# CHESAPEAKE BAY WATERSHED MODEL APPLICATION AND CALCULATION OF NUTRIENT AND SEDIMENT LOADINGS

## Appendix B: Phase IV Chesapeake Bay Watershed Model Water Quality Results

A Report of the
Chesapeake Bay Program
Modeling Subcommittee
Annapolis, MD


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## Appendix Summary

Appendix B documents the water quality calibration of the Phase IV Watershed Model. Simulated and observed concentrations are compared for 8 years of calibration (1984-1991) at 15 water quality stations. Calibration data is shown for temperature, dissolved oxygen, total suspended sediment, total phosphorus, organic and particulate phosphorus, phosphate, total nitrogen, nitrate, total ammonia, and organic nitrogen.

The following plots are completed for each constituent: (1) observed and simulated concentrations; (2) observed and simulated loads (temperature loads are not calculated); (3) scatter plot and regression of simulated versus observed concentrations; (4) observed and simulated actual error of paired data (simulated concentration - observed concentration); (5) frequency distribution of paired simulated and observed data, i.e. coincident observed and simulated concentrations, and; (6) frequency distribution of all simulated and observed data.

The daily observed and simulated concentration plots generally show good to excellent agreement between the model and data for temperature, dissolved oxygen, and total suspended sediment and fair to good agreement on other water quality constituents. Generally, as the number of water quality observations at a station increases the calibration improves.

The simulated and observed load plots are developed from the observed mean daily flow and concentration compared to model estimated loads. Overall the load comparisons range from fair to excellent depending in different cases on the simulation of flow or the simulation of concentration.

Scatter plots of observed and simulated concentrations are shown with the ideal line (slope of 1, intercept of zero) drawn to assist interpretation of the plots with changing x and y axis scales. The actual regression line slope, intercept, correlation coefficient, standard error of the slope, standard error of the intercept, and the number of observations are shown in the plot legend.

The actual error plot is calculated as the difference of the simulated and observed concentrations plotted against time and is useful for indicating calibration bias and the actual magnitude of errors. The two frequency distribution plots are useful for examining the differences between the observed and simulated concentrations with respect to concentration magnitude and frequency of occurrence. Generally, calibration is best in the central area of the data and calibration performance is least in the tails, particularly the $10^{th}$ and $90^{th}$ percentiles.

## List of Phase IV Watershed Model Reference Appendices

| | |
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| Appendix A | Phase IV Chesapeake Bay Watershed Model Hydrology Calibration Results |
| Appendix B | Phase IV Chesapeake Bay Watershed Model Water Quality Calibration |
| Appendix C | Phase IV Chesapeake Bay Watershed Model Nonpoint Source Simulation |
| Appendix D | Phase IV Chesapeake Bay Watershed Model Precipitation and Meteorological Data Development and Atmospheric Nutrient Deposition |
| Appendix E | Phase IV Chesapeake Bay Watershed Land Use & Model Linkages to the Airshed & Estuarine Models |
| Appendix F | Phase IV Chesapeake Bay Watershed Model Point Source Loads and Water Supply Diversions |
| Appendix G | Observed Water Quality Data Used for Calibration, A Simulation of Regression Loads, and a Confirmation Scenario of the Phase IV Chesapeake Bay Watershed Model |
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# B.1.0 Susquehanna River

***Basin Segments:***

Above Fall Line Basin Segments: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 110, 120, 140, 700, 710, and 720

***Section Contents:***

### *B.1.1 East Branch Susquehanna River near Danville, PA at Segment 40 (Monitoring Station: 1540500) (Above Fall Line Basin Segments: 10, 20, 700, 30, and 40)*

**Section Summary:**

The East Branch Susquehanna basin is largely rural in character and influenced by agricultural loads as well as loads from several cities including Binghamton, Scranton, and Wilkes Barre. An unusual feature of the East Branch Susquehanna is the decreasing population in the basin over the 1984-1995 simulation period. This is the only Chesapeake Bay basin with a decreasing population.

The East Branch Susquehanna basin above the gaged site covers an area of 11,522 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 59% forest land, 7% cropland, 27% other agricultural areas, 6% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario, estimated total nitrogen delivered to the gage decreased from 47.9 million pounds in 1985 to 46.7 million pounds in 1996. Total phosphorus loads over the same time period decreased from 2.1 million pounds to 1.6 million pounds. In general, point source loads above the gage site are low. In 1996, the total nitrogen point source load was 12% of the total load and the total phosphorus point source load was 29% of the total load. Estimated septic system total nitrogen loads increased 6%, from 1.35 million pounds in 1985 to 1.44 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 7%, and other agricultural loads (primarily pasture and manure loads) by 7%. Total phosphorus decreased for these land uses by 10% and 24% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 5% for total nitrogen and 5% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

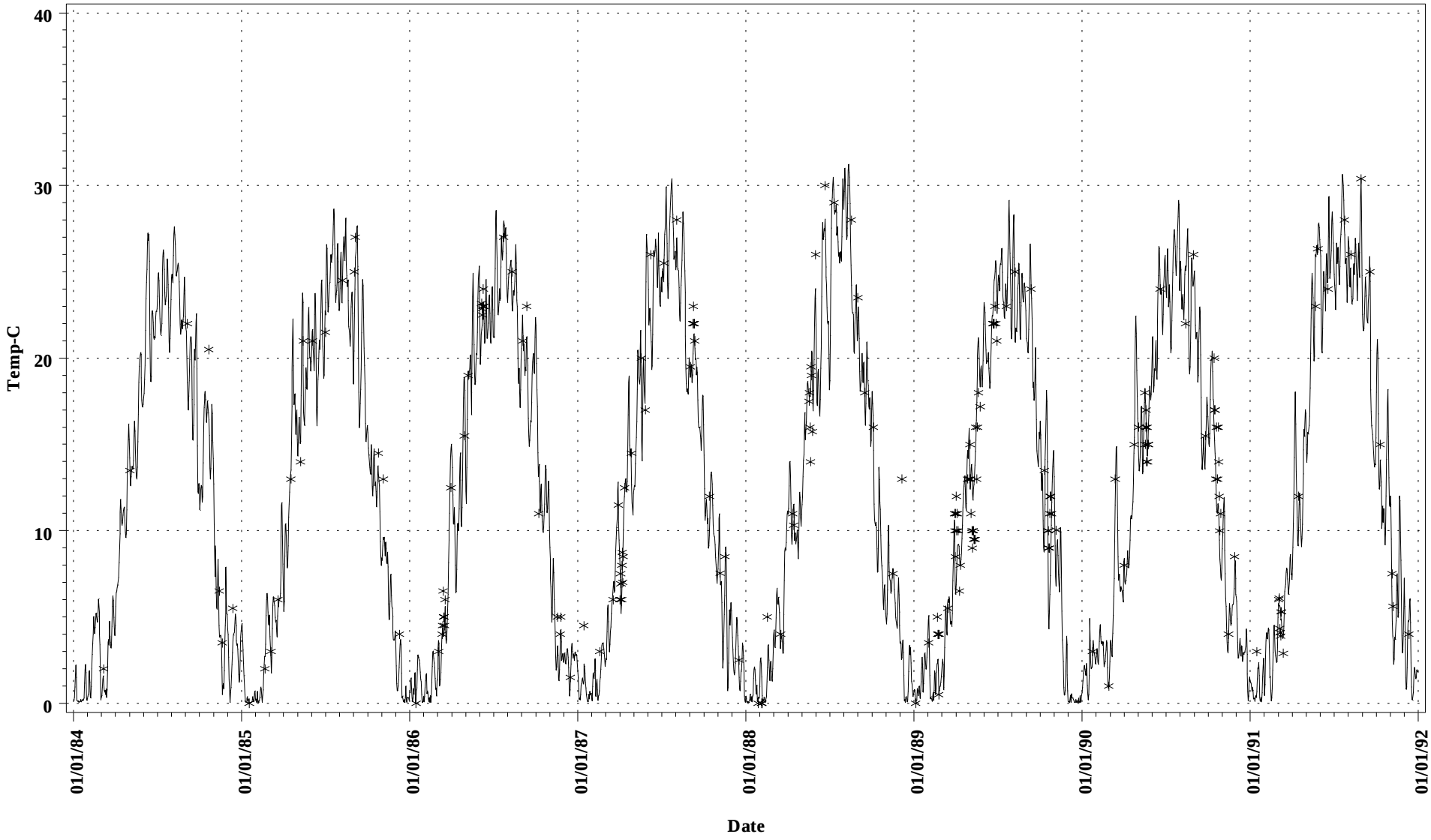
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# East Branch Susquehanna at Segment 40
## Observed and Simulated versus Time
# Temperature-C

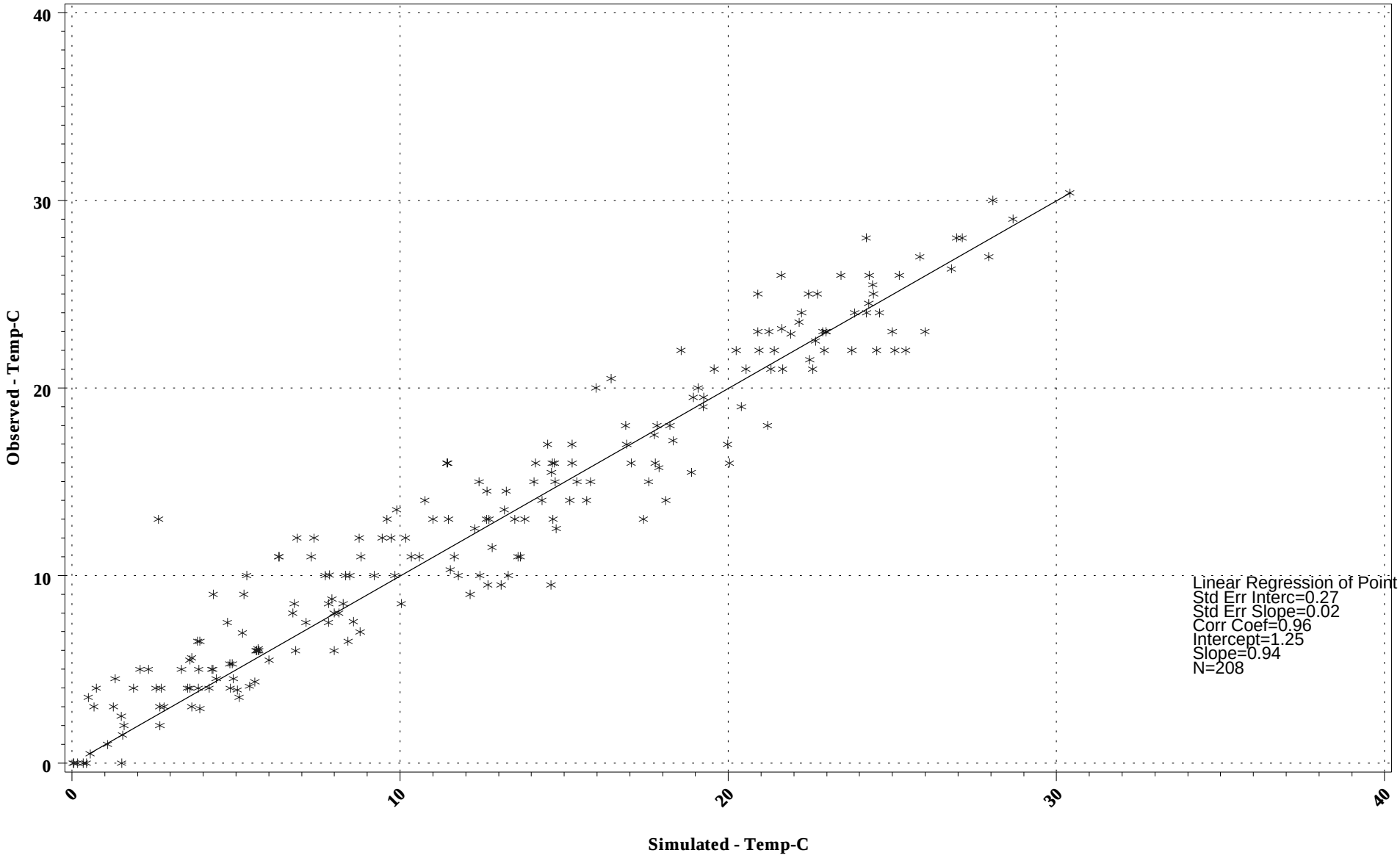
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92

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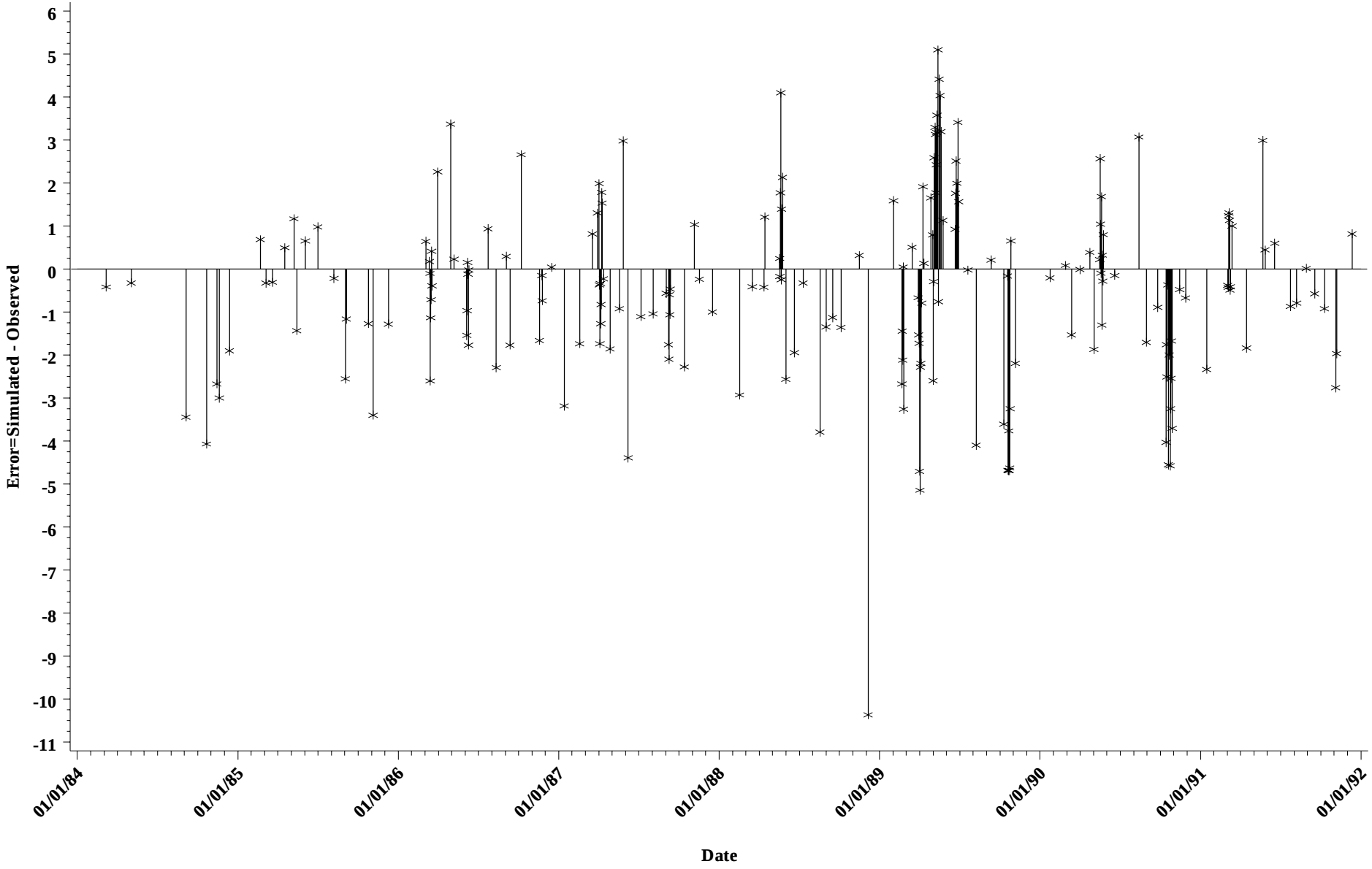
# East Branch Susquehanna at Segment 40
## Actual Error versus Time
## Temperature-C

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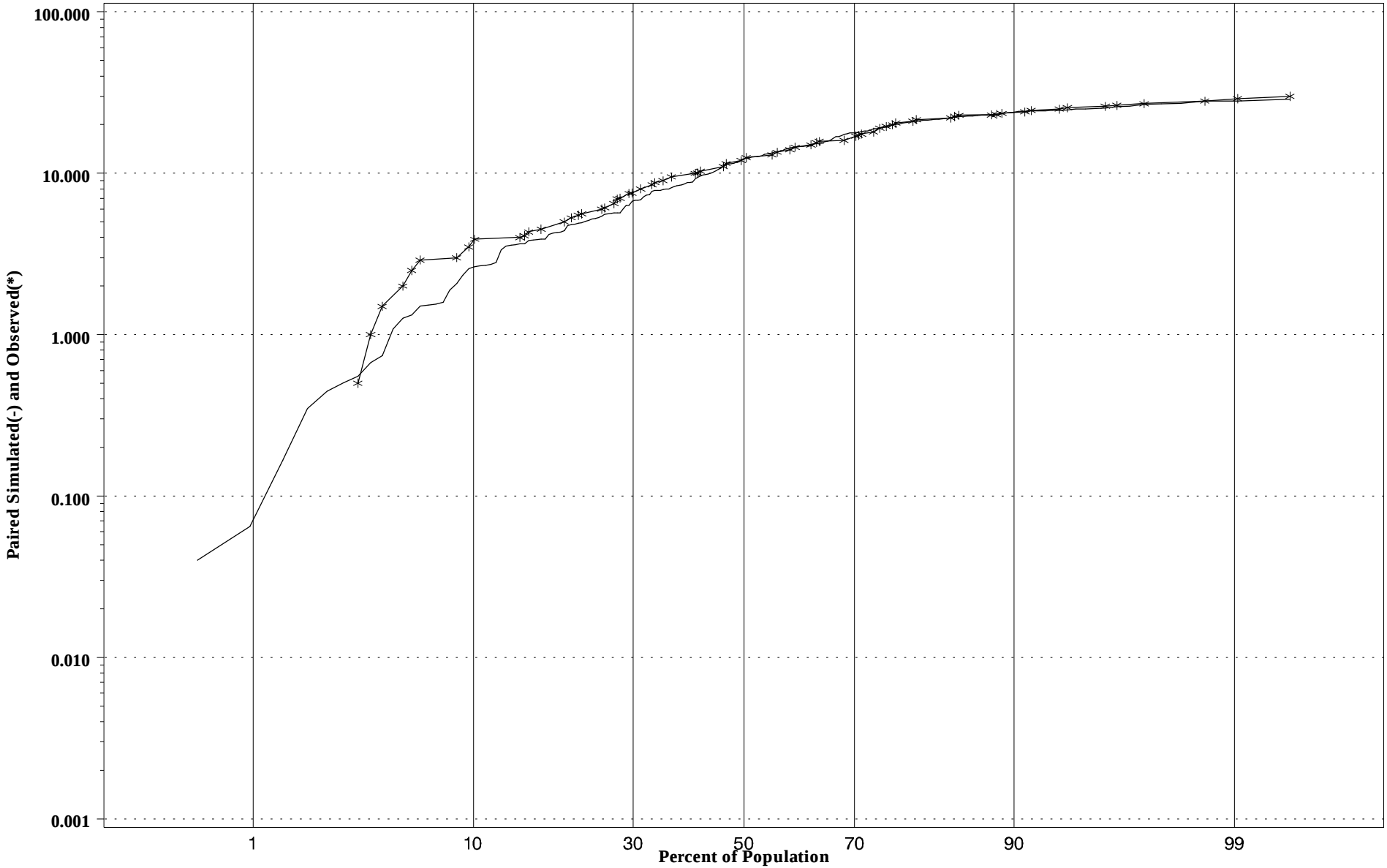
# East Branch Susquehanna at Segment 40

## Temperature-C

### Frequency Distribution - PAIRED Simulated and Observed Data

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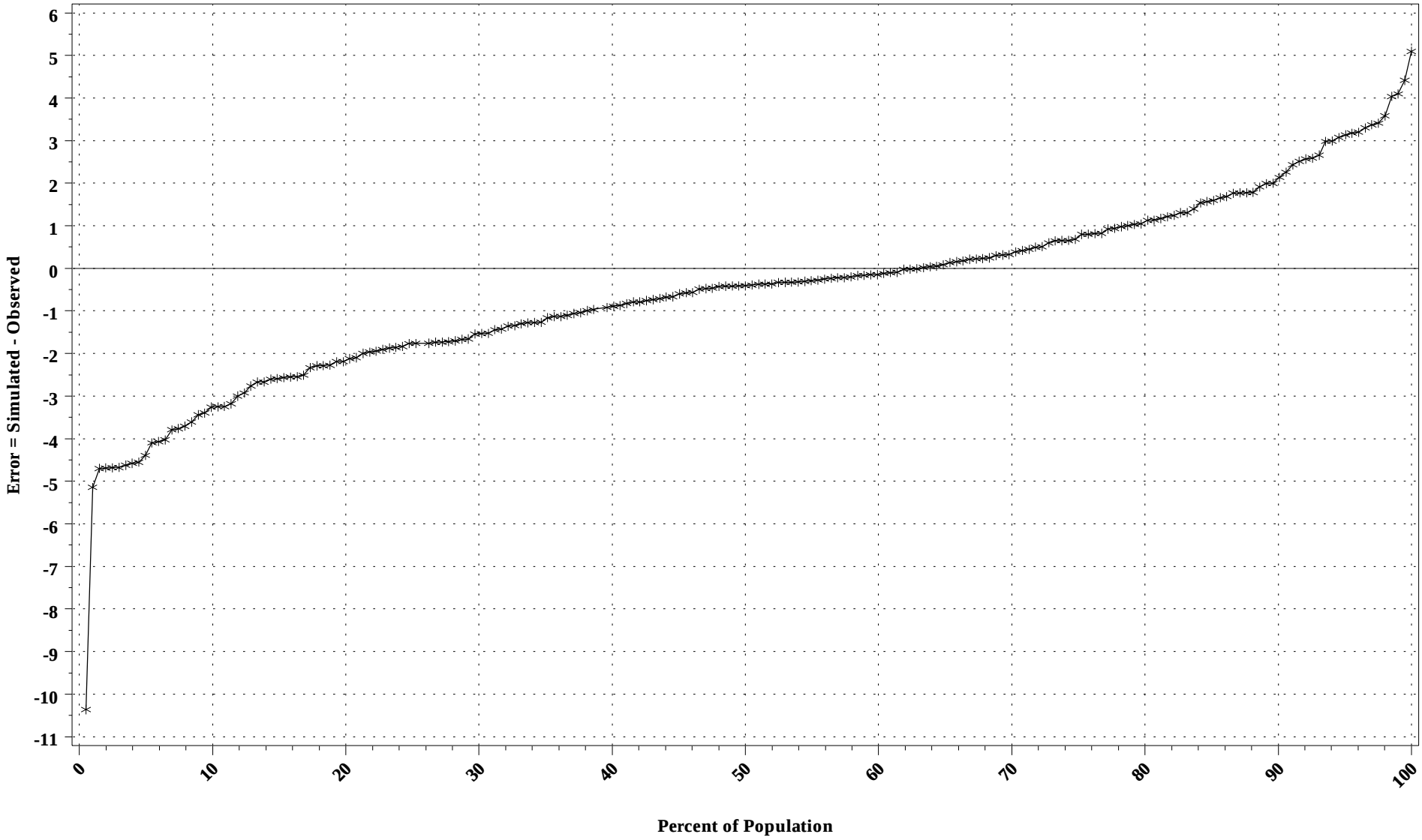
# East Branch Susquehanna at Segment 40
## Actual error versus Percentile Sample Population
## Temperature-C

### Frequency Distribution - All Simulated and Observed Data

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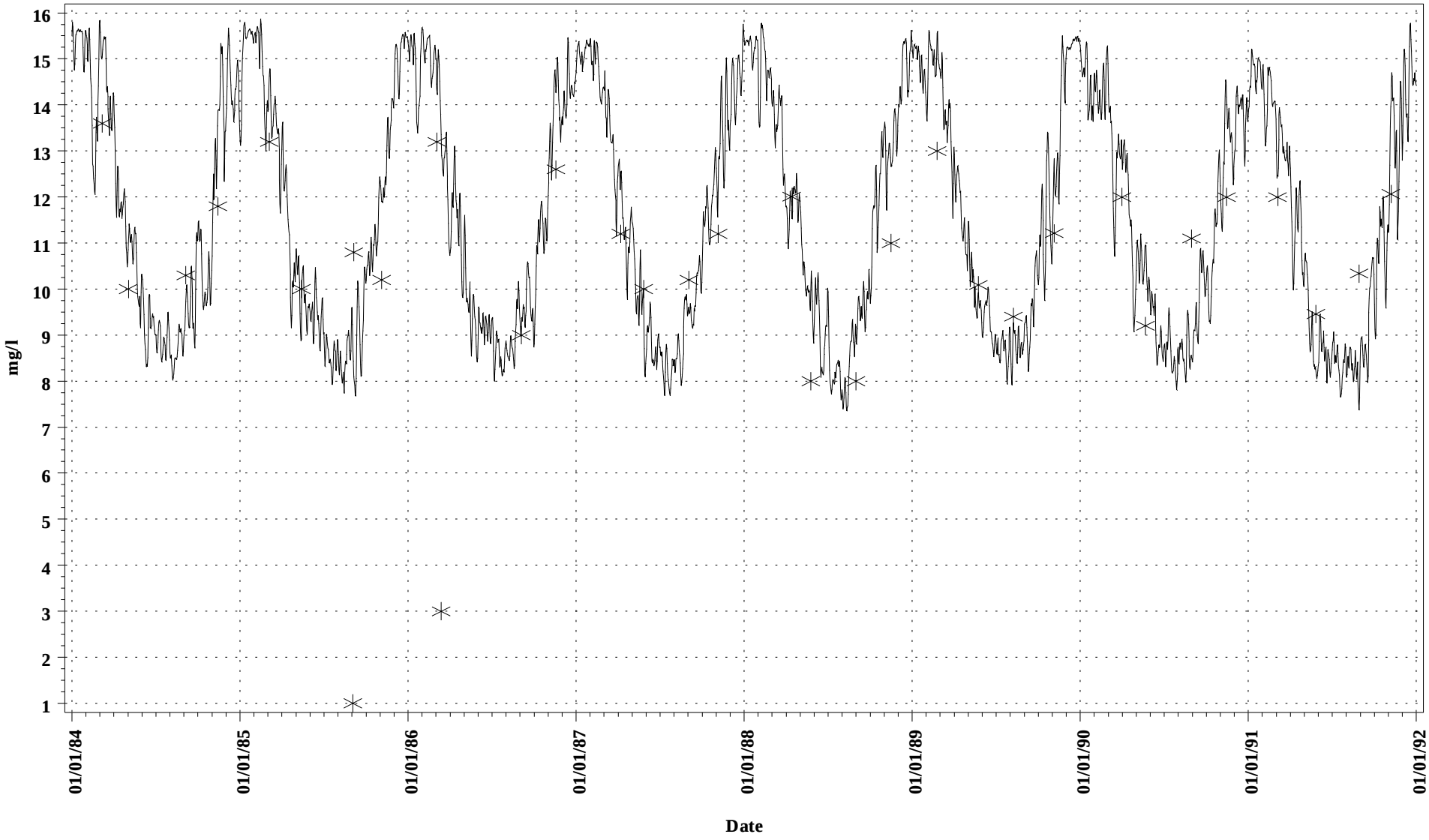
# East Branch Susquehanna at Segment 40
## Observed and Simulated versus Time
# Dissolved Oxygen

**(*=Observed, -=Simulated)**

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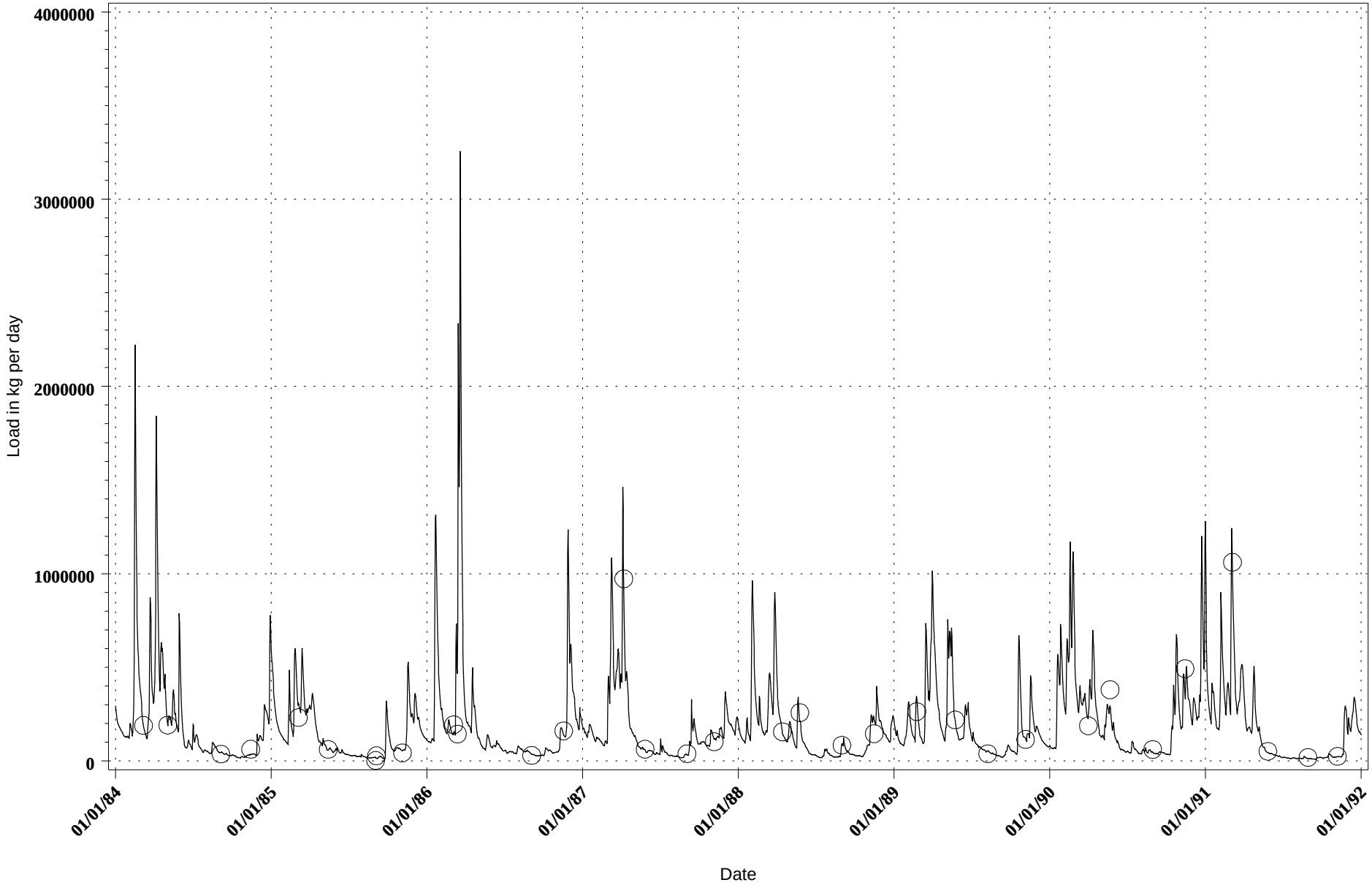
# East Branch Susquehanna at Segment 40
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

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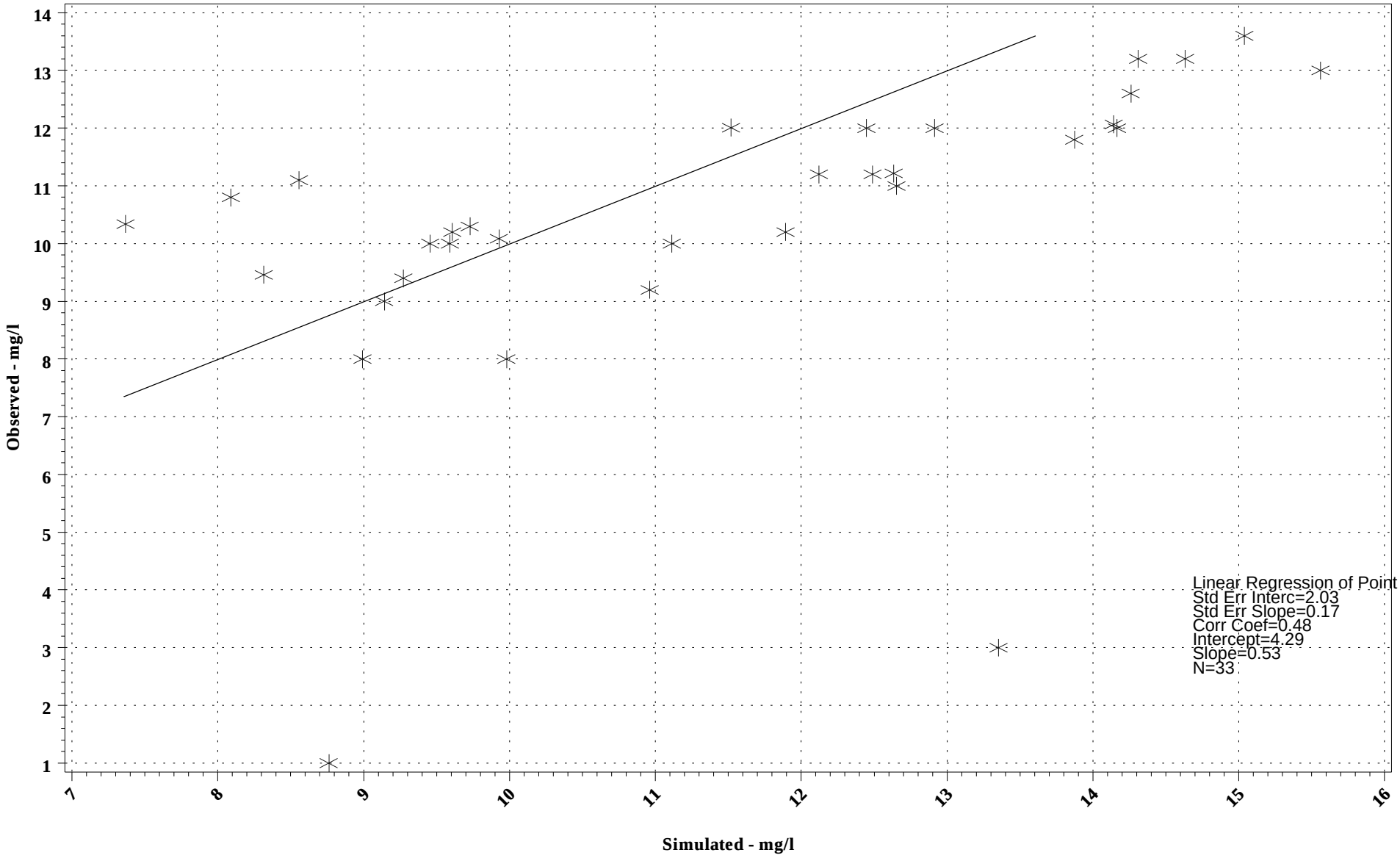
# East Branch Susquehanna at Segment 40

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Dissolved Oxygen: 01JAN84 - 01JAN92

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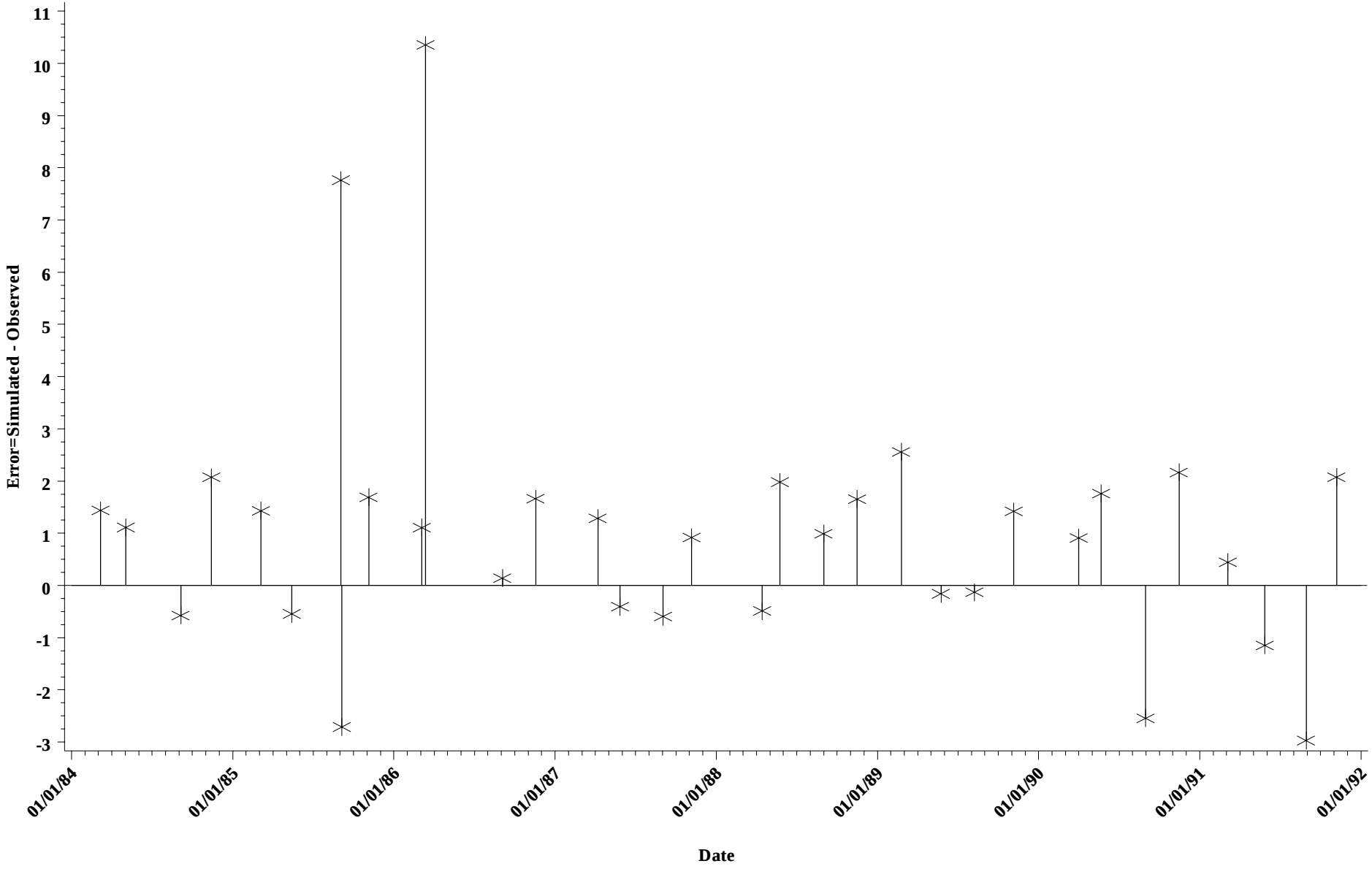
# East Branch Susquehanna at Segment 40
## Actual Error versus Time
## Dissolved Oxygen

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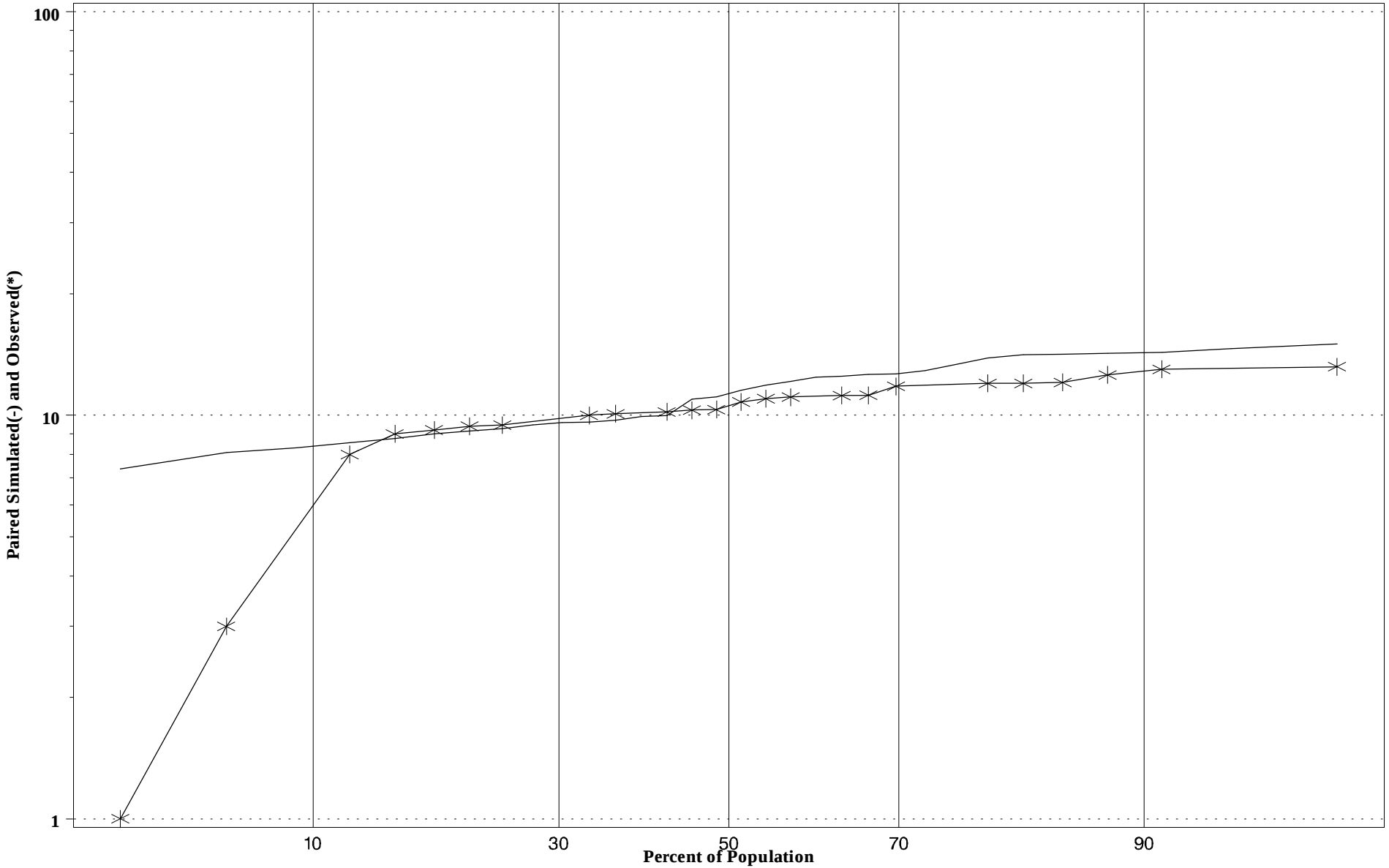
# East Branch Susquehanna at Segment 40
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data

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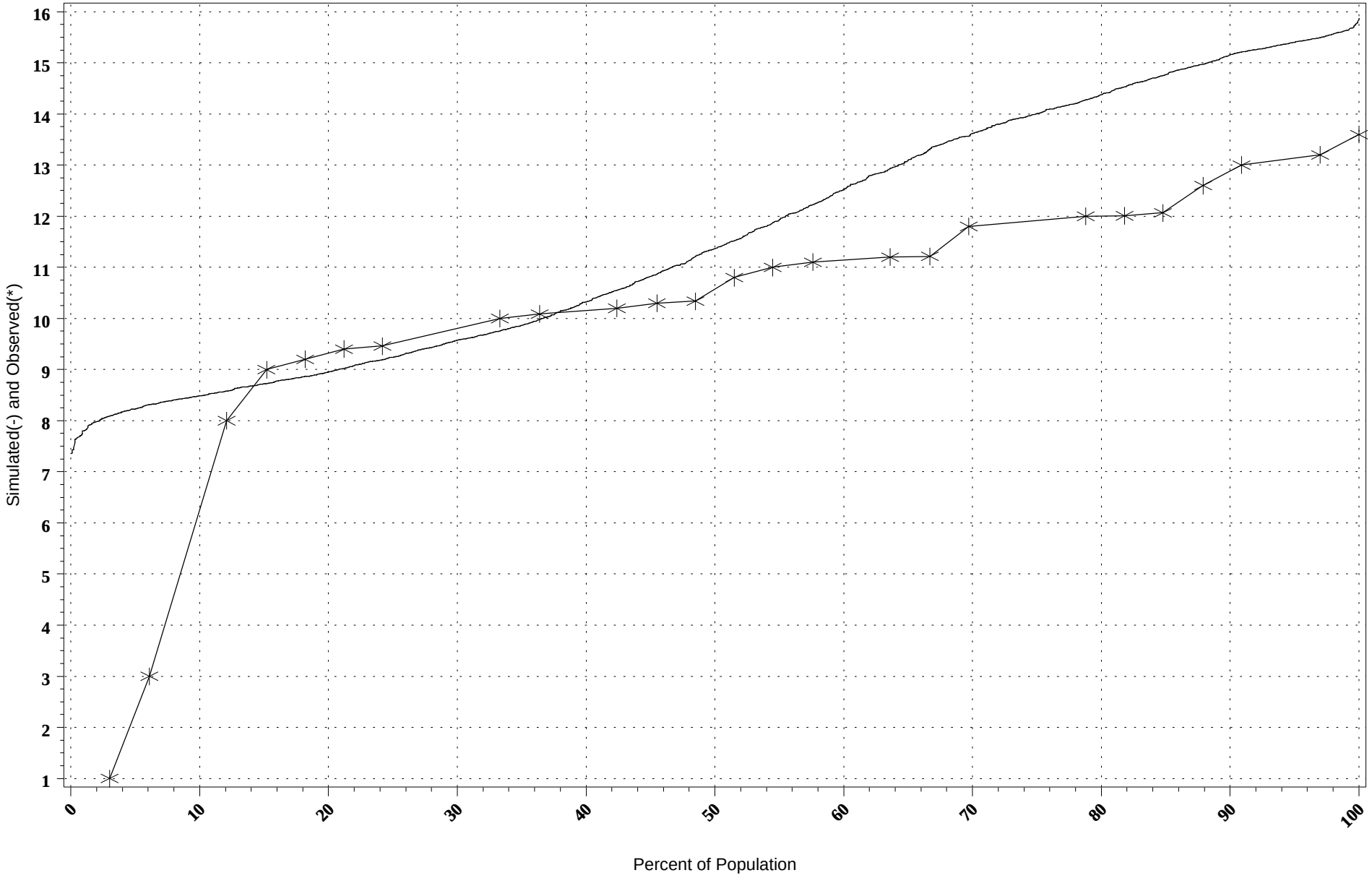
# East Branch Susquehanna at Segment 40

## Dissolved Oxygen

### Frequency Distribution - All Simulated and Observed Data

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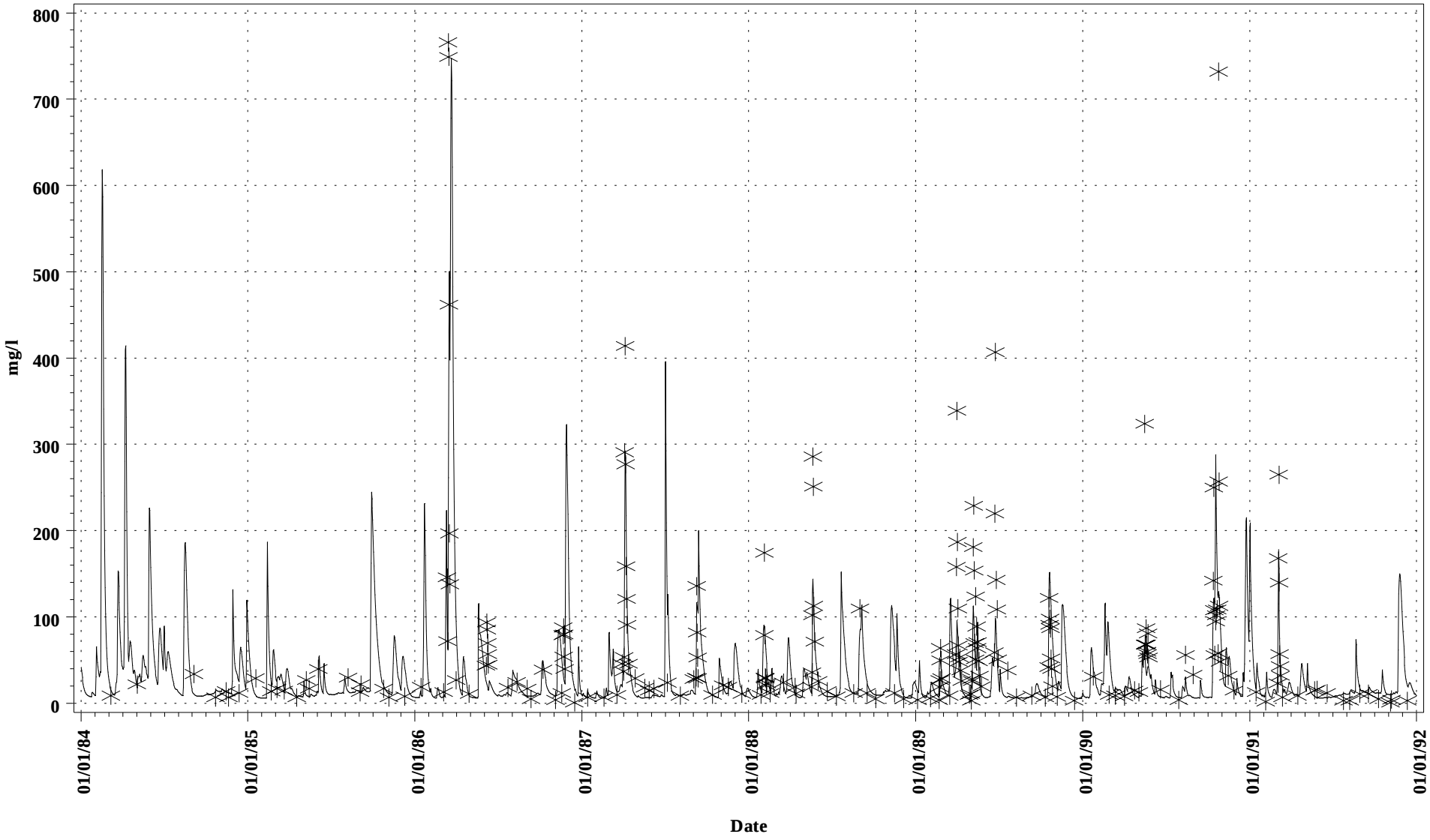
# East Branch Susquehanna at Segment 40
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**

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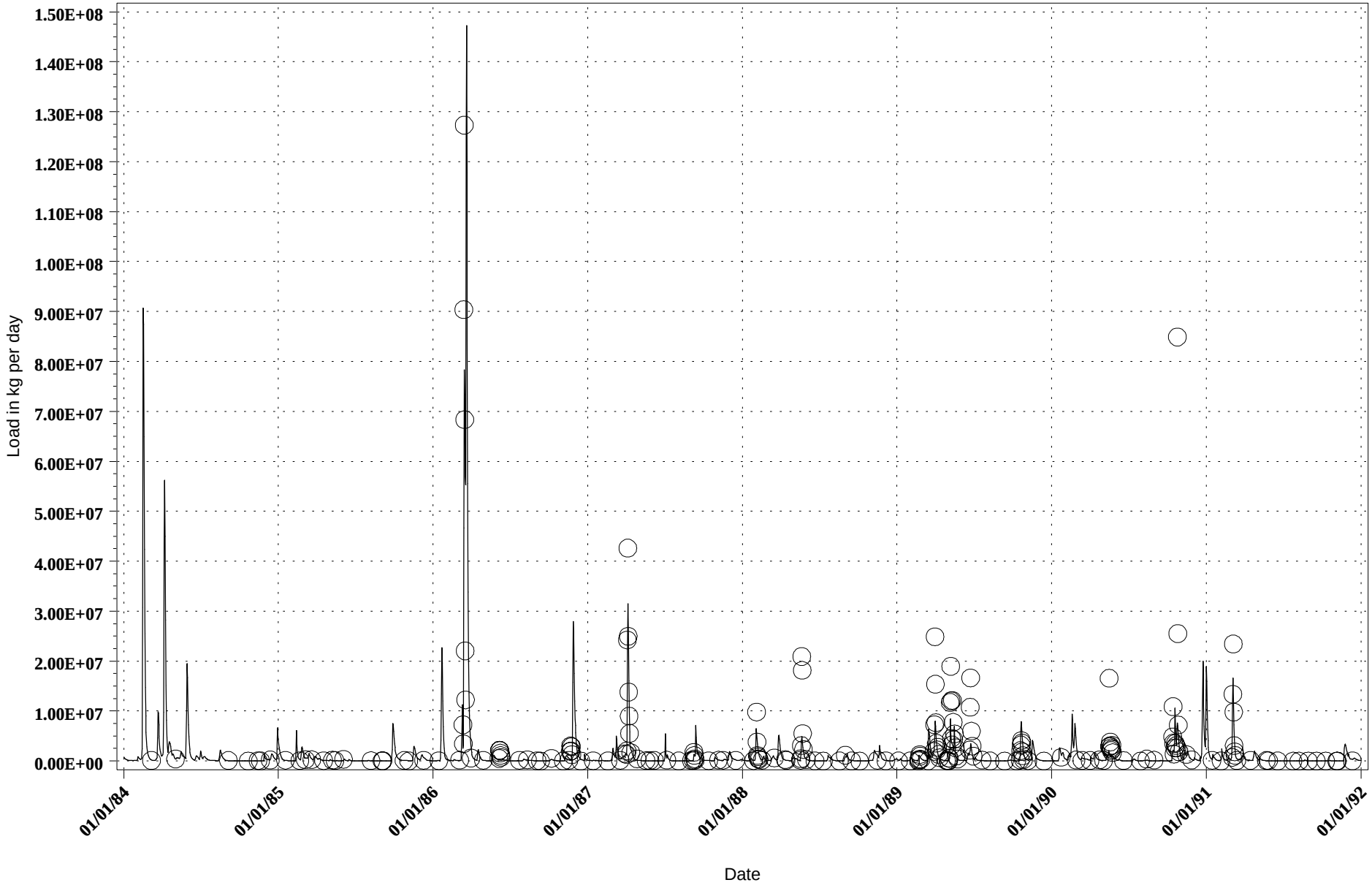
# East Branch Susquehanna at Segment 40

## Total Suspended Sediment Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

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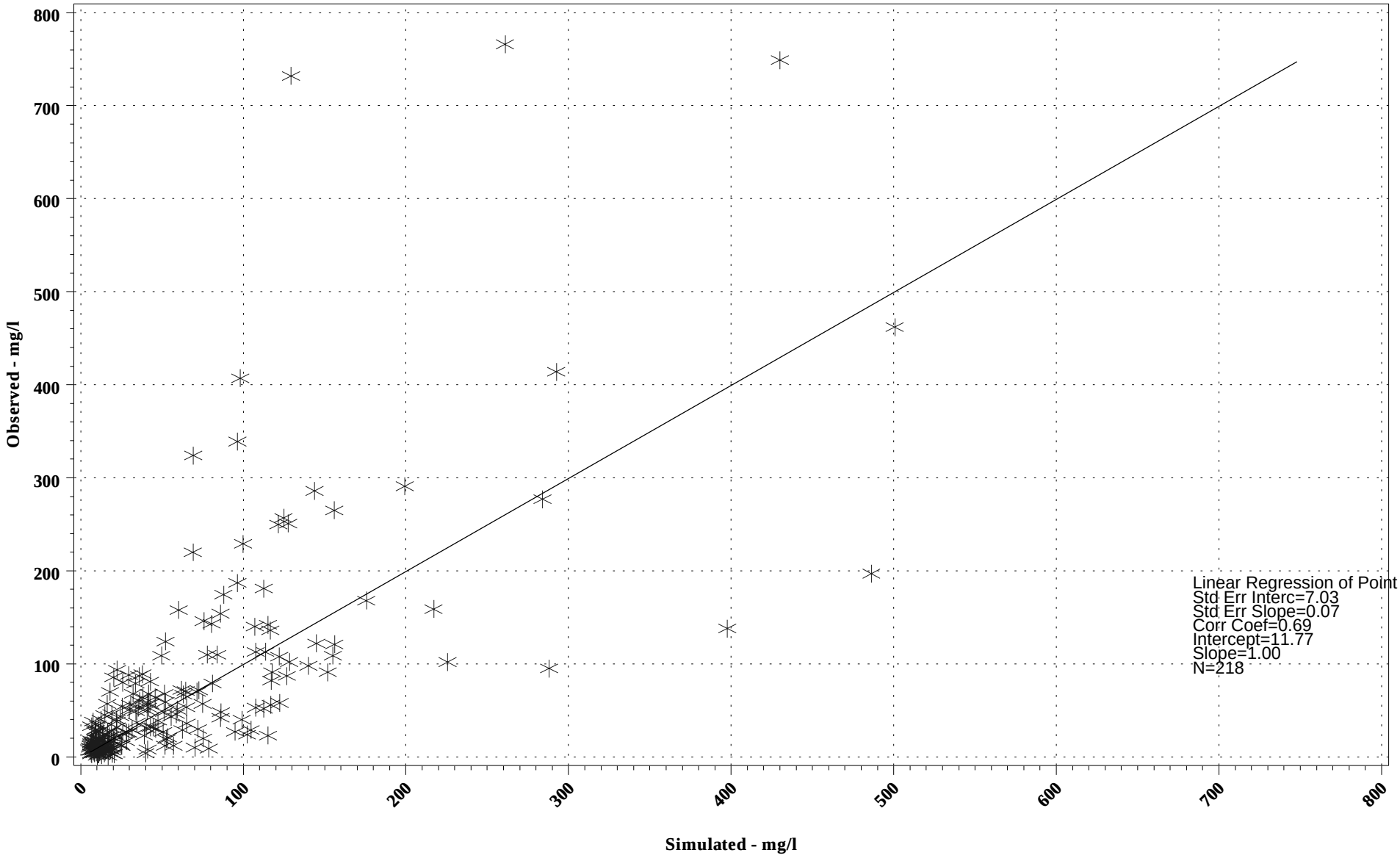
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92

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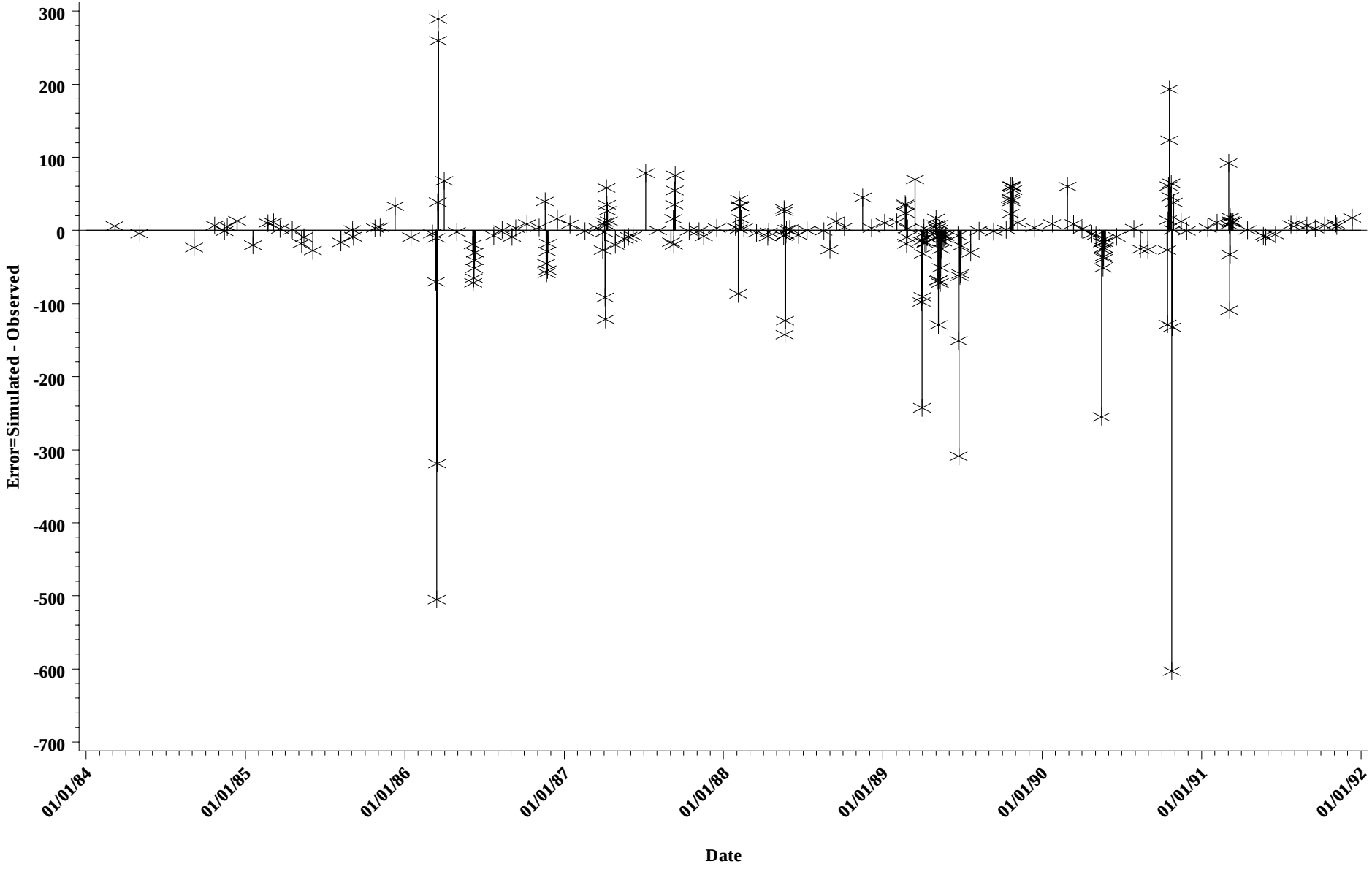
# East Branch Susquehanna at Segment 40
## Actual Error versus Time
## Total Suspended Sediment

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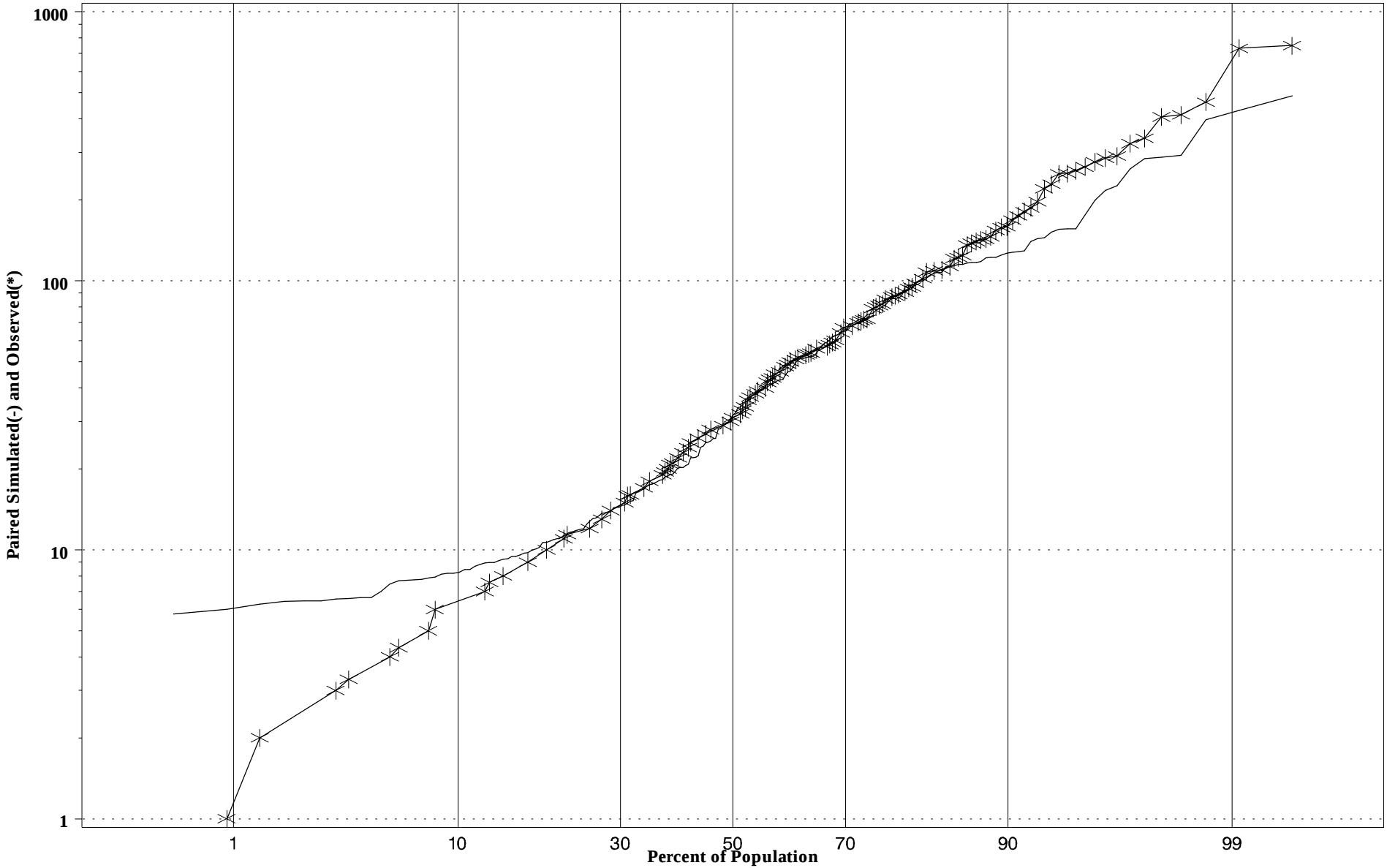
# East Branch Susquehanna at Segment 40

## Total Suspended Sediment

### Frequency Distribution - PAIRED Simulated and Observed Data

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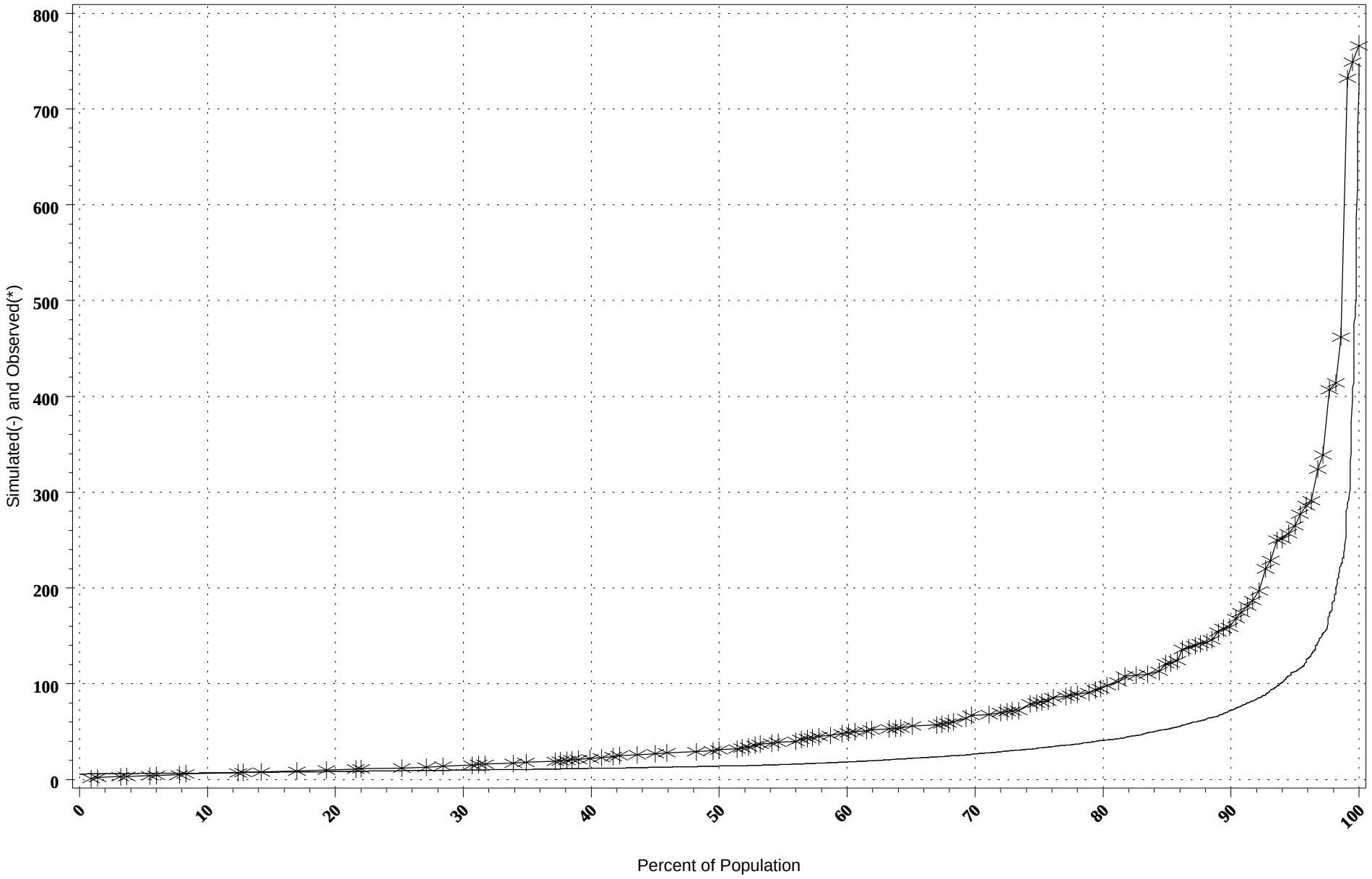
# East Branch Susquehanna at Segment 40

## Total Suspended Sediment

### Frequency Distribution - All Simulated and Observed Data

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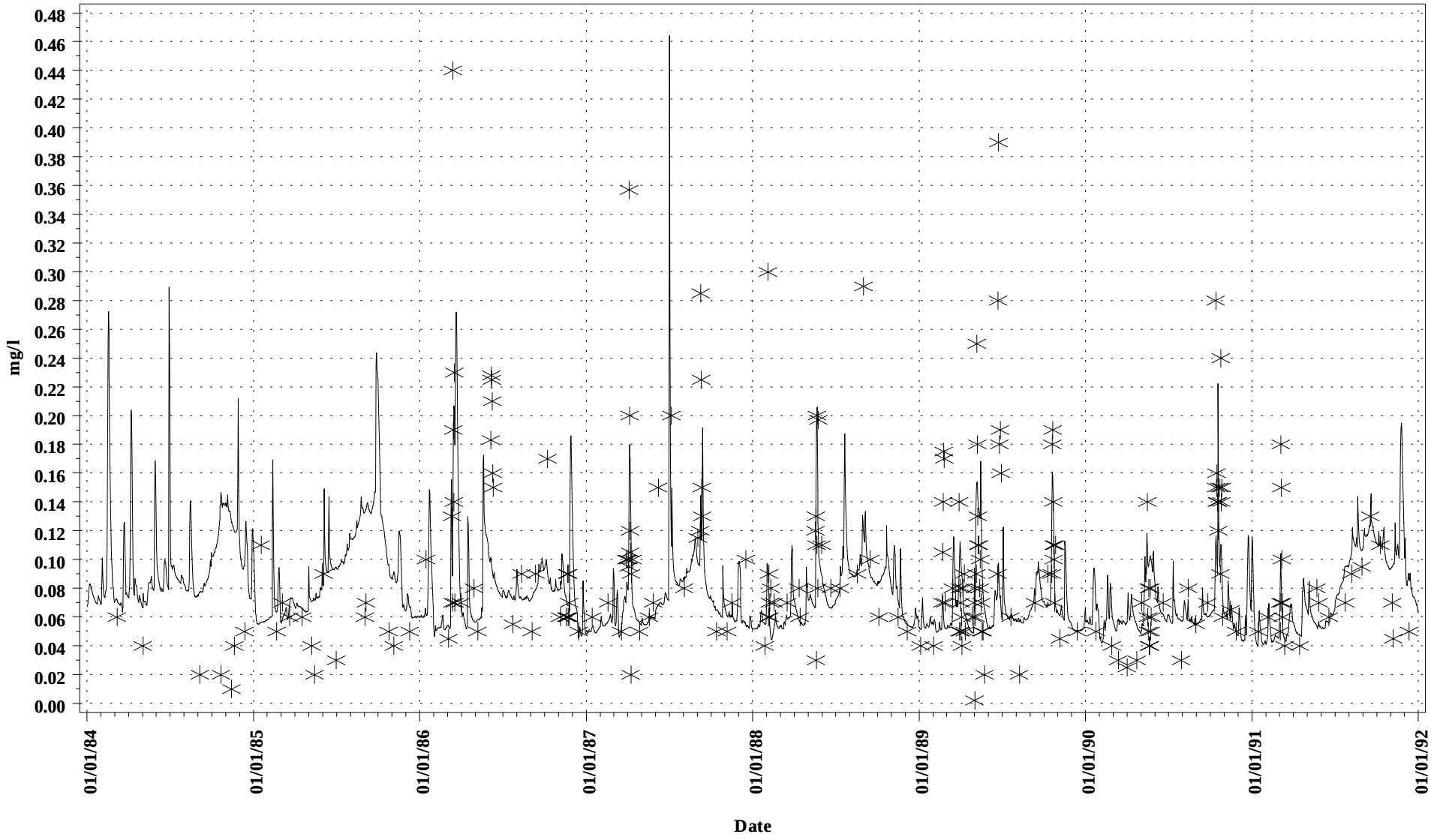
# East Branch Susquehanna at Segment 40
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**

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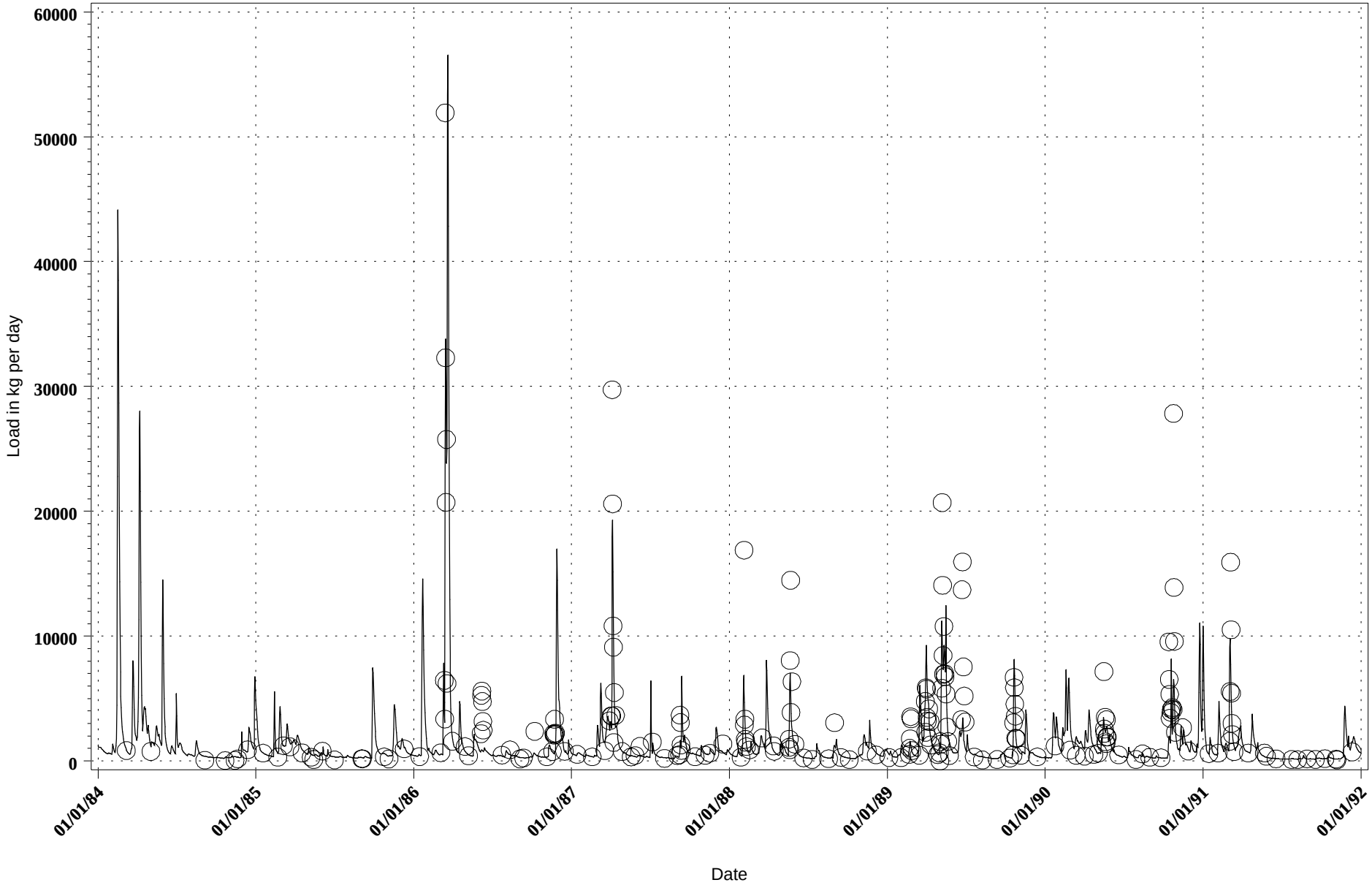
# East Branch Susquehanna at Segment 40
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

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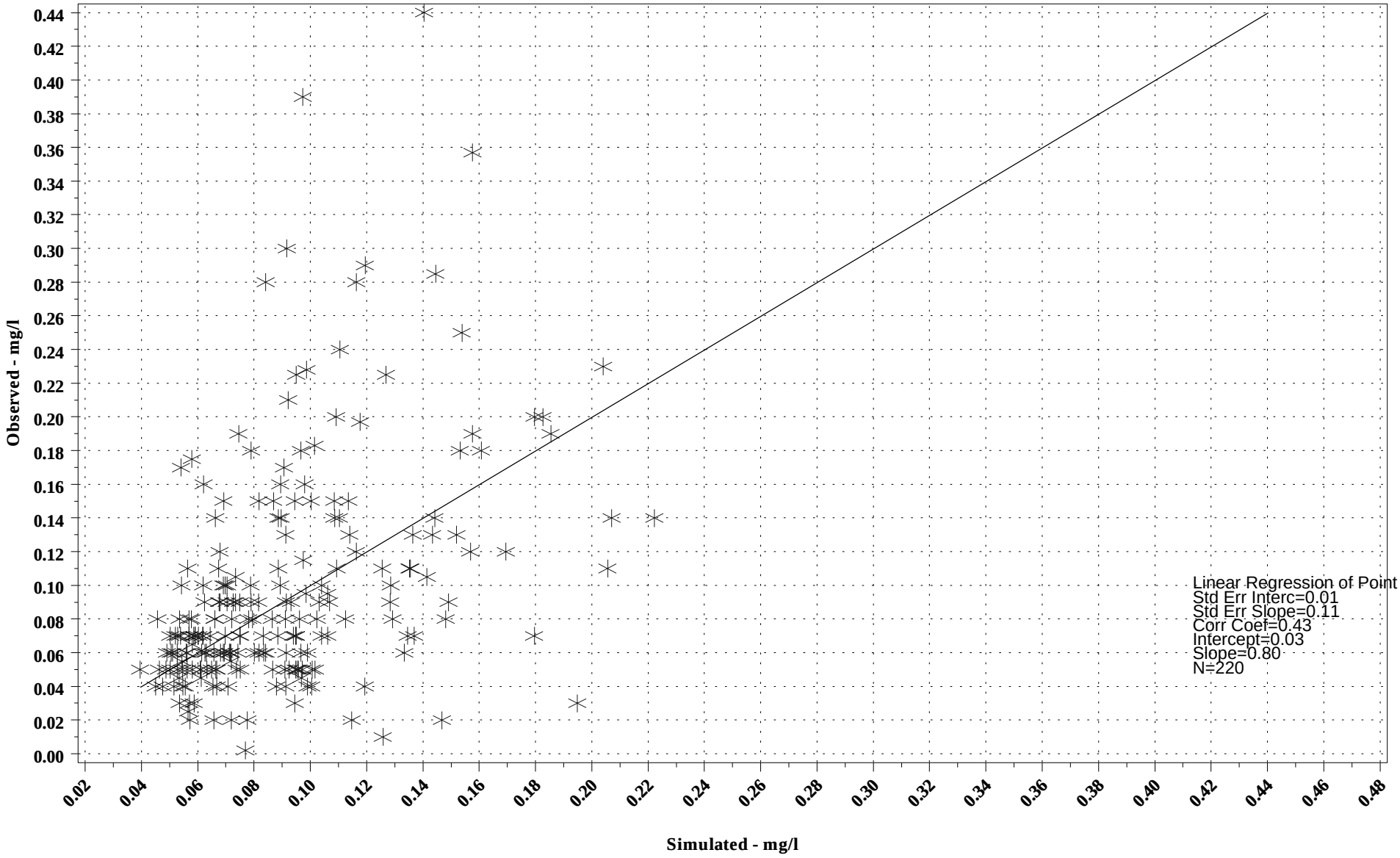
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92

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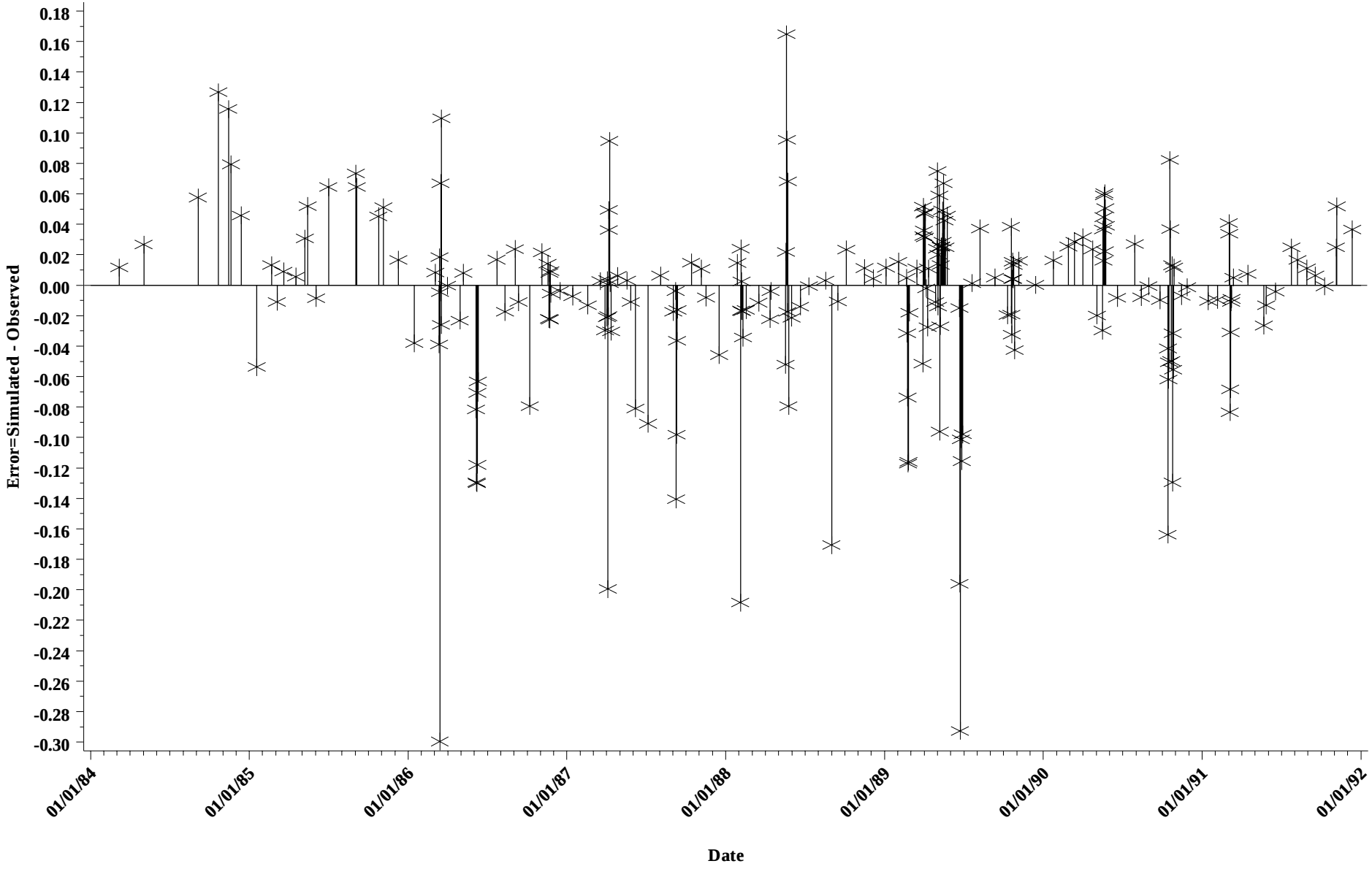
# East Branch Susquehanna at Segment 40
## Actual Error versus Time
## Total Phosphorus

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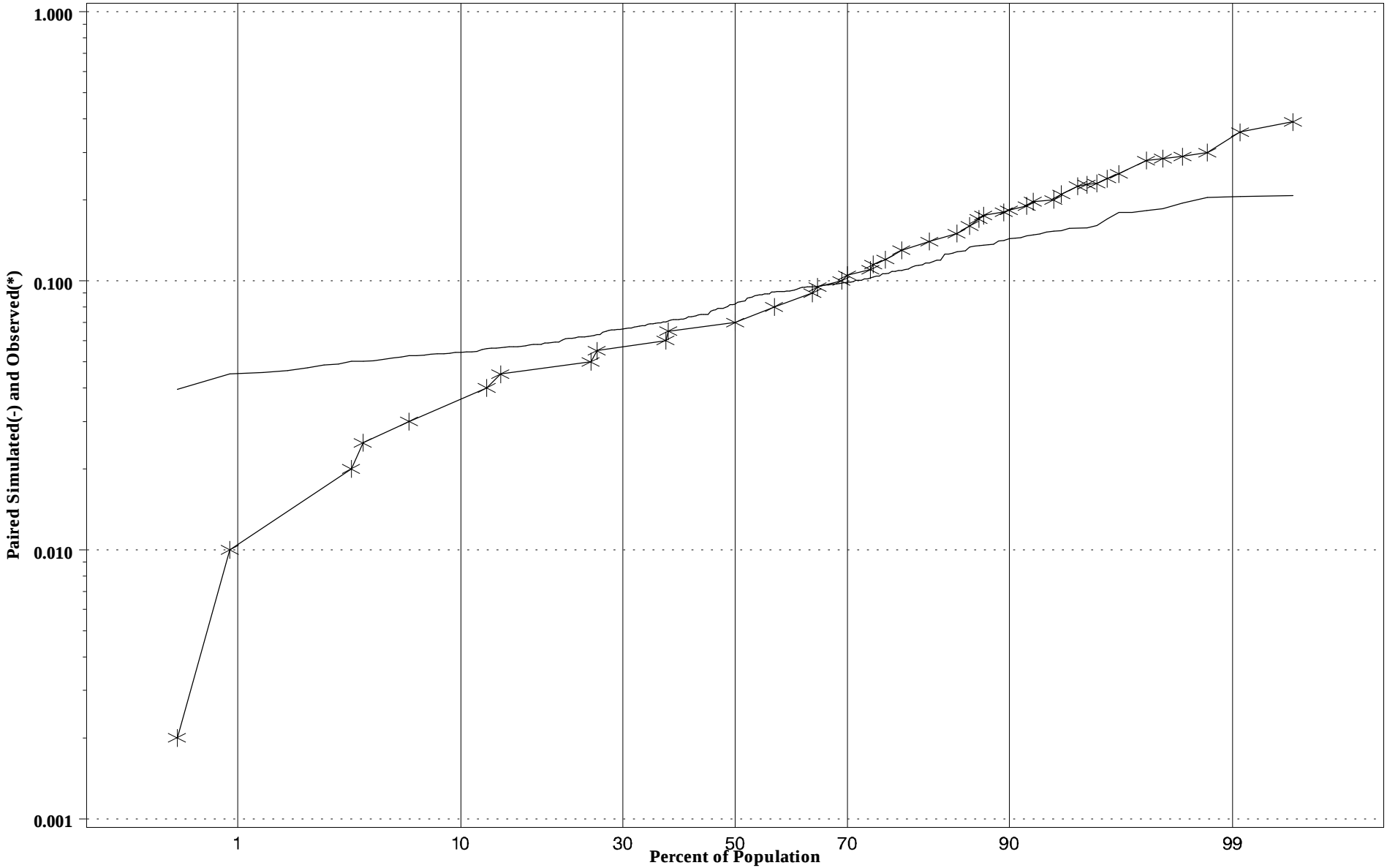
# East Branch Susquehanna at Segment 40

## Total Phosphorus

### Frequency Distribution - PAIRED Simulated and Observed Data

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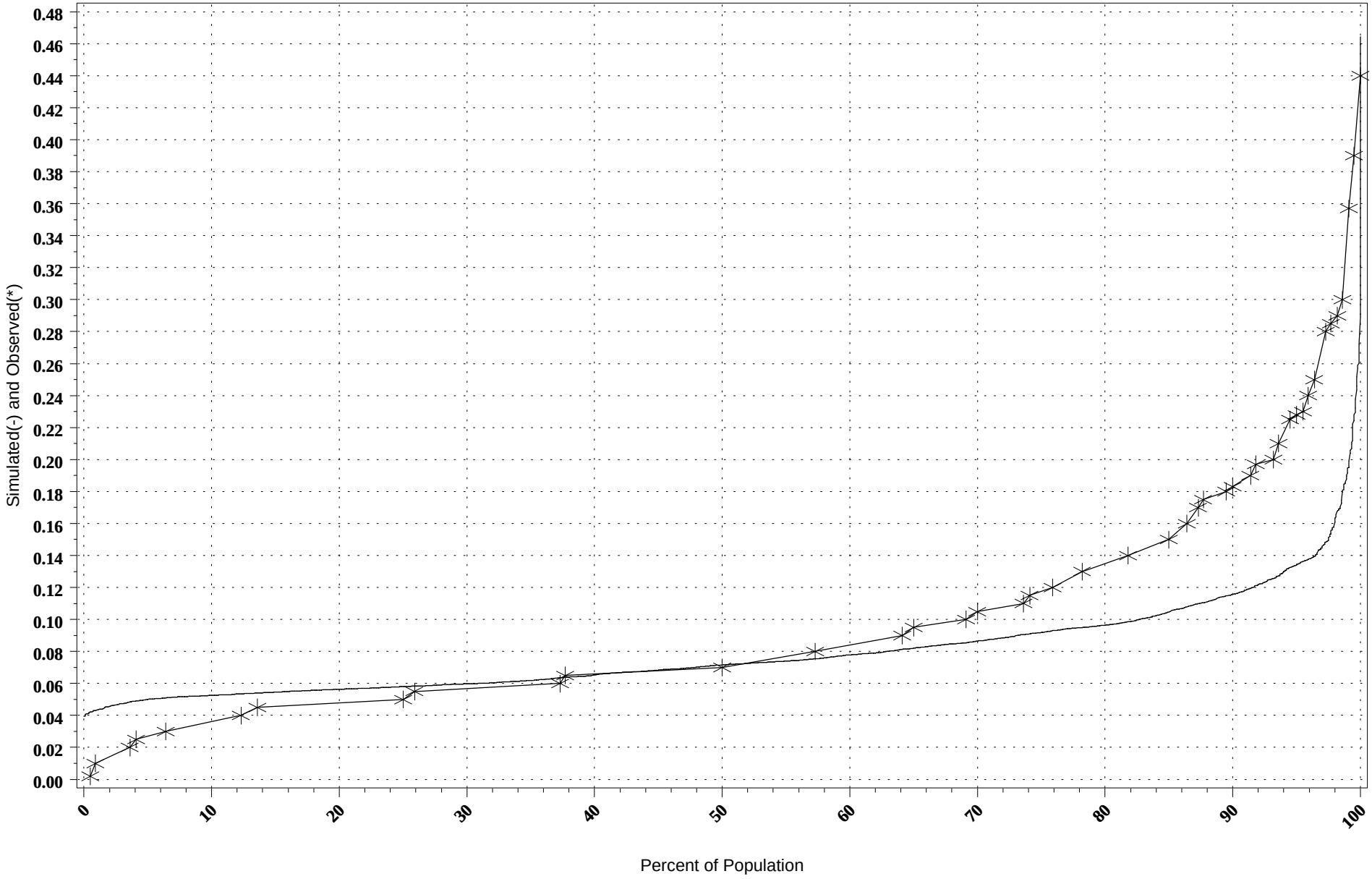
# East Branch Susquehanna at Segment 40

## Total Phosphorus

### Frequency Distribution - All Simulated and Observed Data

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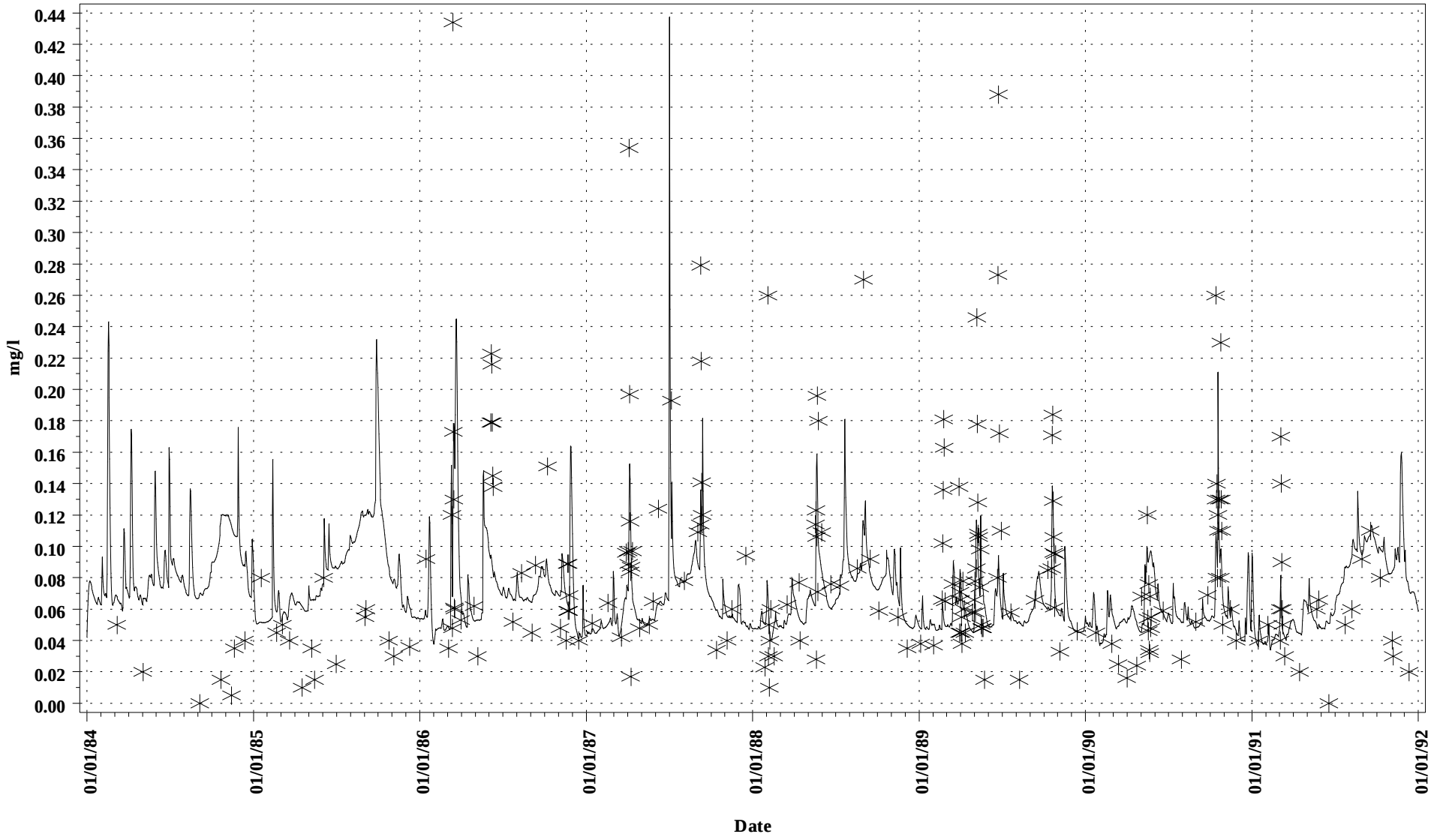
# East Branch Susquehanna at Segment 40
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

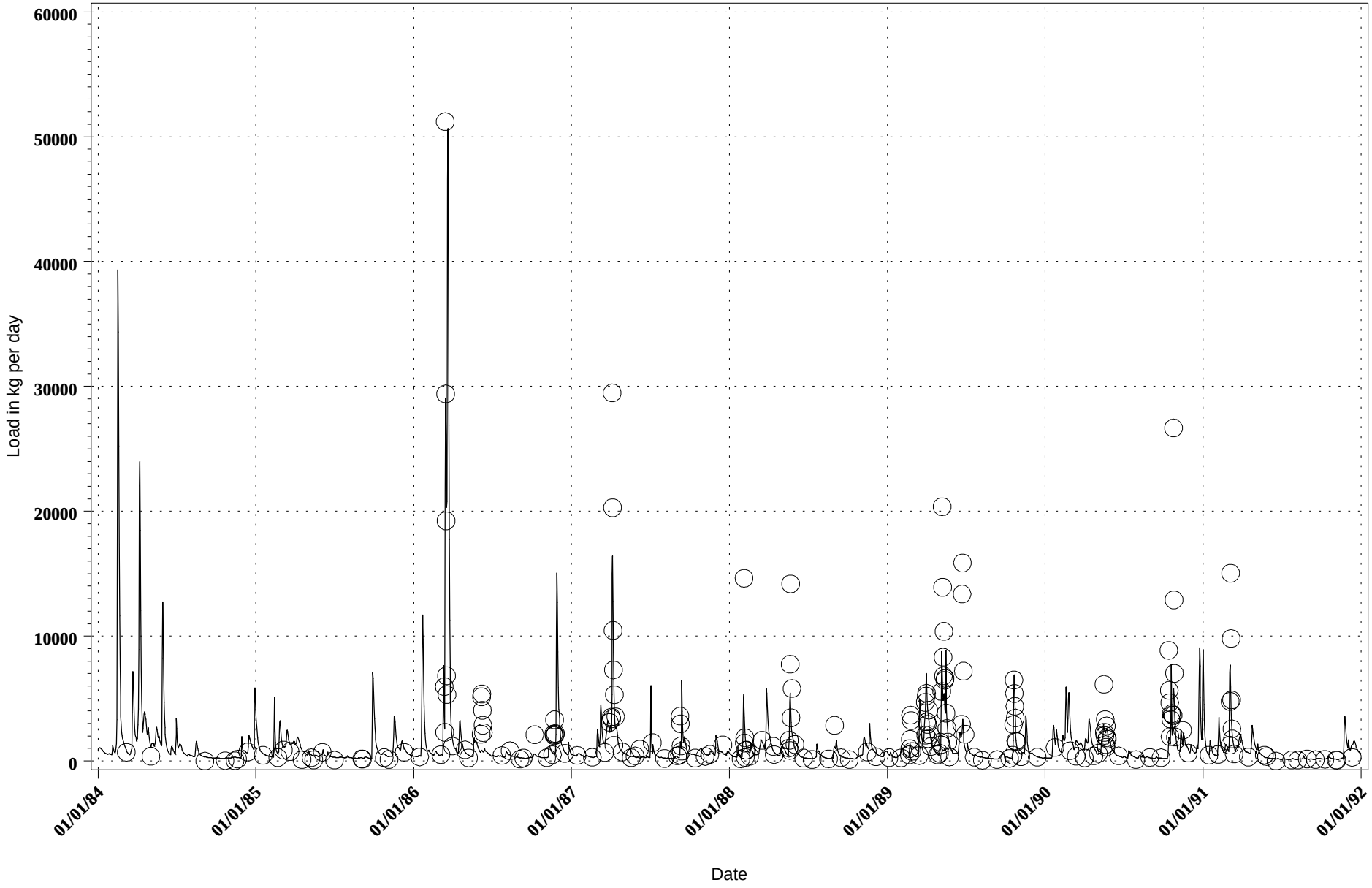



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

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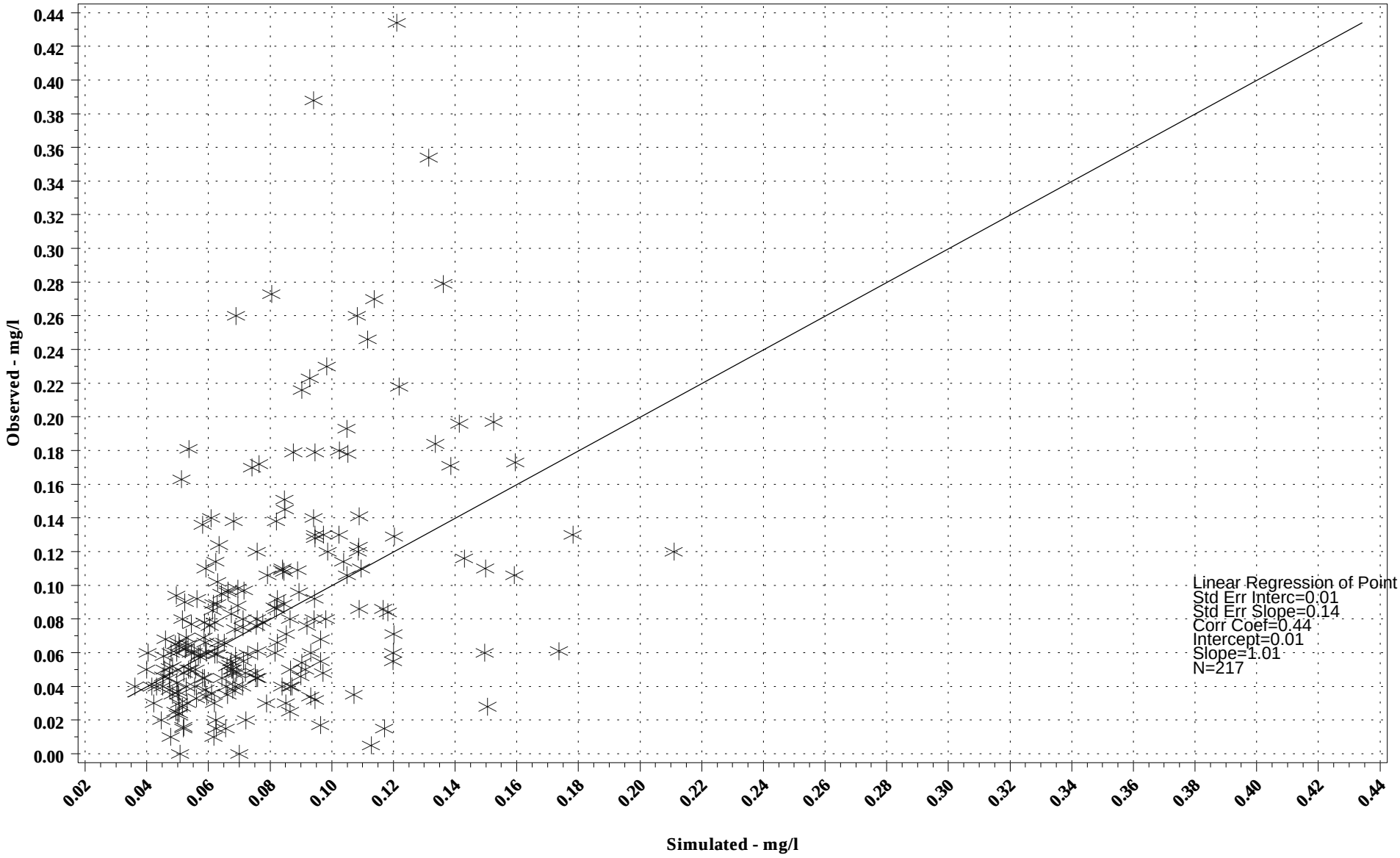
# East Branch Susquehanna at Segment 40

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92

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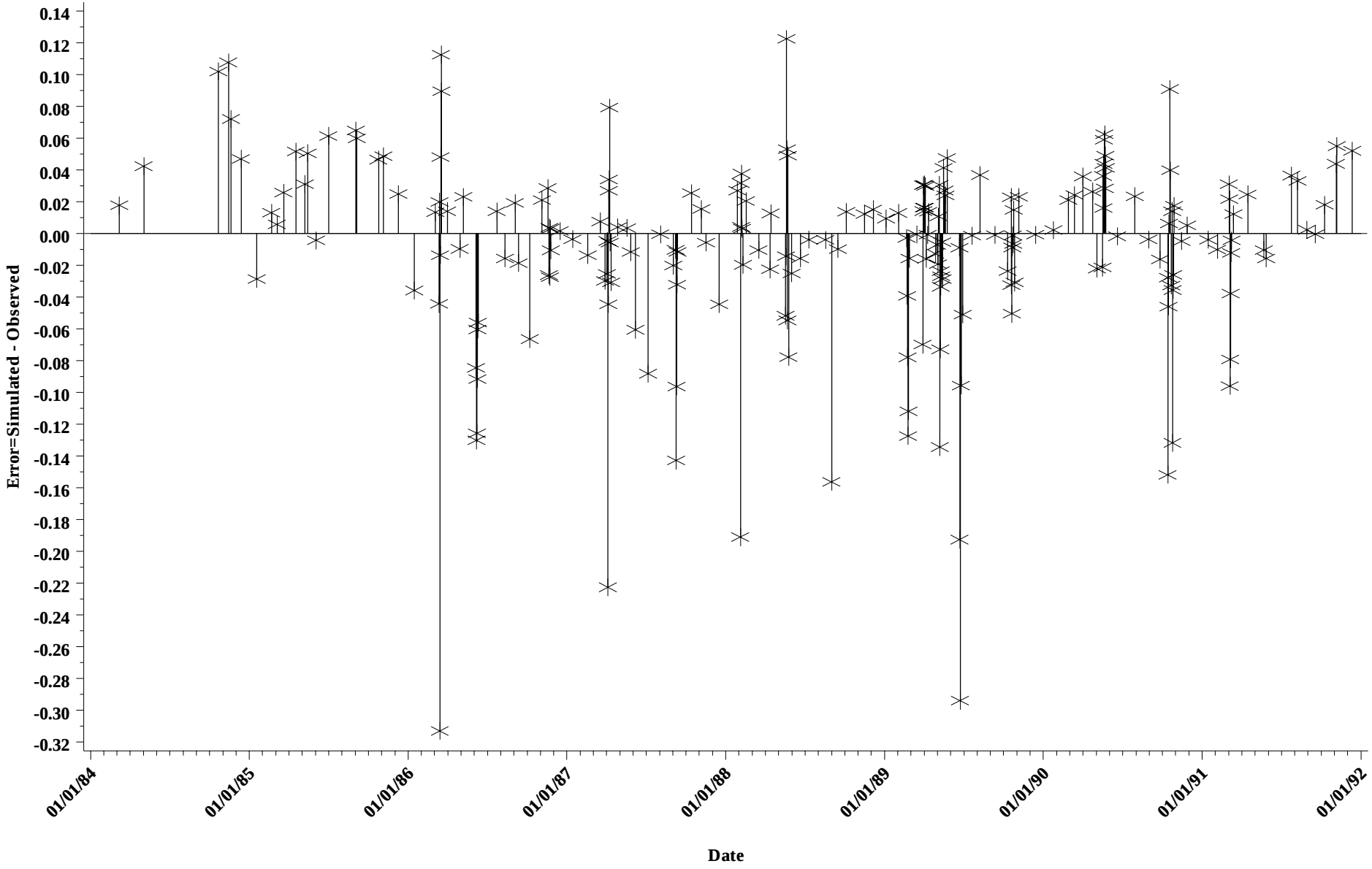
# East Branch Susquehanna at Segment 40
## Actual Error versus Time
## Organic and Particulate Phosphorus

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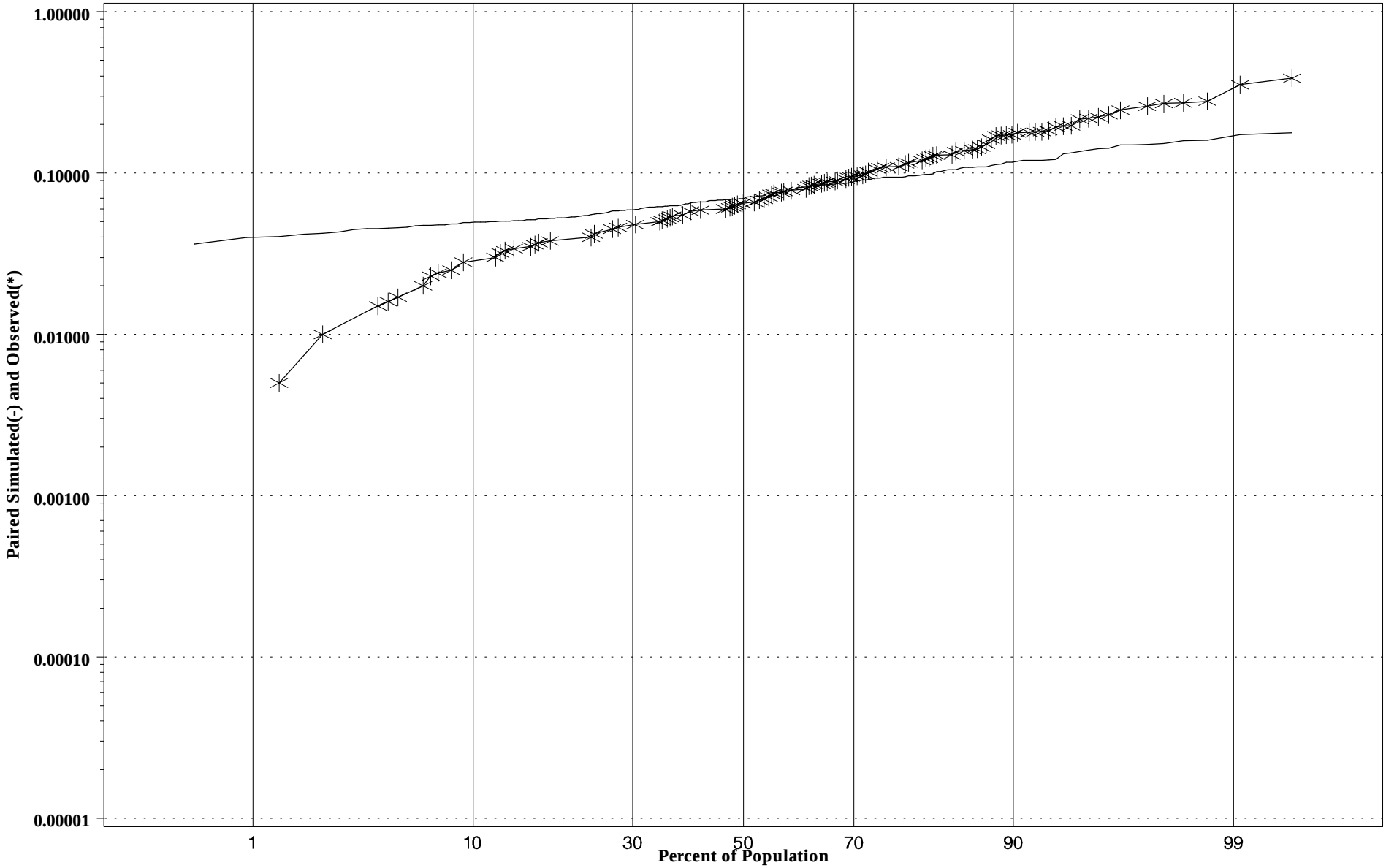
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Organic and Particulate Phosphorus

### Frequency Distribution - PAIRED Simulated and Observed Data

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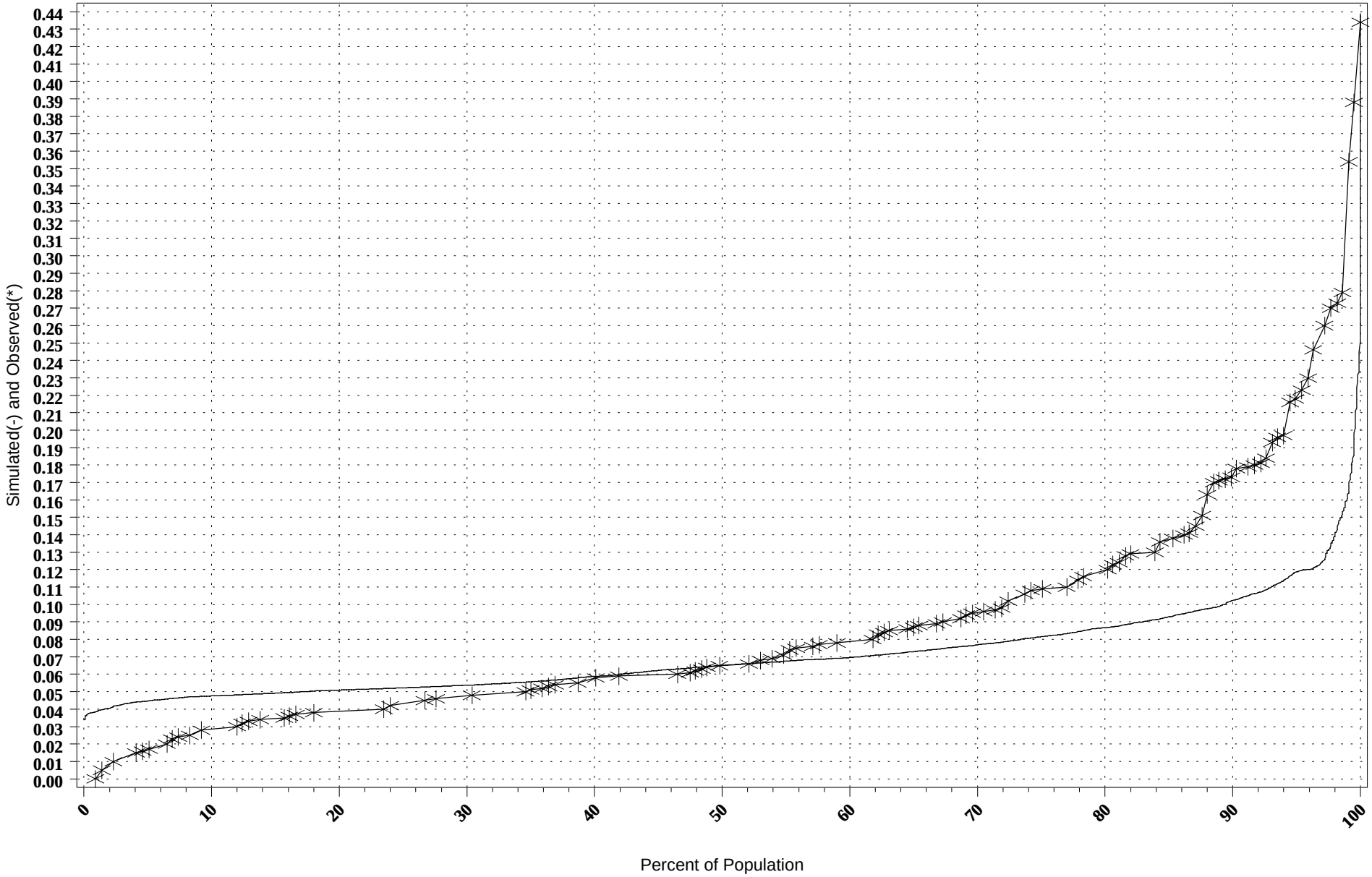
# East Branch Susquehanna at Segment 40

## Organic and Particulate Phosphorus

### Frequency Distribution - All Simulated and Observed Data



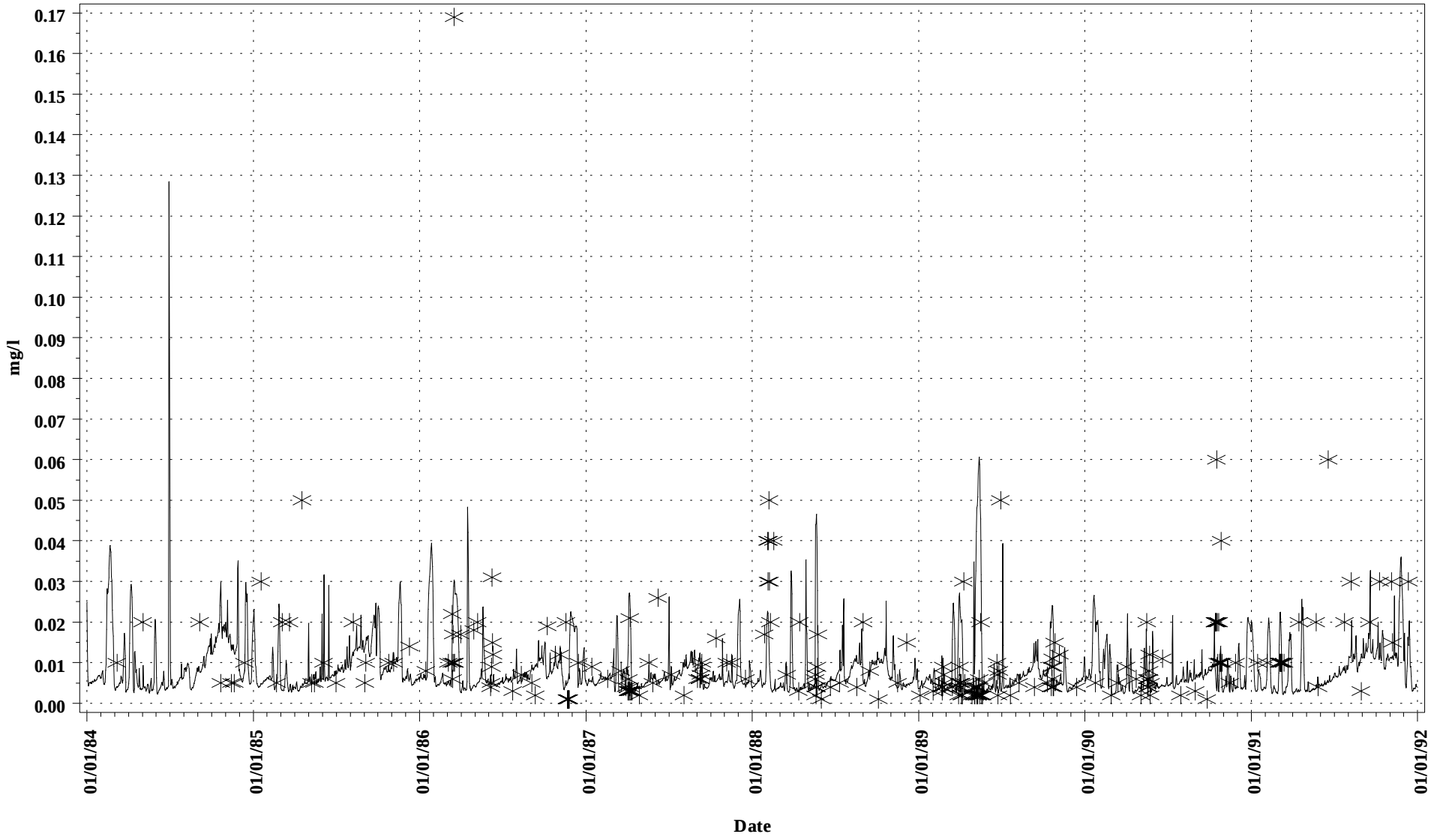

(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Observed and Simulated versus Time

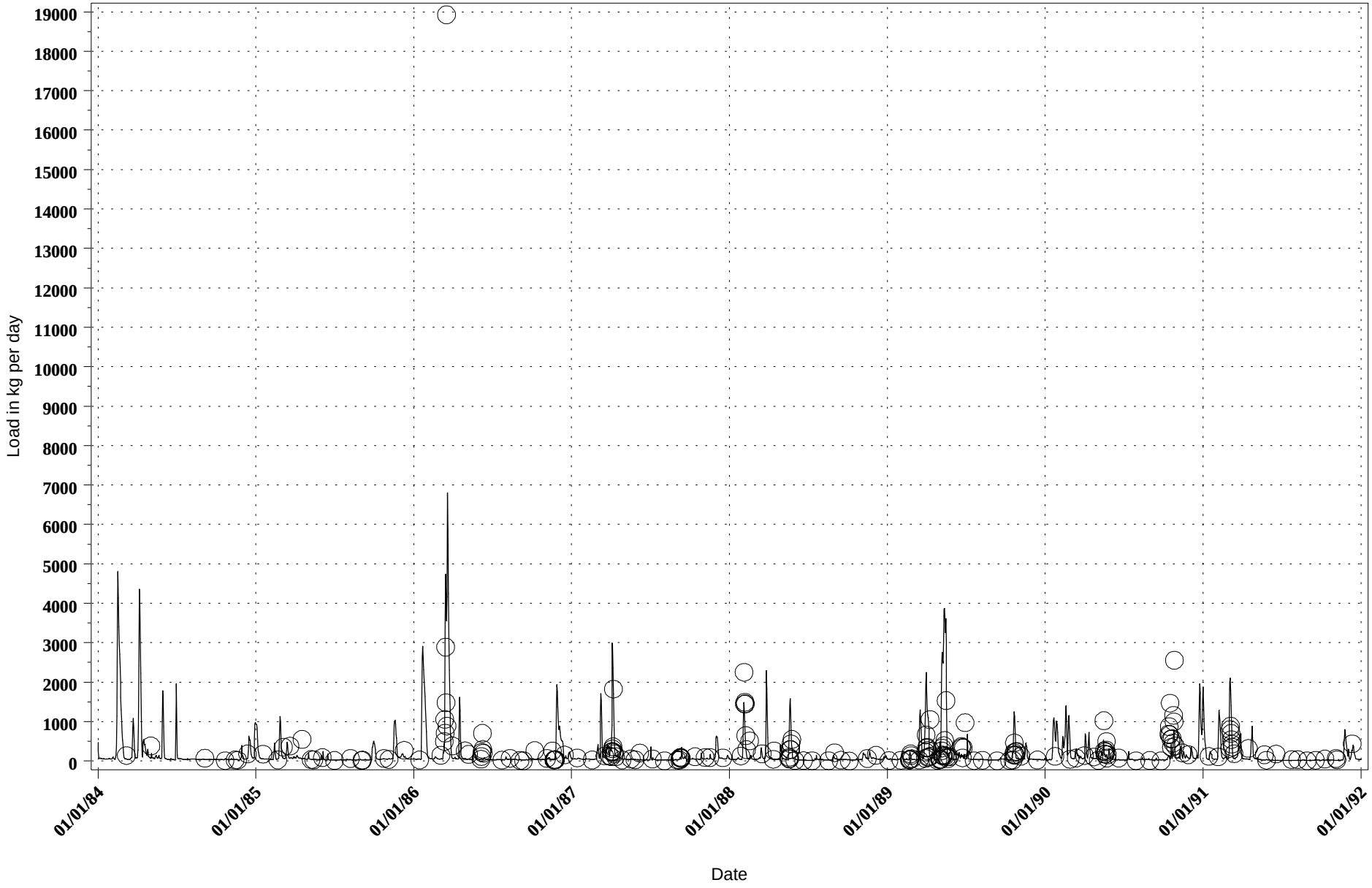
# Dissolved Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40
## Dissolved Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

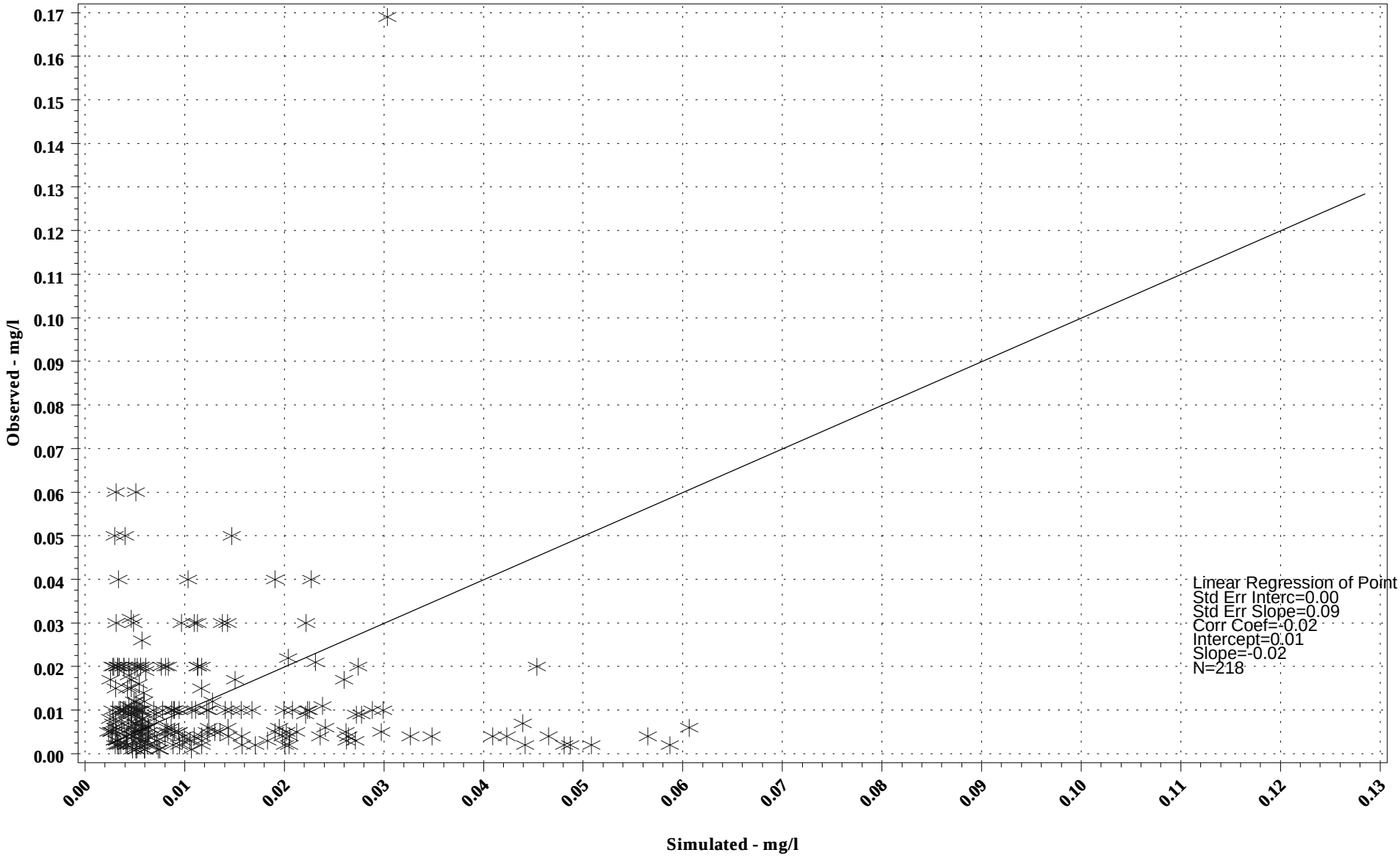



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40

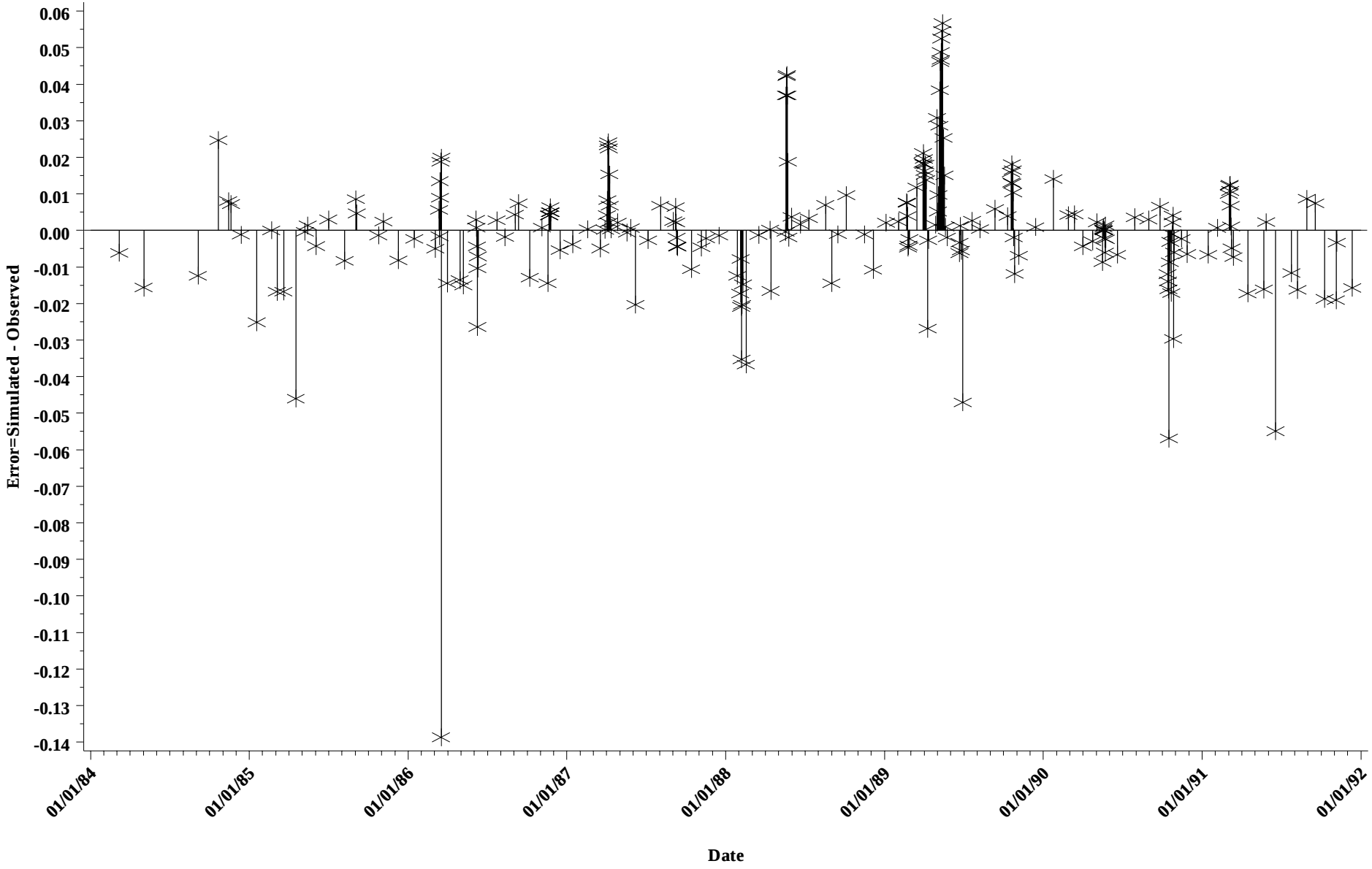
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



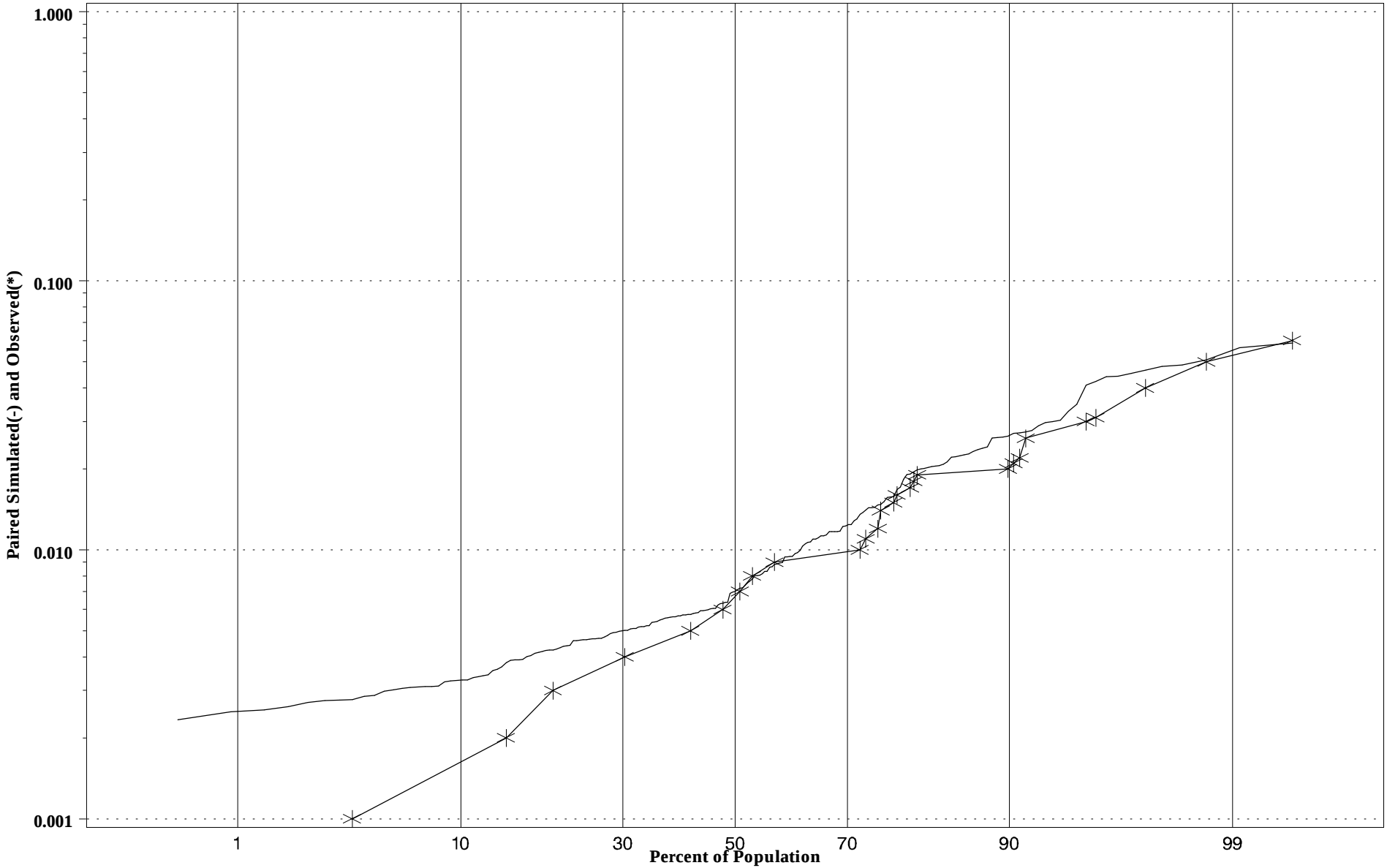

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data

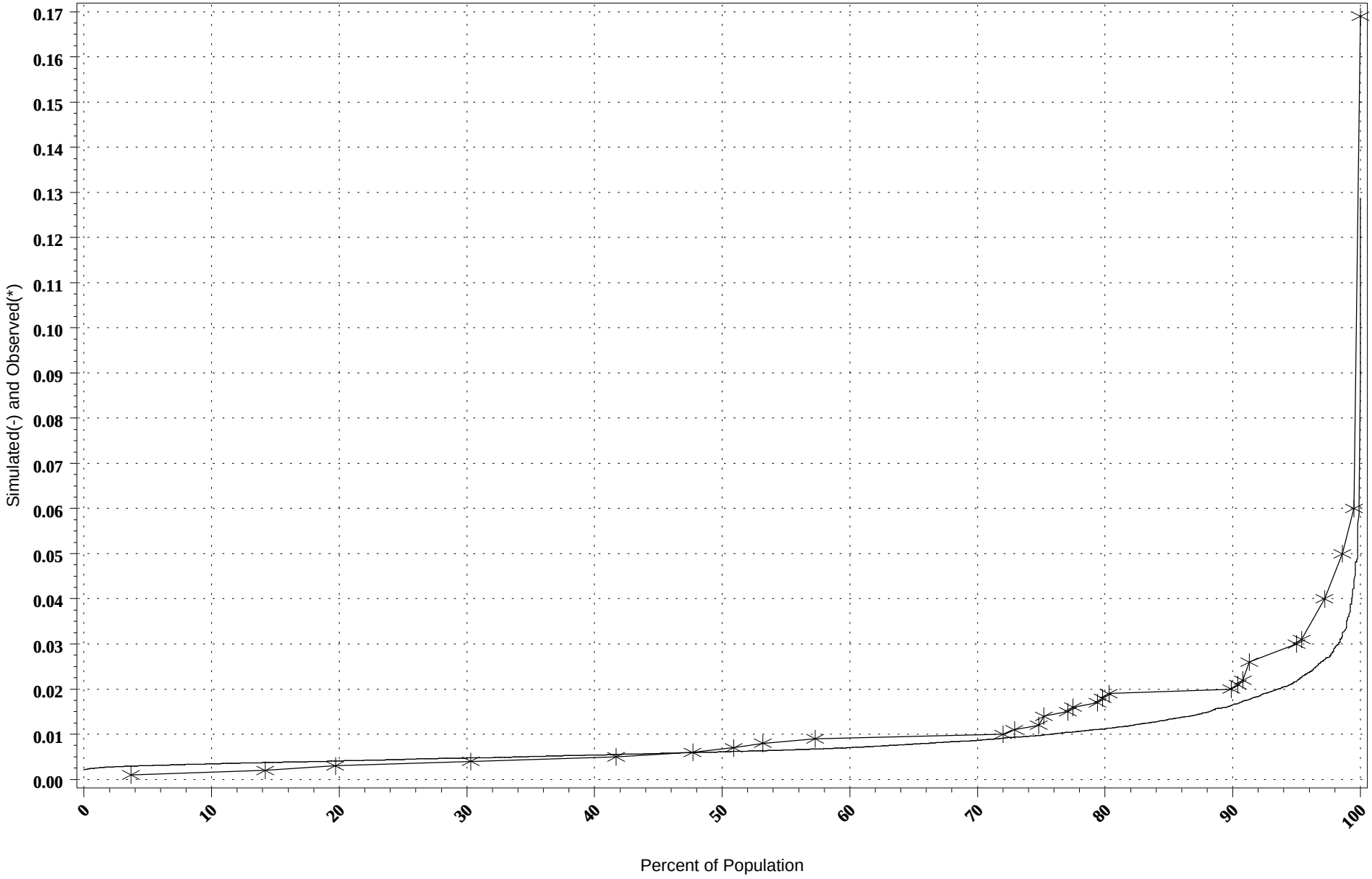



(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Dissolved Phosphorus

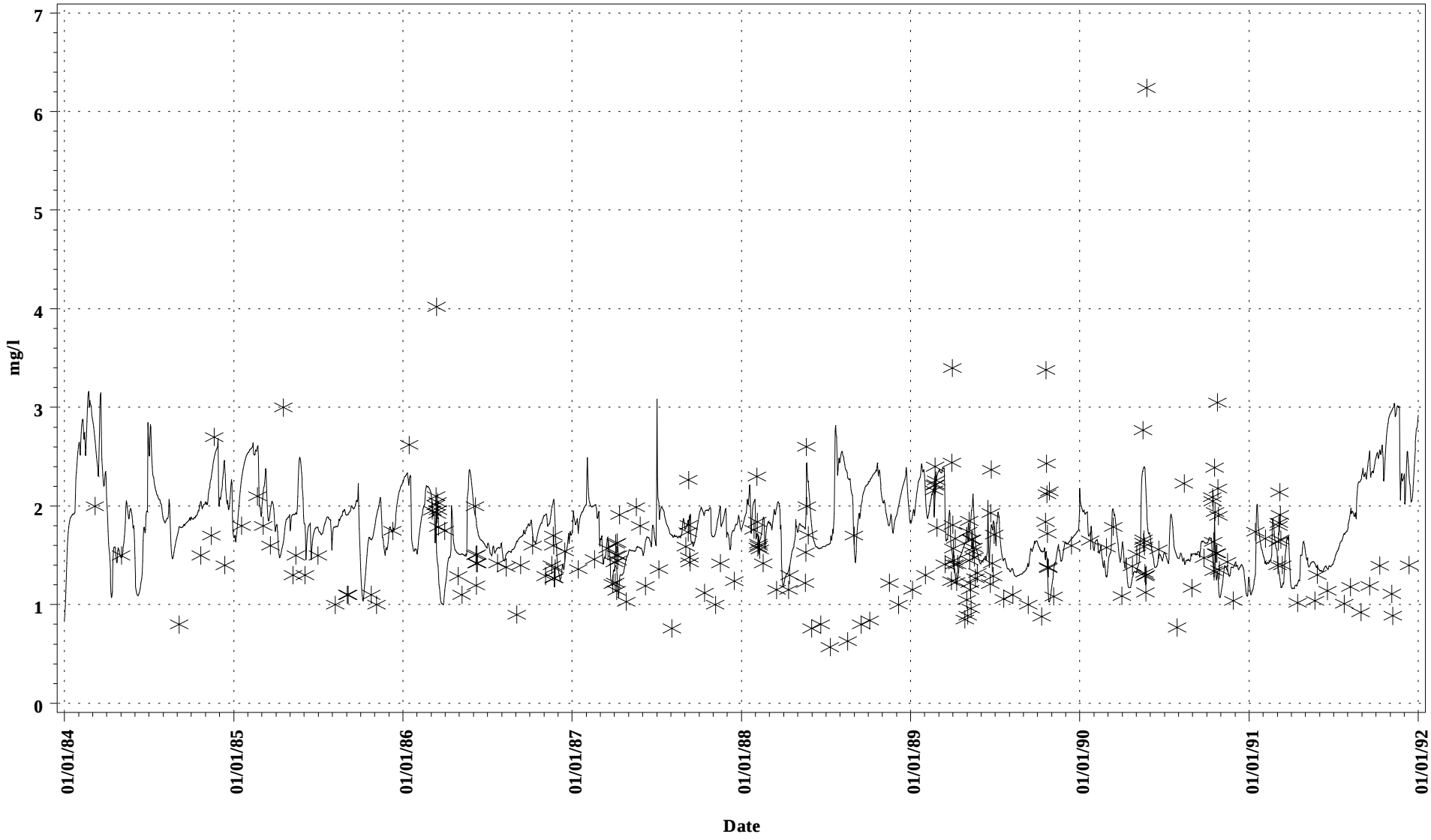
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

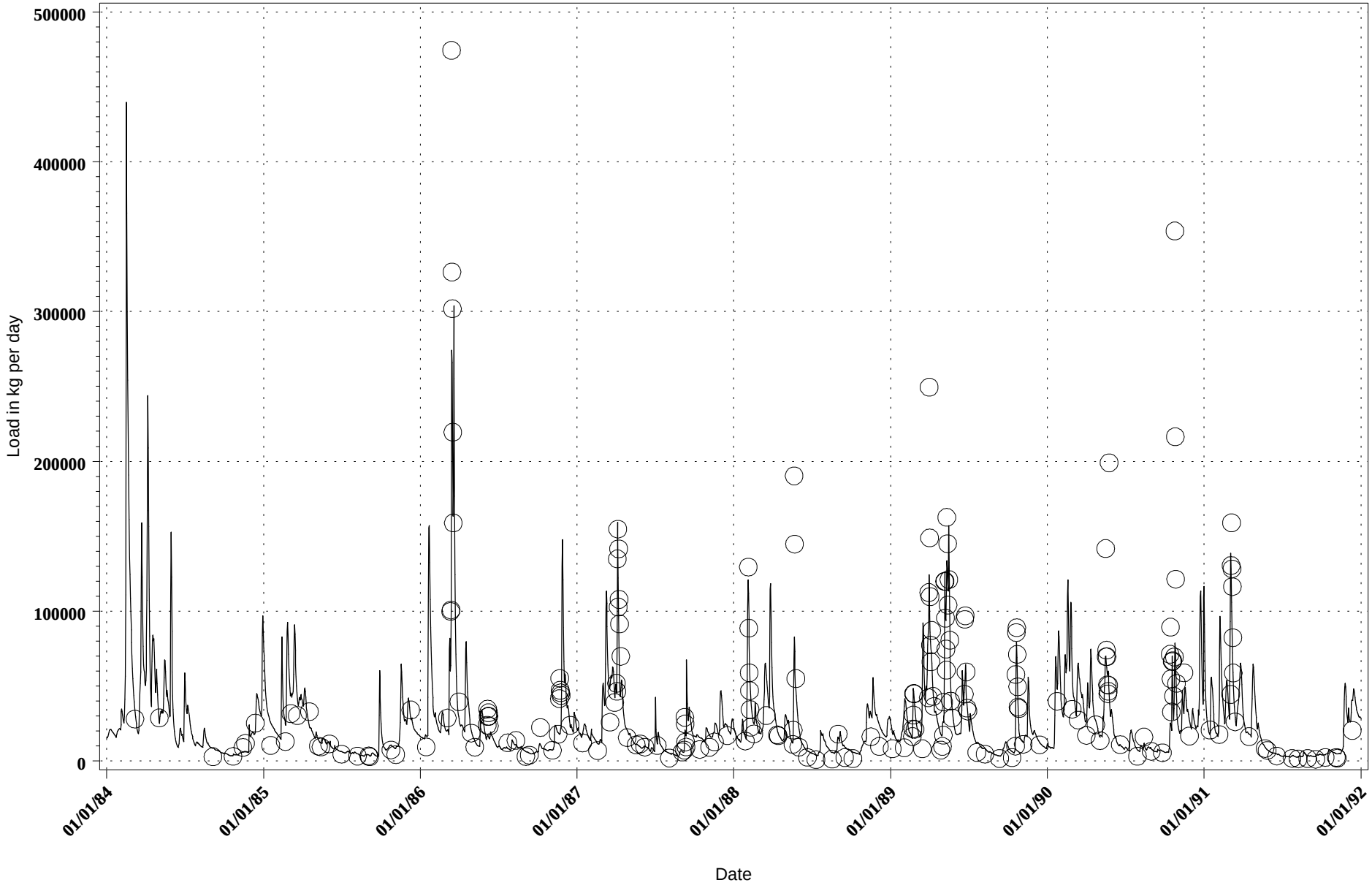
# East Branch Susquehanna at Segment 40
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

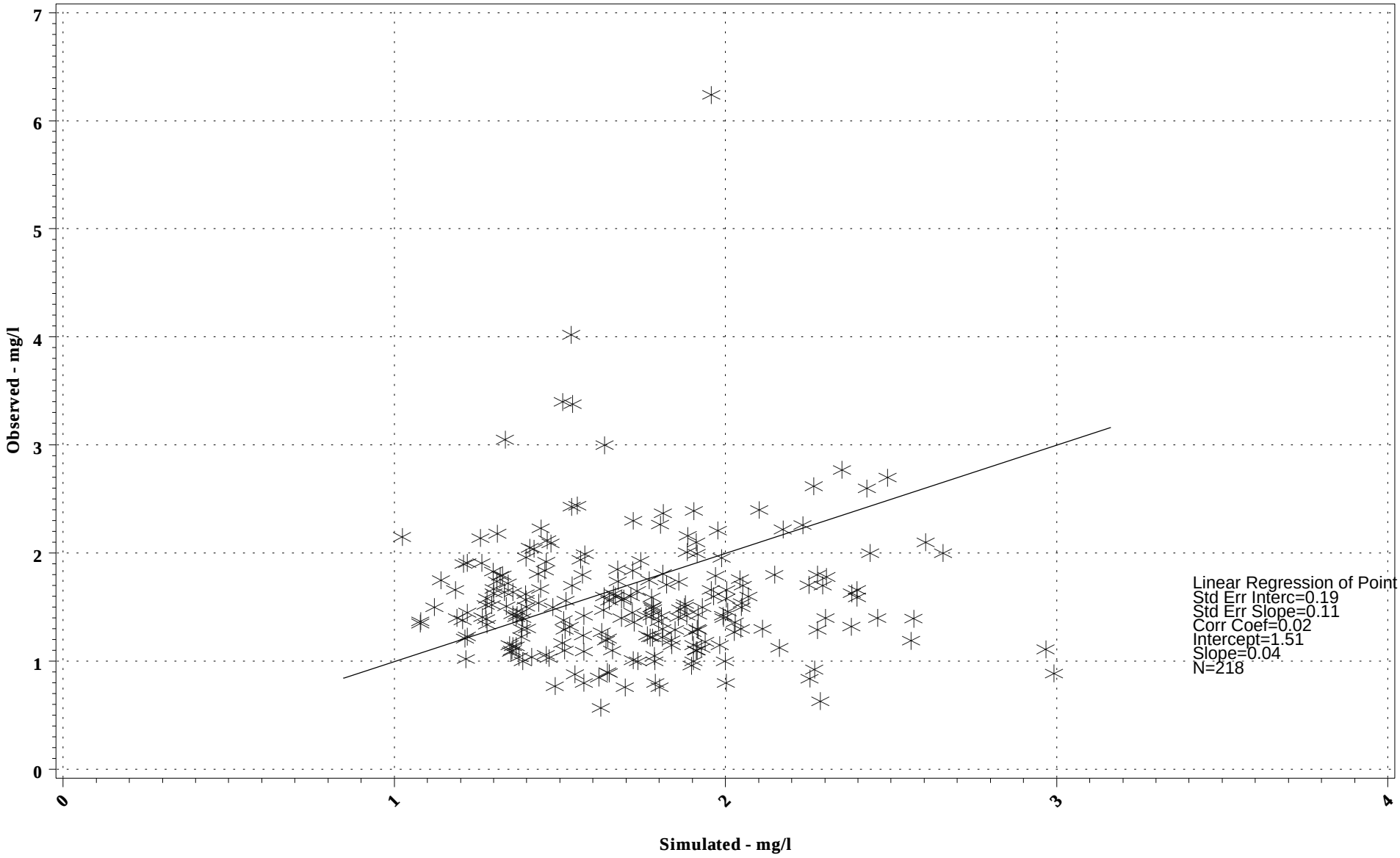



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40

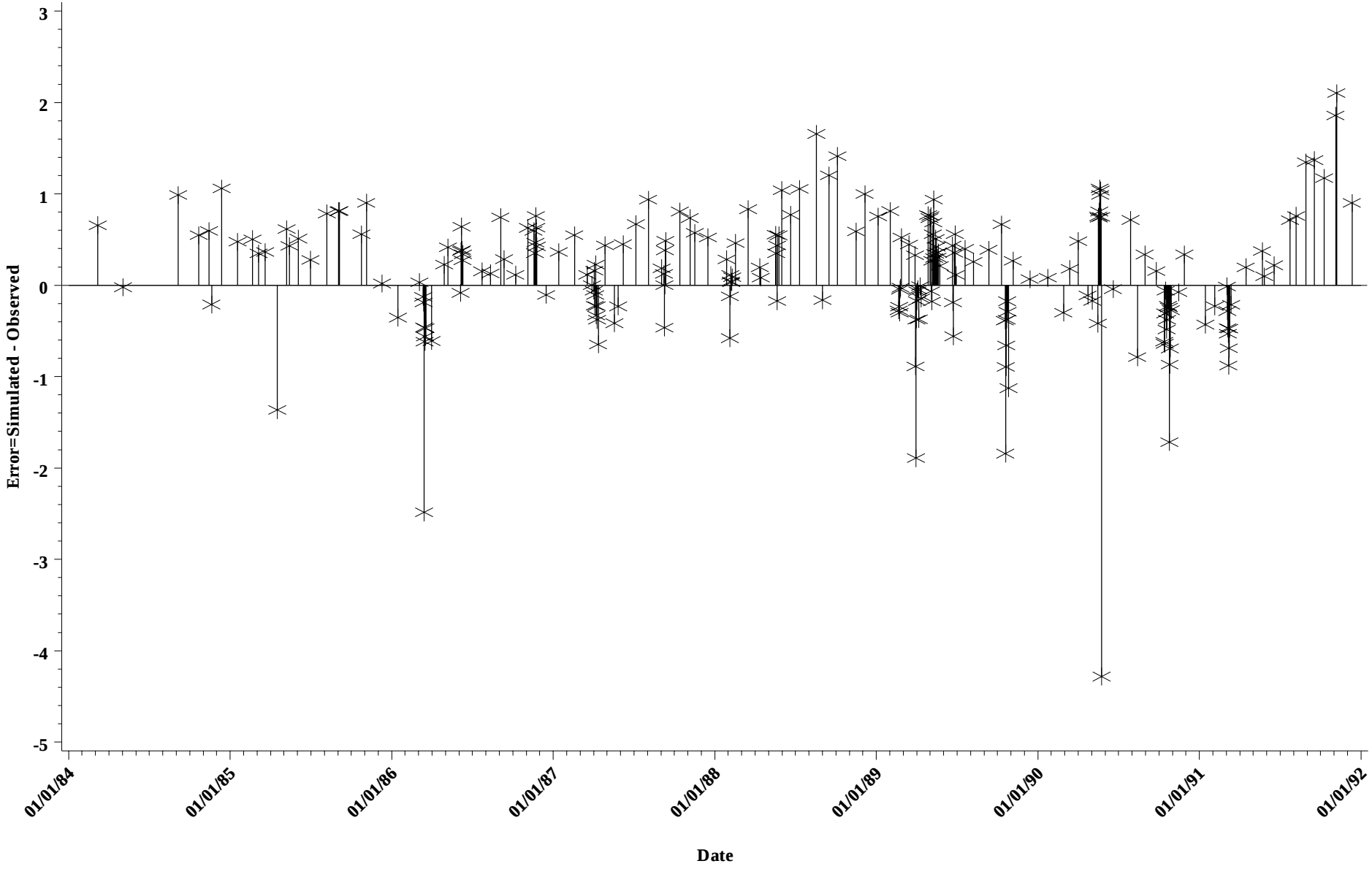
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40
## Actual Error versus Time
## Total Nitrogen

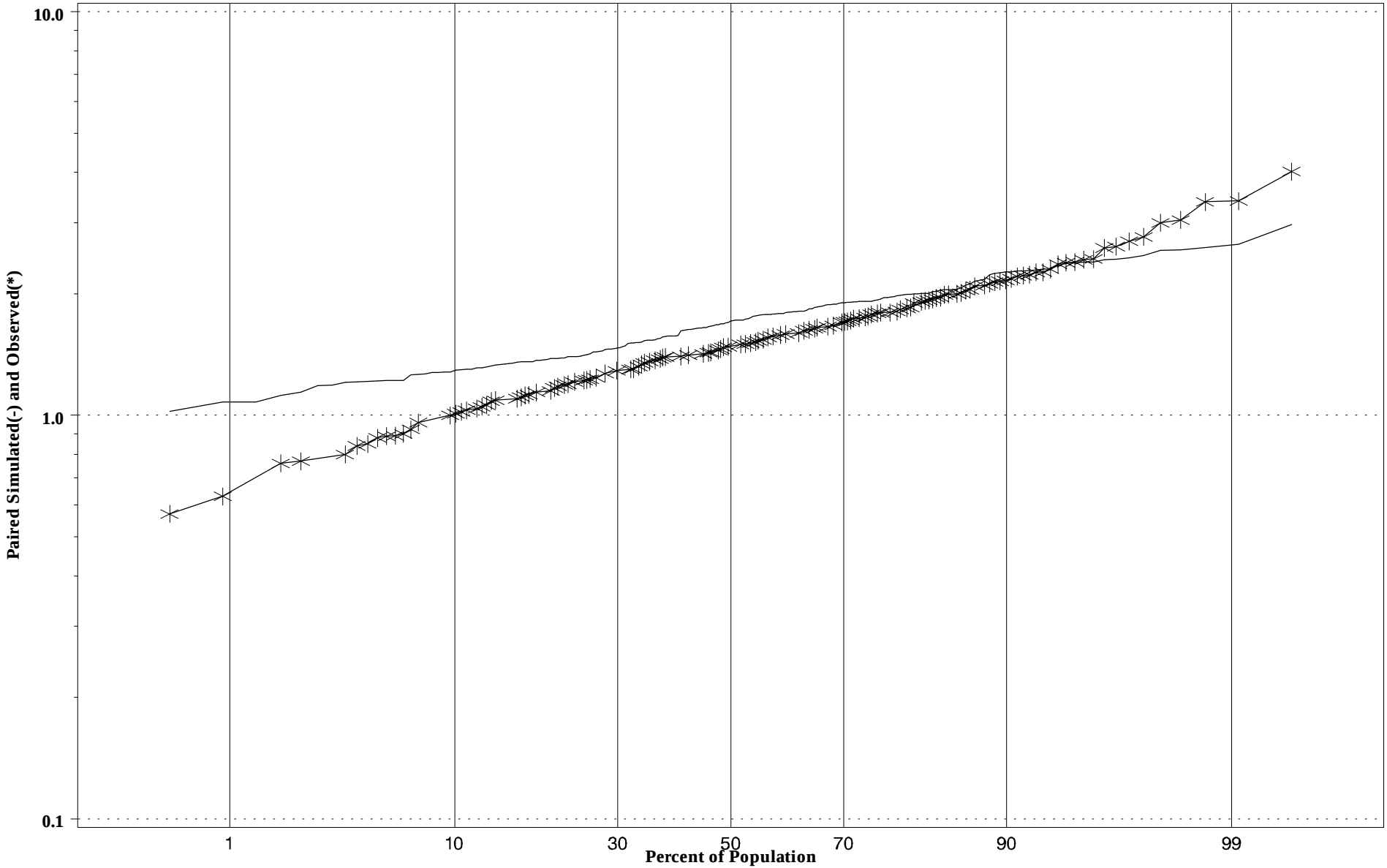



(y21_plotb.sas model3d:[pwang.dt] omerr)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Total Nitrogen

### Frequency Distribution - PAIRED Simulated and Observed Data

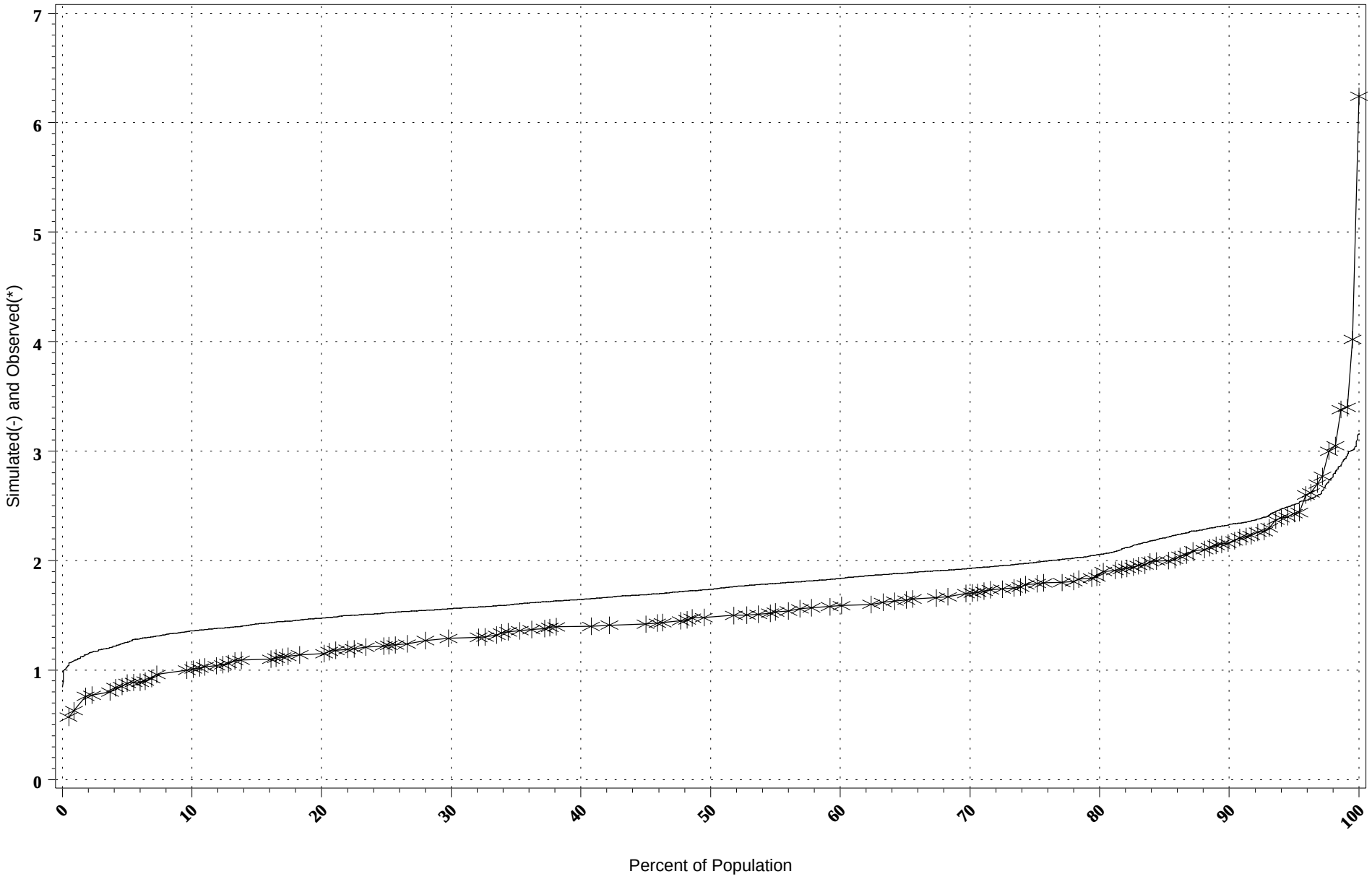



(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Total Nitrogen

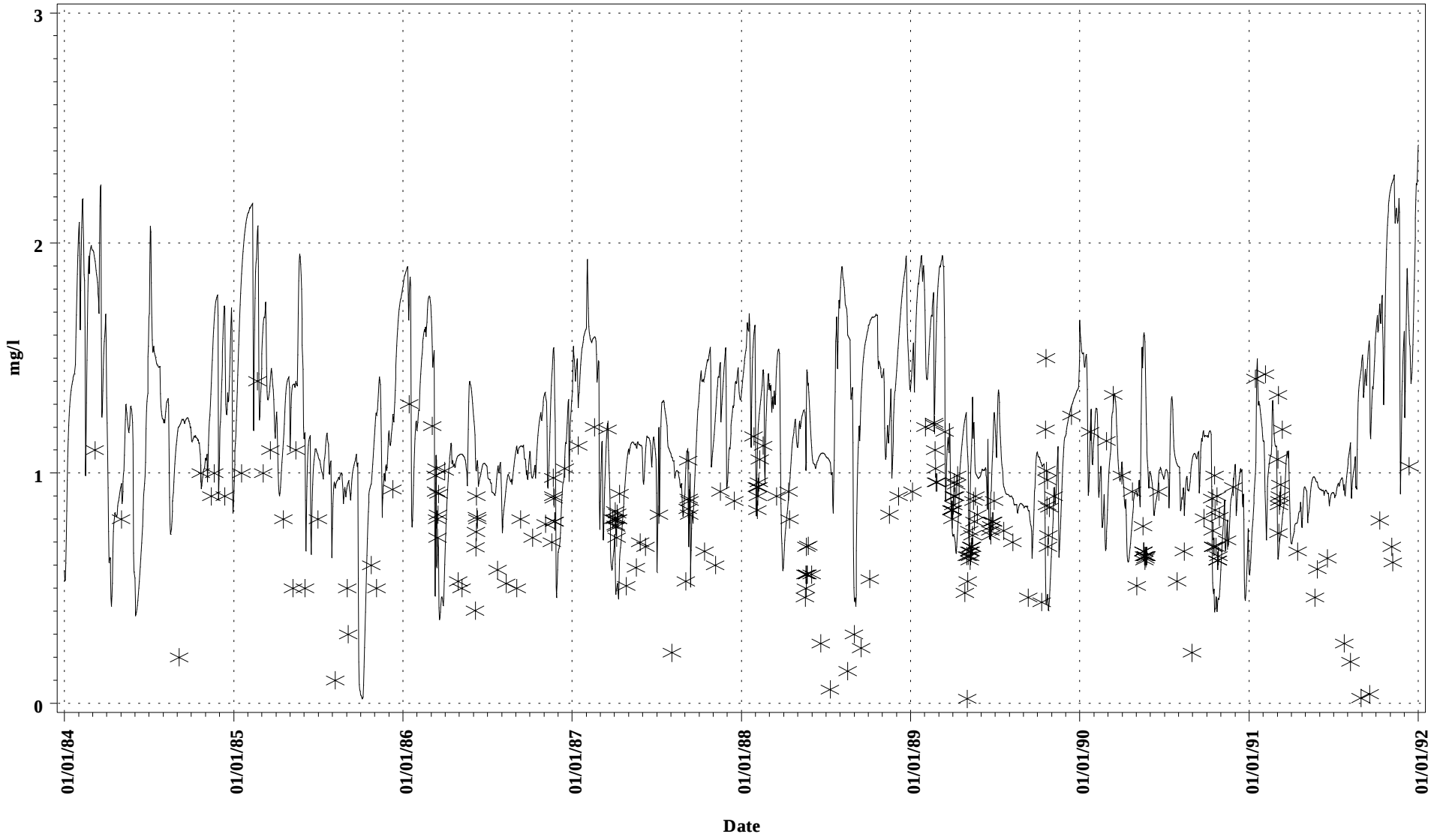
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

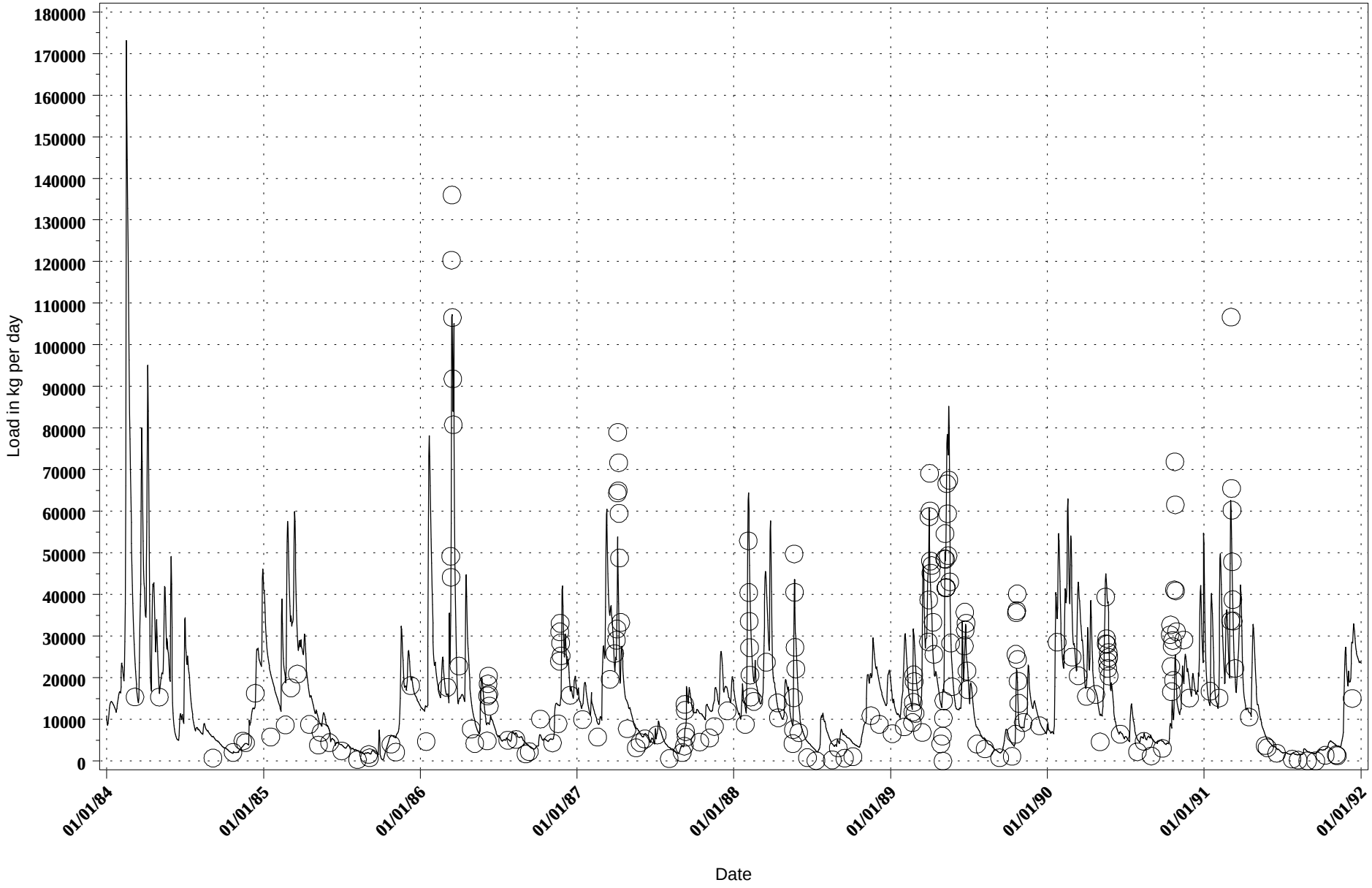



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## NO3 Observed and Simulated Load vs Time

### (line = simulated, O = observed)

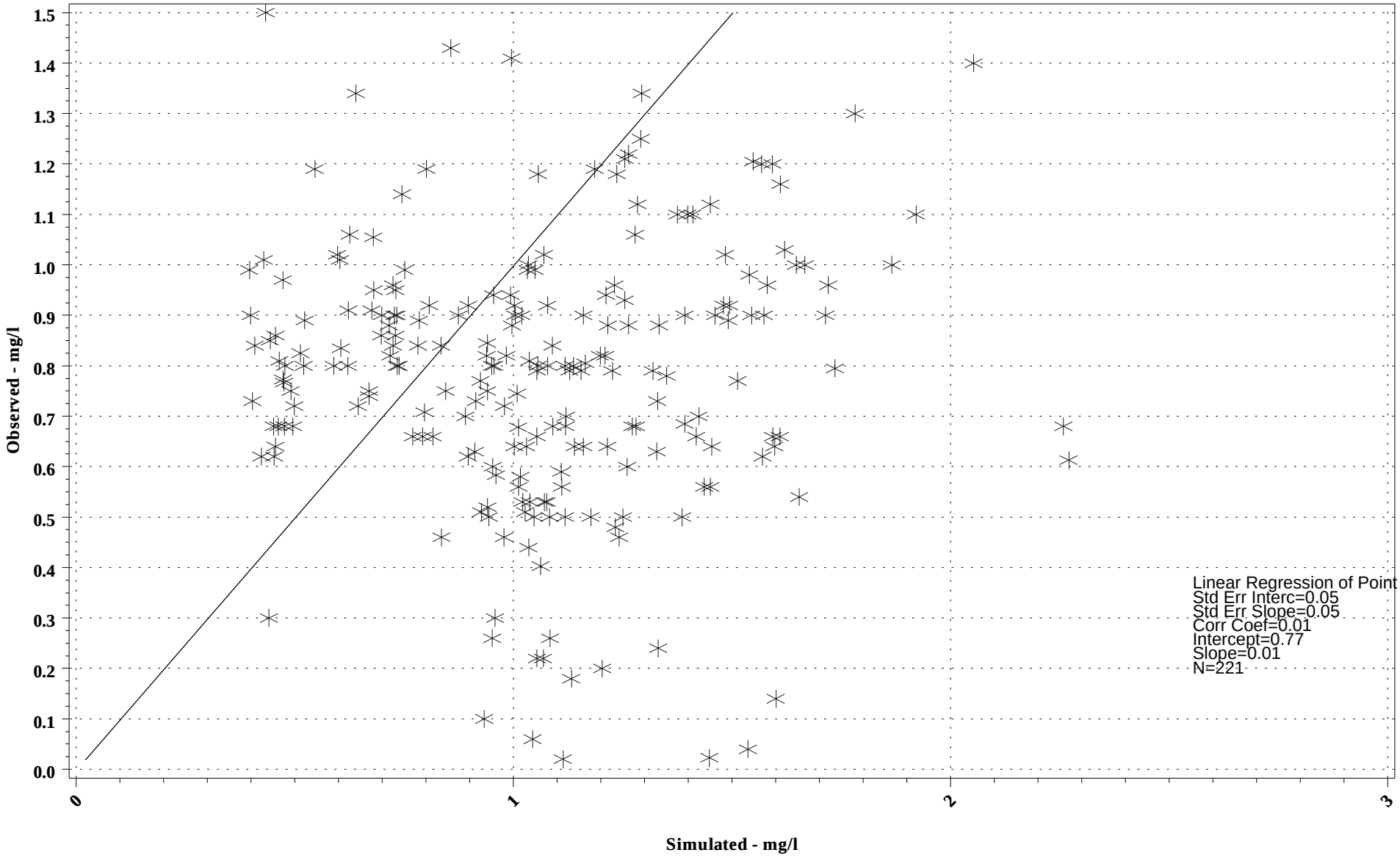



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40

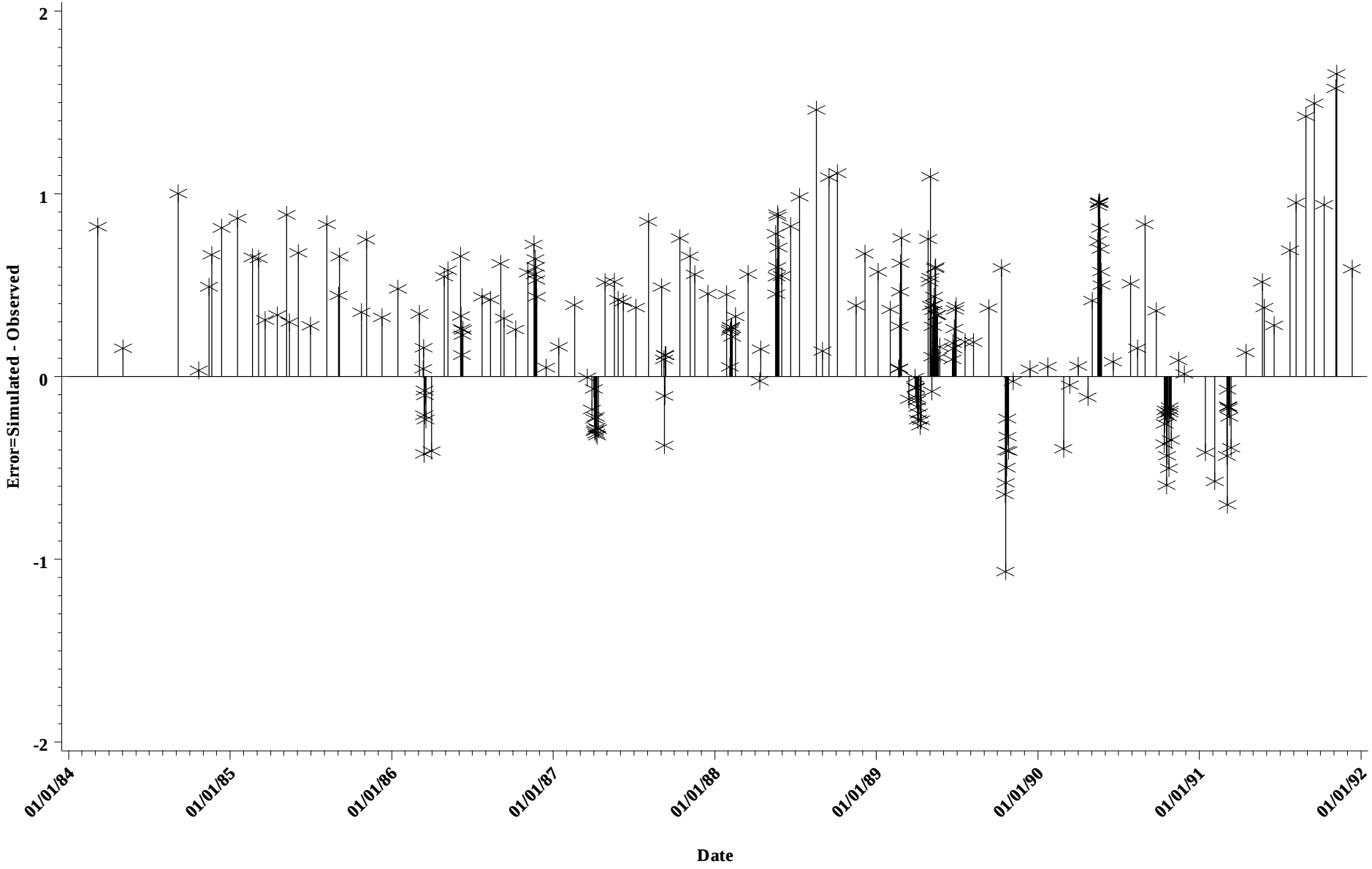
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40
## Actual Error versus Time
## NO3

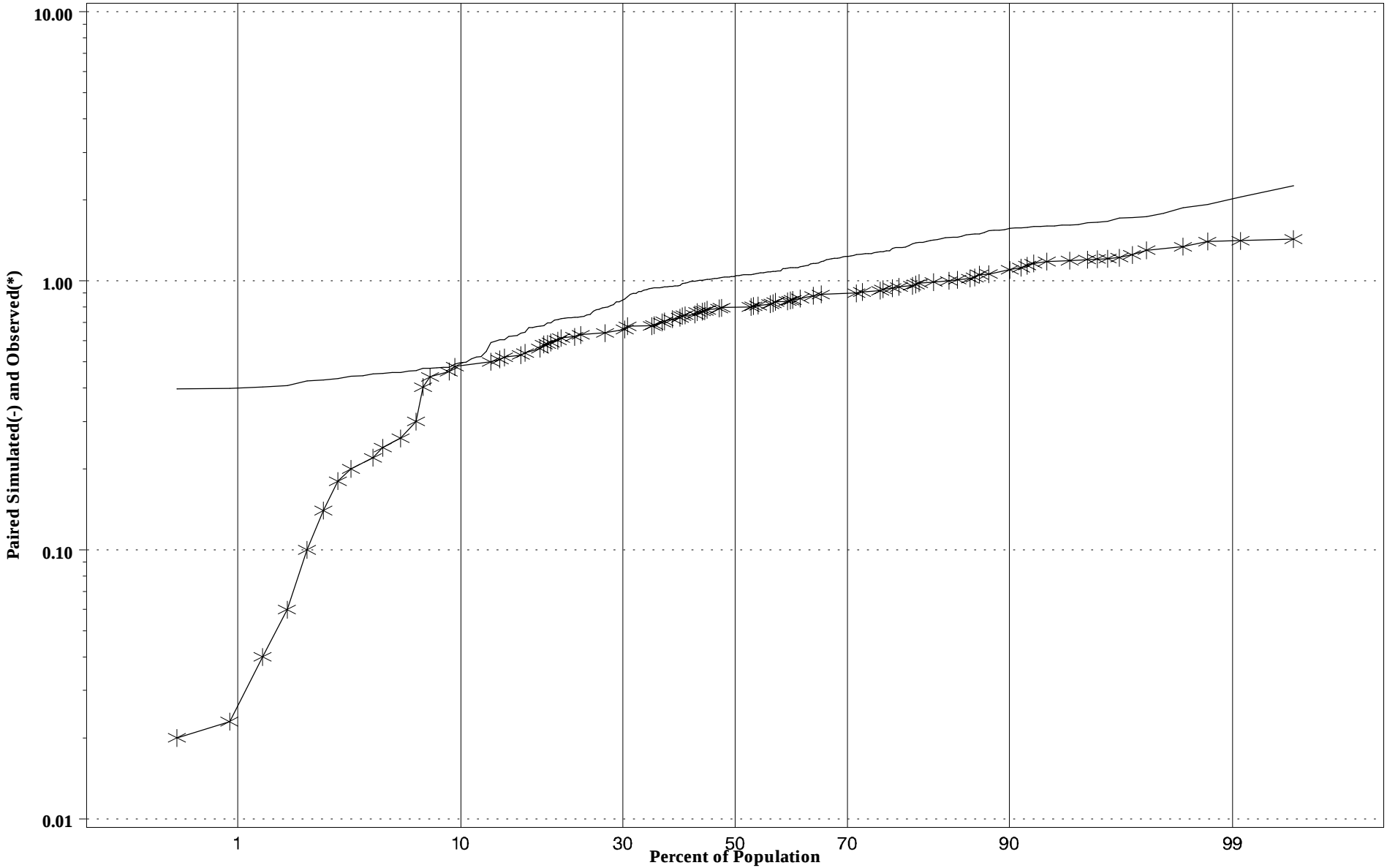



(y21_plotb.sas model3d:[pwang.dt] omerr)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## NO3

### Frequency Distribution - PAIRED Simulated and Observed Data

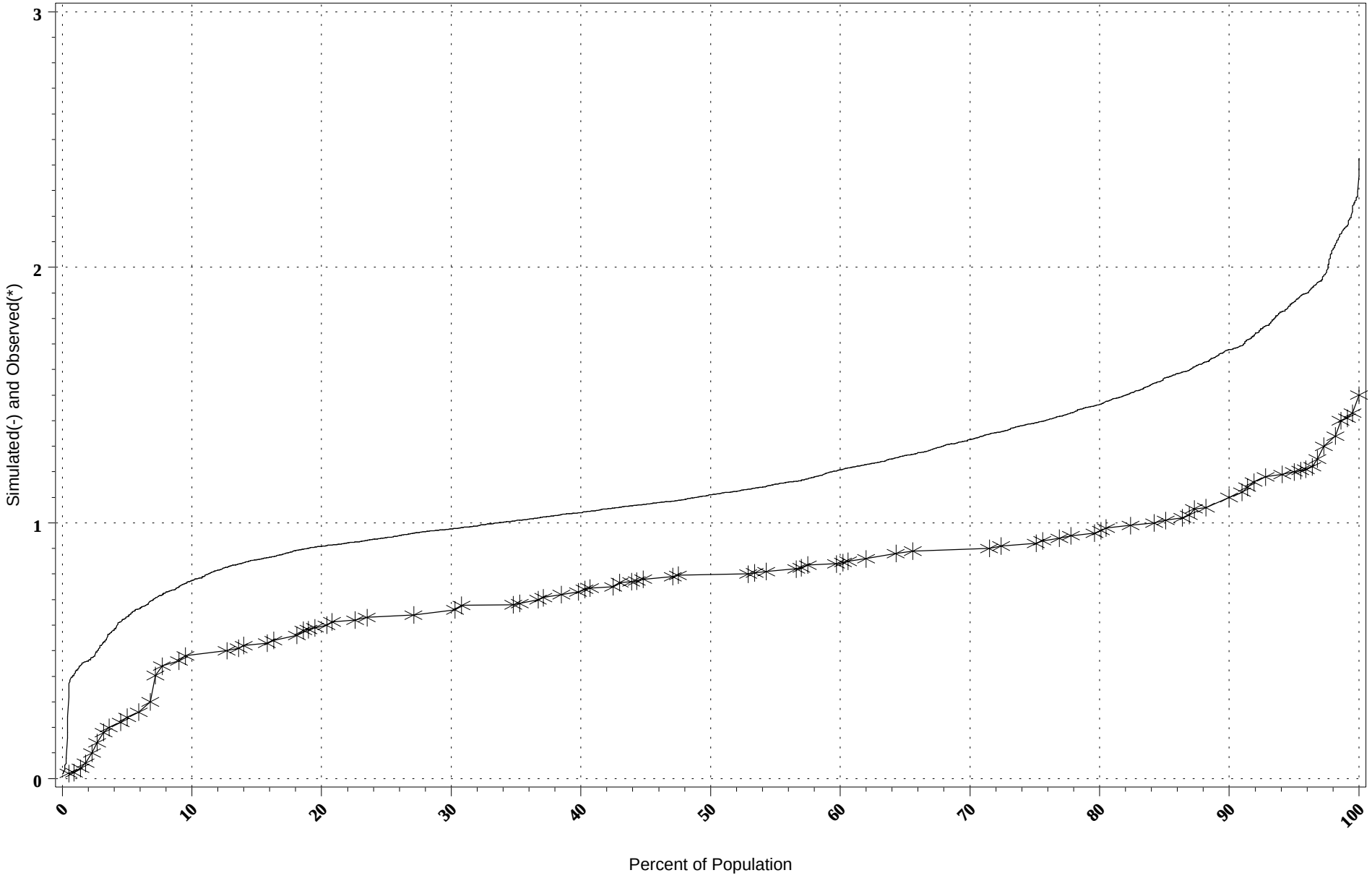



(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## NO3

### Frequency Distribution - All Simulated and Observed Data



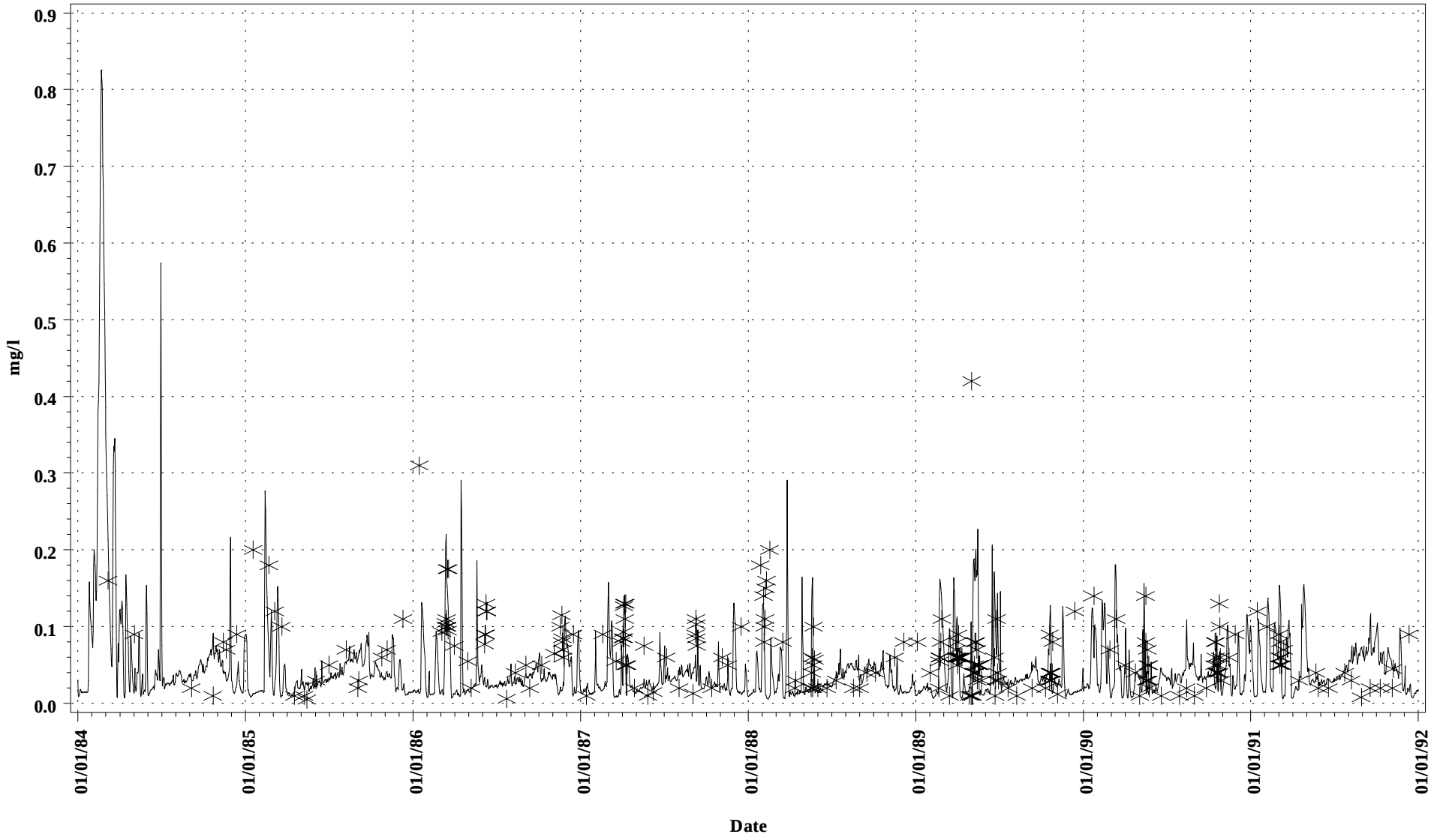

(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Observed and Simulated versus Time

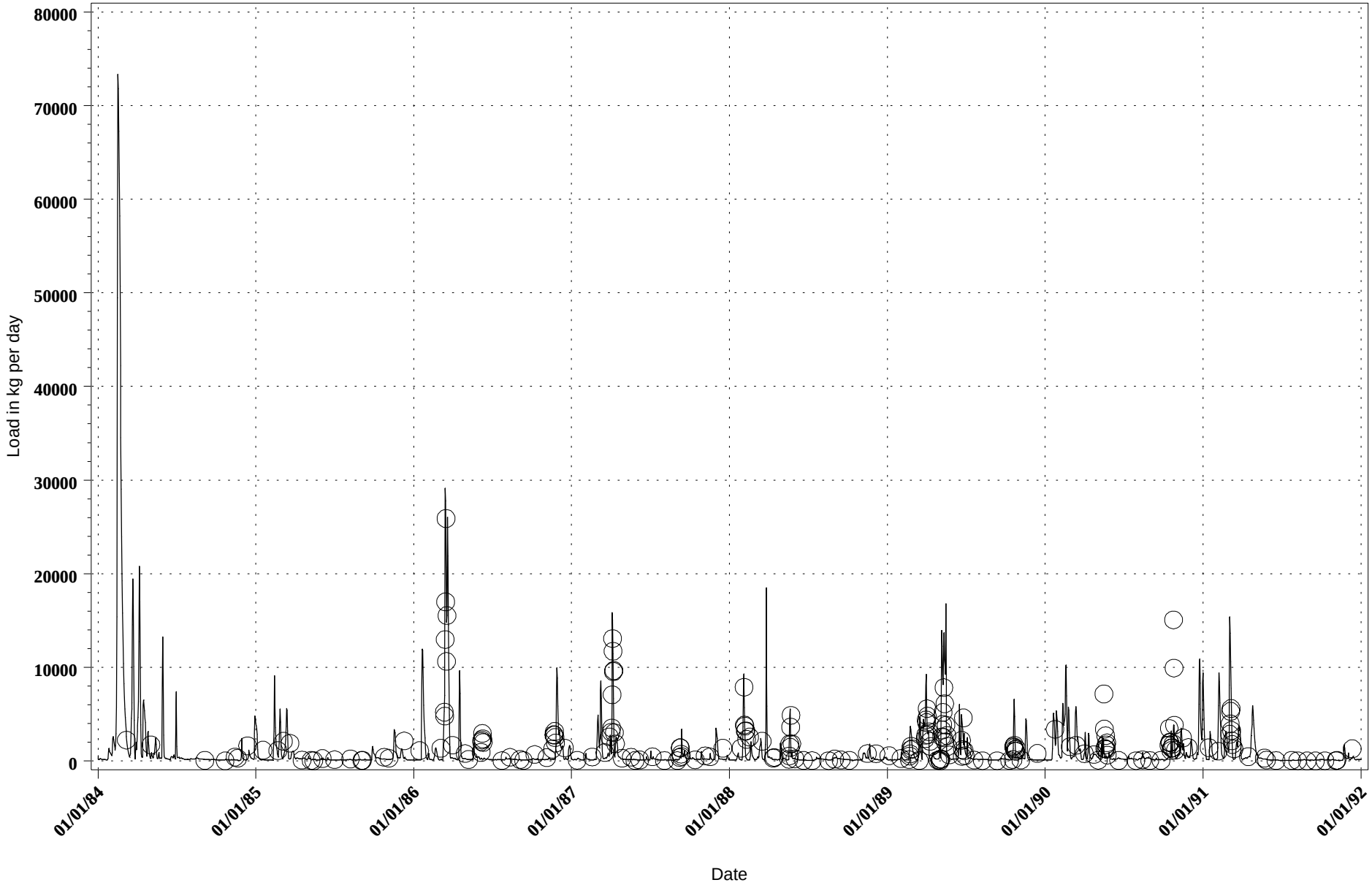
# Total Ammonia

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40
## Total Ammonia Observed and Simulated Load vs Time
### (line = simulated, O = observed)

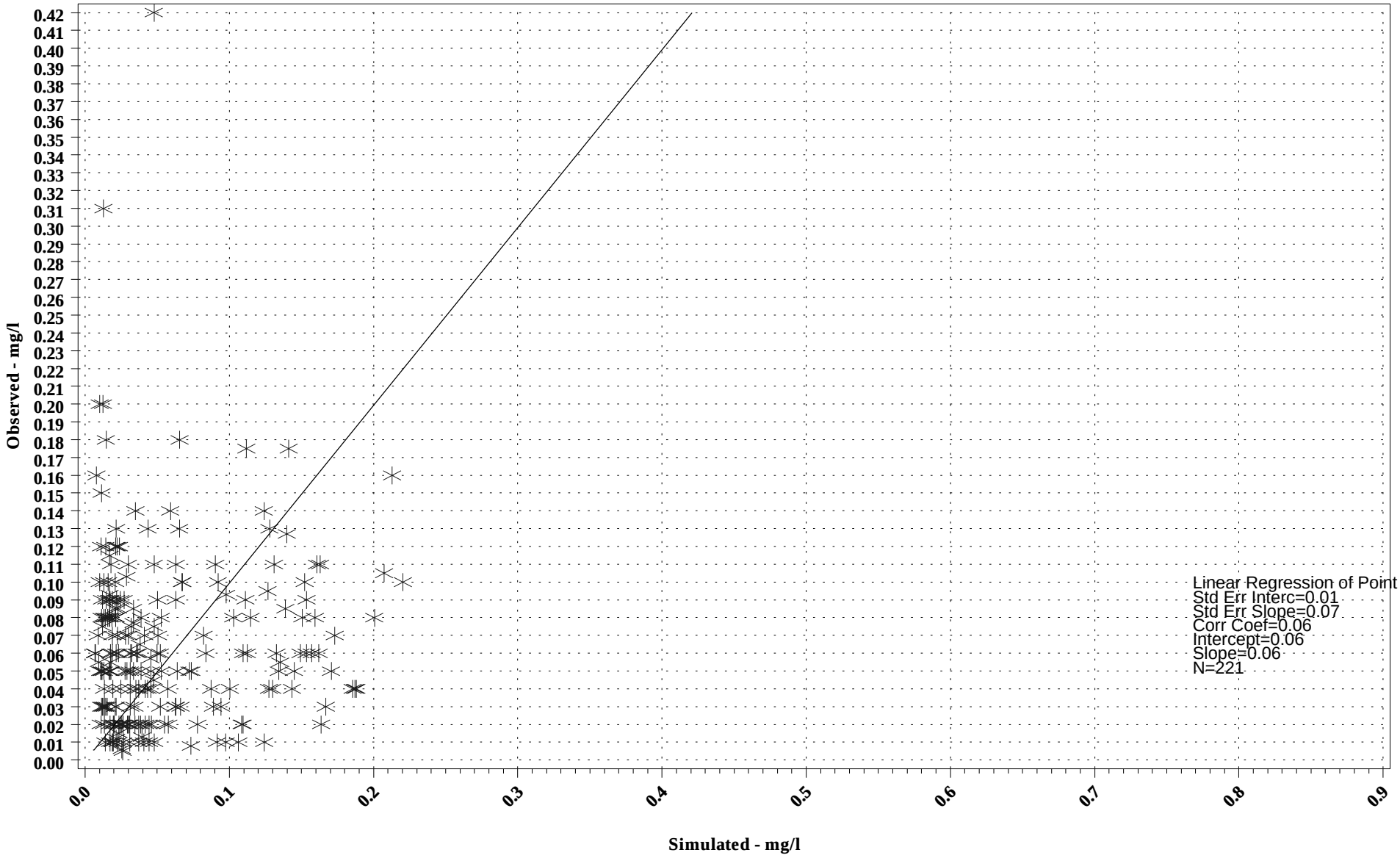



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40

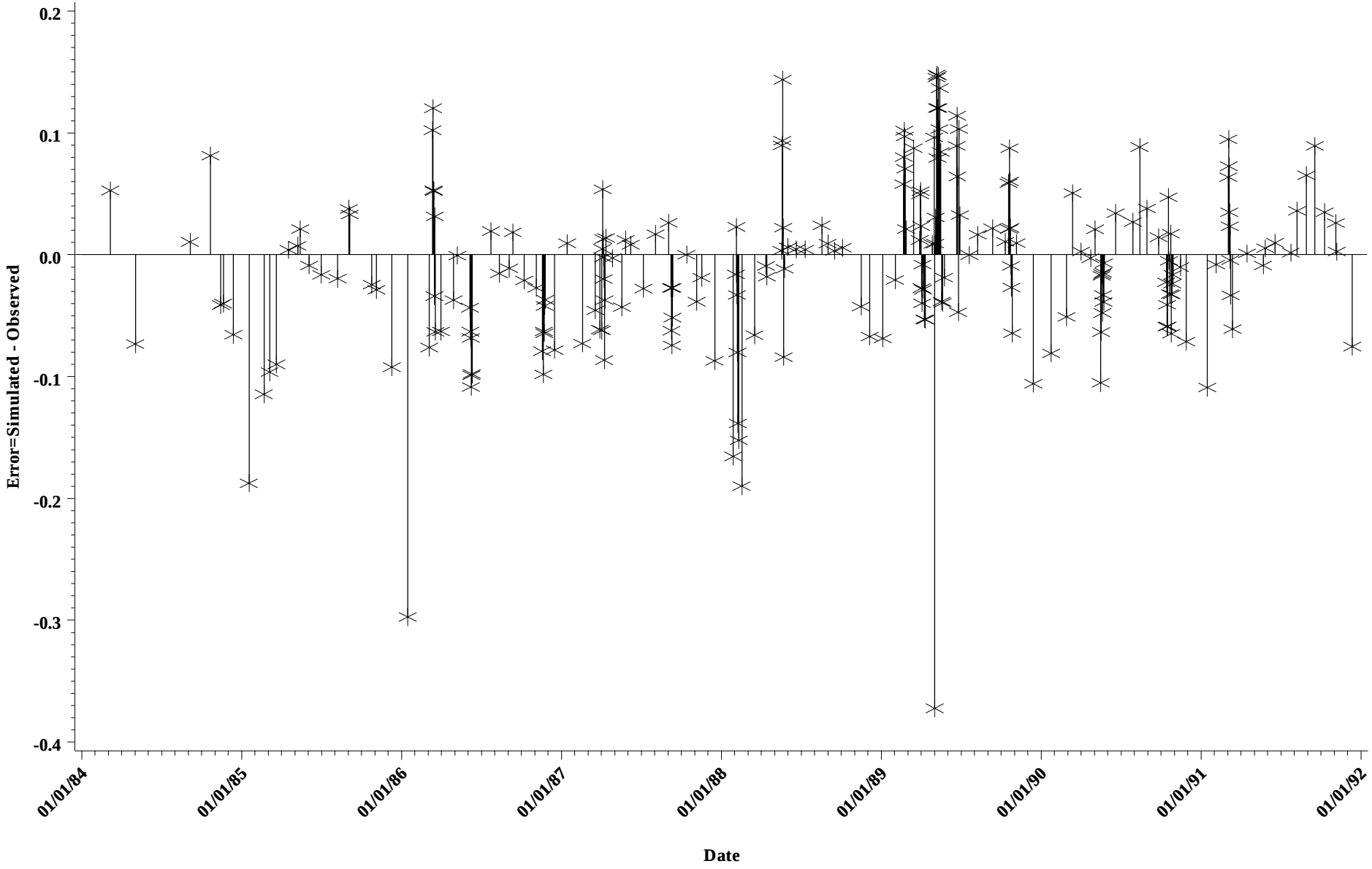
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40
## Actual Error versus Time
## Total Ammonia

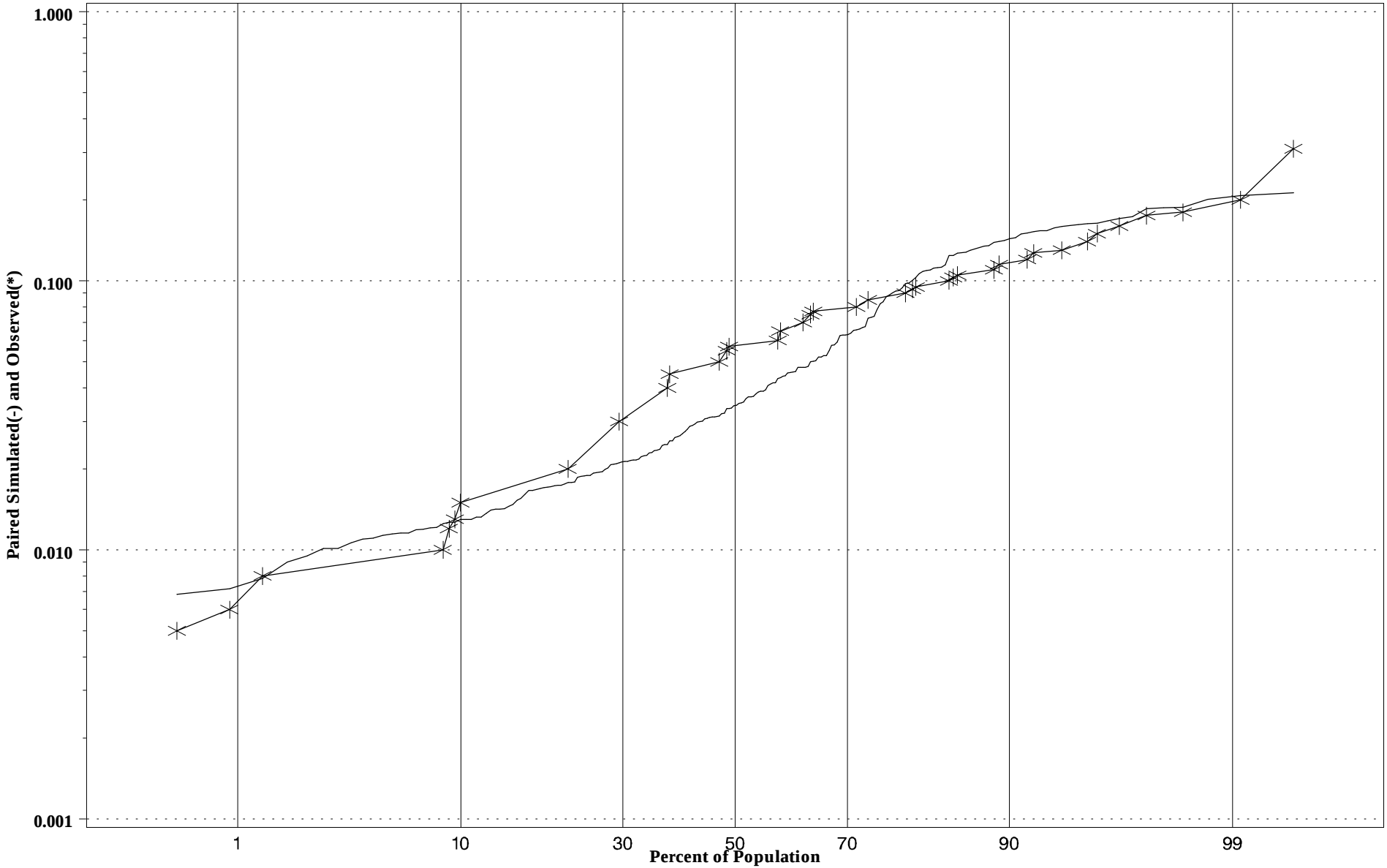



(y21_plotb.sas model3d:[pwang.dt] omerr)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Total Ammonia

### Frequency Distribution - PAIRED Simulated and Observed Data

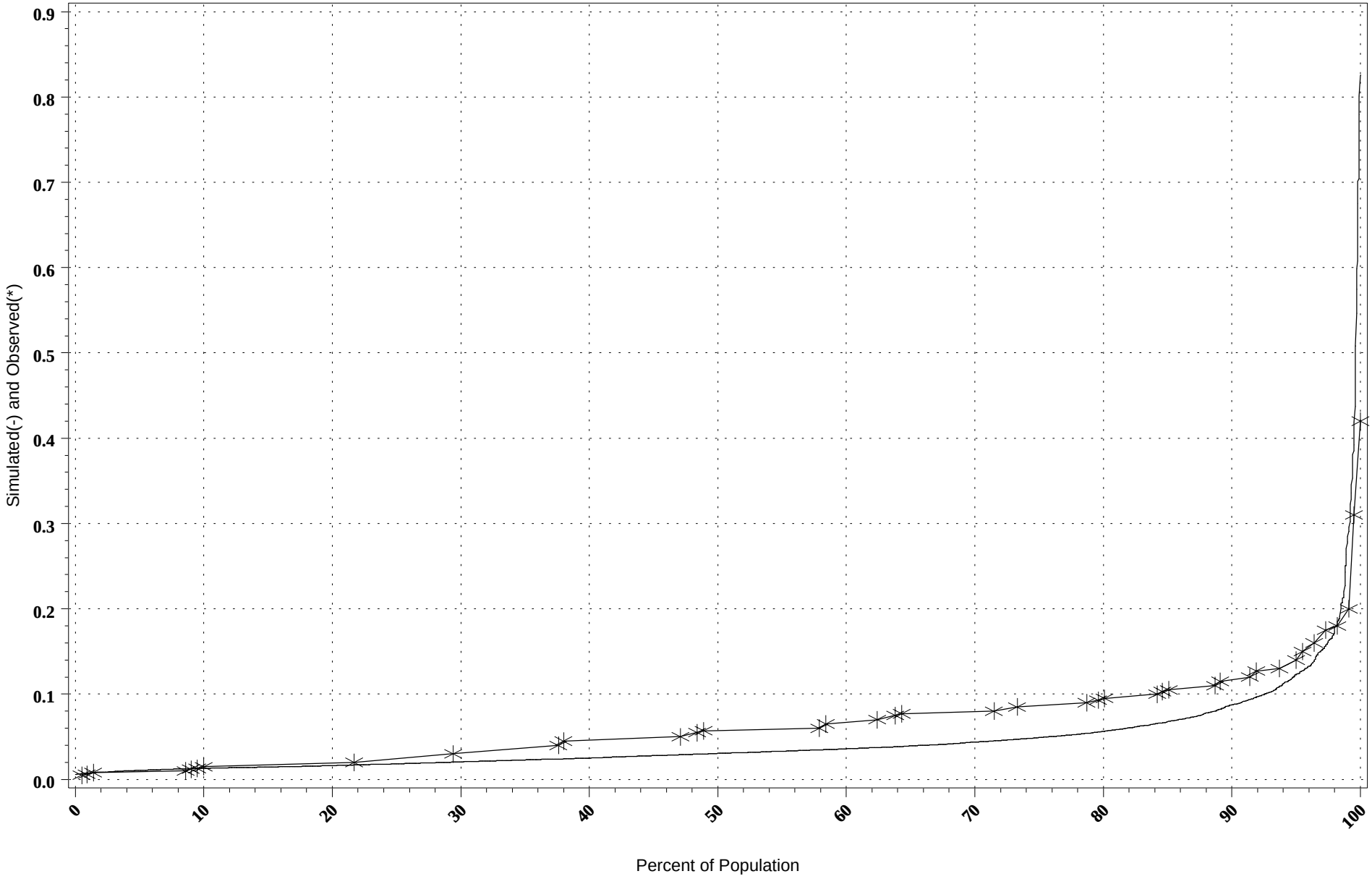



(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data



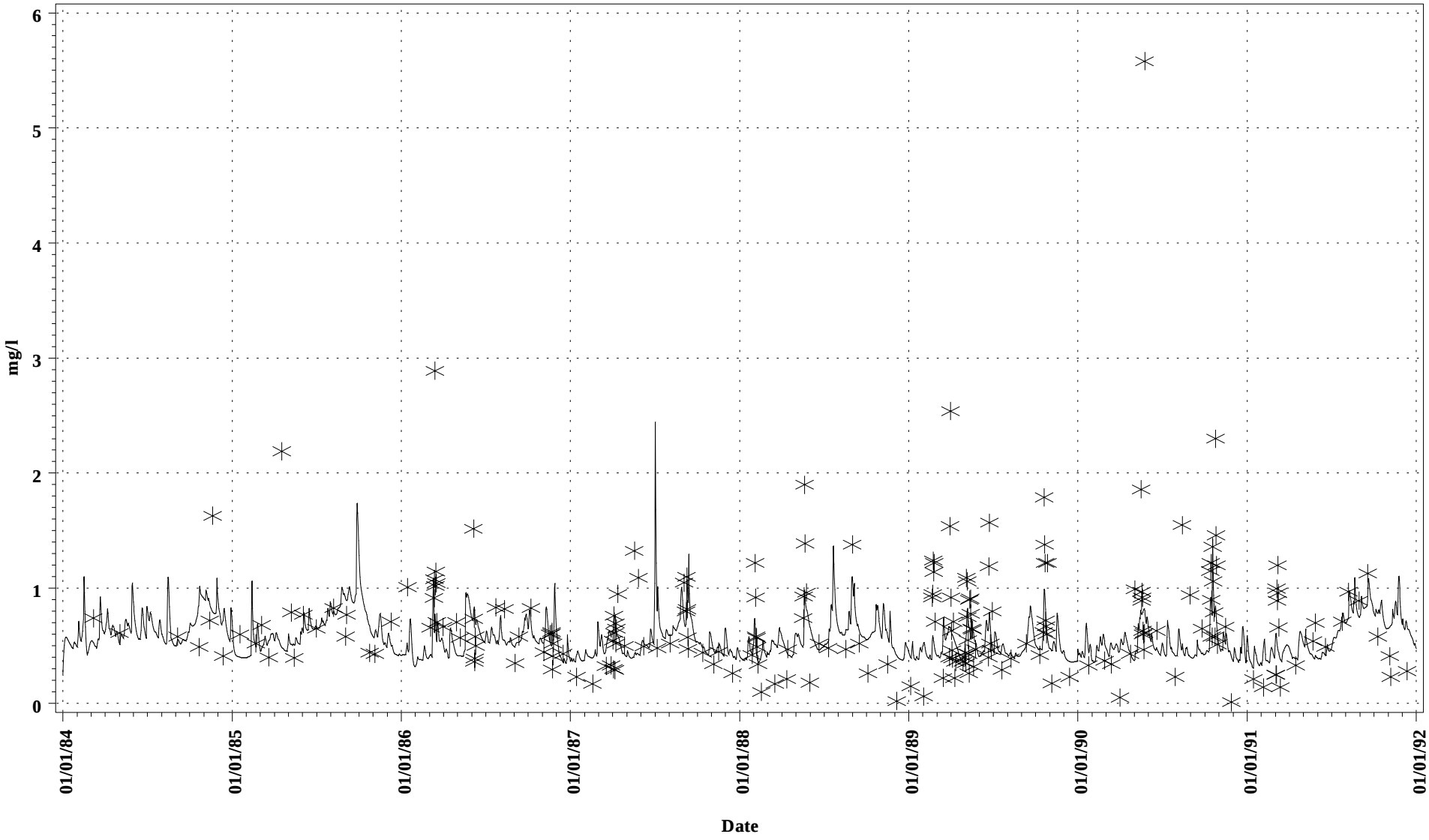

(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Observed and Simulated versus Time

# Organic Nitrogen

**(*=Observed, -=Simulated)**

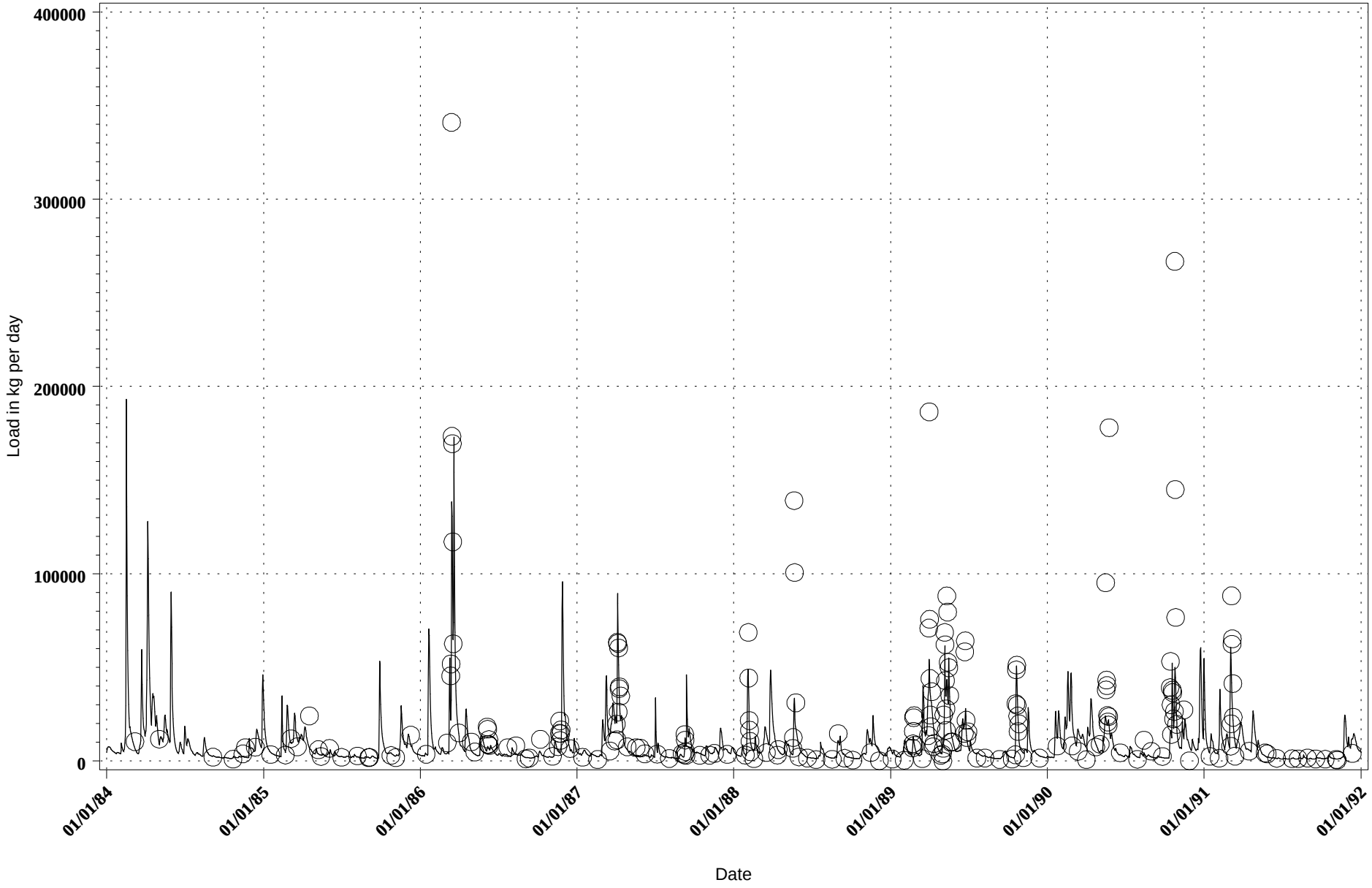



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Organic Nitrogen Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

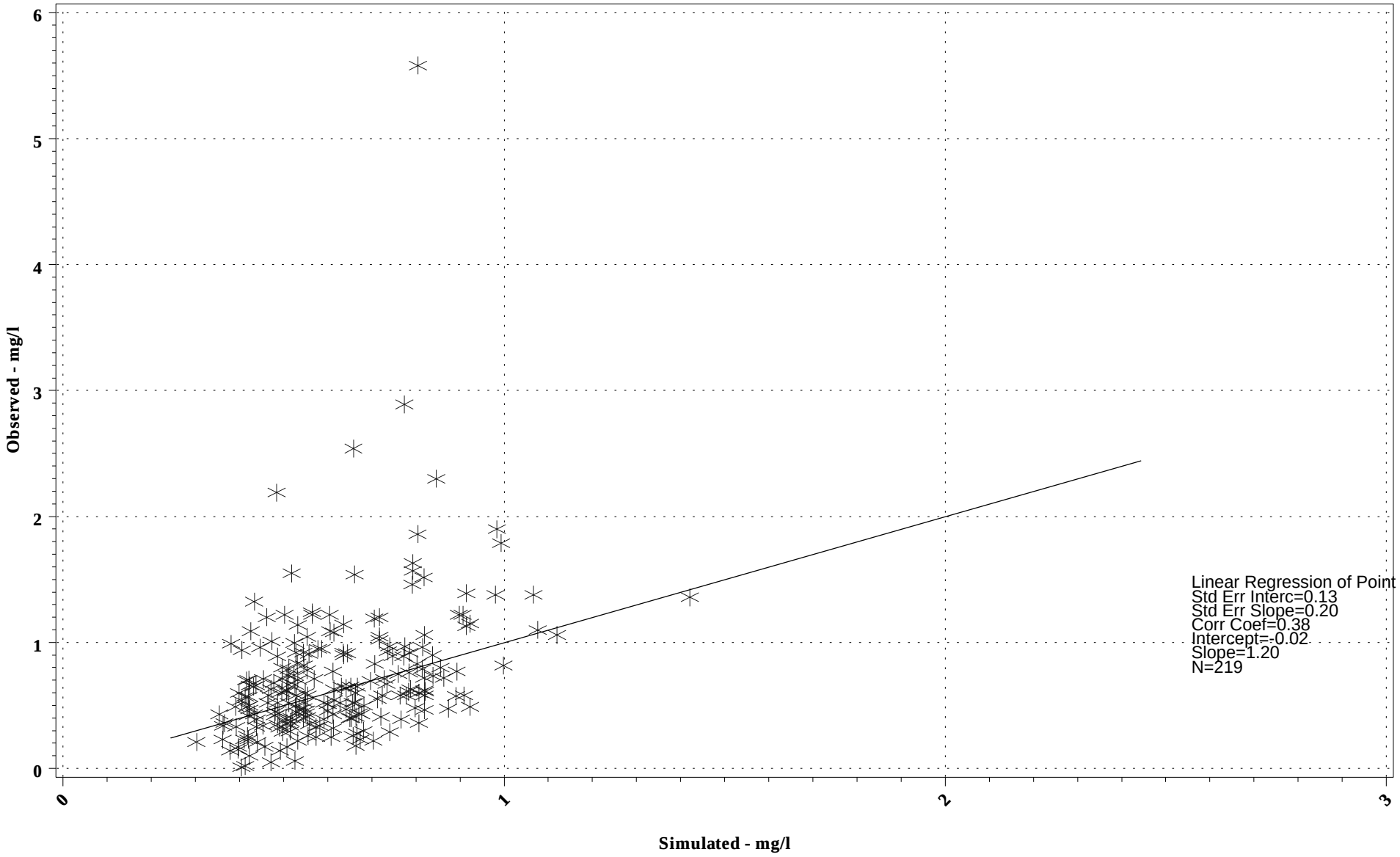



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40

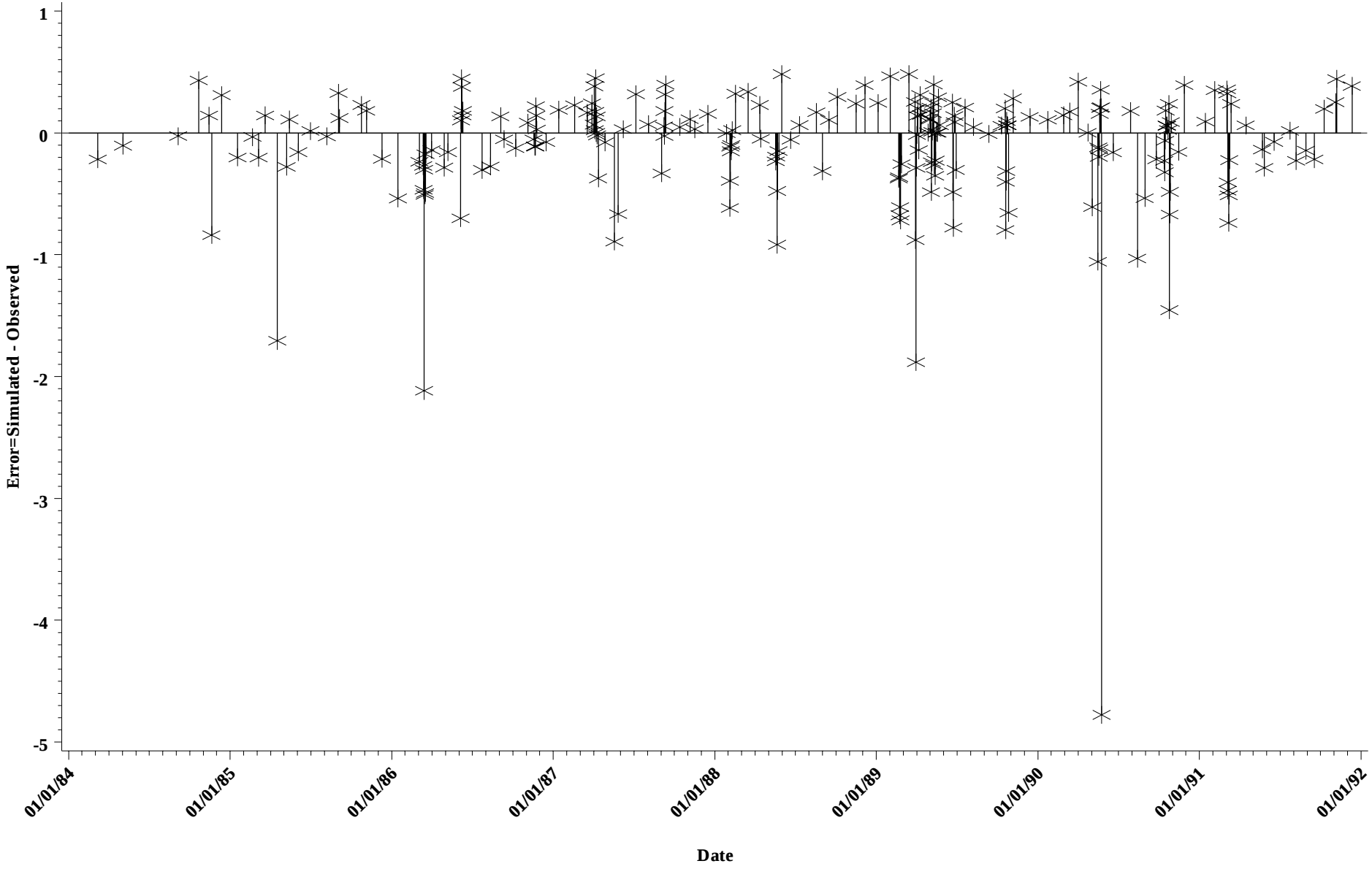
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(ebsus2_d.drv1 25JUN98 13:26,proc reg,model y=x)

# East Branch Susquehanna at Segment 40
## Actual Error versus Time
## Organic Nitrogen

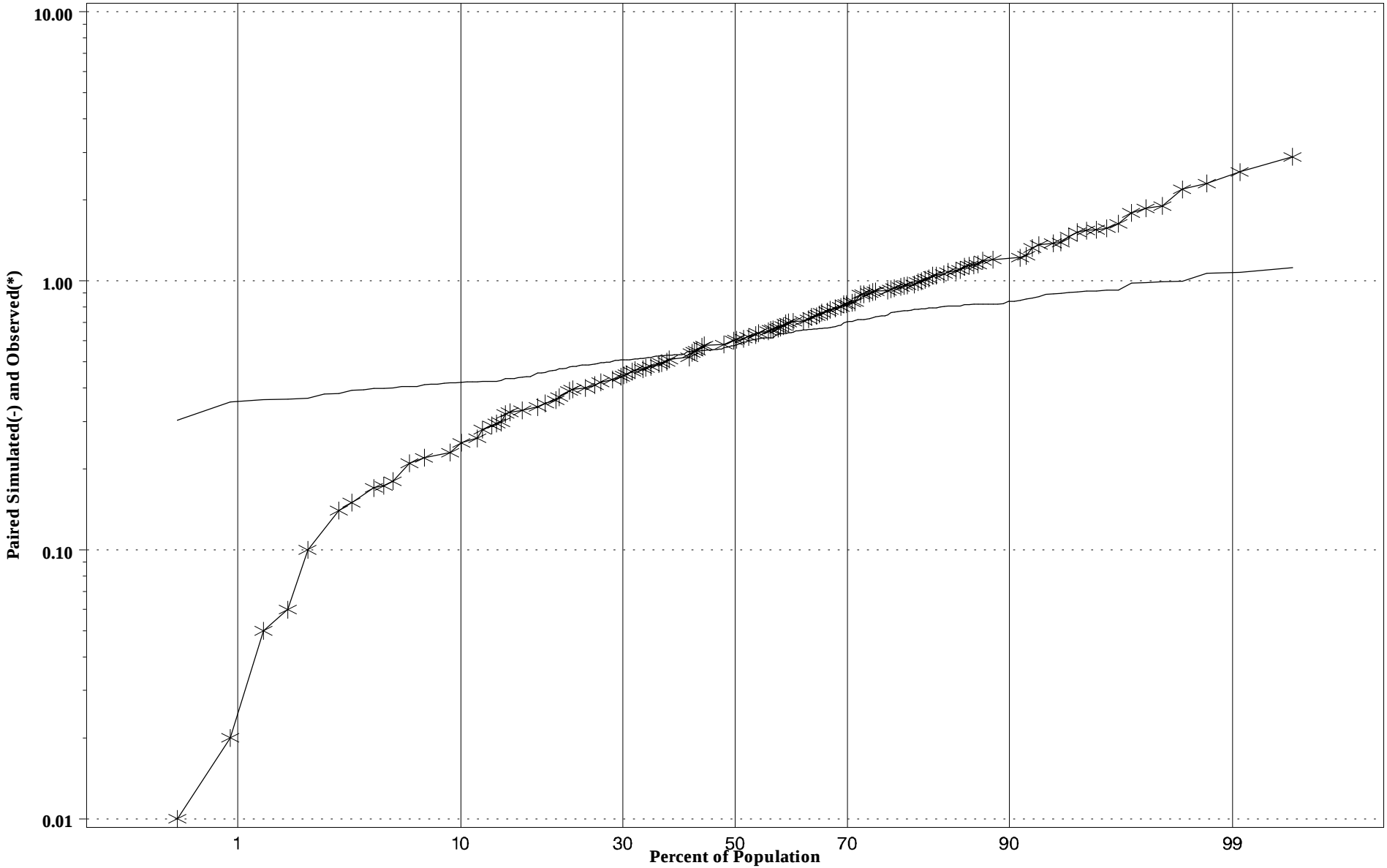



(y21_plotb.sas model3d:[pwang.dt] omerr)
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Organic Nitrogen

### Frequency Distribution - PAIRED Simulated and Observed Data

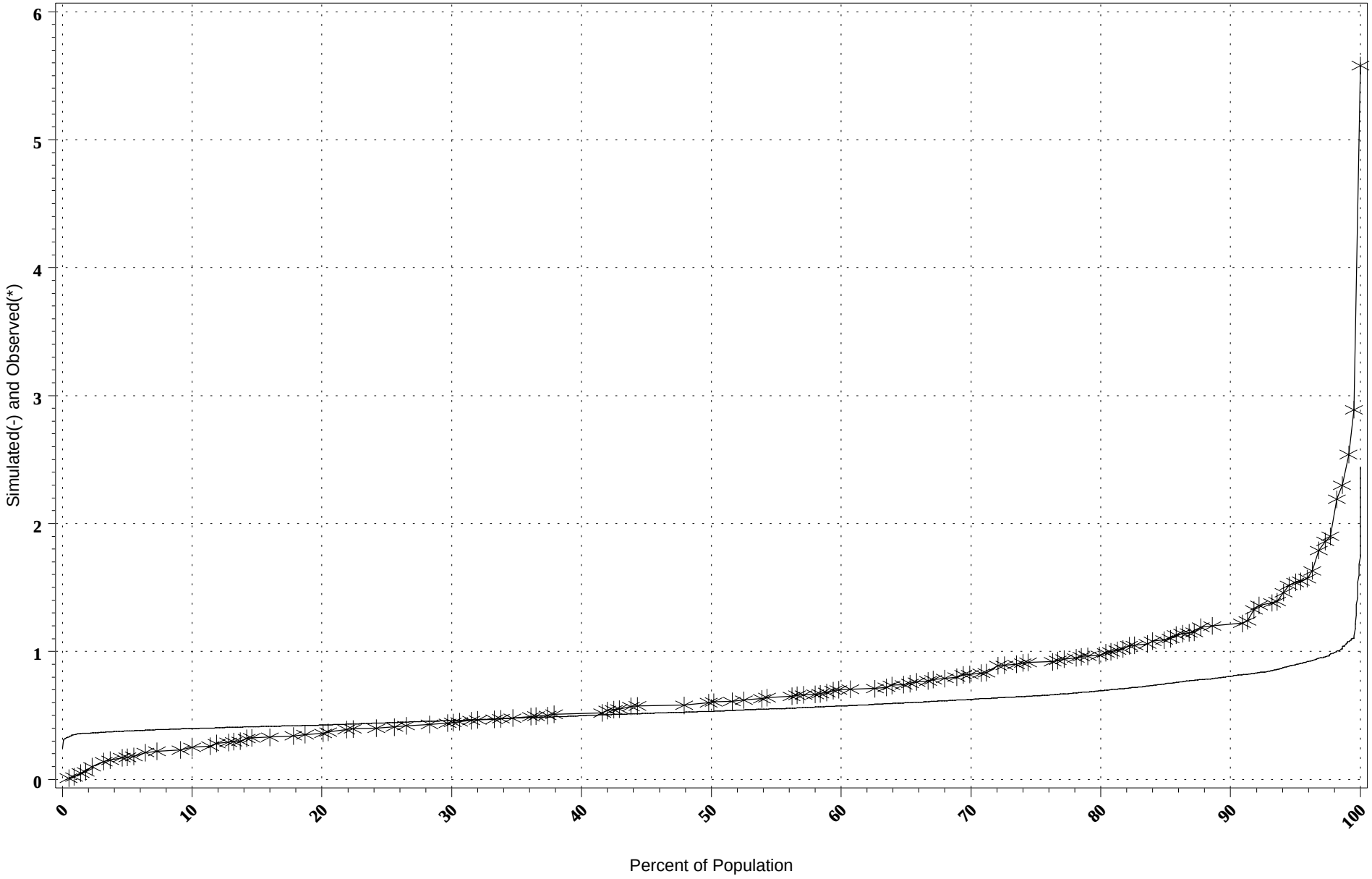



(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

# East Branch Susquehanna at Segment 40

## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(ebsus2_d.drv1 25JUN98 13:26)

### *B.1.2 West Branch Susquehanna River near Lewisburg, PA at Segment 70 (Monitoring Station: 1553500) (Above Fall Line Basin Segments: 50, 60, and 70)*

**Section Summary:**

The West Branch Susquehanna basin is dominated by the large areas of forest. Total nitrogen and total phosphorus loads are generally low.

The West Branch Susquehanna basin above the gaged site covers an area of 7,014 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 80% forest land, 6% cropland, 11% other agricultural areas, 2% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage decreased from 26.1 million pounds in 1985 to 22.2 million pounds in 1996. Total phosphorus loads over the same time period decreased from 0.8 million pounds to 0.5 million pounds. In general, point source loads above the gage site are low. In 1996, the total nitrogen point source load was 7% of the total load and the total phosphorus point source load was 23% of the total load. Estimated septic system total nitrogen loads increased 9%, from 0.50 million pounds in 1985 to 0.55 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 3%, and other agricultural loads (primarily pasture and manure loads) by 10%. Total phosphorus increased for cropland by 1% and decreased for other agricultural loads by 19%. Urban loads were estimated to have increased over the 1985 to 1996 period by 7% for total nitrogen and 9% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

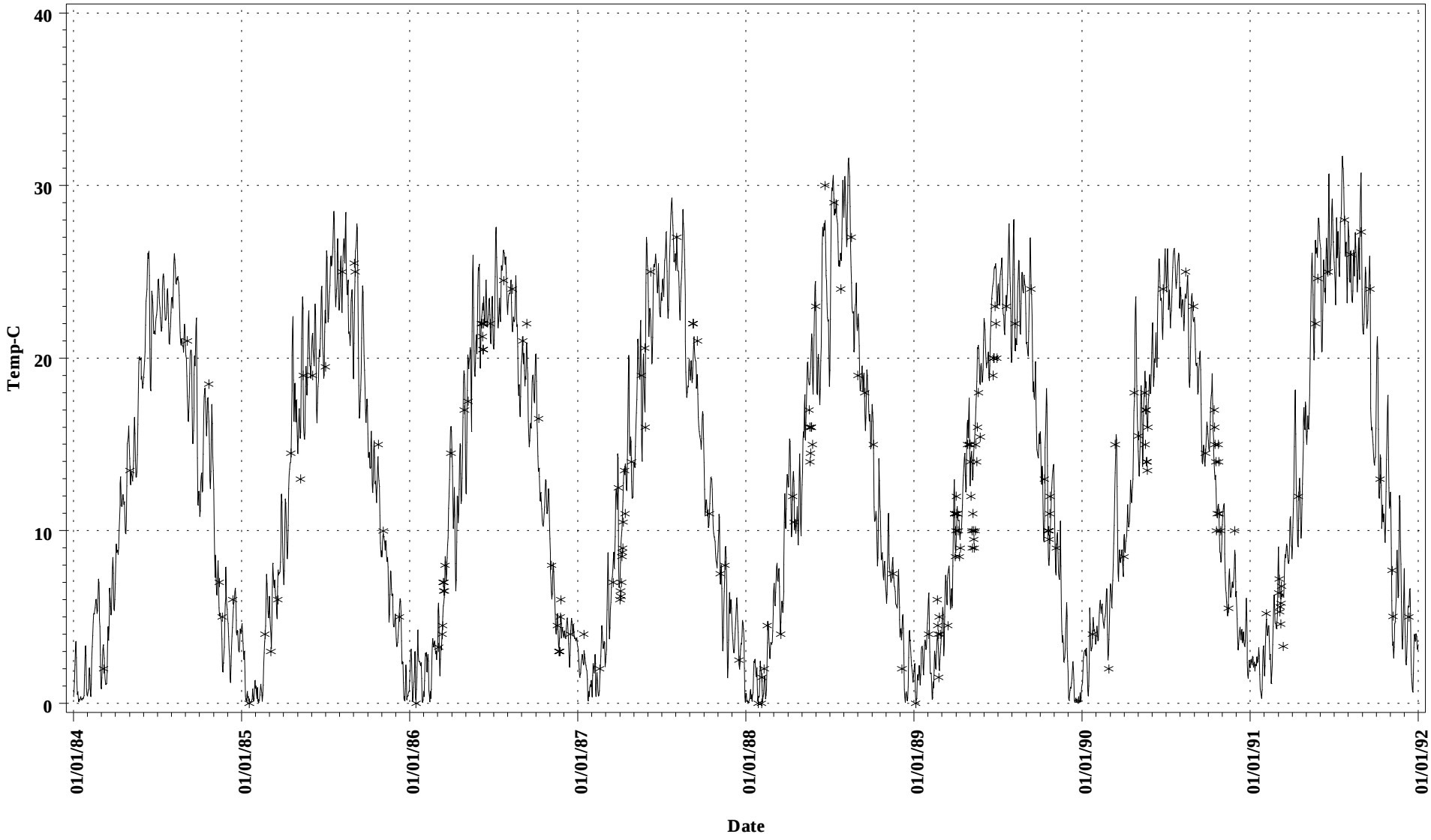
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# West Branch Susquehanna at Segment 70
## Observed and Simulated versus Time
# Temperature-C

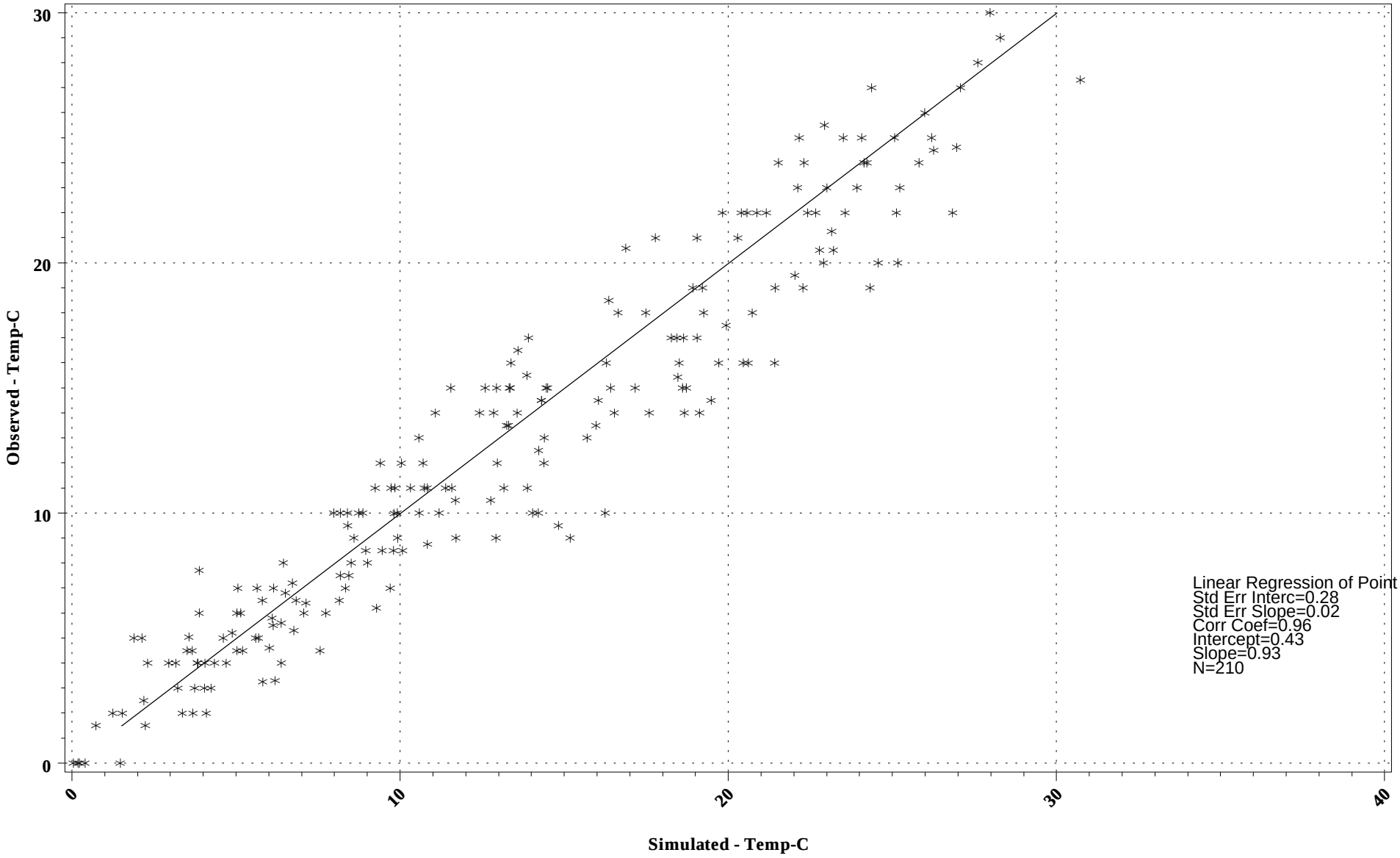
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(wbsus_d.drv1 26JUN98 08:48)

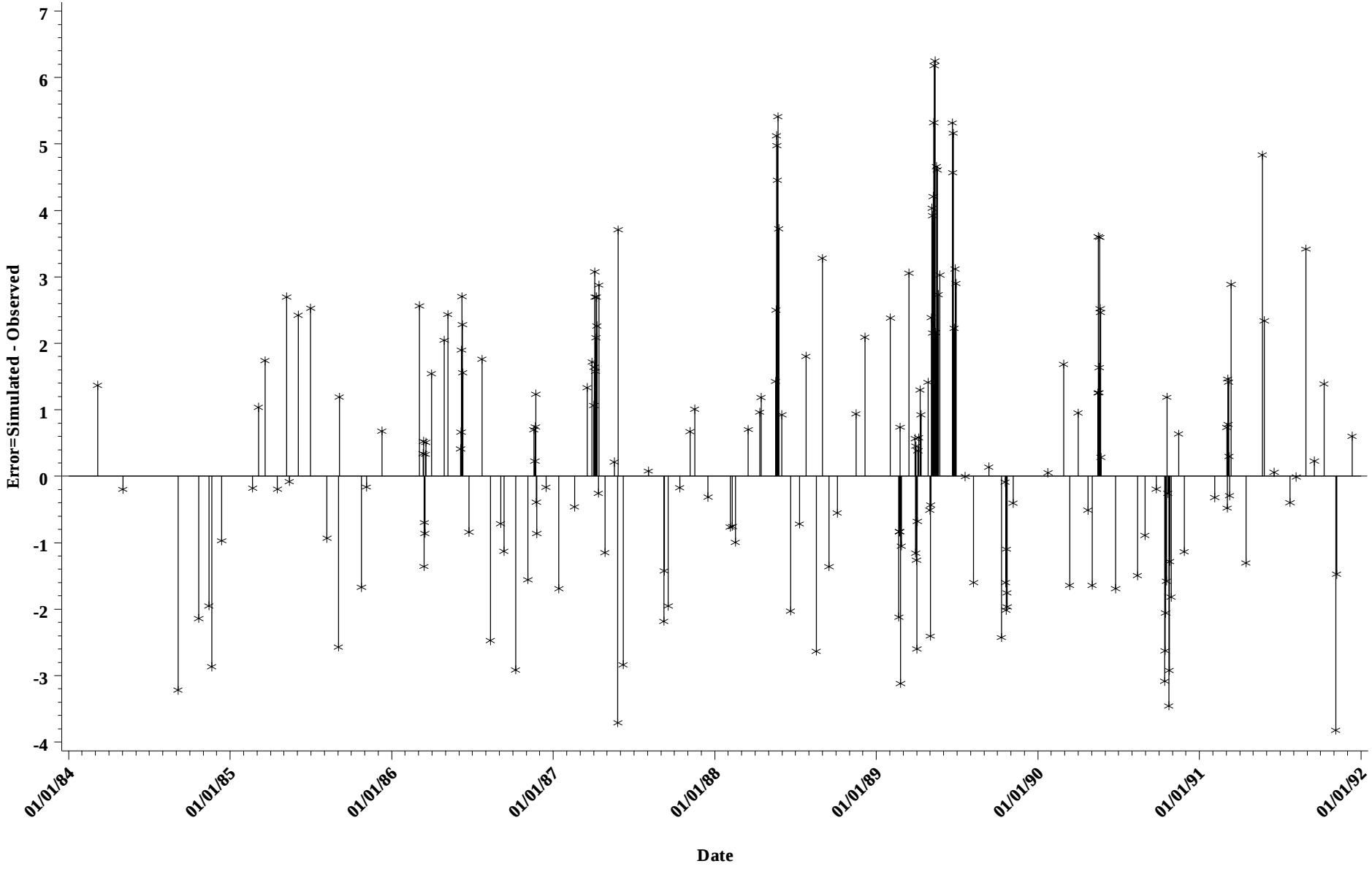
# West Branch Susquehanna at Segment 70

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92



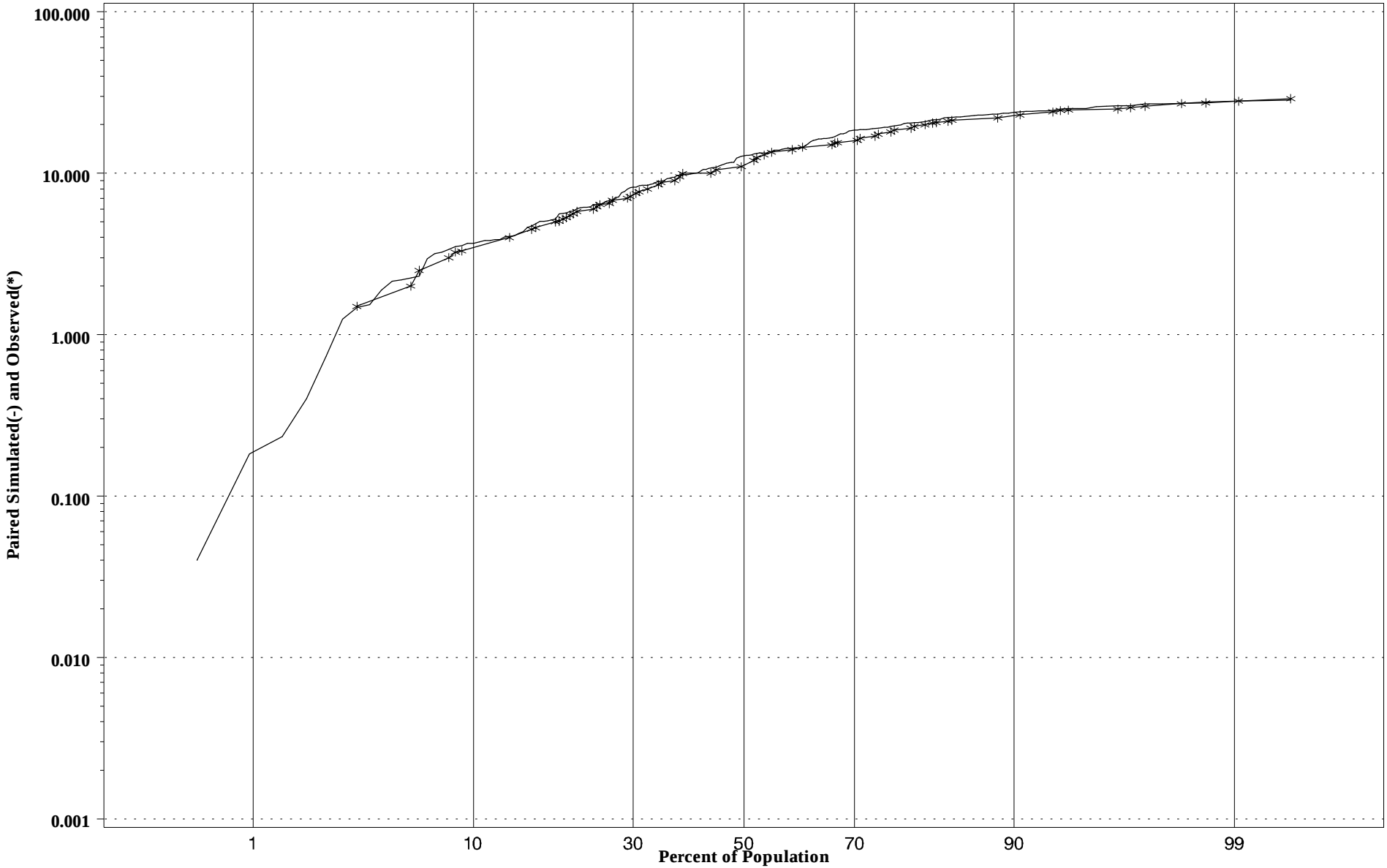

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70
## Actual Error versus Time
## Temperature-C




(y21_plotb.sas model3d:[pwang.dt] omerr)
(wbsus_d.drv1 26JUN98 08:48)

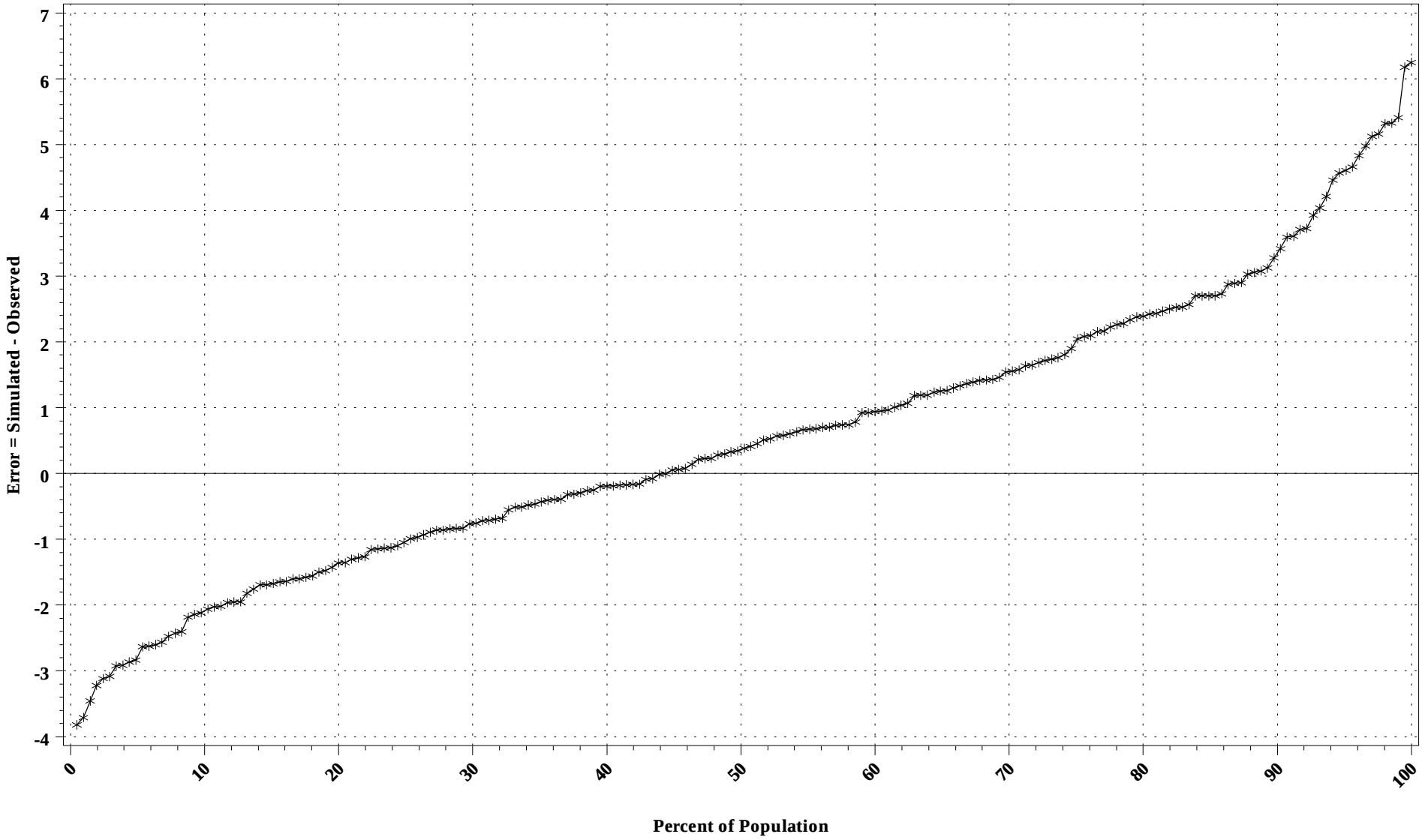
# West Branch Susquehanna at Segment 70
## Temperature-C
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Actual error versus Percentile Sample Population
## Temperature-C

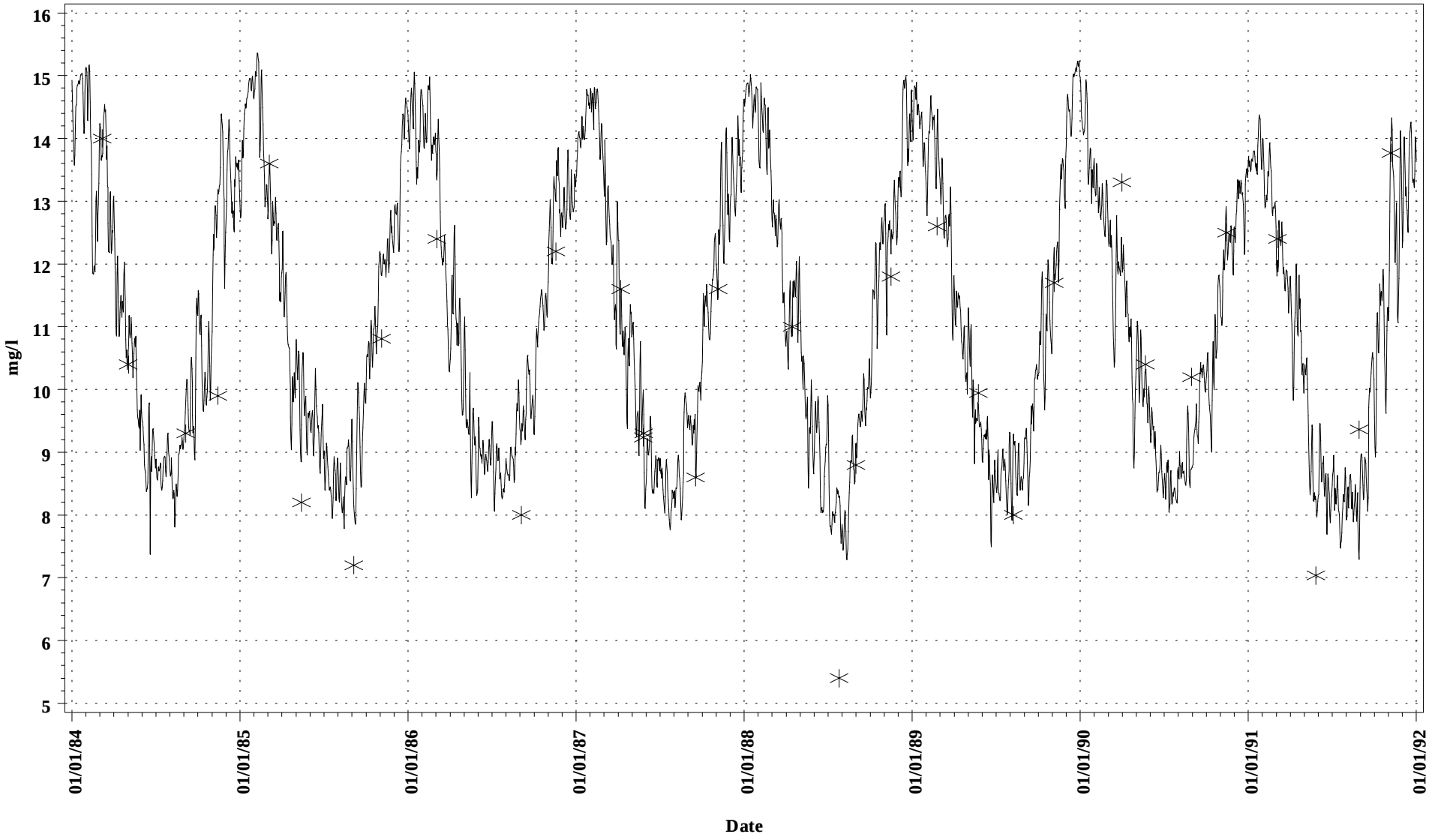
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(wbsus_d.drv1 26JUN98 08:48)

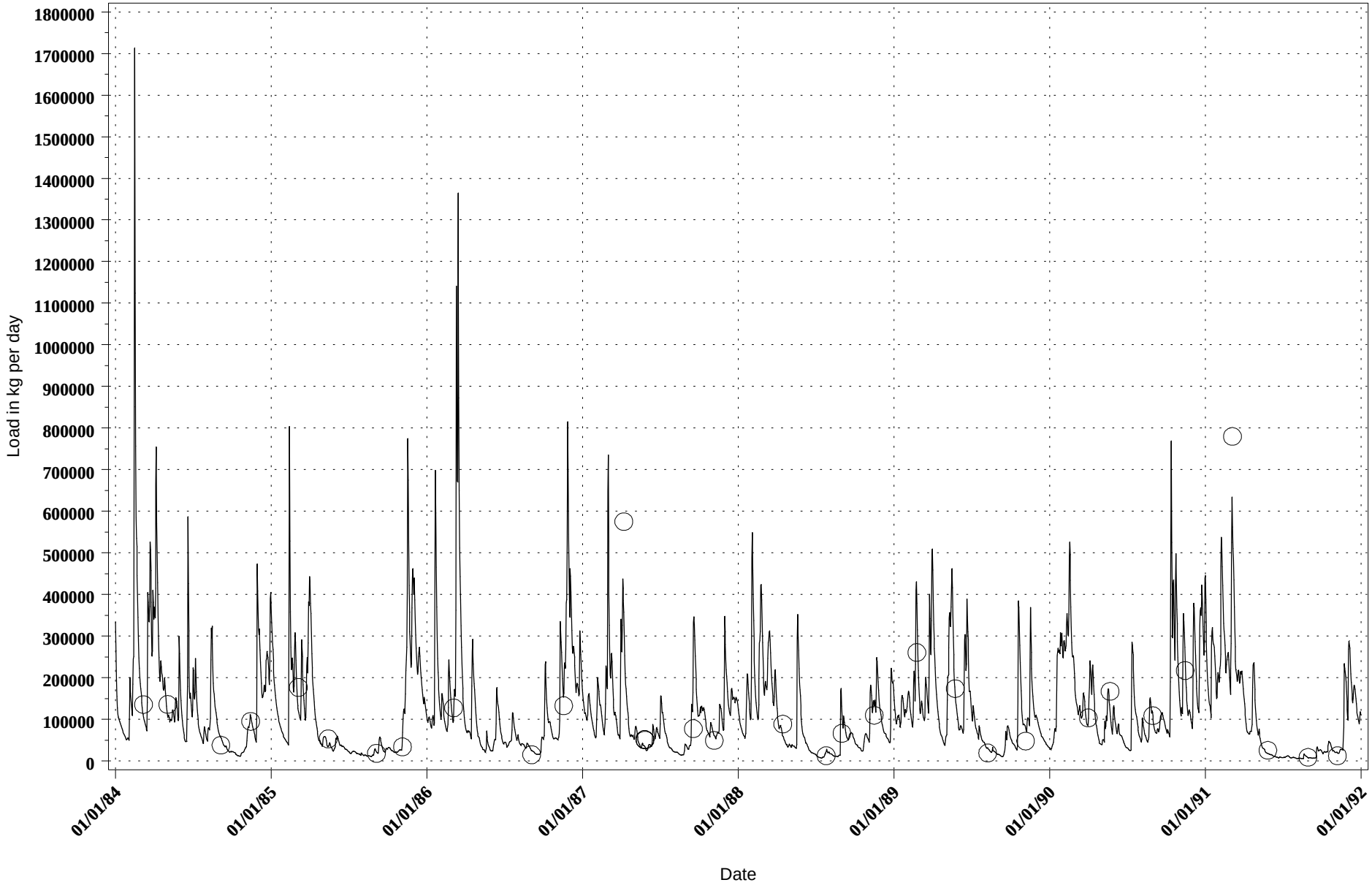
# West Branch Susquehanna at Segment 70
## Observed and Simulated versus Time
# Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(wbsus_d.drv1 26JUN98 08:48)

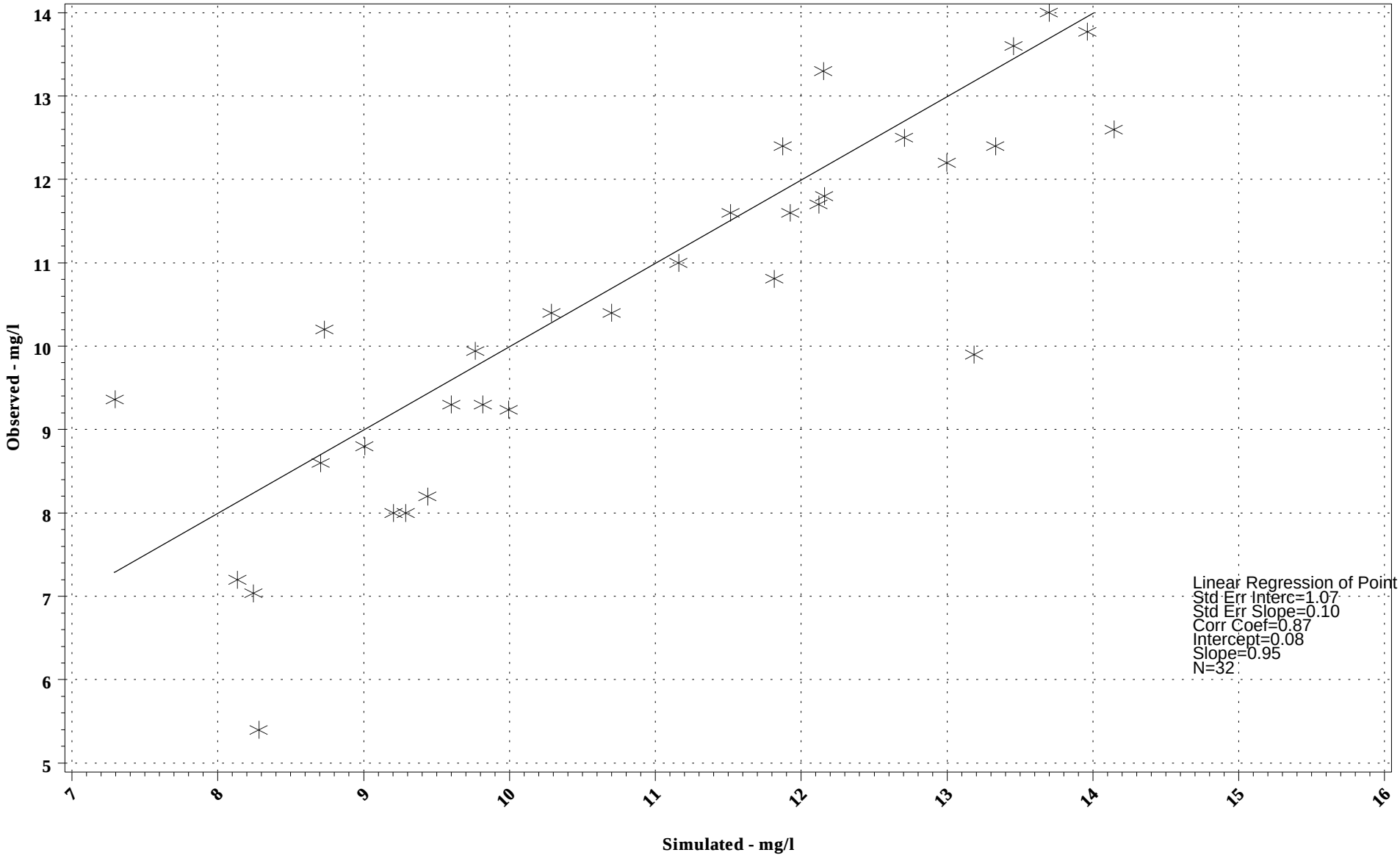
# West Branch Susquehanna at Segment 70
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)




(y21_plotb.sas model3d:[pwang.dt] lldflas)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

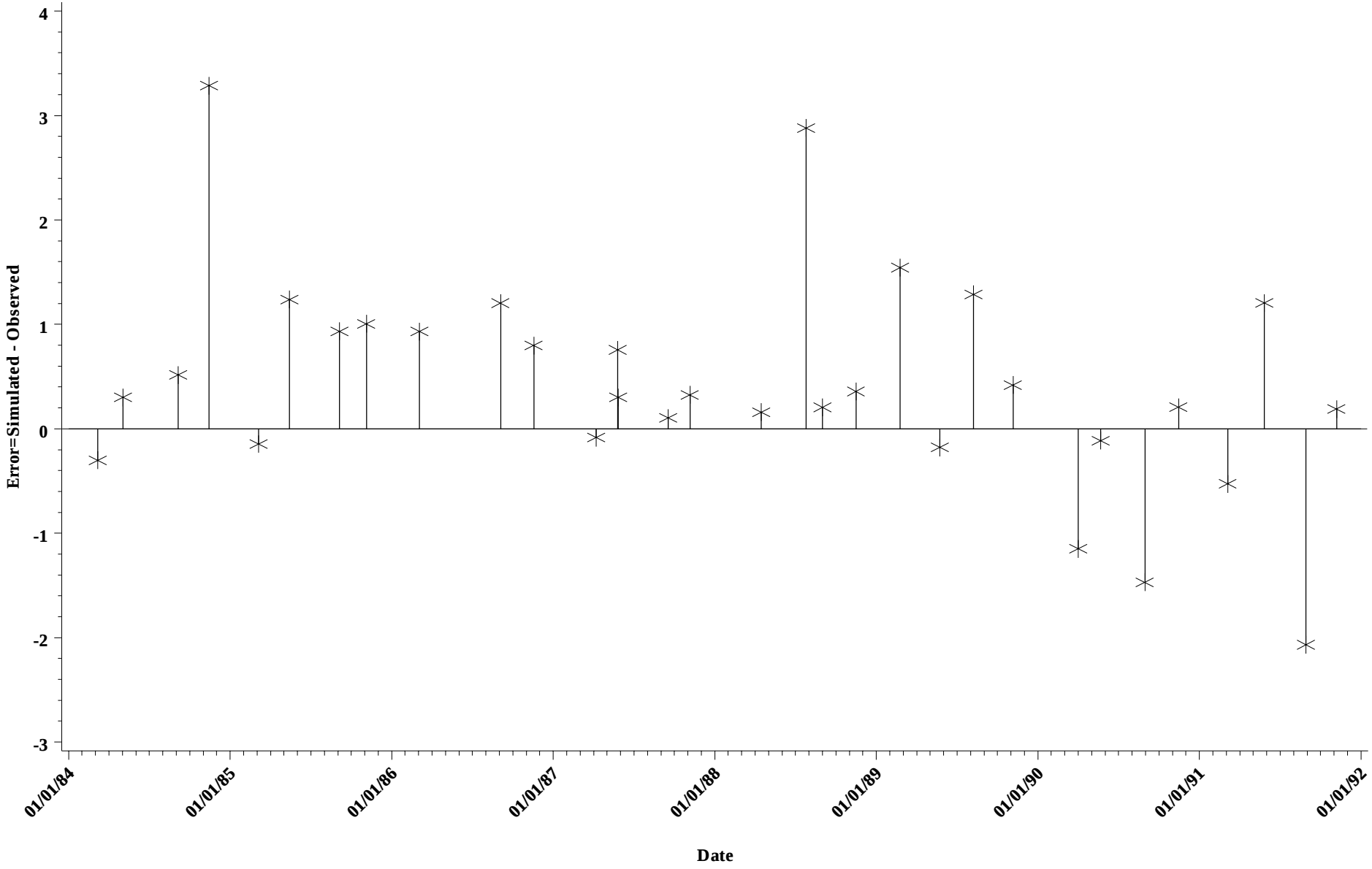
# West Branch Susquehanna at Segment 70

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Dissolved Oxygen: 01JAN84 - 01JAN92



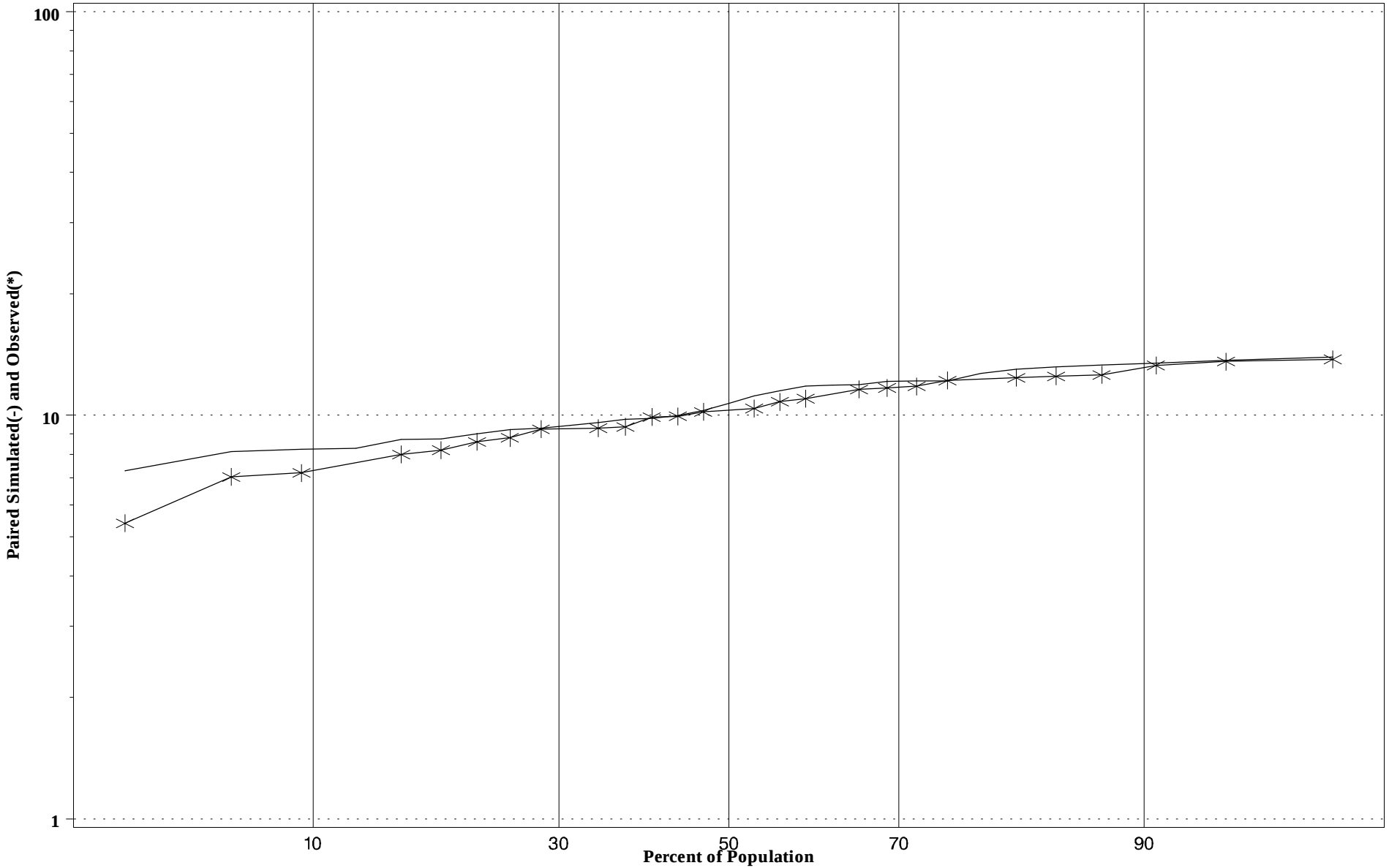

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(wbsus_d.drv1 26JUN98 08:48)

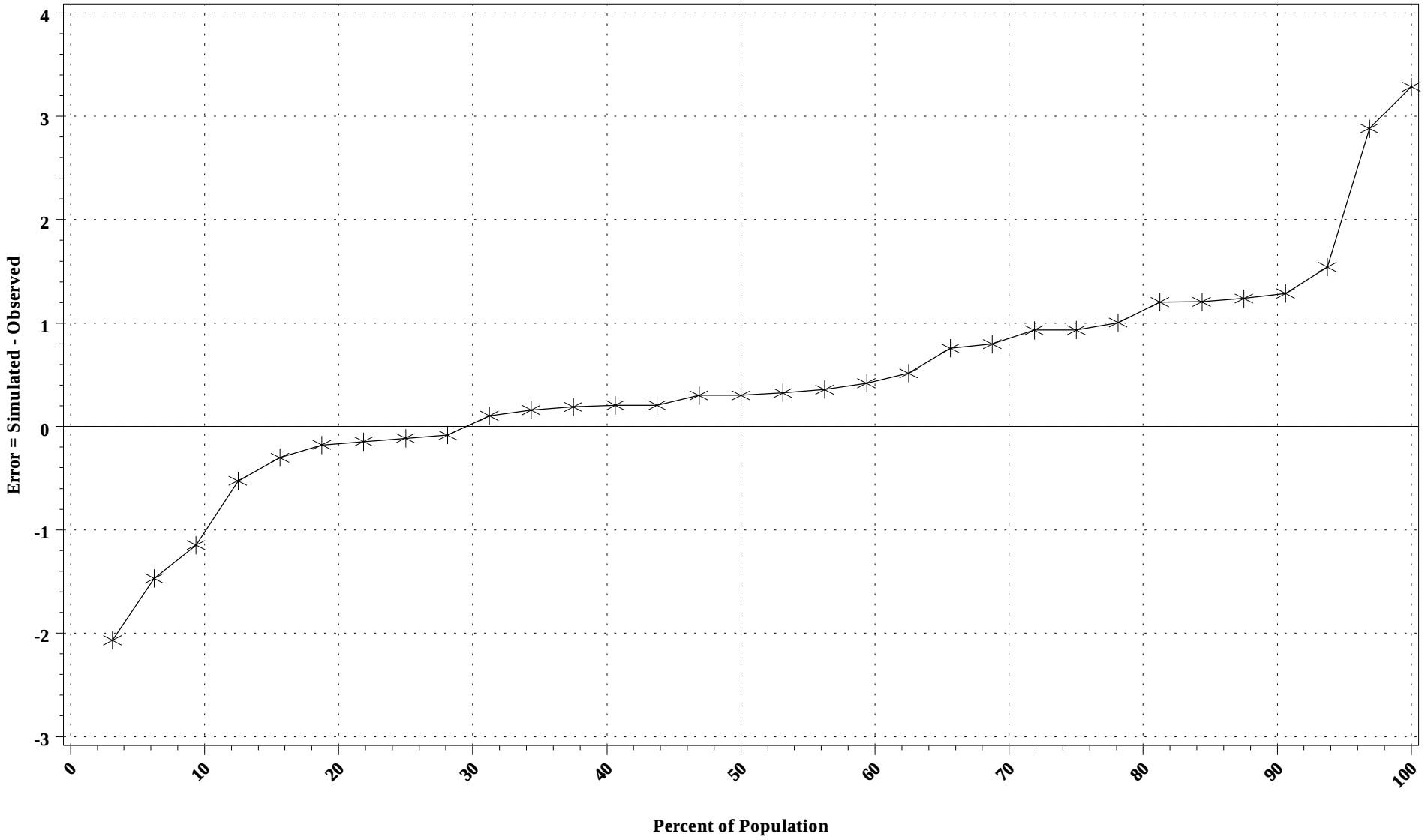
# West Branch Susquehanna at Segment 70
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

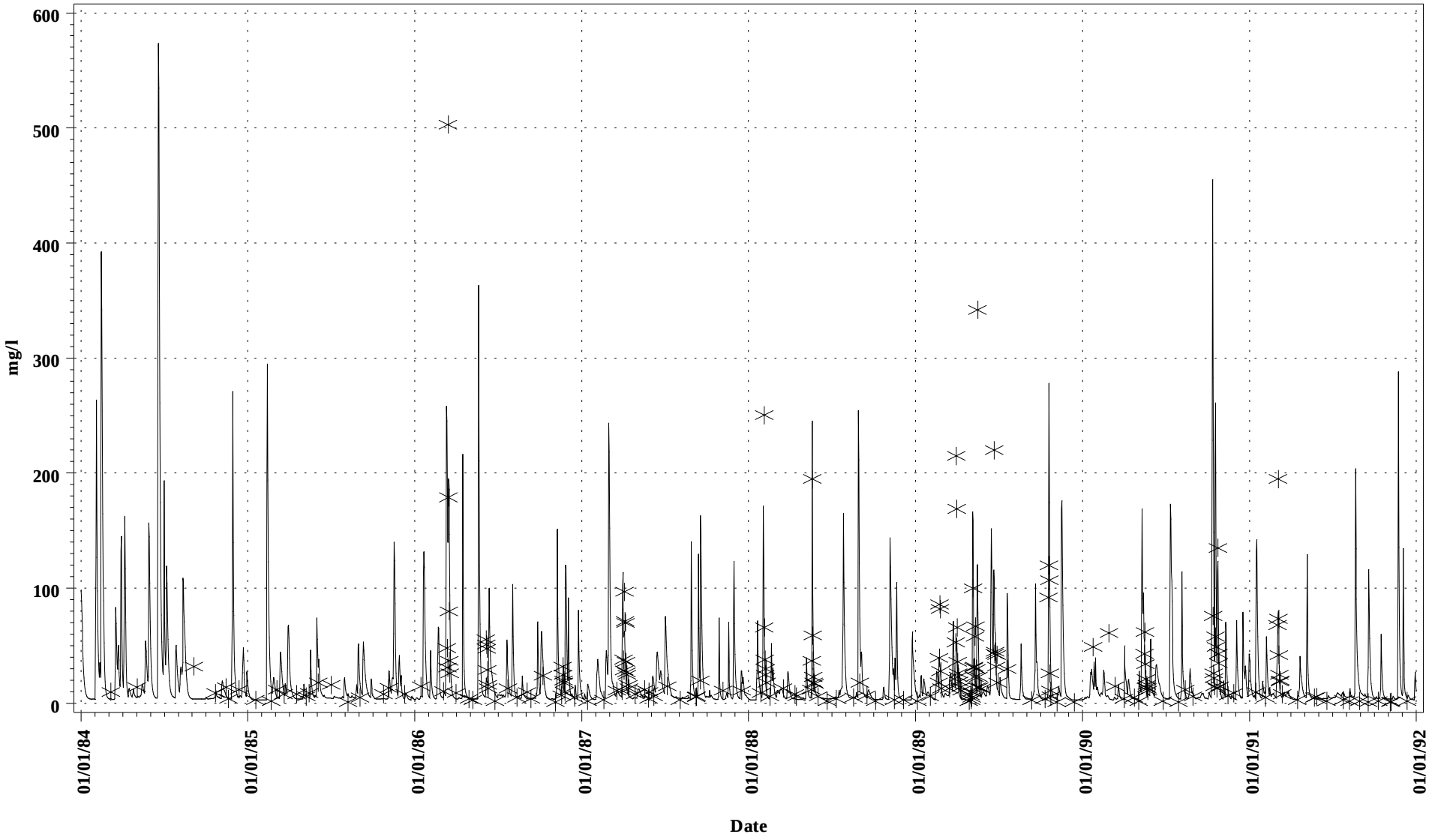
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Observed and Simulated versus Time
# Total Suspended Sediment

**(*=Observed, -=Simulated)**

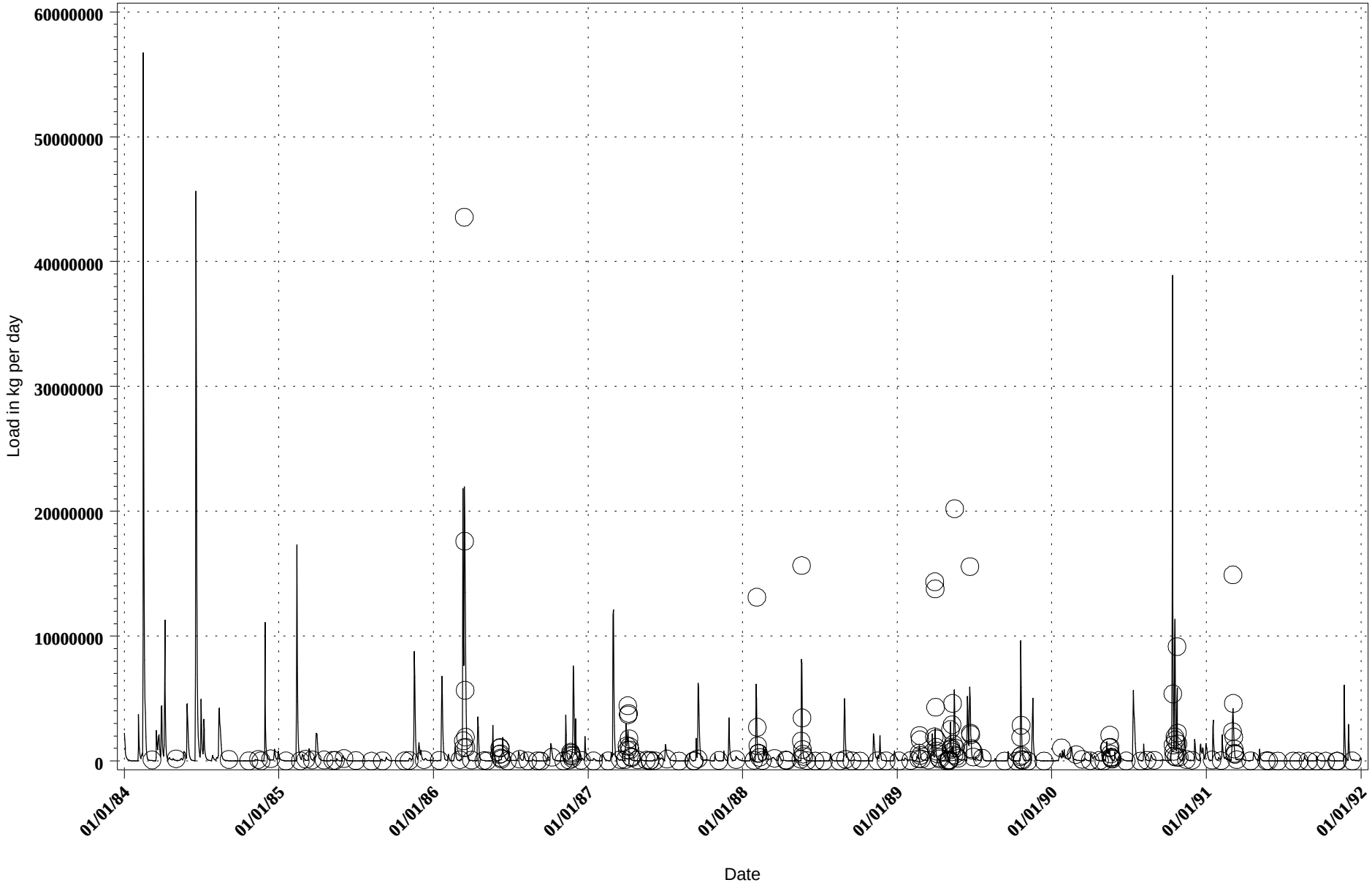



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70

## Total Suspended Sediment Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

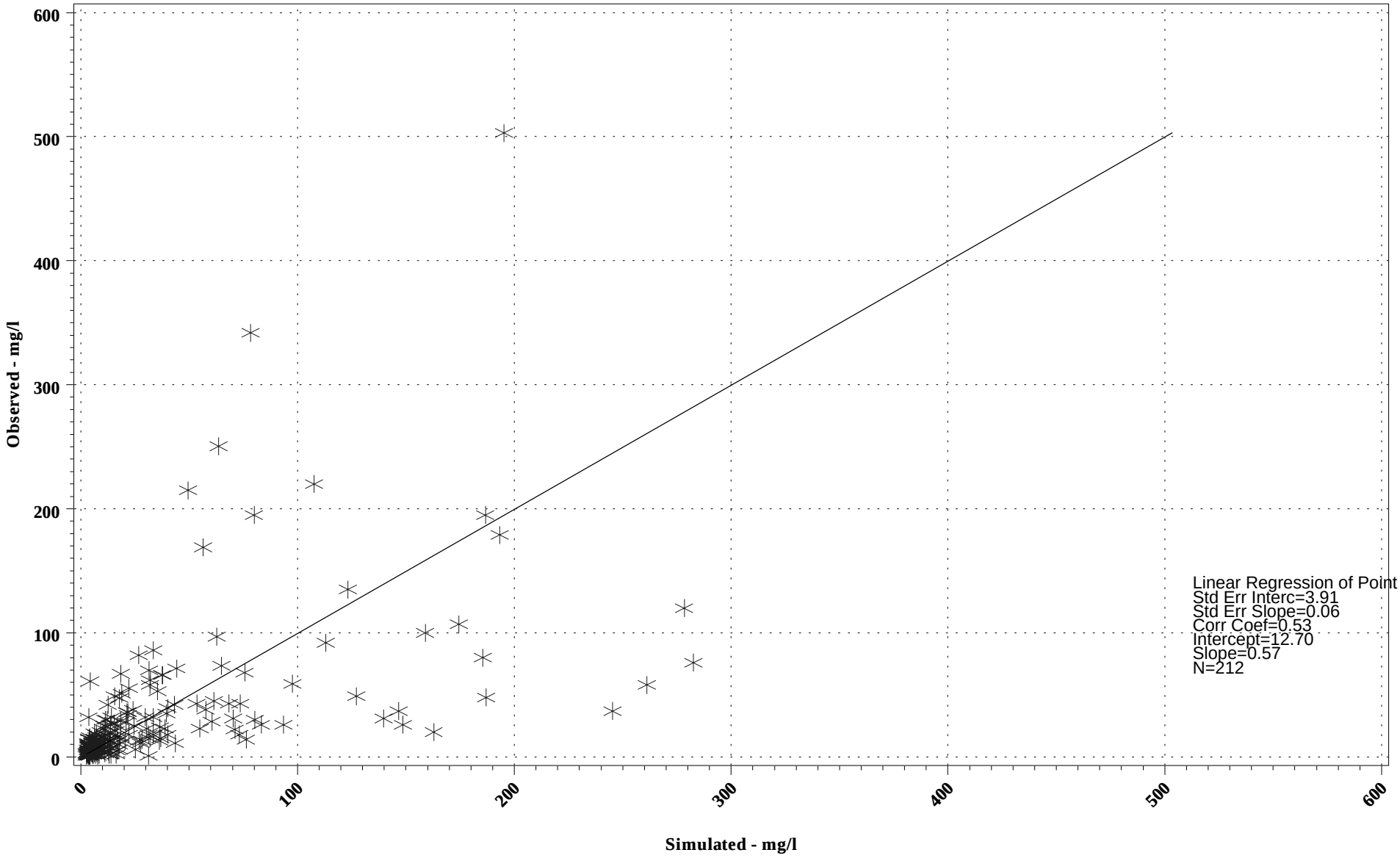



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70

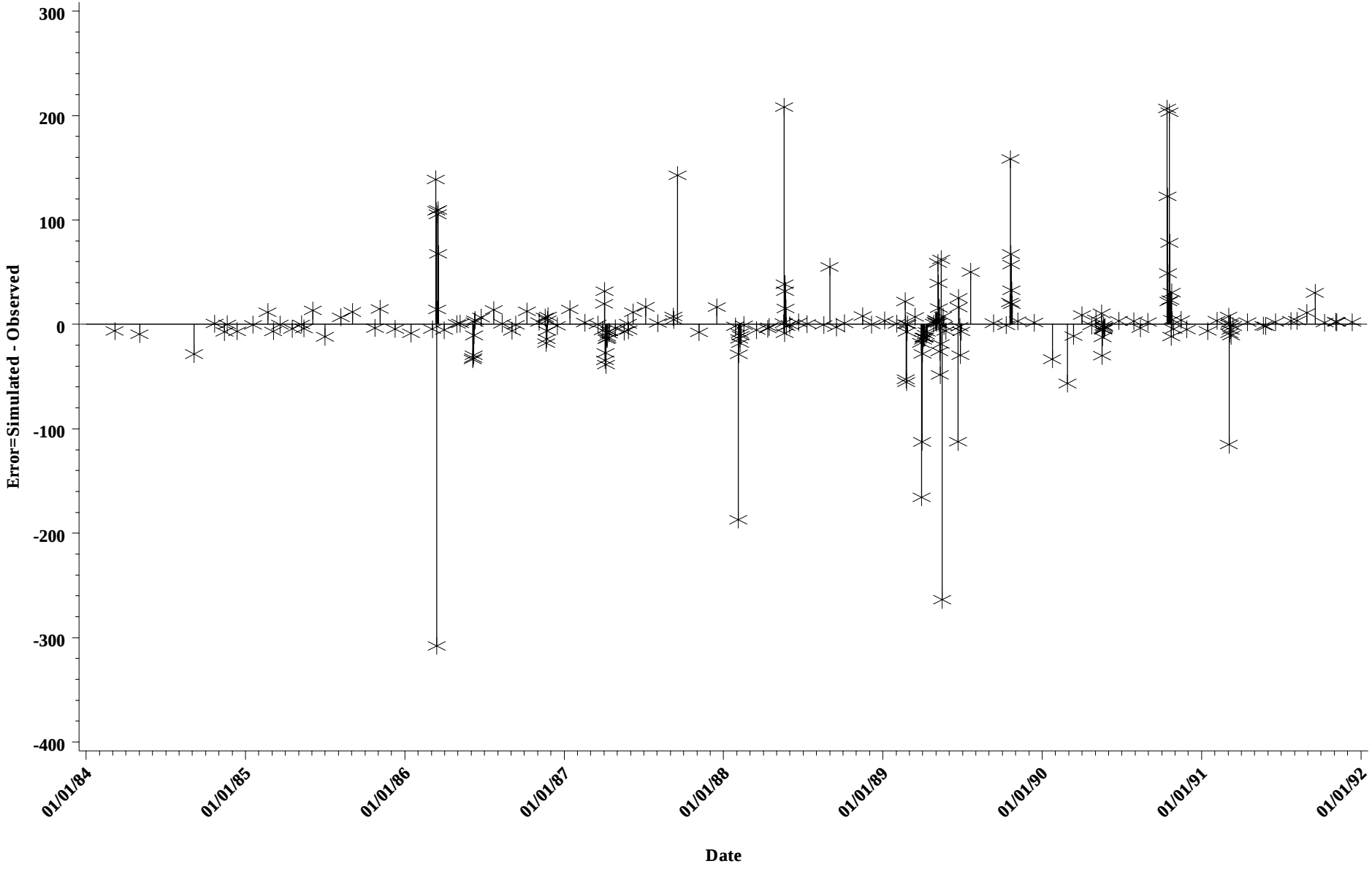
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70
## Actual Error versus Time
## Total Suspended Sediment

