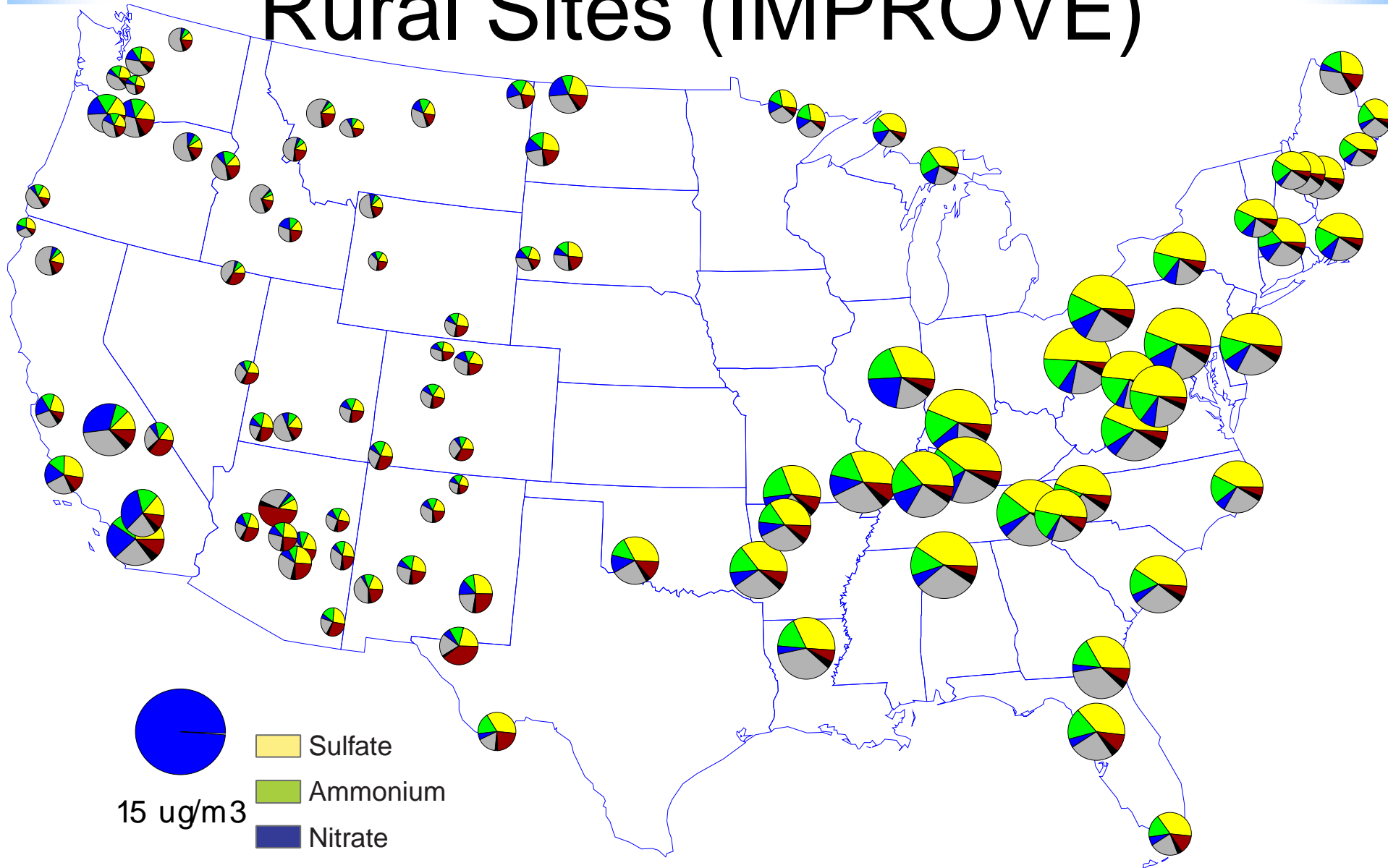
PM_{2.5}

- 24-hour PM_{2.5} nonattainment areas in:
CT, NY, NJ, DE, PA, and MD,
- highest value, 61ug/m³, occurring in PA

Target: 35ug/m³ and below
in all areas



Rural Sites (IMPROVE)



15 $\mu\text{g}/\text{m}^3$

Sulfate

Ammonium

Nitrate

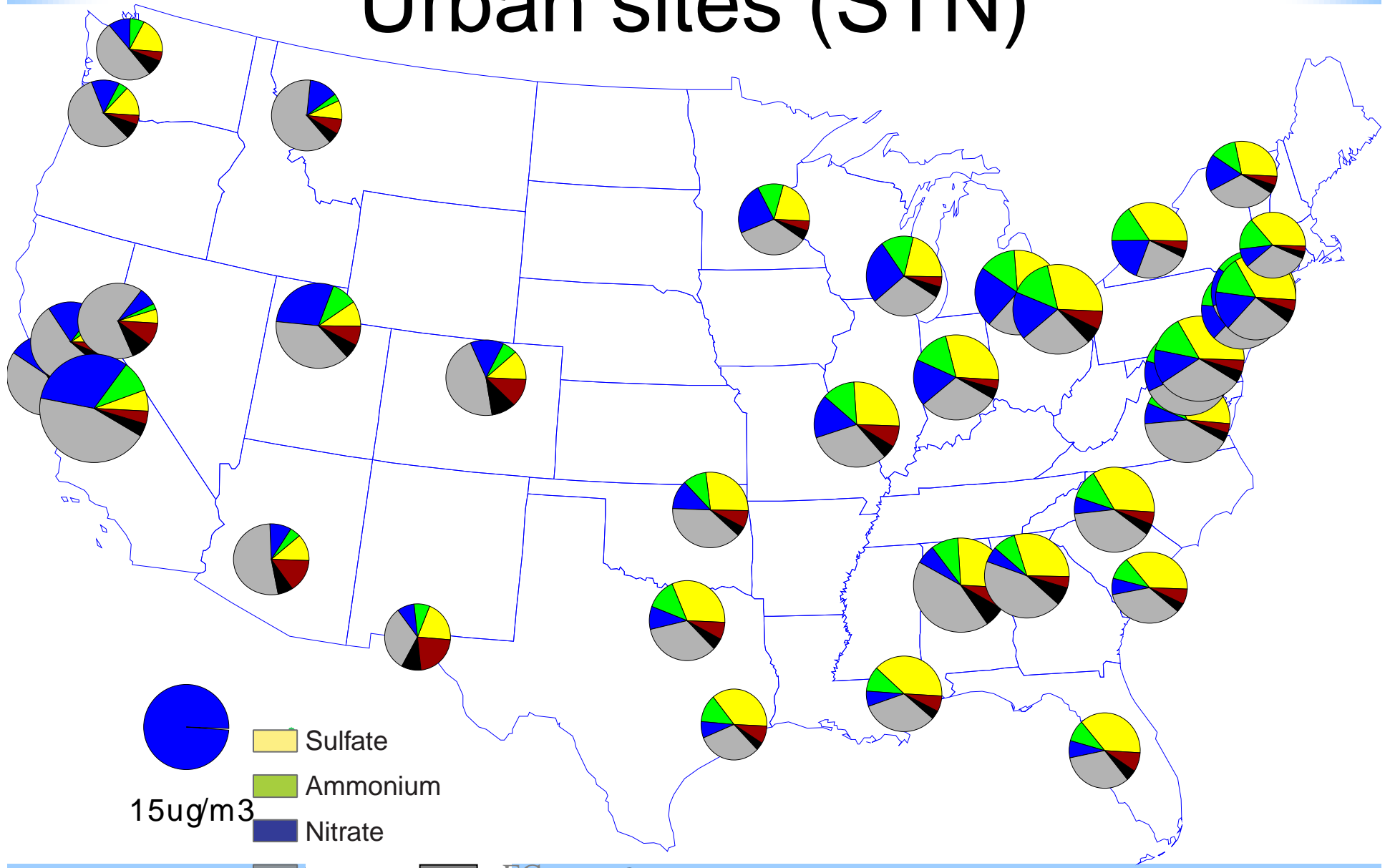
OCM

EC

Crustal Material

Courtesy of Neil Frank, EPA

Urban sites (STN)



