Modeling the Air Quality Impacts of Stationary Sources: Western Air Quality Issues and Modeling Needs

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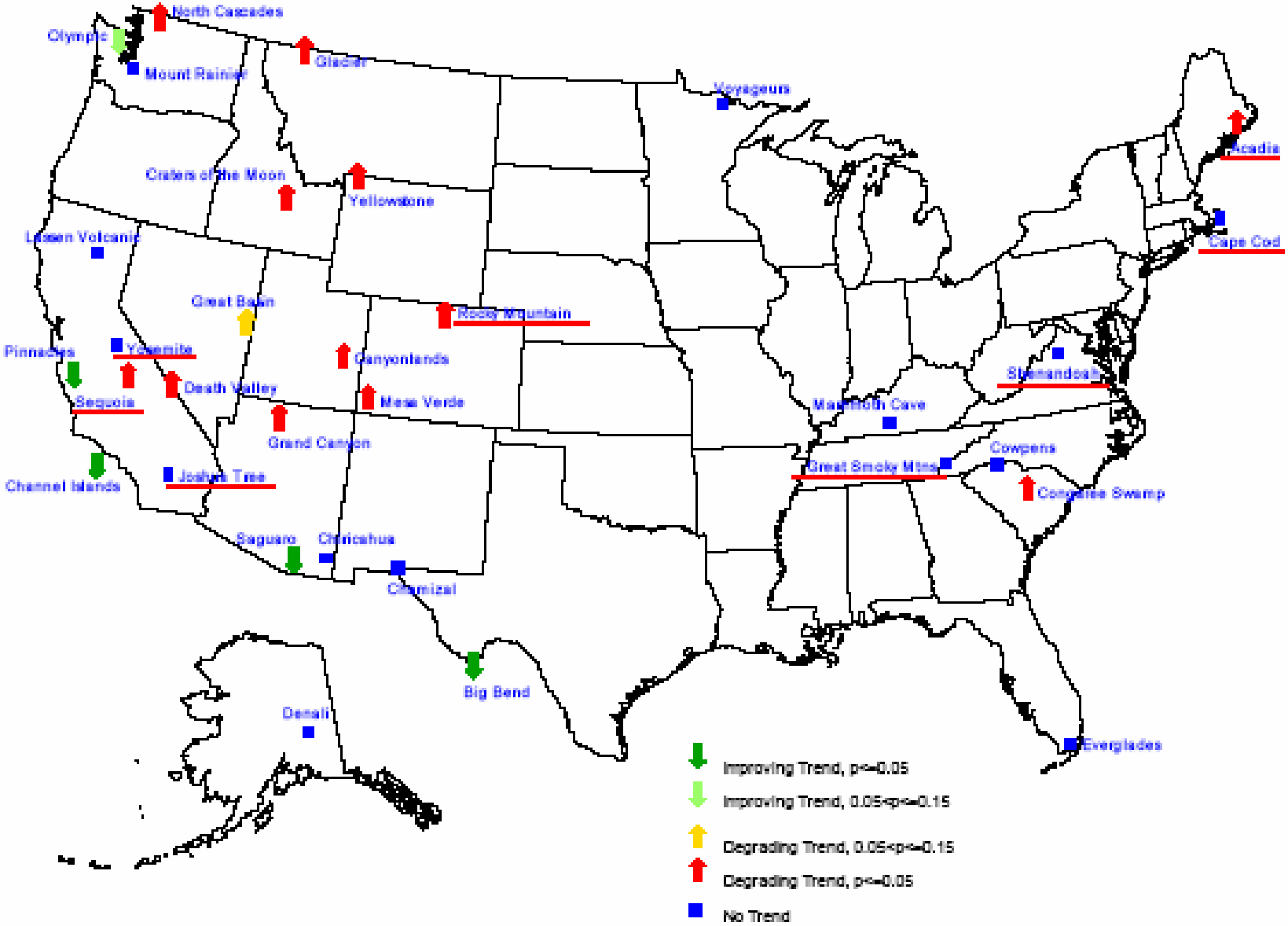
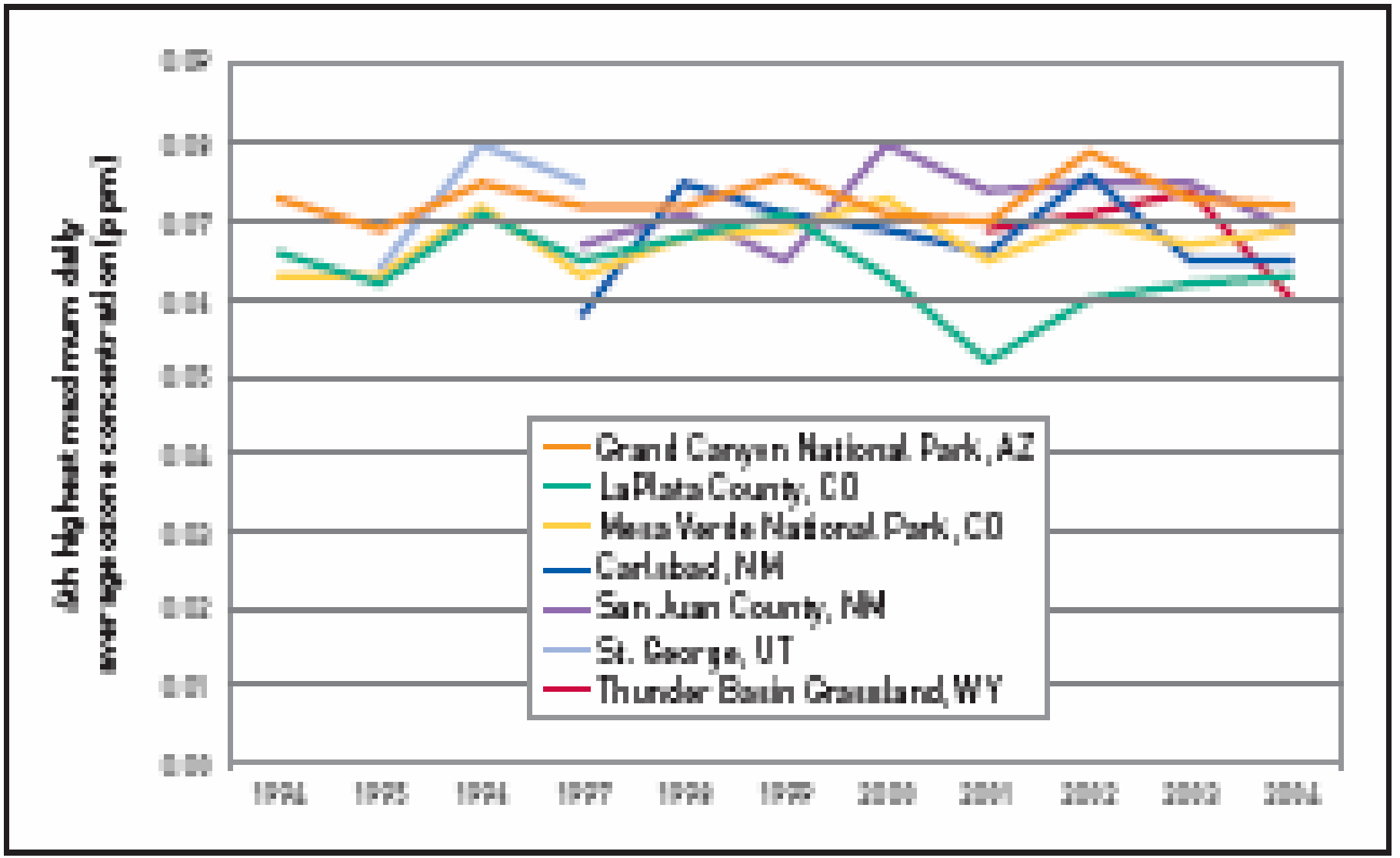
Outline

