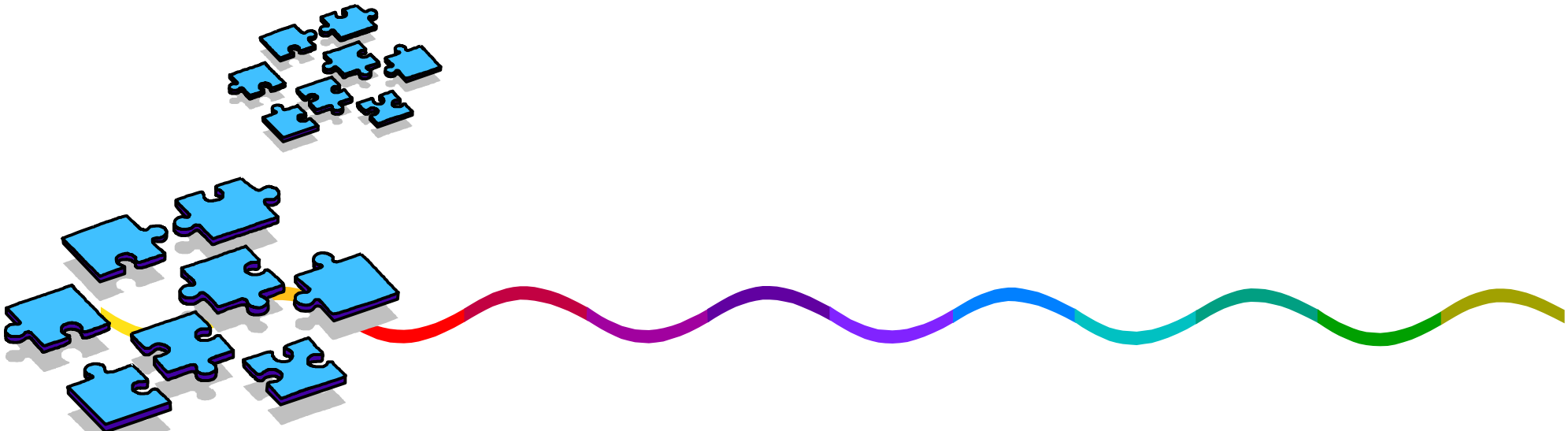
Region 5 Network Assessment

Air Monitoring Section
Air and Radiation Division
Region 5



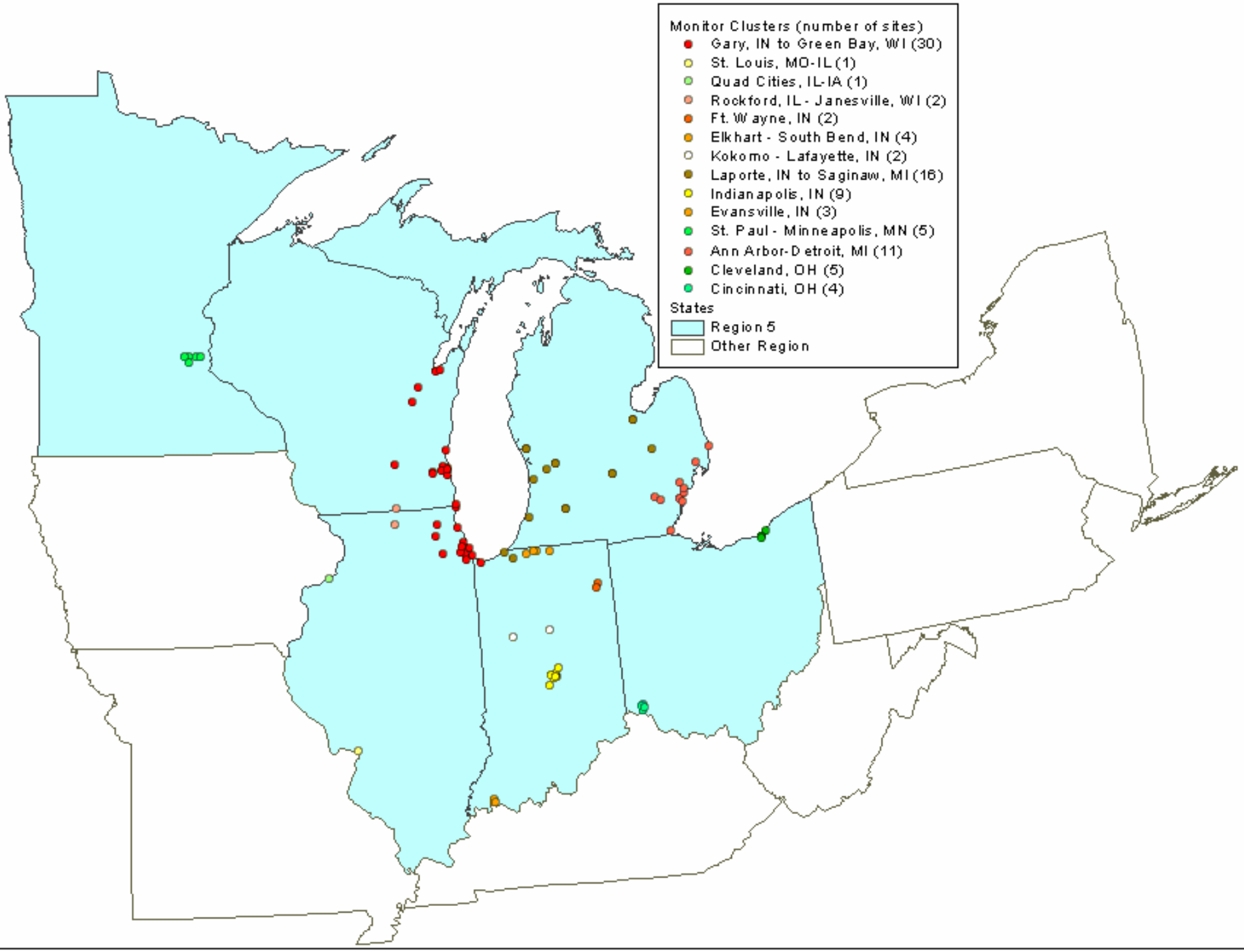
Purpose of $PM_{2.5}$ Network Assessment

- Identify low value and high value $PM_{2.5}$ monitoring sites
- Provide States with informational support for their own proposed network redesign
- Complement national network assessment by providing finer local-scale resolution

