

Draft Final Ozone Guidance Comments and Proposed Changes



3rd PM/RH/O3 Modeling Workshop

New Orleans, LA

May 19, 2005

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Draft Final Ozone Guidance-Comments

- Received ~20 sets of comments
- Most comments were focused on the 6 areas outlined in the note at the beginning of the draft final guidance
 - Applying RRFs “near” a monitor (array of grid cells)
 - Screening test/spatial fields
 - Minimum concentration threshold in RRF test
 - Minimum number of days in RRF test
 - Performance evaluation metrics
 - End of section summary of recommendations



Comments con't

- Many other miscellaneous comments
 - Using 5 year weighted average design value
 - Additional details for conceptual model
 - What concentrations does WOE apply at?
 - Analyses recommended in WOE
 - Use of 2002 as baseline inventory year
 - What are “clean” boundary conditions?
 - Modeling longer episodes and/or seasons
 - More details on met model performance
 - More detailed emissions modeling information
 - Typos, lots of them



Proposed Ozone Guidance Changes- Screening Test

- Screening test/spatial fields (attainment test in unmonitored areas)
 - Many commenters asked clarifying questions on application of screening test
 - Some details are difficult to answer and/or defend
 - 25% of days, grid cell array, threshold, etc.
 - Some commenters liked option to create spatial fields
 - Many commenters recognized limitations of spatial fields
 - May overestimate ambient data in rural areas
 - Does not consider chemistry, science



Proposed Ozone Guidance Changes- Screening Test

- One commenter (GA EPD) suggested replacing screening test with spatial fields test that incorporates model outputs (the “Al Cimorelli test”)
 - Interpolated ambient data can be adjusted upward or downward based on the model outputs
 - Areas of high predicted ozone can be used to increase the ambient data concentrations and vice versa
 - Spatial fields adjusted with model outputs combine the best of both worlds
 - The ambient data is used as an anchor (similar to the relative test)
 - The spatial gradients from the model data is used to indicate potential hot spot areas



Proposed Ozone Guidance Changes- Screening Test

■ **Technical proposal (not final)**

- Apply the default attainment test at each monitor
- Eliminate the screening test
- Replace the screening test with model adjusted spatial fields
 - EPA may provide a default set of base year spatial fields
 - We may also provide a set of future year fields (2009?) that have been adjusted based on our model output
 - We **will** provide software tools to allow States to easily do interpolations and RRF calculations themselves
 - The software tool already exists (BenMAP)
 - It will need to be modified somewhat and provided as a standalone tool



Proposed Ozone Guidance Changes- Screening Test


■ Policy proposal (not final)

- The monitor based test should be the **primary** test which will be used to develop control strategies
- The spatial fields test in unmonitored areas should be used as a secondary tool to indicate potential current and/or future ozone hot spots
 - Identification of potential future hot spots may require an enforceable commitment in the SIP
 - The requirement will be to further examine the problem through additional monitoring, data analysis, and tracking
 - The SIP may need to include contingency measures to address the unmonitored hot spot if ozone is later found to be a problem in the area
- The spatial fields test should be applied in all nonattainment and attainment areas in the State, as well as the nonattainment portion of interstate nonattainment areas (when applicable)



Proposed Ozone Guidance Changes- Minimum RRF Threshold

- Many commenters suggested raising the RRF minimum threshold from 70 ppb to a higher value
 - Most suggested 75-85 ppb
 - Concerned that the model may not be as responsive to emissions changes at concentrations close to 70 ppb
 - Should focus on model predictions closer to the level of the standard
- One commenter suggested tying the threshold to the design value at each monitor
 - Set threshold at DV – 10 ppb



Proposed Ozone Guidance Changes- Minimum RRF Threshold

- We analyzed the CAIR ozone model output to examine the impact of increasing the RRF threshold
 - Looked at the magnitude and variability of **daily RRFs** as well as the mean RRF at each monitoring site
 - Used data from 206 monitoring sites which had at least 10 days with modeled ozone > 85 ppb (out of 30 modeling days)
 - The number of sites were held constant, but the number of days at each site decreases as the threshold increases