- Motivation: air quality trends in the interior West
- Critical modeling needs
  - Point source impacts on ground level ozone for PSD and NEPA applications
- Existing approaches
- Recommendations for sound analyses

Trend in 3-year average 4th highest 8-hr ozone concentrations (NPS ARD, 2005)



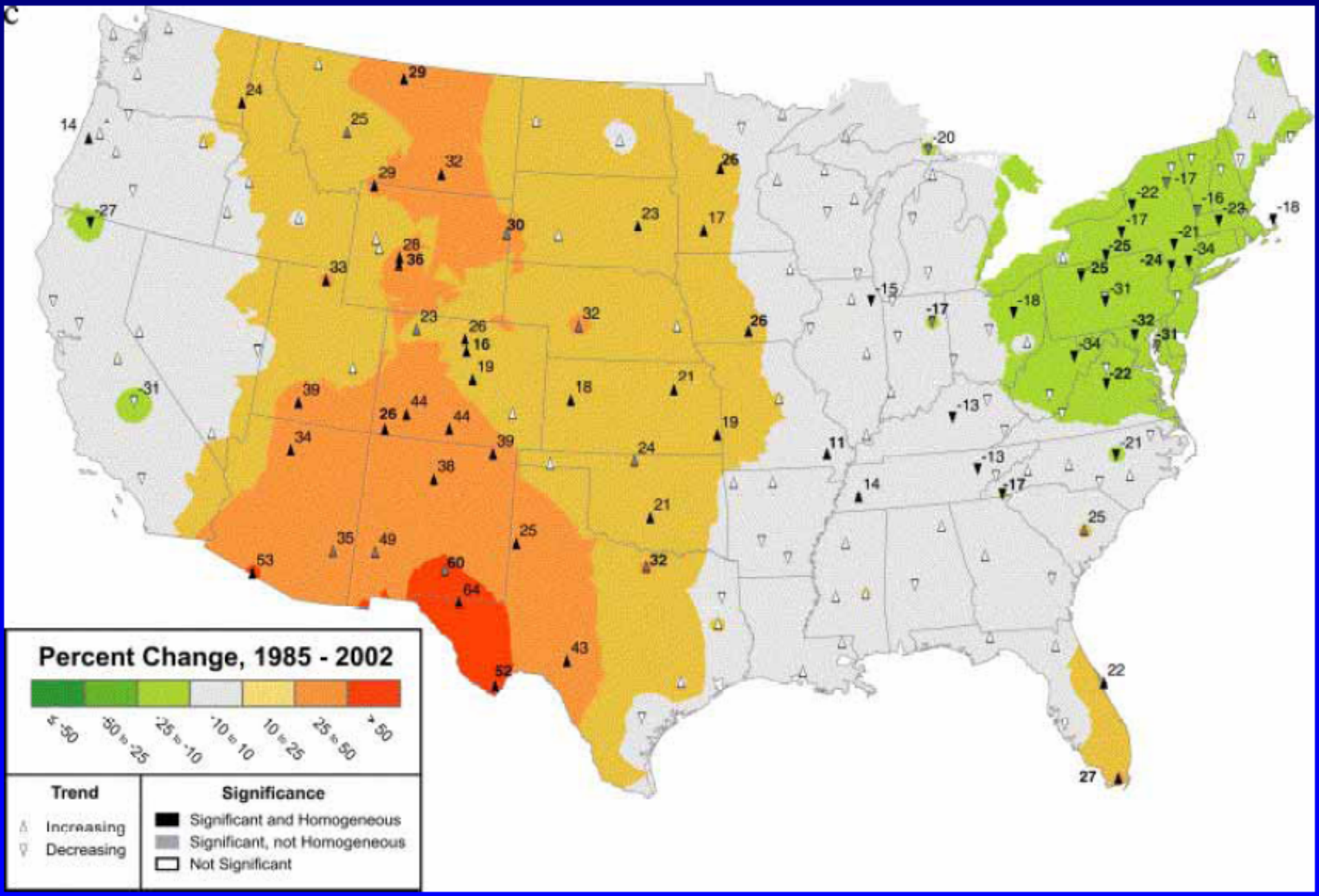
4th High 8-hr Ozone Concentrations at Western Monitors



