REVISED ADDENDUM TO:

ANALYSIS OF PARTICULATE AND VISIBILITY-RELATED DATA WITHIN THE LADCO REGION

Prepared for

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1.0 ANALYSIS METHODS AND RESULTS

On April 7 and again on June 17 (following a presentation of results to date to LADCO participants), LADCO requested that ARS perform several data analyses in addition to those completed for the March 2004 *Analysis of Particulate and Visibility-Related Data Within the LADCO Region* report. The additional analyses included:

- Estimation of standard deviation of natural visibility conditions (measured in deciviews)
- Comparisons between aerosol-based extinction calculated with the IMPROVE method and the EPRI method.
- Comparisons between aerosol-based extinction calculated with the EPA monthly f(RH) enhancement factor and daily f(RH) calculated from on-site data.
- Comparisons between both IMPROVE and EPRI methods and nephelometer data.
- Where applicable, comparisons should reflect individual components of, and the complete EPRI method.

1.1 STANDARD DEVIATION OF NATURAL VISIBILITY CONDITIONS

ARS was contracted to estimate the standard deviation of natural visibility conditions, measured in deciview (dv) for four LADCO sites. ARS took an approach based on Ames (Ames, 2000), EPRI (EPRI, 2004) and Ryan (Ryan, 2004). That approach includes:

- Transformation of daily ammonium sulfate and ammonium nitrate mass to estimate natural conditions. This is done by multiplying each daily mass with the ratio of the EPA estimated value (in the eastern U.S.: 0.23 $\mu g/m^3$ for ammonium sulfate, 0.10 $\mu g/m^3$ for ammonium nitrate) to the measured annual mean. This step is necessary because the sources for both species are largely anthropogenic.
- No change to the carbon, fine soil or coarse mass because these may be significantly affected by natural sources.
- Calculation of daily extinction values in Mm^{-1} (see next section) and conversion to deciview using:

$$\text{Deciview (dv)} = 10 \times \ln (\text{Extinction}/10)$$

- Calculate the standard deviation of the annual data set expressed in deciviews.

ARS performed these calculations to yield the estimates of the standard deviation of natural visibility conditions presented in Table 1. Table 1a data is based on the EPA suggested monthly relative humidity enhancement factor, f(RH), and Table 1b is based on a daily f(RH). The estimated standard deviations calculated using the EPRI method (described in the next section) are always higher then those calculated using the IMPROVE method, ranging from 3 to 10% higher. The difference in estimated standard deviations between f(RH) methods is less, ranging from 0 to 3% higher for the daily method. As a point of reference, Ames (Ames, 2000) estimated a mean standard deviation of 3 for the eastern U.S. IMPROVE sites, and Ryan (Ryan, 2004), estimated a mean standard deviation of 3.5 for the eastern U.S. IMPROVE sites.

Table 1a

Estimated Standard Deviation of Natural Visibility Conditions
IMPROVE and EPRI Methods Expressed in Deciview (dv)
Using Monthly f(RH)

Site	Network	IMPROVE Method Std.Dev. (dv)	EPRI Method Std.Dev. (dv)
Quaker City	IMPROVE	2.95	3.17
Seney	IMPROVE	3.83	4.02
Seney	STN	3.24	3.51
Mayville	STN	2.96	3.22
Bondville	IMPROVE	2.75	2.95

Table 1b

Estimated Standard Deviation of Natural Visibility Conditions
IMPROVE and EPRI Methods Expressed in Deciview (dv)
Using Daily f(RH)

Site	Network	IMPROVE Method Std.Dev. (dv)	EPRI Method Std.Dev. (dv)
Quaker City	IMPROVE	2.91	3.15
Seney	IMPROVE	3.95	4.07
Seney	STN	3.33	3.55
Mayville	STN	2.93	3.23
Bondville	IMPROVE	2.75	2.95

1.2 IMPROVE VS. EPRI METHOD OF EXTINCTION CALCULATION

Comparisons between aerosol-based and directly measured scattering (using a nephelometer) have shown that there is a tendency for high (low) ambient nephelometer scattering to be higher (lower) than aerosol scattering calculated with the IMPROVE method. This has generally been attributed to limitations in some of the assumptions in the IMPROVE aerosol extinction model. The IMPROVE method for calculating extinction is described in ARS' March 2004 report (ARS, 2004). The EPRI method is a modification of the IMPROVE method designed to more accurately model the dry scattering efficiency of ammonium sulfate and ammonium nitrate, and the estimation of total organic material from the measured organic carbon. EPRI's method makes the following two changes (EPRI, 2004):

- To convert organic carbon (OC) to total organic mass (OM) EPRI suggests using 2.0 based on a recent literature review, rather than 1.4 suggested by IMPROVE.
- EPRI suggests using a varying dry scattering efficiency for ammonium sulfate and ammonium nitrate developed by Sonoma Technology, Inc., rather than the static 3.0 suggested by IMPROVE. This is expected to better account for changes in sulfate and nitrate aerosol size distributions with changing mass loadings. The varying dry scattering efficiency is calculated as:

$$e\ (m^2/g) = 1.5 \times ([\text{ammonium sulfate} + \text{ammonium nitrate}])^{0.3}$$

  where e represents the dry scattering efficiency and the brackets [ ] indicate mass concentration in $\mu g/m^3$. The dry efficiency is limited at the low end by 1.2 and at the high end by 3.7 m^2/g.

ARS calculated extinction at all for LADCO sites using the EPRI method (both components separately and together), and compared the results to the same calculations made using the IMPROVE method for the March 2004 report. Table 2 summarizes the linear regression statistics for the comparisons using the complete EPRI method. Figures 1 through 5 present graphical comparisons for all sites. The left scatter plots in each figure compare both methods when using a monthly relative humidity enhancement factor, f(RH), and the right scatter plots compare methods using a daily f(RH). The top set of plots incorporates the organic carbon component of the EPRI method, the middle set incorporates the sulfate/nitrate component, and the bottom set incorporates the complete EPRI method.

The R^2s for all comparisons are nearly 1, showing that the EPRI method does not introduce significant scatter into the data, even when using daily f(RH). Visual review of the plots shows that EPRI extinction based on the organic carbon component is always slightly higher than IMPROVE extinction. EPRI extinction based on the sulfate/nitrate component is generally higher than IMPROVE extinction above about 150 Mm^{-1}, and generally lower than IMPROVE extinction below about 100 Mm^{-1}. The best fit to the data when incorporating the sulfate/nitrate component is not a linear regression, but a power curve. However, for the sake of easier interpretation a linear fit was used. Using the complete EPRI method, the slopes range from 1.11 to 1.28 when using monthly f(RH), and from 1.07 to 1.21 when using daily f(RH). The intercepts are all negative and fairly large in magnitude (-6.7 to -24.9) which is due, in large part, to the use of a linear fit instead of a power curve.

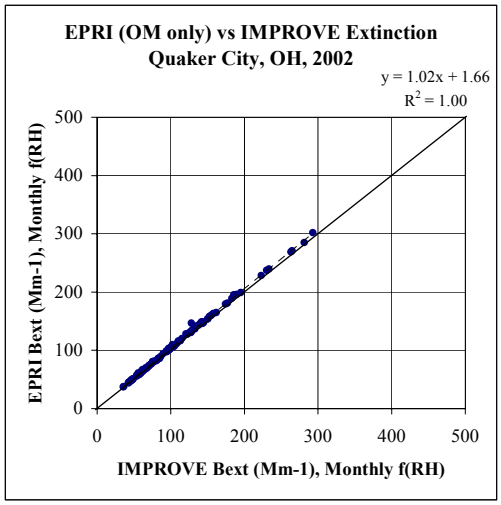
Table 2

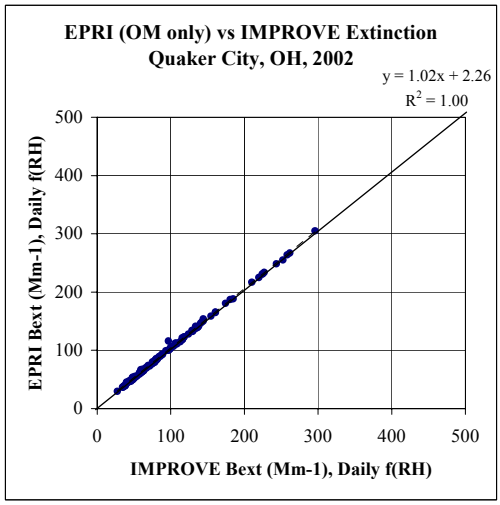
Linear Regression Statistics
EPRI Method vs. IMPROVE Method Extinction
Using Monthly and Daily f(RH)

		Monthly f(RH)			Daily f(RH)		
Site	Network	R^2	Slope	Intercept	R^2	Slope	Intercept
Quaker City	IMPROVE	0.99	1.28	-24.9	0.98	1.21	-15.9
Seney	IMPROVE	0.99	1.11	-8.8	0.98	1.07	-6.7
Seney	STN	0.99	1.20	-12.0	0.98	1.15	-8.7
Mayville	STN	0.99	1.26	-19.3	0.98	1.19	-12.5
Bondville	IMPROVE	0.99	1.25	-23.8	0.99	1.18	-18.6

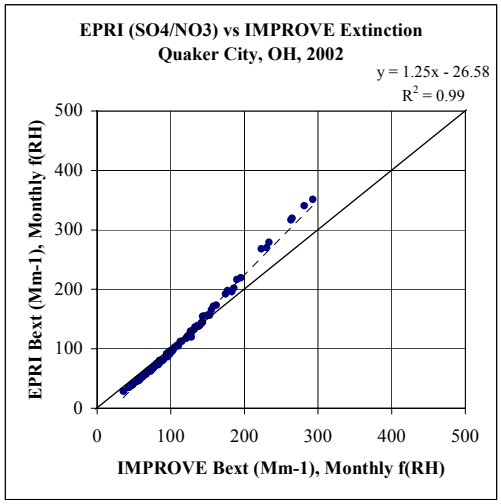
Figure 1.

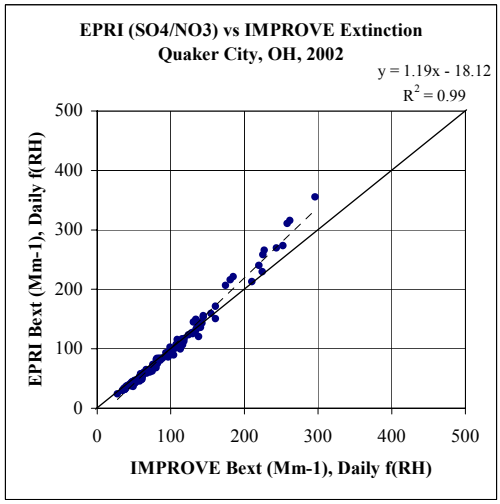
Algorithm Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Quaker City, OH
EPRI (OM only) vs IMPROVE Algorithms for Monthly and Daily f(RH)



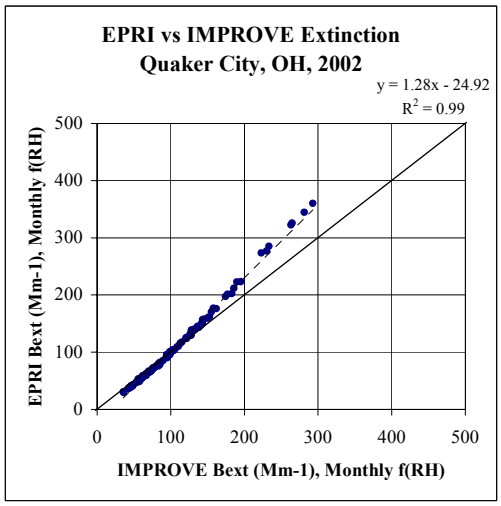


Algorithm Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Quaker City, OH
EPRI (Sulfate/Nitrate only) vs IMPROVE Algorithms for Monthly and Daily f(RH)





Algorithm Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Quaker City, OH
EPRI vs IMPROVE Algorithms for Monthly and Daily f(RH)



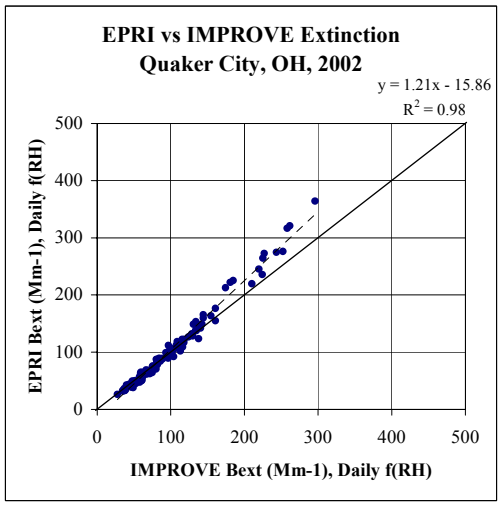
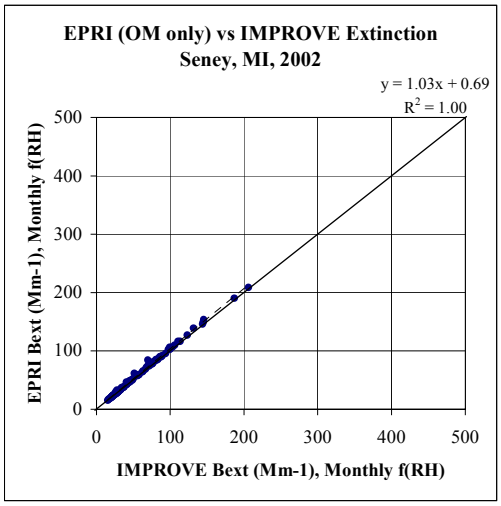
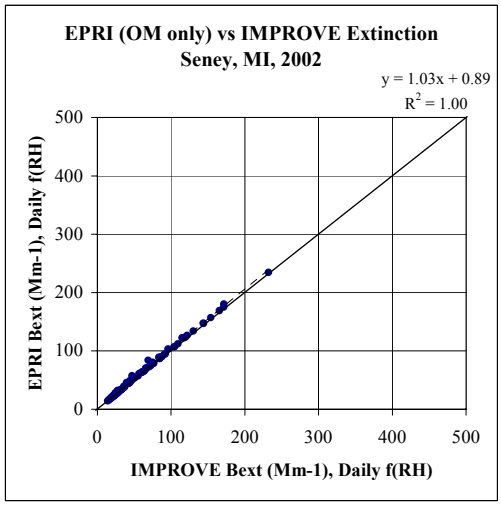


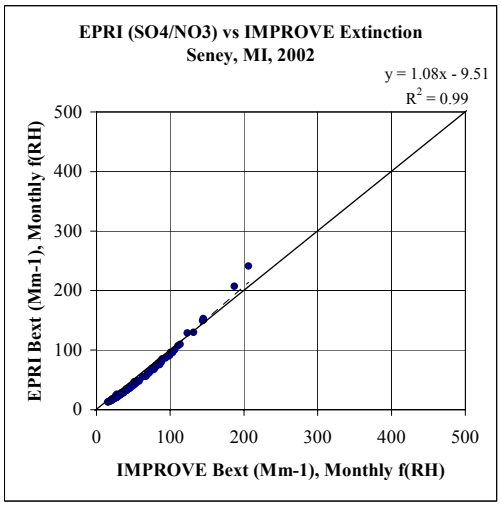
Figure 2.

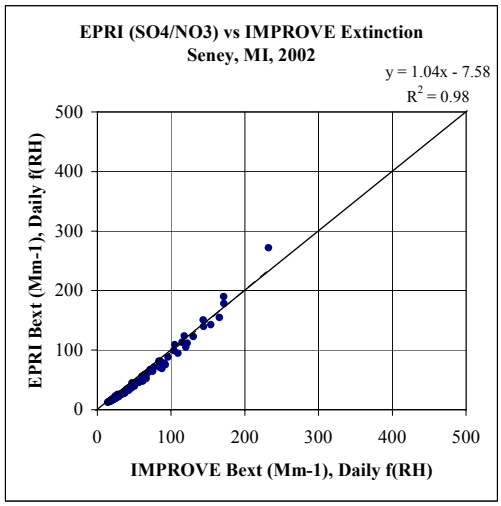
Algorithm Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Seney, MI
EPRI (OM only) vs IMPROVE Algorithms for Monthly and Daily f(RH)



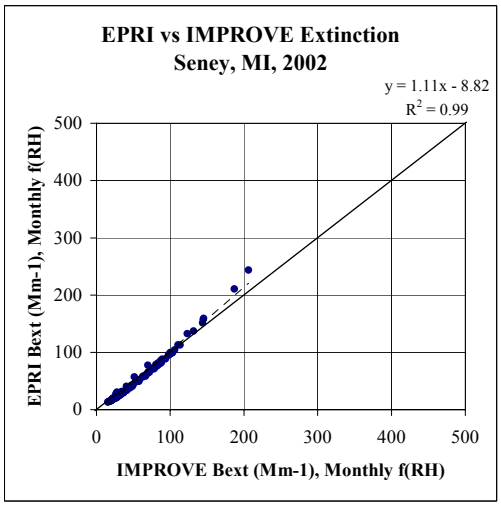


Algorithm Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Seney, MI
EPRI (Sulfate/Nitrate only) vs IMPROVE Algorithms for Monthly and Daily f(RH)





Algorithm Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Seney, MI
EPRI vs IMPROVE Algorithms for Monthly and Daily f(RH)



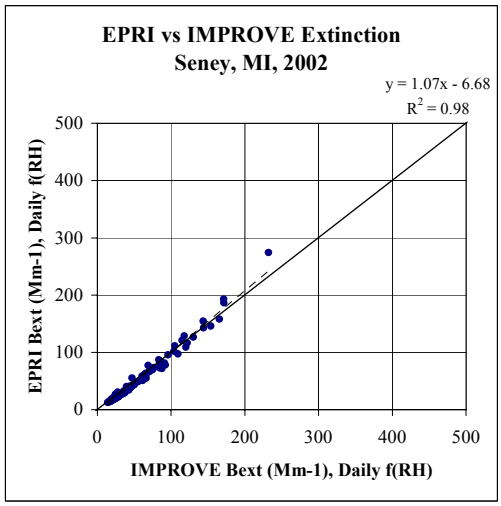
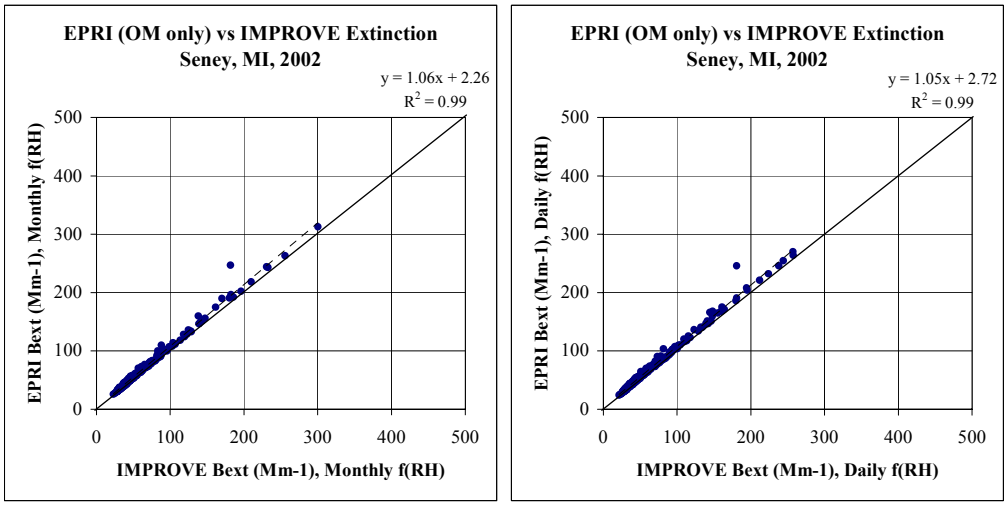
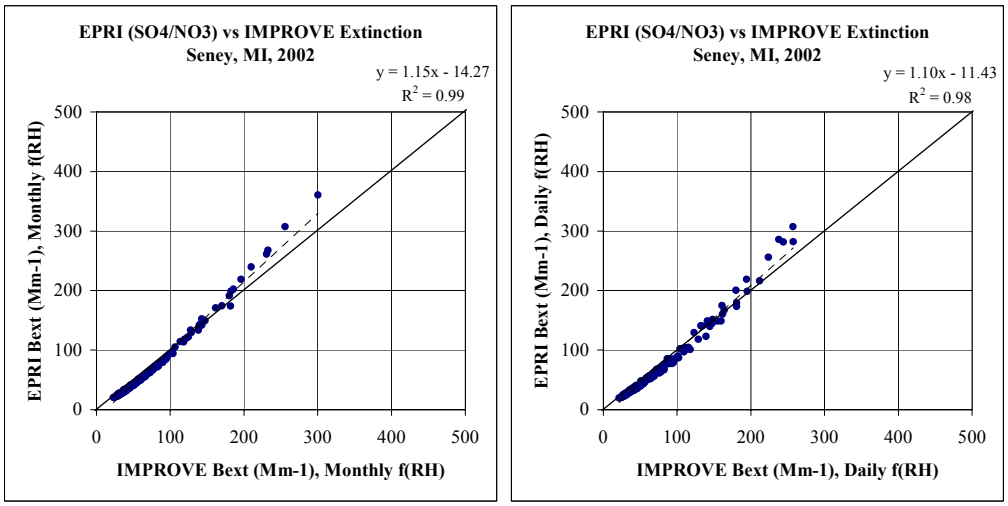


Figure 3.