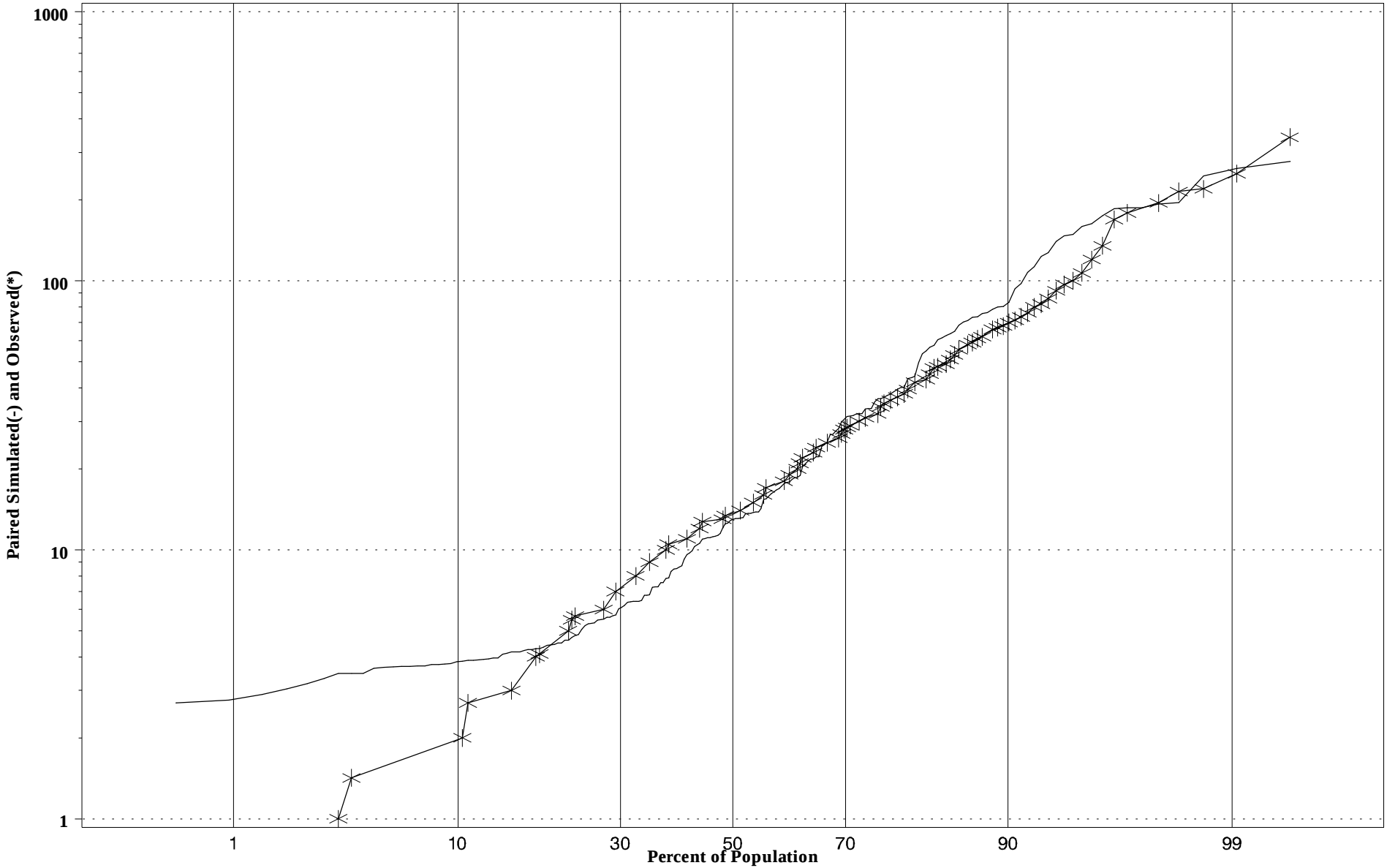



(y21_plotb.sas model3d:[pwang.dt] omerr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70

## Total Suspended Sediment

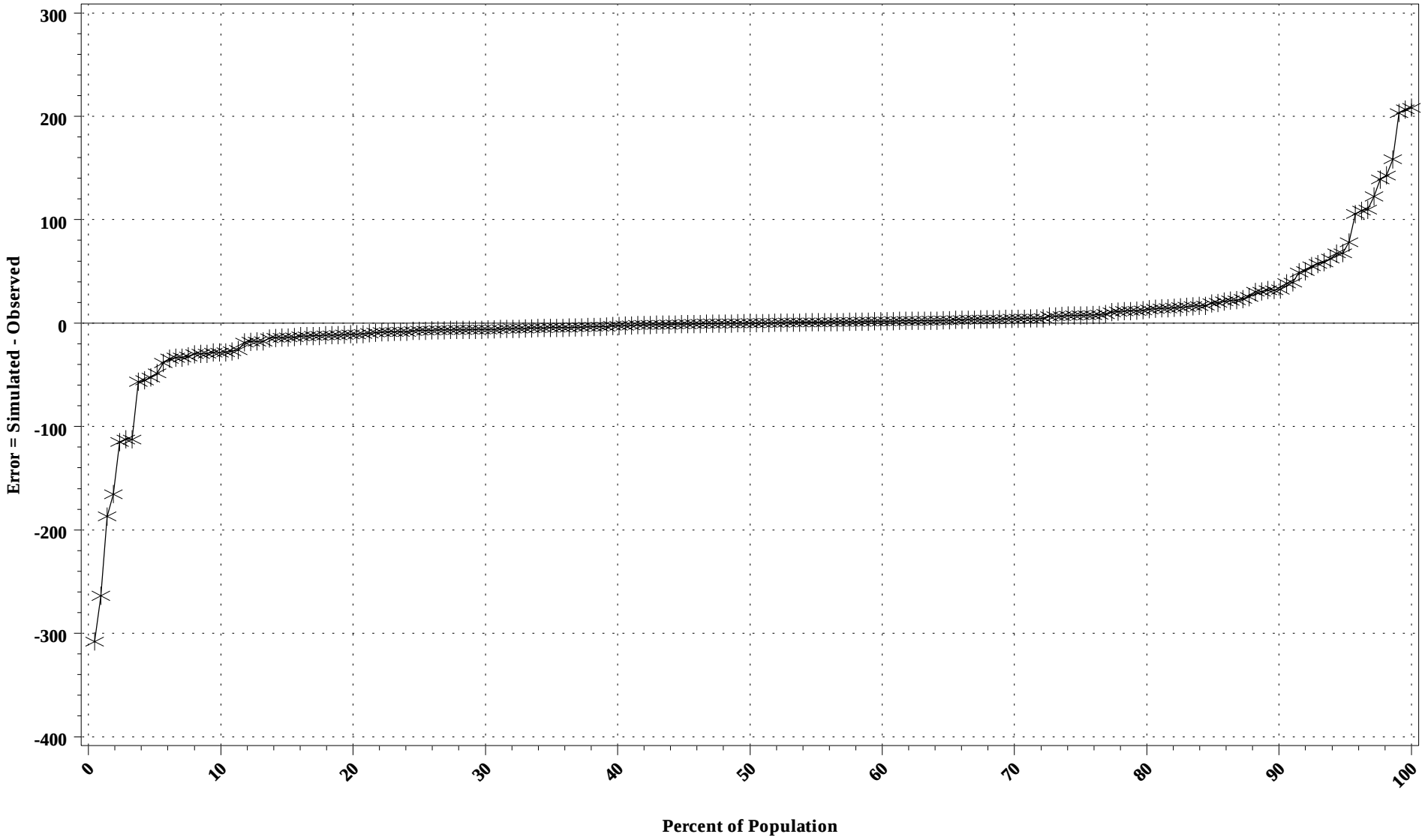
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

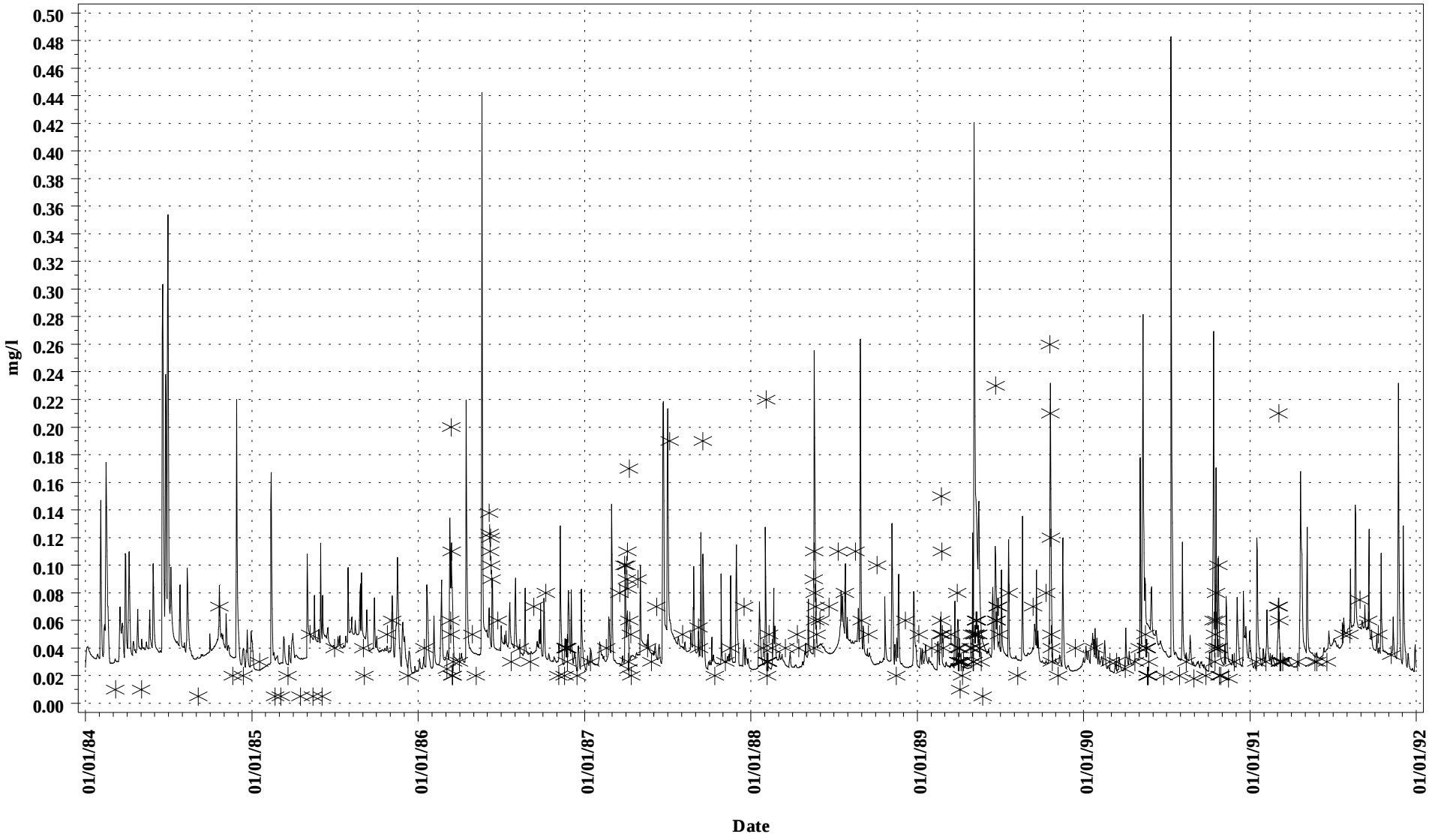
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(wbsus_d.drv1 26JUN98 08:48)

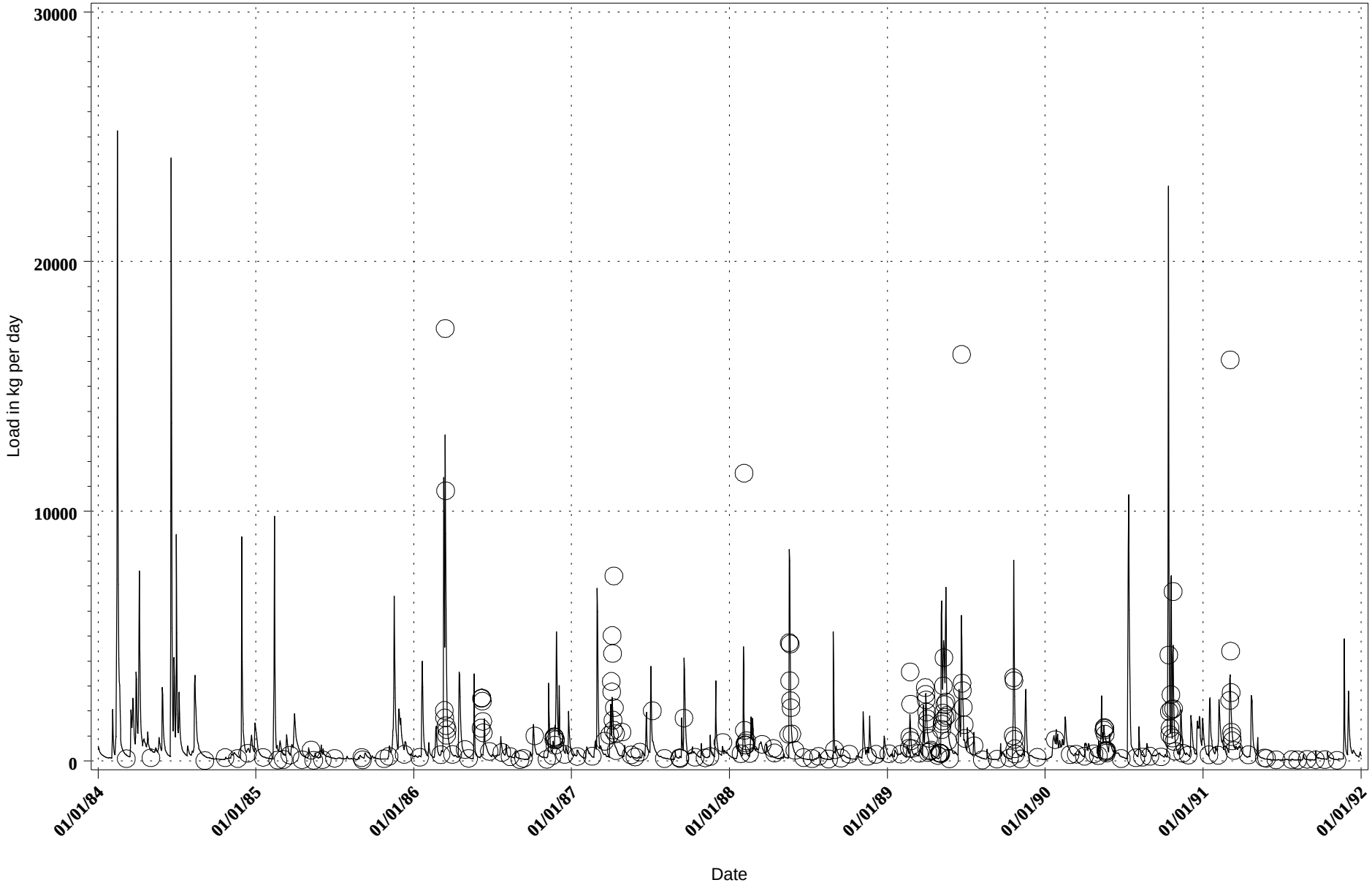
# West Branch Susquehanna at Segment 70
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

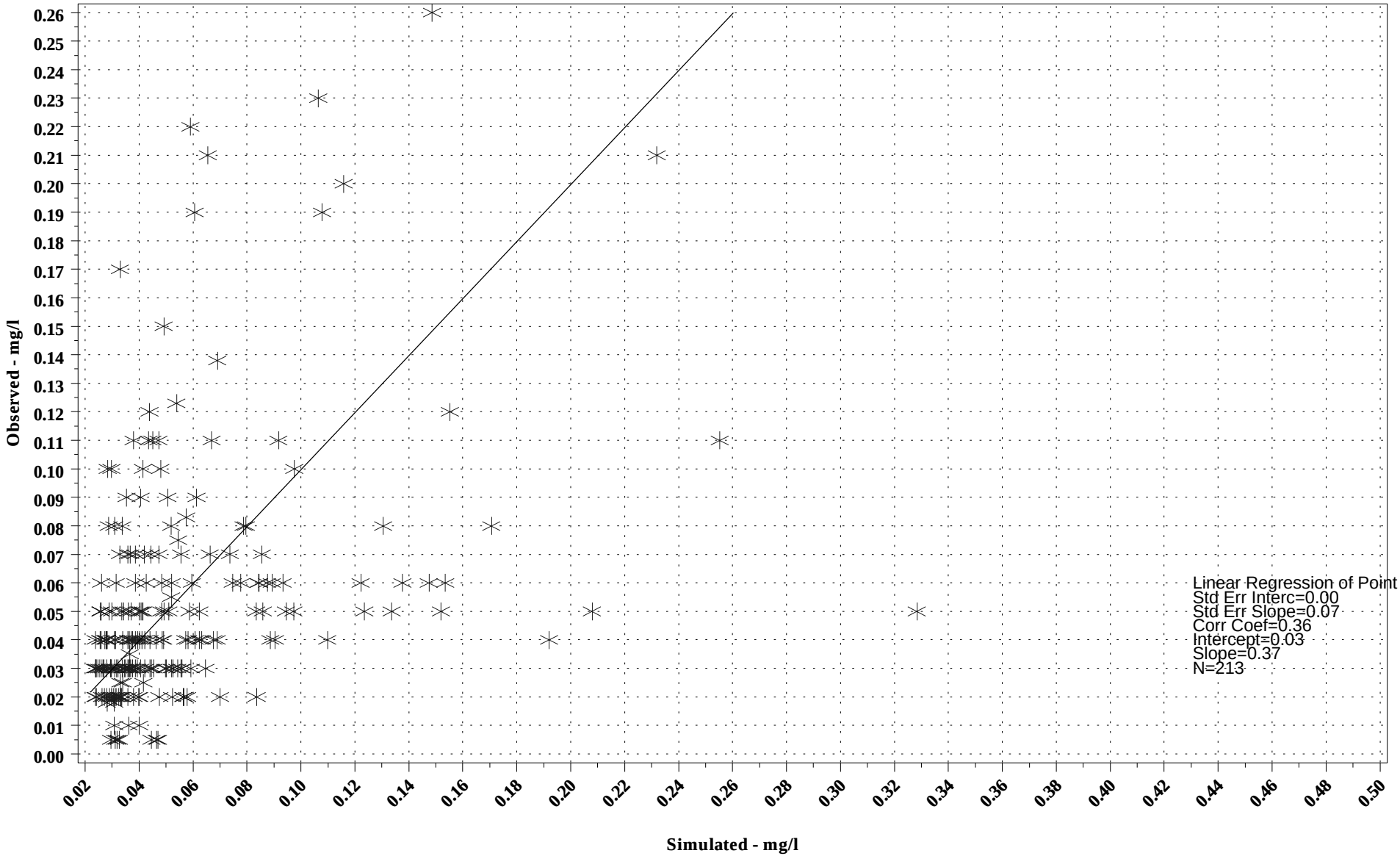



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70

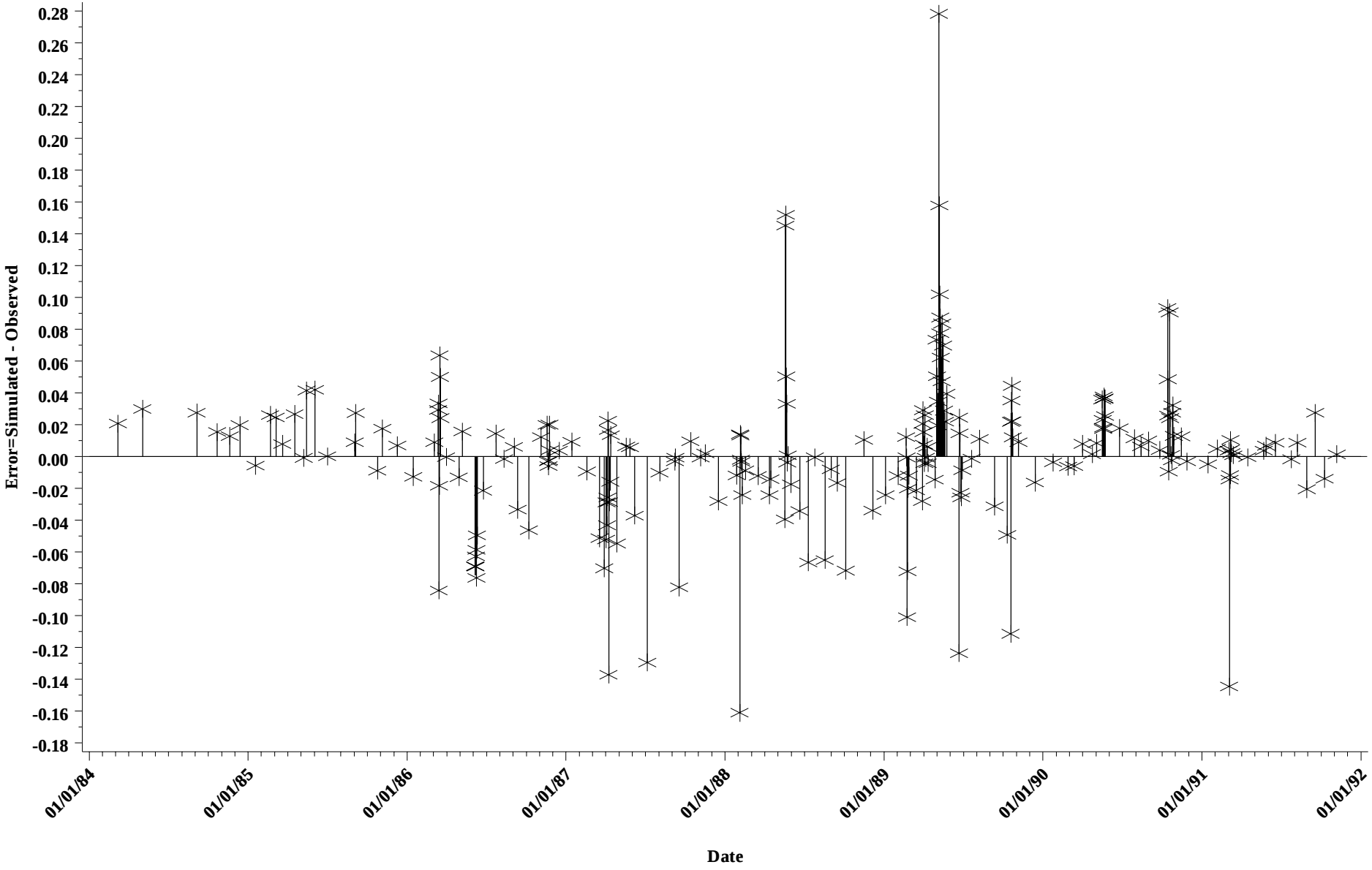
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



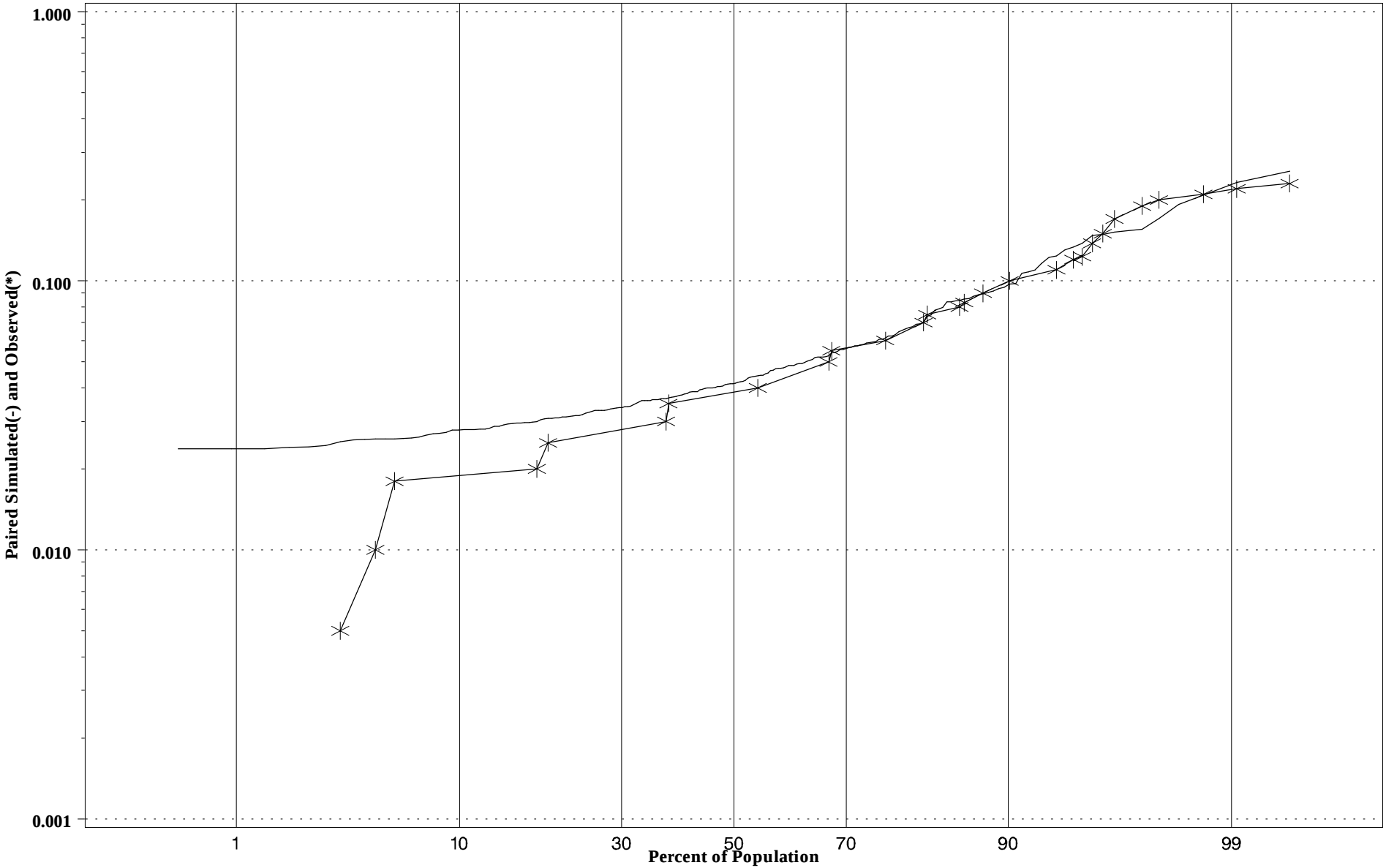

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(wbsus_d.drv1 26JUN98 08:48)

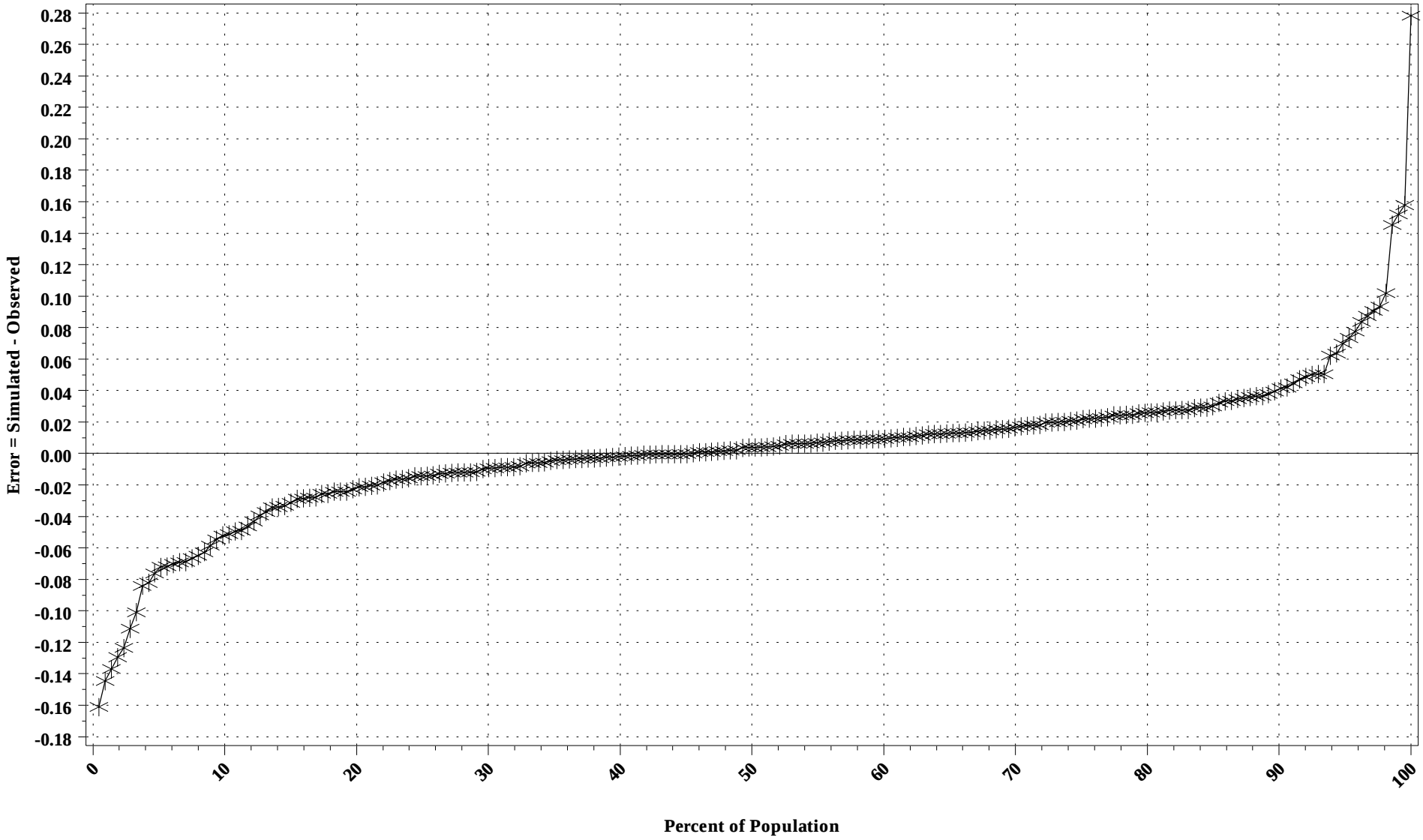
# West Branch Susquehanna at Segment 70
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Actual error versus Percentile Sample Population
## Total Phosphorus

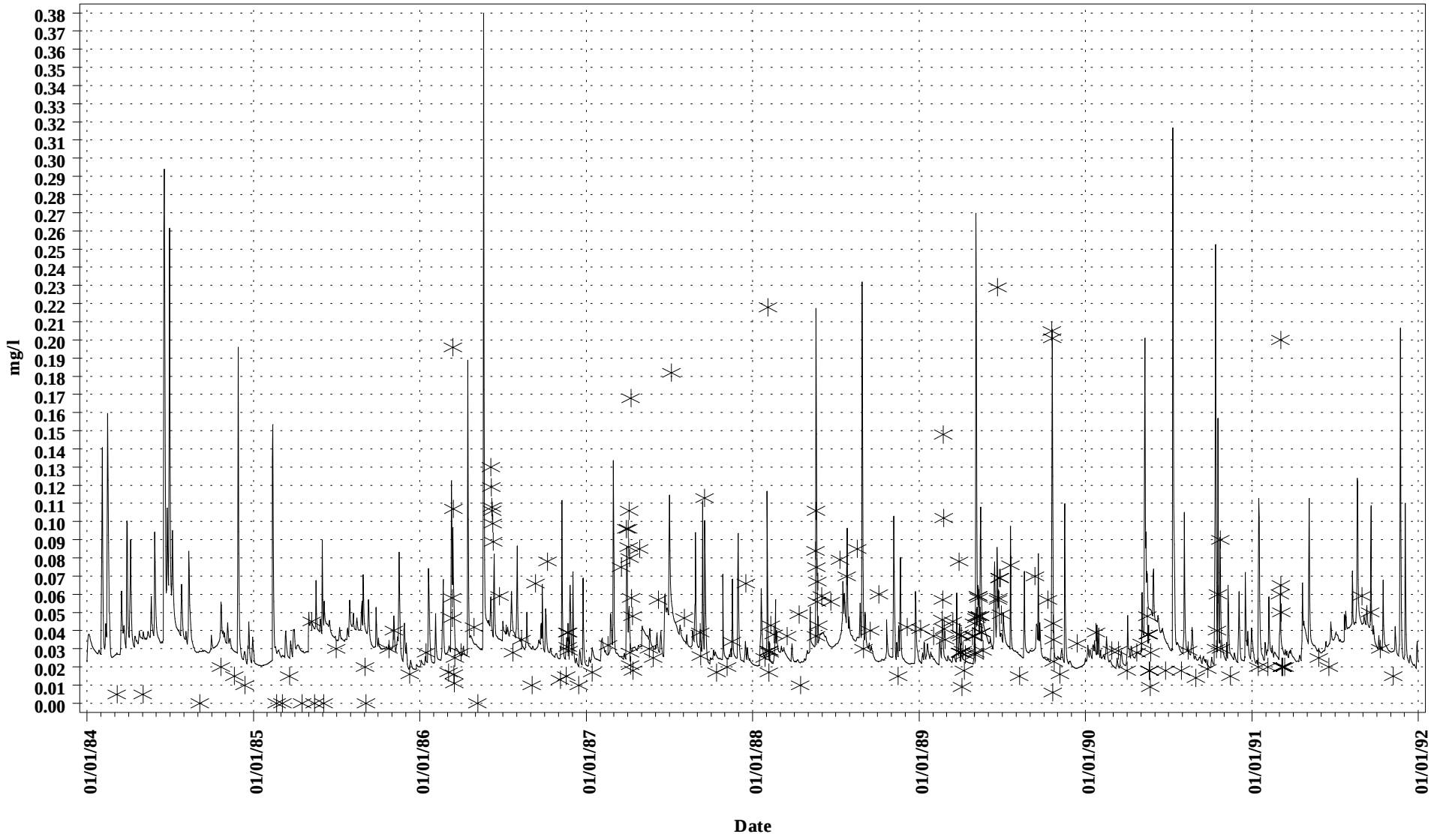
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

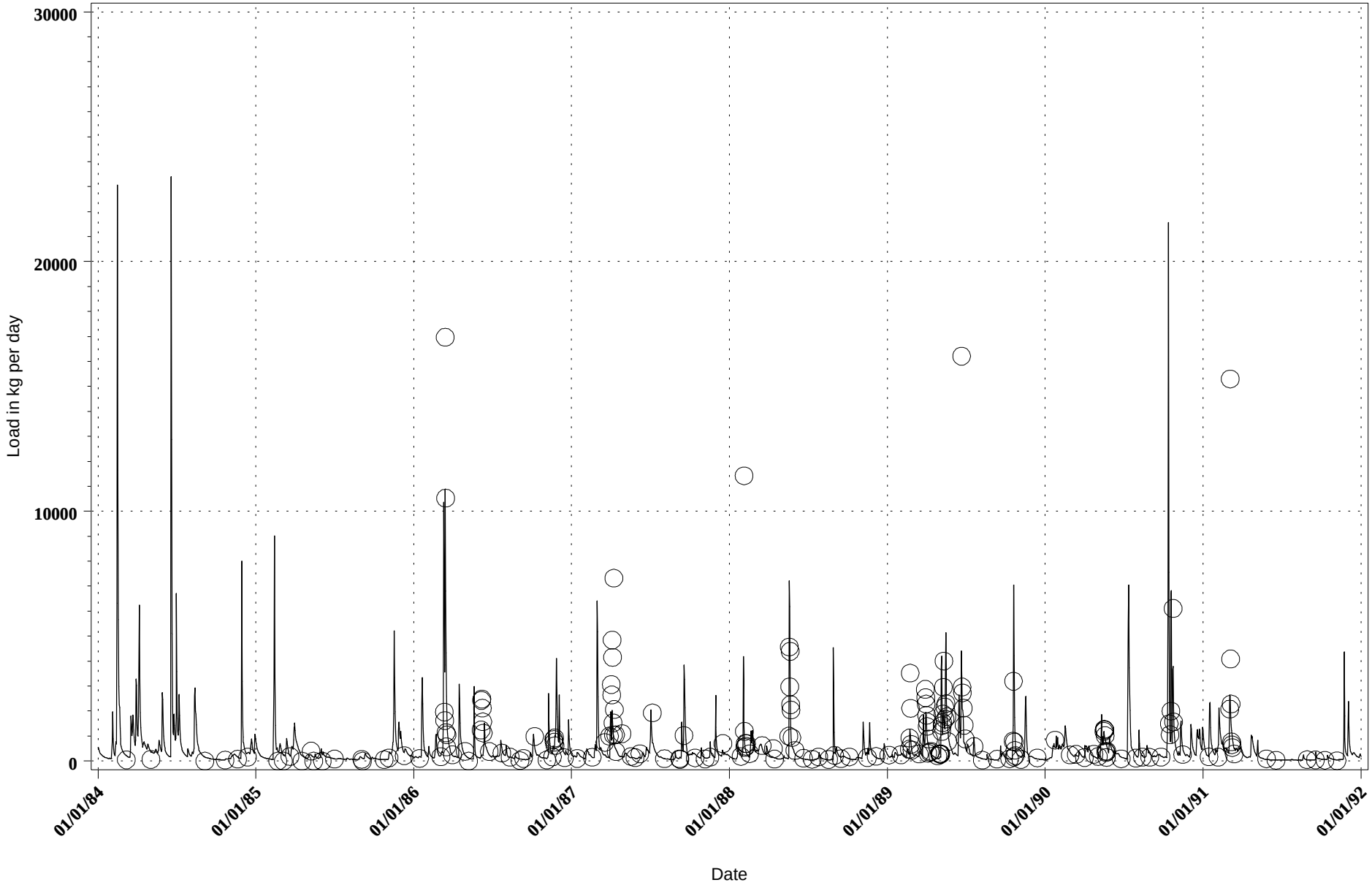



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

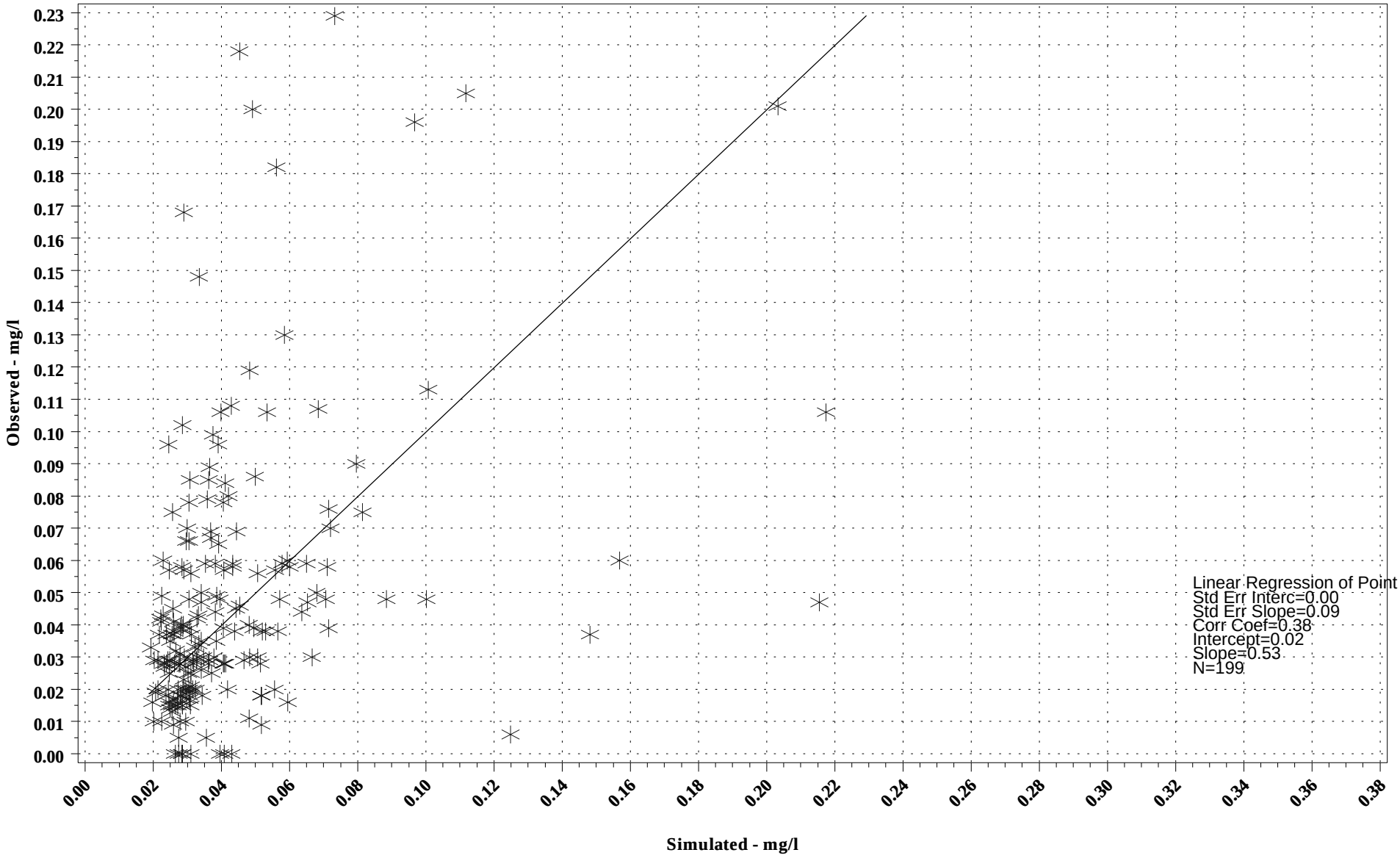



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70

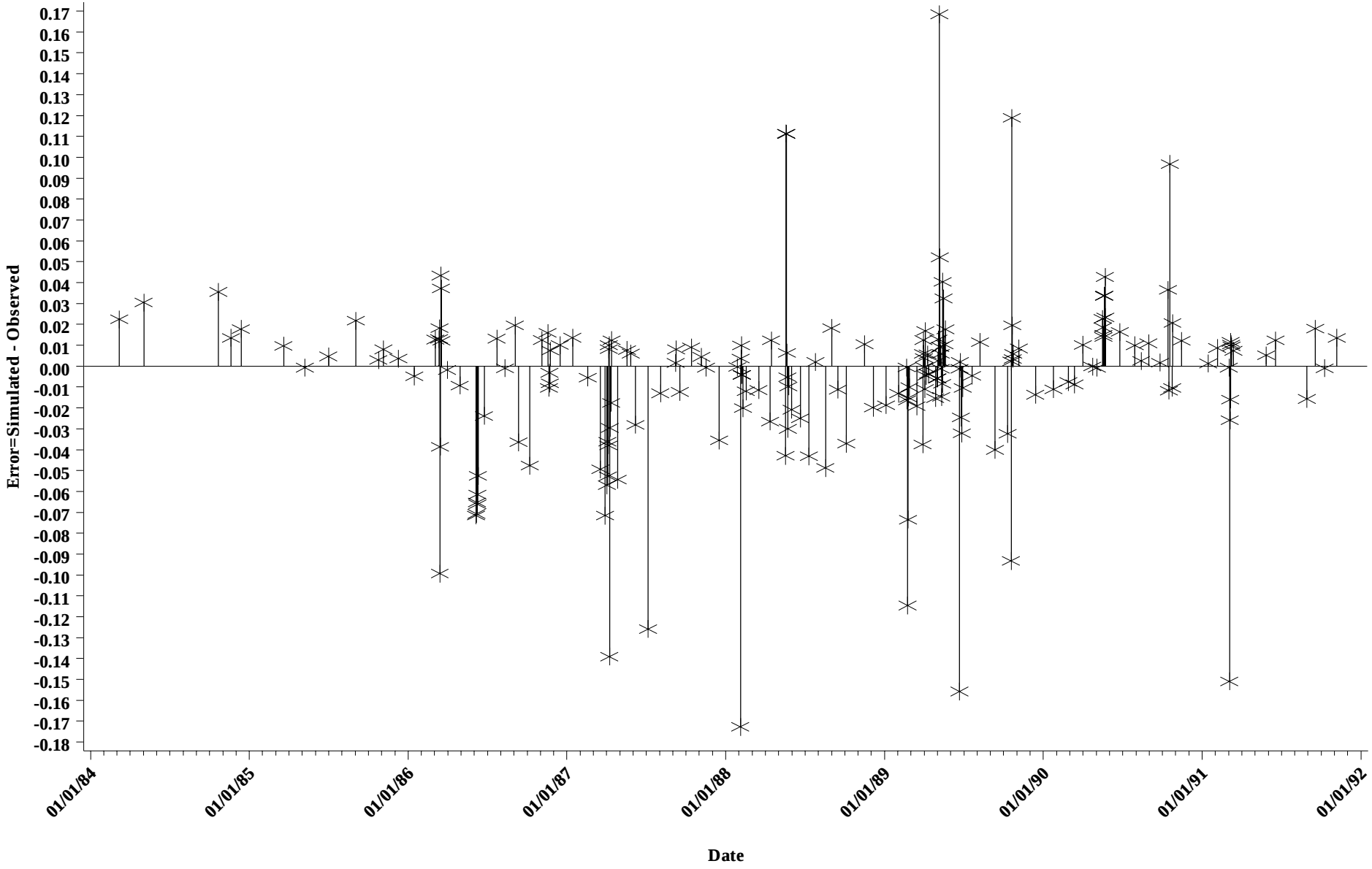
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70
## Actual Error versus Time
## Organic and Particulate Phosphorus

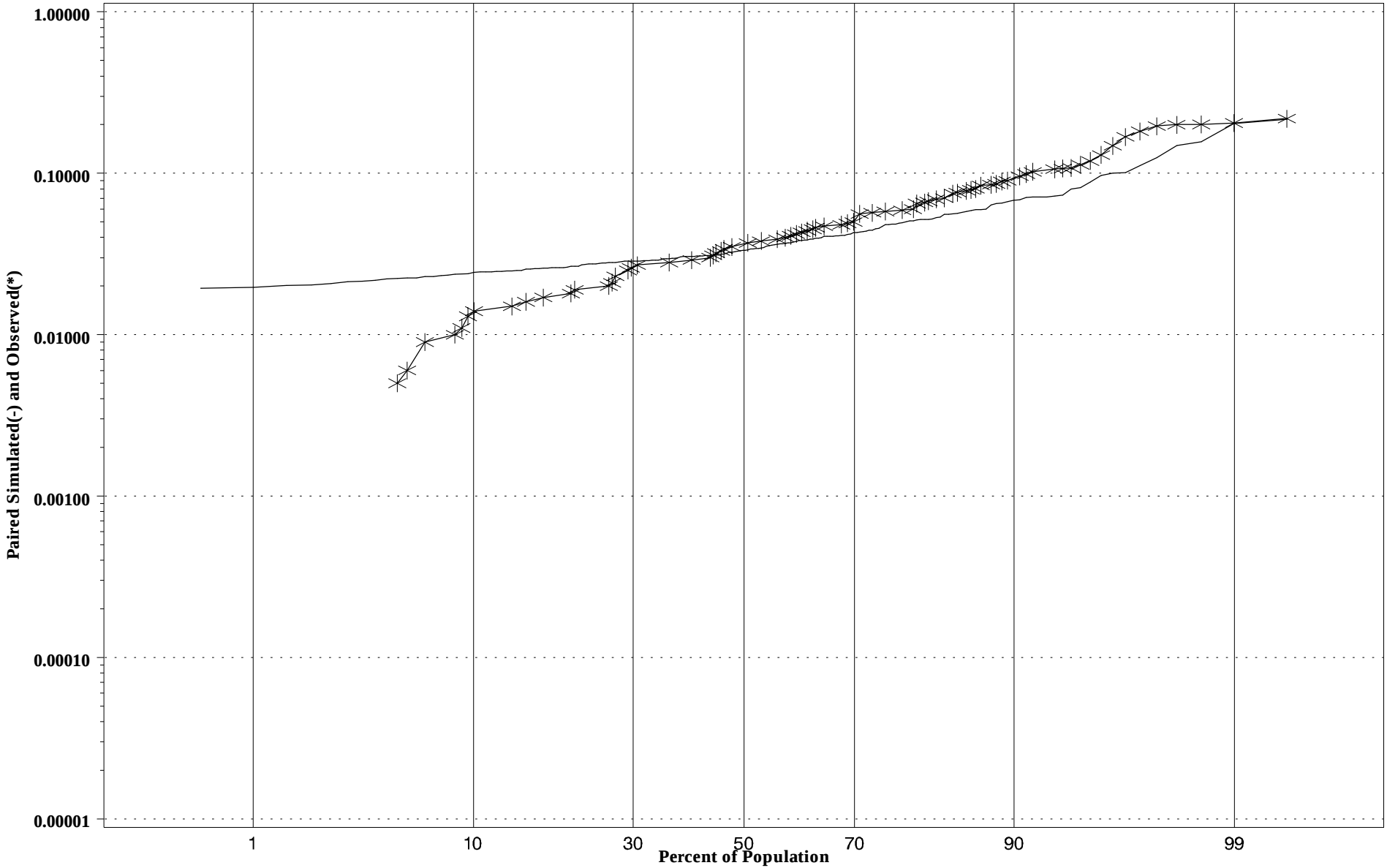



(y21_plotb.sas model3d:[pwang.dt] omerr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70

## Organic and Particulate Phosphorus

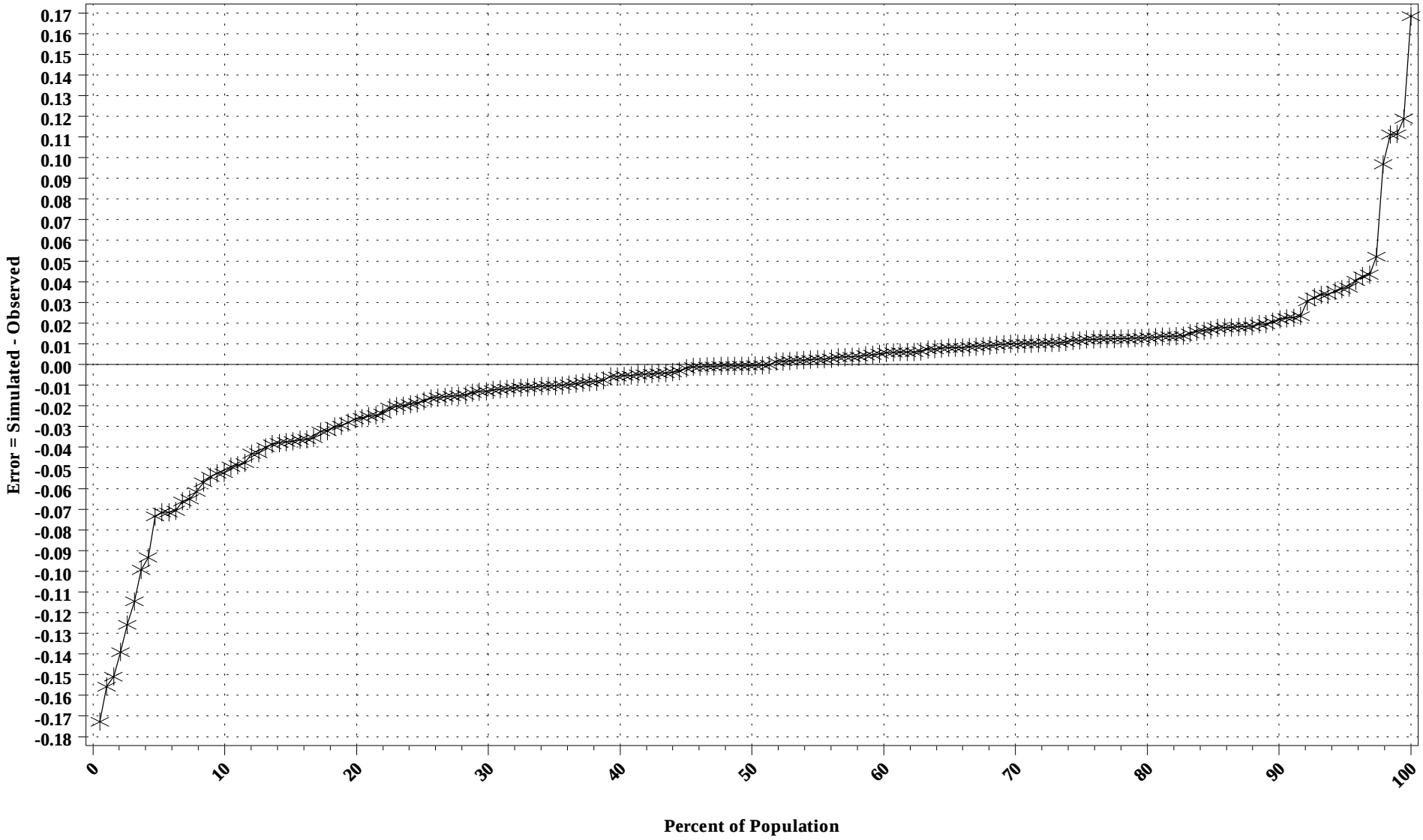
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

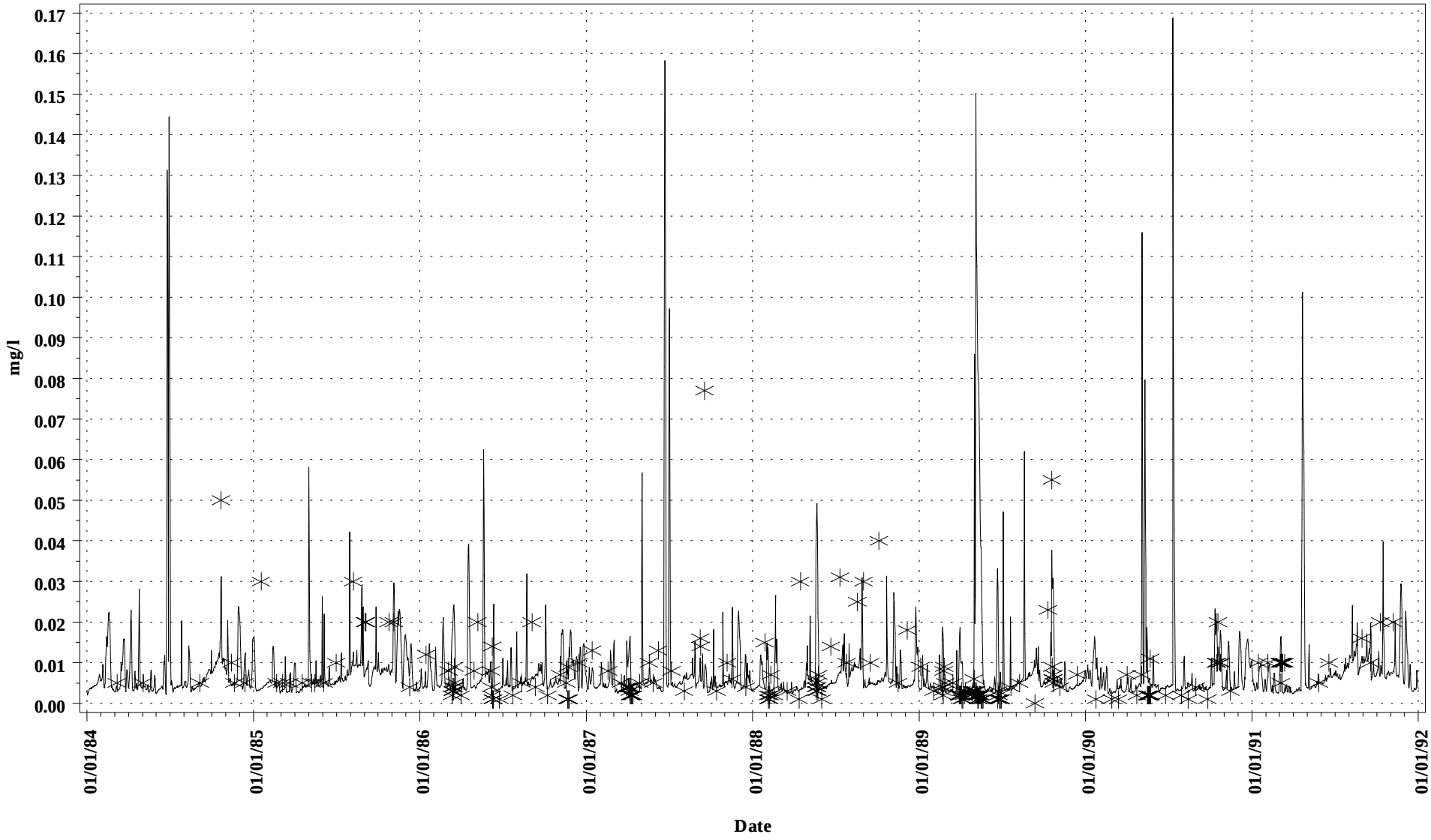
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Observed and Simulated versus Time
# Dissolved Phosphorus

**(*=Observed, -=Simulated)**

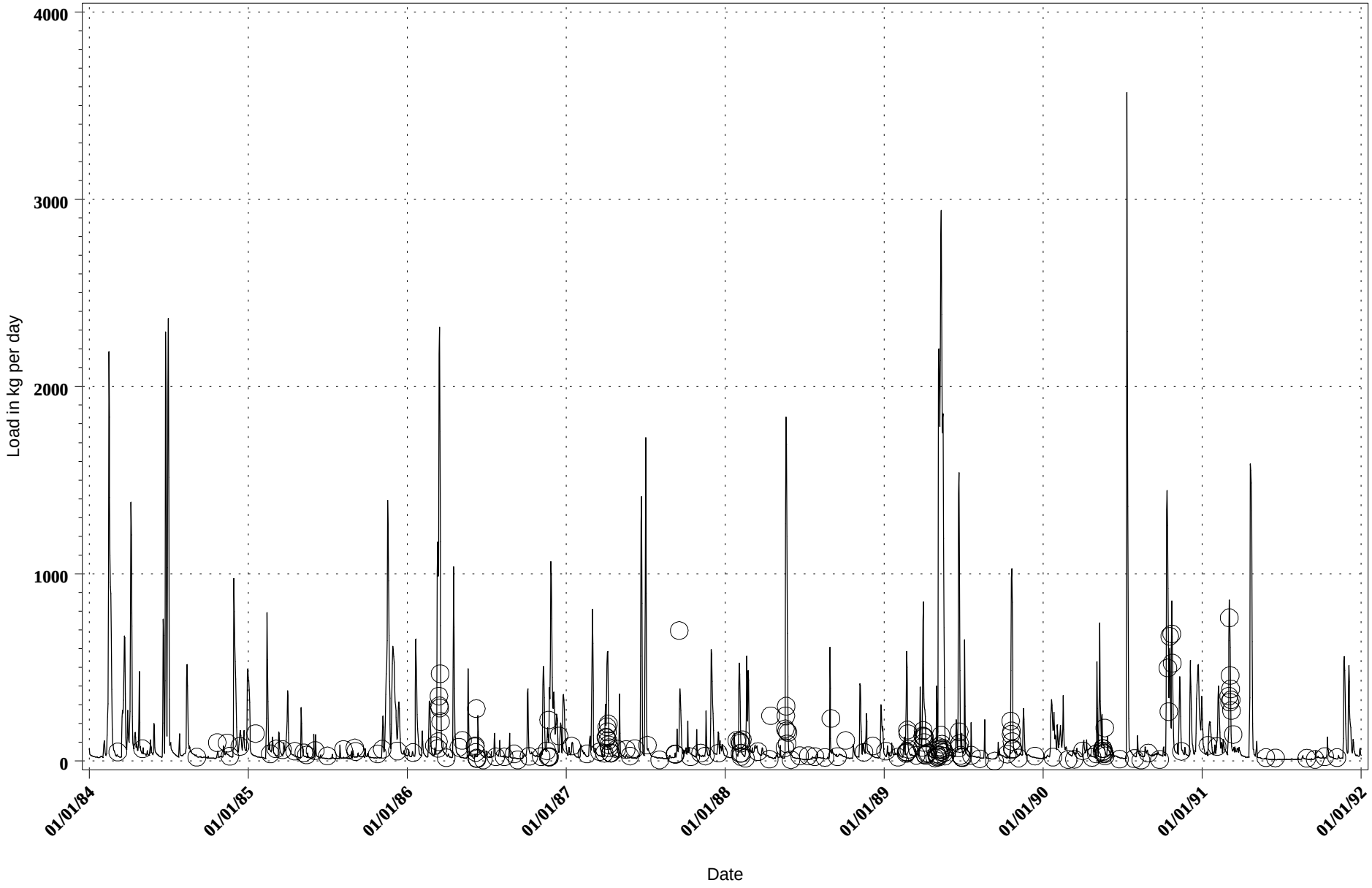



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70

## Dissolved Phosphorus Observed and Simulated Load vs Time

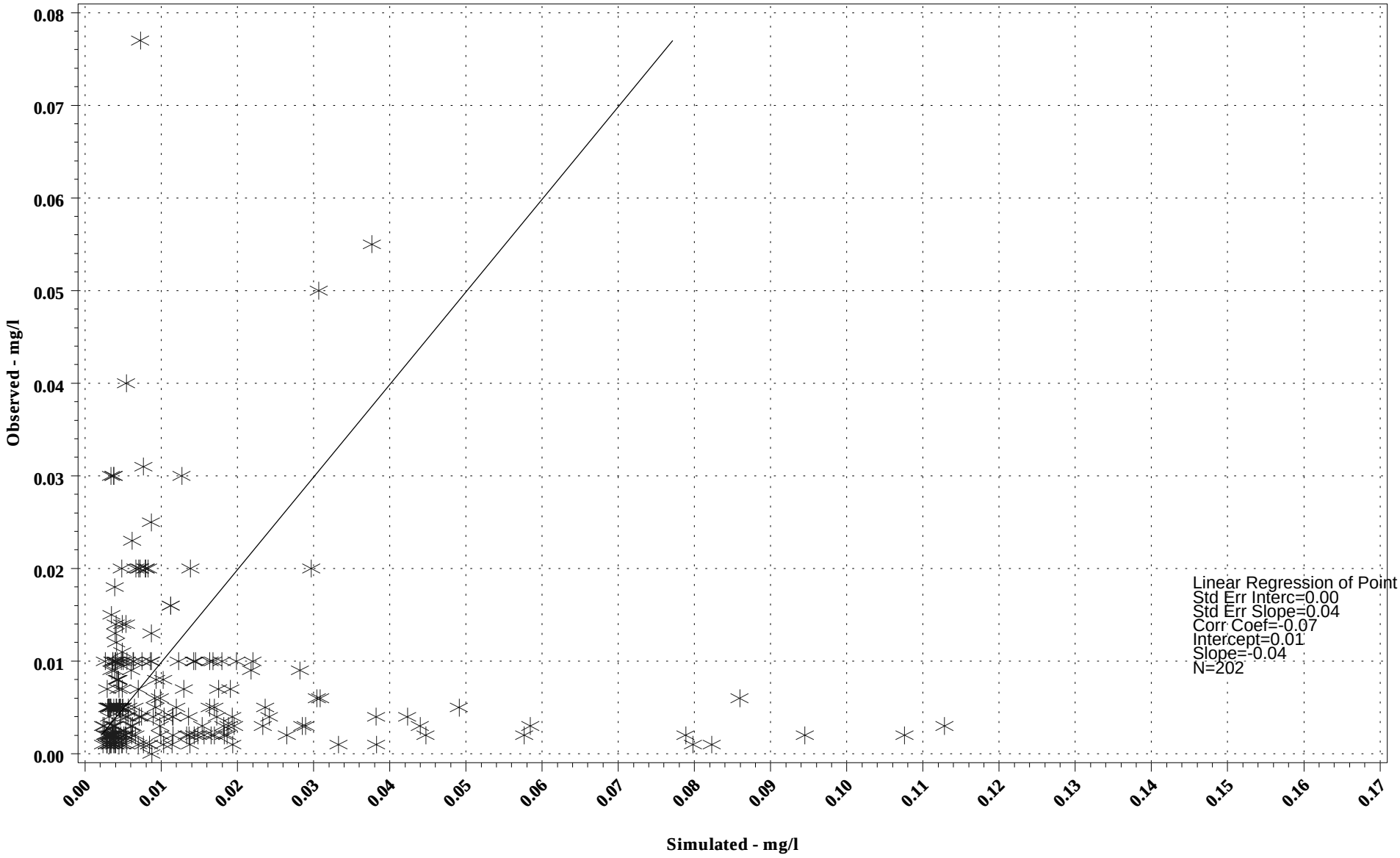
**(line = simulated, O = observed)**




(y21_plotb.sas model3d:[pwang.dt] lldflas)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

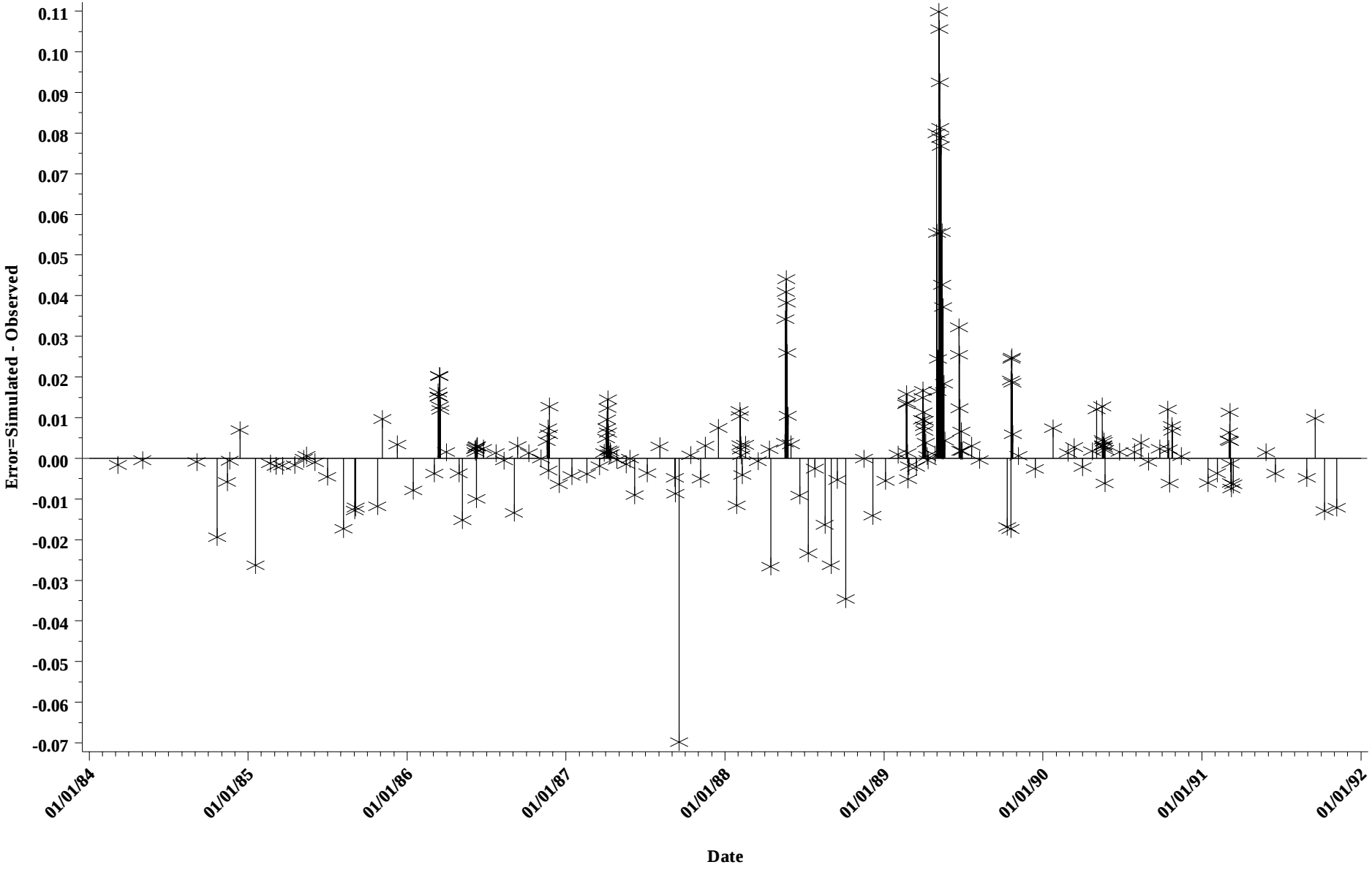
# West Branch Susquehanna at Segment 70

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Dissolved Phosphorus: 01JAN84 - 01JAN92



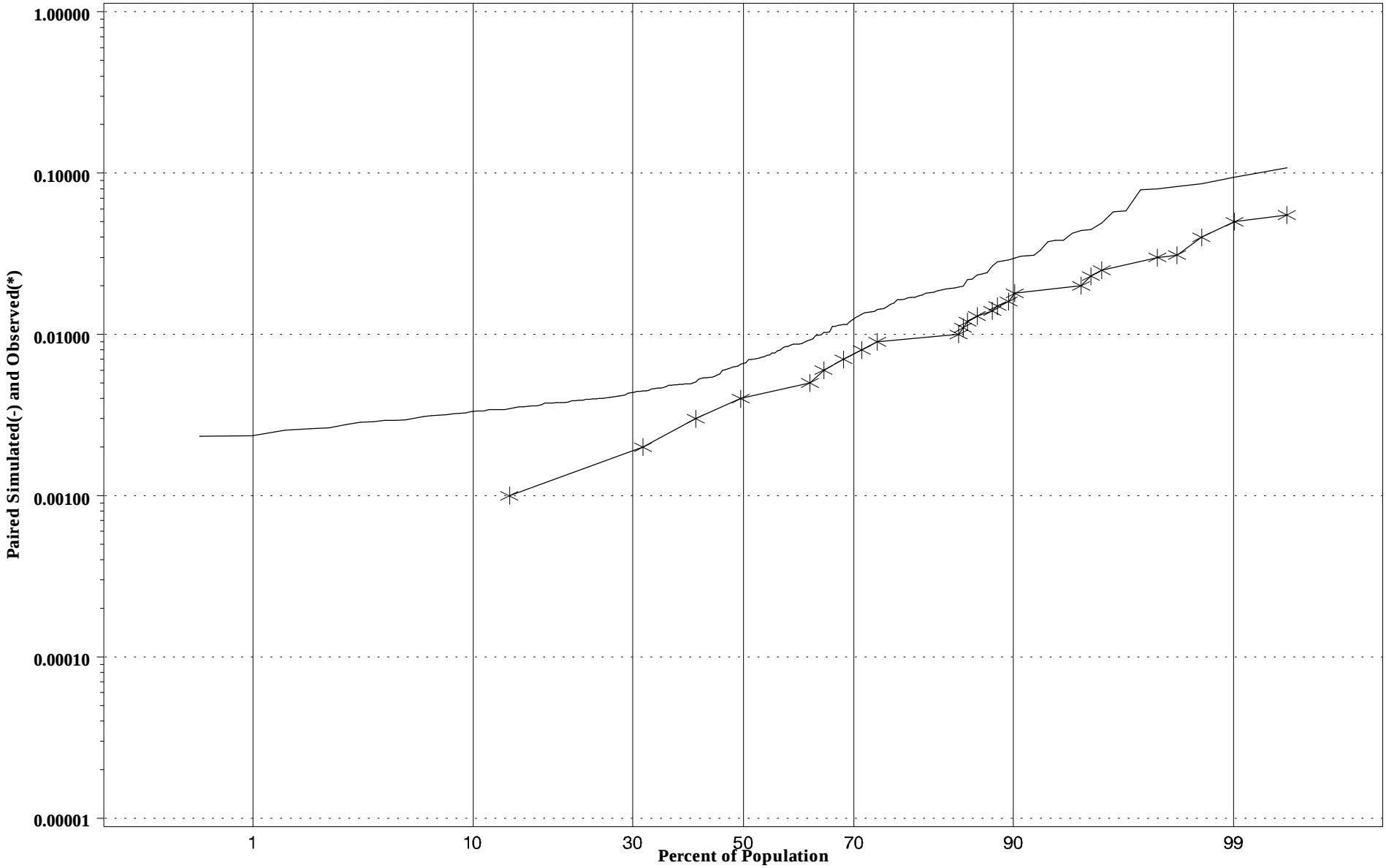

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(wbsus_d.drv1 26JUN98 08:48)

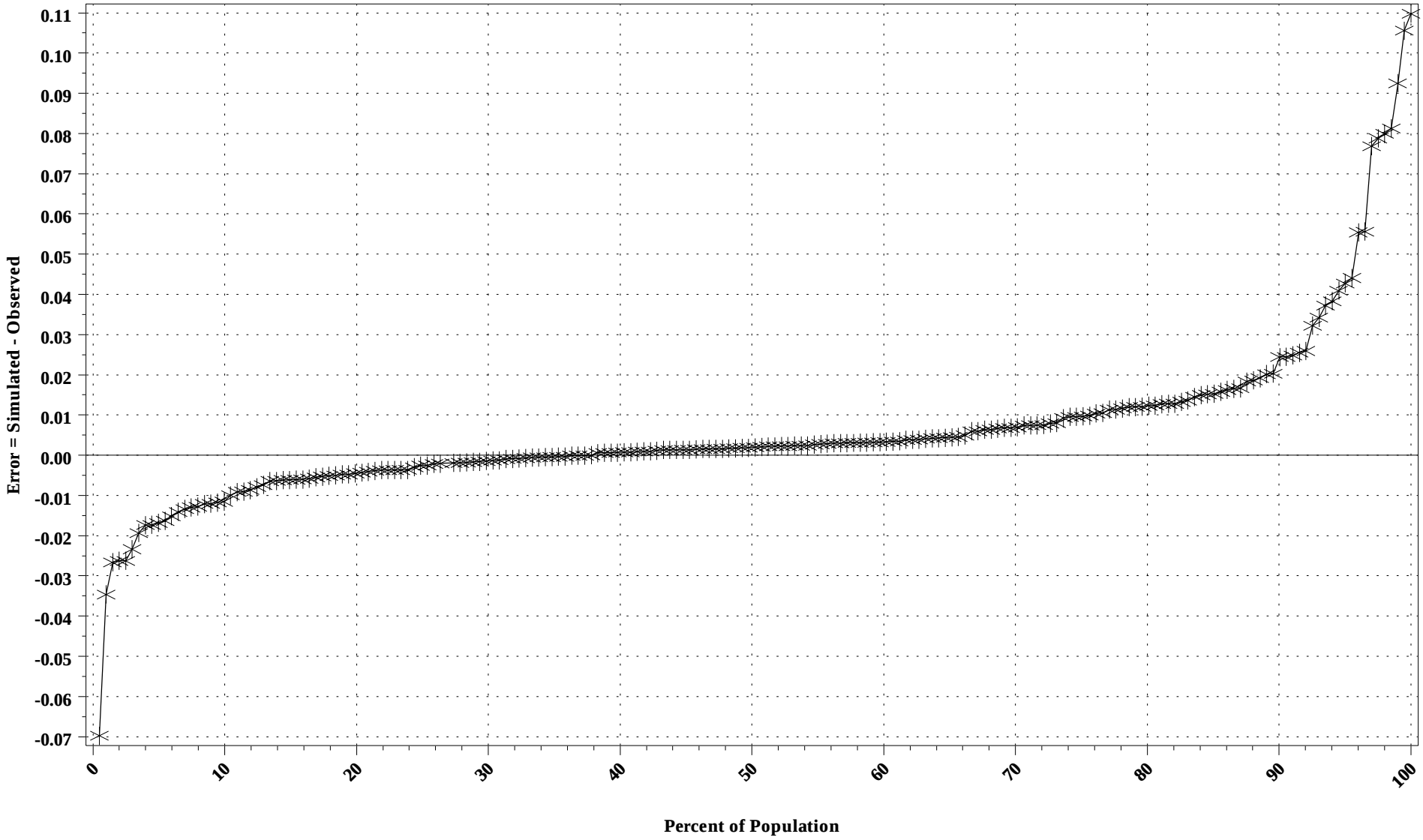
# West Branch Susquehanna at Segment 70
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(wbsus_d.drv1 26JUN98 08:48)

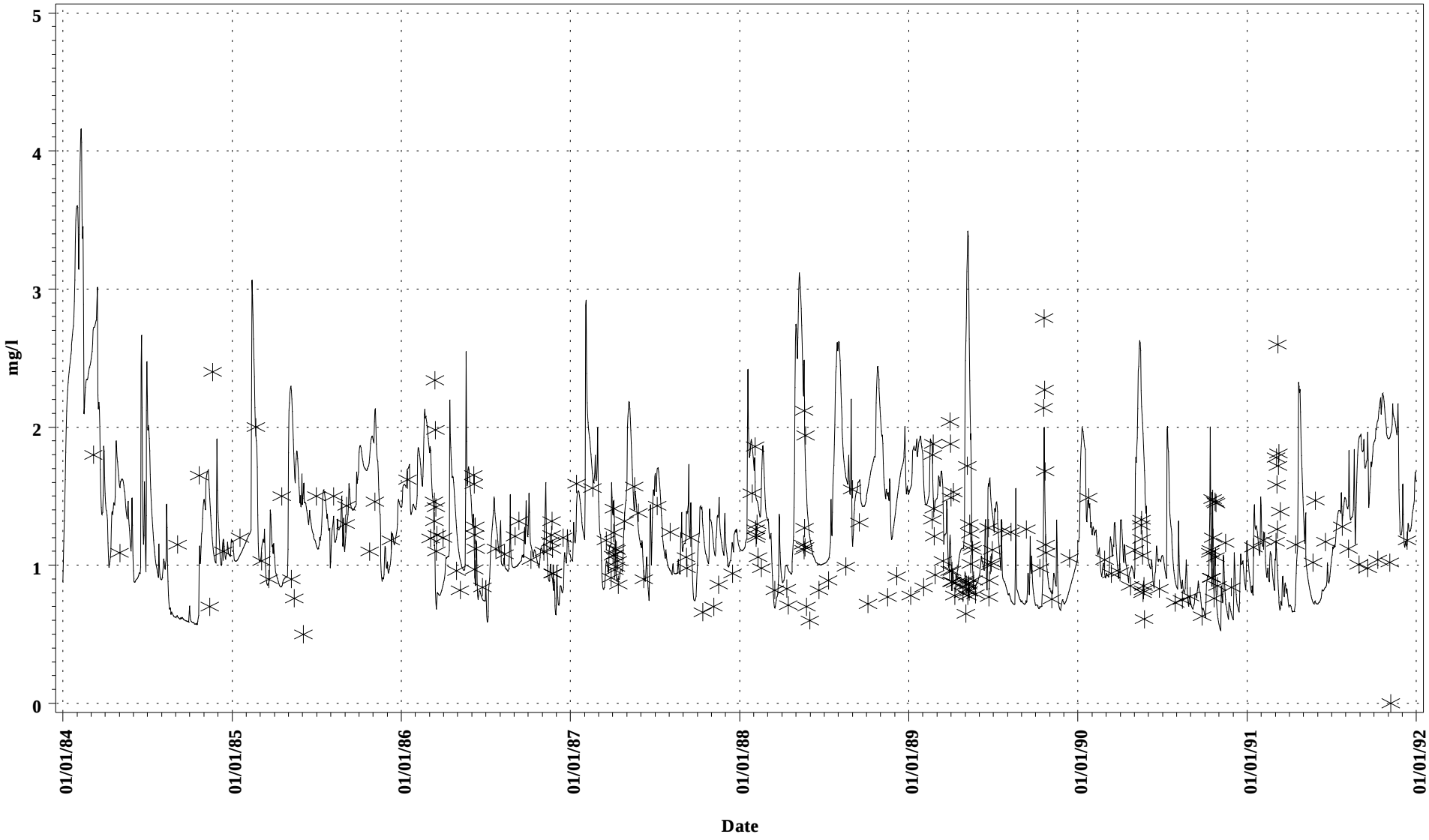
# West Branch Susquehanna at Segment 70
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

### Frequency Distribution - All Simulated and Observed Data



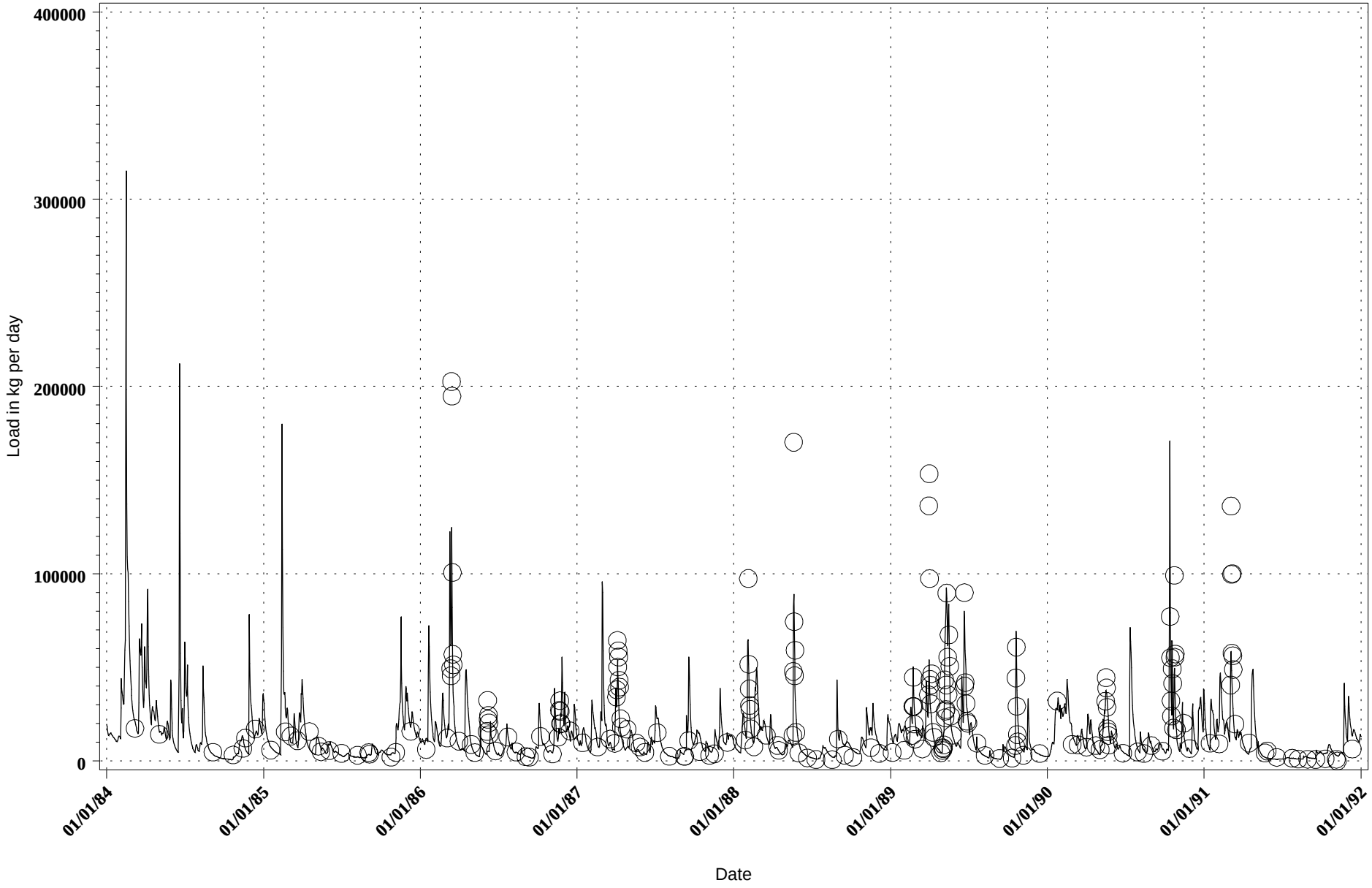

(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Observed and Simulated versus Time
# Total Nitrogen
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

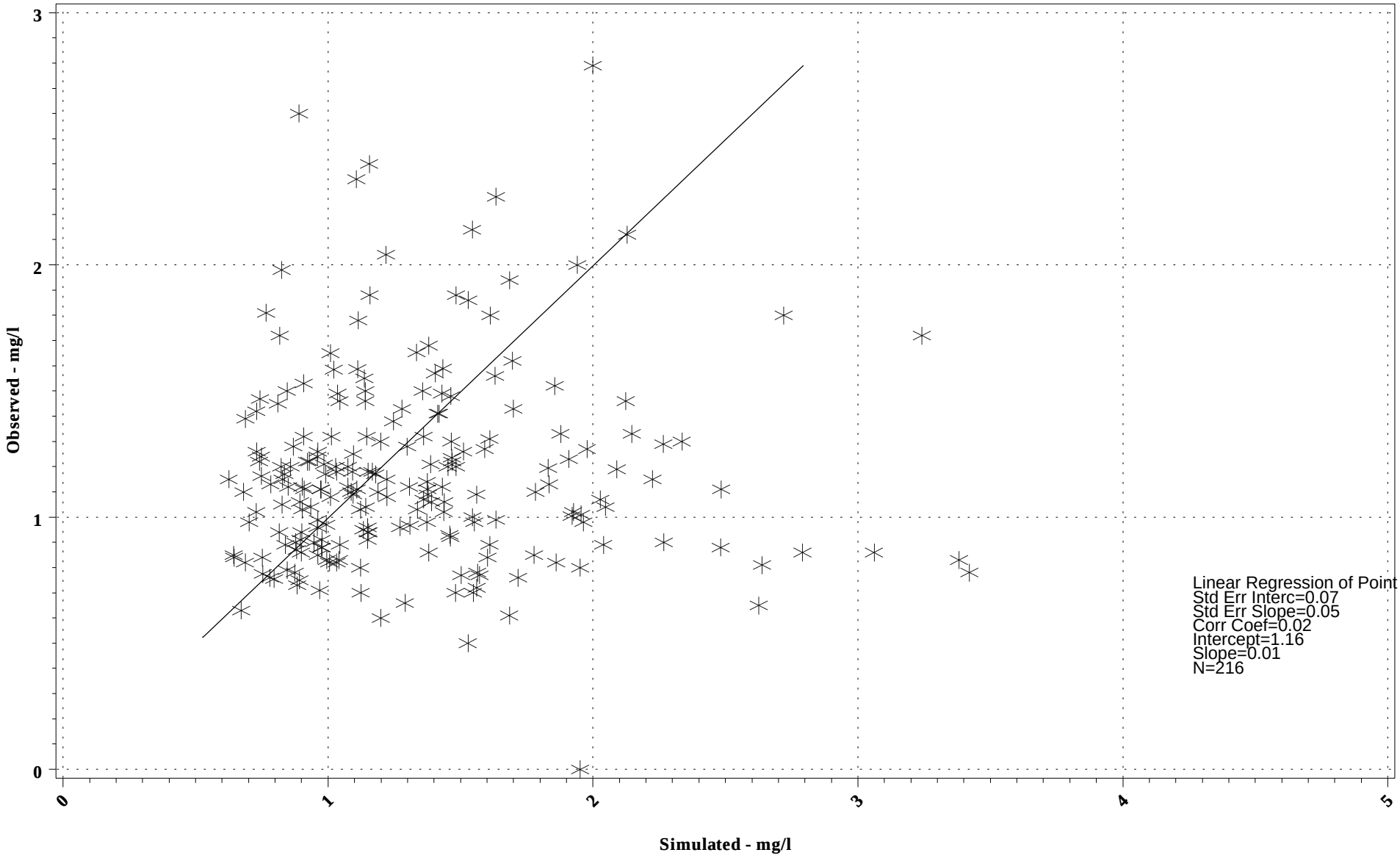



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70

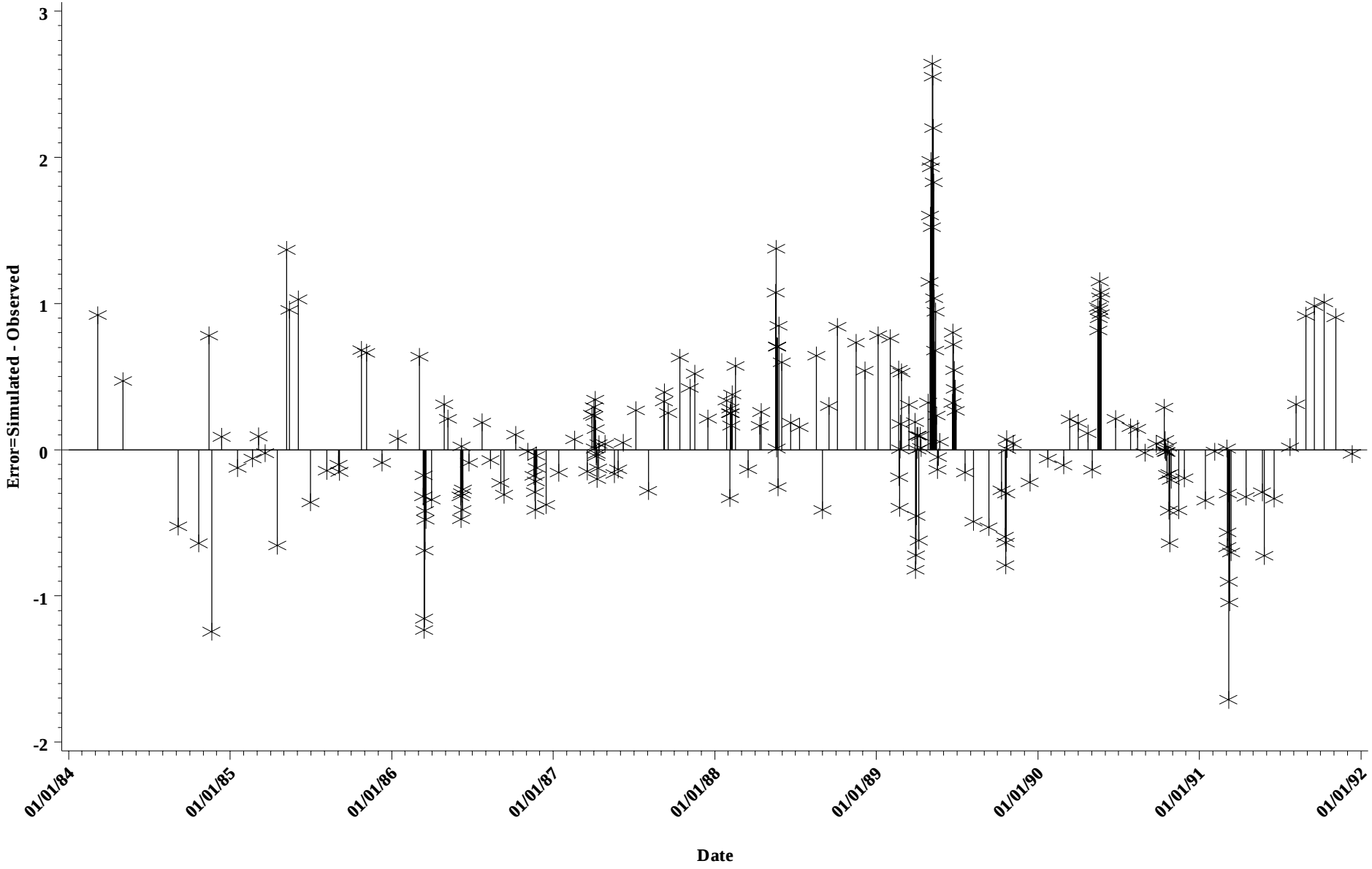
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92



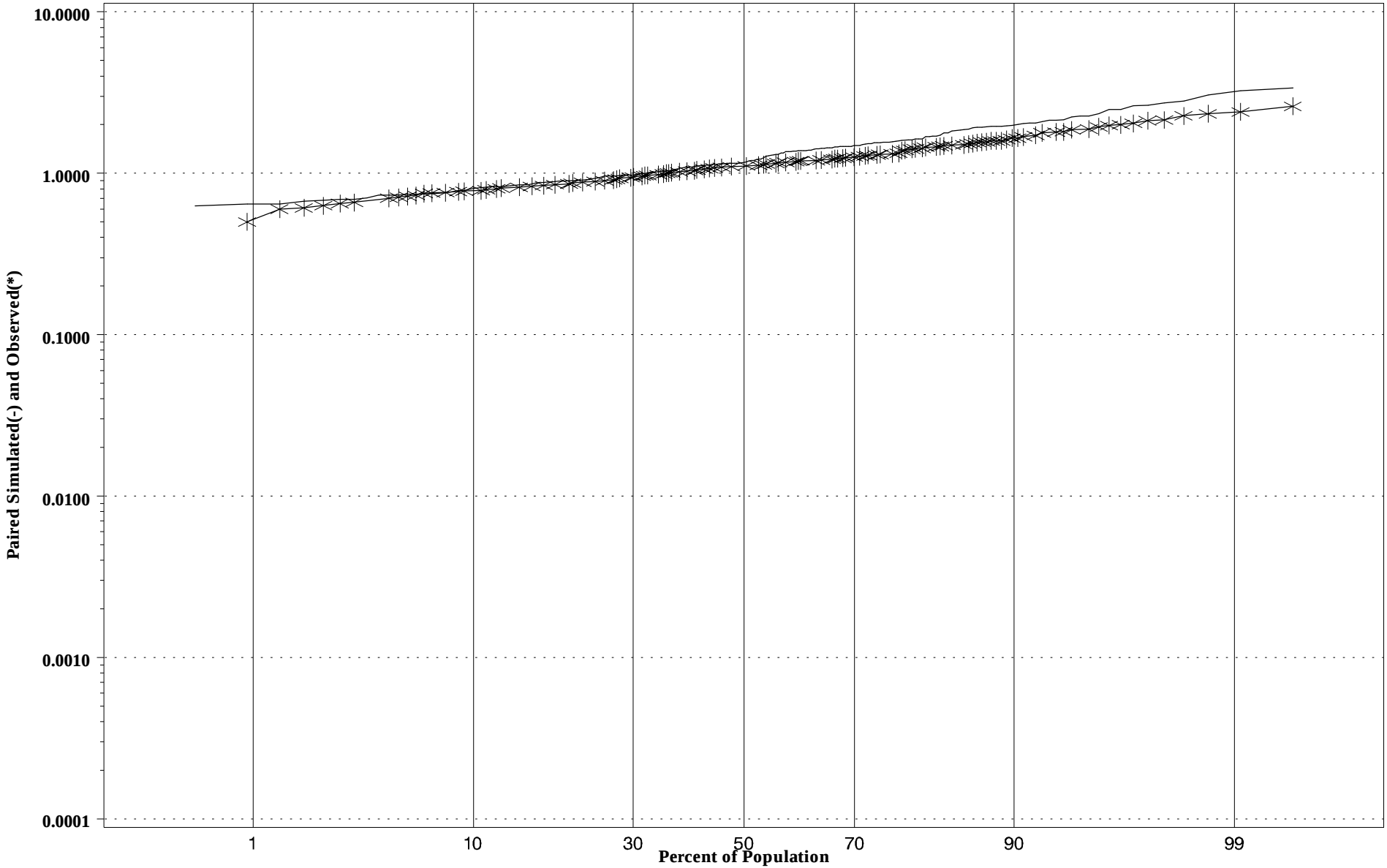

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70
## Actual Error versus Time
## Total Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(wbsus_d.drv1 26JUN98 08:48)

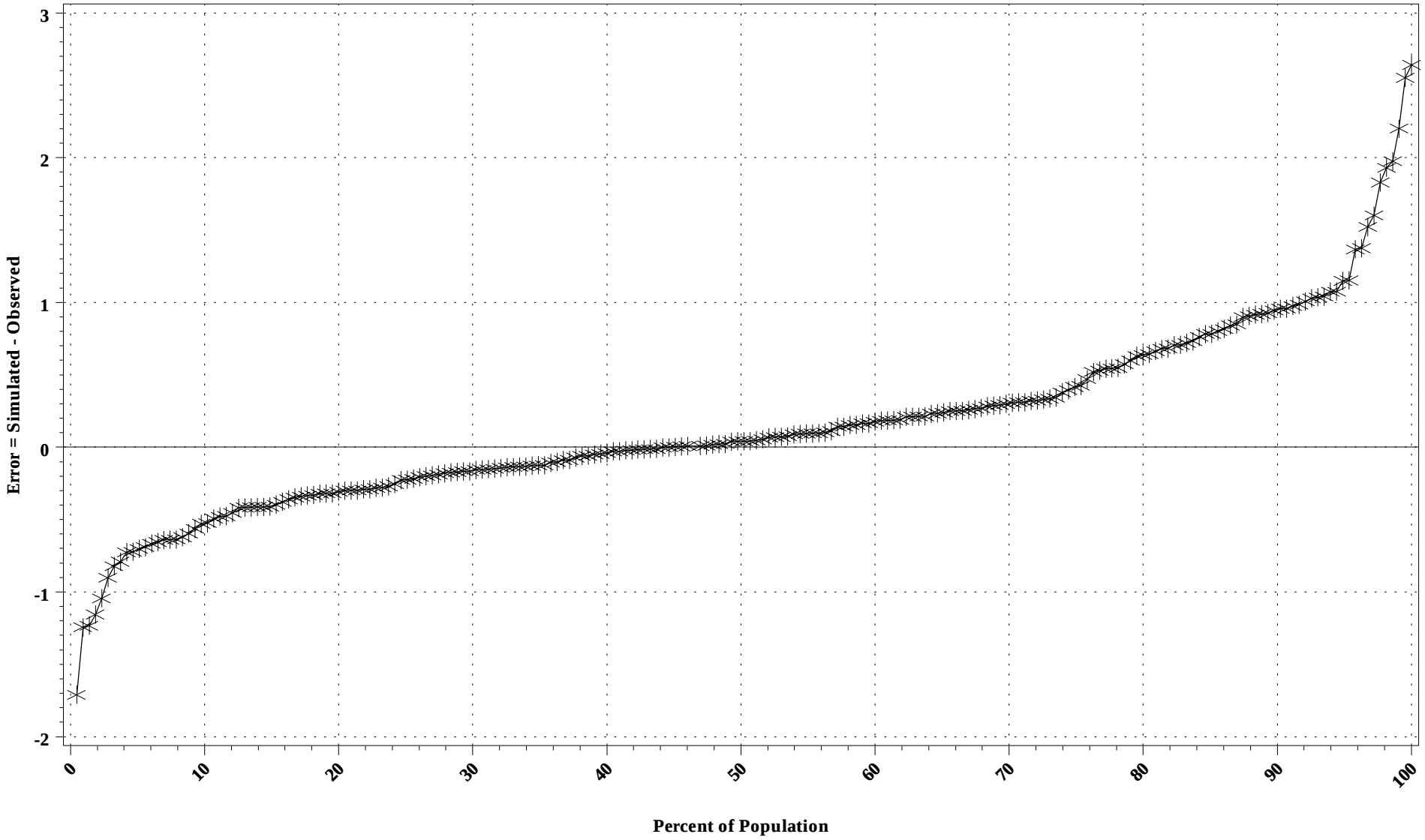
# West Branch Susquehanna at Segment 70
## Total Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Actual error versus Percentile Sample Population
## Total Nitrogen

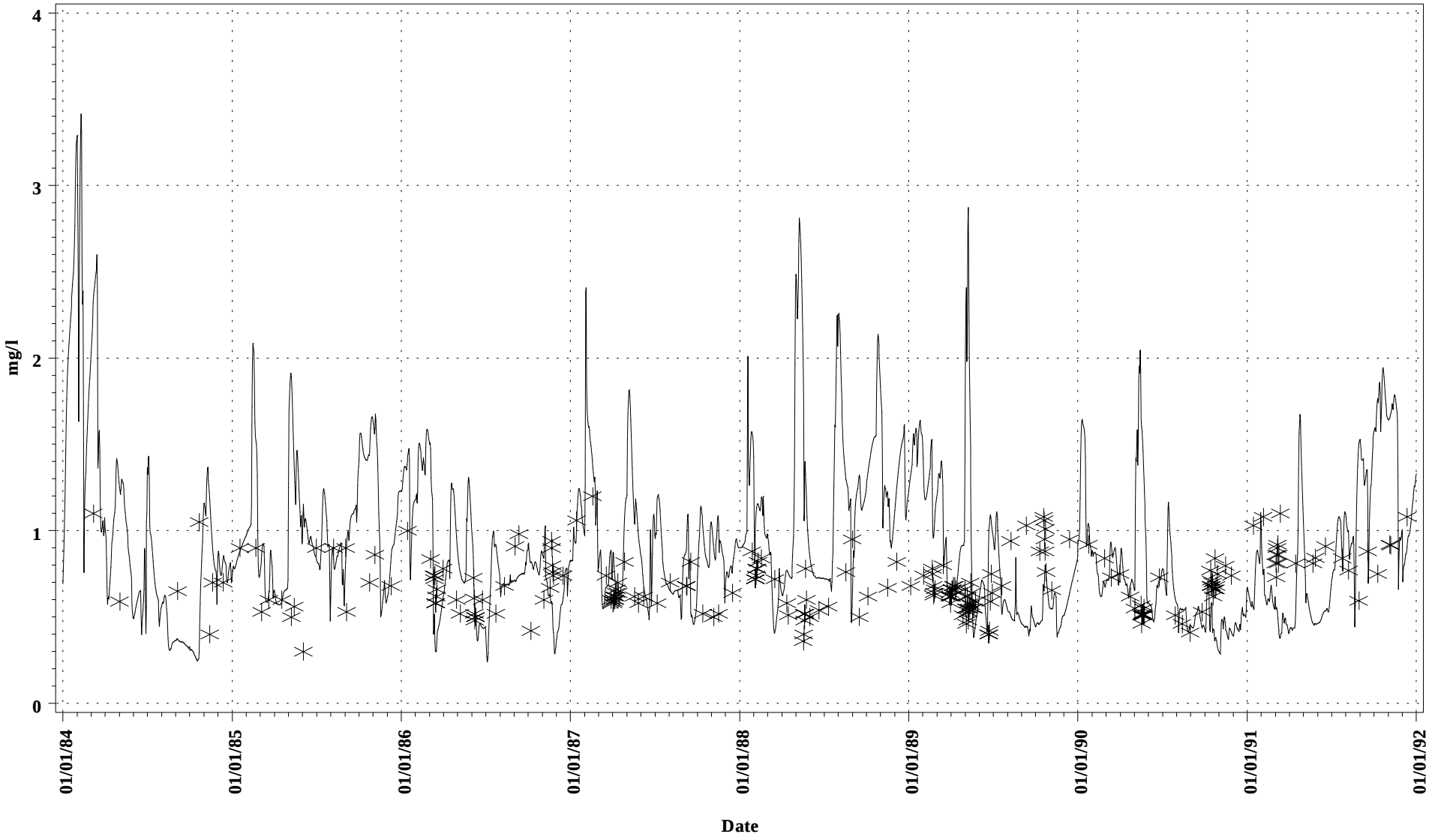
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

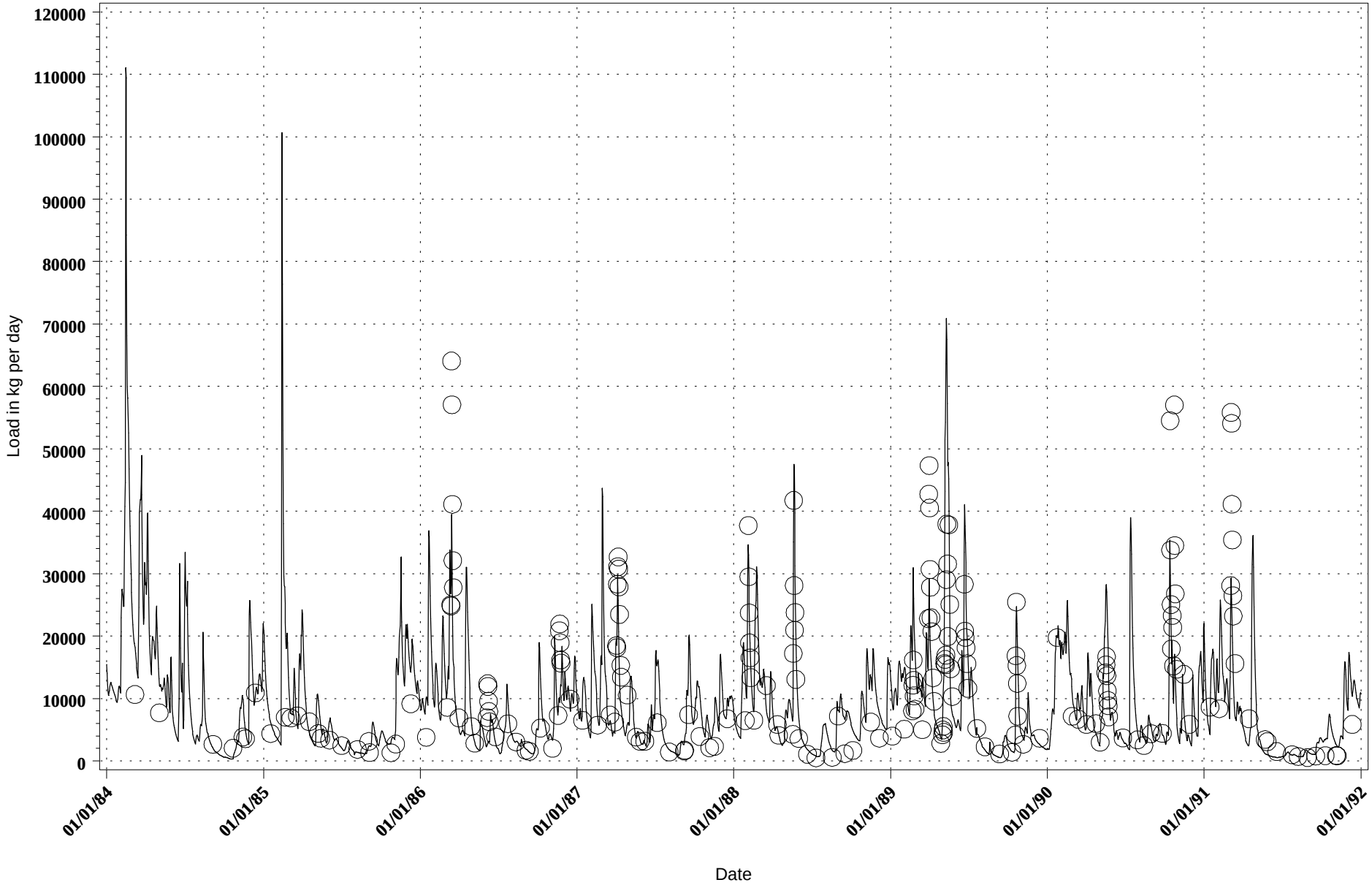



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70

## NO3 Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

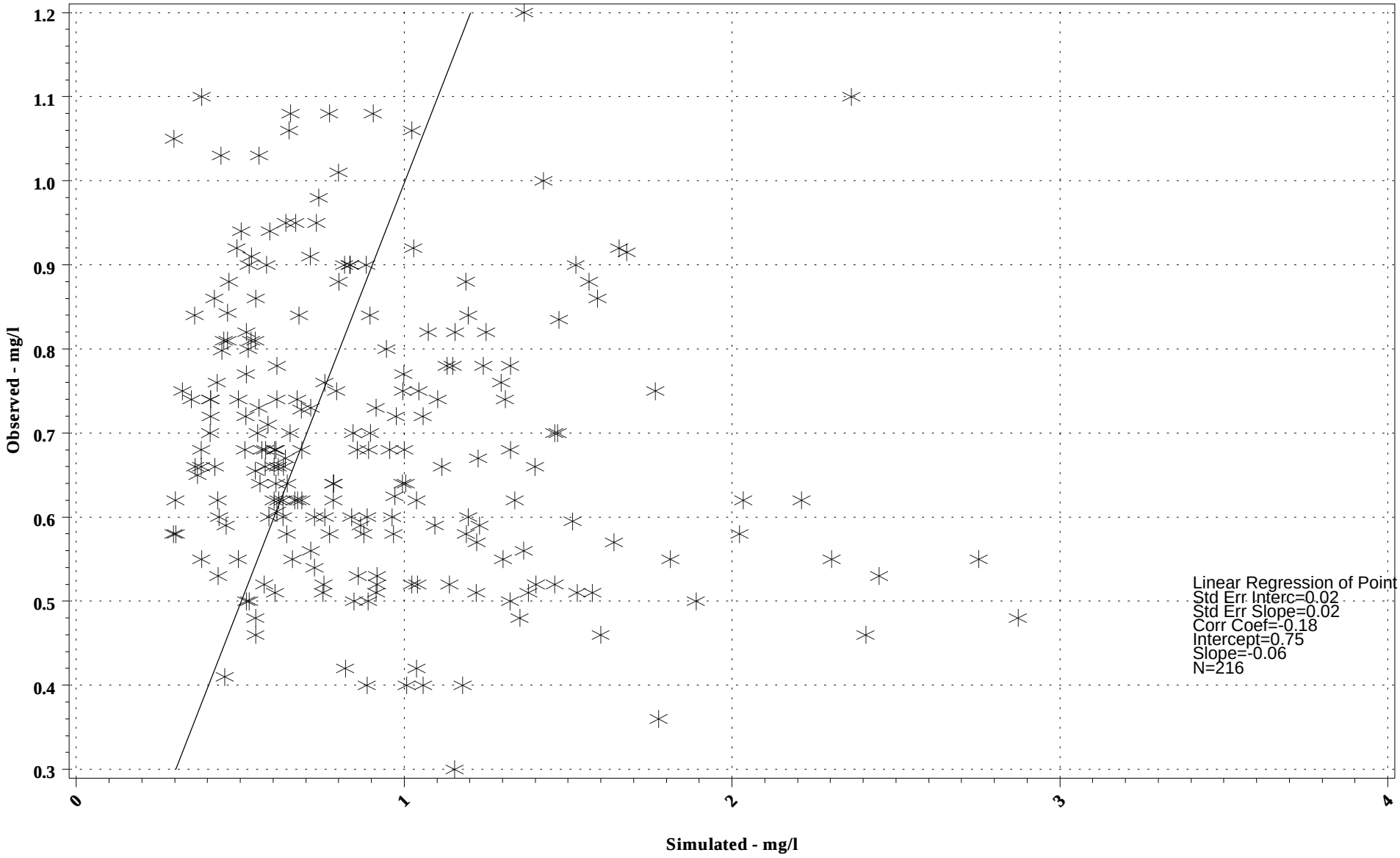



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70

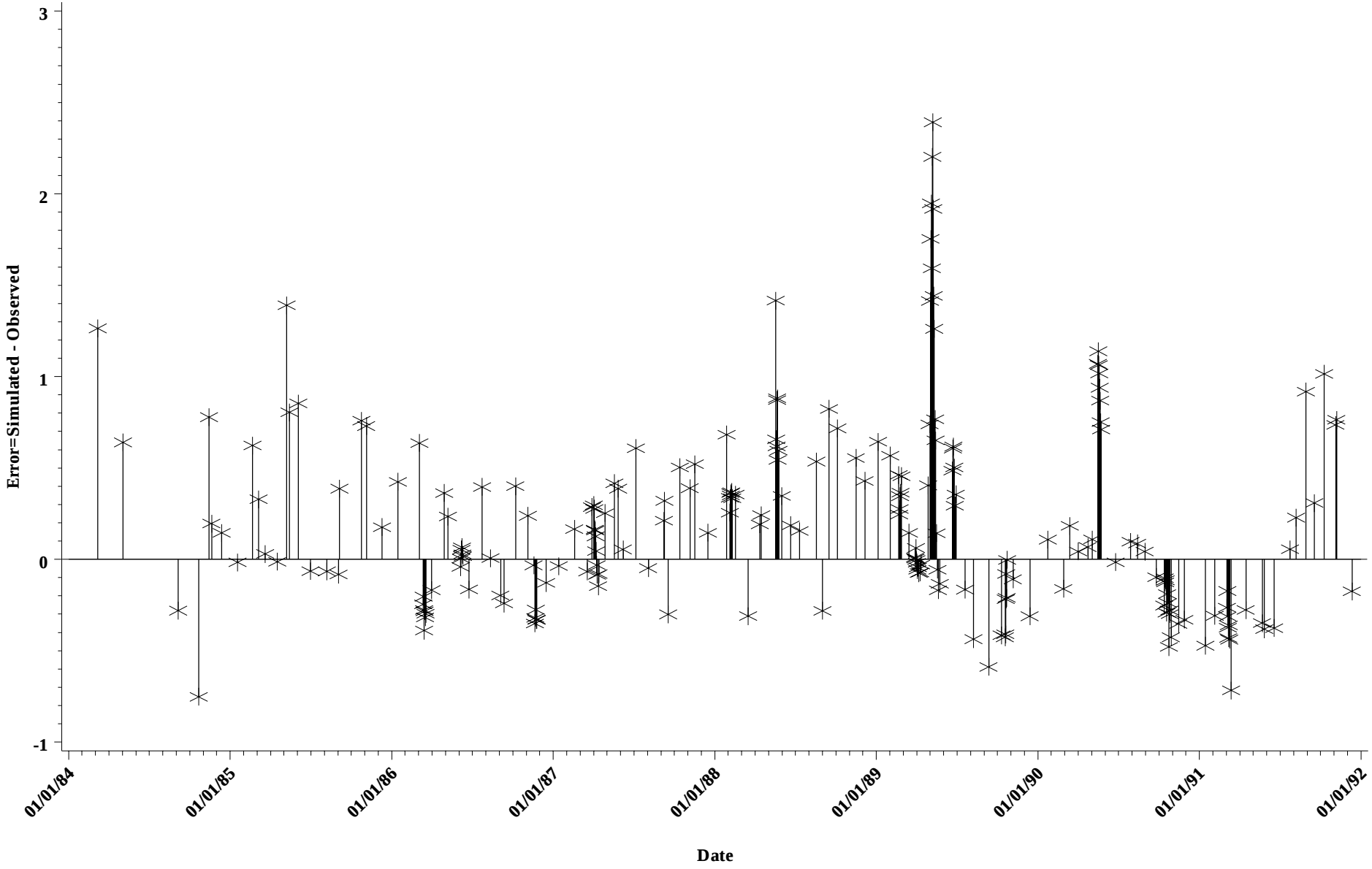
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70
## Actual Error versus Time
## NO3

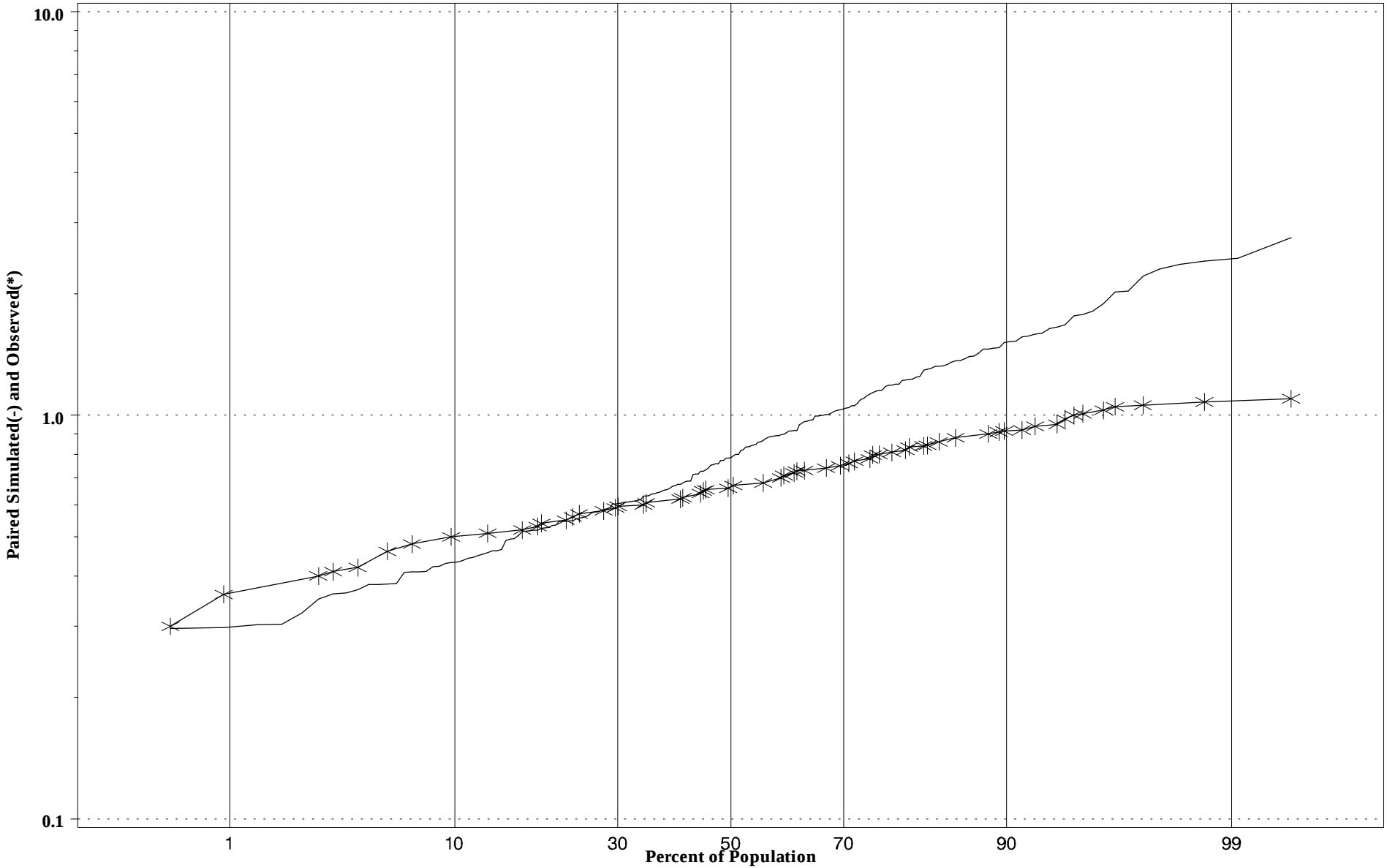



(y21_plotb.sas model3d:[pwang.dt] omerr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70

## NO3

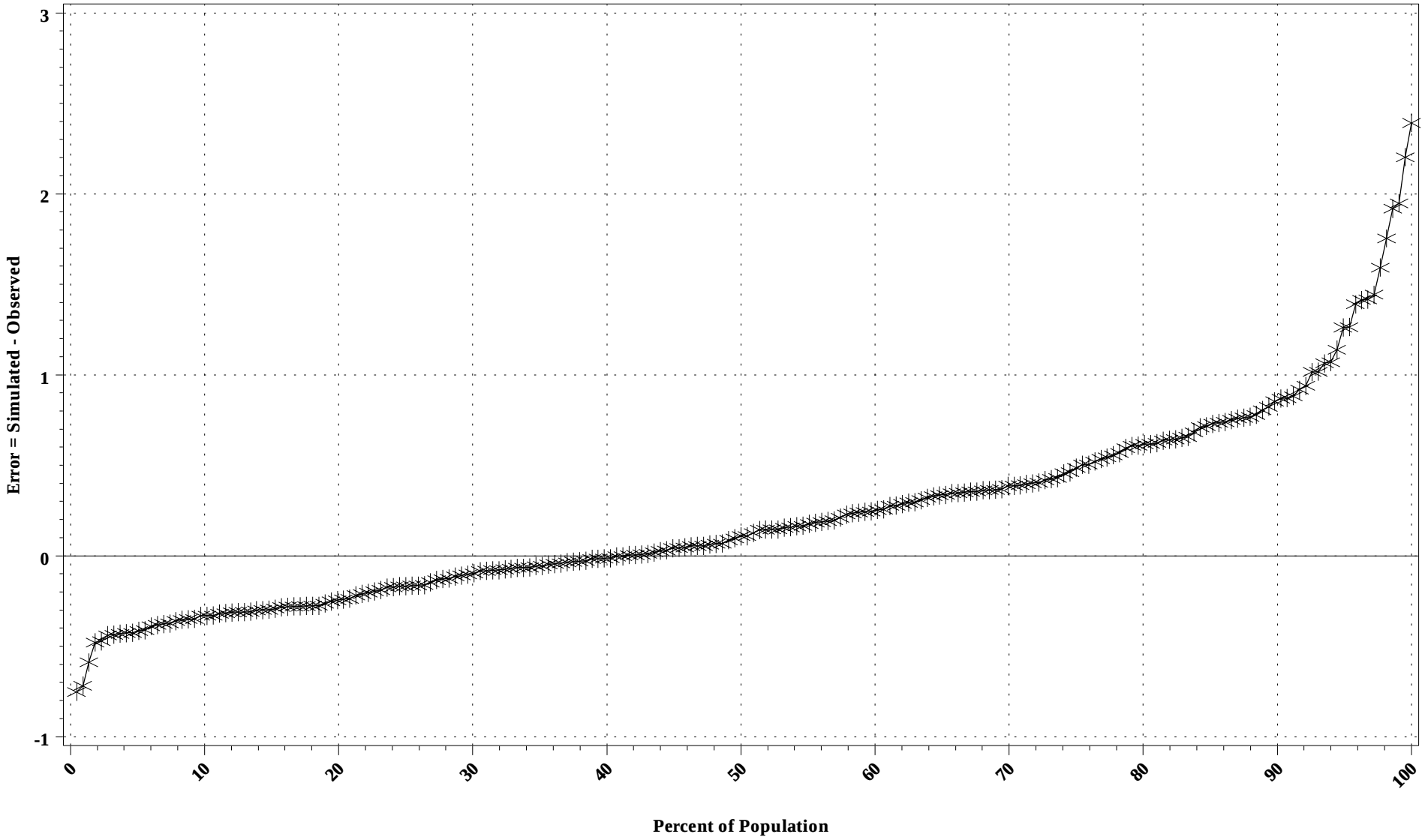
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Actual error versus Percentile Sample Population
## NO3

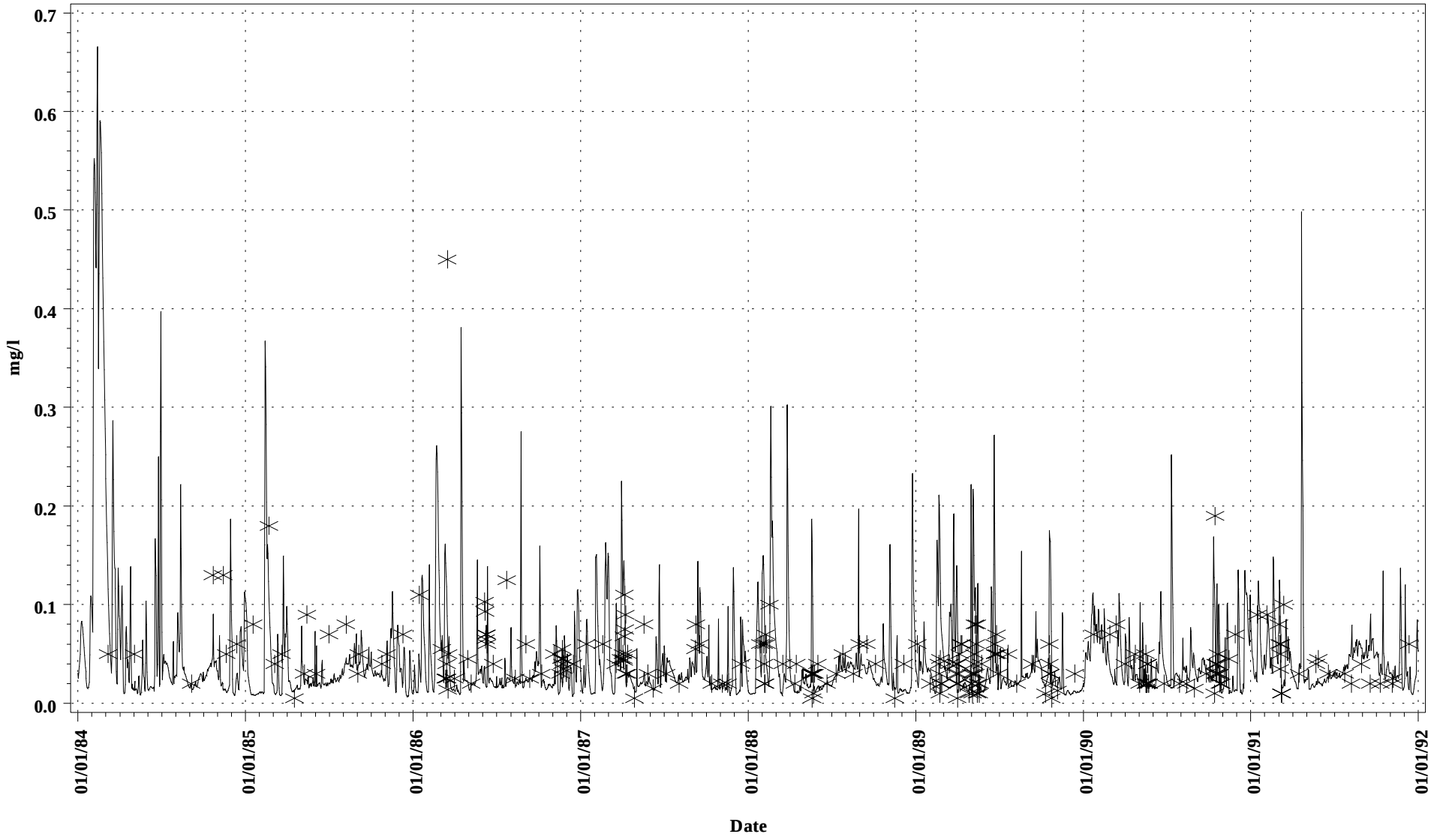
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**

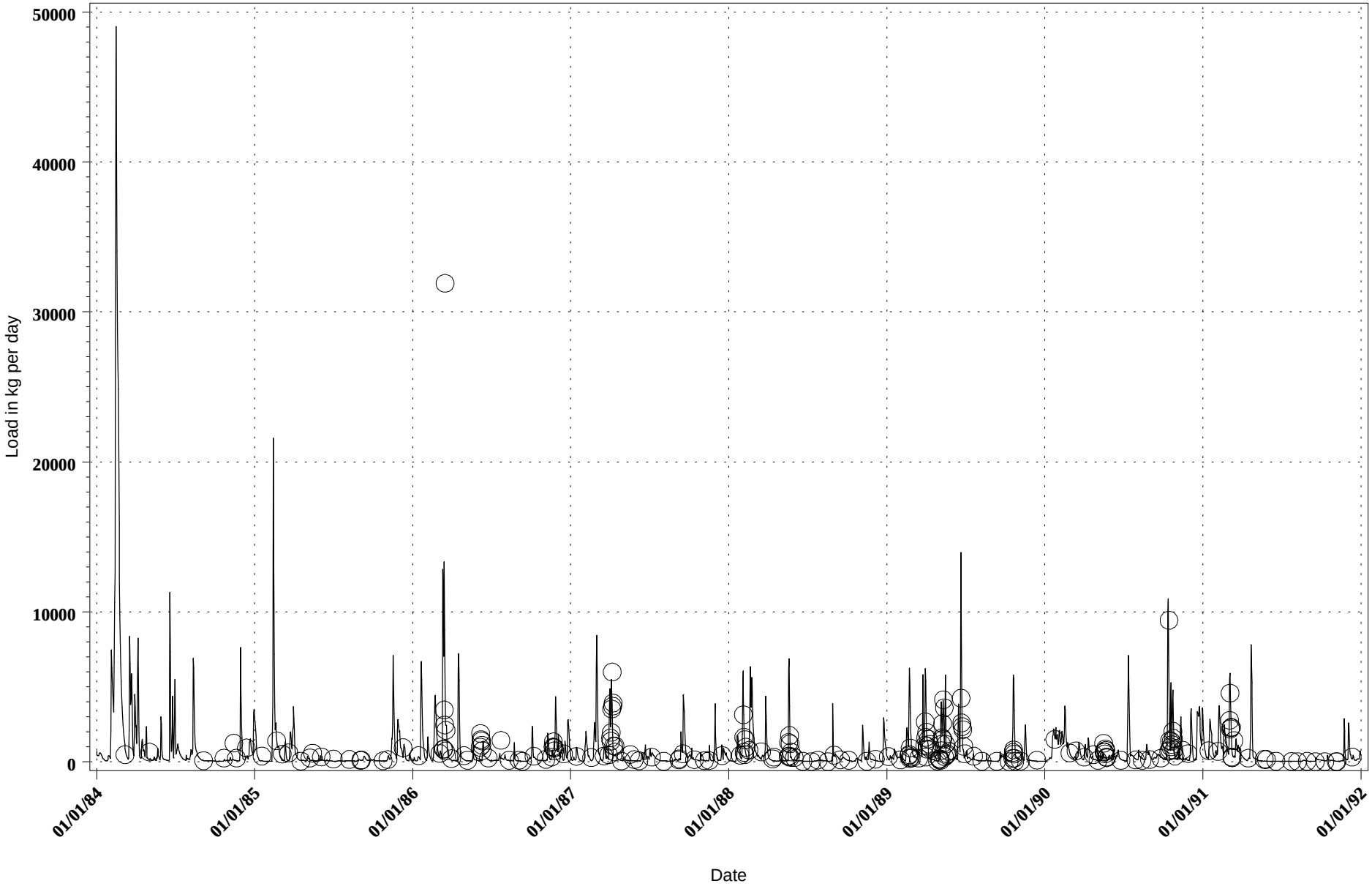



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70

## Total Ammonia Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

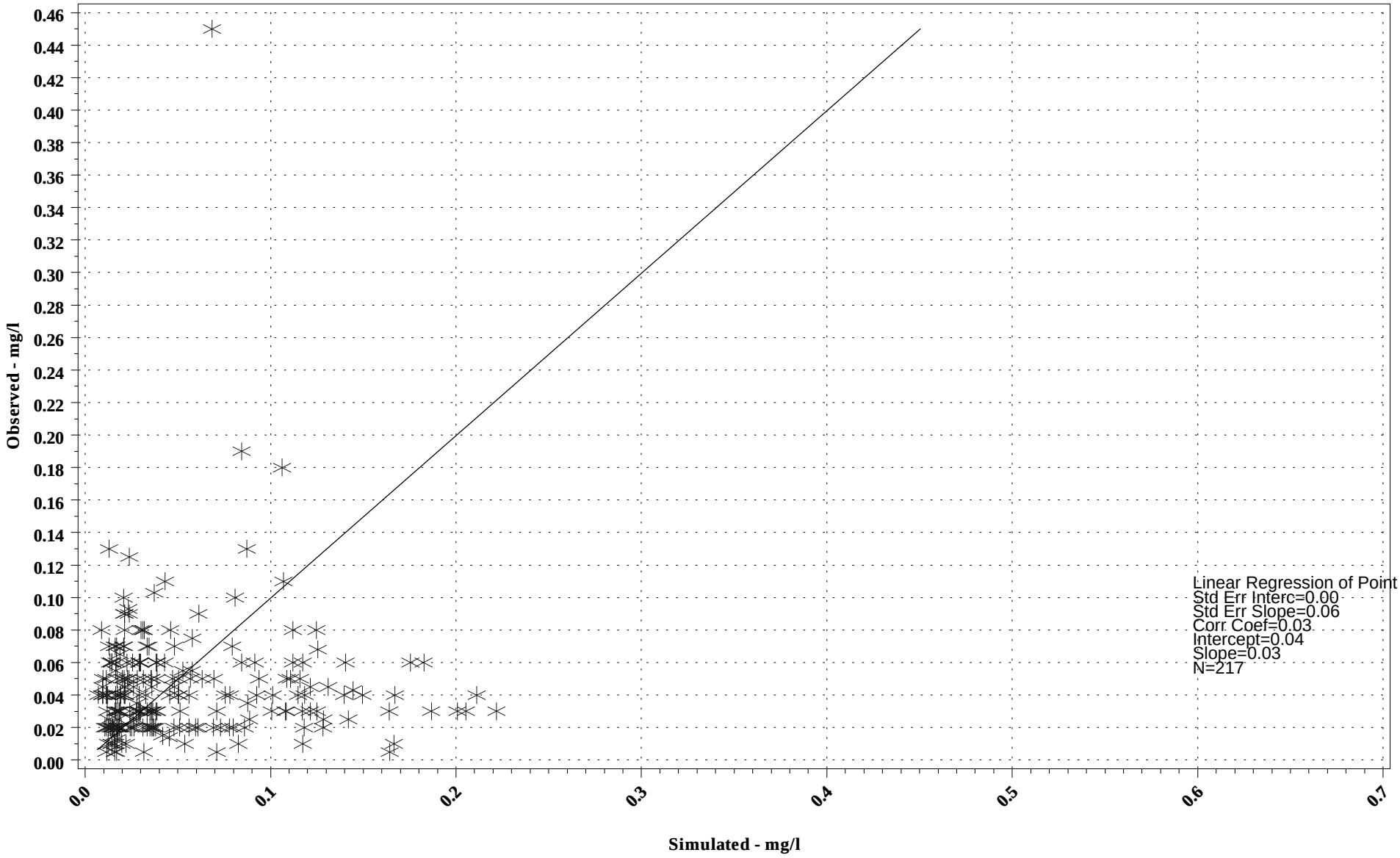



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70

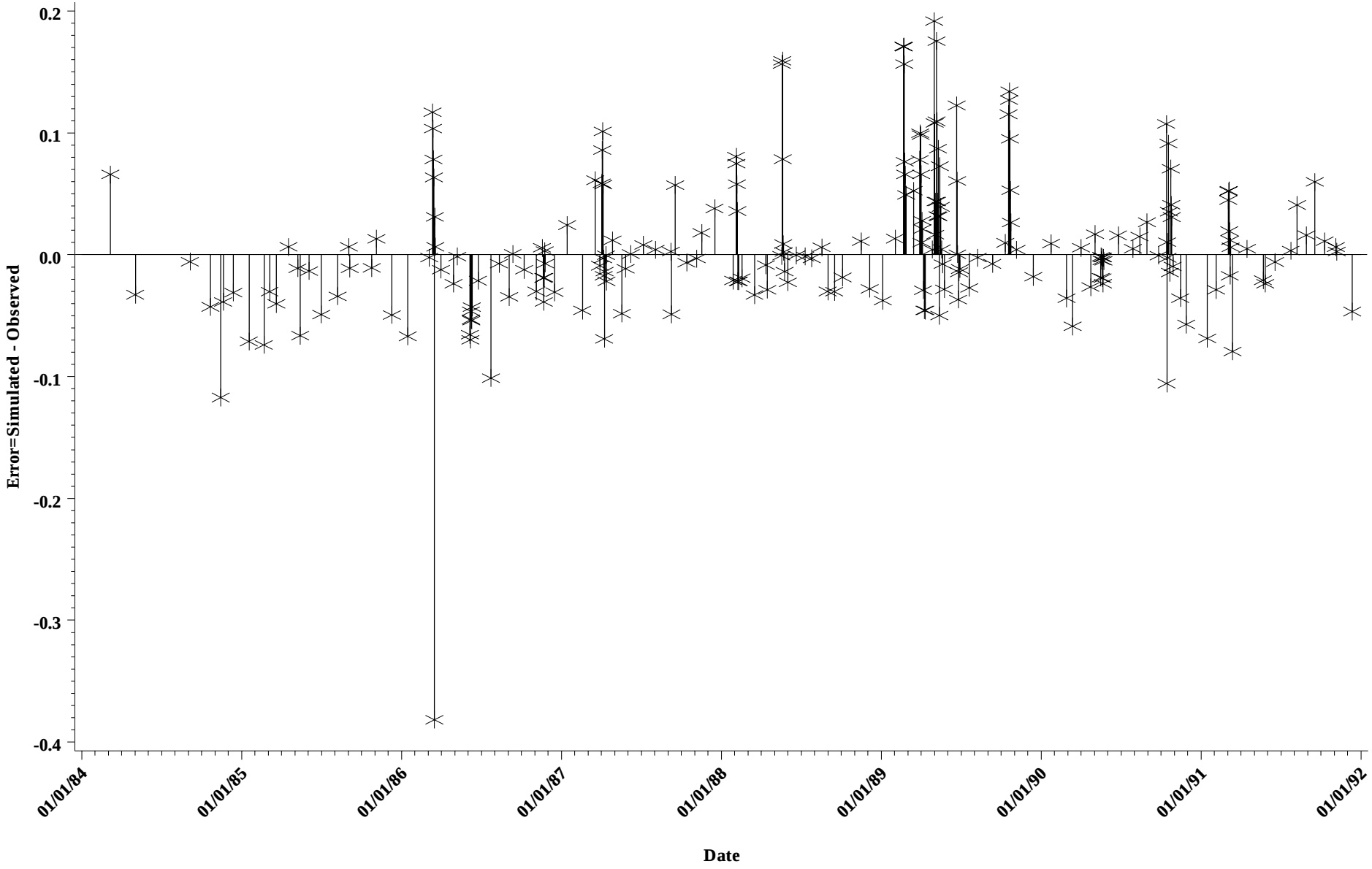
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92



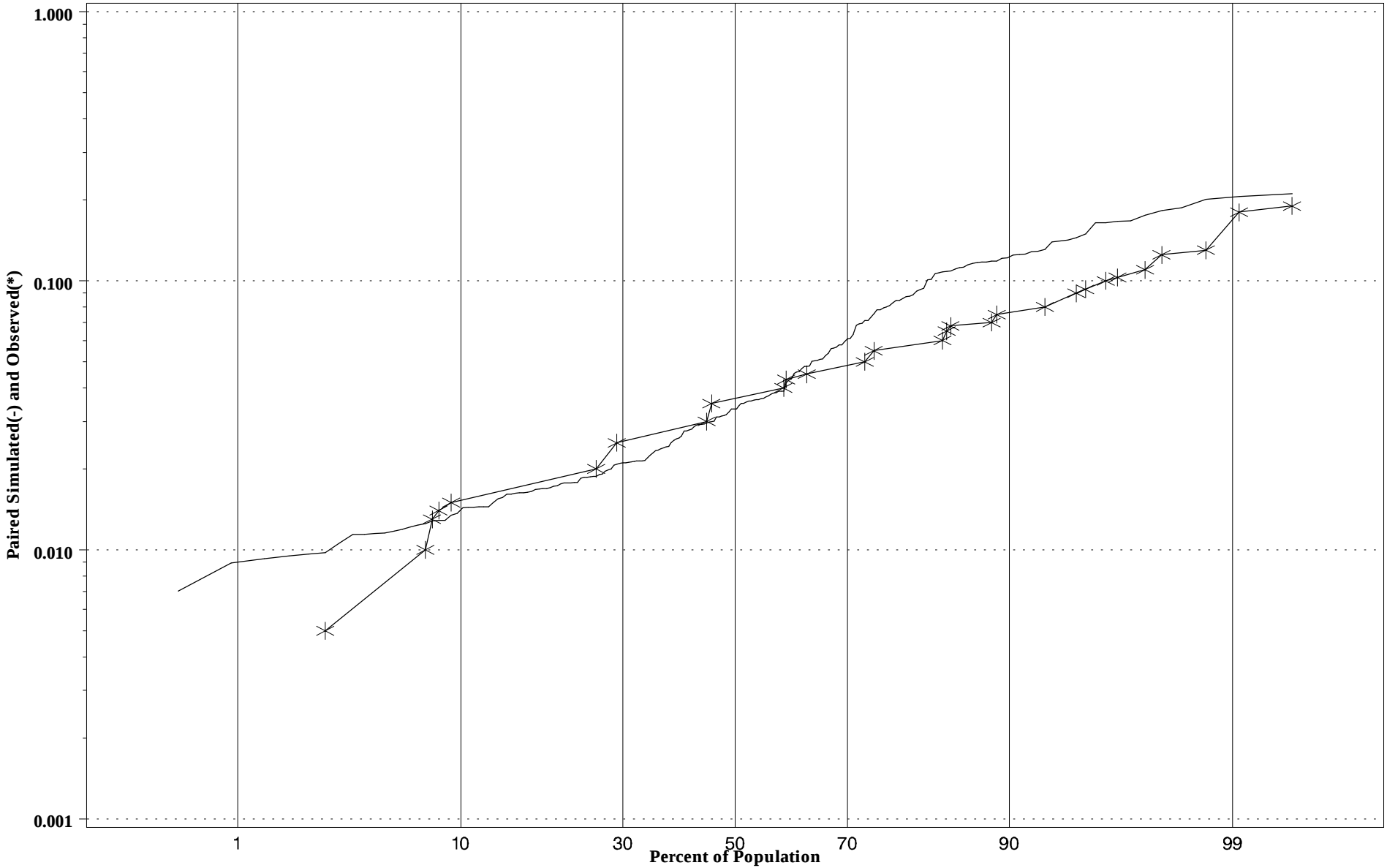

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70
## Actual Error versus Time
## Total Ammonia




(y21_plotb.sas model3d:[pwang.dt] omerr)
(wbsus_d.drv1 26JUN98 08:48)

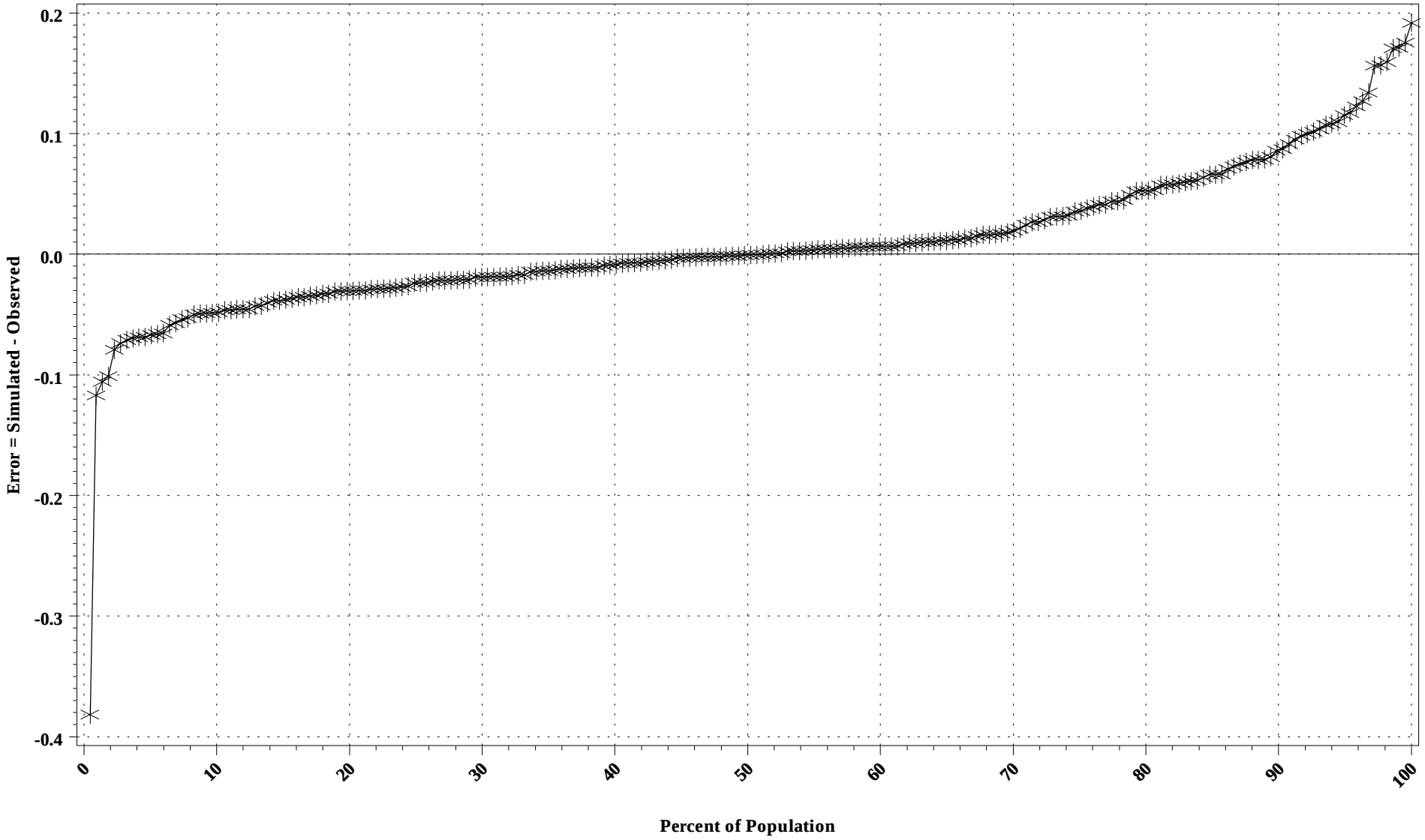
# West Branch Susquehanna at Segment 70
## Total Ammonia
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(wbsus_d.drv1 26JUN98 08:48)

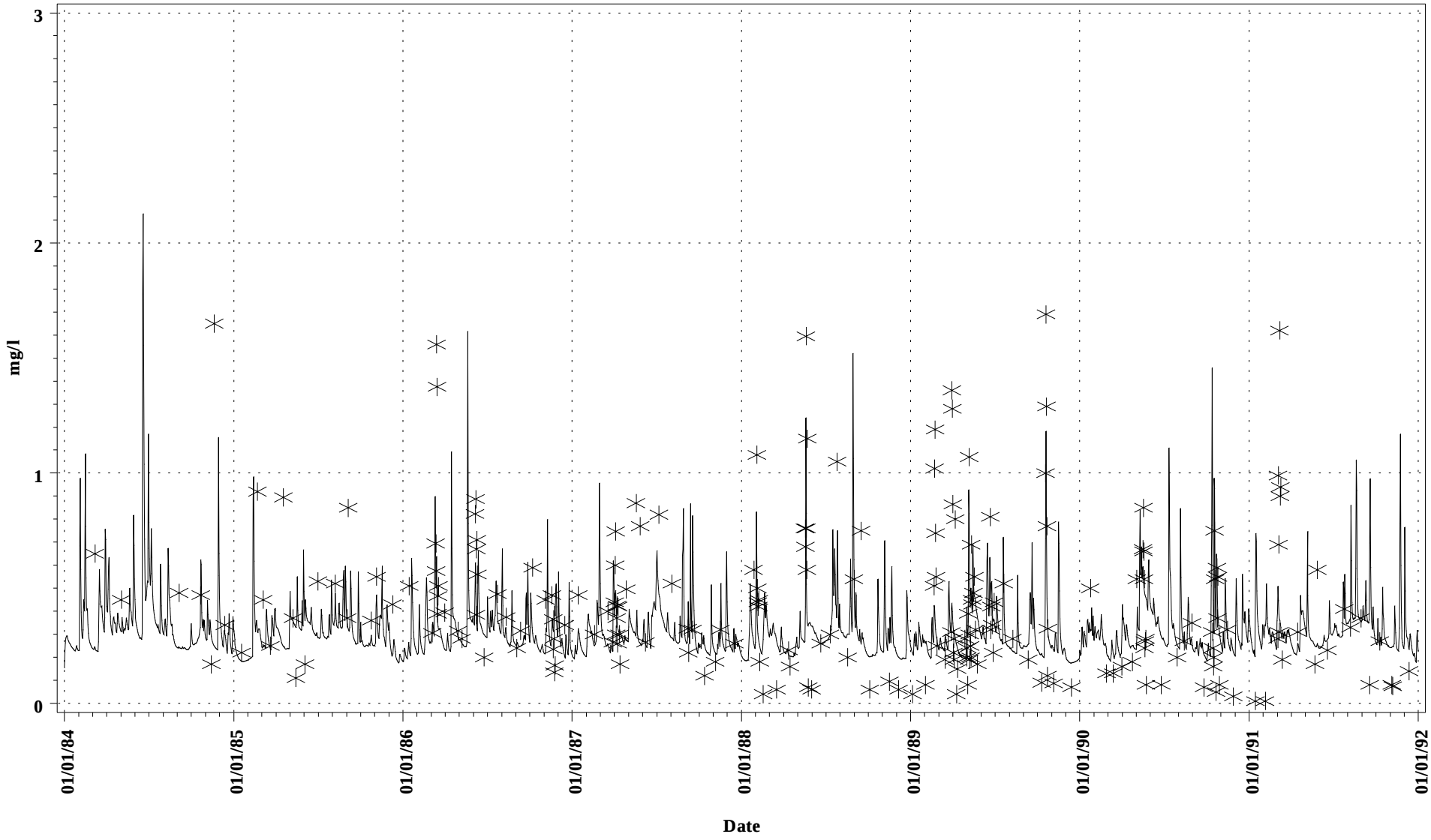
# West Branch Susquehanna at Segment 70
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**

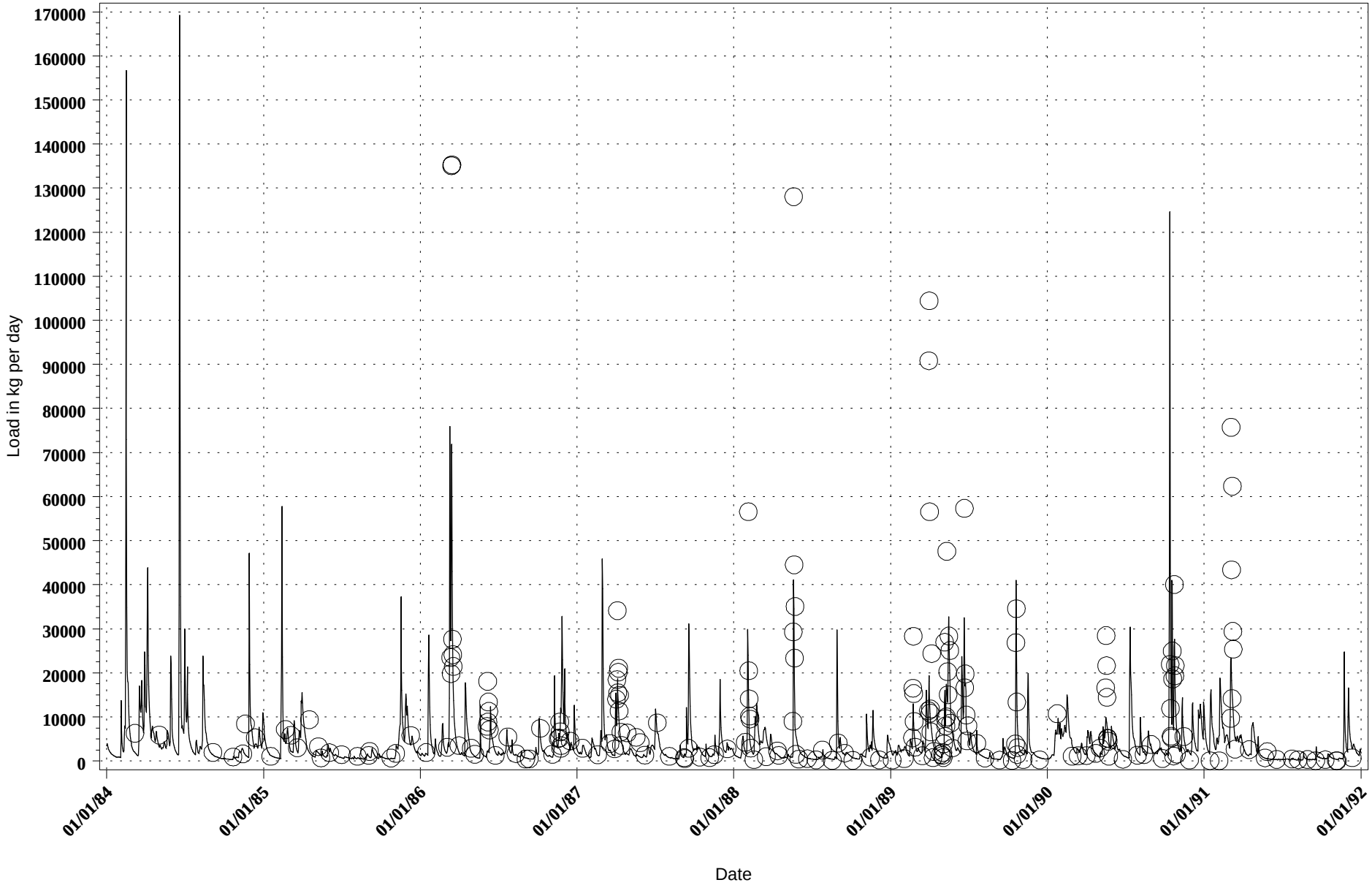



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70

## Organic Nitrogen Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

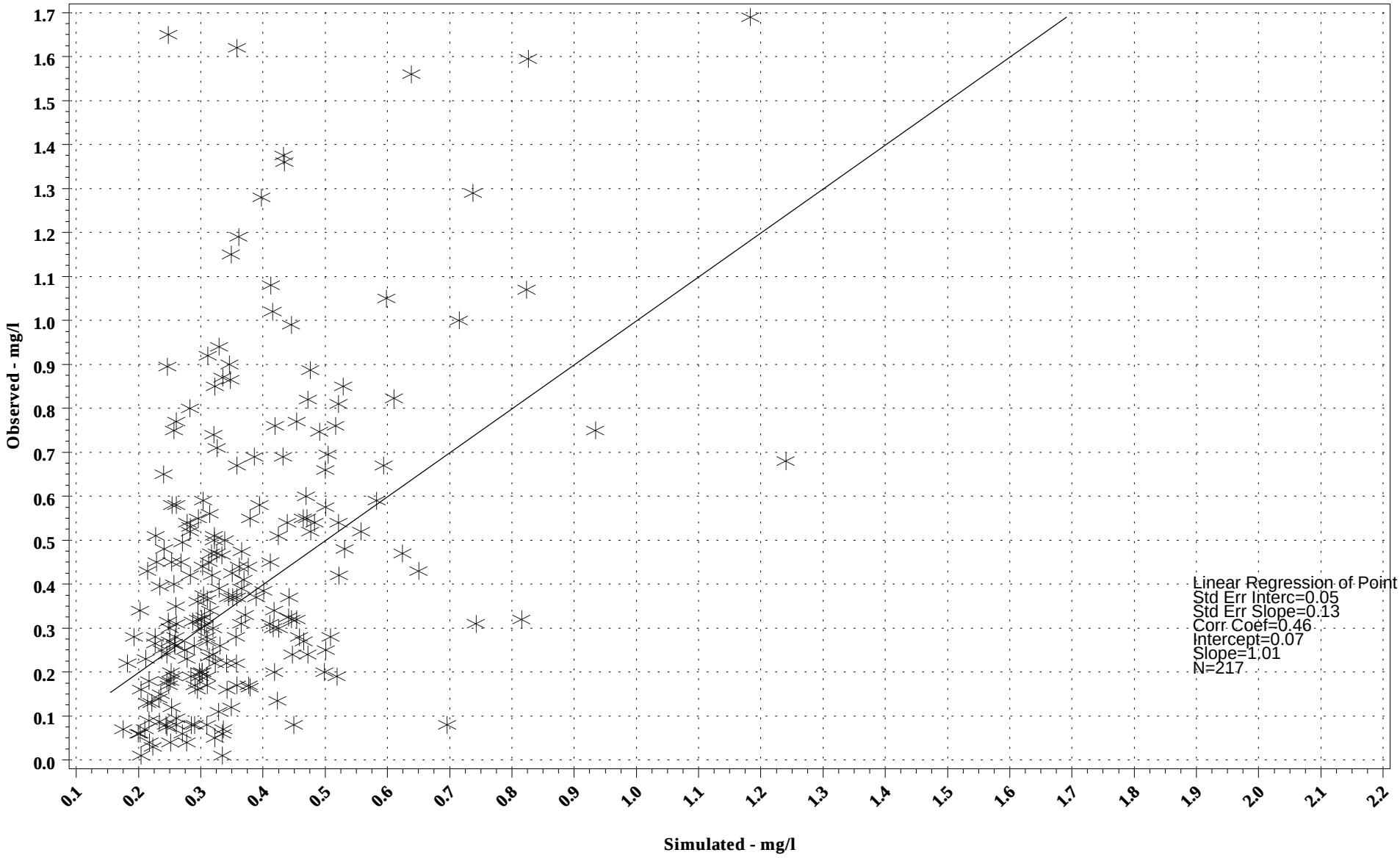



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70

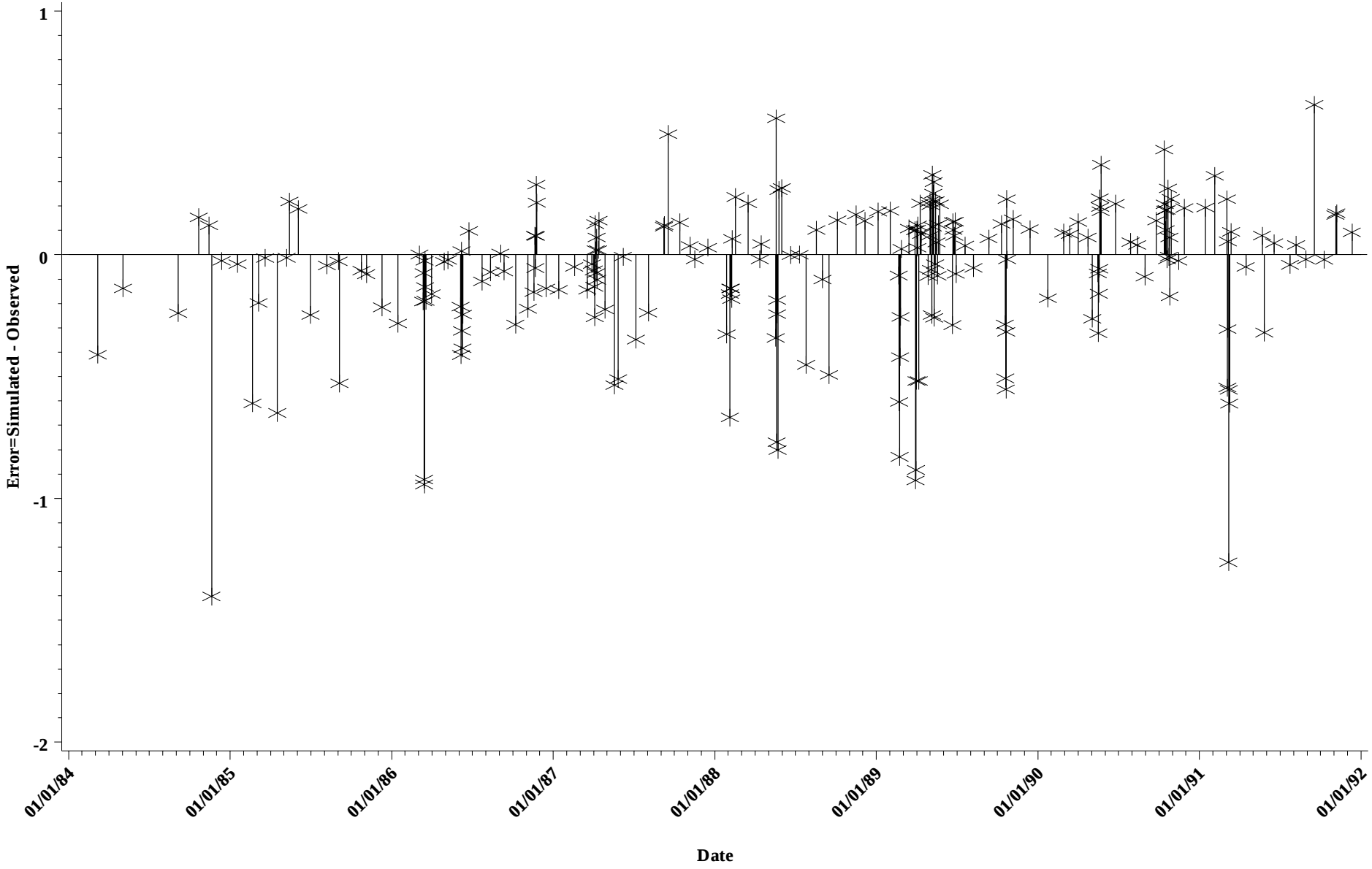
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(wbsus_d.drv1 26JUN98 08:48,proc reg,model y=x)

# West Branch Susquehanna at Segment 70
## Actual Error versus Time
## Organic Nitrogen

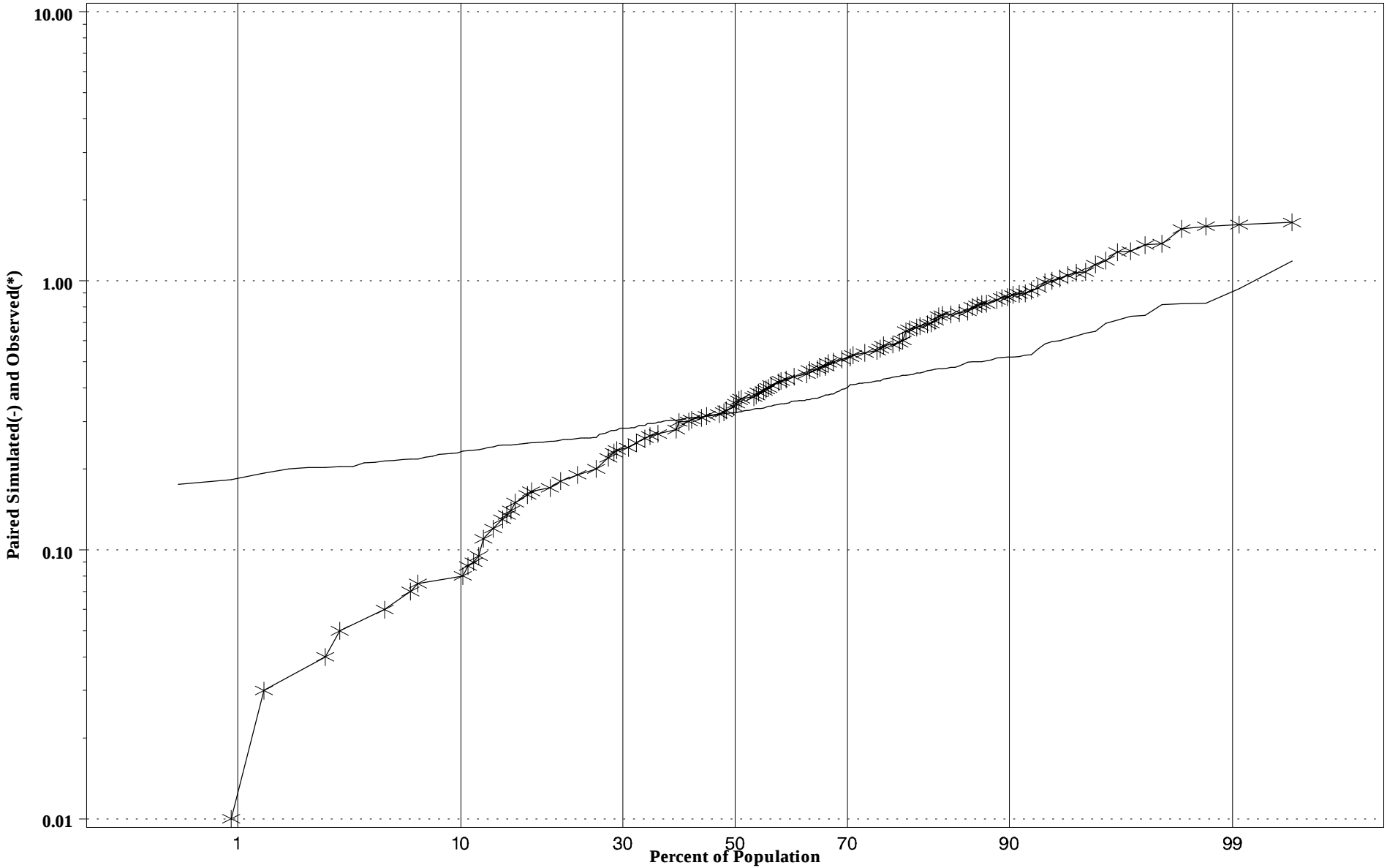



(y21_plotb.sas model3d:[pwang.dt] omerr)
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70

## Organic Nitrogen

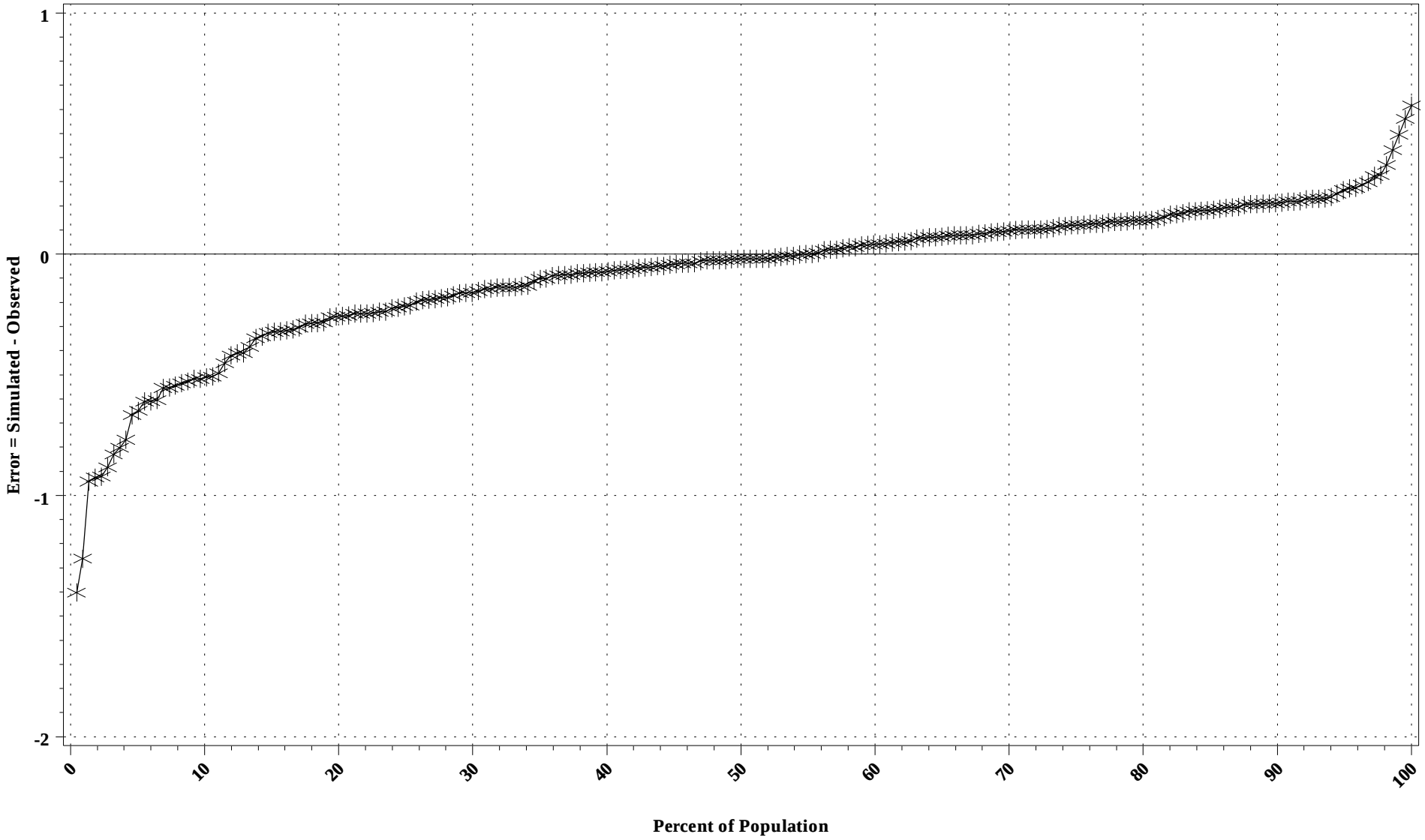
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(wbsus_d.drv1 26JUN98 08:48)

# West Branch Susquehanna at Segment 70
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(wbsus_d.drv1 26JUN98 08:48)

### *B.1.3 Juniata River at Newport, PA near Segment 100 (Monitoring Station: 1567000) (Above Fall Line Basin Segments: 90 and 100)*

**Section Summary:**

The Juniata basin is primarily rural and forested. The Raystown Reservoir, which intercepts drainage of 28% of the basin, has long hydrologic residence times which result in decreased total nitrogen and total phosphorus loads for this portion of the basin.

The Juniata basin above the gaged site covers an area of 3,355 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 69% forest land, 10% cropland, 18% other agricultural areas, 3% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage increased from 11.2 million pounds in 1985 to 11.3 million pounds in 1996. Total phosphorus loads over the same time period decreased from 0.5 million pounds to 0.4 million pounds. In general, point source loads above the gage site are low. In 1996, the total nitrogen point source load was 7% of the total load and the total phosphorus point source load was 12% of the total load. Estimated septic system total nitrogen loads increased 14%, from 0.32 million pounds in 1985 to 0.37 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 9%, and other agricultural loads (primarily pasture and manure loads) by 2%. Total phosphorus decreased for these land uses by 4% and 9% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 11% for total nitrogen and 8% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

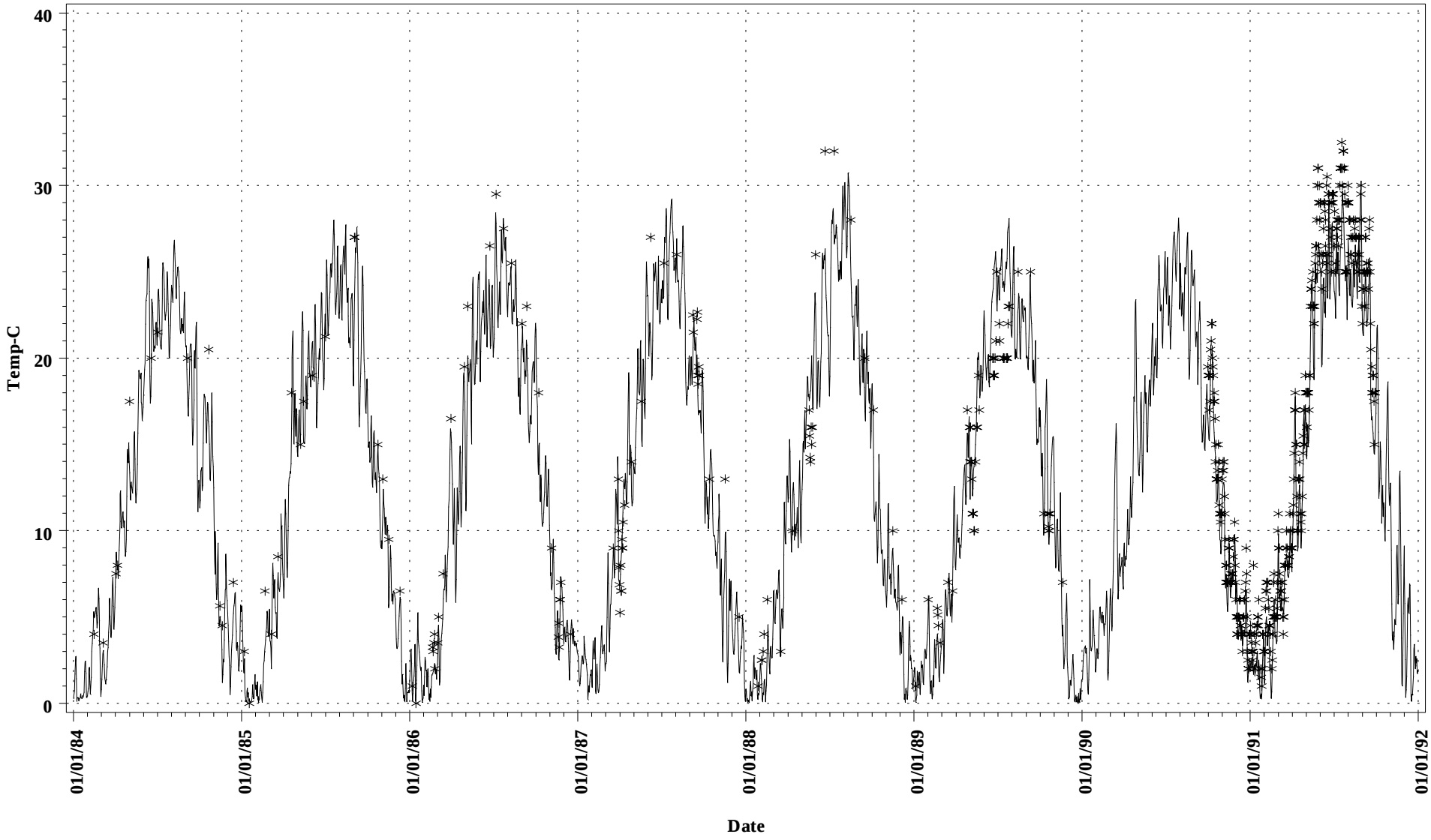
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# Juniata River at Segment 100
## Observed and Simulated versus Time
# Temperature-C

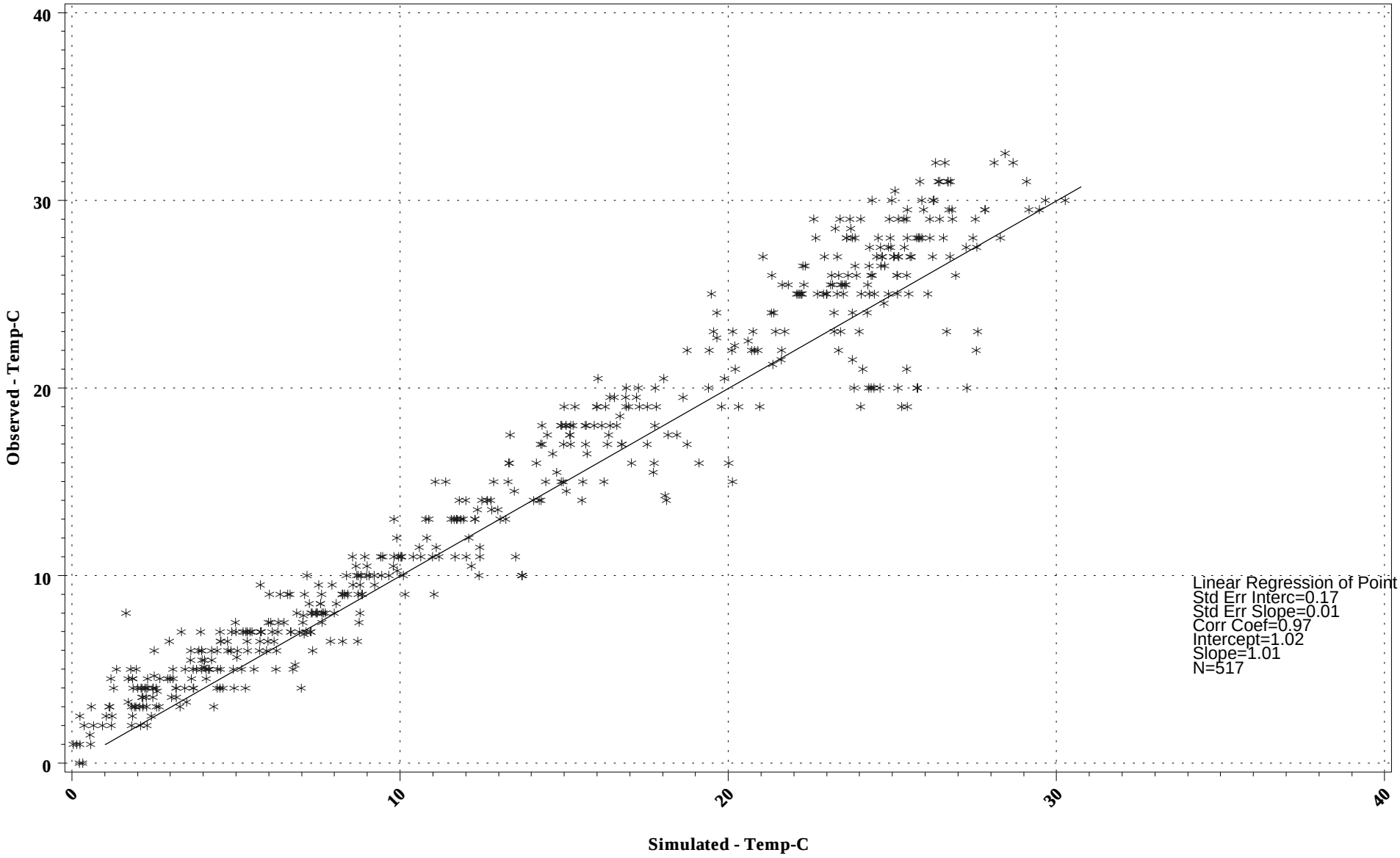
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(junia_d.drv1 26JUN98 08:53)

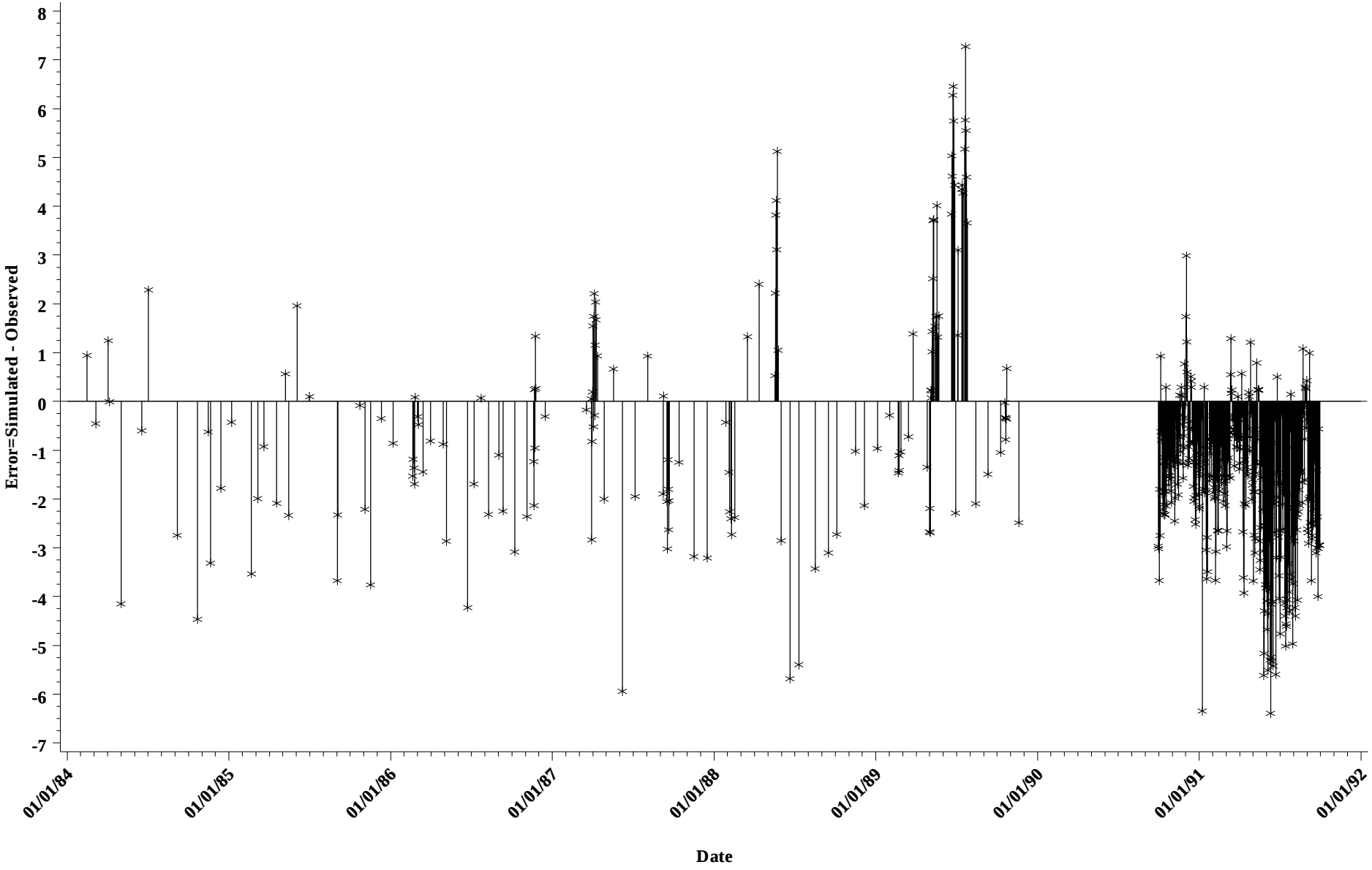
# Juniata River at Segment 100

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92



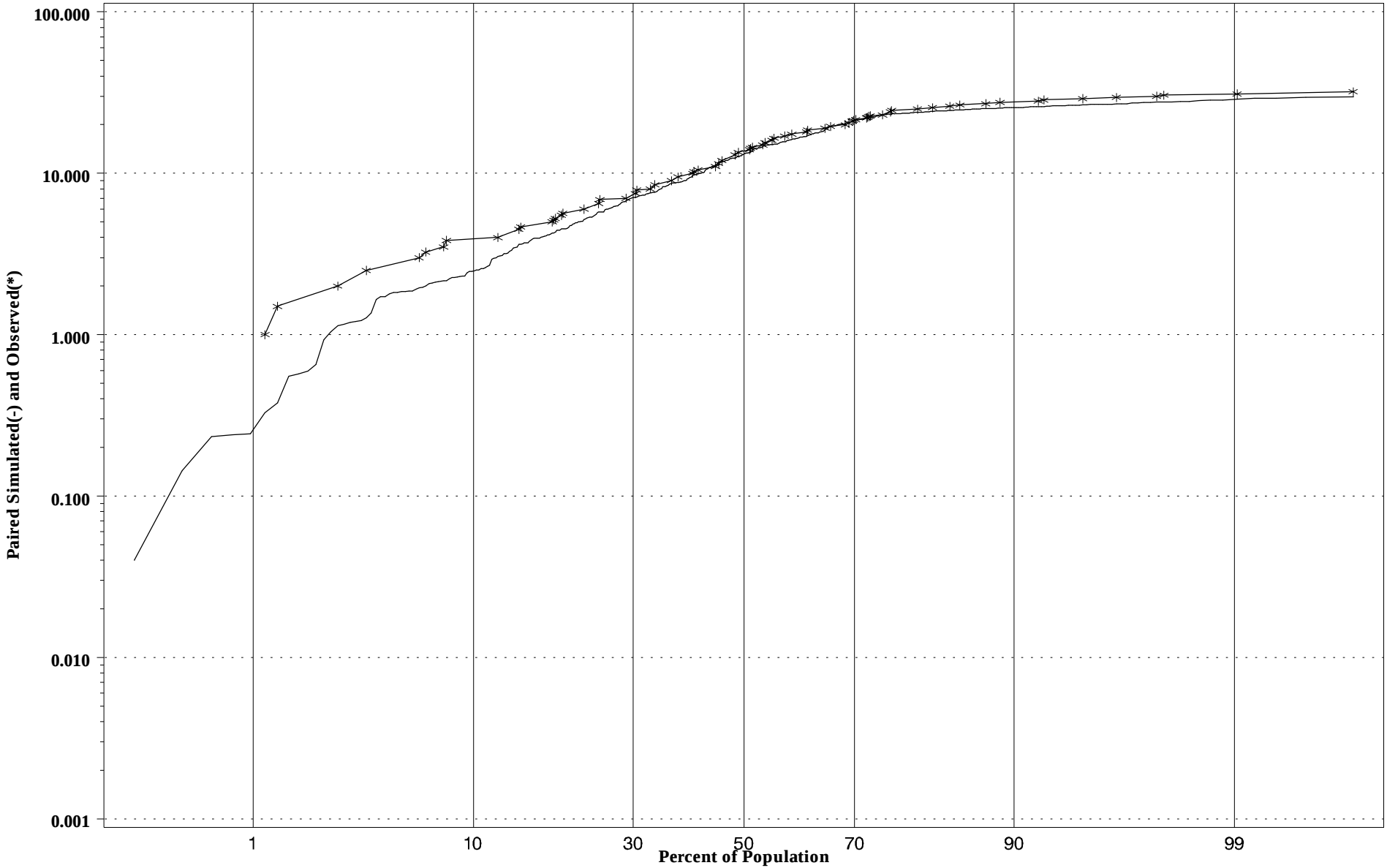

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100
## Actual Error versus Time
## Temperature-C




(y21_plotb.sas model3d:[pwang.dt] omerr)
(junia_d.drv1 26JUN98 08:53)

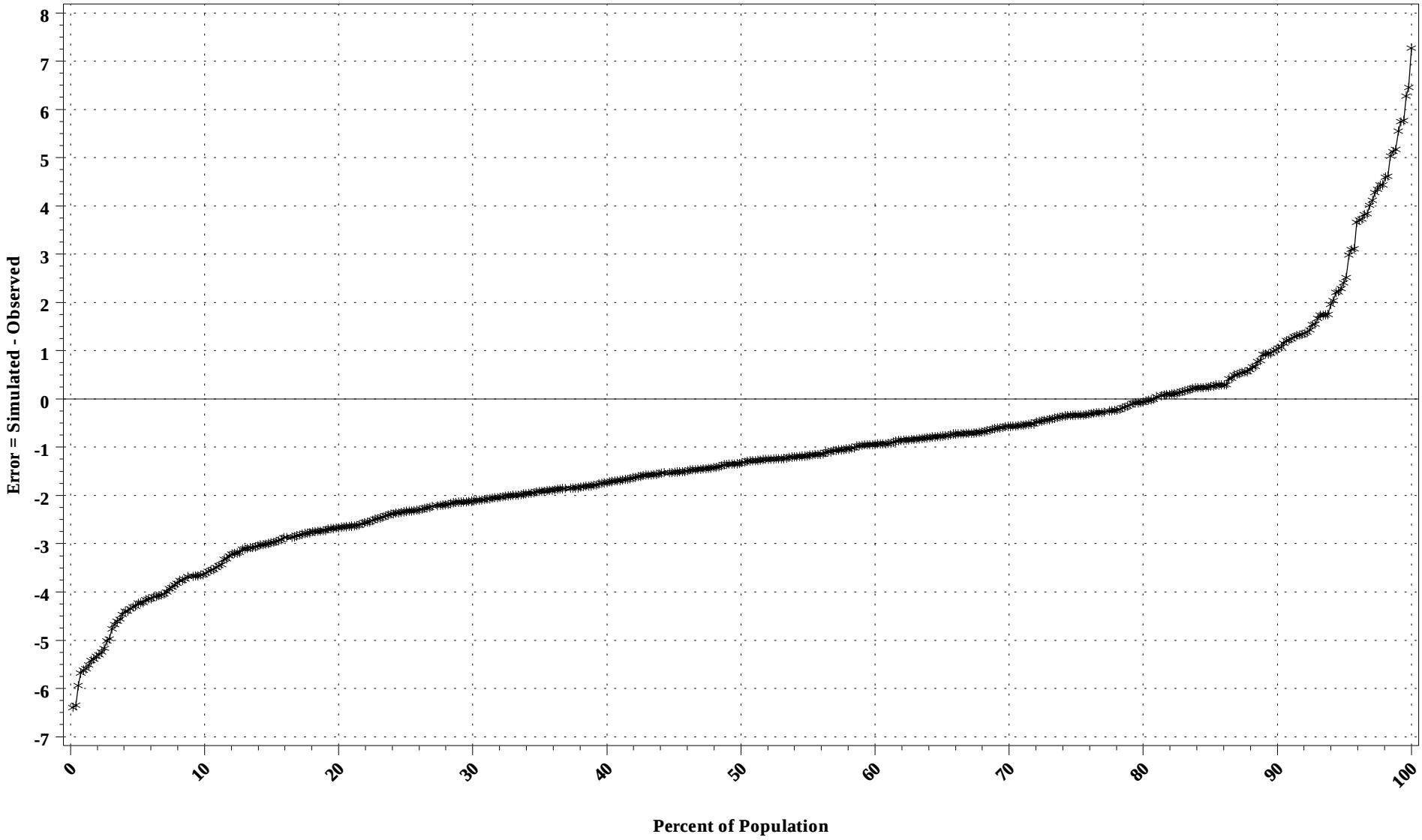
# Juniata River at Segment 100
## Temperature-C
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Actual error versus Percentile Sample Population
## Temperature-C

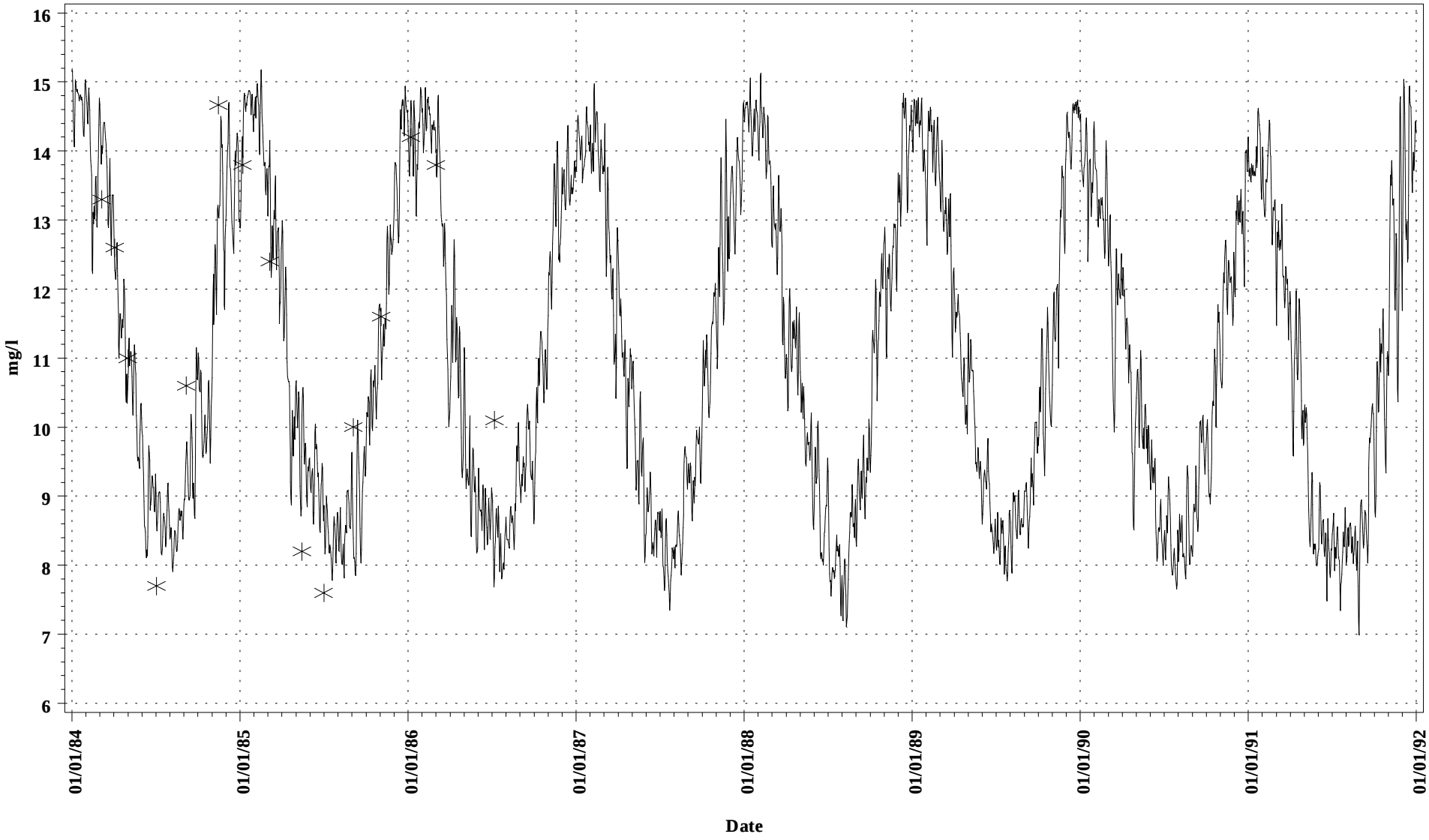
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(junia_d.drv1 26JUN98 08:53)

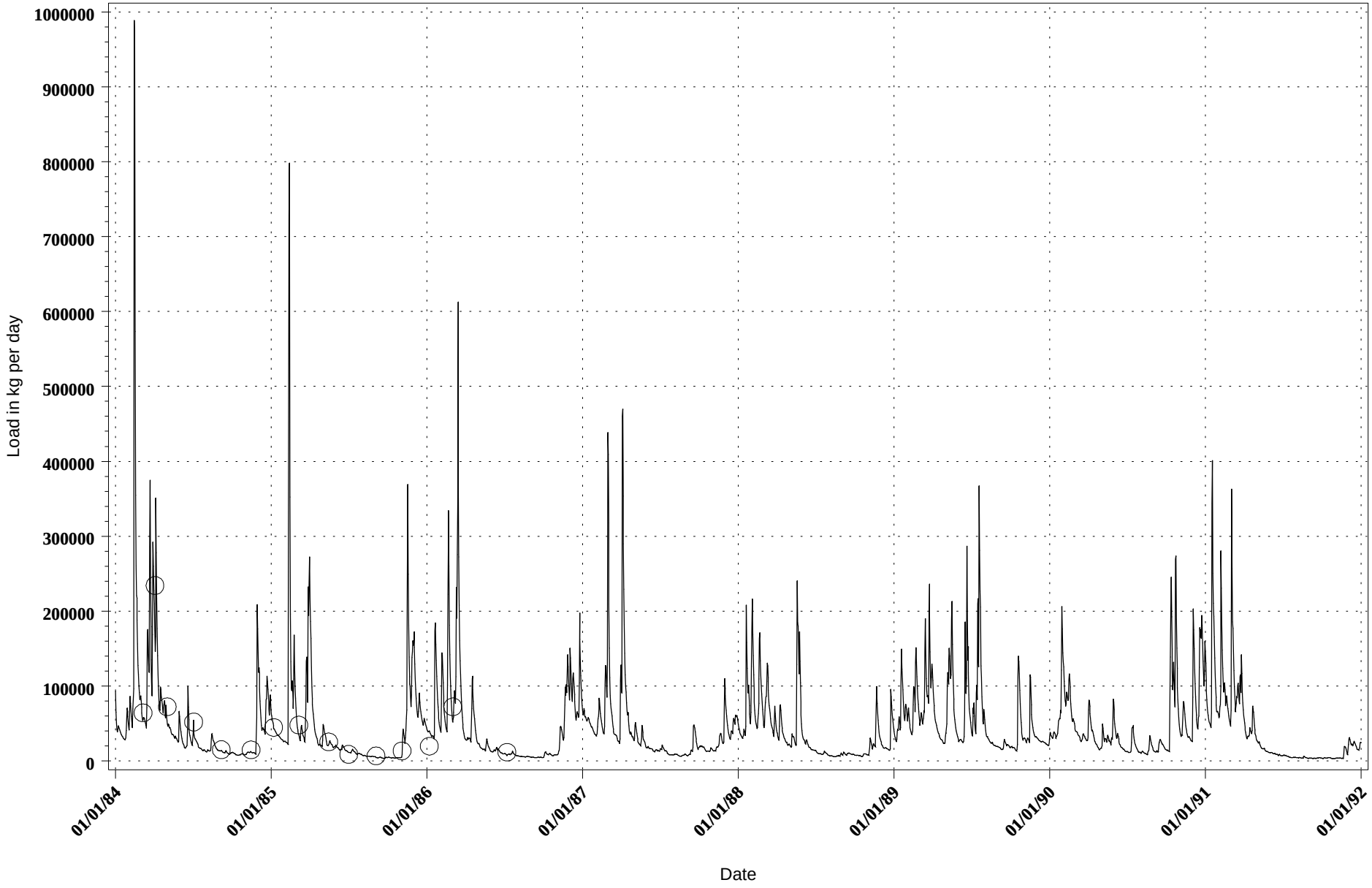
# Juniata River at Segment 100
## Observed and Simulated versus Time
# Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

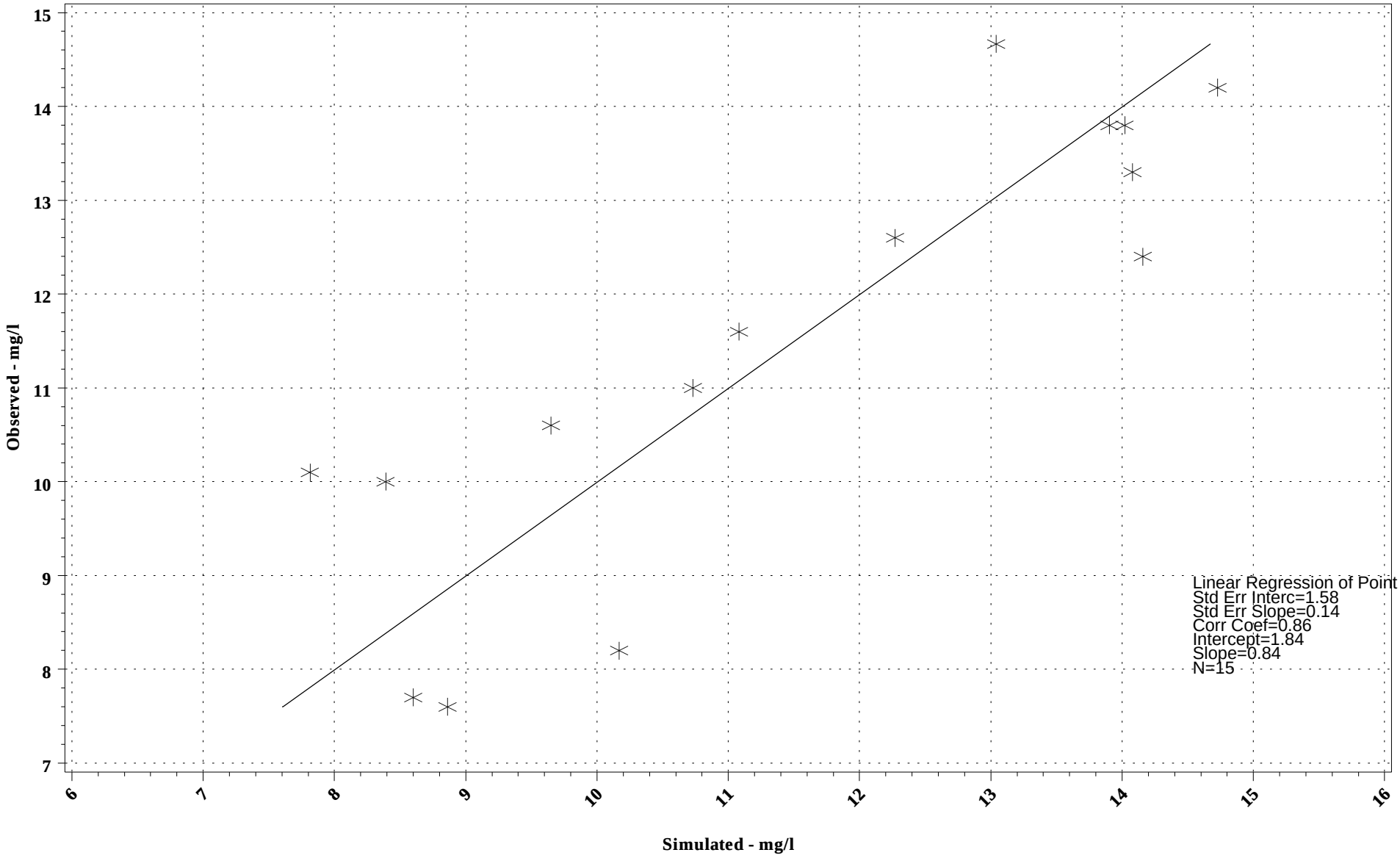



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100

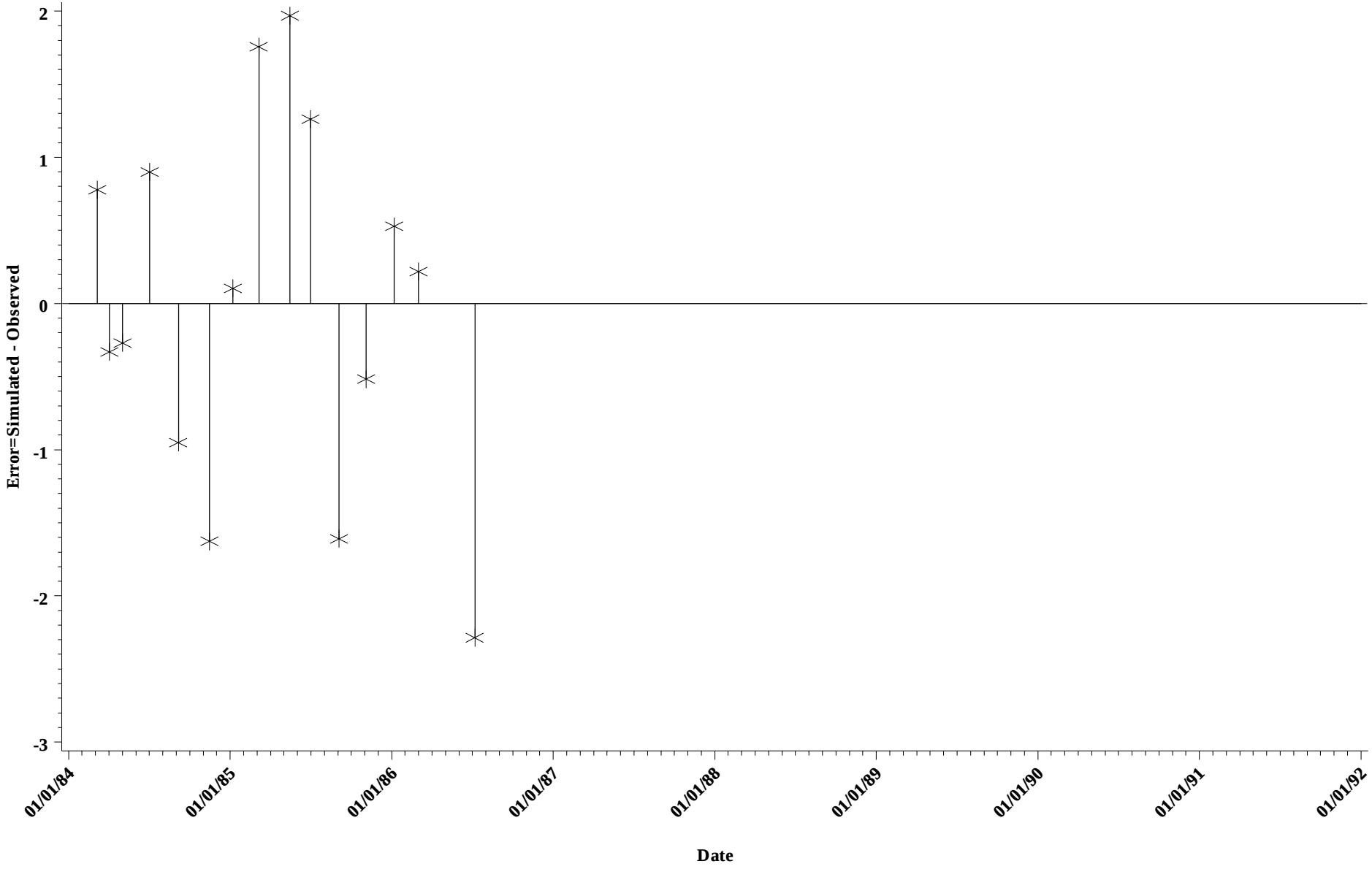
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Oxygen: 01JAN84 - 01JAN92



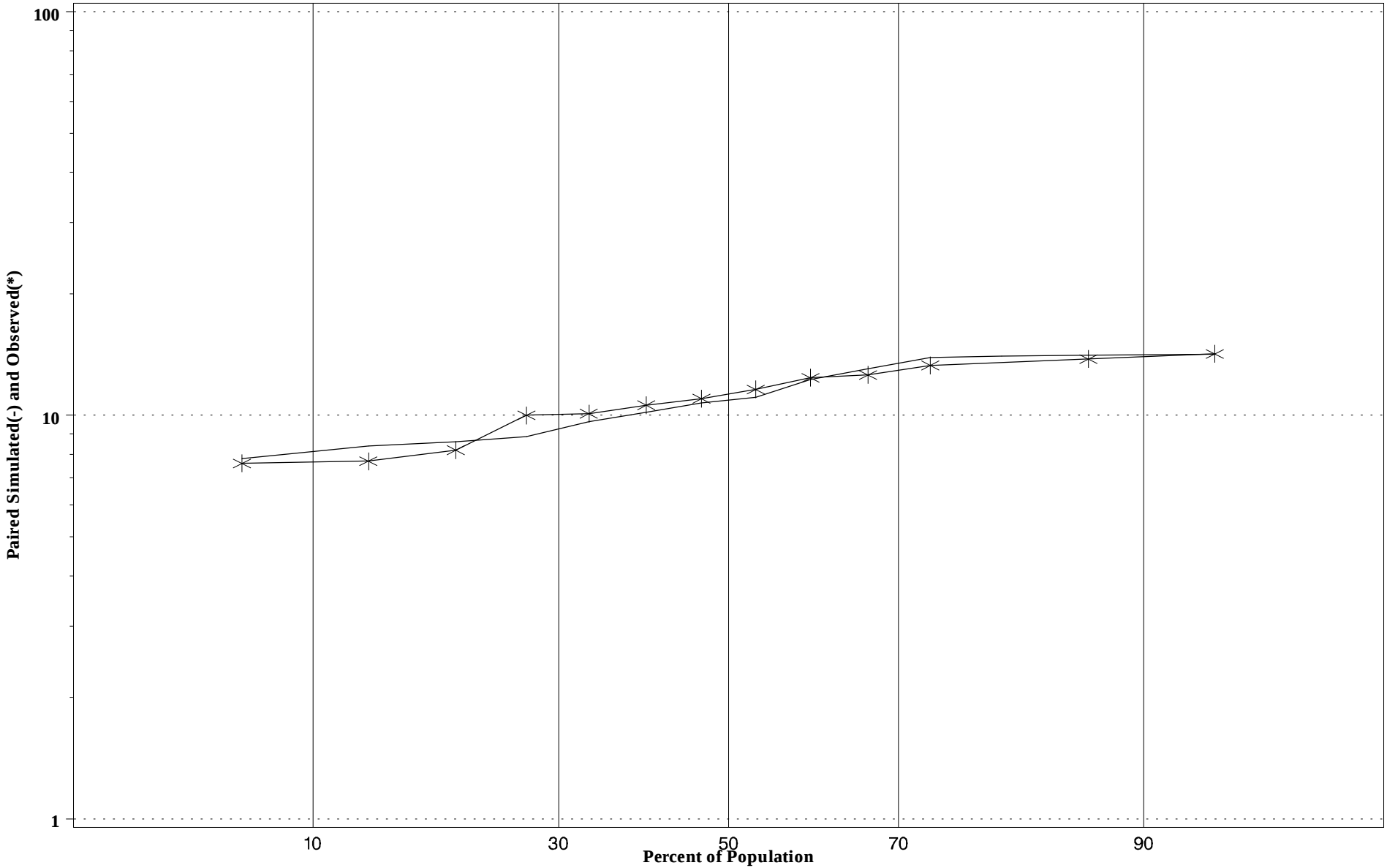

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(junia_d.drv1 26JUN98 08:53)

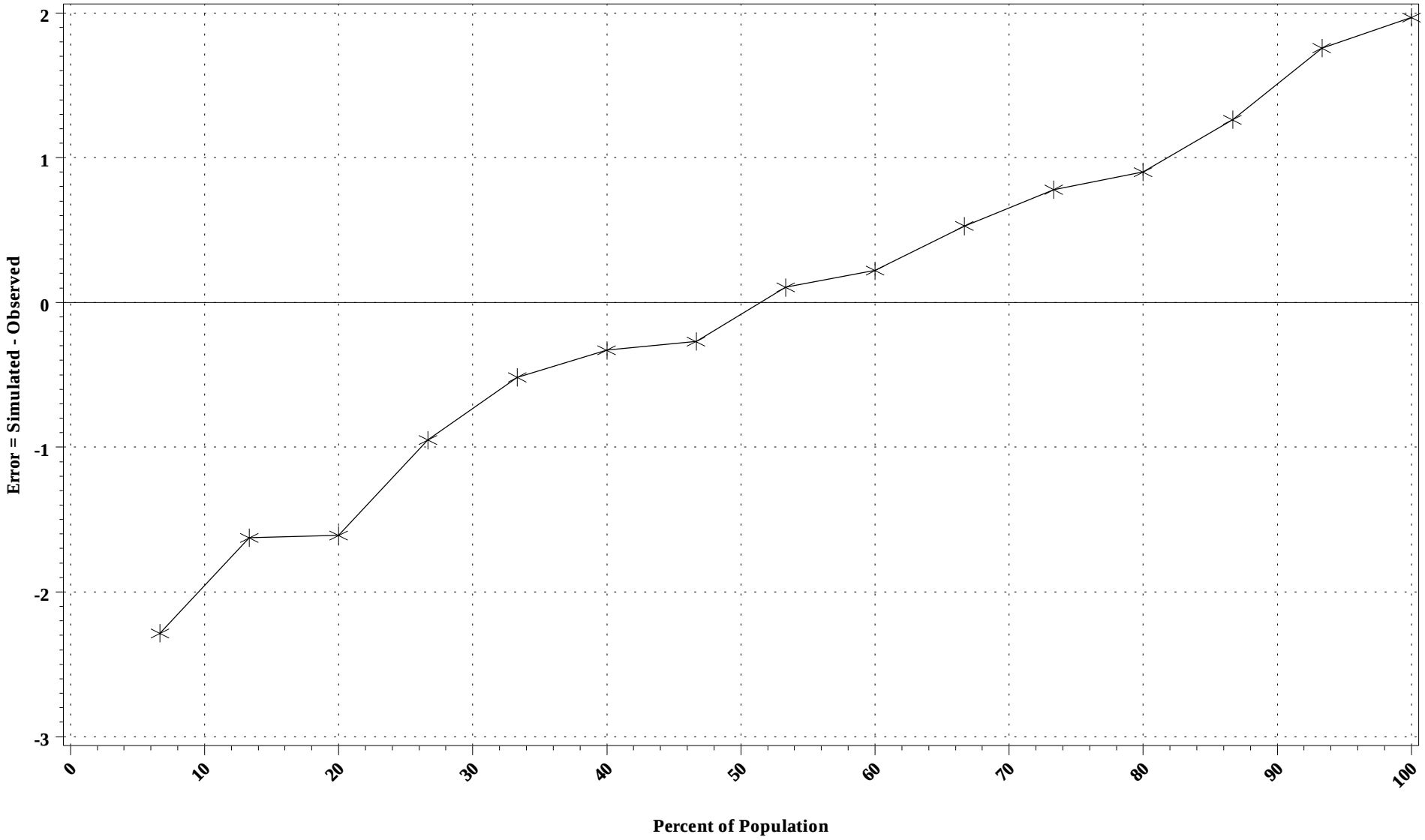
# Juniata River at Segment 100
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

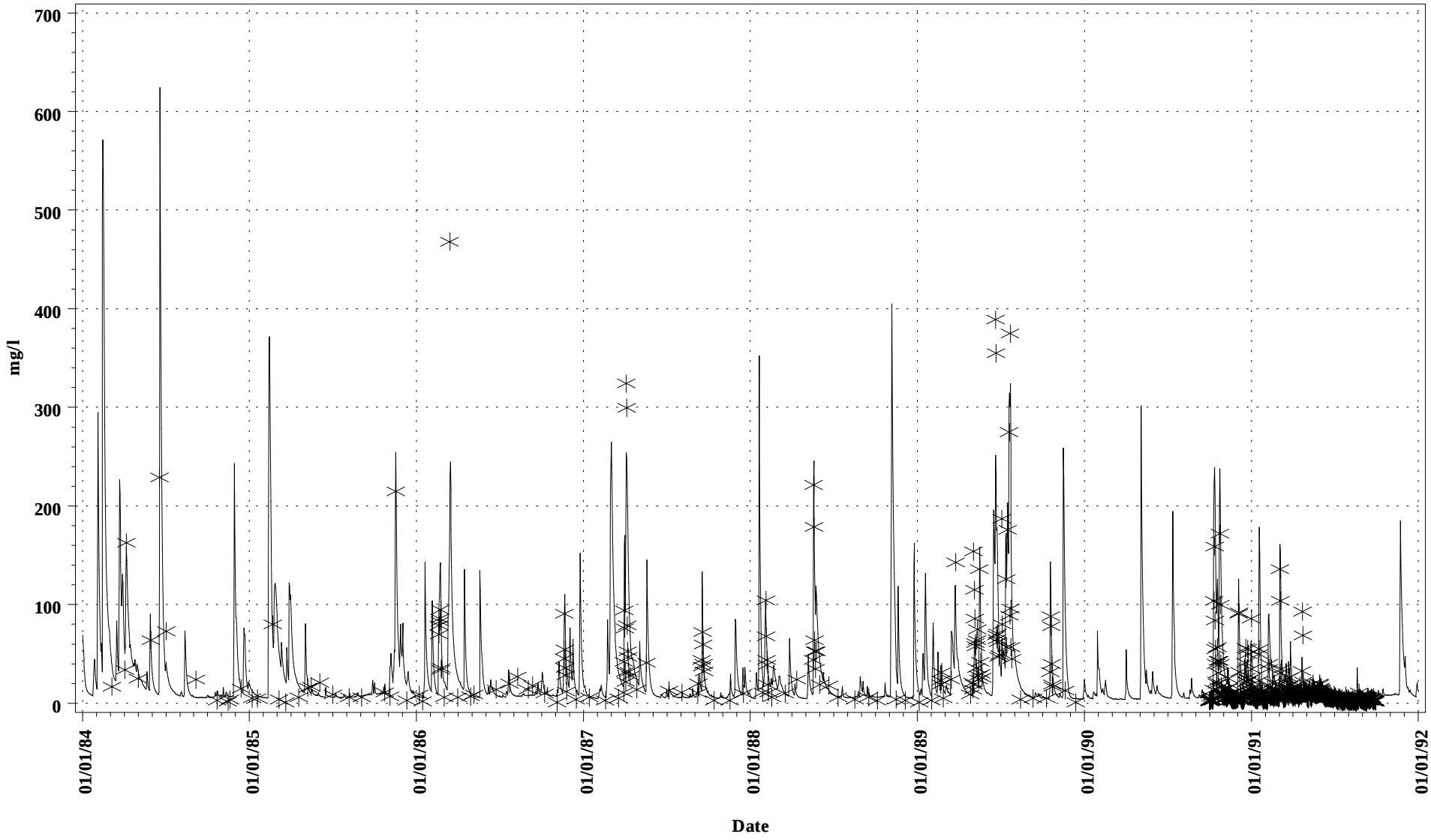
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(junia_d.drv1 26JUN98 08:53)

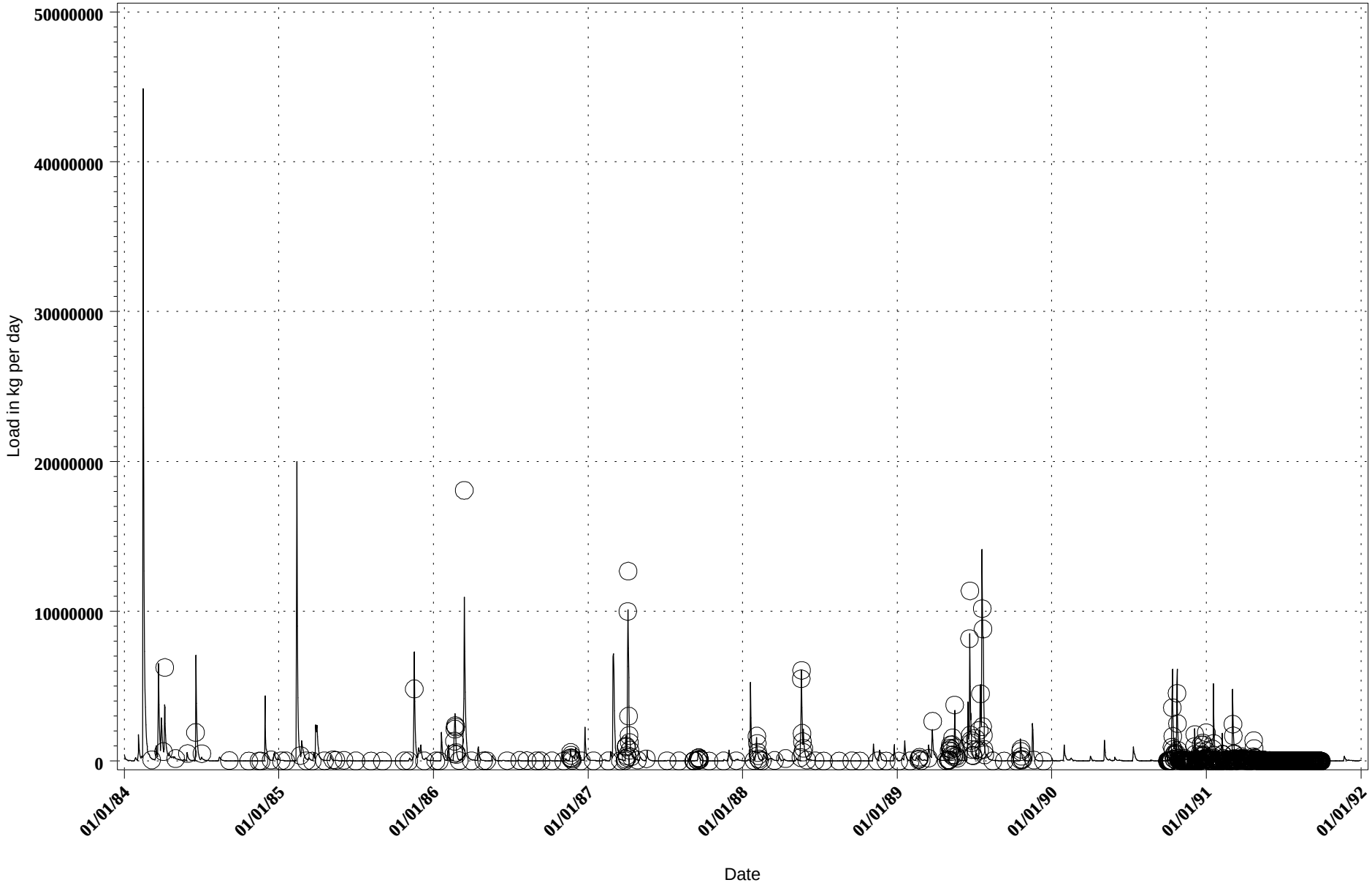
# Juniata River at Segment 100
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Total Suspended Sediment Observed and Simulated Load vs Time
### (line = simulated, O = observed)

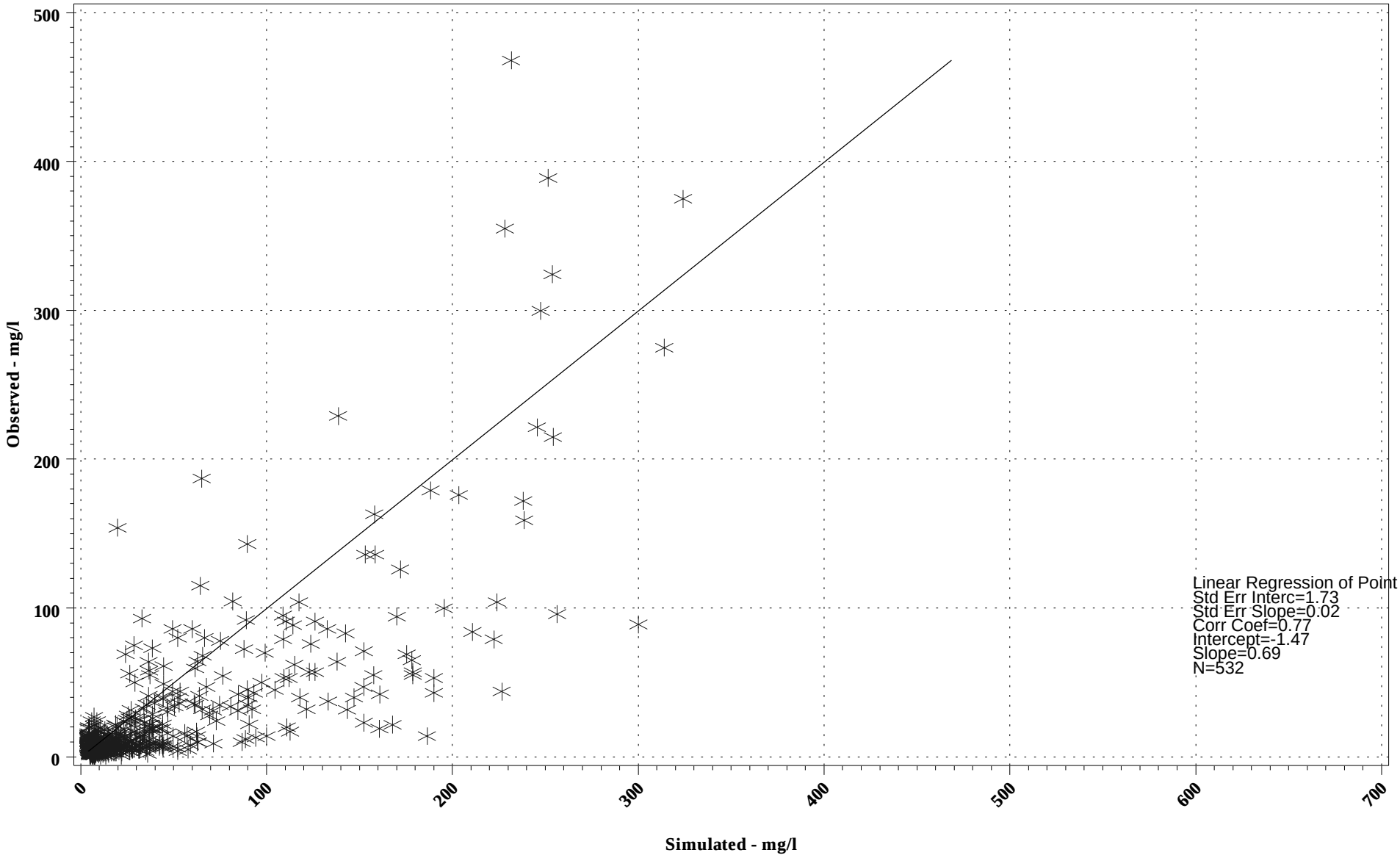



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100

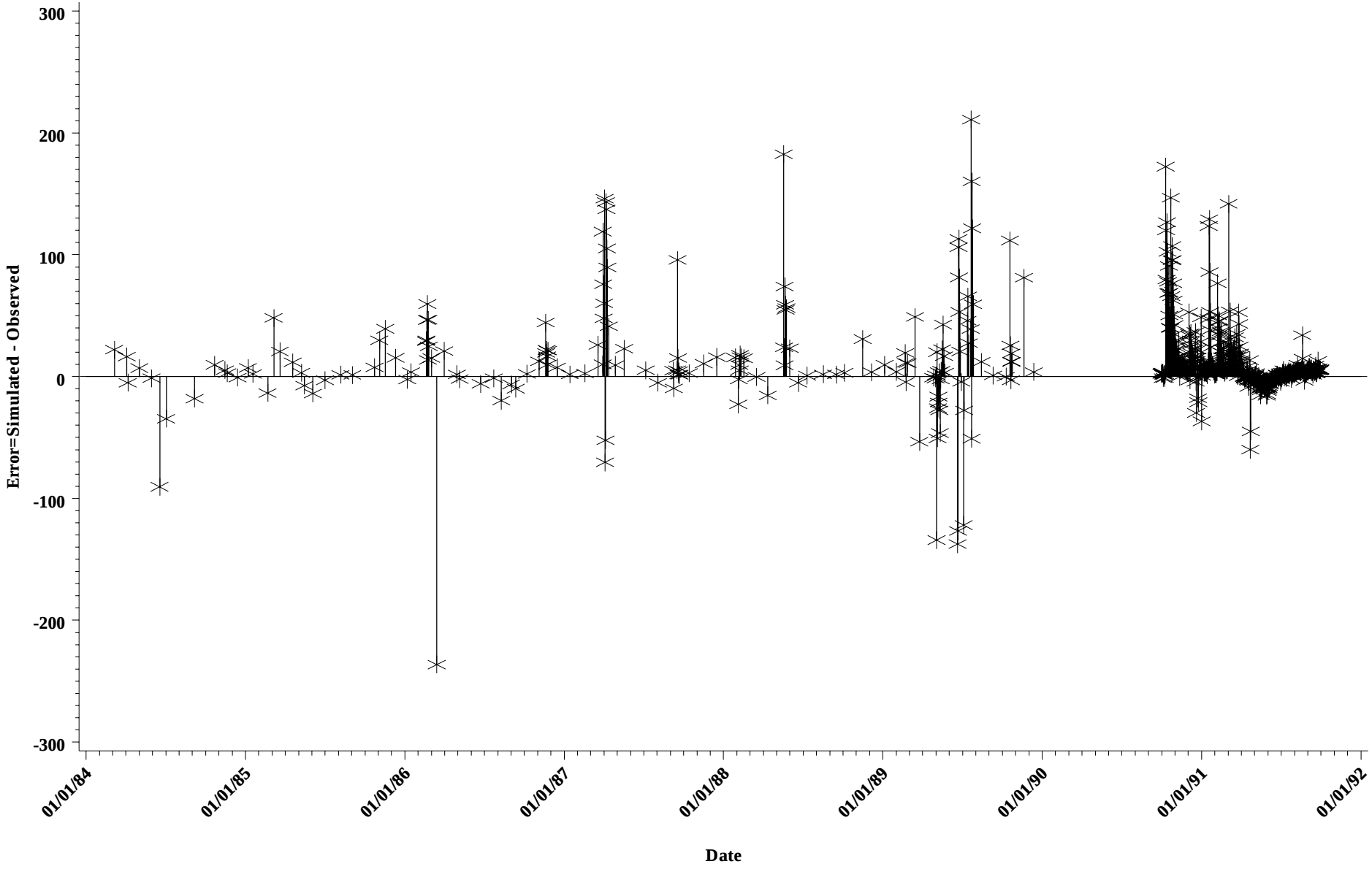
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



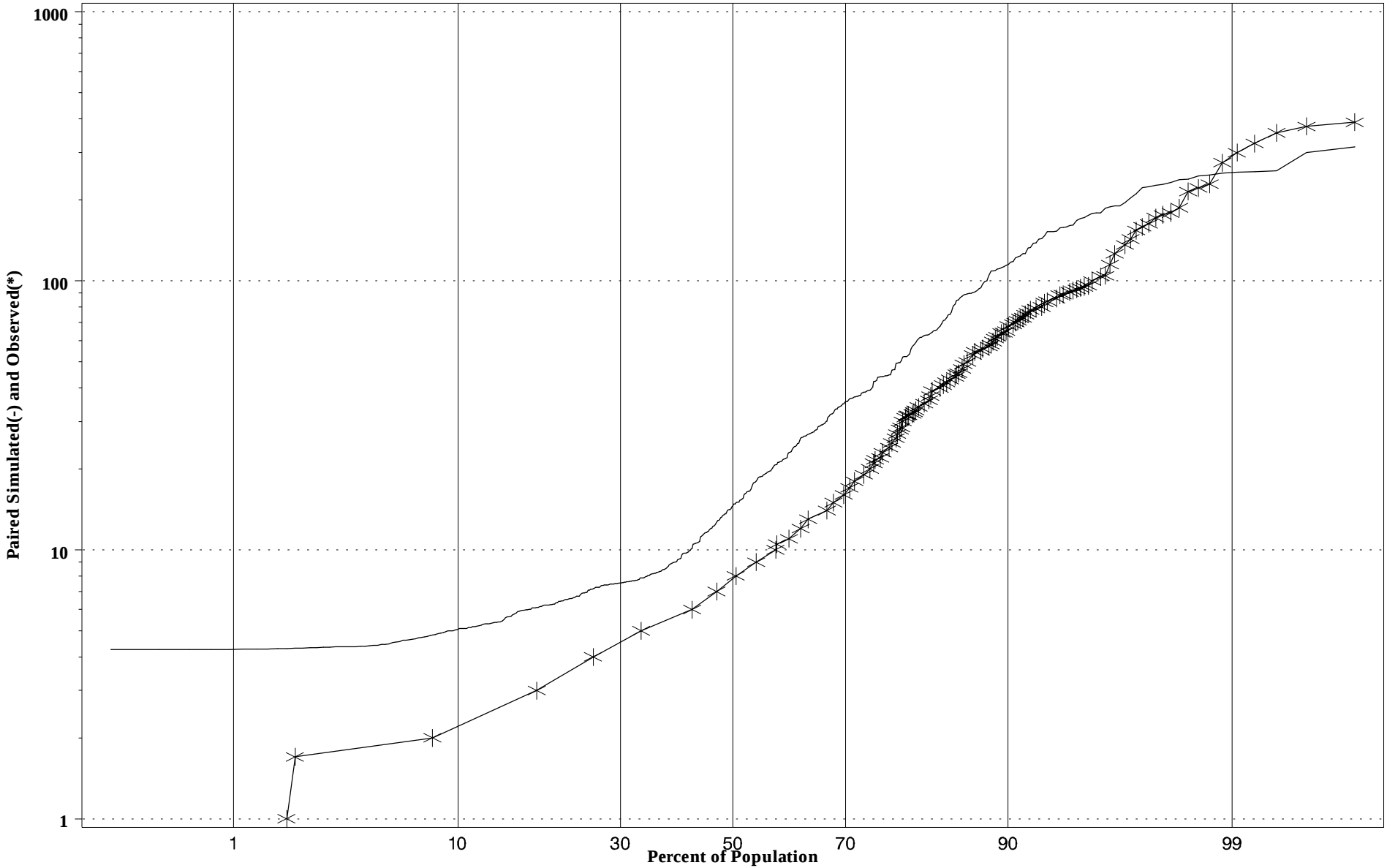

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(junia_d.drv1 26JUN98 08:53)

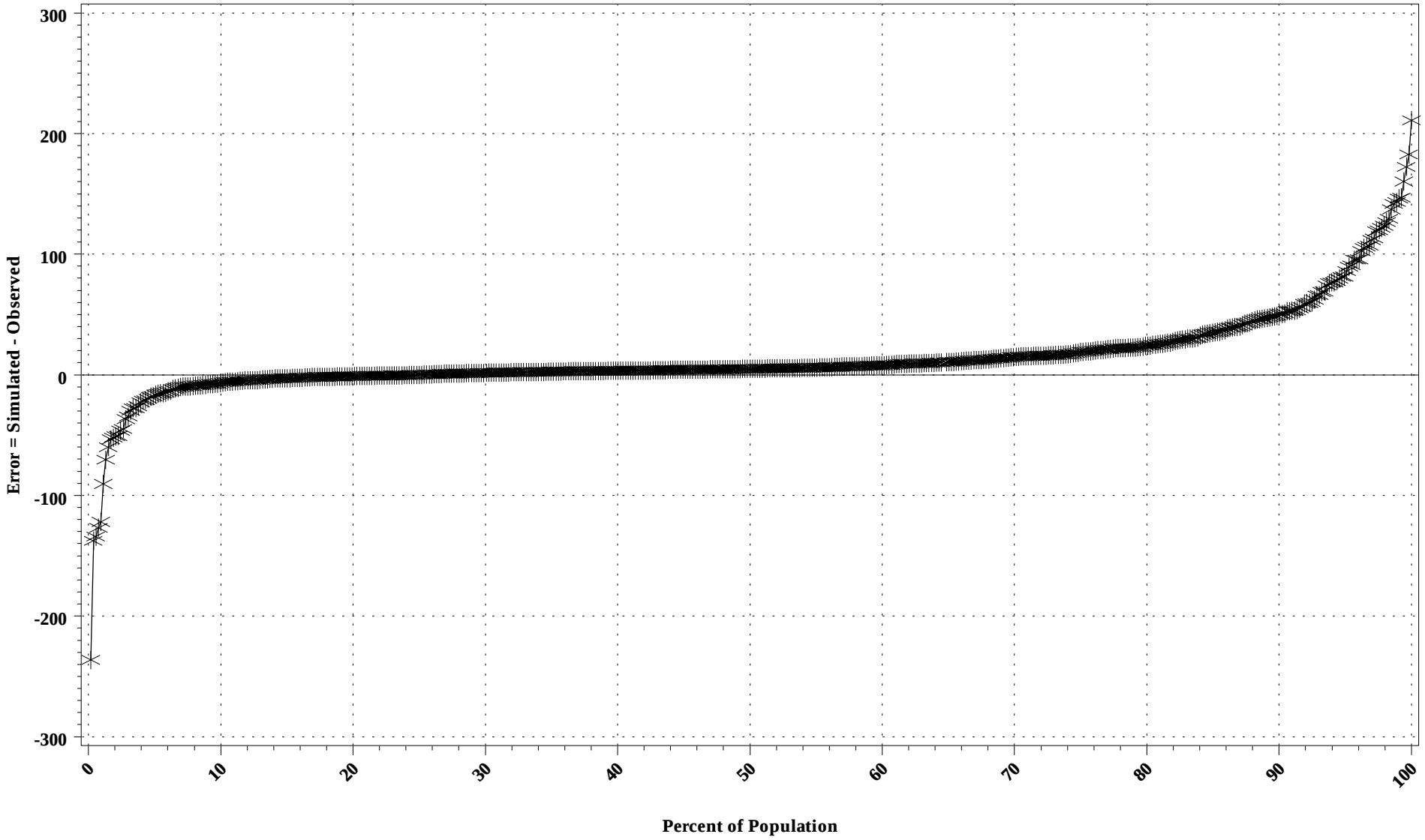
# Juniata River at Segment 100
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

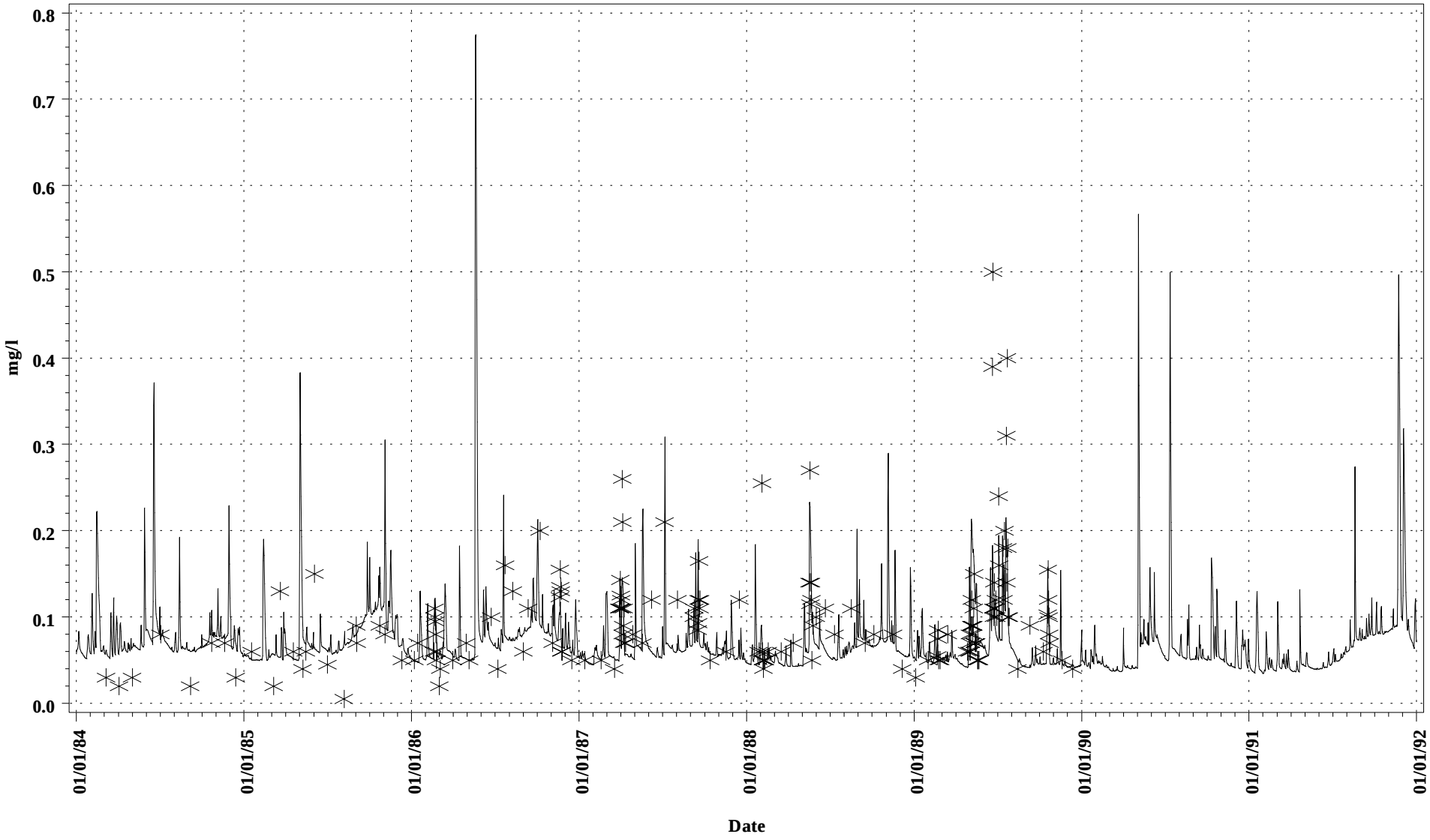
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(junia_d.drv1 26JUN98 08:53)

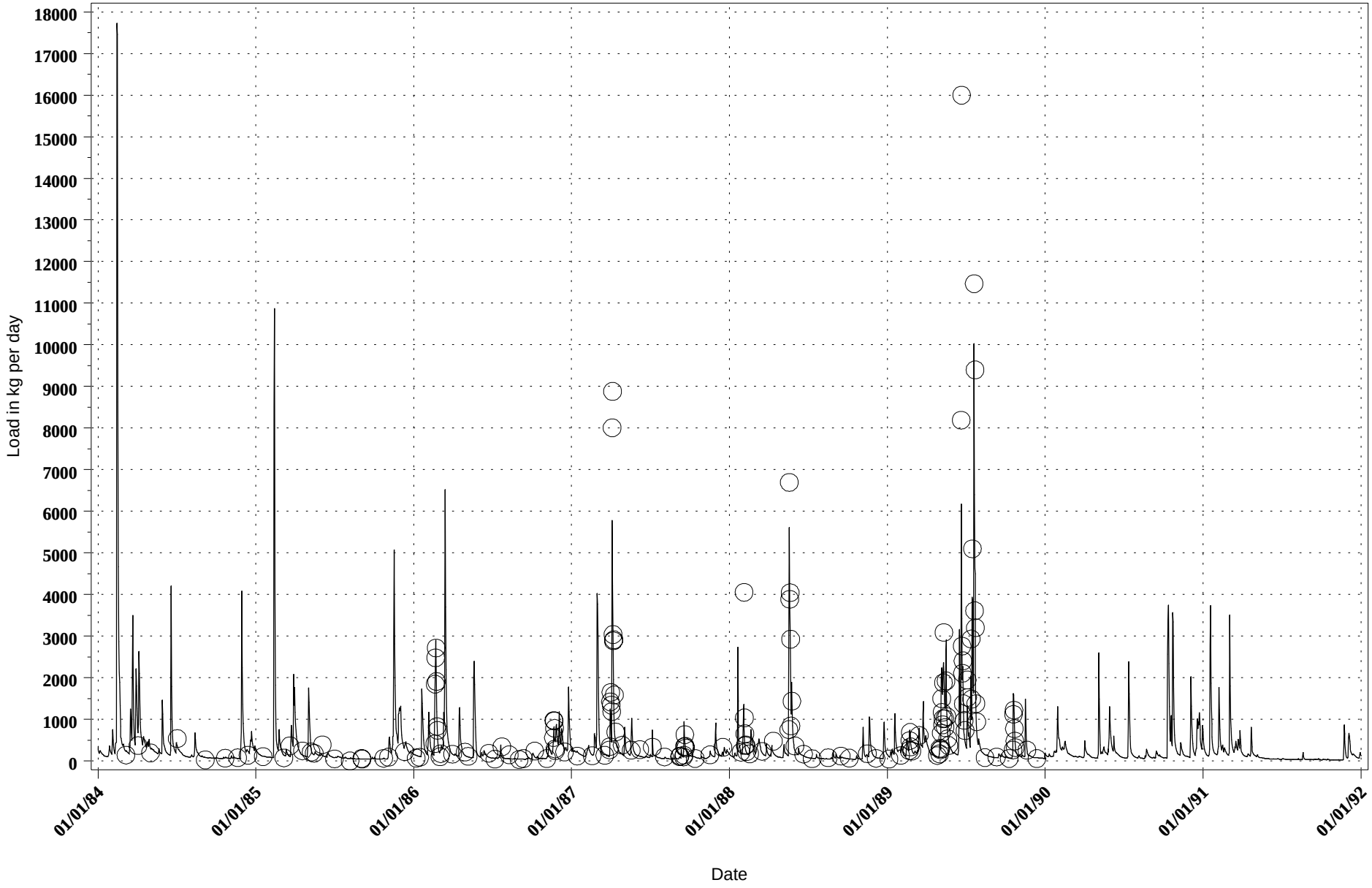
# Juniata River at Segment 100
## Observed and Simulated versus Time
## Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

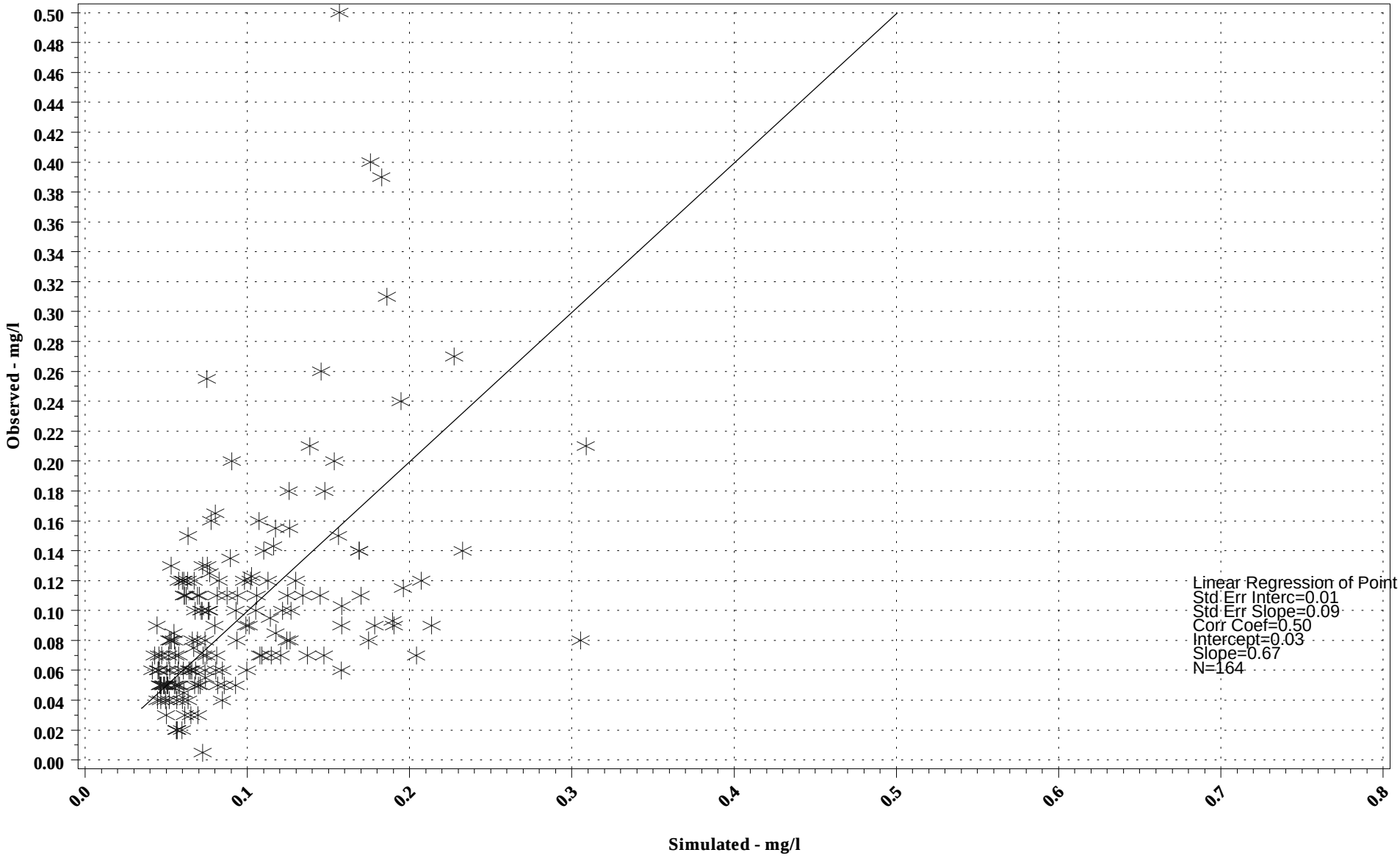



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100

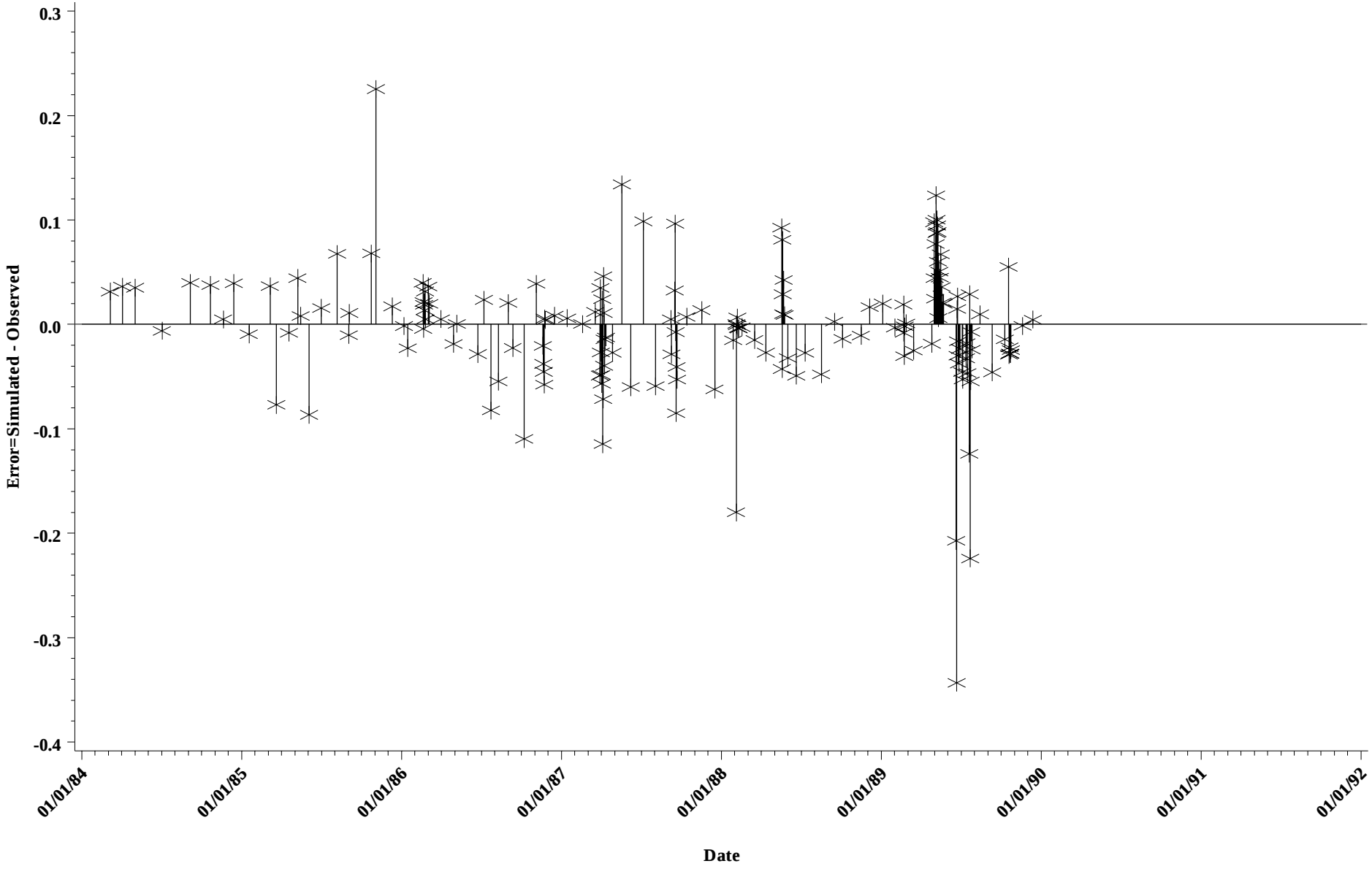
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



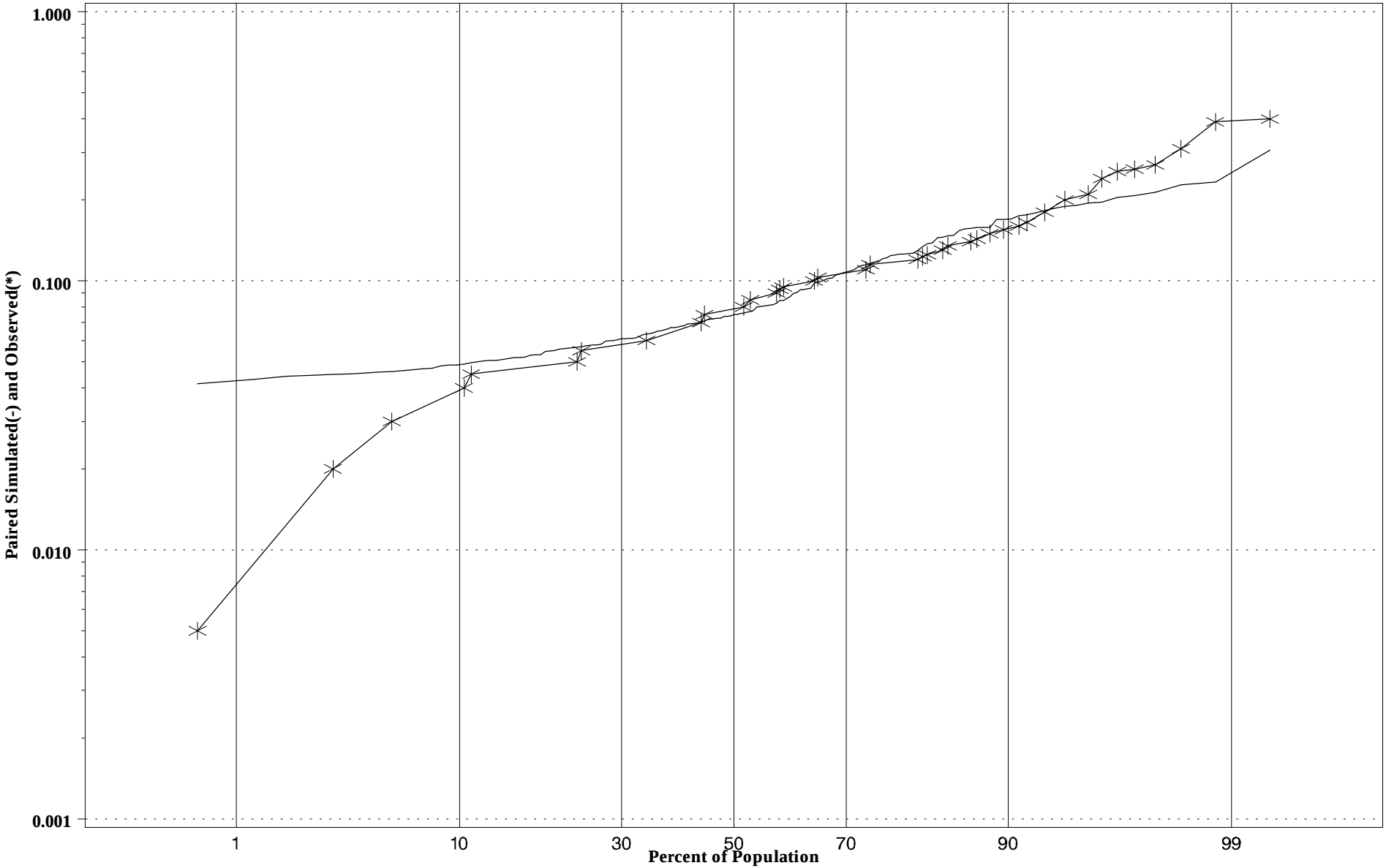

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(junia_d.drv1 26JUN98 08:53)

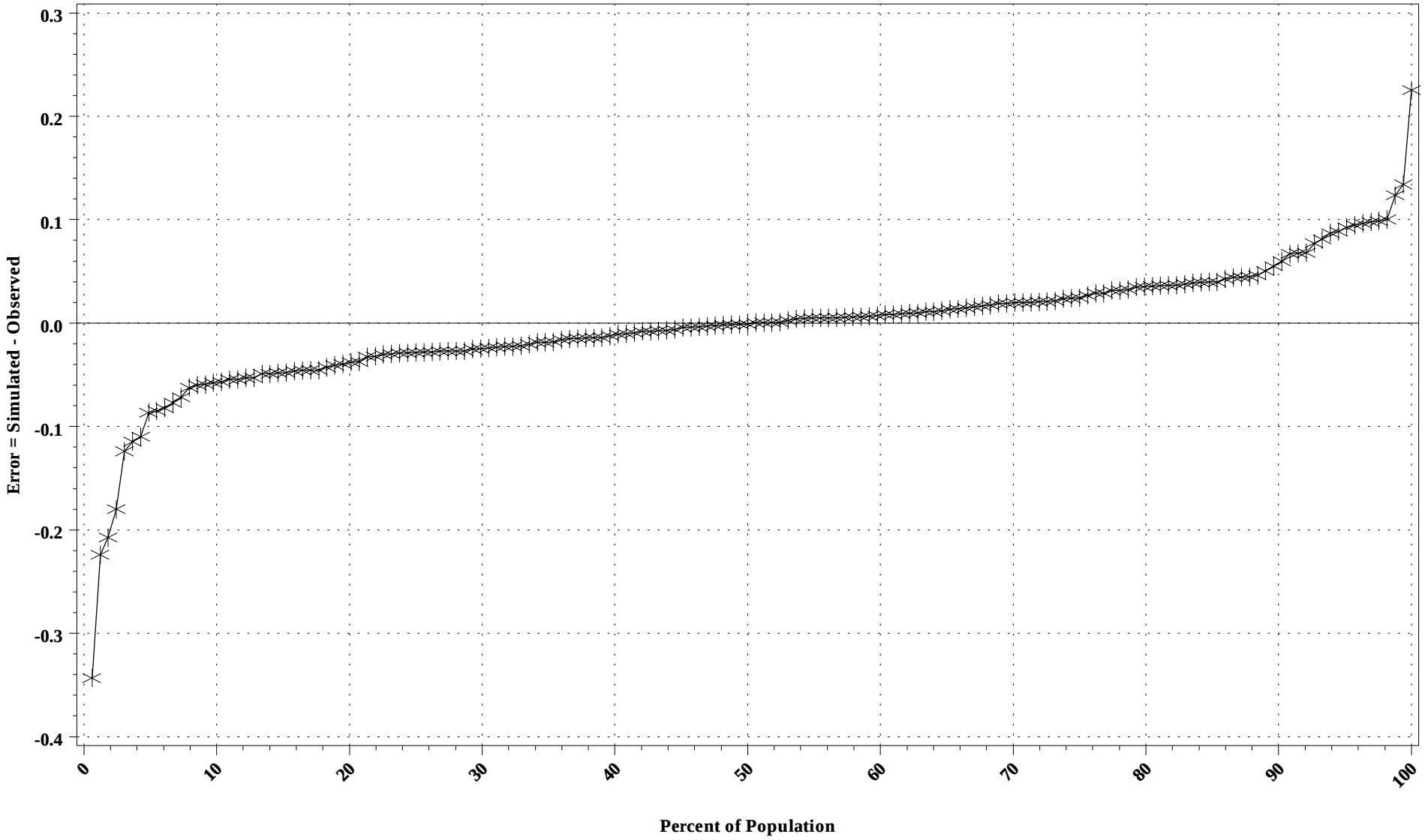
# Juniata River at Segment 100
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Actual error versus Percentile Sample Population
## Total Phosphorus

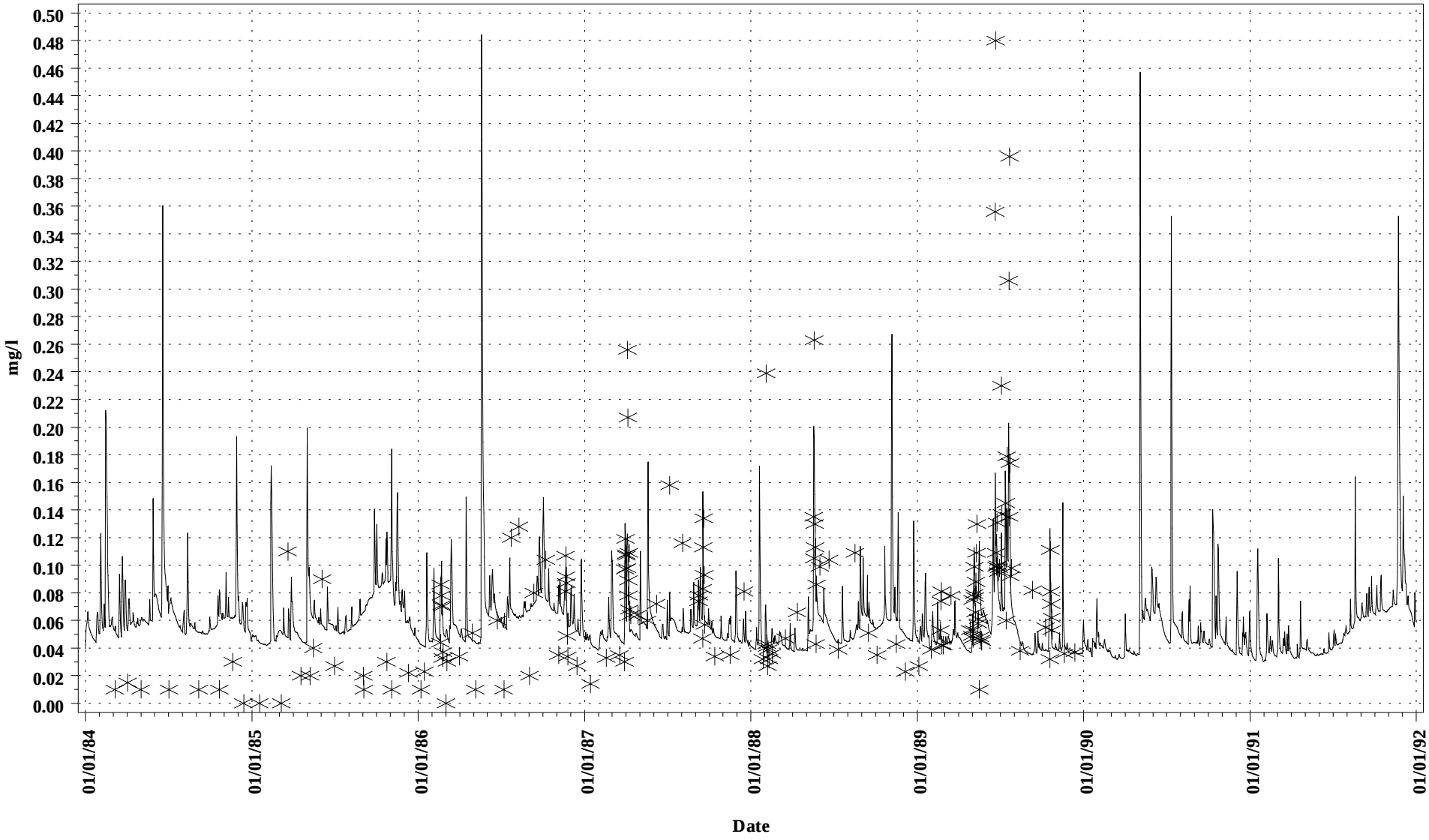
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

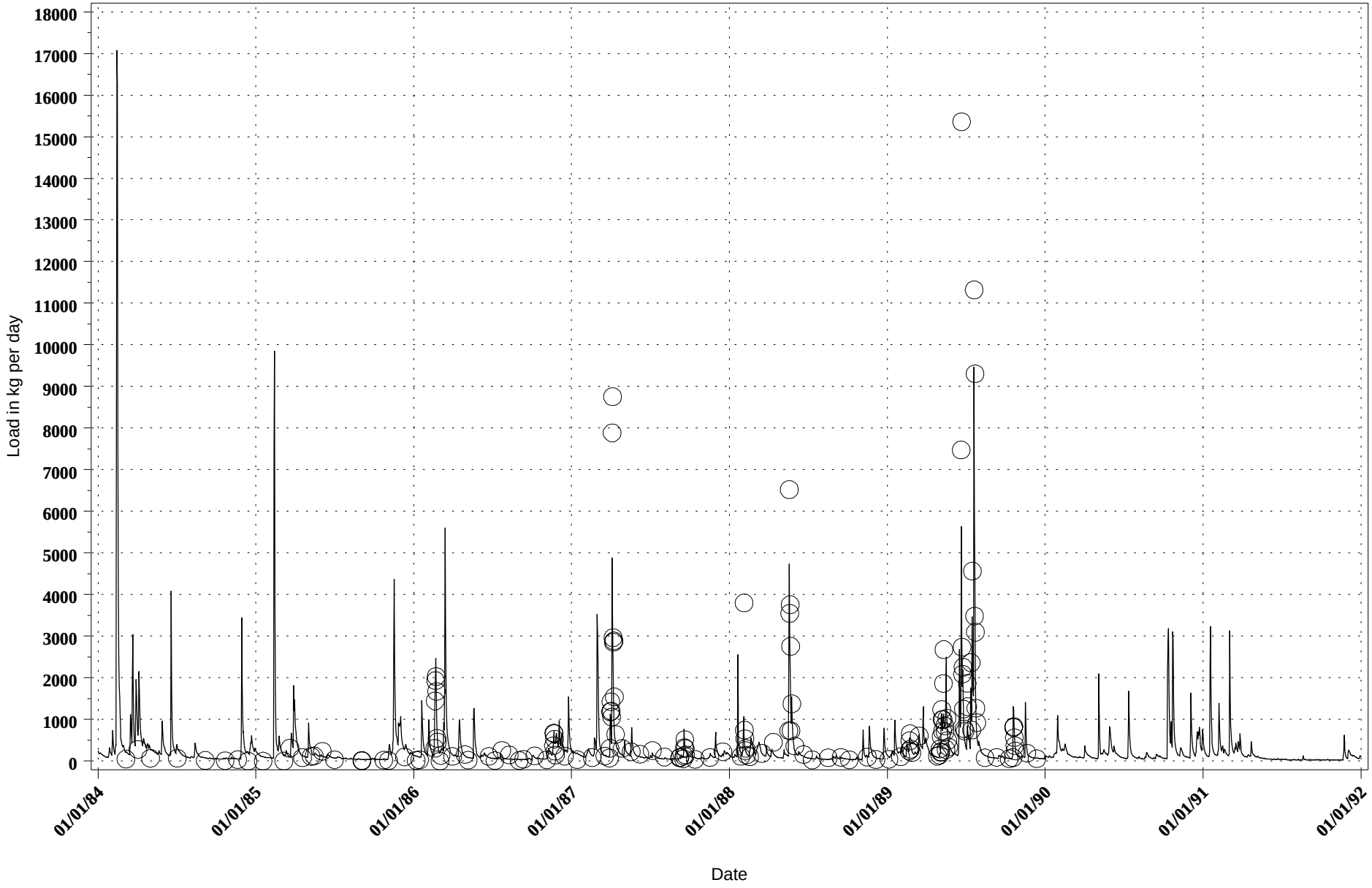



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

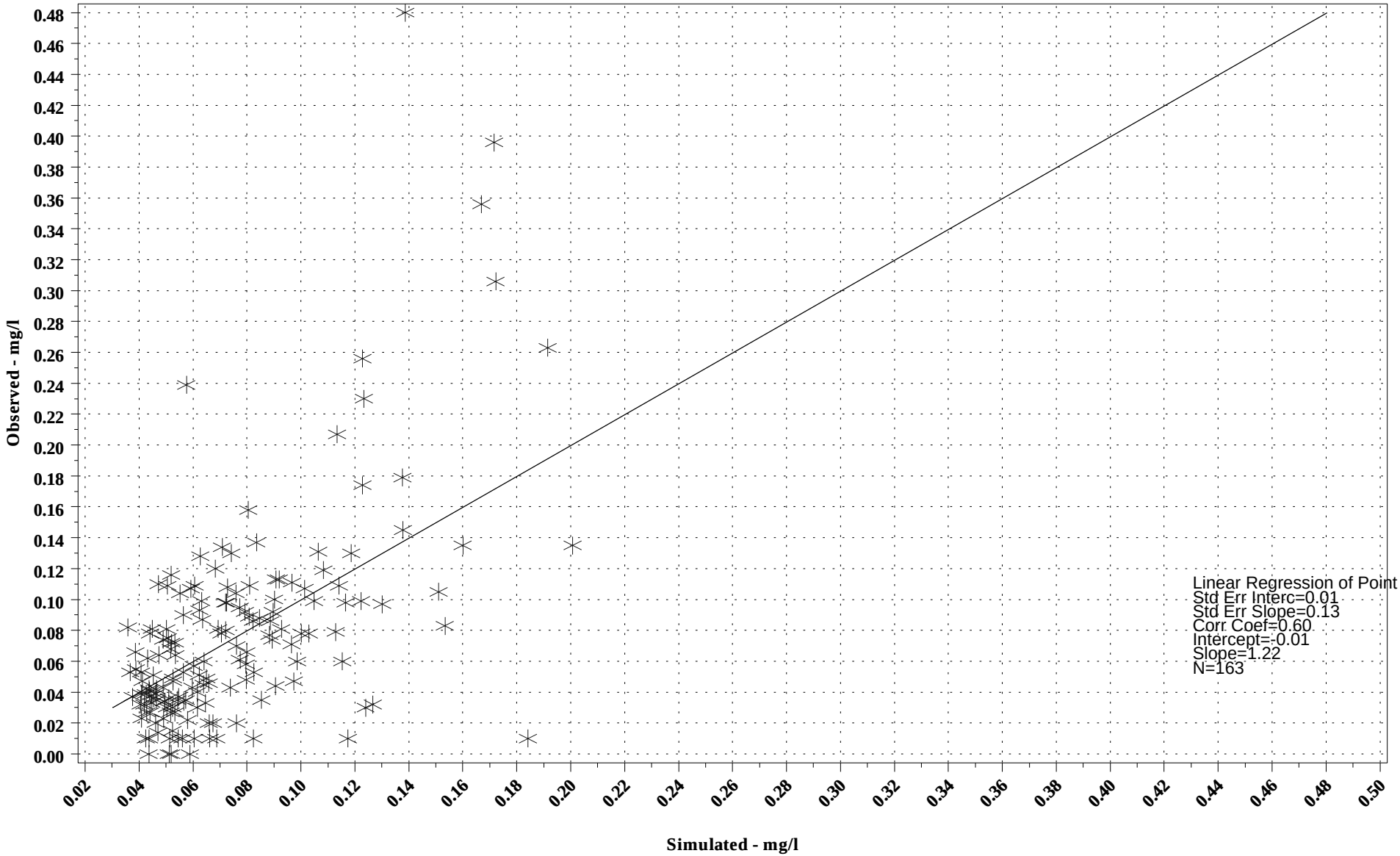



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100

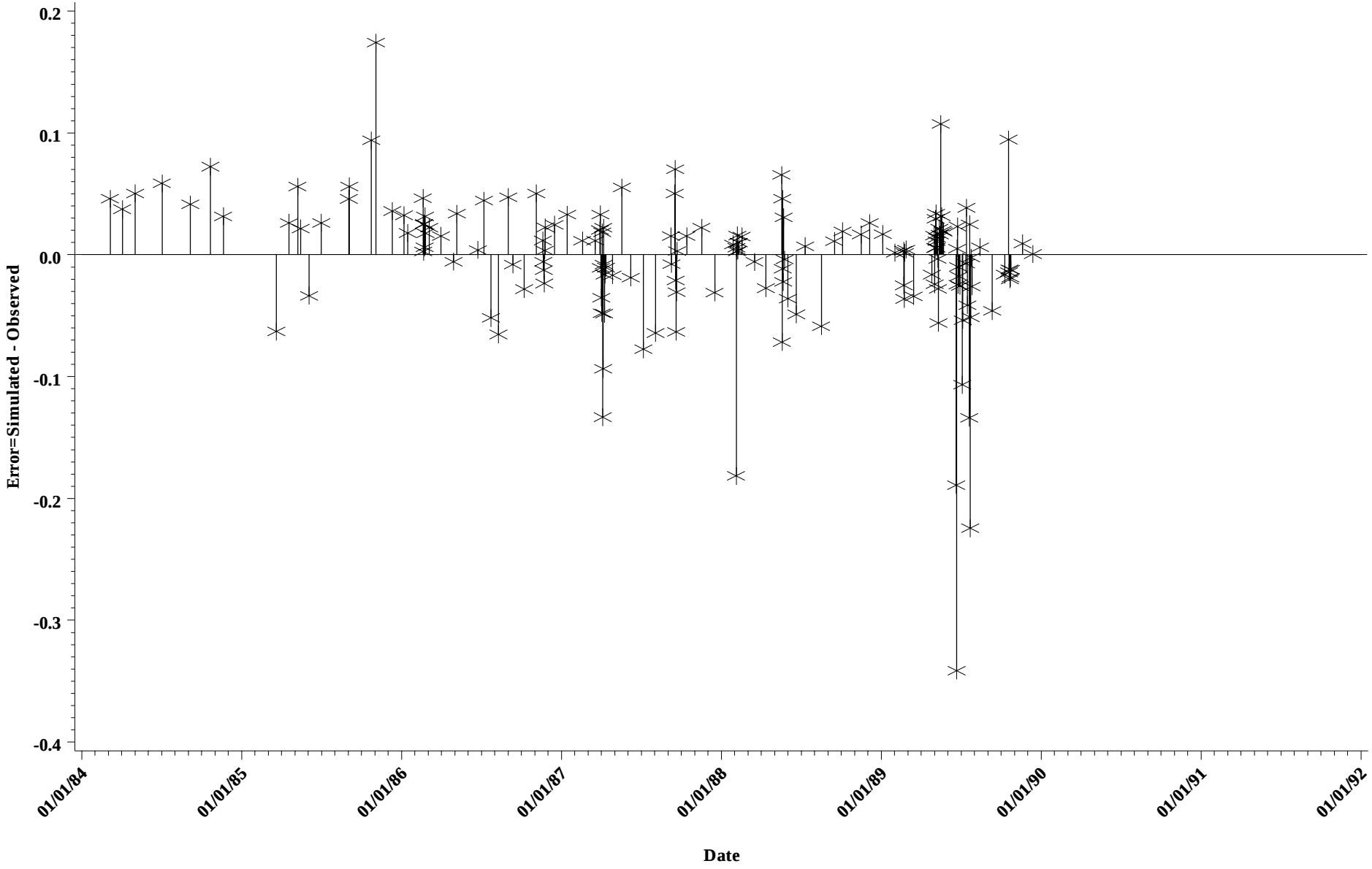
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92



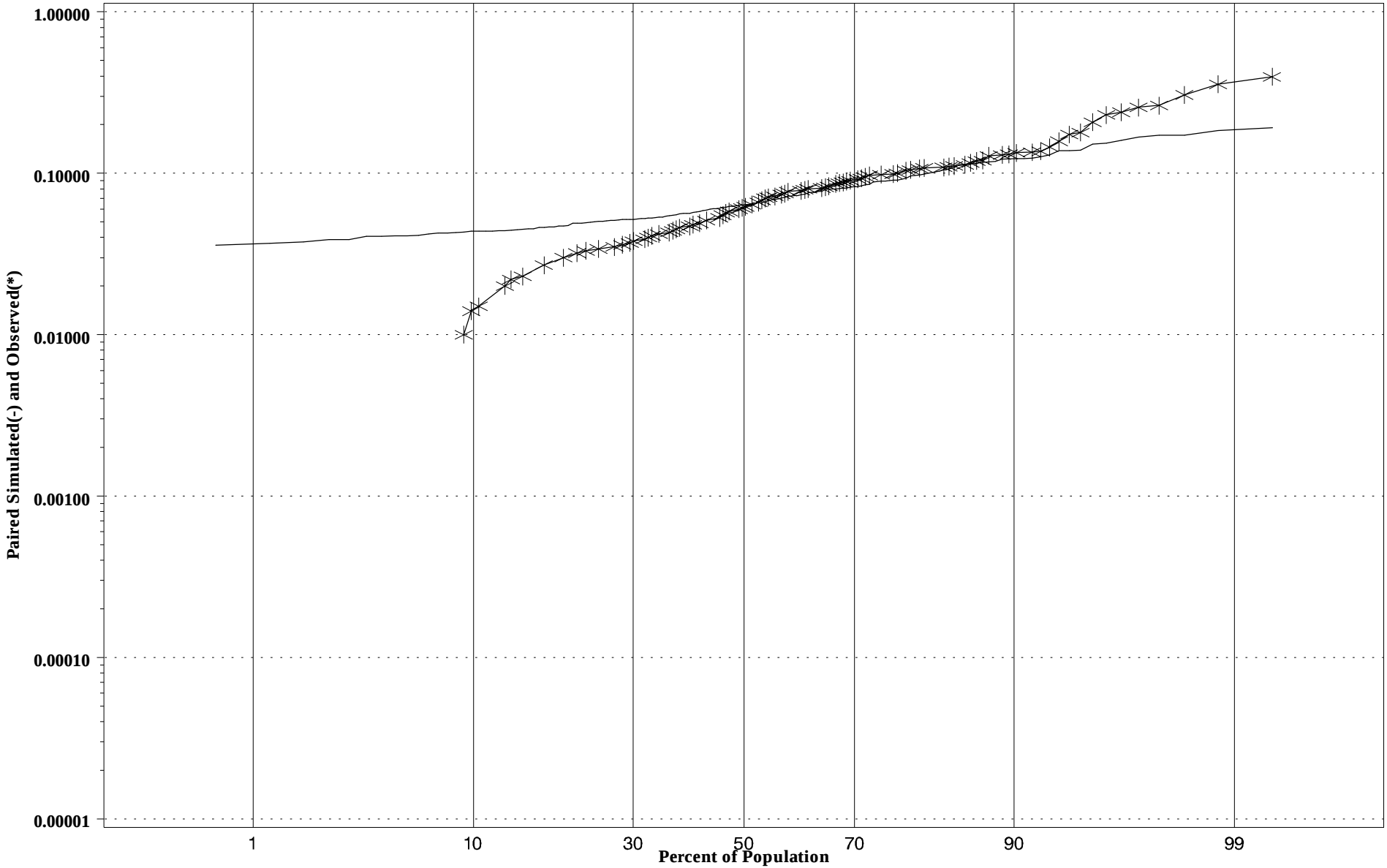

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100
## Actual Error versus Time
## Organic and Particulate Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(junia_d.drv1 26JUN98 08:53)

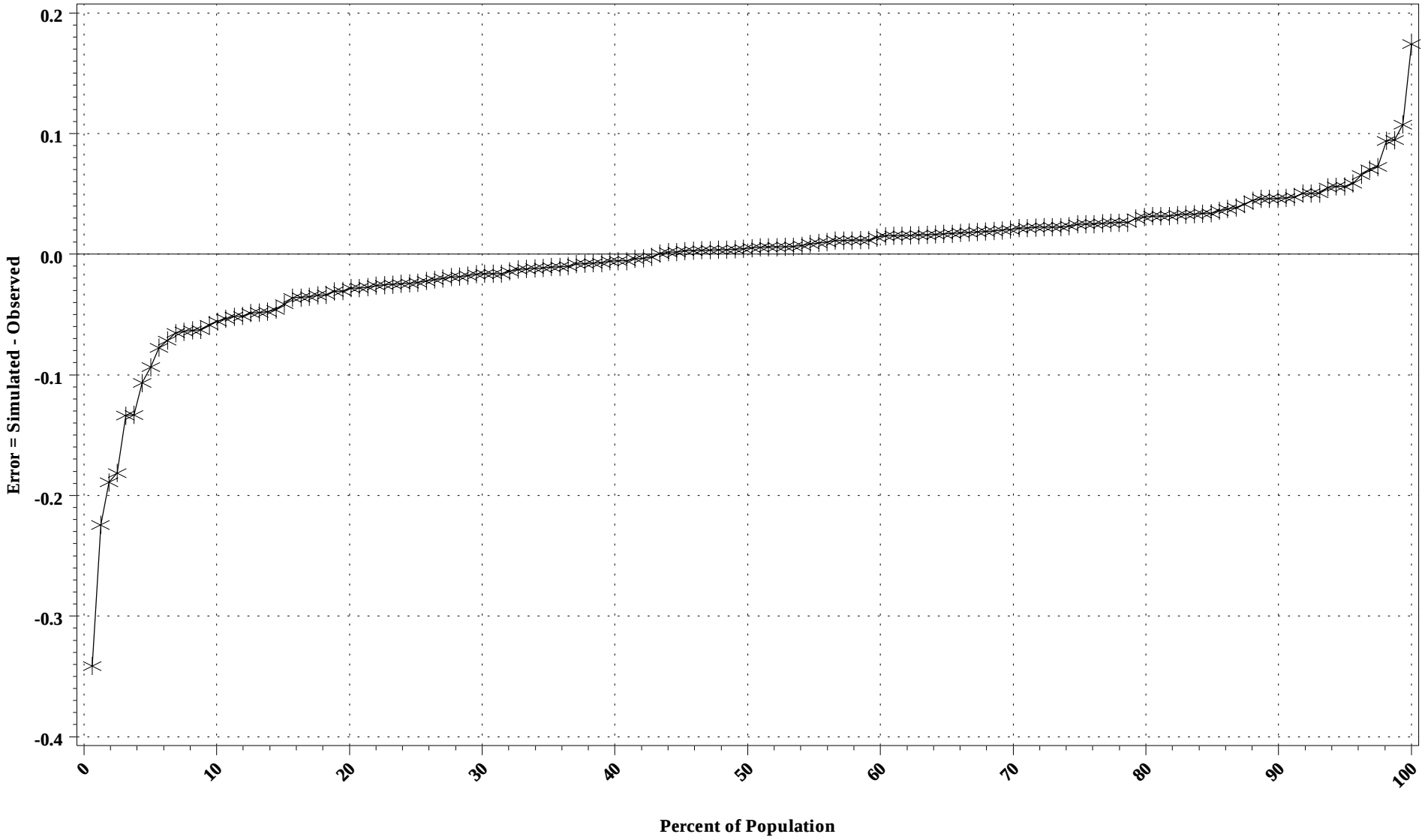
# Juniata River at Segment 100
## Organic and Particulate Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

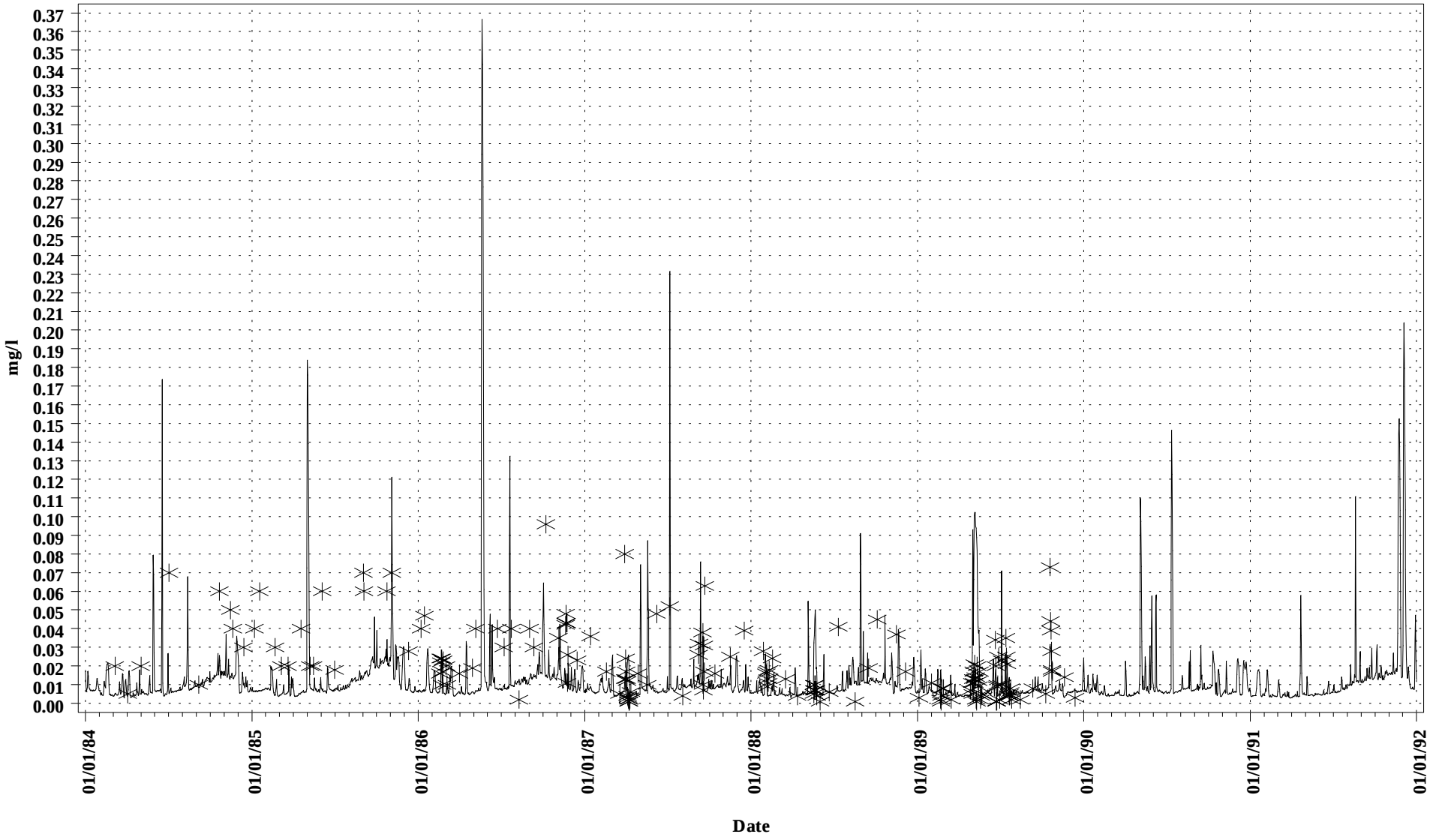
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(junia_d.drv1 26JUN98 08:53)

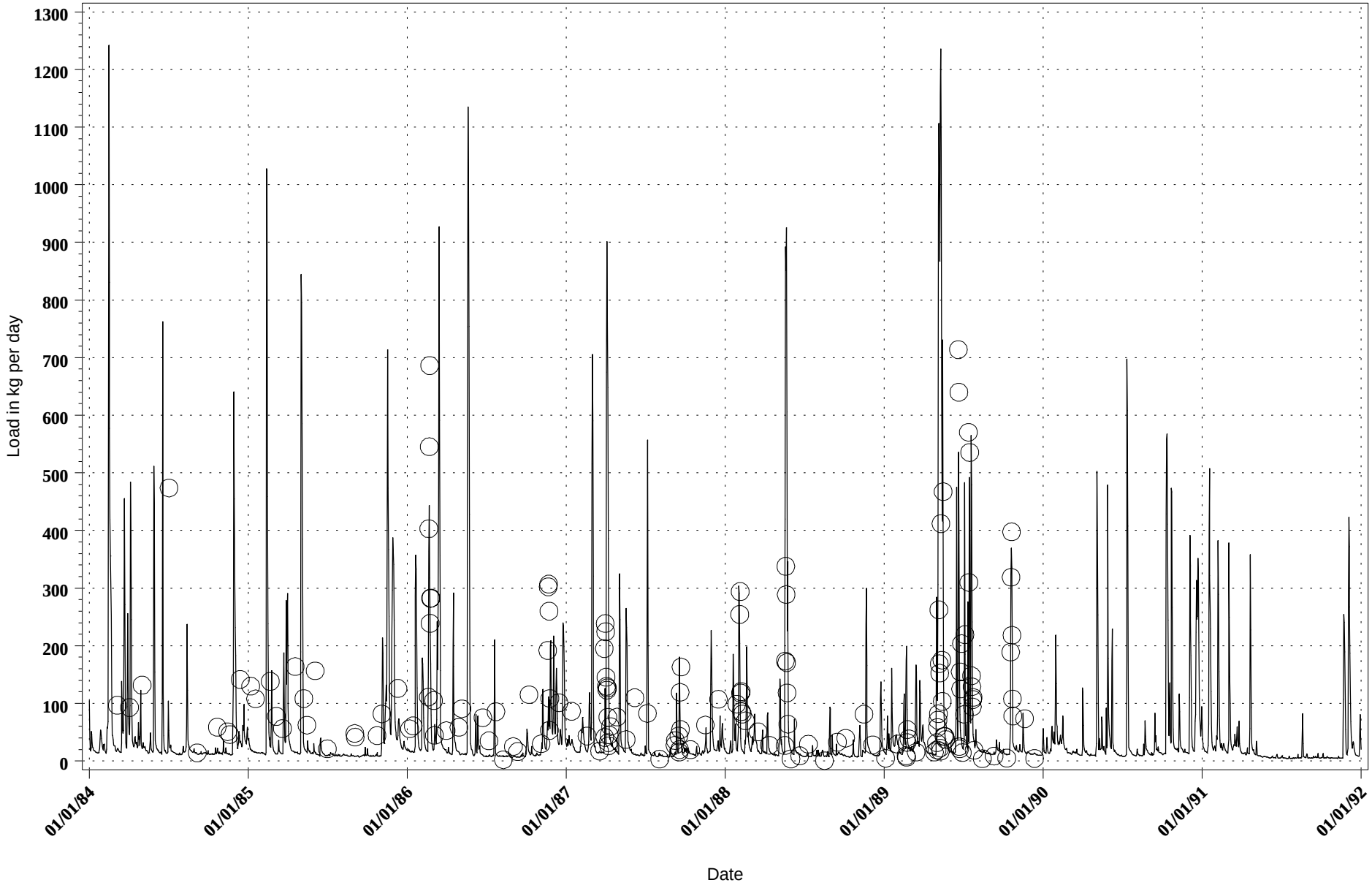
# Juniata River at Segment 100
## Observed and Simulated versus Time
# Dissolved Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Dissolved Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

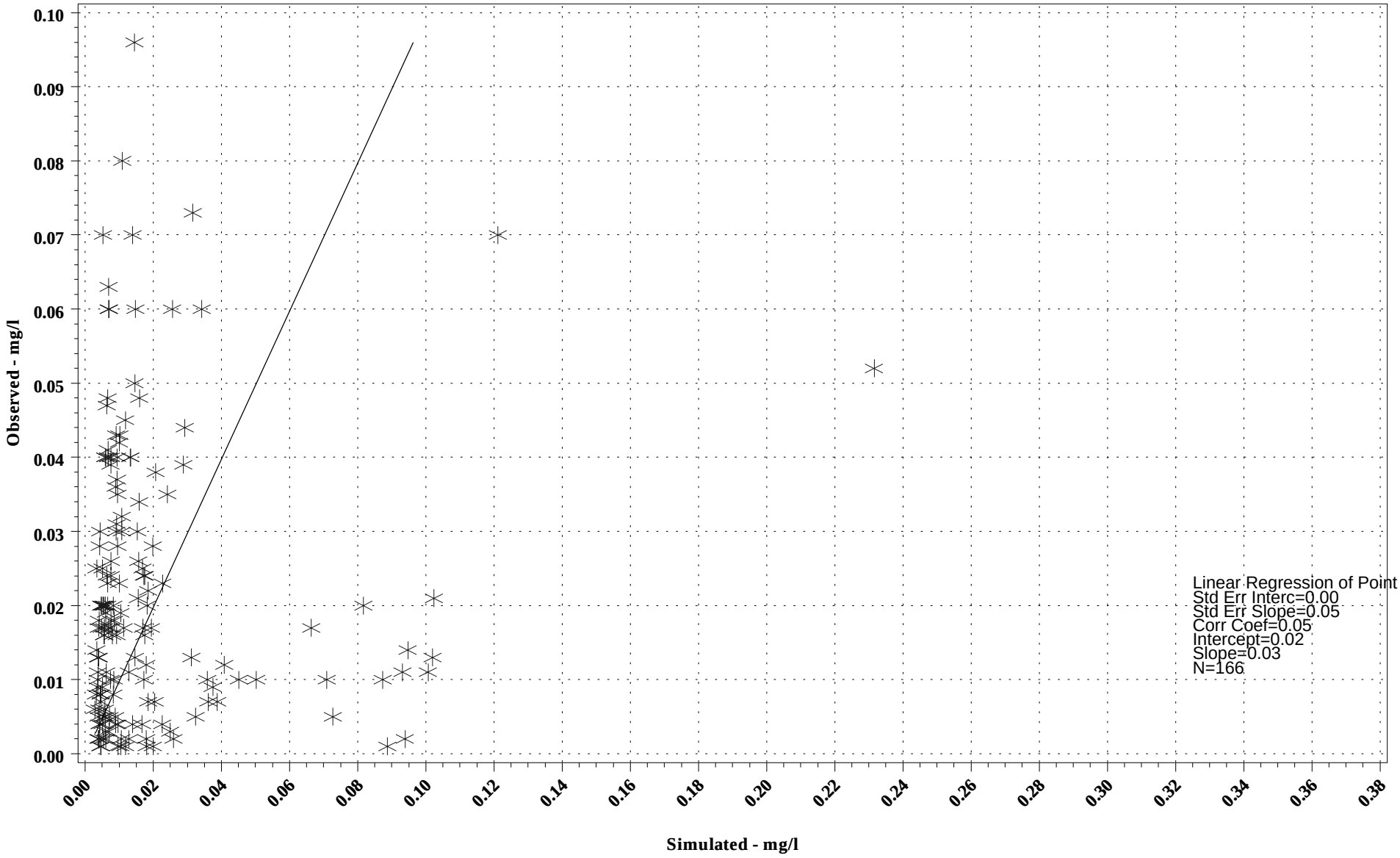



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100

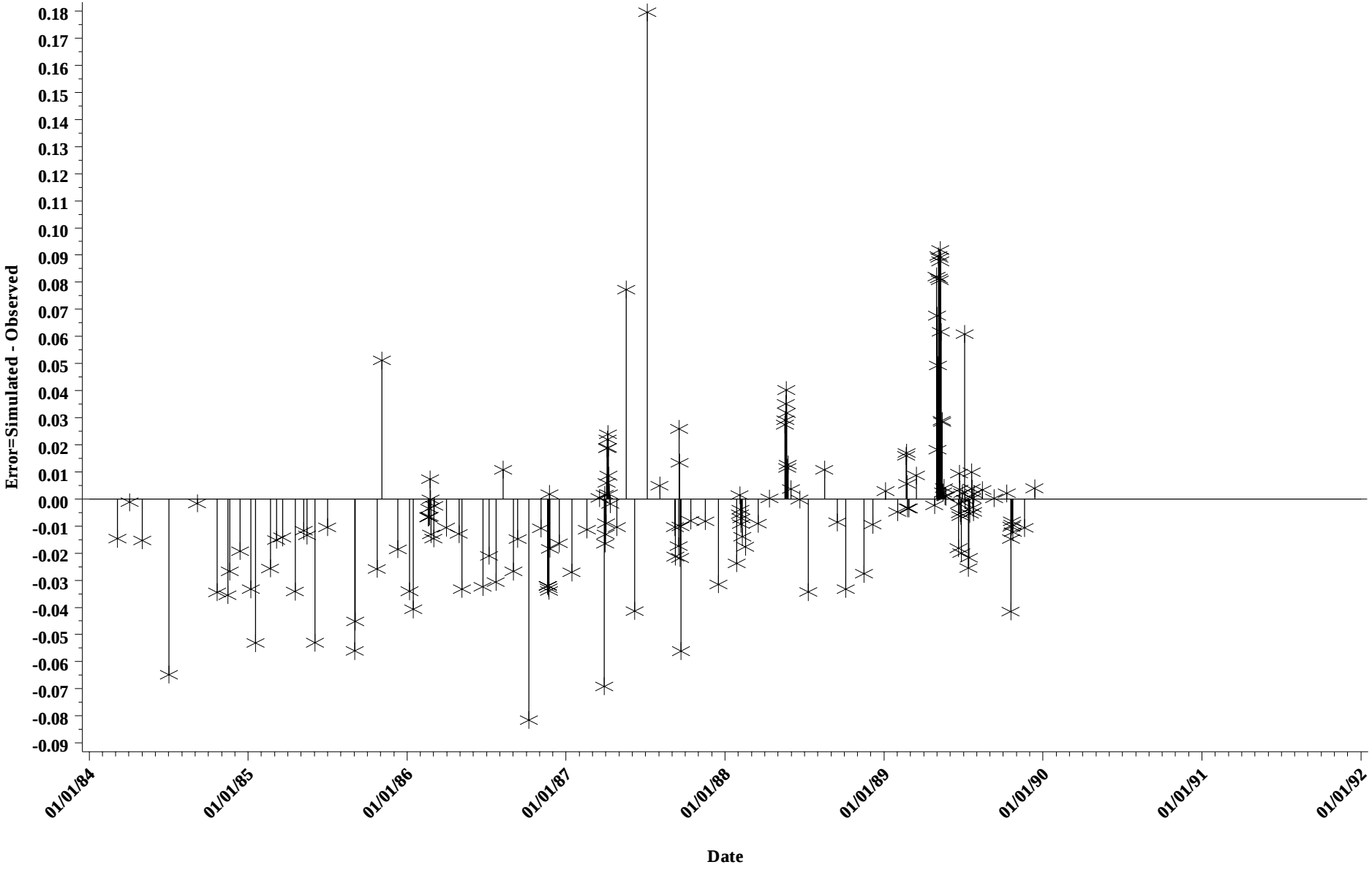
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