15 $\mu\text{g}/\text{m}^3$

- Sulfate
- Ammonium
- Nitrate
- OCM
- EC
- Crustal Material

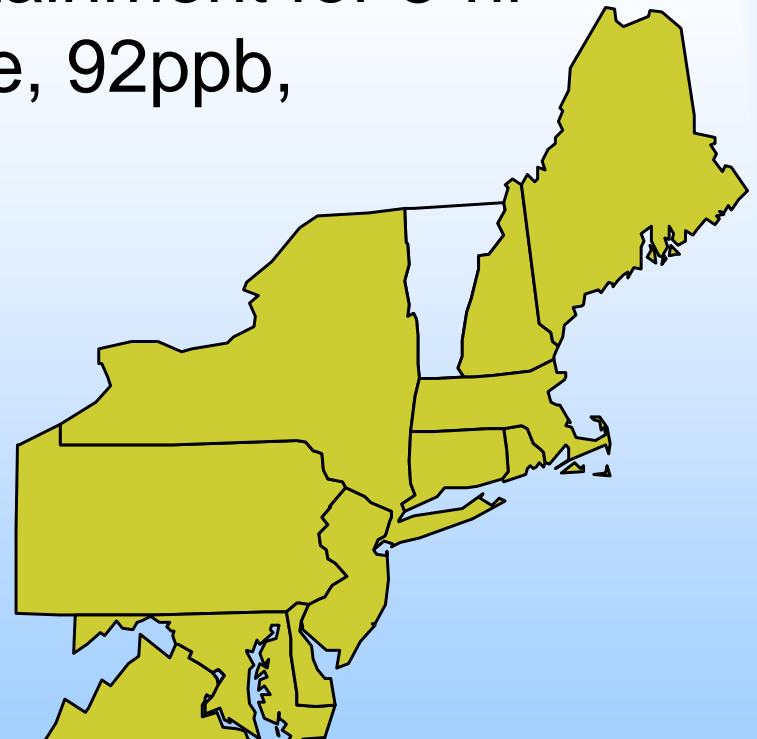
Courtesy of Neil Frank, EPA

The Northeast Challenge

Ozone

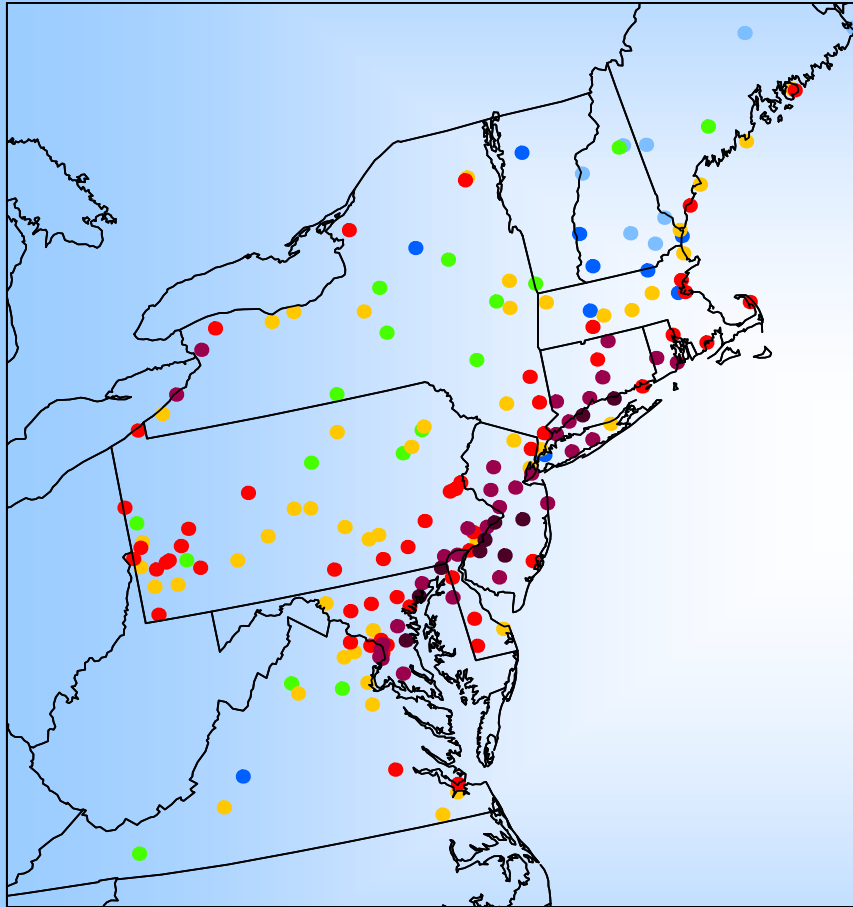
- Preliminary data suggests that all OTC states except for VT, will be nonattainment for 8-hr ozone with the highest value, 92ppb, occurring in PA

Target: 75ppb and below
in all areas

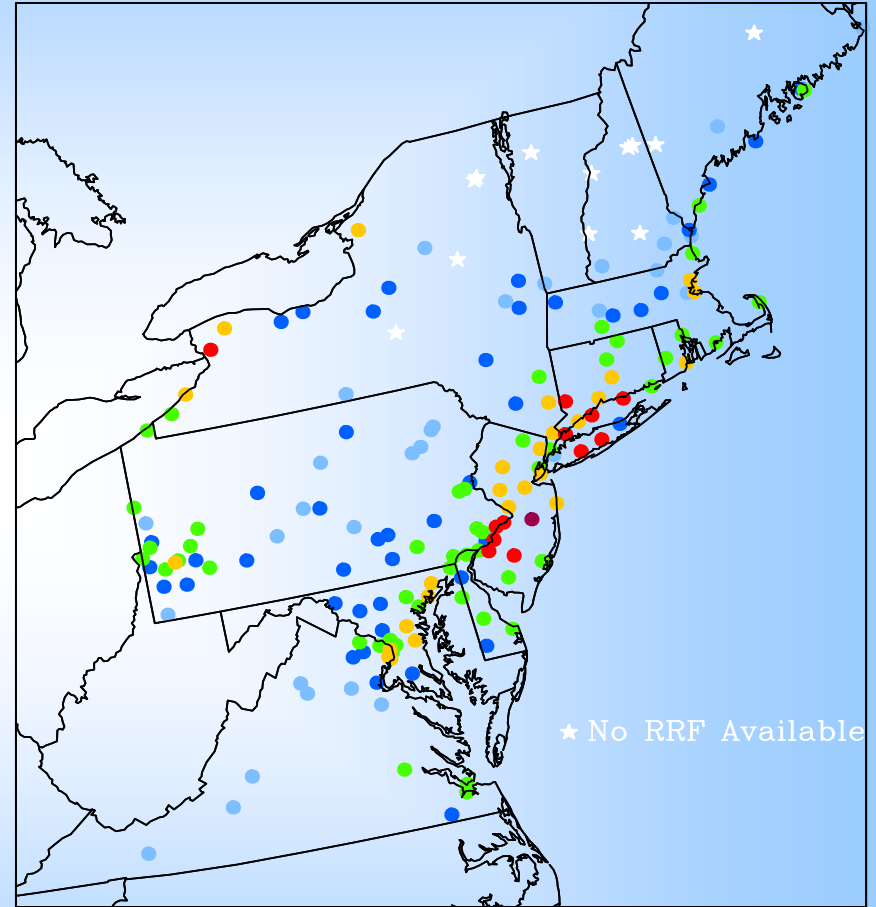


Previous CMAQ Results - OTR Domain

2002 Design Values - Base



2009 Design Values - Base



72 77 82 87 92 97

CMAQ Predicted Design Values above 8-Hour Ozone NAAQS(84 PPB) for OTC States

(Previous CMAQ Modeling for OTC)

