

Research Needs in the San Francisco Bay Area

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BAAQMD Ongoing Work

Goal

- Estimate health benefits of:
 - Reduction in ambient concentrations of PM_{2.5}
 - Various emission control programs

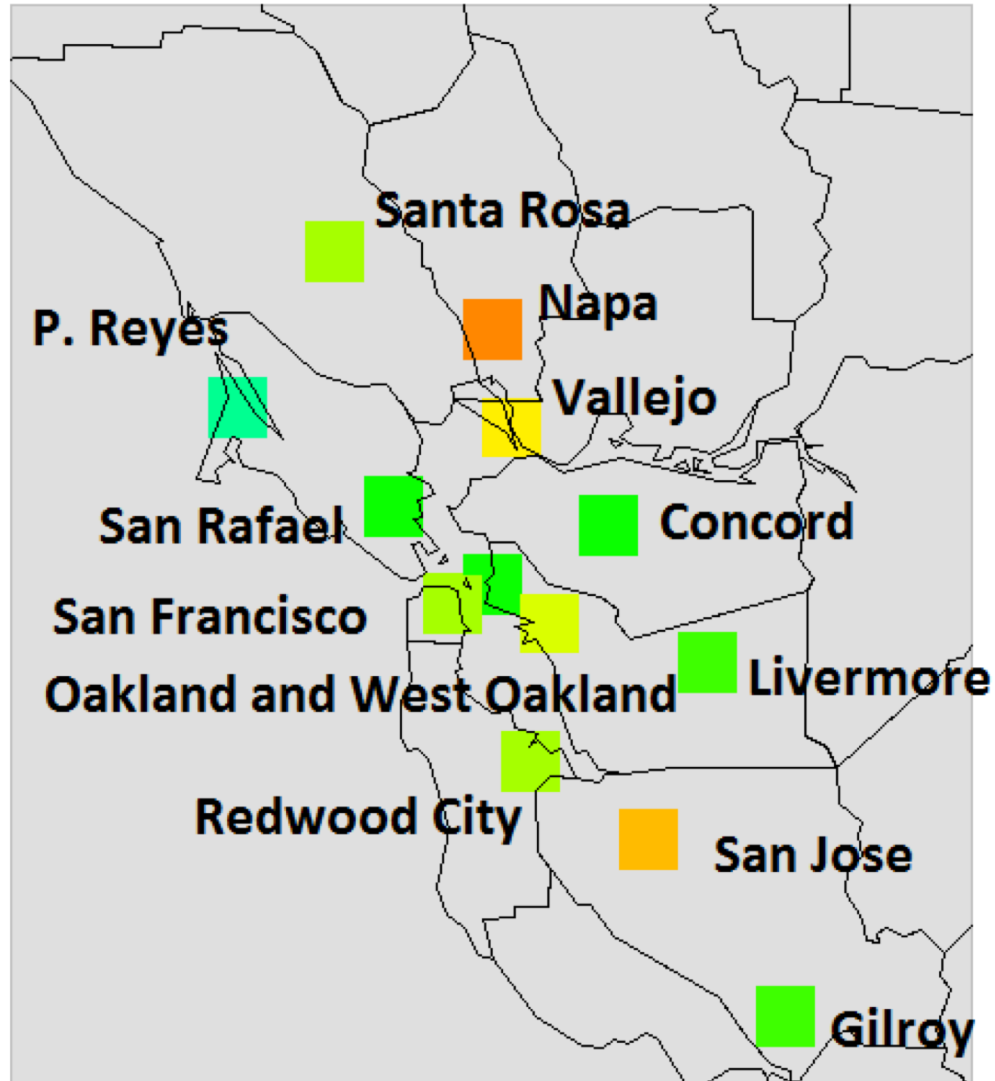
Tools

- BenMAP
- CMAQ to prepare PM inputs to BenMAP

Sources of Winter PM_{2.5} Emissions in the Bay Area

- Wood Smoke – 39%
- Geological Dust – 13%
- On-Road Motor Vehicles – 11%
- Fuel Combustion: Stationary Sources – 12%
- Other Mobile Sources – 10%
- Other Industrial/Commercial Processes – 8%
- Commercial Cooking – 3%
- Animal Waste – 2%
- Wildfires – 2%

Observed monthly average PM2.5 concentrations
January 2012



Wood burning is a tradition in northern and central California

Region possesses diverse PM pattern:

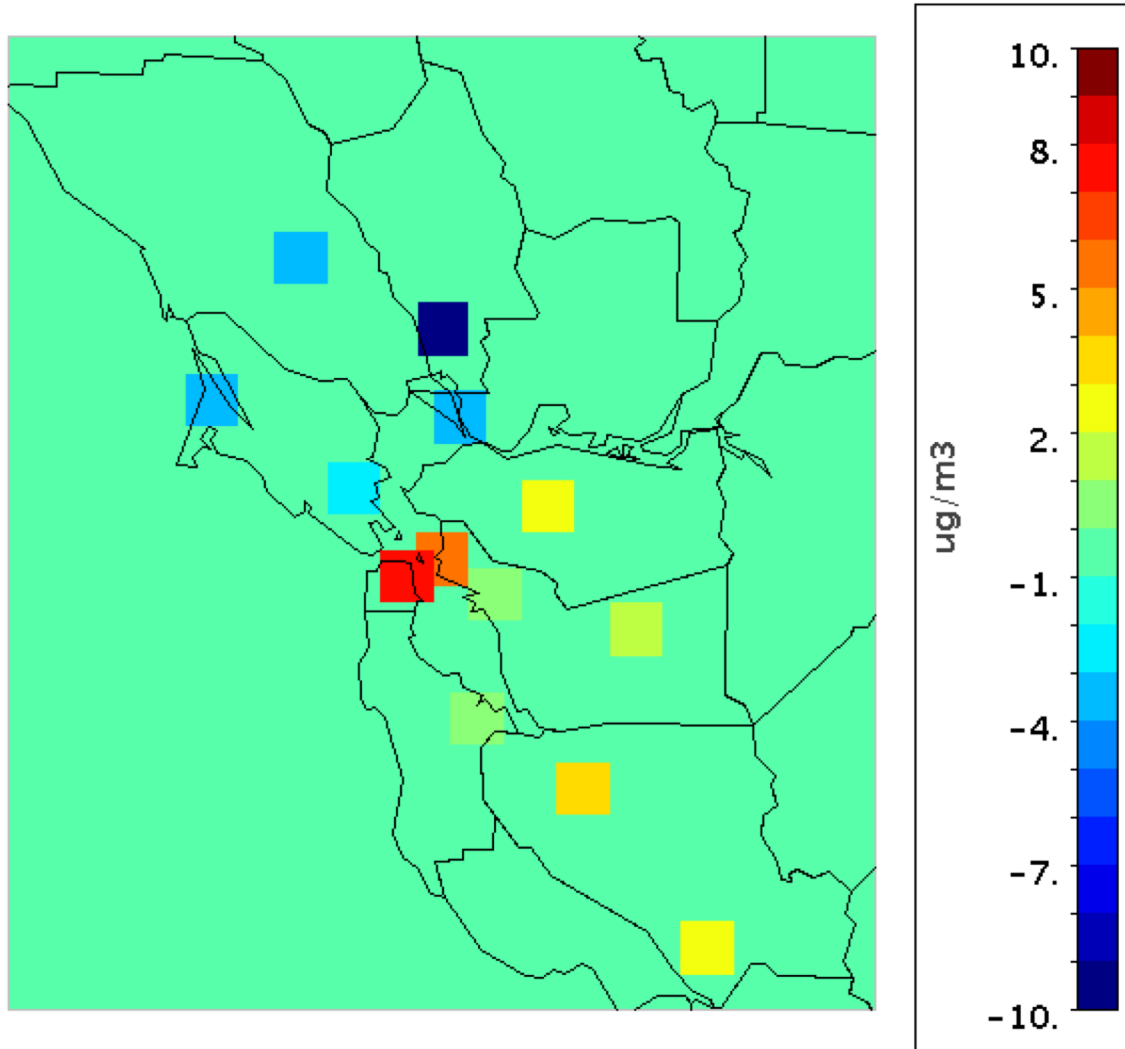
Napa: Over 80% of PM from wood burning

Vallejo: mostly transported PM from the Central Valley

San Francisco/Oakland: PM from mobile and stationary sources, shipping and construction

San Jose: PM from wood burning, mobile and stationary sources and construction

Difference between observed and simulated monthly average PM2.5 for January 2012



Difference between observation and simulation can be large in the San Francisco Bay Area

Horizontal grid resolution: 4x4 km

Vertical layers: 50 in WRF and 15 in CMAQ

Difficult to assess and improve model performance

Difference in observed wind speed at meteorological station and nearby airport: at times 40%

Difference in observed PM2.5 concentrations at two nearby stations: at times 30-60%

The largest difference is in Napa: impacted from heavy wood burning; San Francisco and West Oakland: currently Bay Bridge emissions are placed in the first model layer, which may be inappropriate

Uncertainty in estimating PM2.5 emissions from wood burning can be large; estimates are mostly based on telephone surveys

Large difference between observation and simulation introduces uncertainty in health impact estimates

BAAQMD Efforts

- Conducted carbon-14 analysis of PM filters for seven winters
 - Provides a ratio of old/new carbon
 - Both old and new carbon concentrations change; difficult to assess true contribution of wood burning
- Participated in the winter 2012-13 California Discover-AQ experiment
 - Assessing PM concentrations from satellites on $\mu\text{g}/\text{m}^3$ basis is uncertain
- Considered measuring levoglucosan (a wood burning degradation product), but measurements are uncertain
- Collaborating with SJSU, we will compare and contrast relative differences in MODIS AOD over the Bay Area from inspection of satellite images
 - Use AOD at observation points as a reference
 - Assess PM levels at non-monitoring locations by comparison with this reference

Benefits

Provide additional resources to:

- Evaluate and improve emission estimates
- Evaluate and improve model performance
- Improve air quality forecast, better identify no-burn days
- Identify locations of potential new monitor sites
- Support education and incentive programs
 - Example: incentives to replace non-certified stoves with certified stoves
- Support enforcement on no-burn days
- Better assess impacts of transported vs. locally generated PM
- Better assess trends in emissions and concentrations
- Better specify model boundary conditions

These would all lead to better assessment of PM health impacts