



PM_{2.5} Precursors: Interpollutant Trading Ratios and other Tricks

Phil Allen
ODEQ

June 6, 2012
NWAirquest Annual Meeting
EPA Region X
Seattle, WA



PM2.5 Precursors

- Goal is to stimulate discussion on how the three NWAirquest states might address the issue of PM2.5 precursors in NSR modeling
 - Three-state solution
 - Case by case separately by each state.



Review 101

- Scope here is only for NSR/PSD modeling of industrial source impacts as part of permit actions
- PM2.5 Precursors for NSR/PSD modeling are NO₂ and SO₂ (NH₃ and VOCs could be included for other SIP analyses)
- Interpollutant trading ratios (ITRs) define levels of PM_{2.5} emissions that are considered equivalent to the contribution of secondary PM_{2.5} from NO₂ and SO₂ emissions.



EPA Draft PM2.5 Modeling Guidance

- In part addresses the contribution from secondary PM2.5 to total PM2.5 in general terms
- Qualitative, hybrid, quantitative
- What does this really mean: no specific guidance or examples



PM_{2.5} Compliance Demonstration: Assessment Cases

- Reference: Table III-1.

Assessment Case	Description of Assessment Case	Primary Impacts Approach	Secondary Impacts Approach
Case 1: No Air Quality Analysis	Direct PM _{2.5} emissions < 10 tpy SER Both NO _x and SO ₂ emissions < 40 tpy SER	N/A	N/A
Case 2: Primary Air Quality Impacts Only	Direct PM _{2.5} emissions ≥ 10 tpy SER Both NO _x and SO ₂ emissions < 40 tpy SER	Appendix W preferred or approved alternative dispersion model	N/A
Case 3: Primary and Secondary Air Quality Impacts	Direct PM _{2.5} emissions ≥ 10 tpy SER Both NO _x and/or SO ₂ emissions ≥ 40 tpy SER	Appendix W preferred or approved alternative dispersion model	<ul style="list-style-type: none"> • Qualitative • Hybrid qualitative / quantitative • Full quantitative photochemical grid modeling
Case 4: Secondary Air Quality Impacts Only	Direct PM _{2.5} emissions < 10 tpy SER Both NO _x and/or SO ₂ emissions ≥ 40 tpy SER	N/A	<ul style="list-style-type: none"> • Qualitative • Hybrid qualitative / quantitative • Full quantitative photochemical grid modeling



EPA Draft PM2.5 Modeling Guidance

- But a full quantitative assessment of secondary impacts using a photochemical grid model is:
 - complex, costly, resource intensive
 - Not feasible for most industrial sources



Range of Options

- Qualitative assessment
 - Guidance, template
- Reduce sources subject to analysis of secondaries by establishing high SERs for precursor SO₂ and NO₂ emissions (could be by region or state)
- Develop refined Interpollutant trading ratios defined by area, region, population
- Utilize existing regional photo-chemical grid modeling, such as AIRPACT
- Site-specific photo-chemical grid modeling



EPA's Effort to Develop Trading Ratios

- OAQPS study using CMAQ and Response Surface Model (RMS) in 2006
- Tyler Fox memo July 2007 reported results and recommended ratios base on the RMS analysis
 - Eastern U.S. 200:1 NO_x tpy:PM_{2.5} tpy
40:1 SO₂ tpy:PM_{2.5} tpy
 - Western U.S. 100:1 NO_x tpy: PM_{2.5} tpy
40:1 SO₂ tpy:PM_{2.5} tpy