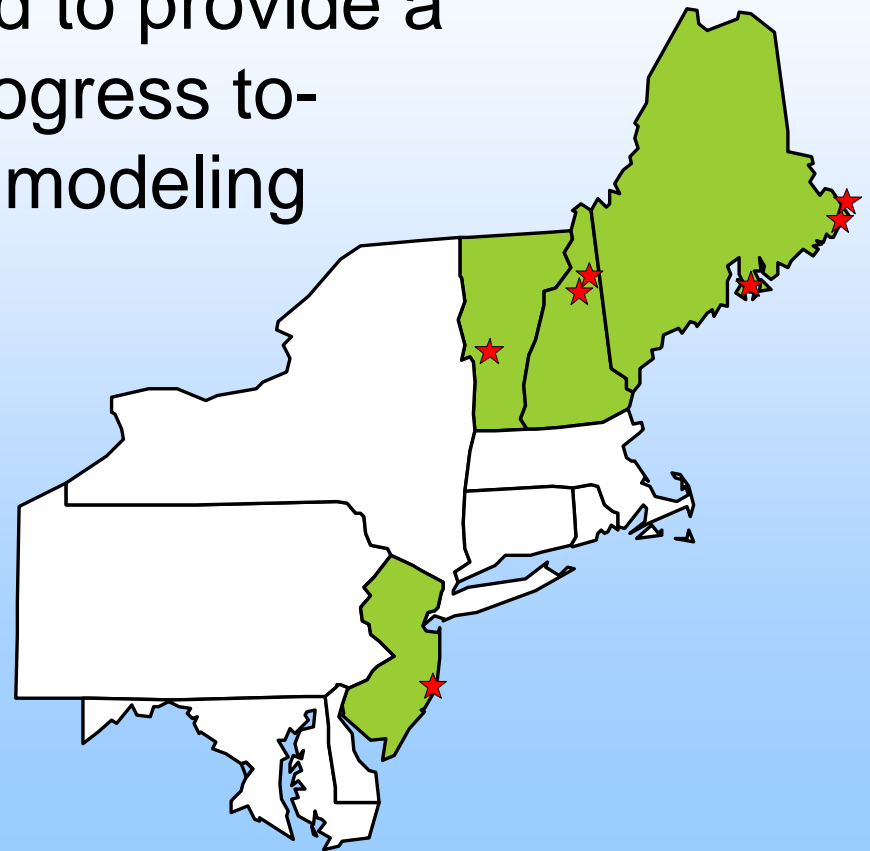
AIRS-ID	State	Monitor	2002	2009 OTB	2009 BOTB	2009 Advanced CAIRPLUS	2012 BOTB
340290006	NJ	Colliers Mills	106.0	92	92	91	86
90013007	CT	Stratford	98.3	90	90	90	86
361030009	NY	Holtsville	97.0	90	89	89	86
420170012	PA	Bristol	99.0	88	88	88	84
90093002	CT	Madison	98.3	89	88	88	83
340070003	NJ	Camden	98.3	88	88	87	83
340155001	NJ	Clarksboro	98.3	88	88	87	83
90010017	CT	Greenwich	95.7	87	87	87	83
340071001	NJ	Ancora St. Hos	100.7	87	87	87	82
421010024	PA	Northeast	96.7	87	87	86	82
340210005	NJ	Rider Univ.	97.0	86	86	85	81
510130020	VA	Arlington Co.	96.7	86	86	85	80
510590018	VA	Fairfax Co.	96.7	86	86	85	79
361030002	NY	Babylon	93.7	85	85	85	82
361192004	NY	White Plains	91.3	85	85	85	82
90011123	CT	Danbury	95.7	86	85	85	81
90019003	CT	Westport	94.0	85	85	85	81
90099005	CT	Hamden	93.3	85	85	85	81
340030005	NJ	Teaneck	91.7	85	85	84	81
240251001	MD	Edgewood	100.3	85	85	85	80

The Northeast Challenge

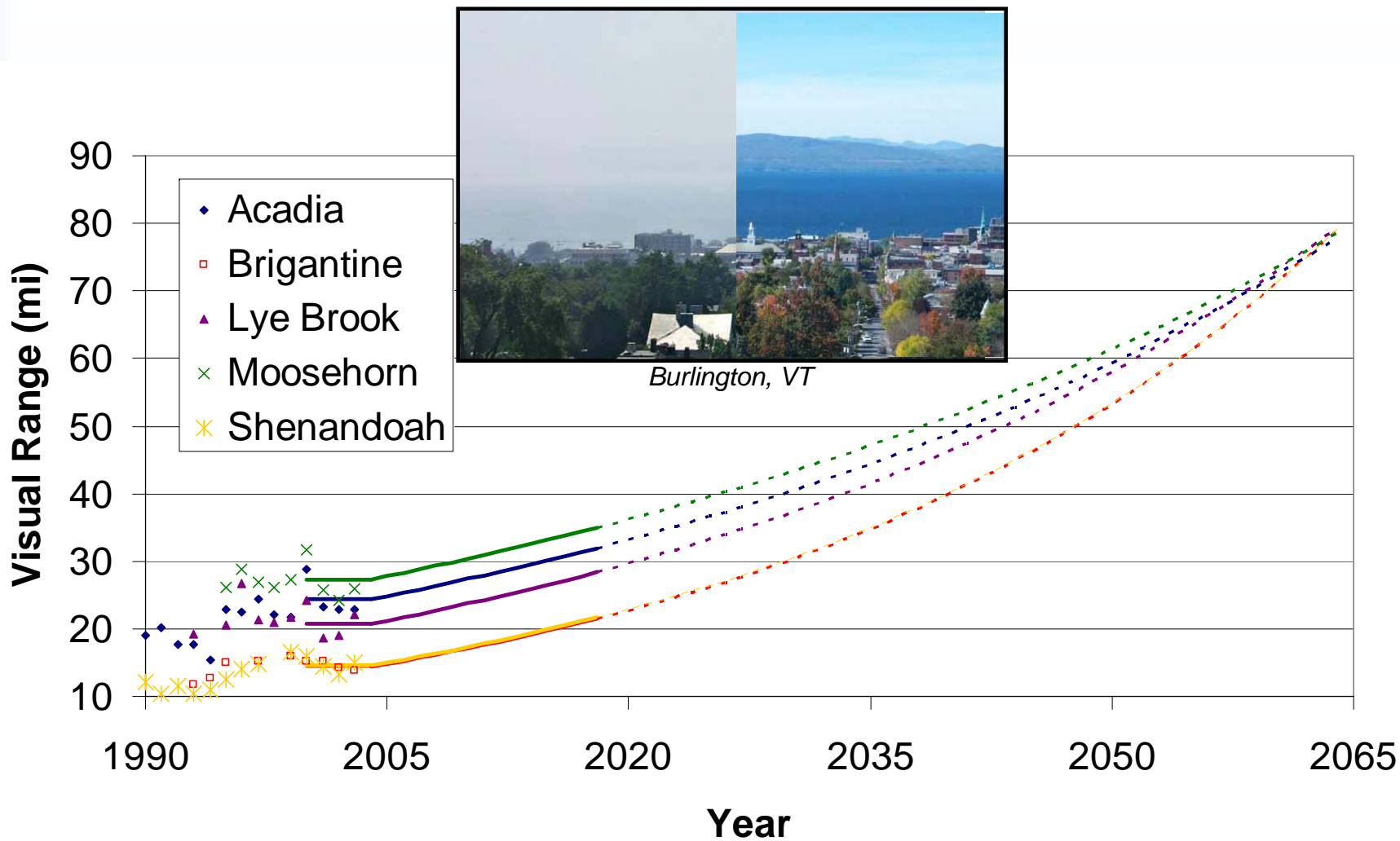
Regional Haze

- Four northeast states have Class 1 Areas subject to the Regional Haze Rule and will be required to provide a mid-course check on progress to-date, including updated modeling projections for 2018.

