A Method for Quantifying Historical Air Quality in Unmonitored Regions
Using Statistical Relationships Developed from Regional Air Quality Model Output

David Nunes, San Joaquin Valley Air Pollution Control District, Fresno, CA

1. Introduction

8-hr Ozone
- Regression equations developed from 23 grid cells representing 27 monitoring sites.
- Daily estimates for all grid cells from 1992 to 2014

24-hr PM2.5
- Regression equations developed from 16 grid cells representing 18 monitors.
- Daily estimates for all grid cells from 2002 to 2014

Daily ozone and 24-hr average PM2.5 observations from 1992 to 2014 were used to estimate air quality between monitors. Spatial interpolation is quick, but may be inadequate at capturing variation between monitors. Regional models are better at capturing variation. However, they are complex, computationally expensive, need historical emissions inventories and require bias correction to match observations.

2. Methodology

Neighborhood Development
The District was divided into 3,880 “neighborhoods” using the 4x4km grid cell boundaries established by CMAQ modeling. Of these 3,880 neighborhoods, 1,827 have estimated 2010 long-term observations, but were not included in model development.

4. Air Quality Trends

- Figure 4.1: Days with 8-hr ozone greater than 75 ppb
- Figure 4.2: Days with 24-hr PM2.5 greater than 35 µg/m3

5. Online Public Access

Daily estimates of 8-hr ozone, 24-hr PM2.5 and Air Quality Index (AQI) were summarized and placed into a web-based tool for retrieval. By entering an address, residents can compare their historical neighborhood air quality to county and district summaries.

The Web-based Archived Air Quality (WAAQ) System is available at: http://www.valleyair.org/waaqs

6. Conclusion

Model Development
Regression equations do very well reproducing CMAQ model output in populated areas.
- 99% of Valley residents live in locations with R2 greater than 0.90 for 8-hr ozone.
- 96% of Valley residents live in locations with R2 greater than 0.90 for 24-hr PM2.5.

Reproducing Observations
Regression equations are successful at reproducing observations at sites with historical data.
- Estimates compared to observations generally have an R2 near 0.90 for 8-hr ozone and 0.83 for 24-hr PM2.5.
- Reduced performance could be due to:
  - Distance from existing monitors
  - Changing source to receptor relationships
  - Emission changes over time
  - Local impacts not modeled
  - CMAQ Model performance
  - Equipment variations

Challenges
Significant challenges remain, including how to handle local emissions (e.g., fires, blowing dust) that may impact a limited number of monitors or unmonitored areas only.

7. Acknowledgements

Seyed Sadredin (APCO) and the San Joaquin Valley Air Pollution Control District Board for direction and resources. Jeff Daniels, Seng Lee and Anton Simanov for developing the online interface. Pete Biscay, Shawn Ferreria, Jon Klassen, Jennifer Ridgway and Stephen Shaw for insight, review and comments. California Air Resources Board for CMAQ modeling and output.