Regional variation in PM_{2.5} composition

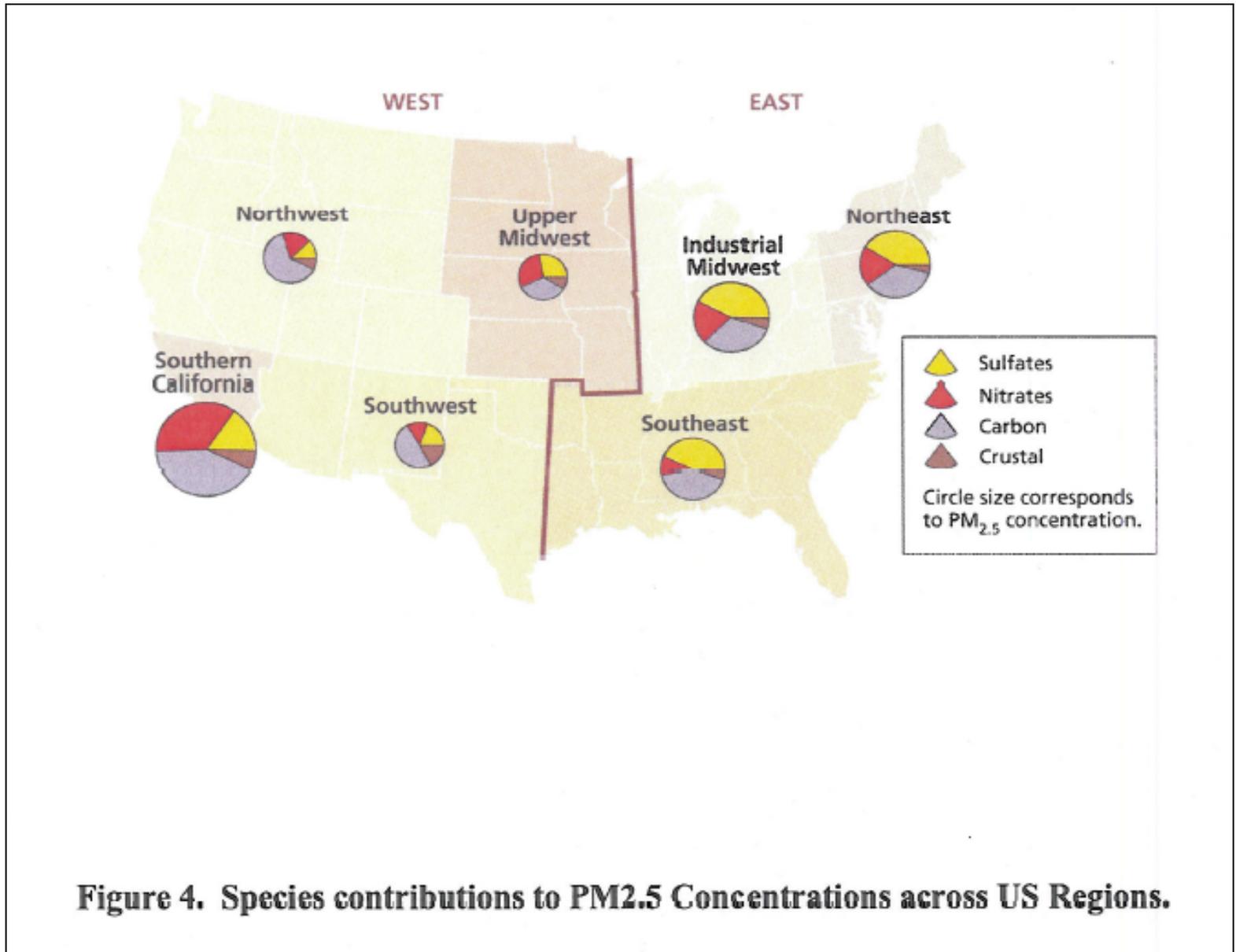


Figure 4. Species contributions to PM_{2.5} Concentrations across US Regions.



