

**Northern California Winter Time PM<sub>2.5</sub> and Meteorology  
2006-07**

***Statistical Analysis Summary Report***

**Draft Report**

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**PM<sub>2.5</sub> Exceedances:**

PM data have been collected from 20 stations over Bay Area (BAAQMD), Sacramento Valley (SACV), and San Joaquin Valley (SJV) air districts during 2006-07 PM<sub>2.5</sub> sessions. There are 12 BAAQMD, 5 SACV, and 3 SJV stations as listed in Table 1.

**Table 1. PM<sub>2.5</sub> Stations and Exceedance days**

Exceedances (days)		Year		Month		Grand Total
		2006		2007		
Region	Site	Nov	Dec	Jan	Feb	
BAAQMD	Concord	1	5	4	2	12
	Fremont	0	2	1	1	4
	Livermore	0	6	5	1	12
	Napa	0	0	5	1	6
	Oakland	2	5	5	3	15
	Point Reyes	0	1	0	0	1
	Redwood City	0	2	3	2	7
	San Francisco	0	3	3	3	9
	San Jose	0	7	4	3	14
	Santa Rosa	0	1	0	0	1
	SJ-Tully	0	8	3	3	14
	Vallejo	0	7	6	0	13
BAAQMD Total		3	47	39	19	108
SACV	Davis	0	2	1	1	4
	Elk Grove	0	4	10	4	18
	Sacramento-TSt	1	7	14	5	27
	Vacaville	0	3	0	1	4
	Woodland	0	0	2	0	2
SACV Total		1	16	27	11	55
SJV	Modesto-14th	2	17	18	8	45
	Stockton-Hazelton	0	12	11	5	28
	Tracy	0	2	4	4	10
SJV Total		2	31	33	17	83
Grand Total		6	94	99	47	246

Total 246 exceedance days occurred over all sites during this period, Figure1 showed that:

- Modesto-14<sup>th</sup> station of SJV exceeded more than 50% of days: 17 days in December 2006, and 18 days in January 2007,
- BAAQMD stations totaled 108 of 246 days during this 4 months period,
- Most exceedances occurred during December and January.

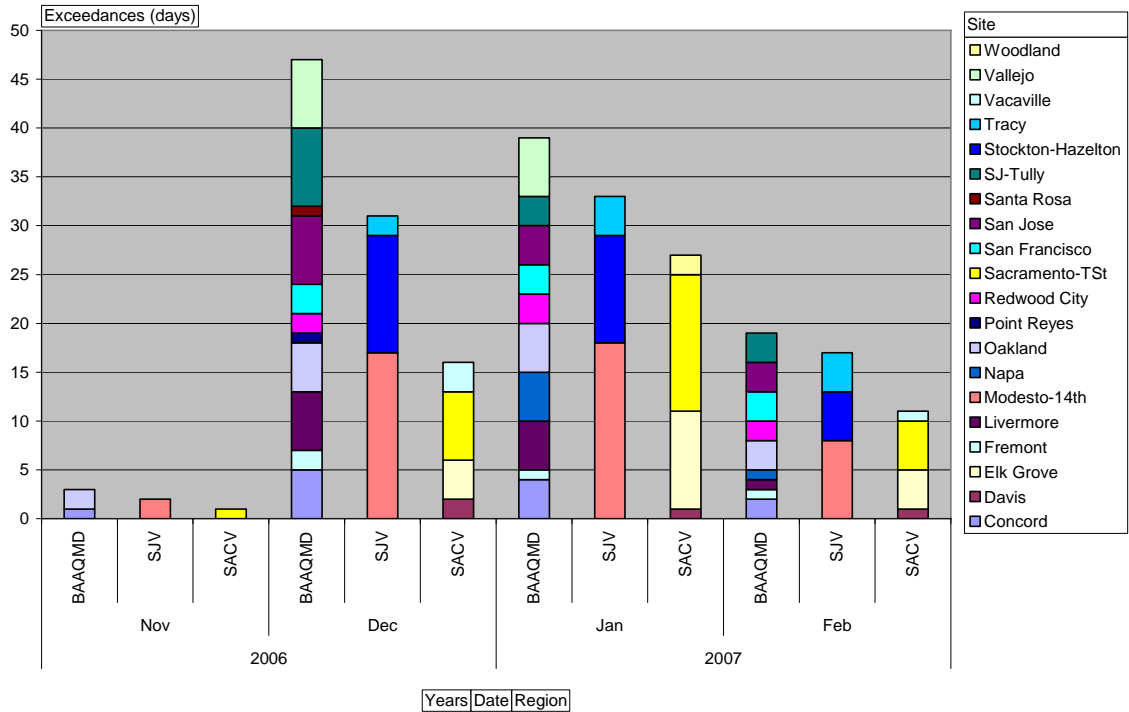


Figure 1. Number of days PM<sub>2.5</sub> Exceedance by region

Each station readings were statistically summarized in Table 2 and sorted by maximum values, where:

- Redwood City topped the daily reading as high as 75.3 ug/m<sup>3</sup>, 4-month averaged high values found in Modesto-14<sup>th</sup>, Stockton-Hazelton, Sacramento-TSt, Elk Grove, and Napa stations, while lowest is located at Point Reyes.

**Table 2. Measured PM<sub>2.5</sub> readings by station**

Stations	PM <sub>2.5</sub> (ug/m <sup>3</sup> )			
	Maximum	Average	Standard Deviation	Variance
Redwood City	75.3	13.94	11.52	132.66
Modesto-14 <sup>th</sup>	75.17	29.72	19.93	397.28
Stockton-Hazelton	66.83	23.54	16.29	265.38
Oakland	65.5	18.83	13.17	173.39
San Jose	64.4	17.19	13.21	174.45
Sacramento-TSt	63.53	21.28	14.34	205.61
SJ-Tully	62.5	16.21	12.75	162.67
Davis	62.17	13.10	10.55	111.31
Concord	62.1	15.76	13.37	178.76
Tracy	60.25	16.40	11.93	142.44
Santa Rosa	59	15.79	12.39	153.56
Elk Grove	55.37	21.32	11.62	135.02
Livermore	55	14.97	12.42	154.34
San Francisco	54.3	13.75	11.12	123.64
Fremont	51.3	14.15	12.35	152.41
Woodland	48.35	14.73	9.62	92.47
Vacaville	45.35	11.68	10.11	102.29
Vallejo	43.49	16.52	12.08	145.91
Napa	43.2	20.17	11.56	133.66
Point Reyes	35.04	8.42	5.98	35.75

Hourly Bay Area BAM data also collected and compared to daily PM data:

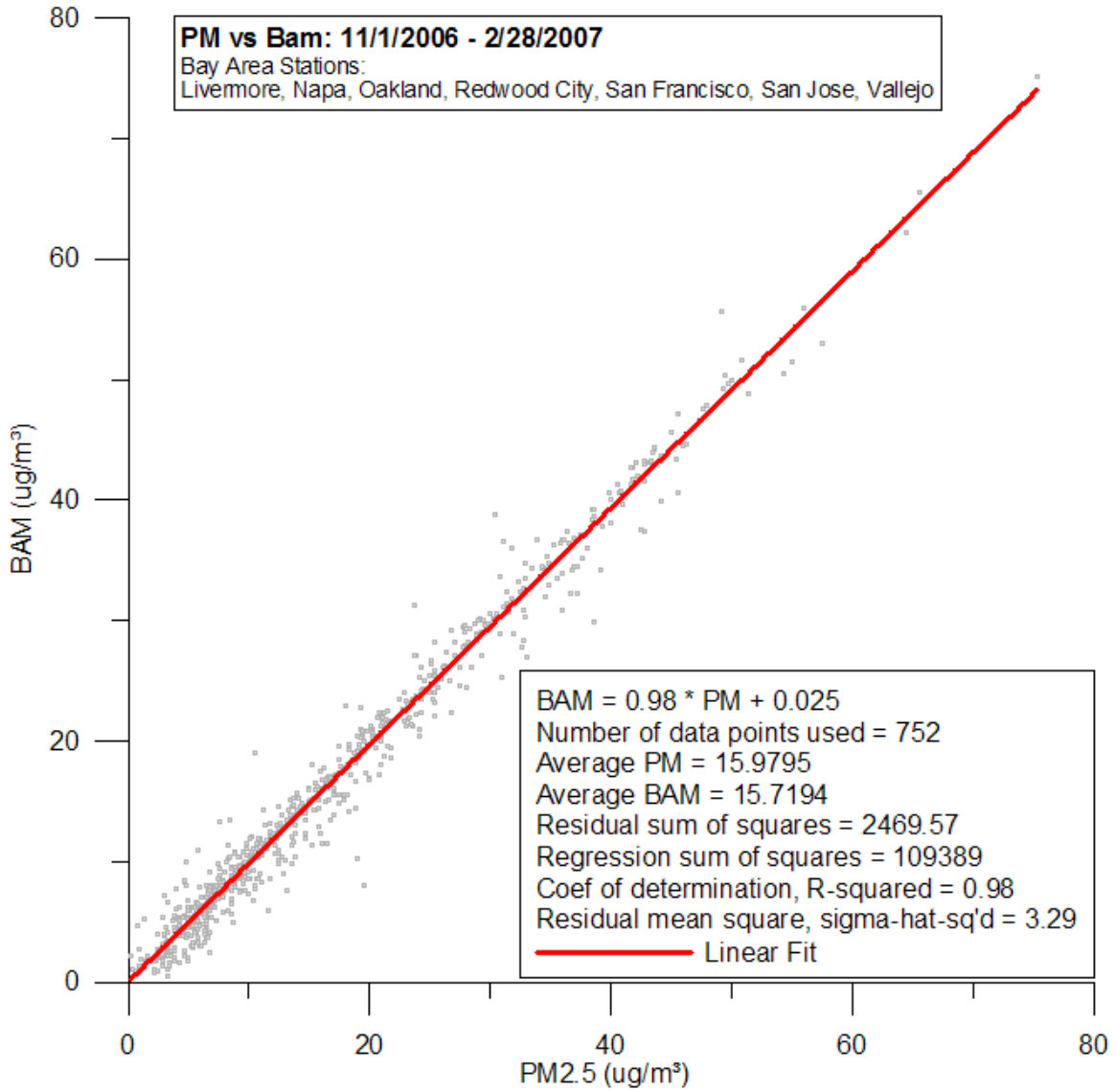
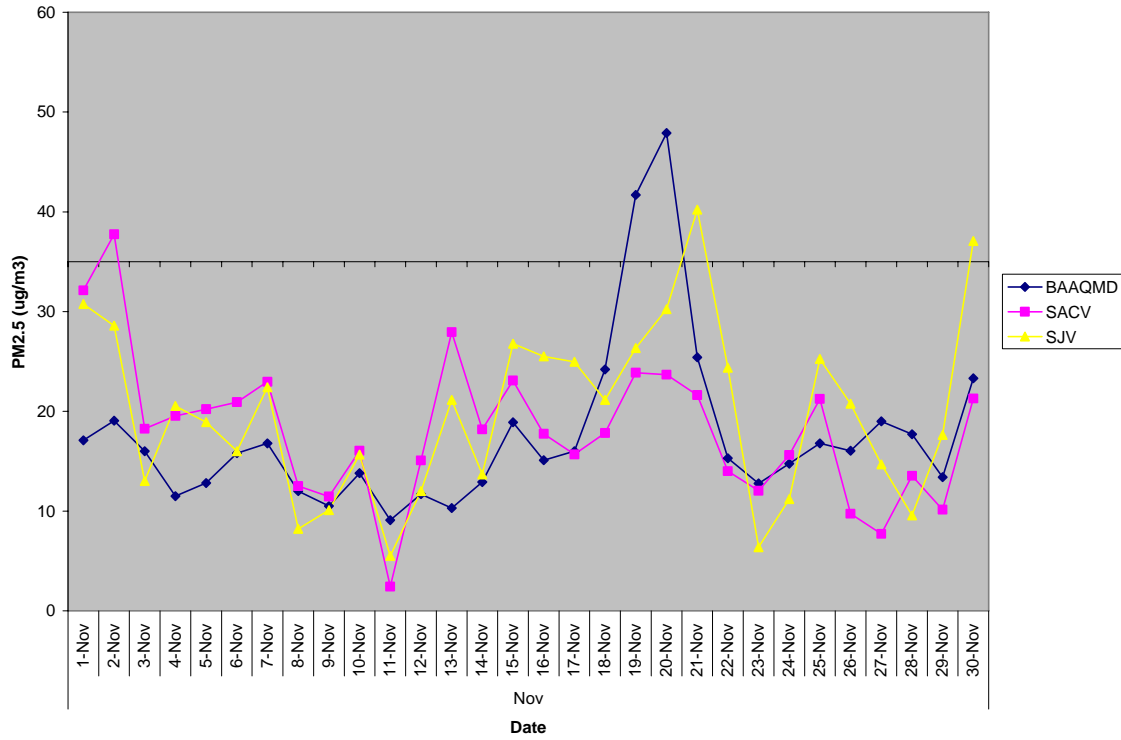


Figure 2. Daily Averaged BAAQMD BAM and PM<sub>2.5</sub>.

***PM<sub>2.5</sub> and meteorology:***

**PM<sub>2.5</sub> concentration and meteorology during winter time**



**Figure 3. PM<sub>2.5</sub> Concentration in November 2006**

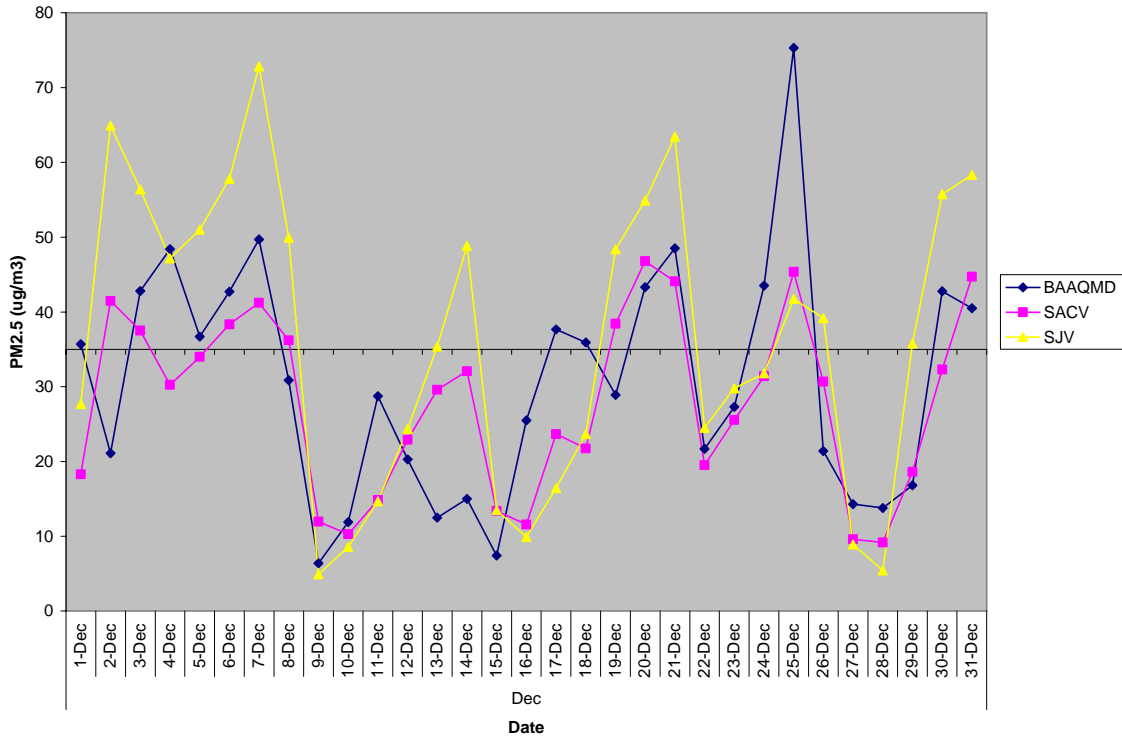


Figure 4. PM2.5 Concentration in December 2006

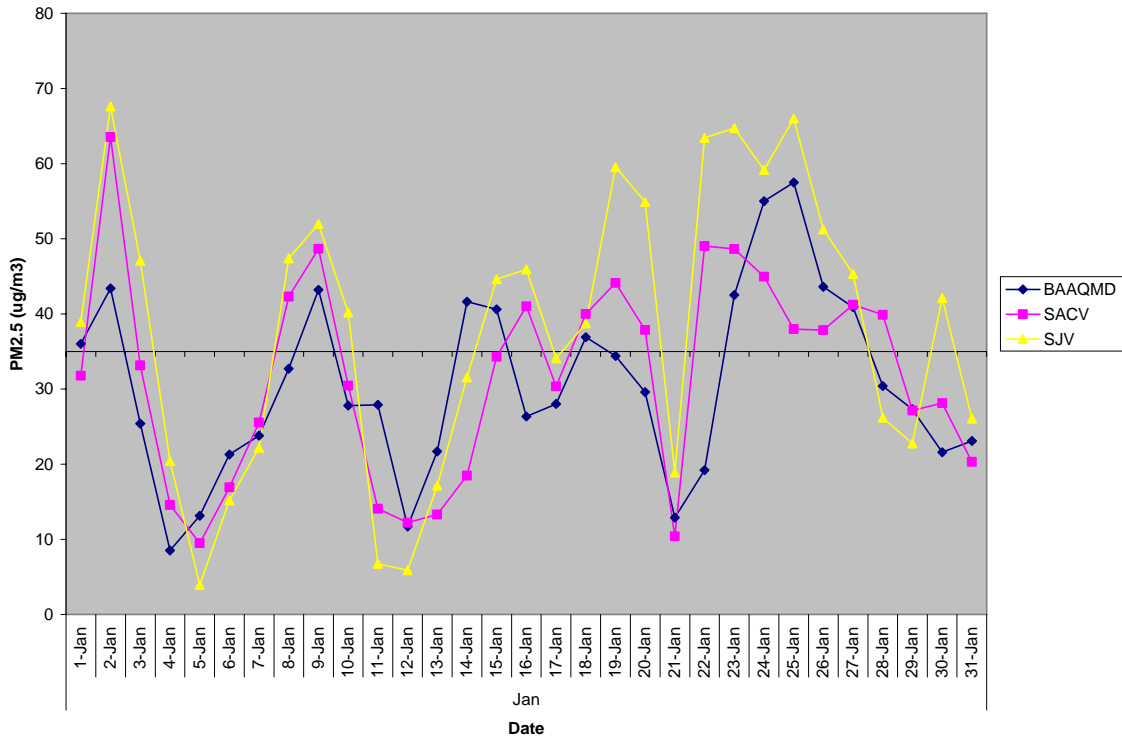


Figure 5. PM2.5 Concentration in January 2007

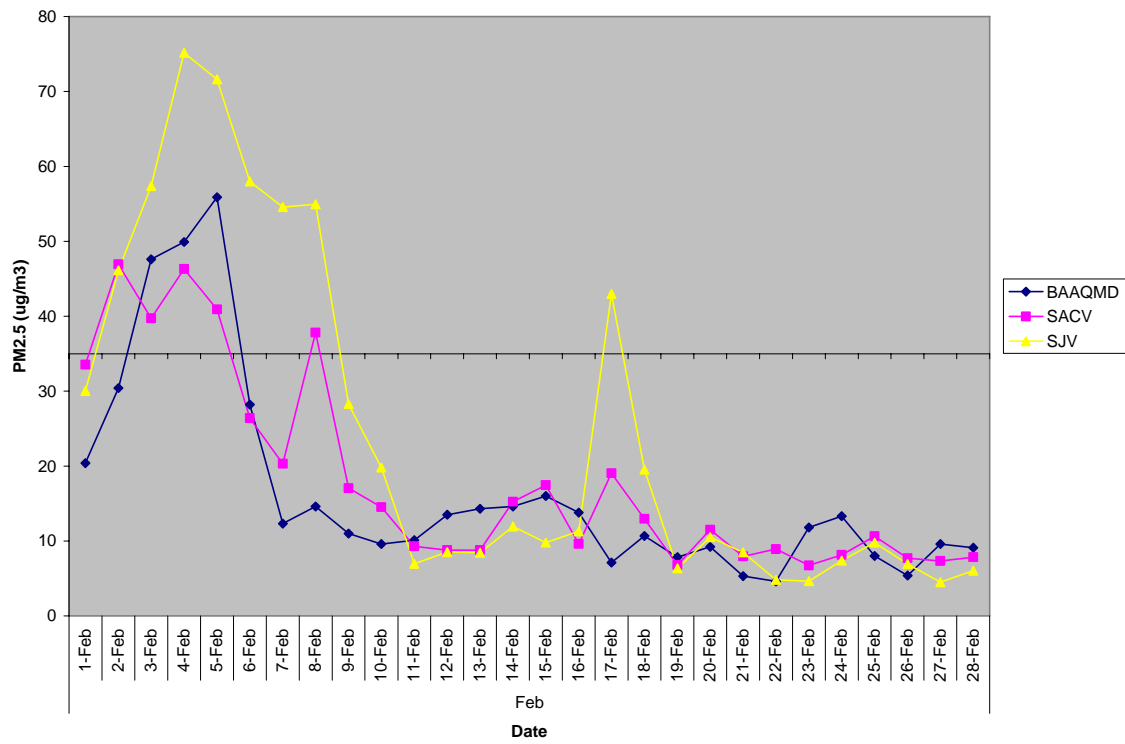


Figure 6. PM2.5 Concentration in February 2007

- BAAQMD stations:

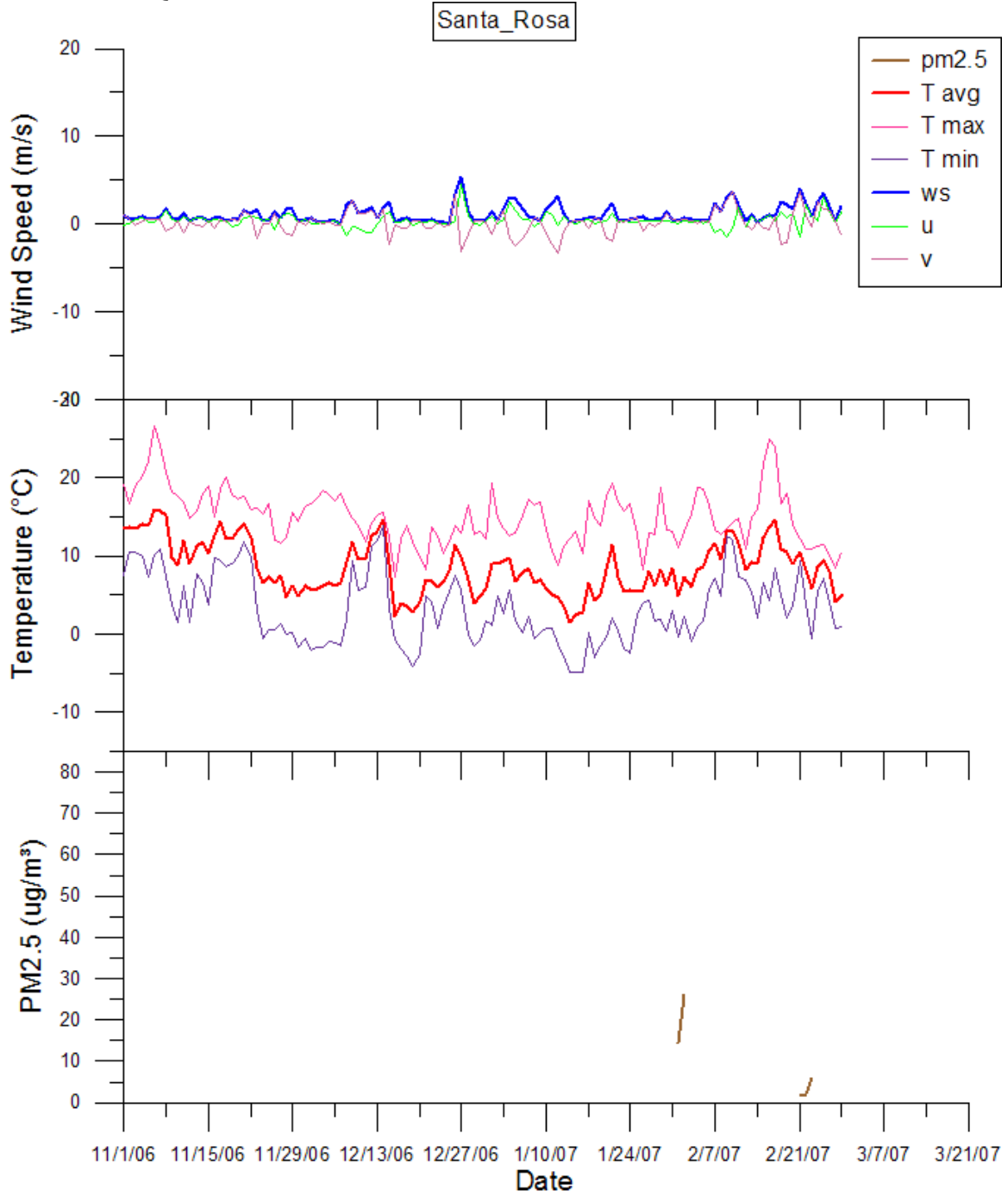
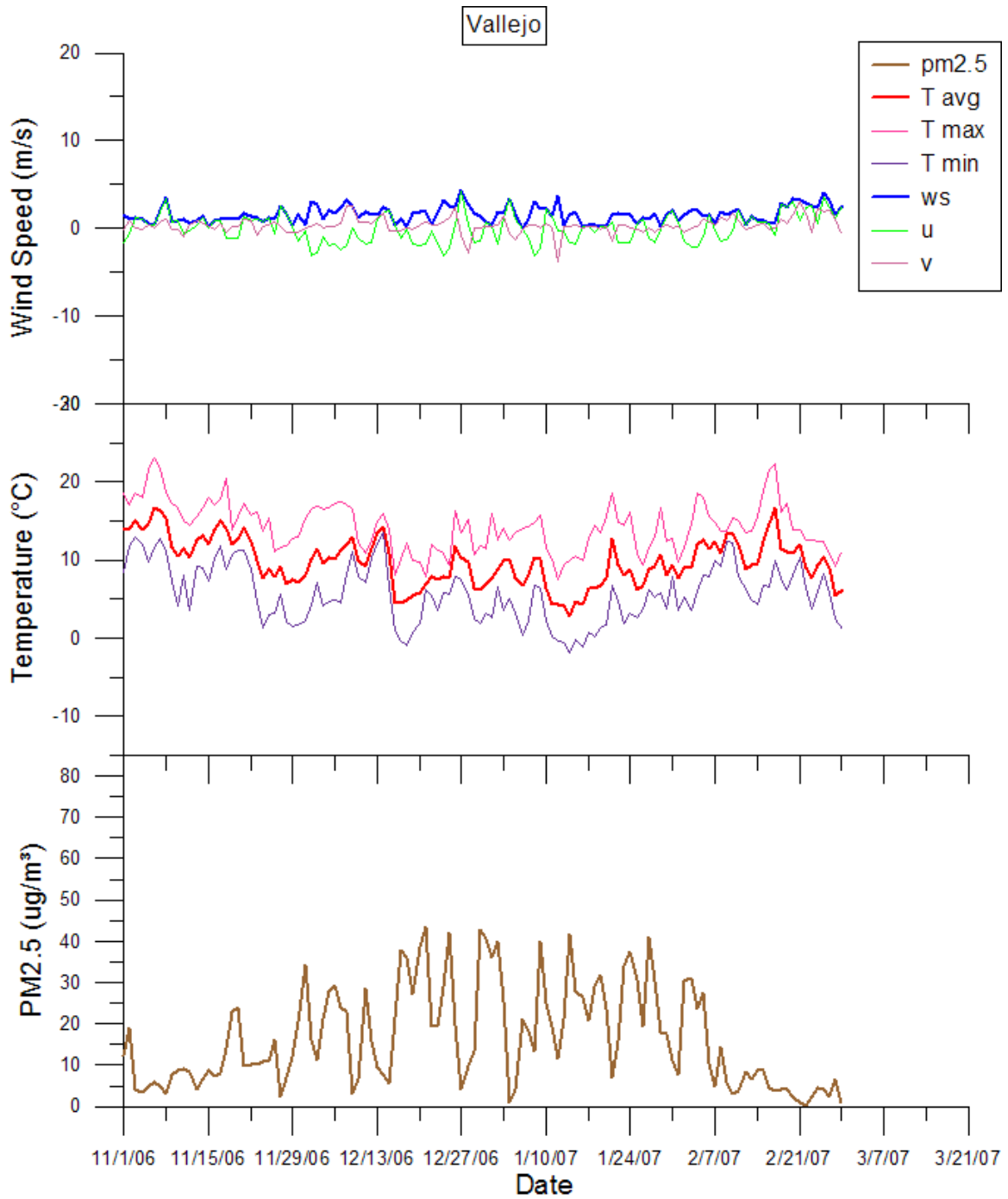


