HOW WELL DO PM AND METEOROLOGICAL MEASUREMENT SYSTEMS QUANTIFY MASS CONCENTRATIONS, PARTICLE SIZES, CHEMICAL COMPONENTS AND METEOROLOGICAL FEATURES?

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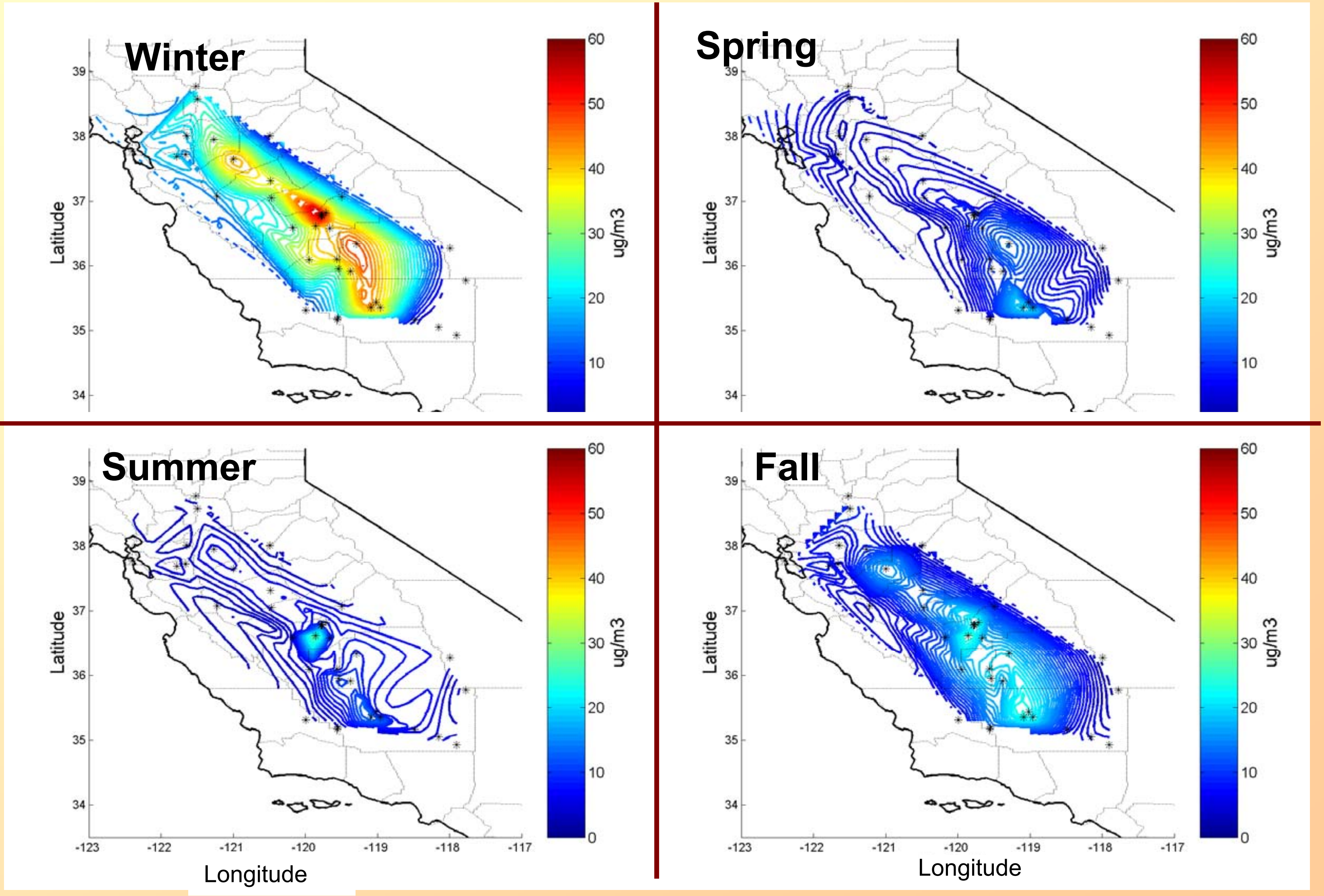
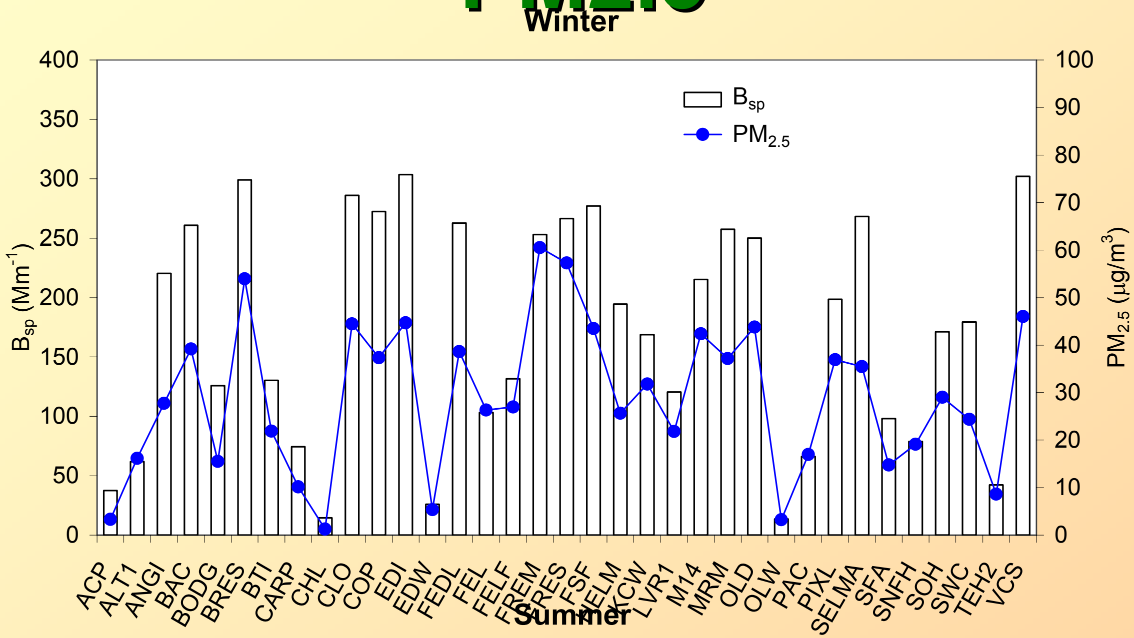
Good comparability for most PM2.5