Data Evaluated

- All available AIRS data for FRM $PM_{2.5}$
  - Region 5 and bordering states
- Summarized site information
- Created a site map
- Calculated summary statistics
- Performed correlation analysis

Region 5 PM25: Clusters of Monitors with R>0.95



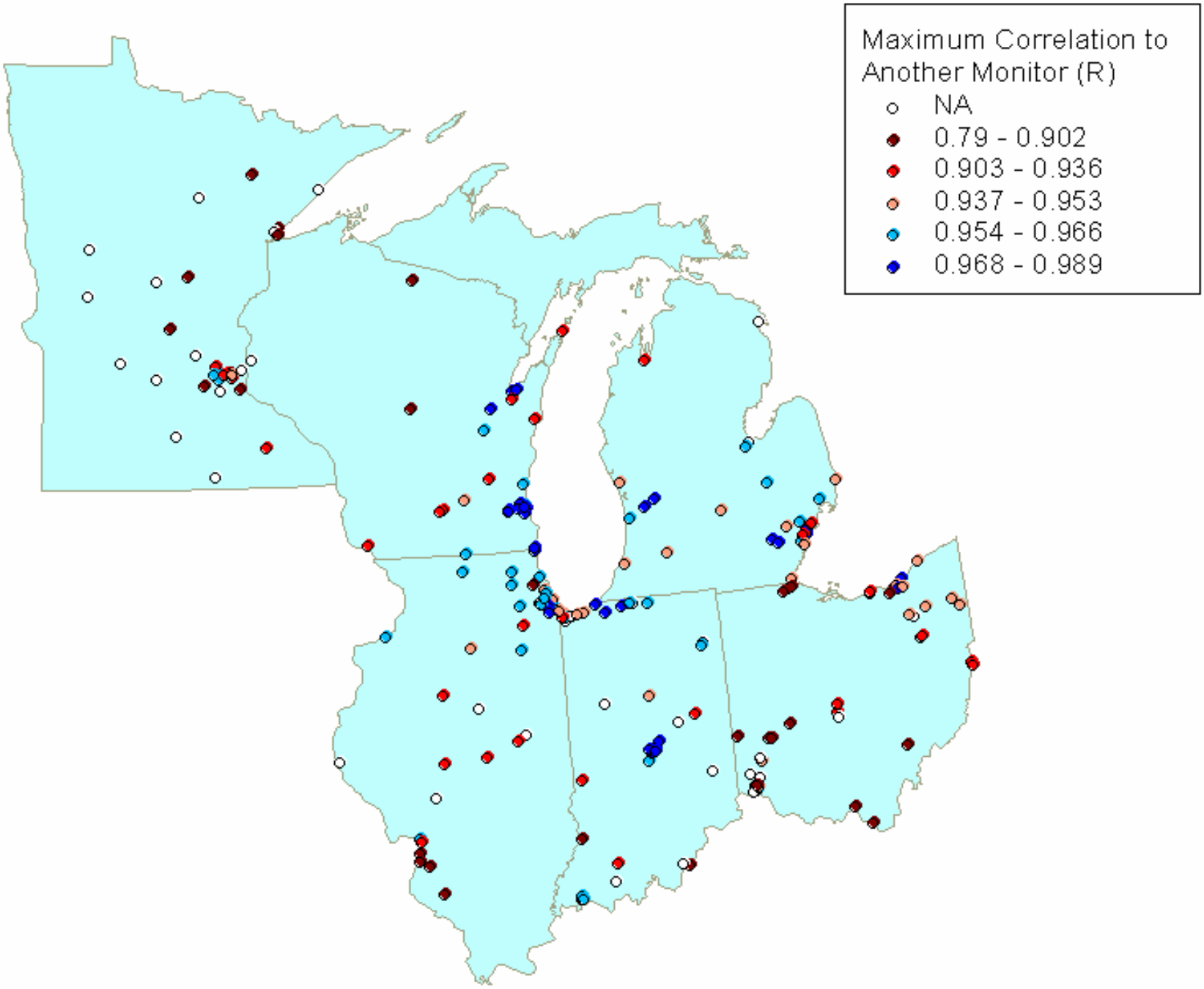
Monitor Evaluation Criteria

- **We evaluated Region 5 $PM_{2.5}$ monitors on the basis of four decision criteria:**
  - correlation
  - monitor density
  - mean concentration
  - population change
- The "least value" monitor would be one highly correlated to others (R2~0.95), close to other sites, showing low means, and located in area of decreasing population