EPA CMAQ PM2.5 + Precursor Modeling

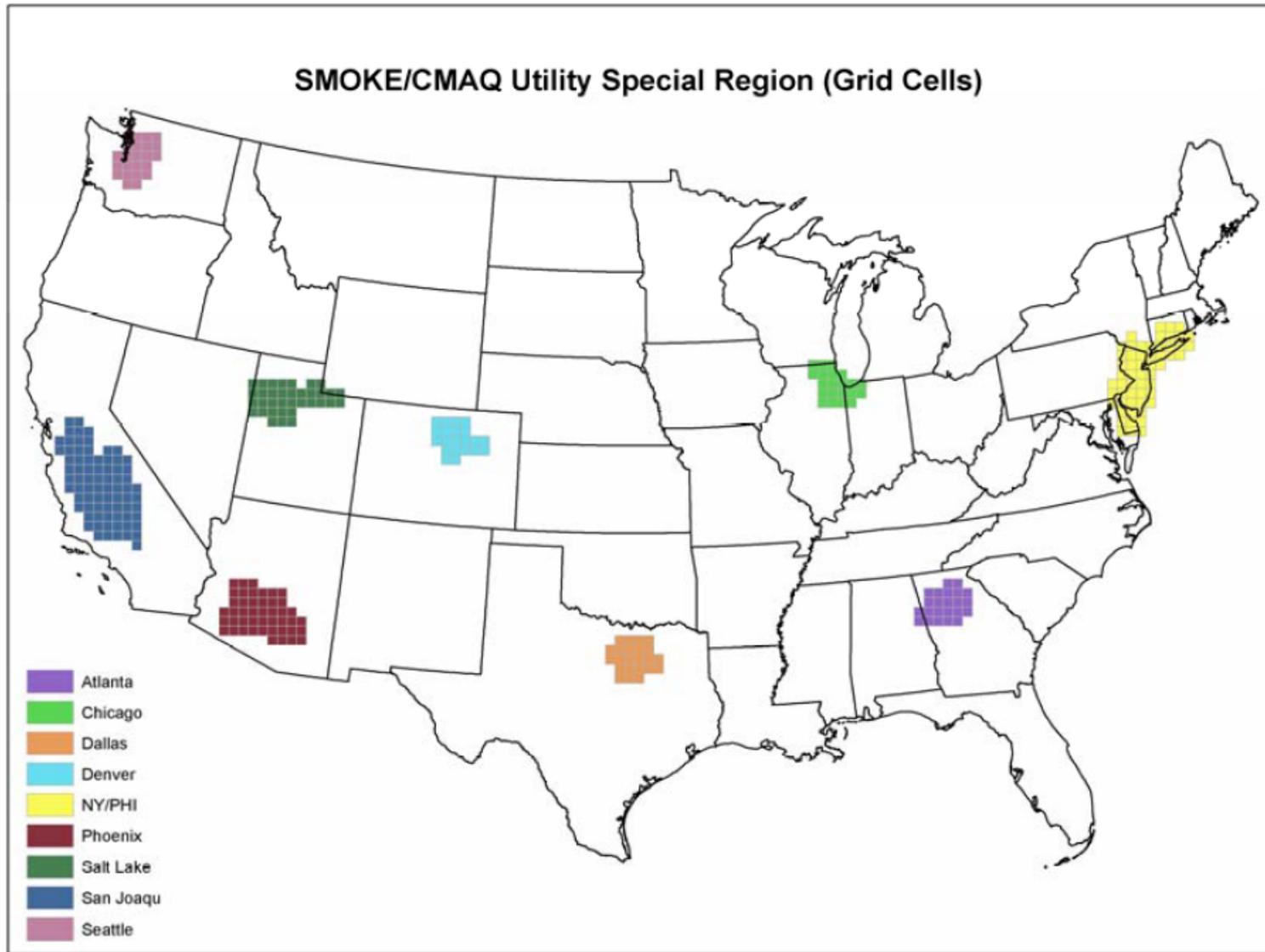


Figure III-6. Map of the CMAQ modeled 36-km grids for nine urban areas modeled.