Algorithm Sensitivity in Calculation of Aerosol (STN) Extinction for Seney, MI
EPRI (OM only) vs IMPROVE Algorithms for Monthly and Daily f(RH)



Algorithm Sensitivity in Calculation of Aerosol (STN) Extinction for Seney, MI
EPRI (Sulfate/Nitrate only) vs IMPROVE Algorithms for Monthly and Daily f(RH)



Algorithm Sensitivity in Calculation of Aerosol (STN) Extinction for Seney, MI
EPRI vs IMPROVE Algorithms for Monthly and Daily f(RH)

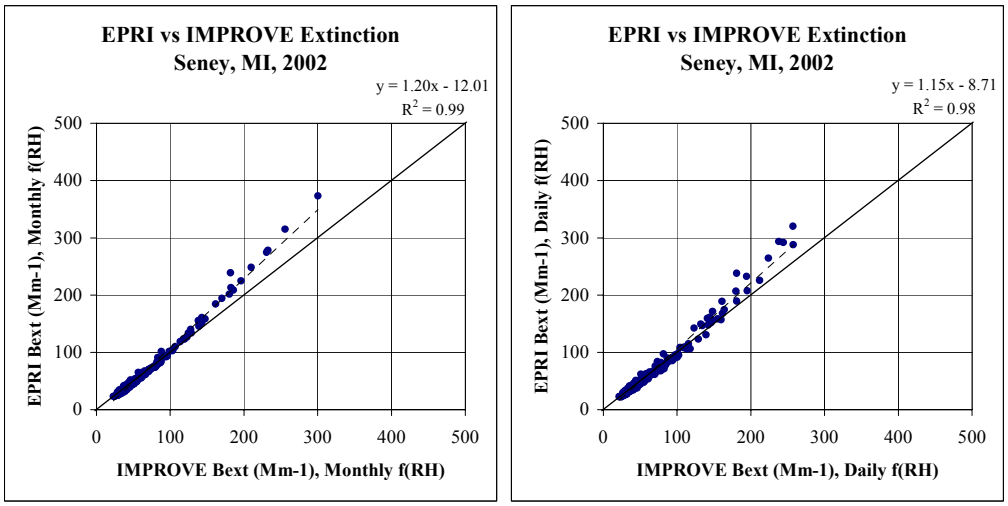
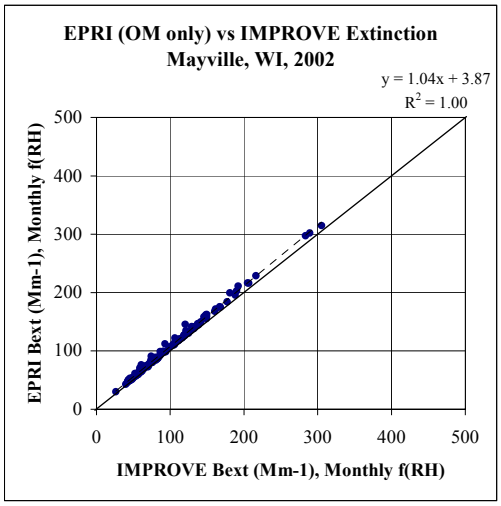
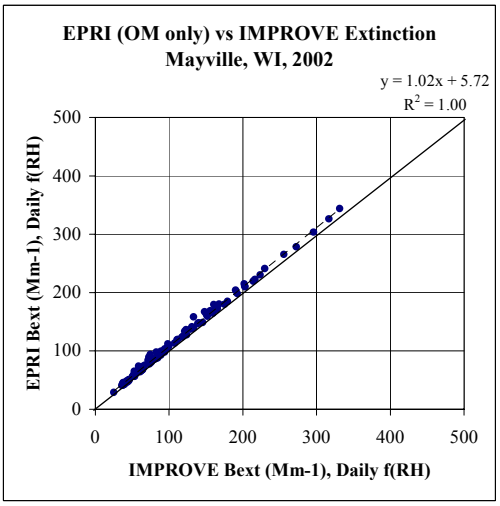


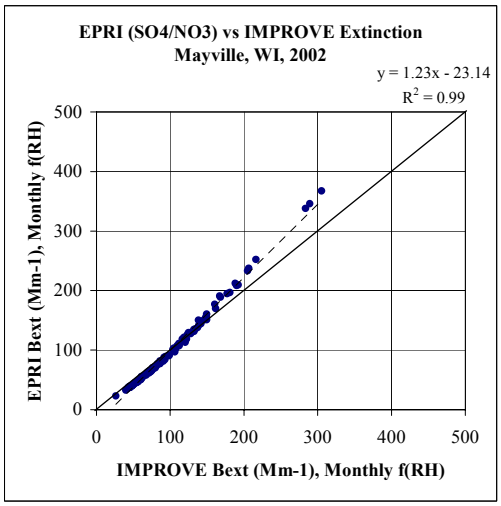
Figure 4.

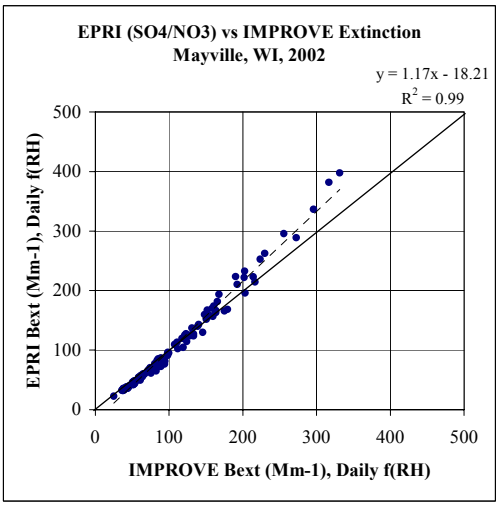
Algorithm Sensitivity in Calculation of Aerosol (STN) Extinction for Mayville, WI
EPRI (OM only) vs IMPROVE Algorithms for Monthly and Daily f(RH)



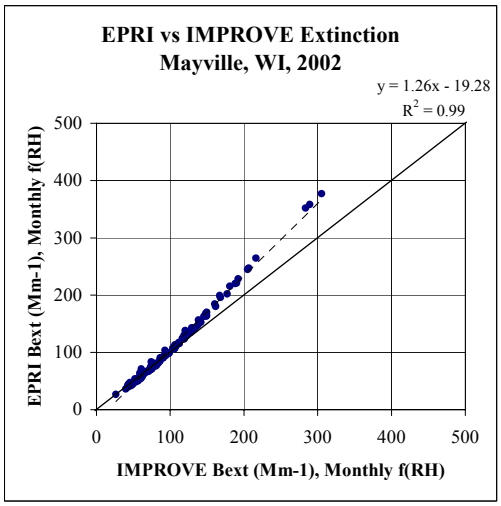


Algorithm Sensitivity in Calculation of Aerosol (STN) Extinction for Mayville, WI
EPRI (Sulfate/Nitrate only) vs IMPROVE Algorithms for Monthly and Daily f(RH)





Algorithm Sensitivity in Calculation of Aerosol (STN) Extinction for Mayville, WI
EPRI vs IMPROVE Algorithms for Monthly and Daily f(RH)



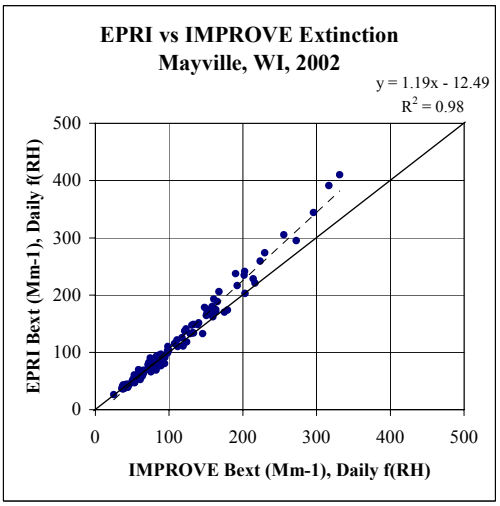
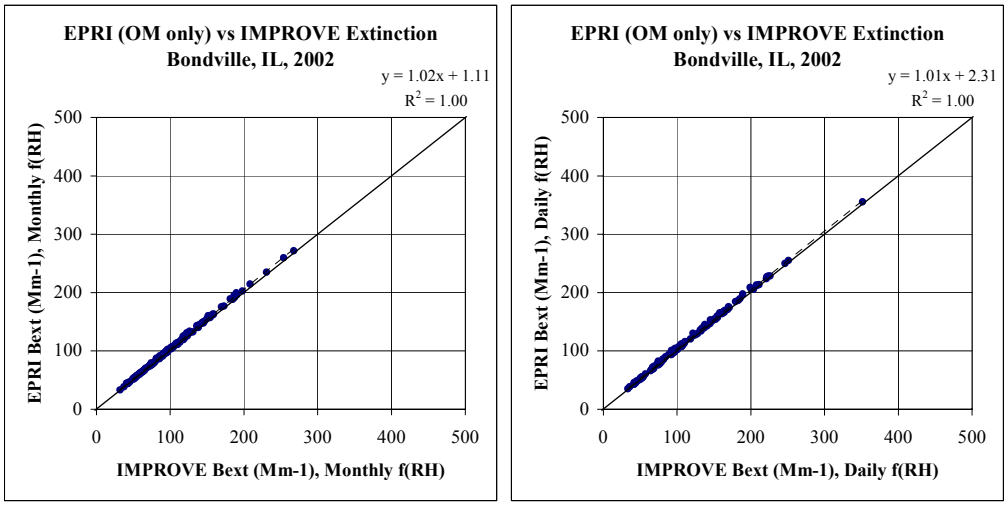
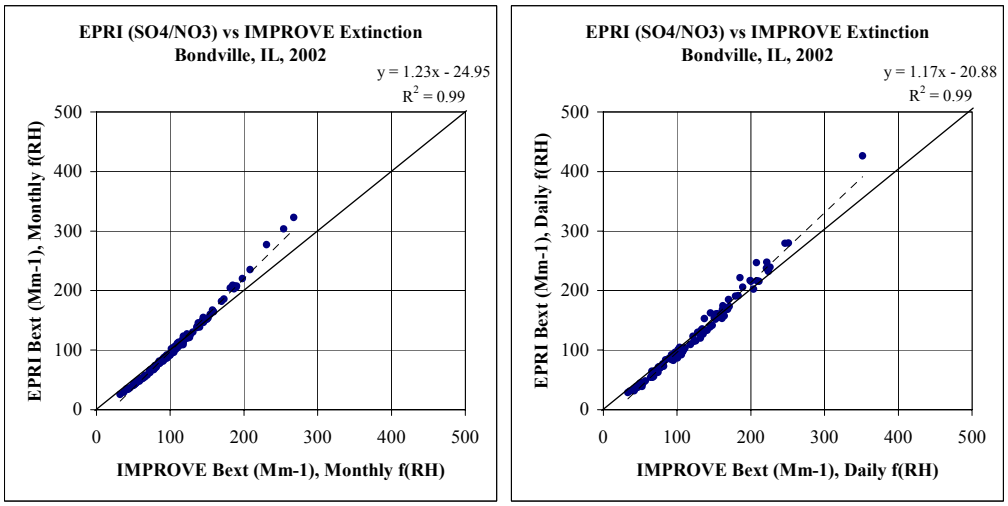


Figure 5.

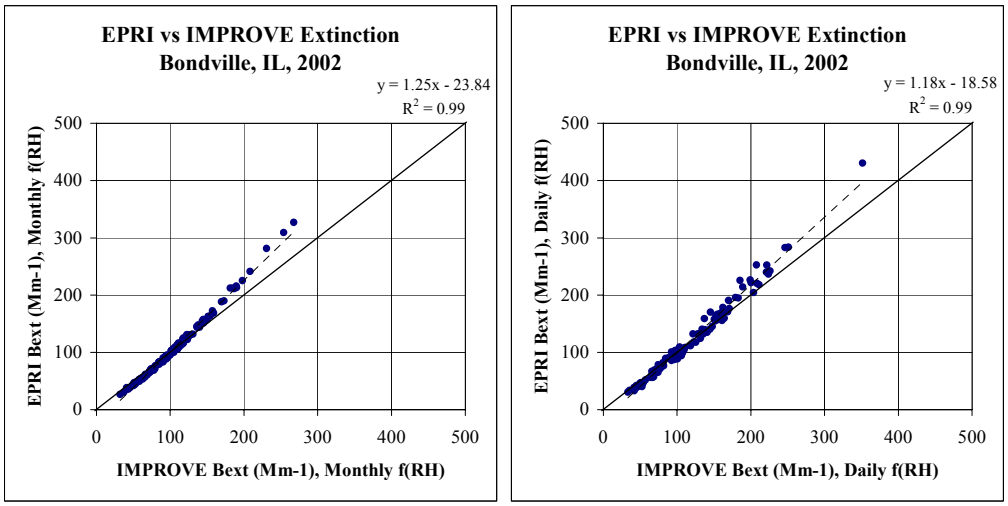
Algorithm Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Bondville, IL
EPRI (OM only) vs IMPROVE Algorithms for Monthly and Daily f(RH)



Algorithm Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Bondville, IL
EPRI (Sulfate/Nitrate only) vs IMPROVE Algorithms for Monthly and Daily f(RH)



Algorithm Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Bondville, IL
EPRI vs IMPROVE Algorithms for Monthly and Daily f(RH)



1.3 MONTHLY VS. DAILY F(RH) IN THE EXTINCTION CALCULATION

When calculating aerosol extinction, EPA guidance is to use a monthly value of the relative humidity enhancement factor, f(RH). The purpose of using a monthly value is to minimize the variability in extinction due to fluctuating RH. It is also useful for sites which collect speciated mass data but to not make measurements of RH. However, this is not the method to use to calculate the "best estimate" of extinction on a given day. ARS calculated IMPROVE and the complete EPRI method extinction using both monthly and daily f(RH) values. (A minimum of 16 valid RH measurements were required to constitute a valid daily f(RH) for this analysis.)

Table 3 summarizes the regression statistics for comparisons at all LADCO sites. Figures 6 through 10 present graphical comparisons for all sites. The spread in the data around the 1-1 line is due to the variability of daily RH. The left scatter plot in each figure compares both f(RH) types using the IMPROVE method, and the right scatter plot compares both f(RH) types using the EPRI method.

The R^2s, slopes and intercepts are nearly identical between IMPROVE and EPRI extinction calculations for individual sites, implying that the affect of choosing one f(RH) type over the other is very similar between analyses. (The EPRI R^2 values are slightly higher due to somewhat higher EPRI extinctions stretching the data set towards the upper right of the plot.) In addition, the slopes for Seney, Mayville, and Bondville are nearly 1, indicating that on average the daily f(RH) agrees well with the monthly value at these sites. The Quaker City slope is 0.89, indicating that the monthly f(RH) is higher than would be expected from the daily values. Since the monthly values were determined from several years' worth of RH data, it is also possible that 2002 was somewhat drier than normal at Quaker City. The intercepts are all a very low percentage of typical extinction values, as would be expected from a good regression fit.

Table 3

Linear Regression Statistics
Extinction Based on Daily vs. Monthly f(RH)
For the IMPROVE and EPRI Methods

		IMPROVE Method			EPRI Method		
Site	Network	R^2	Slope	Intercept	R^2	Slope	Intercept
Quaker City	IMPROVE	0.70	0.89	4.1	0.78	0.89	4.8
Seney	IMPROVE	0.86	1.04	-0.9	0.90	1.03	-0.2
Seney	STN	0.90	1.02	0.1	0.93	0.99	1.6
Mayville	STN	0.73	1.03	3.7	0.81	1.02	4.9
Bondville	IMPROVE	0.70	1.04	5.8	0.77	1.04	5.8

Figure 6.

f(RH) Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Quaker City, OH
Daily vs. Monthly f(RH) for IMPROVE and EPRI Algorithms

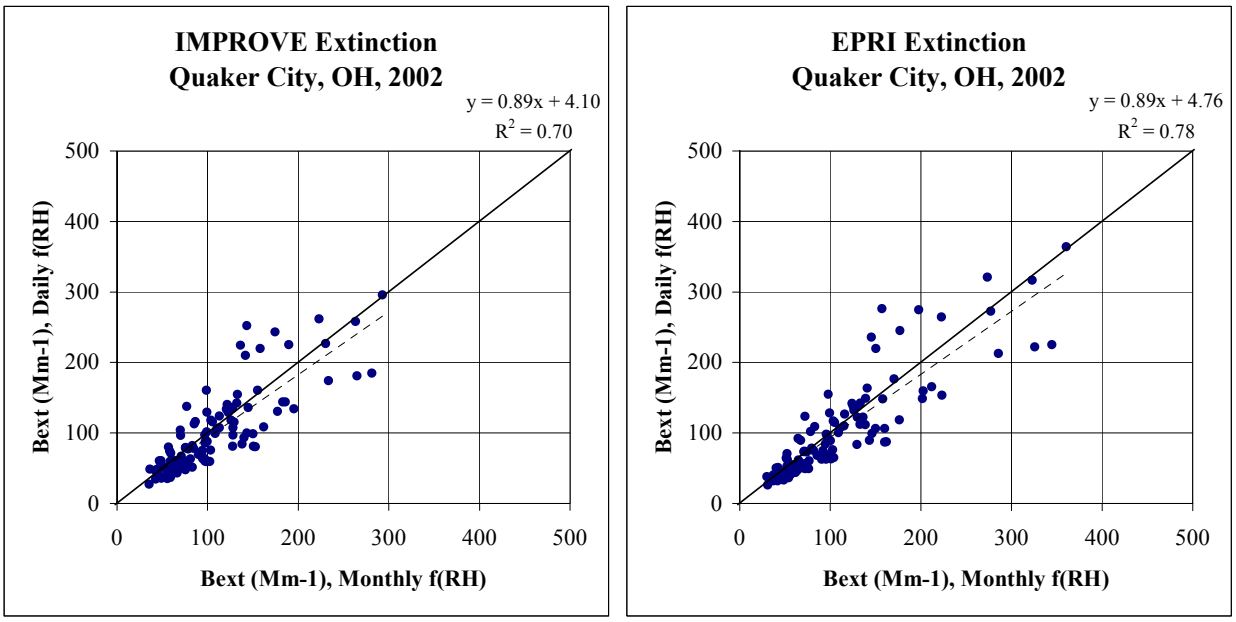


Figure 7.

f(RH) Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Seney, MI
Daily vs. Monthly f(RH) for IMPROVE and EPRI Algorithms

