# Unmonitored Area Analysis

An analysis was conducted to determine if there are any unmonitored areas with potentially high concentrations. Specifically, spatial fields predicted by photochemical modeling were used in conjunction with monitoring data to identify grid cells with no monitors and high concentrations. Results for ozone (8-hour) and PM2.5 (annual and daily average) are presented below. The approach followed here was similar, but not identical to, an unmonitored area analysis conducted by LADCO as part a weight-of-evidence determination for ozone in the last round of SIP modeling (see Section 4.3 in "Regional Air Quality Analyses for Ozone, PM2.5, and Regional Haze: Final Technical Support Document", April 25, 2008.) The analysis suggests that there are a few possible unmonitored hot spots in the 6-state region.

<u>Ozone Analysis</u>

Step 1. Provide a map of the modeled 8-hour ozone concentrations

For this analysis, LADCO's photochemical modeling for 2012[1] (which reflects growth from a 2005 base year and existing control measures) was used. The maps below show the 4th high 8-hour ozone concentration in each grid cell – 12 km grid on the left and 36 km grid on the right. The values in each grid cell were averaged together to produce a domainwide average value.

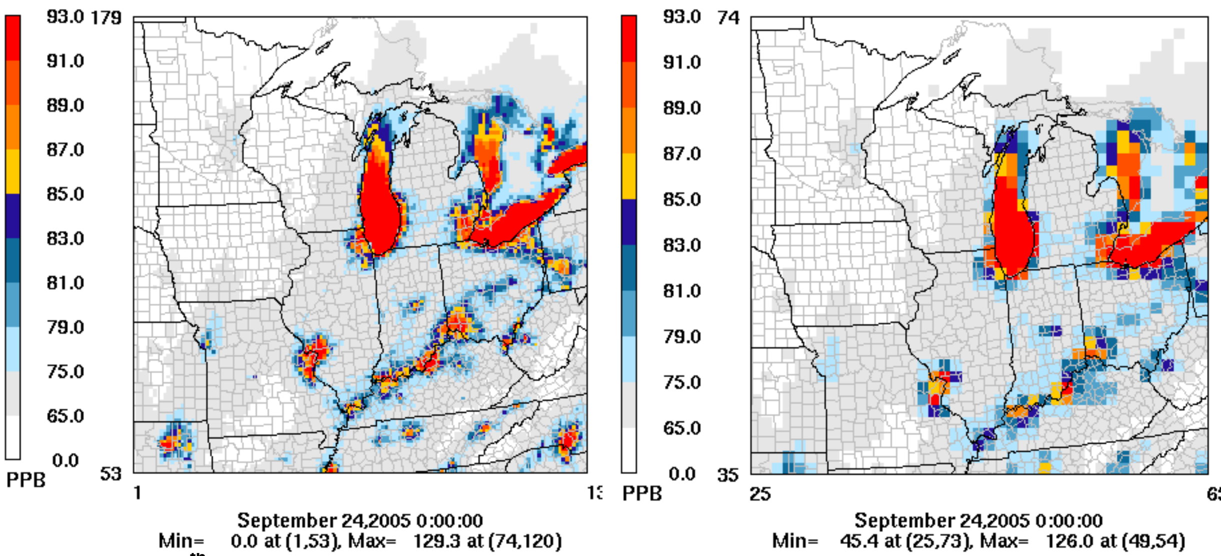


**Figure 1. 4th high modeled ozone concentrations at 12 km (left) and 36 km (right) for 2012**

Step 2. Provide a map of the observed 8-hour ozone concentrations

For this analysis, the 8-hour observed design values averaged over three 3-year periods (2003-2005, 2004-2006, and 2005-2007) were used. The maps below show the average 8-hour ozone design values at each monitoring site – 12 km grid on the left and 36 km grid on the right. The values at each monitoring site were averaged together to produce a domainwide average value.