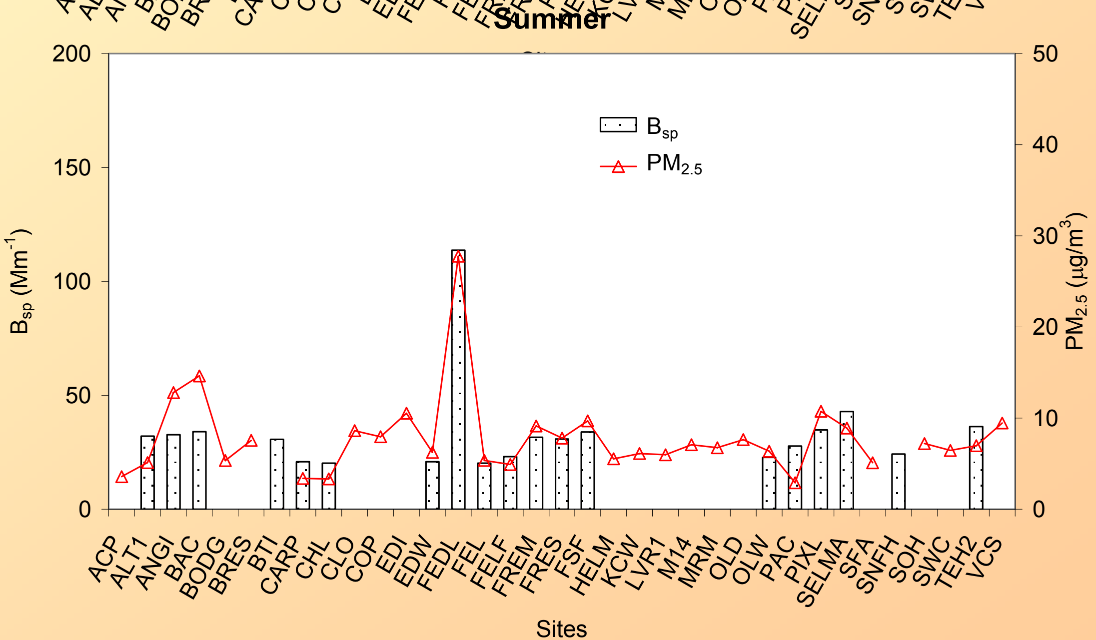
Sampler Code	Model	Manufacturer[a]	Size	FRM[b]	FEM[c]	Measurement Principle
AN100	RAAS 100	Andersen	$PM_{2.5}$	yes	-	Gravimetric
AN300	RAAS 300	Andersen	$PM_{2.5}$	yes	-	Gravimetric
RP2K	R&P 2000	Rupprecht & Patashnick	$PM_{2.5}$	yes	-	Gravimetric
RP225	R&P 2025	Rupprecht & Patashnick	$PM_{2.5}$	yes	-	Gravimetric
AN400	RAAS 400	Andersen	$PM_{2.5}$	no	no	Gravimetric
M1ST	SASS Speciation Sampler	Met One	$PM_{2.5}$	no	no	Gravimetric
DICHOTF	SA-246B	Andersen	$PM_{2.5}$	no	no	Gravimetric
SFS	Sequential Filter Sampler	DRI	$PM_{2.5}$	no	no	Gravimetric
MINIVOL25	MiniVol Portable	Airmetrics	$PM_{2.5}$	no	no	Gravimetric
MOUDI	Model 100	MSP	$PM_{2.5}$	no	no	Gravimetric
BAM25	BAM-1020	Met One	$PM_{2.5}$	no	no	Beta Attenuation
TEOM25	TEOM 1400a	Rupprecht & Patashnick	$PM_{2.5}$	no	no	Inertial Mass
DUSTTRAK	DustTrak 8520	TSI	$PM_{2.5}$	no	no	Light Scattering
GREENTEK	GT640A	GreenTek	$PM_{2.5}$	no	no	Light Scattering
RAD25	M903 (nephelometer)	Radiance Research	$PM_{2.5}$	-	-	Light Scattering
RAD	M903 (nephelometer)	Radiance Research	TSP	-	-	Light Scattering
HIVOL10V	GMW-1200	Andersen	PM_{10}	yes	-	Gravimetric
MINIVOL10	MiniVol Portable	Airmetrics	PM_{10}	no	no	Gravimetric
BAM10	BAM-1020	Met One	PM_{10}	no	yes	Beta Attenuation
TEOM10	TEOM 1400a	Rupprecht & Patashnick	PM_{10}	no	yes	Inertial Mass

