ISSN No. 0737-5352-21

Polynomial Disaggregation Procedures

James B. Whitmore
and
Hariharan K. Iyer

Research Supported by the
National Oceanic Atmospheric Administration
under Grant No. NA90RAH00077

January 1991

CIRA Cooperative Institute for Research in the Atmosphere

Colorado State University

Abstract

In air quality monitoring, often aerosol samples are collected using various filter methods in regular sampling cycles. Some aerosol species samples may be collected at 12 hour cycles while others may be collected at 6 hour cycles or 24 hour cycles, etc. If some species are collected at 6 hour intervals and others at 12 hour intervals, then a statistical analysis of these data are often carried out after aggregating the 6 hour data to produce 12 hour data so that all data correspond to the same time cycle. It is of some interest to investigate the alternative possibility of disaggregating the 12 hour data to obtain "6 hour (pseudo) data," and then performing statistical analyses on the 6 hour scale. In this report we investigate this possibility by studying how well a certain class of disaggregation procedures is able to disaggregate aggregated data. The performance of the methods considered are evaluated using real data collected as part of the WHITEX study.

1 Polynomial Disaggregation Procedures.

Suppose that for a sequence of values $y_1, y_2, \ldots, y_{2n}$ the sums

$$\begin{aligned} s_1 &= y_1 + y_2 \\ s_2 &= y_3 + y_4 \\ &\vdots \\ s_n &= y_{2n-1} + y_{2n} \end{aligned} \tag{1}$$

are available. A disaggregation procedure is a method for "recovering" the values $y_1, y_2, \ldots, y_{2n}$ given the sums $s_1, s_2, \ldots, s_n$. Clearly, a unique solution does not exist as the system of equations (1) amounts to n equations in 2n unknowns. For this reason, additional information or assumptions are necessary. Here, it will be assumed that

any set of $2k$ consecutive values $y_r, y_{r+1}, \ldots, y_{r+2k-1}$ from the y sequence lie "approximately" on a polynomial curve of degree $k-1$. (2)

This assumption leads to useful solutions for the values of $y_1, y_2, \ldots, y_{2n}$ in (2.1). Such a procedure will be called a polynomial disaggregation procedure of degree $k-1$. We now derive explicitly polynomial disaggregation procedures of degree $k-1$ for $k = 1, 2, 3, 4, 5$.

Case 1: $k = 1$.

This implies that every pair of adjacent y values are "approximately" equal. In particular $y_1 \approx y_2$ so that the equation $y_1 + y_2 = s_1$ gives $\hat{y}_1 = \hat{y}_2 = s_1/2$. Similarly, $\hat{y}_3 = \hat{y}_4 = s_2/2$. In general, we get $\hat{y}_{2i-1} = \hat{y}_{2i} = s_i/2$, for $i = 1, 2, \ldots, n$.

Case 2: $k = 2$.

Assumption (2) implies that every sequence of four adjacent values lies "approximately" on a straight line:

$$y_i \approx a + bi, \ \textit{for some } a, b,$$

where a and b will depend on the particular set of four values being considered. In particular, consider y_1, y_2, y_3, and y_4. In this case, we have for some a and b,

$$\begin{aligned} y_1 &\approx a + b & y_3 &\approx a + 3b \\ y_2 &\approx a + 2b & y_4 &\approx a + 4b. \end{aligned}$$

Hence, $s_1 = y_1 + y_2 = 2a + 3b$ and $s_2 = y_3 + y_4 = 2a + 7b$. This yields the solutions:

$$a = \tfrac{7s_1 - 3s_2}{8} \quad b = \tfrac{s_2 - s_1}{4}.$$

Thus, we have the following estimates:

$$\hat{y}_1 = a + b = \frac{5s_1 - s_2}{8} \qquad \hat{y}_3 = a + 3b = \frac{s_1 + 3s_2}{8}$$
$$\hat{y}_2 = a + 2b = \frac{3s_1 + s_2}{8} \qquad \hat{y}_4 = a + 4b = \frac{-s_1 + 5s_2}{8}.$$

Now consider sliding a "window" that is four values wide across the y sequence–sliding it to the right two values each time. This generates the following "windows:"

$$\begin{gathered} y_1, y_2, y_3, y_4 \\ y_3, y_4, y_5, y_6 \\ \vdots \\ y_{2n-5}, y_{2n-4}, y_{2n-3}, y_{2n-2} \\ y_{2n-3}, y_{2n-2}, y_{2n-1}, y_{2n}. \end{gathered}$$

Note that there will be $n - 1$ "windows."

Case 2A: Consider using each "window" to estimate the first two points that it contains. Then, for $1 \leq r \leq n - 1$,

$$\left.\begin{aligned} \hat{y}_{2r-1} &= \frac{5s_r - s_{r+1}}{8} \\ \hat{y}_{2r} &= \frac{3s_r + s_{r+1}}{8} \end{aligned}\right\} \textit{ using the window } \underbrace{y_{2r-1}, y_{2r}}_{s_r}, \underbrace{y_{2r+1}, y_{2r+2}}_{s_{r+1}},$$

and

$$\left.\begin{aligned} \hat{y}_{2n-1} &= \frac{s_{n-1} + 3s_n}{8} \\ \hat{y}_{2n} &= \frac{-s_{n-1} + 5s_n}{8} \end{aligned}\right\} \textit{ using the window } \underbrace{y_{2n-3}, y_{2n-2}}_{s_{n-1}}, \underbrace{y_{2n-1}, y_{2n}}_{s_n}.$$

Note that all four values in the last window are estimated from the information provided by that window. In all other windows, only the first two values are estimated.

Case 2B: Consider using each "window" to estimate the last two points that it contains. Then,

$$\left.\begin{aligned} \hat{y}_1 &= \frac{5s_1 - s_2}{8} \\ \hat{y}_2 &= \frac{3s_1 + s_2}{8} \end{aligned}\right\} \textit{ using the window } \underbrace{y_1, y_2}_{s_1}, \underbrace{y_3, y_4}_{s_2},$$

and, for $2 \leq r \leq n$,

$$\left.\begin{aligned} \hat{y}_{2r-1} &= \frac{s_{r-1} + 3s_r}{8} \\ \hat{y}_{2r} &= \frac{-s_{r-1} + 5s_r}{8} \end{aligned}\right\} \textit{ using the window } \underbrace{y_{2r-3}, y_{2r-2}}_{s_{r-1}}, \underbrace{y_{2r-1}, y_{2r}}_{s_r}.$$

Here, note that all four values in the first window are estimated from the information provided by that window, but in subsequent windows only the last two values are estimated.

Case 2C: There is an asymmetry associated with the disaggregation procedures in cases 2A and 2B which may be unsatisfactory. One may wonder why the two middle values from each window are not estimated. The reason for this is that, when aggregated, the disaggregated data are not guaranteed to reproduce the original sums. Since this could be viewed as an undesirable property, only polynomial disaggregation procedures that preserve the original sums will be considered. To overcome the asymmetry we consider using the average of the two disaggregation procedures–cases 2A and 2B. Then,

$$\left.\begin{aligned}\hat{y}_1 &= \tfrac{5s_1-s_2}{8}\\ \hat{y}_2 &= \tfrac{3s_1+s_2}{8}\end{aligned}\right\}\quad \begin{array}{l}\textit{using the window}\\ \underbrace{y_1, y_2}_{s_1}, \underbrace{y_3, y_4}_{s_2}.\end{array}$$

For $2 \leq r \leq n-1$,

$$\left.\begin{aligned}\hat{y}_{2r-1} &= \tfrac{s_{r-1}+8s_r-s_{r+1}}{16}\\ \hat{y}_{2r} &= \tfrac{-s_{r-1}+8s_r+s_{r+1}}{16}\end{aligned}\right\}\quad \begin{array}{l}\textit{using the window}\\ \underbrace{y_{2r-3}, y_{2r-2}}_{s_{r-1}}, \underbrace{y_{2r-1}, y_{2r}}_{s_r}, \underbrace{y_{2r+1}, y_{2r+2}}_{s_{r+1}}.\end{array}$$

Also,

$$\left.\begin{aligned}\hat{y}_{2n-1} &= \tfrac{s_{n-1}+3s_n}{8}\\ \hat{y}_{2n} &= \tfrac{-s_{n-1}+5s_n}{8}\end{aligned}\right\}\quad \begin{array}{l}\textit{using the window}\\ \underbrace{y_{2n-3}, y_{2n-2}}_{s_{n-1}}, \underbrace{y_{2n-1}, y_{2n}}_{s_n}.\end{array}$$

Case 3: $k = 3$.

Assumption (2) implies that each sequence of six adjacent y values lies "approximately" on a quadratic:

$$y_i = a + bi + ci^2, \ \textit{for some } a, b, c,$$

where a, b, and c will depend on the values of the particular set of six values being considered. In particular, consider $y_1, y_2, \ldots, y_6$. In this case, we have for some a, b and c,

$$\begin{aligned} y_1 &\approx a + b + c & y_4 &\approx a + 4b + 16c\\ y_2 &\approx a + 2b + 4c & y_5 &\approx a + 5b + 25c\\ y_3 &\approx a + 3b + 9c & y_6 &\approx a + 6b + 36c \end{aligned}$$

Hence, $s_1 = 2a + 3b + 5c$, and $s_2 = 2a + 7b + 25c$, and $s_3 = 2a + 11b + 61c$. This yields the solutions:

$$\begin{aligned} a &= \frac{19s_1 - 16s_2 + 5s_3}{16} \\ b &= \frac{-9s_1 + 14s_2 - 5s_3}{16} \\ c &= \frac{s_1 - 2s_2 + s_3}{16}. \end{aligned}$$

Thus, we have the following estimates:

$$\begin{aligned} \hat{y}_1 &= \frac{11s_1 - 4s_2 + s_3}{16} & \hat{y}_4 &= \frac{-s_1 + 8s_2 + s_3}{16} \\ \hat{y}_2 &= \frac{5s_1 + 4s_2 - s_3}{16} & \hat{y}_5 &= \frac{-s_1 + 4s_2 + 5s_3}{16} \\ \hat{y}_3 &= \frac{s_1 + 8s_2 - s_3}{16} & \hat{y}_6 &= \frac{s_1 - 4s_2 + 11s_3}{16}. \end{aligned}$$

Now consider sliding a "window" that is six values wide across the y sequence–sliding it to the right two values each time. This generates the following "windows:"

$$\begin{gathered} y_1, y_2, y_3, y_4, y_5, y_6. \\ y_3, y_4, y_5, y_6, y_7, y_8 \\ \vdots \\ y_{2n-7}, y_{2n-6}, y_{2n-5}, y_{2n-4}, y_{2n-3}, y_{2n-2} \\ y_{2n-5}, y_{2n-4}, y_{2n-3}, y_{2n-2}, y_{2n-1}, y_{2n}. \end{gathered}$$

Note that there will be $n - 2$ "windows." Consider using each "window" to estimate the two middle values that it contains. (The first window will estimate the first two values, also. Similarly, the last window will estimate the last two values, as well.) Then a disaggregation procedure would be:

$$\left.\begin{aligned} \hat{y}_1 &= \frac{11s_1 - 4s_2 + s_3}{16} \\ \hat{y}_2 &= \frac{5s_1 + 4s_2 - s_3}{16} \end{aligned}\right\} \quad \begin{array}{l} \textit{using the window} \\ \underbrace{y_1, y_2}_{s_1}, \underbrace{y_3, y_4}_{s_2}, \underbrace{y_5, y_6}_{s_3}. \end{array}$$

For $2 \leq r \leq n - 1$,

$$\left.\begin{aligned} \hat{y}_{2r-1} &= \frac{s_{r-1} + 8s_r - s_{r+1}}{16} \\ \hat{y}_{2r} &= \frac{-s_{r-1} + 8s_r + s_{r+1}}{16} \end{aligned}\right\} \quad \begin{array}{l} \textit{using the window} \\ \underbrace{y_{2r-3}, y_{2r-2}}_{s_{r-1}}, \underbrace{y_{2r-1}, y_{2r}}_{s_r}, \underbrace{y_{2r+1}, y_{2r+2}}_{s_{r+1}}. \end{array}$$

Also,

$$\left.\begin{aligned}\hat{y}_{2n-1} &= \frac{-s_{n-2}+4s_{n-1}+5s_n}{16} \\ \hat{y}_{2n} &= \frac{s_{n-2}-4s_{n-1}+11s_n}{16}\end{aligned}\right\} \quad \begin{array}{l}\textit{using the window} \\ \underbrace{y_{2n-5}, y_{2n-4}}_{s_{n-2}}, \underbrace{y_{2n-3}, y_{2n-2}}_{s_{n-1}}, \underbrace{y_{2n-1}, y_{2n}}_{s_n}.\end{array}$$

Case 4: $k = 4$.

Assumption (2) implies that each sequence of eight adjacent y values lies "approximately" on a cubic:

$$y_i = a + bi + ci^2 + di^3, \text{ for some } a, b, c, d.$$

where a, b, c, and d will depend on the values of the particular set of eight values being considered. In particular, consider $y_1, y_2, \ldots, y_8$. In this case, we have for some a, b, c, and d,

$$\begin{aligned} y_1 &\approx a + b + c + d & y_5 &\approx a + 5b + 25c + 125d \\ y_2 &\approx a + 2b + 4c + 8d & y_6 &\approx a + 6b + 36c + 216d \\ y_3 &\approx a + 3b + 9c + 27d & y_7 &\approx a + 7b + 49c + 343d \\ y_4 &\approx a + 4b + 16c + 64d & y_8 &\approx a + 8b + 64c + 512d. \end{aligned}$$

Hence,

$$\begin{aligned} s_1 &= 2a + 3b + 5c + 9d \\ s_2 &= 2a + 7b + 25c + 91d \\ s_3 &= 2a + 11b + 61c + 341d \\ s_4 &= 2a + 15b + 113c + 855d. \end{aligned}$$

This yields the solutions:

$$\begin{aligned} a &= \frac{187s_1 - 233s_2 + 145s_3 - 35s_4}{128} \\ b &= \frac{-43s_1 + 90s_2 - 63s_3 + 16s_4}{48} \\ c &= \frac{33s_1 - 87s_2 + 75s_3 - 21s_4}{192} \\ d &= \frac{-s_1 + 3s_2 - 3s_3 + s_4}{96}. \end{aligned}$$

Thus, we have the following estimates:

$$
\begin{aligned}
\hat{y}_1 &= \frac{93s_1-47s_2+23s_3-5s_4}{128}\\
\hat{y}_2 &= \frac{35s_1+47s_2-23s_3+5s_4}{128}\\
\hat{y}_3 &= \frac{5s_1+73s_2-17s_3+3s_4}{128}\\
\hat{y}_4 &= \frac{-5s_1+55s_2+17s_3-3s_4}{128}\\
\hat{y}_5 &= \frac{-3s_1+17s_2+55s_3-5s_4}{128}\\
\hat{y}_6 &= \frac{3s_1-17s_2+73s_3+5s_4}{128}\\
\hat{y}_7 &= \frac{5s_1-23s_2+47s_3+35s_4}{128}\\
\hat{y}_8 &= \frac{-5s_1+23s_2-47s_3+93s_4}{128}.
\end{aligned}
$$

Now consider sliding a "window" that is eight values wide across the y sequence–sliding it to the right two values each time. This generates the following "windows:"

$$
\begin{gathered}
y_1, y_2, y_3, y_4, y_5, y_6, y_7, y_8\\
y_3, y_4, y_5, y_6, y_7, y_8, y_9, y_{10}\\
\vdots\\
y_{2n-9}, y_{2n-8}, y_{2n-7}, y_{2n-6}, y_{2n-5}, y_{2n-4}, y_{2n-3}, y_{2n-2}\\
y_{2n-7}, y_{2n-6}, y_{2n-5}, y_{2n-4}, y_{2n-3}, y_{2n-2}, y_{2n-1}, y_{2n}.
\end{gathered}
$$

Note that this yields $n-3$ "windows."

Case 4A: Consider using each "window" to estimate the third and fourth points that it contains. Then,

$$
\left.\begin{aligned}
\hat{y}_1 &= \frac{93s_1-47s_2+23s_3-5s_4}{128}\\
\hat{y}_2 &= \frac{35s_1+47s_2-23s_3+5s_4}{128}
\end{aligned}\right\}
\quad \textit{using the window} \quad \underbrace{y_1, y_2}_{s_1}, \underbrace{\ldots}_{\cdots}, \underbrace{y_7, y_8}_{s_4}.
$$

For $2 \leq r \leq n-2$,

$$
\left.\begin{aligned}
\hat{y}_{2r-1} &= \frac{5s_{r-1}+73s_r-17s_{r+1}+3s_{r+2}}{128}\\
\hat{y}_{2r} &= \frac{-5s_{r-1}+55s_r+17s_{r+1}-3s_{r+2}}{128}
\end{aligned}\right\}
\quad \textit{using the window} \quad \underbrace{y_{2r-3}, y_{2r-2}}_{s_{r-1}}, \underbrace{\ldots}_{\cdots}, \underbrace{y_{2r+3}, y_{2r+4}}_{s_{r+2}}.
$$

Also,

$$
\left.\begin{aligned}
\hat{y}_{2n-3} &= \frac{-3s_{n-3}+17s_{n-2}+55s_{n-1}-5s_n}{128}\\
\hat{y}_{2n-2} &= \frac{3s_{n-3}-17s_{n-2}+73s_{n-1}+5s_n}{128}\\
\hat{y}_{2n-1} &= \frac{5s_{n-3}-23s_{n-2}+47s_{n-1}+35s_n}{128}\\
\hat{y}_{2n} &= \frac{-5s_{n-3}+23s_{n-2}-47s_{n-1}+93s_n}{128}
\end{aligned}\right\}
\quad \textit{using the window} \quad \underbrace{y_{2n-7}, y_{2n-6}}_{s_{n-3}}, \underbrace{\ldots}_{\cdots}, \underbrace{y_{2n-1}, y_{2n}}_{s_n}.
$$

Note that the first window is used to also estimate the first two values, and the last window is used to also estimate the last four values.

Case 4B: Consider using each "window" to estimate the fifth and sixth points that it contains. Then,

$$\left.\begin{aligned} \hat{y}_1 &= \frac{93s_1-47s_2+23s_3-5s_4}{128} \\ \hat{y}_2 &= \frac{35s_1+47s_2-23s_3+5s_4}{128} \\ \hat{y}_3 &= \frac{5s_1+73s_2-17s_3+3s_4}{128} \\ \hat{y}_4 &= \frac{-5s_1+55s_2+17s_3-3s_4}{128} \end{aligned}\right\} \quad \textit{using the window} \quad \underbrace{y_1, y_2}_{s_1}, \underbrace{\ldots}_{\cdots}, \underbrace{y_7, y_8}_{s_4}.$$

For $3 \le r \le n-1$,

$$\left.\begin{aligned} \hat{y}_{2r-1} &= \frac{-3s_{r-2}+17s_{r-1}+55s_r-5s_{r+1}}{128} \\ \hat{y}_{2r} &= \frac{3s_{r-2}-17s_{r-1}+73s_r+5s_{r+1}}{128} \end{aligned}\right\} \quad \textit{using the window} \quad \underbrace{y_{2r-5}, y_{2r-4}}_{s_{r-2}}, \underbrace{\ldots}_{\cdots}, \underbrace{y_{2r+1}, y_{2r+2}}_{s_{r+1}}.$$

Also,

$$\left.\begin{aligned} \hat{y}_{2n-1} &= \frac{5s_{n-3}-23s_{n-2}+47s_{n-1}+35s_n}{128} \\ \hat{y}_{2n} &= \frac{-5s_{n-3}+23s_{n-2}-47s_{n-1}+93s_n}{128} \end{aligned}\right\} \quad \textit{using the window} \quad \underbrace{y_{2n-7}, y_{2n-6}}_{s_{n-3}}, \underbrace{\ldots}_{\cdots}, \underbrace{y_{2n-1}, y_{2n}}_{s_n}.$$

Note that the first window is used to also estimate the first four values, and the last window is used to also estimate the last two values.

Case 4C: To overcome the asymetry involved in cases 4A and 4B, consider using the average of the two disaggregation procedures. Then,

$$\left.\begin{aligned} \hat{y}_1 &= \frac{93s_1-47s_2+23s_3-5s_4}{128} \\ \hat{y}_2 &= \frac{35s_1+47s_2-23s_3+5s_4}{128} \\ \hat{y}_3 &= \frac{5s_1+73s_2-17s_3+3s_4}{128} \\ \hat{y}_4 &= \frac{-5s_1+55s_2+17s_3-3s_4}{128} \end{aligned}\right\} \quad \textit{using the window} \quad \underbrace{y_1, y_2}_{s_1}, \underbrace{\ldots}_{\cdots}, \underbrace{y_7, y_8}_{s_4}.$$

For $3 \le r \le n-2$,

$$\left.\begin{aligned} \hat{y}_{2r-1} &= \frac{-3s_{r-2}+22s_{r-1}+128s_r-22s_{r+1}+3s_{r+2}}{256} \\ \hat{y}_{2r} &= \frac{3s_{r-2}-22s_{r-1}+128s_r+22s_{r+1}-3s_{r+2}}{256} \end{aligned}\right\} \quad \textit{using the window} \quad \underbrace{y_{2r-5}, y_{2r-4}}_{s_{r-2}}, \underbrace{\ldots}_{\cdots}, \underbrace{y_{2r+3}, y_{2r+4}}_{s_{r+2}}.$$

Also,

$$\left.\begin{aligned}\hat{y}_{2n-3} &= \frac{-3s_{n-3}+17s_{n-2}+55s_{n-1}-5s_n}{128}\\ \hat{y}_{2n-2} &= \frac{3s_{n-3}-17s_{n-2}+73s_{n-1}+5s_n}{128}\\ \hat{y}_{2n-1} &= \frac{5s_{n-3}-23s_{n-2}+47s_{n-1}+35s_n}{128}\\ \hat{y}_{2n} &= \frac{-5s_{n-3}+23s_{n-2}-47s_{n-1}+93s_n}{128}\end{aligned}\right\} \quad \textit{using the window} \quad \underbrace{y_{2n-7}, y_{2n-6}}_{s_{n-3}}, \underbrace{\ldots}_{\cdots}, \underbrace{y_{2n-1}, y_{2n}}_{s_n}.$$

Case 5: $k = 5$.

Assumption (2) implies that each sequence of ten adjacent y values lies "approximately" on a quartic:

$$y_i = a + bi + ci^2 + di^3 + ei^4, \text{ for some } a, b, c, d, e,$$

where a, b, c, d, and e depend on the values of the particular set of ten values being considered. In particular, consider $y_1, y_2, \ldots, y_{10}$. In this case, we have for some a, b, c, d, and e,

$$\begin{aligned}
y_1 &\approx a + b + c + d + e & y_6 &\approx a + 6b + 36c + 216d + 1296e\\
y_2 &\approx a + 2b + 4c + 8d + 16e & y_7 &\approx a + 7b + 49c + 343d + 2401e\\
y_3 &\approx a + 3b + 9c + 27d + 81e & y_8 &\approx a + 8b + 64c + 512d + 4096e\\
y_4 &\approx a + 4b + 16c + 64d + 256e & y_9 &\approx a + 9b + 81c + 729d + 6561e\\
y_5 &\approx a + 5b + 25c + 125d + 625e & y_{10} &\approx a + 10b + 100c + 1000d + 10000e.
\end{aligned}$$

Hence,

$$\begin{aligned}
s_1 &= 2a + 3b + 5c + 9d + 17e\\
s_2 &= 2a + 7b + 25c + 91d + 337e\\
s_3 &= 2a + 11b + 61c + 341d + 1921e\\
s_4 &= 2a + 15b + 113c + 855d + 6497e\\
s_5 &= 2a + 19b + 181c + 1729d + 16561e.
\end{aligned}$$

This yields the solutions:

$$\begin{aligned}
a &= \frac{1311s_1-2154s_2+2004s_3-966s_4+189s_5}{768}\\
b &= \frac{-949s_1+2484s_2-2574s_3+1300s_4-261s_5}{768}\\
c &= \frac{242s_1-788s_2+960s_3-524s_4+110s_5}{768}\\
d &= \frac{-26s_1+96s_2-132s_3+80s_4-18s_5}{768}\\
e &= \frac{s_1-4s_2+6s_3-4s_4+s_5}{768}.
\end{aligned}$$

Thus, we have the following estimates:

$$\begin{aligned}
\hat{y}_1 &= \frac{193s_1-122s_2+88s_3-38s_4+7s_5}{256}\\
\hat{y}_2 &= \frac{63s_1+122s_2-88s_3+38s_4-7s_5}{256}\\
\hat{y}_3 &= \frac{7s_1+158s_2-52s_3+18s_4-3s_5}{256}\\
\hat{y}_4 &= \frac{-7s_1+98s_2+52s_3-18s_4+3s_5}{256}\\
\hat{y}_5 &= \frac{-3s_1+22s_2+128s_3-22s_4+3s_5}{256}\\
\hat{y}_6 &= \frac{3s_1-22s_2+128s_3+22s_4-3s_5}{256}\\
\hat{y}_7 &= \frac{3s_1-18s_2+52s_3+98s_4-7s_5}{256}\\
\hat{y}_8 &= \frac{-3s_1+18s_2-52s_3+158s_4+7s_5}{256}\\
\hat{y}_9 &= \frac{-7s_1+38s_2-88s_3+122s_4+63s_5}{256}\\
\hat{y}_{10} &= \frac{7s_1-38s_2+88s_3-122s_4+193s_5}{256}.
\end{aligned}$$

Now consider sliding a "window" that is ten values wide across the y sequence–sliding it to the right two values each time. This generates the following "windows:"

$$\begin{gathered}
y_1, y_2, y_3, y_4, y_5, y_6, y_7, y_8, y_9, y_{10}\\
y_3, y_4, y_5, y_6, y_7, y_8, y_9, y_{10}, y_{11}, y_{12}\\
\vdots\\
y_{2n-11}, y_{2n-10}, y_{2n-9}, y_{2n-8}, y_{2n-7}, y_{2n-6}, y_{2n-5}, y_{2n-4}, y_{2n-3}, y_{2n-2}\\
y_{2n-9}, y_{2n-8}, y_{2n-7}, y_{2n-6}, y_{2n-5}, y_{2n-4}, y_{2n-3}, y_{2n-2}, y_{2n-1}, y_{2n}.
\end{gathered}$$

Note that there will be $n-4$ "windows." Consider using each "window" to estimate the two middle values that it contains. Here, the first window is used to also estimate the first four values, and the last window is used to also estimate the last four values. Then a disaggregation procedure would be:

$$\left.\begin{aligned}
\hat{y}_1 &= \frac{193s_1-122s_2+88s_3-38s_4+7s_5}{256}\\
\hat{y}_2 &= \frac{63s_1+122s_2-88s_3+38s_4-7s_5}{256}\\
\hat{y}_3 &= \frac{7s_1+158s_2-52s_3+18s_4-3s_5}{256}\\
\hat{y}_4 &= \frac{-7s_1+98s_2+52s_3-18s_4+3s_5}{256}
\end{aligned}\right\}\quad \textit{using the window}\ \underbrace{y_1, y_2}_{s_1}, \underbrace{\ldots}_{\cdots}, \underbrace{y_9, y_{10}}_{s_5}.$$

For $3 \le r \le n-2$,

$$\left.\begin{aligned}
\hat{y}_{2r-1} &= \frac{-3s_{r-2}+22s_{r-1}+128s_r-22s_{r+1}+3s_{r+2}}{256}\\
\hat{y}_{2r} &= \frac{3s_{r-2}-22s_{r-1}+128s_r+22s_{r+1}-3s_{r+2}}{256}
\end{aligned}\right\}\quad \textit{using the window}\ \underbrace{y_{2r-5}, y_{2r-4}}_{s_{r-2}}, \underbrace{\ldots}_{\cdots}, \underbrace{y_{2r+3}, y_{2r+4}}_{s_{r+2}}.$$

Also,

$$\left.\begin{aligned}\hat{y}_{2n-3} &= \frac{3s_{n-4}-18s_{n-3}+52s_{n-2}+98s_{n-1}-7s_n}{256}\\ \hat{y}_{2n-2} &= \frac{-3s_{n-4}+18s_{n-3}-52s_{n-2}+158s_{n-1}+7s_n}{256}\\ \hat{y}_{2n-1} &= \frac{-7s_{n-4}+38s_{n-3}-88s_{n-2}+122s_{n-1}+63s_n}{256}\\ \hat{y}_{2n} &= \frac{7s_{n-4}-38s_{n-3}+88s_{n-2}-122s_{n-1}+193s_n}{256}\end{aligned}\right\} \quad \textit{using the window} \quad \underbrace{y_{2n-9}, y_{2n-8}}_{s_{n-4}}, \underbrace{\ldots}_{\cdots}, \underbrace{y_{2n-1}, y_{2n}}_{s_n}.$$

2 Comment on the Procedures

On examination, one will notice a relationship among some of the procedures. In particular, cases 3 and 2C yield the same estimates for $y_3, \ldots, y_{2n-2}$, and cases 5 and 4C yield the same estimates for $y_5, \ldots, y_{2n-4}$. As proposed, case 2C is the average of cases 2A and 2B, and case 4C is the average of cases 4A and 4B. For these reasons, one might consider using only polynomial disaggregation procedures of even degree. In the applications in this paper, cases 2C and 4C will not be considered since they are only different from cases 3 and 5, respectively, at the beginning and end of the sequence.

Since it is possible that the disaggregation procedure will yield negative solutions, a modification to the described procedures will be needed if the individual terms in the y sequence are assumed to be nonnegative. Let $y_1, \ldots, y_{2n}$ denote the disaggregated y sequence. The modification used in this paper is:

> If $y_{2k-1} < 0$, then set $y_{2k-1} = 0$ and $y_{2k} = s_k$, and if $y_{2k} < 0$, then set $y_{2k-1} = s_k$ and $y_{2k} = 0$, for $k = 1, \ldots, 2n$.

Another problem one might encounter is missing values. The way they were handled, here, was to break the data up into complete sequences. For example, if the data consisted of $s_1, \ldots, s_{10}$, where s_8 was missing, then the data would be broken into two complete sequences: $s_1, \ldots, s_7$, and s_9, s_{10}. Missing values cause a difficulty in the sense that one must examine each complete sequence to see which cases of the polynomial disaggregation procedures can be applied. In the previously mentioned example, only cases 1, 2A, and 2B could be applied to the second complete sequence since the sequence is of only two sums.

3 Artificial Examples

Four artificial y sequences of 100 values were generated, and then aggregated to get 50 sums. The disaggregation procedures were used on each set of sums to "recover" the original values of the y sequence. This was done mainly as a preliminary investigation step only and no general conclusions can be drawn from these limited results. A more in depth study will be beneficial. A brief description of the models used to generate the y sequences follows:

Table 1: Correlation between Actual and Recovered Data for Artificial Data Sets.

	Case						
Model	1	2A	2B	3	4A	4B	5
AR(1)	0.899570	0.890959	0.896676	0.918599	0.906304	0.908505	0.905130
MA(1)	0.735753	0.772545	0.731759	0.786077	0.760003	0.772304	0.763941
Sin(t)	0.879573	0.906997	0.908833	0.955458	0.968981	0.968533	0.986296
Sin(t/20)	0.999715	0.999999	0.999999	1.000000	1.000000	1.000000	1.000000

Autoregressive Process. The y sequence was generated using a first order autoregressive process, AR(1), given by:

$$y(t) = \frac{1}{2}y(t-1) + z(t),$$

where $z(t) \sim NID(0,1)$, and $t = 1, \ldots, 100$.

Moving Average Process. The y sequence was generated using a first order moving average process, MA(1), given by:

$$y(t) = z(t) + \frac{1}{2}z(t-1),$$

where $z(t) \sim NID(0,1)$, and $t = 1, \ldots, 100$.

Trigonometric Models. Two y sequences were generated using the following relations:

$$y(t) = sin(t/20)$$

$$y(t) = sin(t),$$

for $t = 1, \ldots, 100$.

The correlation between the actual and "recovered" y sequence, as well as the root mean square error,

$$RMSE = \sqrt{\frac{\Sigma(y-\hat{y})^2}{n}},$$

where $\hat{y}$ denotes the value of y "recovered" by the disaggregation procedure, were calculated for each y sequence generated. The results are summarized in Tables 1 and 2.

As can be seen from these examples, the disaggregation procedures work best for y sequences that are smooth: This is what one would expect. It is interesting to note that, for some examples, increasing the order does not yield a significantly better set of recovered

Table 2: RMSE between Actual and Recovered Data for Artificial Data Sets.

	Case						
Model	1	2A	2B	3	4A	4B	5
AR(1)	0.545102	0.569264	0.554476	0.493243	0.528942	0.522687	0.532873
MA(1)	0.626905	0.588157	0.633091	0.572321	0.604064	0.589352	0.599681
Sin(t)	0.337317	0.300278	0.297431	0.212244	0.175985	0.177245	0.121933
Sin(t/20)	0.017104	0.000917	0.000905	0.000033	0.000002	0.000002	0.000000

values. For each data set, plots of the actual data values versus the disaggregated values for each order are given in the appendix.

In a further test of the procedures, the same four artificial y sequences were aggregated twice to get 25 sums. The disaggregation procedures were used on each set of sums twice to "recover" the y sequences. (This would be useful if one wants to disaggregate 24 hour data to obtain "6 hour (pseudo) data.") Hence, we are assuming for a sequence of values $y_1, y_2, \ldots, y_{4n}$, that the sums

$$\begin{aligned} s_1 &= y_1 + y_2 + y_3 + y_4 \\ s_2 &= y_5 + y_6 + y_7 + y_8 \\ &\vdots \\ s_n &= y_{4n-3} + y_{4n-2} + y_{4n-1} + y_{4n} \end{aligned}$$

are available. The disaggregation procedures are applied to the sums, $s_1, \ldots, s_n$, to recover the sums

$$\begin{aligned} \tilde{s}_1 &= y_1 + y_2 \\ \tilde{s}_2 &= y_3 + y_4 \\ &\vdots \\ \tilde{s}_{2n} &= y_{4n-1} + y_{4n}. \end{aligned}$$

Then, the disaggregation procedures are applied to the sums, $\tilde{s}_1, \tilde{s}_2, \ldots, \tilde{s}_{2n}$, to recover the y sequence, $y_1, \ldots, y_{4n}$.

The correlation between the actual and "recovered" y sequences and the root mean square error are summarized in Tables 3 and 4. For each data set, plots of the actual data values versus the recovered values for each order are given in the appendix.

It is clear from Tables 3 and 4 that the resemblance between the actual and recovered values gets worse when using the disaggregation procedures twice. However, for the smoother examples, the procedures perform well. Here, it is interesting to note the degradation in performance when one goes to higher orders, for the first three artificial data sets.

Table 3: Correlation between Actual and Recovered Data for Twice Aggregated Artificial Data Sets.

	Case						
Model	1	2A	2B	3	4A	4B	5
AR(1)	0.765637	0.731539	0.753123	0.770482	0.728481	0.723534	0.668960
MA(1)	0.417748	0.394650	0.276728	0.327402	0.304301	0.240814	0.204894
Sin(t)	0.467211	0.281098	0.295267	0.361950	0.242390	0.233924	0.201307
Sin(t/20)	0.998574	0.999983	0.999983	1.000000	1.000000	1.000000	1.000000

Table 4: RMSE between Actual and Recovered Data for Twice Aggregated Artificial Data Sets.

	Case						
Model	1	2A	2B	3	4A	4B	5
AR(1)	0.802813	0.859050	0.825745	0.796589	0.872400	0.879168	0.990155
MA(1)	0.841023	0.852569	0.904861	0.880660	0.894682	0.922833	0.947530
Sin(t)	0.626861	0.703700	0.698035	0.667130	0.716293	0.719657	0.732503
Sin(t/20)	0.038222	0.004228	0.004120	0.000286	0.000037	0.000036	0.000004

4 Page Data Set

The performance of the different disaggregation procedures was evaluated using the data from the WHITEX study. In particular, the data used are those collected at Page, and are part of the WHITEX data base file (Source: Kristi Gebhart, NPS, Air Quality Division, CIRA Building, Foothills Campus, Colorado State University.).

The Page data set consists of samples of 27 different aerosol species. The samples were collected at either 6, 12, or 24 hour cycles over a period of days. The data were aggregated, and the disaggregation procedures were then applied. The correlation and RMSE between the actual and recovered values for the variables in the Page data set are given in Tables 5 and 6.

Table 7 ranks the performance of the procedures–based on RMSE–for each variable. As can be seen from the table, the performance of the procedures varies widely, depending on the variable. As a test to see if there is a difference in the performance of the procedures, Friedman's rank test (as available on MINITAB) was applied to the RMSE's using the seven procedures as treatments and the 27 variables as blocks. The results are summarized in Table 8. Based on these results, it would appear that there is a difference in the procedures. In this instance, case 3 has performed the best.

In a further evaluation of the performance of the procedures, three of the variables were aggregated twice, and then disaggregated twice, using the steps discussed in section 3. The variables chosen were ones that had the fewest number of missing values. The correlation and RMSE between the actual and recovered values for the variables in the Page data set that were aggregated twice and then disaggregated twice are given in Tables 9 and 10.

Tables 9 and 10 would indicate that the disaggregation procedures do not perform nearly as well when applied twice. Further, it appears that the procedures achieve worsening results as the order is increased. Just a small number of variables have been examined, so no general conclusions can be drawn regarding disaggregating data twice.

5 Conclusion.

The evidence, here, suggests that polynomial disaggregation procedures can be useful. Further, it appears that only the even degrees need be considered. These preliminary results would also indicate that one's intuition is correct: The higher the degree, the better the results.

For the Page data, the case $k = 3$ (i.e. degree 2) yielded the best results–not case $k = 5$ (i.e. degree 4). The reason for this is due largely to the presence of missing values within the Page data set. To use case $k = 5$, there must be at least 10 adjacent y values–hence, 5 sums–that are not missing, and to utilize the higher degrees to their fullest potential, it is best to have large blocks of complete data. Otherwise, one is using a small number of

Table 5: Correlation between Actual and Recovered Data for the Page Data Set.

Model	Case 1	2A	2B	3	4A	4B	5
fbrc	0.896966	0.863555	0.899356	0.888726	0.875605	0.894511	0.888978
fsrc	0.776335	0.771986	0.774129	0.759582	0.762057	0.778467	0.791836
fzrc	0.645784	0.649856	0.702139	0.665220	0.670403	0.698417	0.625379
fpbc	0.730975	0.758433	0.662260	0.724167	0.743156	0.682904	0.710986
mcd4c	0.926913	0.913538	0.926789	0.939646	0.897479	0.889418	0.831476
mcdmwc	0.996152	0.997153	0.997114	0.997797	0.997686	0.997773	0.997913
mfwcdc	0.913141	0.928883	0.939779	0.955940	0.921612	0.917507	0.842570
qtr1c	0.921285	0.933845	0.942270	0.940398	0.936710	0.941155	0.927753
qnepc	0.881259	0.899474	0.886584	0.901951	0.904782	0.900152	0.905942
qtemc	0.968189	0.902450	0.991509	0.965408	0.918635	0.983378	0.955491
qrhc	0.936240	0.900276	0.960955	0.950098	0.918387	0.964716	0.949920
qwsc	0.884294	0.899970	0.898701	0.916662	0.911865	0.914065	0.918072
qwdc	0.747979	0.732810	0.708498	0.746203	0.733826	0.710679	0.724263
sso2c	0.736398	0.800754	0.700838	0.741678	0.769434	0.691382	0.722729
wycpmc	0.829511	0.792348	0.811715	0.816342	0.793497	0.811165	0.797463
nsoilc	0.861038	0.892722	0.870950	0.923569	0.925597	0.913262	0.905725
nomhc	0.827736	0.778942	0.865005	0.839996	0.815228	0.859770	0.839841
bso4c	0.963061	0.961829	0.976944	0.972570	0.969512	0.976814	0.979460
cocc	0.775758	0.791800	0.821192	0.825966	0.819822	0.821545	0.824700
cecc	0.885971	0.884256	0.887144	0.898834	0.899231	0.892480	0.896730
eno3c	0.872472	0.930202	0.776287	0.872929	0.912308	0.823465	0.866604
ffpmc	0.921329	0.918433	0.946548	0.941125	0.936602	0.947193	0.942728
ffec	0.868889	0.893688	0.857817	0.885179	0.889795	0.865077	0.871419
fcuc	0.882919	0.859719	0.863468	0.878825	0.861168	0.889243	0.885369
fznc	0.924409	0.907972	0.888261	0.912380	0.905646	0.895358	0.893984
fasc	0.743923	0.768247	0.612673	0.707090	0.729228	0.628963	0.696880
fsec	0.848295	0.816993	0.884004	0.862507	0.843470	0.869869	0.860252

Table 6: RMSE between Actual and Recovered Data for the Page Data Set.

	Case						
Model	1	2A	2B	3	4A	4B	5
fbrc	0.000378	0.000430	0.000371	0.000389	0.000411	0.000380	0.000389
fsrc	0.000083	0.000085	0.000084	0.000087	0.000087	0.000084	0.000081
fzrc	0.000131	0.000124	0.000116	0.000122	0.000121	0.000117	0.000127
fpbc	0.001166	0.001125	0.001304	0.001191	0.001156	0.001270	0.001219
mcd4c	0.004509	0.005010	0.004617	0.004309	0.005670	0.005886	0.007568
mcdmwc	0.076565	0.065872	0.066325	0.057955	0.059399	0.058269	0.056413
mfwcdc	0.003430	0.003172	0.002927	0.002574	0.003252	0.003334	0.003979
qtrlc	0.006883	0.006331	0.005931	0.006024	0.006279	0.006063	0.006841
qnepc	0.003918	0.003622	0.003835	0.003581	0.003531	0.003611	0.003511
qtemc	1.873578	3.293800	0.973715	1.952973	3.002634	1.359799	2.217906
qrhc	5.486683	6.873435	4.321379	4.871890	6.210885	4.112450	4.879755
qwsc	2.158179	2.016628	2.029336	1.848634	1.897445	1.874627	1.832595
qwdc	72.573957	74.686716	77.663610	72.813640	74.562771	77.400051	75.699459
sso2c	4.547551	4.153350	4.942119	3.840328	3.740391	4.243564	4.149390
wycpmc	0.808982	0.889017	0.848894	0.837499	0.887231	0.850326	0.880807
nsoilc	0.069391	0.060912	0.066358	0.054240	0.053539	0.057666	0.060298
nomhc	0.403555	0.461689	0.368089	0.429949	0.459748	0.404742	0.430164
bso4c	0.227663	0.235870	0.183906	0.206762	0.226215	0.197615	0.194042
cocc	0.349038	0.341427	0.318961	0.315196	0.320005	0.318596	0.316102
cecc	0.163961	0.165800	0.163770	0.155377	0.155155	0.160031	0.156979
eno3c	0.087500	0.065848	0.115324	0.087404	0.073326	0.102720	0.090065
ffpmc	0.678068	0.689962	0.561951	0.589076	0.610305	0.558704	0.581040
ffec	0.004421	0.003943	0.004522	0.004088	0.004009	0.004412	0.004314
fcuc	0.000207	0.000226	0.000224	0.000210	0.000225	0.000202	0.000205
fznc	0.000442	0.000482	0.000530	0.000470	0.000488	0.000514	0.000517
fasc	0.000342	0.000328	0.000414	0.000363	0.000351	0.000405	0.000368
fsec	0.000604	0.000660	0.000533	0.000577	0.000613	0.000562	0.000581

Table 7: Ranks Disaggregation Procedures for Each Variable Based on RMSE.

	Case						
Model	1	2A	2B	3	4A	4B	5
fbrc	2	7	1	4.5	6	3	4.5
fsrc	2	5	3.5	6.5	6.5	3.5	1
fzrc	7	5	1	4	3	2	6
fpbc	3	1	7	4	2	6	5
mcd4c	2	4	3	1	5	6	7
mcdmwc	7	5	6	2	4	3	1
mfwcdc	6	3	2	1	4	5	7
qtrlc	7	5	1	2	4	3	6
qnepc	7	5	6	3	2	4	1
qtemc	3	7	1	4	6	2	5
qrhc	5	7	2	3	6	1	4
qwsc	7	5	6	2	4	3	1
qwdc	1	4	7	2	3	6	5
sso2c	6	4	7	2	1	5	3
wycpmc	1	7	3	2	6	4	5
nsoilc	7	5	6	2	1	3	4
nomhc	2	7	1	4	6	3	5
bso4c	6	7	1	4	5	3	2
cocc	7	6	4	1	5	3	2
cecc	6	7	5	2	1	4	3
eno3c	4	1	7	3	2	6	5
ffpmc	6	7	2	4	5	1	3
ffec	6	1	7	3	2	5	4
fcuc	3	7	5	4	6	1	2
fznc	1	3	7	2	4	5	6
fasc	2	1	7	4	3	6	5
fsec	5	7	1	3	6	2	4

Table 8: Results of Friedman's Test Applied to RMSE Using the Disaggregation Procedures as Treatment.

S = 13.73 d.f. = 6 p = 0.034
S = 13.76 d.f. = 6 p = 0.033 (adjusted for ties)

Case	N	Est. Median	Sum of RANKS
1	27	0.05945	121.0
2A	27	0.05954	133.0
2B	27	0.05942	109.5
3	27	0.05922	79.0
4A	27	0.05940	108.5
4B	27	0.05940	98.5
5	27	0.05942	106.5

Grand median = 0.05941

Table 9: Correlation between Actual and Recovered Data for Twice Aggregated Variables.

	Case						
Model	1	2A	2B	3	4A	4B	5
2qtemc	0.865953	0.869504	0.873498	0.873376	0.870641	0.872604	0.869722
2wycpmc	0.721602	0.637625	0.740485	0.689560	0.616241	0.616967	0.541133
2eno3c	0.630901	0.694111	0.535496	0.580634	0.614136	0.529689	0.53960

Table 10: RMSE between Actual and Recovered Data for Twice Aggregated Page Data Sets.

	Case						
Model	1	2A	2B	3	4A	4B	5
2qtemc	3.744821	3.698430	3.645279	3.646992	3.683382	3.657245	3.695570
2wycpmc	1.028034	1.161978	0.999443	1.145701	1.298056	1.296348	1.570445
2eno3c	0.137439	0.127599	0.151537	0.150944	0.14644	0.158390	0.158048

"windows" to "recover" a large number of y values. Polynomial disaggregation procedures will work best with data that has no missing values.

These results are preliminary. It would be beneficial to carry out a more rigorous study of the proposed procedures using a broad variety of artificial data sets without any missing values. It would also be of interest to further examine the repeated (2 or more times) use of polynomial disaggregation procedures on single data sets.

6 Minitab Macros.

In order to implement the disaggregation procedures, several macros were written for use with Minitab. A brief description of how to use them follows:

order$k$.mtb for k = 1, 2A, 2B, 3, 4A, 4B, 5. These programs assume that the aggregated data (the sums) are in C1 and that K9 = n. Using the disaggregation procedure called for by k, it puts the disaggregated data (estimated y sequences) in C2. K1 and K8 are used in the computations.

chkdisag.mtb. This program assumes that K2 = source column number for the y sequence and that K9 = n. It aggregates the y sequence, and performs all of the disaggregation procedures. The original y sequence is put in C3 and the disaggregated data are put in C4 - C10. In its computations, the following are used: C1, C2, K1, K8, and K10.

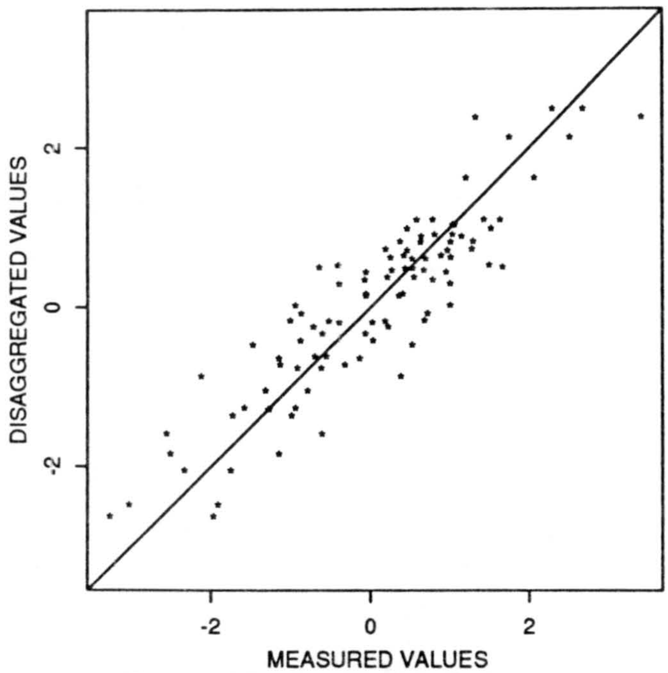
2upto4.mtb. Here, it is assumed that C1 contains the twice disaggregated data, and that K9 = the number of entries in C1. The program performs all of the disaggregation procedures twice, and stores the estimated y sequences in C30 - C36. The following are used in its computations: C2, C4, K1, K8, and K11.

In the programs discussed above, the following are called in iterative loops: Kone.mtb, ktwoA.mtb, ktwoB.mtb, kthree.mtb, kfourA.mtb, kfourB.mtb, kfive.mtb, and sums.mtb.

Appendix

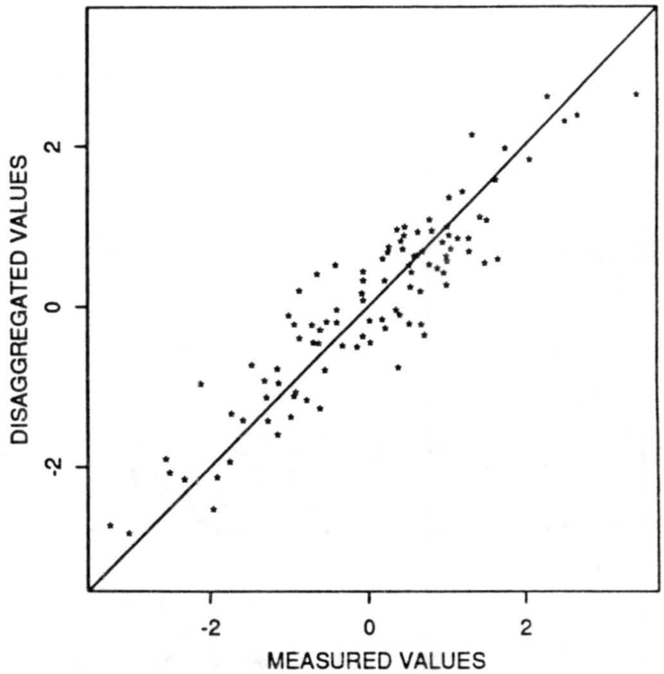
Plots of observed data versus disaggregated data.