[1] Modeling is based on "Regional Modeling for the Eastern U.S.: Technical Support Document", State Collaborative Modeling Workgroup, July 9, 2009

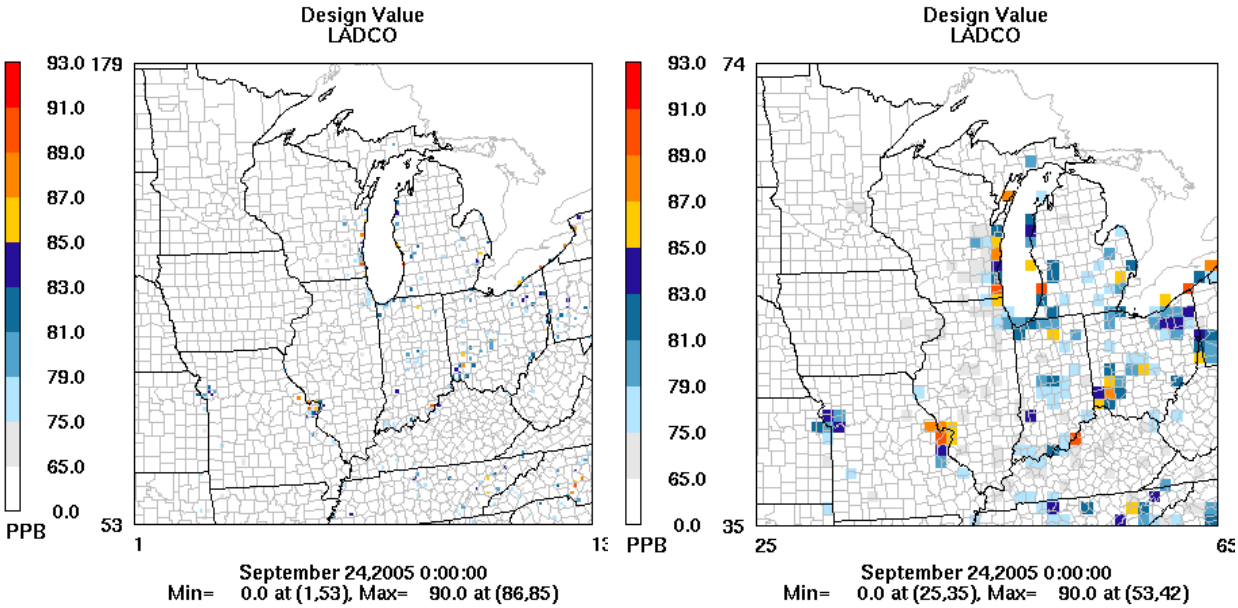


**Figure 2. Observed ozone design values at 12 km (left) and 36 km (right)**

Step 3. Derive a spatial adjustment factor (i.e., ratio of modeled concentration in each grid cell to the domainwide average modeled concentration)
For this analysis, the ozone modeling data in Step 1 was used to derive the adjustment factors. The maps below show the adjustment factors in each grid cell – 12 km (left) and 36 km (right).