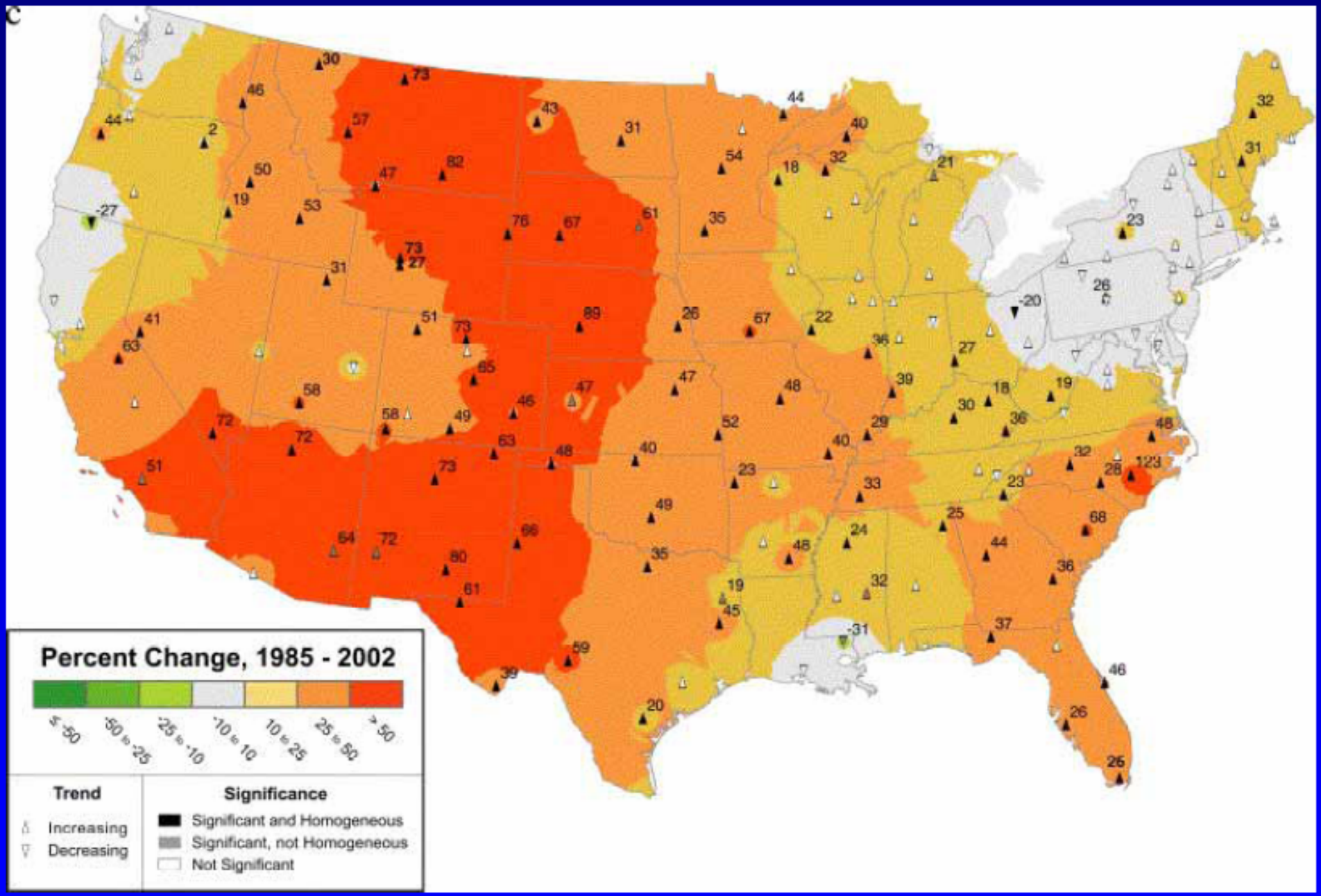
Adverse health effects of ozone

- Breathing ozone is associated with serious adverse respiratory effects
  - Respiratory tract inflammation and irritation
  - Exacerbated asthma
  - Decreased lung function
  - Long-term lung damage
  - Increased hospital and ER visits and school absenteeism
- Recent studies have linked ozone to premature mortality
- California standard lowered to 70 ppb in April 2005 in response to new information