Seasonal Variations of $PM_{2.5}$

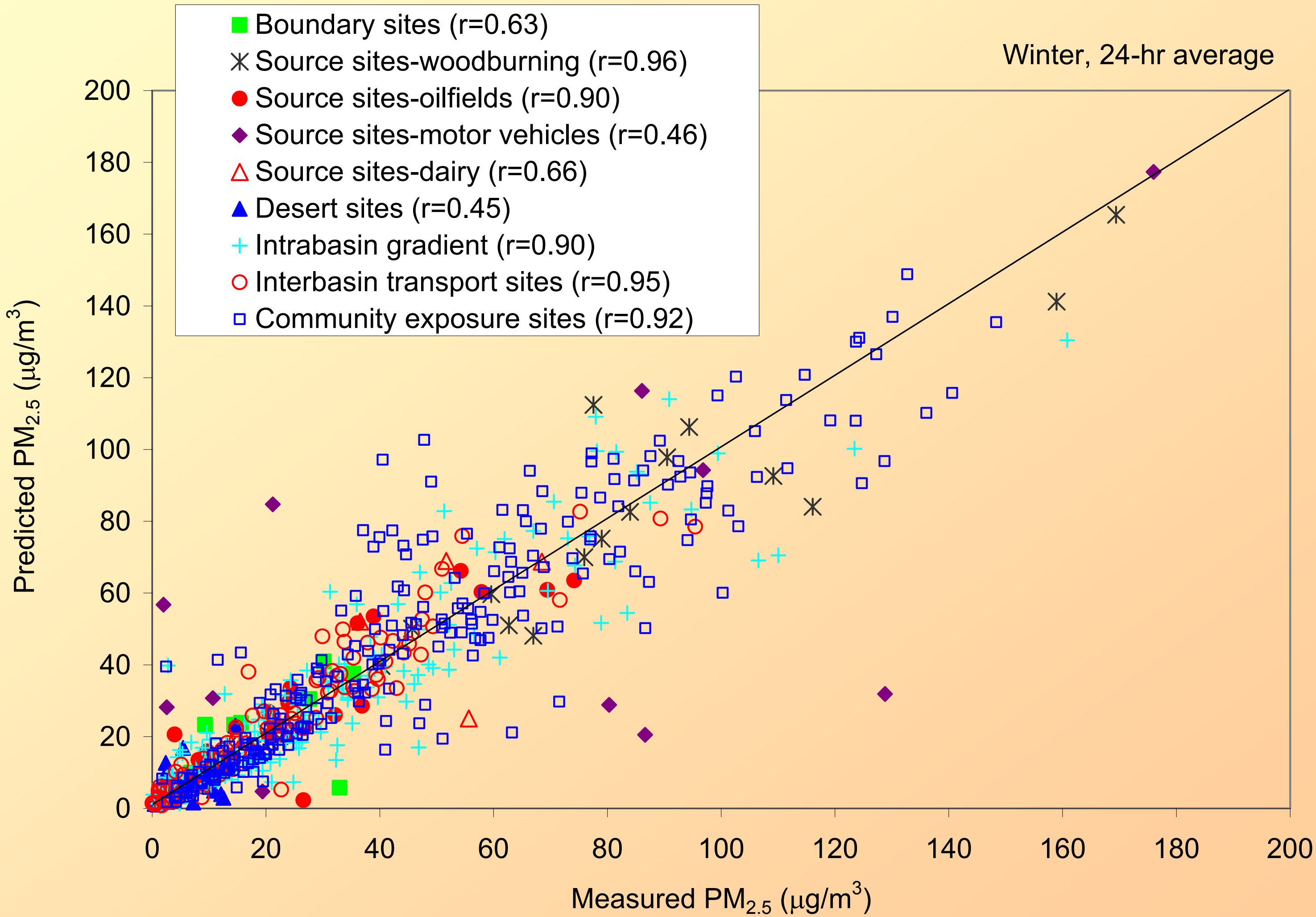


Good relationships between bscat and PM2.5

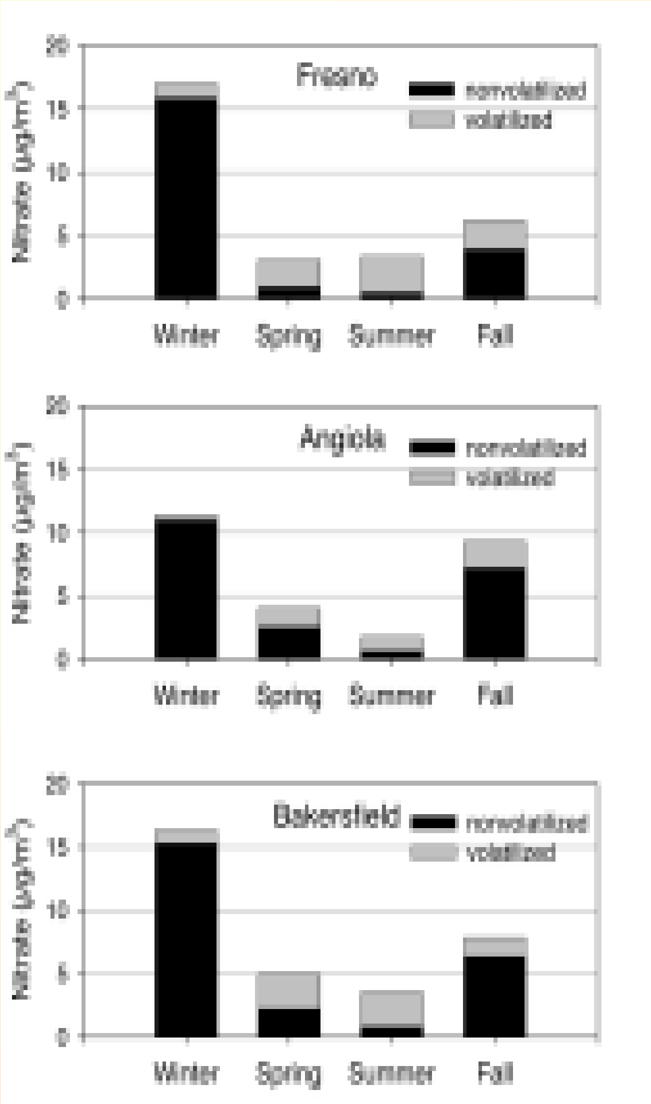




Bscat/PM2.5 relationship better by site type and in winter (low coarse, more data



Nitrate and FRM PM2.5 well-quantified during winter. Much lost in summer



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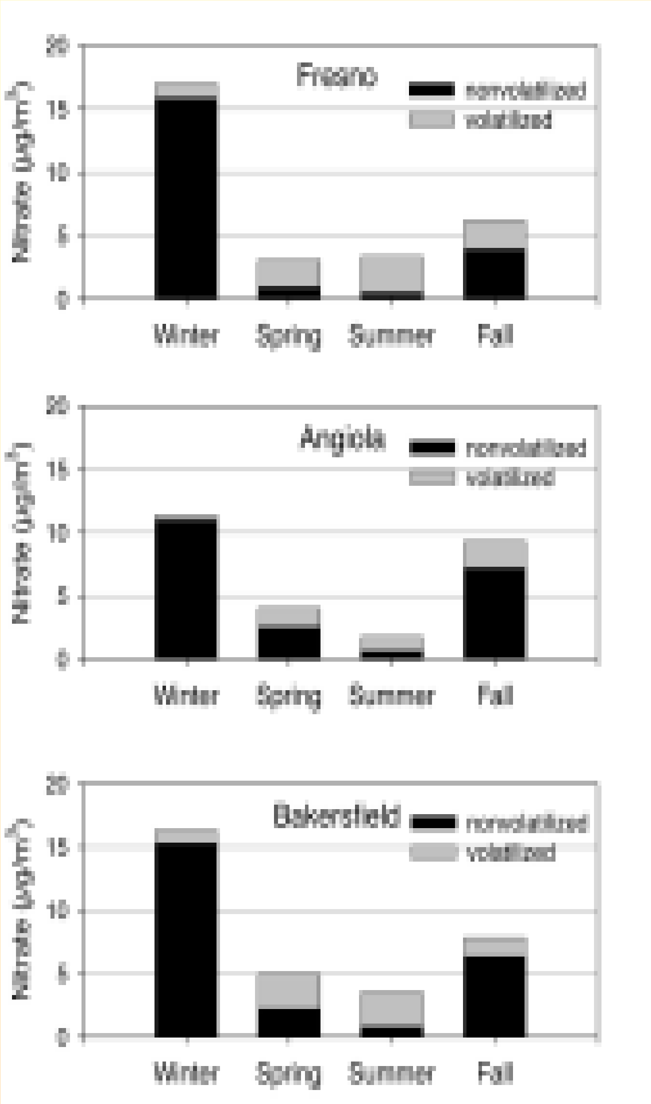
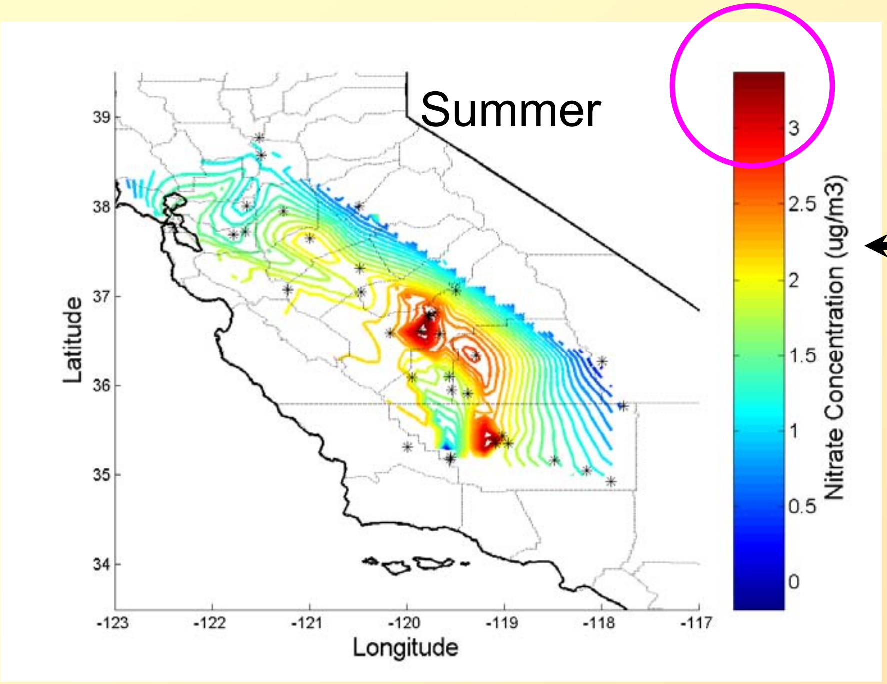
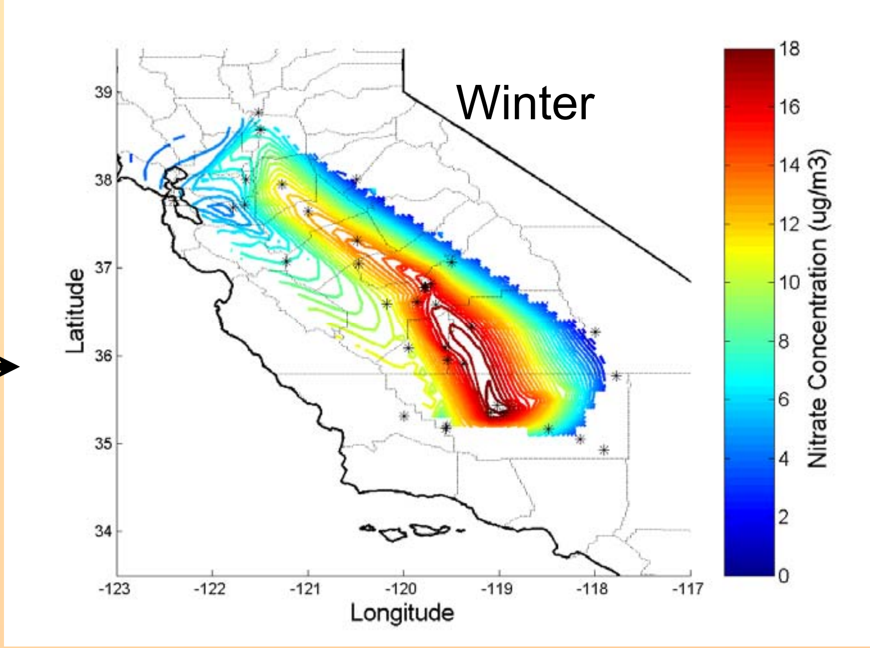