ORDER 0 DISAGGREGATION FOR AR1



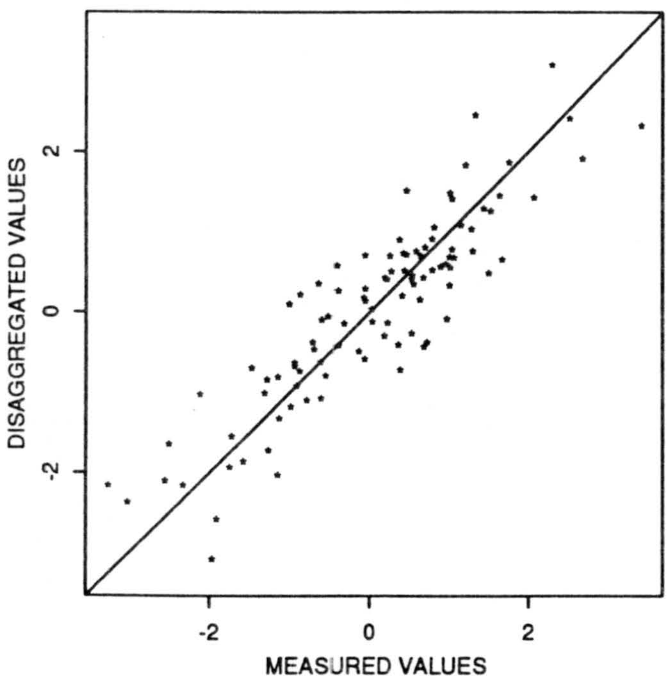
MEAN = 0.0514122 CORRELATION = 0.8995701
RMSE = 0.5451023 n = 100

ORDER 2 DISAGGREGATION FOR AR1



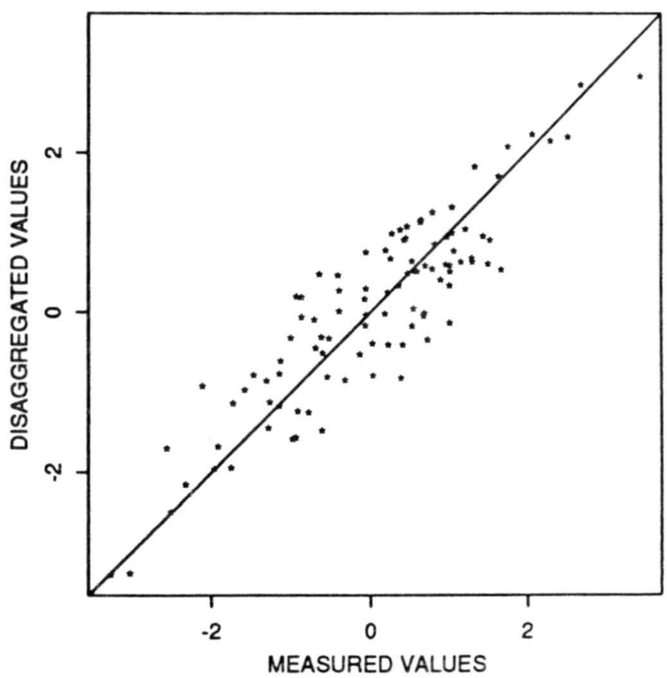
MEAN = 0.0514123 CORRELATION = 0.9185992
RMSE = 0.4932433 n = 100

ORDER 1A DISAGGREGATION FOR AR1



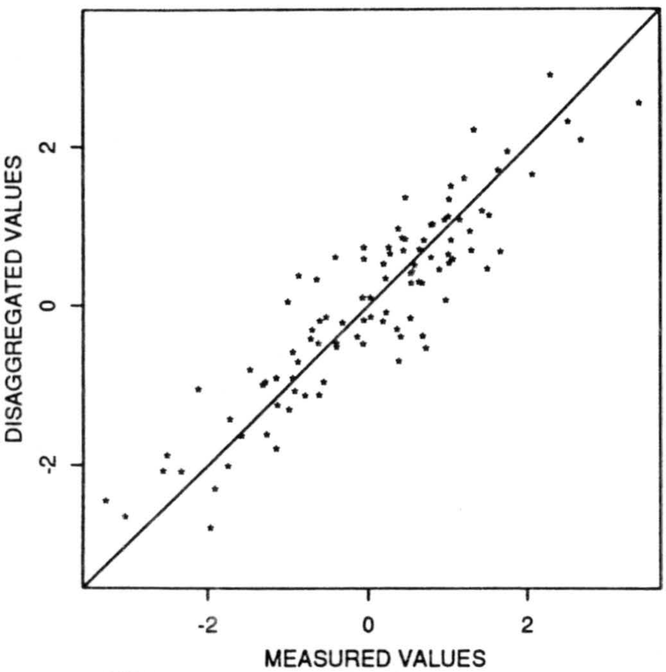
MEAN = 0.0514121 CORRELATION = 0.8909593
RMSE = 0.5692636 n = 100

ORDER 1B DISAGGREGATION FOR AR1



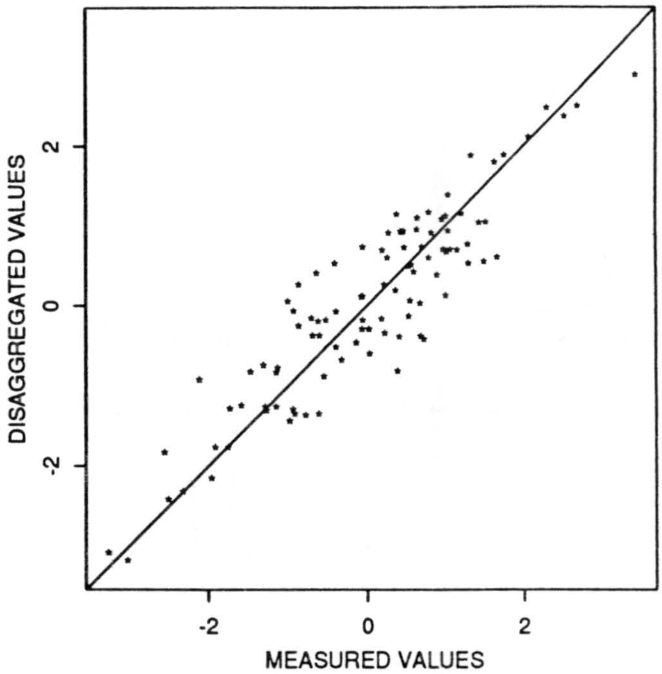
MEAN = 0.0514120 CORRELATION = 0.8966756
RMSE = 0.5544760 n = 100

ORDER 3A DISAGGREGATION FOR AR1



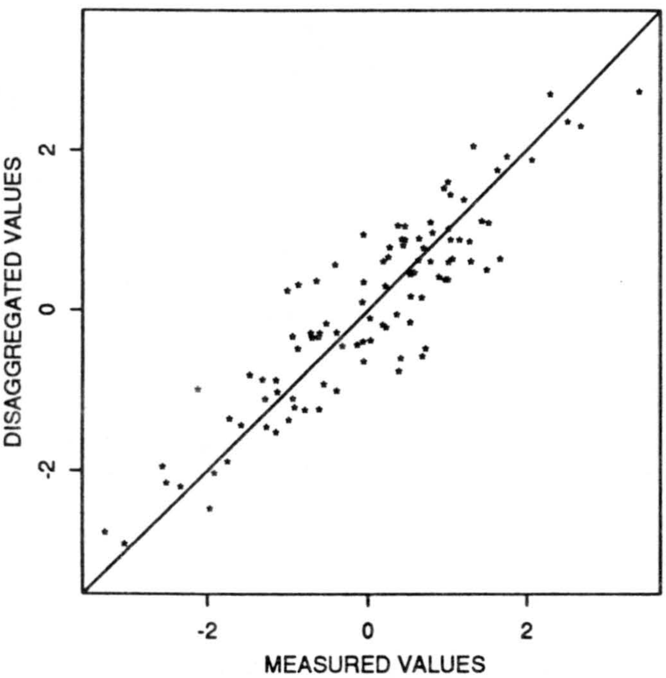
MEAN = 0.0514120 CORRELATION = 0.9063039
RMSE = 0.5289418 n = 100

ORDER 3B DISAGGREGATION FOR AR1



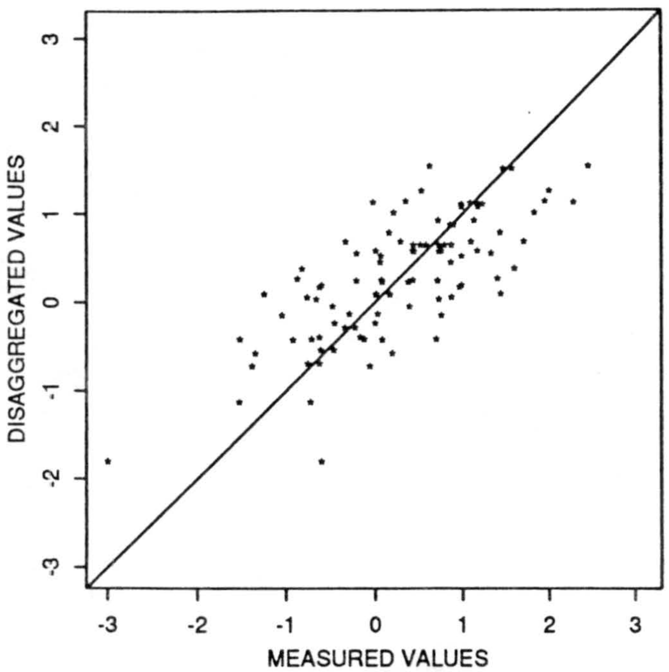
MEAN = 0.0514125 CORRELATION = 0.9085052
RMSE = 0.5226872 n = 100

ORDER 4 DISAGGREGATION FOR AR1



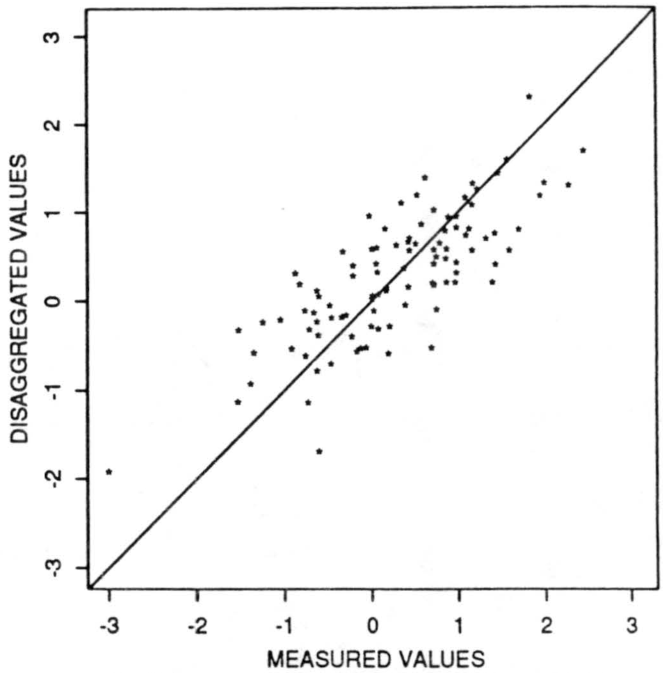
MEAN = 0.0514123 CORRELATION = 0.9051300
RMSE = 0.5328728 n = 100

ORDER 0 DISAGGREGATION FOR MA1



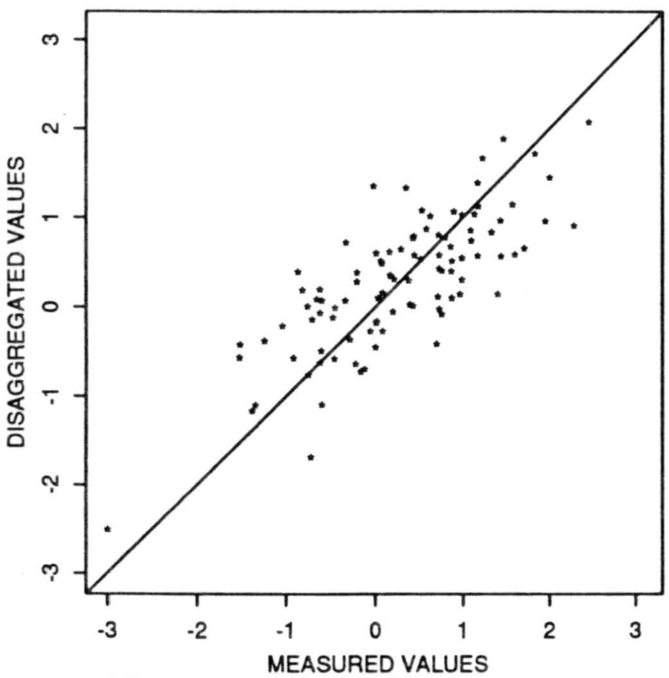
MEAN = 0.2899650 CORRELATION = 0.7357532
RMSE = 0.6269053 n = 100

ORDER 2 DISAGGREGATION FOR MA1



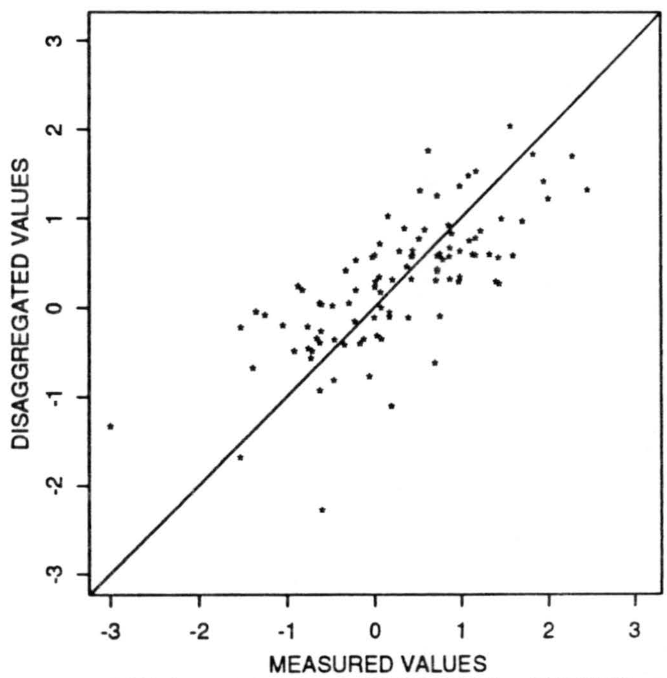
MEAN = 0.2899660 CORRELATION = 0.7860765
RMSE = 0.5723212 n = 100

ORDER 1A DISAGGREGATION FOR MA1



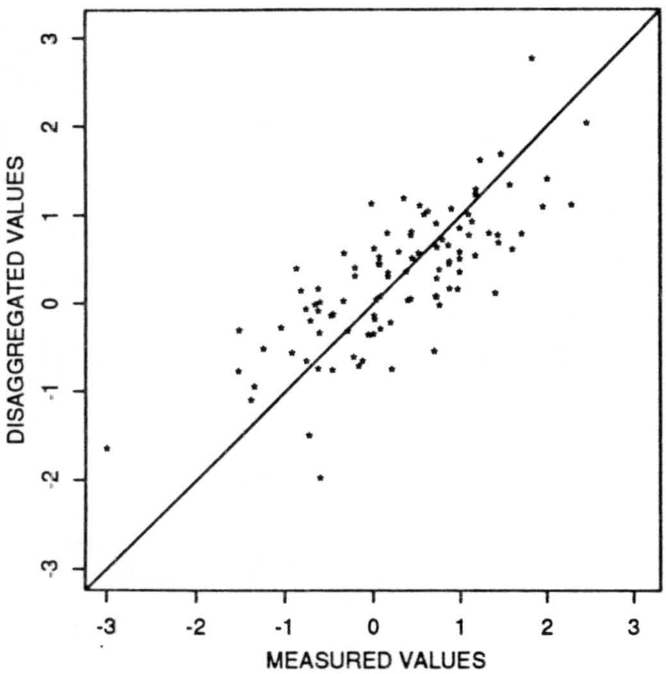
MEAN = 0.2899664 CORRELATION = 0.7725450
RMSE = 0.5881573 n = 100

ORDER 1B DISAGGREGATION FOR MA1



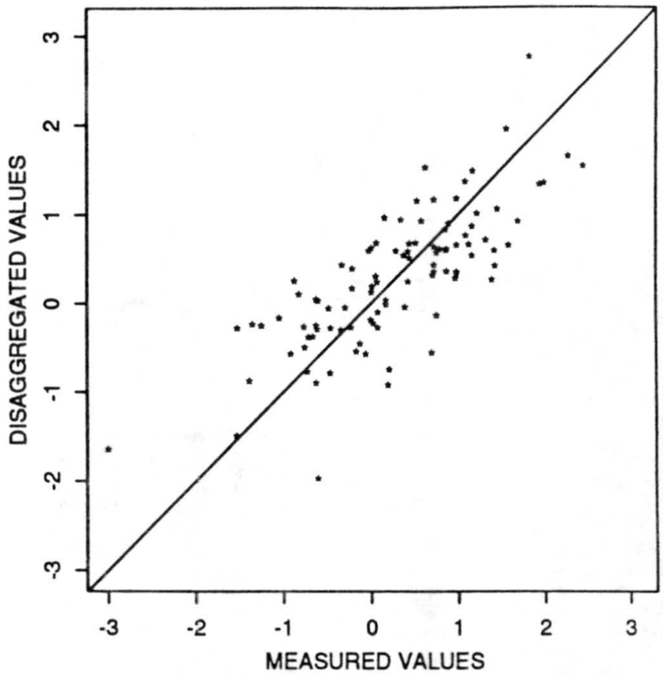
MEAN = 0.2899662 CORRELATION = 0.7317585
RMSE = 0.6330912 n = 100

ORDER 3A DISAGGREGATION FOR MA1



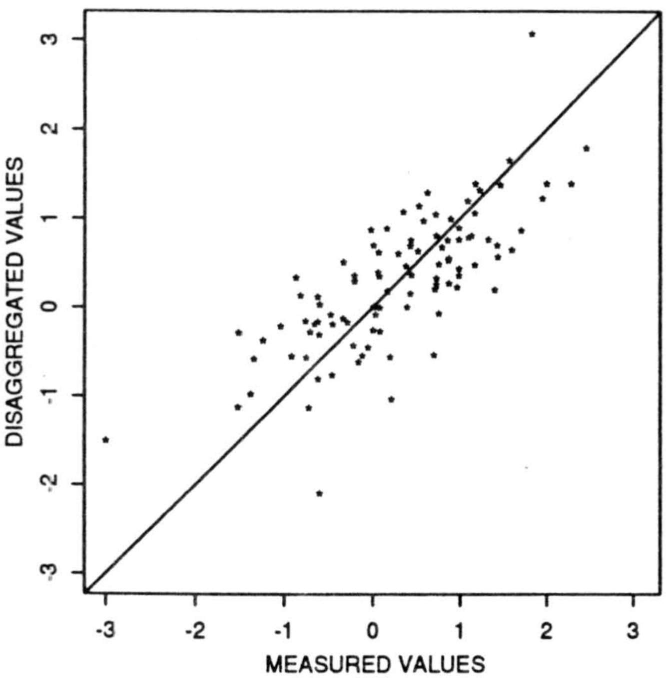
MEAN = 0.2899658 CORRELATION = 0.7600030
RMSE = 0.6040636 n = 100

ORDER 3B DISAGGREGATION FOR MA1



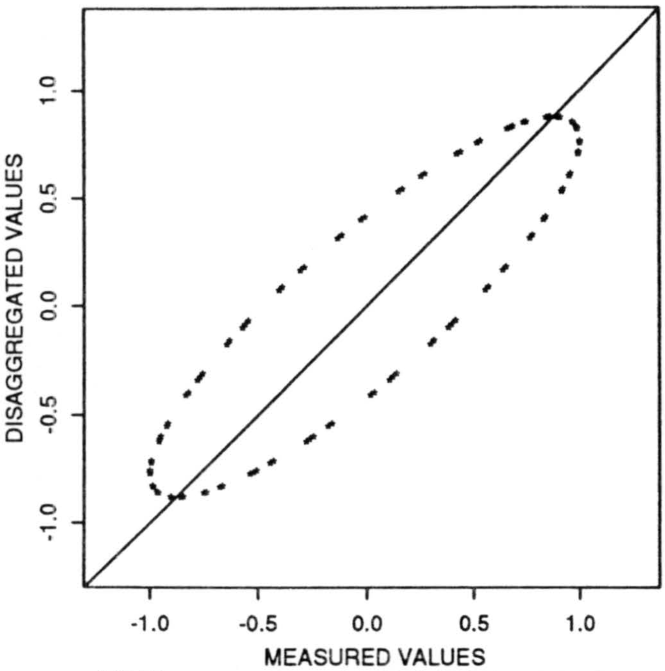
MEAN = 0.2899659 CORRELATION = 0.7723045
RMSE = 0.5893522 n = 100

ORDER 4 DISAGGREGATION FOR MA1



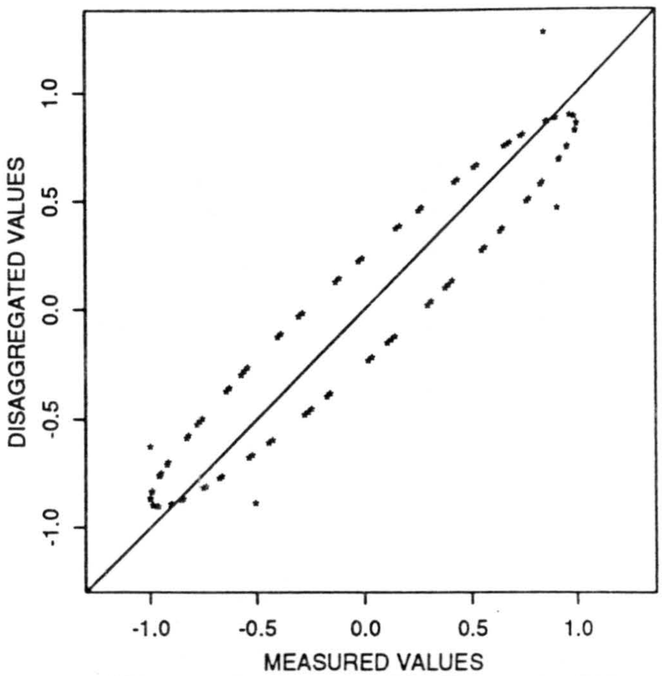
MEAN = 0.2899660 CORRELATION = 0.7639408
RMSE = 0.5996807 n = 100

ORDER 0 DISAGGREGATION FOR SINT



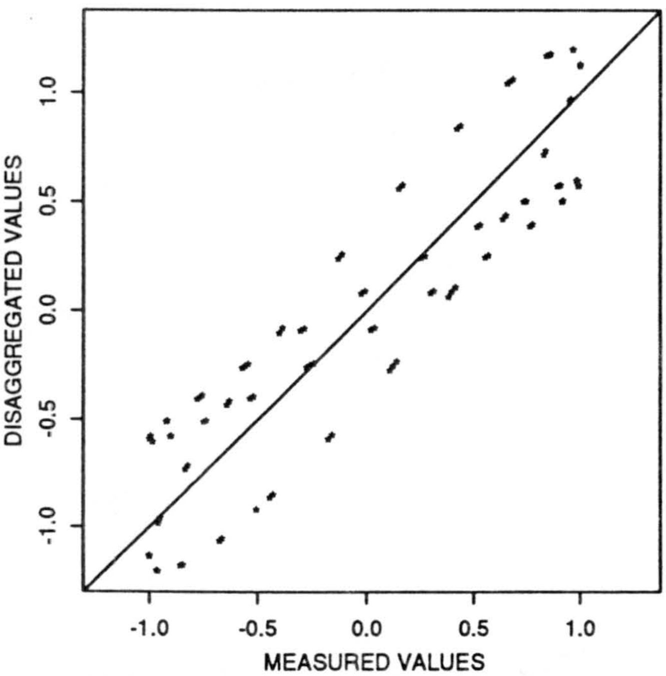
MEAN = -0.0012720 CORRELATION = 0.8795731
RMSE = 0.3373172 n = 100

ORDER 2 DISAGGREGATION FOR SINT



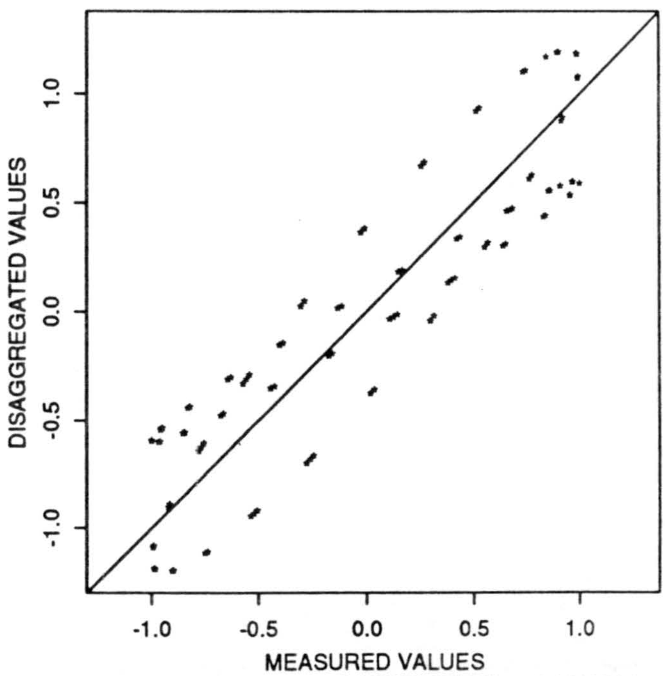
MEAN = -0.0012720 CORRELATION = 0.9554579
RMSE = 0.2122438 n = 100

ORDER 1A DISAGGREGATION FOR SINT



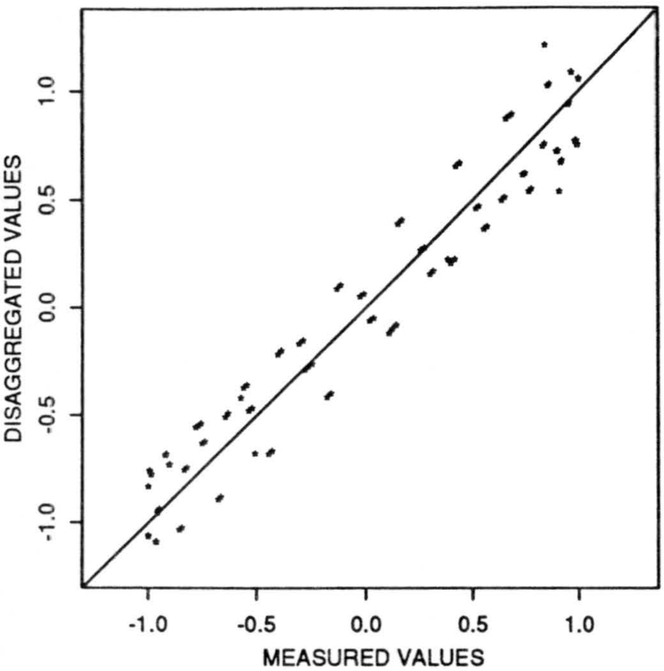
MEAN = -0.0012715 CORRELATION = 0.9069969
RMSE = 0.3002782 n = 100

ORDER 1B DISAGGREGATION FOR SINT



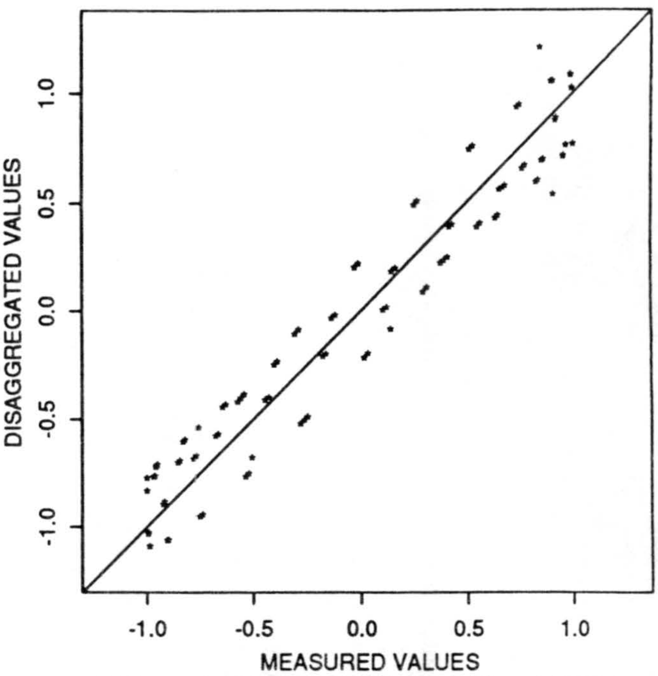
MEAN = -0.0012719 CORRELATION = 0.9088334
RMSE = 0.2974308 n = 100

ORDER 3A DISAGGREGATION FOR SINT



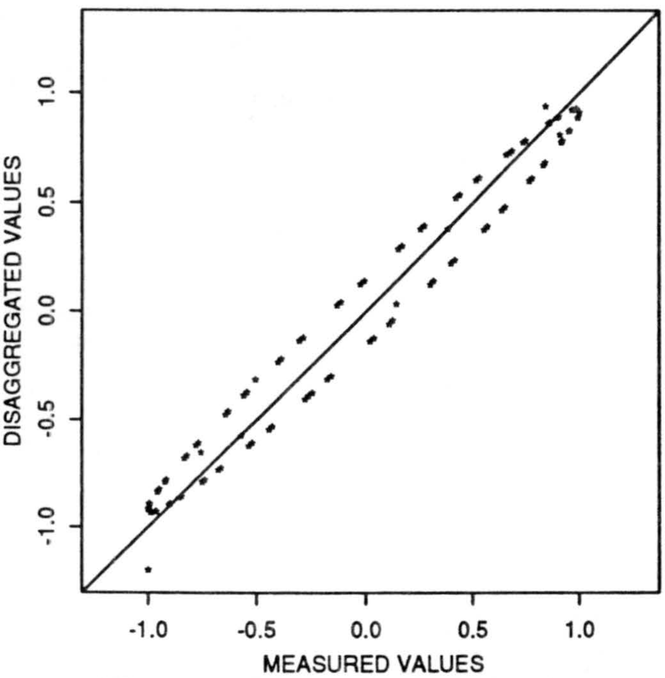
MEAN = -0.0012716 CORRELATION = 0.9689811
RMSE = 0.1759854 n = 100

ORDER 3B DISAGGREGATION FOR SINT



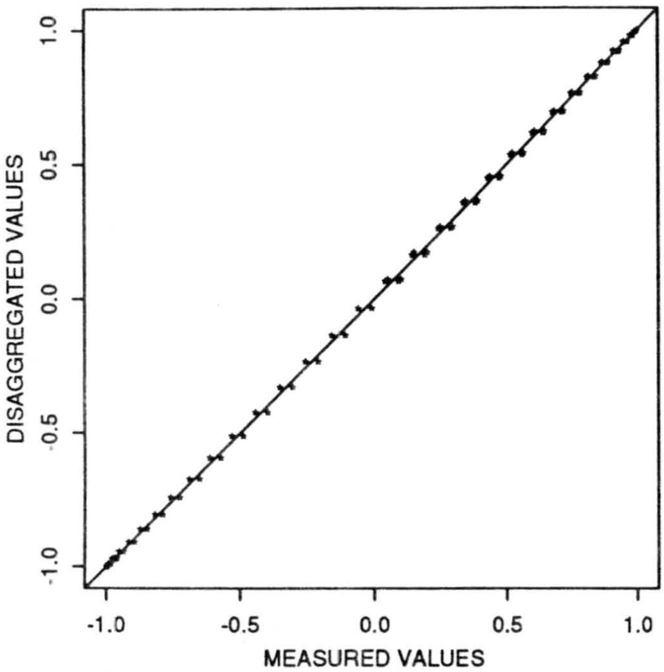
MEAN = -0.0012720 CORRELATION = 0.9685332
RMSE = 0.1772453 n = 100

ORDER 4 DISAGGREGATION FOR SINT



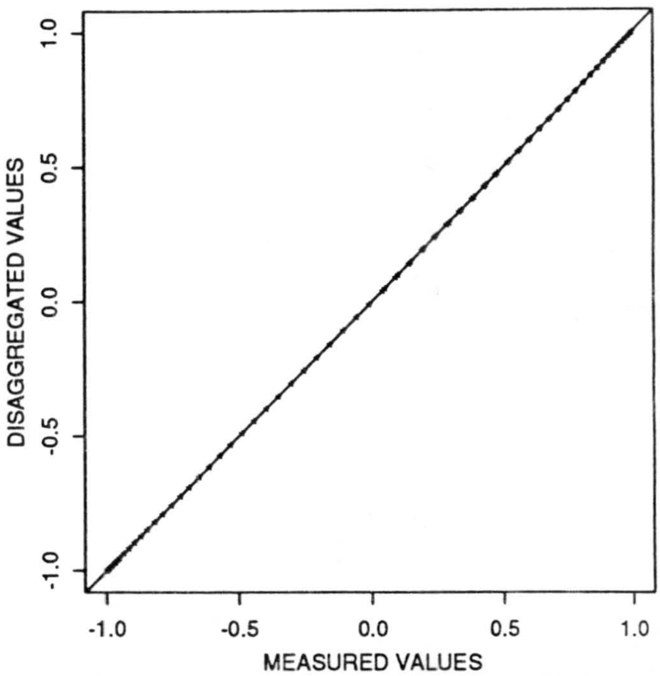
MEAN = -0.0012717 CORRELATION = 0.9862964
RMSE = 0.1219335 n = 100

ORDER 0 DISAGGREGATION FOR SINT20



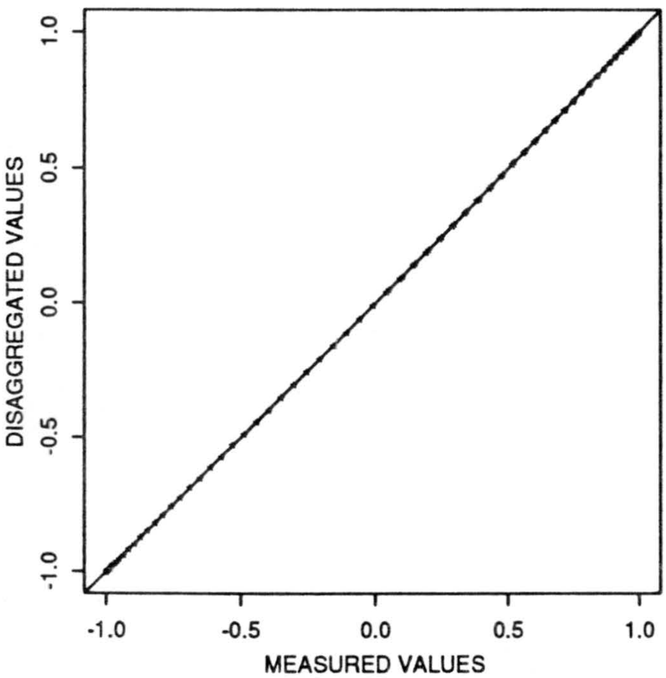
MEAN = 0.13844312 CORRELATION = 0.99971461
RMSE = 0.01710421 n = 100

ORDER 2 DISAGGREGATION FOR SINT20



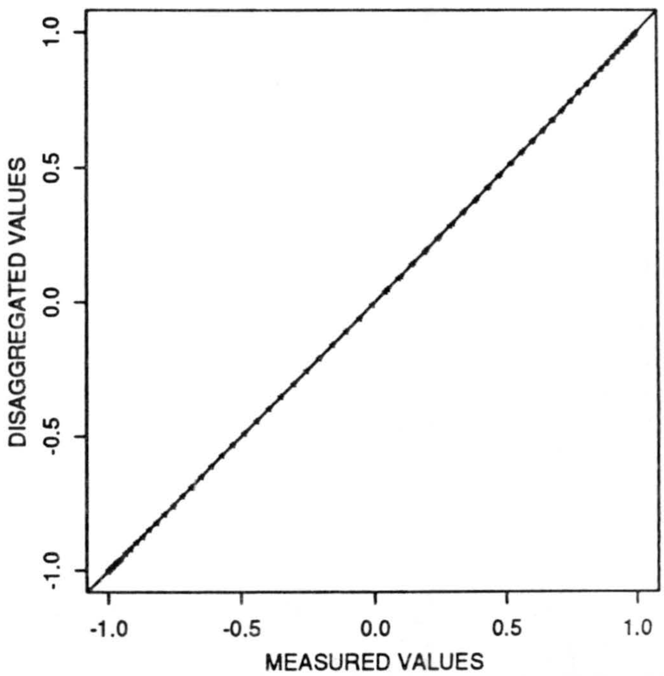
MEAN = 1.384431e-01 CORRELATION = 1.000000e+00
RMSE = 3.321024e-05 n = 100

ORDER 1A DISAGGREGATION FOR SINT20



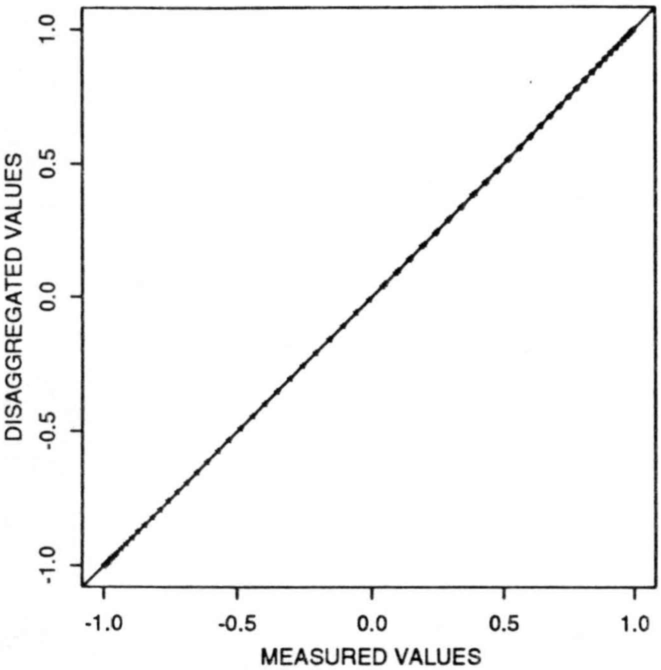
MEAN = 0.1384428000 CORRELATION = 0.9999991655
RMSE = 0.0009171299 n = 100

ORDER 1B DISAGGREGATION FOR SINT20



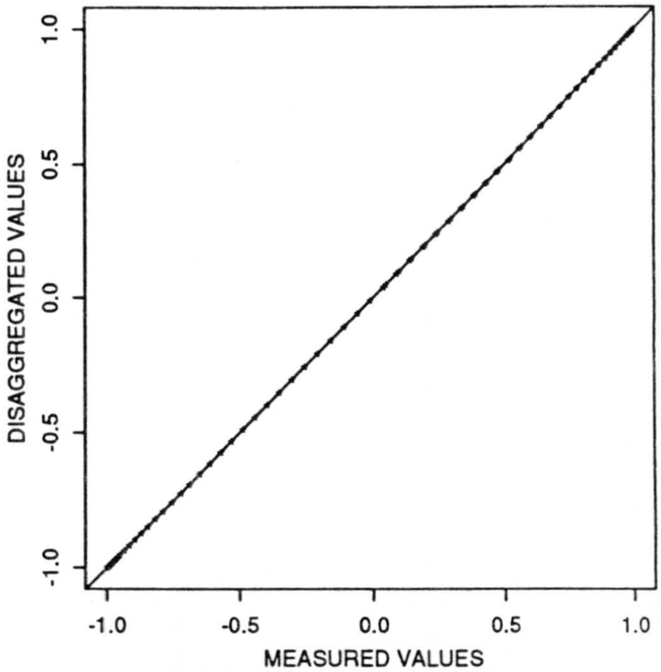
MEAN = 0.1384428000 CORRELATION = 0.9999991655
RMSE = 0.0009049011 n = 100

ORDER 3A DISAGGREGATION FOR SINT20



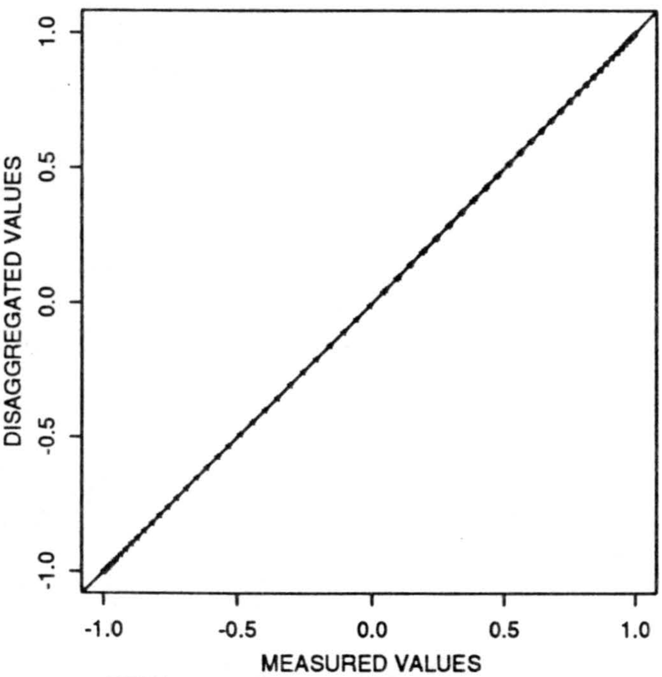
MEAN = 1.384431e-01 CORRELATION = 9.999999e-01
RMSE = 1.897367e-06 n = 100

ORDER 3B DISAGGREGATION FOR SINT20



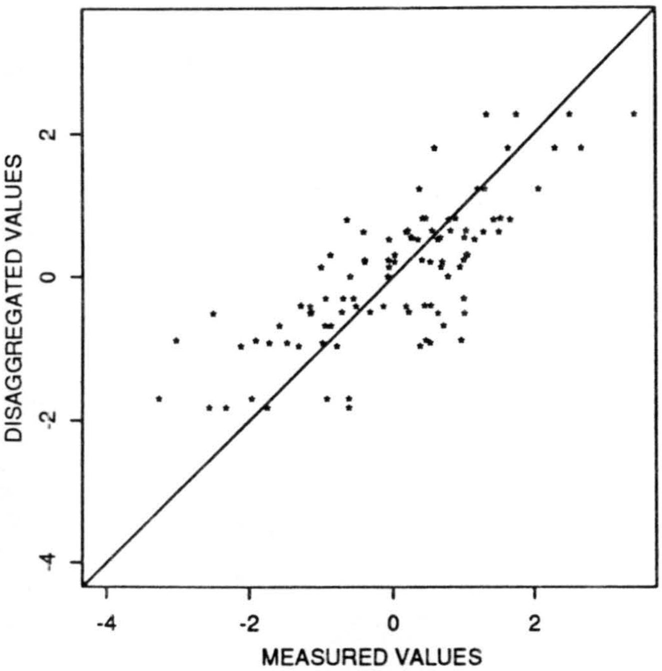
MEAN = 1.384431e-01 CORRELATION = 9.999999e-01
RMSE = 1.854724e-06 n = 100

ORDER 4 DISAGGREGATION FOR SINT20



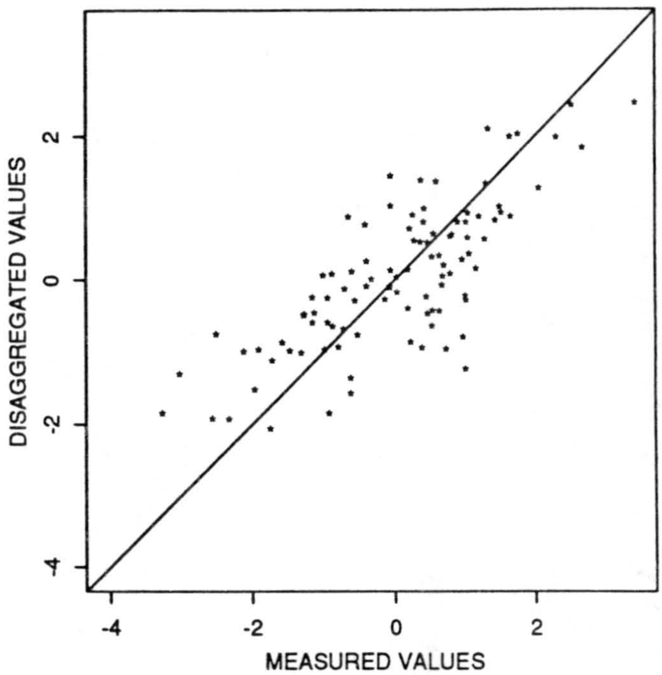
MEAN = 0.1384431 CORRELATION = 1.0000000
RMSE = 0.0000000 n = 100

ORDER 0 DISAGGREGATION FOR 2AR1



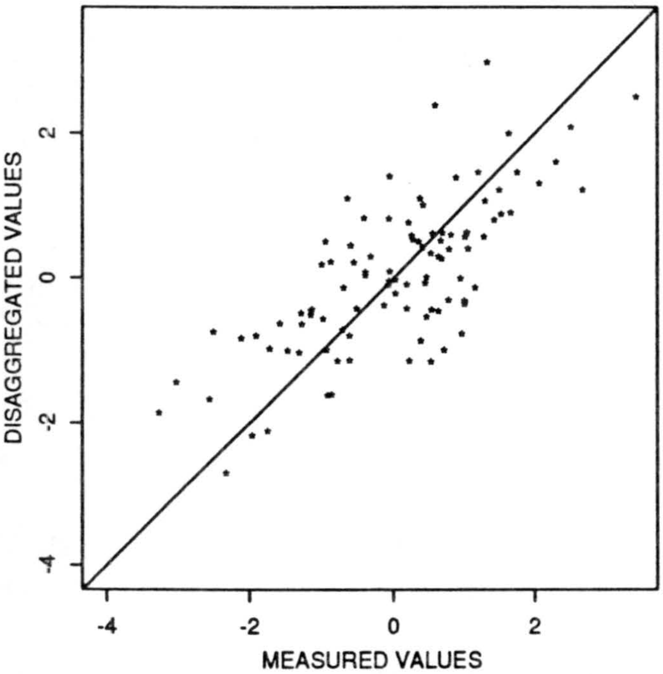
MEAN = 0.0514124 CORRELATION = 0.7656367
RMSE = 0.8028127 n = 100

ORDER 2 DISAGGREGATION FOR 2AR1



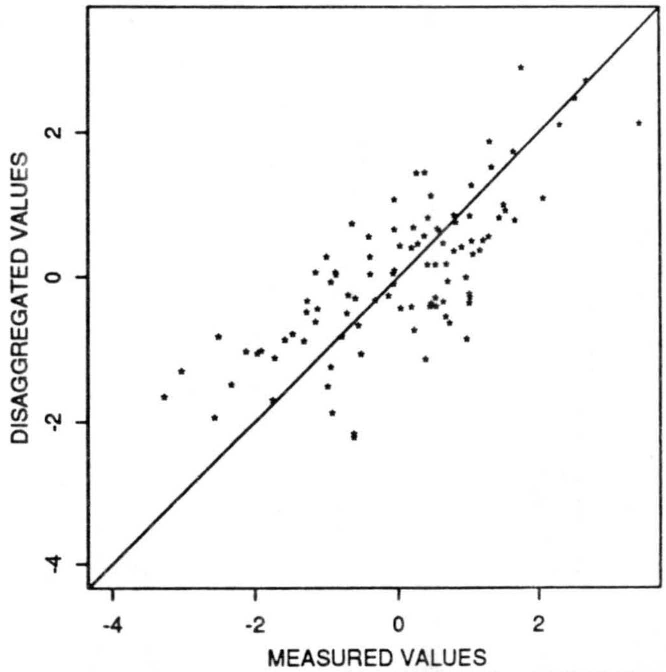
MEAN = 0.0514117 CORRELATION = 0.7704819
RMSE = 0.7965890 n = 100

ORDER 1A DISAGGREGATION FOR 2AR1

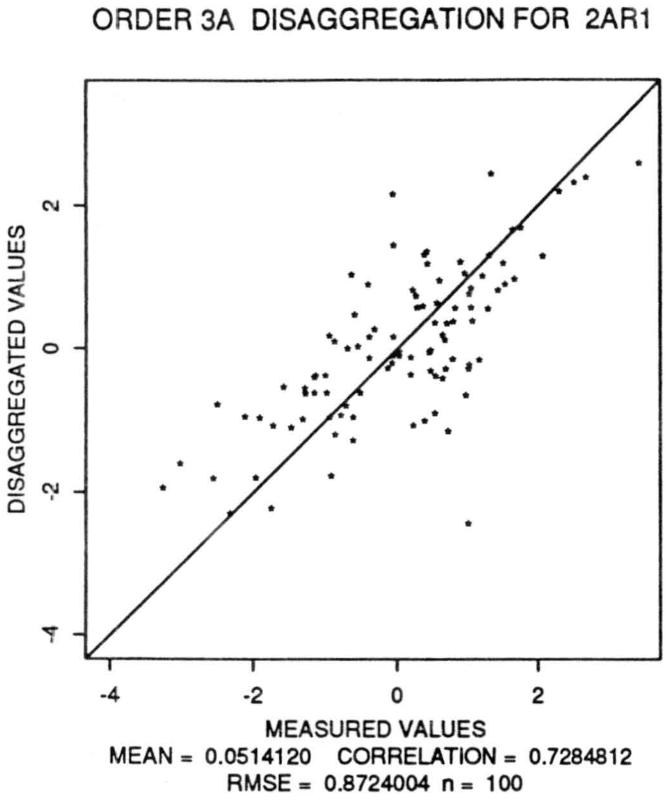


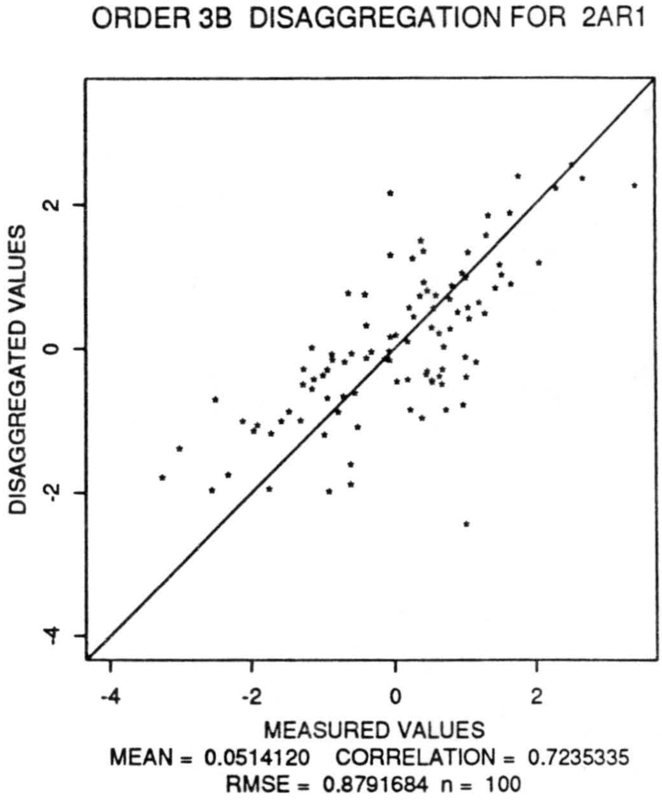
MEAN = 0.0514124 CORRELATION = 0.7315390
RMSE = 0.8590501 n = 100

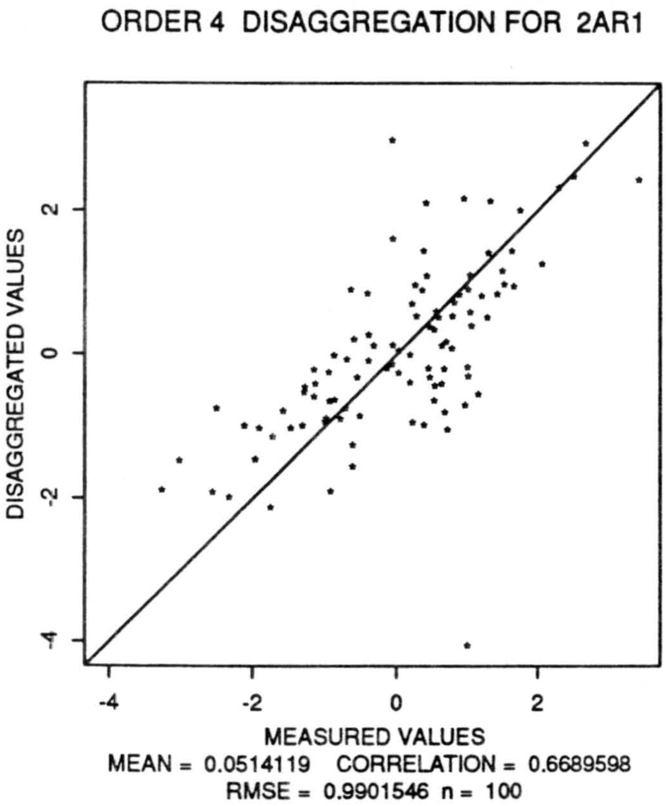
ORDER 1B DISAGGREGATION FOR 2AR1



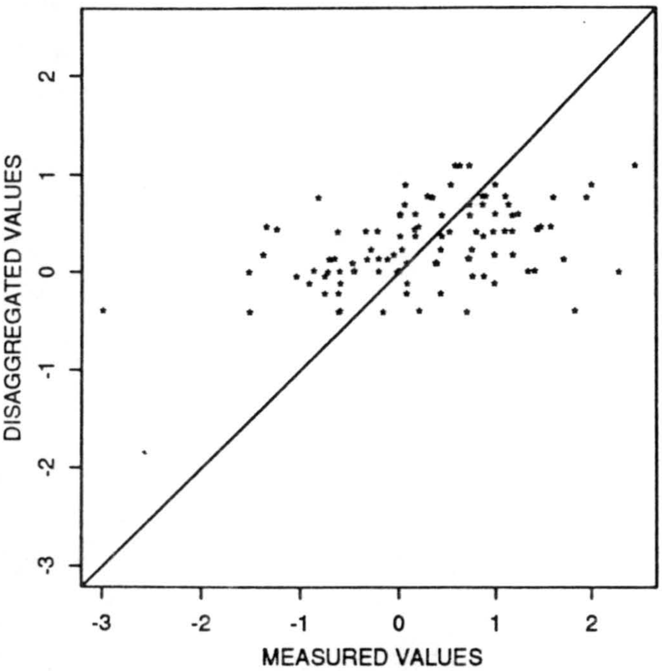
MEAN = 0.0514123 CORRELATION = 0.7531235
RMSE = 0.8257454 n = 100


ORDER 3A DISAGGREGATION FOR 2AR1
DISAGGREGATED VALUES
MEASURED VALUES
MEAN = 0.0514120 CORRELATION = 0.7284812
RMSE = 0.8724004 n = 100


ORDER 3B DISAGGREGATION FOR 2AR1
DISAGGREGATED VALUES
MEASURED VALUES
MEAN = 0.0514120 CORRELATION = 0.7235335
RMSE = 0.8791684 n = 100

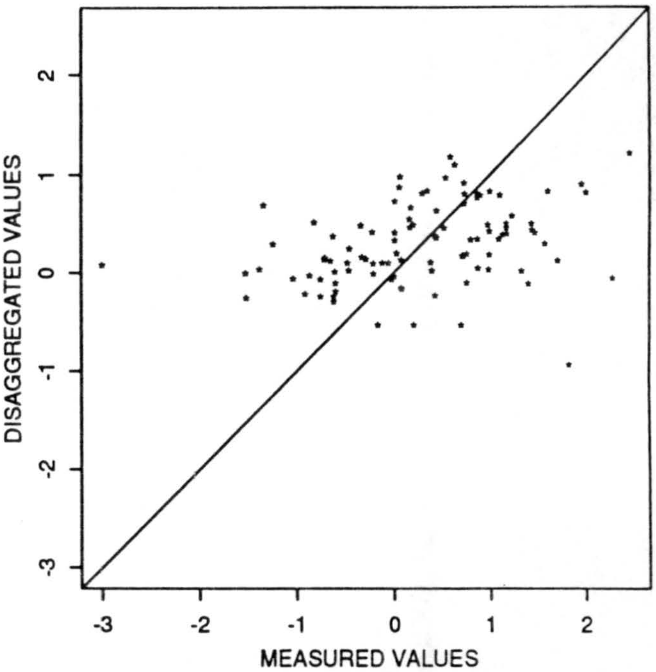

ORDER 4 DISAGGREGATION FOR 2AR1
DISAGGREGATED VALUES
MEASURED VALUES
MEAN = 0.0514119 CORRELATION = 0.6689598
RMSE = 0.9901546 n = 100

ORDER 0 DISAGGREGATION FOR 2MA1



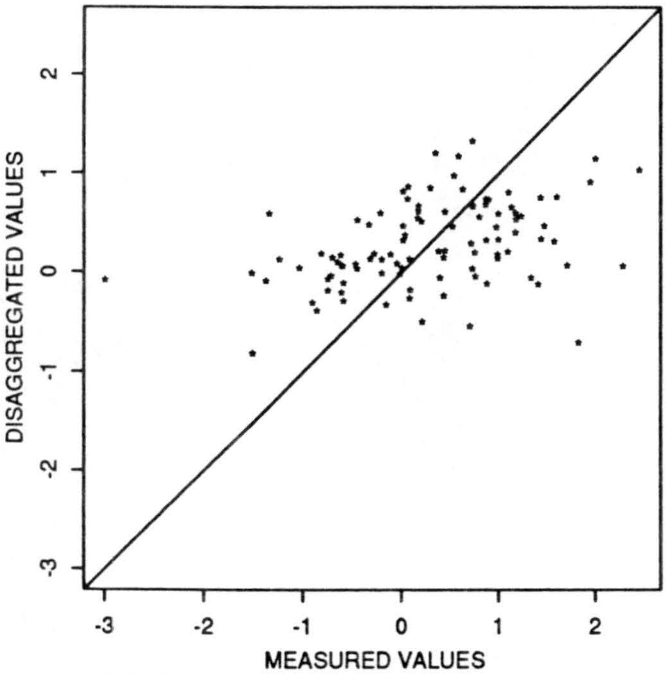
MEAN = 0.2899660 CORRELATION = 0.4177485
RMSE = 0.8410233 n = 100

ORDER 2 DISAGGREGATION FOR 2MA1



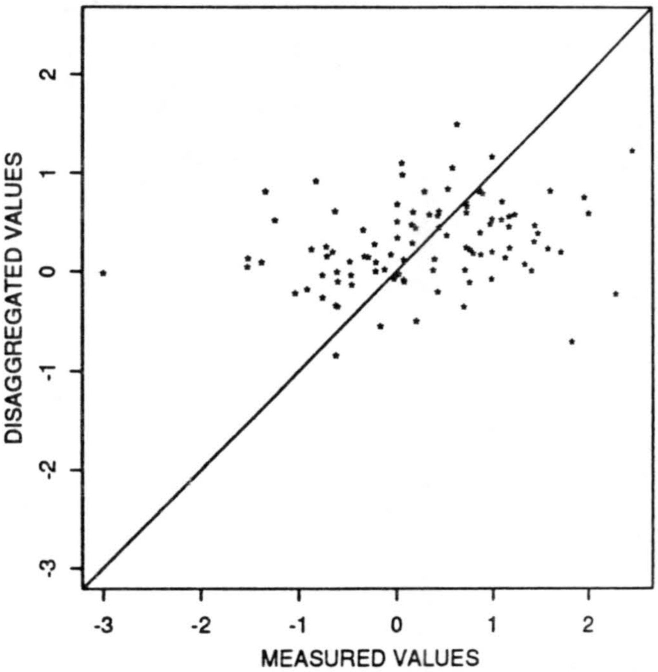
MEAN = 0.2899656 CORRELATION = 0.3274018
RMSE = 0.8806601 n = 100

ORDER 1A DISAGGREGATION FOR 2MA1



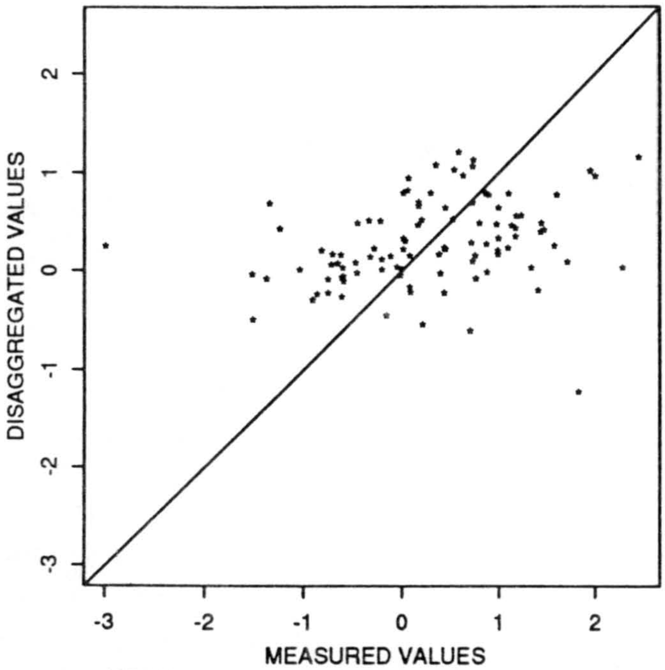
MEAN = 0.2899656 CORRELATION = 0.3946503
RMSE = 0.8525695 n = 100

ORDER 1B DISAGGREGATION FOR 2MA1



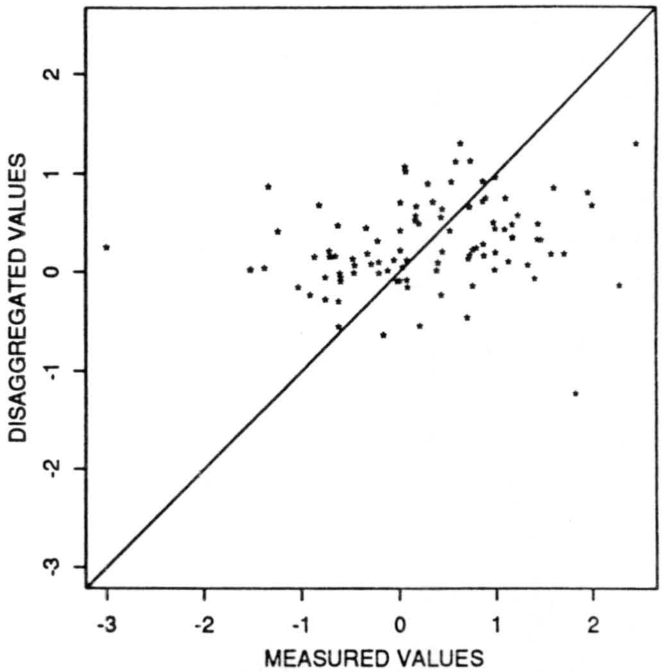
MEAN = 0.2899661 CORRELATION = 0.2767280
RMSE = 0.9048612 n = 100

ORDER 3A DISAGGREGATION FOR 2MA1



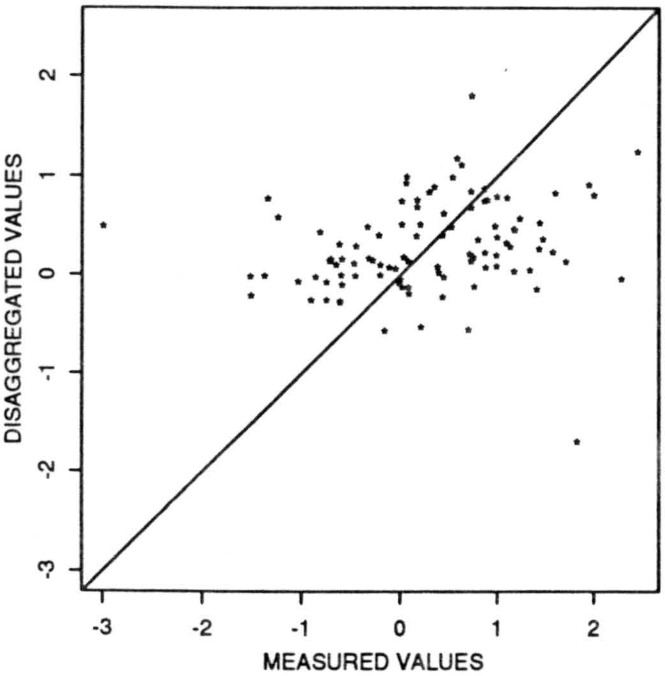
MEAN = 0.2899662 CORRELATION = 0.3043006
RMSE = 0.8946817 n = 100

ORDER 3B DISAGGREGATION FOR 2MA1



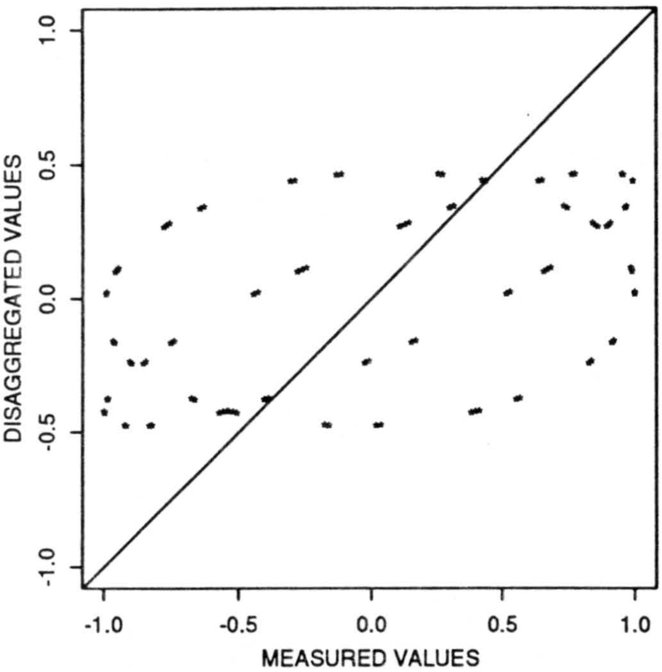
MEAN = 0.2899659 CORRELATION = 0.2408142
RMSE = 0.9228326 n = 100

ORDER 4 DISAGGREGATION FOR 2MA1



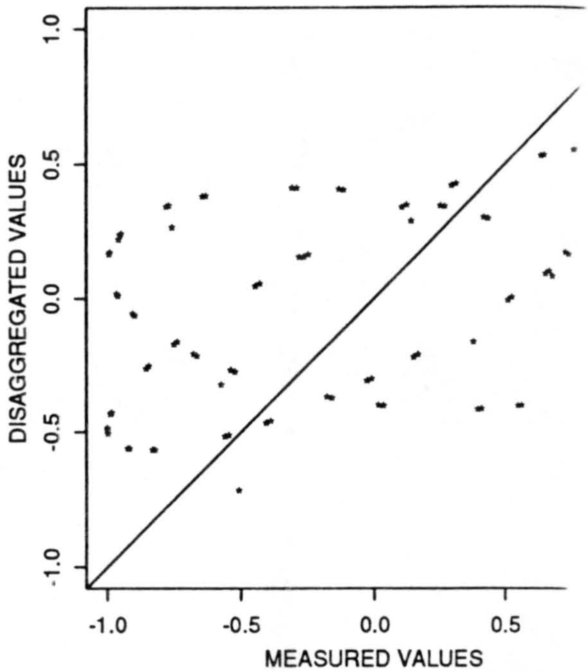
MEAN = 0.2899659 CORRELATION = 0.2048943
RMSE = 0.9475298 n = 100