Target: reasonable progress

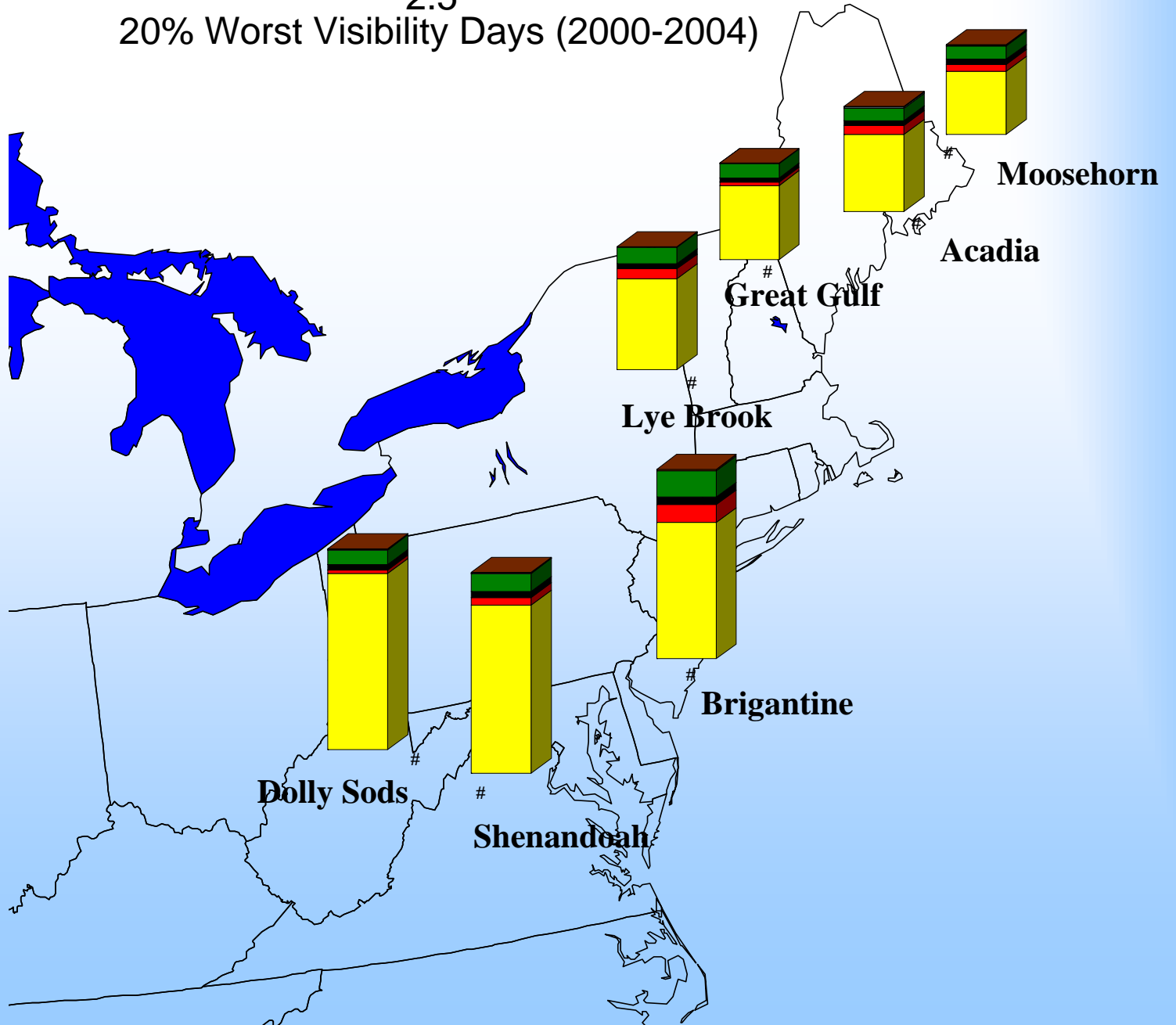
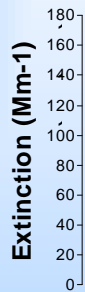
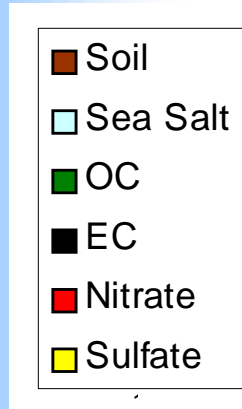


Uniform Progress Goals (20% Worst Visibility Days)



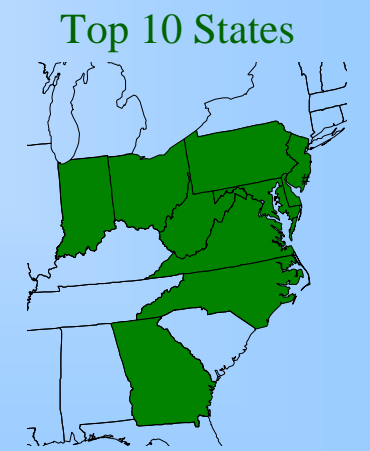
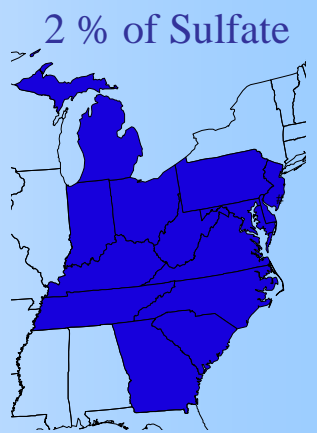
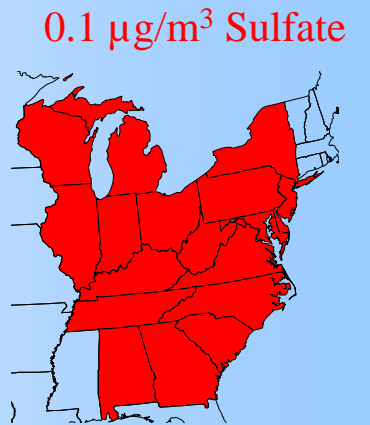
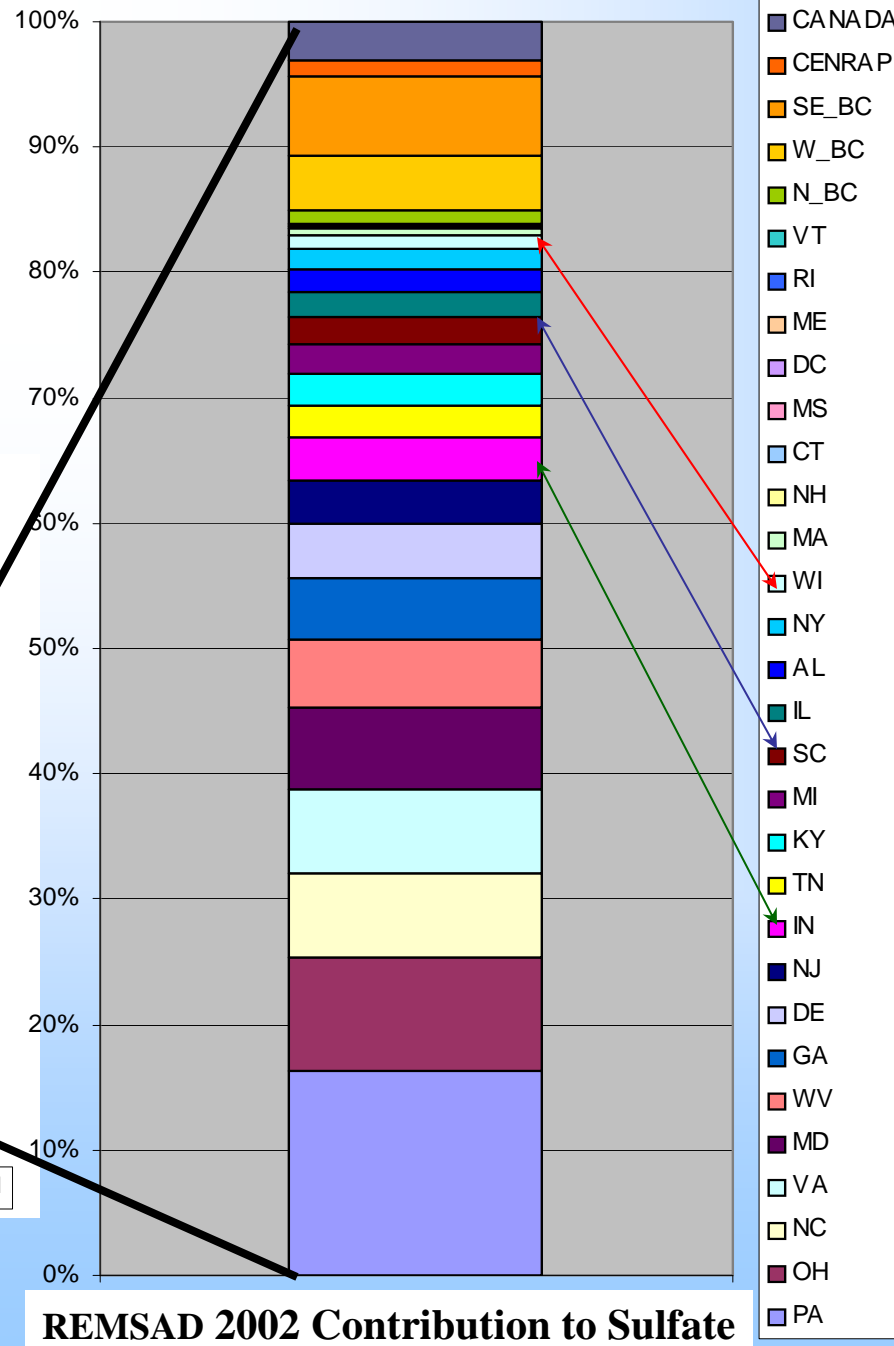
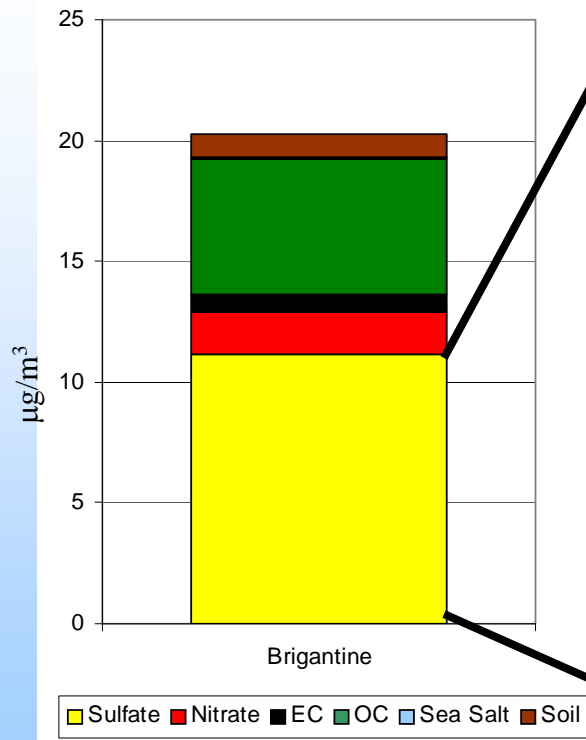
Contributions to PM_{2.5} Extinction at 7 Sites