U.S. Environmental Protection Agency
Region 5 - Air and Radiation

08/17/01, Air Monitoring Section

Region 5 PM2.5 Monitor Correlations



EPA
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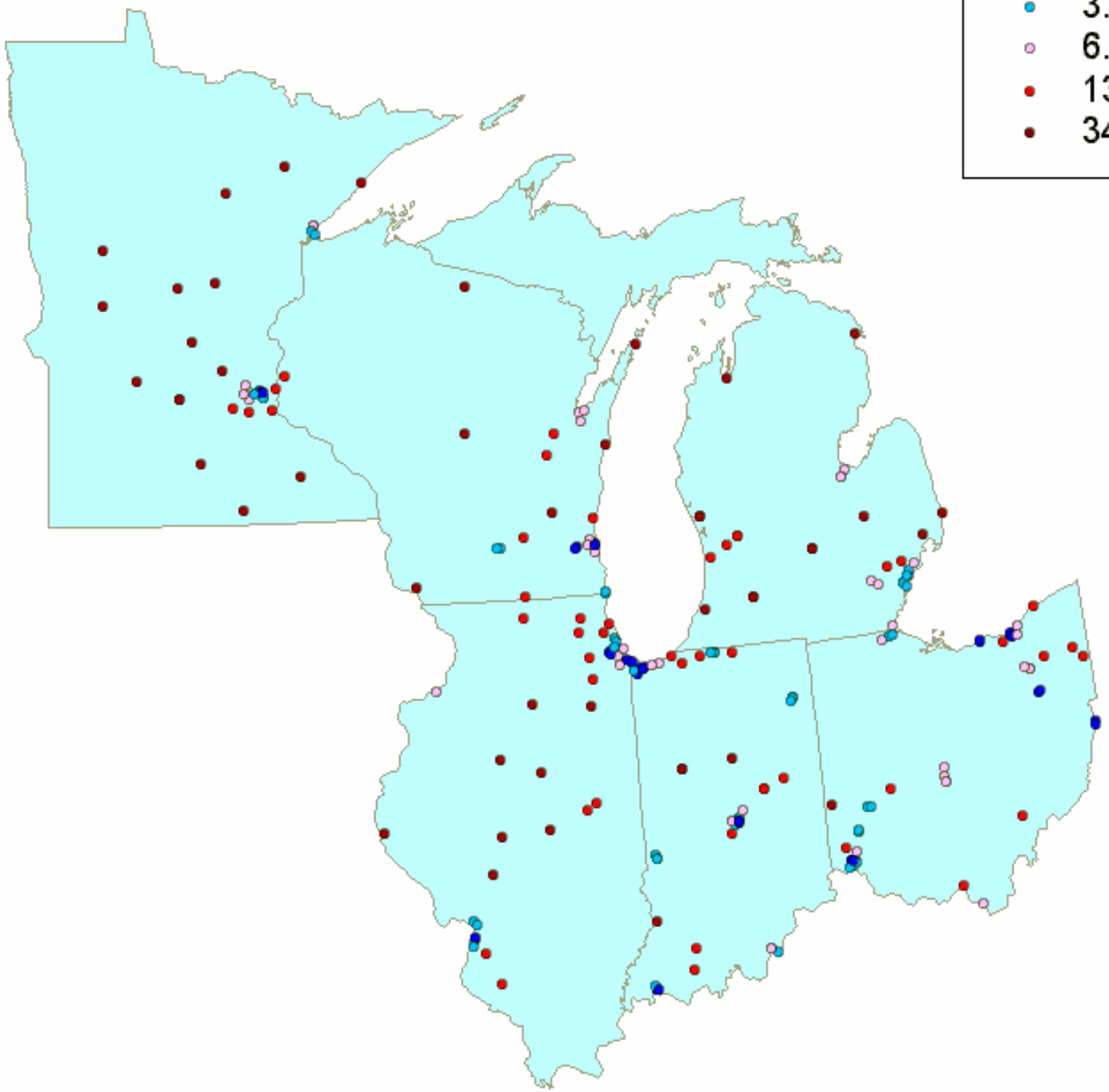
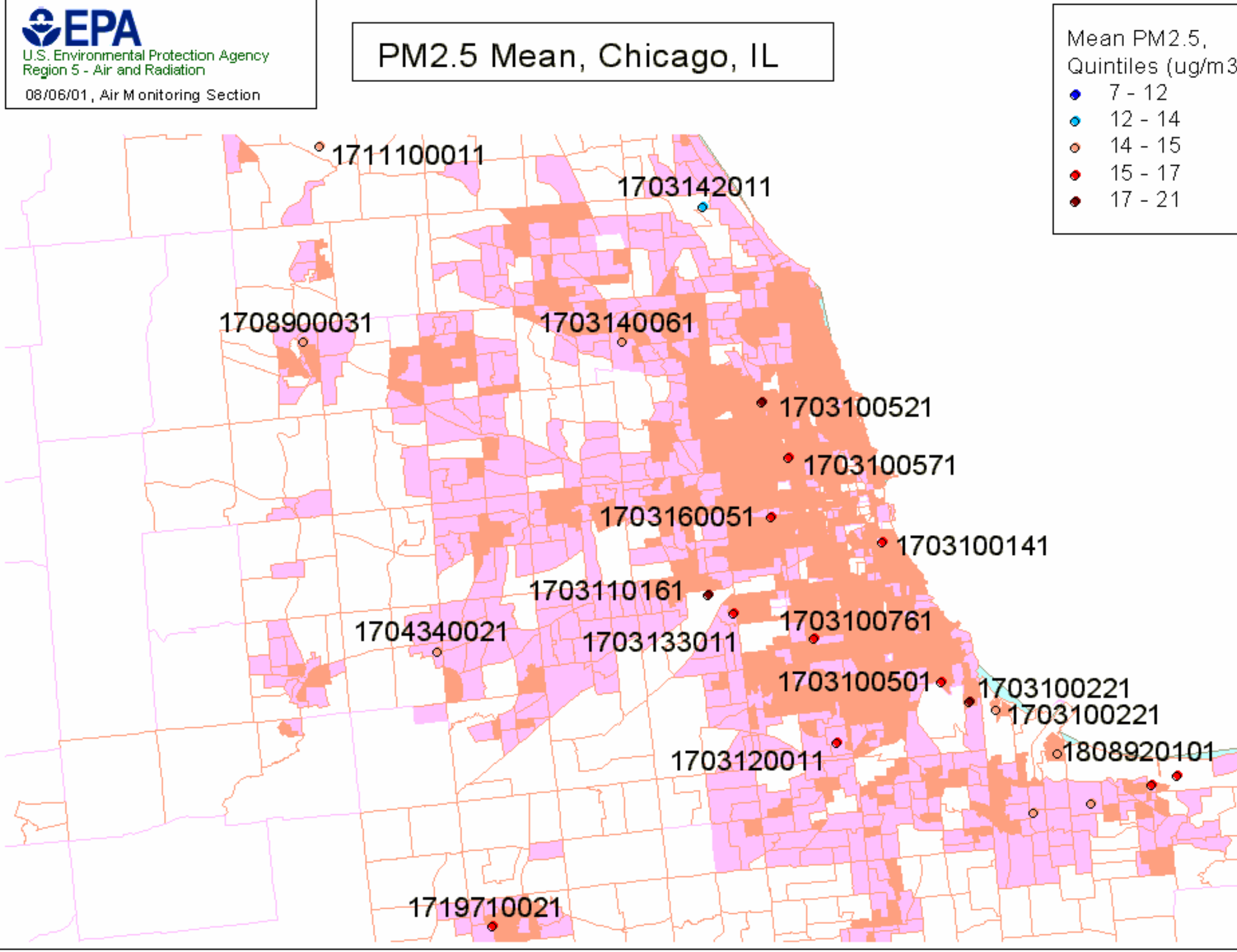
Region 5 - Air and Radiation