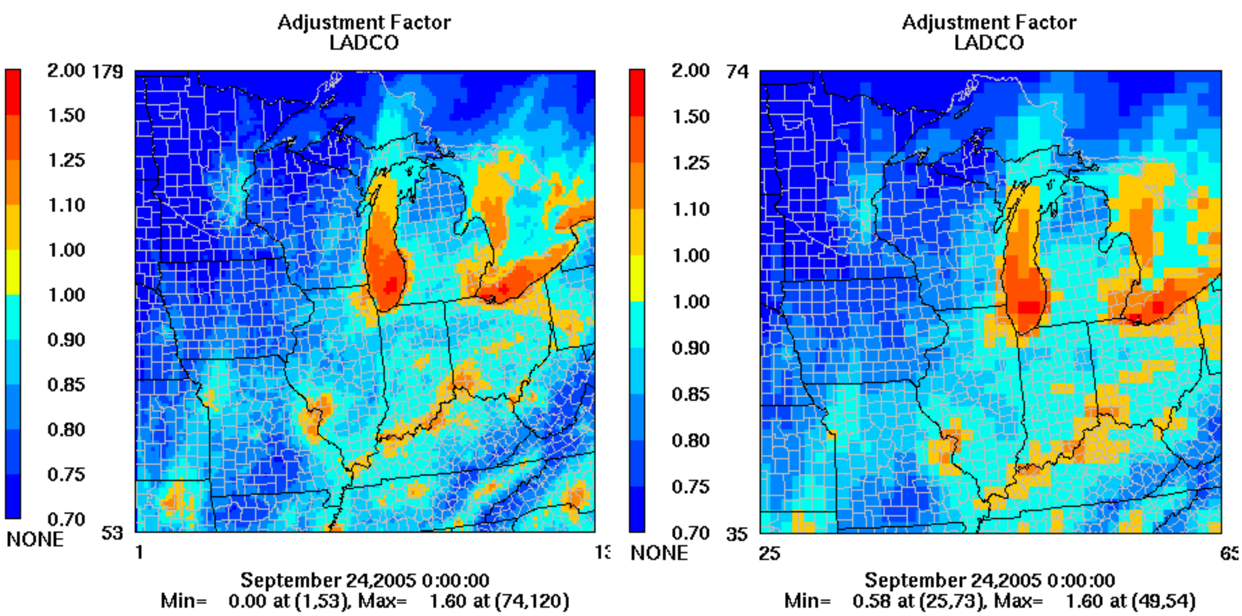


**Figure 3. Adjustment factors at 12 km (left) and 36 km (right)**

Step 4. Estimate "observed" concentrations in grid cells without monitors
For this analysis, the domainwide average observed concentration was multiplied by the spatial adjustment factors (Step 3) to estimate an "observed" concentration in all grid cells. The maps below show the estimated concentrations – 12 km grid on the left and 36 km grid on the right. Both grid cells with monitors and grid cells over water were omitted in the map. It should be

noted that to provide a better estimate of future year air quality, EPA's modeling guidance would suggest the application of relative reduction factors. This is expected to produce concentration values somewhat lower than those shown here. In general, the two maps are similar, although more high concentration cells show up in the 12 km map, due to the greater number of grid cells.

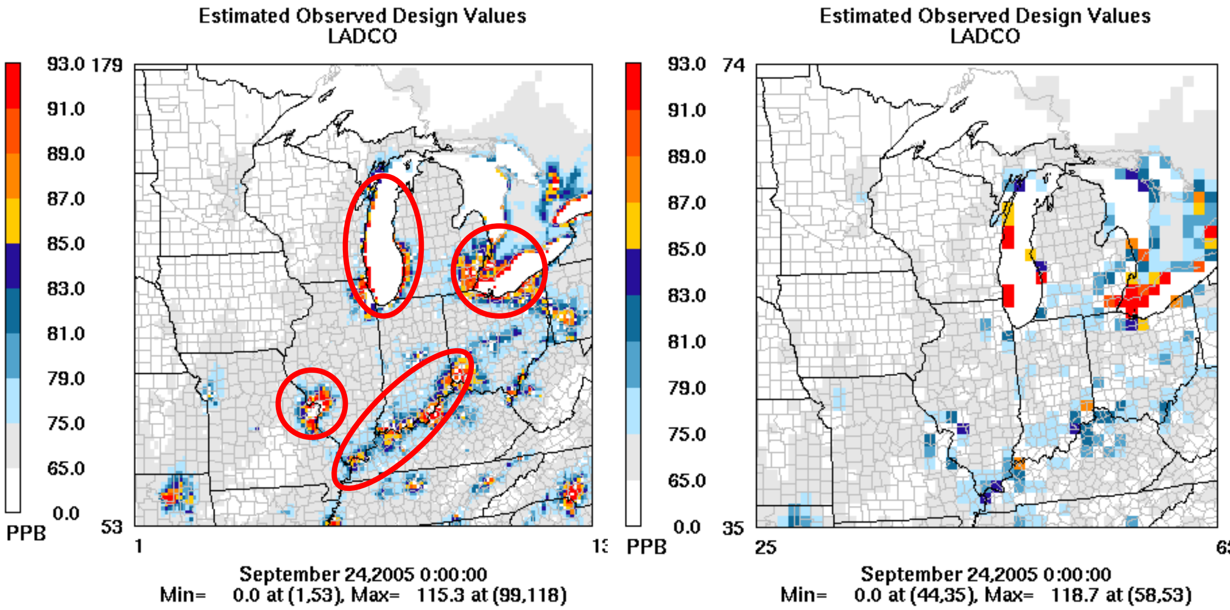


**Figure 4. Estimated observed ozone design values at 12 km (left) and 36 km (right)**

The results in Figure 4 indicate a few unmonitored areas with potentially high ozone concentrations, in particular:

- Lake Michigan area: both portions of the western and eastern shores
- Lake Erie area: northeastern Ohio and southeastern Michigan
- Ohio River Valley
- St.Louis area: northeast (downwind) in Illinois

These results suggest: (1) the importance of shoreline monitors around the Great Lakes, especially Lake Michigan and Lake Erie (i.e., none of the existing sites should be shutdown and more would be helpful), (2) importance of rural monitoring, especially between Evansville, IN and Cincinnati, OH, and (3) monitoring downwind of other urban areas in the region (e.g., St. Louis).