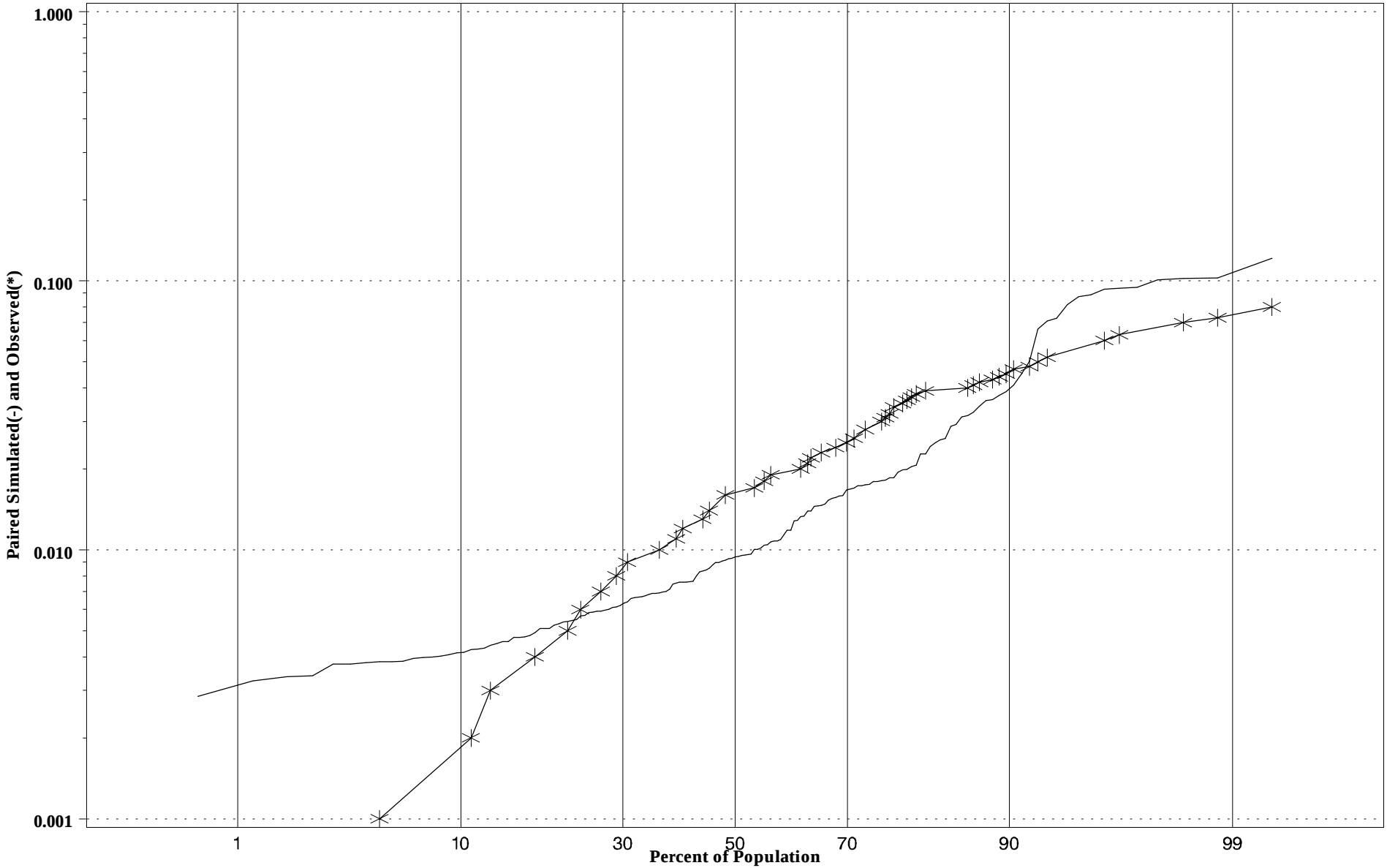

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(junia_d.drv1 26JUN98 08:53)

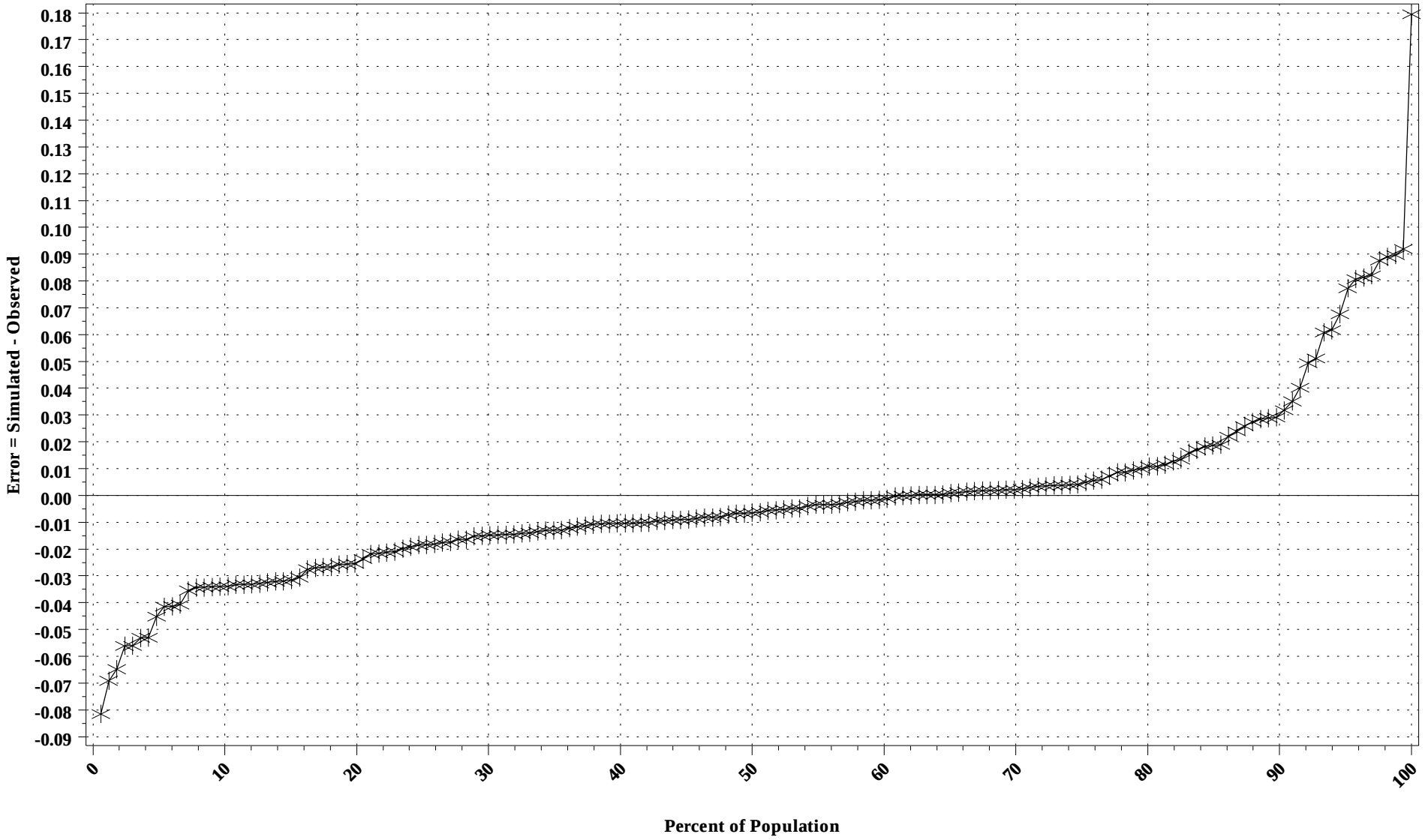
# Juniata River at Segment 100
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

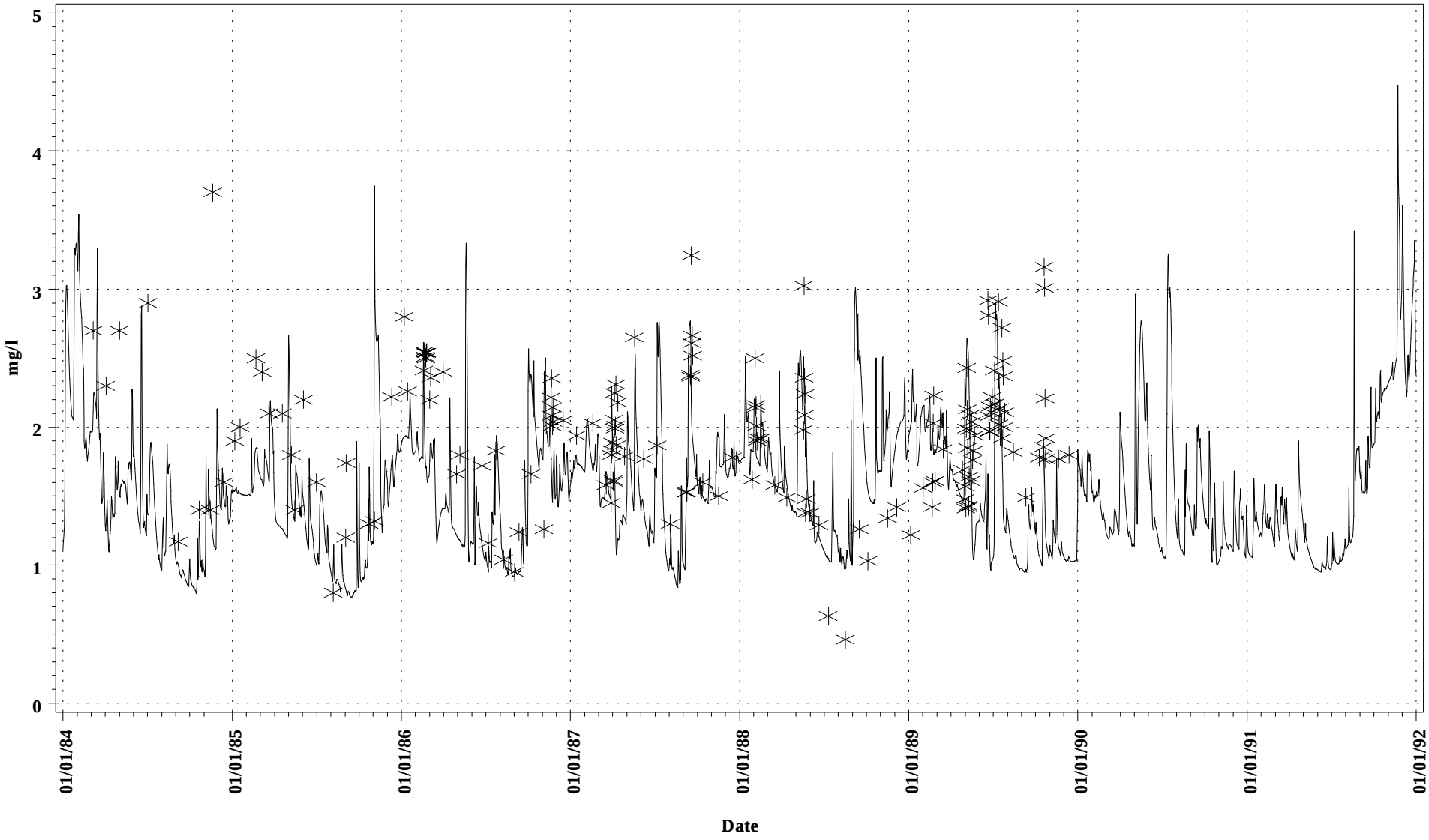
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(junia_d.drv1 26JUN98 08:53)

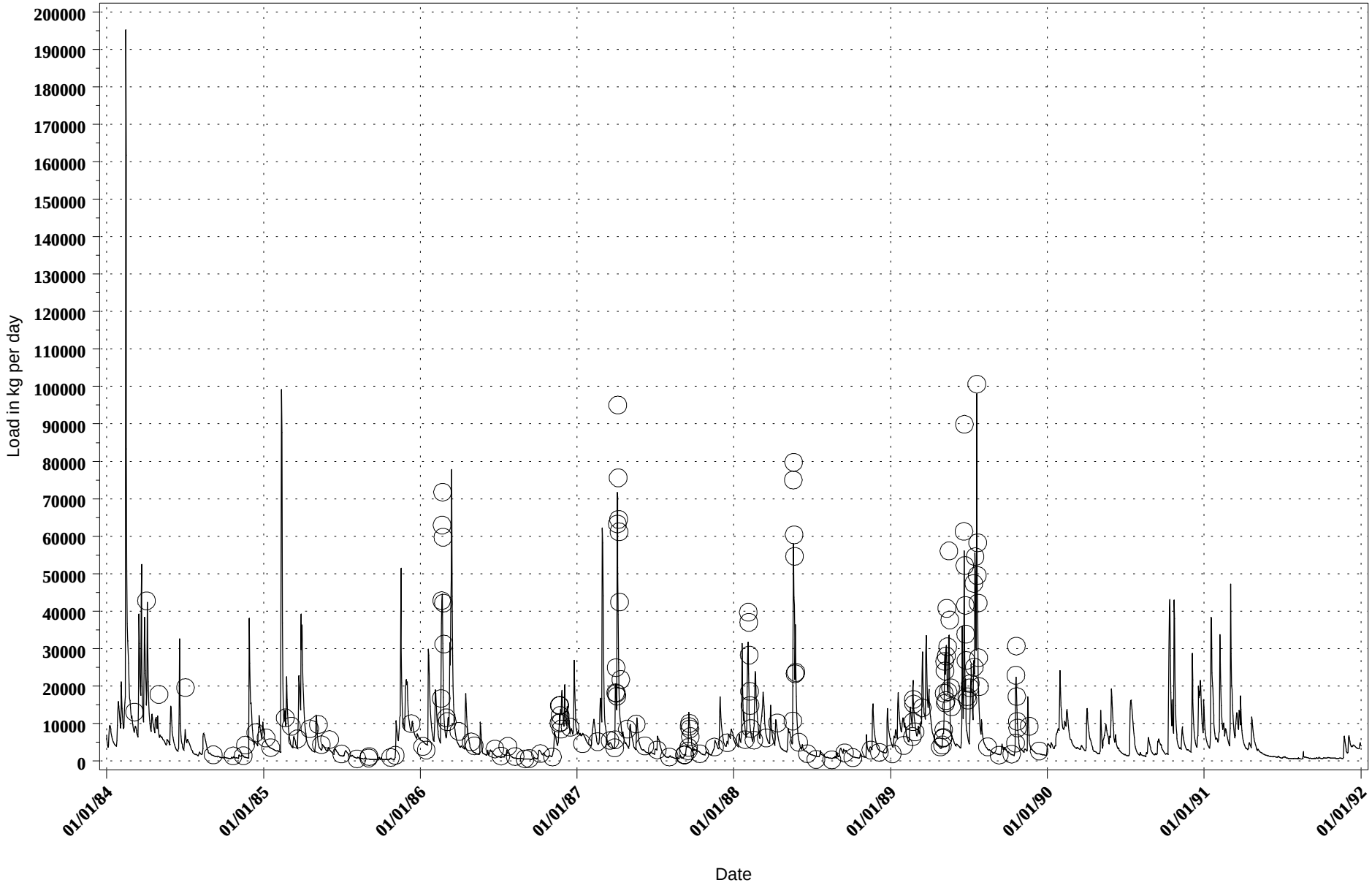
# Juniata River at Segment 100
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

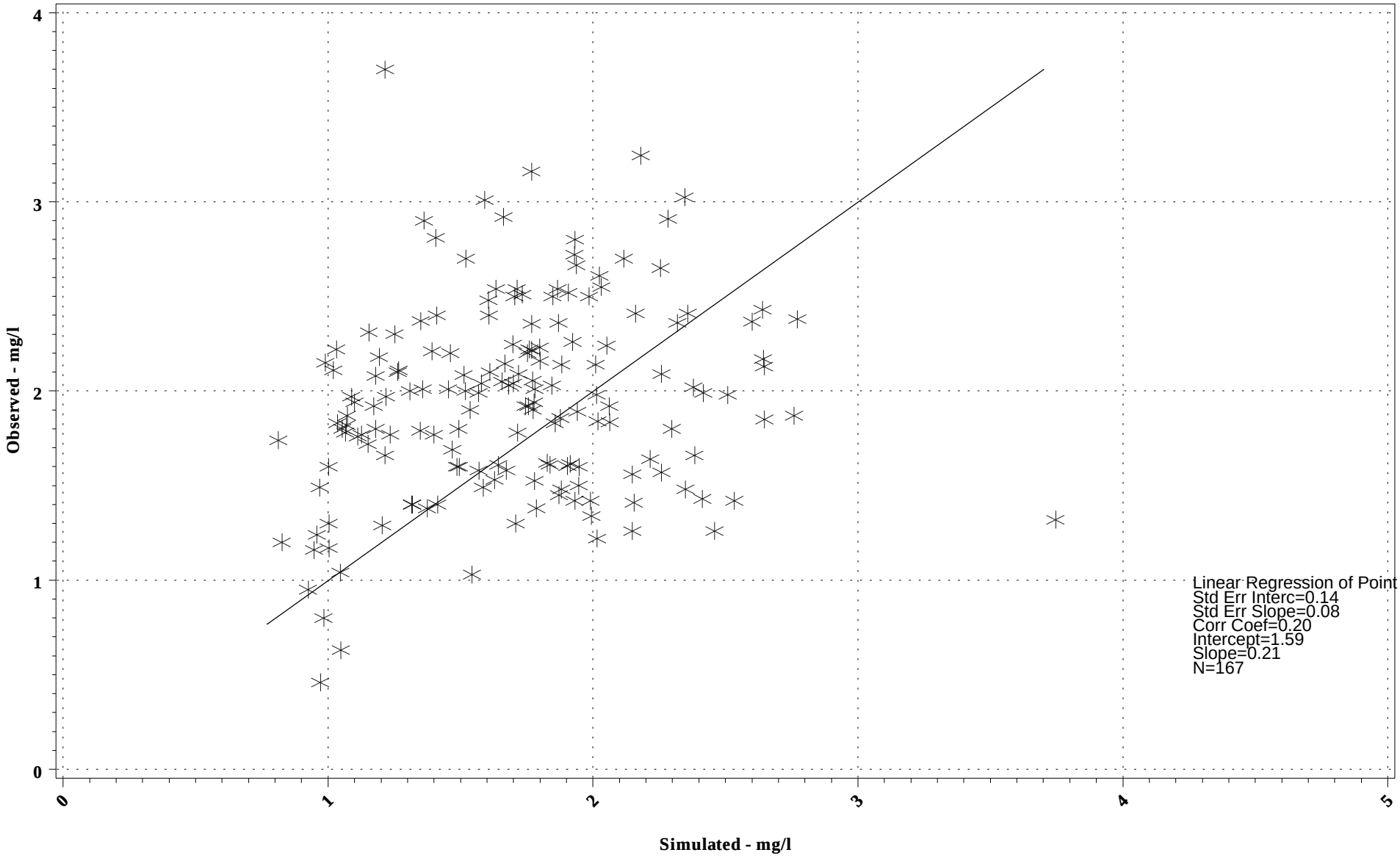



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100

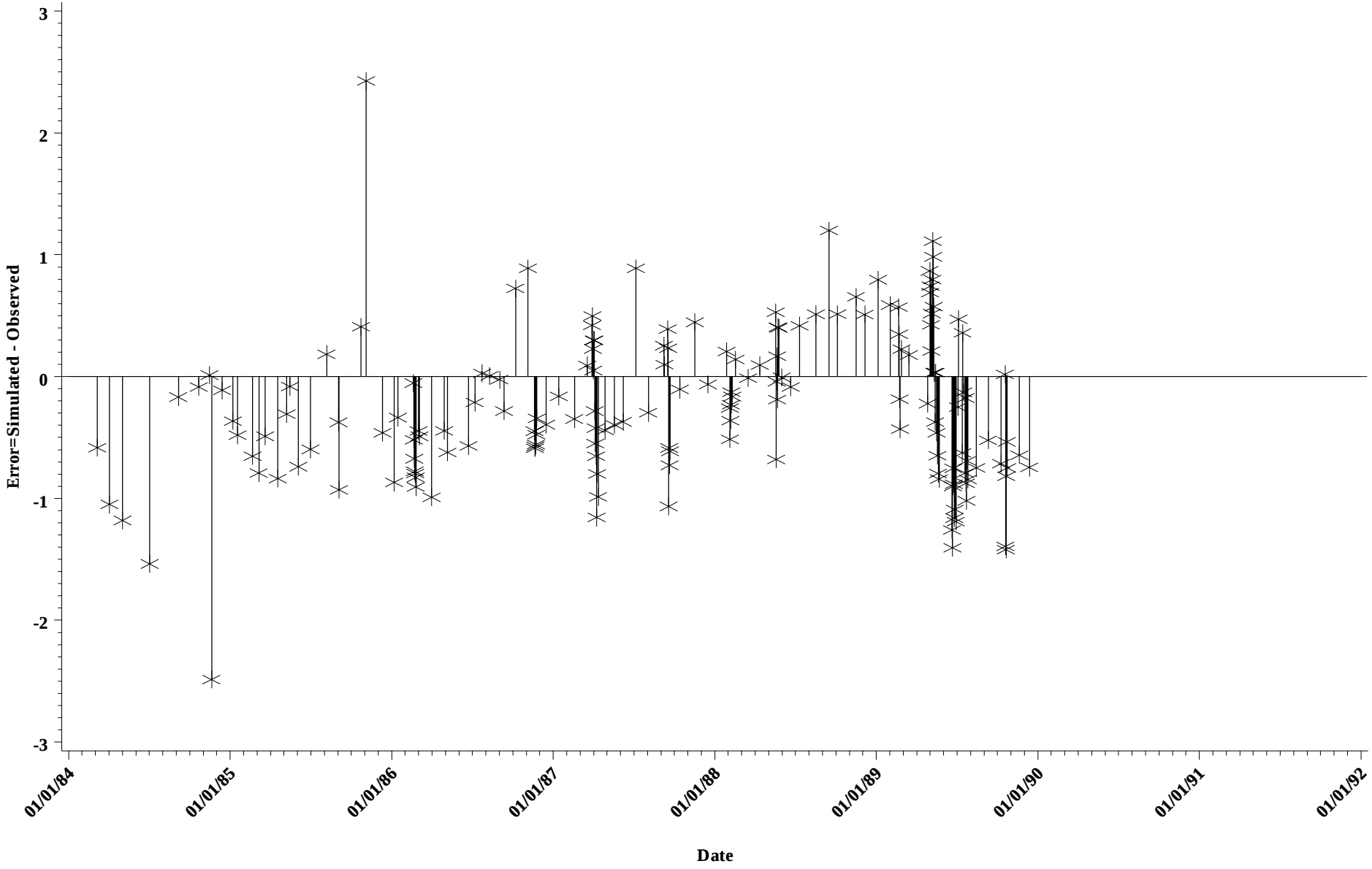
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92



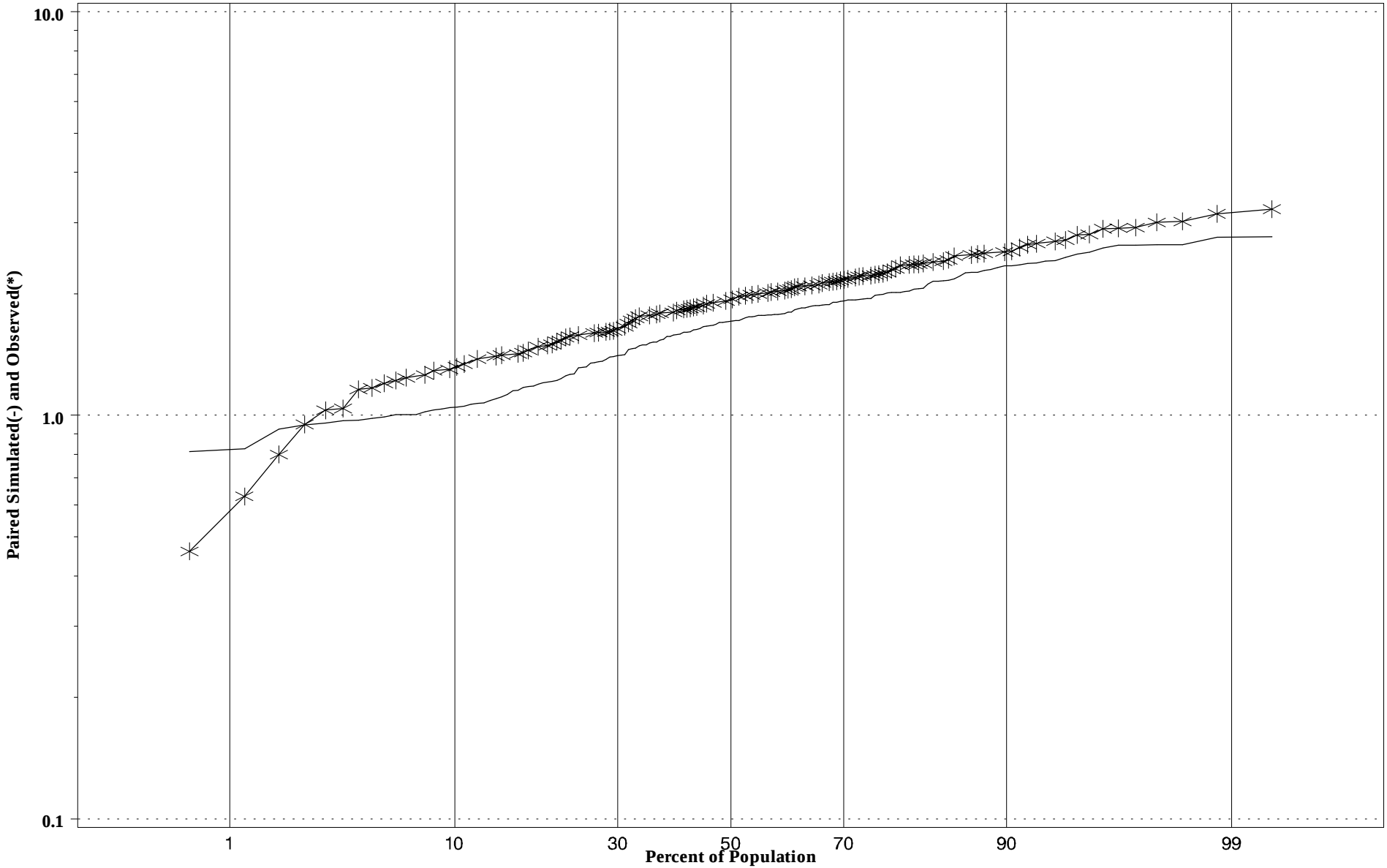

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100
## Actual Error versus Time
## Total Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(junia_d.drv1 26JUN98 08:53)

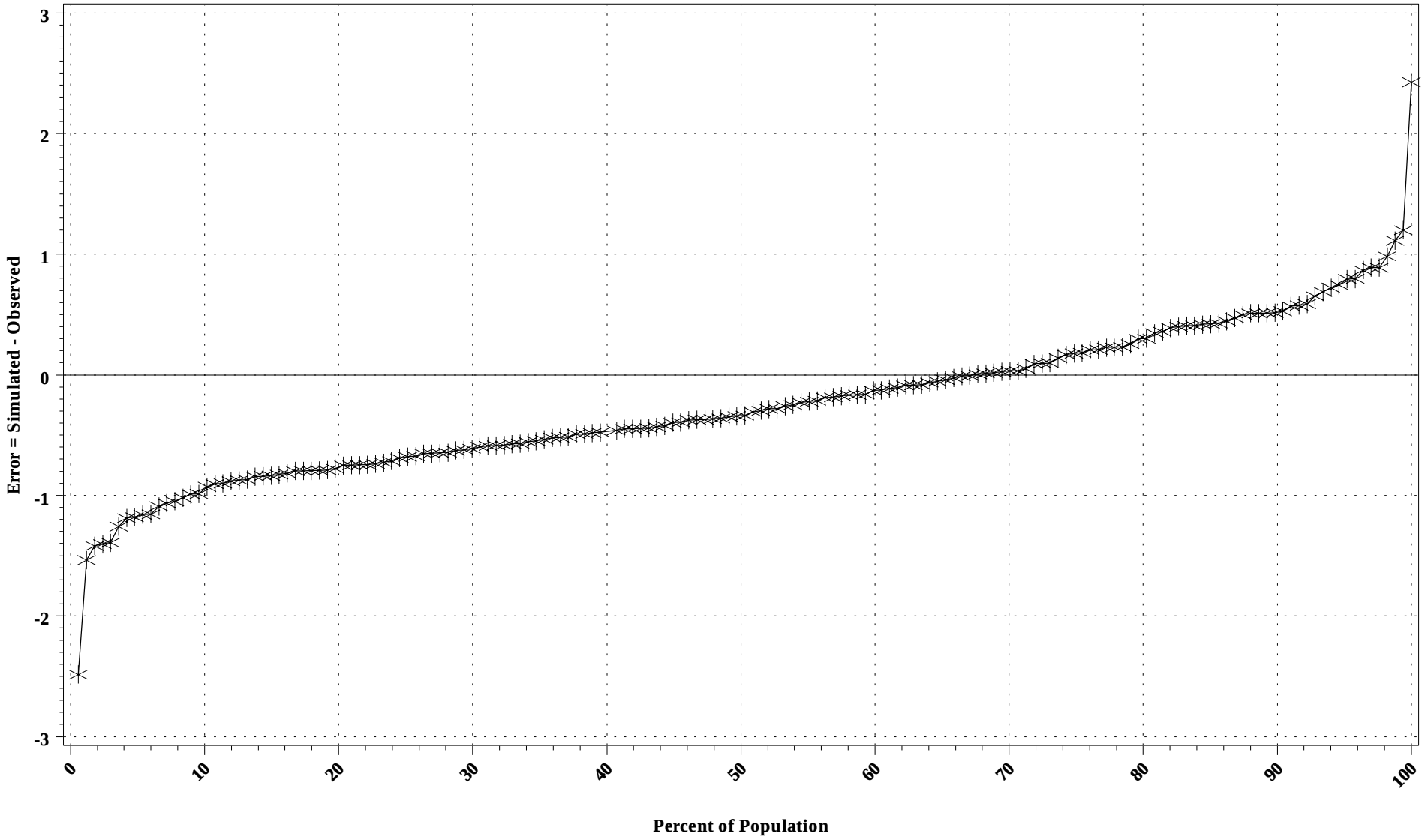
# Juniata River at Segment 100
## Total Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Actual error versus Percentile Sample Population
## Total Nitrogen

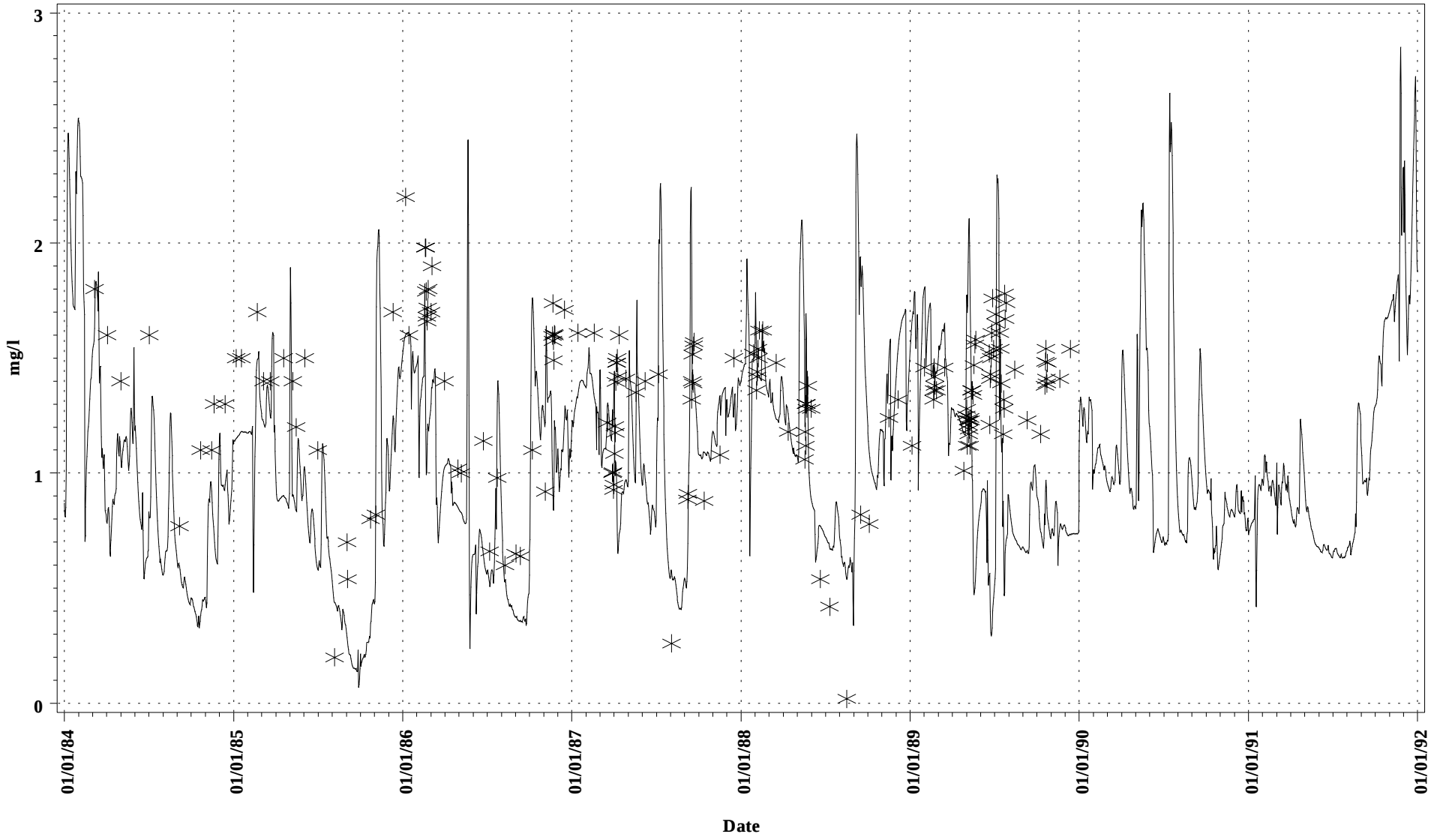
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(junia_d.drv1 26JUN98 08:53)

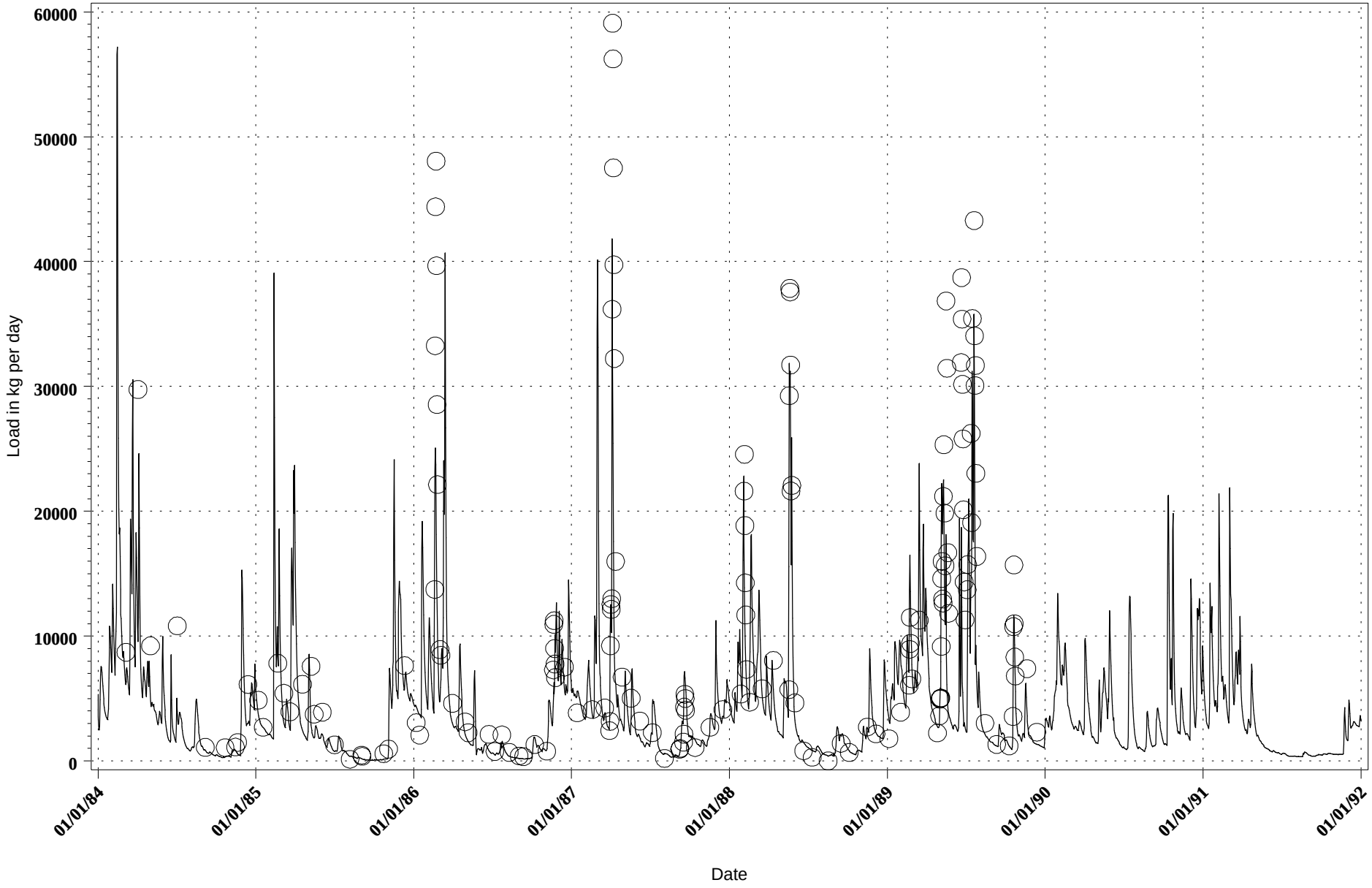
# Juniata River at Segment 100
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## NO3 Observed and Simulated Load vs Time
### (line = simulated, O = observed)

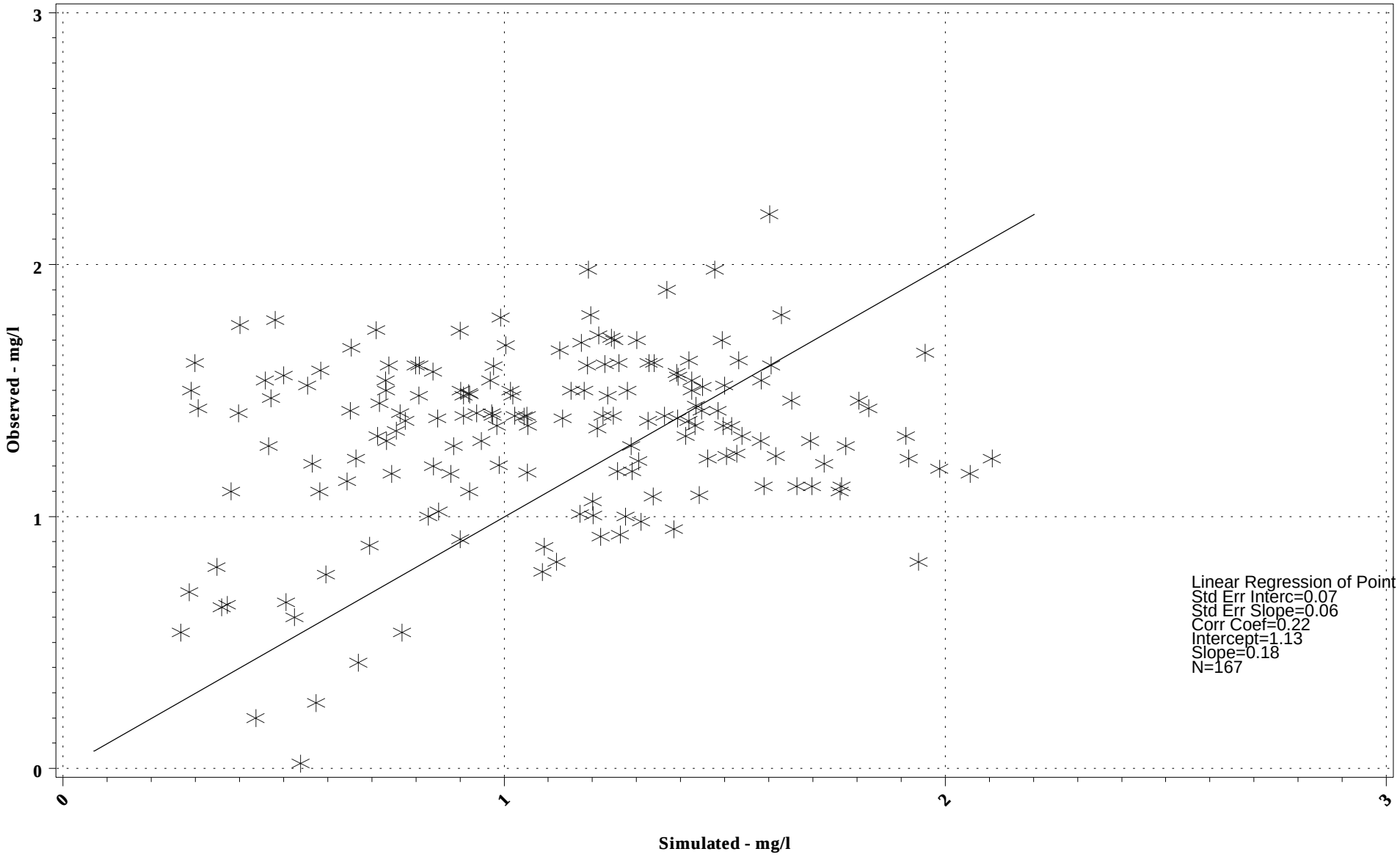



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100

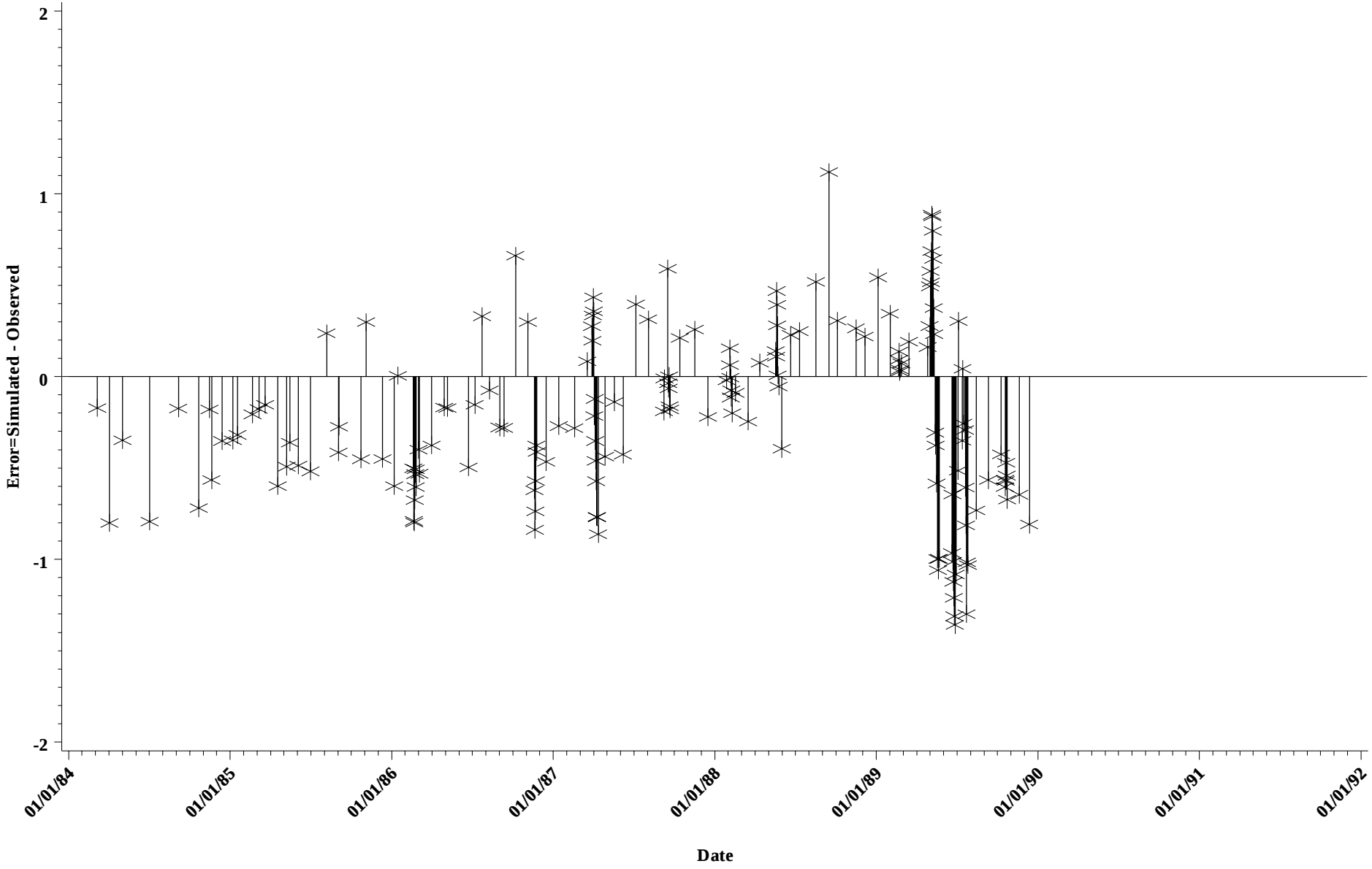
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100
## Actual Error versus Time
## NO3

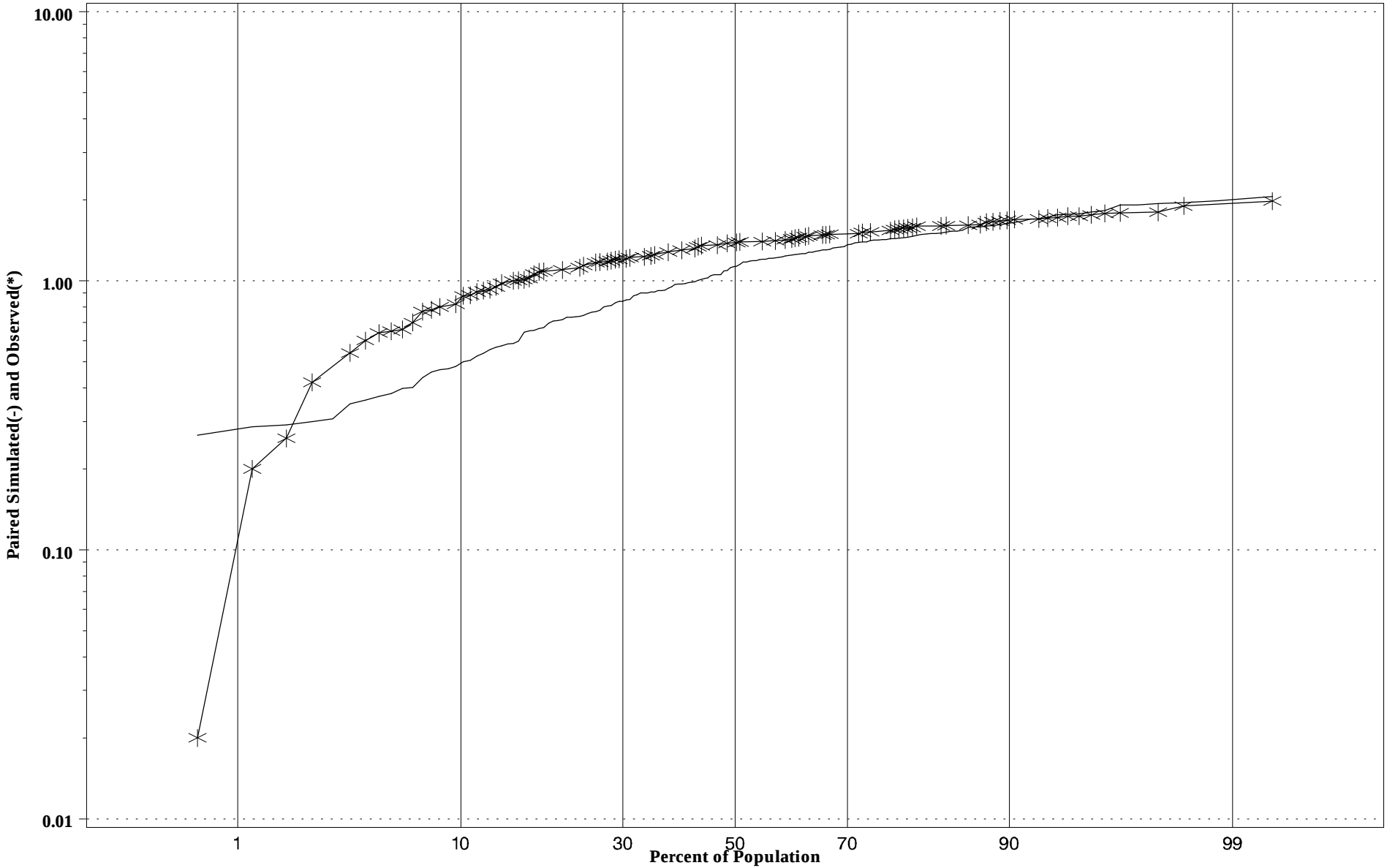



(y21_plotb.sas model3d:[pwang.dt] omerr)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100

## NO3

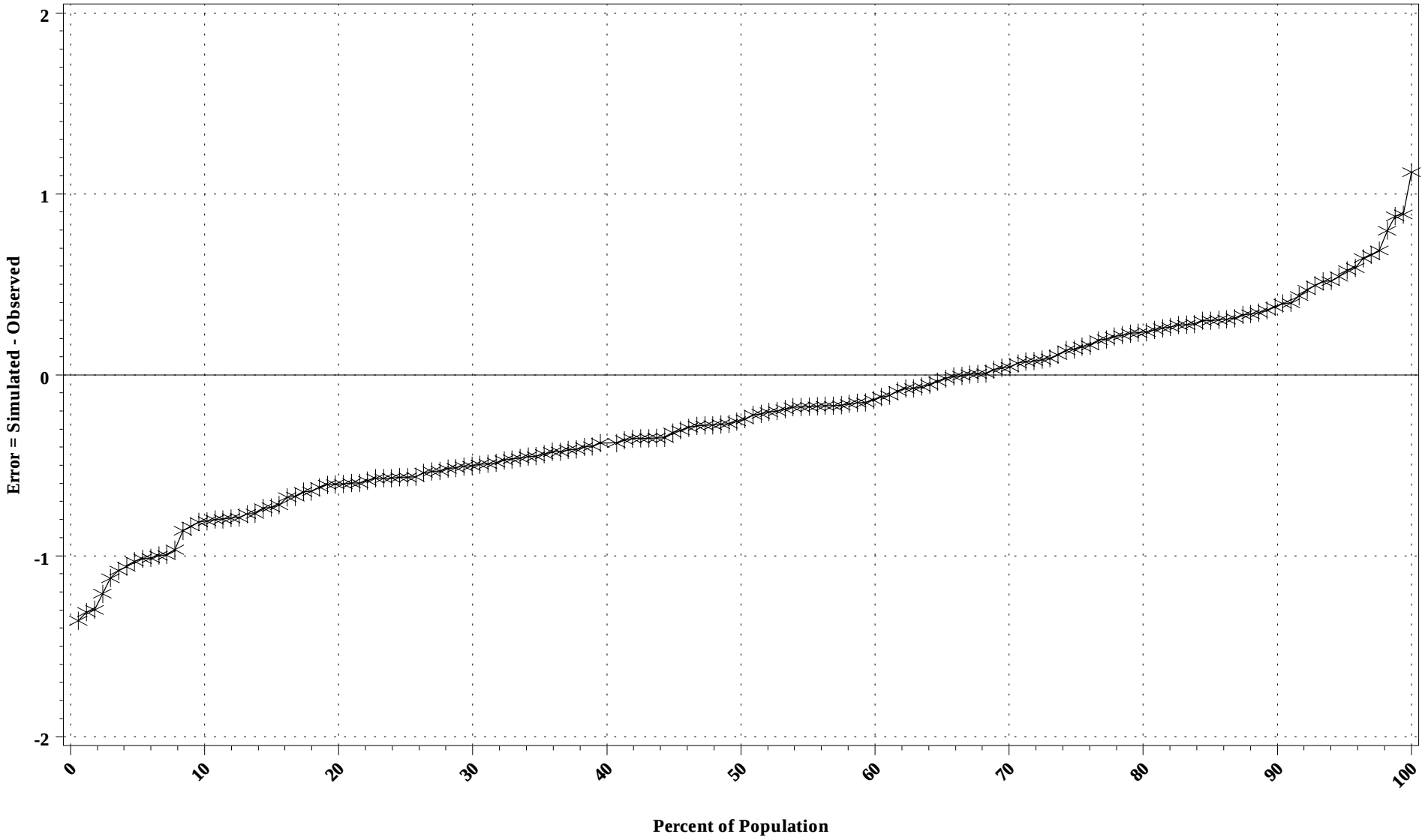
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Actual error versus Percentile Sample Population
## NO3

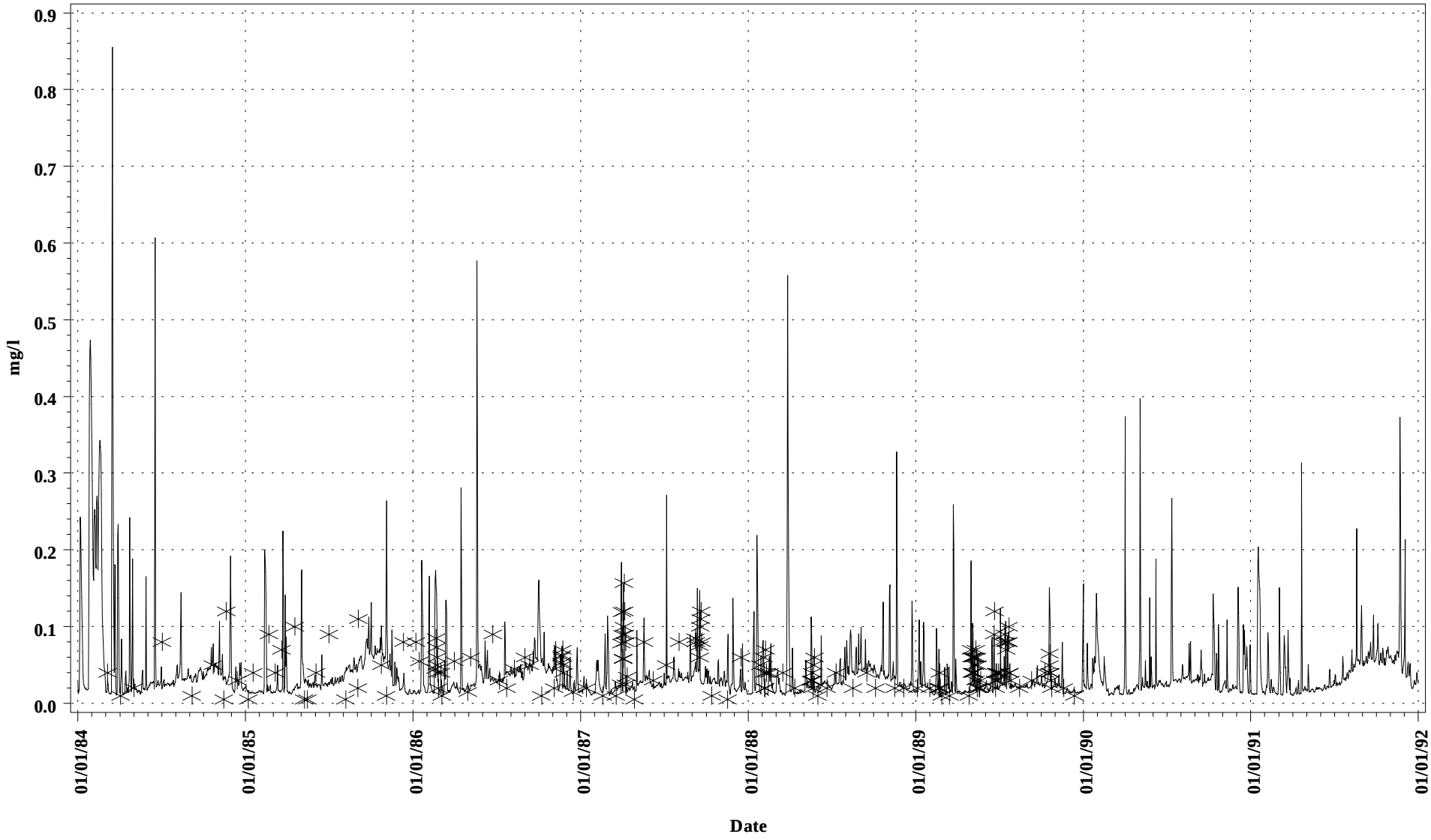
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(junia_d.drv1 26JUN98 08:53)

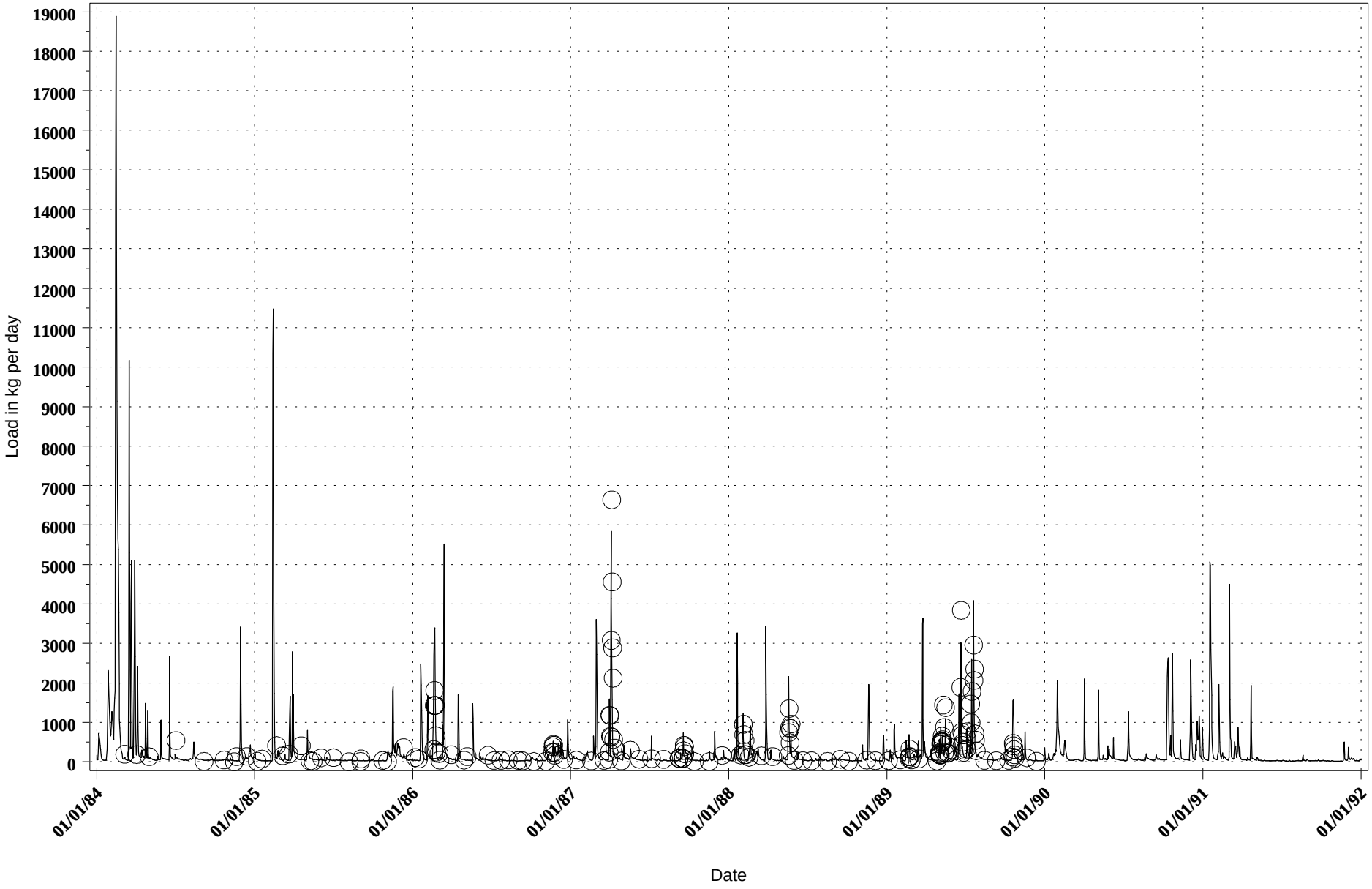
# Juniata River at Segment 100
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Total Ammonia Observed and Simulated Load vs Time
### (line = simulated, O = observed)

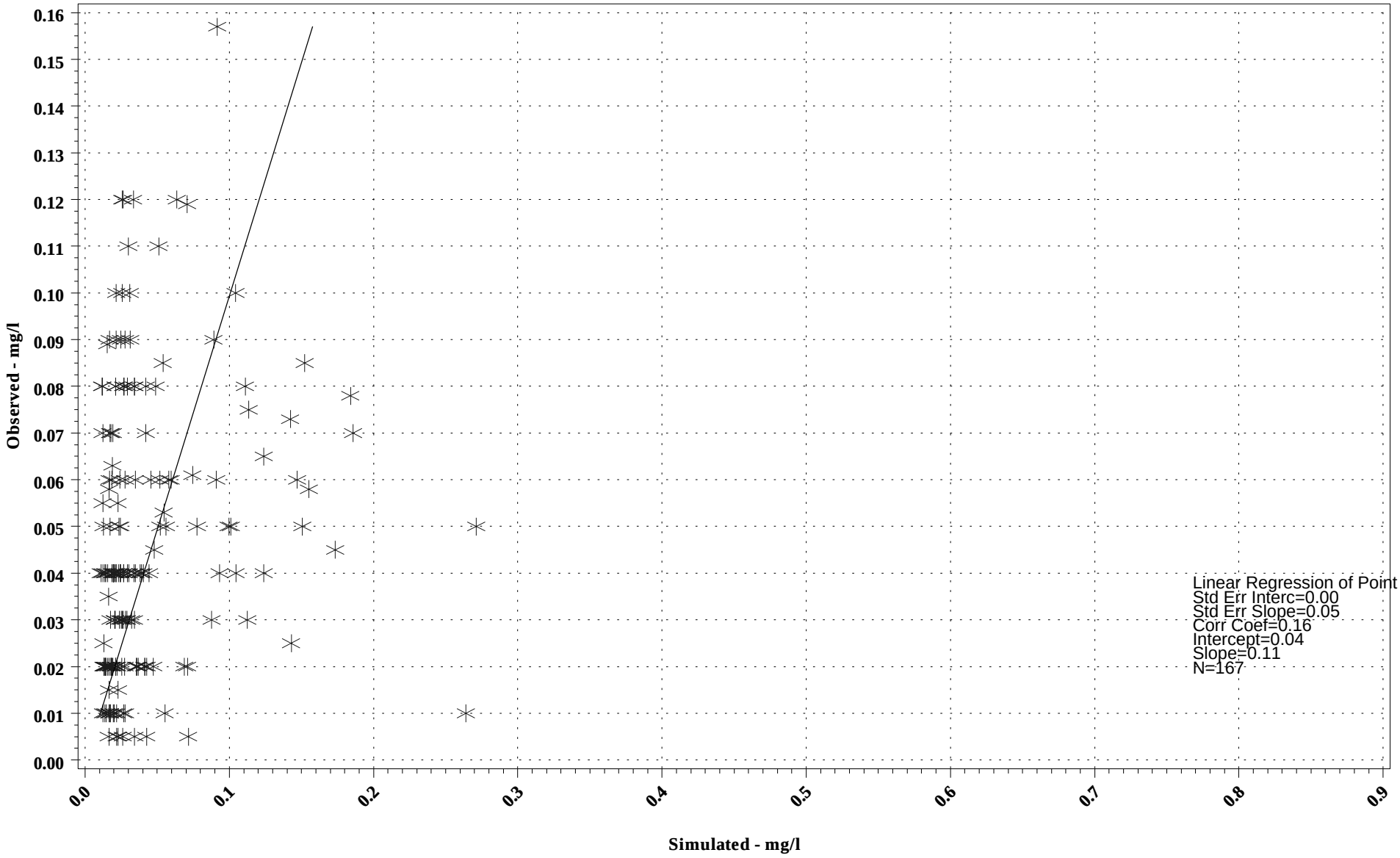



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100

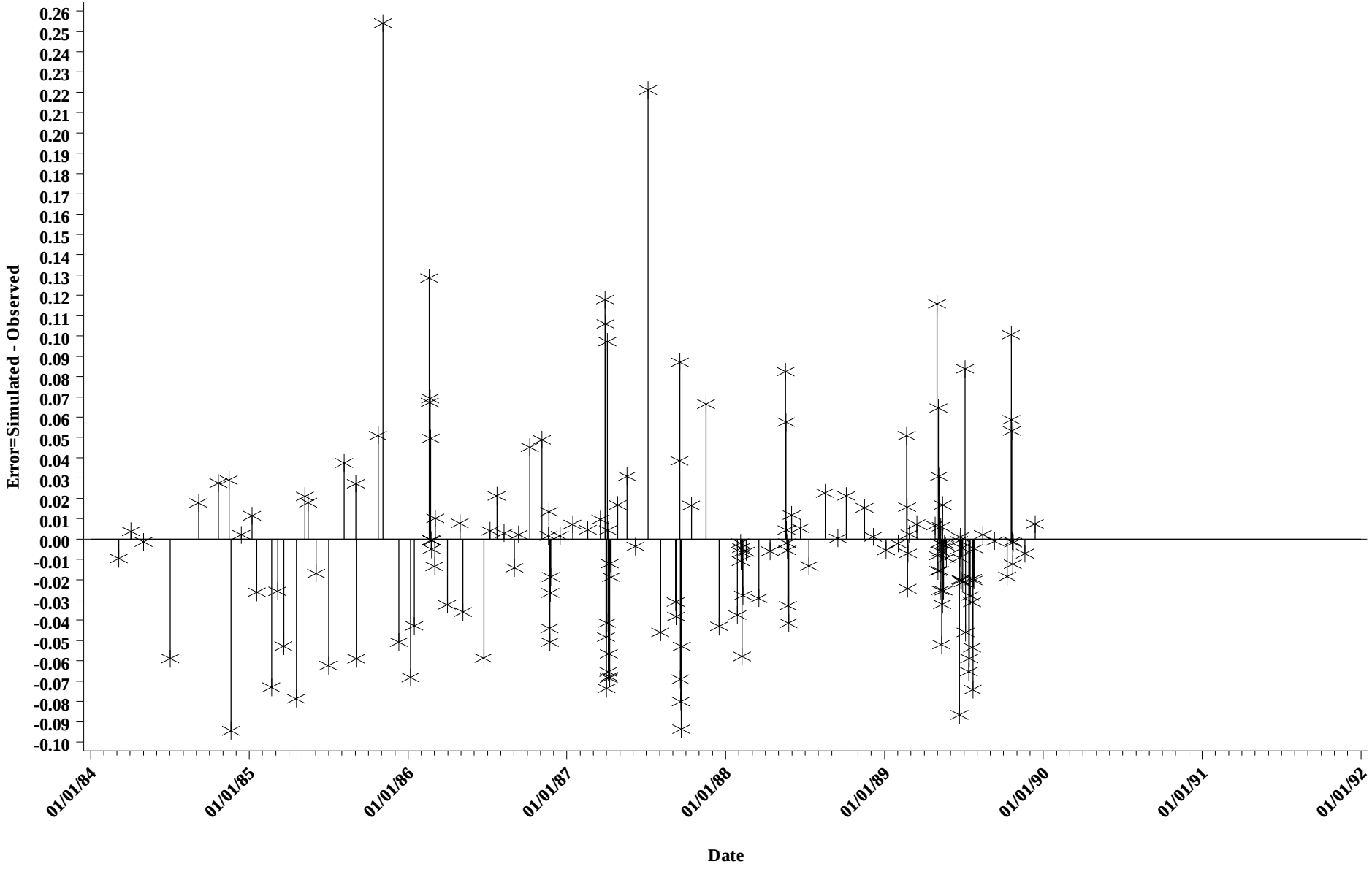
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92



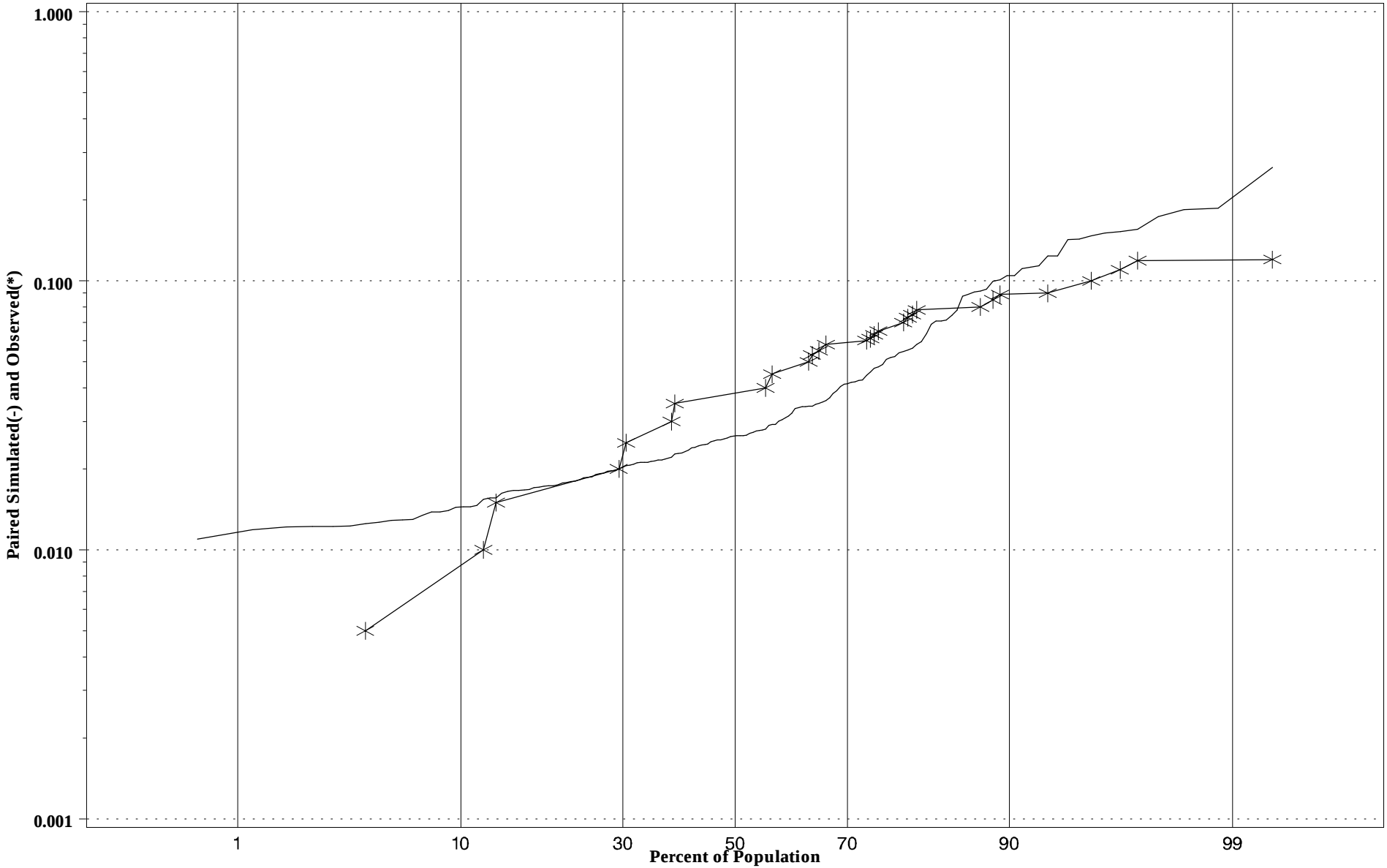

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100
## Actual Error versus Time
## Total Ammonia




(y21_plotb.sas model3d:[pwang.dt] omerr)
(junia_d.drv1 26JUN98 08:53)

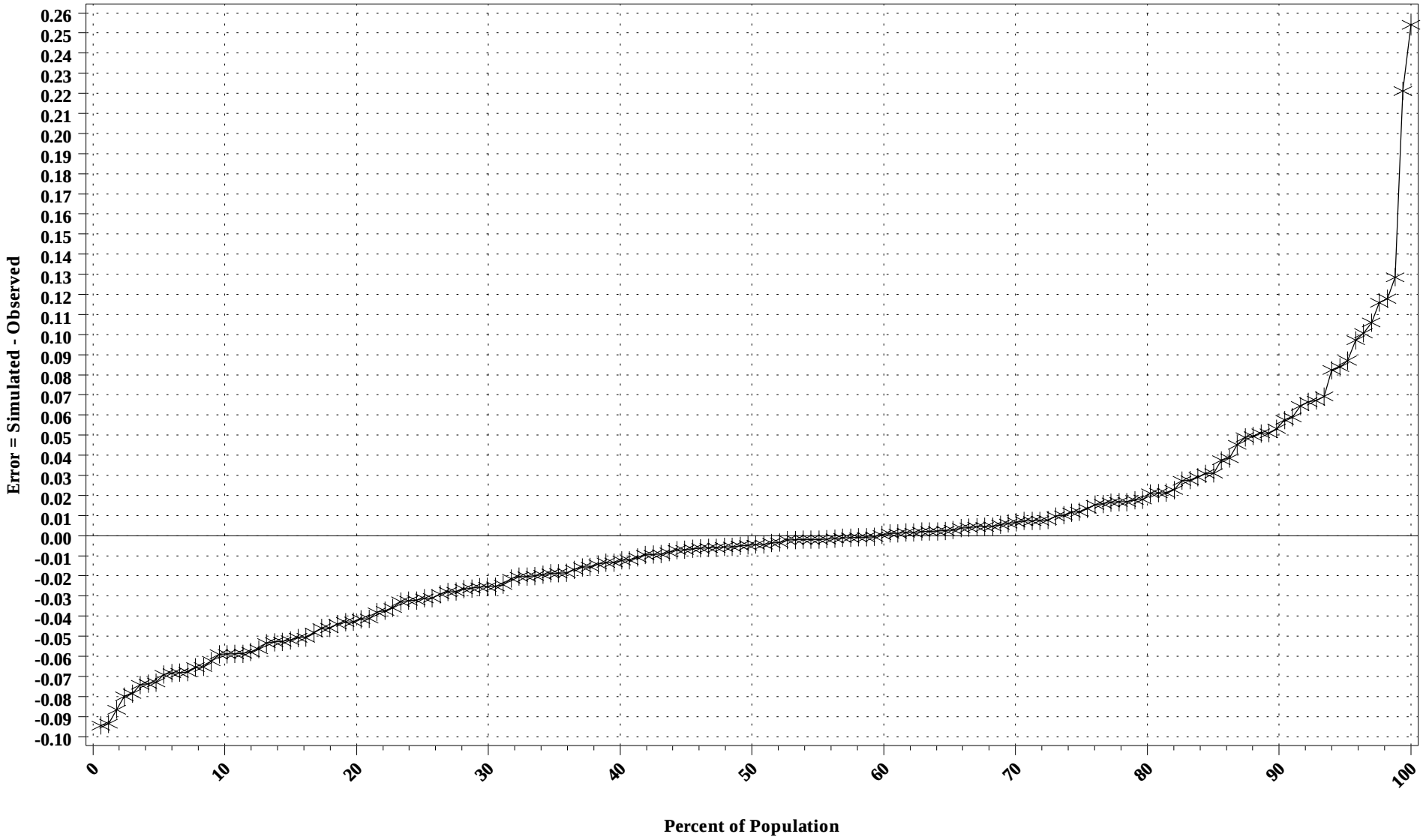
# Juniata River at Segment 100
## Total Ammonia
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(junia_d.drv1 26JUN98 08:53)

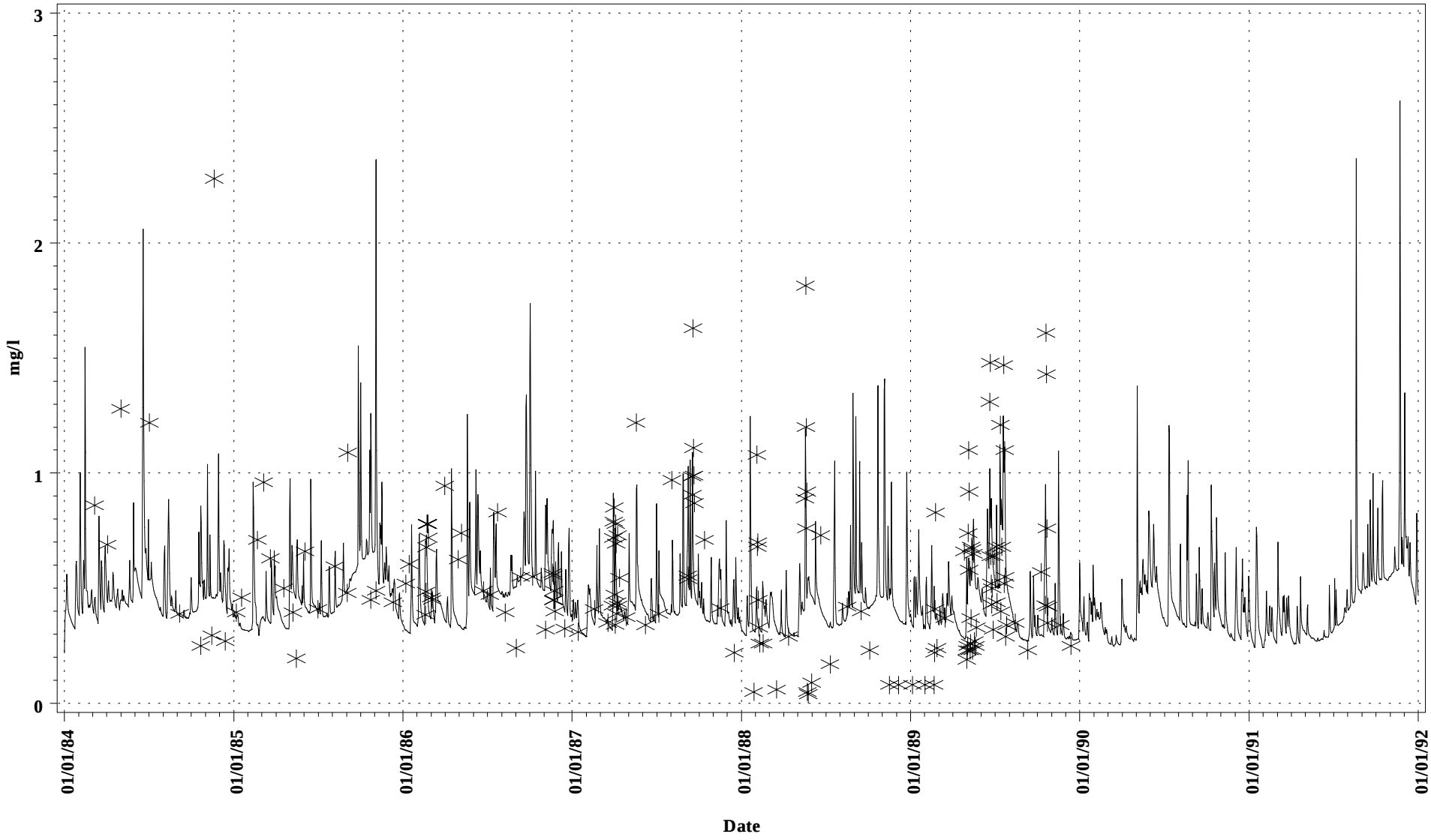
# Juniata River at Segment 100
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data



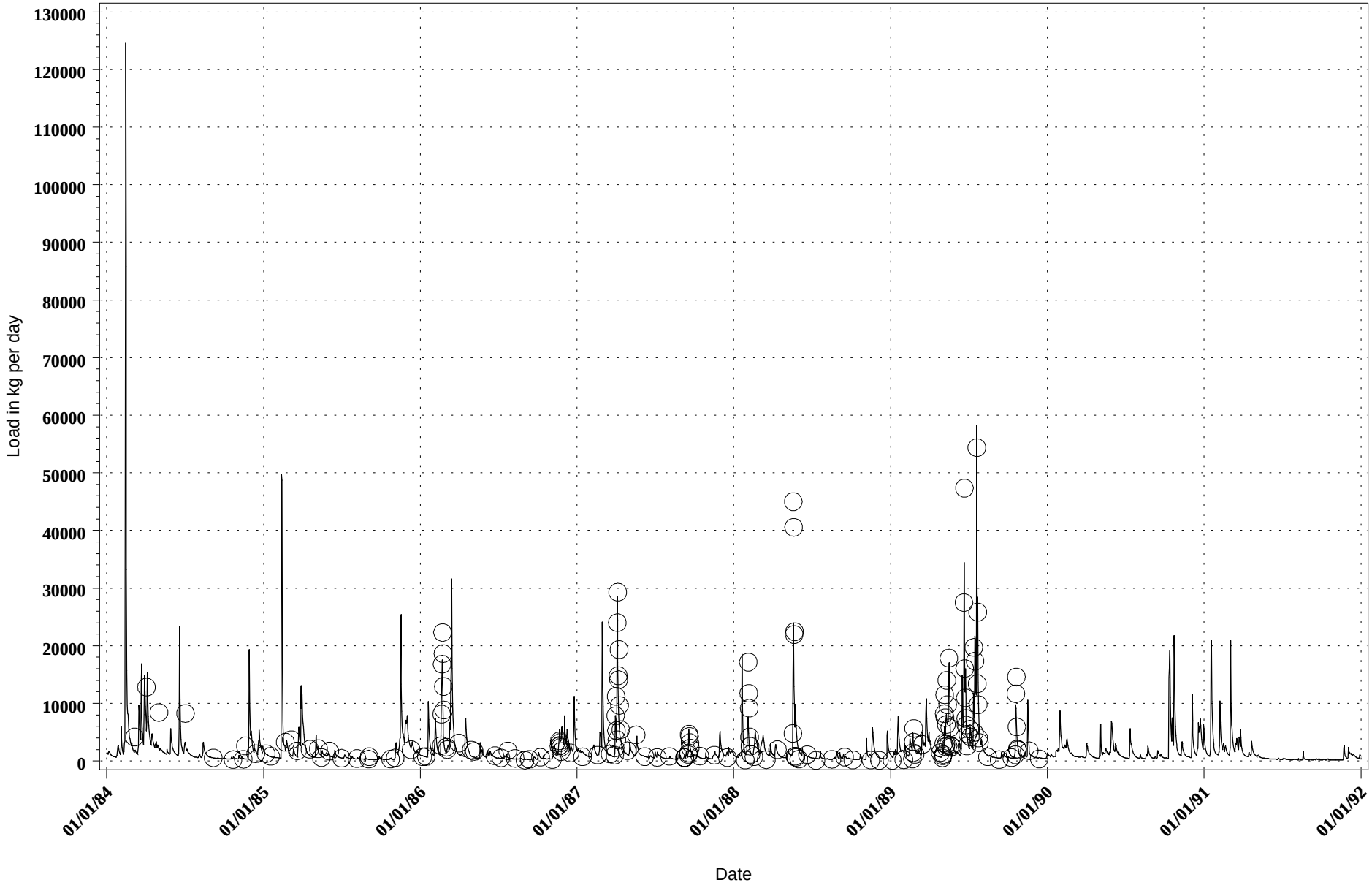

(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Organic Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

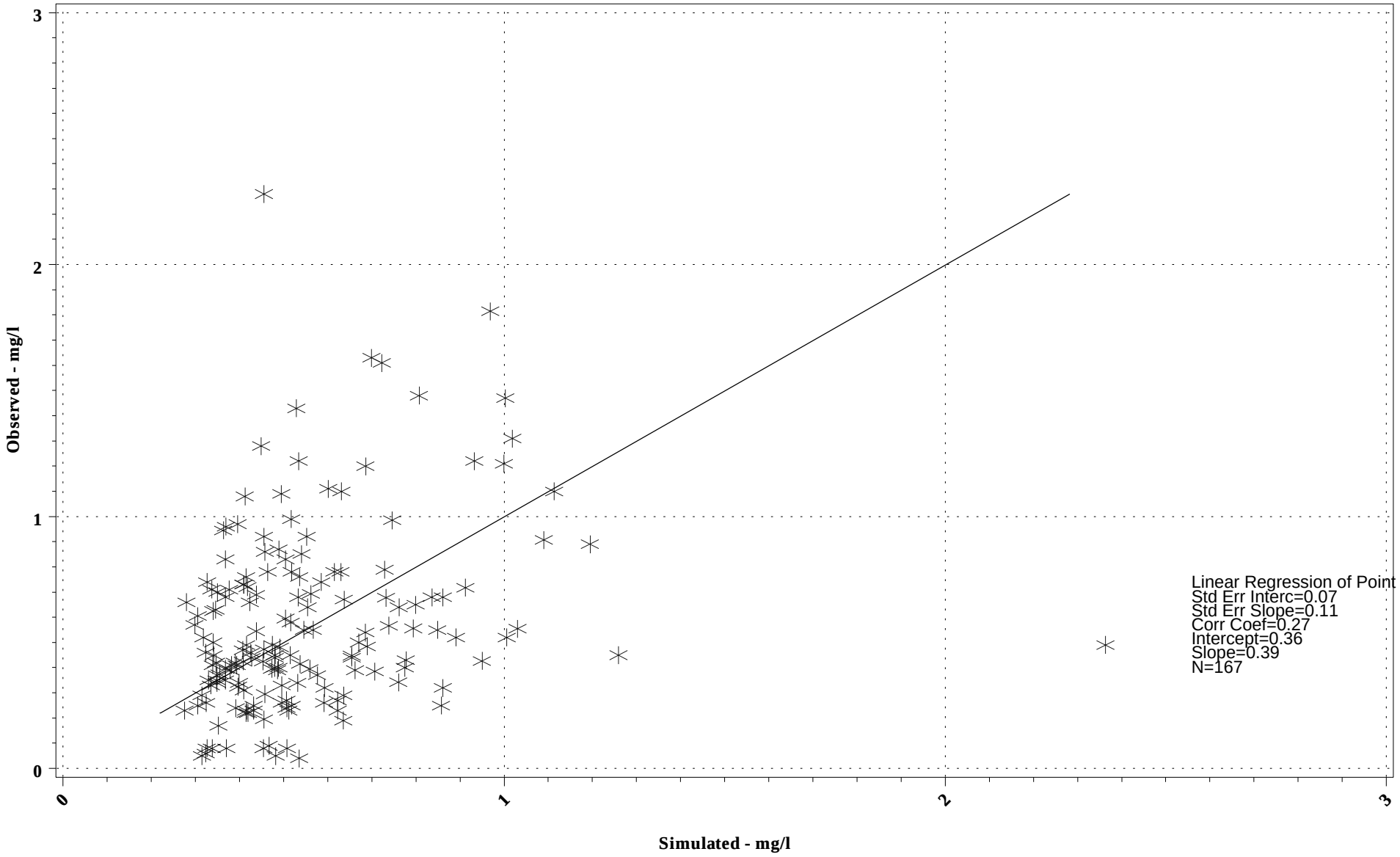



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100

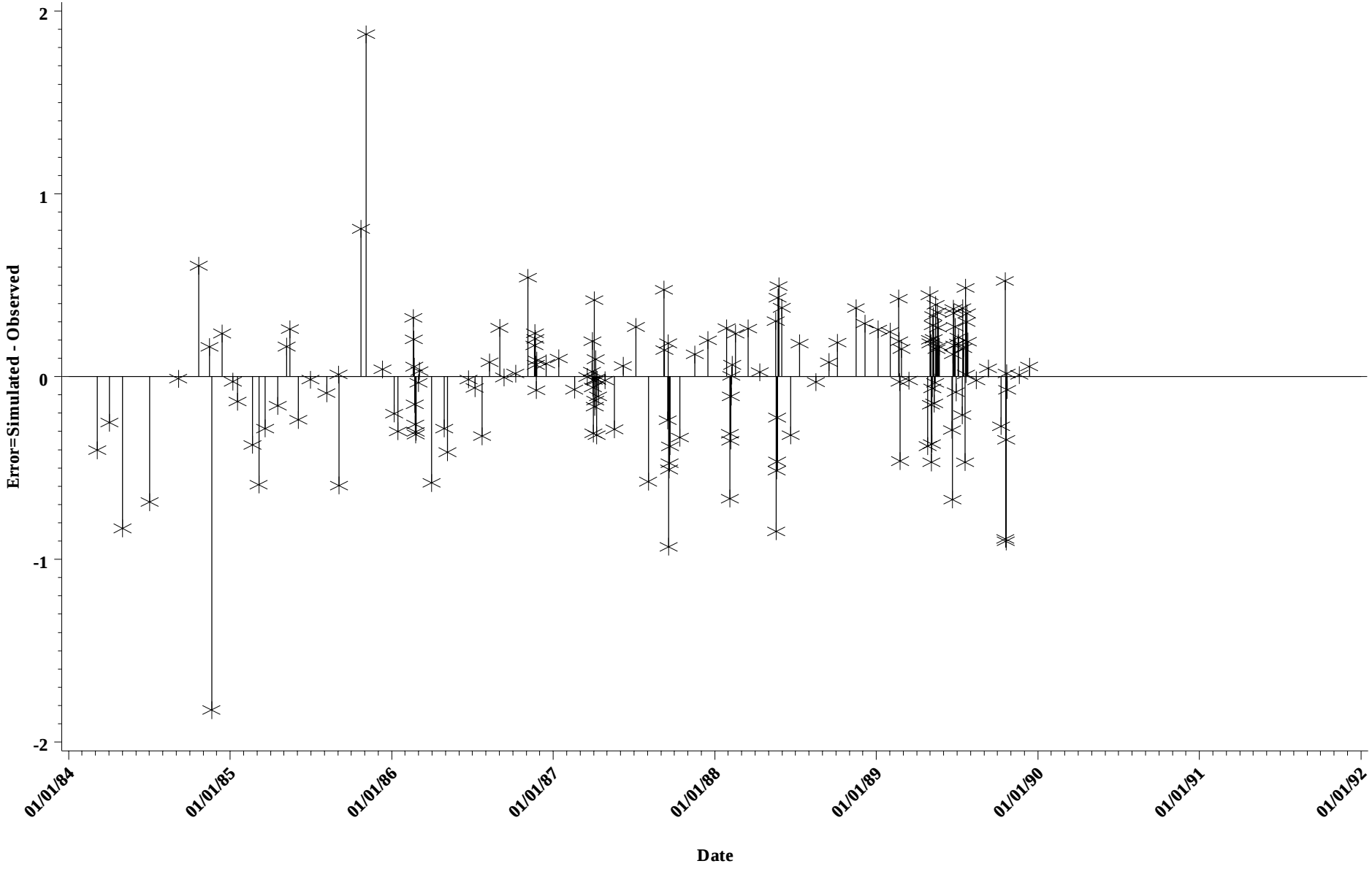
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92



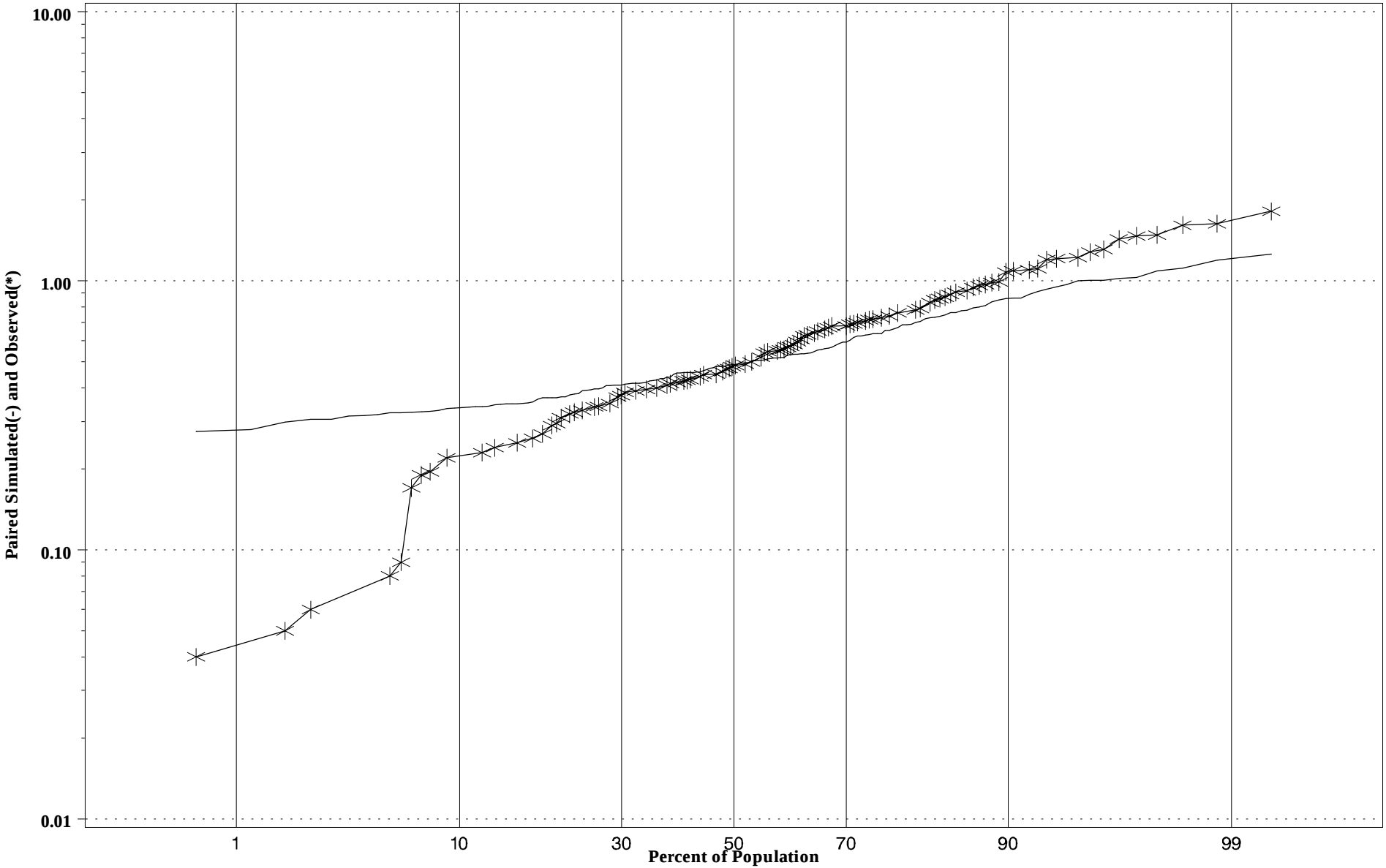

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(junia_d.drv1 26JUN98 08:53,proc reg,model y=x)

# Juniata River at Segment 100
## Actual Error versus Time
## Organic Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(junia_d.drv1 26JUN98 08:53)

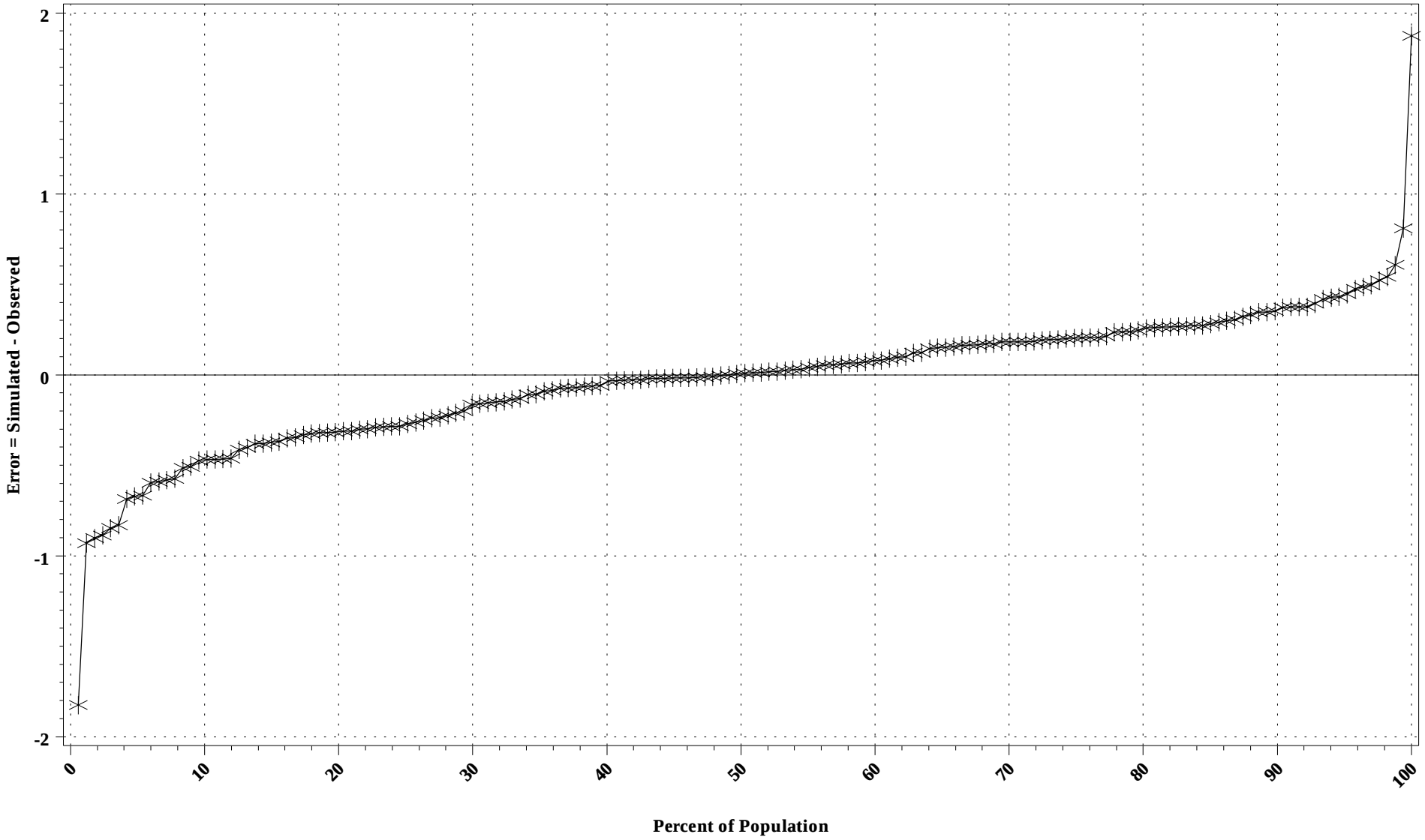
# Juniata River at Segment 100
## Organic Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(junia_d.drv1 26JUN98 08:53)

# Juniata River at Segment 100
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(junia_d.drv1 26JUN98 08:53)

### *B.1.4 Lower Susquehanna River at Marietta, PA Segment 110 (Monitoring Station: 1576000) (Above Fall Line Basin Segments: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 700, and 710)*

**Section Summary:**

Water quality at the Lower Susquehanna water quality gaging station reflects the water quality of the upstream basins of the East Branch Susquehanna, West Branch Susquehanna, and the Juniata as well as changes in land use, point source loads, and nonpoint source management practices of the Lower Susquehanna basin. The Lower Susquehanna basin is largely rural, and influenced by the upstream agricultural loads and forest loads, as well as lower basin agricultural loads and point sources from the cities of Harrisburg, York, and Hershey.

The Lower Susquehanna basin above the gaged site covers an area of 26,184 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 64% forest land, 10% cropland, 20% other agricultural areas, 5% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage decreased from 122 million pounds in 1985 to 115 million pounds in 1996. Total phosphorus loads over the same time period decreased from 4.8 million pounds to 3.9 million pounds. In general, point source loads above the gage site are low. In 1996, the total nitrogen point source load was 11% of the total load and the total phosphorus point source load was 22% of the total load. Estimated septic system total nitrogen loads increased 9%, from 3.5 million pounds in 1985 to 3.8 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 9%, and other agricultural loads (primarily pasture and manure loads) by 10%. Total phosphorus decreased for these land uses by 5% and 22% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 7% for total nitrogen and 9% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date – Temperature
Observed and Simulated Loads versus Date – Dissolved Oxygen

### *B.1.5 Susquehanna River near Conowingo, MD At Segment 140 (Monitoring Station: 1578310) (Above Fall Line Basin Segments: 120, 140, and 720)*

**Section Summary:**

Water quality at the Conowingo water quality gaging station reflects water quality of the upstream basins of the East Branch Susquehanna, West Branch Susquehanna, Juniata, and the Lower Susquehanna basins as well as local changes in land use, point source loads, and nonpoint source management practices. The Conowingo gage station is the largest basin in the Chesapeake watershed. The Conowingo basin is largely rural, with particularly high agricultural loads from areas in the basin like the Conestoga watershed. Water quality at the Conowingo gage station is influenced by three reservoirs on the Conowingo mainstem, the Holtwood, Safe Harbor, and Conowingo reservoirs.

The Conowingo basin above the gaged site covers an area of 27,155 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 47% forest land, 23% cropland, 22% other agricultural areas, 8% urban areas, and 2% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage decreased from 134 million pounds in 1985 to 130 million pounds in 1996. Total phosphorus loads over the same time period decreased from 5.5 million pounds to 4.5 million pounds. In general, point source loads above the gage site are low. In 1996, the total nitrogen point source load was 11% of the total load and the total phosphorus point source load was 20% of the total load. Estimated septic system total nitrogen loads increased 13%, from 3.8 million pounds in 1985 to 4.3 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 9%, and other agricultural loads (primarily pasture and manure loads) by 11%. Total phosphorus decreased for these land uses by 5% and 23% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 9% for total nitrogen and 10% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

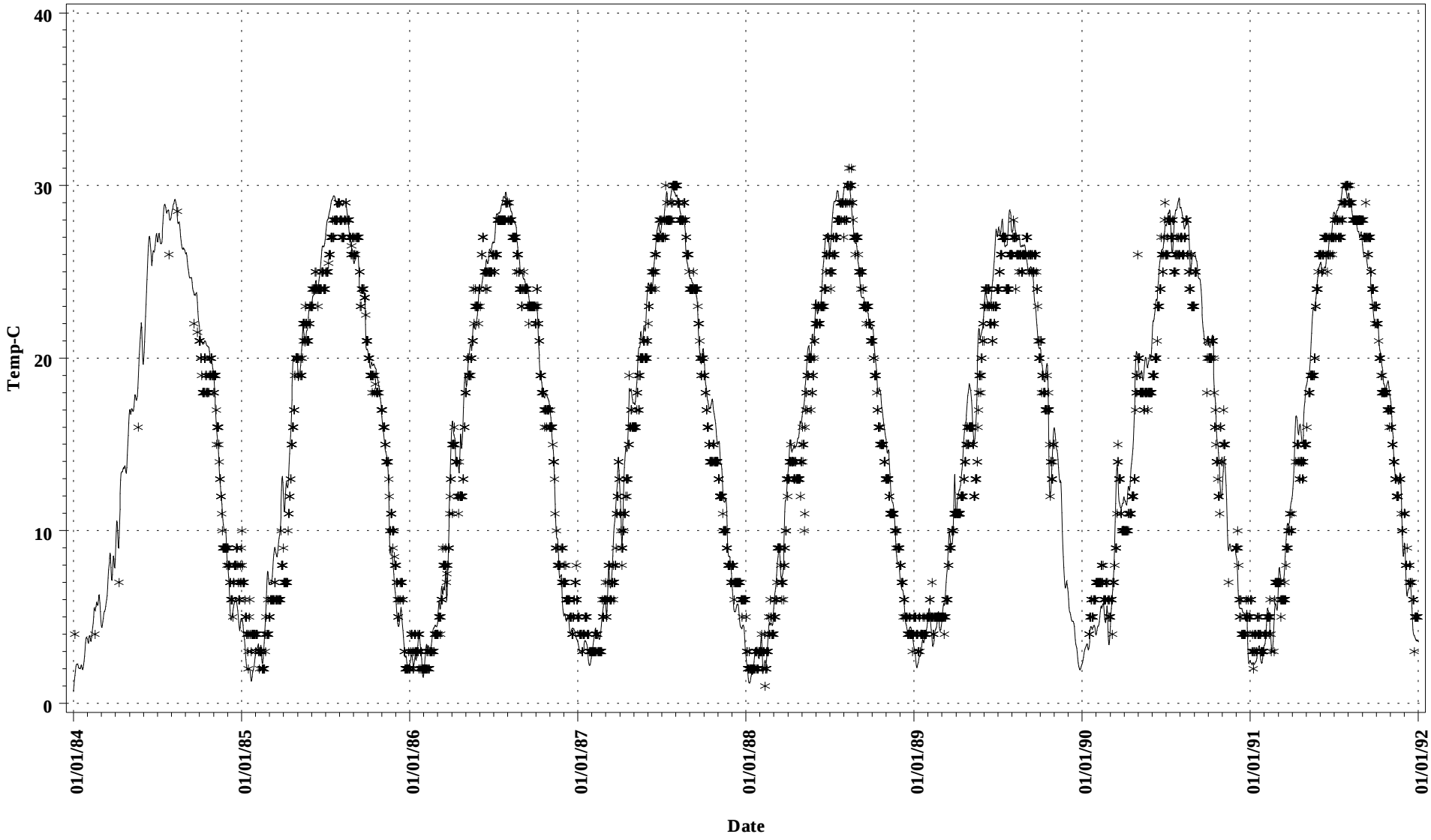
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# Susquehanna River at Segment 140
## Observed and Simulated versus Time
# Temperature-C

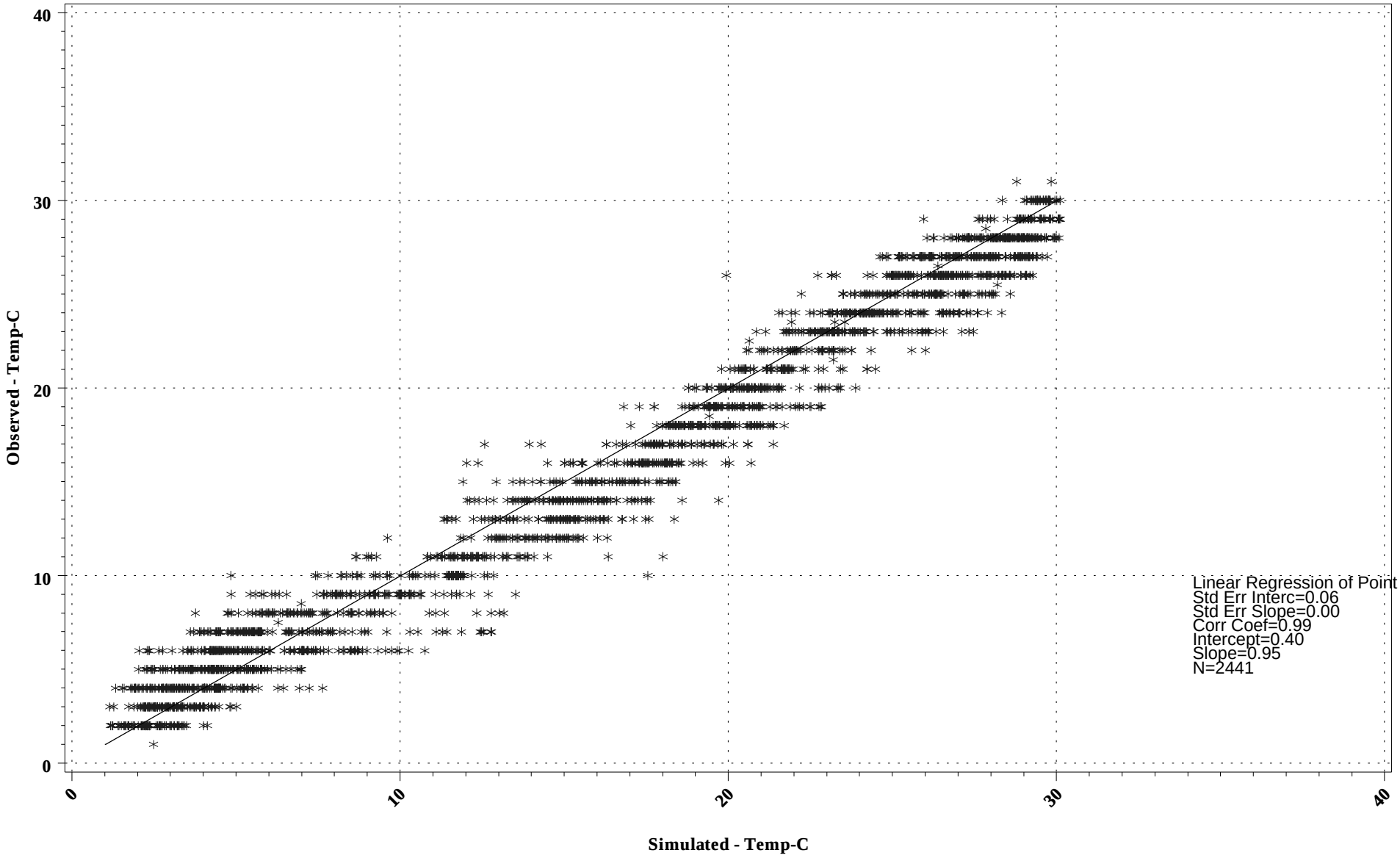
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(conow.drv 25JUN98 15:08)

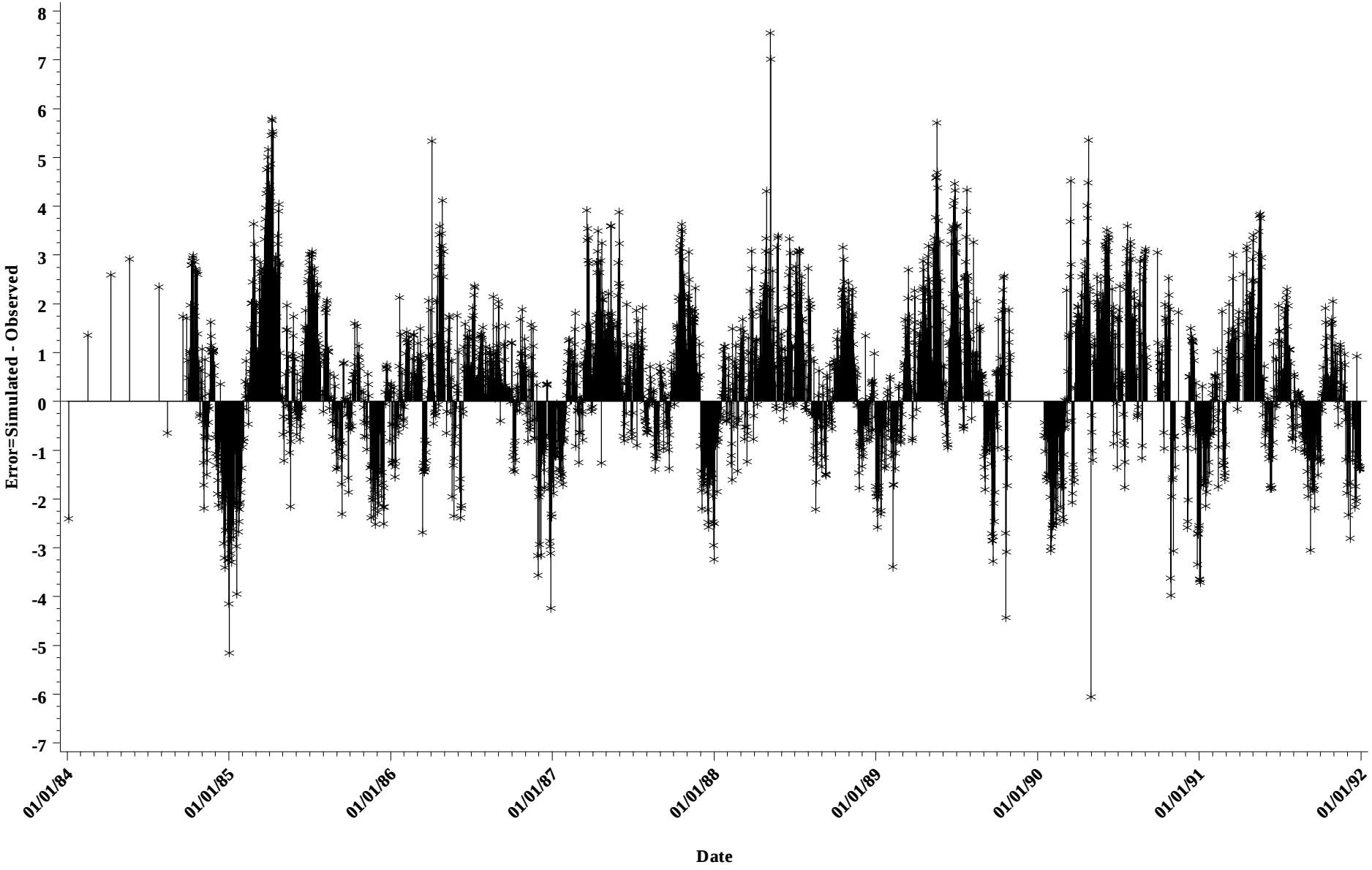
# Susquehanna River at Segment 140

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140
## Actual Error versus Time
## Temperature-C

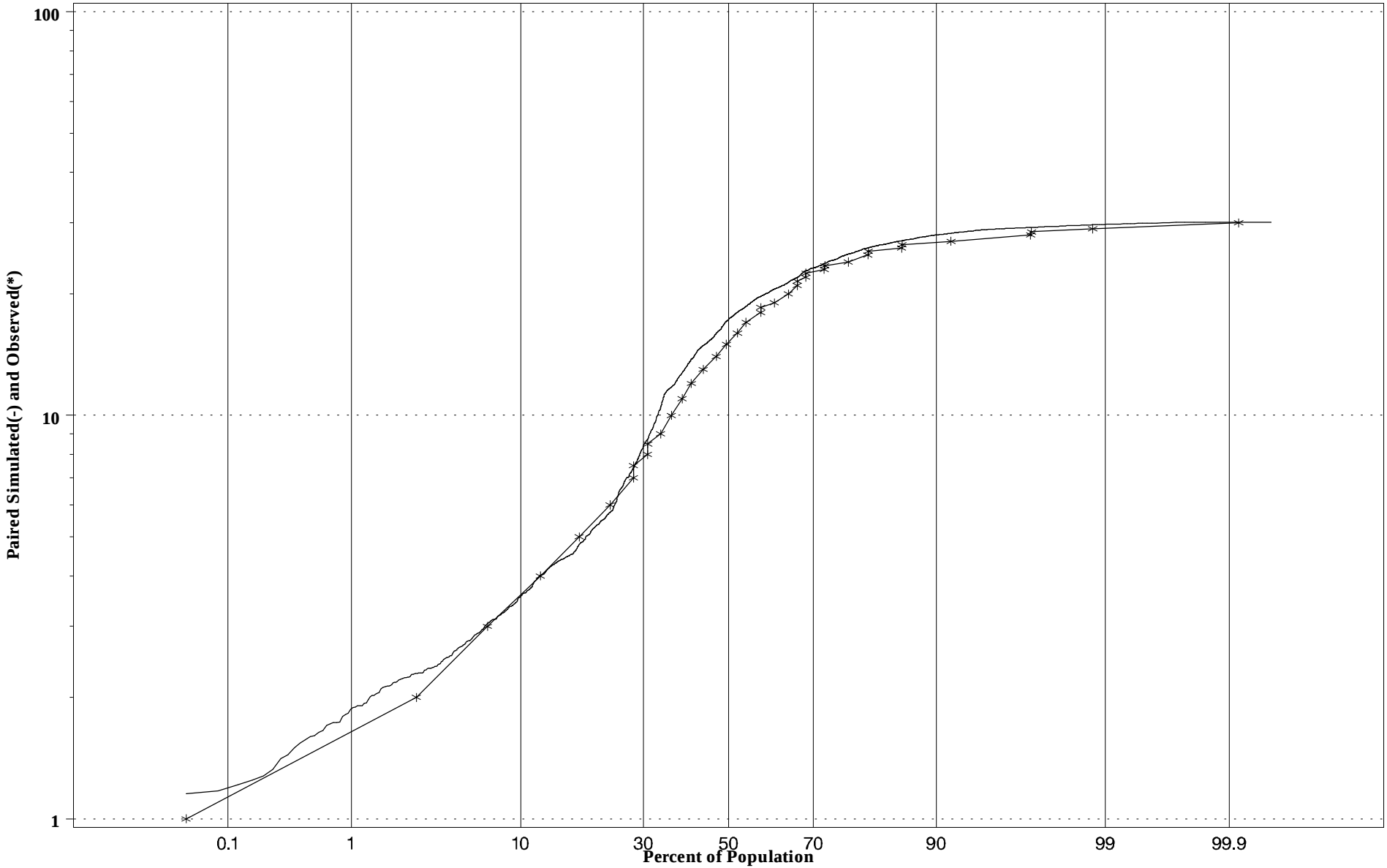



(y21_plotb.sas model3d:[pwang.dt] omerr)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140

## Temperature-C

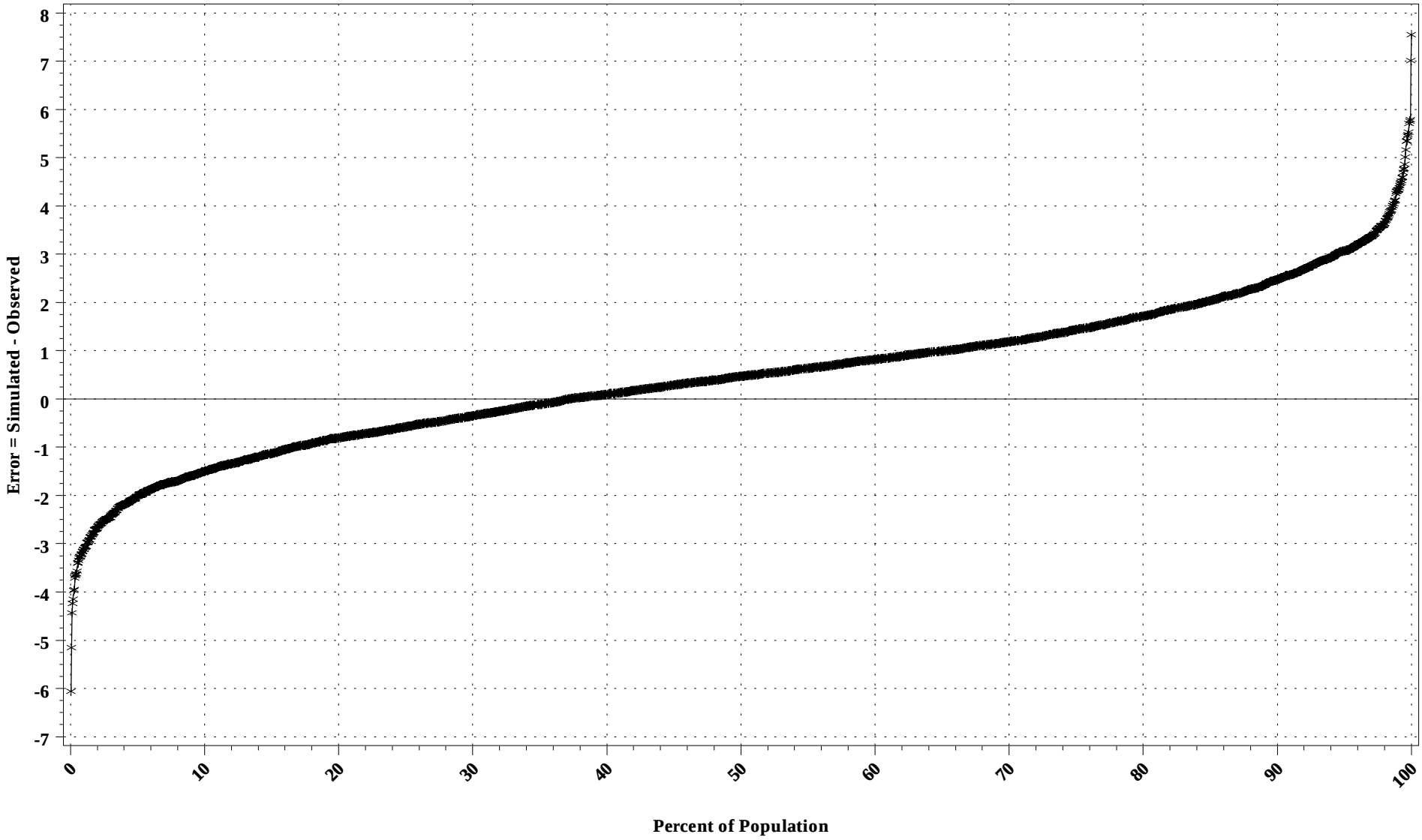
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Actual error versus Percentile Sample Population
## Temperature-C

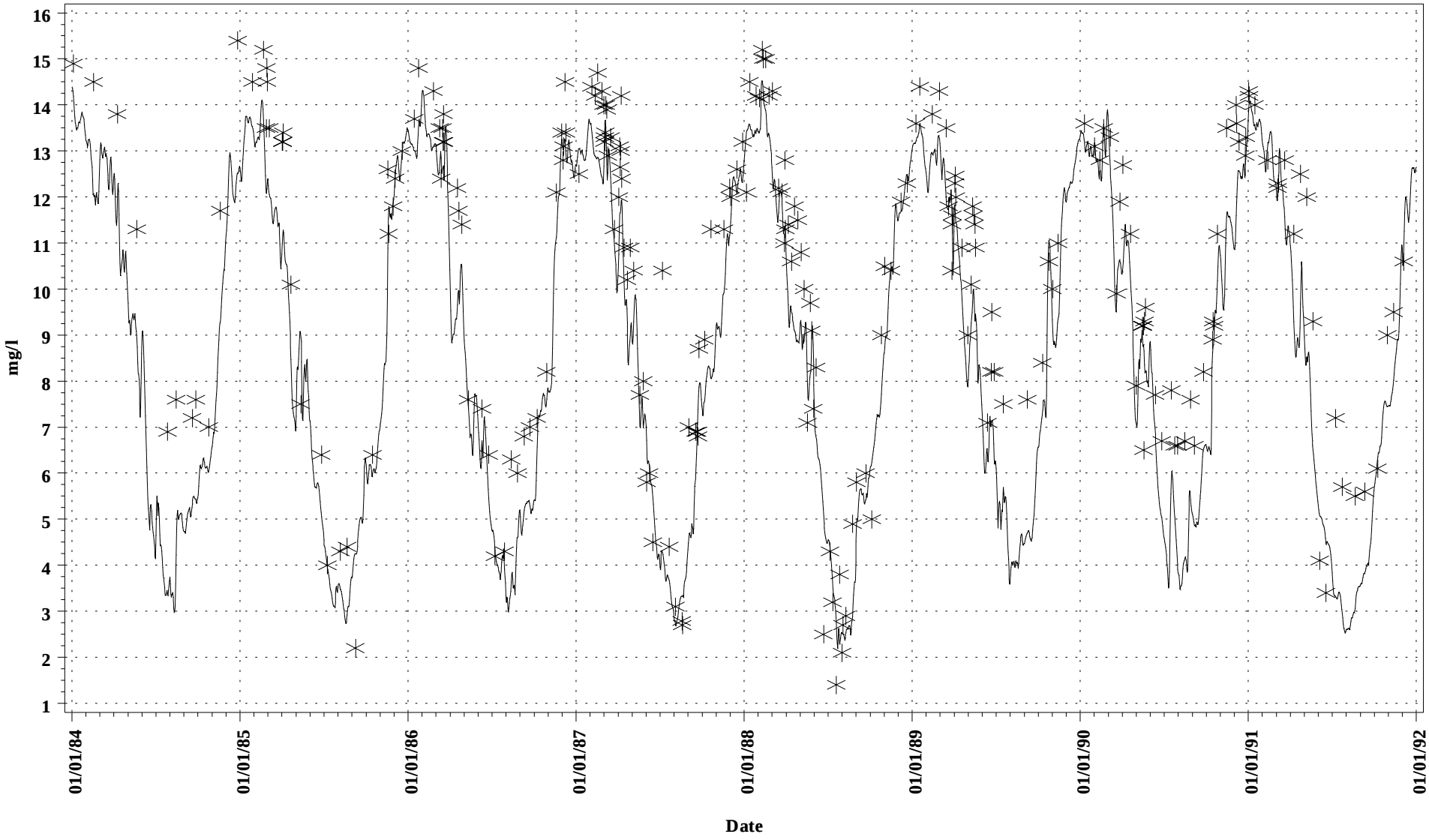
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(conow.drv 25JUN98 15:08)

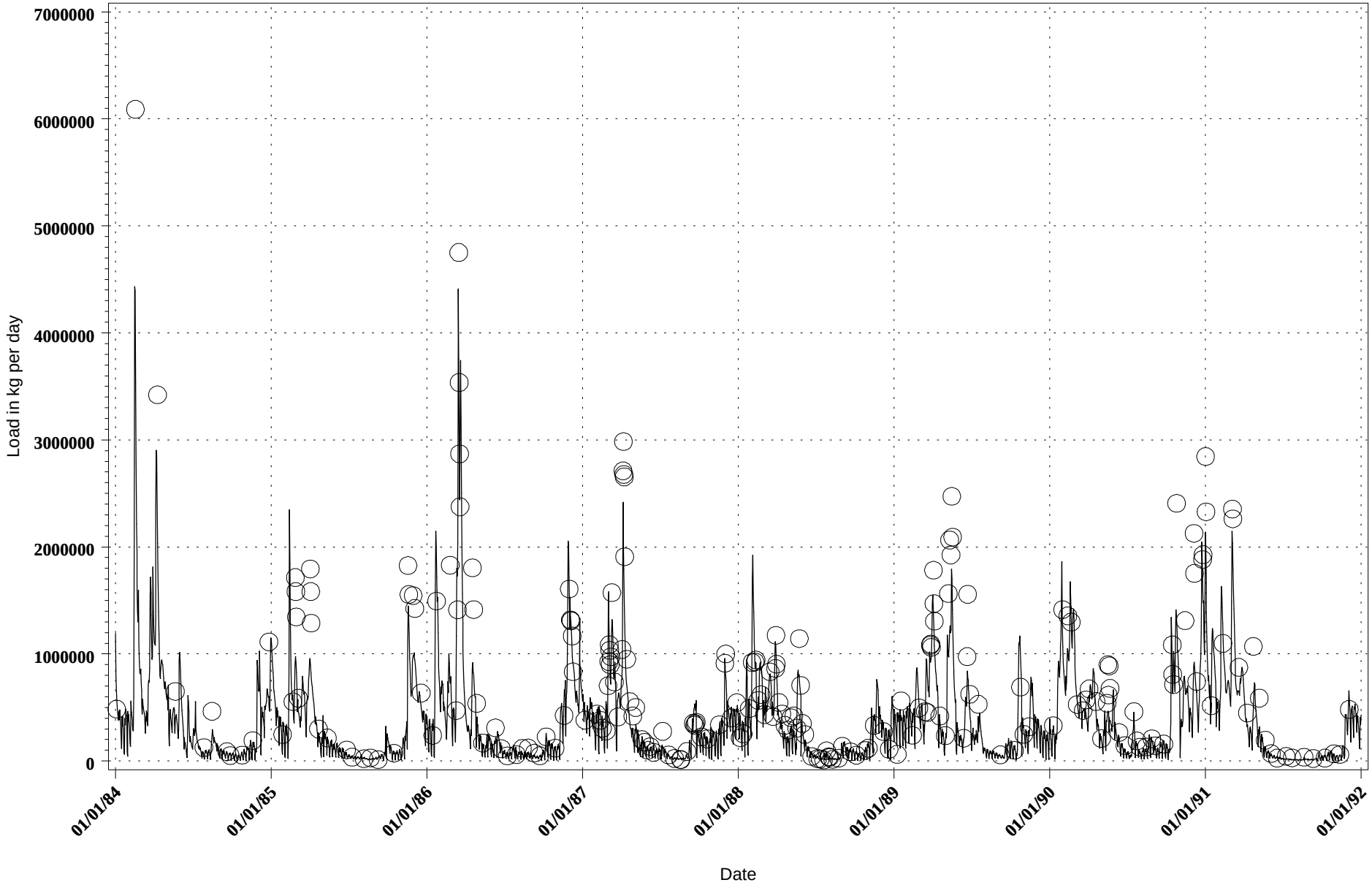
# Susquehanna River at Segment 140
## Observed and Simulated versus Time
# Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

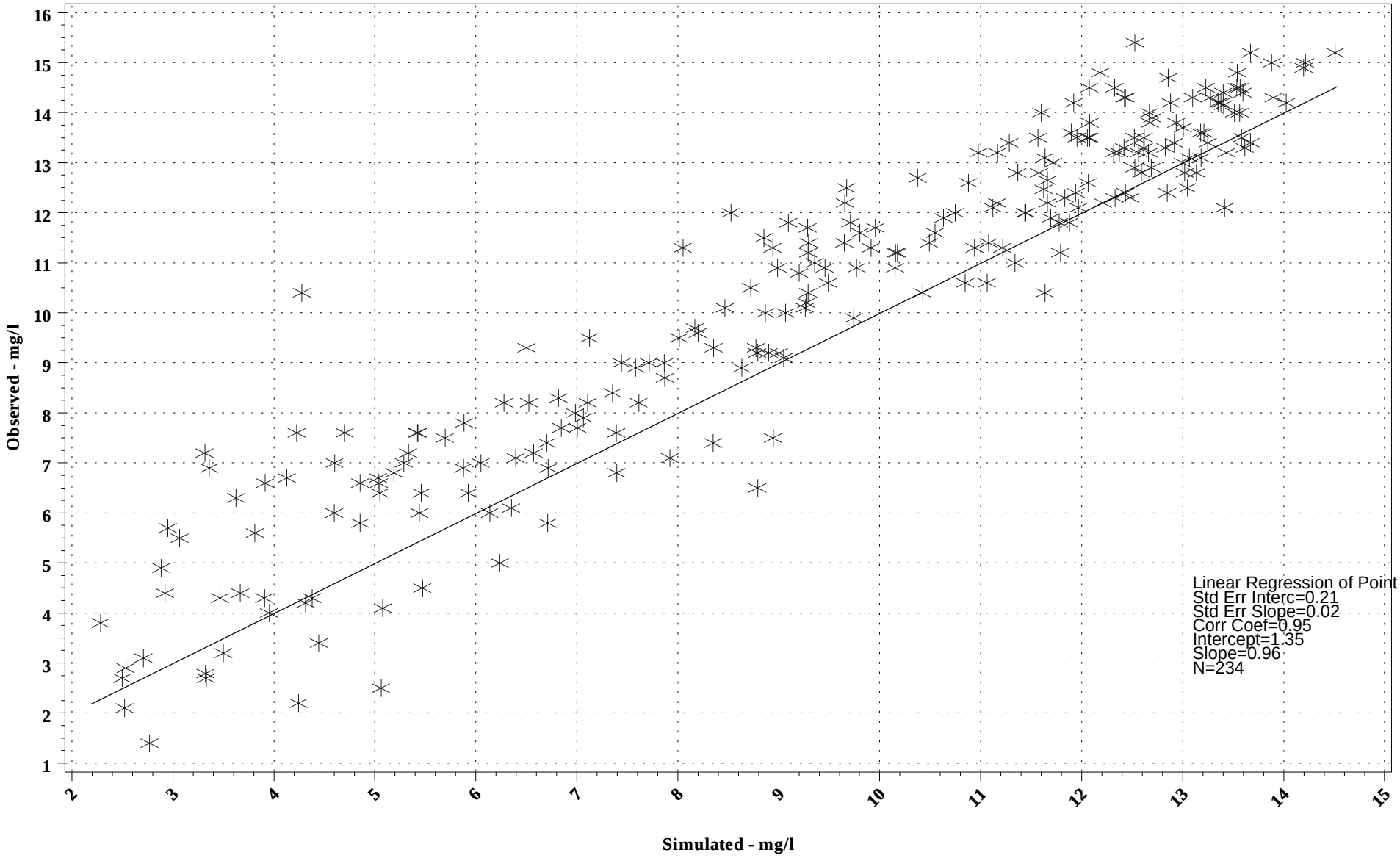



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140

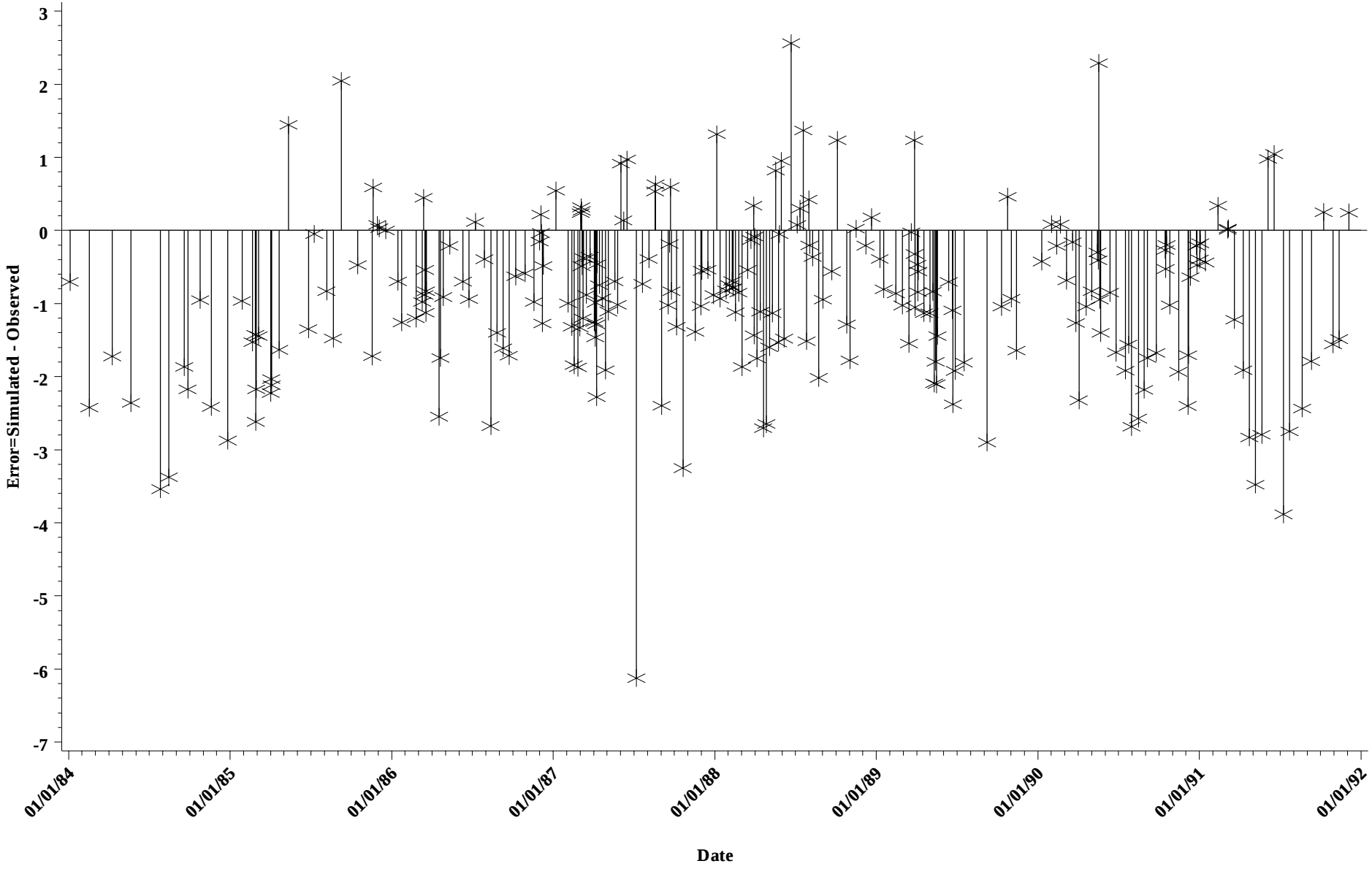
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Oxygen: 01JAN84 - 01JAN92



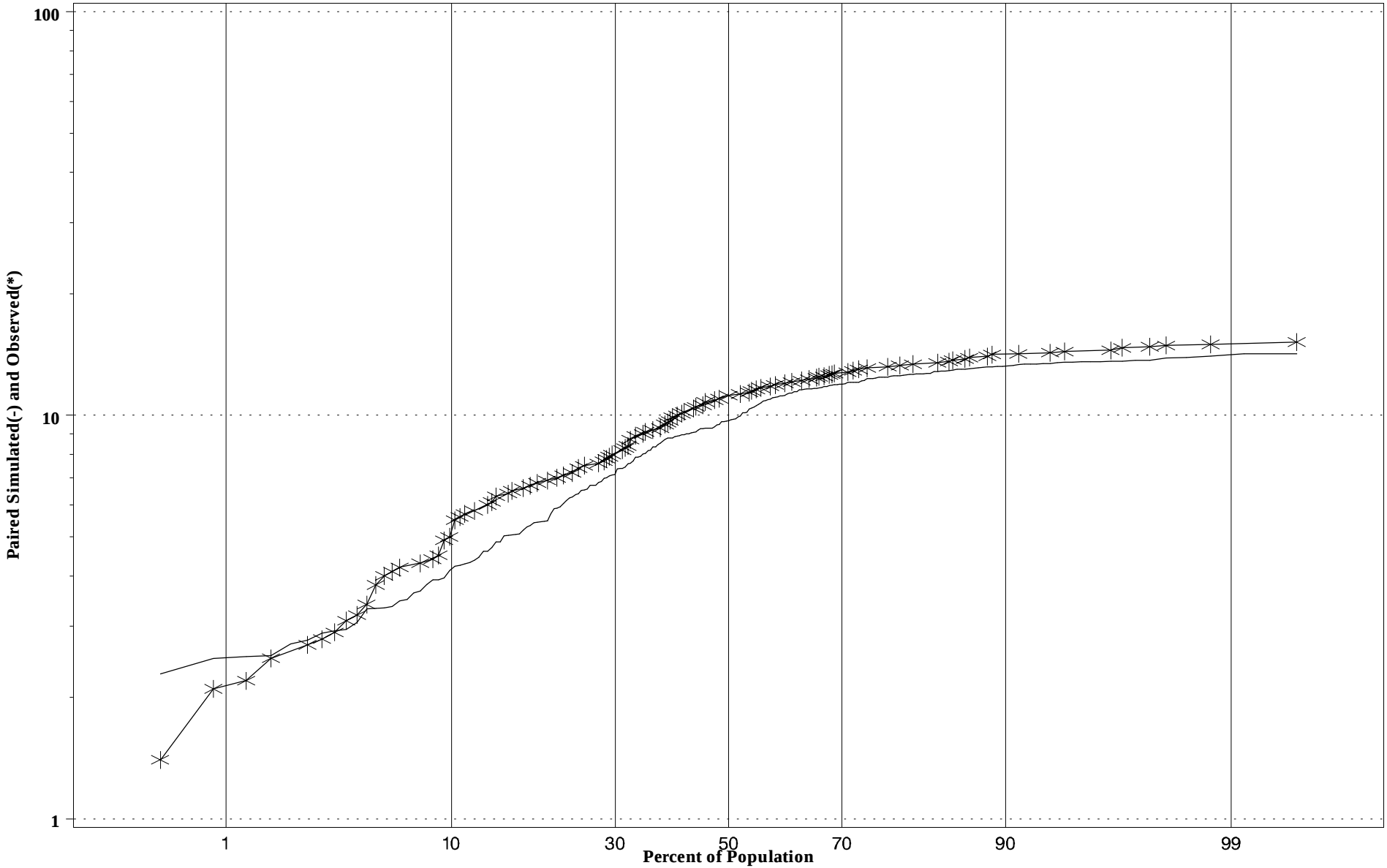

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(conow.drv 25JUN98 15:08)

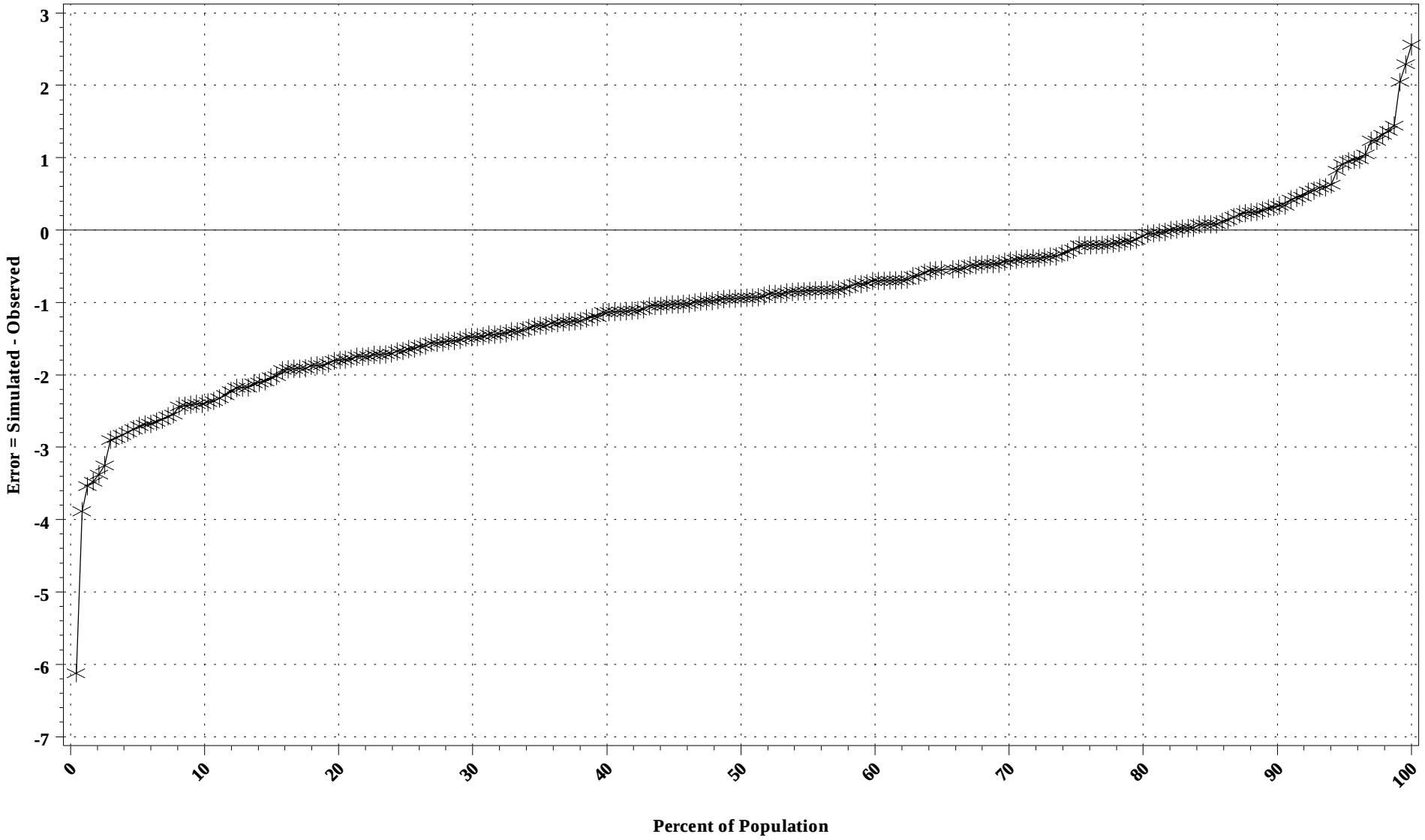
# Susquehanna River at Segment 140
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

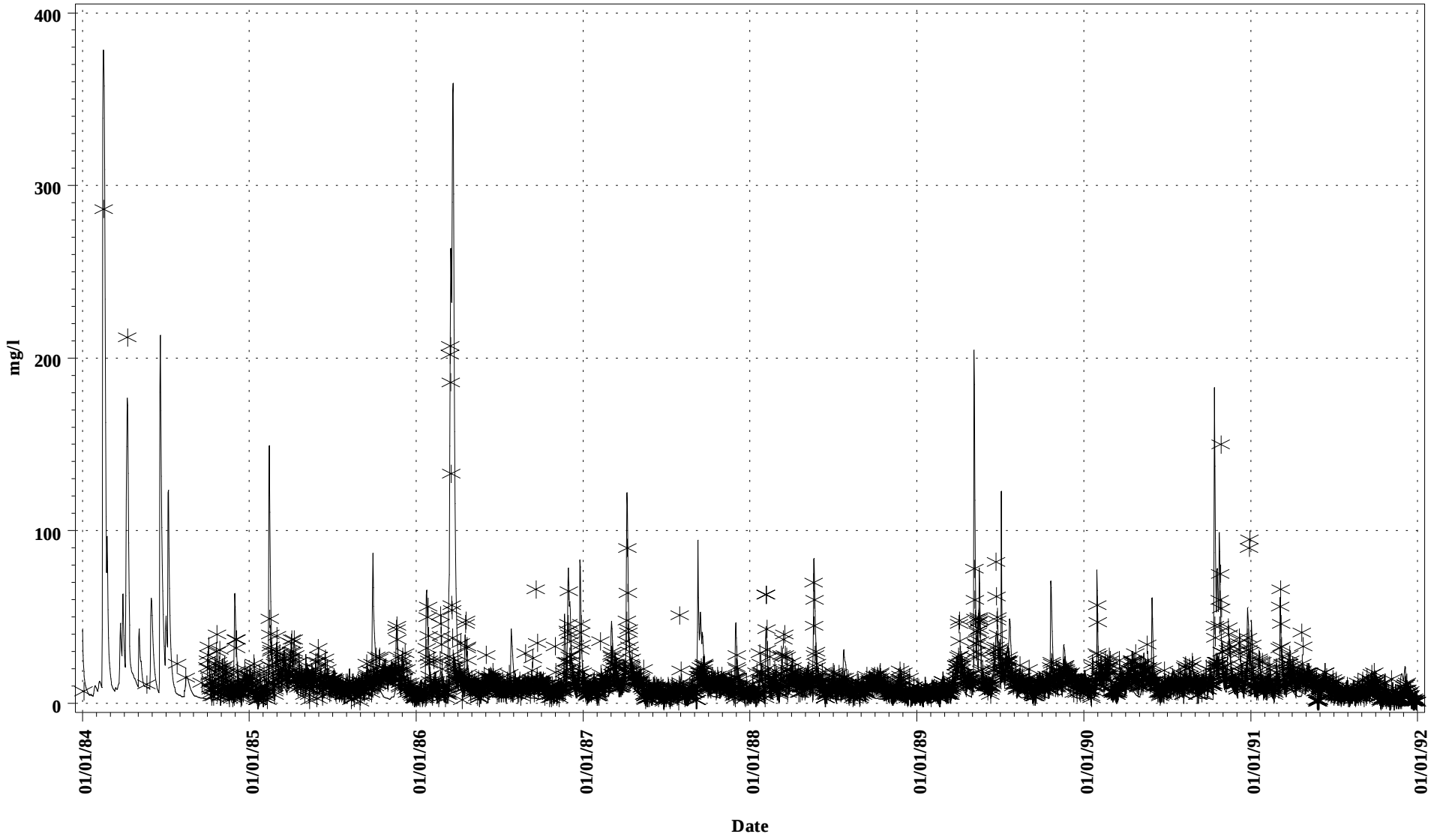
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**

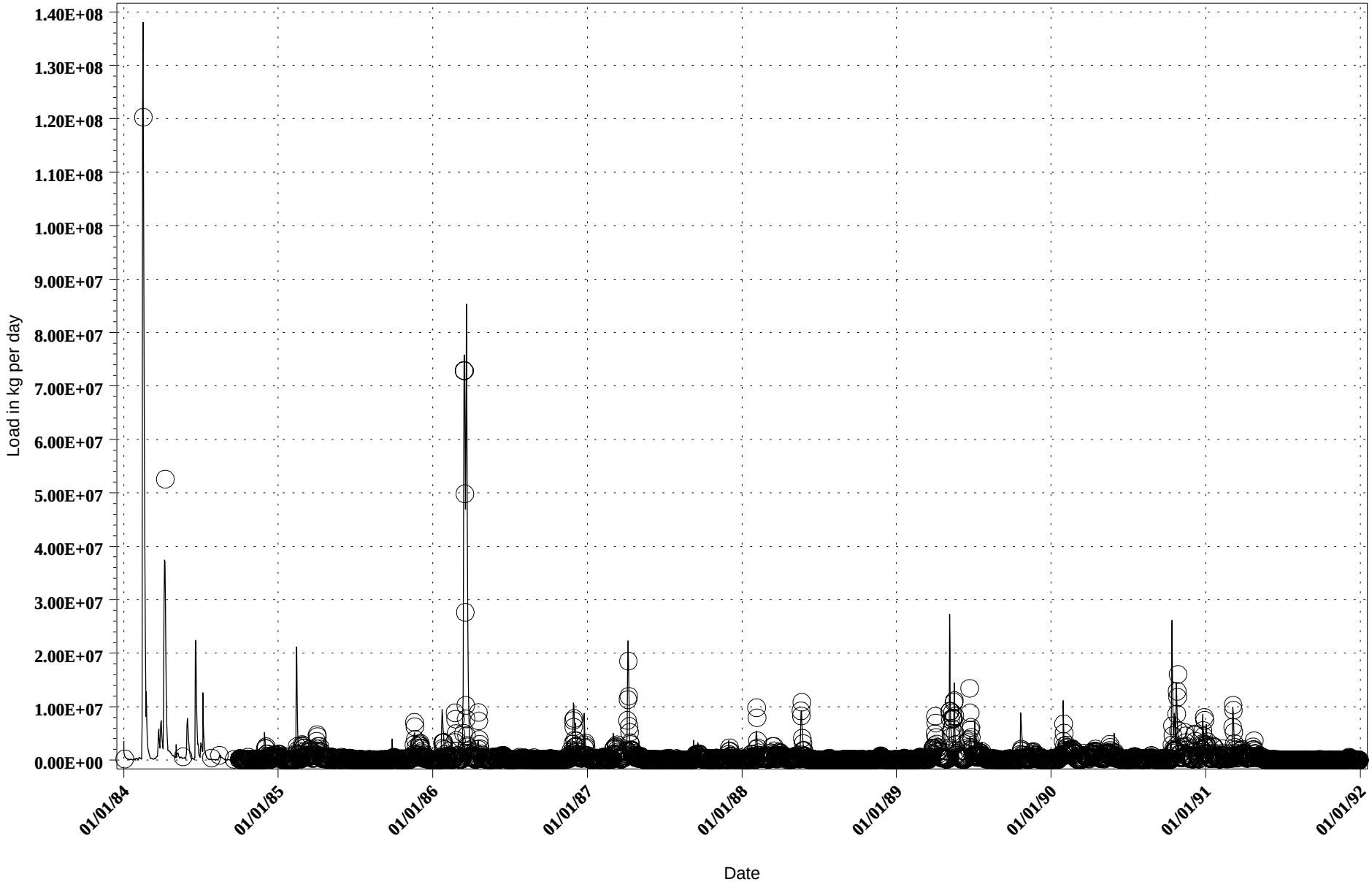



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140

## Total Suspended Sediment Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

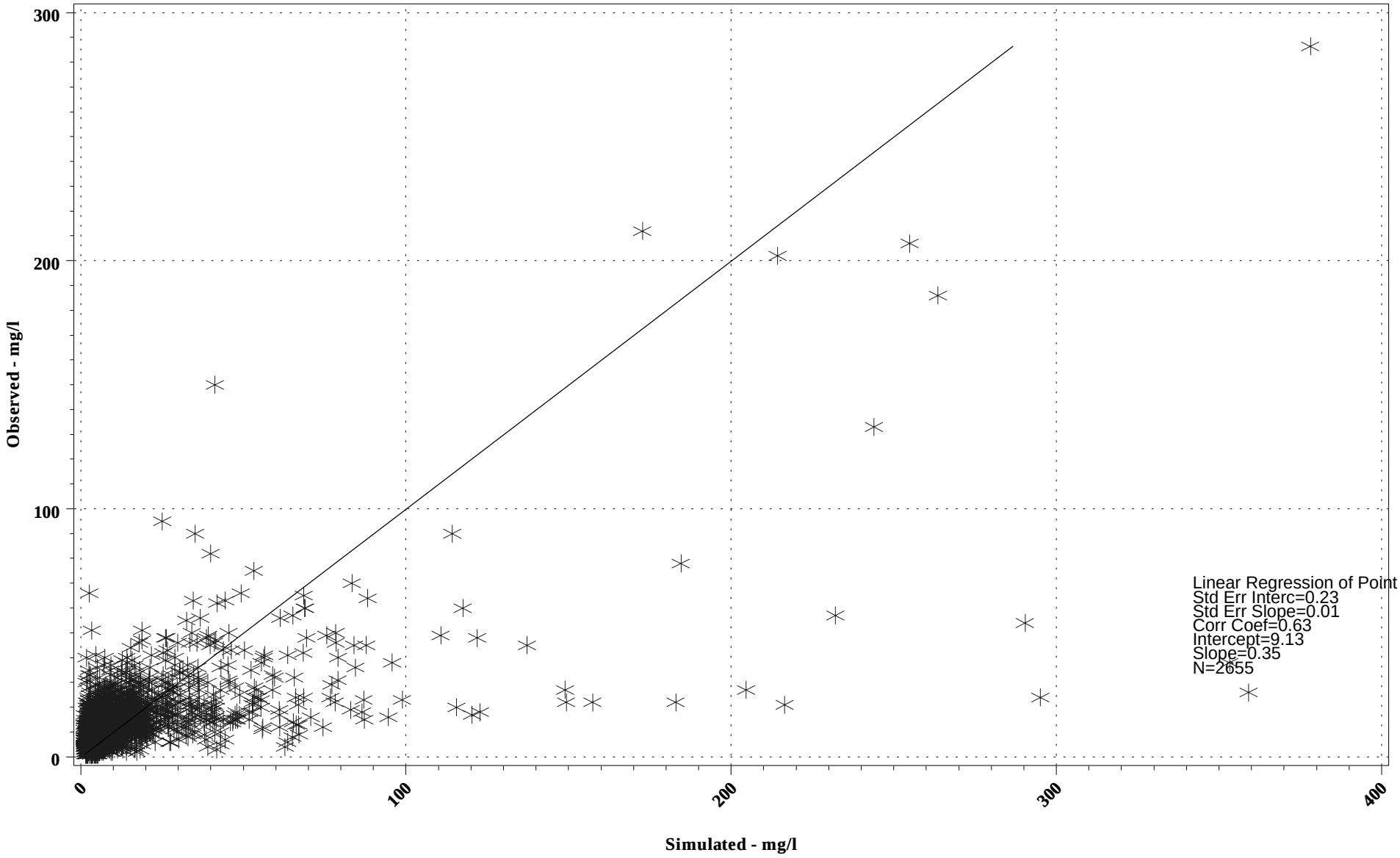



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140

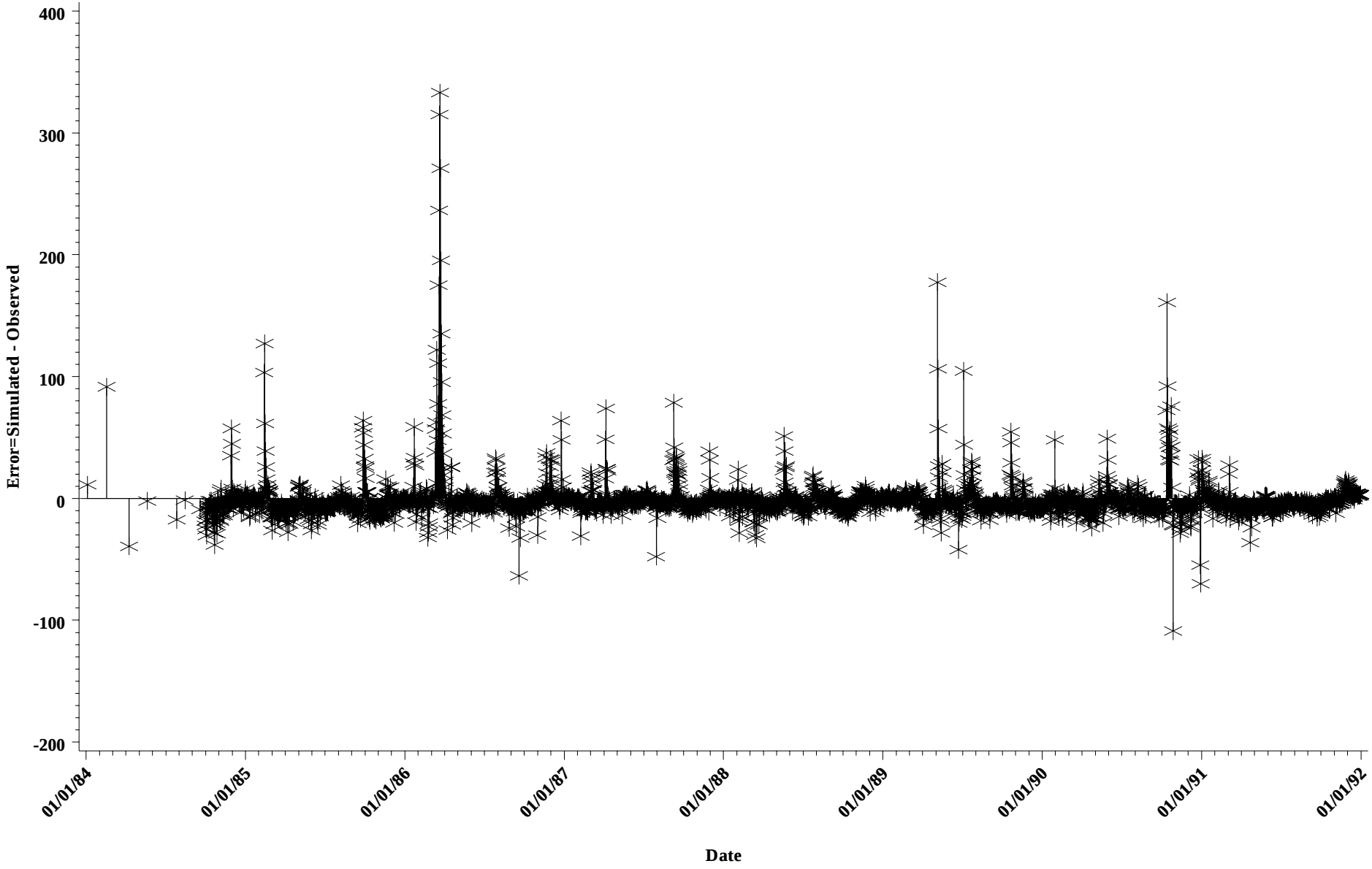
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



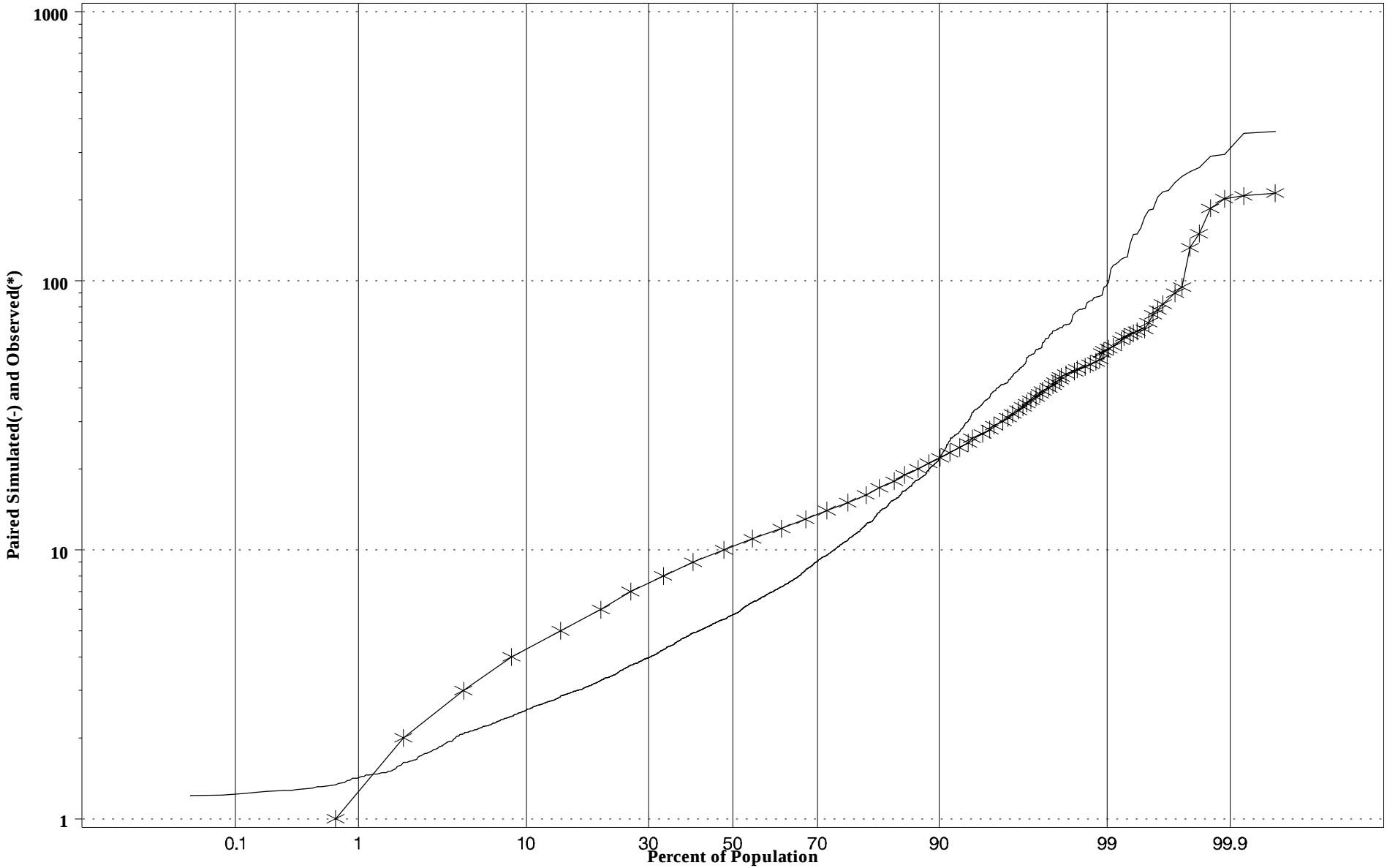

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(conow.drv 25JUN98 15:08)

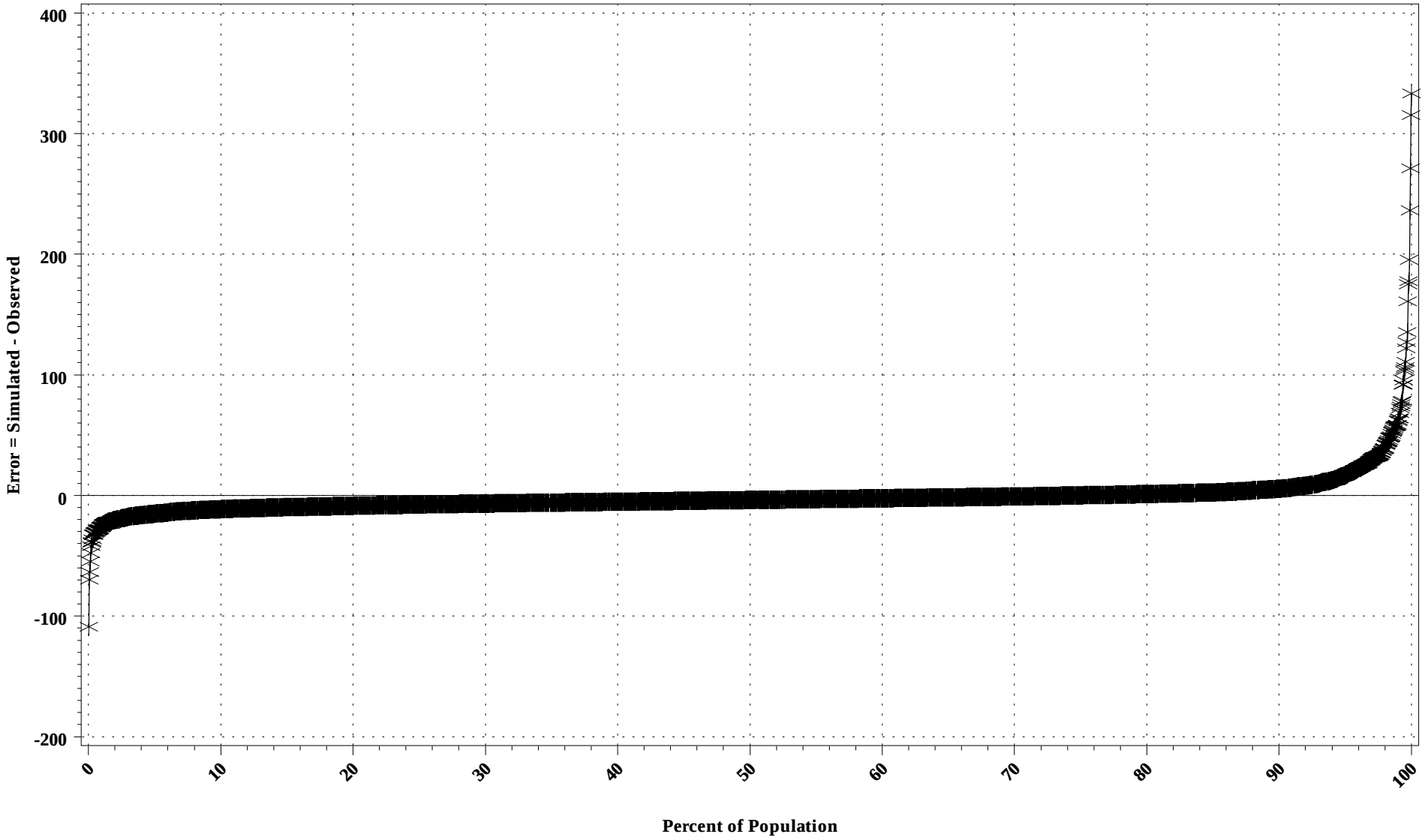
# Susquehanna River at Segment 140
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

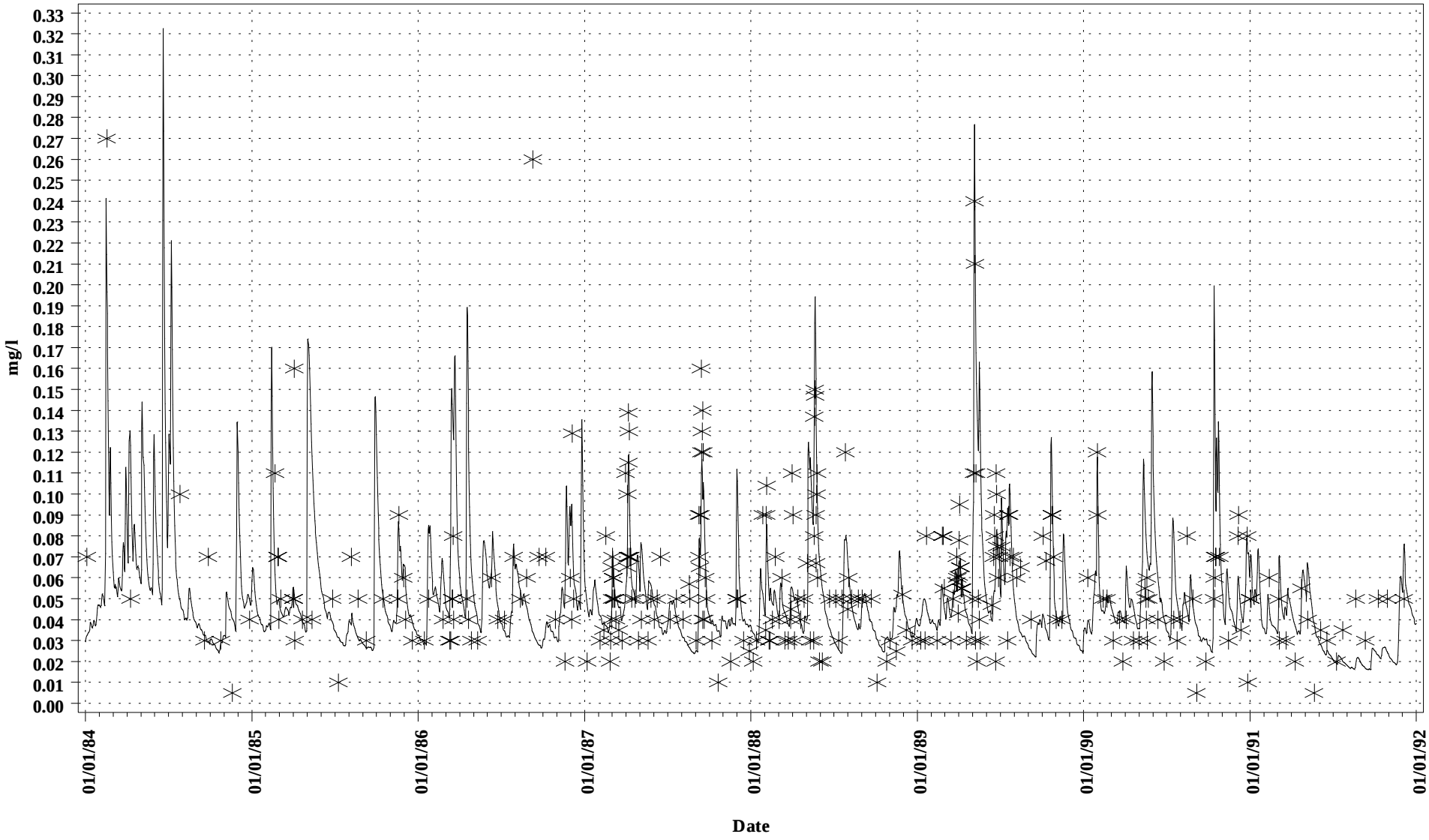
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(conow.drv 25JUN98 15:08)

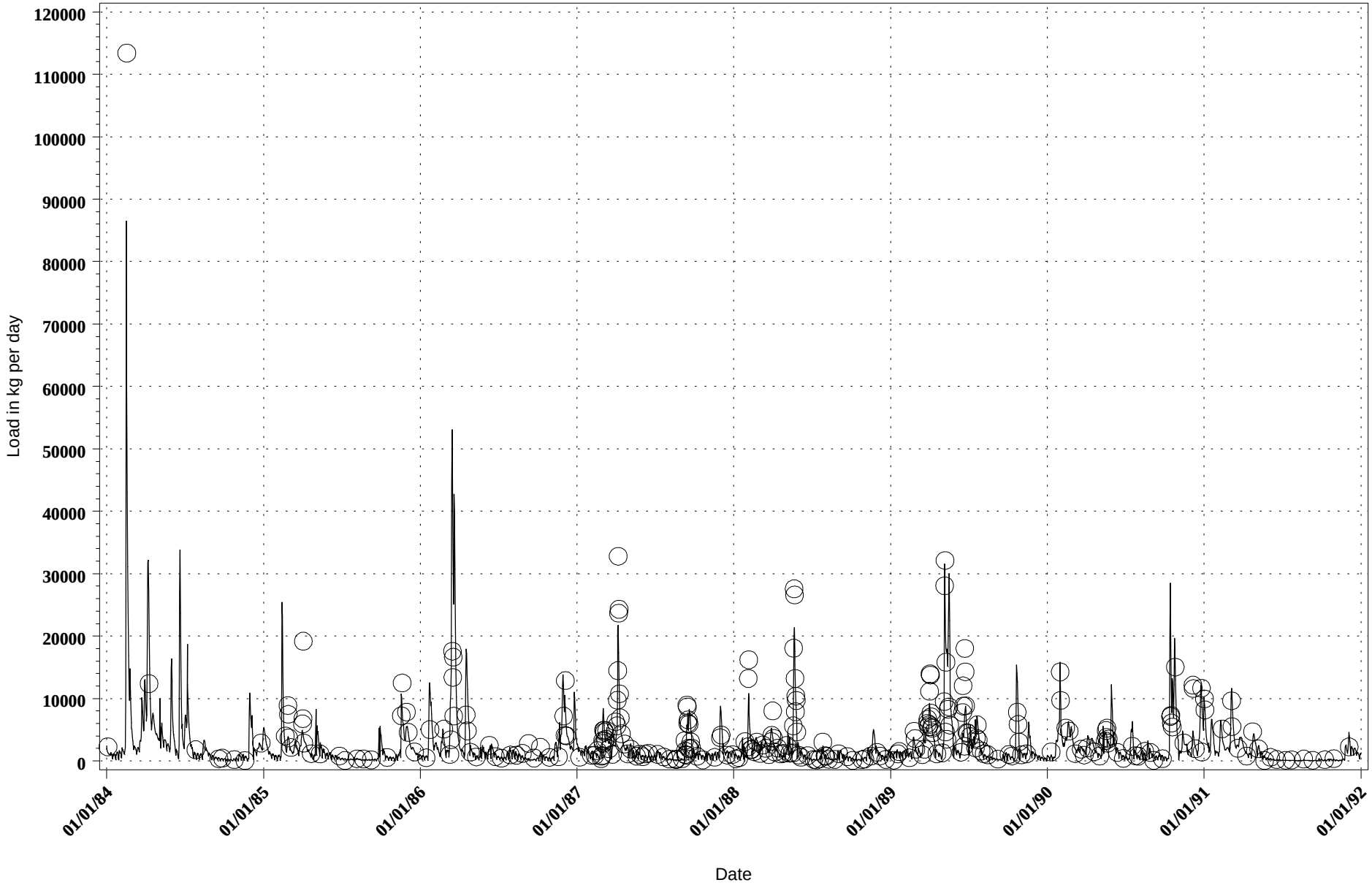
# Susquehanna River at Segment 140
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

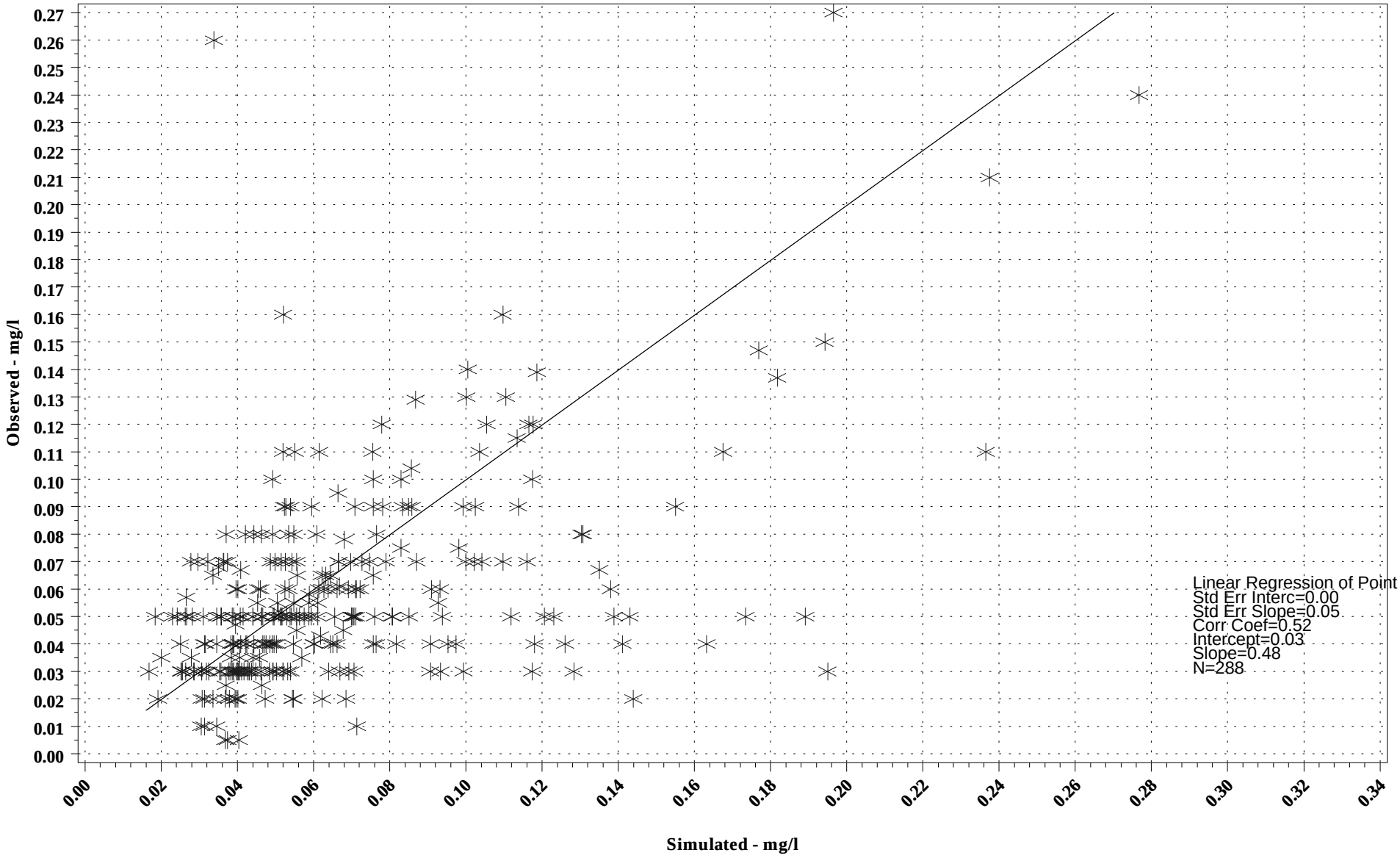



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140

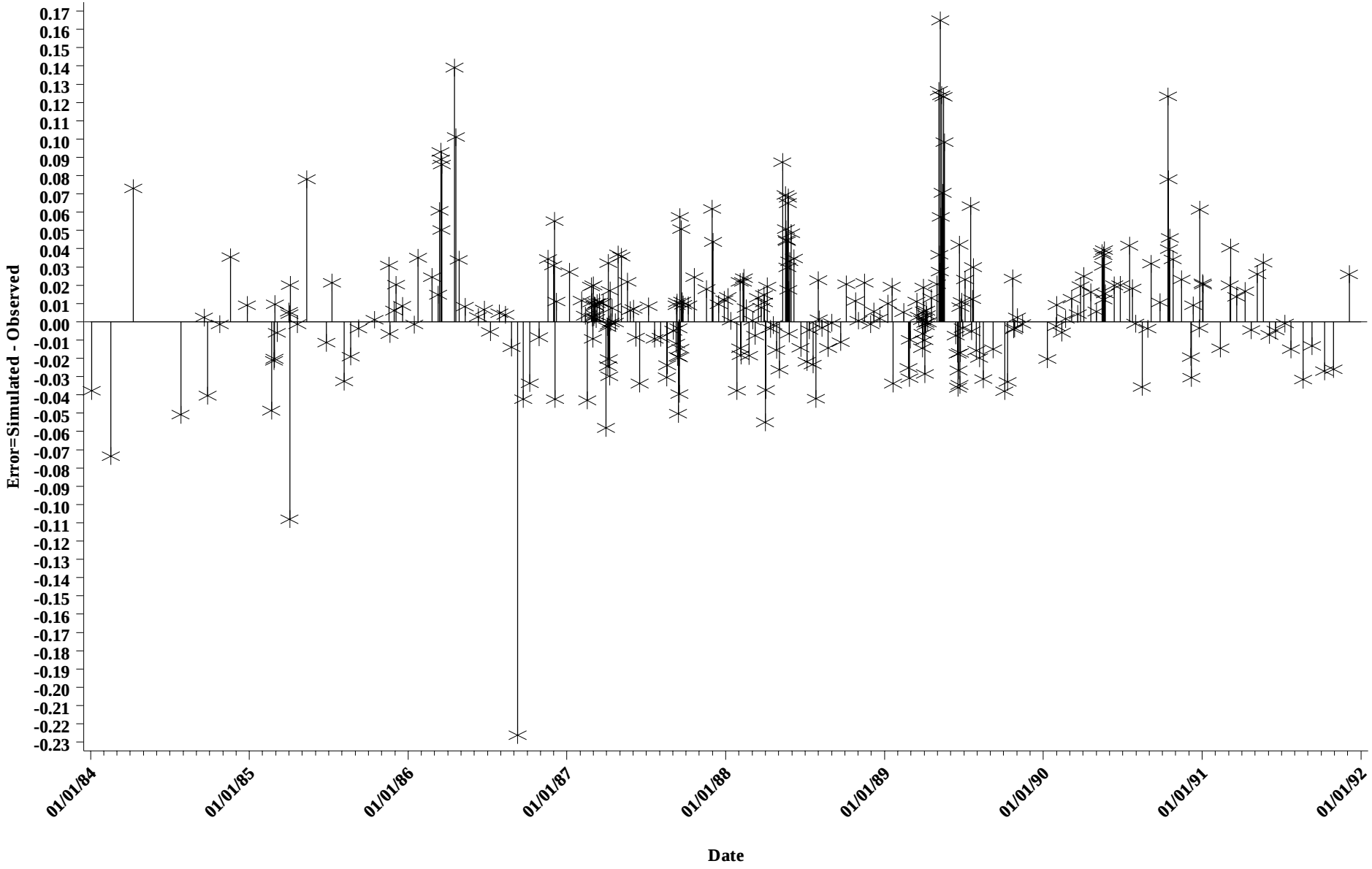
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



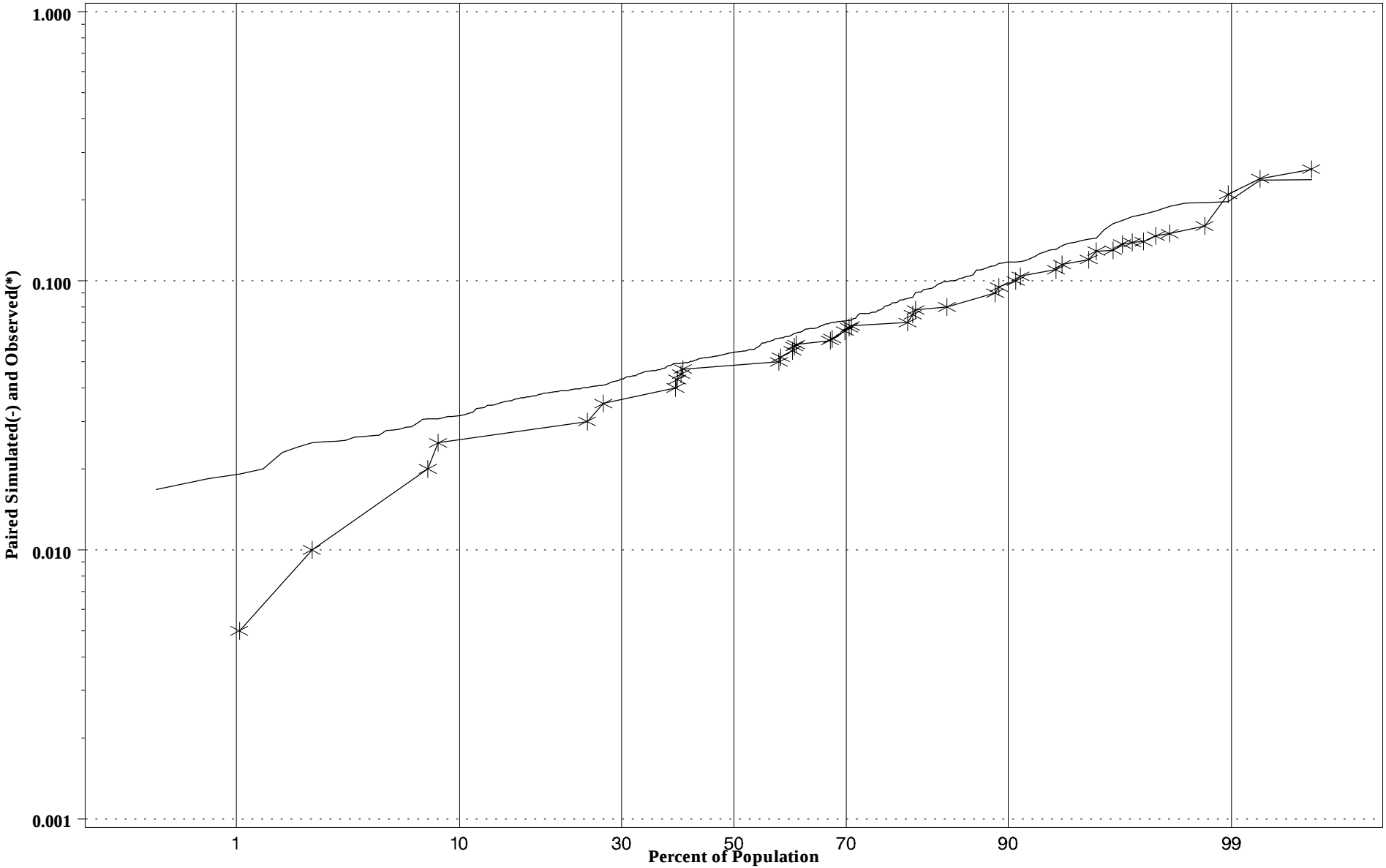

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(conow.drv 25JUN98 15:08)

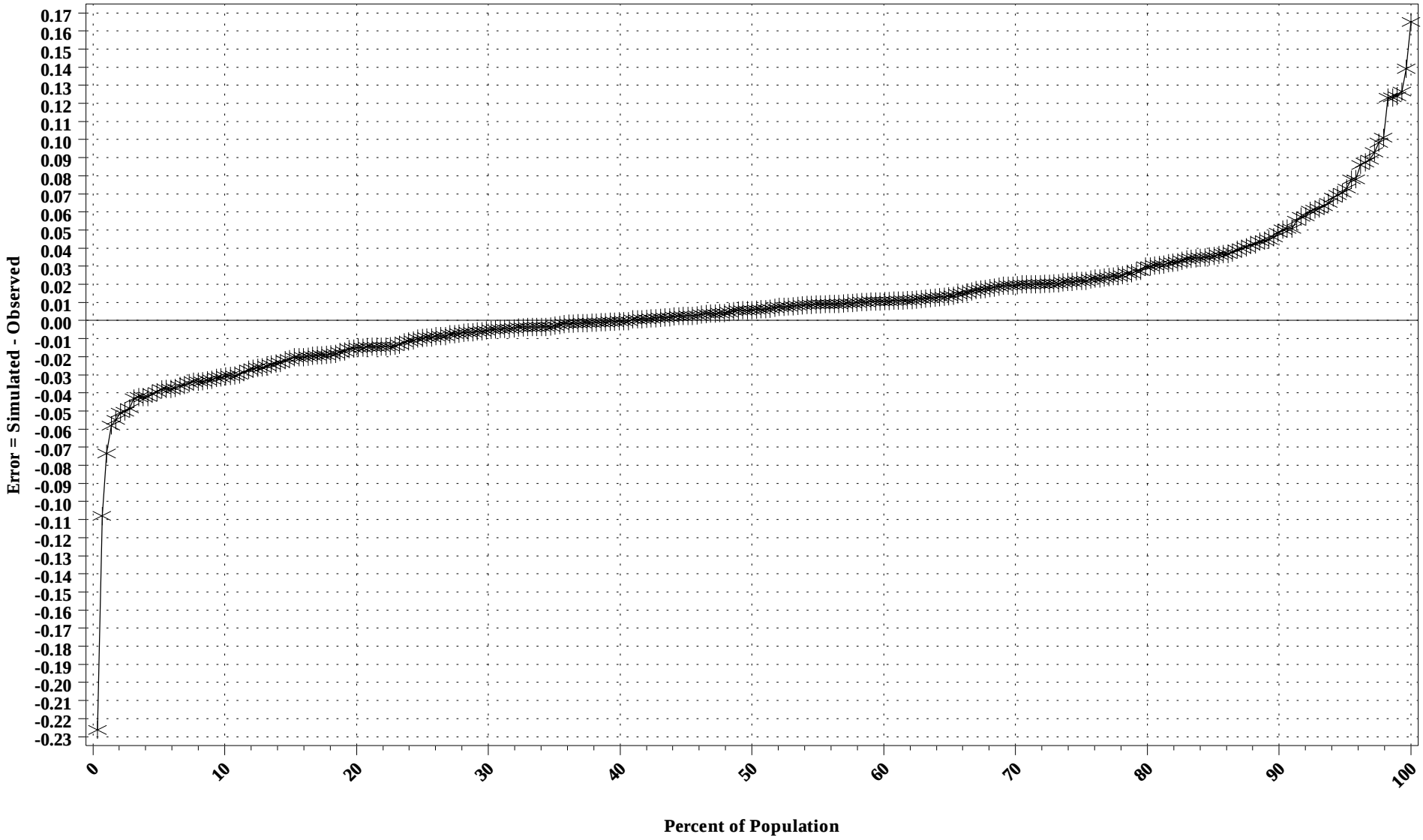
# Susquehanna River at Segment 140
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Actual error versus Percentile Sample Population
## Total Phosphorus

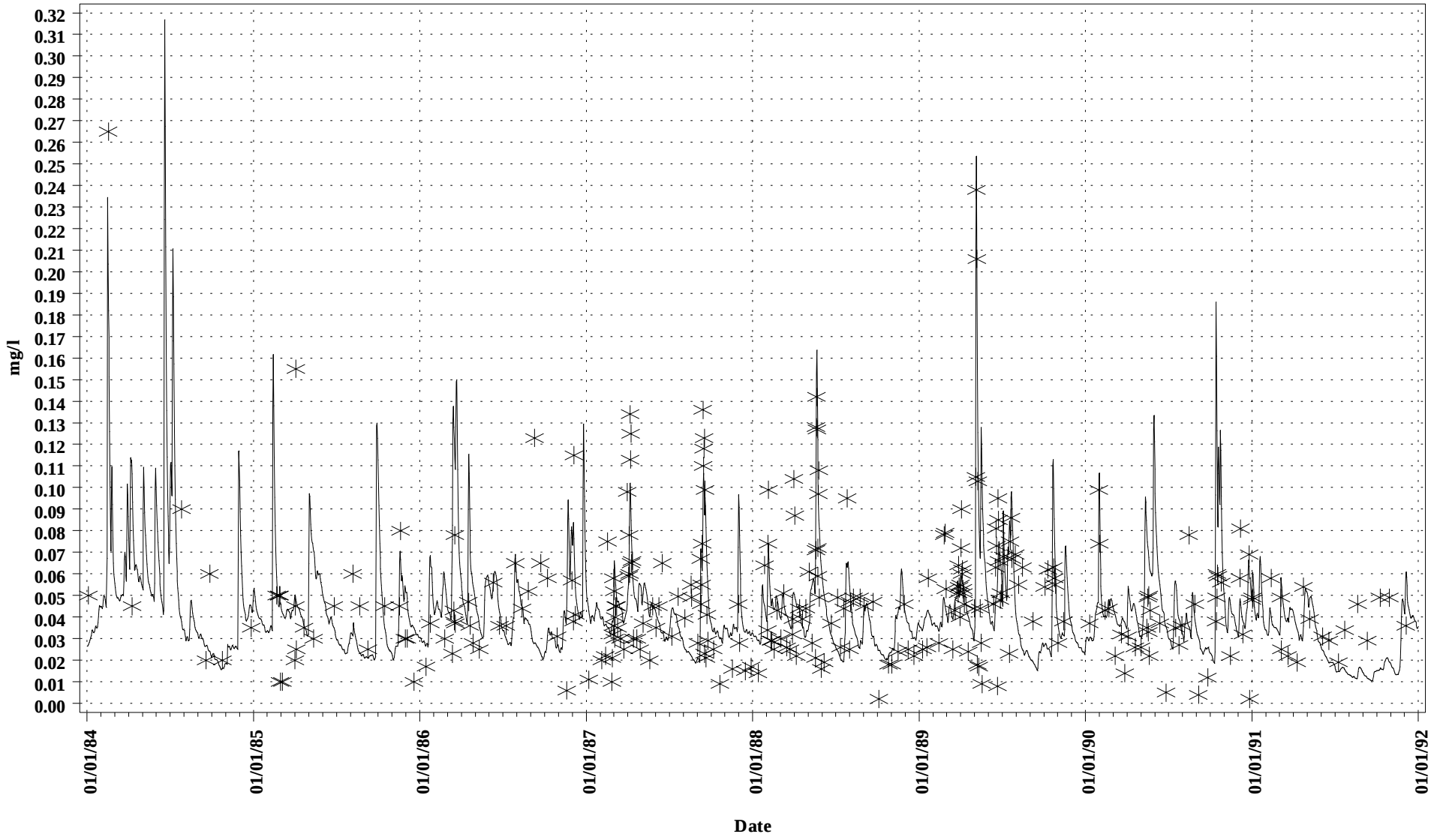
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

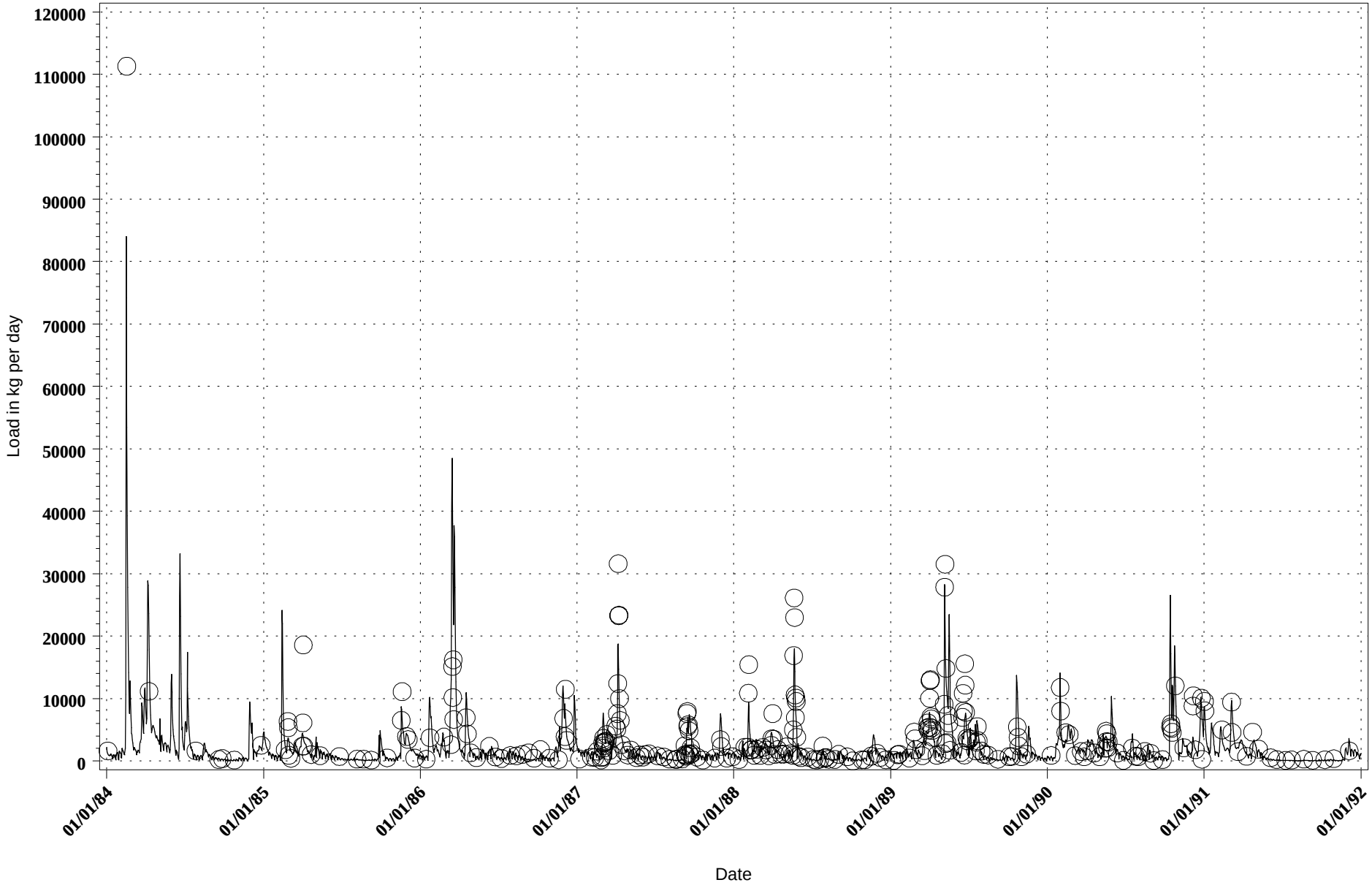



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

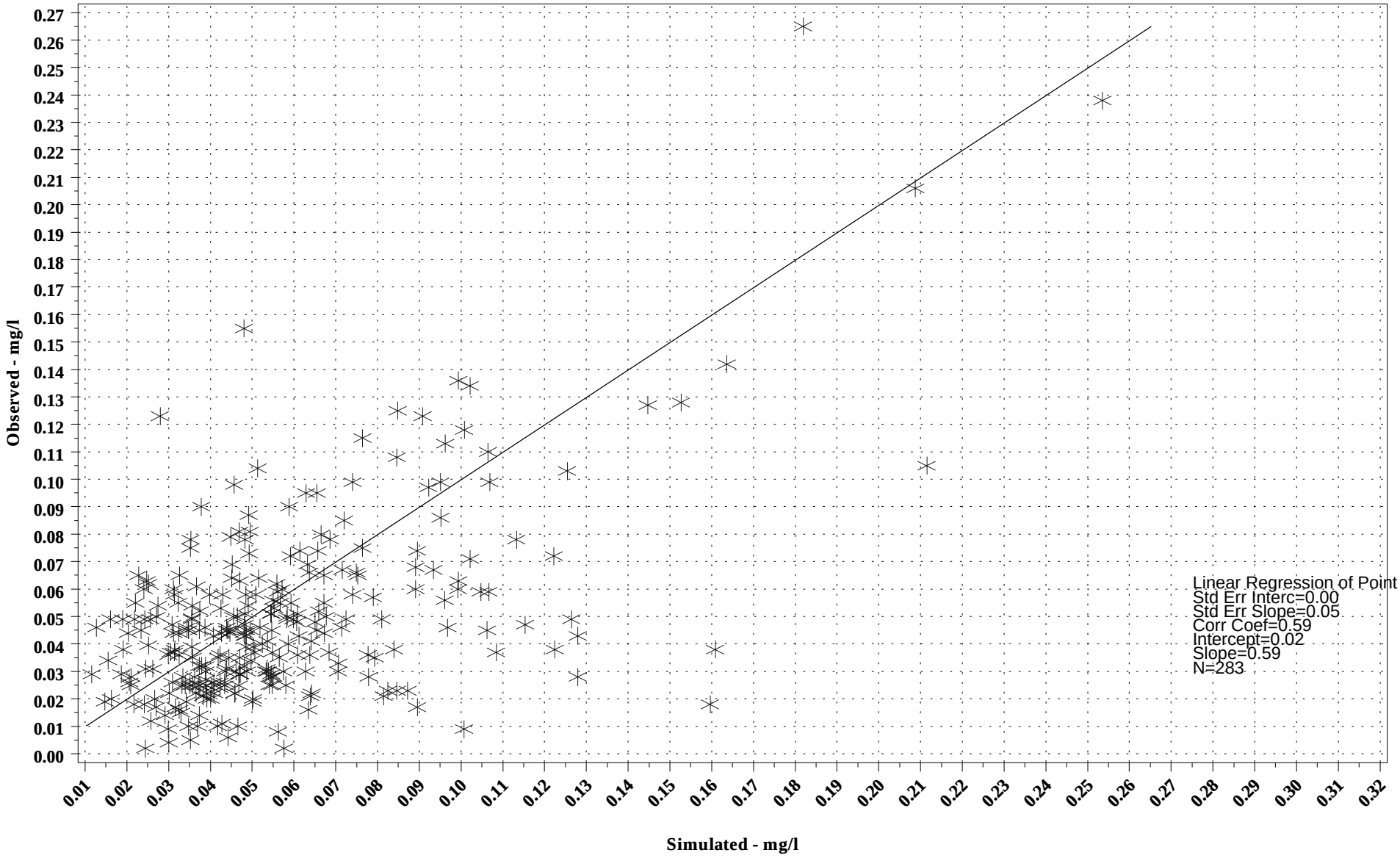



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140

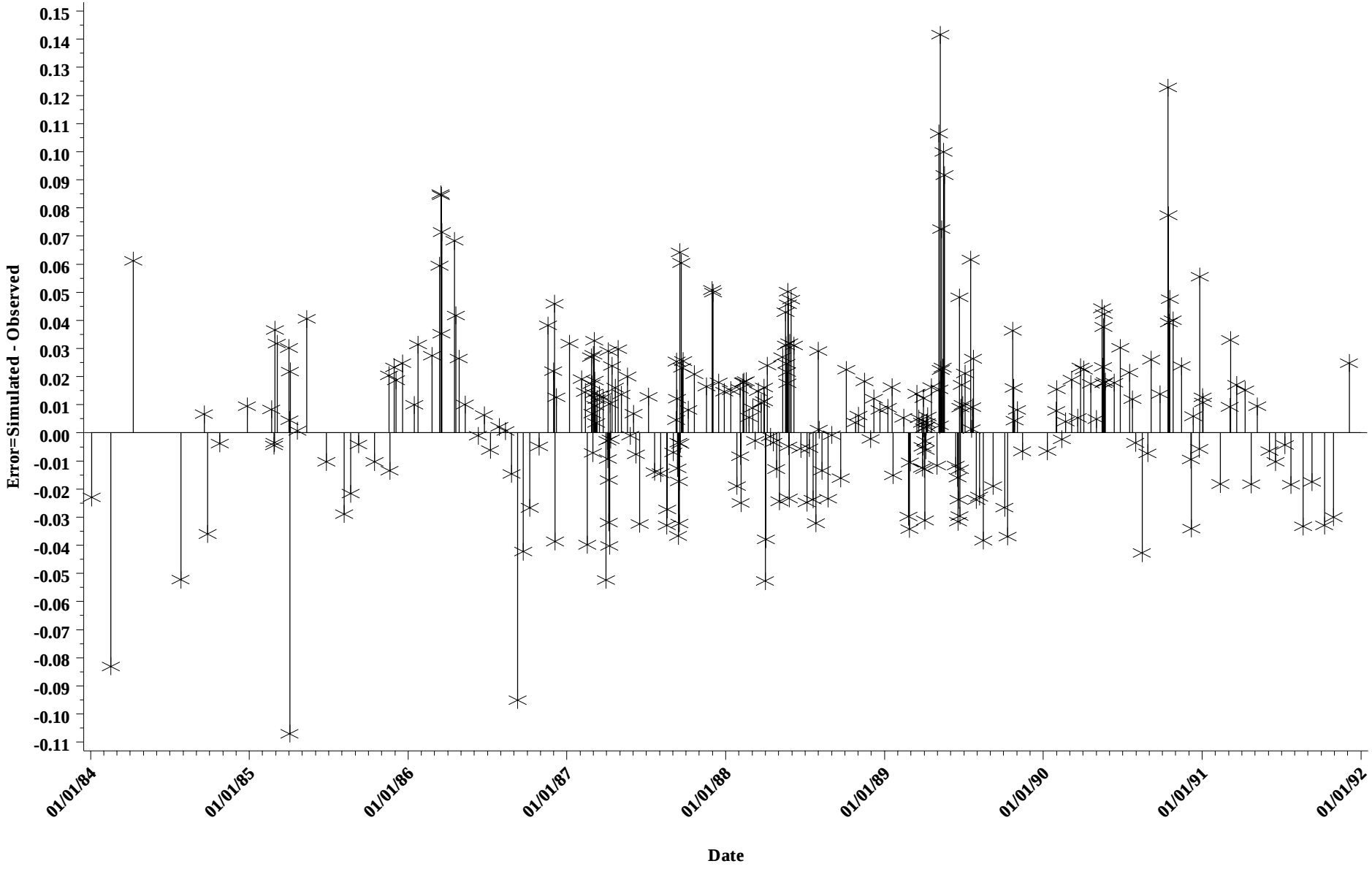
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92



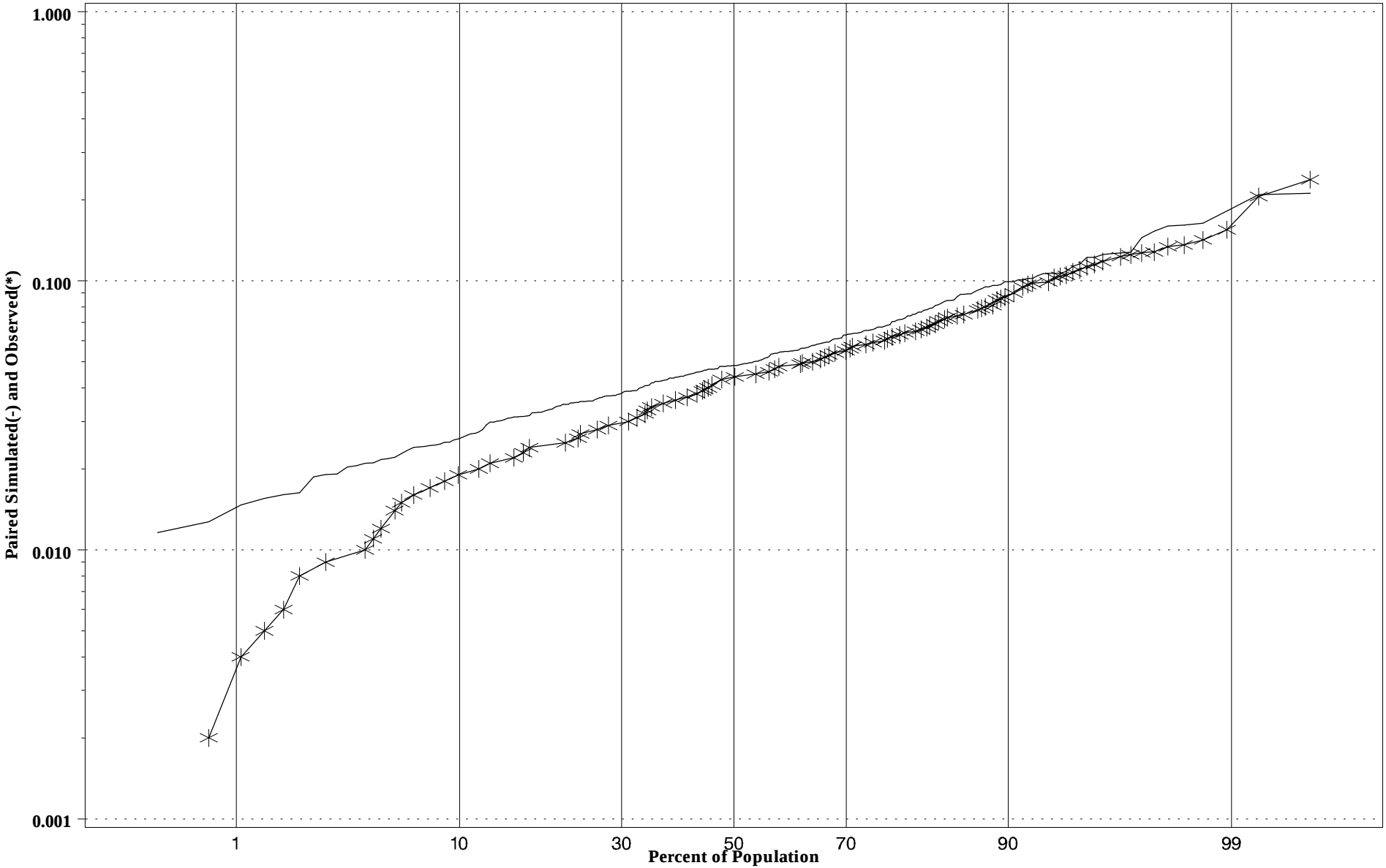

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140
## Actual Error versus Time
## Organic and Particulate Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(conow.drv 25JUN98 15:08)

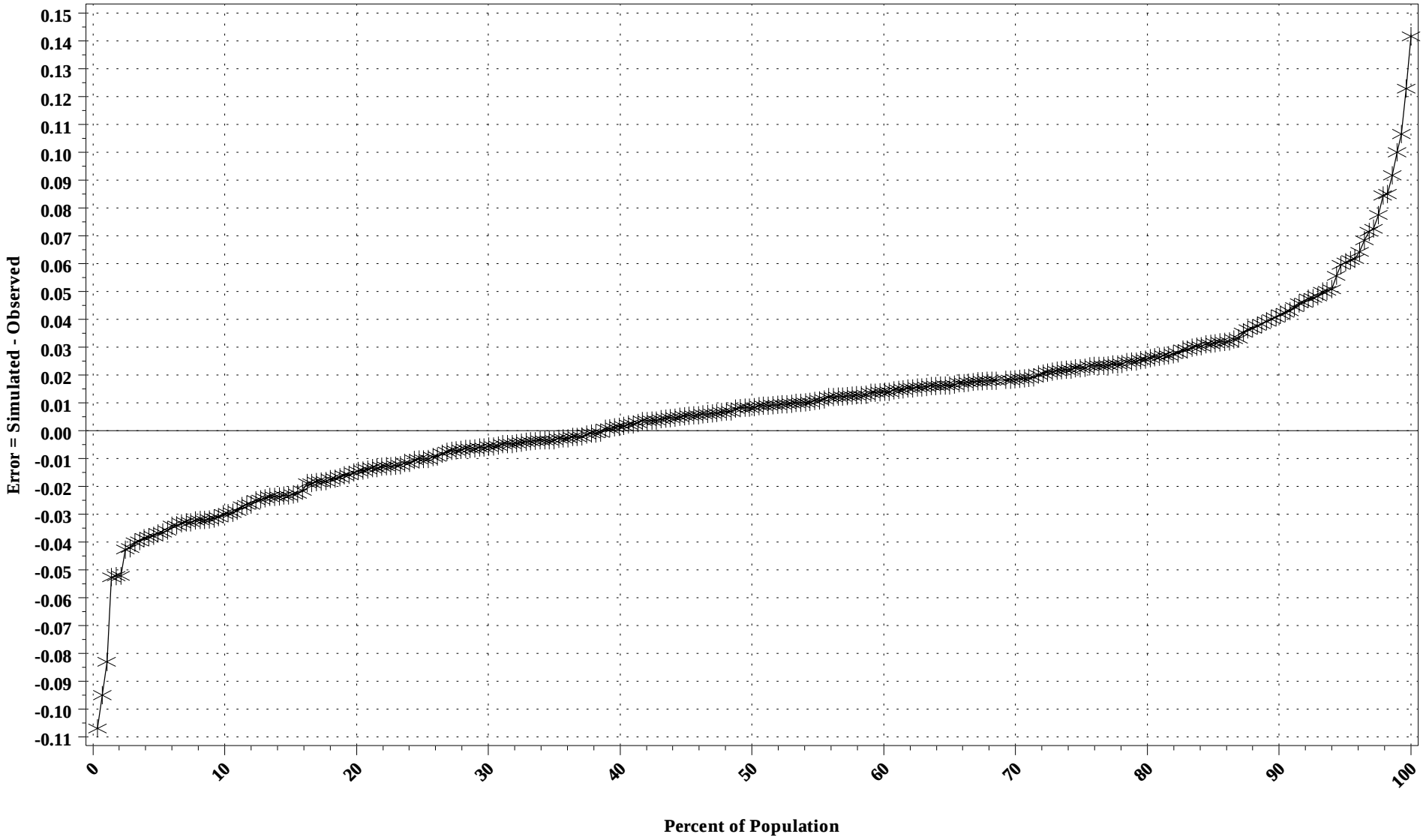
# Susquehanna River at Segment 140
## Organic and Particulate Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

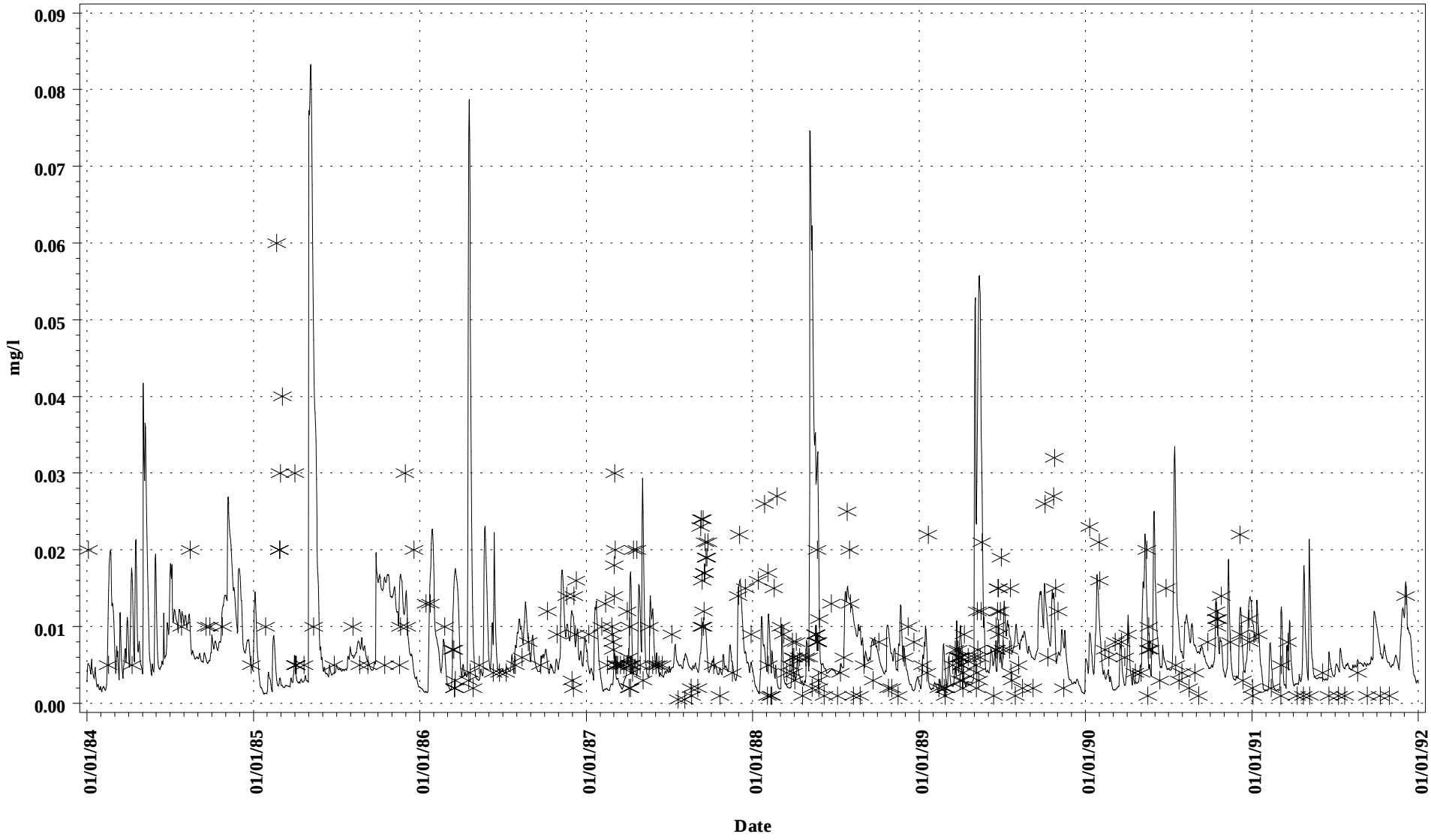
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Observed and Simulated versus Time
## Dissolved Phosphorus

**(*=Observed, -=Simulated)**

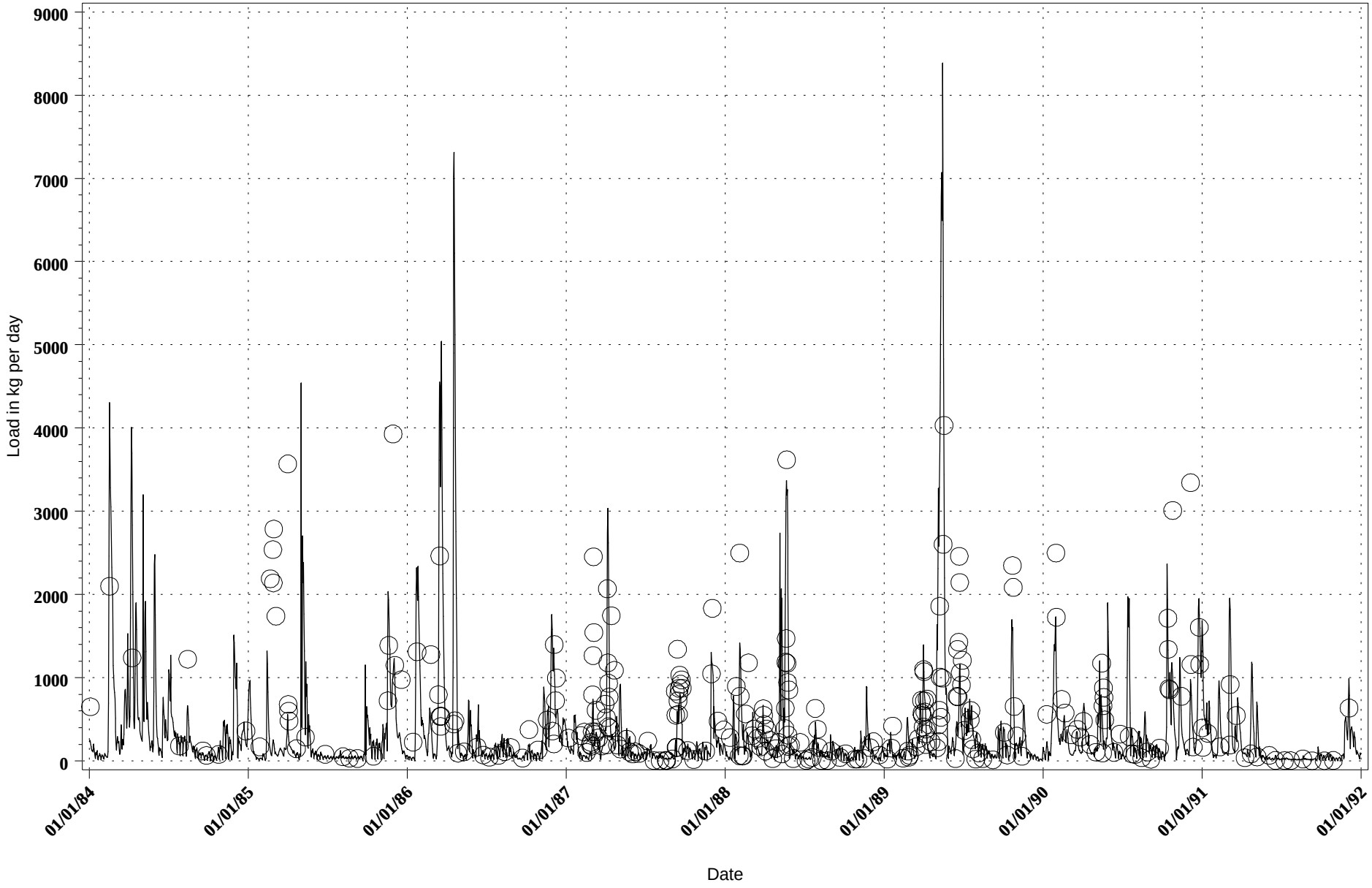



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140

## Dissolved Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

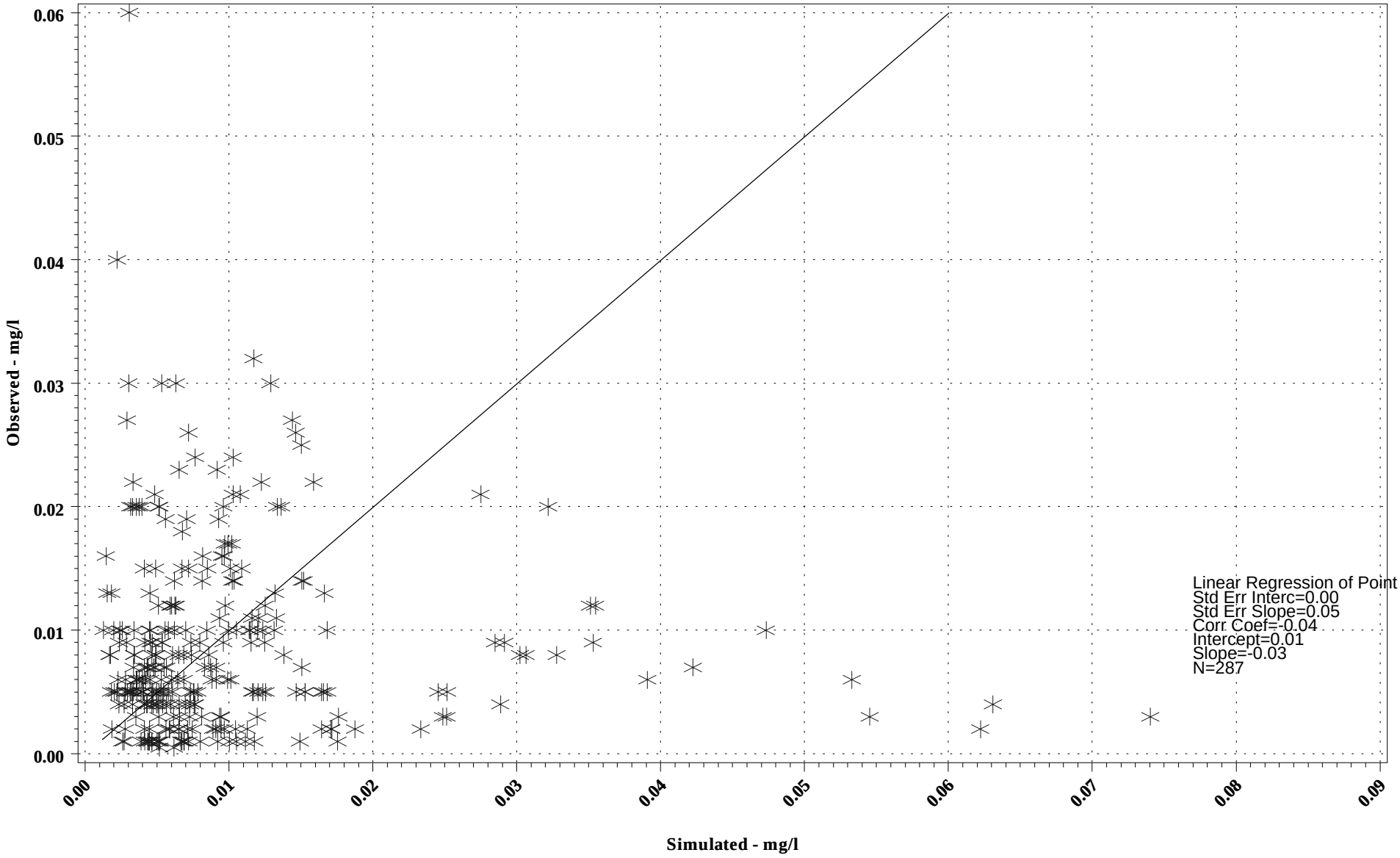



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140

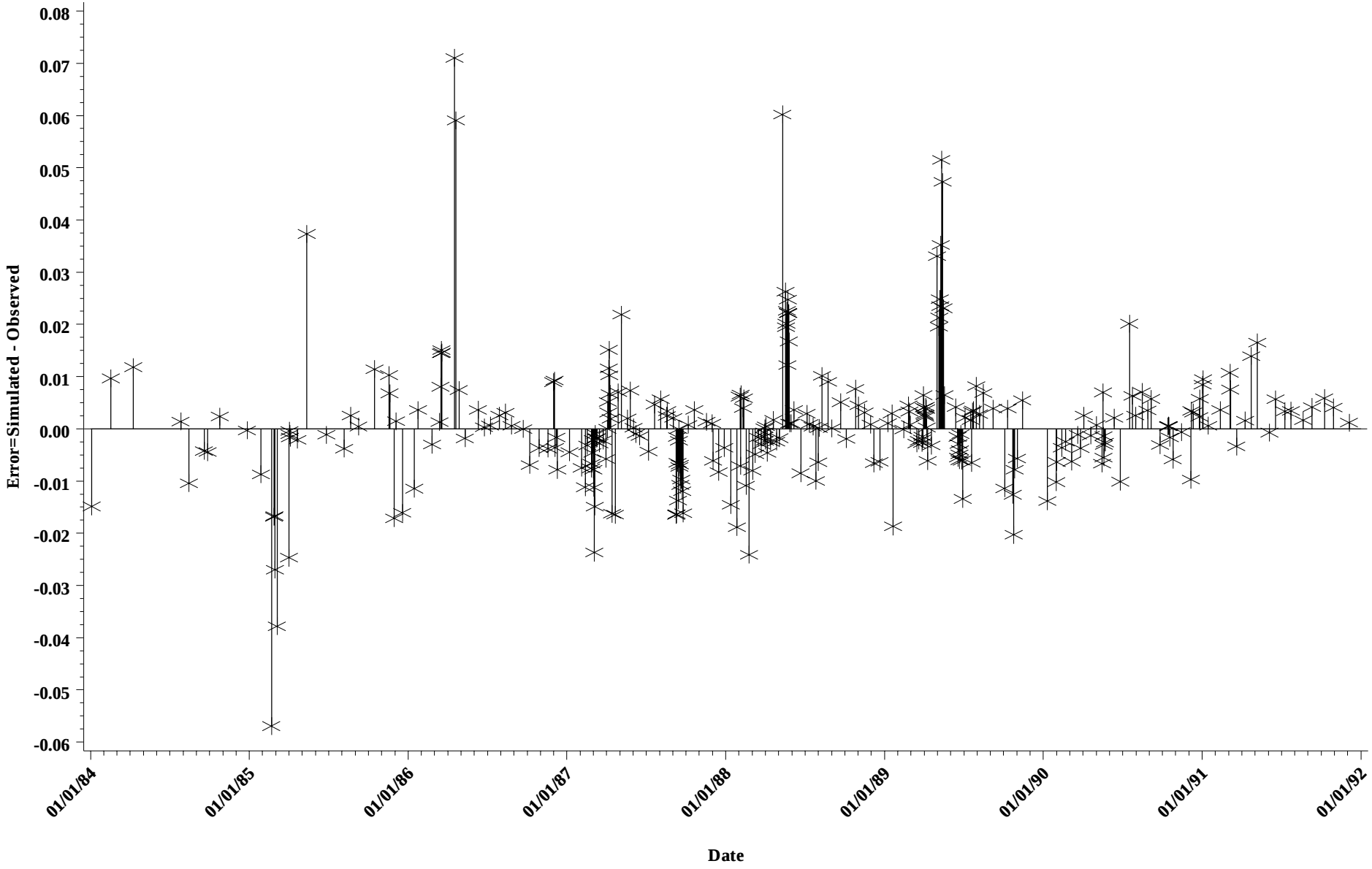
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



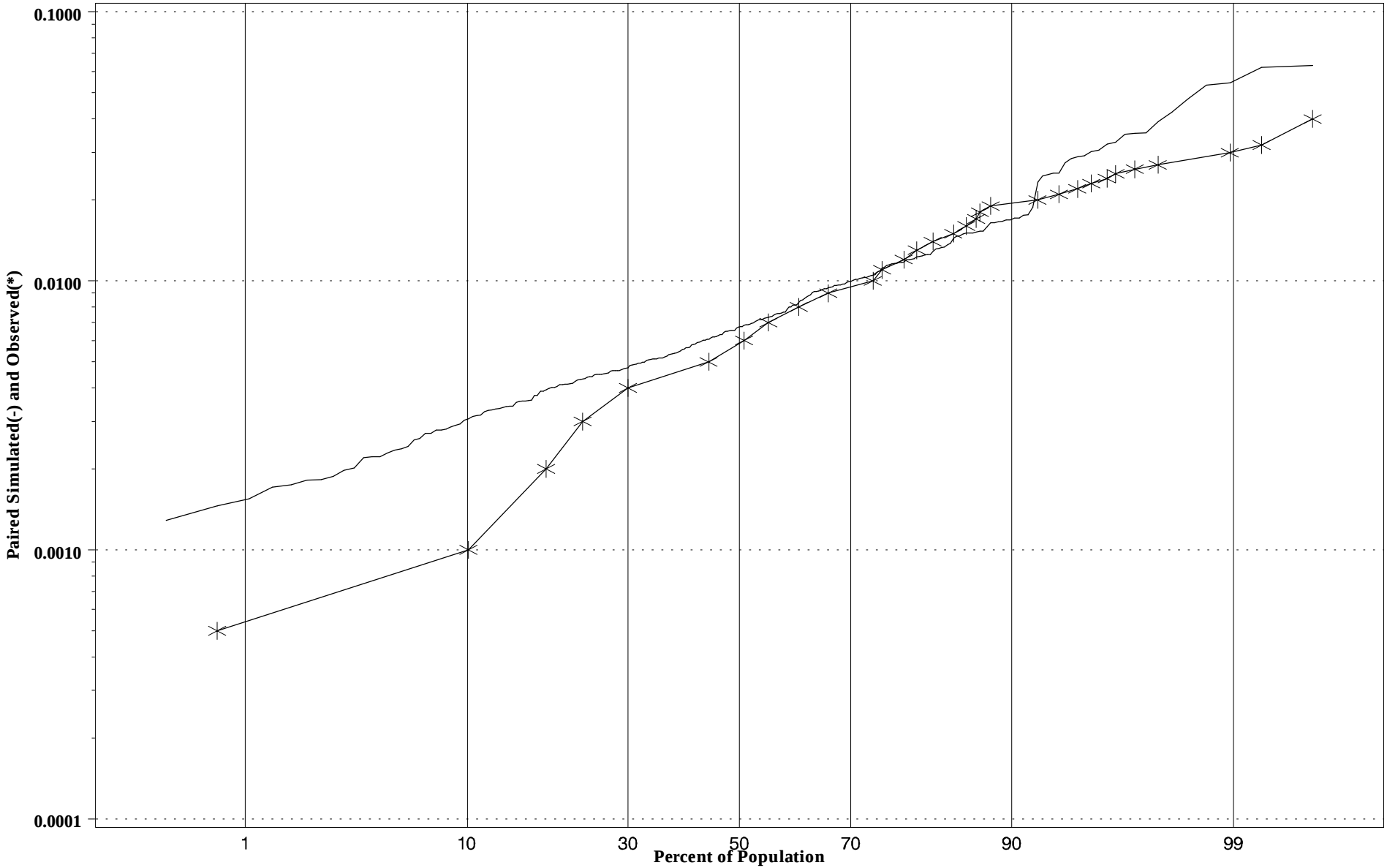

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(conow.drv 25JUN98 15:08)

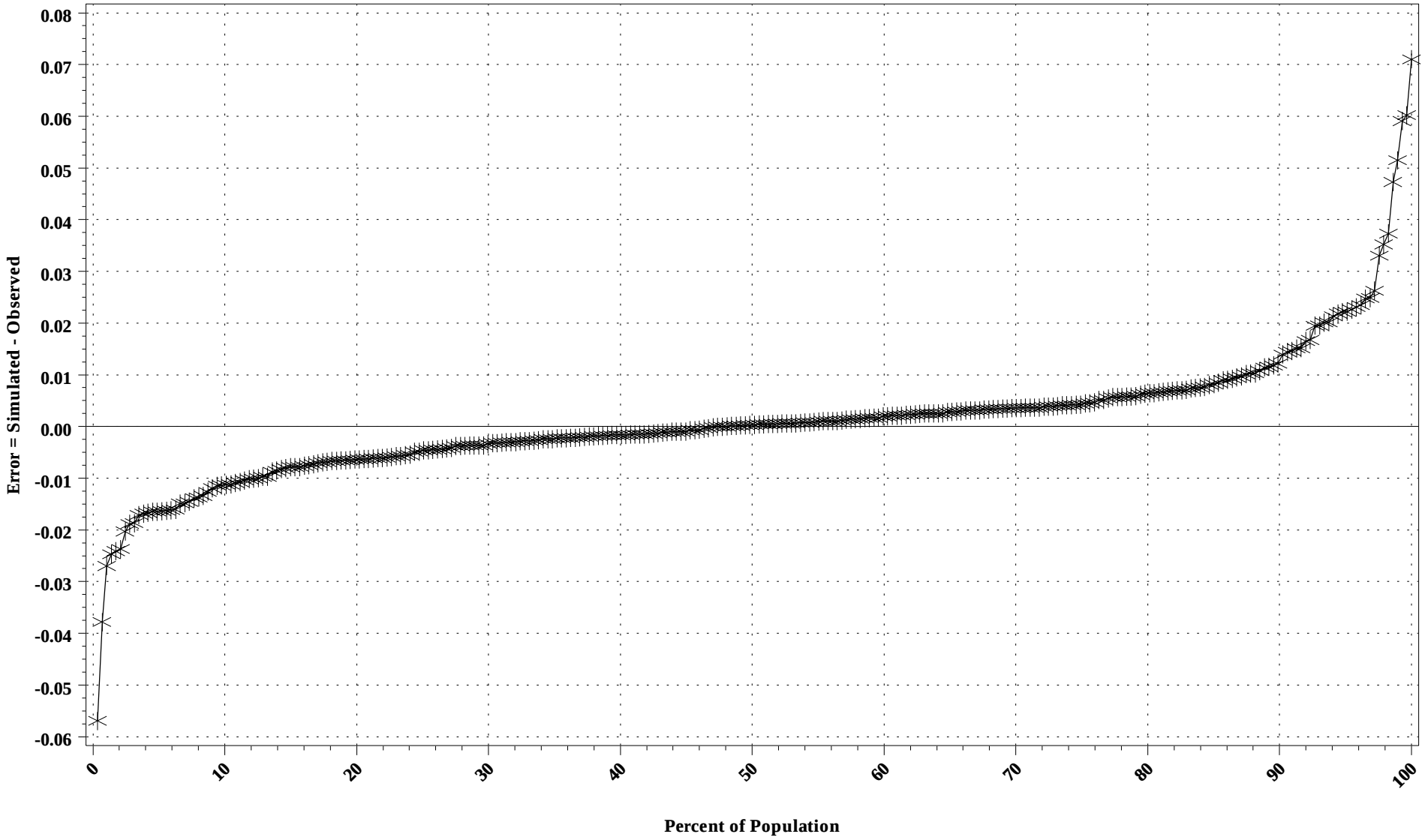
# Susquehanna River at Segment 140
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

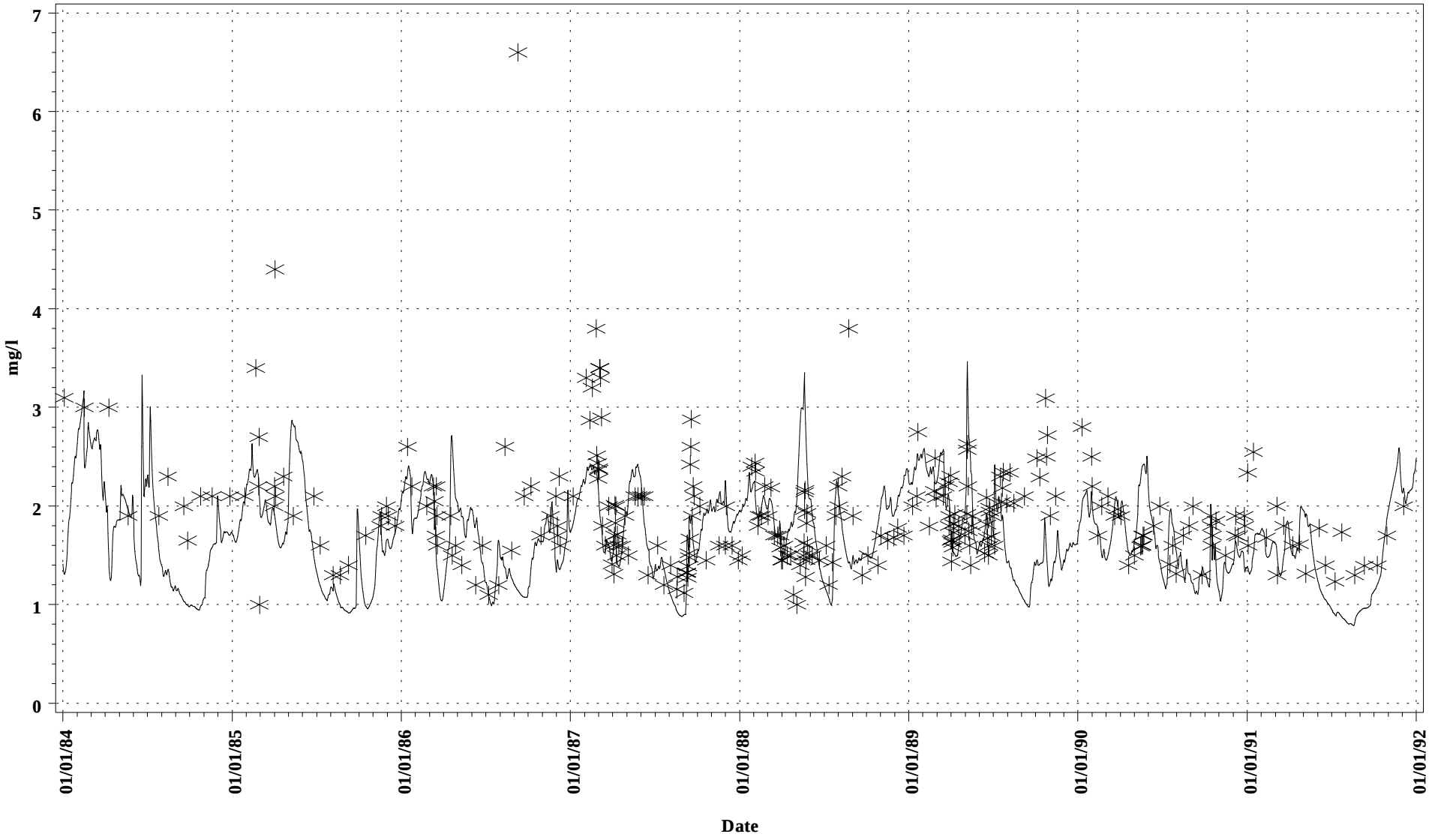
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(conow.drv 25JUN98 15:08)

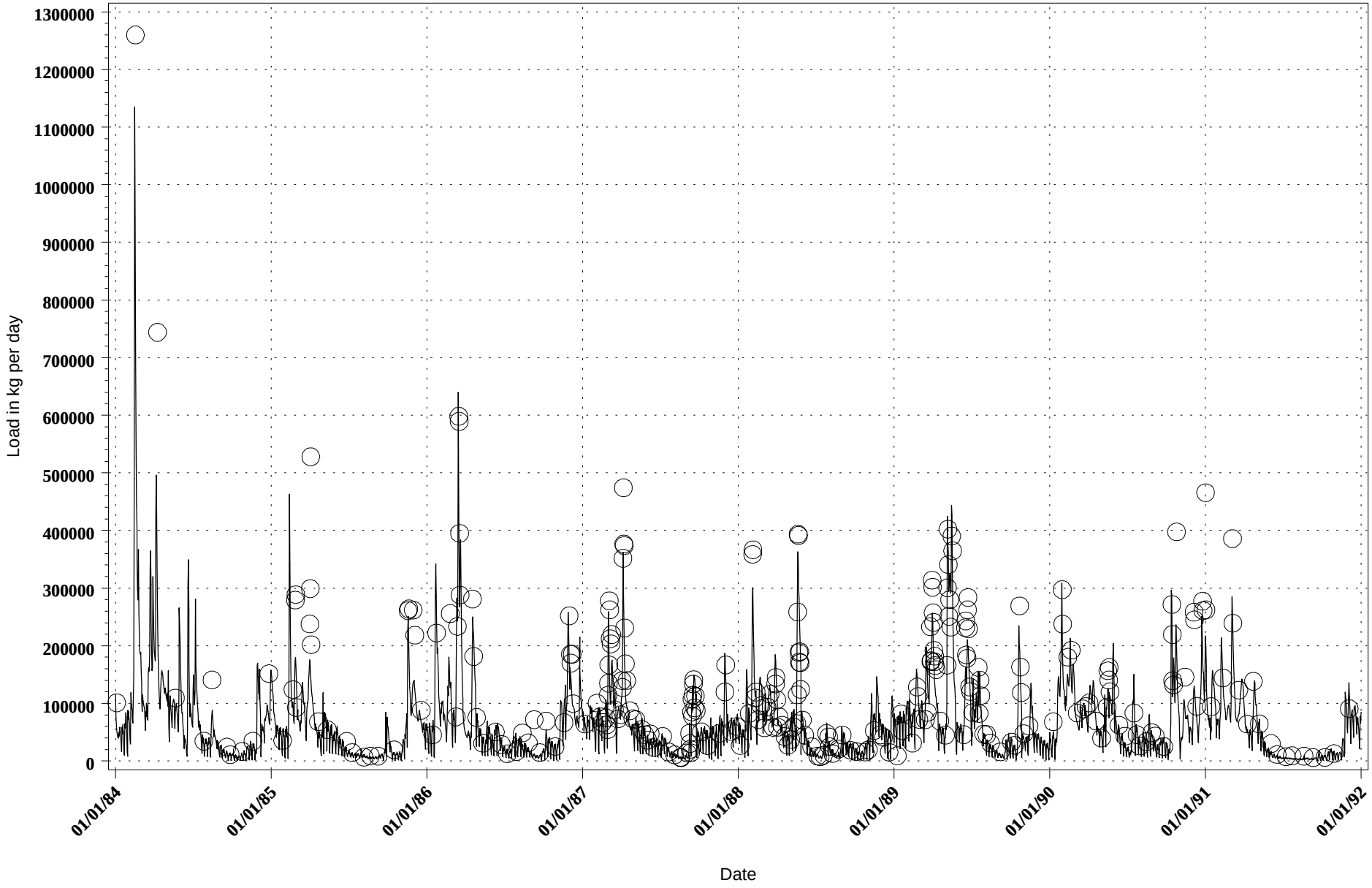
# Susquehanna River at Segment 140
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

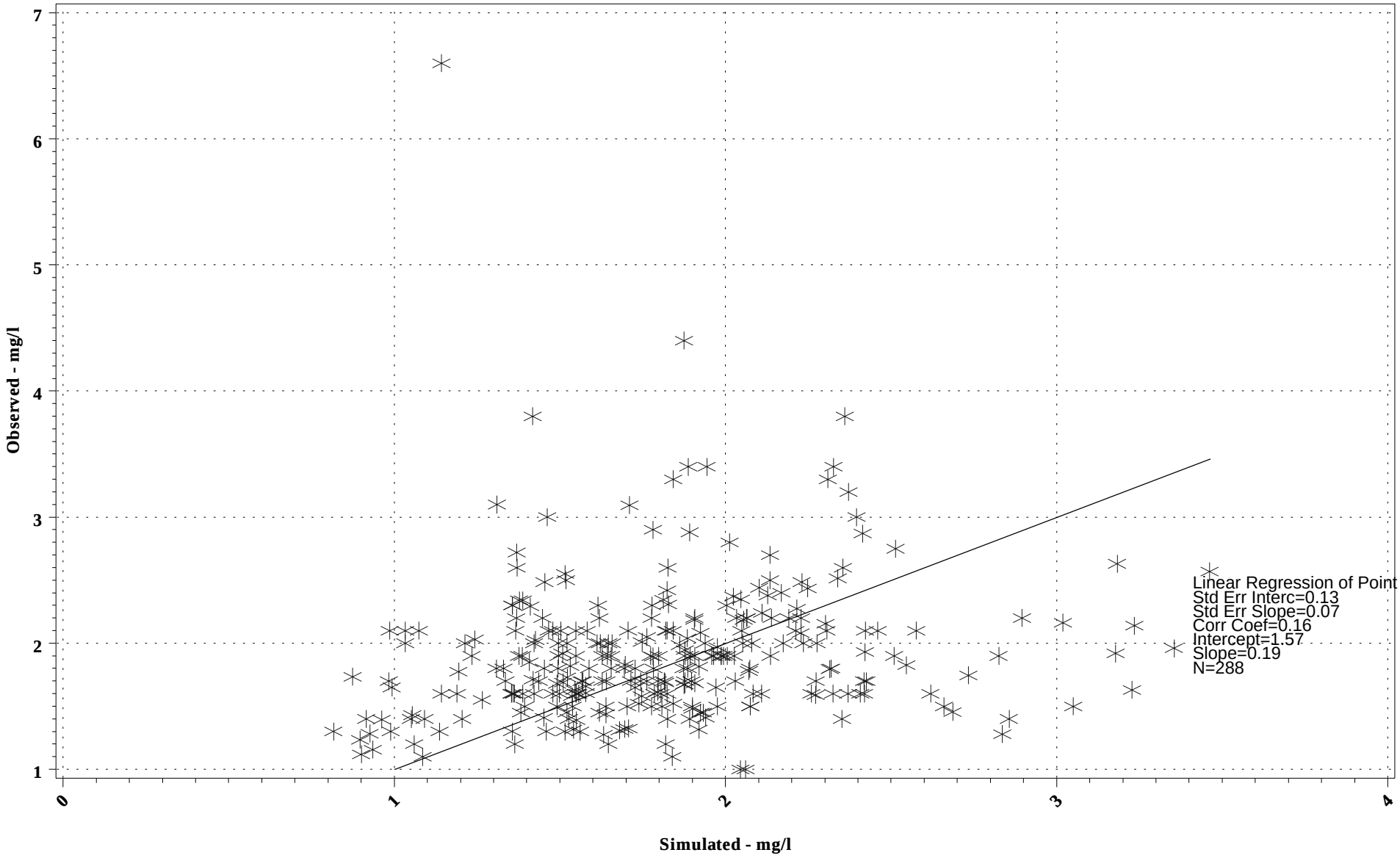



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140

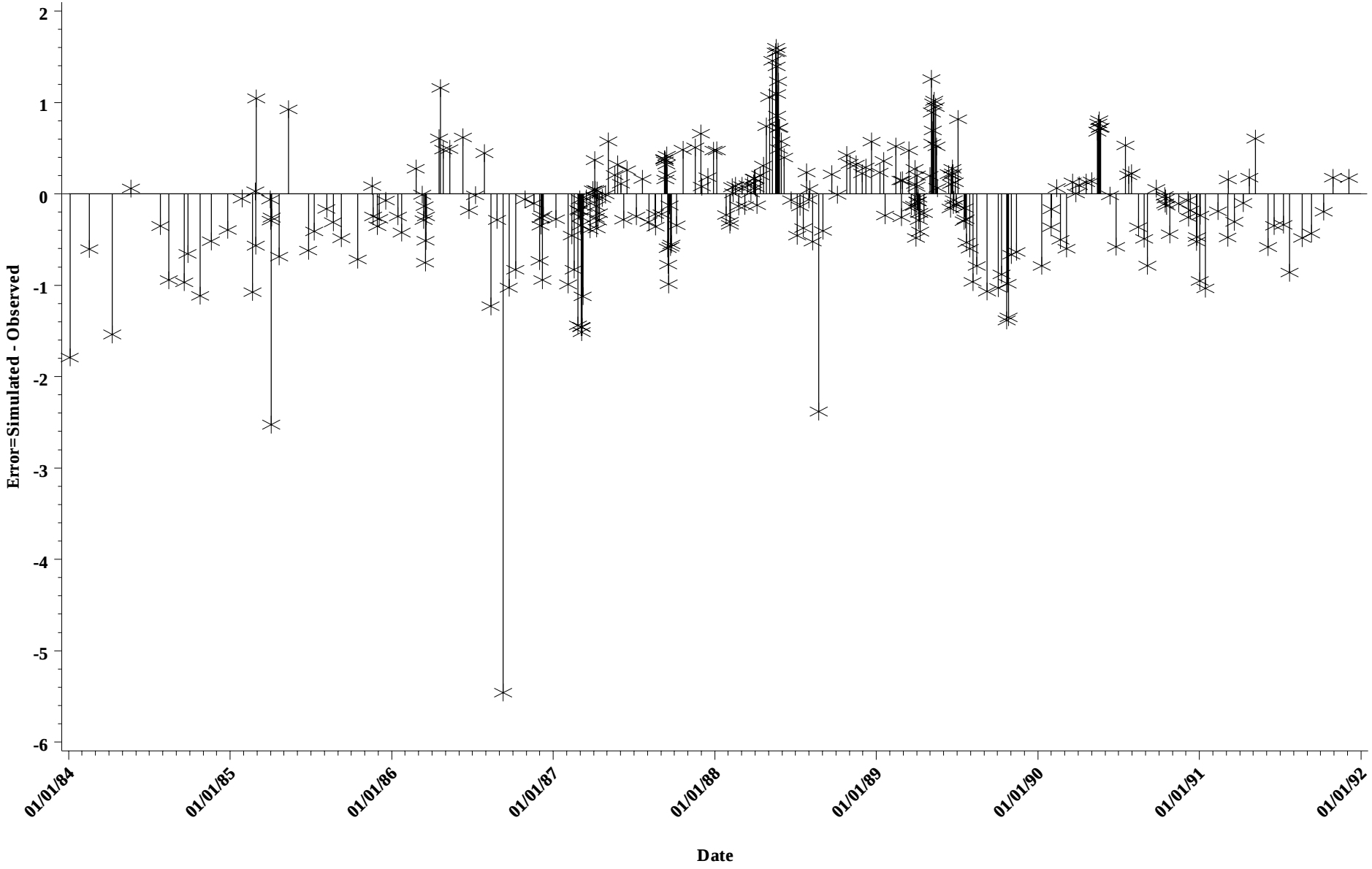
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92



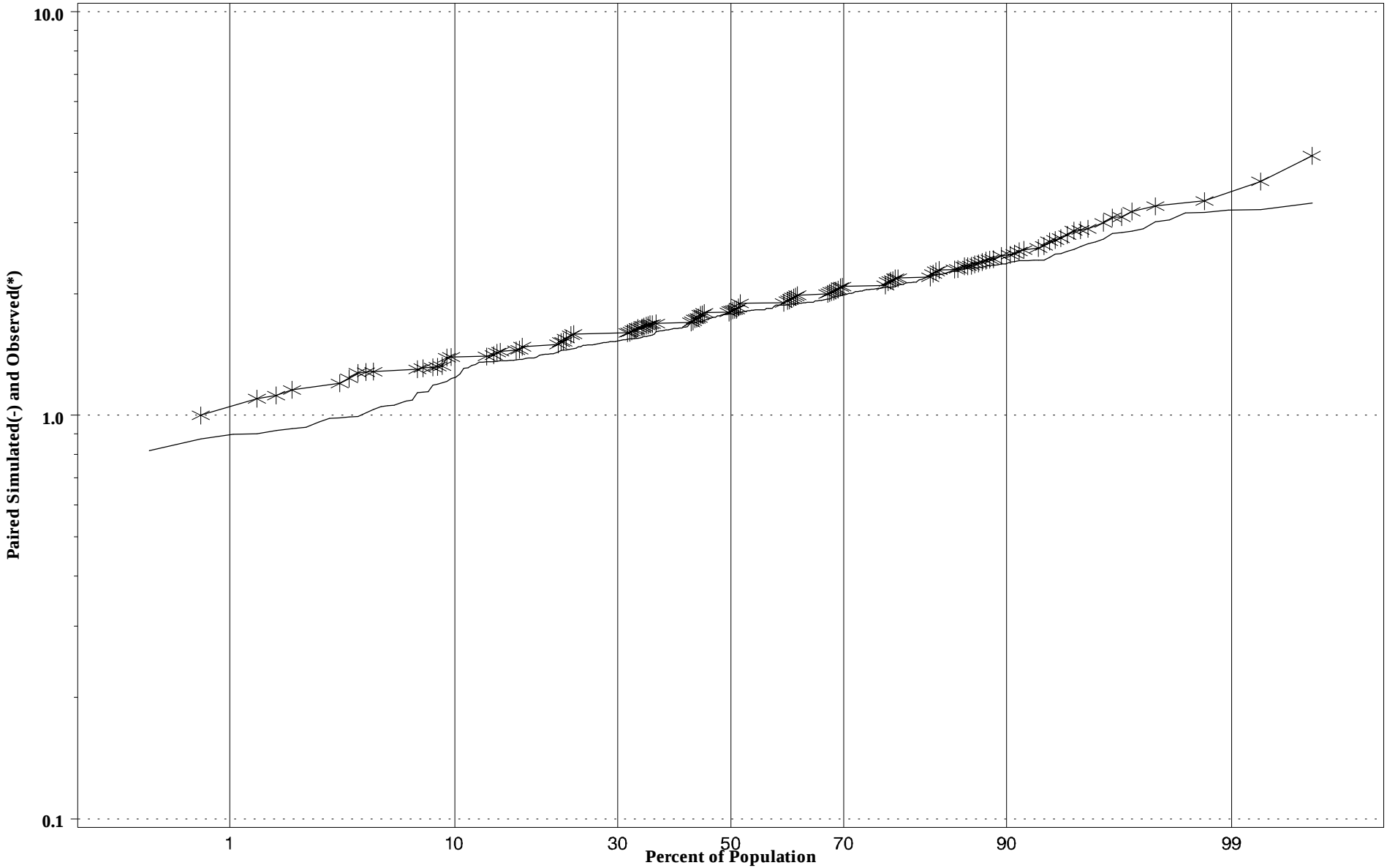

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140
## Actual Error versus Time
## Total Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(conow.drv 25JUN98 15:08)

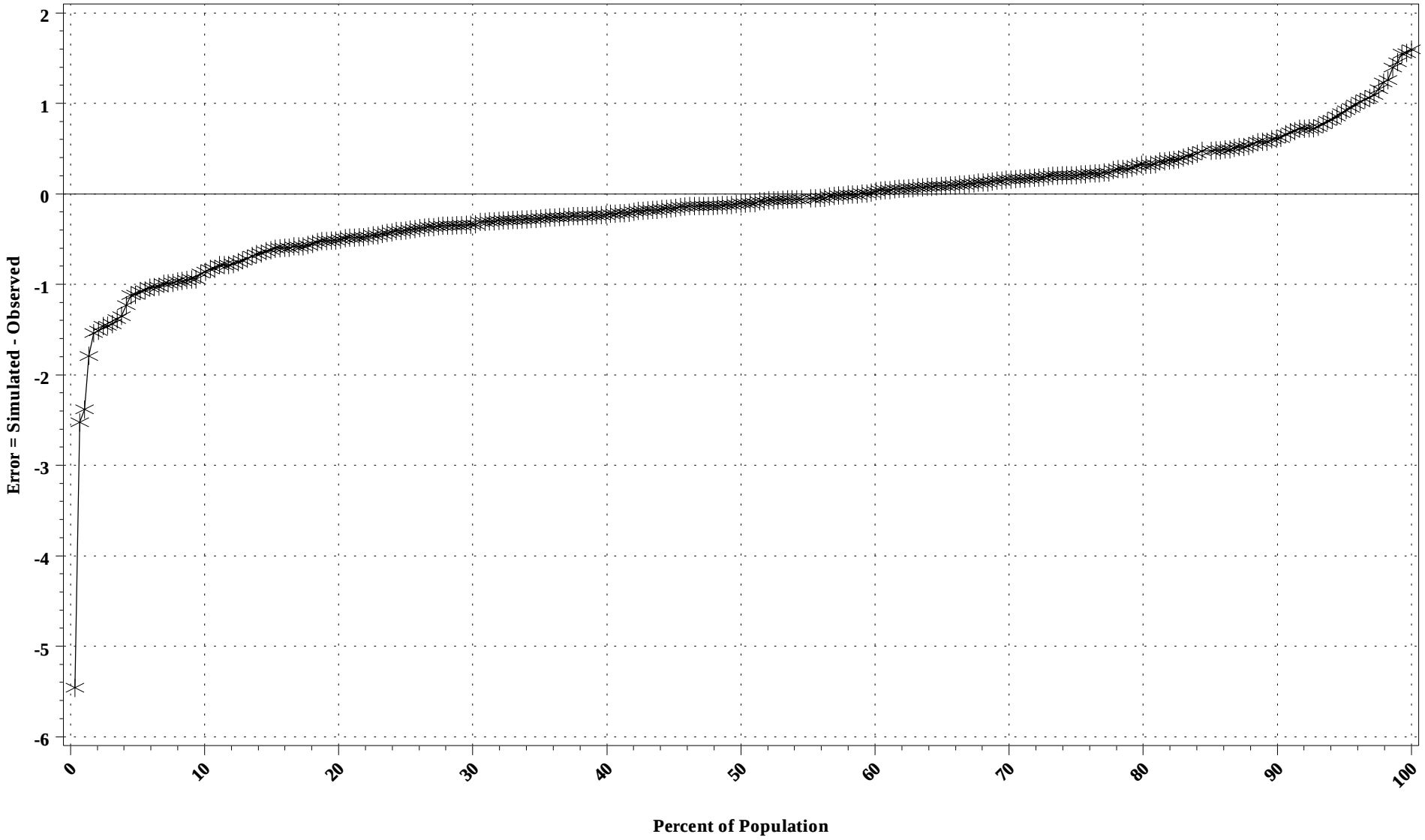
# Susquehanna River at Segment 140
## Total Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Actual error versus Percentile Sample Population
## Total Nitrogen

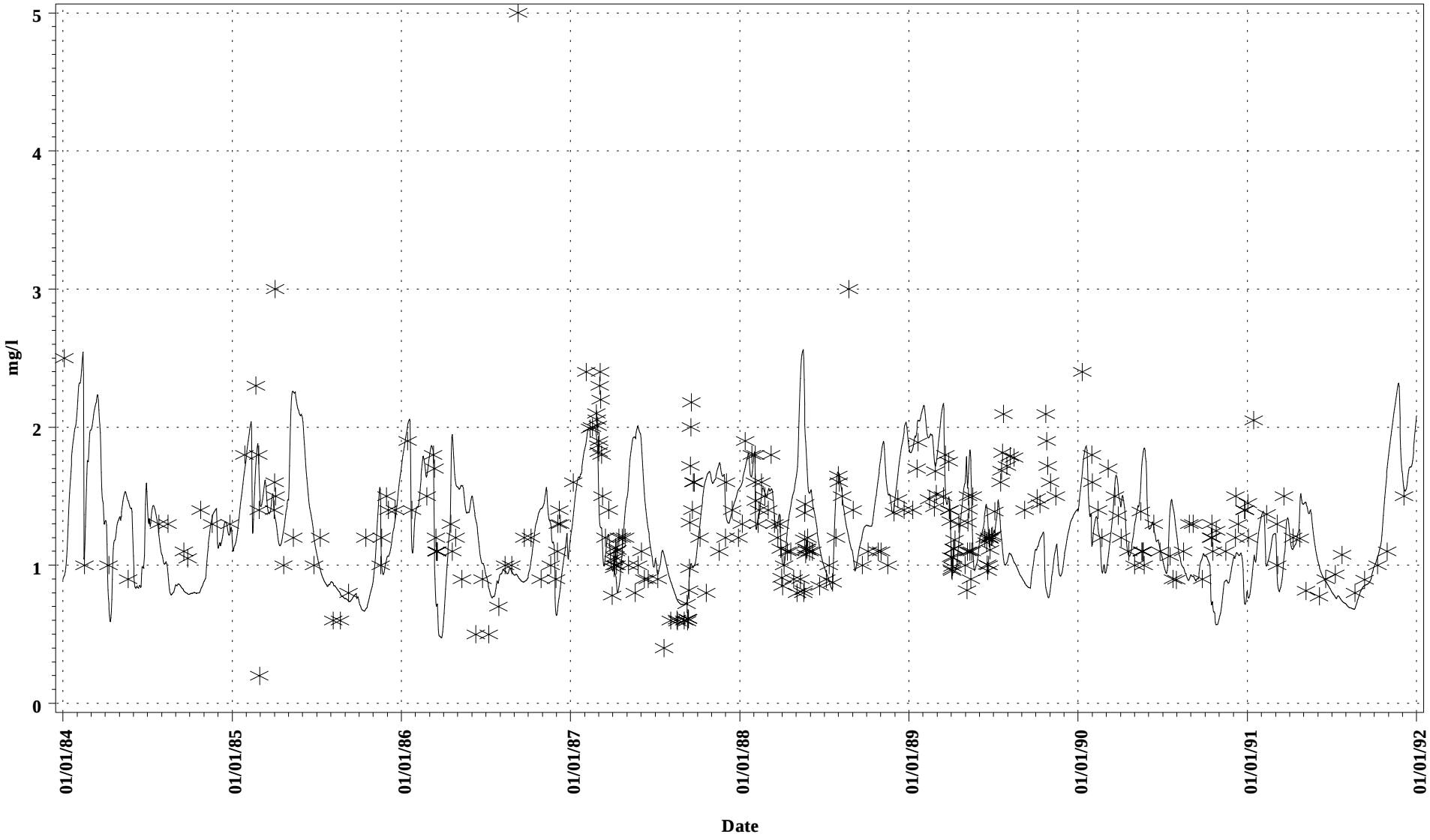
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

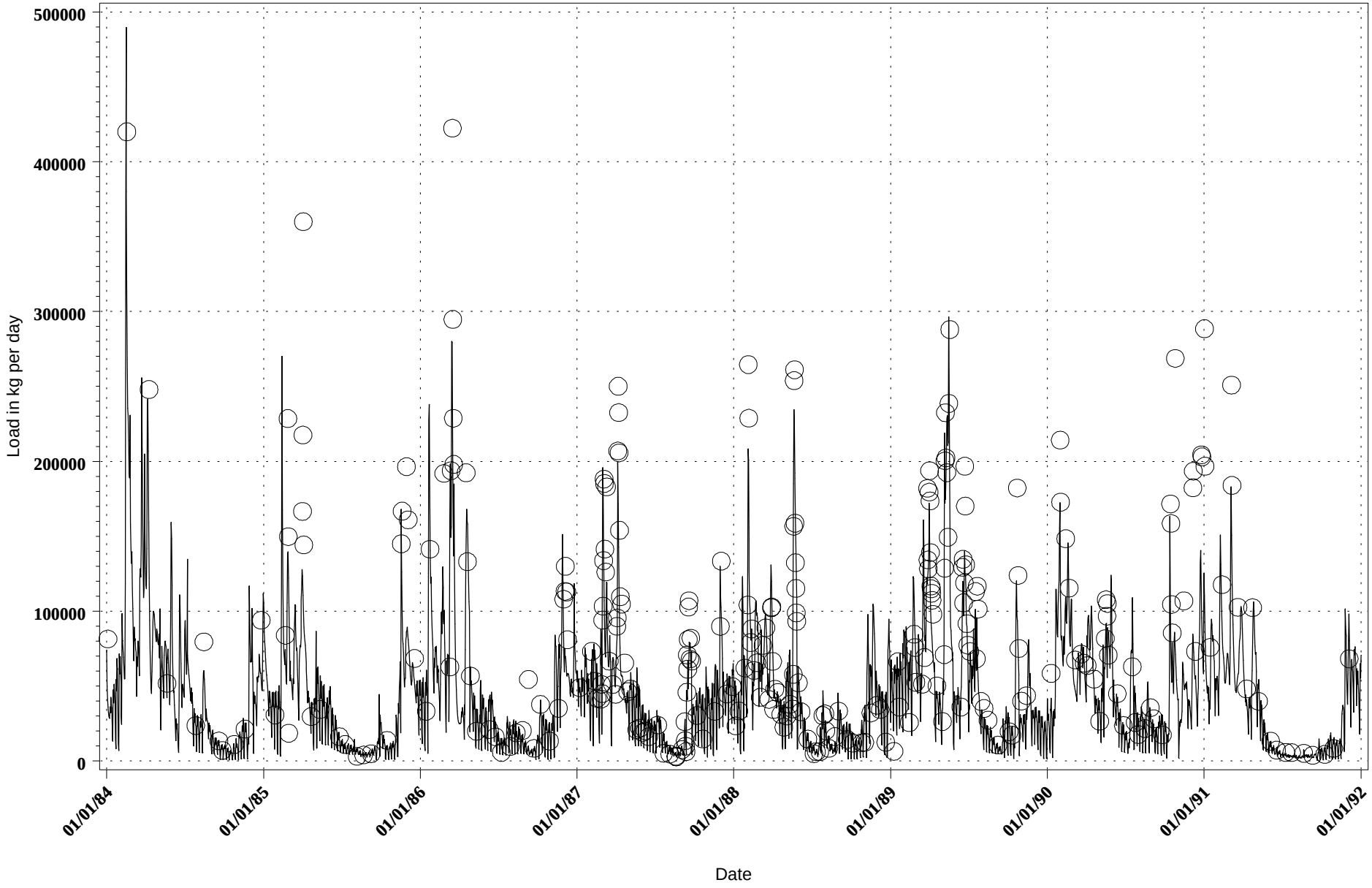



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140

## NO3 Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

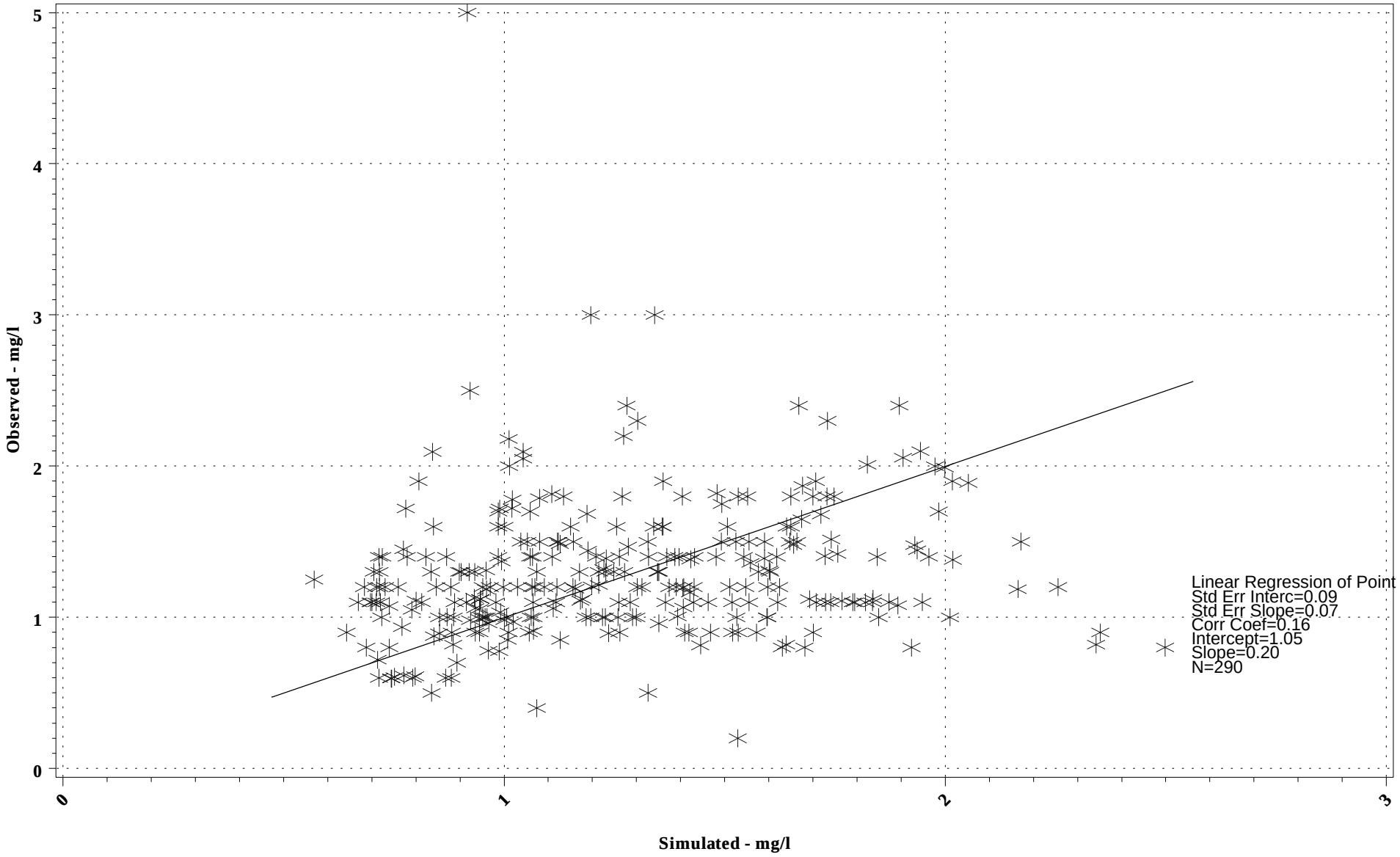



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140

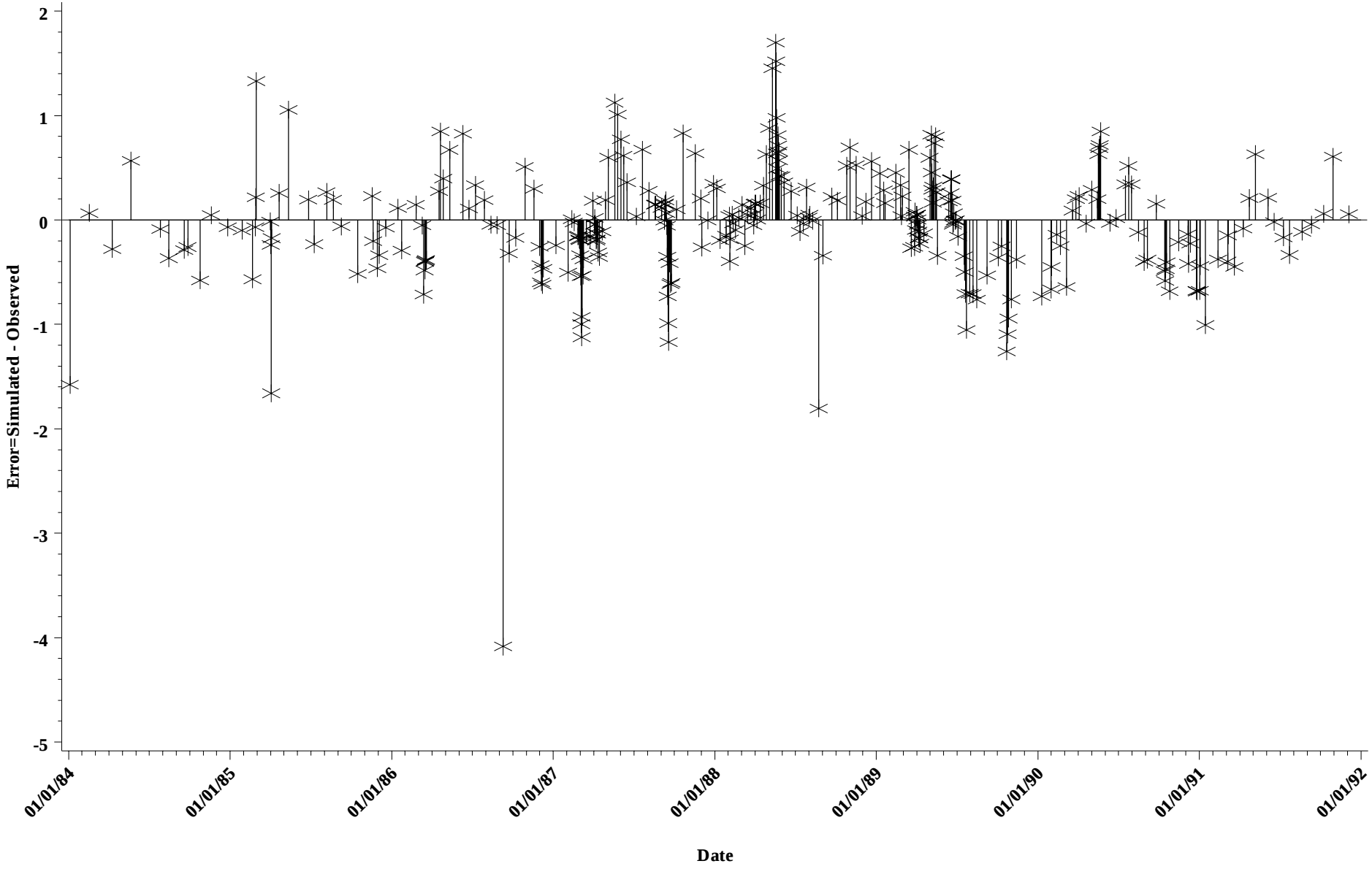
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140
## Actual Error versus Time
## NO3

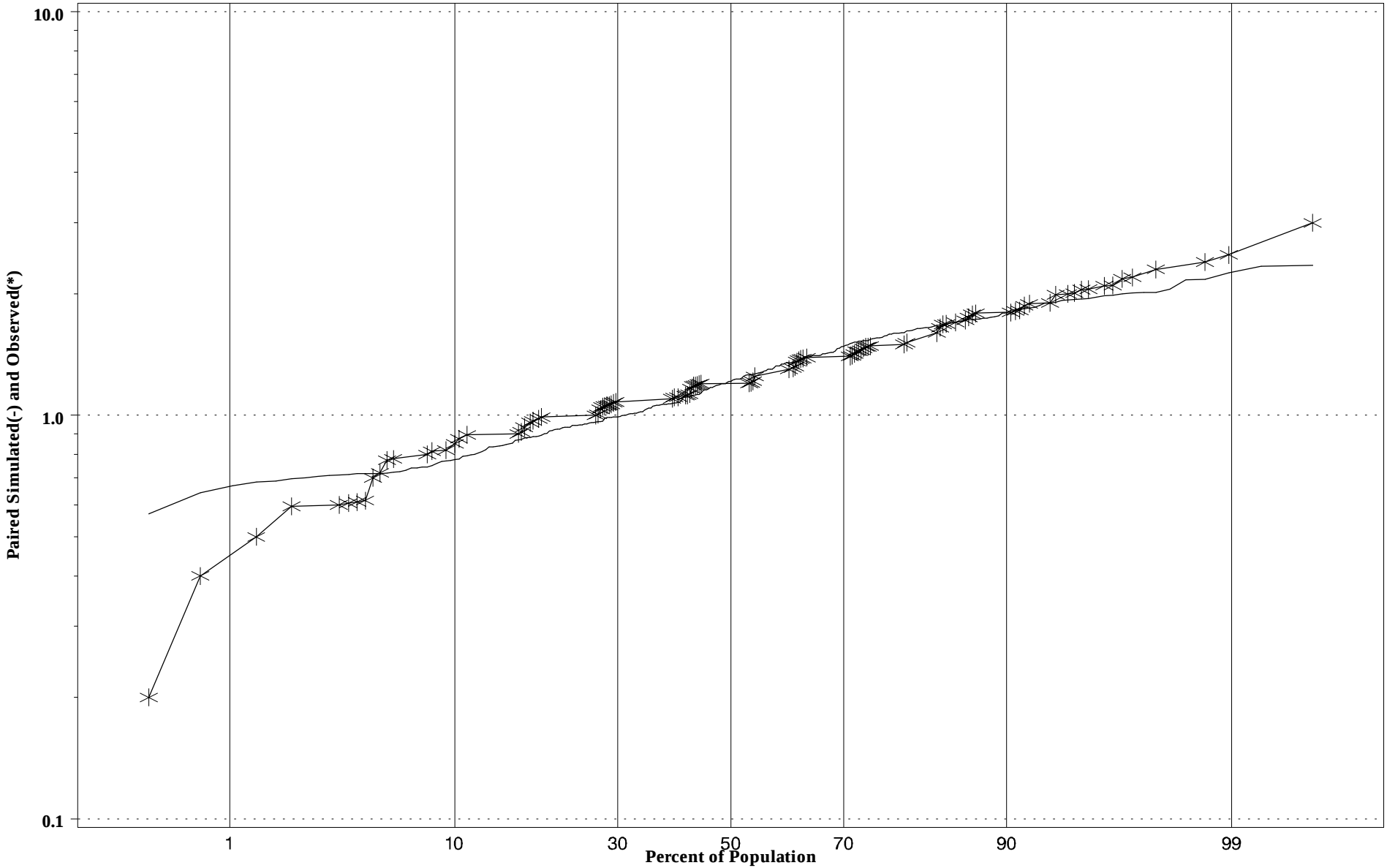



(y21_plotb.sas model3d:[pwang.dt] omerr)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140

## NO3

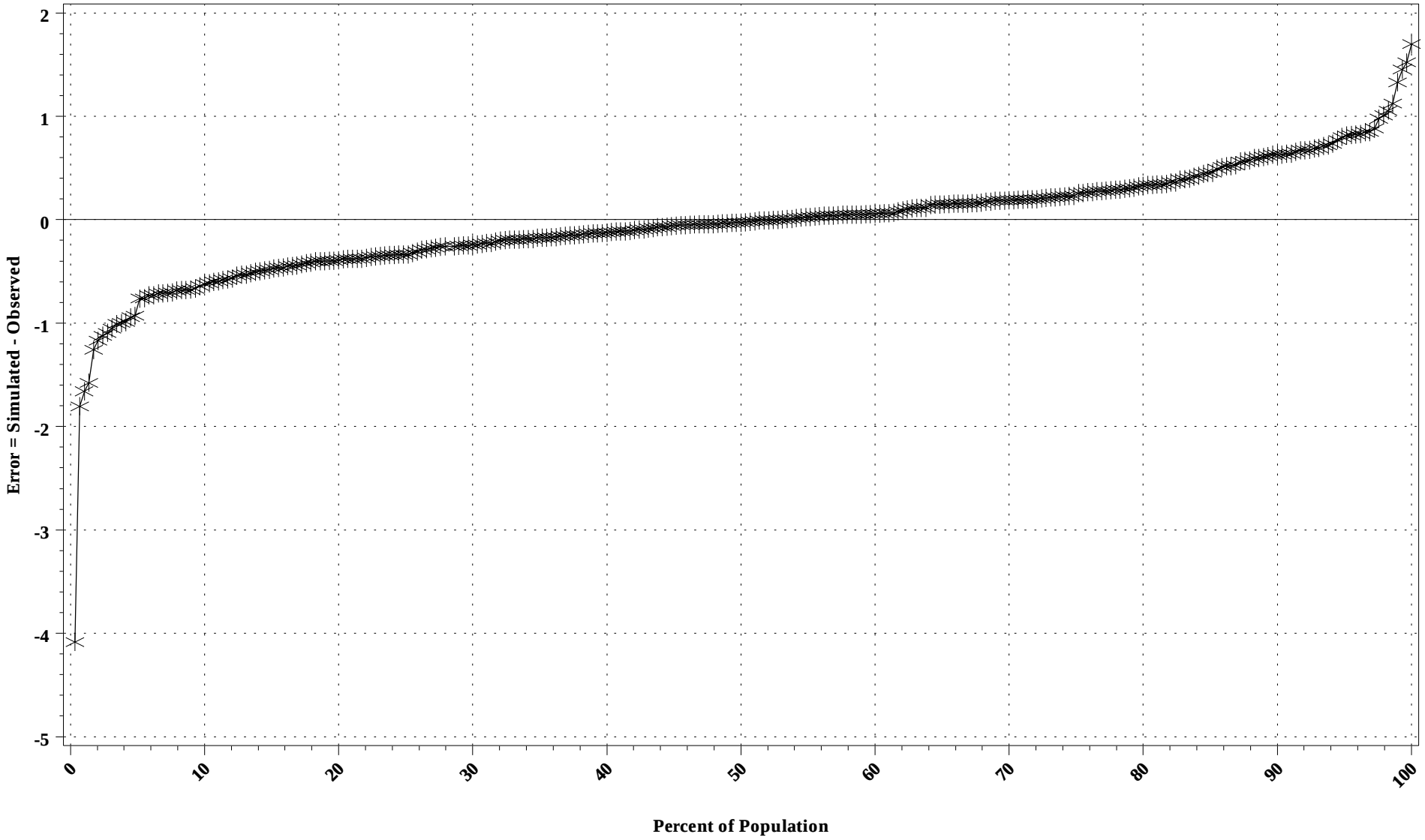
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Actual error versus Percentile Sample Population
## NO3

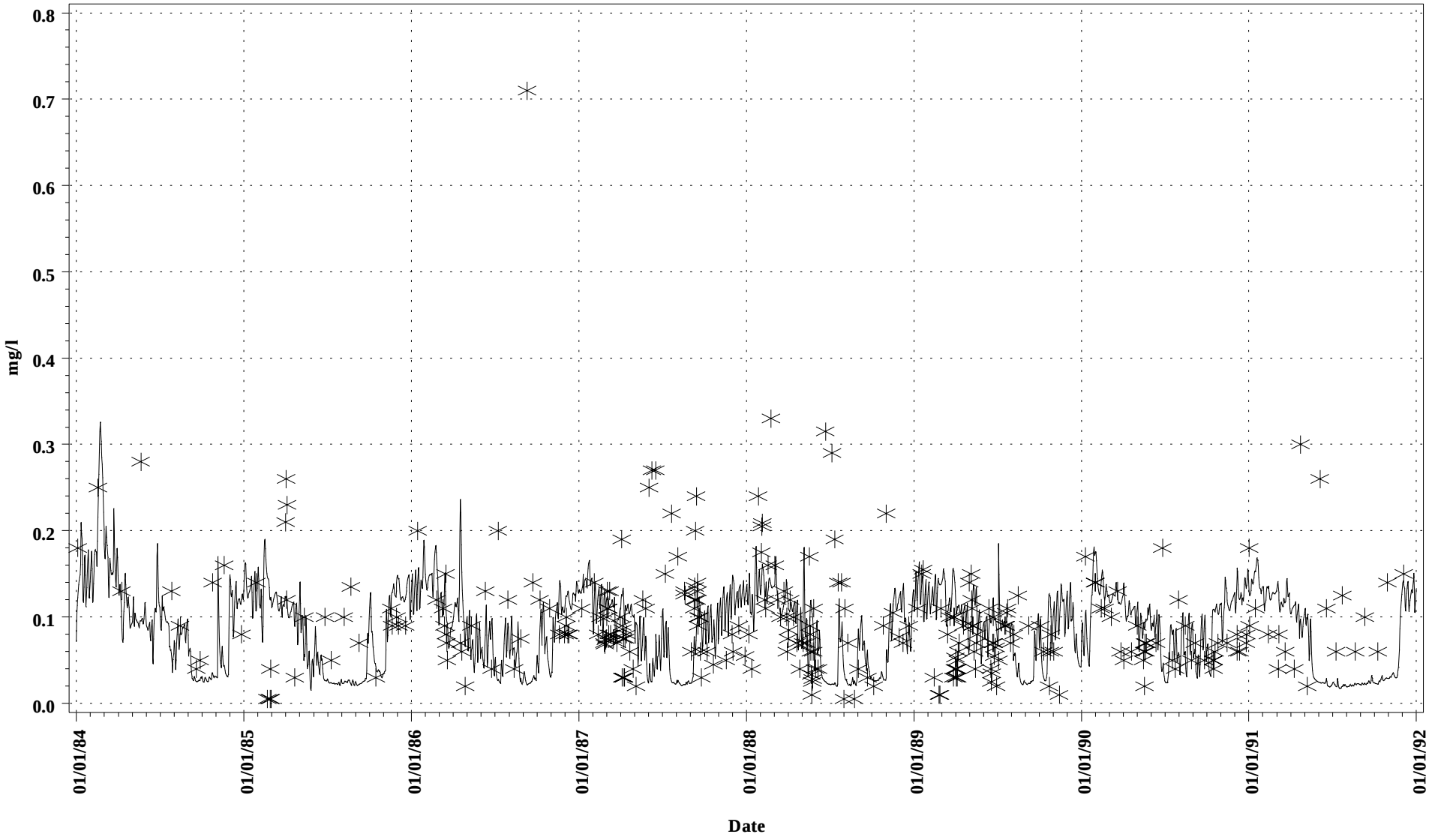
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**

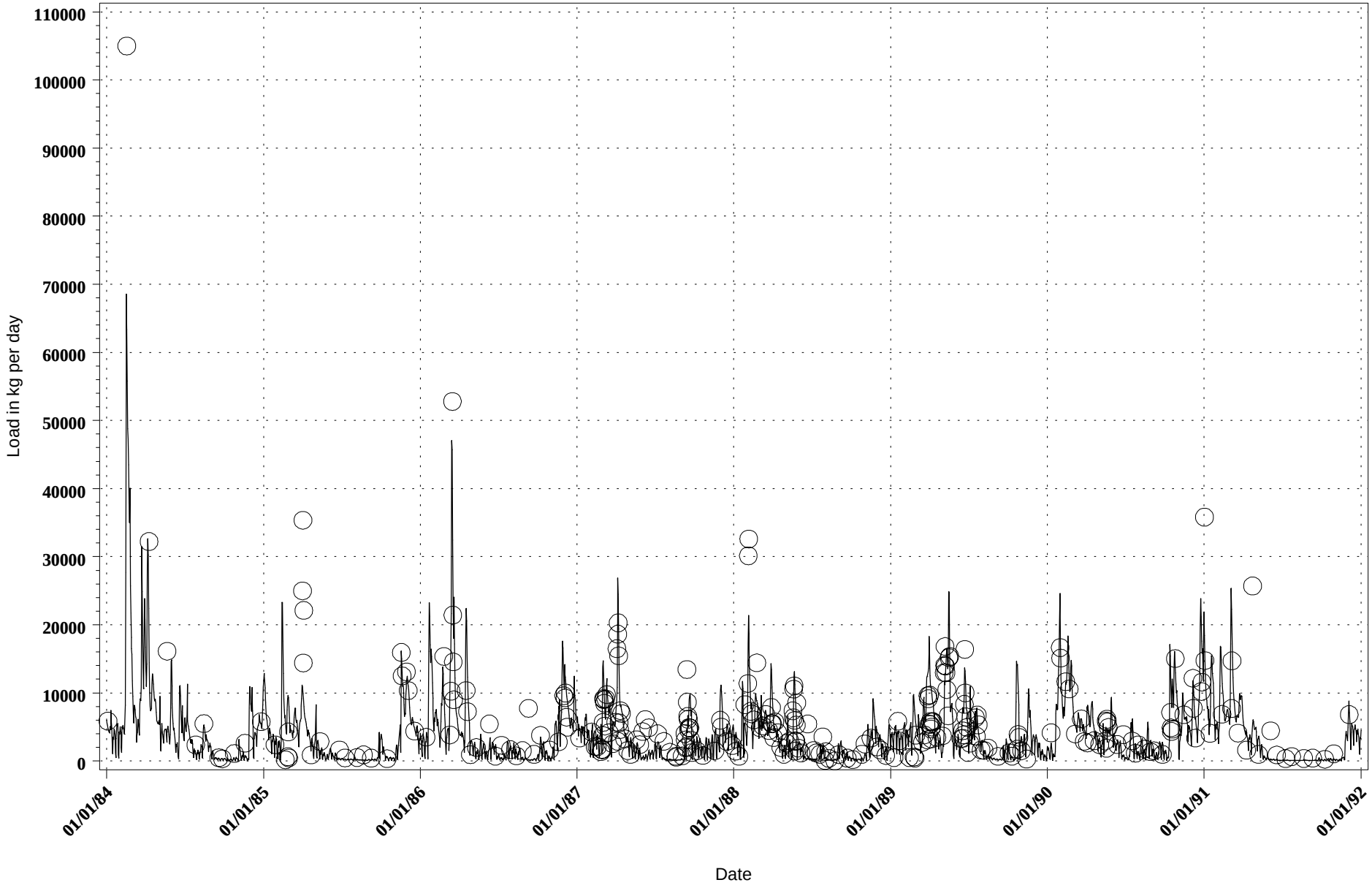



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140

## Total Ammonia Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

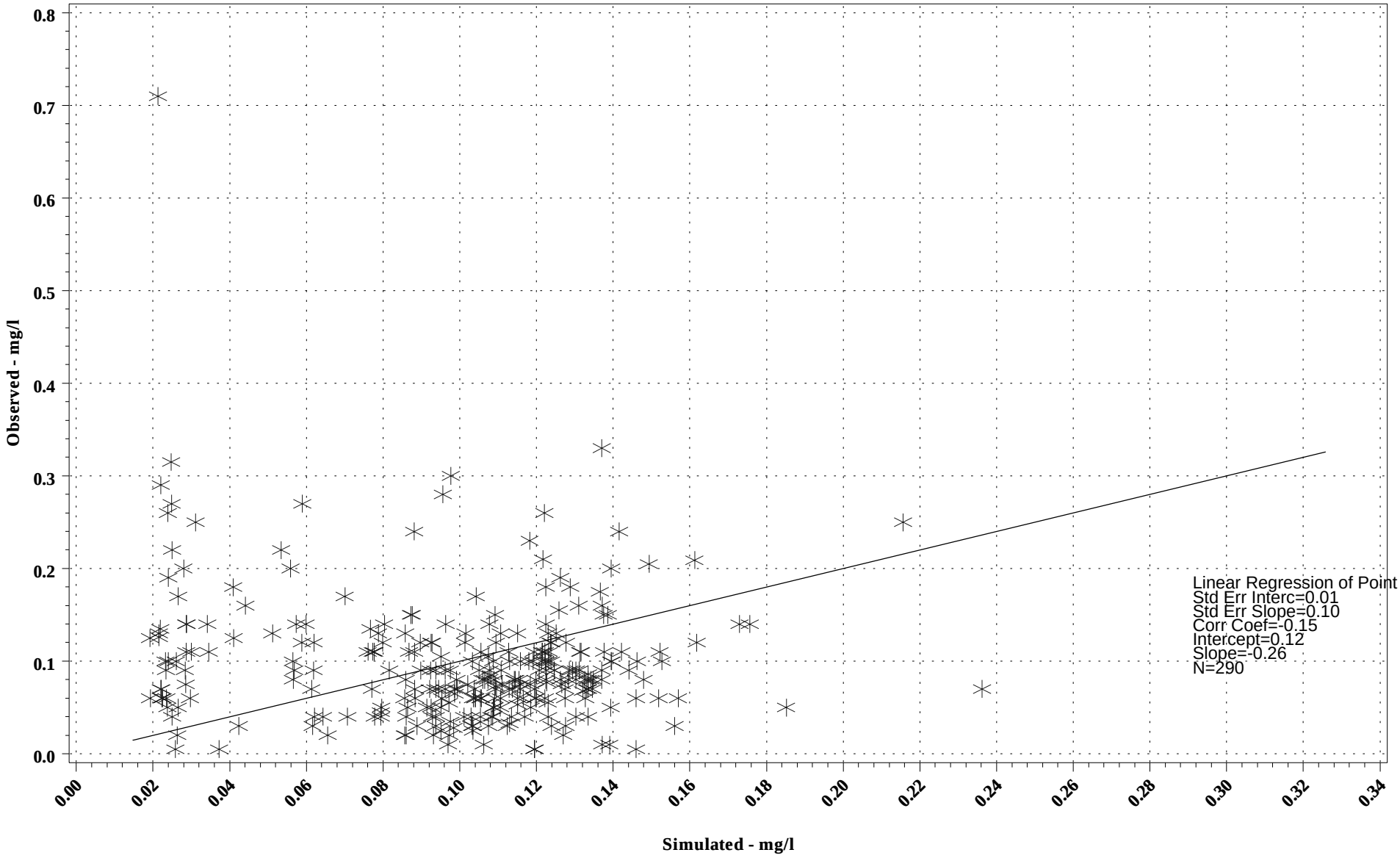



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140

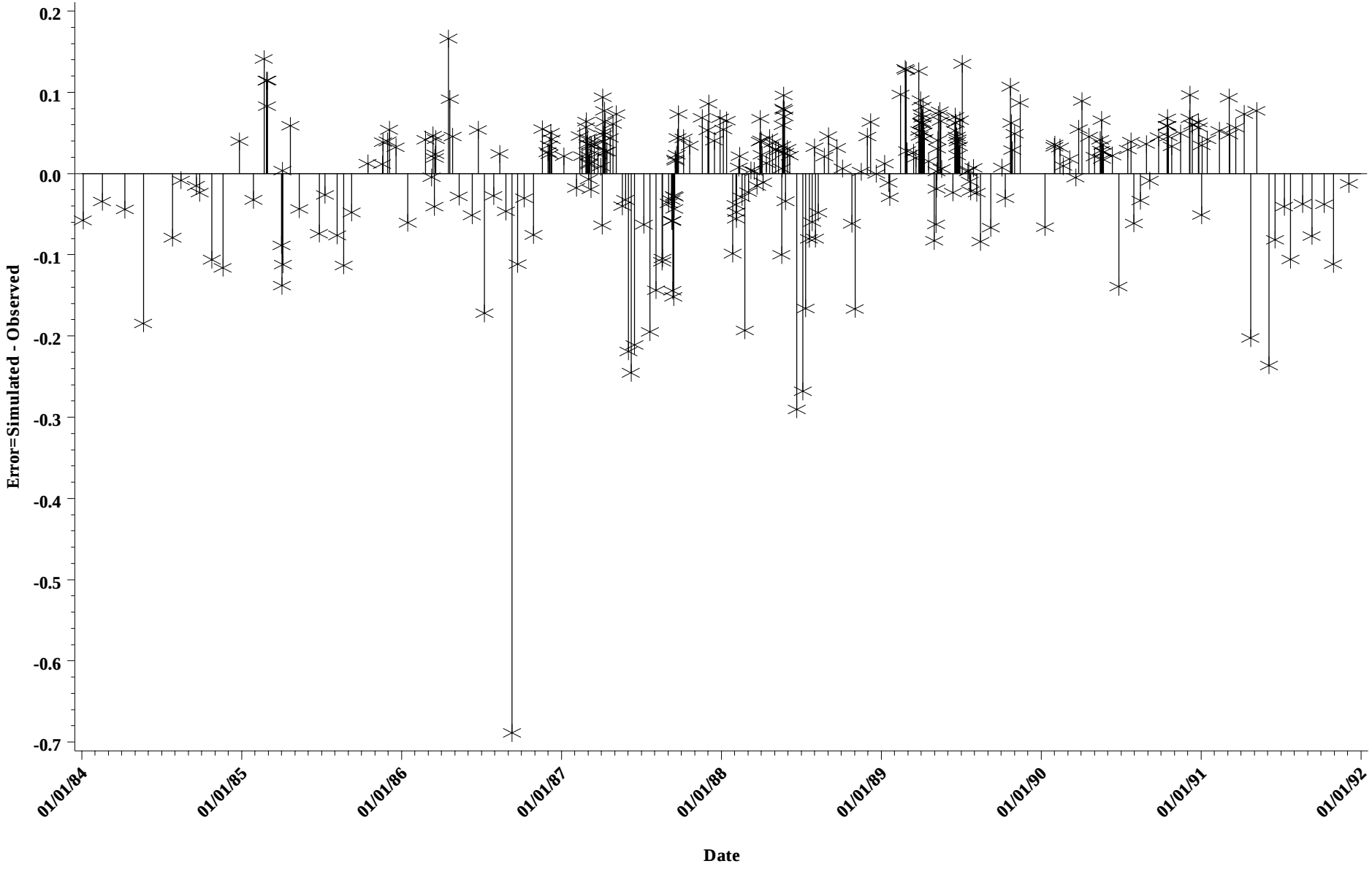
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140
## Actual Error versus Time
## Total Ammonia

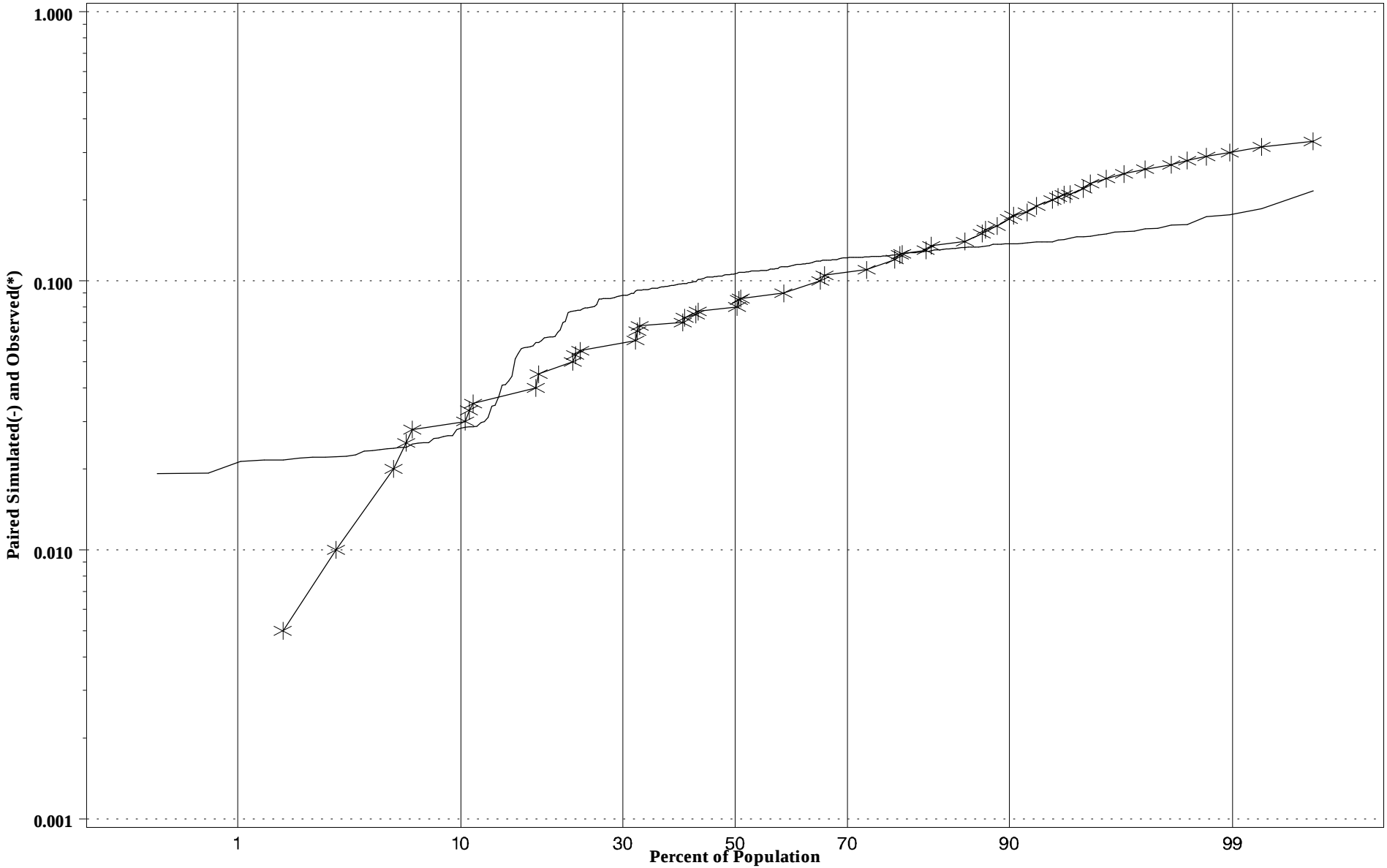



(y21_plotb.sas model3d:[pwang.dt] omerr)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140

## Total Ammonia

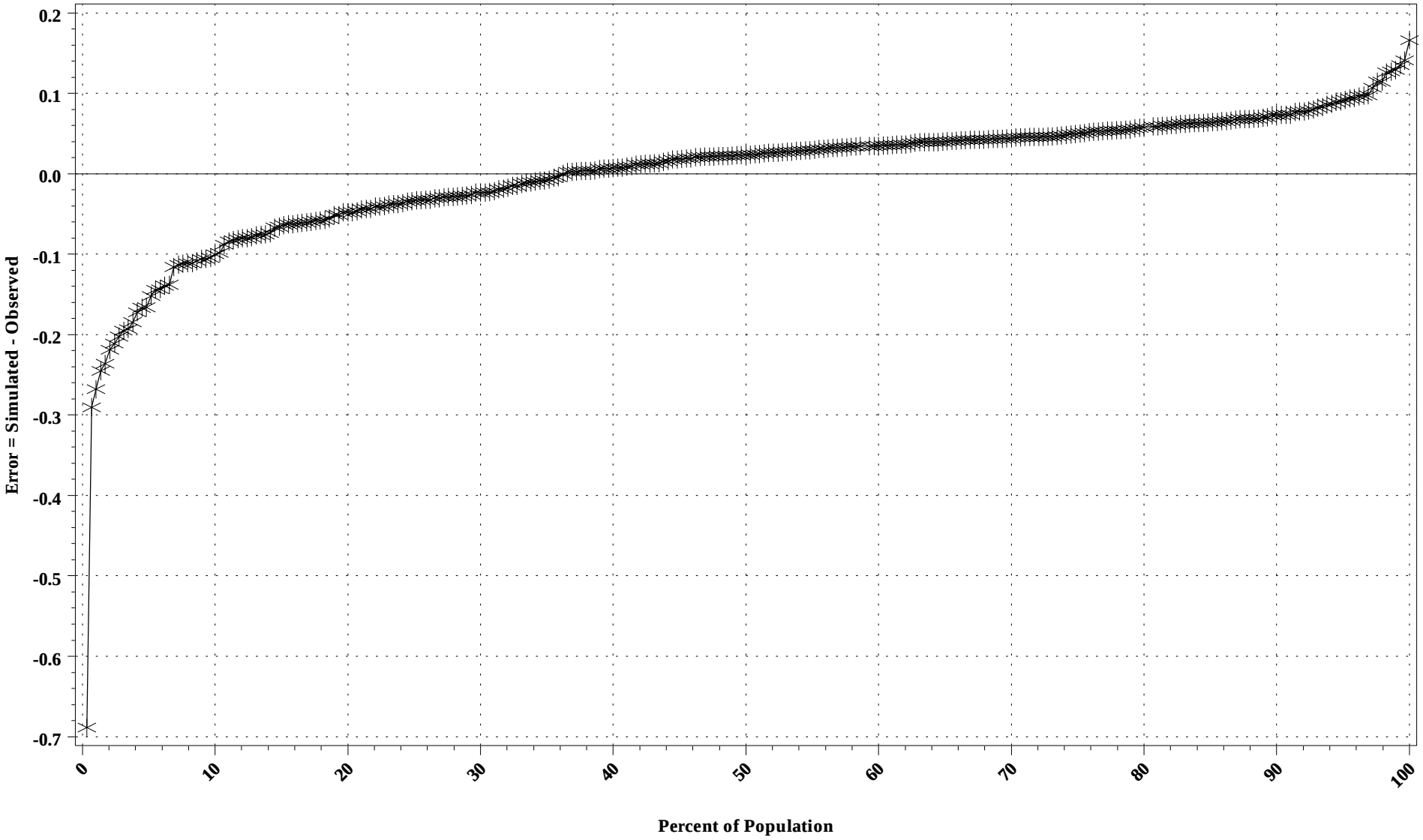
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(conow.drv 25JUN98 15:08)

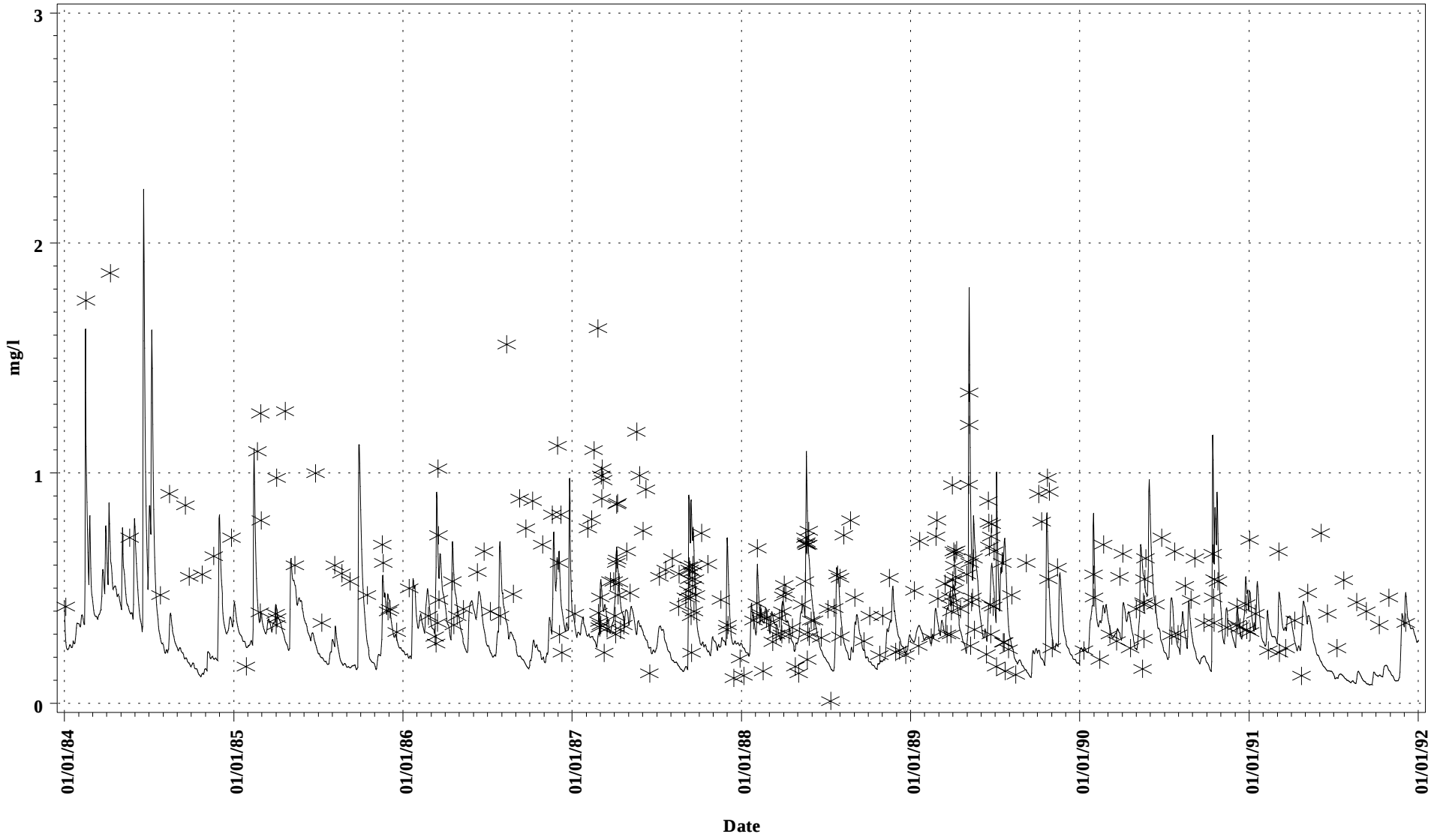
# Susquehanna River at Segment 140
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**

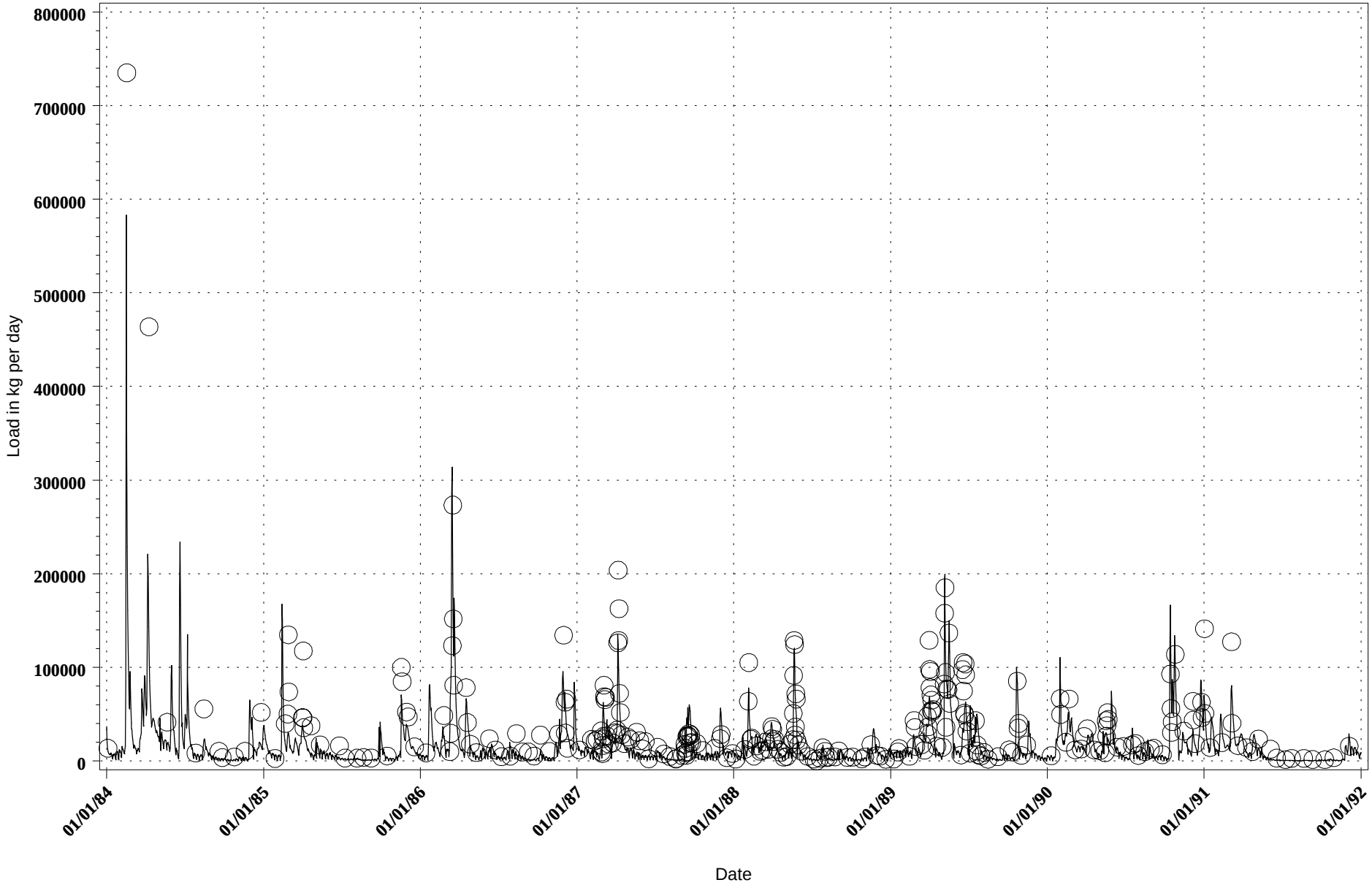



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140

## Organic Nitrogen Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

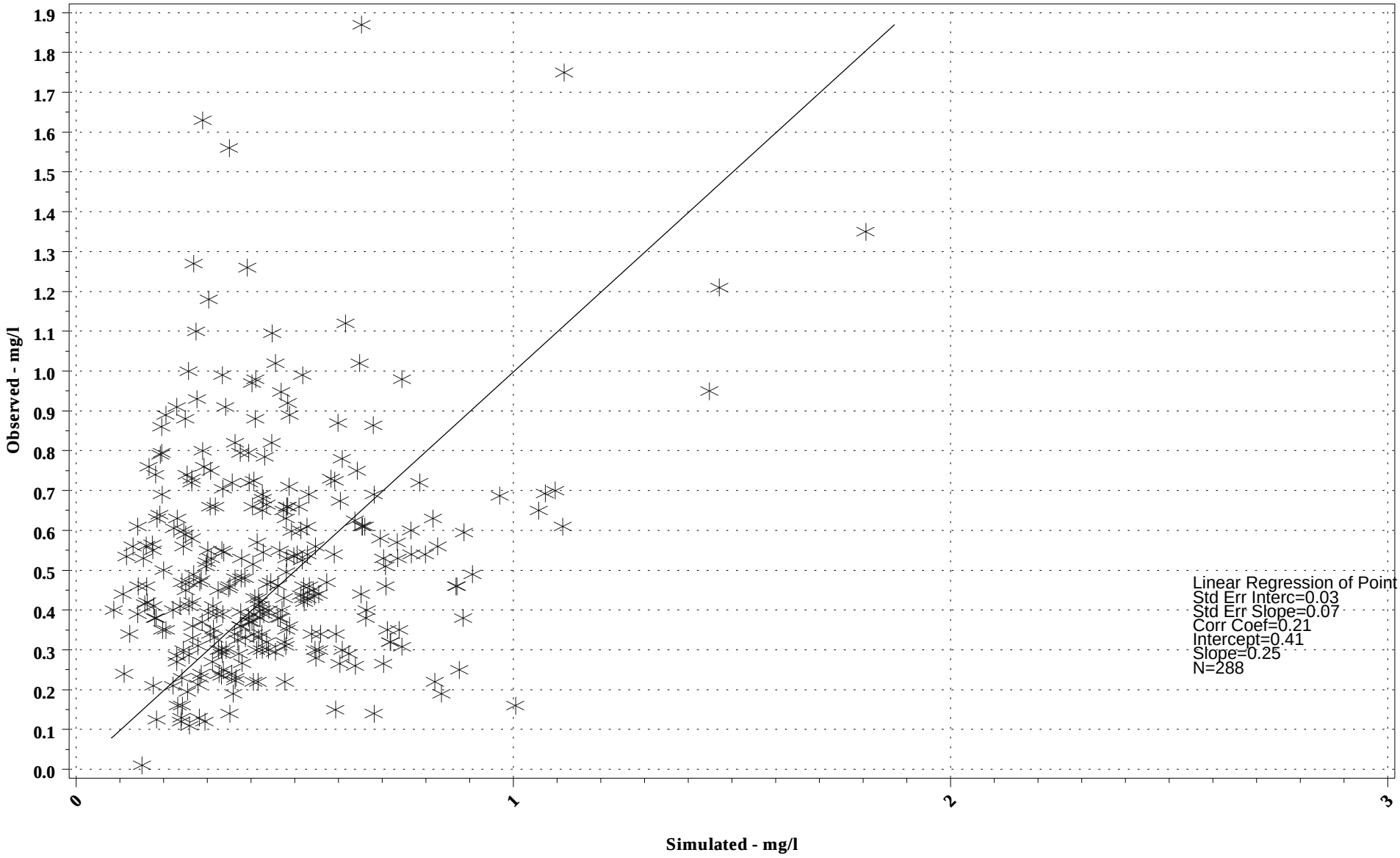



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140

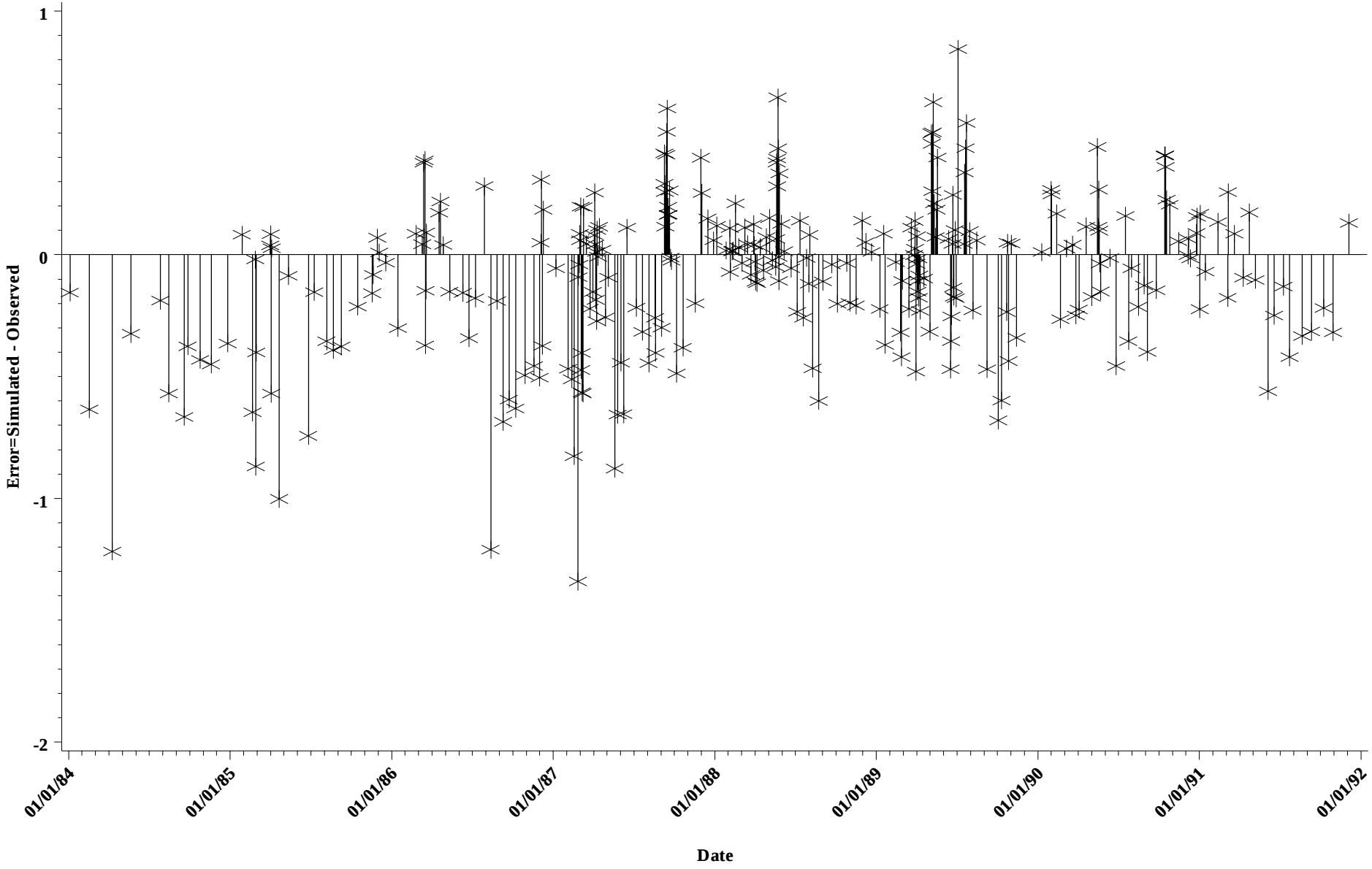
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(conow.drv 25JUN98 15:08,proc reg,model y=x)

# Susquehanna River at Segment 140
## Actual Error versus Time
## Organic Nitrogen

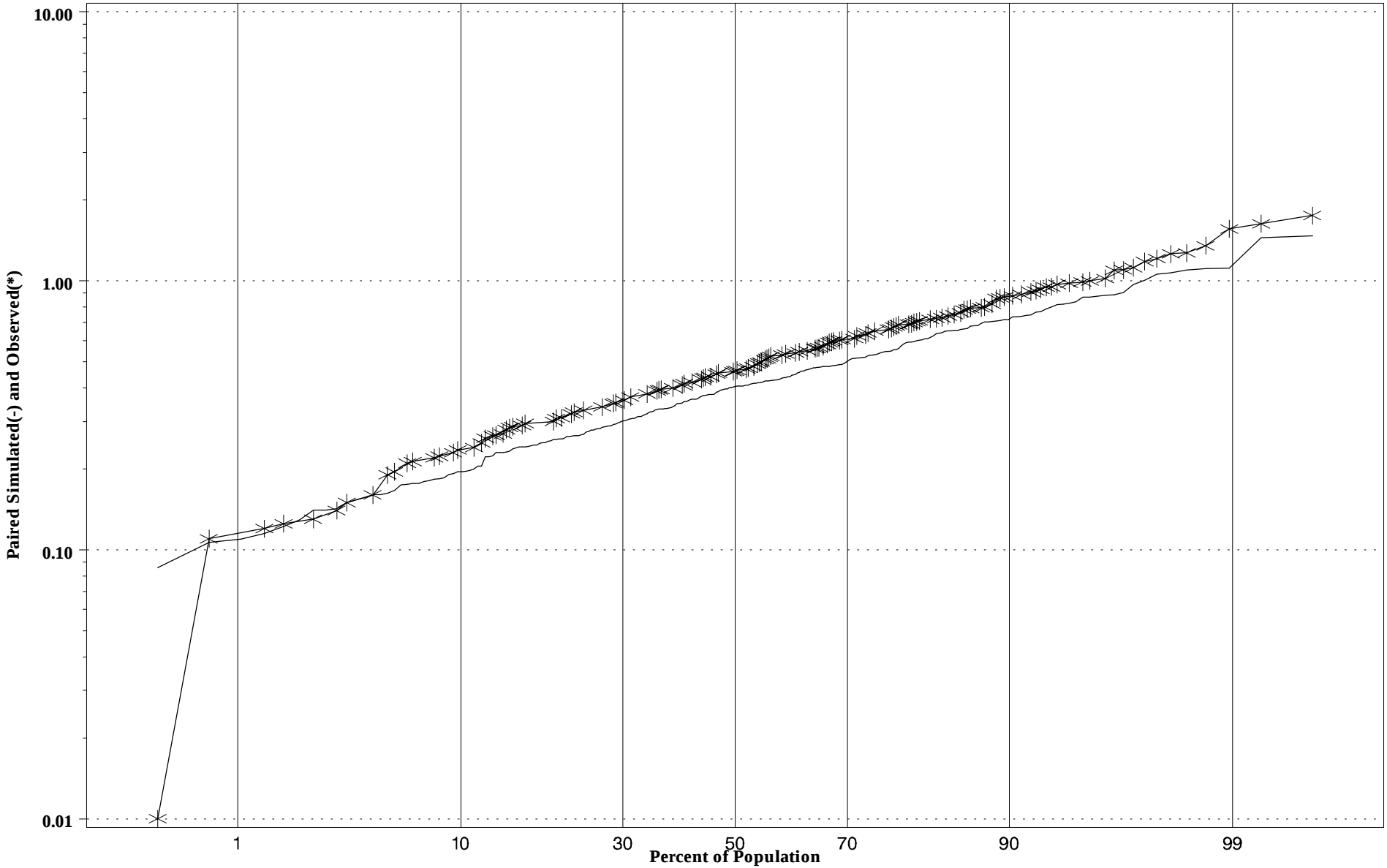



(y21_plotb.sas model3d:[pwang.dt] omerr)
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140

## Organic Nitrogen

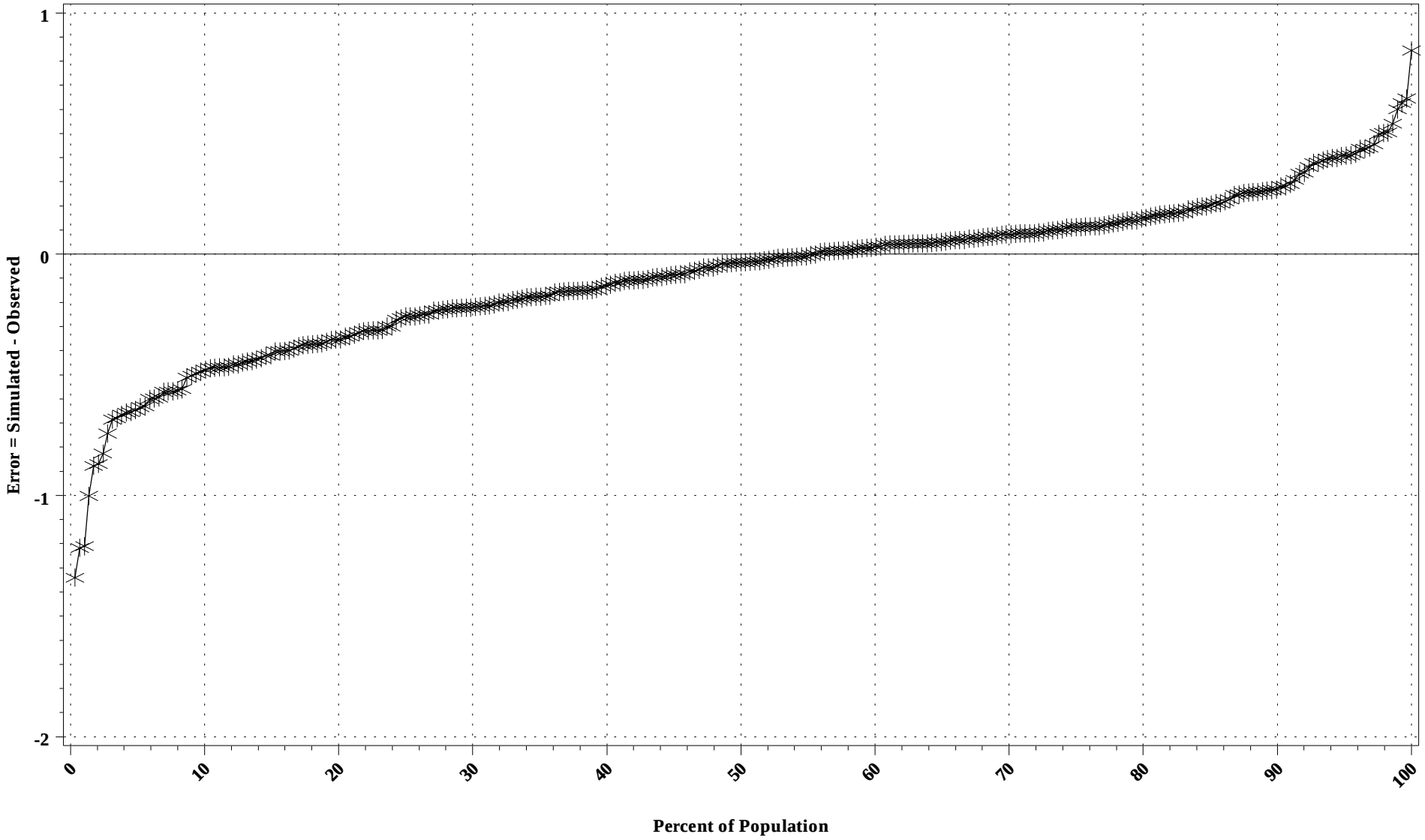
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(conow.drv 25JUN98 15:08)

# Susquehanna River at Segment 140
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(conow.drv 25JUN98 15:08)

# B.2.0 Patuxent River

***Basin Segments:***

Above Fall Line Basin Segments: 330, and 340
Below Fall Line Basin Segments: 500, and 990

***Section Contents:***

### *B.2.1 Patuxent River near Bowie, MD at Segment 340 (Monitoring Station: 1594440) (Above Fall Line Basin Segments: 330, 340, 500, and 990)*

**Section Summary:**

The Patuxent basin is the most urbanized of the major Chesapeake Bay Program basins. The water quality time series reflects the urban, hydrologically "flashy" character of the basin. Basin water quality is dominated by point source discharges. Changes in point source discharges over the simulation period including the phosphorus detergent ban in January, 1984, and Biological Nutrient Removal (BNR) treatment in the 1990s have resulted in large step-wise changes in water quality in both the observed and simulated water quality data.

