

USE OF RPO MODELING TO MEET REGIONAL HAZE AND NAAQS REQUIREMENTS

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Outline

- What is regional haze?
- What are the modeling requirements under the Regional Haze Rule?
- What are RPOs?
- How are RPOs helping with regional haze, ozone and PM_{2.5} modeling?
- **NO MODELING RESULTS WILL BE PRESENTED HERE.**

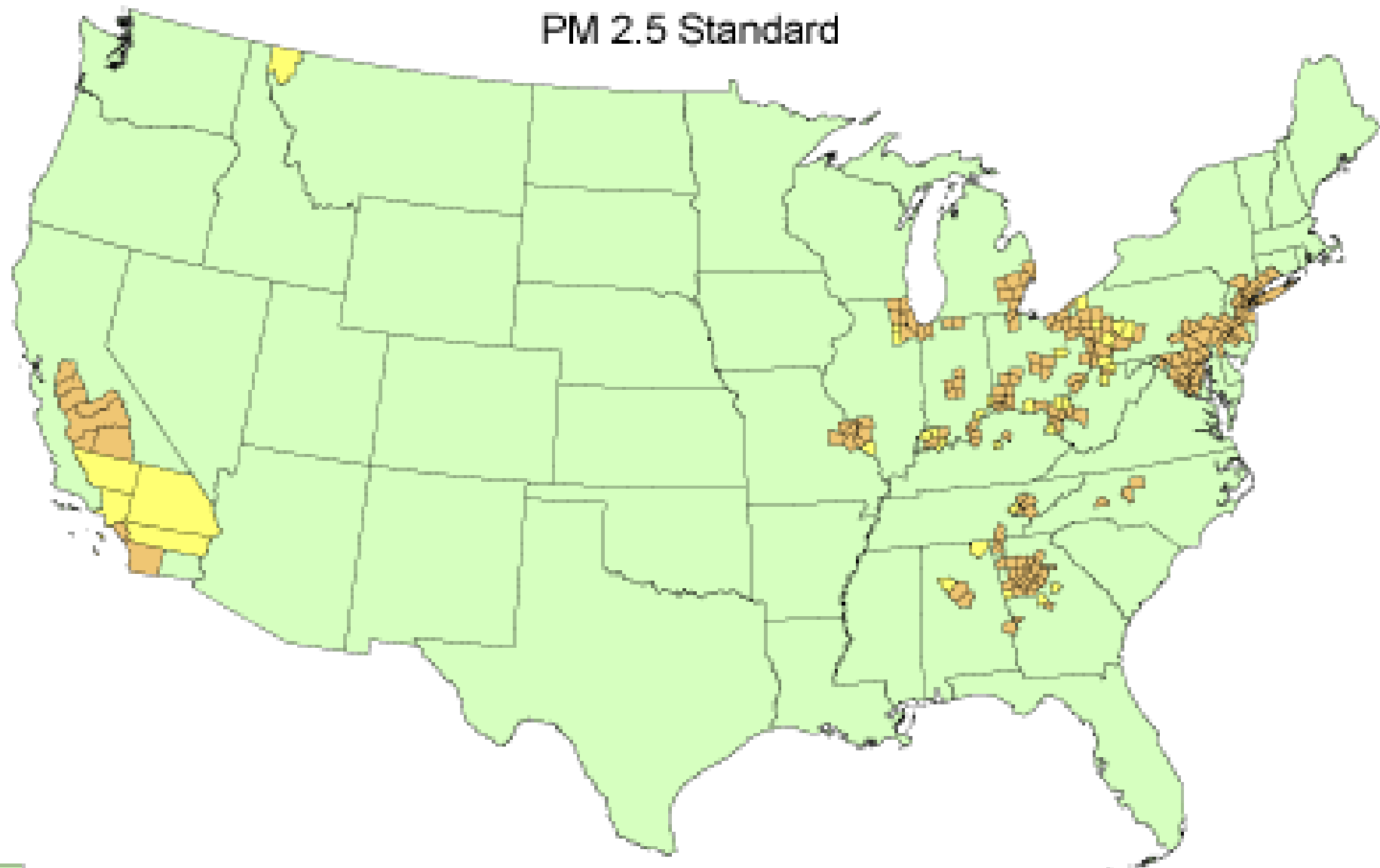
Background

Attainment and Nonattainment Areas in the U.S. 8-hour Ozone Standard



- Attainment (or Unclassifiable) Areas (2668 counties)
- Nonattainment Areas (432 entire counties)
- Nonattainment Areas (42 partial counties)