Example of influence of secondary PM_{2.5}

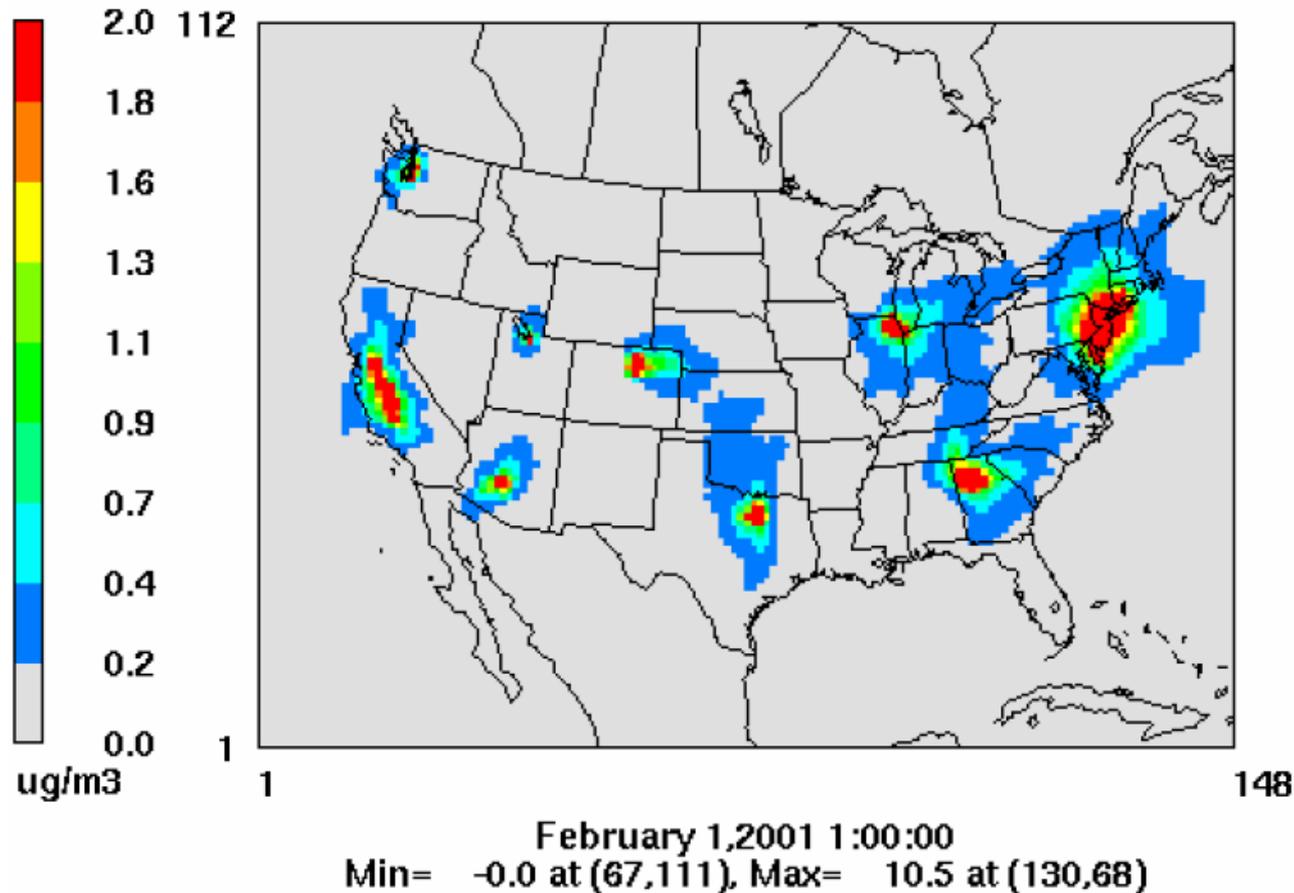


Figure III-5. PM_{2.5}: Areas of influence for nine selected RSM urban locations for the monthly average of February 2001.