Figure 7. BAAQMD: Santa Rosa



**Figure 8. BAAQMD: Vallejo**

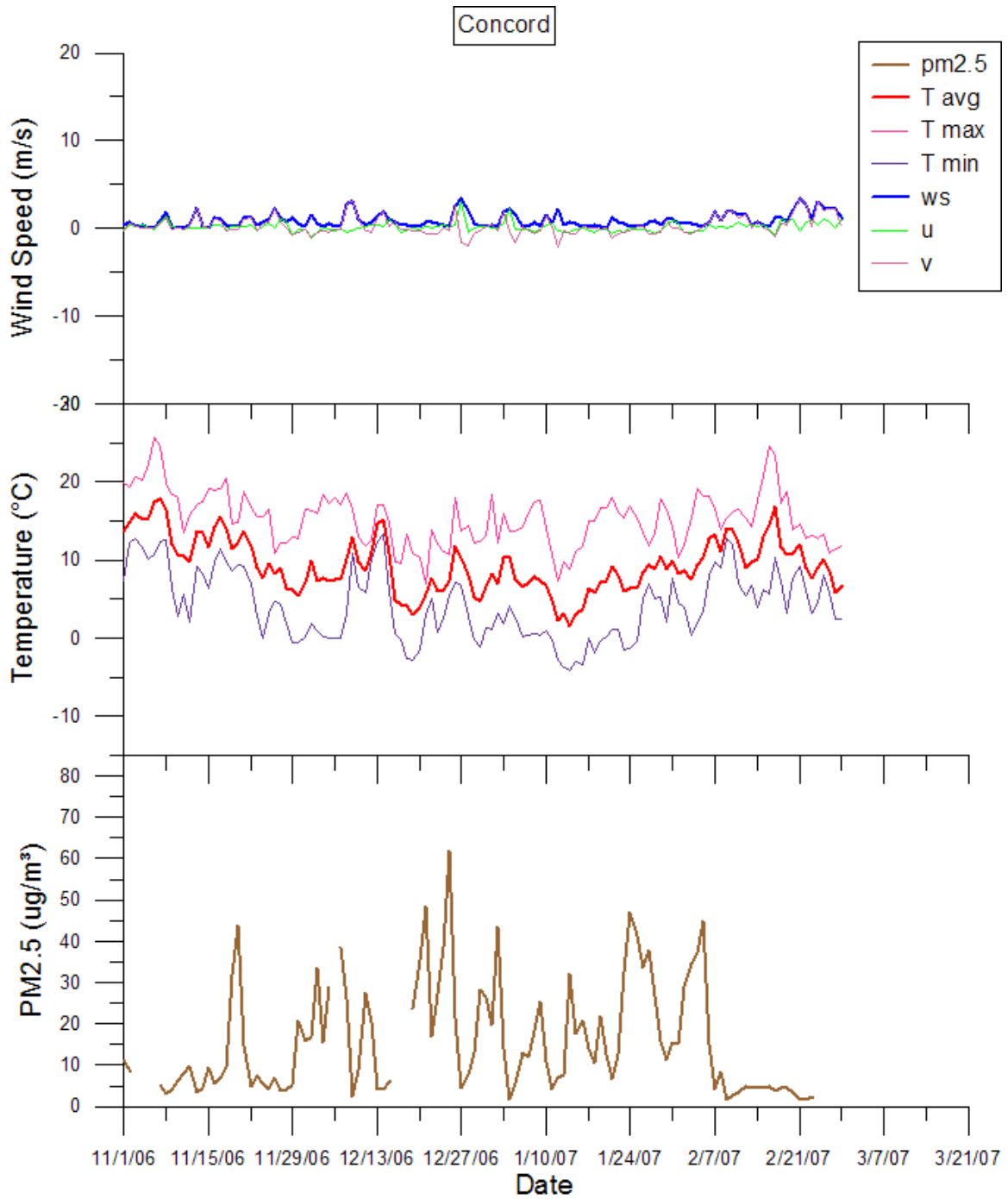


Figure 9. BAAQMD: Concord

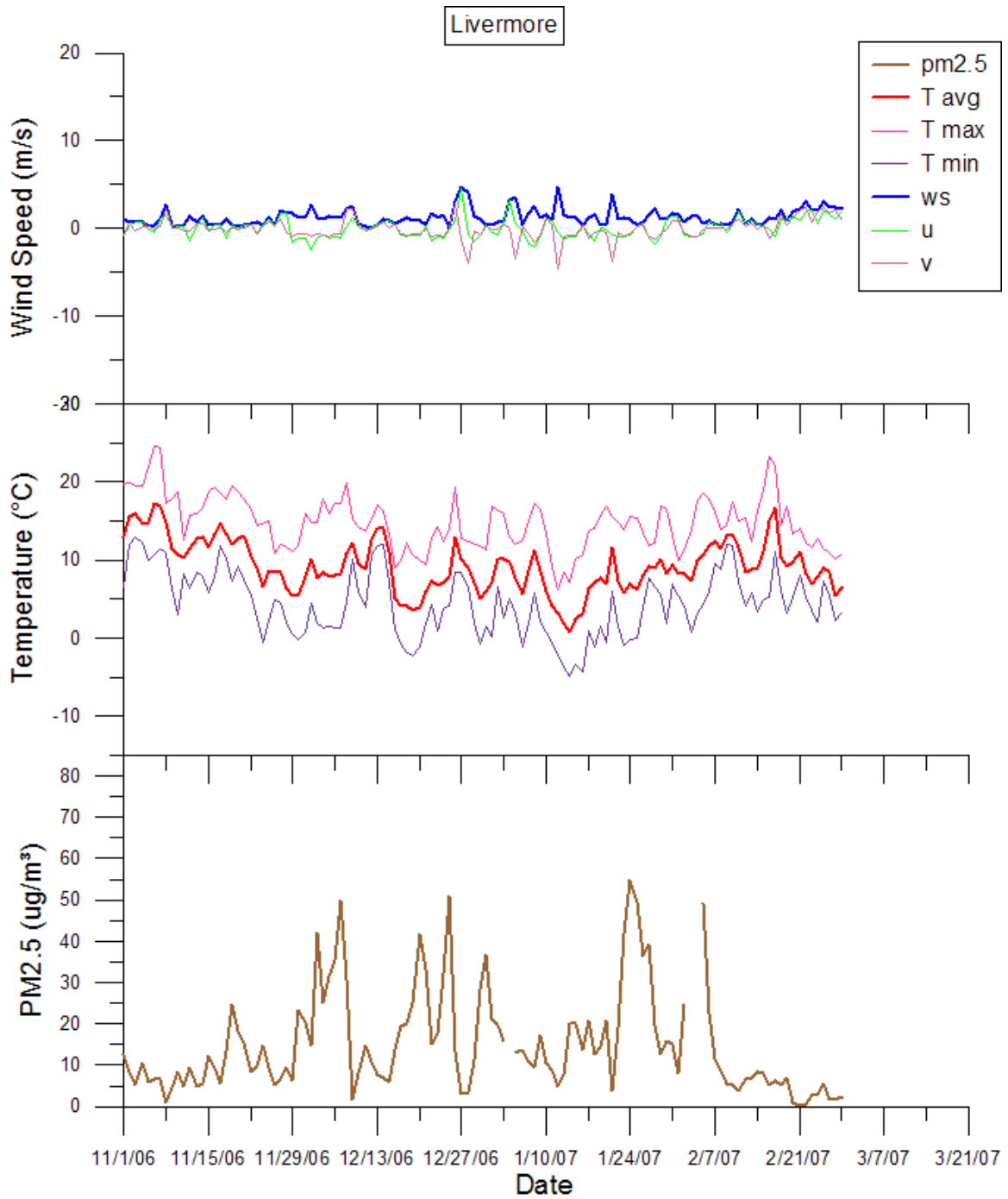


Figure 10. BAAQMD: Livermore

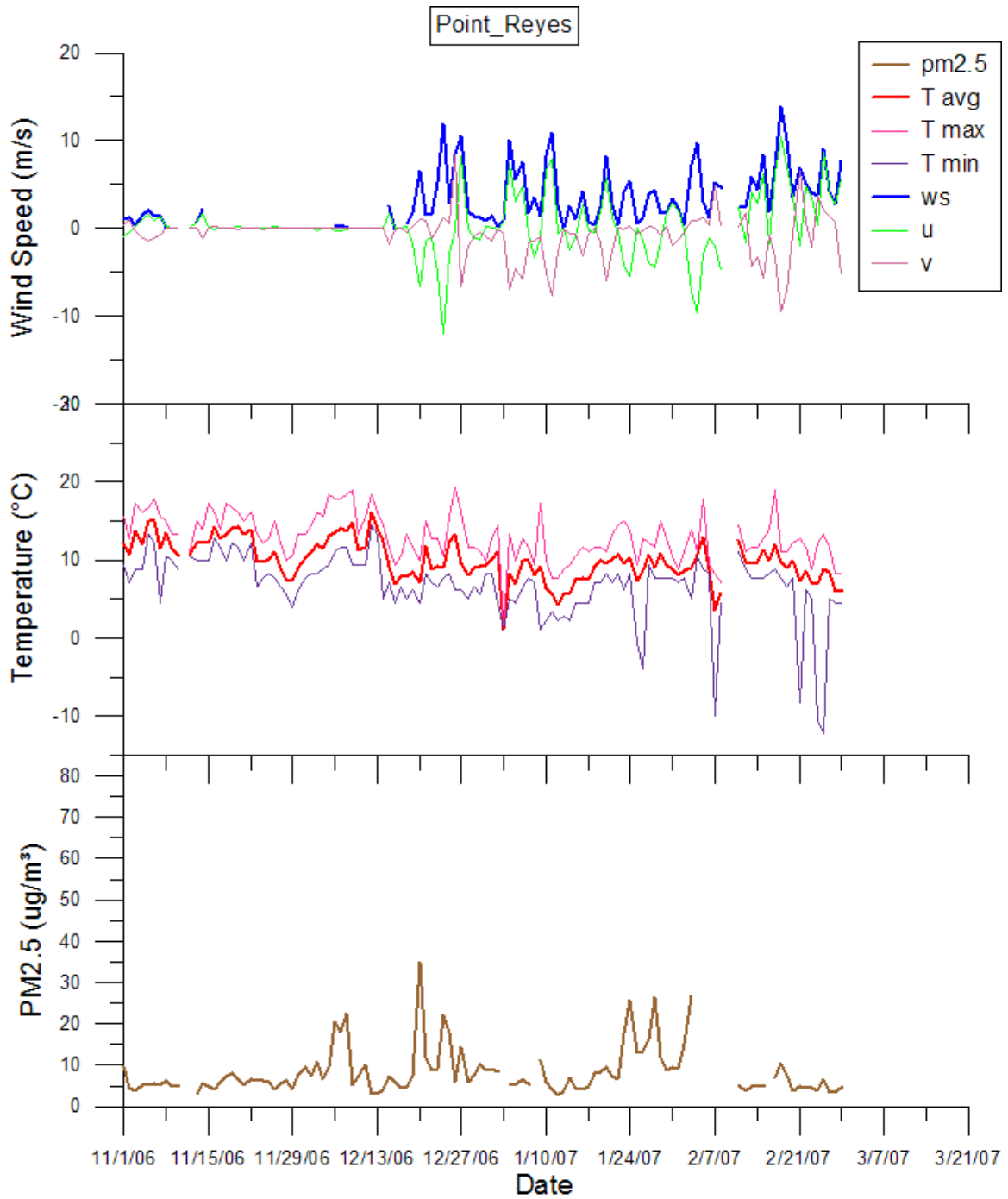


Figure 11. BAAQMD: Point Reyes

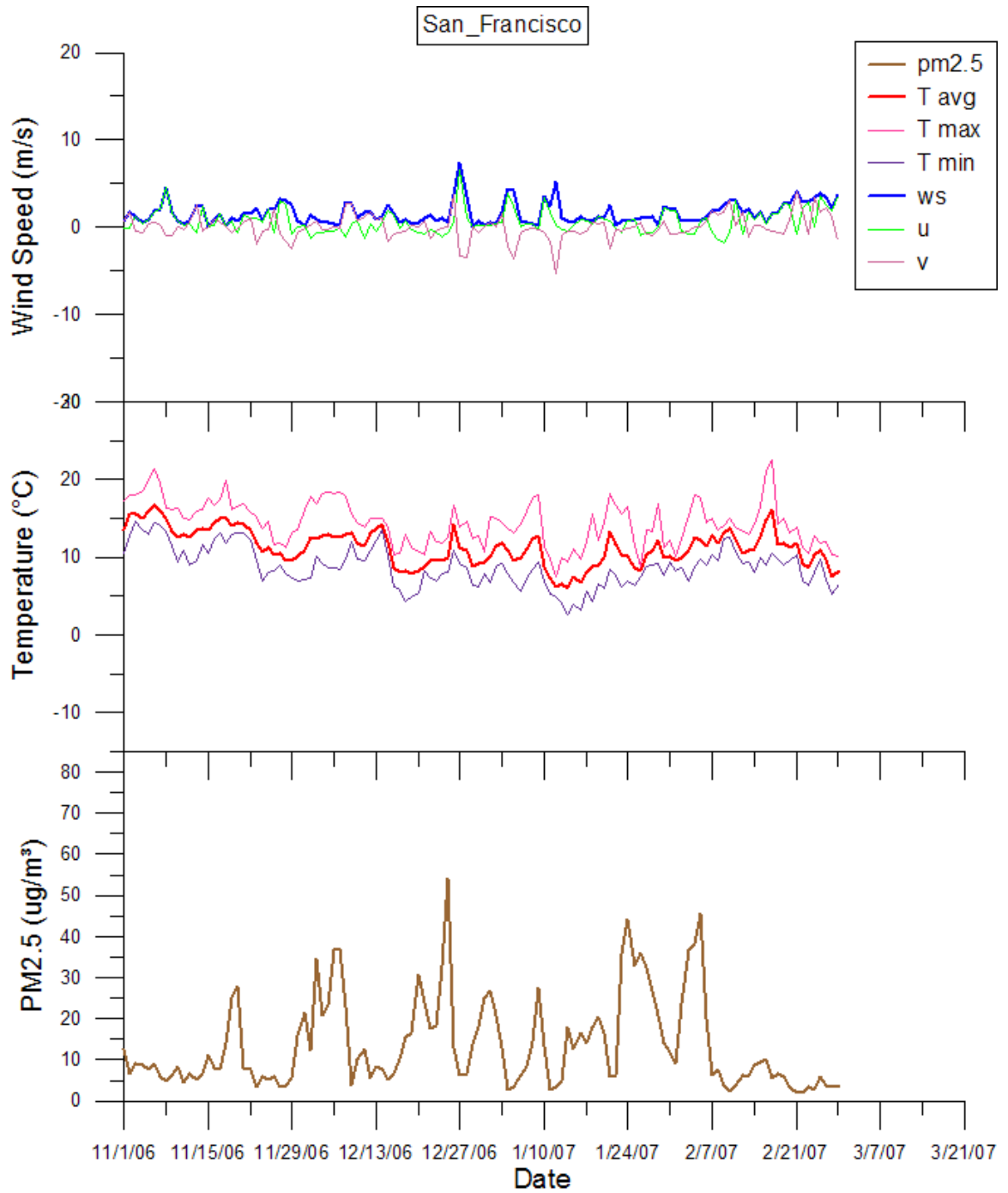


Figure 12. BAAQMD: San Francisco

▪ SACV Stations:

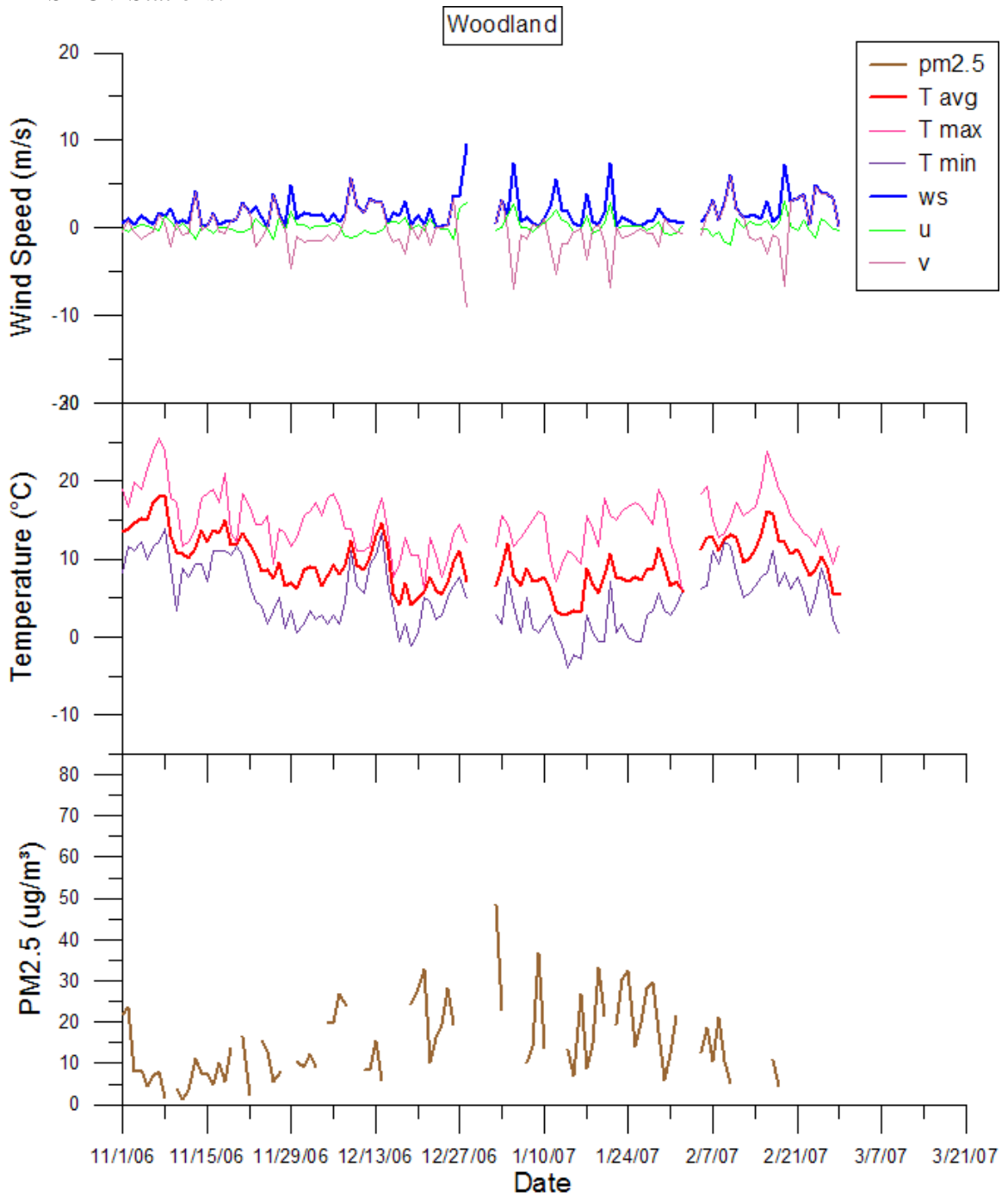


Figure 13. SACV: Woodland

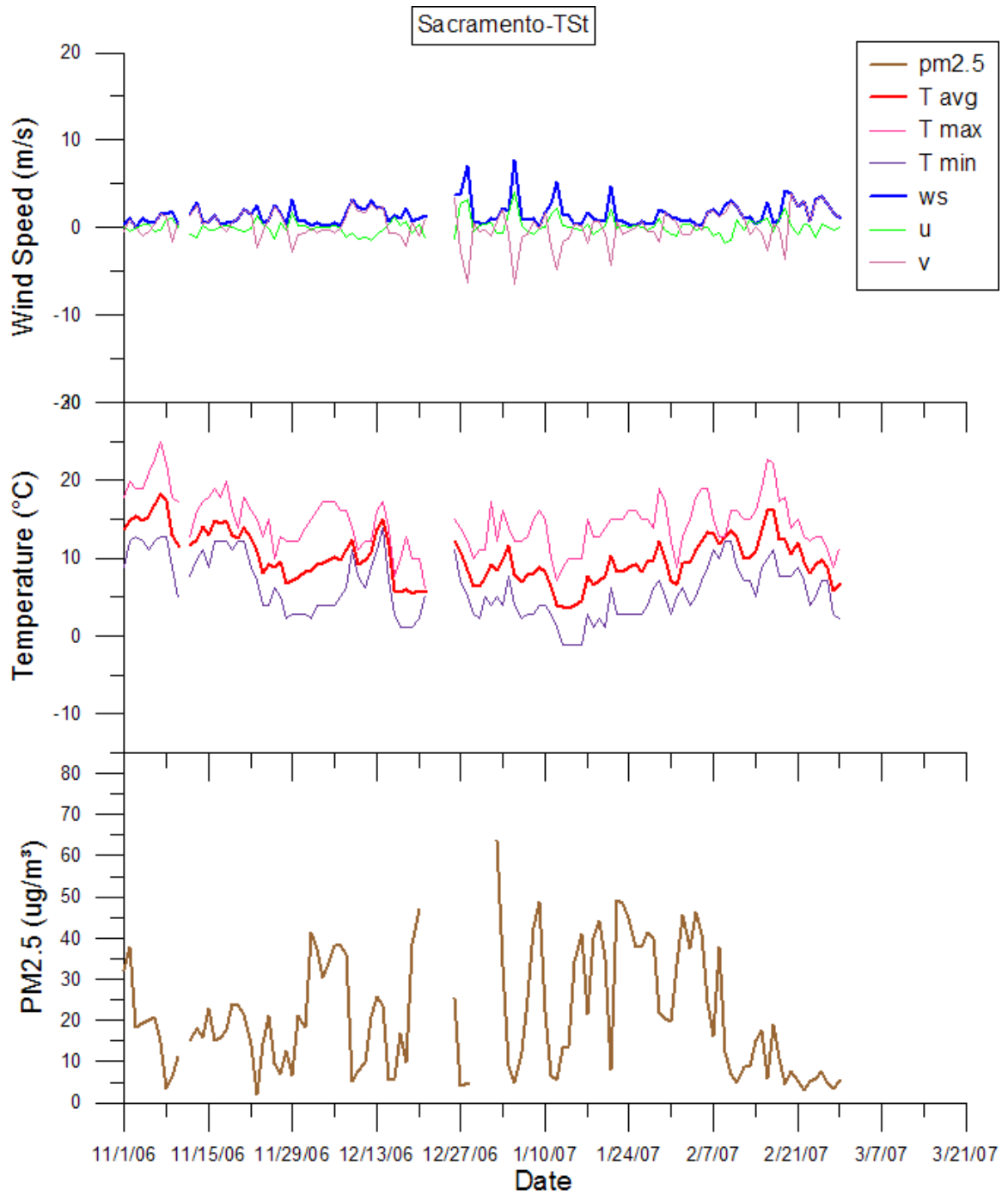


Figure 14. SACV: Sacramento

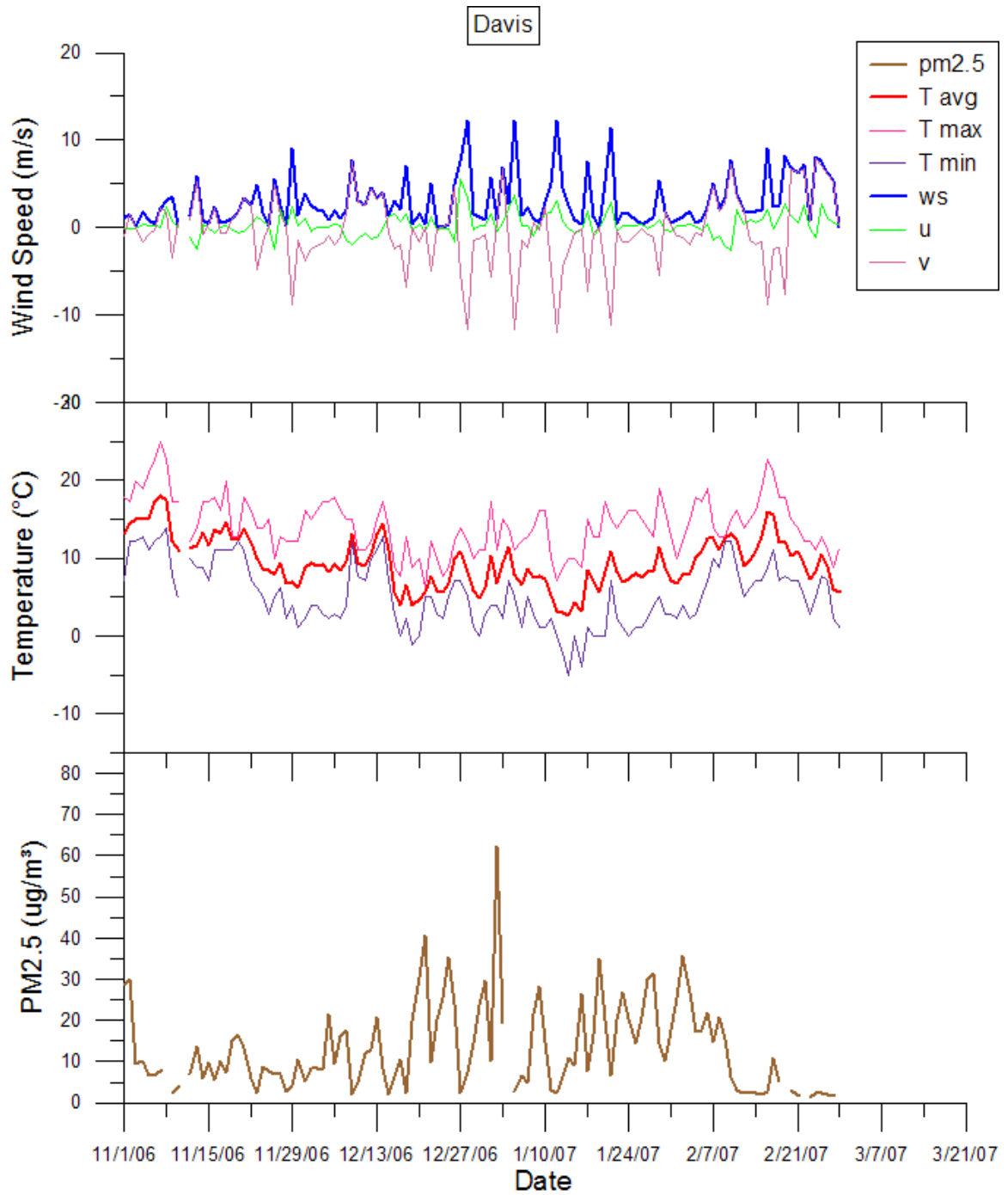


Figure 15. SACV: Davis

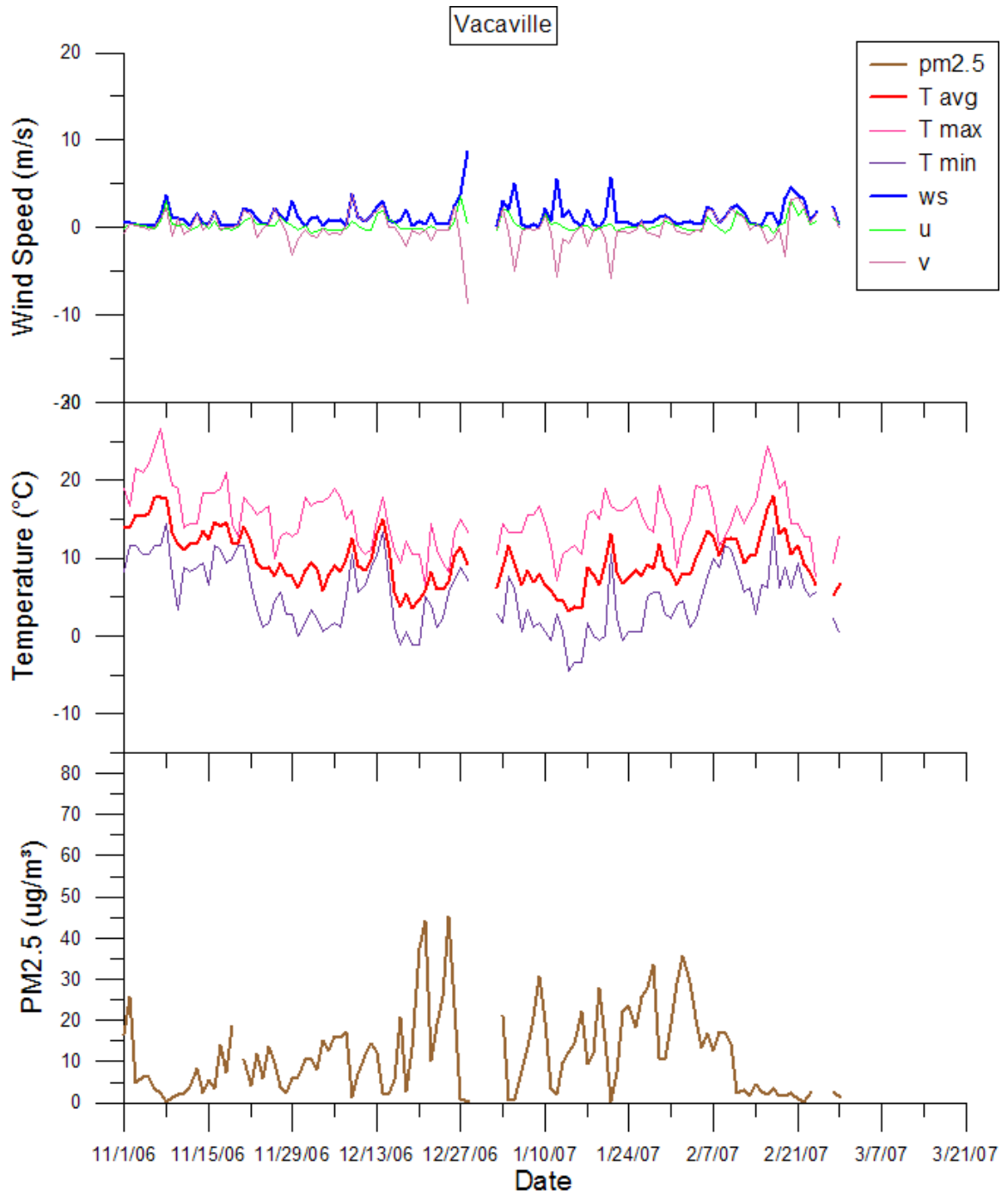


Figure 16. SACV: Vacaville

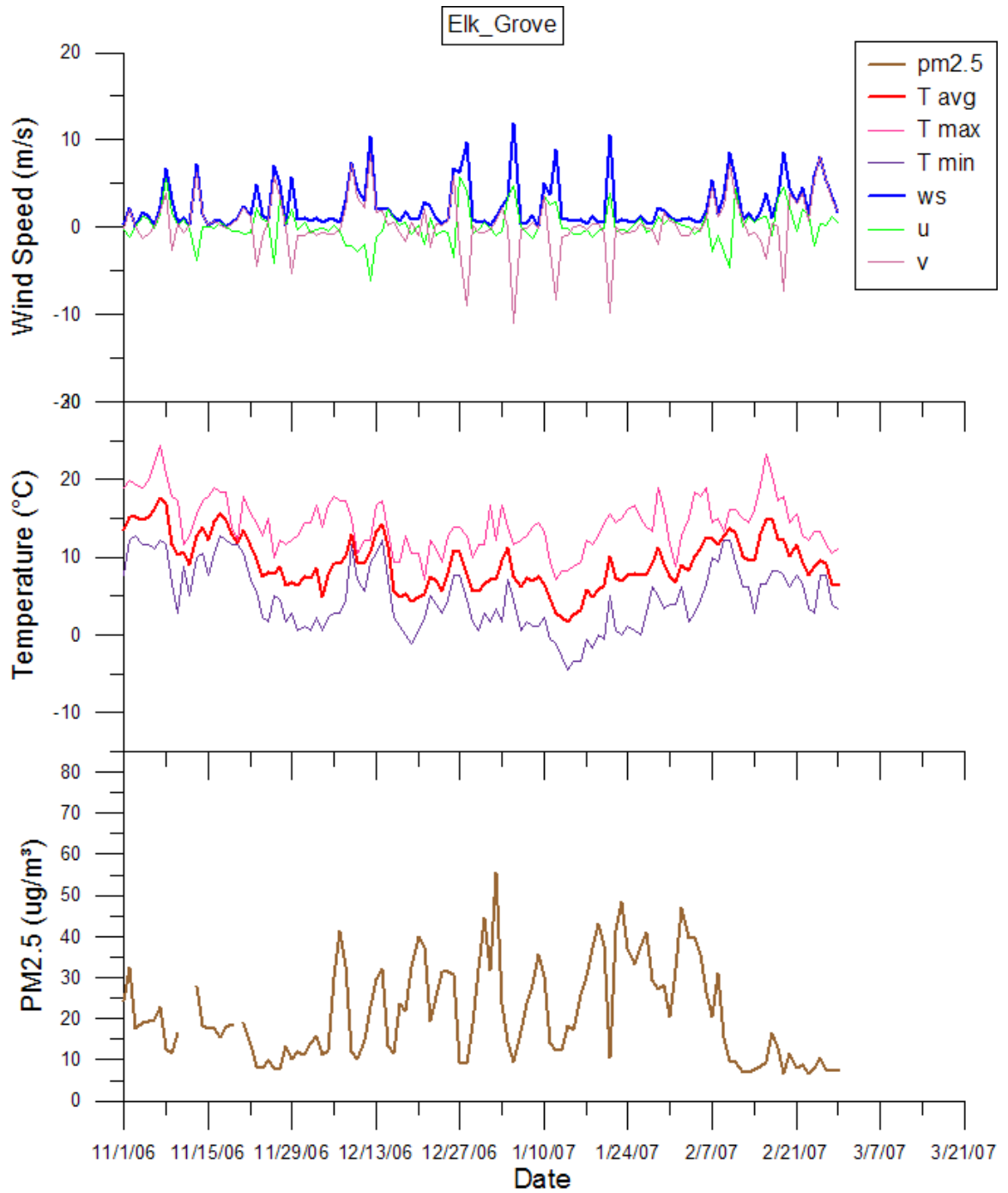


Figure 17. SACV: Elk Grove

▪ SJV Stations:

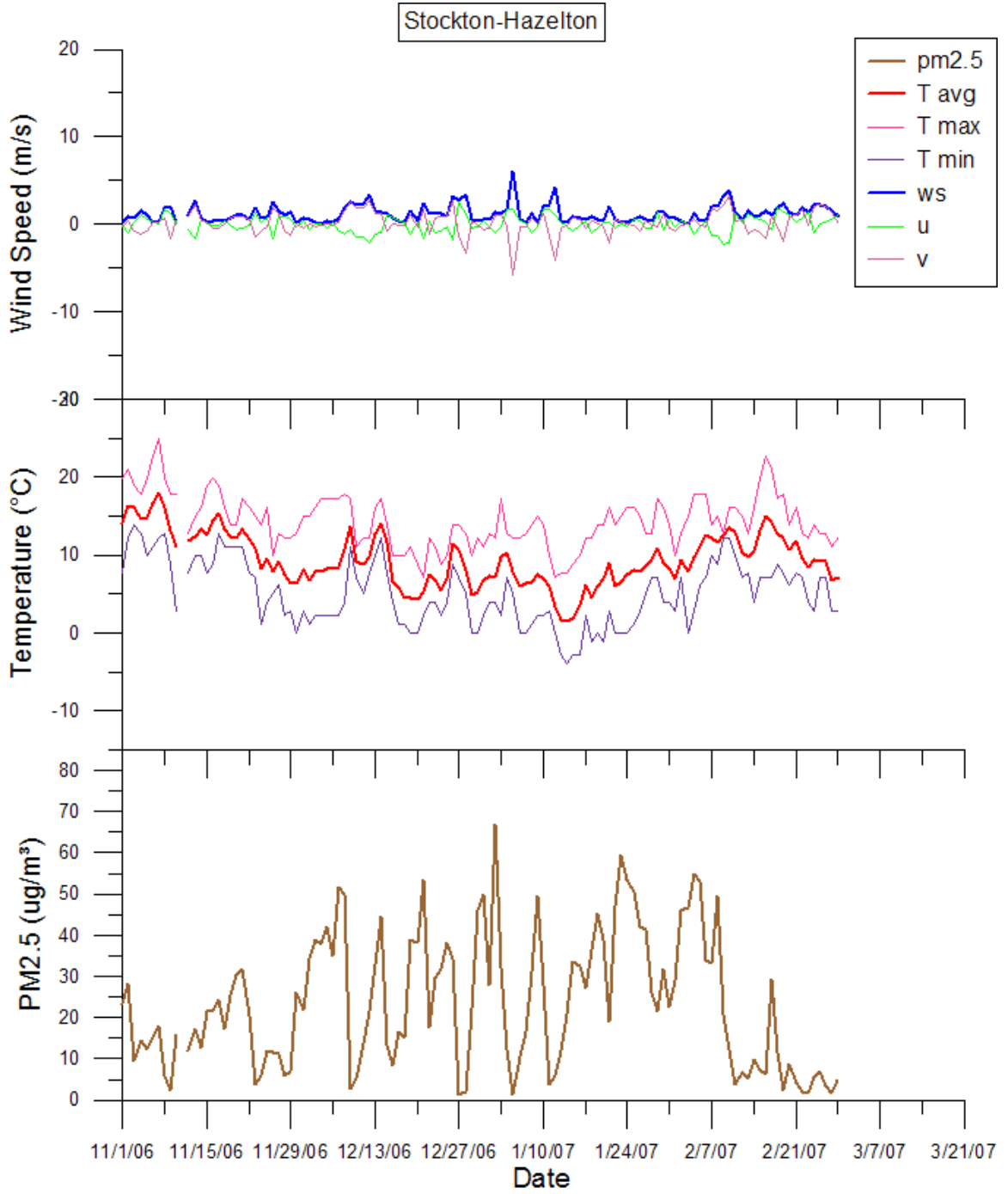


Figure 18. SJV: Stockton

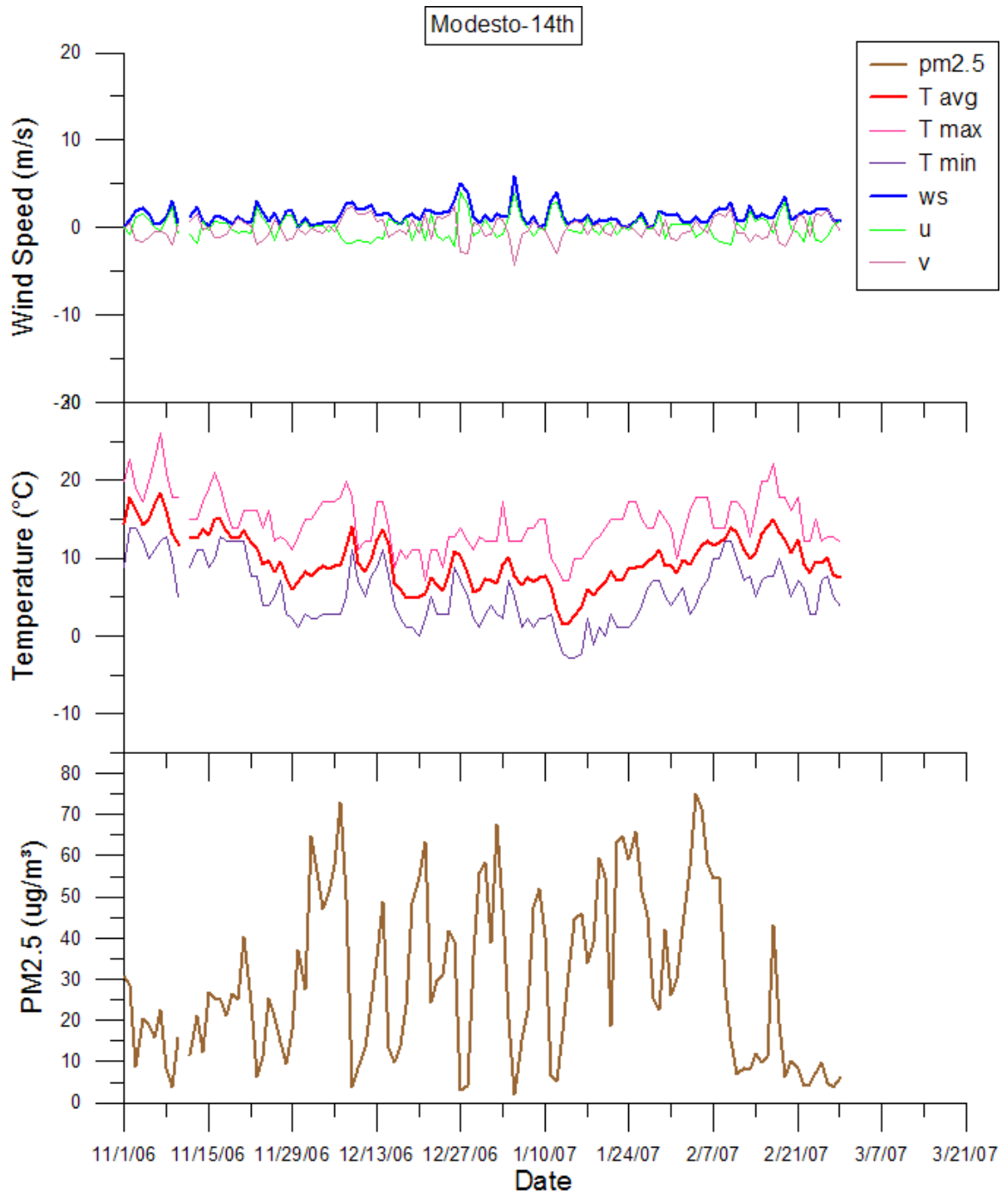


Figure 19. SJV: Modesto

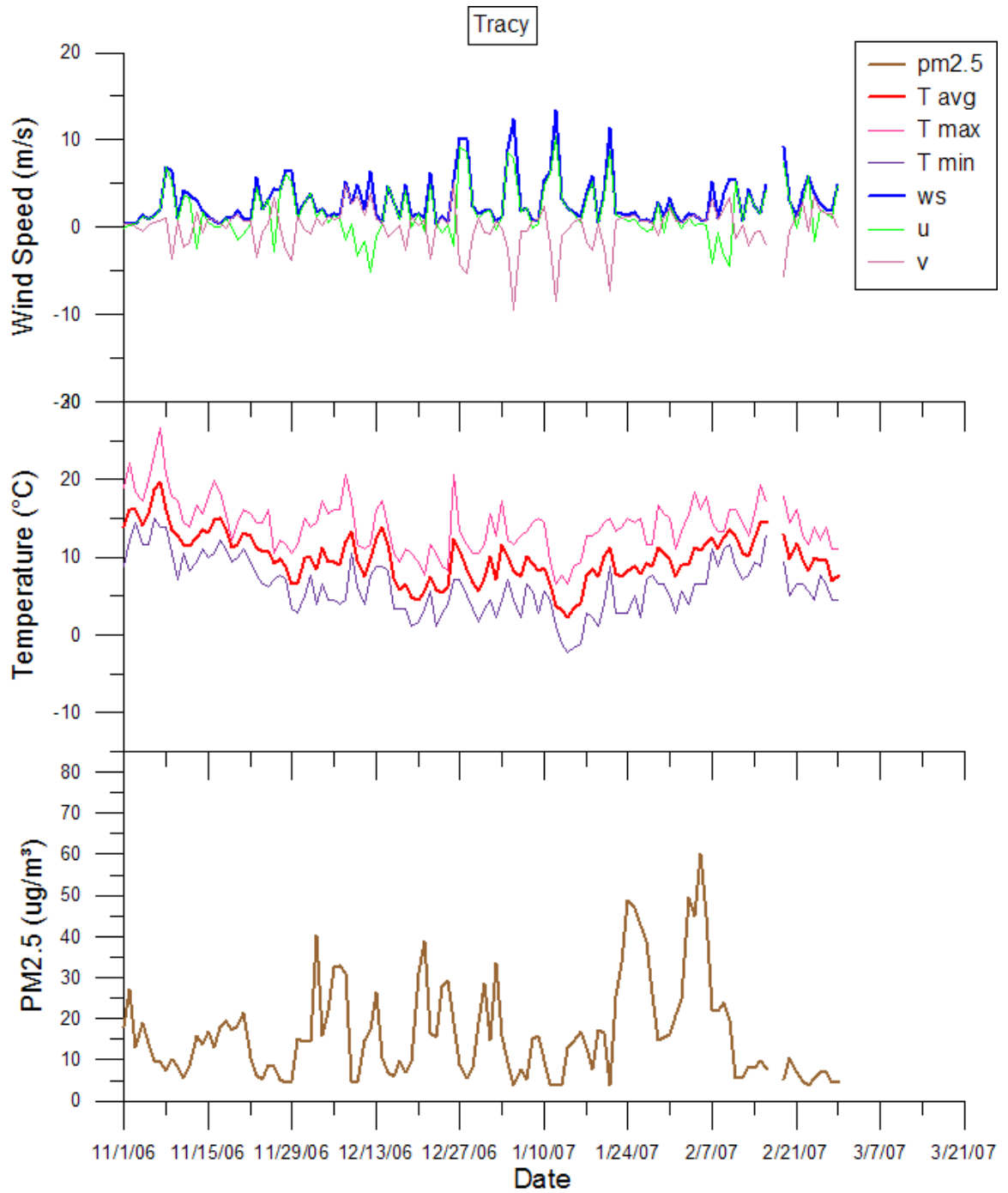


Figure 20. SJV: Tracy

# PM<sub>2.5</sub> concentration and wind directions

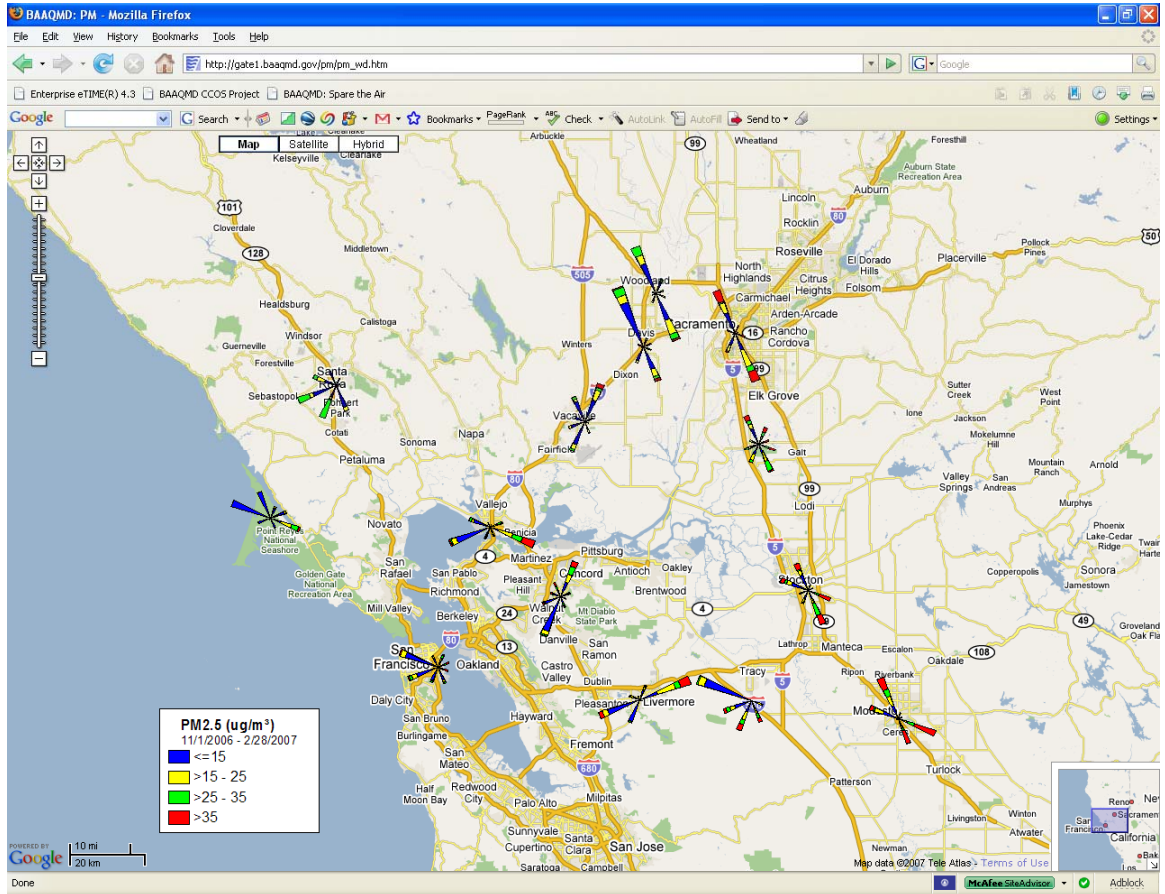
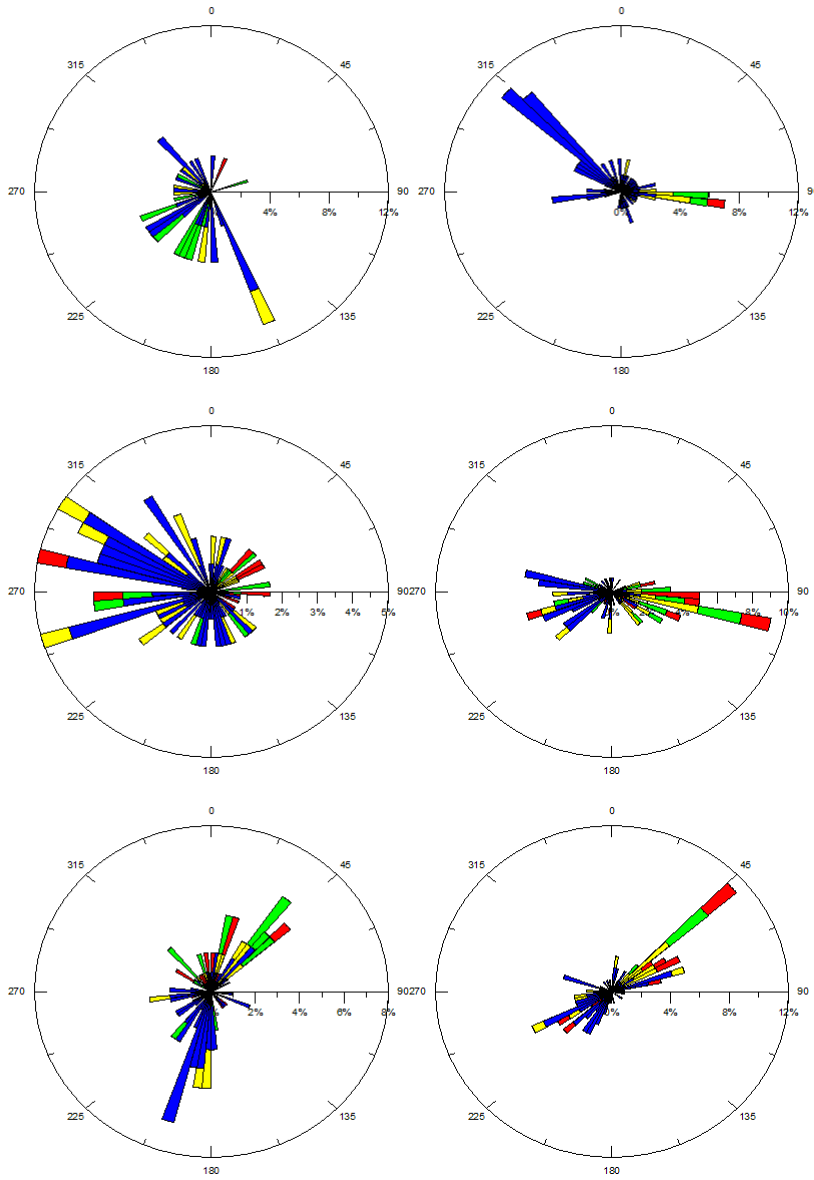
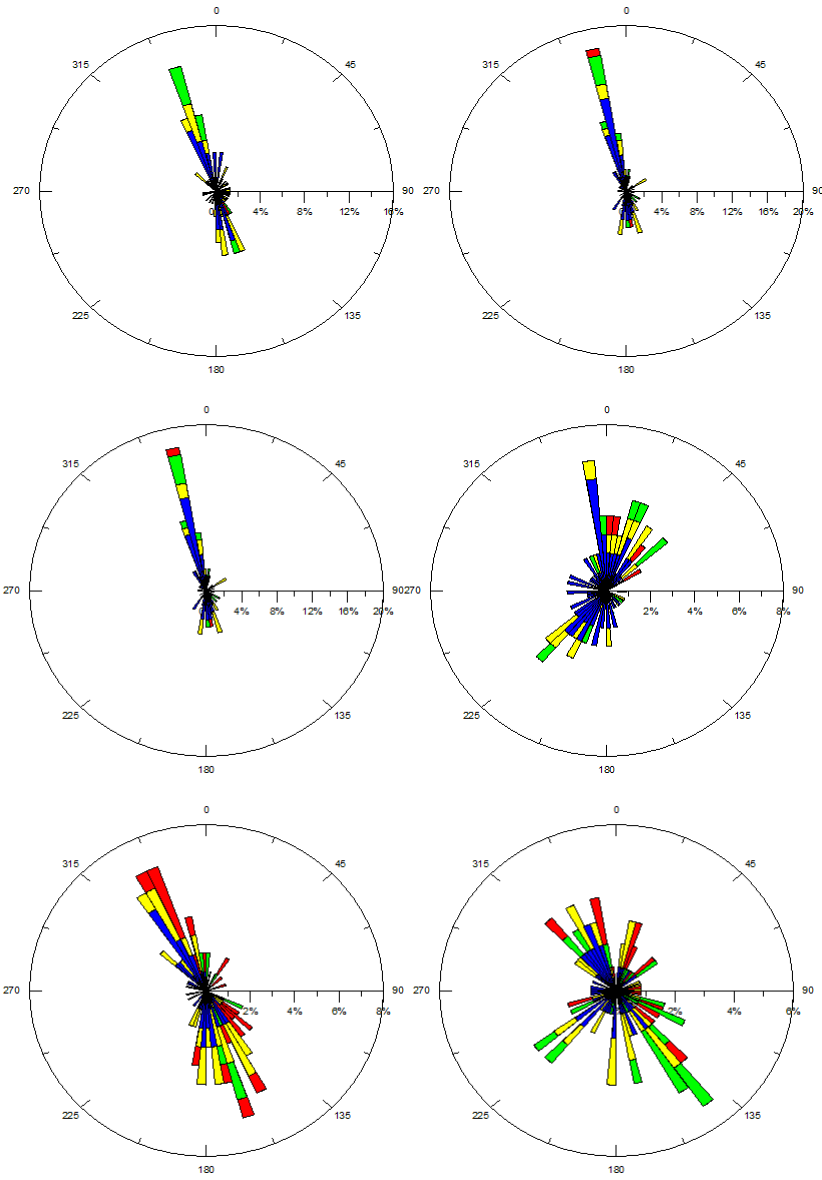


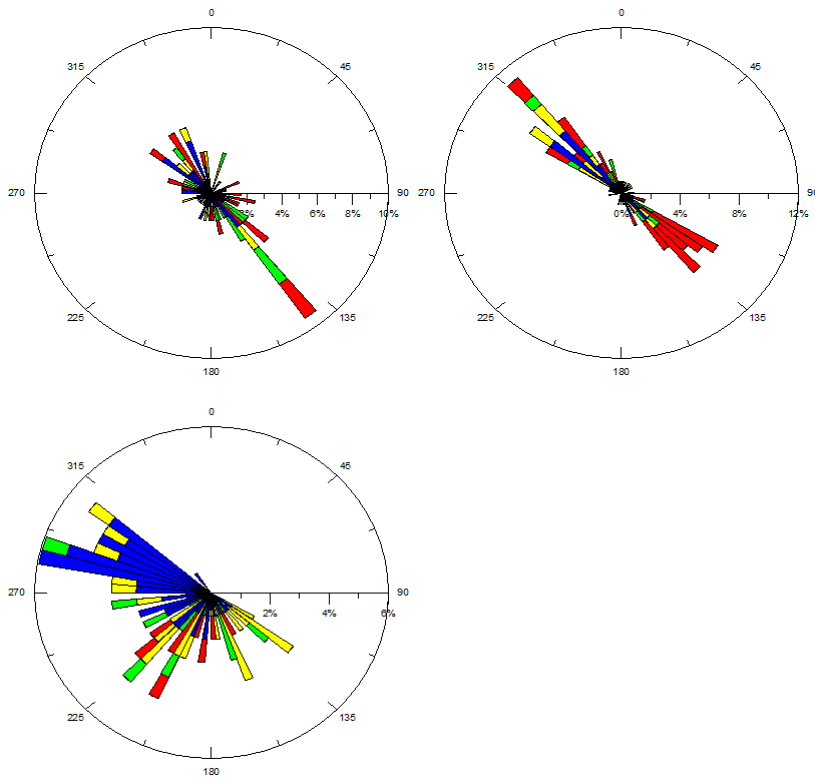
Figure 21. PM<sub>2.5</sub> and Wind Directions



**Figure 22. PM<sub>2.5</sub> and Wind Directions: Santa Rosa, Point Reyes, San Francisco, Vallejo, Concord, and Livermore**



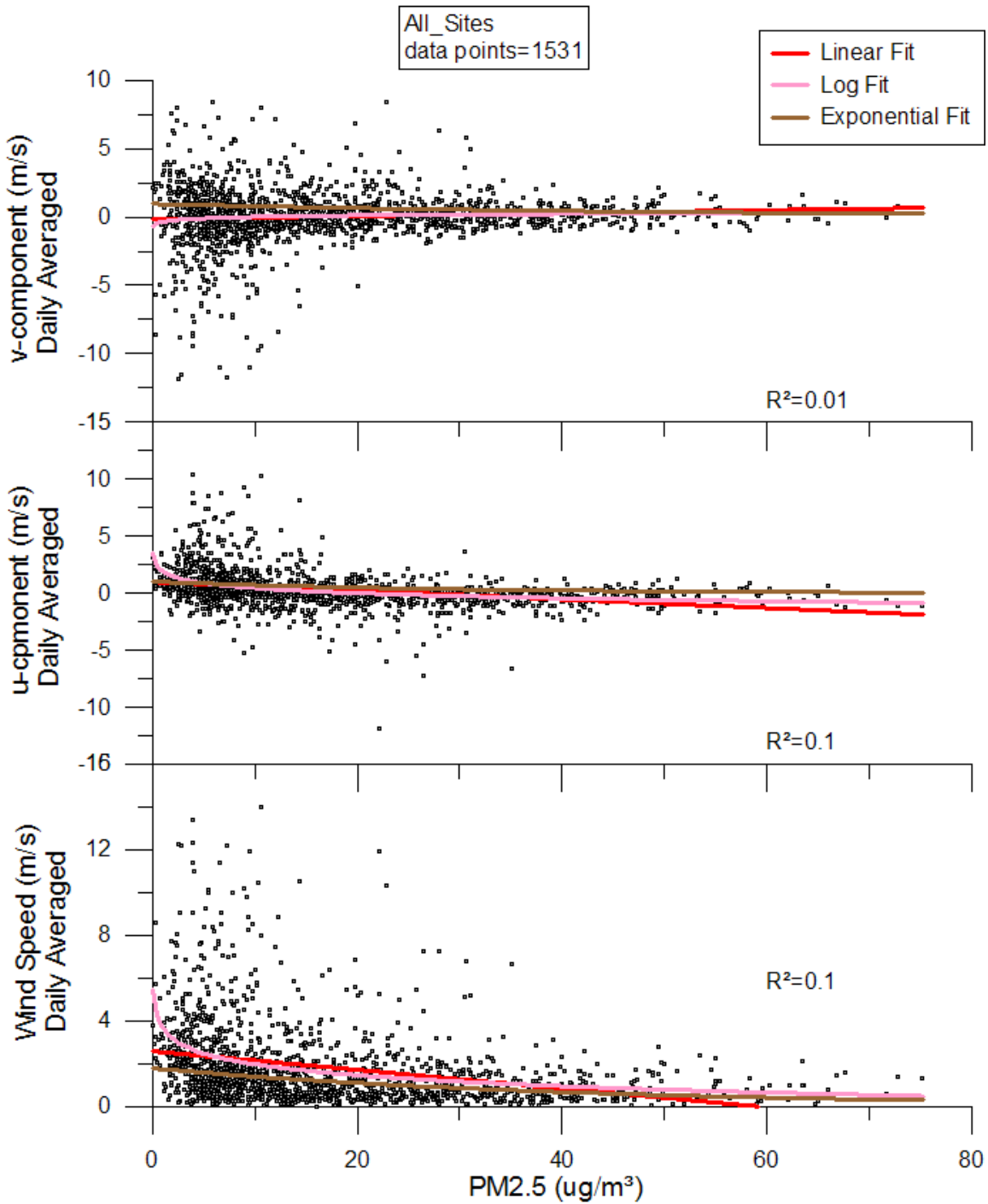
**Figure 23. PM<sub>2.5</sub> and Wind Directions: Woodland, Davis, Vacaville, Sacramento, El Grove**



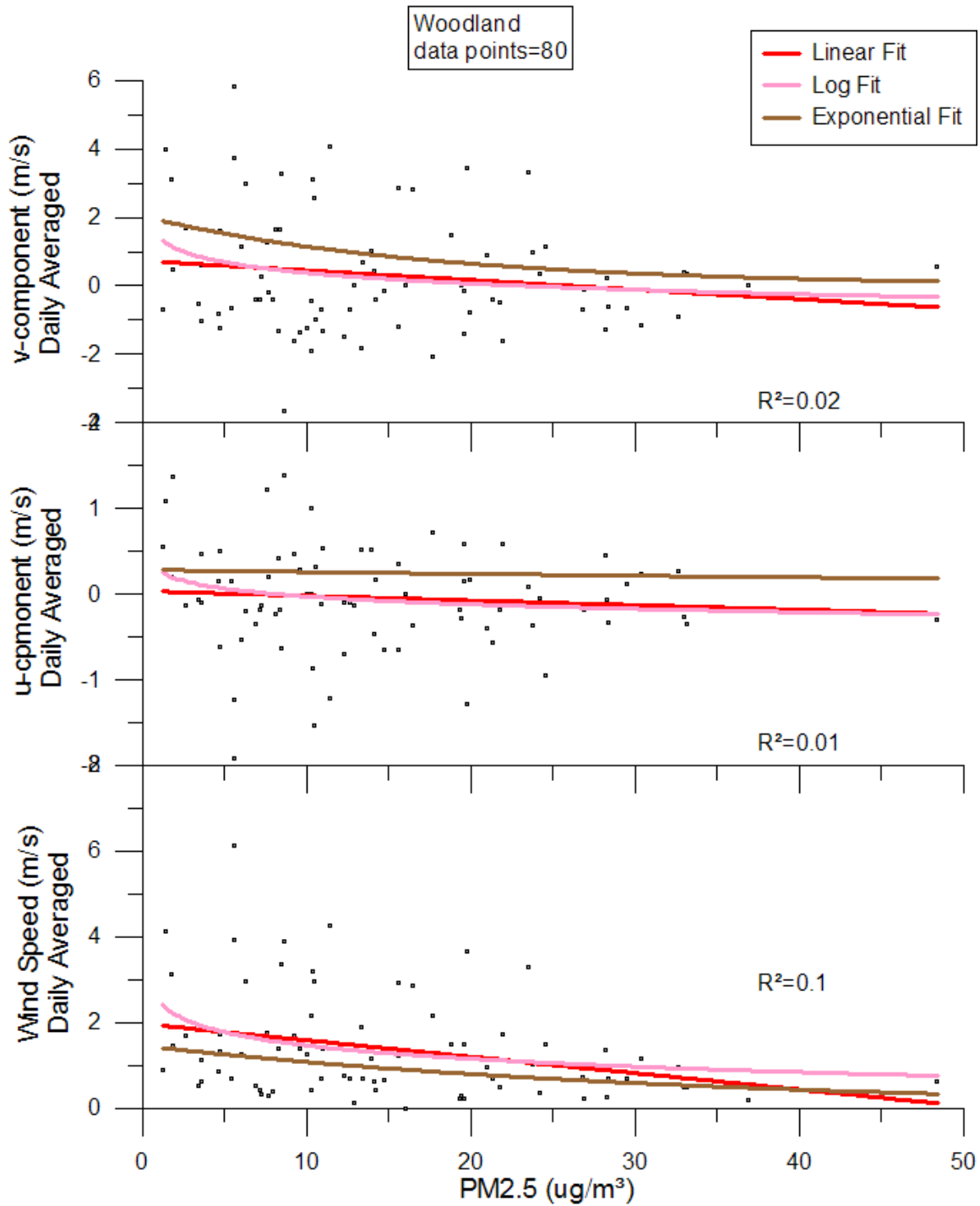
**Figure 24. PM<sub>2.5</sub> and Wind Directions: Stockton, Modesto, Tracy**

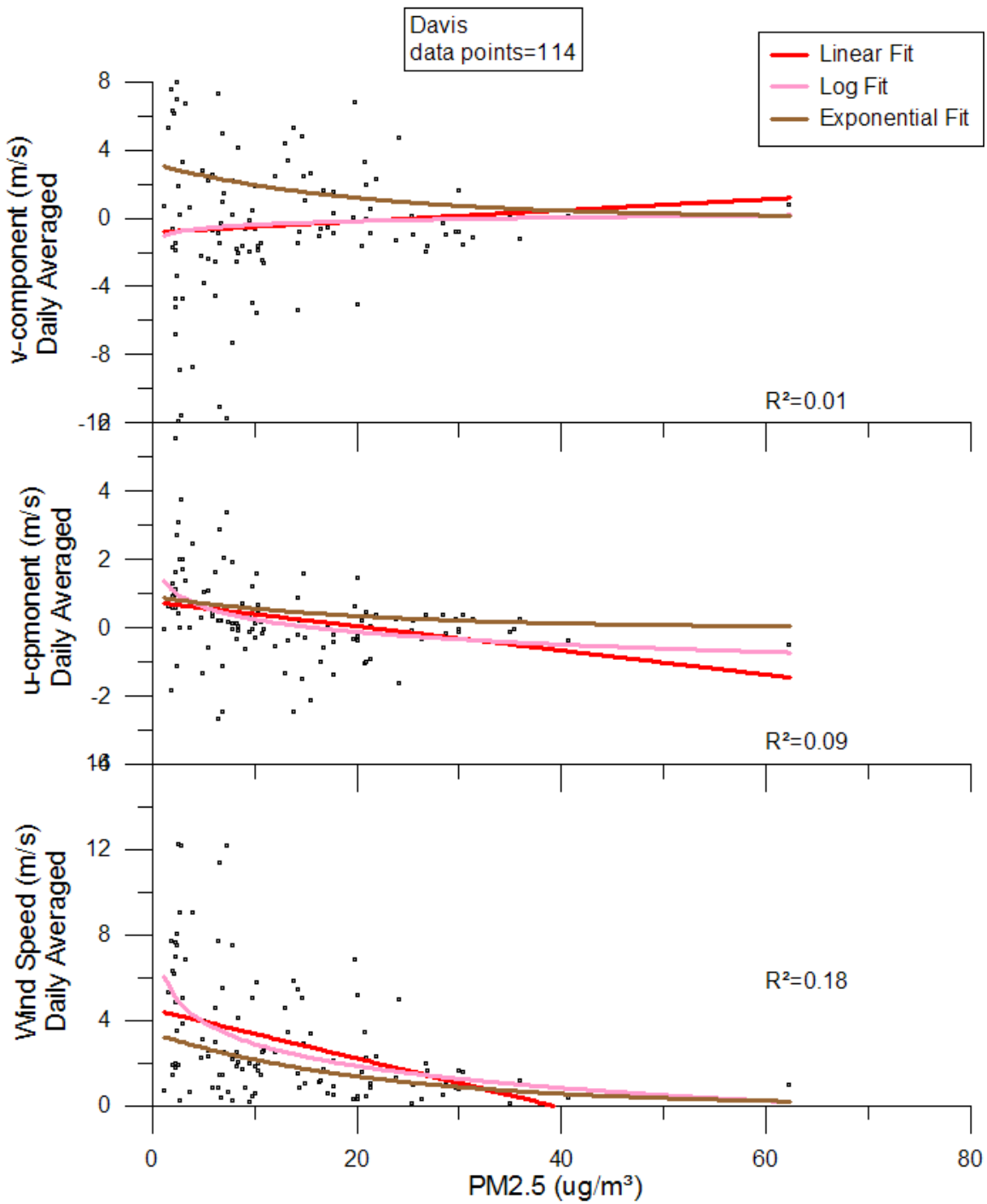
## PM<sub>2.5</sub> concentration and wind speed:

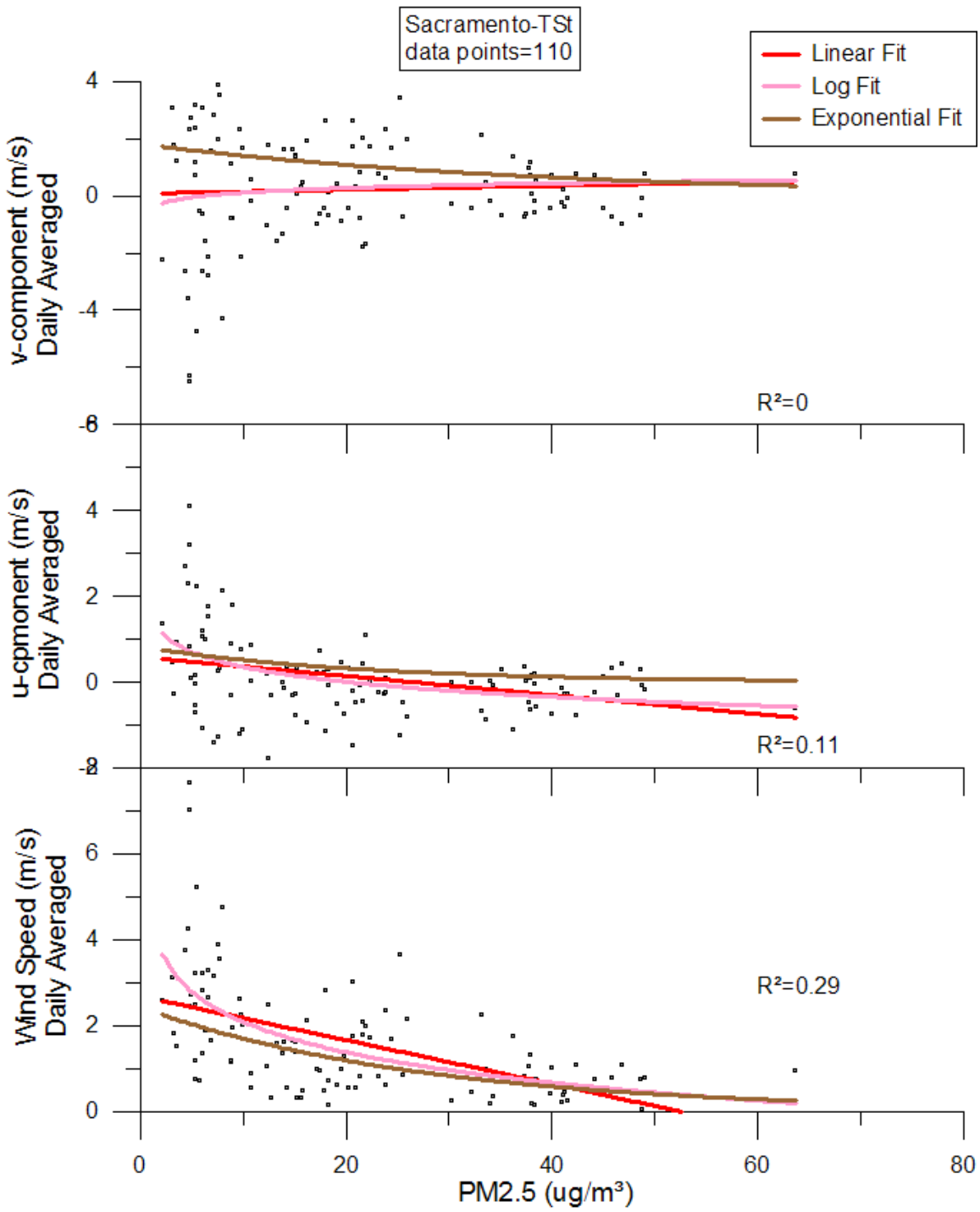
No significant correlation has been found between PM<sub>2.5</sub> and wind speed for all and each individual station during this winter season.