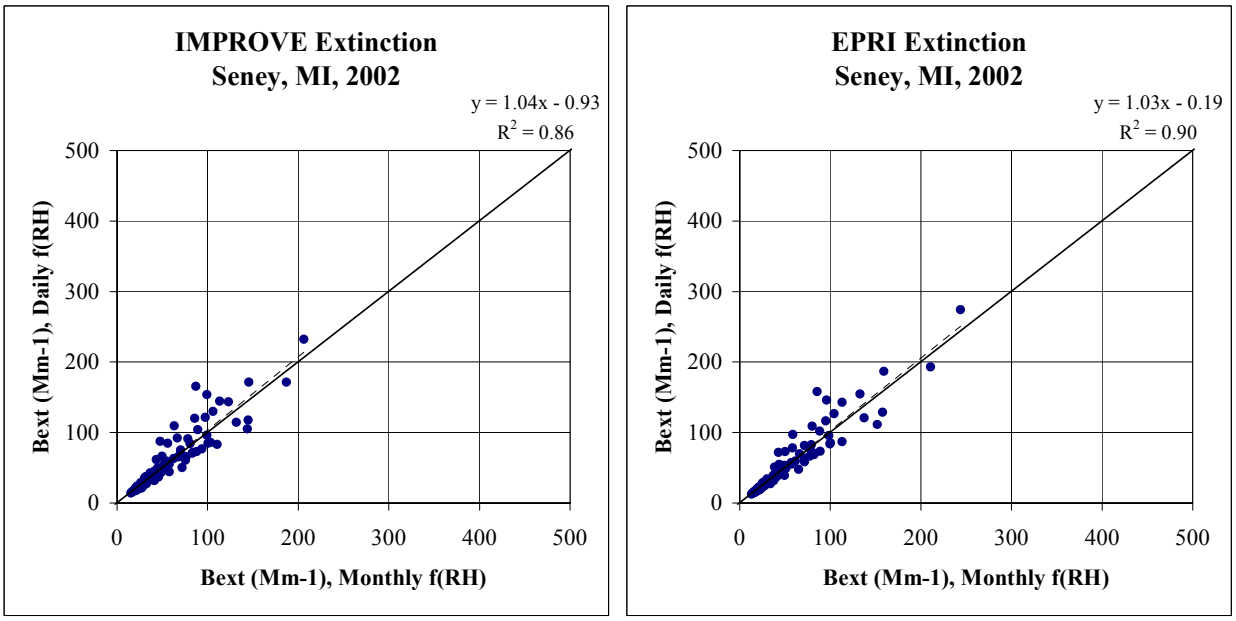


Figure 8.

f(RH) Sensitivity in Calculation of Aerosol (STN) Extinction for Seney, MI
Daily vs. Monthly f(RH) for IMPROVE and EPRI Algorithms

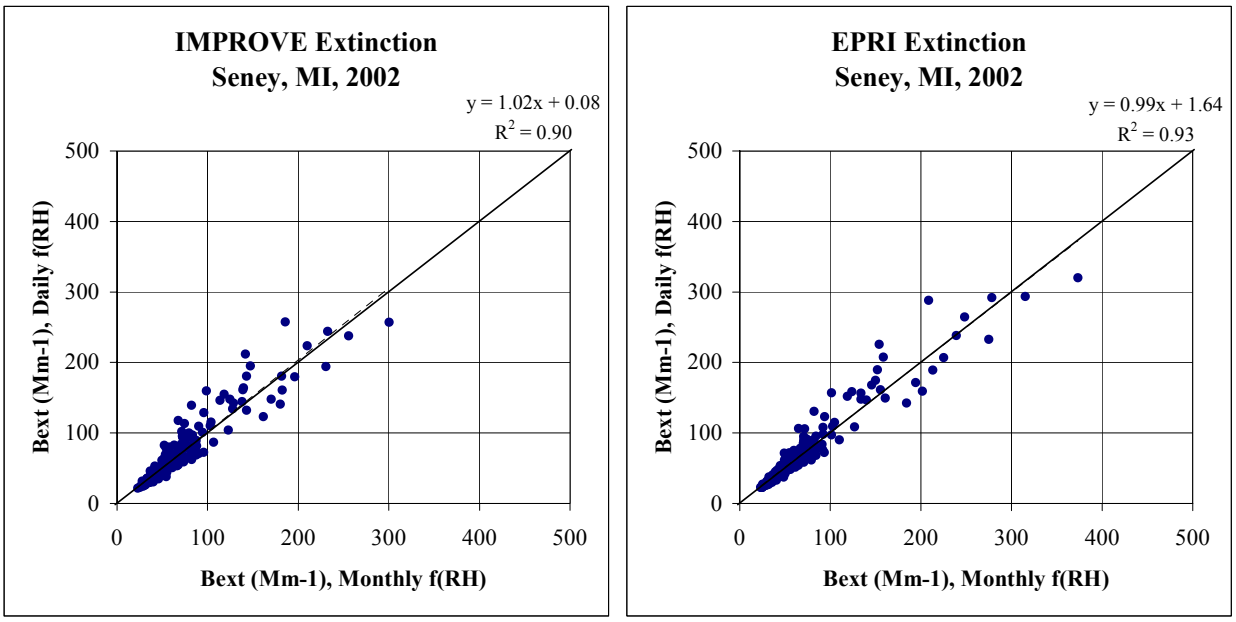


Figure 9.

f(RH) Sensitivity in Calculation of Aerosol (STN) Extinction for Mayville, WI
Daily vs. Monthly f(RH) for IMPROVE and EPRI Algorithms

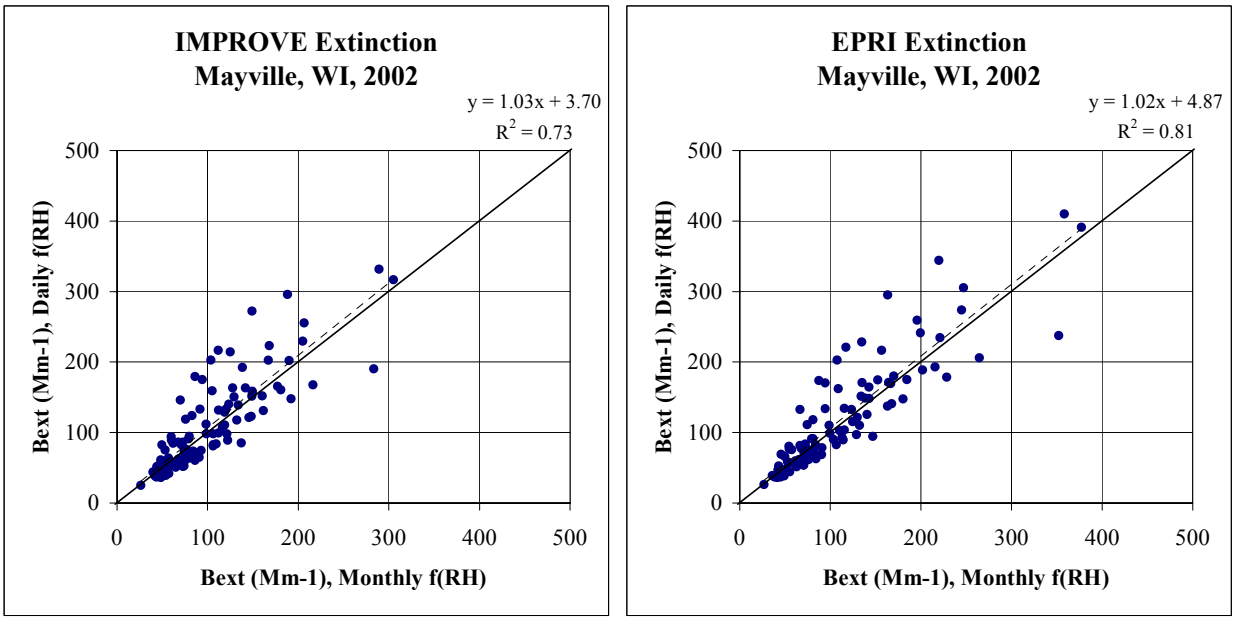
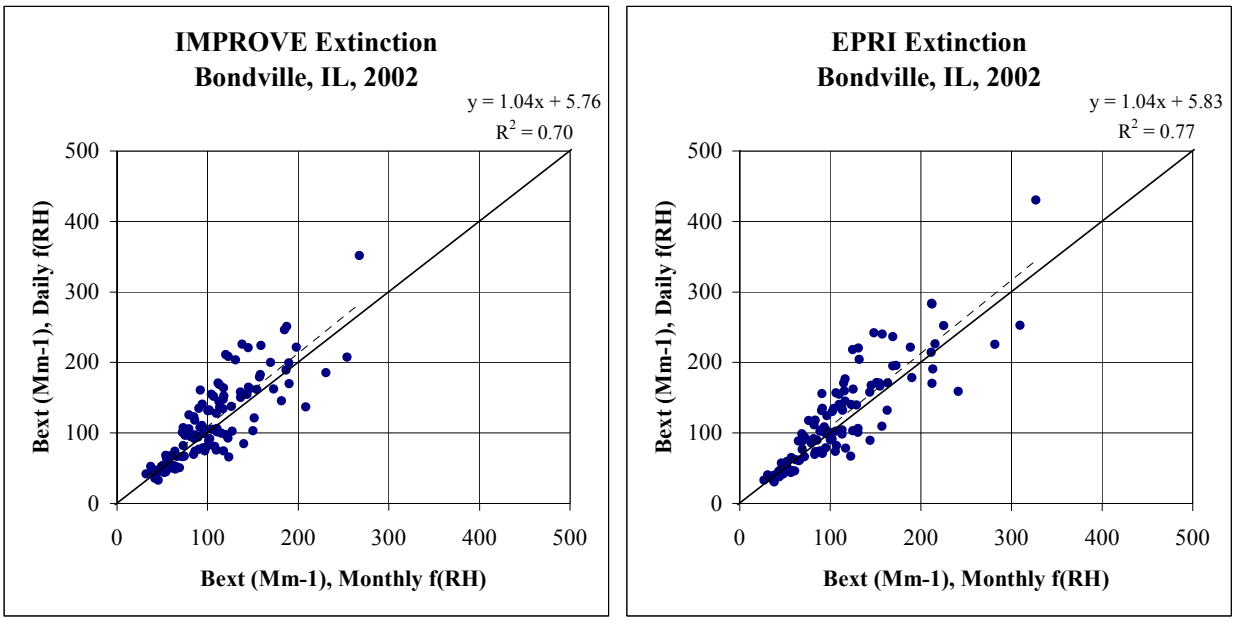


Figure 10.

f(RH) Sensitivity in Calculation of Aerosol (IMPROVE) Extinction for Bondville, IL
Daily vs. Monthly f(RH) for IMPROVE and EPRI Algorithms



1.4 COMPARISON OF AEROSOL AND NEPHELOMETER LIGHT SCATTERING

ARS computed daily nephelometer scattering and daily aerosol scattering using the IMPROVE and EPRI methods. EPRI scattering was computed for both components of, and for the complete method. The aerosol scattering was calculated using daily f(RH). Only those hourly RH measurements which corresponded with filtered nephelometer data were used. A minimum of sixteen valid hourly RH measurements were required to calculate aerosol scattering for a given day. Likewise, a minimum of sixteen filtered hourly nephelometer measurements were required to represent a given day. The cutoff RH for nephelometer filtering was set to 95% (ARS, 2004).

Figures 11 through 15 present comparisons of 2002 daily aerosol and nephelometer scattering by annual period and individual quarters for each site, first using IMPROVE scattering (blue dots), followed by similar plots using EPRI scattering based on the organic carbon component (green diamonds), EPRI scattering based on the sulfate/nitrate component (brown x's), and EPRI scattering based on the complete method (red circles). (Note that dry aerosol and dry nephelometer scattering is presented for Bondville.) At the bottom of each of the figures is a timeline of the difference between aerosol and nephelometer scattering for 2002. The changes to these timelines between methods is generally that the differences are slightly higher for the EPRI analyses. There is no significant change in spread of the data from one method to the other. Differences between daily estimated and measured scattering may occur due to the following reasons:

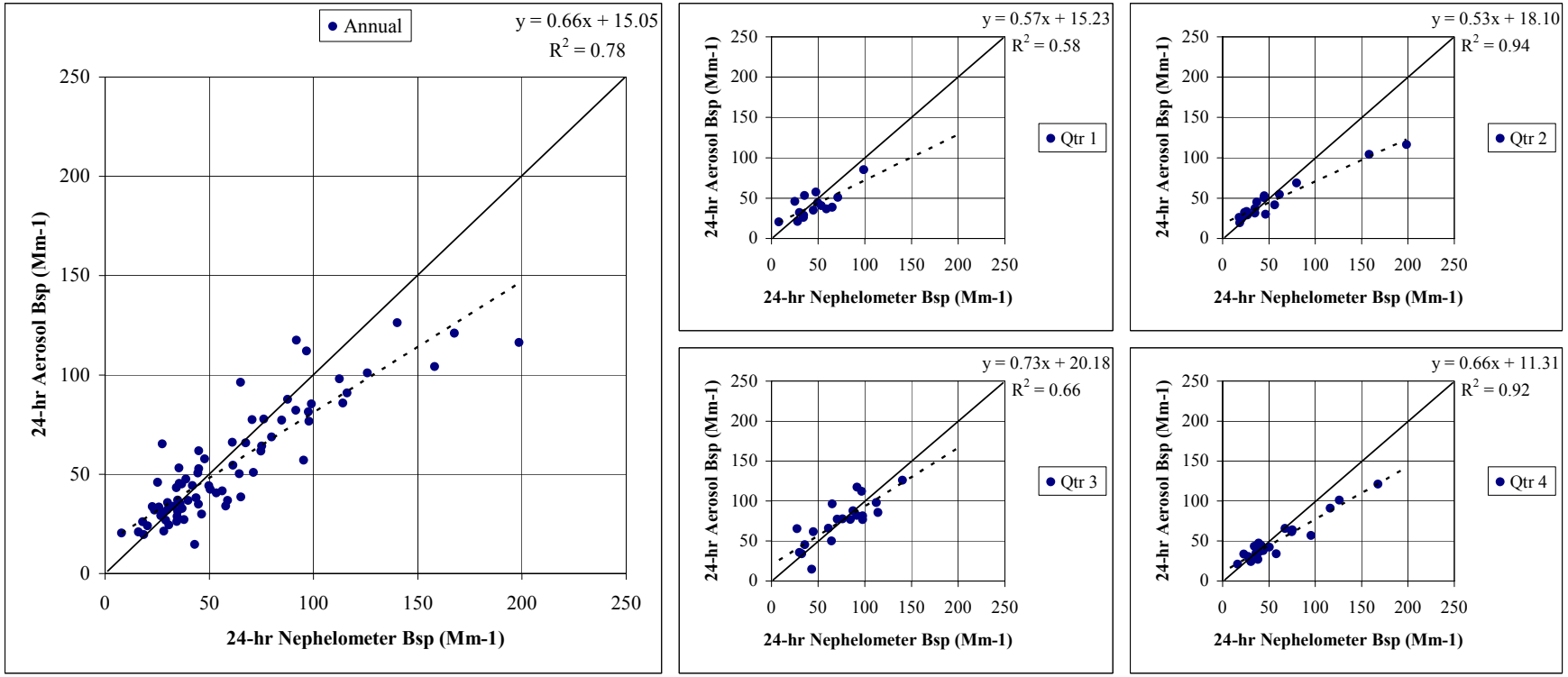
- Differences between assumed and actual aerosol characteristics (size, scattering efficiency, acidity, hygroscopicity, etc.).
- Nephelometer measurement error (e.g., weather or other interference not caught by screening algorithms; systematic bias in measurement from one instrument to another).
- Aerosol sample measurement or analysis error (e.g., variable sample flow which affects particle size cut point; contamination of filter sample).
- Instrument uncertainty associated with the aerosol sample or nephelometer measurement.
- Uncertainty about the sample chamber relative humidity at Bondville.

Table 4 summarizes the regression statistics for comparisons between aerosol and nephelometer scattering at all LADCO sites. Figure 16 presents these regression statistics in graphical format by annual and quarterly periods. The regression slopes shown in the top plot indicate the EPRI method generally increases the slope of the aerosol to nephelometer comparison, and the largest changes are associated with the sulfate/nitrate component. The complete EPRI method slopes are almost always closer to 1.0 than the IMPROVE method slopes. The regression intercepts shown in the middle plot indicate that the sulfate/nitrate component of the EPRI method tends to decrease the intercepts, whereas the organic carbon component increases them. Overall, the complete EPRI method intercepts are lower than the IMPROVE method intercepts, but often still high enough to indicate a less than ideal fit. Seney (IMPROVE data) is the only site that exhibits intercepts close to 0. The regression R^2 values shown in the bottom plot are nearly identical in most cases, indicating that the EPRI method does not introduce significant scatter into the data.

This combination of slopes closer to 1.0, lower intercepts, and nearly identical R^2 values implies that in general the EPRI method fits the nephelometer data better than the IMPROVE method. There are a couple exceptions where the IMPROVE method agrees very well and the EPRI method appears to over estimate the scattering: Mayville, quarter 1; Seney, quarter 2 (both data sets); and Seney, quarter 3 (STN data). The Bondville comparison still shows poor agreement between aerosol and nephelometer scattering. (As discussed in the March 2004 report, the Bondville nephelometer is heat controlled to keep the sample air relative humidity no greater than approximately 40%. However, no valid sampling chamber RH was available with the data so it is not known if this condition was met.)

Figure 11a.

Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using IMPROVE Algorithm and Daily f(RH)
Quaker City, OH, 2002



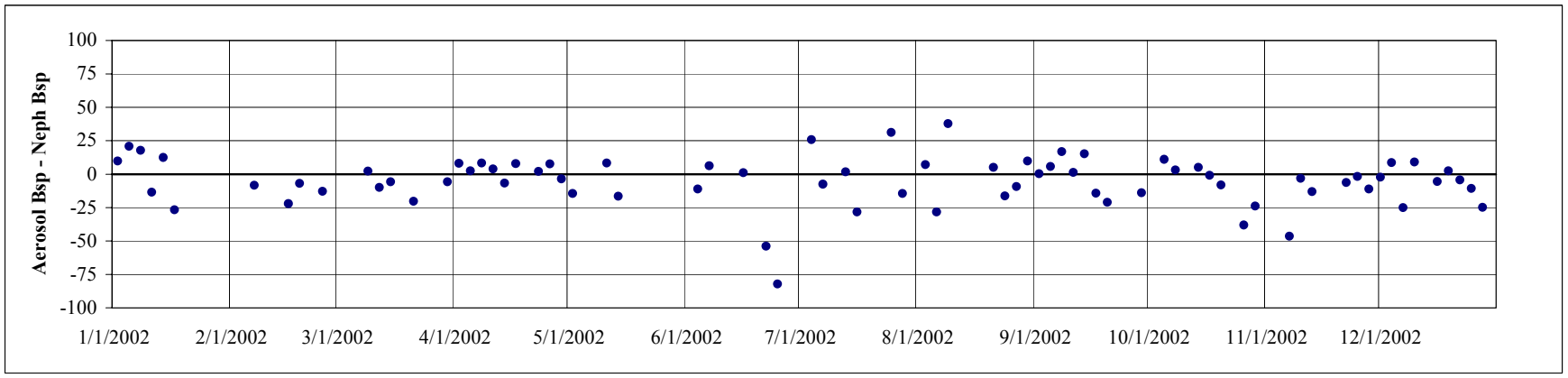


Figure 11b.

Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using EPRI Algorithm (OM only) and Daily f(RH)
Quaker City, OH, 2002

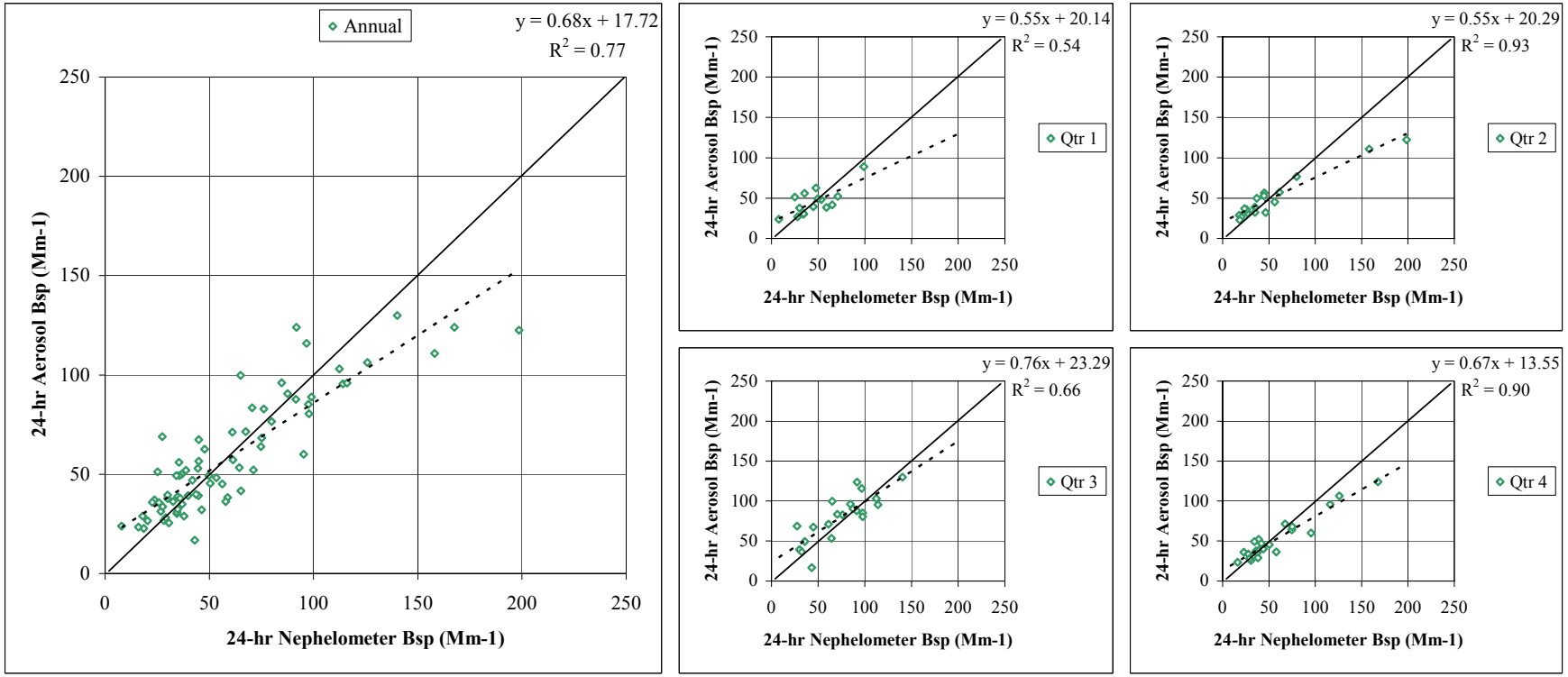


Figure 11c.

Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using EPRI Algorithm (Sulfate and Nitrate only) and Daily f(RH)
Quaker City, OH, 2002

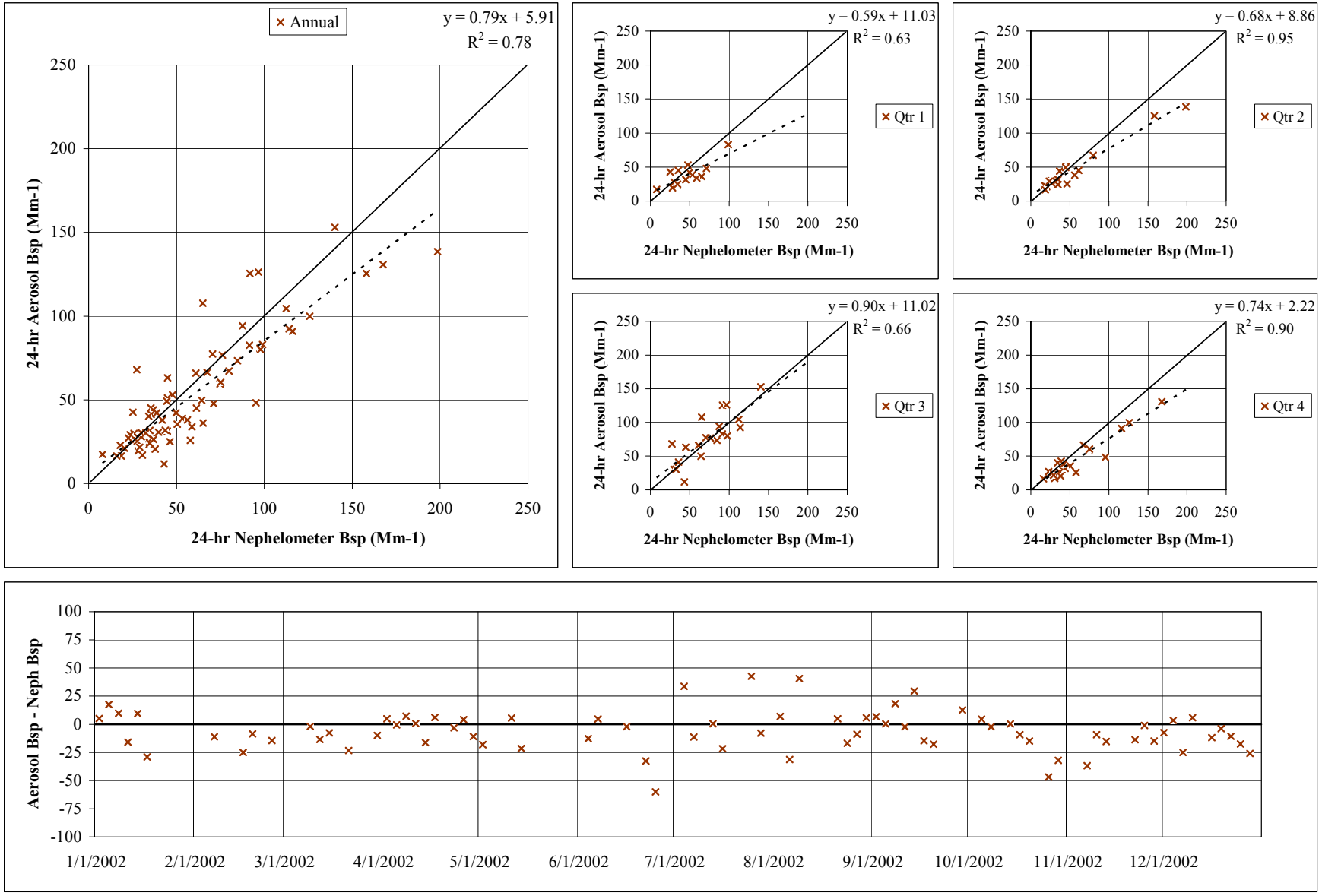
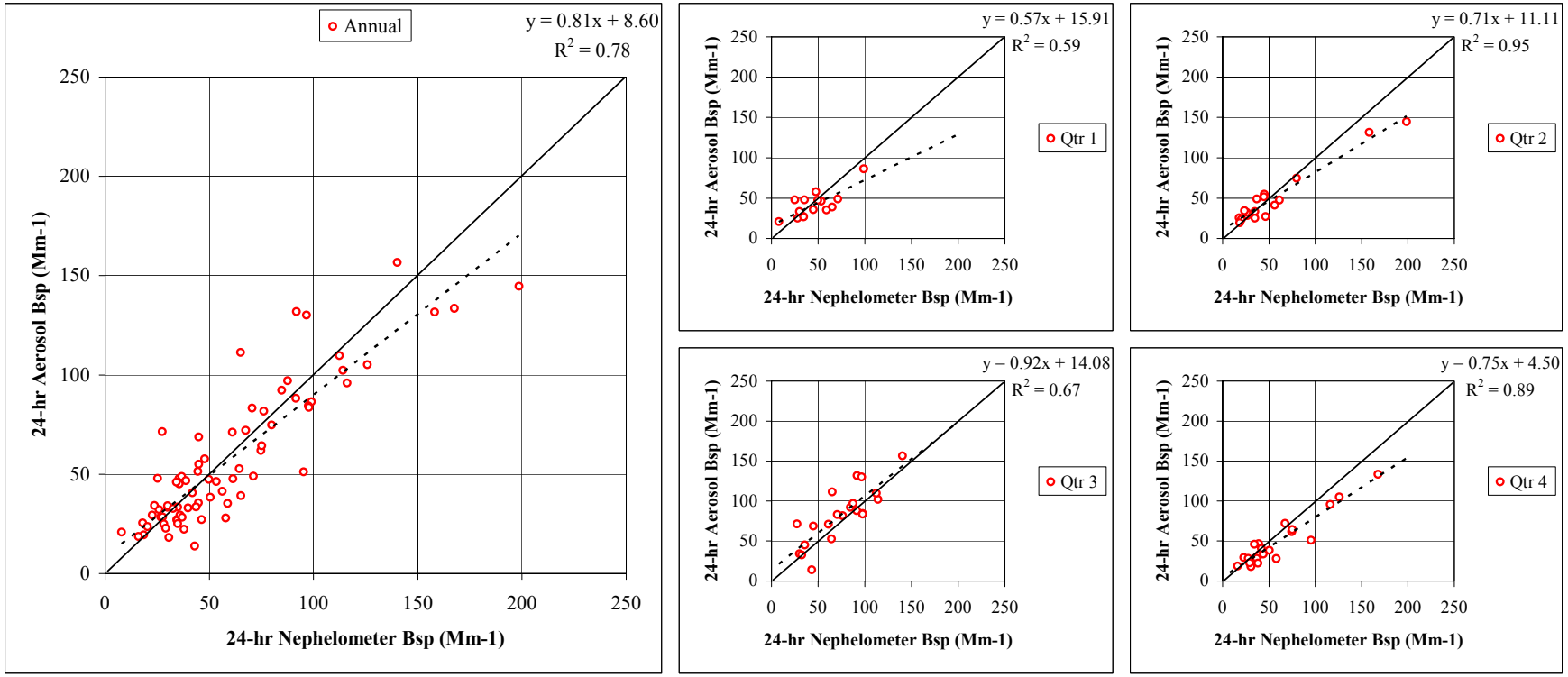


Figure 11d.

Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using EPRI Algorithm and Daily f(RH)
Quaker City, OH, 2002



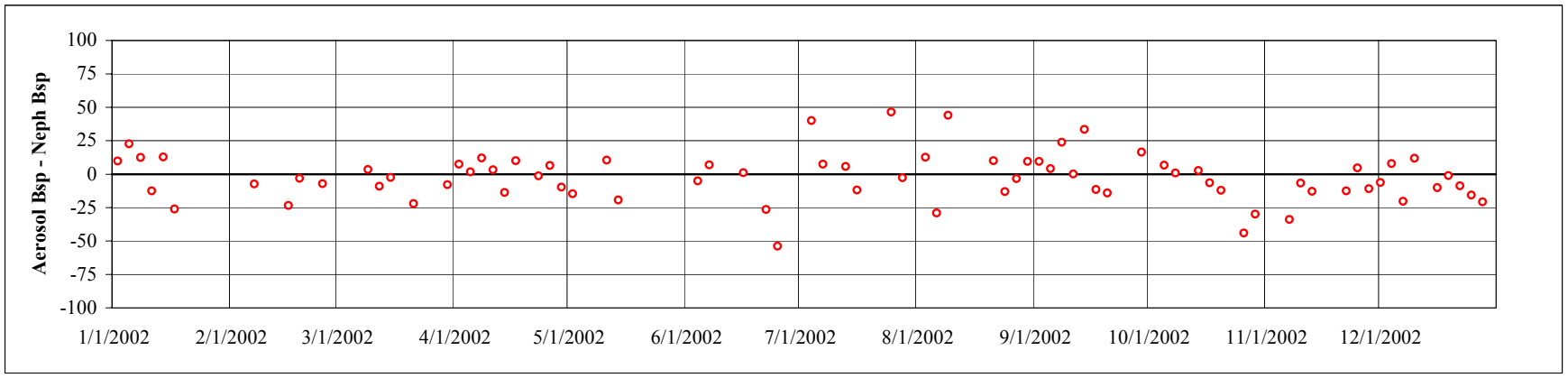


Figure 12a.

Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using IMPROVE Algorithm and Daily f(RH)
Seney, MI, 2002

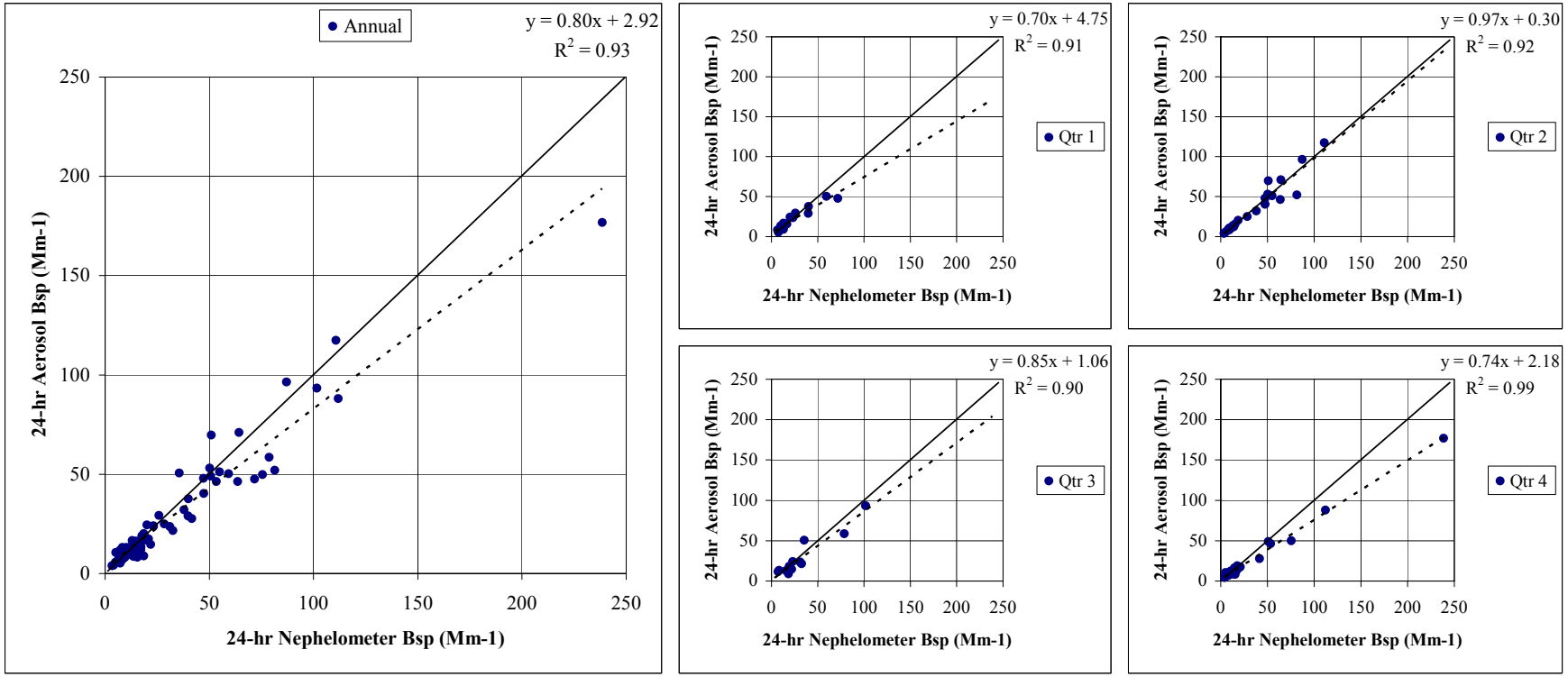


Figure 12b.

Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using EPRI Algorithm (OM only) and Daily f(RH)
Seney, MI, 2002

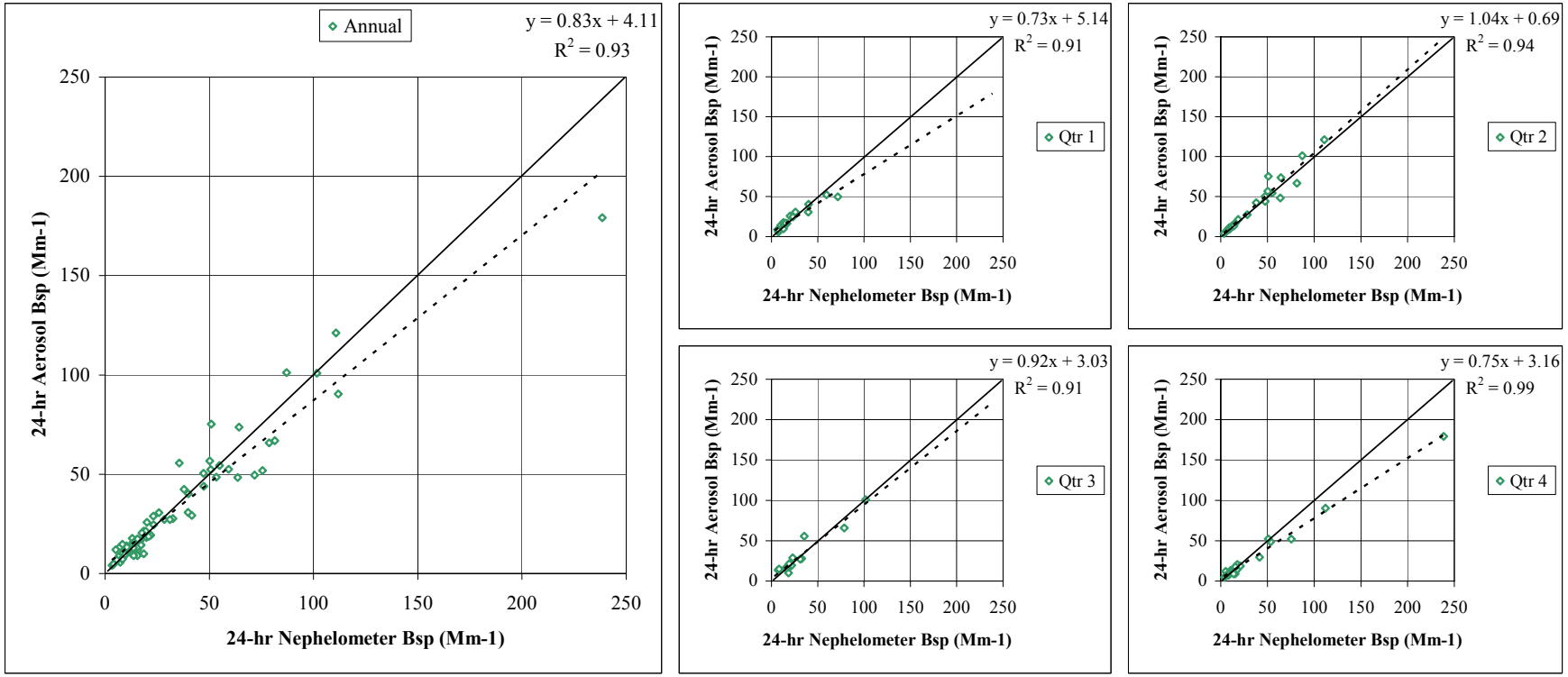


Figure 12c.

Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using EPRI Algorithm (Sulfate and Nitrate only) and Daily f(RH)
Seney, MI, 2002

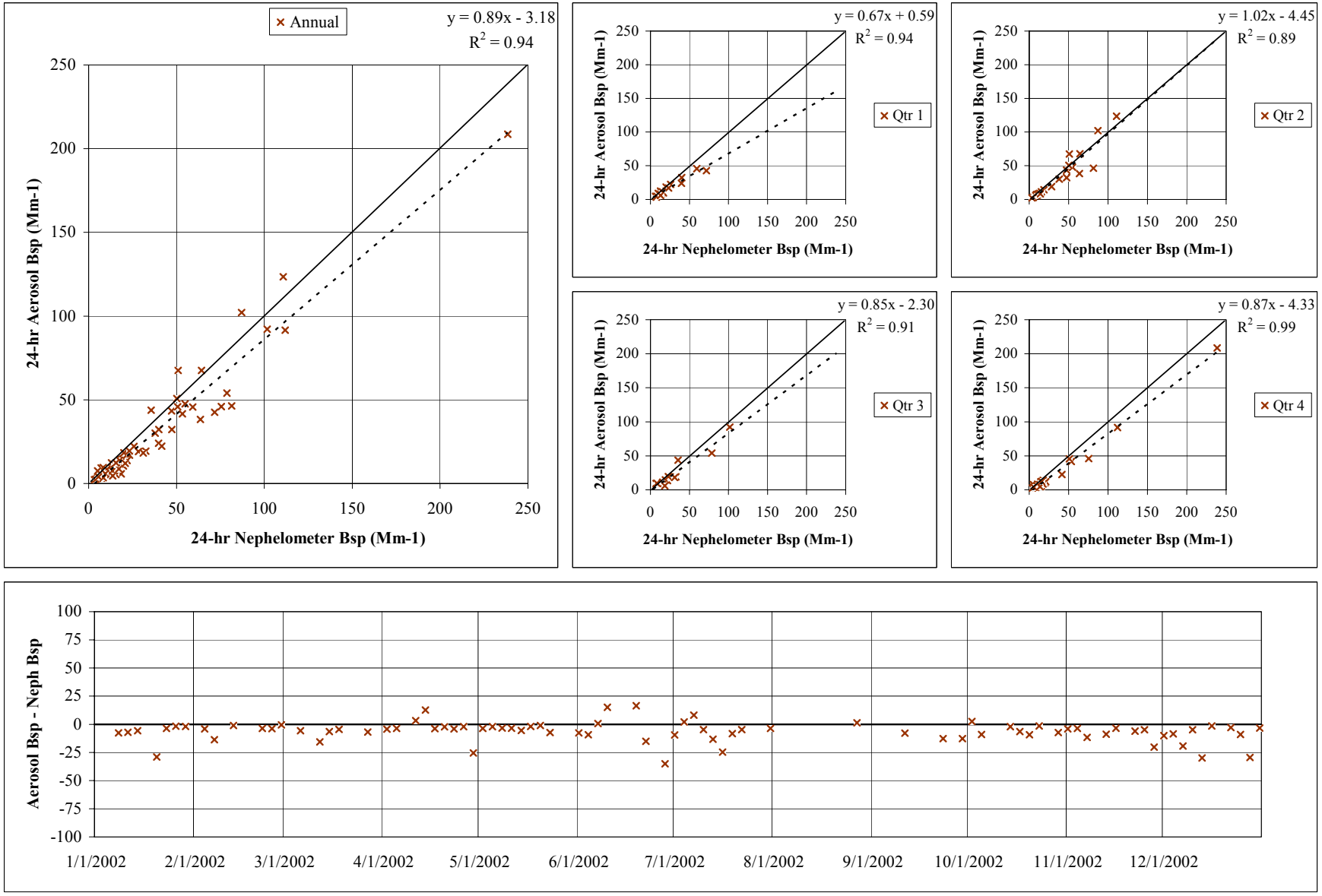
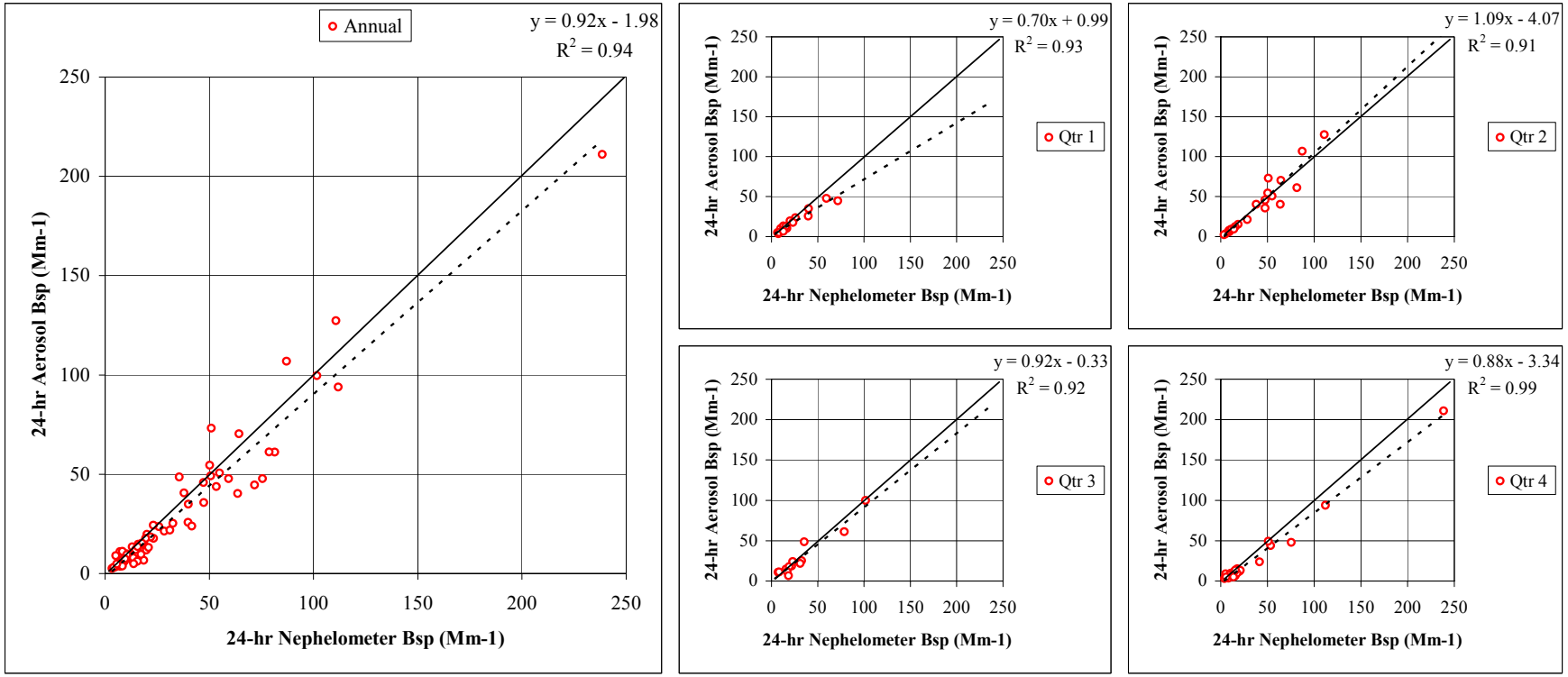


Figure 12d.

Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using EPRI Algorithm and Daily f(RH)
Seney, MI, 2002



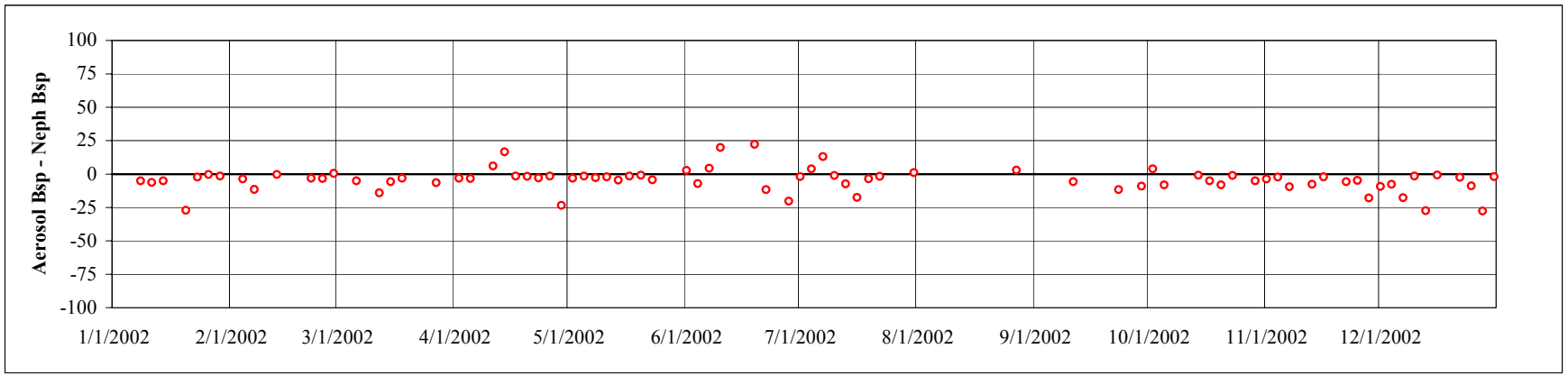
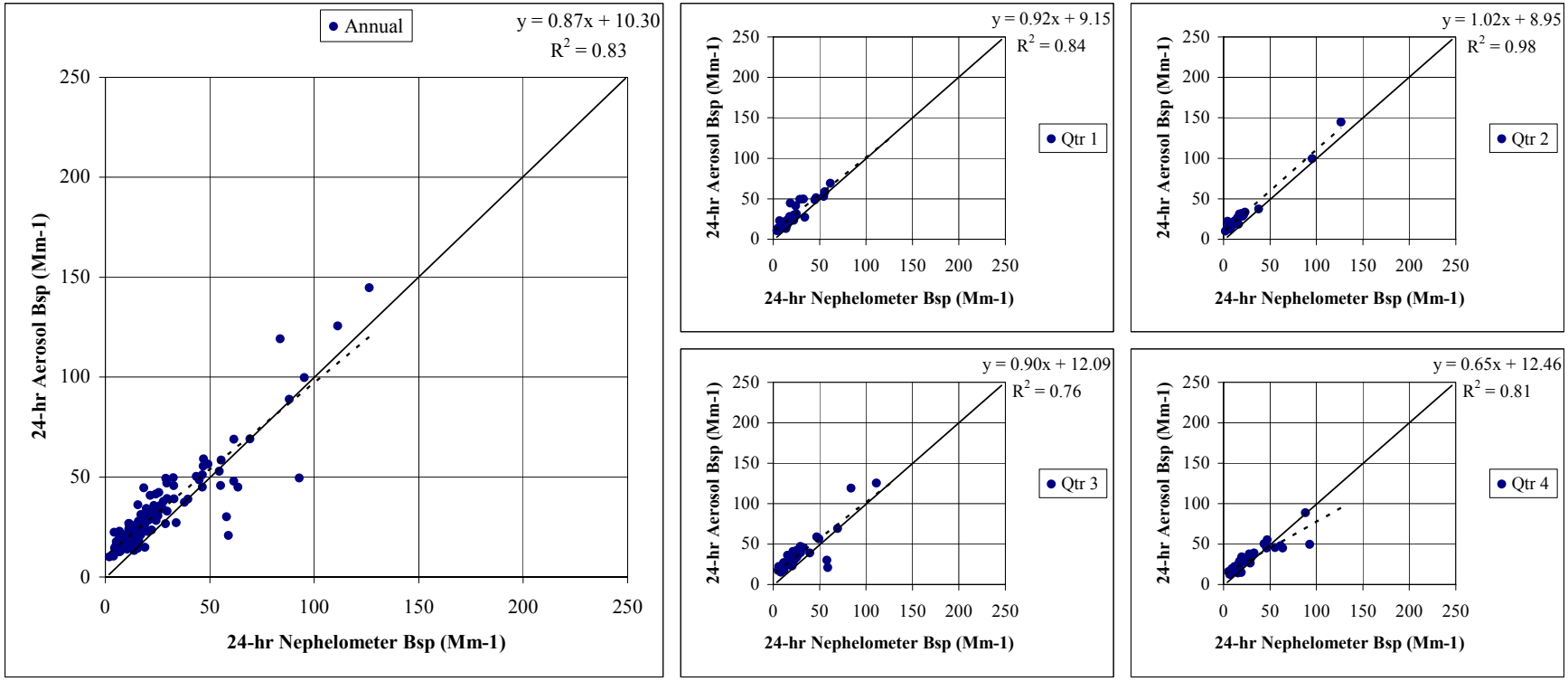


Figure 13a.

Aerosol Scattering (STN) vs. Nephelometer Scattering
Using IMPROVE Algorithm and Daily f(RH)
Seney, MI, 2002



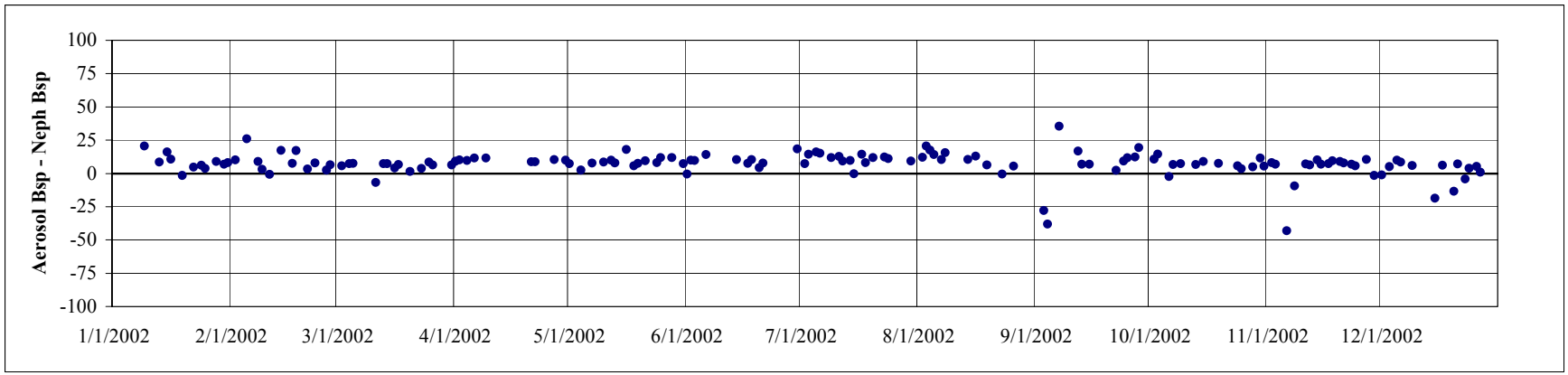


Figure 13b.

Aerosol Scattering (STN) vs. Nephelometer Scattering
Using EPRI Algorithm (OM only) and Daily f(RH)
Seney, MI, 2002

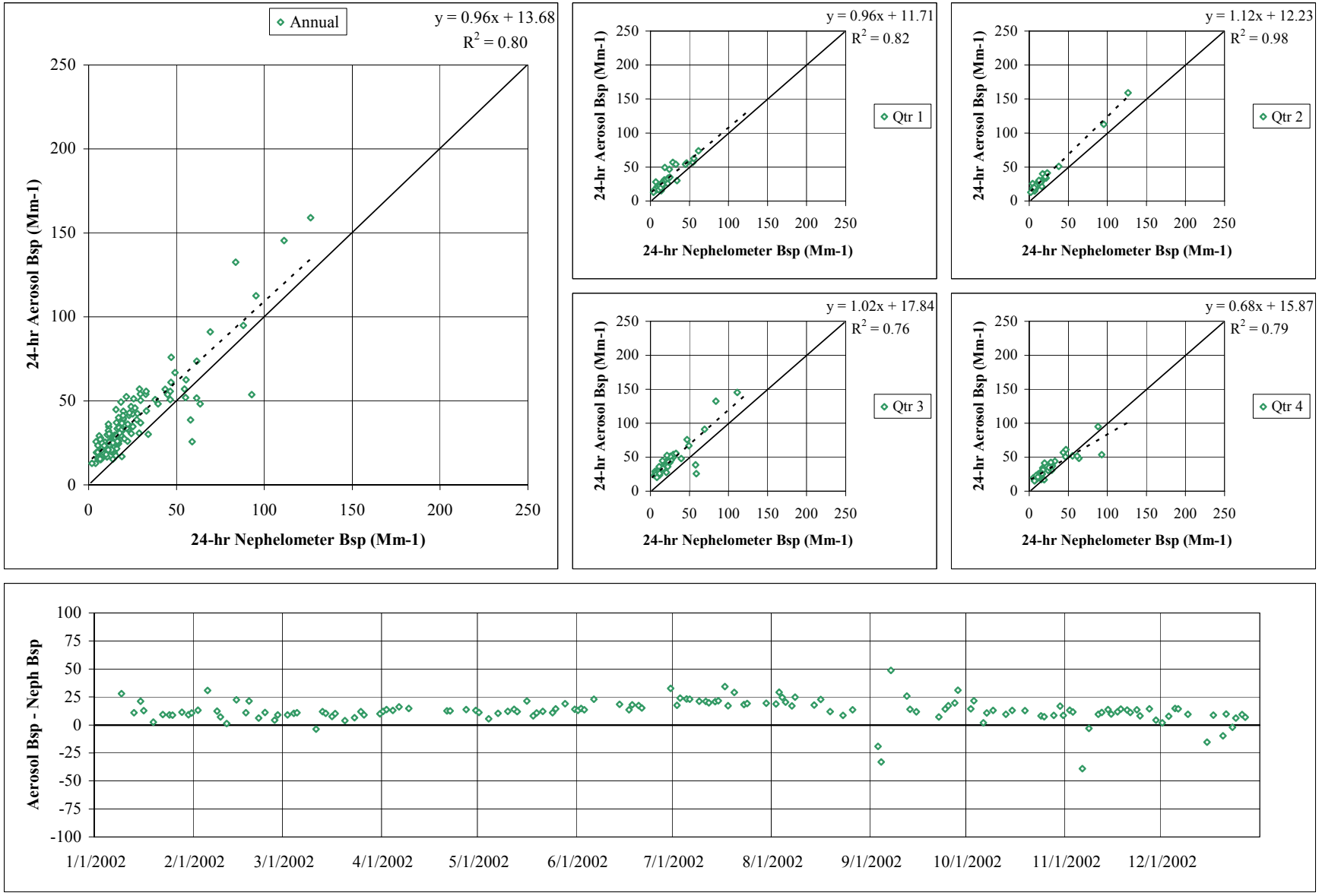
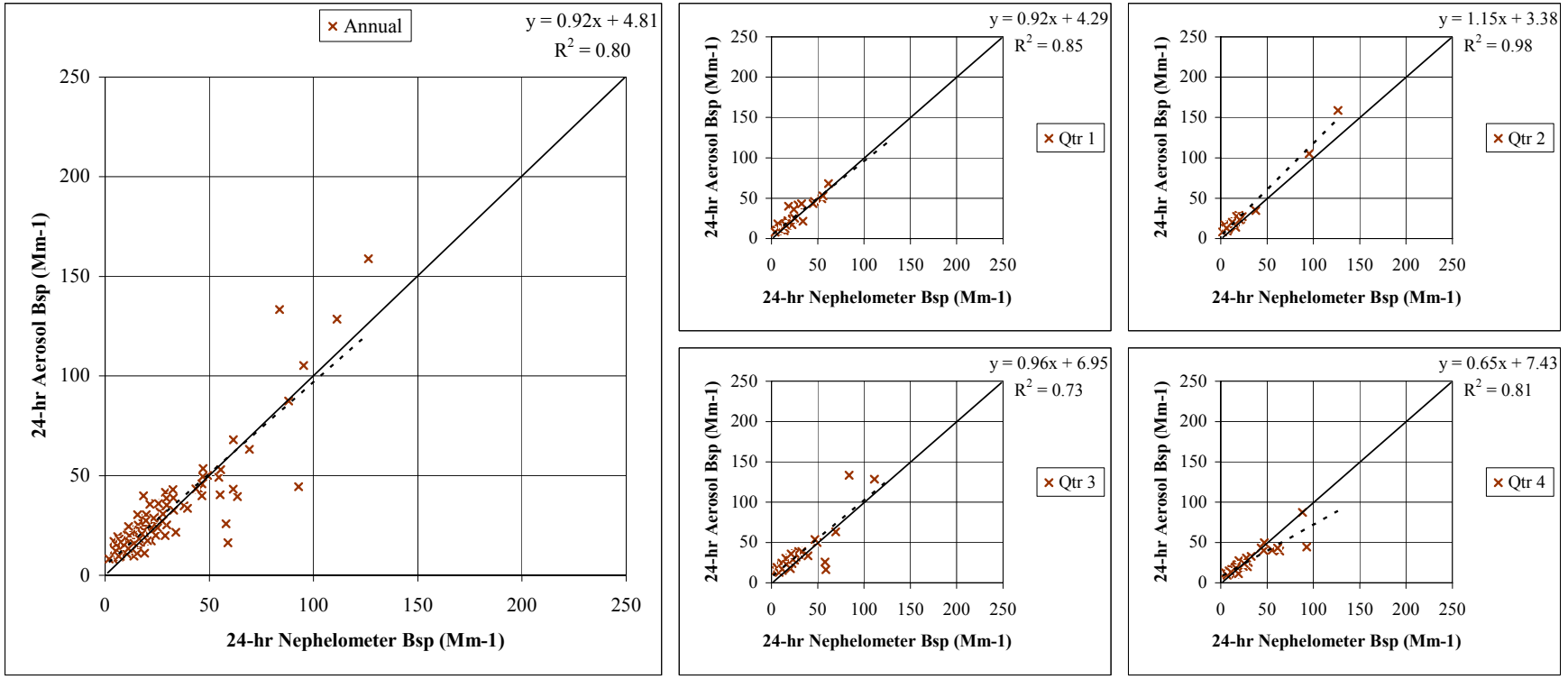


Figure 13c.