EPA's Effort to Develop Trading Ratios

- Problems with the CMAQ-RSM approach
 - Possible NO_x dis-benefits in urban areas
 - For some areas, broad representative ratios not feasible
 - Range of ratios within eastern and western sub regions was large
- Gina McCarthy memo of July 2011 rescinded the use of the trading ratios as a default option



Resources to develop ratios in Pacific NW

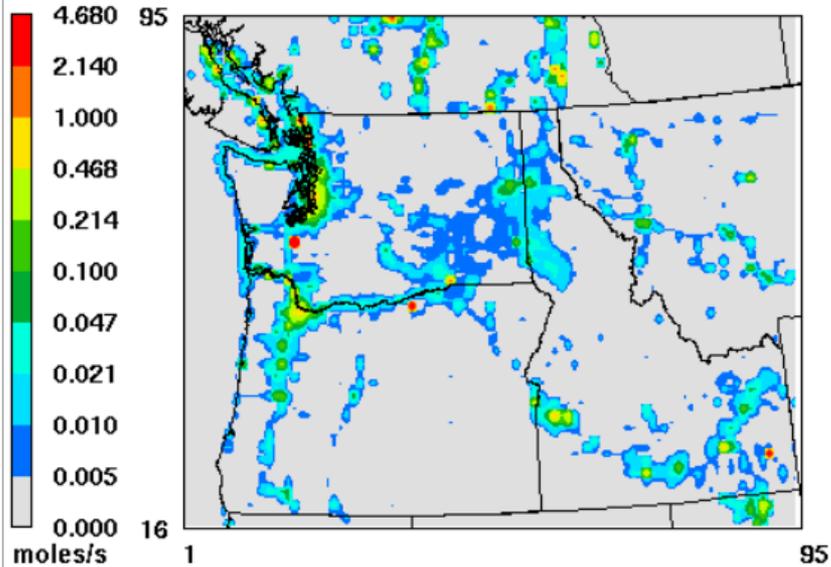
- AIRPACT
 - Emissions density maps
 - Concentration maps
- Ecology DV-Background gridded maps linking monitored concentrations to the AIRPACT spatial distribution
- Ratios defined by region and sub-region
 - Urban areas
 - Rural interior
 - Transportation corridors



Comparison of SO₂ emissions and SO₄ concentrations

SO₂ EMISSIONS

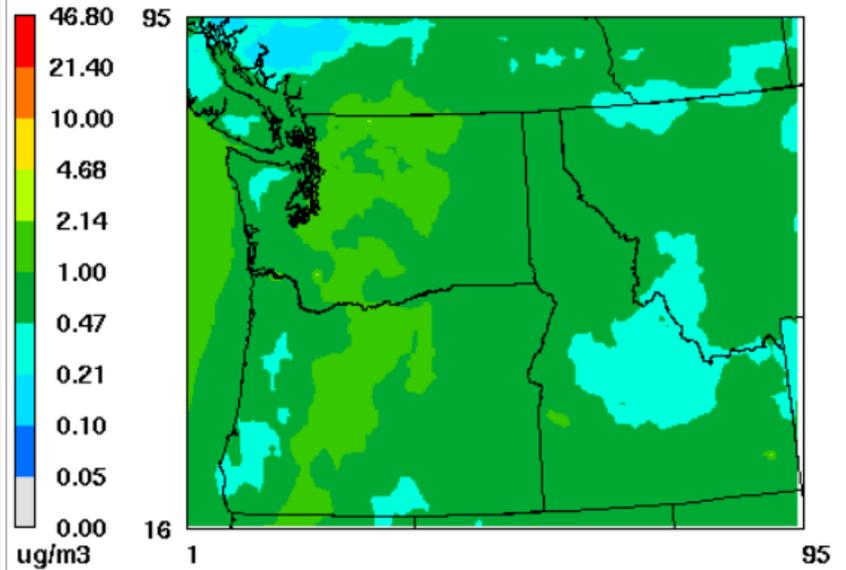
summed over all vertical layers.