Variation of Nitrate (NO_3^-)

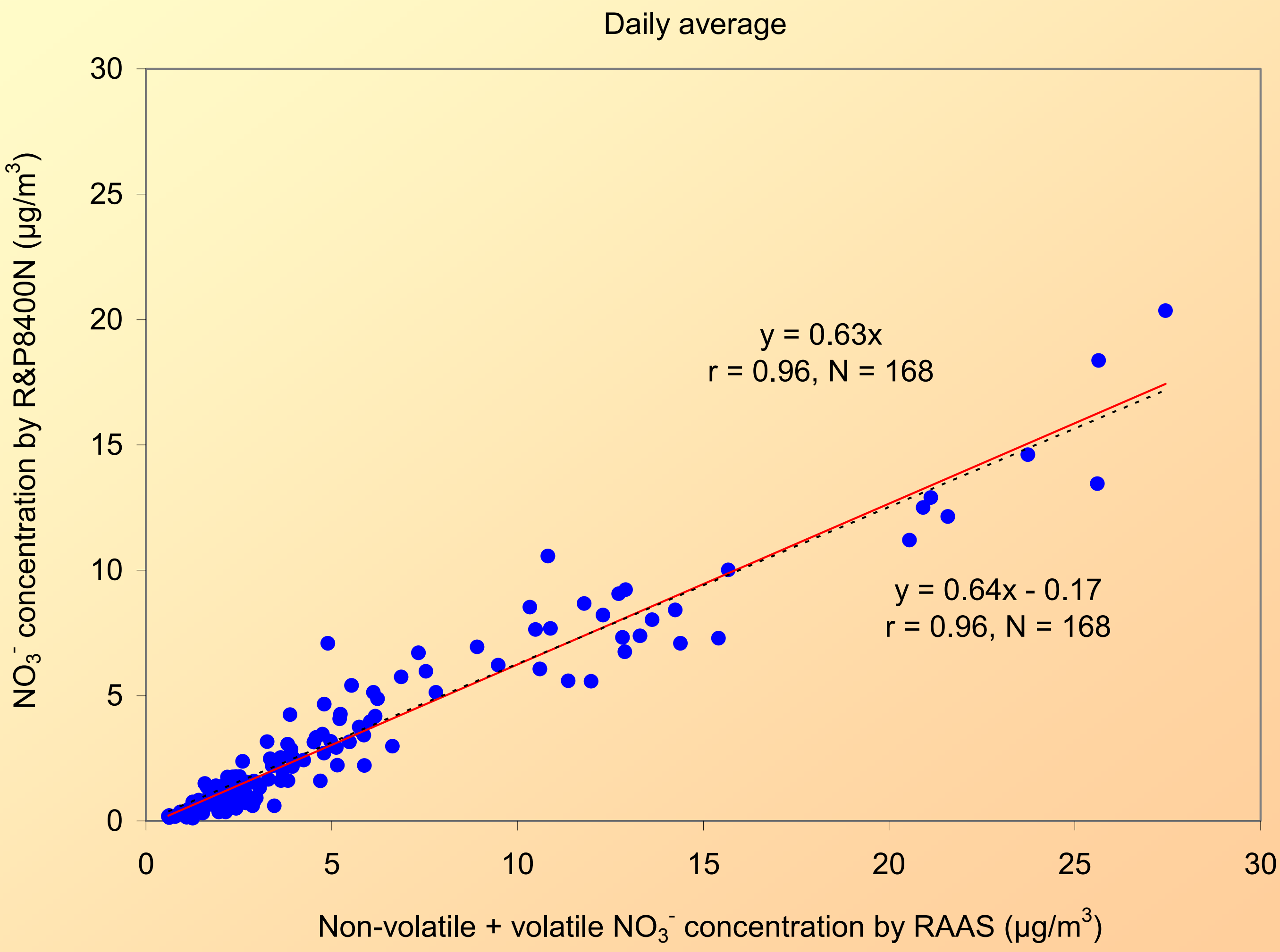


- Low NO_3^- found in summer (<3.5 µg/m³) (Note: different scales)
- Nitrate centered at urban areas.

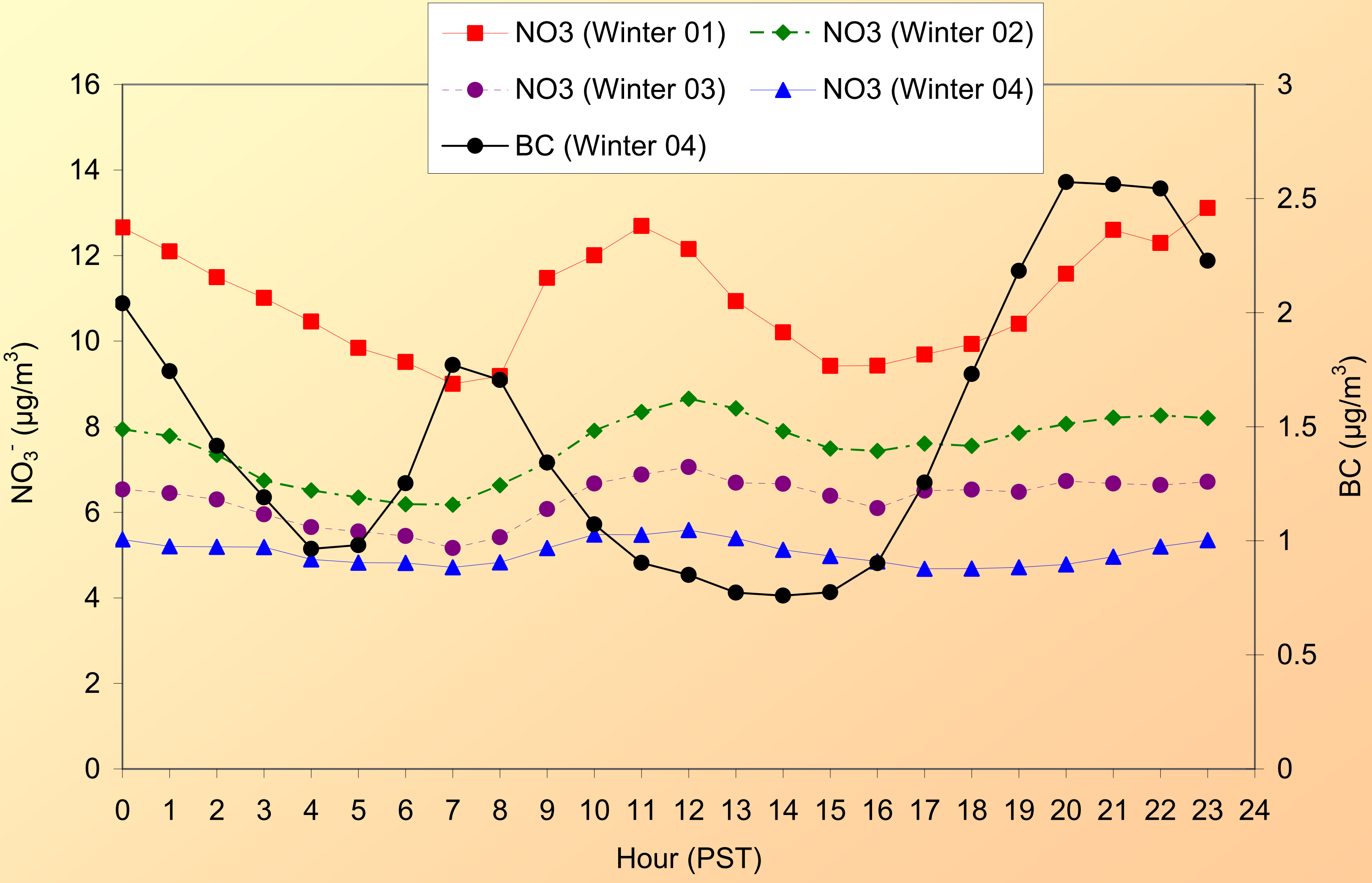


- High NO_3^- found in winter.
- Elevated NO_3^- found in rural areas between urban centers.