ORDER 0 DISAGGREGATION FOR 2SINT



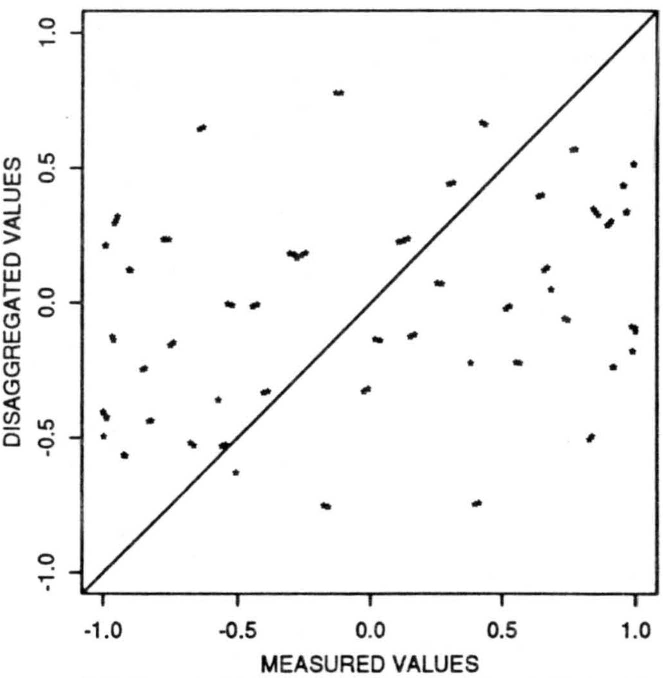
MEAN = -0.00127176 CORRELATION = 0.46721071
RMSE = 0.62686070 n = 100

ORDER 2 DISAGGREGATION FOR 2



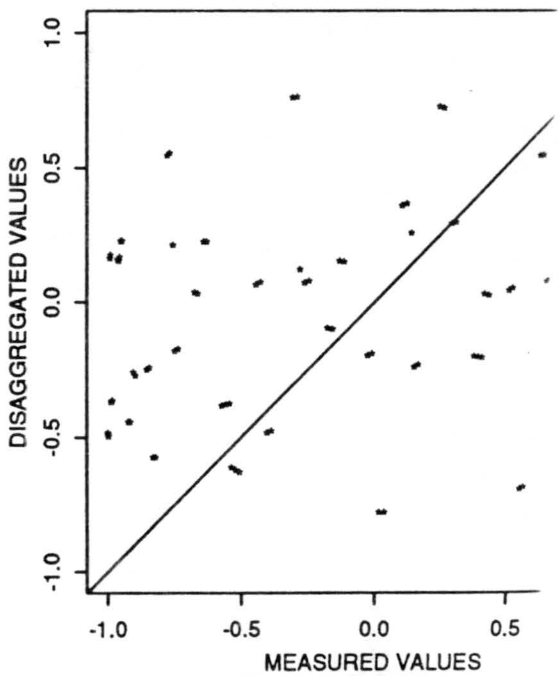
MEAN = -0.00127174 CORRELATION = 0.3
RMSE = 0.66712976 n = 100

ORDER 1A DISAGGREGATION FOR 2SINT



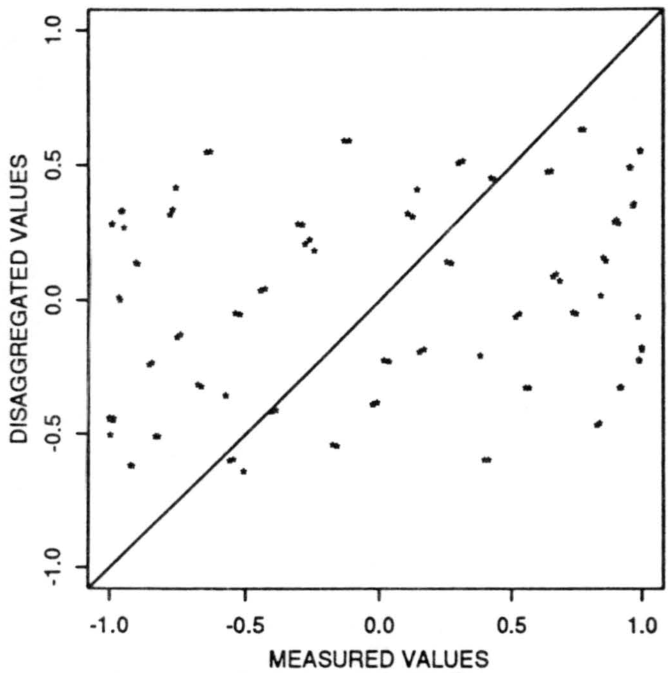
MEAN = -0.00127173 CORRELATION = 0.28109816
RMSE = 0.70369967 n = 100

ORDER 1B DISAGGREGATION FOR



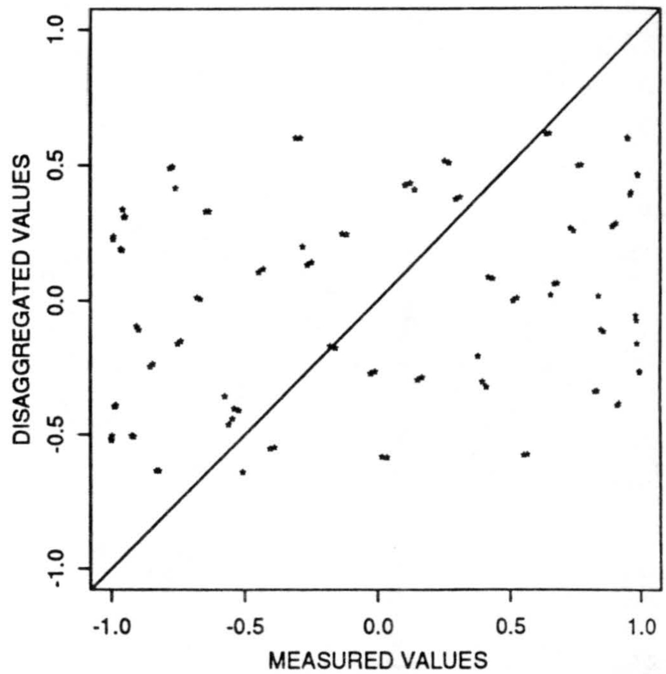
MEAN = -0.00127171 CORRELATION =
RMSE = 0.69803509 n = 100

ORDER 3A DISAGGREGATION FOR 2SINT



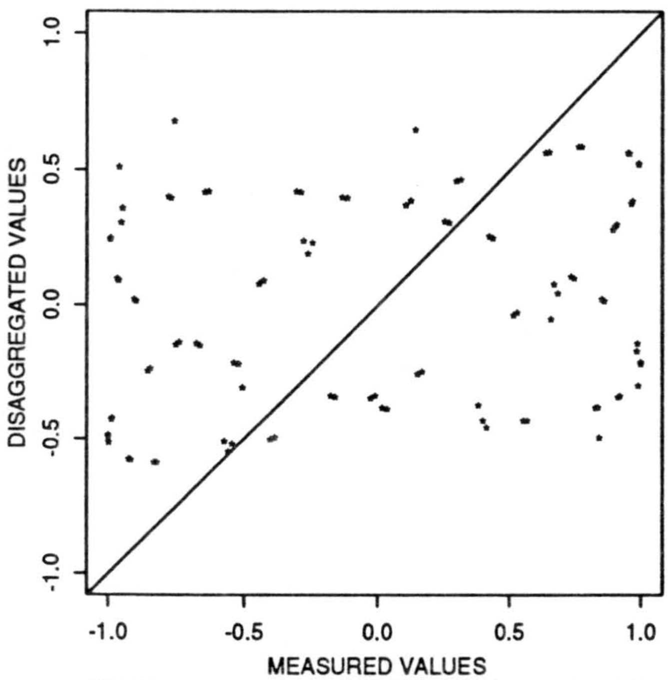
MEAN = -0.0012717 CORRELATION = 0.2423897
RMSE = 0.7162927 n = 100

ORDER 3B DISAGGREGATION FOR 2SINT



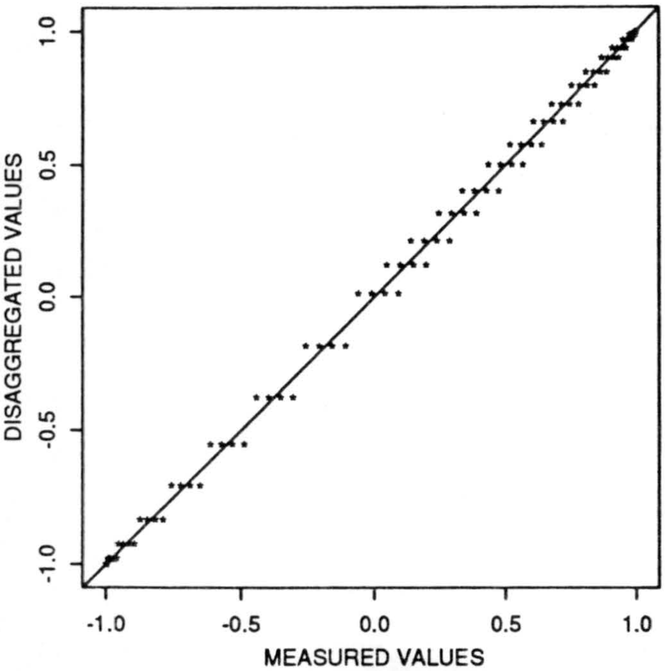
MEAN = -0.00127172 CORRELATION = 0.23392363
RMSE = 0.71965657 n = 100

ORDER 4 DISAGGREGATION FOR 2SINT



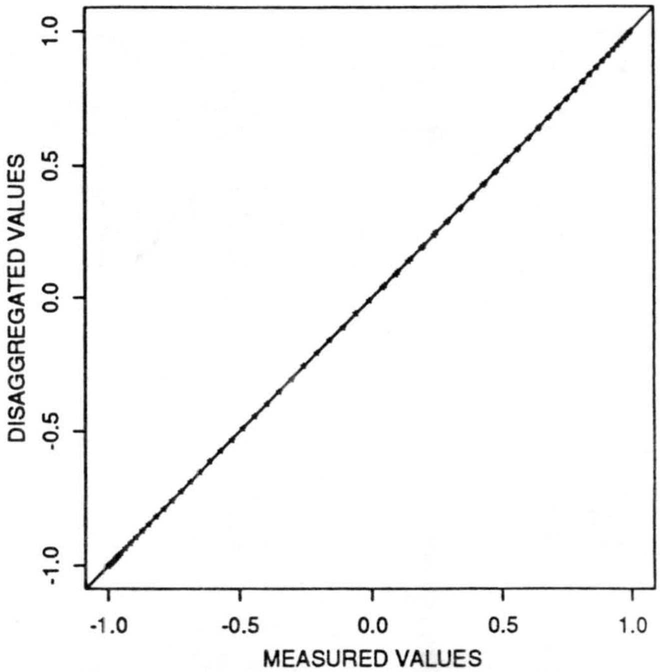
MEAN = -0.00127175 CORRELATION = 0.20130678
RMSE = 0.73250297 n = 100

ORDER 0 DISAGGREGATION FOR 2SINT20



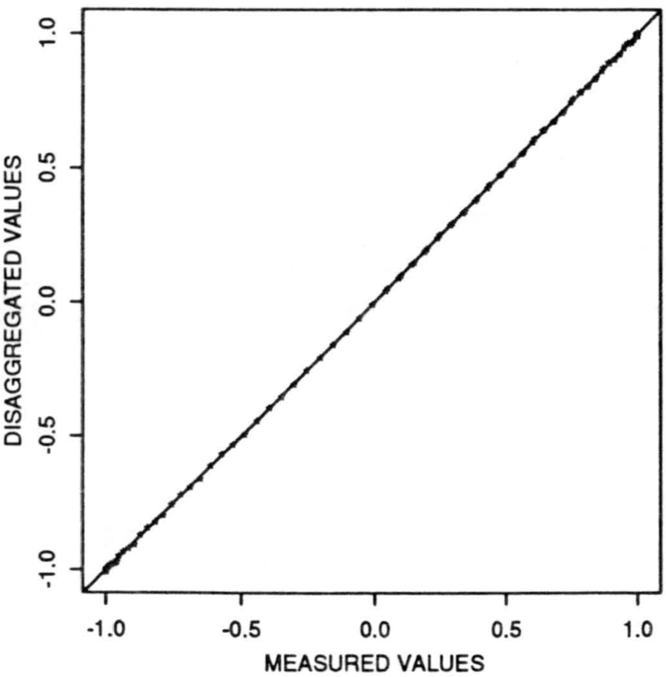
MEAN = 0.13844300 CORRELATION = 0.99857390
RMSE = 0.03822183 n = 100

ORDER 2 DISAGGREGATION FOR 2SINT20



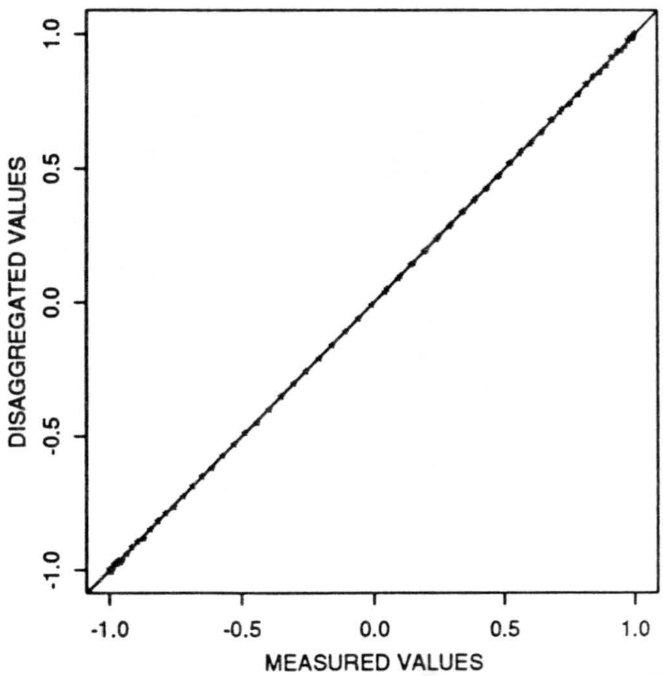
MEAN = 0.1384430500 CORRELATION = 0.9999999404
RMSE = 0.0002859665 n = 100

ORDER 1A DISAGGREGATION FOR 2SINT20



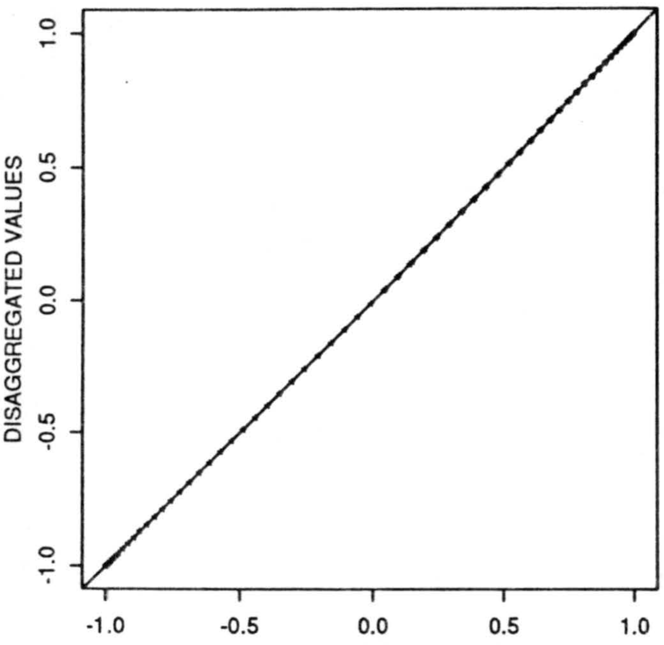
MEAN = 0.138443000 CORRELATION = 0.999982536
RMSE = 0.004228271 n = 100

ORDER 1B DISAGGREGATION FOR 2SINT20



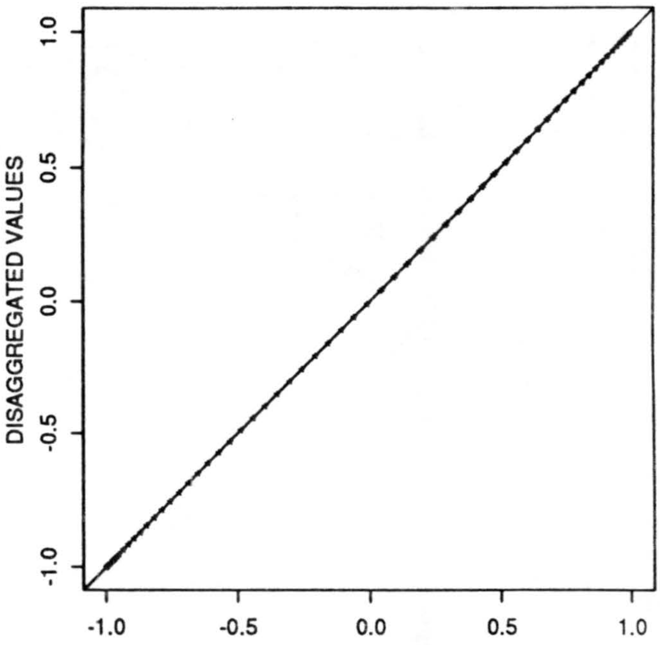
MEAN = 0.13844350 CORRELATION = 0.99998343
RMSE = 0.00412019 n = 100

ORDER 3A DISAGGREGATION FOR 2SINT20



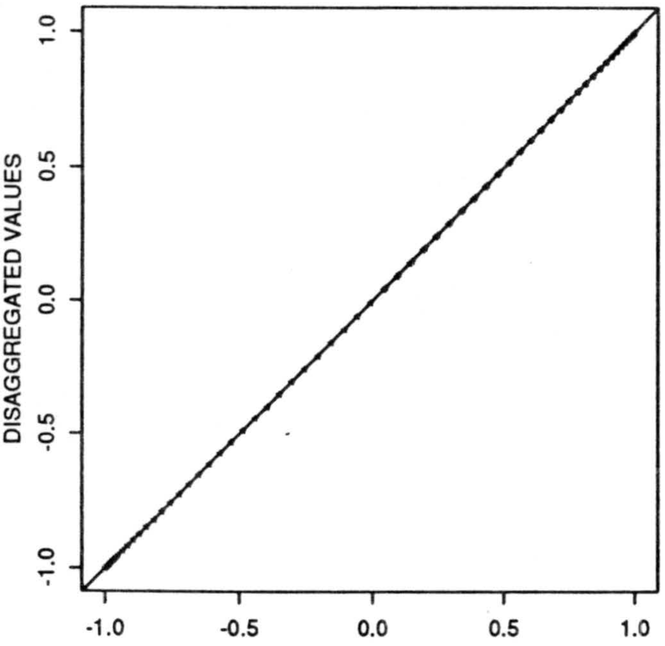
MEAN = 1.384431e-01 CORRELATION = 1.000000e+00
RMSE = 3.681318e-05 n = 100

ORDER 3B DISAGGREGATION FOR 2SINT20



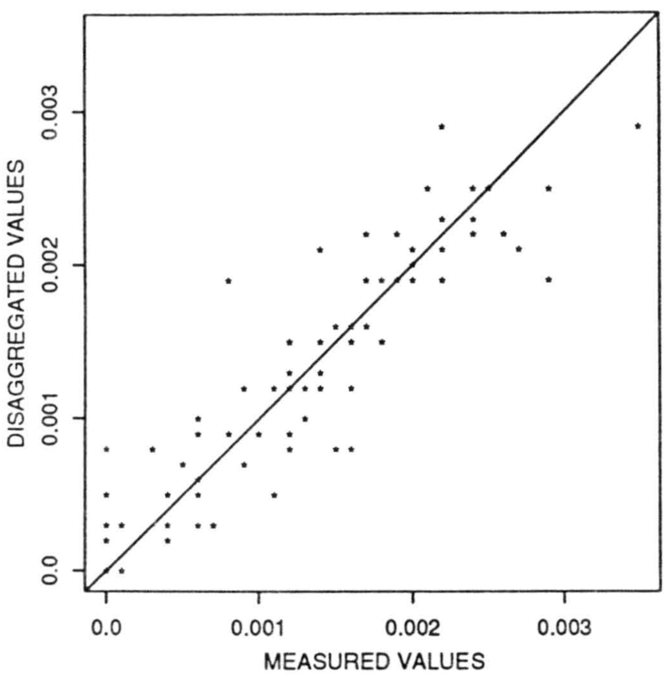
MEAN = 1.384431e-01 CORRELATION = 1.000000e+00
RMSE = 3.612298e-05 n = 100

ORDER 4 DISAGGREGATION FOR 2SINT20



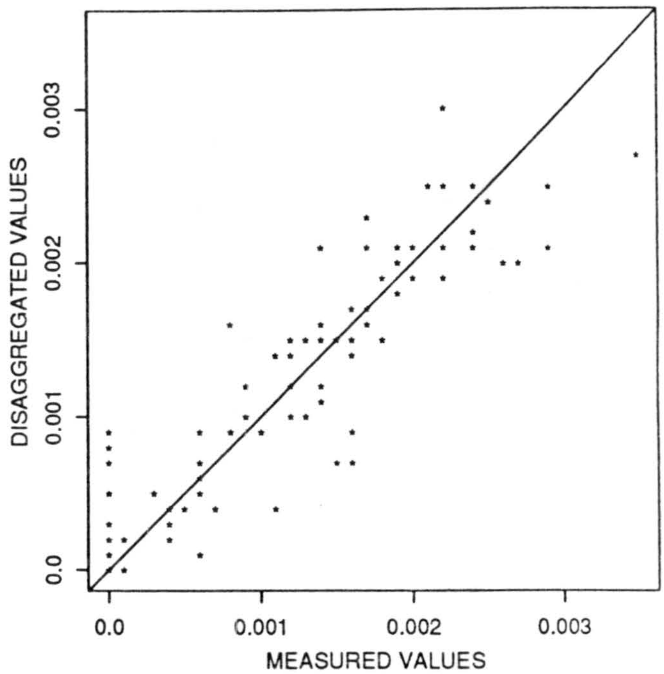
MEAN = 1.384431e-01 CORRELATION = 1.000000e+00
RMSE = 3.687818e-06 n = 100

ORDER 0 DISAGGREGATION FOR FBRC



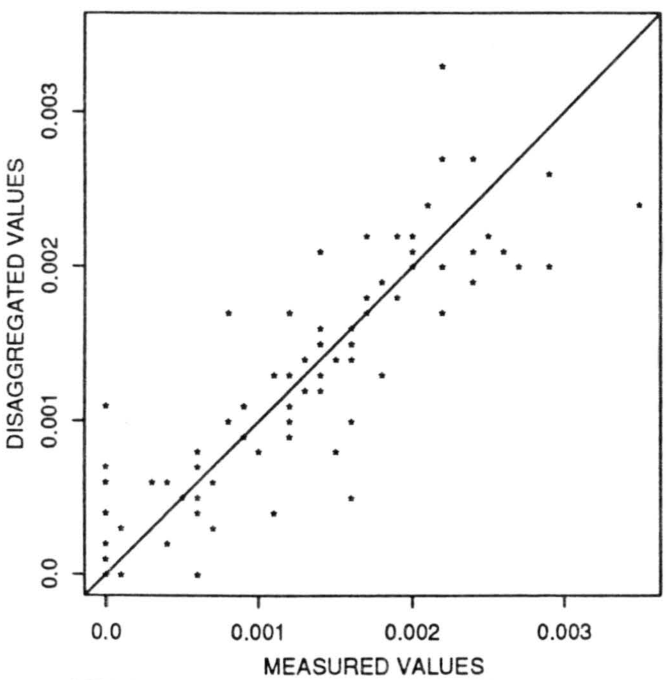
MEAN = 0.0012414634 CORRELATION = 0.8969655037
RMSE = 0.0003778953 n = 82

ORDER 2 DISAGGREGATION FOR FBRC



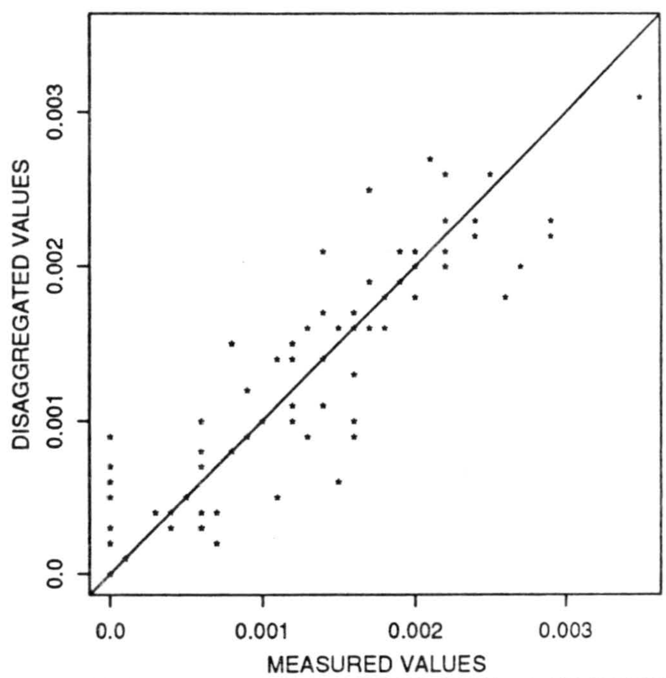
MEAN = 0.00126875 CORRELATION = 0.88872623
RMSE = 0.00038923 n = 80

ORDER 1A DISAGGREGATION FOR FBRC



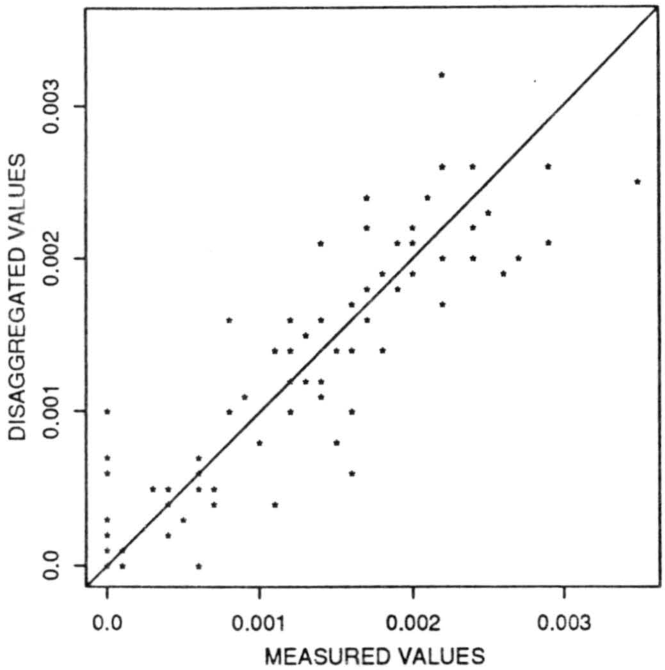
MEAN = 0.0012662500 CORRELATION = 0.8635545969
RMSE = 0.0004301163 n = 80

ORDER 1B DISAGGREGATION FOR FBRC



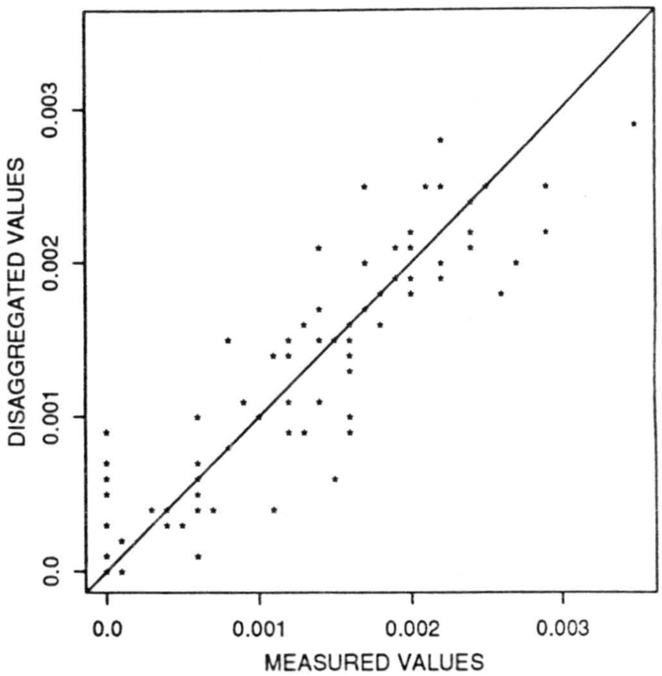
MEAN = 0.0012687500 CORRELATION = 0.8993560672
RMSE = 0.0003711469 n = 80

ORDER 3A DISAGGREGATION FOR FBRC



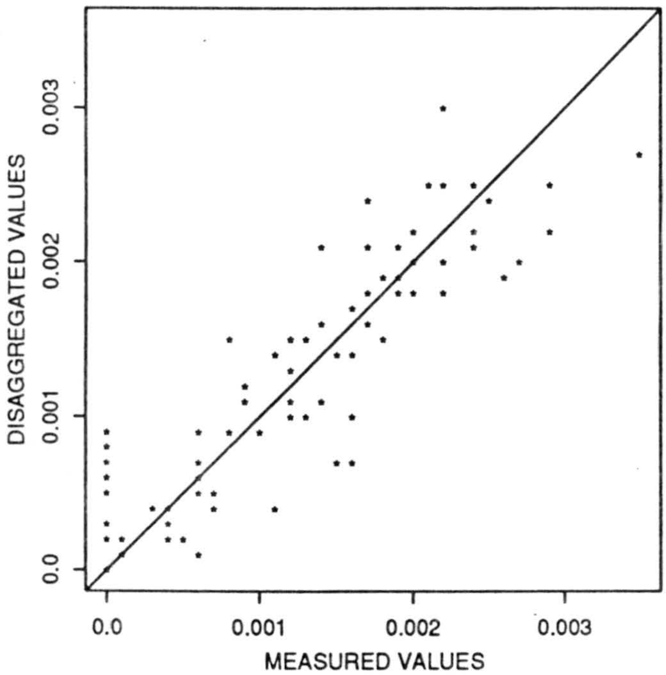
MEAN = 0.00126625 CORRELATION = 0.87560511
RMSE = 0.00041140 n = 80

ORDER 3B DISAGGREGATION FOR FBRC



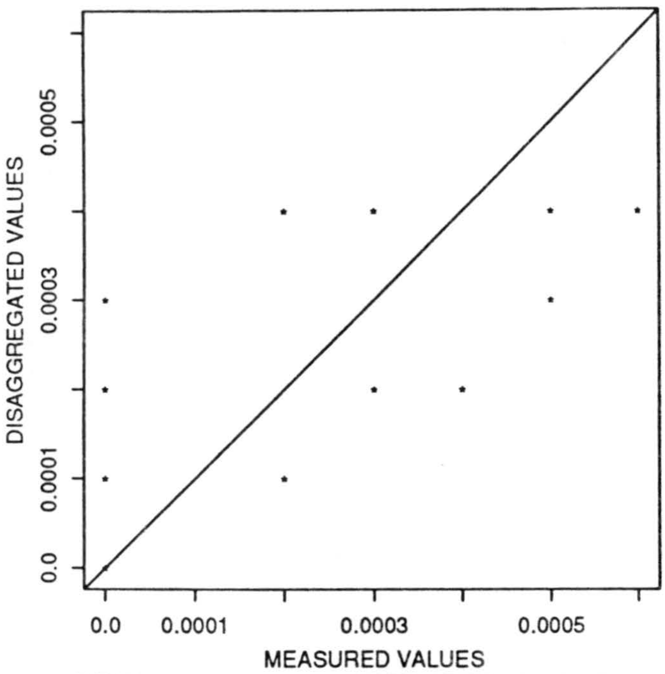
MEAN = 0.0012662500 CORRELATION = 0.8945111632
RMSE = 0.0003798026 n = 80

ORDER 4 DISAGGREGATION FOR FBRC



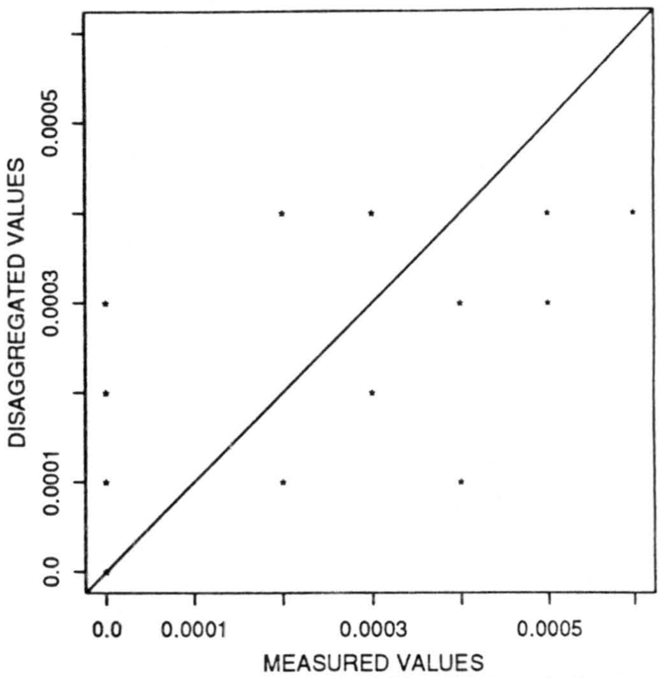
MEAN = 0.00126625 CORRELATION = 0.88897818
RMSE = 0.00038923 n = 80

ORDER 0 DISAGGREGATION FOR FSRC



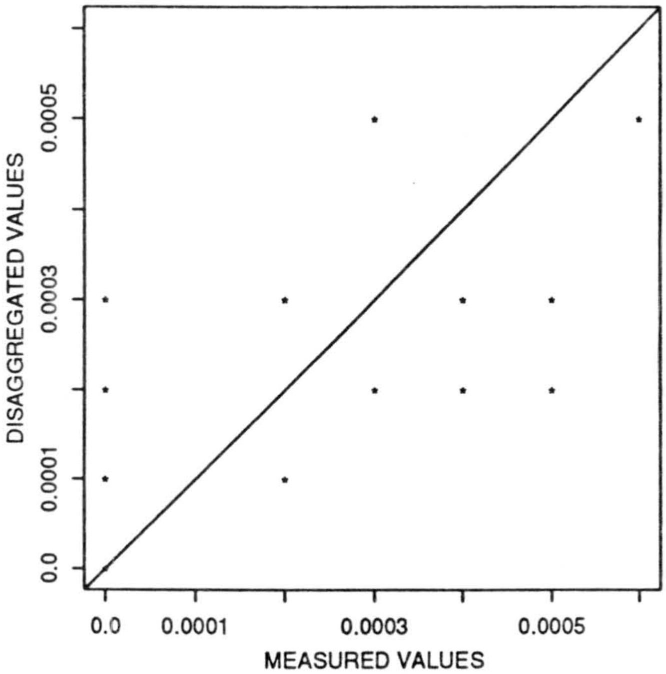
MEAN = 5.609756e-05 CORRELATION = 7.763354e-01
RMSE = 8.337397e-05 n = 82

ORDER 2 DISAGGREGATION FOR FSRC



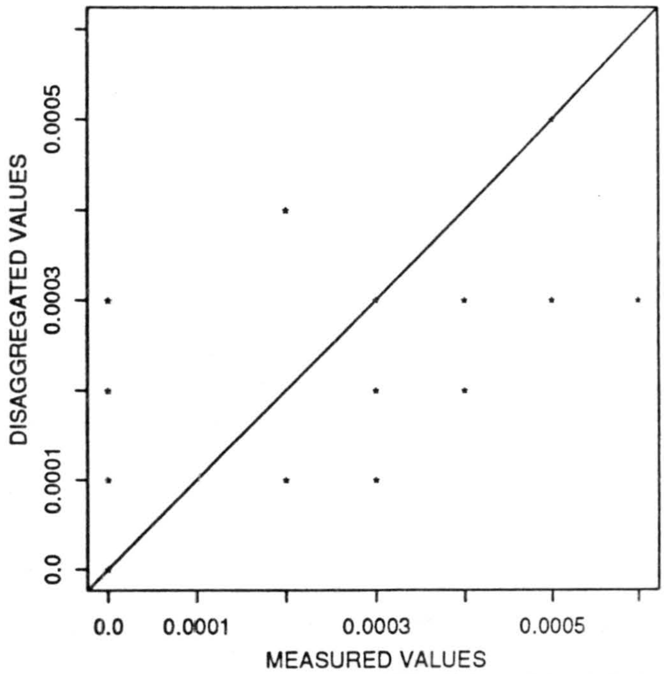
MEAN = 5.750000e-05 CORRELATION = 7.595822e-01
RMSE = 8.732125e-05 n = 80

ORDER 1A DISAGGREGATION FOR FSRC



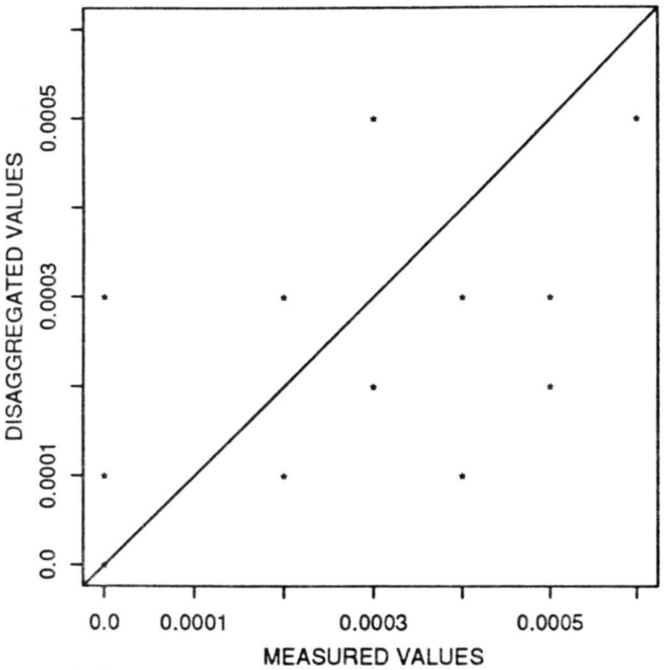
MEAN = 5.625000e-05 CORRELATION = 7.719859e-01
RMSE = 8.514693e-05 n = 80

ORDER 1B DISAGGREGATION FOR FSRC



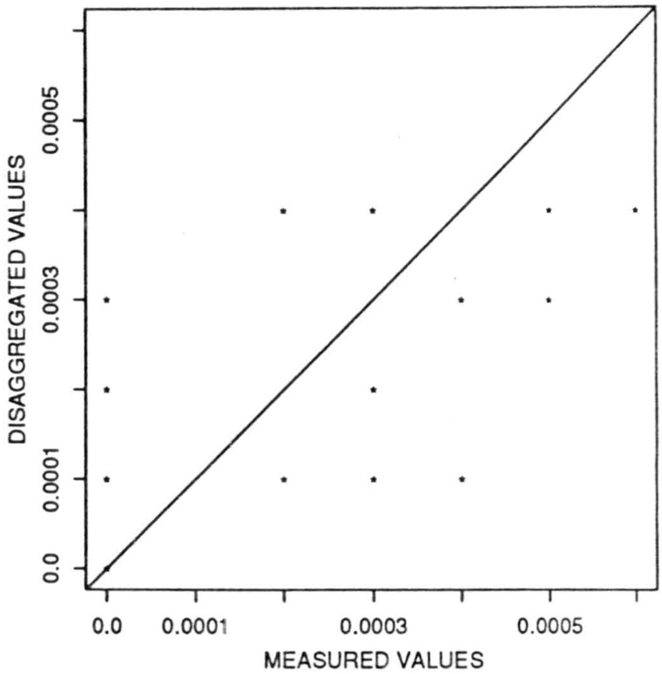
MEAN = 5.500000e-05 CORRELATION = 7.741287e-01
RMSE = 8.440972e-05 n = 80

ORDER 3A DISAGGREGATION FOR FSRC



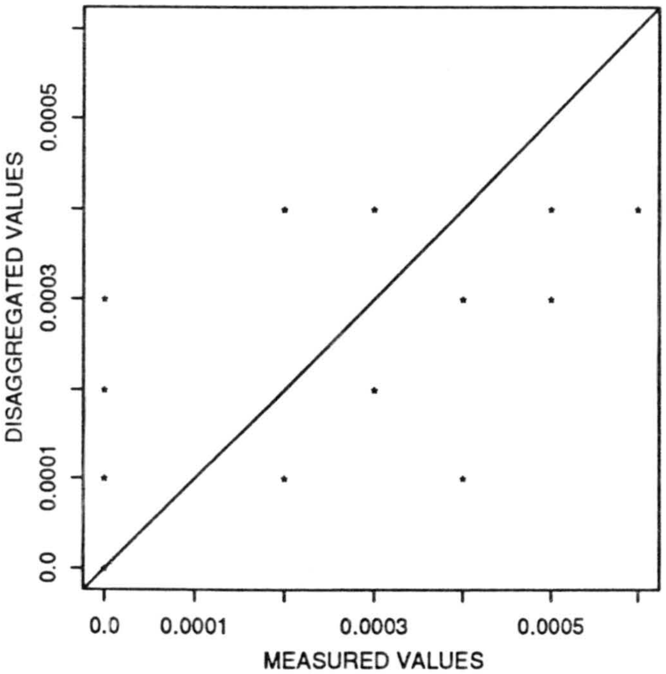
MEAN = 5.375000e-05 CORRELATION = 7.620572e-01
RMSE = 8.660254e-05 n = 80

ORDER 3B DISAGGREGATION FOR FSRC



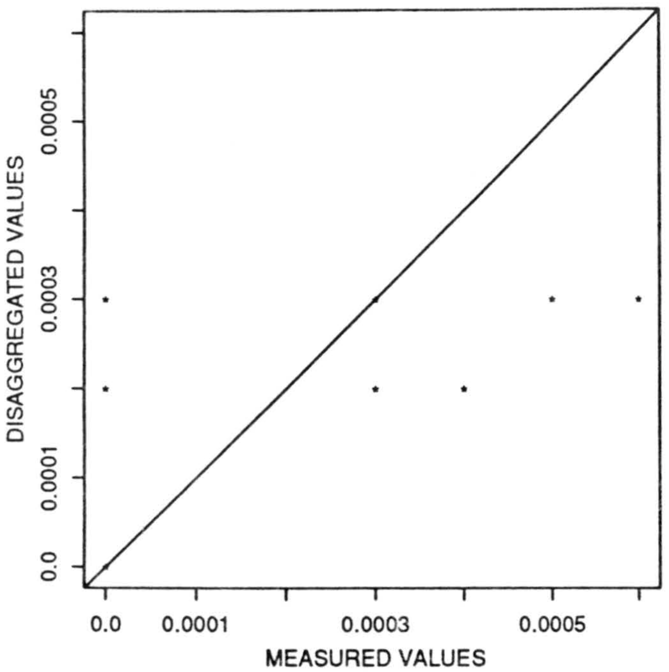
MEAN = 0.000053750 CORRELATION = 0.778467357
RMSE = 0.000083666 n = 80

ORDER 4 DISAGGREGATION FOR FSRC



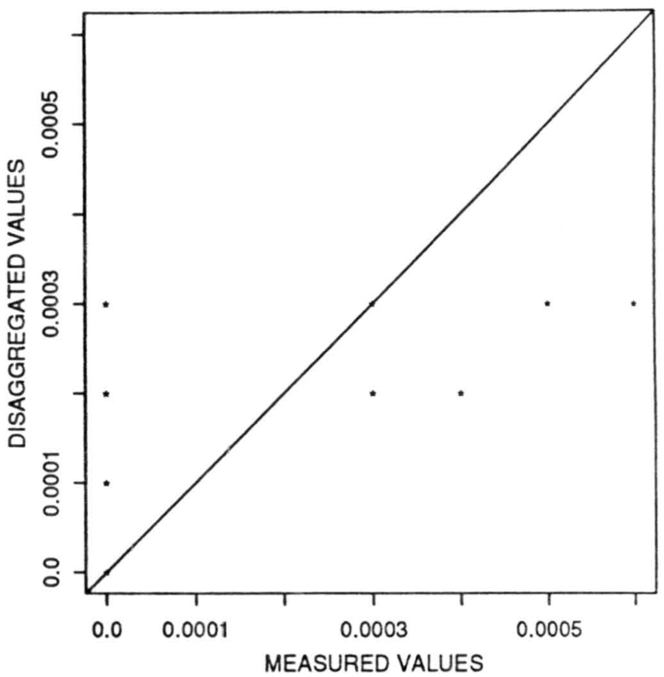
MEAN = 0.0000550000 CORRELATION = 0.7918356657
RMSE = 0.0000813941 n = 80

ORDER 0 DISAGGREGATION FOR FZRC



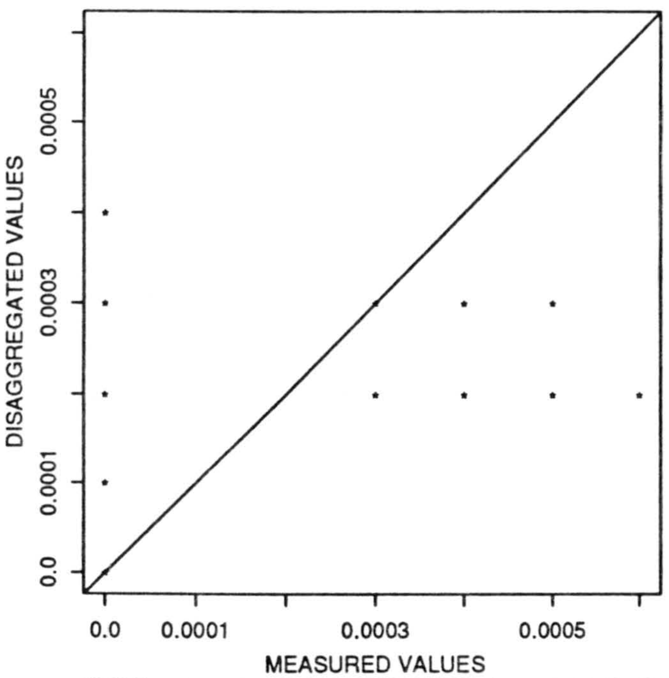
MEAN = 8.780488e-05 CORRELATION = 6.457842e-01
RMSE = 1.311302e-04 n = 82

ORDER 2 DISAGGREGATION FOR FZRC



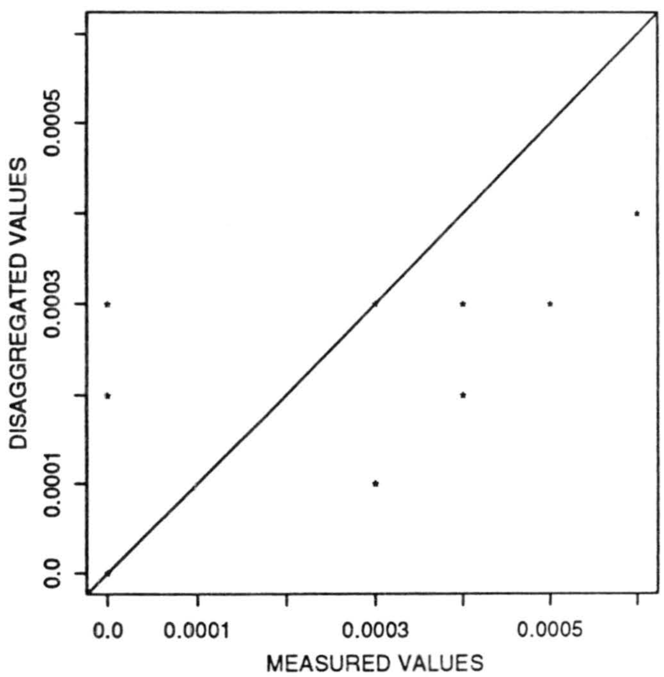
MEAN = 0.0000825000 CORRELATION = 0.6652201414
RMSE = 0.0001219631 n = 80

ORDER 1A DISAGGREGATION FOR FZRC



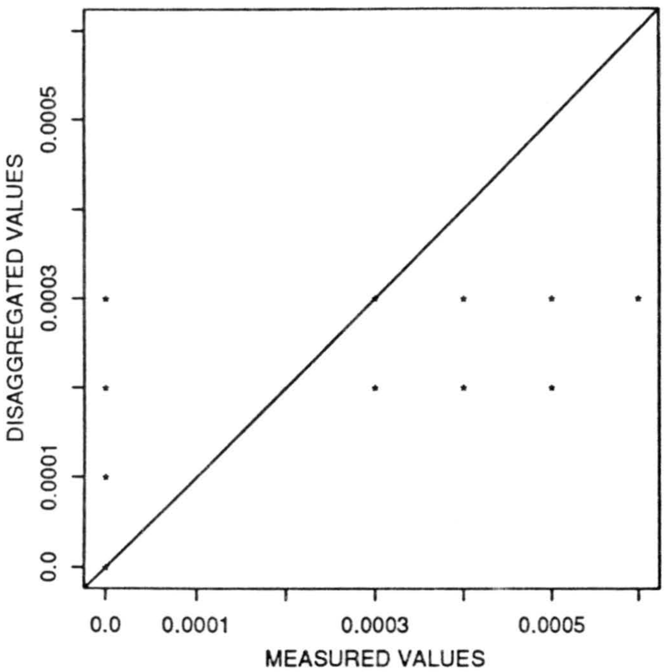
MEAN = 0.000081250 CORRELATION = 0.649856389
RMSE = 0.000124499 n = 80

ORDER 1B DISAGGREGATION FOR FZRC



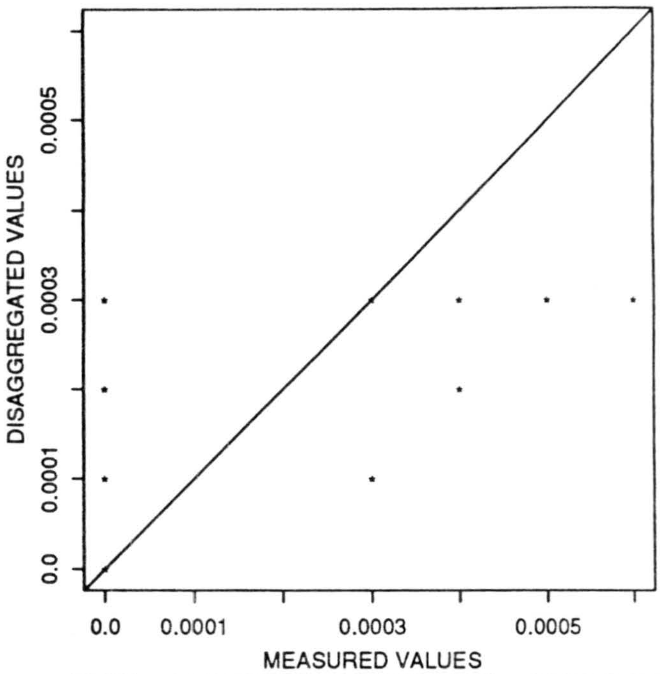
MEAN = 0.0000812500 CORRELATION = 0.7021390200
RMSE = 0.0001161895 n = 80

ORDER 3A DISAGGREGATION FOR FZRC



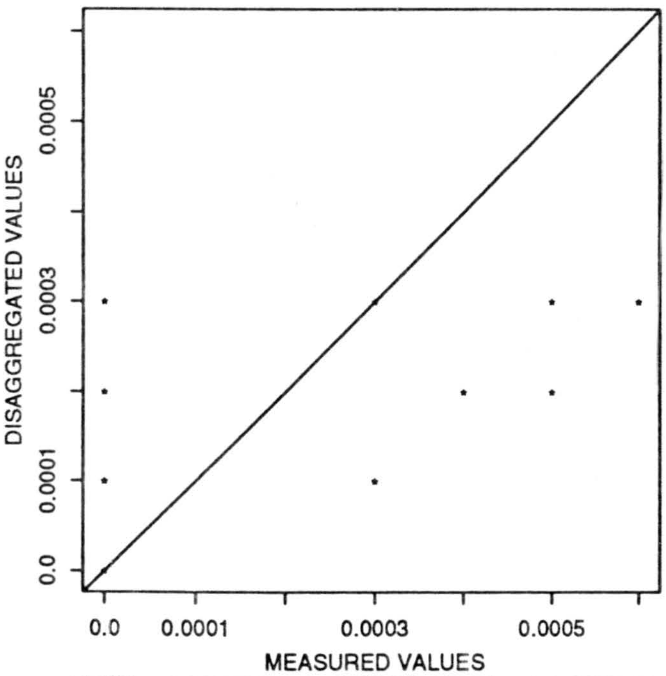
MEAN = 0.0000775000 CORRELATION = 0.6704033613
RMSE = 0.0001209339 n = 80

ORDER 3B DISAGGREGATION FOR FZRC

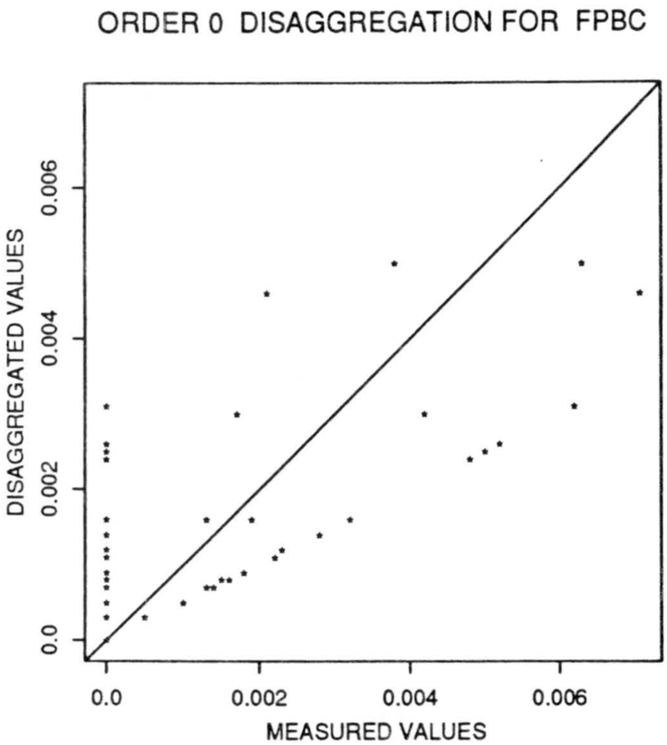


MEAN = 0.0000775000 CORRELATION = 0.6984171271
RMSE = 0.0001167262 n = 80

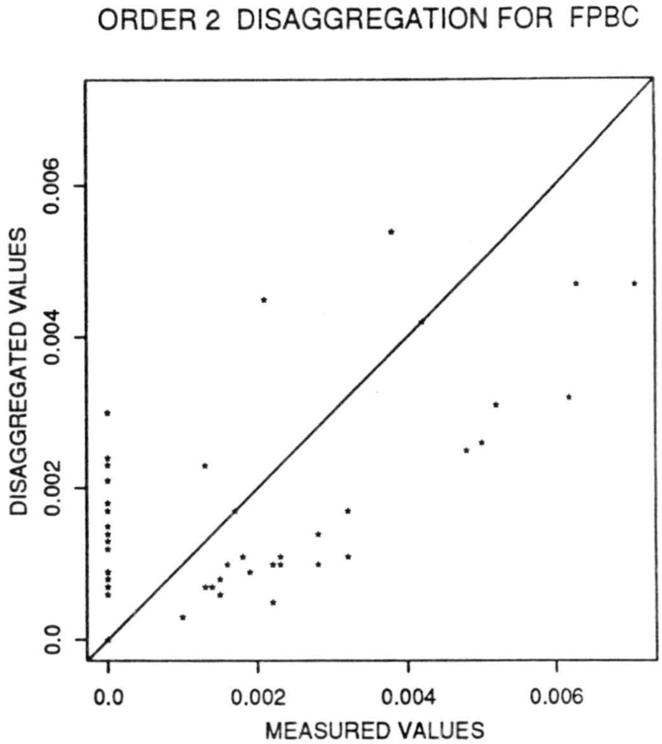
ORDER 4 DISAGGREGATION FOR FZRC



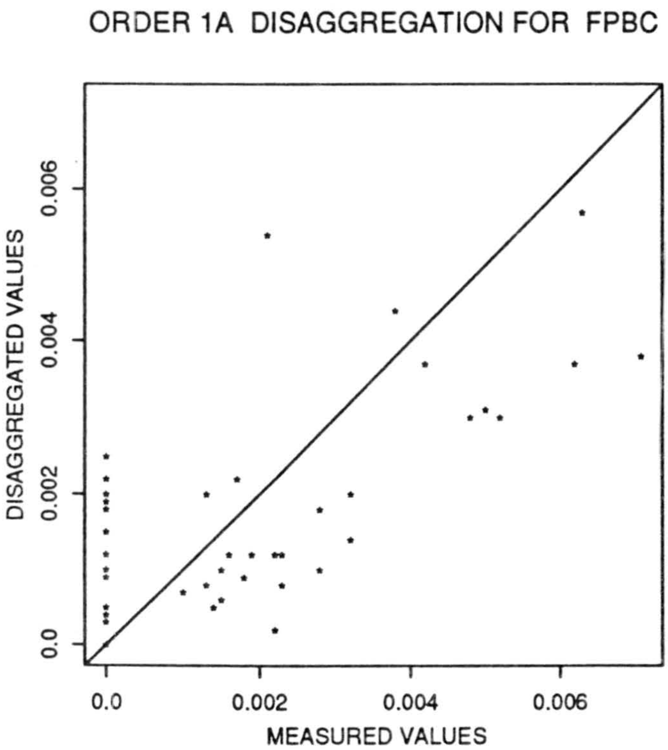
MEAN = 0.0000787500 CORRELATION = 0.6253789663
RMSE = 0.0001274755 n = 80



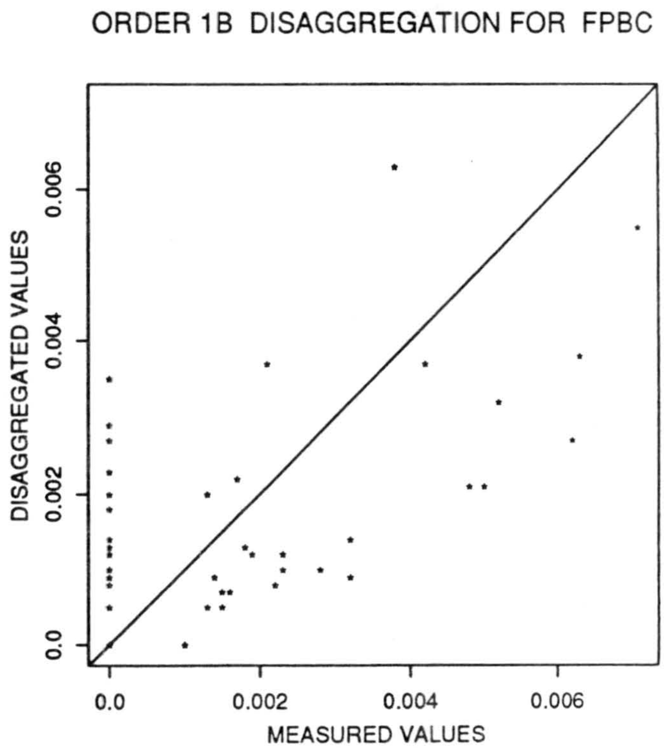
MEAN = 0.000997561 CORRELATION = 0.730975211
RMSE = 0.001166295 n = 82