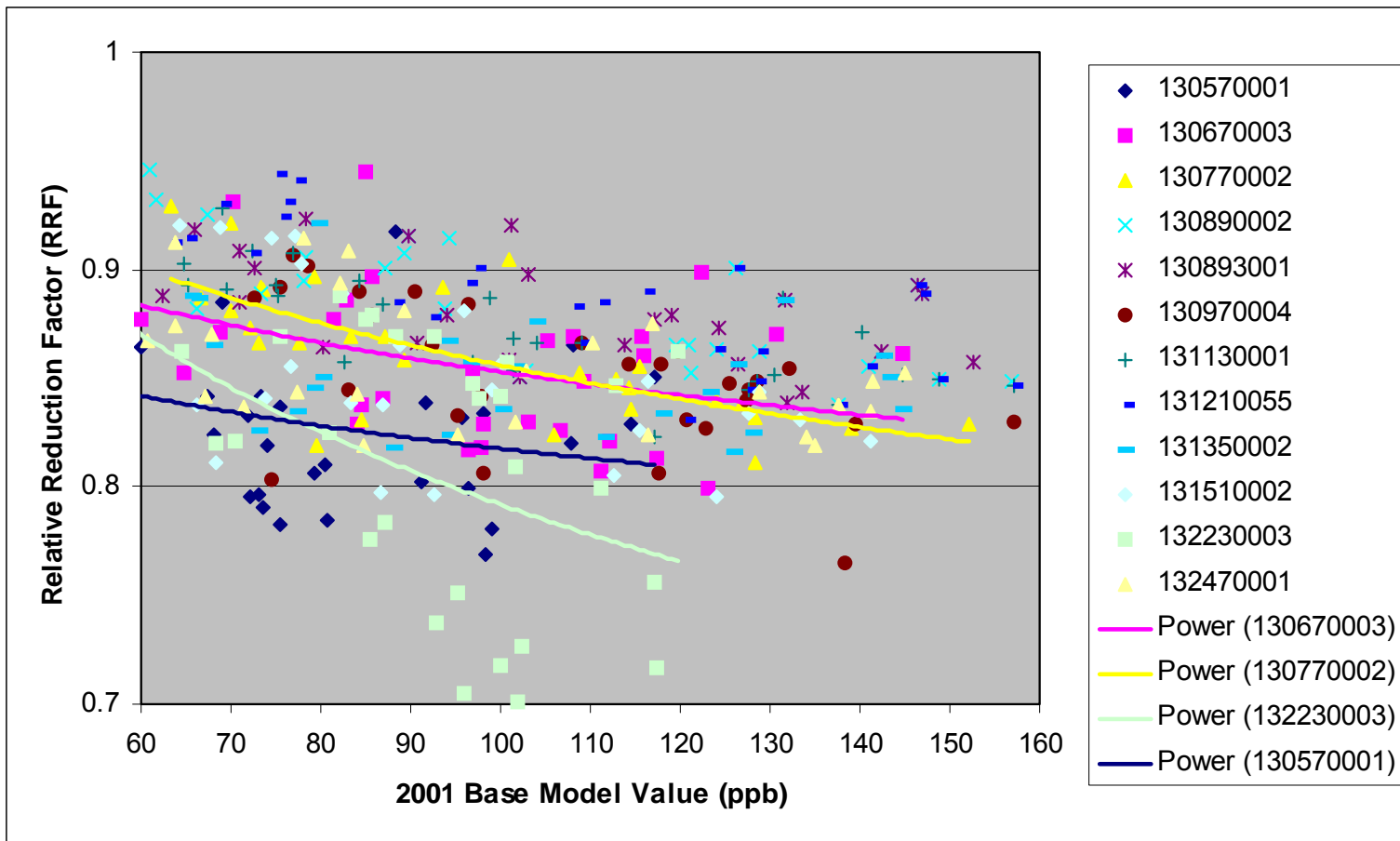


Proposed Ozone Guidance Changes- Minimum RRF Threshold

- On average, the RRFs were lower (greater ozone reduction) when the threshold is increased from 70 to 85 ppb
 - ~0.2 ppb average RRF change for each 5 ppb increment (0.6 ppb change from 70 to 85)
 - The pattern is consistent at most sites
 - The RRF decreased at 177 out of 206 sites
 - The variability of daily RRFs is also **reduced** when the threshold is increased
 - Standard deviation of the daily RRFs was 3.0% at 70 ppb and 2.4% at 85 ppb
 - Less variability in the daily RRFs indicates that the mean RRF is less influenced by the choice of days and the number of days

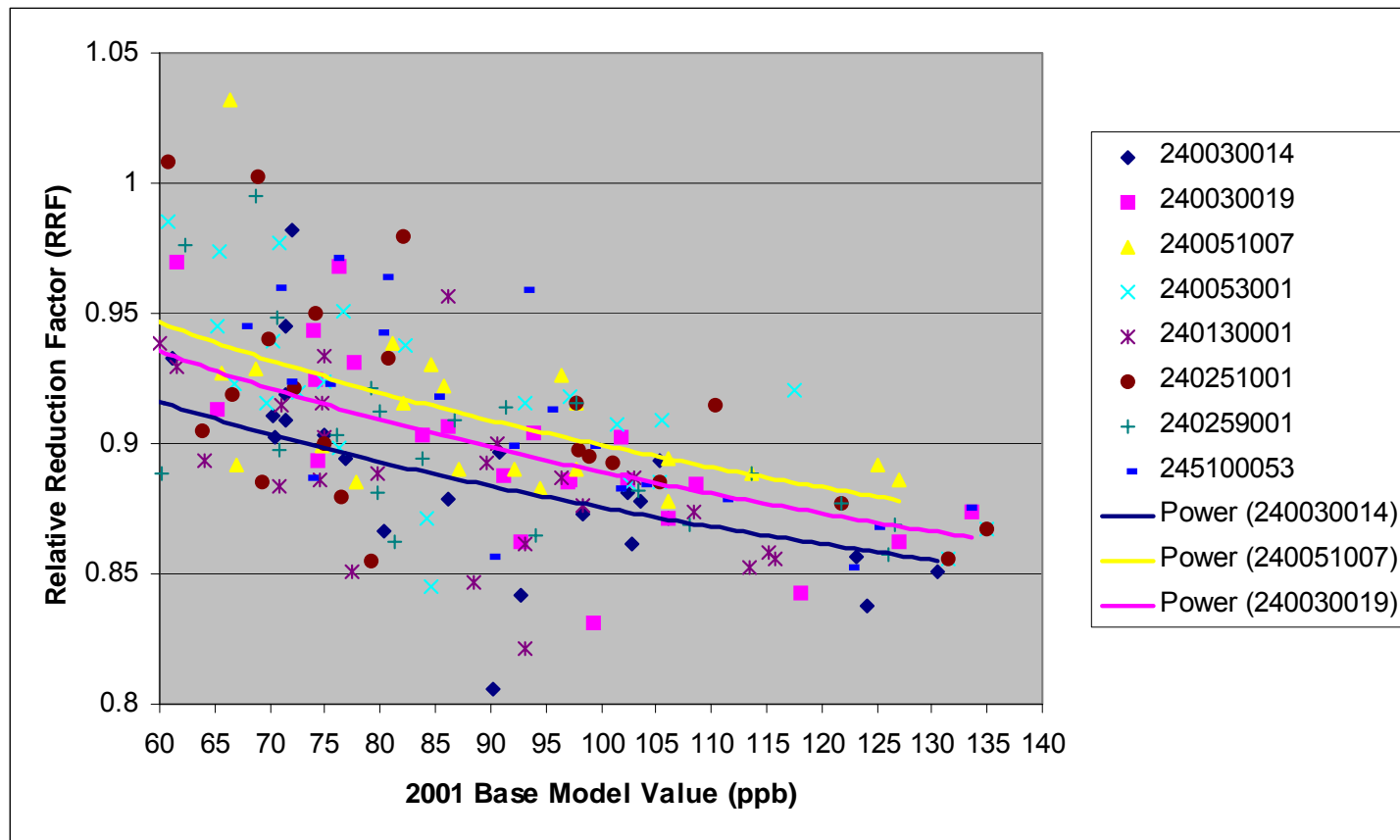
Proposed Ozone Guidance Changes- Minimum RRF Threshold

Atlanta MSA Daily RRFs- CAIR Ozone Modeling



Proposed Ozone Guidance Changes- Minimum RRF Threshold

Baltimore MSA Daily RRFs- CAIR Ozone Modeling





Proposed Ozone Guidance Changes- Minimum RRF Threshold

- The results of the analysis indicates that a higher threshold is warranted
 - Greater response to emissions controls at higher threshold
 - Lower thresholds appear to bias the results
 - Less variability in the daily RRFs at higher threshold (with fewer days)
 - More stable mean RRF
- **Recommend a default minimum threshold of 85 ppb**
 - An even higher threshold may be justifiable, but the level of the standard is a logical number to use
 - It makes sense to confine the analysis to the types of days that are conducive to ozone levels above the level of the standard



Proposed Ozone Guidance Changes- Minimum RRF Threshold

- What if there are not “enough” days > 85 to use in the RRF test?
 - **Default to a “fall back” minimum threshold of 70 ppb**
 - Use the 85 ppb threshold when possible, but use a value between 70 and 85 when more days are needed in the RRF test at certain monitors
- How do you know if more days are needed?
 - That brings us to the next analysis....