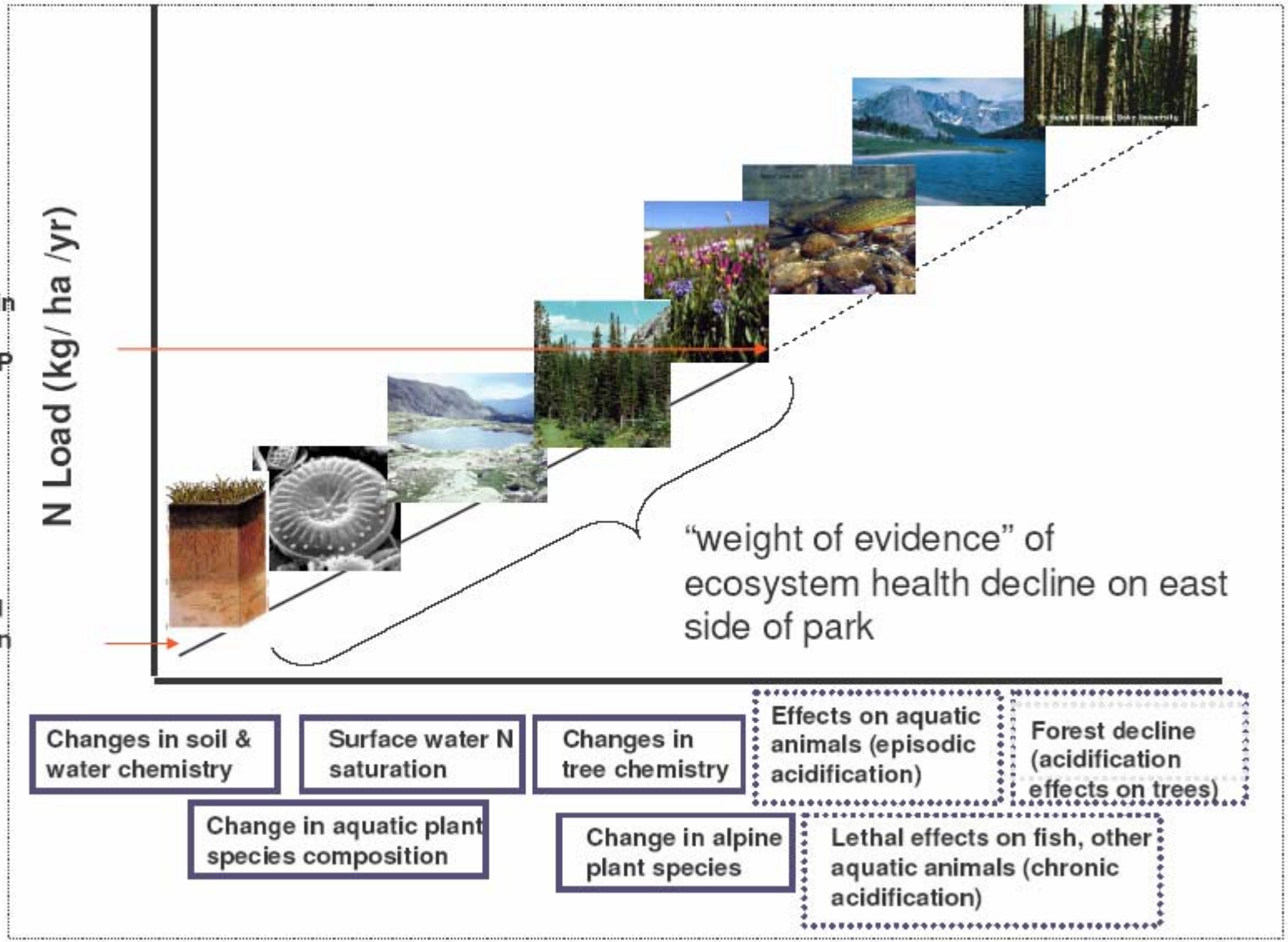
Change in NO3- Concentration in Wetfall (Lehmann et al., 2005)



Change in NH4+ Concentration in Wetfall (Lehmann et al., 2005)