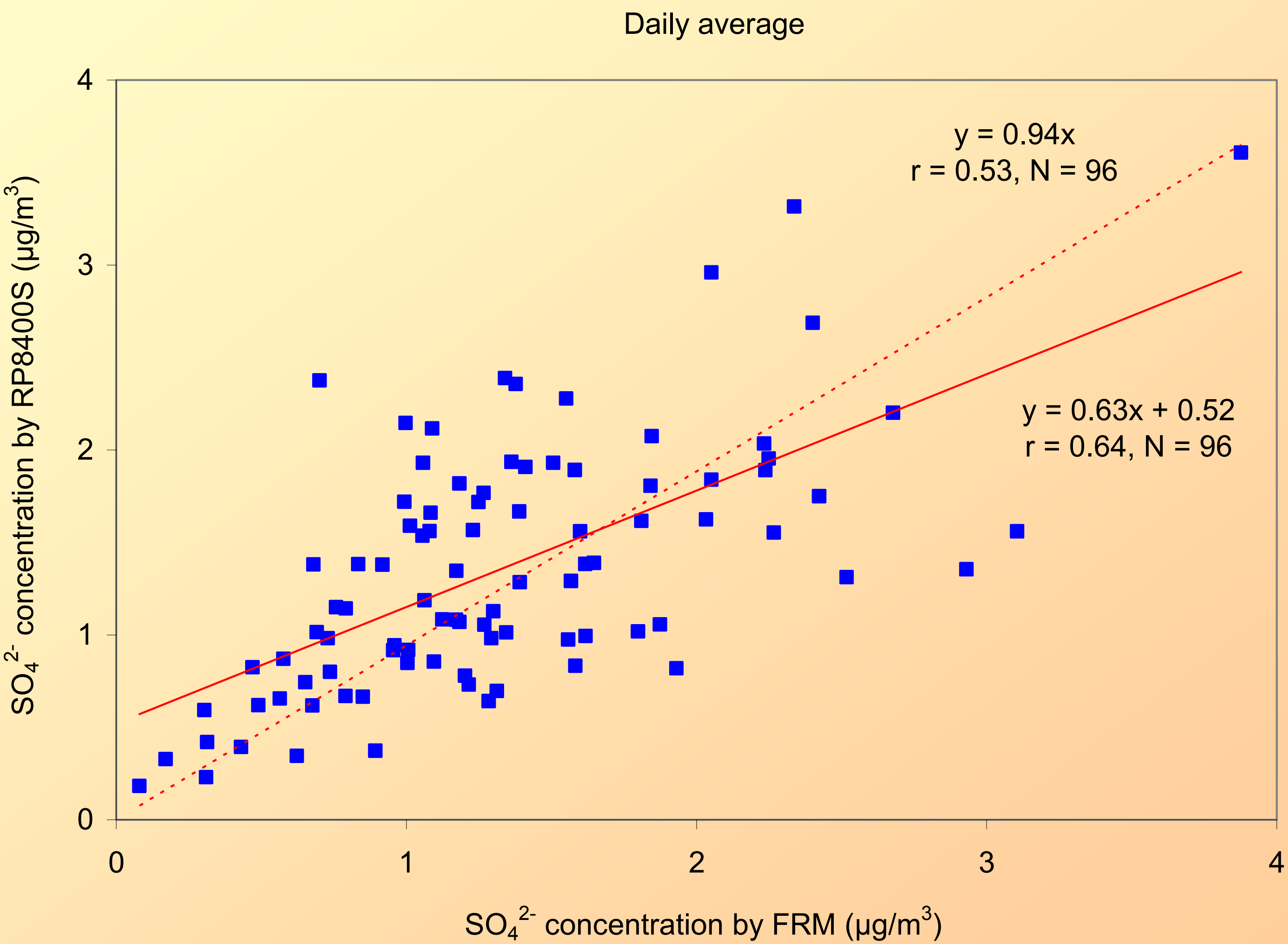
Continuous nitrate biased low, but consistent with filter nitrate



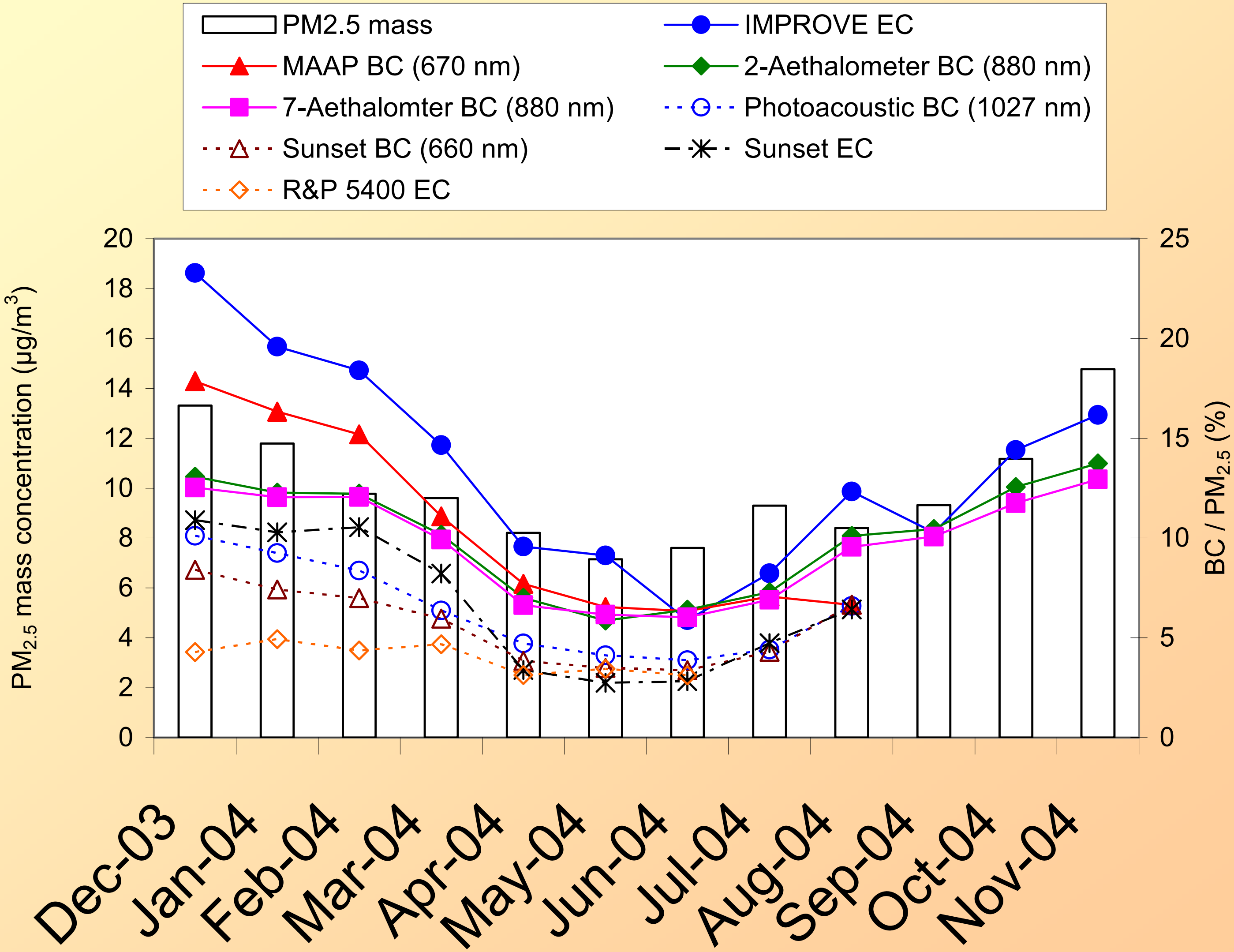
Continuous nitrate sufficient to detect vertical mixing phenomenon