Attainment and Nonattainment Areas in the U.S. PM 2.5 Standard

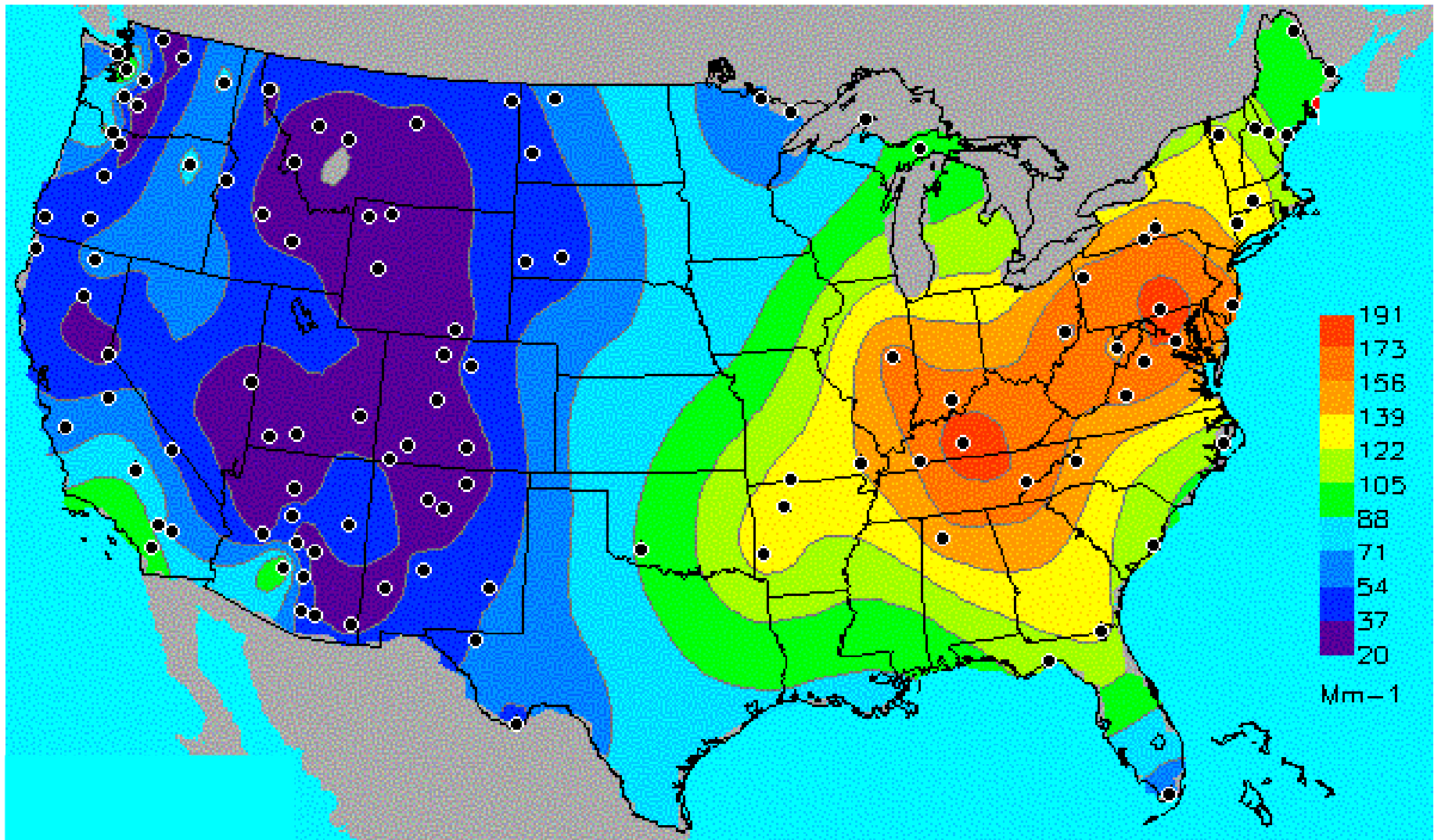


- Attainment (or Unclassifiable) Areas (2916 counties)
- Nonattainment Areas (191 entire counties)
- Nonattainment Areas (34 partial counties)

Regional Haze

- Regional haze is the impairment of visibility caused by the presence of particulate matter in the atmosphere that scatter and absorb light
- Visibility is a measure of the clearness of the atmosphere and can be expressed in terms of:
 - Light Extinction (b_{ext})
 - b_{ext} (Mm^{-1}) = $3*f(RH)*[SO_4] + 3*f(RH)*[NO_3] + 4*[ORG] + 10*[EC] + 1*[Soils] + 0.6*[PMC] + b_{rayleigh}$
 - $b_{rayleigh} = 10 Mm^{-1}$
 - Deciview
 - $dV = 10 * \ln(b_{ext} / b_{rayleigh})$

b_{ext} on 20% Hazyest Days (2002)