To assess the adequacy of the current monitoring networks in the four areas with the highest estimated observed design values, a higher resolution view of the 12 km modeling results is provided in Figure 5. In general, it appears that these areas have adequate monitoring, as indicted by the 'blanked-out' (white) grid cells. The analysis supports maintaining monitors in these areas (i.e., don't shut down and add more, if possible).

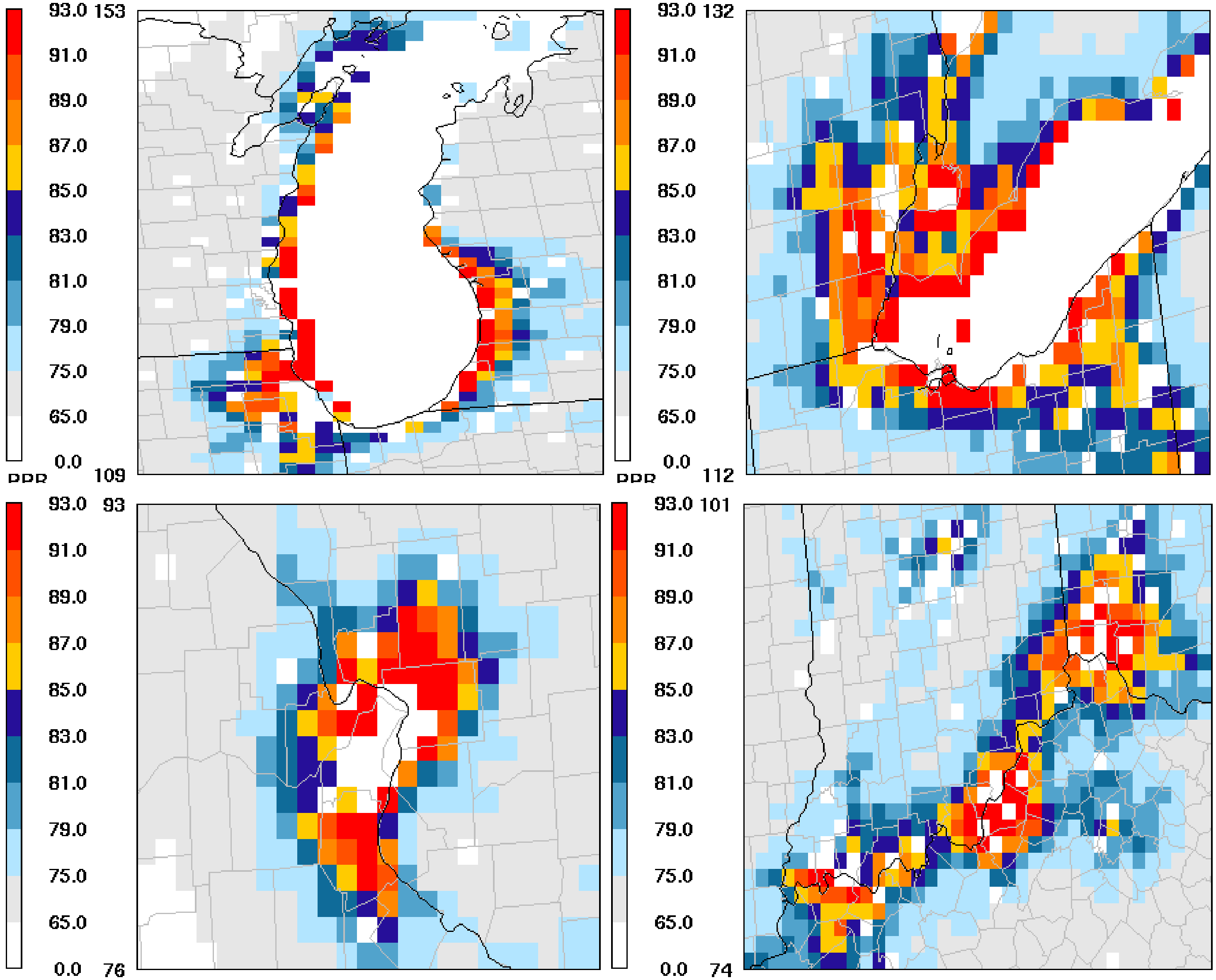


**Figure 5. Estimated observed ozone design values at 12 km for Lake Michigan area (upper left), southeastern Michigan (upper right), St. Louis area (lower left), and Ohio River Valley (lower right)**