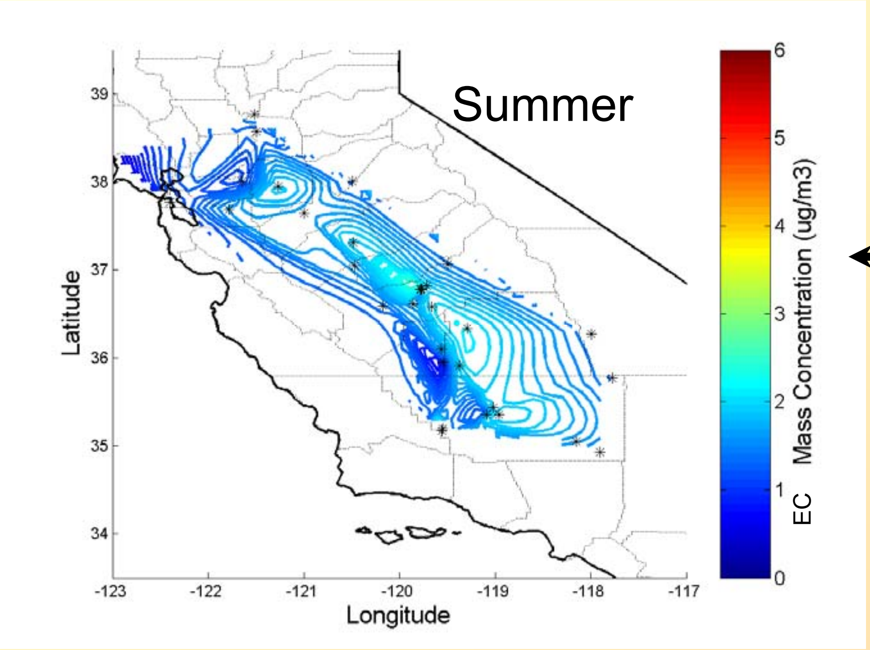
Continuous sulfate not as well related to filter measurements



Total carbon comparable (except for RP5400), EC varies by detection method.

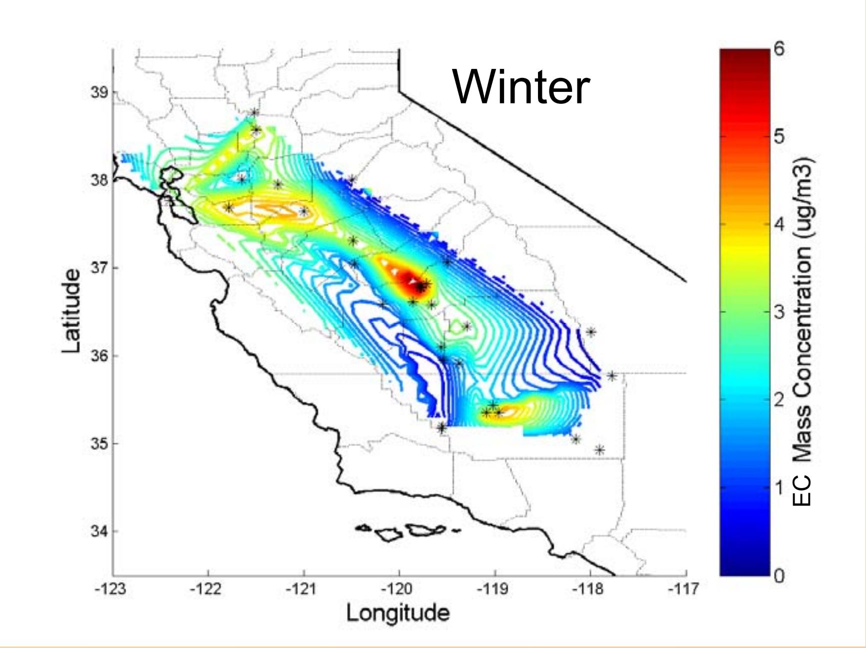


Variation of Elemental Carbon (EC)

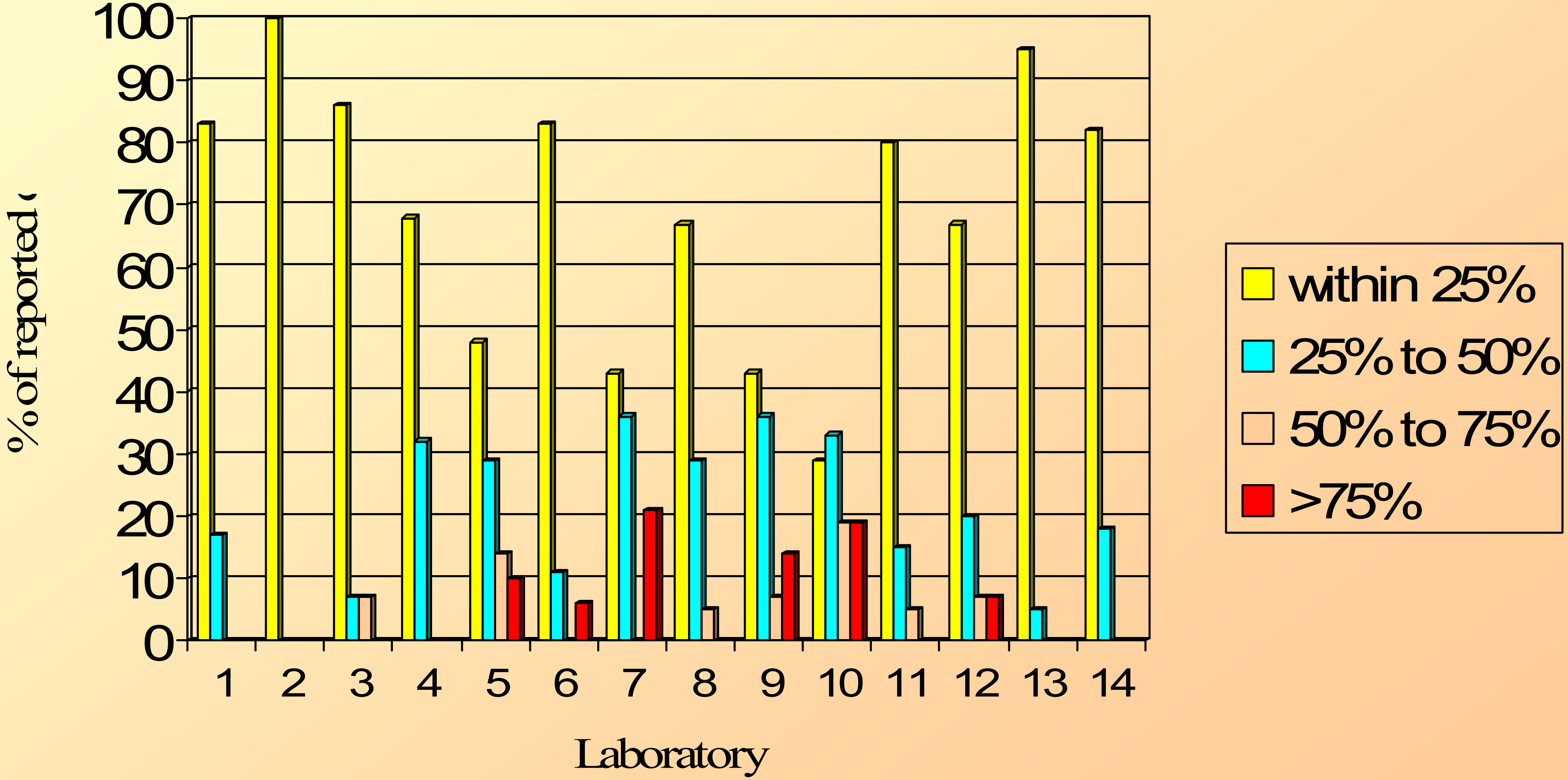


- Higher EC around urban centers.