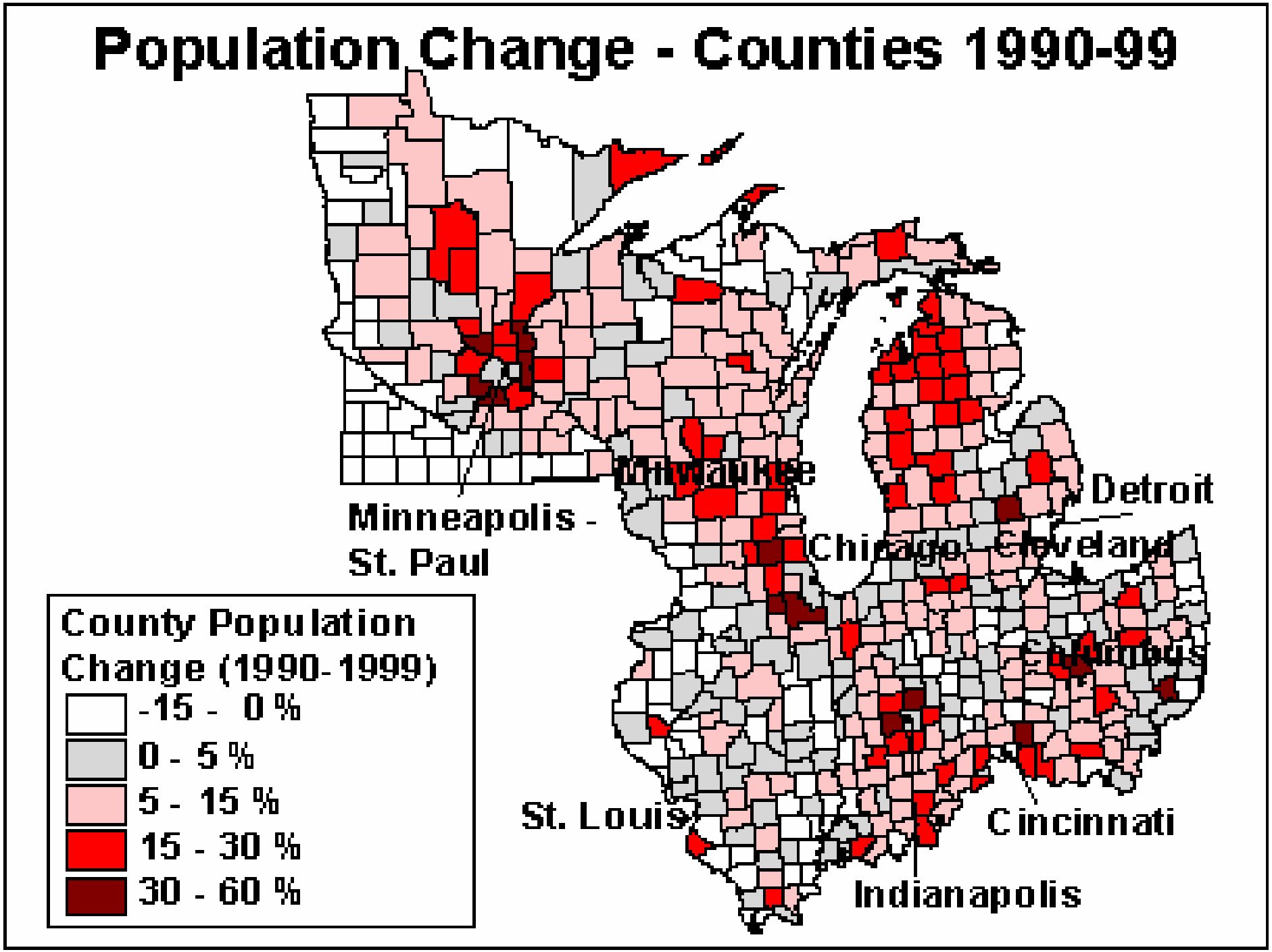
08/09/01, Air Monitoring Section

Region 5 PM2.5 Monitor Density




EPA
U.S. Environmental Protection Agency
Region 5 - Air and Radiation
08/06/01, Air Monitoring Section
PM2.5 Mean, Chicago, IL
Mean PM2.5, Quintiles (ug/m3
7 - 12
12 - 14
14 - 15
15 - 17
17 - 21
1711100011
1703142011
1708900031
1703140061
1703100521
1703100571
1703160051
1703100141
1703110161
1703100761
1704340021
1703133011
1703100501
1703100221
1703100221
1808920101
1703120011
1719710021