Proposed Ozone Guidance Changes- Minimum Number of Days

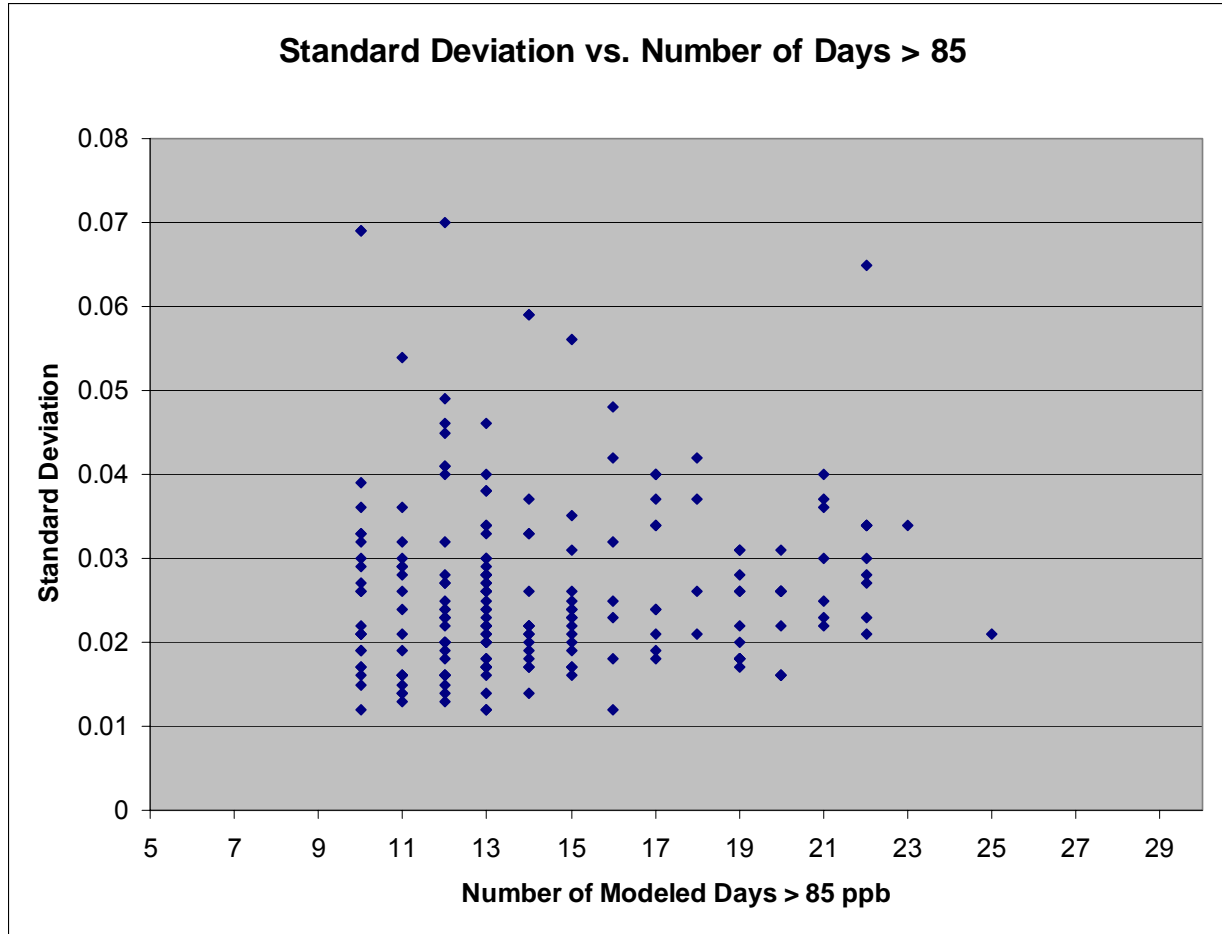
- Analyzed number of days in mean RRF calculation
- Used the same CAIR dataset as the threshold analysis (206 sites with 10 or more days > 85 ppb)
 - The minimum number of days and minimum RRF threshold are closely linked



Proposed Ozone Guidance Changes- Minimum Number of Days

- Assumed that the mean RRF is more stable and accurate with a large number of days
 - If the mean RRF is calculated from a “large” set of days, then the variability of the mean RRF can be calculated for any subset of those days
 - The variability of a subset of days is determined by the standard deviation of the **daily RRFs**
 - If the daily RRFs are highly variable, then it will take many days to simulate the full dataset mean (a large minimum number of days is needed)
- Analyzed the ability of subsets of days to accurately reflect the “large” dataset mean RRF
 - The range of the standard deviation was determined using the data from the 206 sites
 - The standard deviation does not appear to be correlated to the number of days
 - Assumed that a sample size of 10 days was enough to get a stable SD

Proposed Ozone Guidance Changes- Minimum Number of Days



Standard deviation is not strongly correlated with the number of days in the sample

Proposed Ozone Guidance Changes- Minimum Number of Days

- Calculated the minimum number of days needed to simulate the 25, 50, and 100 day mean RRF within $\pm 1\%$ and $\pm 2\%$ (e.g. for an RRF of $0.85 \pm 2\% = 0.83-0.87$) with a 95% confidence interval
- Used the standard deviations calculated at the 206 sites
- Formula:

$$n = \frac{N(\sigma^2)}{N(TSEM / 2)^2 + \sigma^2}$$

- Where n = number of days (subset of mean RRF population)
 N =mean RRF population (e.g. 50 days)
 σ = Standard deviation of the daily RRFs
 $TSEM$ = twice the standard error of the mean RRF (e.g. $\pm 1\%$)