Rocky Mountain National Park: Continuum of Impacts to Ecological Health

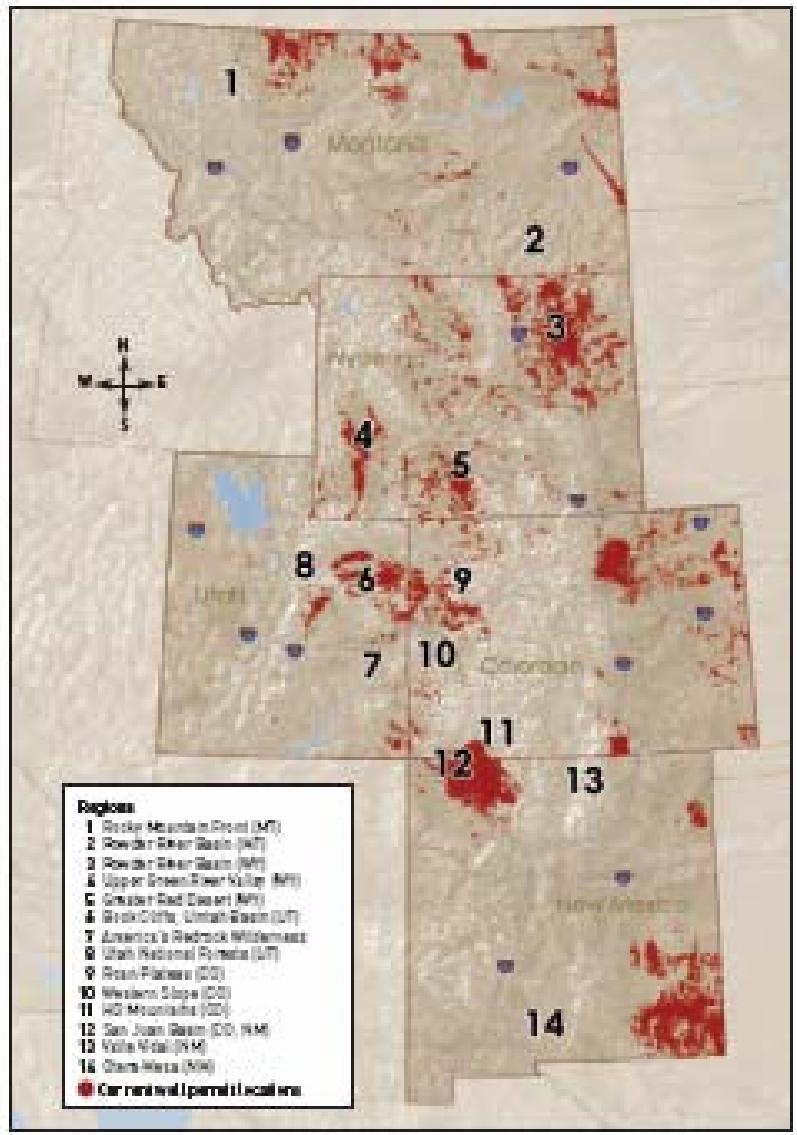


How do we use air quality models in U.S. regulations?

- Control strategy design and analysis
  - National (Clean Air Interstate Rule), regional (RPO-haze) and local (Denver Early Action Compact attainment demonstrations)
  - Predict aggregate impact of multi-source control strategies on air quality
- Permitting and Environmental Impact Assessment
  - New Source Review, Environmental Impact Statements
  - Predict impacts of individual sources or developments

Modeling Needs for Permitting and Environmental Impact Assessment

- Section 166 PSD programs for photochemical oxidants and nitrogen oxides
  - Requirements never promulgated for ozone
  - NO2 increments for NOx
  - Not limited to source-by-source approaches
- Section 165/40 CFR 52.21 Source impact analysis
- 2005 Ozone Implementation Rule
  - Designates NOx as ozone precursor for PSD purposes
- NEPA analyses for oil and gas leasing on federal lands