MEAN = 0.001011250 CORRELATION = 0.724166870
RMSE = 0.001190903 n = 80

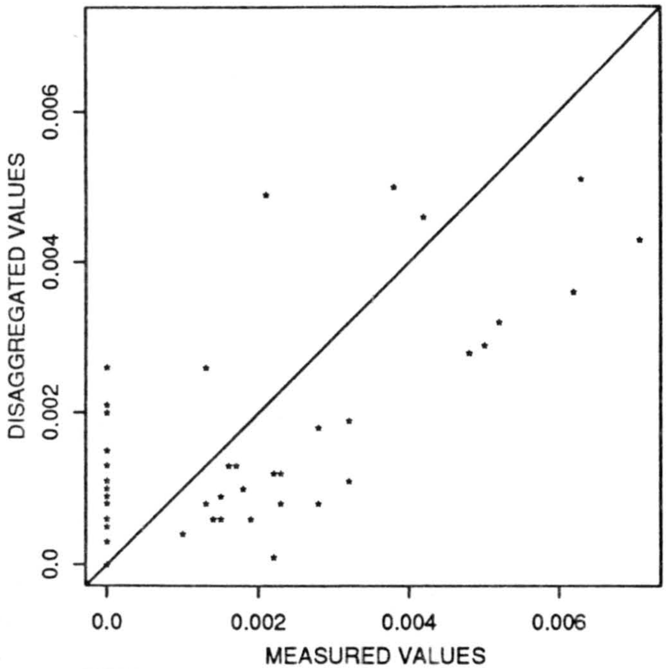


MEAN = 0.001010000 CORRELATION = 0.758433223
RMSE = 0.001124778 n = 80



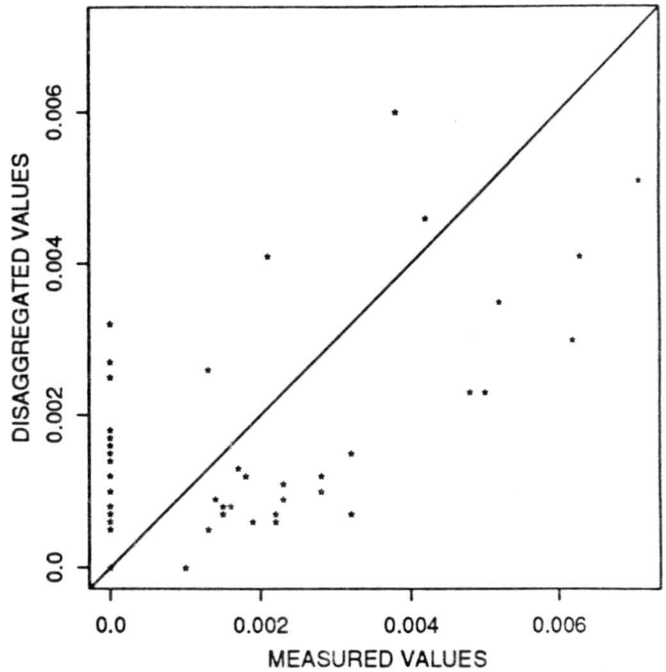
MEAN = 0.001010000 CORRELATION = 0.662260473
RMSE = 0.001304176 n = 80

ORDER 3A DISAGGREGATION FOR FPBC



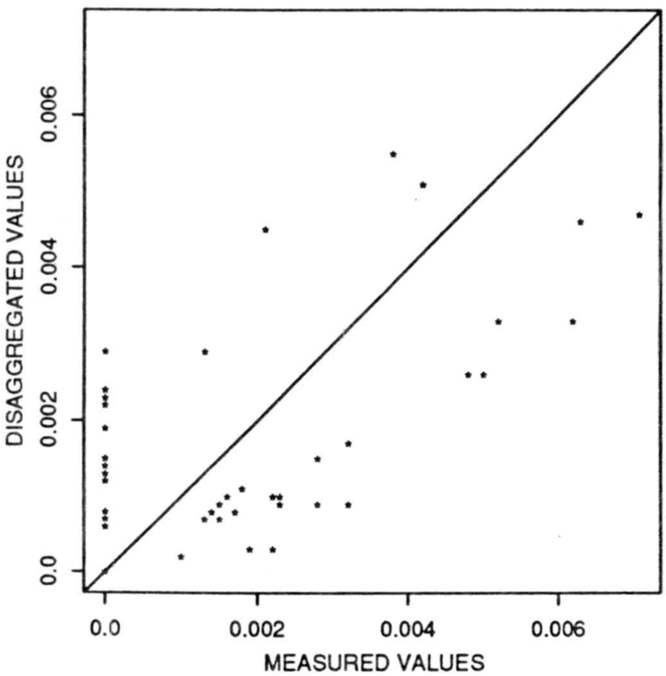
MEAN = 0.001008750 CORRELATION = 0.743155956
RMSE = 0.001155638 n = 80

ORDER 3B DISAGGREGATION FOR FPBC



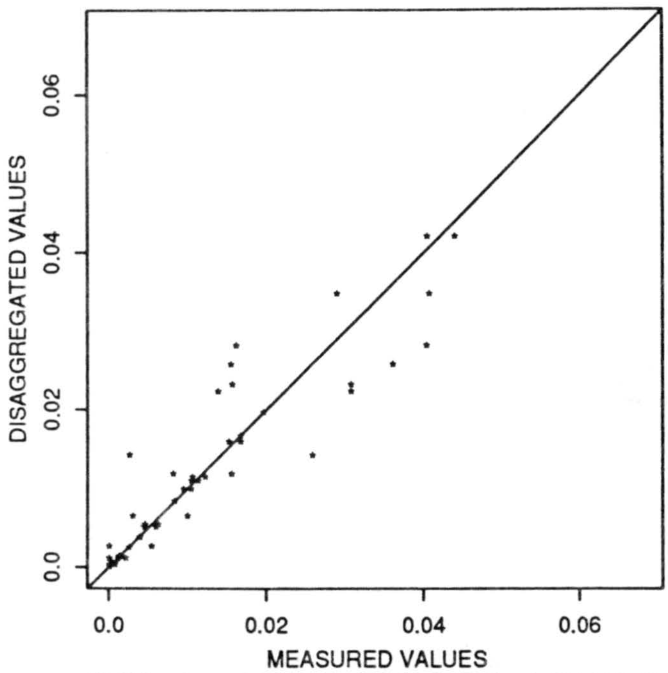
MEAN = 0.001008750 CORRELATION = 0.682904363
RMSE = 0.001270138 n = 80

ORDER 4 DISAGGREGATION FOR FPBC



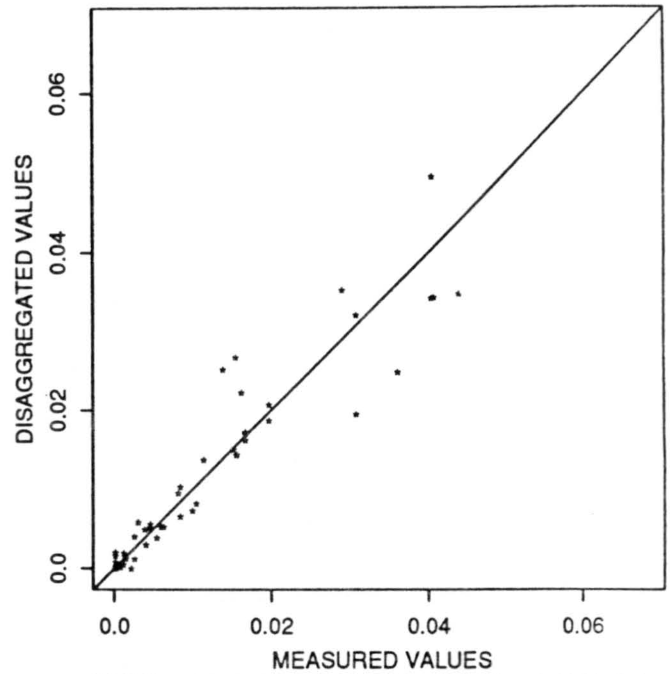
MEAN = 0.00101000 CORRELATION = 0.71098584
RMSE = 0.00121917 n = 80

ORDER 0 DISAGGREGATION FOR MCD4C



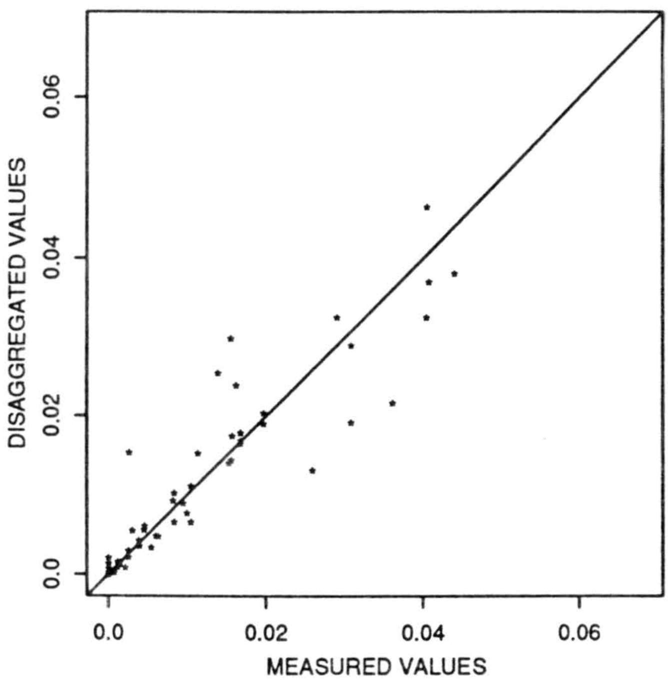
MEAN = 0.011358621 CORRELATION = 0.926913142
RMSE = 0.004509186 n = 58

ORDER 2 DISAGGREGATION FOR MCD4C



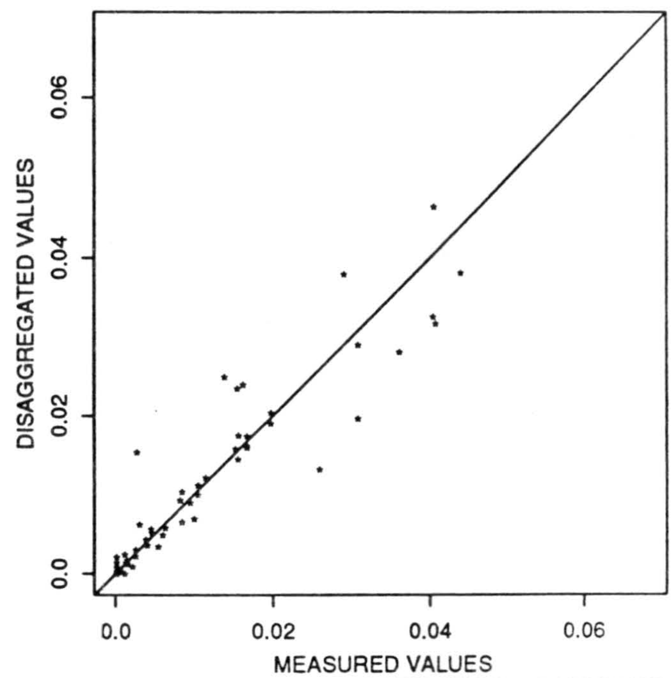
MEAN = 0.012191667 CORRELATION = 0.939646184
RMSE = 0.004308712 n = 48

ORDER 1A DISAGGREGATION FOR MCD4C



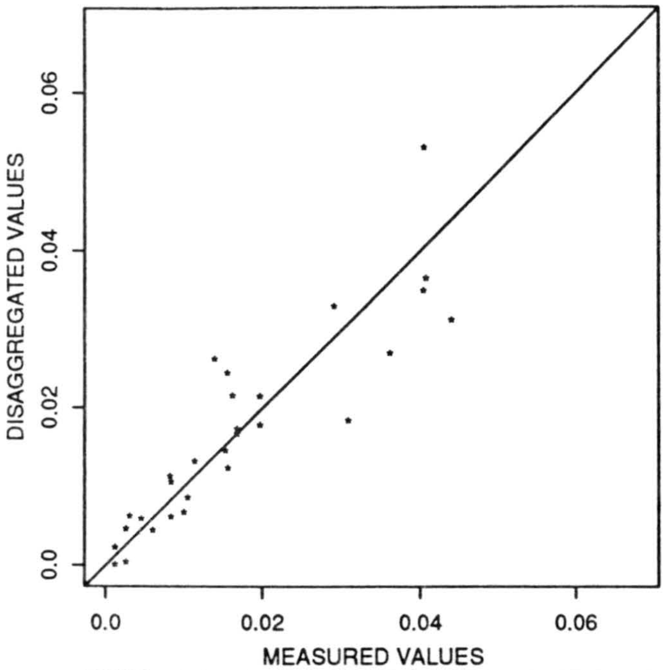
MEAN = 0.012196154 CORRELATION = 0.913538277
RMSE = 0.005009798 n = 52

ORDER 1B DISAGGREGATION FOR MCD4C



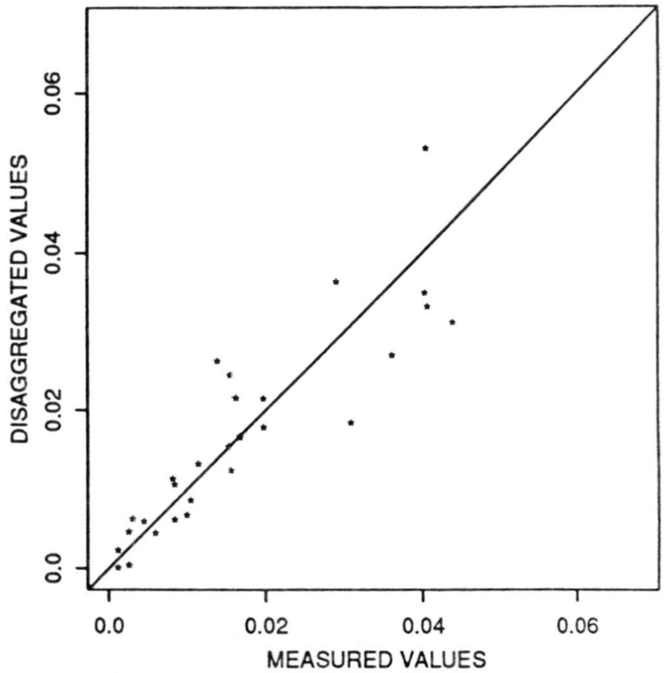
MEAN = 0.012192308 CORRELATION = 0.926788807
RMSE = 0.004617234 n = 52

ORDER 3A DISAGGREGATION FOR MCD4C



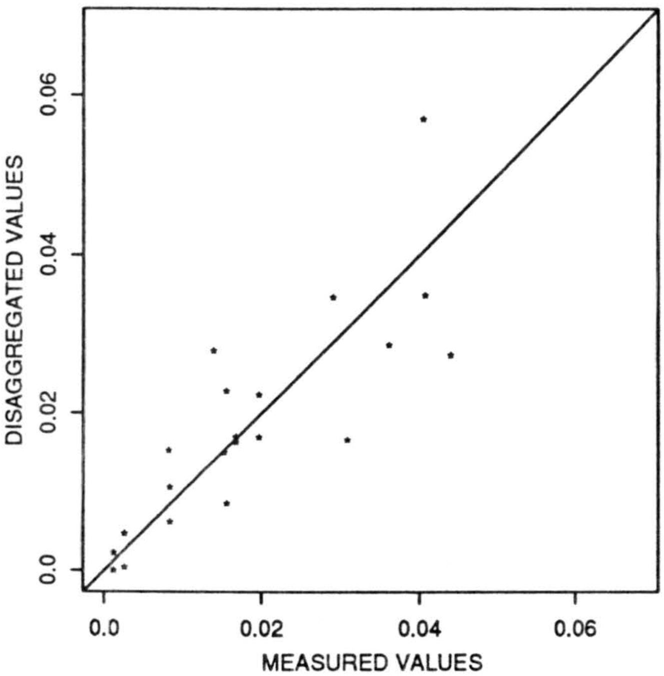
MEAN = 0.016853333 CORRELATION = 0.897479296
RMSE = 0.005669685 n = 30

ORDER 3B DISAGGREGATION FOR MCD4C



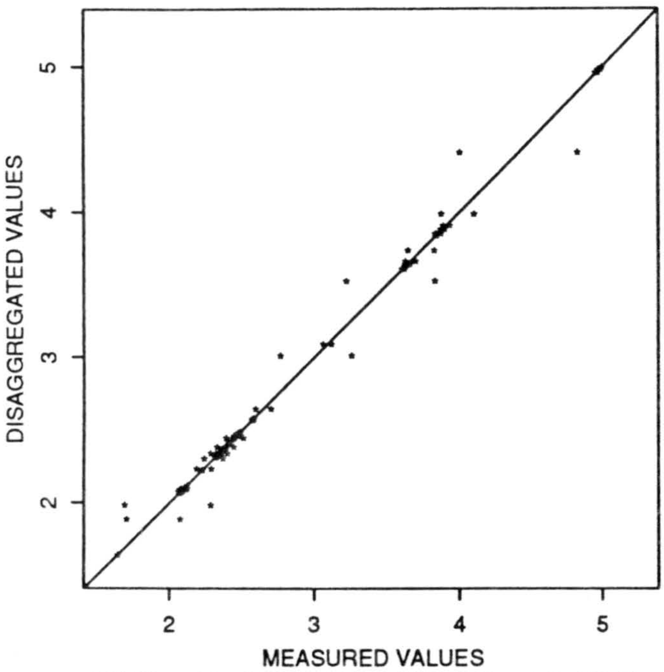
MEAN = 0.016853333 CORRELATION = 0.889417529
RMSE = 0.005885859 n = 30

ORDER 4 DISAGGREGATION FOR MCD4C



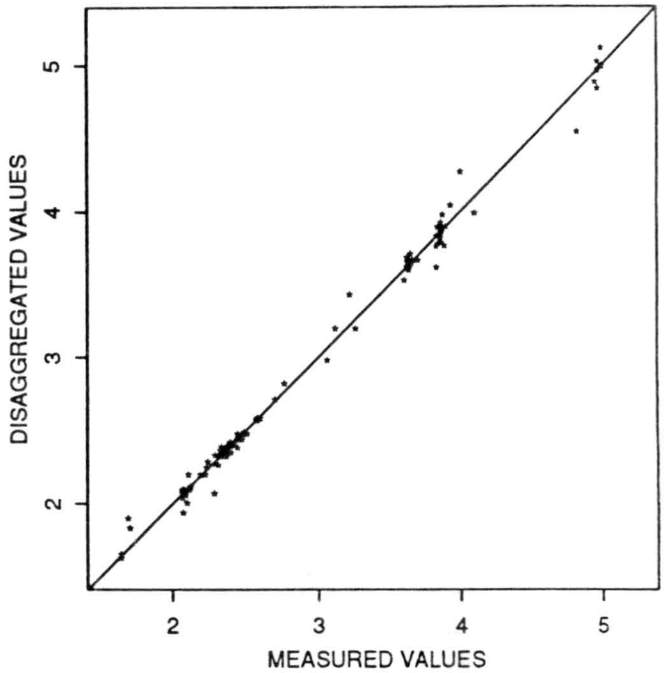
MEAN = 0.018340909 CORRELATION = 0.831475854
RMSE = 0.007568055 n = 22

ORDER 0 DISAGGREGATION FOR MCDMWC



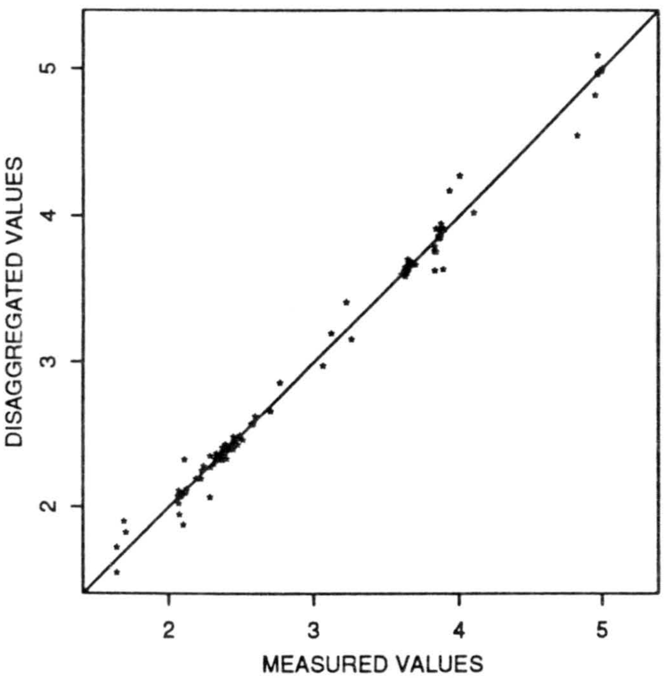
MEAN = 2.88782262 CORRELATION = 0.99615151
RMSE = 0.07656454 n = 168

ORDER 2 DISAGGREGATION FOR MCDMWC



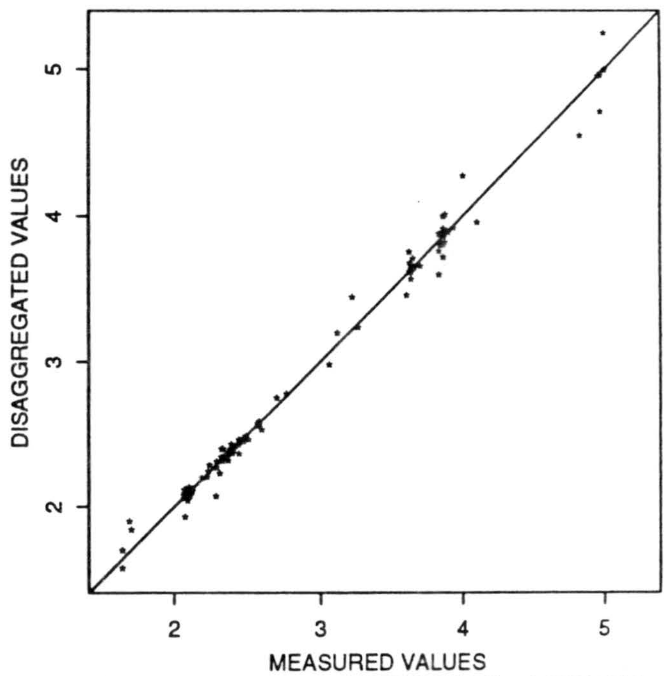
MEAN = 2.88782798 CORRELATION = 0.99779683
RMSE = 0.05795475 n = 168

ORDER 1A DISAGGREGATION FOR MCDMWC



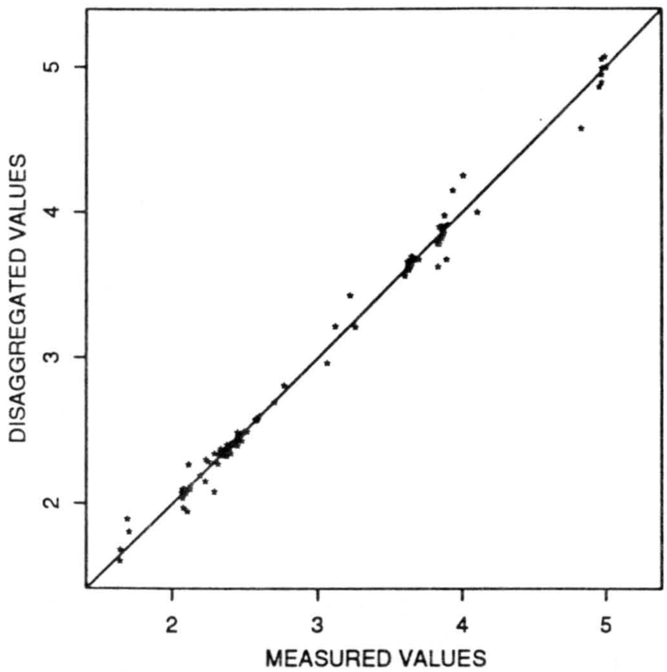
MEAN = 2.88782798 CORRELATION = 0.99715328
RMSE = 0.06587153 n = 168

ORDER 1B DISAGGREGATION FOR MCDMWC



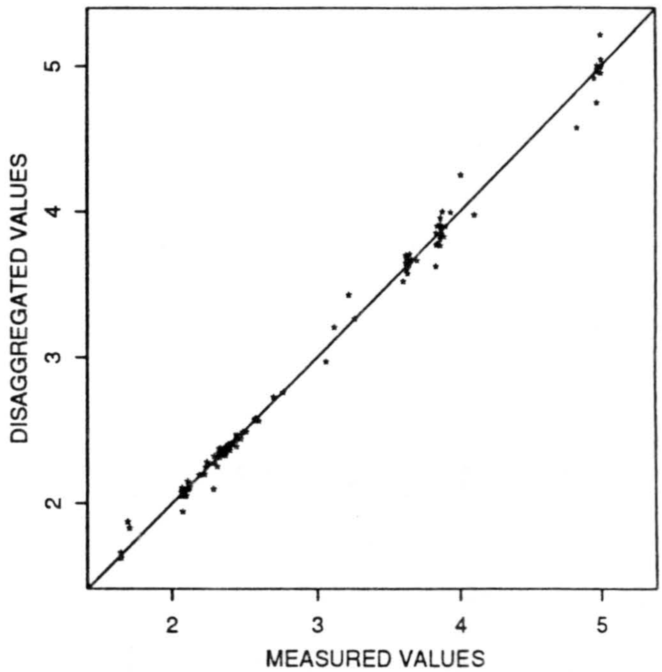
MEAN = 2.88782679 CORRELATION = 0.99711394
RMSE = 0.06632487 n = 168

ORDER 3A DISAGGREGATION FOR MCDMWC



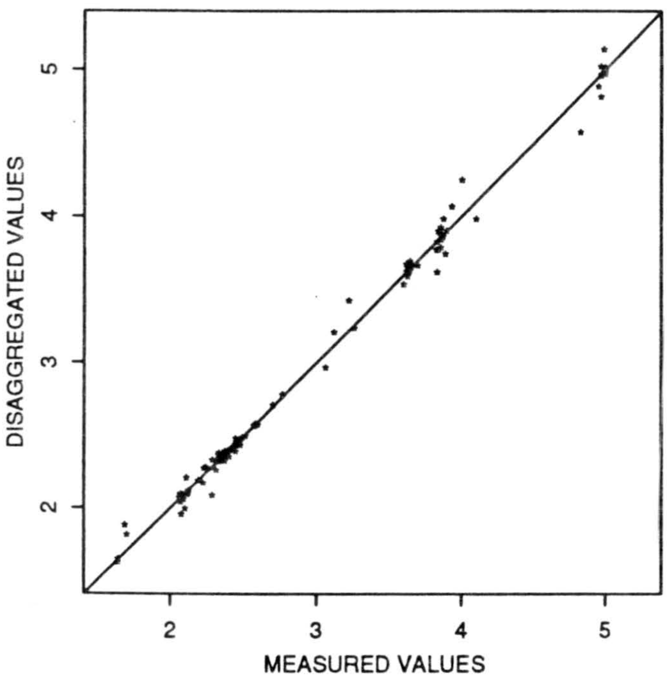
MEAN = 2.88782679 CORRELATION = 0.99768555
RMSE = 0.05939916 n = 168

ORDER 3B DISAGGREGATION FOR MCDMWC



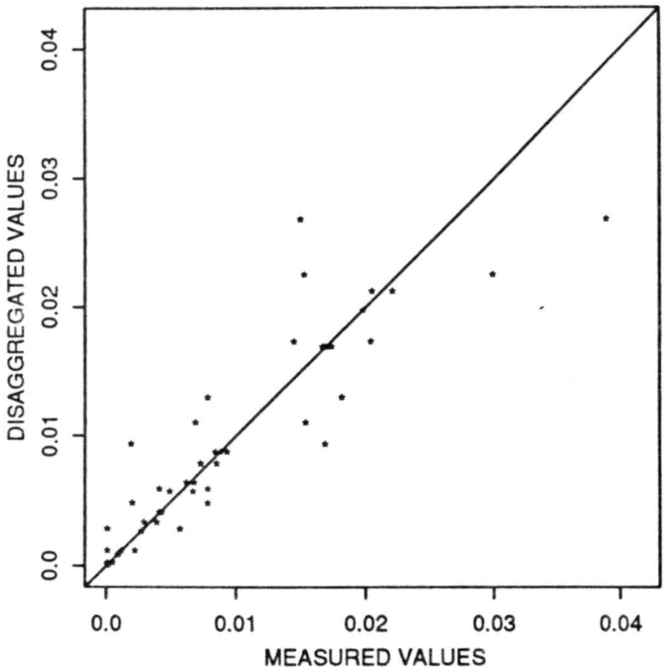
MEAN = 2.88782679 CORRELATION = 0.99777287
RMSE = 0.05826867 n = 168

ORDER 4 DISAGGREGATION FOR MCDMWC



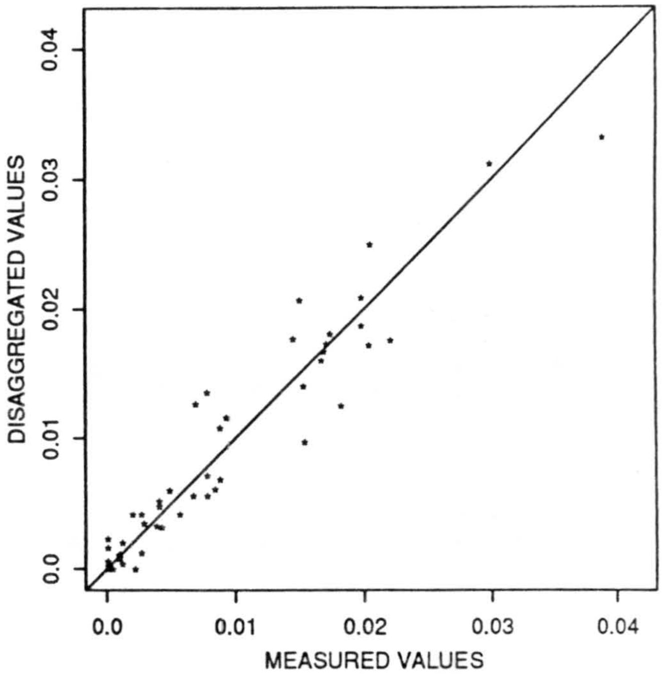
MEAN = 2.88782560 CORRELATION = 0.99791259
RMSE = 0.05641267 n = 168

ORDER 0 DISAGGREGATION FOR MFWCDC



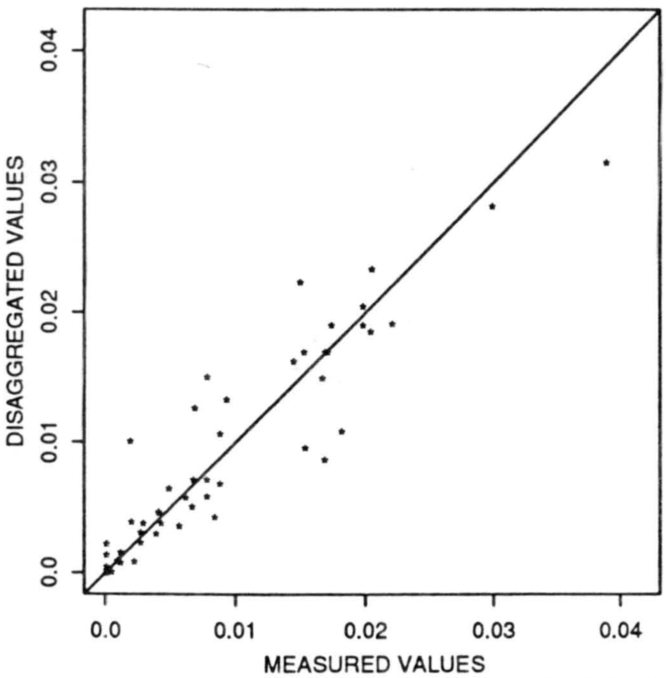
MEAN = 0.008653571 CORRELATION = 0.913141072
RMSE = 0.003430327 n = 56

ORDER 2 DISAGGREGATION FOR MFWCDC



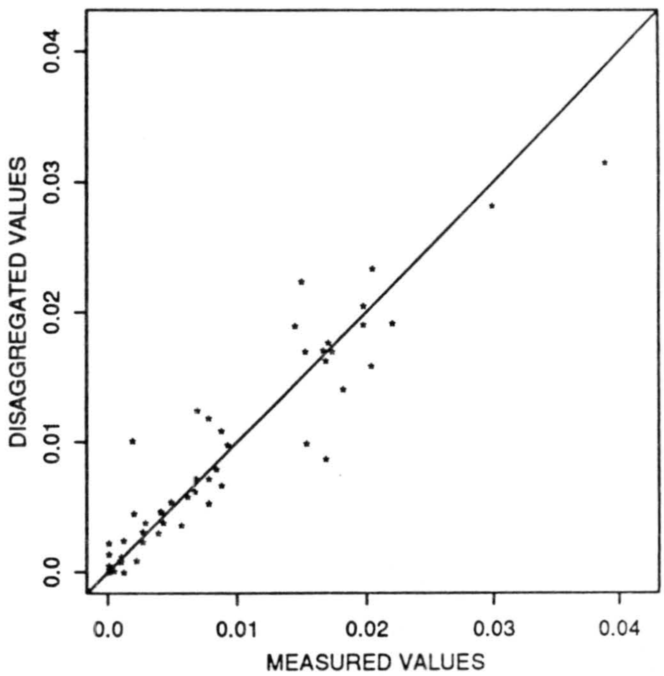
MEAN = 0.009102083 CORRELATION = 0.955940068
RMSE = 0.002574312 n = 48

ORDER 1A DISAGGREGATION FOR MFWCDC



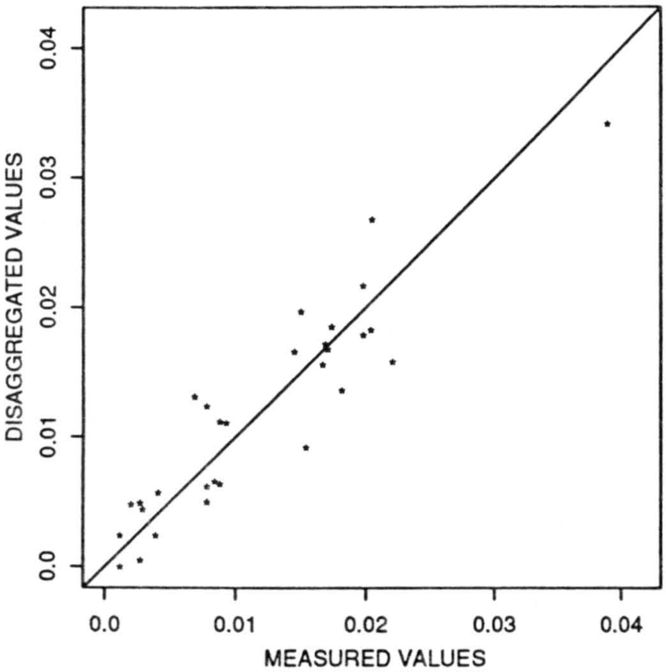
MEAN = 0.009013462 CORRELATION = 0.928883195
RMSE = 0.003172114 n = 52

ORDER 1B DISAGGREGATION FOR MFWCDC



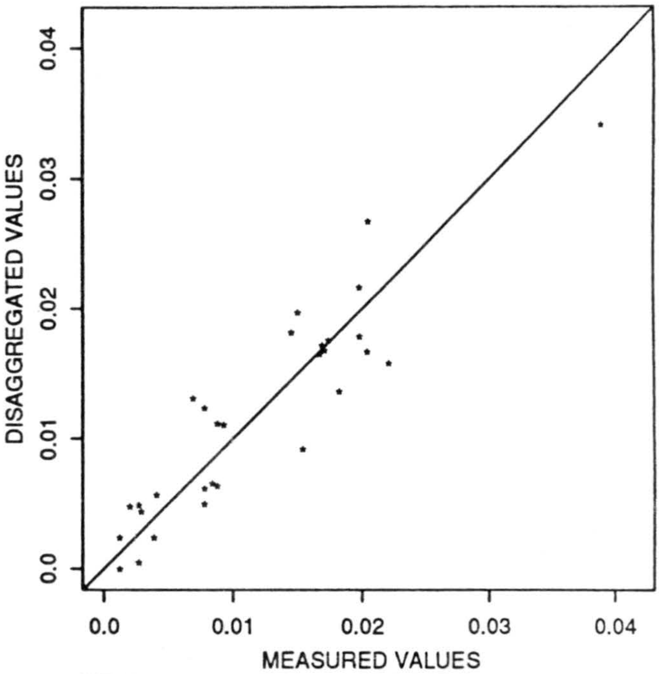
MEAN = 0.009015385 CORRELATION = 0.939778745
RMSE = 0.002927489 n = 52

ORDER 3A DISAGGREGATION FOR MFWCDC



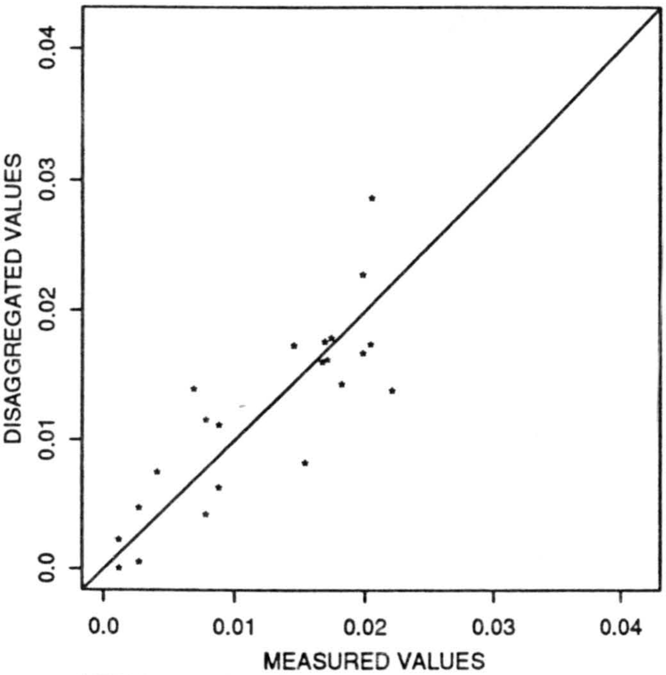
MEAN = 0.011966667 CORRELATION = 0.921611667
RMSE = 0.003251974 n = 30

ORDER 3B DISAGGREGATION FOR MFWCDC



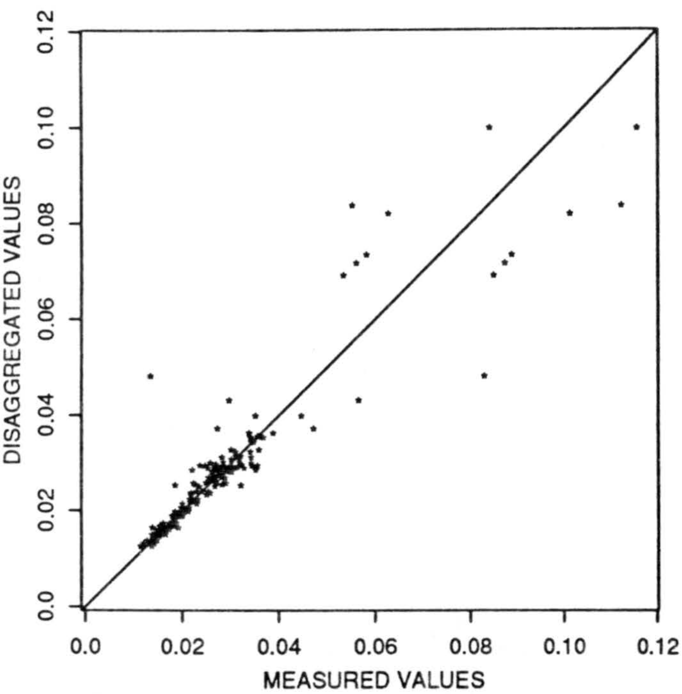
MEAN = 0.011966667 CORRELATION = 0.917507112
RMSE = 0.003334067 n = 30

ORDER 4 DISAGGREGATION FOR MFWCDC



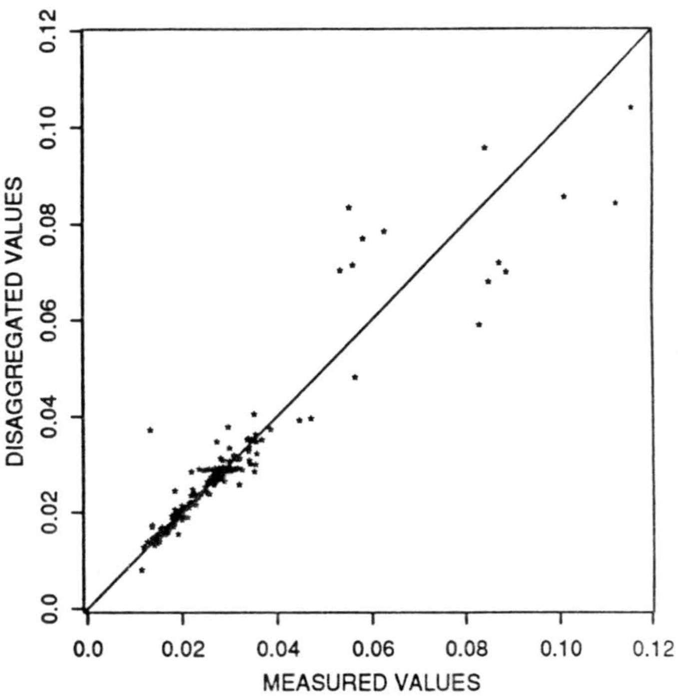
MEAN = 0.012309091 CORRELATION = 0.842570126
RMSE = 0.003978693 n = 22

ORDER 0 DISAGGREGATION FOR QTR1C



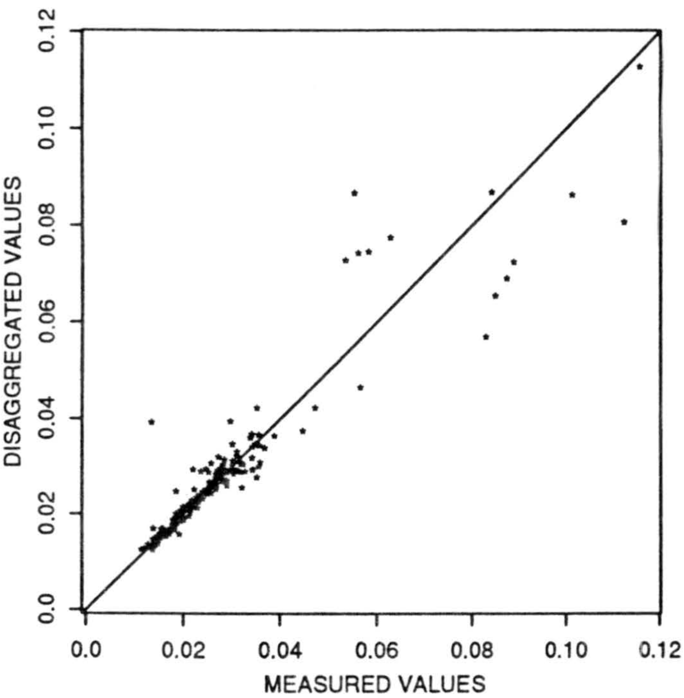
MEAN = 0.028484524 CORRELATION = 0.921285033
RMSE = 0.006883183 n = 168

ORDER 2 DISAGGREGATION FOR QTR1C



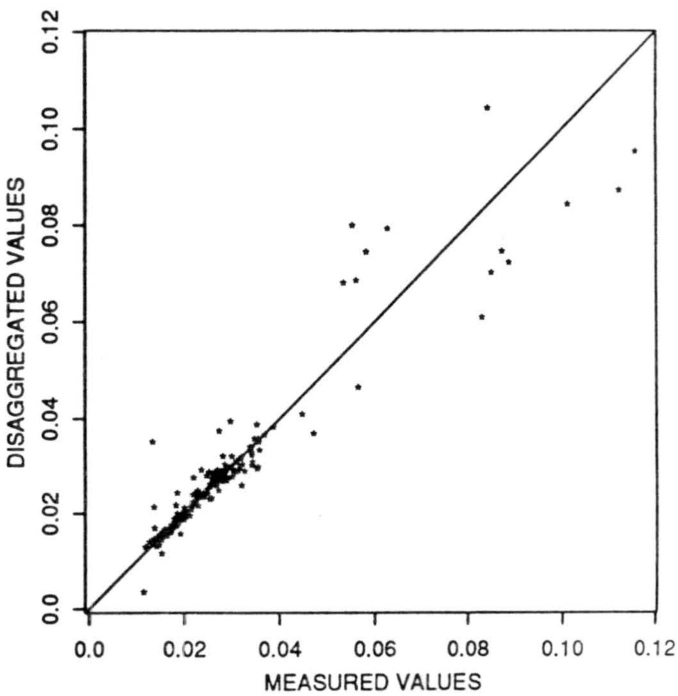
MEAN = 0.028482738 CORRELATION = 0.940398395
RMSE = 0.006024103 n = 168

ORDER 1A DISAGGREGATION FOR QTR1C

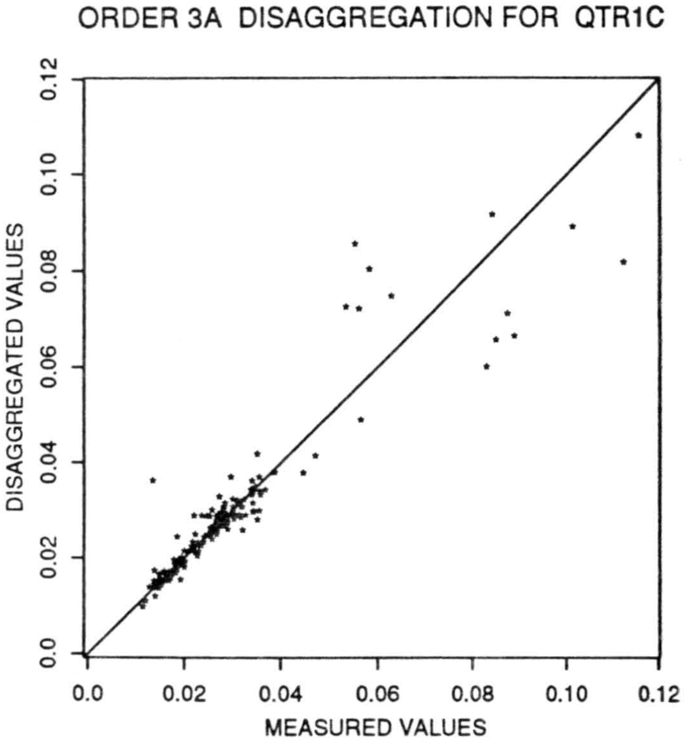


MEAN = 0.028481548 CORRELATION = 0.933844864
RMSE = 0.006331352 n = 168

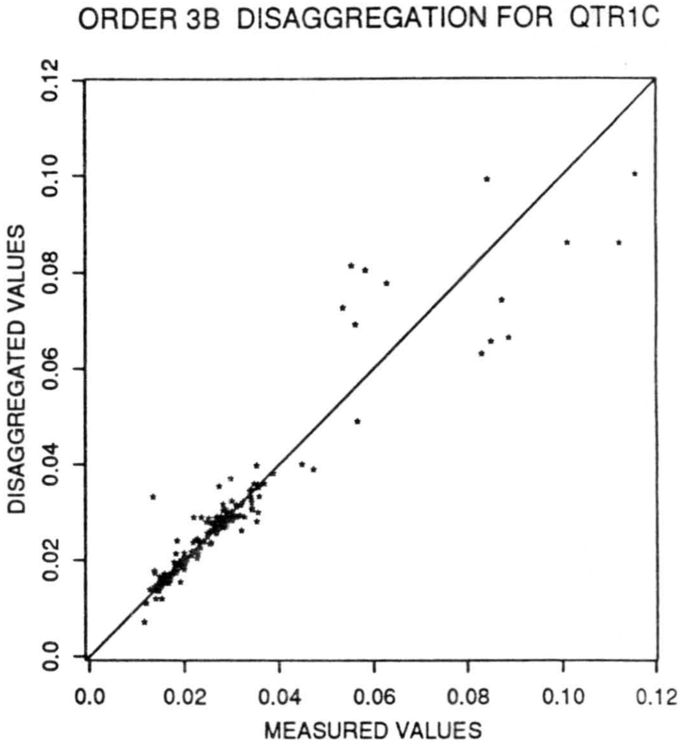
ORDER 1B DISAGGREGATION FOR QTR1C



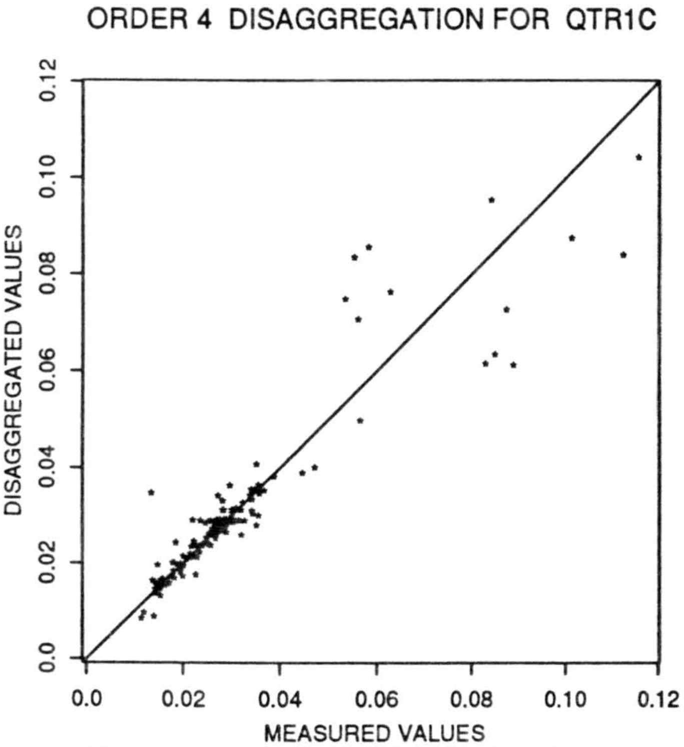
MEAN = 0.028482143 CORRELATION = 0.942270339
RMSE = 0.005931183 n = 168



MEAN = 0.028822222 CORRELATION = 0.936710060
RMSE = 0.006278702 n = 162

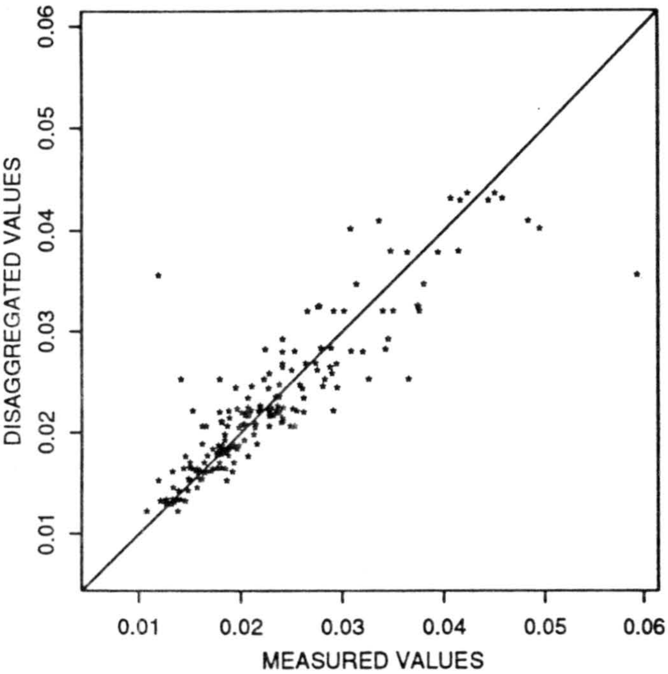


MEAN = 0.028822222 CORRELATION = 0.941155434
RMSE = 0.006063104 n = 162



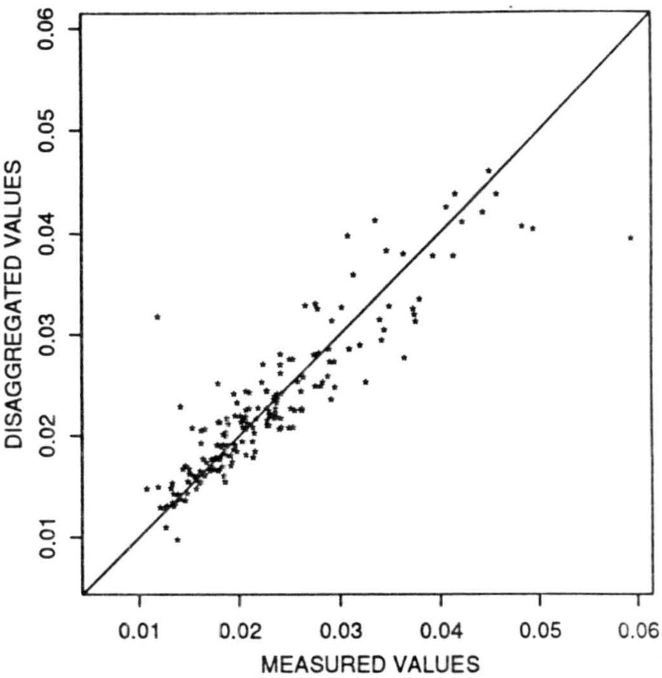
MEAN = 0.030234932 CORRELATION = 0.927752614
RMSE = 0.006841118 n = 146

ORDER 0 DISAGGREGATION FOR QNEPC



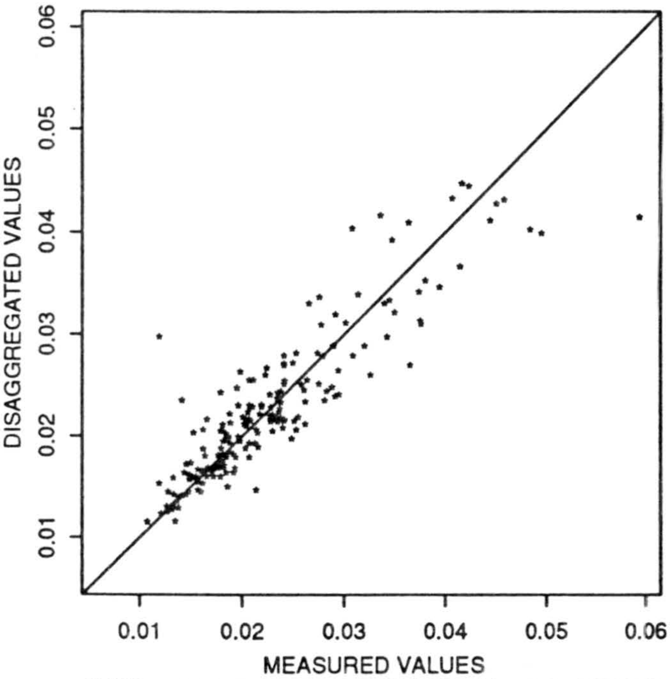
MEAN = 0.023030435 CORRELATION = 0.881259203
RMSE = 0.003917623 n = 184

ORDER 2 DISAGGREGATION FOR QNEPC



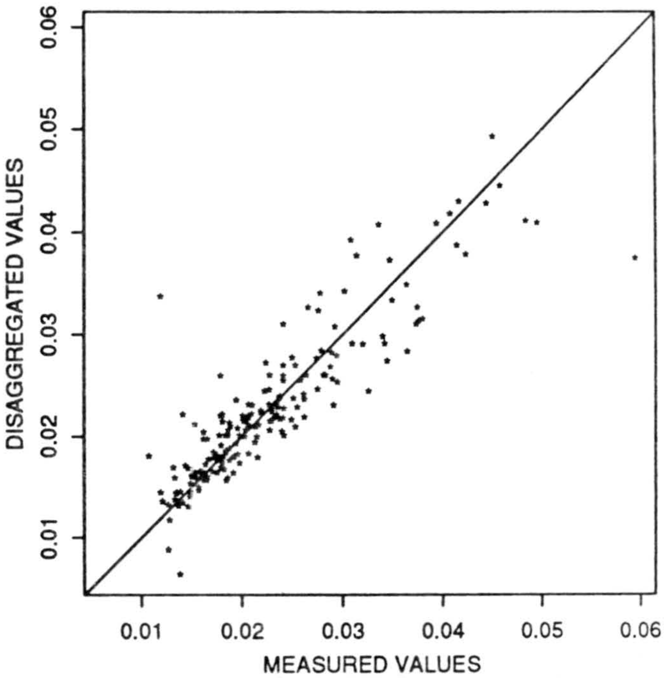
MEAN = 0.023028261 CORRELATION = 0.901950717
RMSE = 0.003581375 n = 184

ORDER 1A DISAGGREGATION FOR QNEPC



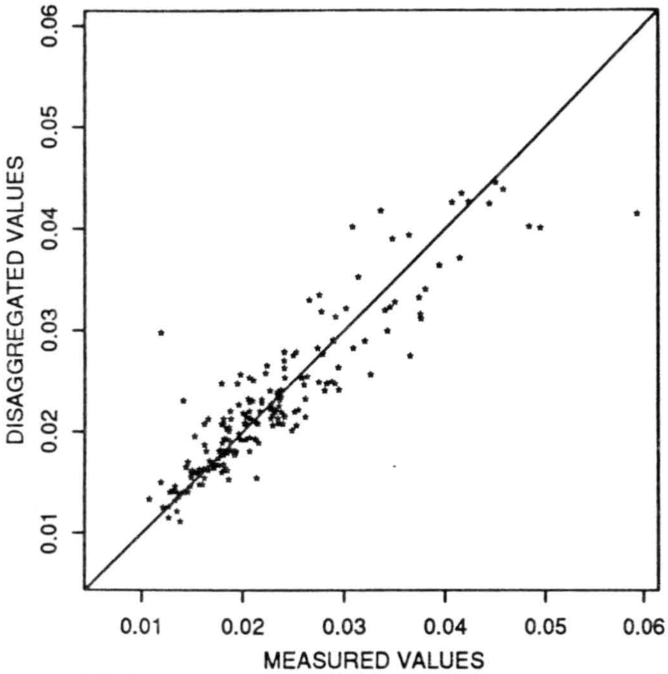
MEAN = 0.023027174 CORRELATION = 0.899473667
RMSE = 0.003622162 n = 184

ORDER 1B DISAGGREGATION FOR QNEPC



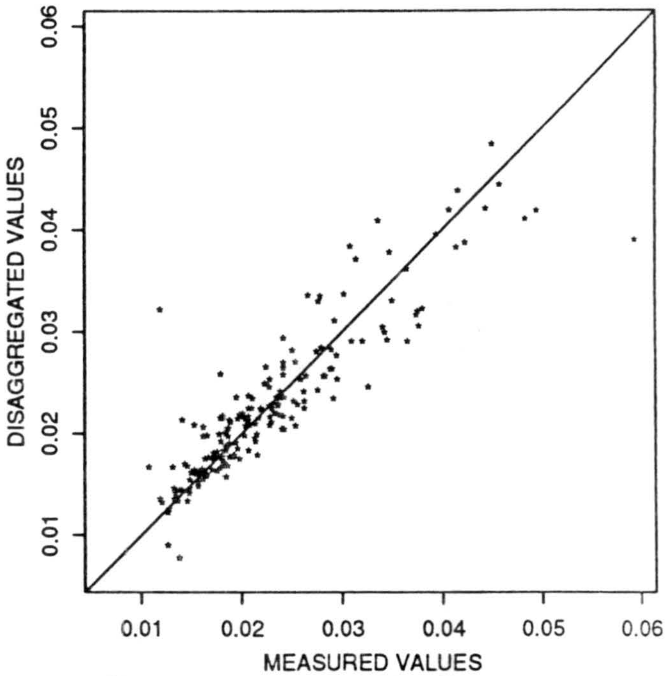
MEAN = 0.02302717 CORRELATION = 0.88658369
RMSE = 0.00383500 n = 184