PM2.5 Analysis

Step 1. Provide a map of the modeled annual and daily PM2.5 concentrations

For this analysis, LADCO's photochemical modeling for 2012 (which reflects growth from a 2005 base year and several existing control measures) was used. The maps below show the annual average values and the 4th high daily PM2.5 values in each grid cell. The values in each grid cell were averaged together to produce a domainwide average value.

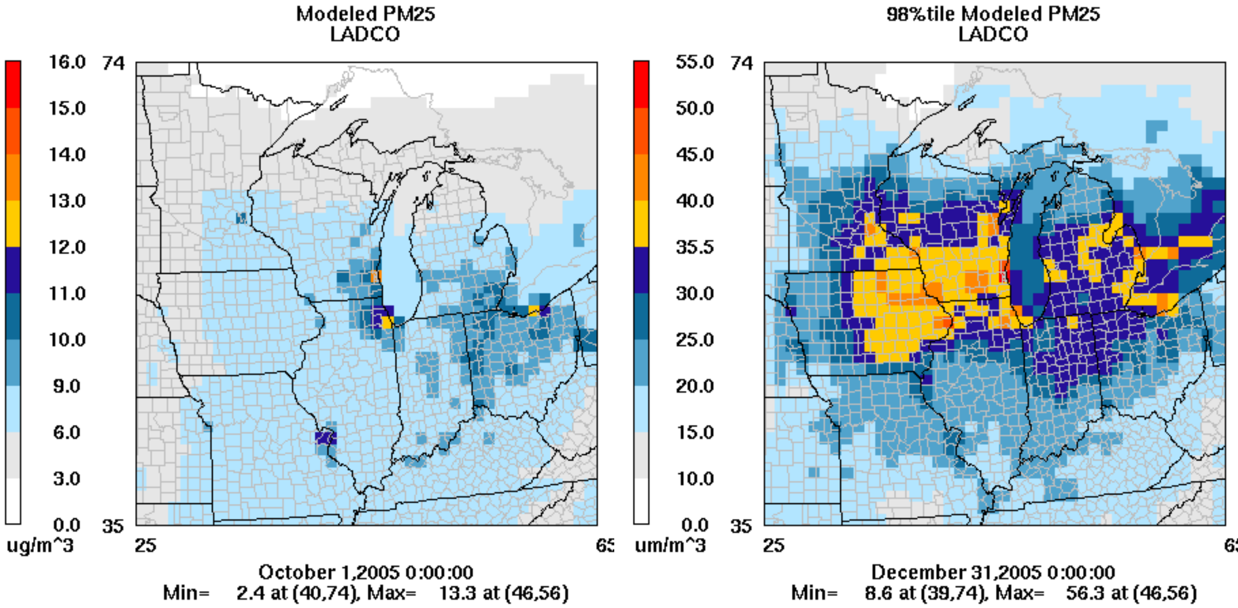


**Figure 6. Modeled PM2.5 concentrations - annual (left) and daily (right)**

Step 2. Provide a map of the observed PM2.5 concentrations

For this analysis, the 8-hour design values averaged over three 3-year periods (2003-2005, 2004-2006, and 2005-2007) were used. The maps below show the e annual average PM2.5 design values and the daily PM2.5 design values at each monitoring site. The values at each monitoring site were averaged together to produce a domainwide average value.