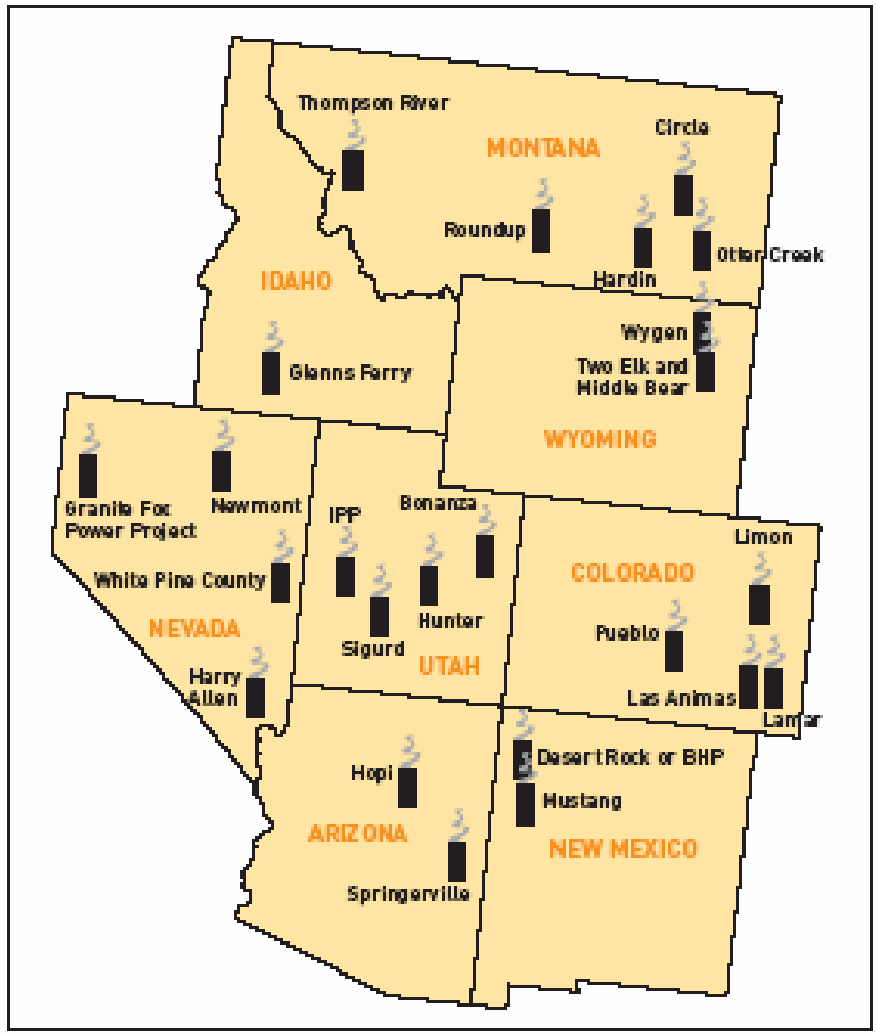
New Coal Plants Proposed for the Interior West