The Patuxent basin above the gaged site covers an area of 902 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 45% forest land, 19% cropland, 11% other agricultural areas, 24% urban areas, and 2% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage decreased from 5.7 million pounds in 1985 to 5.1 million pounds in 1996. Total phosphorus loads over the same time period decreased from 0.53 million pounds to 0.35 million pounds. In general, point source loads above the gage site decreased. In 1996, the total nitrogen point source load was 22% of the total load and the total phosphorus point source load was 28% of the total load. Estimated septic system total nitrogen loads increased 30%, from 0.31 million pounds in 1985 to 0.41 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 15%, and other agricultural loads (primarily pasture and manure loads) by 34%. Total phosphorus decreased for these land uses by 16% and 44% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 22% for total nitrogen and 23% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

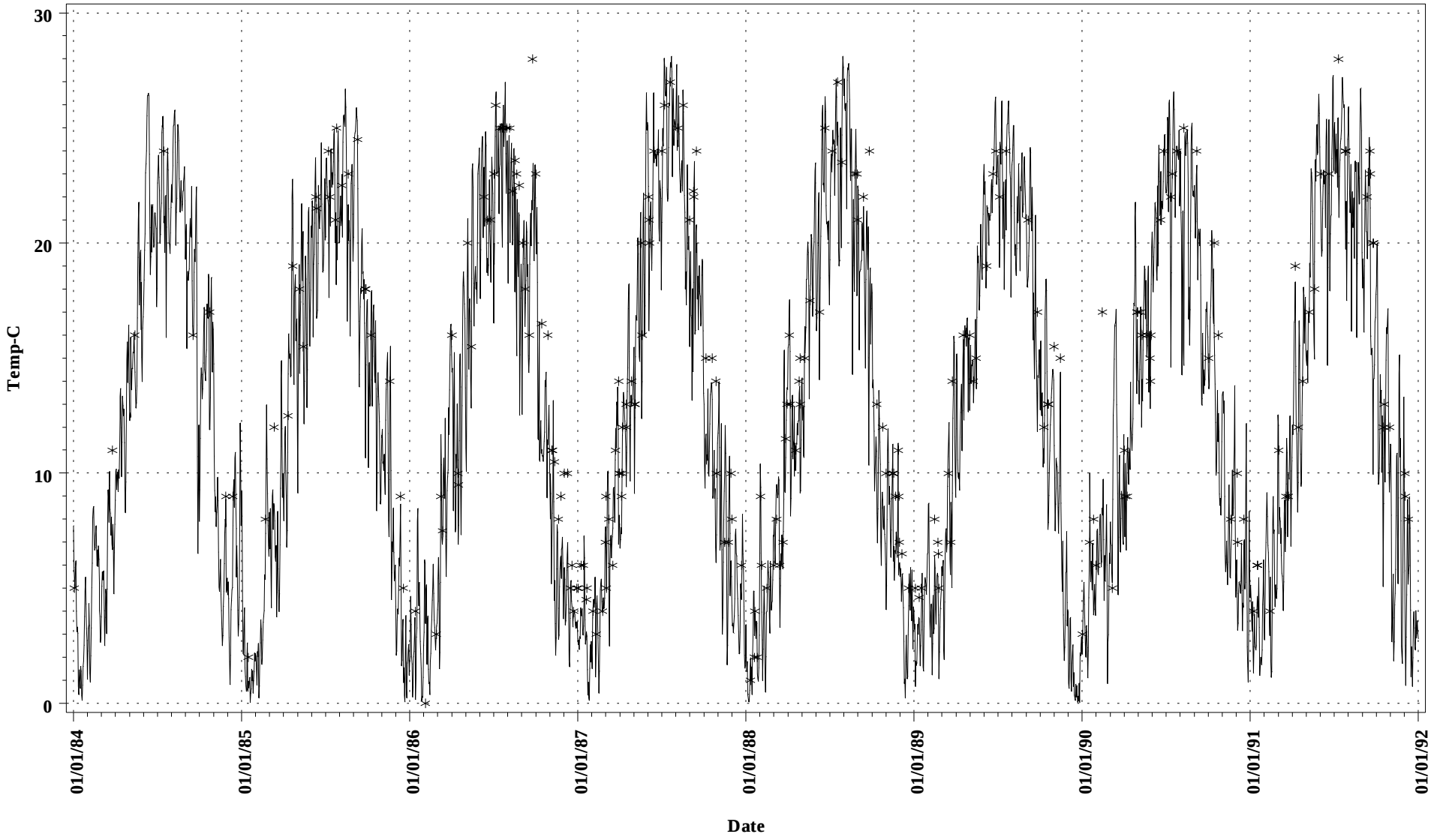
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# Patuxent River at Segment 340
## Observed and Simulated versus Time
# Temperature-C

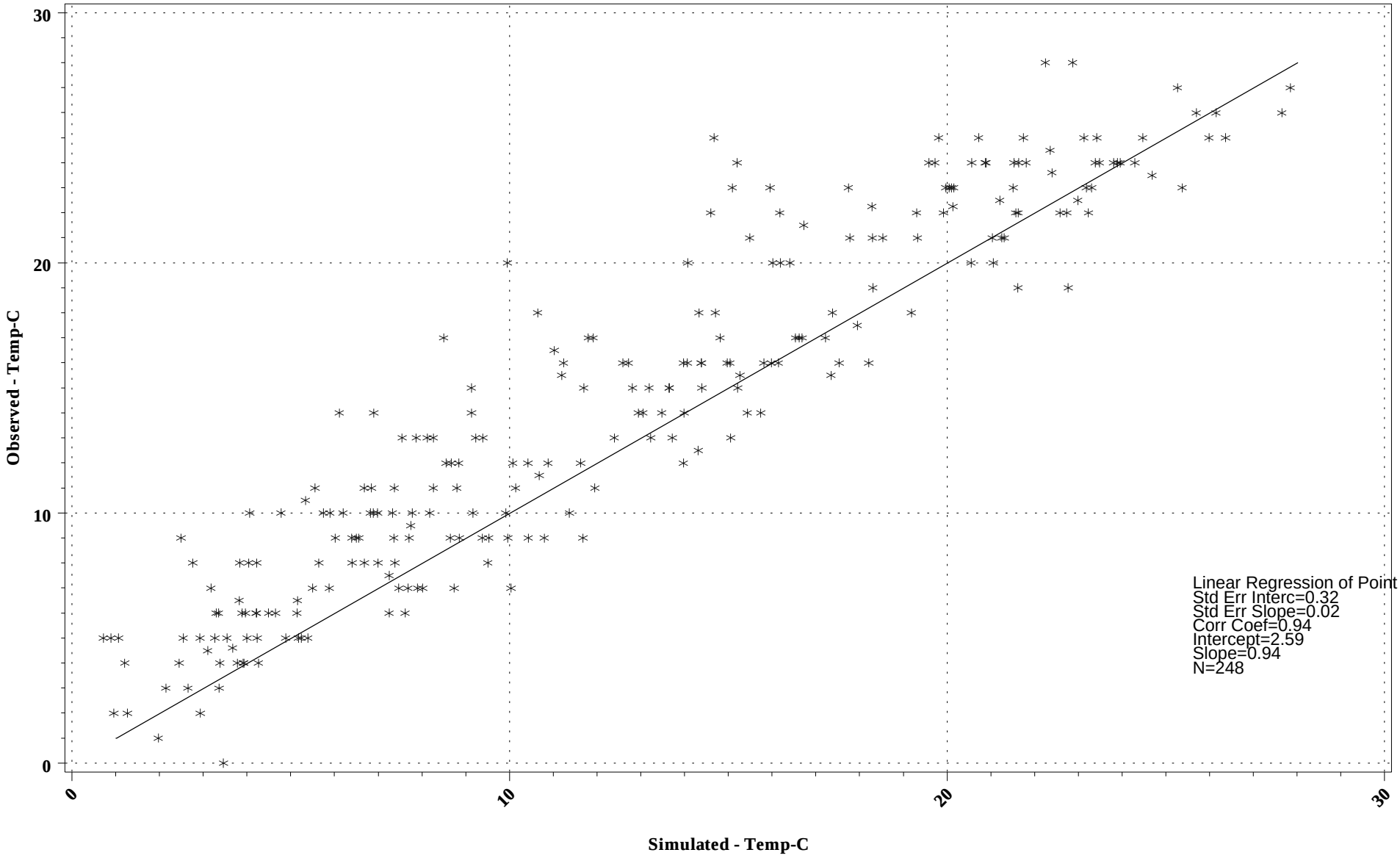
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(patux340.drv 25JUN98 12:48)

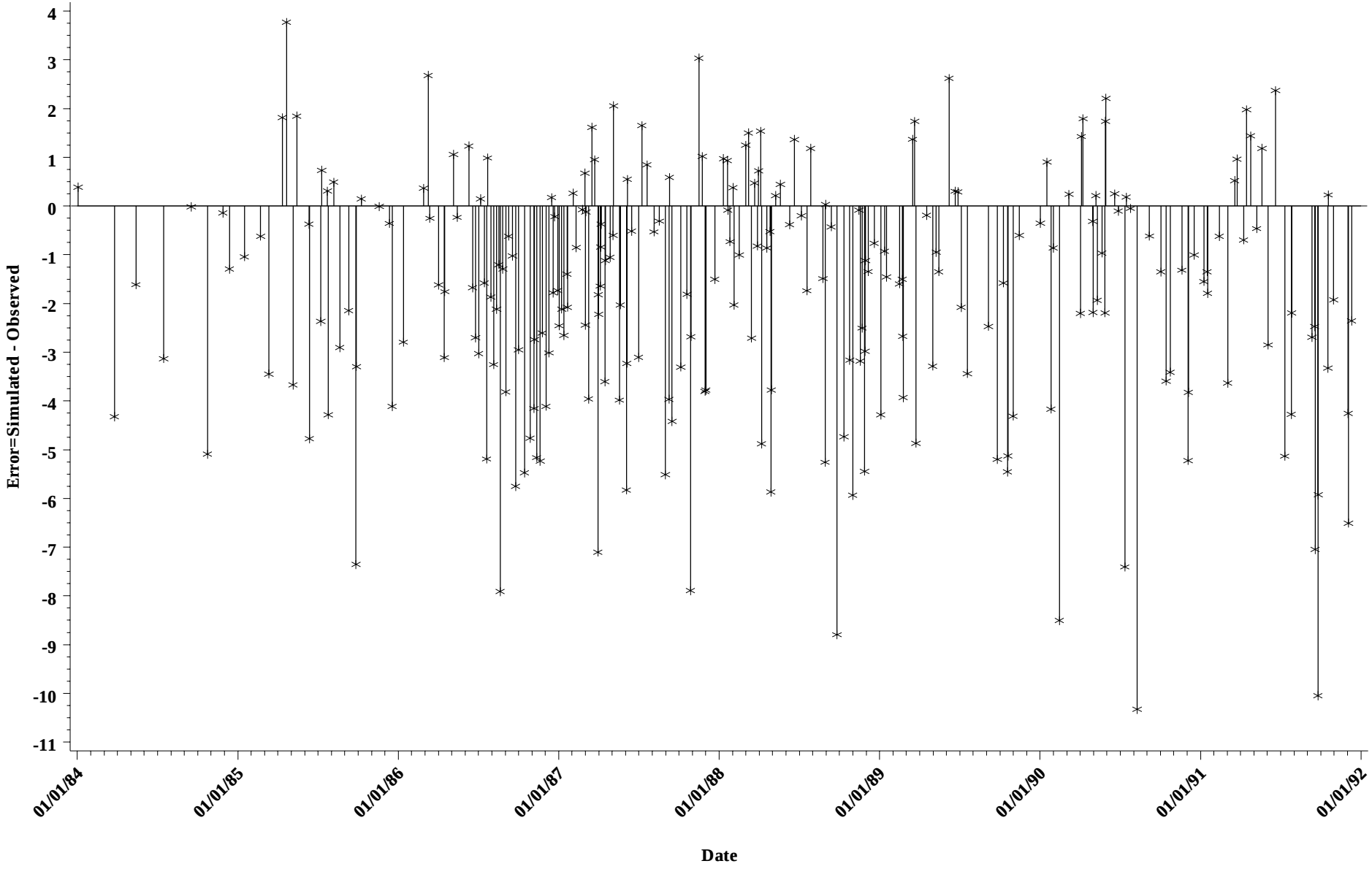
# Patuxent River at Segment 340

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92



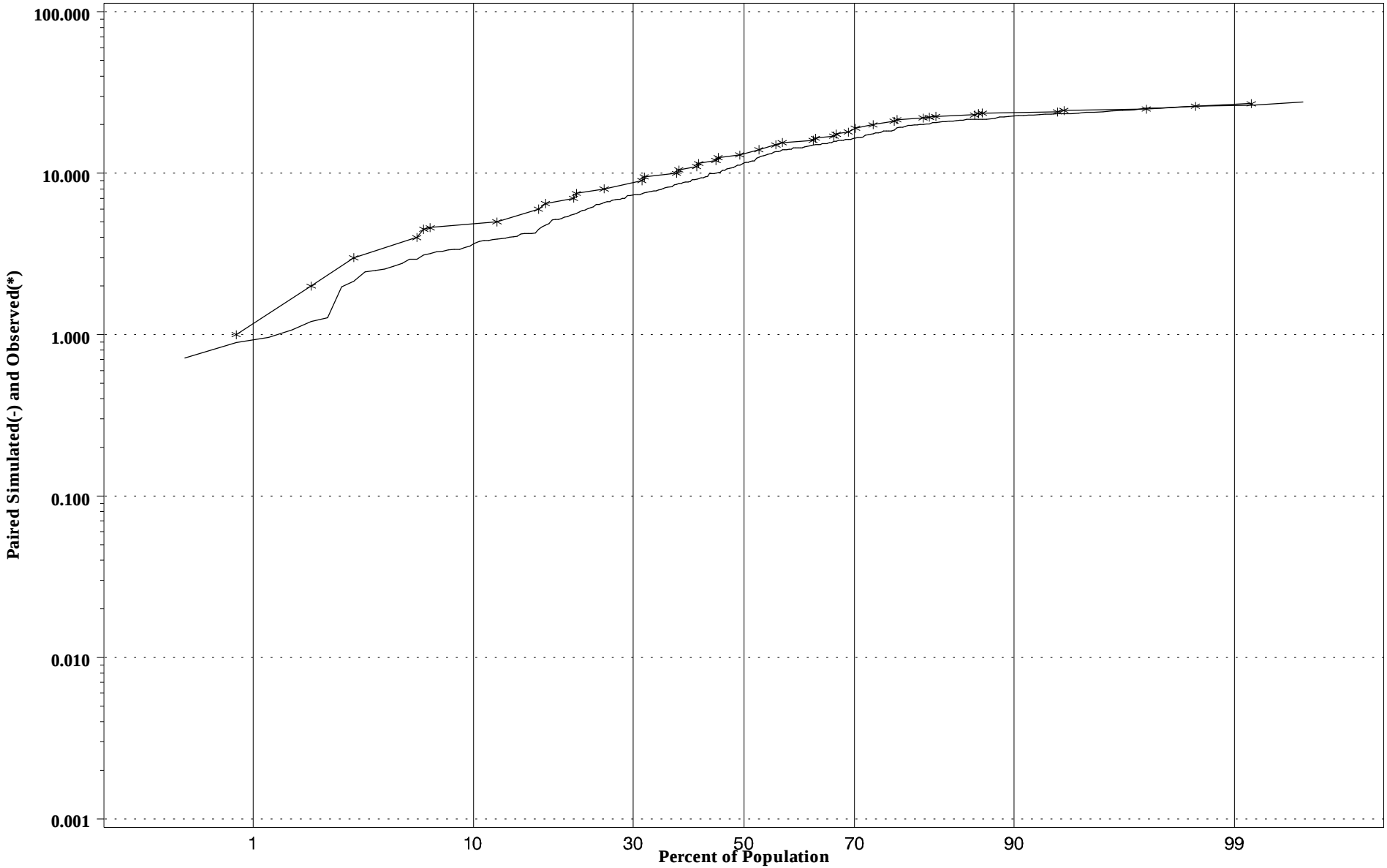

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340
## Actual Error versus Time
## Temperature-C




(y21_plotb.sas model3d:[pwang.dt] omerr)
(patux340.drv 25JUN98 12:48)

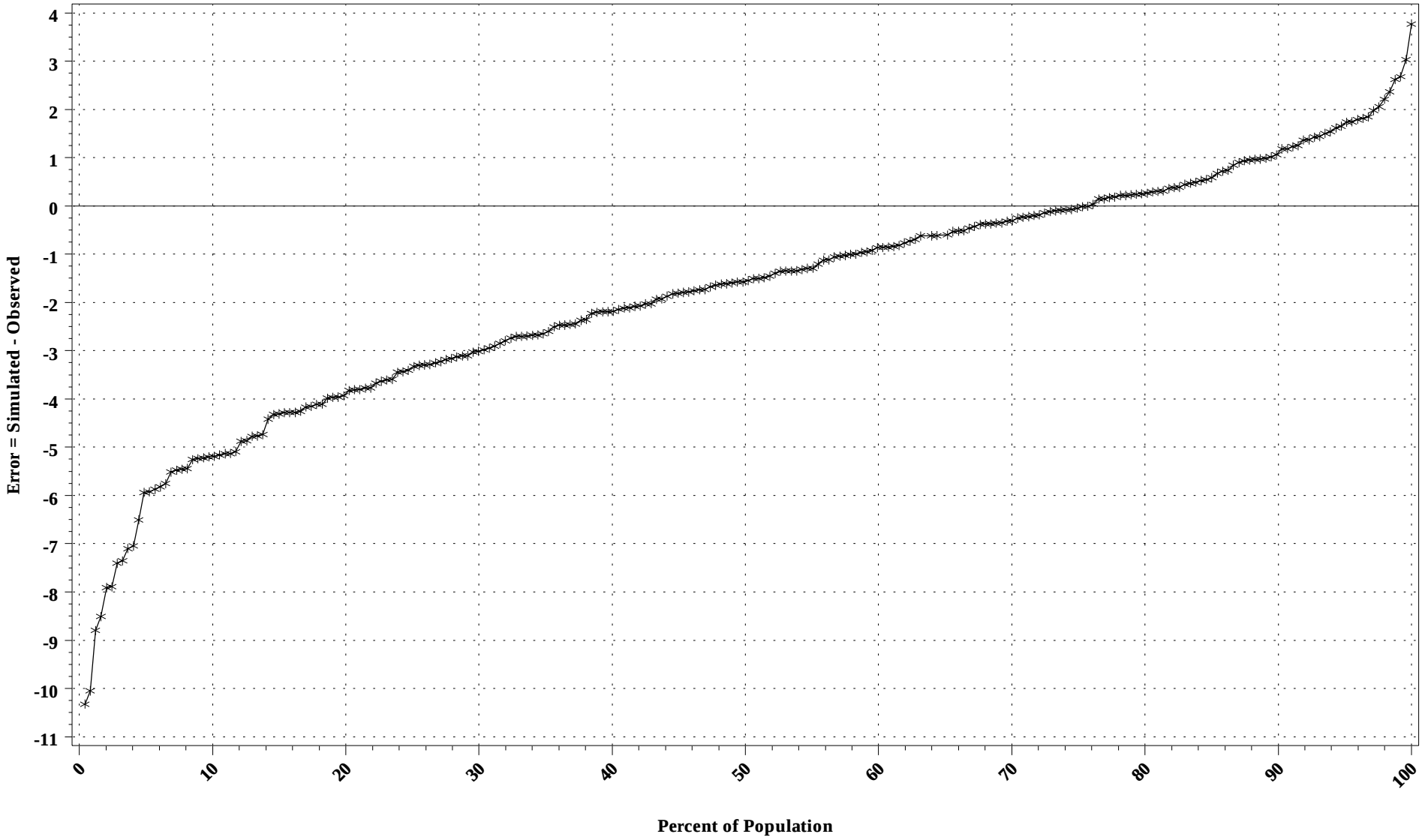
# Patuxent River at Segment 340
## Temperature-C
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Actual error versus Percentile Sample Population
## Temperature-C

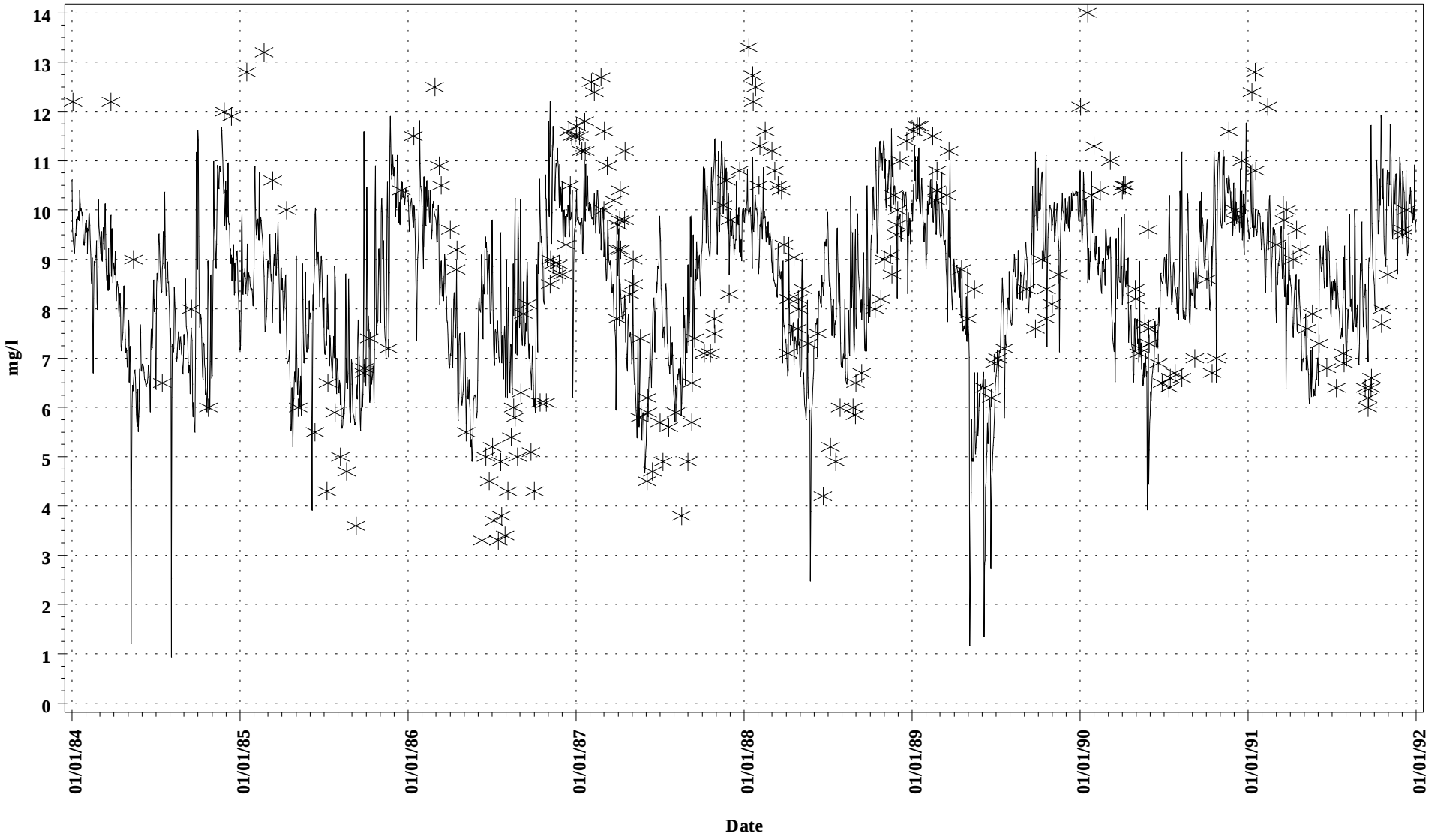
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(patux340.drv 25JUN98 12:48)

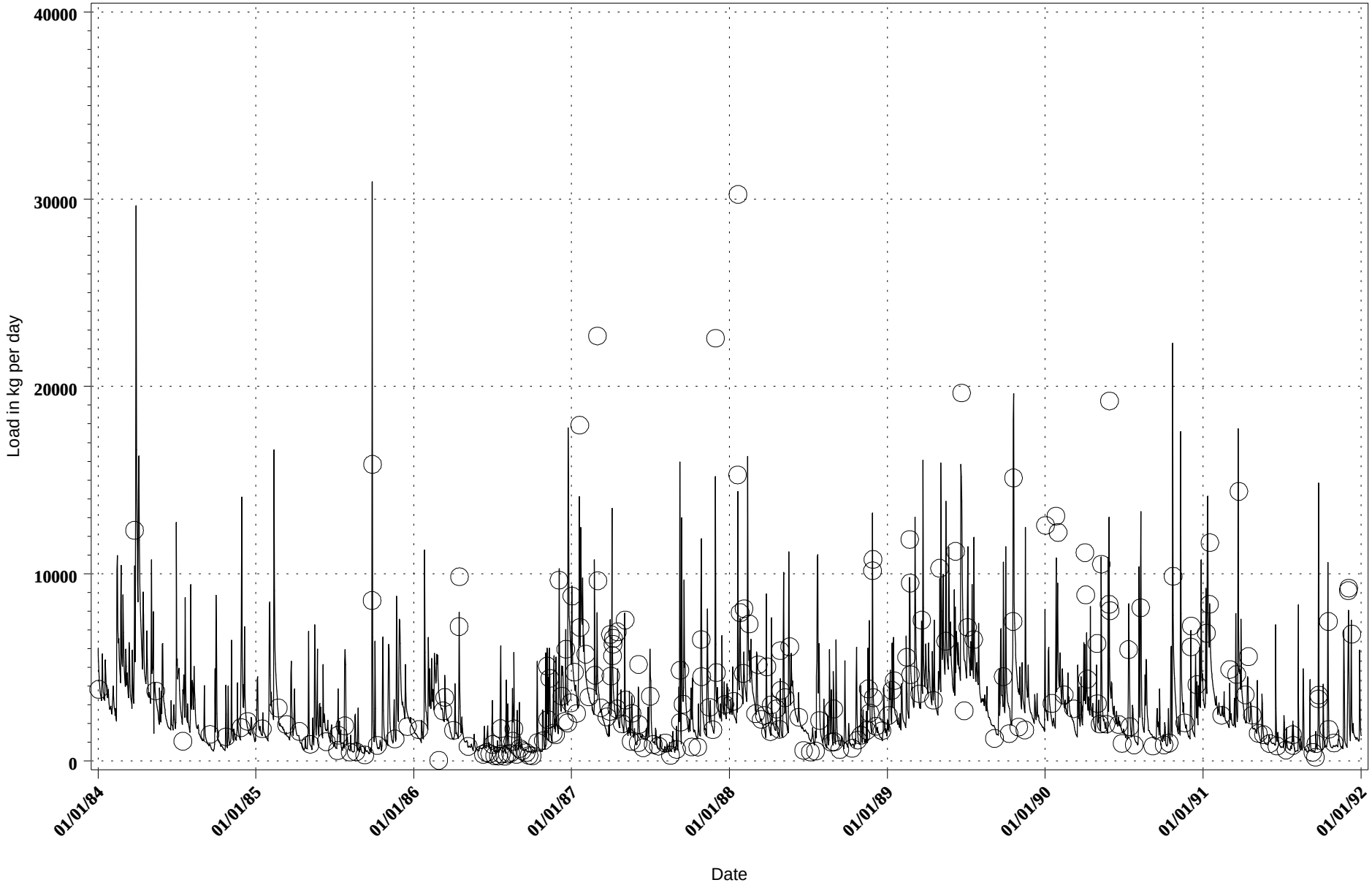
# Patuxent River at Segment 340
## Observed and Simulated versus Time
# Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

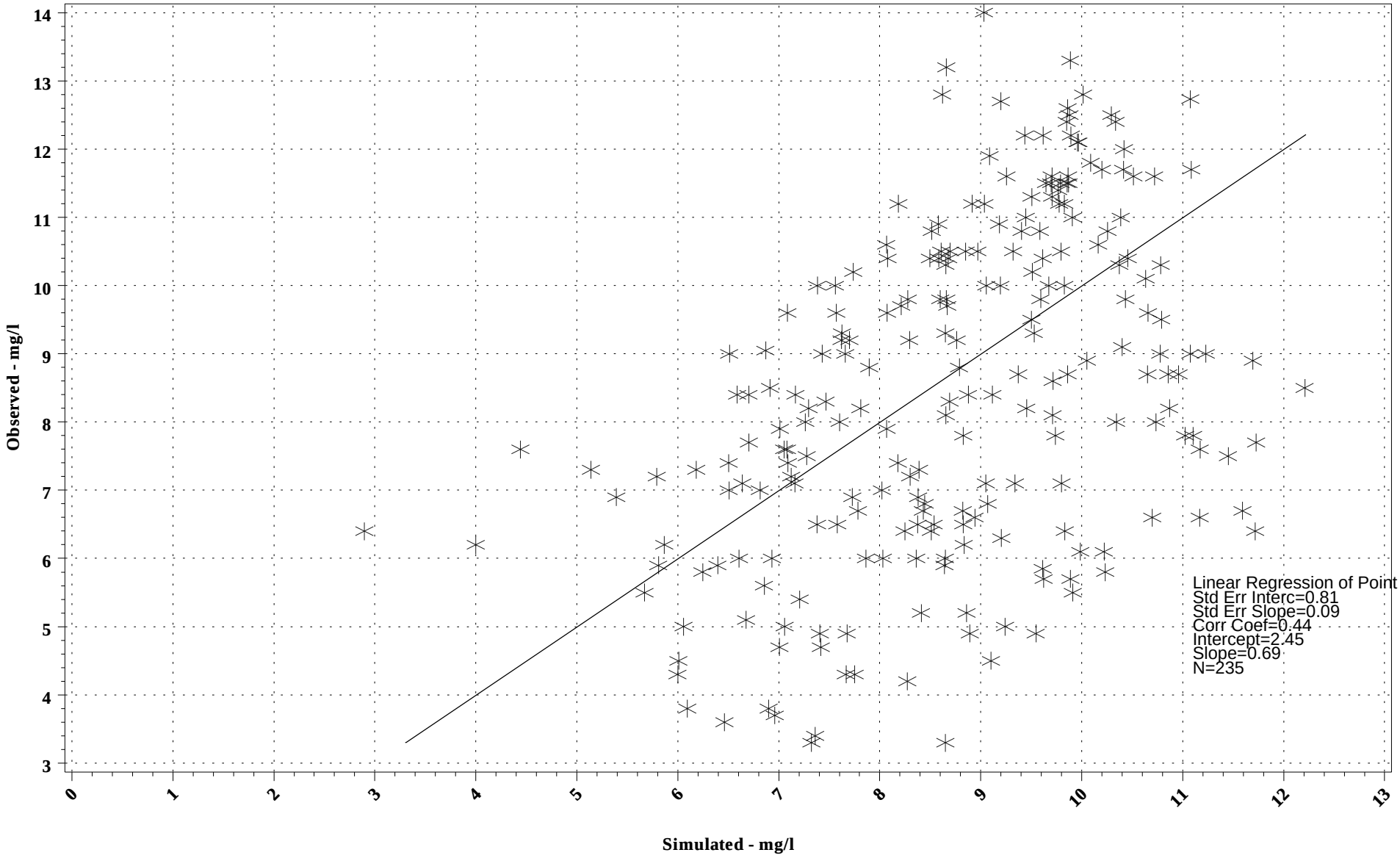



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340

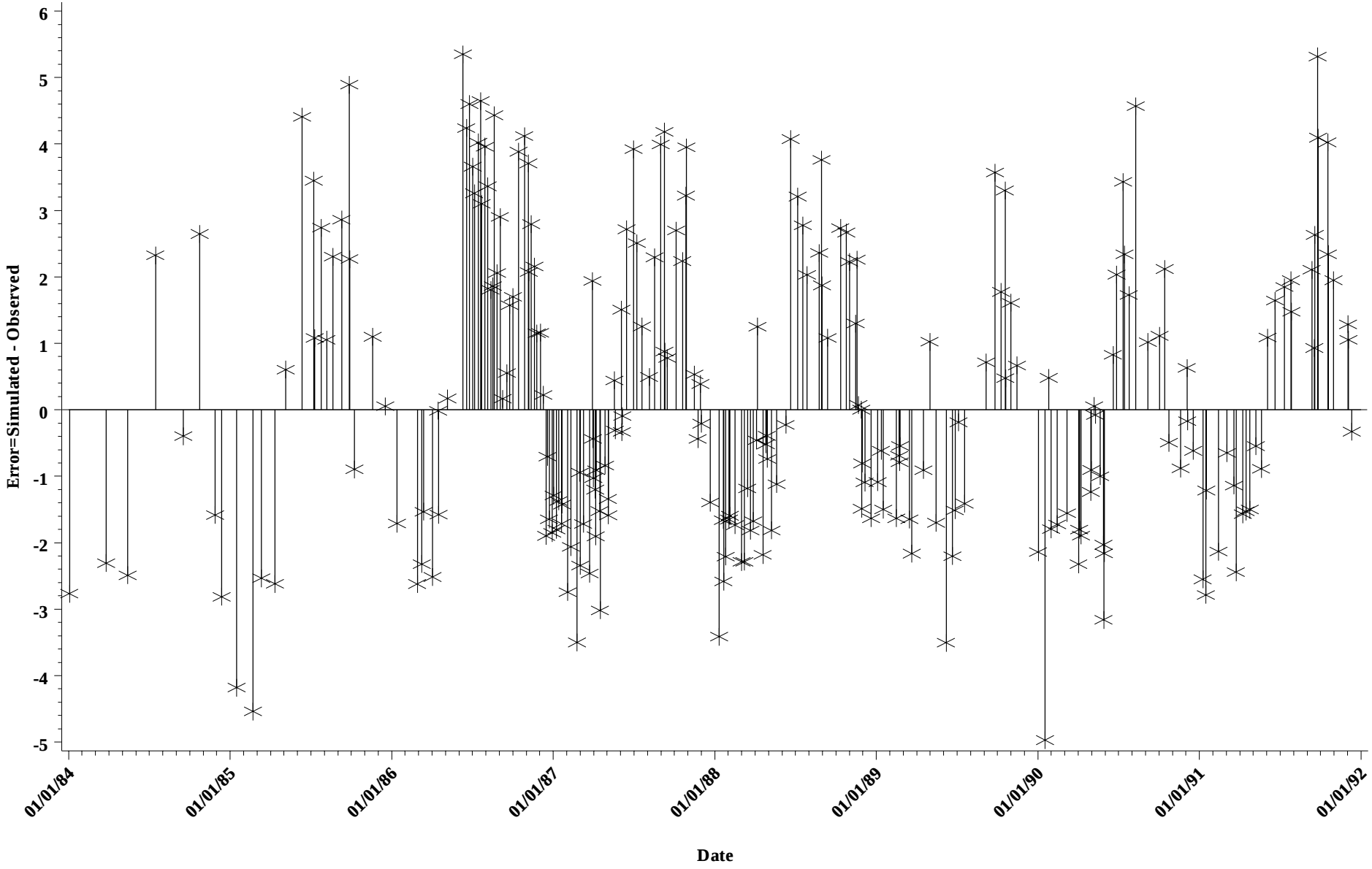
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Oxygen: 01JAN84 - 01JAN92



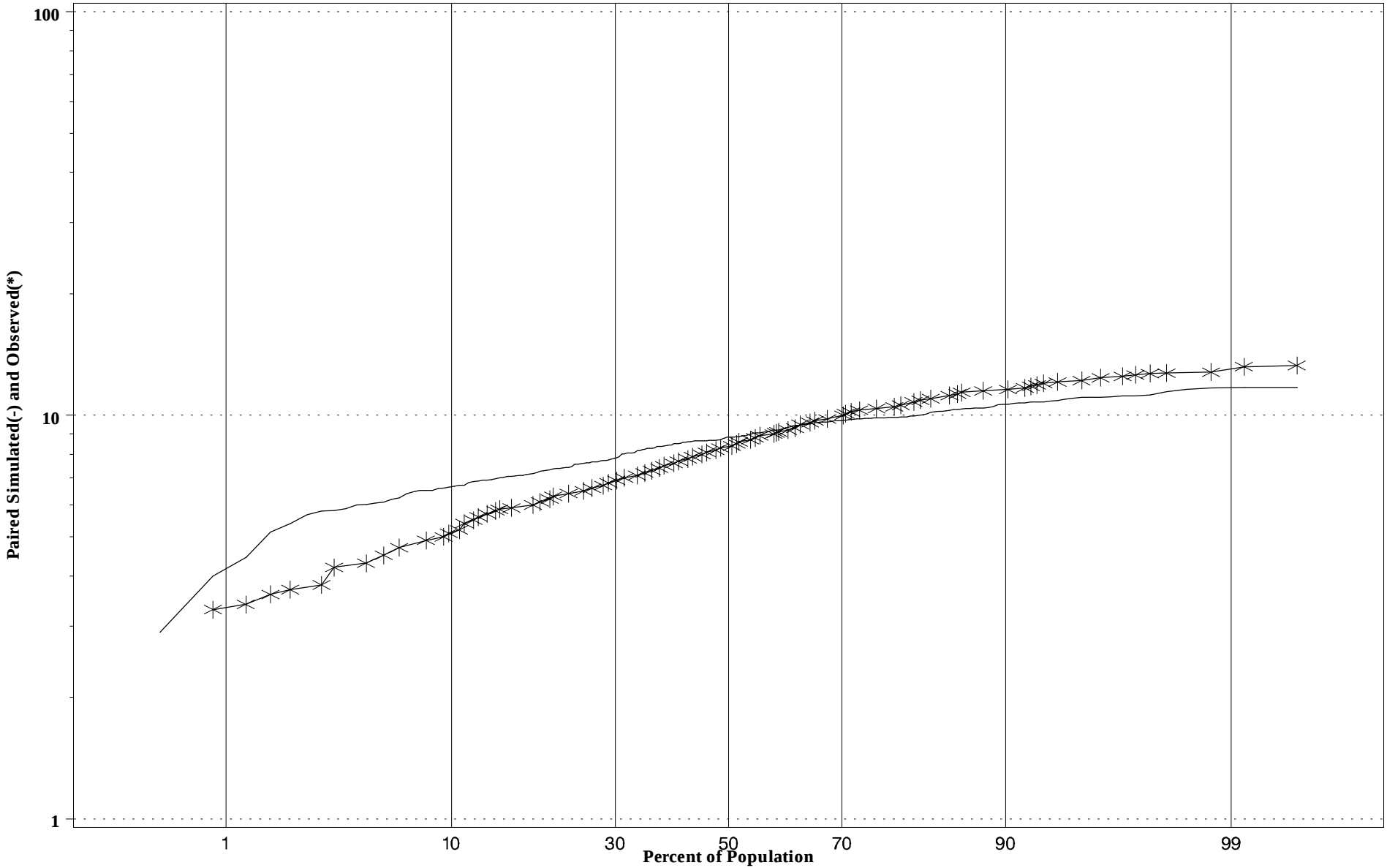

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(patux340.drv 25JUN98 12:48)

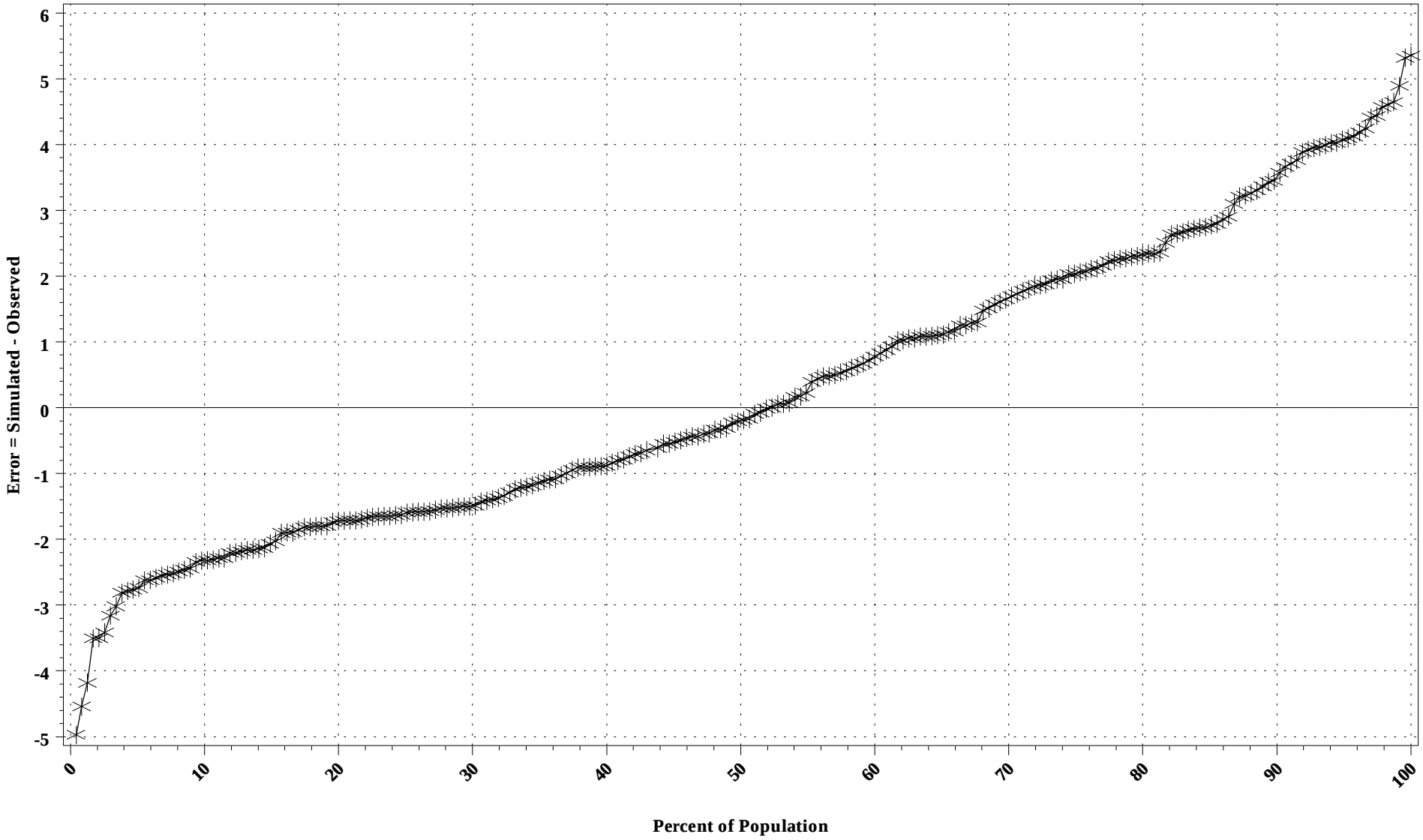
# Patuxent River at Segment 340
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

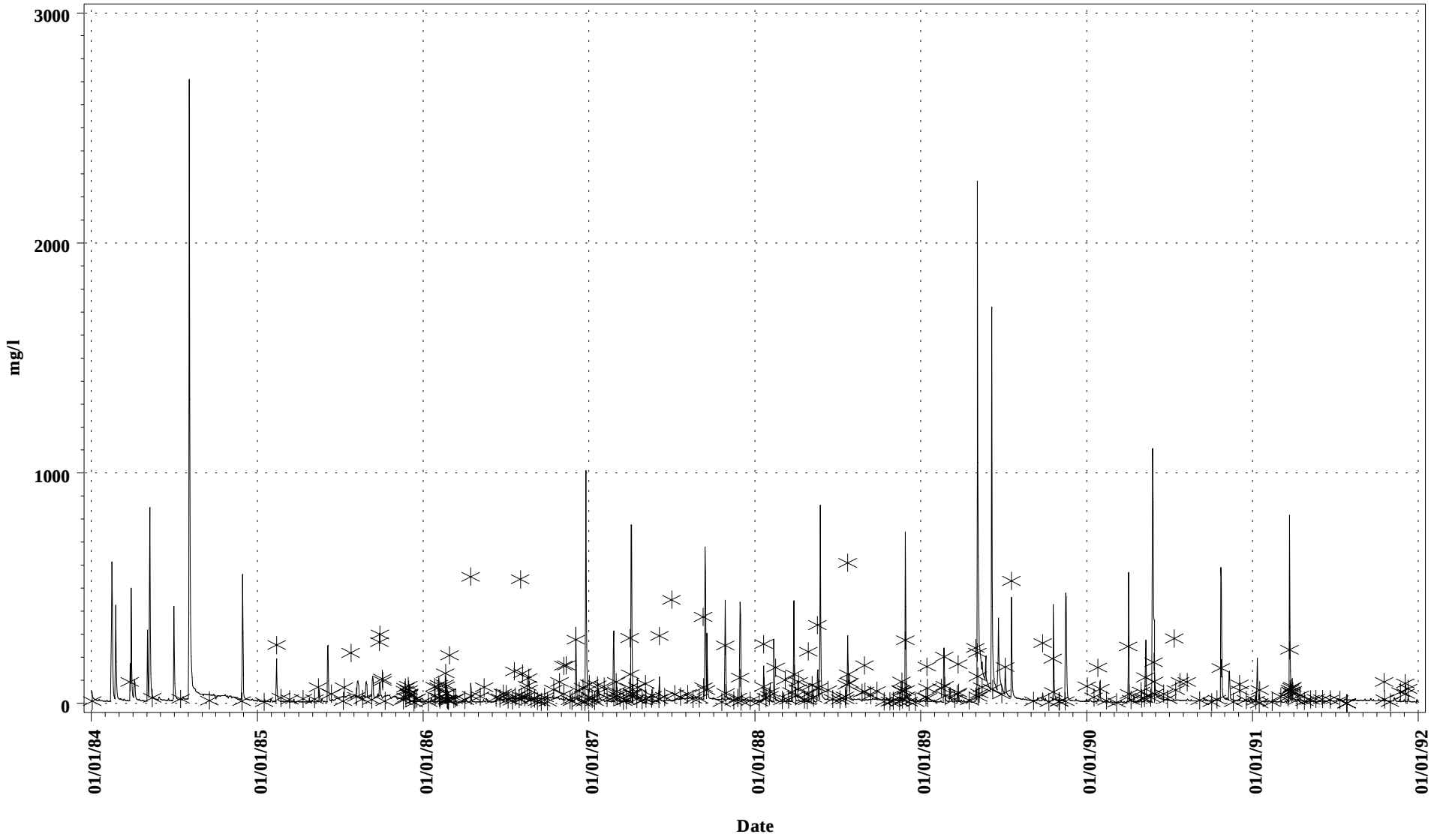
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**

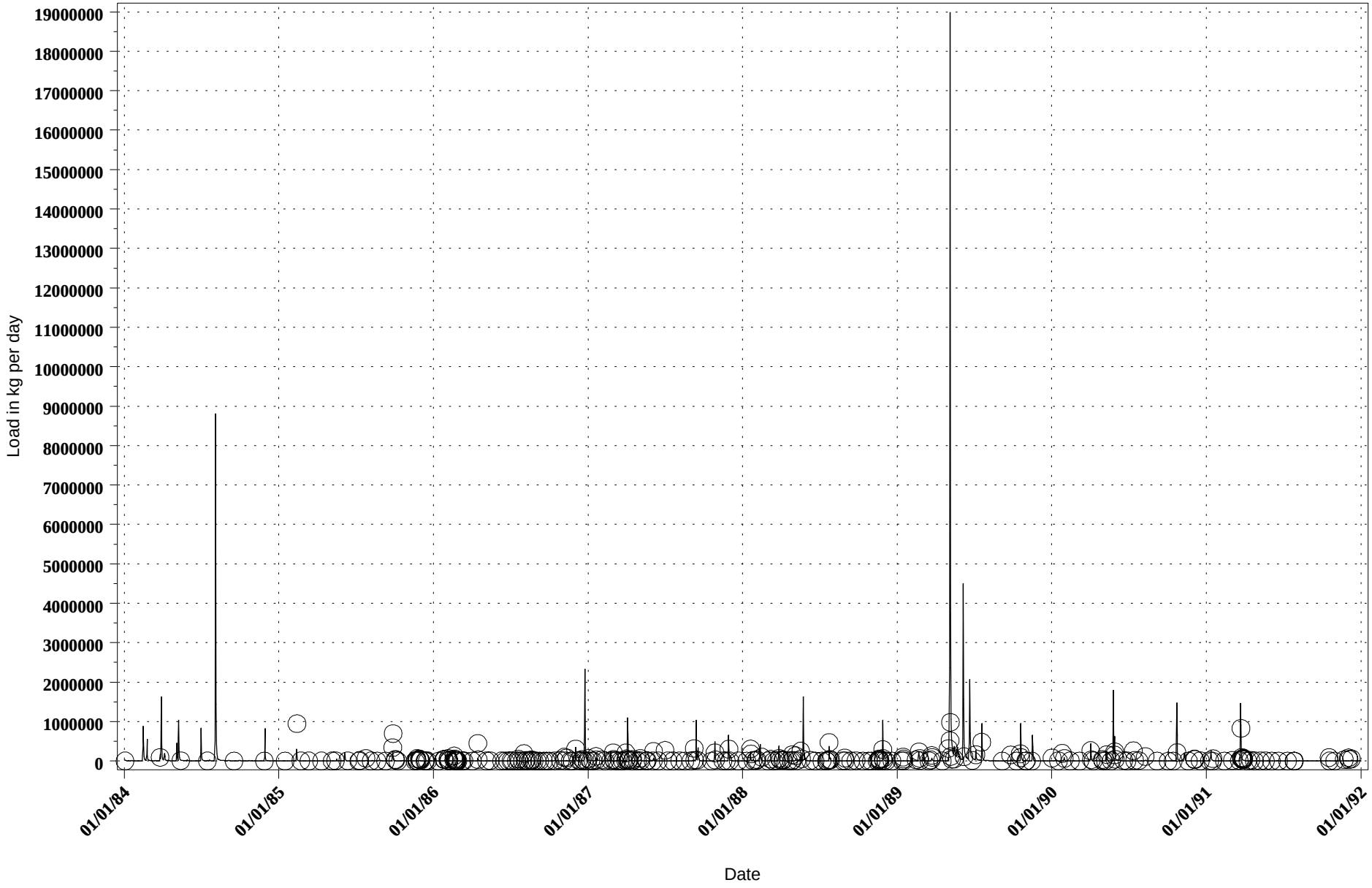



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340

## Total Suspended Sediment Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

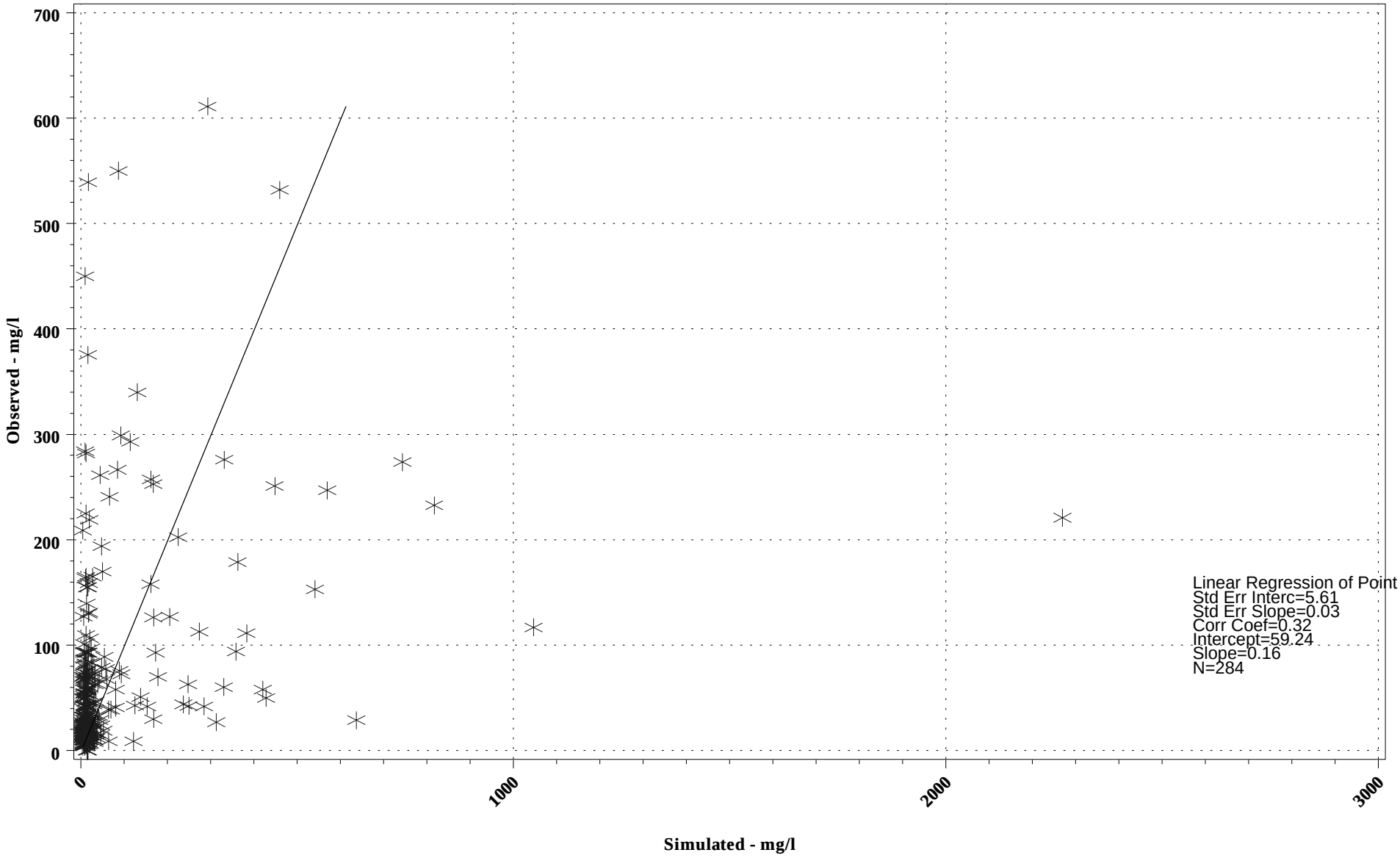



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340

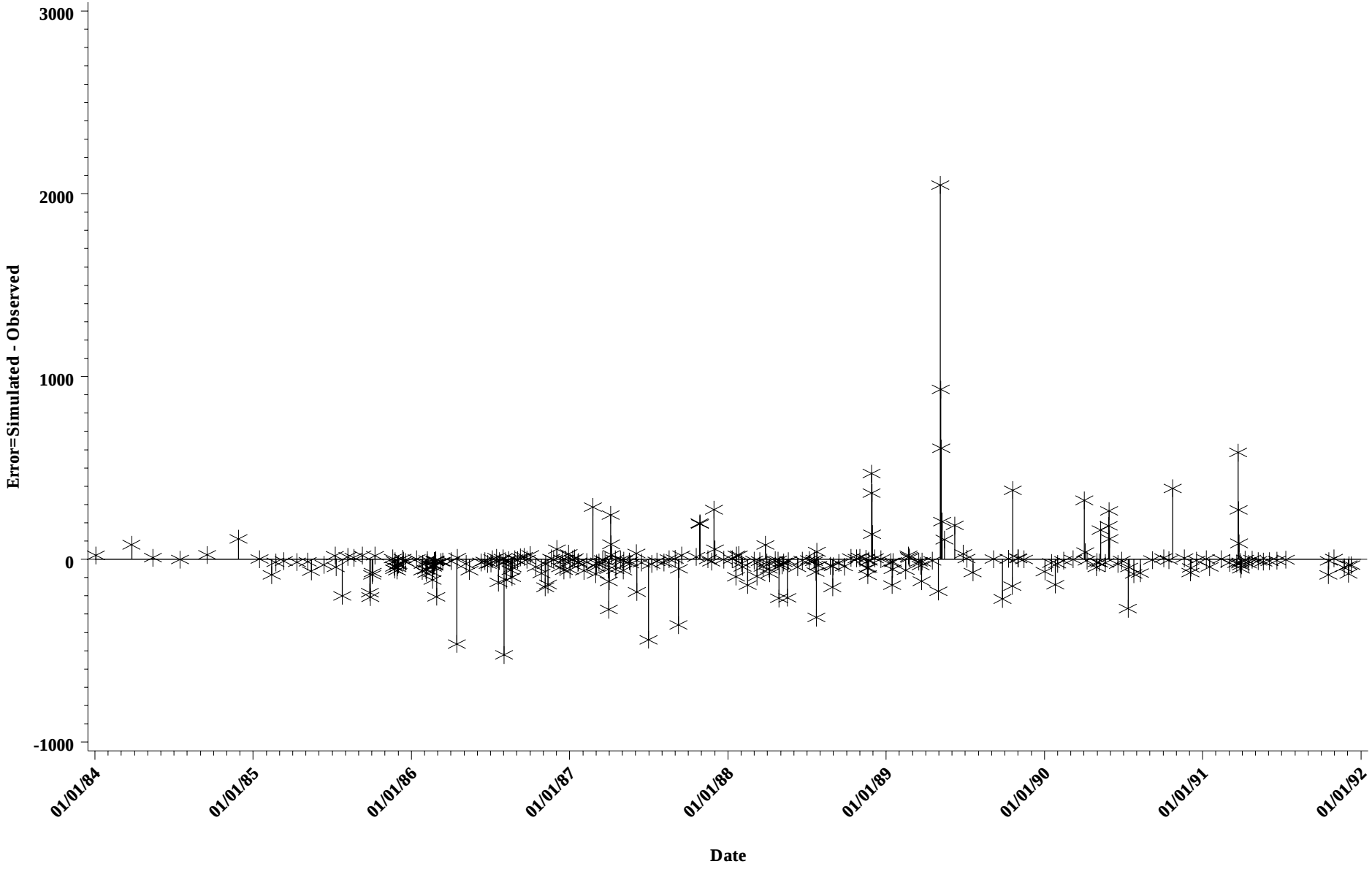
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



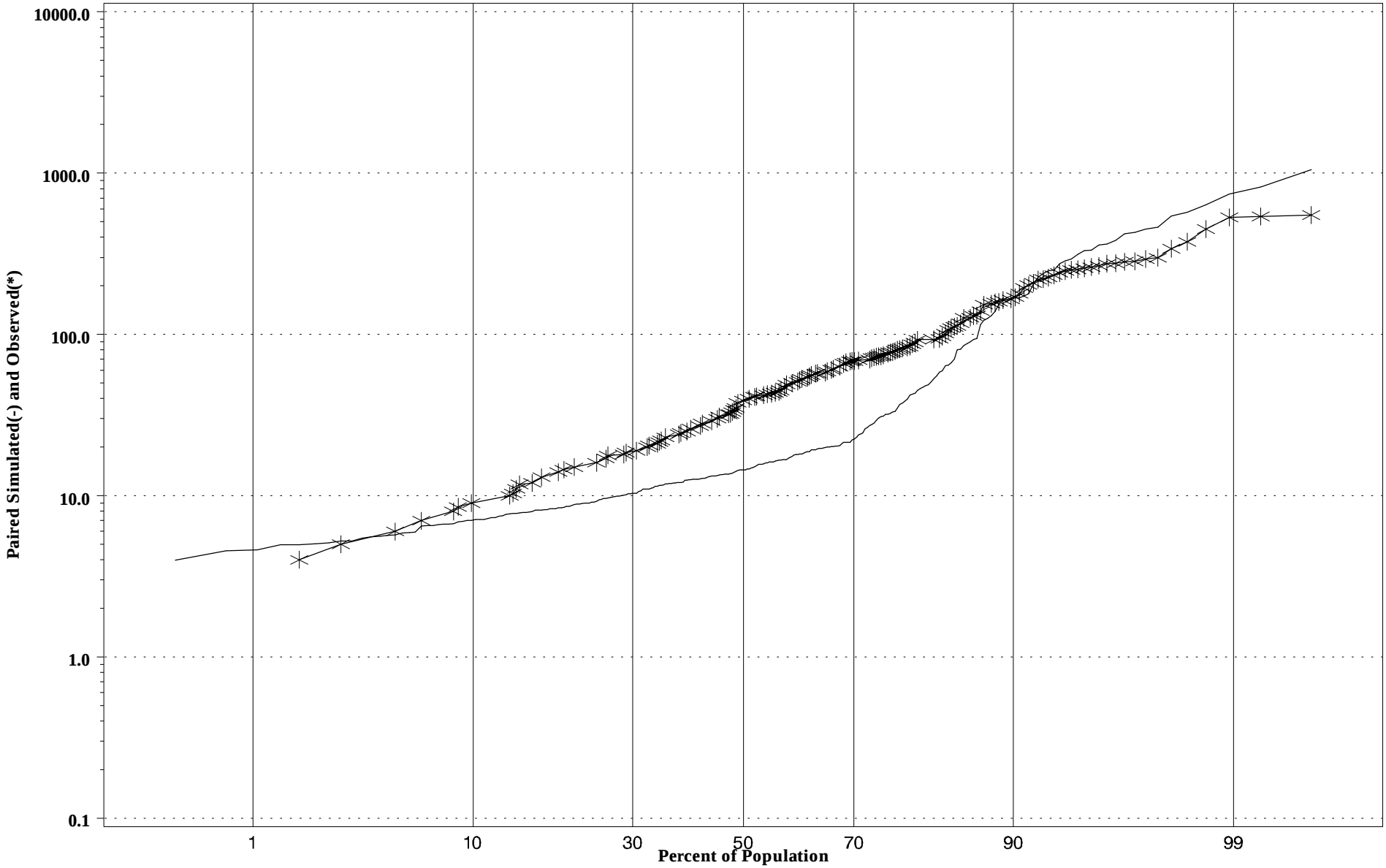

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(patux340.drv 25JUN98 12:48)

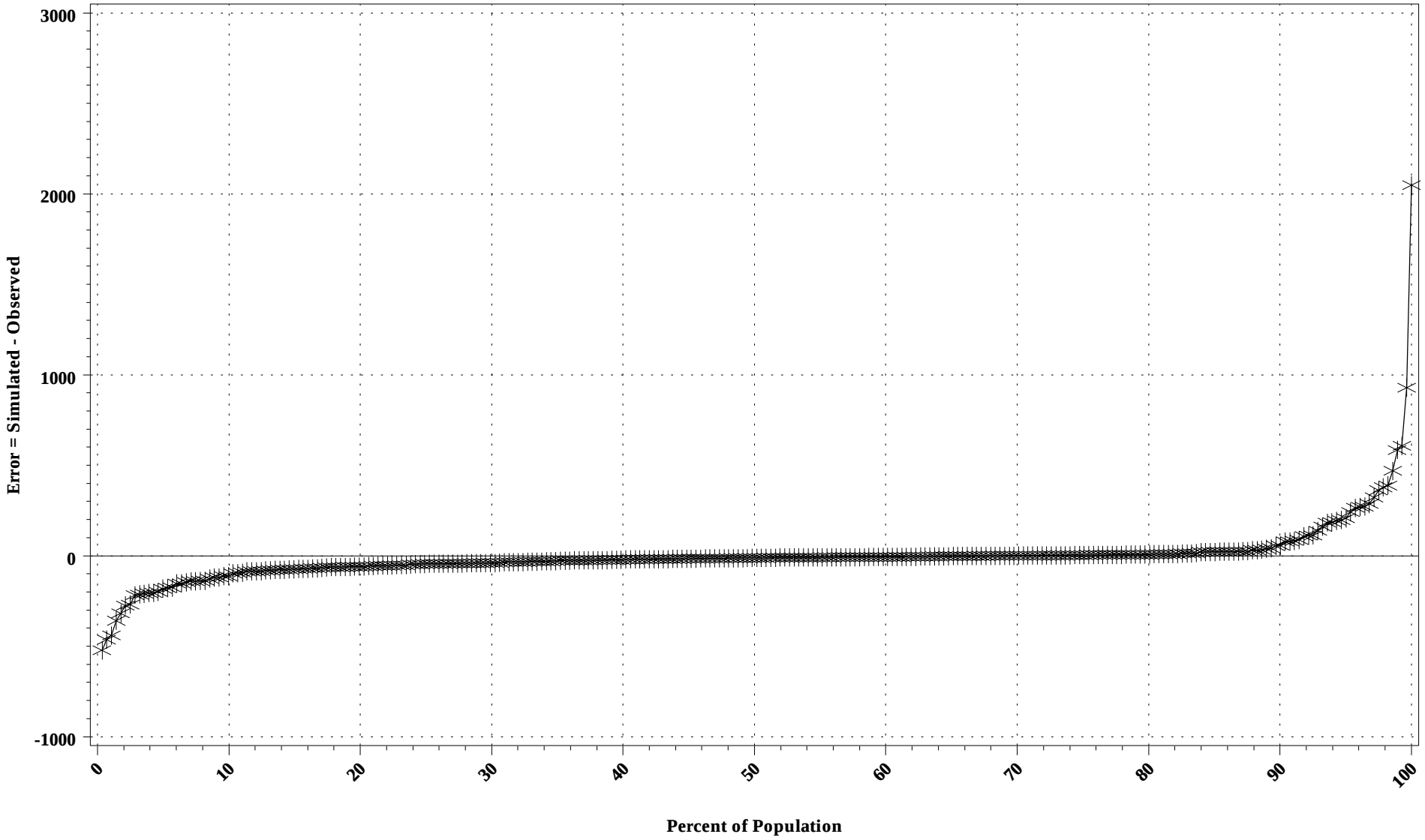
# Patuxent River at Segment 340
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

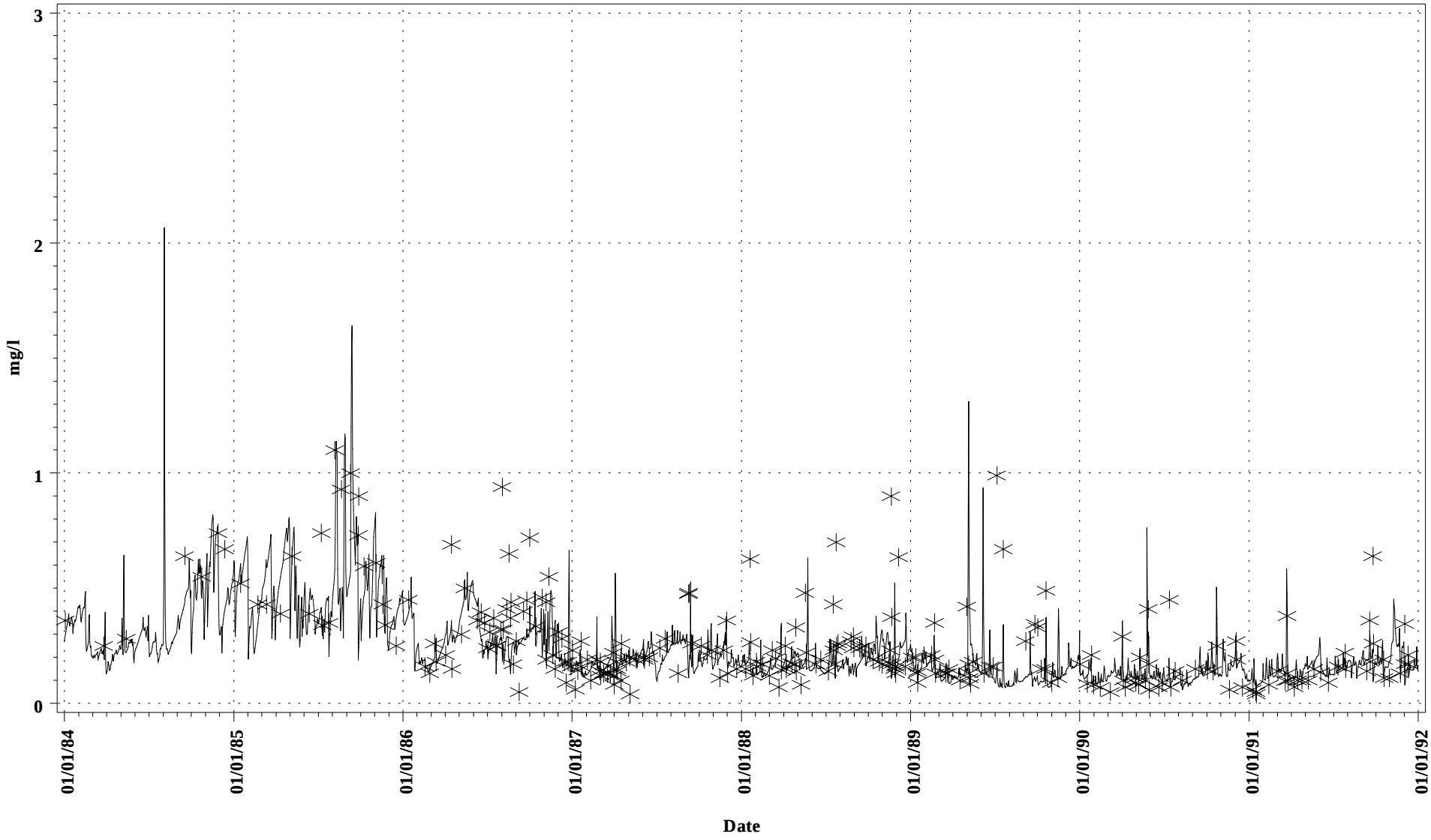
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(patux340.drv 25JUN98 12:48)

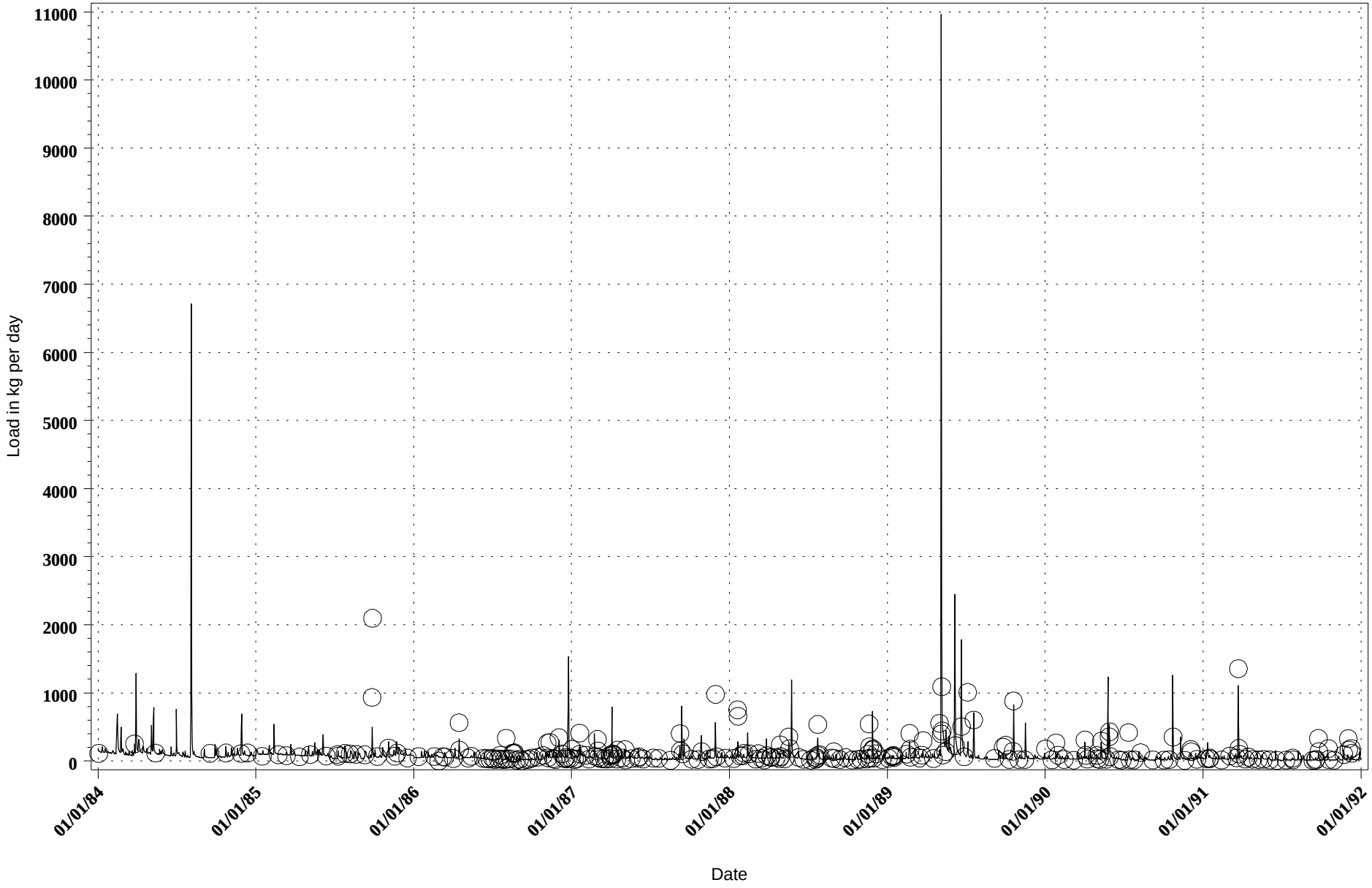
# Patuxent River at Segment 340
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

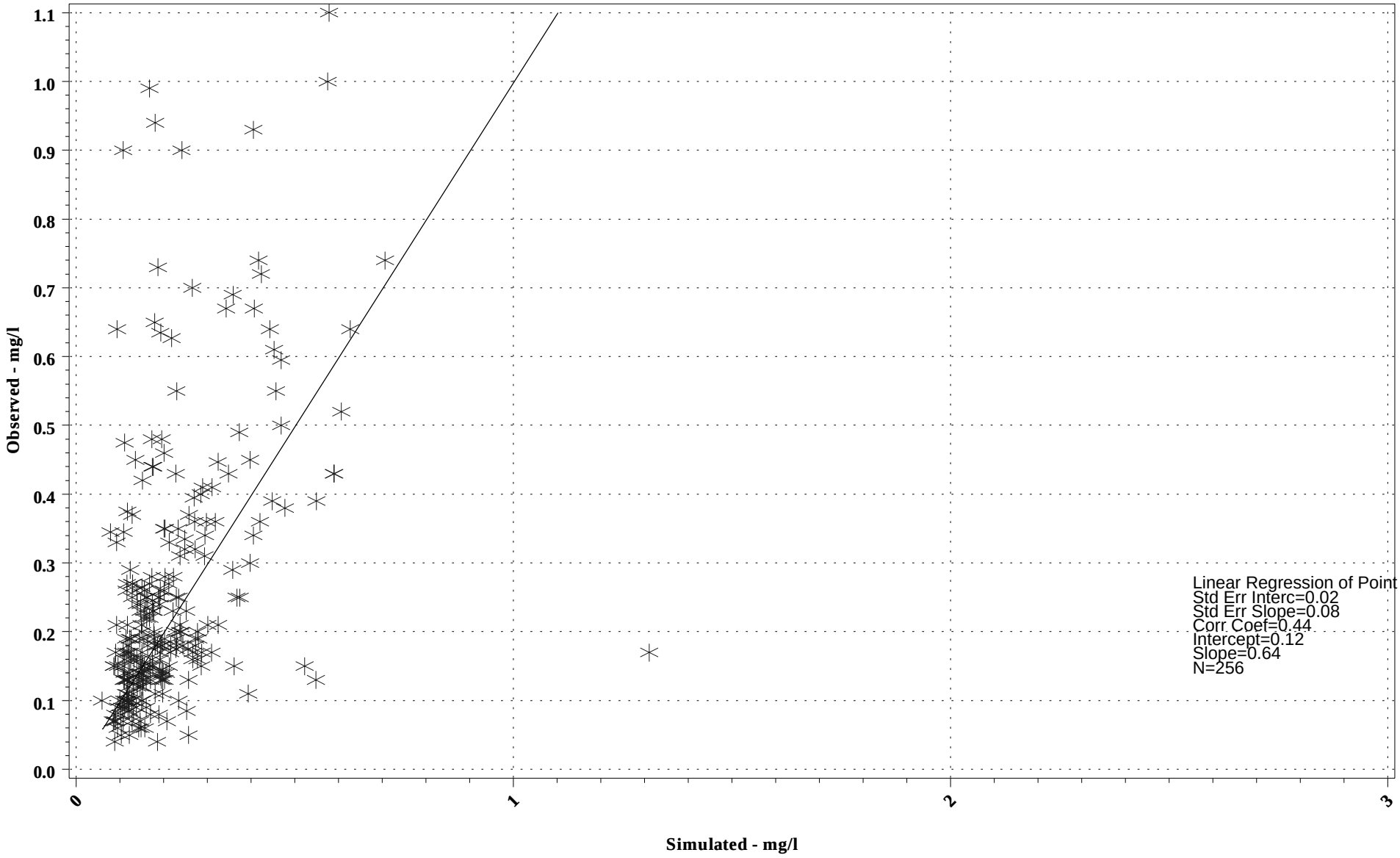



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340

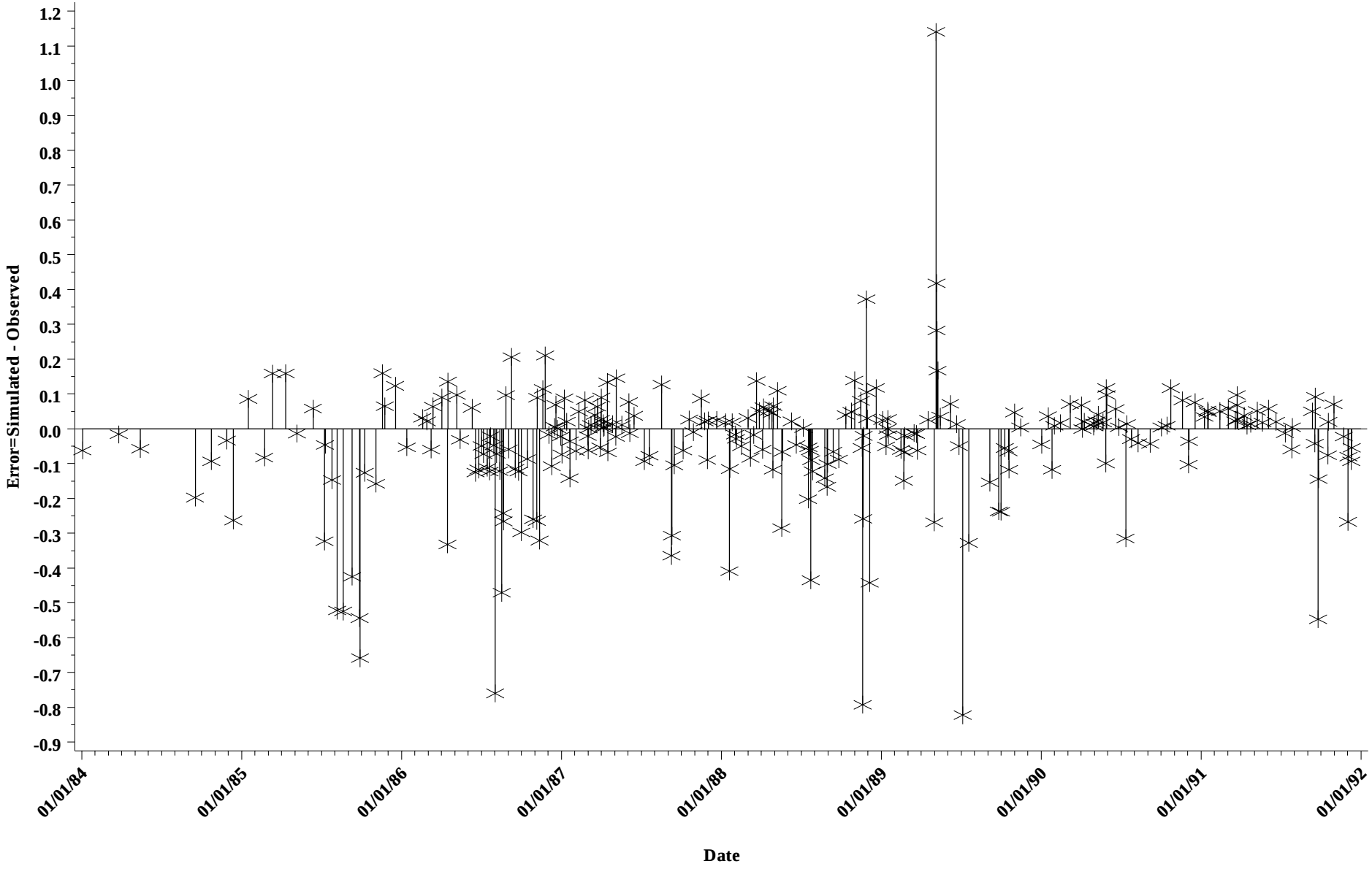
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



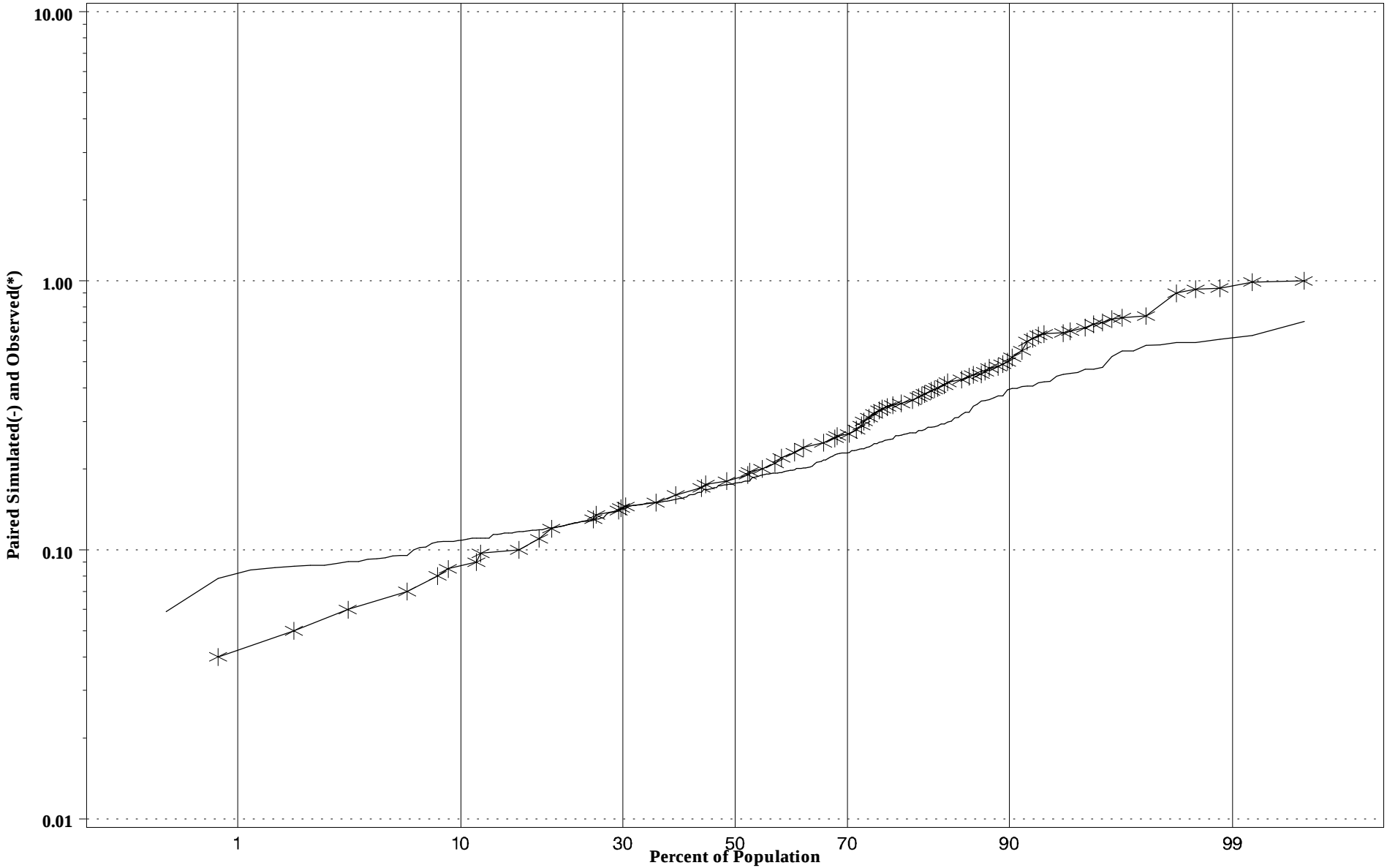

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(patux340.drv 25JUN98 12:48)

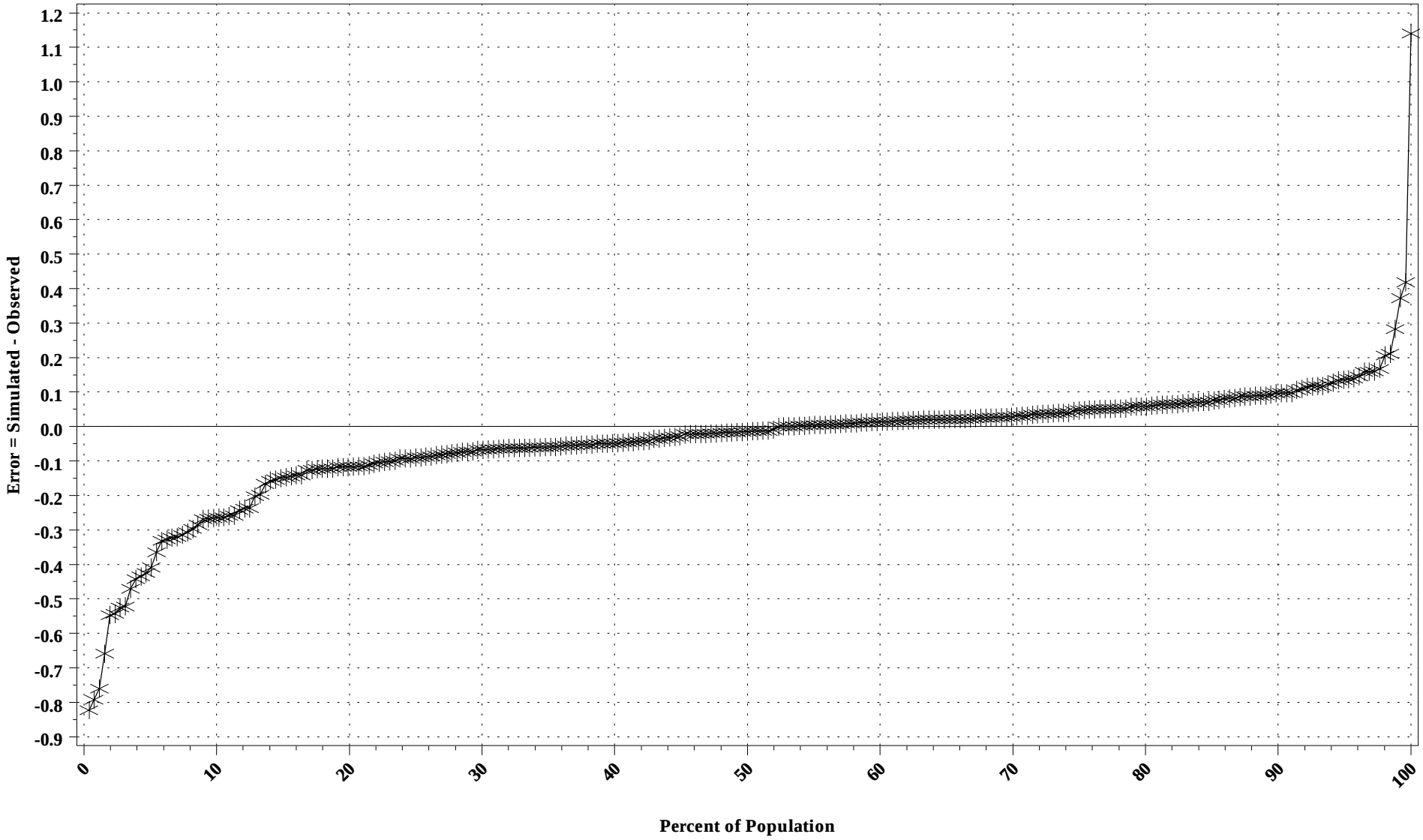
# Patuxent River at Segment 340
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Actual error versus Percentile Sample Population
## Total Phosphorus

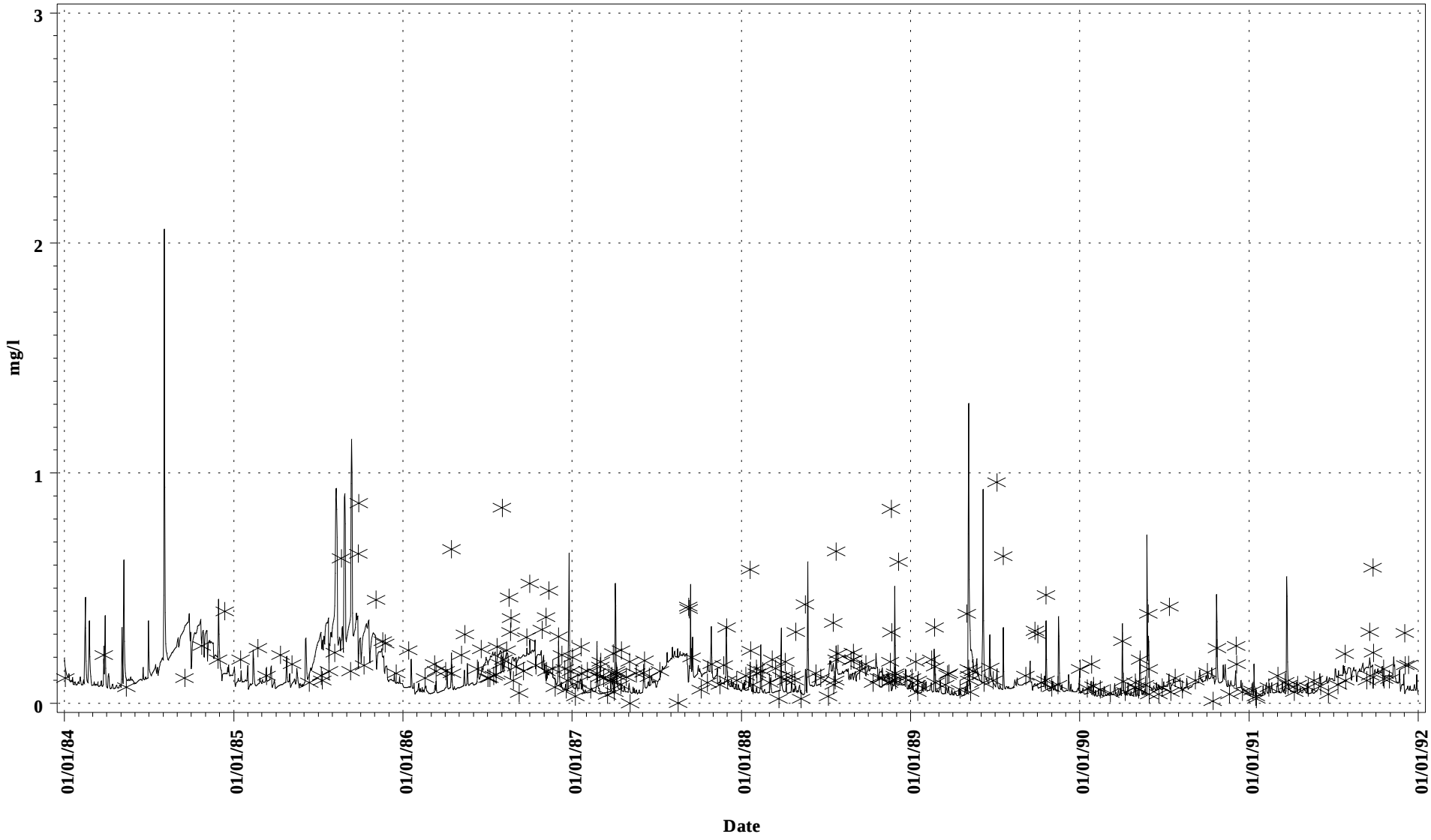
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

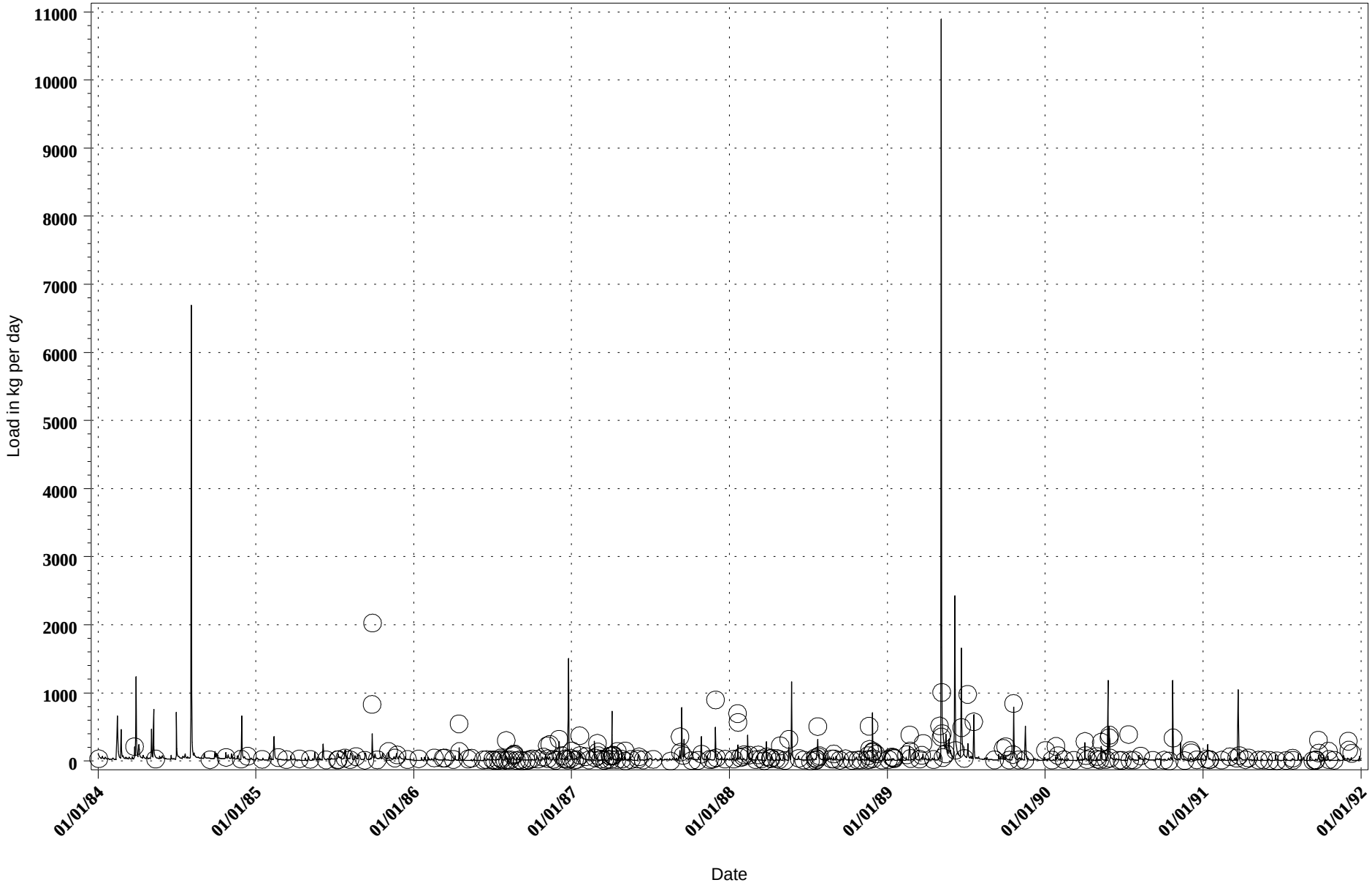



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

### (line = simulated, O = observed)

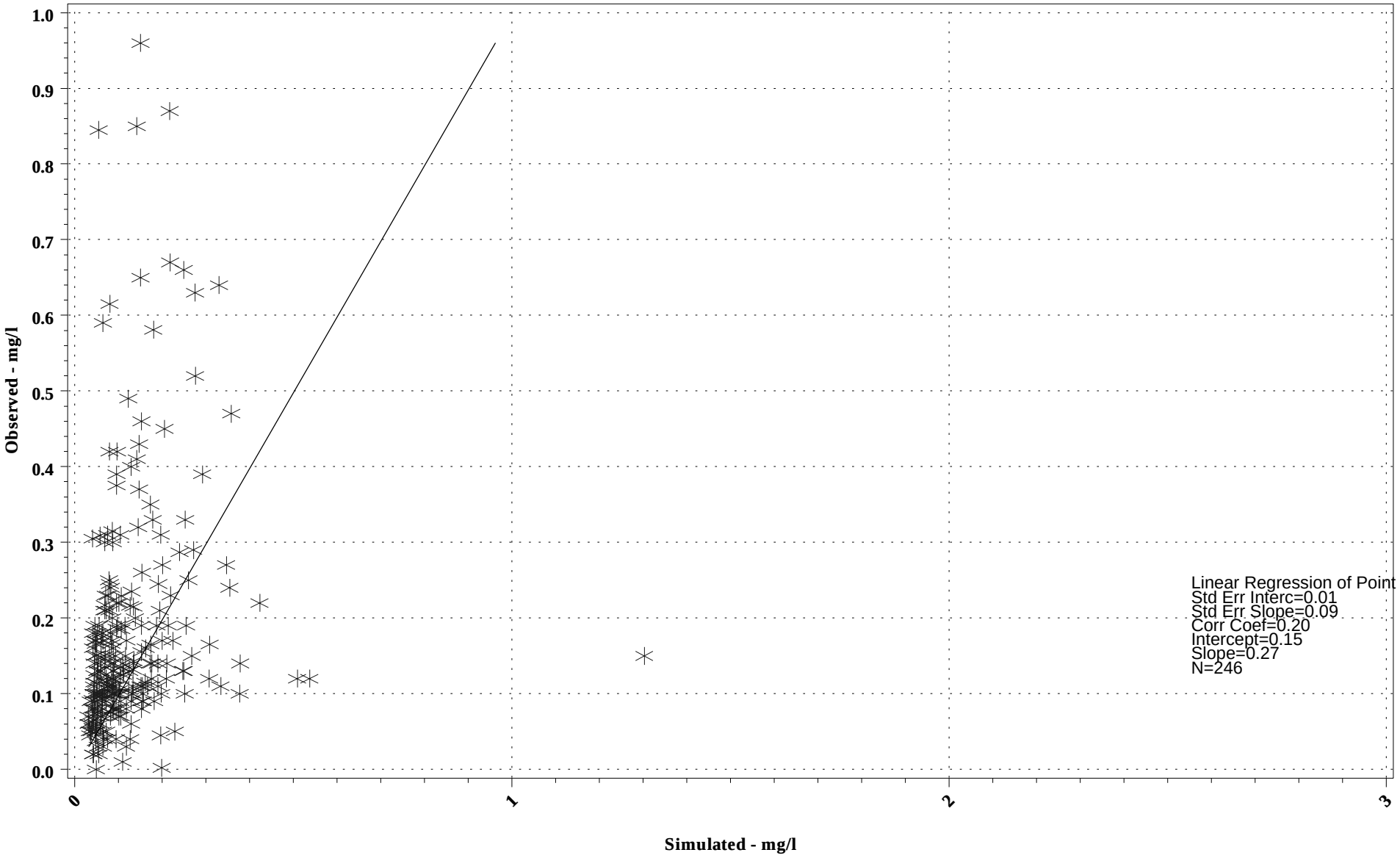



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340

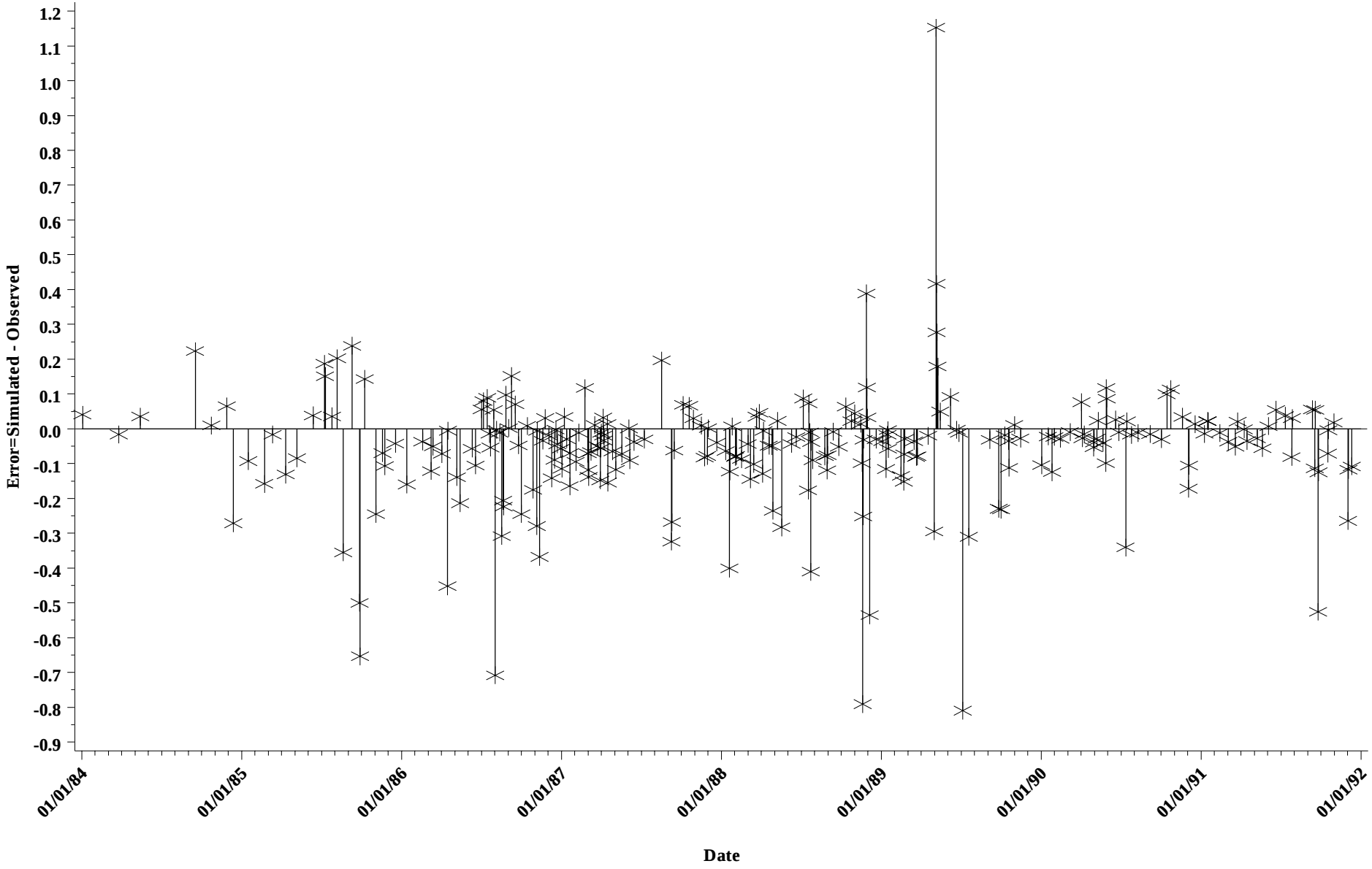
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92



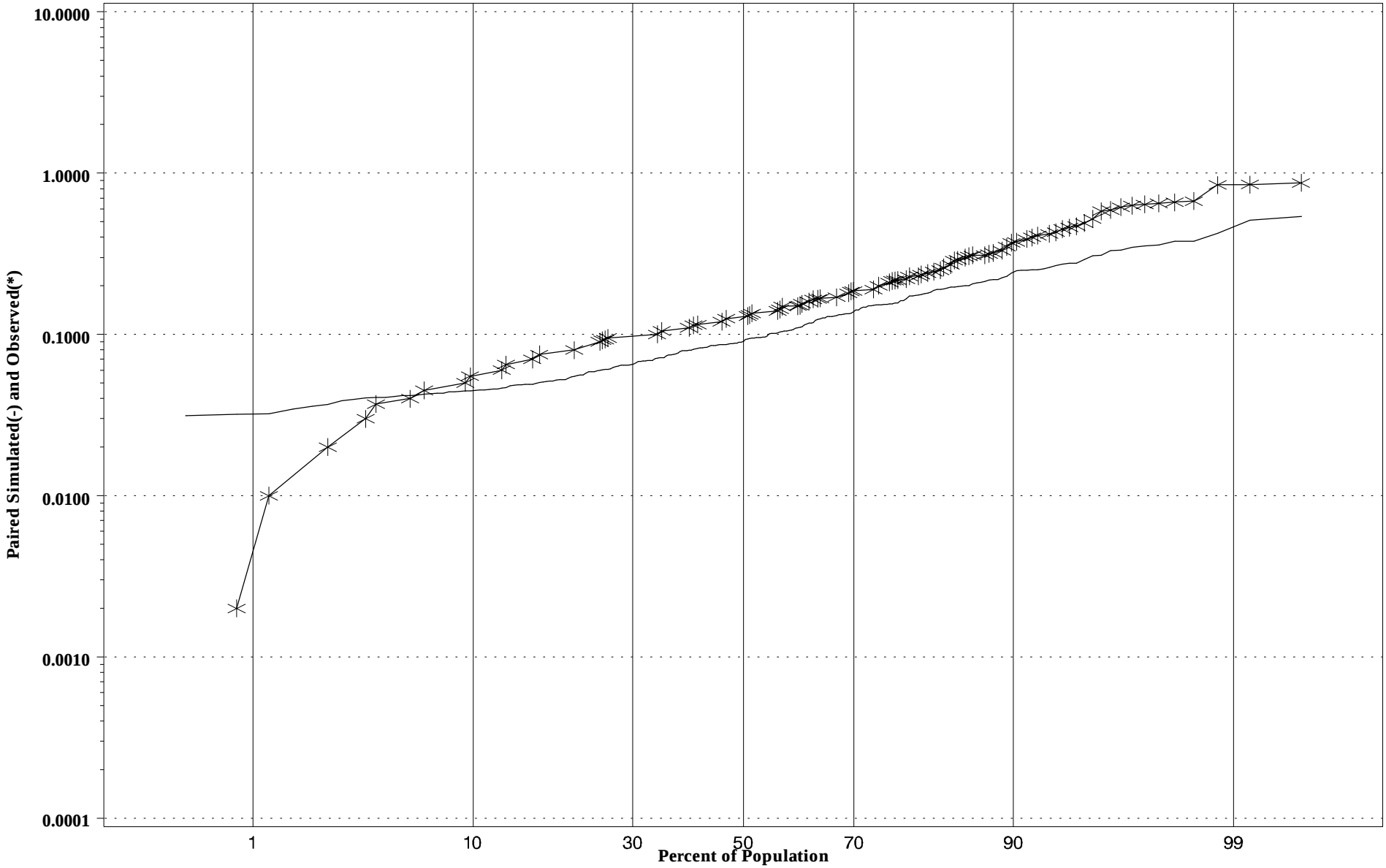

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340
## Actual Error versus Time
## Organic and Particulate Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(patux340.drv 25JUN98 12:48)

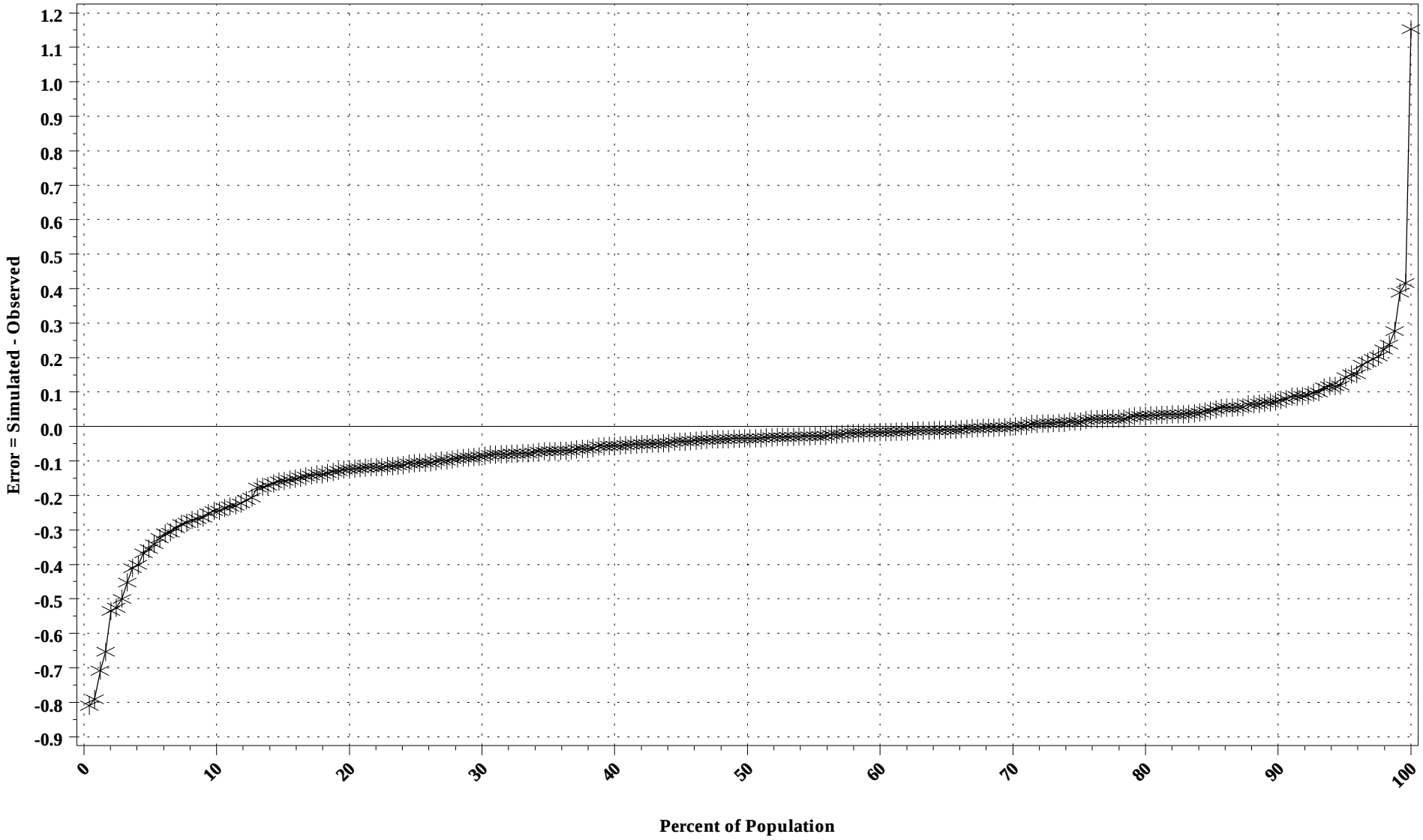
# Patuxent River at Segment 340
## Organic and Particulate Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

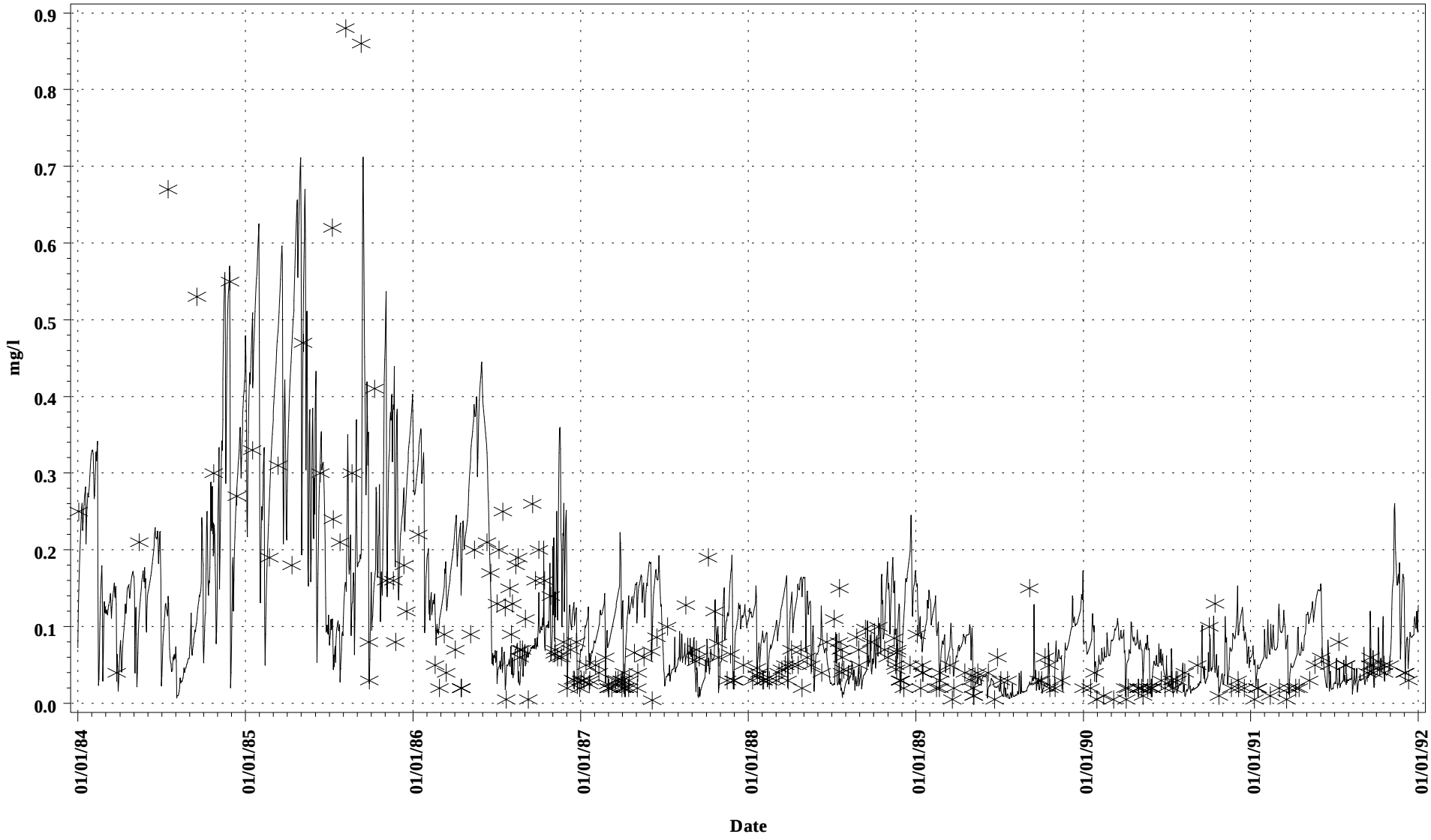
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Observed and Simulated versus Time
## Dissolved Phosphorus

**(*=Observed, -=Simulated)**

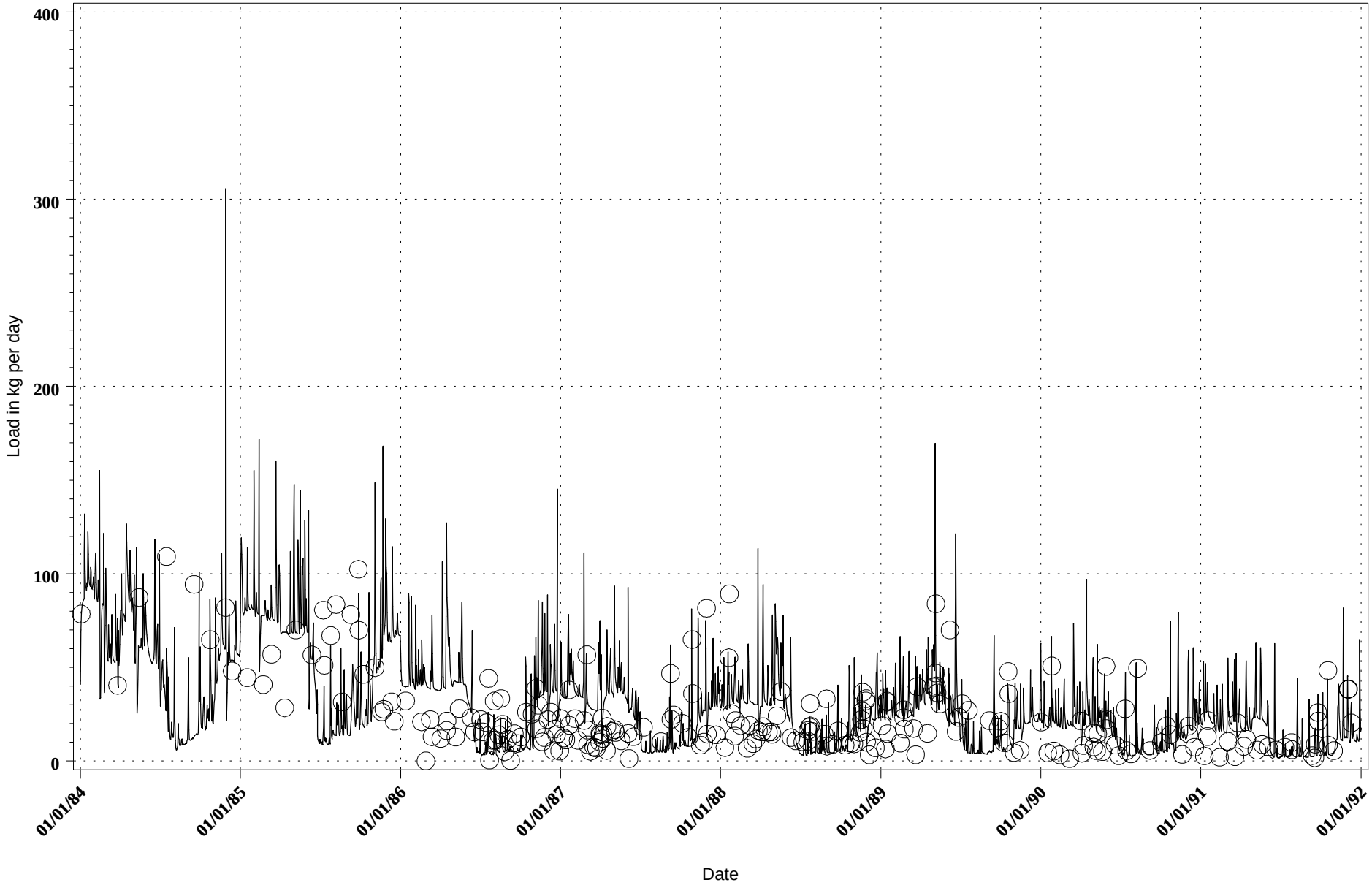



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340

## Dissolved Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

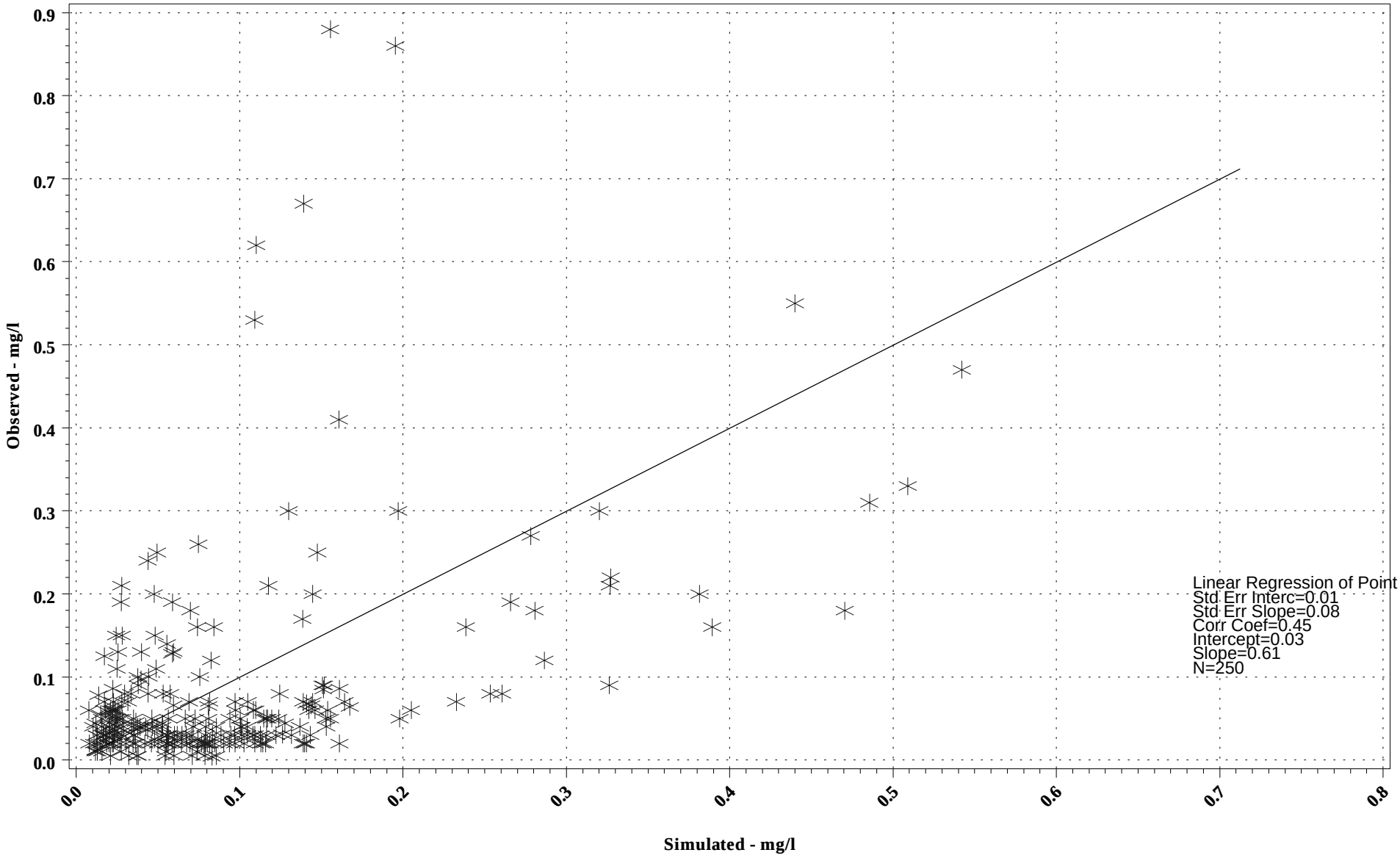



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340

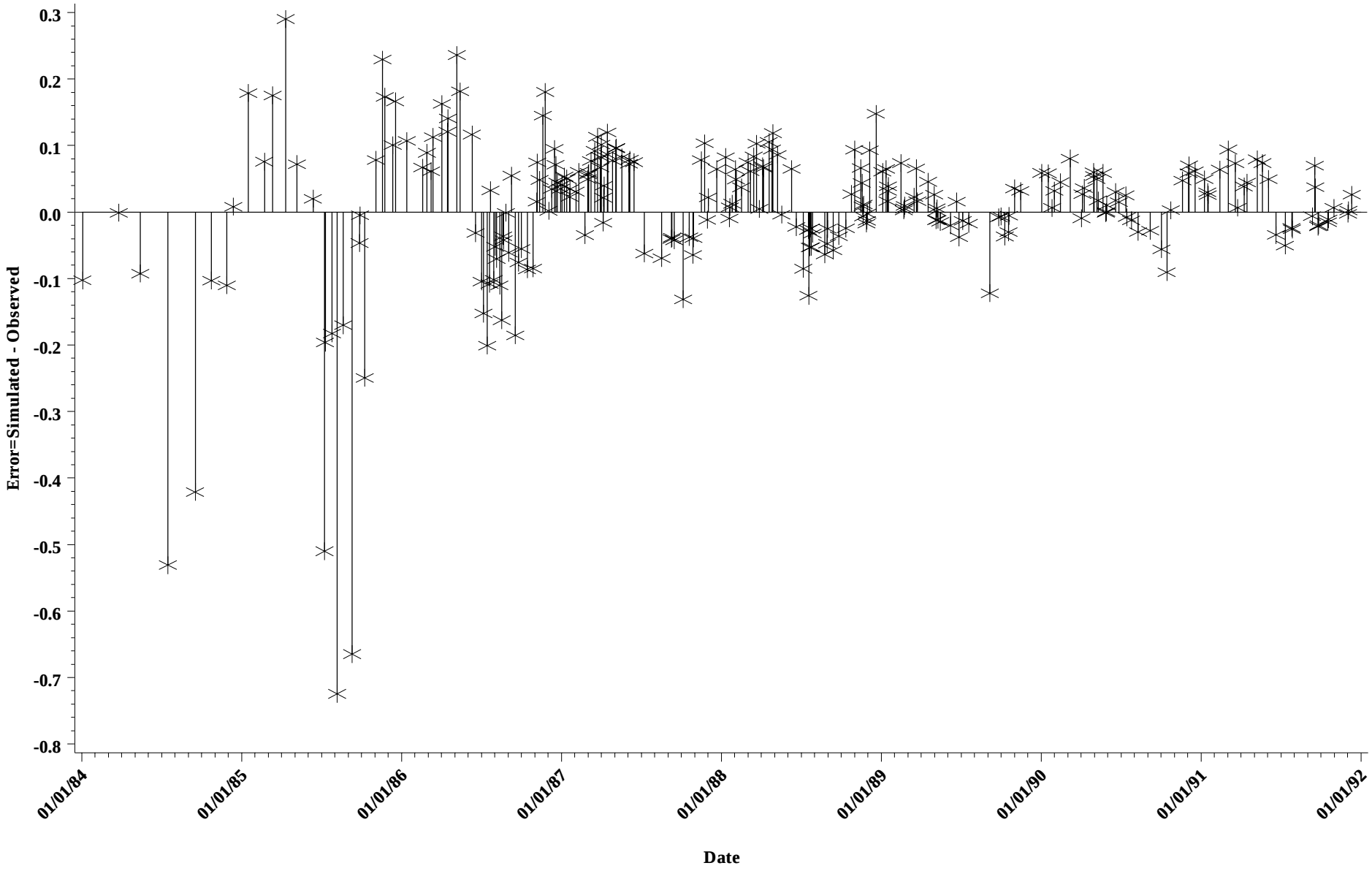
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



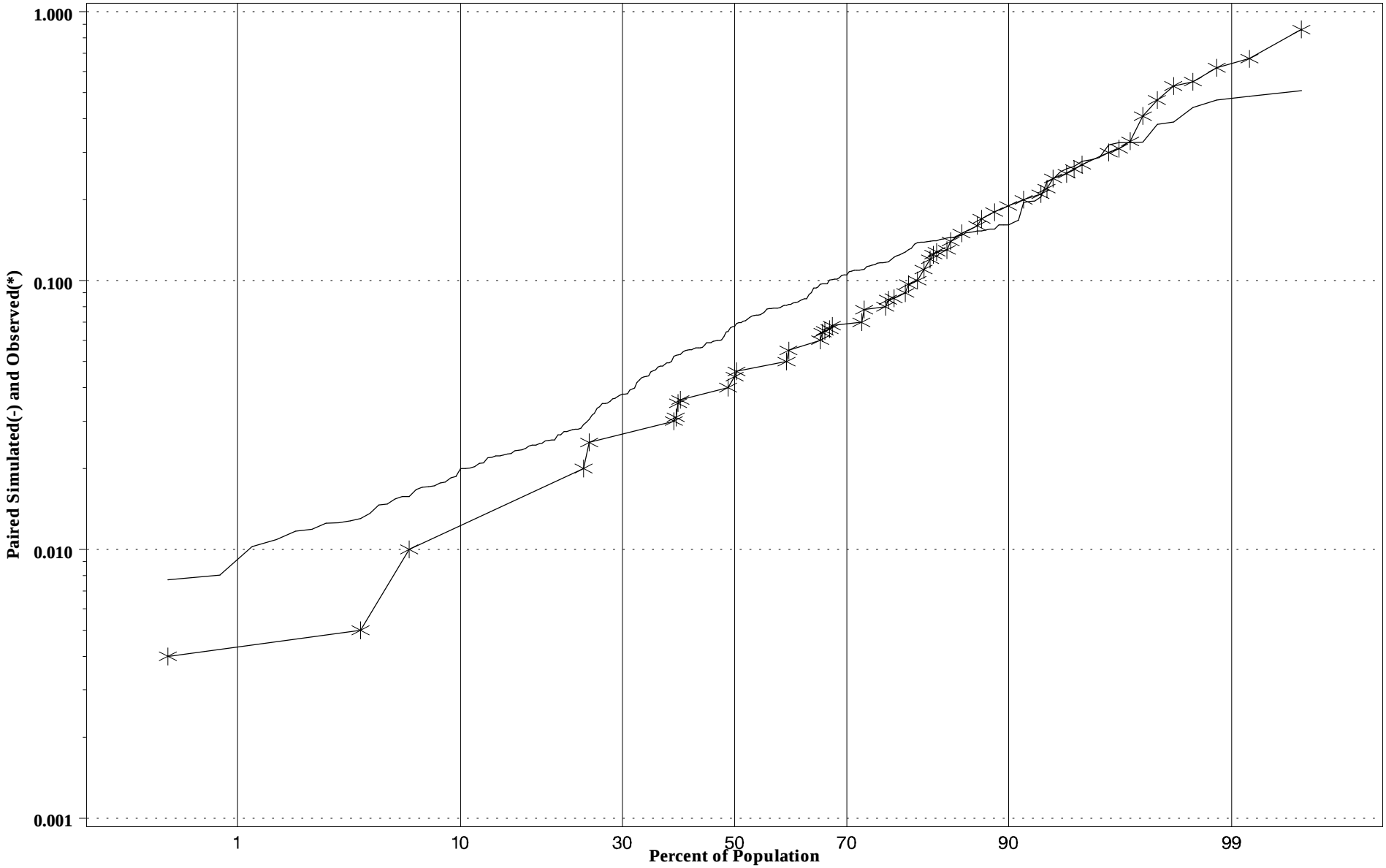

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(patux340.drv 25JUN98 12:48)

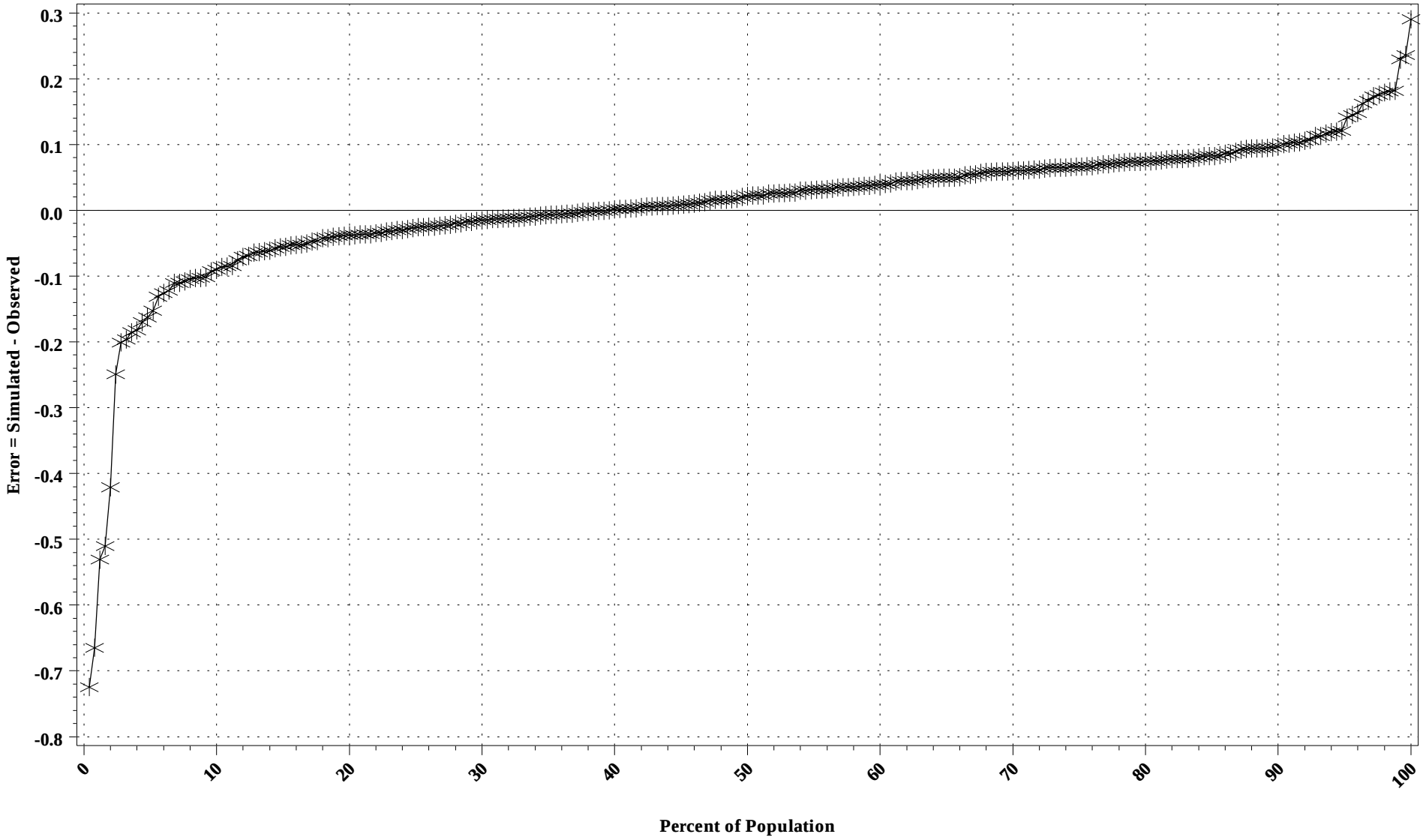
# Patuxent River at Segment 340
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

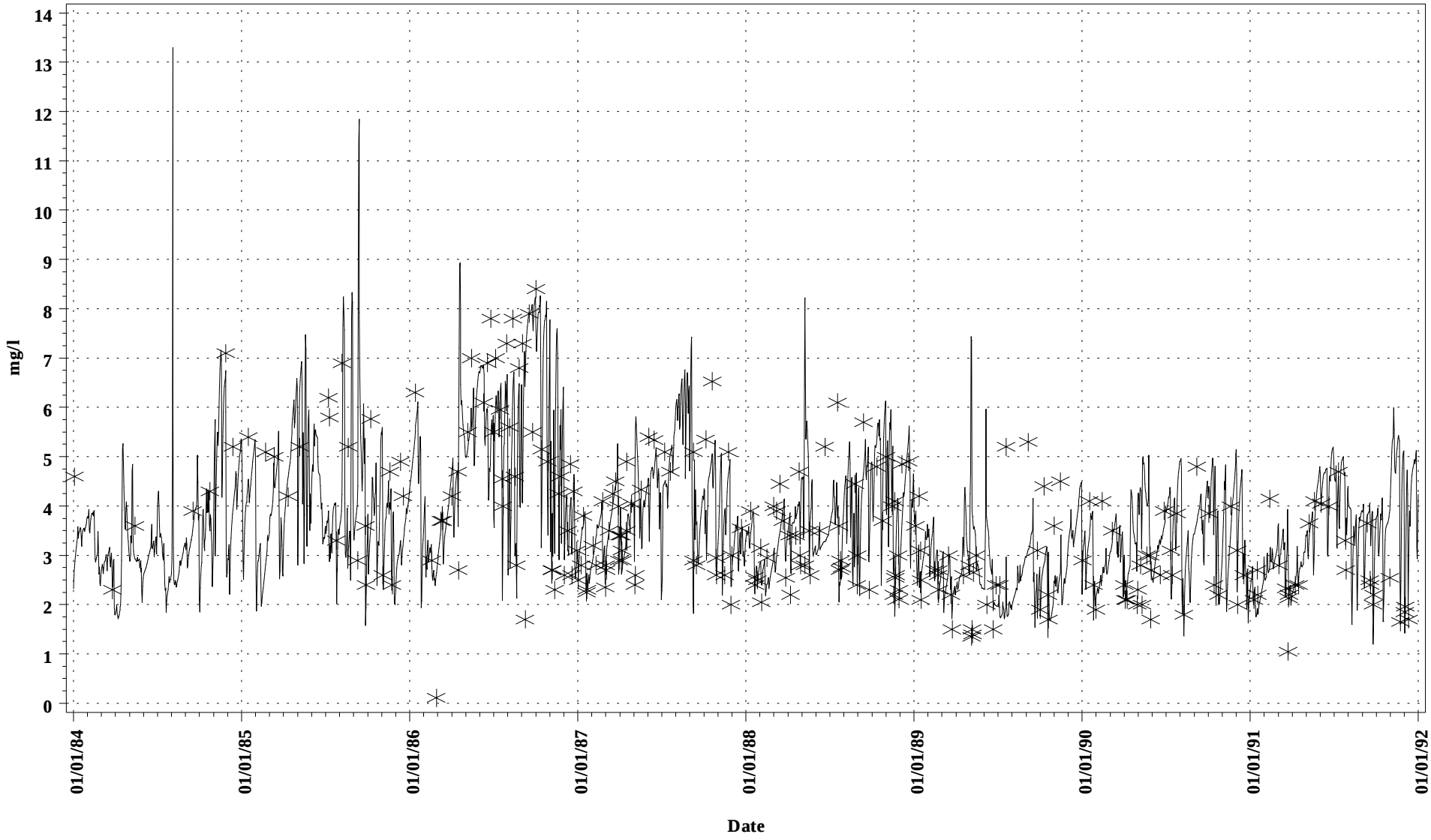
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(patux340.drv 25JUN98 12:48)

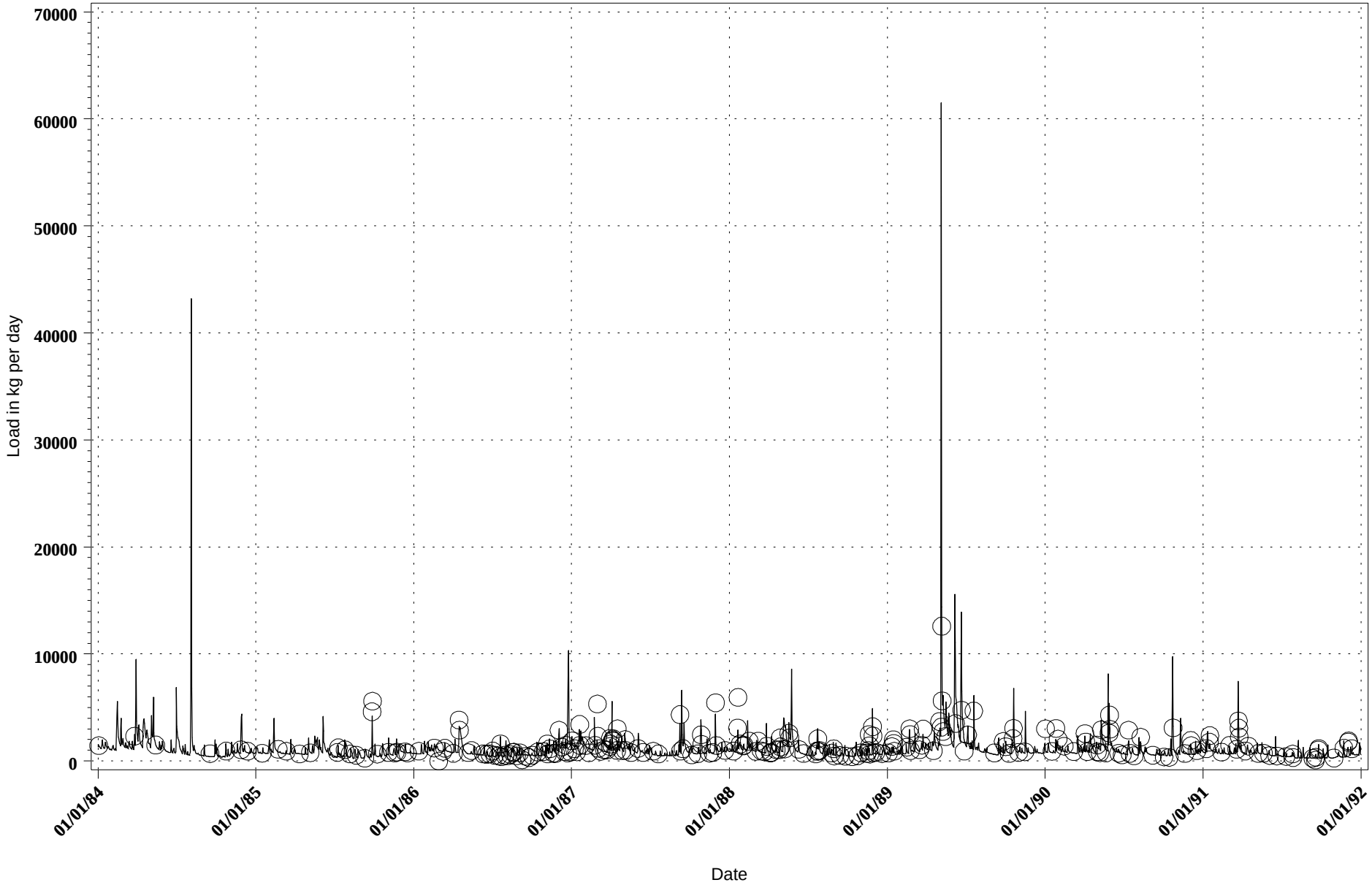
# Patuxent River at Segment 340
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

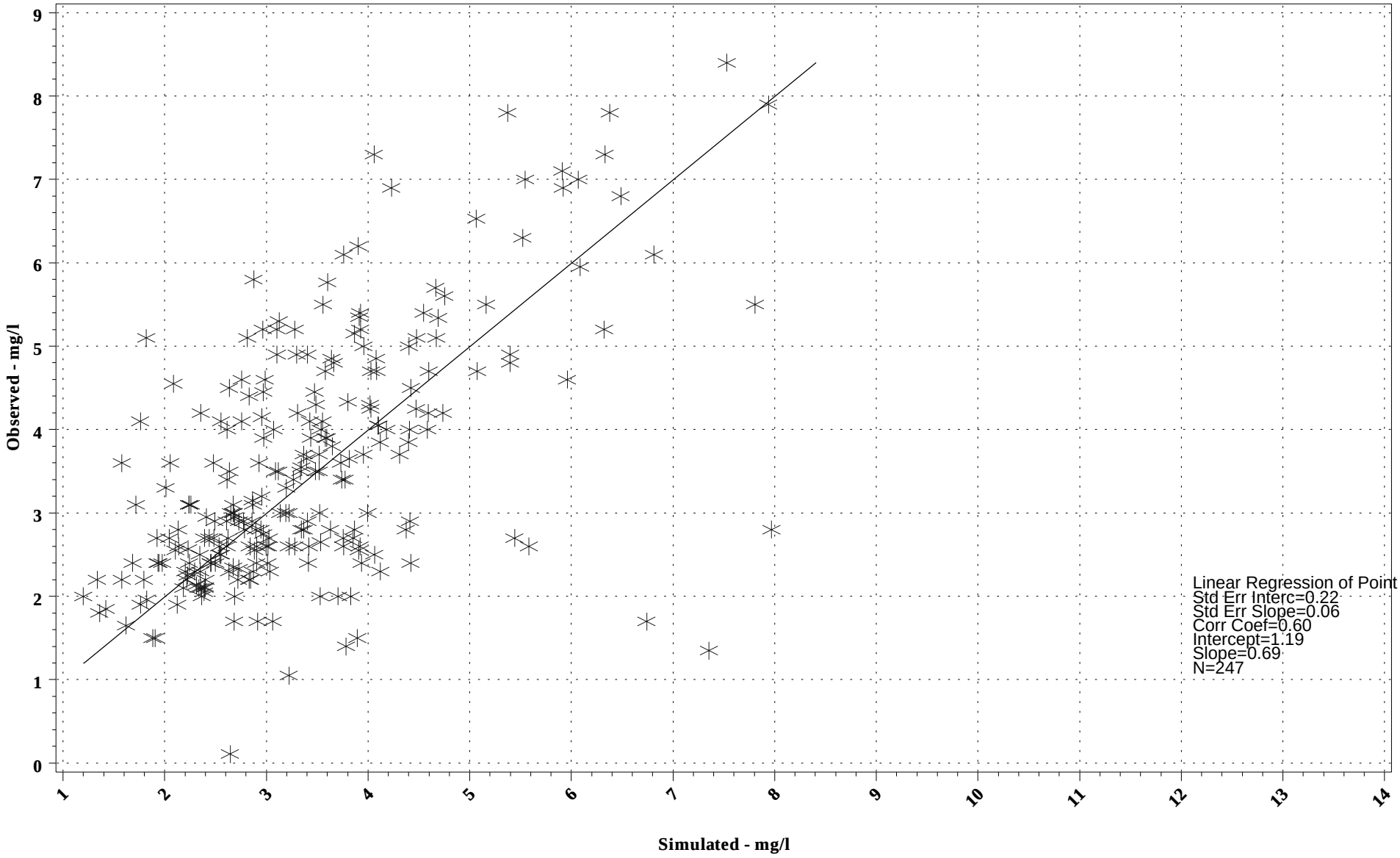



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340

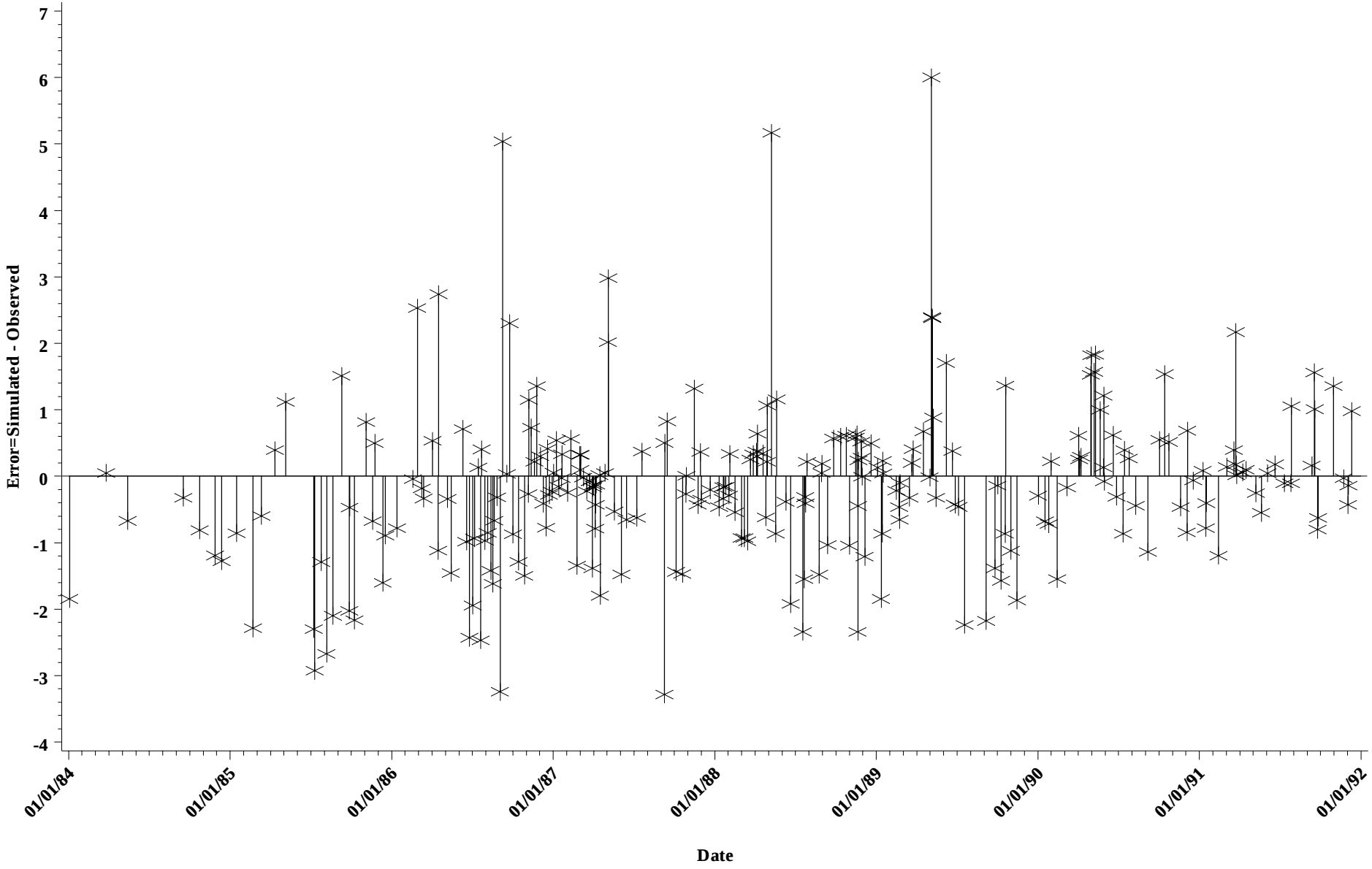
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92



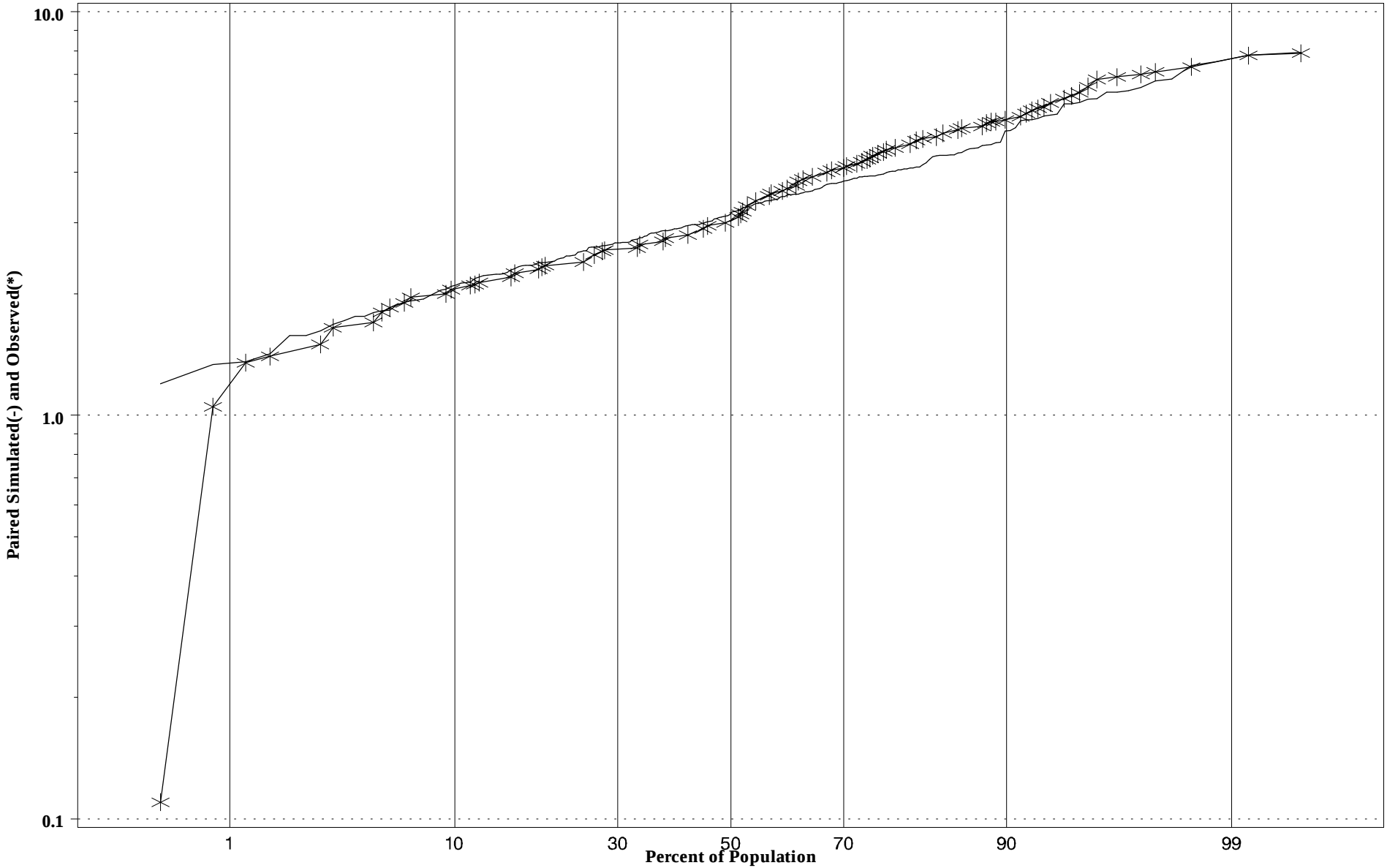

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340
## Actual Error versus Time
## Total Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(patux340.drv 25JUN98 12:48)

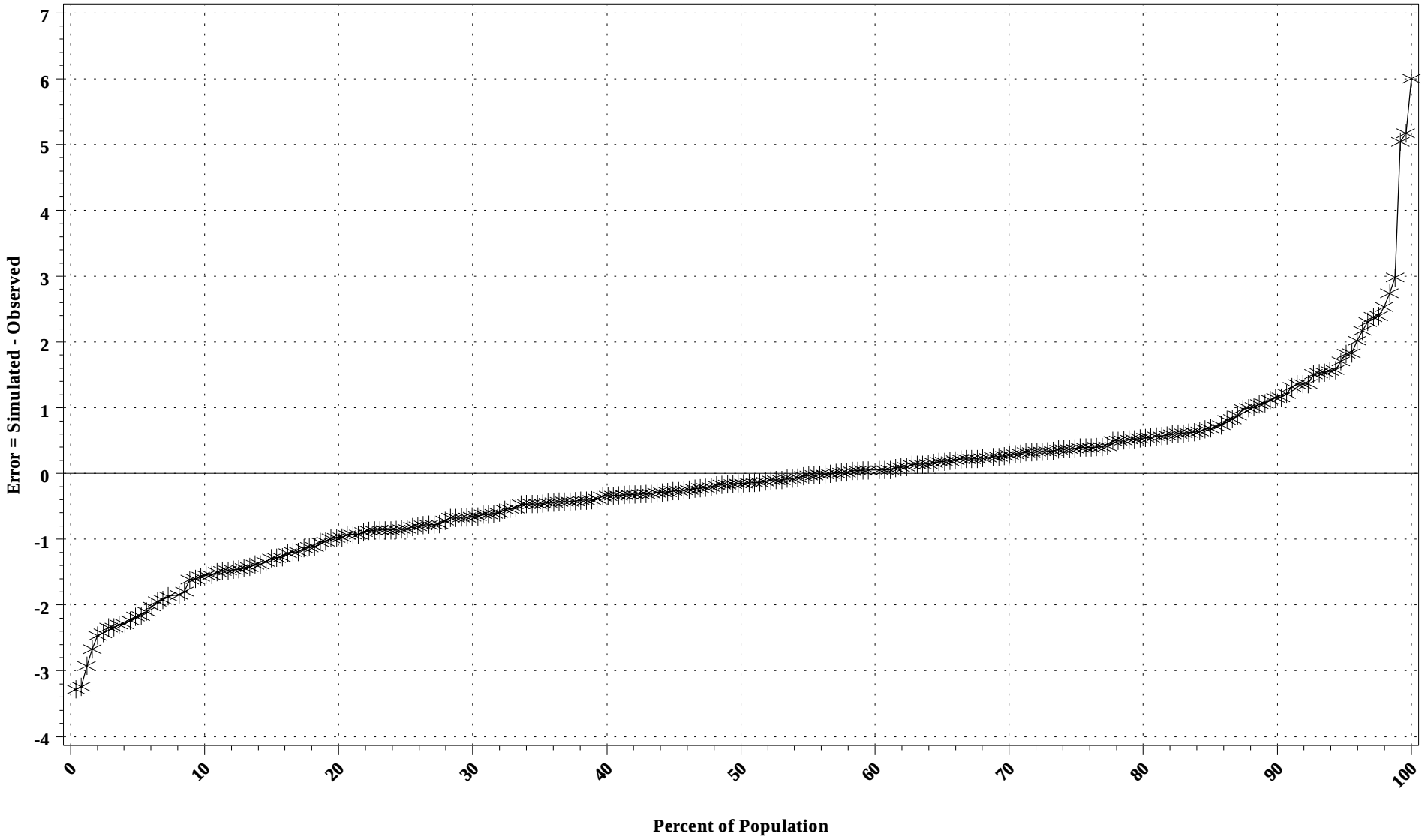
# Patuxent River at Segment 340
## Total Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Actual error versus Percentile Sample Population
## Total Nitrogen

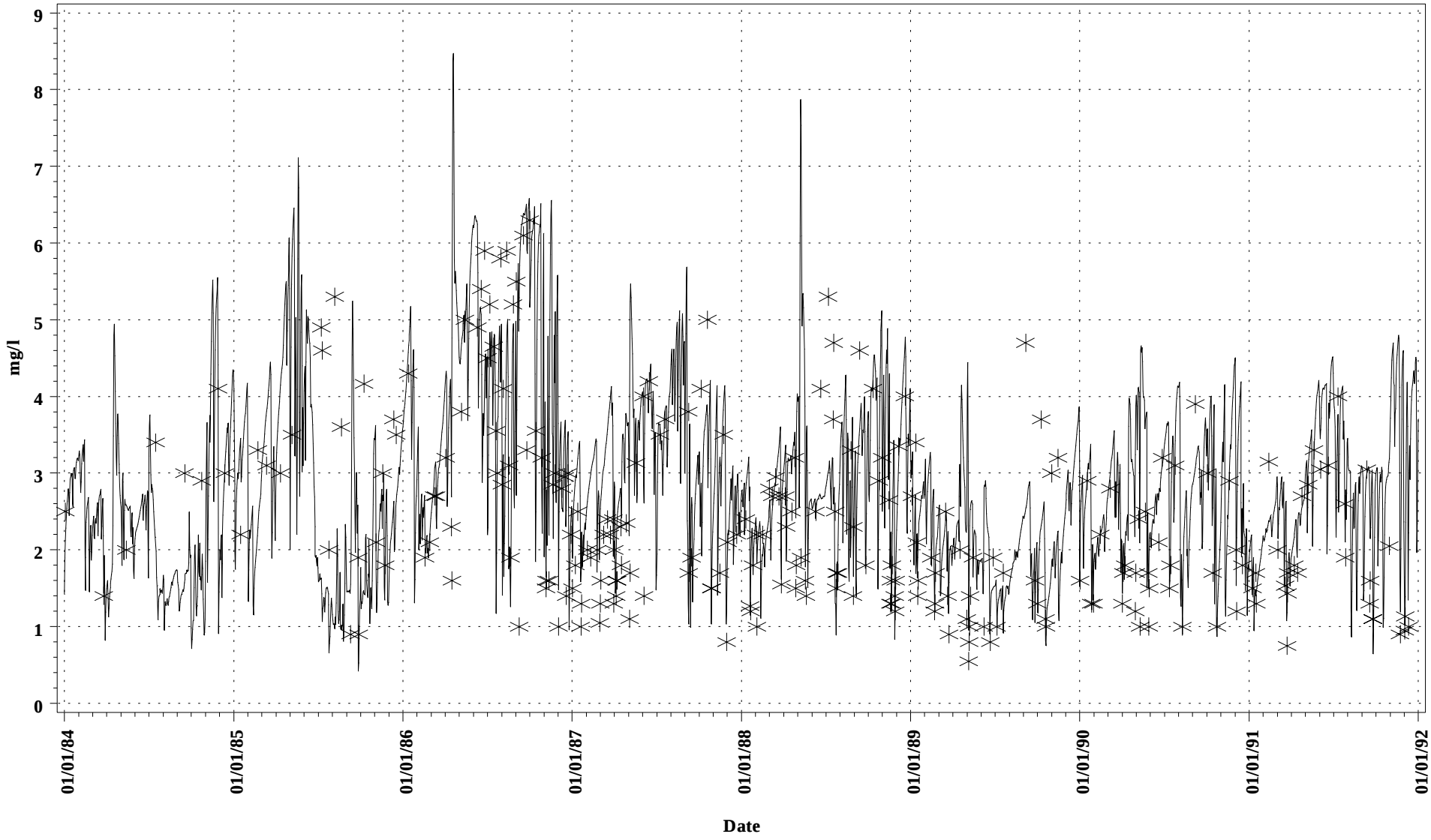
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

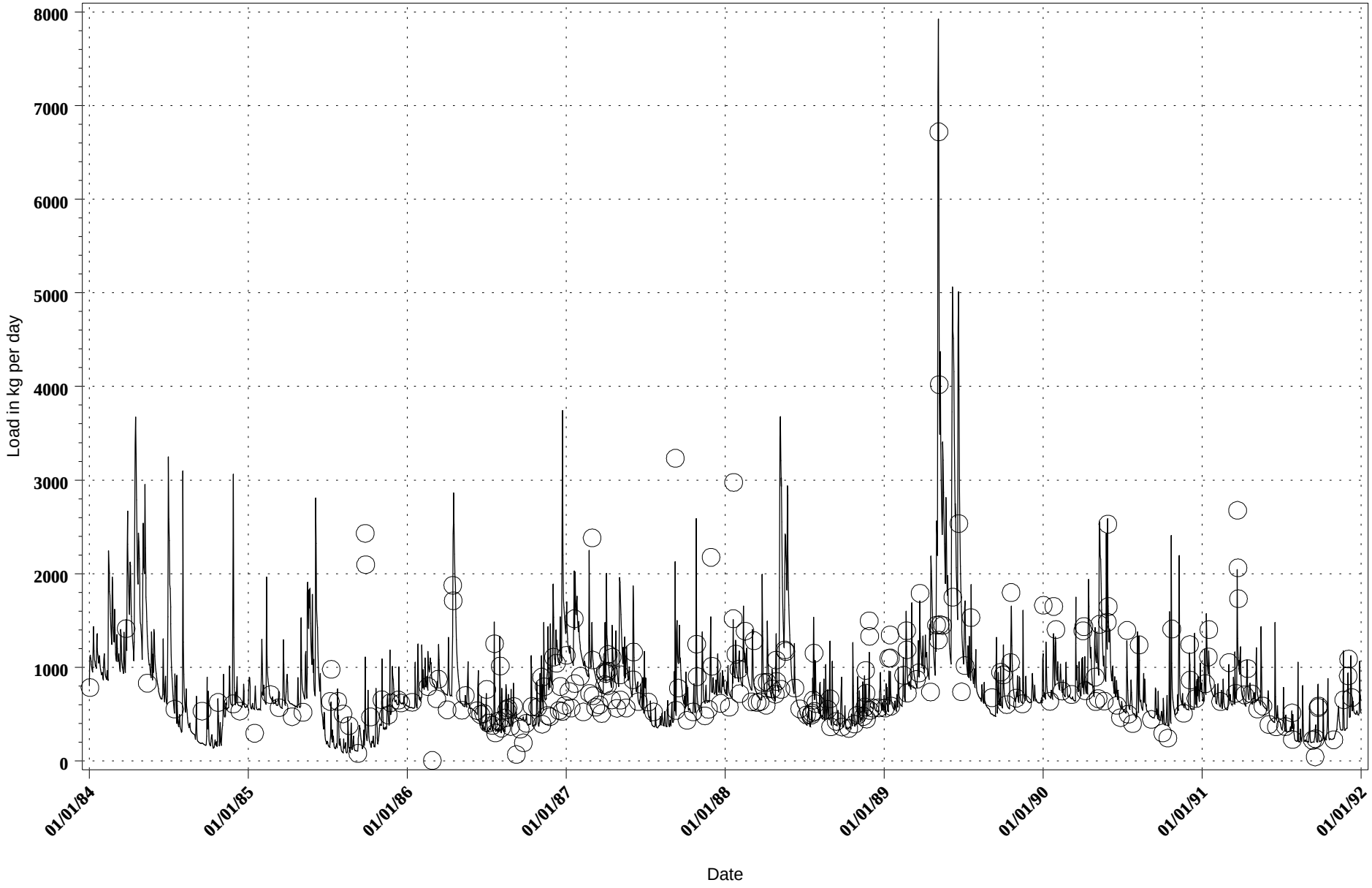



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340

## NO3 Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

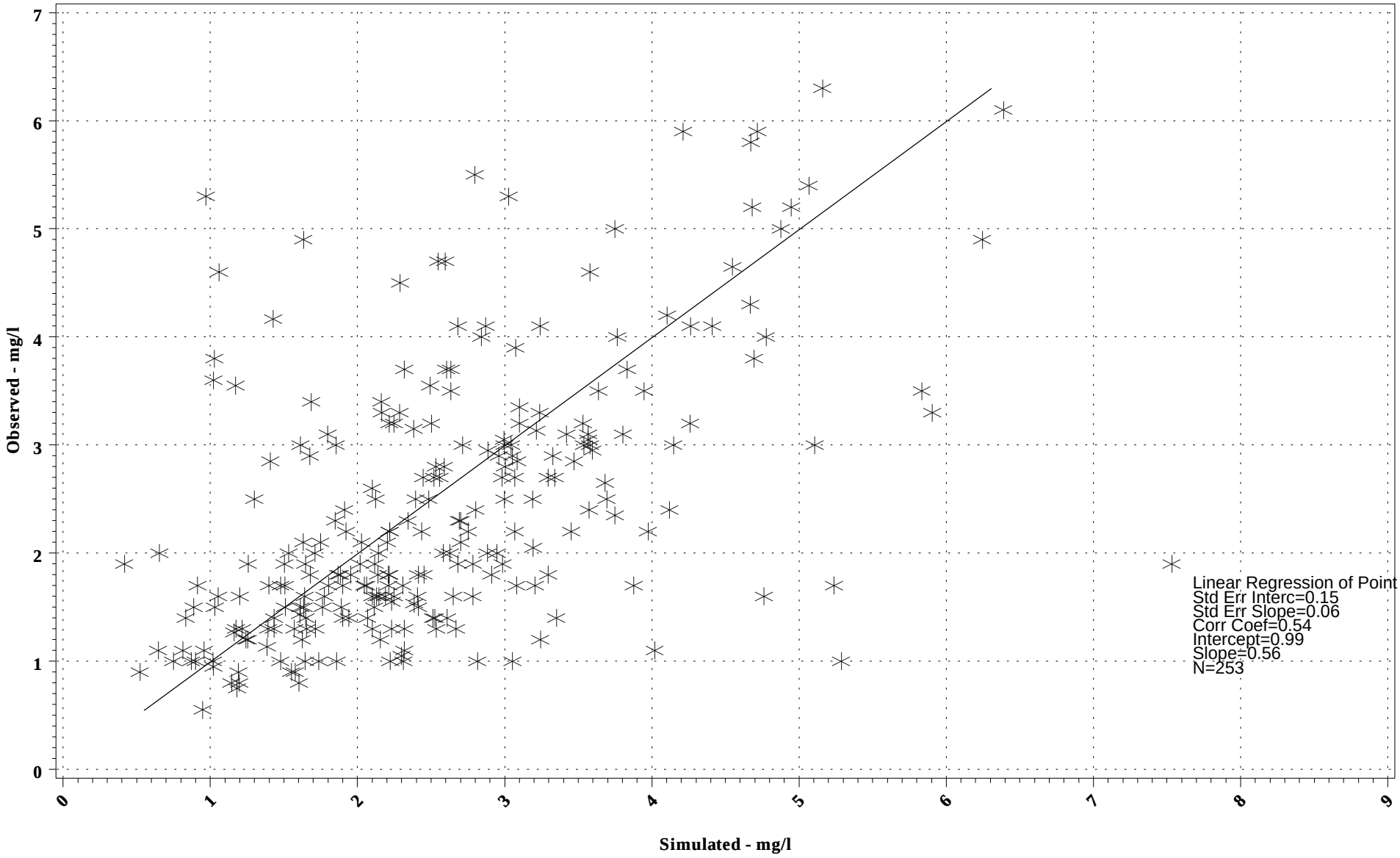



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340

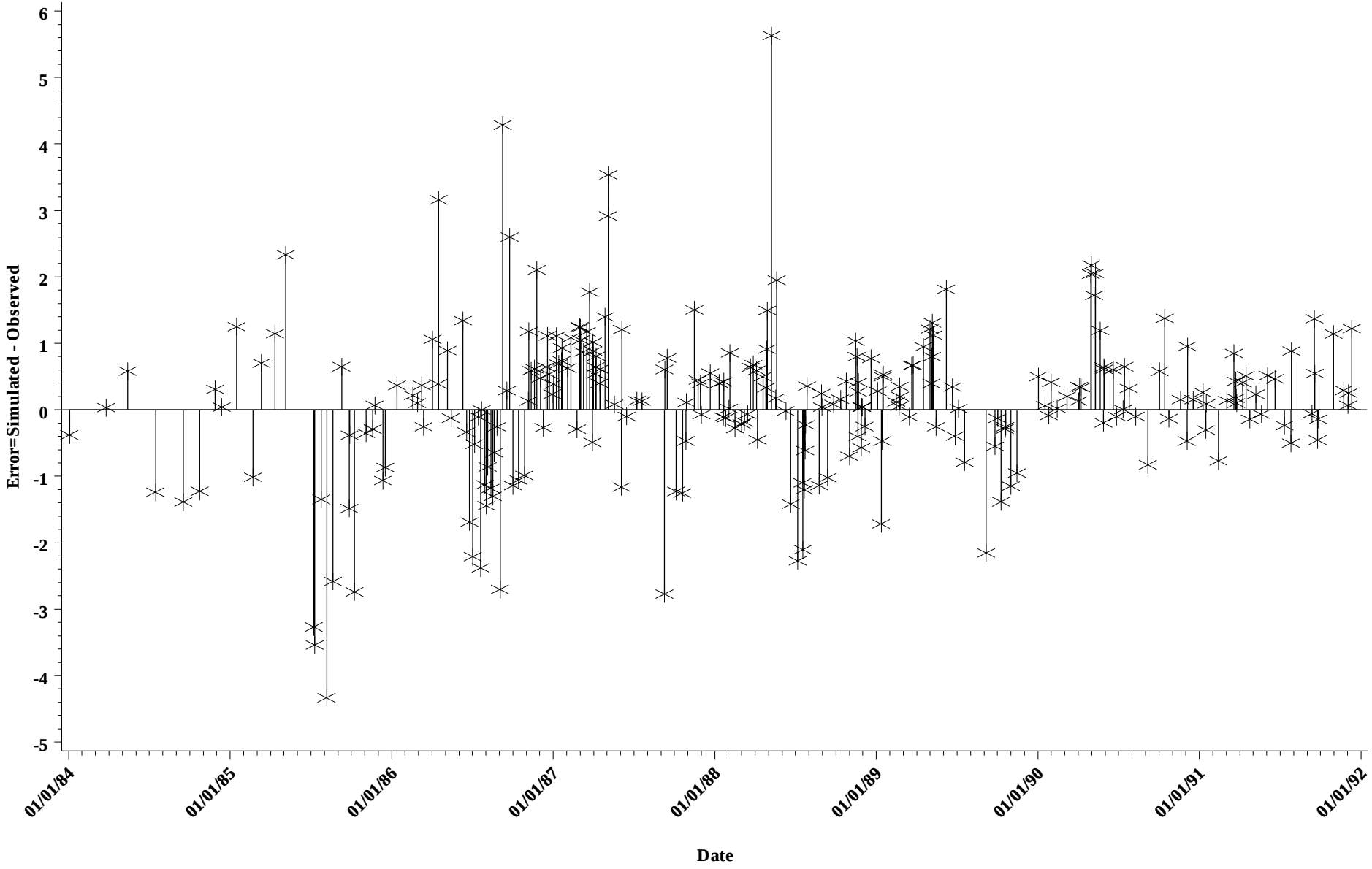
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340
## Actual Error versus Time
## NO3

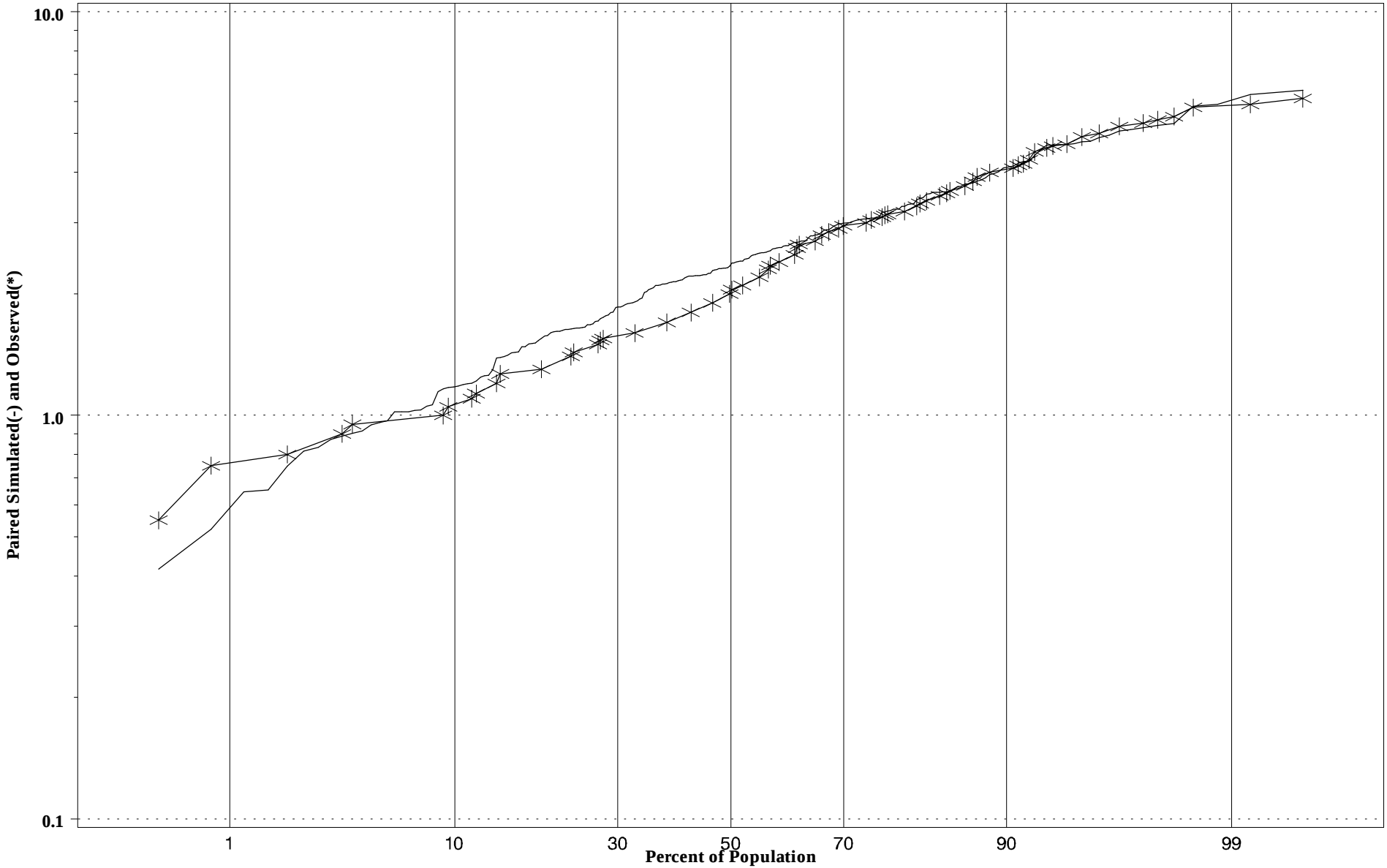



(y21_plotb.sas model3d:[pwang.dt] omerr)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340

## NO3

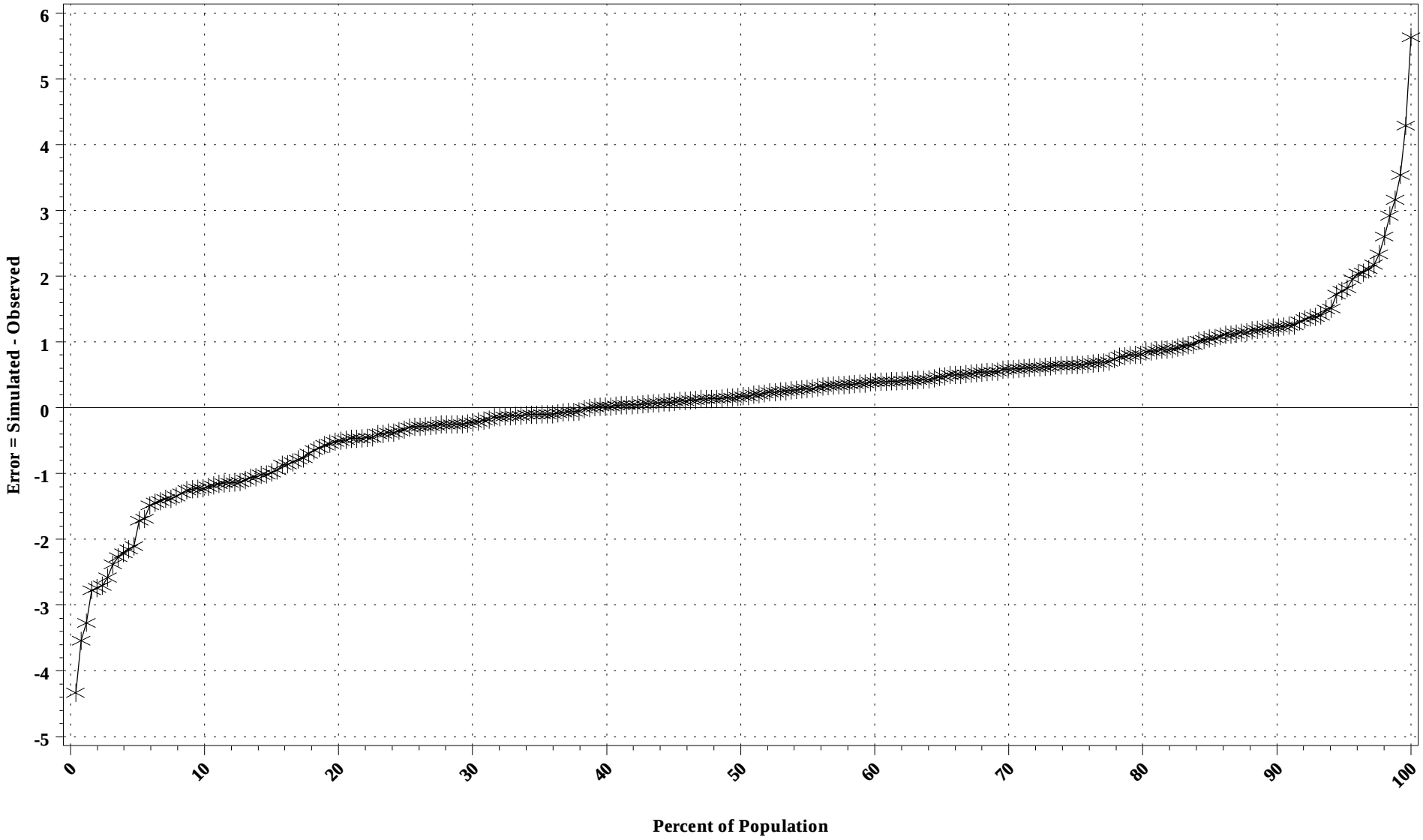
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Actual error versus Percentile Sample Population
## NO3

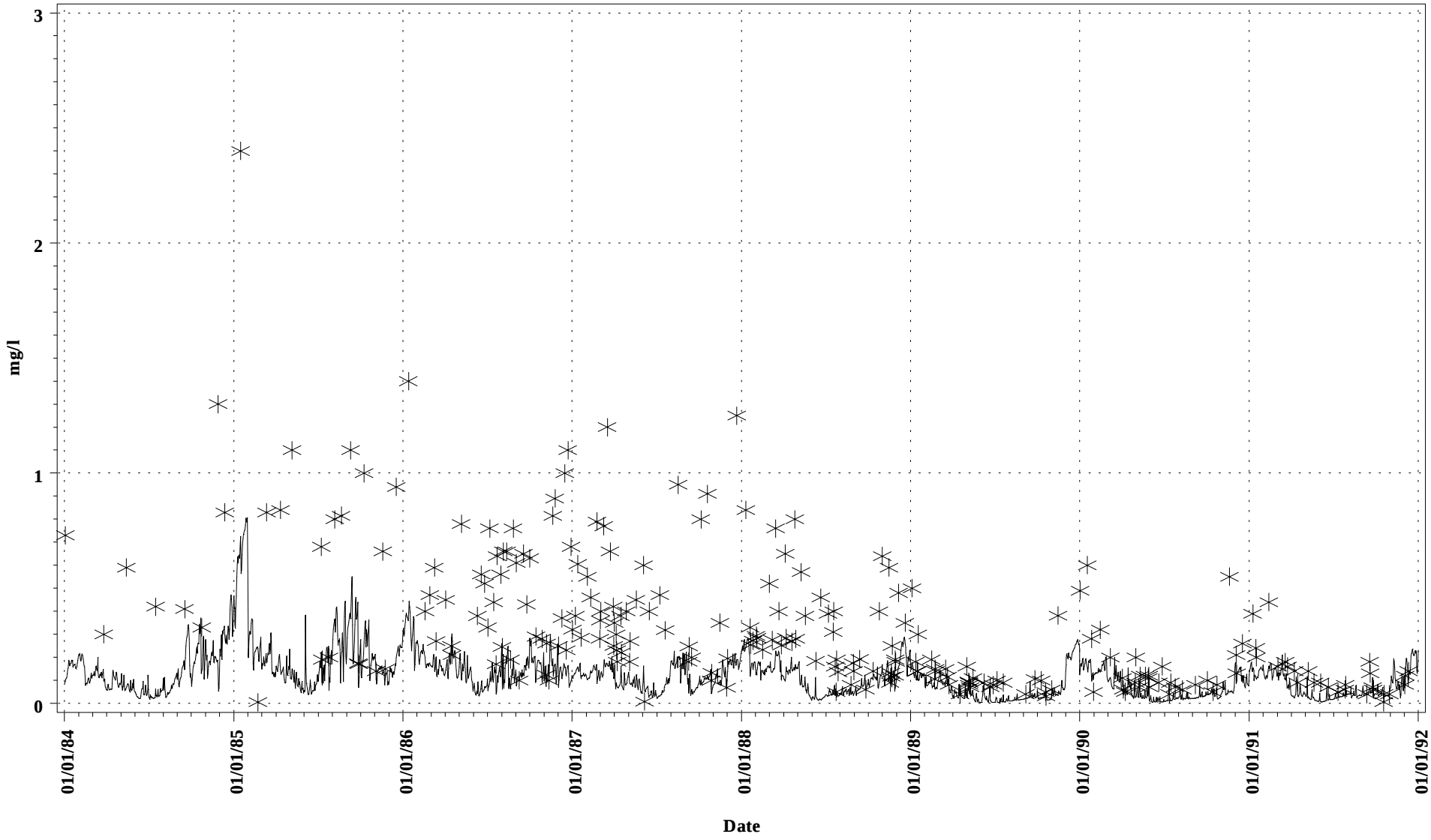
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**

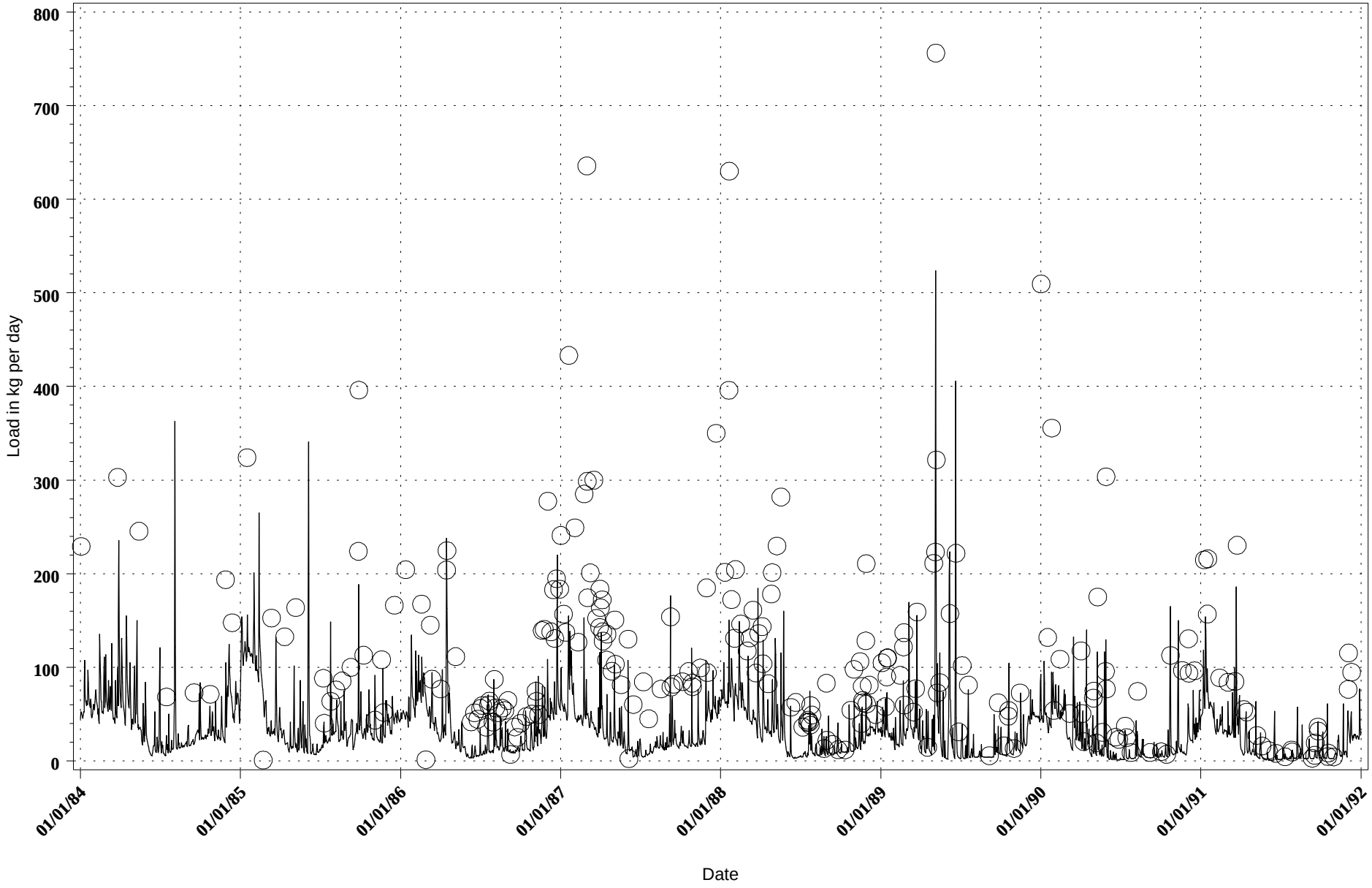



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340

## Total Ammonia Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

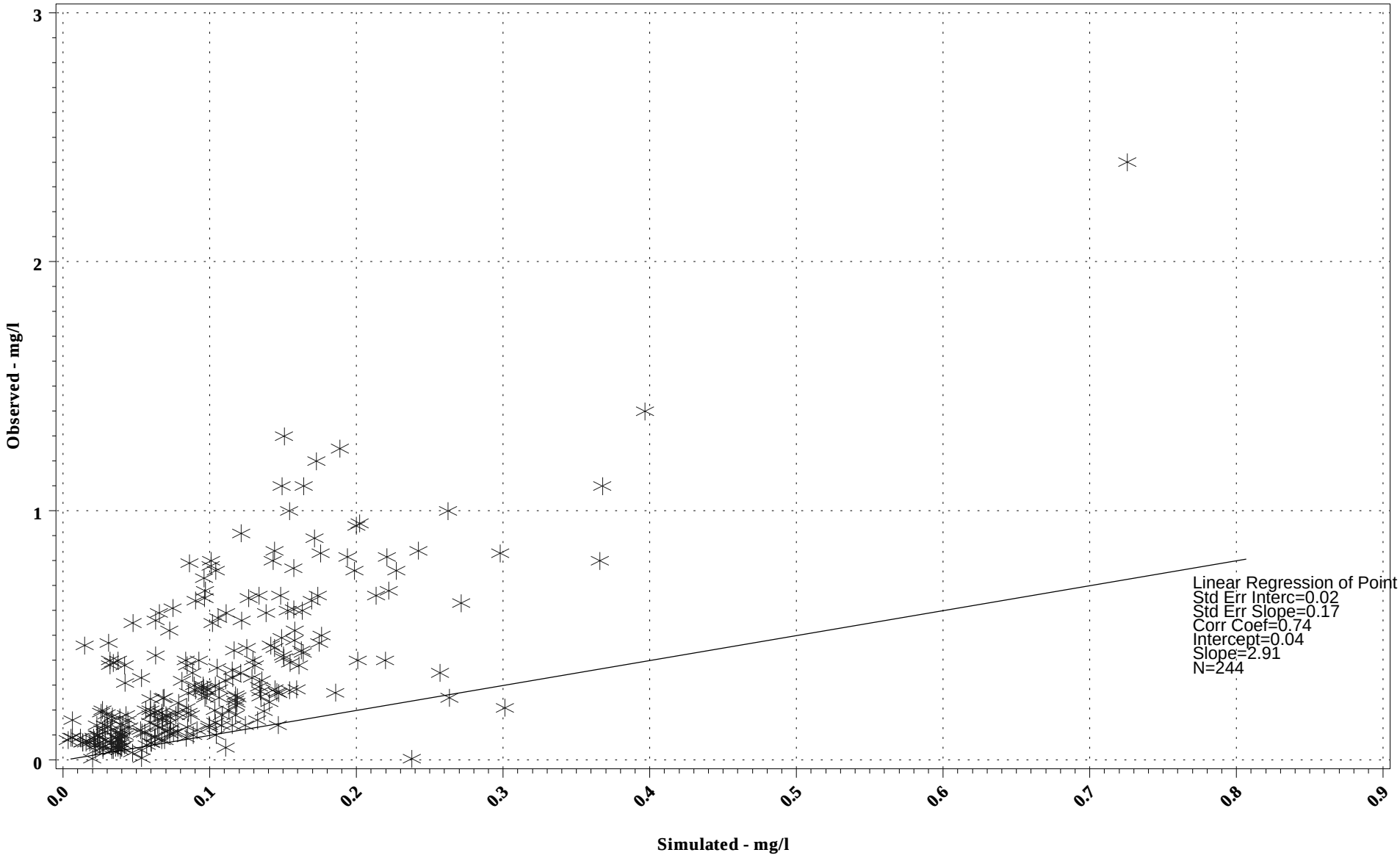



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340

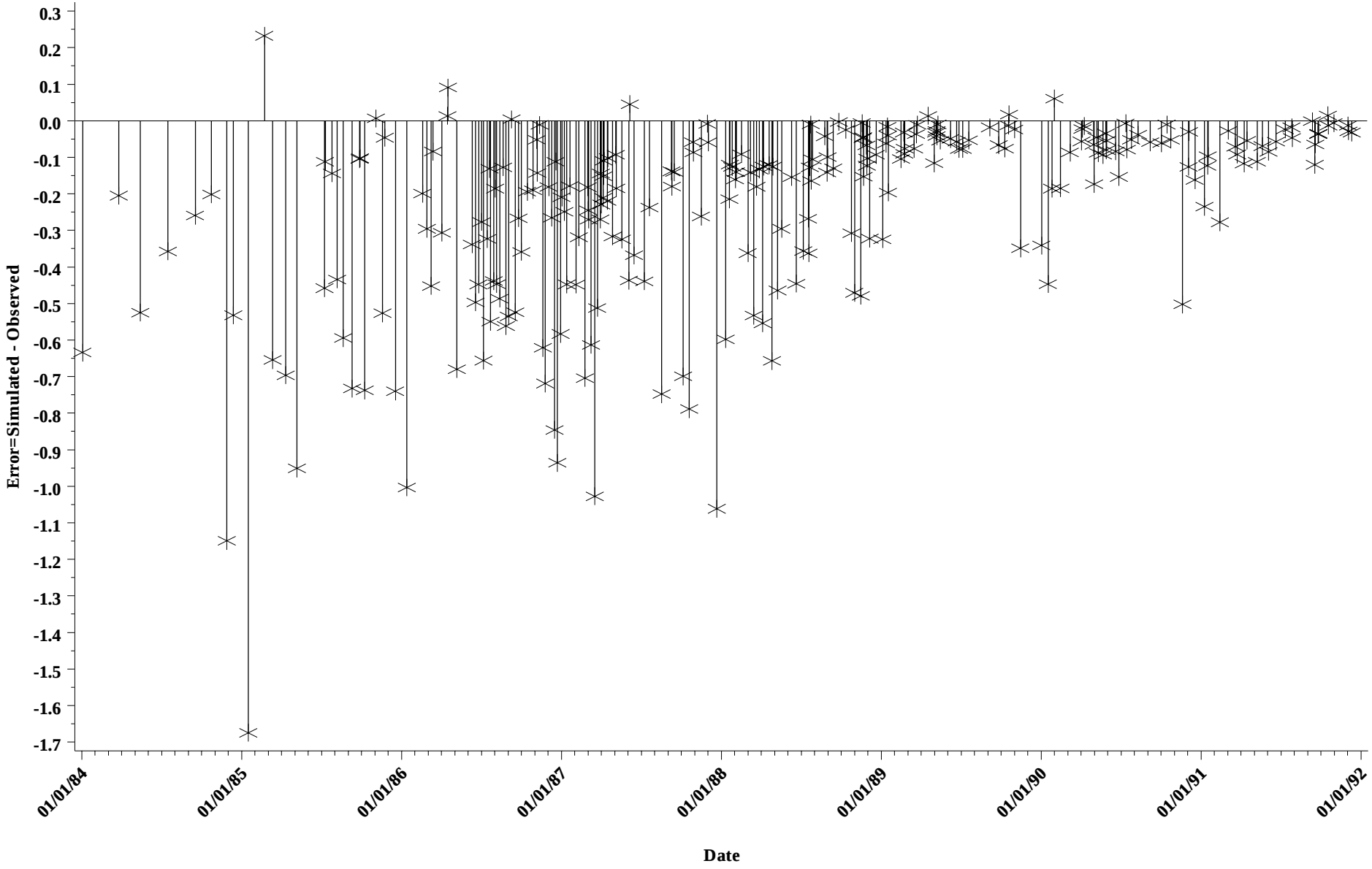
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92



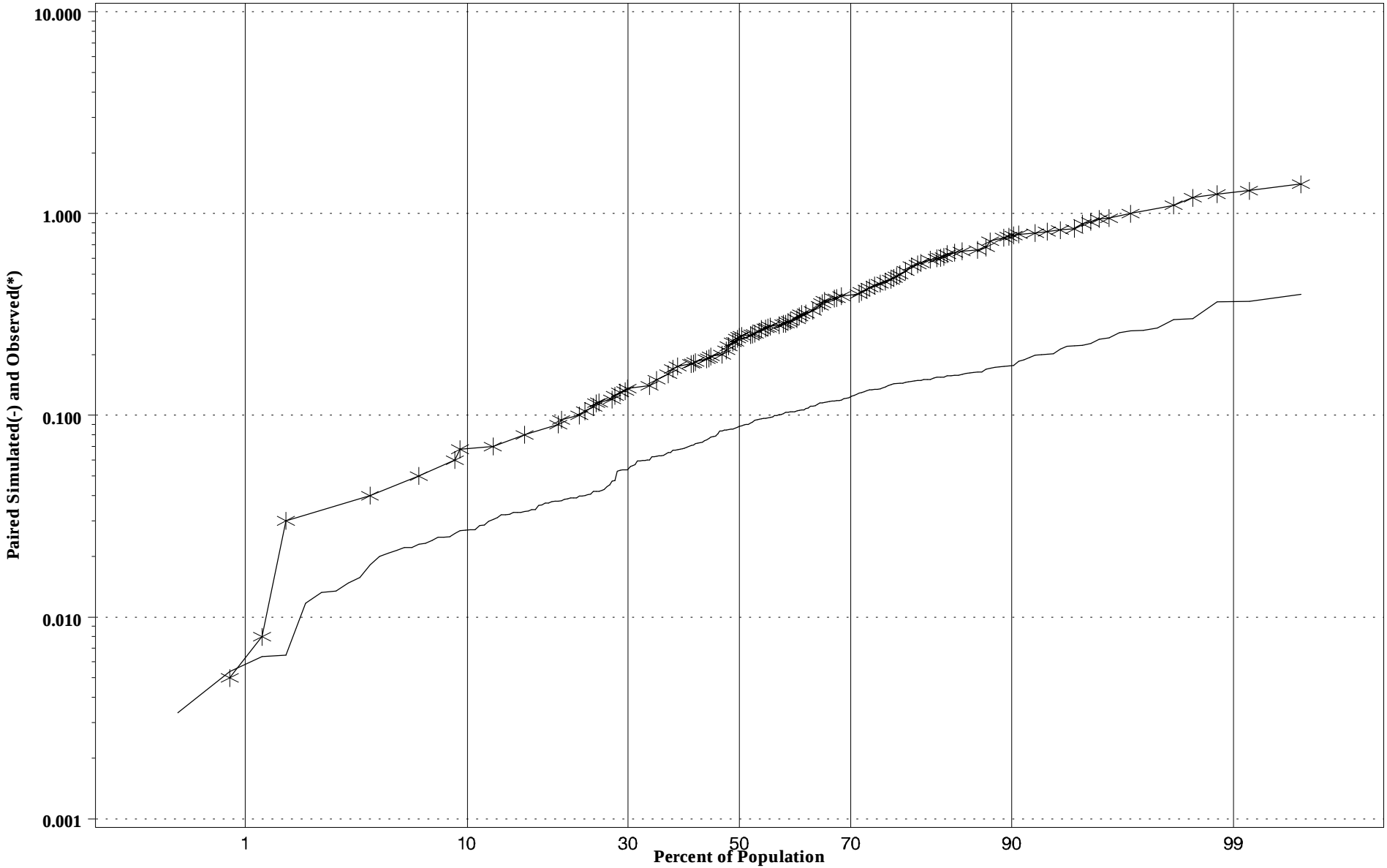

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340
## Actual Error versus Time
## Total Ammonia




(y21_plotb.sas model3d:[pwang.dt] omerr)
(patux340.drv 25JUN98 12:48)

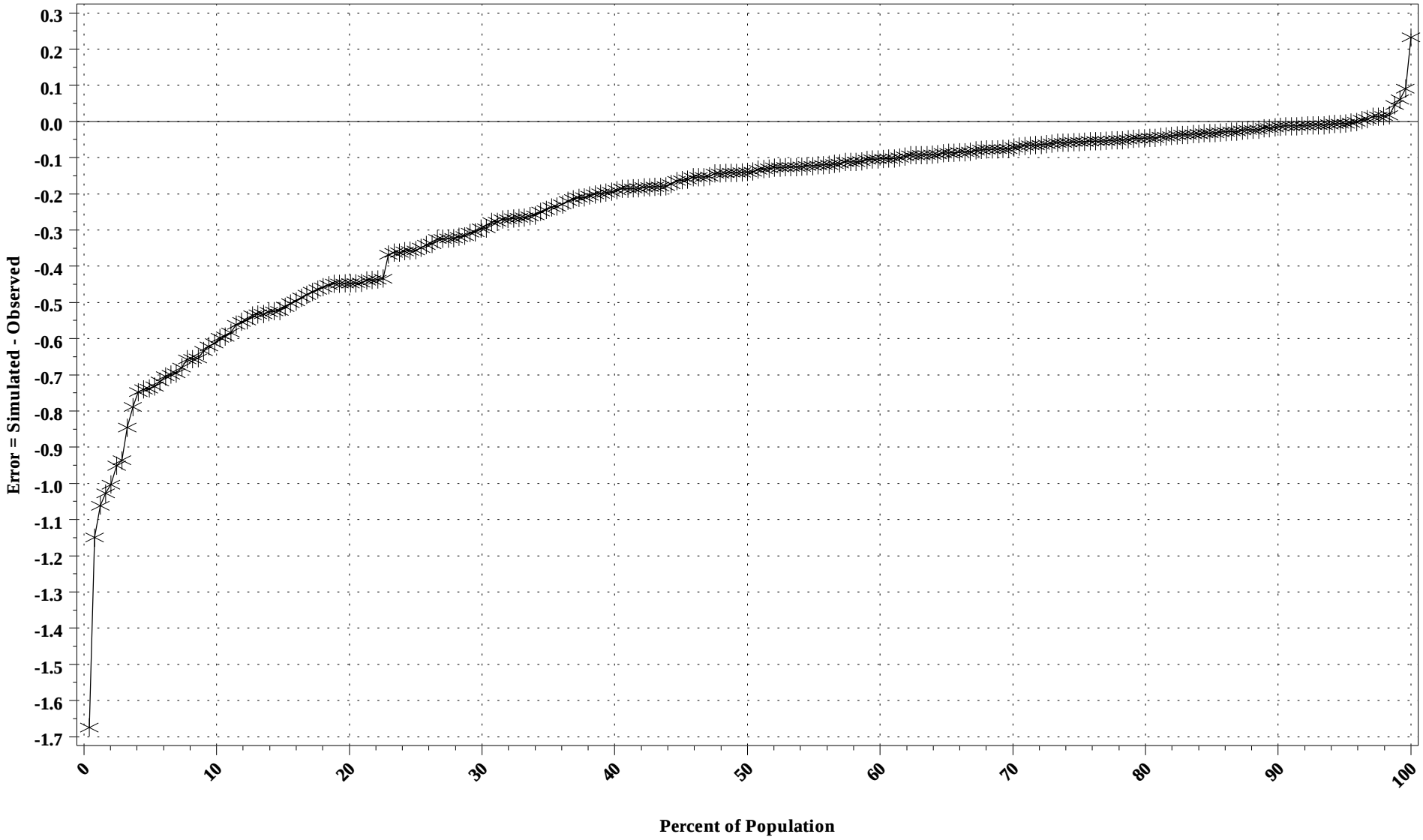
# Patuxent River at Segment 340
## Total Ammonia
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(patux340.drv 25JUN98 12:48)

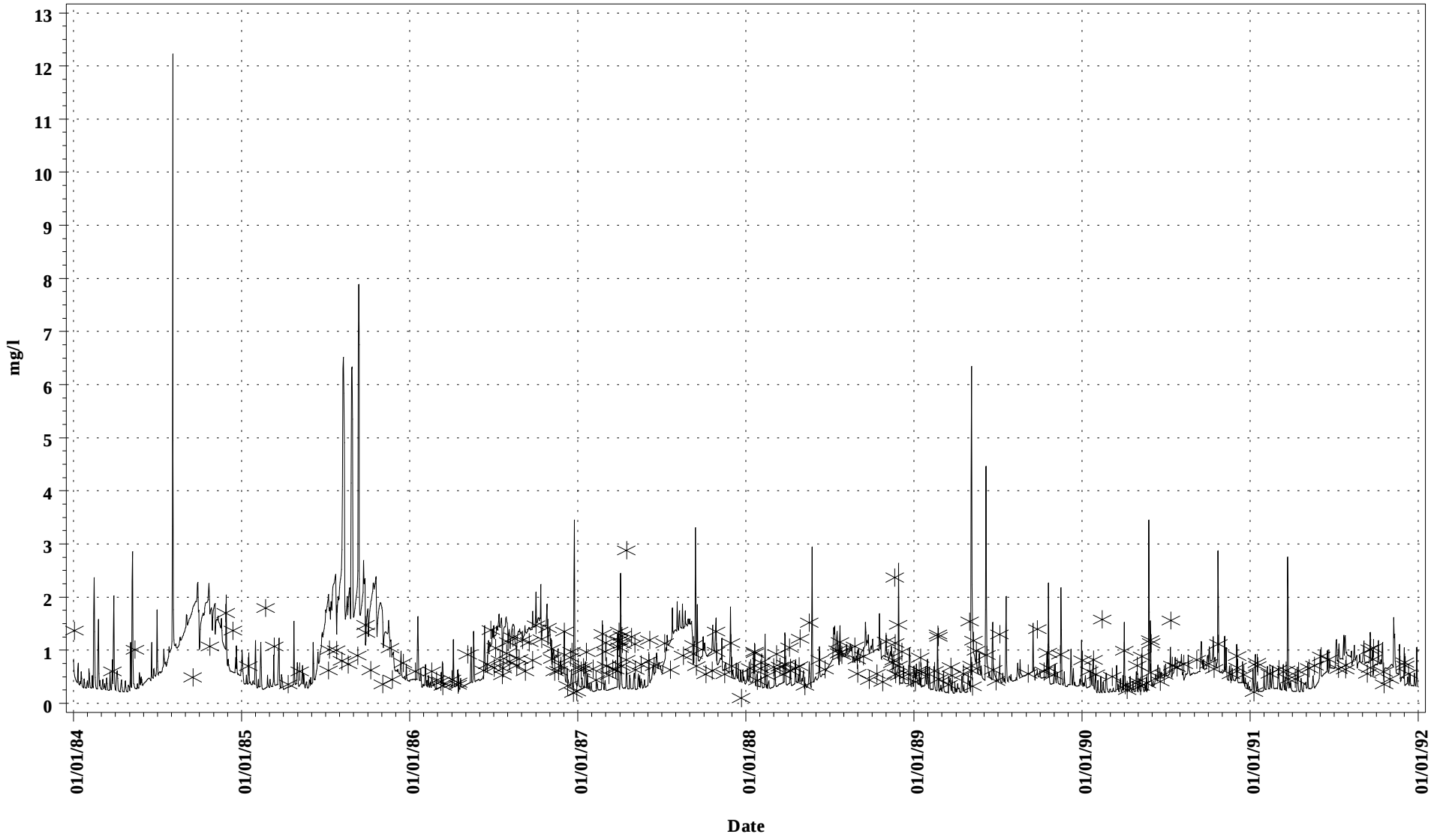
# Patuxent River at Segment 340
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**

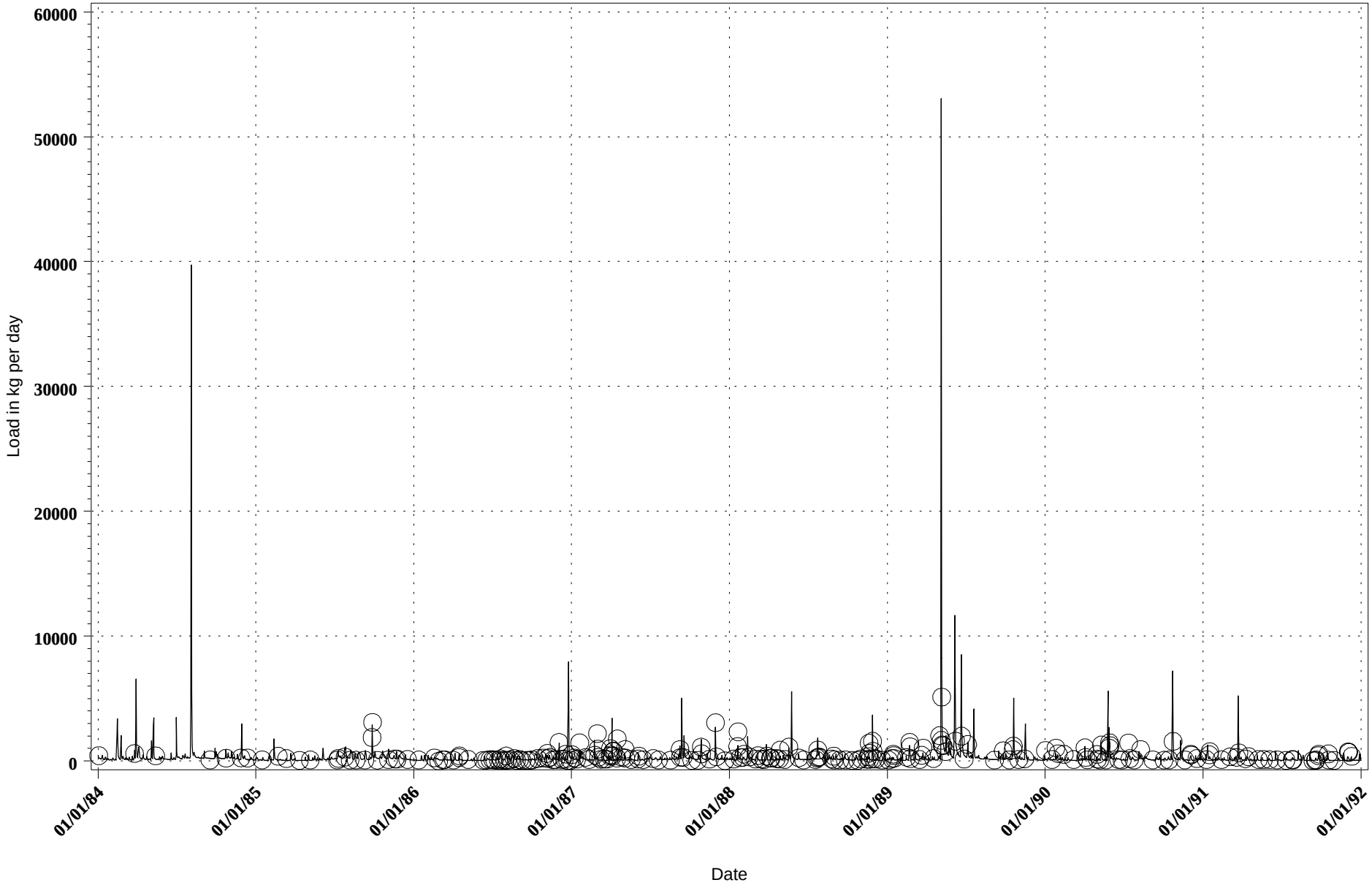



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340

## Organic Nitrogen Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

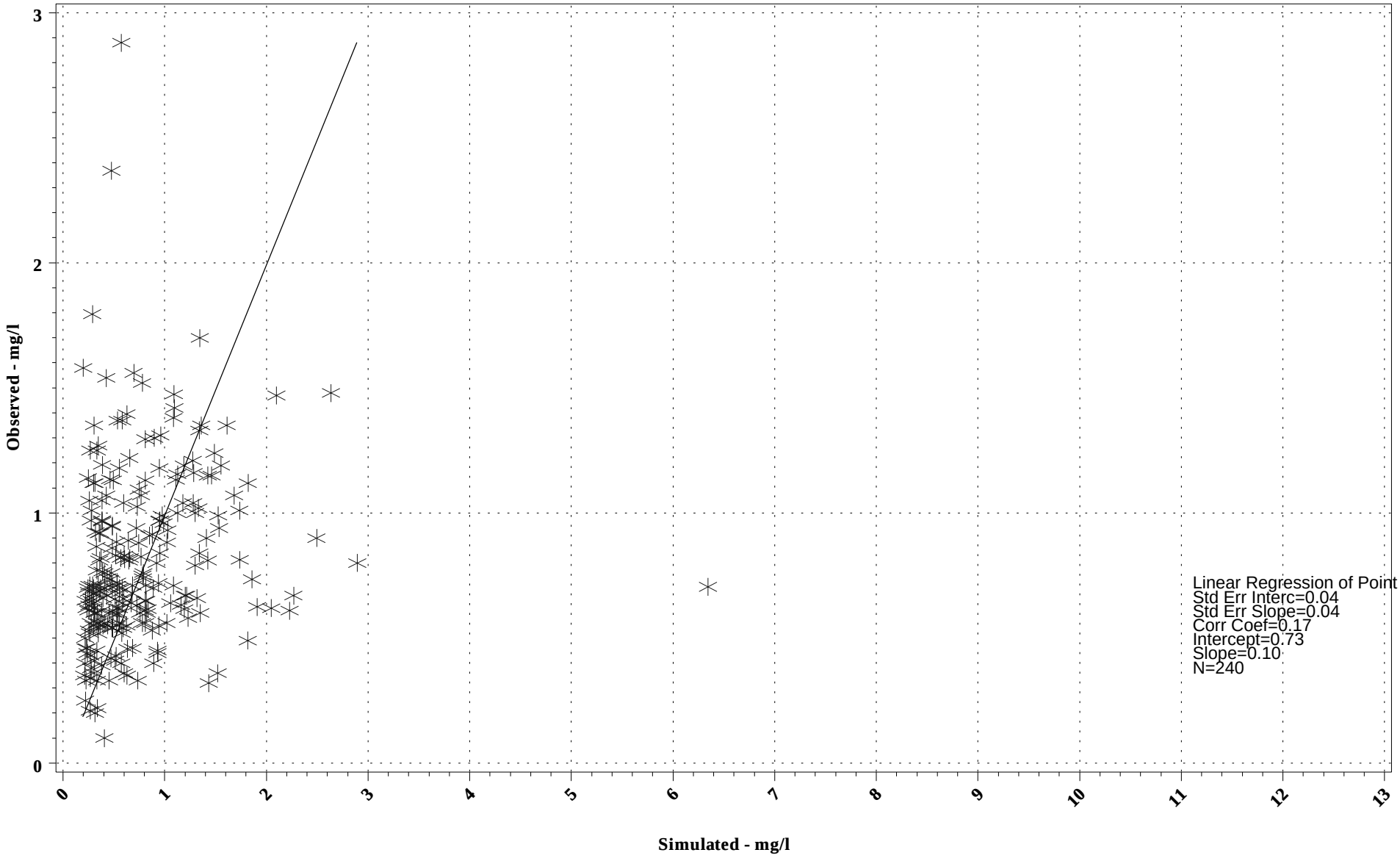



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340

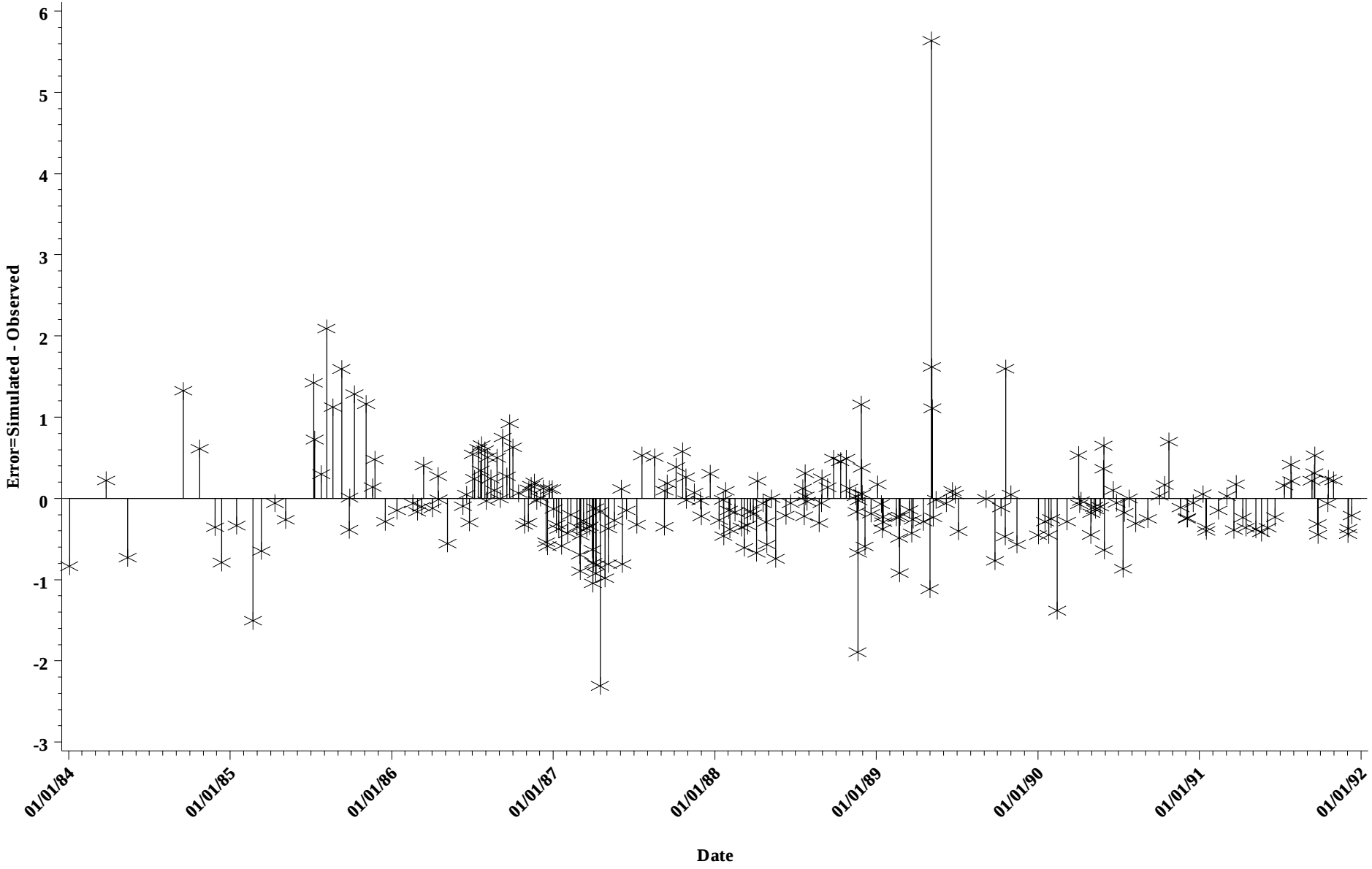
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(patux340.drv 25JUN98 12:48,proc reg,model y=x)

# Patuxent River at Segment 340
## Actual Error versus Time
## Organic Nitrogen

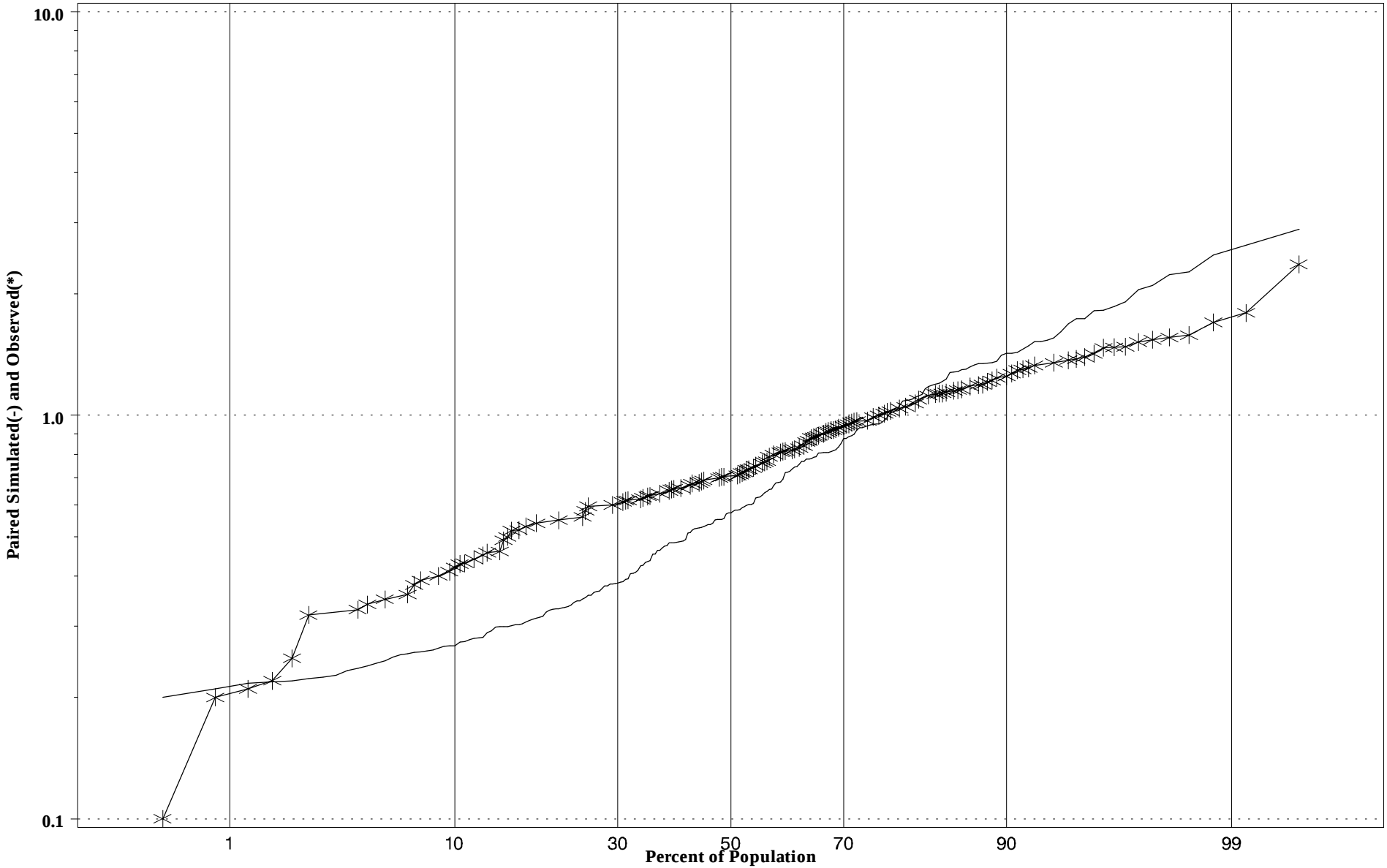



(y21_plotb.sas model3d:[pwang.dt] omerr)
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340

## Organic Nitrogen

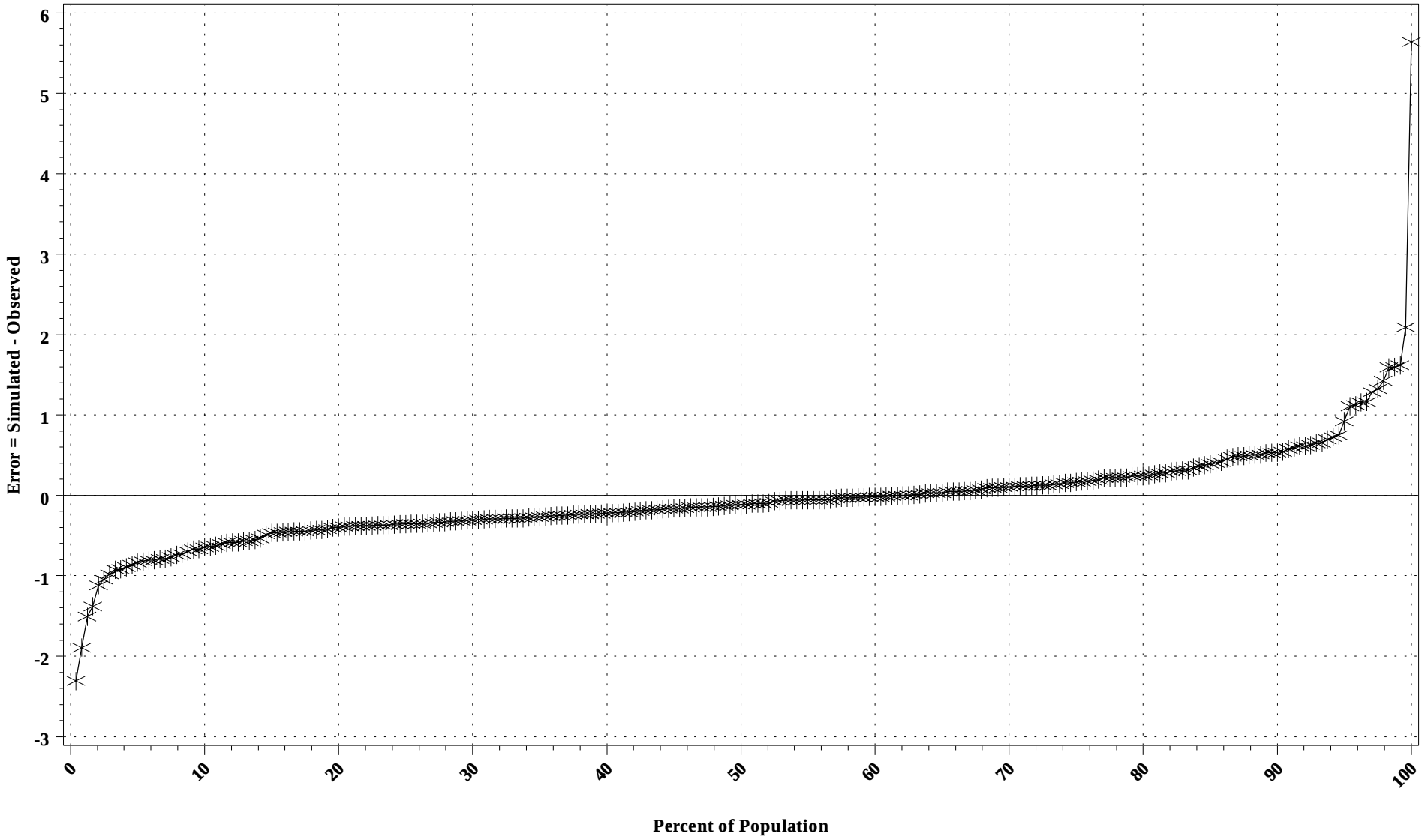
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(patux340.drv 25JUN98 12:48)

# Patuxent River at Segment 340
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(patux340.drv 25JUN98 12:48)

# B.3.0 Potomac River

***Basin Segments:***

Above Fall Line Basin Segments: 160, 170, 175, 180, 190, 200, 210, 220, 730, 740, and 750

Below Fall Line Basin Segments: 540, 550, 890, 900, 910, 920, 970, and 980

***Section Contents:***

### *B.3.1 Mid Potomac River near Shepardstown, WV at Segment 740 (Monitoring Station: 1613000) (Above Fall Line Basin Segments: 160, 170, 175, 730, and 740)*

**Section Summary:**

The mid-Potomac gage at Shepardstown, WV, is downstream of a largely forested basin which is rural in nature and is dominated by agricultural loads. The mid-Potomac basin above the gage covers an area of 5,961 square miles. At the midpoint of the simulation period, 1990, the land use for the basin was composed of 67% forest land, 7% cropland, 23% other agricultural areas, 3% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage increased from 18.8 million pounds in 1985 to 19.3 million pounds in 1996. Total phosphorus loads over the same time period decreased from 2.0 million pounds to 1.9 million pounds. In general, point source loads above the gage site decreased. In 1996, the total nitrogen point source load was 8% of the total load and the total phosphorus point source load was 21% of the total load. Estimated septic system total nitrogen loads increased 19%, from 0.5 million pounds in 1985 to 0.7 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation increased estimated cropland total nitrogen loads by 2%, and decreased other agricultural loads (primarily pasture and manure loads) by 10%. Total phosphorus increased for cropland by 9% and decreased for other agricultural loads by 6%. Urban loads were estimated to have increased over the 1985 to 1996 period by 12% for total nitrogen and 13% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

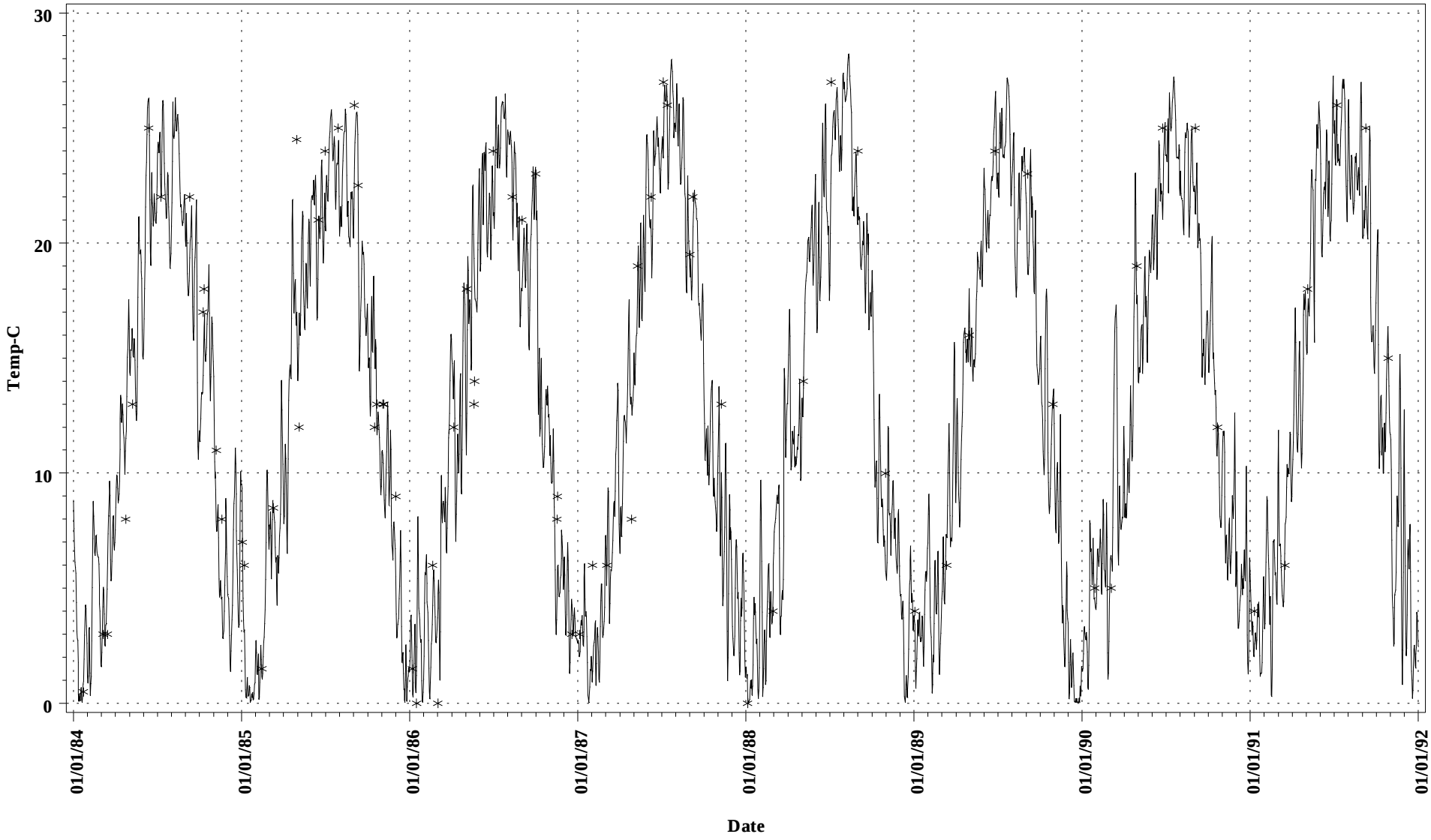
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date – Temperature

# Mid Potomac River at Segment 740
## Observed and Simulated versus Time
# Temperature-C

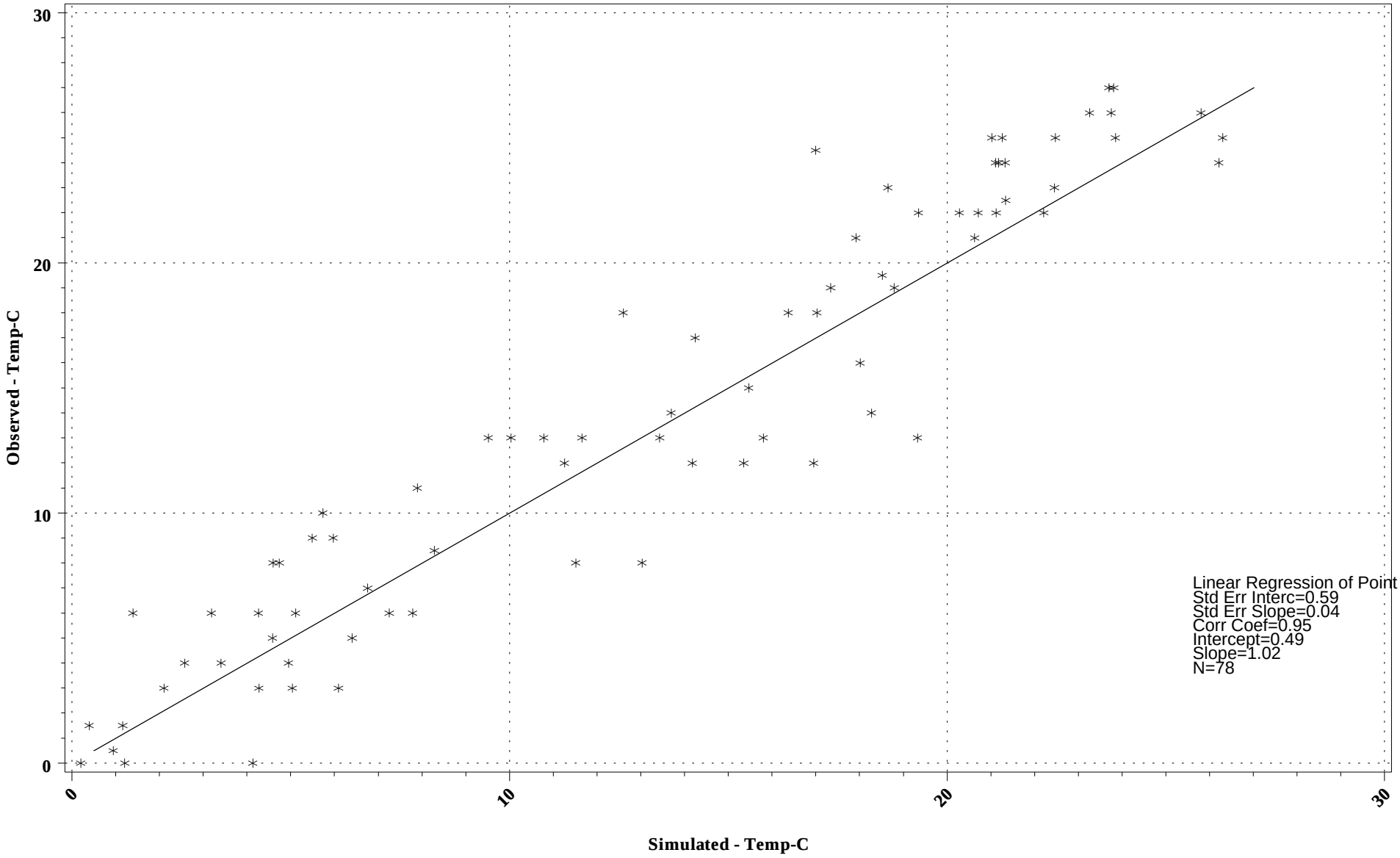
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(mid.drv 25JUN98 12:50)

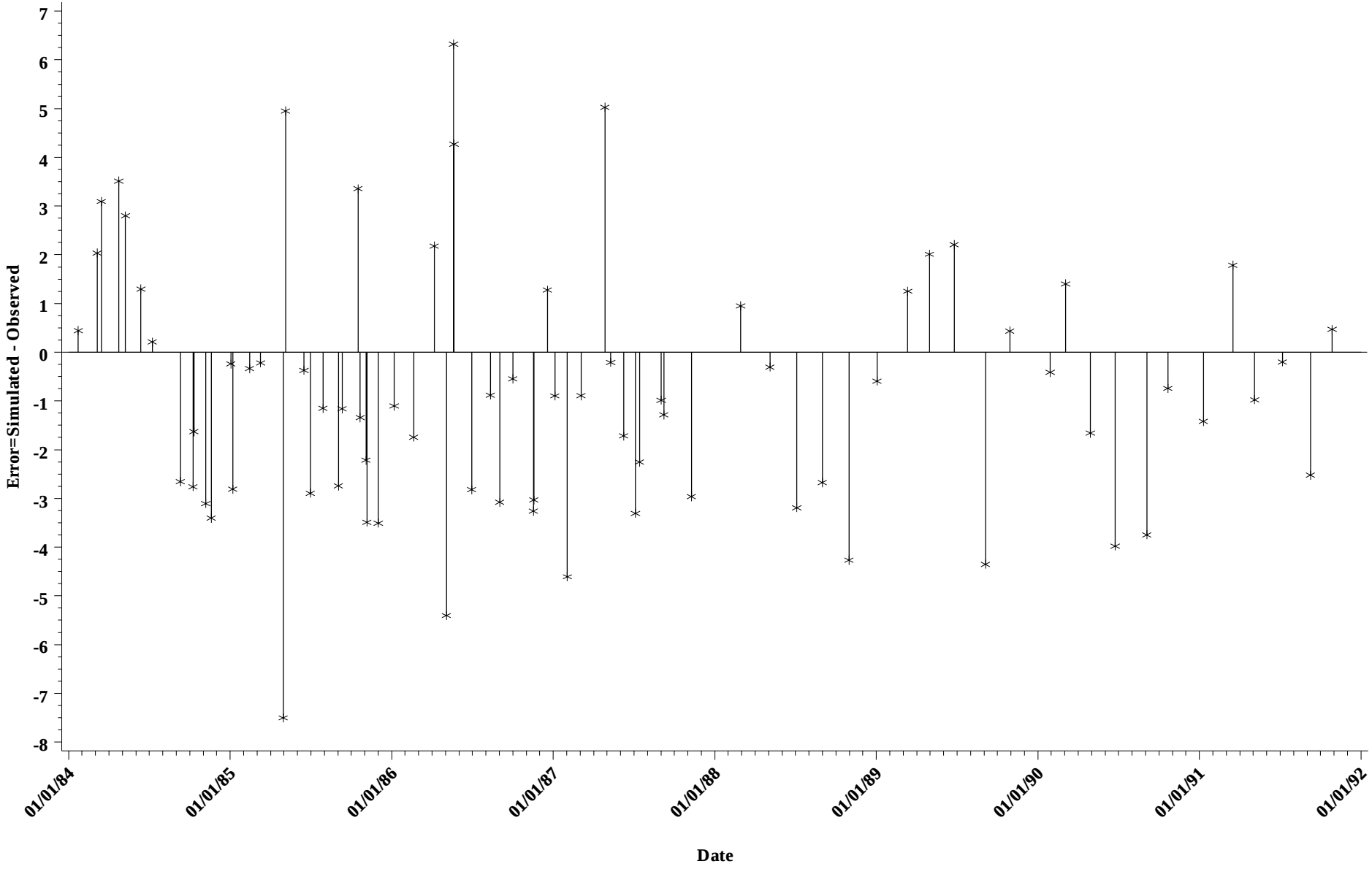
# Mid Potomac River at Segment 740

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740
## Actual Error versus Time
## Temperature-C

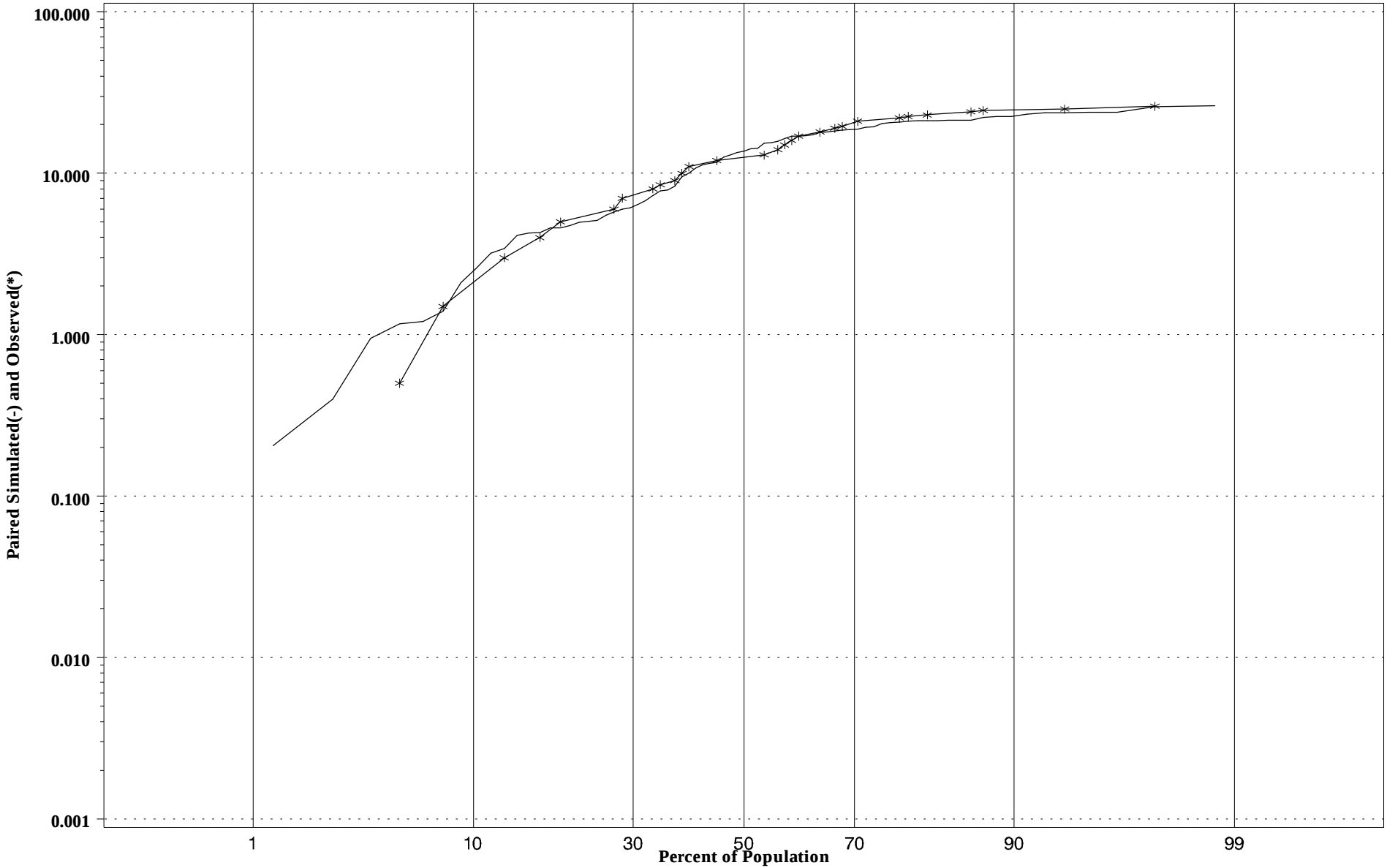



(y21_plotb.sas model3d:[pwang.dt] omerr)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740

## Temperature-C

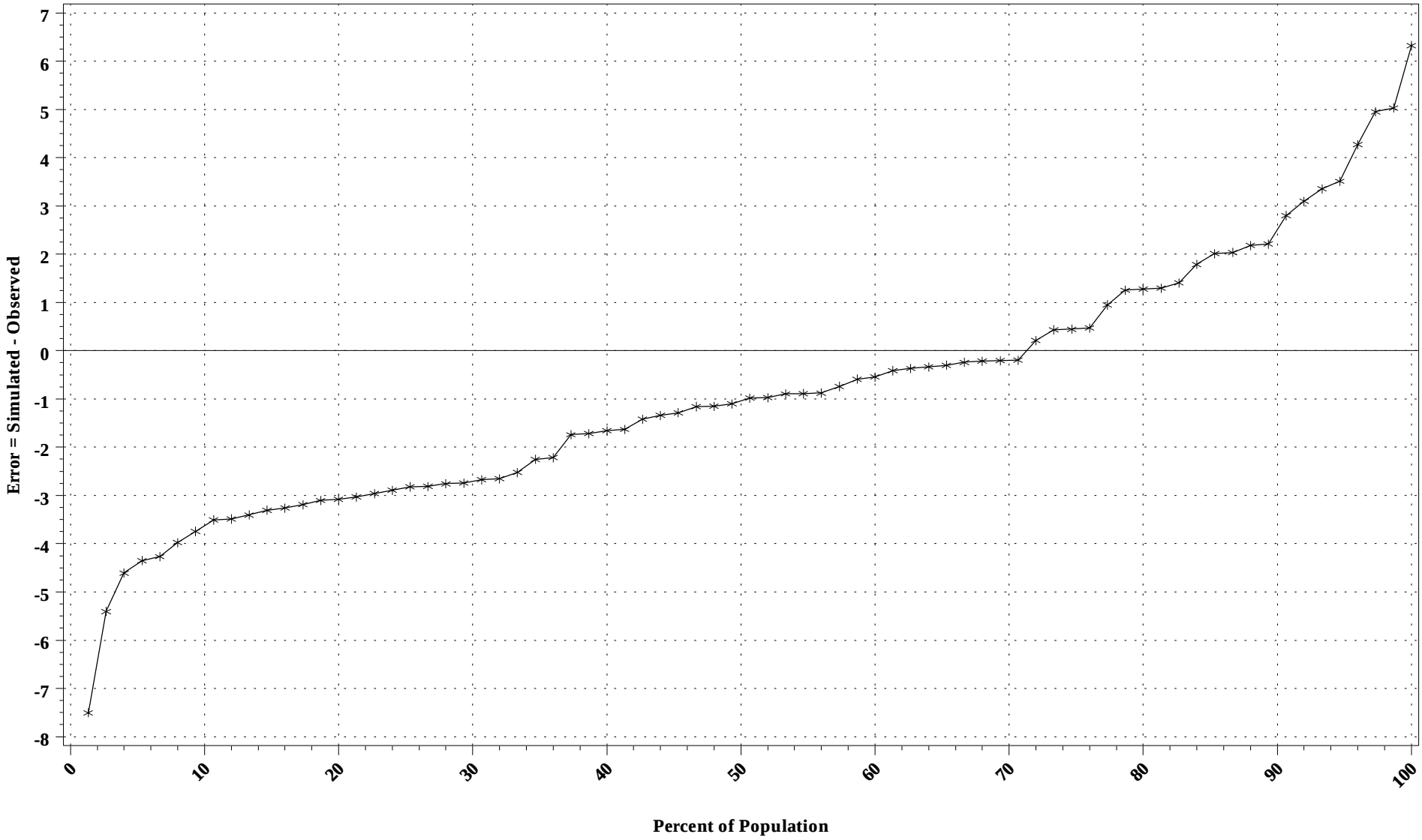
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Actual error versus Percentile Sample Population
## Temperature-C

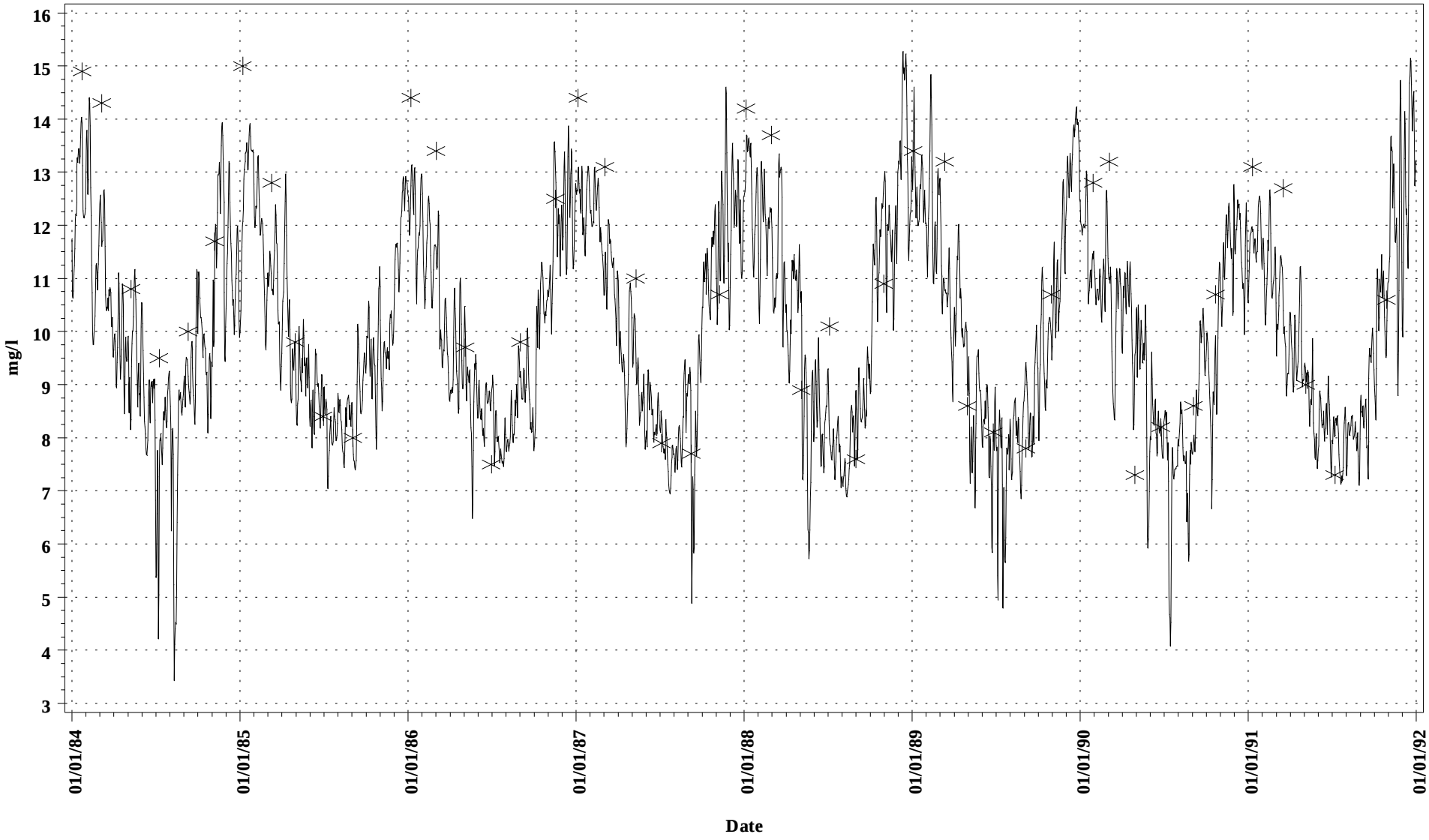
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(mid.drv 25JUN98 12:50)

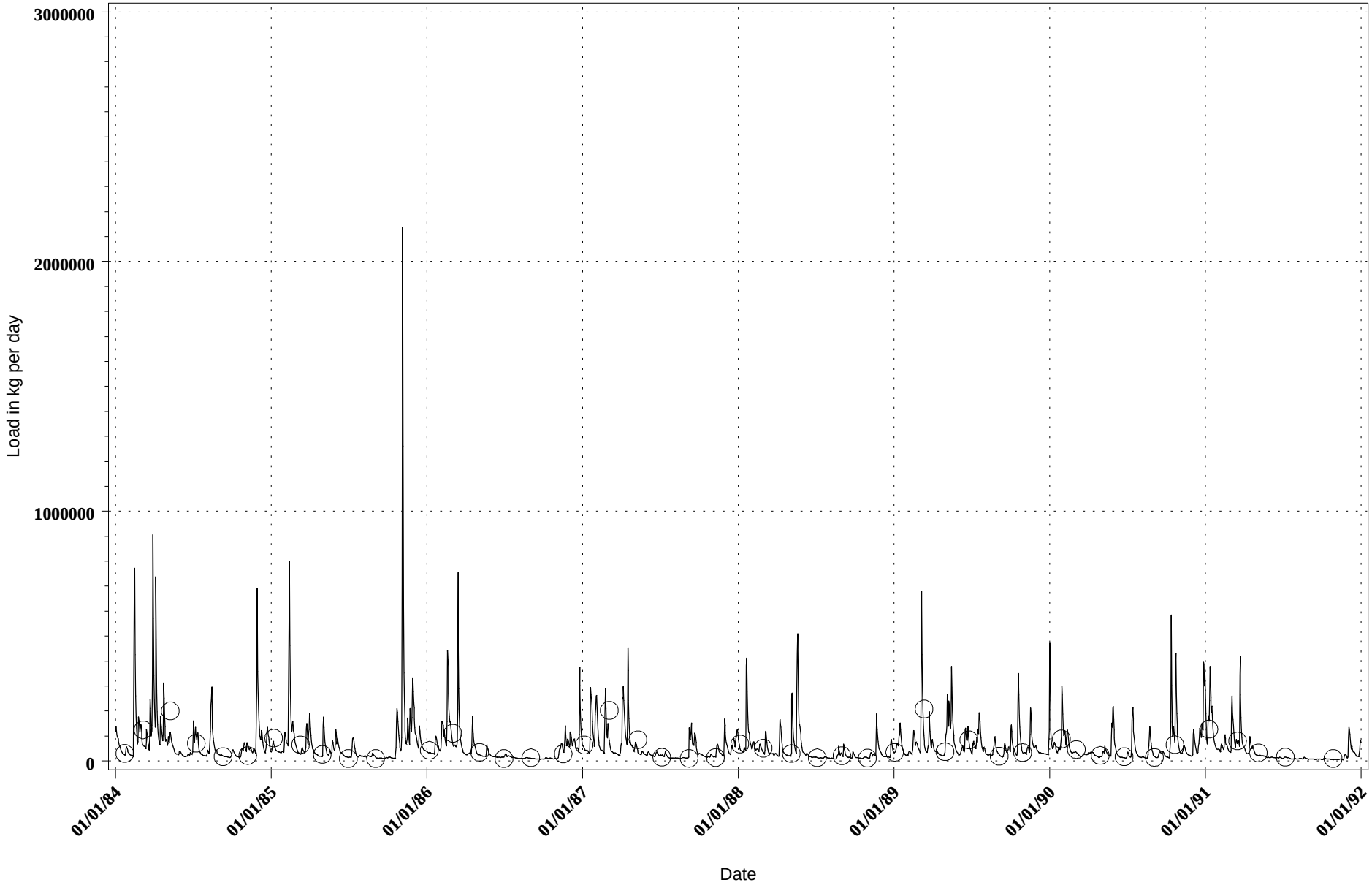
# Mid Potomac River at Segment 740
## Observed and Simulated versus Time
# Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