<http://vista.cira.colostate.edu/views/>

Regional Haze Rule

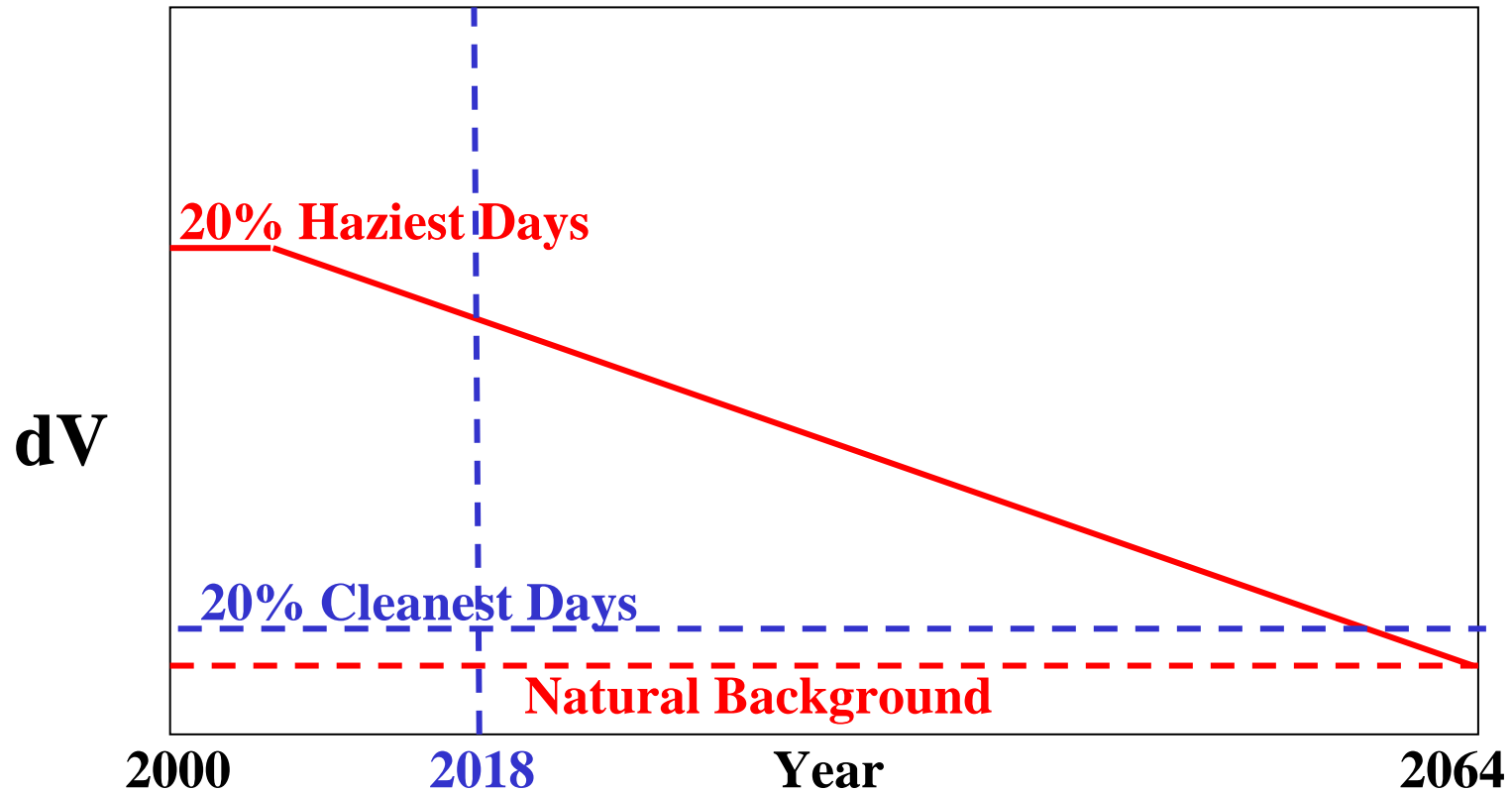
- Objectives of Regional Haze Rule
 - Achieve natural (no man-made impairment) visibility conditions at federal mandated Class I areas by 2064 for worst 20% visibility days
 - No worsening in visibility at Class I areas for best 20% visibility days
- First progress SIPs due December 2007 demonstrating “reasonable progress” toward natural conditions between 2000-2004 and 2018

Mandatory Class I Areas



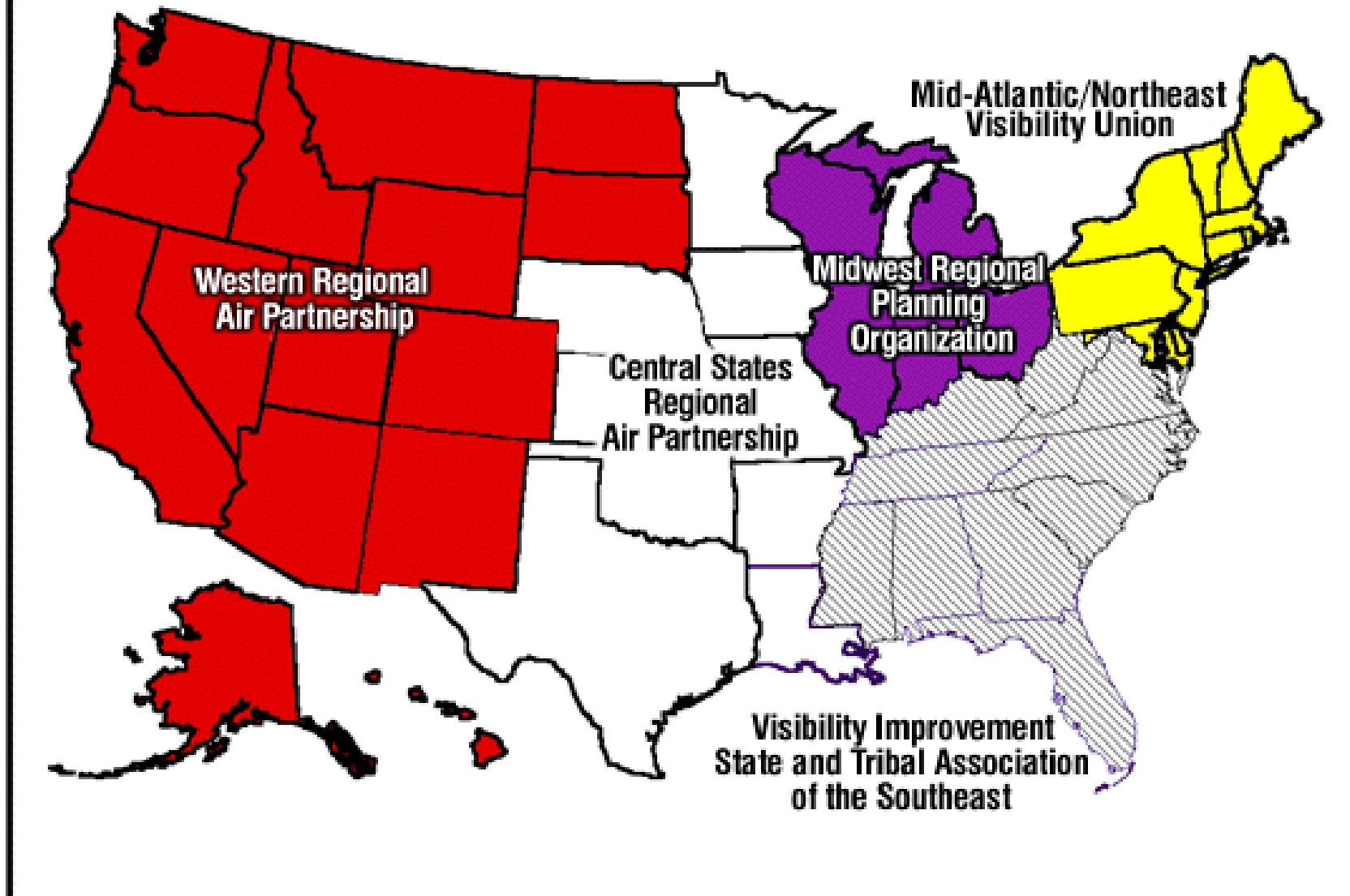
* Rainbow Lake, WI and Bradwell Bay, FL are Class 1 Areas where visibility is not an important air quality related value