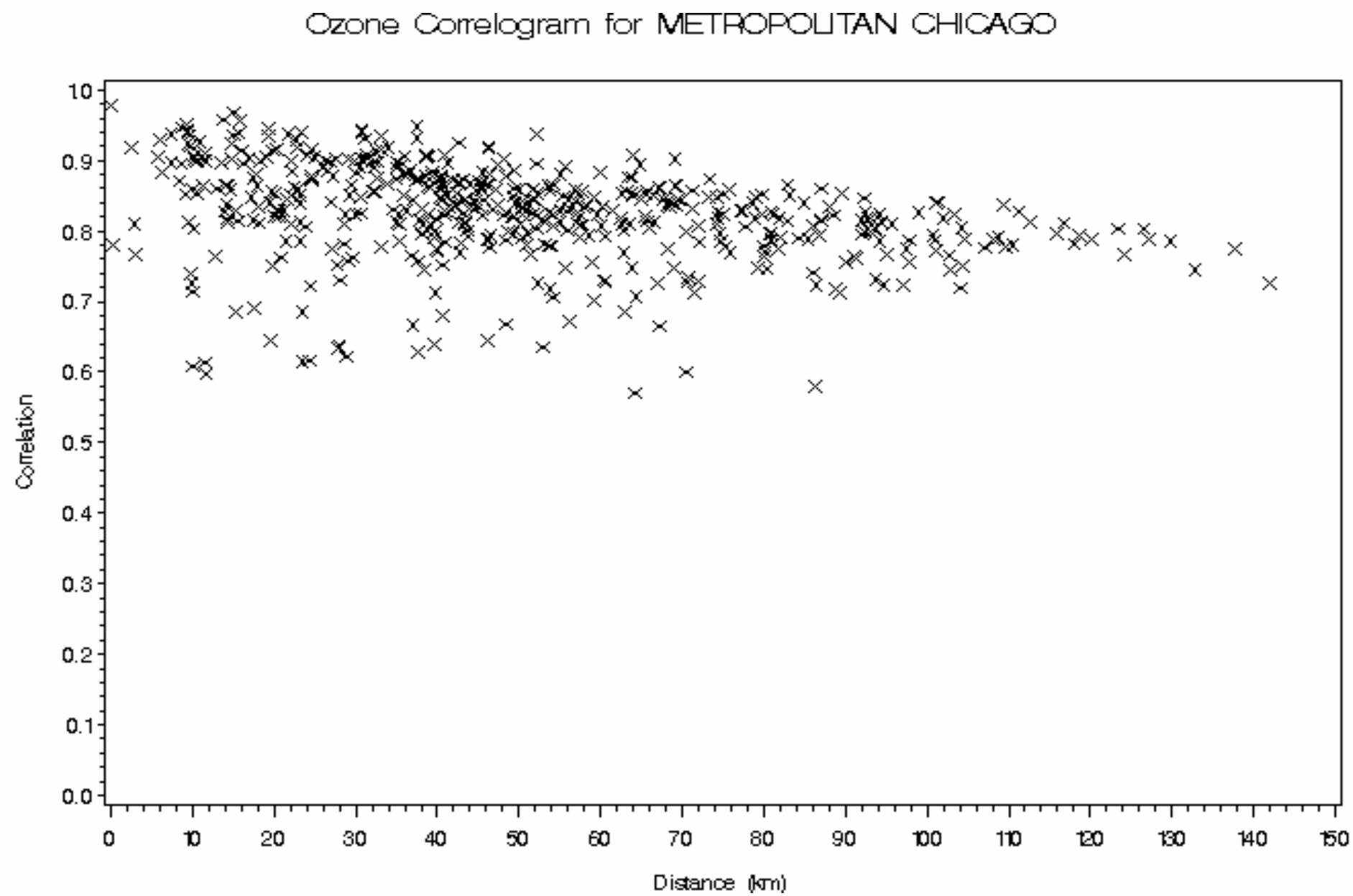
Population Change - Counties 1990-99



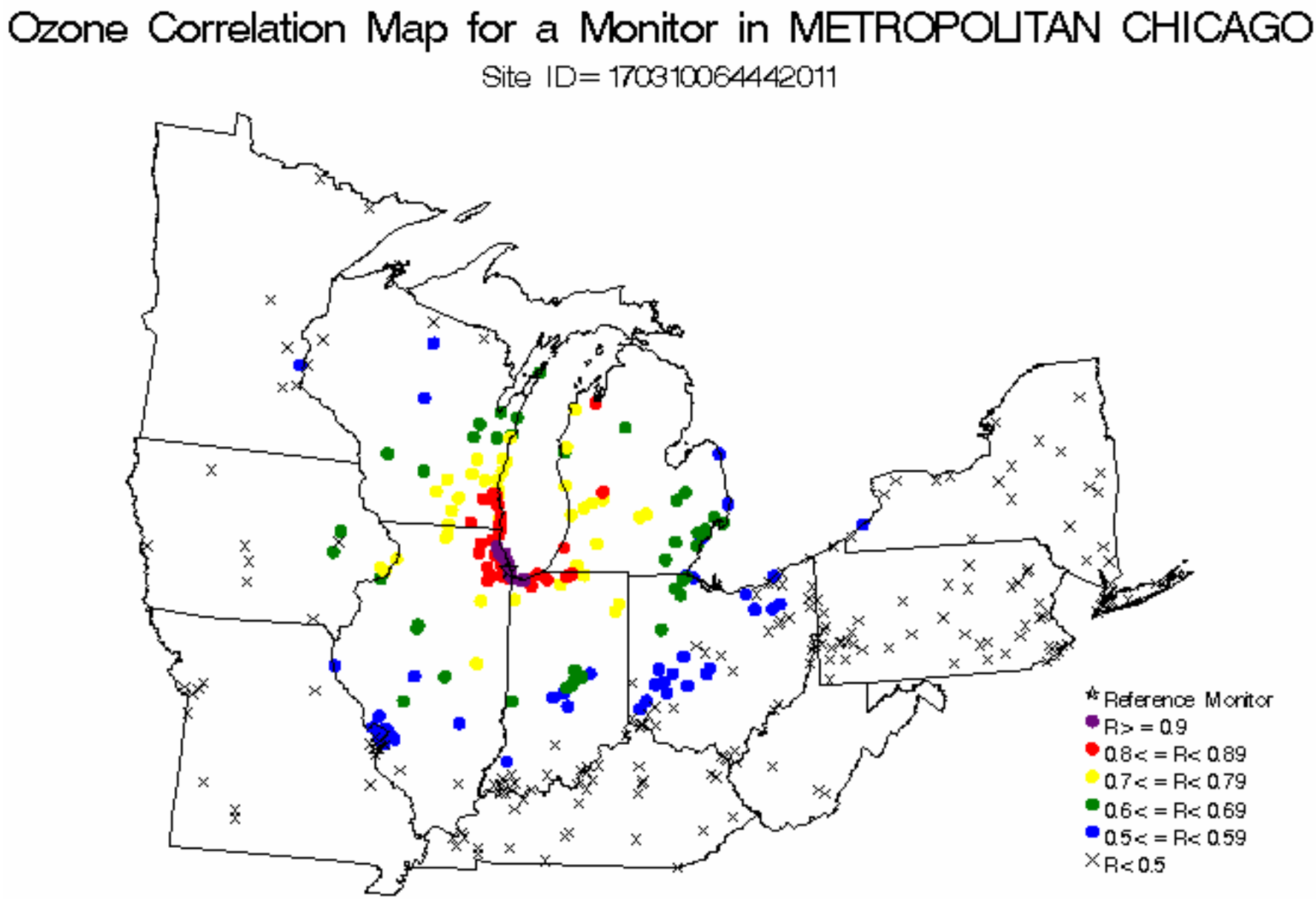
Ozone Analysis

- Correlation Analysis
  - Determine "redundant" monitoring sites
  - Preserve "unique" sites
  - Data
    - 1996-2000 8 hour daily maximum ozone concentration
    - IL, IN, OH, MI, MN, WI, IA, MO, KY, WV, PA, NY
- Positive Matrix Factorization (PMF)
  - Group monitors by spatial factors
    - Examine areas with similar ozone concentrations