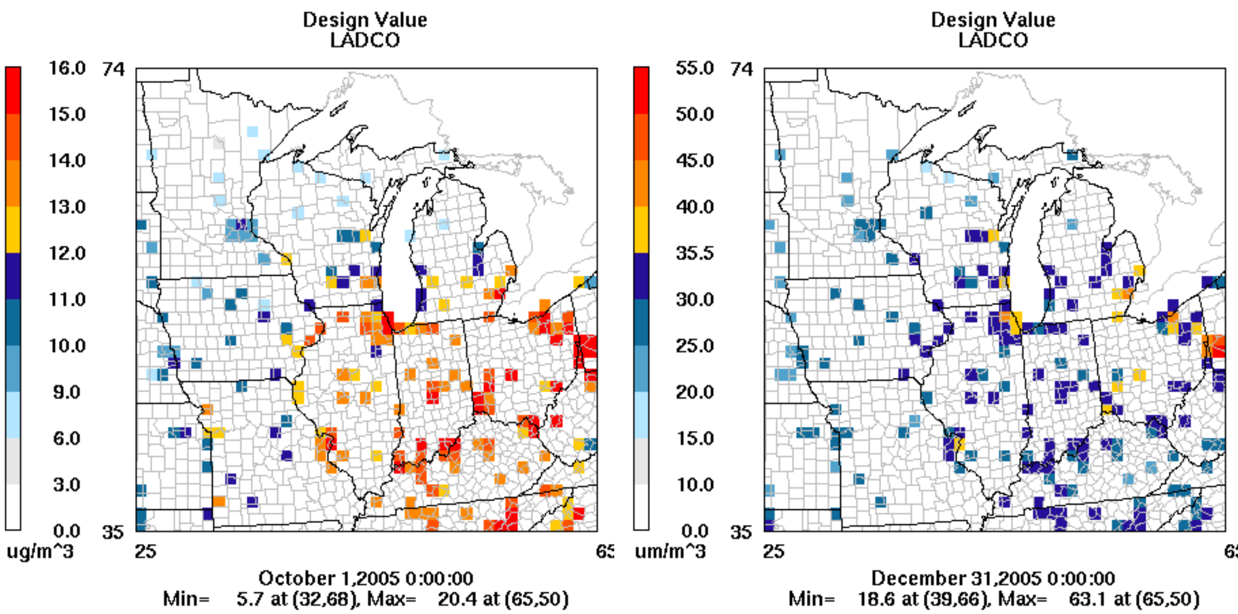


**Figure 7. Observed PM2.5 design values - annual (left) and daily (right)**

Step 3. Derive a spatial adjustment factor (i.e., ratio of concentration in each grid cell to the domainwide average concentration)
For this analysis, the PM2.5 modeling data in Step 1 was used to derive adjustment factors. The maps below show the adjustment factors in each grid cell – annual (left) and daily (right.).