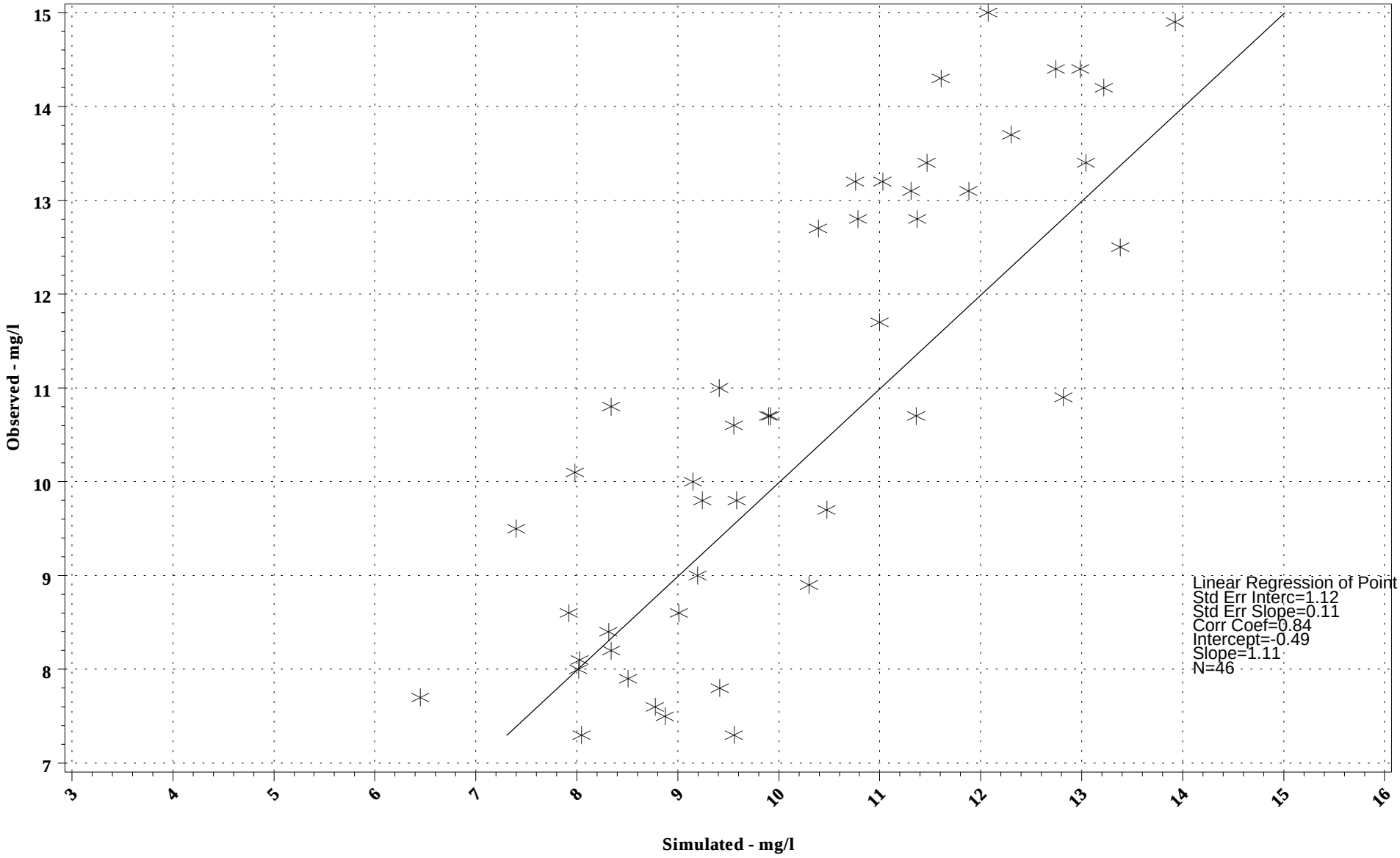



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740

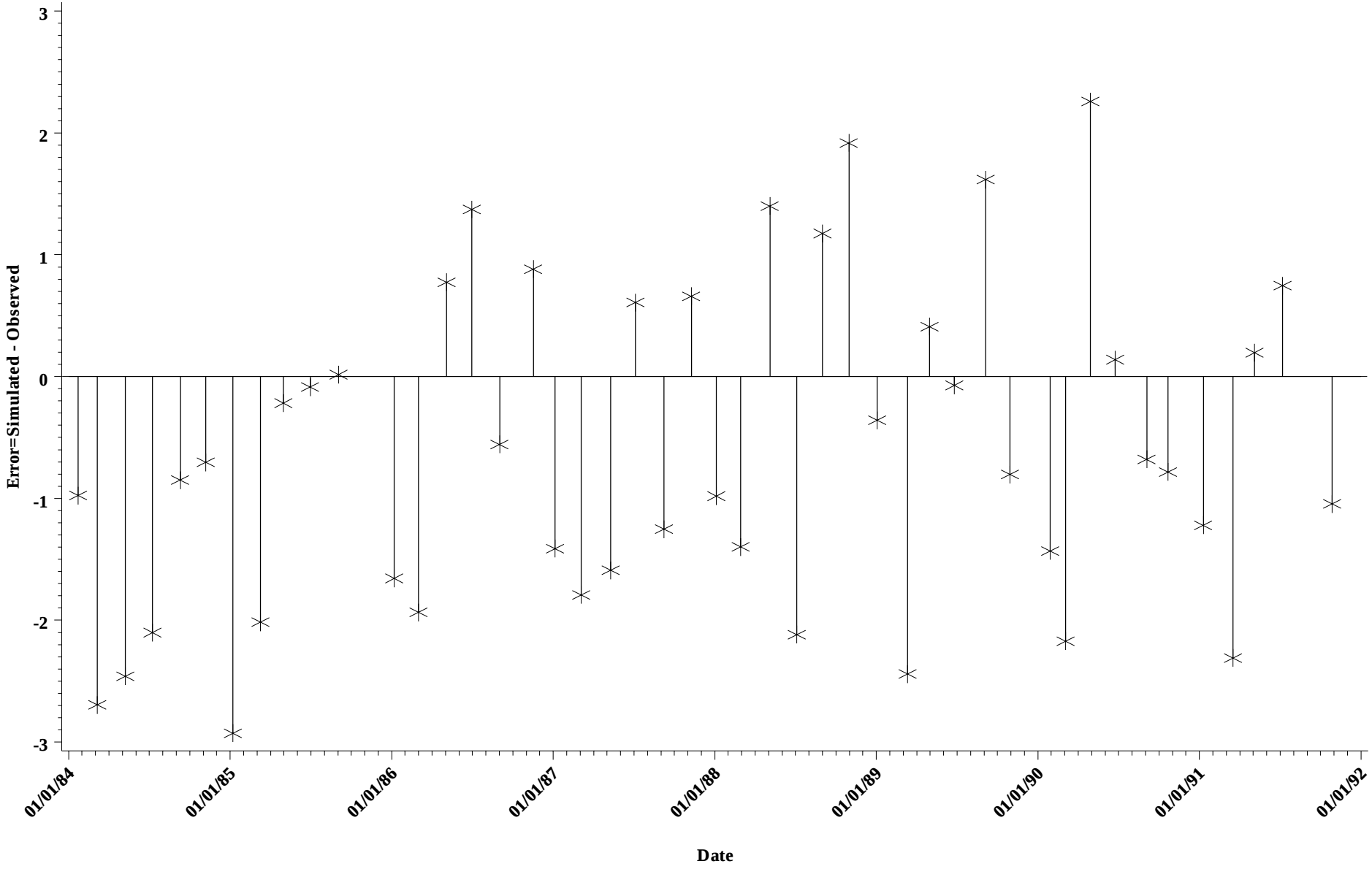
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Oxygen: 01JAN84 - 01JAN92



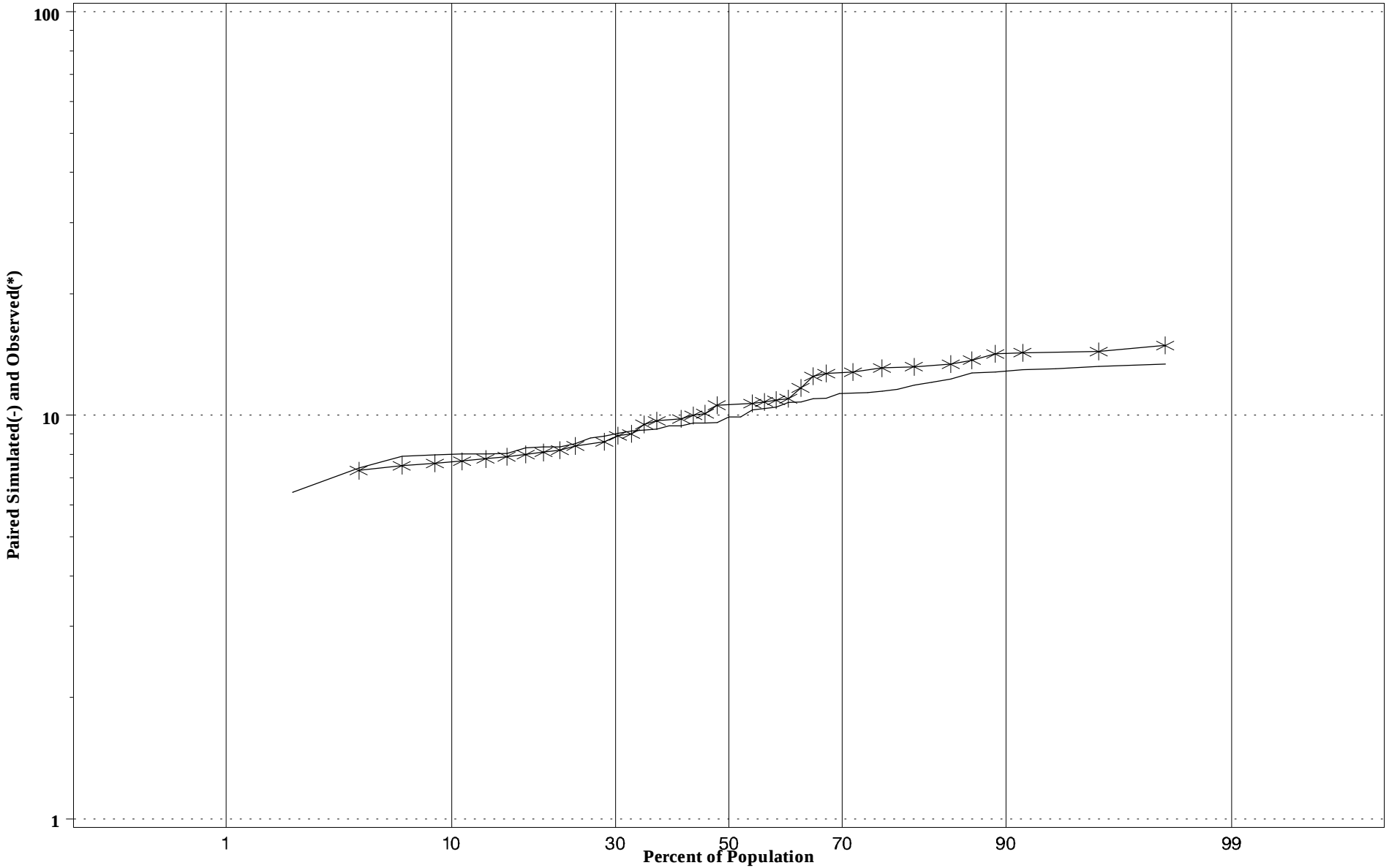

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(mid.drv 25JUN98 12:50)

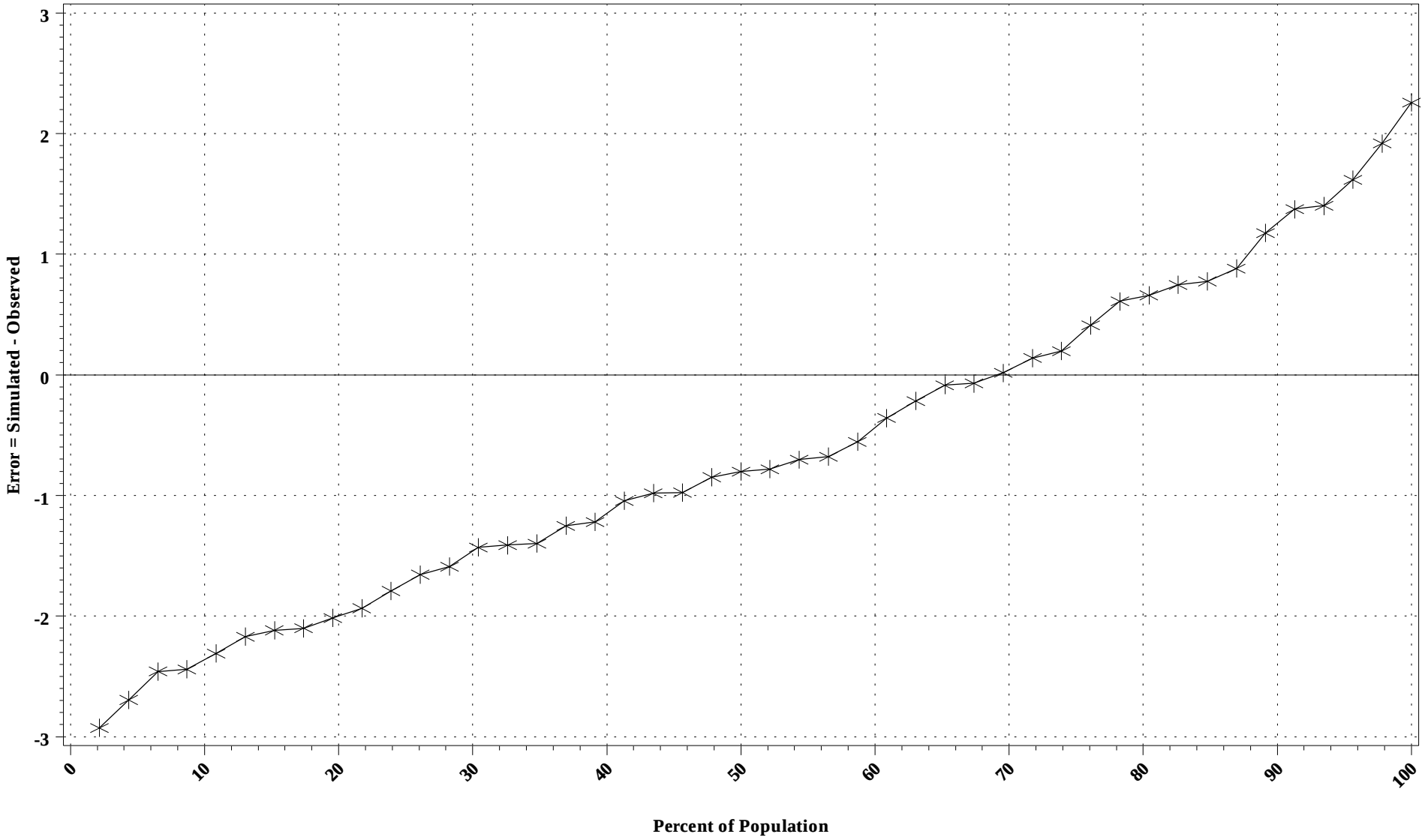
# Mid Potomac River at Segment 740
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

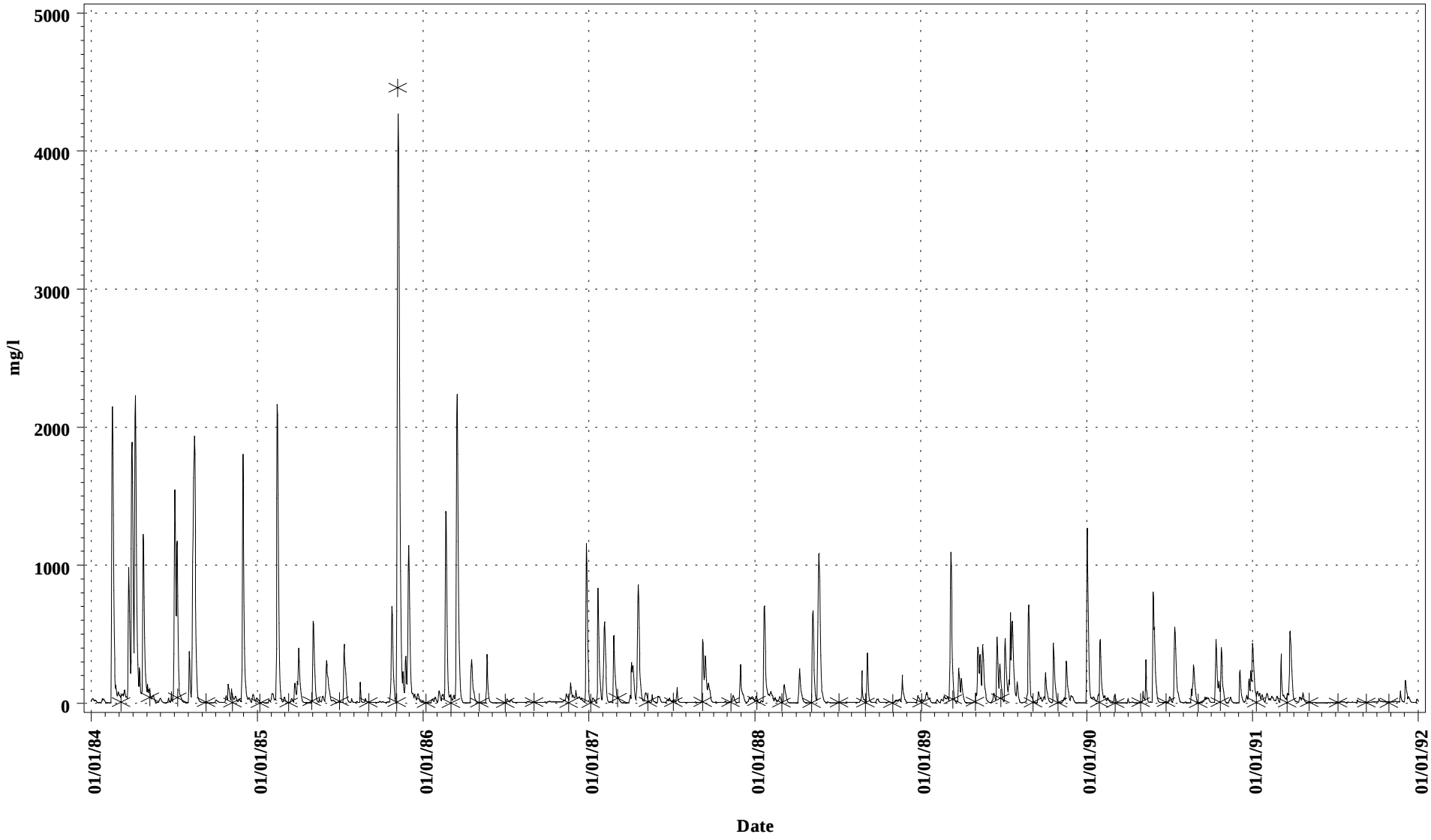
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Observed and Simulated versus Time
# Total Suspended Sediment

**(*=Observed, -=Simulated)**

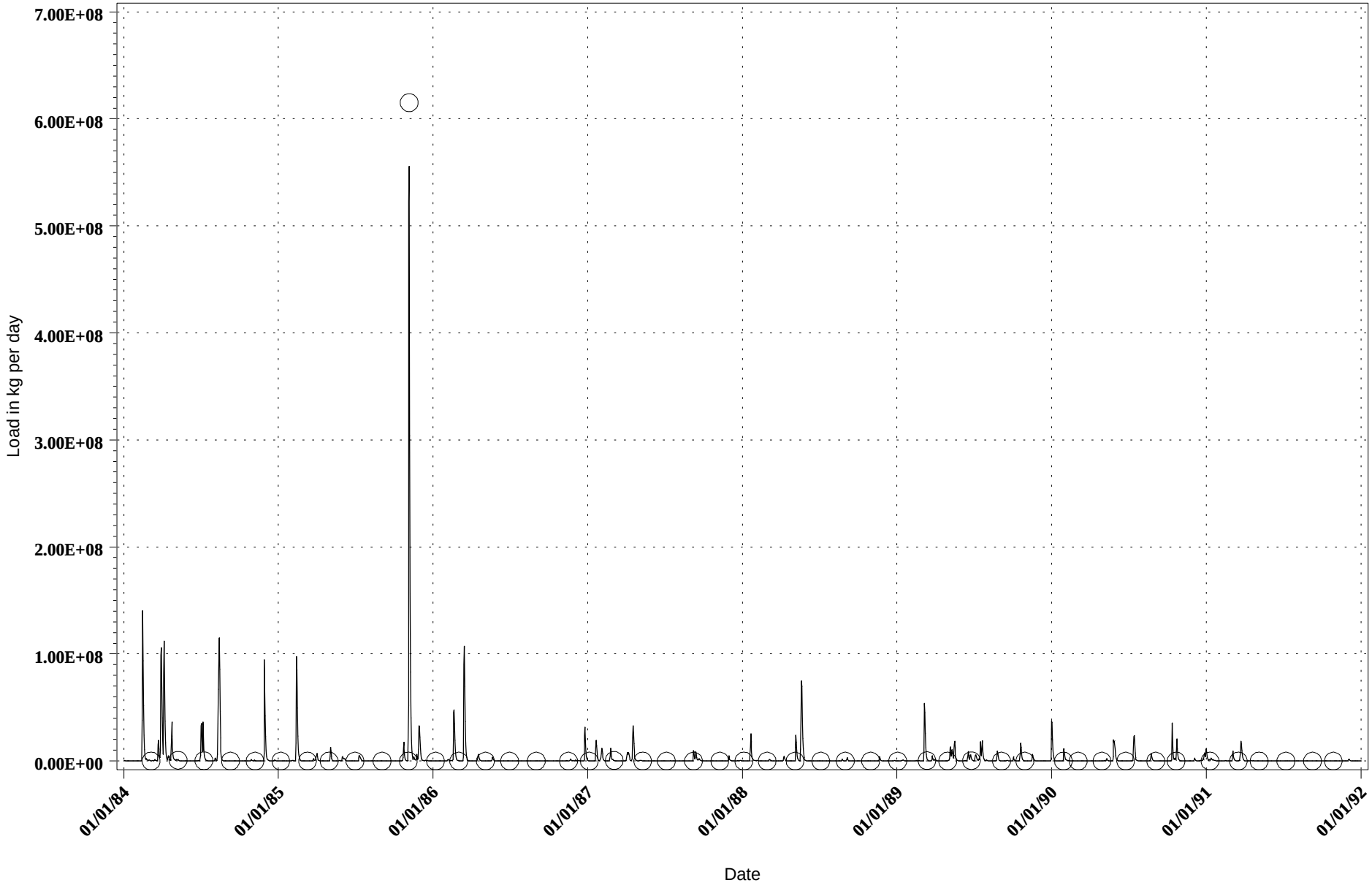



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740

## Total Suspended Sediment Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

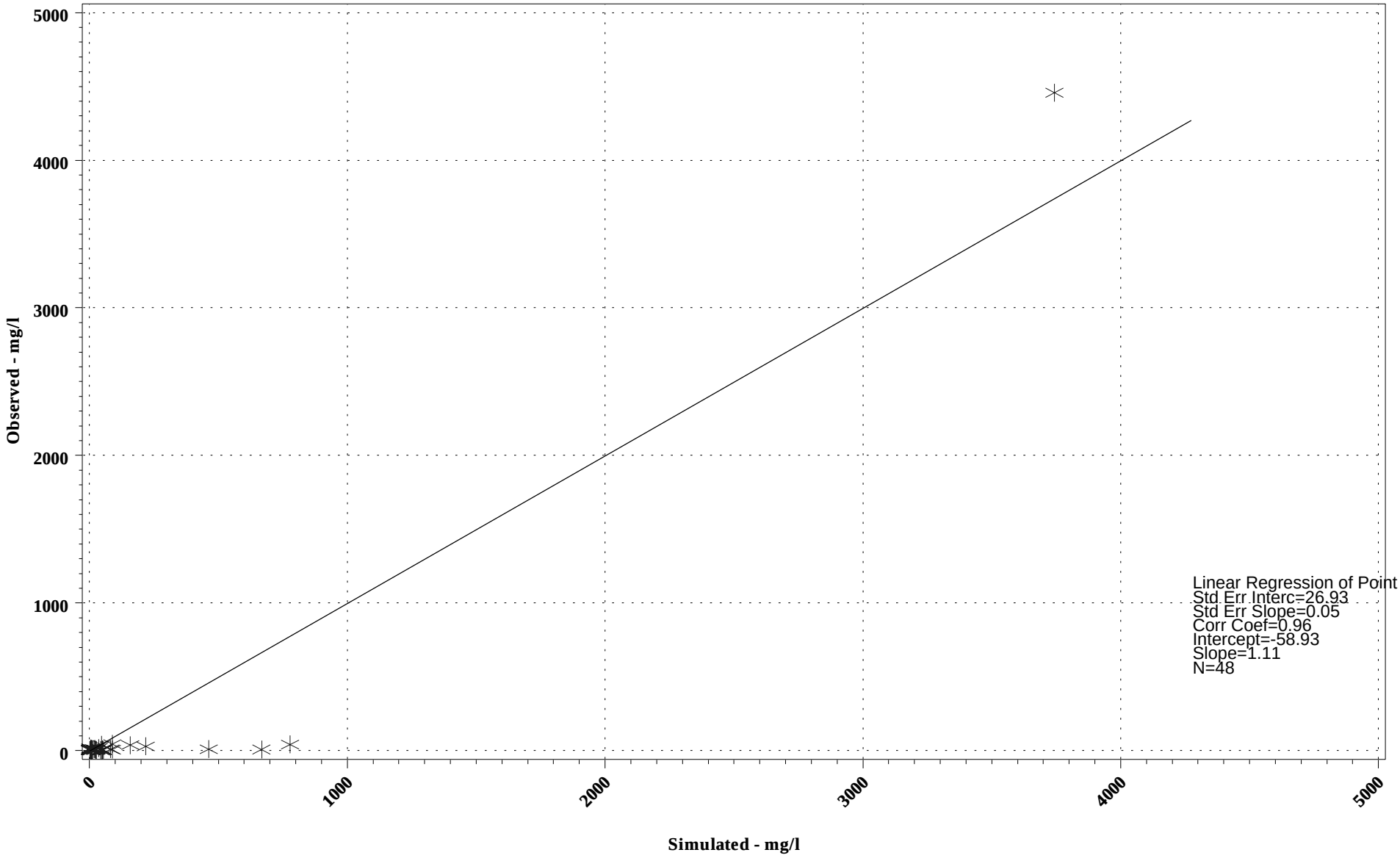



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740

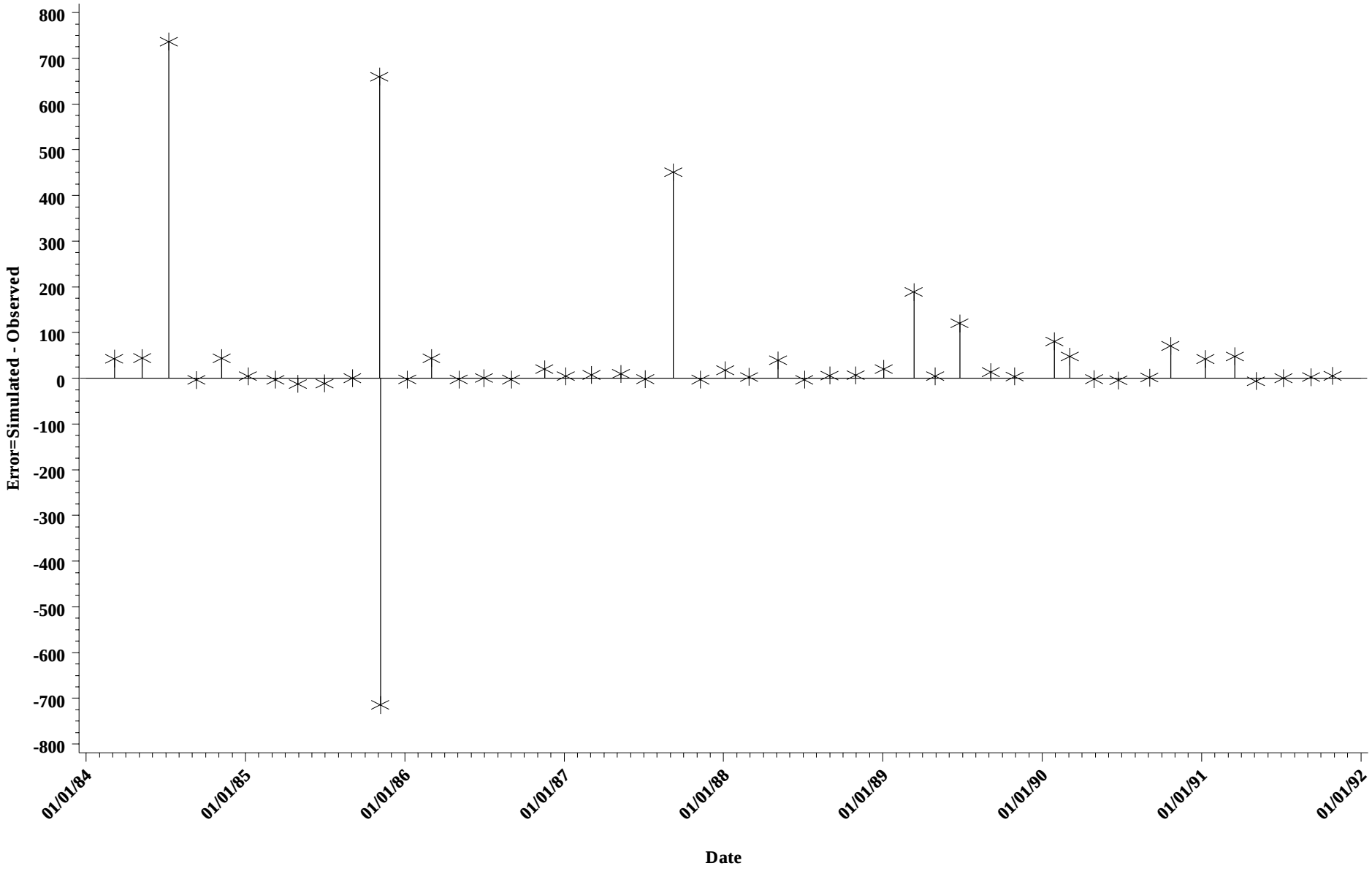
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



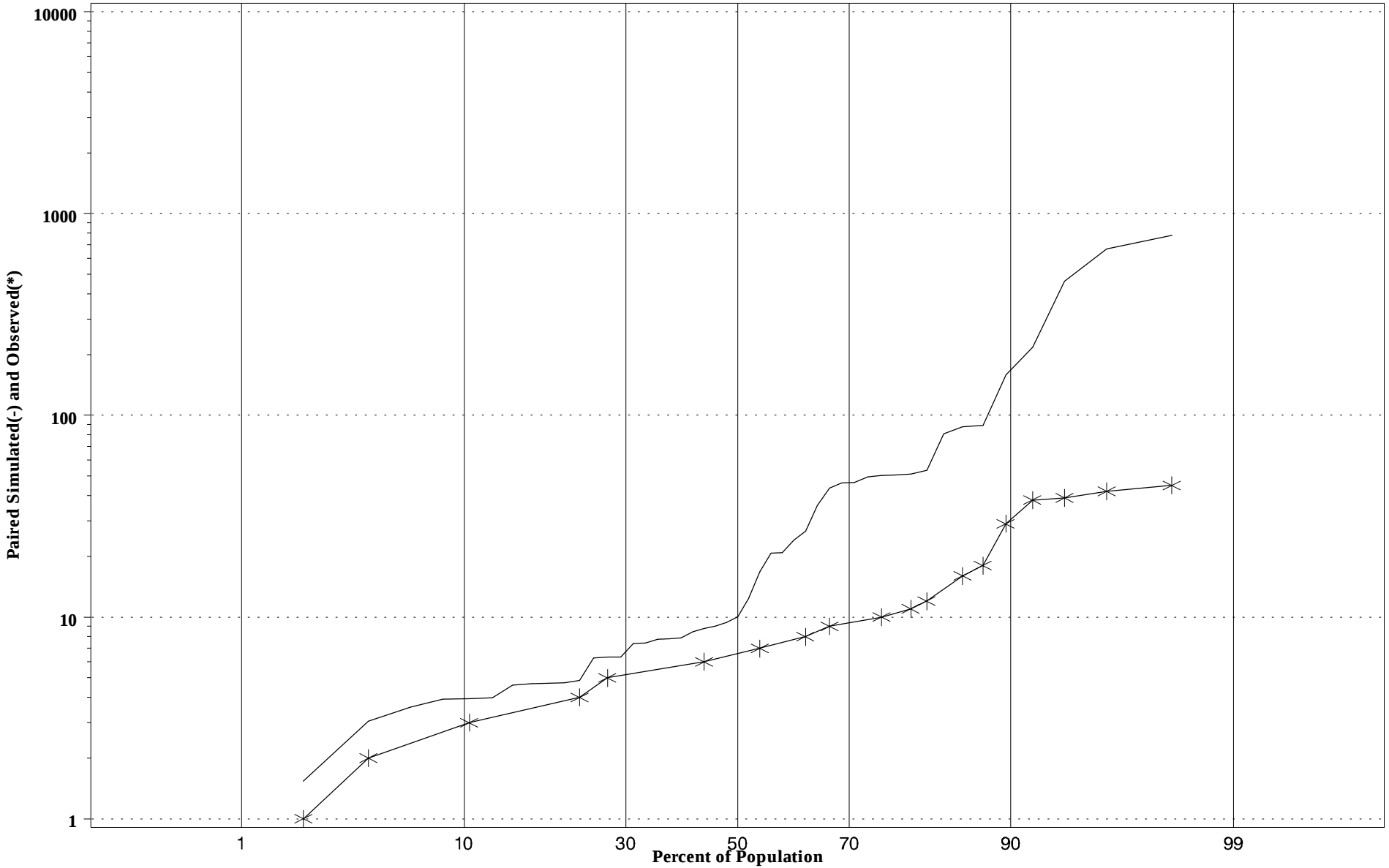

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(mid.drv 25JUN98 12:50)

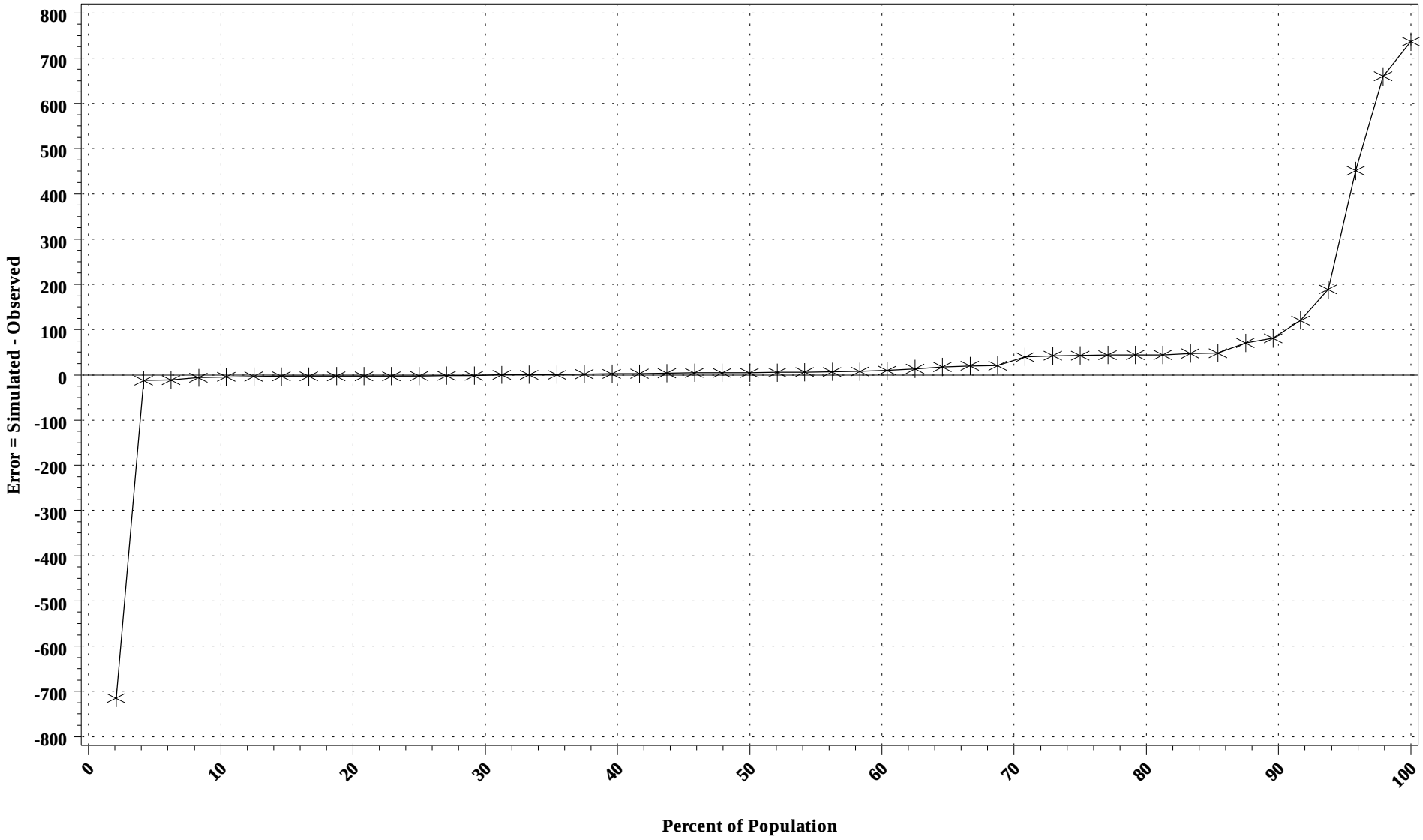
# Mid Potomac River at Segment 740
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

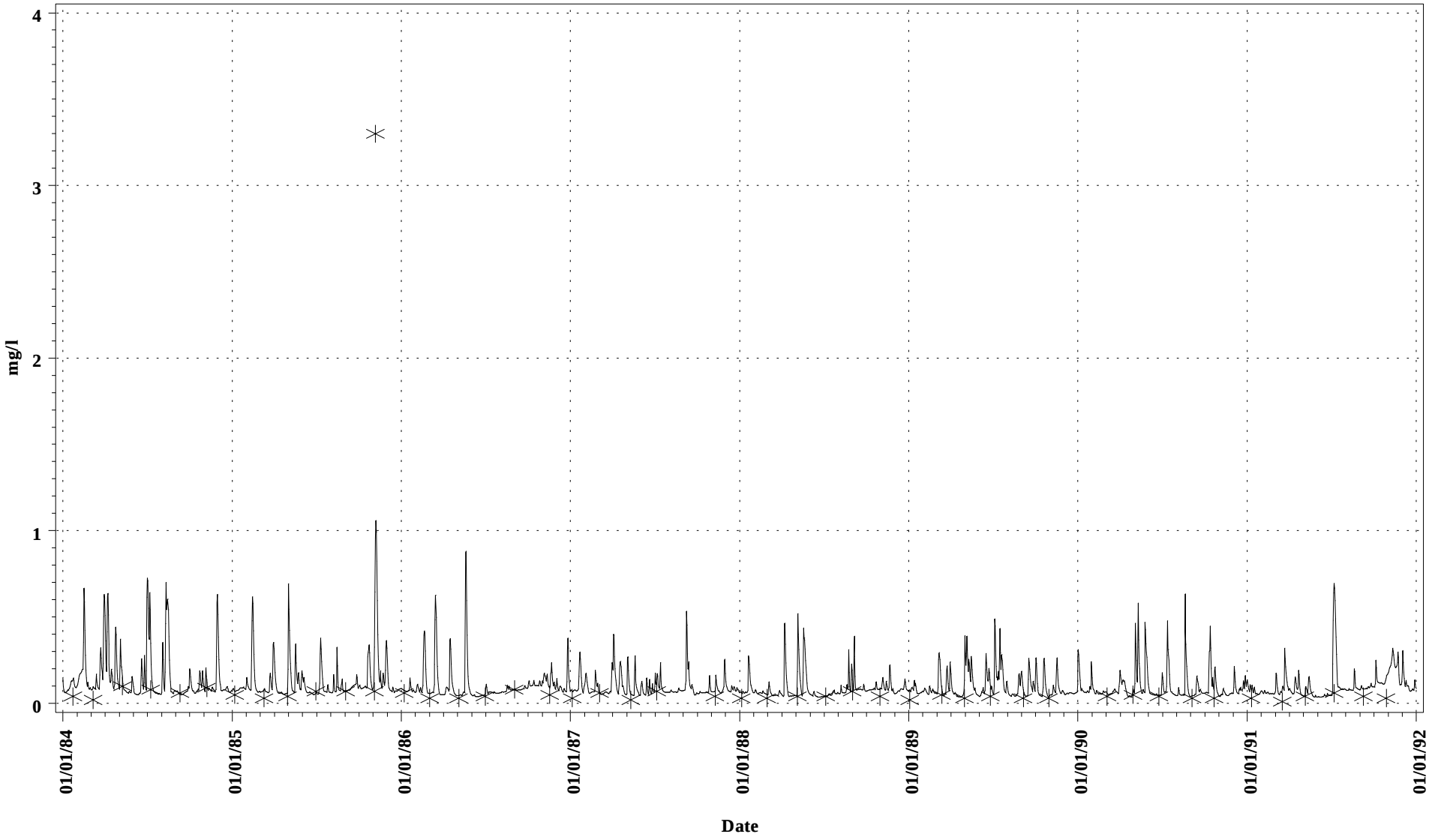
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(mid.drv 25JUN98 12:50)

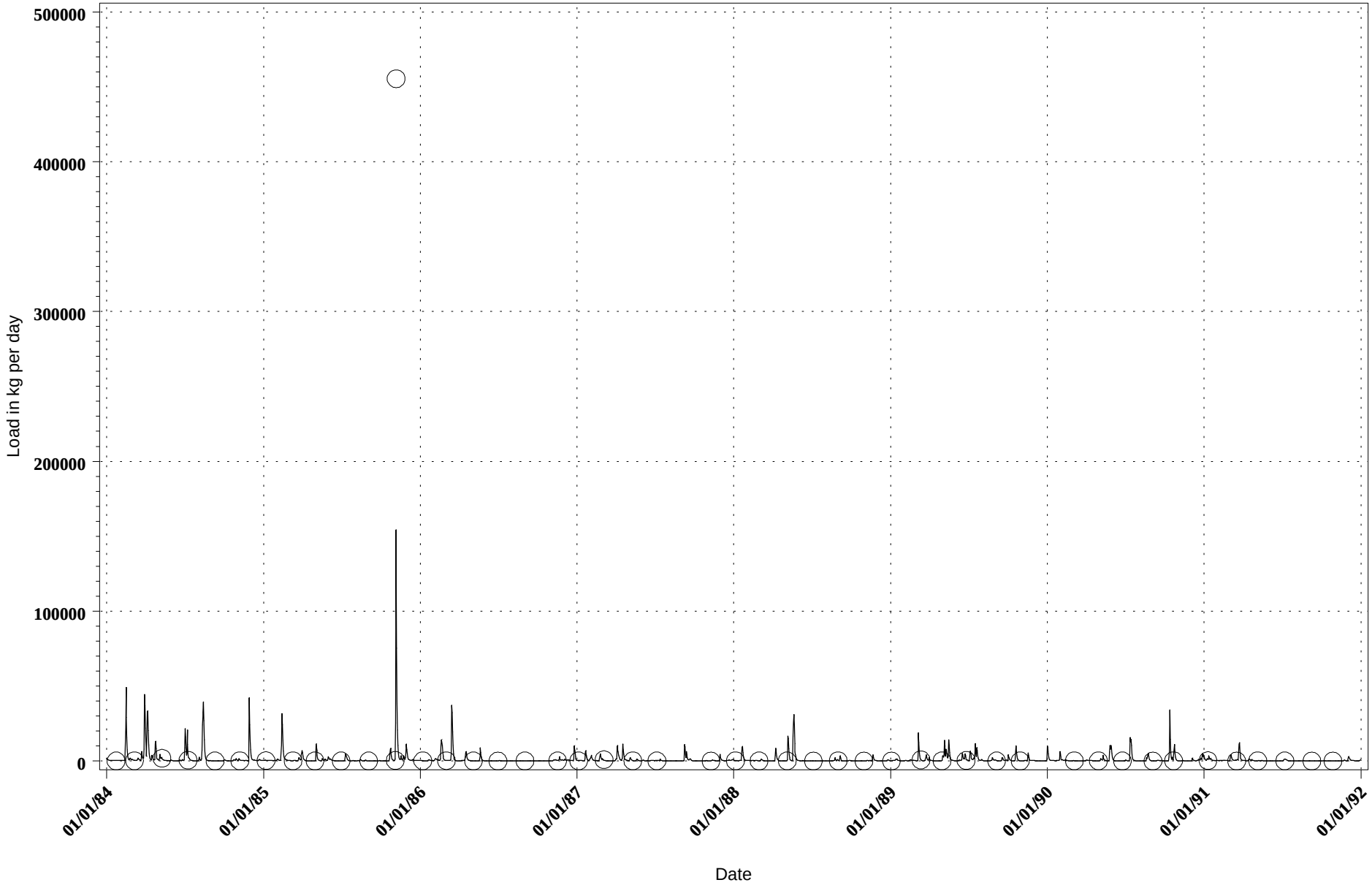
# Mid Potomac River at Segment 740
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

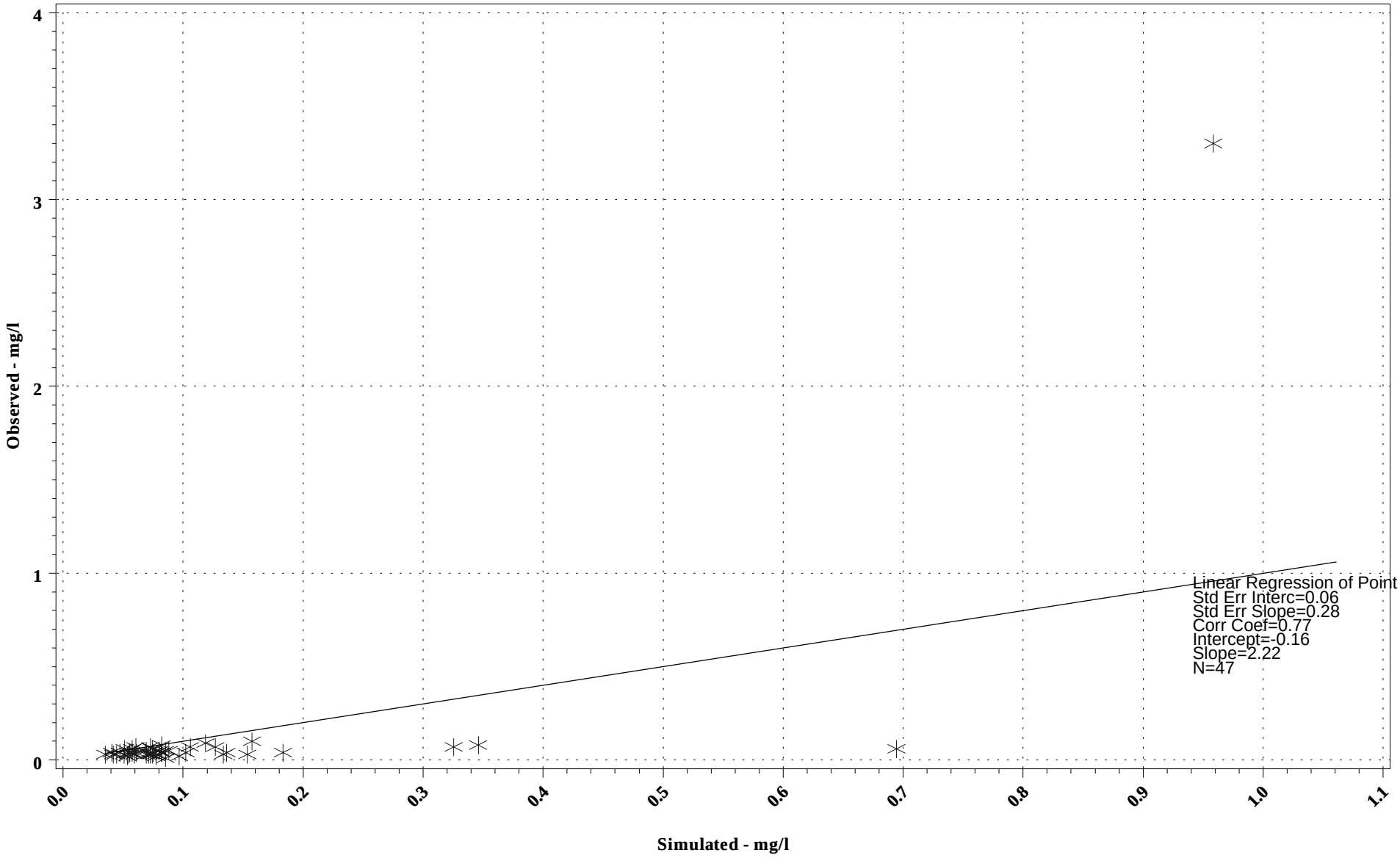



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740

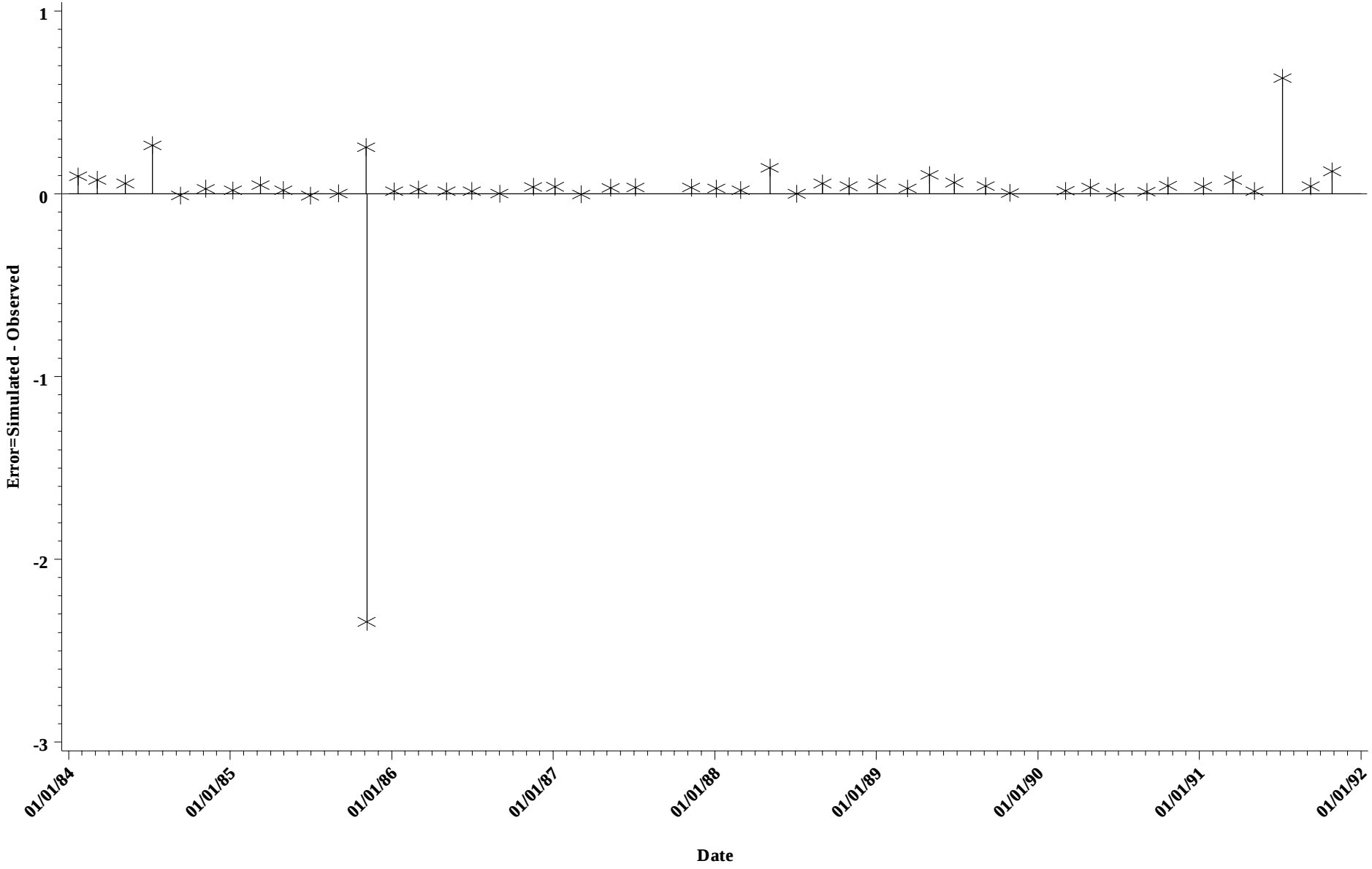
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



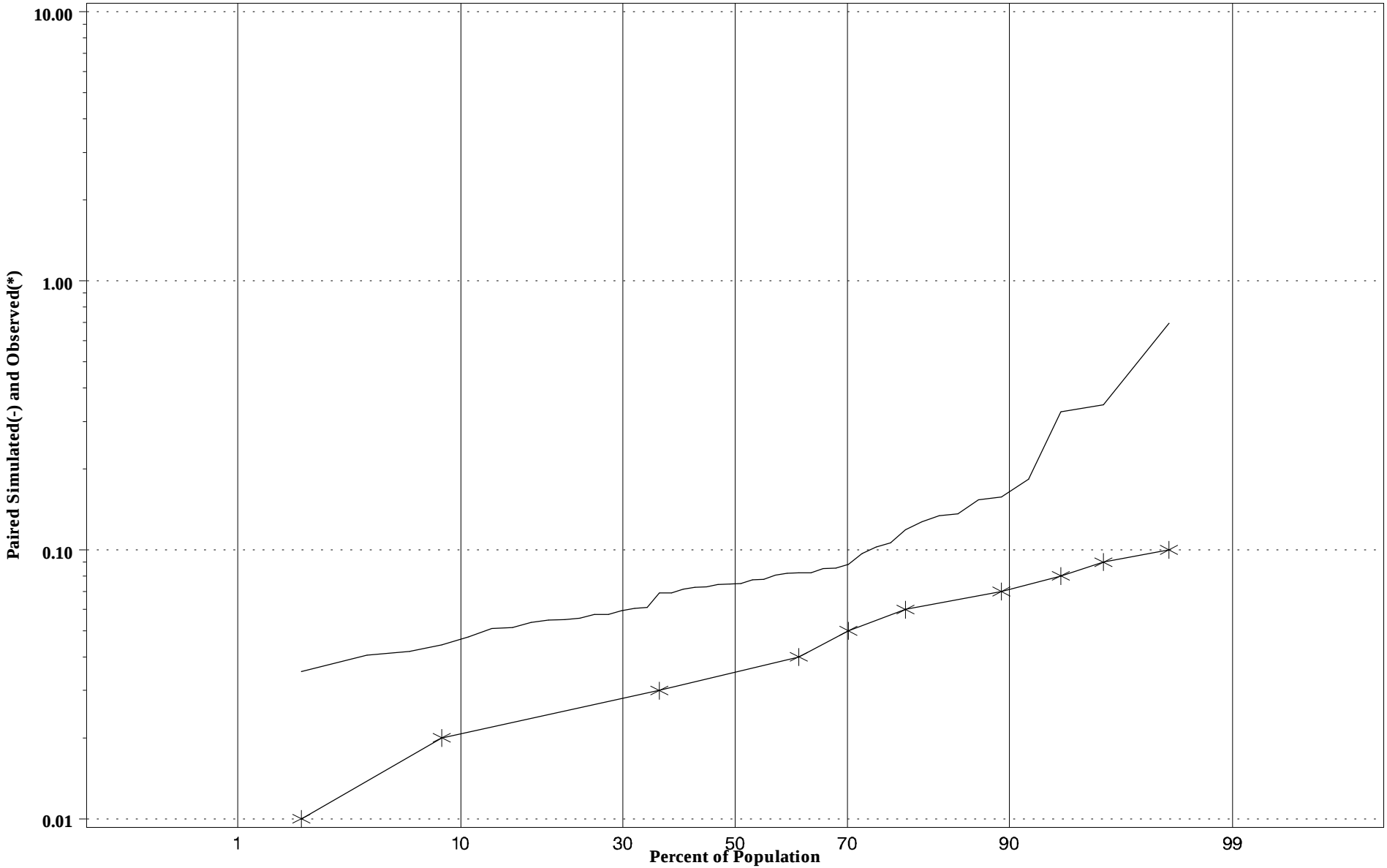

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(mid.drv 25JUN98 12:50)

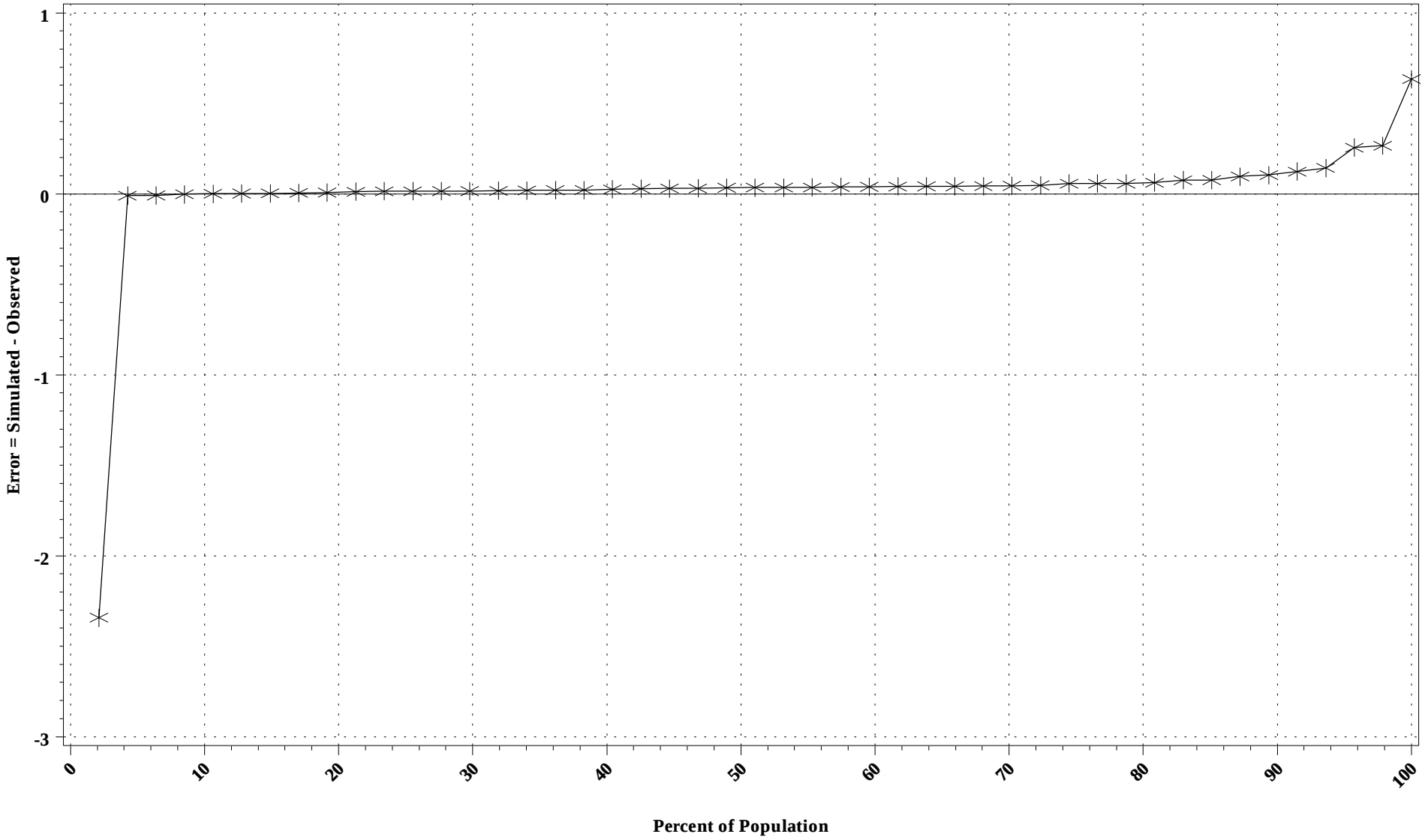
# Mid Potomac River at Segment 740
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Actual error versus Percentile Sample Population
## Total Phosphorus

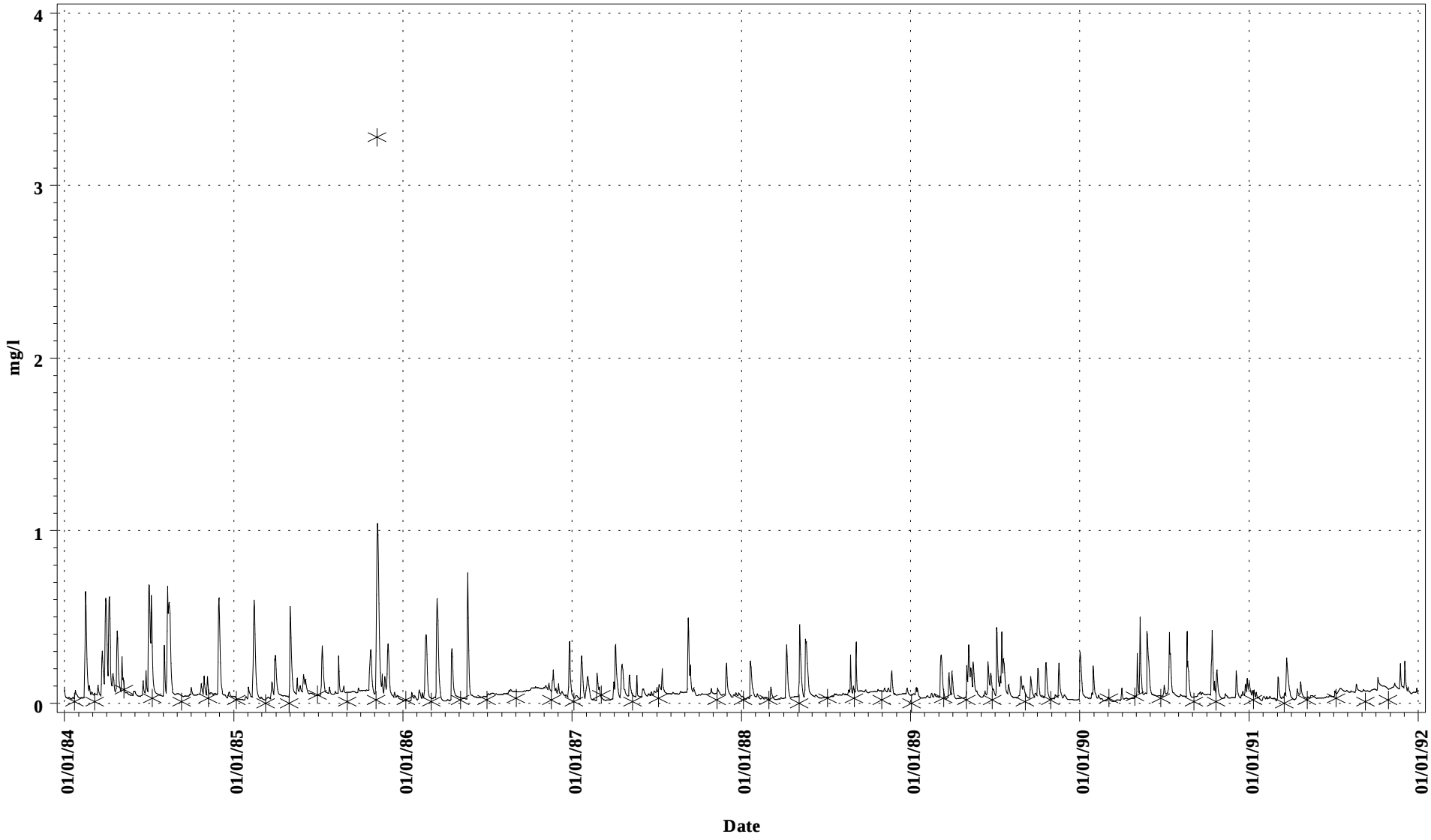
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

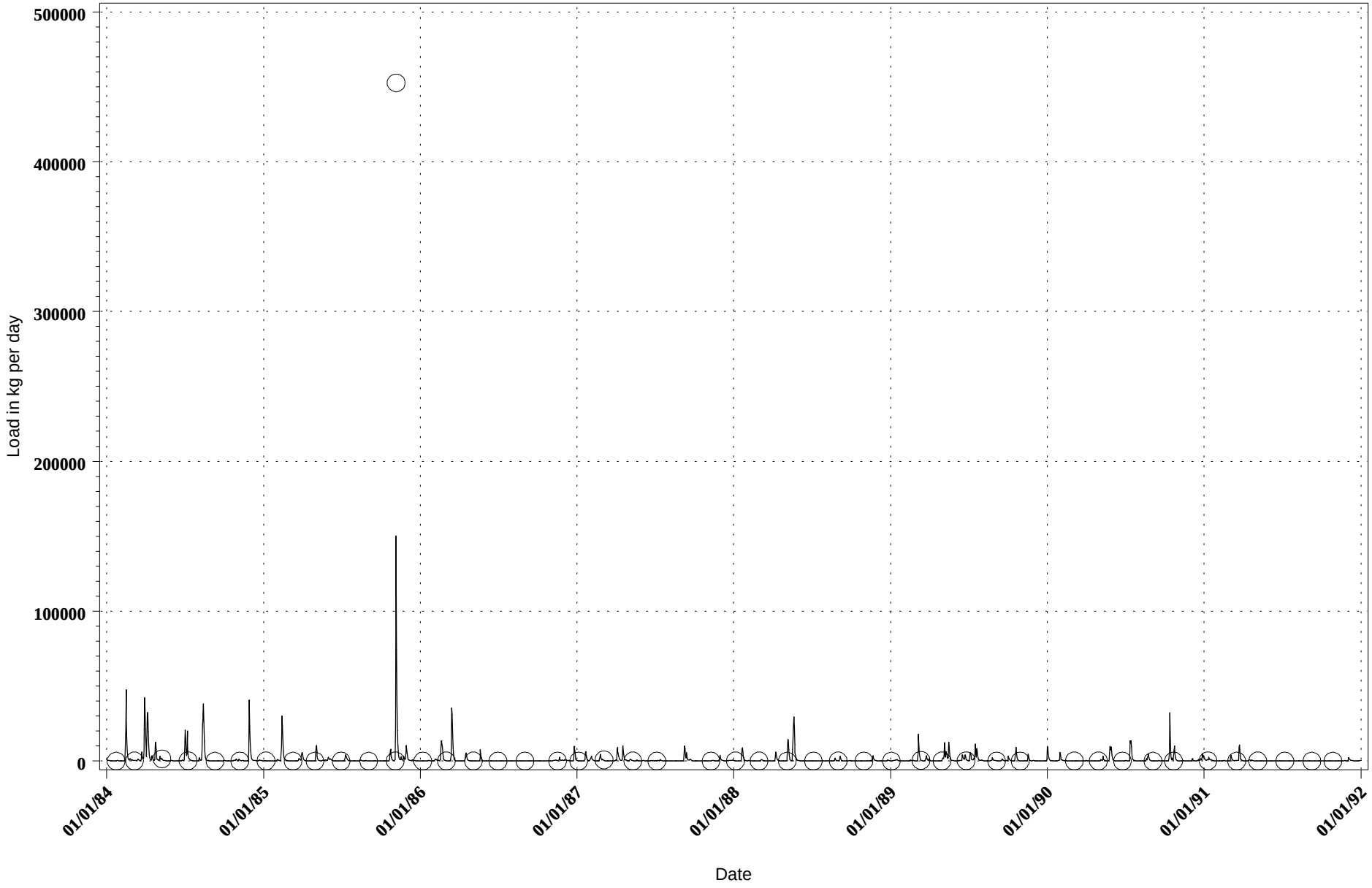



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

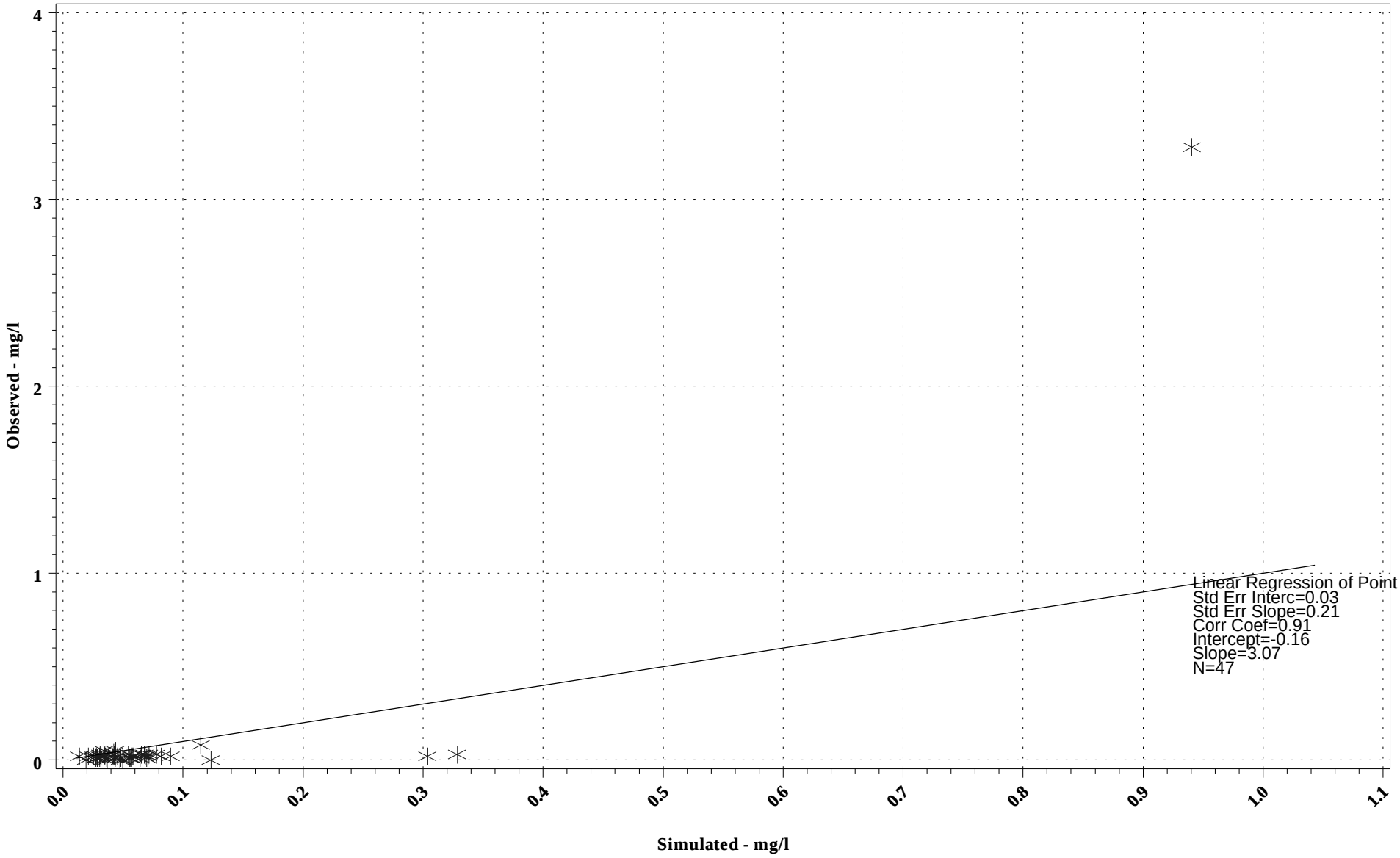



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740

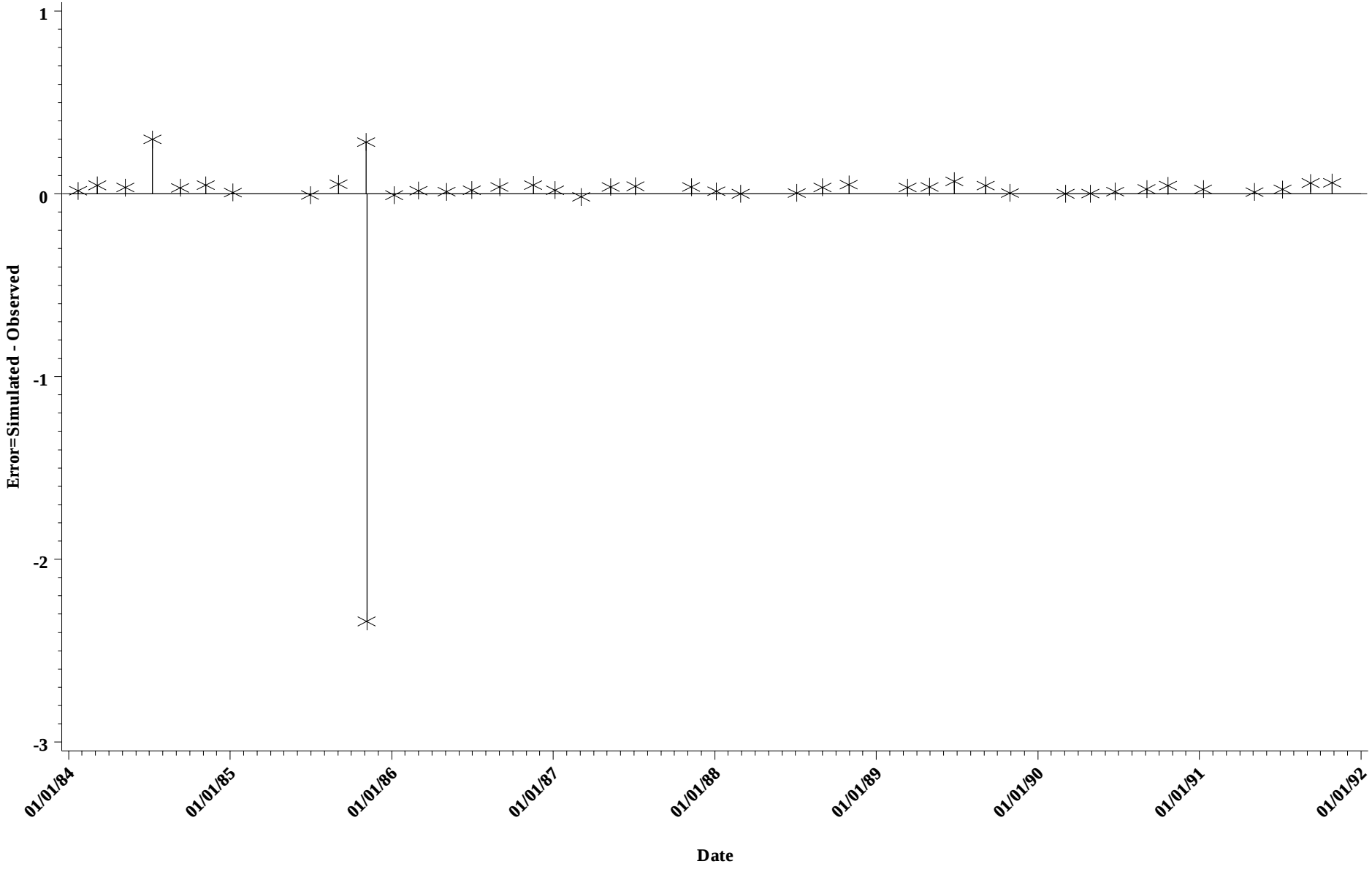
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92



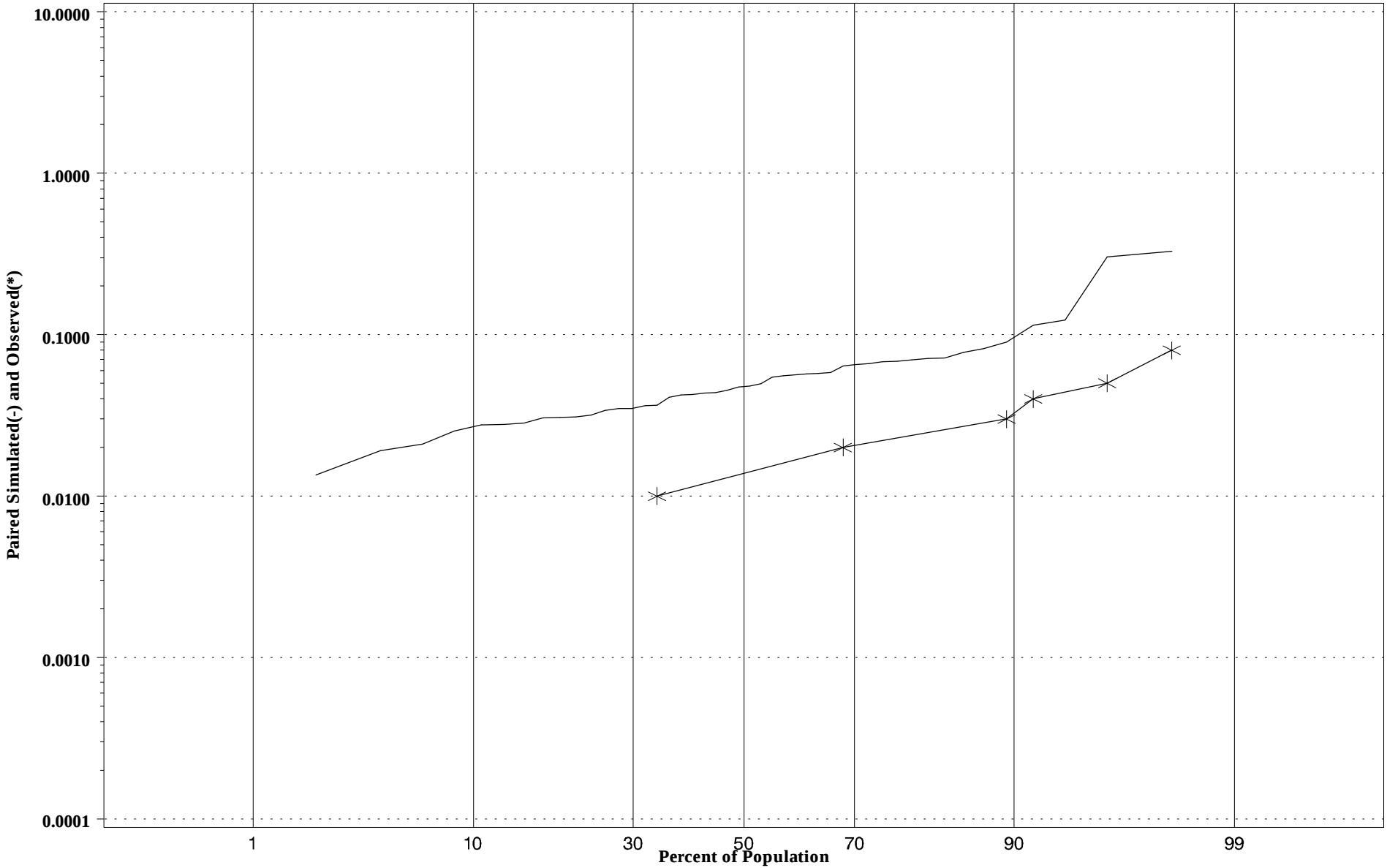

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740
## Actual Error versus Time
## Organic and Particulate Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(mid.drv 25JUN98 12:50)

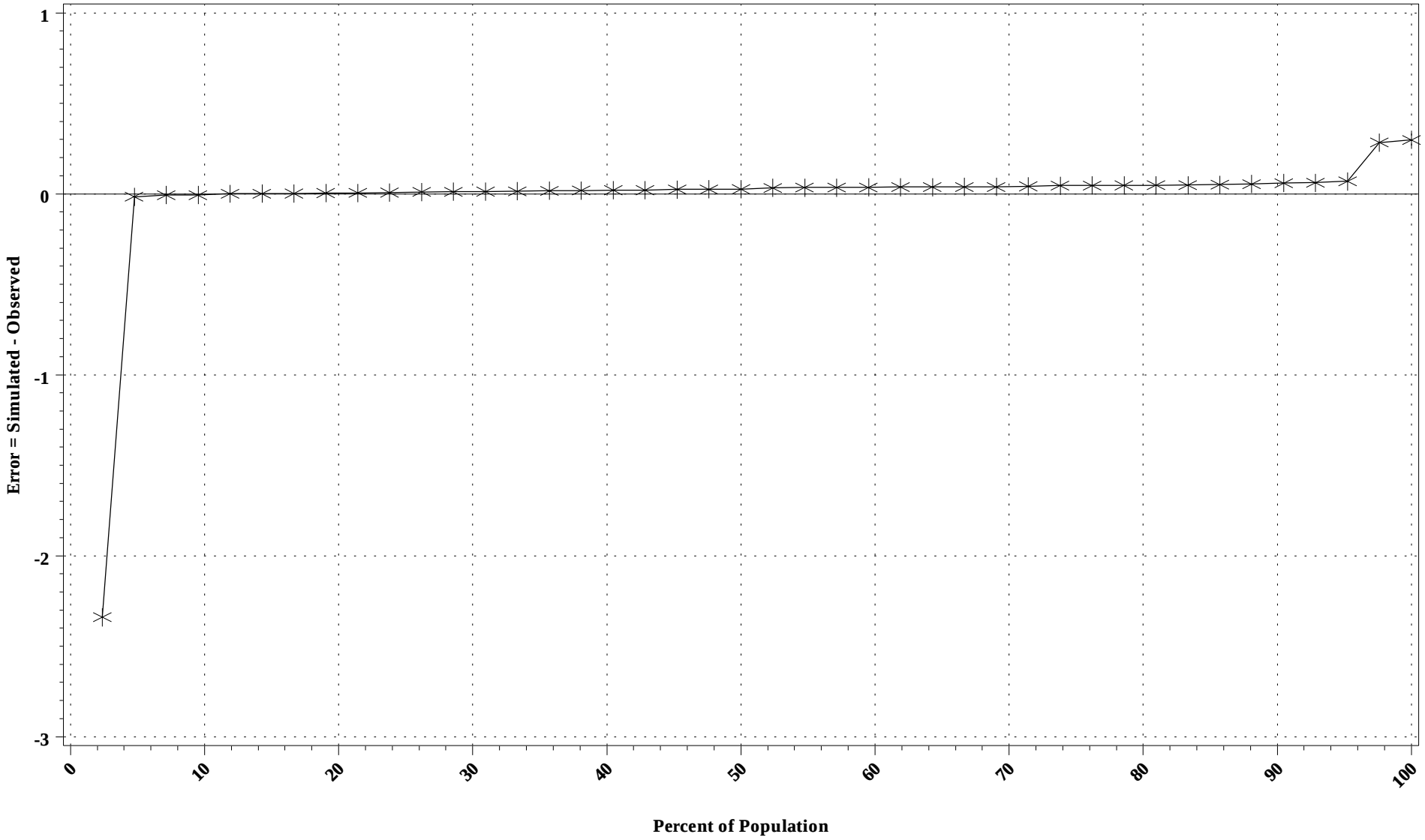
# Mid Potomac River at Segment 740
## Organic and Particulate Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

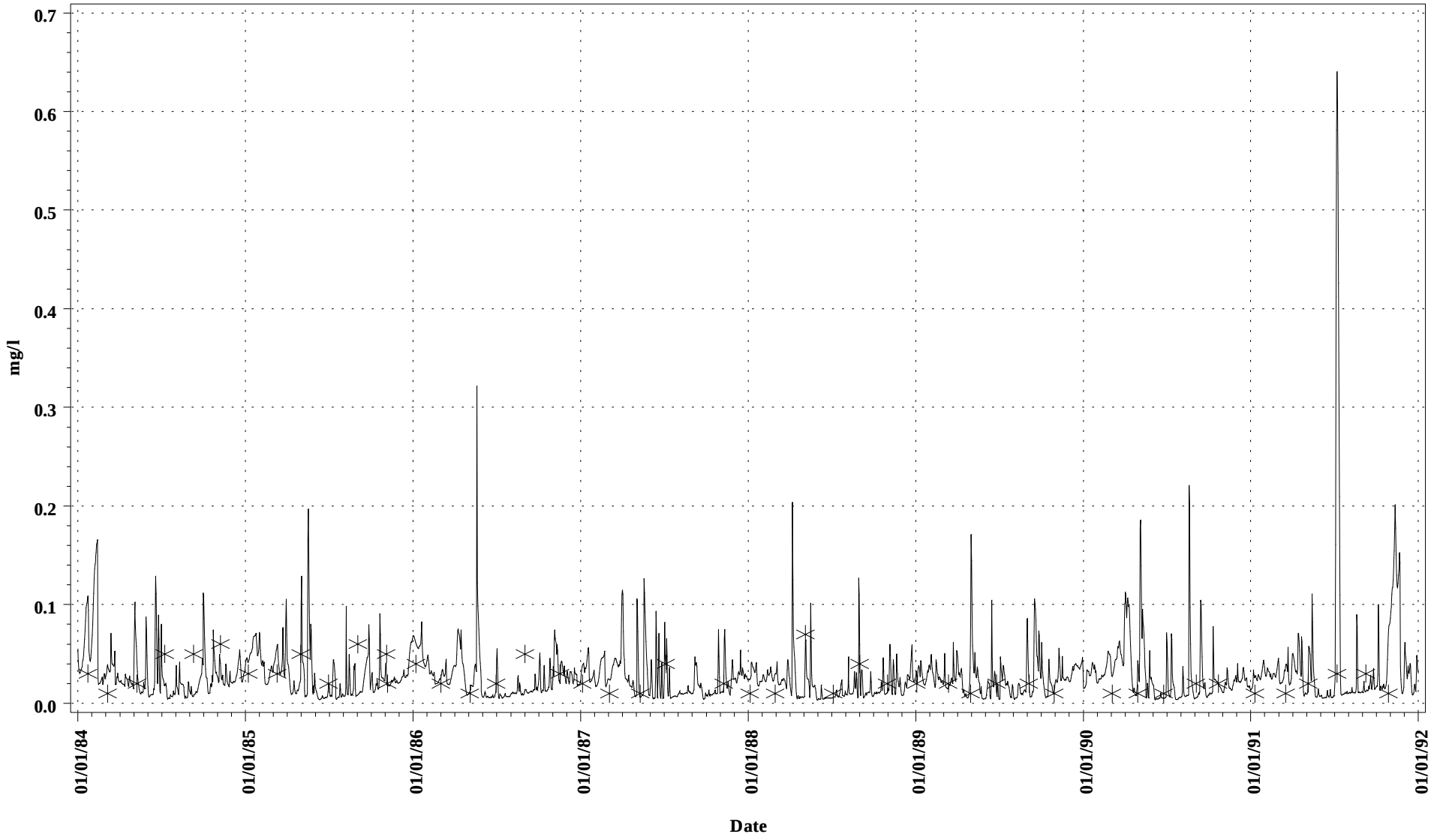
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Observed and Simulated versus Time
# Dissolved Phosphorus

**(*=Observed, -=Simulated)**

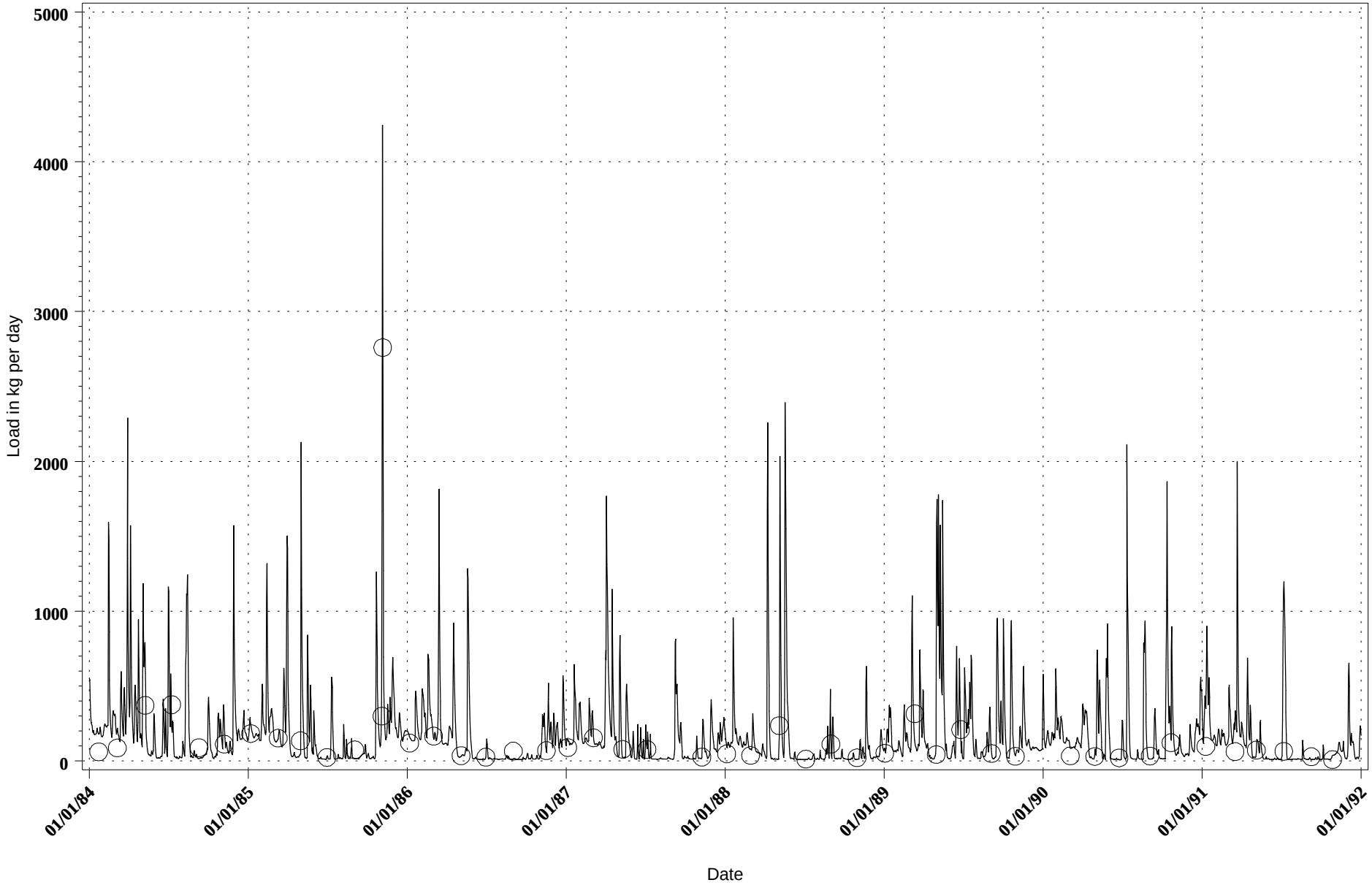



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740

## Dissolved Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

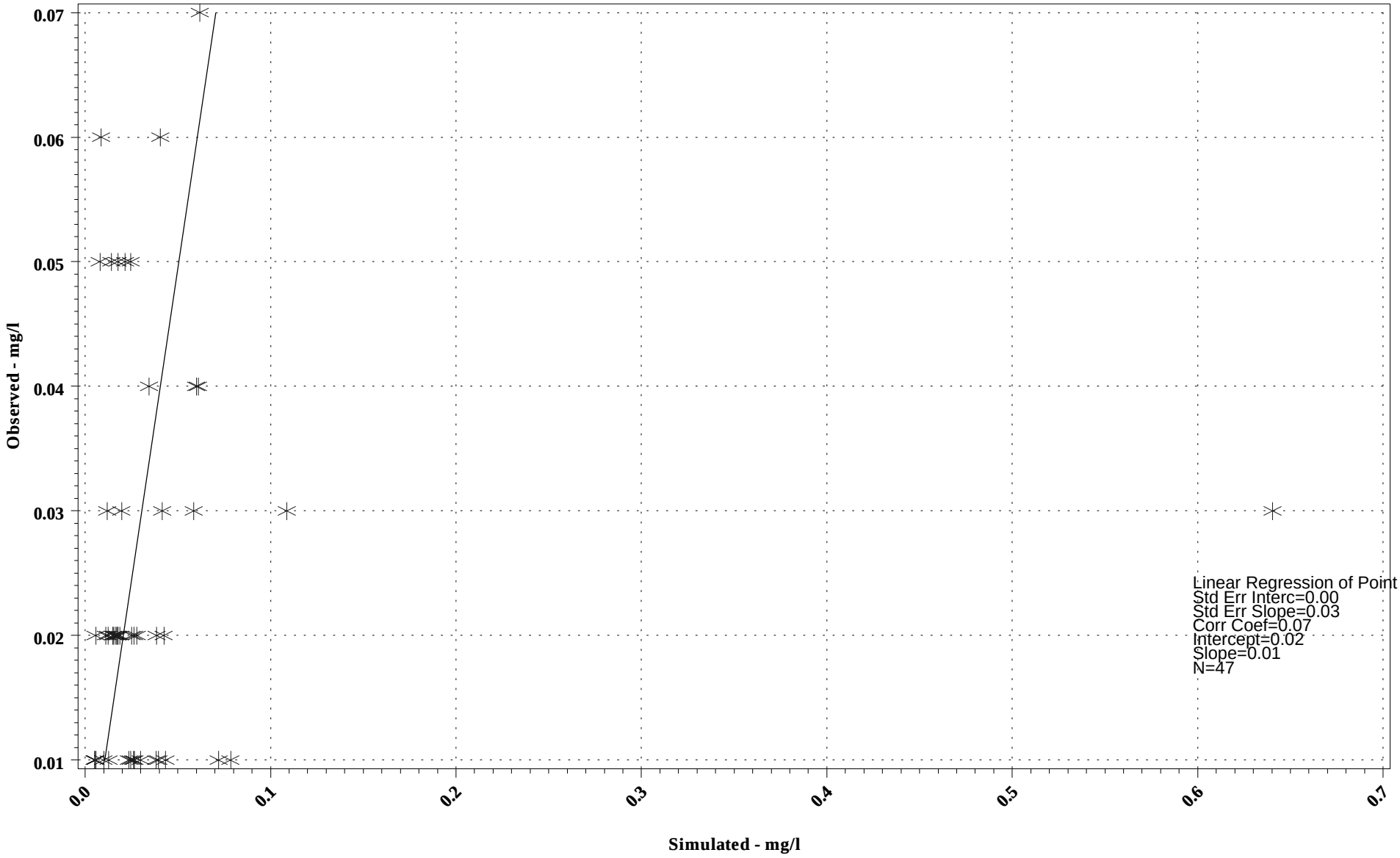



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740

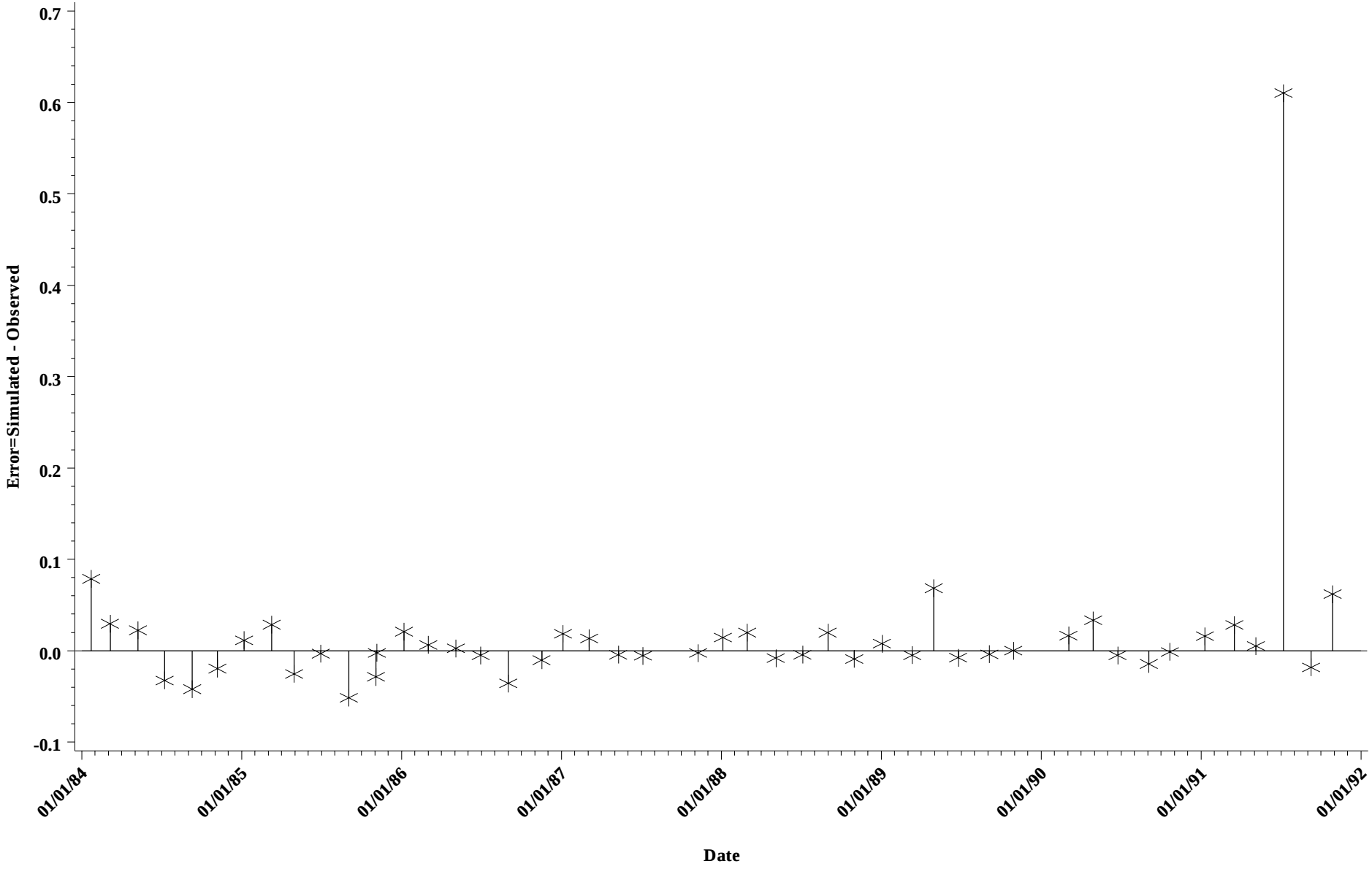
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



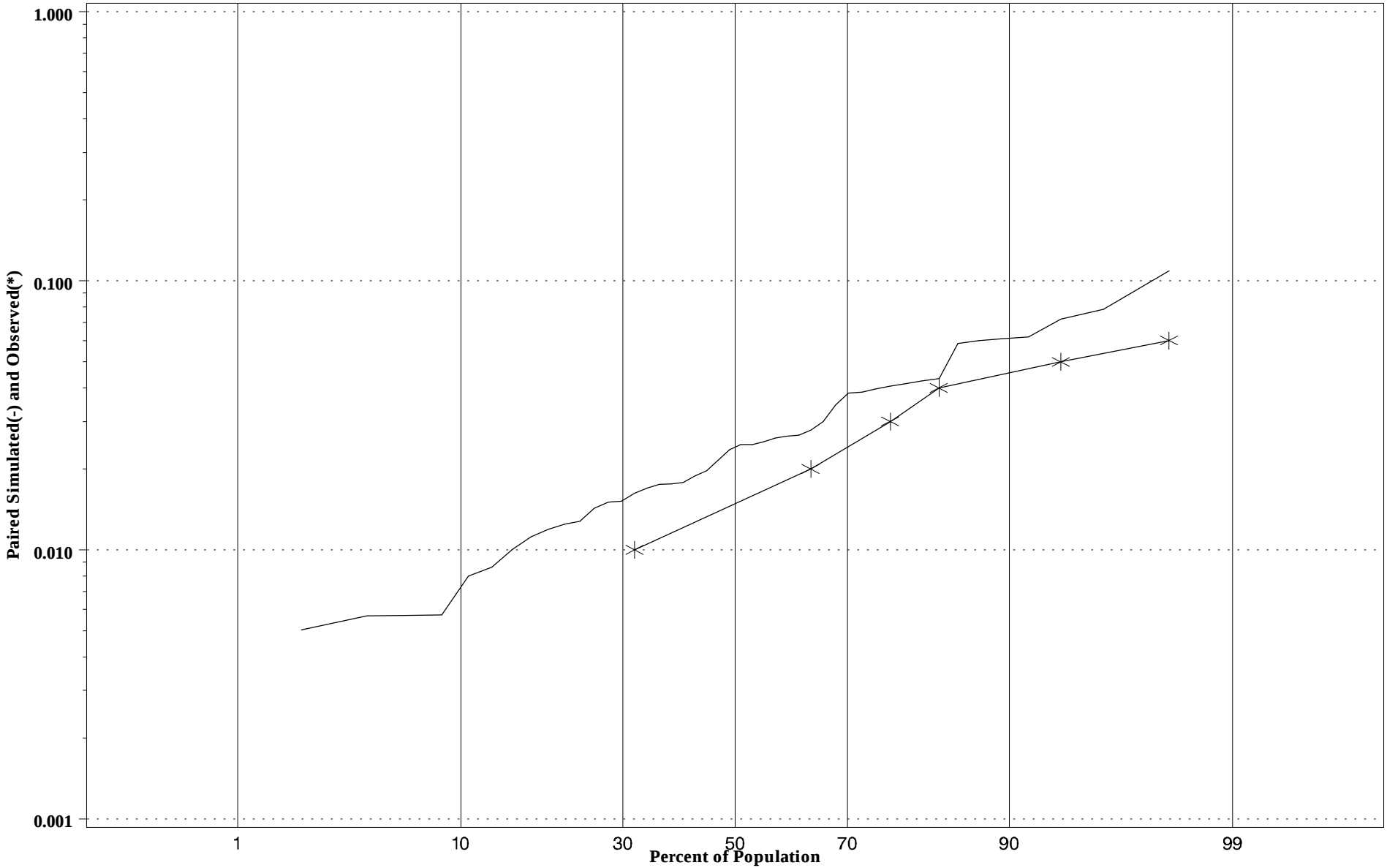

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(mid.drv 25JUN98 12:50)

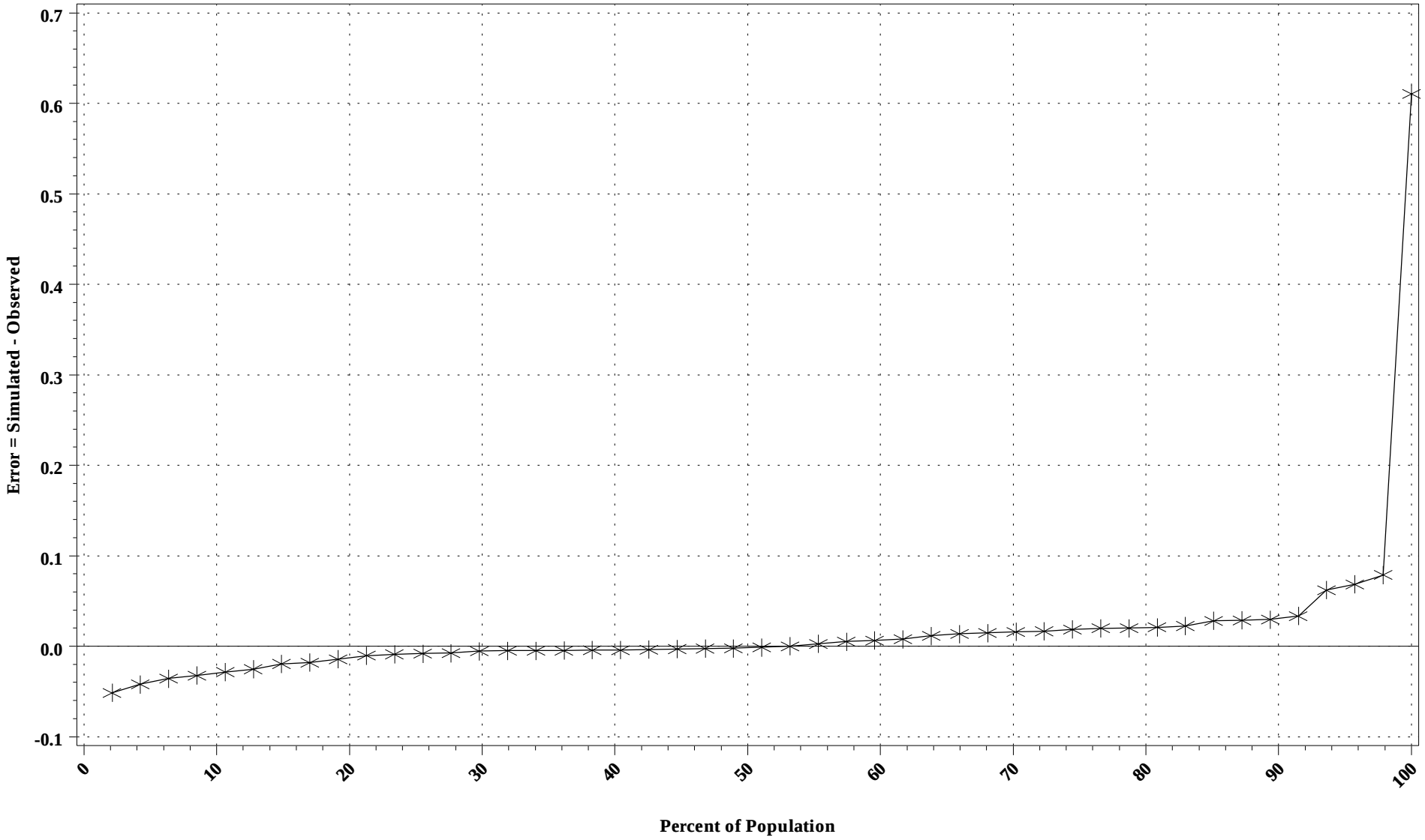
# Mid Potomac River at Segment 740
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

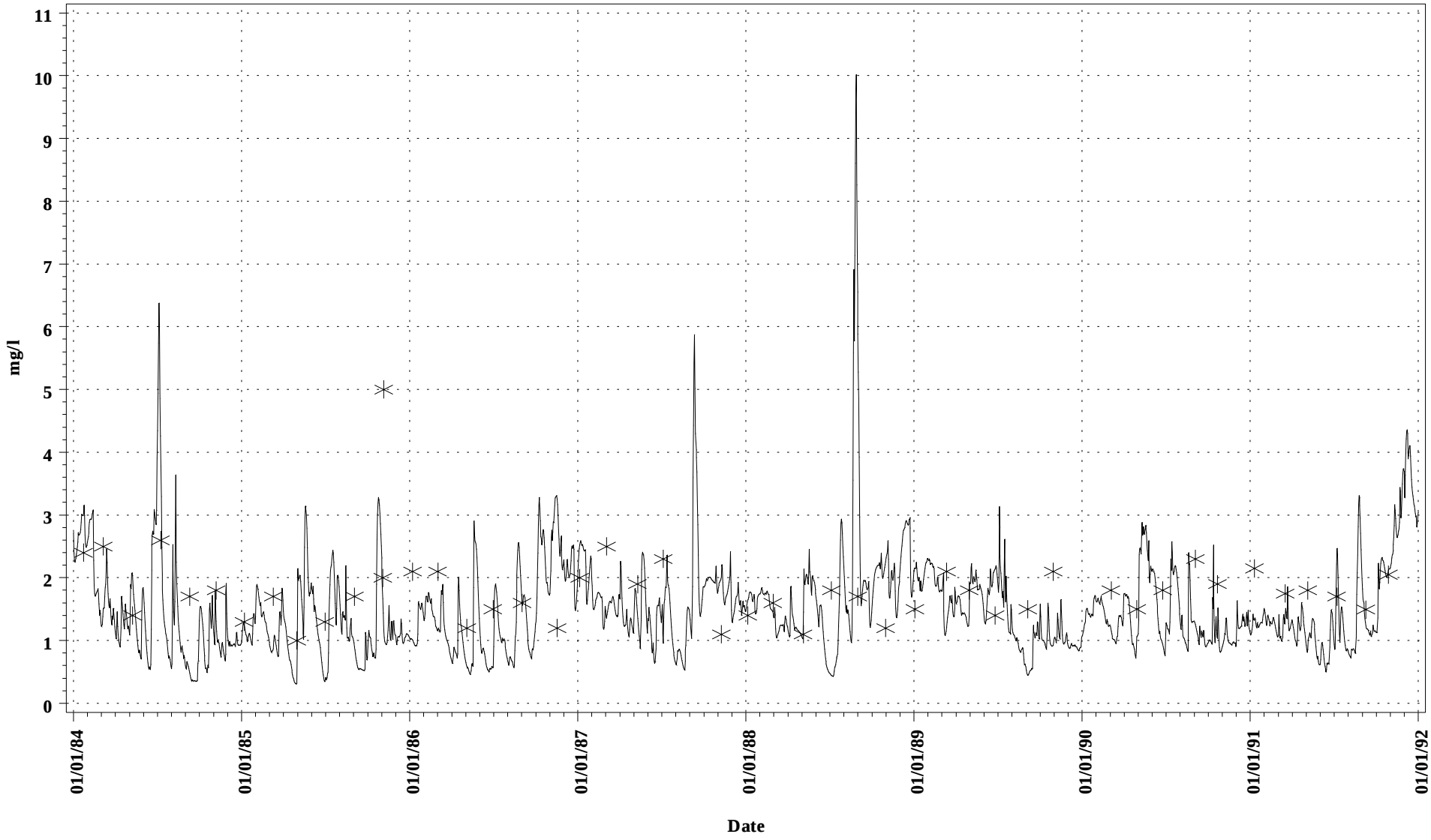
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(mid.drv 25JUN98 12:50)

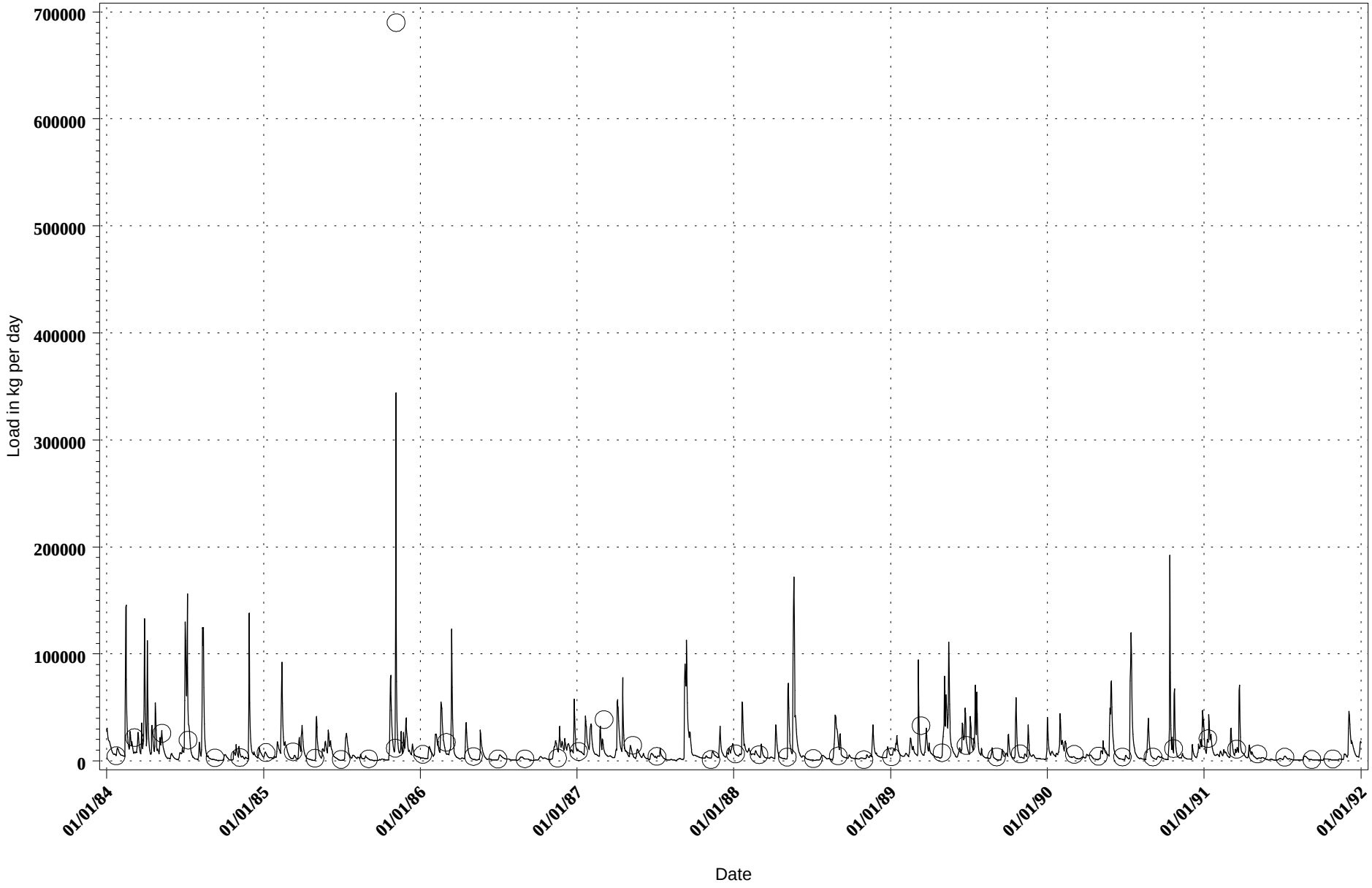
# Mid Potomac River at Segment 740
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

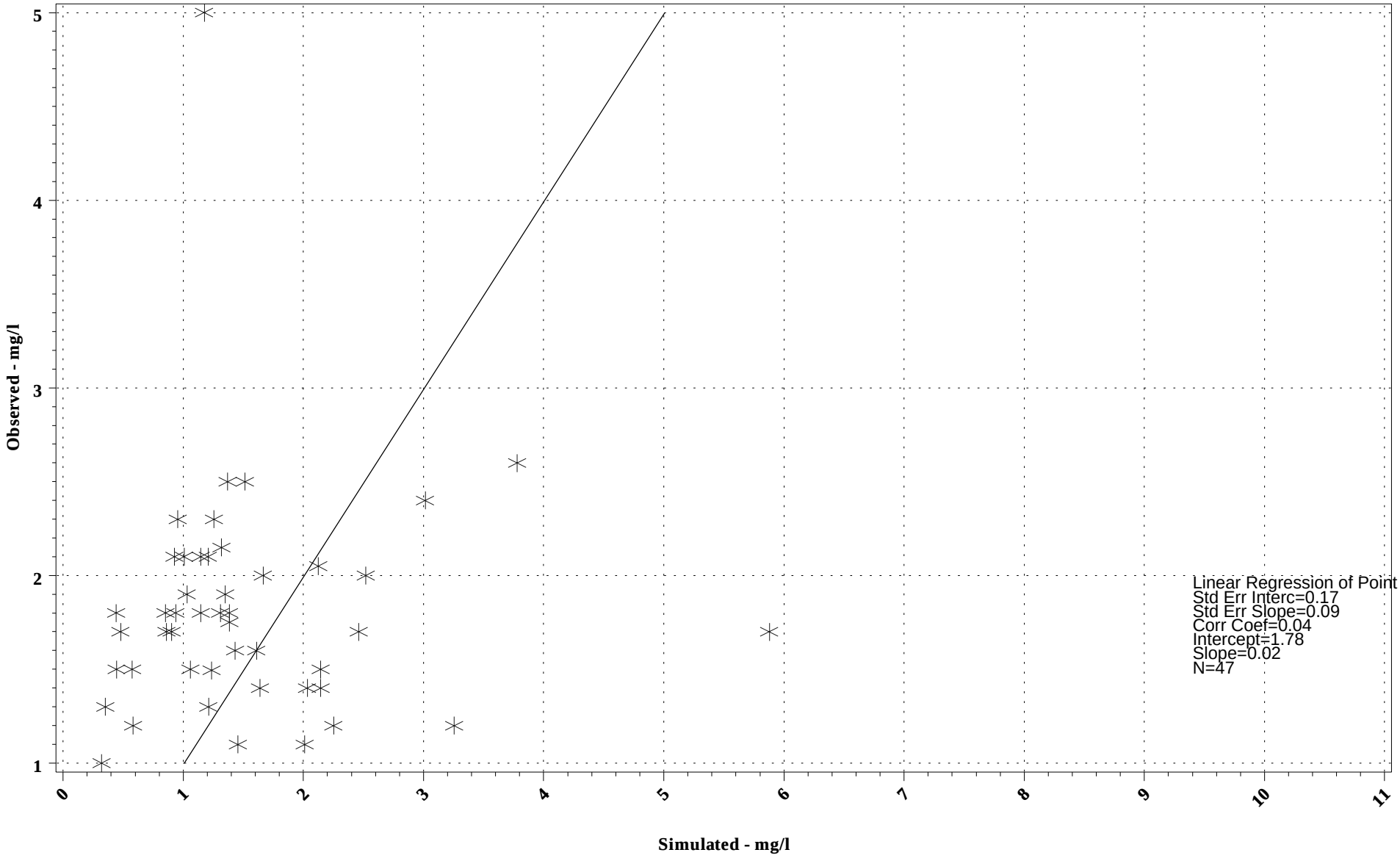



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740

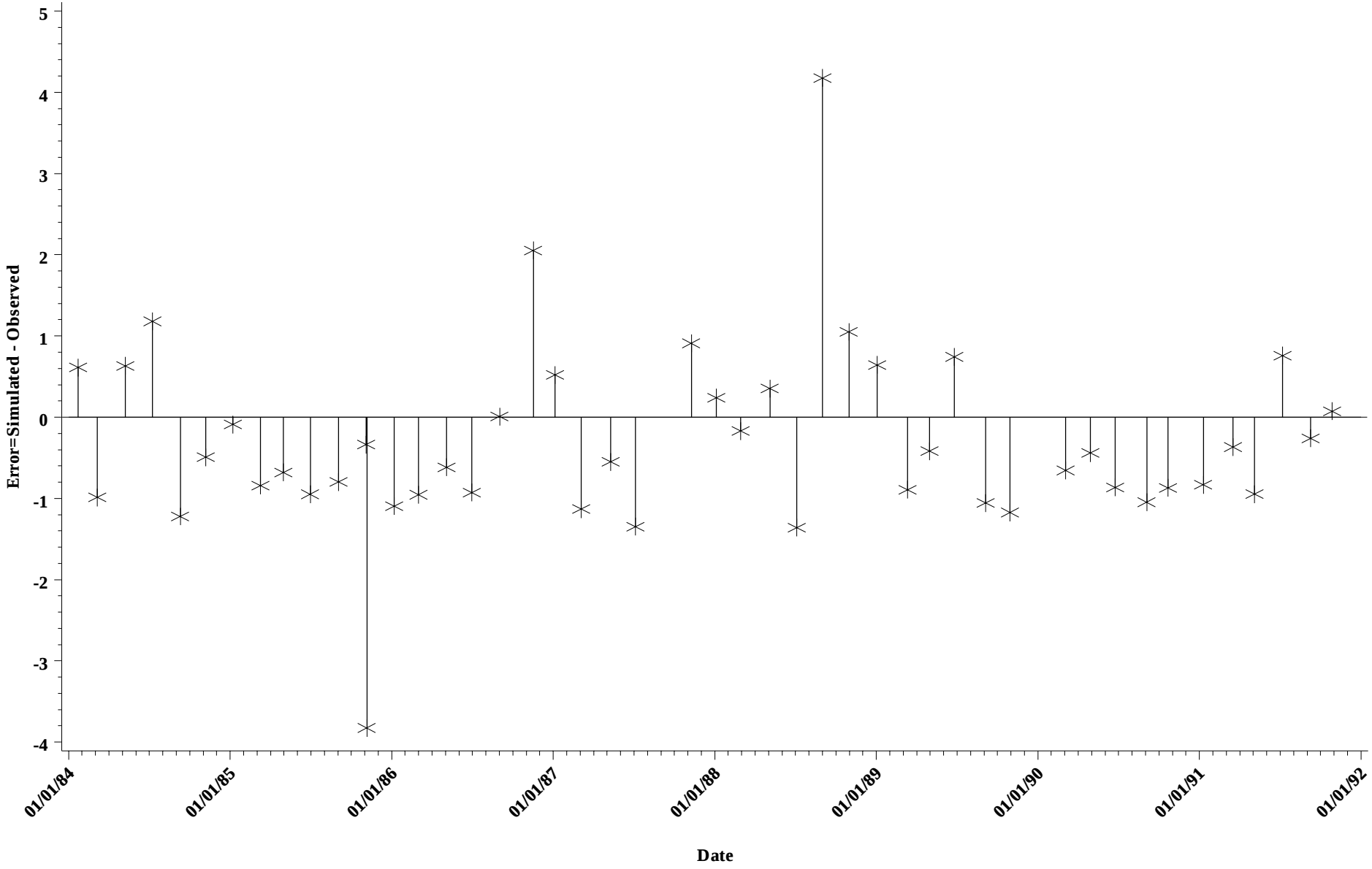
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740
## Actual Error versus Time
## Total Nitrogen

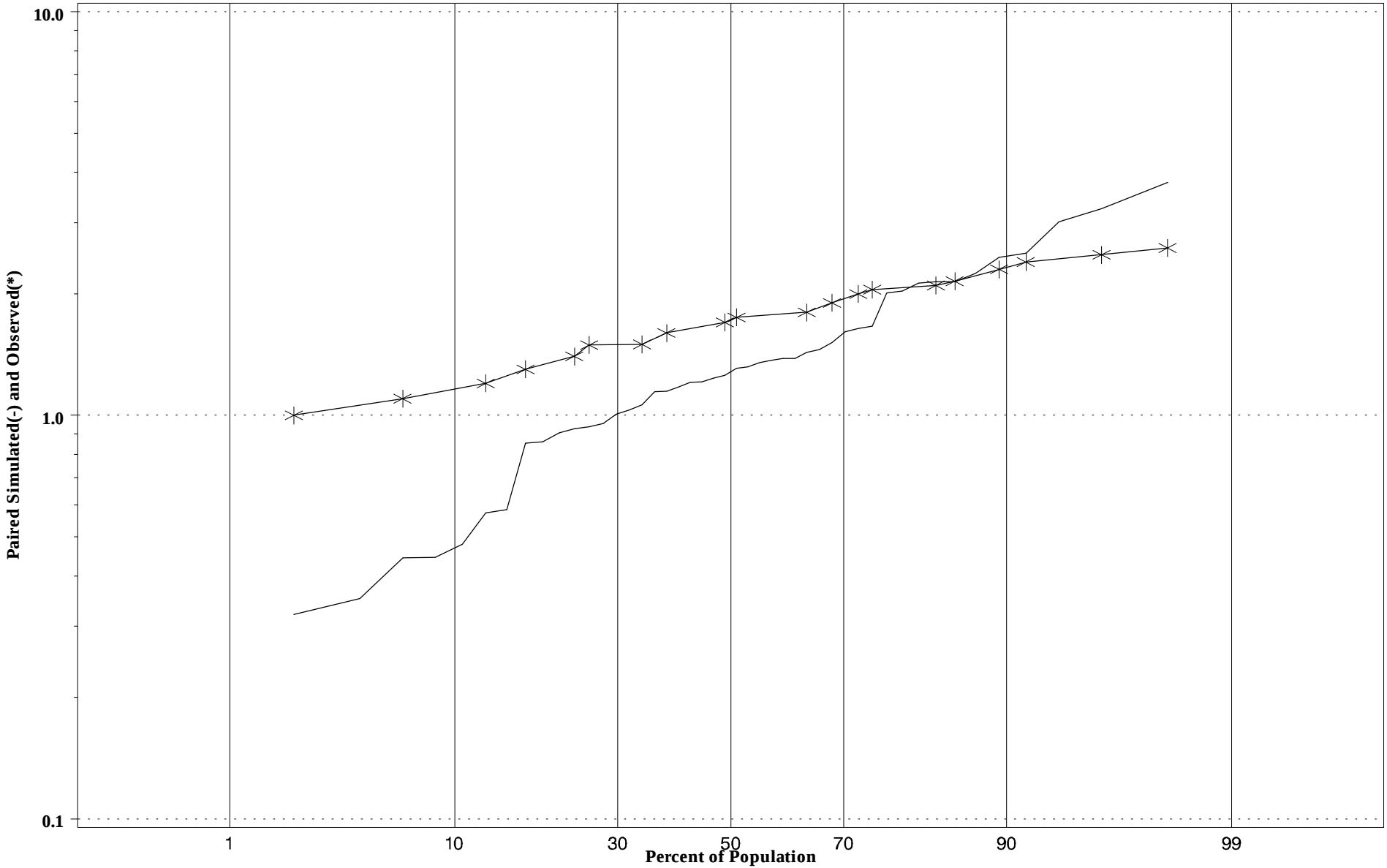



(y21_plotb.sas model3d:[pwang.dt] omerr)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740

## Total Nitrogen

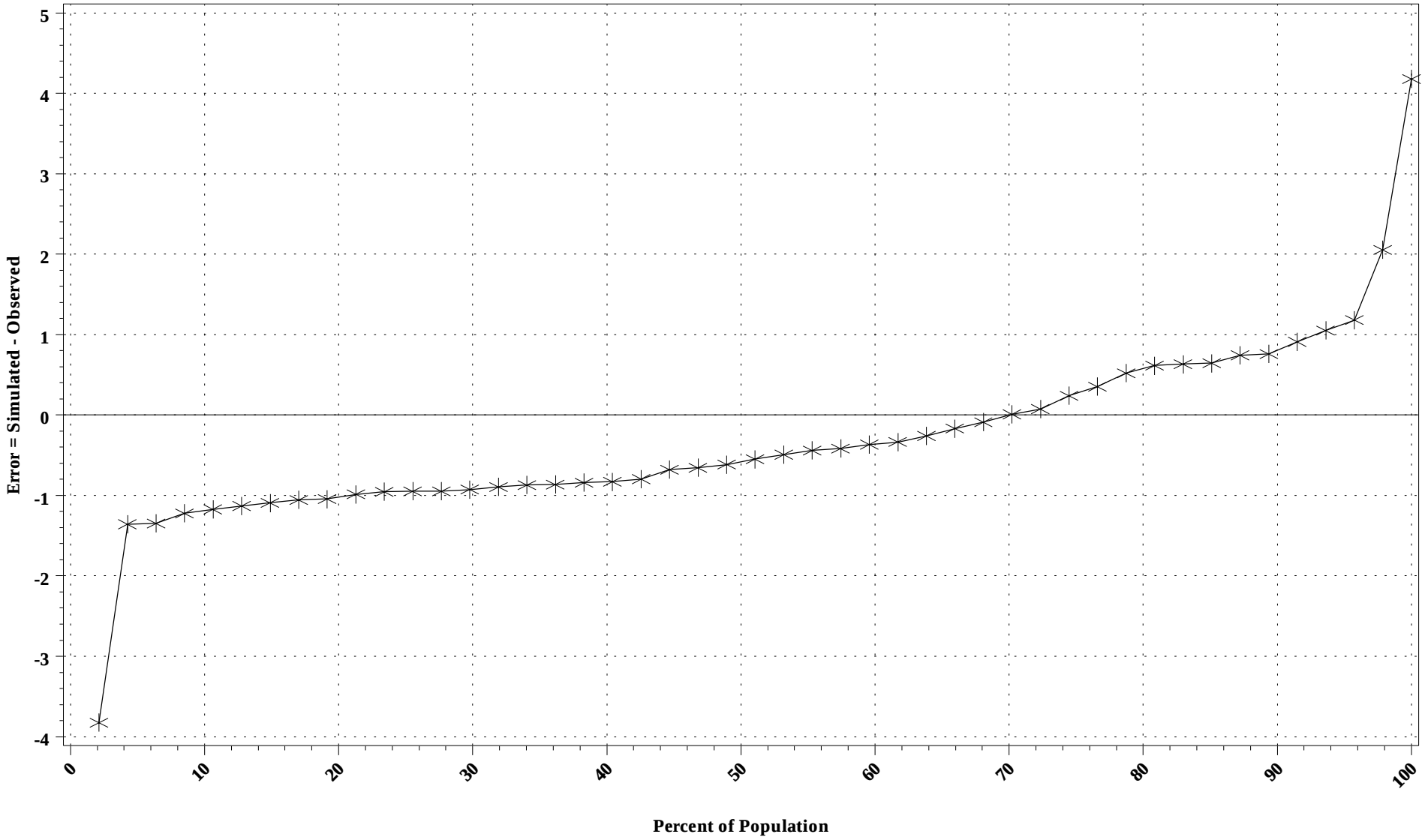
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Actual error versus Percentile Sample Population
## Total Nitrogen

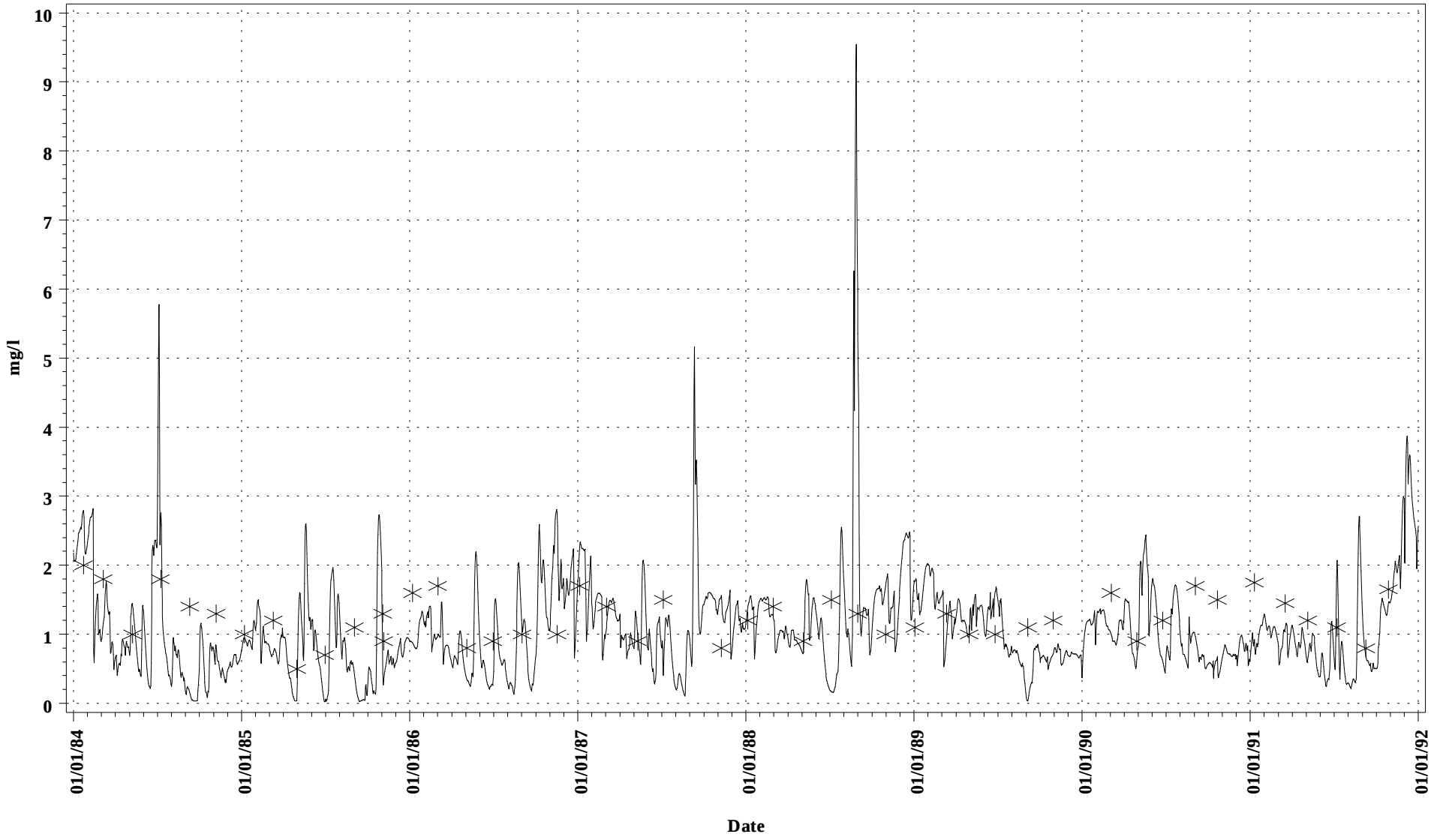
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

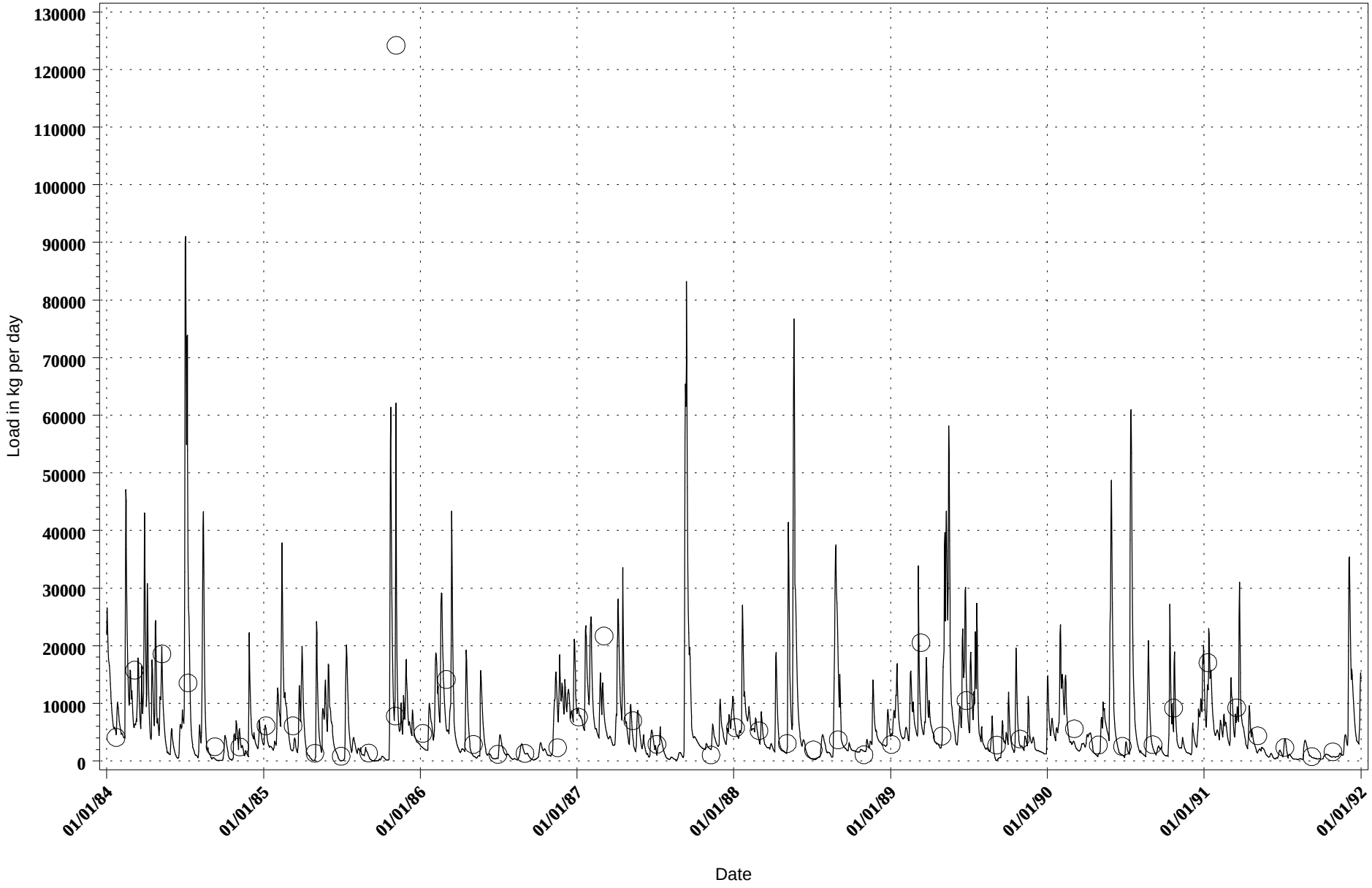



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740

## NO3 Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

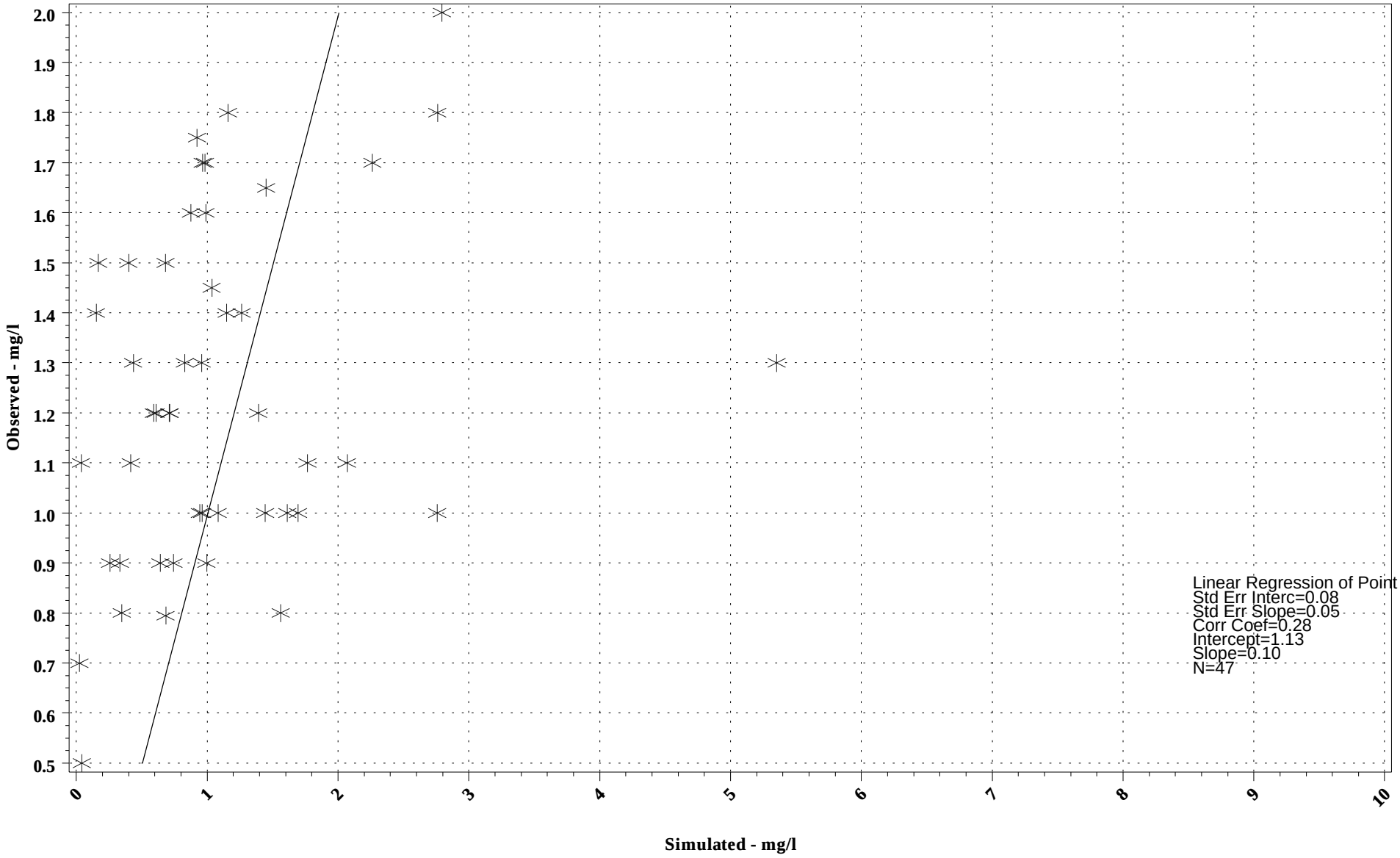



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740

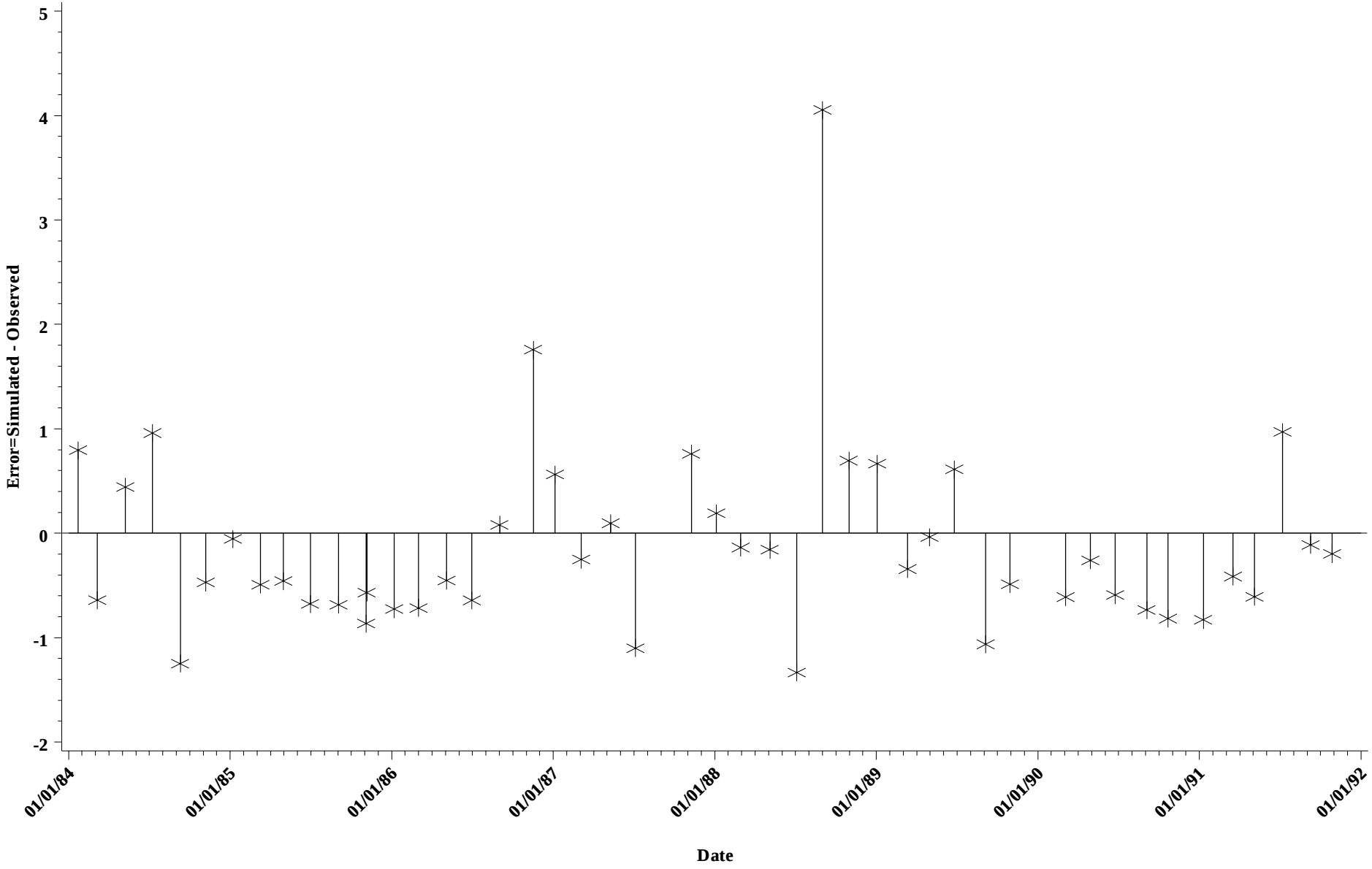
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740
## Actual Error versus Time
## NO3

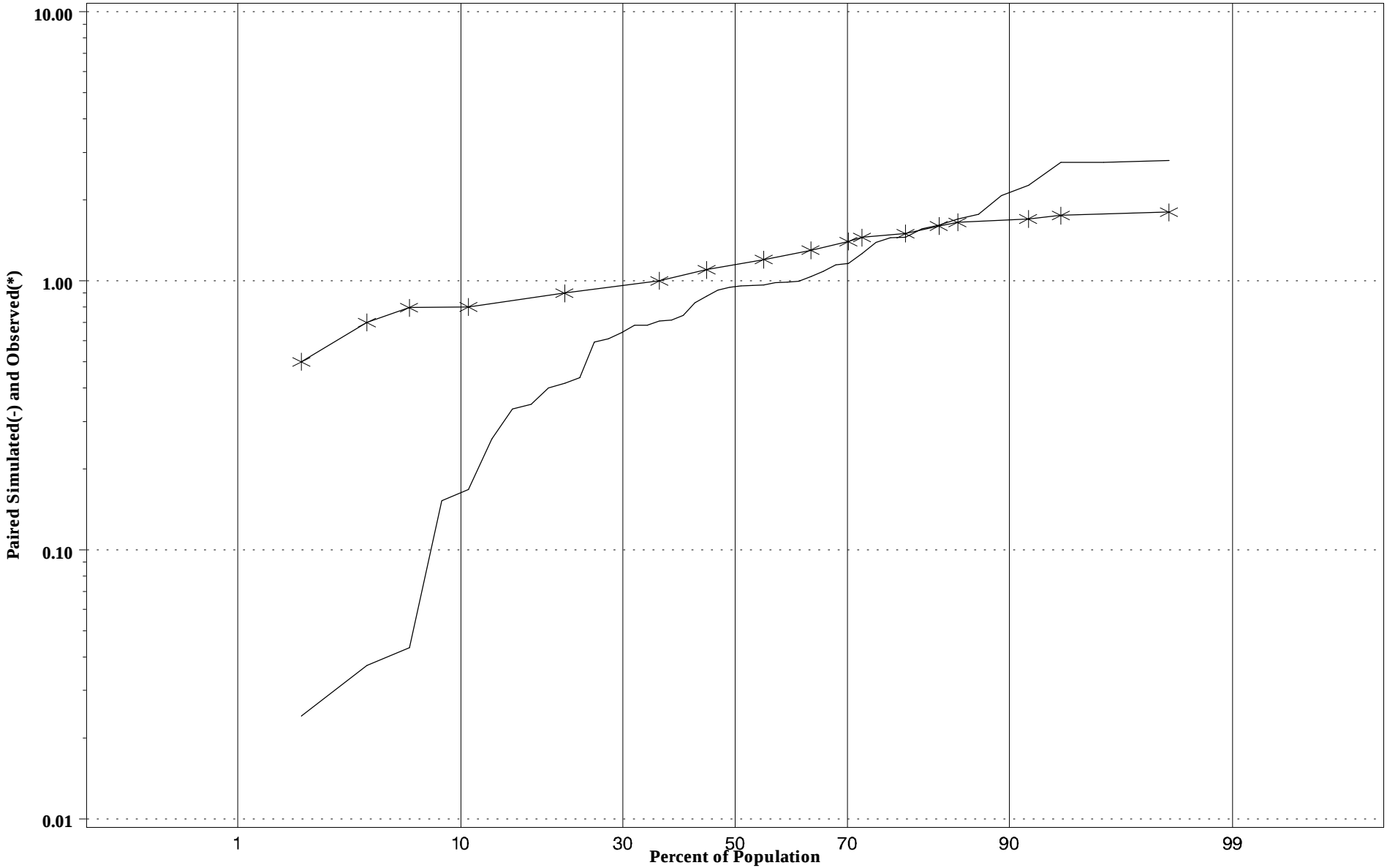



(y21_plotb.sas model3d:[pwang.dt] omerr)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740

## NO3

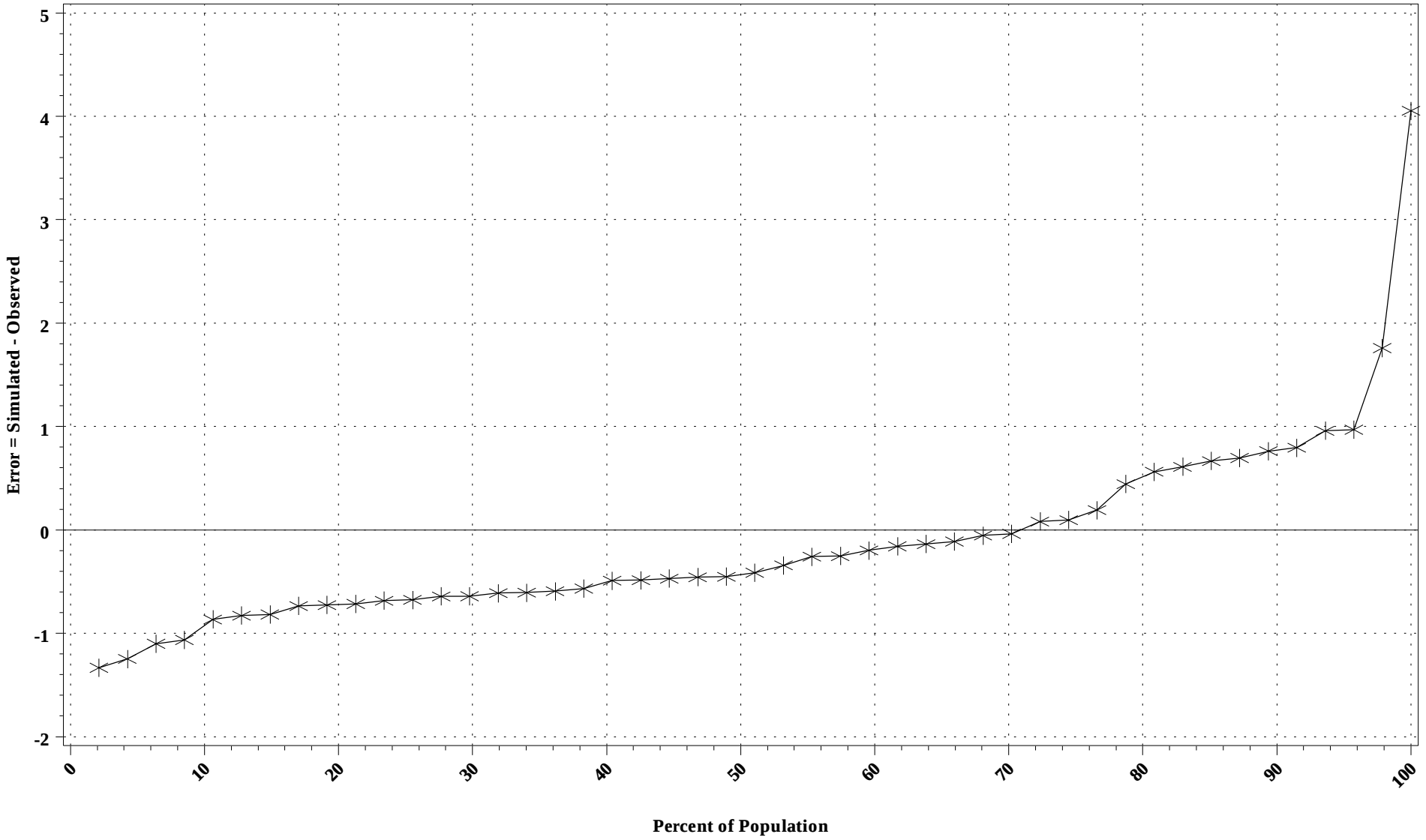
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Actual error versus Percentile Sample Population
## NO3

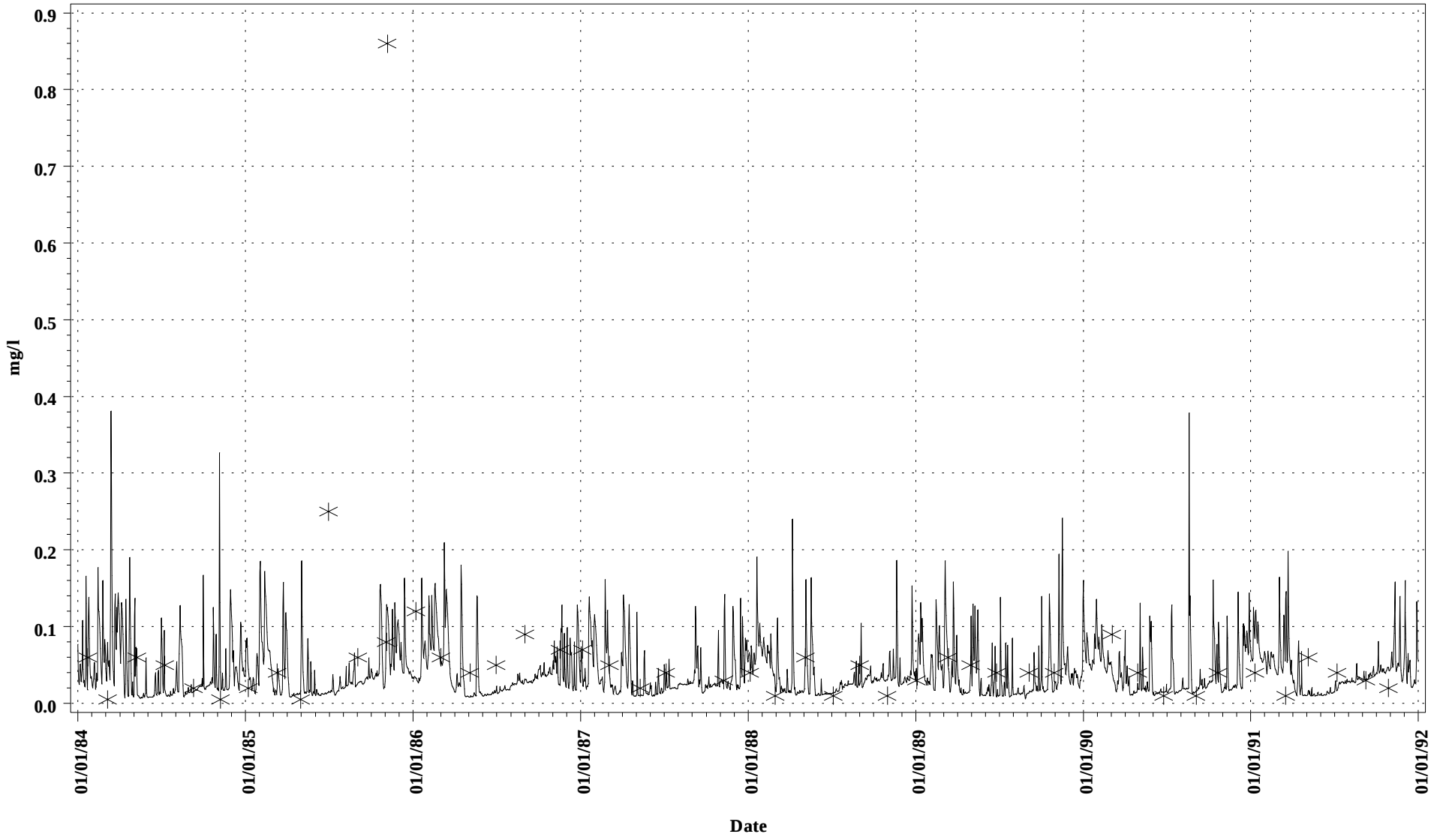
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(mid.drv 25JUN98 12:50)

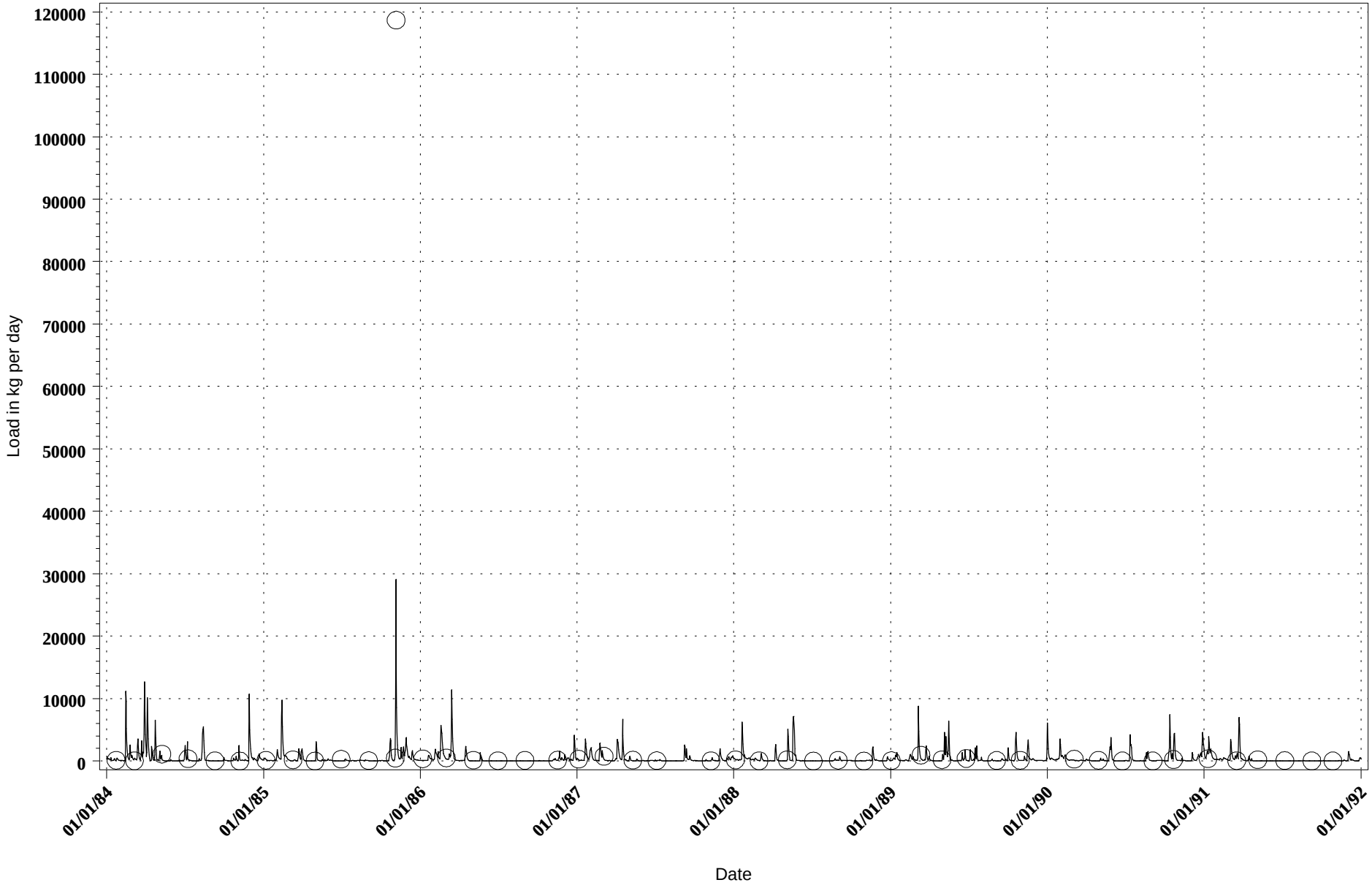
# Mid Potomac River at Segment 740
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Total Ammonia Observed and Simulated Load vs Time
### (line = simulated, O = observed)

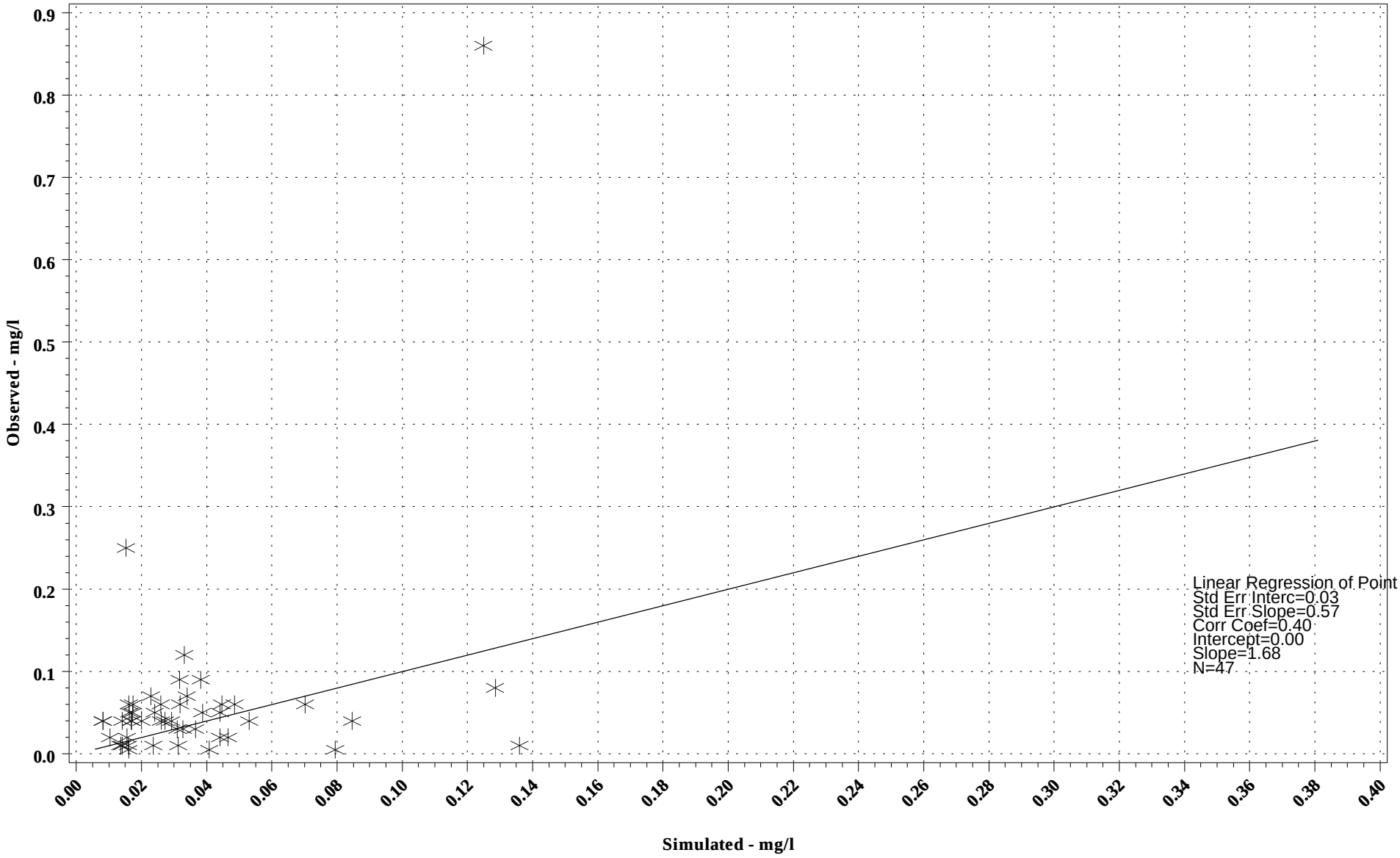



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740

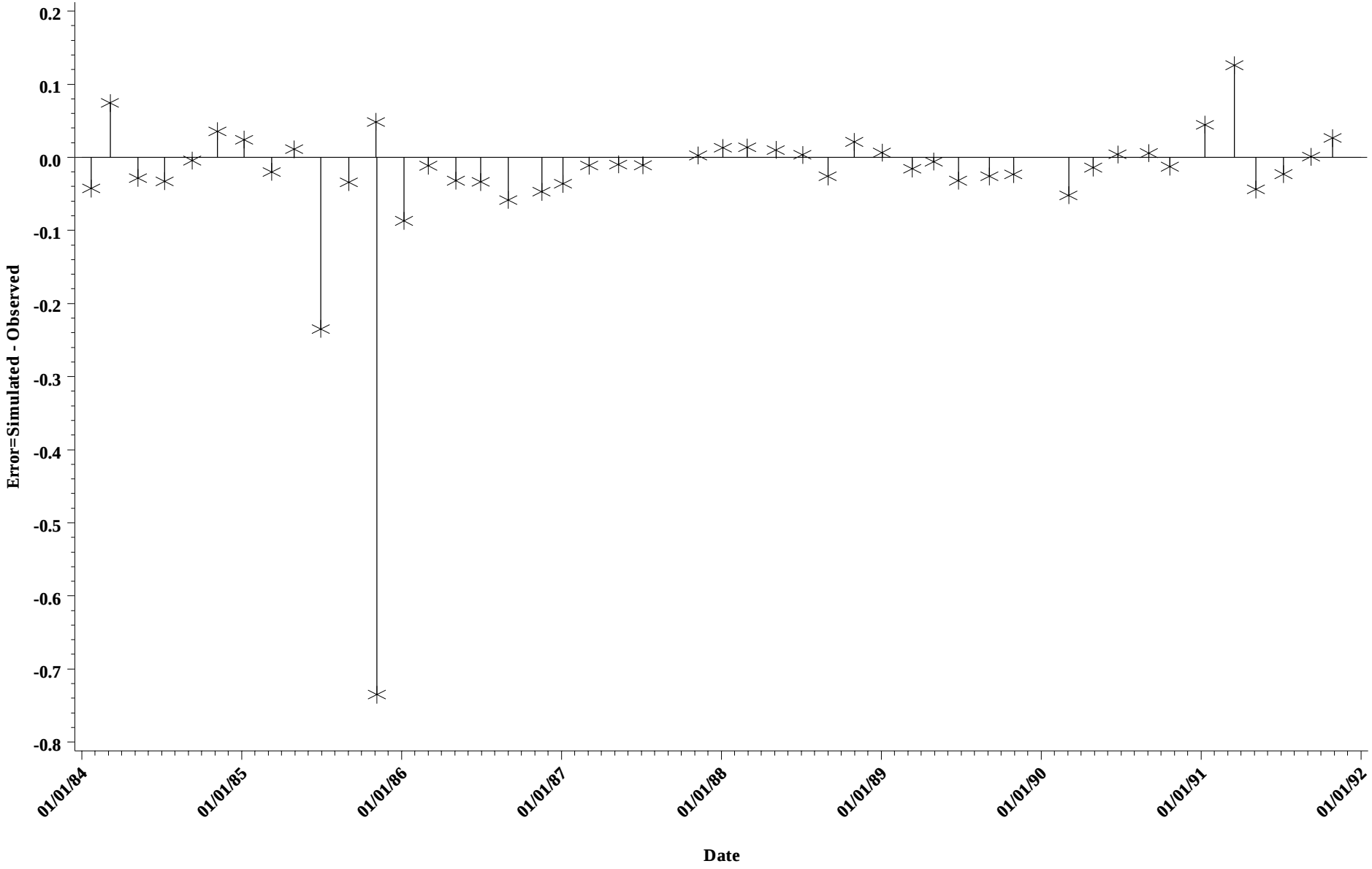
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740
## Actual Error versus Time
## Total Ammonia

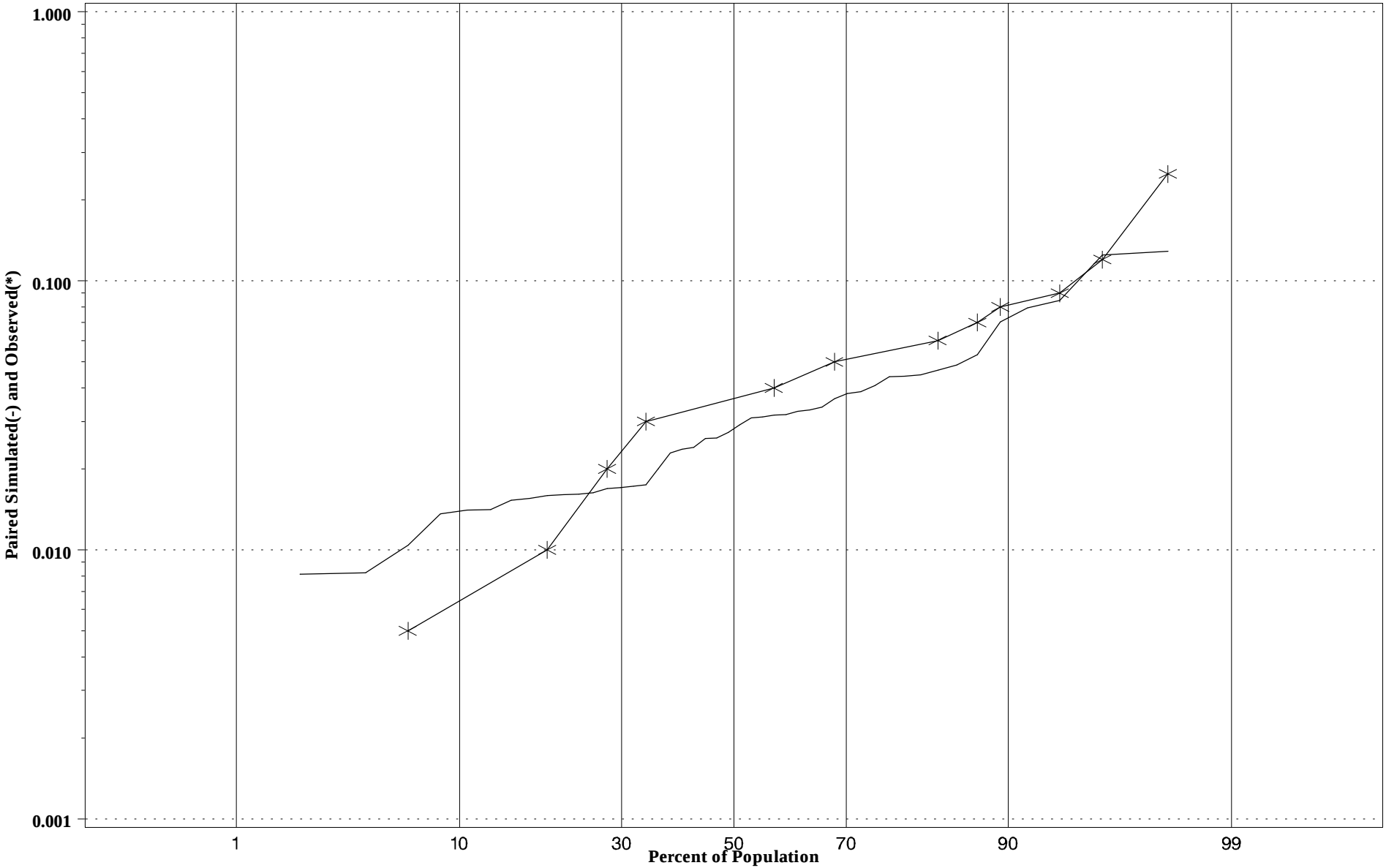



(y21_plotb.sas model3d:[pwang.dt] omerr)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740

## Total Ammonia

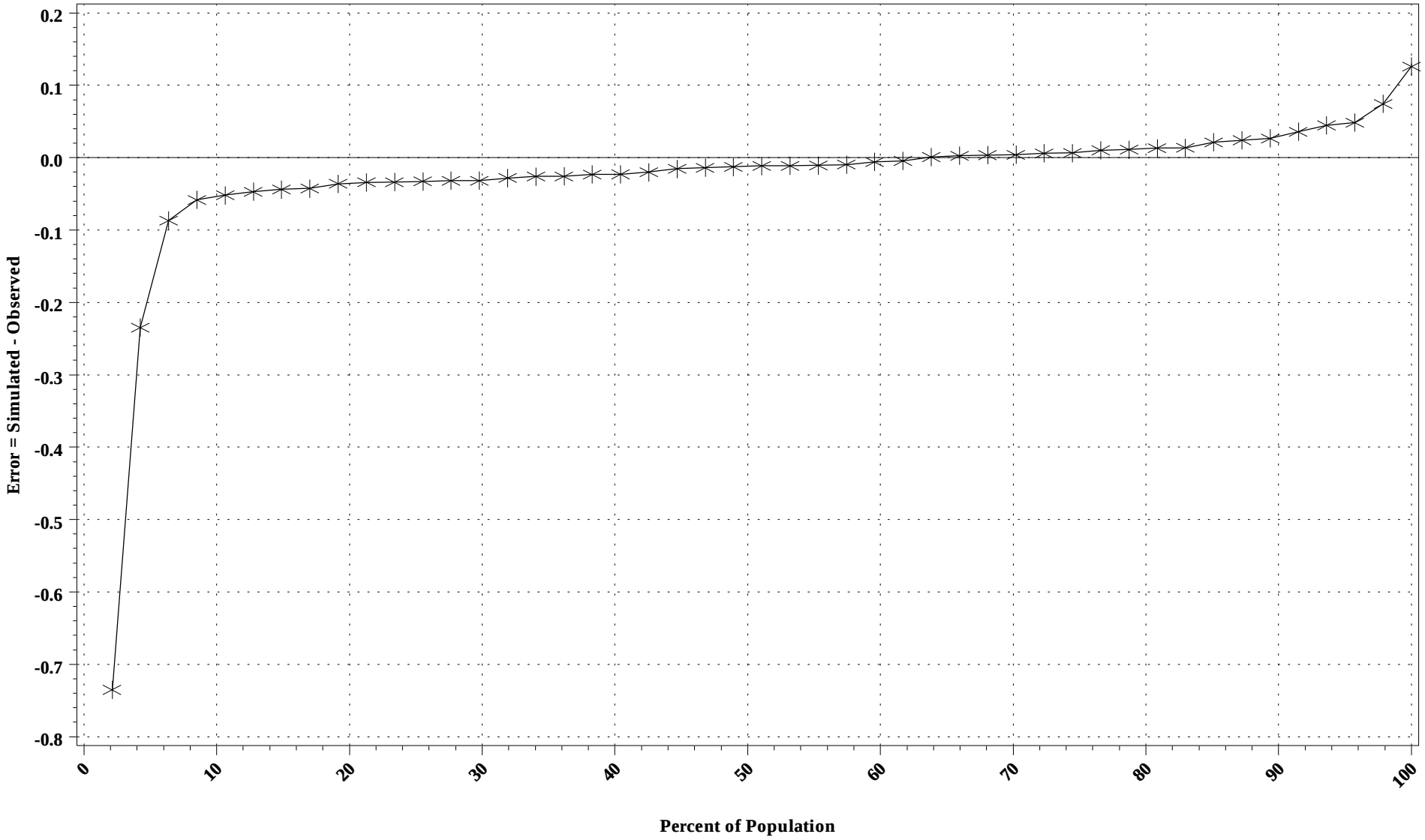
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(mid.drv 25JUN98 12:50)

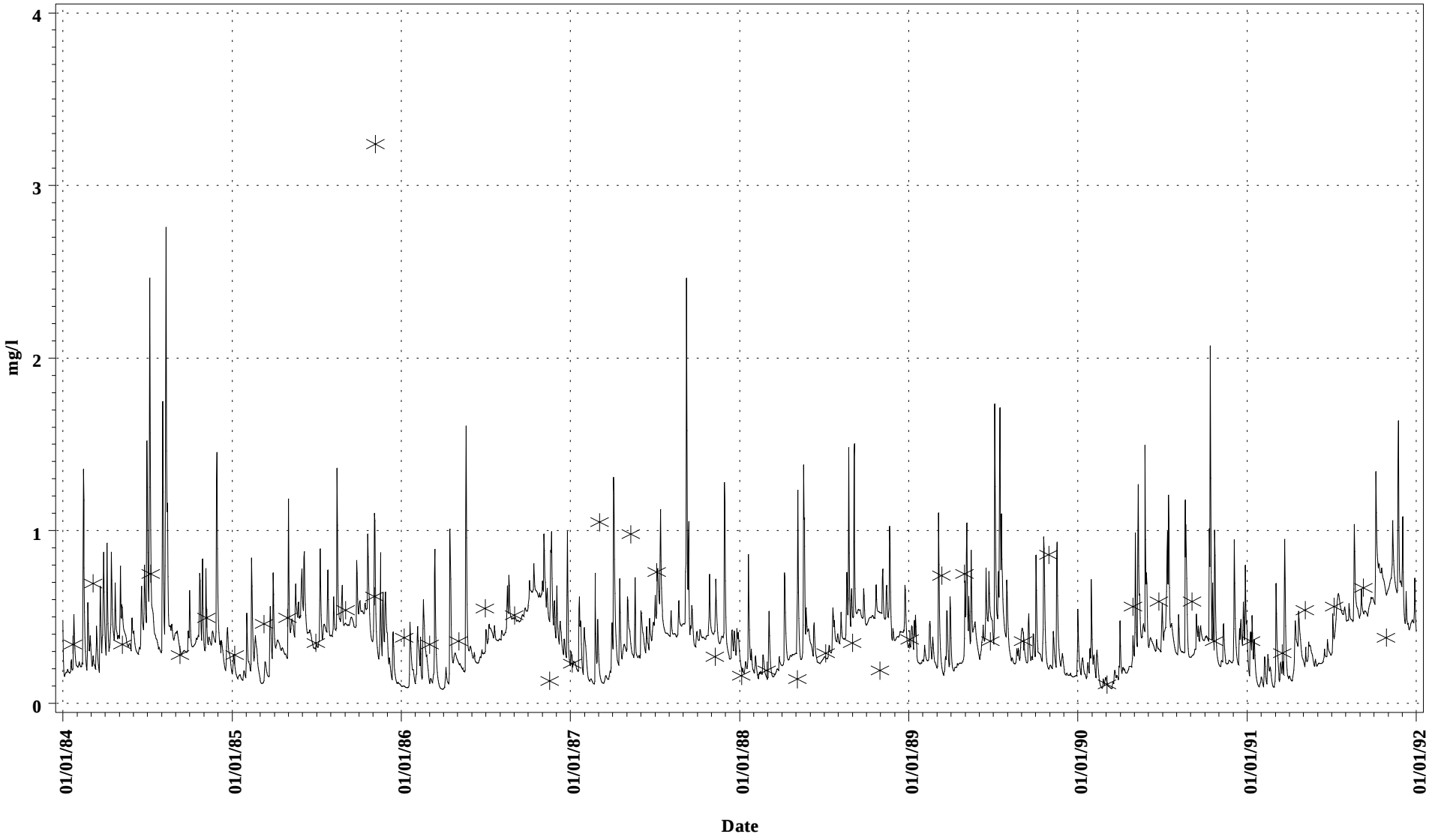
# Mid Potomac River at Segment 740
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data



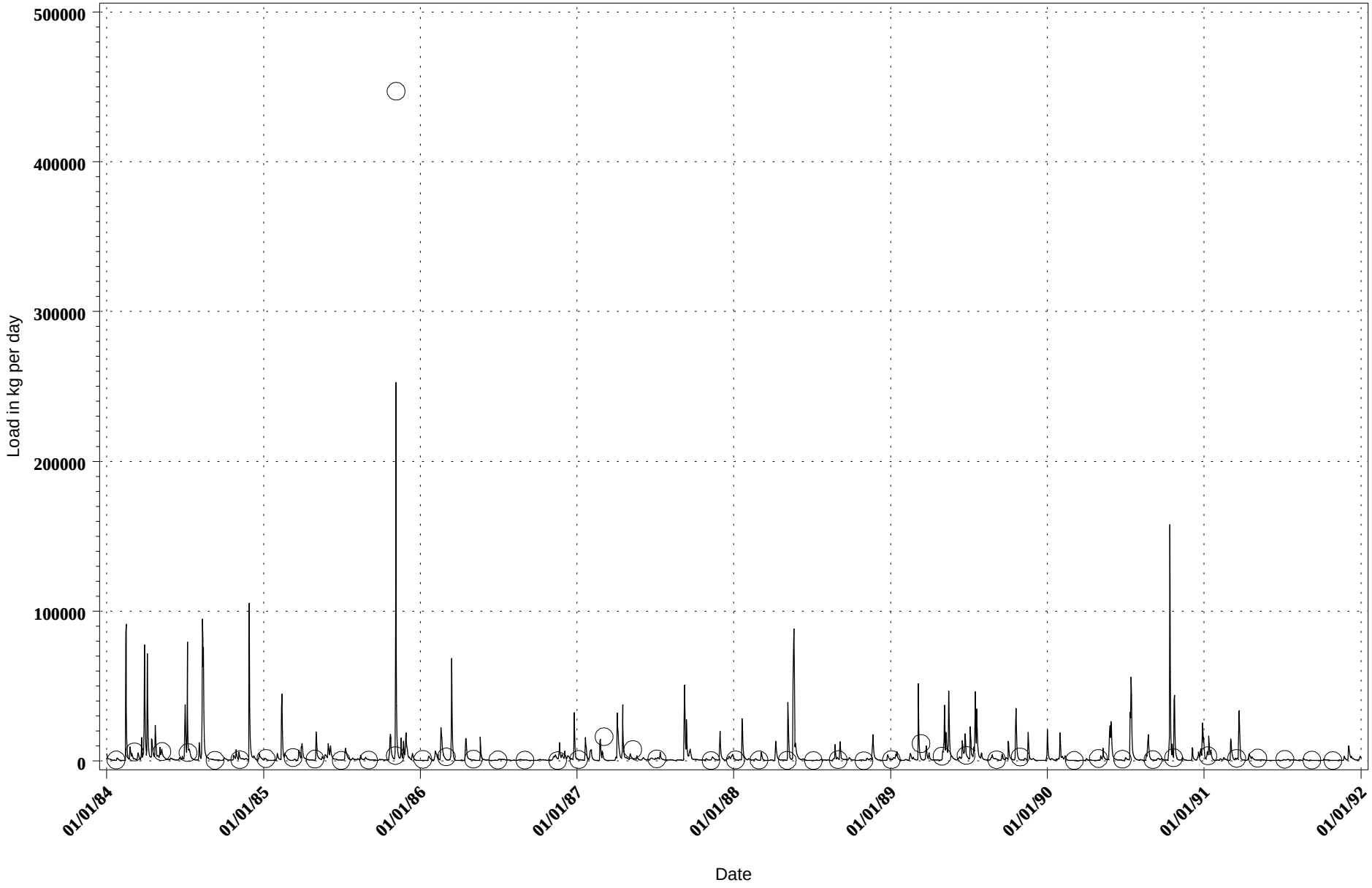

(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Organic Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

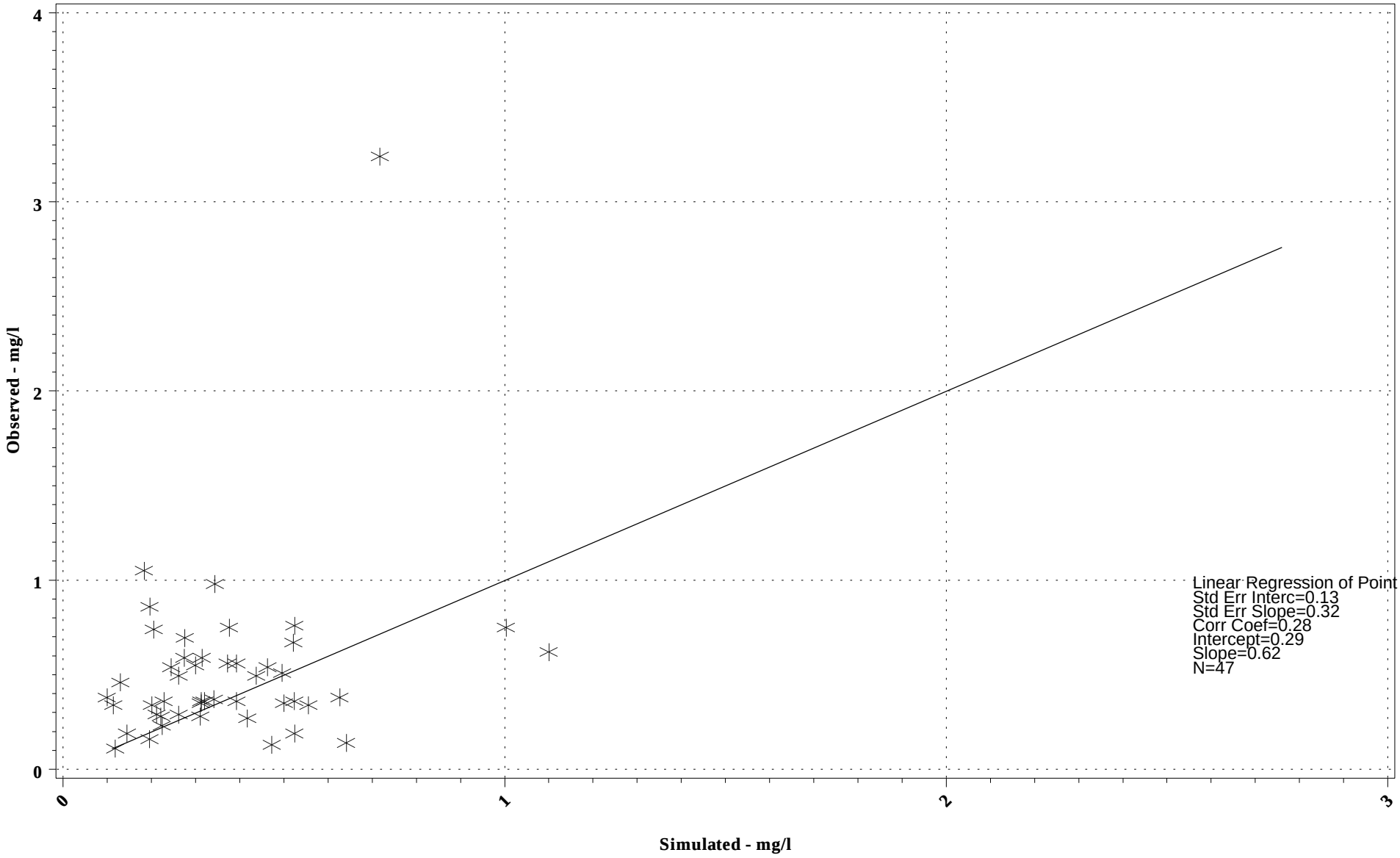



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740

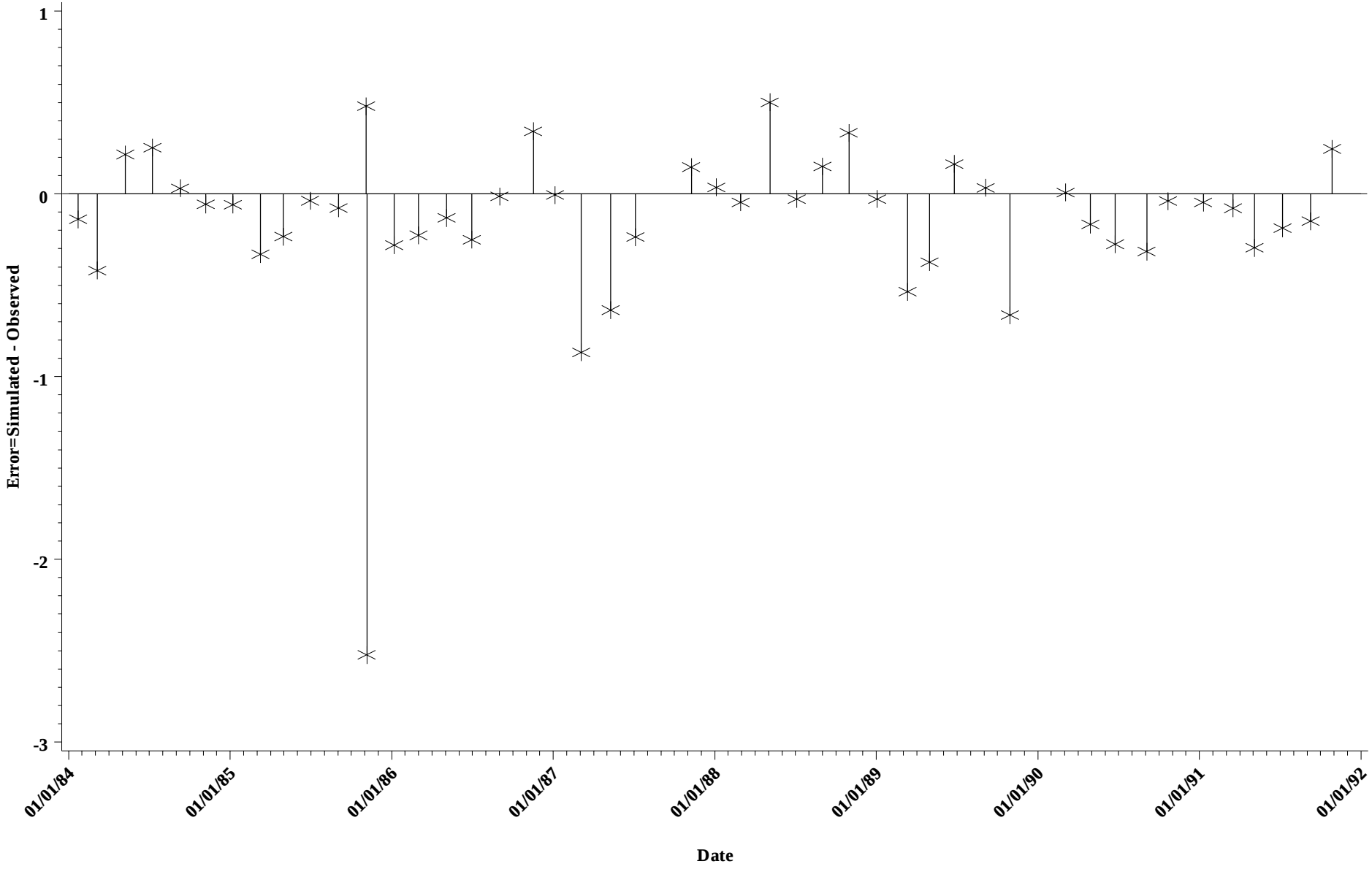
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(mid.drv 25JUN98 12:50,proc reg,model y=x)

# Mid Potomac River at Segment 740
## Actual Error versus Time
## Organic Nitrogen

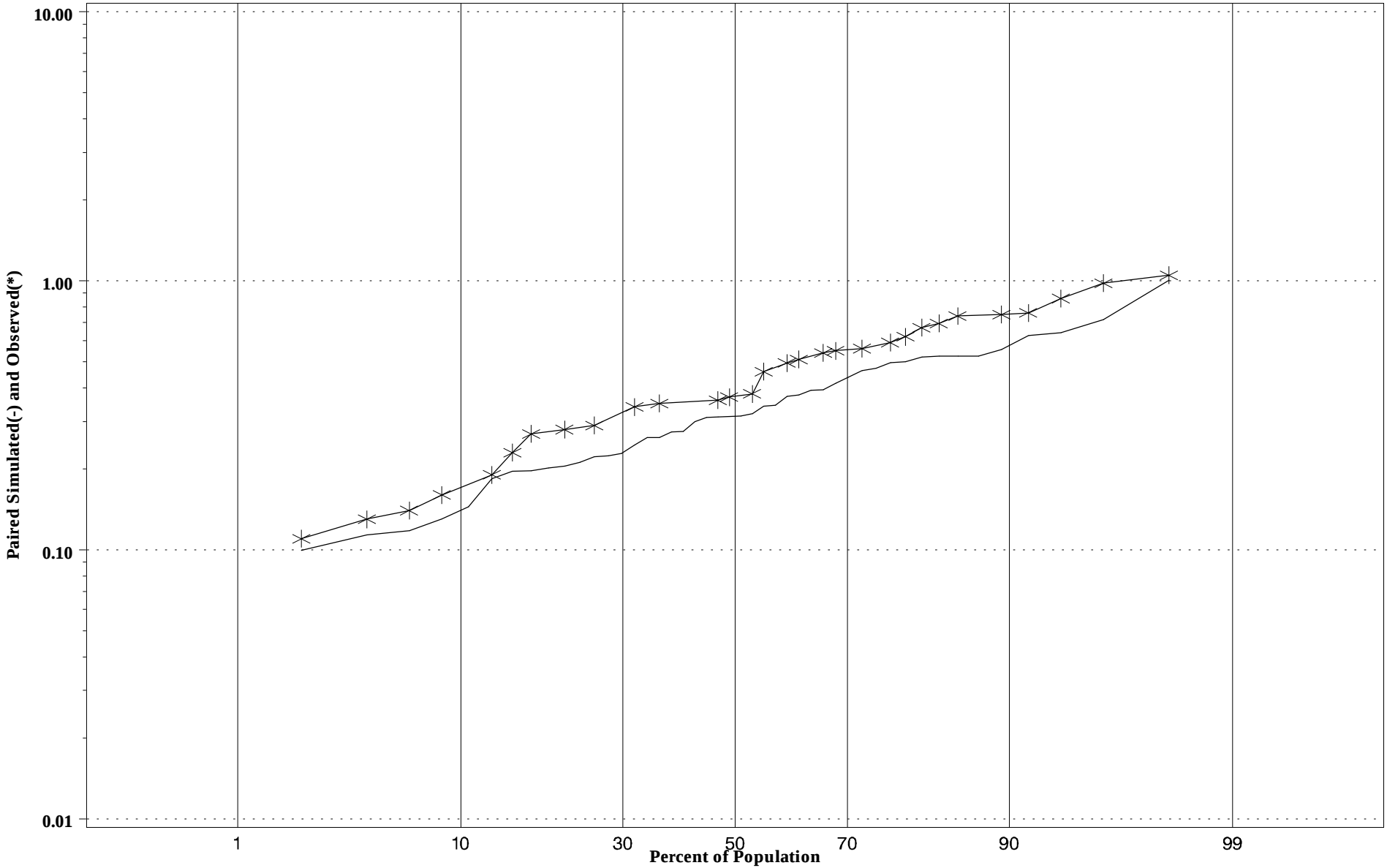



(y21_plotb.sas model3d:[pwang.dt] omerr)
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740

## Organic Nitrogen

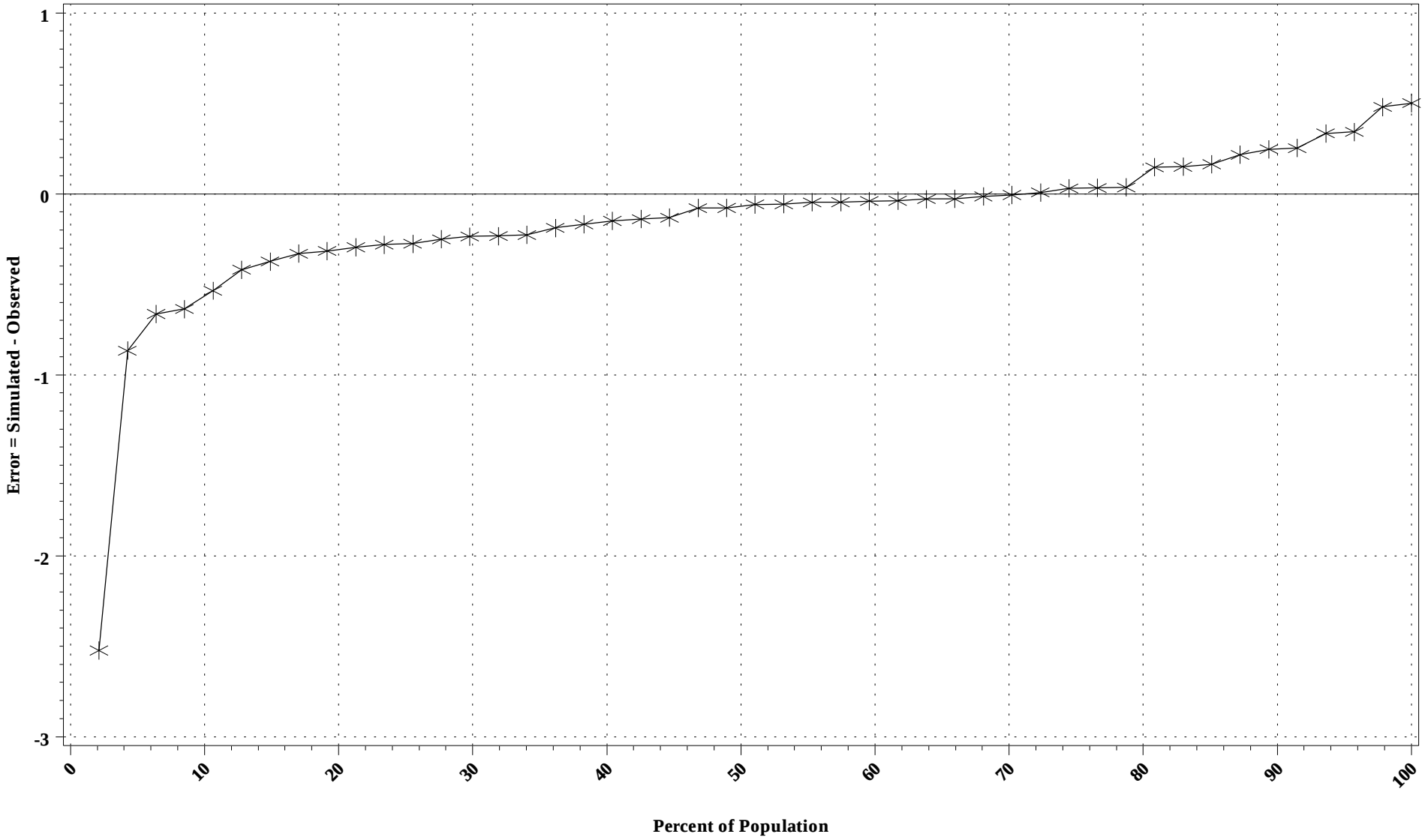
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(mid.drv 25JUN98 12:50)

# Mid Potomac River at Segment 740
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(mid.drv 25JUN98 12:50)

### *B.3.2 Shenandoah River near Millville, WV at Segment 200 (Monitoring Station: 1636500) (Above Fall Line Basin Segments: 190 and 200)*

**Section Summary:**

The Shenandoah basin is largely rural and is dominated by agricultural loads of the Shenandoah Valley. The Shenandoah basin above the gaged site covers an area of 3,033 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 51% forest land, 6% cropland, 34% other agricultural areas, 8% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage decreased from 9.1 million pounds in 1985 to 8.4 million pounds in 1996. Total phosphorus loads over the same time period decreased from 1.5 million pounds to 1.2 million pounds. In general, point source loads above the gage site decreased. In 1996, the total nitrogen point source load was 16% of the total load and the total phosphorus point source load was 32% of the total load. Estimated septic system total nitrogen loads increased 28%, from 0.30 million pounds in 1985 to 0.38 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 32%, and other agricultural loads (primarily pasture and manure loads) by 11%. Total phosphorus decreased for these land uses by 23% and 25% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 35% for total nitrogen and 30% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

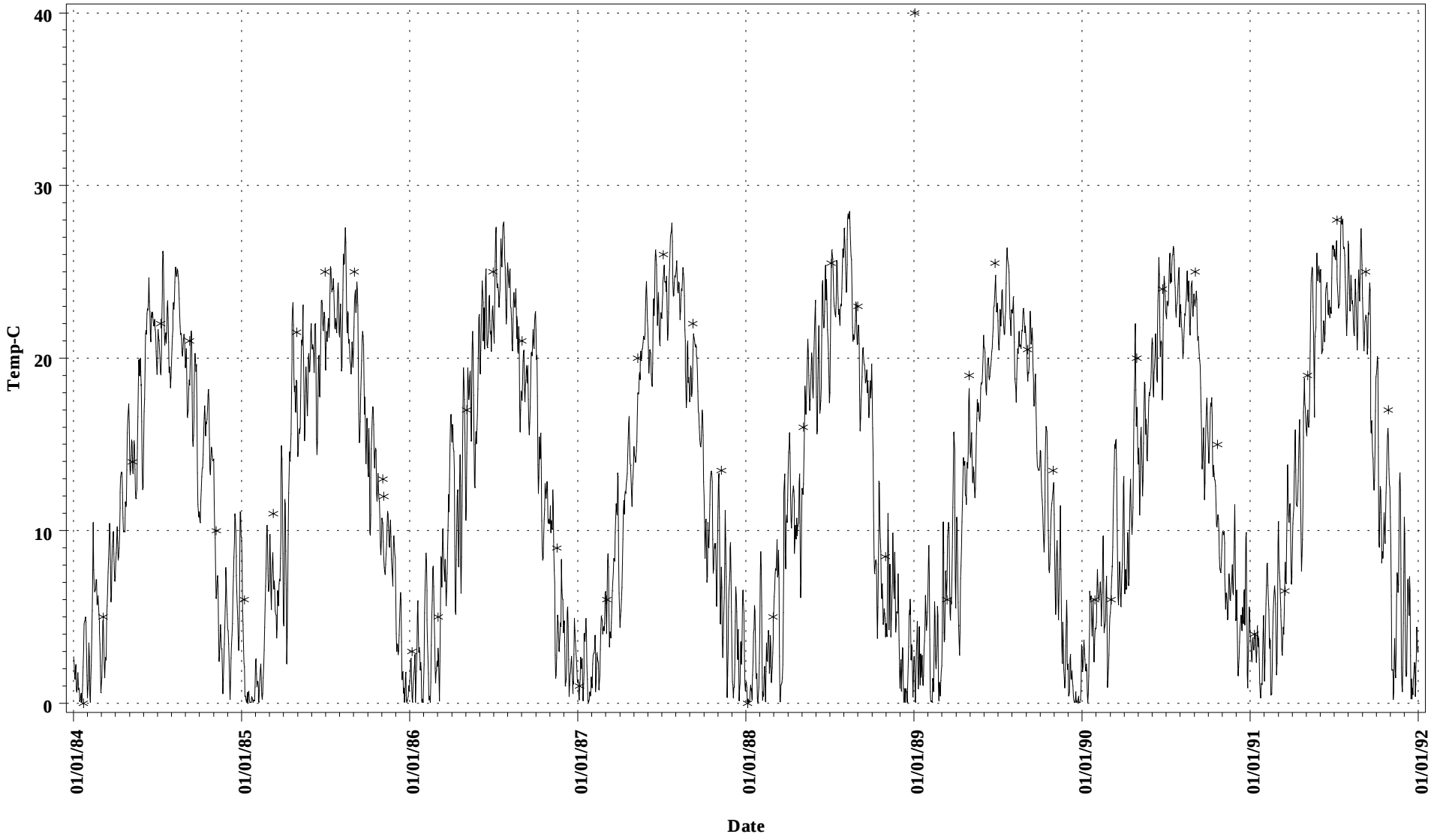
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# Shenadoah River at Segment 200
## Observed and Simulated versus Time
## Temperature-C

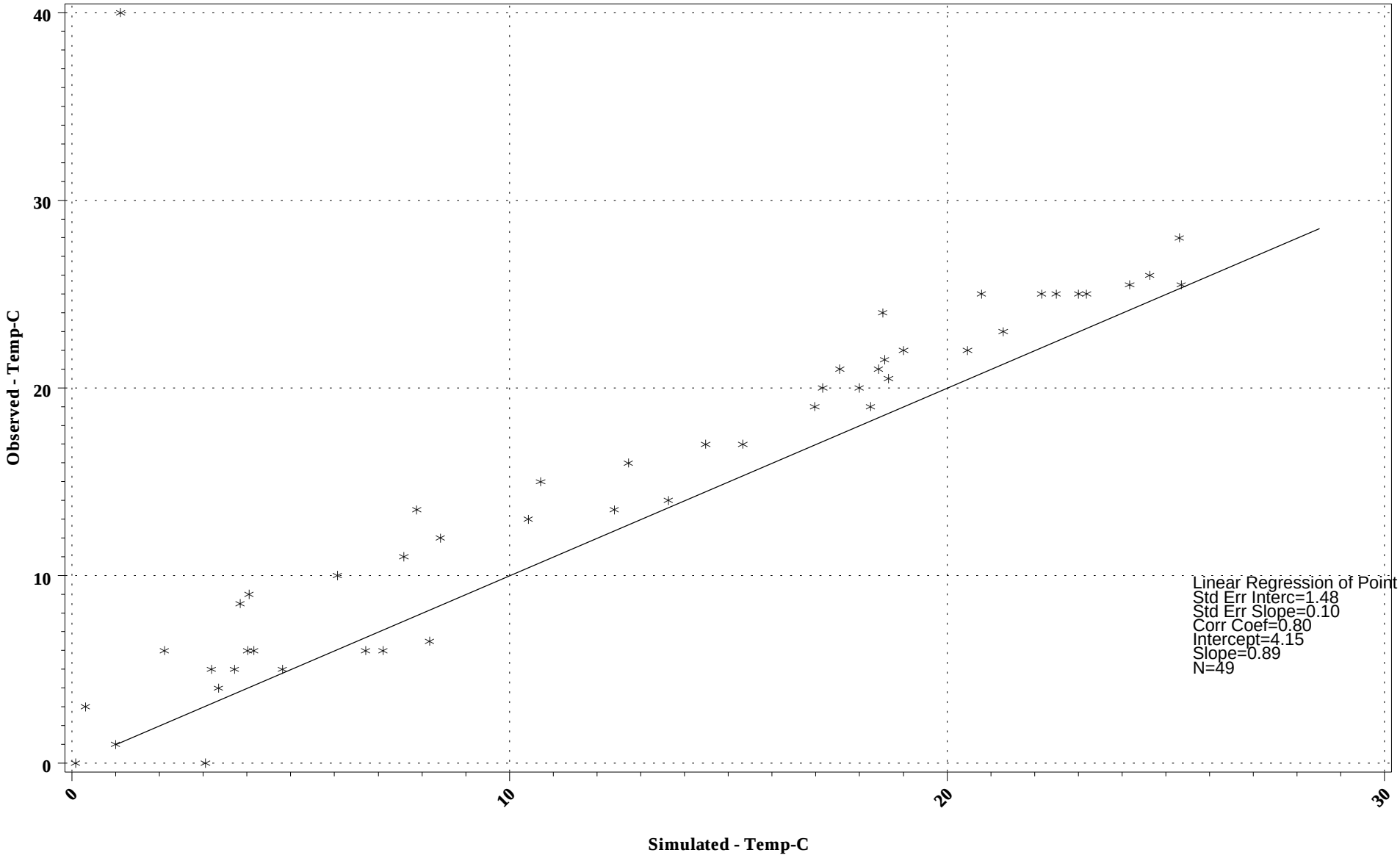
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(sh.drv 26JUN98 12:42)

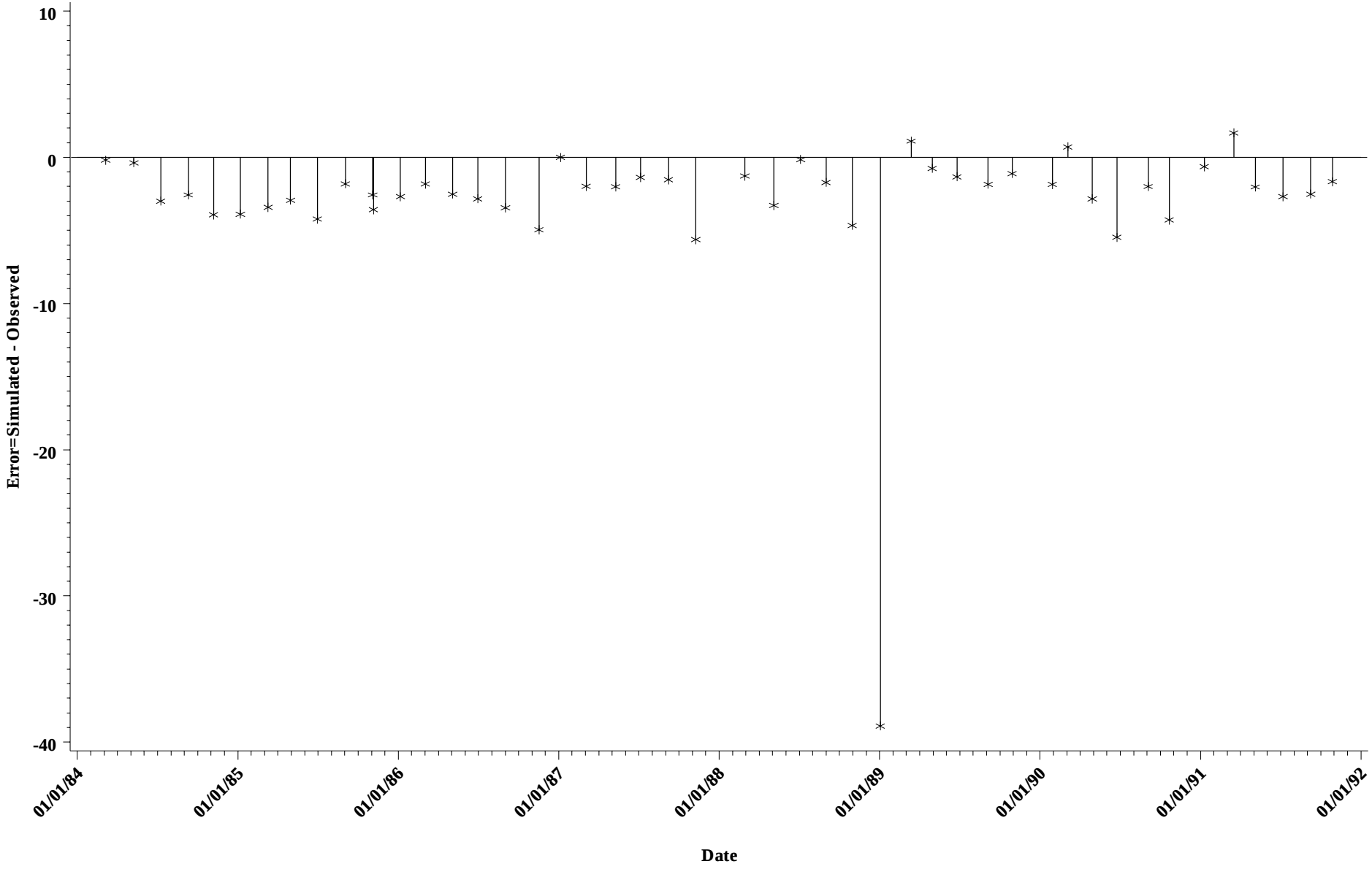
# Shenadoah River at Segment 200

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200
## Actual Error versus Time
## Temperature-C

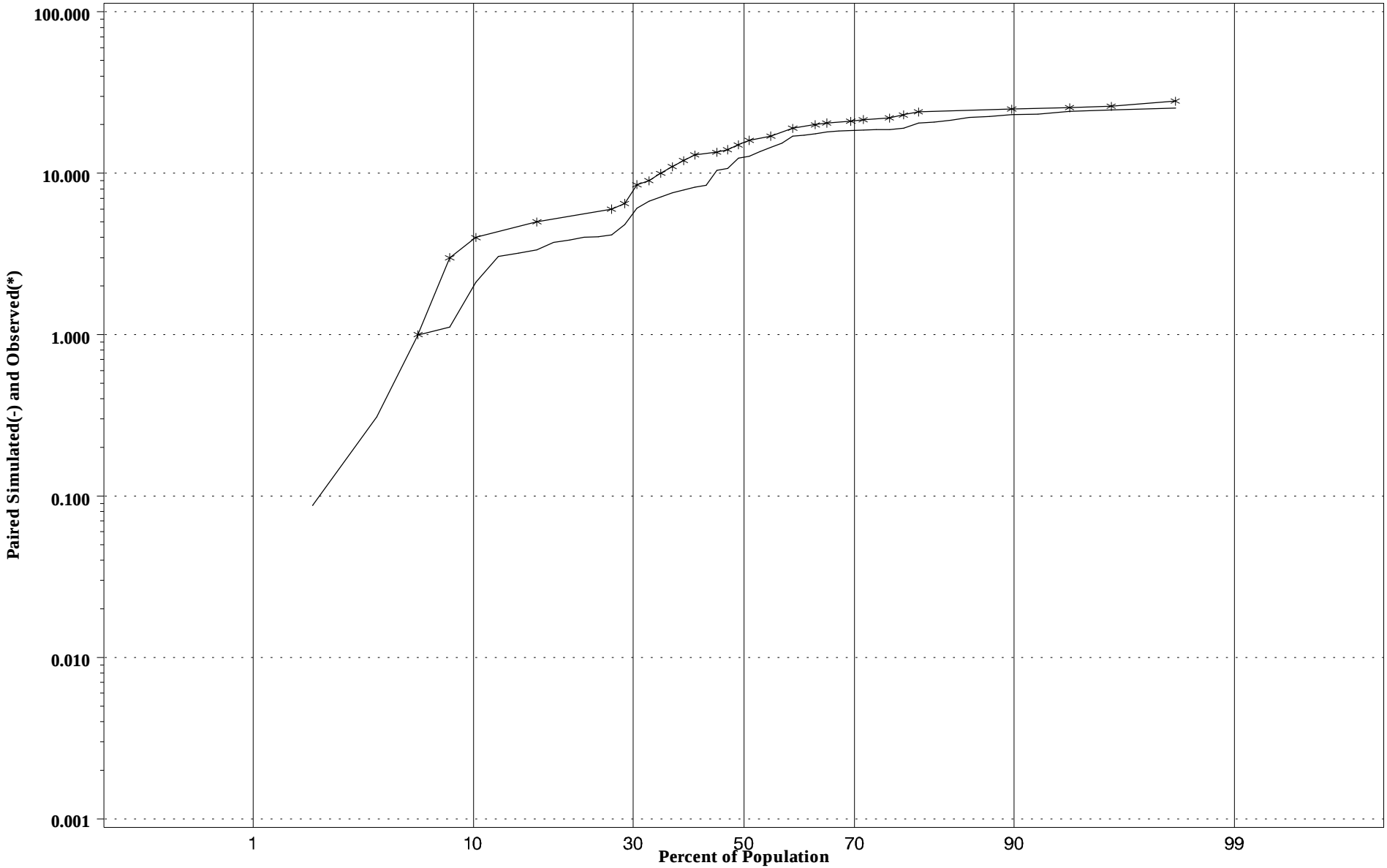



(y21_plotb.sas model3d:[pwang.dt] omerr)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200

## Temperature-C

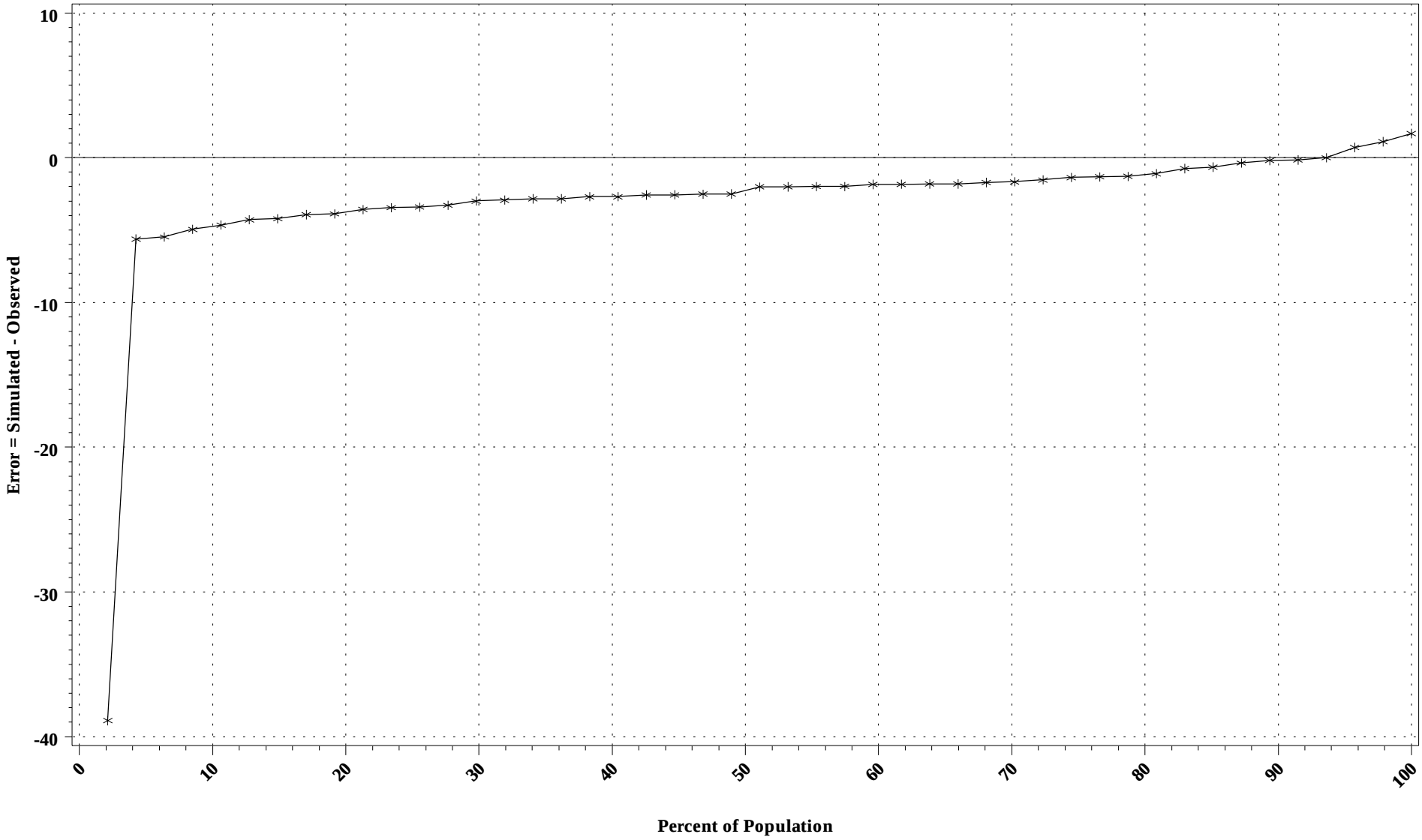
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Actual error versus Percentile Sample Population
## Temperature-C

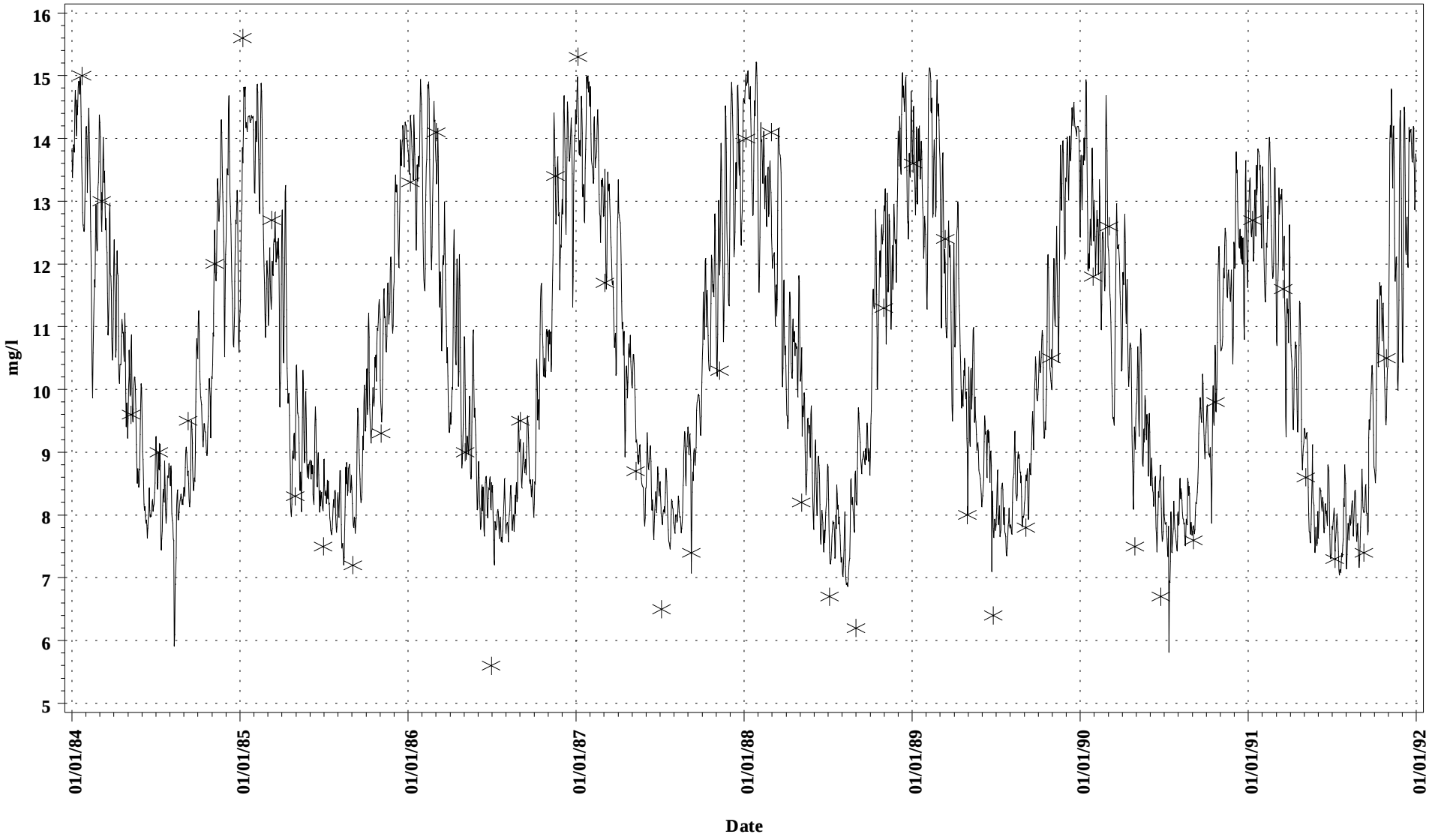
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(sh.drv 26JUN98 12:42)

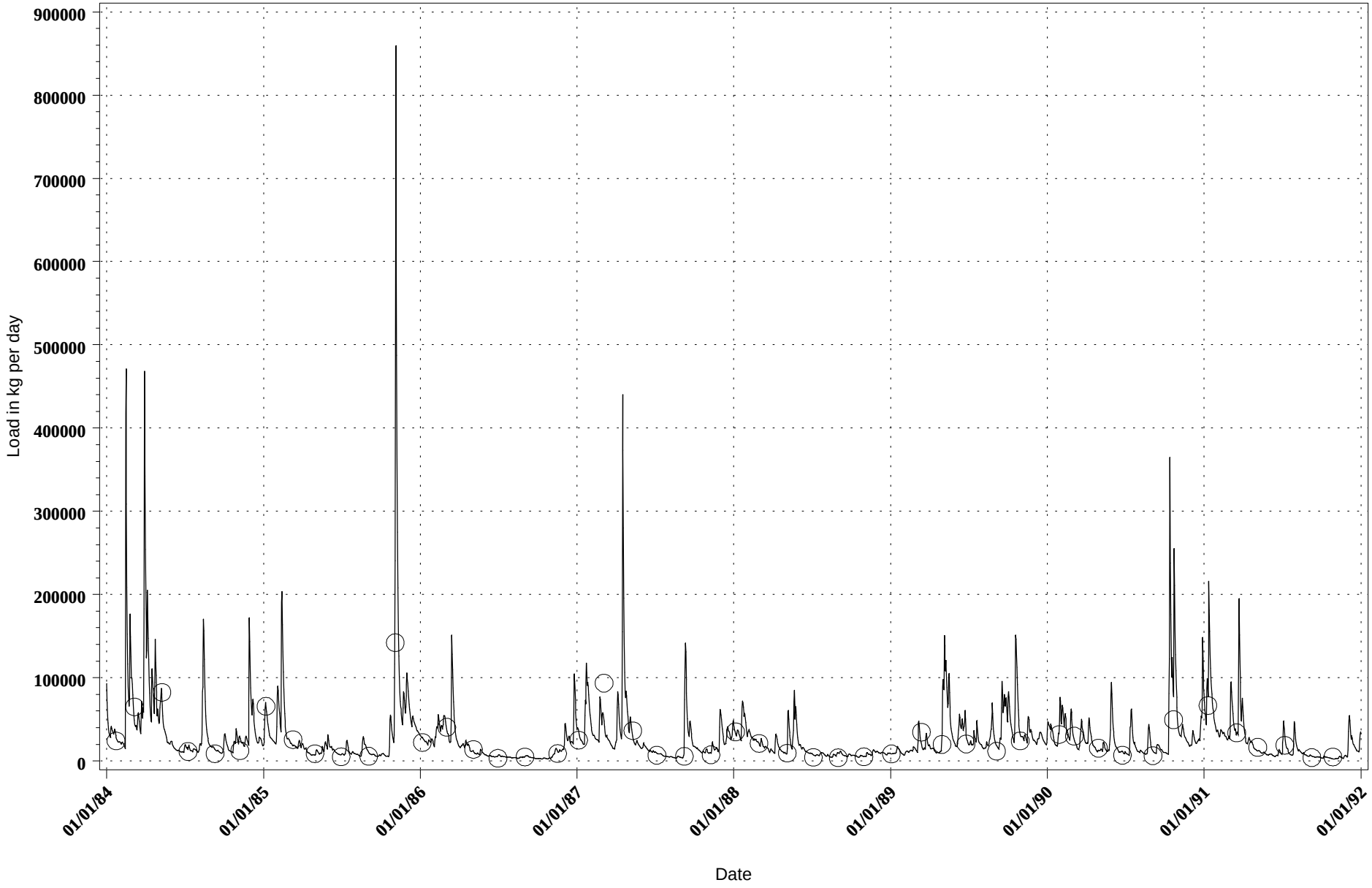
# Shenadoah River at Segment 200
## Observed and Simulated versus Time
# Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(sh.drv 26JUN98 12:42)

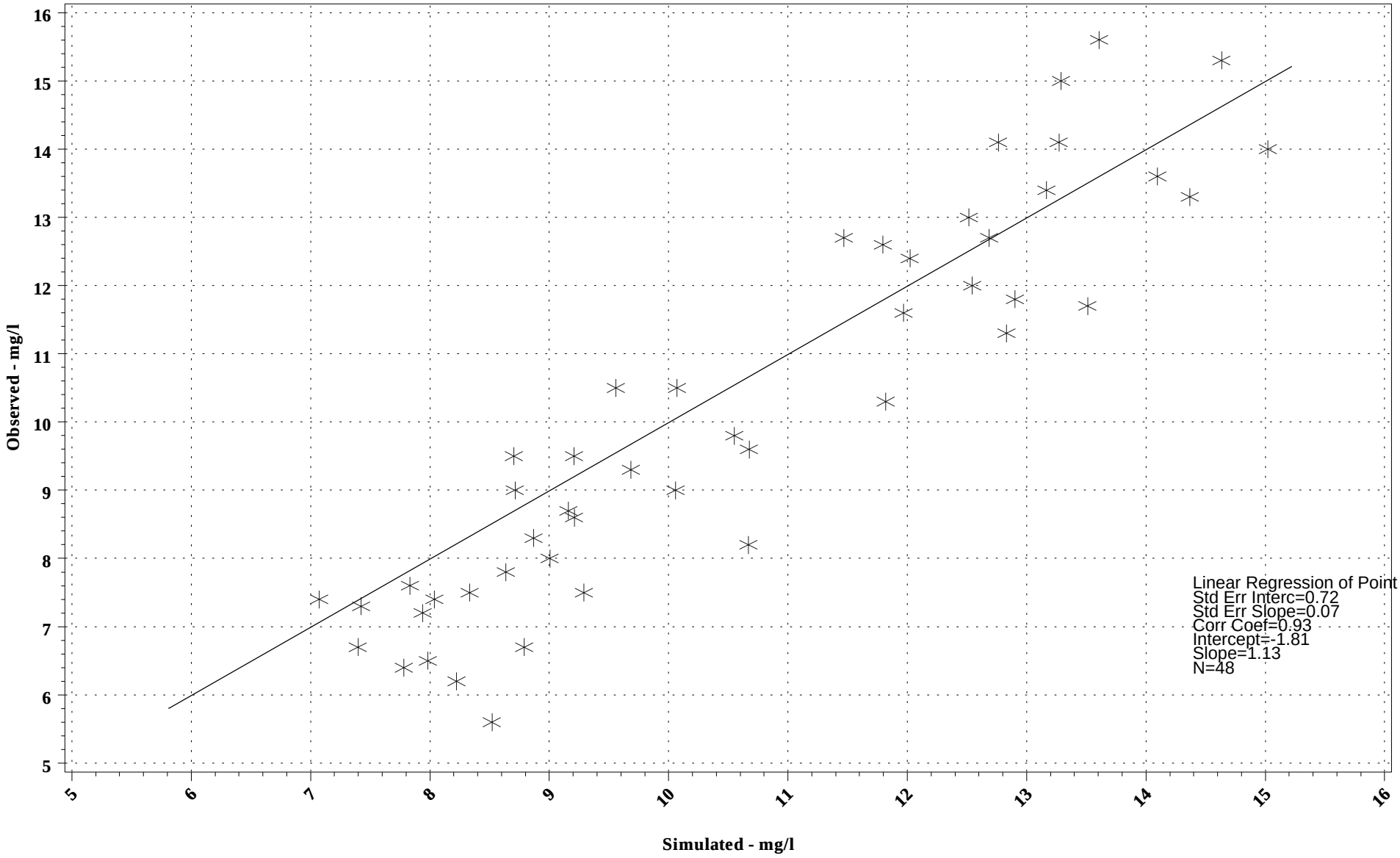
# Shenadoah River at Segment 200
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)




(y21_plotb.sas model3d:[pwang.dt] lldflas)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

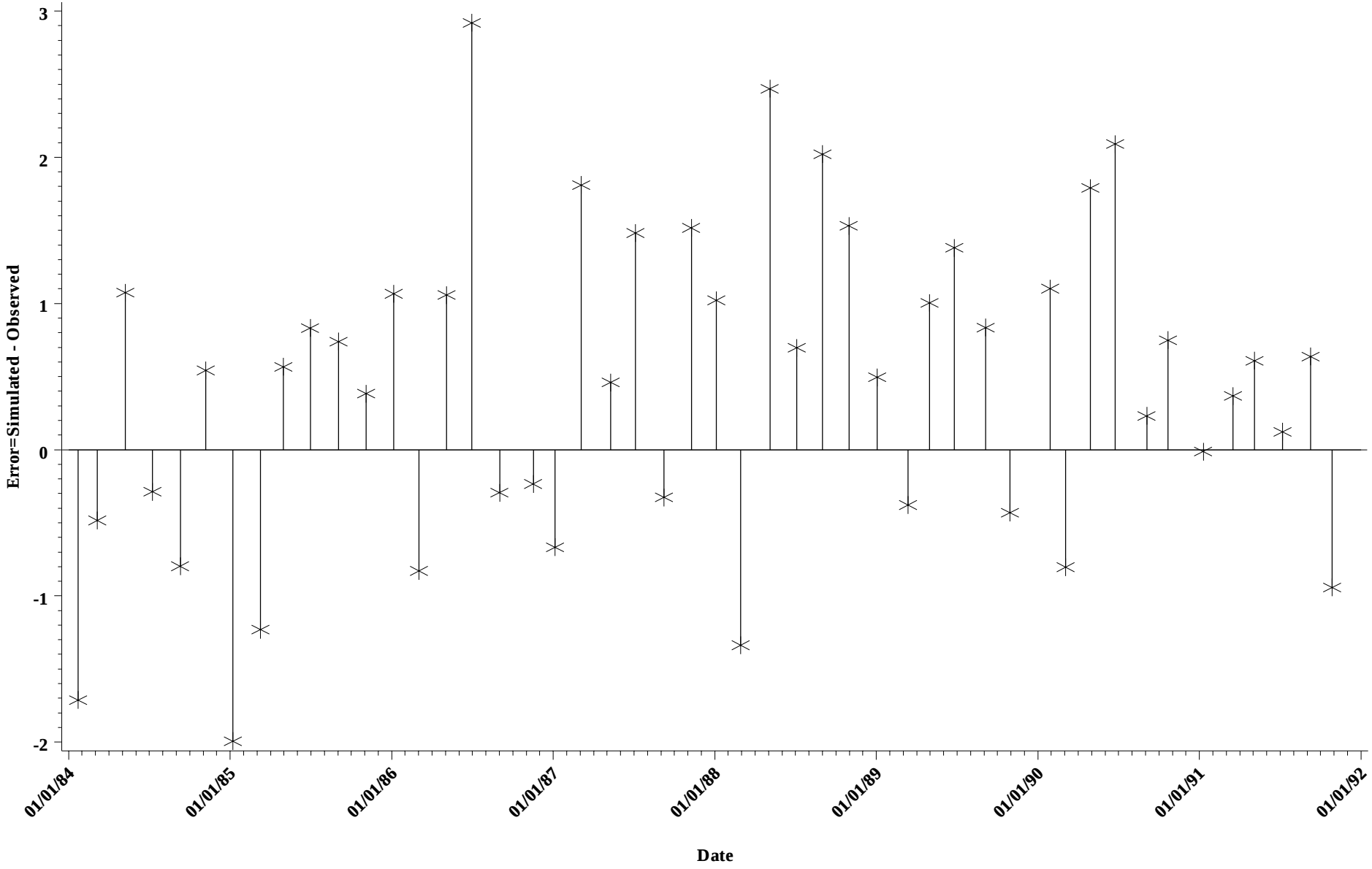
# Shenadoah River at Segment 200

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Dissolved Oxygen: 01JAN84 - 01JAN92



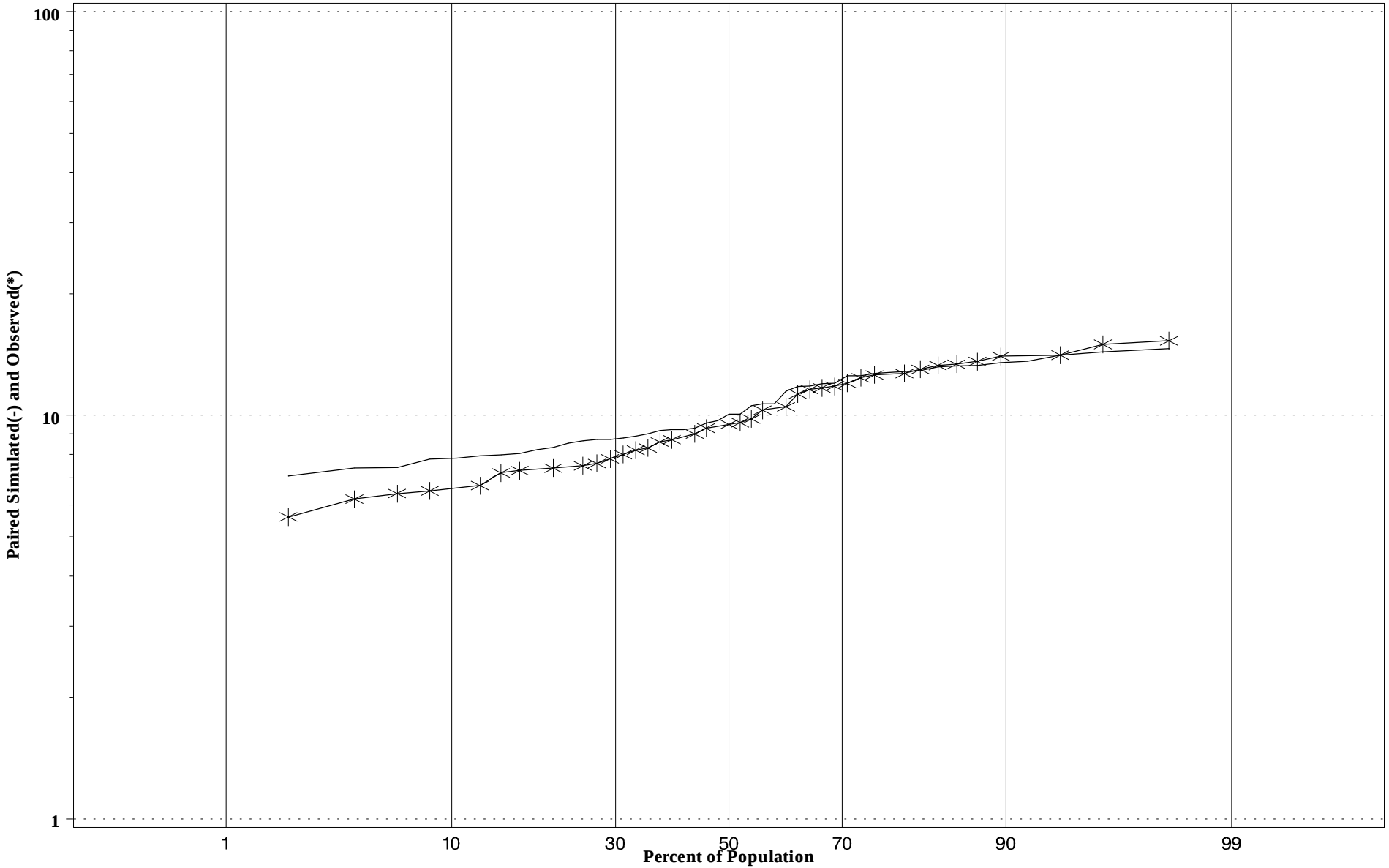

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(sh.drv 26JUN98 12:42)

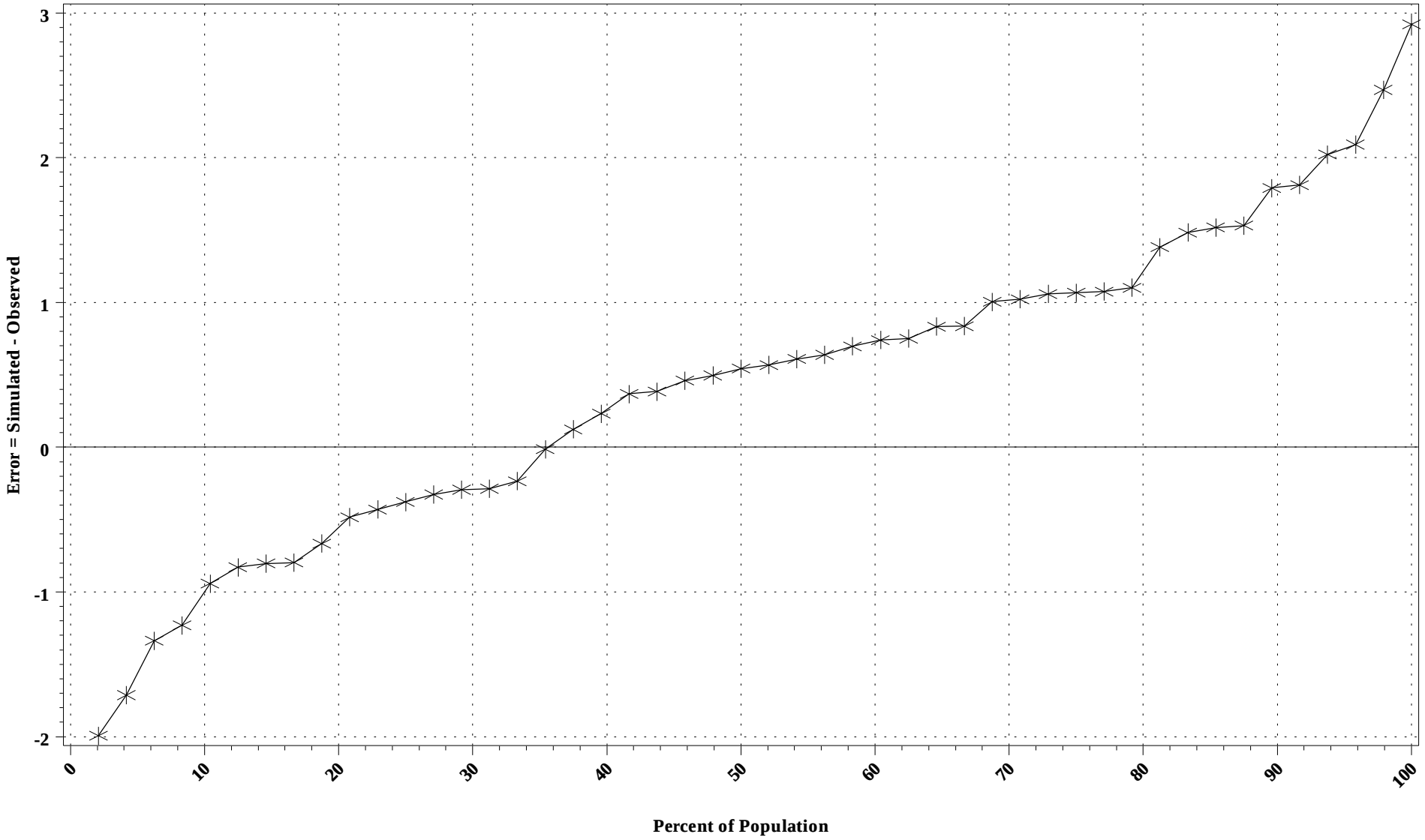
# Shenadoah River at Segment 200
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

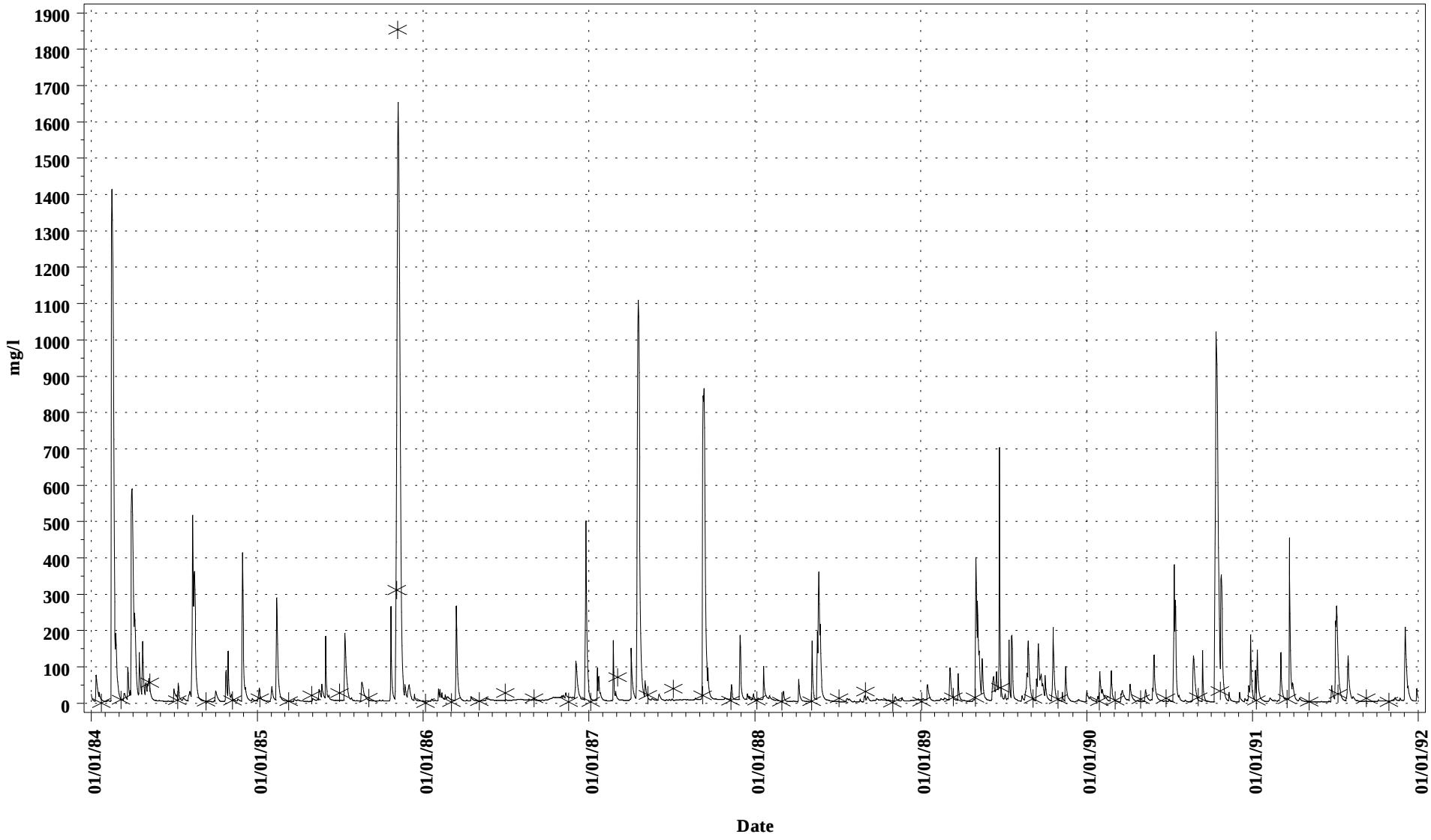
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(sh.drv 26JUN98 12:42)

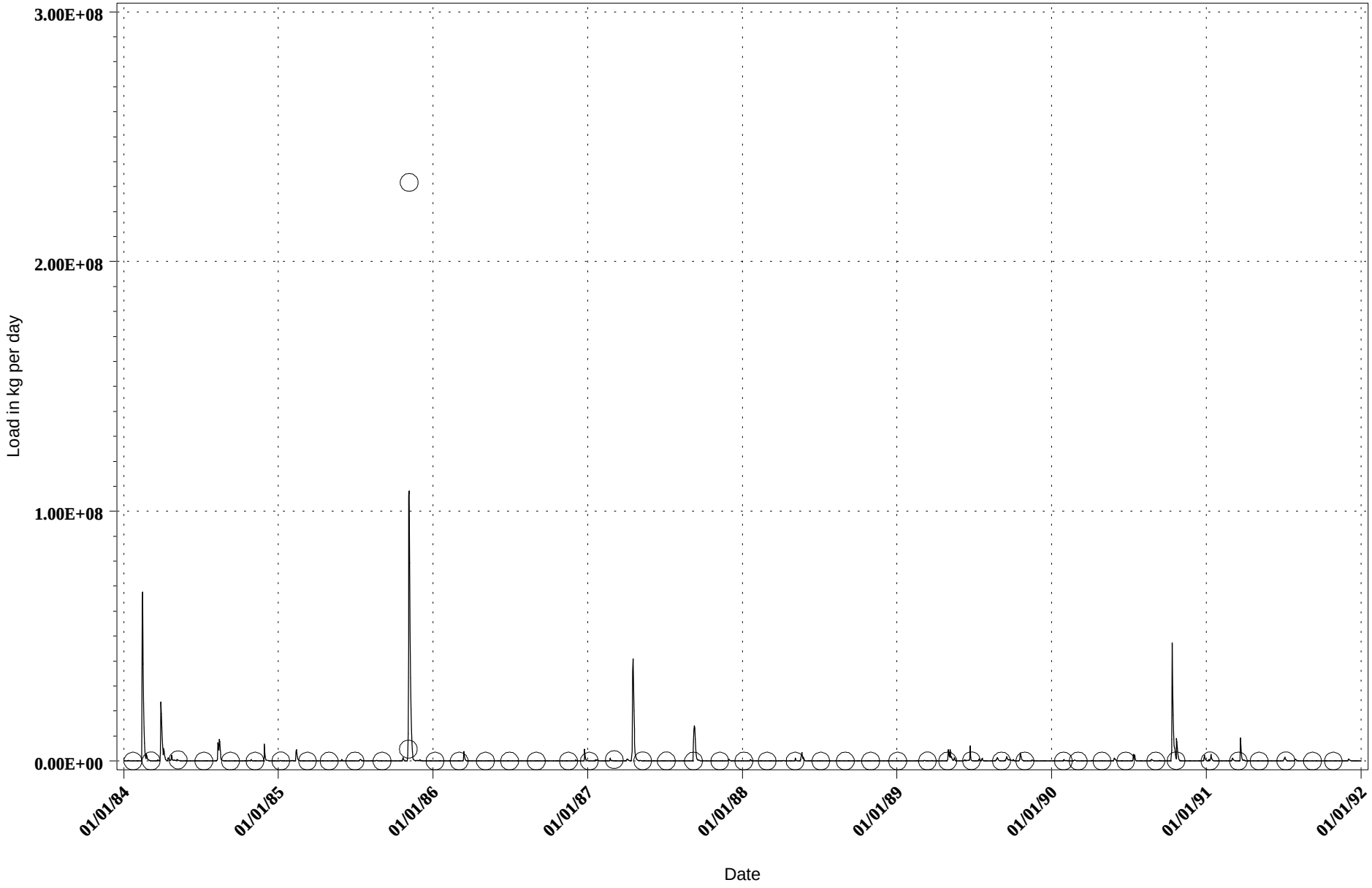
# Shenadoah River at Segment 200
## Observed and Simulated versus Time
# Total Suspended Sediment

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Total Suspended Sediment Observed and Simulated Load vs Time
### (line = simulated, O = observed)

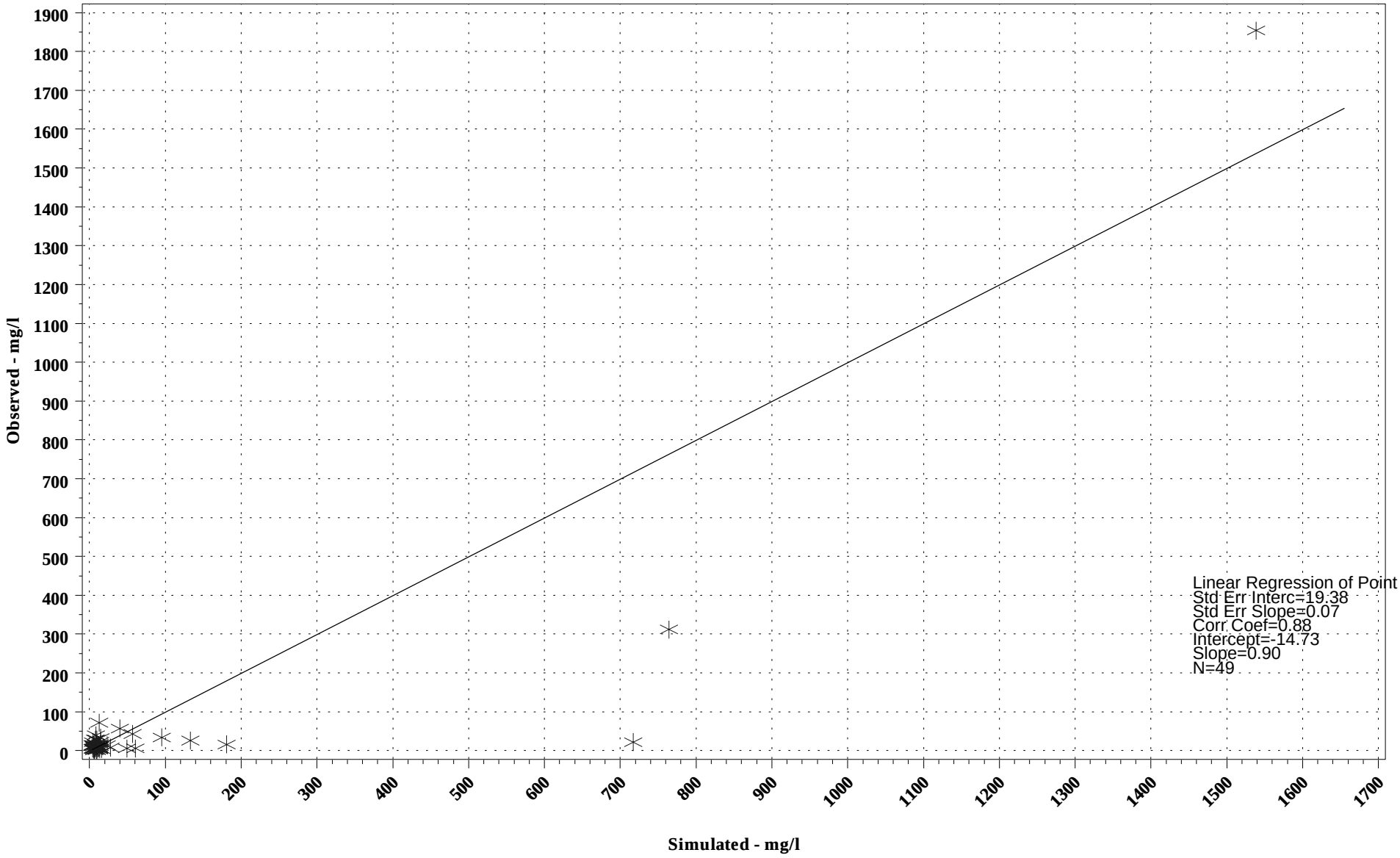



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200

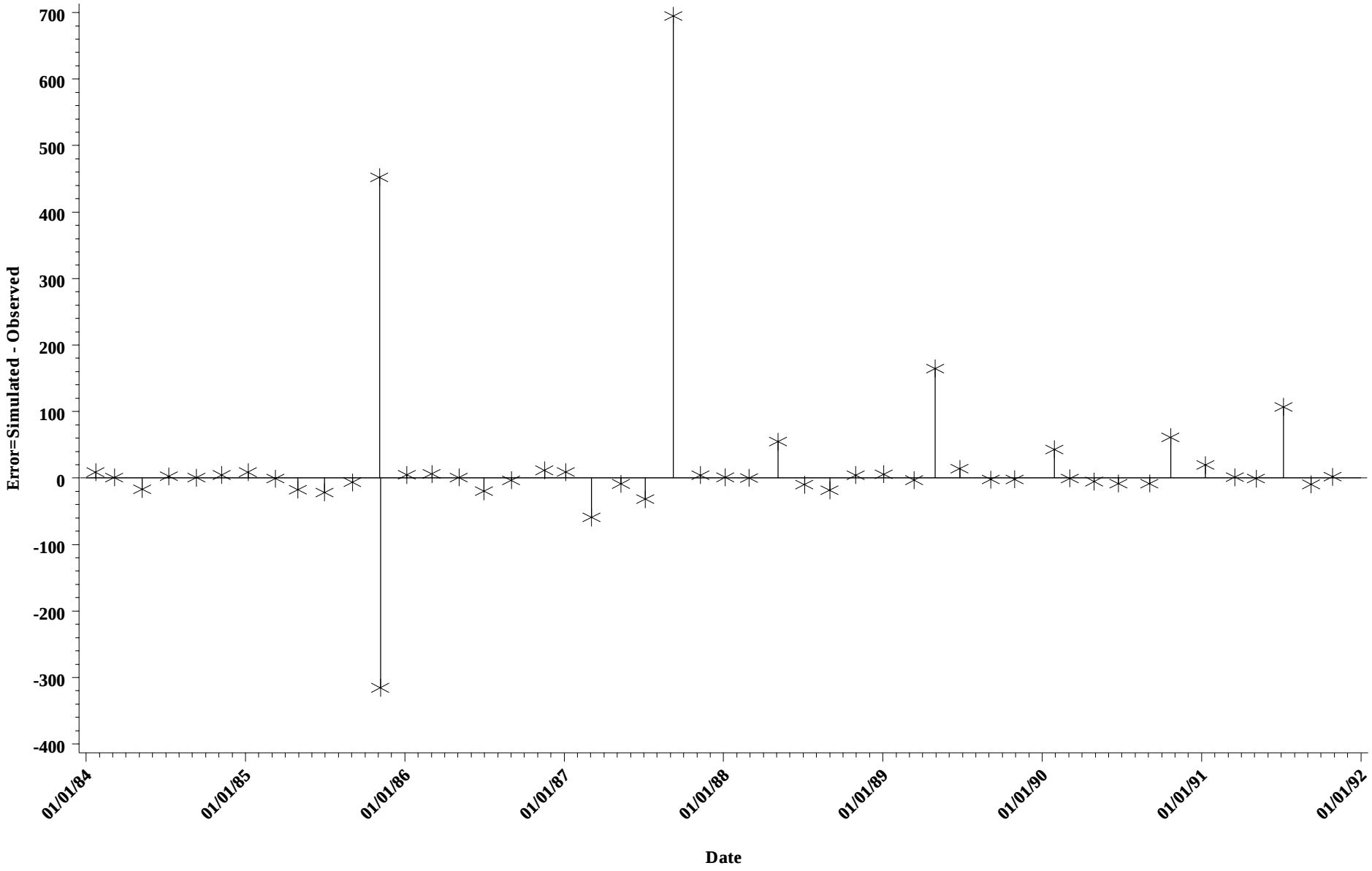
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



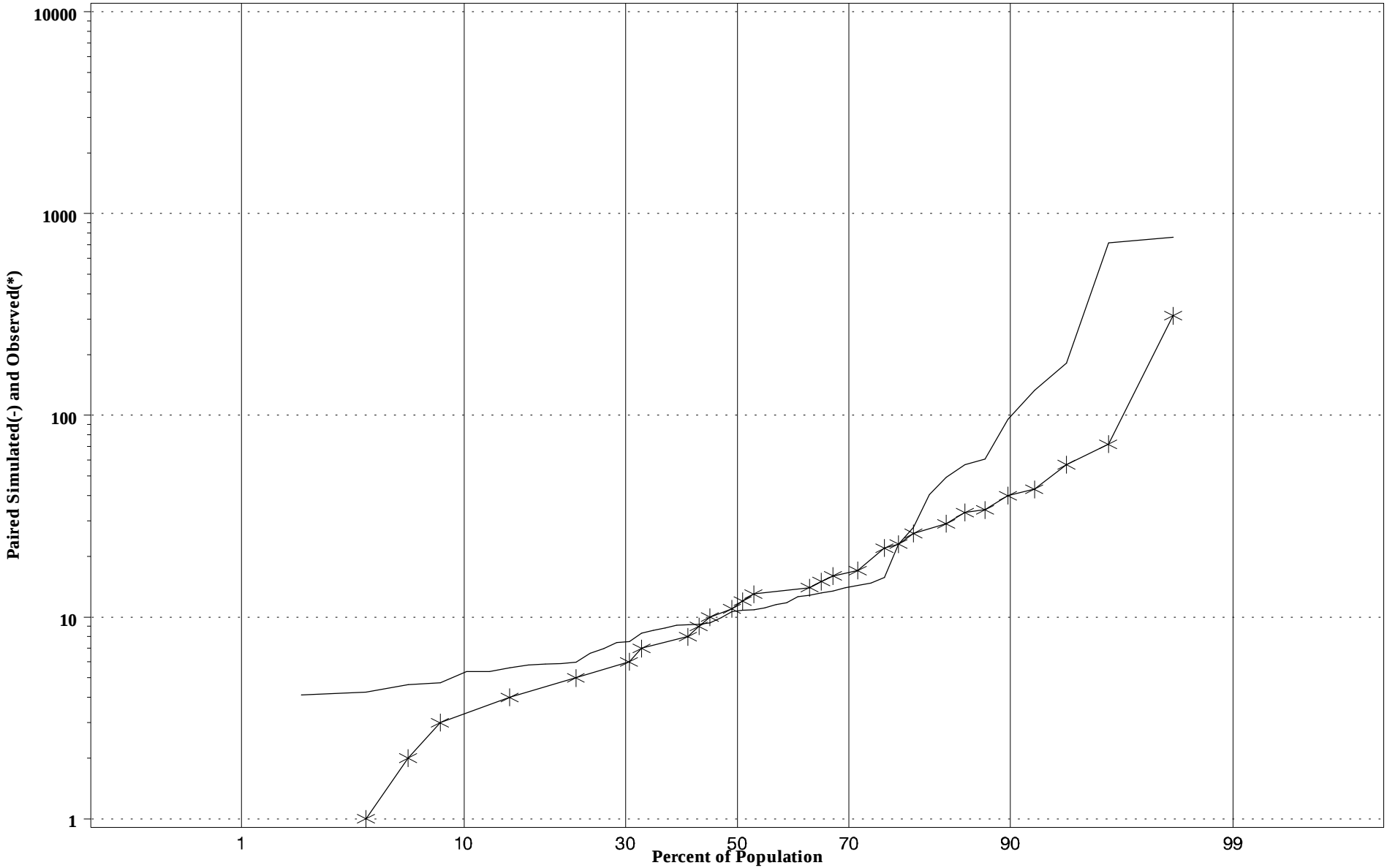

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(sh.drv 26JUN98 12:42)

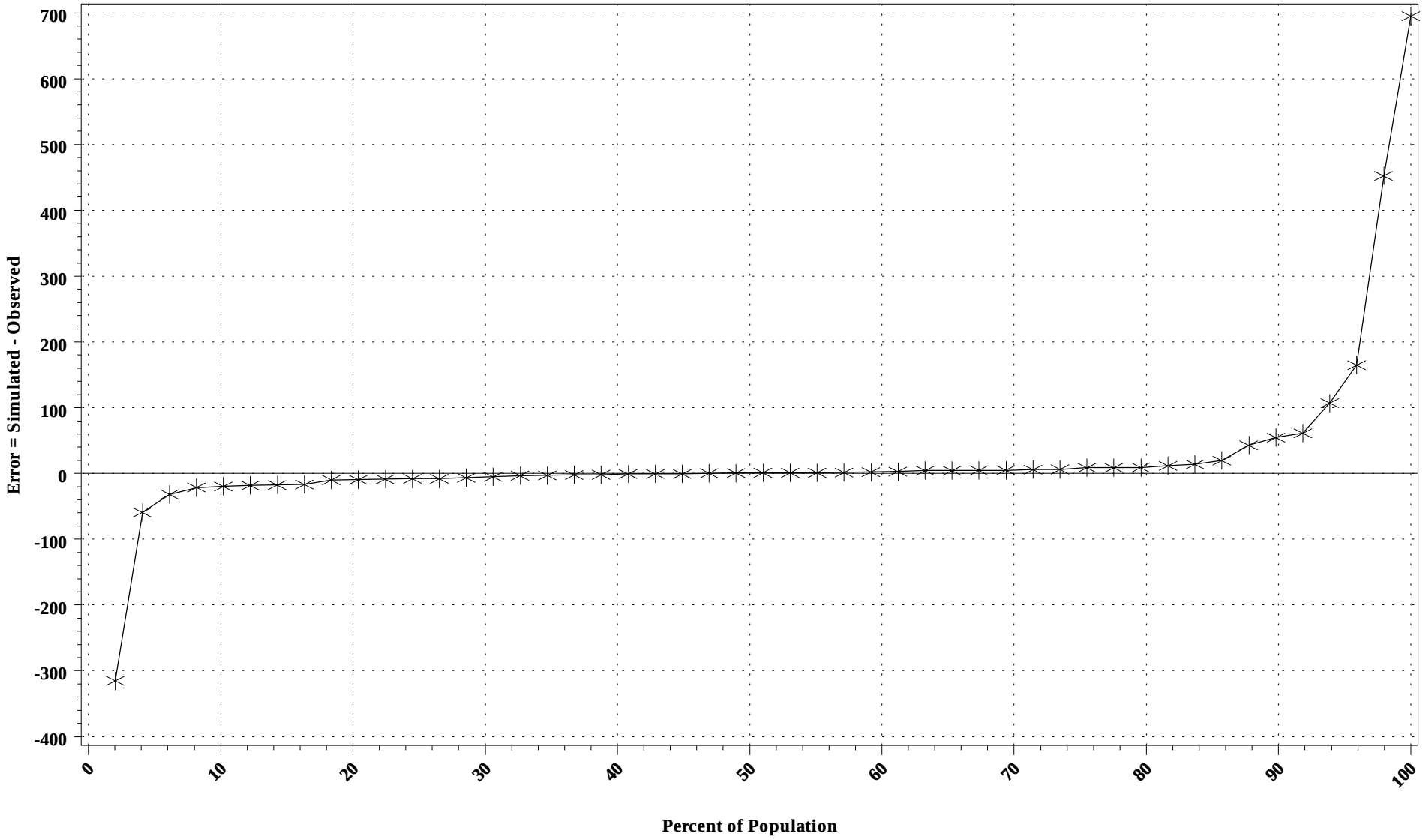
# Shenadoah River at Segment 200
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

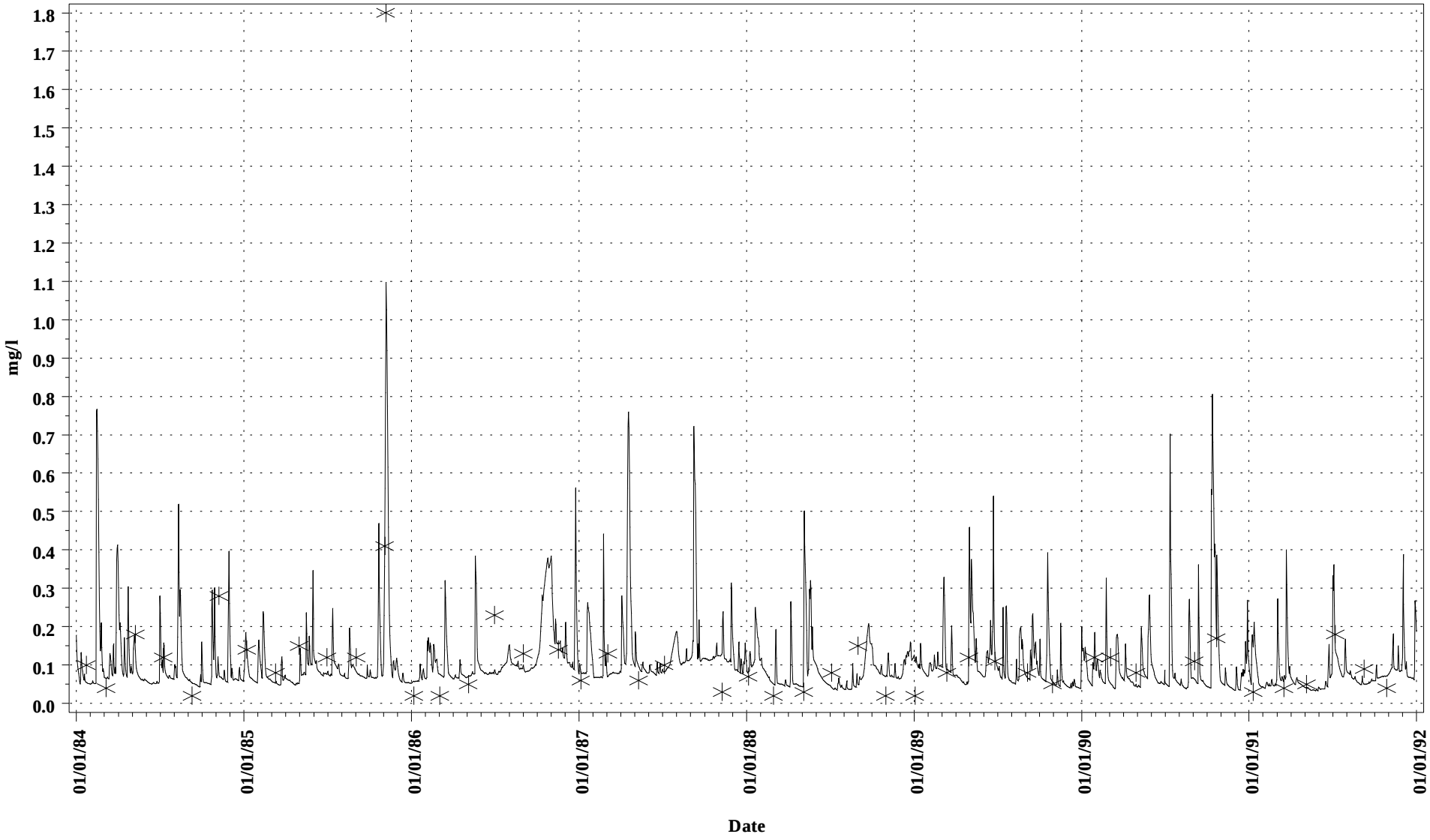
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(sh.drv 26JUN98 12:42)

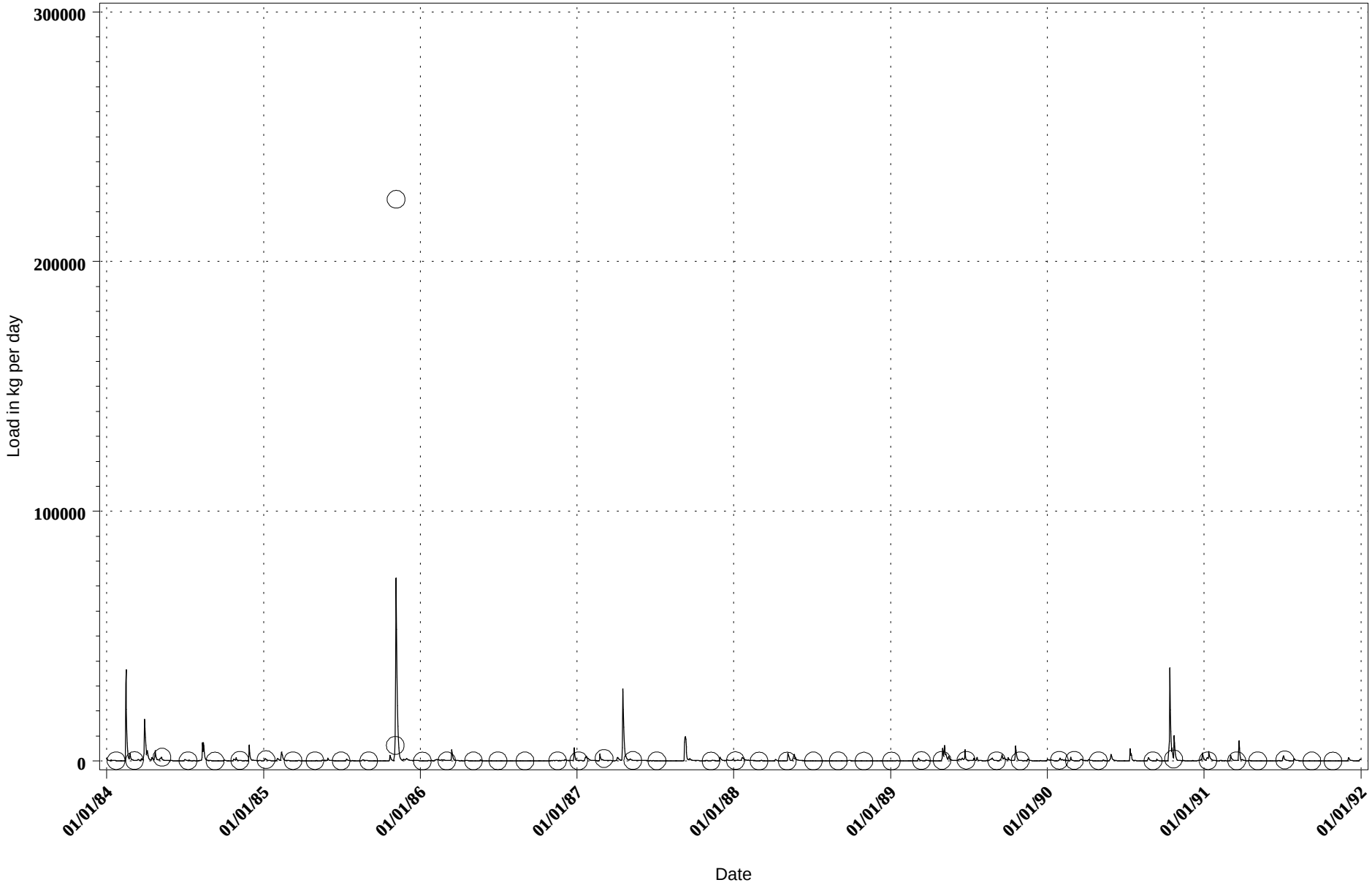
# Shenadoah River at Segment 200
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

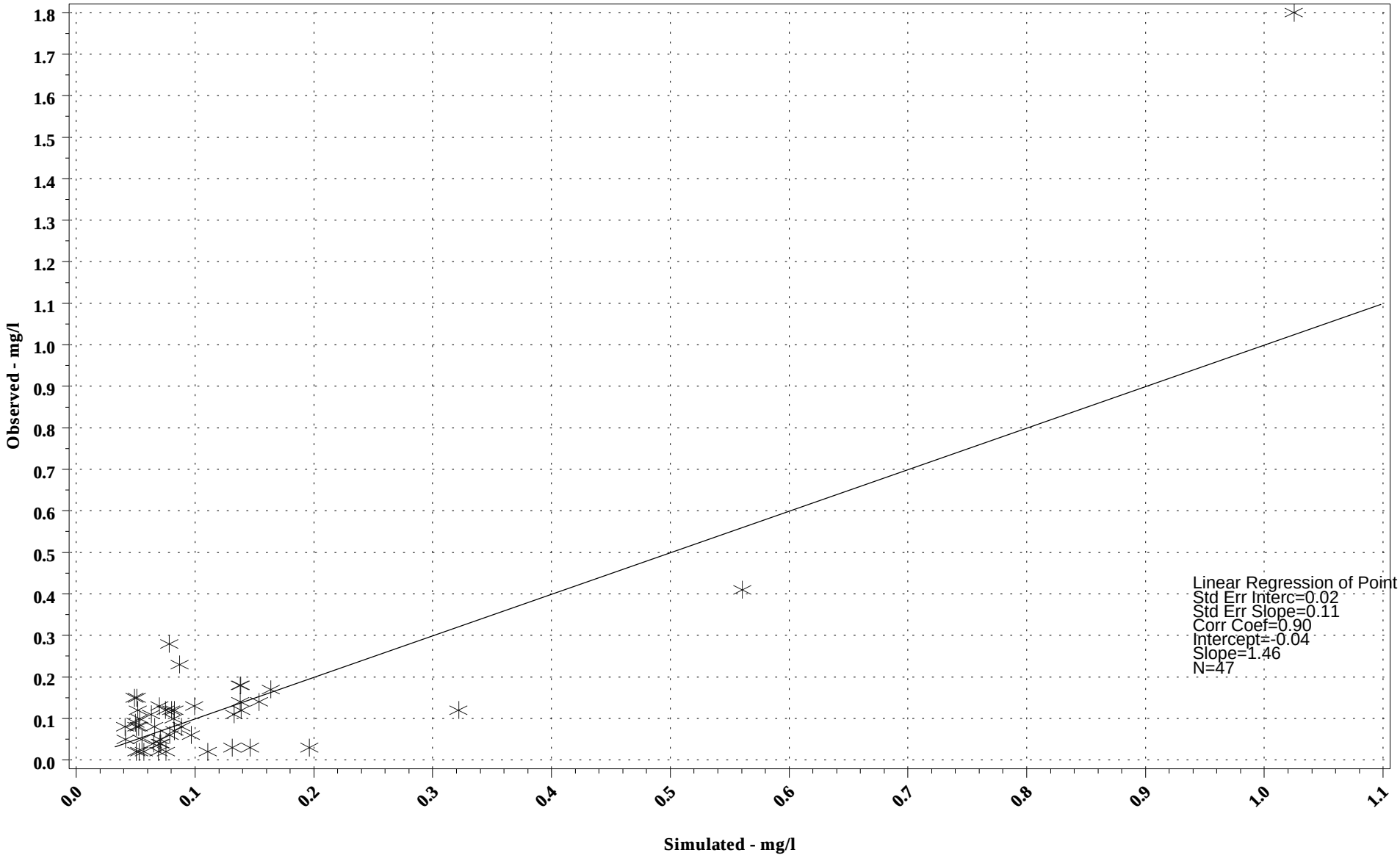



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200

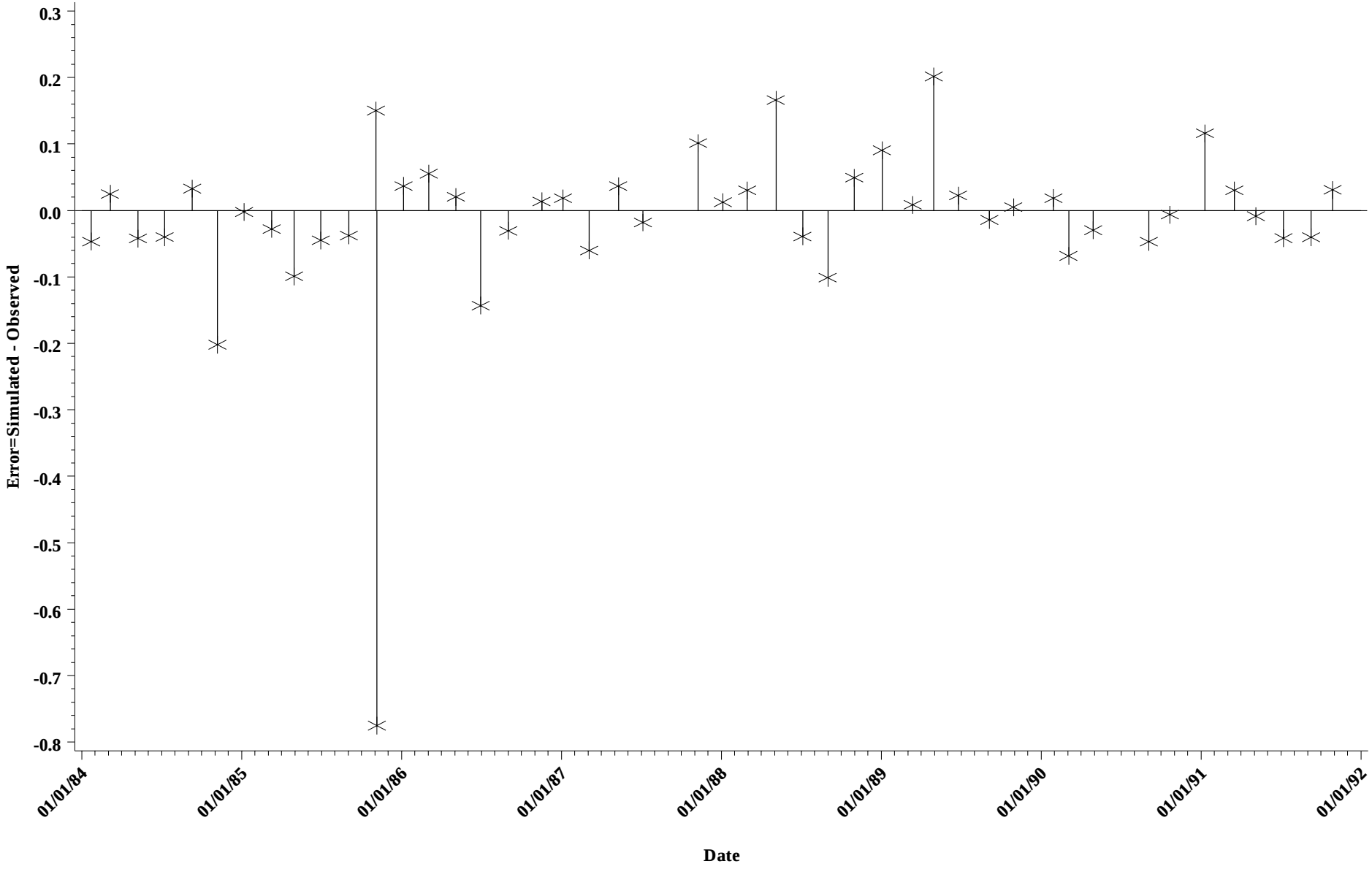
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



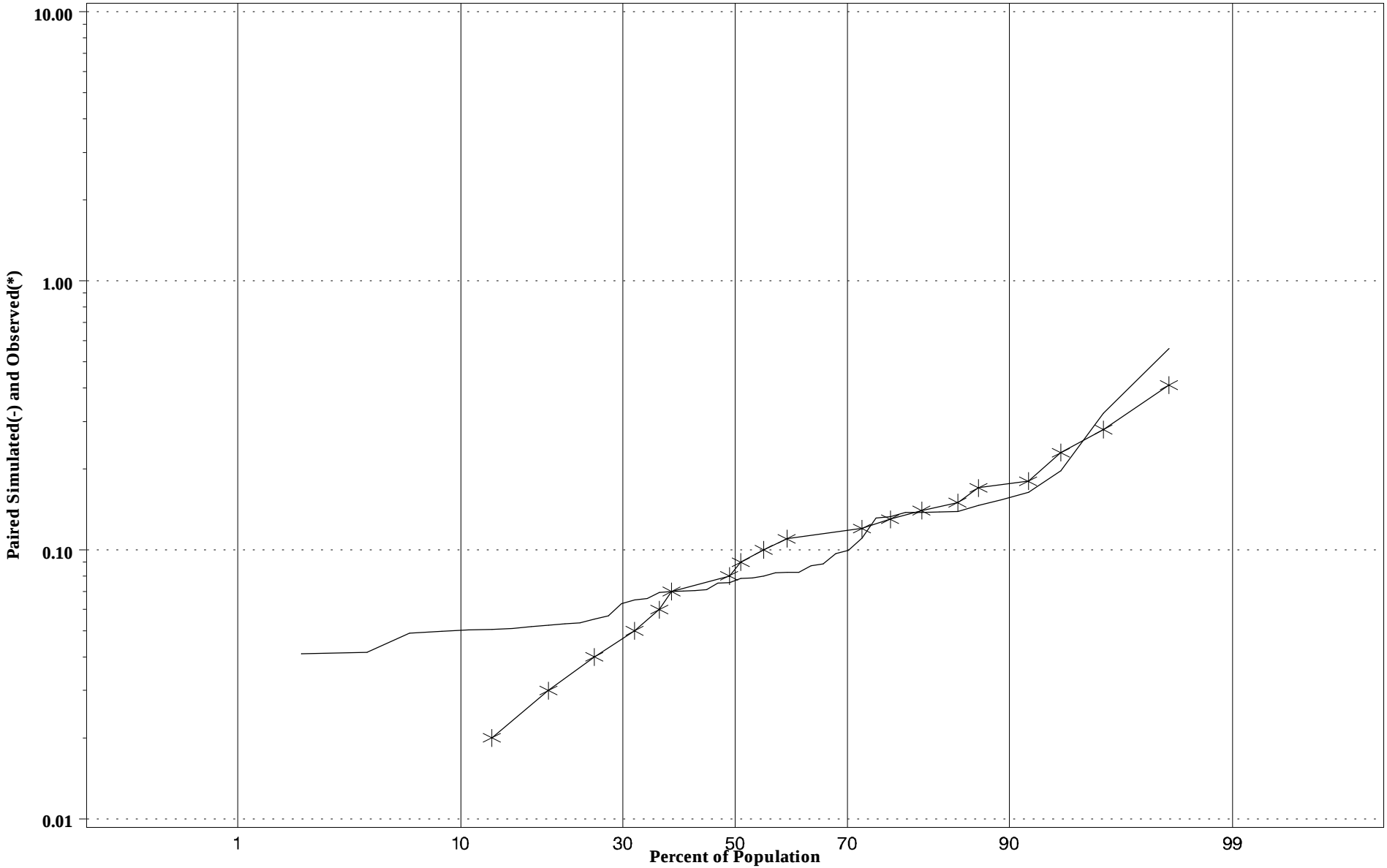

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(sh.drv 26JUN98 12:42)

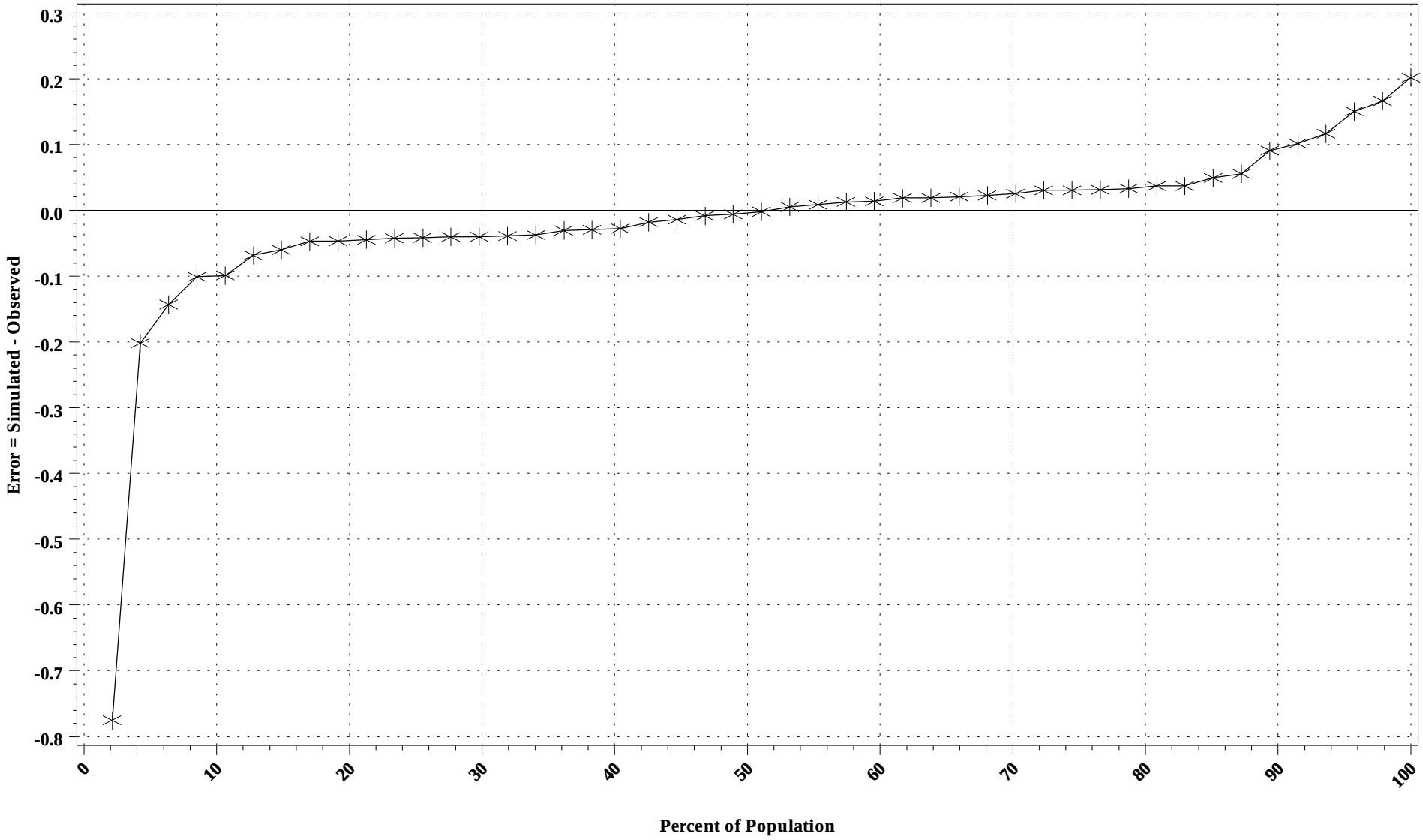
# Shenadoah River at Segment 200
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Actual error versus Percentile Sample Population
## Total Phosphorus

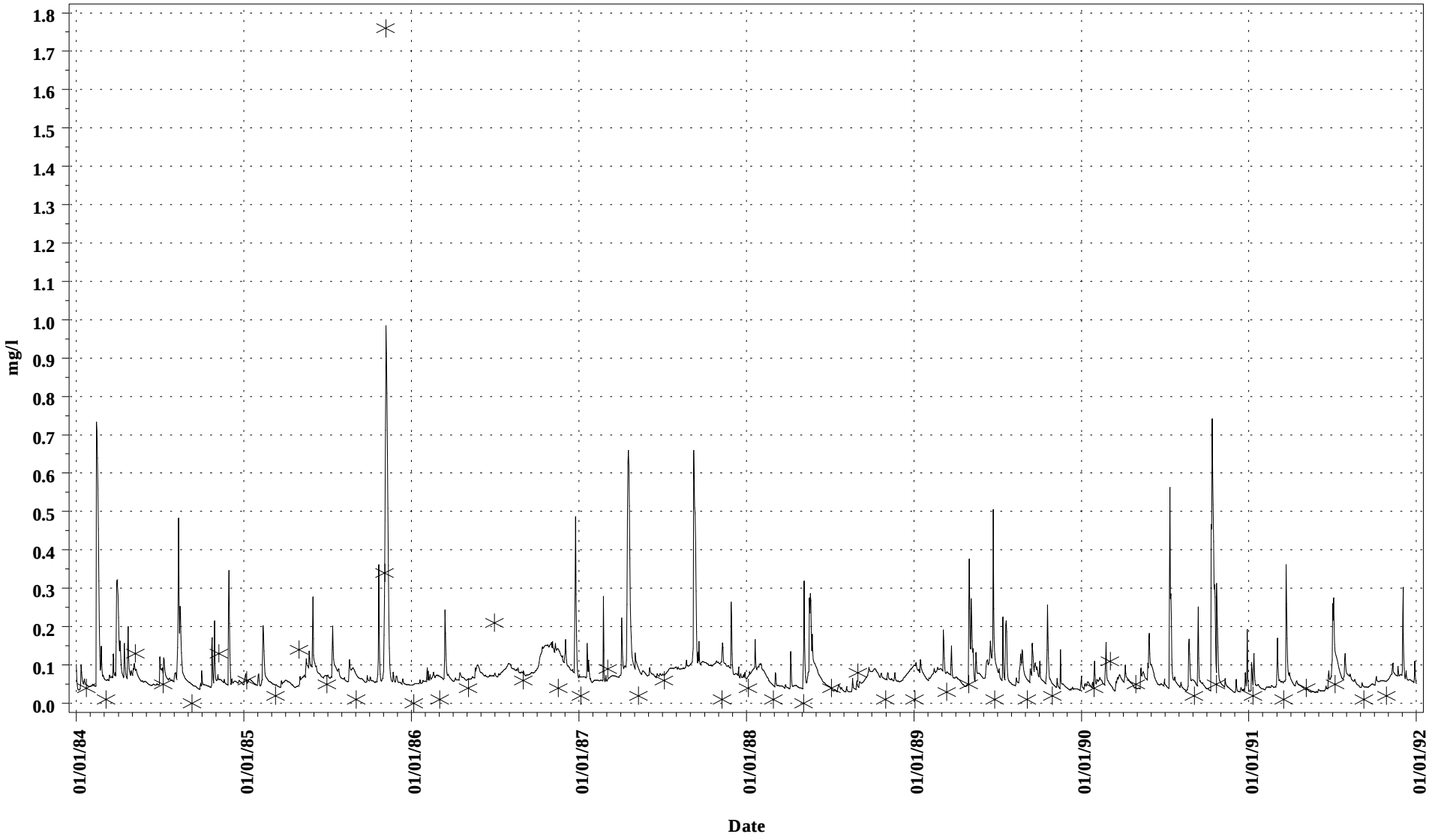
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

