# COMPARISONS BETWEEN LIGHT SCATTERING AND FINE PARTICLE MASS DATA

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## California Regional $PM_{10}/PM_{2.5}$ Air Quality Study (CRPAQS)

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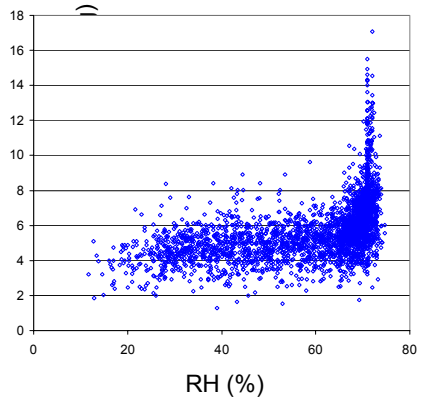
### Experimental: $b_{sp}$ Measurement Method

All light scattering by particle data ($b_{sp}$) were measured using Radiance Research model 903 nephelometers. Smart heaters were used to minimize the effects of high relative humidity (RH) on the $b_{sp}$ measurements. The sample air was heated only when the RH exceeded 65%, and the heater controller did not allow the RH in the scattering chamber to exceed 72%. The nephelometers were run without size-selective inlets. All $b_{sp}$ data were collected with a 5-minute averaging time.

### Scattering Efficiency vs. RH

in the Nephelometer Scattering Chamber

Bakersfield November through April data. Scattering Efficiencies are calculated from collocated hourly BAM $PM_{2.5}$ and $b_{sp}$ data.



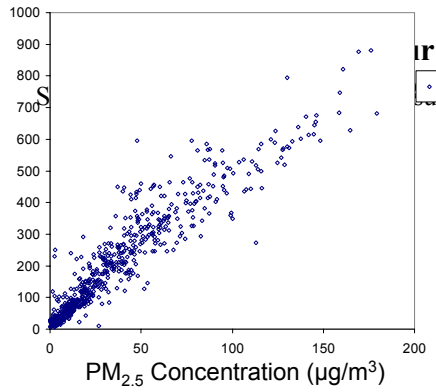

- For relative humidity (RH) 65%, $PM_{2.5} > 10$ µg/m³, and 10 outliers removed: Scattering Efficiency = (0.022±0.002) m²/(g %) * RH + (3.821±0.098) m²/g.
- Most of the variability in scattering efficiencies occurs at high RH. Some of this variability is probably caused by an inadequate residence time after the sample air was heated for the particles to equilibrate at the indicated RH. Fog events are included in these data.
- Scattering efficiencies in the summer (not

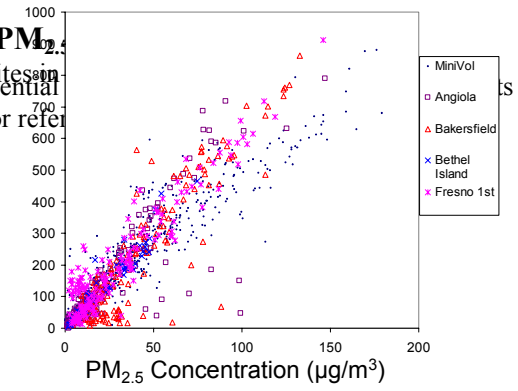
### r $b_{sp}$ vs. $PM_{2.5}$

S om sites in ts

Sequential

For refer




- Strong correlation ($R^2 = 0.88$) during the winter, the season when $PM_{2.5}$ concentrations are highest.
- The 24-hour Federal $PM_{2.5}$ standard, 65 µg/m³, is exceeded often in the data shown.
- Average scattering efficiency of 4.6±0.07 m²/g.
- $PM_{2.5}$ concentrations can vary by a factor of three for a given $b_{sp}$ value.

- Observed relationship between $PM_{2.5}$ mass and $b_{sp}$ differ between MiniVol and SFS mass measurements.
- Low scattering efficiencies at Angiola and Bakersfield occur in discrete periods of November and December respectively, and may be due to dust events (see below).