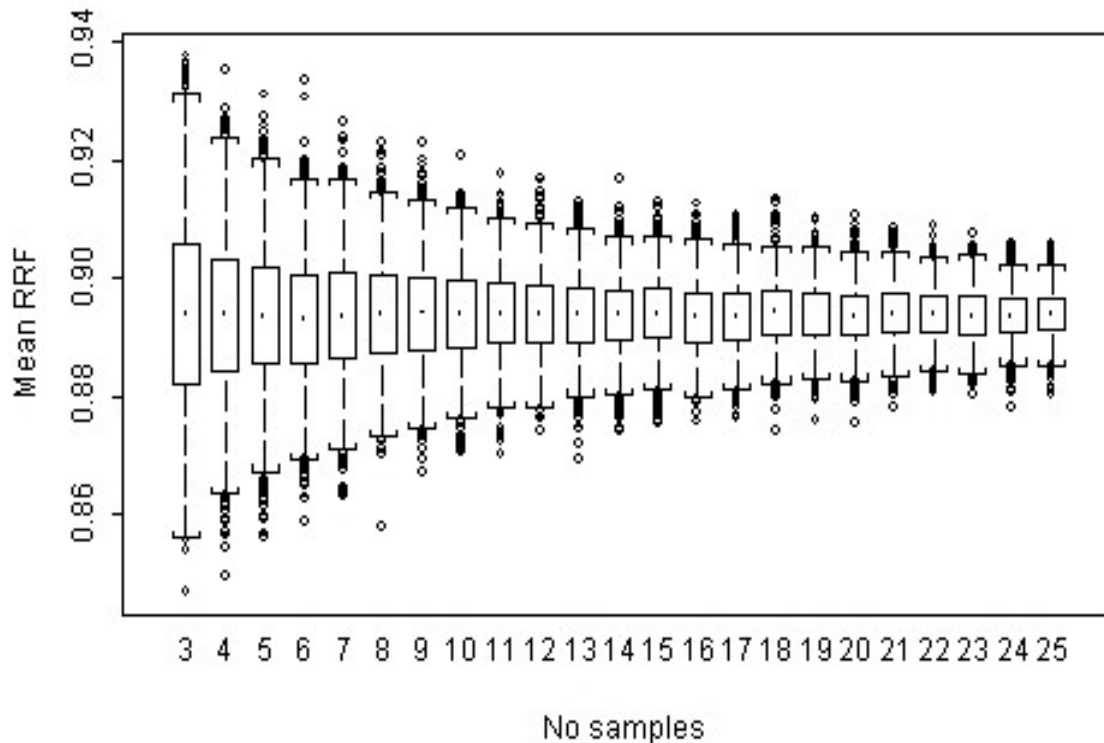
Proposed Ozone Guidance Changes- Minimum Number of Days

Example:

Ozone Monitor in Harford County MD

Mean RRF= 0.90

Standard Deviation of daily RRF= .034 (3.4%)



Sampled 3 to 50 days,
1000 times (results
shown for 3 to 25
days)

Plot shows the
range of the mean
RRFs over the
1000 samples

The variability of the
mean RRF
decreases as the
number of days in
the sample increases

Proposed Ozone Guidance Changes- Minimum Number of Days

Value (206 sites)	Standard Deviation	± 1% (25/50/100 days)	± 2% (25/50/100 days)
25th Percentile	1.9%	9/10/12	3/4/4
Median	2.4%	10/13/16	5/5/6
75th Percentile	3.1%	12/17/23	6/8/9

- Median standard deviation (2.4%) indicates that the mean RRF can be simulated to within ± 1% with ~10 days and ± 2% with ~5 days



Proposed Ozone Guidance Changes- Minimum Number of Days

- **Recommend using a minimum number of 10 days in the RRF calculation at each monitor**
 - Use an absolute minimum of 5 days
 - Better to have more days, but 5 is minimally sufficient if relatively few days are modeled
- The minimum threshold and minimum number of days can be combined to give a hierarchy of days used and thresholds used at each monitor

Proposed Ozone Guidance Changes- Minimum Number of Days

- Minimum number of days hierarchy at each monitor
 - If 10 or more days > 85 ppb then use 85 ppb threshold
 - If less than 10 days > 85 ppb then reduce the threshold (down to as low as 70) until 10 days are used
 - If less than 10 days > 70 ppb then use all days > 70 (with an absolute minimum of 5)

Hierarchy
Examples
for a single
monitor

Number of Days > 70 ppb	Number of Days > 85 ppb	Number of Days in Mean RRF	Threshold < 85 ppb?
50	15	15	No
20	12	12	No
12	7	10	Yes
11	3	10	Yes
9	6	9	Yes
6	1	6	Yes
3	0	N/A	N/A



Ozone Guidance-Grid Cell Array

- Grid cell array
 - Should we continue to use the maximum prediction in the array (3 X 3 or 7 X 7) in the base and future?
 - Could use the average concentrations in the array (suggested by GA EPD)
 - Georgia also suggested 2 more complicated ideas
 - RRF for each grid cell in the array
 - RRF for each grid cell, weighted by model predictions
 - Recommend further analysis
 - Comparisons may include:
 - Maximum prediction in array (unpaired in space)
 - Maximum prediction in array (paired in space)
 - Average concentration of array
 - Single grid cell where monitor is located
 - Bi-linear interpolation to monitor location



Other Issues

- Average design values
 - Most commenters supported the 5 year weighted average design value test
 - Some commenters didn't like the "weighting" aspect of the test
 - Others didn't like the fact that it is not completely consistent with the form of the NAAQS



Ozone Guidance- Weighted Average Design Values

- Analysis: 471 ozone monitoring sites with complete data for the most recent 10 design value periods (1993-2004)
- Calculated 5 year weighted design values and compared to standard design values
 - Variability: Over the 12 year period, the median standard deviation of the standard design values was 3.3 ppb vs 2.4 ppb for the weighted average design values

Ozone Guidance- Weighted Average Design Values

Additional analysis of the 471 monitors

- Change in ozone concentration in most recently updated design value period (moving from period ending in 2003 to period ending in 2004)

	Design Values	Weighted Average Design Values
Number of sites with > 2 ppb change	322	45
Number of sites with > 4 ppb change	163	1
Number of sites with > 6 ppb change	53	0

- Maximum design value change was -11 ppb
- Maximum weighted average design value change was 4.8 ppb



Proposed Ozone Guidance Changes- Weighted Average Design Values

- The weighted average design values are considerably less variable than standard design values
 - Provide a relatively stable base for projections to the future
- They are weighted toward the base emissions year, but consider emissions variability across the 5 year period
- They take into account the variability of meteorology during the 5 year period (although weighted toward center years)
- For all of the above reasons, we propose to keep the weighted design value methodology in the final guidance



Other Issues

- Model performance evaluations
 - Add more statistics and details
- Include summaries at the end of each section
 - Three people liked the summaries and 3 didn't like
 - Tie goes to the status quo- no summaries