ORDER 3A DISAGGREGATION FOR QNEPC



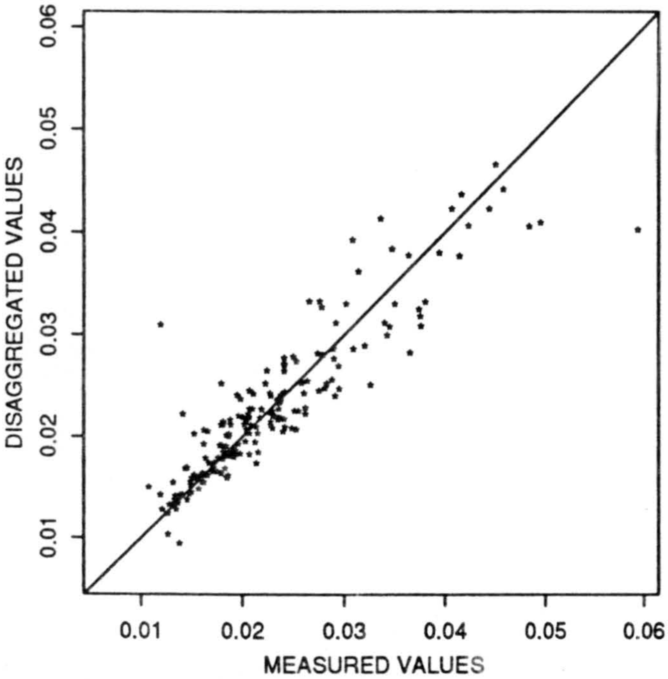
MEAN = 0.023027717 CORRELATION = 0.904782355
RMSE = 0.003531058 n = 184

ORDER 3B DISAGGREGATION FOR QNEPC



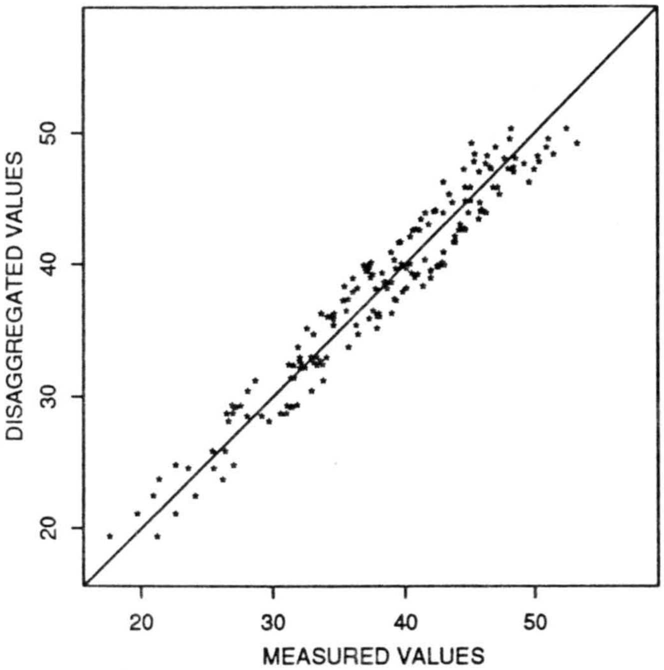
MEAN = 0.023027174 CORRELATION = 0.900152445
RMSE = 0.003610755 n = 184

ORDER 4 DISAGGREGATION FOR QNEPC



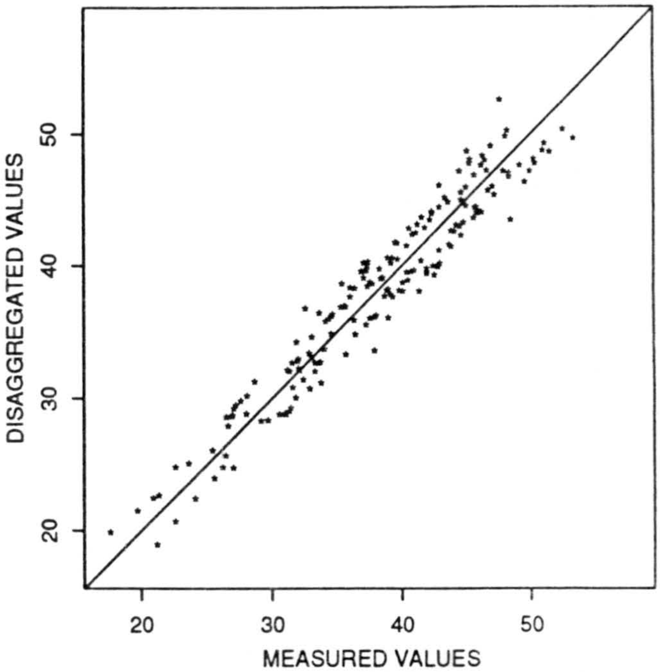
MEAN = 0.023027717 CORRELATION = 0.905942082
RMSE = 0.003511456 n = 184

ORDER 0 DISAGGREGATION FOR QTEMC



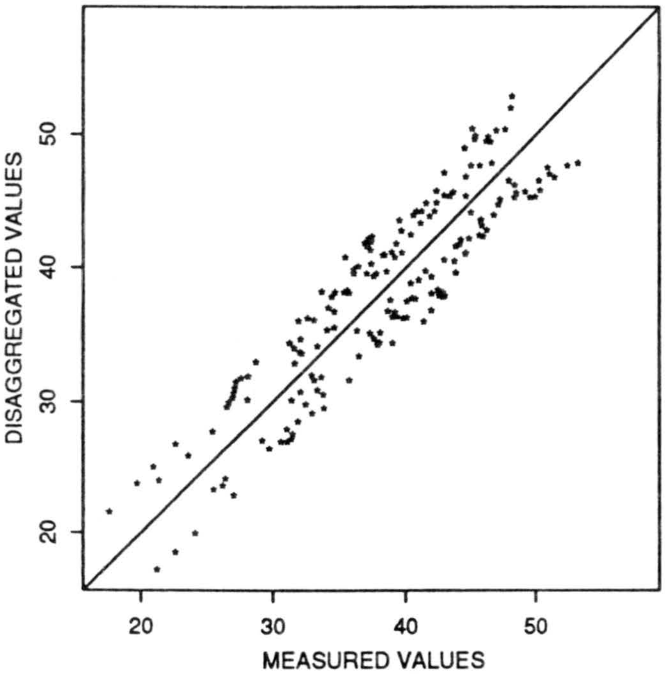
MEAN = 38.1567778 CORRELATION = 0.9681895
RMSE = 1.8735775 n = 180

ORDER 2 DISAGGREGATION FOR QTEMC



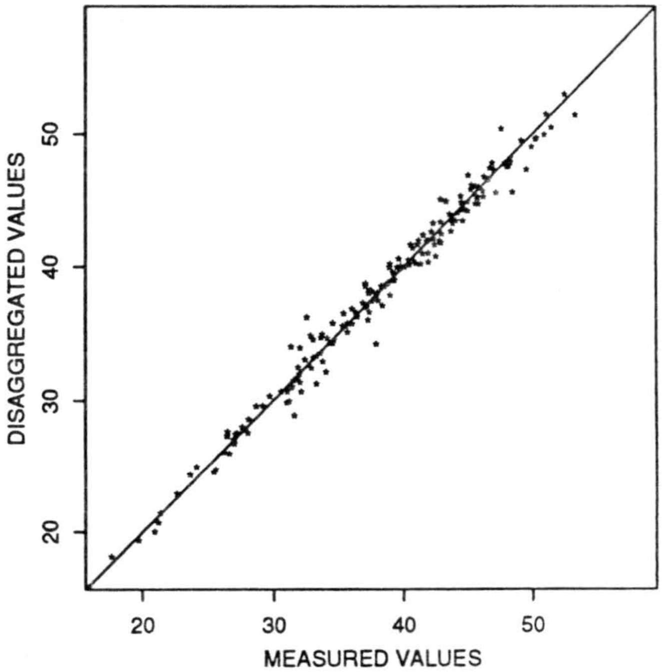
MEAN = 38.1567761 CORRELATION = 0.9654078
RMSE = 1.9529726 n = 180

ORDER 1A DISAGGREGATION FOR QTEMC



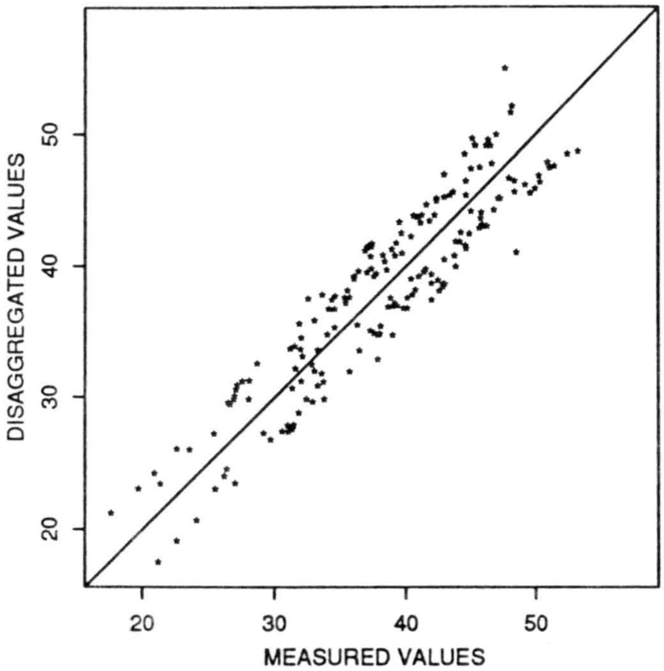
MEAN = 38.1567778 CORRELATION = 0.9024496
RMSE = 3.2938004 n = 180

ORDER 1B DISAGGREGATION FOR QTEMC



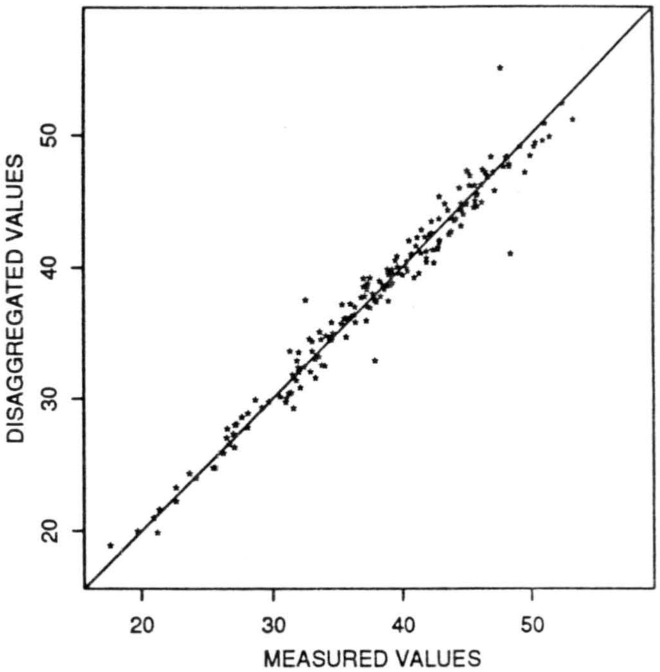
MEAN = 38.1567789 CORRELATION = 0.9915088
RMSE = 0.9737153 n = 180

ORDER 3A DISAGGREGATION FOR QTEMC



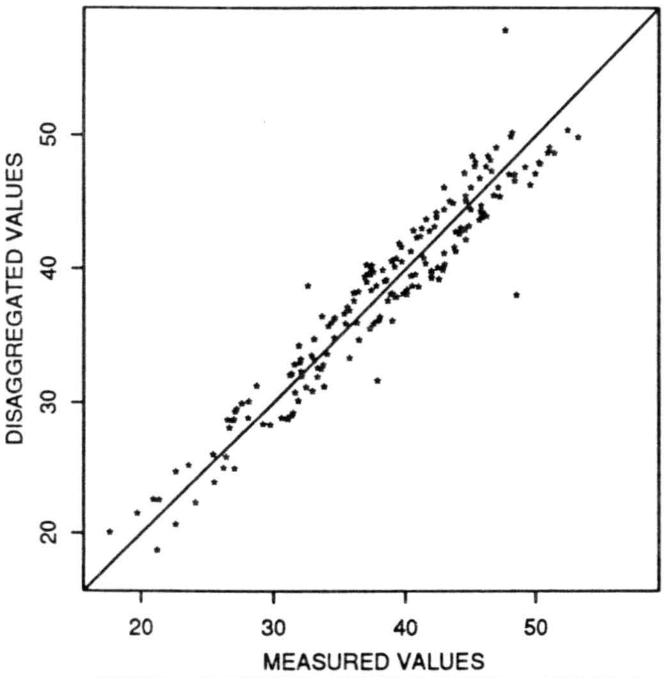
MEAN = 38.1567789 CORRELATION = 0.9186353
RMSE = 3.0026344 n = 180

ORDER 3B DISAGGREGATION FOR QTEMC



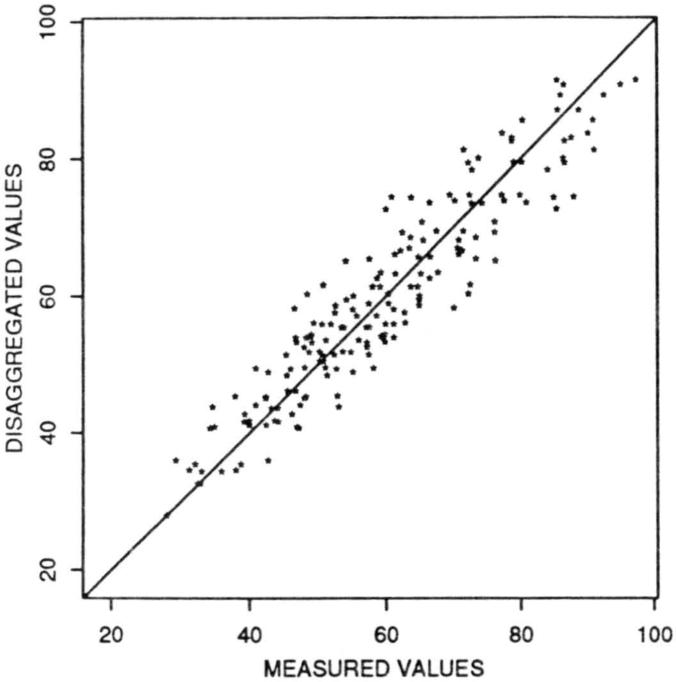
MEAN = 38.1567783 CORRELATION = 0.9833776
RMSE = 1.3597994 n = 180

ORDER 4 DISAGGREGATION FOR QTEMC



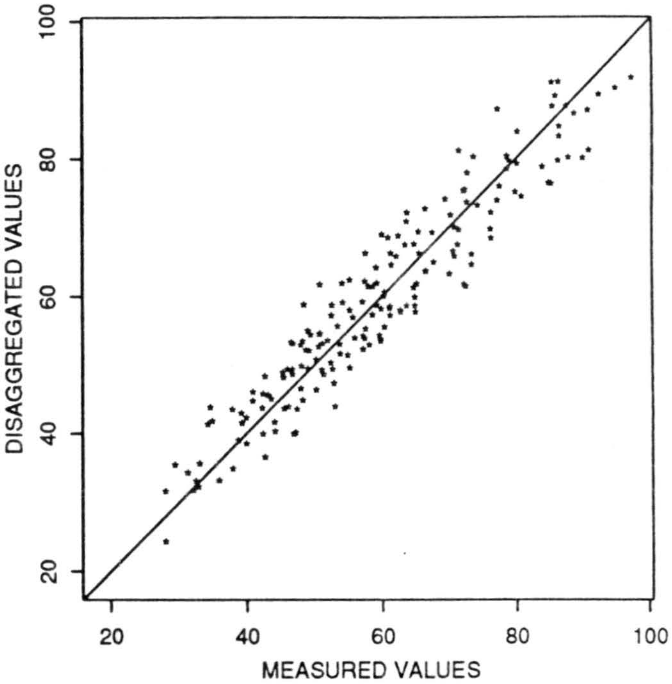
MEAN = 38.1567778 CORRELATION = 0.9554911
RMSE = 2.2179061 n = 180

ORDER 0 DISAGGREGATION FOR QRHC



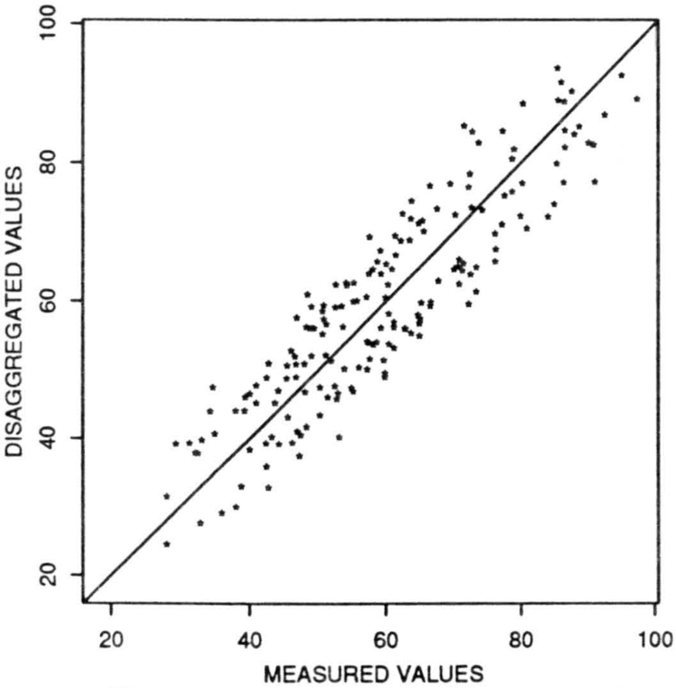
MEAN = 59.6120556 CORRELATION = 0.9362397
RMSE = 5.4866825 n = 180

ORDER 2 DISAGGREGATION FOR QRHC



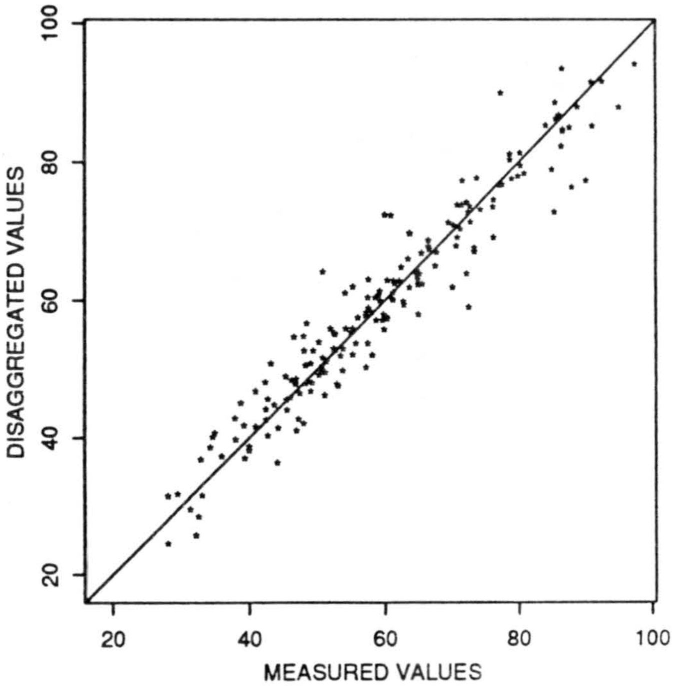
MEAN = 59.6120556 CORRELATION = 0.9500979
RMSE = 4.8718904 n = 180

ORDER 1A DISAGGREGATION FOR QRHC



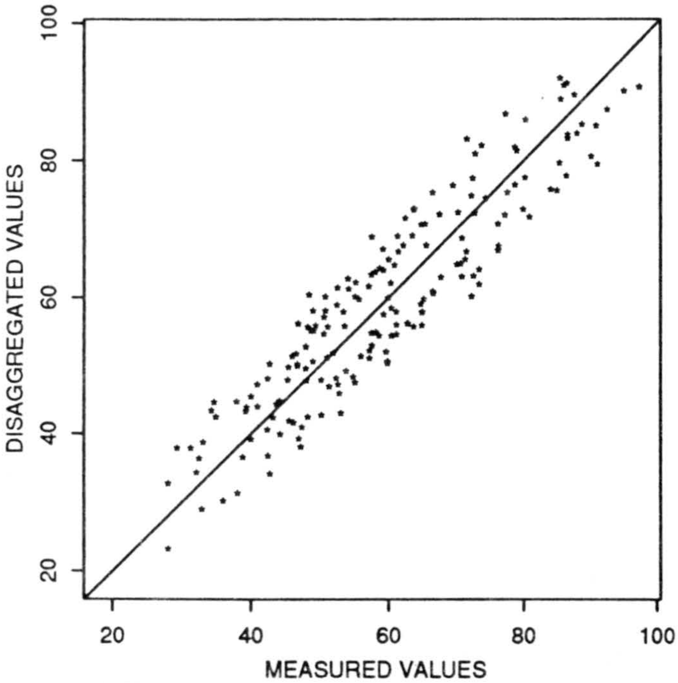
MEAN = 59.6120567 CORRELATION = 0.9002756
RMSE = 6.8734355 n = 180

ORDER 1B DISAGGREGATION FOR QRHC



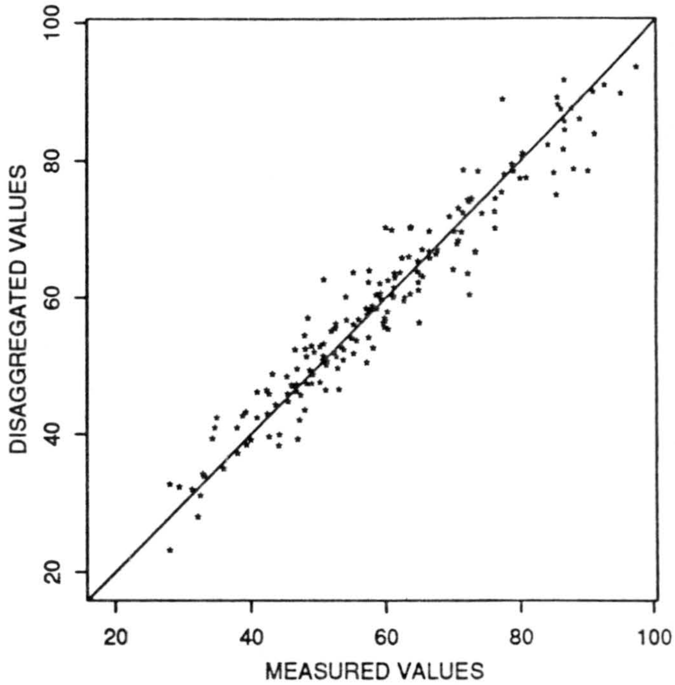
MEAN = 59.6120528 CORRELATION = 0.9609548
RMSE = 4.3213786 n = 180

ORDER 3A DISAGGREGATION FOR QRHC



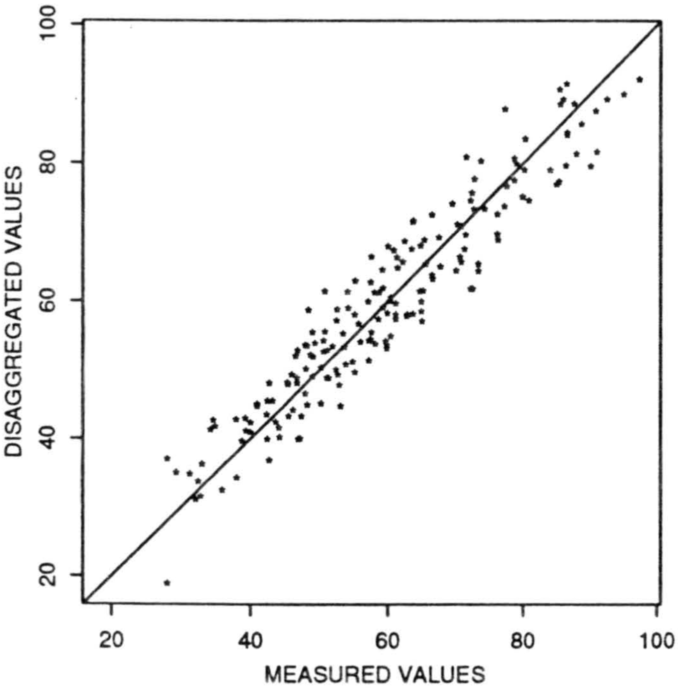
MEAN = 59.6120550 CORRELATION = 0.9183868
RMSE = 6.2108848 n = 180

ORDER 3B DISAGGREGATION FOR QRHC



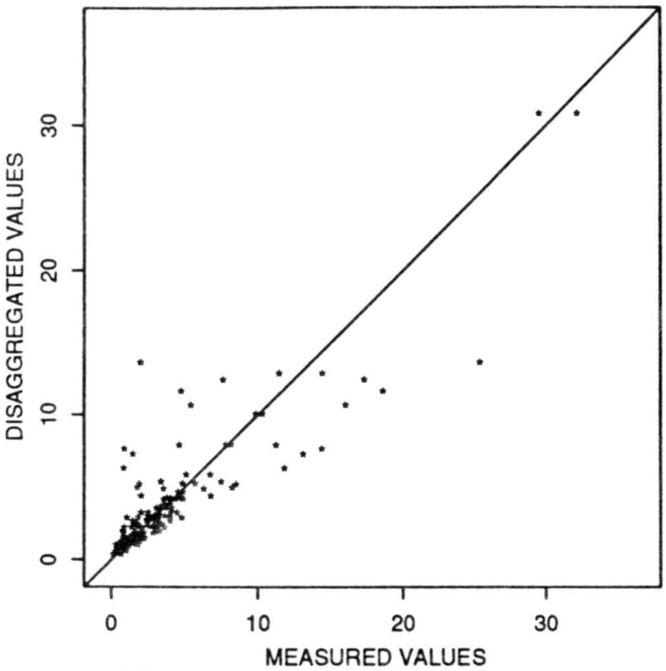
MEAN = 59.6120550 CORRELATION = 0.9647157
RMSE = 4.1124497 n = 180

ORDER 4 DISAGGREGATION FOR QRHC



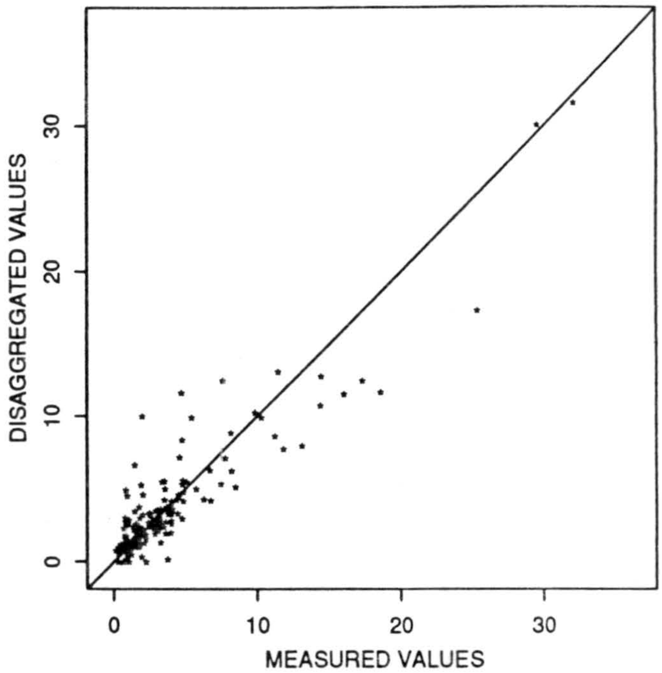
MEAN = 59.6120556 CORRELATION = 0.9499196
RMSE = 4.8797554 n = 180

ORDER 0 DISAGGREGATION FOR QWSC



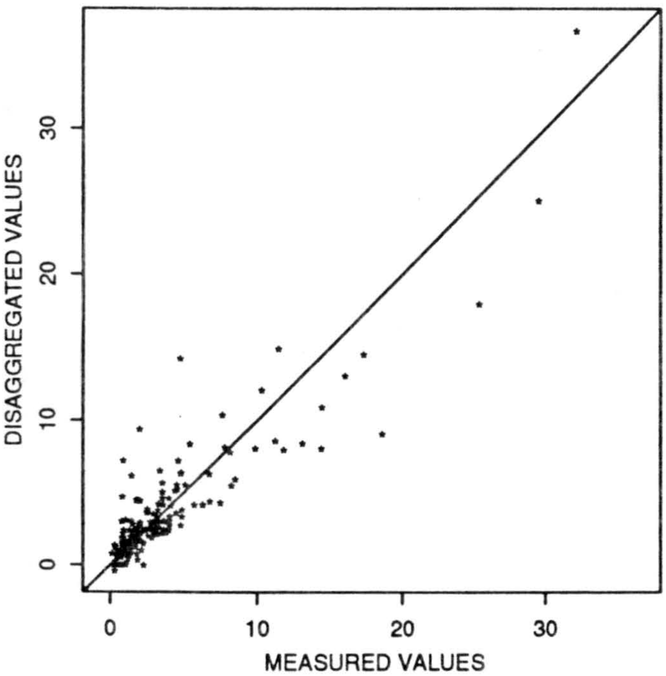
MEAN = 3.6365556 CORRELATION = 0.8842937
RMSE = 2.1581793 n = 180

ORDER 2 DISAGGREGATION FOR QWSC



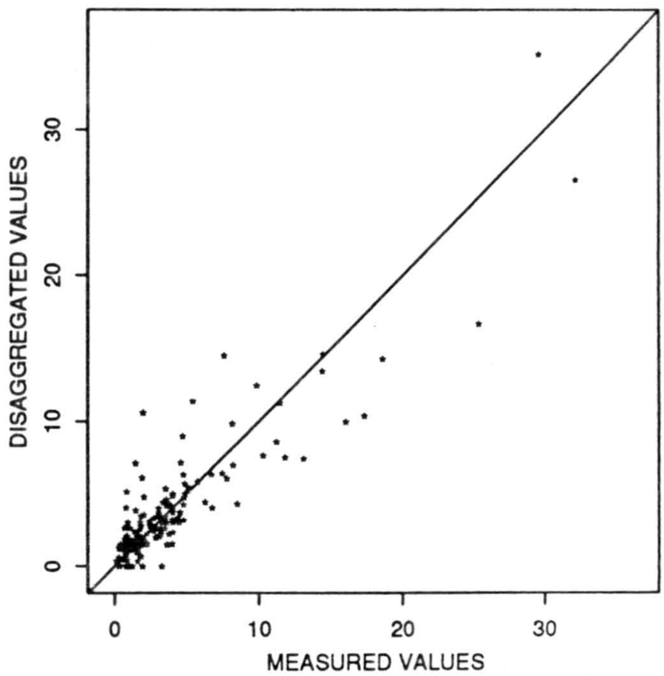
MEAN = 3.6365539 CORRELATION = 0.9166616
RMSE = 1.8486344 n = 180

ORDER 1A DISAGGREGATION FOR QWSC



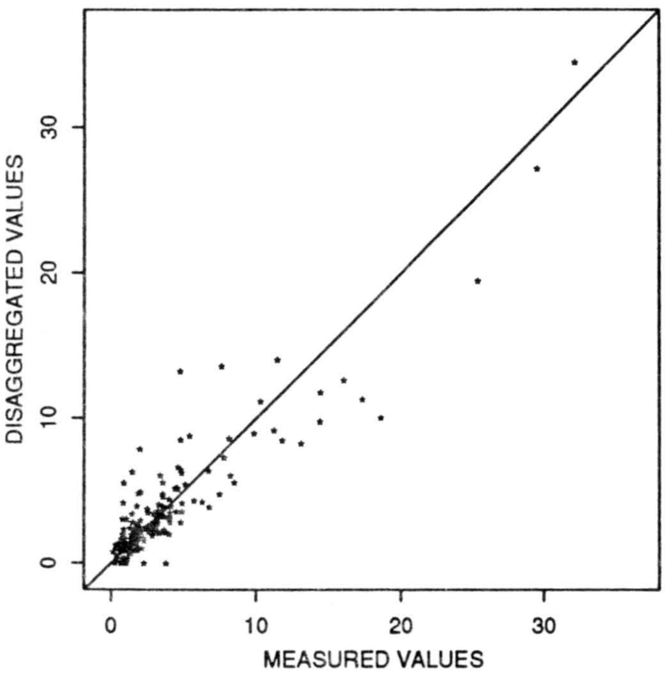
MEAN = 3.6365544 CORRELATION = 0.8999696
RMSE = 2.0166282 n = 180

ORDER 1B DISAGGREGATION FOR QWSC



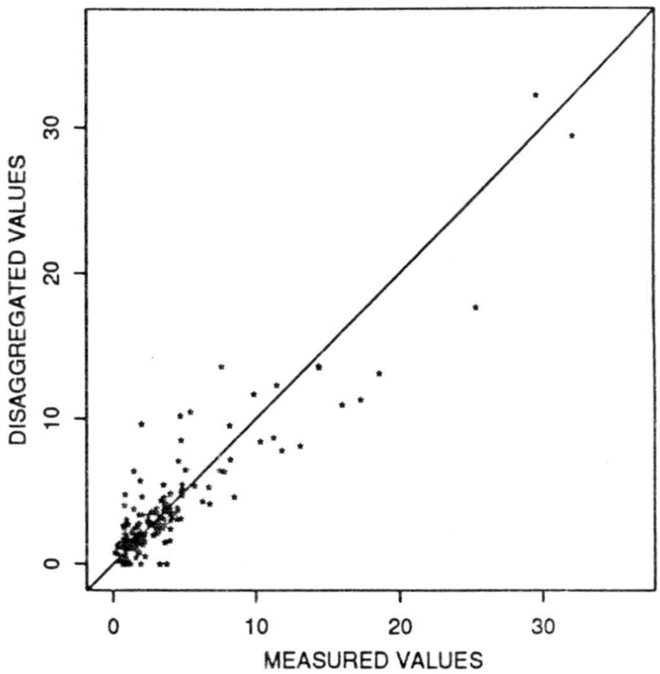
MEAN = 3.6365544 CORRELATION = 0.8987005
RMSE = 2.0293360 n = 180

ORDER 3A DISAGGREGATION FOR QWSC



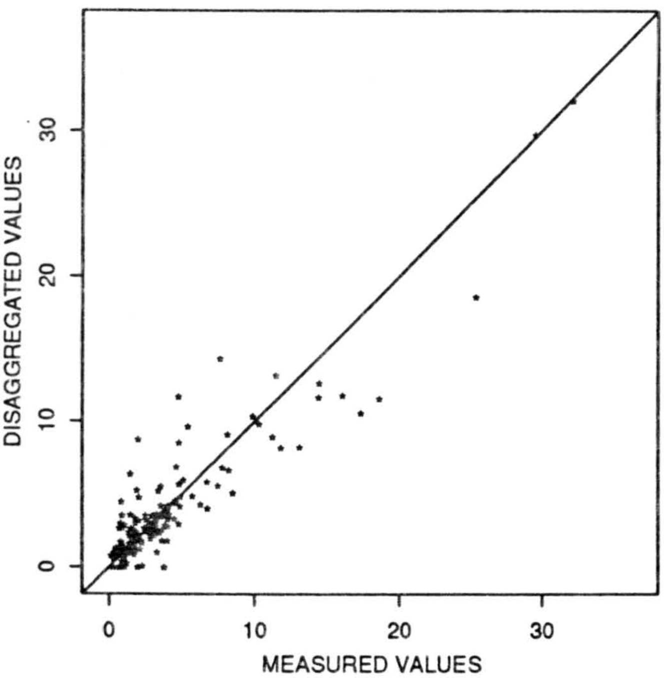
MEAN = 3.6365550 CORRELATION = 0.9118647
RMSE = 1.8974446 n = 180

ORDER 3B DISAGGREGATION FOR QWSC



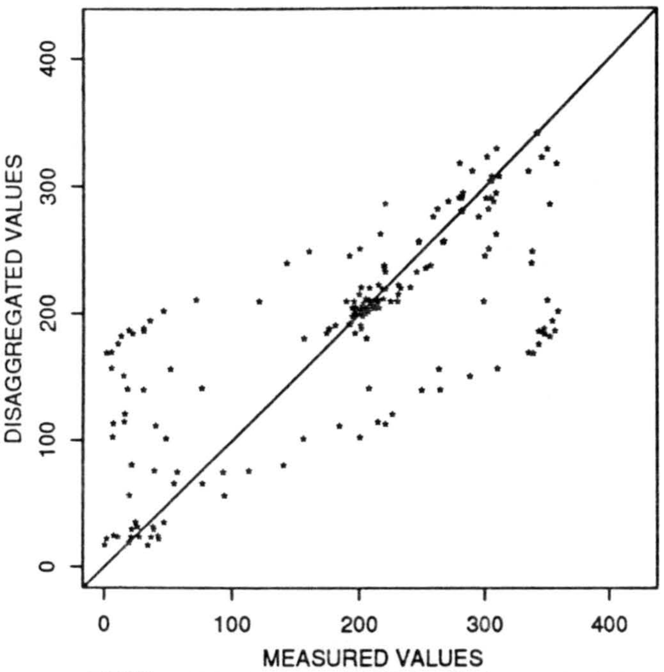
MEAN = 3.6365550 CORRELATION = 0.9140655
RMSE = 1.8746274 n = 180

ORDER 4 DISAGGREGATION FOR QWSC



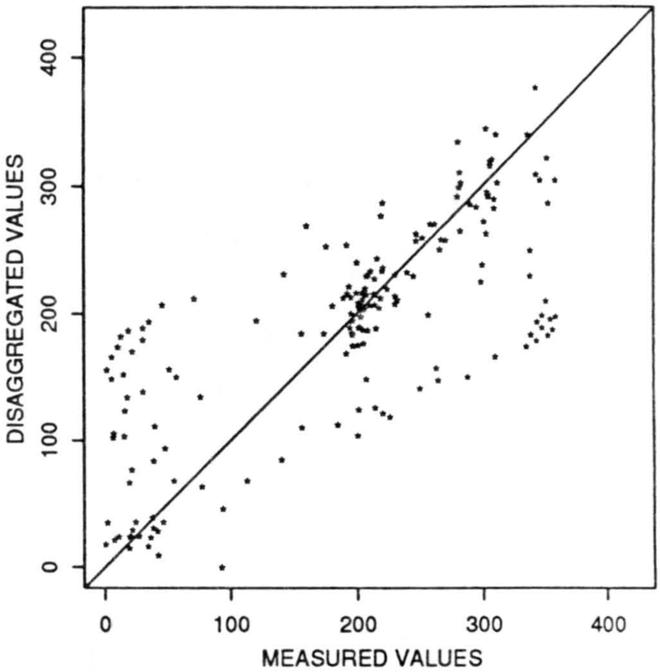
MEAN = 3.6365556 CORRELATION = 0.9180721
RMSE = 1.8325947 n = 180

ORDER 0 DISAGGREGATION FOR QWDC



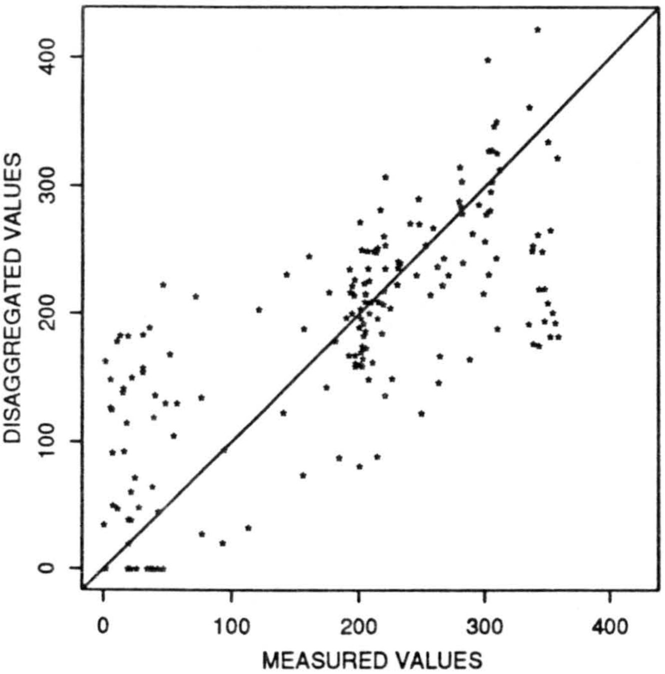
MEAN = 188.4000556 CORRELATION = 0.7479785
RMSE = 72.5739571 n = 180

ORDER 2 DISAGGREGATION FOR QWDC



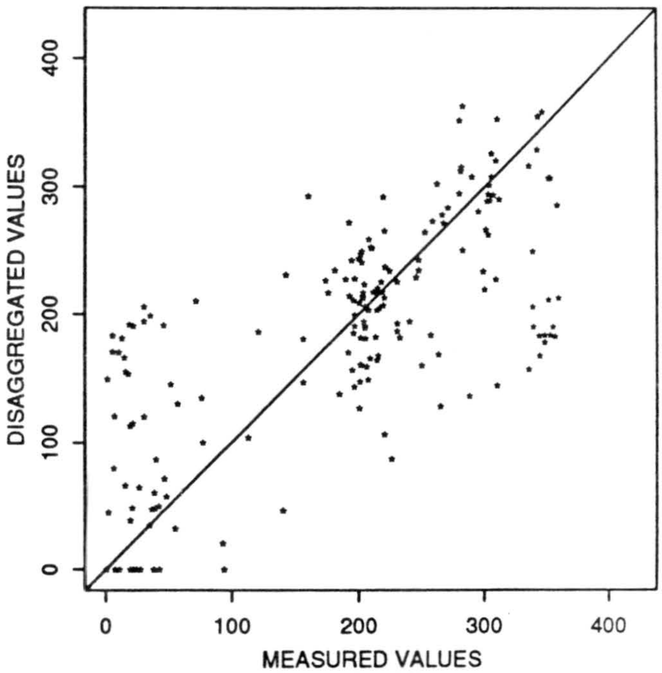
MEAN = 188.4000611 CORRELATION = 0.7462027
RMSE = 72.8136396 n = 180

ORDER 1A DISAGGREGATION FOR QWDC



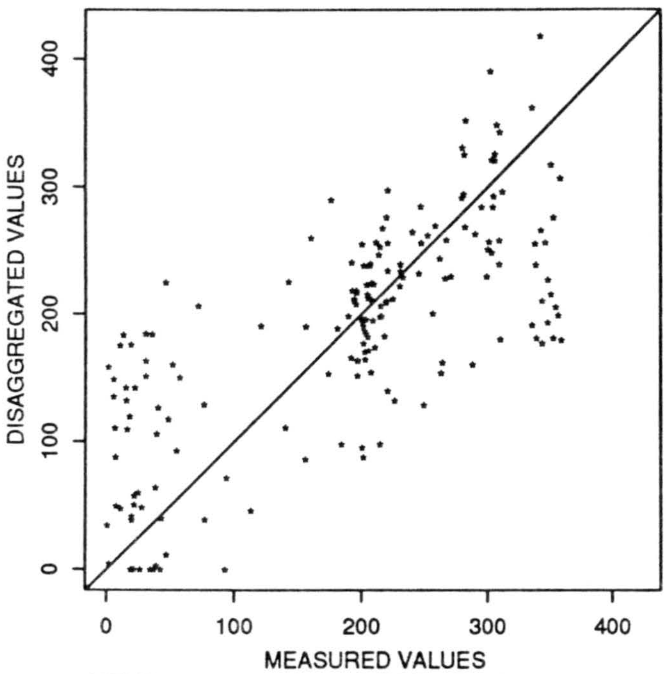
MEAN = 188.40006 CORRELATION = 0.73281
RMSE = 74.68672 n = 180

ORDER 1B DISAGGREGATION FOR QWDC



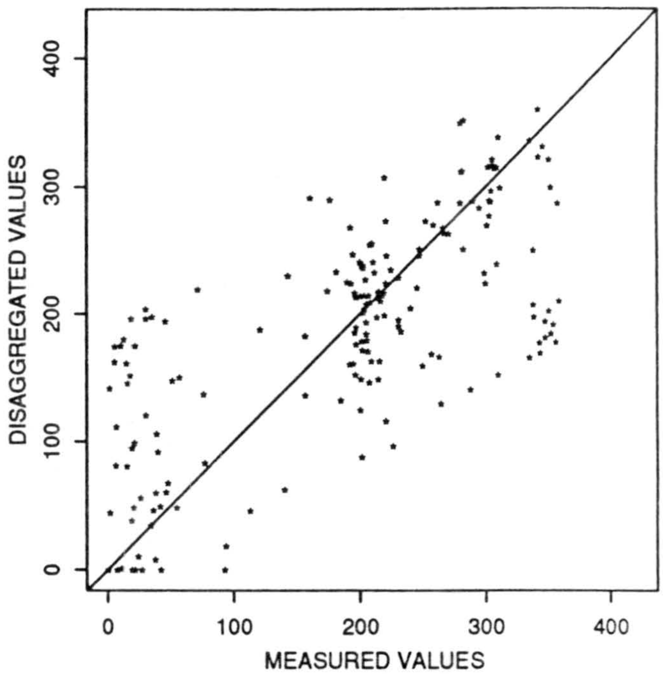
MEAN = 188.4000667 CORRELATION = 0.7084981
RMSE = 77.6636096 n = 180

ORDER 3A DISAGGREGATION FOR QWDC



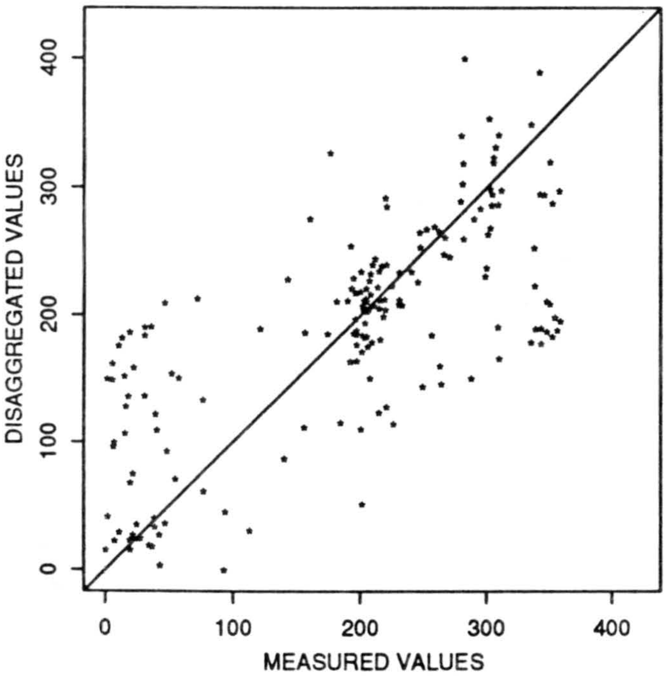
MEAN = 188.4000500 CORRELATION = 0.7338257
RMSE = 74.5627711 n = 180

ORDER 3B DISAGGREGATION FOR QWDC



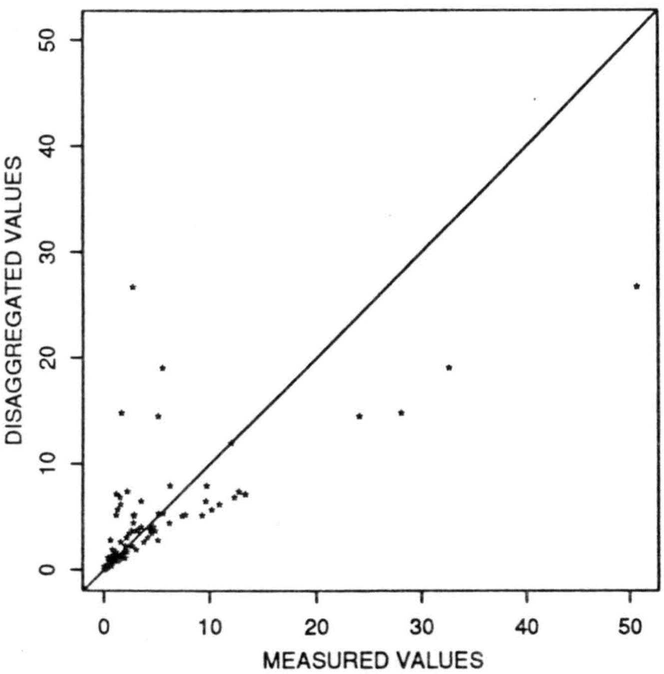
MEAN = 188.4000444 CORRELATION = 0.7106794
RMSE = 77.4000514 n = 180

ORDER 4 DISAGGREGATION FOR QWDC



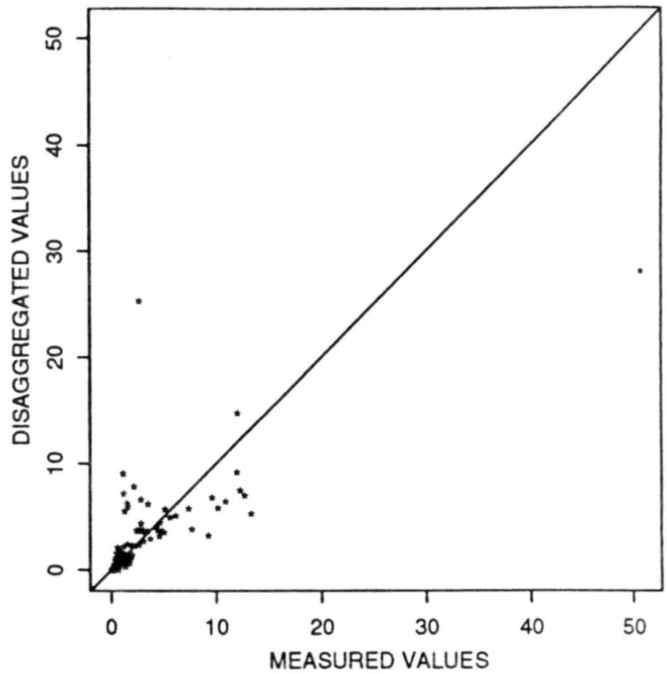
MEAN = 188.4000500 CORRELATION = 0.7242625
RMSE = 75.6994591 n = 180

ORDER 0 DISAGGREGATION FOR SSO2C



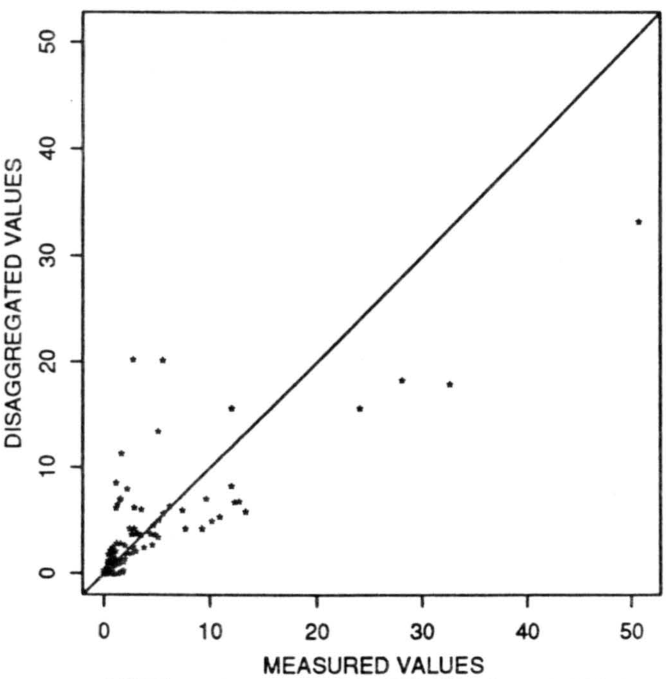
MEAN = 3.679639 CORRELATION = 0.736398
RMSE = 4.547551 n = 118

ORDER 2 DISAGGREGATION FOR SSO2C



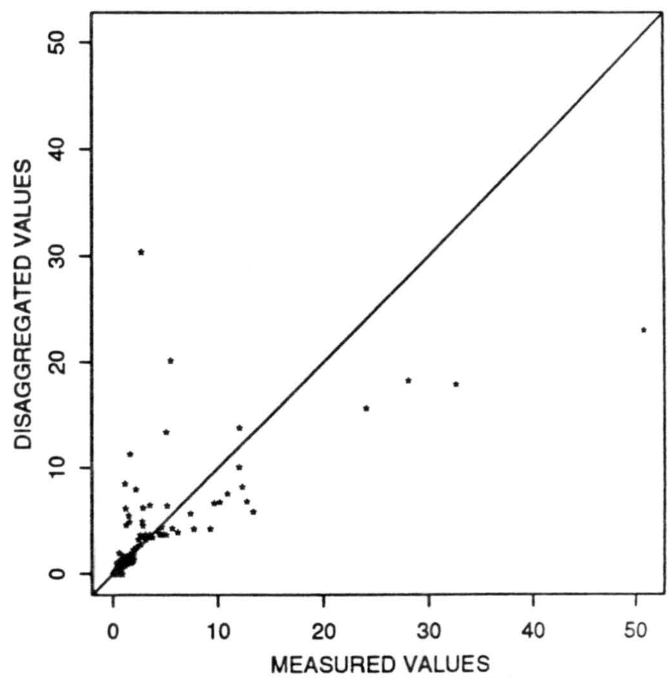
MEAN = 3.0296961 CORRELATION = 0.7416782
RMSE = 3.8403278 n = 102

ORDER 1A DISAGGREGATION FOR SSO2C



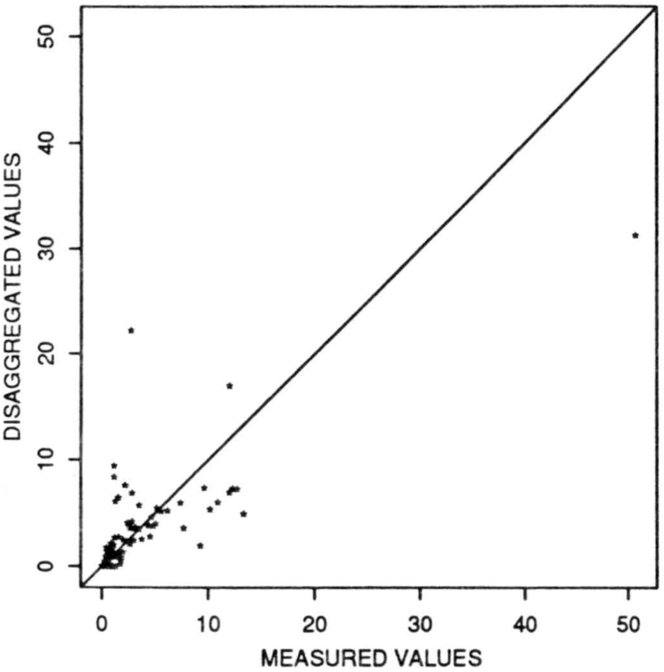
MEAN = 3.7060427 CORRELATION = 0.8007538
RMSE = 4.1533498 n = 110

ORDER 1B DISAGGREGATION FOR SSO2C



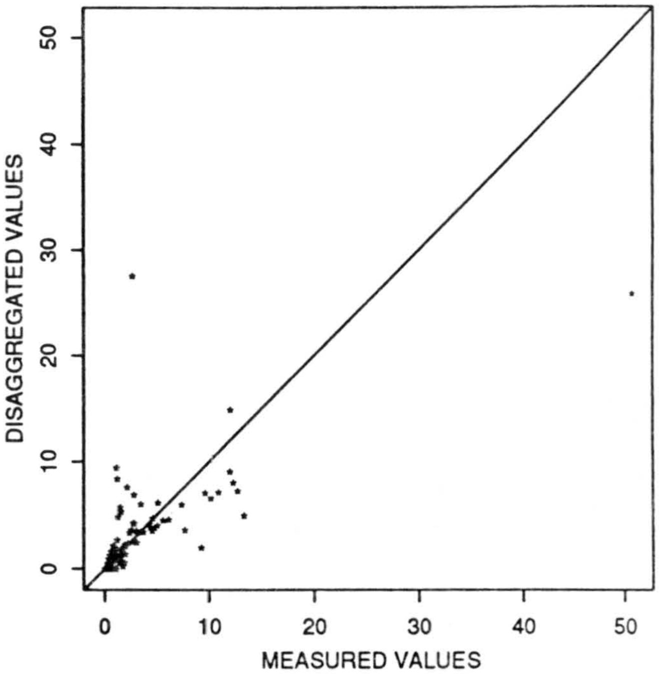
MEAN = 3.7060418 CORRELATION = 0.7008379
RMSE = 4.9421186 n = 110

ORDER 3A DISAGGREGATION FOR SSO2C



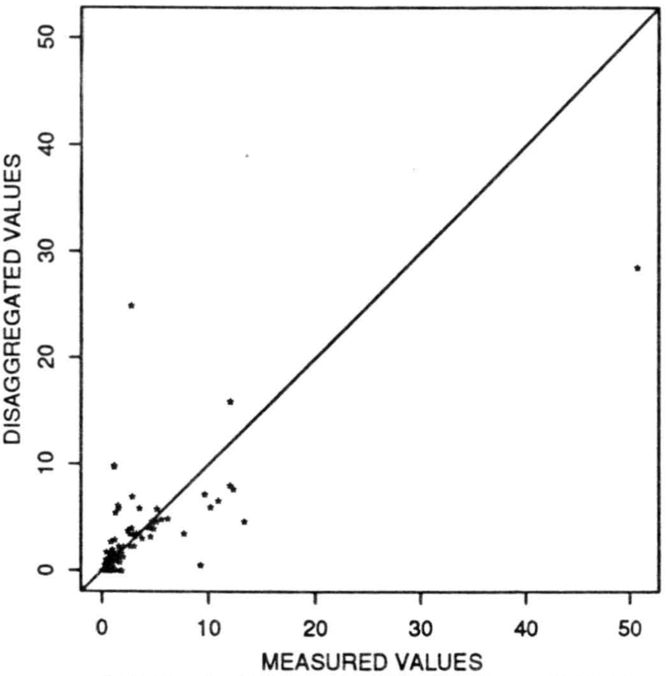
MEAN = 3.2077375 CORRELATION = 0.7694343
RMSE = 3.7403912 n = 96

ORDER 3B DISAGGREGATION FOR SSO2C



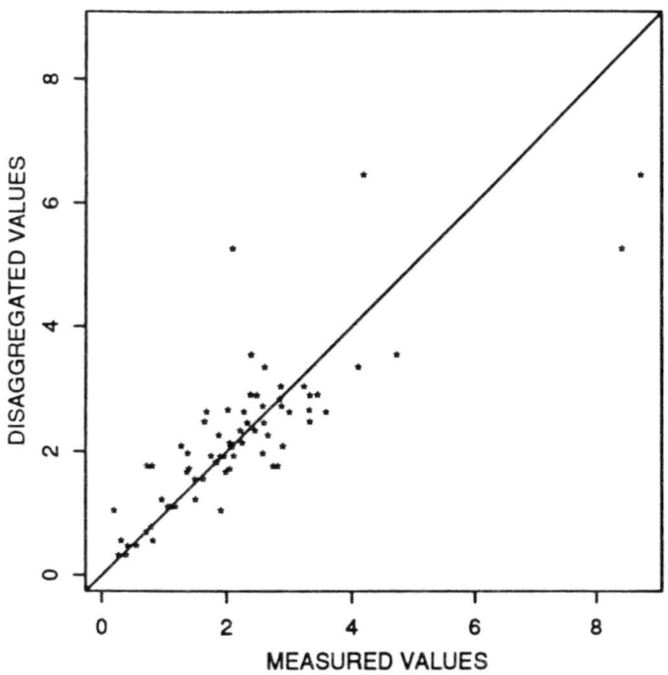
MEAN = 3.2077375 CORRELATION = 0.6913823
RMSE = 4.2435640 n = 96