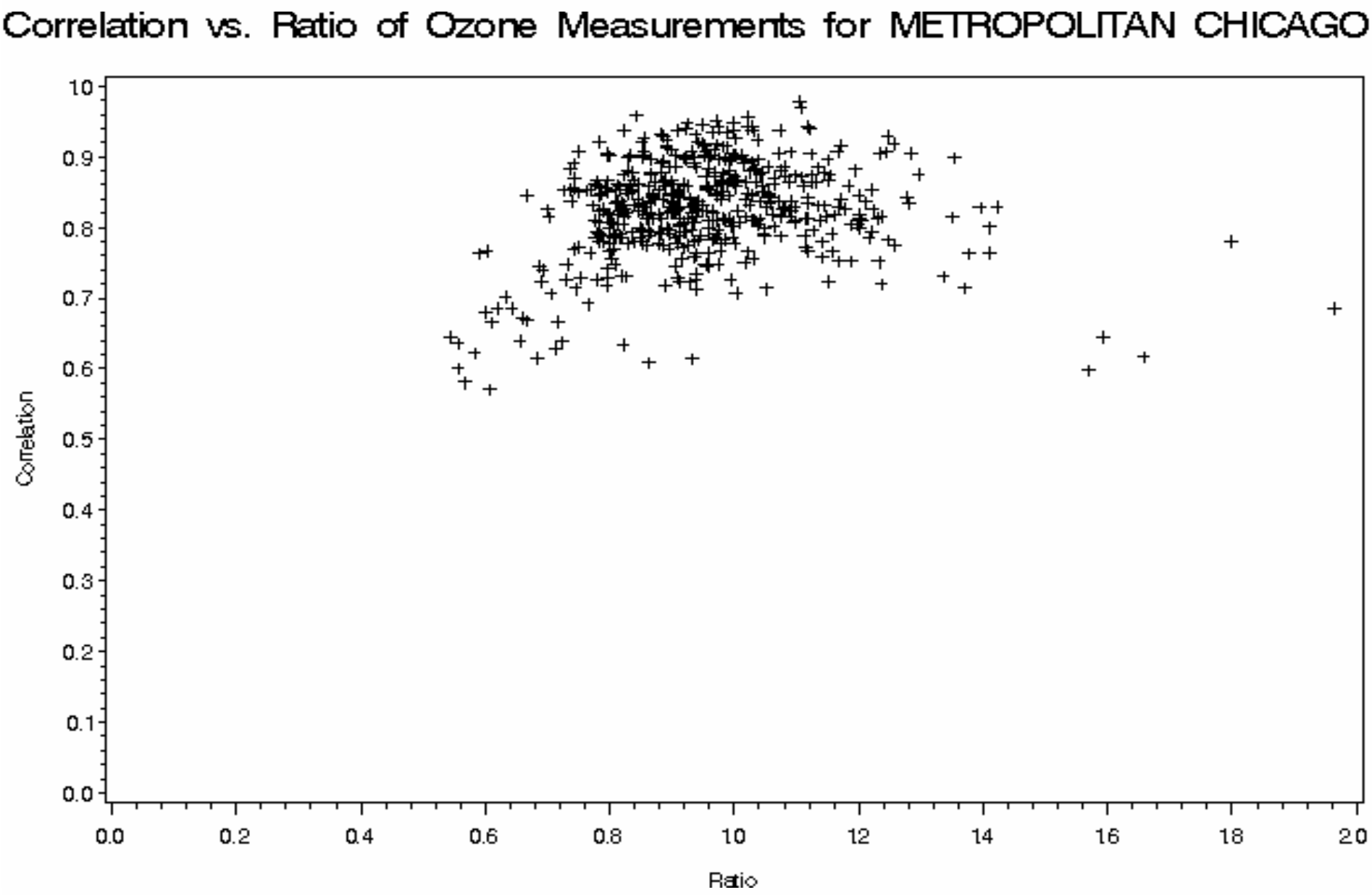
Correlation Analysis



Correlation Analysis



Correlation Analysis



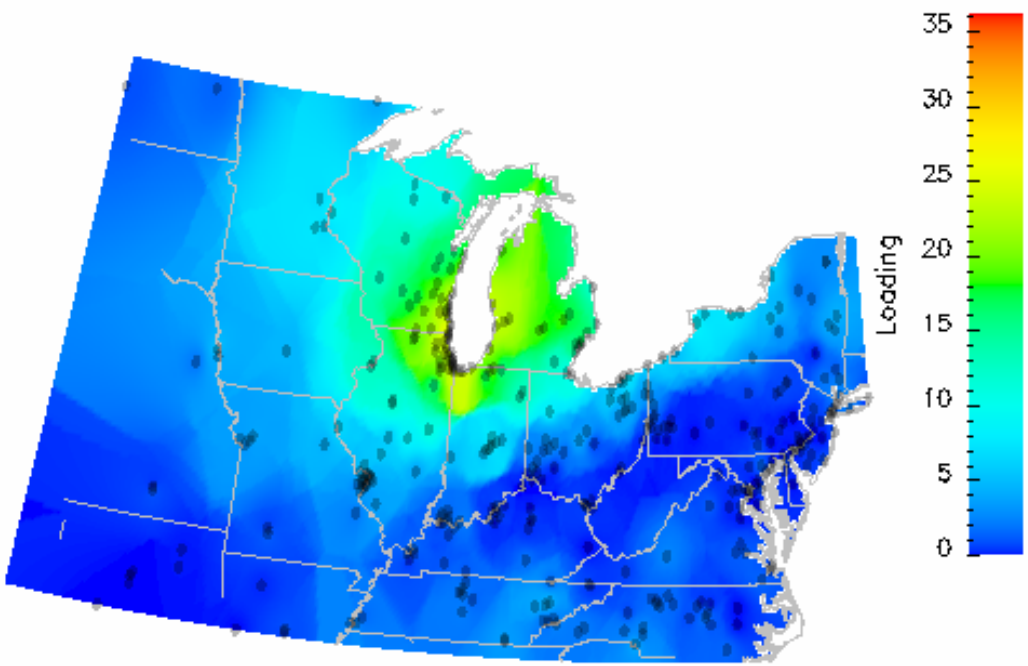
Monitor Pairwise Correlations and Ratios for METROPOLITAN CHICAGO