20% Worst Visibility Days (2000-2004)



Brigantine

20% Worst Days



Threshold options

IMPROVE mass 00-04

OTC Charge to Committees

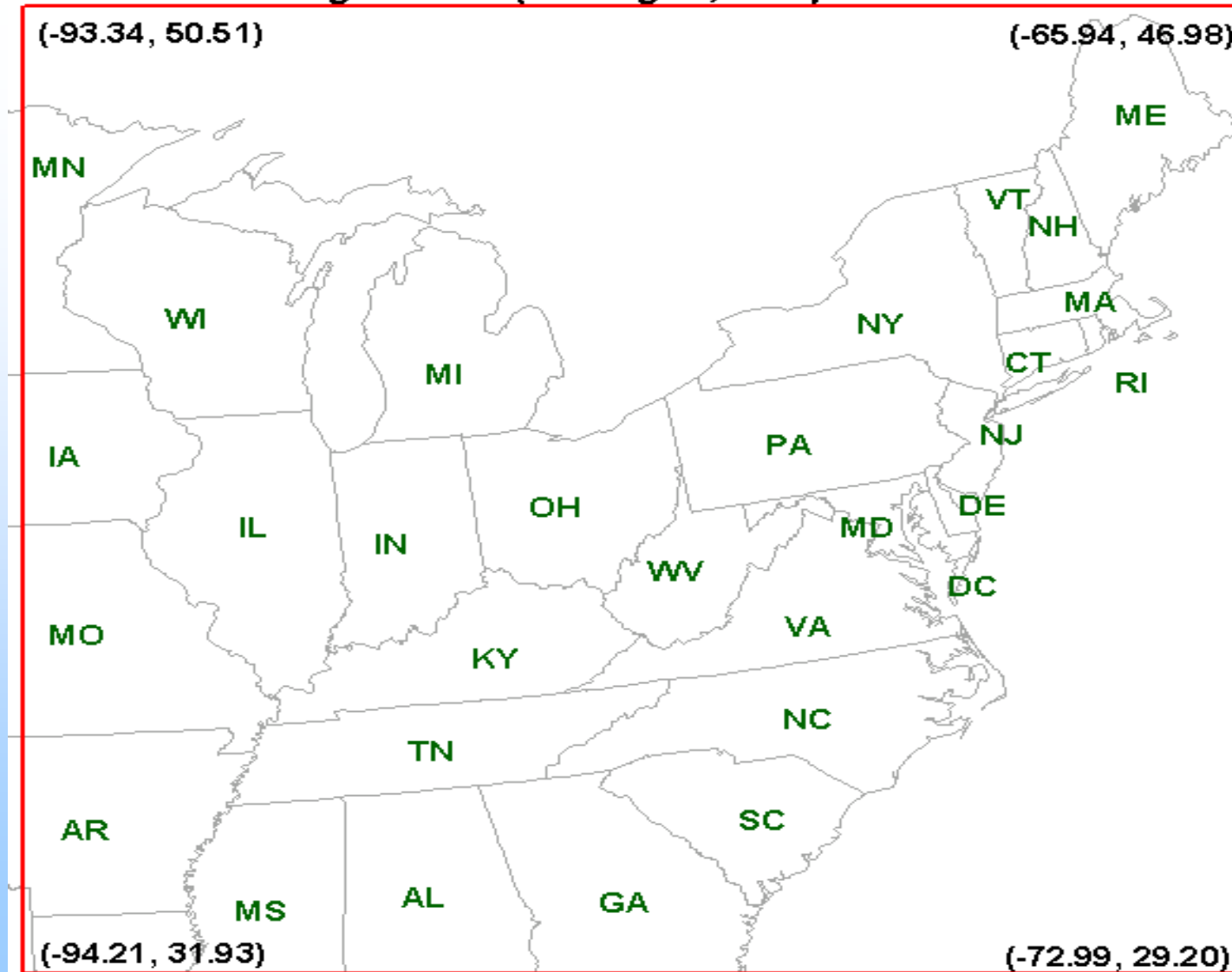
- The OTC Modeling committee has been charged by the OTC to examine how and what are the needs to ensure that the region would be able to meet the new NAAQS for PM_{2.5} and Ozone
- Based upon the schedule initial efforts are directed to addressing the 24-hour PM_{2.5} NAAQS
- As a by-product of the initial efforts for PM_{2.5}, the states would also assess the new 8-hour ozone NAAQS