ORDER 4 DISAGGREGATION FOR SSO2C



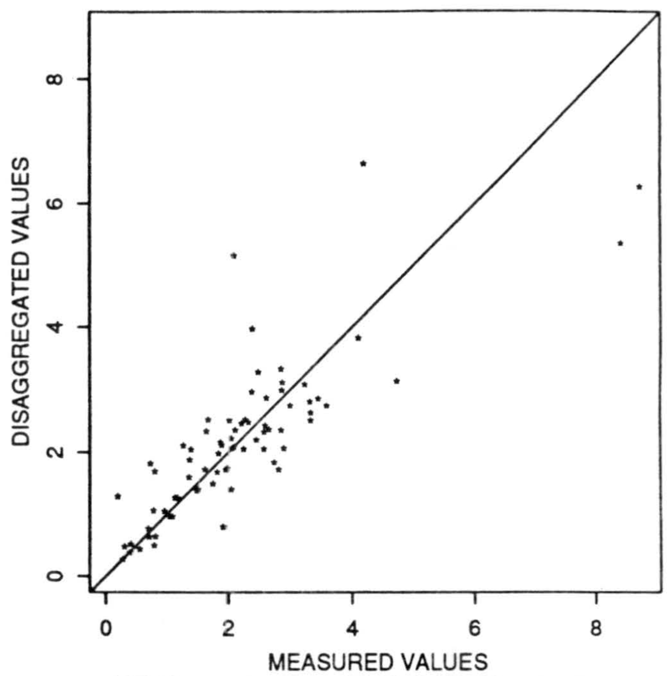
MEAN = 3.1649761 CORRELATION = 0.7227286
RMSE = 4.1493897 n = 88

ORDER 0 DISAGGREGATION FOR WYCPMC



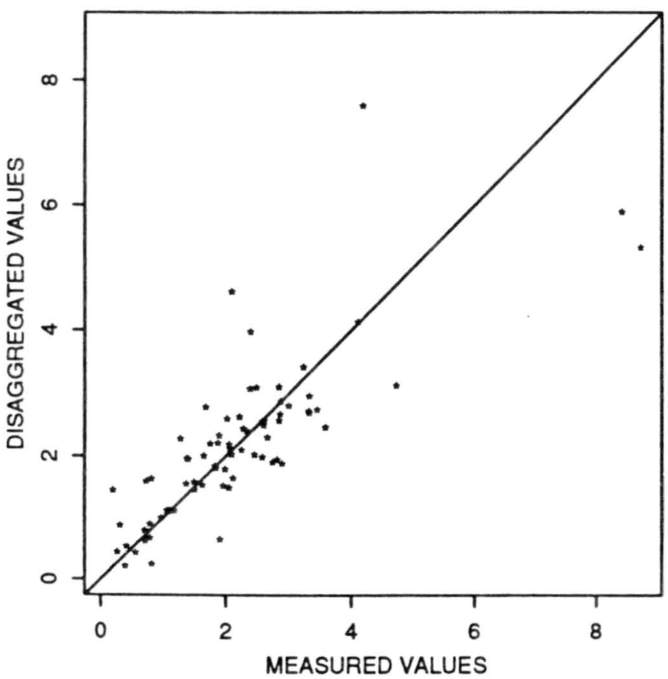
MEAN = 2.1736054 CORRELATION = 0.8295112
RMSE = 0.8089820 n = 74

ORDER 2 DISAGGREGATION FOR WYCPMC



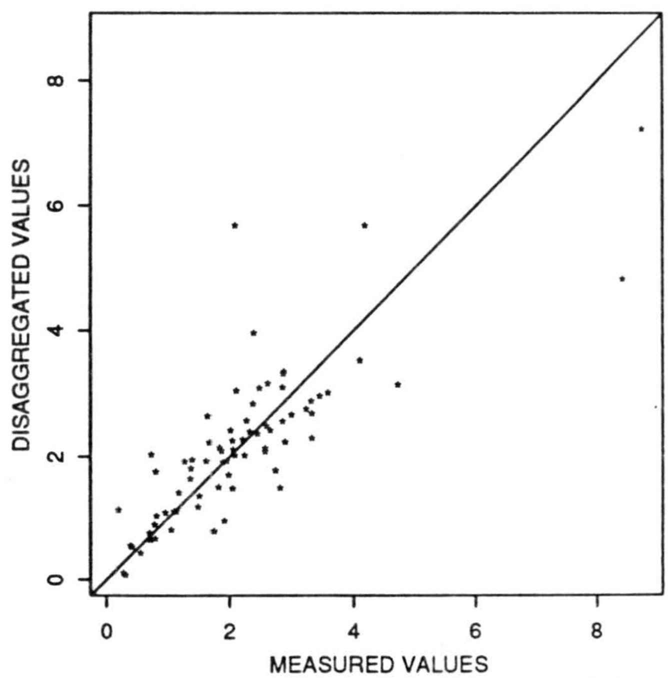
MEAN = 2.1736054 CORRELATION = 0.8163424
RMSE = 0.8374995 n = 74

ORDER 1A DISAGGREGATION FOR WYCPMC



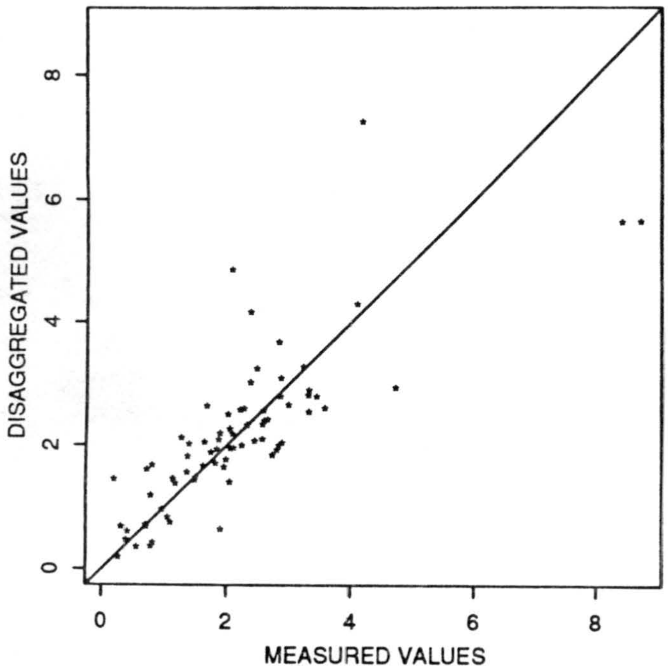
MEAN = 2.1736081 CORRELATION = 0.7923478
RMSE = 0.8890171 n = 74

ORDER 1B DISAGGREGATION FOR WYCPMC



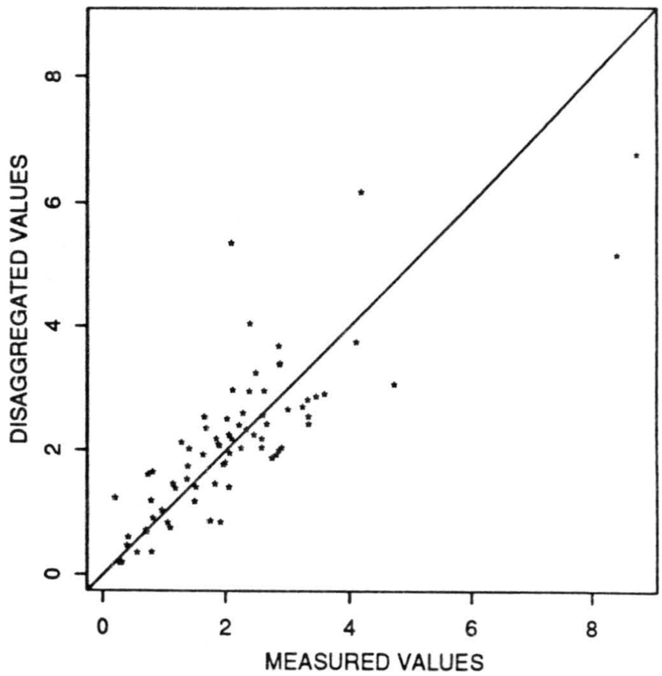
MEAN = 2.1736095 CORRELATION = 0.8117150
RMSE = 0.8488939 n = 74

ORDER 3A DISAGGREGATION FOR WYCPMC



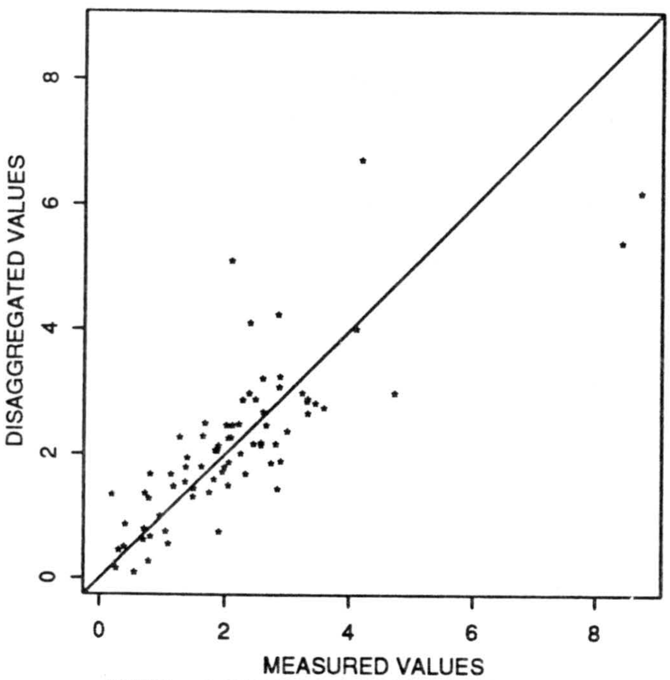
MEAN = 2.1736095 CORRELATION = 0.7934971
RMSE = 0.8872309 n = 74

ORDER 3B DISAGGREGATION FOR WYCPMC



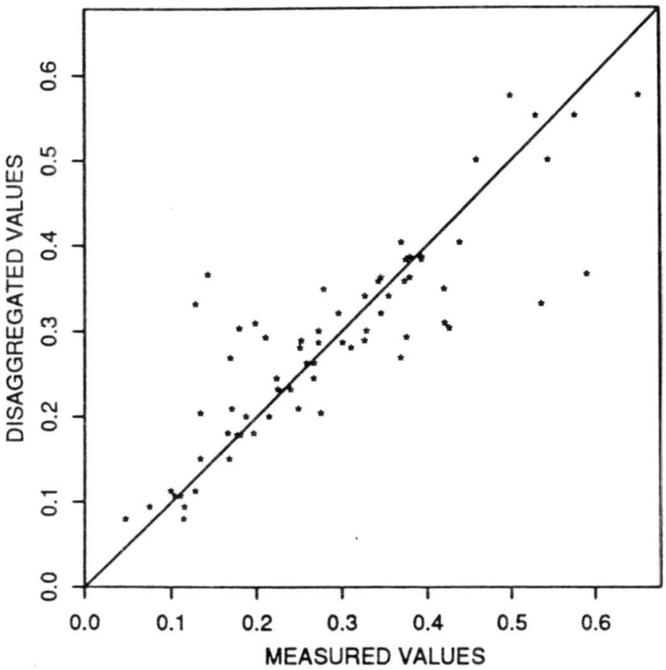
MEAN = 2.1736108 CORRELATION = 0.8111650
RMSE = 0.8503262 n = 74

ORDER 4 DISAGGREGATION FOR WYCPMC



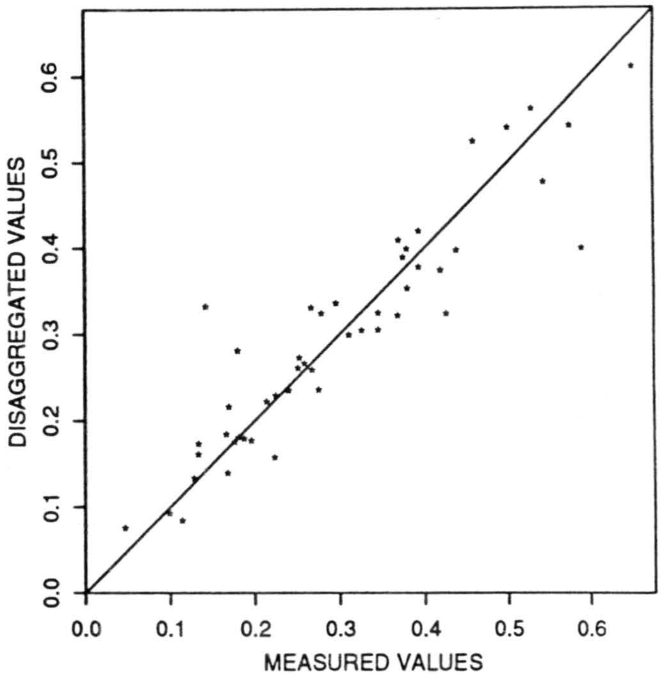
MEAN = 2.1736054 CORRELATION = 0.7974626
RMSE = 0.8808071 n = 74

ORDER 0 DISAGGREGATION FOR NSOILC



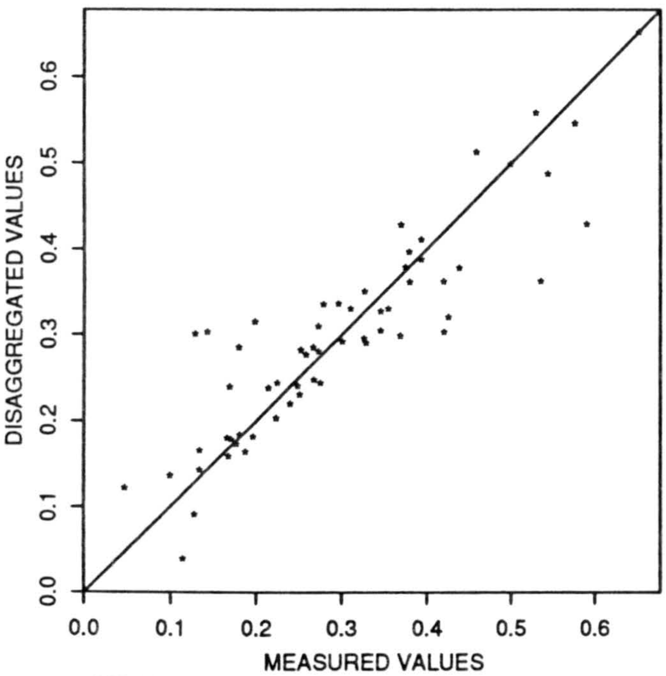
MEAN = 0.2891765 CORRELATION = 0.8610381
RMSE = 0.0693906 n = 68

ORDER 2 DISAGGREGATION FOR NSOILC



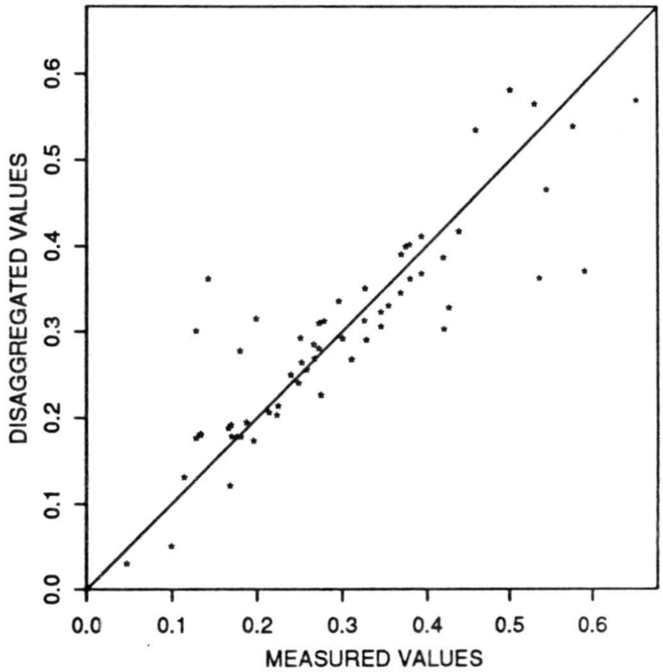
MEAN = 0.29995000 CORRELATION = 0.92356861
RMSE = 0.05423973 n = 48

ORDER 1A DISAGGREGATION FOR NSOILC



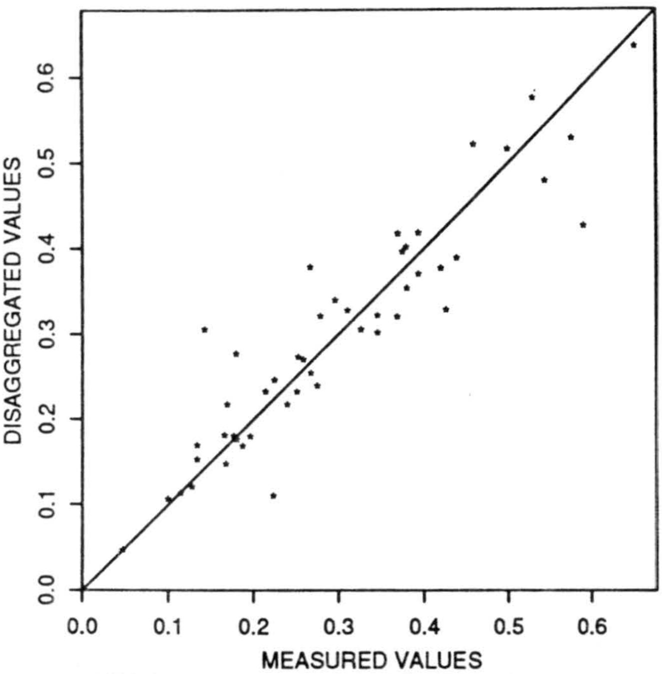
MEAN = 0.29927667 CORRELATION = 0.89272249
RMSE = 0.06091159 n = 60

ORDER 1B DISAGGREGATION FOR NSOILC



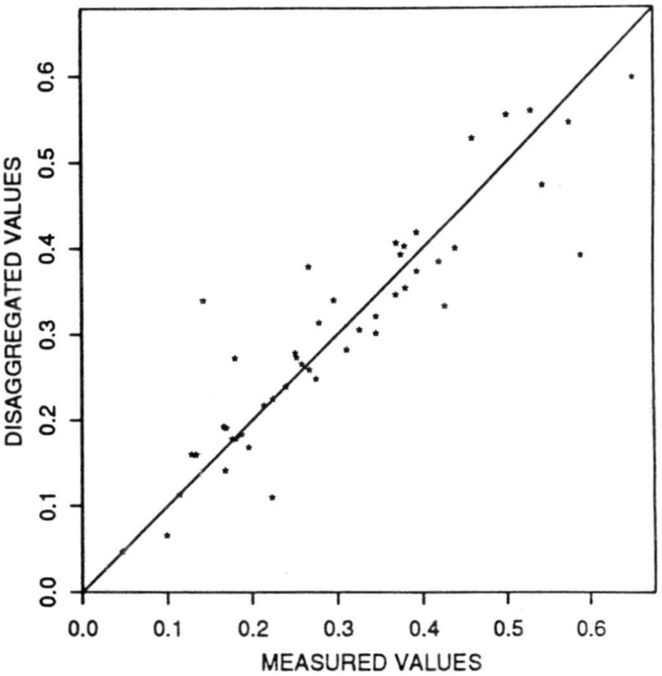
MEAN = 0.29927500 CORRELATION = 0.87094951
RMSE = 0.06635818 n = 60

ORDER 3A DISAGGREGATION FOR NSOILC



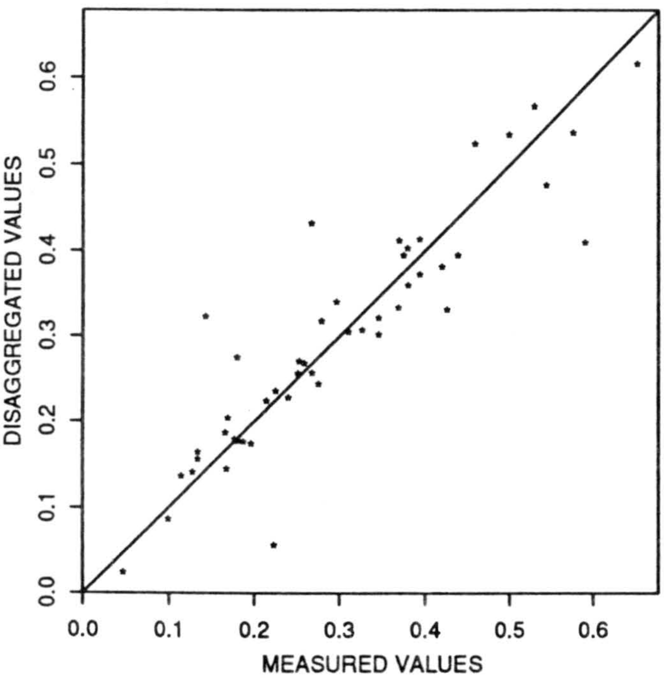
MEAN = 0.29995000 CORRELATION = 0.92559665
RMSE = 0.05353868 n = 48

ORDER 3B DISAGGREGATION FOR NSOILC



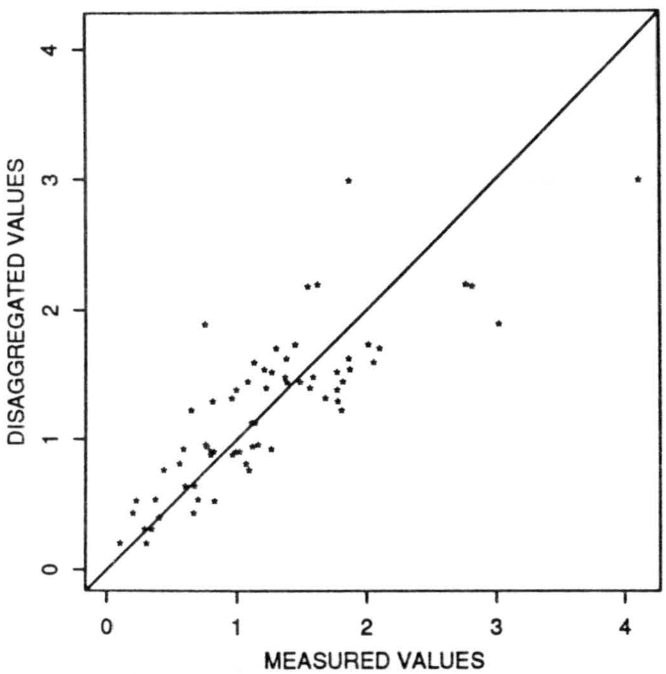
MEAN = 0.29995000 CORRELATION = 0.91326225
RMSE = 0.05766575 n = 48

ORDER 4 DISAGGREGATION FOR NSOILC



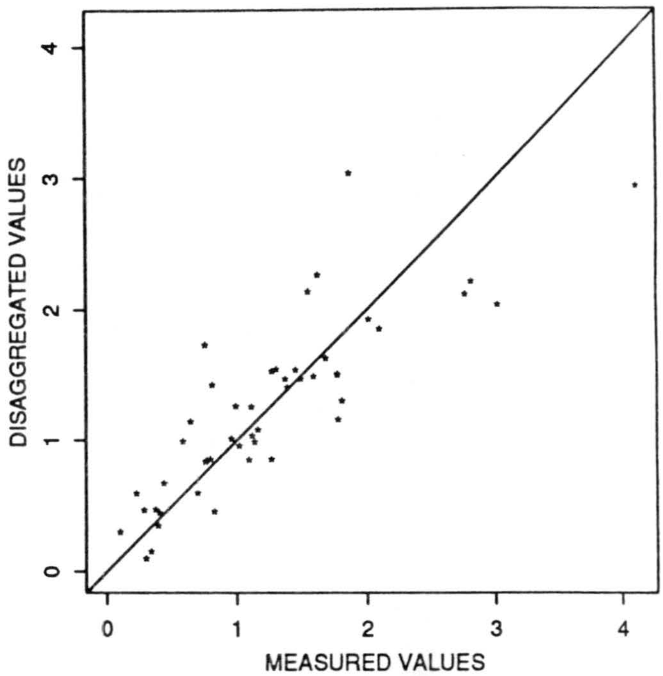
MEAN = 0.29995000 CORRELATION = 0.90572476
RMSE = 0.06029849 n = 48

ORDER 0 DISAGGREGATION FOR NOMHC



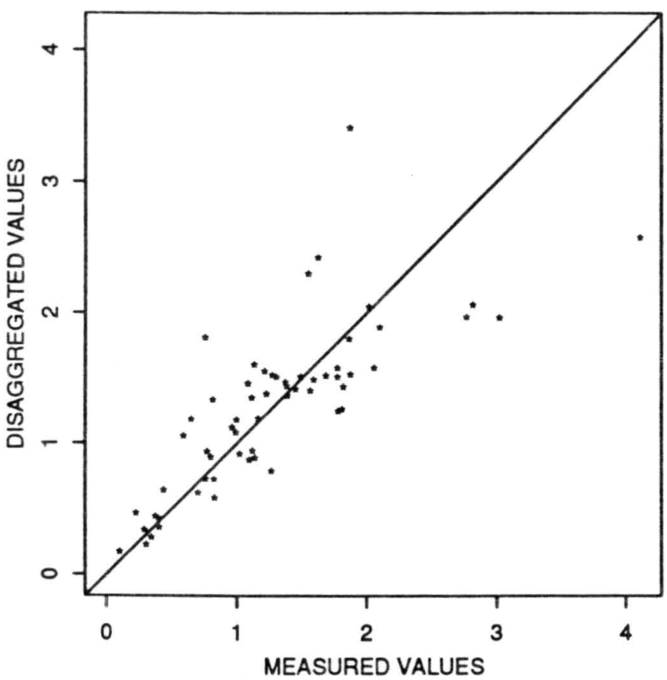
MEAN = 1.2142206 CORRELATION = 0.8277357
RMSE = 0.4035553 n = 68

ORDER 2 DISAGGREGATION FOR NOMHC



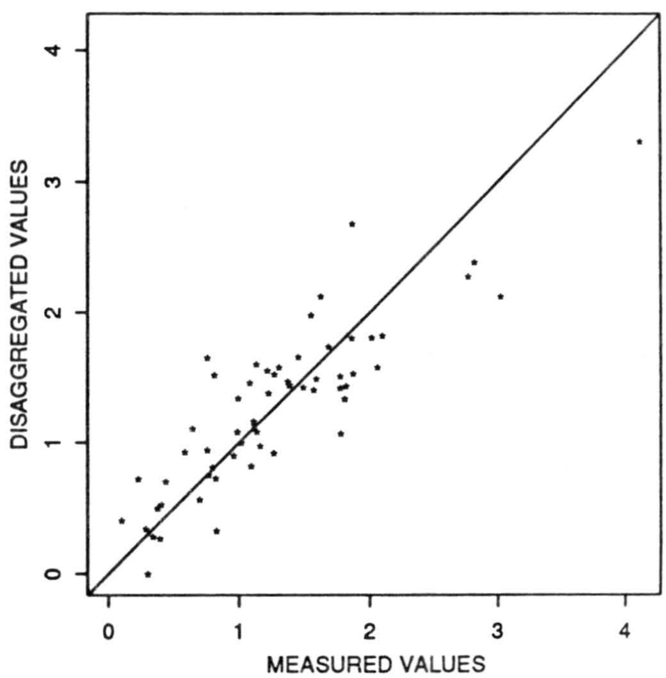
MEAN = 1.2496479 CORRELATION = 0.8399959
RMSE = 0.4299491 n = 48

ORDER 1A DISAGGREGATION FOR NOMHC



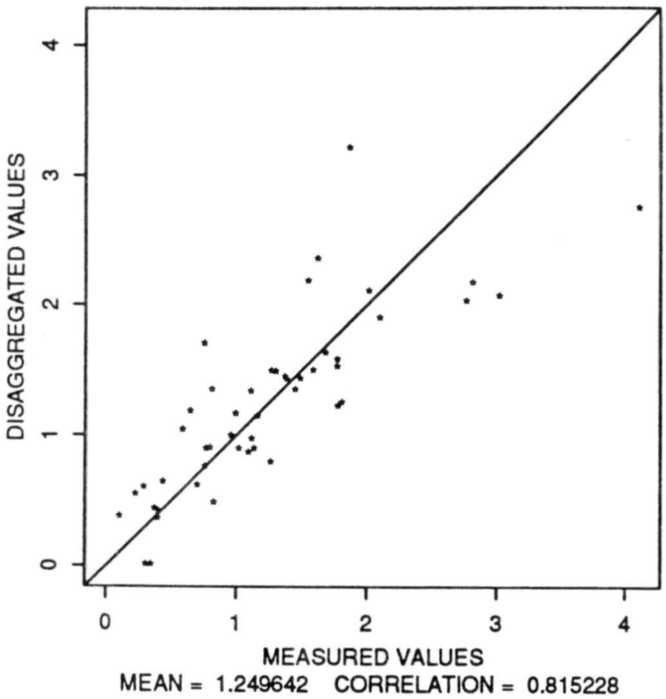
MEAN = 1.2837367 CORRELATION = 0.7789418
RMSE = 0.4616889 n = 60

ORDER 1B DISAGGREGATION FOR NOMHC



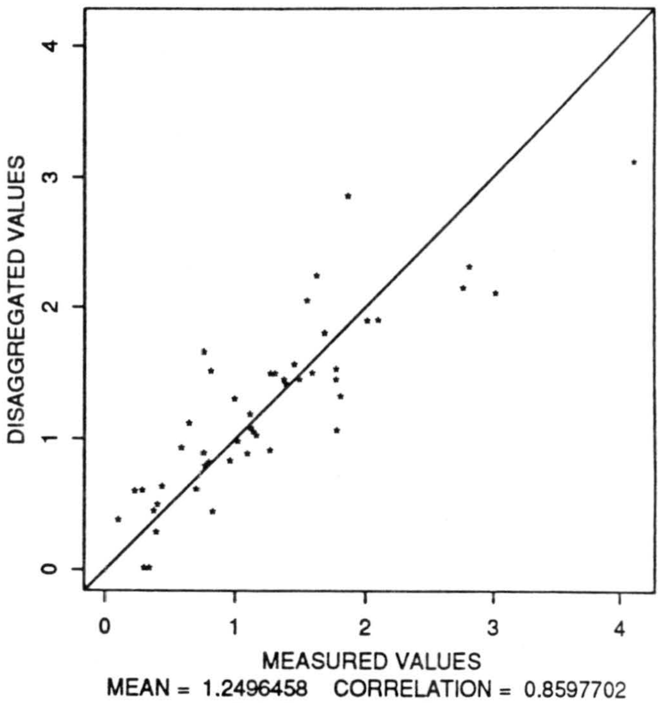
MEAN = 1.2837400 CORRELATION = 0.8650046
RMSE = 0.3680891 n = 60

ORDER 3A DISAGGREGATION FOR NOMHC



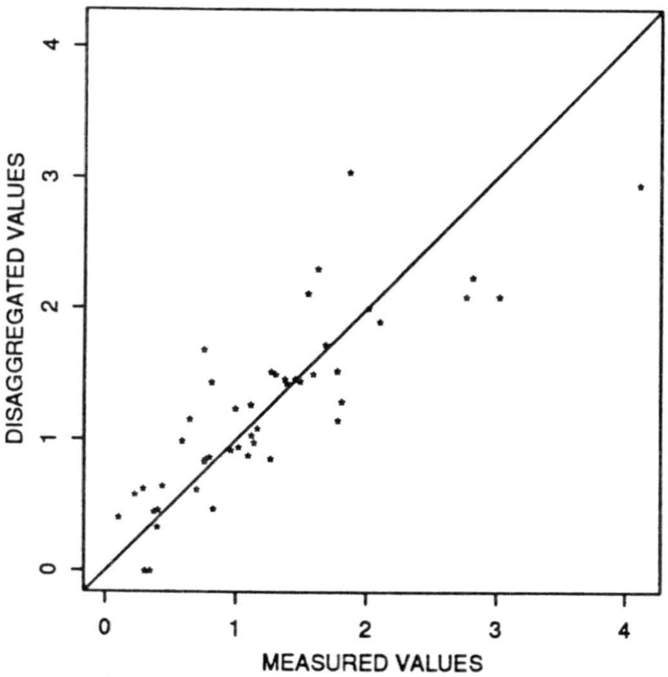
MEAN = 1.249642 CORRELATION = 0.815228
RMSE = 0.459748 n = 48

ORDER 3B DISAGGREGATION FOR NOMHC



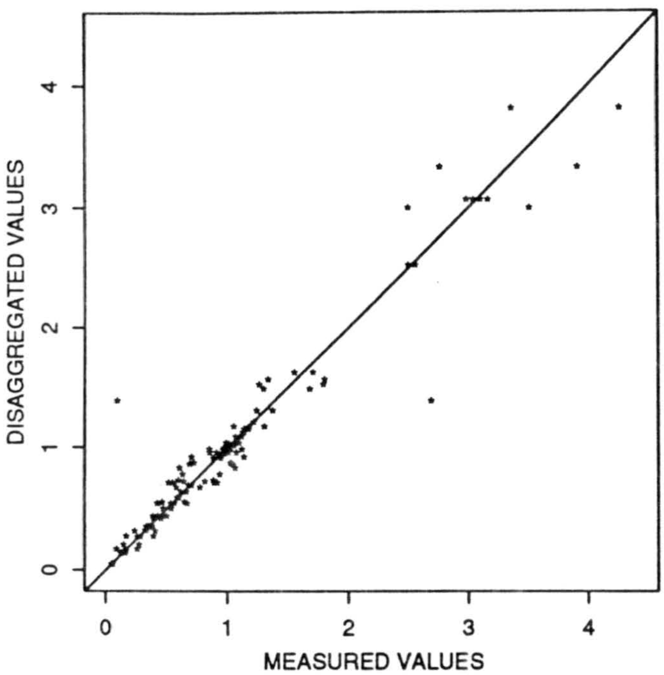
MEAN = 1.2496458 CORRELATION = 0.8597702
RMSE = 0.4047421 n = 48

ORDER 4 DISAGGREGATION FOR NOMHC



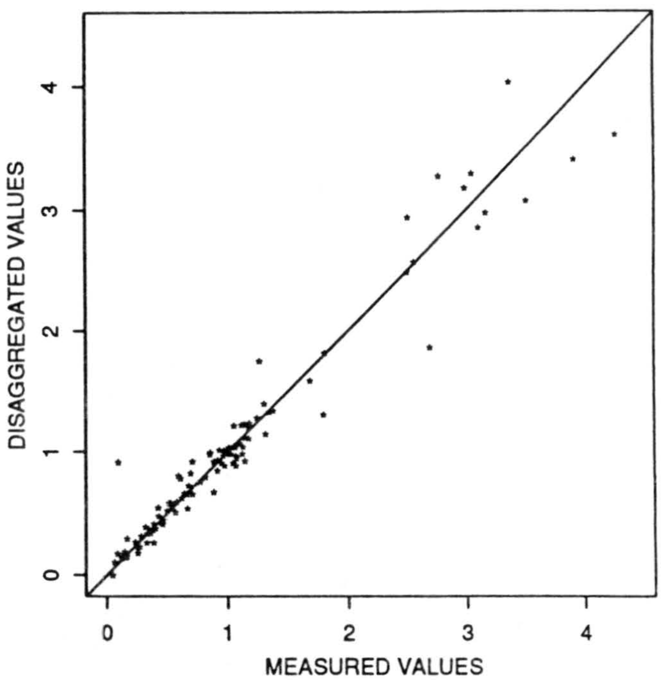
MEAN = 1.2496437 CORRELATION = 0.8398414
RMSE = 0.4301645 n = 48

ORDER 0 DISAGGREGATION FOR BSO4C



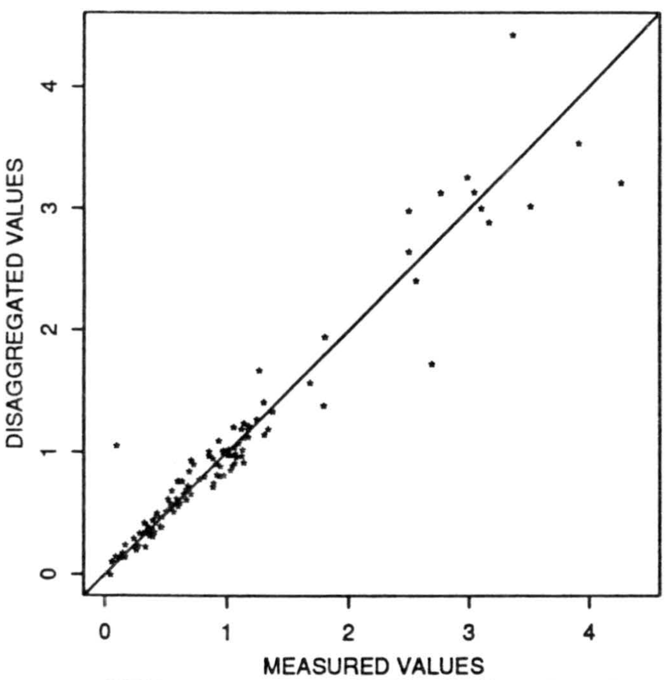
MEAN = 1.0256644 CORRELATION = 0.9630613
RMSE = 0.2276625 n = 118

ORDER 2 DISAGGREGATION FOR BSO4C



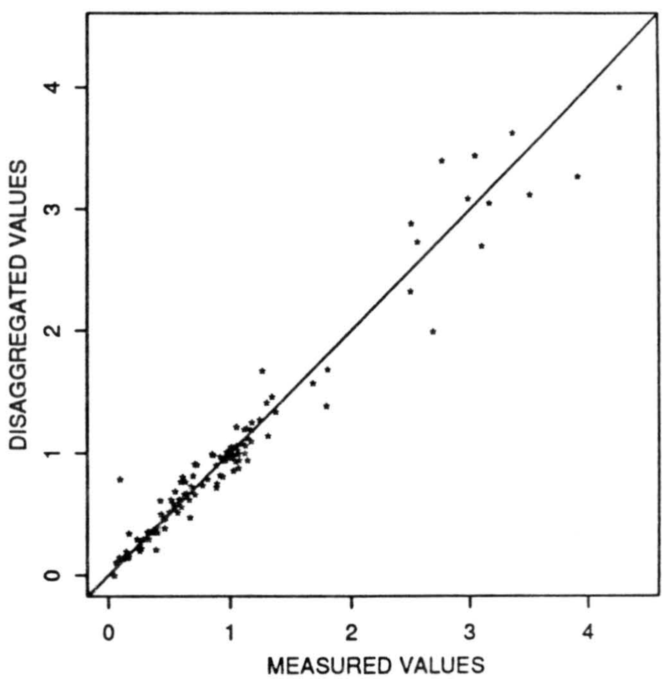
MEAN = 1.0409894 CORRELATION = 0.9725697
RMSE = 0.2067624 n = 104

ORDER 1A DISAGGREGATION FOR BSO4C



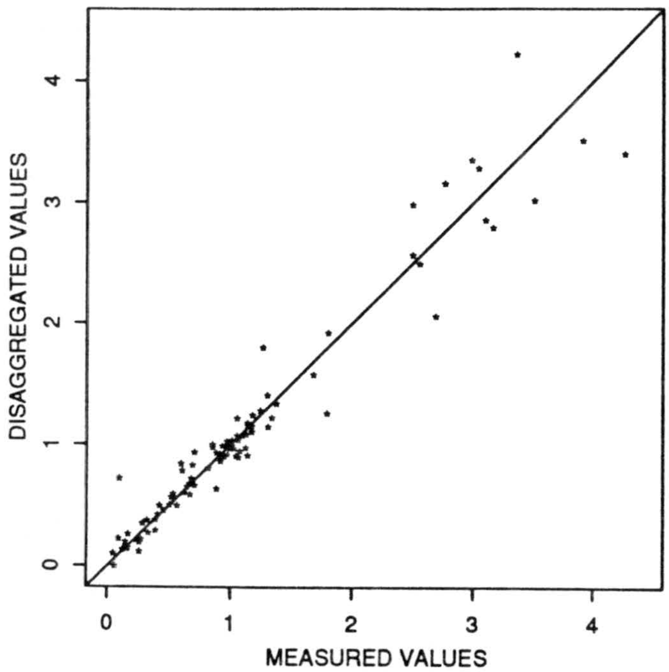
MEAN = 1.0197723 CORRELATION = 0.9618292
RMSE = 0.2358705 n = 112

ORDER 1B DISAGGREGATION FOR BSO4C



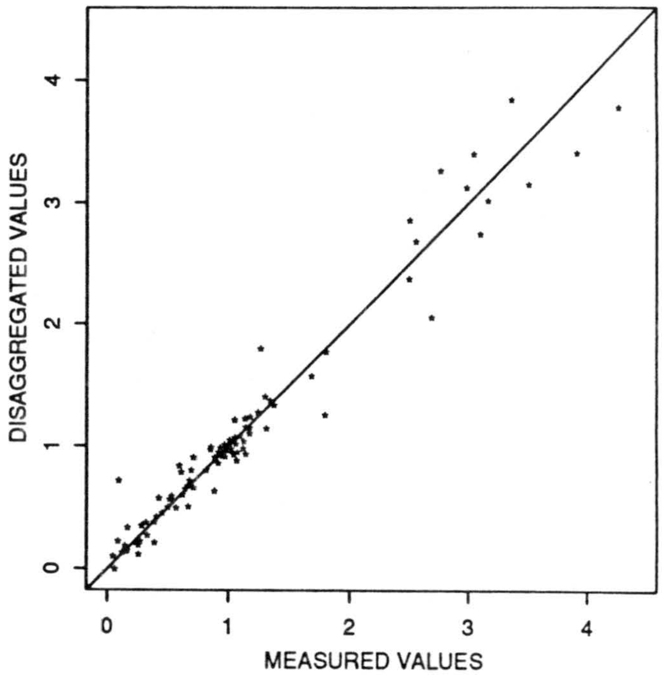
MEAN = 1.0197687 CORRELATION = 0.9769443
RMSE = 0.1839064 n = 112

ORDER 3A DISAGGREGATION FOR BSO4C



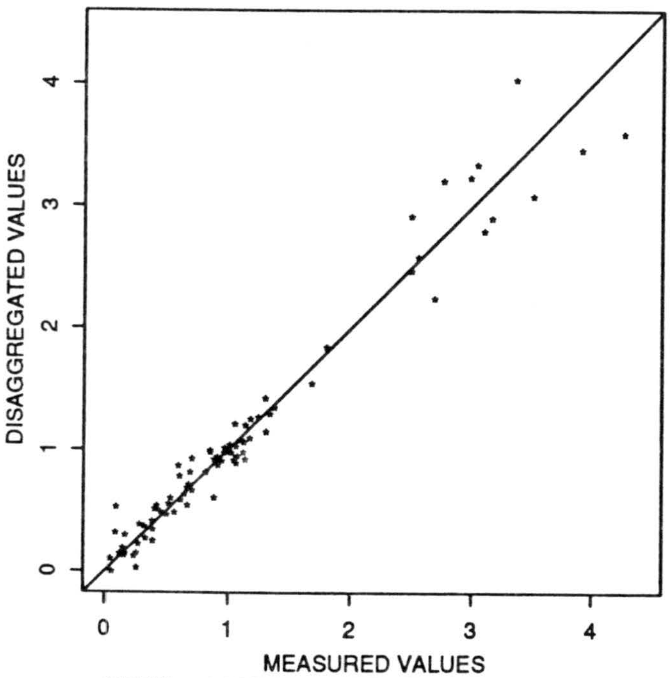
MEAN = 1.1021250 CORRELATION = 0.9695124
RMSE = 0.2262154 n = 92

ORDER 3B DISAGGREGATION FOR BSO4C



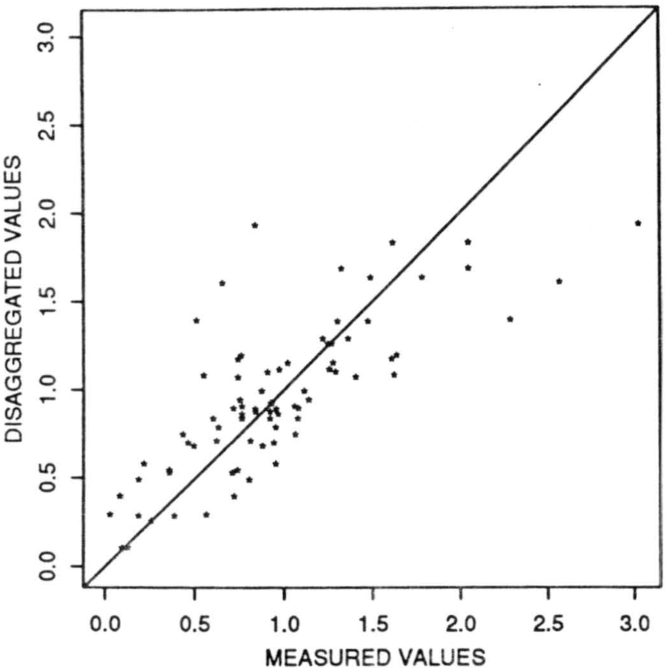
MEAN = 1.1021250 CORRELATION = 0.9768143
RMSE = 0.1976146 n = 92

ORDER 4 DISAGGREGATION FOR BSO4C



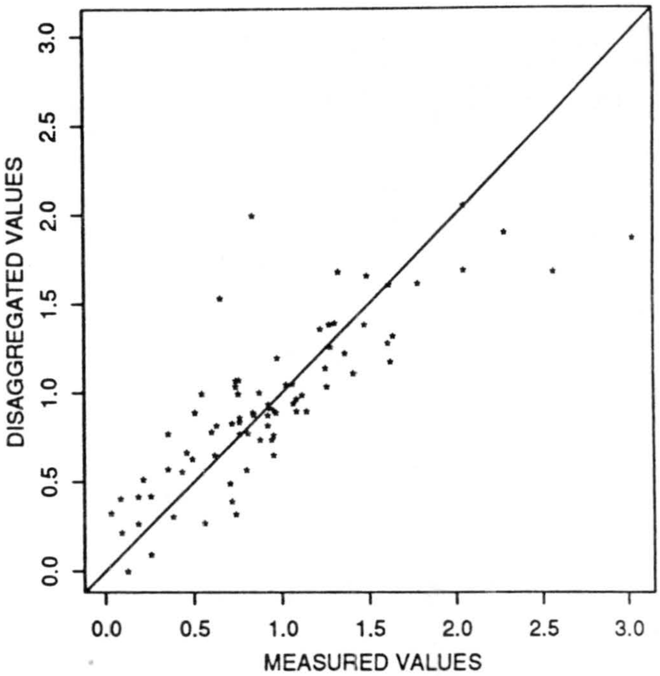
MEAN = 1.0959131 CORRELATION = 0.9794598
RMSE = 0.1940423 n = 84

ORDER 0 DISAGGREGATION FOR COCC



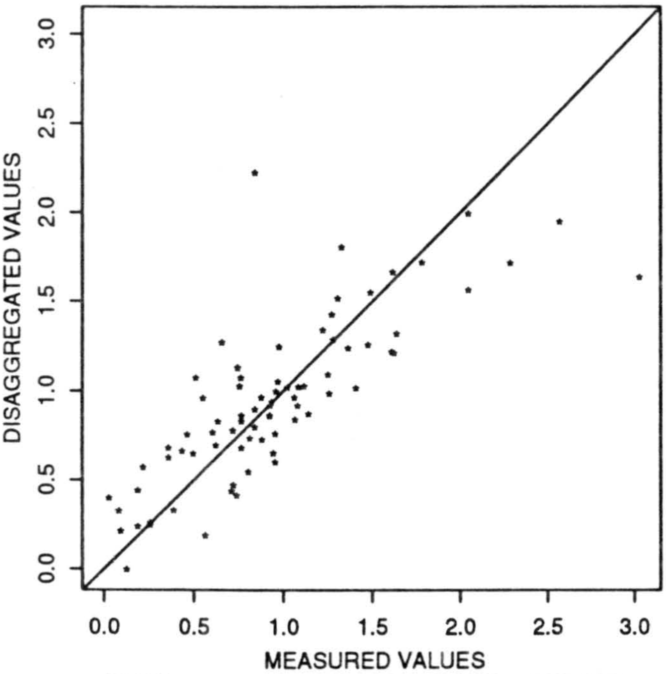
MEAN = 0.9530750 CORRELATION = 0.7757584
RMSE = 0.3490377 n = 80

ORDER 2 DISAGGREGATION FOR COCC



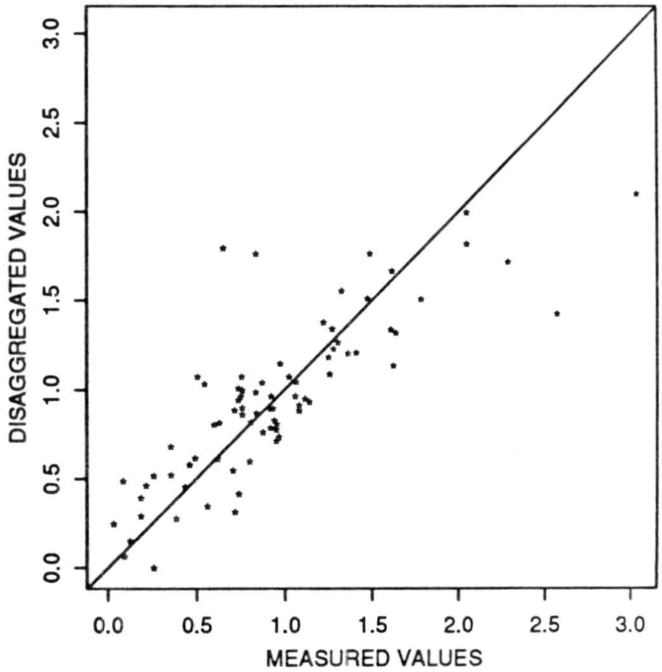
MEAN = 0.9492756 CORRELATION = 0.8259664
RMSE = 0.3151962 n = 78

ORDER 1A DISAGGREGATION FOR COCC



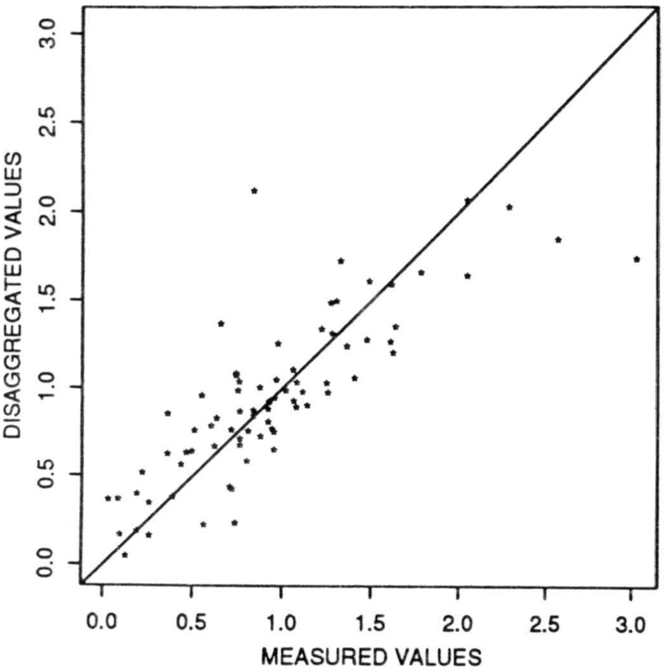
MEAN = 0.9492744 CORRELATION = 0.7917998
RMSE = 0.3414270 n = 78

ORDER 1B DISAGGREGATION FOR COCC



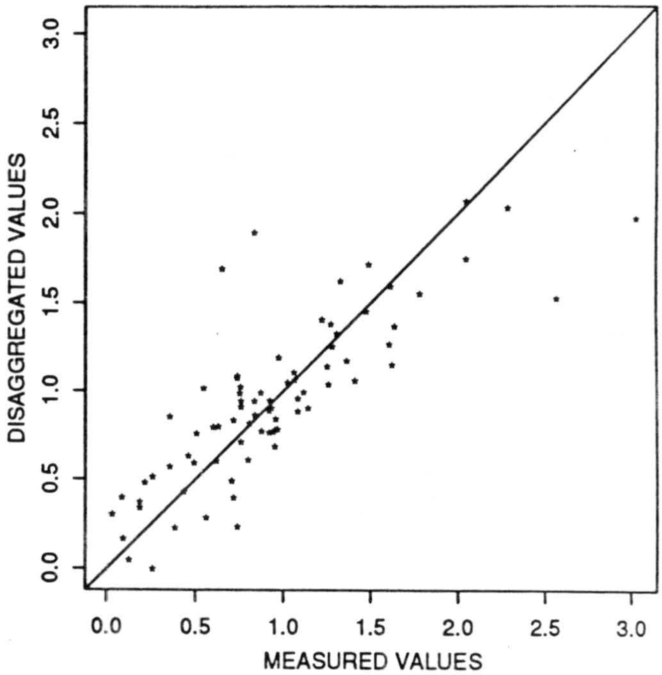
MEAN = 0.9492769 CORRELATION = 0.8211923
RMSE = 0.3189612 n = 78

ORDER 3A DISAGGREGATION FOR COCC



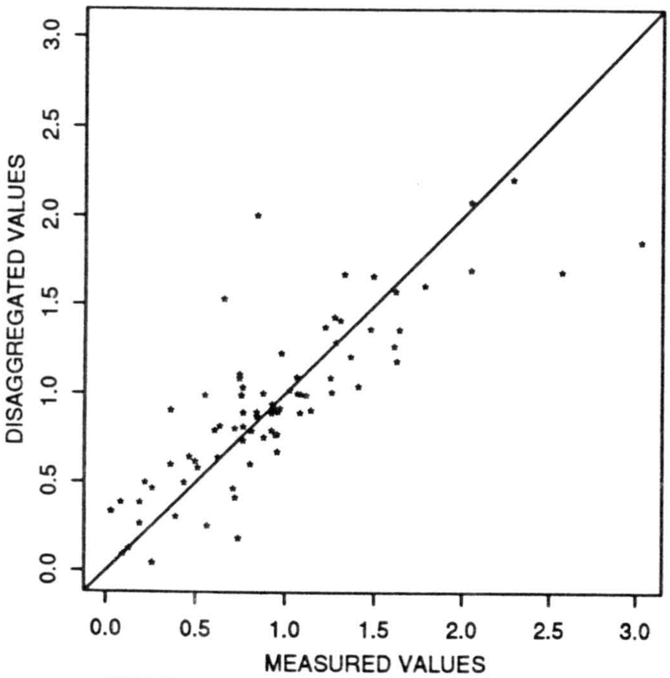
MEAN = 0.9492769 CORRELATION = 0.8198218
RMSE = 0.3200046 n = 78

ORDER 3B DISAGGREGATION FOR COCC



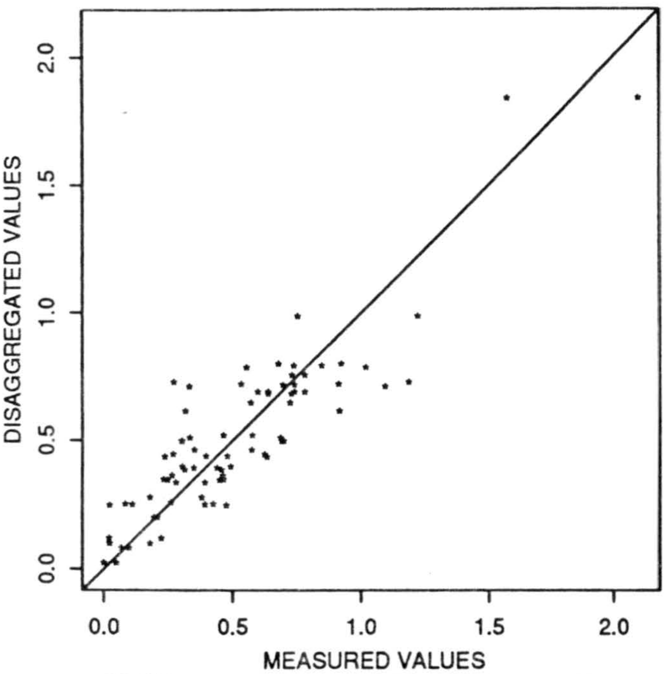
MEAN = 0.9492744 CORRELATION = 0.8215450
RMSE = 0.3185959 n = 78

ORDER 4 DISAGGREGATION FOR COCC



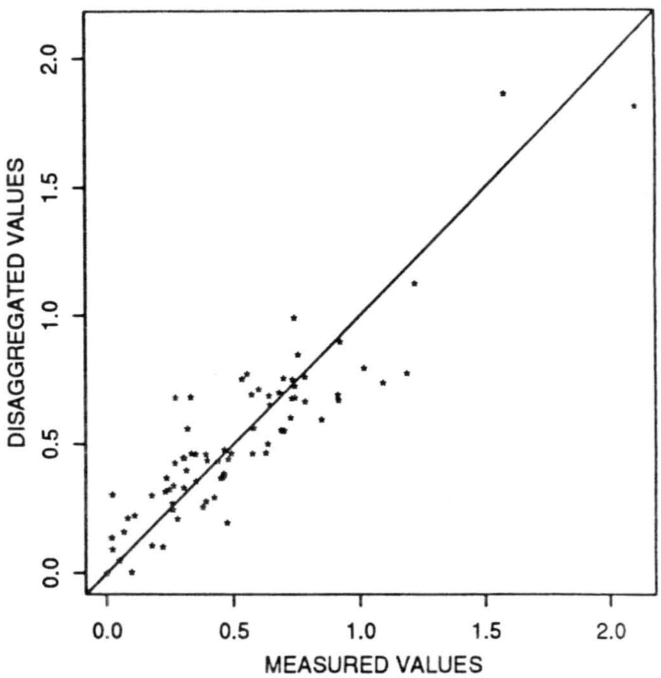
MEAN = 0.9492782 CORRELATION = 0.8247002
RMSE = 0.3161021 n = 78

ORDER 0 DISAGGREGATION FOR CECC



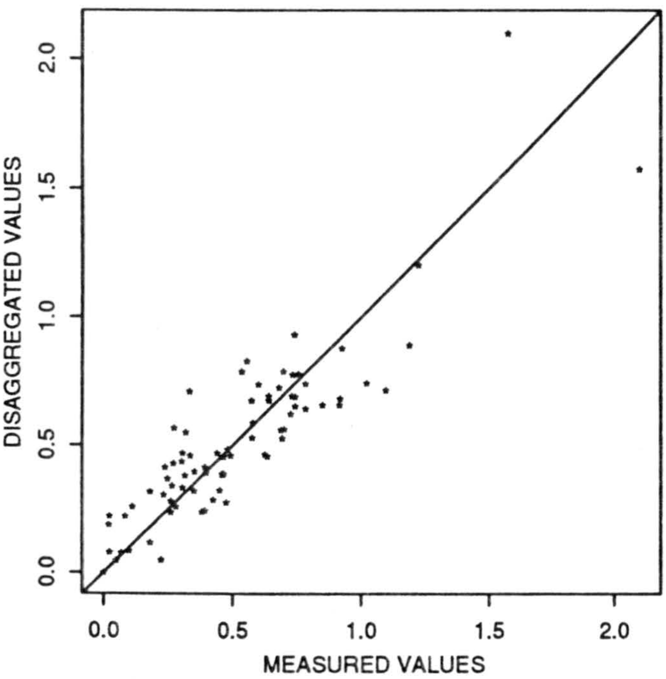
MEAN = 0.5094825 CORRELATION = 0.8859714
RMSE = 0.1639608 n = 80