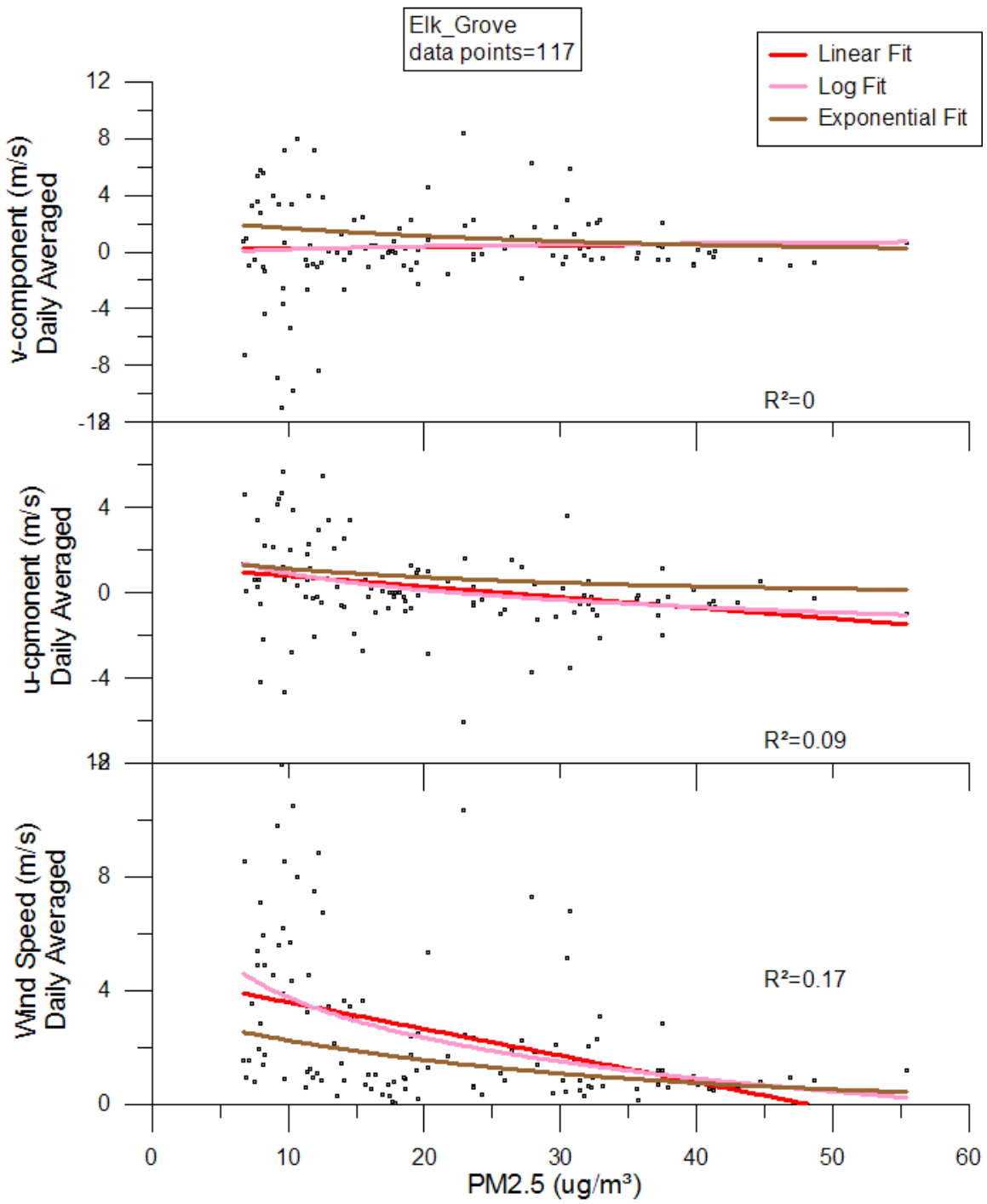


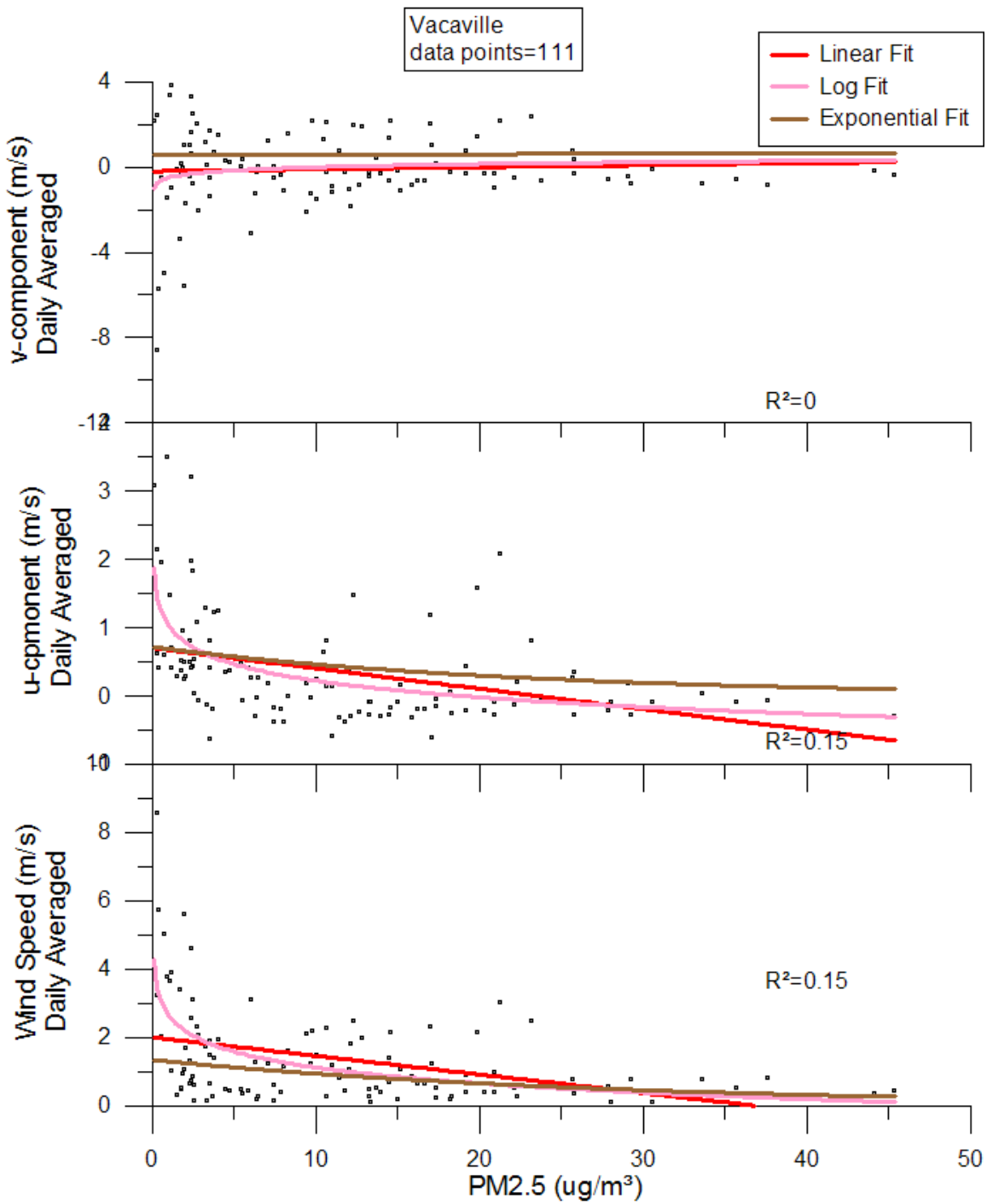
SACV stations:



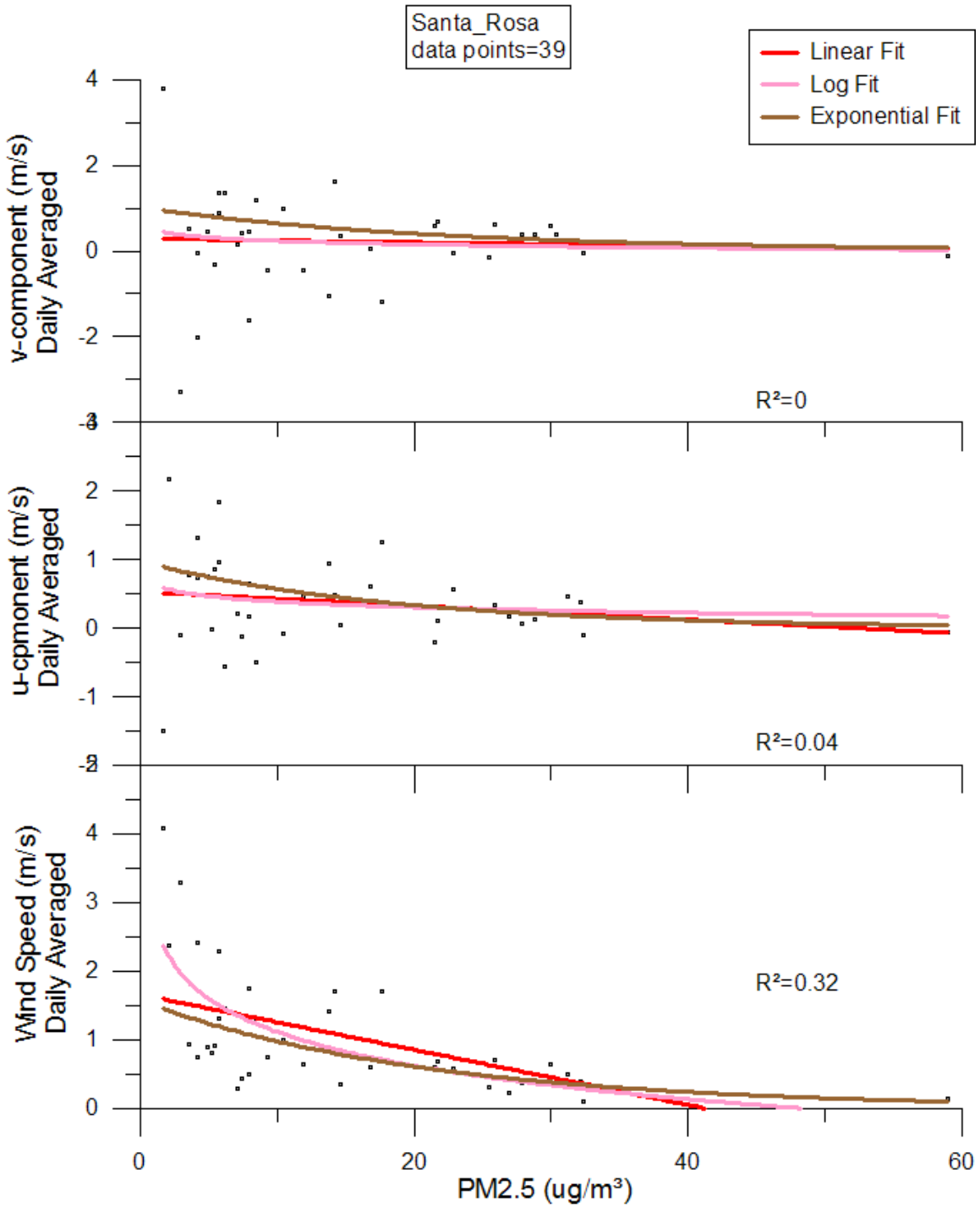


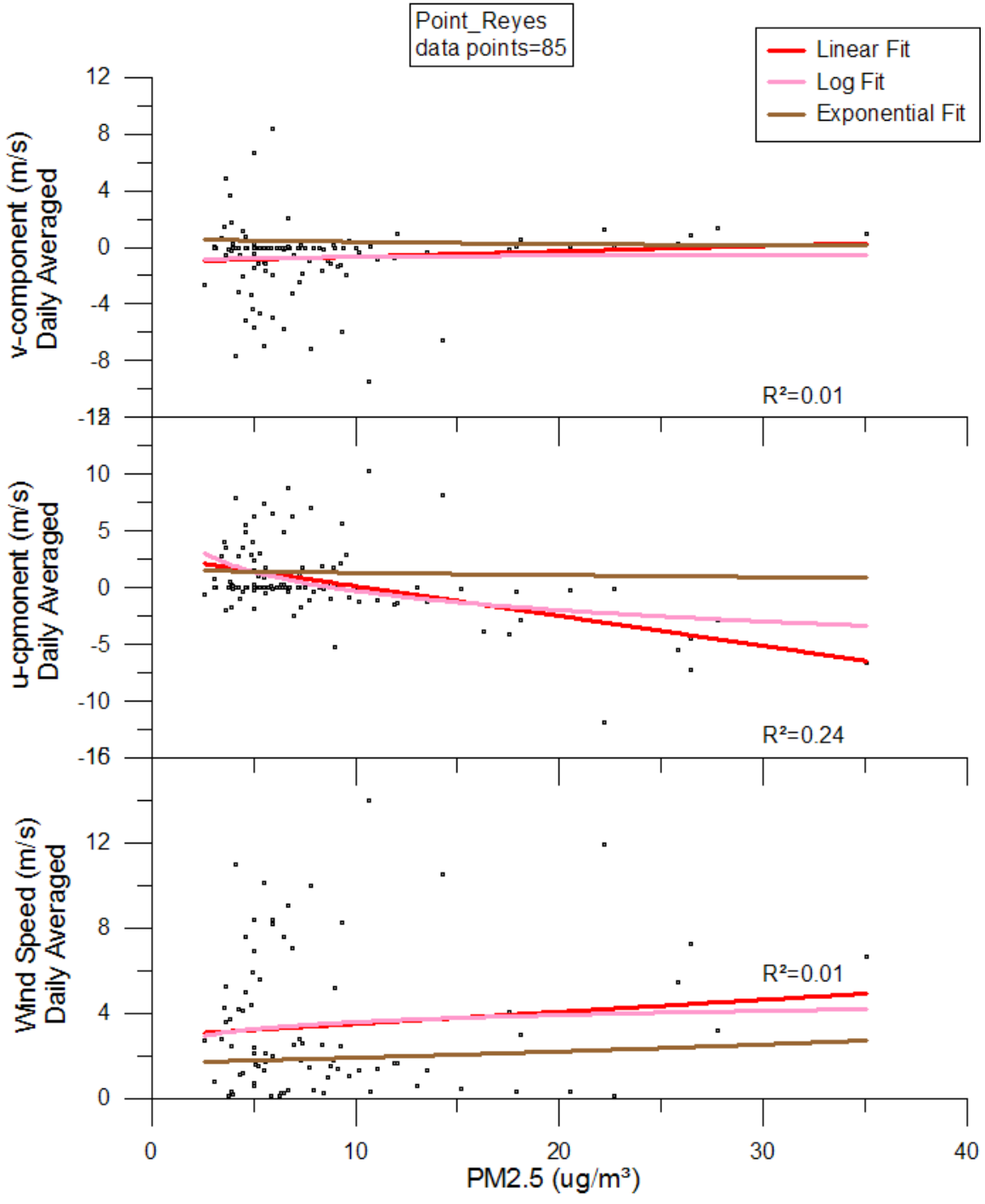


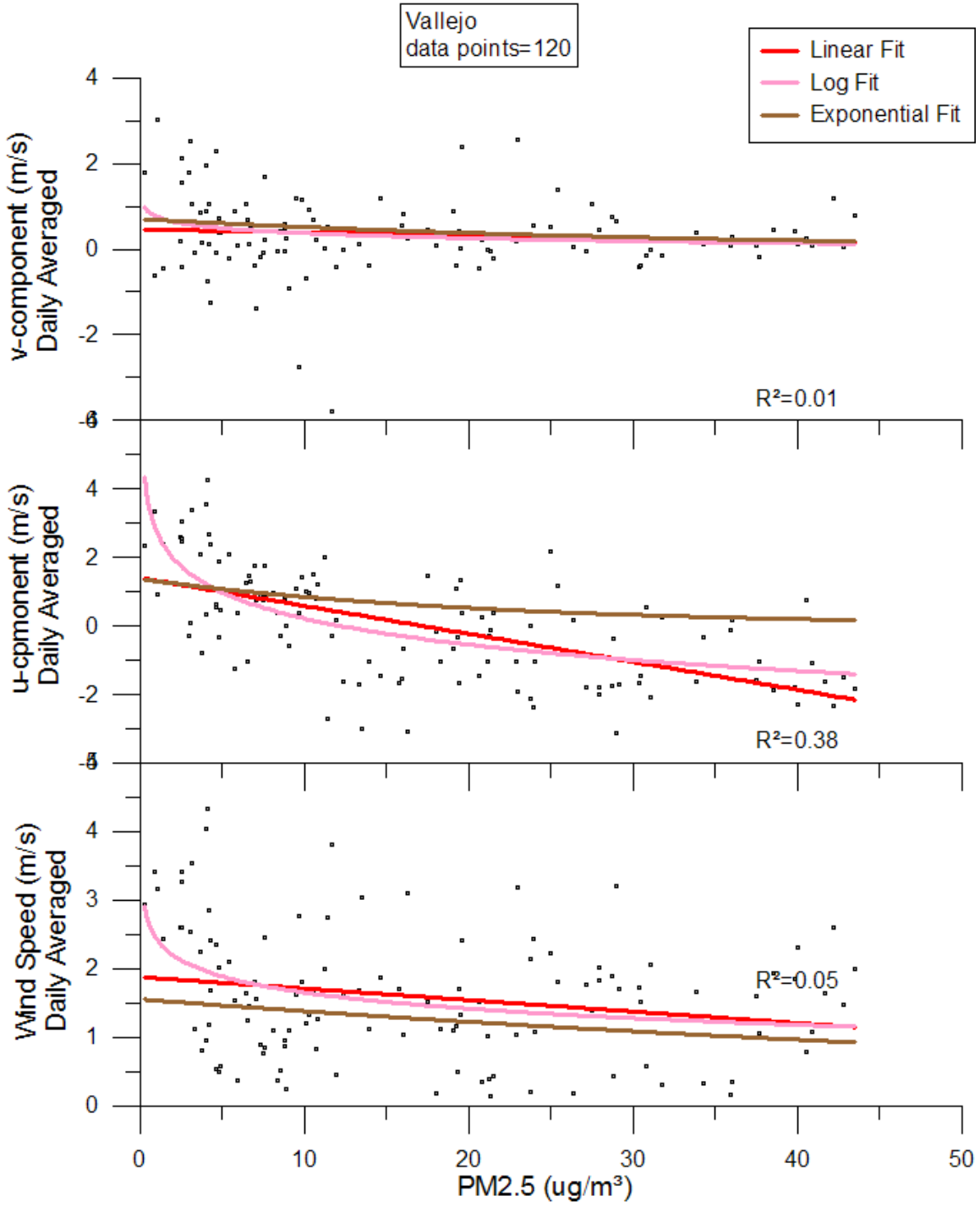


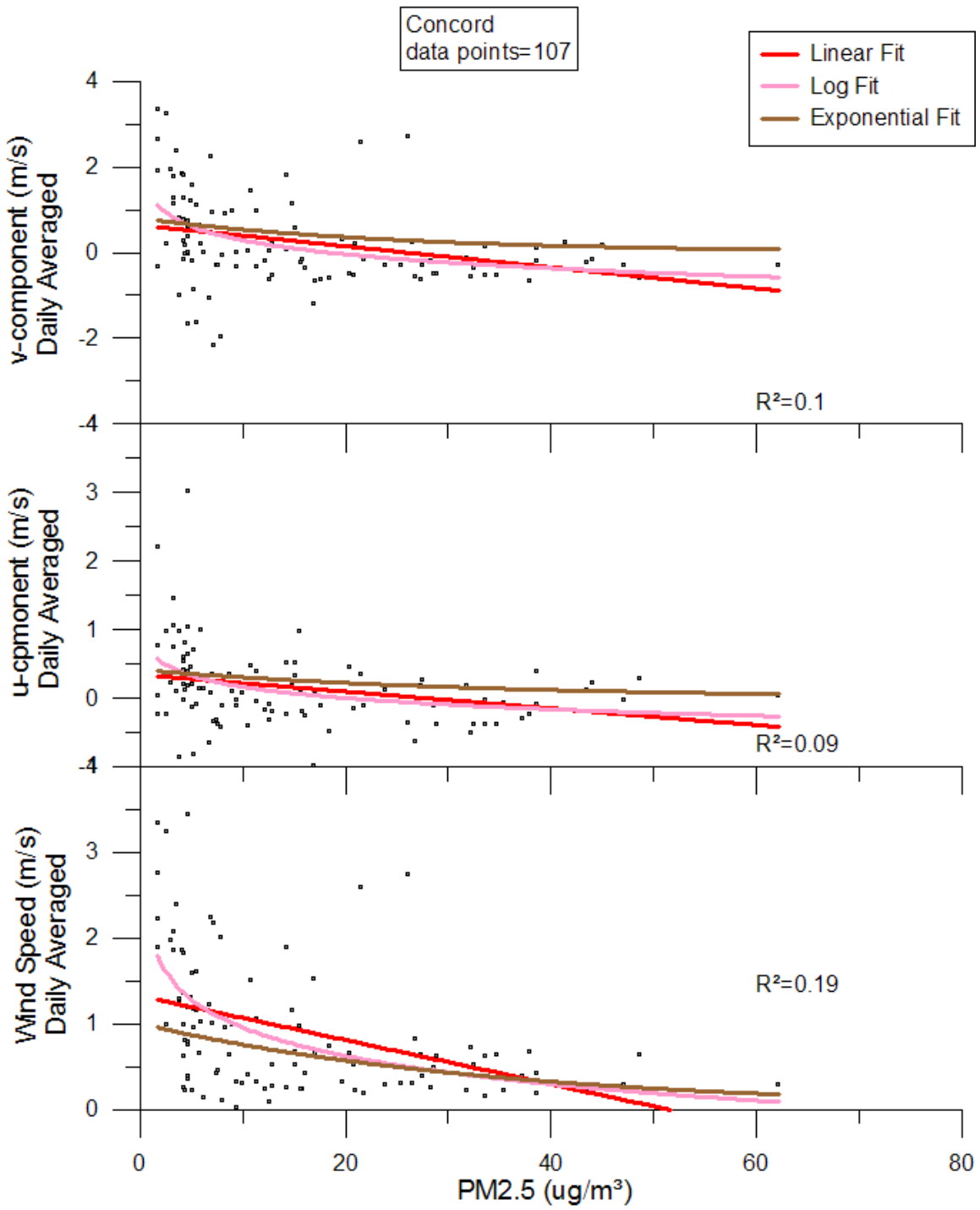


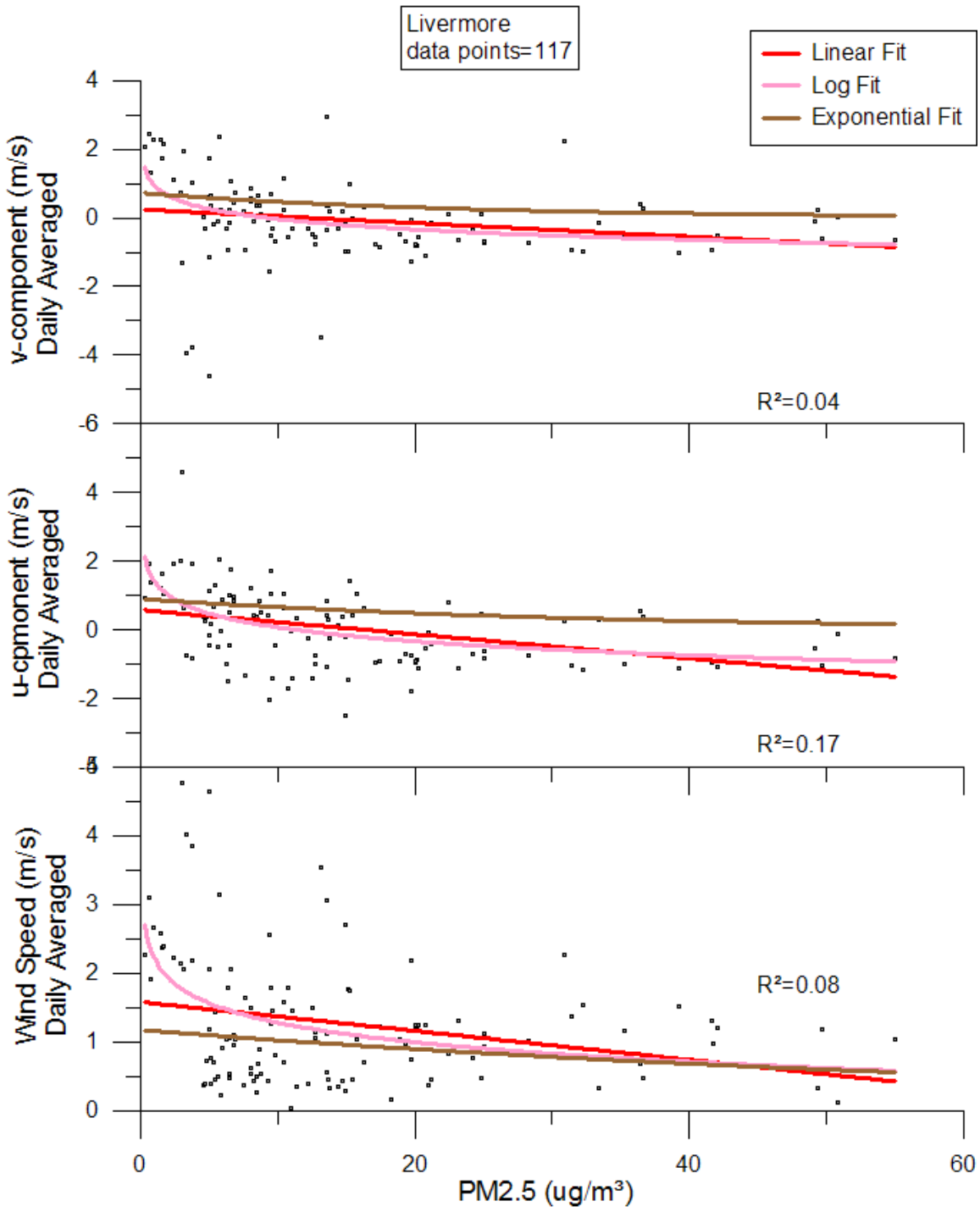
BAAQMD stations:

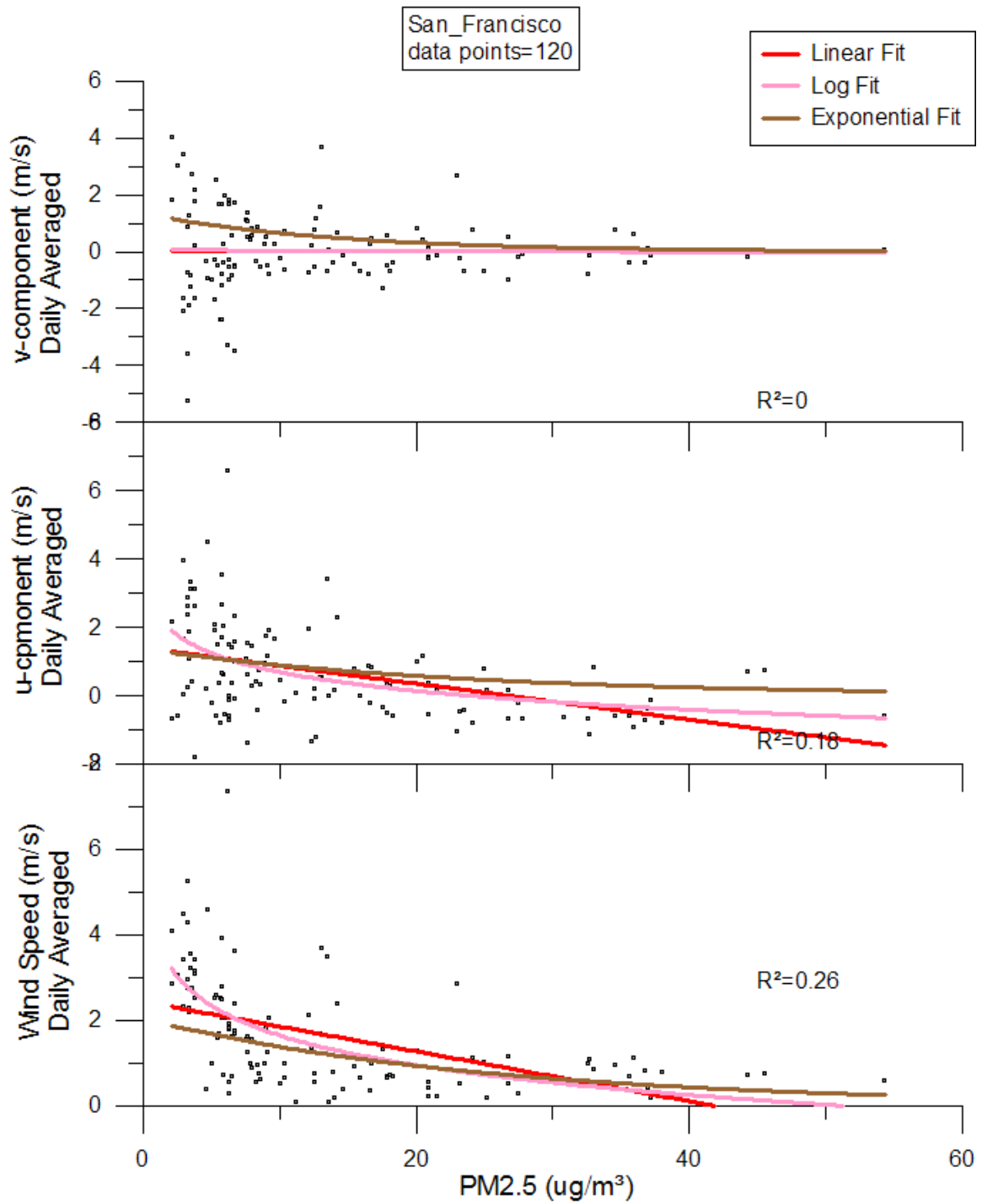




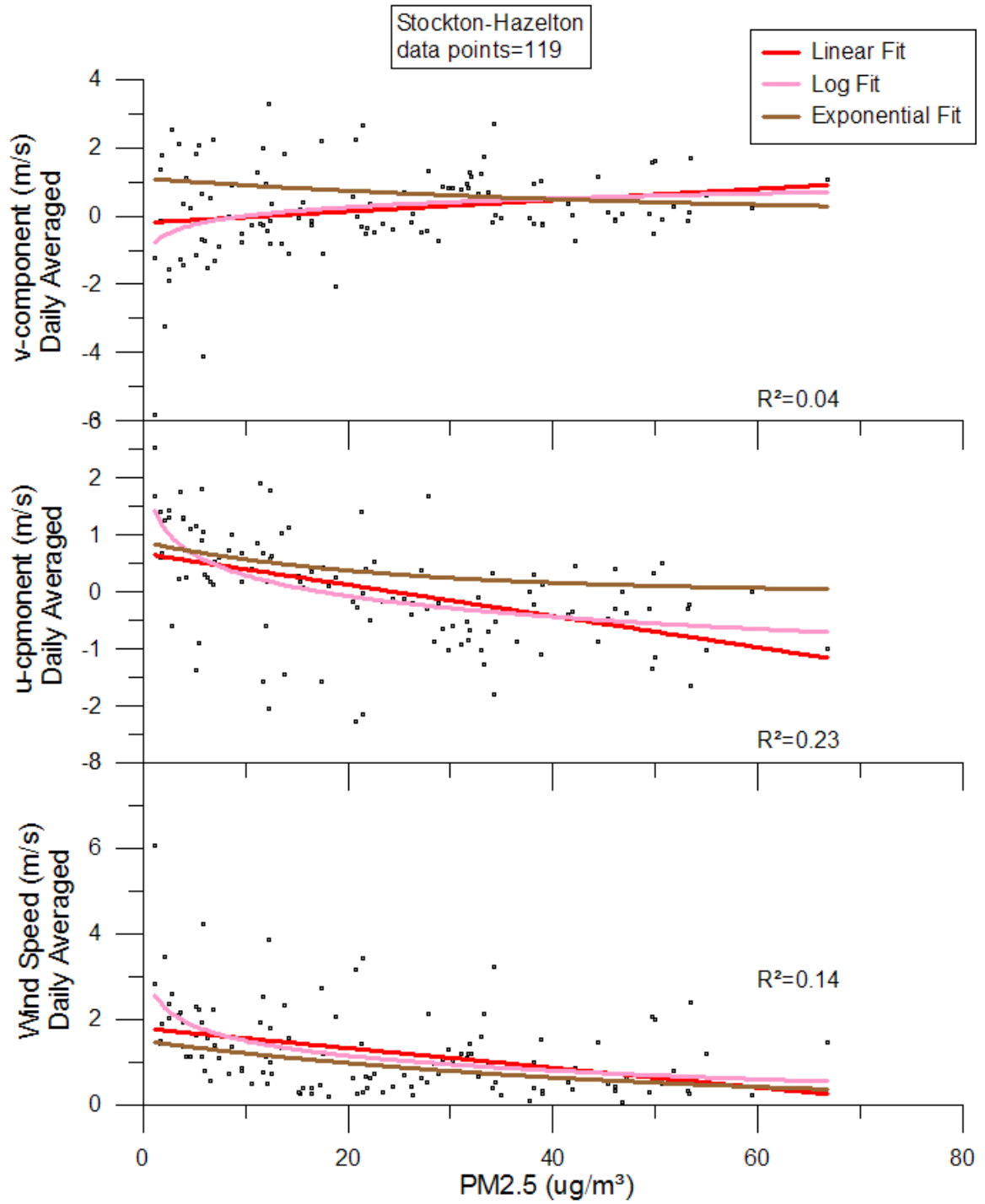


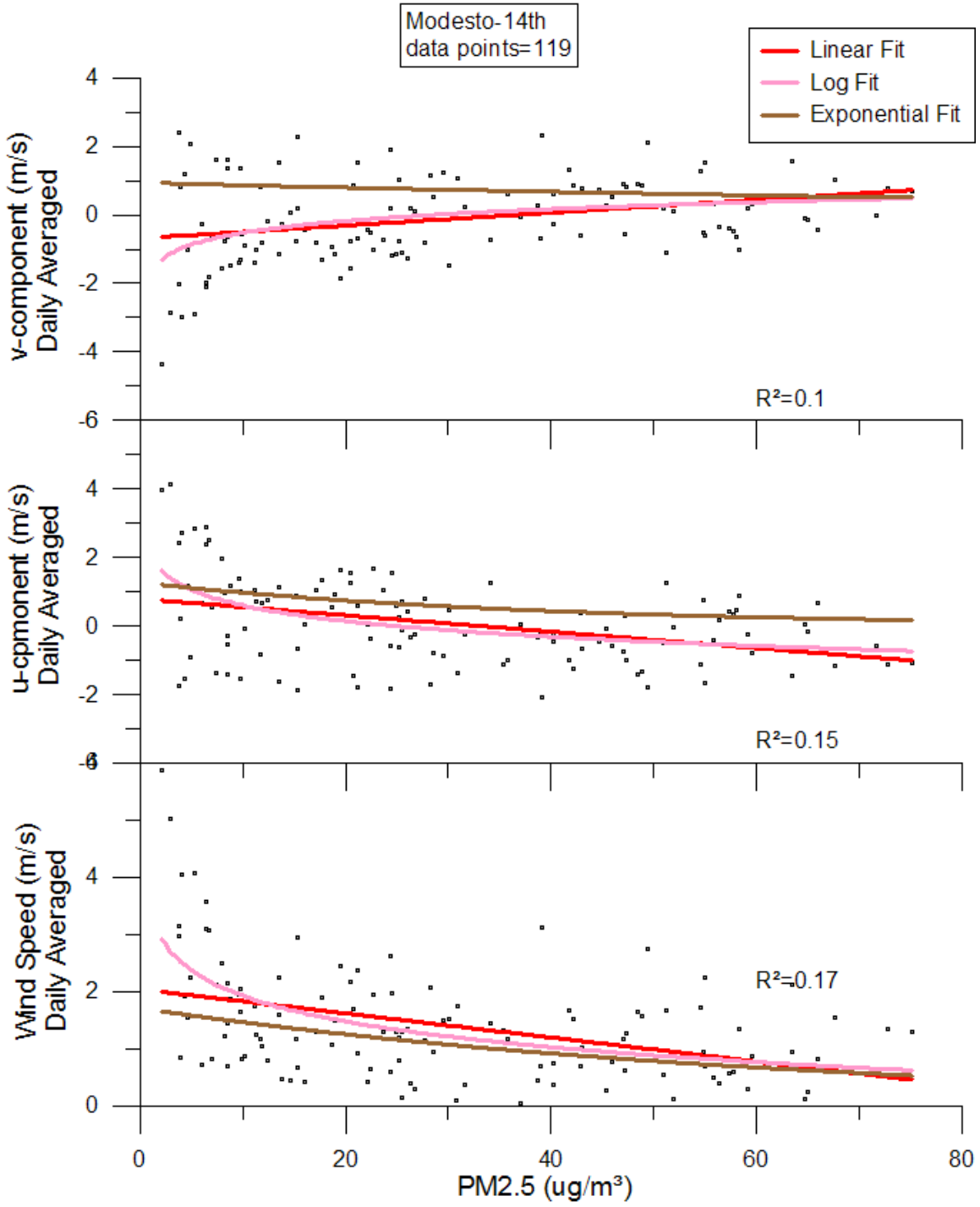


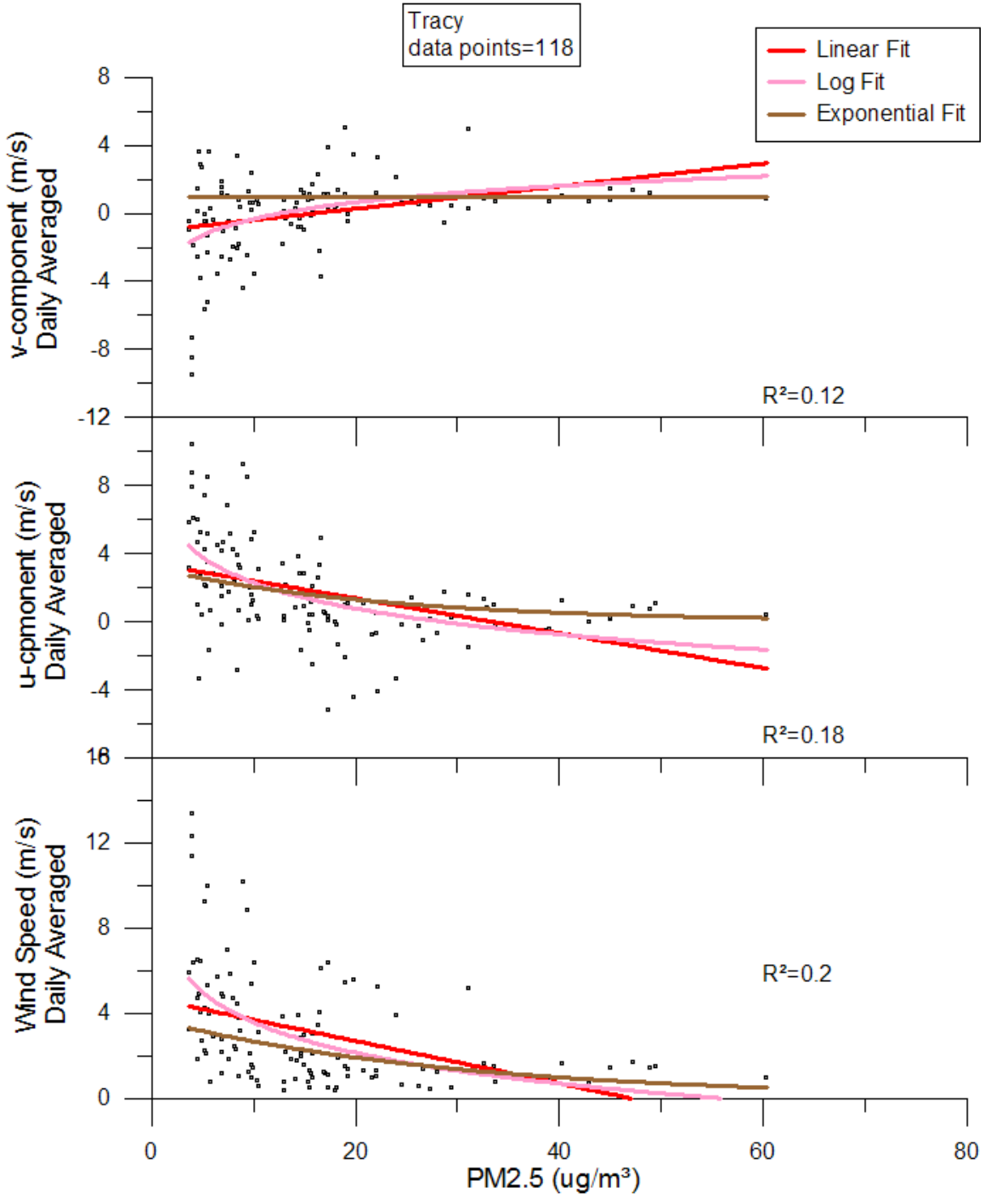




SJV stations:

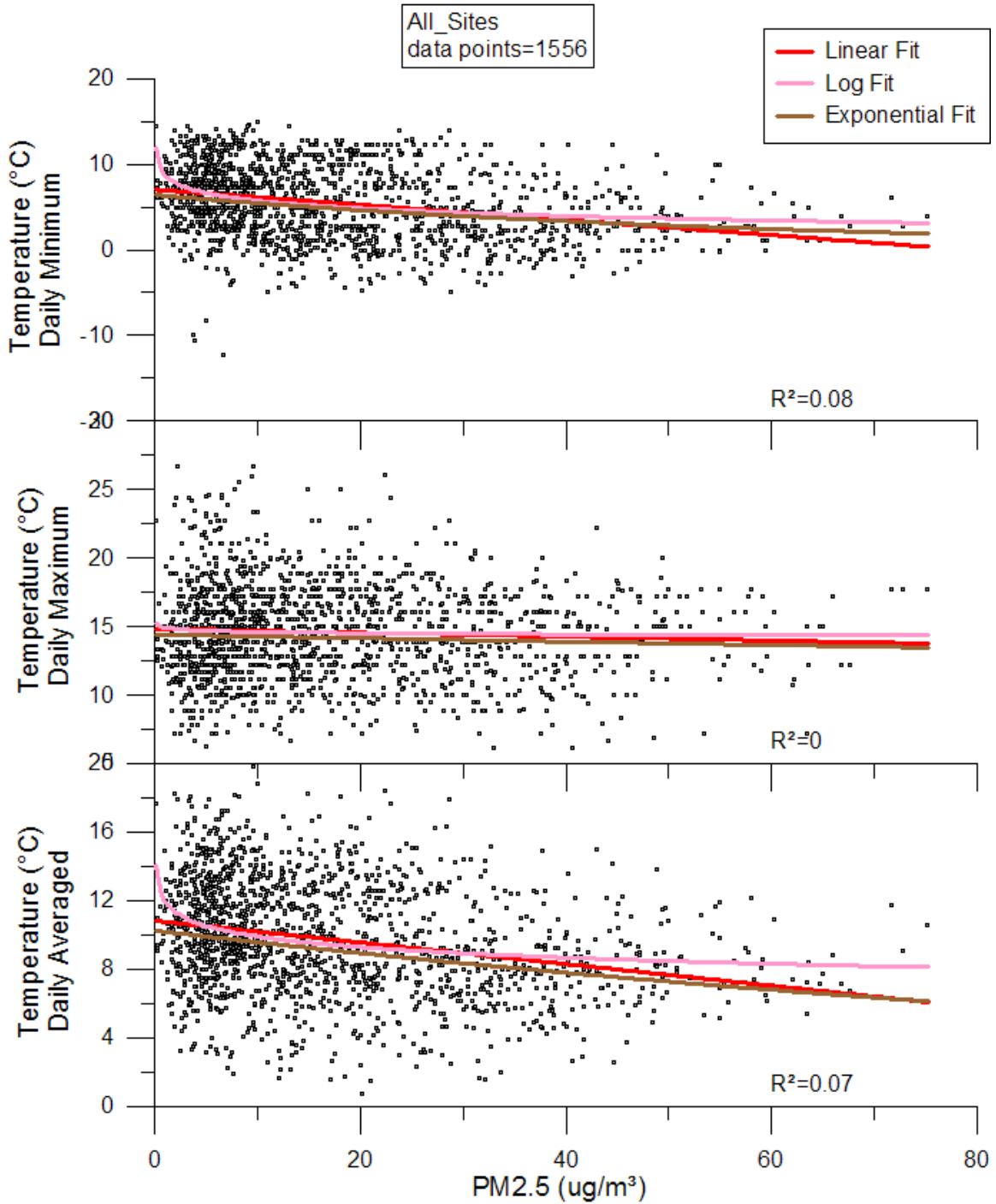


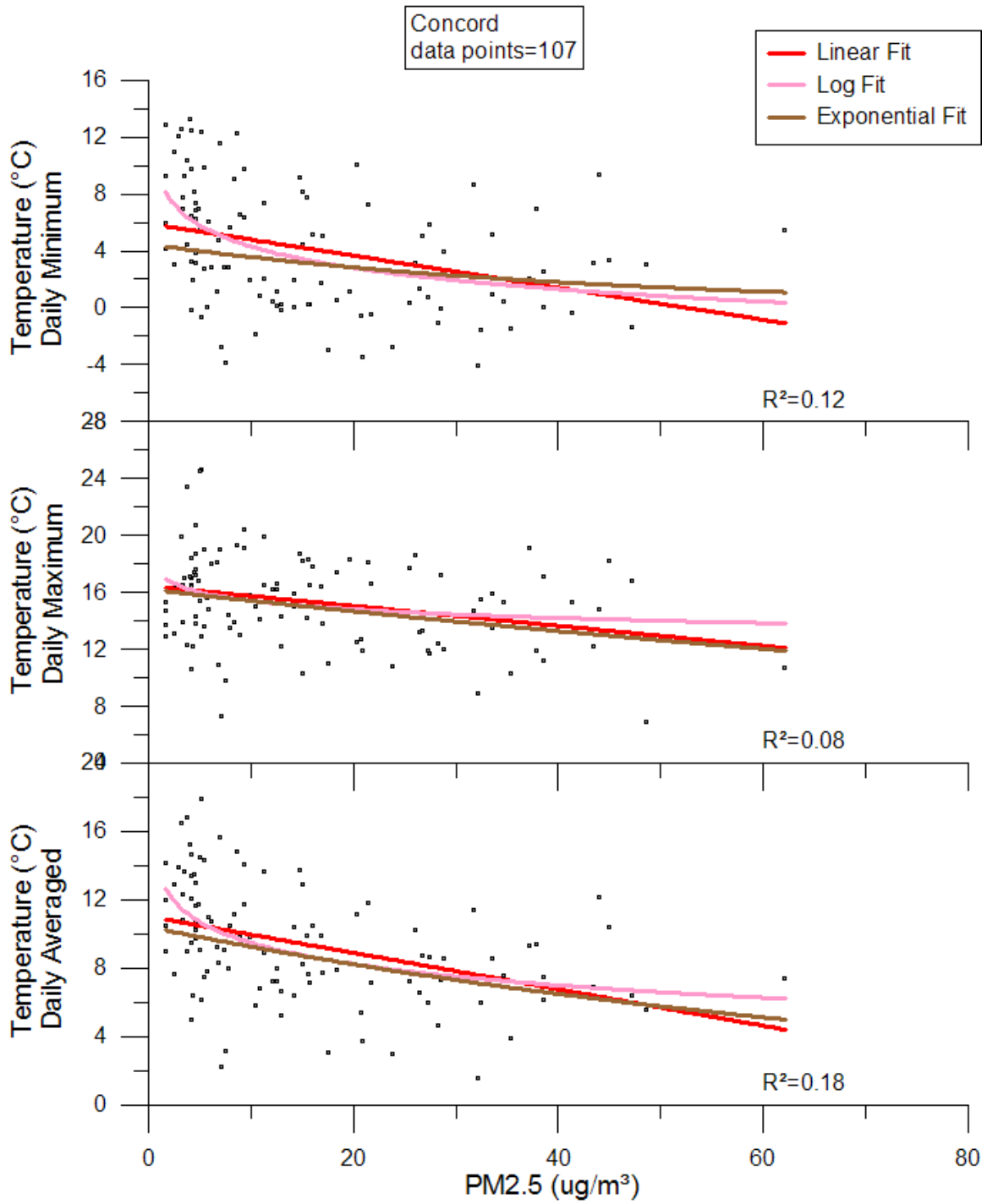


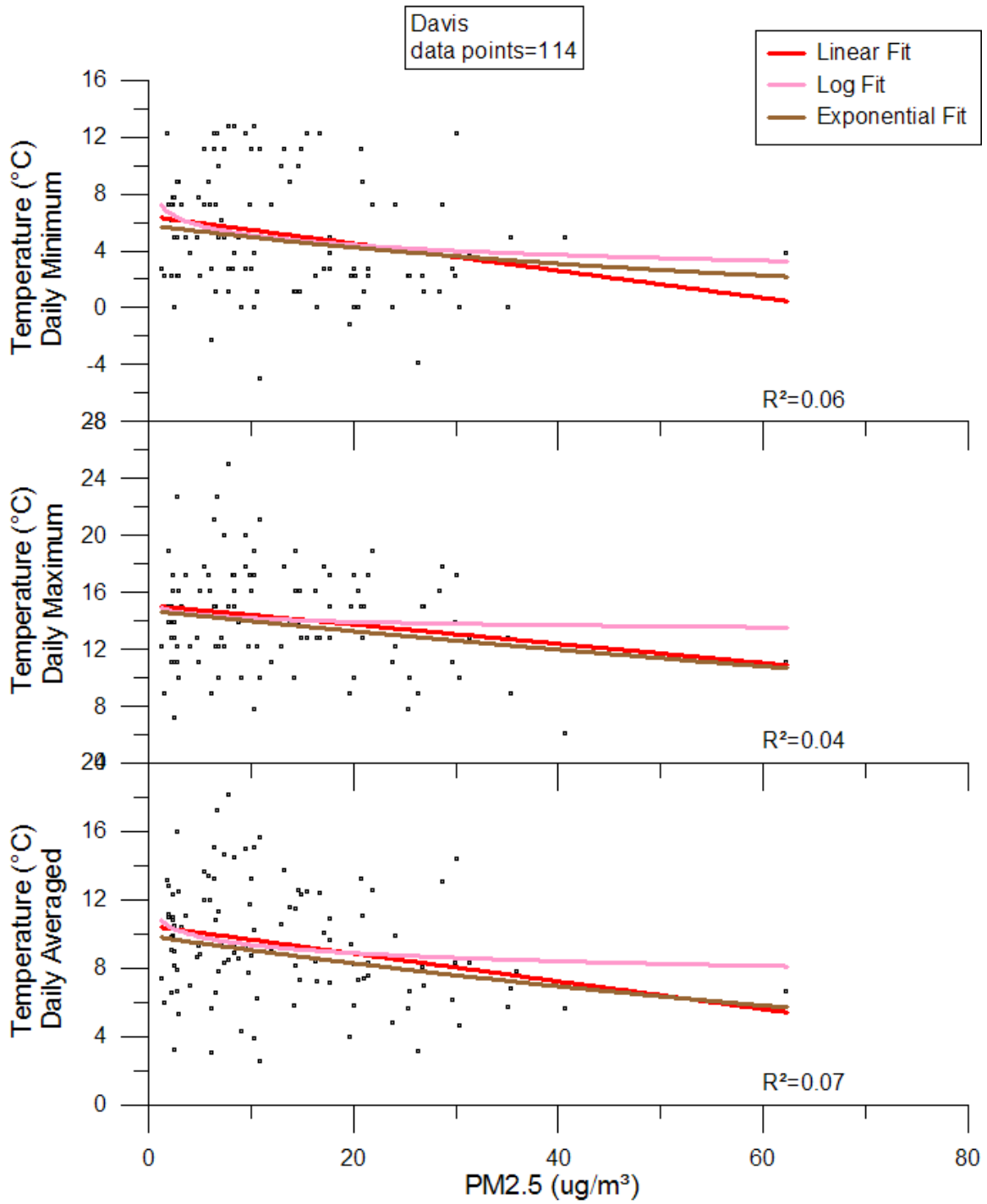


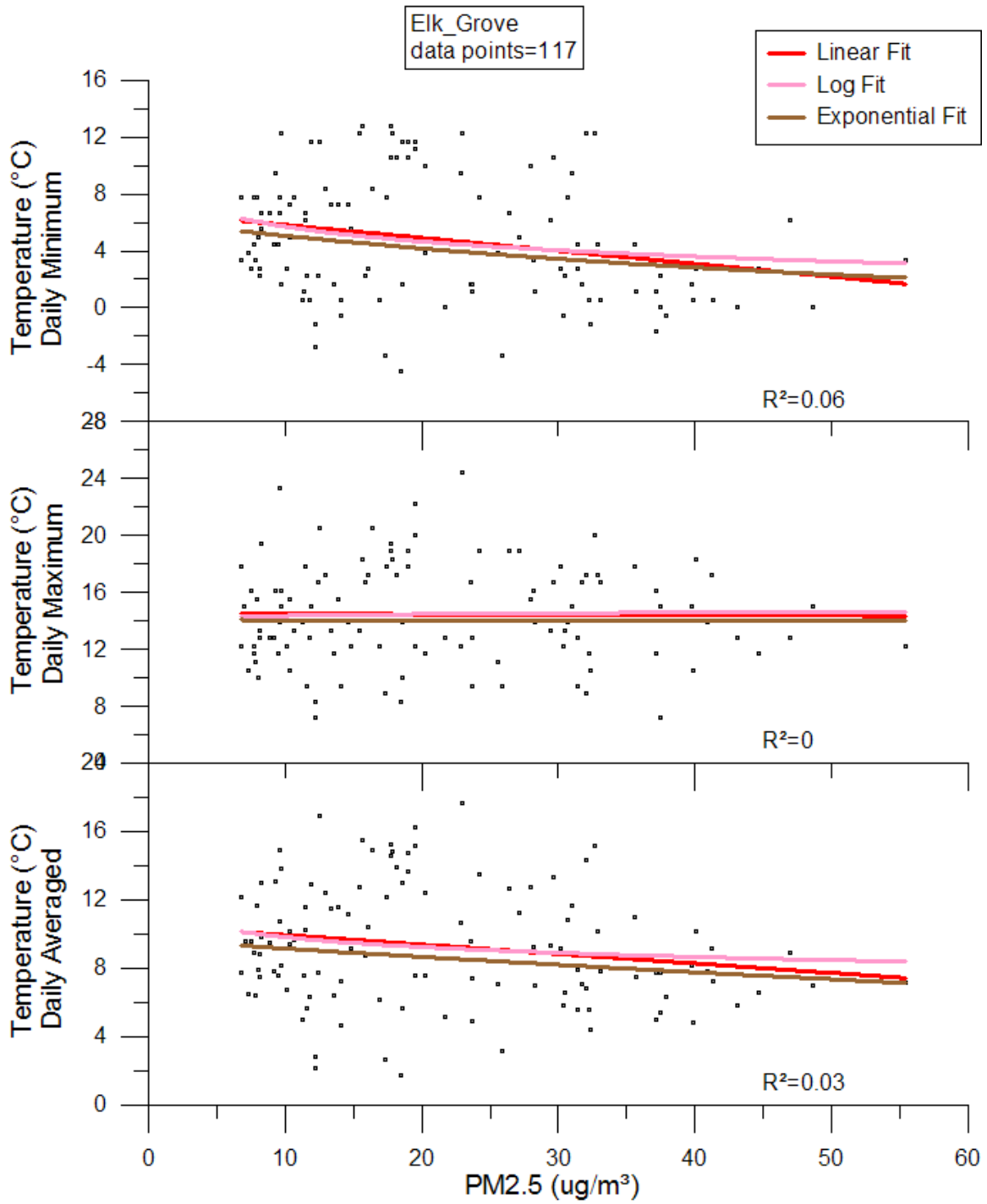
## PM<sub>2.5</sub> concentration and temperature:

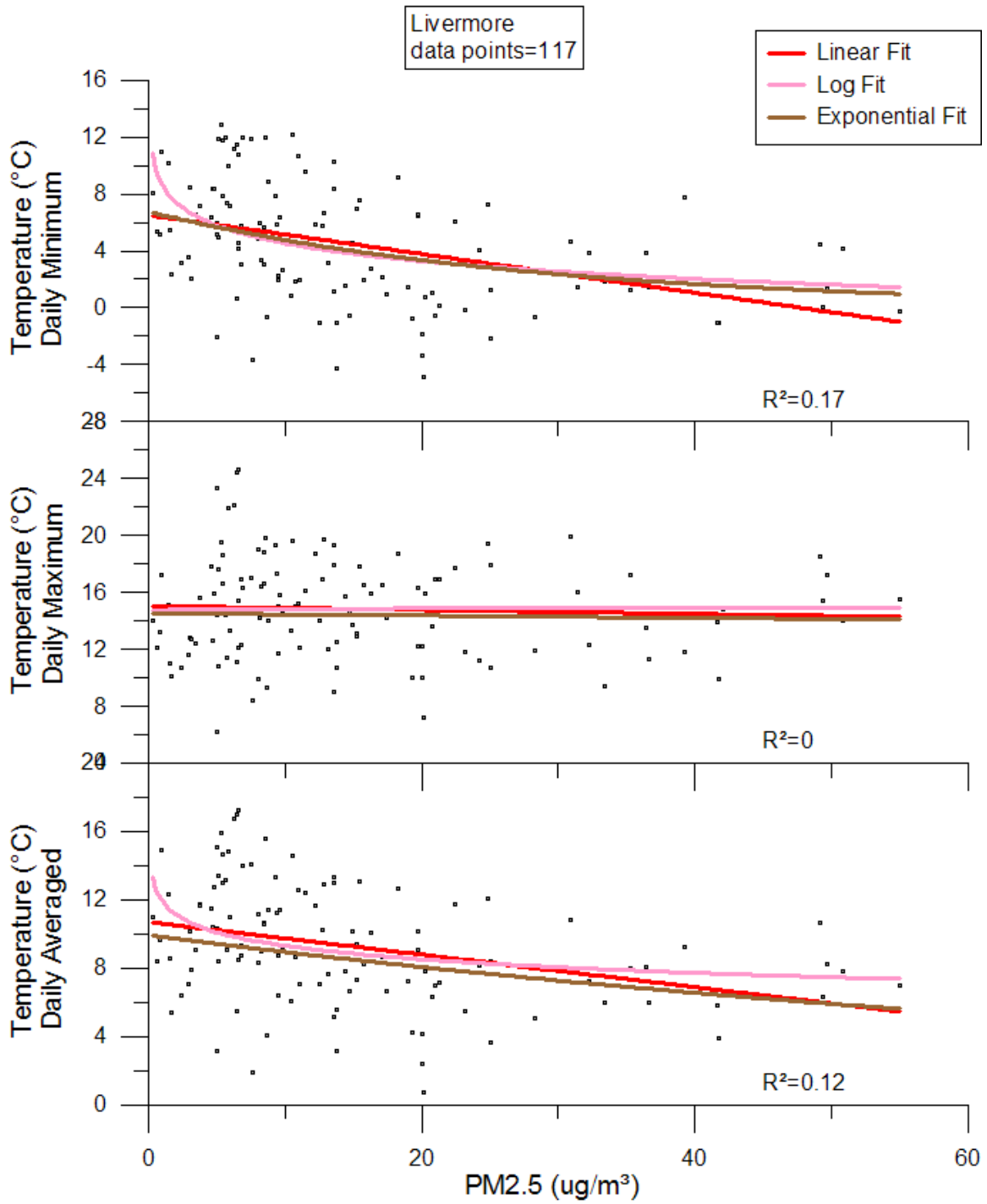
No significant correlation has been found between PM<sub>2.5</sub> and temperature for all and each individual station during this winter season.