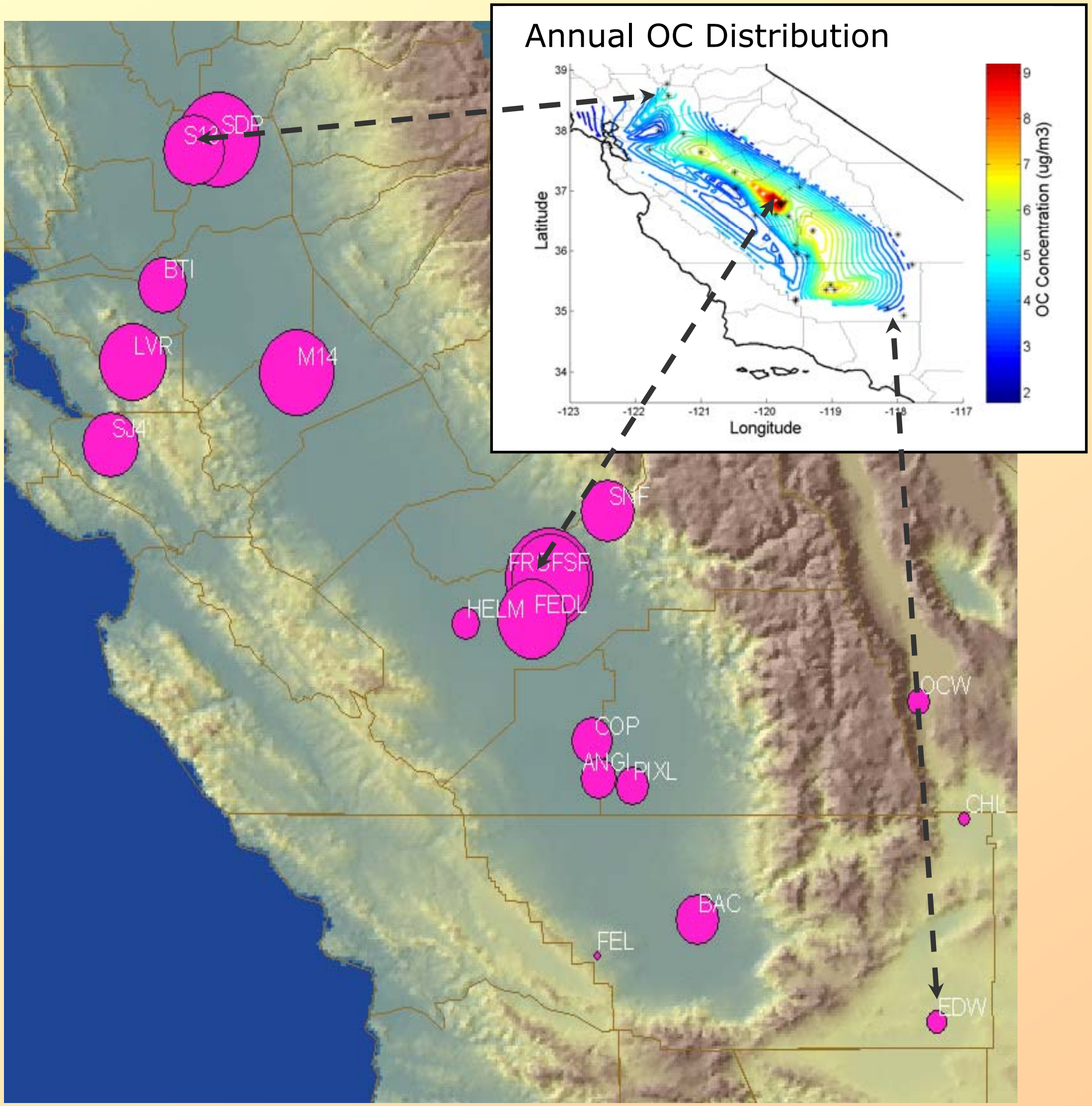
- Elevated EC found near the Fresno Supersite and Bakersfield. Rural sites show limited summer-winter contrast.



Interlaboratory comparisons not too good for organic compounds (Supersite meeting, Schantz et al, 1C-1)



Distribution of Levoglucosan, a Wood-Burning Marker, Compared to OC Distribution



Levoglucosan Concentrations (ng/m3)

	Annual Avg	Winter Avg*
FEL	6	26
CHL	7	32
YOSE	9	38
EDW	12	52
OCW	14	58
HELM	19	81
PIXL	19	82
ANGI	23	98
COP	32	138
BAC	49	209
BTI	50	215
SNF	57	244
SJ4	58	247
S13	63	269
LVR	68	291
FEDL	75	323
M14	101	433
FRS	121	521
SDP	128	551
FSF	202	868

** Predicted concentration based on mass concentration measurements*

Meteorological data quality summary

- Surface network OK, CIMIS, NWS, and PG&E nonstandard heights. ARB and Bay area best. RAWS are more for local rather than regional analyses. Some CIMIS wind vanes mis-alinged by up to 30 degrees.
- Surface spatial coverage is very good.
- Sonics on tower out of alignment, but agree with mechanicals when 230 degrees added. Mounted upside down. 97 m sonic not good. Good comparability with mechanical.
- Sodars had poor return at lowest levels at Angiola. Agreed well at 100 m.
- Rawinsondes have slow response time for T and RH. Not too good for short distances, e.g. surface vs. valleywide transition.

Meteorological data quality summary

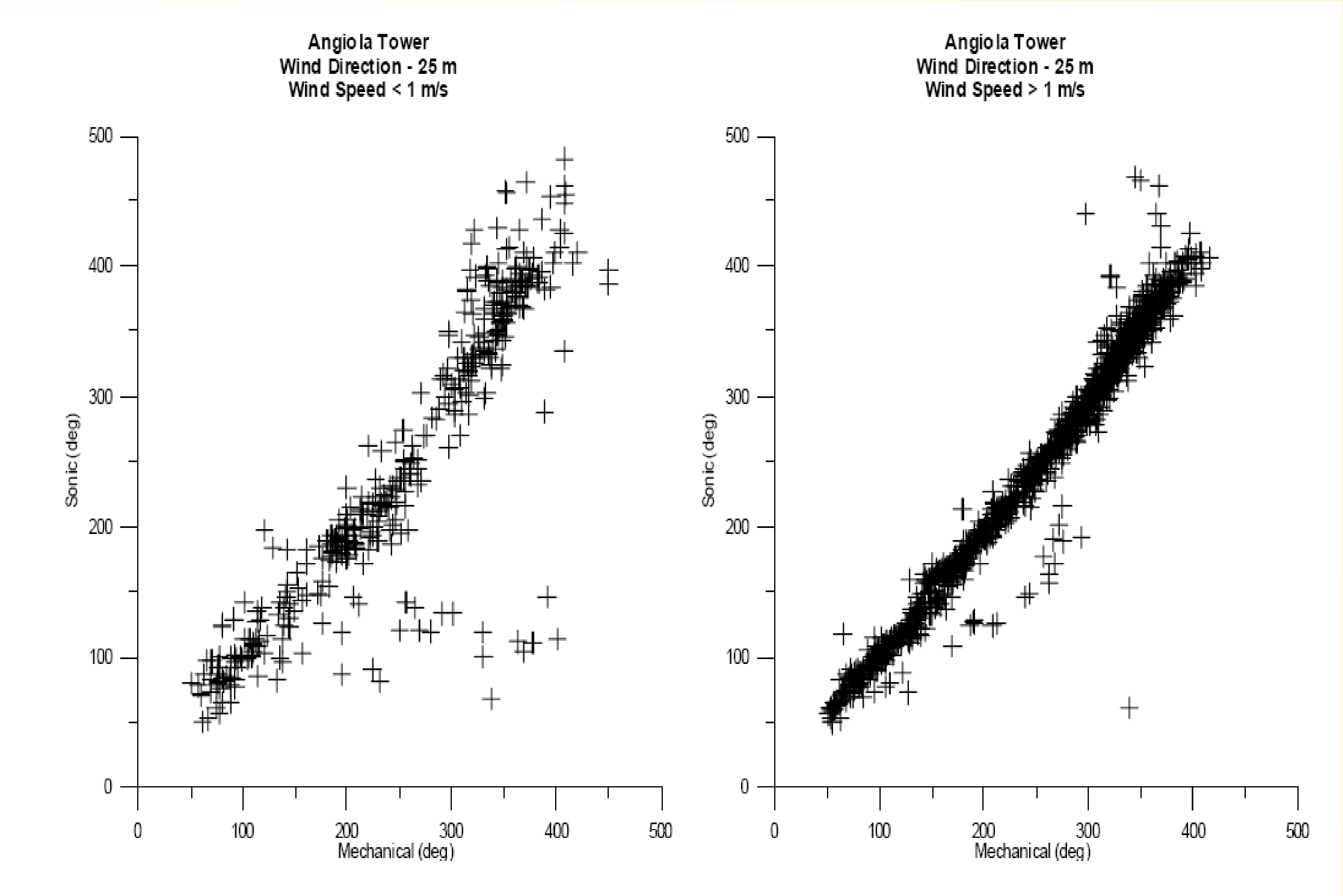
- RASS not good < 100 m, but appear to sufficiently capture changes in the valleywide layer. Reasaonable comparisons with audit rawinsondes, considering limitations of both methods.
- Hourly averages appear to adequately represent vector directions and speeds for shorter time periods (5 min).
- RH are sufficient to estimate locations and frequency of fogs (RH>95%).
- Profilers can detect light winds aloft.