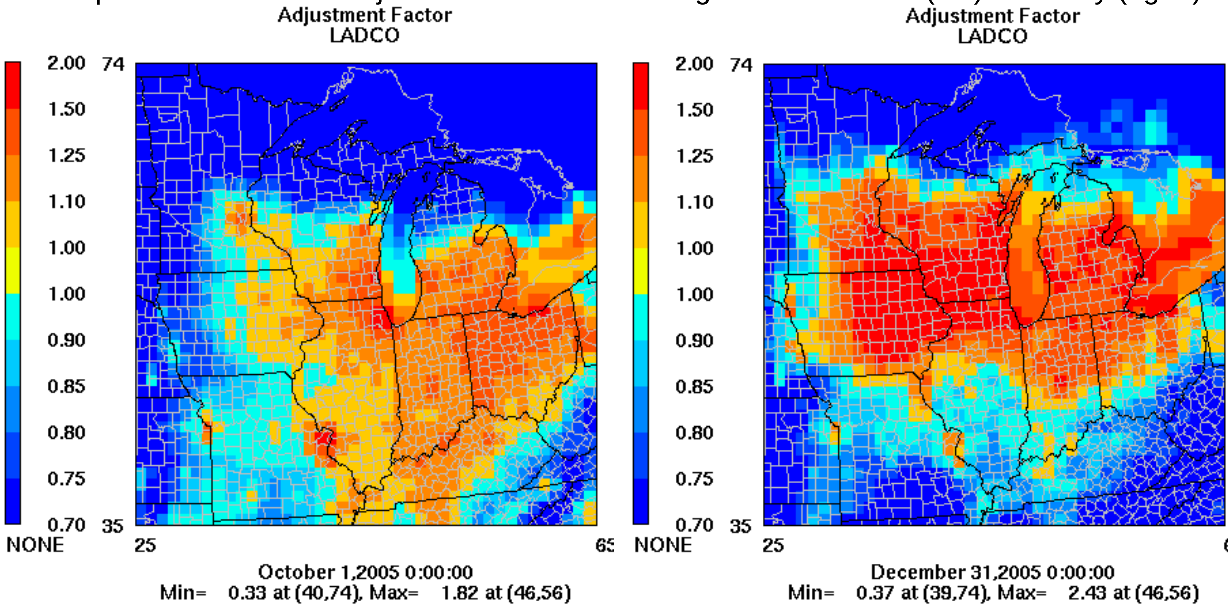


**Figure 8. Adjustment factors - annual (left) and daily (right)**

Step 4. Estimate "observed" concentrations in grid cells without monitors
For this analysis, the domainwide average observed concentration was multiplied by the spatial adjustment factors (Step 3) to estimate an "observed" concentration in all grid cells. The maps below show the estimated concentrations – annual on the left and daily on the right. Both grid cells with monitors and grid cells over water were omitted in the map. It should be noted that to provide a better estimate of future year air quality, EPA's modeling guidance would suggest the application of relative reduction factors. This is expected to produce concentration values somewhat lower than those shown here.

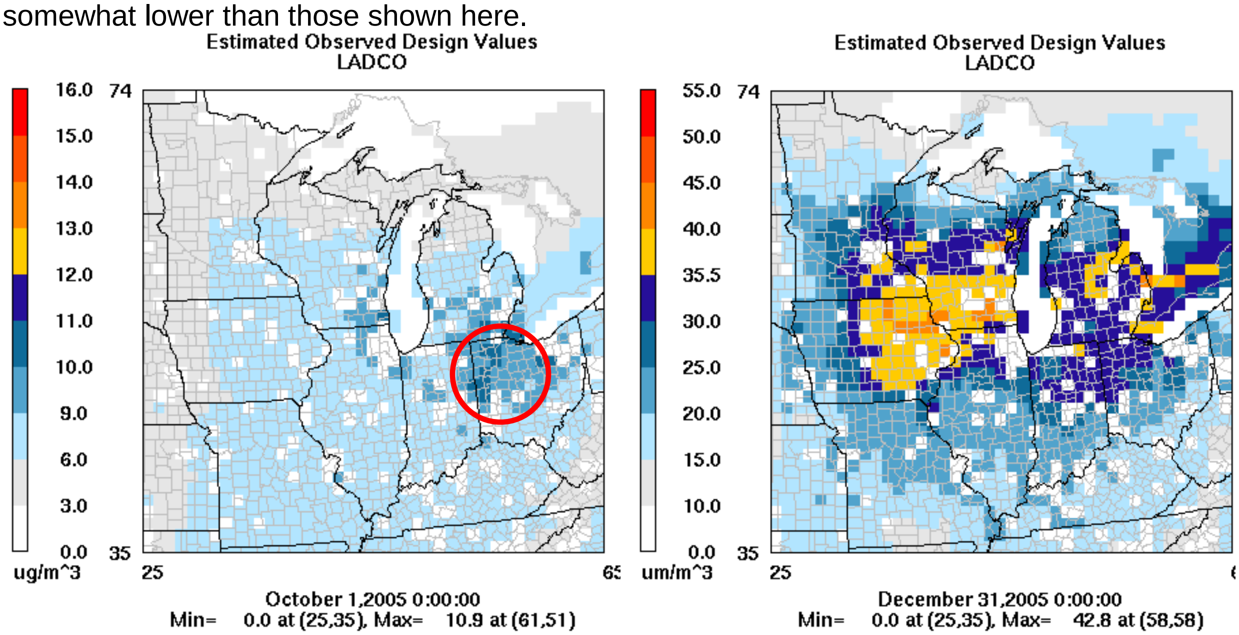


**Figure 9. Adjusted observed PM2.5 design values - annual (left) and daily (right)**

The results in Figure 9 indicate a few unmonitored areas with potentially high PM2.5 concentrations; in particular, in northwest Ohio, and eastern Iowa through southern Wisconsin. The eastern Iowa-southern Wisconsin area currently has adequate monitoring, as indicted by the 'blanked-out' (white) grid cells in the figure above. The analysis supports maintaining monitors in this area (i.e., don't shut down and add more, if possible). Northwestern Ohio, however, does not have many monitors (i.e., few 'blanked out' (white) grid cells). Consideration should be given to adding one or more new sites there.