Proposed Modeling Approach

- Two phases
 1. Screening/sensitivity (for time sensitive issues)
 2. SIP quality final modeling
- **Phase 1 – Screening/Sensitivity Modeling Design**
 - Base year 2005 emissions, projected to future years 2012 and 2018 (from previous SIP work)
 - Use of existing emissions data where available
 - 2012 projections would approximate 2013 conditions for ozone
 - 2007 meteorology data to be developed
 - Annual model runs to be initially conducted
 - Episodes to be identified for further modeling efforts
 - SMOKE/CMAQ or CAMx, and/or other acceptable models may be used at 36km and 12km grids, in a manner similar to earlier work
 - Upgrades for Biogenics and the inclusion of CB05 chemistry
 - Anticipate use of Global models for initial and boundary conditions for 36km grid, and 12km grid conditions would be extracted from the 36km simulation

Modeling Domain for Ozone, PM_{2.5} and Regional Haze

Eastern Modeling Domain (12km grid, LCC)



Proposed Modeling Approach

- **Phase 2 – SIP Quality Final Modeling Design**
 - Significant OTC discussion of 2005 vs. 2007 for Base year
 - Base year 2007 emissions, project to future years 2013 and 2018
 - 2007 CEMS data to be used
 - 2007 emissions for non-CEMS sources would be developed by either:
 1. Forecasting 2005 NEI emissions to 2007, or
 2. Backcasting 2008 NEI emissions to 2007
 - 2007 meteorology data – same as used for screening
 - Seasonal runs to be done for ozone
 - Annual model runs to be conducted for PM_{2.5} and haze
 - SMOKE/CMAQ or CAMx, and/or other acceptable models may be used at 36km and 12km grids, in a manner similar to earlier work
 - Upgrades for Biogenics and the inclusion of CB05 chemistry
 - Anticipate use of Global models for initial and boundary conditions for 36km grid, and 12km grid conditions would be extracted from the 36km simulation

Analyses

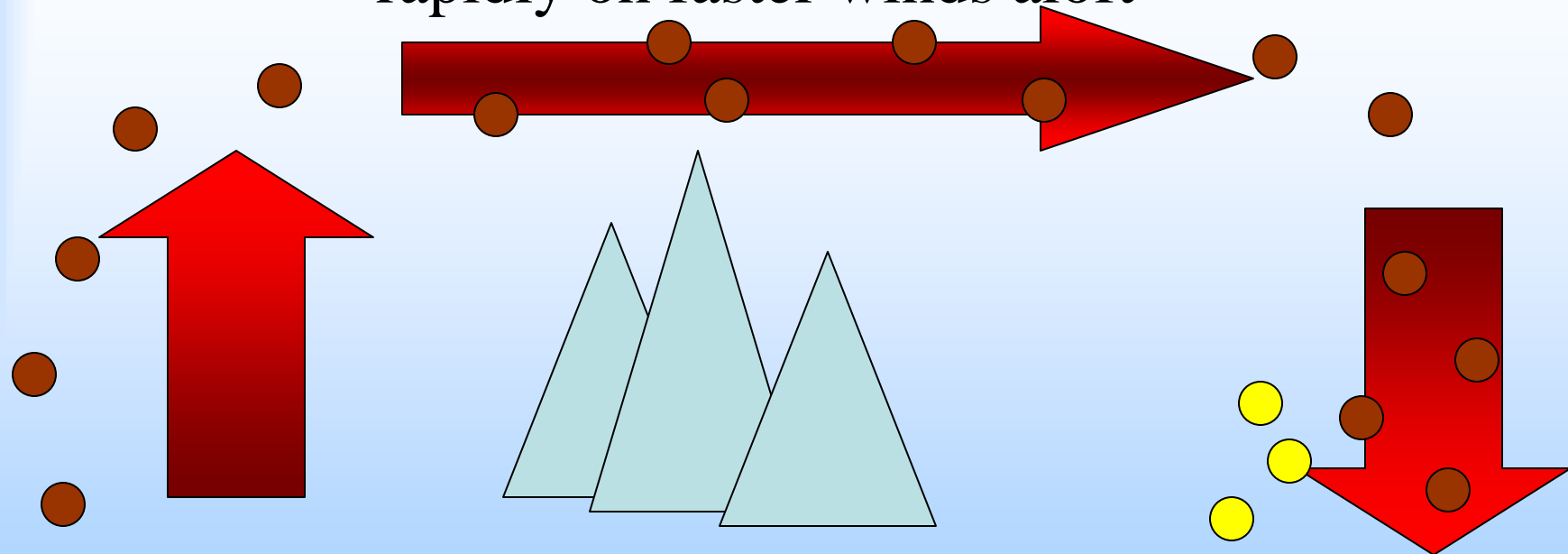
- Meteorological data testing
- Model performance testing
- Analysis for 24-hr PM_{2.5} to be based on EPA MATS program
- Seasonal modeling for 8-hr Ozone with relative reduction factors
- All modeling and analyses to be performed according to EPA guidance
- Results and technical documentation will be developed
- Although 2013/2014 may not be the attainment year for 8-hour Ozone for all states, model results will be analyzed in the development of other scenarios
- Comprehensive weight of evidence analyses to be performed (trajectory, tagged species, and factor analyses)

Special Sensitivity Runs

- OTC states expressed interest in exploring:
 - How well the models replicate transport
 - At ground level
 - At elevation (several mountain top nonattainment areas – including Mt. Washington at 6288 feet msl)
 - Are low-level jets reasonably accounted for?

Long-Range Transport: Up, Over, Down – Does the model get it right?

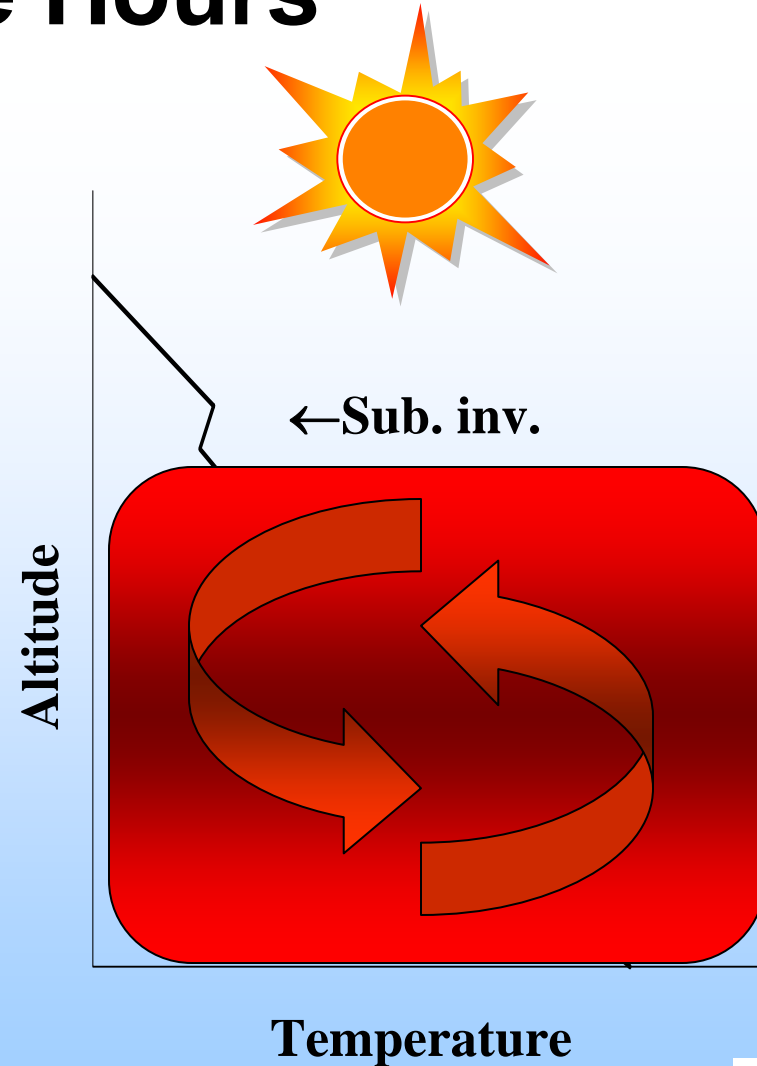
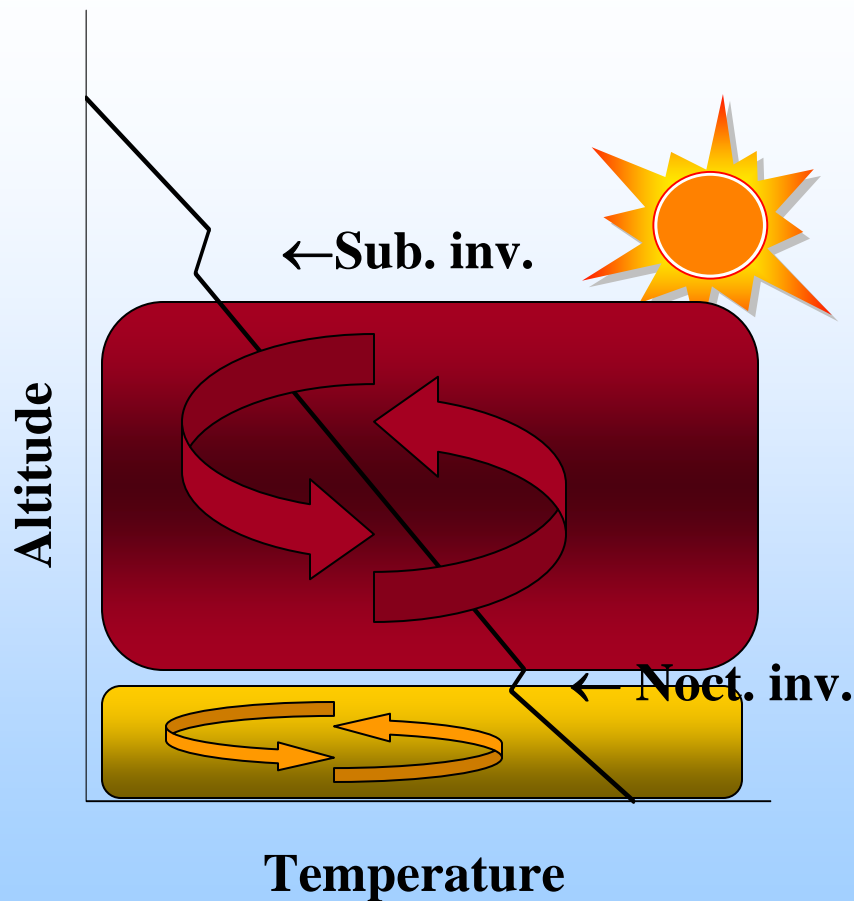
OVER Pollution is transported rapidly on faster winds aloft