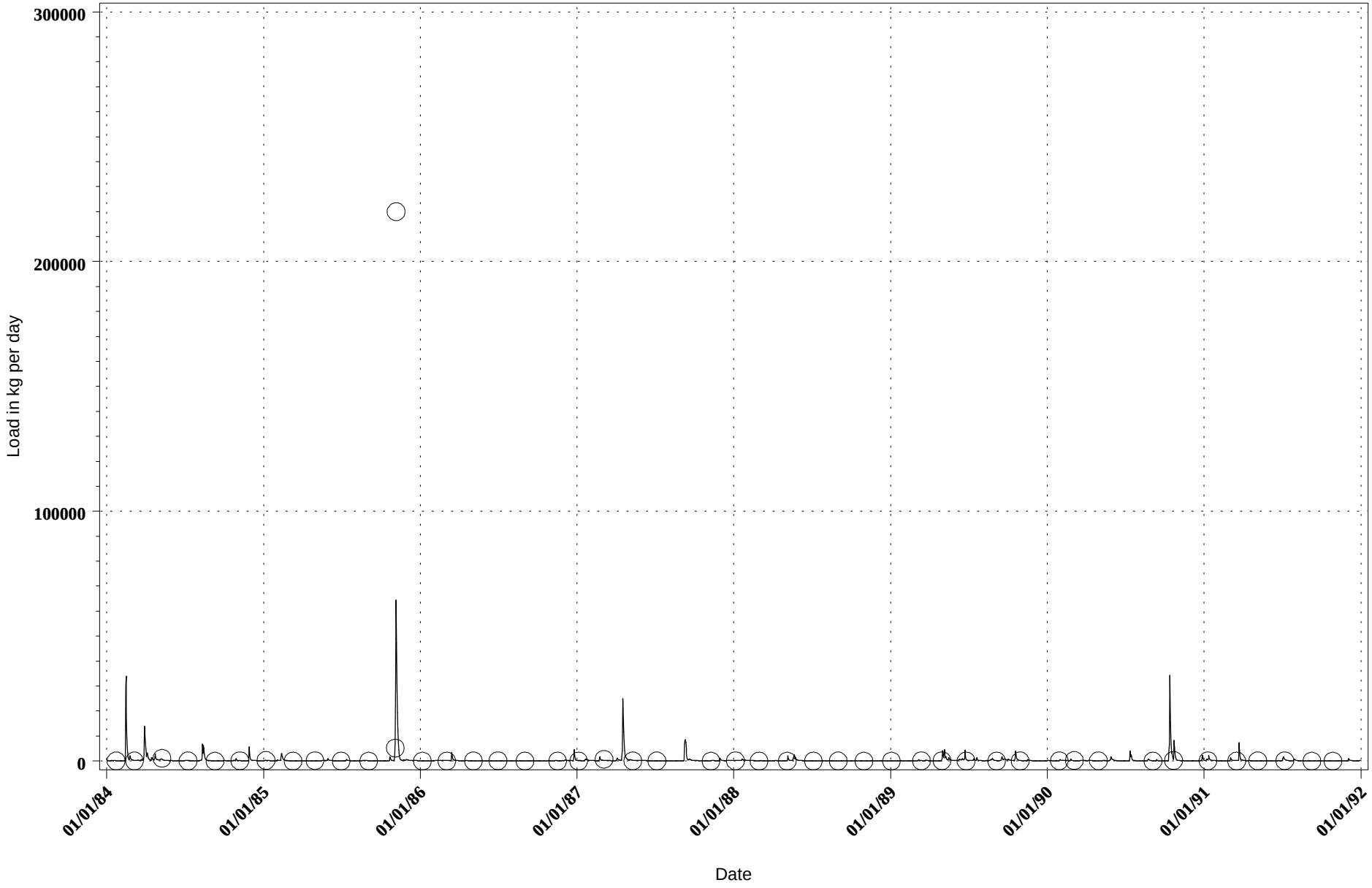



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

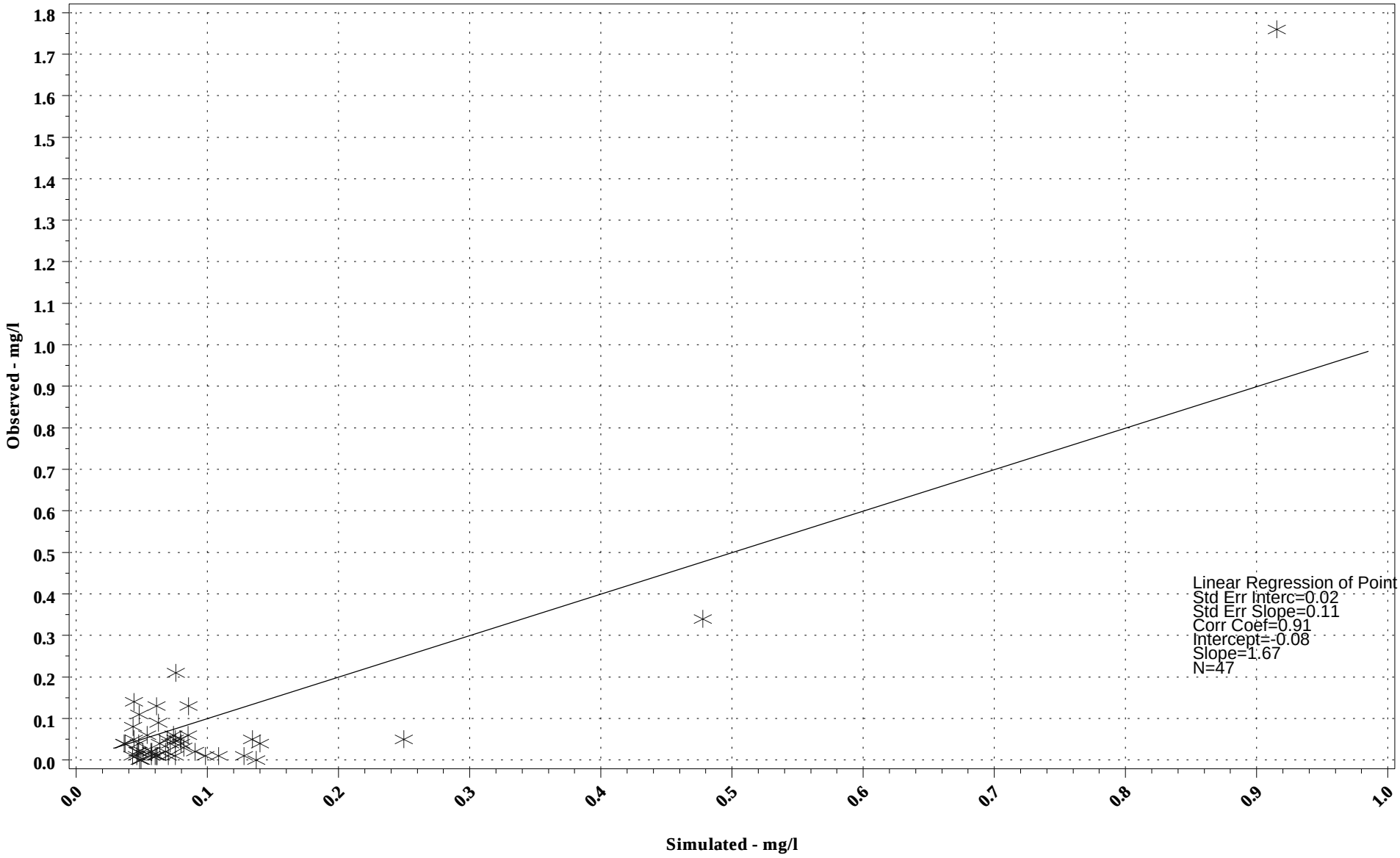



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200

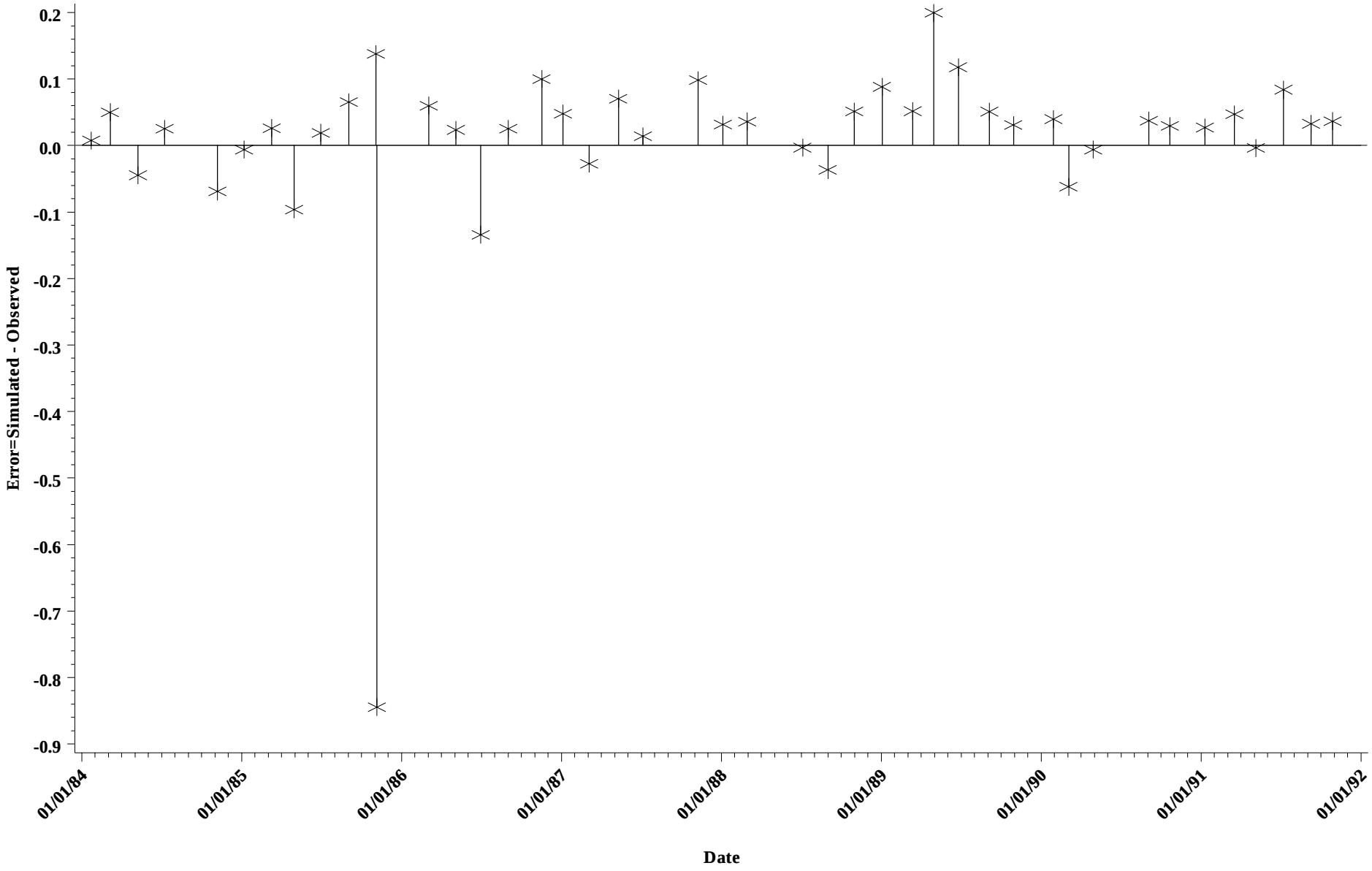
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92



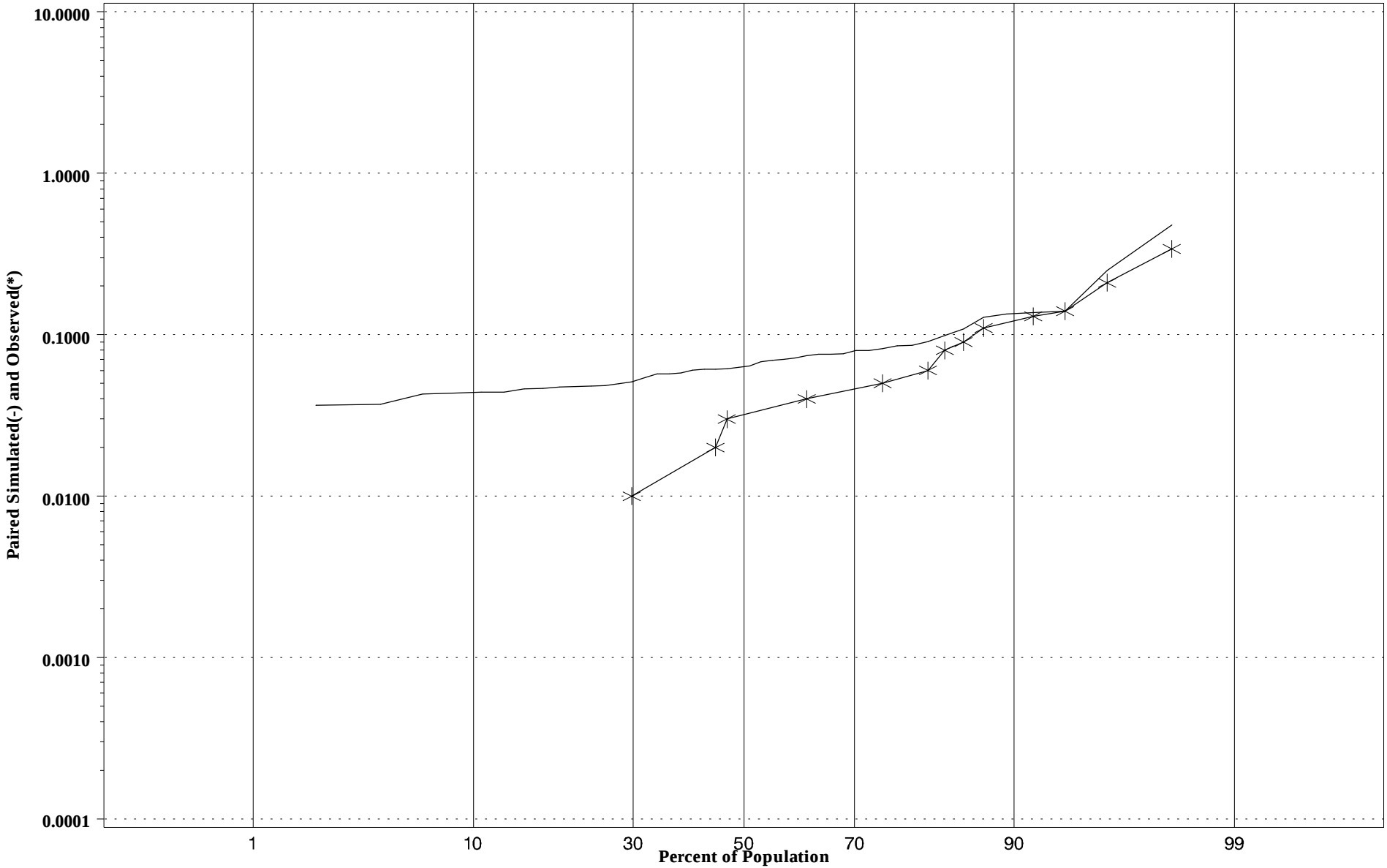

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200
## Actual Error versus Time
## Organic and Particulate Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(sh.drv 26JUN98 12:42)

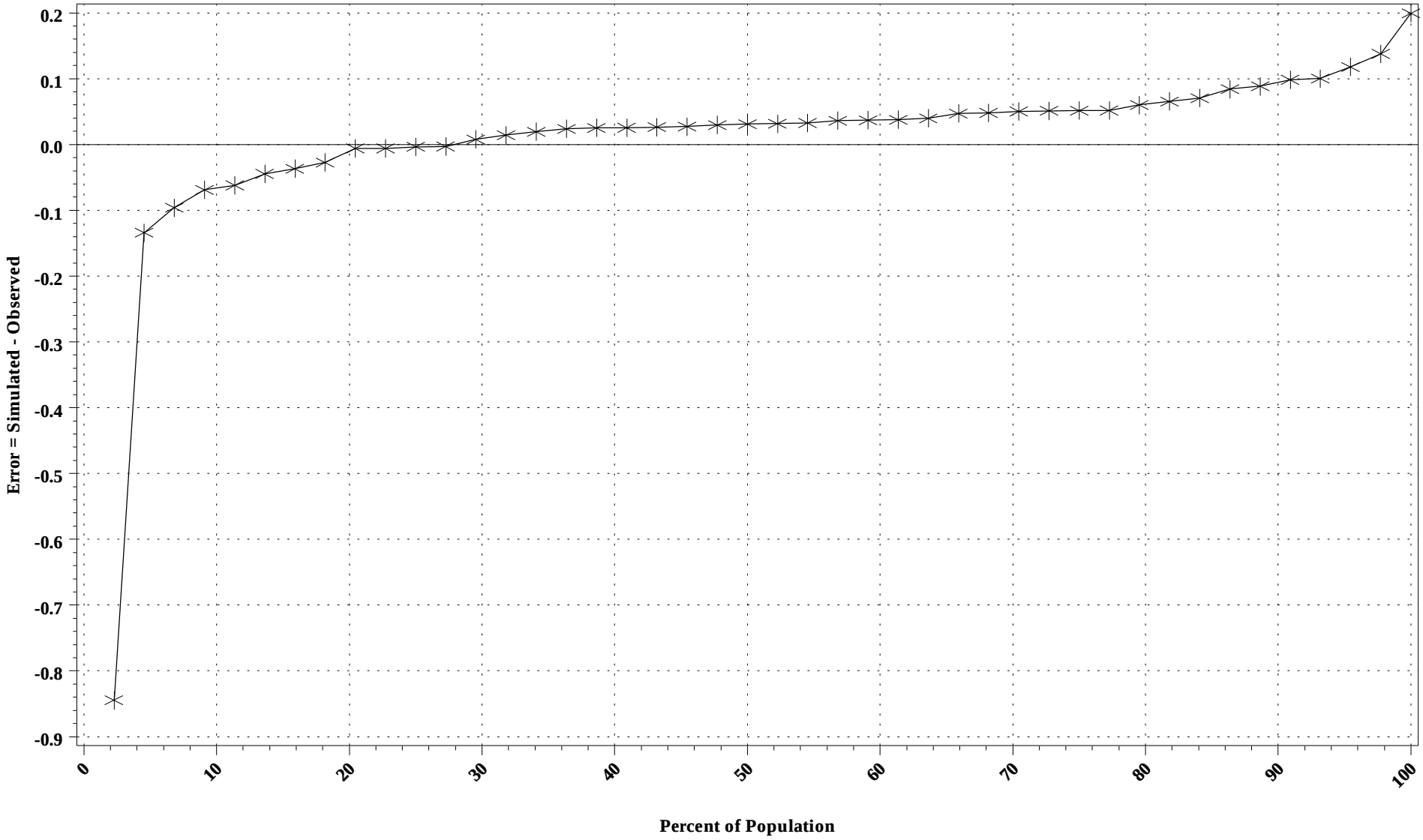
# Shenadoah River at Segment 200
## Organic and Particulate Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

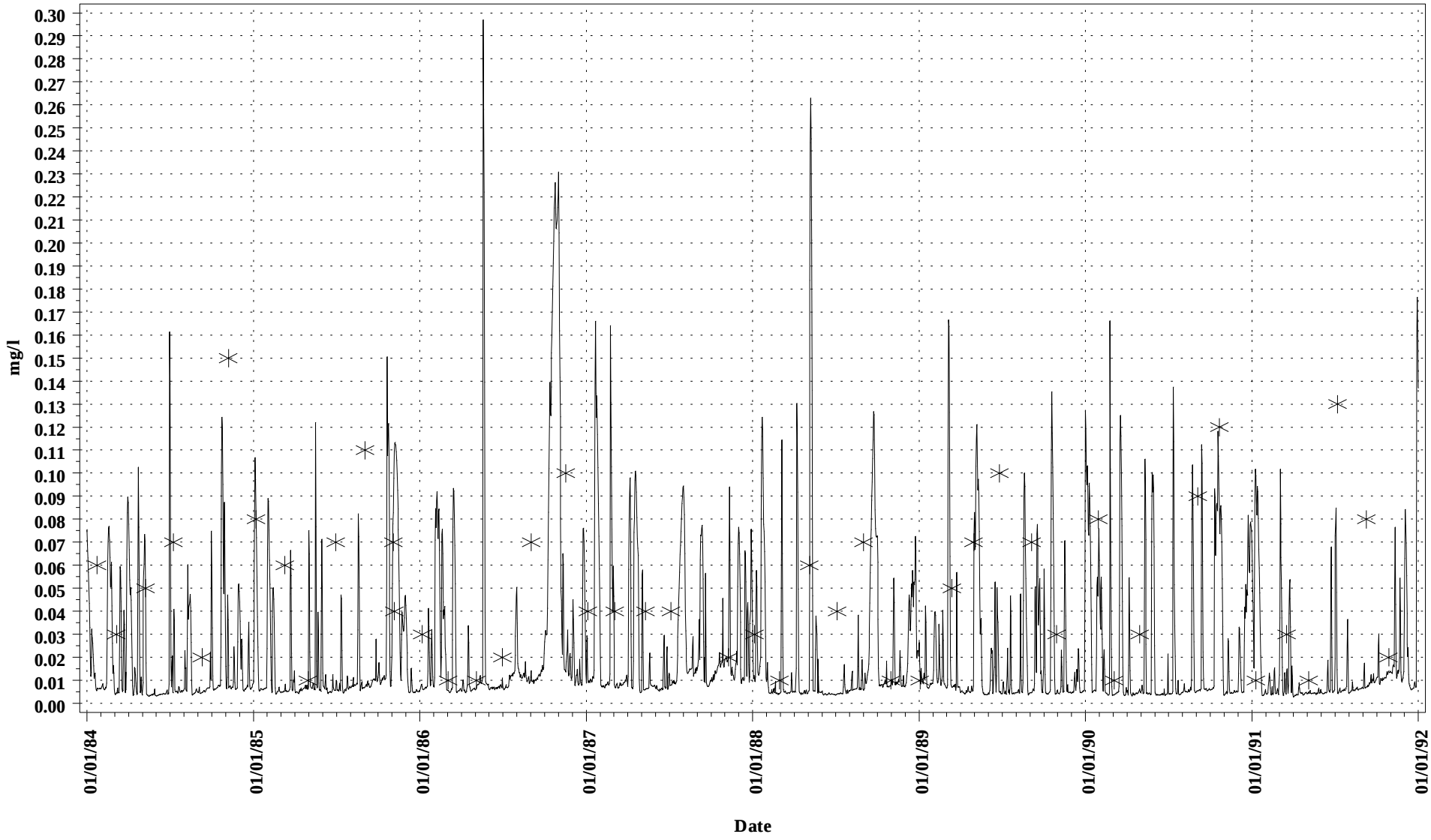
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(sh.drv 26JUN98 12:42)

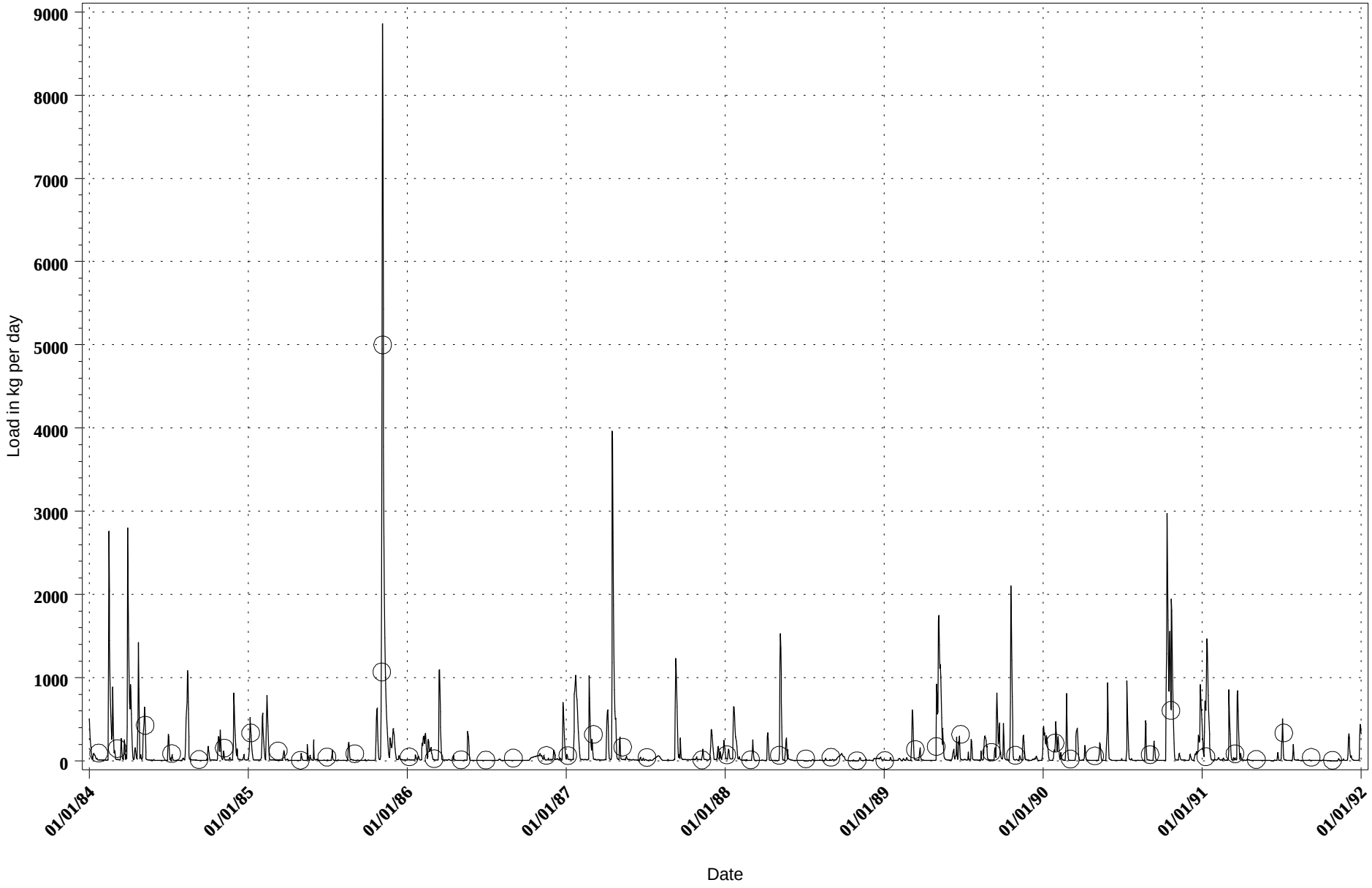
# Shenadoah River at Segment 200
## Observed and Simulated versus Time
# Dissolved Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Dissolved Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

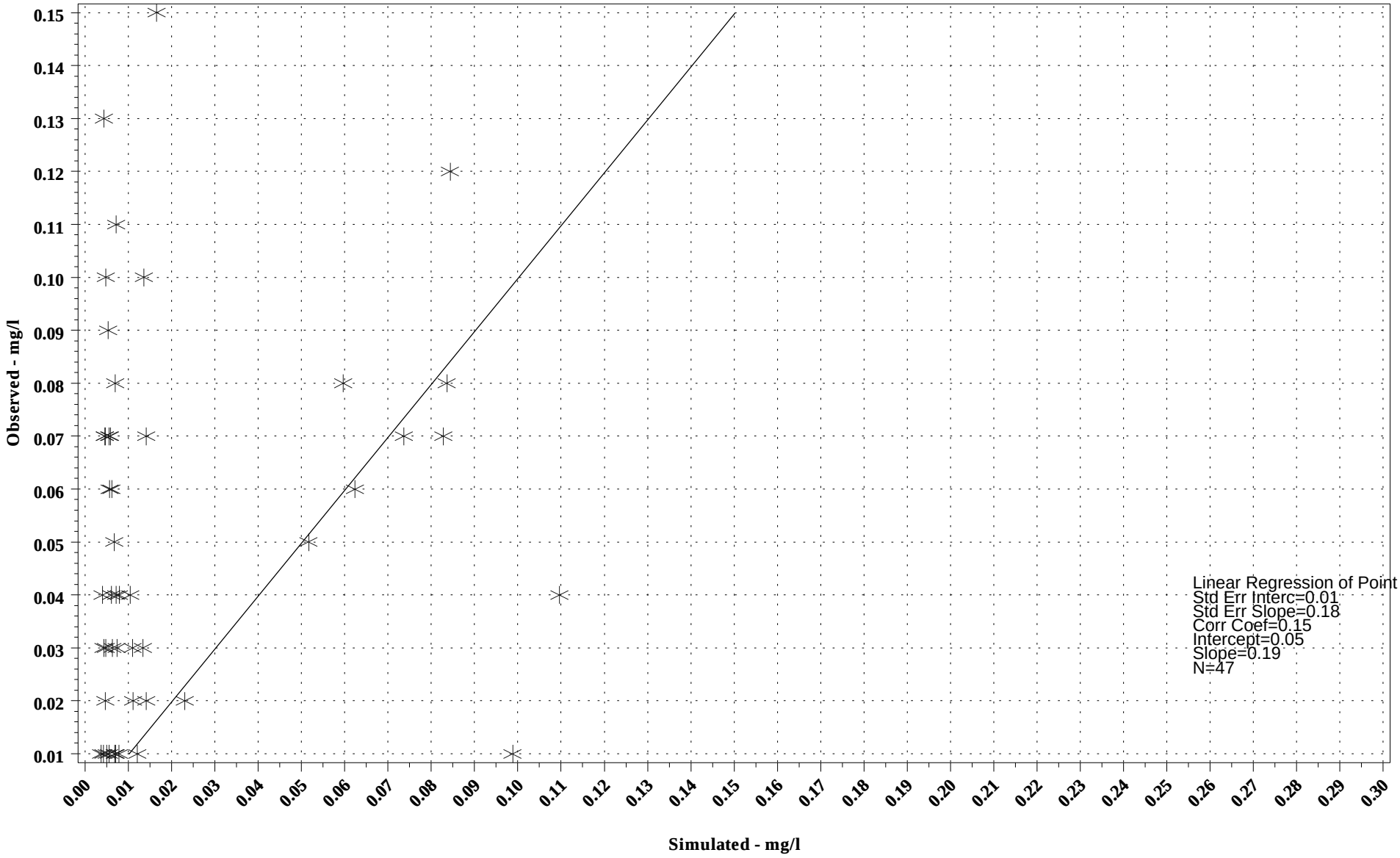



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200

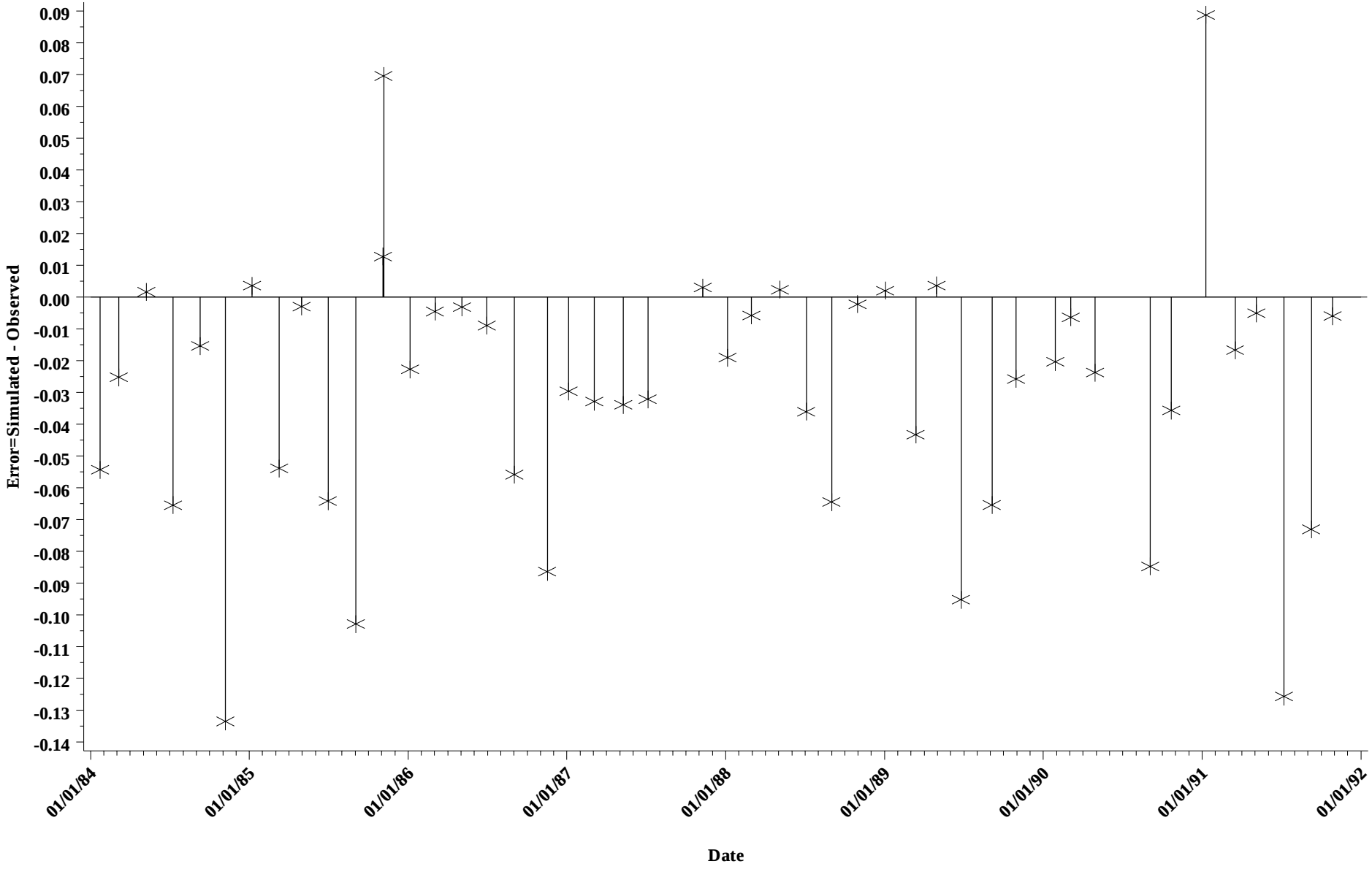
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



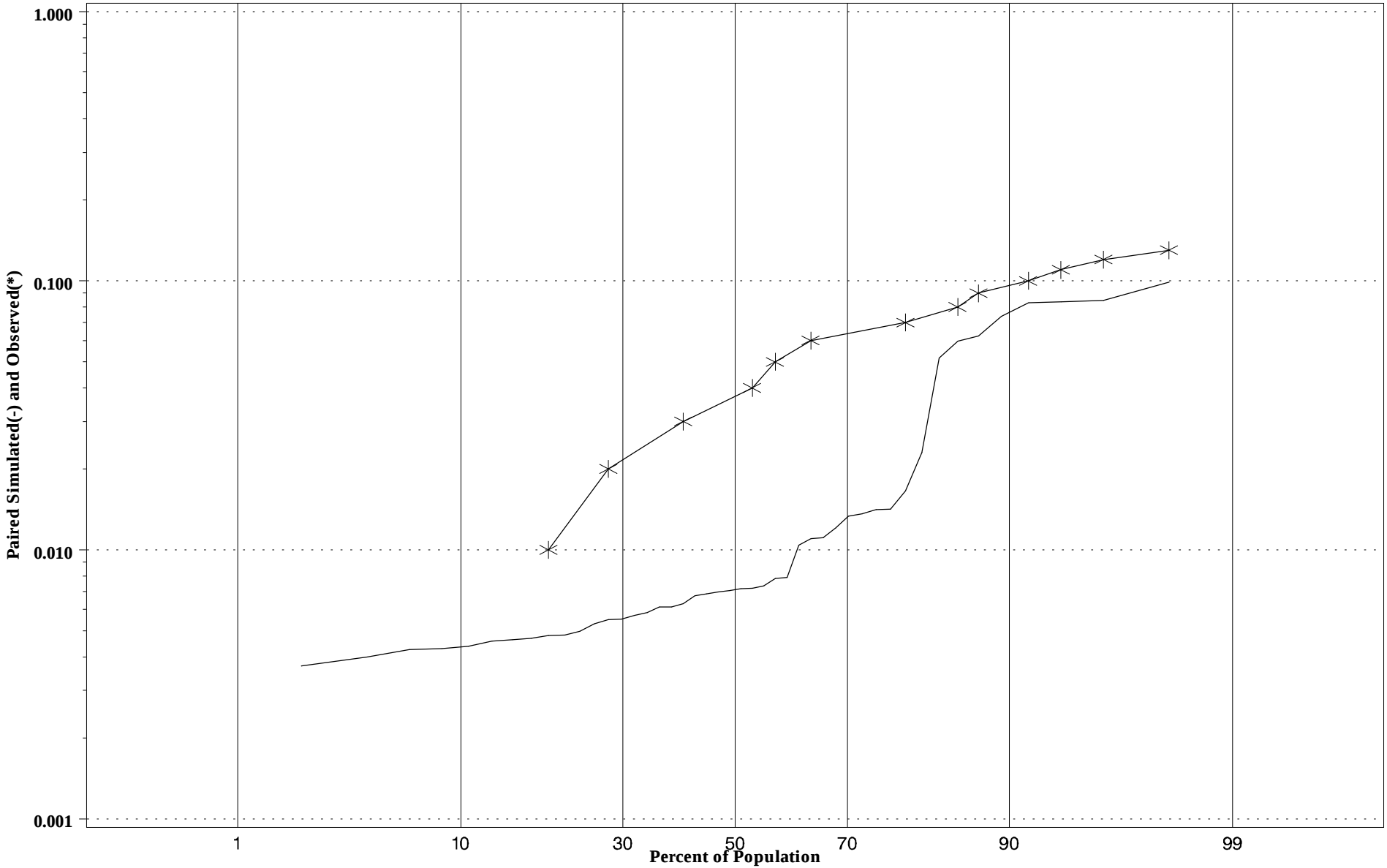

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(sh.drv 26JUN98 12:42)

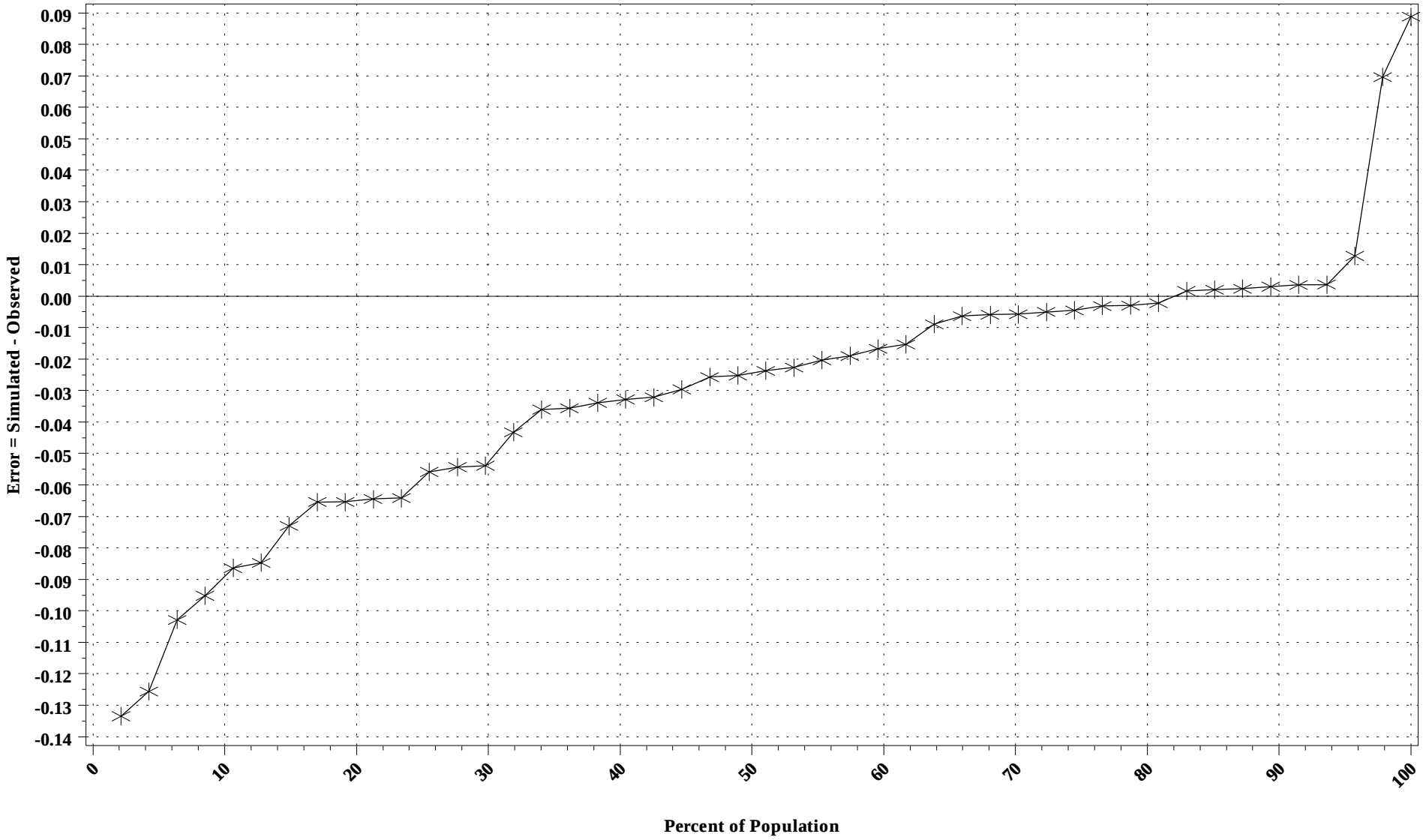
# Shenadoah River at Segment 200
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

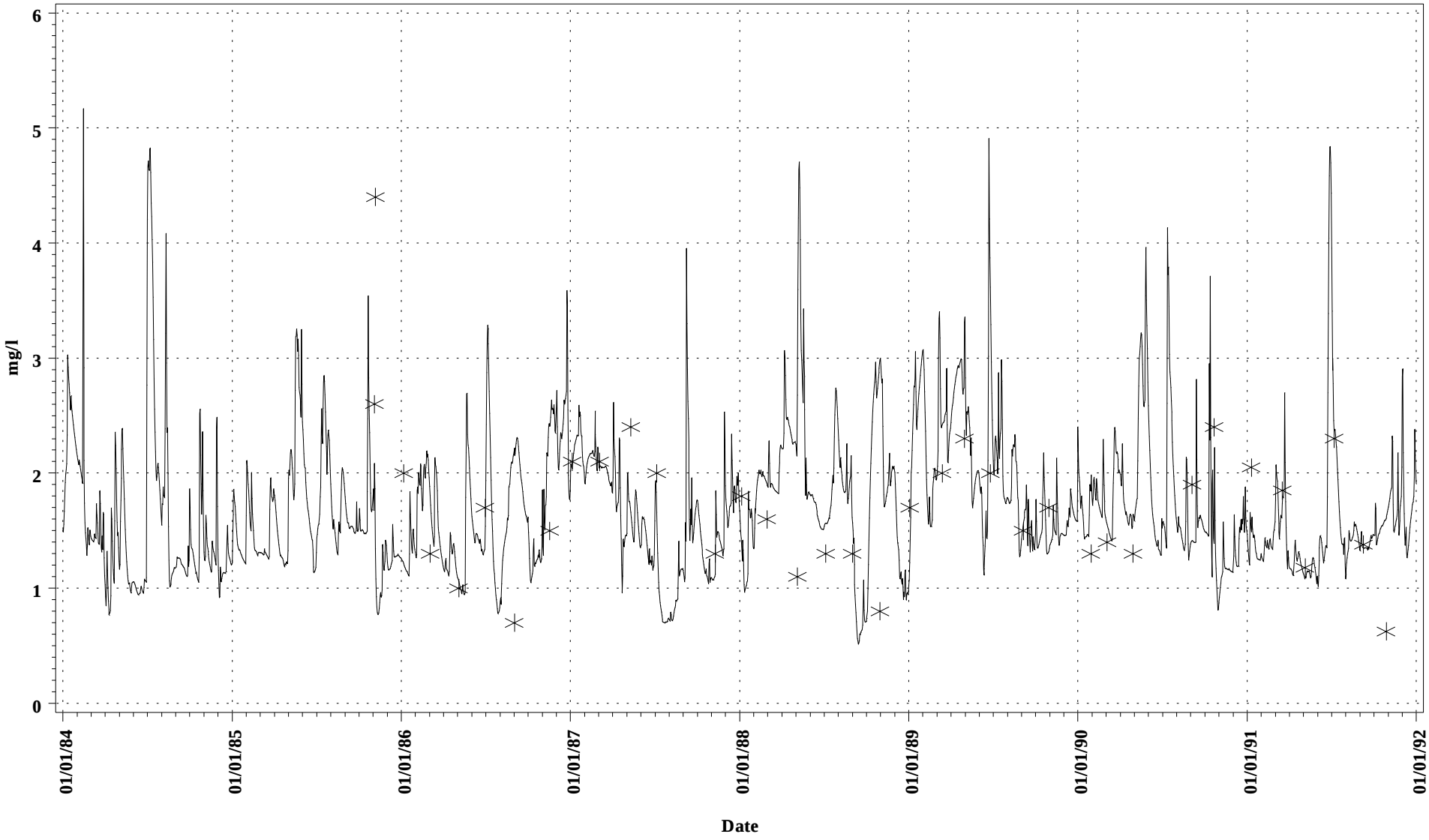
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(sh.drv 26JUN98 12:42)

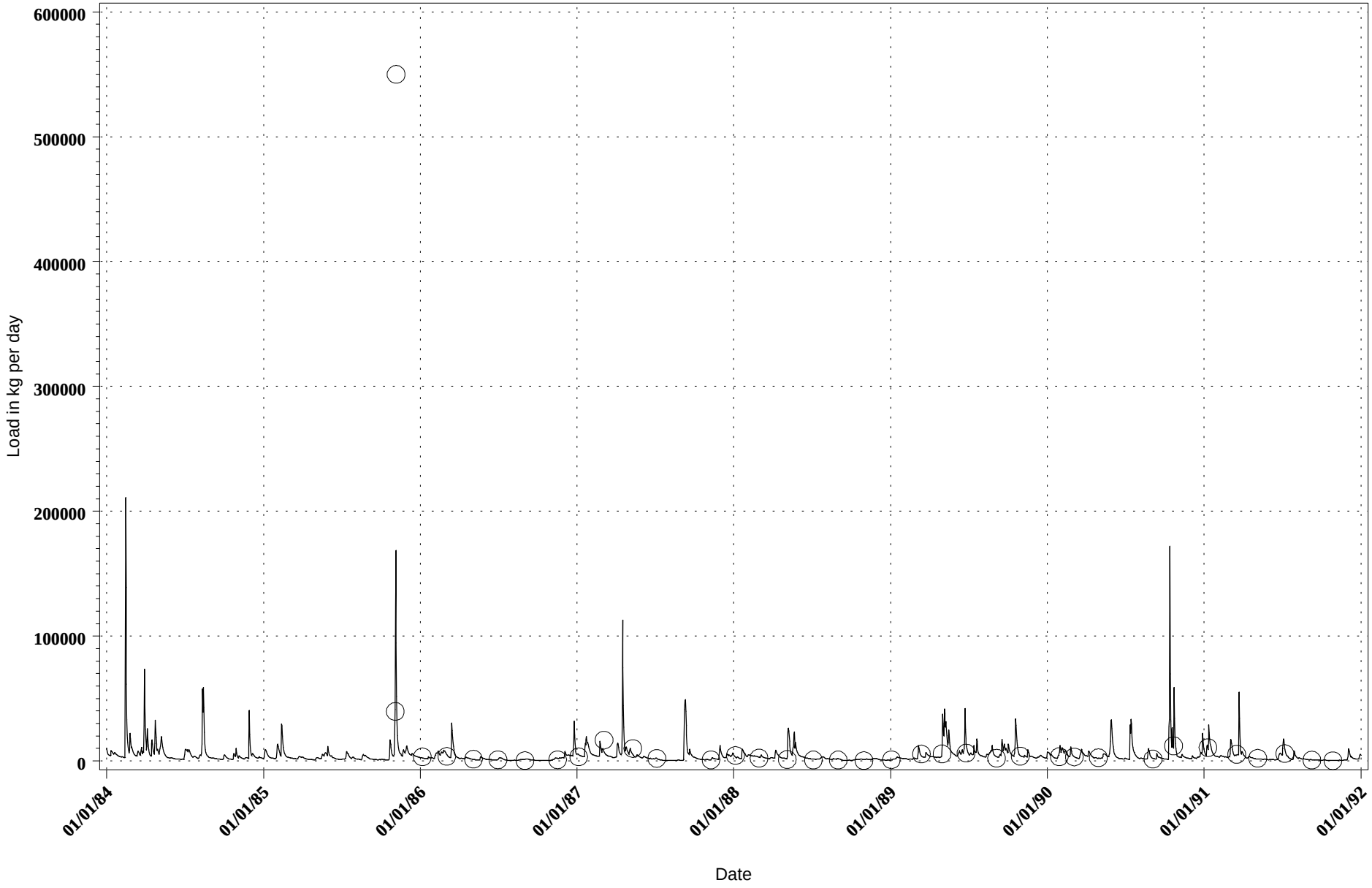
# Shenadoah River at Segment 200
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

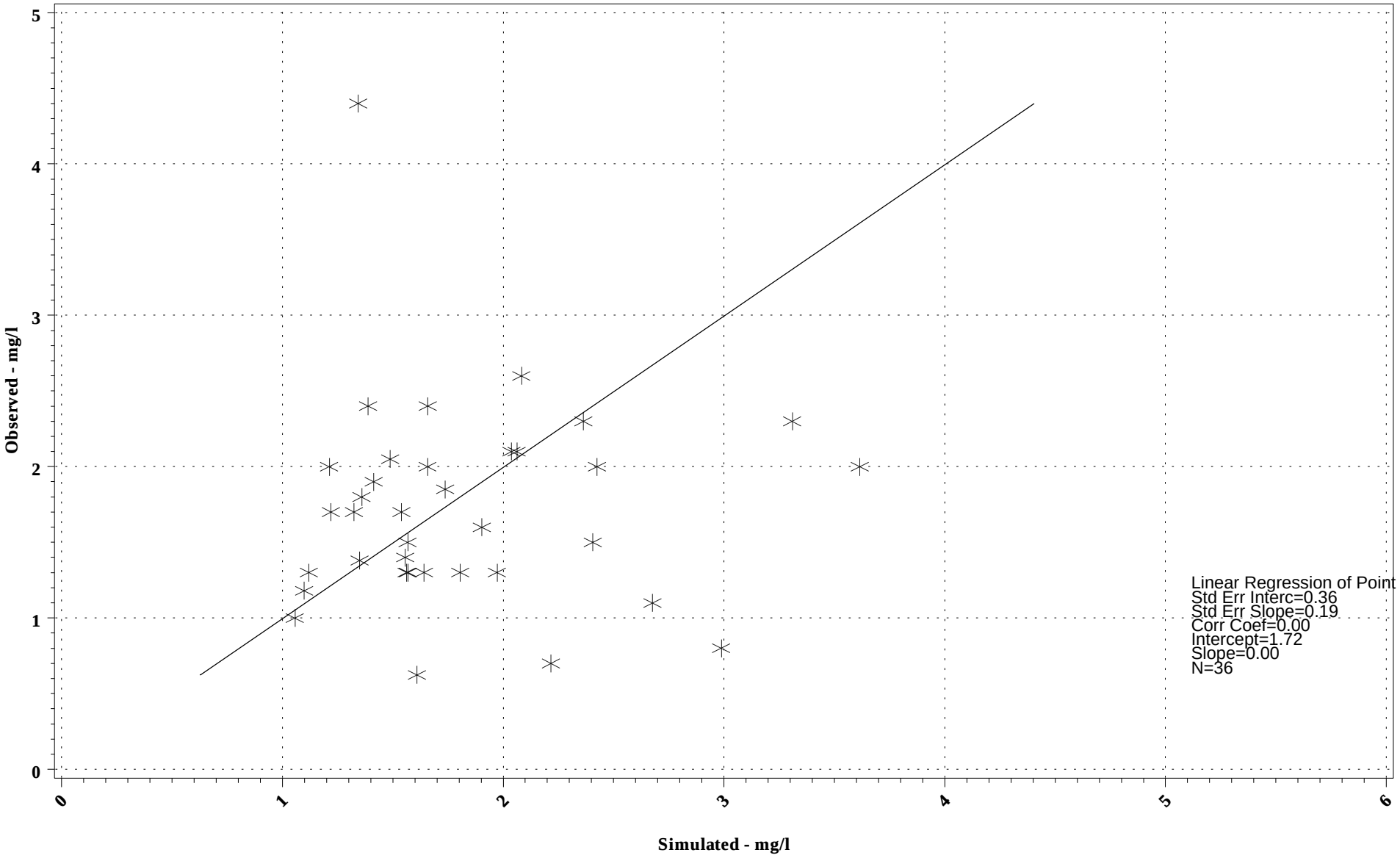



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200

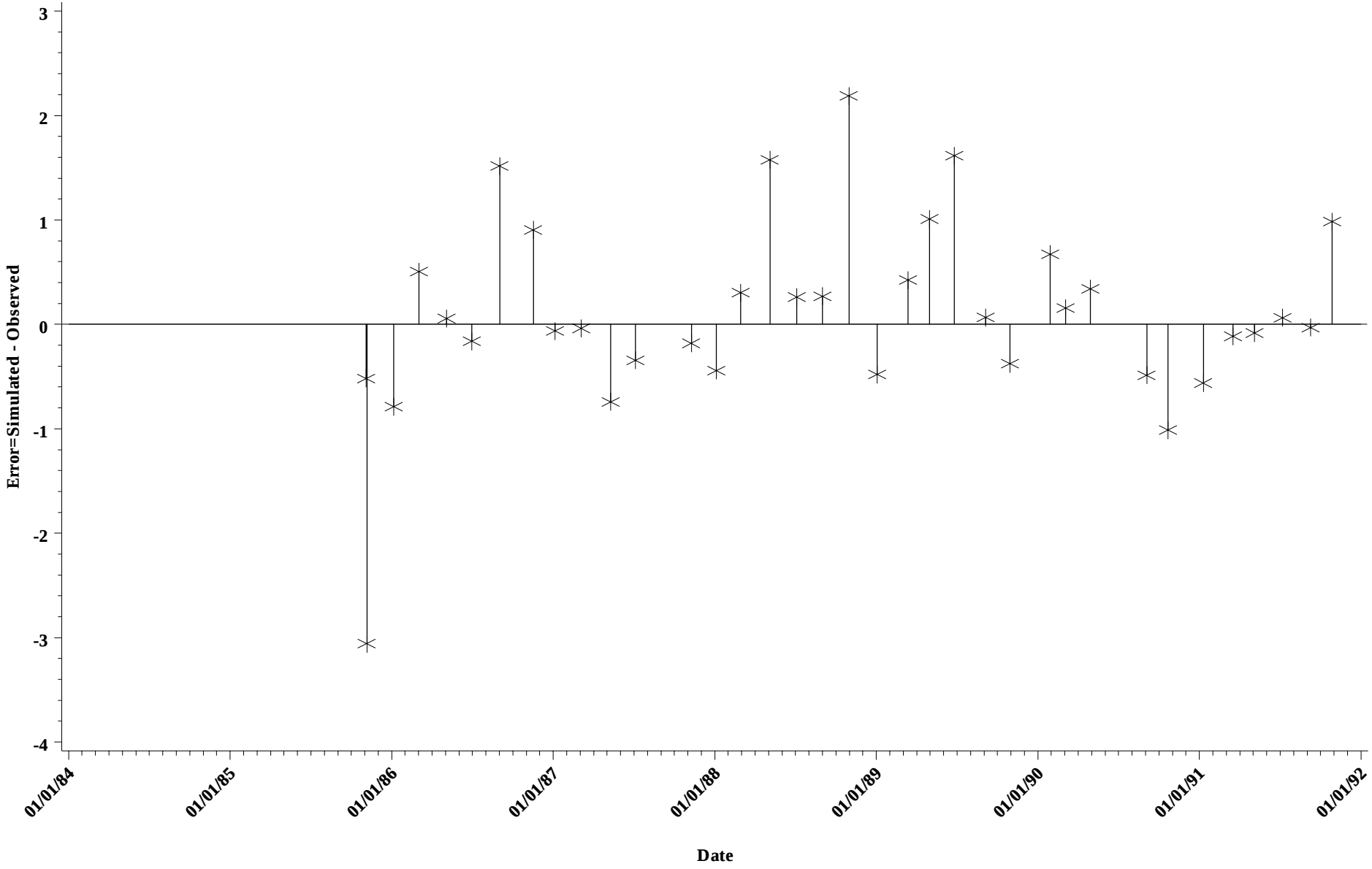
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92



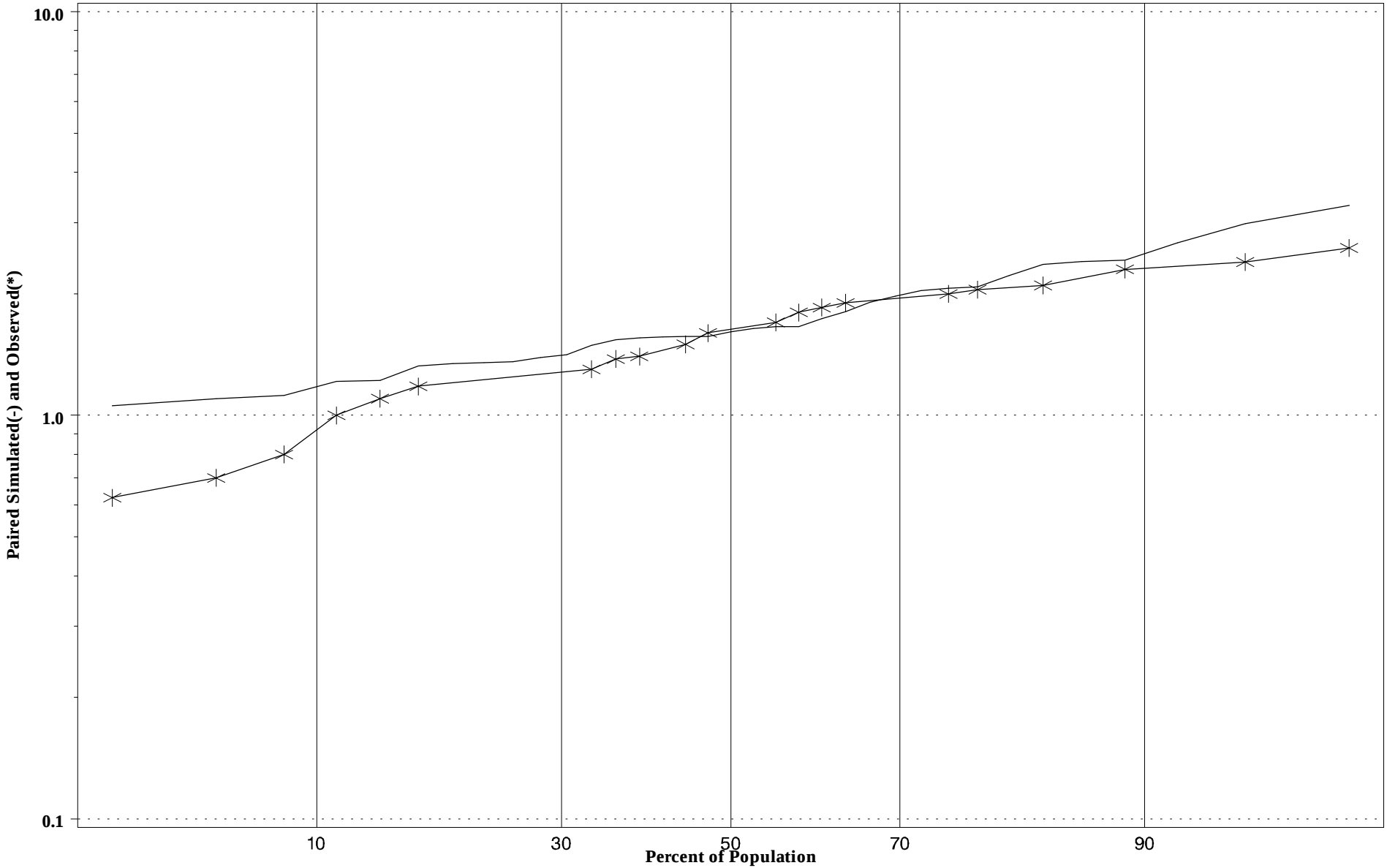

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200
## Actual Error versus Time
## Total Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(sh.drv 26JUN98 12:42)

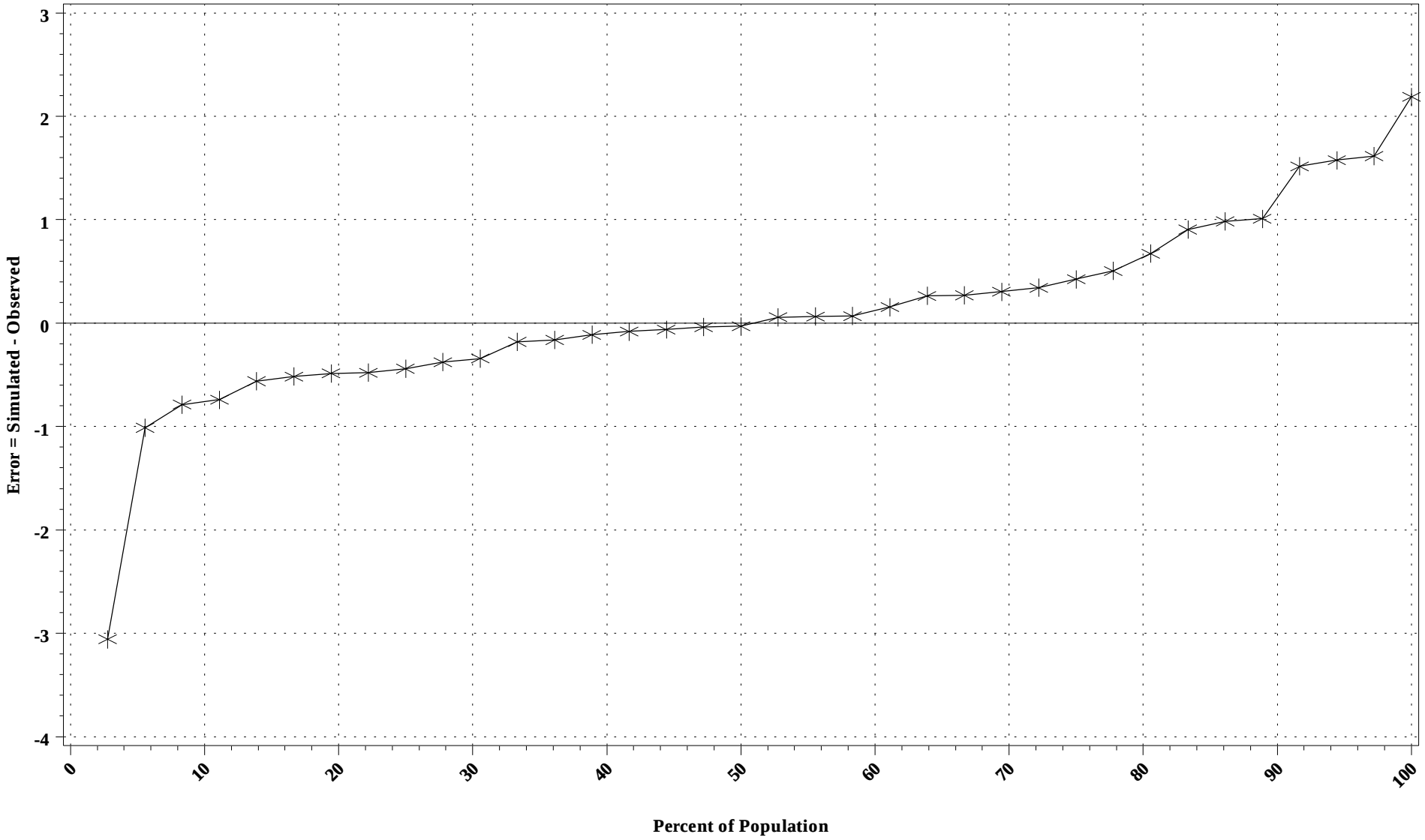
# Shenadoah River at Segment 200
## Total Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Actual error versus Percentile Sample Population
## Total Nitrogen

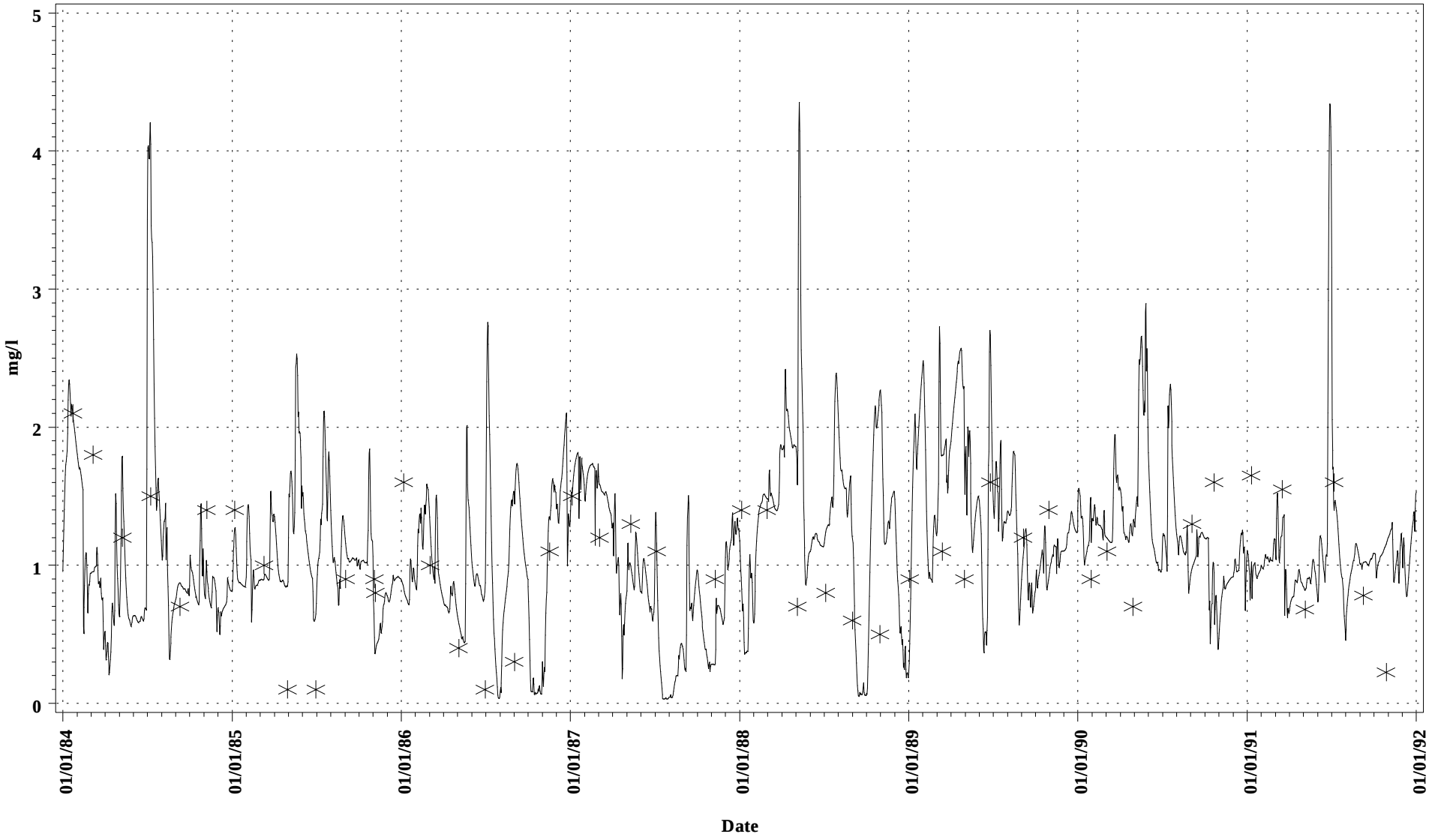
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

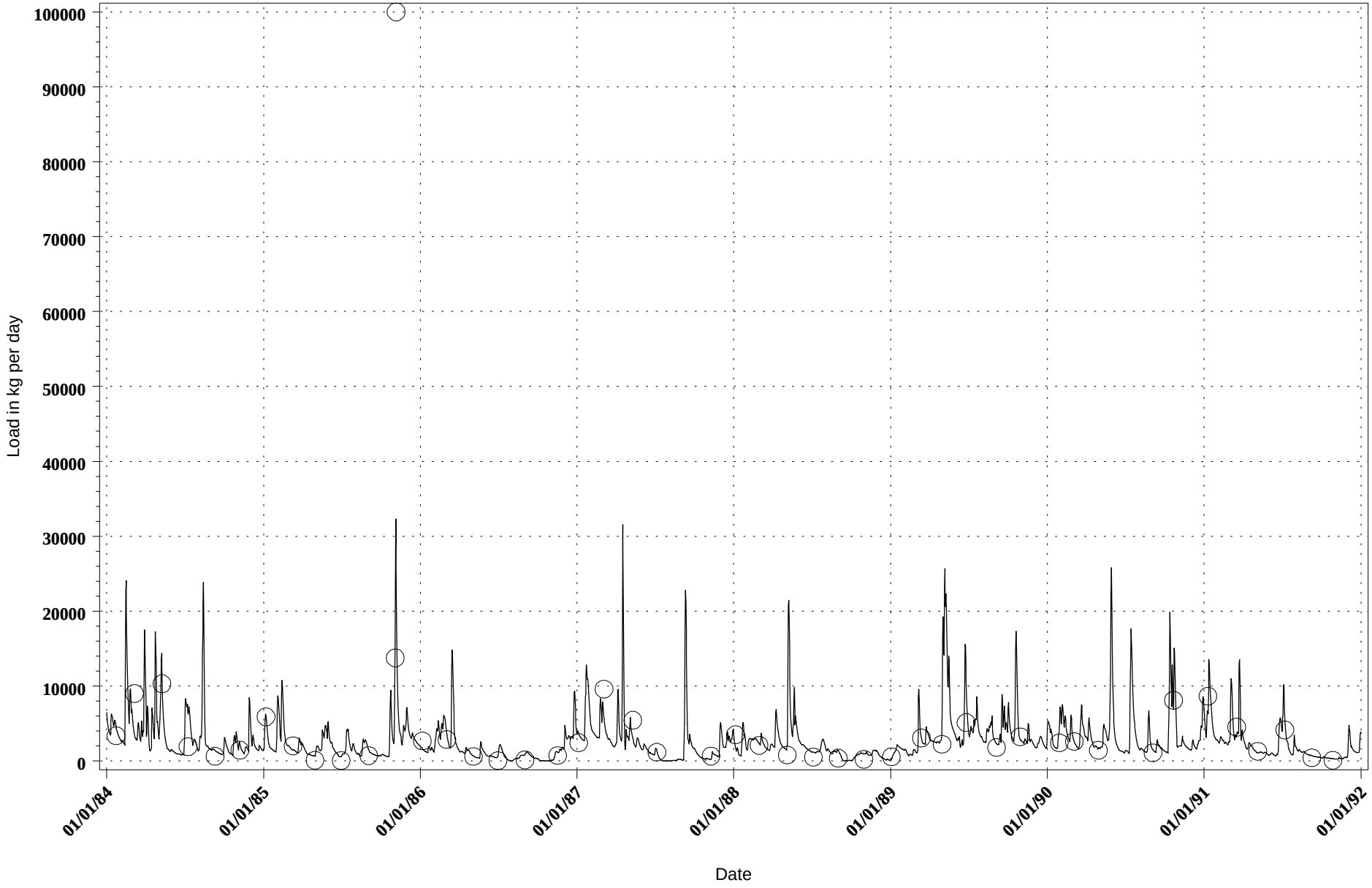



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200

## NO3 Observed and Simulated Load vs Time

### (line = simulated, O = observed)

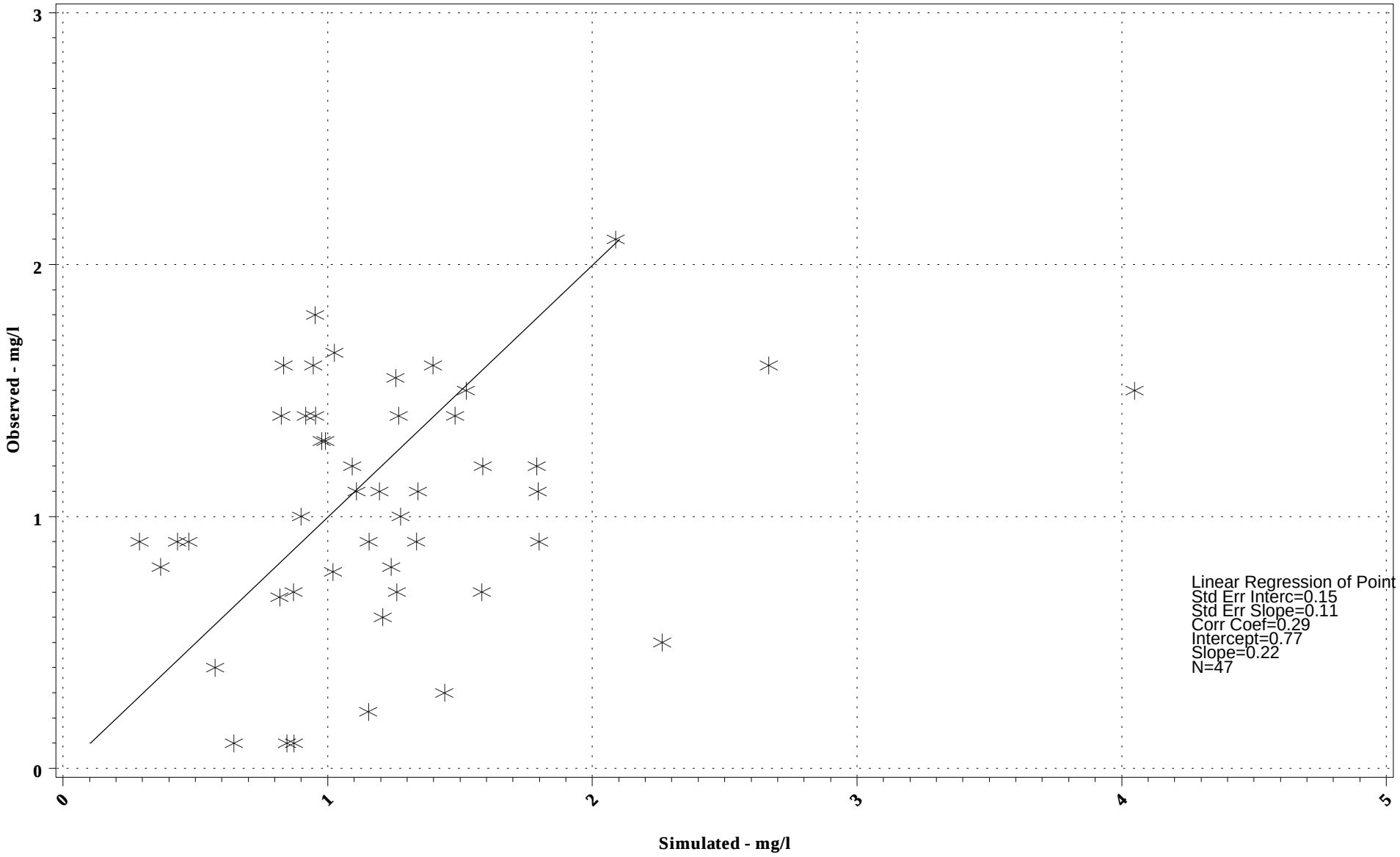



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200

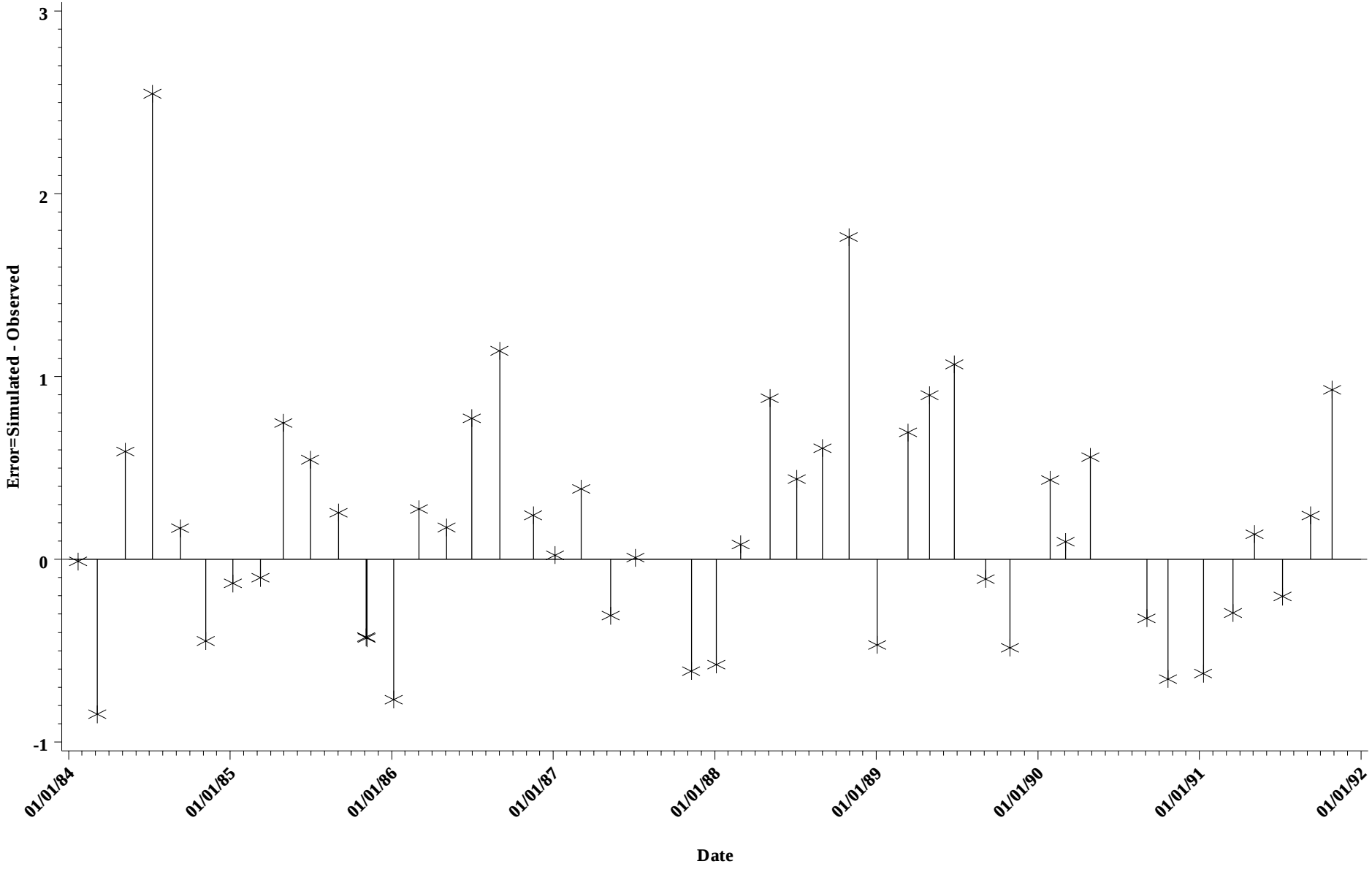
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200
## Actual Error versus Time
## NO3

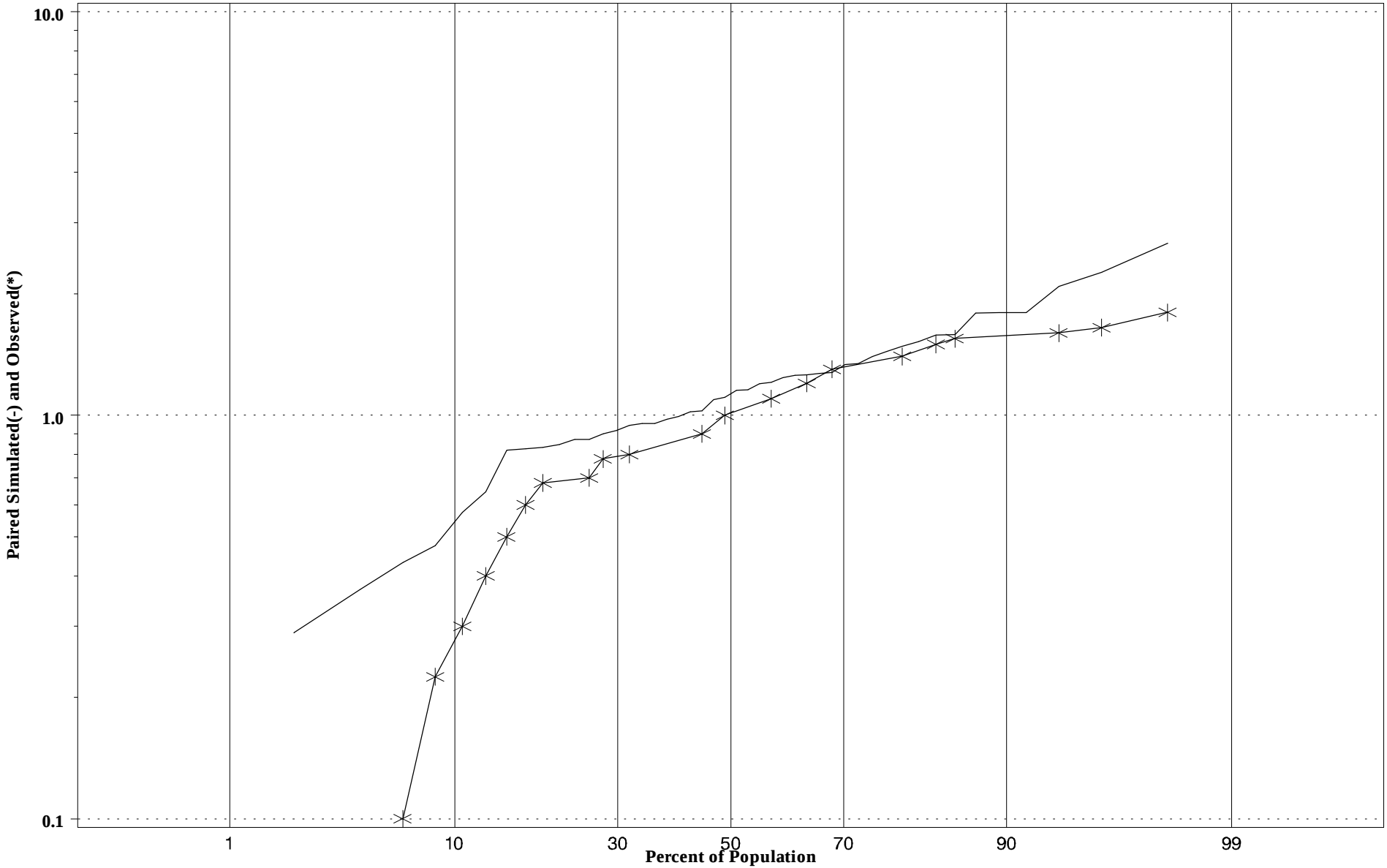



(y21_plotb.sas model3d:[pwang.dt] omerr)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200

## NO3

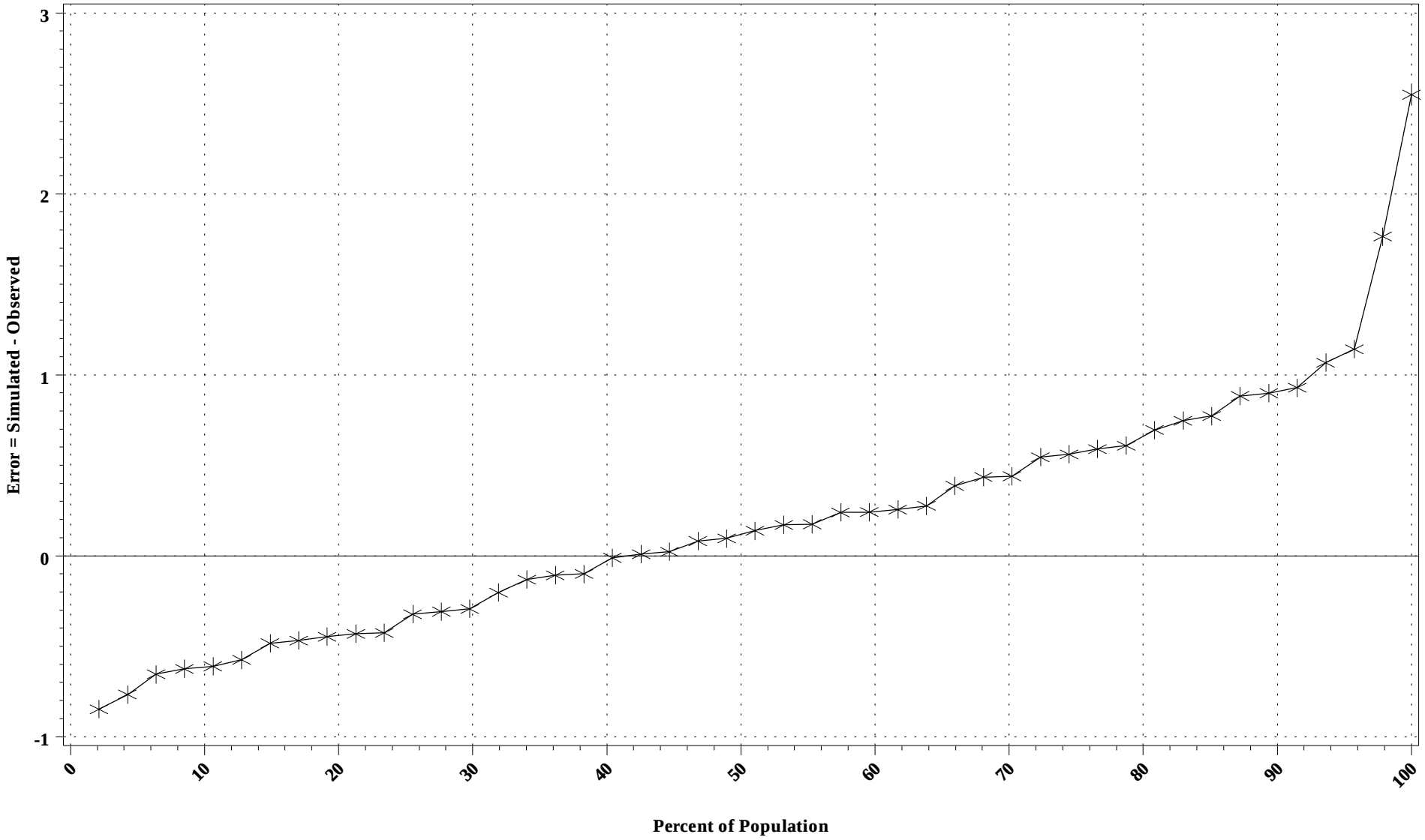
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Actual error versus Percentile Sample Population
## NO3

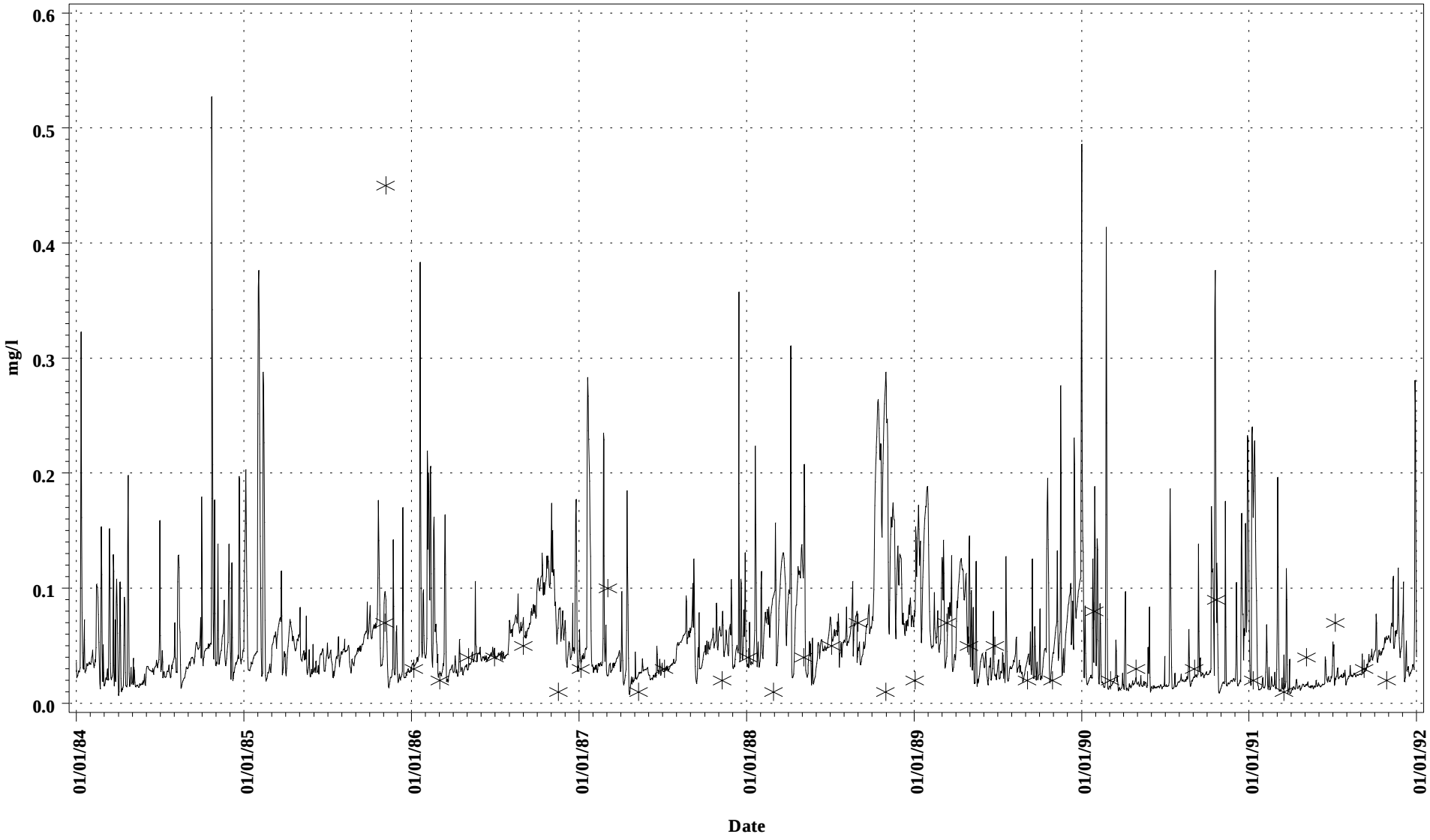
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(sh.drv 26JUN98 12:42)

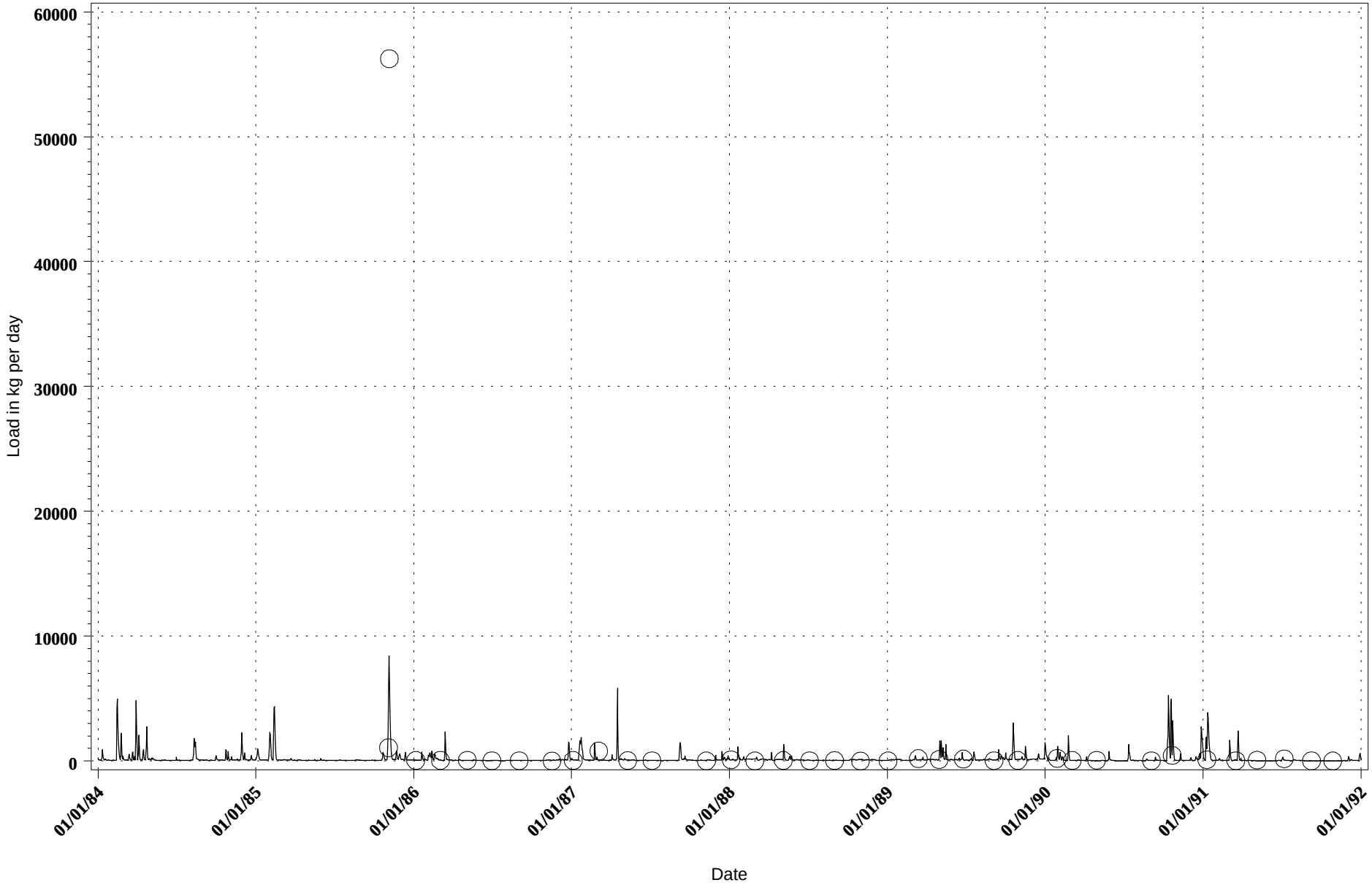
# Shenadoah River at Segment 200
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Total Ammonia Observed and Simulated Load vs Time
### (line = simulated, O = observed)

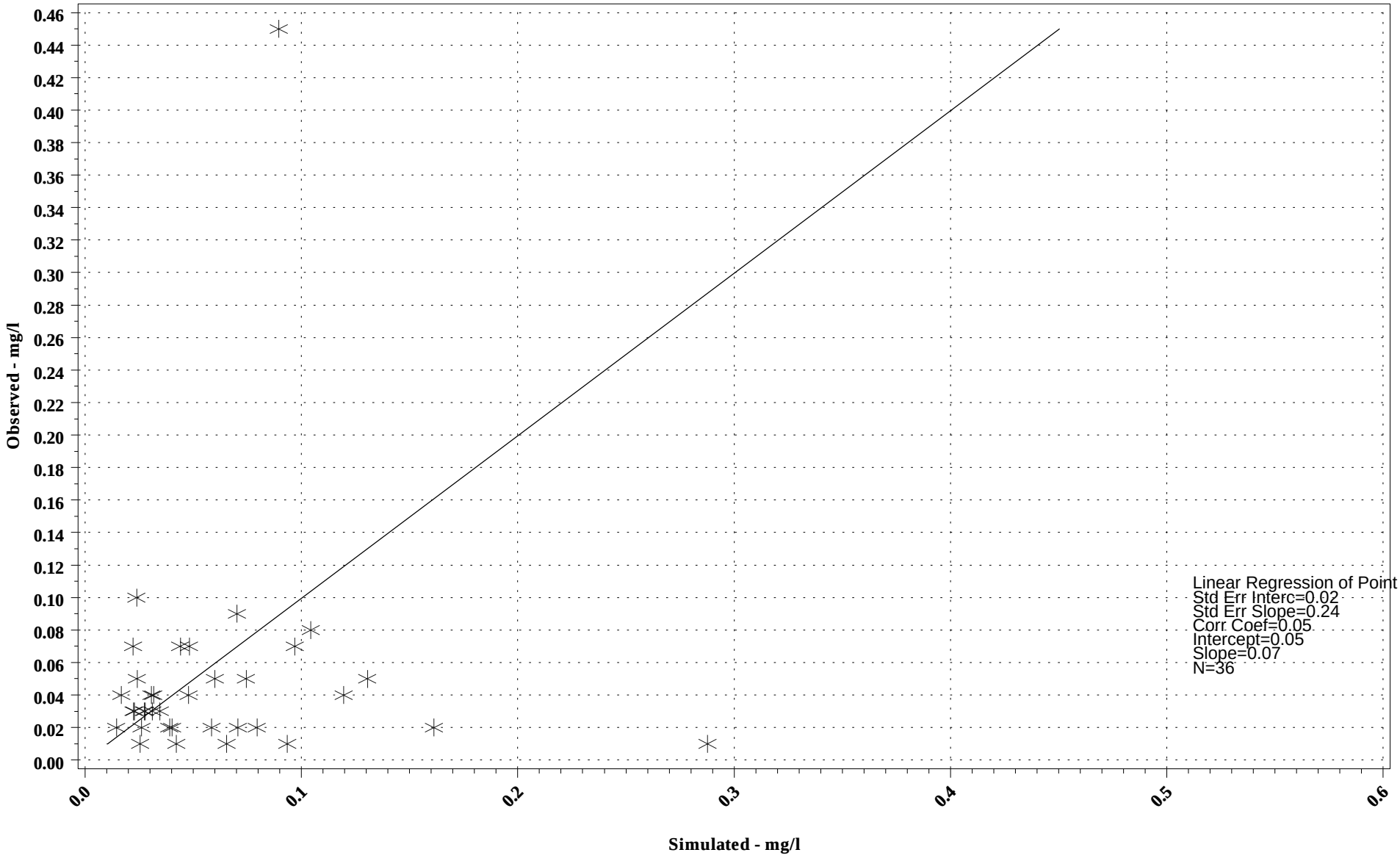



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200

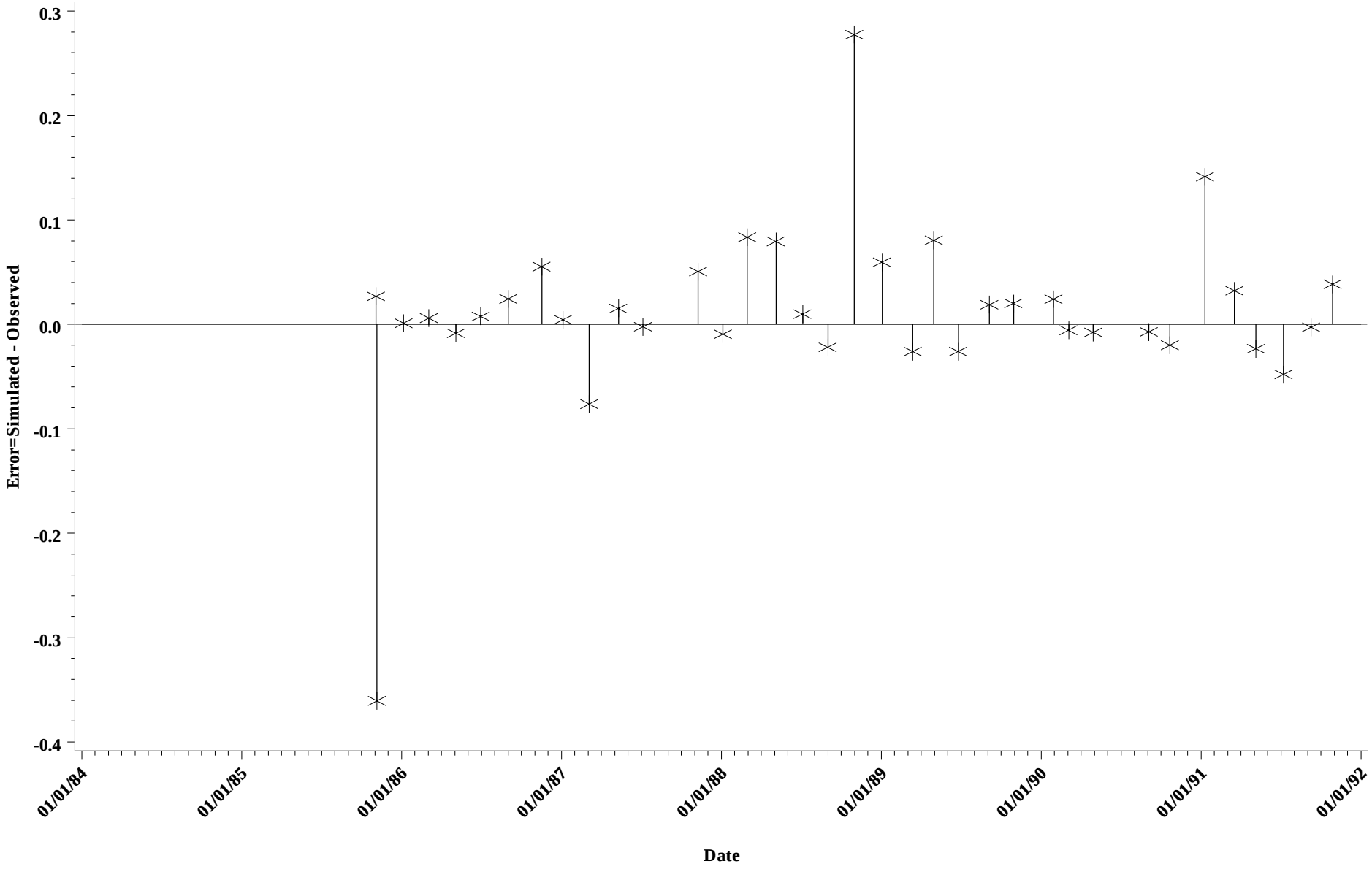
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92



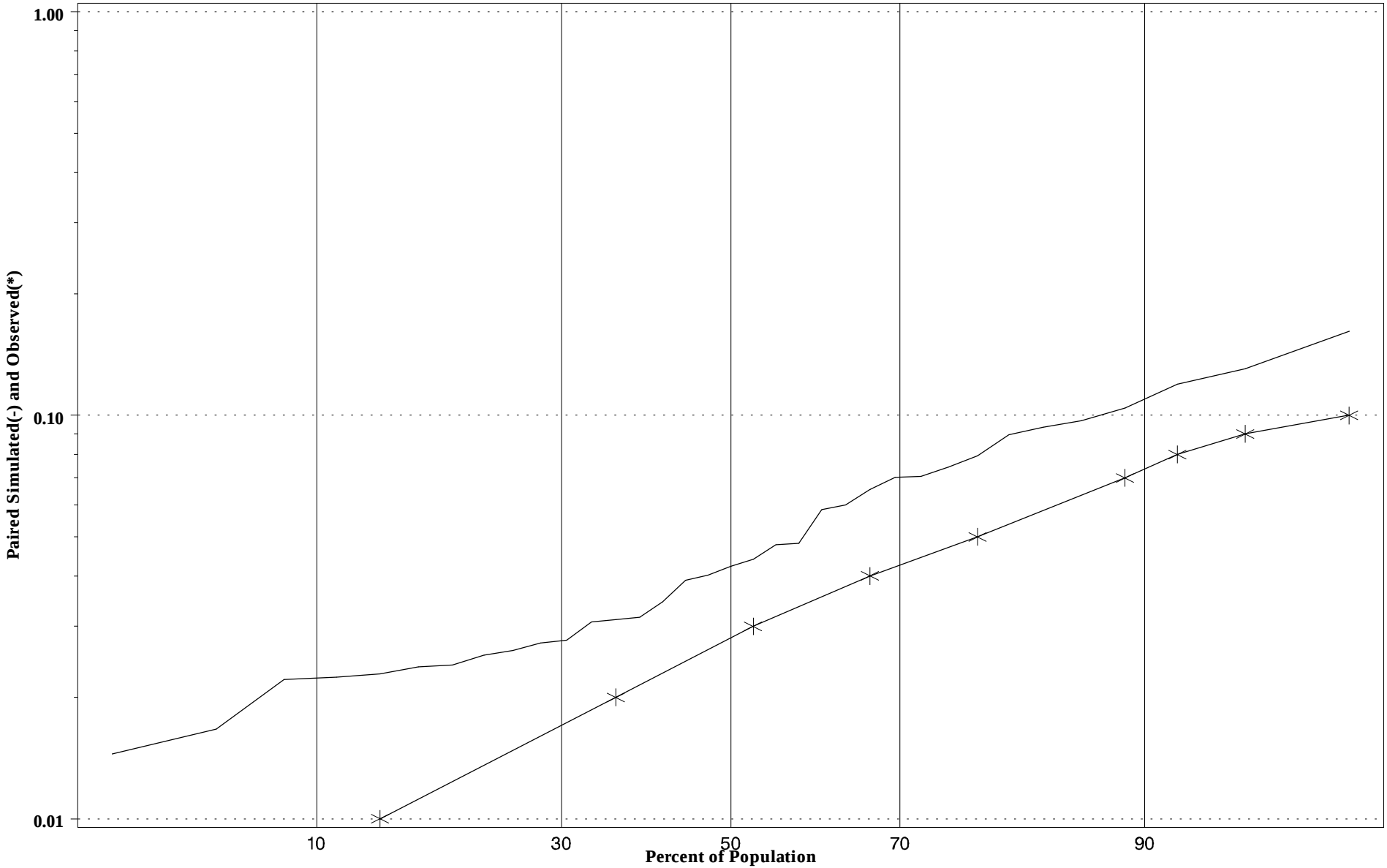

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200
## Actual Error versus Time
## Total Ammonia




(y21_plotb.sas model3d:[pwang.dt] omerr)
(sh.drv 26JUN98 12:42)

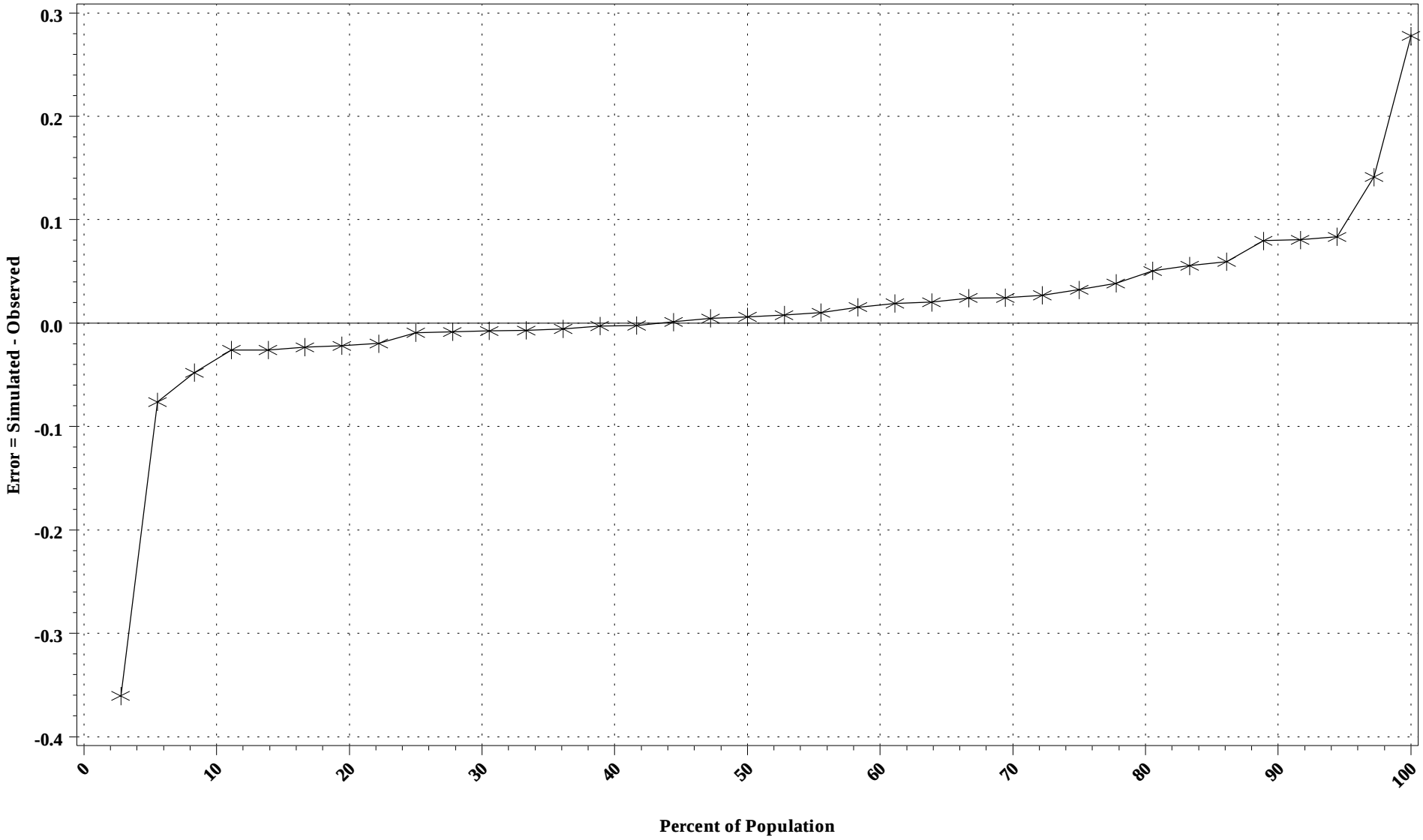
# Shenadoah River at Segment 200
## Total Ammonia
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(sh.drv 26JUN98 12:42)

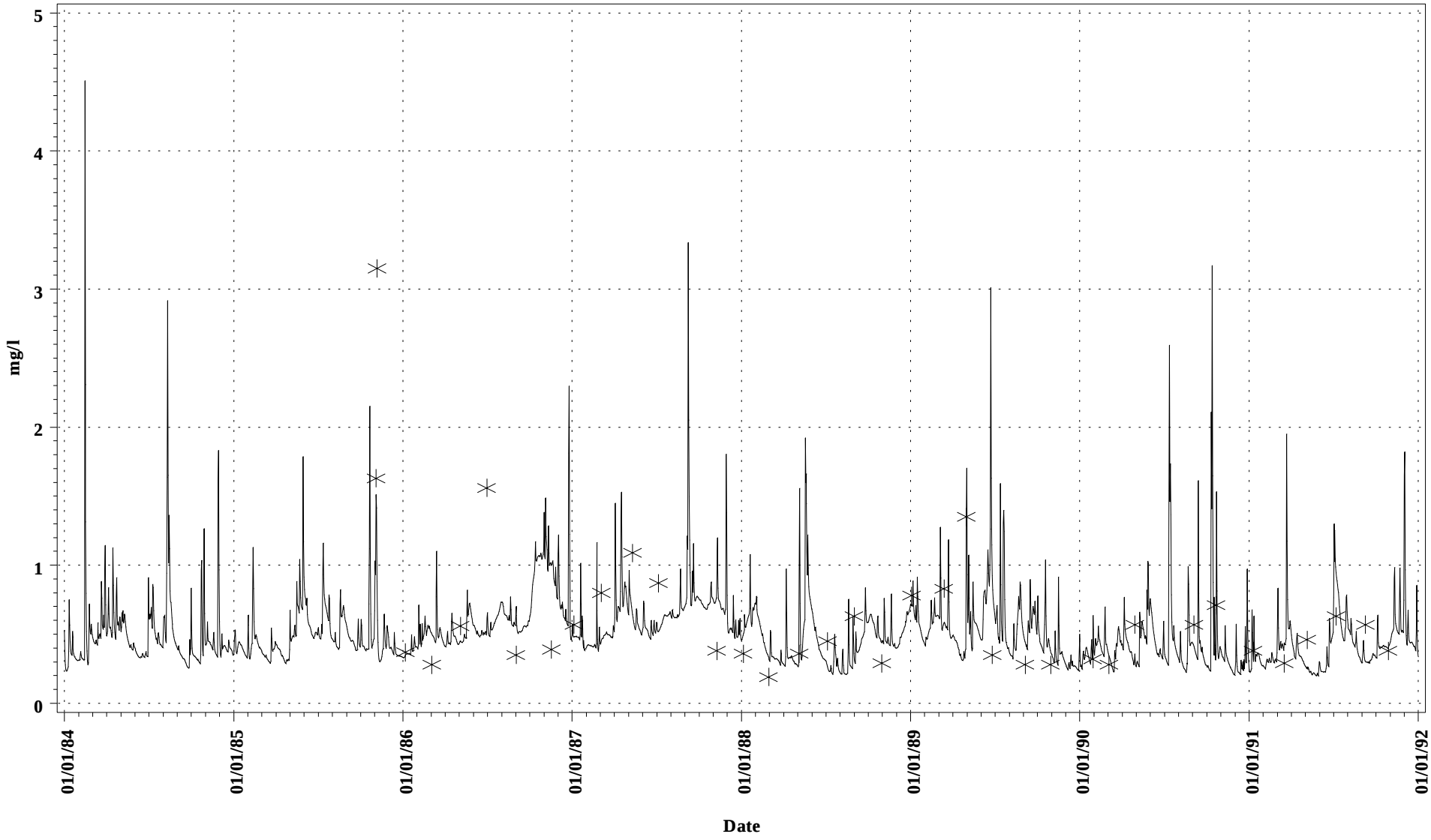
# Shenadoah River at Segment 200
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data



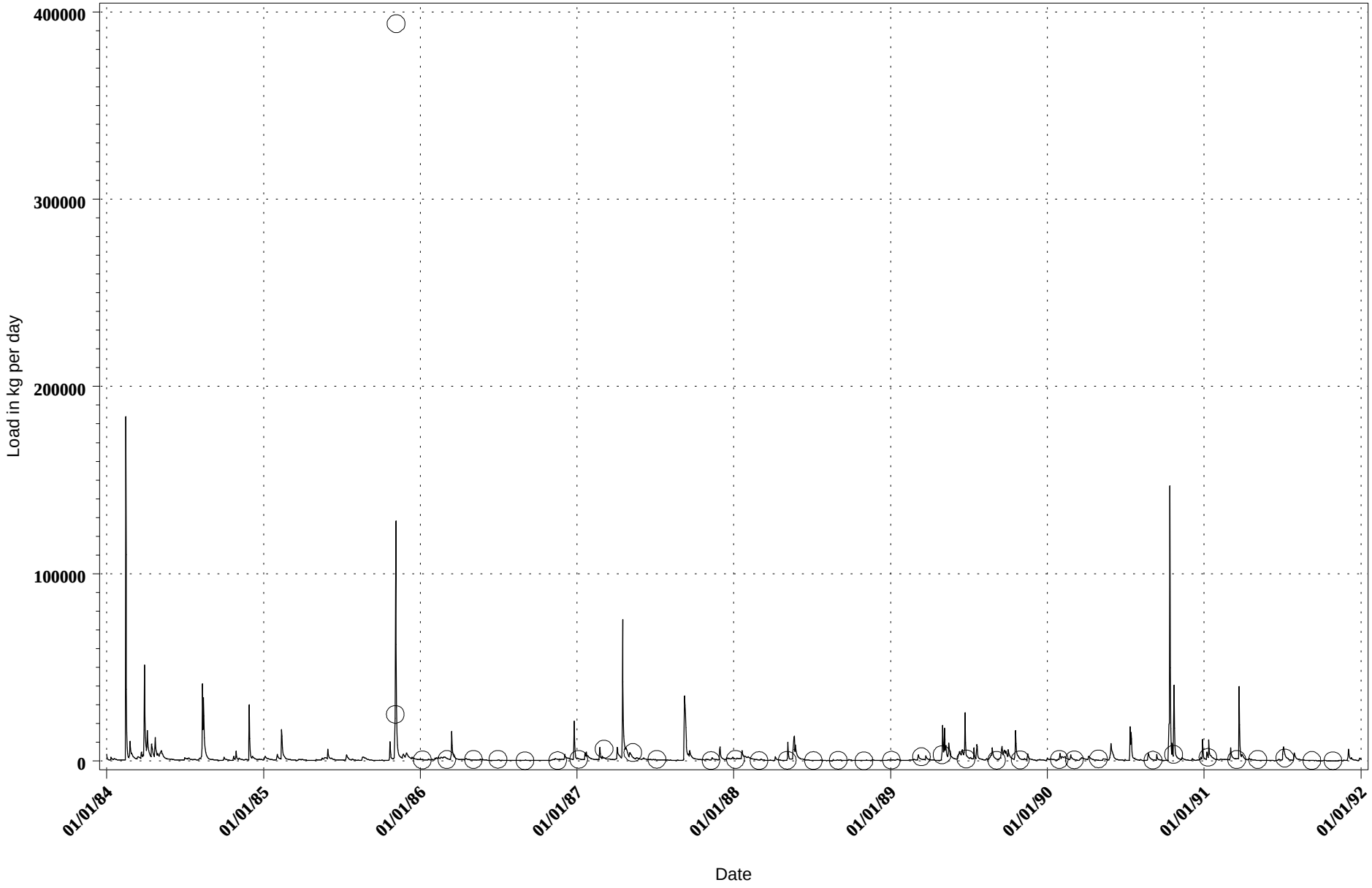

(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Organic Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

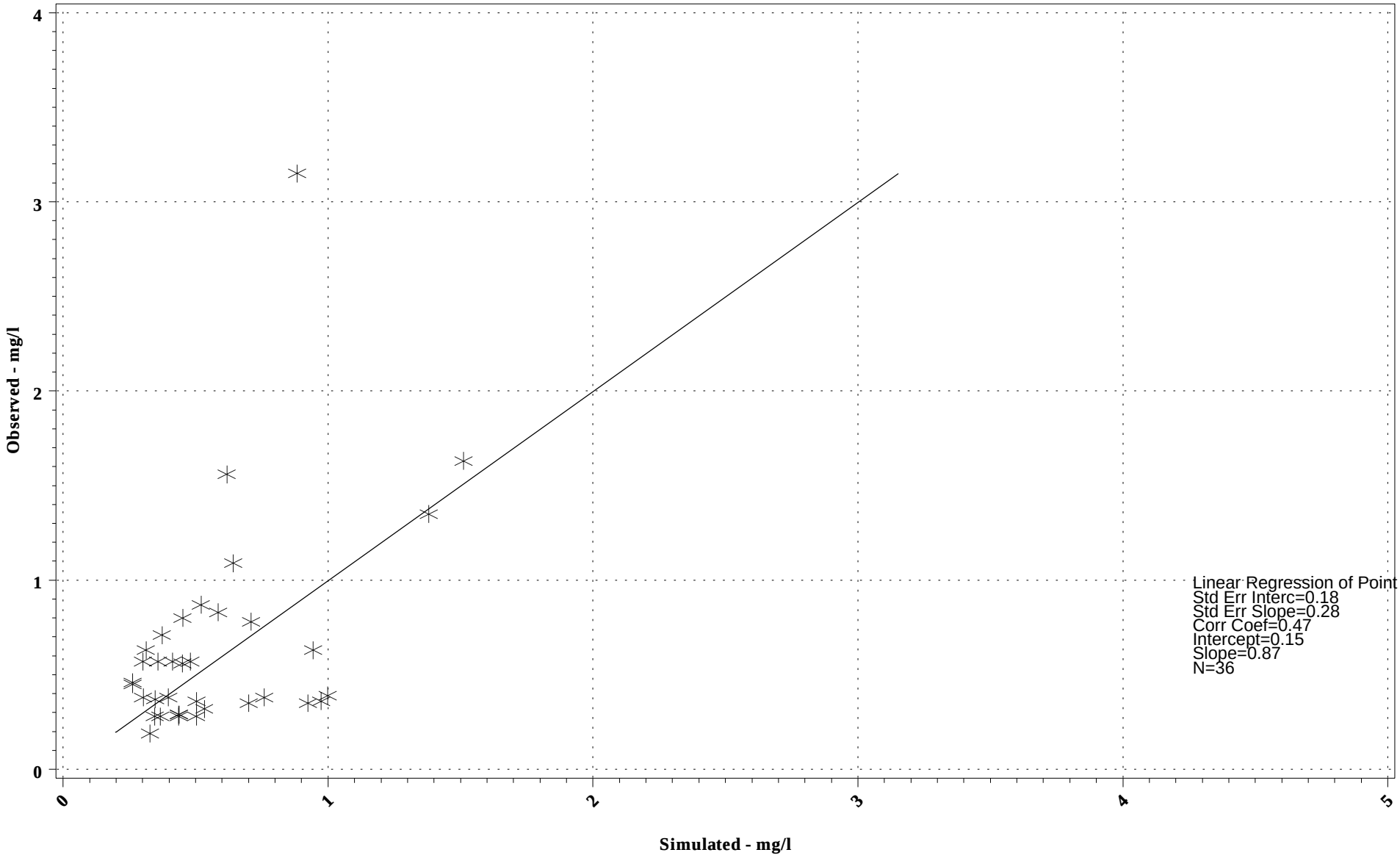



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200

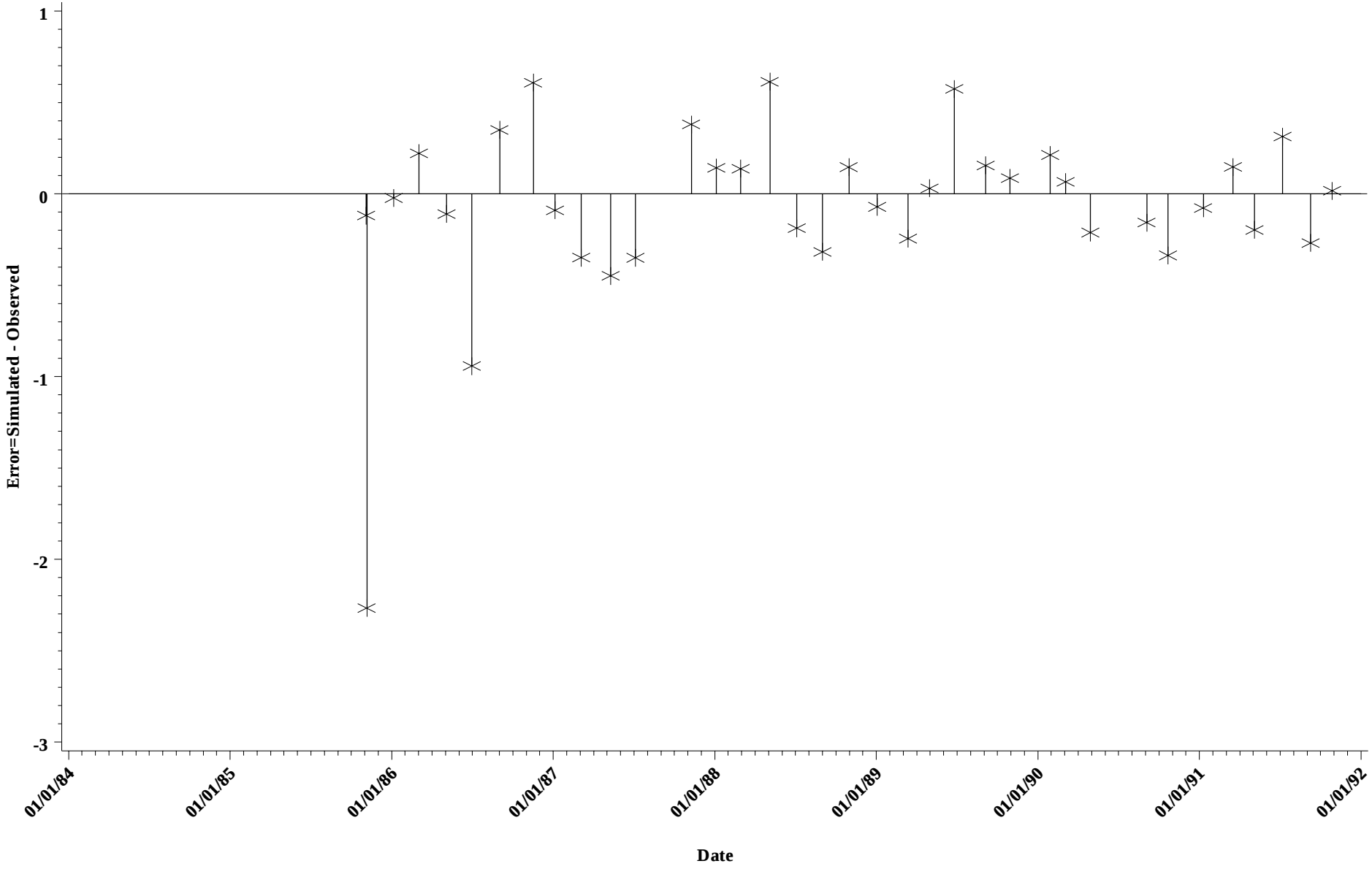
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92



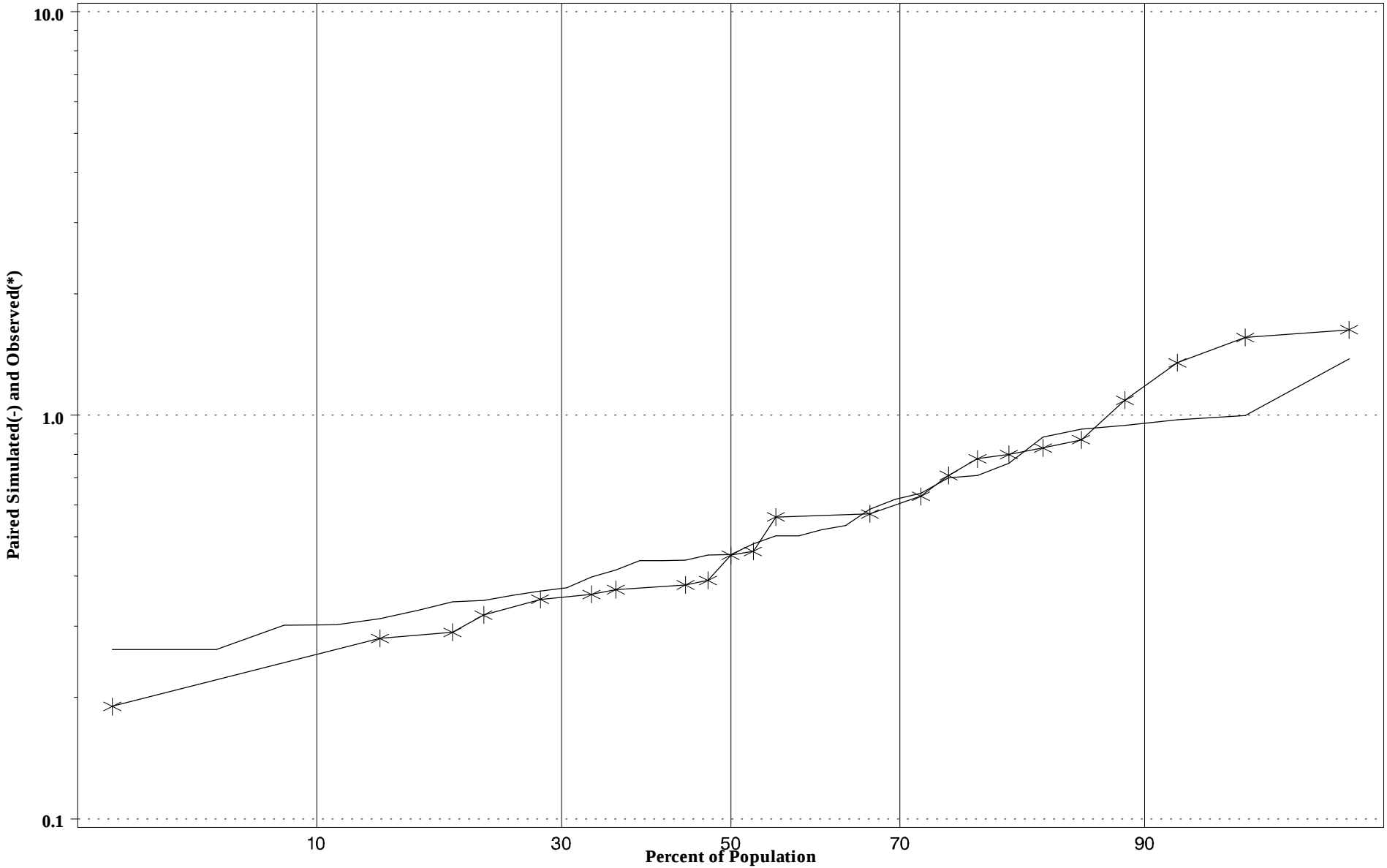

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(sh.drv 26JUN98 12:42,proc reg,model y=x)

# Shenadoah River at Segment 200
## Actual Error versus Time
## Organic Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(sh.drv 26JUN98 12:42)

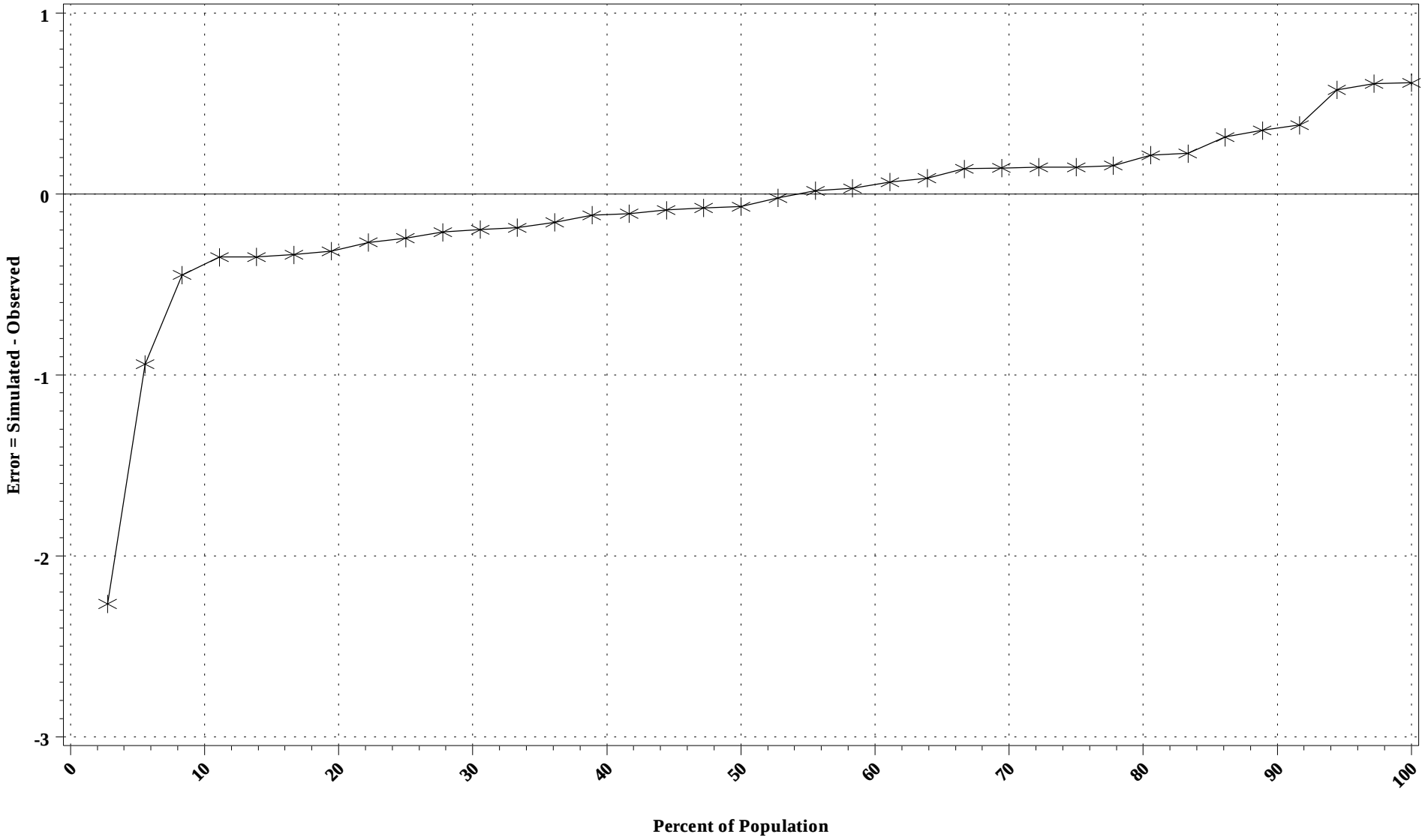
# Shenadoah River at Segment 200
## Organic Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(sh.drv 26JUN98 12:42)

# Shenadoah River at Segment 200
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(sh.drv 26JUN98 12:42)

### *B.3.3 Lower Potomac River at Chain Bridge near Washington, DC at Segment 220 (Monitoring Station: 1646580) (Above Fall Line Basin Segments: 160, 170, 175, 180, 190, 200, 210, 220, 730, 740, and 750)*

**Section Summary:**

The Potomac River at the fall line is primarily rural, with the lowest portions of the basin changing to the urban character of the Washington Metropolitan region. Land use upstream is predominantly forest with agricultural loads from the Piedmont and the Great Valley the primary influence on water quality. The upstream basins of the upper Potomac and Shenandoah contribute to the water quality characteristics at the Potomac fall line. Nitrate comprises the greatest part of total nitrogen and is highly seasonal with nitrate concentrations highest in winter and lowest in summer. An unusual feature of the water quality time series at the Potomac is a 100-year storm in November, 1985. Total suspended sediment increased to about 4,500 mg/l at the Shepardstown gage, the highest observed total suspended sediment concentrations recorded in the Chesapeake watershed.

The Potomac basin above the gaged site covers an area of 8,744 square miles. At the midpoint of the simulation period, 1990, the land use for the basin was composed of 36% forest land, 22% cropland, 30% other agricultural areas, 11% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage decreased from 42.8 million pounds in 1985 to 41.1 million pounds in 1996. Total phosphorus loads over the same time period decreased from 5.0 million pounds to 4.3 million pounds. In general, point source loads above the gage site decreased. In 1996, the total nitrogen point source load was 11% of the total load and the total phosphorus point source load was 25% of the total load. Estimated septic system total nitrogen loads increased 28%, from 1.5 million pounds in 1985 to 1.9 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 18%, and other agricultural loads (primarily pasture and manure loads) by 12%. Total phosphorus decreased for these land uses by 10% and 17% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 24% for total nitrogen and 26% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

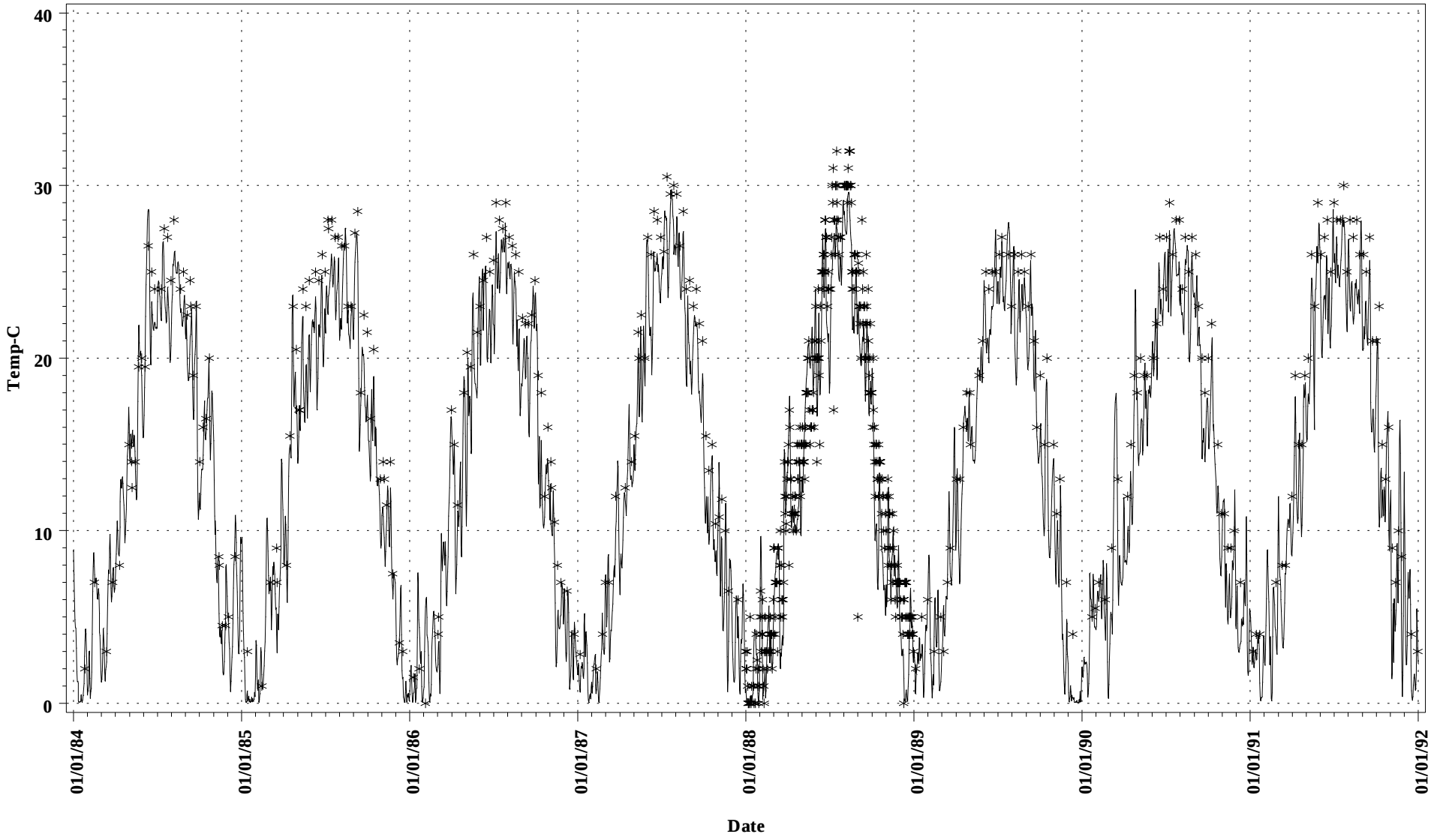
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# Lower Potomac River at Segment 220
## Observed and Simulated versus Time
# Temperature-C

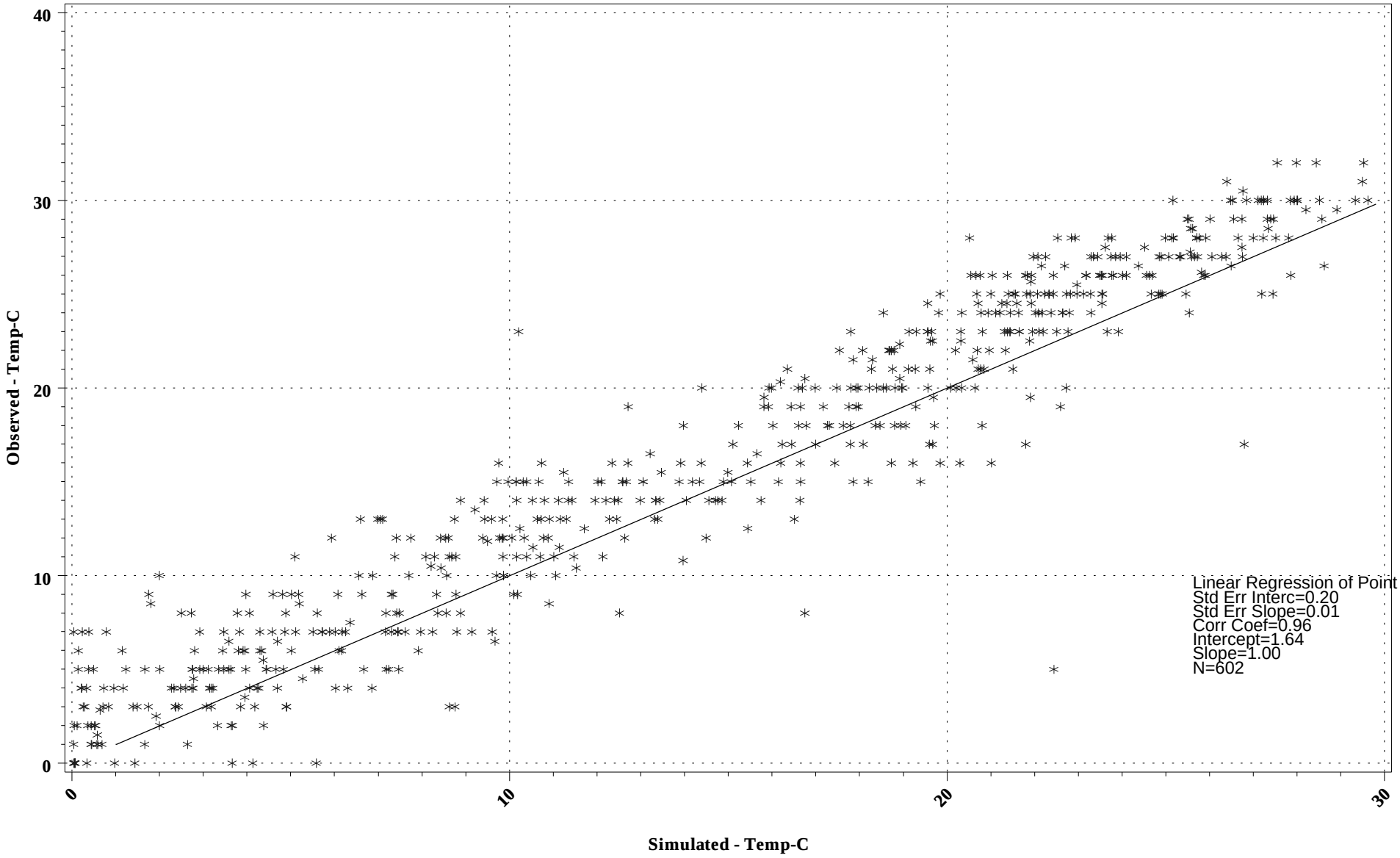
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(lo.drv 26JUN98 12:43)

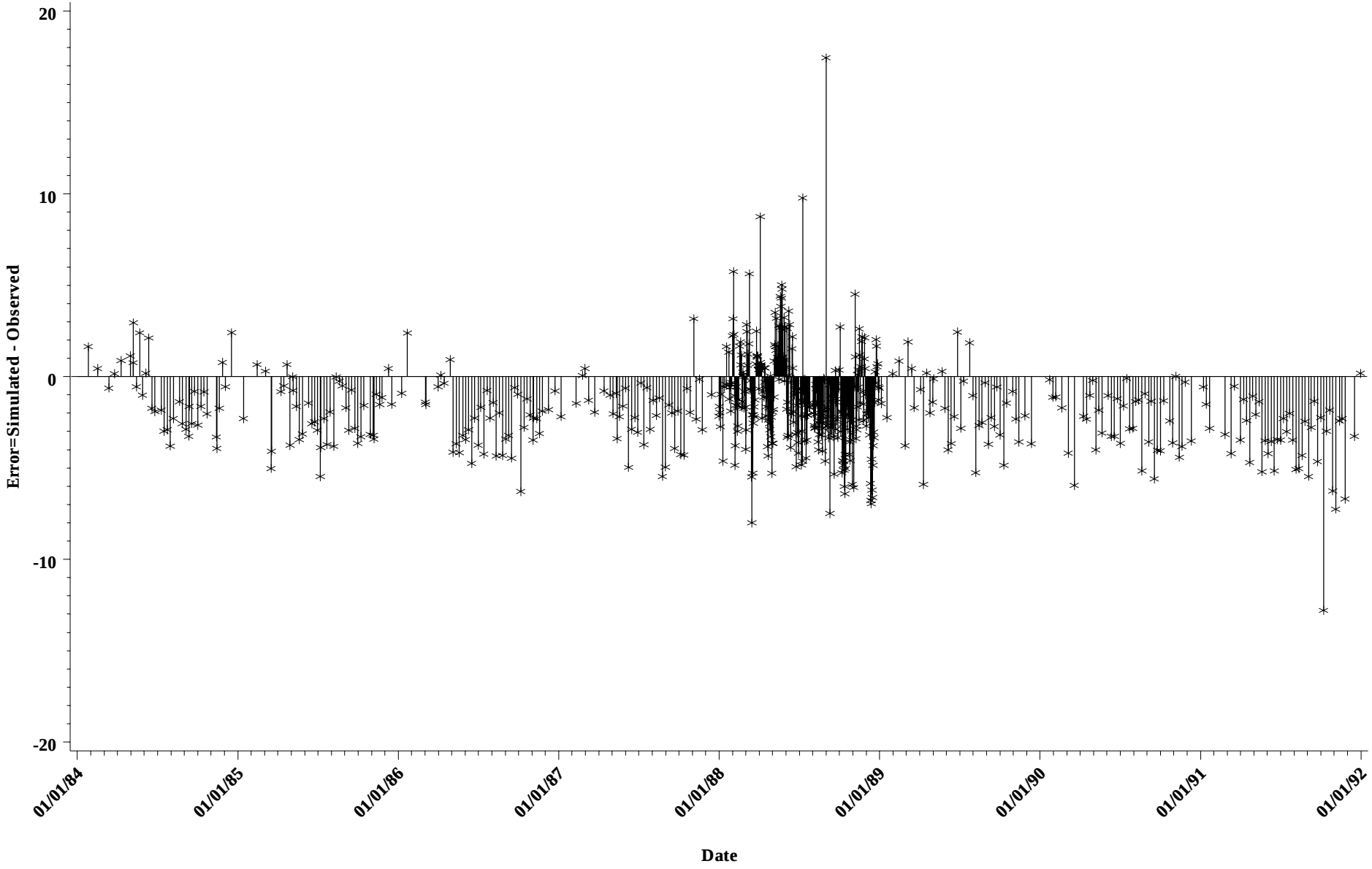
# Lower Potomac River at Segment 220

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220
## Actual Error versus Time
## Temperature-C

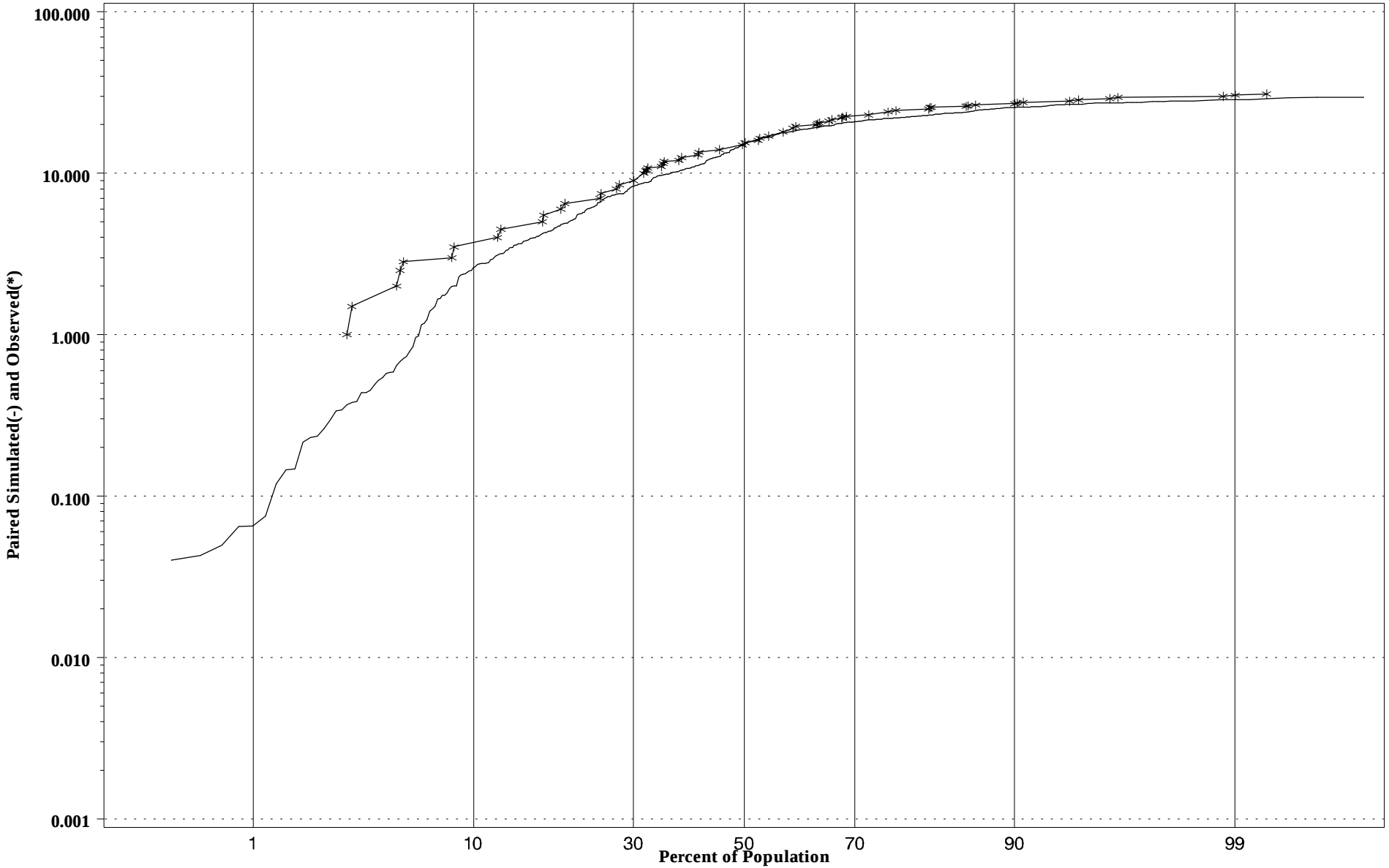



(y21_plotb.sas model3d:[pwang.dt] omerr)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220

## Temperature-C

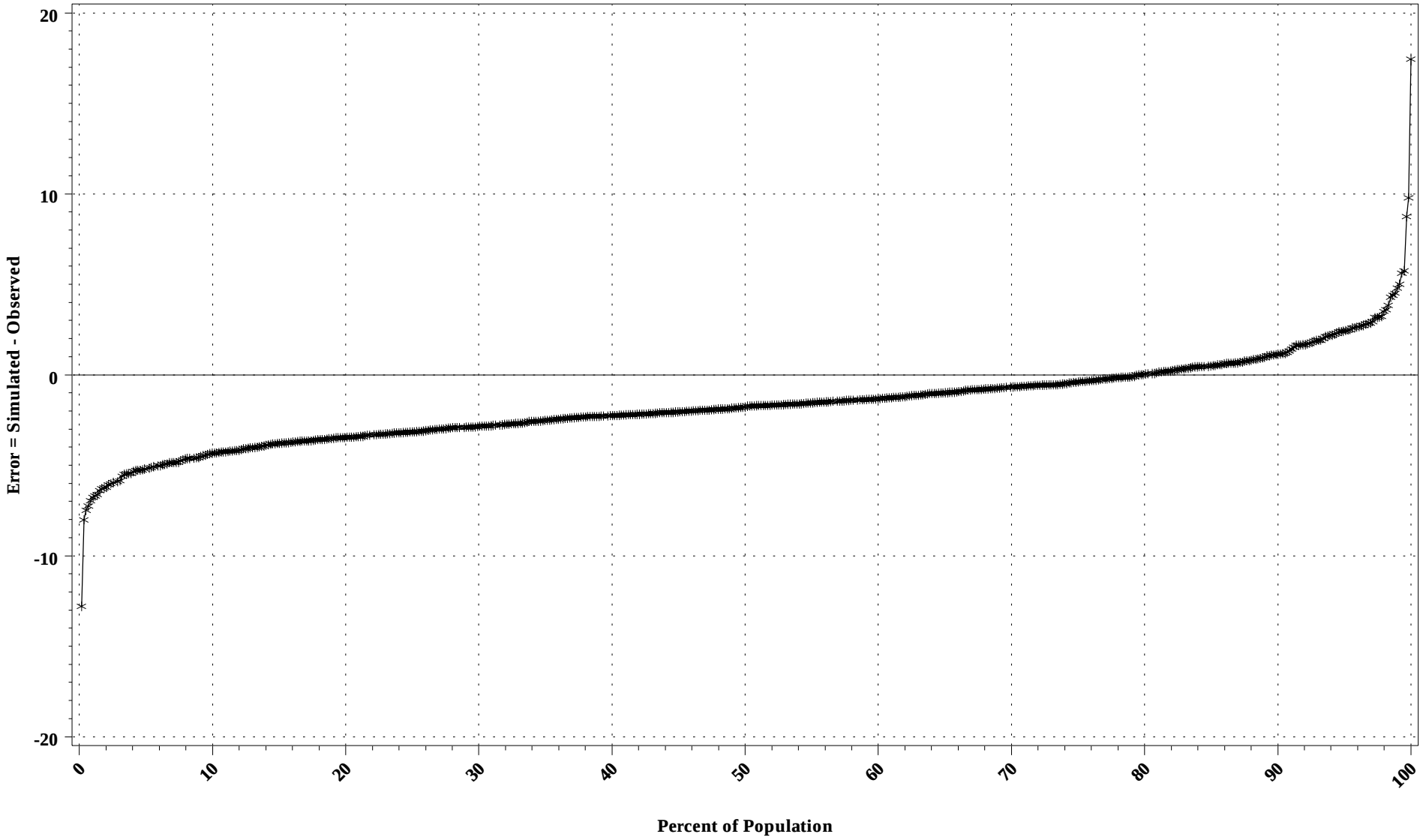
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Actual error versus Percentile Sample Population
## Temperature-C

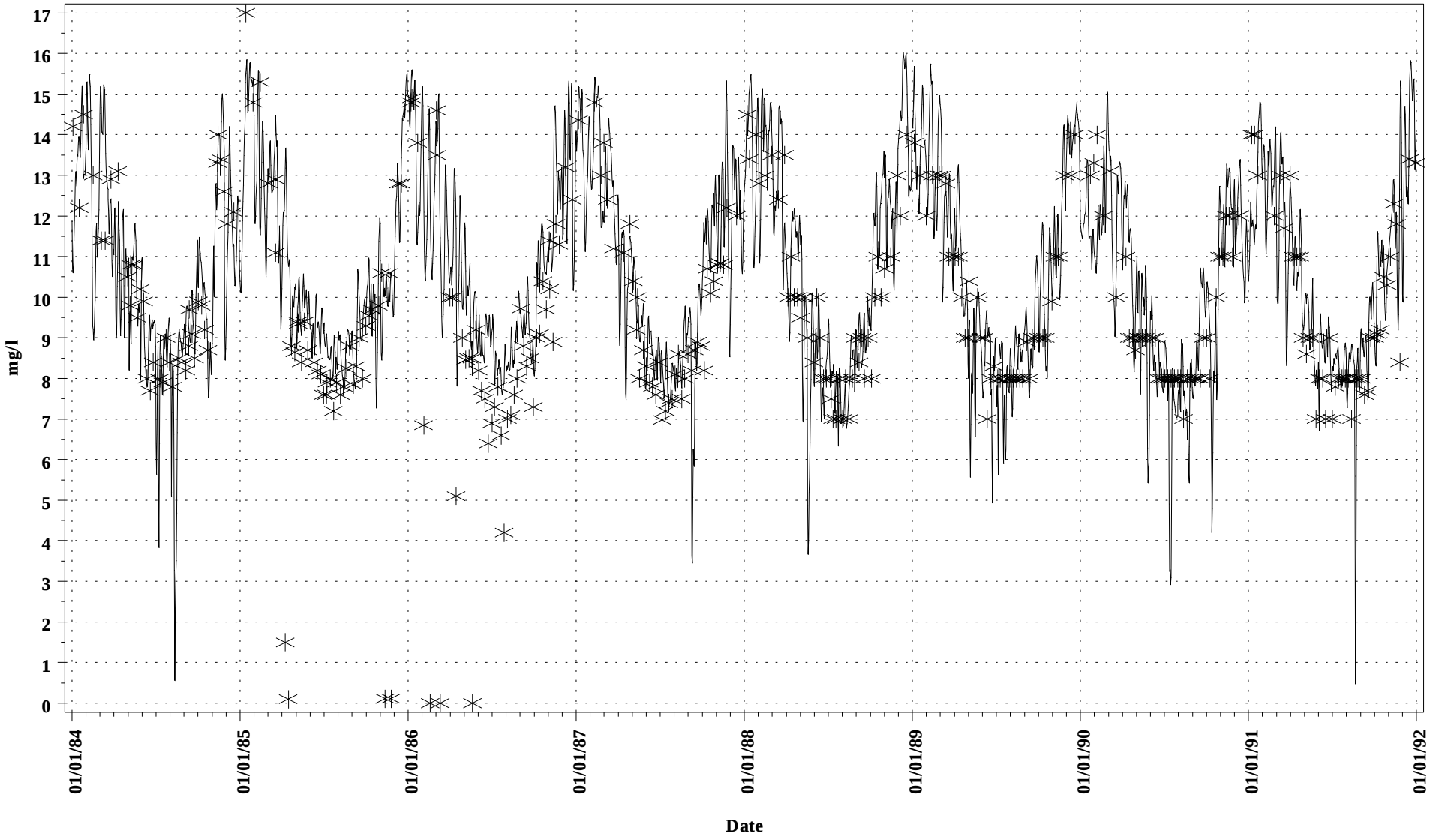
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(lo.drv 26JUN98 12:43)

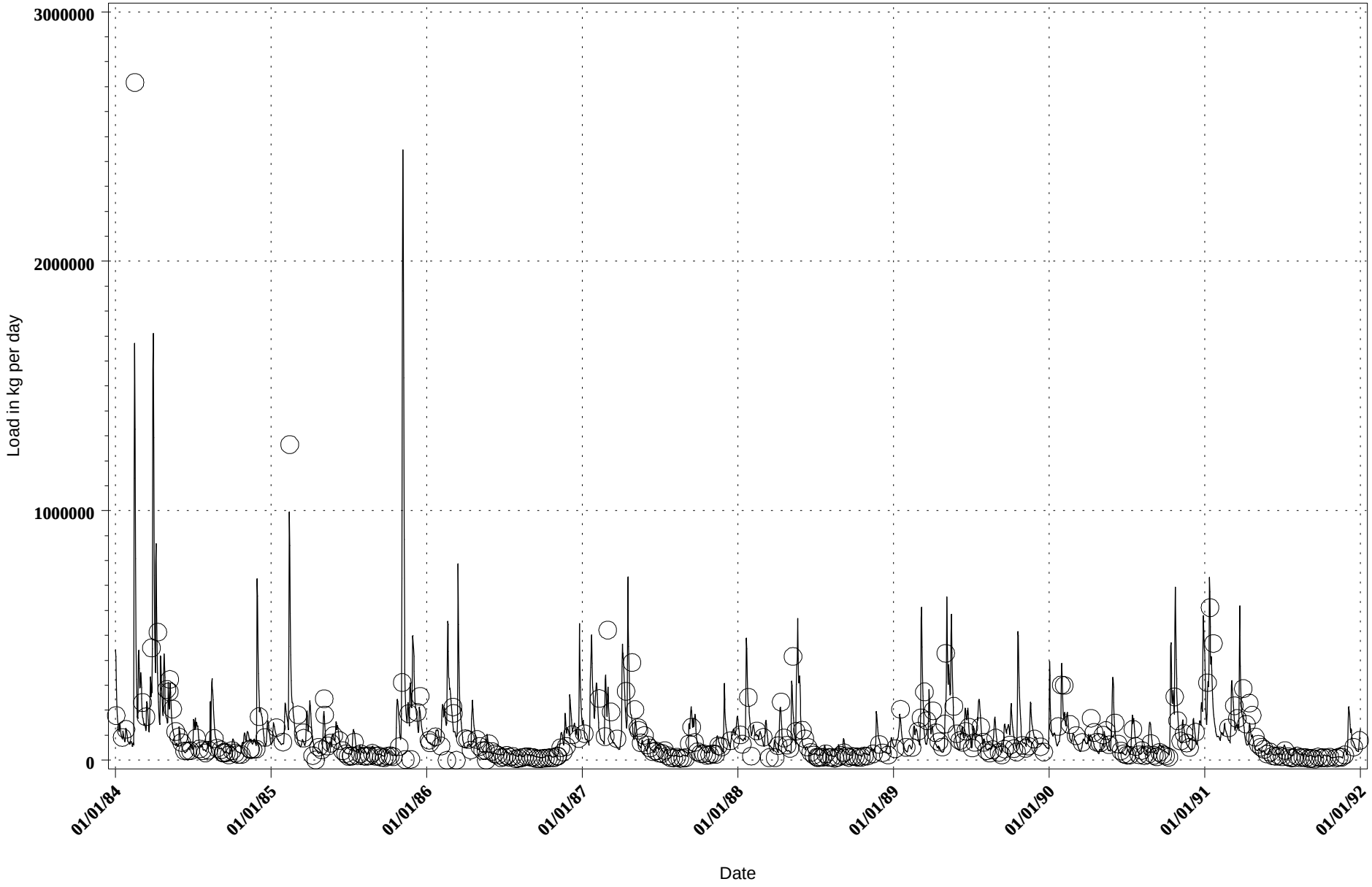
# Lower Potomac River at Segment 220
## Observed and Simulated versus Time
## Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

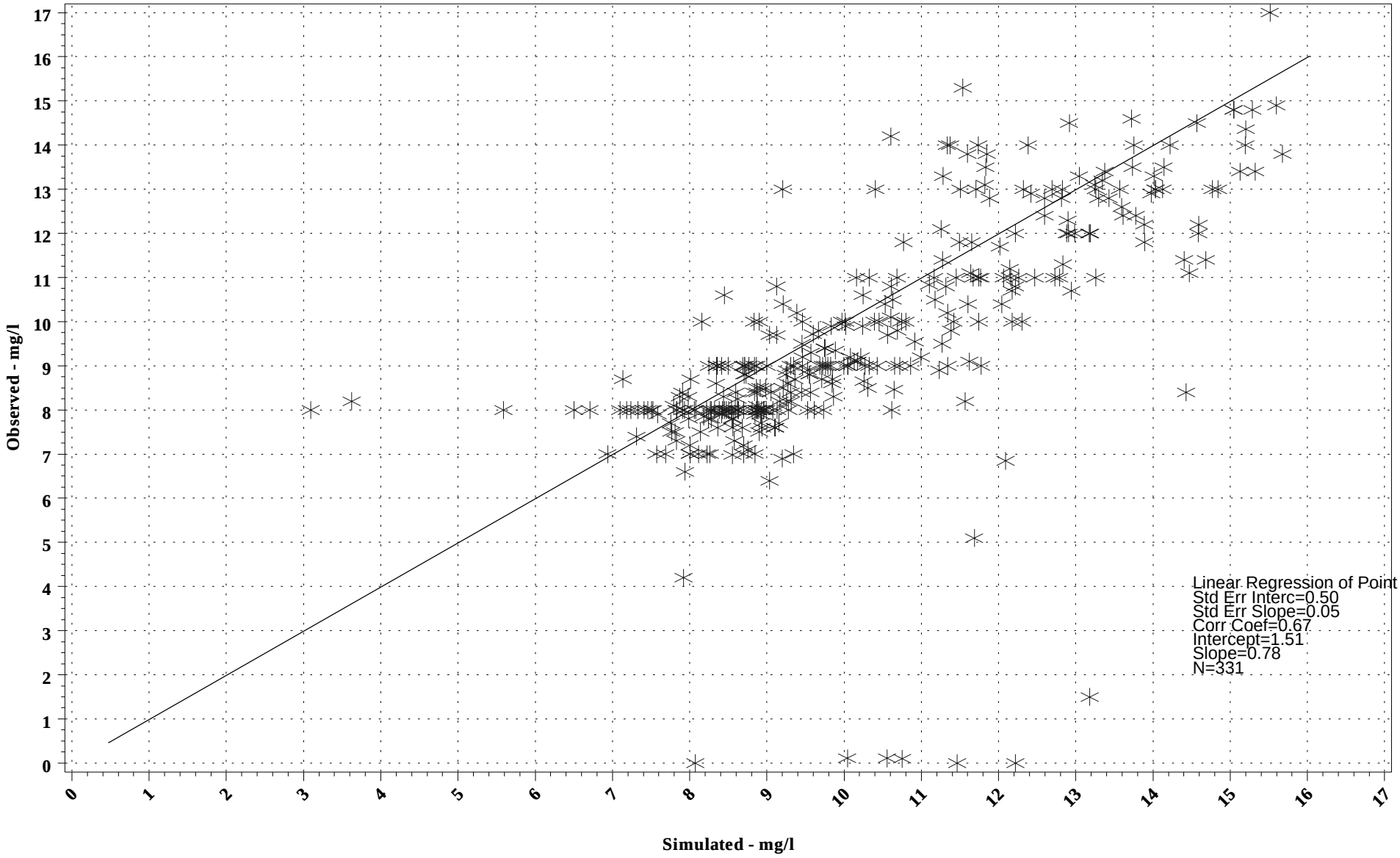



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220

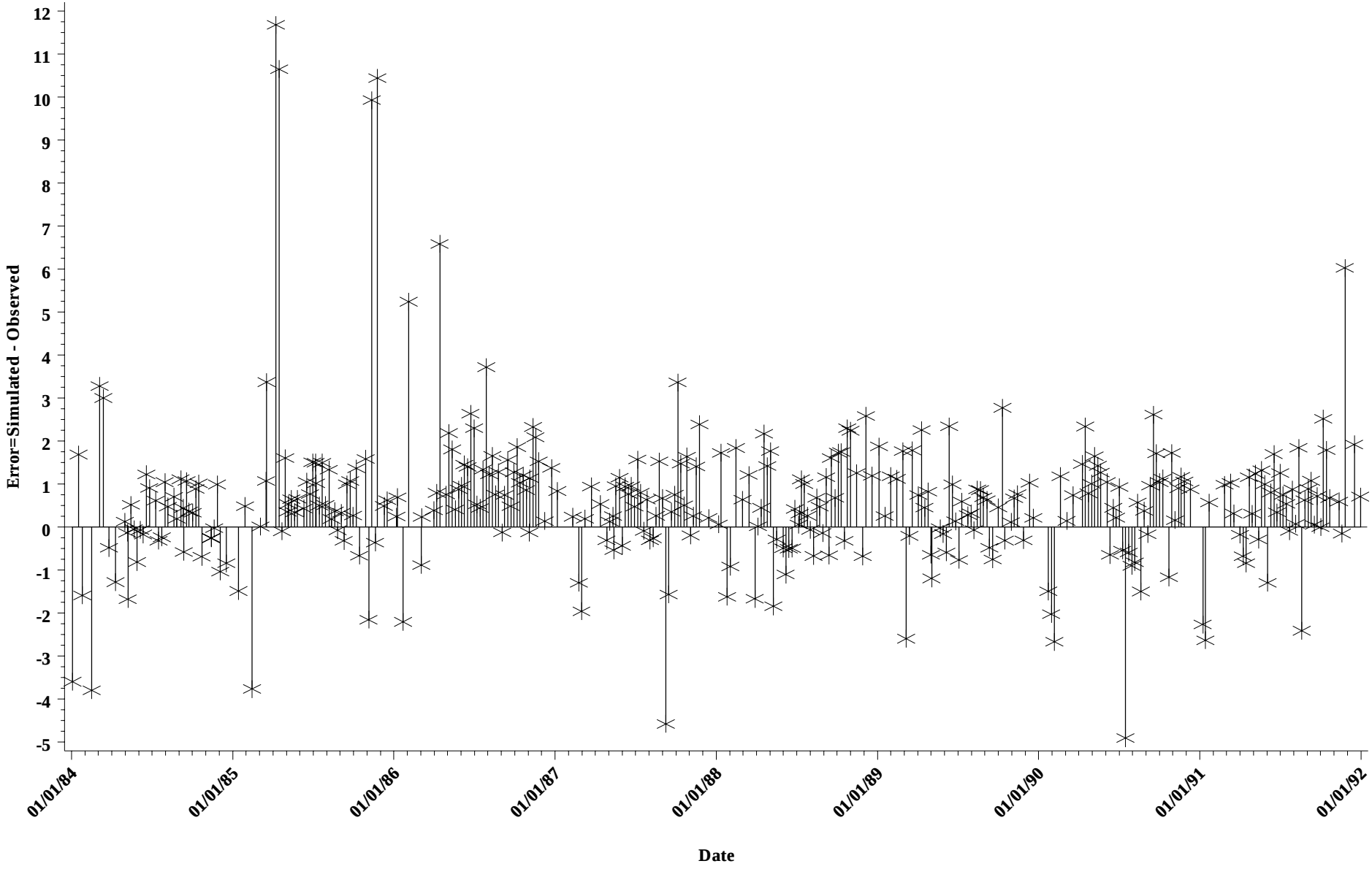
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Oxygen: 01JAN84 - 01JAN92



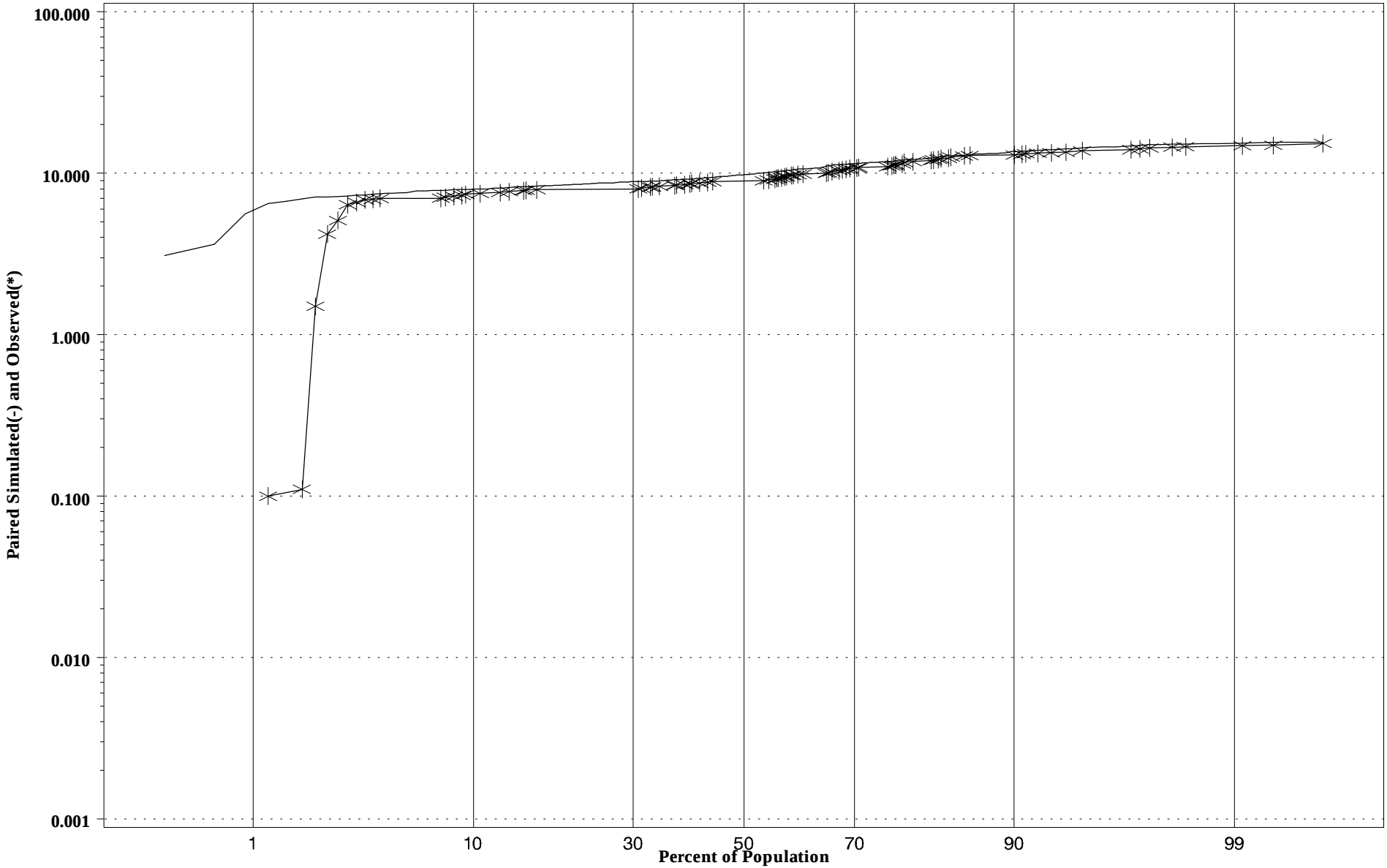

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(lo.drv 26JUN98 12:43)

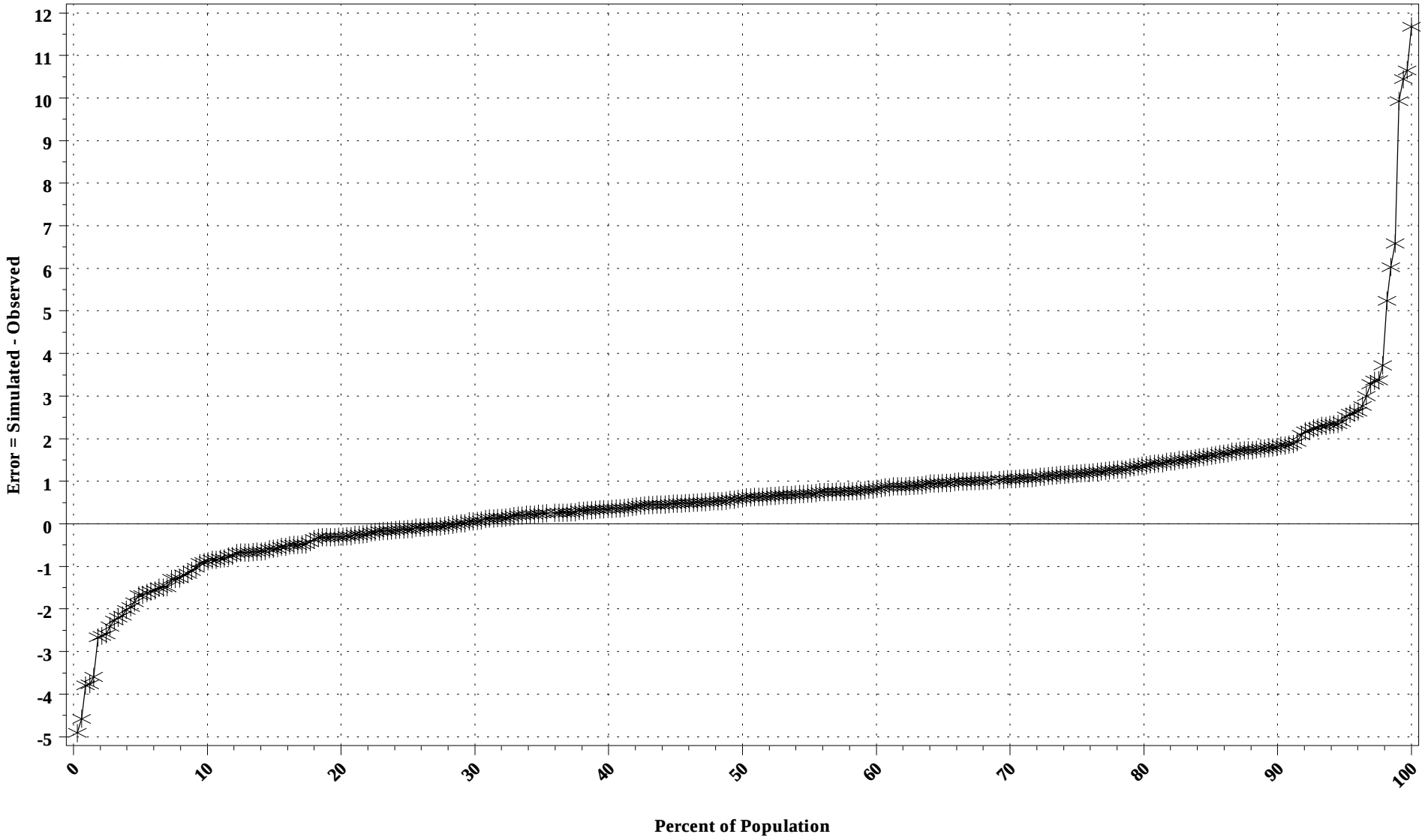
# Lower Potomac River at Segment 220
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

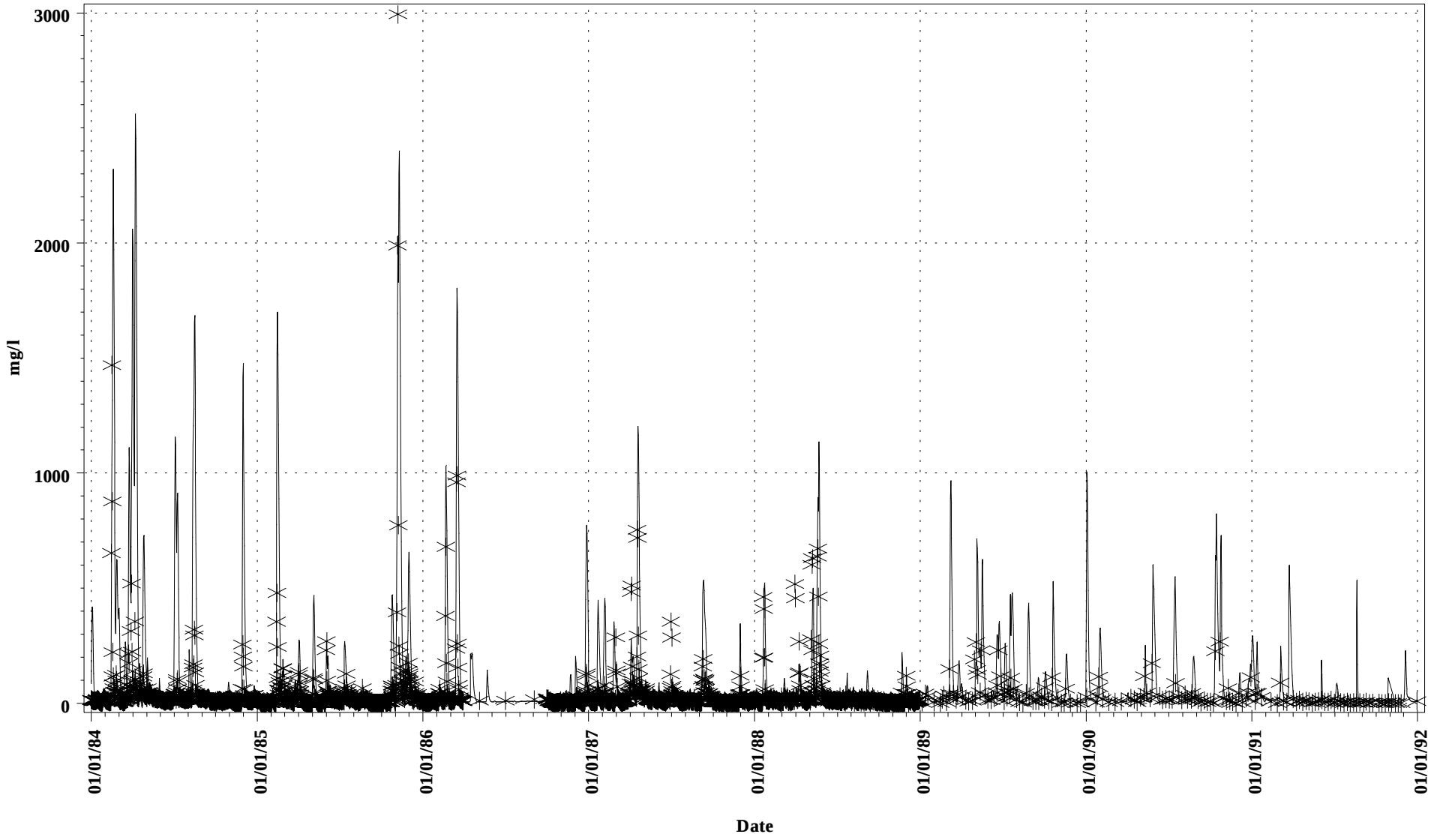
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(lo.drv 26JUN98 12:43)

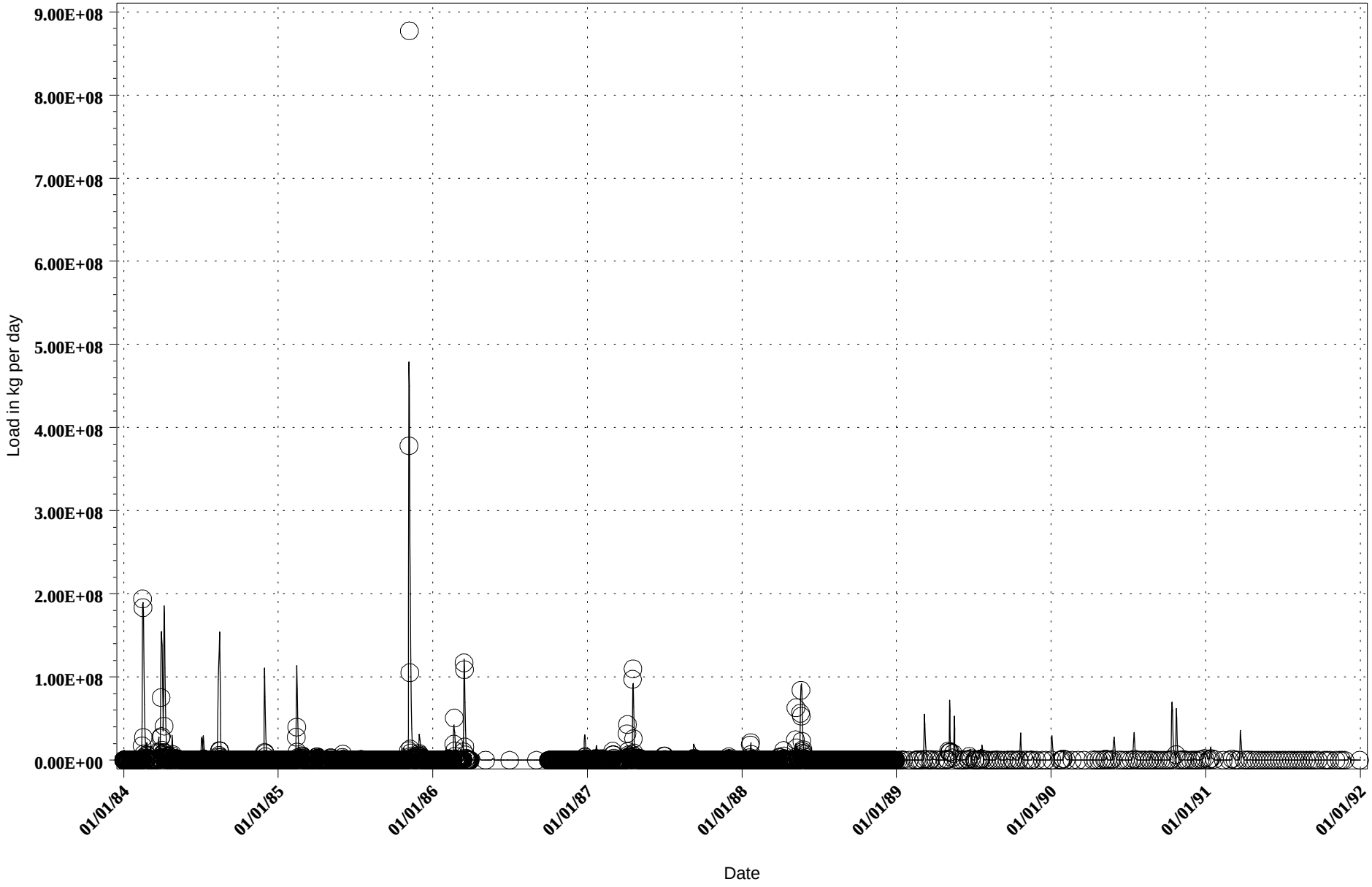
# Lower Potomac River at Segment 220
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Total Suspended Sediment Observed and Simulated Load vs Time
### (line = simulated, O = observed)

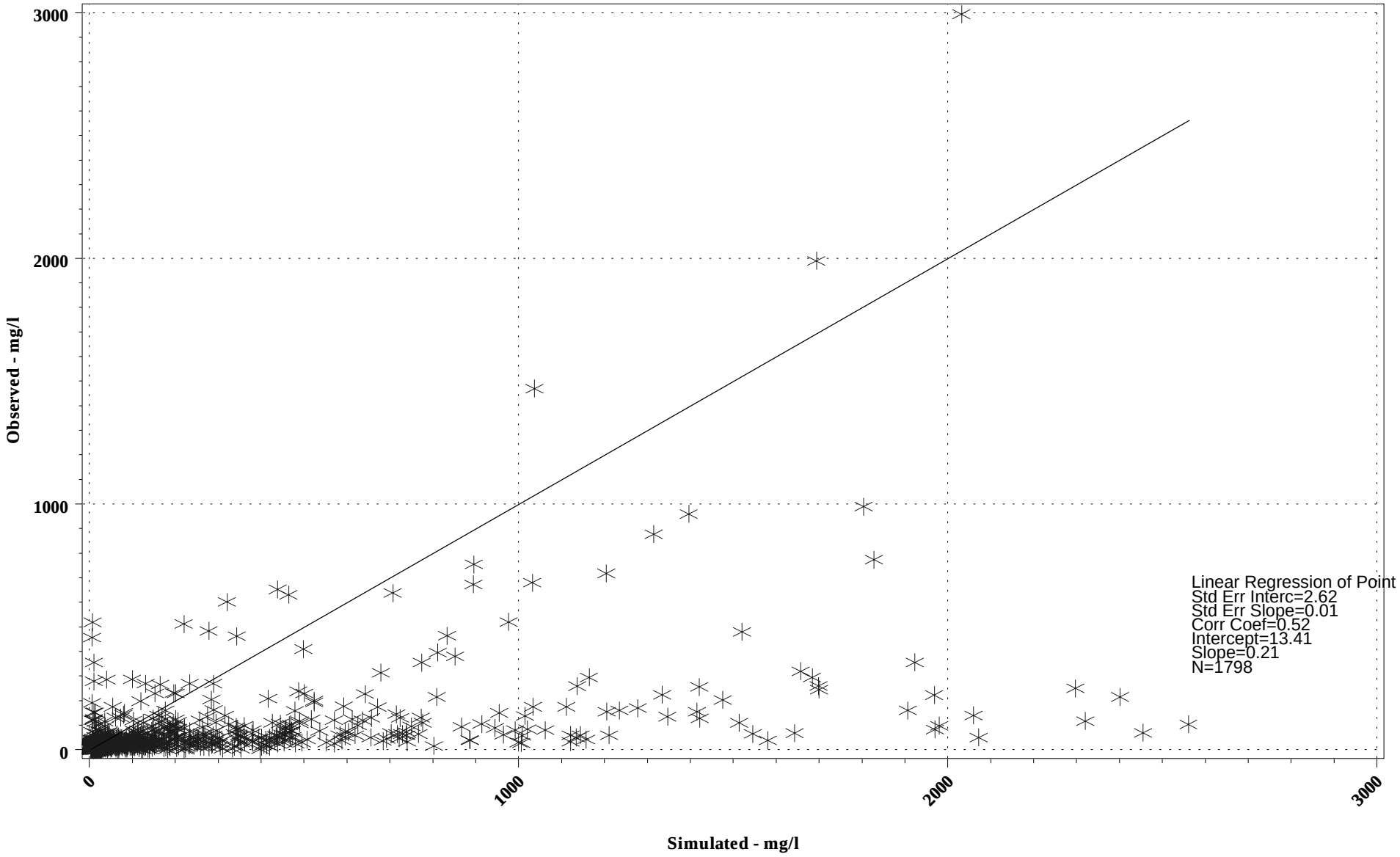



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220

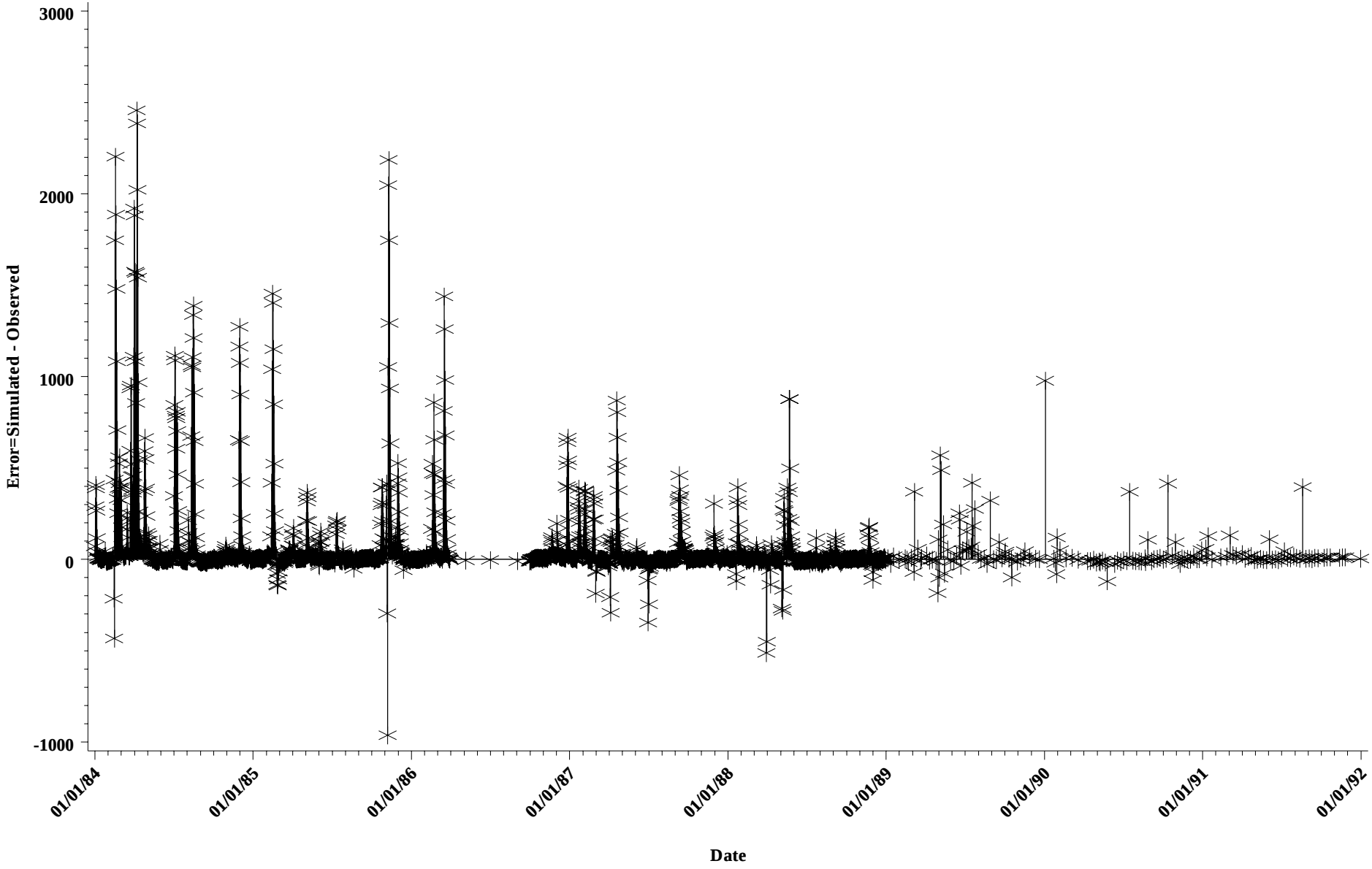
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



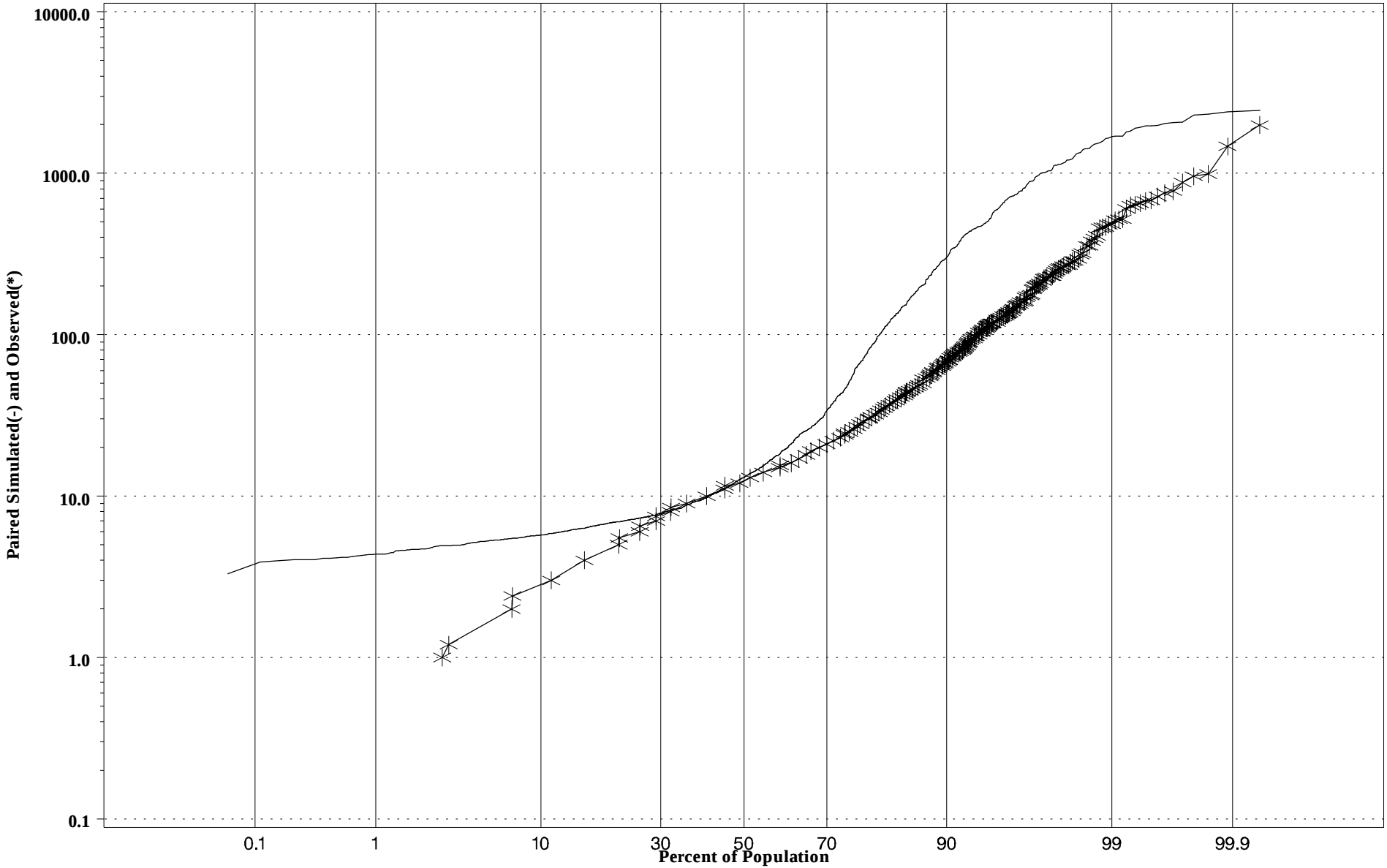

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(lo.drv 26JUN98 12:43)

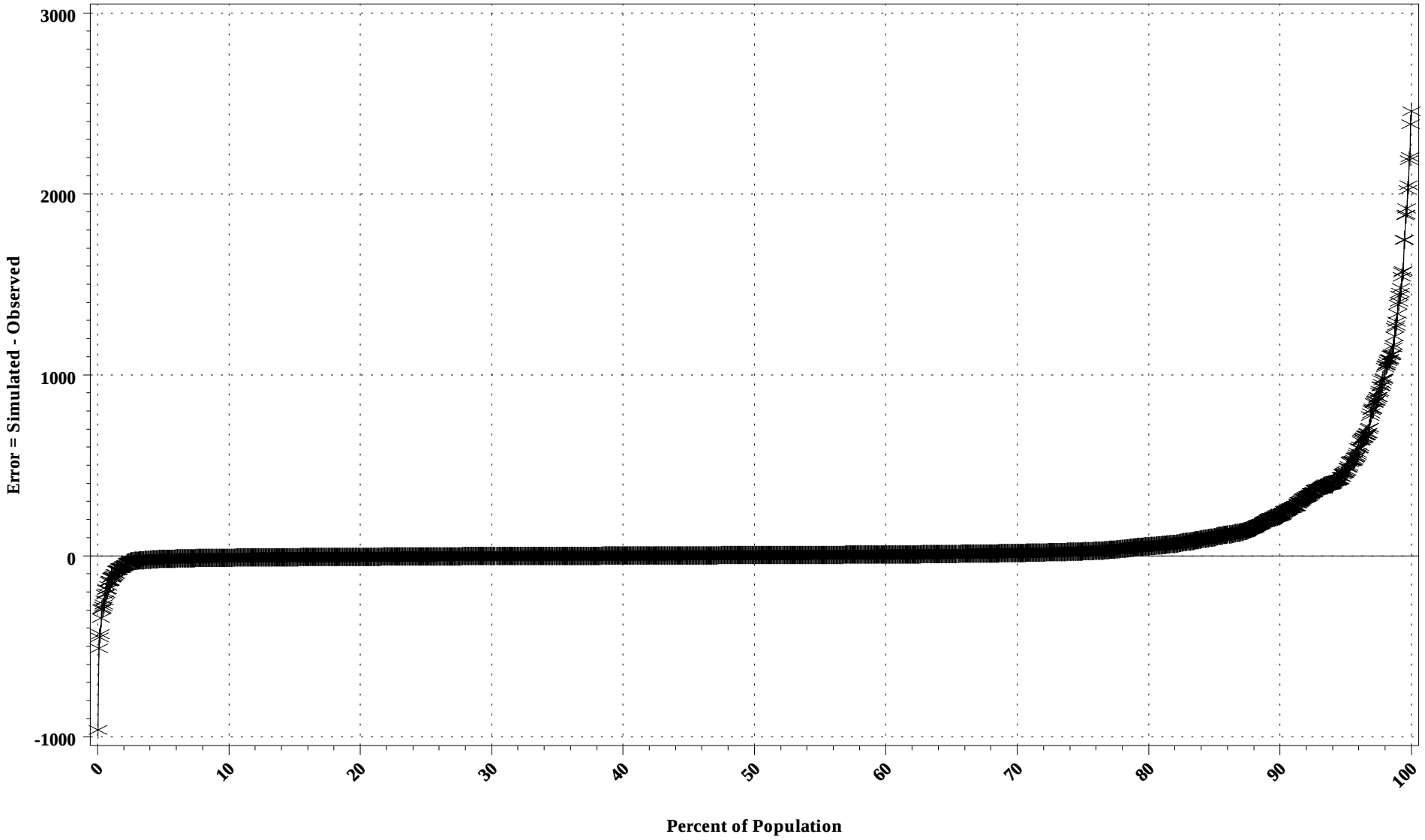
# Lower Potomac River at Segment 220
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

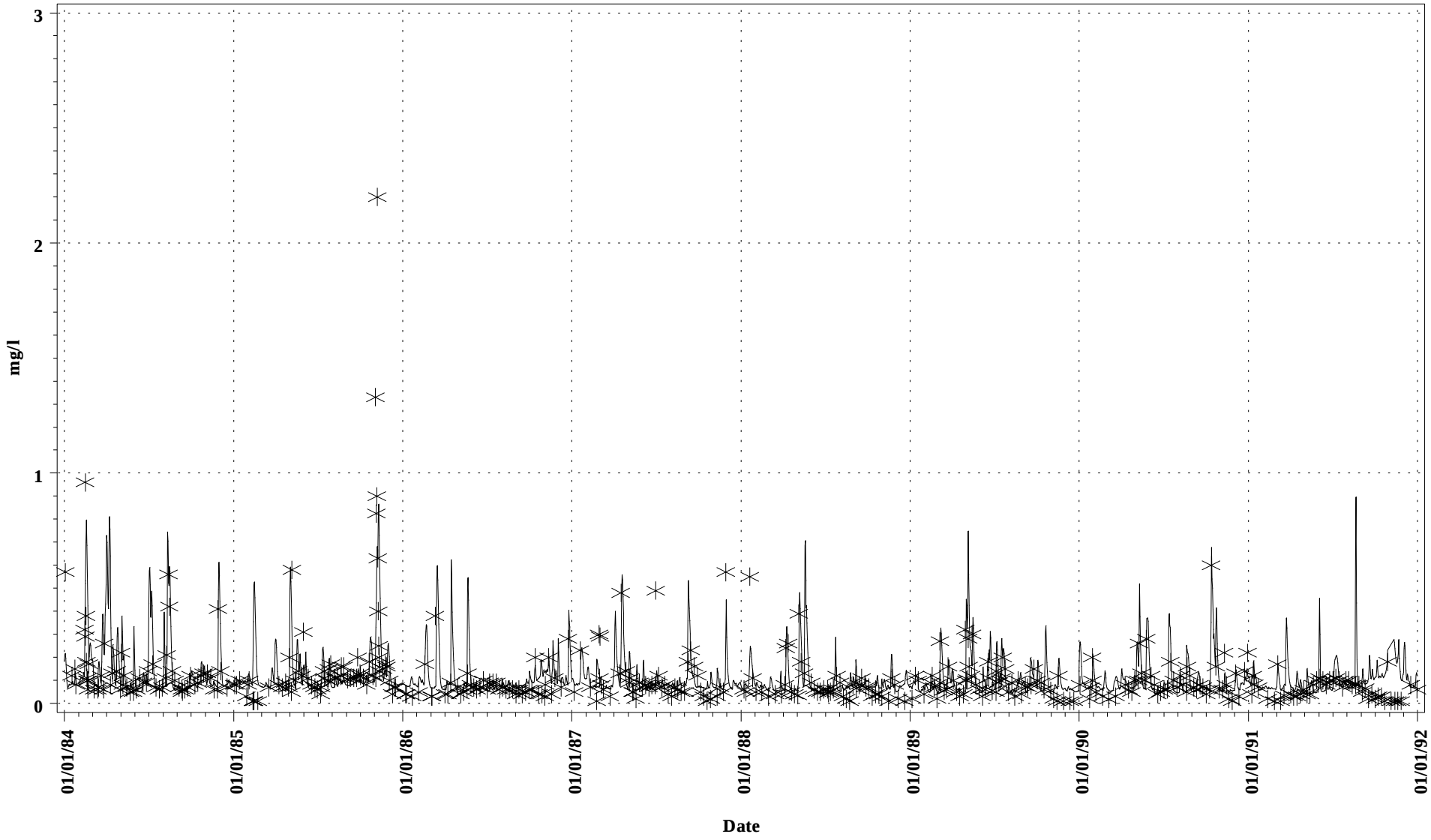
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(lo.drv 26JUN98 12:43)

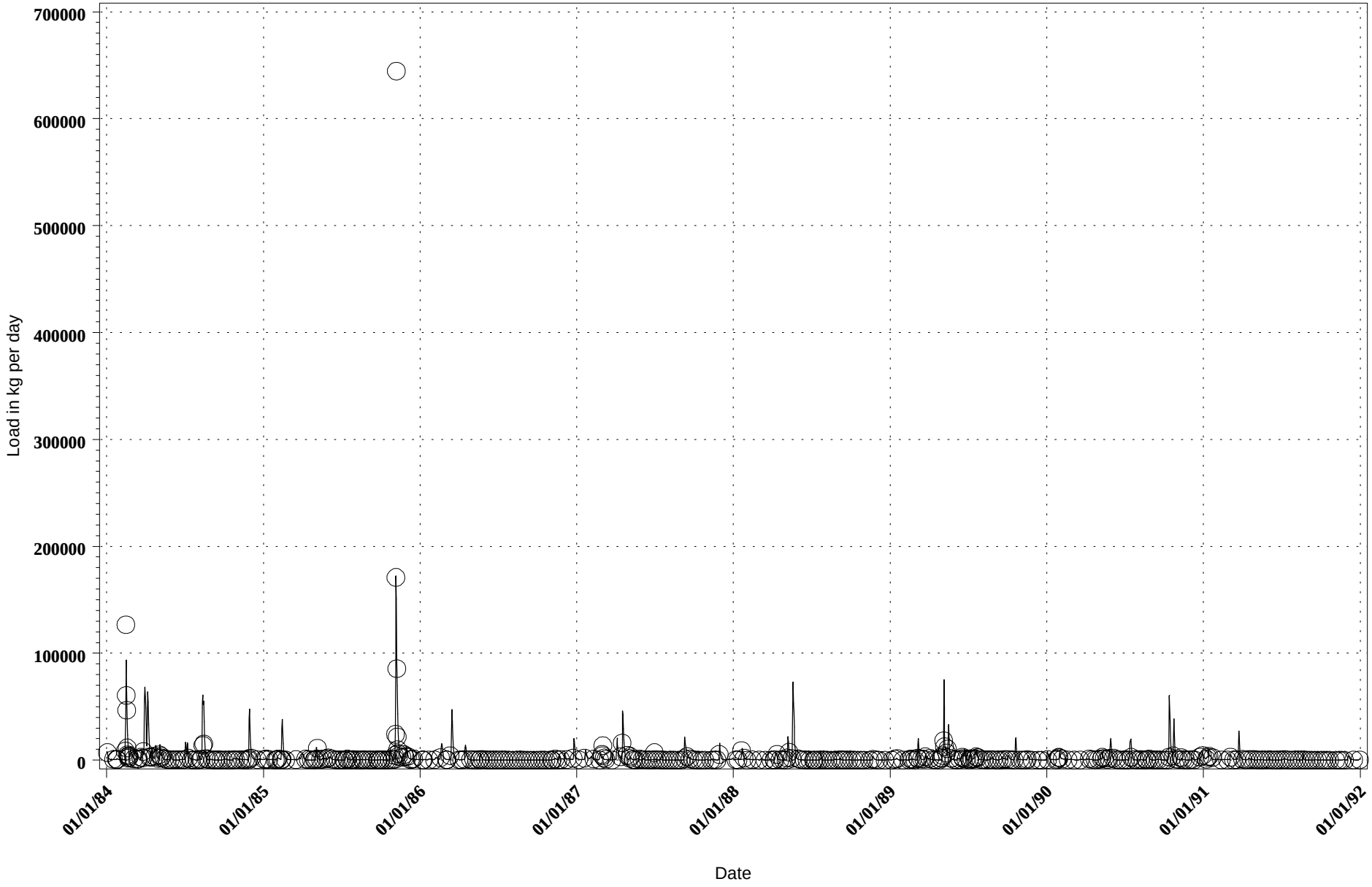
# Lower Potomac River at Segment 220
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

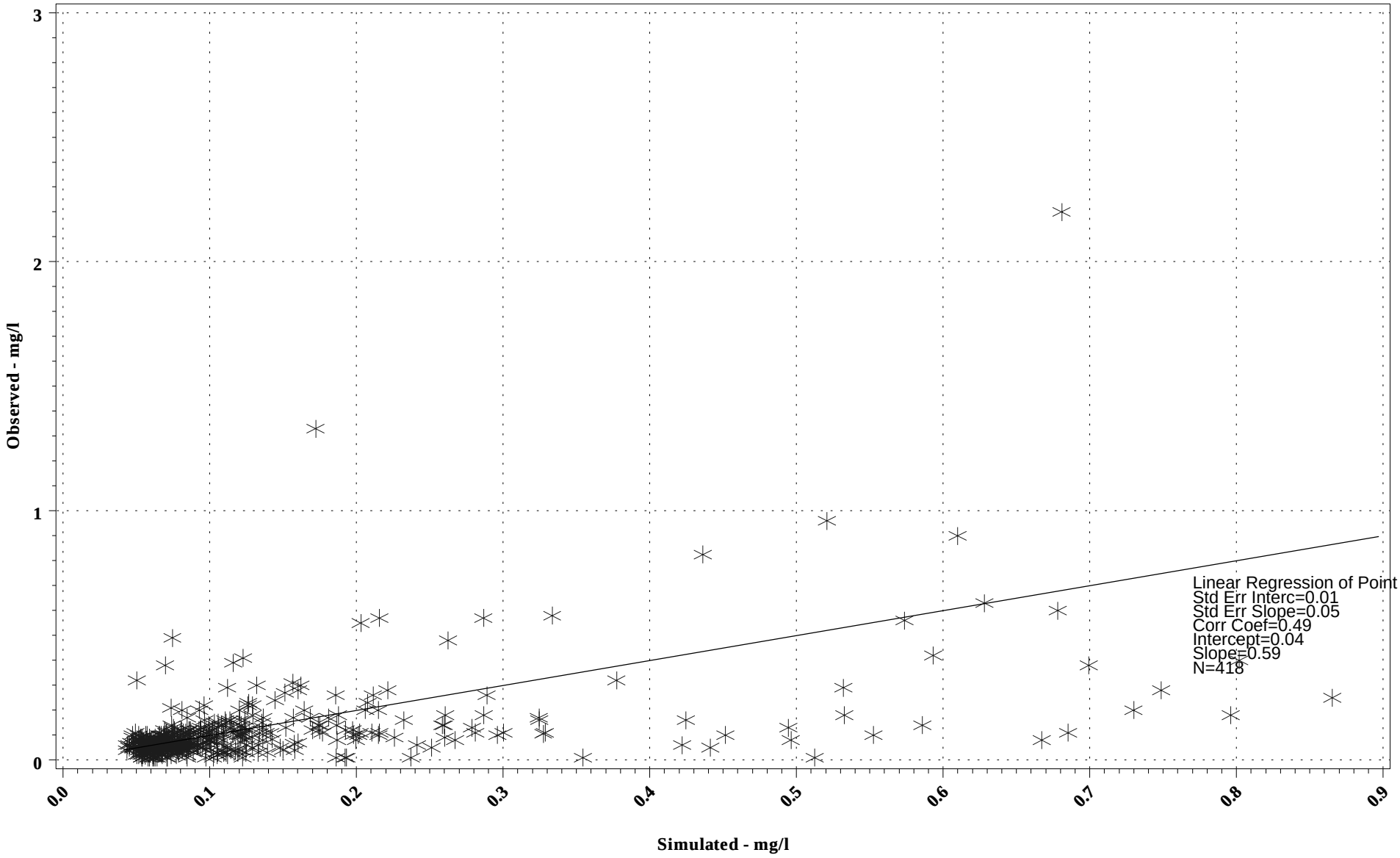



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220

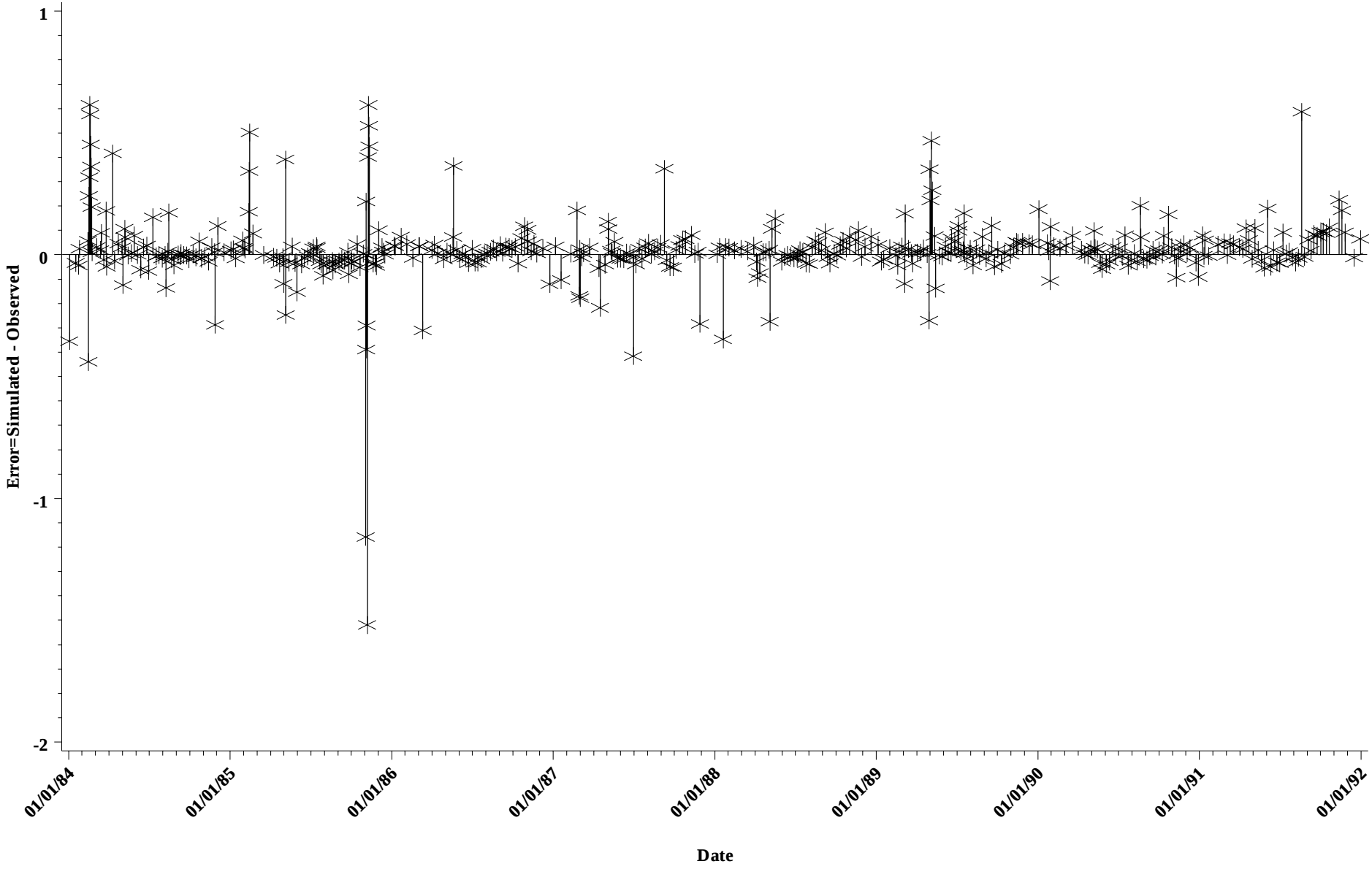
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



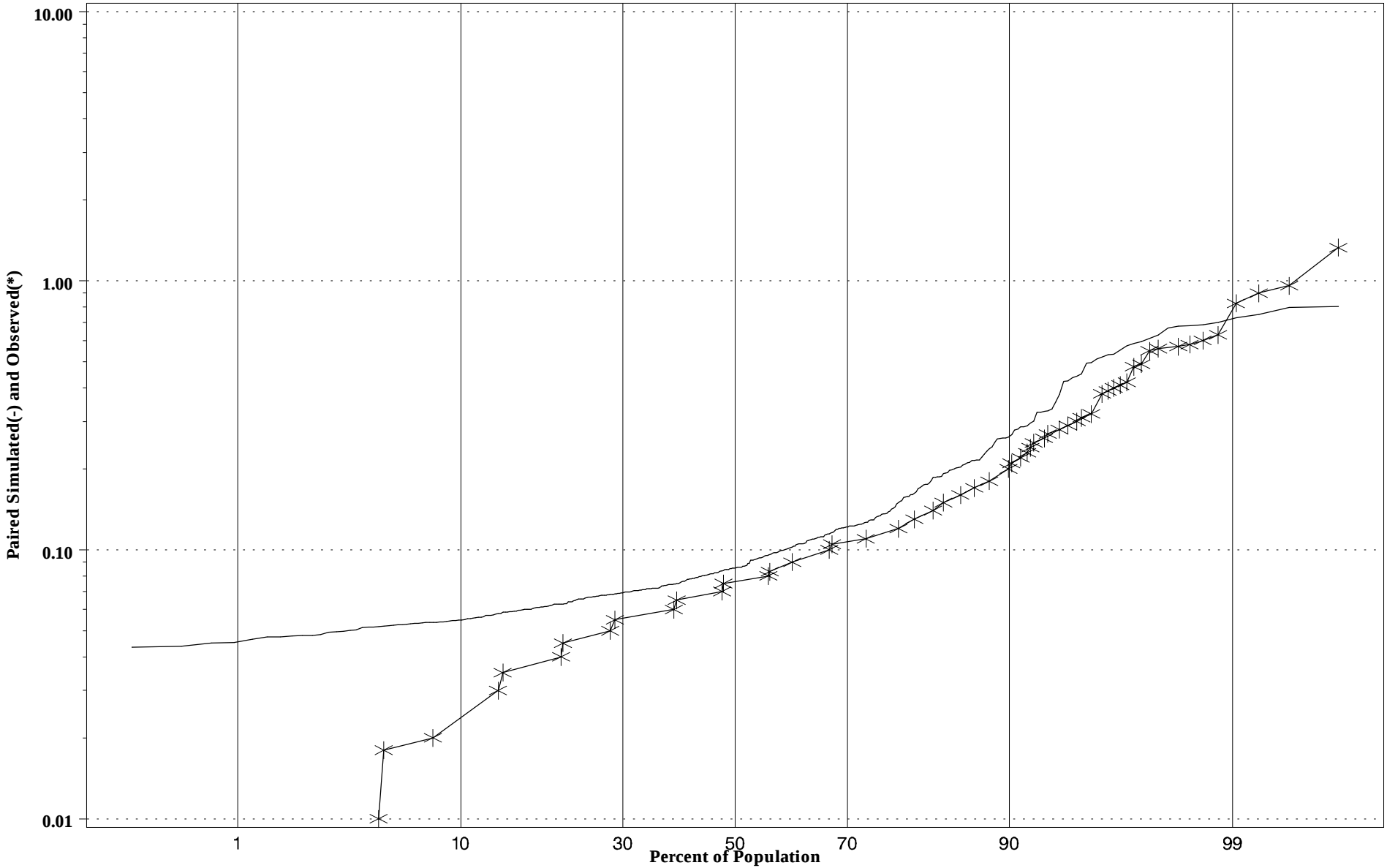

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(lo.drv 26JUN98 12:43)

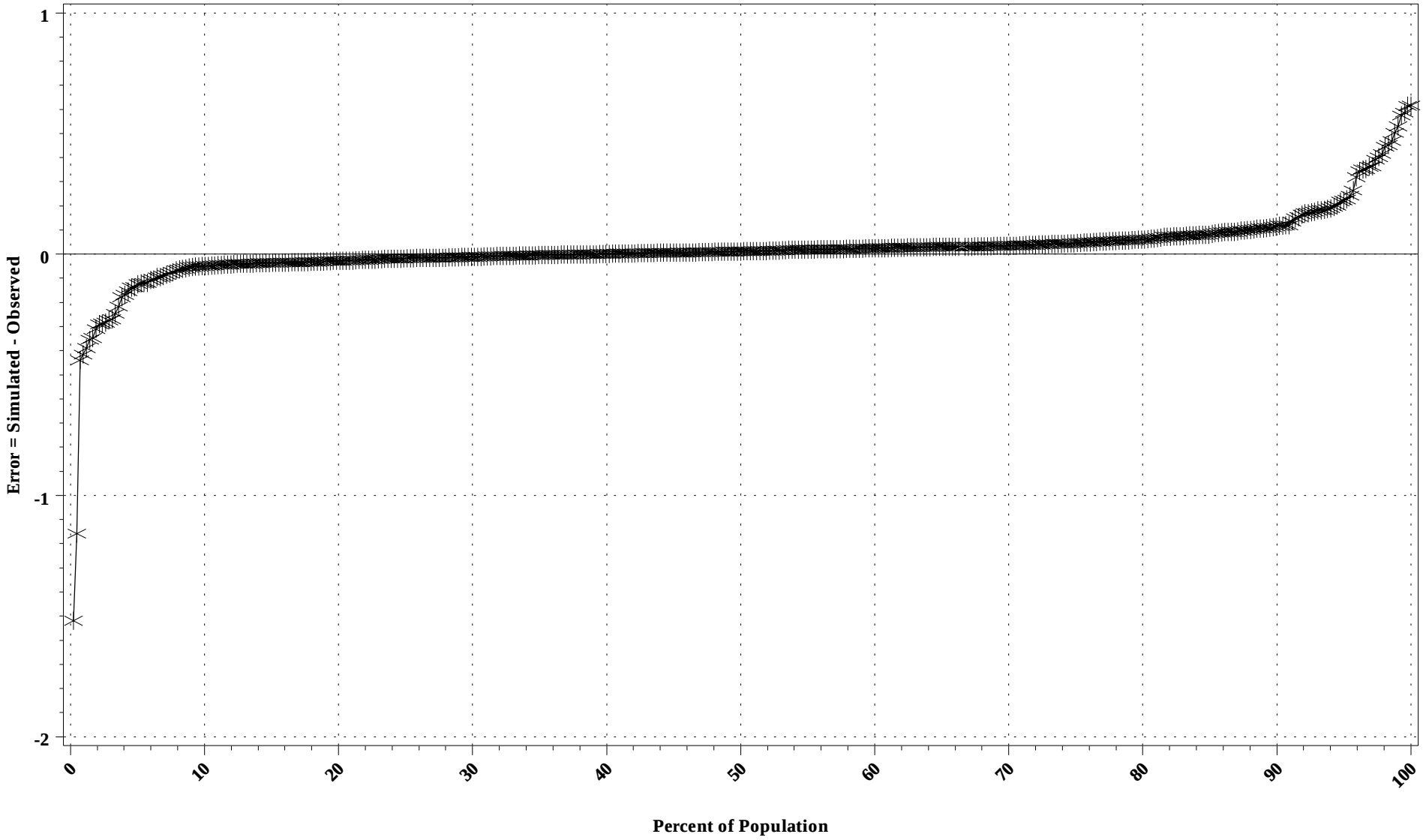
# Lower Potomac River at Segment 220
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Actual error versus Percentile Sample Population
## Total Phosphorus

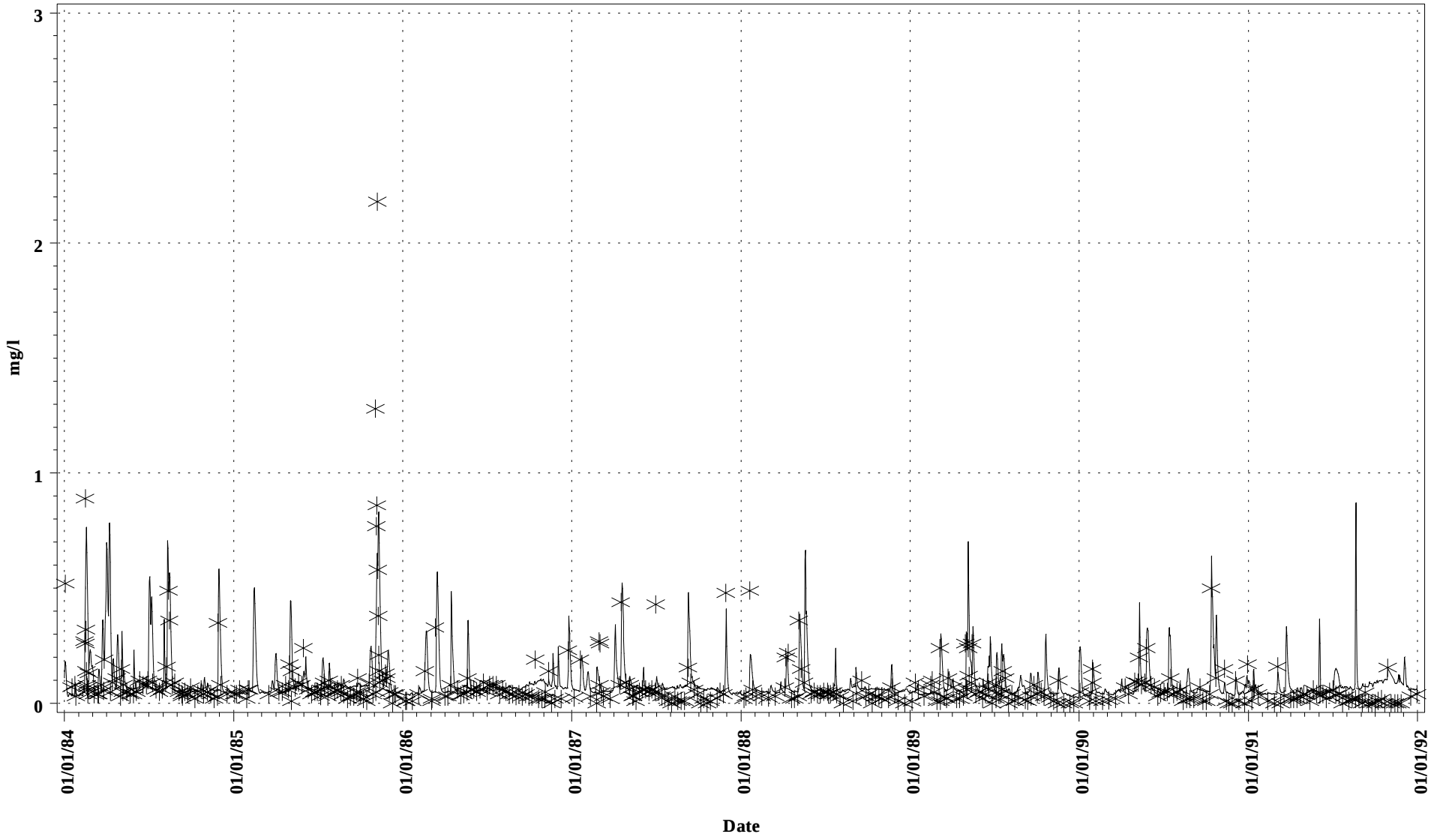
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

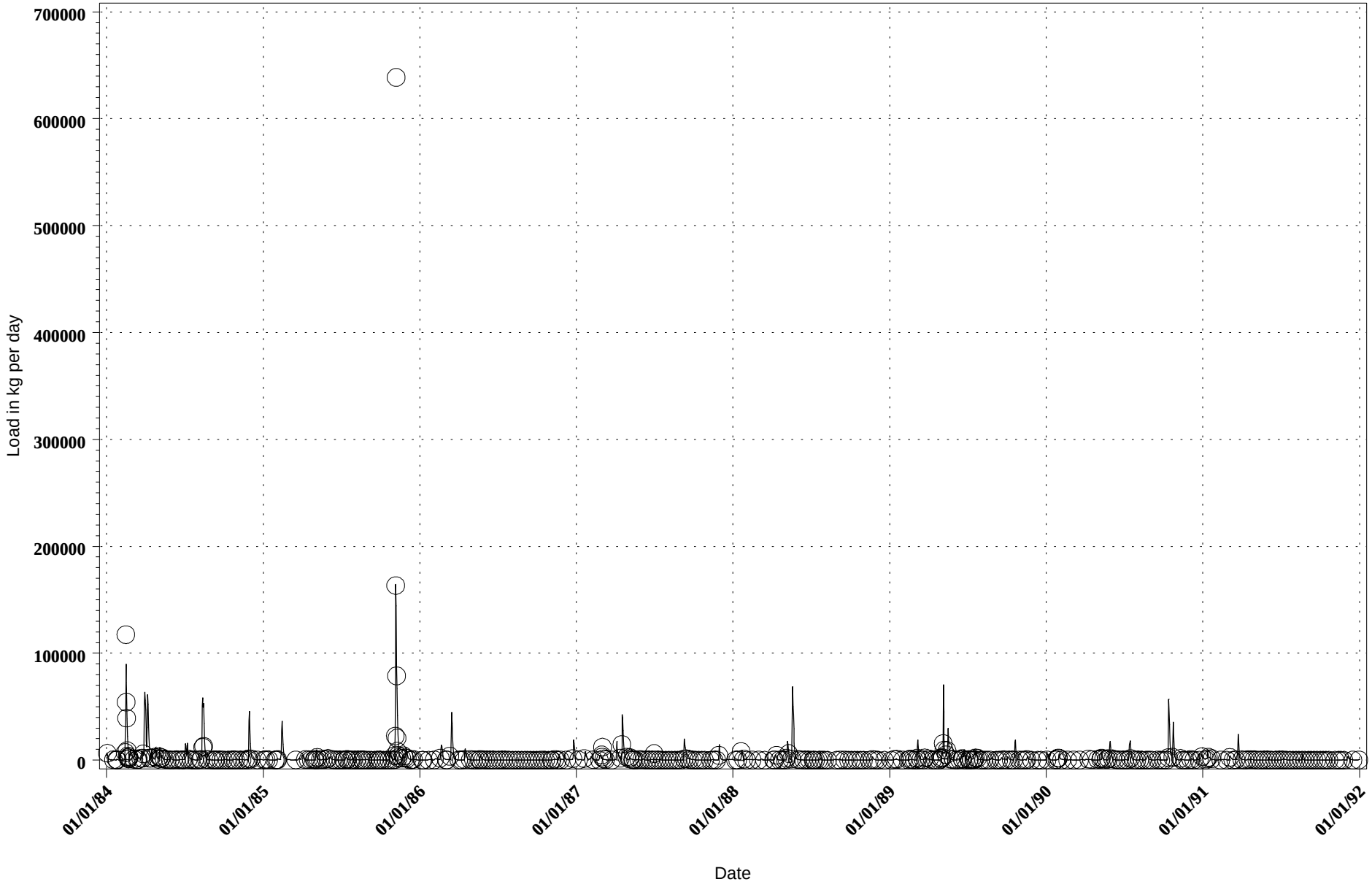



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

### (line = simulated, O = observed)

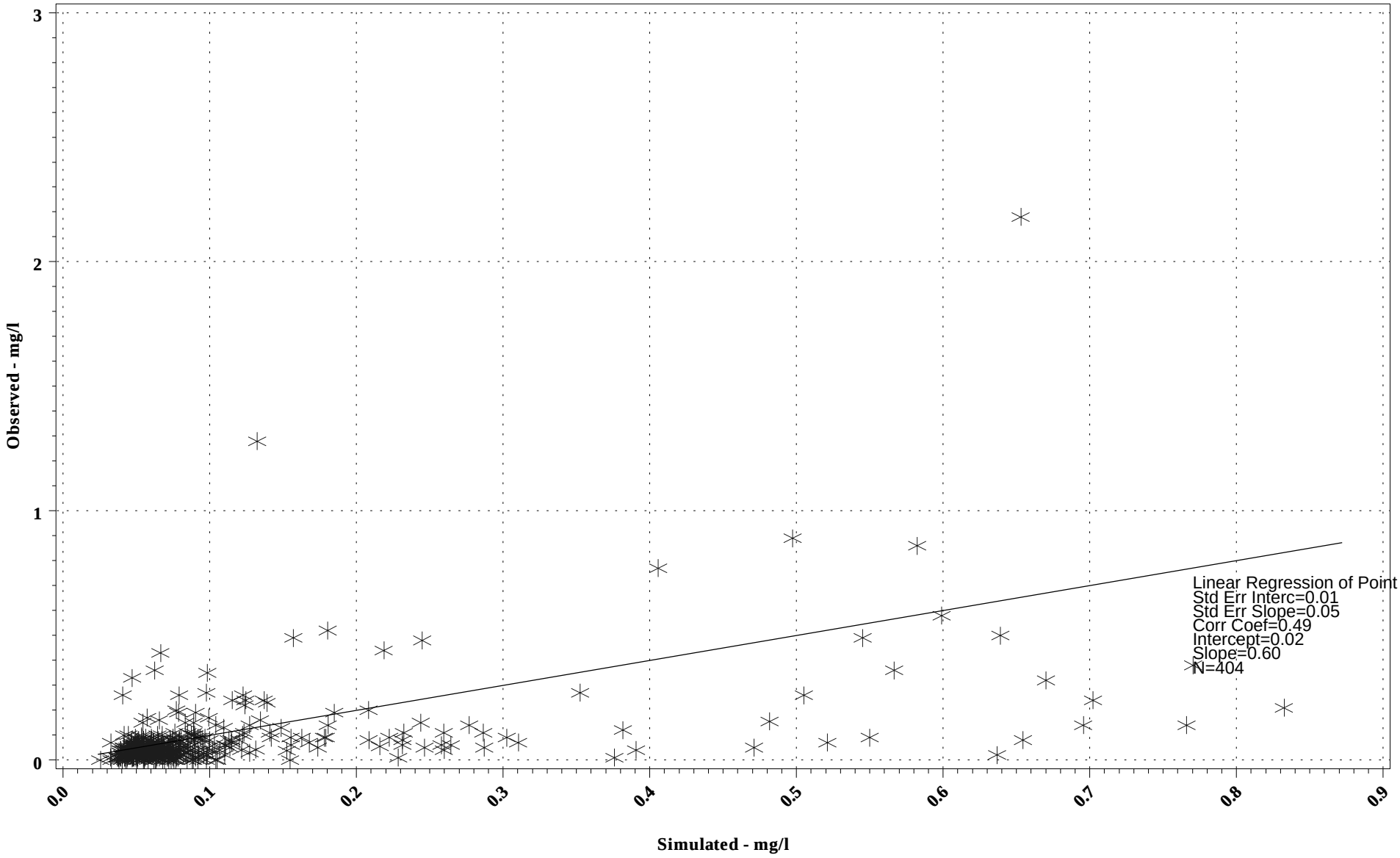



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220

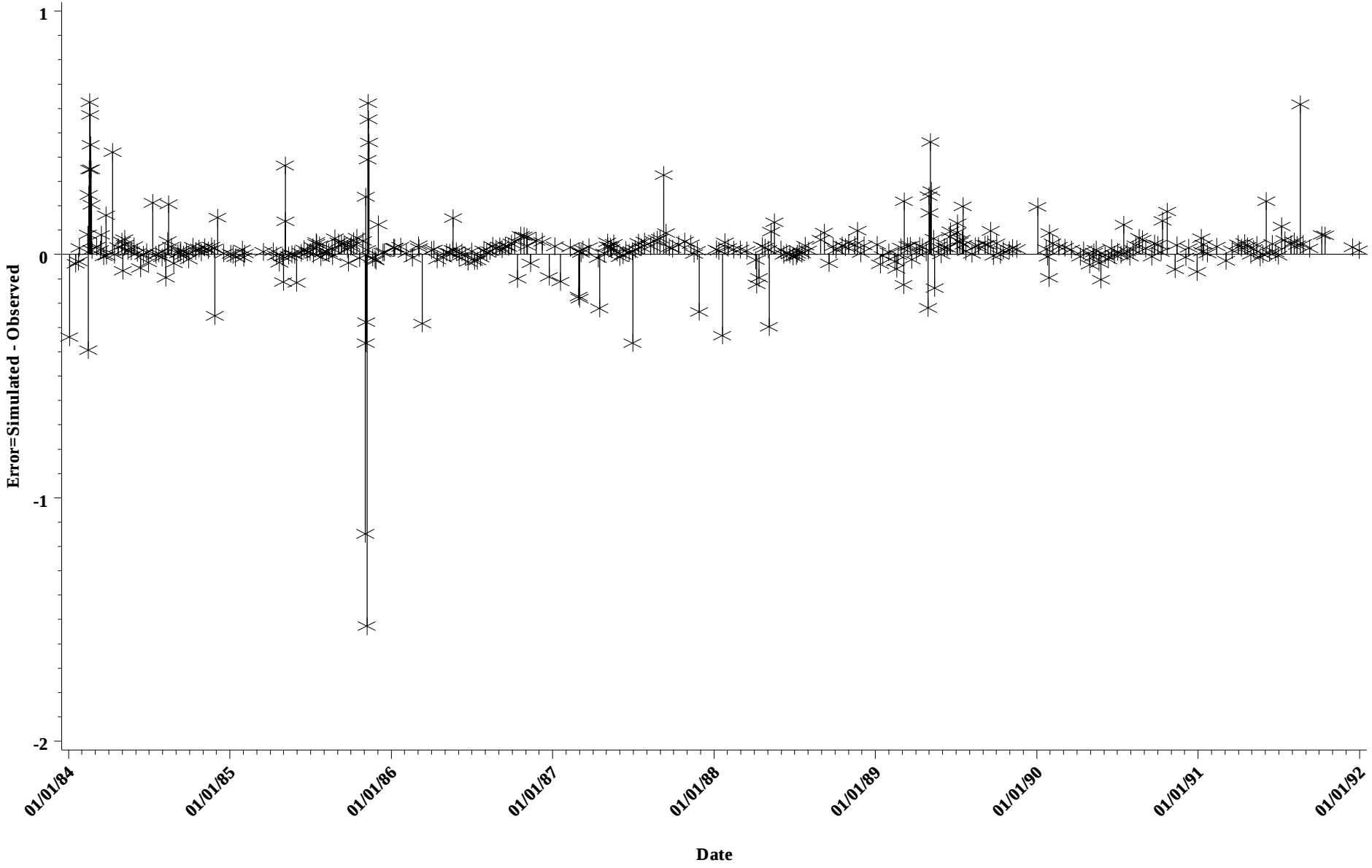
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220
## Actual Error versus Time
## Organic and Particulate Phosphorus

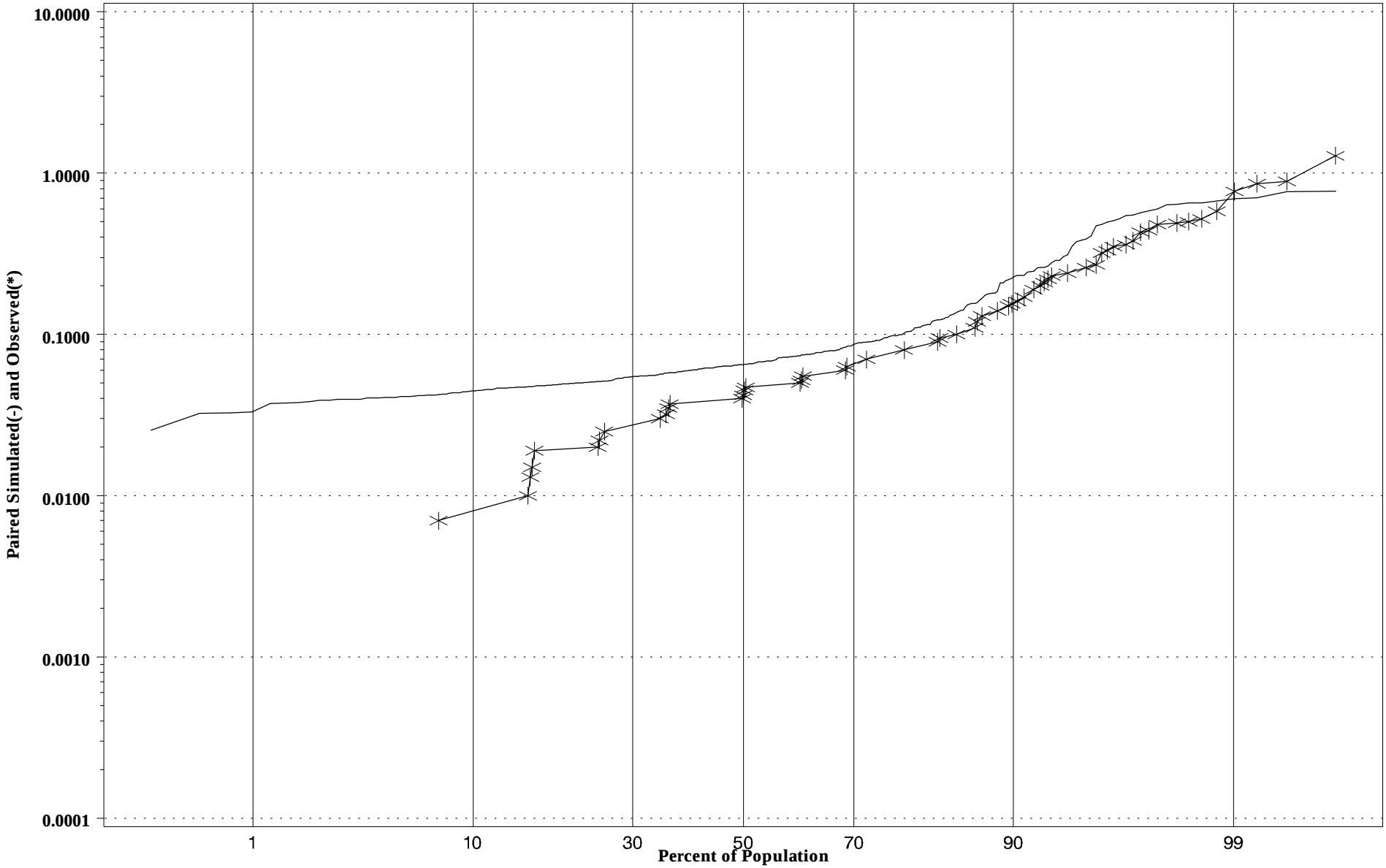



(y21_plotb.sas model3d:[pwang.dt] omerr)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220

## Organic and Particulate Phosphorus

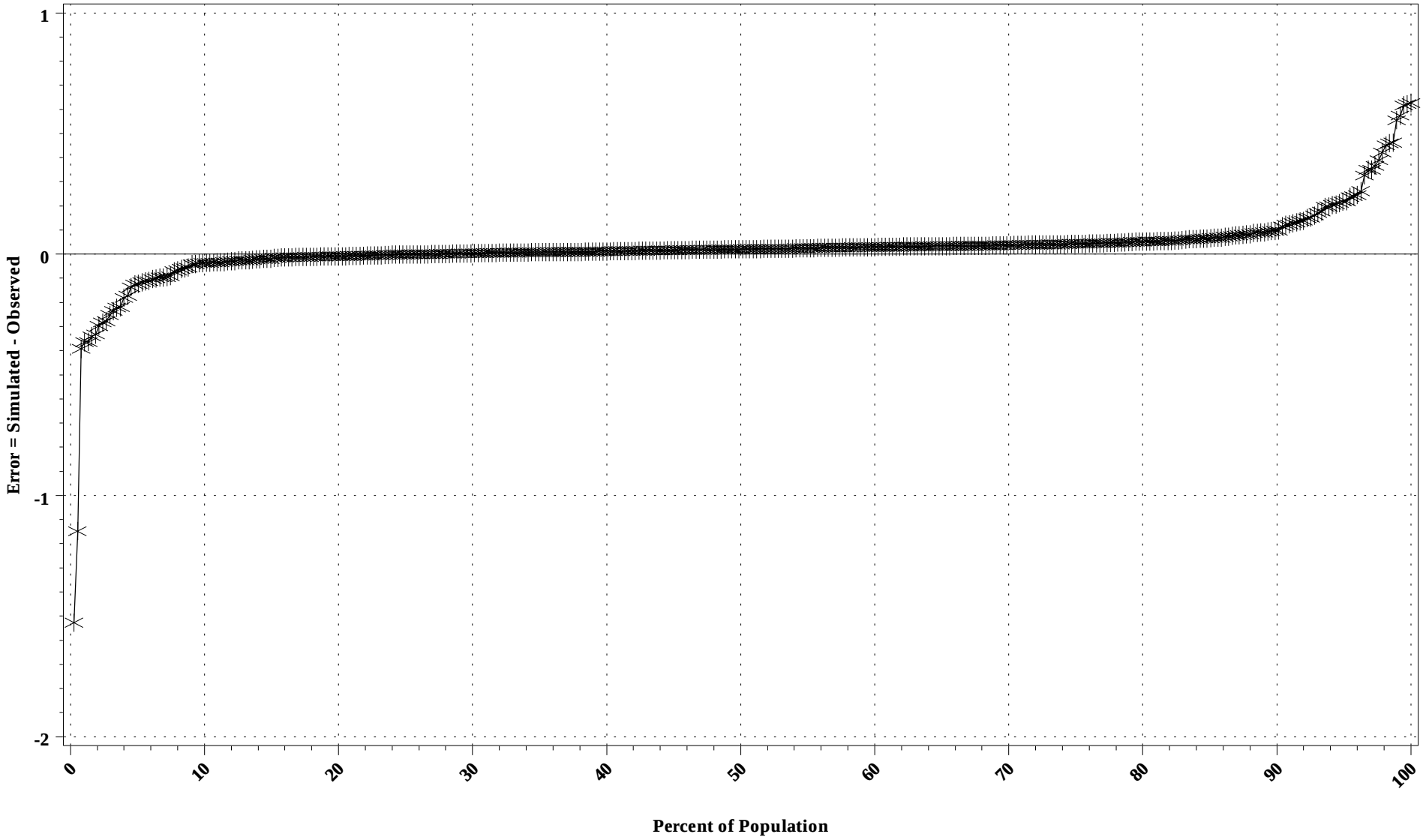
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

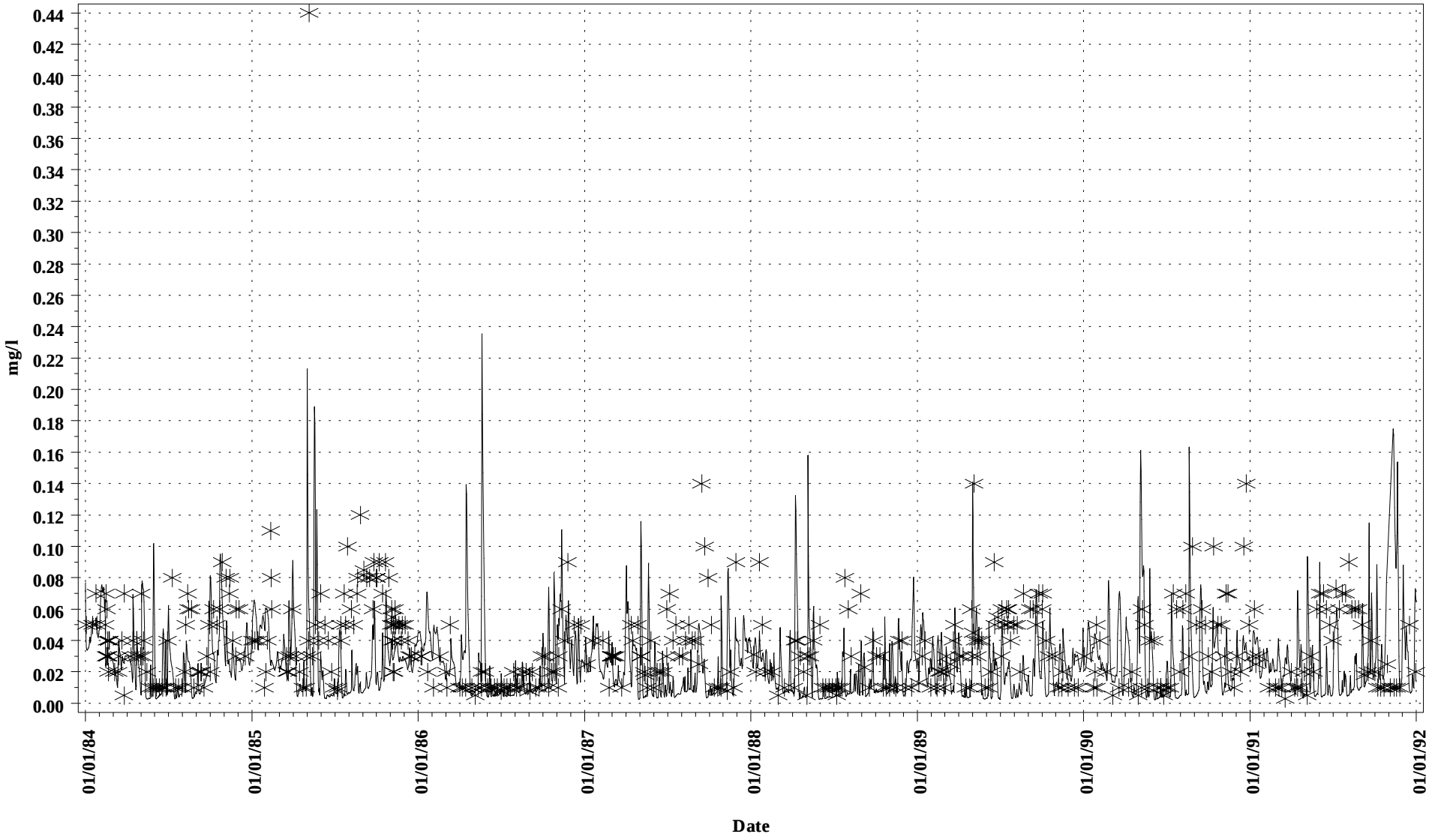
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(lo.drv 26JUN98 12:43)

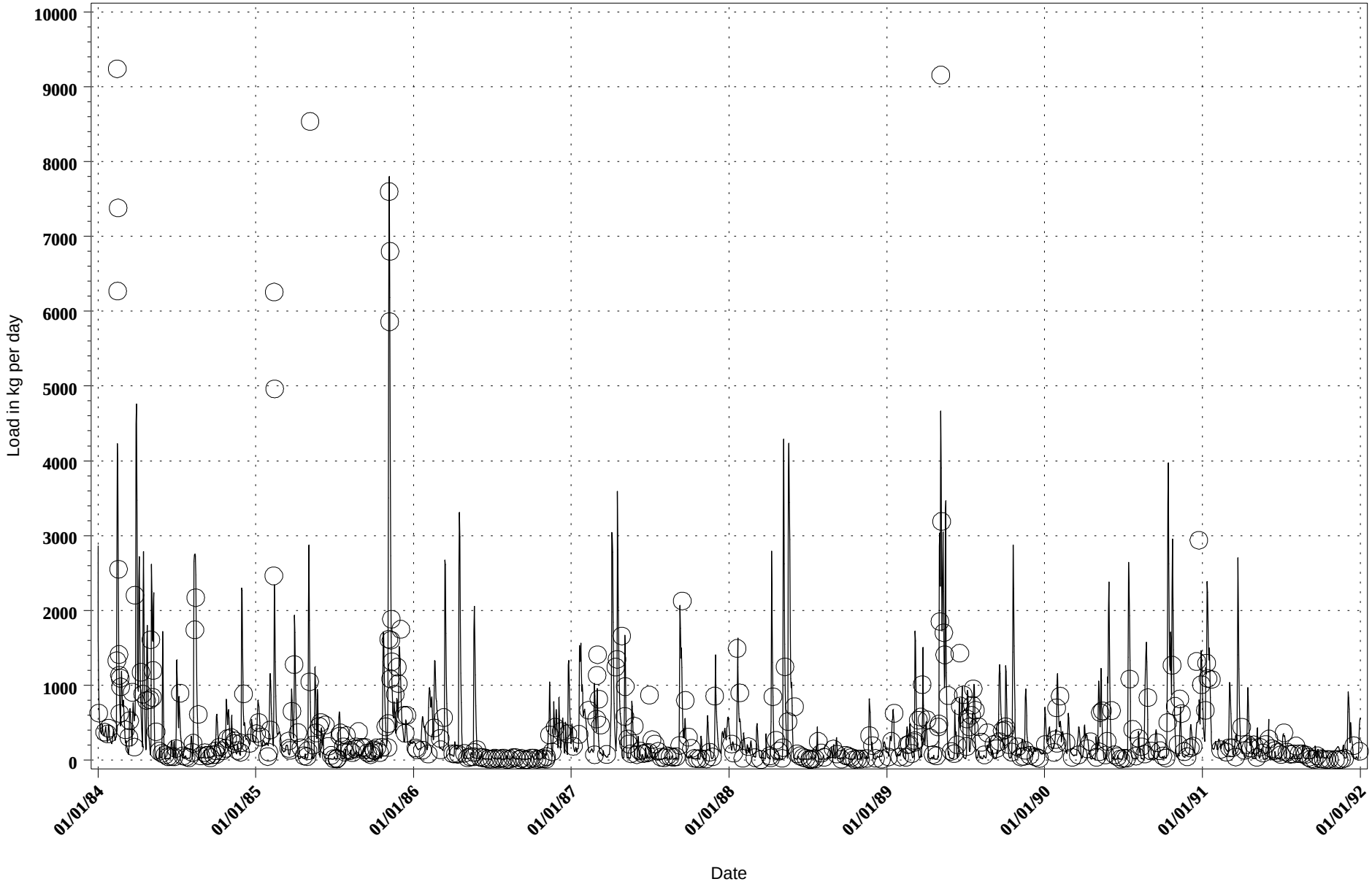
# Lower Potomac River at Segment 220
## Observed and Simulated versus Time
## Dissolved Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Dissolved Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

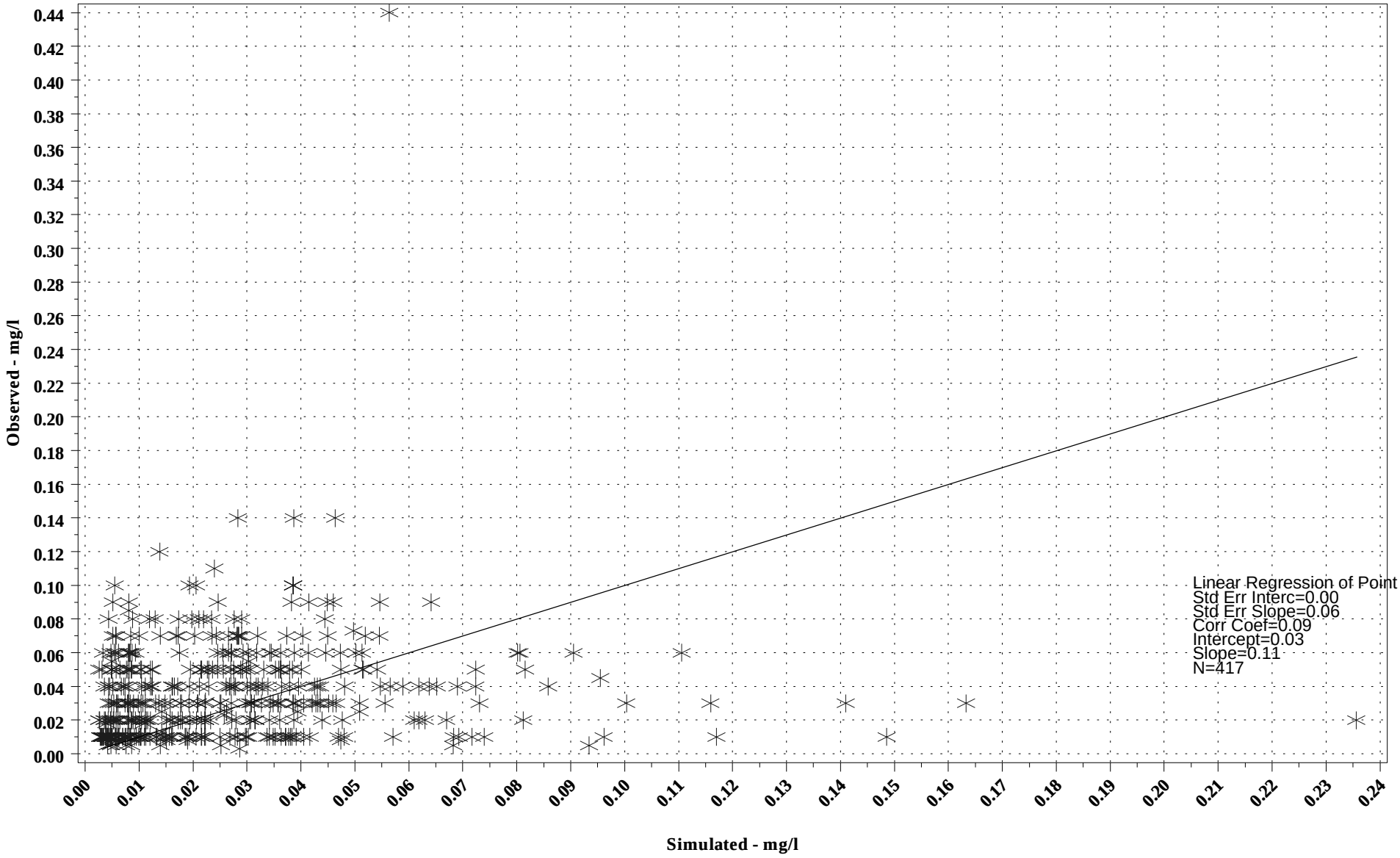



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220

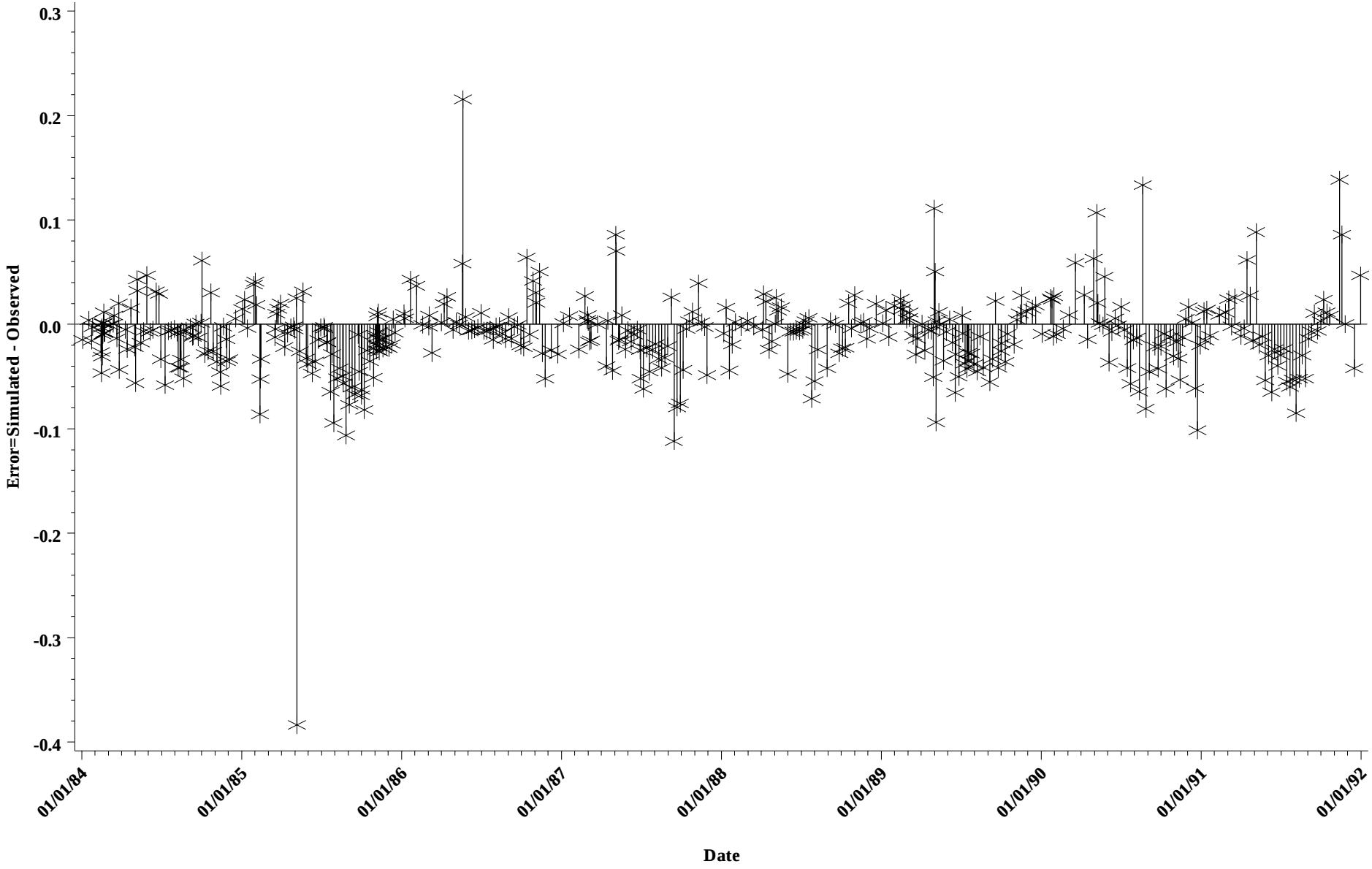
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



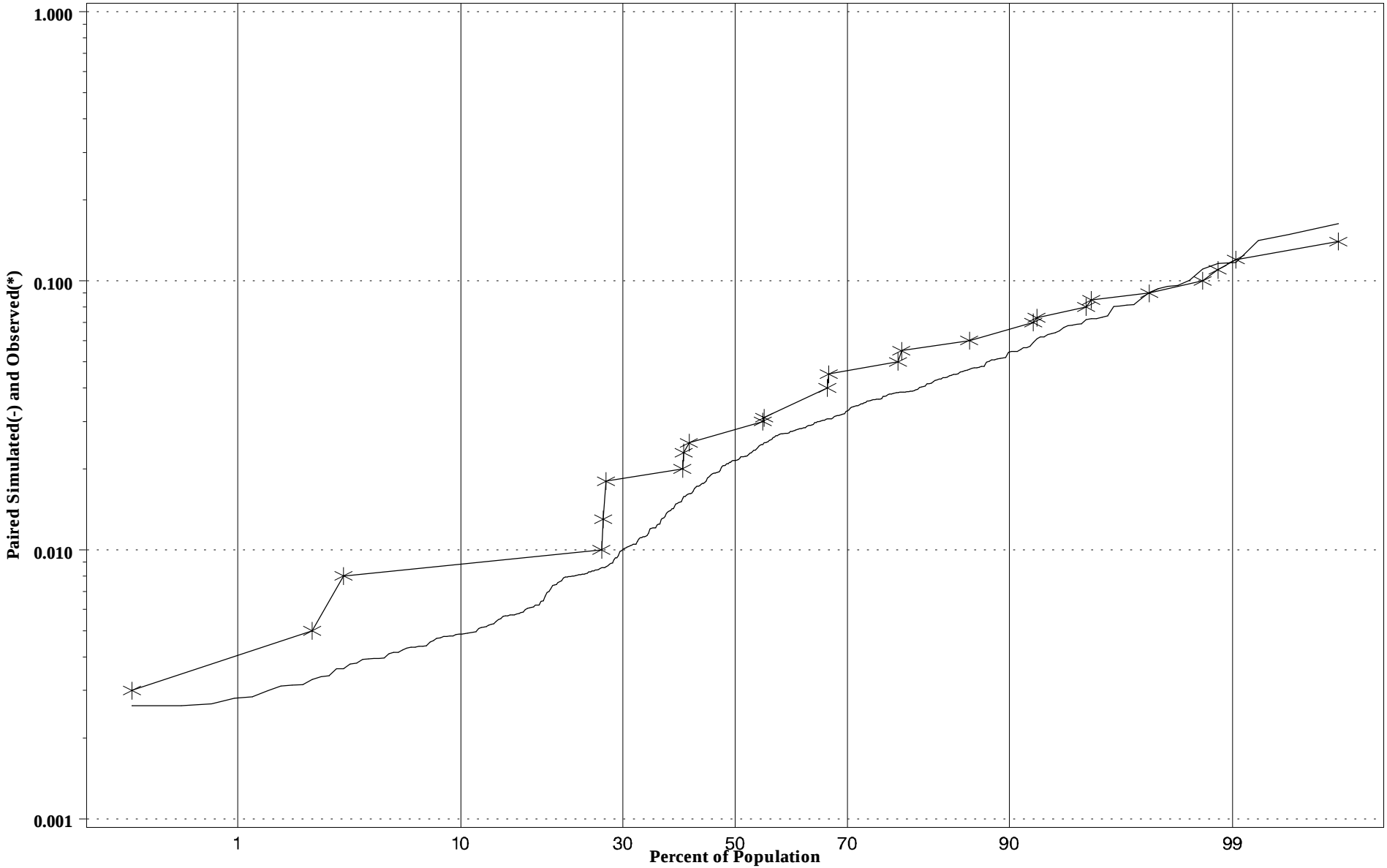

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(lo.drv 26JUN98 12:43)

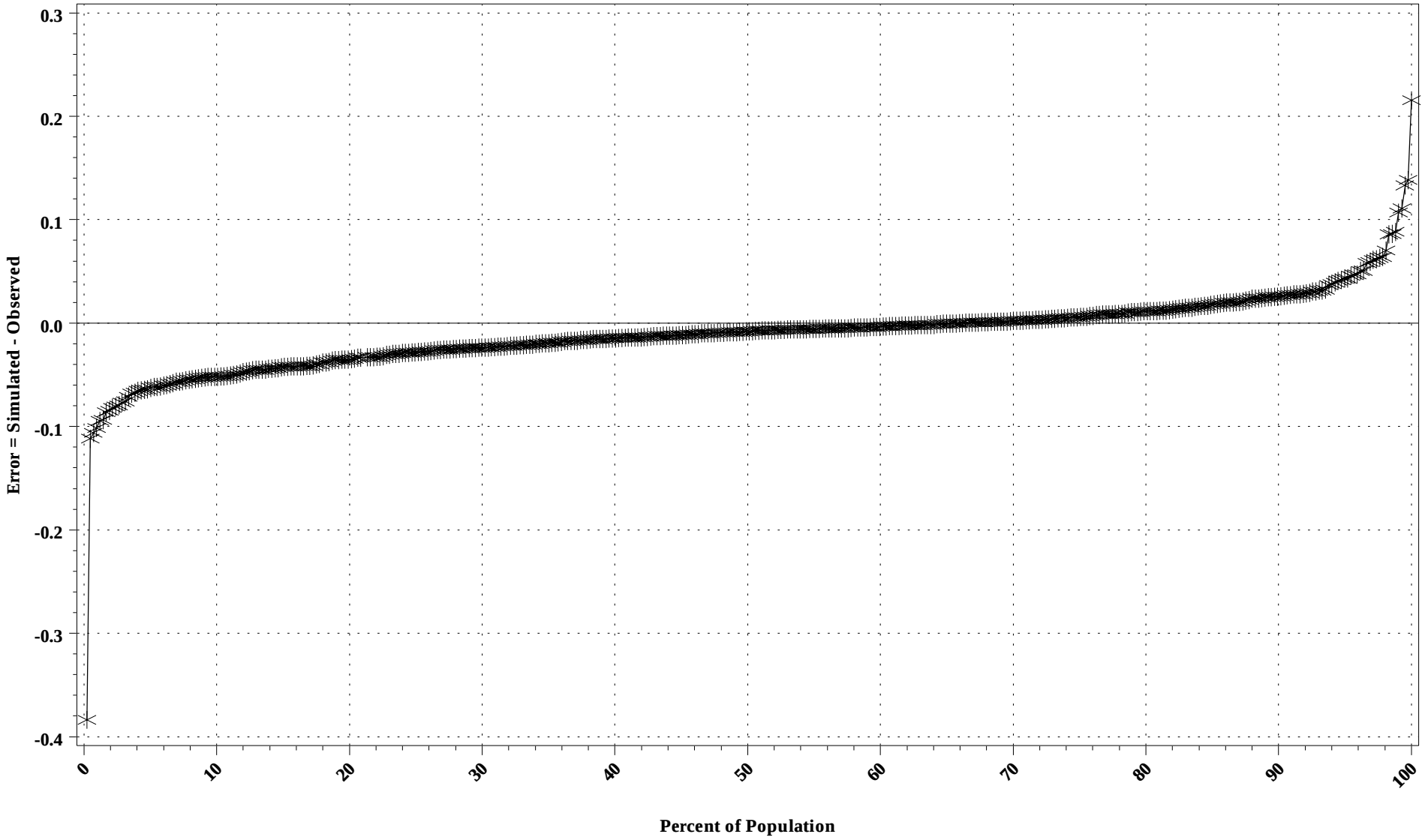
# Lower Potomac River at Segment 220
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

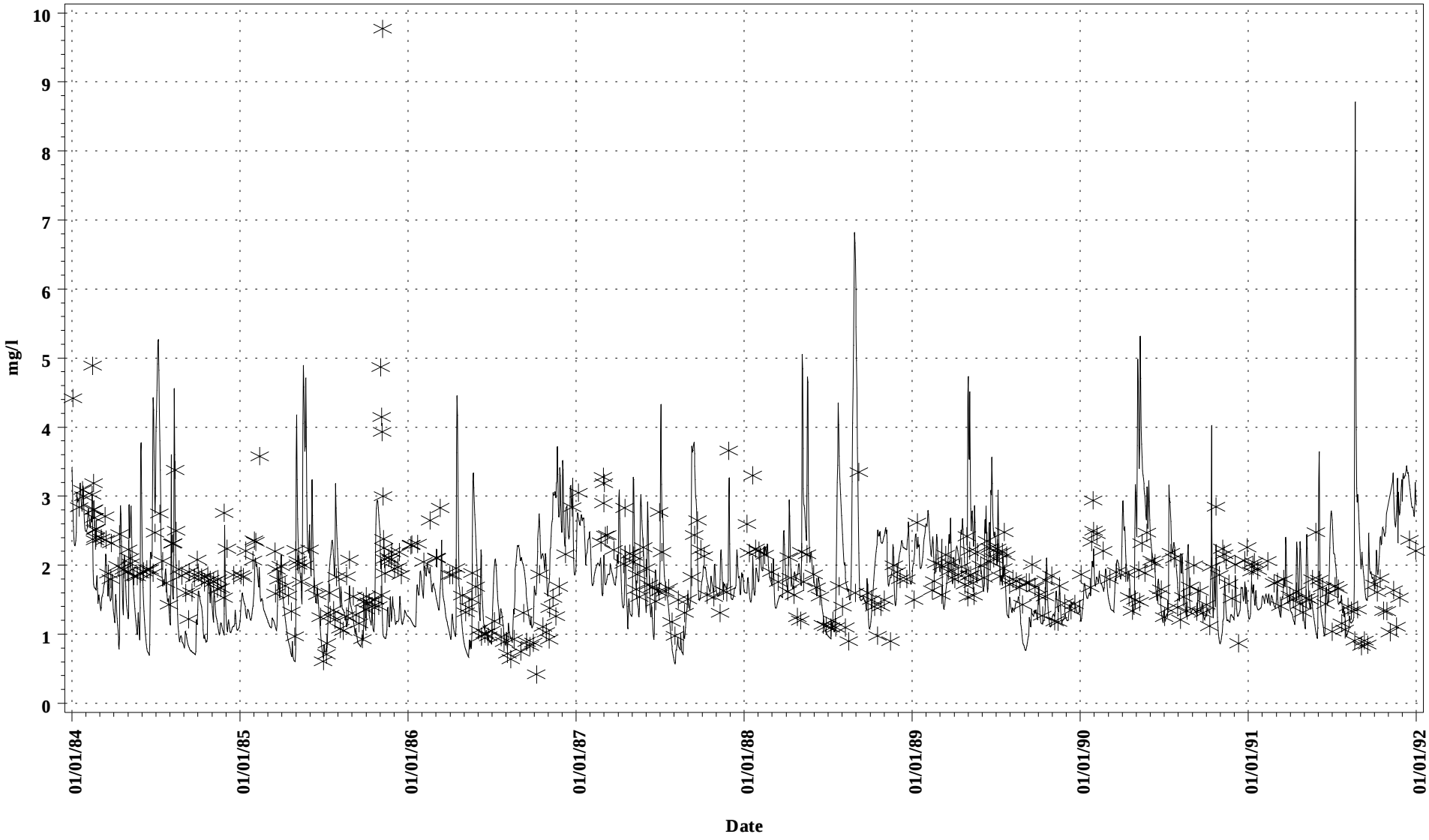
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(lo.drv 26JUN98 12:43)

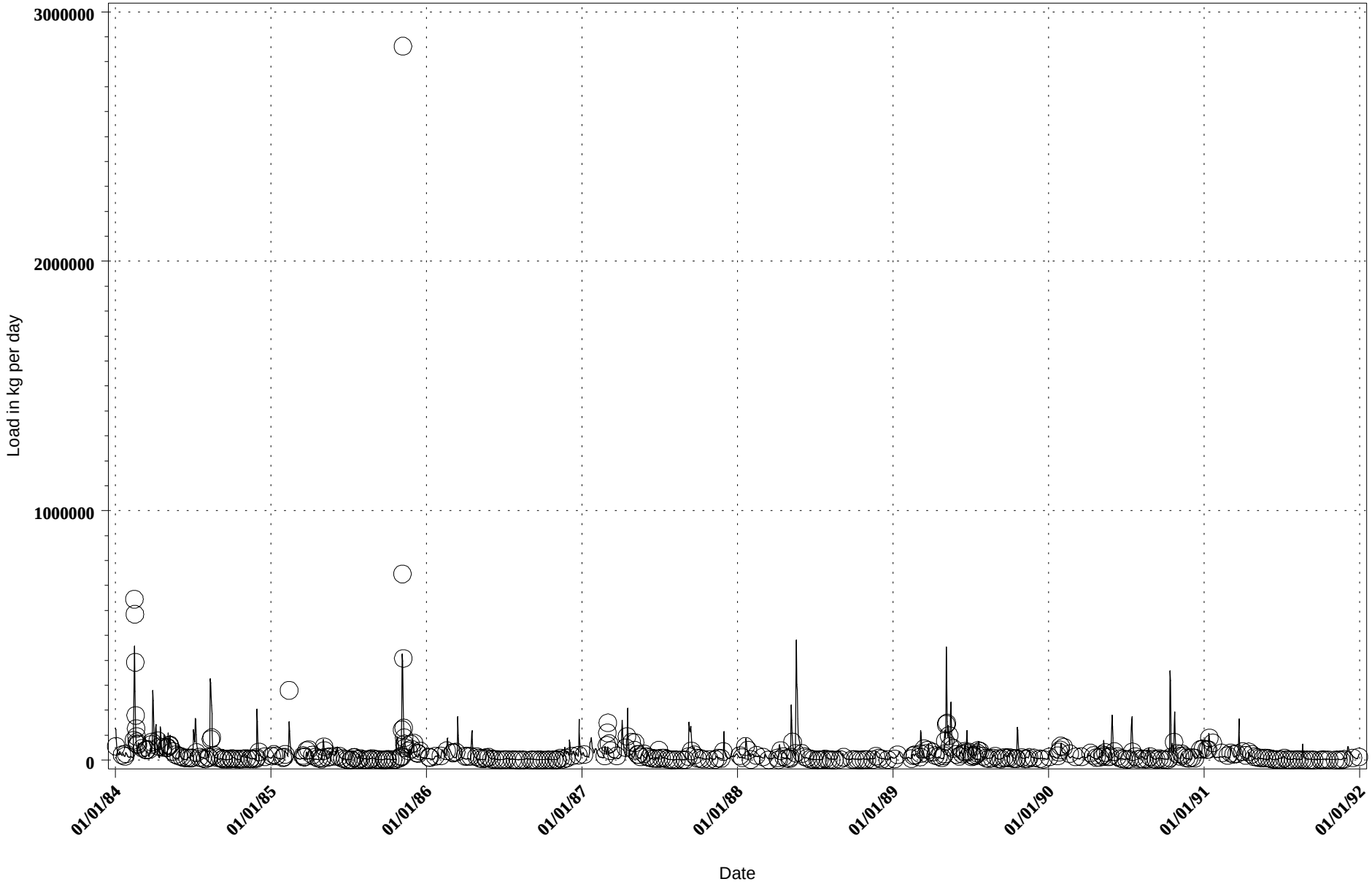
# Lower Potomac River at Segment 220
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

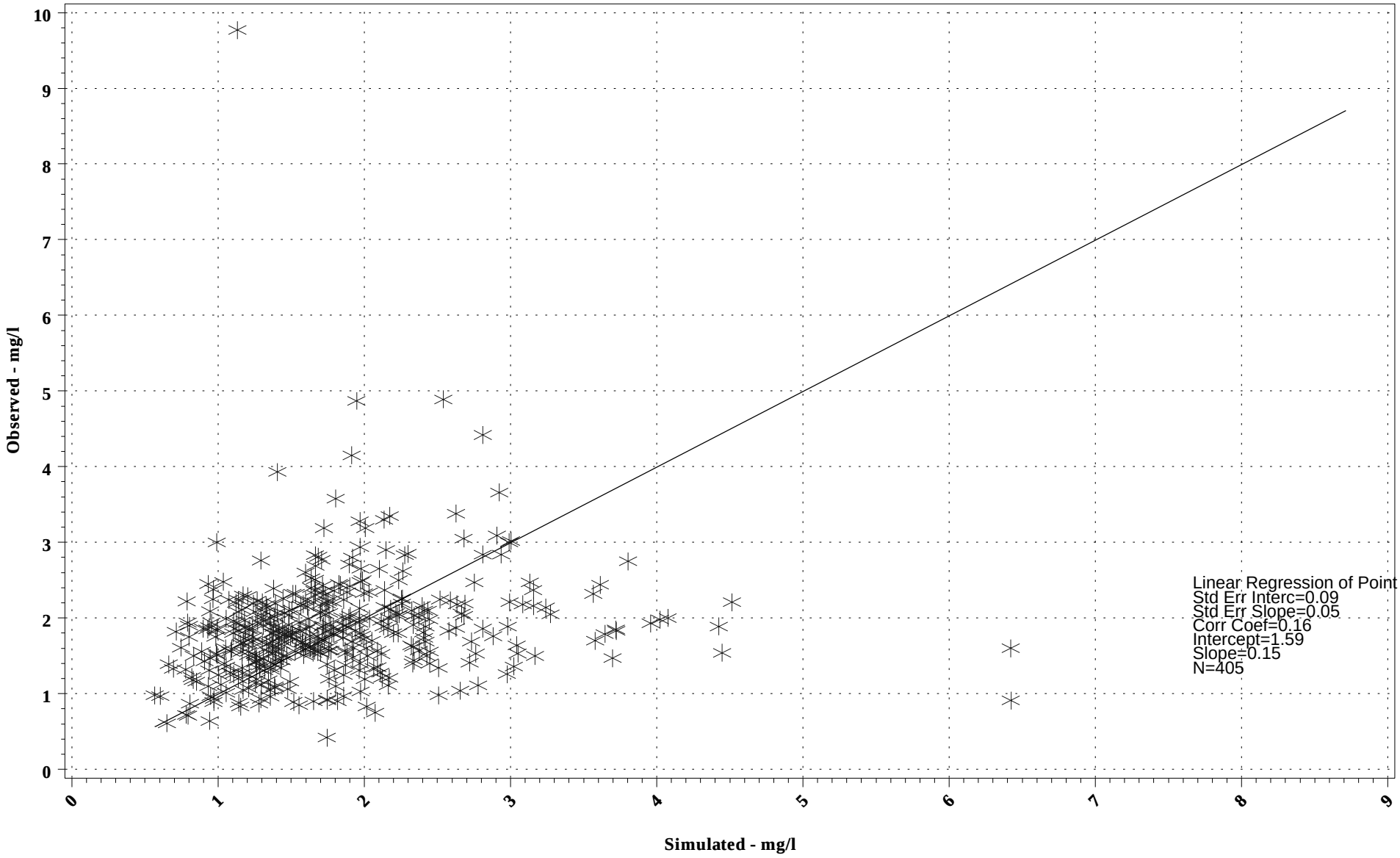



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220

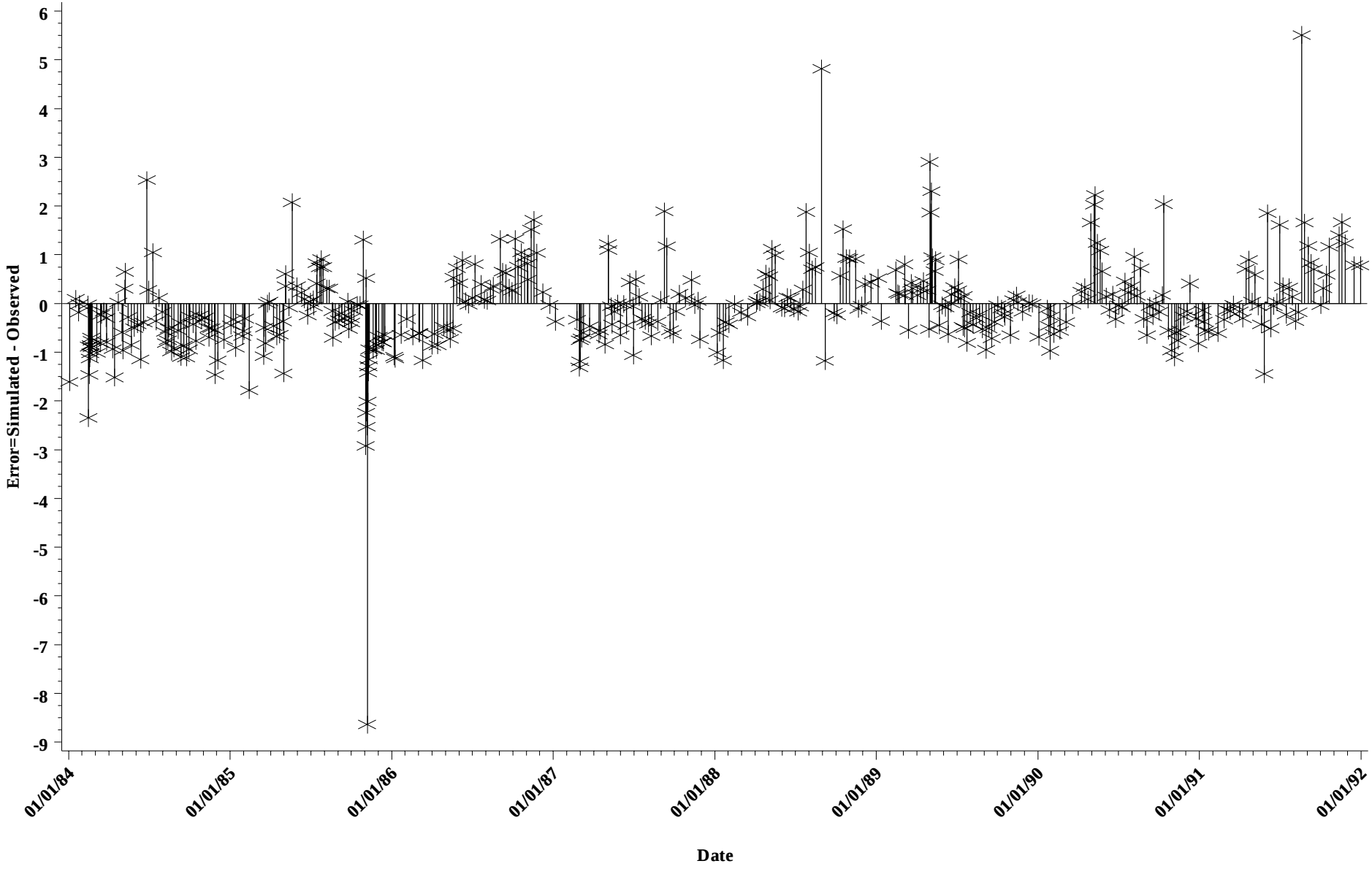
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220
## Actual Error versus Time
## Total Nitrogen

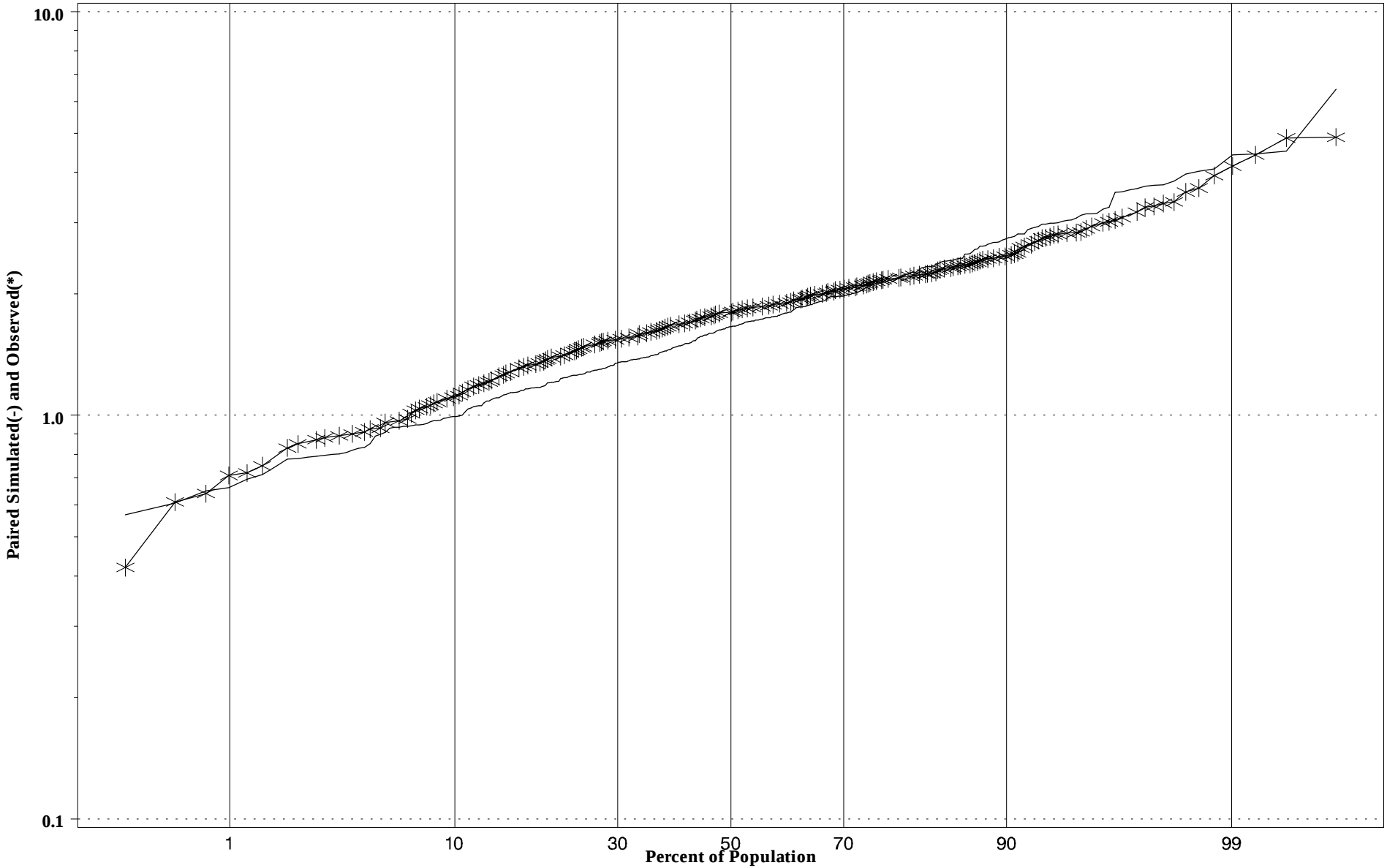



(y21_plotb.sas model3d:[pwang.dt] omerr)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220

## Total Nitrogen

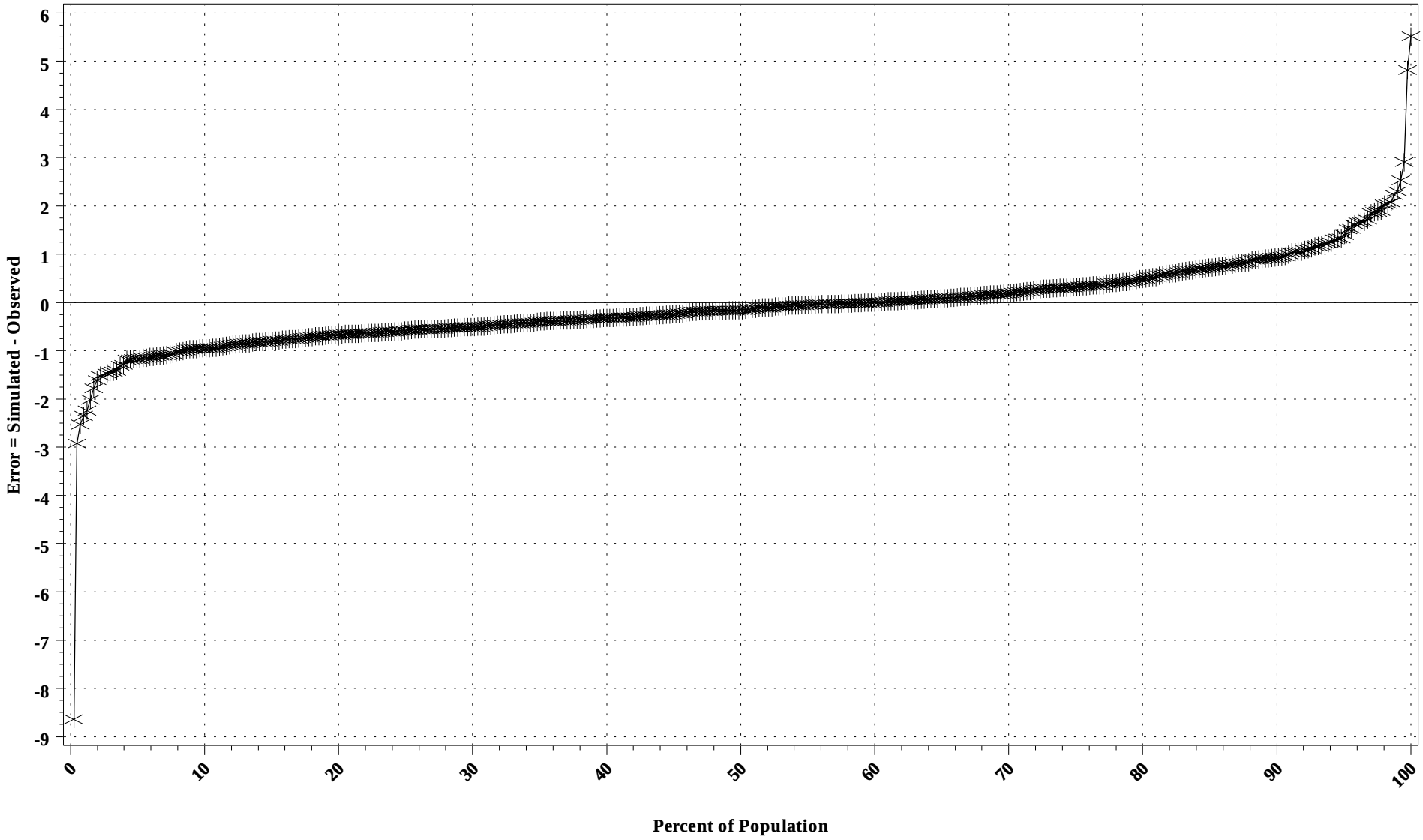
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Actual error versus Percentile Sample Population
## Total Nitrogen

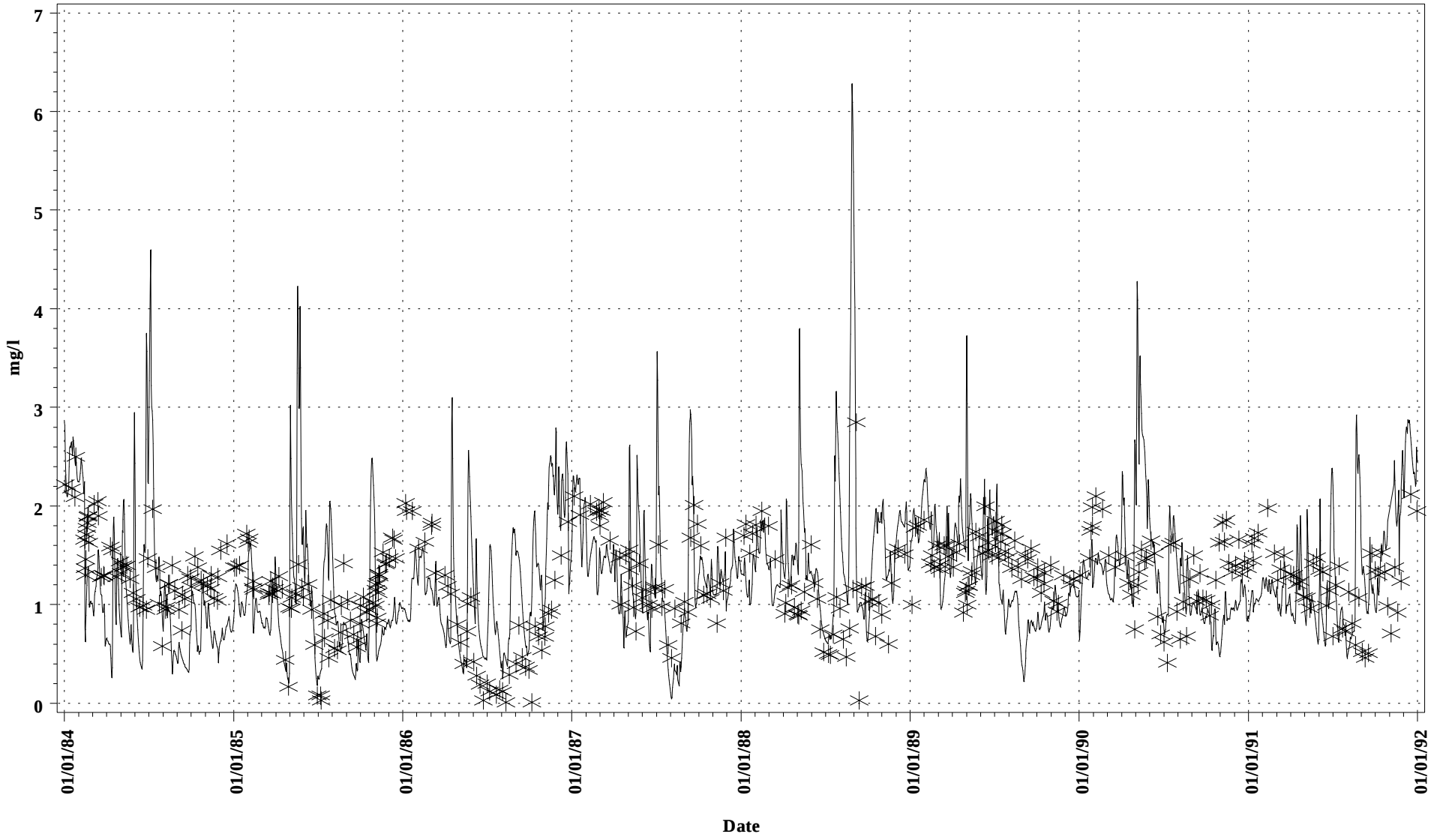
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