ORDER 2 DISAGGREGATION FOR CECC



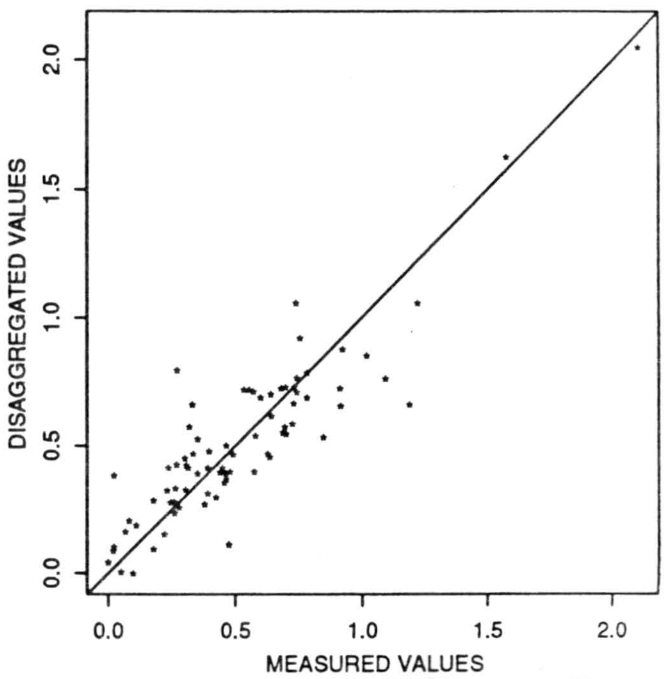
MEAN = 0.5174269 CORRELATION = 0.8988337
RMSE = 0.1553772 n = 78

ORDER 1A DISAGGREGATION FOR CECC



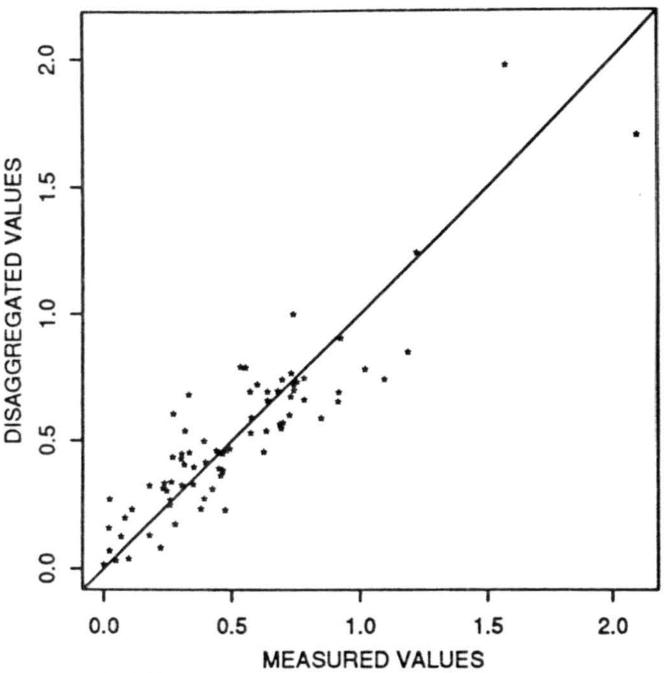
MEAN = 0.5174269 CORRELATION = 0.8842562
RMSE = 0.1657998 n = 78

ORDER 1B DISAGGREGATION FOR CECC



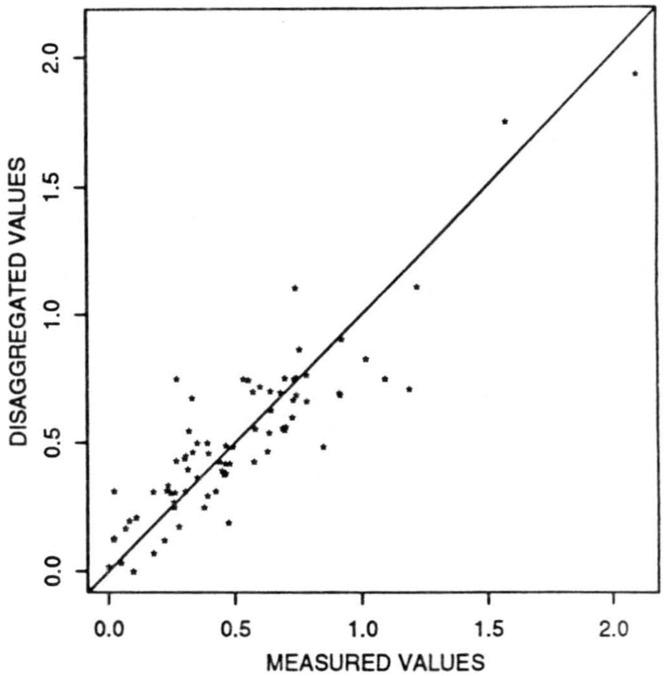
MEAN = 0.5174295 CORRELATION = 0.8871444
RMSE = 0.1637699 n = 78

ORDER 3A DISAGGREGATION FOR CECC



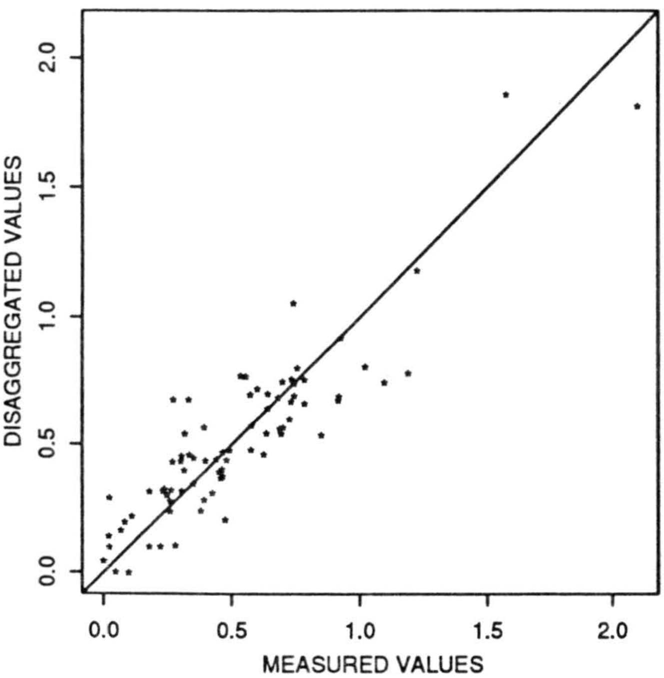
MEAN = 0.5174256 CORRELATION = 0.8992305
RMSE = 0.1551547 n = 78

ORDER 3B DISAGGREGATION FOR CECC



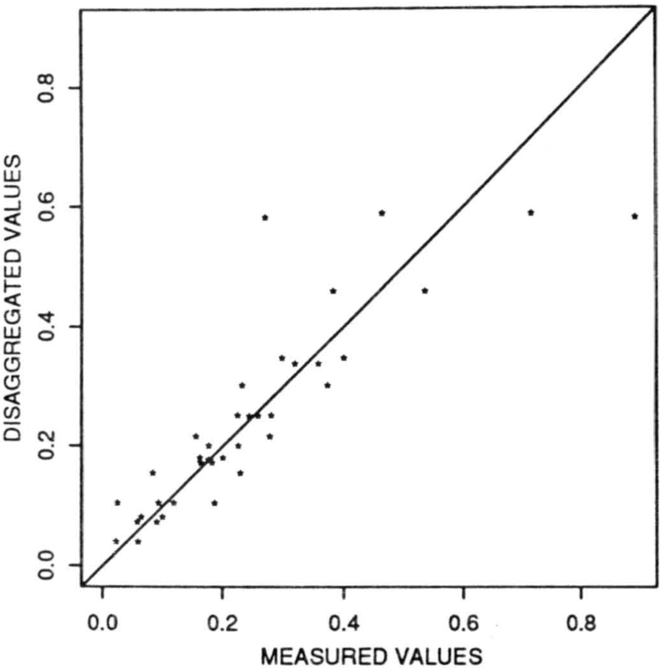
MEAN = 0.5174308 CORRELATION = 0.8924803
RMSE = 0.1600312 n = 78

ORDER 4 DISAGGREGATION FOR CECC



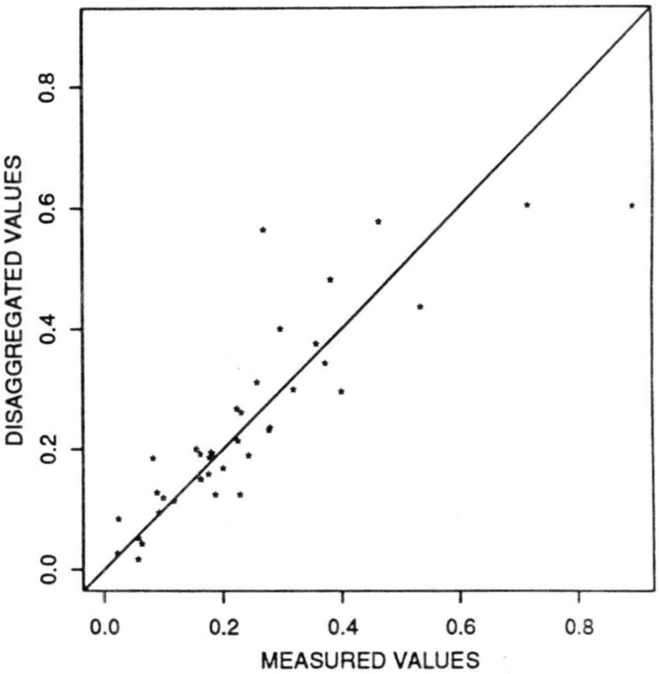
MEAN = 0.5174282 CORRELATION = 0.8967299
RMSE = 0.1569790 n = 78

ORDER 0 DISAGGREGATION FOR ENO3C



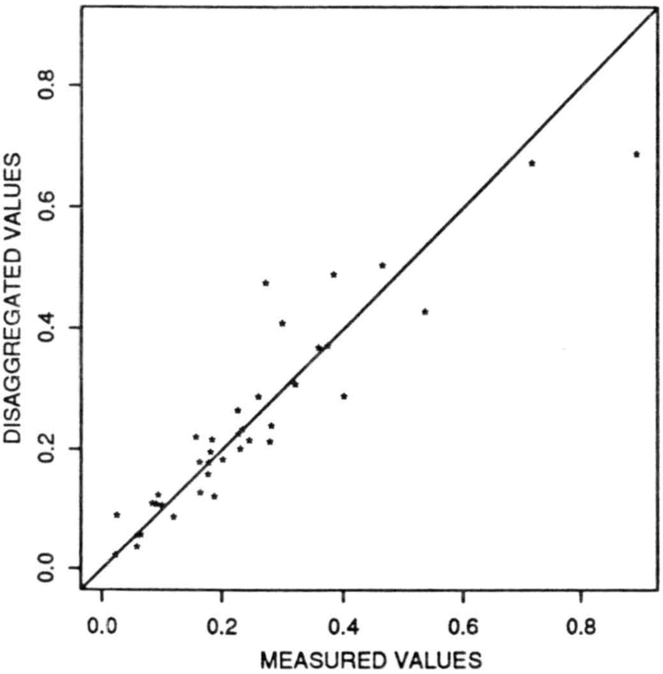
MEAN = 0.24427895 CORRELATION = 0.87247157
RMSE = 0.08750023 n = 38

ORDER 2 DISAGGREGATION FOR ENO3C



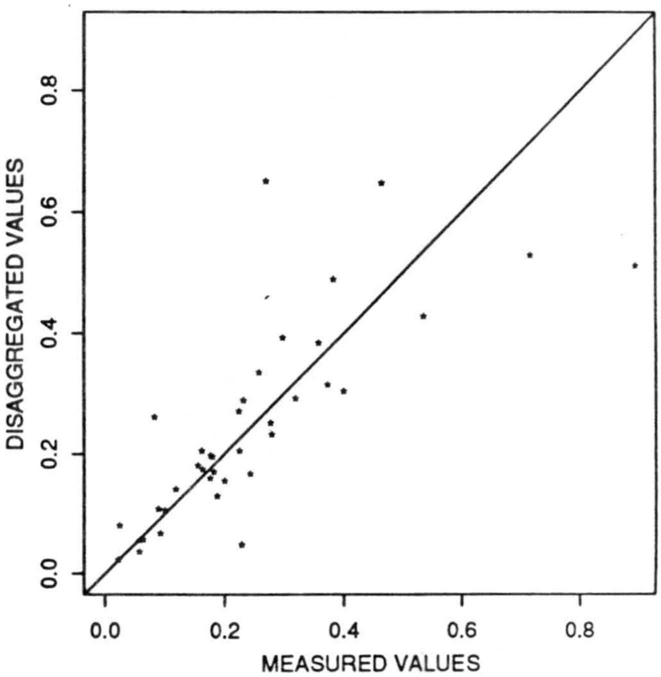
MEAN = 0.24428947 CORRELATION = 0.87292874
RMSE = 0.08740429 n = 38

ORDER 1A DISAGGREGATION FOR ENO3C



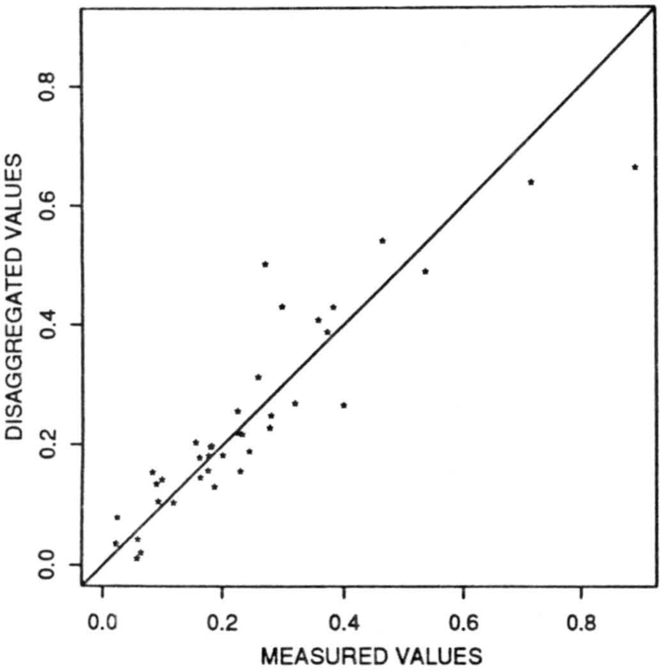
MEAN = 0.2442868 CORRELATION = 0.9302019
RMSE = 0.0658479 n = 38

ORDER 1B DISAGGREGATION FOR ENO3C



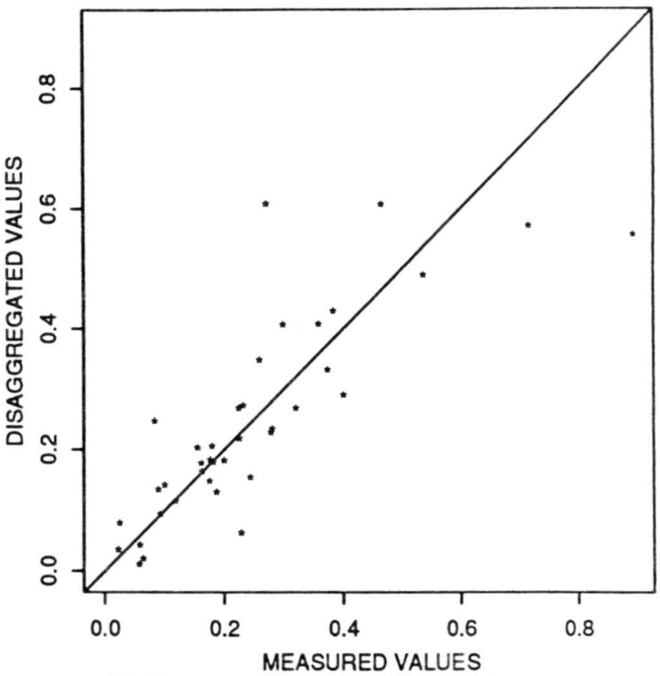
MEAN = 0.2442895 CORRELATION = 0.7762865
RMSE = 0.1153235 n = 38

ORDER 3A DISAGGREGATION FOR ENO3C



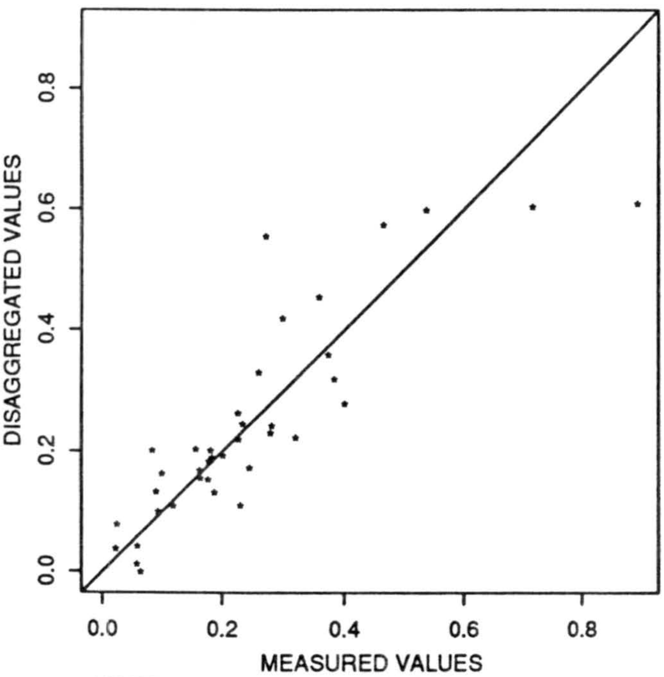
MEAN = 0.24428684 CORRELATION = 0.91230839
RMSE = 0.07332587 n = 38

ORDER 3B DISAGGREGATION FOR ENO3C



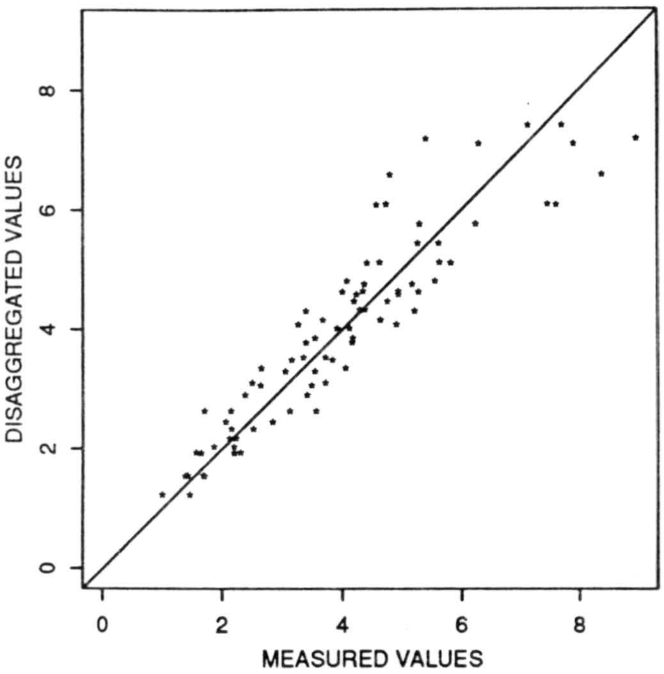
MEAN = 0.2442868 CORRELATION = 0.8234646
RMSE = 0.1027199 n = 38

ORDER 4 DISAGGREGATION FOR ENO3C



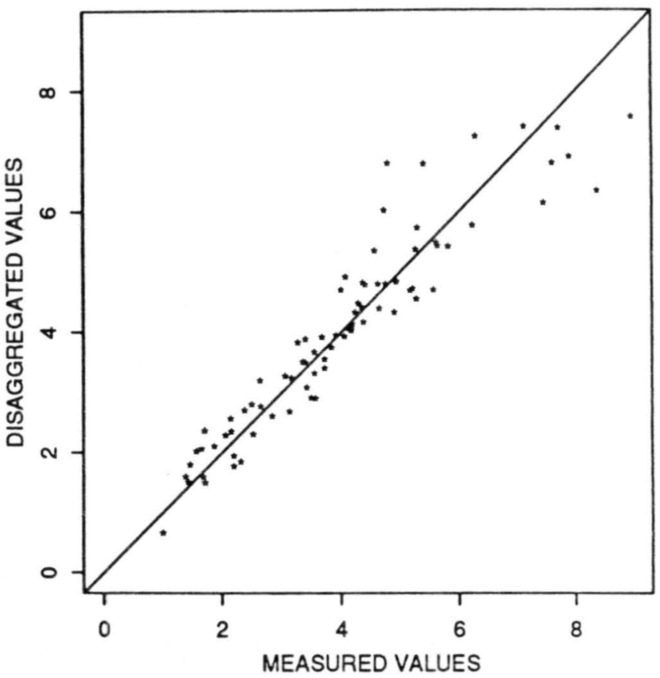
MEAN = 0.24428684 CORRELATION = 0.86660373
RMSE = 0.09006483 n = 38

ORDER 0 DISAGGREGATION FOR FFPMC



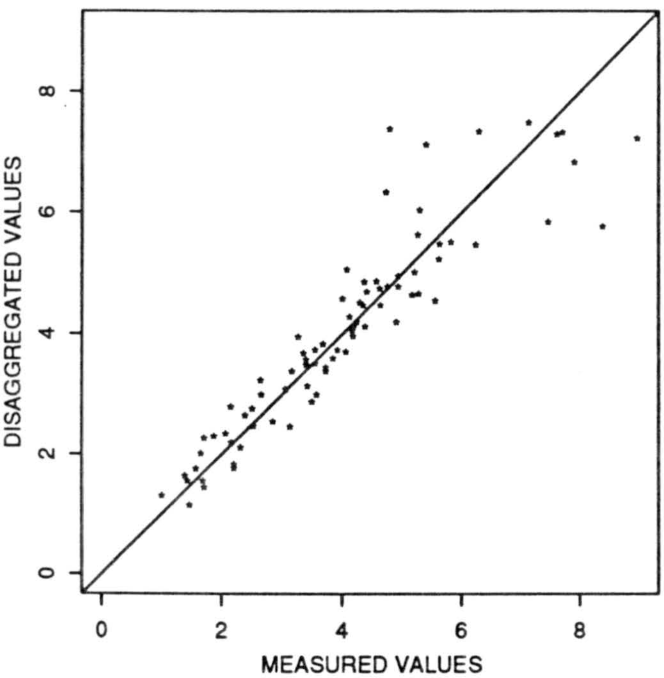
MEAN = 3.9897439 CORRELATION = 0.9213287
RMSE = 0.6780683 n = 82

ORDER 2 DISAGGREGATION FOR FFPMC



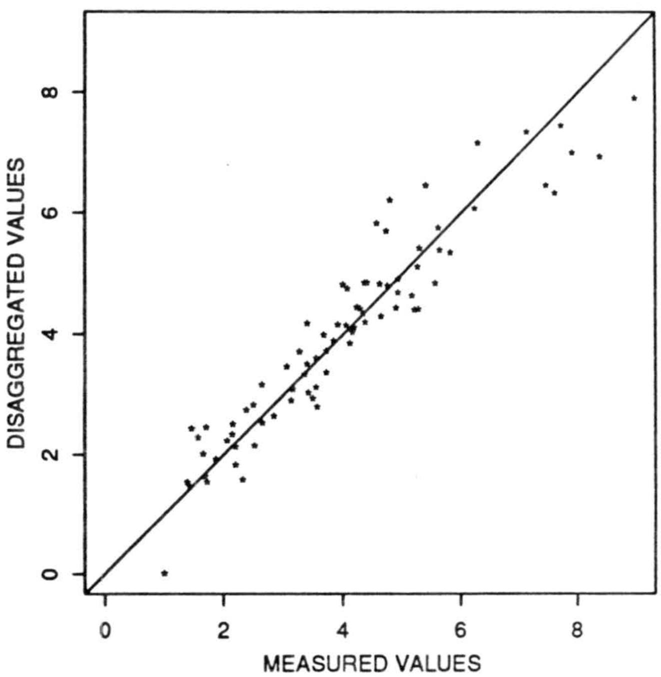
MEAN = 4.0350525 CORRELATION = 0.9411251
RMSE = 0.5890755 n = 80

ORDER 1A DISAGGREGATION FOR FFPMC



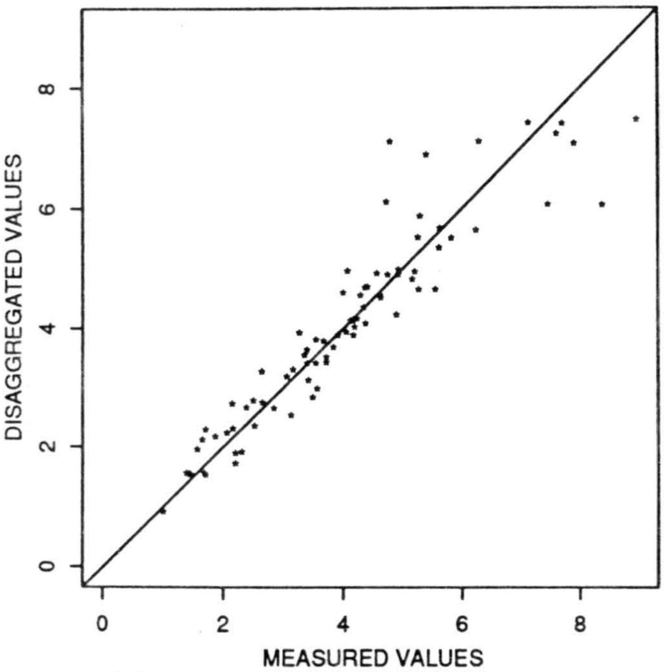
MEAN = 4.0350500 CORRELATION = 0.9184328
RMSE = 0.6899622 n = 80

ORDER 1B DISAGGREGATION FOR FFPMC



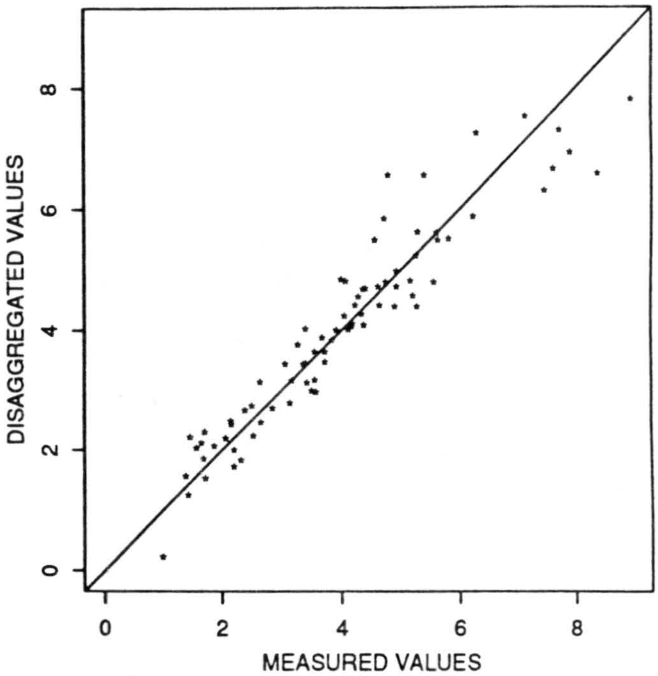
MEAN = 4.0350512 CORRELATION = 0.9465481
RMSE = 0.5619508 n = 80

ORDER 3A DISAGGREGATION FOR FFPMC



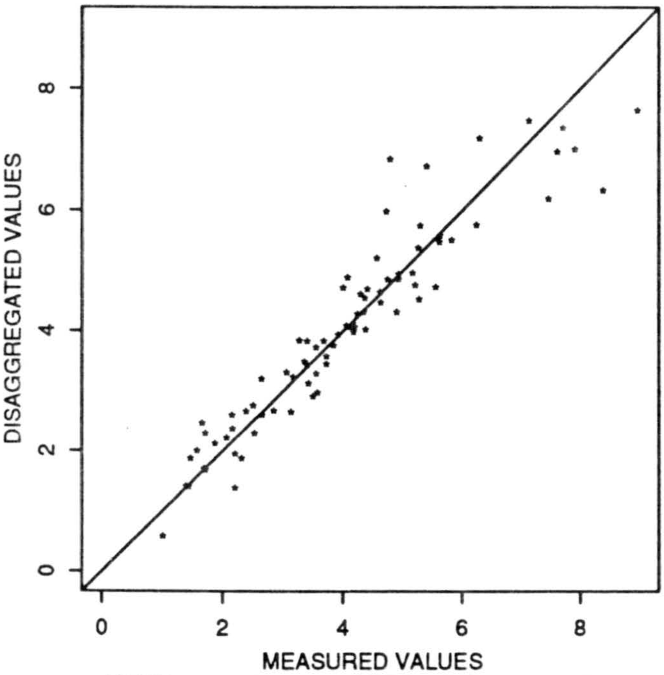
MEAN = 4.0350525 CORRELATION = 0.9366016
RMSE = 0.6103049 n = 80

ORDER 3B DISAGGREGATION FOR FFPMC



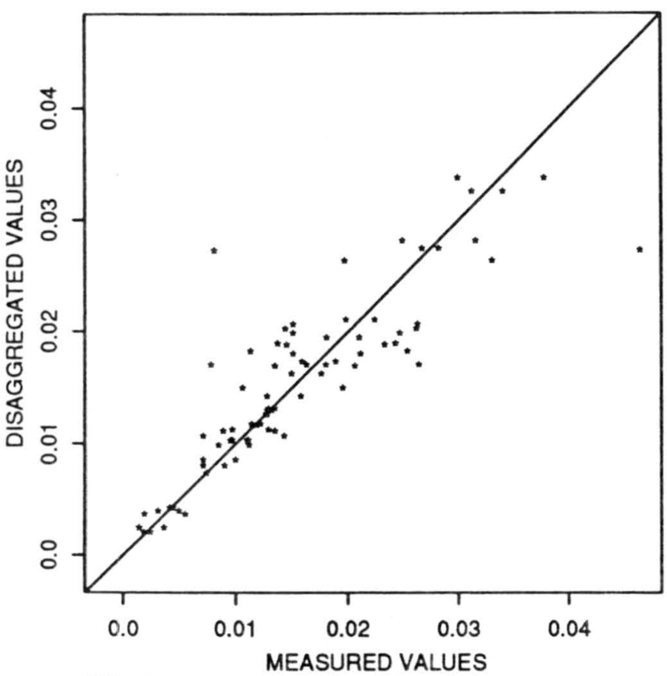
MEAN = 4.0350537 CORRELATION = 0.9471931
RMSE = 0.5587043 n = 80

ORDER 4 DISAGGREGATION FOR FFPMC



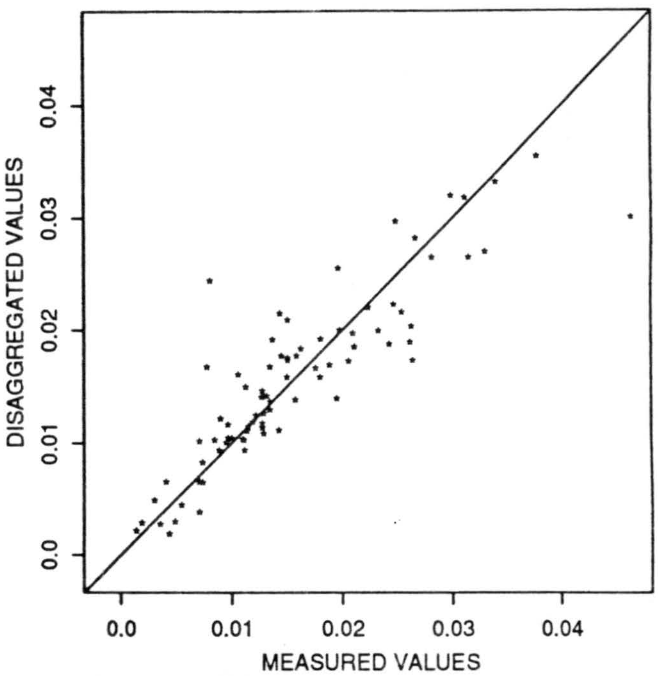
MEAN = 4.0350512 CORRELATION = 0.9427283
RMSE = 0.5810405 n = 80

ORDER 0 DISAGGREGATION FOR FFEC



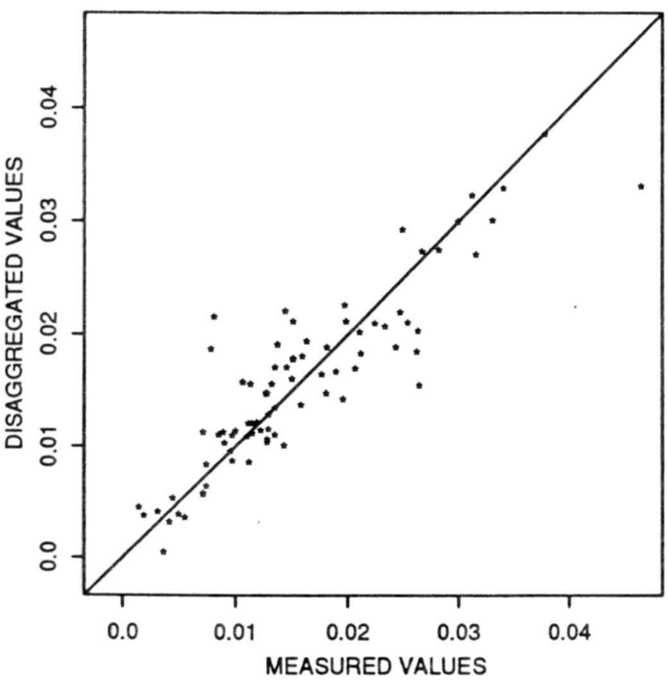
MEAN = 0.015431707 CORRELATION = 0.868888676
RMSE = 0.004420559 n = 82

ORDER 2 DISAGGREGATION FOR FFEC



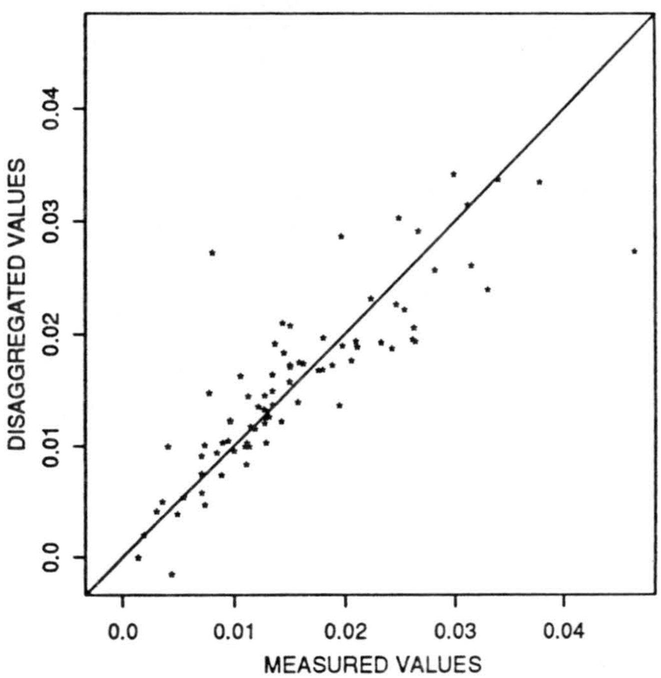
MEAN = 0.015765000 CORRELATION = 0.885179341
RMSE = 0.004088414 n = 80

ORDER 1A DISAGGREGATION FOR FFEC



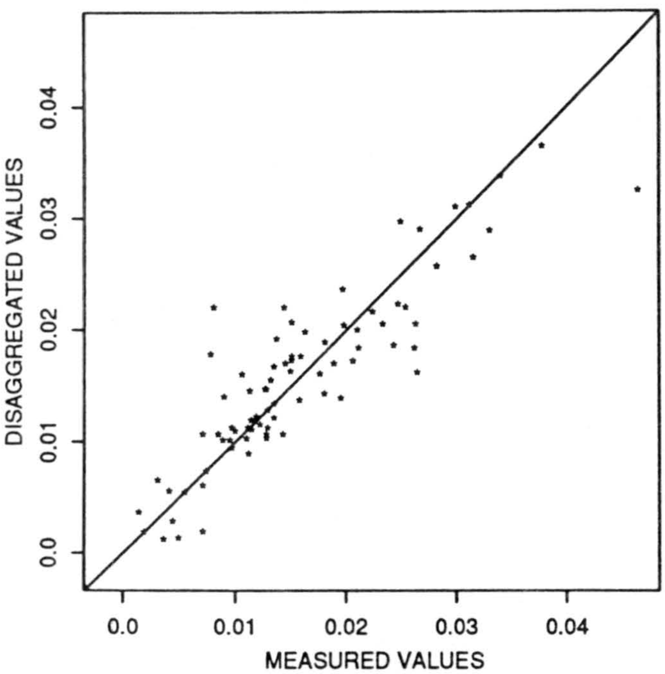
MEAN = 0.015766250 CORRELATION = 0.893688262
RMSE = 0.003942842 n = 80

ORDER 1B DISAGGREGATION FOR FFEC



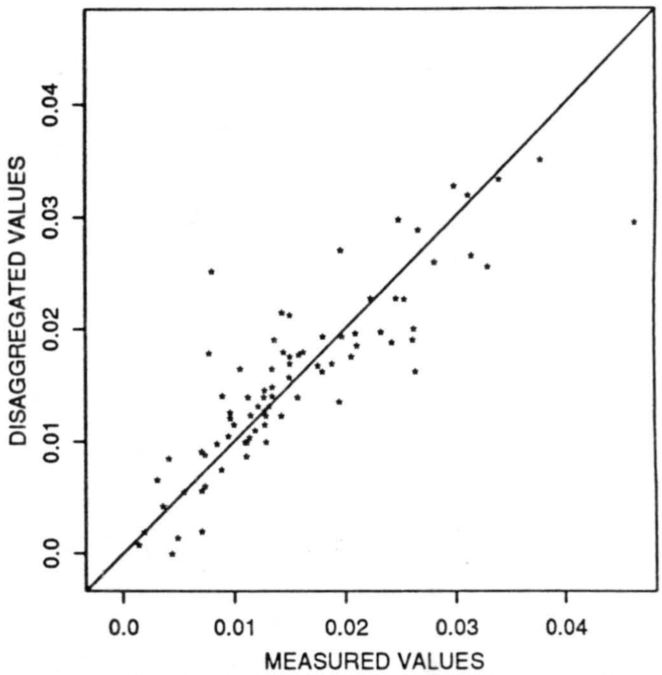
MEAN = 0.015763750 CORRELATION = 0.857816815
RMSE = 0.004521753 n = 80

ORDER 3A DISAGGREGATION FOR FFEC



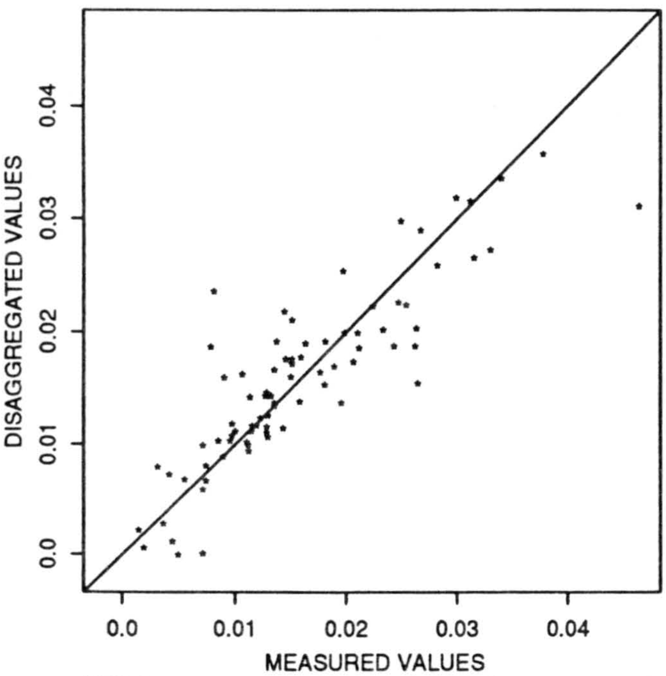
MEAN = 0.01576500 CORRELATION = 0.88979512
RMSE = 0.00400938 n = 80

ORDER 3B DISAGGREGATION FOR FFEC



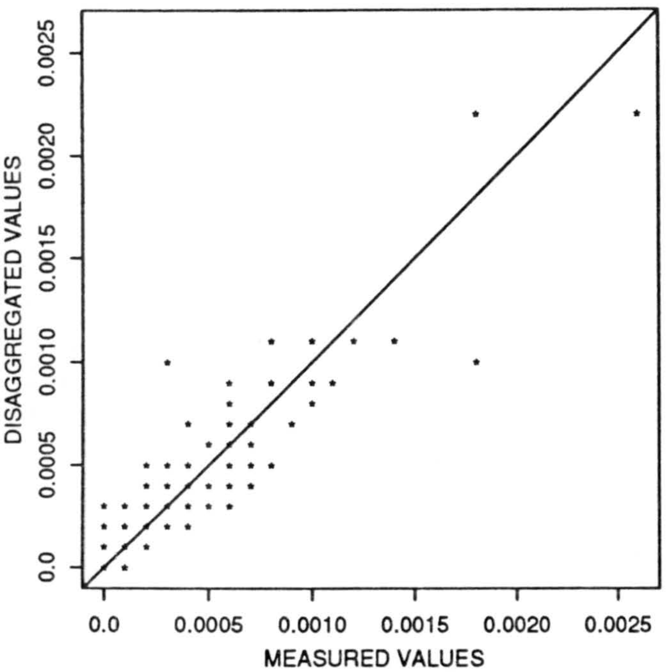
MEAN = 0.015766250 CORRELATION = 0.865076602
RMSE = 0.004412142 n = 80

ORDER 4 DISAGGREGATION FOR FFEC



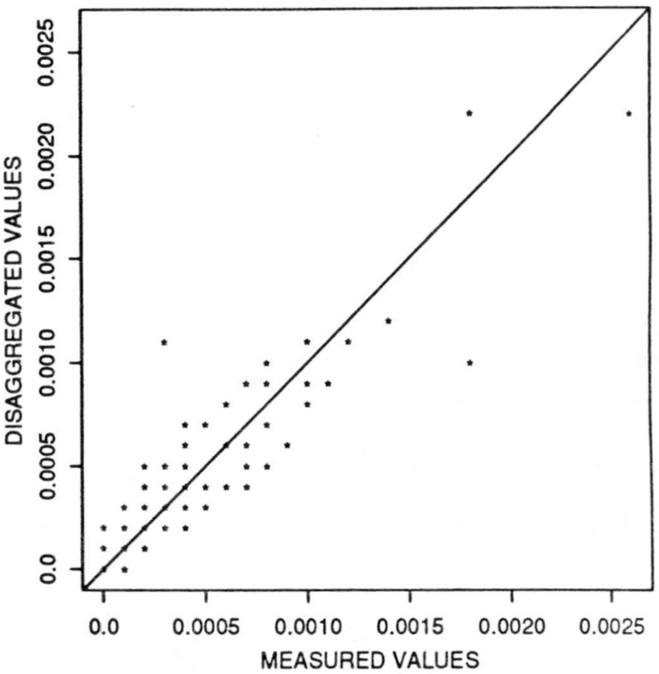
MEAN = 0.015767500 CORRELATION = 0.871418893
RMSE = 0.004314148 n = 80

ORDER 0 DISAGGREGATION FOR FCUC



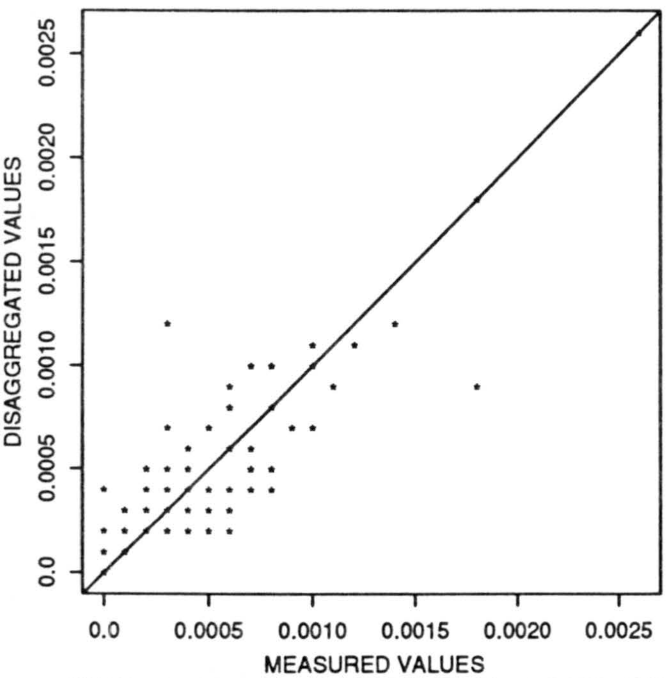
MEAN = 0.0004756098 CORRELATION = 0.8829186559
RMSE = 0.0002068934 n = 82

ORDER 2 DISAGGREGATION FOR FCUC



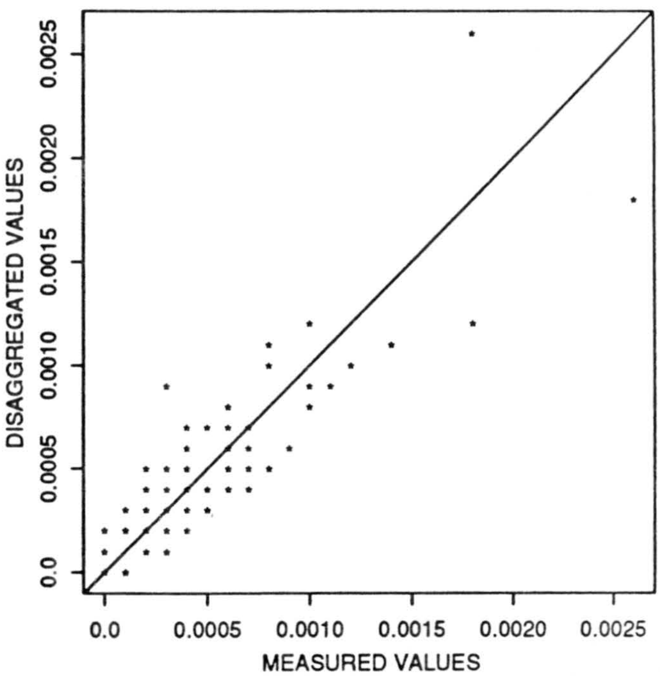
MEAN = 0.0004900000 CORRELATION = 0.8788254857
RMSE = 0.0002103568 n = 80

ORDER 1A DISAGGREGATION FOR FCUC



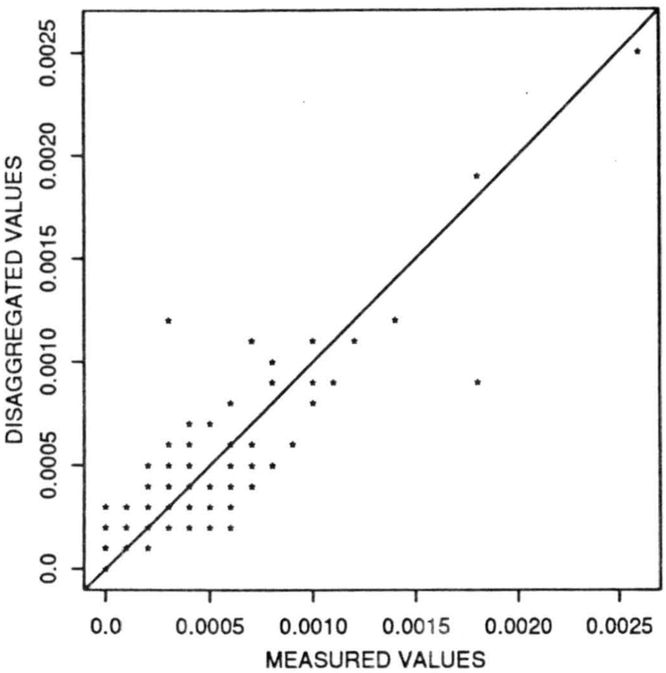
MEAN = 0.0004900000 CORRELATION = 0.8597191572
RMSE = 0.0002263846 n = 80

ORDER 1B DISAGGREGATION FOR FCUC



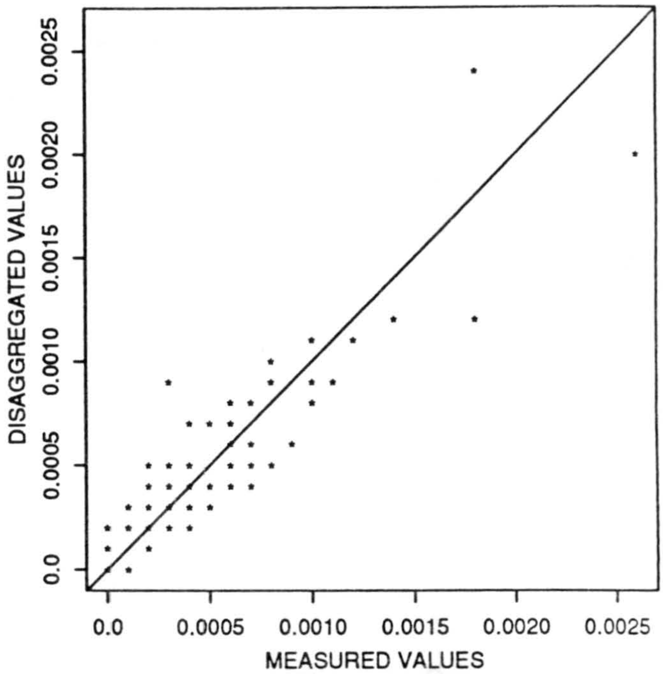
MEAN = 0.0004887500 CORRELATION = 0.8634676337
RMSE = 0.0002238861 n = 80

ORDER 3A DISAGGREGATION FOR FCUC



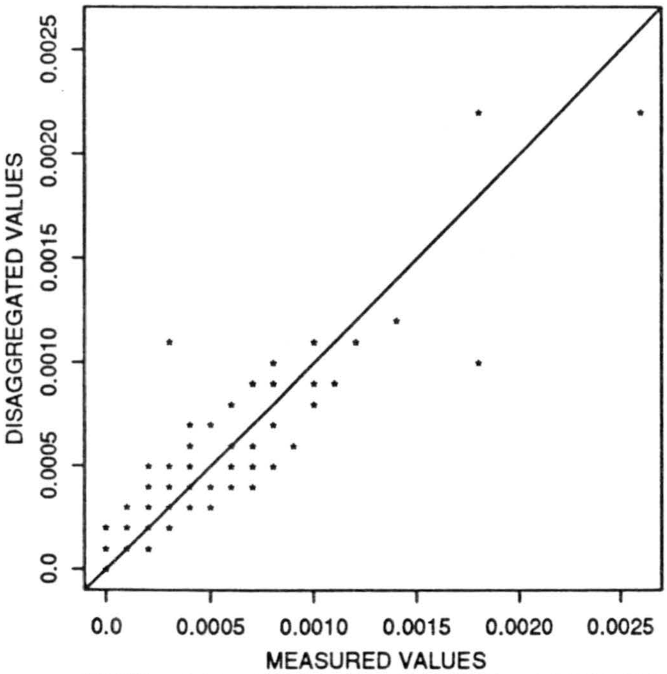
MEAN = 0.0004900000 CORRELATION = 0.8611677885
RMSE = 0.0002252776 n = 80

ORDER 3B DISAGGREGATION FOR FCUC

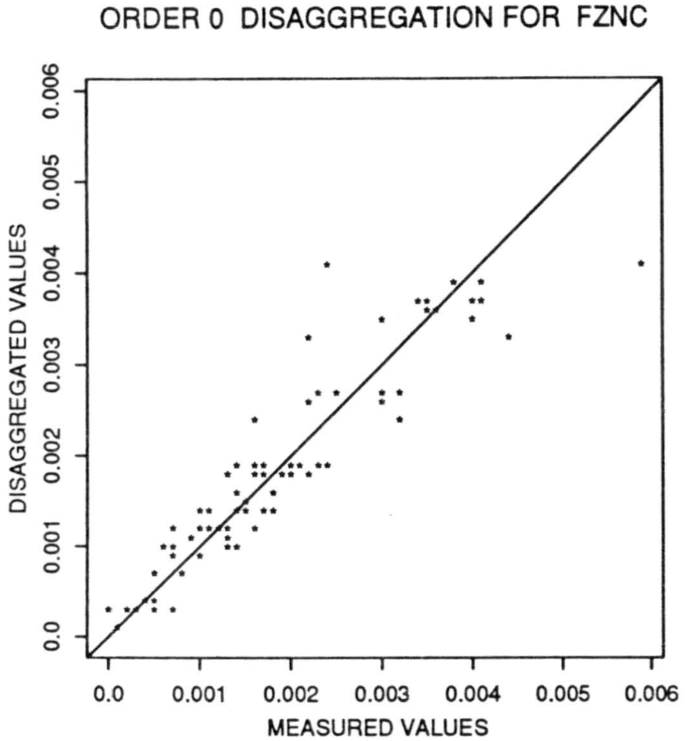


MEAN = 0.0004900000 CORRELATION = 0.8892429471
RMSE = 0.0002018663 n = 80

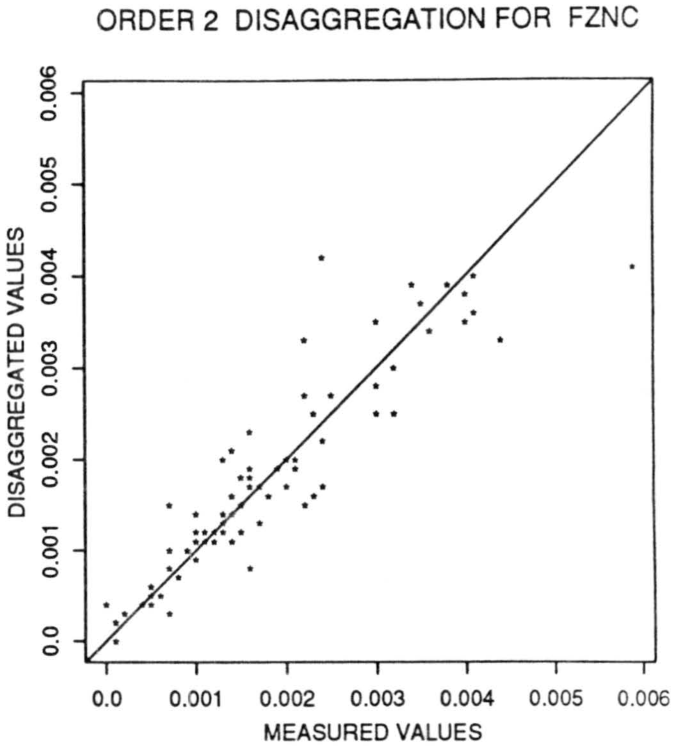
ORDER 4 DISAGGREGATION FOR FCUC



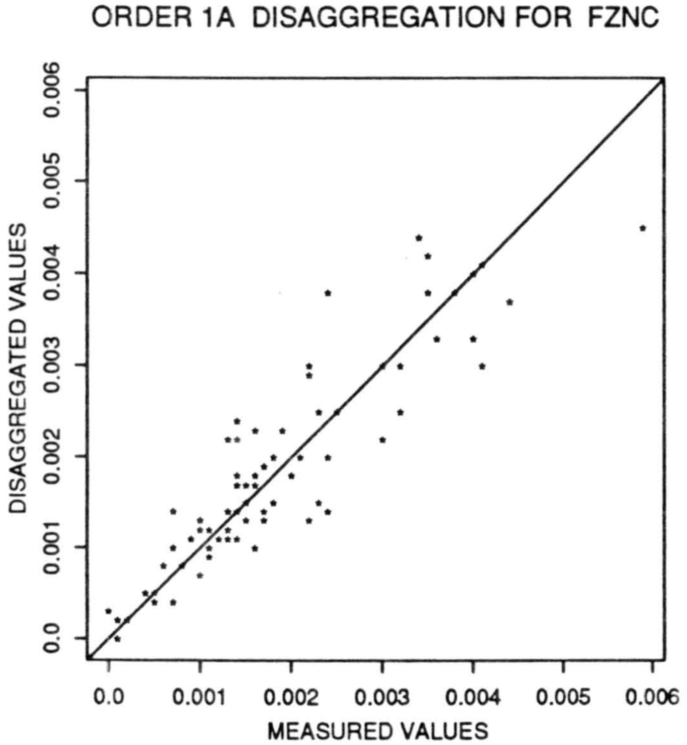
MEAN = 0.000490000 CORRELATION = 0.885368526
RMSE = 0.000204939 n = 80



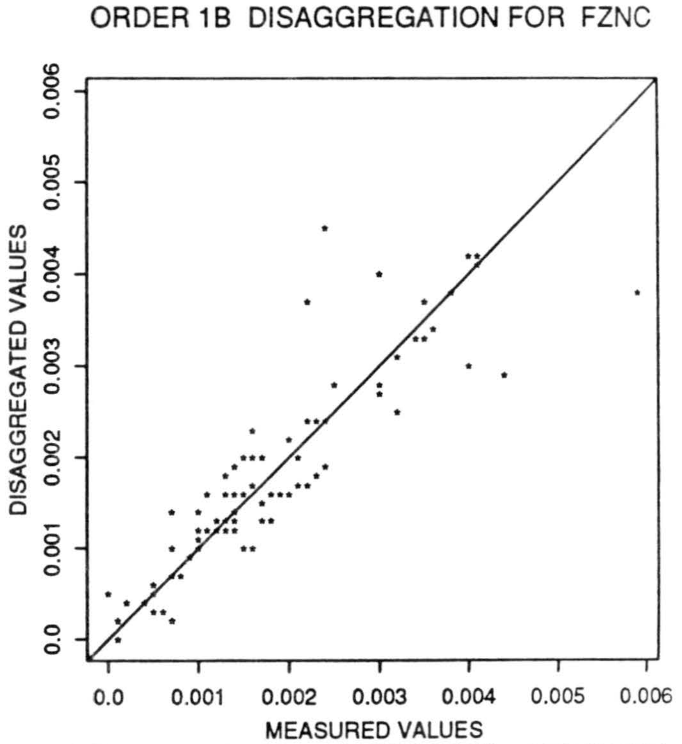
MEAN = 0.0017951220 CORRELATION = 0.9244092703
RMSE = 0.0004417261 n = 82