UP Pollution mixes up through a deep layer in daytime heating

DOWN Pollution mixes down the same way it came up

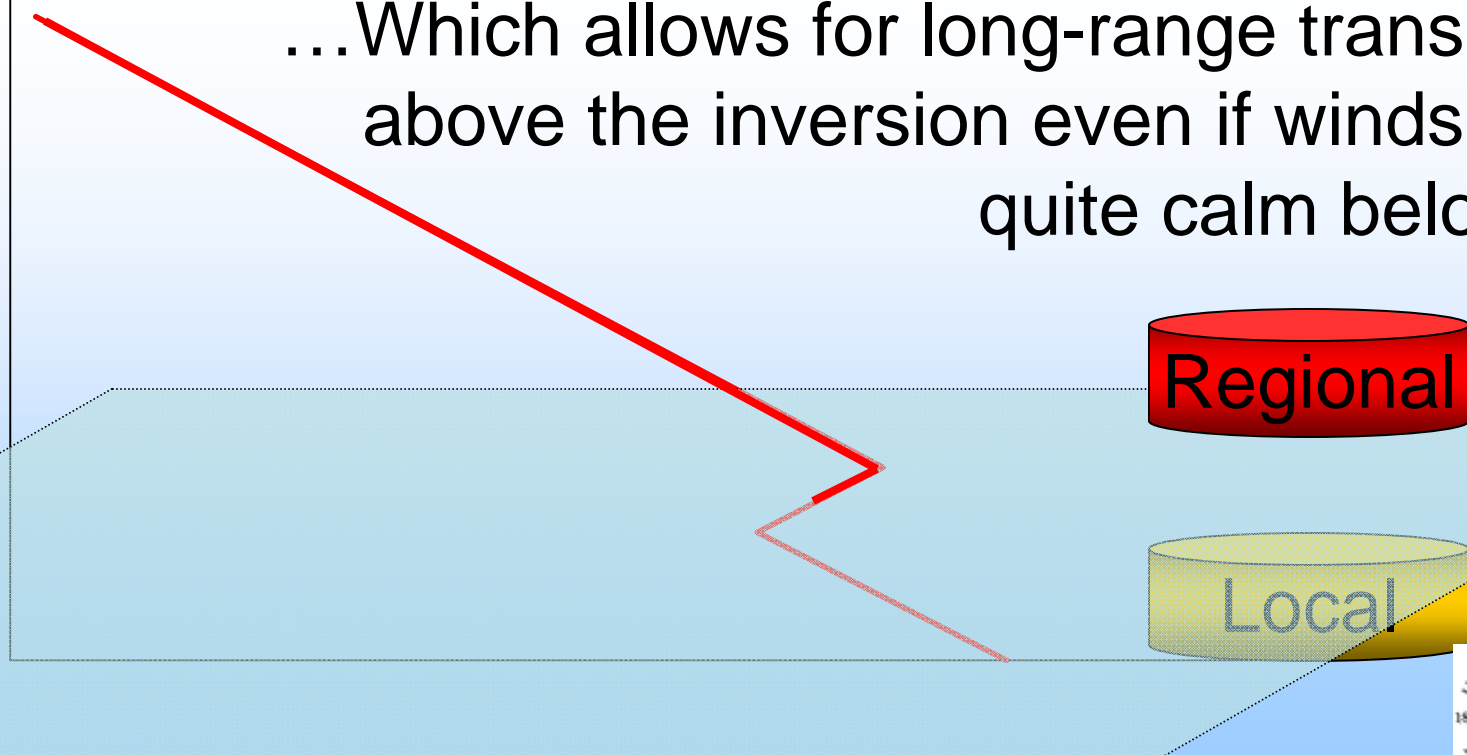
Up and Down Mixing Occurs Best During Day-time Hours



The Night-Time Inversion Can Enhance Transport

The inversion layer creates a low friction cushion of air, much like an air hockey table