Evaluation of Reasonable Progress



- Reasonable Progress must be demonstrated every 10 years

Regional Planning Organizations



RPOs: created by EPA to initiate and coordinate activities associated with the management of regional haze at federally mandated Class I areas.

VISTAS

VISTAS

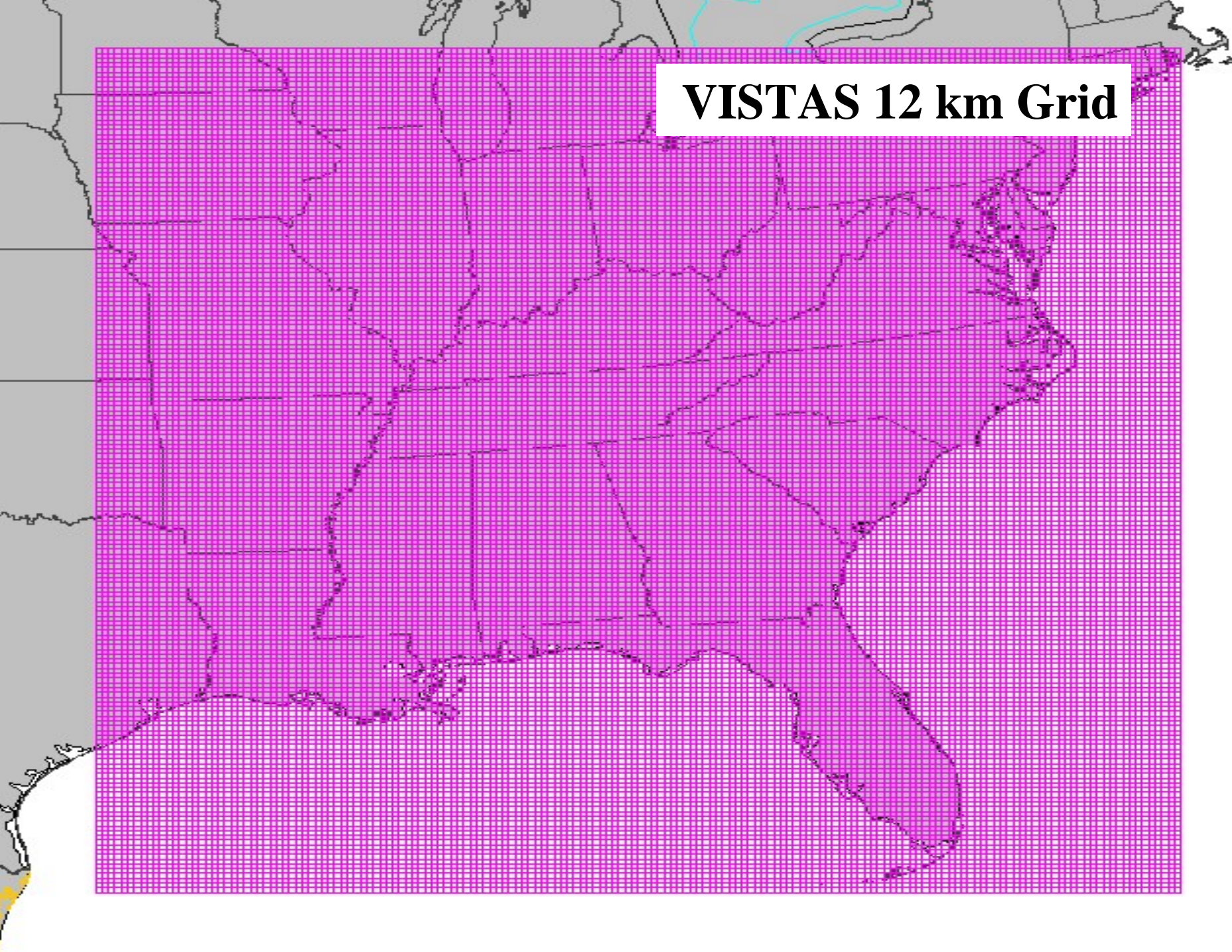
- Visibility Improvement State and Tribal Association of the Southeast
 - SESARM
 - AL, GA, MS, FL, SC, NC, TN, KY, VA, WV
- Modeling Approach
 - 2002, 2009, and 2018 annual simulations at 36 and 12 km
 - MM5 Meteorology and SMOKE Emissions
 - CMAQ (primary model) and CAMx (corroborative model)
- Modeling Contractors
 - Baron Advanced Meteorological Systems (MM5)
 - Environ (CMAQ, CAMx)
 - Alpine Geophysics (SMOKE, CMAQ, CAMx)
 - University of California - Riverside (CMAQ)
 - Georgia Tech (episodic emission sensitivities with CMAQ)



The image shows a map of the United States with a 36 km grid overlaid. A large purple rectangle highlights a specific region in the central-eastern part of the country. The grid is composed of small squares, and the purple rectangle covers a significant portion of the eastern half of the grid. The text 'VISTAS 36 km Grid' is written in a bold, black, serif font on a white background, positioned in the upper right quadrant of the map.