MEAN = 0.0018312500 CORRELATION = 0.9123796821
RMSE = 0.0004695743 n = 80

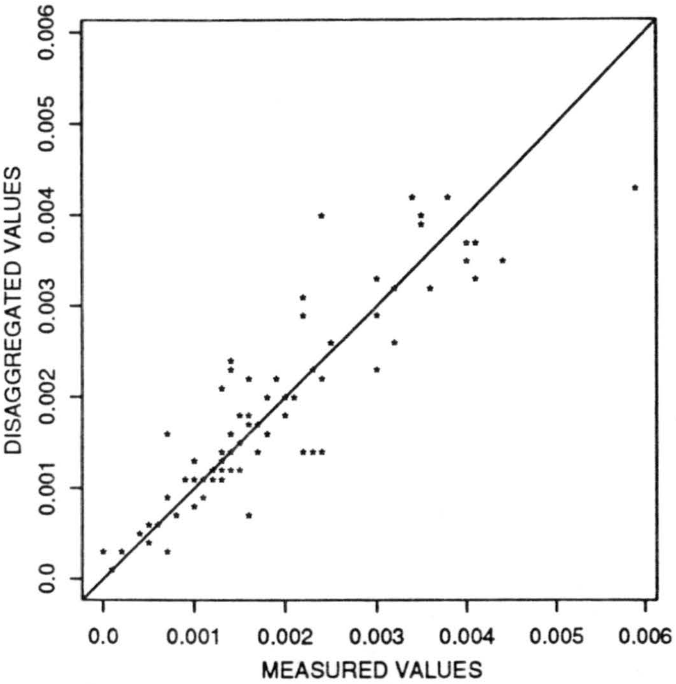


MEAN = 0.0018337500 CORRELATION = 0.9079719782
RMSE = 0.0004824417 n = 80



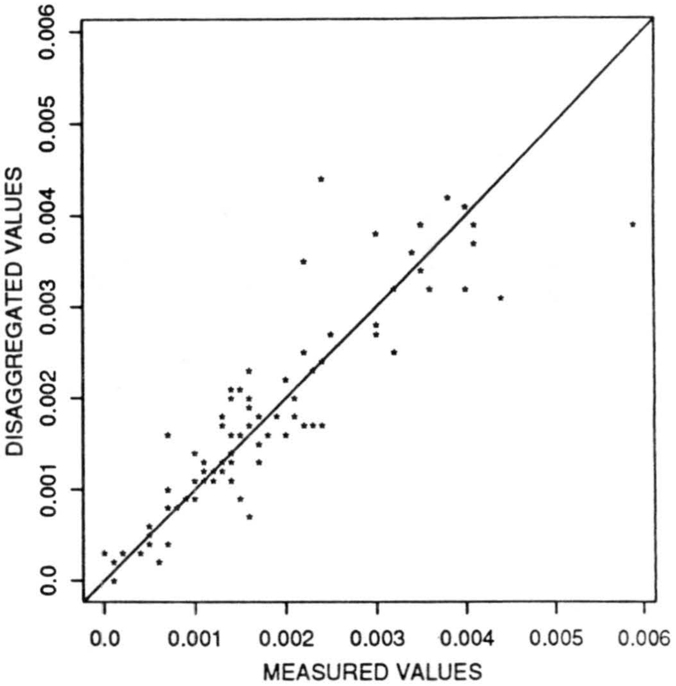
MEAN = 0.0018362500 CORRELATION = 0.8882611394
RMSE = 0.0005303301 n = 80

ORDER 3A DISAGGREGATION FOR FZNC



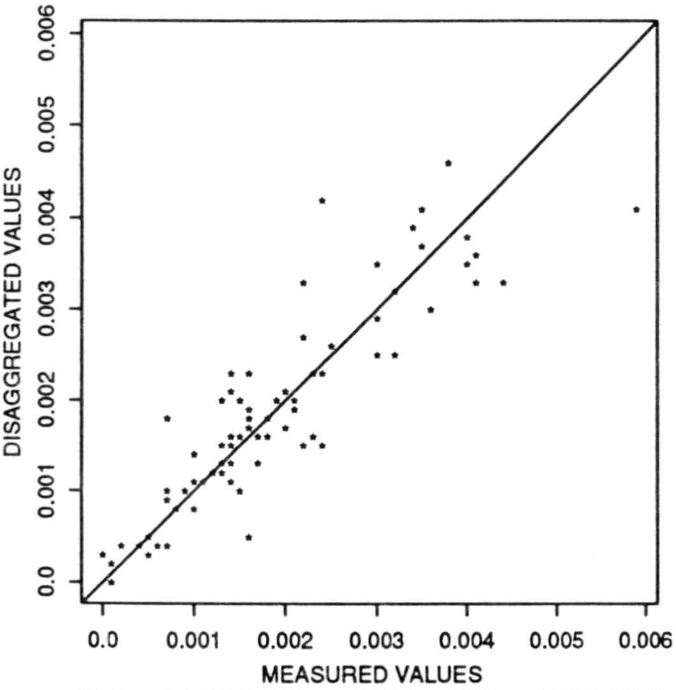
MEAN = 0.0018300000 CORRELATION = 0.9056463242
RMSE = 0.0004884926 n = 80

ORDER 3B DISAGGREGATION FOR FZNC



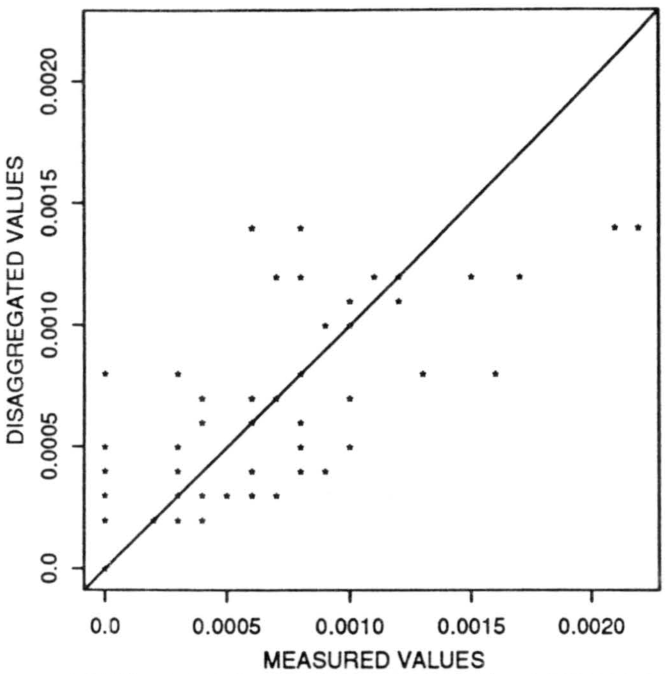
MEAN = 0.0018312500 CORRELATION = 0.8953576088
RMSE = 0.0005138093 n = 80

ORDER 4 DISAGGREGATION FOR FZNC



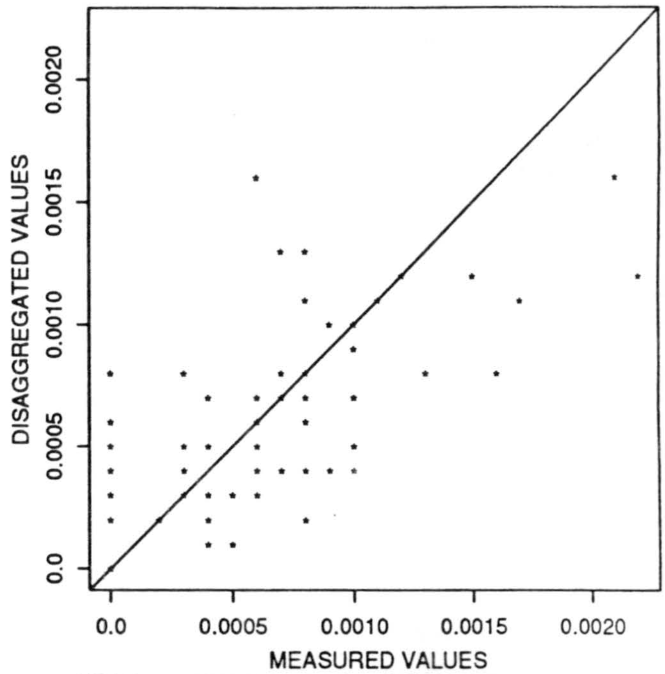
MEAN = 0.0018312500 CORRELATION = 0.8939835429
RMSE = 0.0005174456 n = 80

ORDER 0 DISAGGREGATION FOR FASC



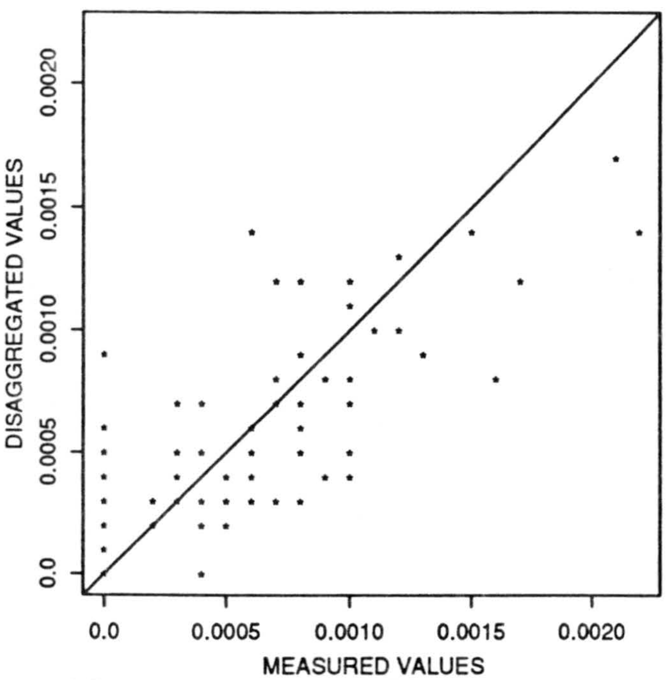
MEAN = 0.0005243902 CORRELATION = 0.7439229488
RMSE = 0.0003423377 n = 82

ORDER 2 DISAGGREGATION FOR FASC



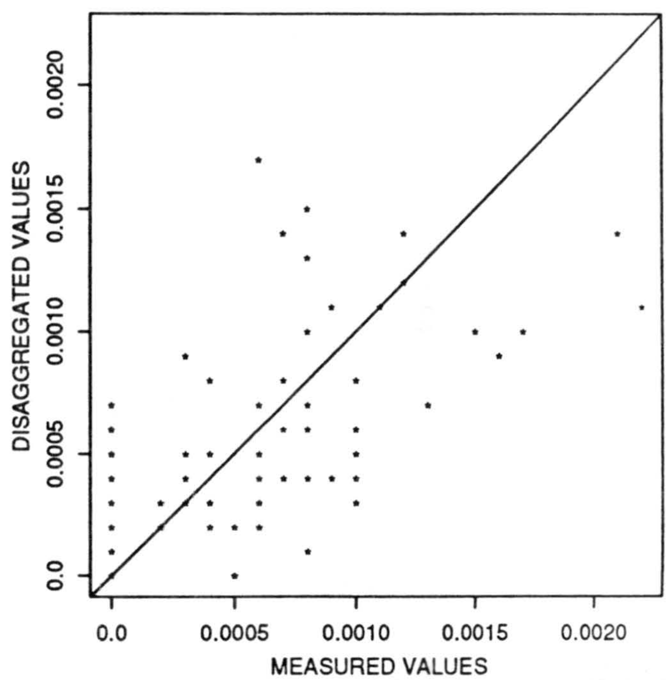
MEAN = 0.0005325000 CORRELATION = 0.7070896626
RMSE = 0.0003628016 n = 80

ORDER 1A DISAGGREGATION FOR FASC



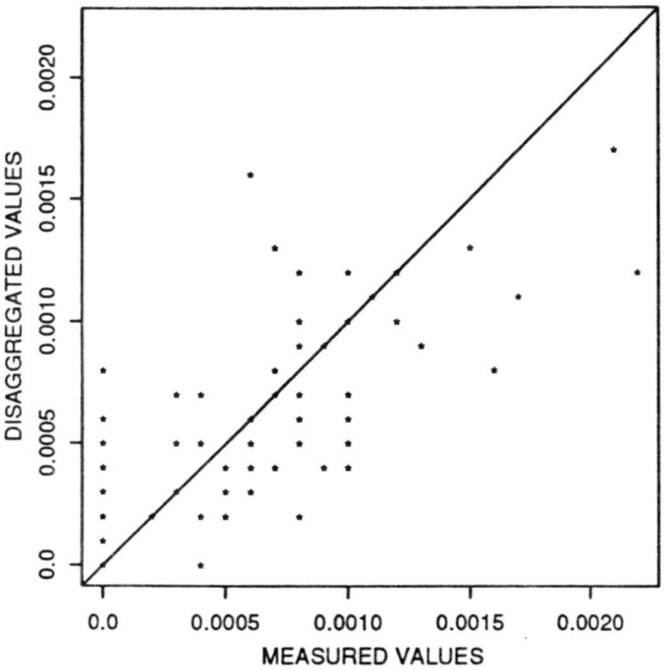
MEAN = 0.0005375000 CORRELATION = 0.7682472467
RMSE = 0.0003276812 n = 80

ORDER 1B DISAGGREGATION FOR FASC



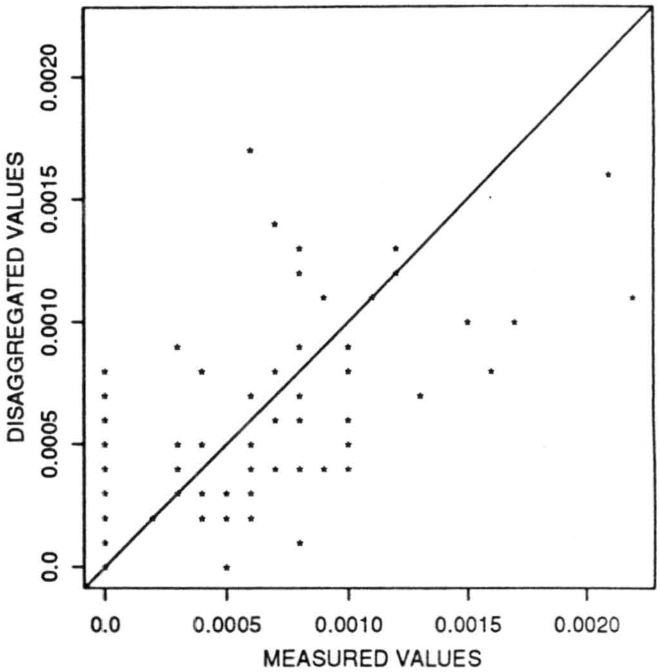
MEAN = 0.0005337500 CORRELATION = 0.6126730442
RMSE = 0.0004135215 n = 80

ORDER 3A DISAGGREGATION FOR FASC



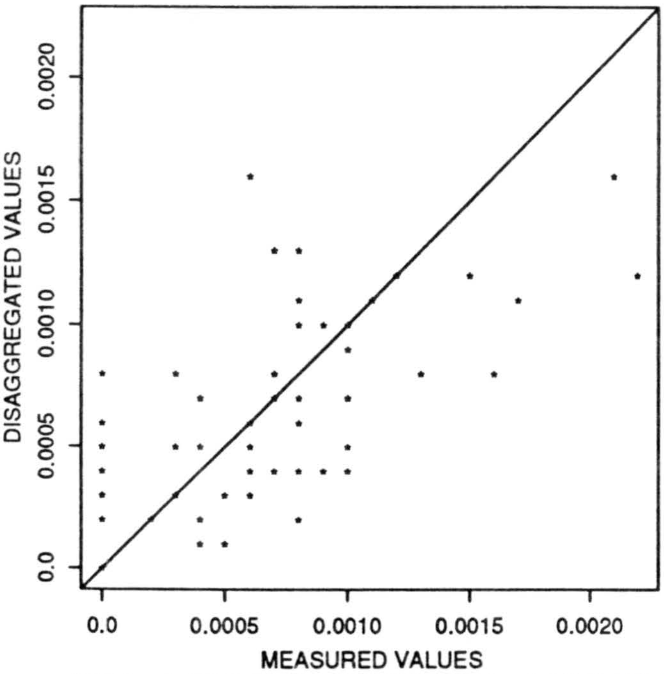
MEAN = 0.0005337500 CORRELATION = 0.7292282581
RMSE = 0.0003507136 n = 80

ORDER 3B DISAGGREGATION FOR FASC



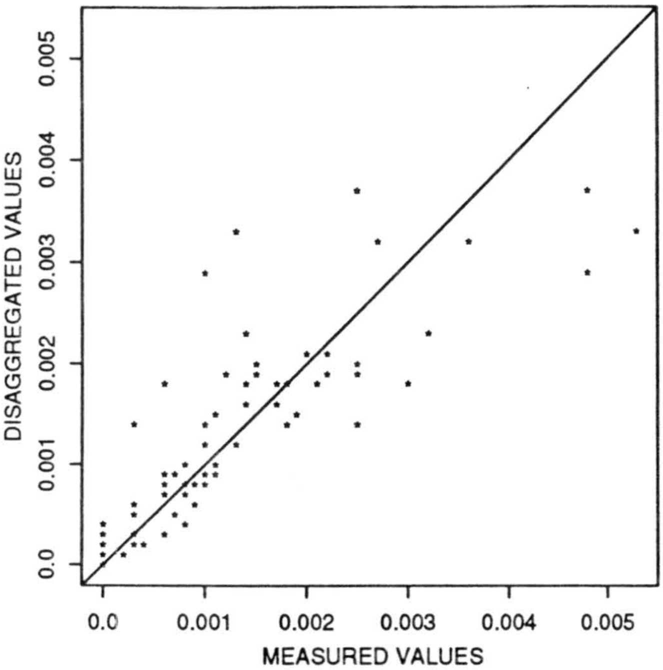
MEAN = 0.0005325000 CORRELATION = 0.6289632916
RMSE = 0.0004045059 n = 80

ORDER 4 DISAGGREGATION FOR FASC



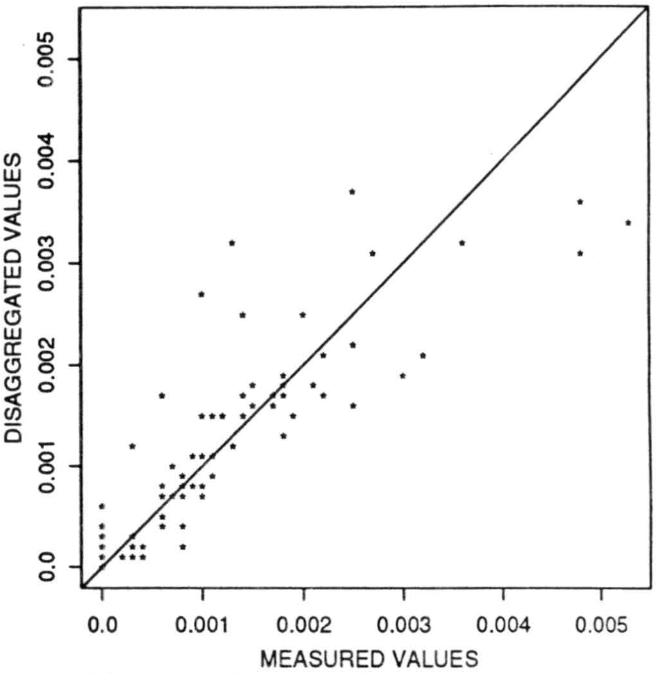
MEAN = 0.0005337500 CORRELATION = 0.6968804598
RMSE = 0.0003684427 n = 80

ORDER 0 DISAGGREGATION FOR FSEC



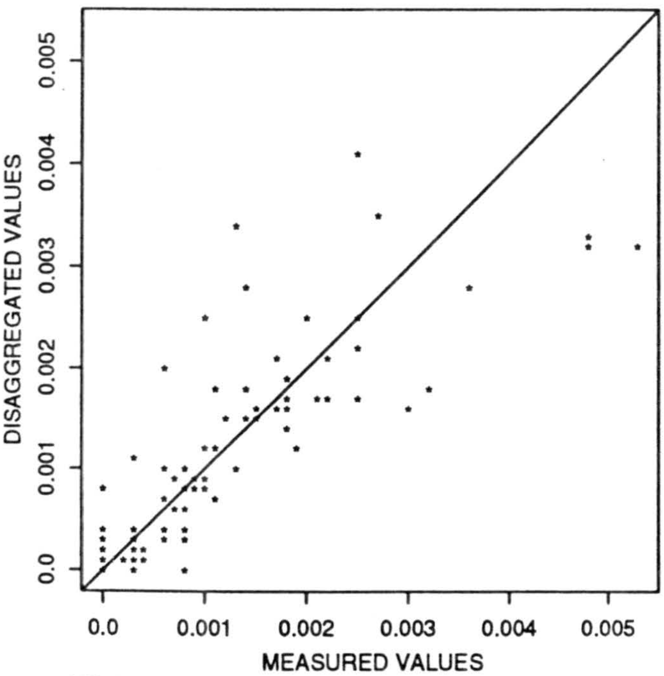
MEAN = 0.0011585366 CORRELATION = 0.8482951522
RMSE = 0.0006041523 n = 82

ORDER 2 DISAGGREGATION FOR FSEC



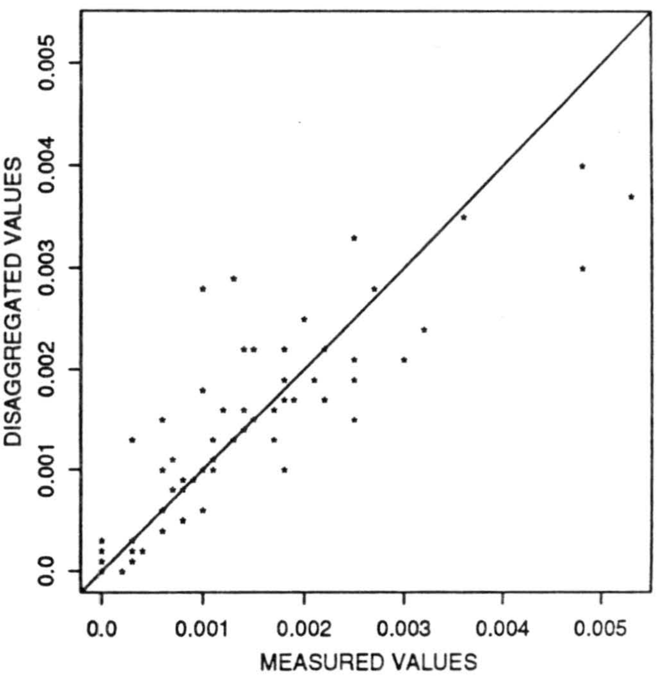
MEAN = 0.0011700000 CORRELATION = 0.8625067472
RMSE = 0.0005769532 n = 80

ORDER 1A DISAGGREGATION FOR FSEC



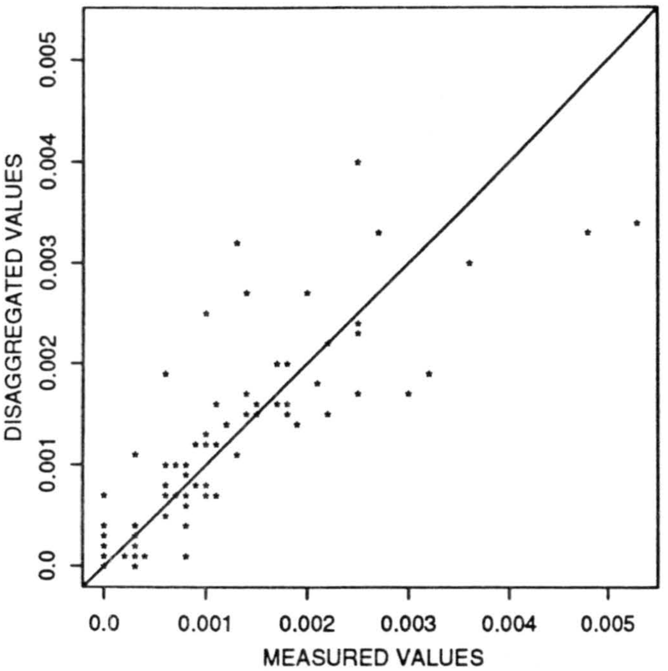
MEAN = 0.0011675000 CORRELATION = 0.8169934750
RMSE = 0.0006602083 n = 80

ORDER 1B DISAGGREGATION FOR FSEC



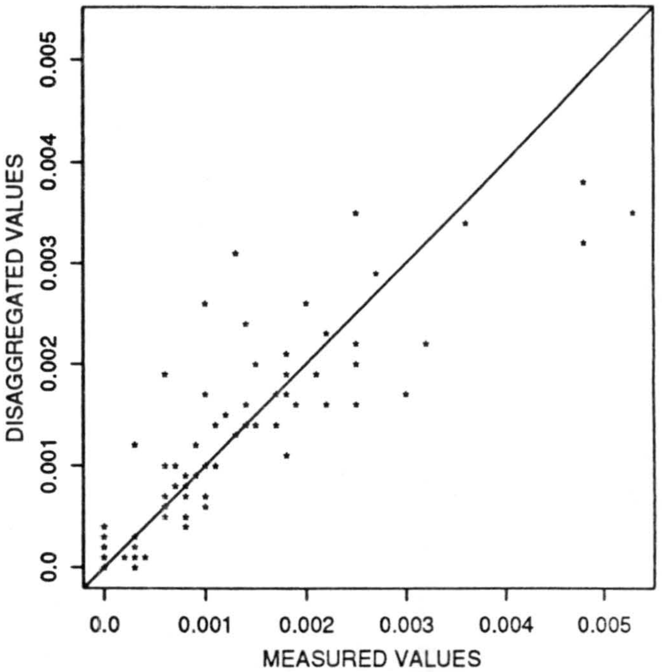
MEAN = 0.0011712500 CORRELATION = 0.8840038180
RMSE = 0.0005333854 n = 80

ORDER 3A DISAGGREGATION FOR FSEC



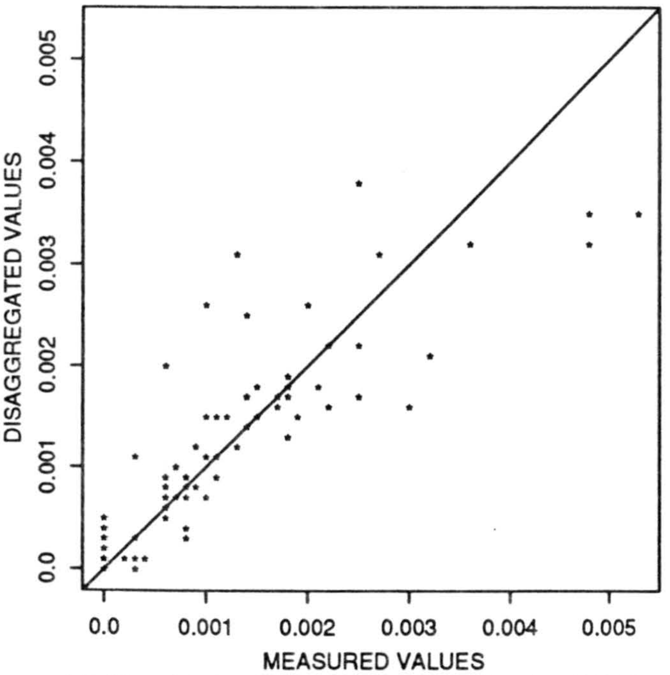
MEAN = 0.0011687500 CORRELATION = 0.8434697986
RMSE = 0.0006131884 n = 80

ORDER 3B DISAGGREGATION FOR FSEC



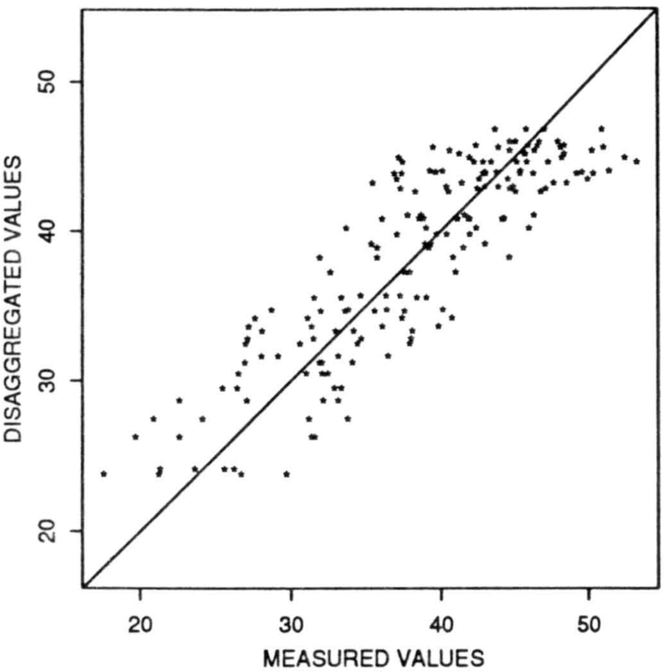
MEAN = 0.0011687500 CORRELATION = 0.8698689938
RMSE = 0.0005623611 n = 80

ORDER 4 DISAGGREGATION FOR FSEC



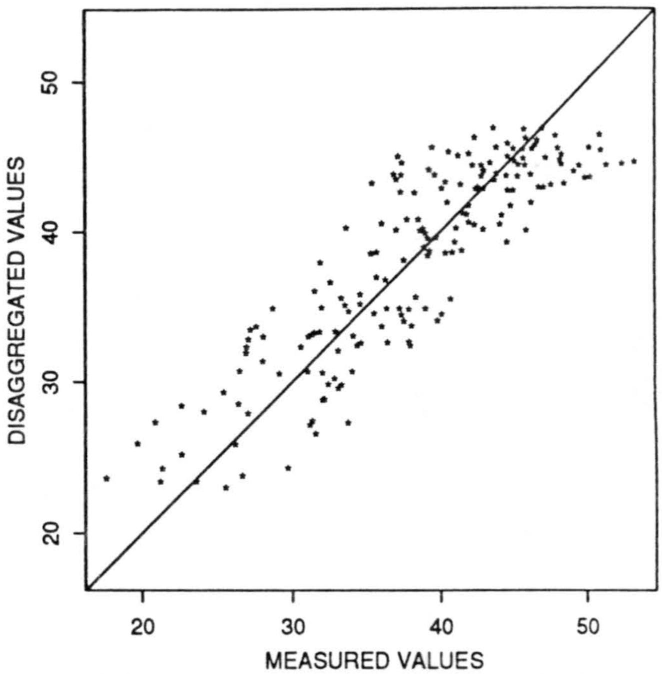
MEAN = 0.0011675000 CORRELATION = 0.8602517247
RMSE = 0.0005812702 n = 80

ORDER 0 DISAGGREGATION FOR 2QTEMC



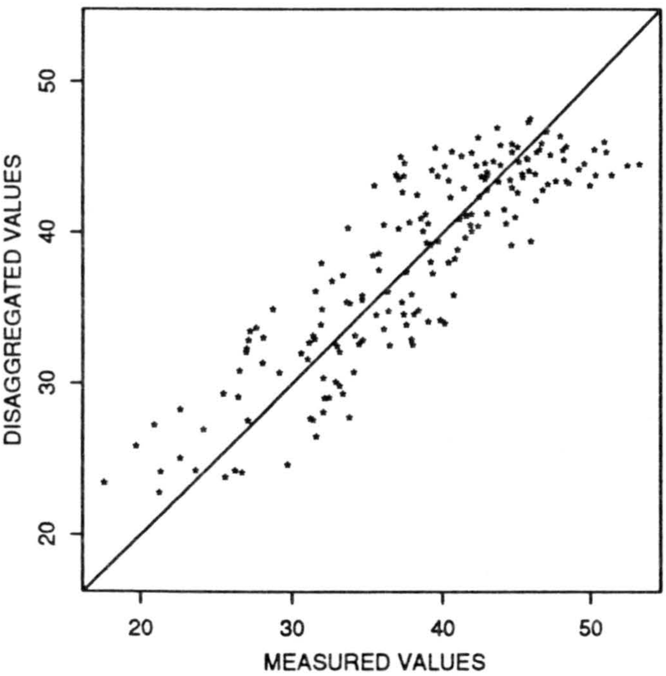
MEAN = 38.156778 CORRELATION = 0.865953
RMSE = 3.744821 n = 180

ORDER 2 DISAGGREGATION FOR 2QTEMC



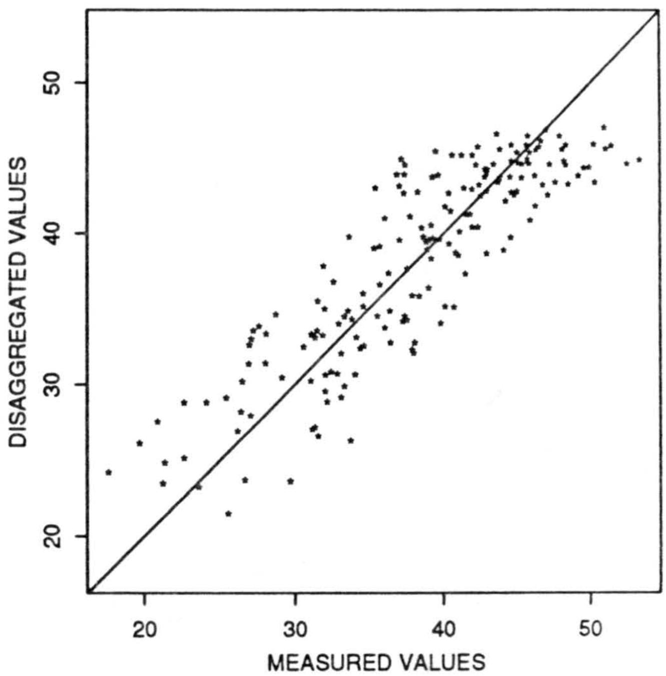
MEAN = 38.1567756 CORRELATION = 0.8733761
RMSE = 3.6469918 n = 180

ORDER 1A DISAGGREGATION FOR 2QTEMC



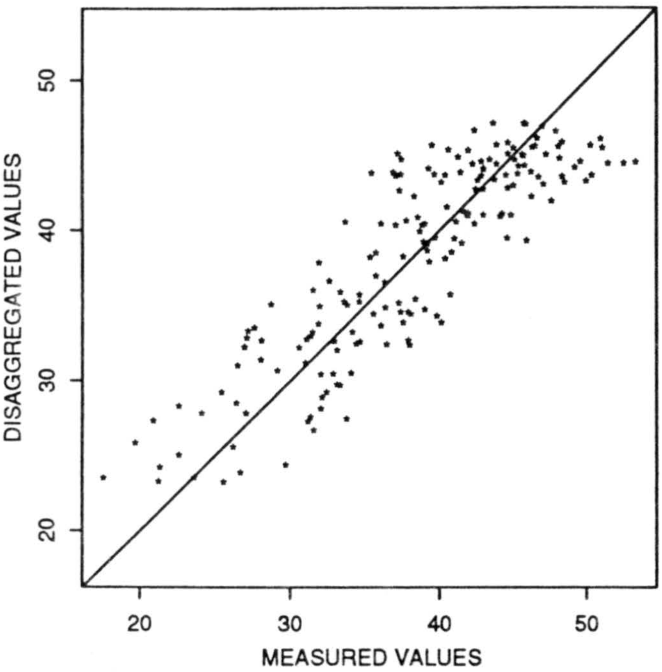
MEAN = 38.1567756 CORRELATION = 0.8695037
RMSE = 3.6984301 n = 180

ORDER 1B DISAGGREGATION FOR 2QTEMC



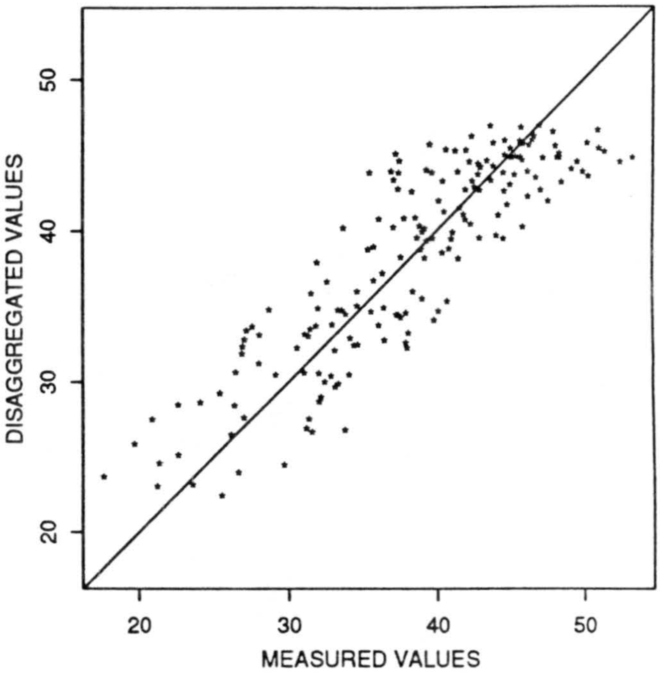
MEAN = 38.156781 CORRELATION = 0.873498
RMSE = 3.645279 n = 180

ORDER 3A DISAGGREGATION FOR 2QTEMC



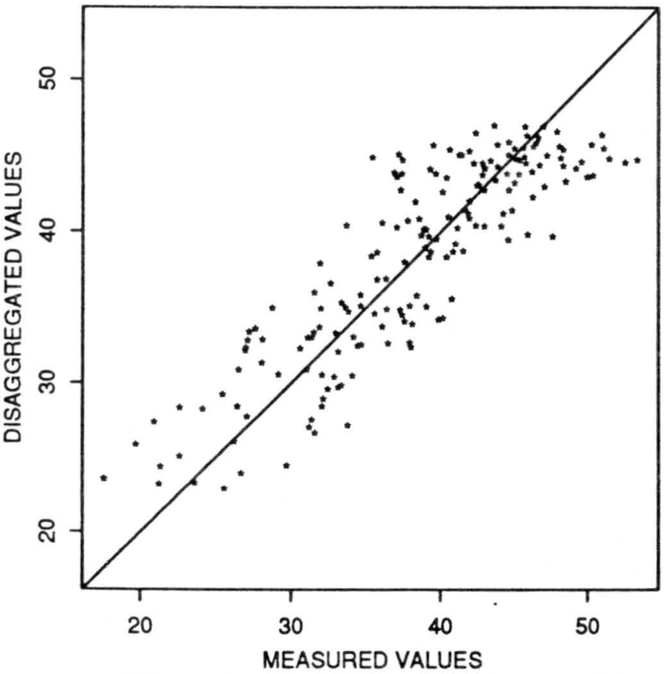
MEAN = 38.1567767 CORRELATION = 0.8706409
RMSE = 3.6833817 n = 180

ORDER 3B DISAGGREGATION FOR 2QTEMC



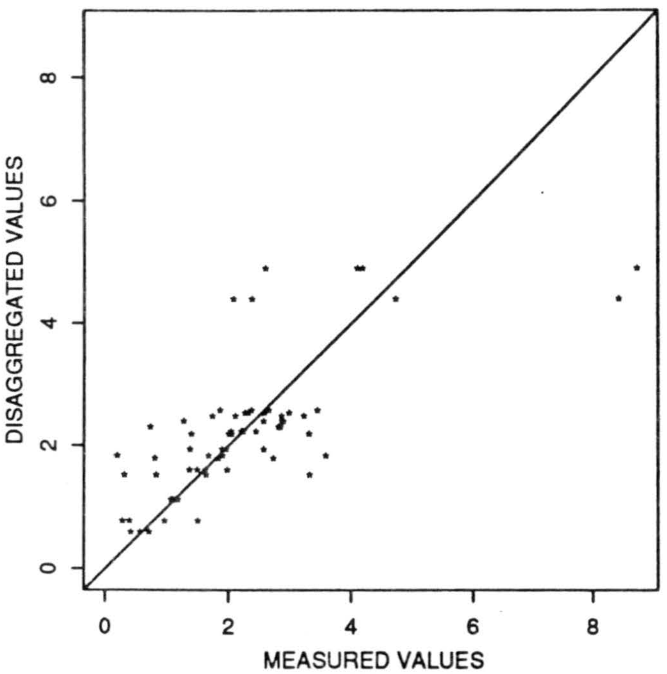
MEAN = 38.1567811 CORRELATION = 0.8726037
RMSE = 3.6572451 n = 180

ORDER 4 DISAGGREGATION FOR 2QTEMC



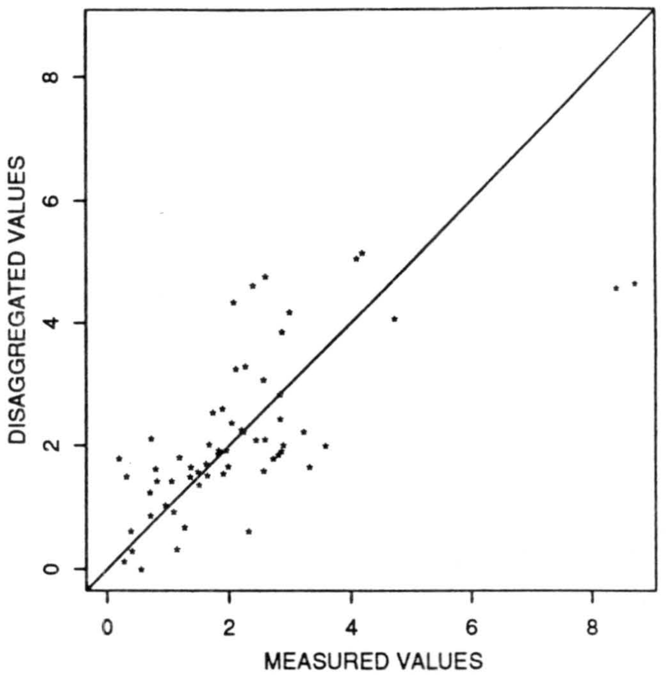
MEAN = 38.156776 CORRELATION = 0.869722
RMSE = 3.695570 n = 180

ORDER 0 DISAGGREGATION FOR 2WYCPMC



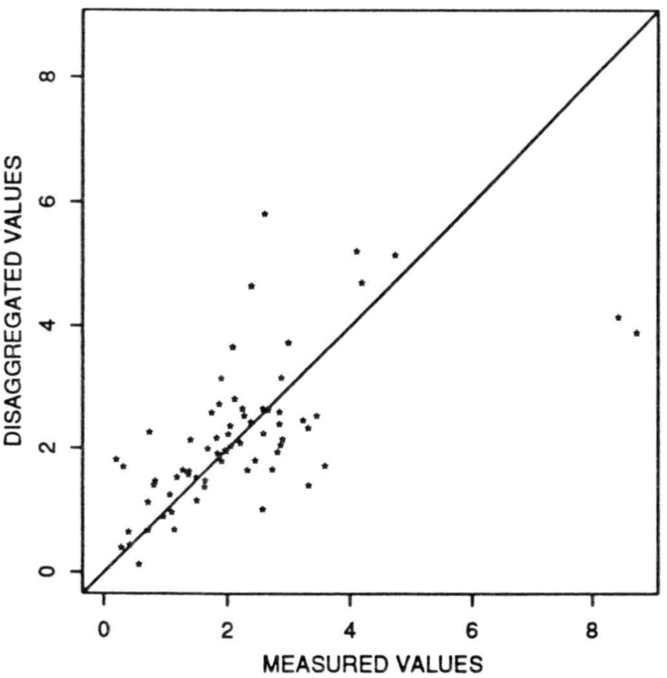
MEAN = 2.1958647 CORRELATION = 0.7216024
RMSE = 1.0280342 n = 68

ORDER 2 DISAGGREGATION FOR 2WYCPMC



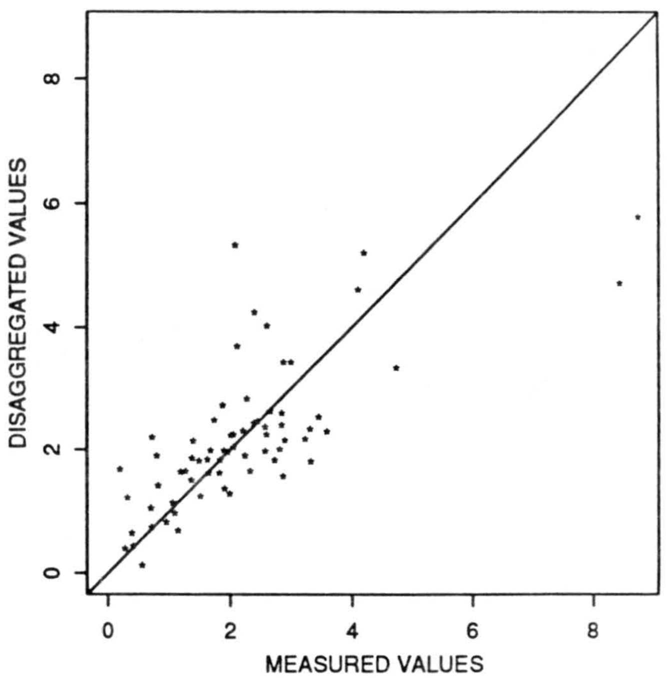
MEAN = 2.1696267 CORRELATION = 0.6895602
RMSE = 1.1457014 n = 60

ORDER 1A DISAGGREGATION FOR 2WYCPMC



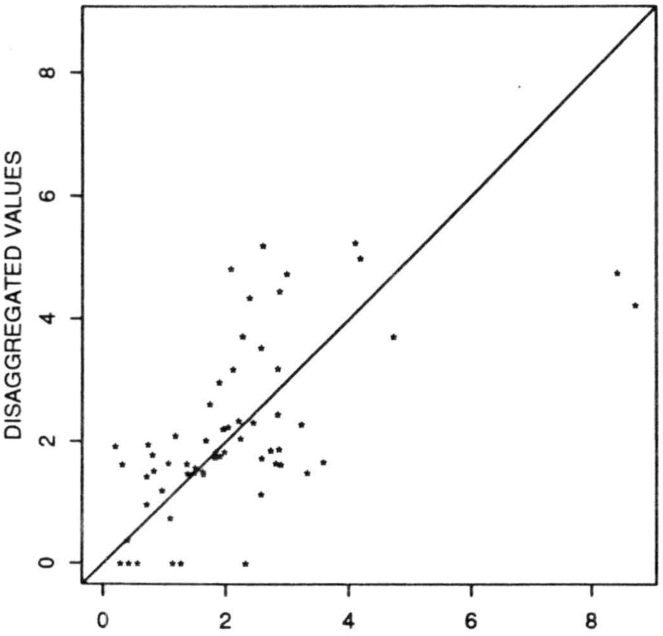
MEAN = 2.1958588 CORRELATION = 0.6376248
RMSE = 1.1619778 n = 68

ORDER 1B DISAGGREGATION FOR 2WYCPMC



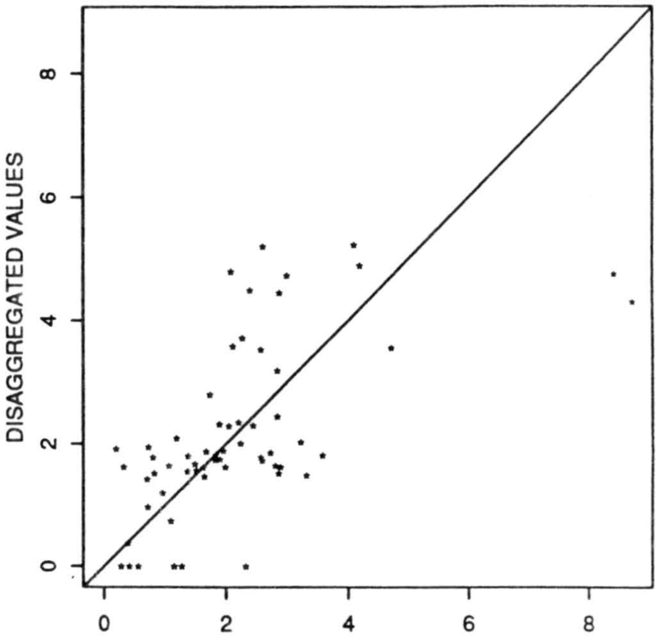
MEAN = 2.1958544 CORRELATION = 0.7404849
RMSE = 0.9994427 n = 68

ORDER 3A DISAGGREGATION FOR 2WYCPMC



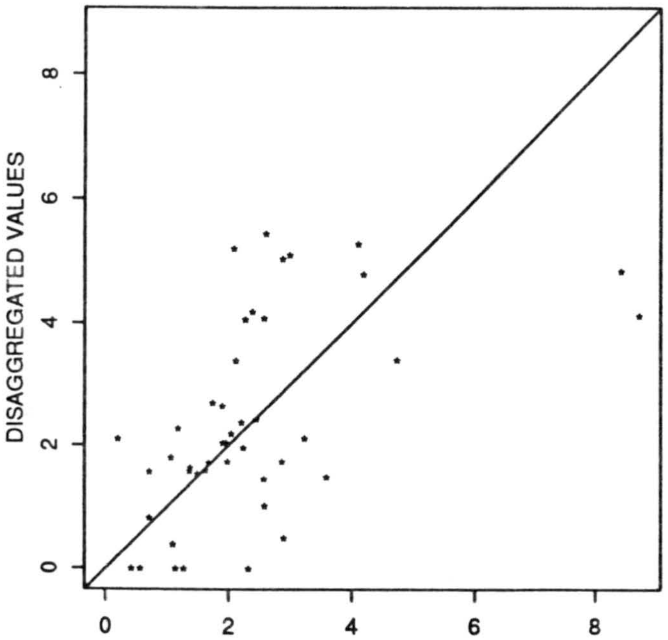
MEASURED VALUES
MEAN = 2.1696183 CORRELATION = 0.6162413
RMSE = 1.2980556 n = 60

ORDER 3B DISAGGREGATION FOR 2WYCPMC



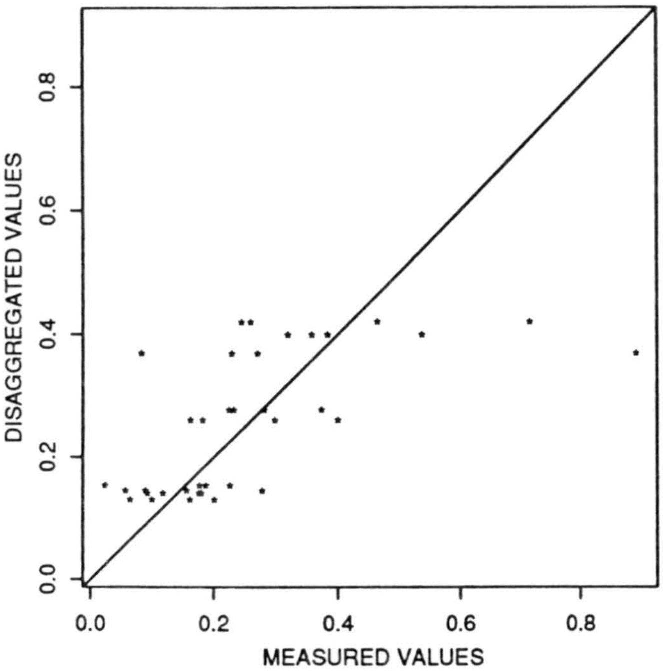
MEASURED VALUES
MEAN = 2.1696183 CORRELATION = 0.6169671
RMSE = 1.2963481 n = 60

ORDER 4 DISAGGREGATION FOR 2WYCPMC



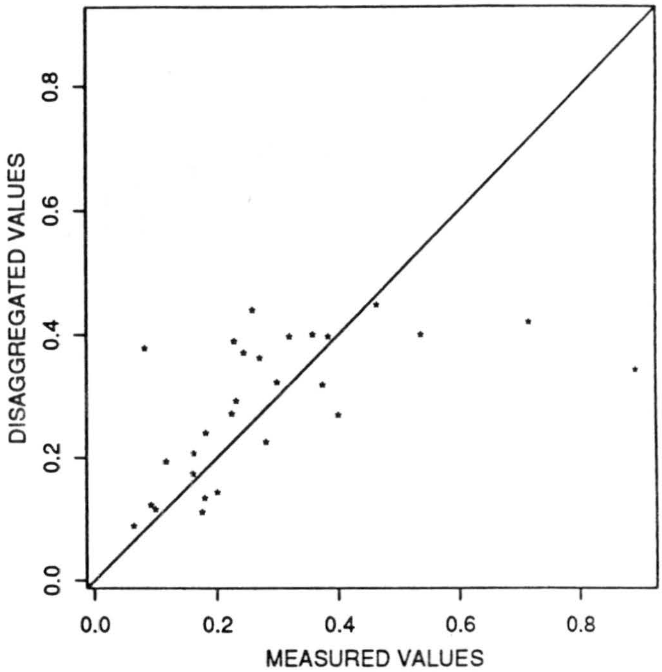
MEASURED VALUES
MEAN = 2.3748977 CORRELATION = 0.5411331
RMSE = 1.5704448 n = 44

ORDER 0 DISAGGREGATION FOR 2ENO3C



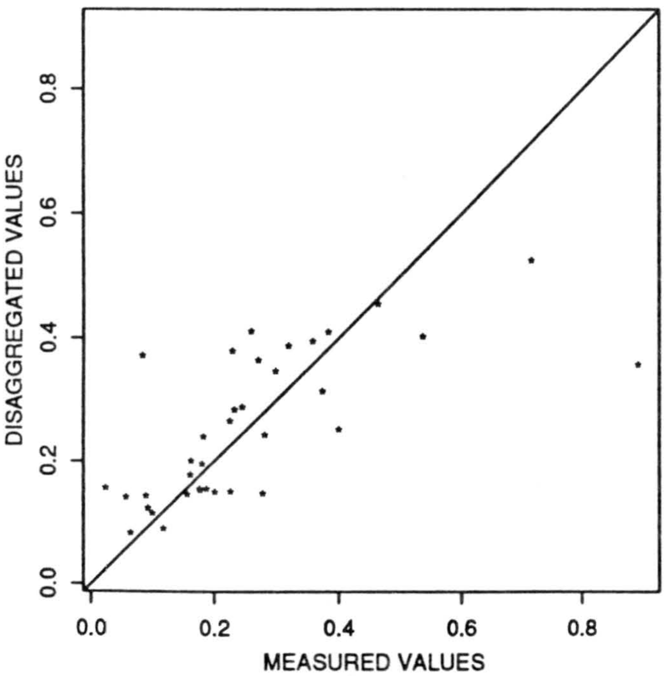
MEAN = 0.2556444 CORRELATION = 0.6309013
RMSE = 0.1374387 n = 36

ORDER 2 DISAGGREGATION FOR 2ENO3C



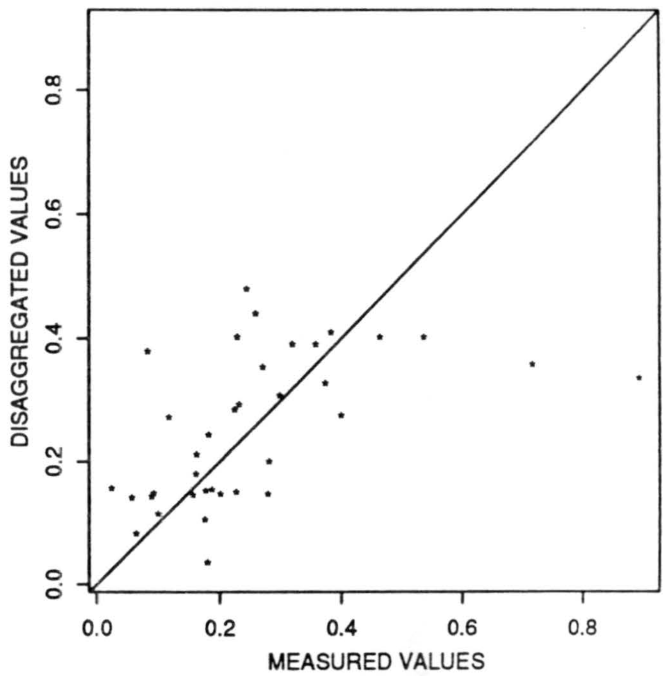
MEAN = 0.2859500 CORRELATION = 0.5806337
RMSE = 0.1509436 n = 28

ORDER 1A DISAGGREGATION FOR 2ENO3C



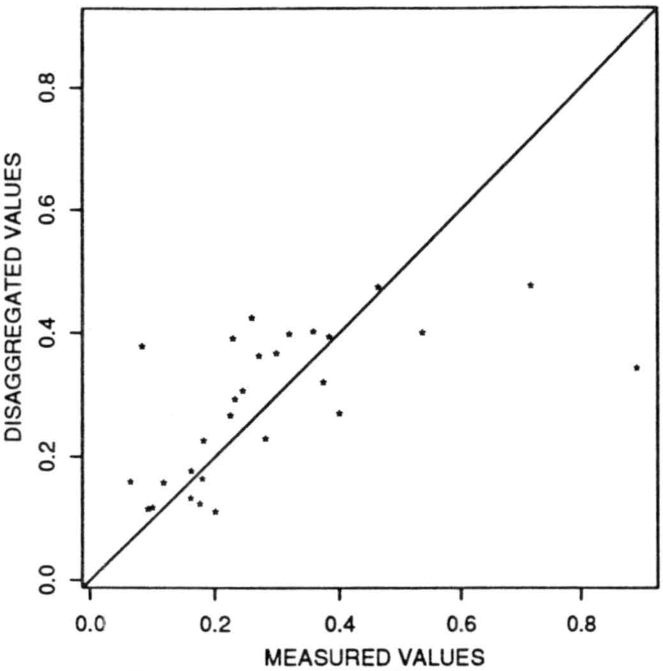
MEAN = 0.2556306 CORRELATION = 0.6941106
RMSE = 0.1275987 n = 36

ORDER 1B DISAGGREGATION FOR 2ENO3C



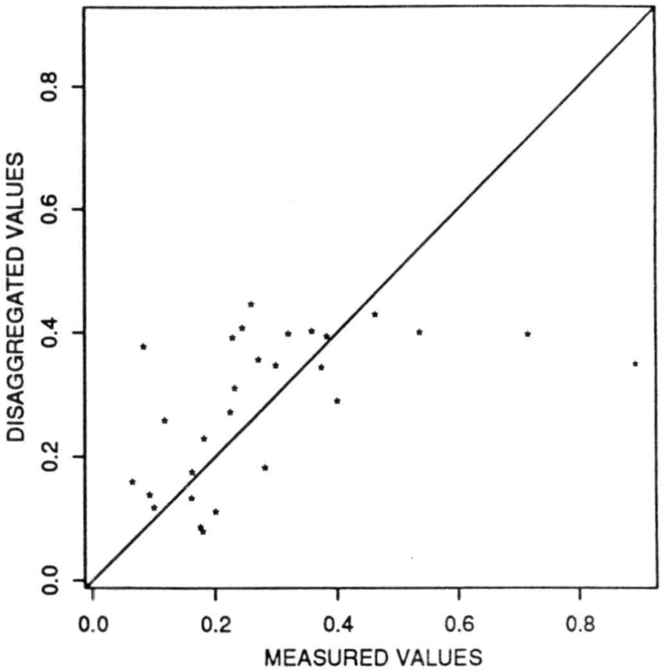
MEAN = 0.2556361 CORRELATION = 0.5354959
RMSE = 0.1515365 n = 36

ORDER 3A DISAGGREGATION FOR 2ENO3C



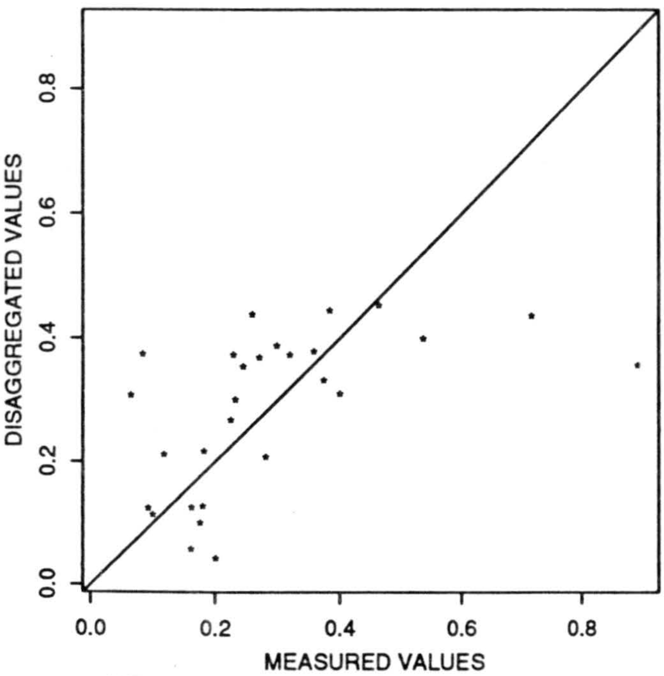
MEAN = 0.2859393 CORRELATION = 0.6141361
RMSE = 0.1462439 n = 28

ORDER 3B DISAGGREGATION FOR 2ENO3C



MEAN = 0.2859536 CORRELATION = 0.5296888
RMSE = 0.1583905 n = 28

ORDER 4 DISAGGREGATION FOR 2ENO3C



MEAN = 0.2859643 CORRELATION = 0.5399597
RMSE = 0.1580481 n = 28