08:52 Wednesday, July 25, 2001

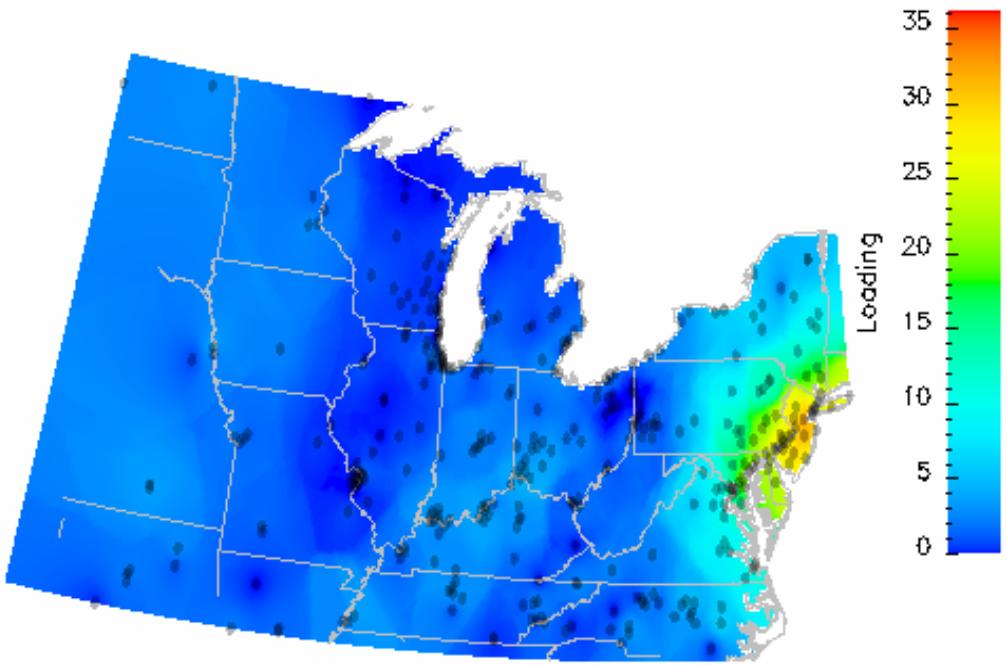
Site 1	Site 2	Distance (km)	No. Obs.	Corr: R	Avg. Ratio	Median Ratio	Std. Dev.	Min Ratio	Max Ratio
170310001442011	170310032442011	18.2	759	0.81	0.86	0.89	0.22	0.16	2.07
170310001442011	170310037442011	34.7	92	0.83	1.14	1.12	0.33	0.21	2.67
170310001442011	170310042442012	24.5	753	0.72	0.93	0.94	0.29	0.15	2.40
170310001442011	170310050442011	14.2	759	0.84	1.07	1.07	0.29	0.26	3.00
170310001442011	170310063442011	24.4	743	0.62	1.66	1.47	0.83	0.30	6.57
170310001442011	170310064442011	17.2	760	0.85	1.06	1.06	0.30	0.24	3.13
170310001442011	170310072442011	27.1	746	0.77	0.89	0.89	0.26	0.08	2.05
170310001442011	170310075442011	33.2	444	0.78	1.00	1.03	0.28	0.26	2.11
170310001442011	170311003442012	35.3	751	0.82	1.09	1.07	0.33	0.25	4.00
170310001442011	170311601442011	21.5	755	0.79	1.00	1.00	0.30	0.28	4.38
170310001442011	170314002442011	20.6	757	0.83	1.17	1.14	0.76	0.27	20.0
170310001442011	170314006442011	42.2	758	0.84	1.02	1.00	0.28	0.26	3.17
170310001442011	170314201442011	42.7	604	0.81	0.91	0.93	0.23	0.23	1.93
170310001442011	170314201442012	42.7	112	0.87	1.06	1.08	0.22	0.27	1.62
170310001442011	170317002442011	43.8	753	0.79	0.87	0.88	0.24	0.08	2.00
170310001442011	170318003442011	14.4	751	0.82	1.16	1.13	0.48	0.22	7.43
170310001442011	170436001442011	32.4	758	0.86	1.00	1.02	0.24	0.26	3.33