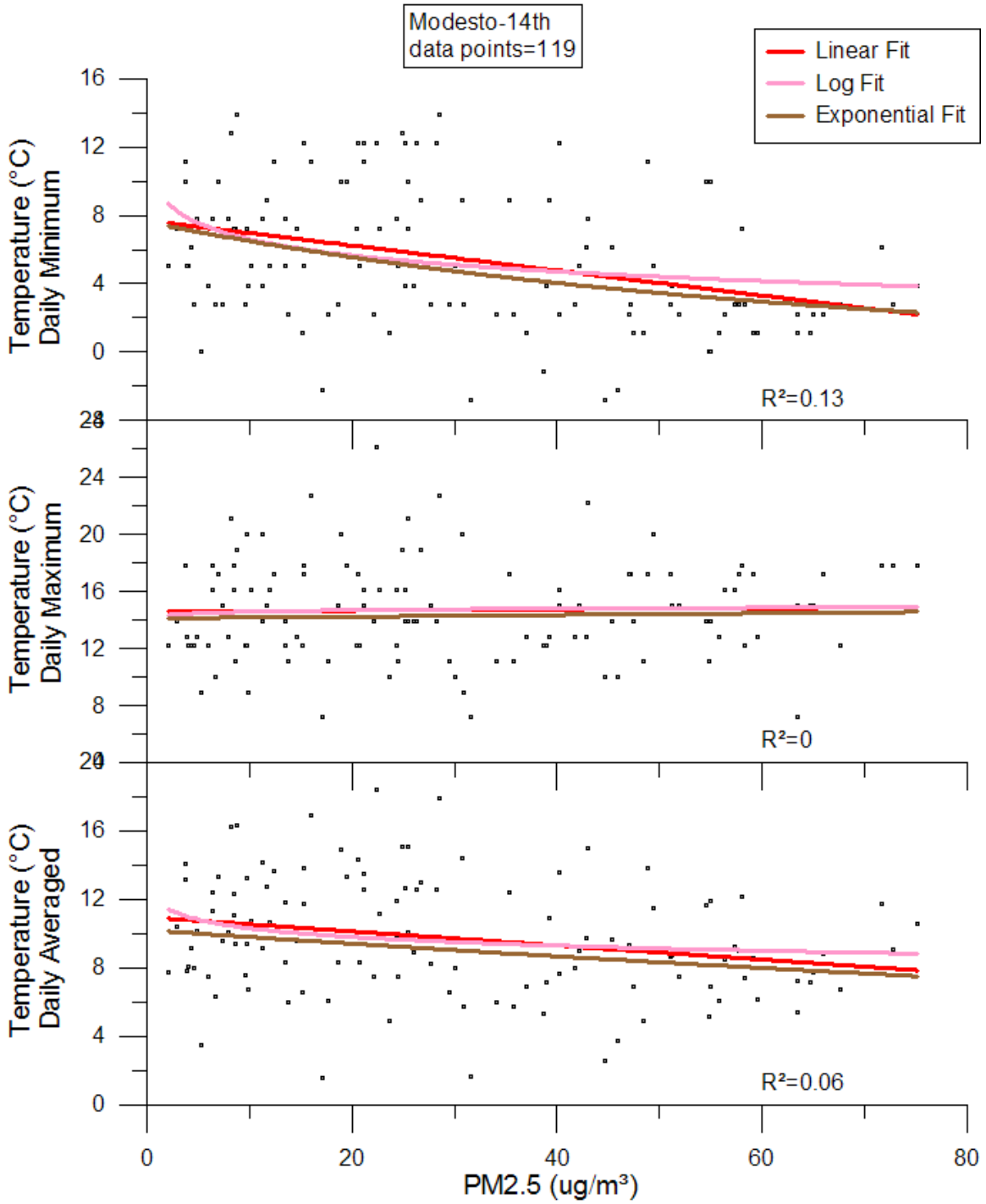


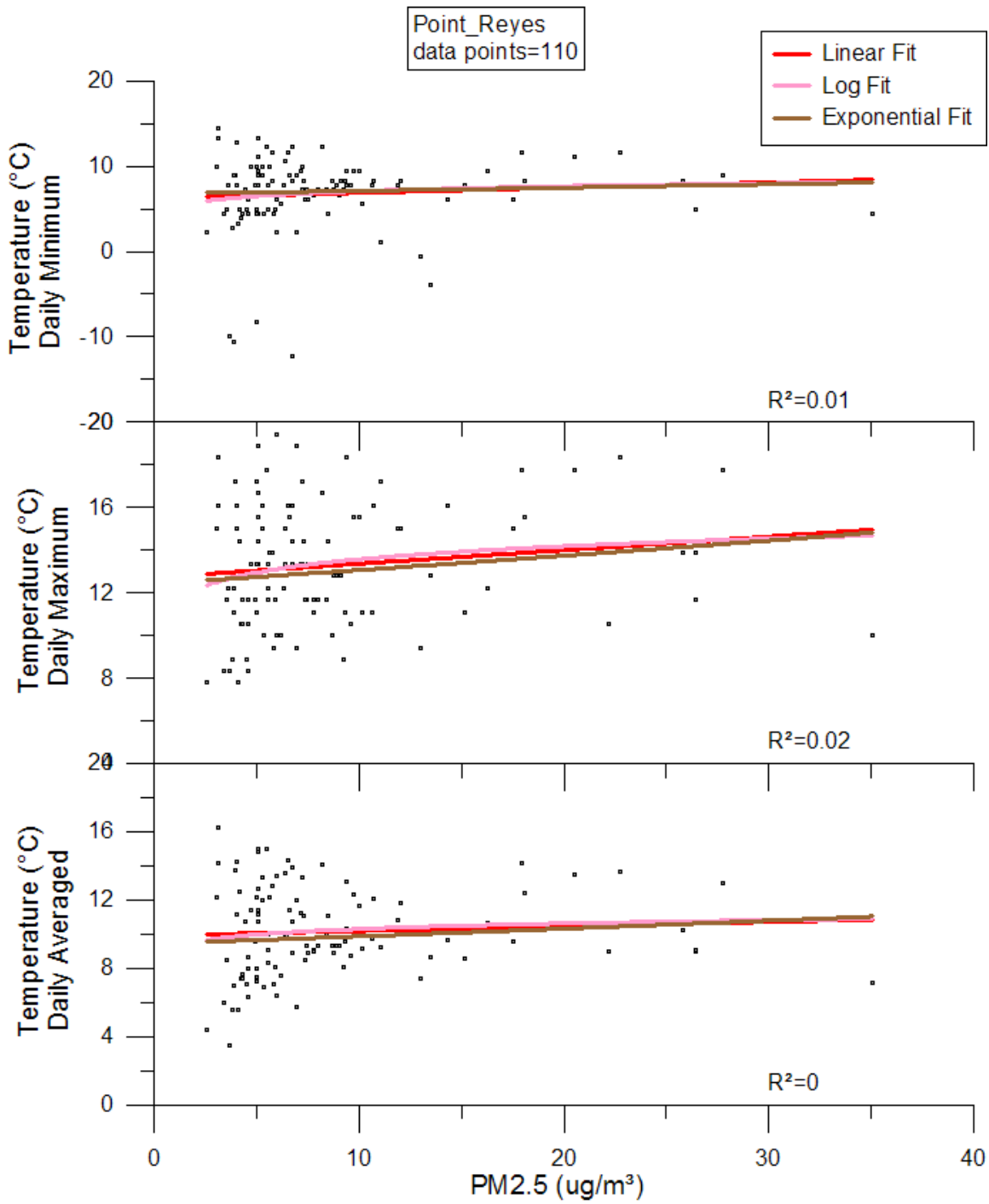


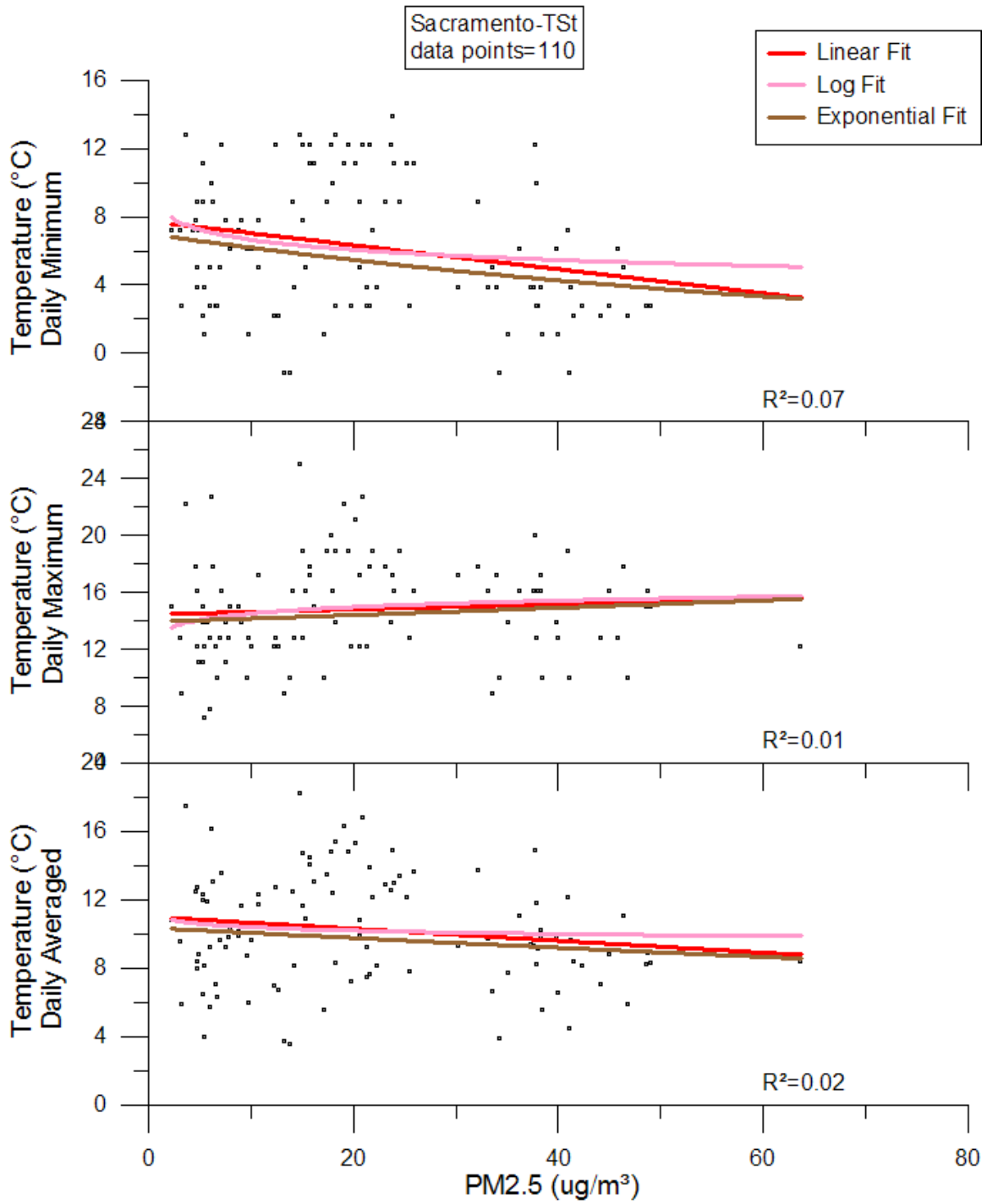


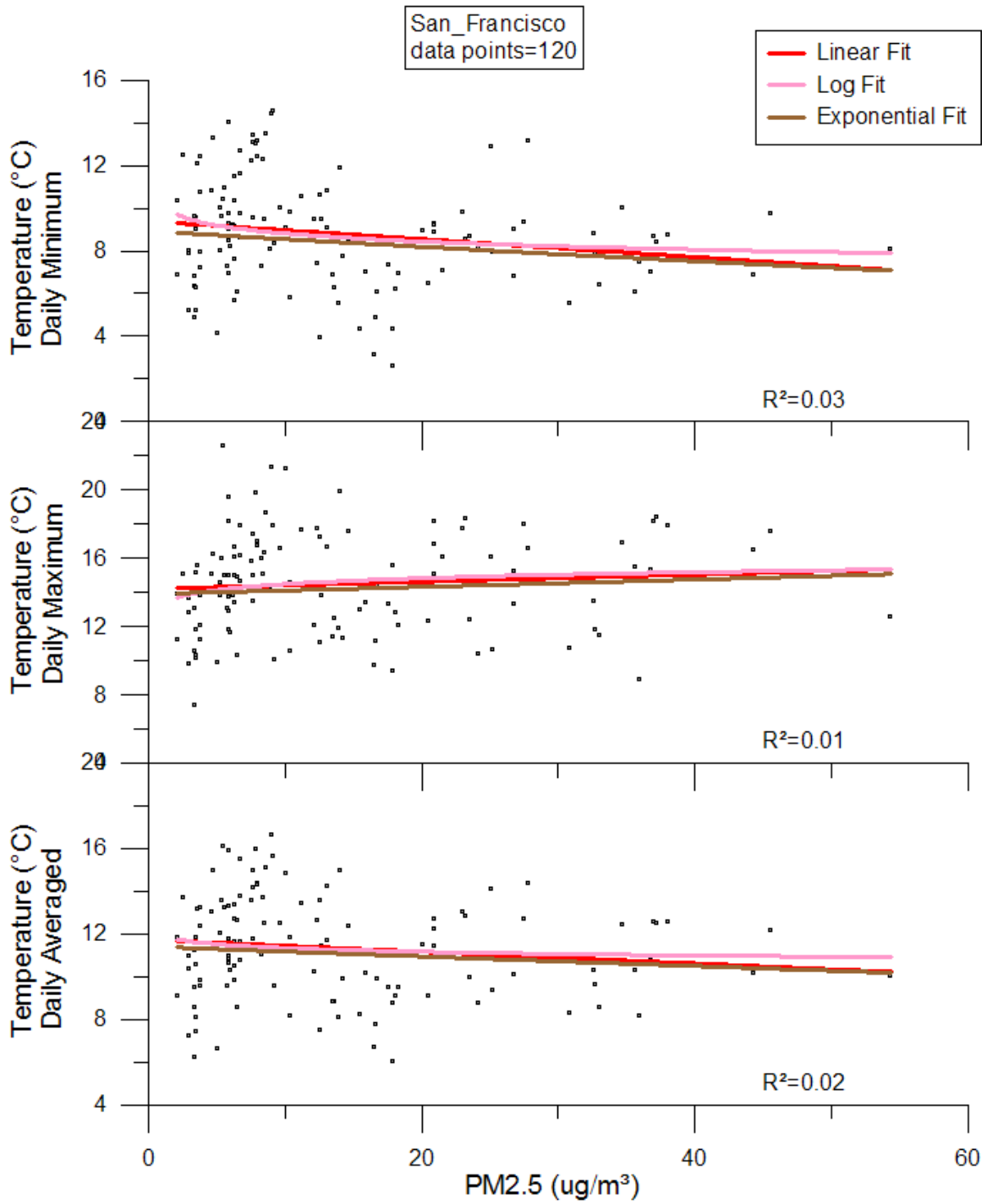


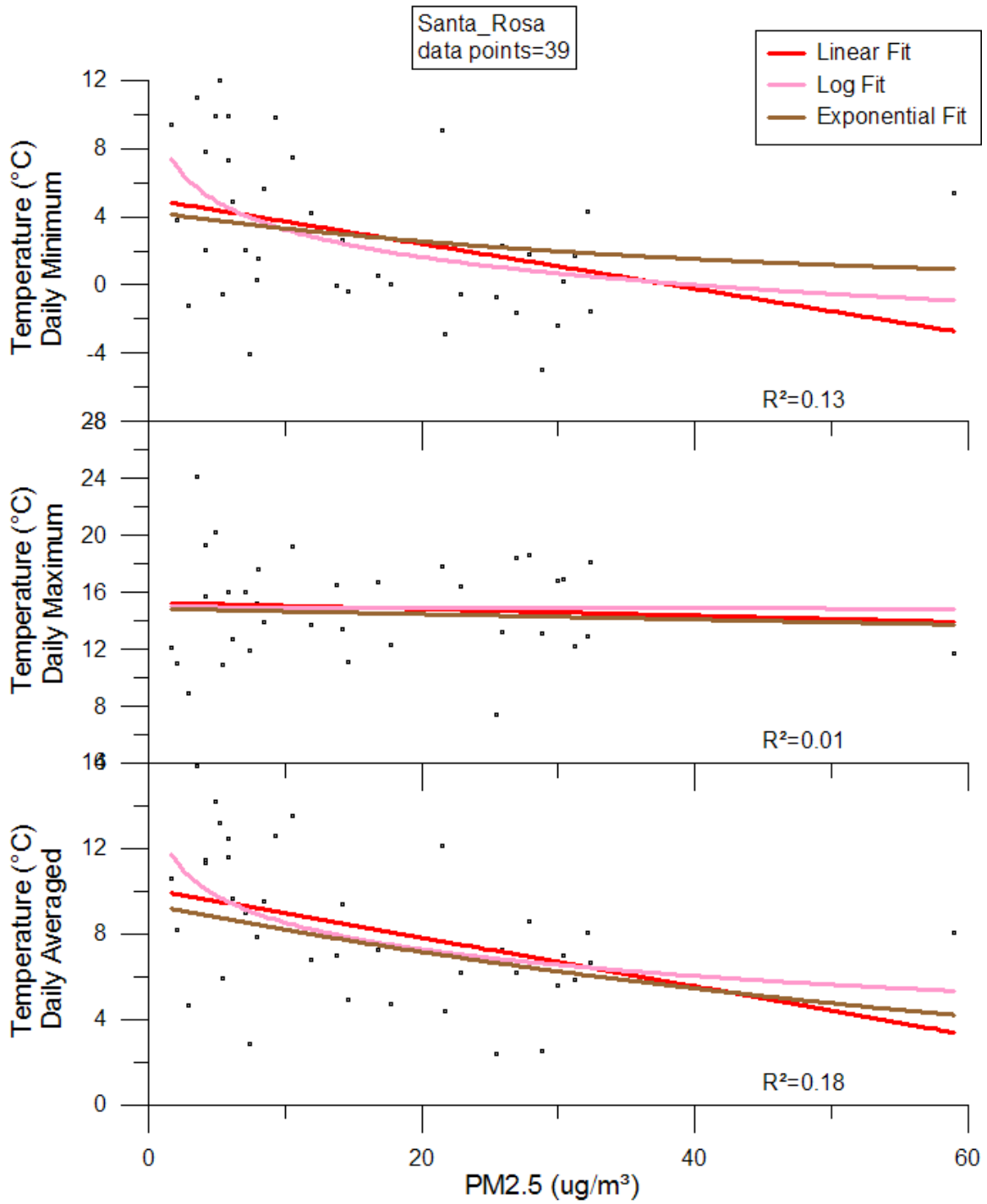


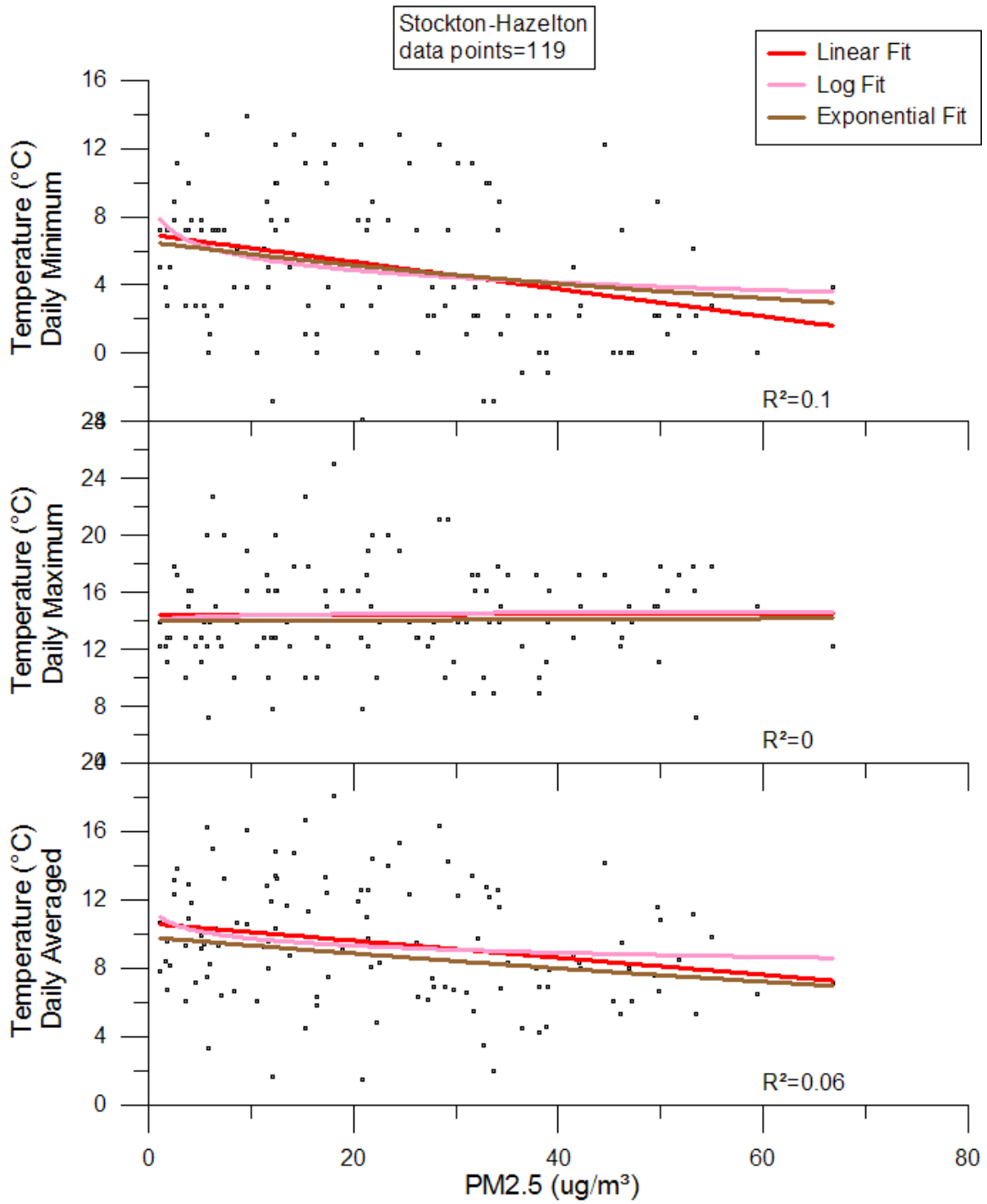


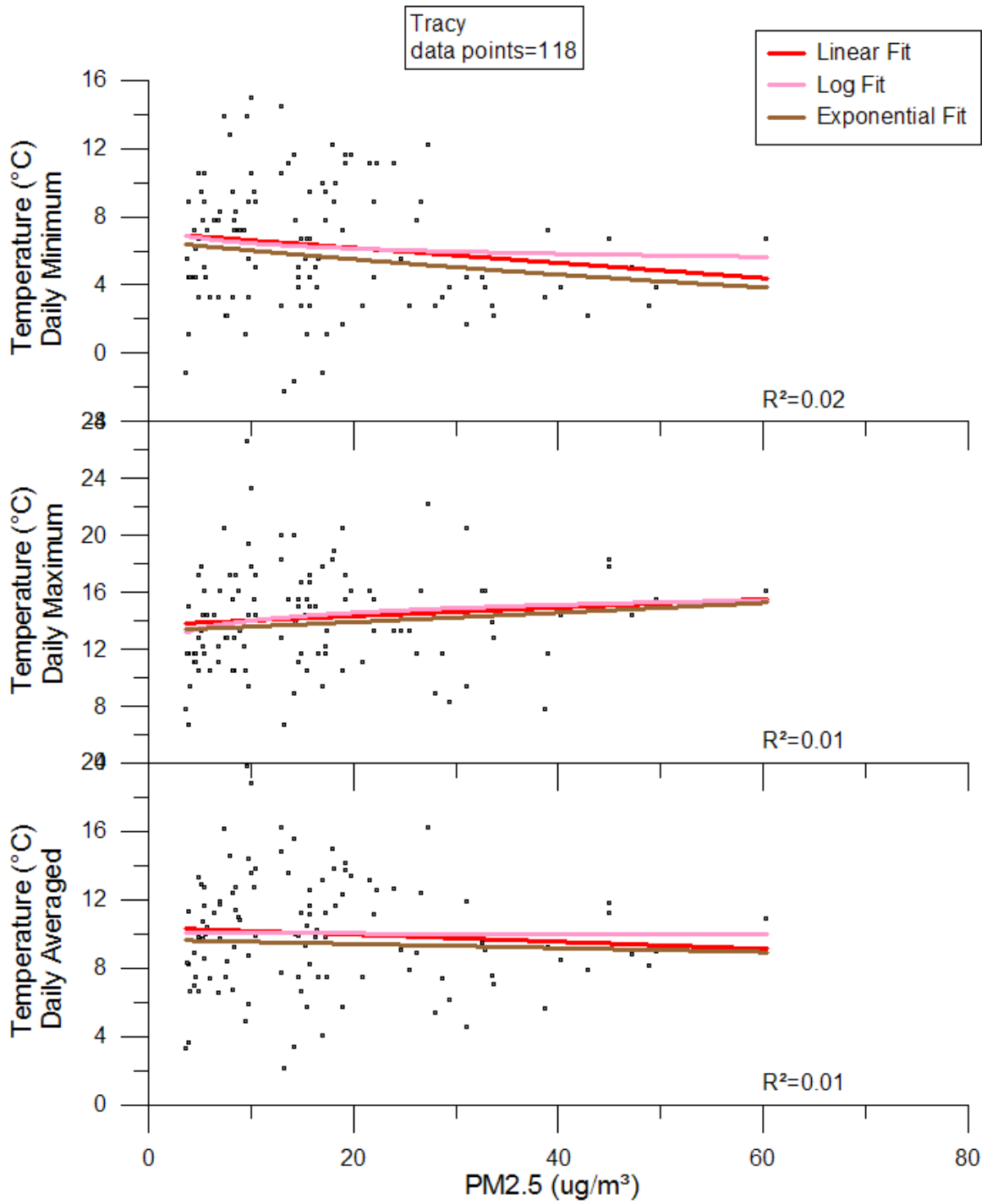


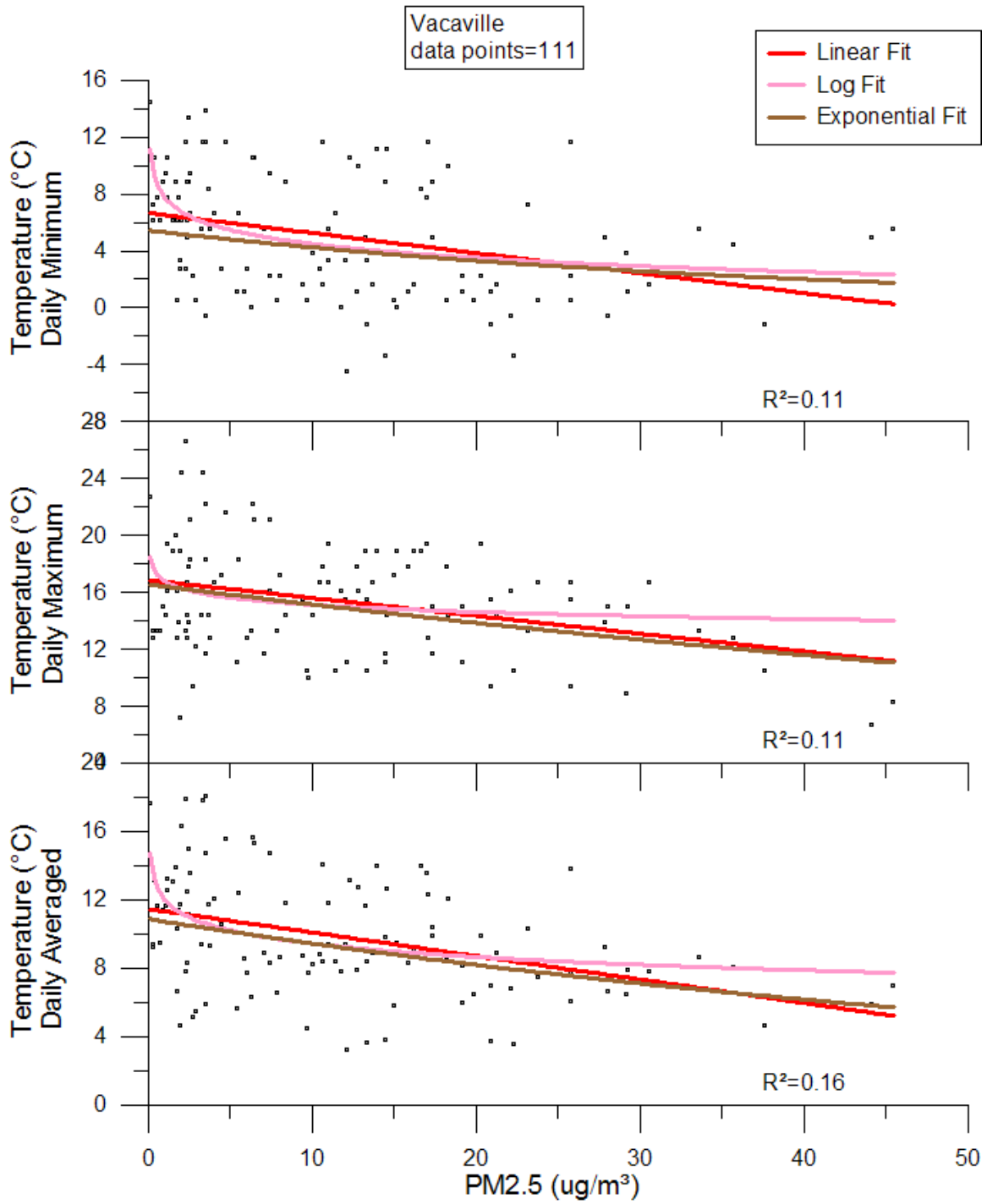


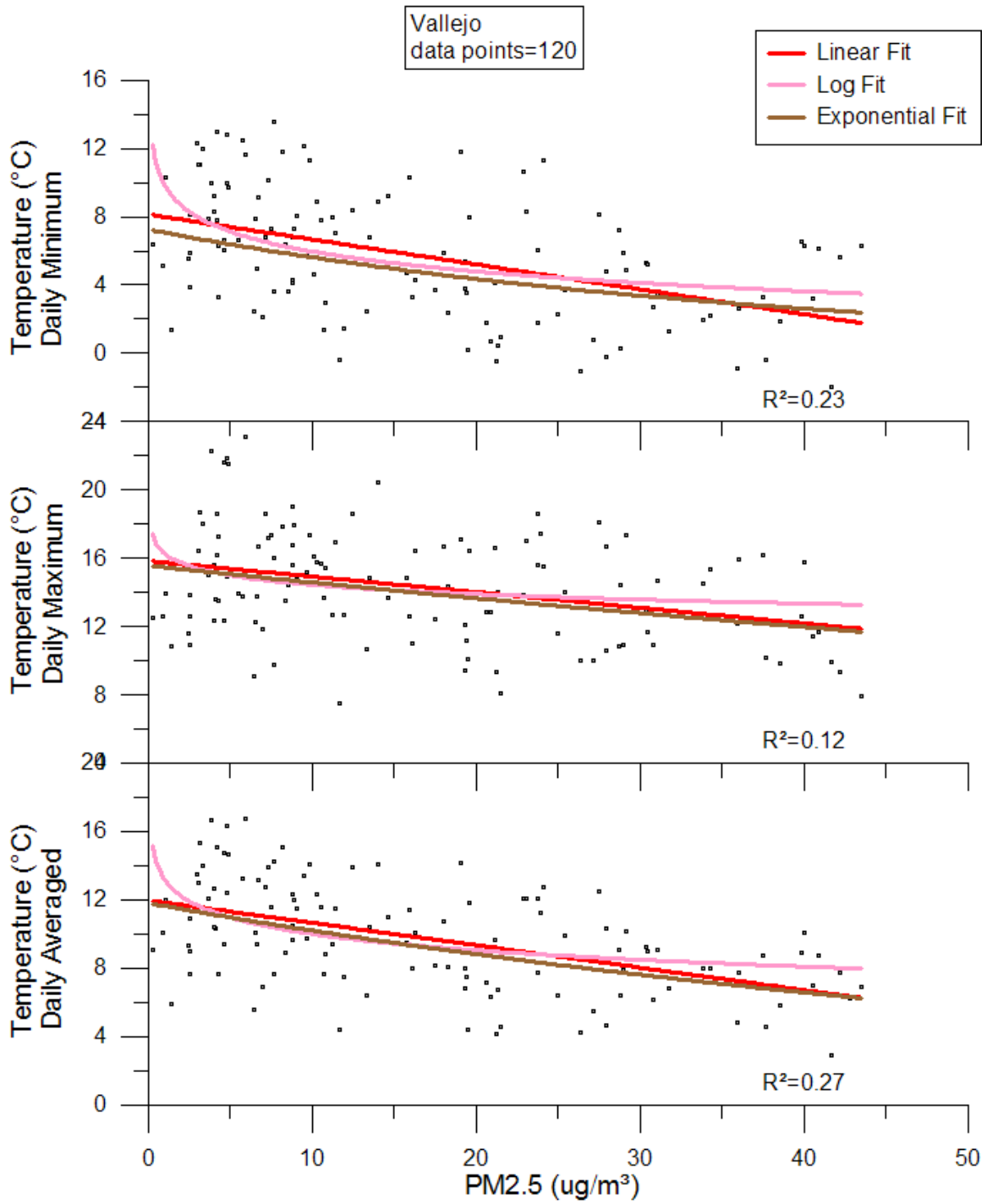


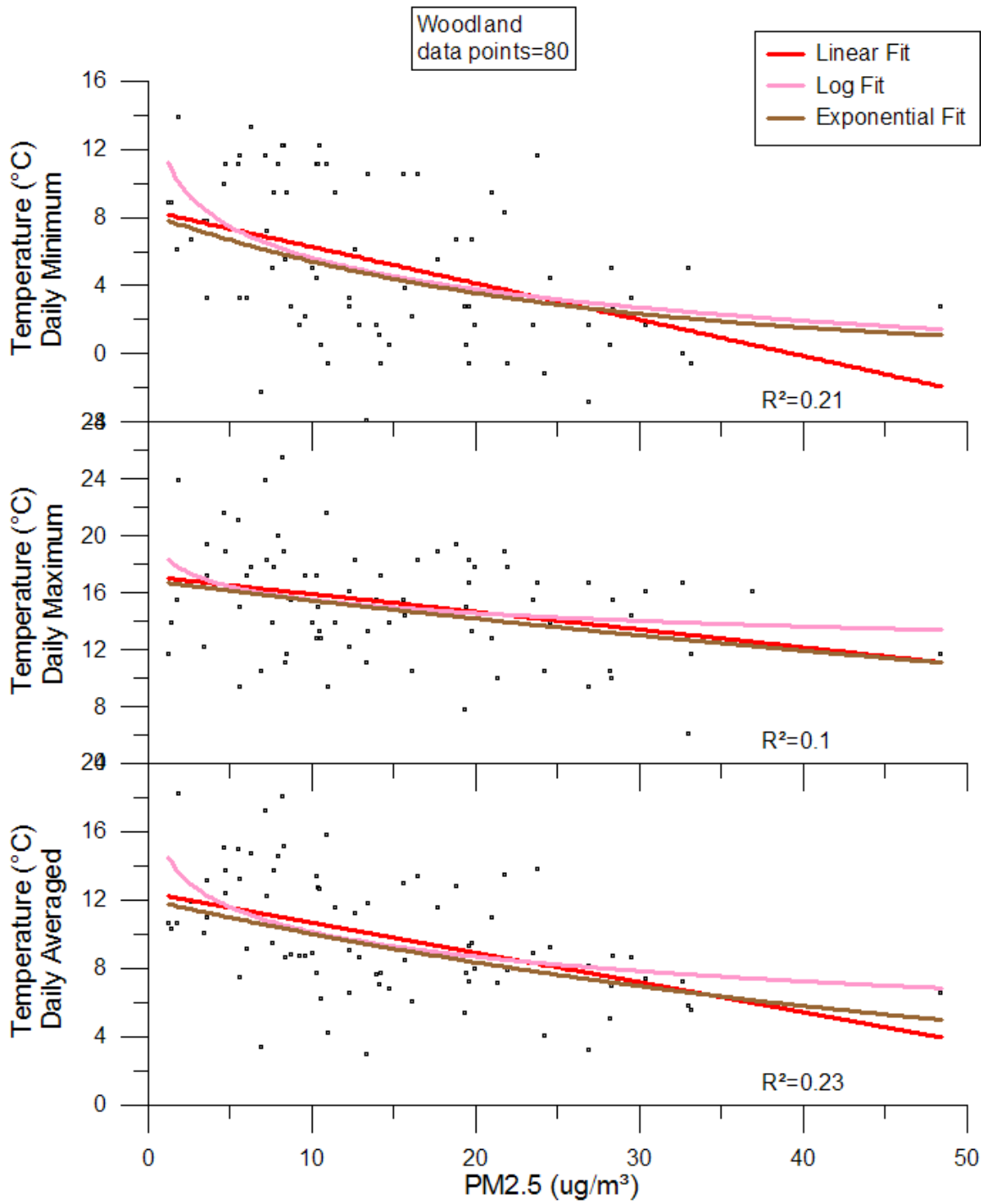












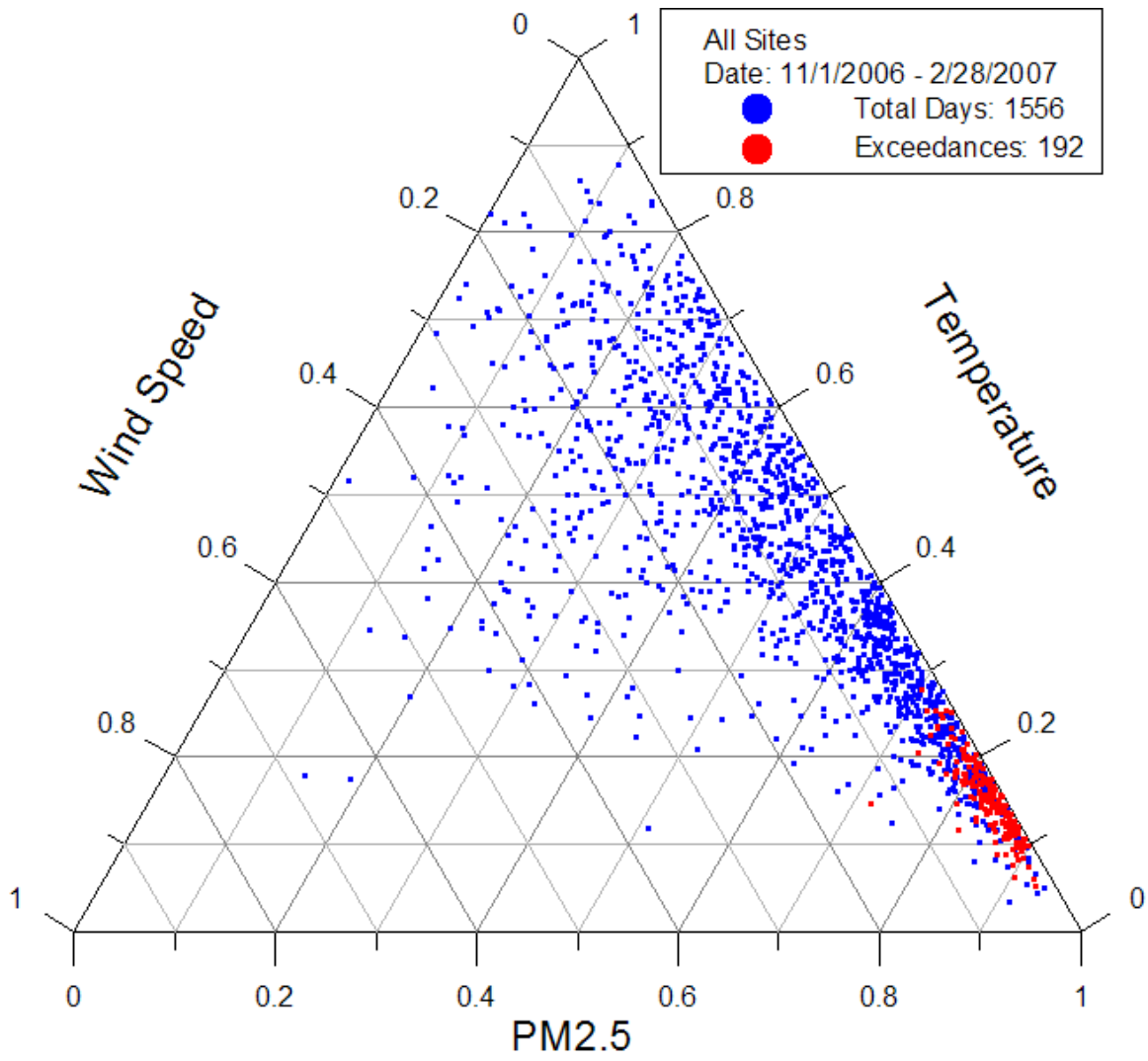
## **Preliminary Summary:**

A four months daily PM<sub>2.5</sub> concentration dataset has been statically compared to collocated meteorological measurements during wintertime 2006-07 over northern California air districts. Figure 3-6 showed that:

- Possible PM<sub>2.5</sub> transport From Bay Area to San Joaquin Valley during November 18<sup>th</sup> - 22<sup>nd</sup> 2006,
- Region-wide PM<sub>2.5</sub> season December, 2006, January 2007, and 1<sup>st</sup> week in February 2007,
- Possible large source of PM<sub>2.5</sub> concentration along highway 99 in San Joaquin and Sacramento valleys during wintertime.

Generally, PM<sub>2.5</sub> exceedances occur when temperature is low and wind speed is light, but no significant correlation has found between PM<sub>2.5</sub> and wind speed, or temperature observations.

Future study is needed to investigate hourly values and meteorology changes.



**Reference:**

Fairley, David, 2007: Bay Area PM2.5 Concentrations and relation to meteorology,  
(DRAFT 2)

1