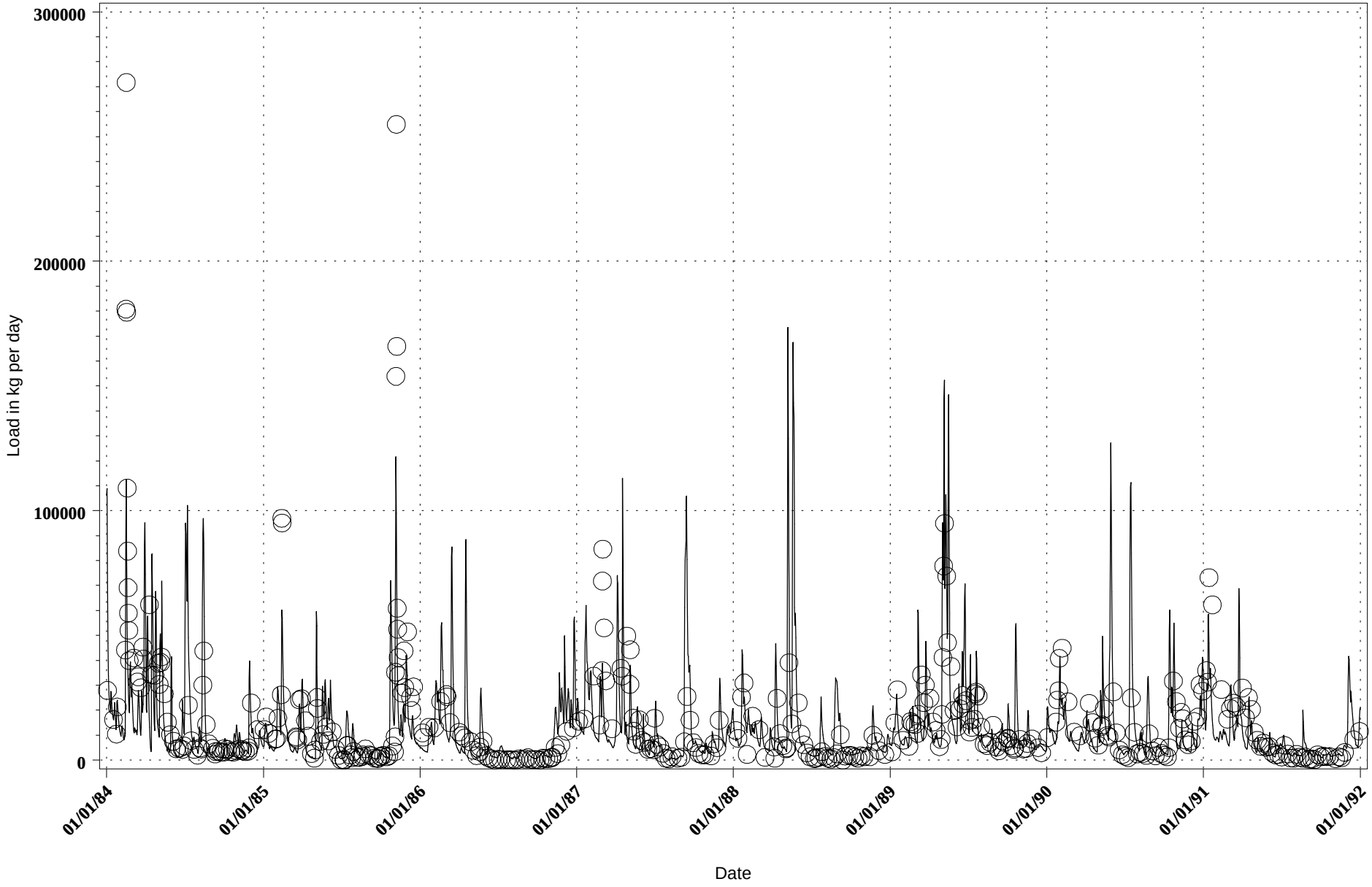



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220

## NO3 Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

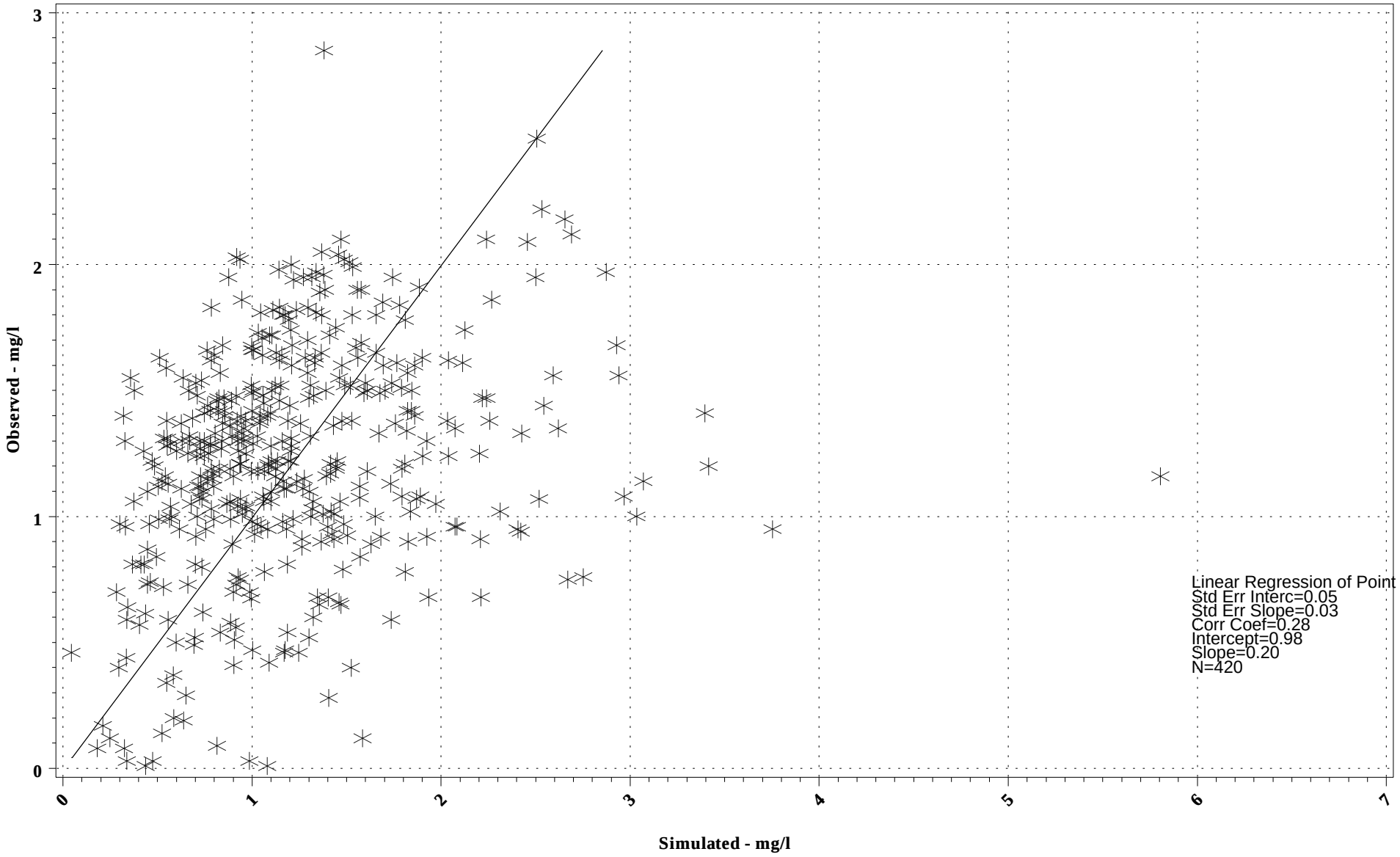



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220

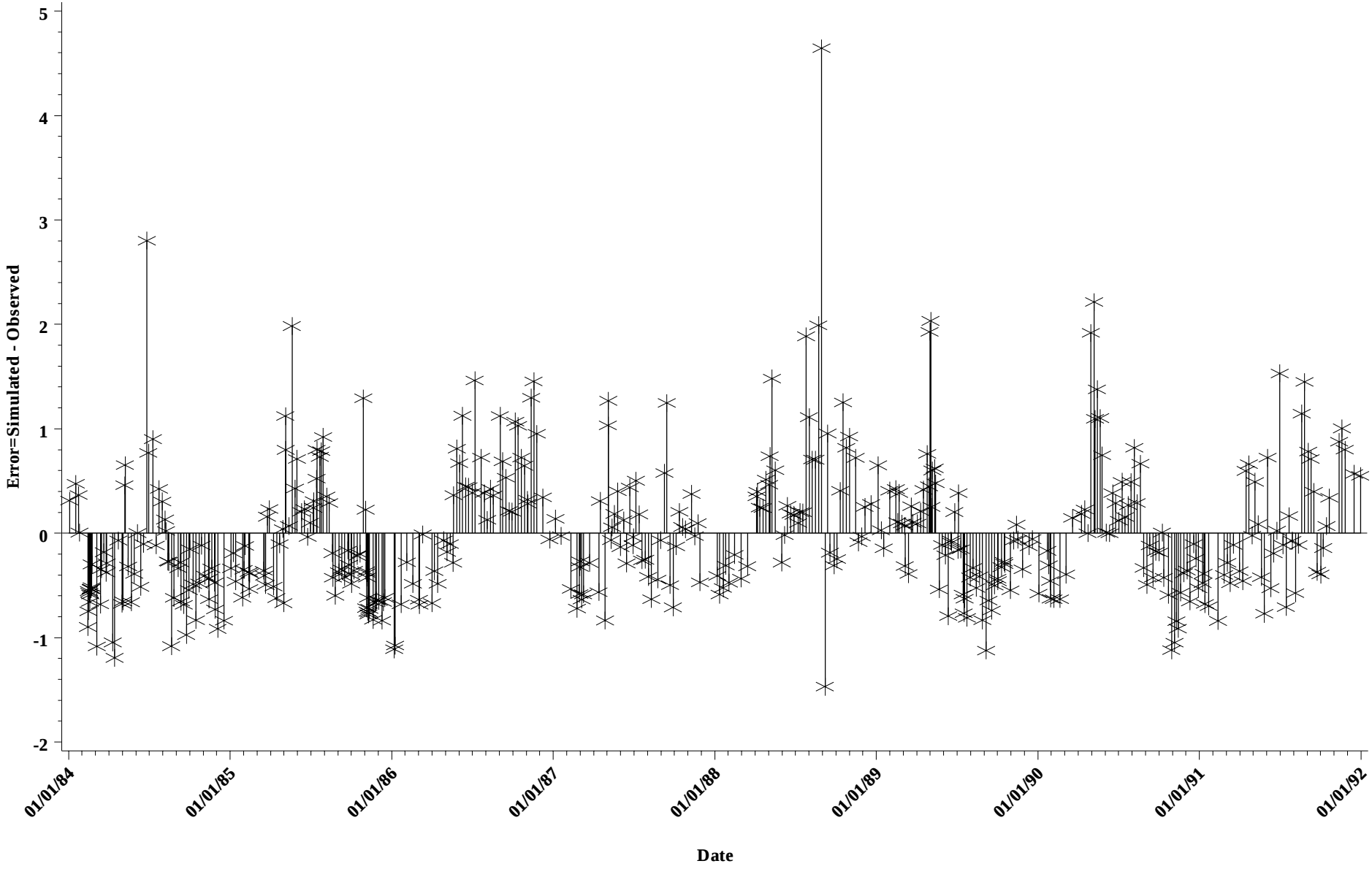
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220
## Actual Error versus Time
## NO3

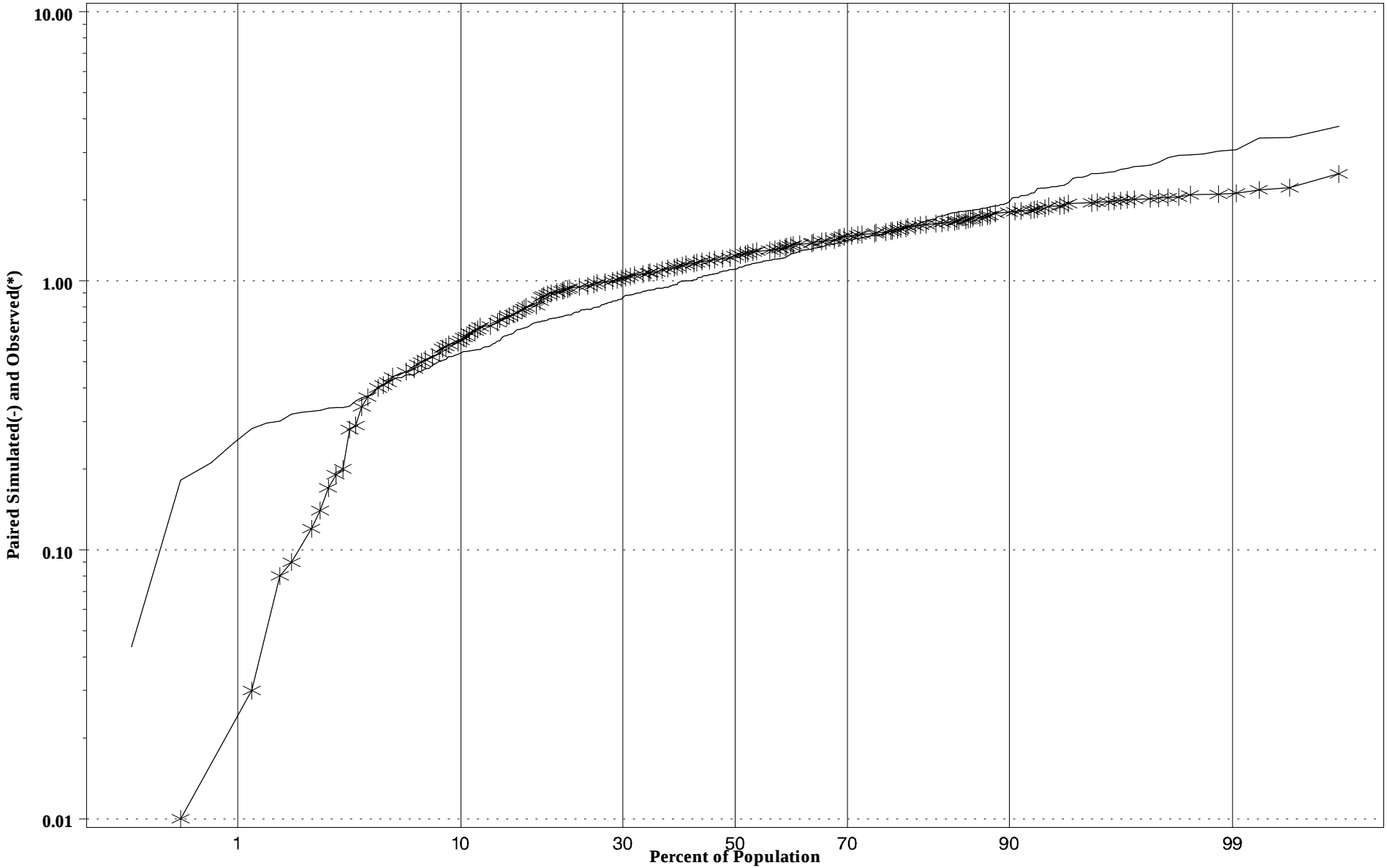



(y21_plotb.sas model3d:[pwang.dt] omerr)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220

## NO3

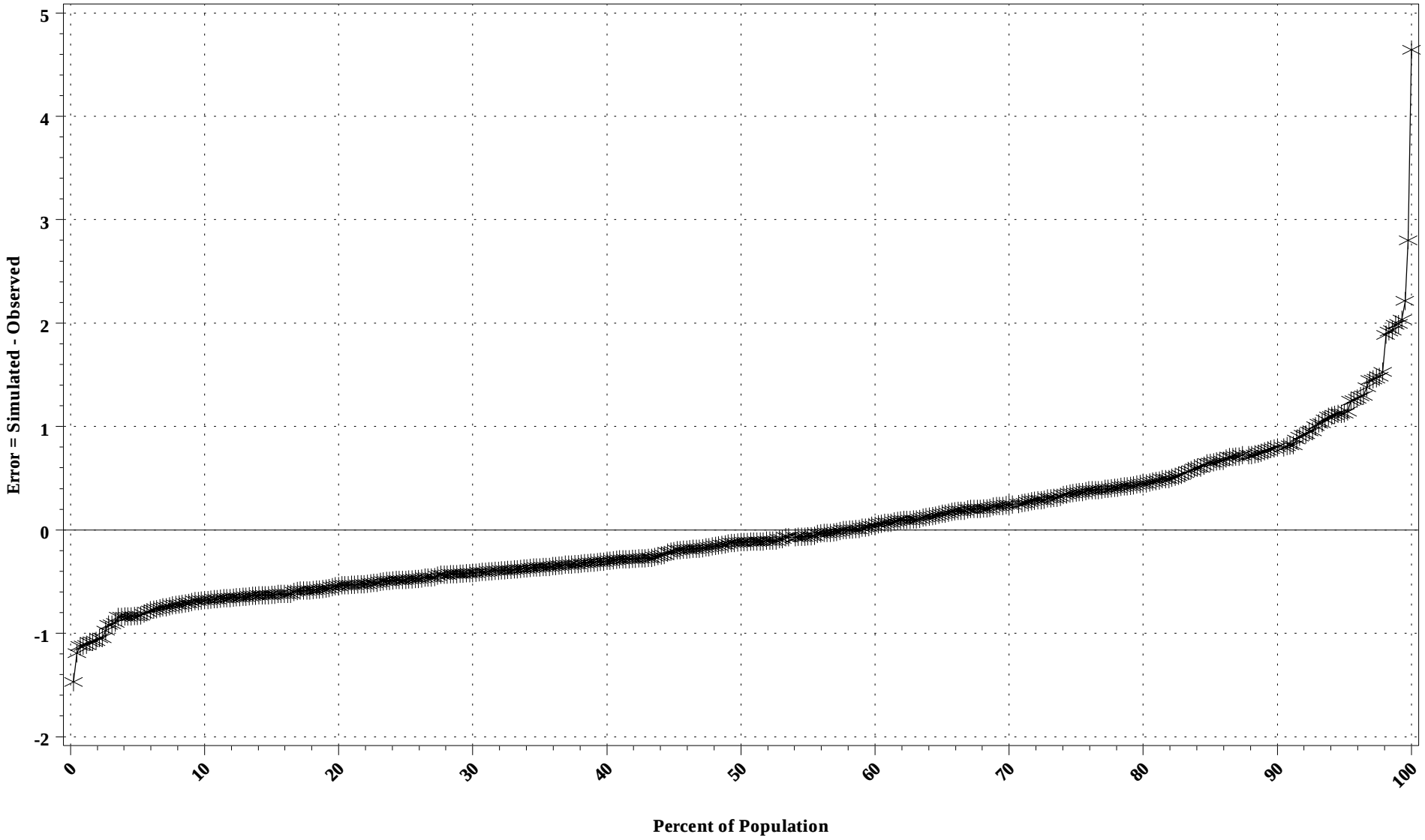
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Actual error versus Percentile Sample Population
## NO3

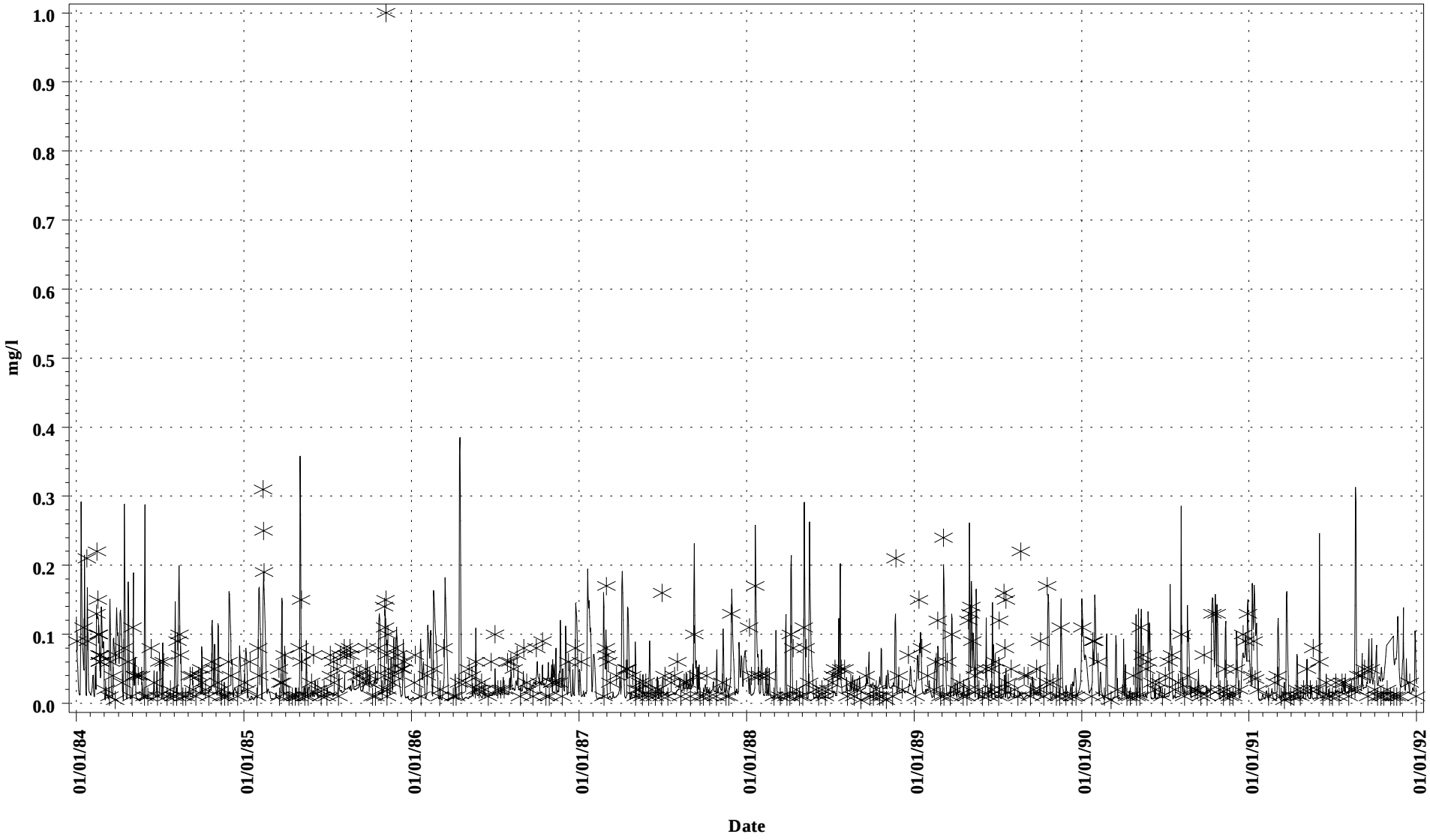
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(lo.drv 26JUN98 12:43)

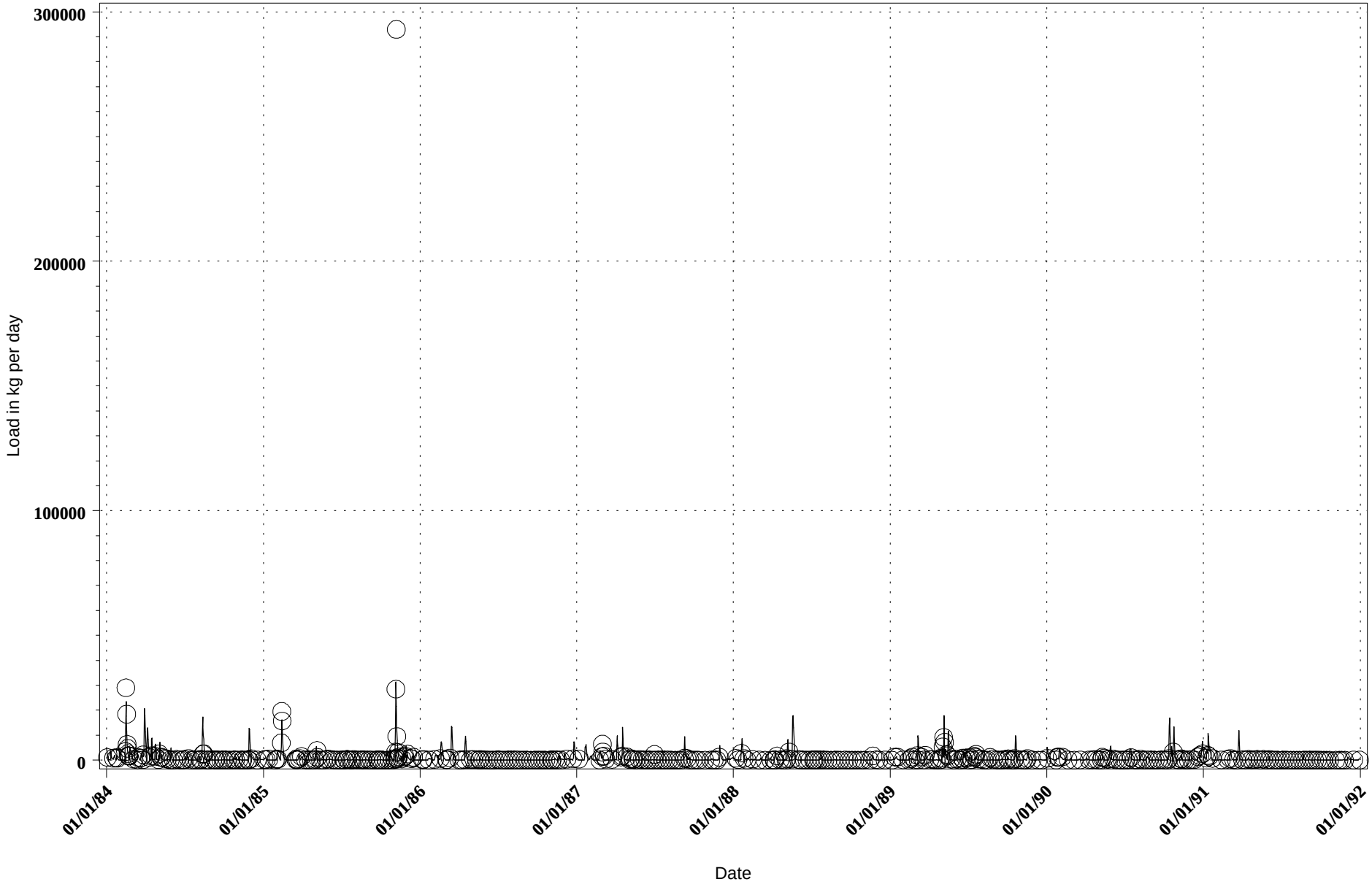
# Lower Potomac River at Segment 220
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Total Ammonia Observed and Simulated Load vs Time
### (line = simulated, O = observed)

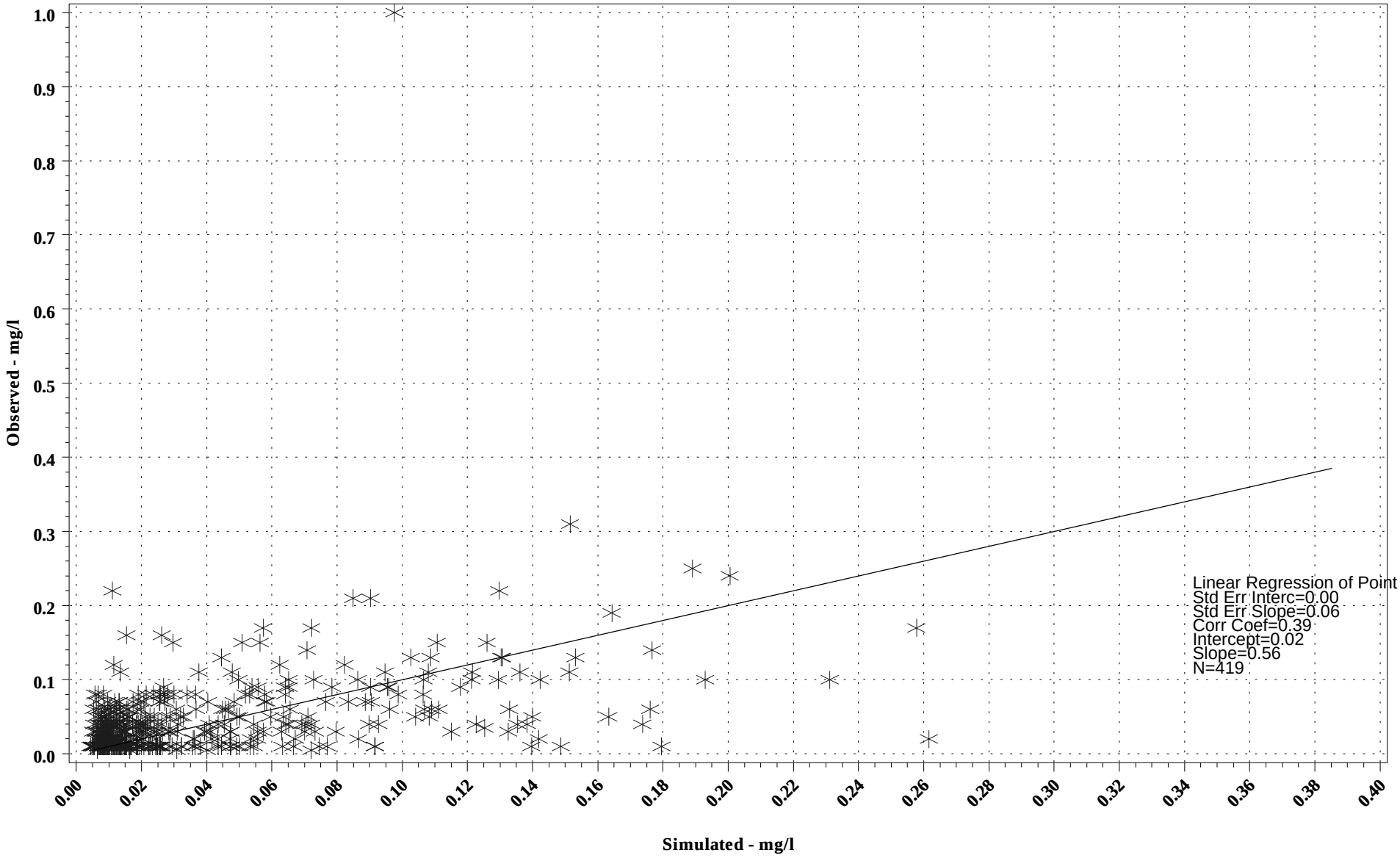



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220

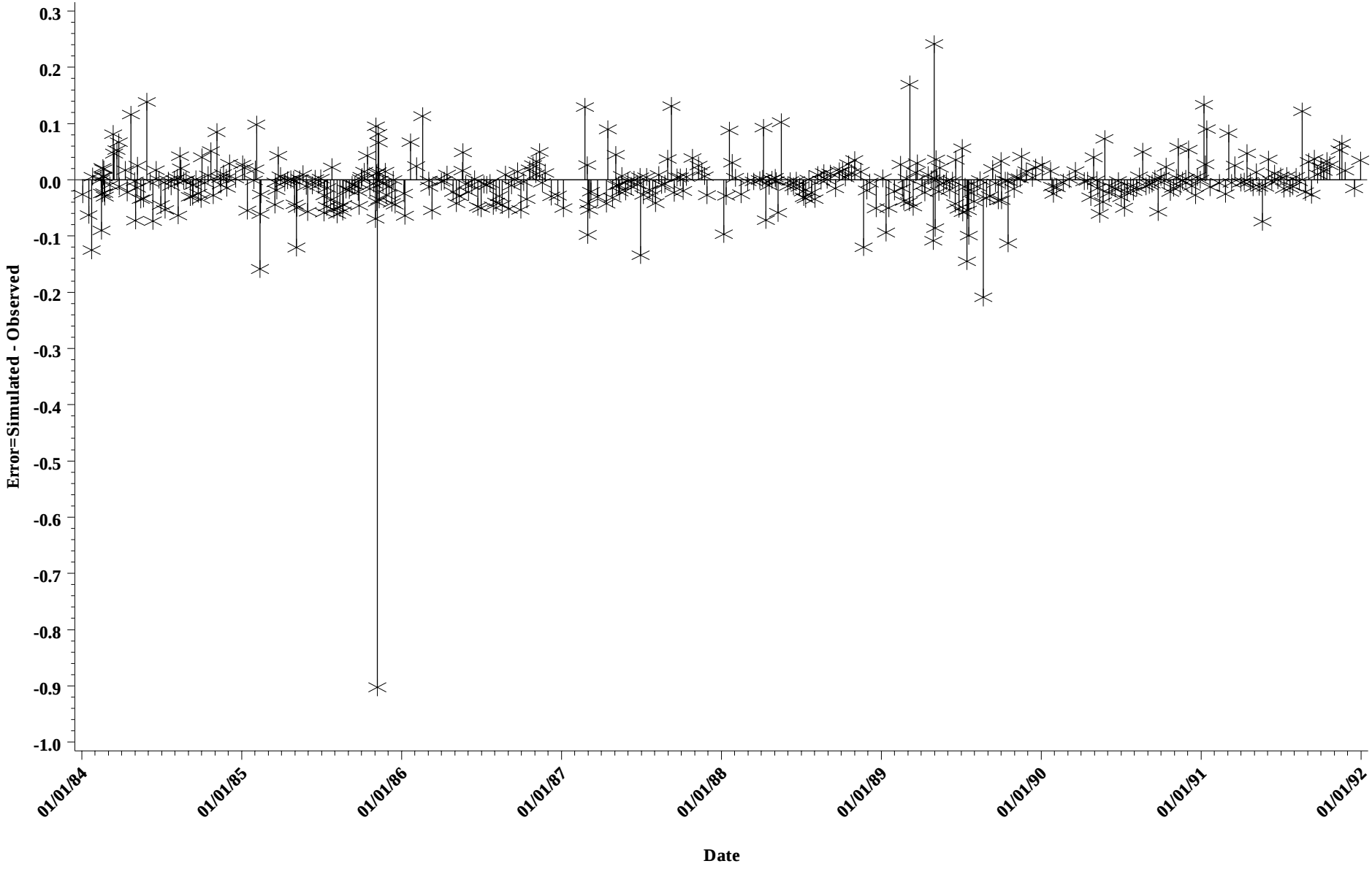
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220
## Actual Error versus Time
## Total Ammonia

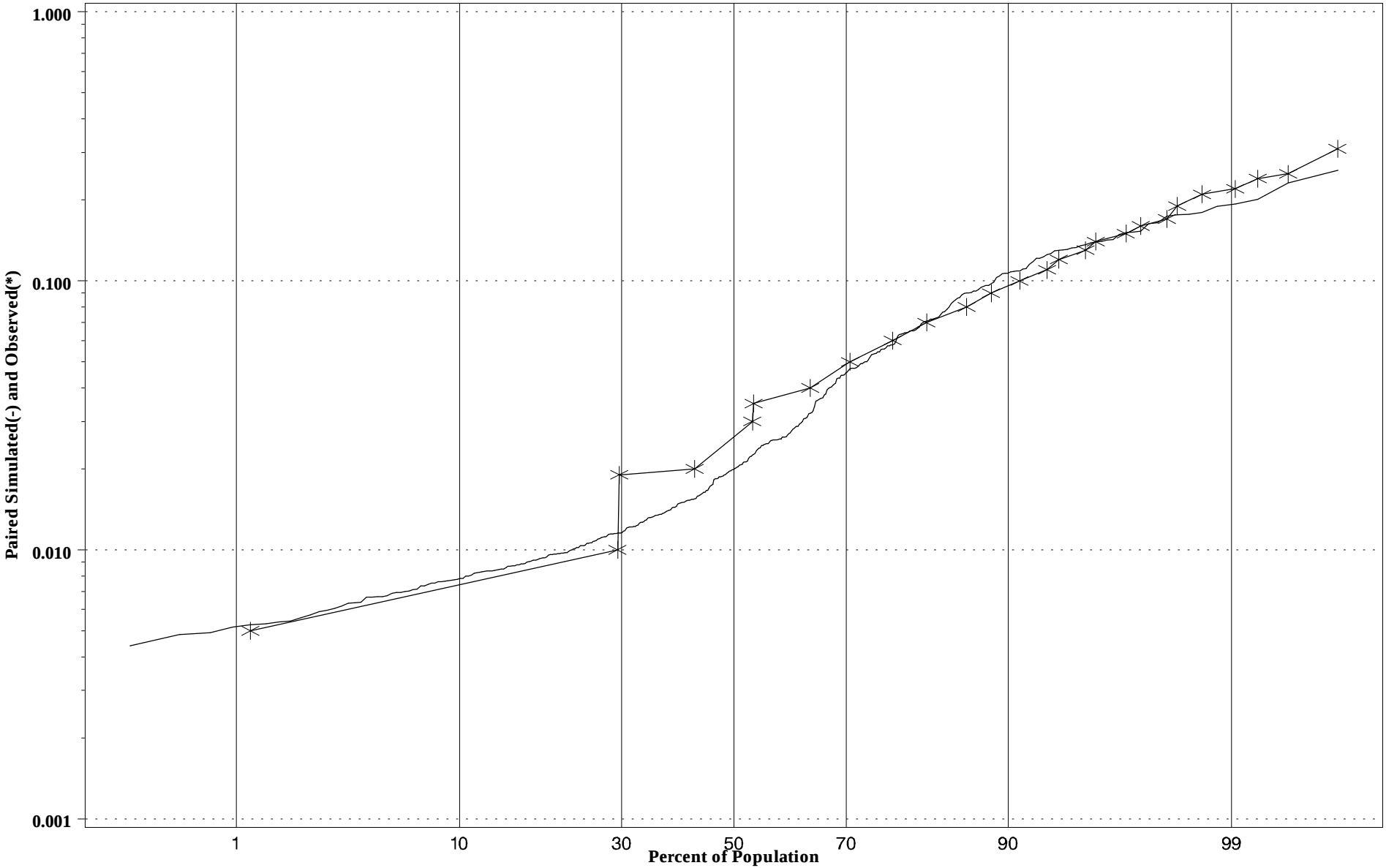



(y21_plotb.sas model3d:[pwang.dt] omerr)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220

## Total Ammonia

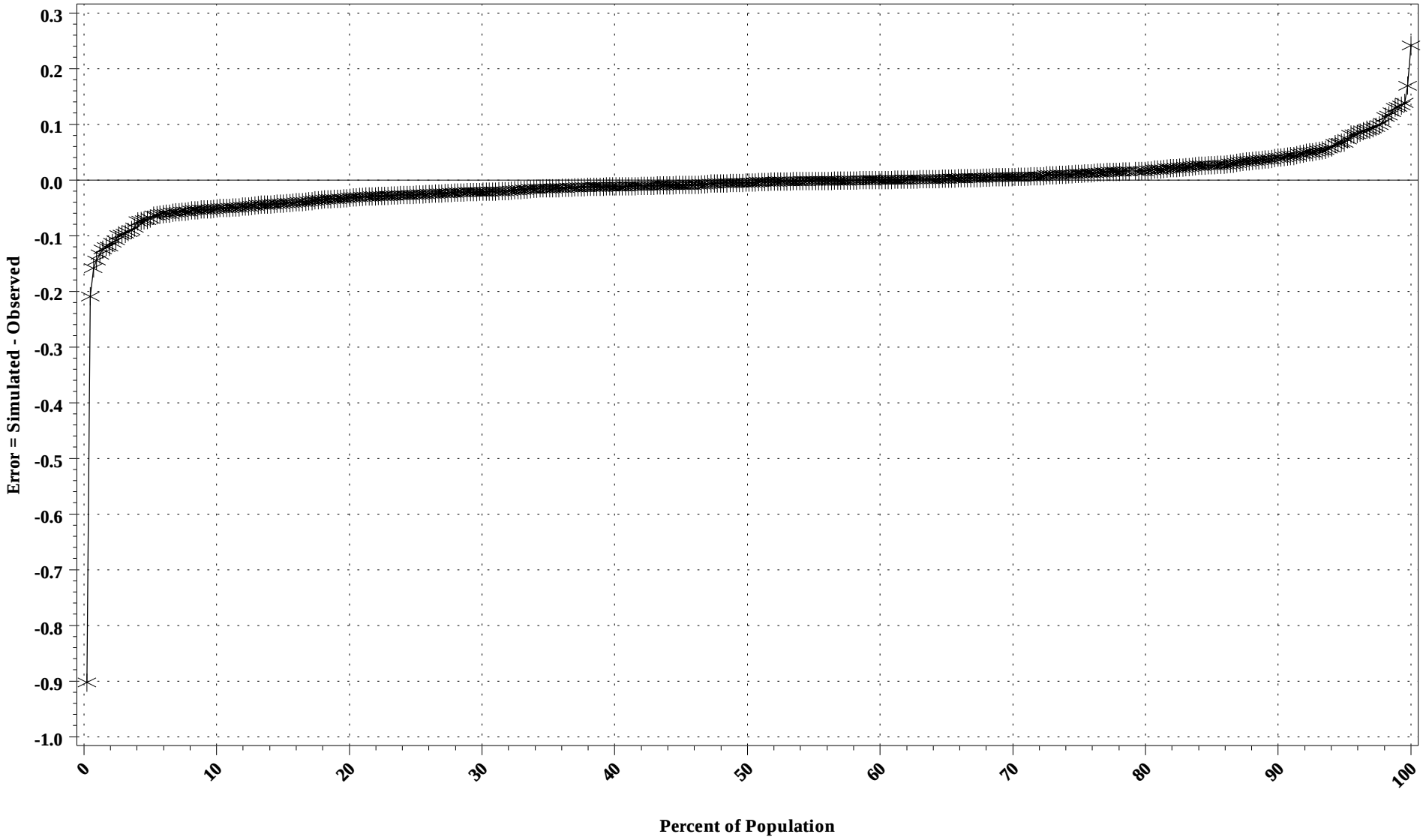
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(lo.drv 26JUN98 12:43)

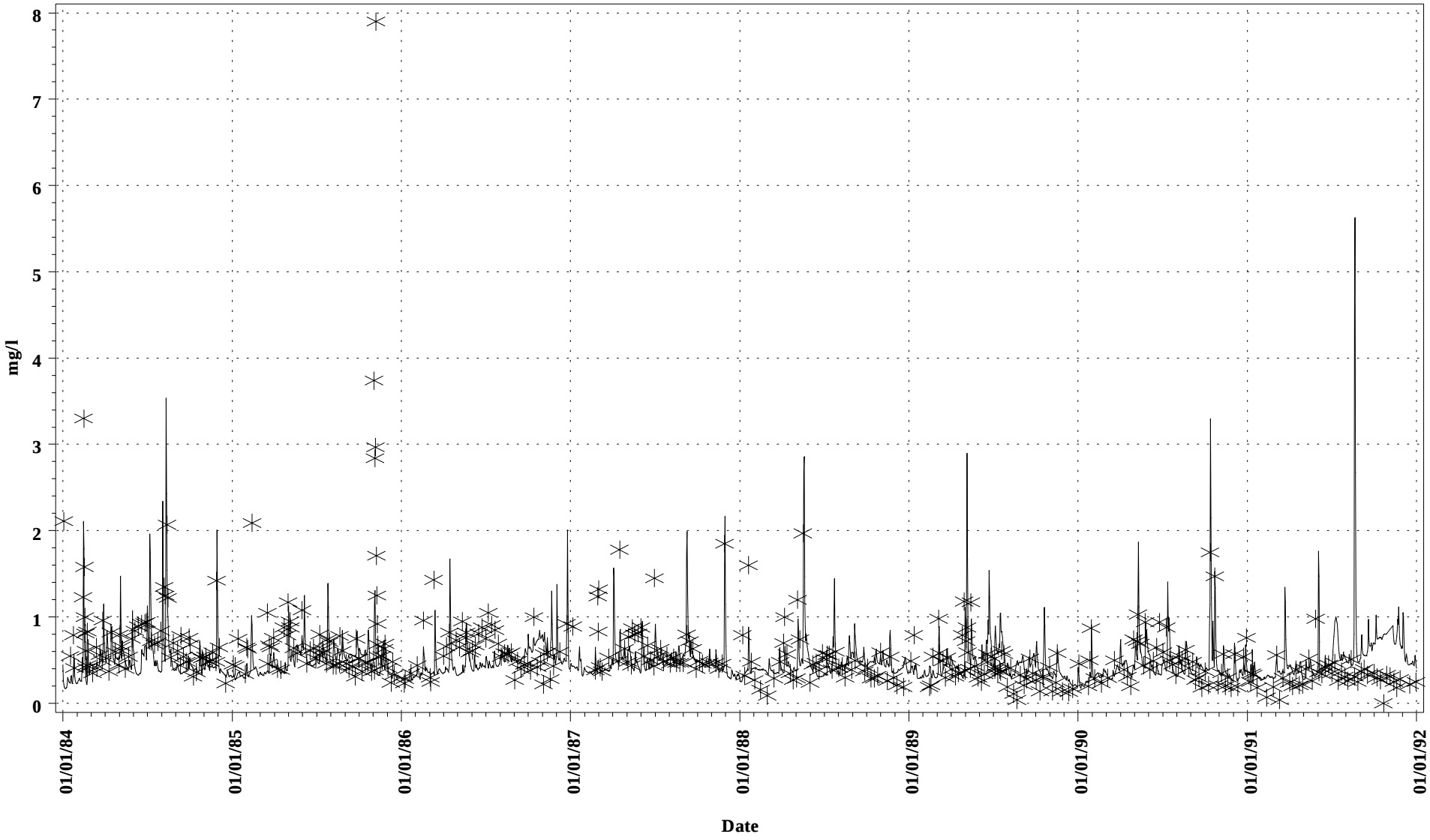
# Lower Potomac River at Segment 220
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data



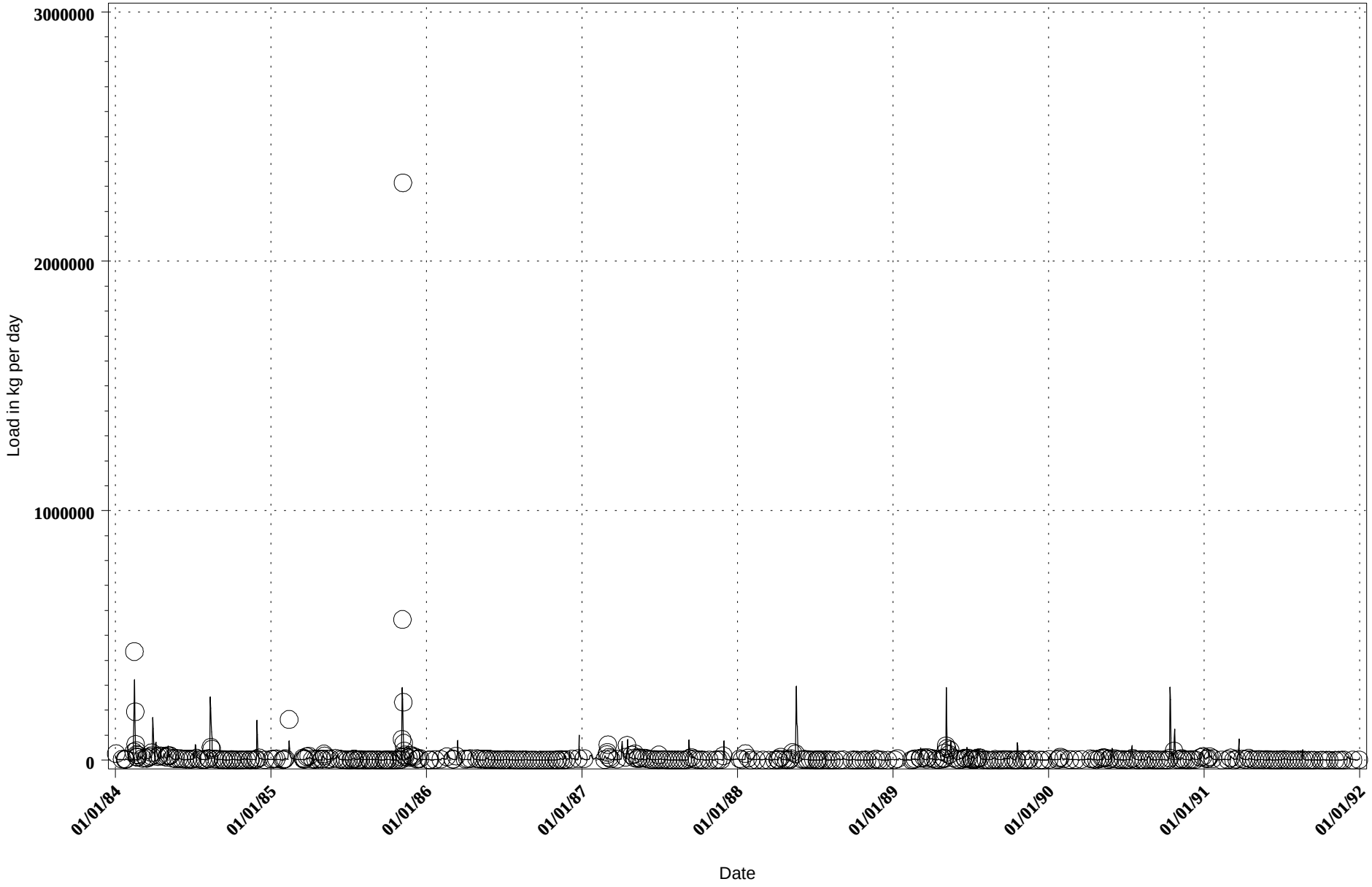

(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Organic Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

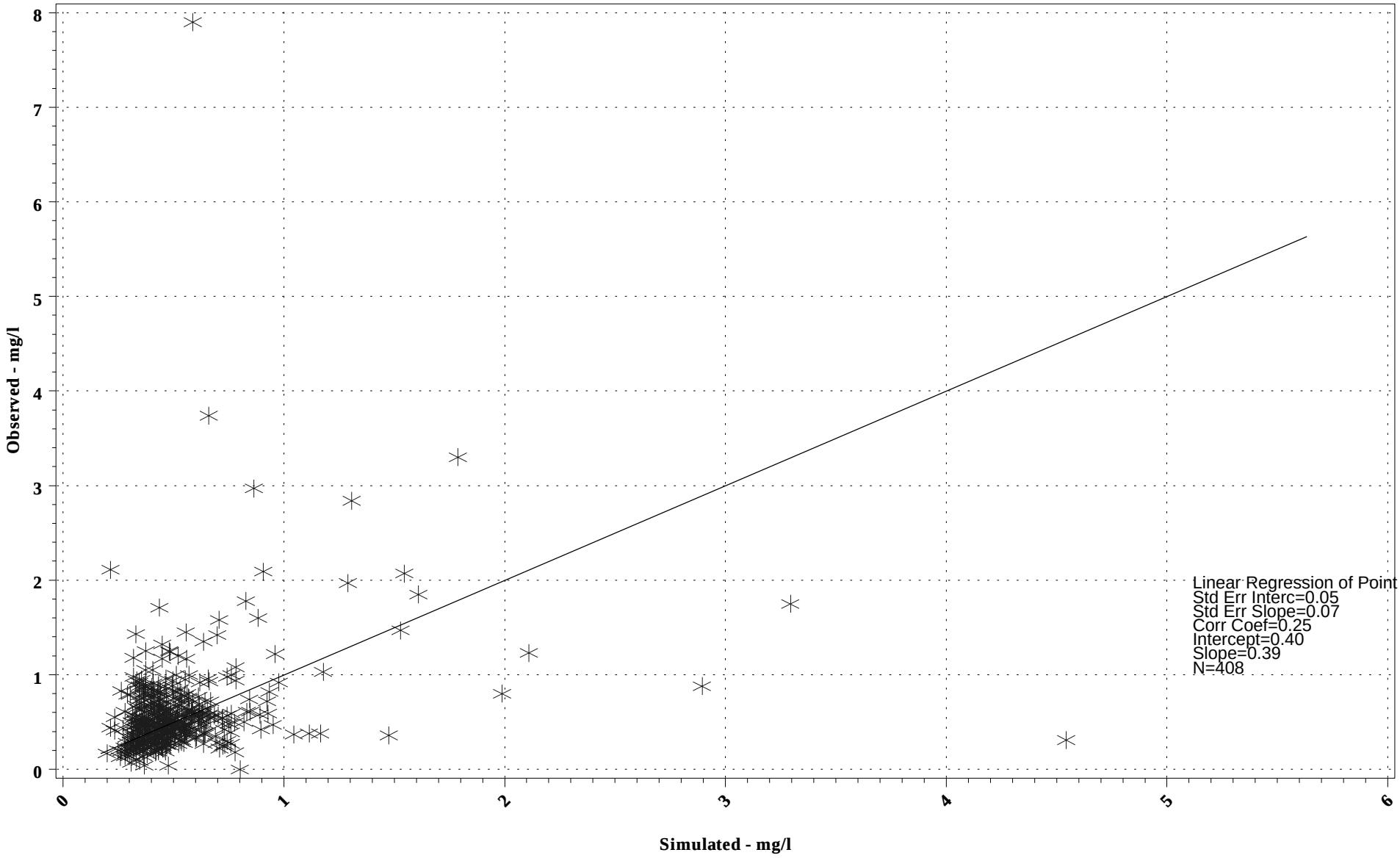



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220

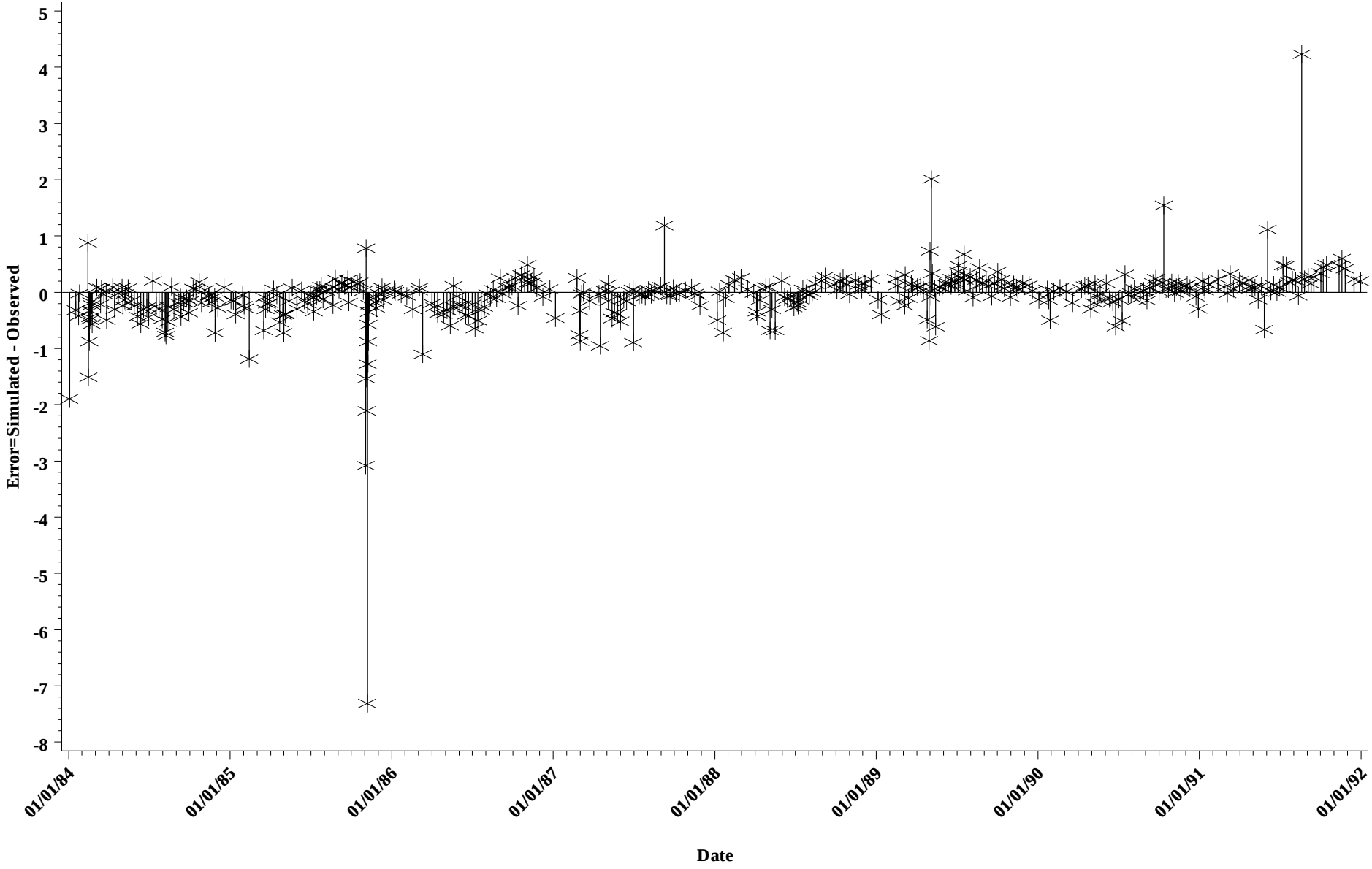
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(lo.drv 26JUN98 12:43,proc reg,model y=x)

# Lower Potomac River at Segment 220
## Actual Error versus Time
## Organic Nitrogen

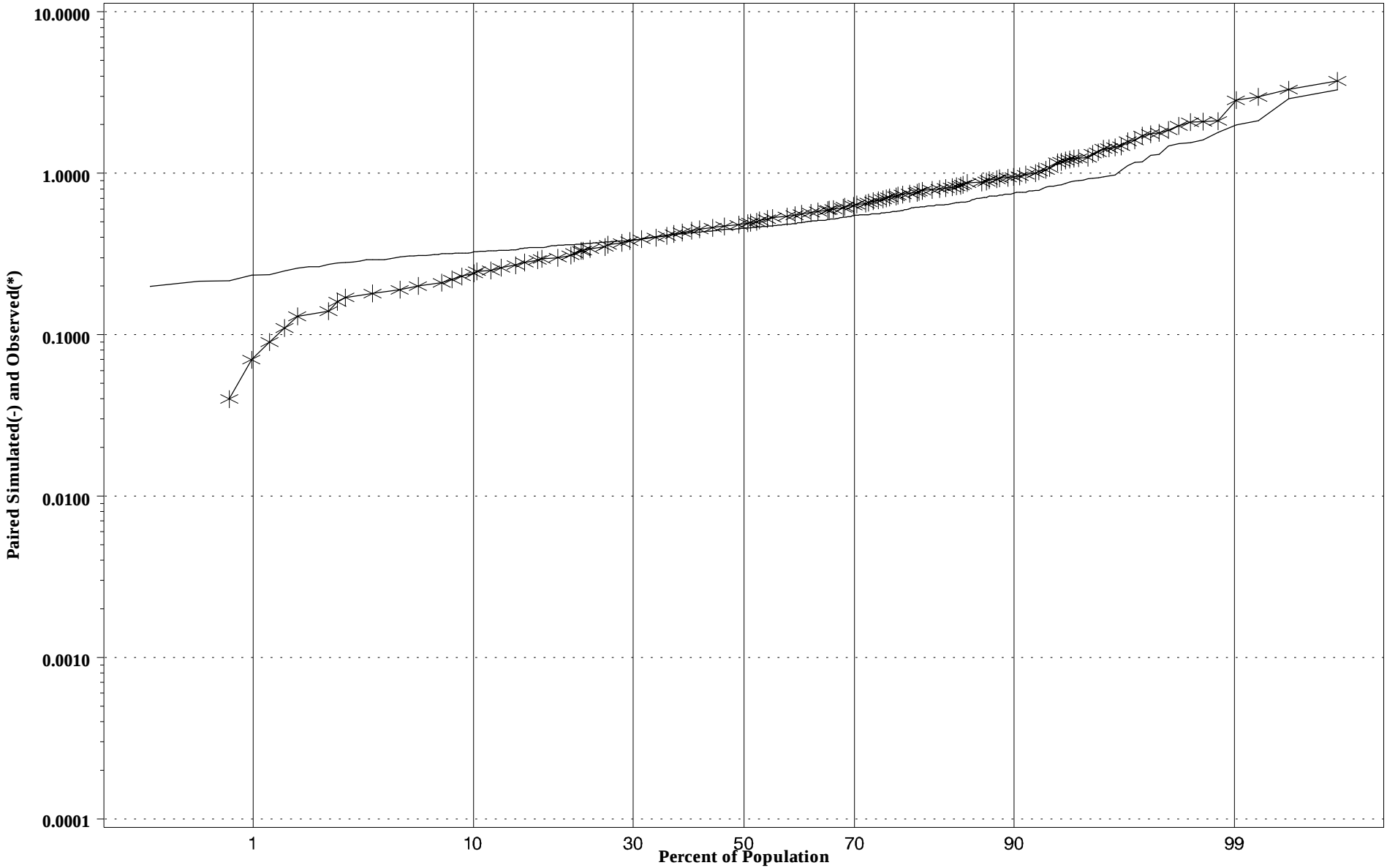



(y21_plotb.sas model3d:[pwang.dt] omerr)
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220

## Organic Nitrogen

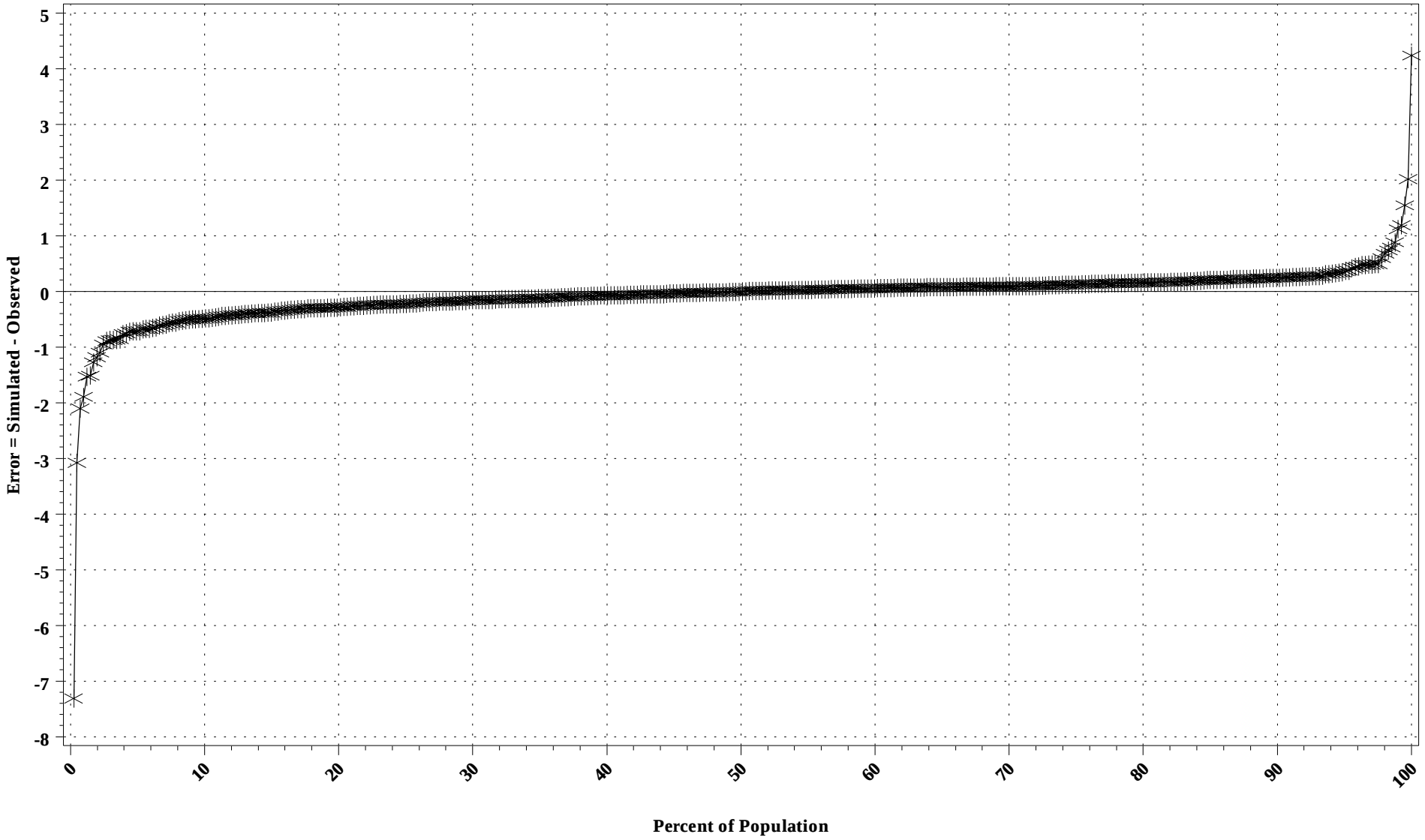
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(lo.drv 26JUN98 12:43)

# Lower Potomac River at Segment 220
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(lo.drv 26JUN98 12:43)

# B.4.0 Rappahannock River Basin

***Basin Segments:***

Above Fall Line Basin Segments: 230
Below Fall Line Basin Segments: 560

***Section Contents:***

### *B.4.1 Rappahannock River near Fredericksburg, VA at Segment 230 (Monitoring Station: 1668000) (Above Fall Line Basin Segments: 230)*

**Section Summary:**

The Rappahannock basin is largely rural in character and is dominated by agricultural loads. Concentrations of total nitrogen, total phosphorus, and total suspended solids are generally low. Water quality observations increased and were oriented toward storm weighted sampling after 1989. Model calibration focused primarily on the refined, storm weighted sampling after 1989.

The Rappahannock basin above the gaged site covers an area of 2,582 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 55% forest land, 12% cropland, 26% other agricultural areas, 6% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage decreased from 5.3 million pounds in 1985 to 5.0 million pounds in 1996. Total phosphorus loads over the same time period decreased from 0.55 million pounds to 0.46 million pounds. In general, point source loads above the gage site decreased. In 1996, the total nitrogen point source load was 4% of the total load and the total phosphorus point source load was 7% of the total load. Estimated septic system total nitrogen loads increased 38%, from 0.13 million pounds in 1985 to 0.18 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 18%, and other agricultural loads (primarily pasture and manure loads) by 5%. Total phosphorus decreased for these land uses by 25% and 2% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 23% for total nitrogen and 25% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

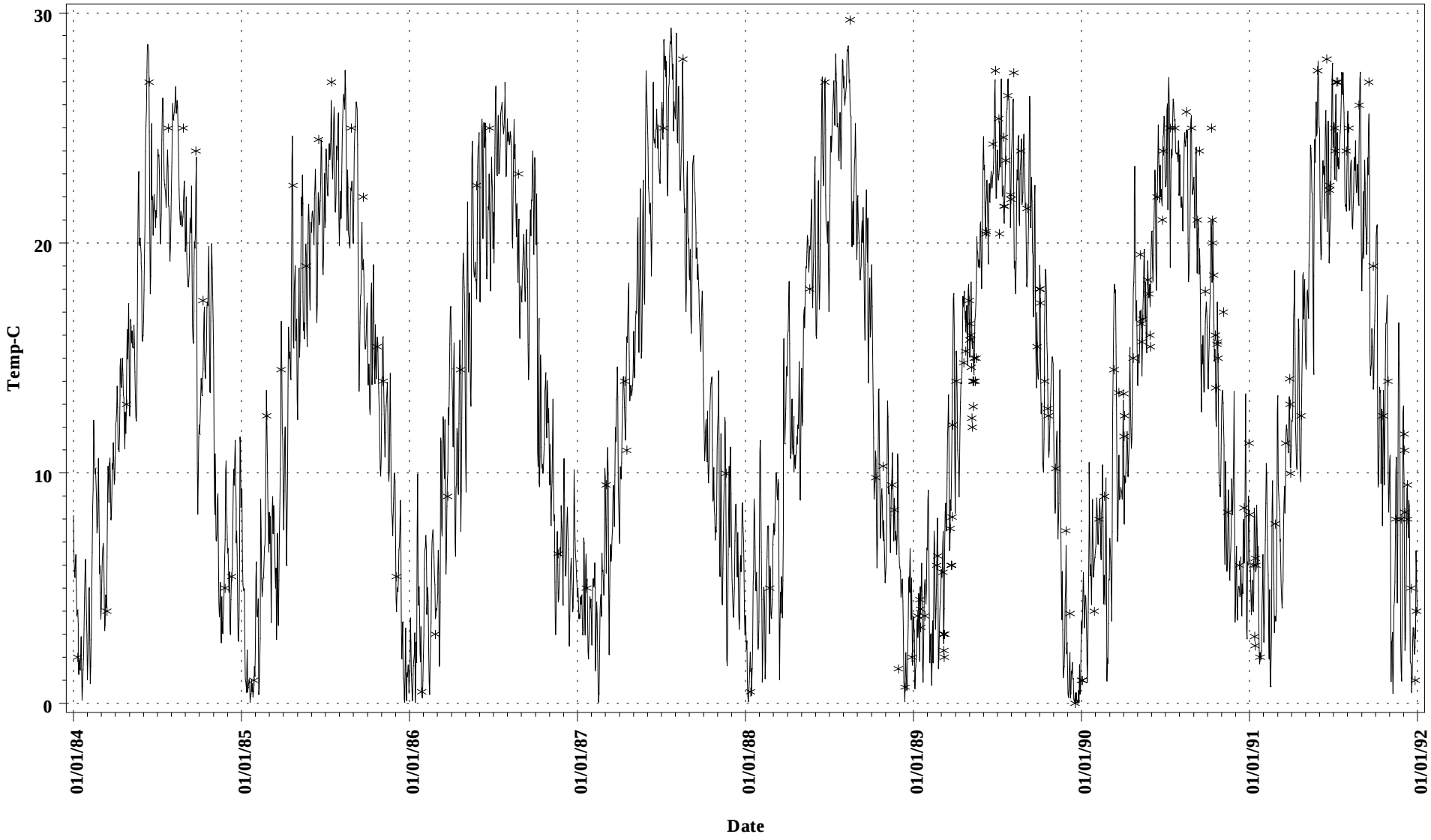
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# Rappahannock River at Segement 230
## Observed and Simulated versus Time
## Temperature-C

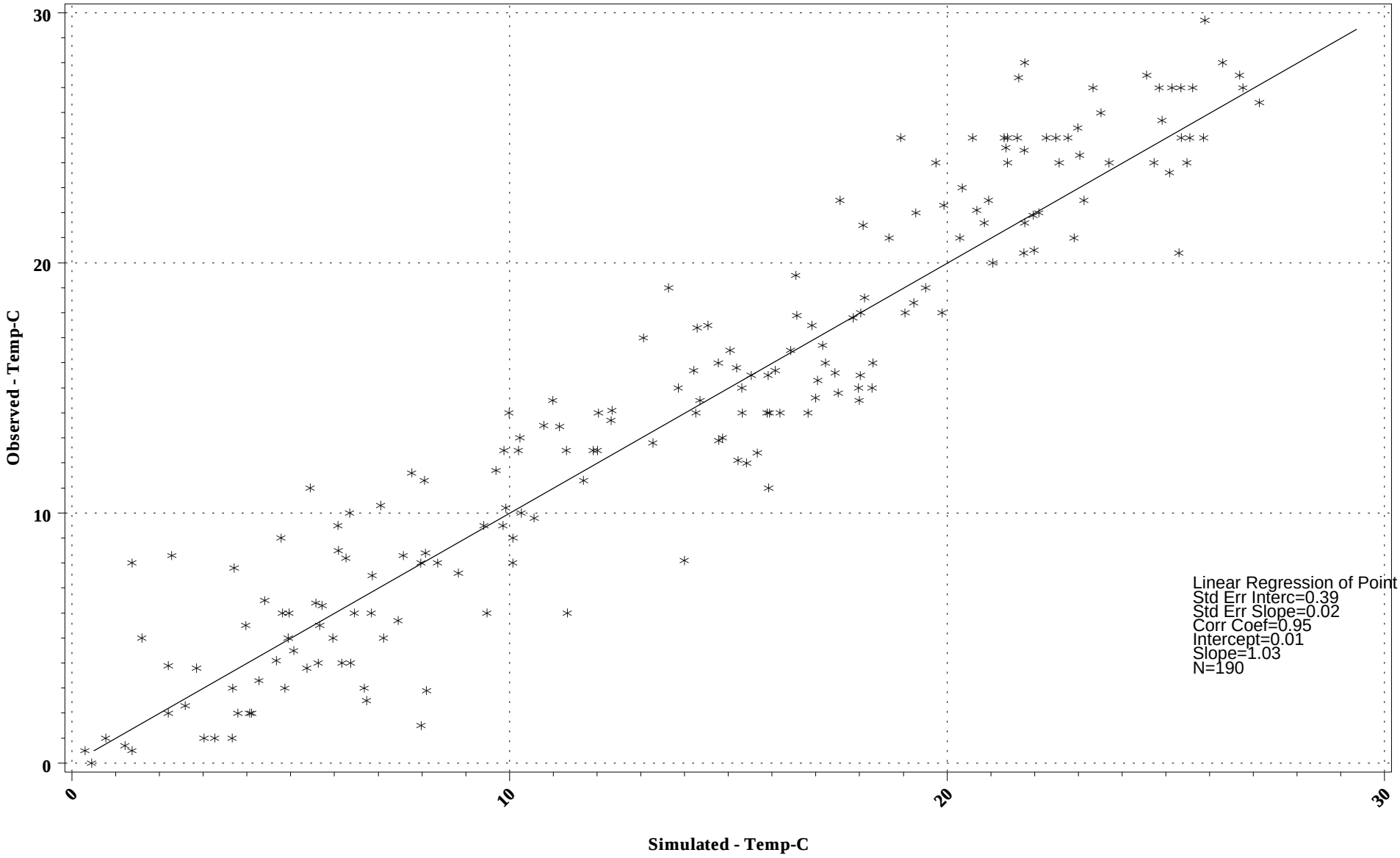
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(rap.drv 29JUN98 09:34)

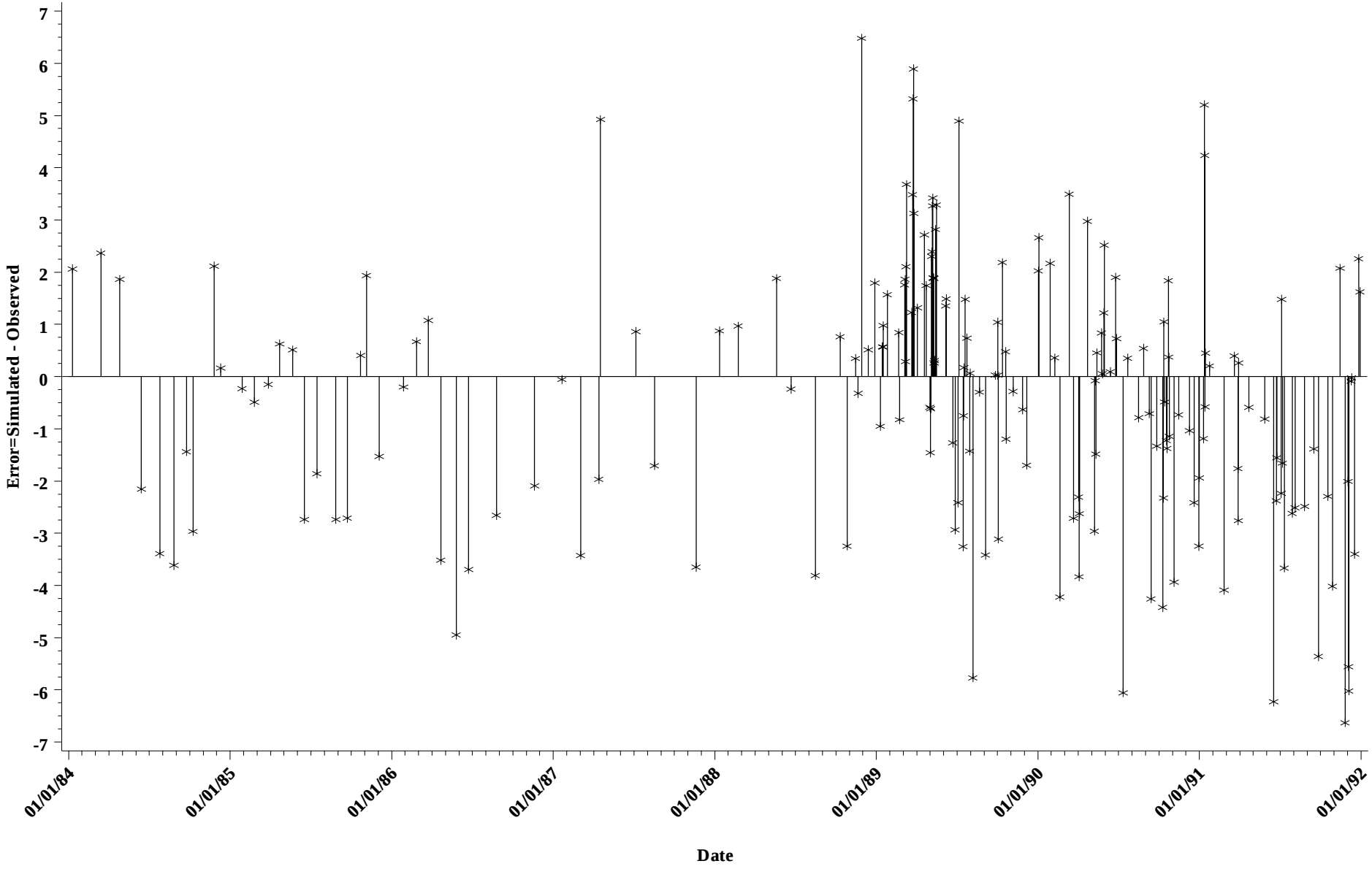
# Rappahannock River at Segement 230

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230
## Actual Error versus Time
## Temperature-C

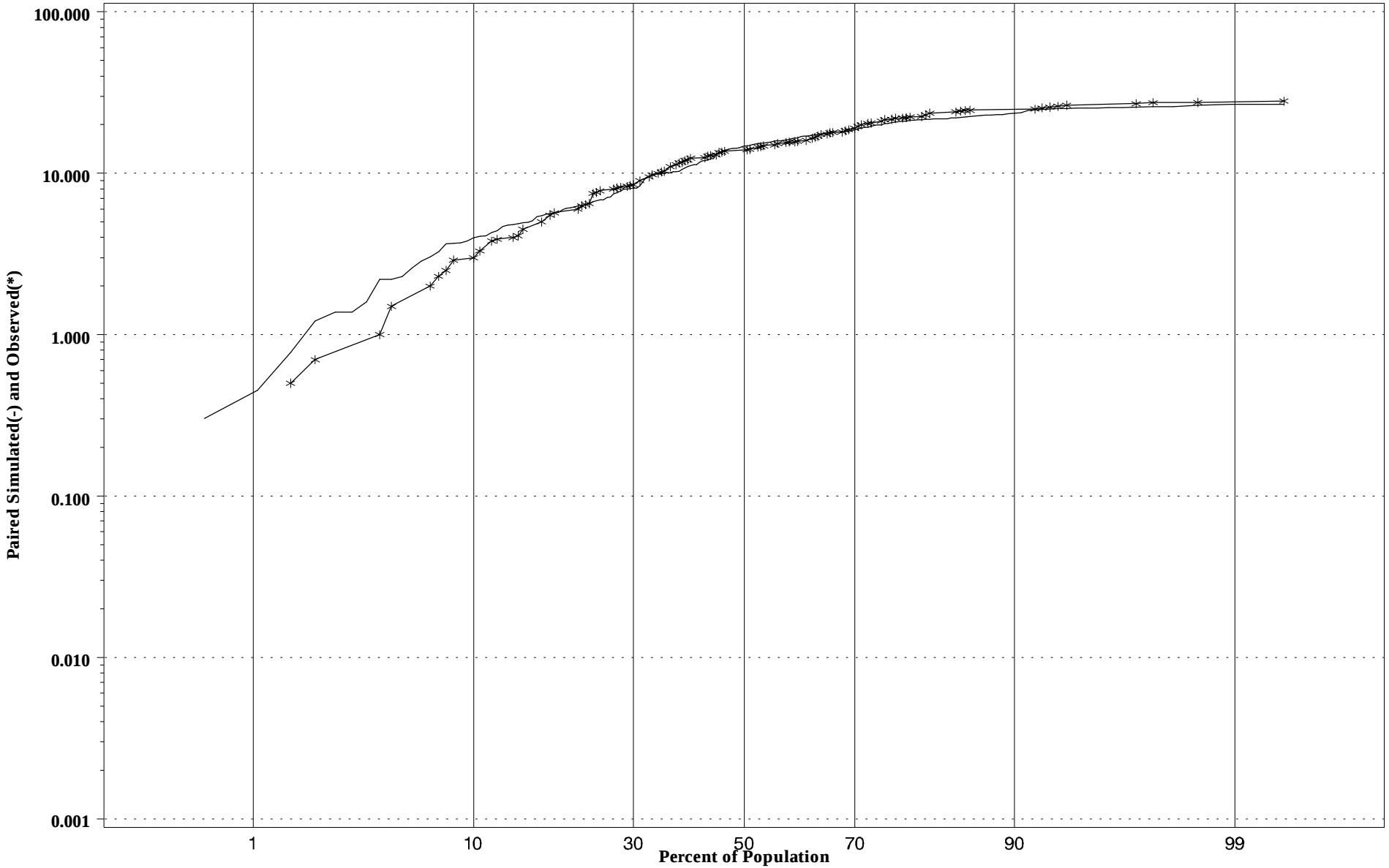



(y21_plotb.sas model3d:[pwang.dt] omerr)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230

## Temperature-C

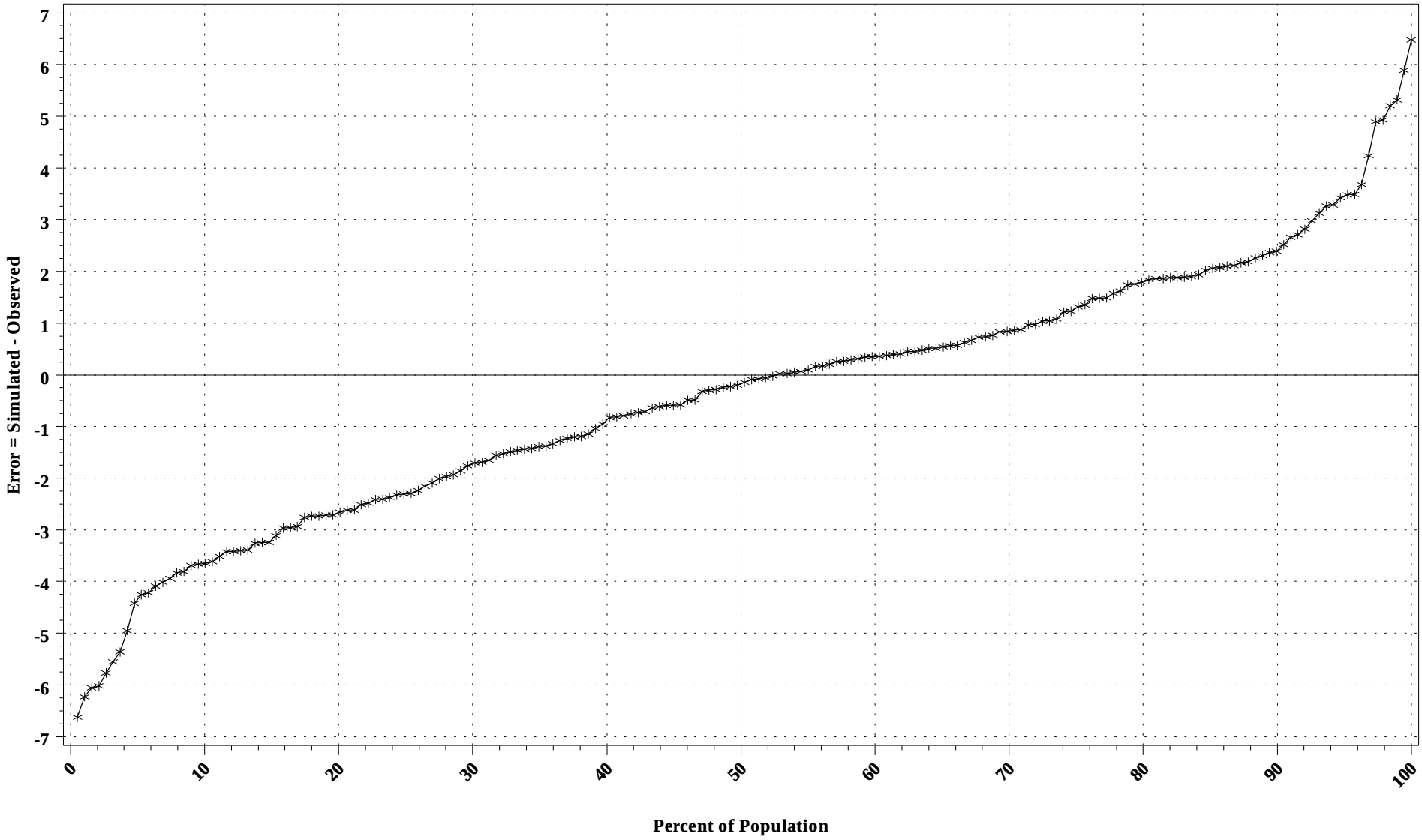
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Actual error versus Percentile Sample Population
## Temperature-C

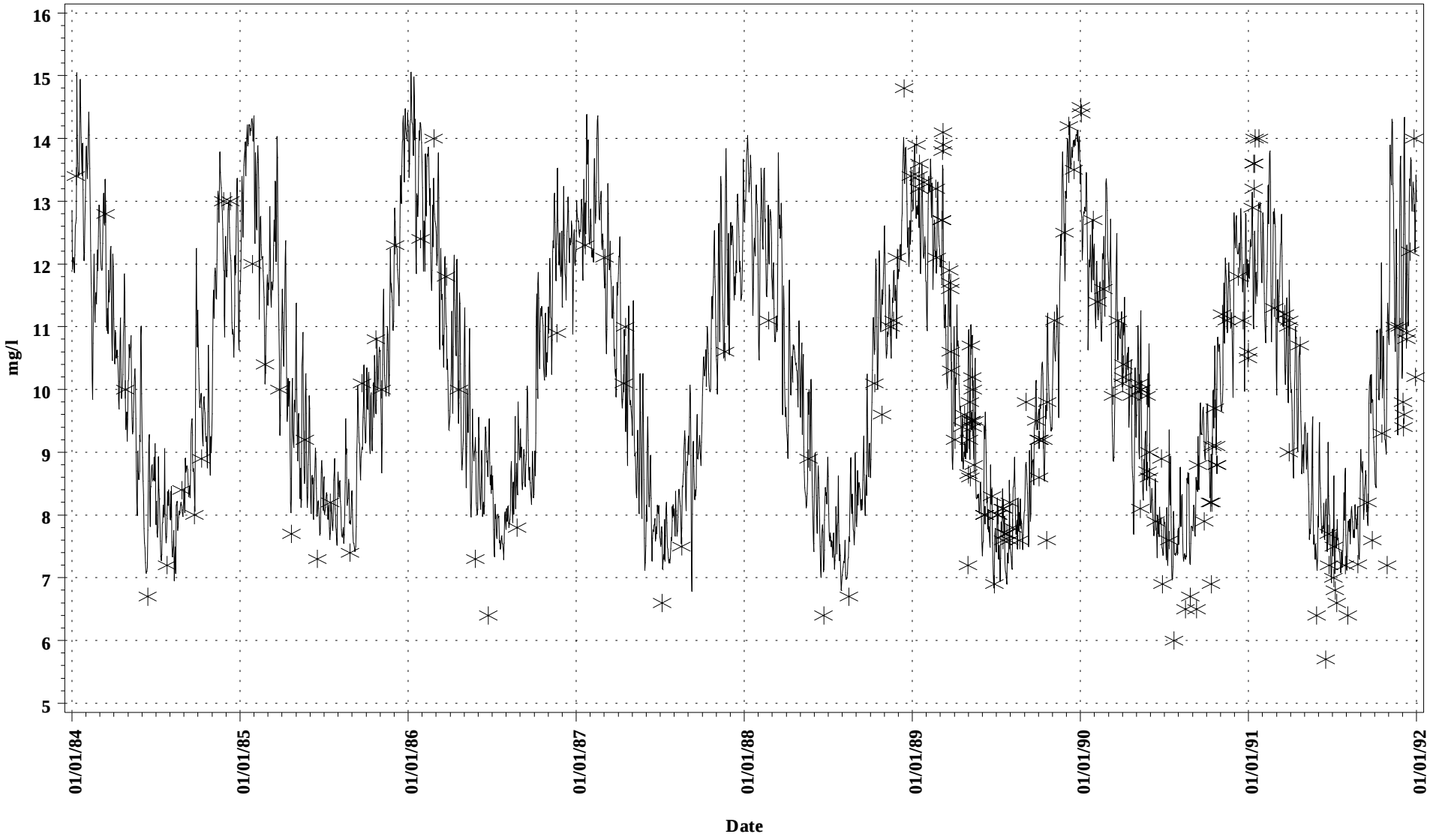
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(rap.drv 29JUN98 09:34)

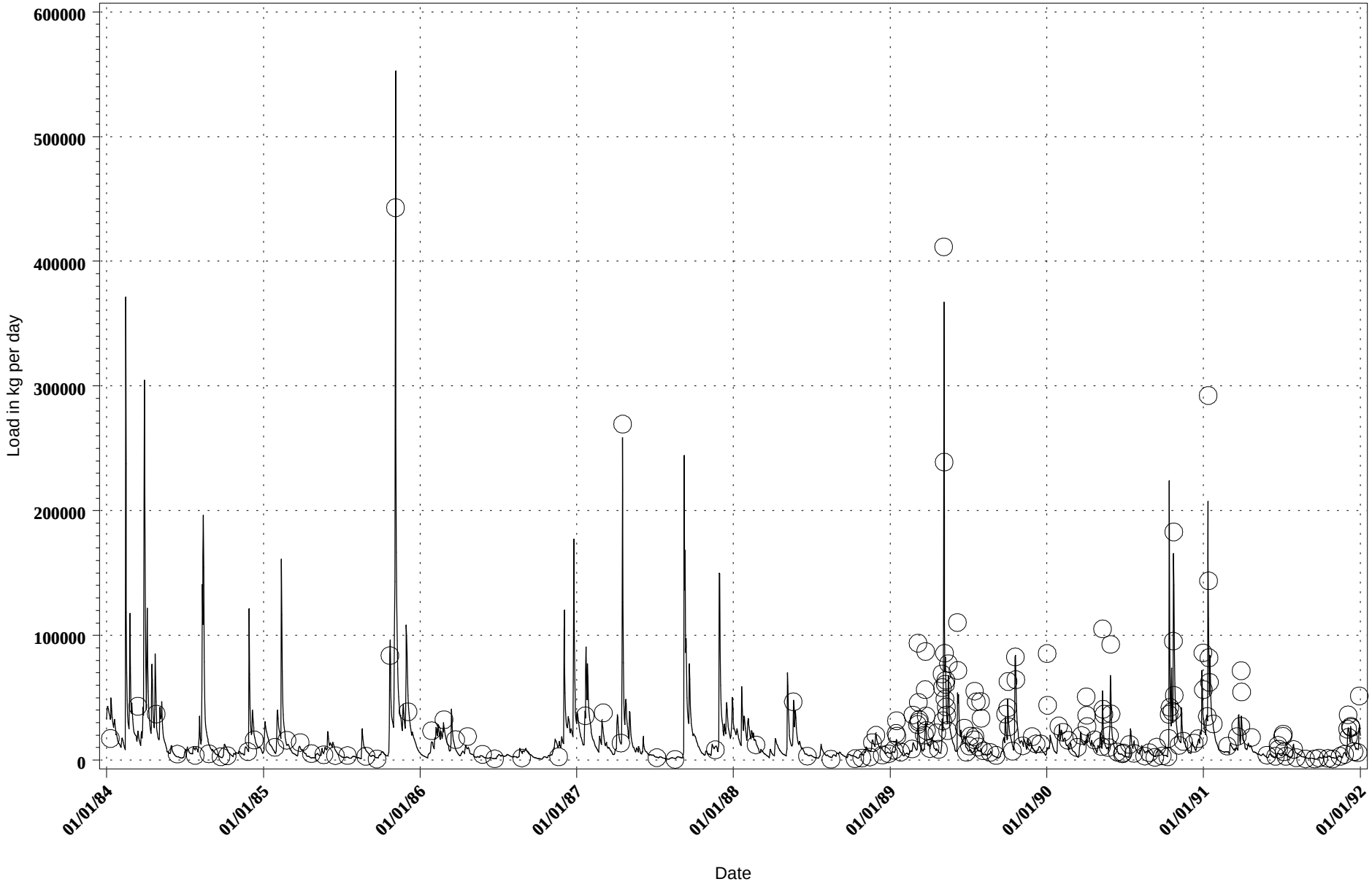
# Rappahannock River at Segement 230
## Observed and Simulated versus Time
# Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(rap.drv 29JUN98 09:34)

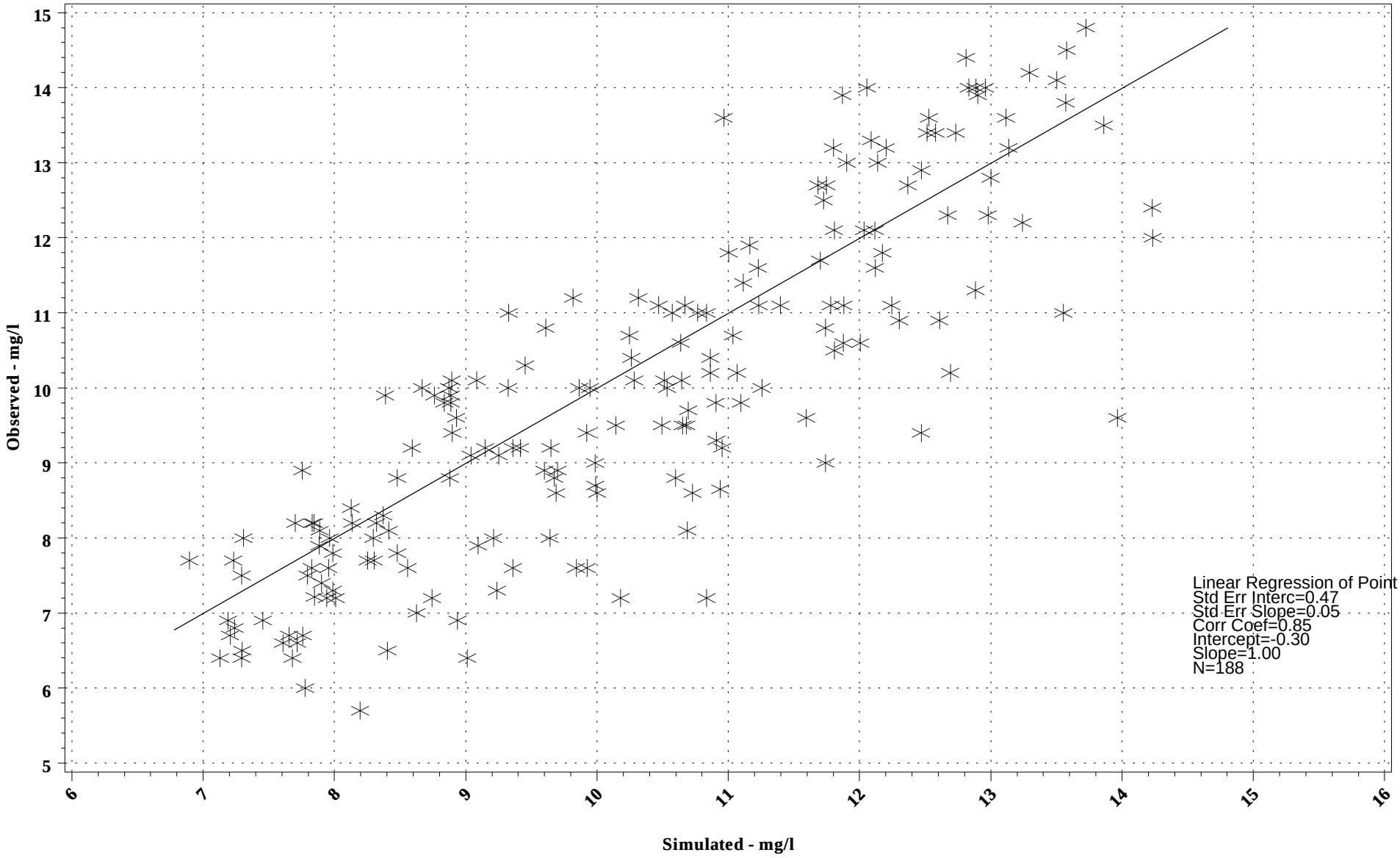
# Rappahannock River at Segement 230
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)




(y21_plotb.sas model3d:[pwang.dt] lldflas)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

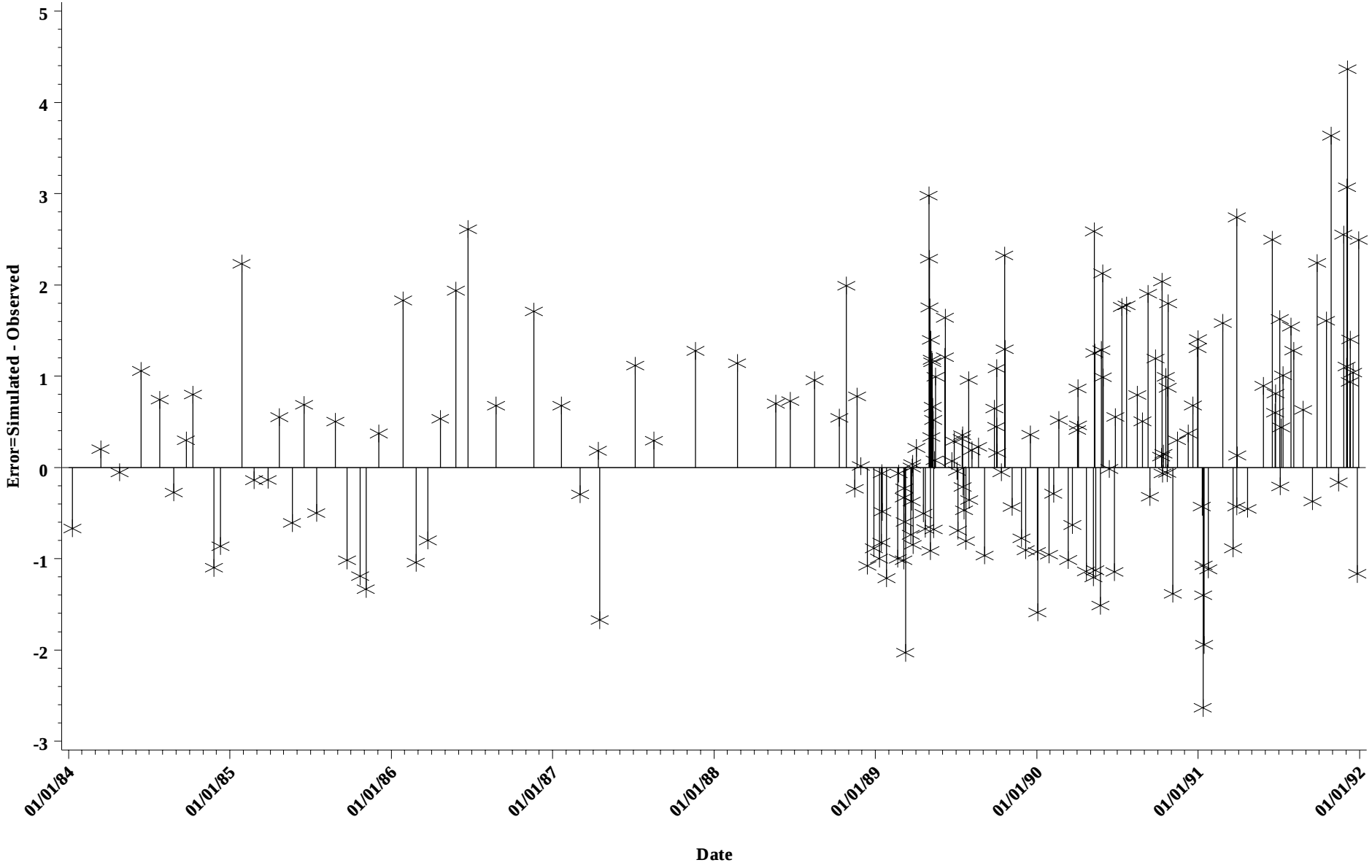
# Rappahannock River at Segement 230

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Dissolved Oxygen: 01JAN84 - 01JAN92



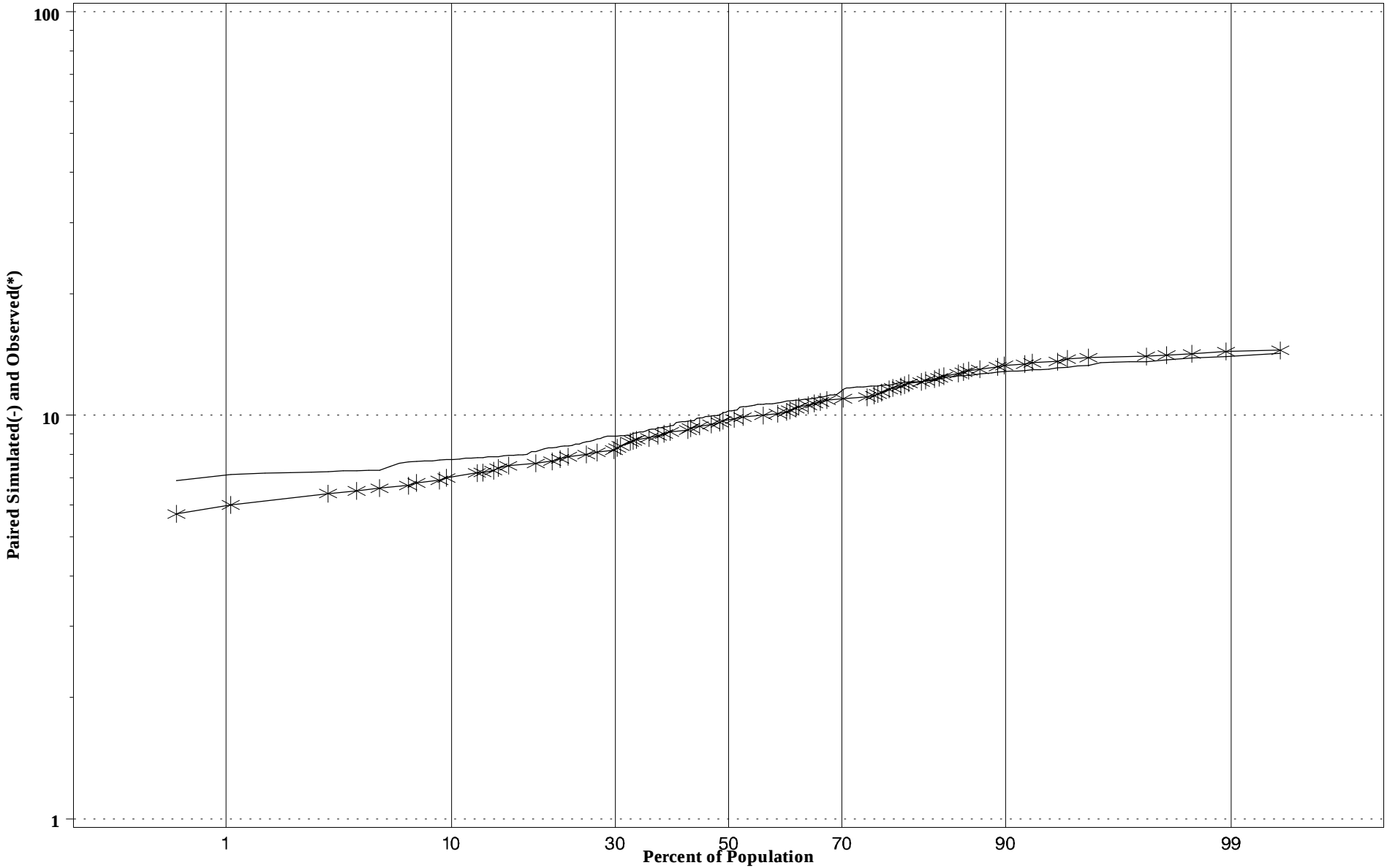

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(rap.drv 29JUN98 09:34)

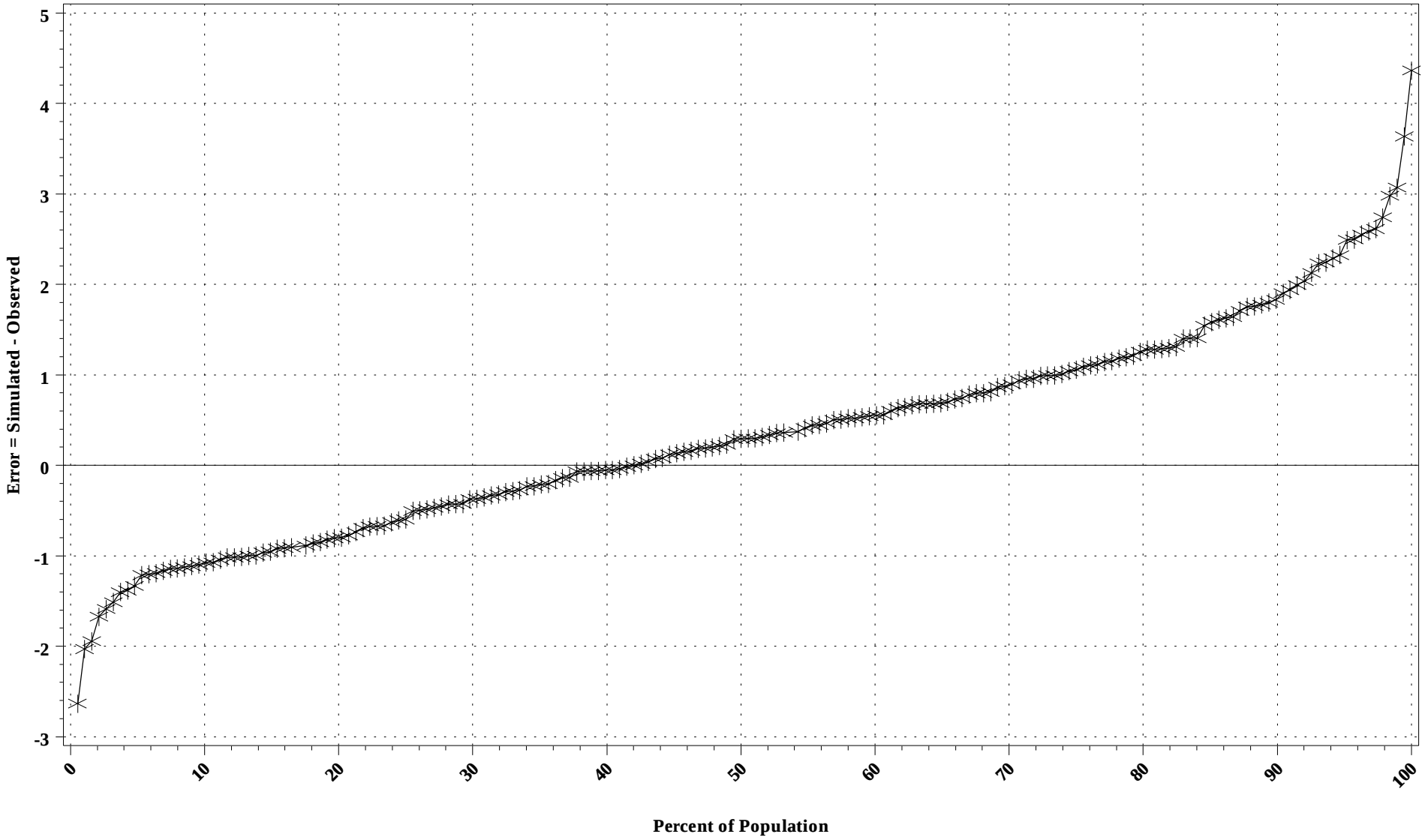
# Rappahannock River at Segement 230
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

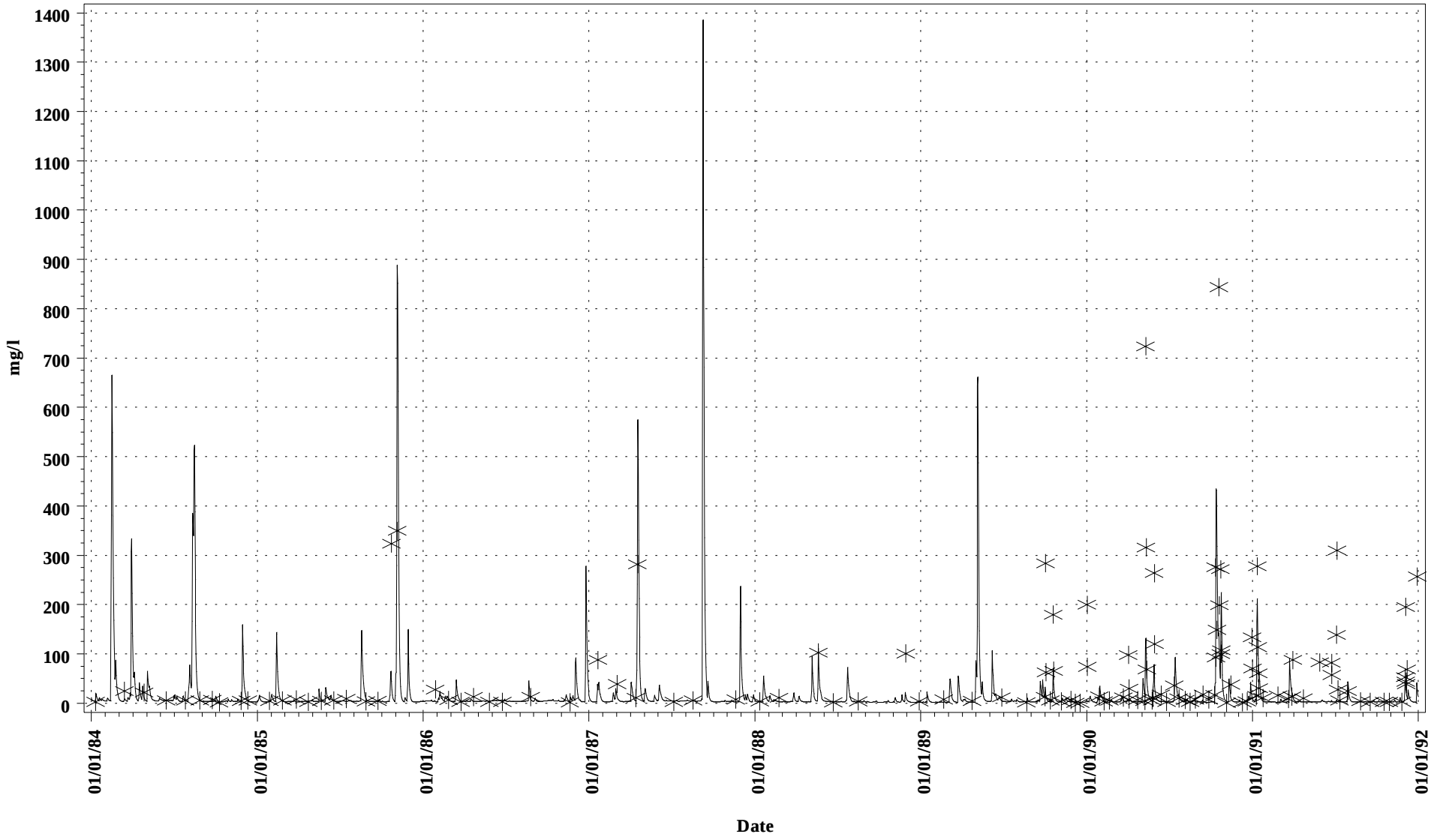
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**

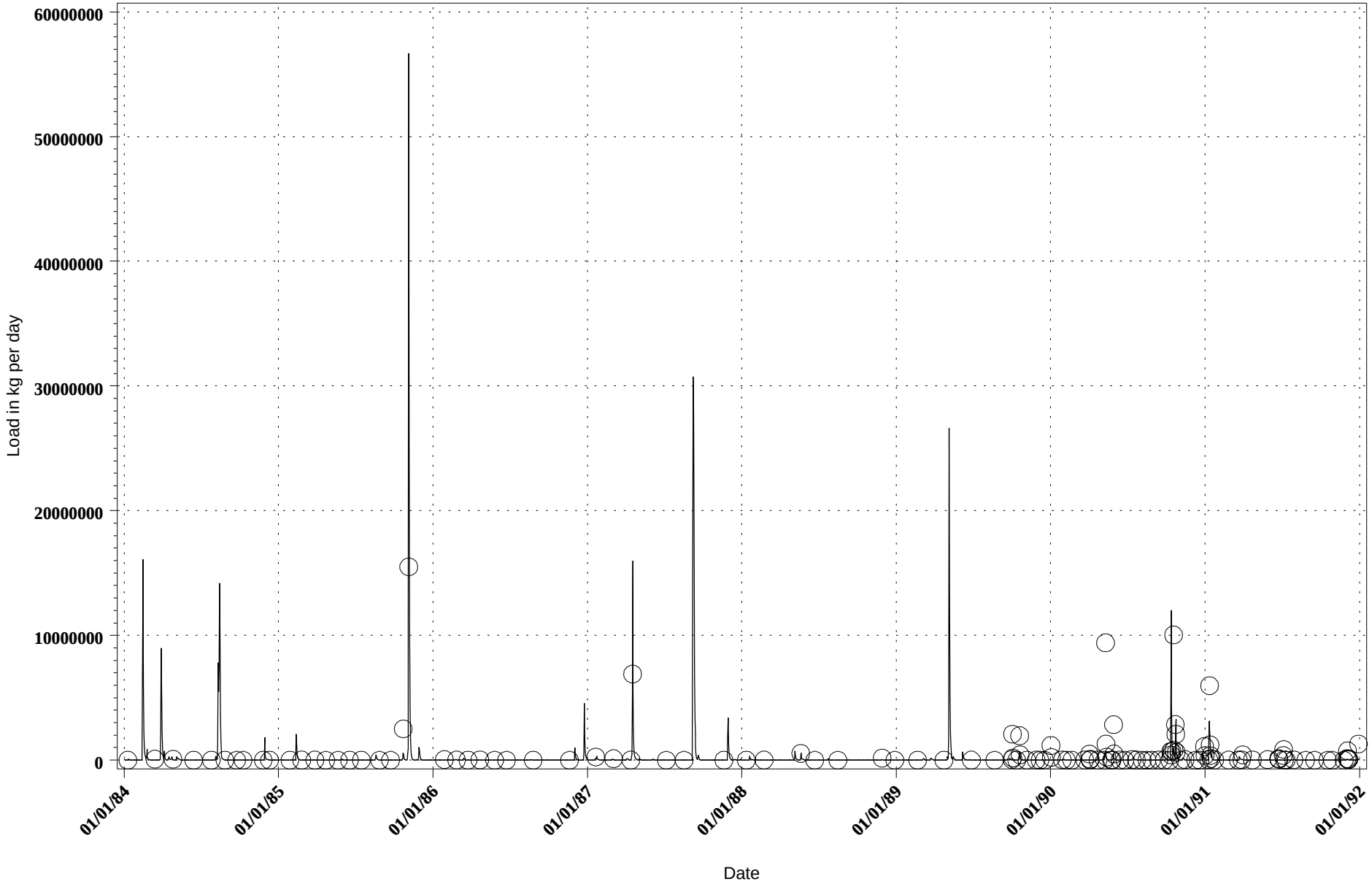



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230

## Total Suspended Sediment Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

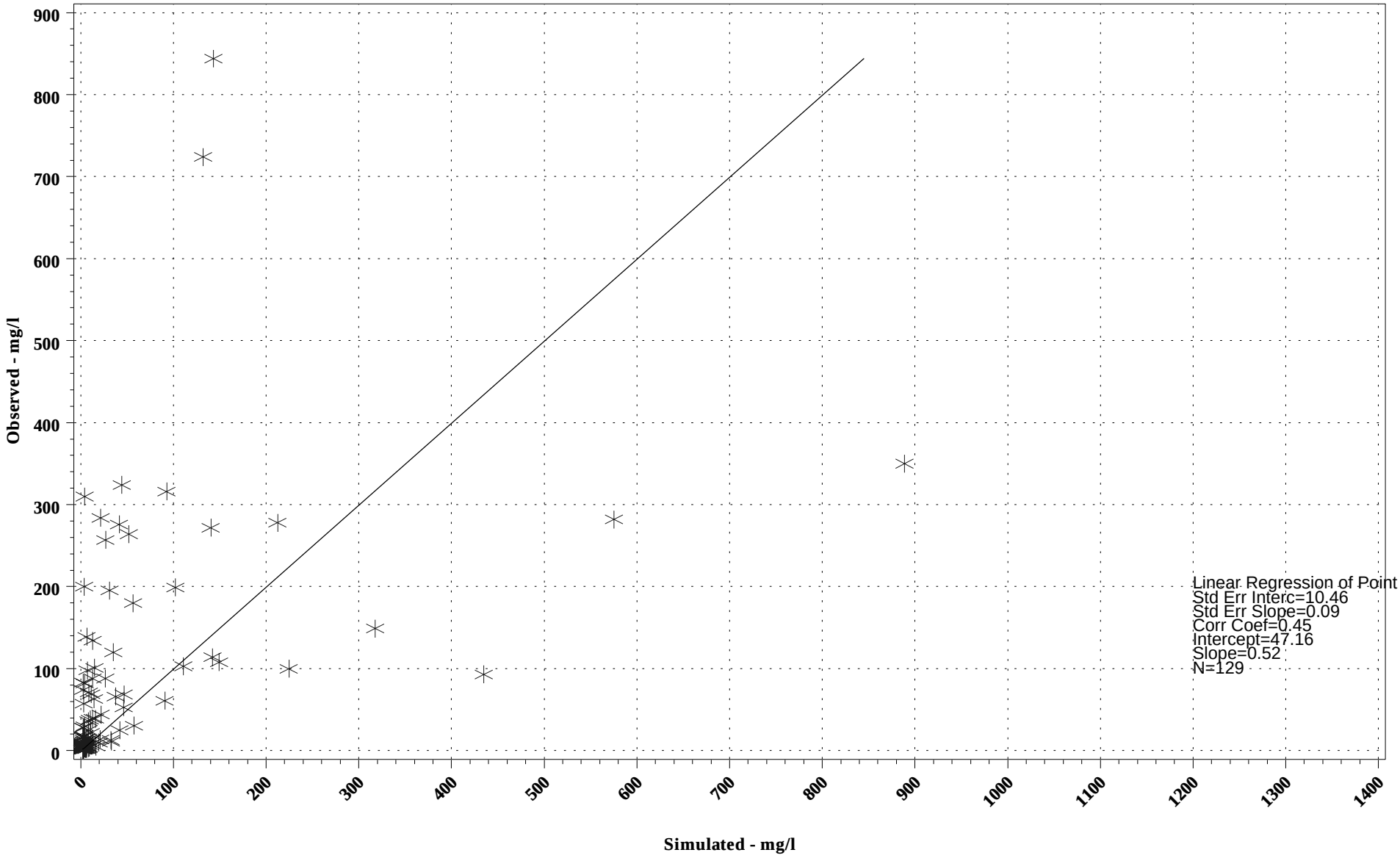



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230

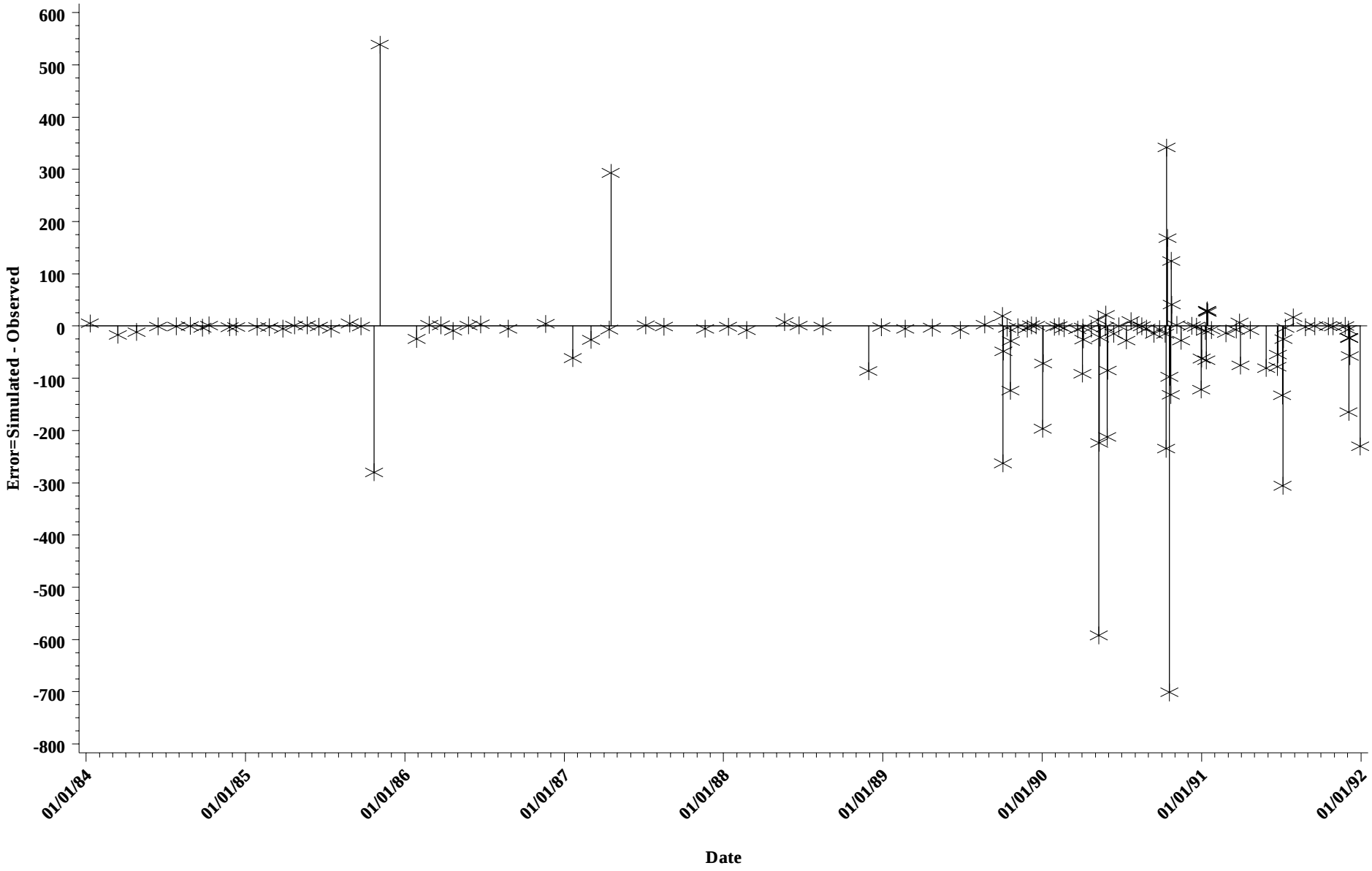
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



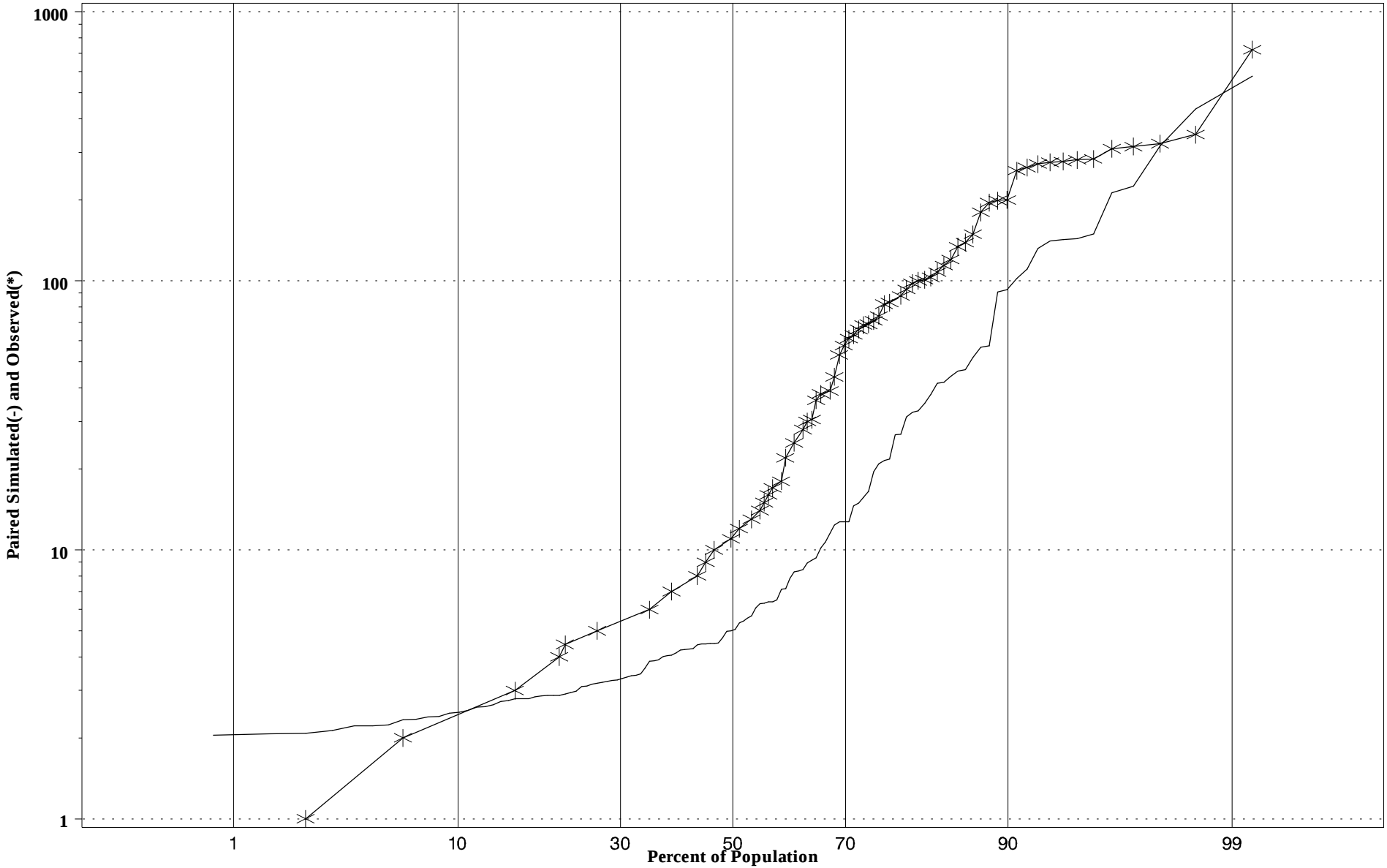

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(rap.drv 29JUN98 09:34)

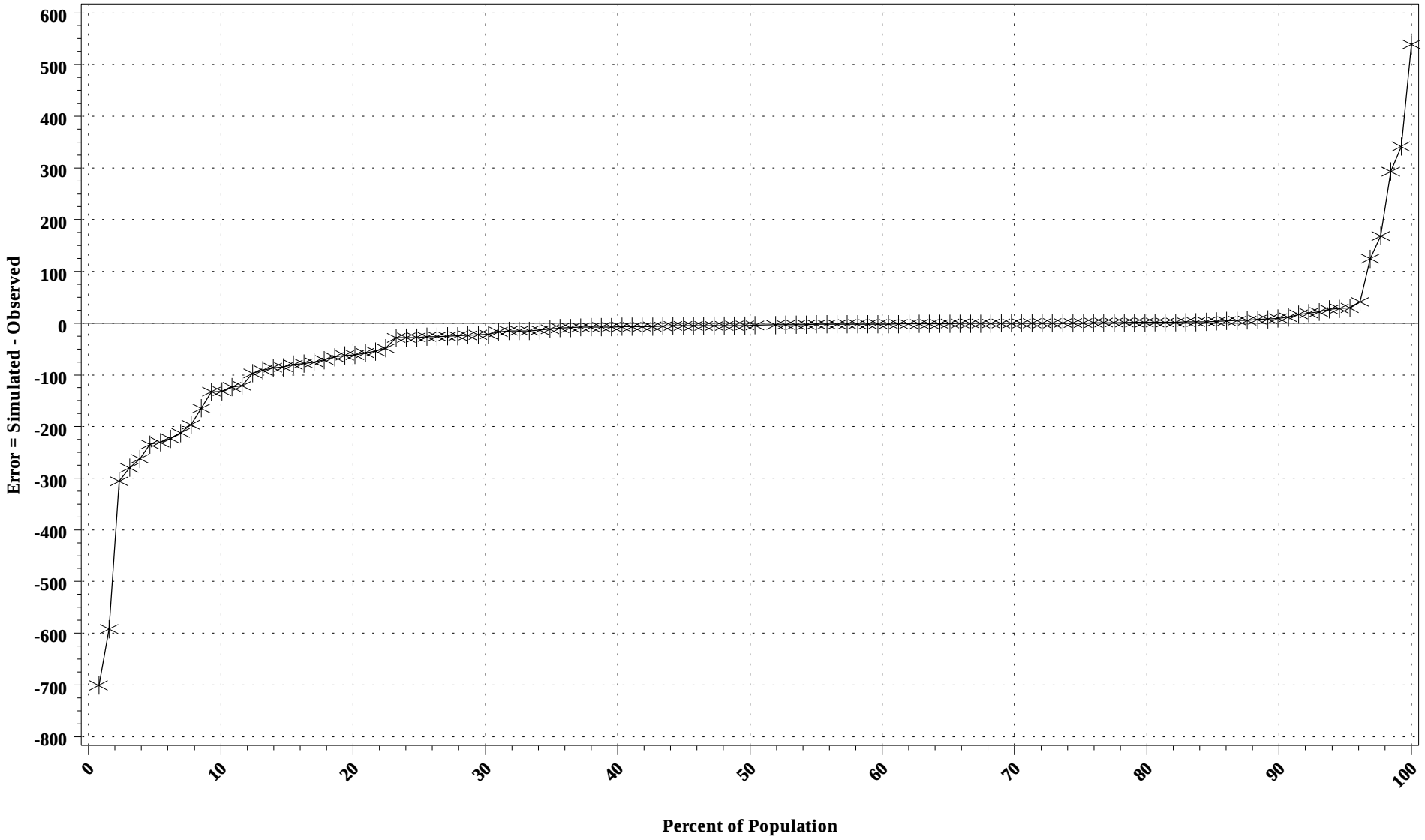
# Rappahannock River at Segement 230
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

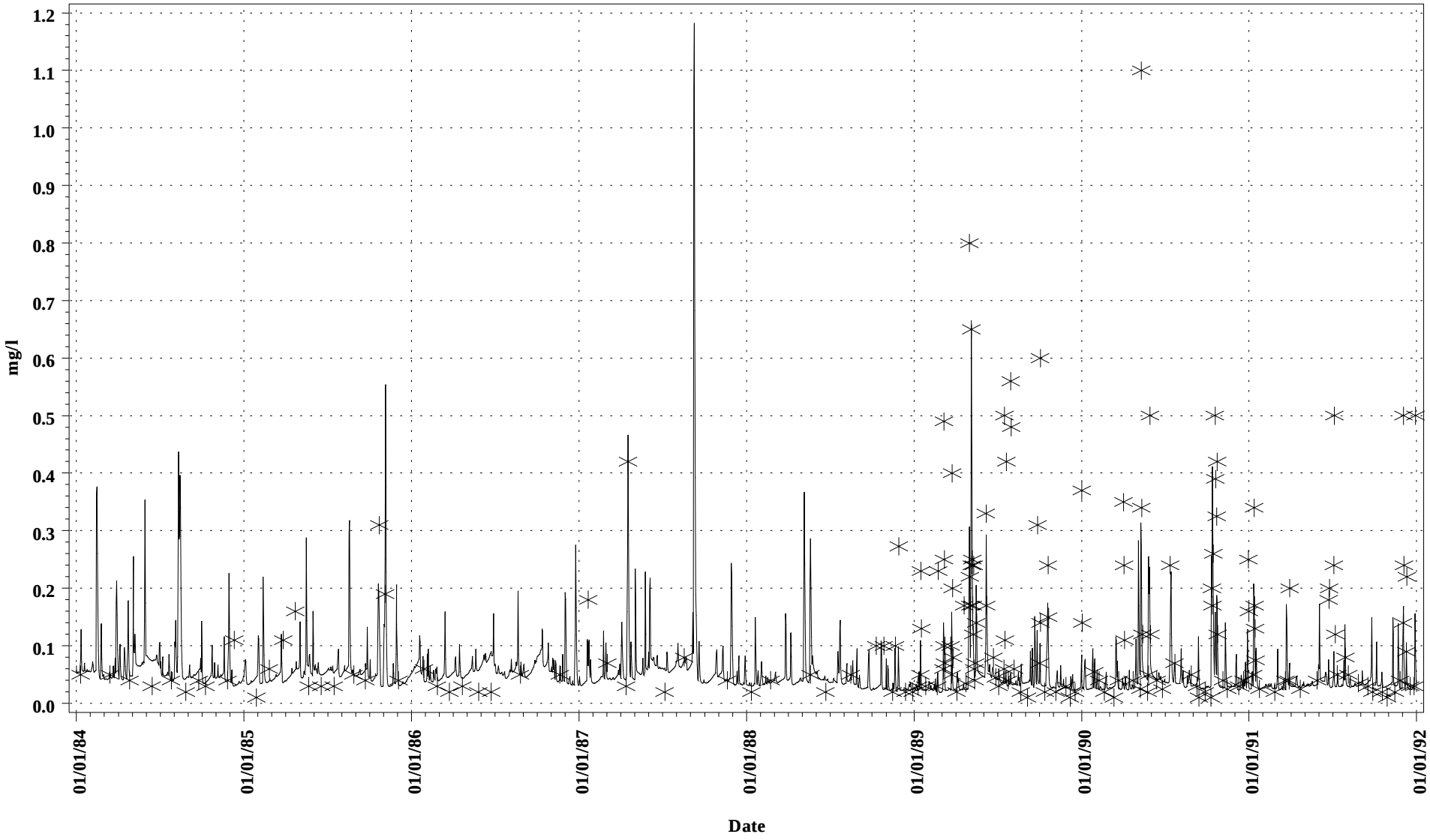
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(rap.drv 29JUN98 09:34)

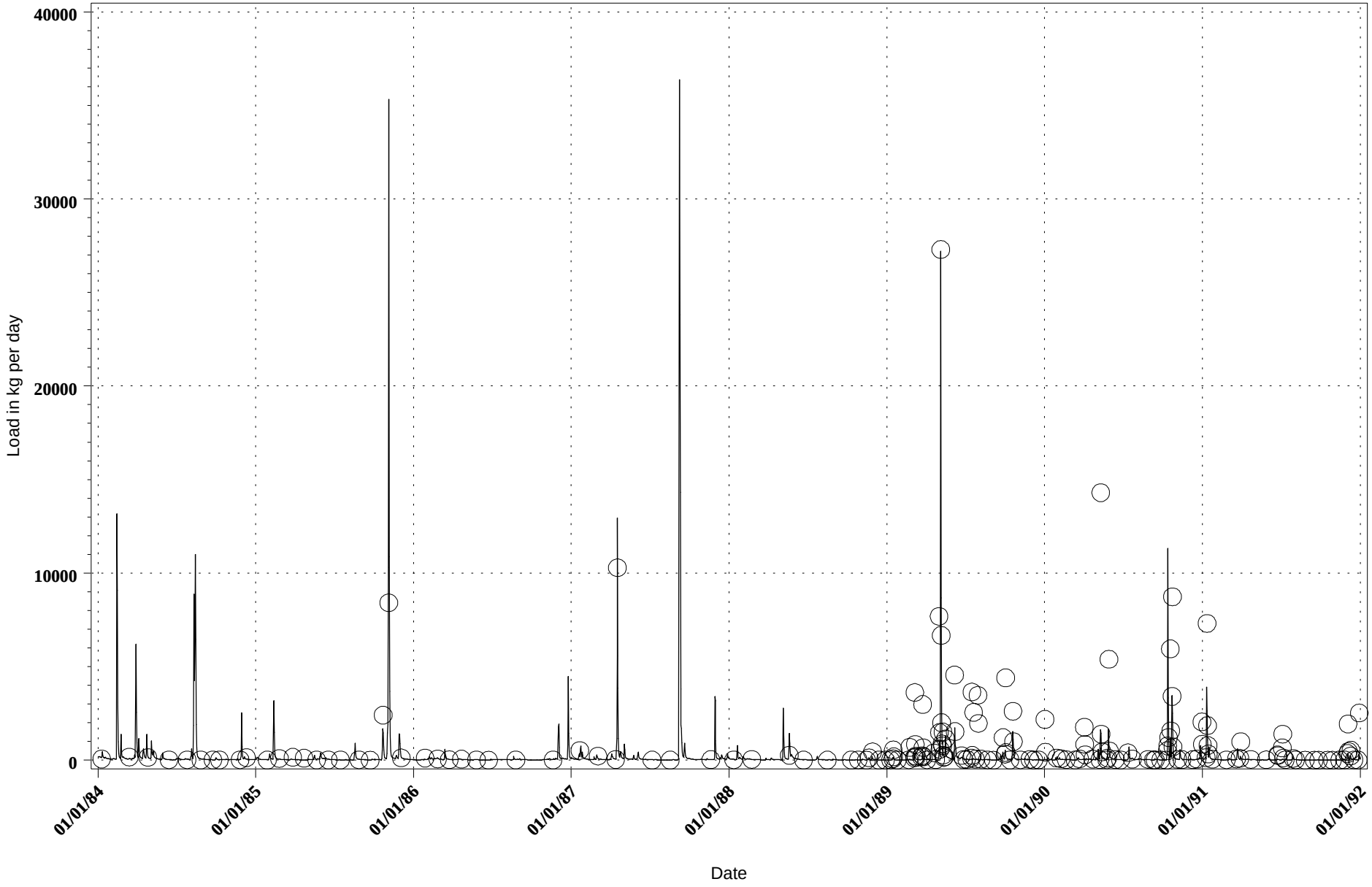
# Rappahannock River at Segement 230
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

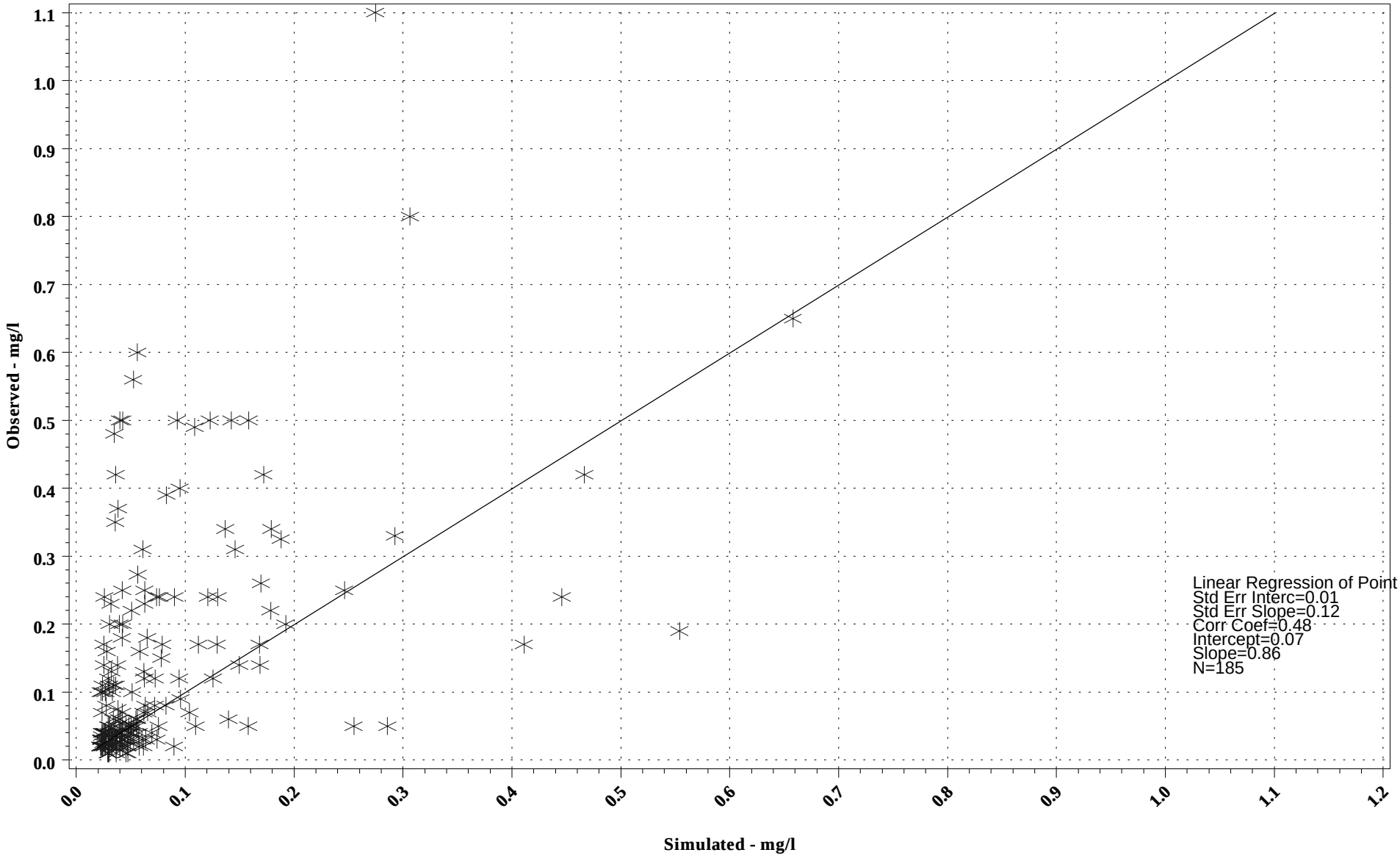



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230

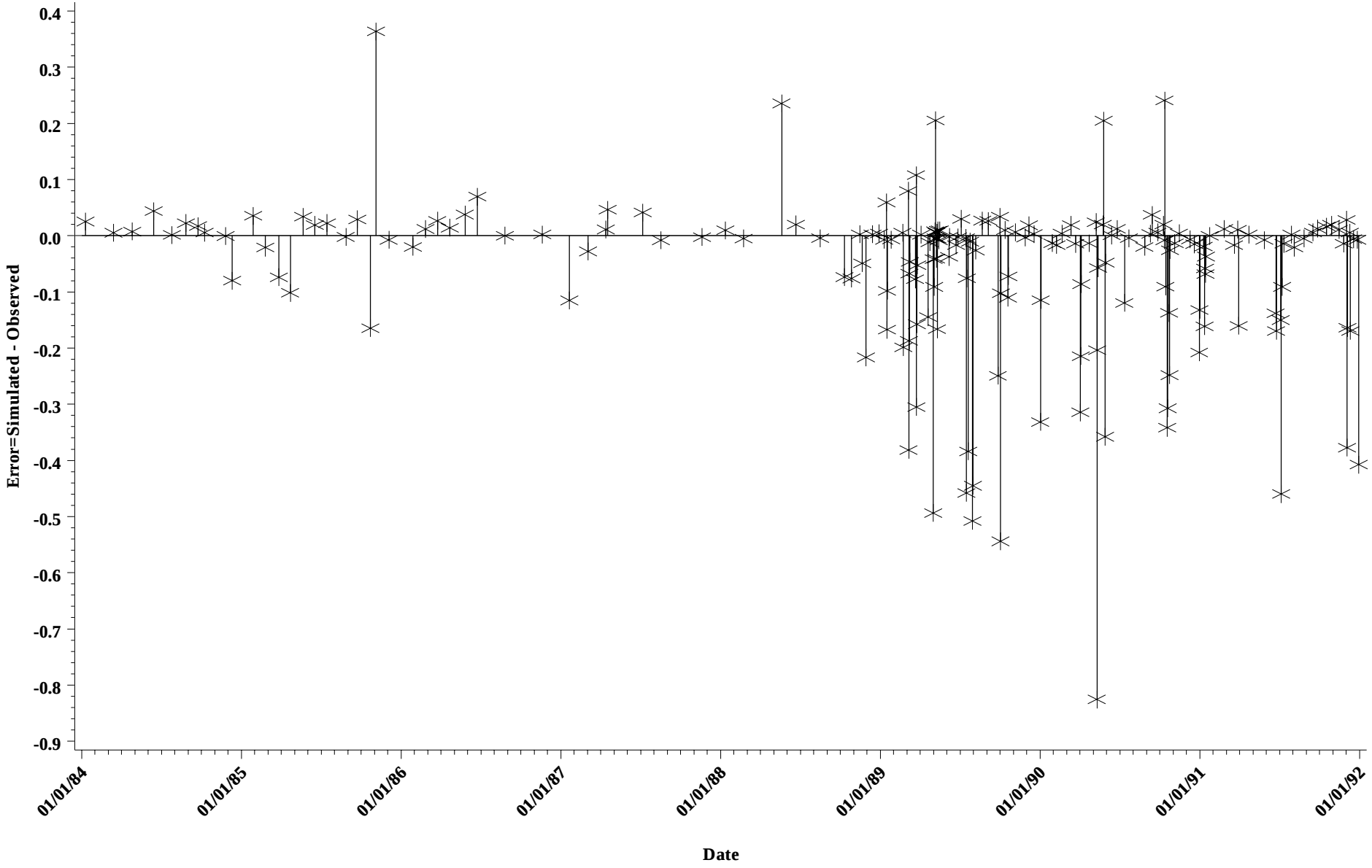
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



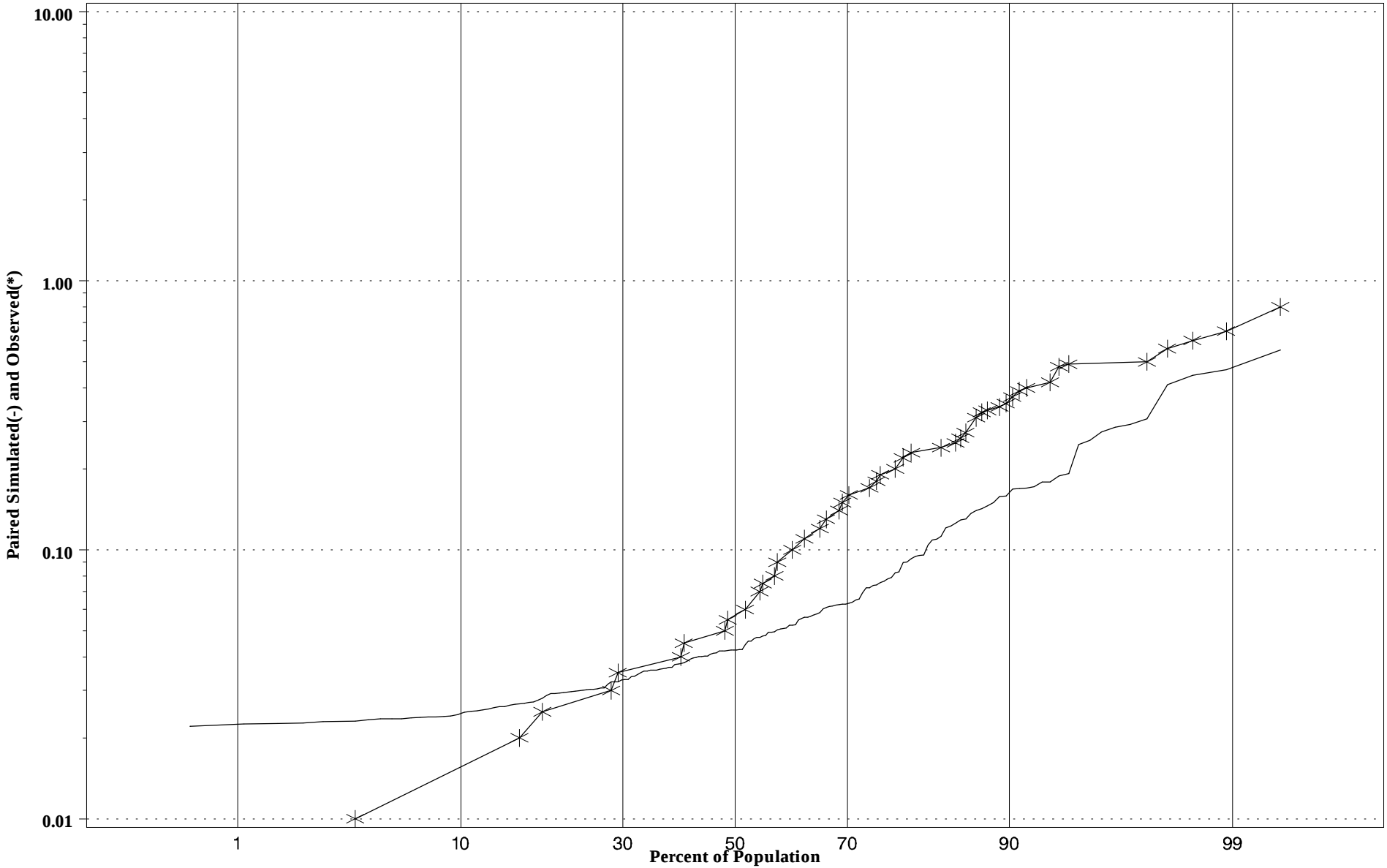

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(rap.drv 29JUN98 09:34)

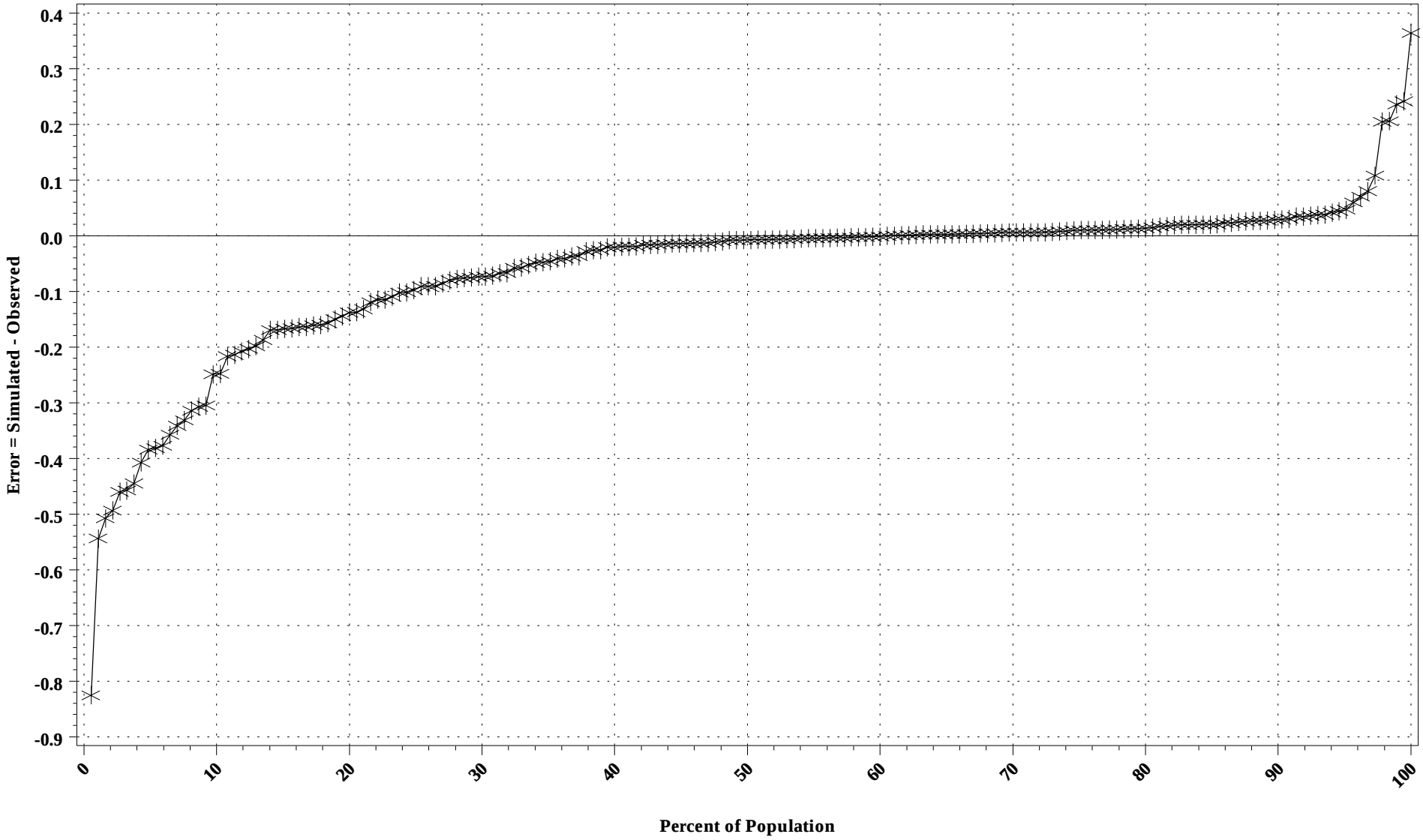
# Rappahannock River at Segement 230
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Actual error versus Percentile Sample Population
## Total Phosphorus

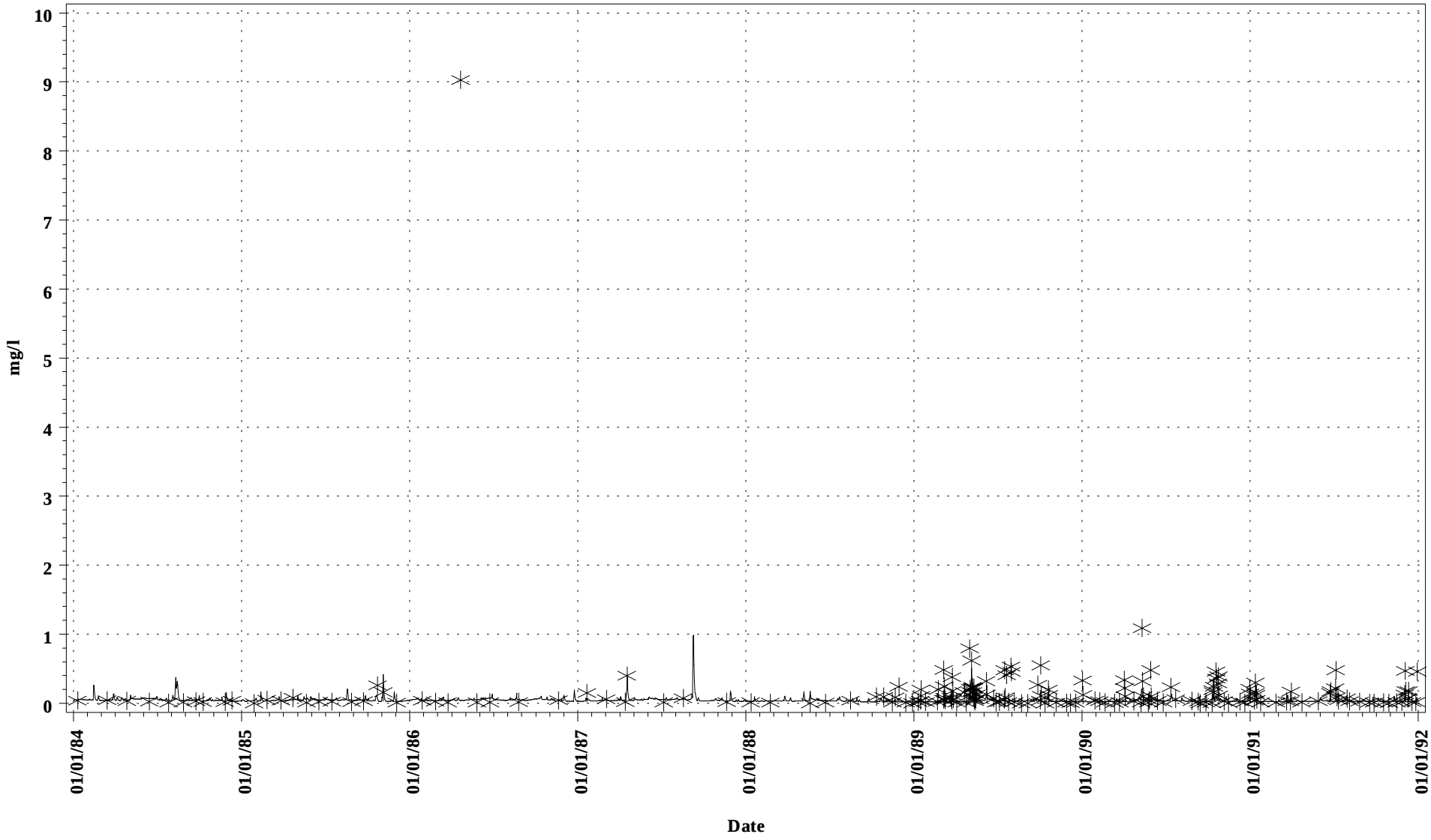
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

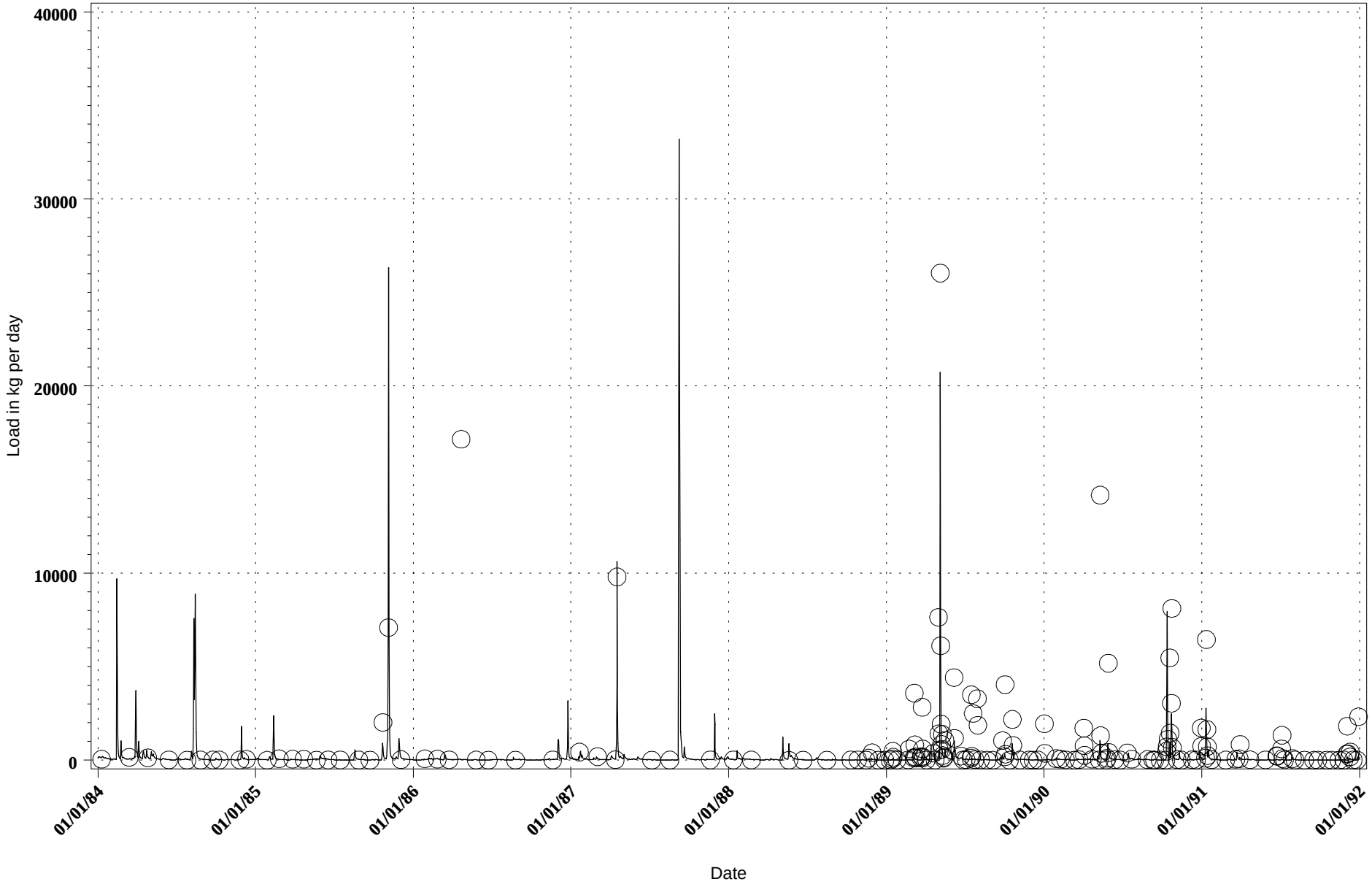



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

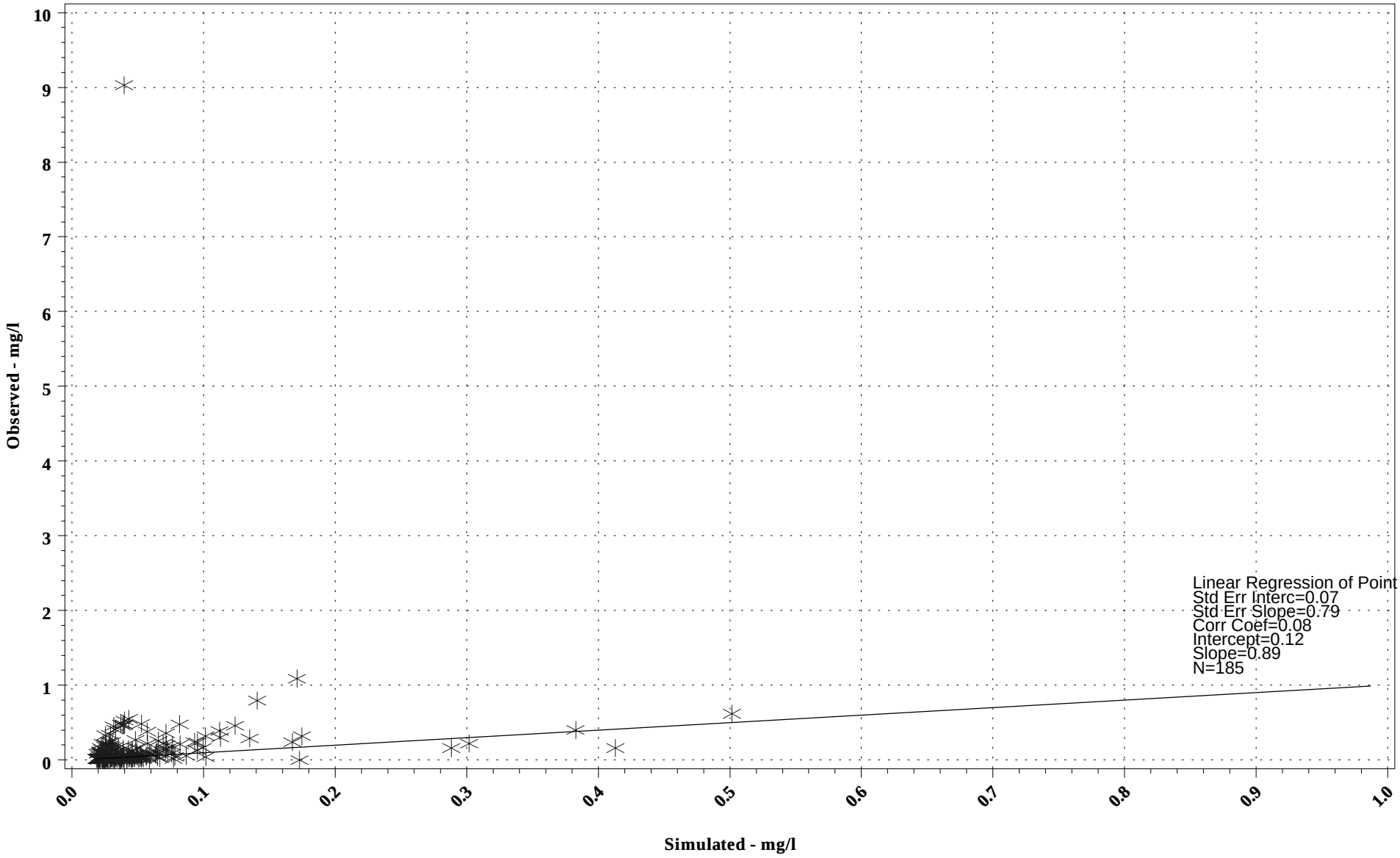



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230

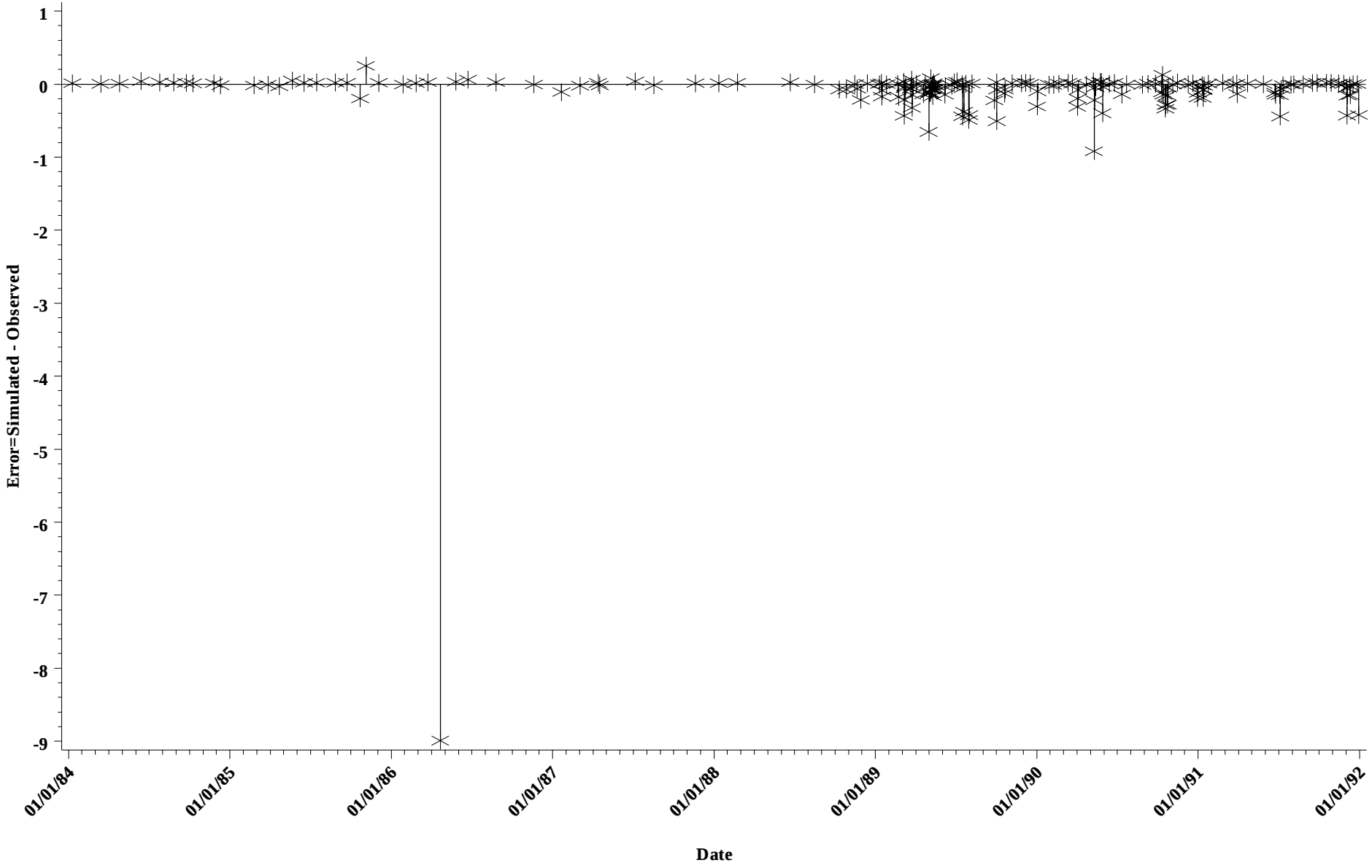
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92



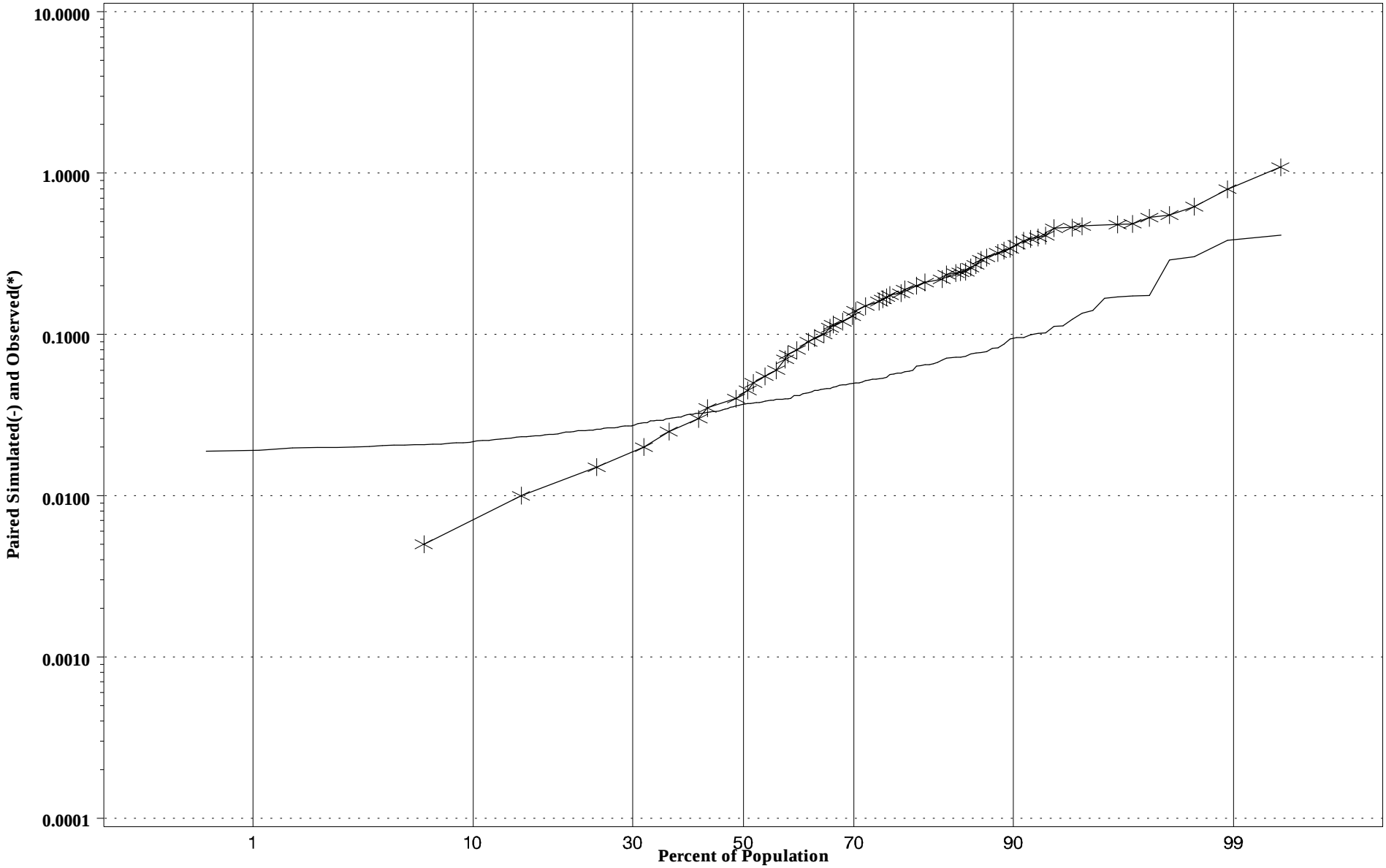

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230
## Actual Error versus Time
## Organic and Particulate Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(rap.drv 29JUN98 09:34)

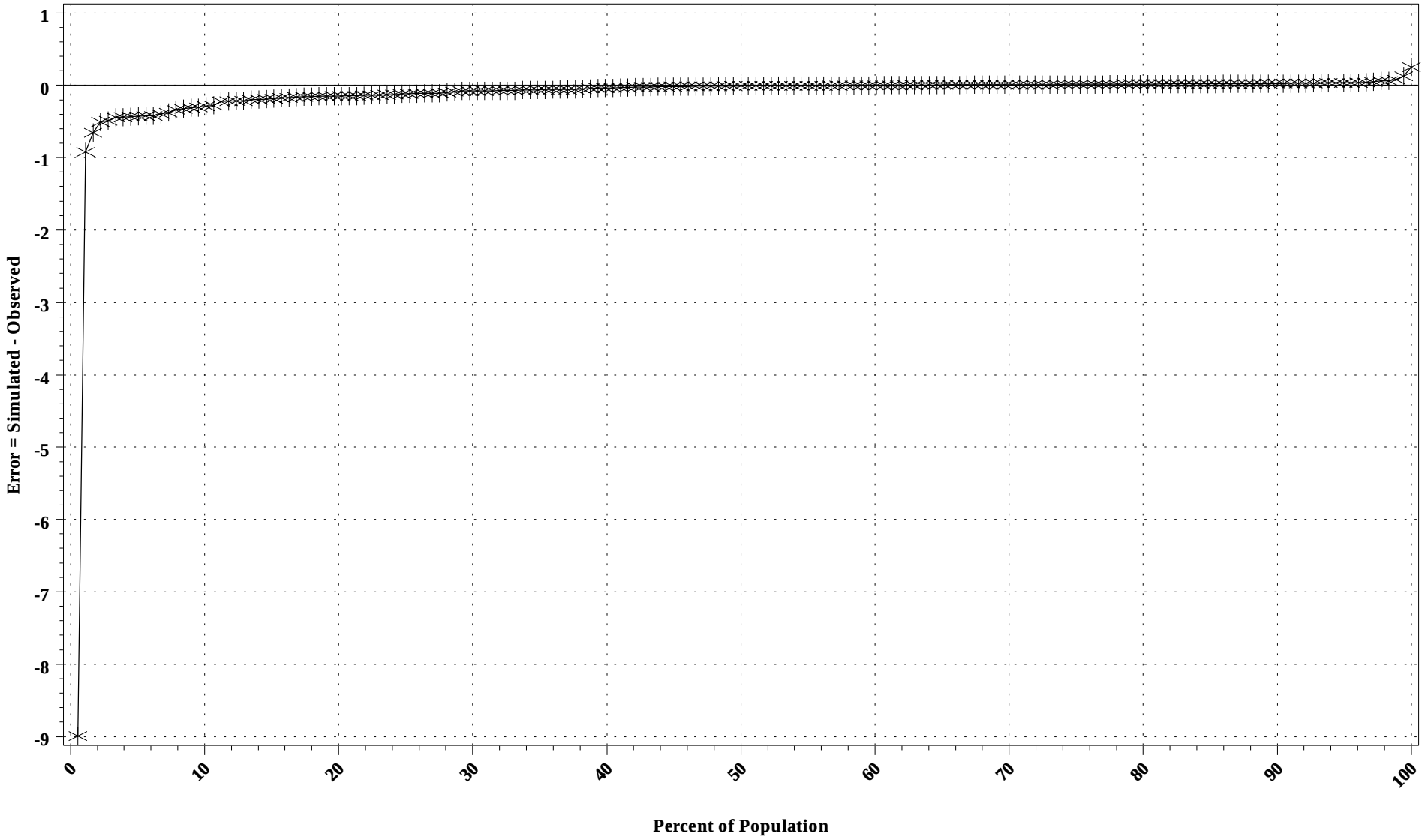
# Rappahannock River at Segement 230
## Organic and Particulate Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

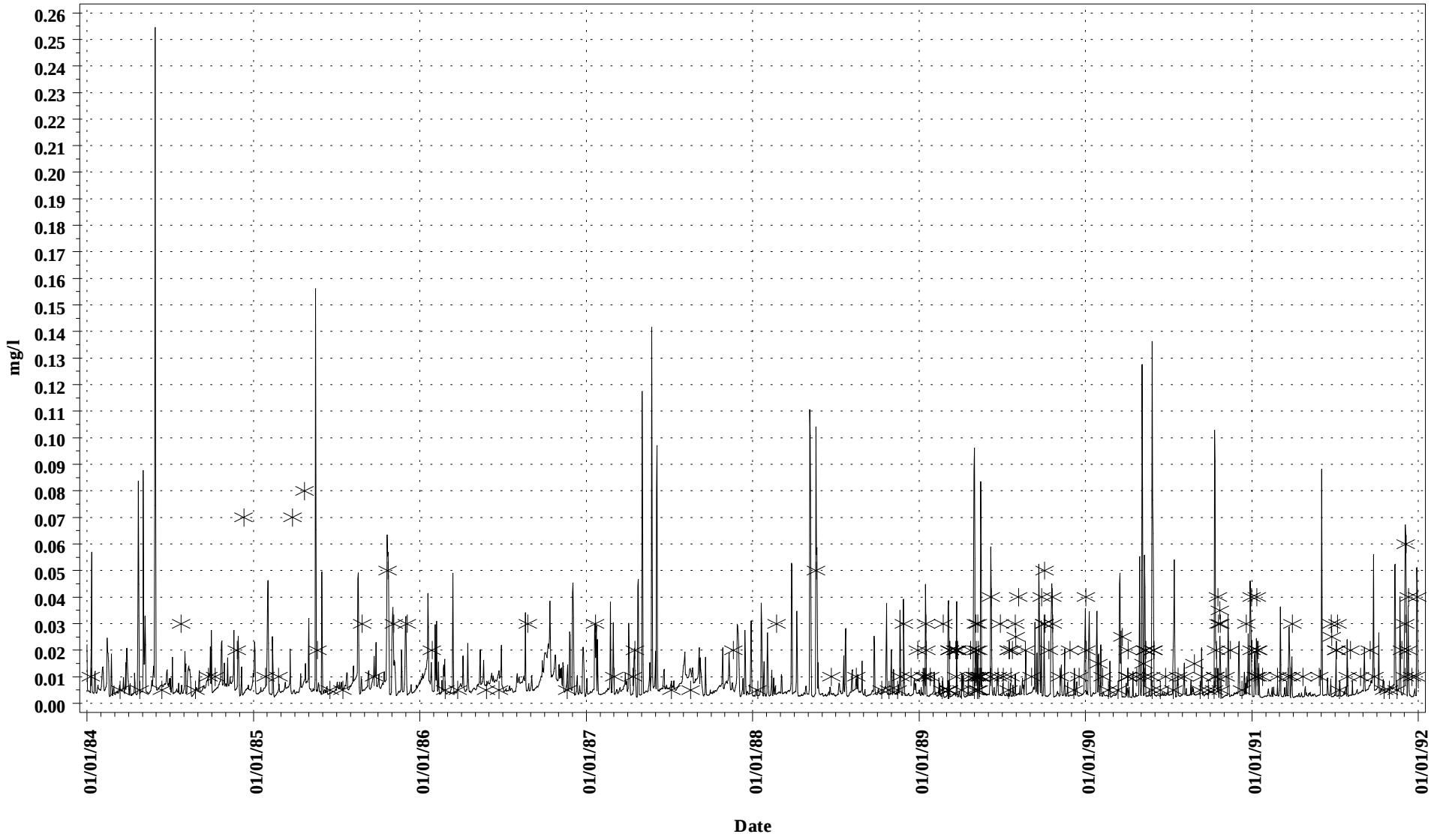
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(rap.drv 29JUN98 09:34)

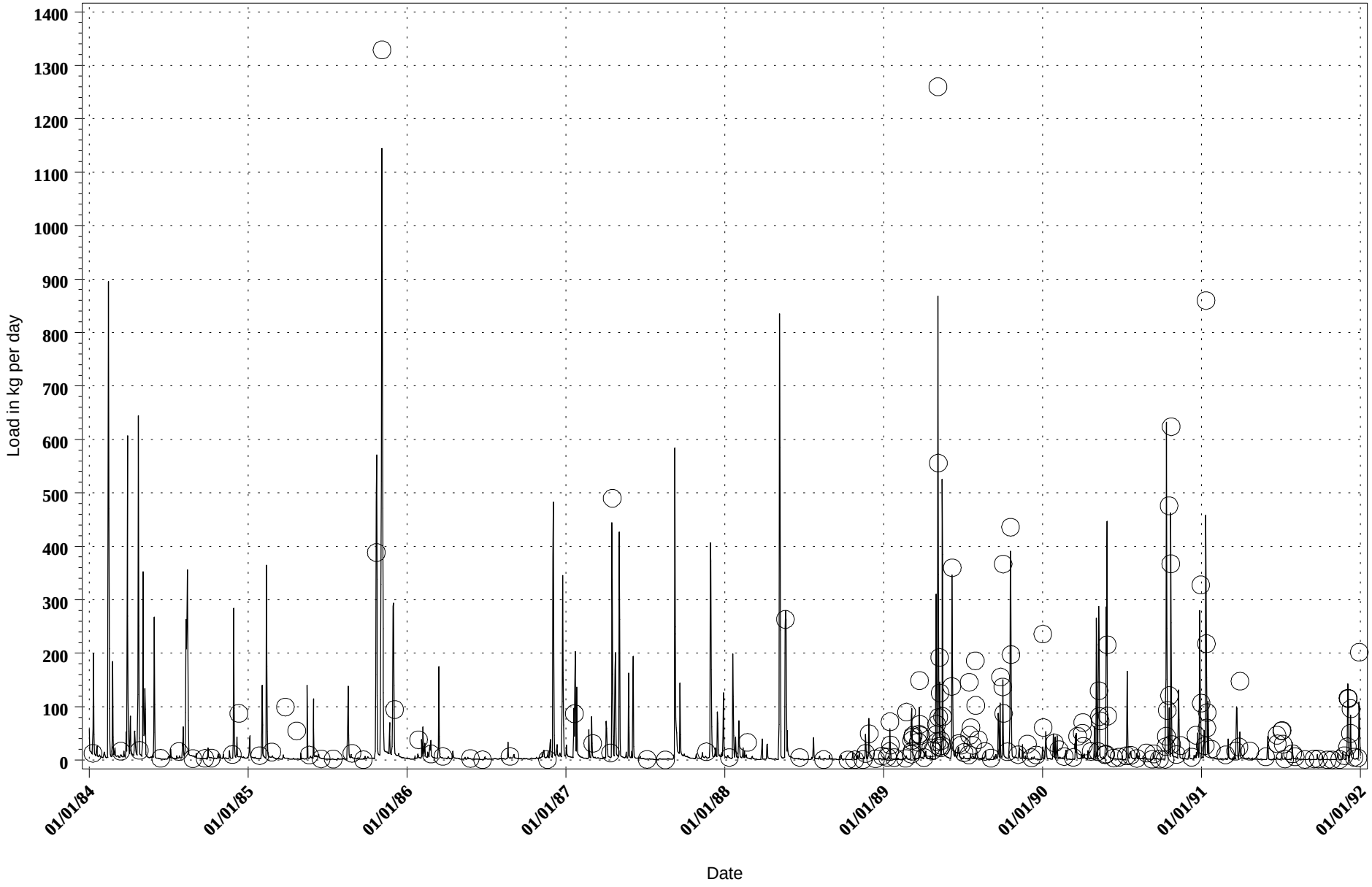
# Rappahannock River at Segement 230
## Observed and Simulated versus Time
# Dissolved Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Dissolved Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

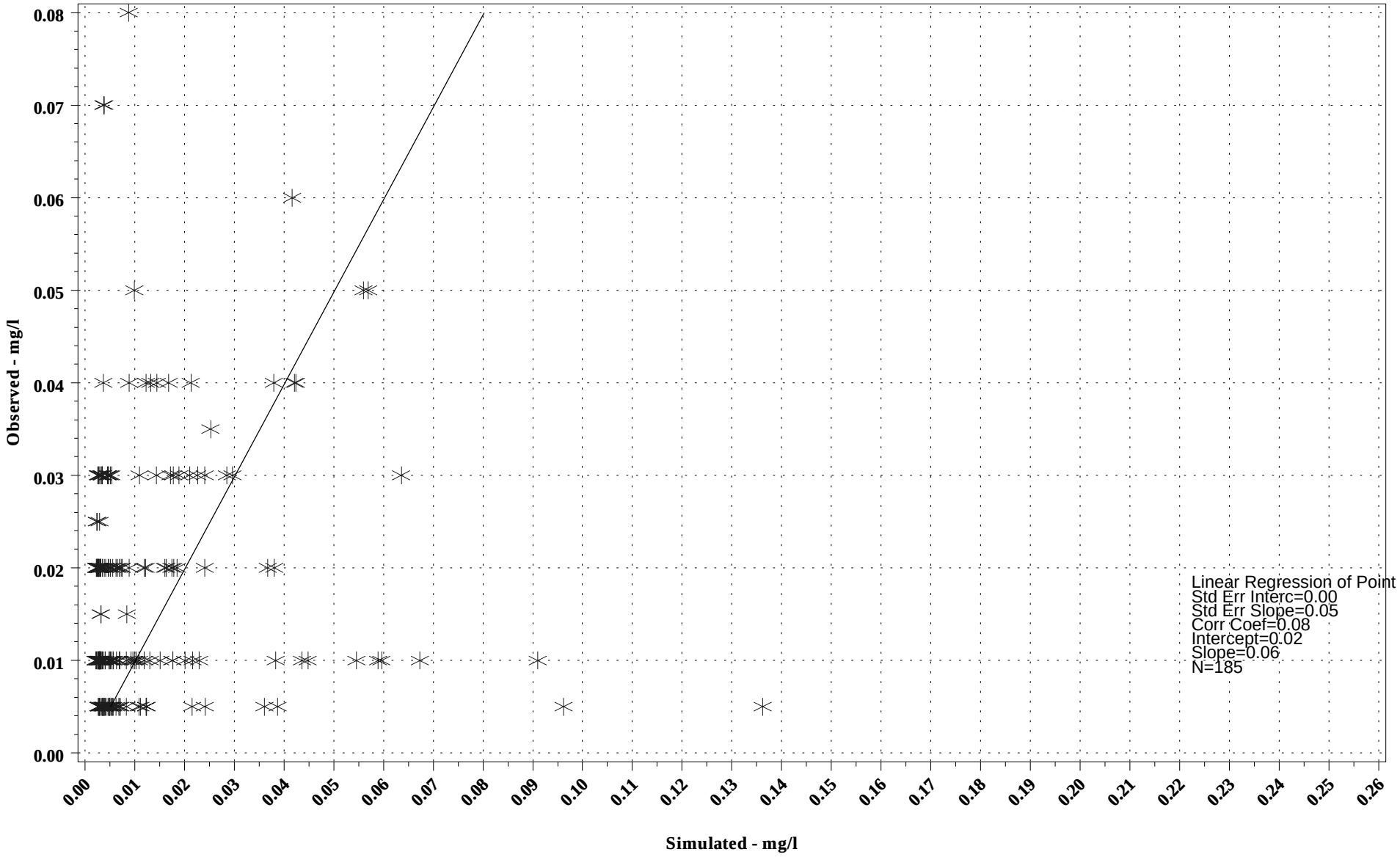



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230

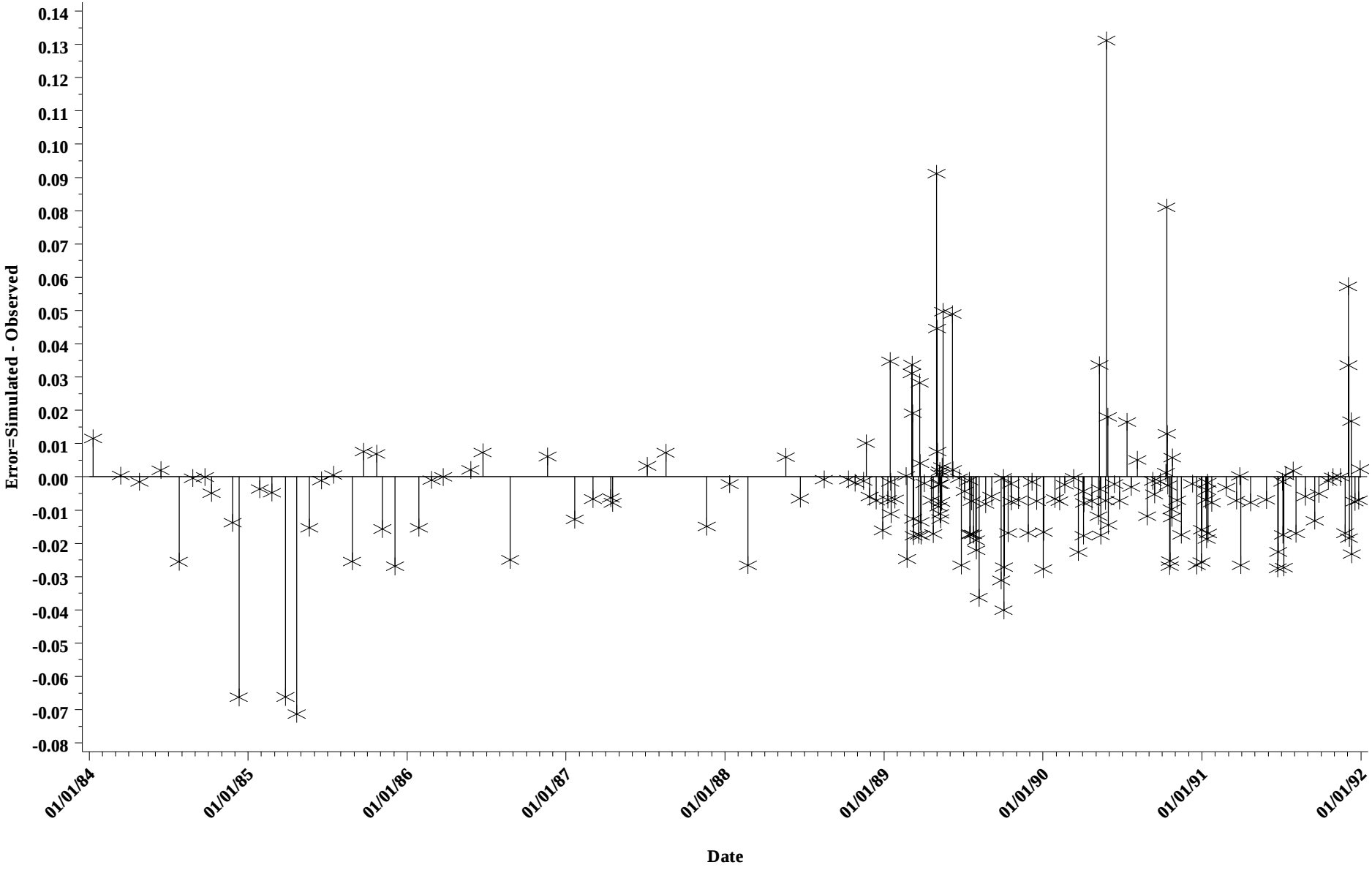
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



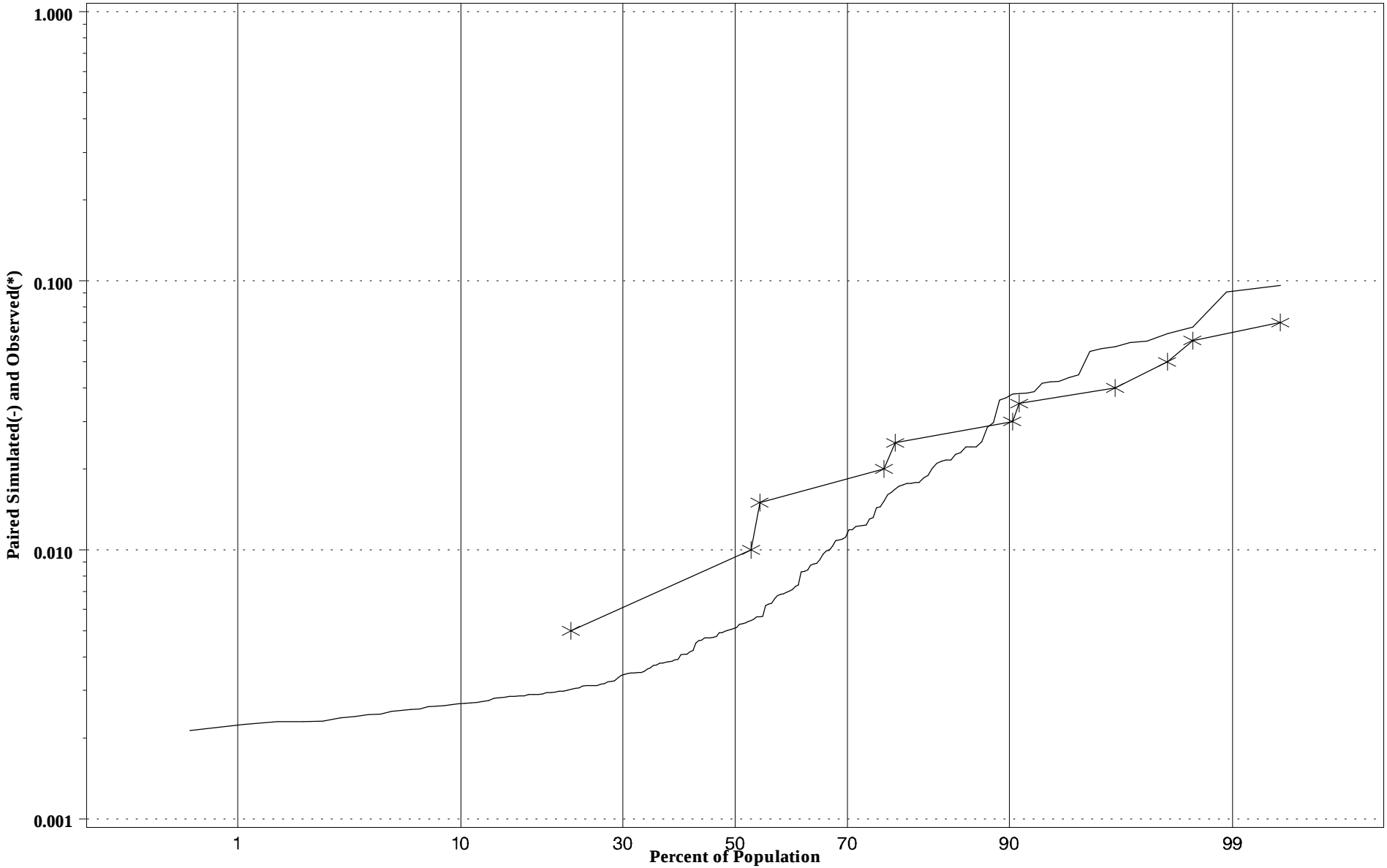

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(rap.drv 29JUN98 09:34)

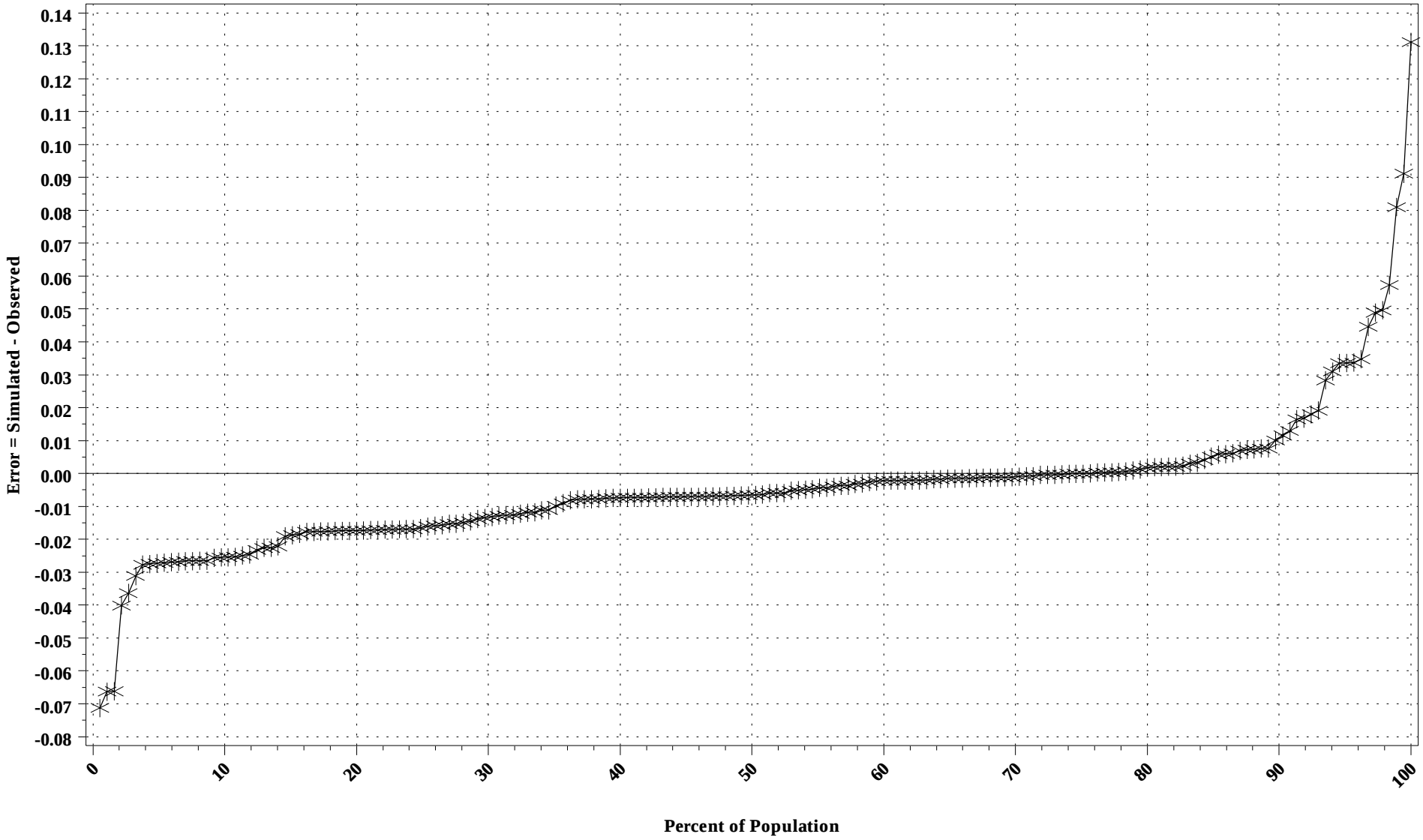
# Rappahannock River at Segement 230
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

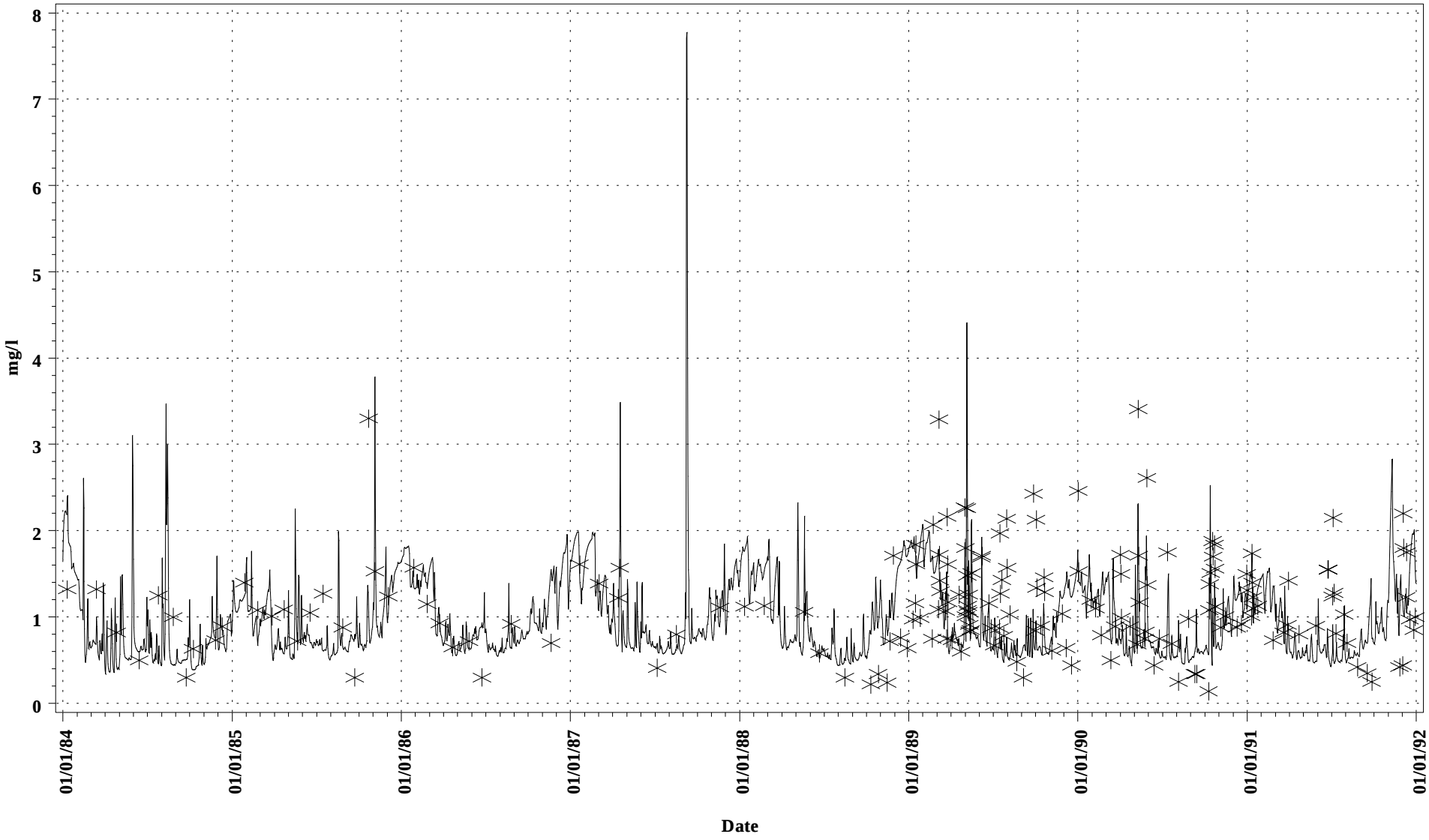
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(rap.drv 29JUN98 09:34)

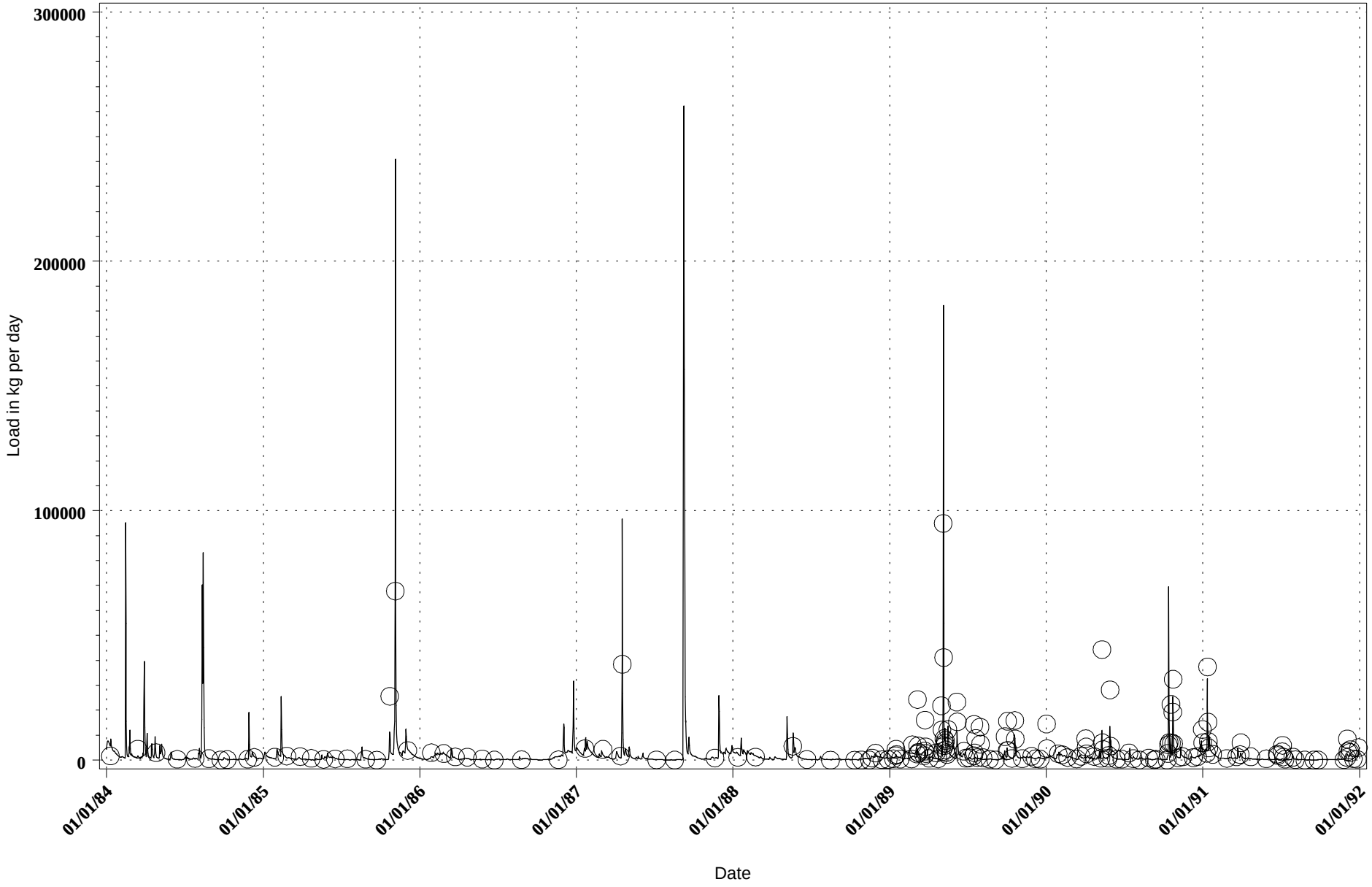
# Rappahannock River at Segement 230
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

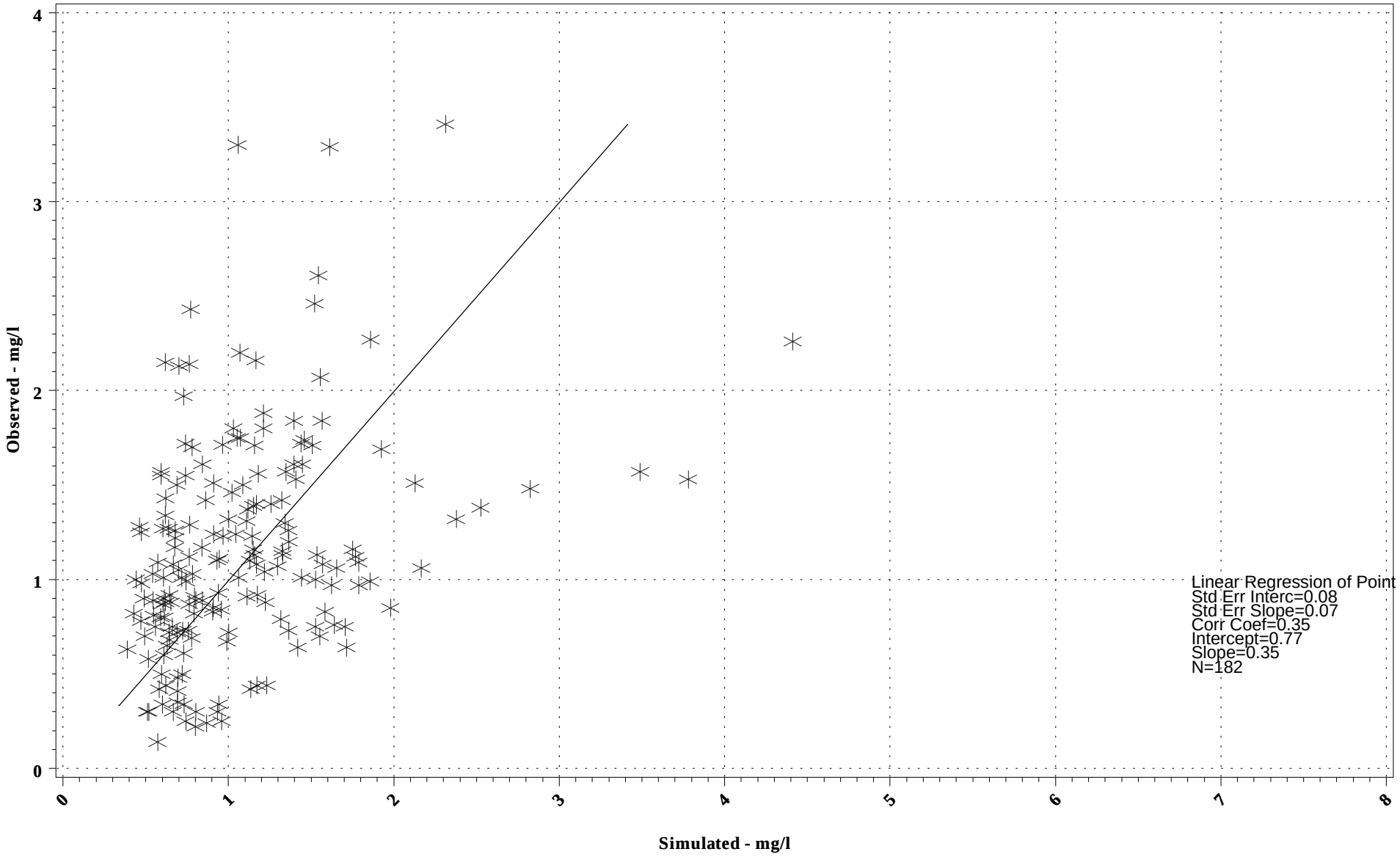



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230

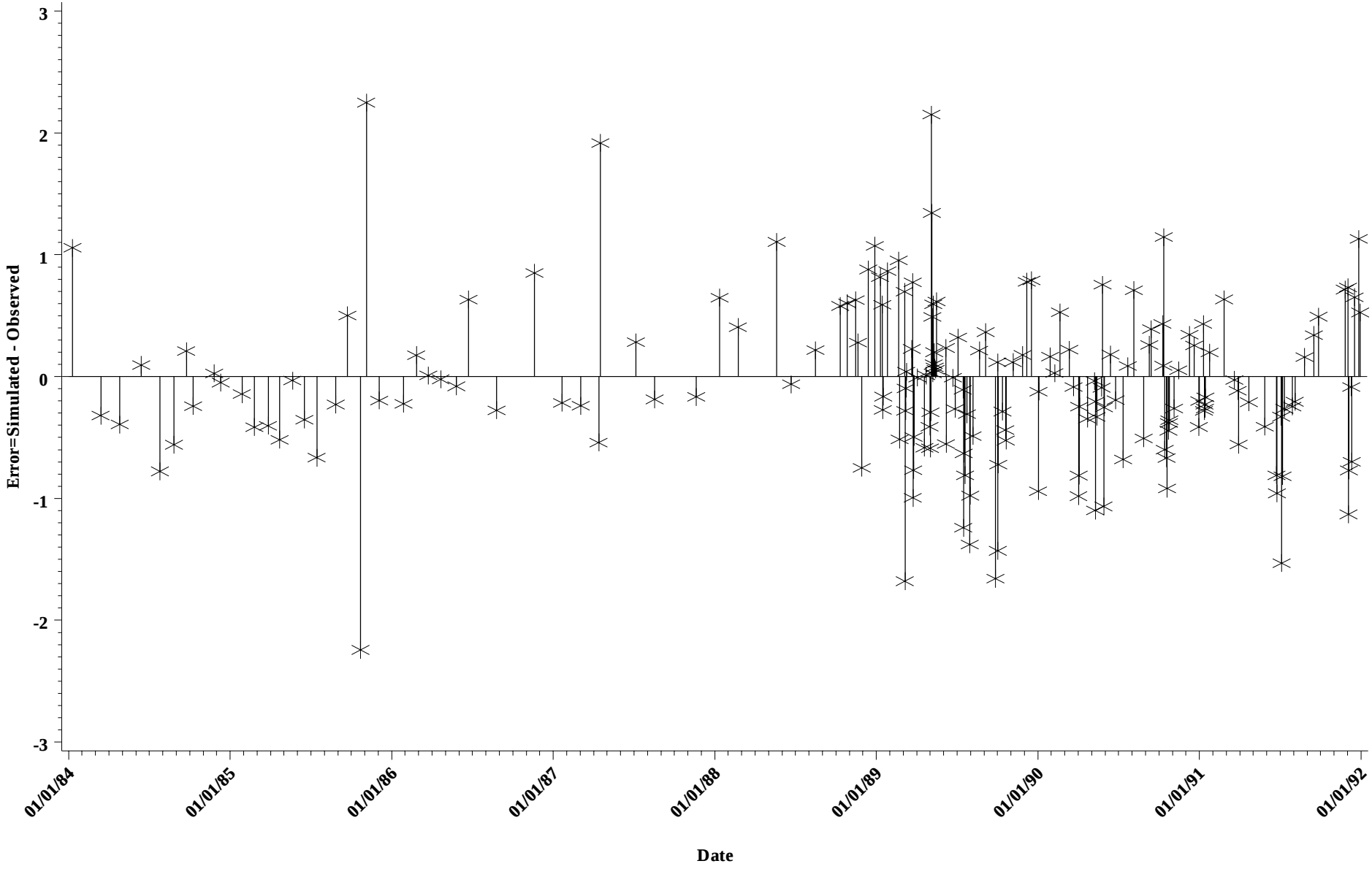
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230
## Actual Error versus Time
## Total Nitrogen

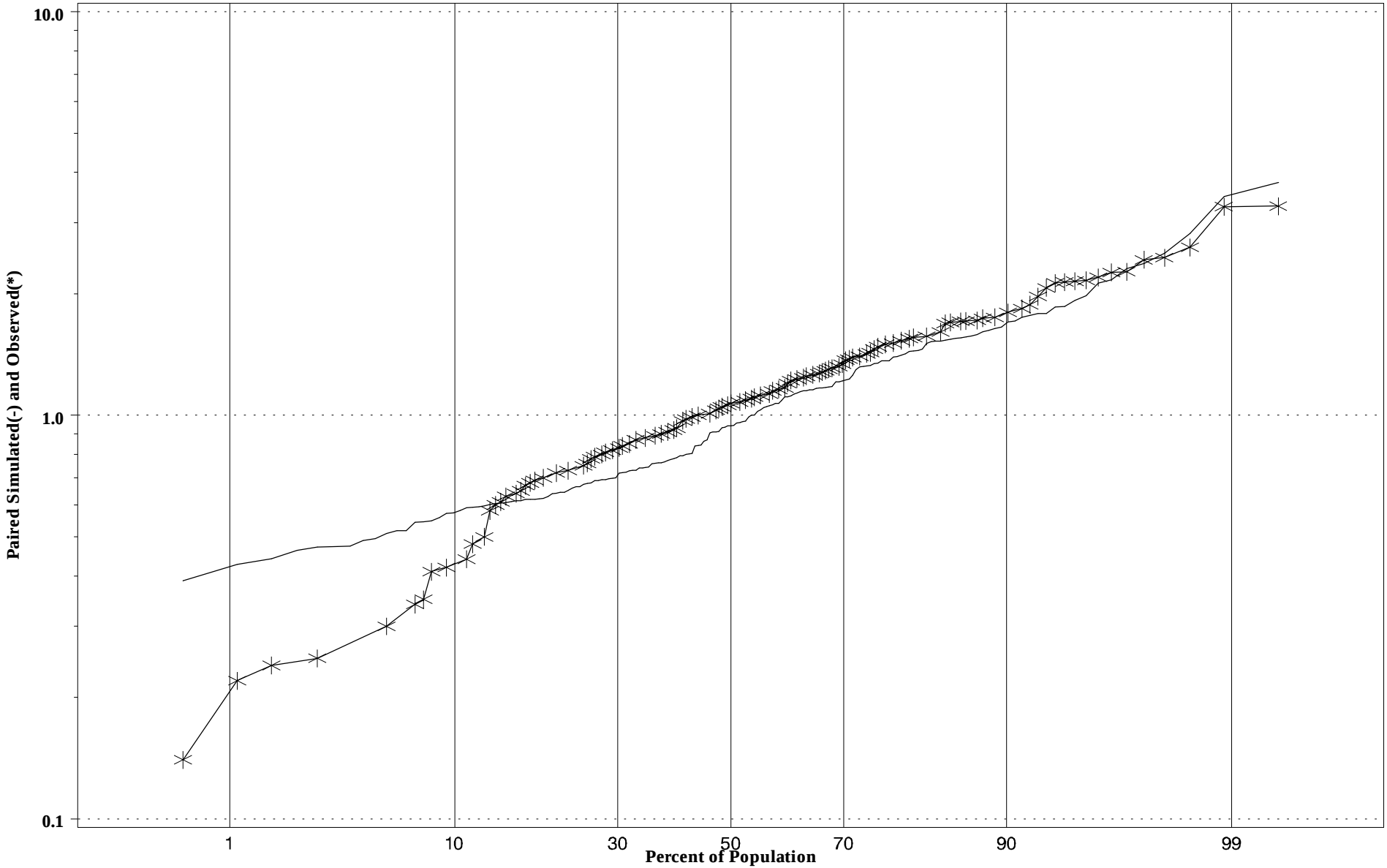



(y21_plotb.sas model3d:[pwang.dt] omerr)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230

## Total Nitrogen

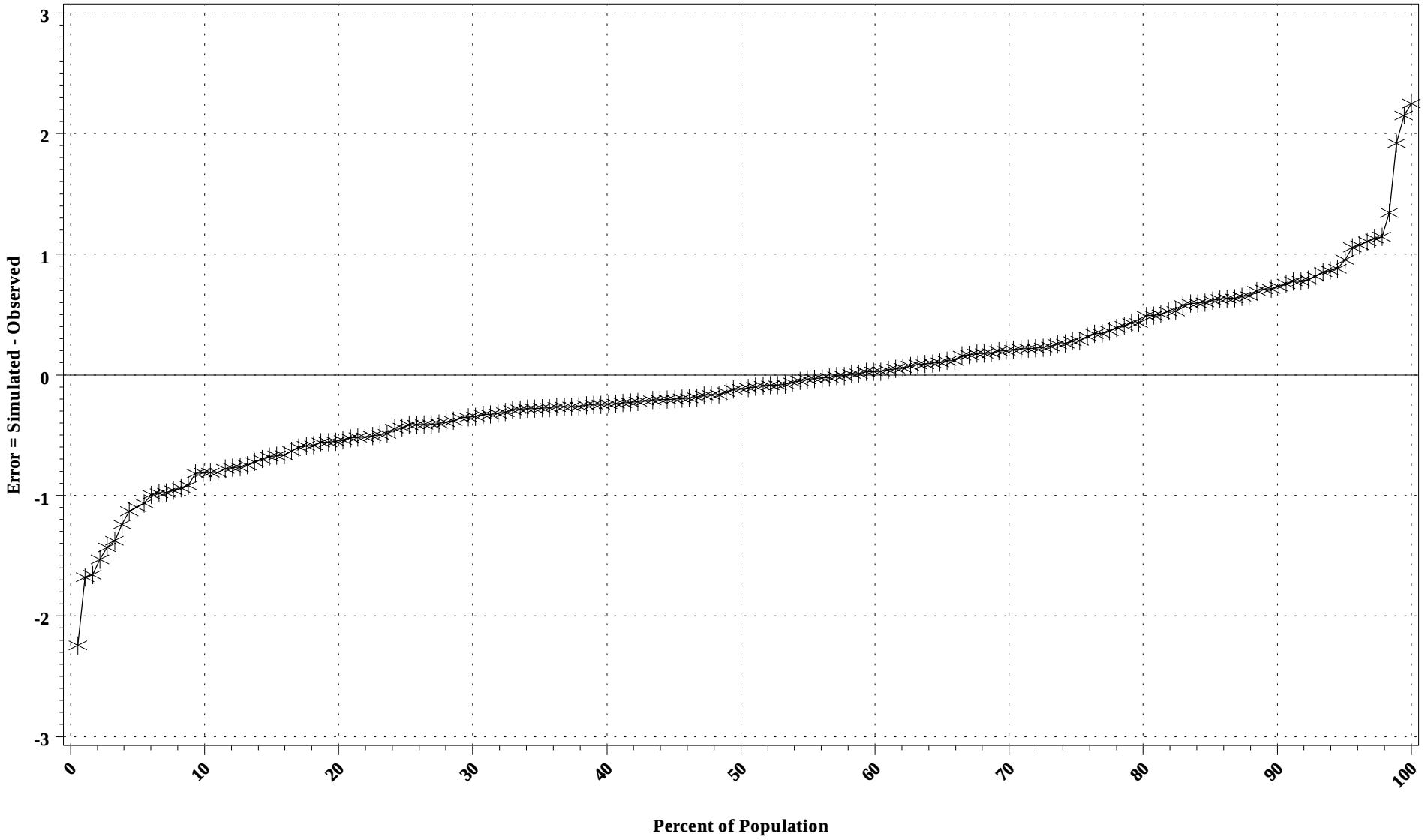
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Actual error versus Percentile Sample Population
## Total Nitrogen

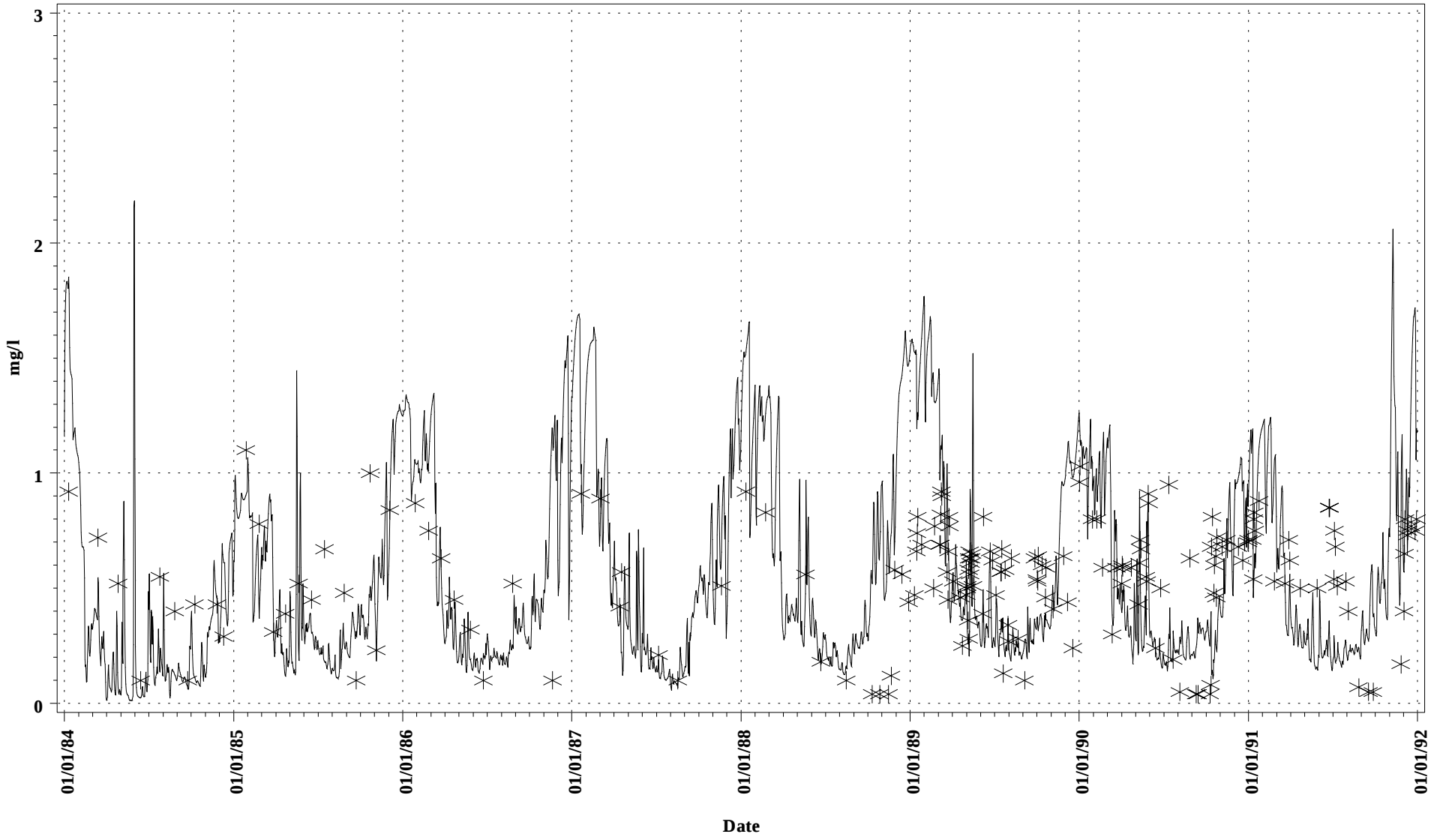
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

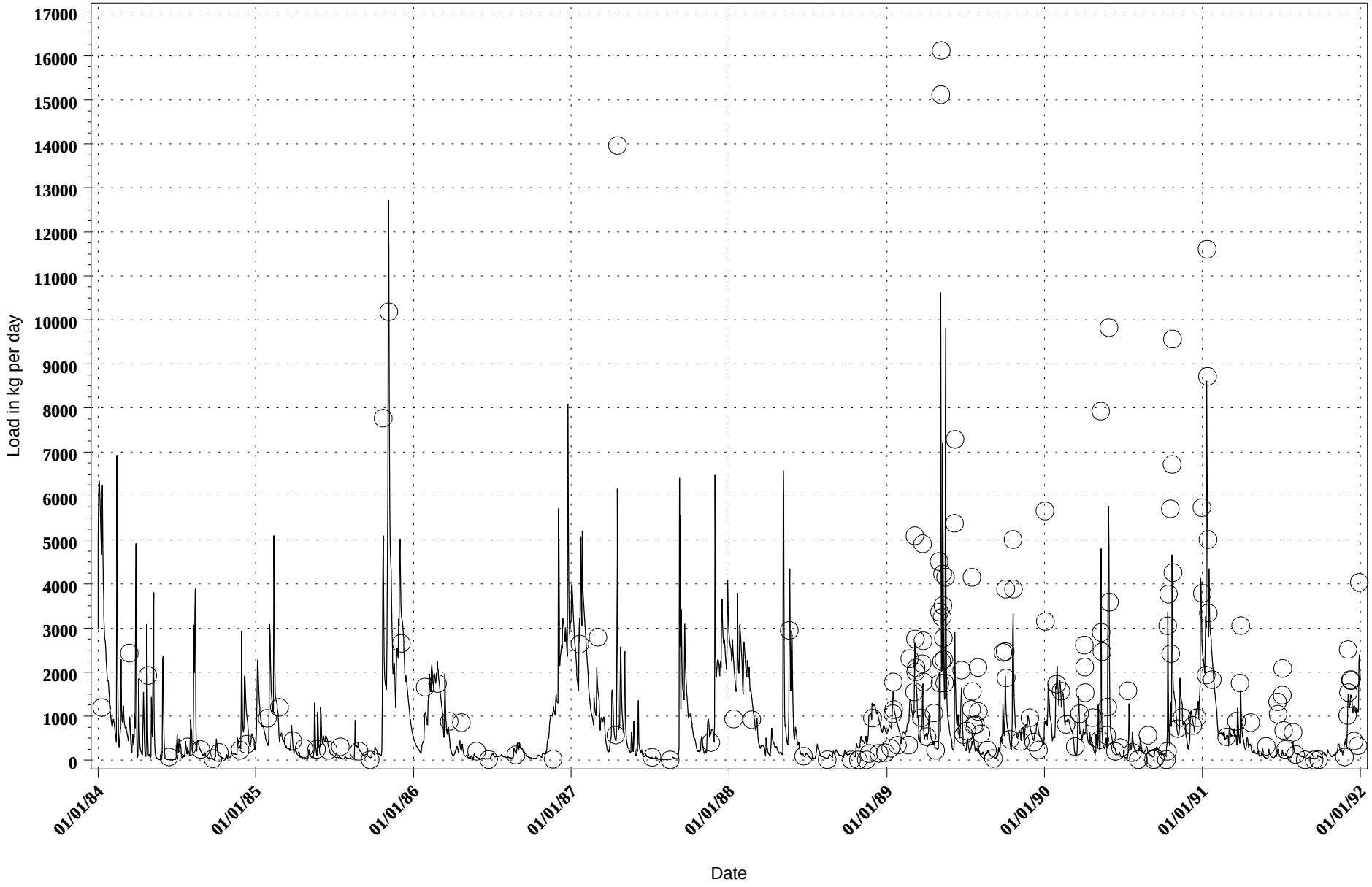



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230

## NO3 Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

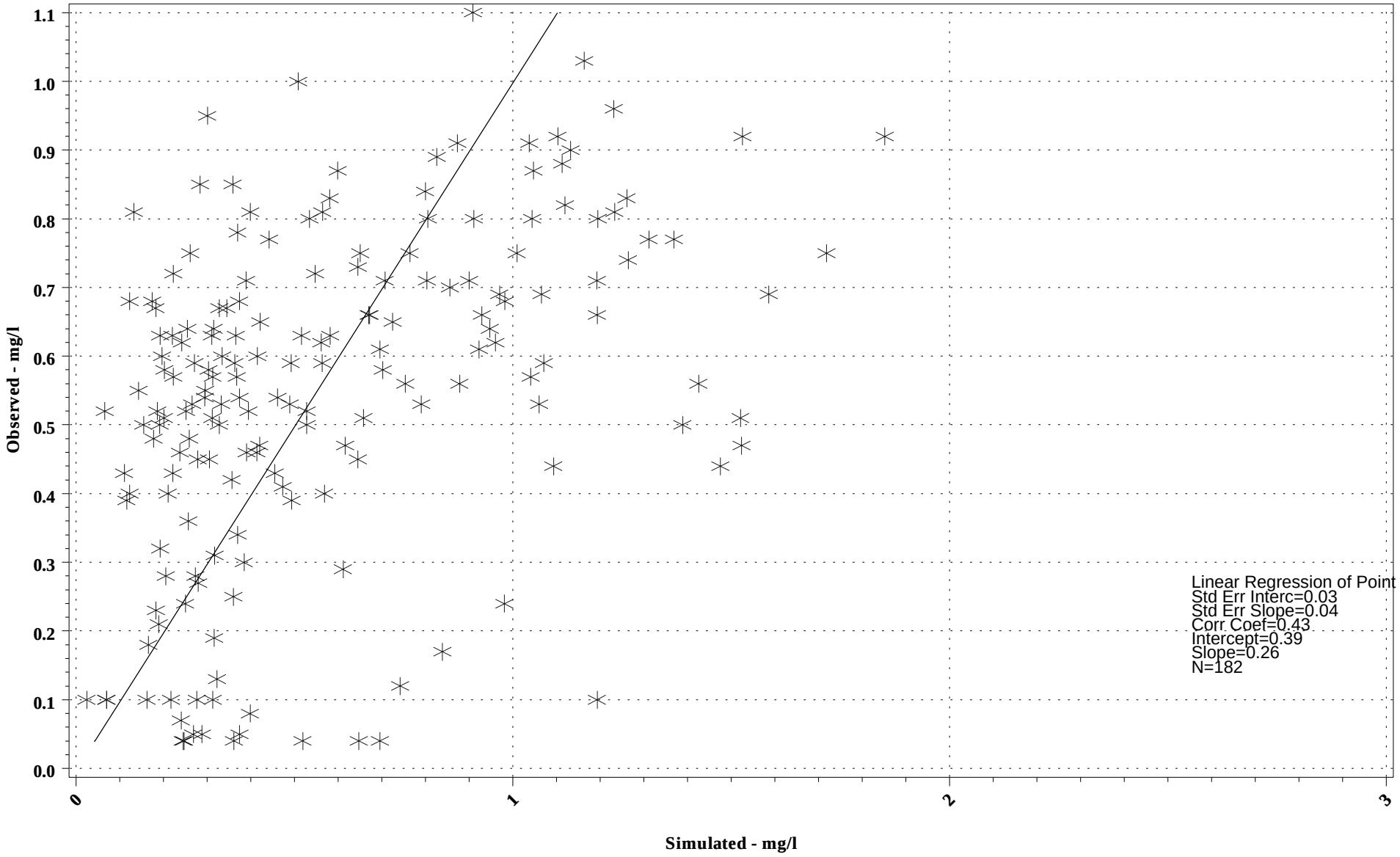



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230

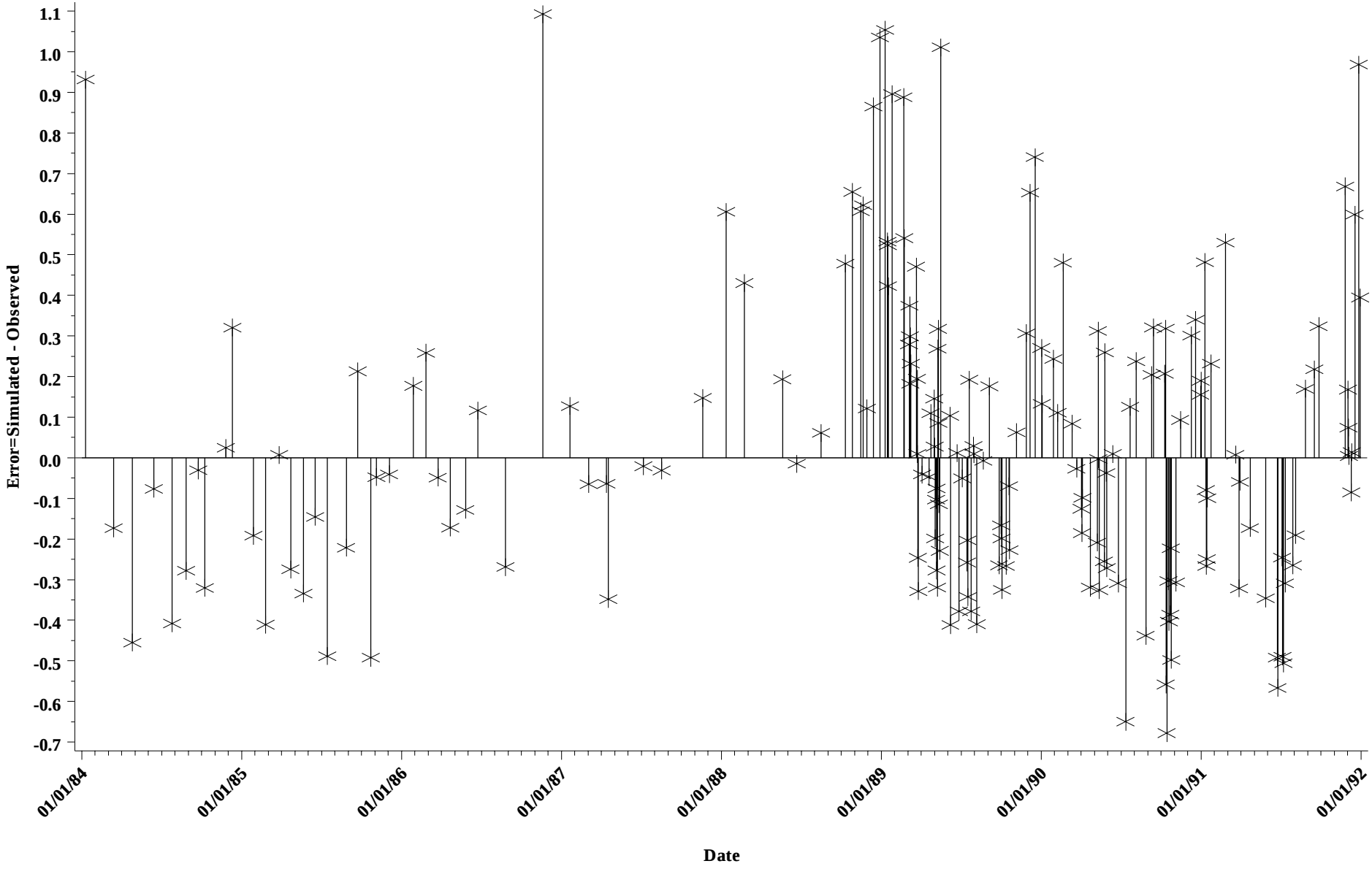
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230
## Actual Error versus Time
## NO3

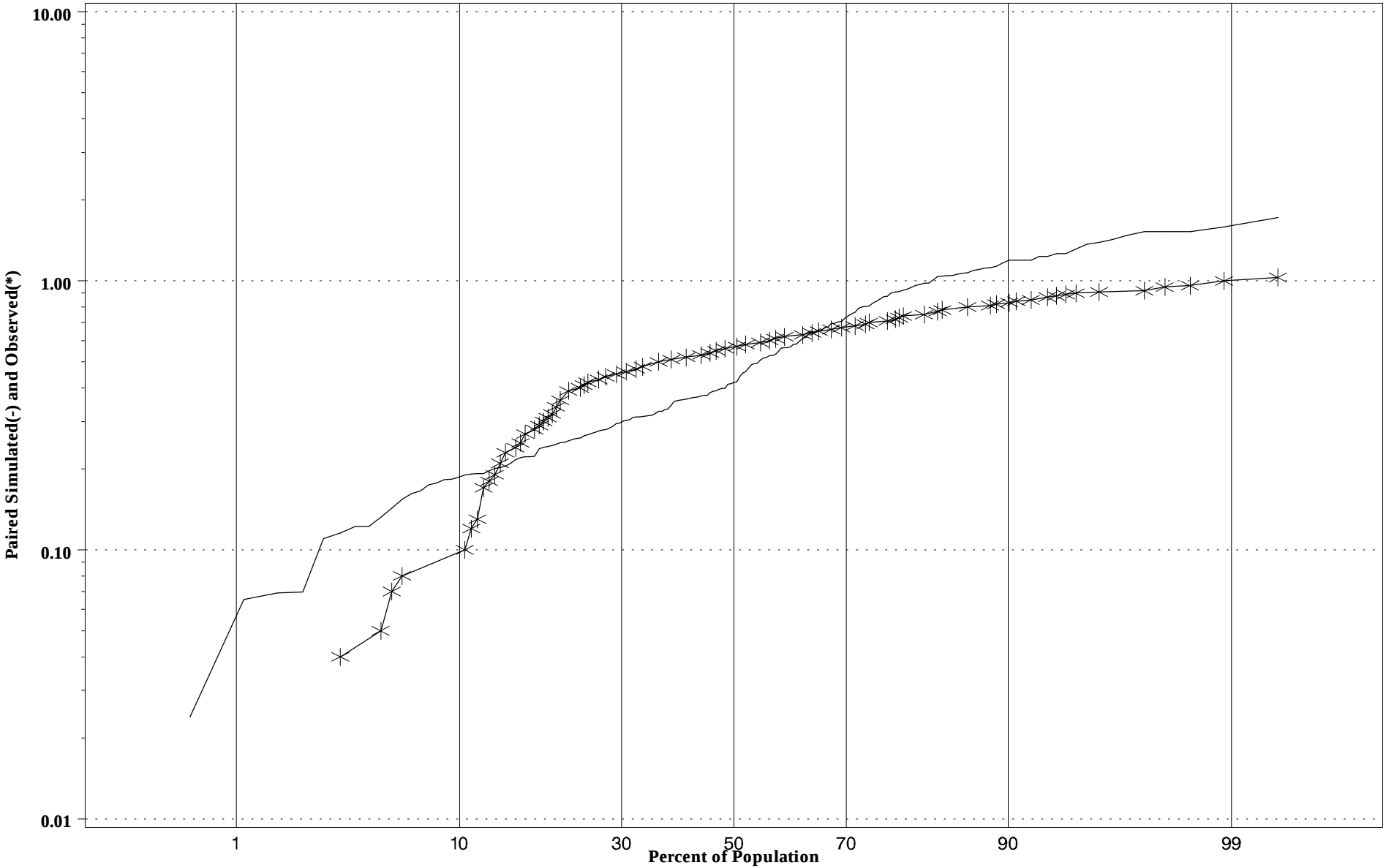



(y21_plotb.sas model3d:[pwang.dt] omerr)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230

## NO3

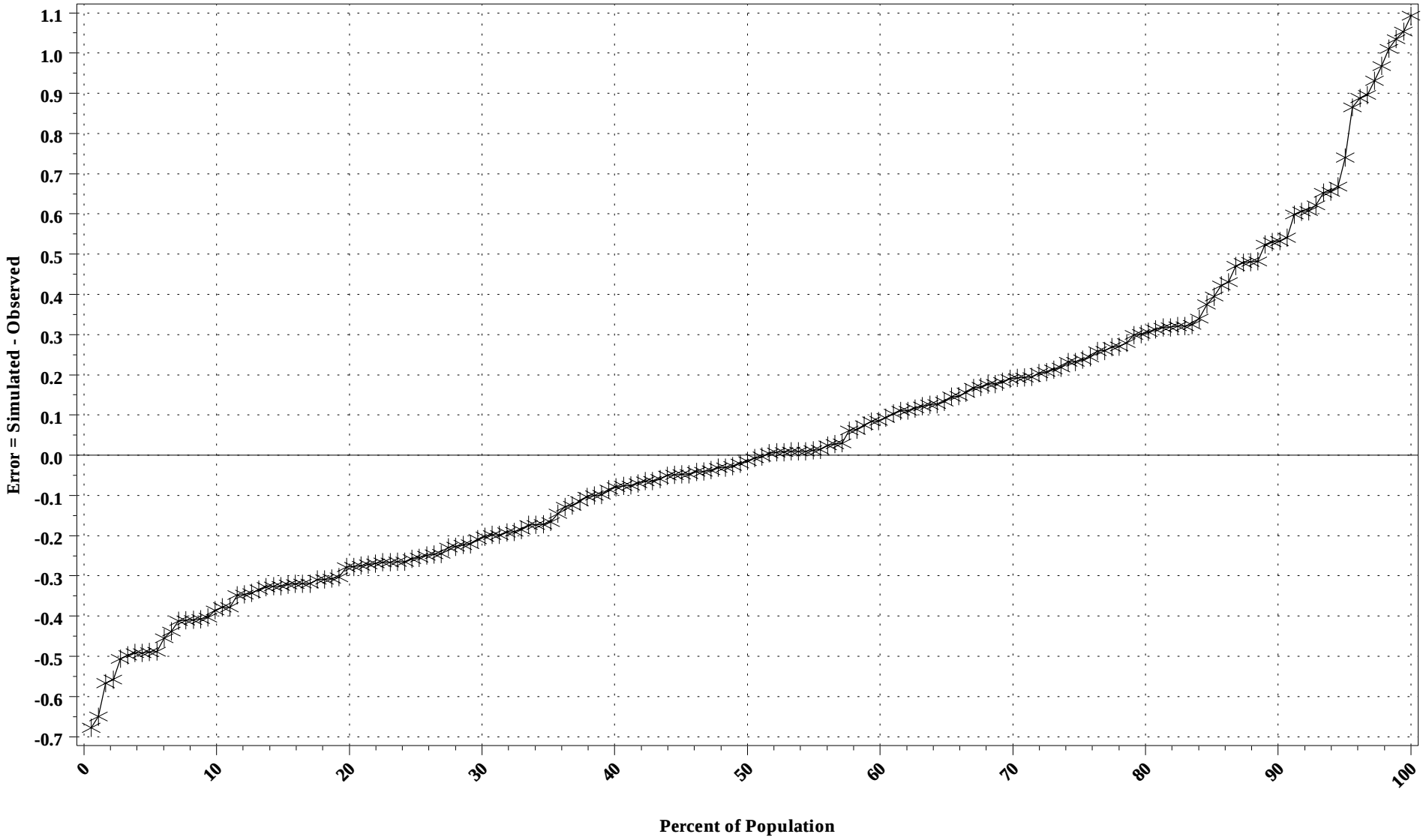
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Actual error versus Percentile Sample Population
## NO3

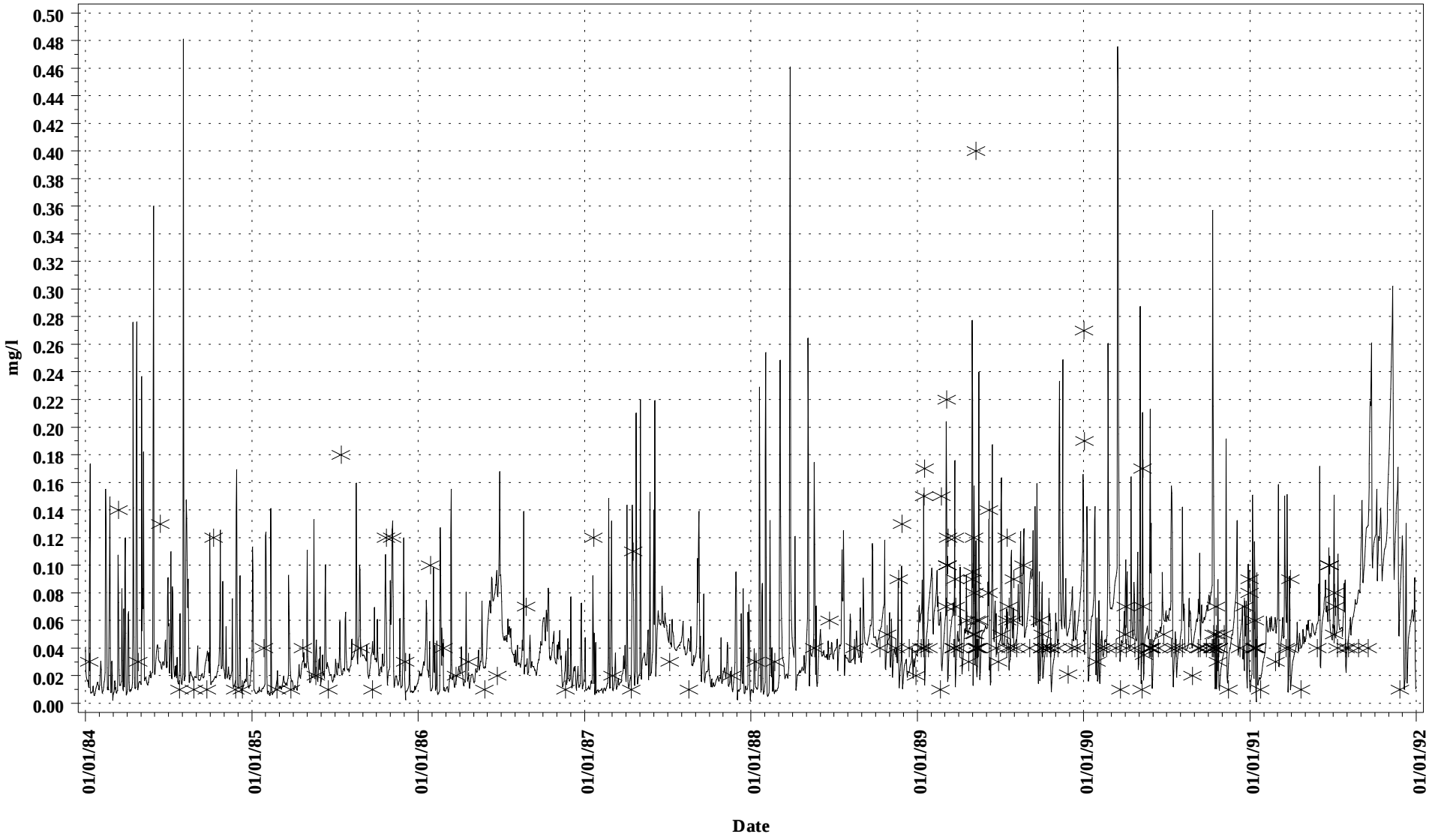
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(rap.drv 29JUN98 09:34)

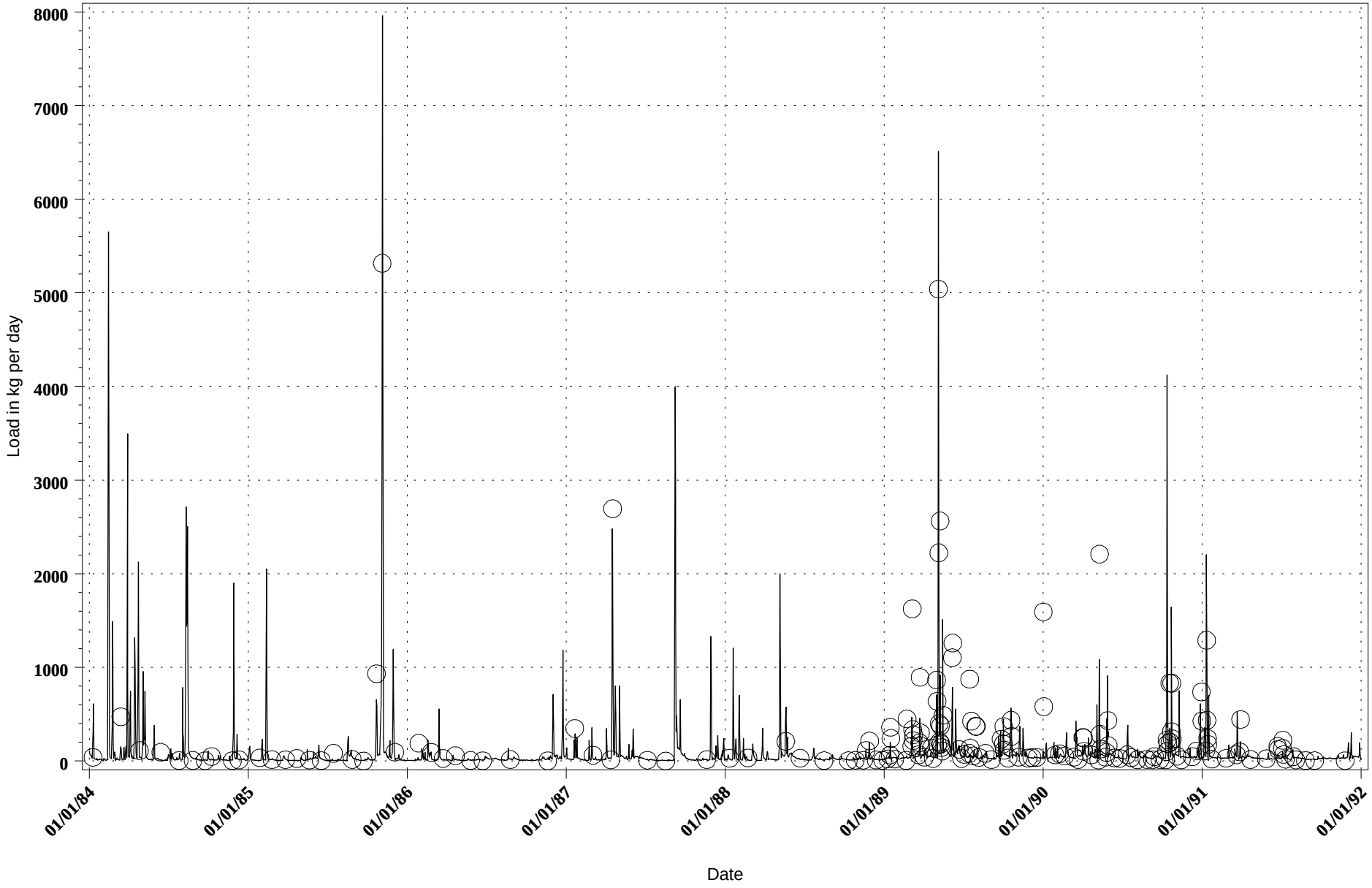
# Rappahannock River at Segement 230
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Total Ammonia Observed and Simulated Load vs Time
### (line = simulated, O = observed)

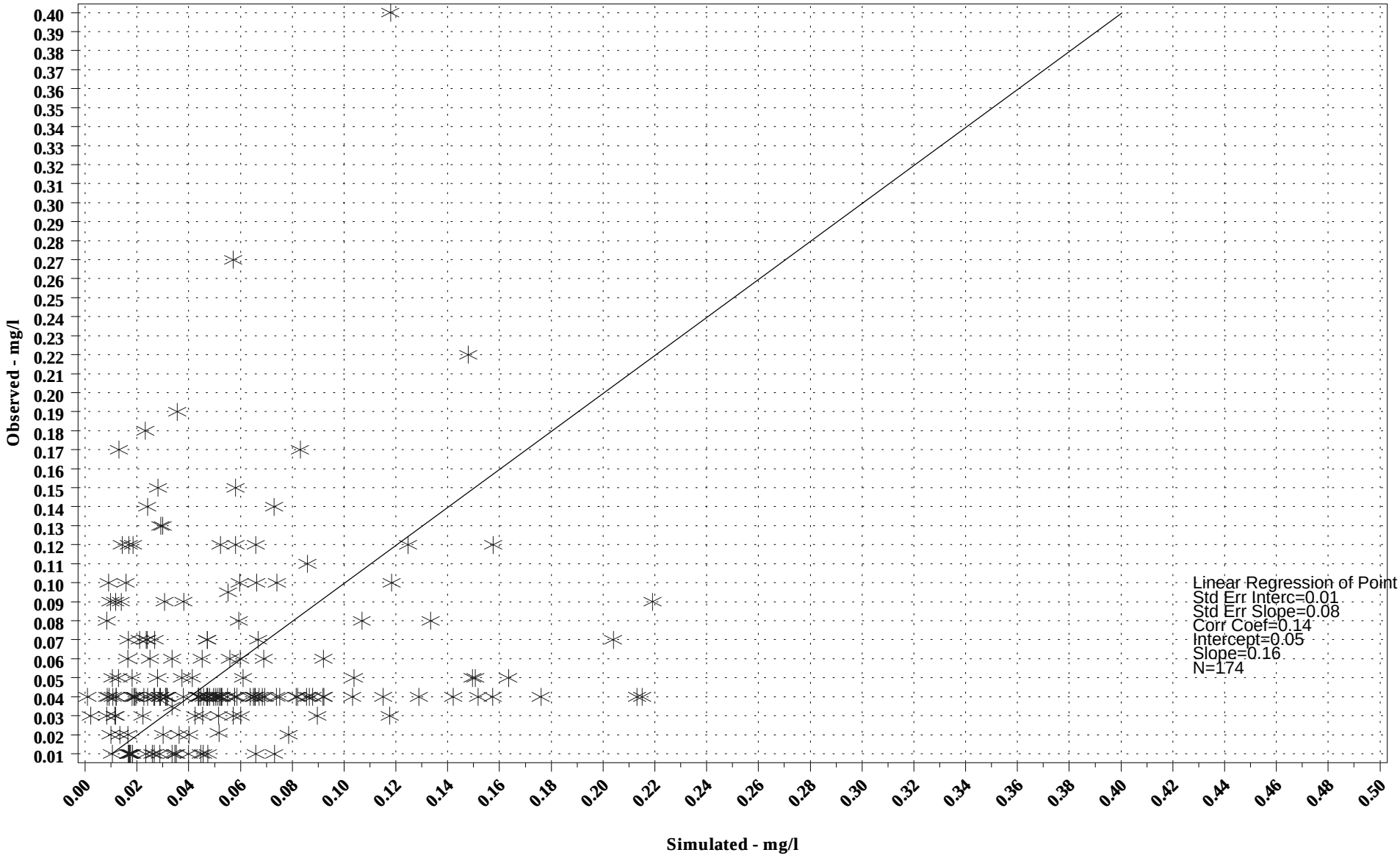



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230

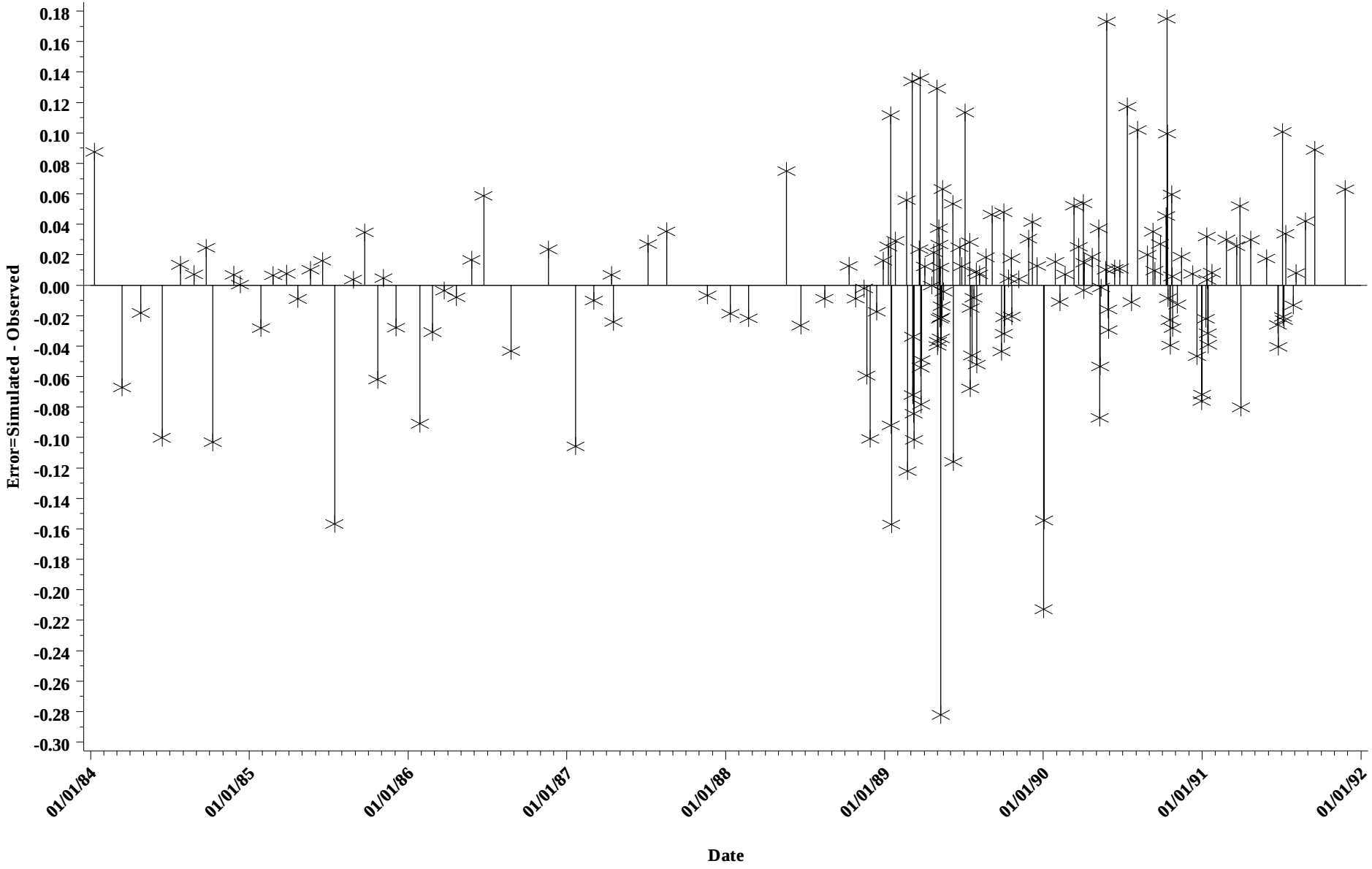
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92



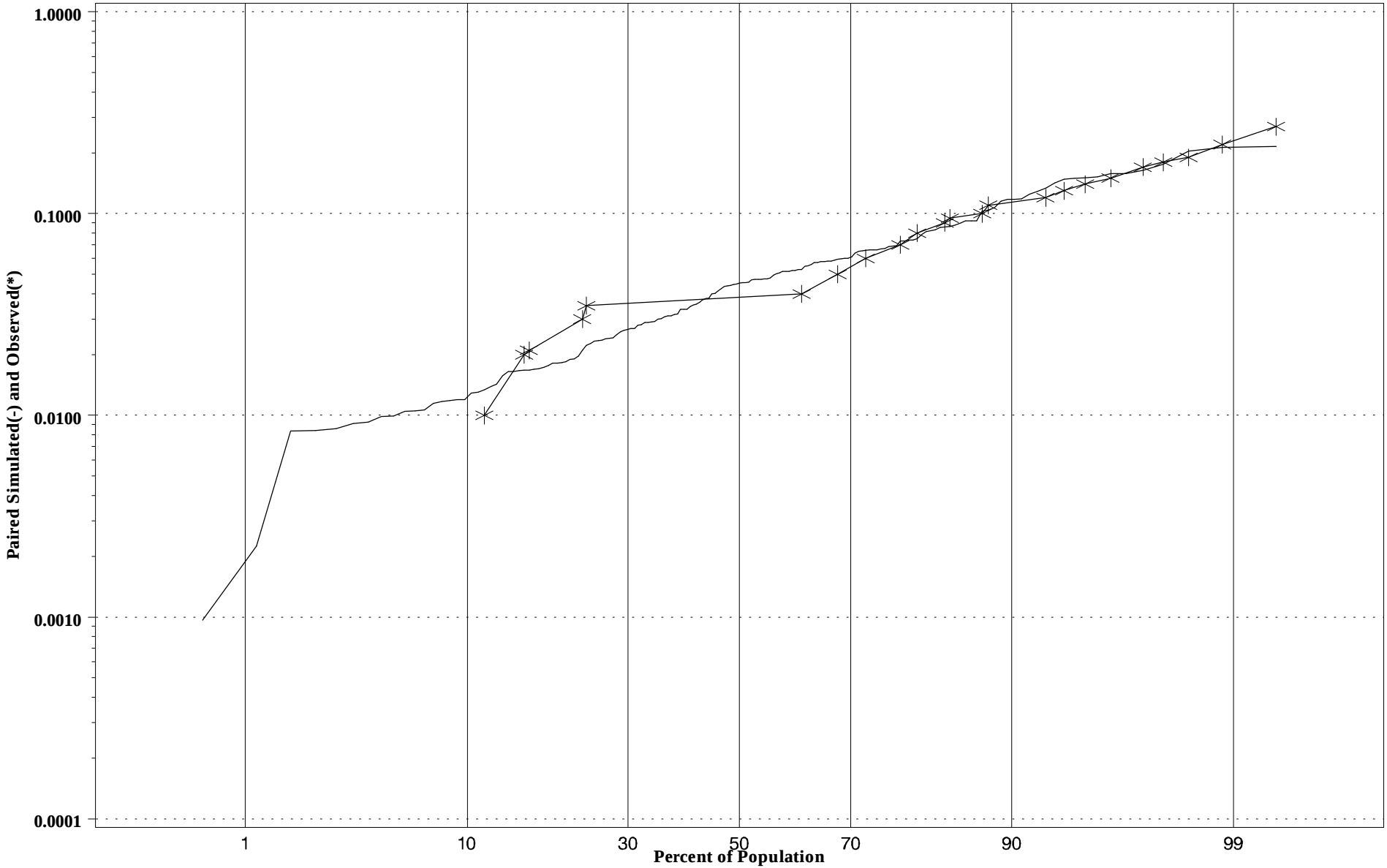

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230
## Actual Error versus Time
## Total Ammonia




(y21_plotb.sas model3d:[pwang.dt] omerr)
(rap.drv 29JUN98 09:34)

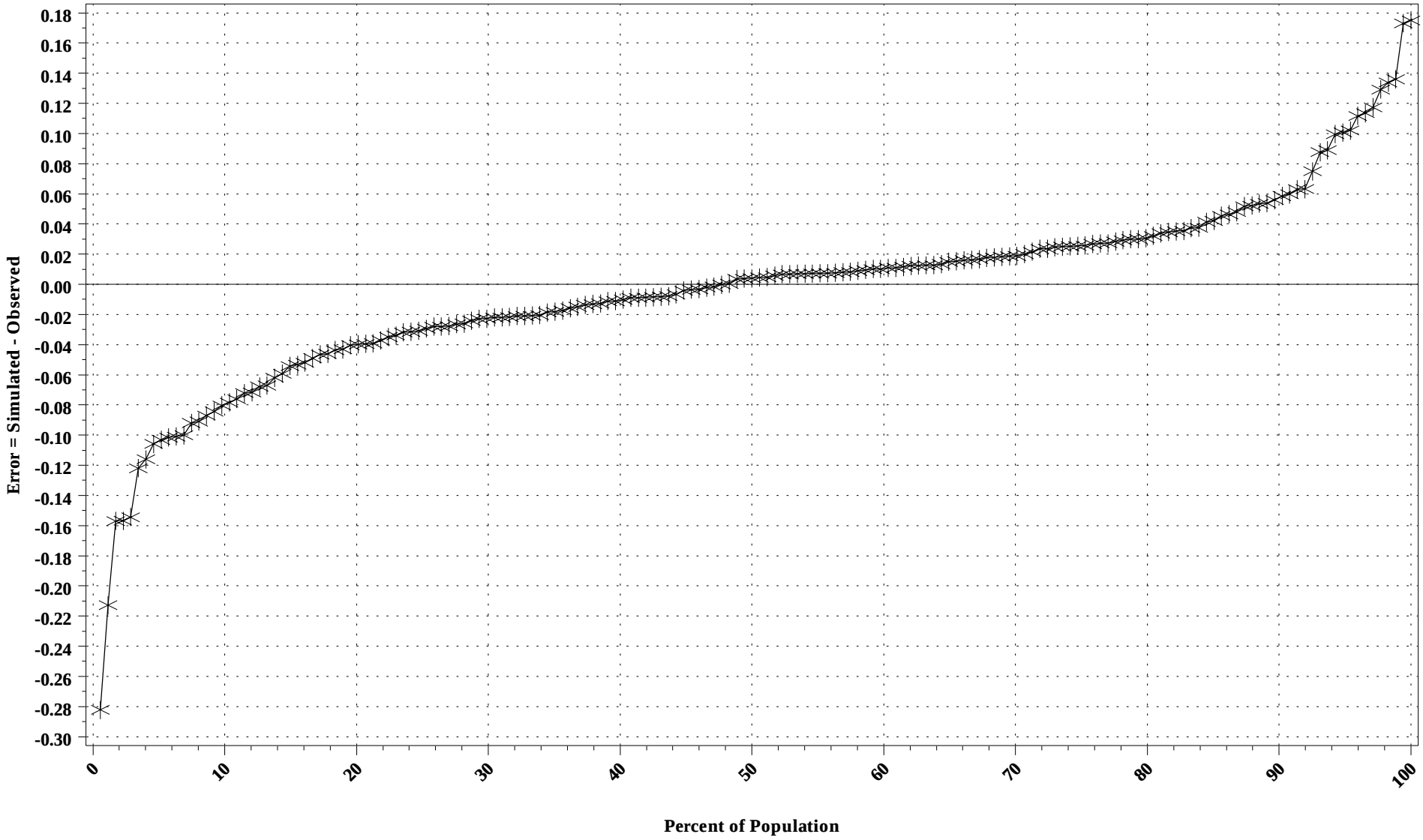
# Rappahannock River at Segement 230
## Total Ammonia
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(rap.drv 29JUN98 09:34)

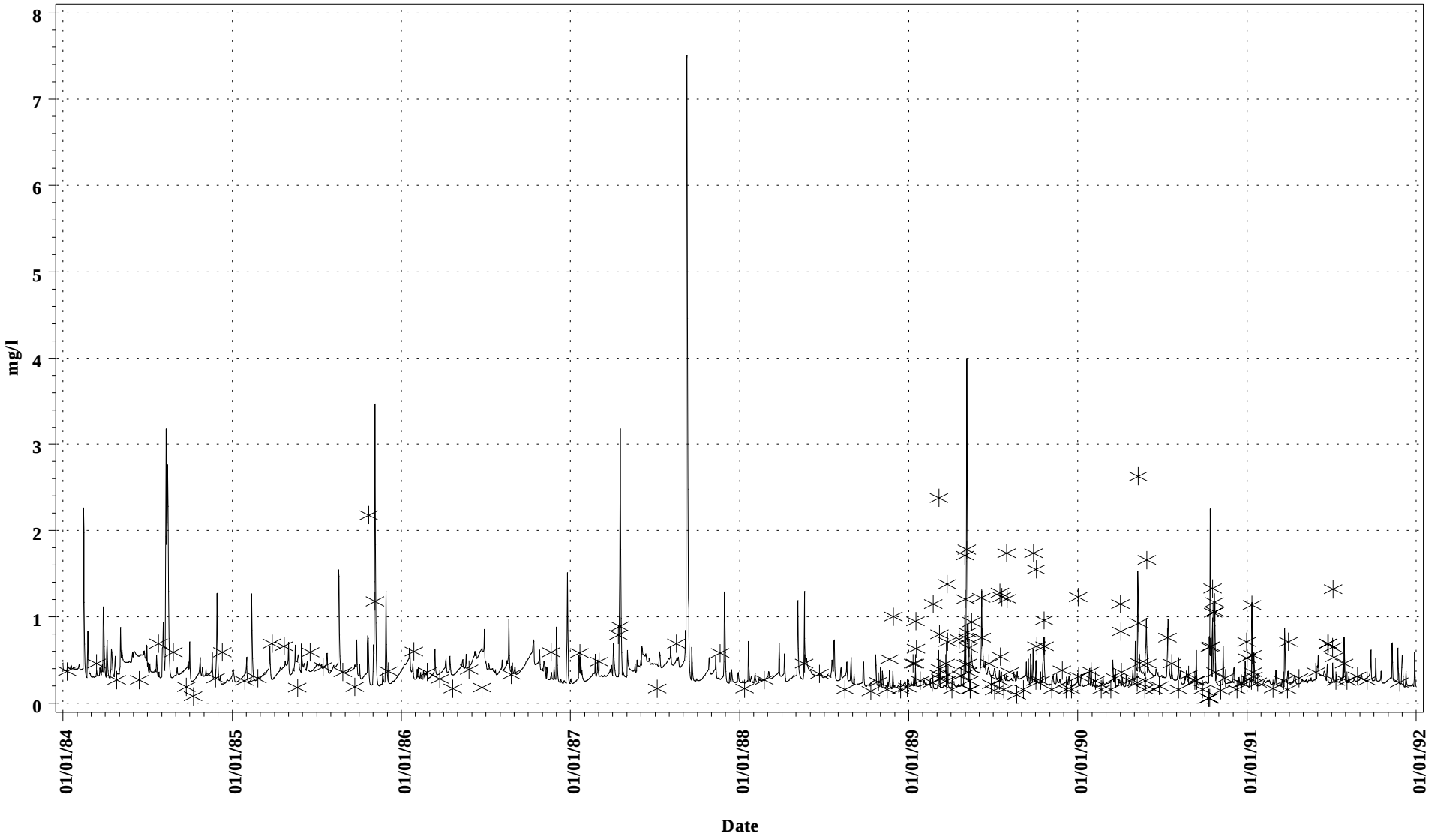
# Rappahannock River at Segement 230
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**

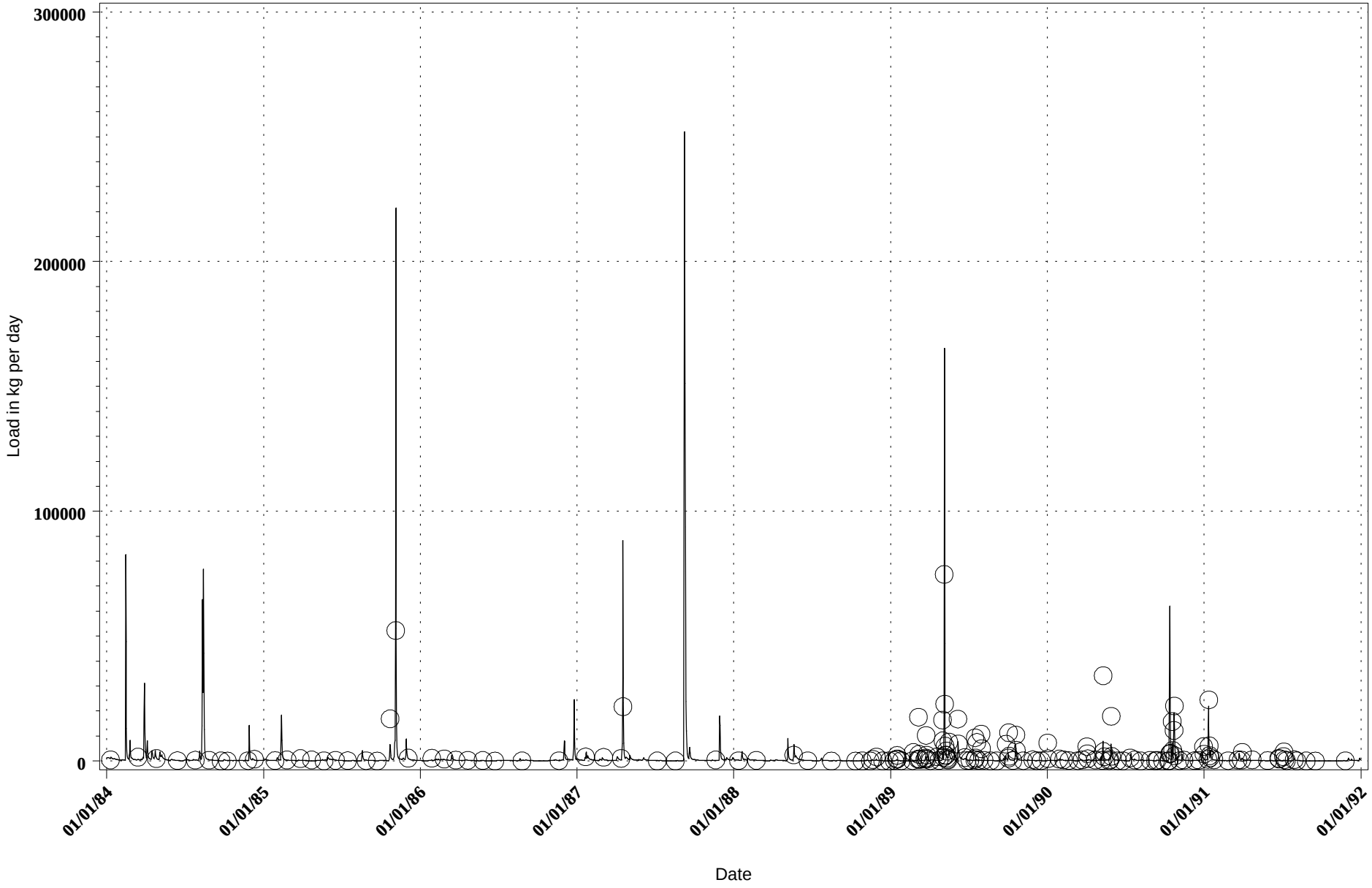



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230

## Organic Nitrogen Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

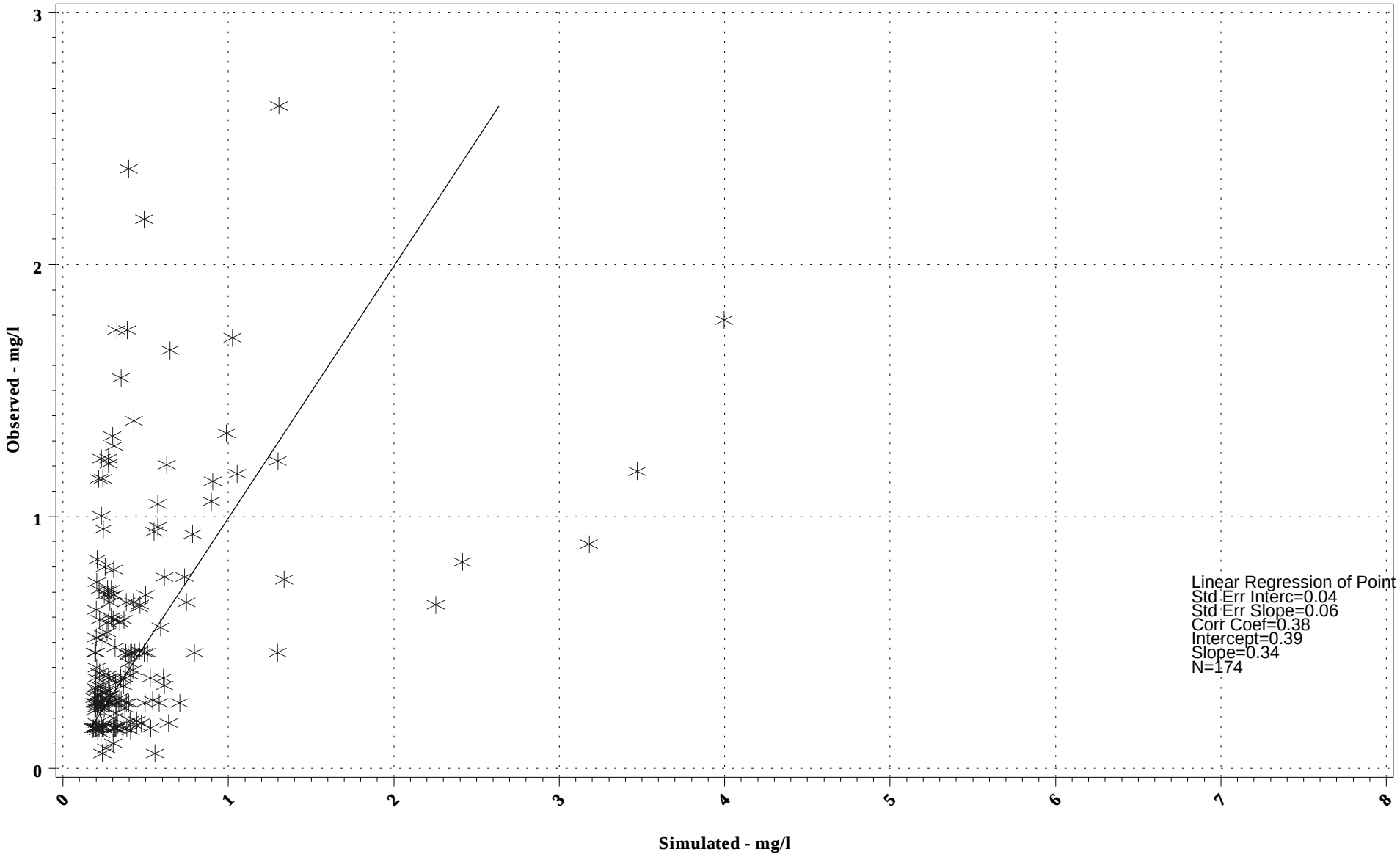



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230

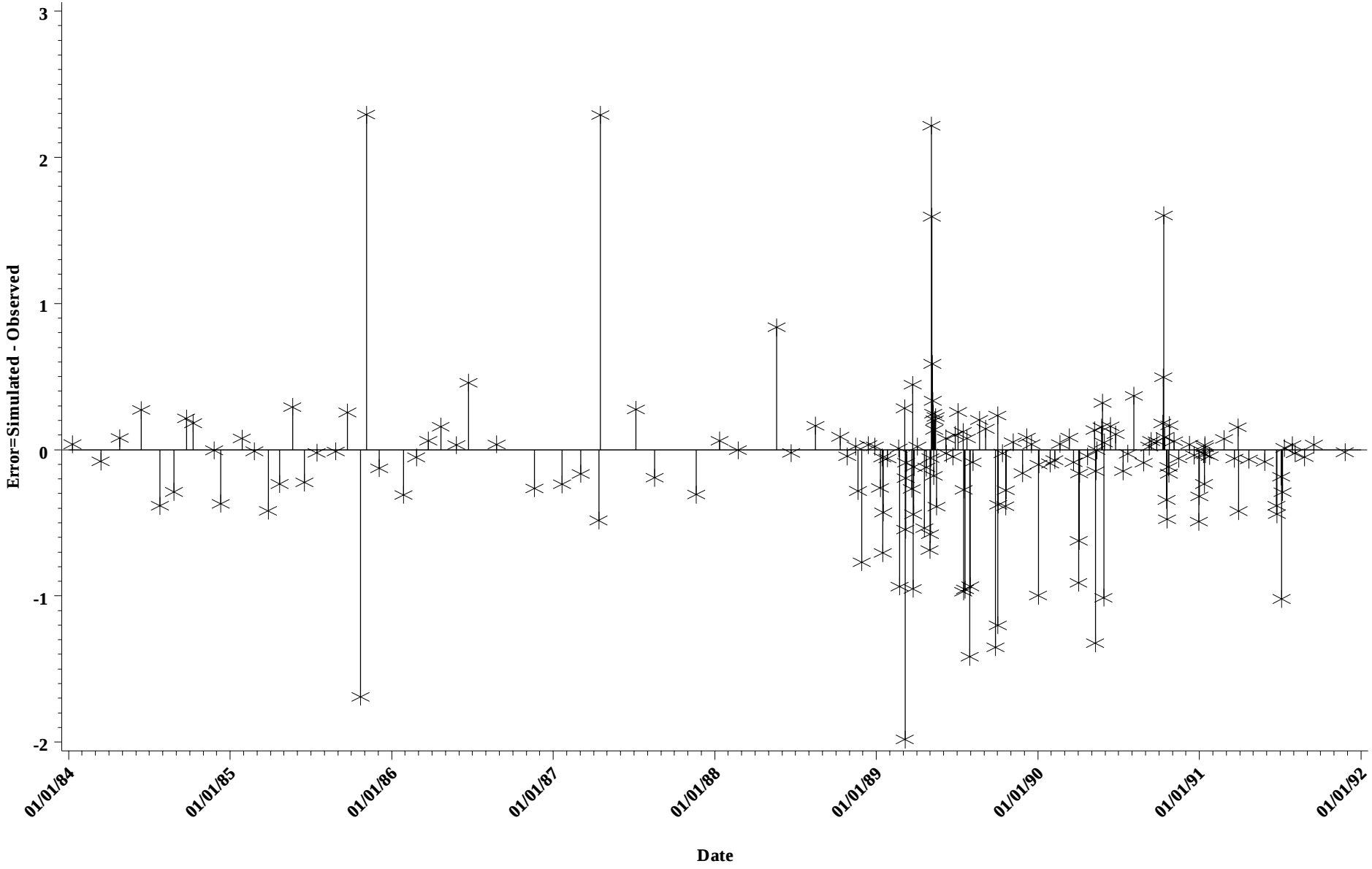
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(rap.drv 29JUN98 09:34,proc reg,model y=x)

# Rappahannock River at Segement 230
## Actual Error versus Time
## Organic Nitrogen

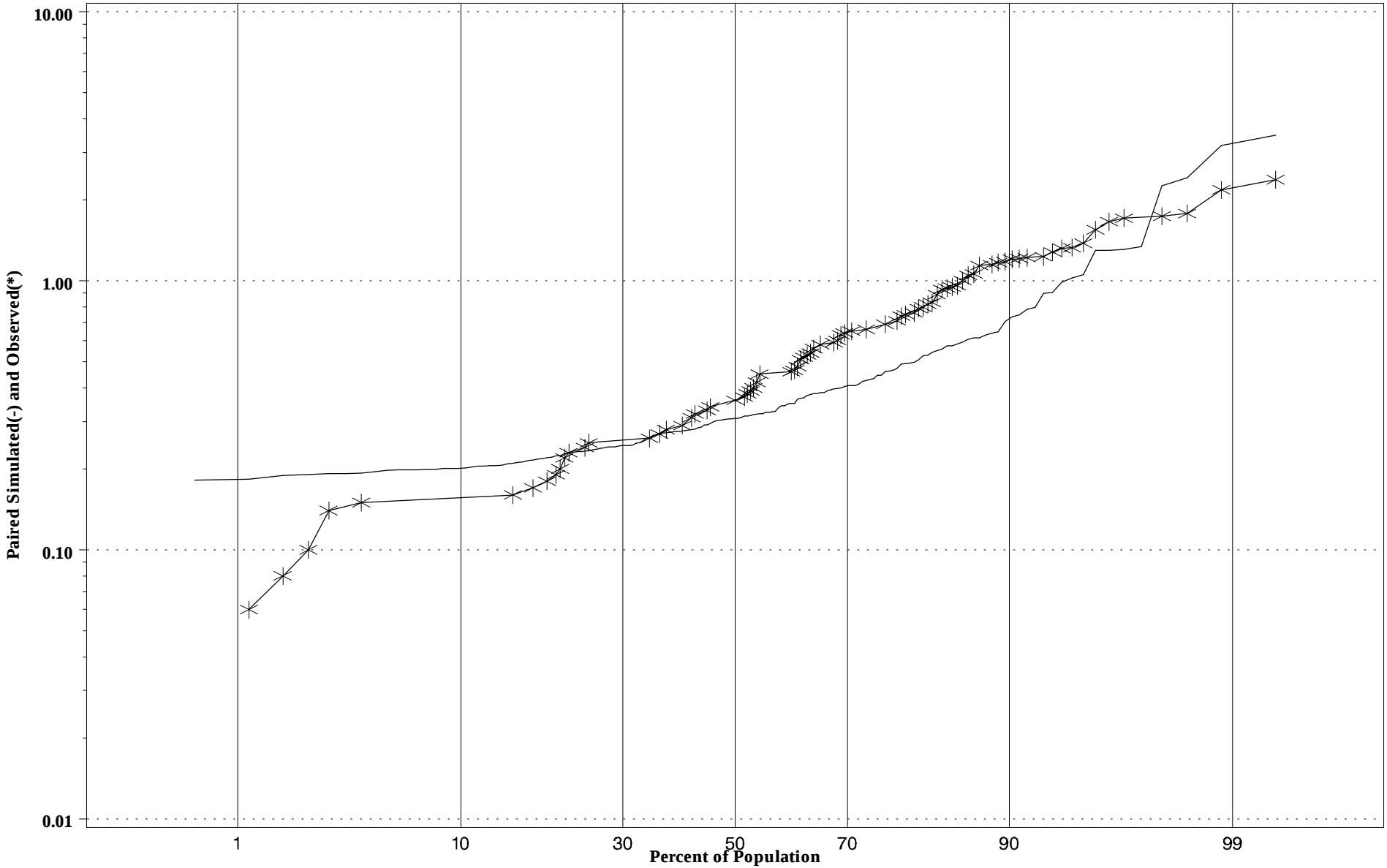



(y21_plotb.sas model3d:[pwang.dt] omerr)
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230

## Organic Nitrogen

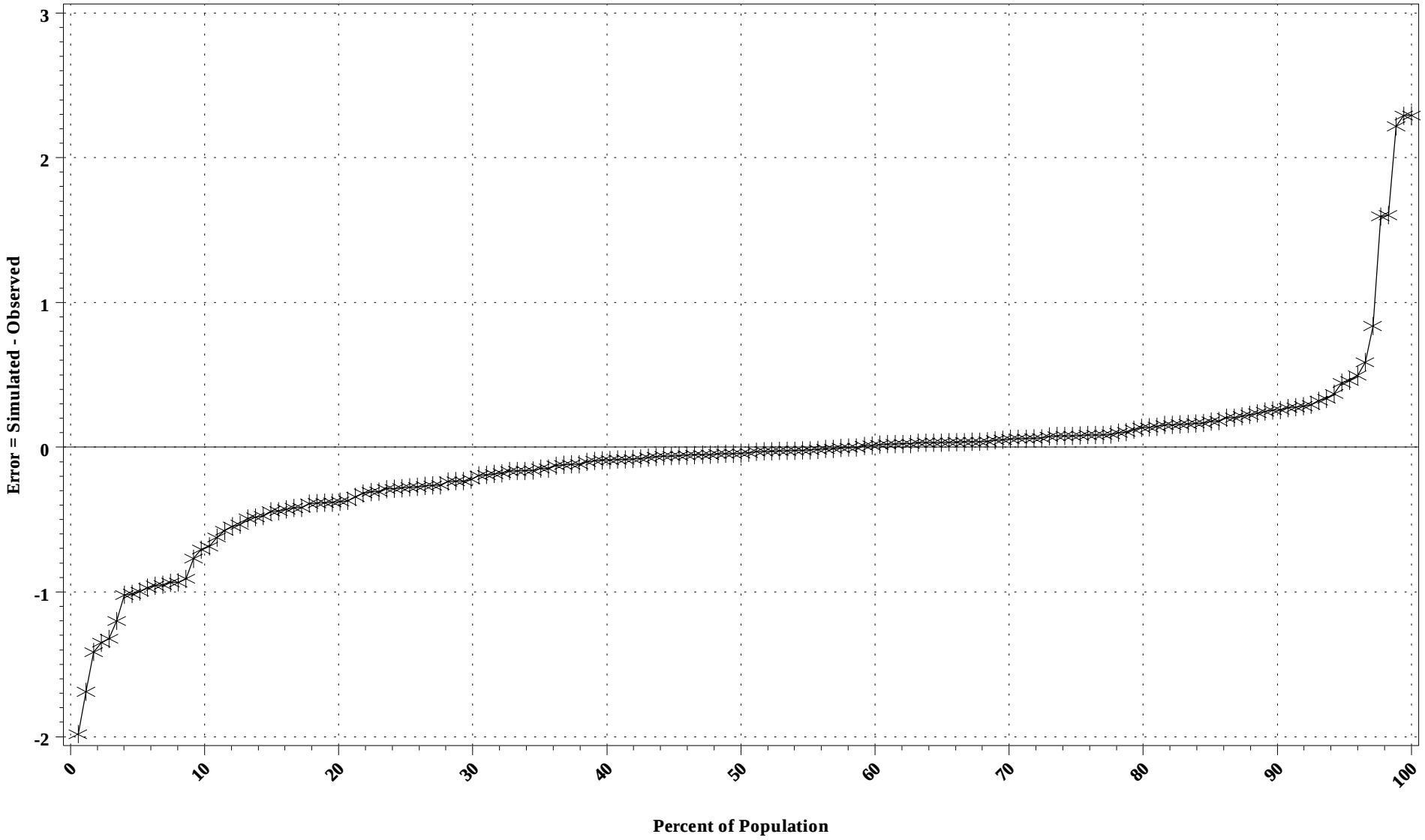
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(rap.drv 29JUN98 09:34)

# Rappahannock River at Segement 230
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(rap.drv 29JUN98 09:34)

# B.5.0 York River Basin

***Basin Segments:***

Above Fall Line Basin Segments: 235, 240, 250, and 260
Below Fall Line Basin Segments: 590

***Section Contents:***

### *B.5.1 Mattaponi River near Beulahville, VA at Segment 240 (Monitoring Station: 1674500) (Above Fall Line Basin Segments: 235 and 240)*

**Section Summary:**

The Mattaponi basin together with the Pamunkey form the above fall line portion of the York River. The Mattaponi is similar to the Rappahannock in its rural character dominated by agricultural loads. Concentrations of total nitrogen, total phosphorus, and total suspended sediment are generally low at the Mattaponi gage station. Water quality observations increased and were oriented toward storm weighted sampling after 1989. Model calibration focused primarily on the refined, storm-weighted sampling after 1989.