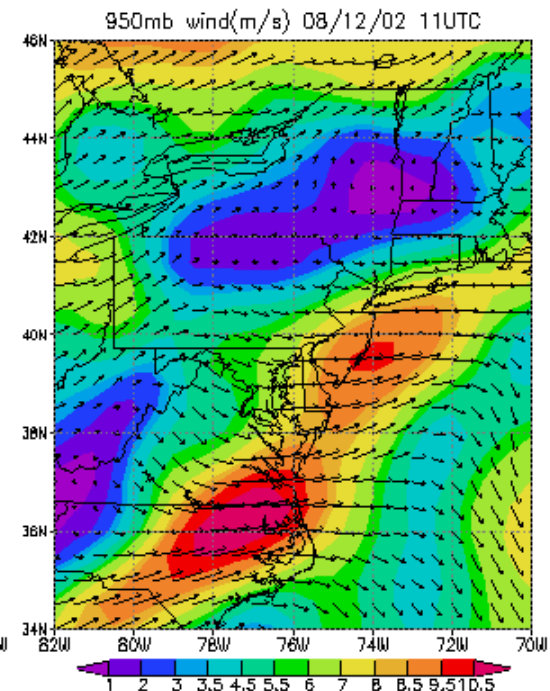
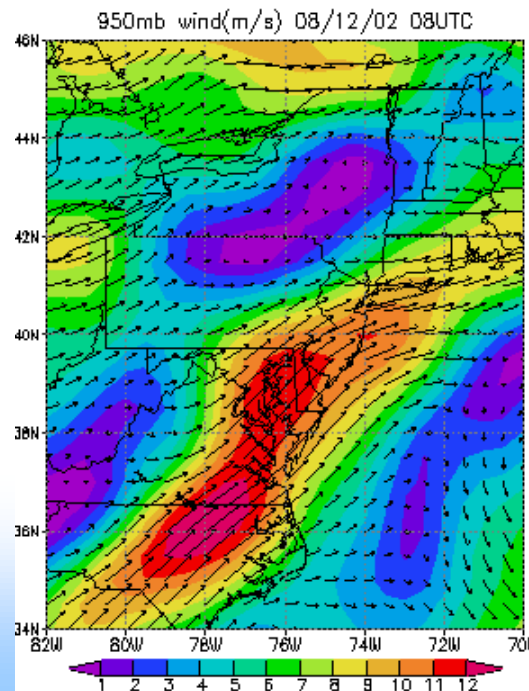
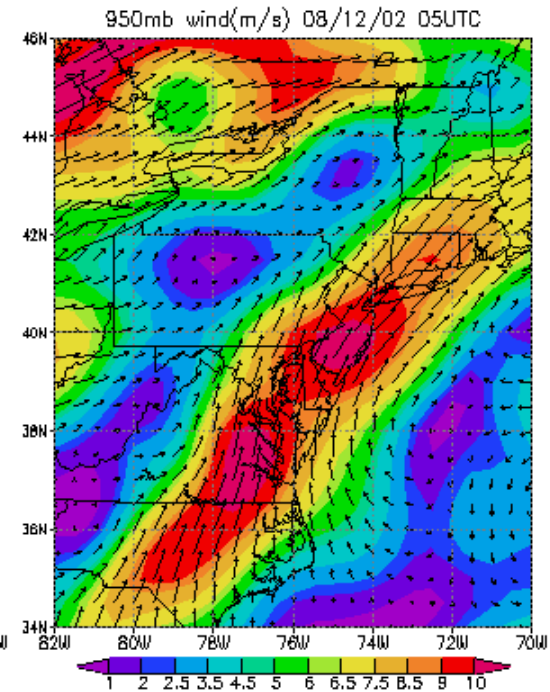
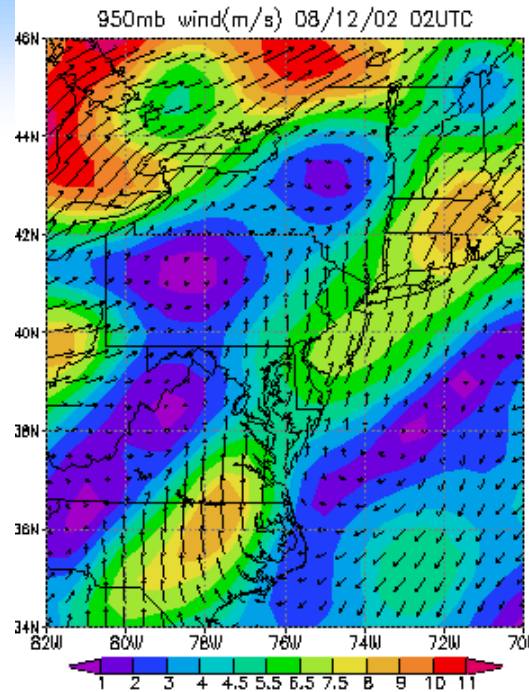
...Which allows for long-range transport above the inversion even if winds are quite calm below it



One frequent result is the formation of the Low-Level Jet (**high wind speeds in red**).

This LLJ formed during an ozone event

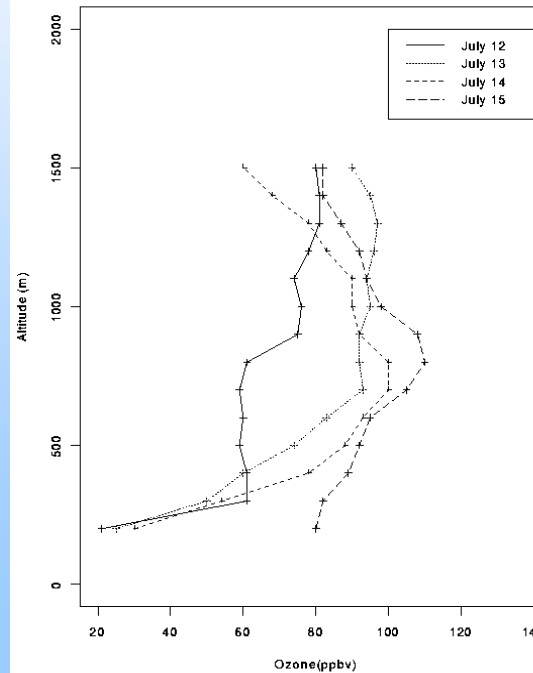
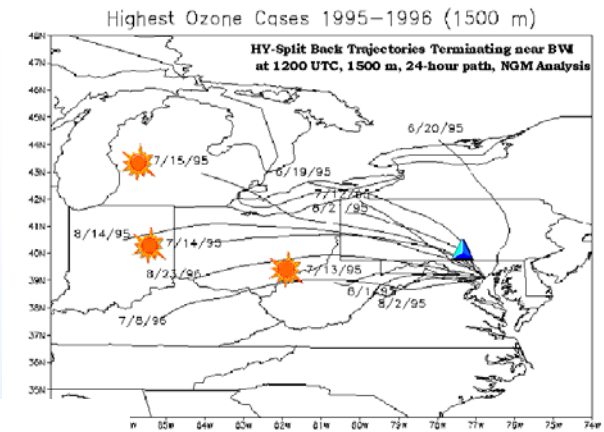
Peak at 03:00 AM



Transport Aloft Can Be Very Significant

Verified by Aircraft Measurements?

- On the mid-Atlantic's worst ozone days, a significant amount of pollution comes from long distance transport.
- UMD Aircraft measure levels as high as 110 ppbv floating into the Northeast corridor from the west



Challenges

- The OTR is subject to rolling events where episodes begin in one portion of the region and work their way towards the Northeast. By the time it reaches the downwind region, another episode could be developing in the upwind areas.
 - In order to capture enough episode days for all nonattainment areas, the OTC region pretty much needs to model the full ozone season

Challenges

What Happens In Other Regions Matters!

- Need for significant coordination regarding base and projected emissions
 - Timely data sharing needed to initiate modeling
 - Delays can create risks of late SIPs due to tight timelines and varying state rulemaking requirements.
 - Different regions may be working with different base years to model
 - Northeast states will likely need to project emissions to base year 2007

Challenges

- Limited time and declining budgets to perform and coordinate work
- Low hanging fruit for emission reductions already picked – less desirable measures remain, thus more controversy possible
- Wildfire smoke – How big a problem for modeling?

HEDD – A Special Case

- Peaking units operate preferentially on High Electricity Demand Days (HEDD), usually on hot and humid days.
- HEDD units are largely uncontrolled and not factored-in to modeling emission inventories. They can represent a significant portion of NOx emissions and advancing controls on these units is a major challenge.
 - Need significant coordination with the operators
 - Past efforts have manually attempted to enter these units into preexisting modeling inventories.
 - Modeling results were a bit unstable since emissions were added to baseline and then subtracted to represent applied controls.
- These units need to be accounted for in the inventory efforts up-front, possibly as a separate point source modeling file.
- Process for HEDD emission projections into future years uncertain.

Opportunities for Partnerships

- Inter-regional coordination on emission inventory development for base and projected years.
- Can EPA/others help with meteorology development?
- Can EPA/others help with GeosChem model runs to help states with boundary conditions?
- Need early EPA guidance for modeling and implementation (early draft?)
 - Concern regarding need for seasonal modeling to reasonably cover the needs of a large modeling domain and the Dallas precedent, where EPA has expressed preference for several iterations of short episodes. Isolated areas vs. transport areas.
- Procurement and development of accurate Canadian emissions
- On-going coordination of plans and findings for emission control strategies and modeling results