PM2.5 NO3 and OC on 1/1/2003

Legend
- ug/m^3
- 5
- NO3
- OC

0 2 4 Miles
PM2.5 NO3 and OC
PM2.5 EC and SO4 on 1/1/2003
PM2.5 EC and SO4
Ag to Zr
"StartDate" = date '2002-11-20'
Ag to Zr
"StartDate" = date '2003-1-11'
Acenaphthen to Pyrene
"StartDate" = date '2003-1-11'
Acenapthen to Pyrene
"StartDate" = date '2003-2-8'
Representativeness

How much spatial variability?

\[
CV = \frac{1}{n} \sum_{n=1}^{\text{ndays}} \frac{\text{StDev of } C_{xn}}{\text{Mean } C_{xn}}
\]

How much bias relative to central site?

\[
R = \frac{1}{n} \sum_{n=1}^{\text{ndays}} \left[ \sum_{x}^{\text{sites}} \frac{C_{xn}}{C_{CSn}} \right]
\]
Warm Season (April – September)
Spatial Variability in 24-hr Average Concentrations
Fresno, CA 2002-2003
Cool Season (October – March)
Spatial Variability in 24-hr Average Concentrations
Fresno, CA 2002-2003

* Supersite and Trailer Locations Only
Spatial Variability in 24-hr Average Concentrations
Fresno, CA 2002-2003

Mean Spatial Coefficient of Variability (%)

* Supersite and Trailer Locations
PM10 Elements by XRF
Spatial Variability in 24-hr Average Concentrations
Fresno, CA 2002-2003
Polycyclic Aromatic Hydrocarbons (Gas + Aerosol Phases)
Spatial Variability in 24-hr Average Concentrations
Fresno, CA 2002-2003

Mean Spatial Coefficient of Variability (%)

- Flouranthene (FLT)
- Pyrene (PYR)
- Phenathrene (PHE)
- Flourene (FLU)
- Naphthalene (NAP)
- Acenaphthene (ACE)
- Chrysene (CRY)
- Benzo[ghi]perylene (BGP)
- Acenaphthylene (ACY)
- Benz[a]anthracene (BAA)
- Benzo[b]flouranthene (BBF)
- Benzo[k]pyrene (BAP)
- Benzo[k]fluoranthene (BKF)
- Indeno[1,2,3-cd]pyrene (ICP)
- Dibenzo[a,h]anthracene (DBA)
- Anthracene (ANT)
# Spatial Variability Rankings

<table>
<thead>
<tr>
<th>Low (CV&lt;20%)</th>
<th>Moderate (20%&lt;CV &lt;40%)</th>
<th>High (CV&gt;40%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM$_{2.5}$ Mass</td>
<td>OC, EC</td>
<td>NO</td>
</tr>
<tr>
<td>SO$_4$</td>
<td>PN</td>
<td>PAHs</td>
</tr>
<tr>
<td>NO$_3$</td>
<td>PM Coarse</td>
<td>Other Elements</td>
</tr>
<tr>
<td>NH$_4$</td>
<td>Endotoxin</td>
<td></td>
</tr>
<tr>
<td>PM$_{10}$ Mass</td>
<td>NO$_2$, NOx, O$_3$, CO</td>
<td></td>
</tr>
<tr>
<td>PM$_{10}$ K, Si, Fe, Ca</td>
<td>PM$_{10}$ Zn, Br, Mn</td>
<td></td>
</tr>
<tr>
<td>PM$_{10}$ Al, Sr, Cu, Co</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Spatial Bias
Average Ratio of 24-hr Concentrations at Schools and Residences to Supersite

- Spatial Bias
- Average Ratio of 24-hr Concentrations at Schools and Residences to Supersite
Average Bias of 24-hr Concentrations at Schools and Residences Relative to Supersite
Average Ratio of 24-hr Concentrations at Schools and Residences to Supersite by Season
Conclusions

• The representativeness of Fresno supersite measurements varies by species; primary species are most variable
• Spatial variability is low for PM$_{2.5}$ Mass, SO$_4$, NO$_3$, NH$_4$, and PM$_{10}$ Mass, and abundant elements (K, Si, Fe, Ca)
• Spatial variability is moderate for OC, EC, PN, PM Coarse, Endotoxin, and most gases and other elements
• Spatial variability is high for NO, PAHs, and scarce metals
• PM$_{2.5}$ mass concentrations at locations within 10 km of supersite show little bias on average; EC and PAH show the most bias
• Persistent spatial patterns are evident; concentrations lower than those at the supersite occur in northern and eastern Fresno for most species
Acknowledgement

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- U.S. Environmental Protection Agency
- Desert Research Institute
- San Joaquin Valley Air Pollution Study Agency
- FACES Project TEAM (UCB & STI)