Aerosol Scattering (STN) vs. Nephelometer Scattering
Using EPRI Algorithm (Sulfate and Nitrate only) and Daily f(RH)
Seney, MI, 2002



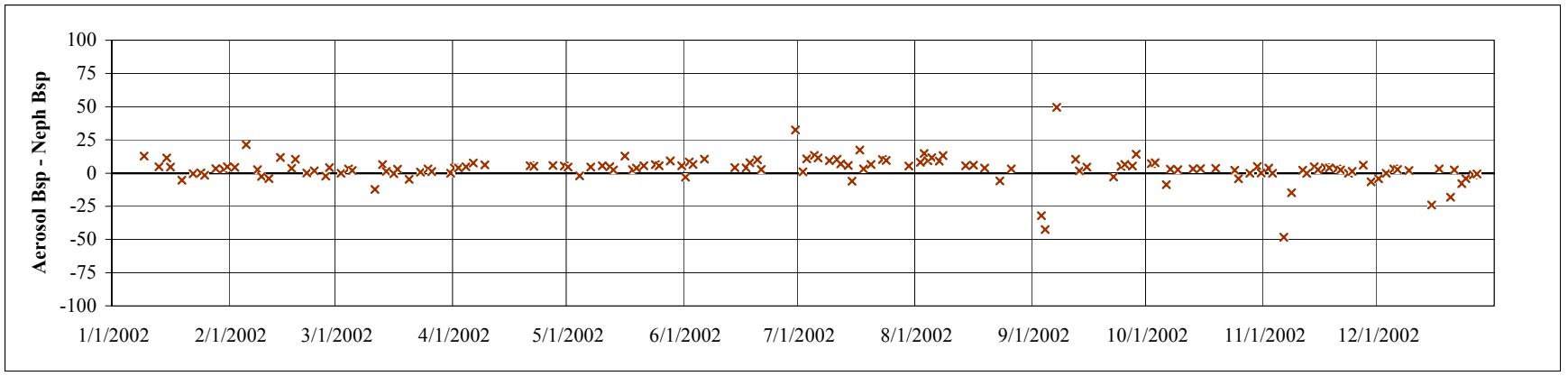
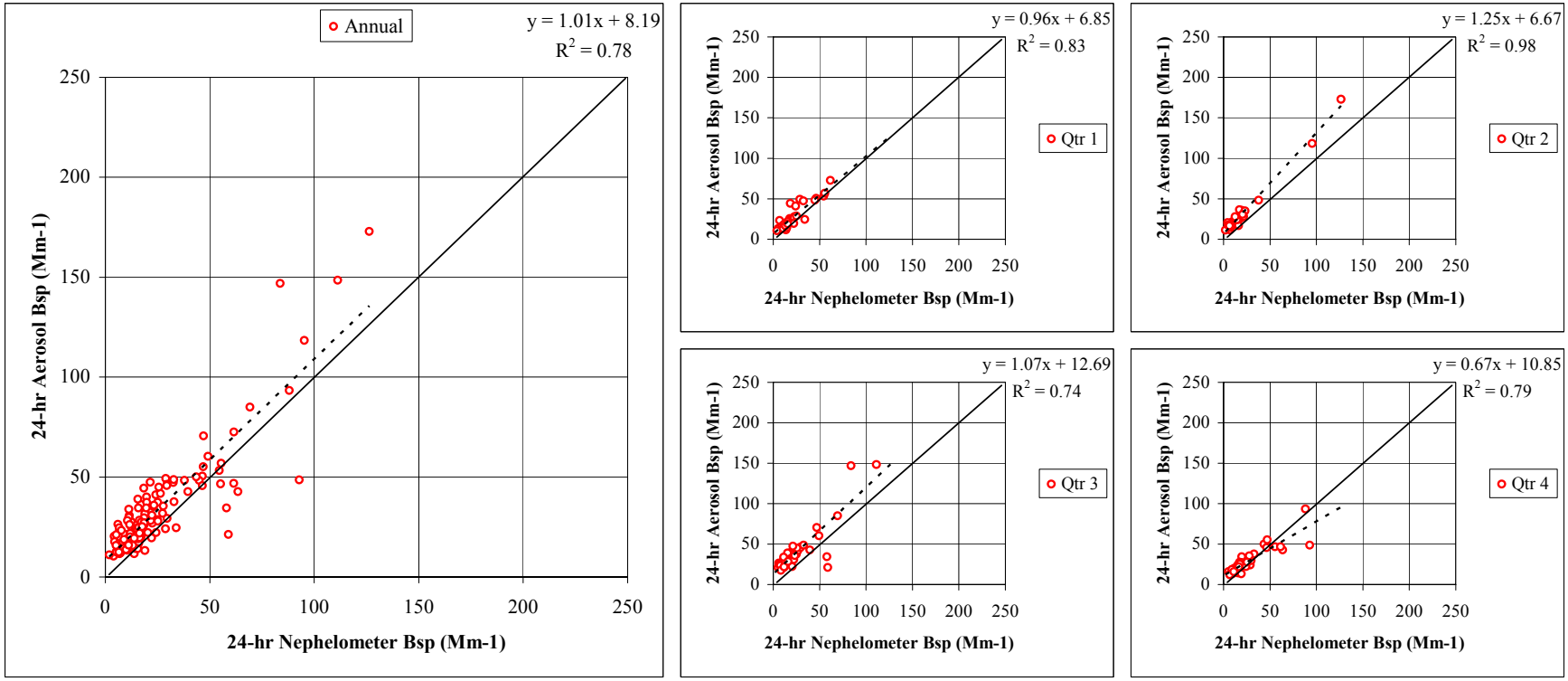


Figure 13d.

Aerosol Scattering (STN) vs. Nephelometer Scattering
Using EPRI Algorithm and Daily f(RH)
Seney, MI, 2002



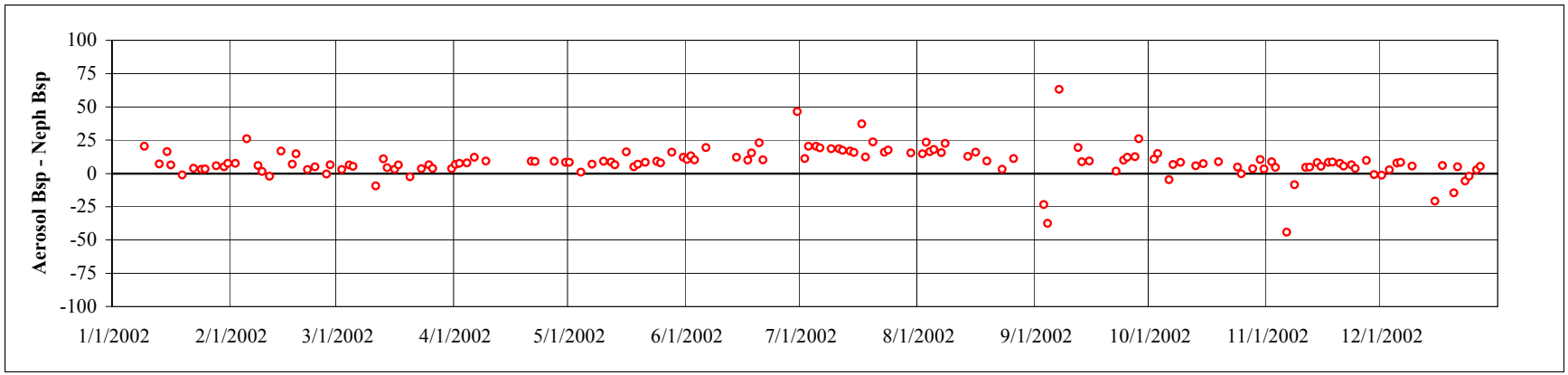


Figure 14a.

Aerosol Scattering (STN) vs. Nephelometer Scattering
Using IMPROVE Algorithm and Daily f(RH)
Mayville, WI, 2002

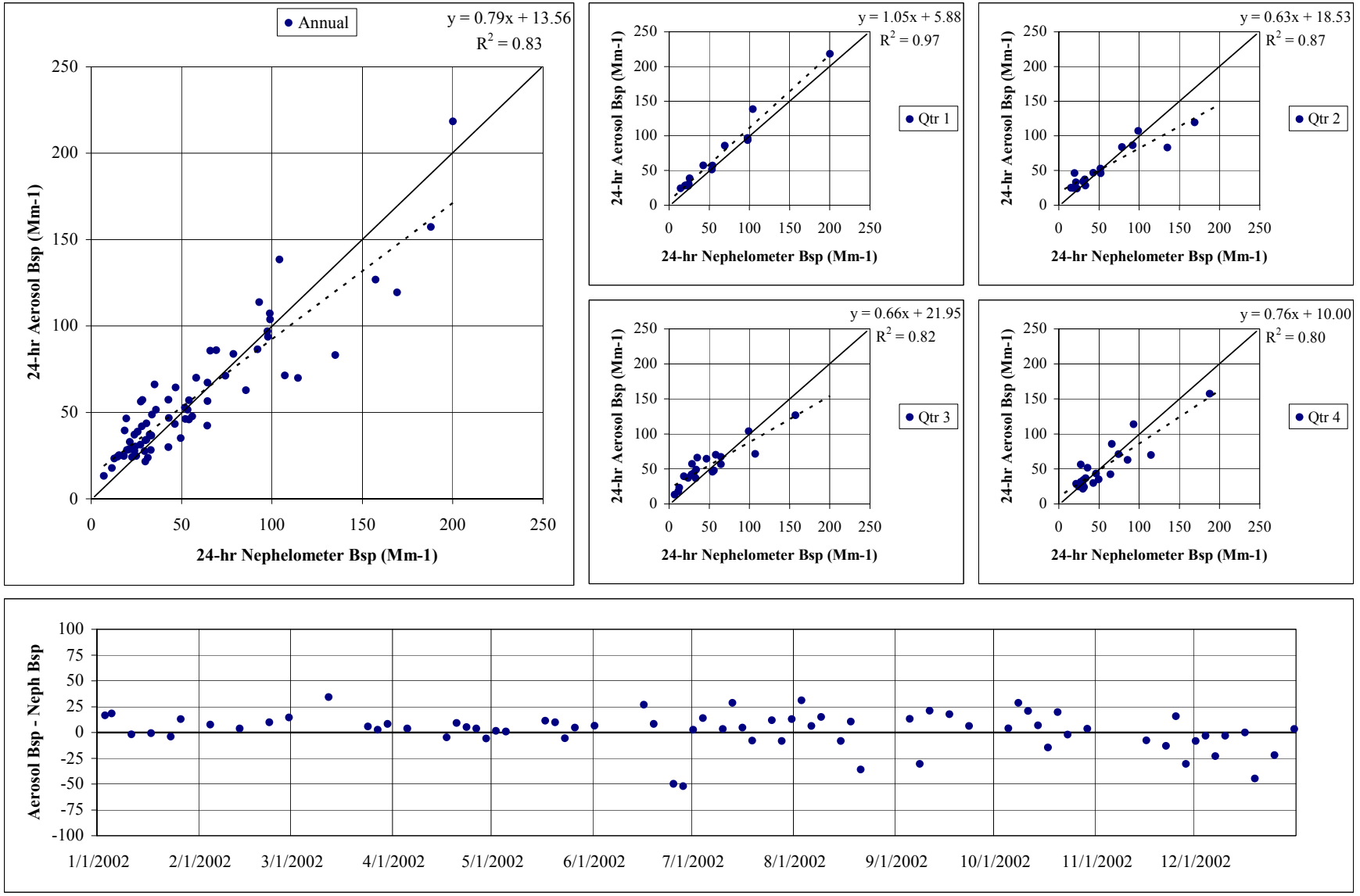


Figure 14b.

Aerosol Scattering (STN) vs. Nephelometer Scattering
Using EPRI Algorithm (OM only) and Daily f(RH)
Mayville, WI, 2002

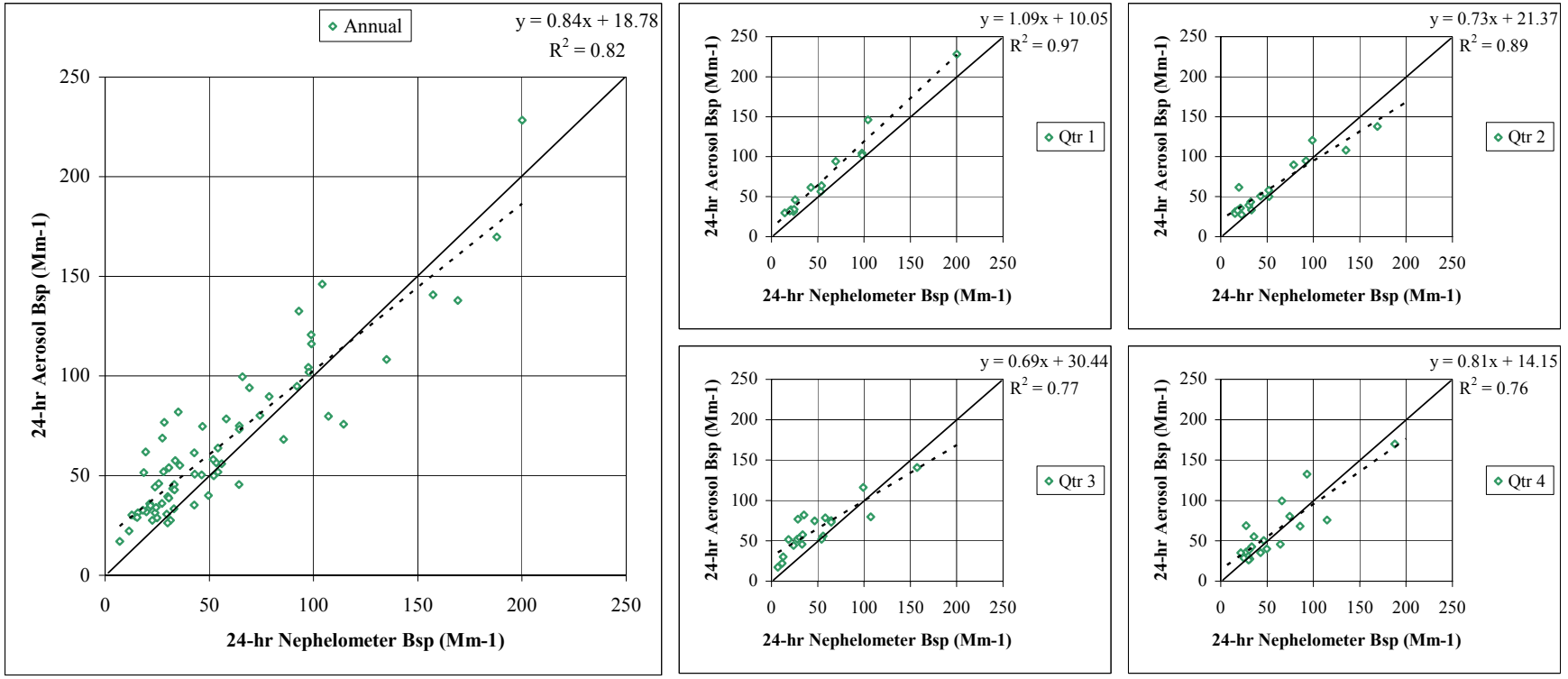


Figure 14c.

Aerosol Scattering (STN) vs. Nephelometer Scattering
Using EPRI Algorithm (Sulfate and Nitrate only) and Daily f(RH)
Mayville, WI, 2002