PMF

Examples of two spatial factors

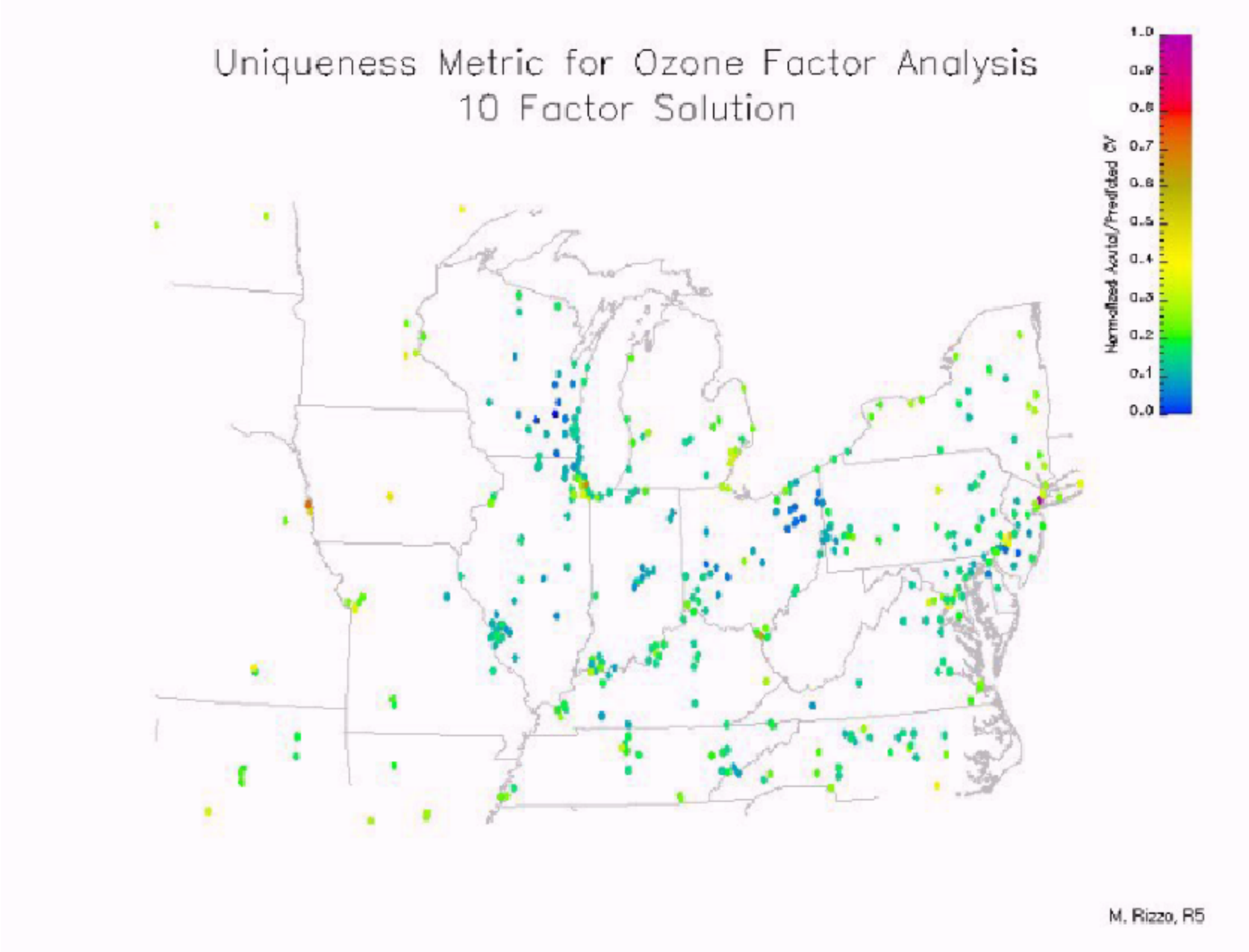


Lake Michigan Area Factor

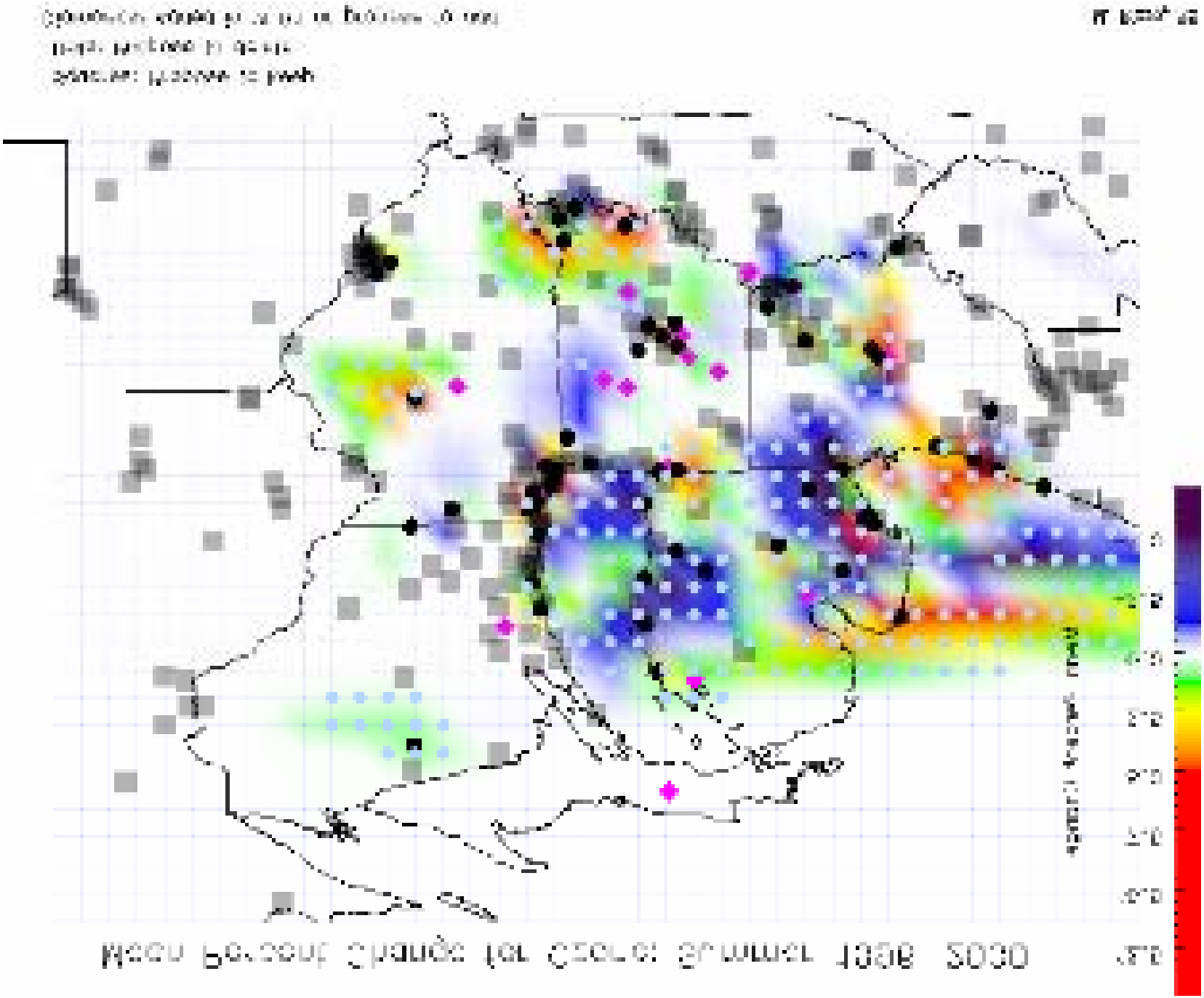


East Coast Factor

PMF


Uniqueness Metric for Ozone Factor Analysis
10 Factor Solution
Normalized Acutal/Predicted CV
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
M. Rizzo, R5

Validation



What was it all used for?

- "Bottom-Up" Network Assessment
  - Create networks "from scratch"
  - States established set of criteria
    - Public Information — Public health/NAAQS
    - Strategy development — trends/strategy evaluation
    - multi-pollutant sites — population-oriented sites
    - over/under-monitoring — low concentrations
    - regional/local scale — population growth
  - Analyses used to aid in decision process

The Goal

"Top-Down" and "Bottom-Up" meet in the middle

- Implement changes in networks over period of up to five years

Where We Are Now

- Phase I: "Fine pruning" by States COMPLETE (~ 3 months)
- Phase II: Thorough assessment of networks resulting in initial revisions COMPLETE (~ 6 months)
- Phase III: Review by technical and regulatory staffs at both Regional and State level to see if data needs met COMPLETE (~ 3 months)
- Phase IV: Approval of proposed networks by State Air Directors IN PROGRESS (Approved by 4 of 6 States)
- Phase V: Outreach to public to explain changes IN PLANNING STAGES

Outcomes

- Regional approach
- Implement changes in networks over period of up to five years
  - Many States have begun implementation
- **<u>Monitoring staffs need to work extensively with regulatory/designation staffs at both Federal and State levels</u>**
- Overall: 24% reduction in criteria pollutant networks
  - ozone: 14%
  - PM2.5: 18%
  - PM10: 36%
  - Lead: 48%

CO: 25%

SO2: 33%

NO2: 14%