VISTAS 36 km Grid

VISTAS 12 km Grid



VISTAS NAAQS SIP Modeling

- PM2.5 Non-Attainment Areas
 - AL, GA, KY, NC, TN, VA, WV
 - All NAA states will use VISTAS modeling for PM2.5 modeling
 - Annual 36 and 12 km modeling for 2002 and 2009
- 8-Hour Ozone Non-Attainment Areas
 - AL, GA, KY, NC, SC, TN, VA, WV
 - Most NAA states will use VISTAS modeling for 8-hr ozone modeling
 - Seasonal 36 and 12 km modeling for 2002 and 2009
 - Association for Southeastern Integrated Planning (ASIP)
 - Seasonal 12 km modeling for 2008 (Basic areas)

Additional Modeling

- Some states will do additional modeling beyond VISTAS
 - Annual simulations on smaller 36/12 km domains
 - Modeling on 4 km grids
 - Improvement to specific emission categories
 - e.g., updated mobile source emissions
 - Pollutant and source specific emission sensitivities



VISTAS 12 km

ALGA 12 km

GA 4 km

Additional Information

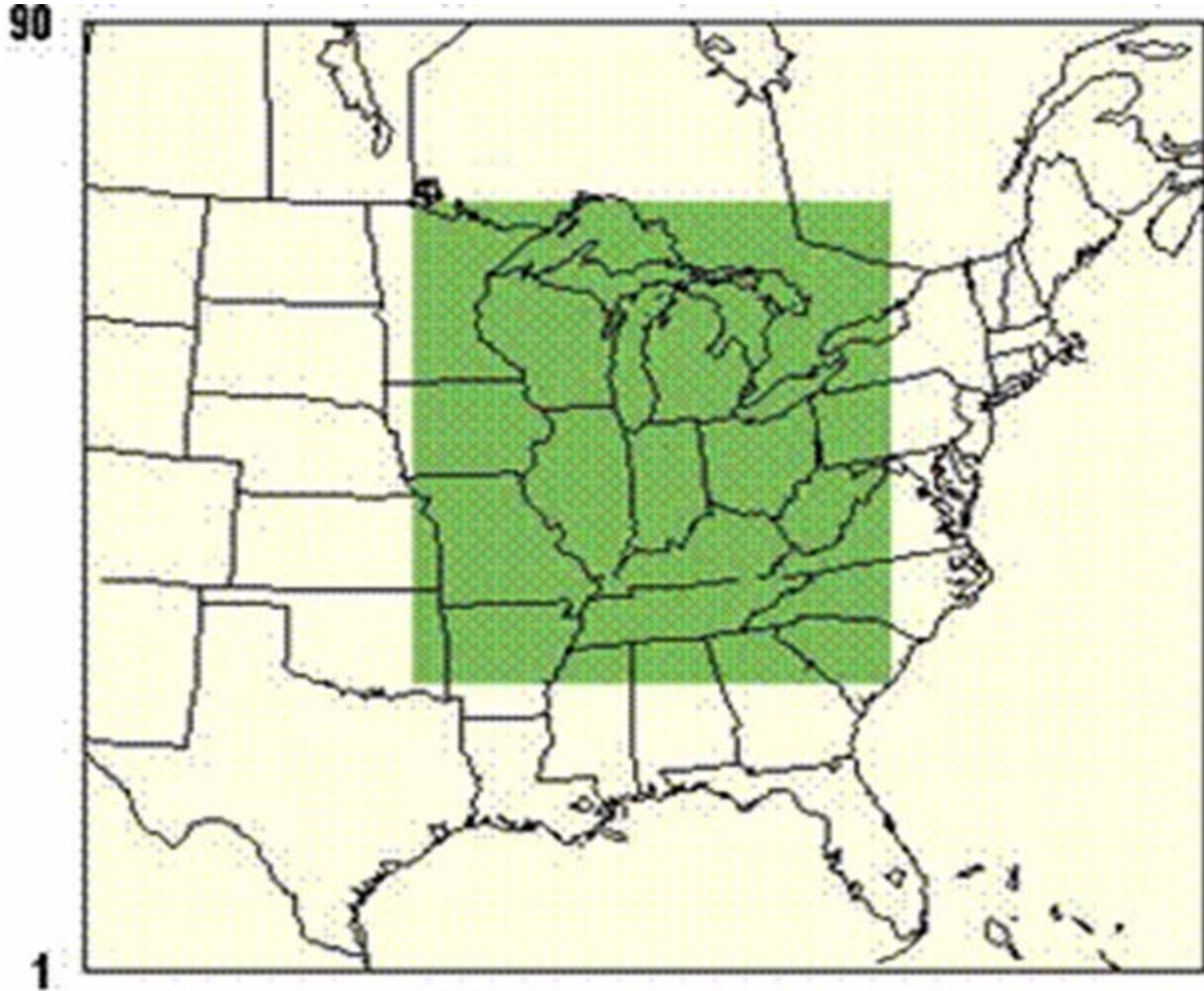
- <http://www.vistas-sesarm.org/tech/>
- <http://www.baronams.com/projects/VISTAS/>
- <http://pah.cert.ucr.edu/vistas/vistas2/>
- <http://www.ce.gatech.edu/research/vistas>