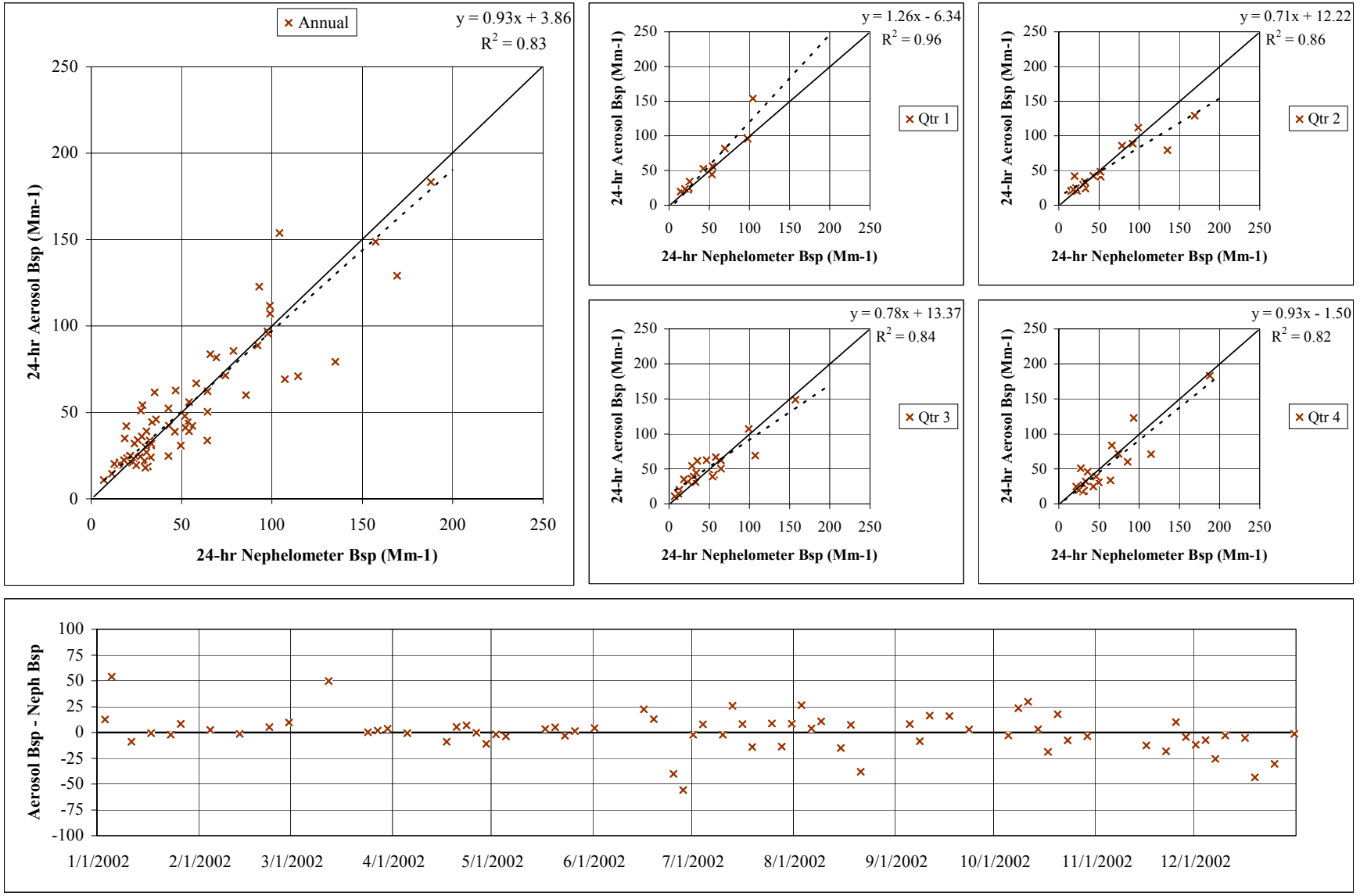
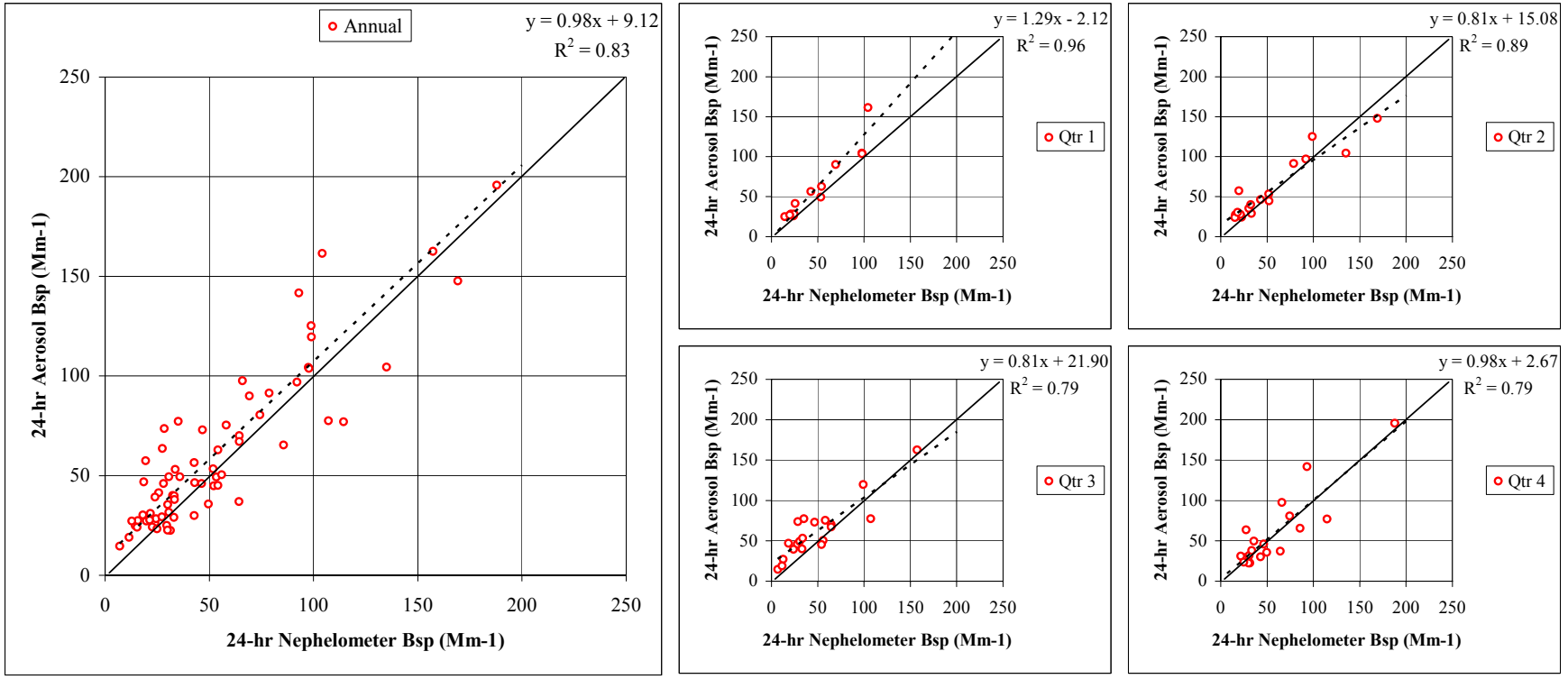


Figure 14d.

Aerosol Scattering (STN) vs. Nephelometer Scattering
Using EPRI Algorithm and Daily f(RH)
Mayville, WI, 2002



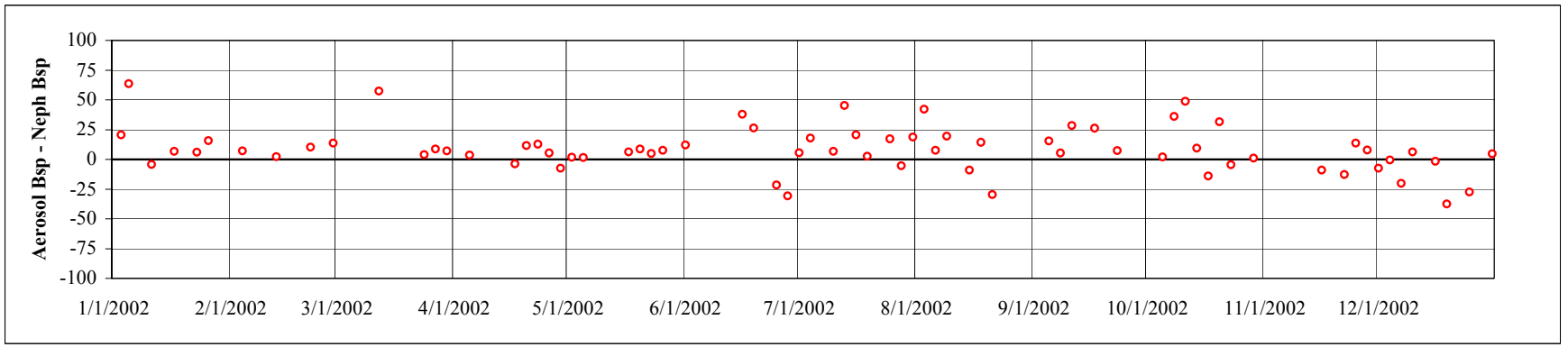
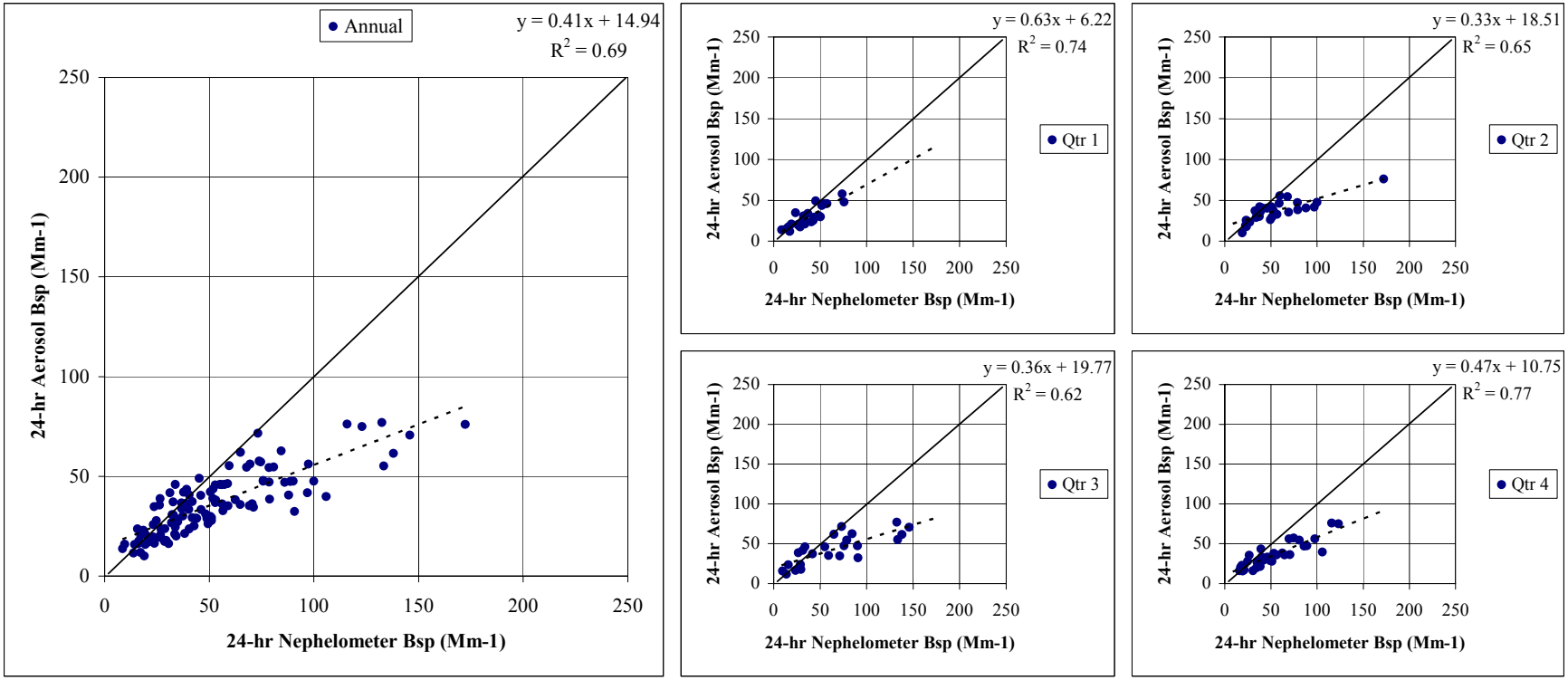


Figure 15a.

Dry Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using IMPROVE Algorithm and No f(RH)
Bondville, IL, 2002



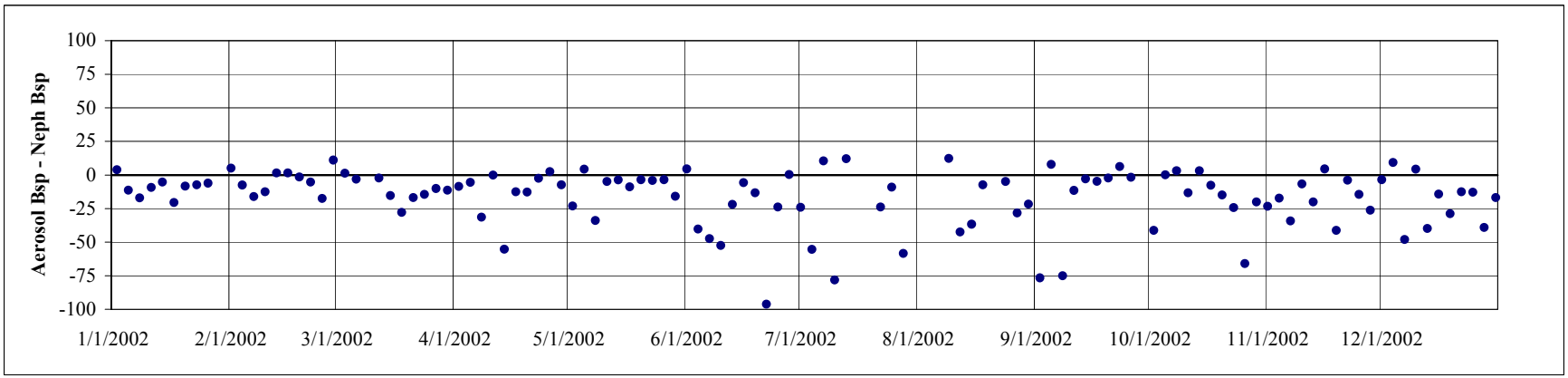
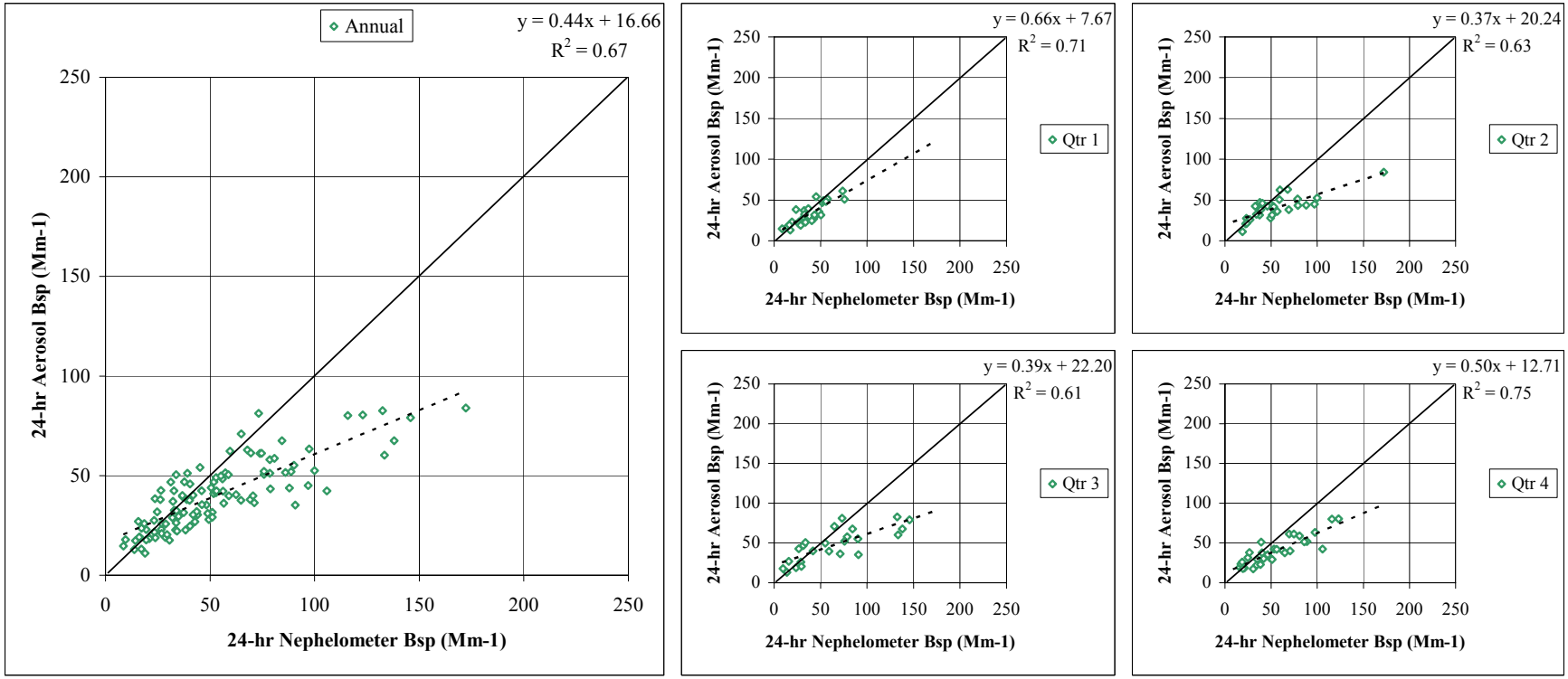


Figure 15b.

Dry Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using EPRI Algorithm (OM only) and No f(RH)
Bondville, IL, 2002



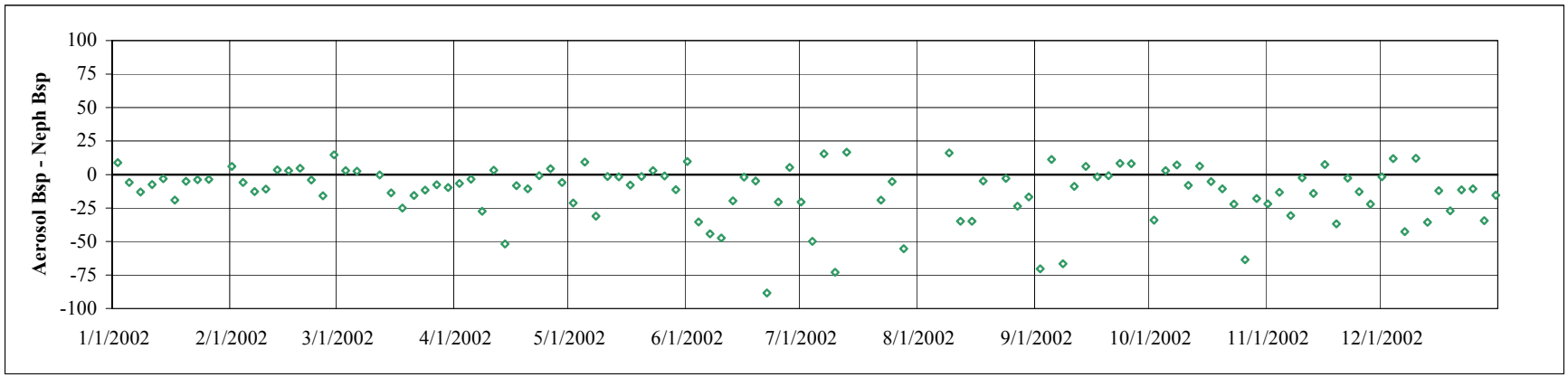
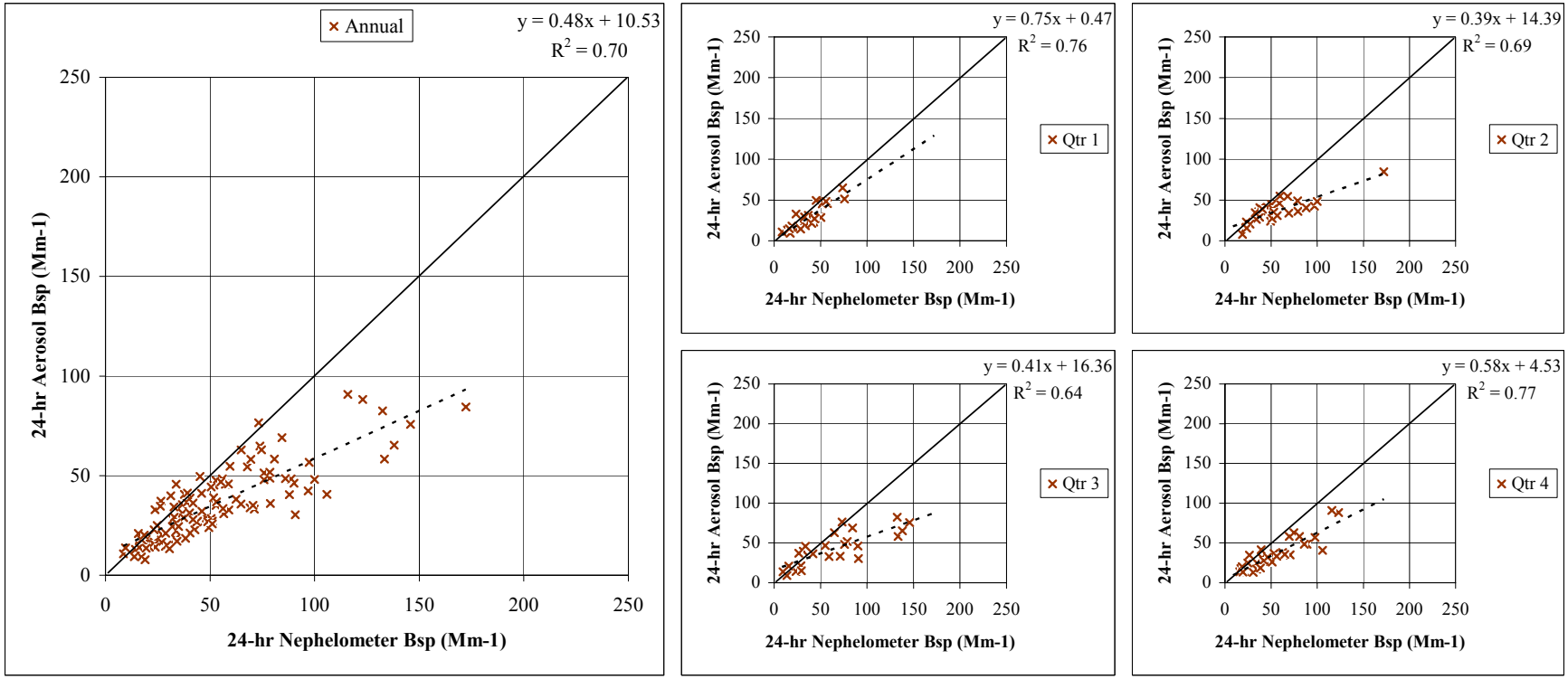


Figure 15c.