Next Steps

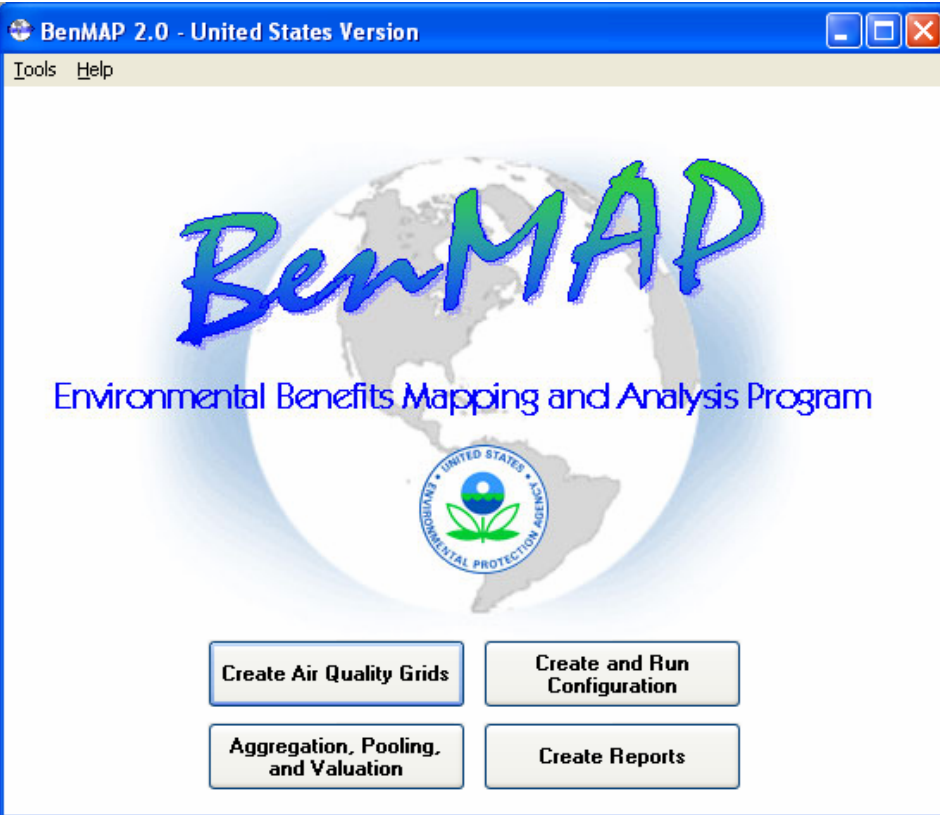
- Work to finalize the ozone guidance in the June/July time frame
- Continue work on updating the PM/Regional Haze guidance

Example BenMAP Model Adjusted Spatial Fields

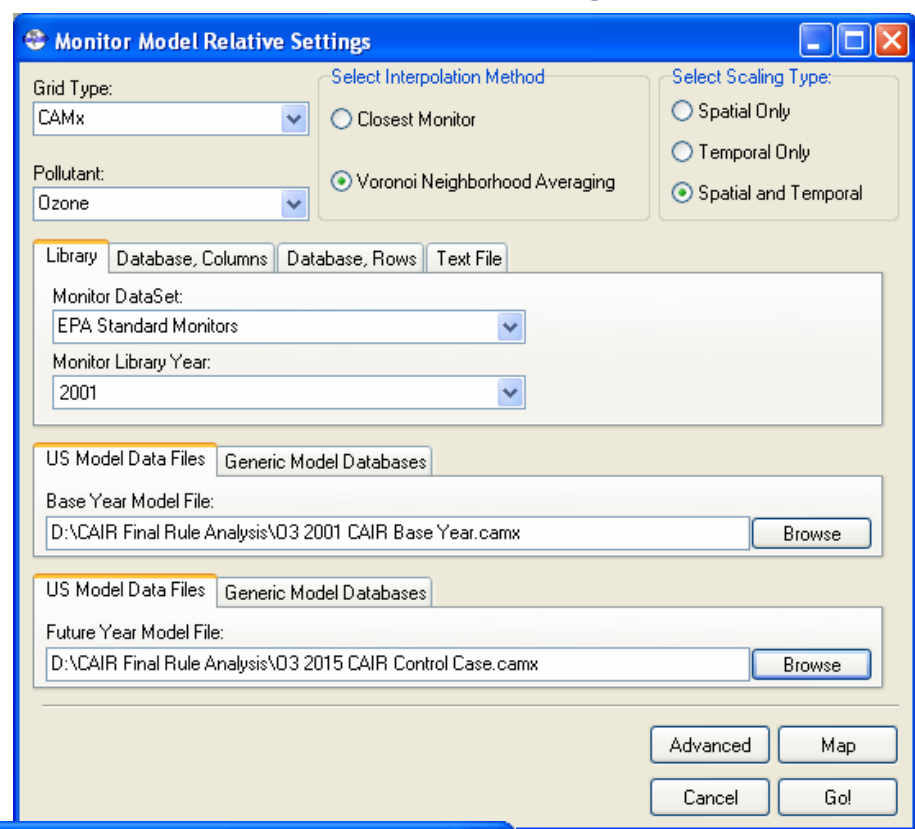


BenMAP Screen Shots

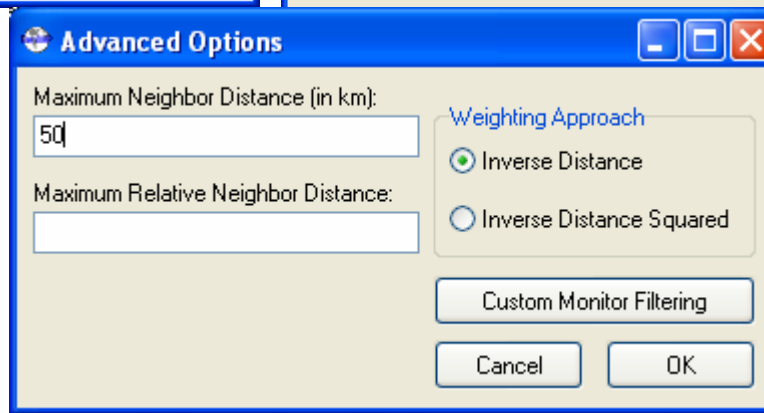
BenMAP start up screen



Spatial Interpolation Configuration Screen



Options for Spatial Interpolation



BenMAP Screen Shots

Detail of Custom Monitor Filtering Utility

Filter Monitors

If you wish to include individual monitors by ID, enter the ID's here, separated by commas. If you do not enter any monitors here, all monitors which meet the rest of the selection criteria will be included:

If you wish to exclude individual monitors by ID, enter the ID's here, separated by commas:

If you wish to restrict monitors to certain states or areas, enter comma separated state abbreviations, and minimum and/or maximum latitudes and longitudes:

States:

Minimum Longitude: Minimum Latitude:

Maximum Longitude: Maximum Latitude:

Select maximum POC code to include and the POC preference:

Maximum POC: POC Preference Order:

Select the Methods you wish to include:

<input checked="" type="checkbox"/> 103	<input checked="" type="checkbox"/> 3	<input checked="" type="checkbox"/> 87
<input checked="" type="checkbox"/> 11	<input checked="" type="checkbox"/> 47	<input checked="" type="checkbox"/> 91
<input checked="" type="checkbox"/> 112	<input checked="" type="checkbox"/> 53	
<input checked="" type="checkbox"/> 14	<input checked="" type="checkbox"/> 56	
<input checked="" type="checkbox"/> 19	<input checked="" type="checkbox"/> 78	

Select the Monitor Objectives you wish to include:

- EXTREME DOWNWIND
- GENERAL/BACKGROUND

Select the parameters specific to the pollutant:

Start Hour: Number of Valid Hours:

End Hour:

Start Date: Percent of Valid Days:

End Date:

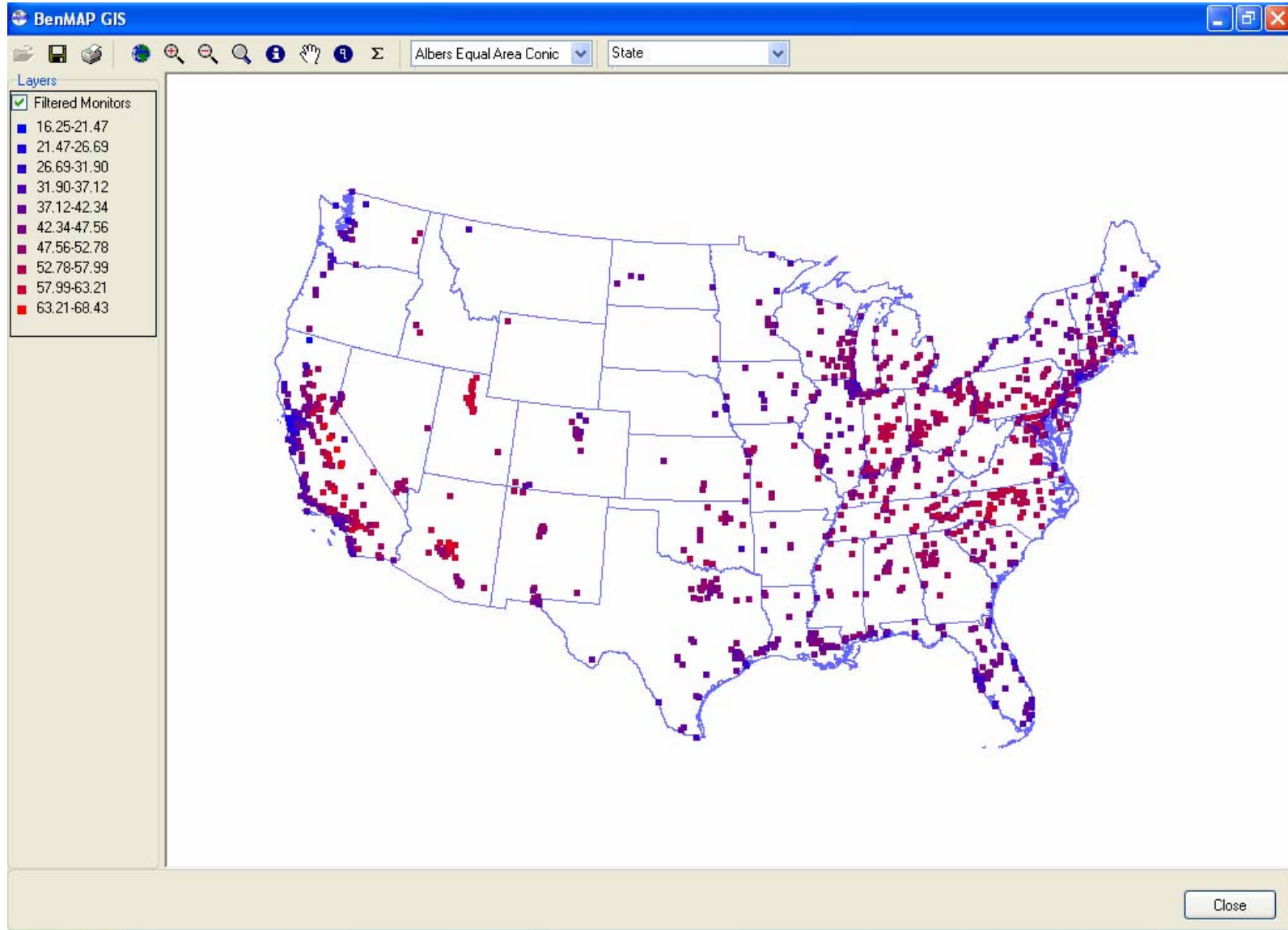


Example Spatial Field

- The next five slides show an example of interpolated spatial fields and model adjusted spatial fields
- The example adjusts interpolated seasonal average ozone concentrations
 - For the attainment demonstration modeling, we would want to use a metric more closely related to the form of the standard (4th daily maximum?)
- BenMAP needs to be reconfigured so that it can interpolate and adjust the appropriate values

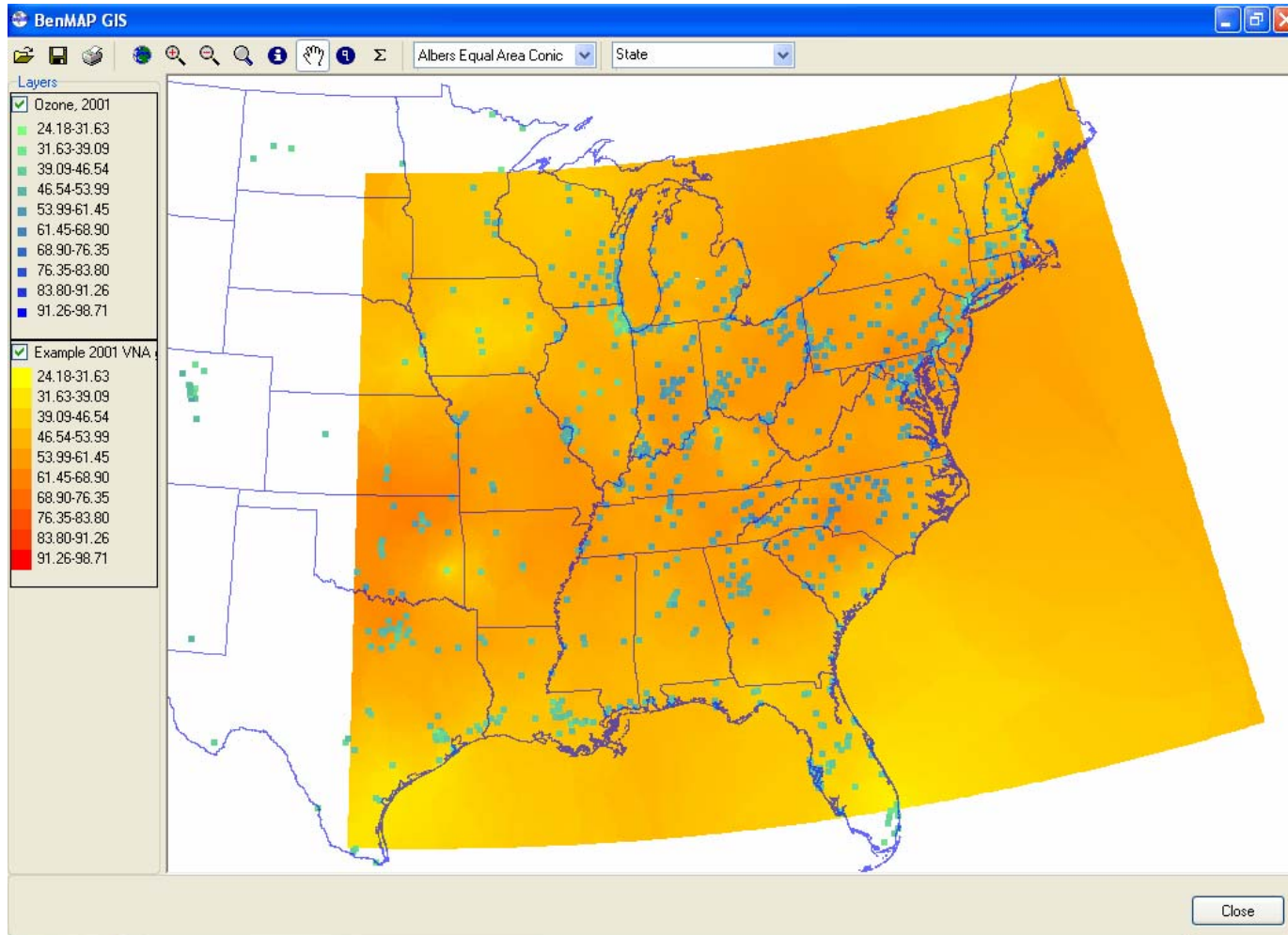
Example of Monitor Map Produced with Filtering Utility