MRPO

MRPO

- Midwest Regional Planning Organization
 - LADCO
 - Illinois, Indiana, Michigan, Ohio, and Wisconsin
- Modeling Approach
 - 2001, 2002, 2003, 2009, and 2018 annual simulations at 36 km for Regional Haze and PM_{2.5}
 - 2002, 2008, and 2012 on a 12 km grid for ozone
 - MM5 Meteorology and EMS-2004 Emissions
 - CAMx (primary model) and CMAQ (corroborative model)
- Most modeling work done in-house
 - Model (photochemical and emissions) development and emission inventory development contracted out

MRPO 12 km Modeling Domain



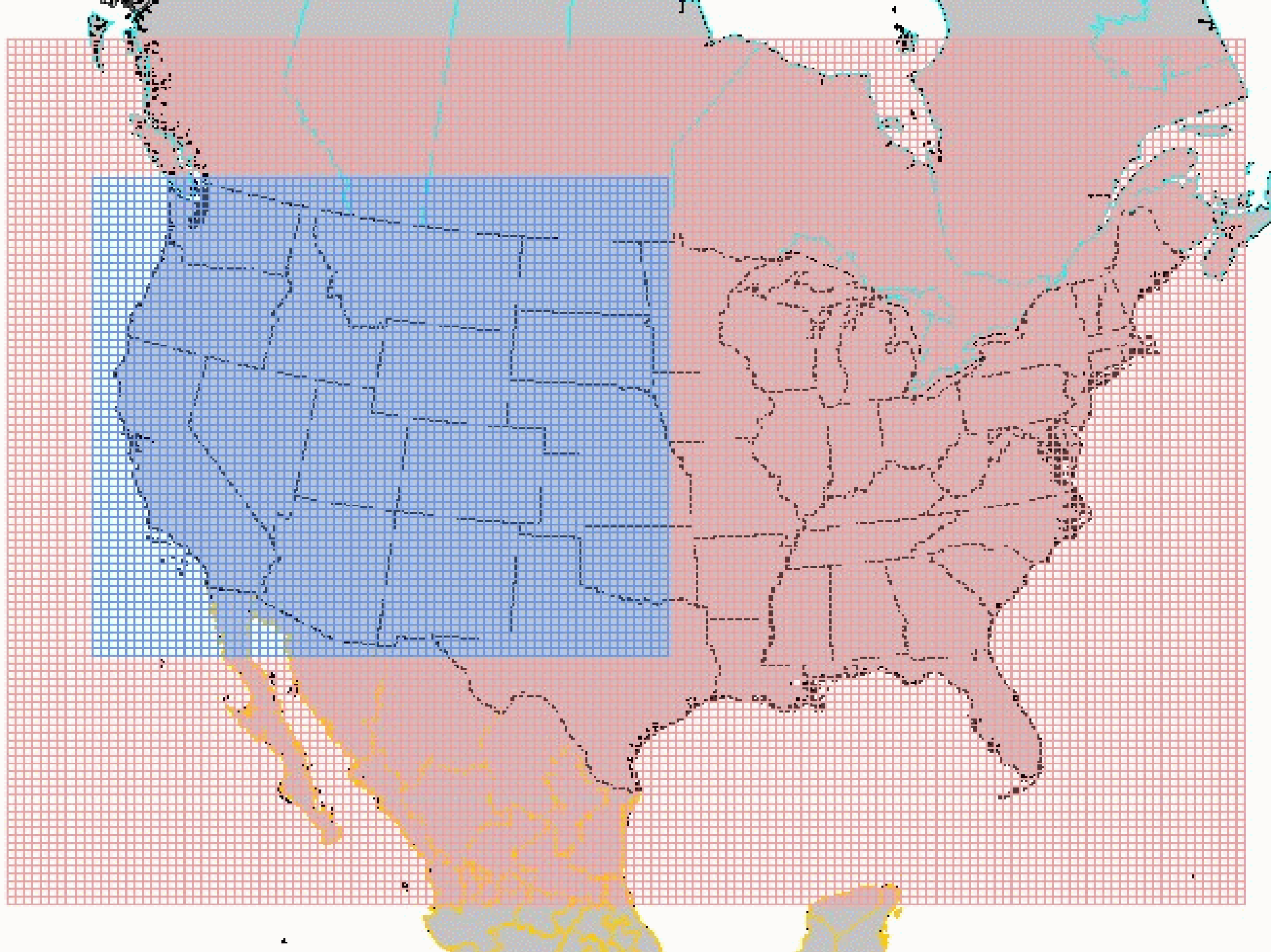
MRPO NAAQS SIP Modeling

- PM2.5 and Ozone Non-Attainment Areas
 - Illinois, Indiana, Michigan, Ohio, and Wisconsin
- Additional Modeling
 - OSAT and PSAT to perform ozone and PM2.5 source apportionment
- Each state has in-house modeling capability
 - Local scale assessments to help determine local/regional culpability
- <http://www.ladco.org/>

WRAP

WRAP

- Western Regional Air Partnership
 - AK, AZ, CA, CO, ID, MT, ND, NM, NV, OR, SD, UT, WA, WY
- Modeling Approach
 - 2002 and 2018 annual simulations at 36 and 12 km
 - MM5 Meteorology and SMOKE Emissions
 - CMAQ and CAMx Models
- Modeling Contractors
 - Carolina Environmental Program (SMOKE)
 - Environ (MM5, CMAQ, CAMx)
 - University of California - Riverside (CMAQ)