Dry Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using EPRI Algorithm (Sulfate and Nitrate only) and No f(RH)
Bondville, IL, 2002



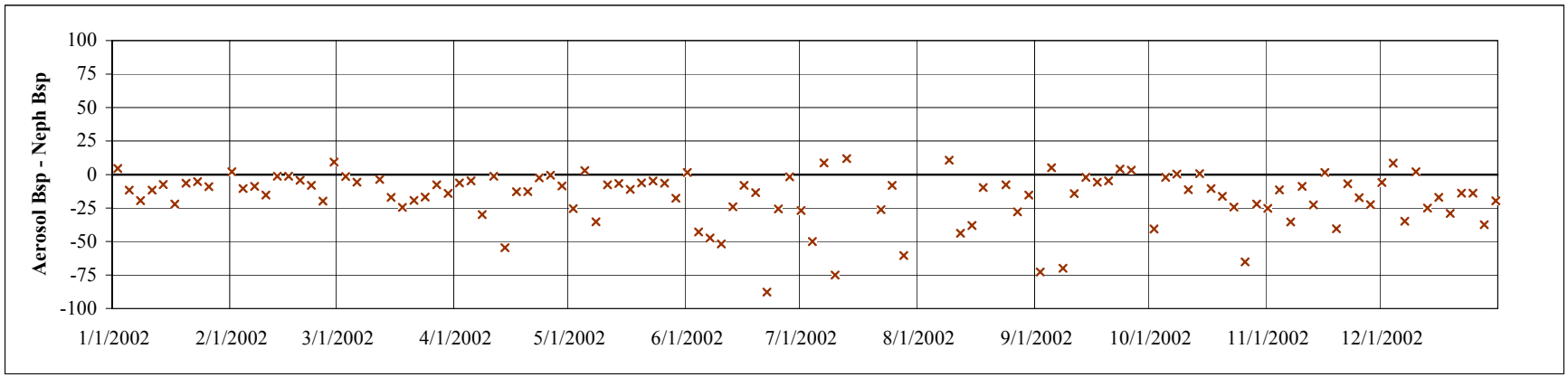
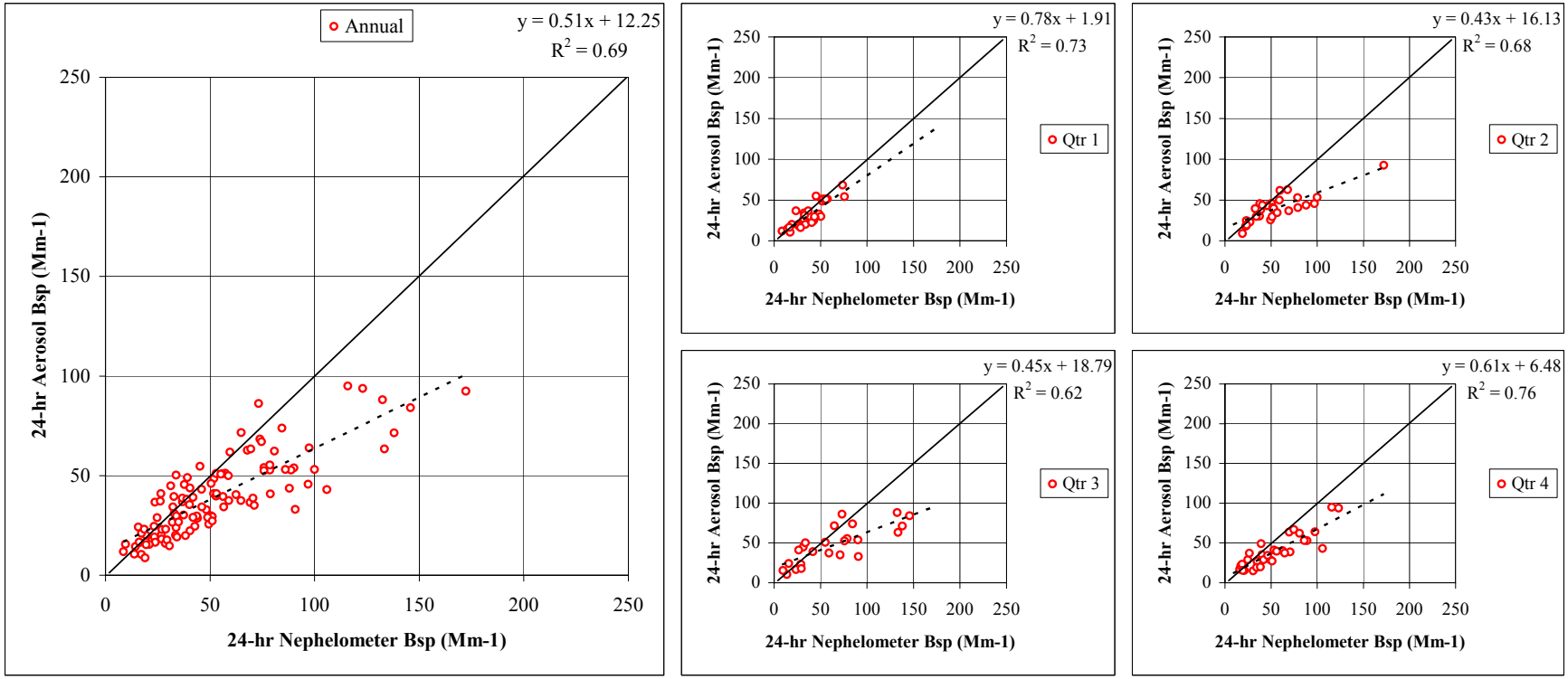


Figure 15d.

Dry Aerosol Scattering (IMPROVE) vs. Nephelometer Scattering
Using EPRI Algorithm and No f(RH)
Bondville, IL, 2002



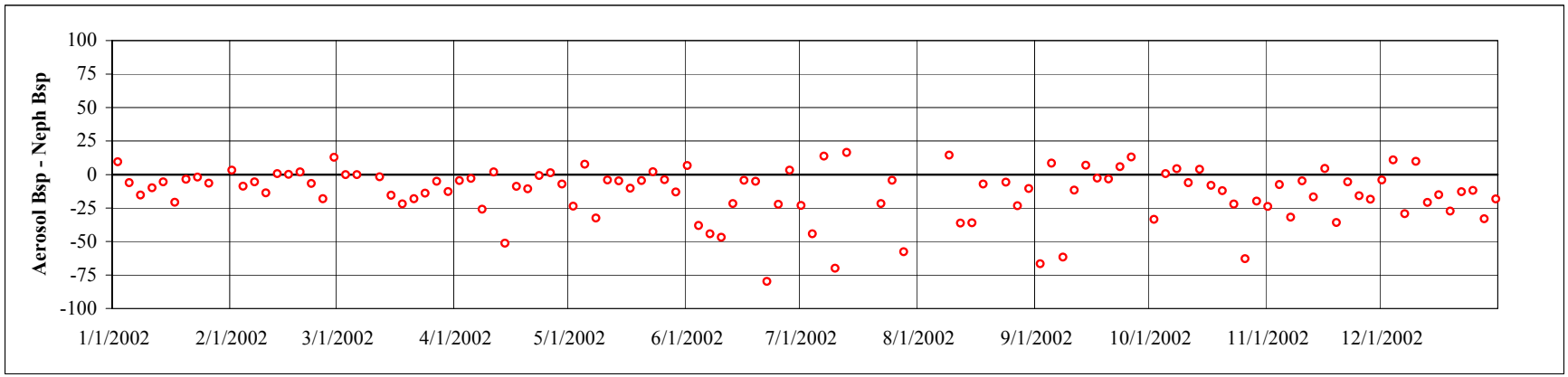
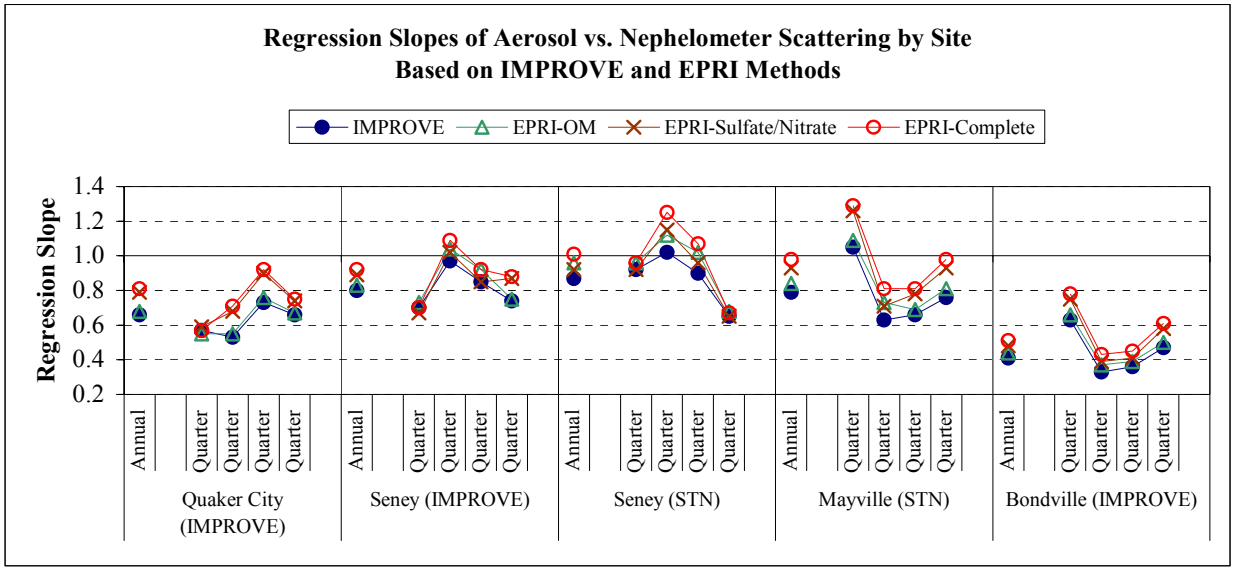


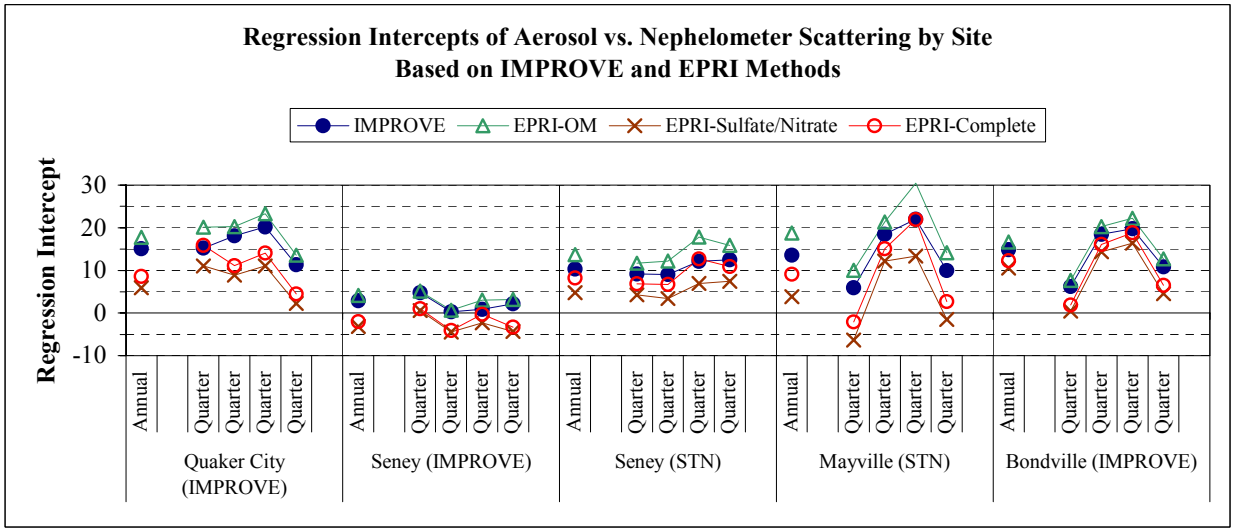
Table 4

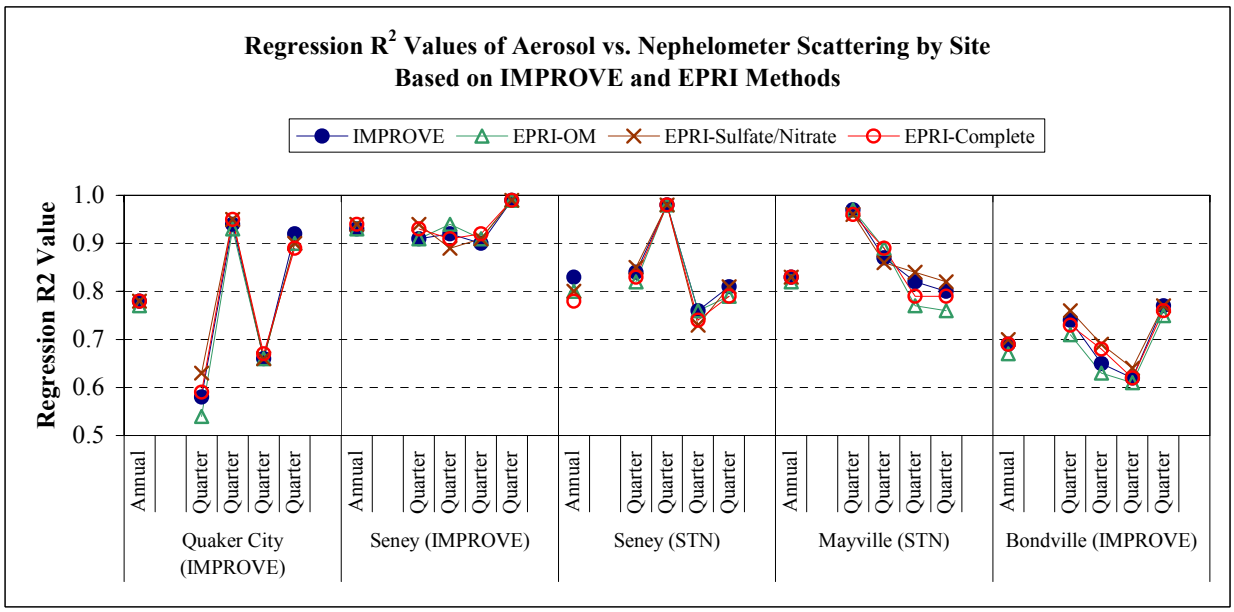
Linear Regression Statistics
Aerosol vs. Nephelometer Scattering
For the IMPROVE and EPRI Methods

			IMPROVE Method			EPRI Method - OM			EPRI Method - Sulfate/Nitrate			EPRI Method - Complete		
Site	Network	Period	R^2	Slope	Intercept	R^2	Slope	Intercept	R^2	Slope	Intercept	R^2	Slope	Intercept
Quaker City	IMPROVE	Annual	0.78	0.66	15.1	0.77	0.68	17.7	0.78	0.79	5.9	0.78	0.81	8.6
		Quarter 1	0.58	0.57	15.2	0.54	0.55	20.1	0.63	0.59	11.0	0.59	0.57	15.9
		Quarter 2	0.94	0.53	18.1	0.93	0.55	20.3	0.95	0.68	8.9	0.95	0.71	11.1
		Quarter 3	0.66	0.73	20.2	0.66	0.76	23.3	0.66	0.90	11.0	0.67	0.92	14.1
		Quarter 4	0.92	0.66	11.3	0.90	0.67	13.6	0.90	0.74	2.2	0.89	0.75	4.5
Seney	IMPROVE	Annual	0.93	0.80	2.9	0.93	0.83	4.1	0.94	0.89	-3.2	0.94	0.92	-2.0
		Quarter 1	0.91	0.70	4.8	0.91	0.73	5.1	0.94	0.67	0.6	0.93	0.70	1.0
		Quarter 2	0.92	0.97	0.3	0.94	1.04	0.7	0.89	1.02	-4.5	0.91	1.09	-4.1
		Quarter 3	0.90	0.85	0.9	0.91	0.92	3.0	0.91	0.85	-2.3	0.92	0.92	-0.3
		Quarter 4	0.99	0.74	2.2	0.99	0.75	3.2	0.99	0.87	-4.3	0.99	0.88	-3.3
Seney	STN	Annual	0.83	0.87	10.3	0.80	0.96	13.7	0.80	0.92	4.8	0.78	1.01	8.2
		Quarter 1	0.84	0.92	9.2	0.82	0.96	11.7	0.85	0.92	4.3	0.83	0.96	6.9
		Quarter 2	0.98	1.02	9.0	0.98	1.12	12.2	0.98	1.15	3.4	0.98	1.25	6.7
		Quarter 3	0.76	0.90	12.1	0.76	1.02	17.8	0.73	0.96	7.0	0.74	1.07	12.7
		Quarter 4	0.81	0.65	12.5	0.79	0.68	15.9	0.81	0.65	7.4	0.79	0.67	10.9
Mayville	STN	Annual	0.83	0.79	13.6	0.82	0.84	18.8	0.83	0.93	3.9	0.83	0.98	9.1
		Quarter 1	0.97	1.05	5.9	0.97	1.09	10.1	0.96	1.26	-6.3	0.96	1.29	-2.1
		Quarter 2	0.87	0.63	18.5	0.89	0.73	21.4	0.86	0.71	12.2	0.89	0.81	15.1
		Quarter 3	0.82	0.66	22.0	0.77	0.69	30.4	0.84	0.78	13.4	0.79	0.81	21.9
		Quarter 4	0.80	0.76	10.0	0.76	0.81	14.2	0.82	0.93	-1.5	0.79	0.98	2.7
Bondville	IMPROVE	Annual	0.69	0.41	14.9	0.67	0.44	16.7	0.70	0.48	10.5	0.69	0.51	12.3
		Quarter 1	0.74	0.63	6.2	0.71	0.66	7.7	0.76	0.75	0.5	0.73	0.78	1.9
		Quarter 2	0.65	0.33	18.5	0.63	0.37	20.2	0.69	0.39	14.4	0.68	0.43	16.1
		Quarter 3	0.62	0.36	19.8	0.61	0.39	22.2	0.64	0.41	16.4	0.62	0.45	18.8
		Quarter 4	0.77	0.47	10.8	0.75	0.50	12.7	0.77	0.58	4.5	0.76	0.61	6.5

Figure 16.


Regression Slopes of Aerosol vs. Nephelometer Scattering by Site
Based on IMPROVE and EPRI Methods
IMPROVE
EPRI-OM
EPRI-Sulfate/Nitrate
EPRI-Complete
Regression Slope
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Annual
Quarter
Quarter
Quarter
Quarter
Quaker City (IMPROVE)
Seney (IMPROVE)
Seney (STN)
Mayville (STN)
Bondville (IMPROVE)


Regression Intercepts of Aerosol vs. Nephelometer Scattering by Site
Based on IMPROVE and EPRI Methods
IMPROVE
EPRI-OM
EPRI-Sulfate/Nitrate
EPRI-Complete
Regression Intercept
30
20
10
0
-10
Annual
Quarter
Quarter
Quarter
Quarter
Quaker City (IMPROVE)
Seney (IMPROVE)
Seney (STN)
Mayville (STN)
Bondville (IMPROVE)


Regression R2 Values of Aerosol vs. Nephelometer Scattering by Site
Based on IMPROVE and EPRI Methods
IMPROVE
EPRI-OM
EPRI-Sulfate/Nitrate
EPRI-Complete
Regression R2 Value
1.0
0.9
0.8
0.7
0.6
0.5
Annual
Quarter
Quarter
Quarter
Quarter
Quaker City (IMPROVE)
Seney (IMPROVE)
Seney (STN)
Mayville (STN)
Bondville (IMPROVE)

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