June 5, 2013 16:00:00 (PST)
Min= 0.000 at (1,16), Max= 8.560 at (18,60)

CMAQ SO₄

Layer 1



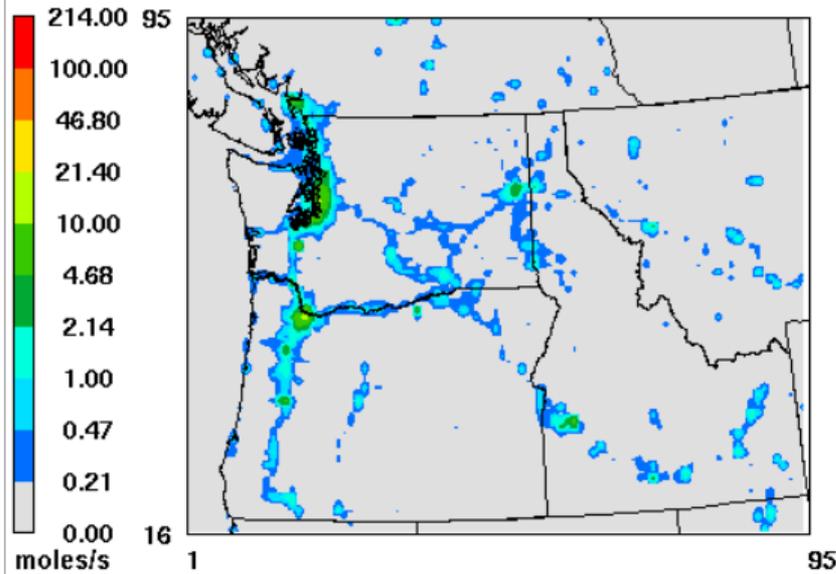
June 5, 2013 22:00:00 (PST)
Min= 0.11 at (15,91), Max= 2.35 at (21,55)



Comparison of NO_x emissions and NO₃ concentrations

NO_x EMISSIONS

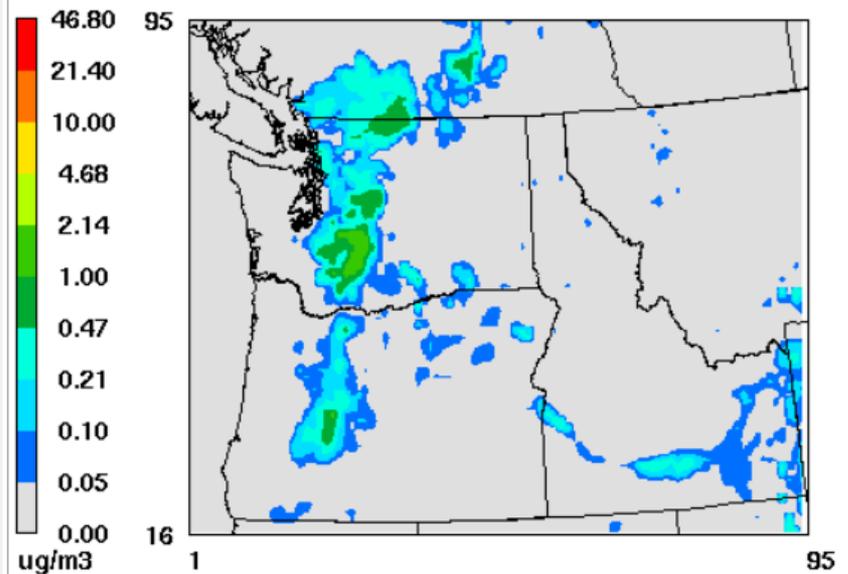
summed over all vertical layers.



June 5, 2013 16:00:00 (PST)
Min= 0.00 at (1,16), Max= 12.85 at (19,49)