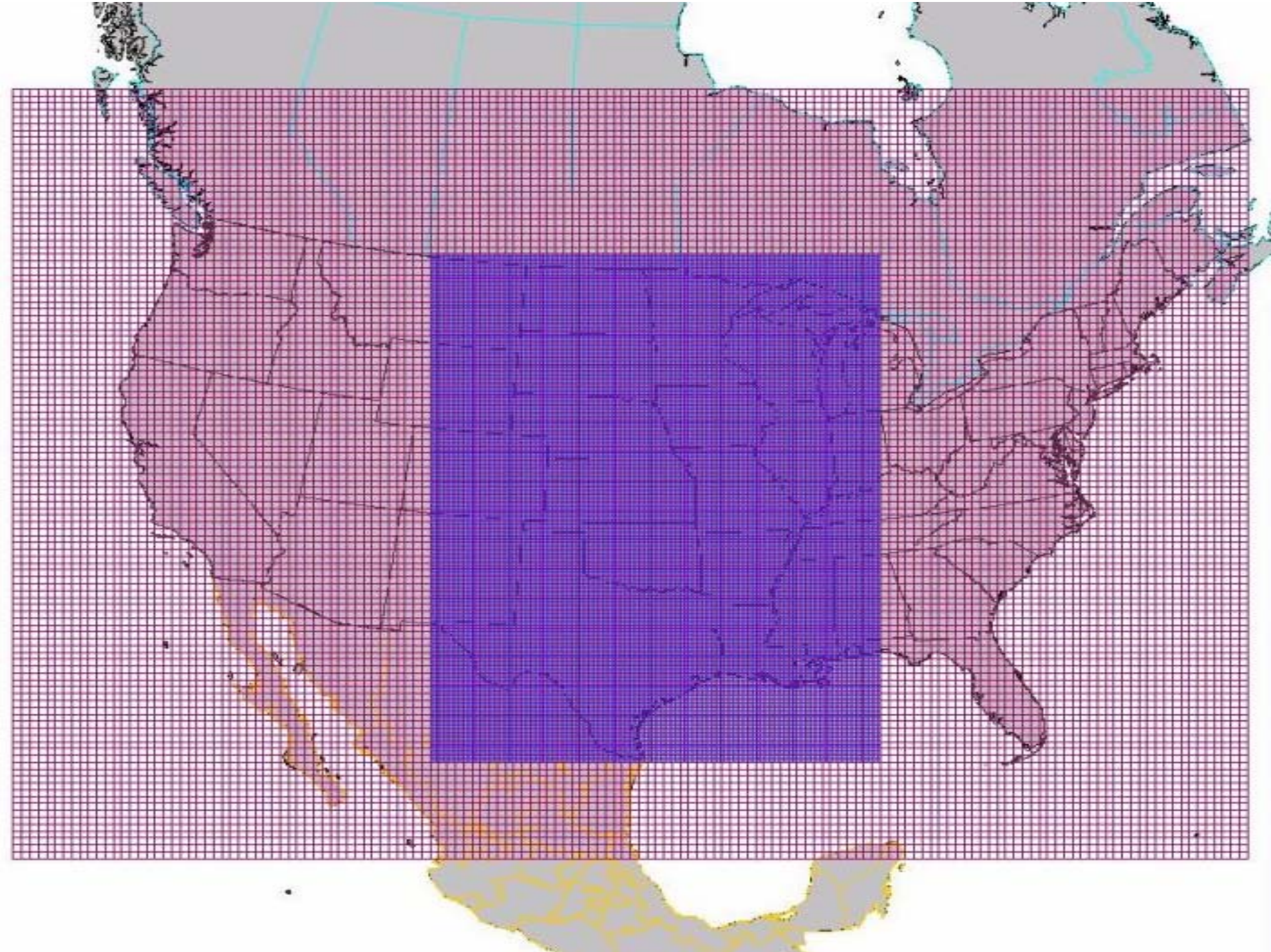
WRAP NAAQS SIP Modeling

- PM2.5 Non-Attainment Areas
 - California and Libby, MT (wood smoke?)
 - California ARB performing CA NAAQS SIP Modeling
- 8-Hour Ozone Non-Attainment Areas
 - California, Phoenix, Las Vegas, and Denver
 - Some NAA and EAC areas using 2002 MM5 and SMOKE files (36 and 12 km)
- WRAP does not plan to perform any 2008/2009 air quality modeling
- <http://www.wrapair.org/> and <http://pah.cert.ucr.edu/aqm/308/>

CENRAP

CENRAP

- Central Regional Air Planning Association
 - CenSARA
 - Nebraska, Kansas, Oklahoma, Texas, Minnesota, Iowa, Missouri, Arkansas, and Louisiana
- Modeling Approach
 - 2002 and 2018 at 36 km (annual) and 12 km (episodic)
 - MM5 Meteorology (Iowa DNR) and SMOKE Emissions
 - CMAQ and CAMx Models
- Modeling Contractors
 - Environ (CMAQ, CAMx)
 - University of California - Riverside (SMOKE, CMAQ)



CENRAP NAAQS SIP Modeling

- PM2.5 Non-Attainment Areas
 - St. Louis (MO)
- 8-Hour Ozone Non-Attainment Areas
 - Texas, Louisiana, Arkansas, Missouri
- Some states will use CENRAP's model input files and information on model science options in their PM2.5 and 8-hour ozone modeling
 - CENRAP does not plan to perform any 2008/2009 modeling
- <http://cenrap.org/> and <http://pah.cert.ucr.edu/aqm/cenrap/>