Plants proposed as of June 2004

- 16000 MW
- 40,000 tons of NOx

Modeling requirements

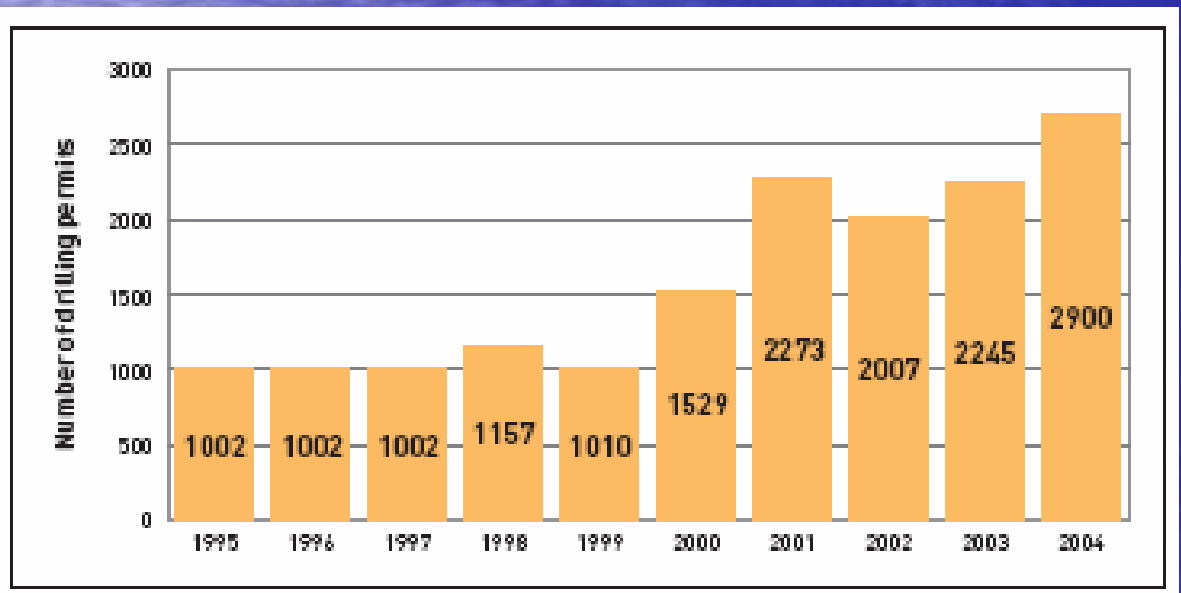
- Ozone impacts in nonattainment/ maintenance and Class II areas
- AQRVs in Class I areas



Rapid Expansion in Oil and Gas Emissions

State	NOx (tpy)	VOC (tpy)
NM	118,000	178,000
CO	49,000	89,000
WY	35,000	121,000

2002 Emissions Oil and Gas Production (Environ, 2005)



Drilling permits issued in Colorado

PSD and EIS analyses of ozone impacts

- Scheffe method (1988)
  - Look-up tables based on Reactive Plume Model
  - Deemed inadequate in early review by Seinfeld and Georgopoulous
  - Continues to be used to check the box in PSD/EIS applications
    - BLM – Jonah Infill FEIS (2005)
    - Nevada DEP
    - Iowa DNR
    - Louisiana DEQ
  - Recently described as "antiquated and useless" by Rich Scheffe

PSD and EIS analyses of ozone impacts

- Photochemical grid modeling analyses
  - Missouri DNR – adapted OTAG modeling to assess air quality impact of new source on St. Louis
  - Oklahoma DEQ – adapted DFW model to refine grid for OK to assess impacts of several new sources since 1999
  - TX – examination of out-of-state sources on DFW; new sources on San Antonio based on EAC modeling
  - R9 – cursory examination of Desert Rock impacts on Farmington ozone based on EAC modeling

Source: Adapted from Erik Snyder, Region 6, May 2006

What are key objectives for regulatory modeling?

- Apply sound science to guide decision-making
  - Ensure control requirements are cost-effective and equitable
  - Strive for accuracy, sound science, objective application
- Facilitate administrative efficiency and reviewability
  - Minimize resources and time requirements
  - Strive for consistency across applications
- Facilitate public/stakeholder participation
  - Strive for simplicity, ease of communication, flexibility to test alternative assumptions

Recommendations for PSD/EIS applications of grid models

- Robust range of episodes to capture impacts
  - Watch false negatives
  - Watch possibility of enhanced photochemistry over snow (western Wyoming wintertime exceedances)
- Comprehensive impact metrics
  - Cover receptor area, not just monitoring sites
  - Cumulative exposure metrics to capture impacts on vegetation
- Adequate resolution of source and key receptor areas
  - Plume-in-grid treatment preferred

Source: Adapted from Erik Snyder, Region 6, May 2006

Recommendations for PSD/EIS applications of grid models

- Adequate representation of transport in complex terrain
- Ideal situation – established and maintained modeling system including base meteorological fields and emissions, suitable for updating
  - State, FLM, EPA collaboration
- Modeling systems available now: CMAQ, CAMx, AIRPACT

Conclusions

- Health and environmental impacts of ozone and ecosystem impacts of reactive nitrogen deposition are important
- Upward trends in West require attention
- Modern modeling systems are available to address impacts of new sources, individually and in cumulative analyses
- EPA could facilitate their application through clear guidance and modeling center support