Representativeness of CRPAQS PM2.5 and PM10 Measurements

Richard J. Countess and Susan Countess
Countess Environmental

Judith C. Chow and John G. Watson
Desert Research Institute

CRPAQS Data Analysis Workshop
March 9-10, 2004
Spatial variation in PM10 measurements

![Graph showing spatial variation in PM10 measurements.](image_url)
Average PM10 mass and geological dust at Modesto is lower than other sites where concentrations are relatively uniform.

Urban scale: 100-km radius centered on COP
PM10 geological dust at Oildale is 25% lower than at Bakersfield 4 miles away.
Temporal variation in PM10 geological dust shows peaks in Fall 2000 & December 1999.
Spatial variation in PM10 mass and geological dust in the Corcoran neighborhood during Fall Intensive is due to impact from local sources.
Average PM10 mass and geological dust relative to COP during Fall Intensive
Spatial variation in PM2.5 mass by type of site shows a 6-fold maximum increase over background sites.
Spatial variation in PM2.5 composition during Winter Intensive shows up to a 16-fold increase over background sites.
Annual average PM2.5 mass, nitrate, and OC are relatively uniform.

Urban scale: 100-km radius centered on COP.
PM2.5 mass, nitrate, and OC during Winter IOP days are 3 to 4 times higher than other periods

Urban scale: 100-km radius centered on COP
Annual average PM2.5 mass, nitrate, and OC in Kern County

Neighborhood scale: 4-km radius centered on BAC
Urban scale: 100-km radius centered on BAC
Spatial variation in PM2.5 composition at Kern County sites relative to BAC anchor site

Concentrations tend to decrease as a function of distance from BAC.

Distances from BAC increase along x-axis.

The diagram shows the ratio of concentrations relative to the BAC anchor site for various locations and components. The y-axis represents the ratio relative to the BAC anchor site, and the x-axis shows distances from BAC along the x-axis.

Key components and sites include:
- Mass
- AmN
- AmS
- OC
- EC
- GD

Sites include BRES (S), OLD (E), EDI (IG), FEL (S), FELF (IG), TEH2 (IG), MOP (E), EDW (IG), and the Average.

Concentrations decrease as the distance from BAC increases.
Average PM2.5 mass, nitrate, and OC during Winter IOP days in Kern County are 3 to 4 times higher than other periods.

Neighborhood scale: 4-km radius centered on BAC
Urban scale: 100-km radius centered on BAC
Spatial variation in PM2.5 composition at Kern County sites during Winter Intensive relative to BAC anchor site

Concentrations at two Fellows sites track each other except for GD

Distances from BAC increase along x-axis
Annual Average PM2.5 Mass, Nitrate, and OC in Fresno County
Spatial variation in PM2.5 composition at Fresno County sites relative to FSF anchor site

Concentrations are higher in source dominated areas

Distances from BAC increase along x-axis

Ratio relative to FSF Anchor Site

FRES (S)  FRESM (S)  CLO (E)  FEDL (S)  SELM (E)  SNFH (V)  HELM (IG)  Average

Mass AmN AmS OC EC GD
Average PM2.5 mass, nitrate, and OC during Winter IOP days in Fresno County are 3 to 4 times higher than other periods.

<table>
<thead>
<tr>
<th>Location</th>
<th>PM2.5 Mass</th>
<th>Nitrate</th>
<th>OC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SNFH</td>
<td>19</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td>FREM</td>
<td>81</td>
<td>24</td>
<td>25</td>
</tr>
<tr>
<td>CLO</td>
<td>57</td>
<td>28</td>
<td>19</td>
</tr>
<tr>
<td>FSF</td>
<td>72</td>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td>FRES</td>
<td>76</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>FEDL</td>
<td>46</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>HELM</td>
<td>36</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>SELM</td>
<td>53</td>
<td>29</td>
<td>13</td>
</tr>
</tbody>
</table>
Spatial variation in PM2.5 composition at Fresno County sites during Winter Intensive relative to FSF anchor site
Spatial variation in PM2.5 composition at sites in vicinity of ANGI anchor site

Distances from ANGI increase along x-axis

- COP (E)
- KCW (IG)
- VCS (E)
- Average

Ratio relative to ANGI Anchor Site

- Mass
- AmN
- AmS
- OC
- EC
- GD
Spatial variation in PM2.5 composition at sites in vicinity of ANGI during Winter Intensive relative to ANGI anchor site.
Conclusions

Geological dust concentrations

- impacted by local sources
- decrease with distance from source (25% loss within 1 mile observed during Fall intensive)
- limited ground level transport due to low surface wind speeds
- lower at community exposure site in northern SJV compared to central and southern SJV
- highest in fall, but also very high in December 1999
- highest in vicinity of cotton handling operations; also very high near cattle feedlot
- account for ~70% of PM10 mass May thru September
- minor component of PM2.5 mass (< 10%)
Conclusions (continued)

PM2.5 concentrations

- up to 6-fold increase over background sites for annual averages, and 16-fold increase during winter
- highest concentrations observed at source dominated sites, followed by community exposure sites
- relatively uniform concentrations in mass, nitrate, sulfate, OC and EC for annual averages at community exposure sites, less so during winter
Conclusions (continued)

Representativeness of Sites

- long-term network of community exposure sites generally does a good job of representing primary and secondary PM contributions; however, need collocated measurements to quantify inherent uncertainty
- maintaining operation of satellite PM monitoring sites and equipping more sites with continuous monitors for particulate species and/or particulate surrogates is needed to document effect of recently adopted control measures to attain PM NAAQS