MANE-VU

MANE-VU

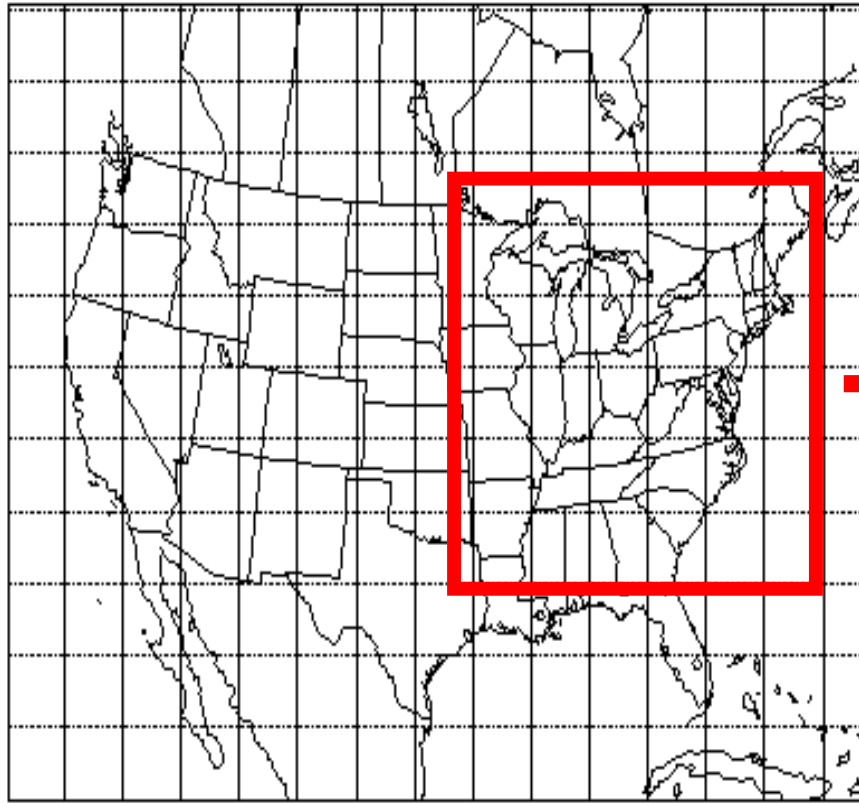
- Mid-Atlantic/Northeast Visibility Union
 - NESCAUM, MARAMA, OTC
 - CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT
- Modeling Approach
 - 2002, 2009, and 2018 annual simulations at 36 and 12 km
 - MM5 Meteorology and SMOKE Emissions
 - CMAQ and REMSAD
- Modeling conducted by:
 - NESCAUM (CMAQ and REMSAD)
 - MARAMA (SMOKE)
 - New York DEC (CMAQ)
 - University of Maryland (MM5)

CMAQ & REMSAD Grids

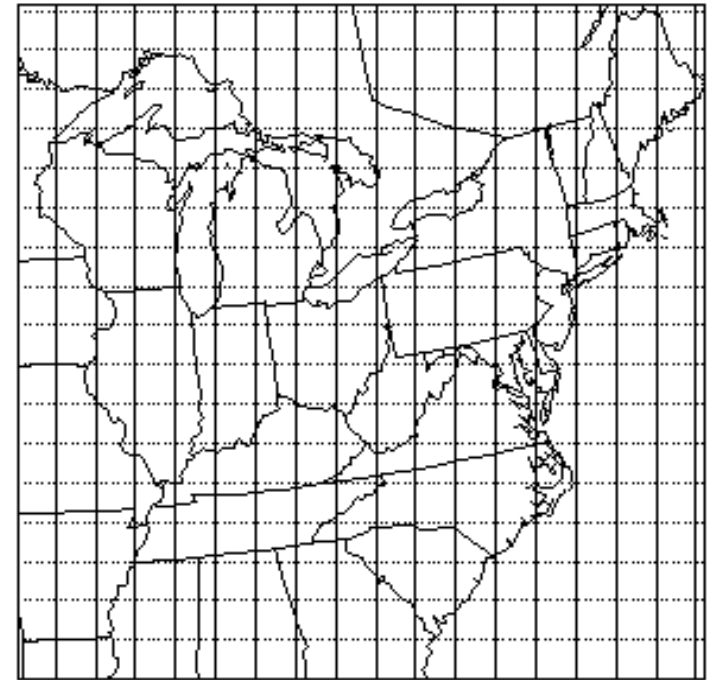
36 km Grid

12 km Grid

111



172



1

172

1

1

147

MANE-VU NAAQS SIP Modeling

- PM2.5 Non-Attainment Areas
 - NY, NJ, CT, PA, DC, MD, DE
 - States will use MANE-VU modeling as starting point for PM2.5 modeling
- 8-Hour Ozone Non-Attainment Areas
 - NY, NJ, CT, PA, DC, MD, DE, MA, RI, CT, NH, ME
 - OTC modeling committee is coordinating 8-hour ozone modeling as a regional activity
- Additional modeling using REMSAD with tagged sulfur species to help perform source apportionment
- <http://www.manevu.org/>

Summary

- RPOs are using CMAQ, CAMx, and REMSAD to model regional haze, PM2.5, and ozone.
 - Multiple years, domains, and grid resolutions
- RPO efforts have resulted in:
 - Model enhancements
 - Accurate emission inventories
 - SIP quality modeling results

Acknowledgements

- Pat Brewer (VISTAS)
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