(Inputs for eVNA spatial interpolation)



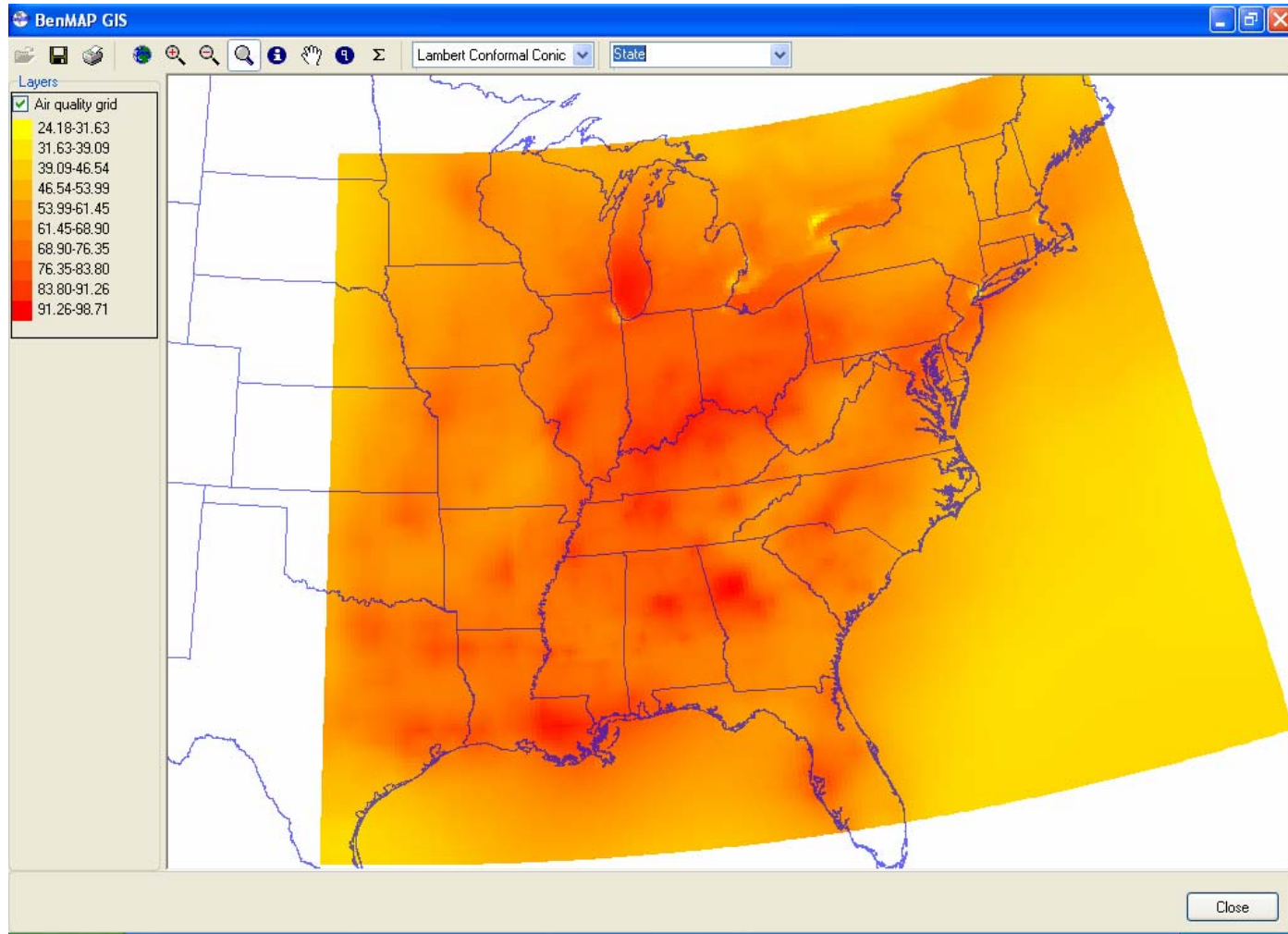
BenMAP Generated VNA Ozone Surface (monitors only)

(O3 Season Average of Daily 8-hour Max)