CIMIS comparison with ARB and NOAA

Table 4. Comparison of CIMIS (2-m) vs. NOAA (10-m) "Collocated" Wind Measurements

		vs. ARB (1mph resolution)			vs. NOAA	
		Arvin	Davis	Parlier	Lost Hills	Chowchilla
Distance between sites (km)		0.6	0.3	0.5	13.6	11.1
WS < 1 m/s	Wind Speed					
	Correlation	0.5514	0.5343	0.4808	0.0380	0.3019
	Slope	0.287	0.247	0.215	0.083	0.141
	Intercept (m/s)	0.39	0.37	0.35	0.88	0.43
	Wind Direction					
	Correlation	0.9224	0.9313	0.9257	0.8385	0.8716
	Slope	1.045	0.991	1.114	1.074	1.047
	Intercept (deg)	-39.1	-7.3	-53.1	-12.6	-16.4
WS >= 1 m/s	Wind Speed					
	Correlation	0.7891	0.9724	0.9418	0.6472	0.9401
	Slope	0.619	0.799	0.718	0.635	0.730
	Intercept (m/s)	0.35	0.18	0.10	0.20	0.24
	Wind Direction					
	Correlation	0.9910	0.9932	0.9983	0.9346	0.9770
	Slope	1.055	0.995	1.013	1.024	1.009
	Intercept (deg)	-32.0	-0.1	-28.6	0.4	-11.8

Sonic vs. mechanical wind direction, after corrections



Sodar OK at 100 m

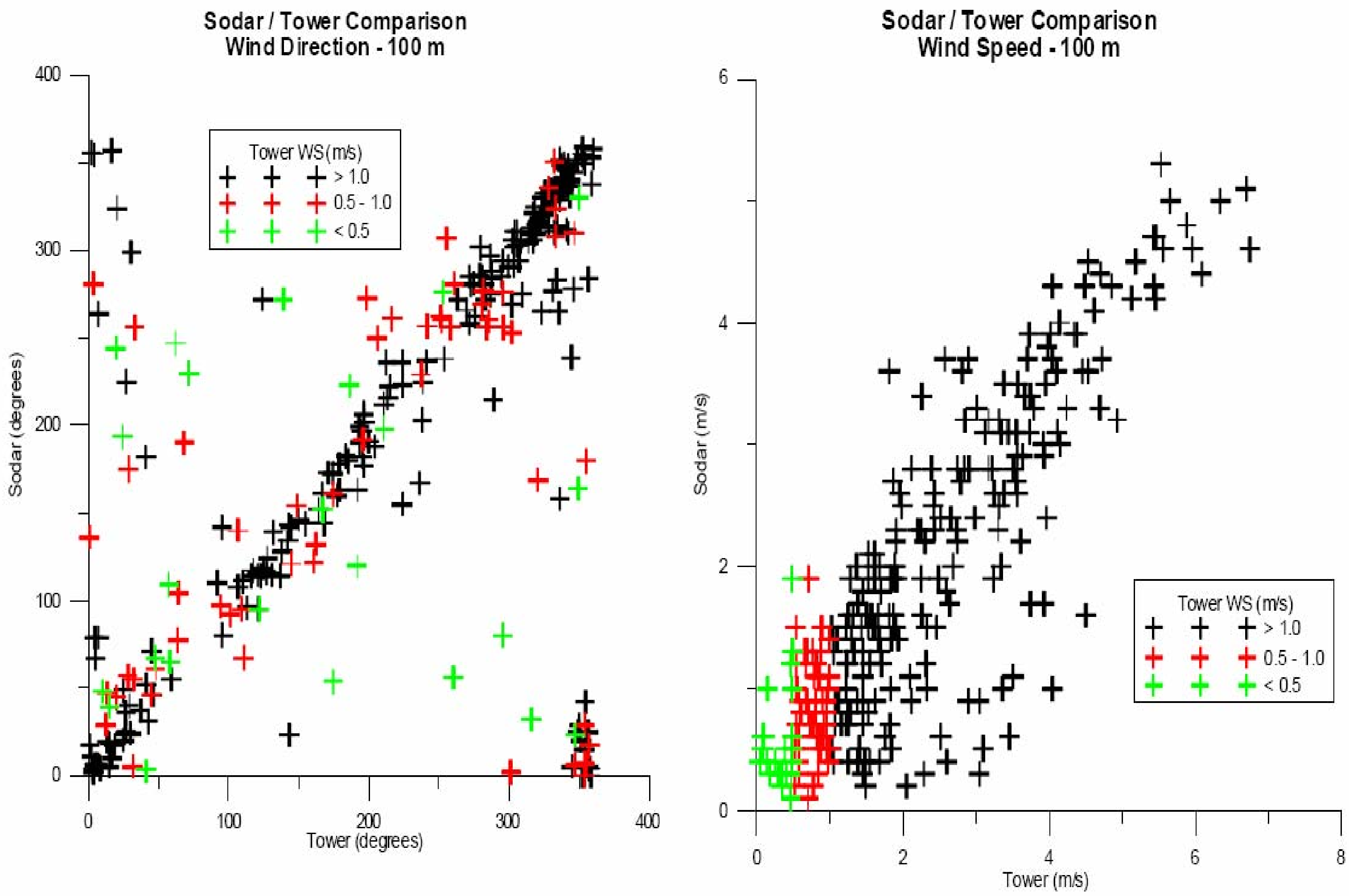


Figure 2. Comparison of sodar and tower (mechanical sensors) wind data – December 14 – 31, 2000.

CRPAQS measurement evaluation studies

- Measurement evaluations did a good job of determining how well measurement systems did or didn't work.
- With a few exceptions, measurements appear adequate to determine general features, test conceptual models, and to serve as input and to evaluate air quality modeling.
- There are individual times and locations where data are compromised, but this is evident from similar measurements at the same or nearby sites. The network is redundant.
- Given that many of the measurement methods were new and innovative, a broader perspective is needed on their overall accuracy and precision relevant to central