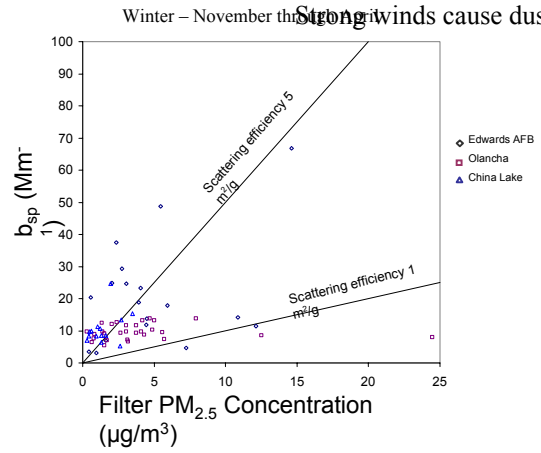
### Desert $b_{sp}$ versus Fine Mass

Data from the east (dry) side of the Sierra

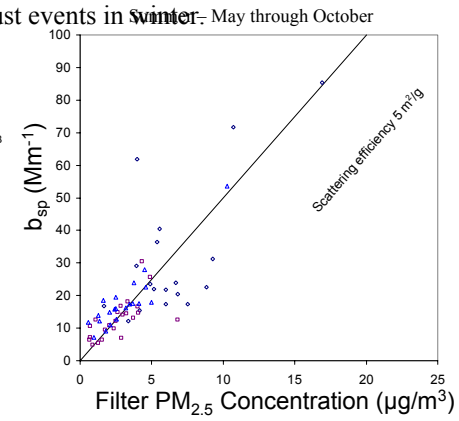
Fine particle haze is transported from the Los Angeles Basin and the San Joaquin Valley through mountain passes to these sites more often in summer than in winter.

Strong winds cause dust events in winter.

Winter – November through April



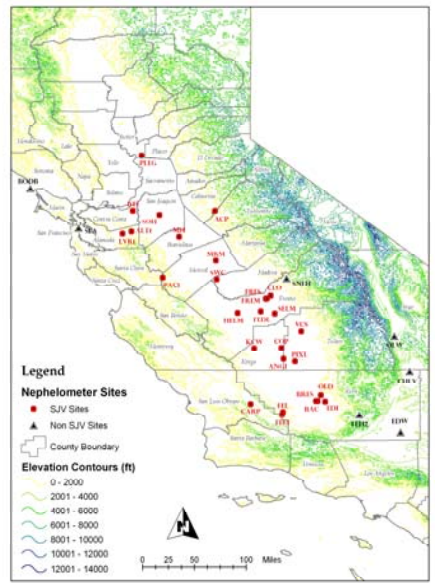

Summer – May through October



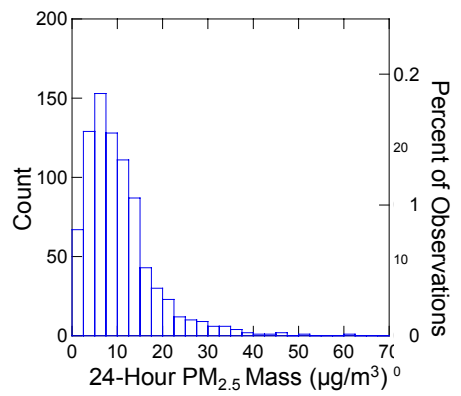

- Points near the 1 m²/g line with $PM_{2.5}$ concentrations greater than 6 µg/m³ are dust events associated with high winds.
- The scattering efficiency of the $PM_{2.5}$ fraction of desert dust is approximately 1 m²/g or less and can be less than 0.4

- The scattering efficiency for haze events is similar to the efficiency for urban or San Joaquin Valley haze events.
- Dust may be the cause of scattering efficiencies appreciably less than 5 m²/g.

### CRPAQS Sites with Collocated $b_{sp}$ and $PM_{2.5}$ Mass Measurements




### May through October Filter $PM_{2.5}$




- Because of the dust, $b_{sp}$ is not a good predictor of $PM_{2.5}$ during the dry seasons.
- These data are presented to show that high $PM_{2.5}$ concentrations are rare in the dry seasons. Federal 24-hour $PM_{2.5}$ concentration standard is rarely exceeded.
- Both MiniVol and SFS data are shown.

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