CMAQ NO₃

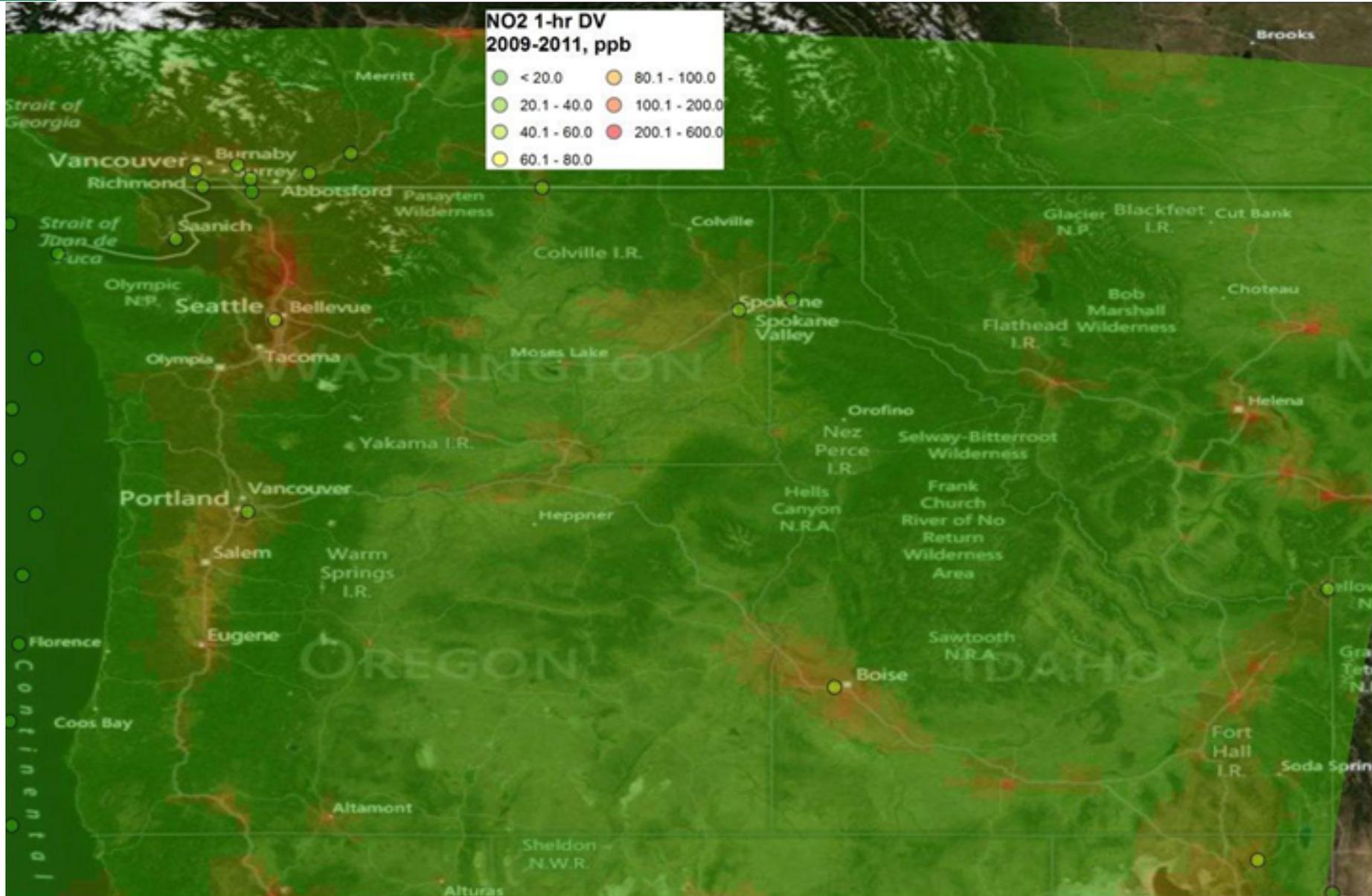
Layer 1



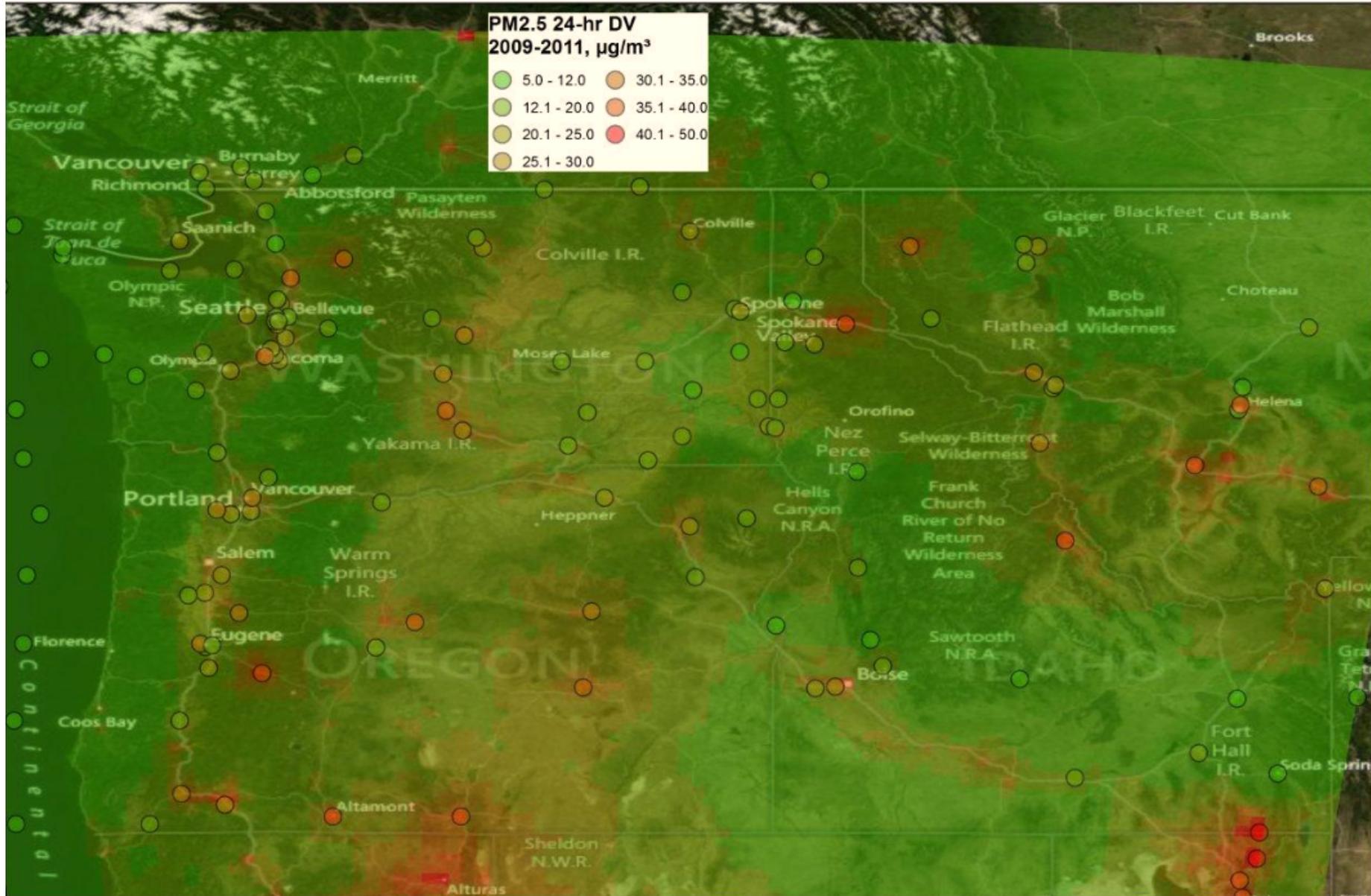
June 5, 2013 22:00:00 (PST)
Min= 0.00 at (4,22), Max= 2.00 at (28,61)



NO2 DV-Background Plot



PM2.5 DV-Background Plot





Interpollutant trading ratios in Pacific NW

- Advantages to defining a three-state approach
- Advantages to case-by-case analysis and development of informal guidance to direct consistency
- Is it worthwhile to keep on table and periodically see how the three states are meeting the challenge in NSR/PSD modeling