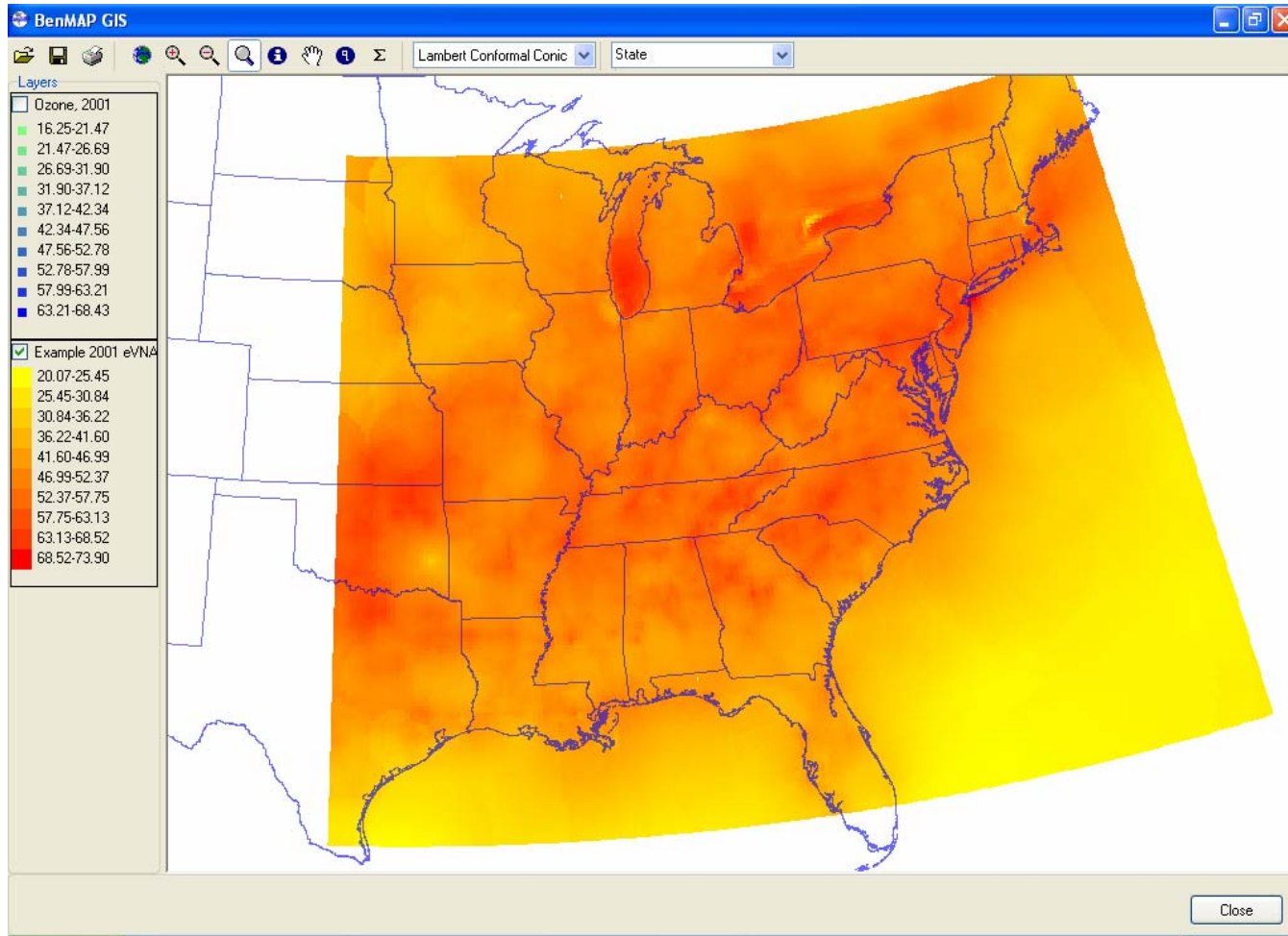
Interpolated ambient data (spatial field)

CAMx Modeled 2001 Ozone (input for eVNA Interpolation) (O₃ Season Average of Daily 8-hour Max)



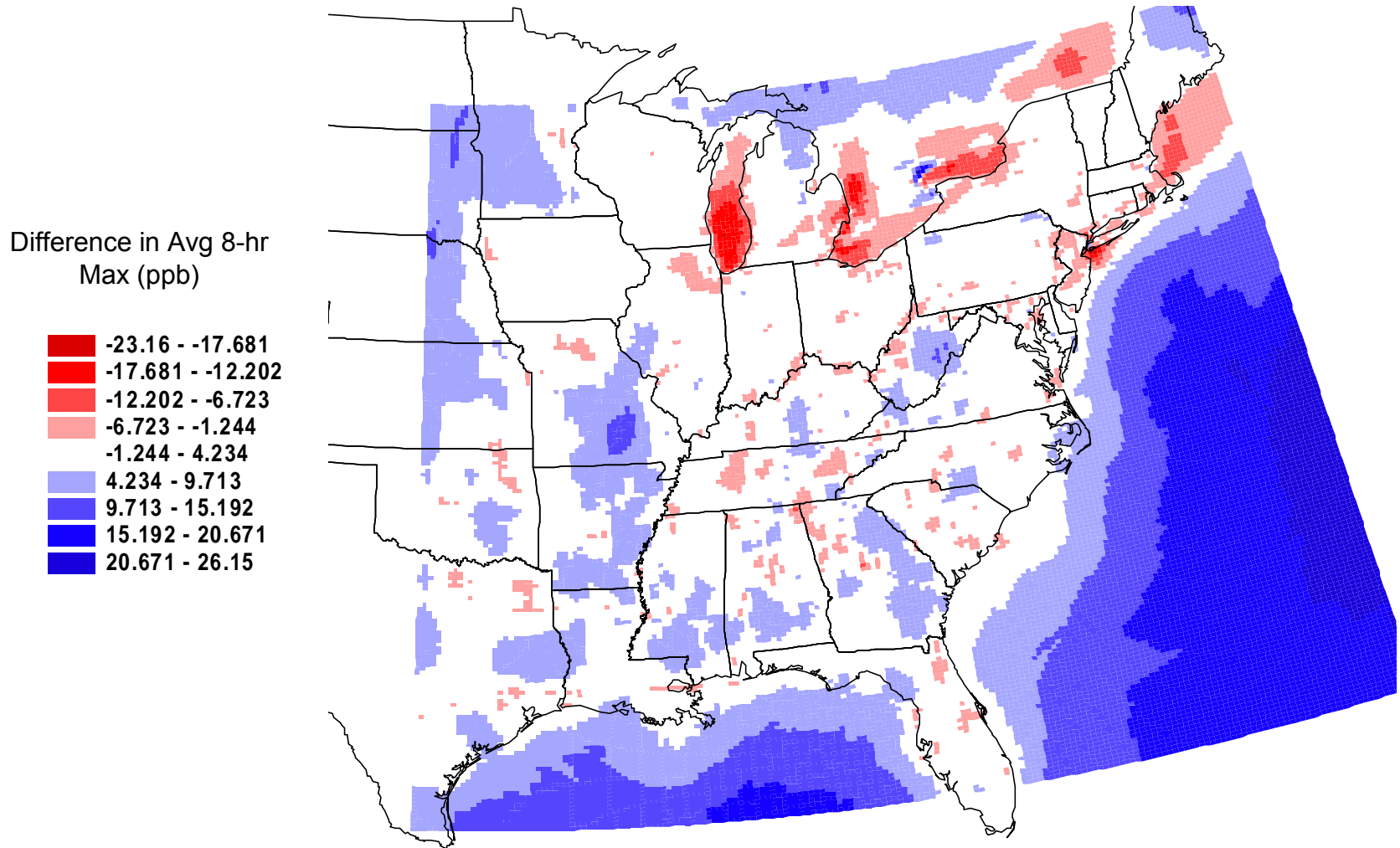
Modeled data

BenMAP Generated eVNA Ozone Surface (O3 Season Average of Daily 8-hour Max)



Model adjusted spatial field

Difference between VNA and eVNA Surfaces (VNA – eVNA)



Blue= Lower interpolated ozone
due to model adjustment

Red= Higher interpolated ozone
due to model adjustment