The Mattaponi basin above the gaged site covers an area of 594 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 72% forest land, 11% cropland, 8% other agricultural areas, 7% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage increased from 0.64 million pounds in 1985 to 0.67 million pounds in 1996. Total phosphorus loads over the same time period decreased from 58 thousand pounds to 49 thousand pounds. In general, point source loads above the gage site decreased. Estimated septic system total nitrogen loads increased 39%, from 41 thousand pounds in 1985 to 58 thousand pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 2%, and other agricultural loads (primarily pasture and manure loads) by 28%. Total phosphorus decreased for these land uses by 22% and 54% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 32% for total nitrogen and 29% for total phosphorus due to increases in population and urban land use area

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

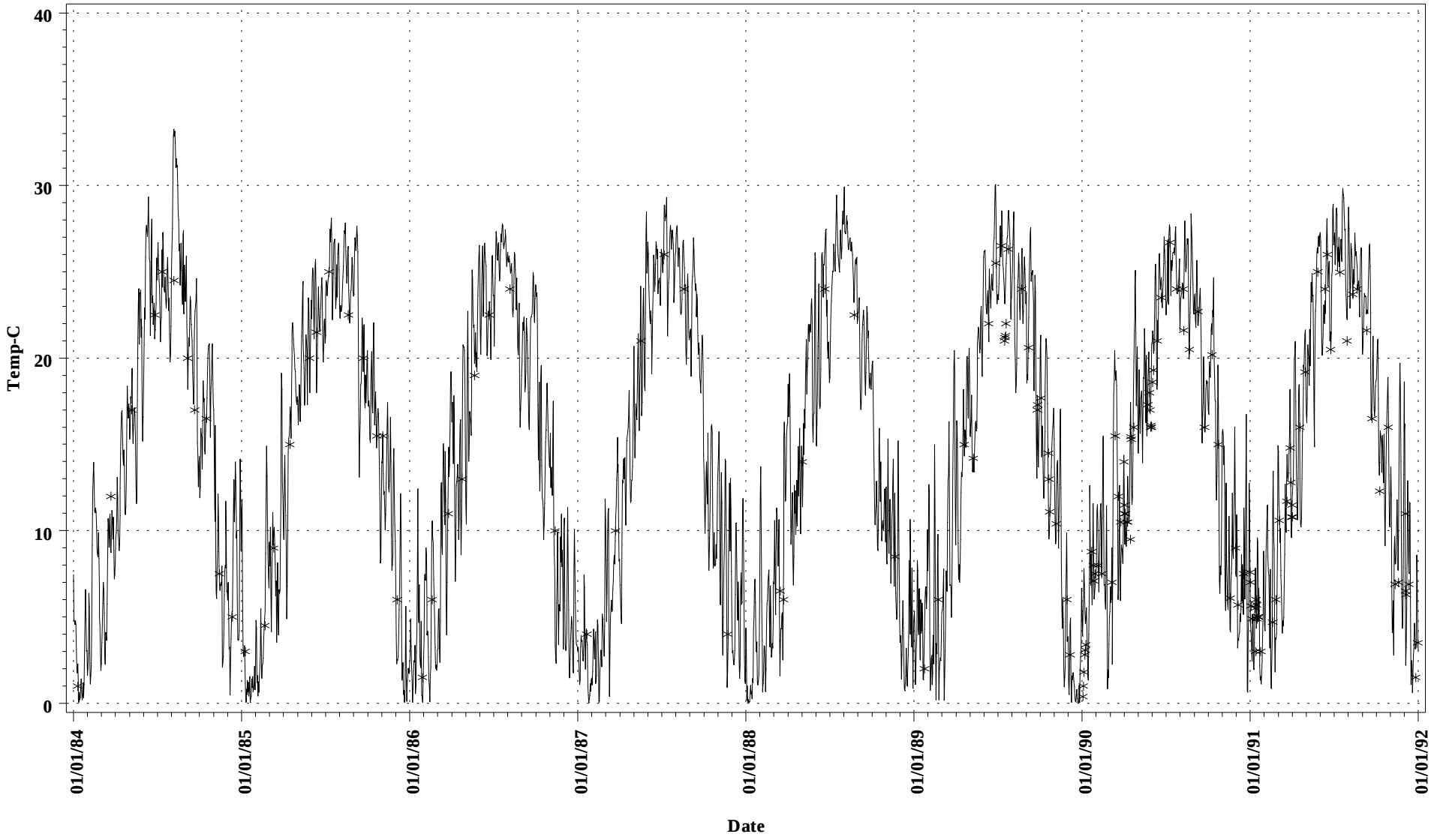
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# Mattaponi River at Segment 240
## Observed and Simulated versus Time
# Temperature-C

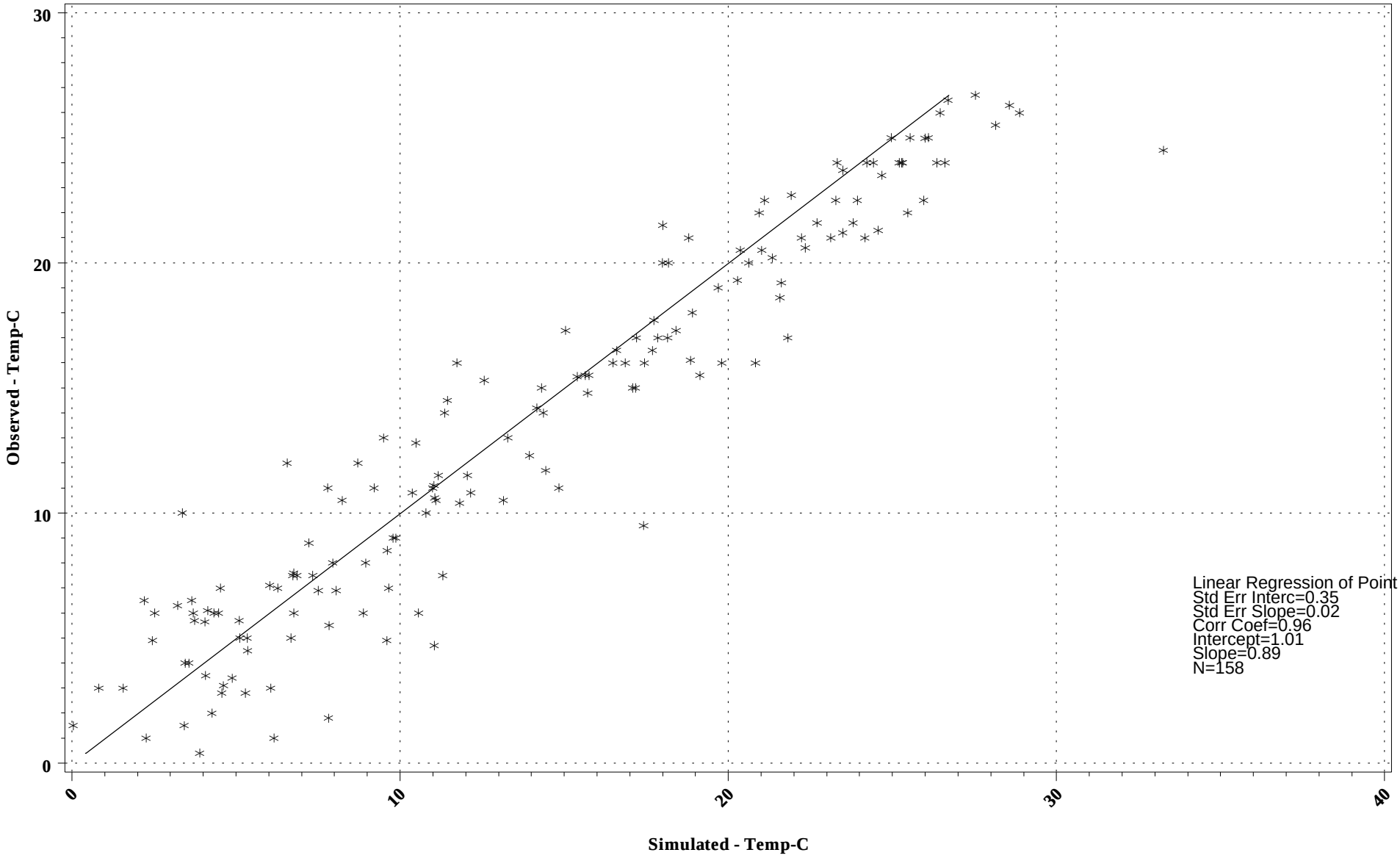
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(matta240.drv 26JUN98 16:08)

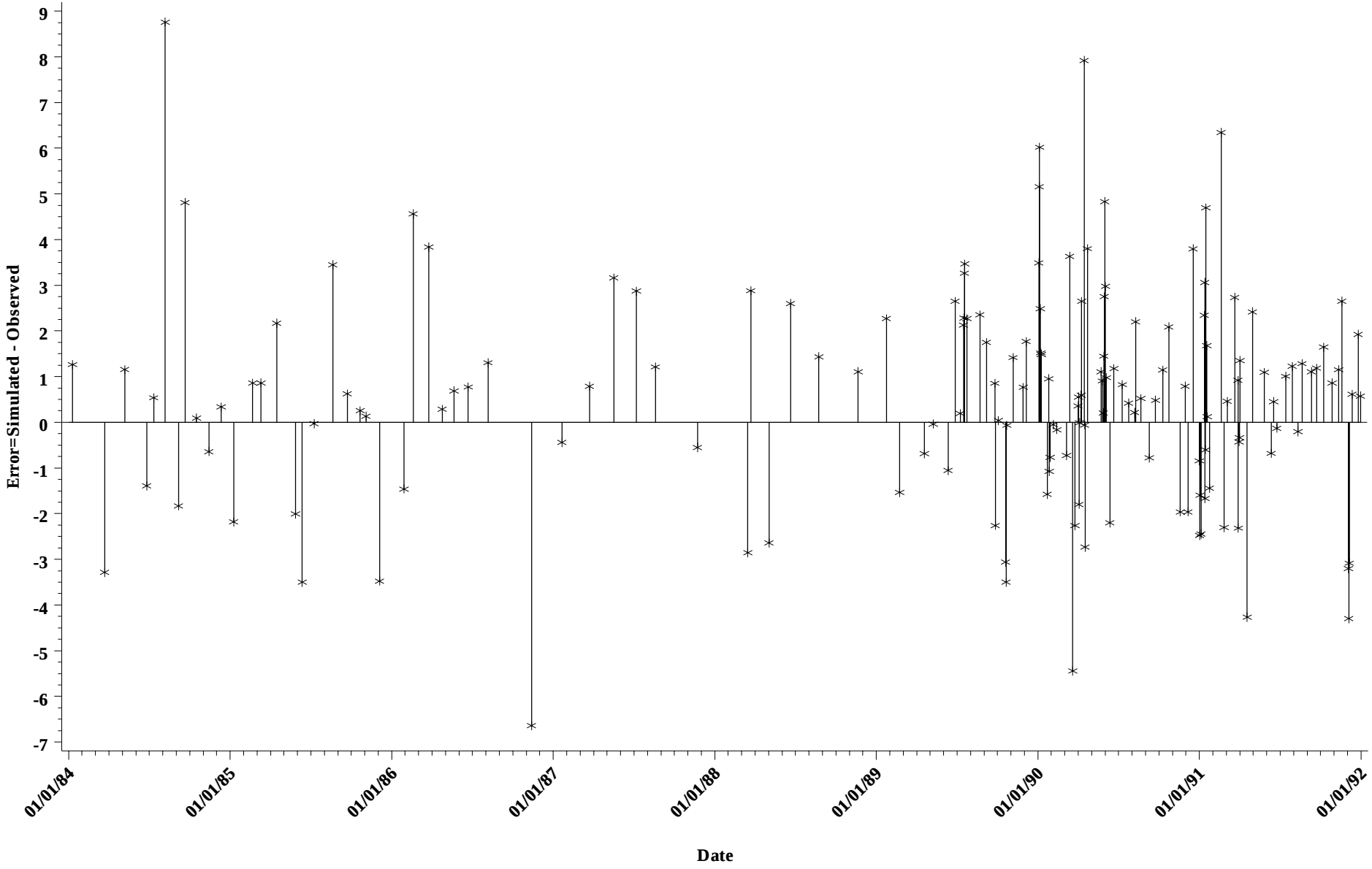
# Mattaponi River at Segment 240

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92



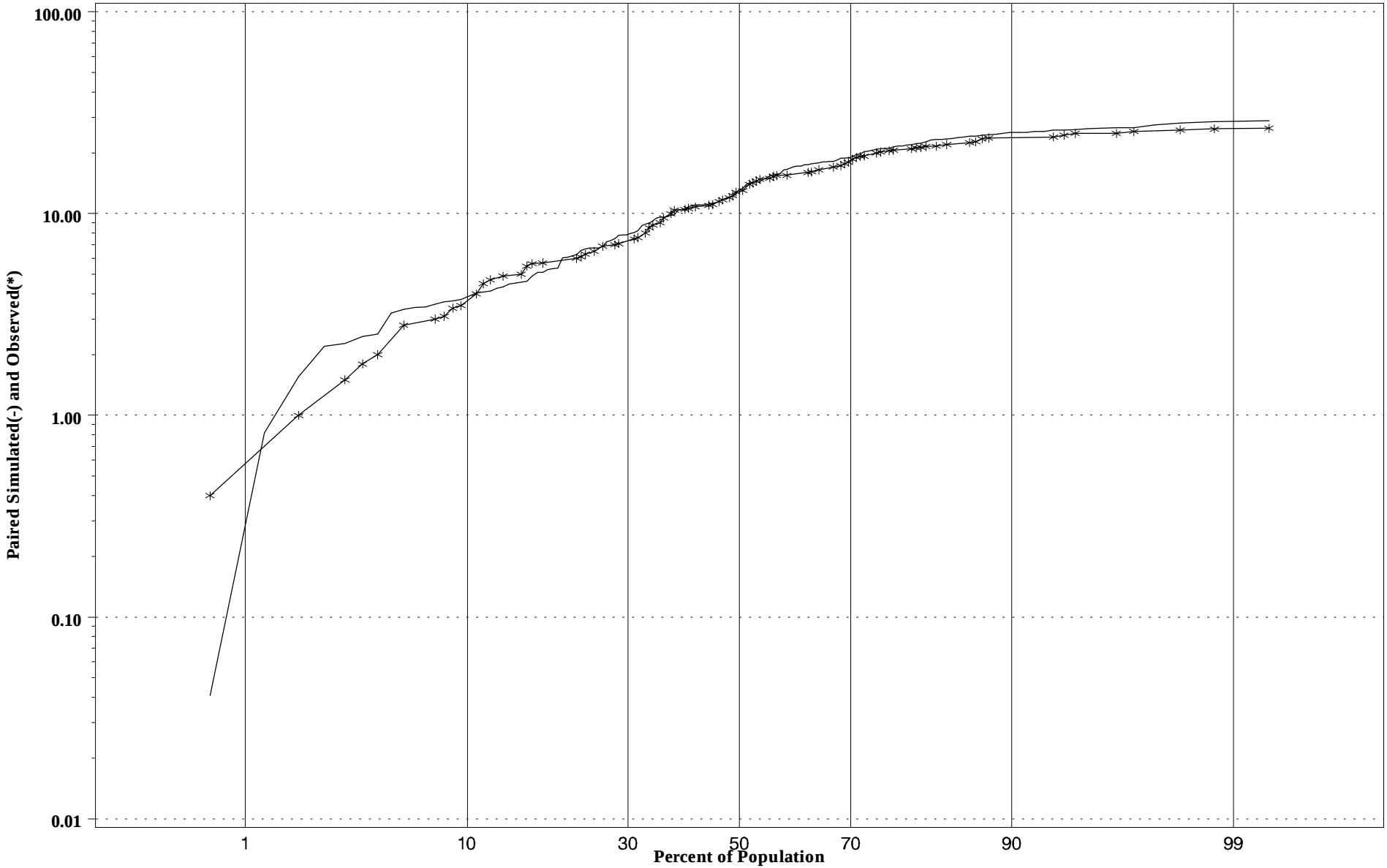

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240
## Actual Error versus Time
## Temperature-C




(y21_plotb.sas model3d:[pwang.dt] omerr)
(matta240.drv 26JUN98 16:08)

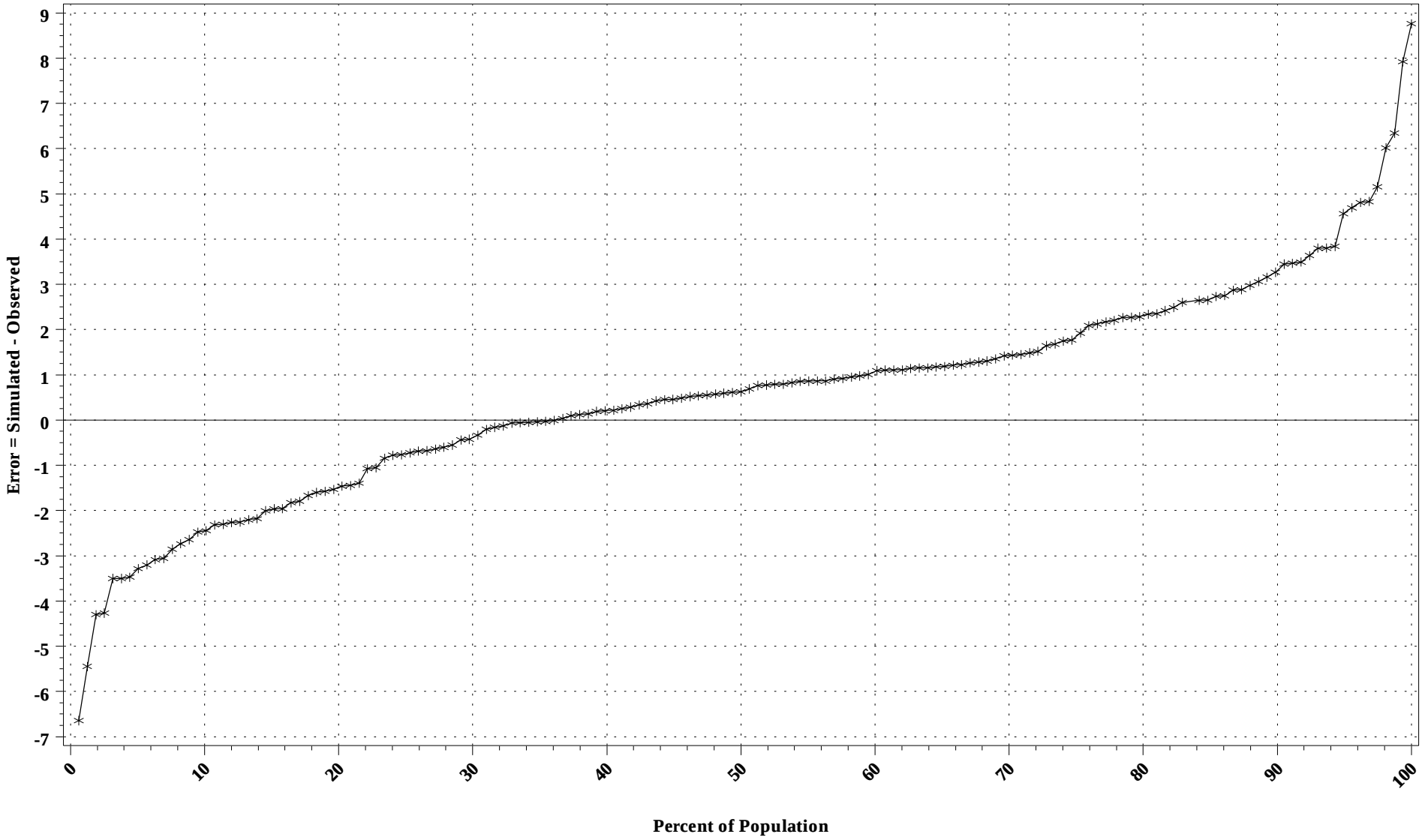
# Mattaponi River at Segment 240
## Temperature-C
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Actual error versus Percentile Sample Population
## Temperature-C

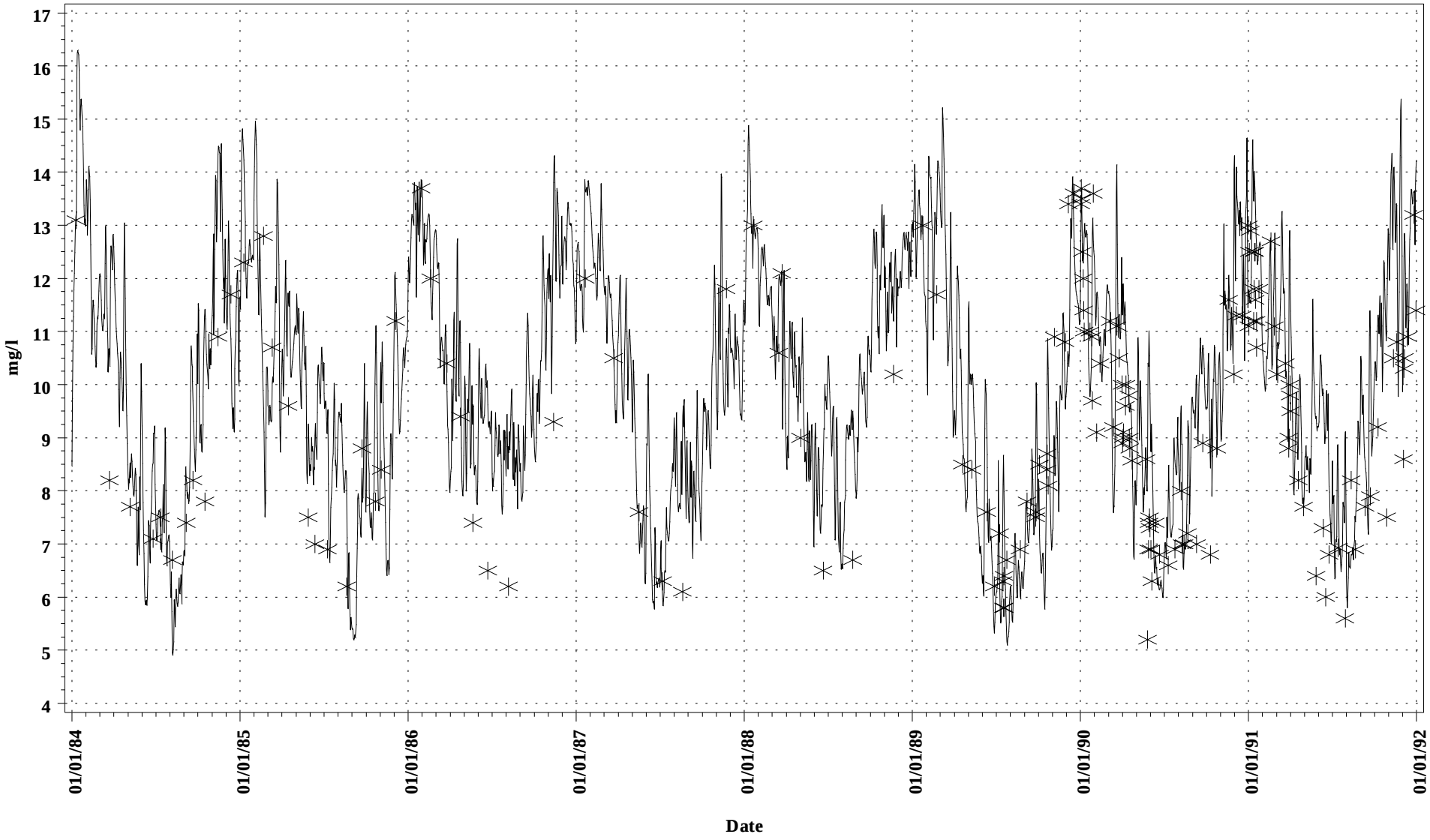
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(matta240.drv 26JUN98 16:08)

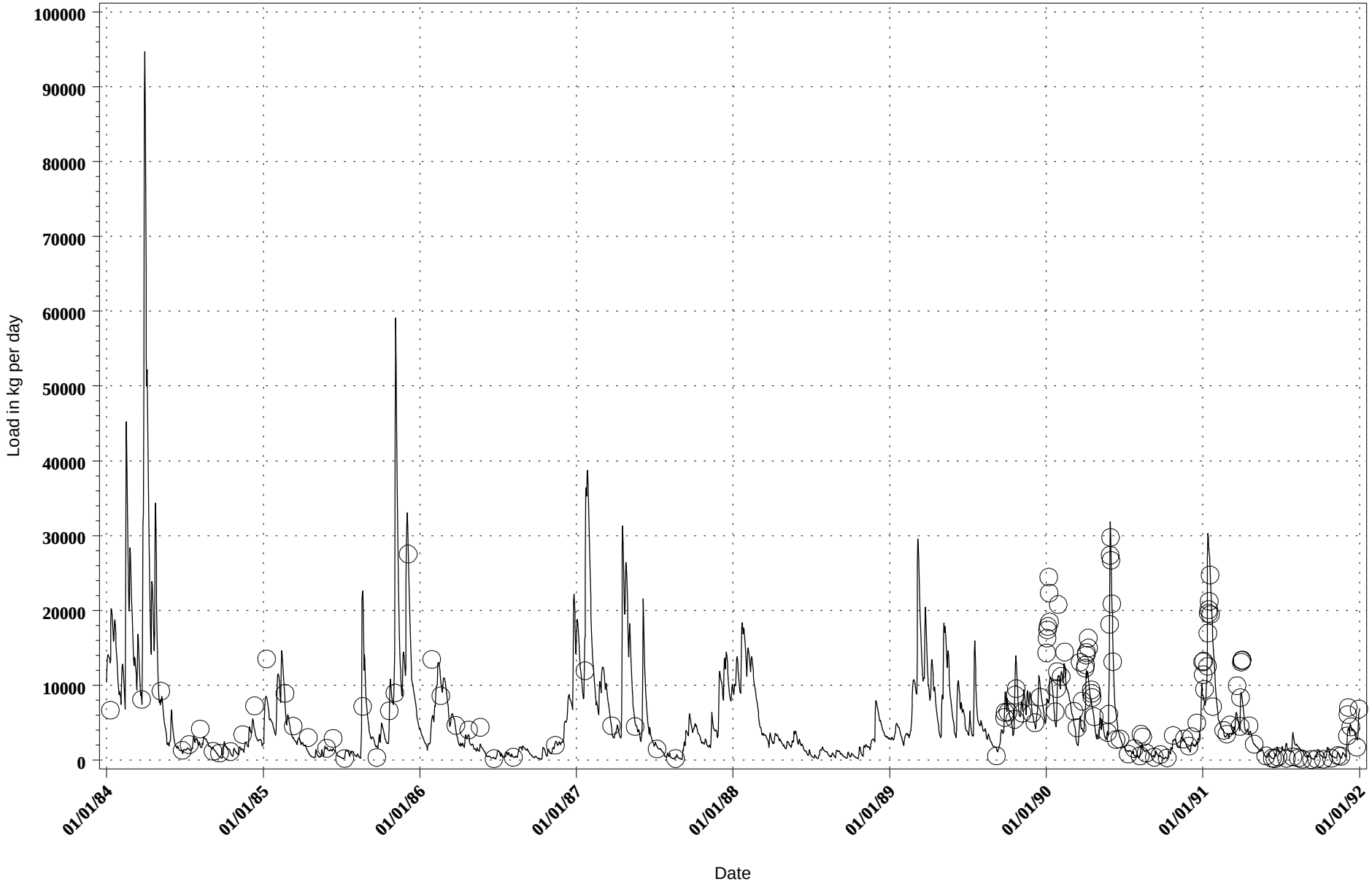
# Mattaponi River at Segment 240
## Observed and Simulated versus Time
## Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

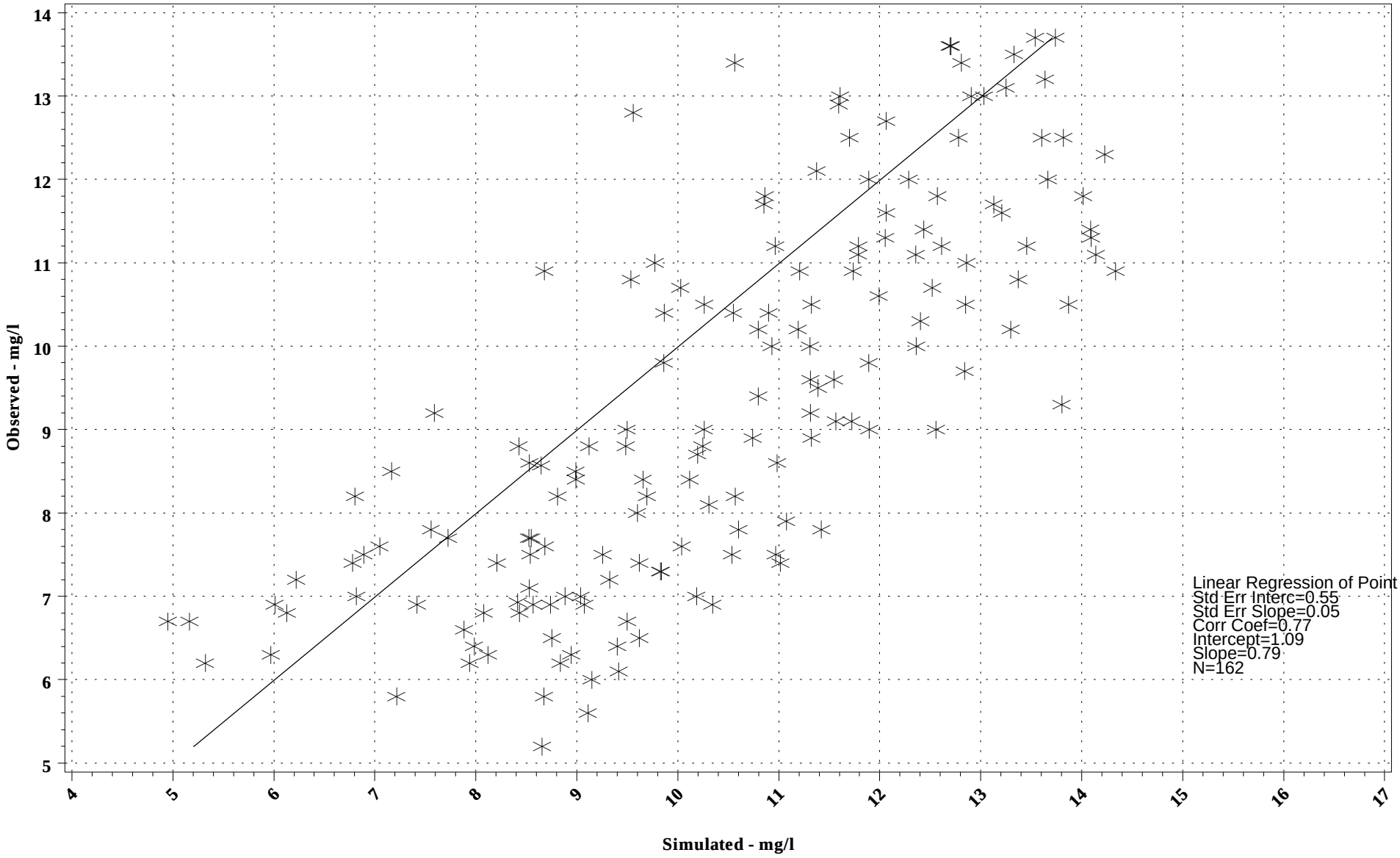



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240

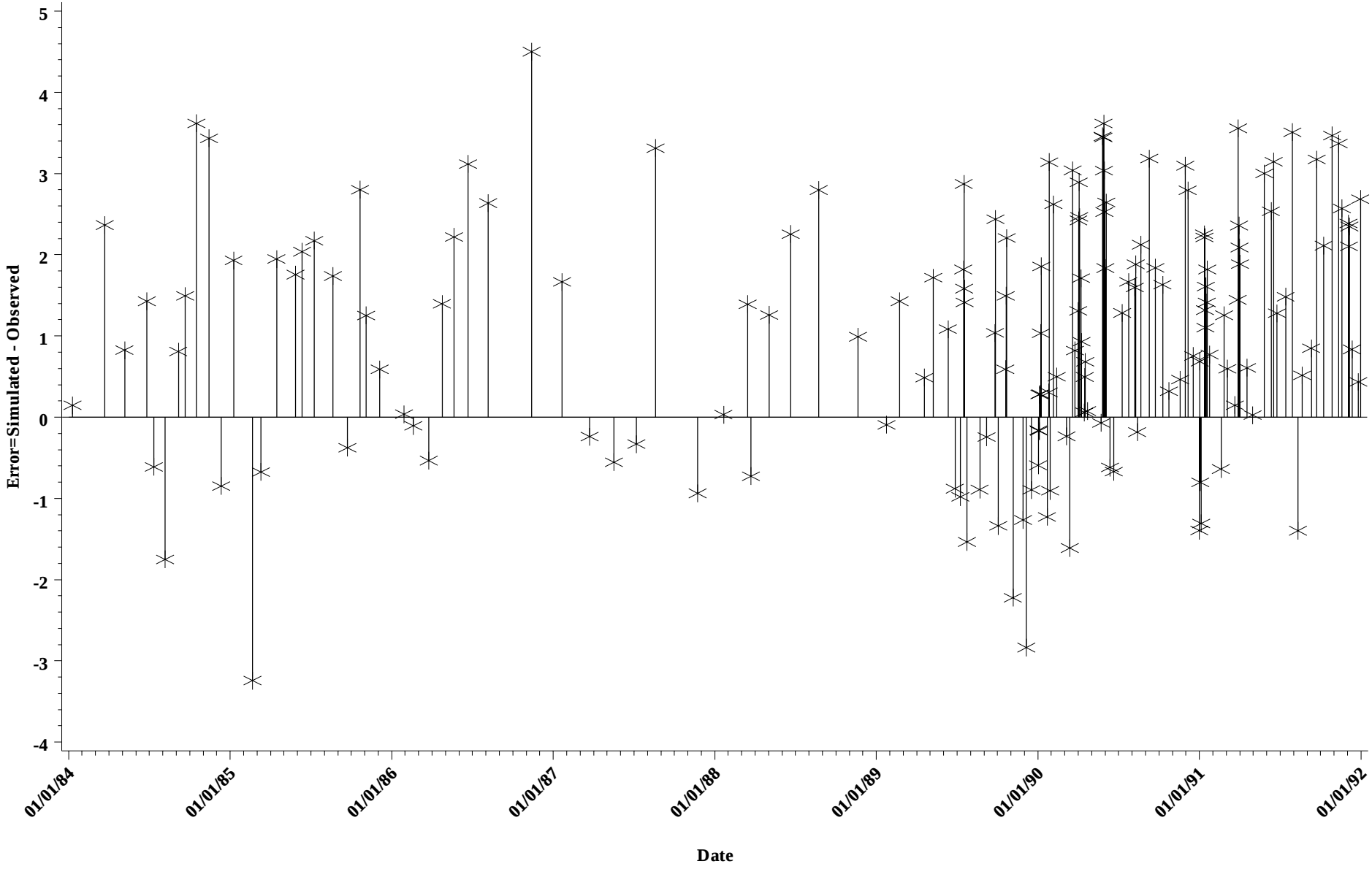
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Oxygen: 01JAN84 - 01JAN92



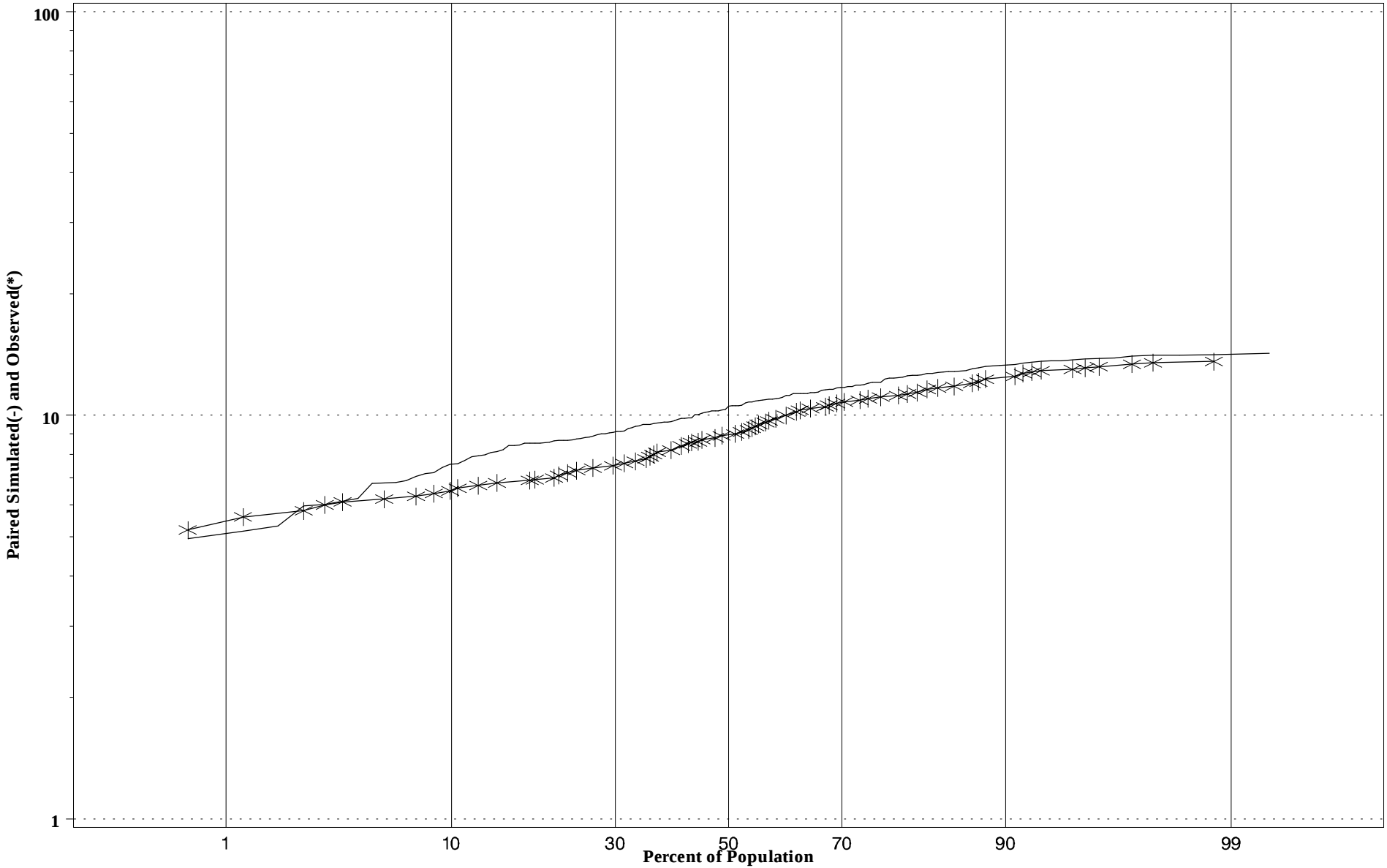

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(matta240.drv 26JUN98 16:08)

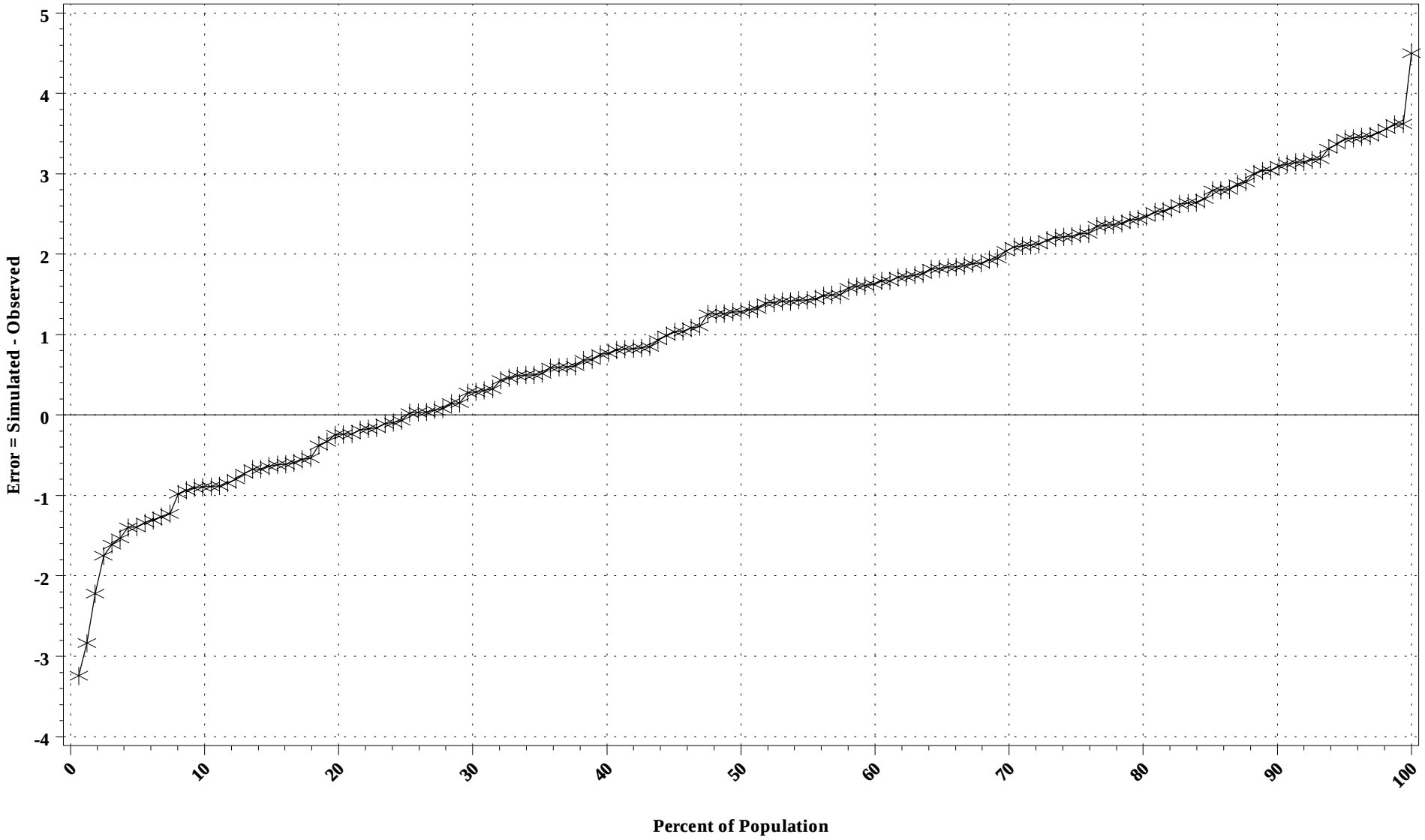
# Mattaponi River at Segment 240
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

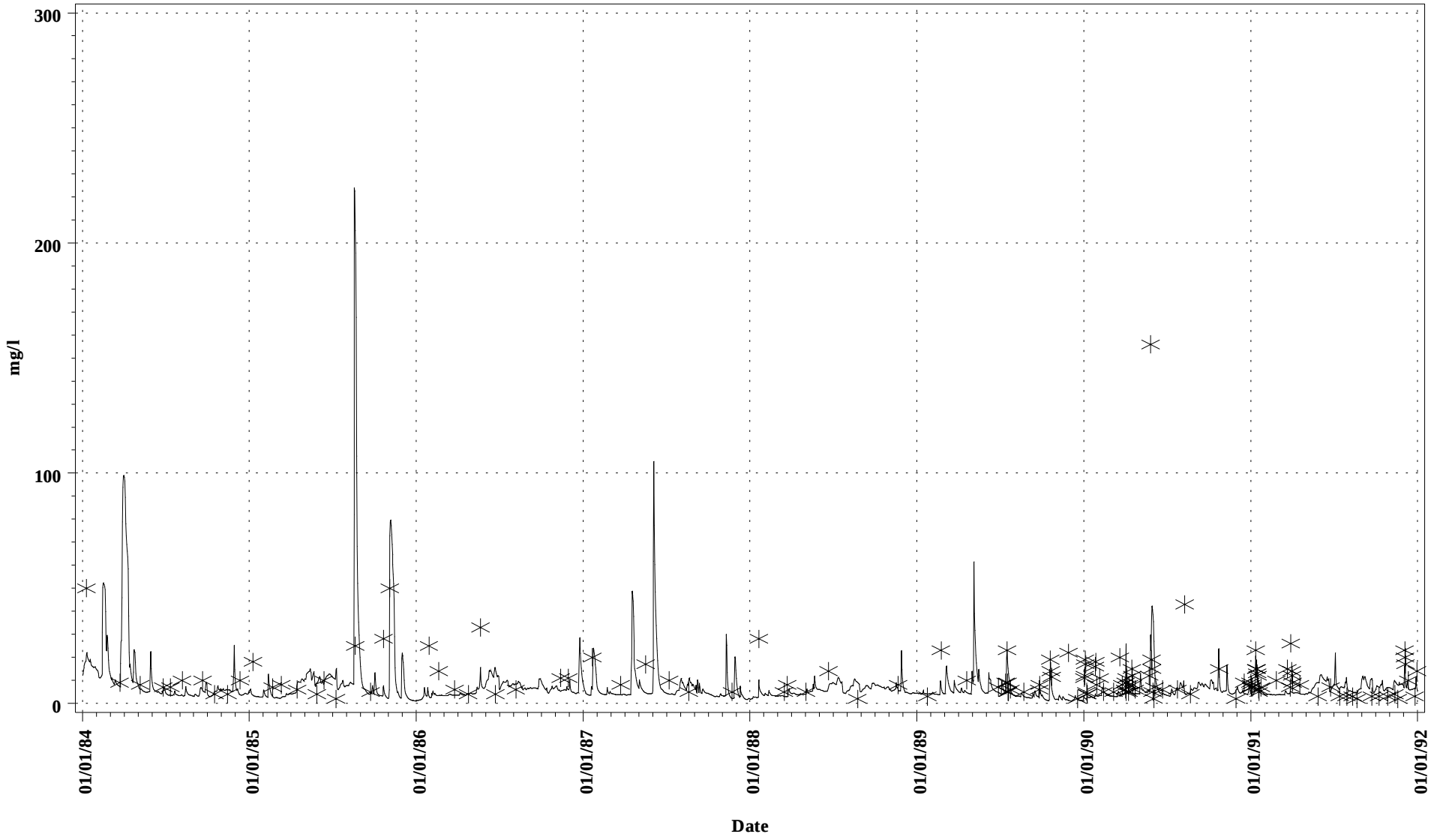
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**

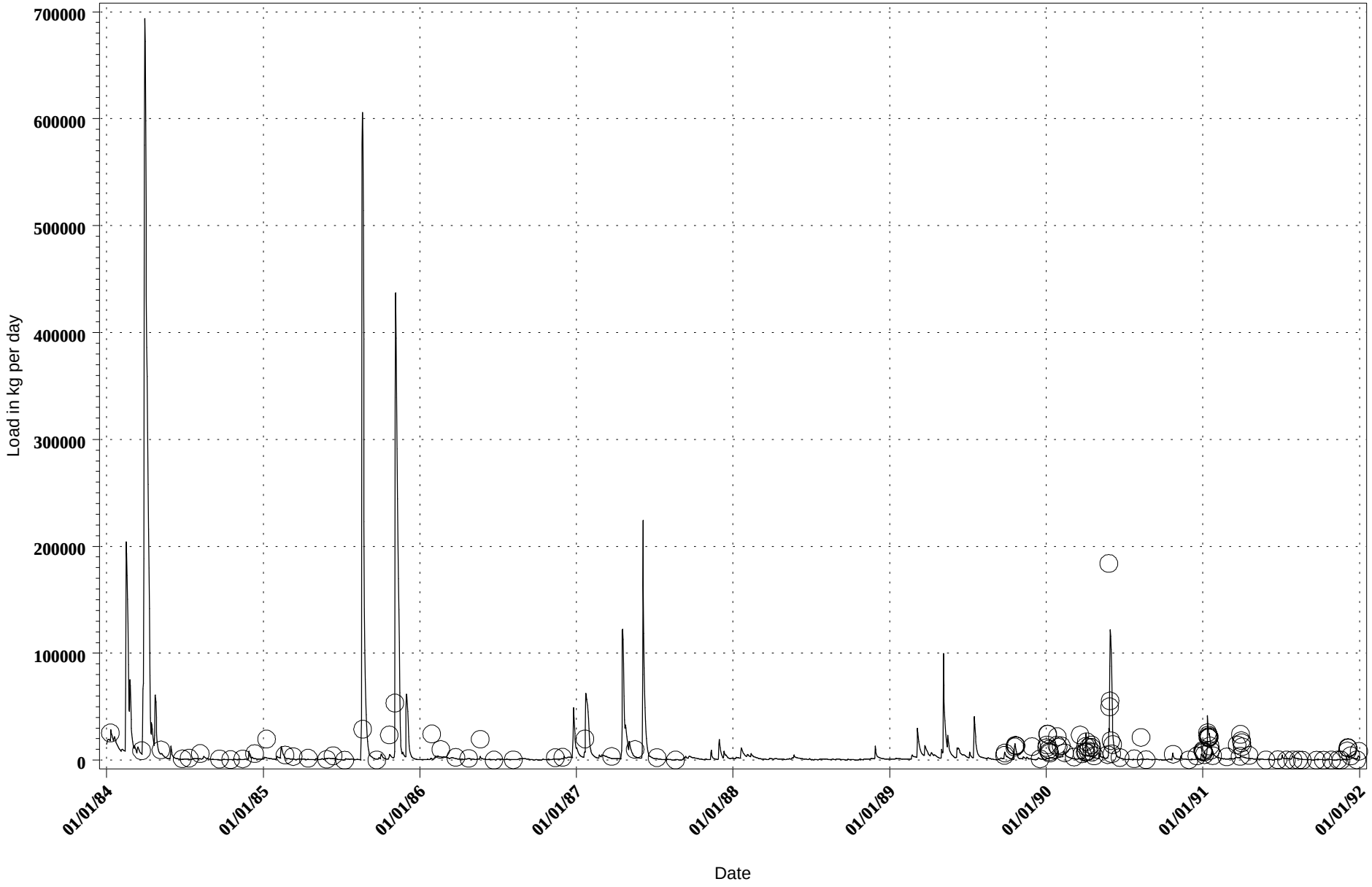



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240

## Total Suspended Sediment Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

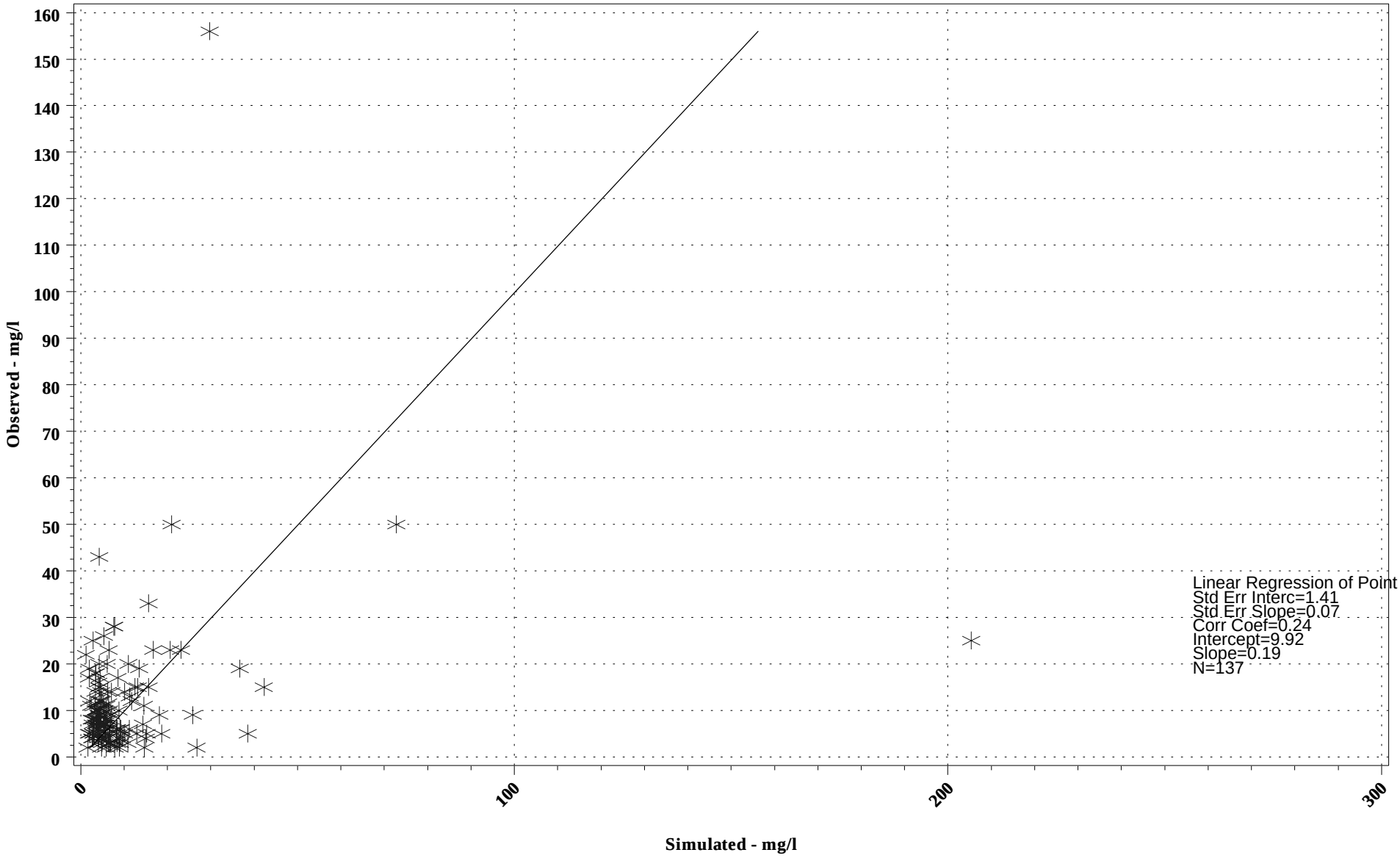



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240

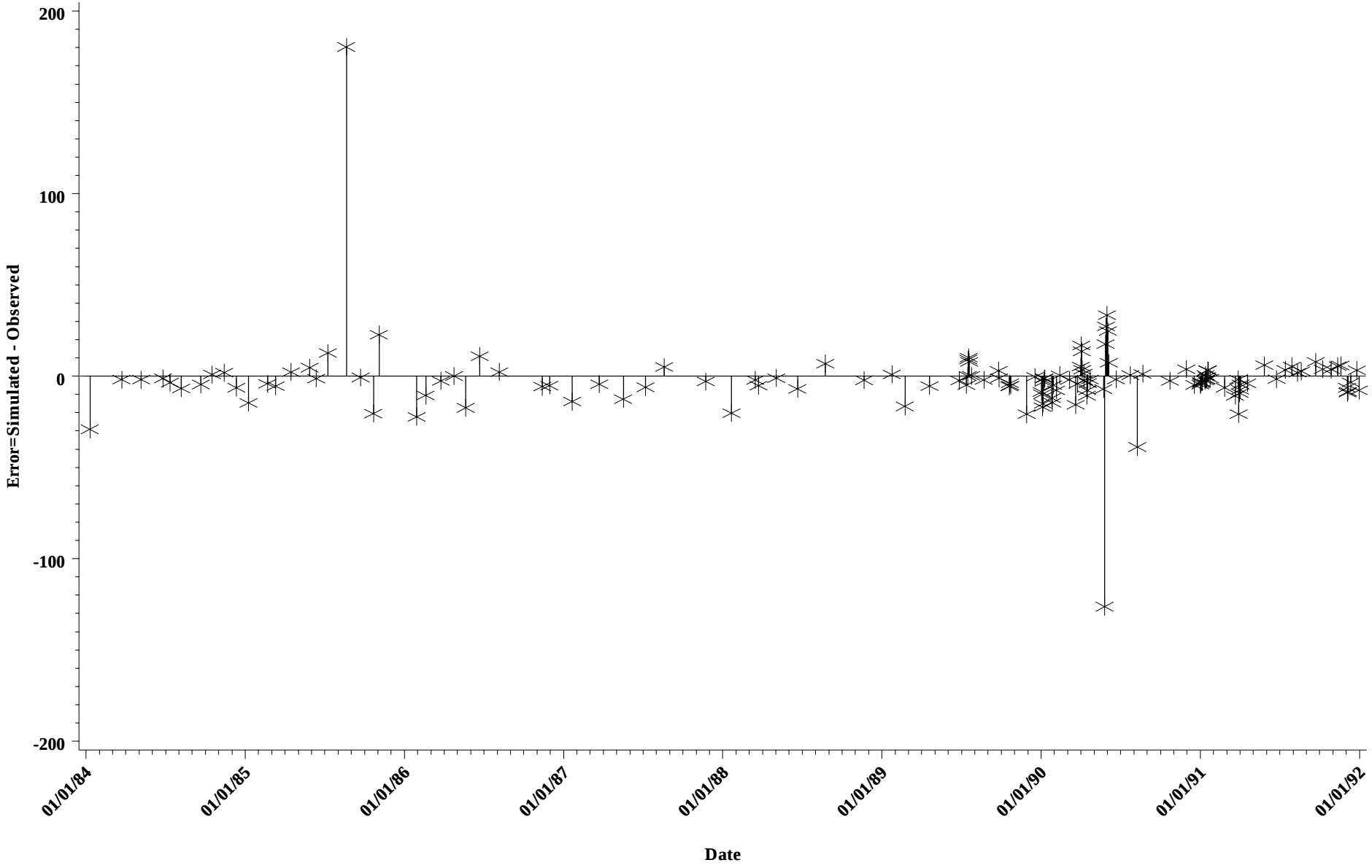
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



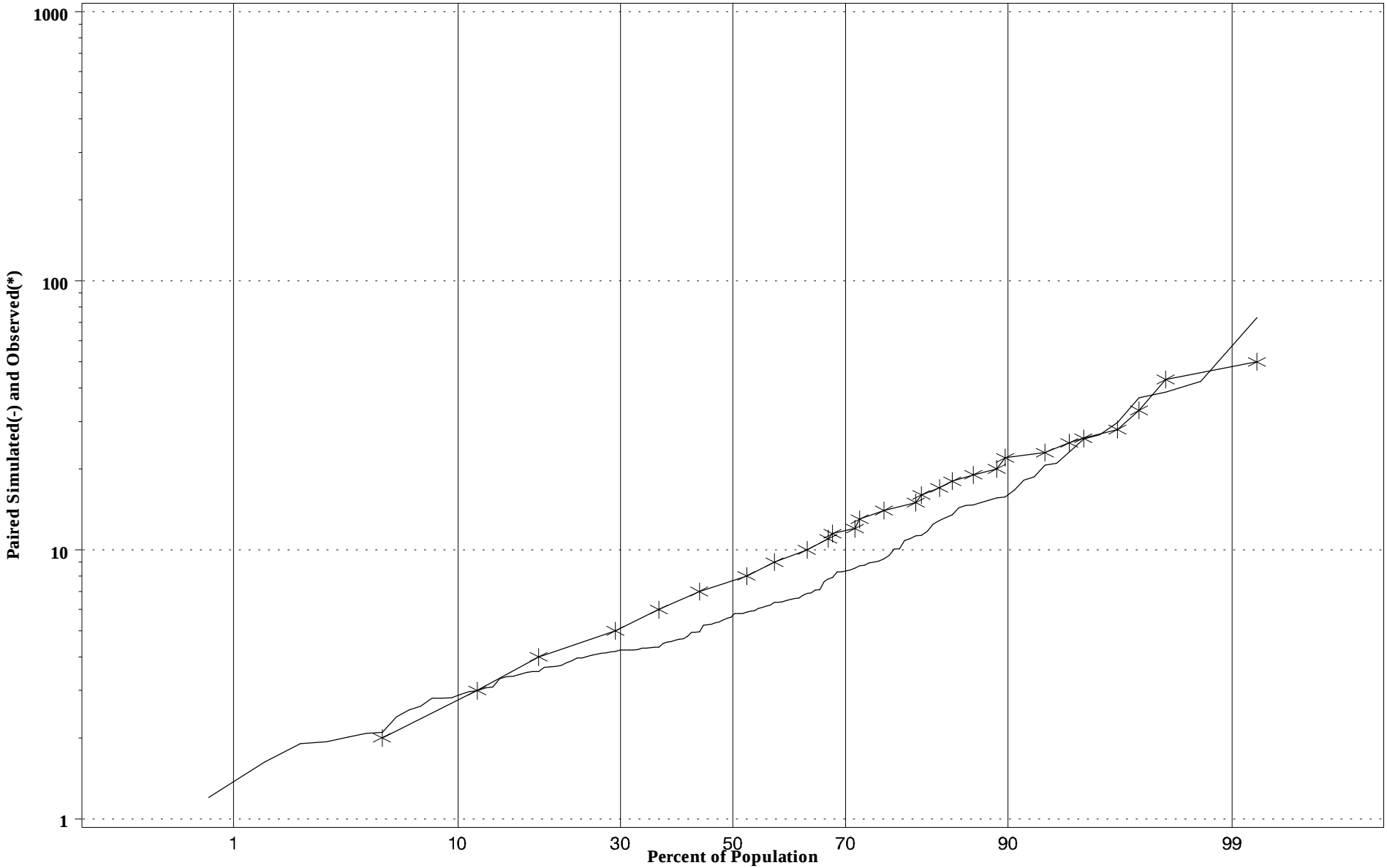

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(matta240.drv 26JUN98 16:08)

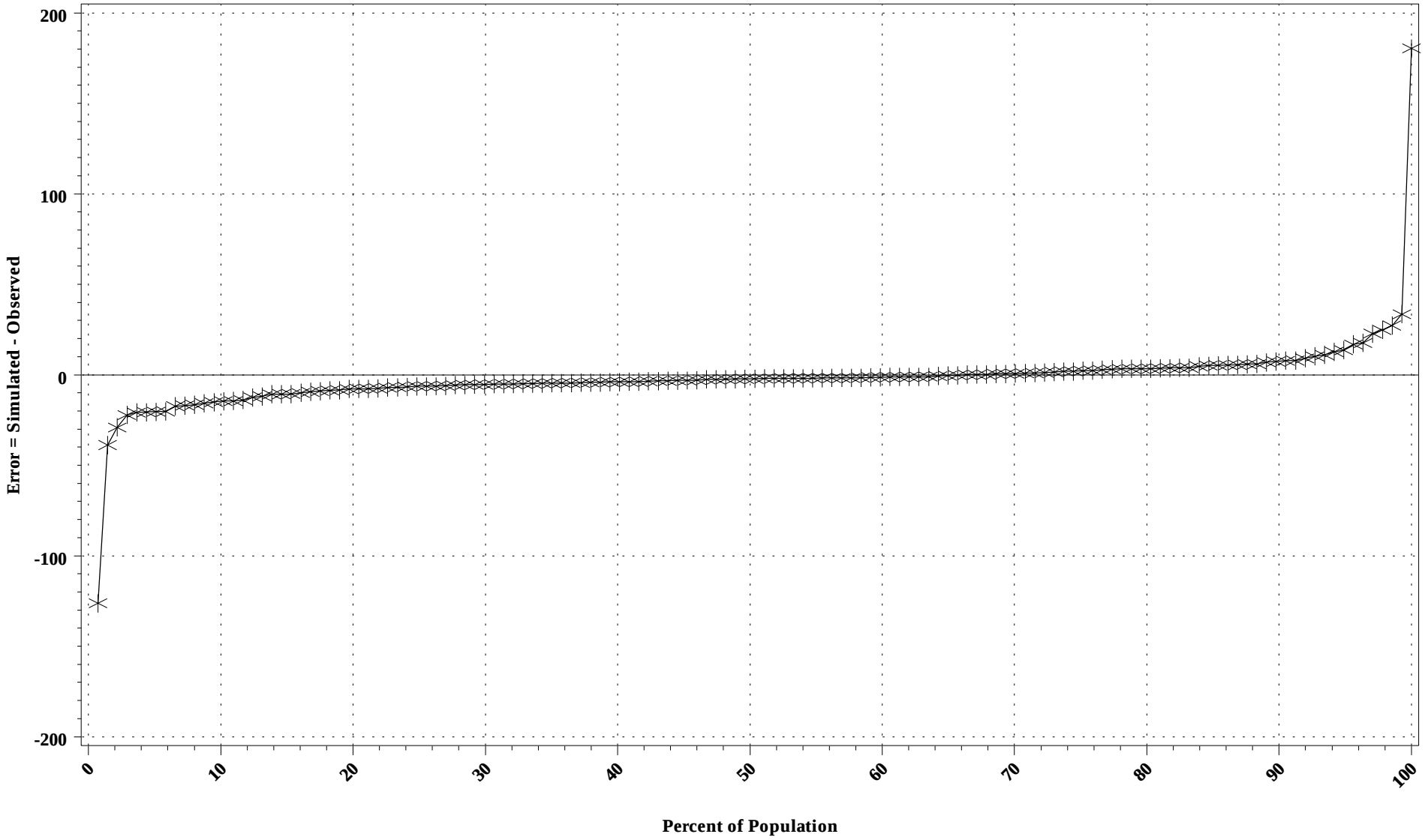
# Mattaponi River at Segment 240
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

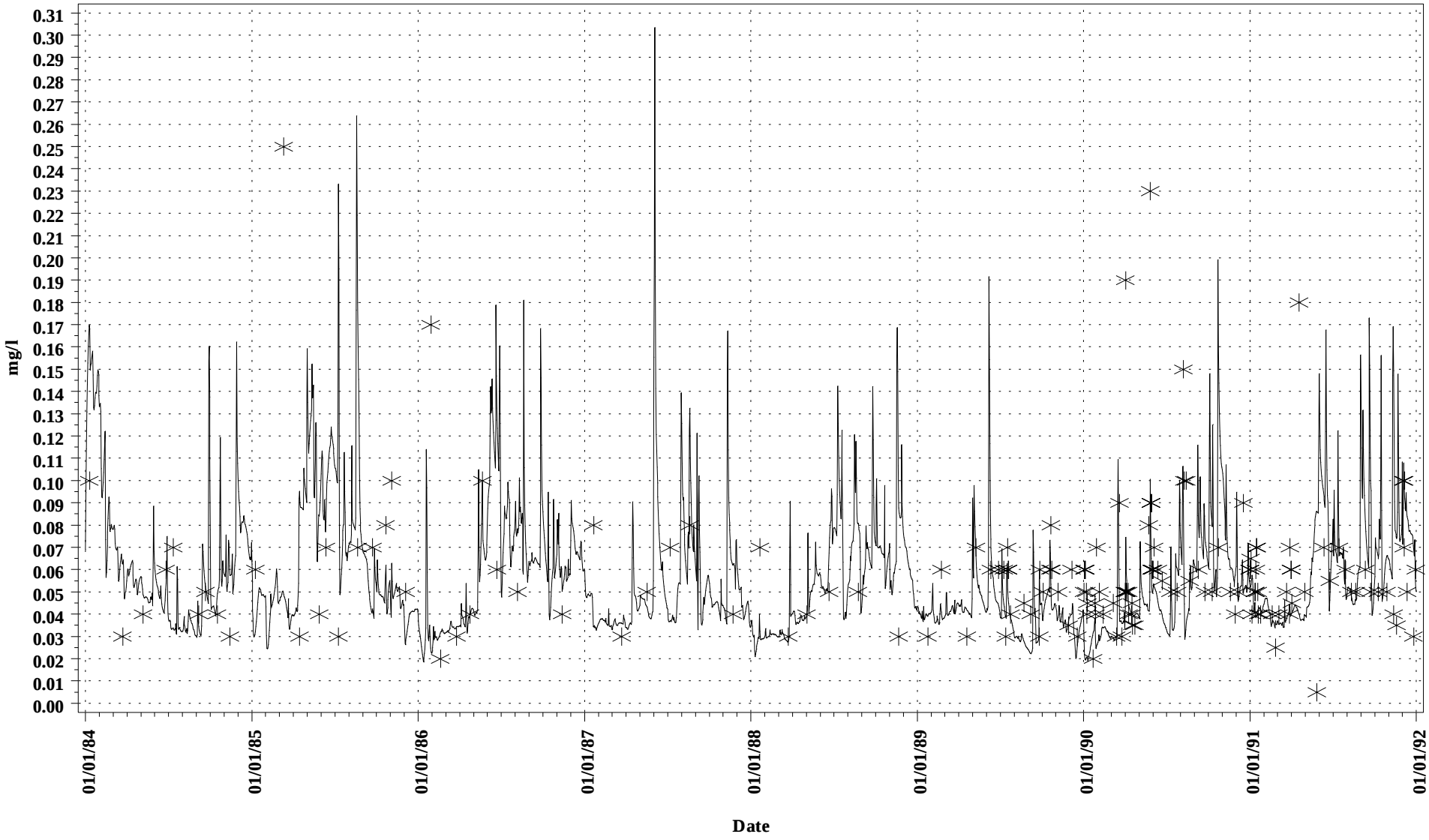
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(matta240.drv 26JUN98 16:08)

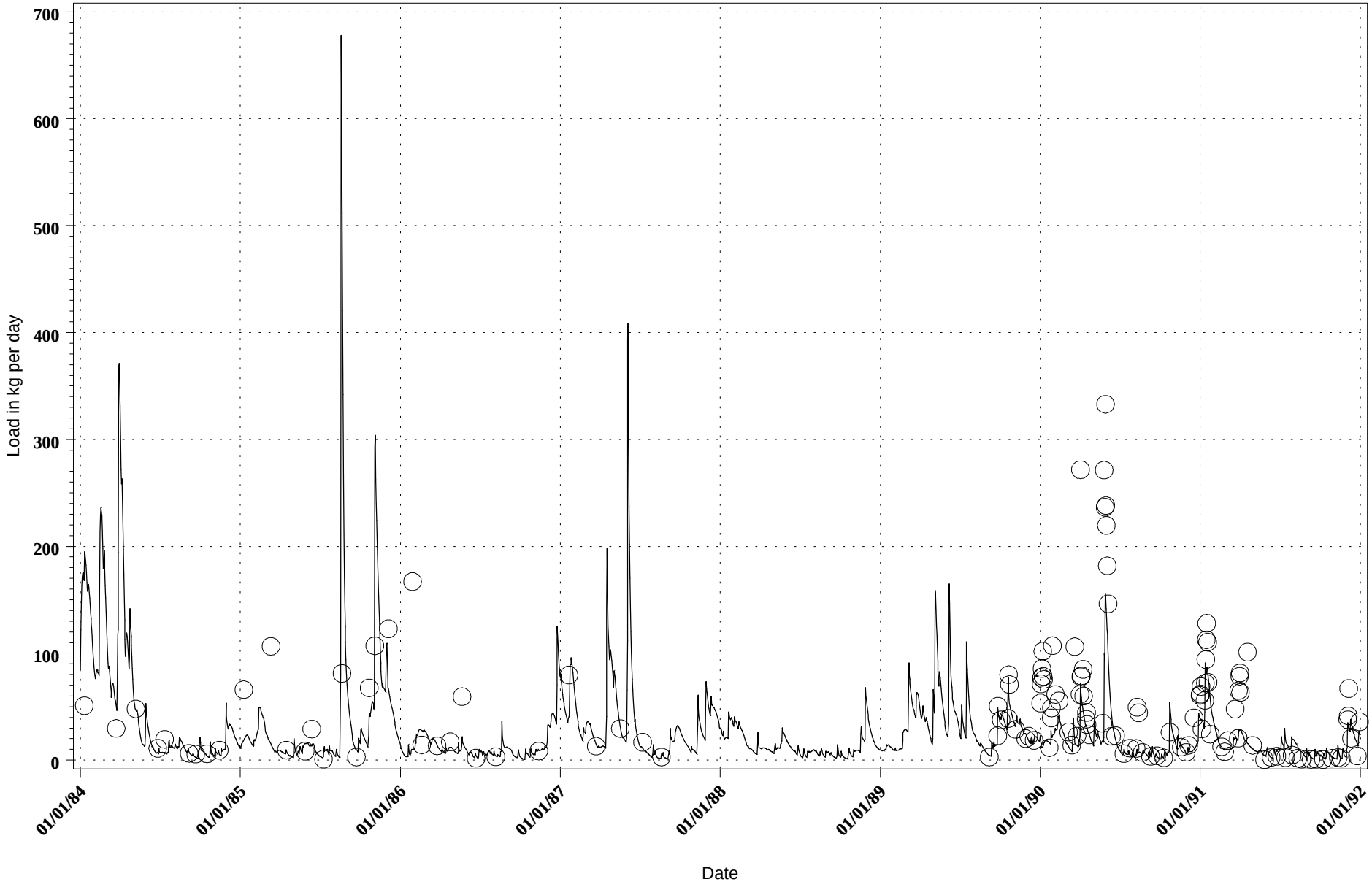
# Mattaponi River at Segment 240
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

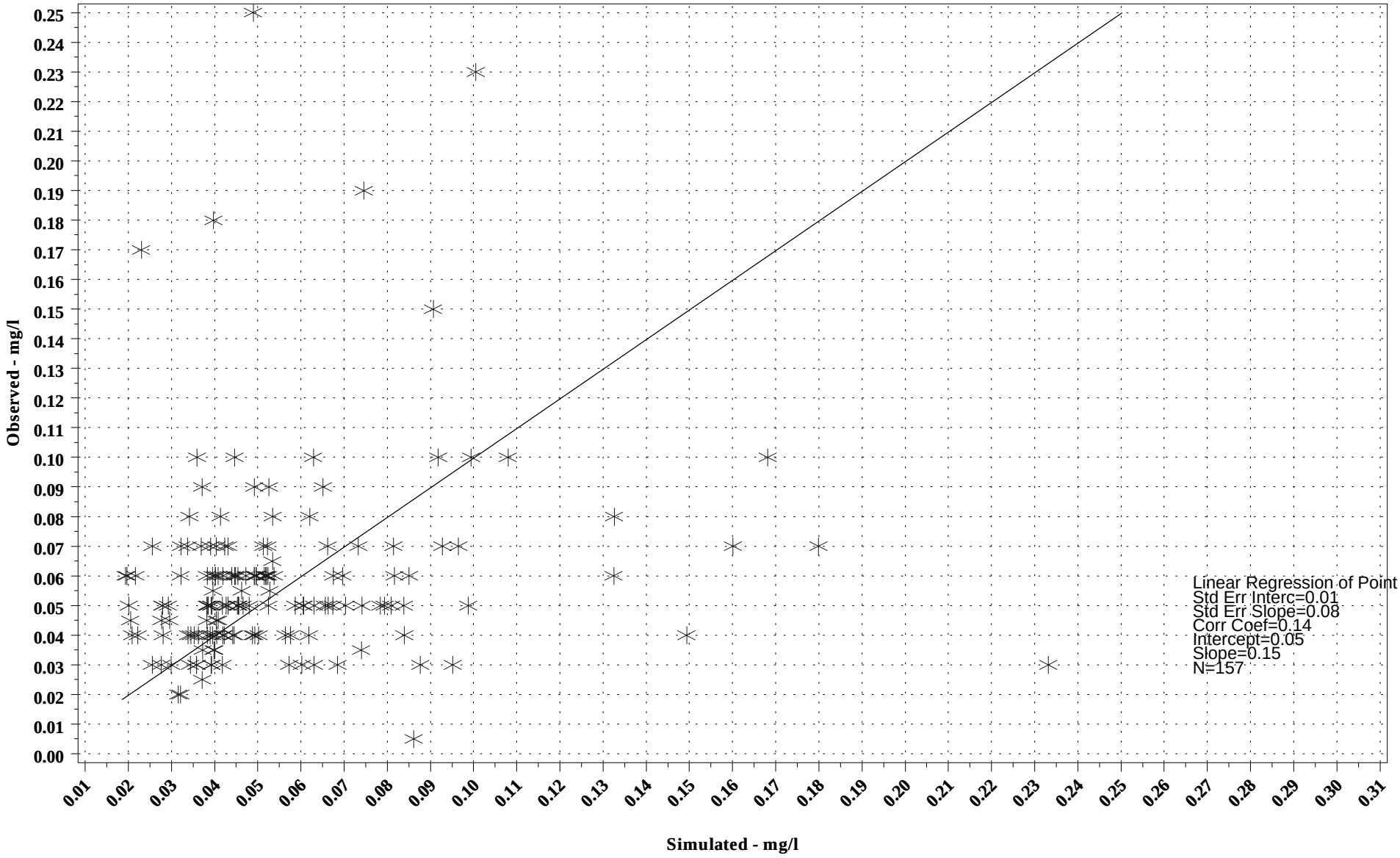



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240

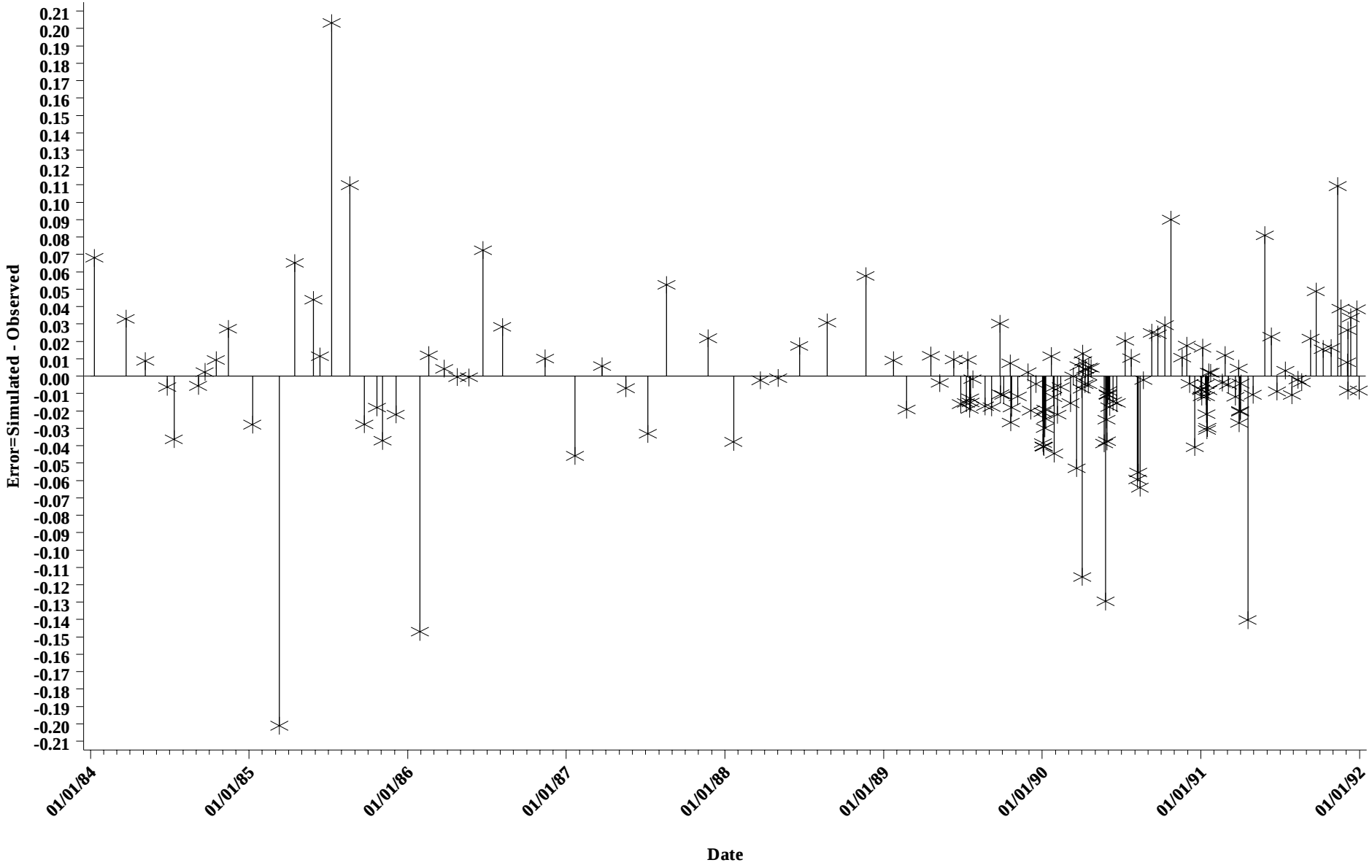
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



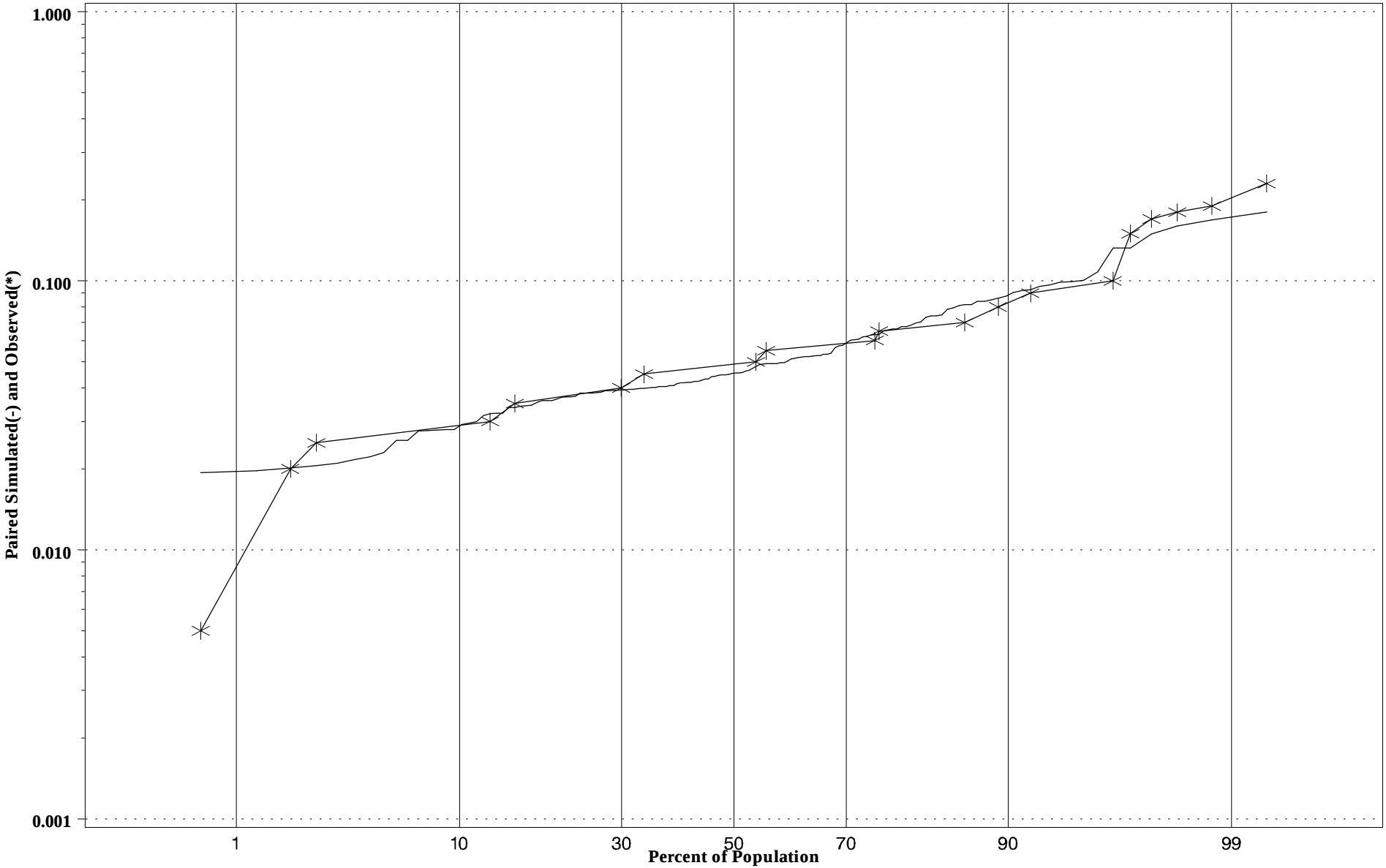

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(matta240.drv 26JUN98 16:08)

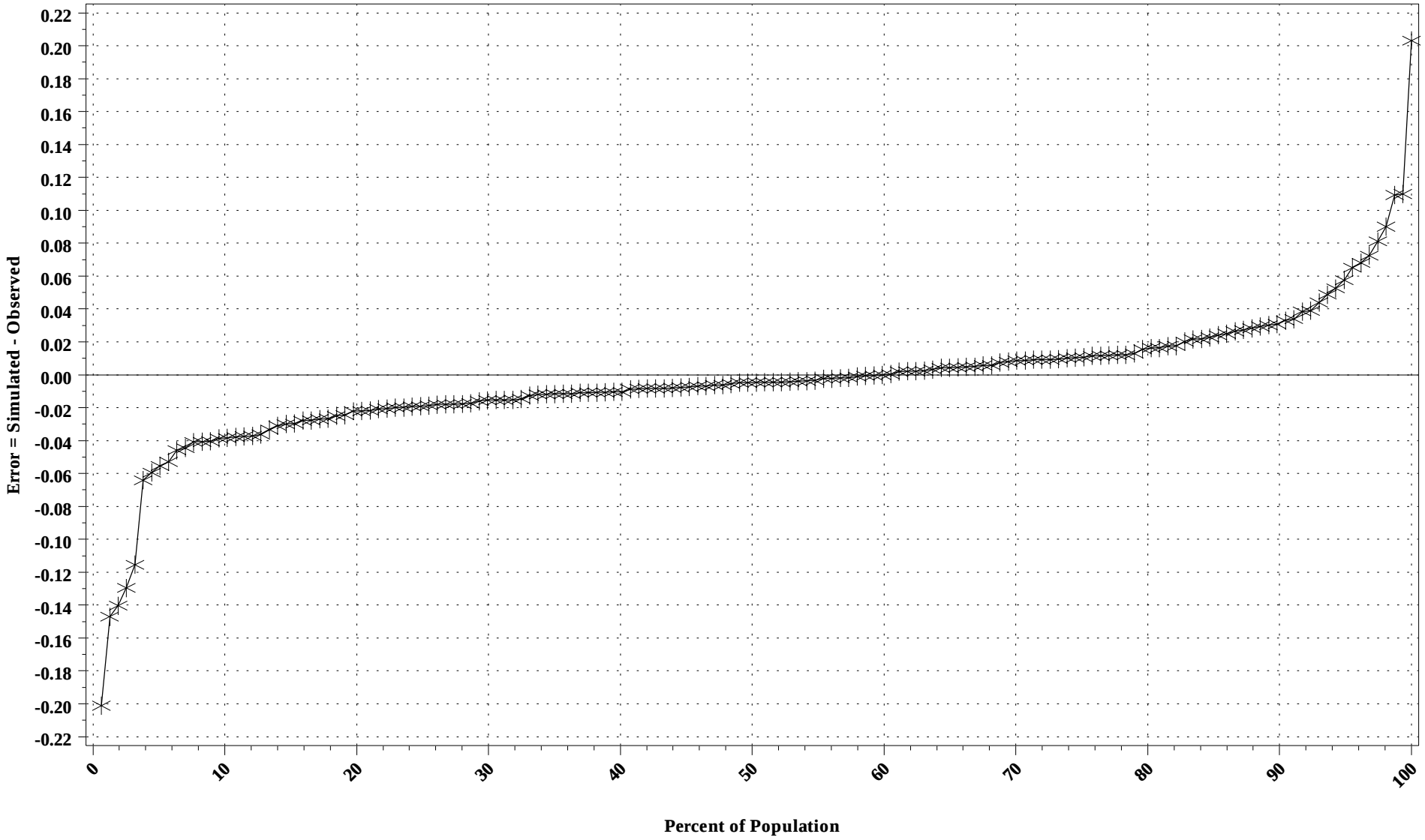
# Mattaponi River at Segment 240
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Actual error versus Percentile Sample Population
## Total Phosphorus

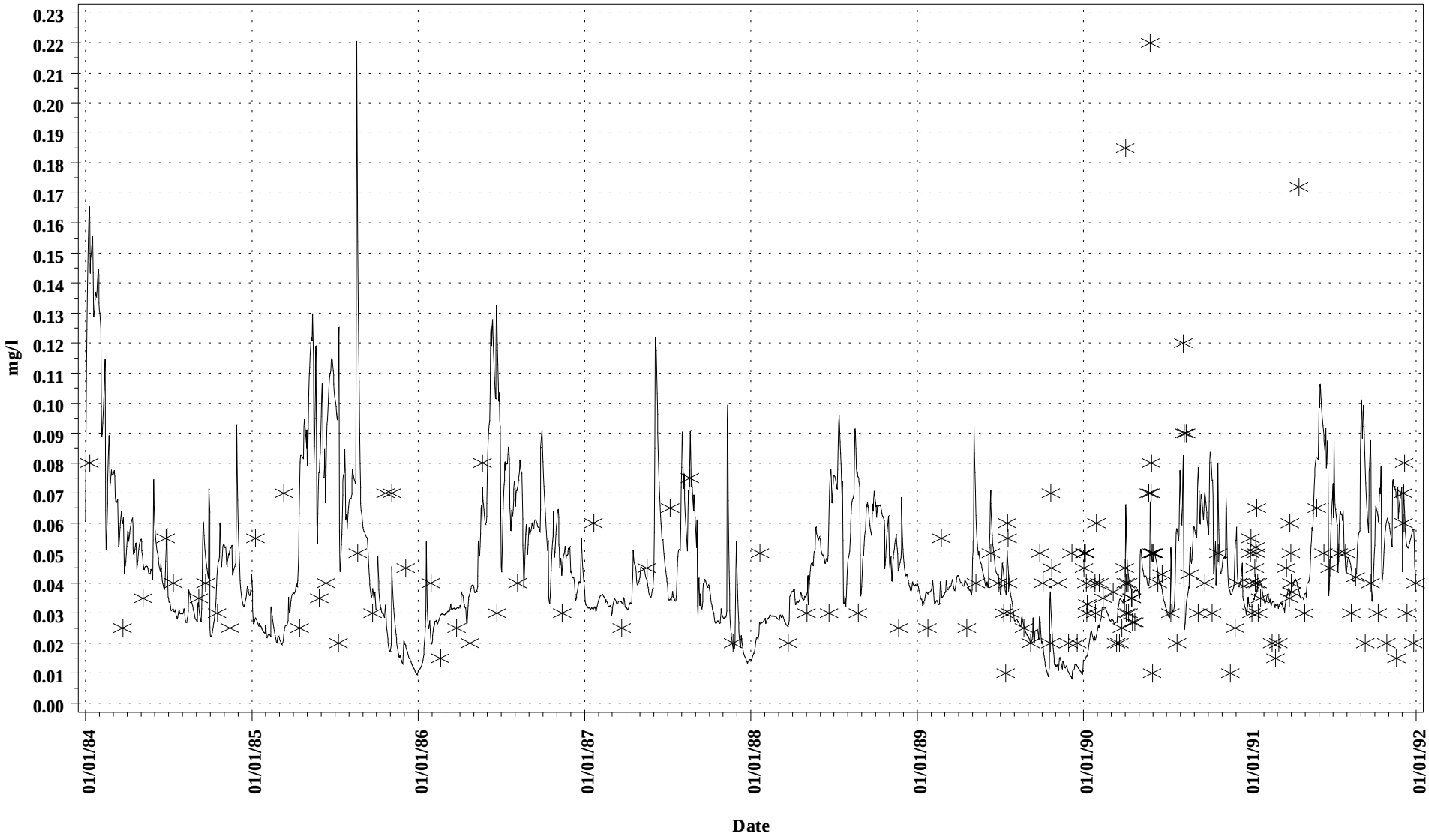
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

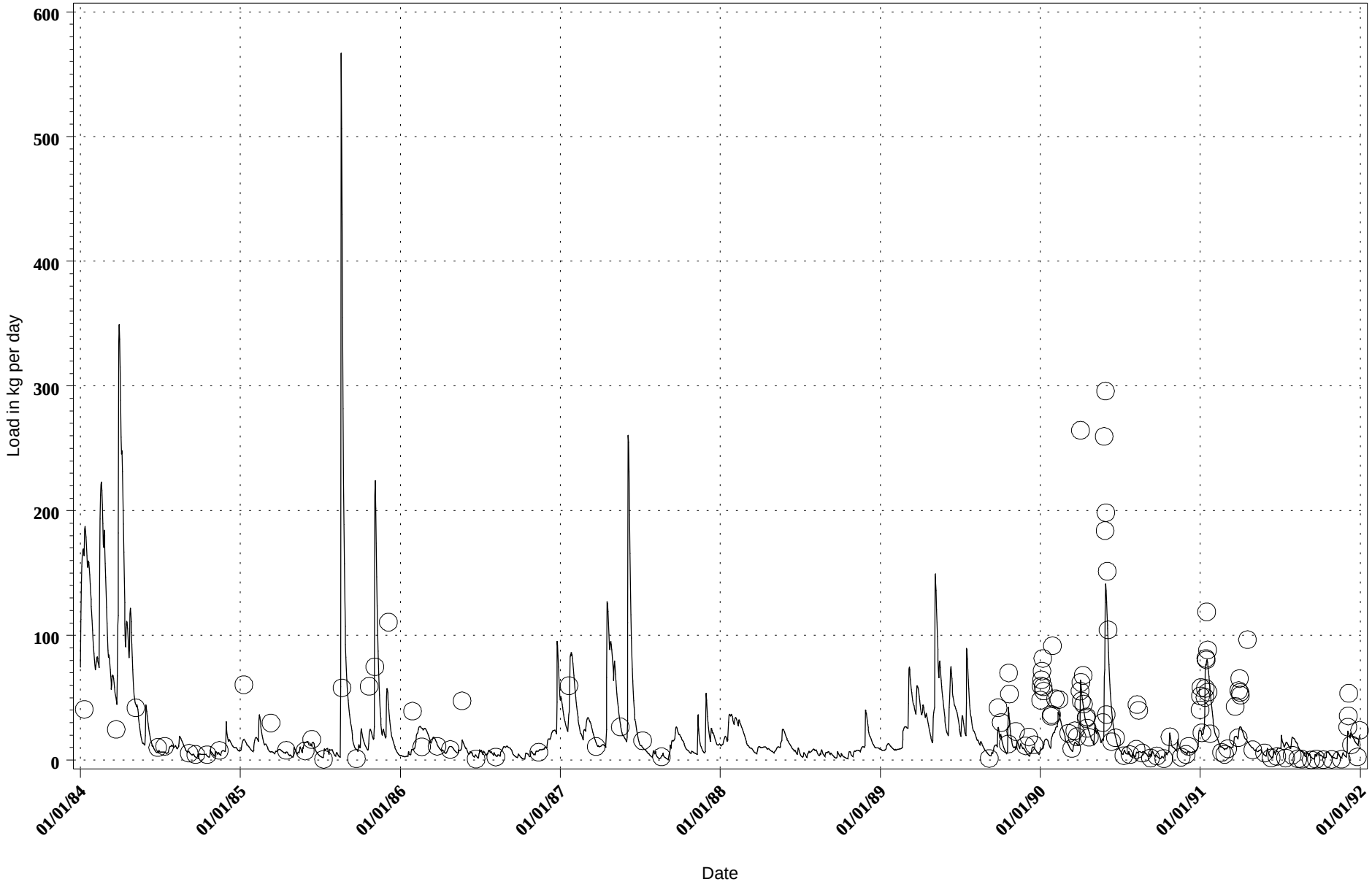



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

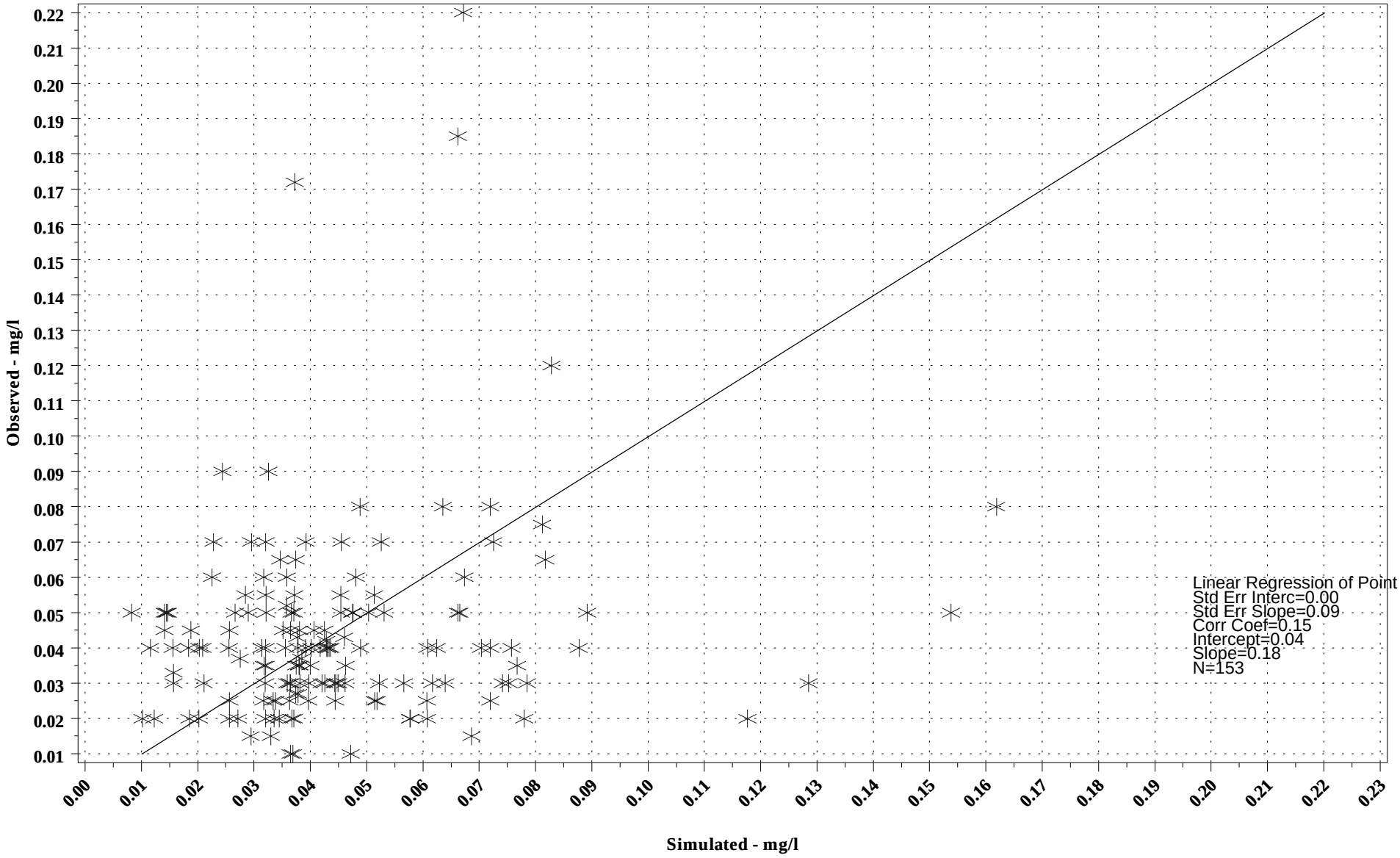



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240

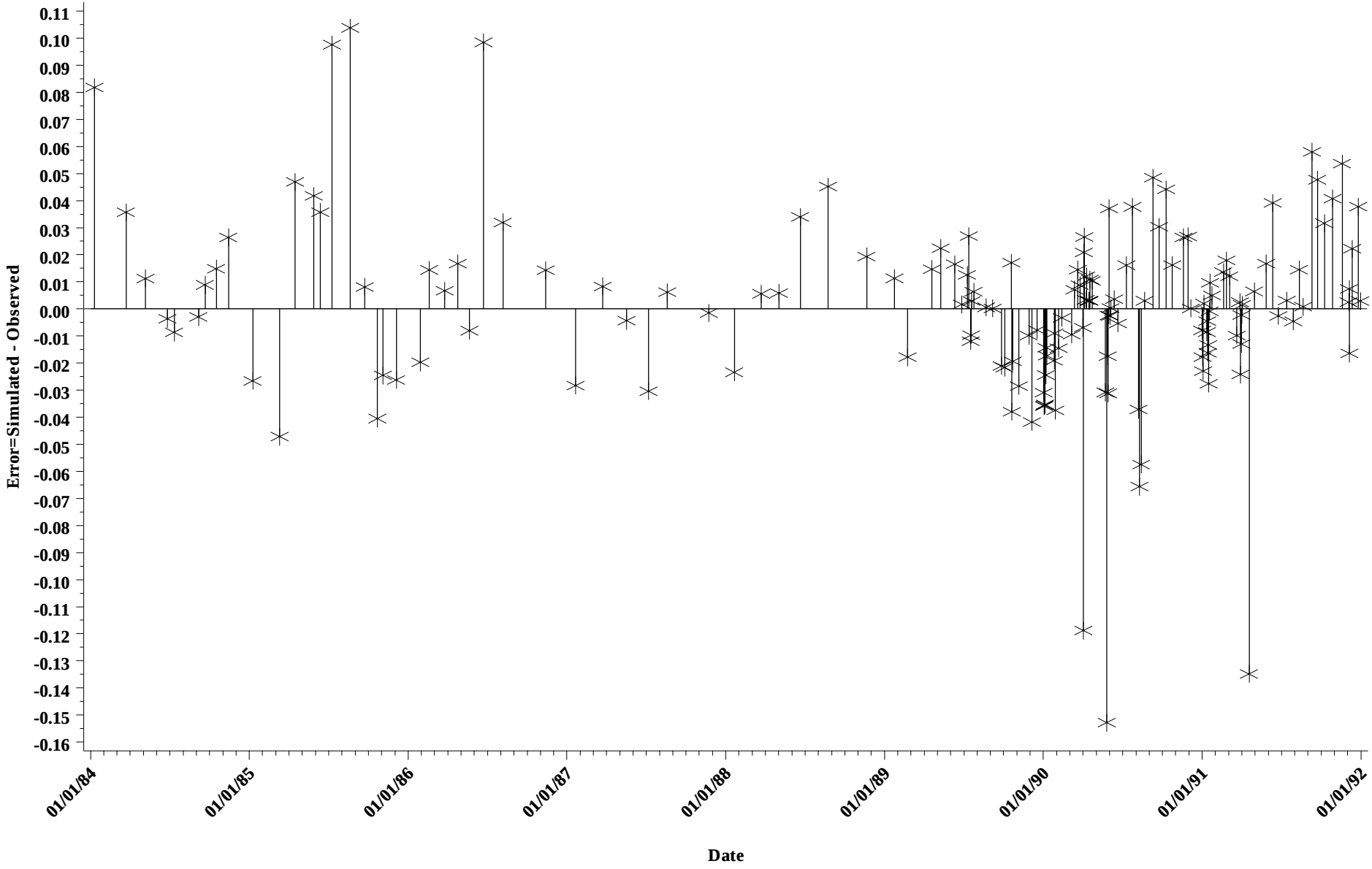
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240
## Actual Error versus Time
## Organic and Particulate Phosphorus

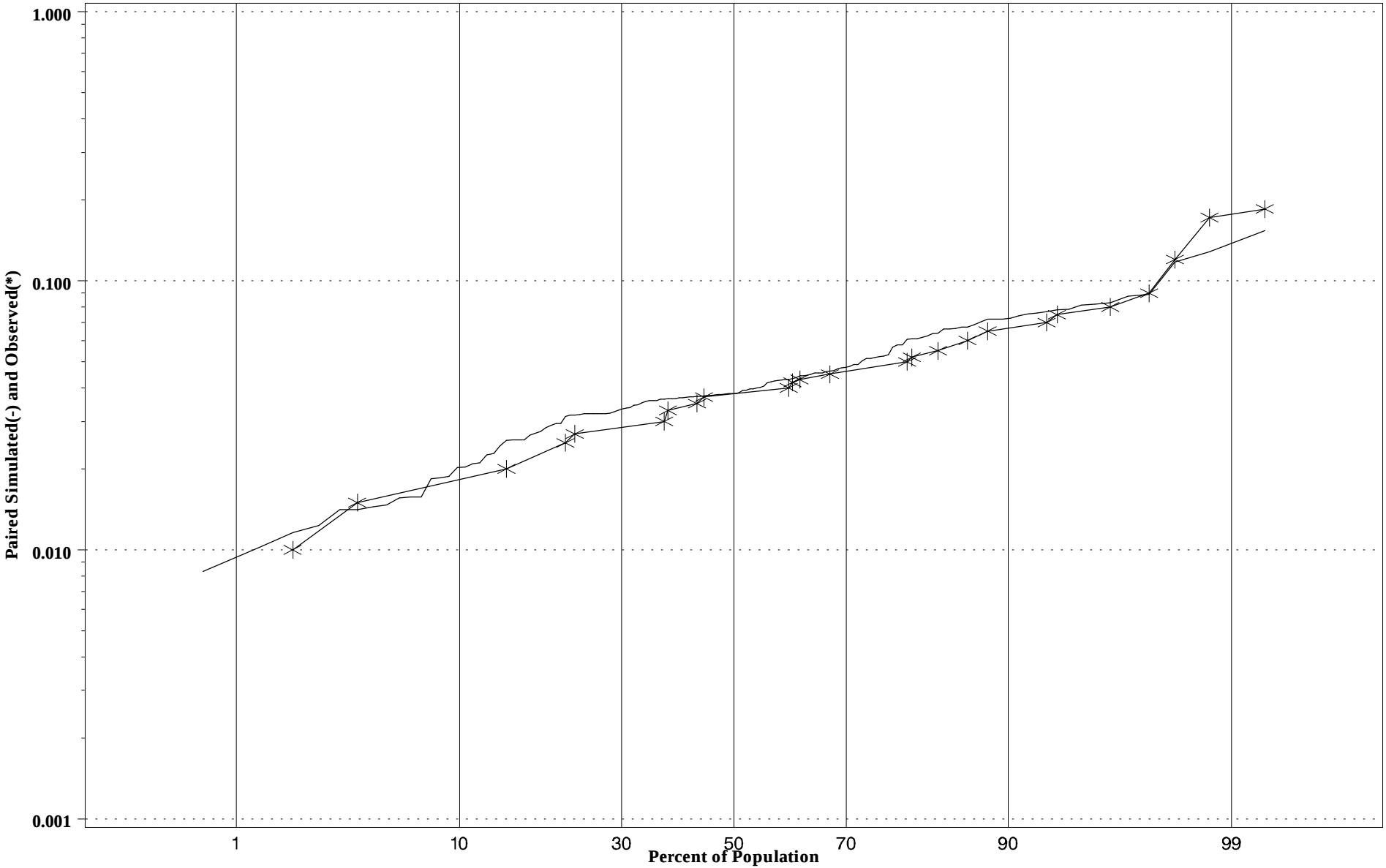



(y21_plotb.sas model3d:[pwang.dt] omerr)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240

## Organic and Particulate Phosphorus

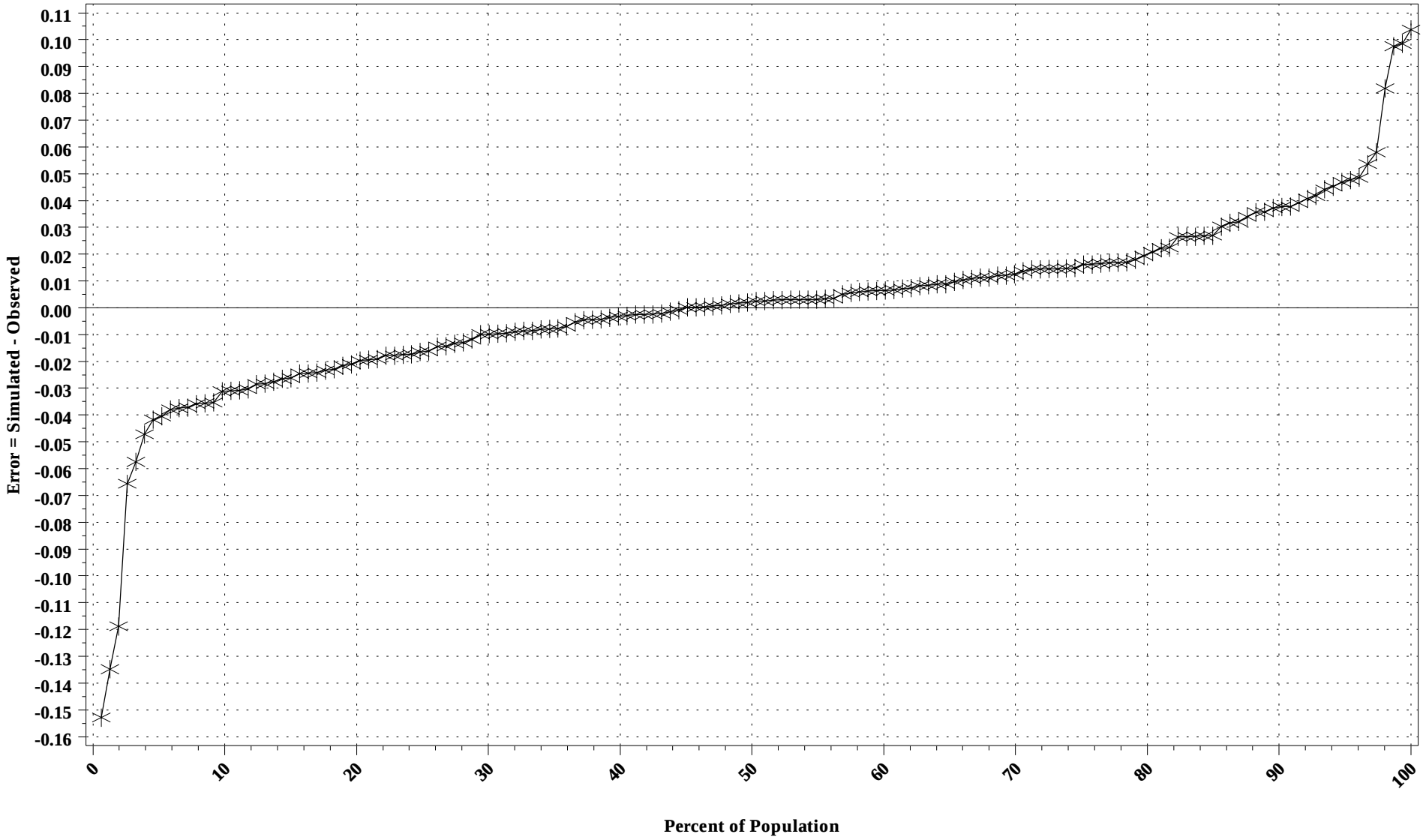
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

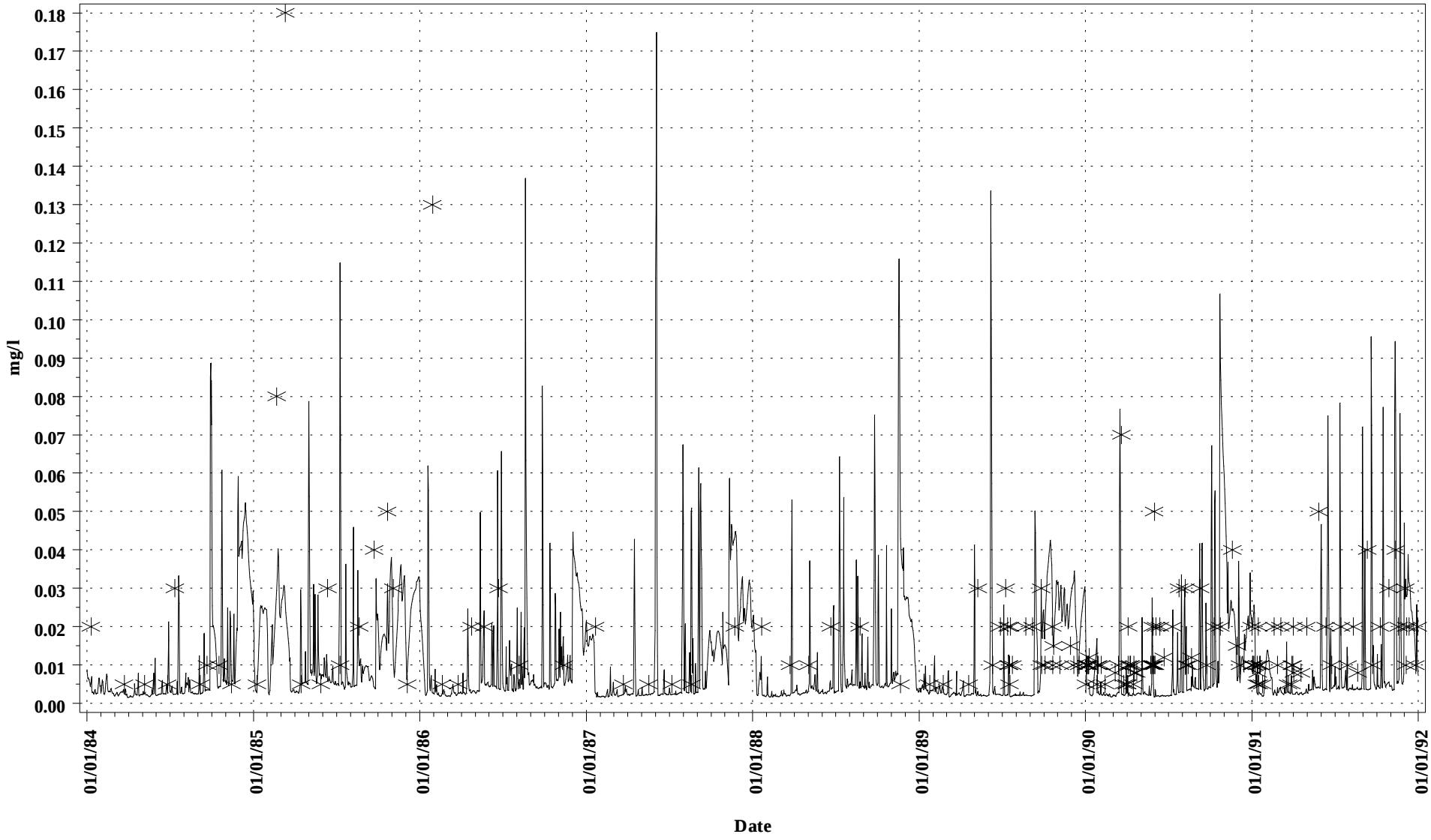
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Observed and Simulated versus Time
# Dissolved Phosphorus

**(*=Observed, -=Simulated)**

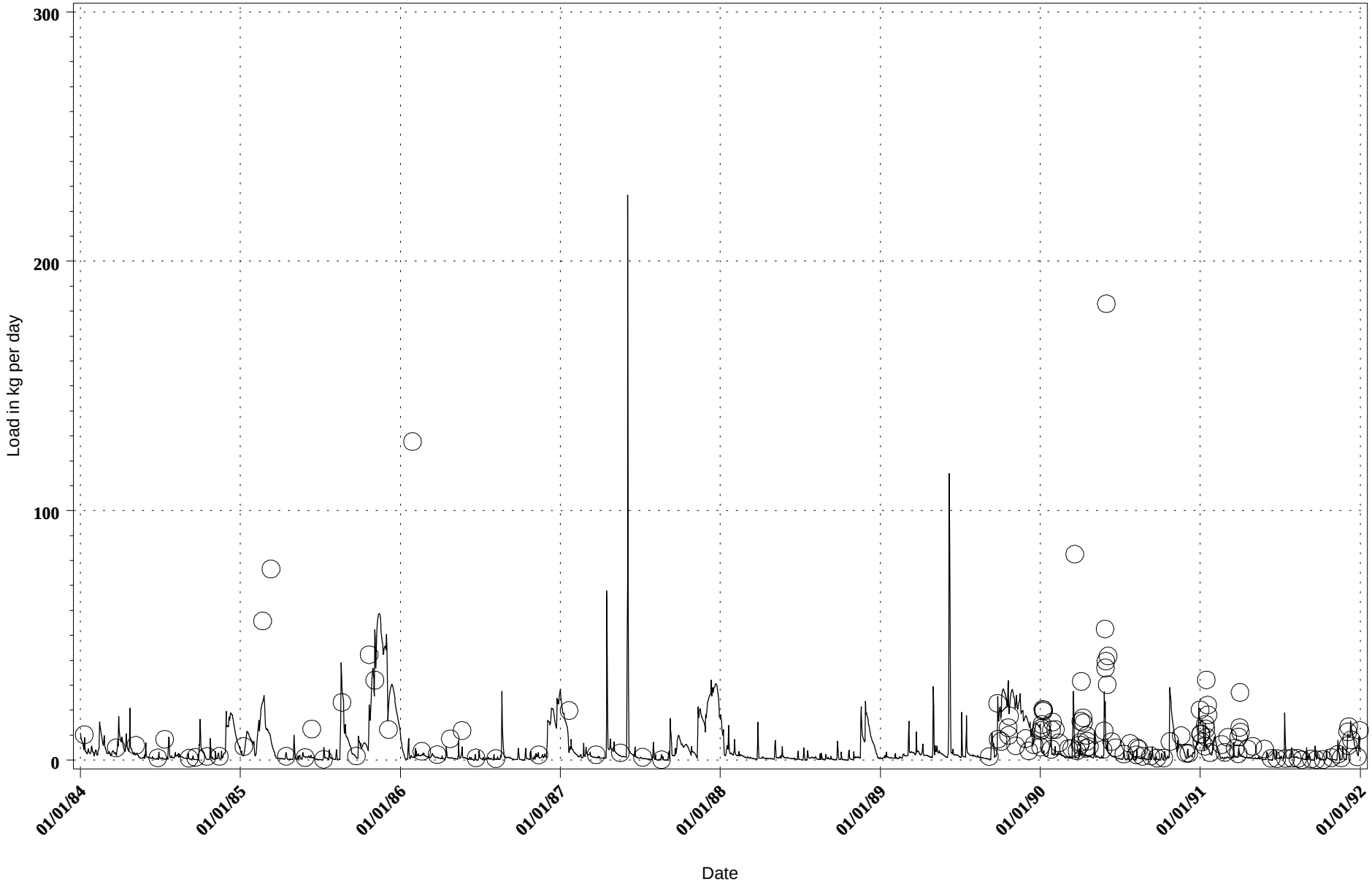



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240

## Dissolved Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

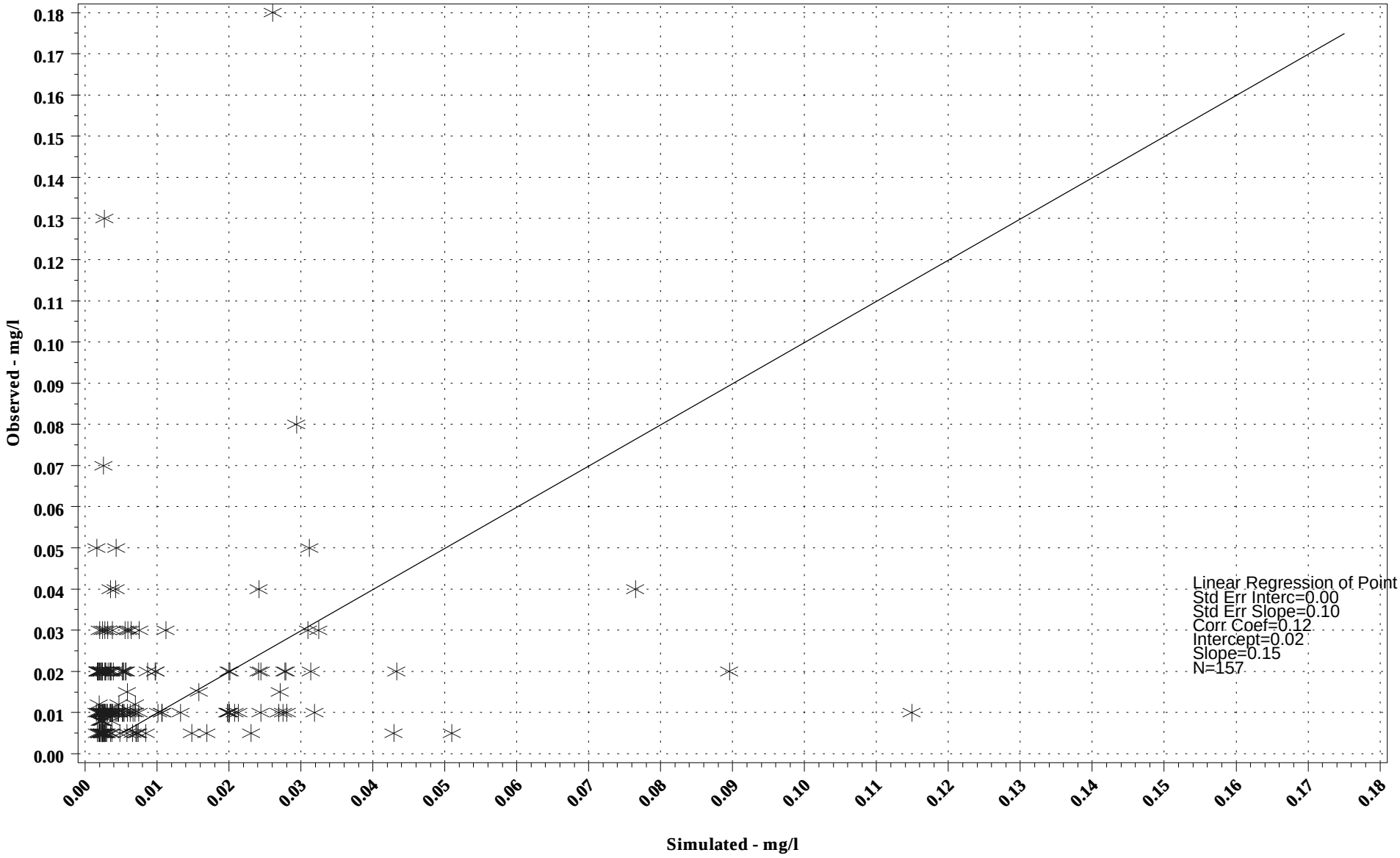



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240

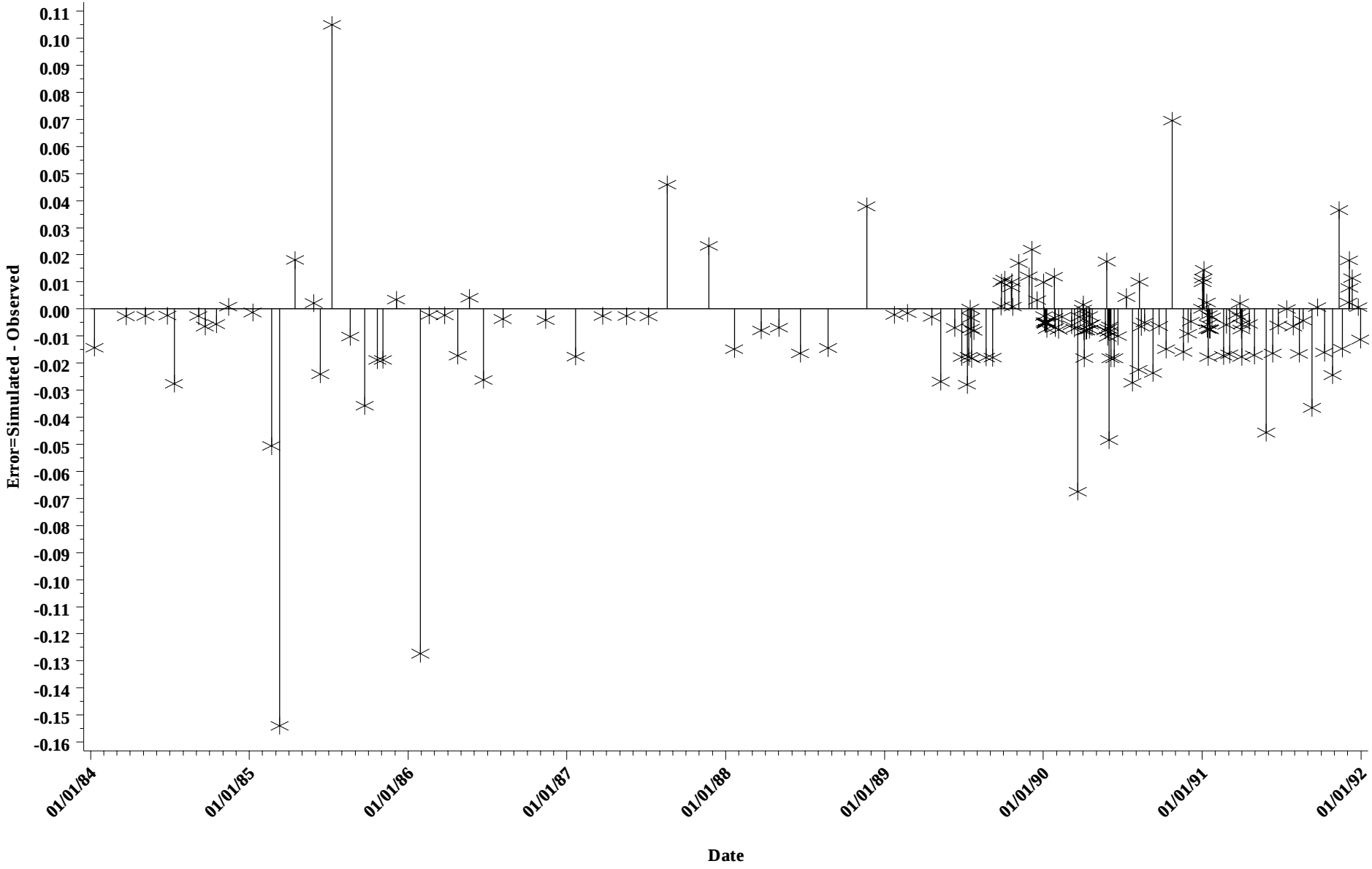
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



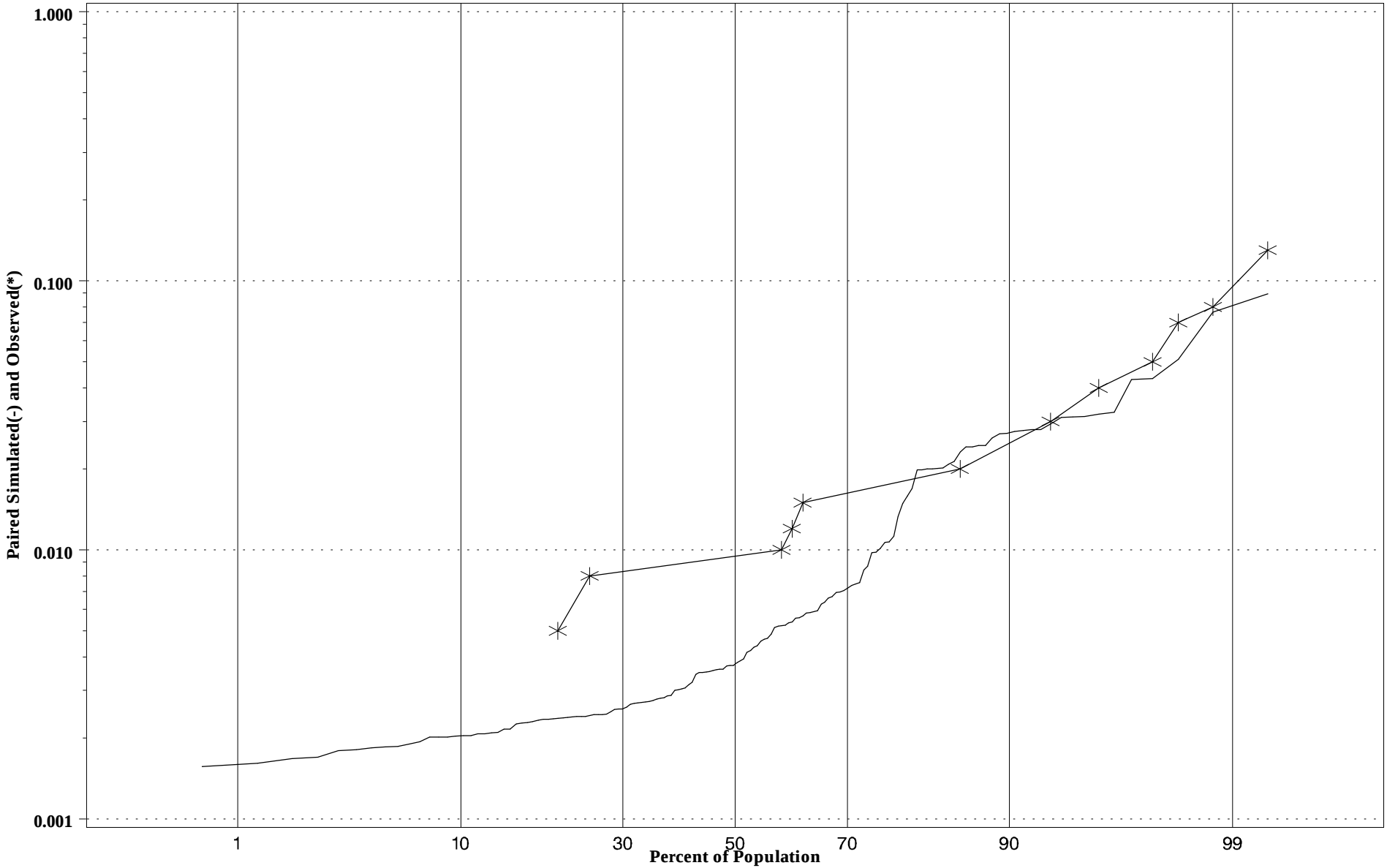

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(matta240.drv 26JUN98 16:08)

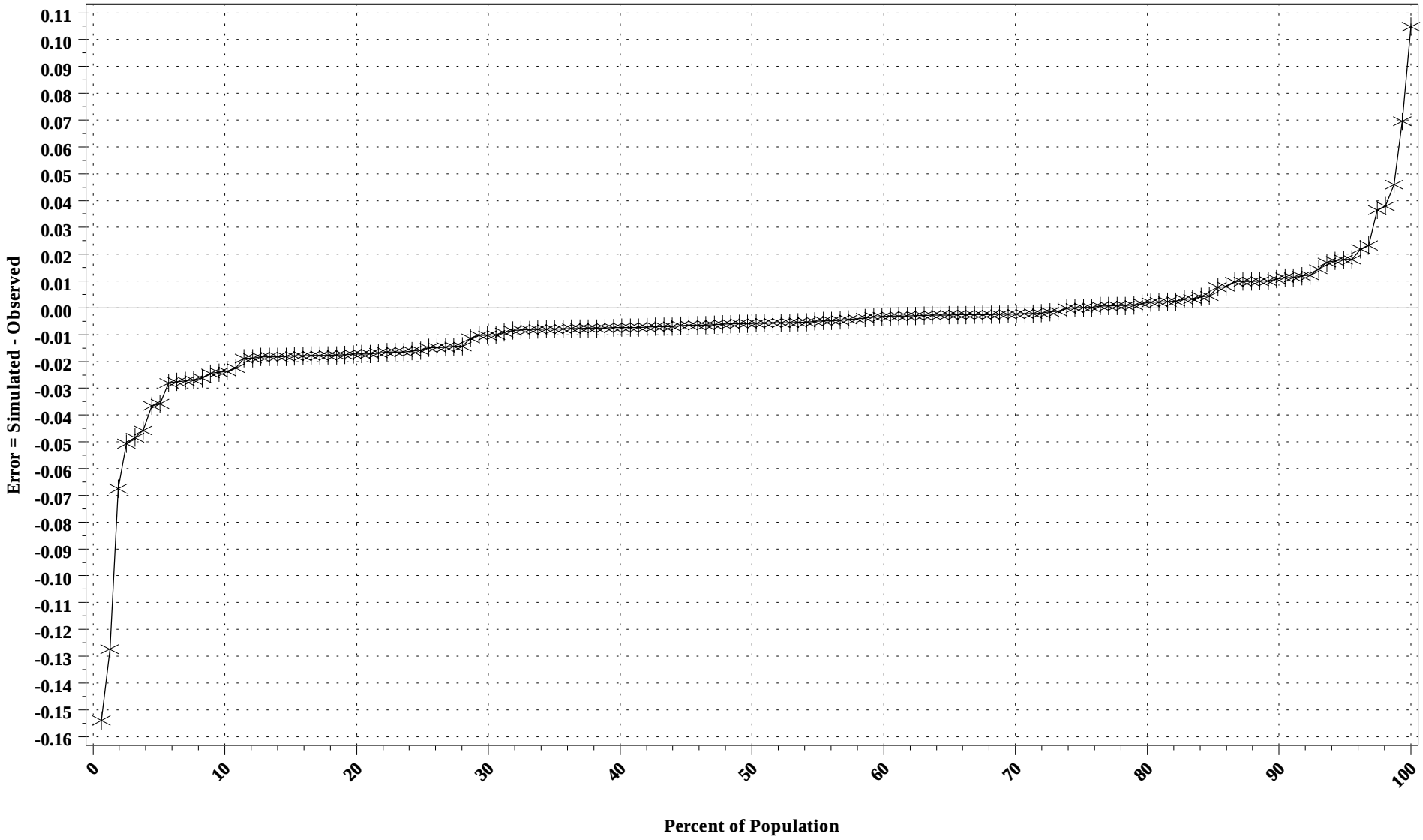
# Mattaponi River at Segment 240
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

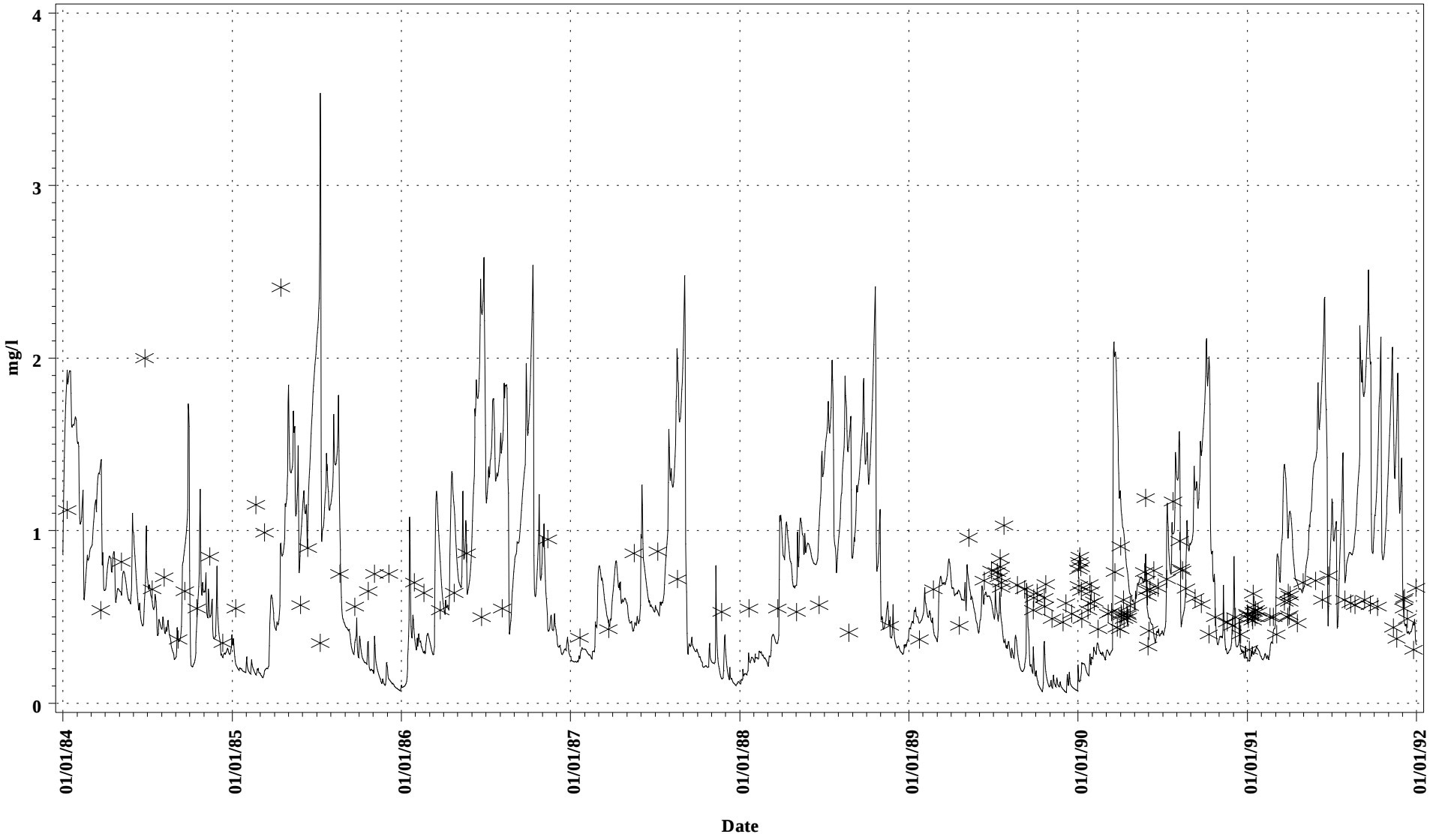
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**

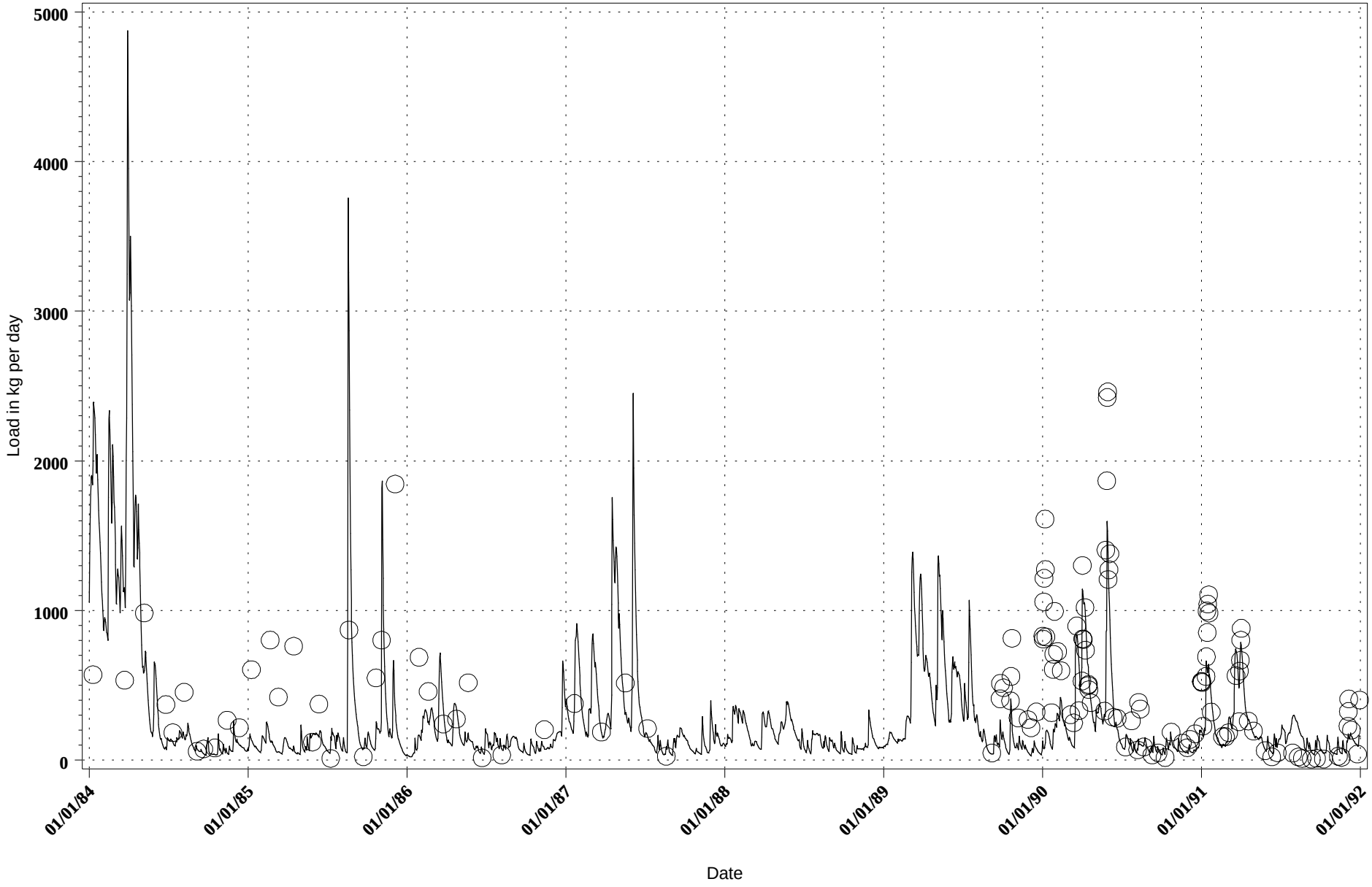



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240

## Total Nitrogen Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

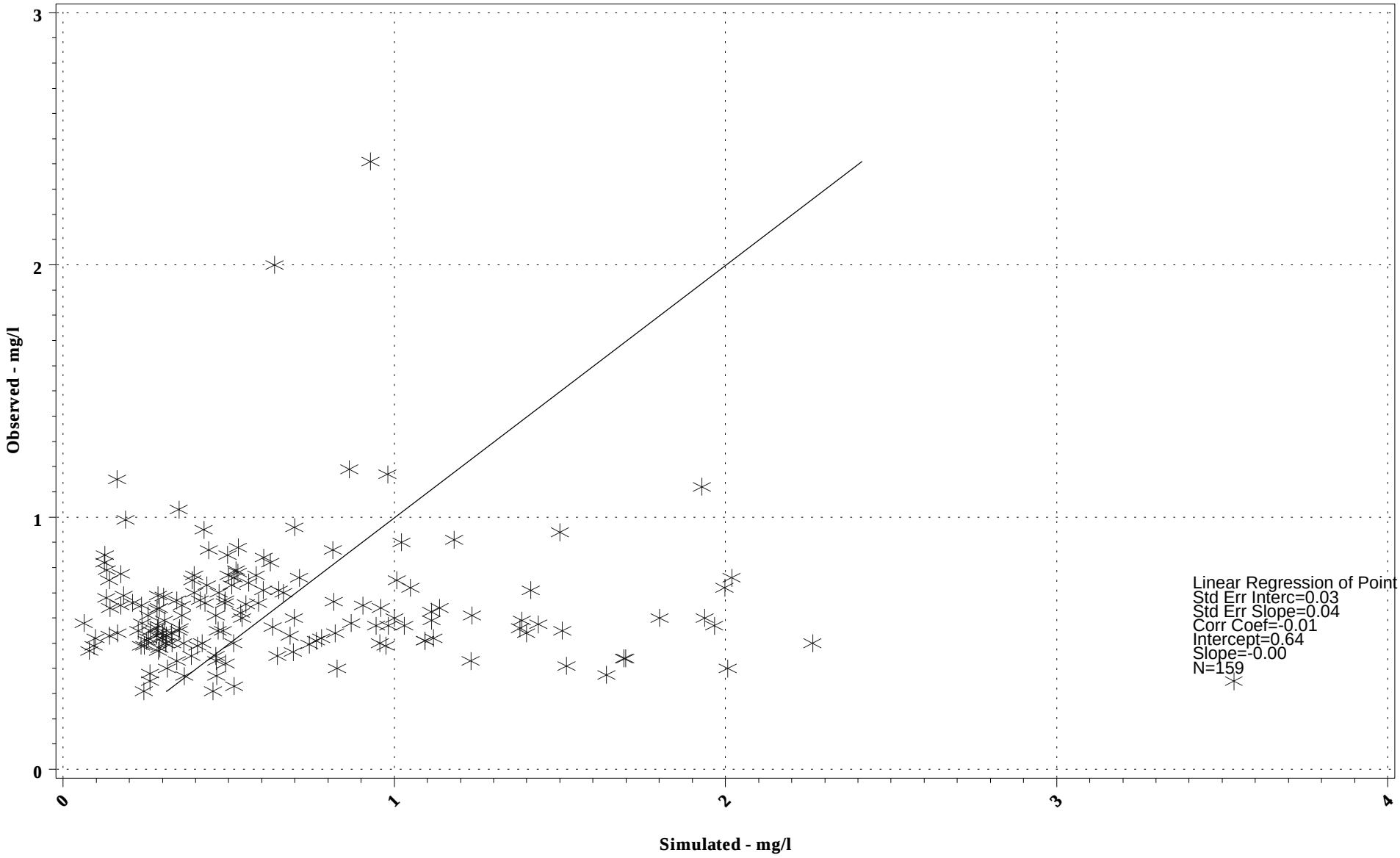



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240

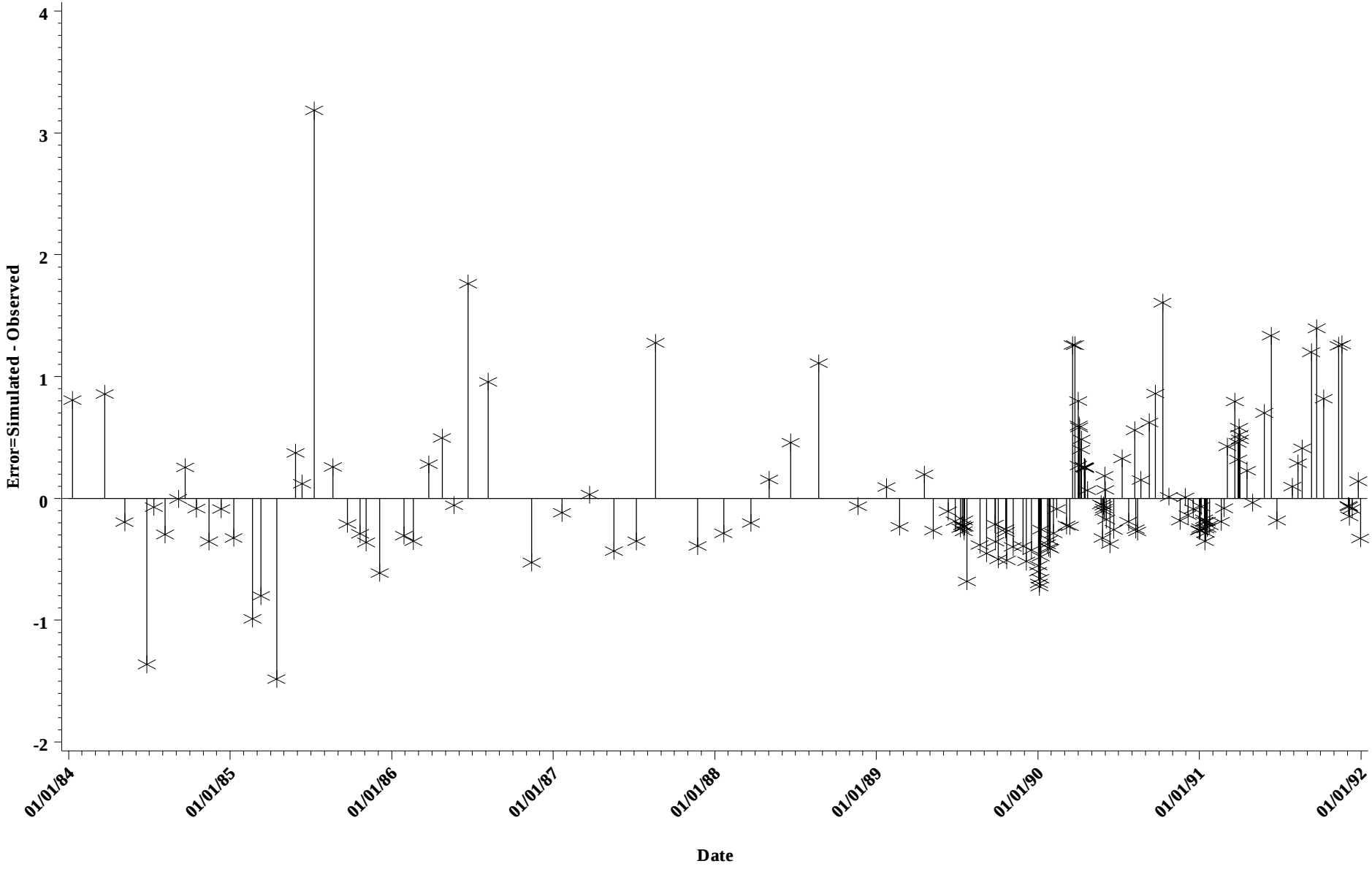
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92



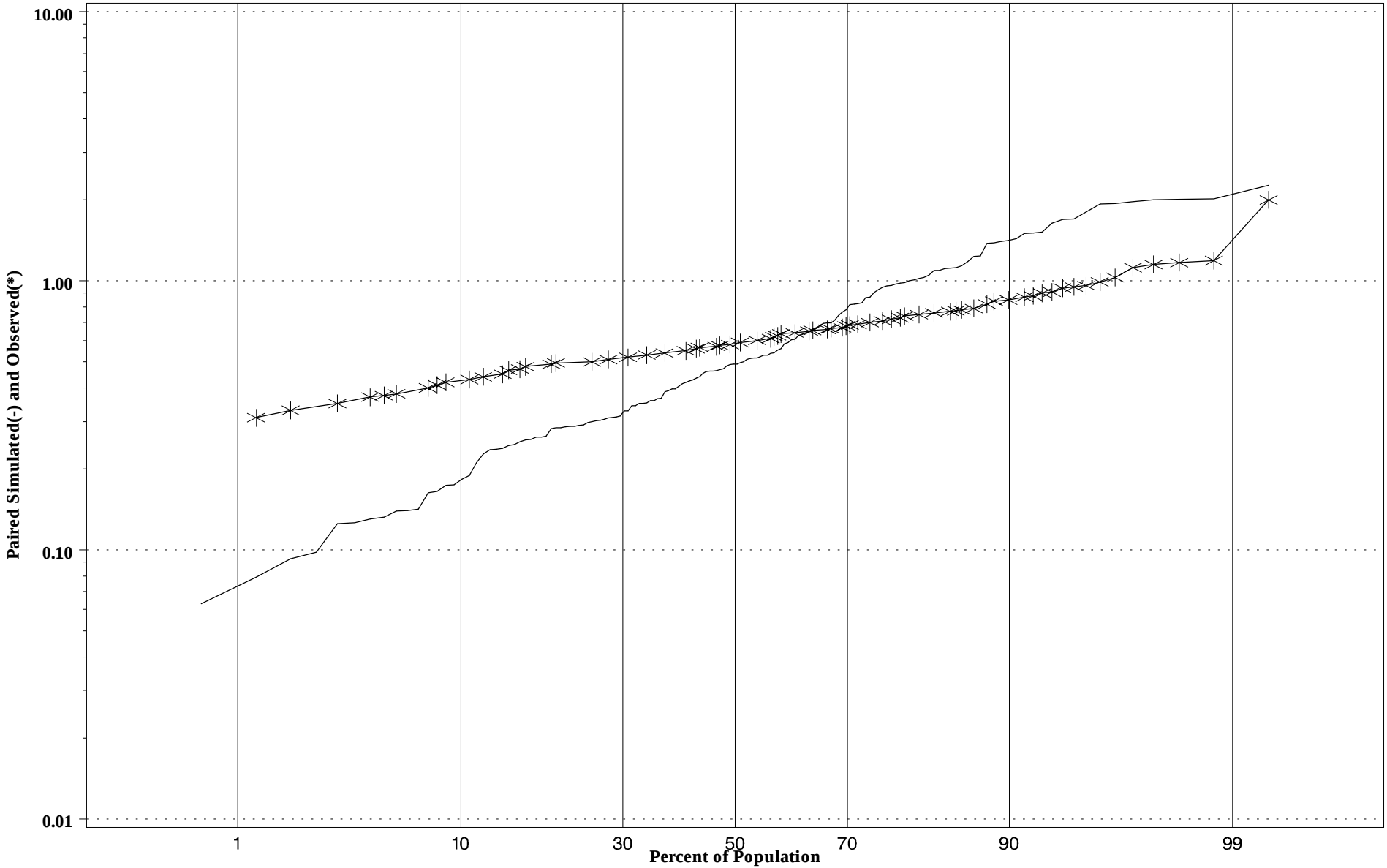

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240
## Actual Error versus Time
## Total Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(matta240.drv 26JUN98 16:08)

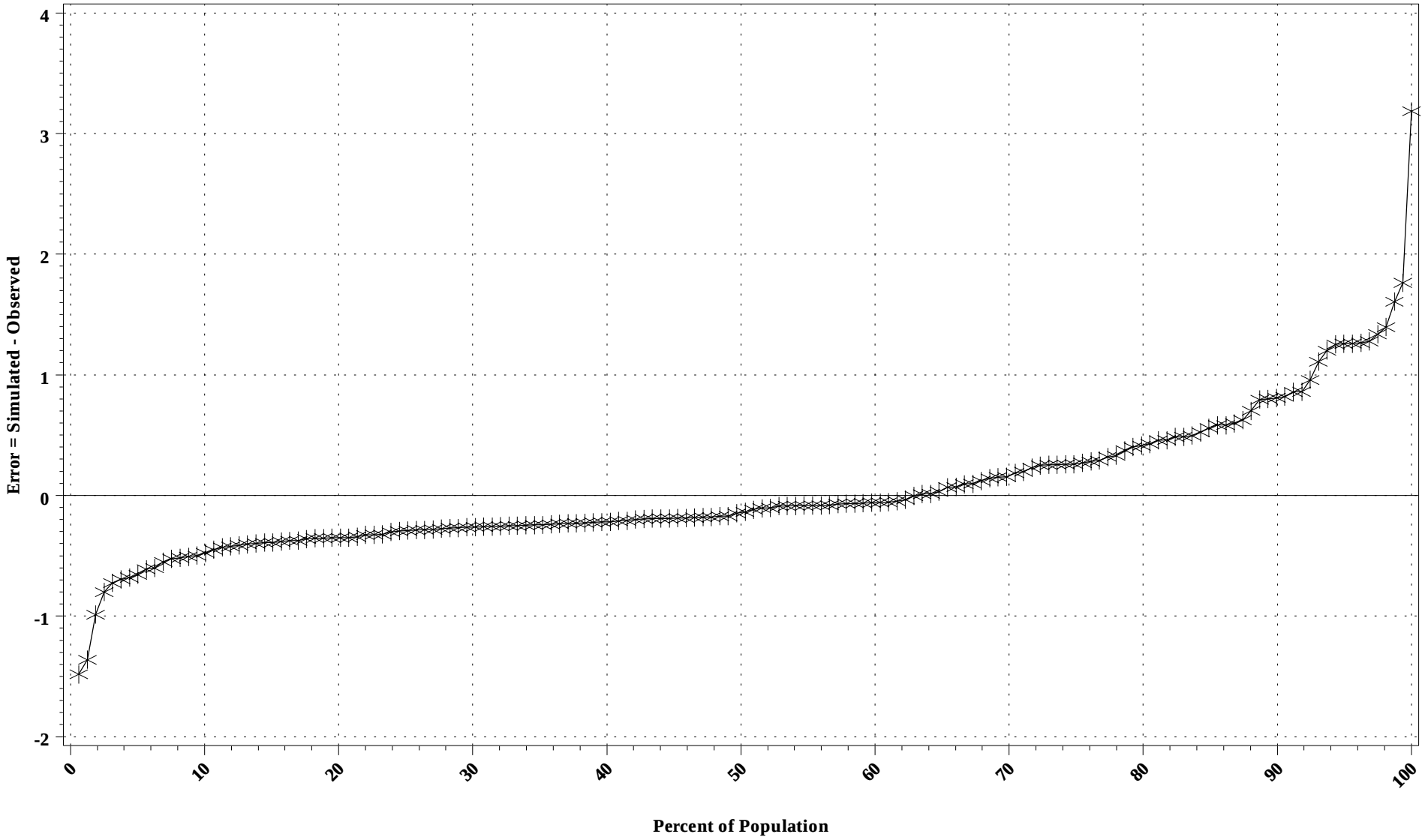
# Mattaponi River at Segment 240
## Total Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Actual error versus Percentile Sample Population
## Total Nitrogen

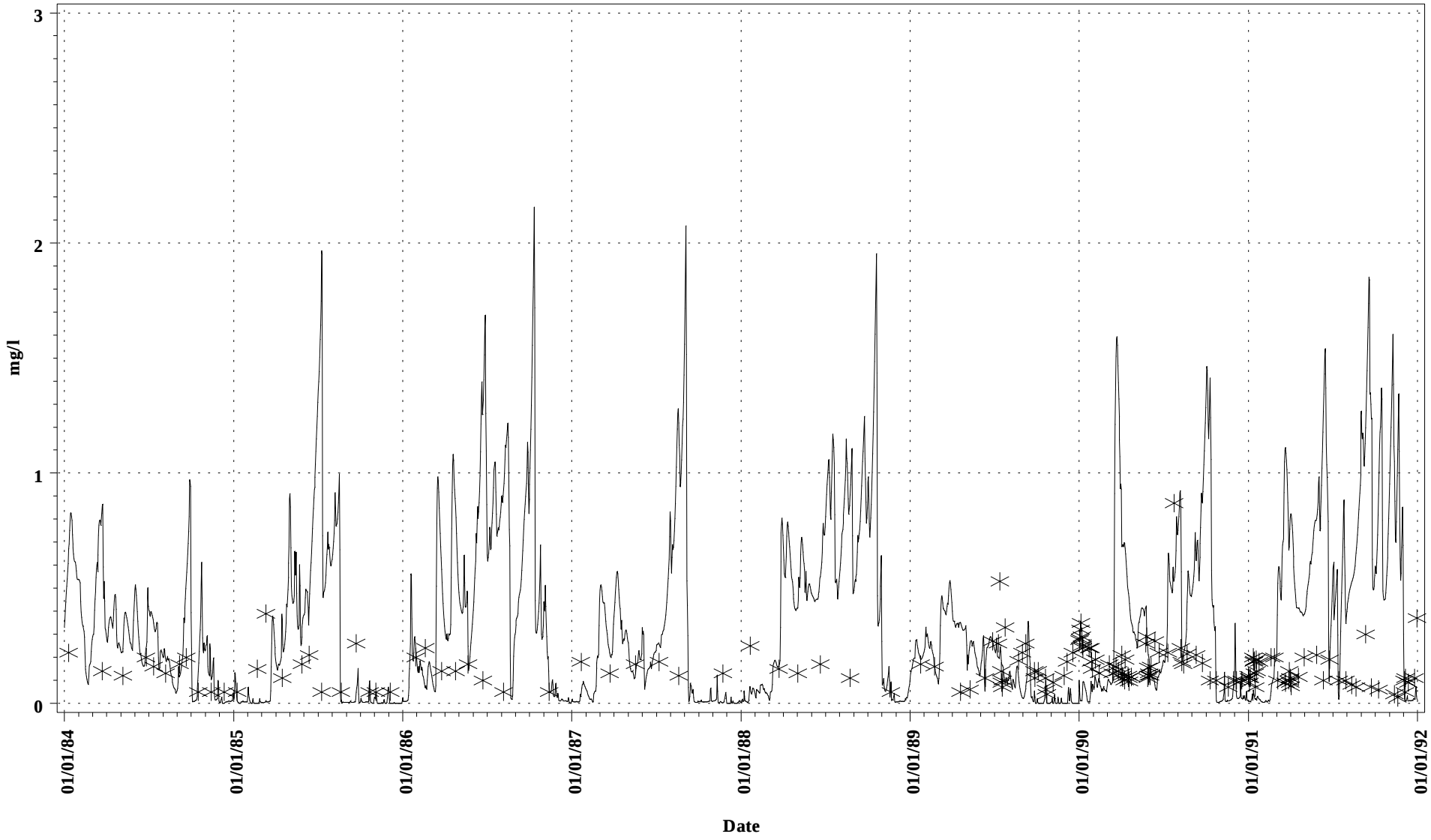
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

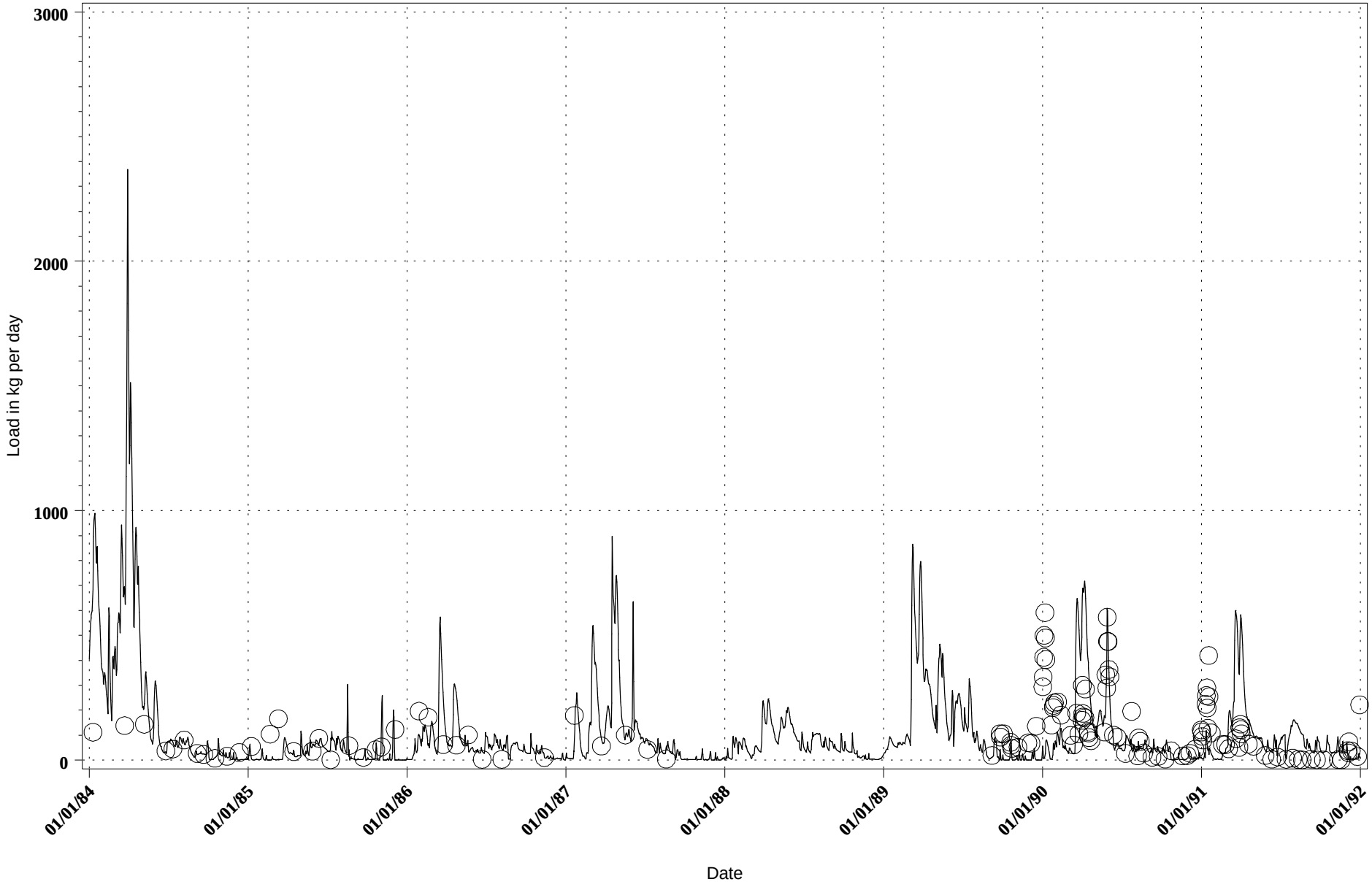



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240

## NO3 Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

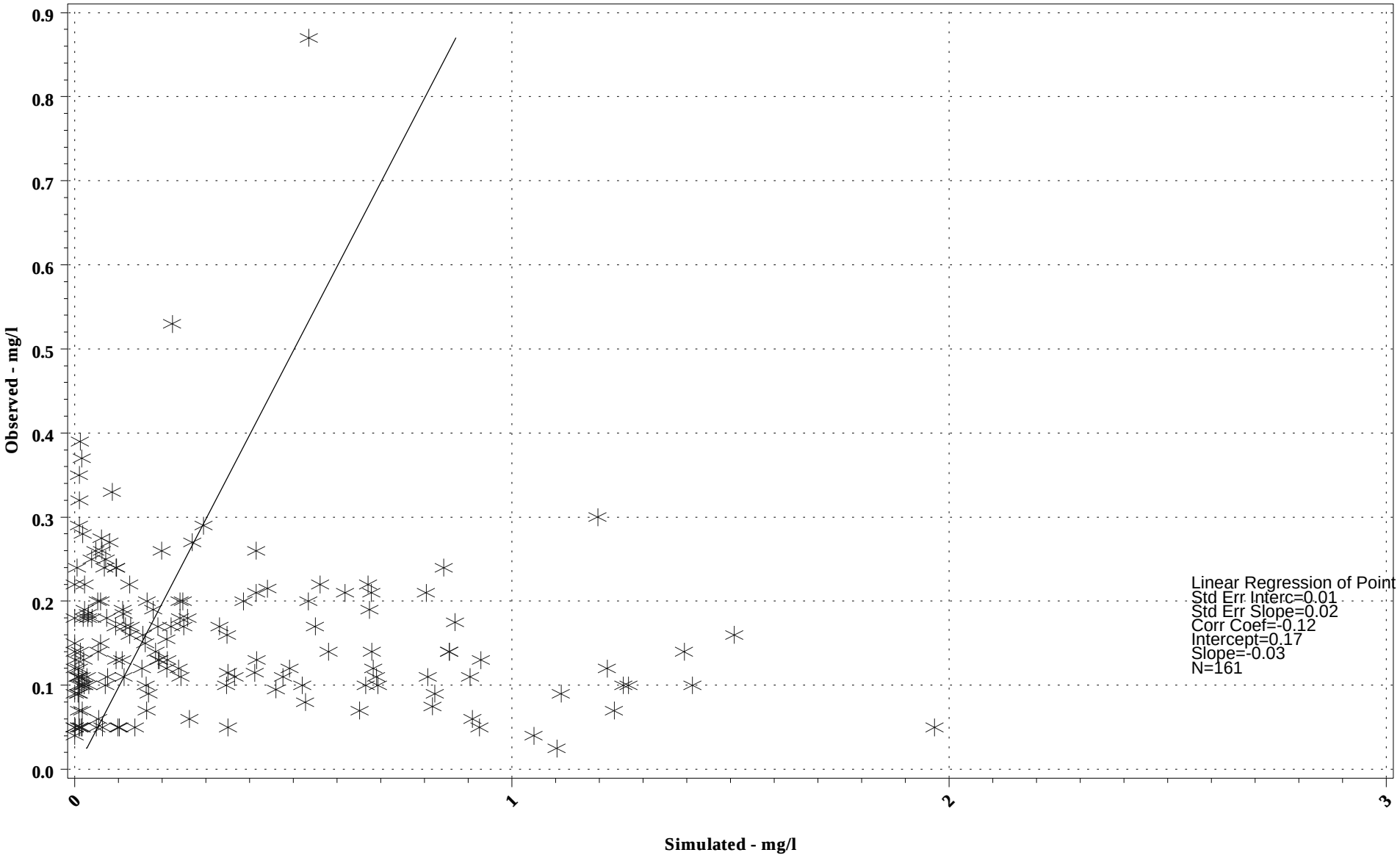



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240

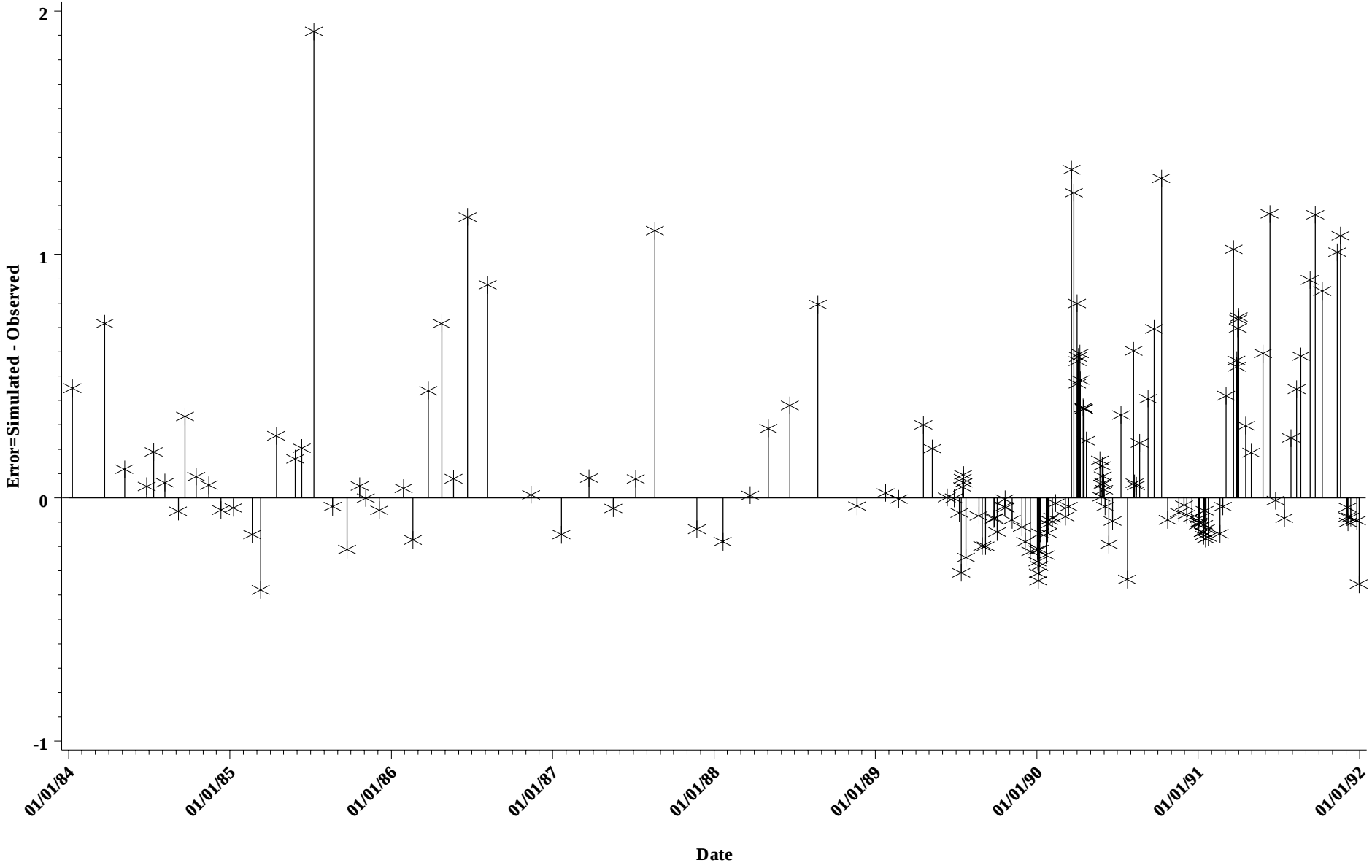
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240
## Actual Error versus Time
## NO3

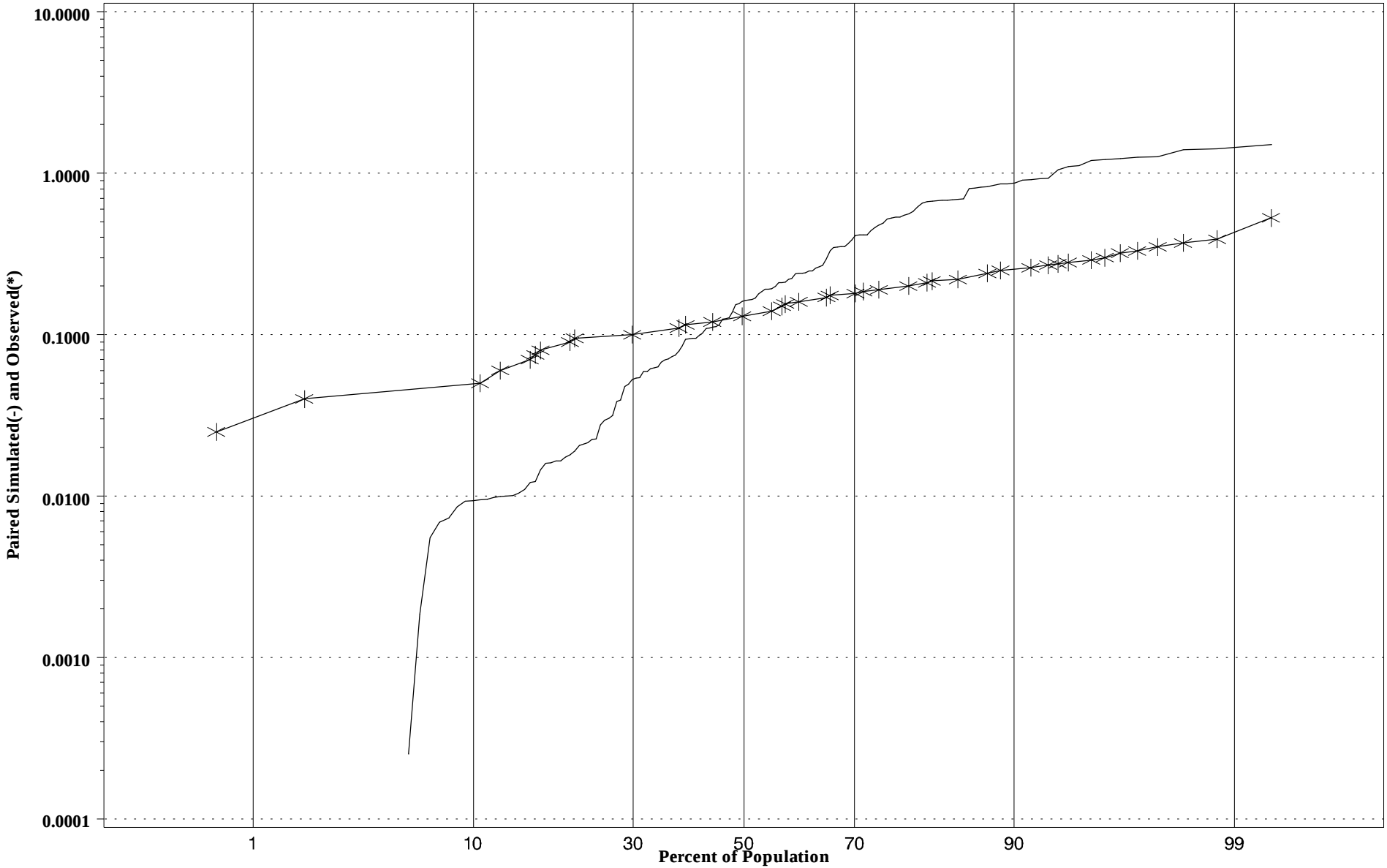



(y21_plotb.sas model3d:[pwang.dt] omerr)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240

## NO3

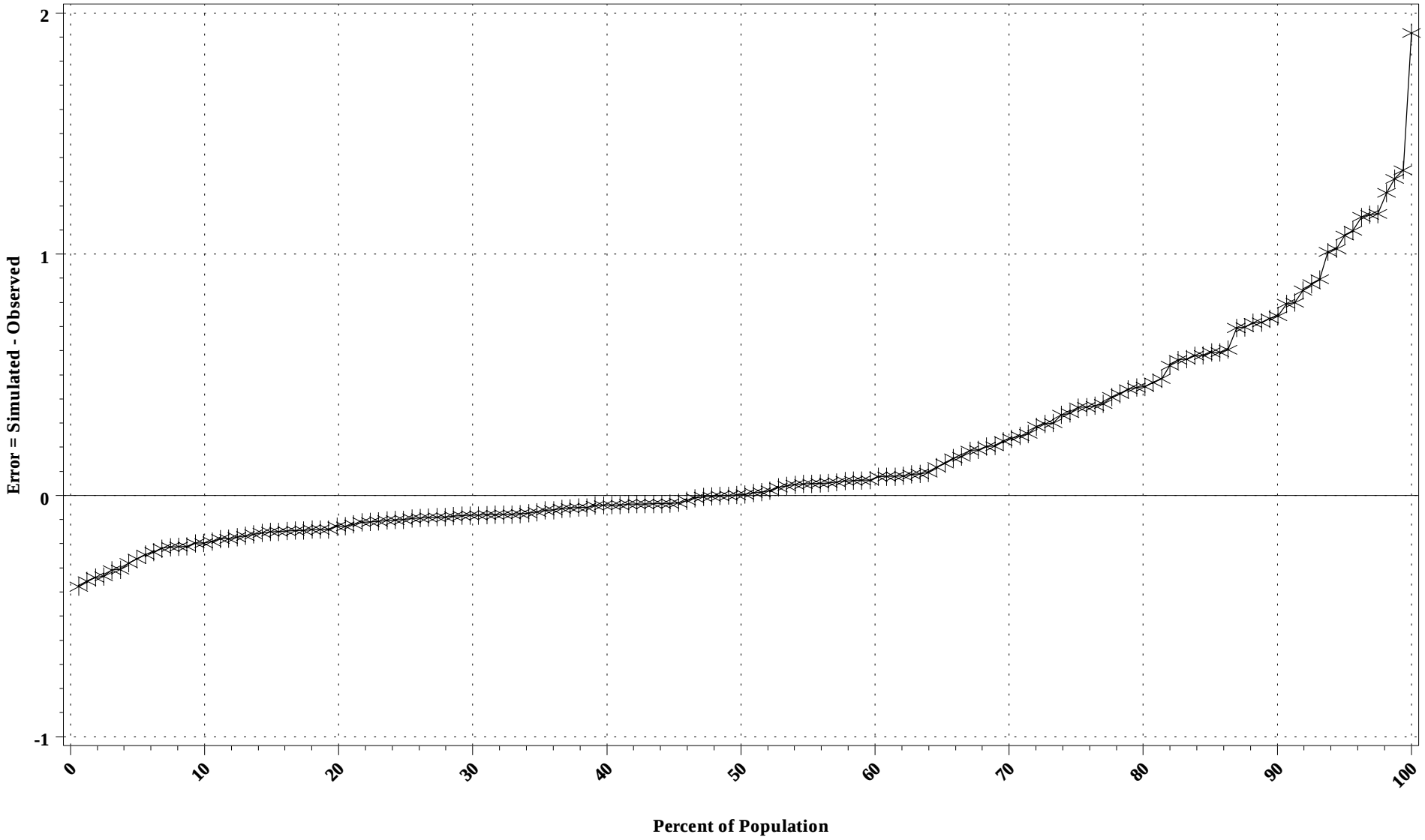
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Actual error versus Percentile Sample Population
## NO3

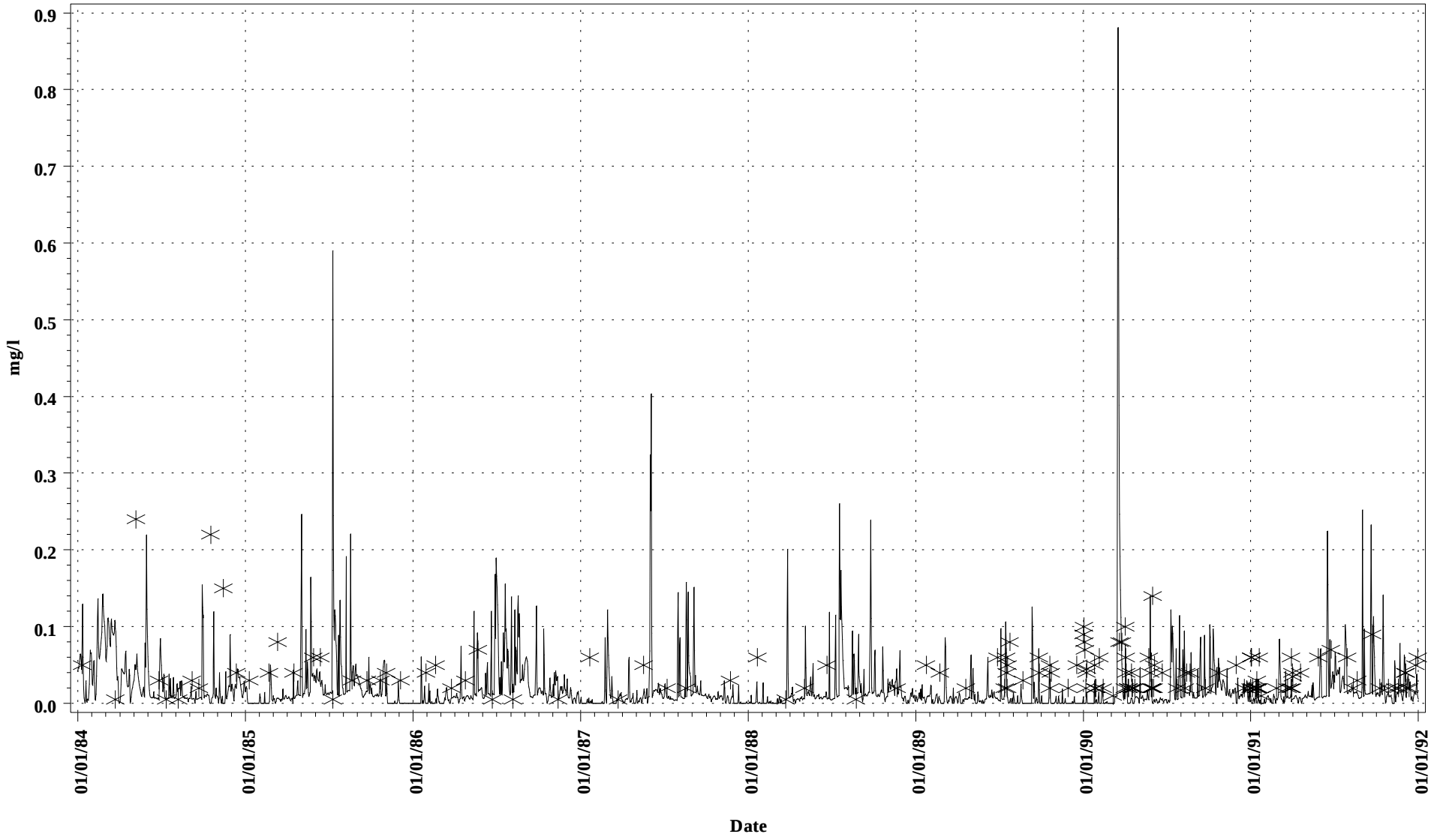
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**

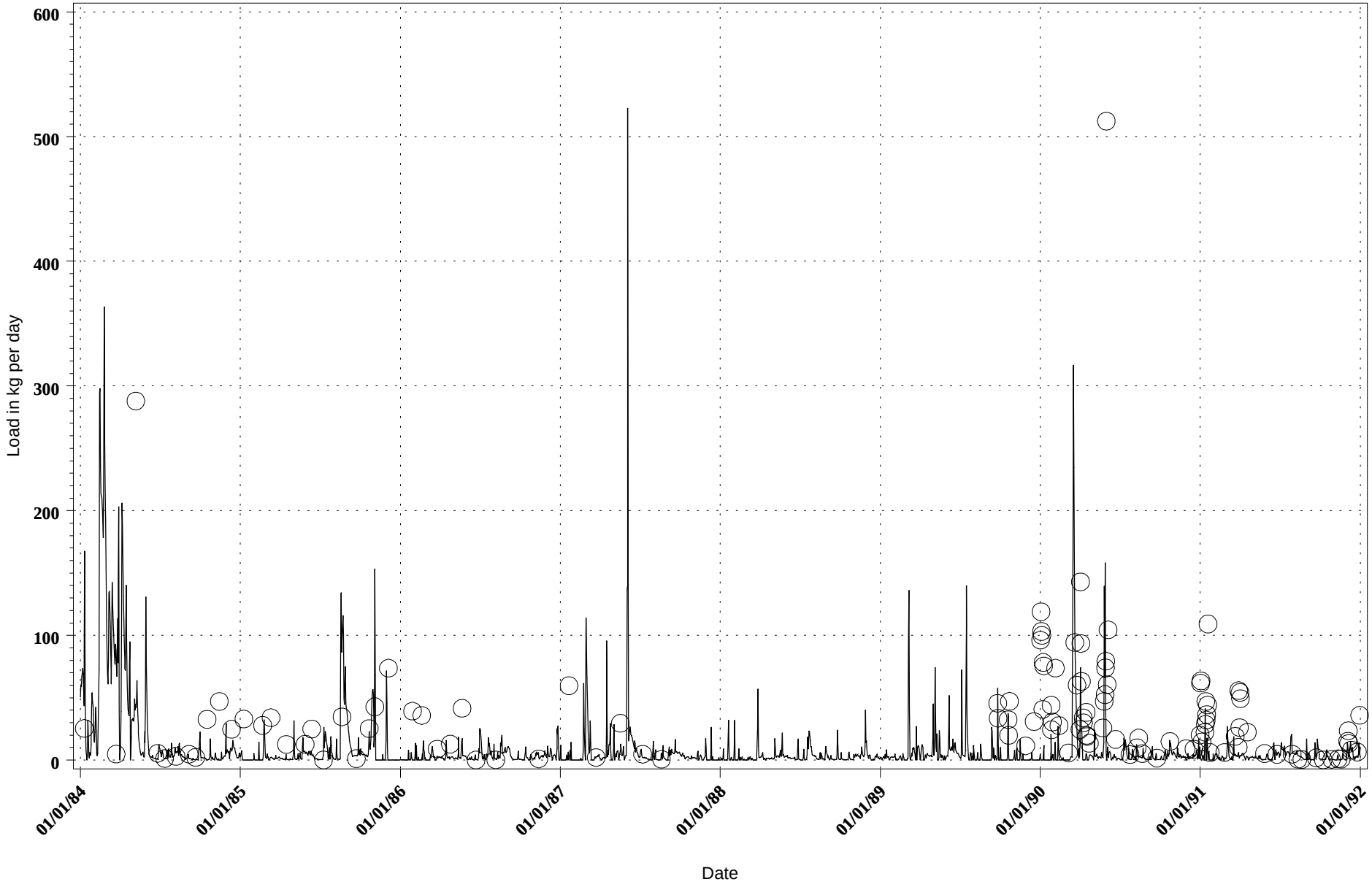



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240

## Total Ammonia Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

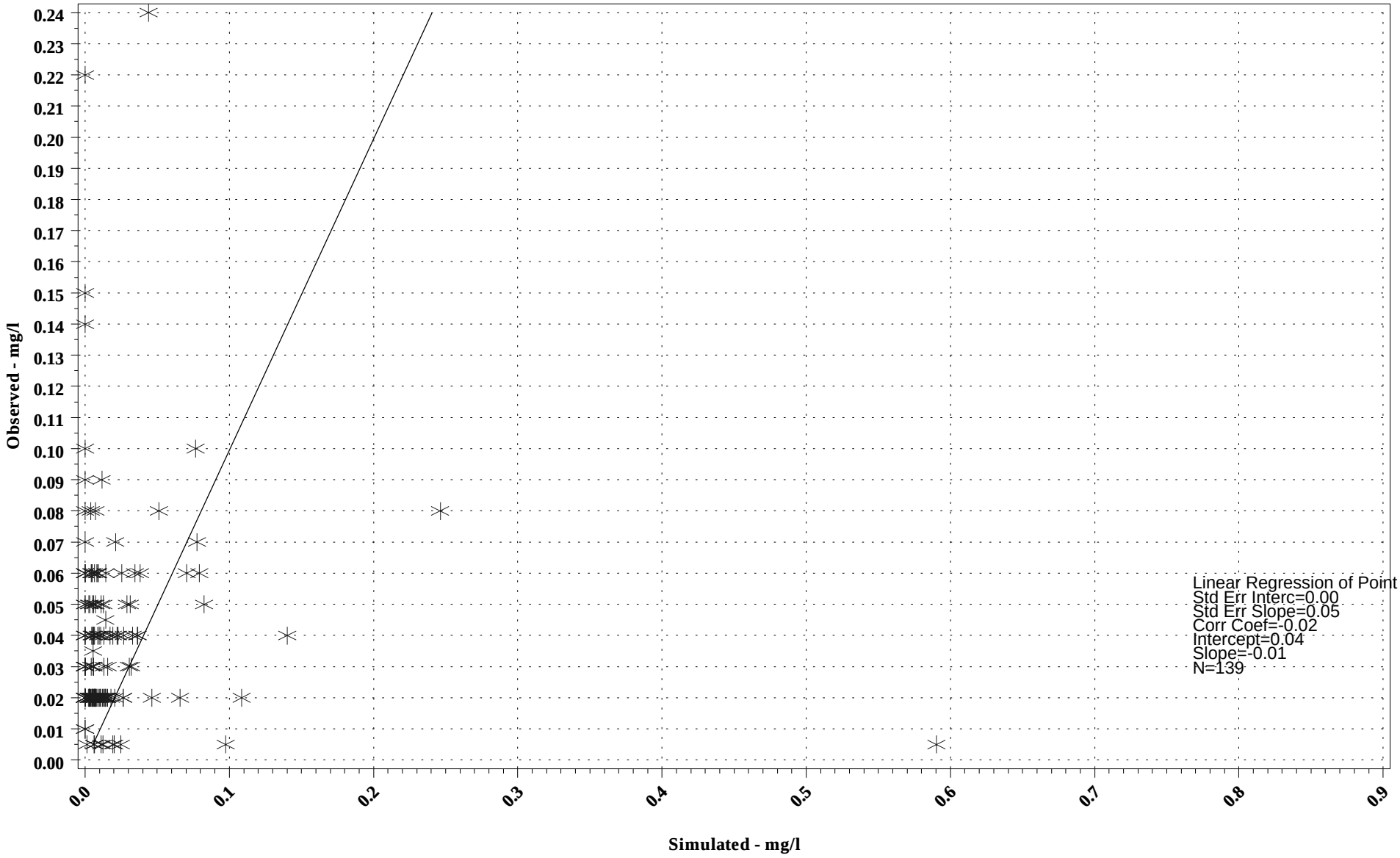



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240

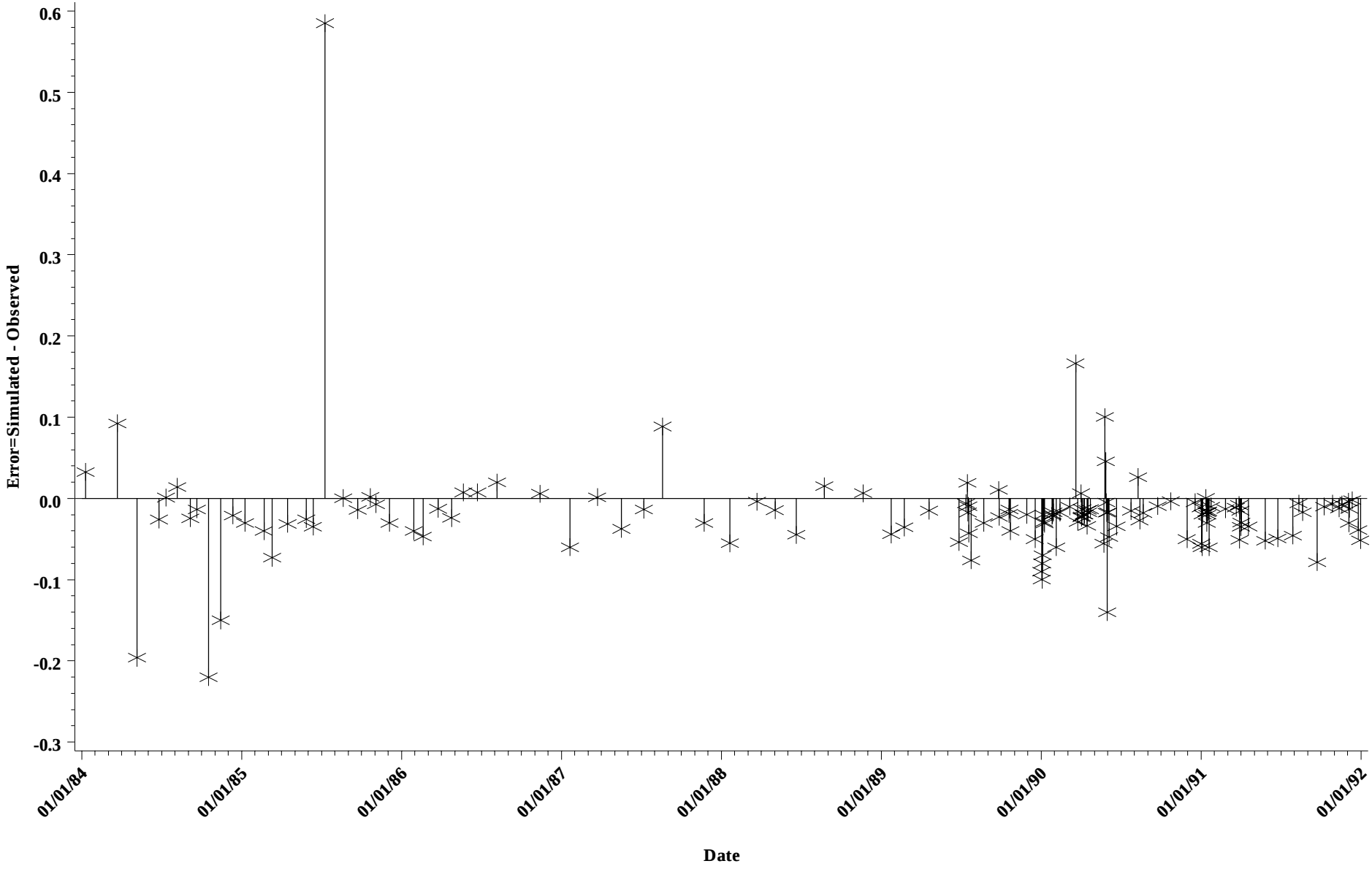
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92



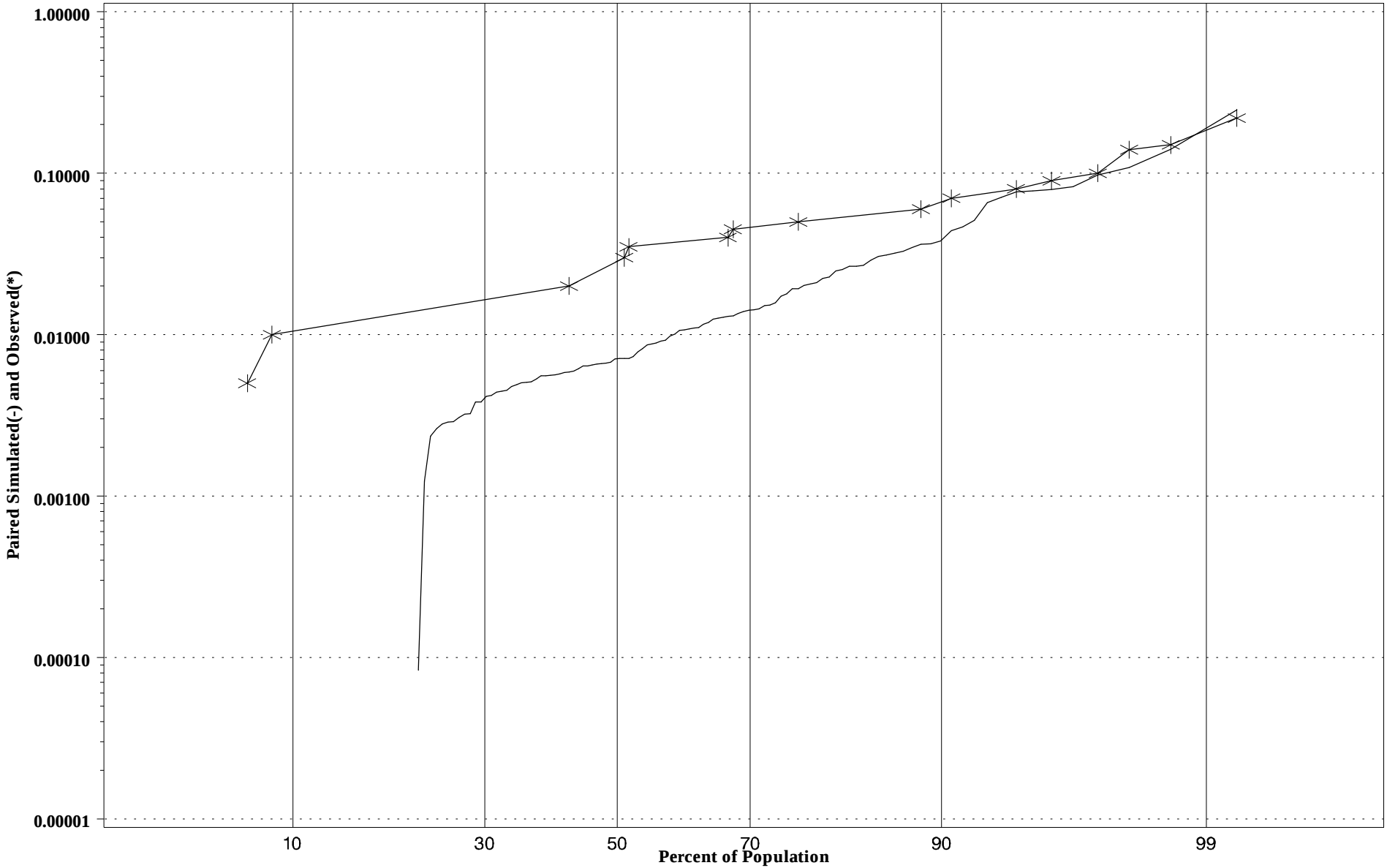

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240
## Actual Error versus Time
## Total Ammonia




(y21_plotb.sas model3d:[pwang.dt] omerr)
(matta240.drv 26JUN98 16:08)

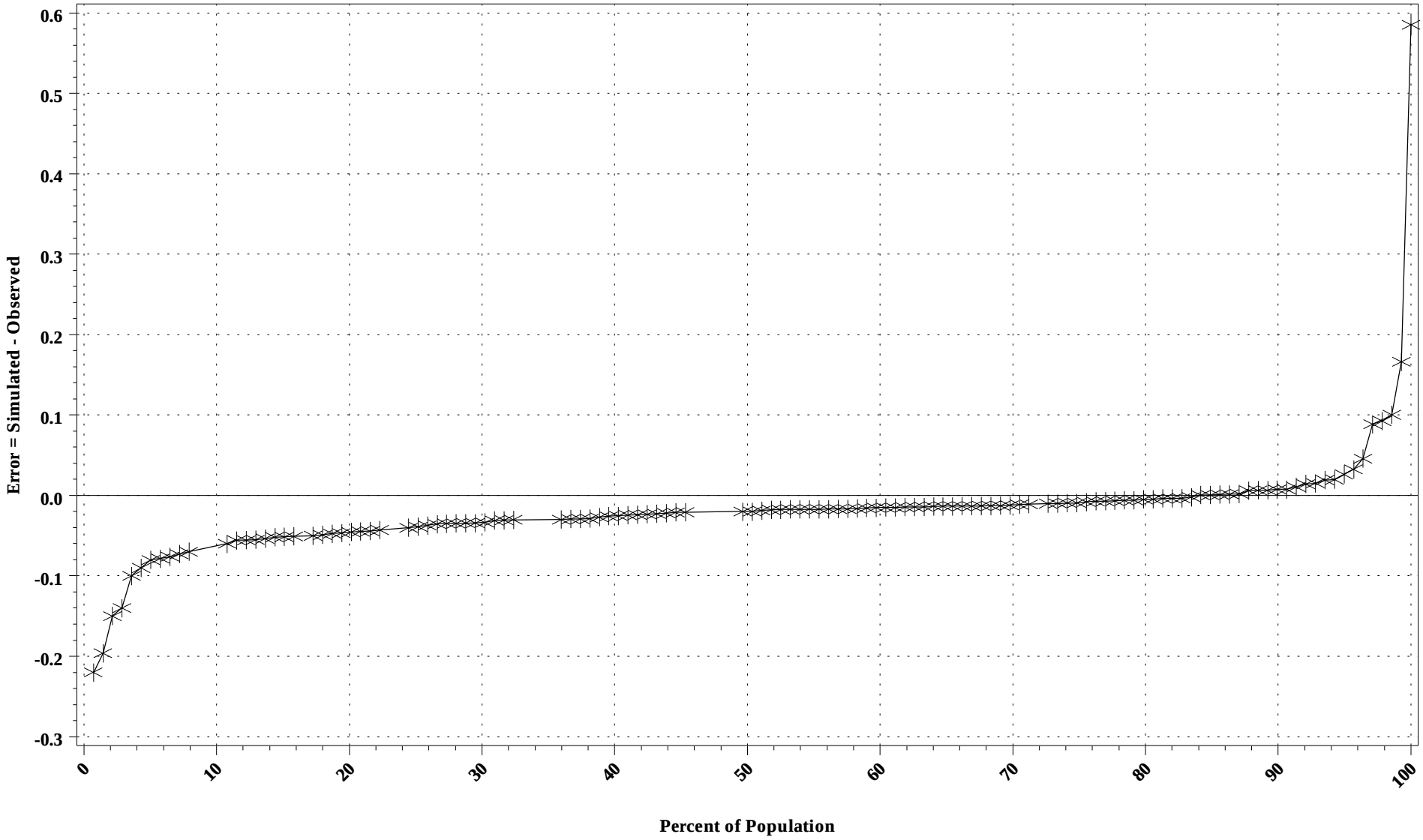
# Mattaponi River at Segment 240
## Total Ammonia
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(matta240.drv 26JUN98 16:08)

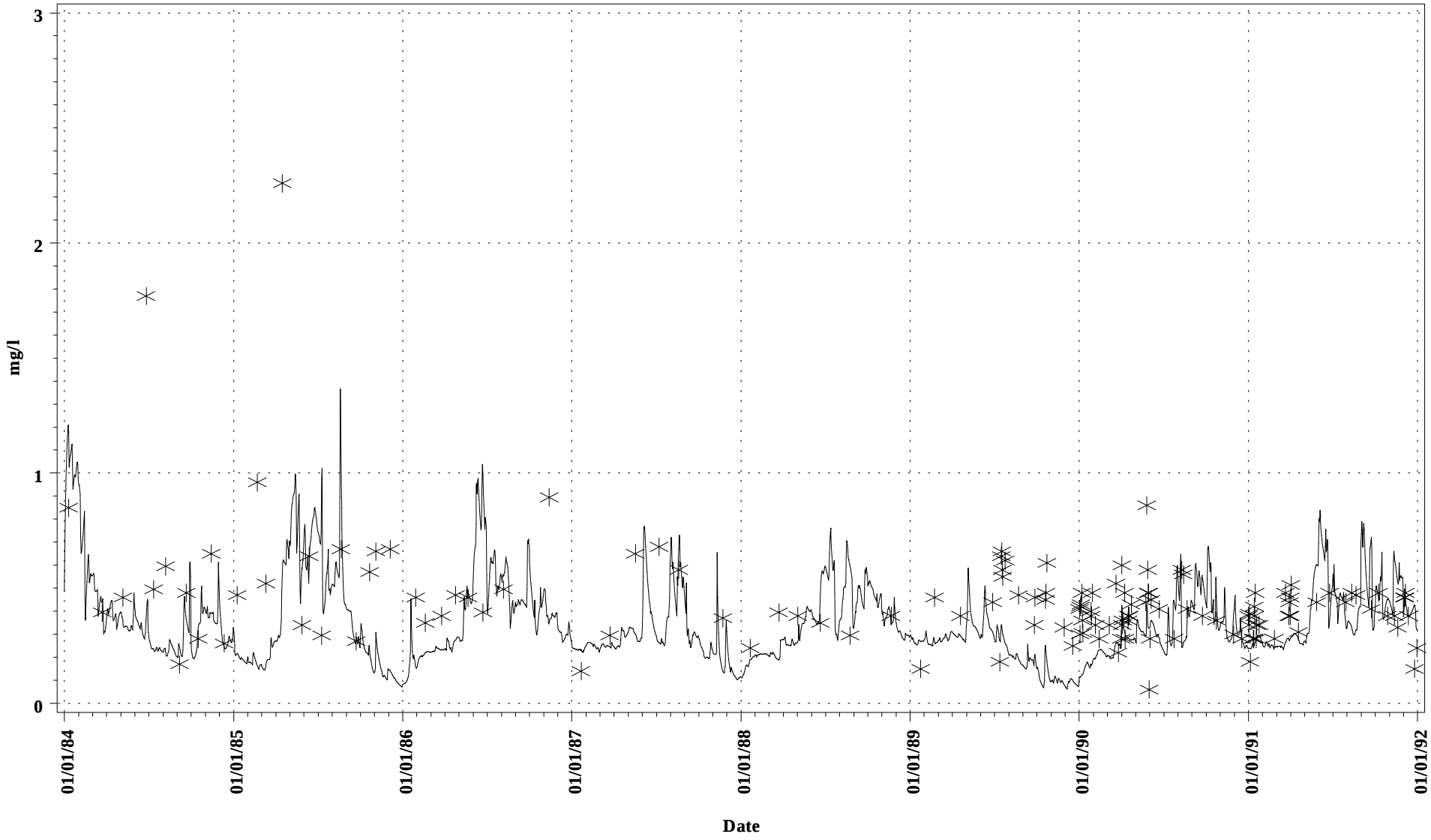
# Mattaponi River at Segment 240
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data



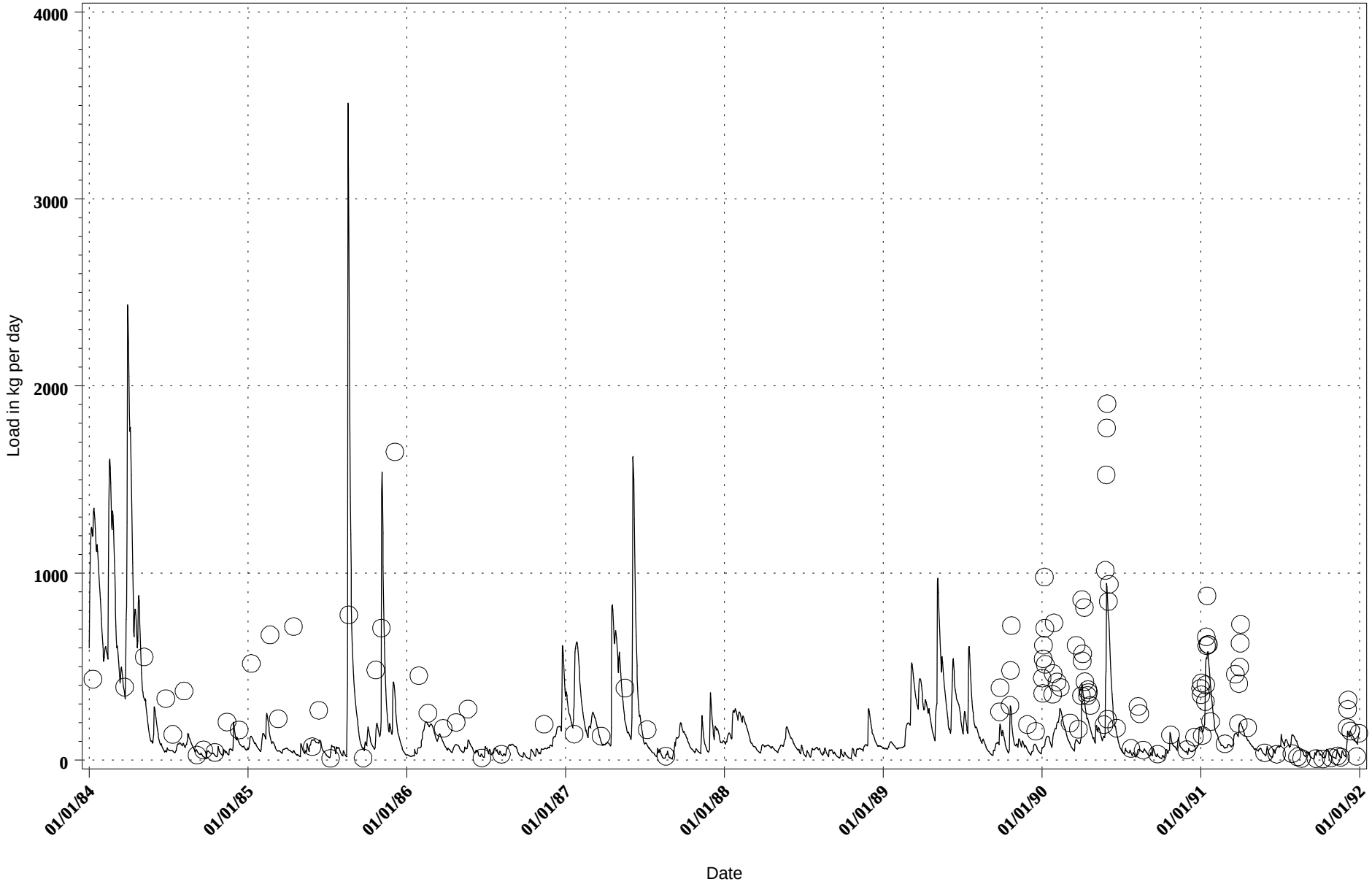

(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Organic Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

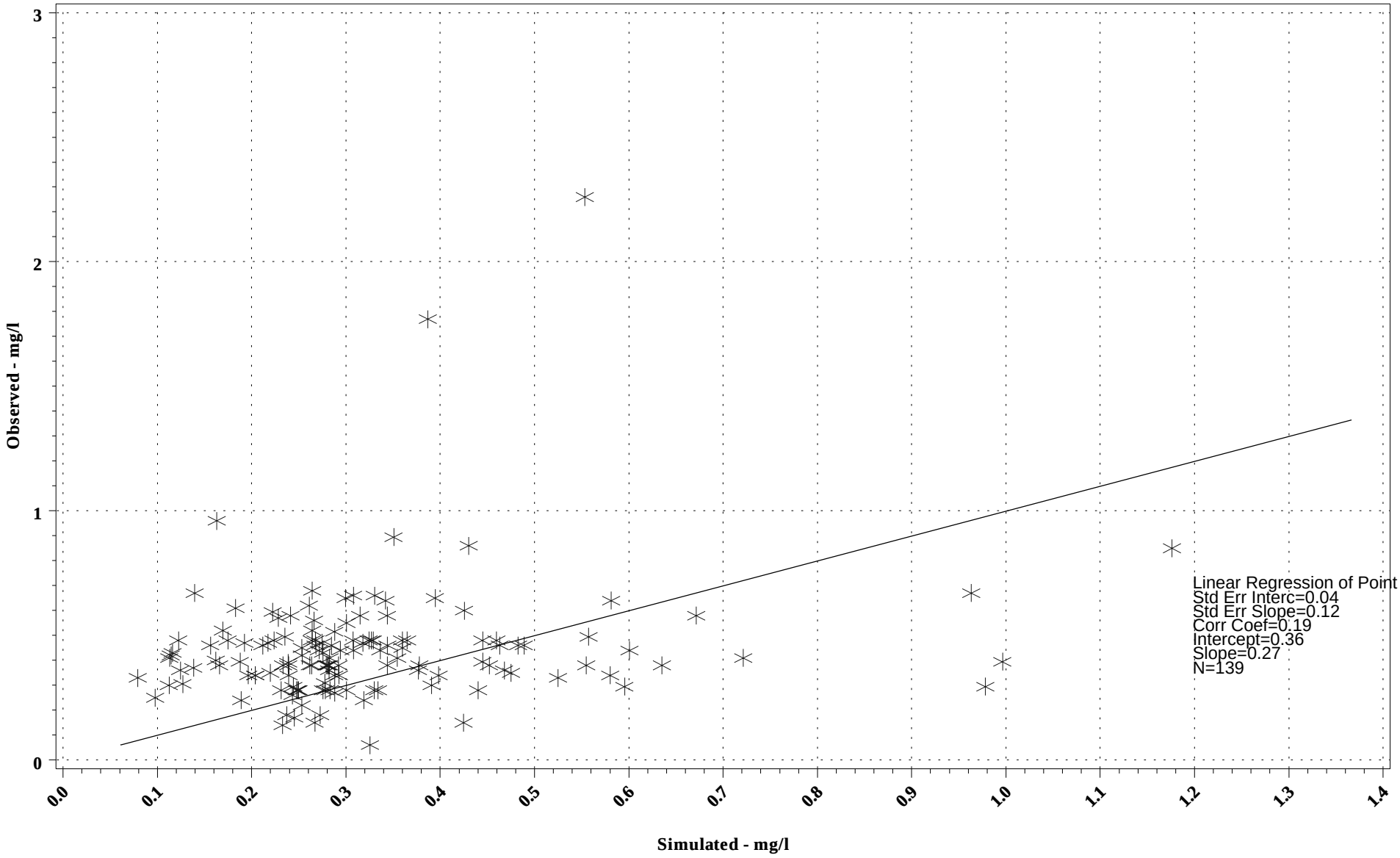



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240

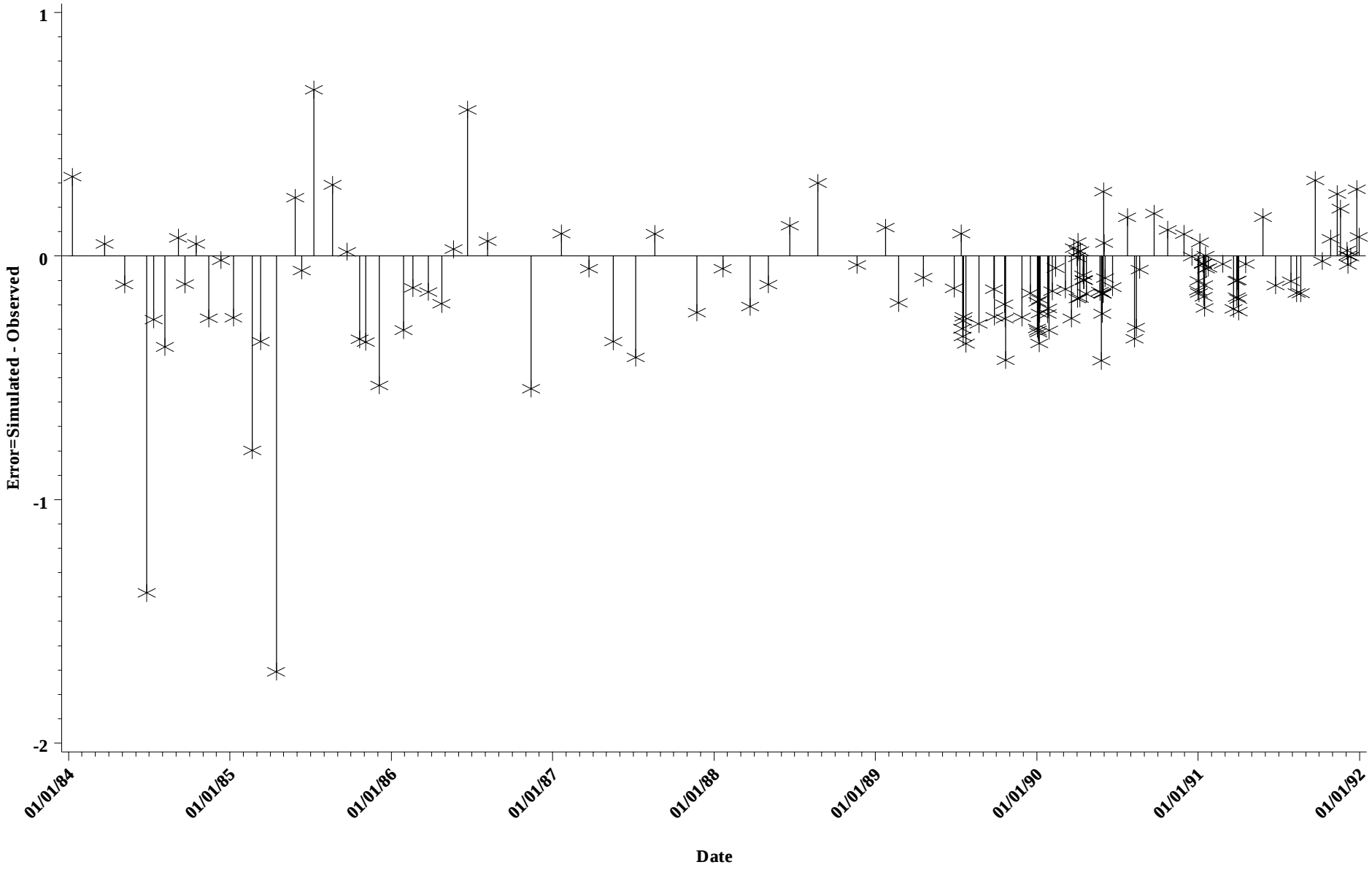
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(matta240.drv 26JUN98 16:08,proc reg,model y=x)

# Mattaponi River at Segment 240
## Actual Error versus Time
## Organic Nitrogen

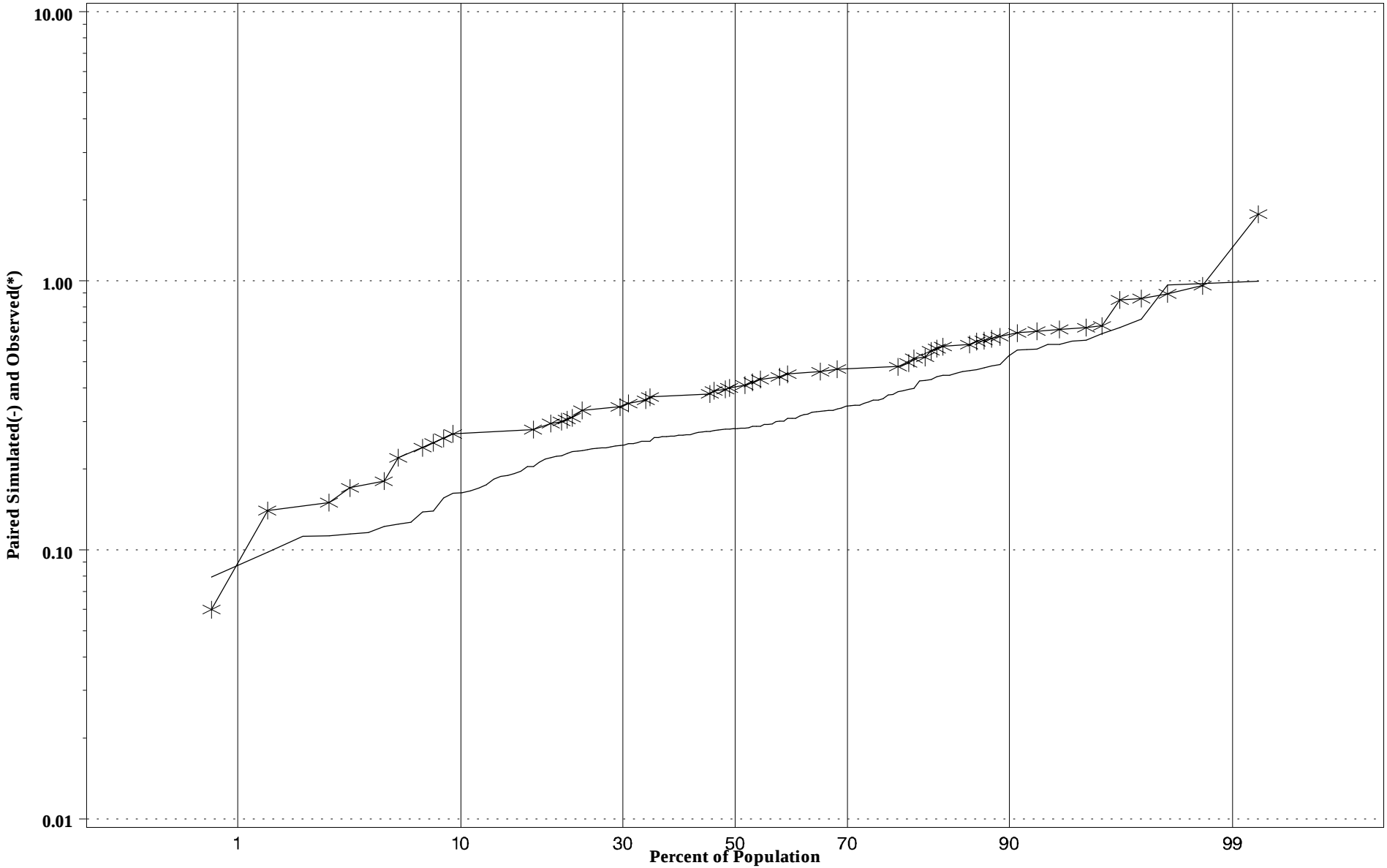



(y21_plotb.sas model3d:[pwang.dt] omerr)
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240

## Organic Nitrogen

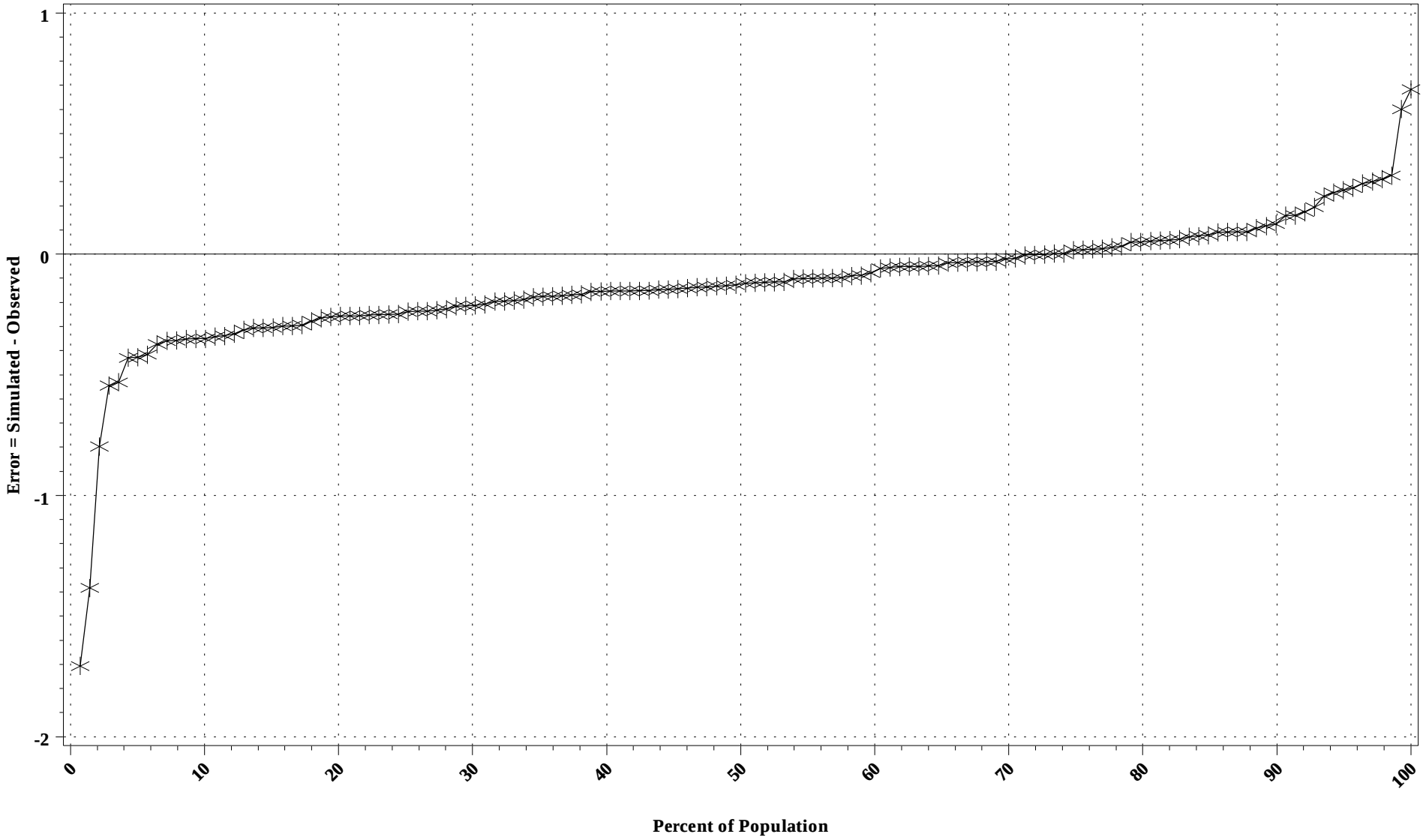
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(matta240.drv 26JUN98 16:08)

# Mattaponi River at Segment 240
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(matta240.drv 26JUN98 16:08)

### *B.5.2 Pamunkey River near Hanover, VA at Segment 260 (Monitoring Station: 1673000) (Above Fall Line Basin Segments: 250 and 260)*

**Section Summary:**

The Pamunkey basin together with the Mattaponi form the above fall line portion of the York River. The Pamunkey basin is largely rural. The Lake Anna Reservoir influences water quality in this basin contributing to the low concentrations of total nitrogen, total phosphorus, and total suspended sediment at the Pamunkey gage station. Water quality observations increased and were oriented toward storm weighted sampling after 1989. Model calibration focused primarily on the refined, storm-weighted sampling after 1989.

The Pamunkey basin above the gaged site covers an area of 1,070 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 67% forest land, 8% cropland, 17% other agricultural areas, 6% urban areas, and 3% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage increased from 1.7 million pounds in 1985 to 1.9 million pounds in 1996. Total phosphorus loads over the same time period did not change at 0.15 million pounds. In general, point source loads above the gage site decreased. In 1996, the total nitrogen point source load was 9% of the total load and the total phosphorus point source load was 11% of the total load. Estimated septic system total nitrogen loads increased 36%, from 61 thousand pounds in 1985 to 83 thousand pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation resulted in no change in the estimated cropland total nitrogen loads, and decreased other agricultural loads (primarily pasture and manure loads) by 6%. Total phosphorus decreased for cropland by 10% and increased for other agriculture by 2%. Urban loads were estimated to have increased over the 1985 to 1996 period by 36% for total nitrogen and 44% for total phosphorus due to increases in population and urban land use area

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

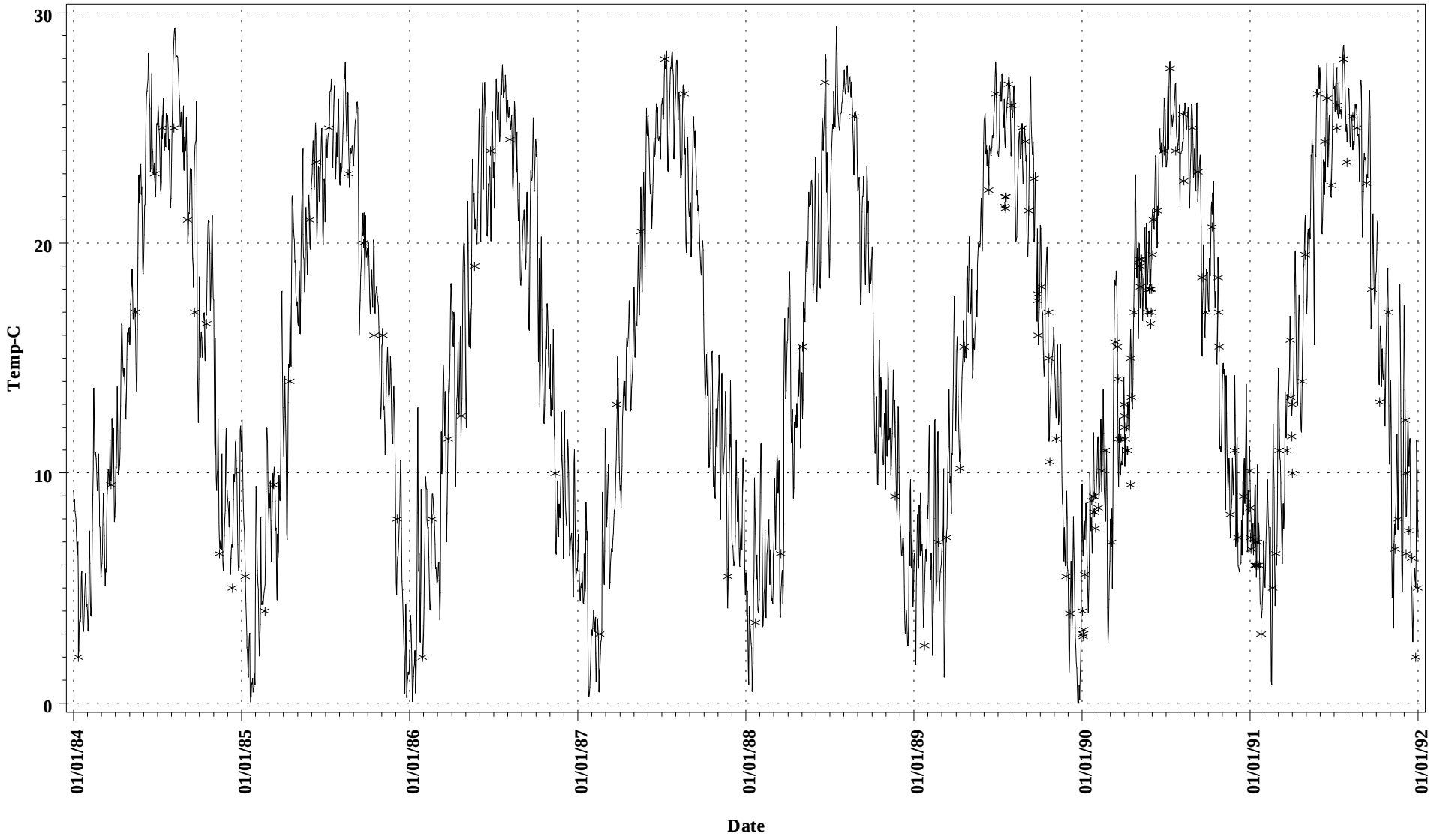
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# Pamunkey River at Segment 260
## Observed and Simulated versus Time
## Temperature-C

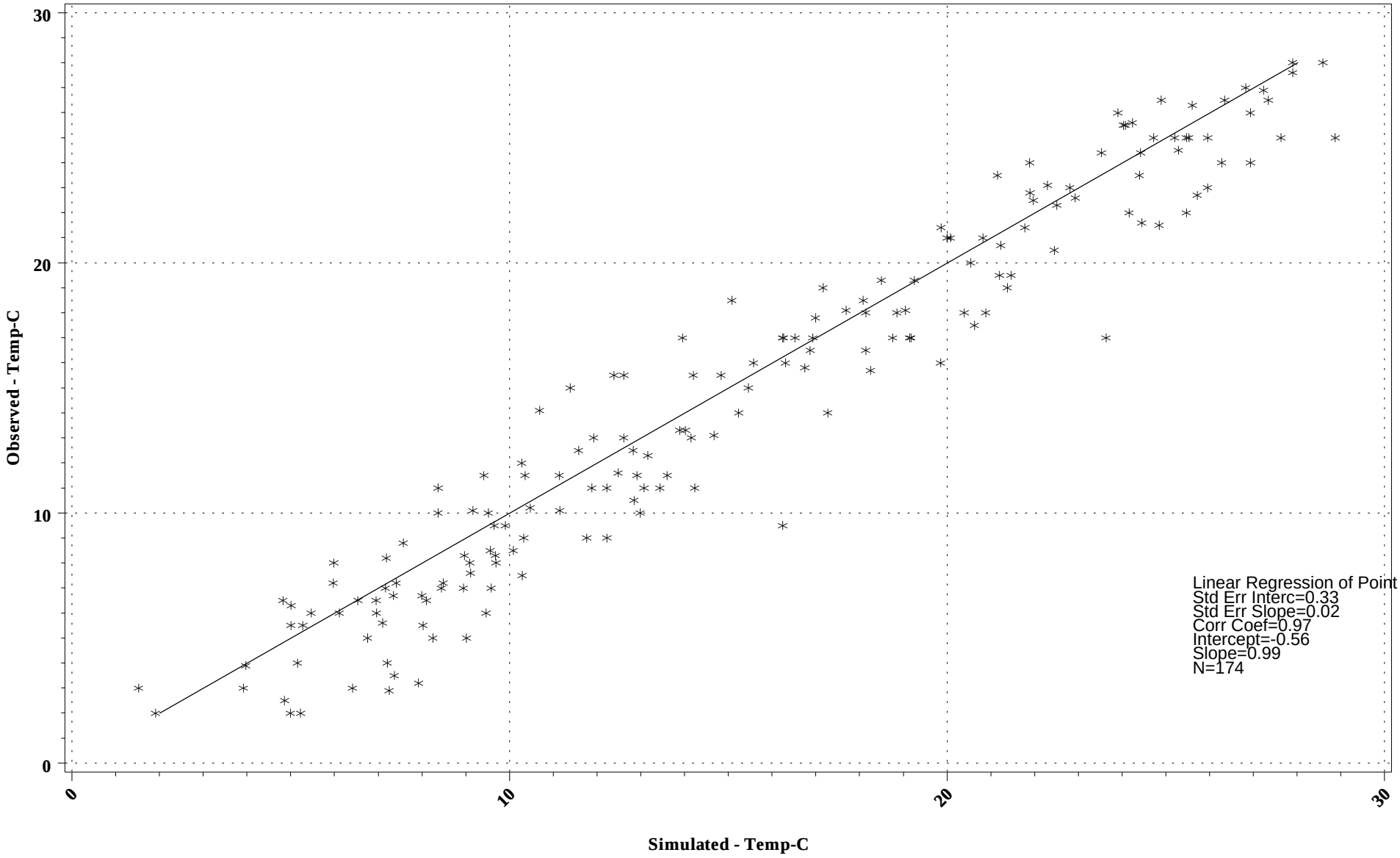
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(pamun260.drv 29JUN98 11:31)

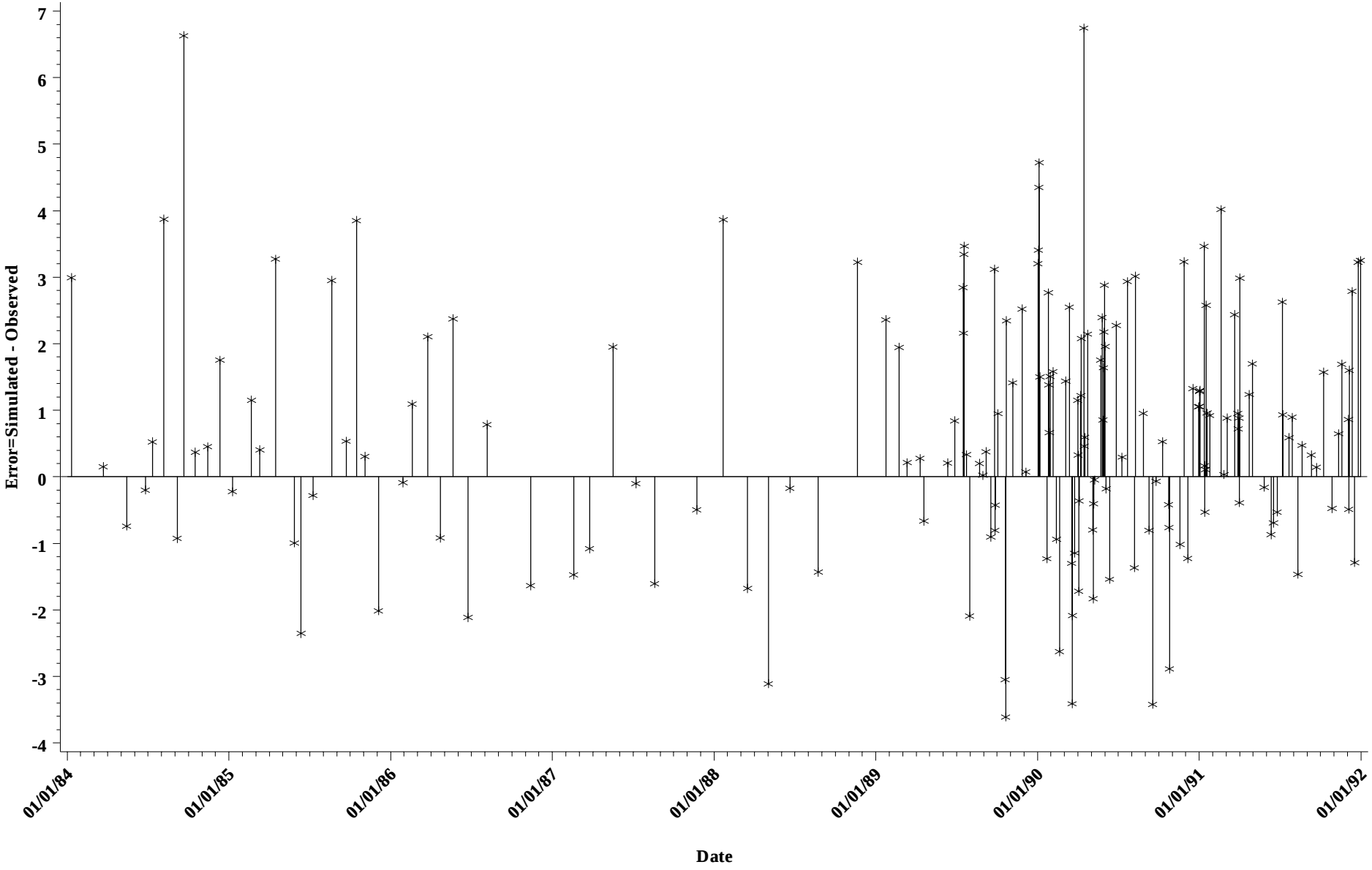
# Pamunkey River at Segment 260

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92



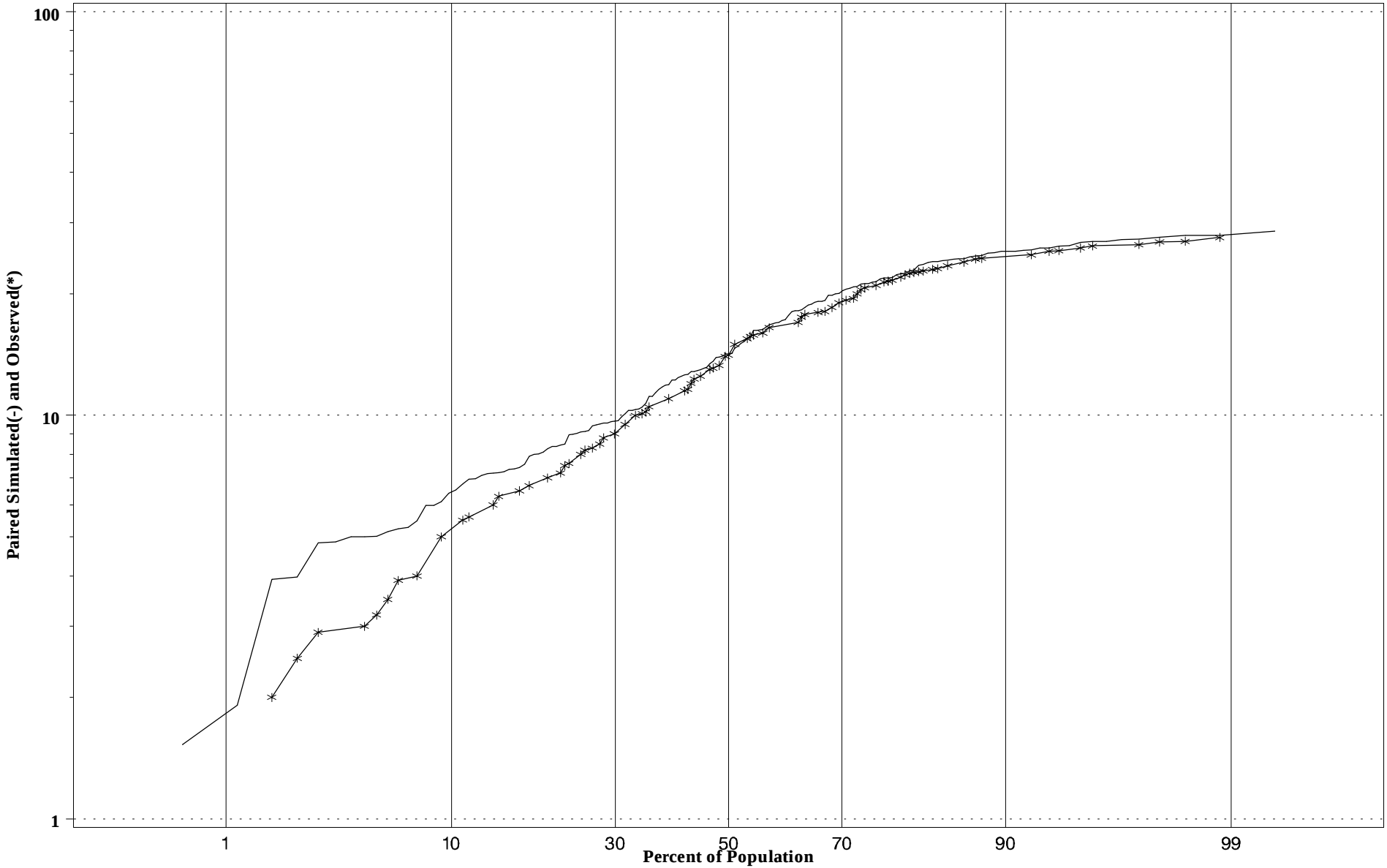

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260
## Actual Error versus Time
## Temperature-C




(y21_plotb.sas model3d:[pwang.dt] omerr)
(pamun260.drv 29JUN98 11:31)

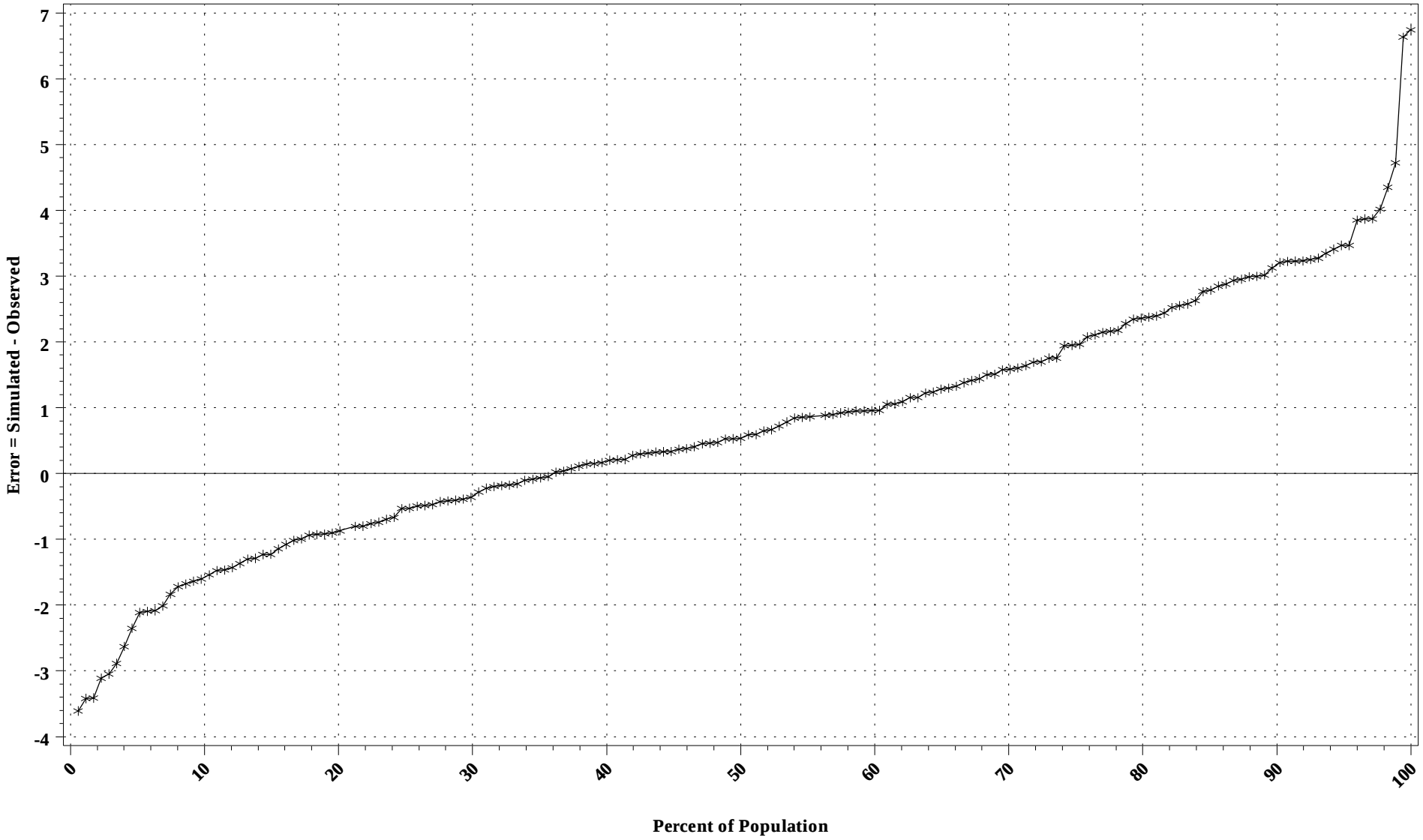
# Pamunkey River at Segment 260
## Temperature-C
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Actual error versus Percentile Sample Population
## Temperature-C

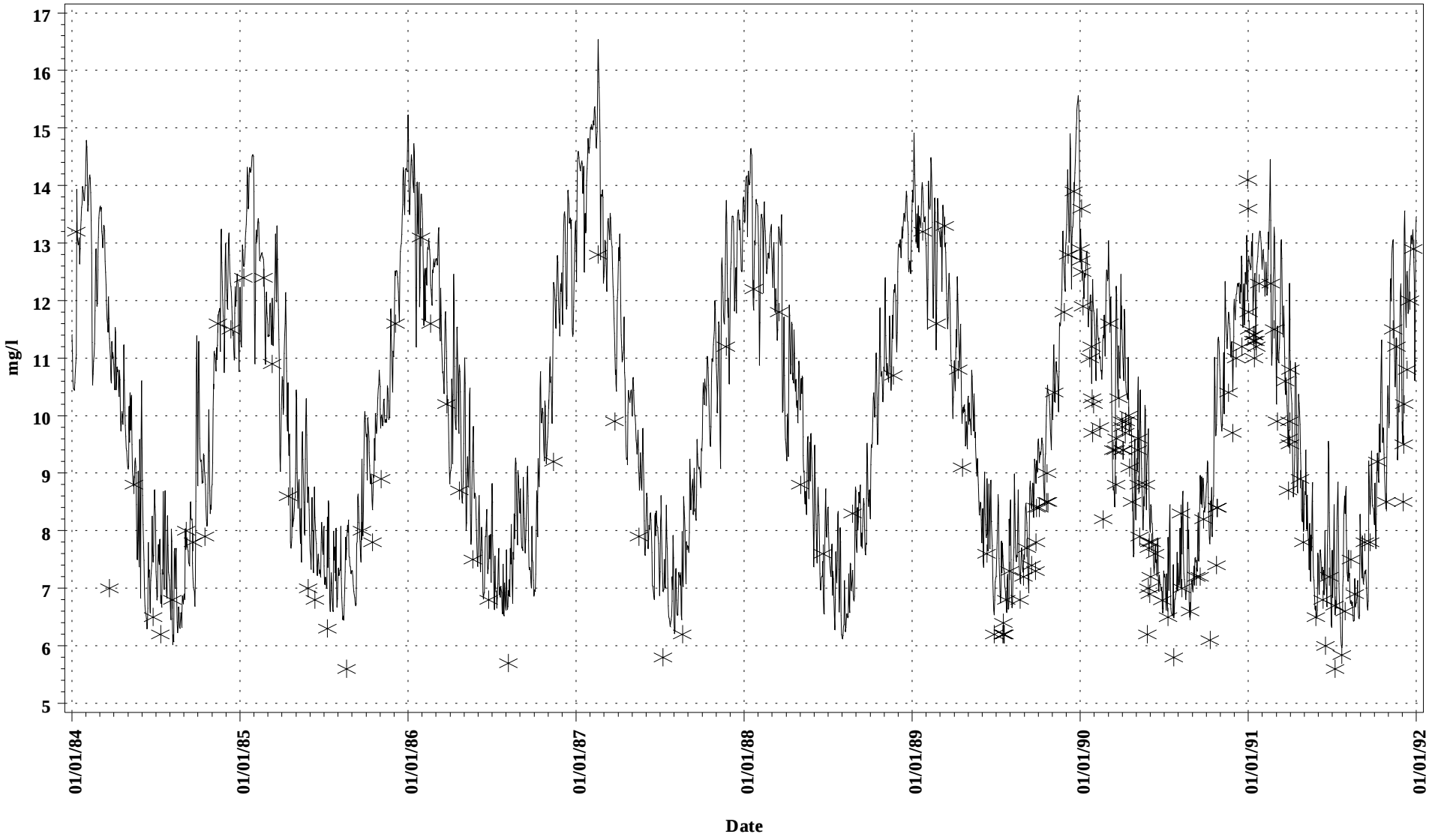
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(pamun260.drv 29JUN98 11:31)

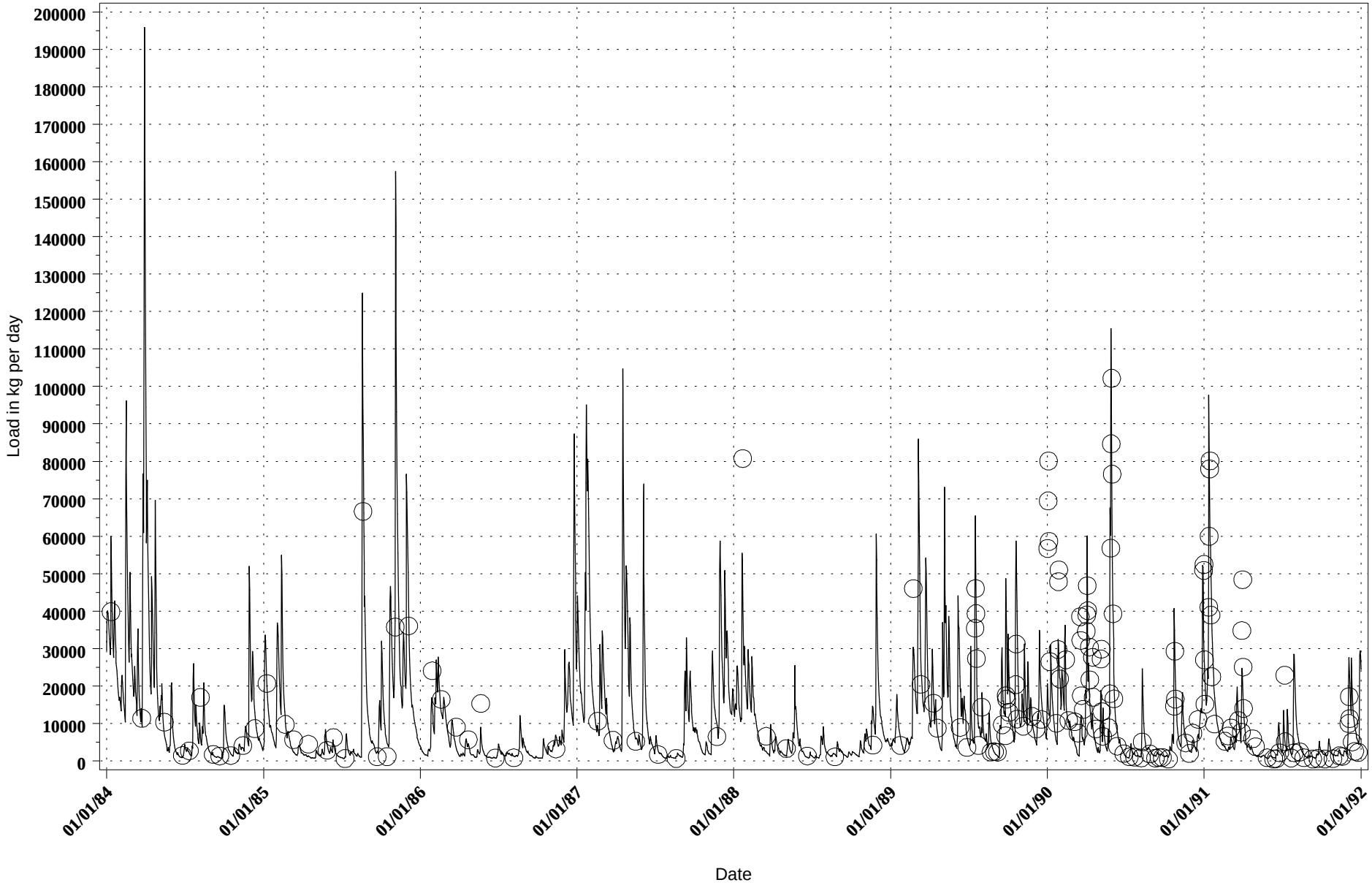
# Pamunkey River at Segment 260
## Observed and Simulated versus Time
# Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

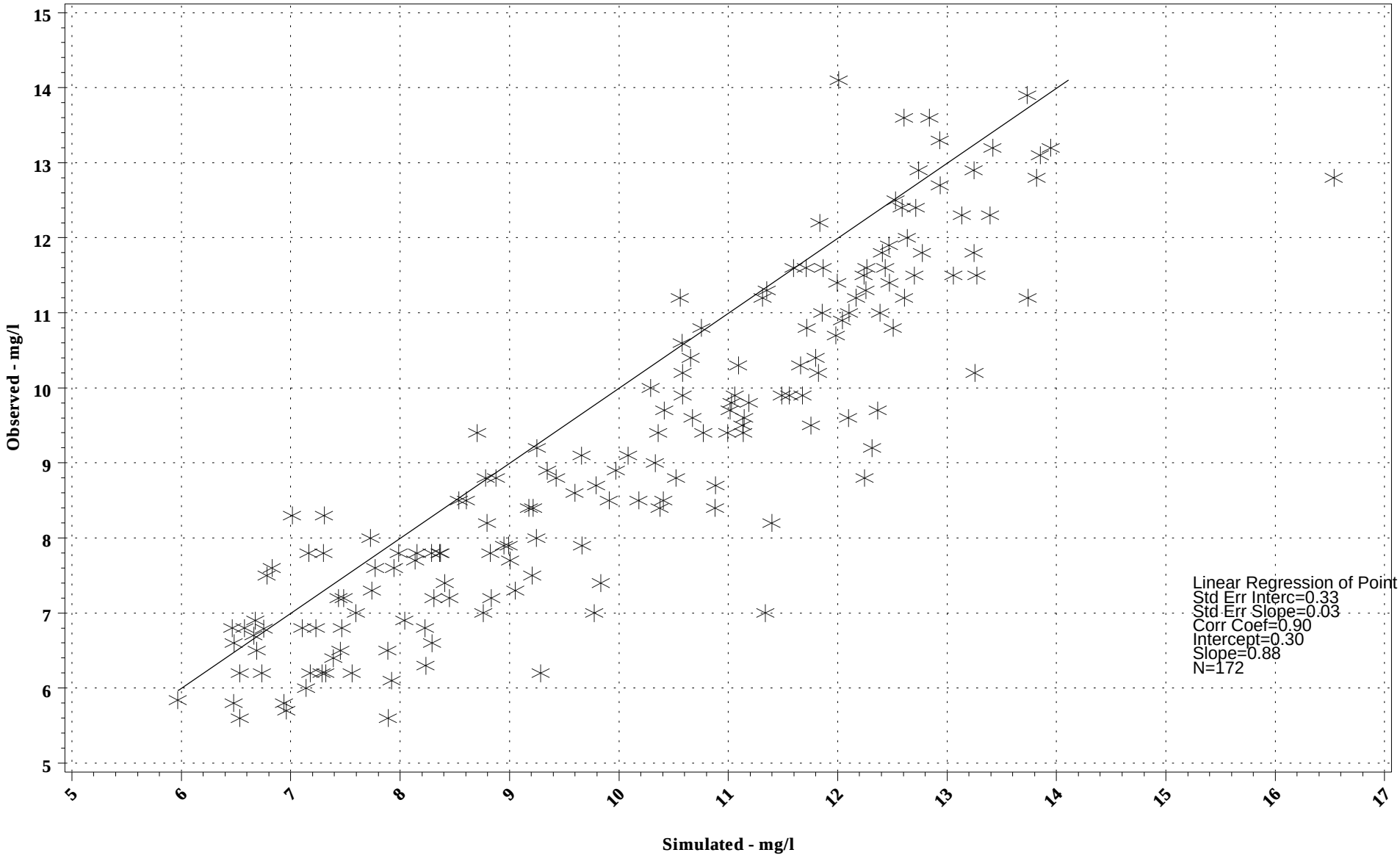



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260

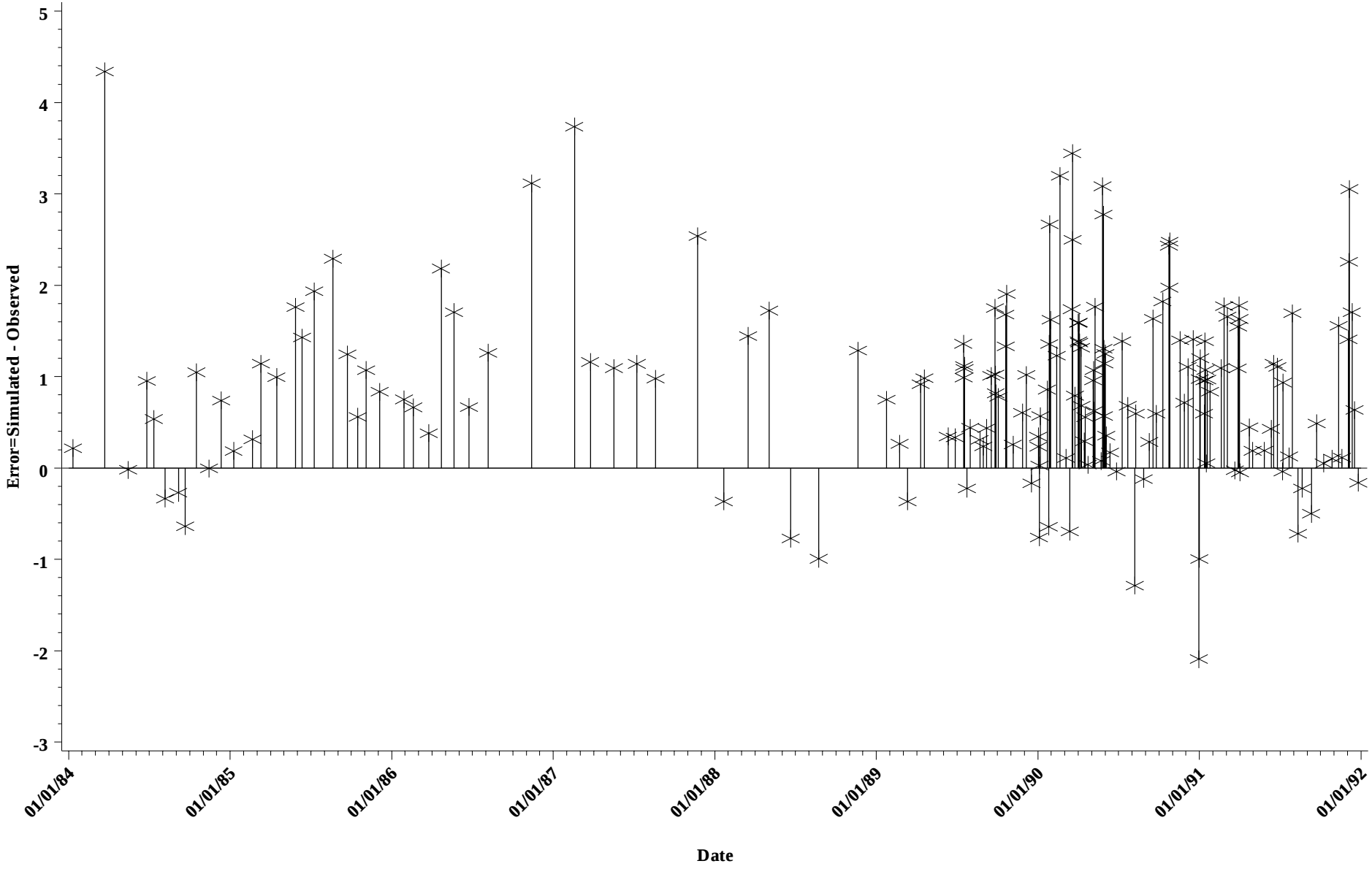
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Oxygen: 01JAN84 - 01JAN92



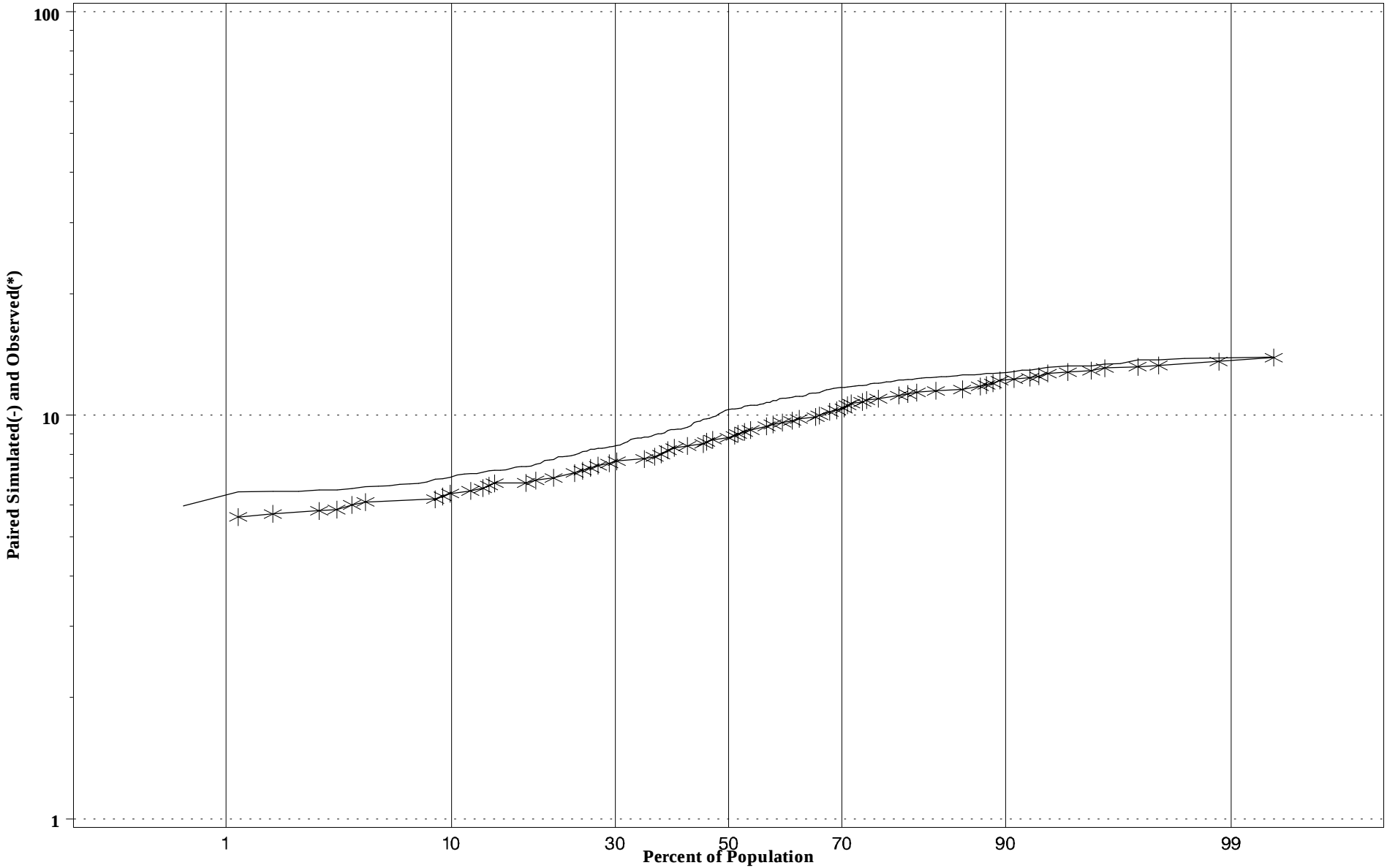

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(pamun260.drv 29JUN98 11:31)

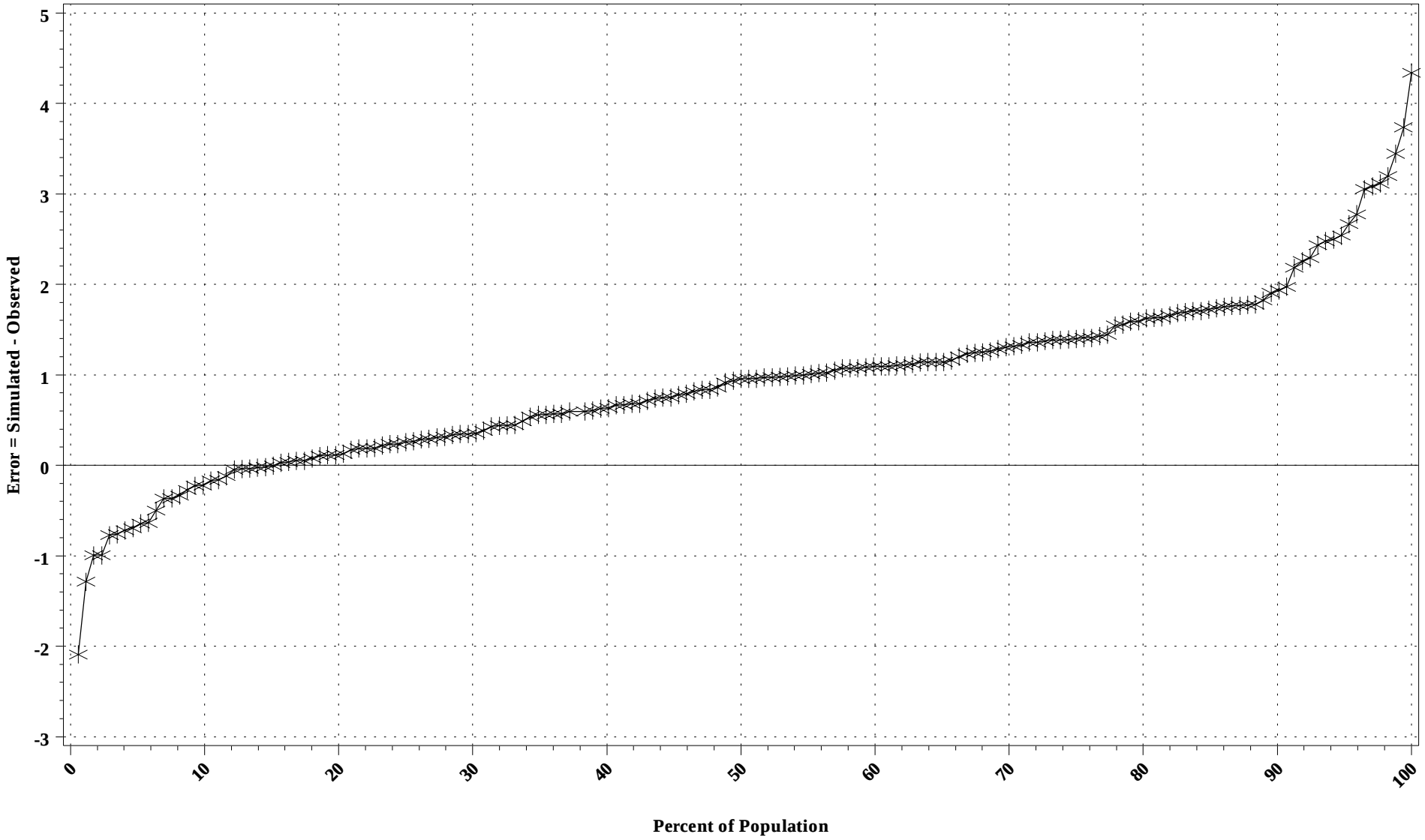
# Pamunkey River at Segment 260
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

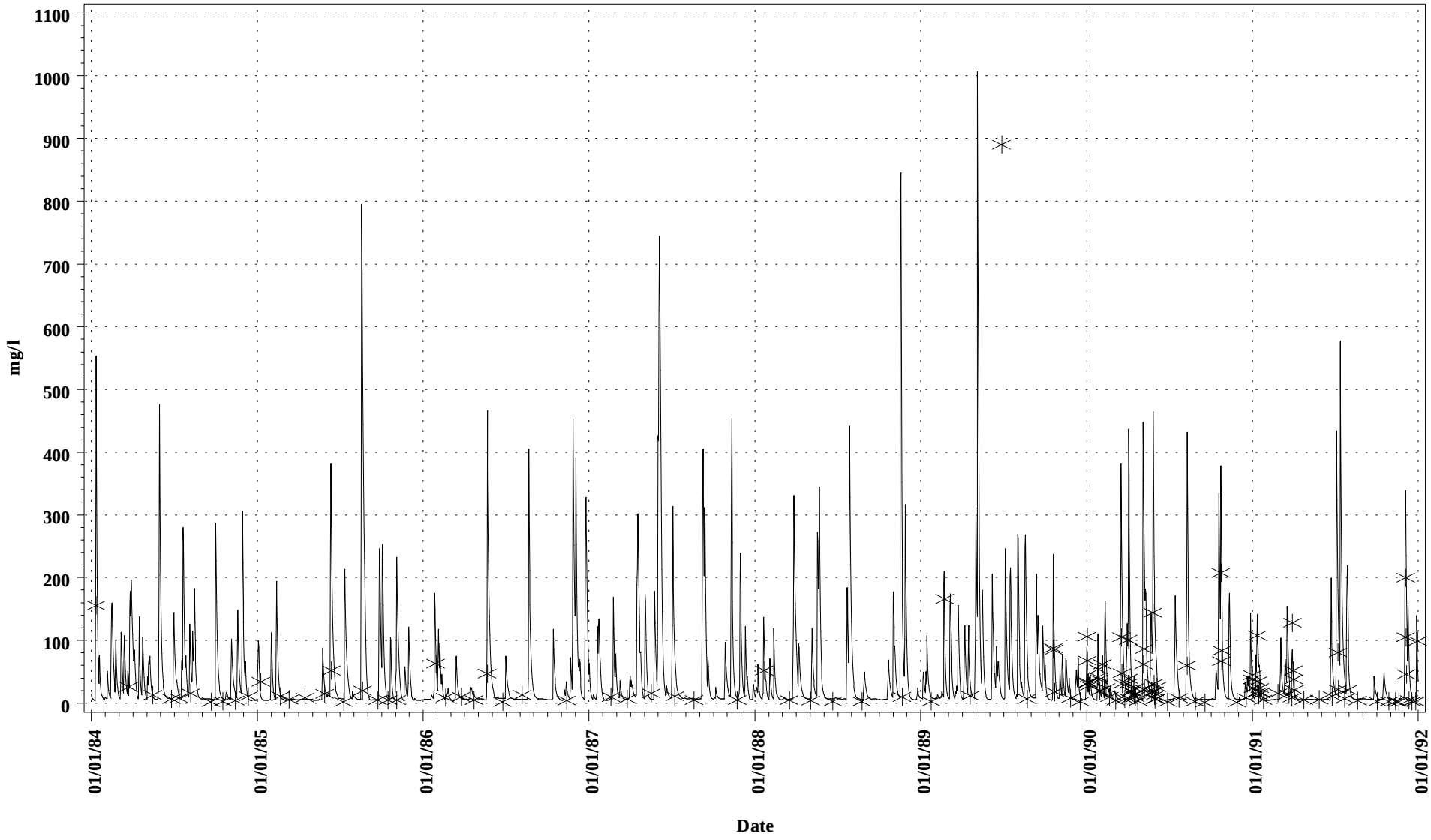
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**

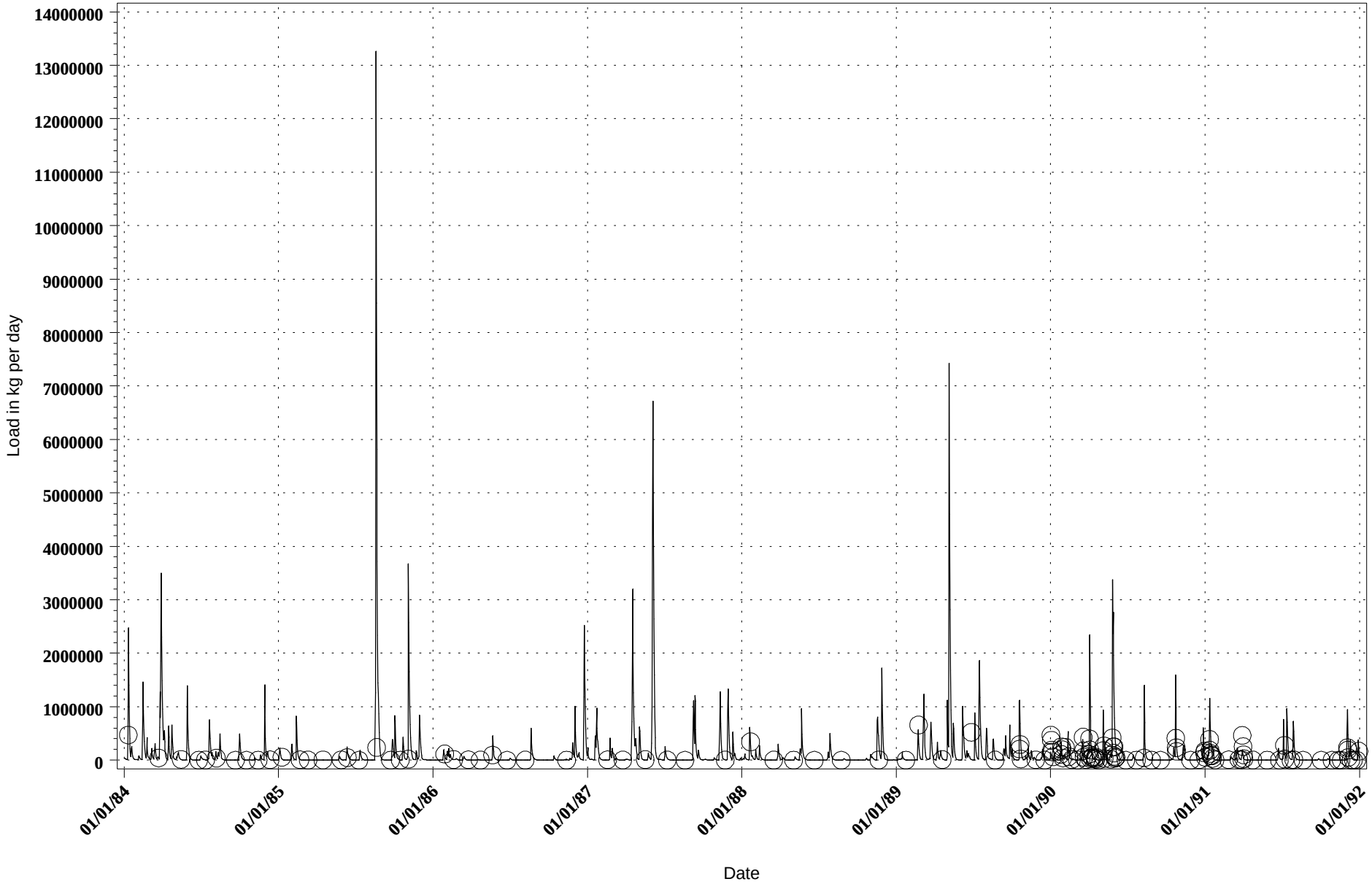



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260

## Total Suspended Sediment Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

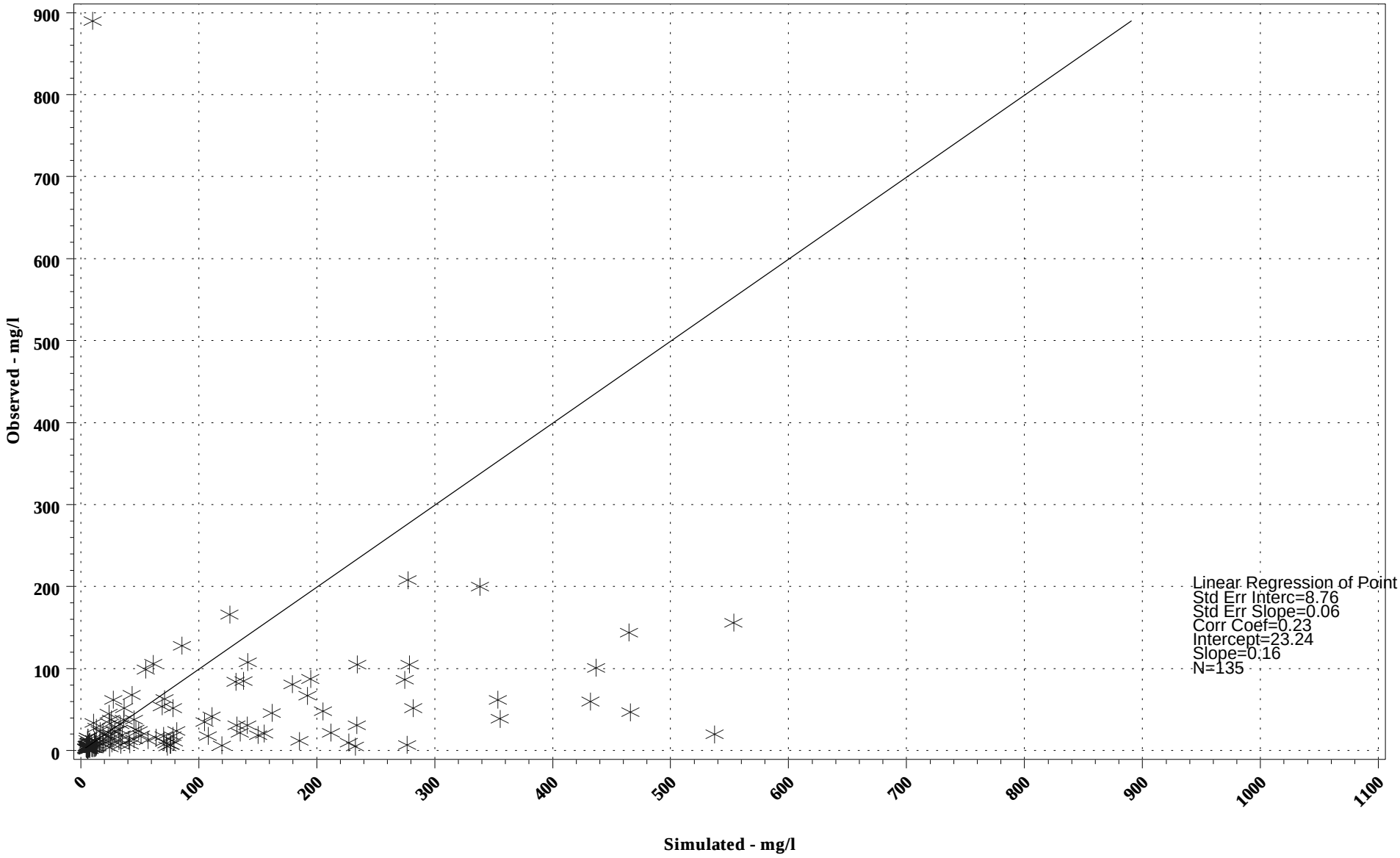



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260

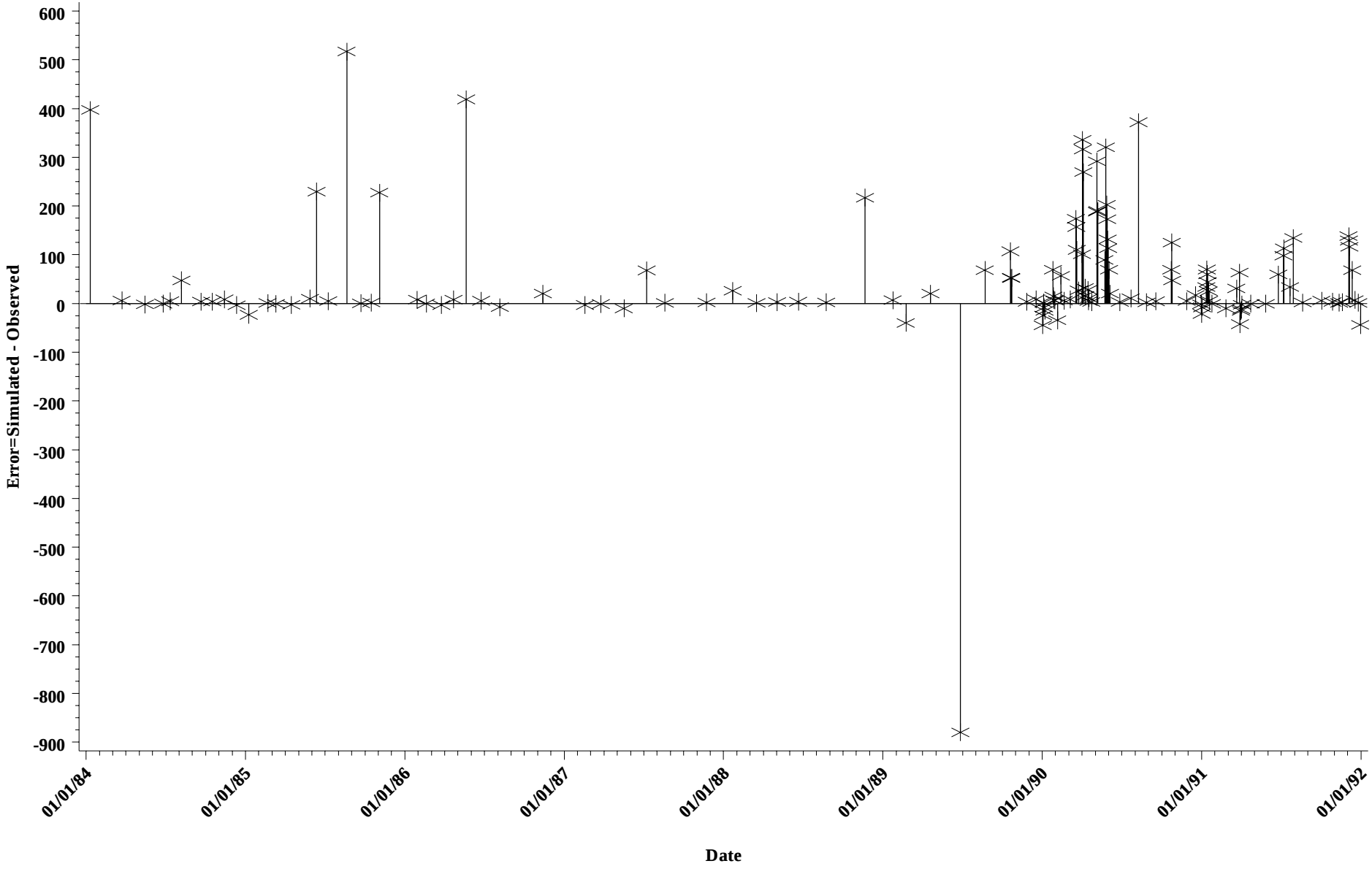
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260
## Actual Error versus Time
## Total Suspended Sediment

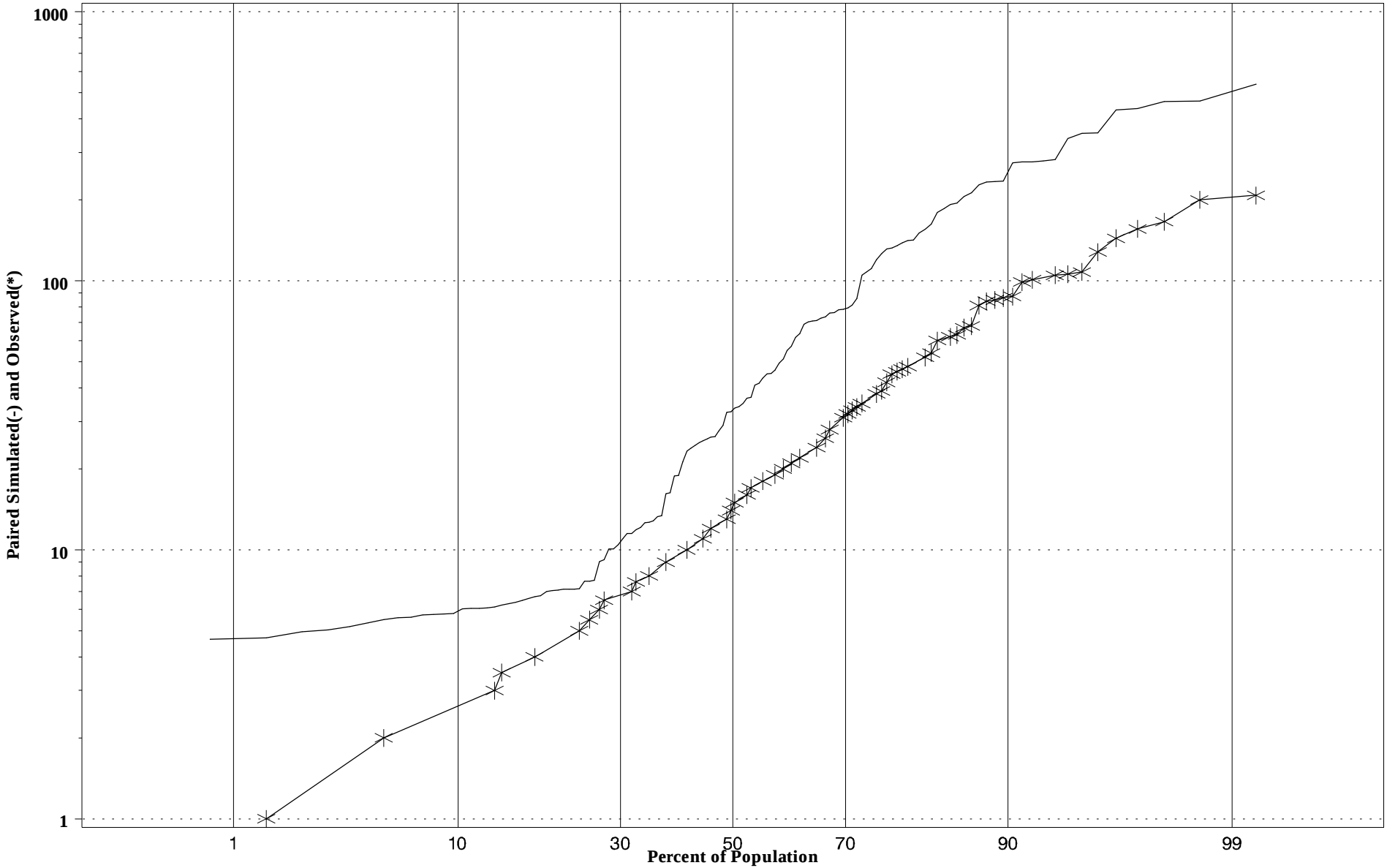



(y21_plotb.sas model3d:[pwang.dt] omerr)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260

## Total Suspended Sediment

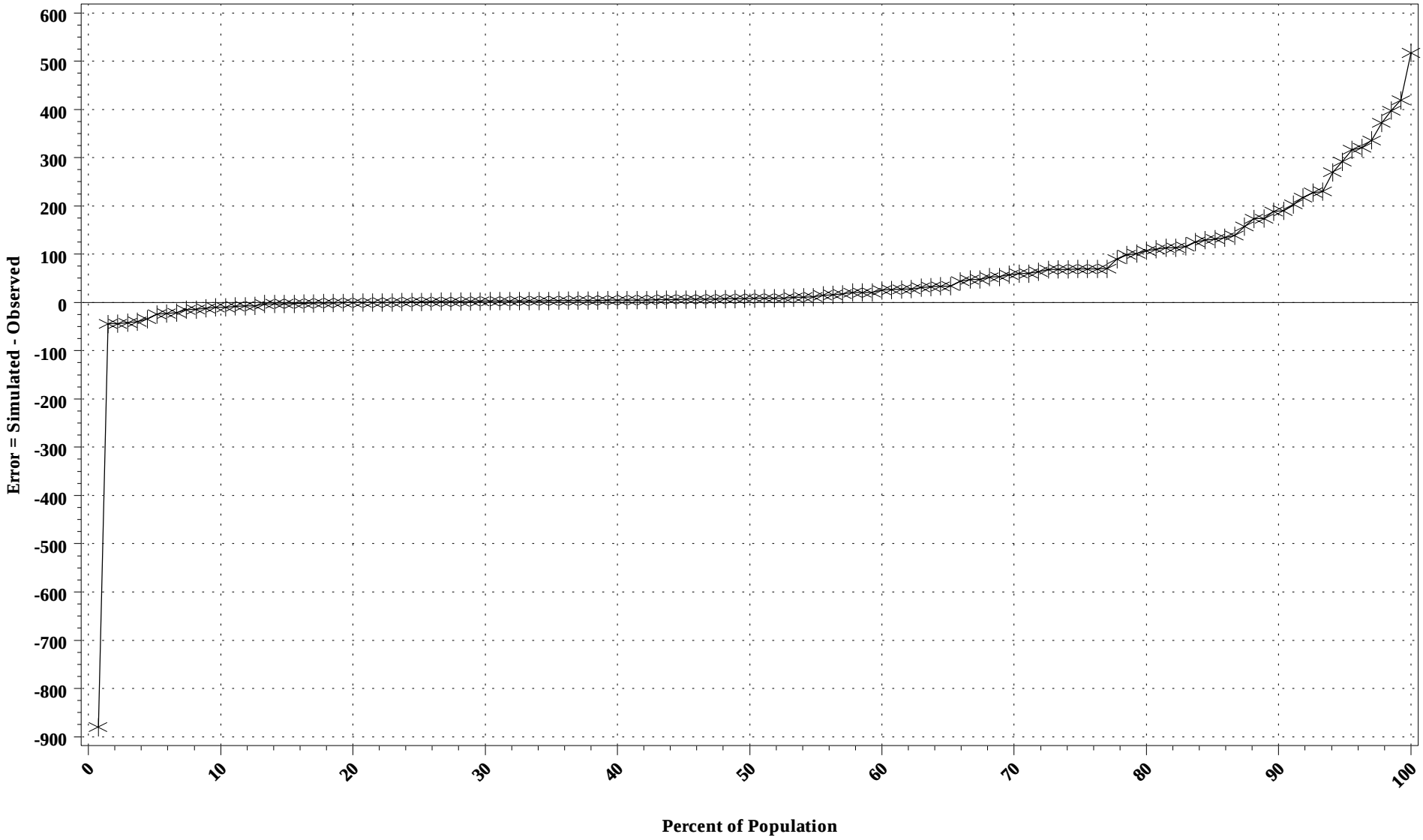
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

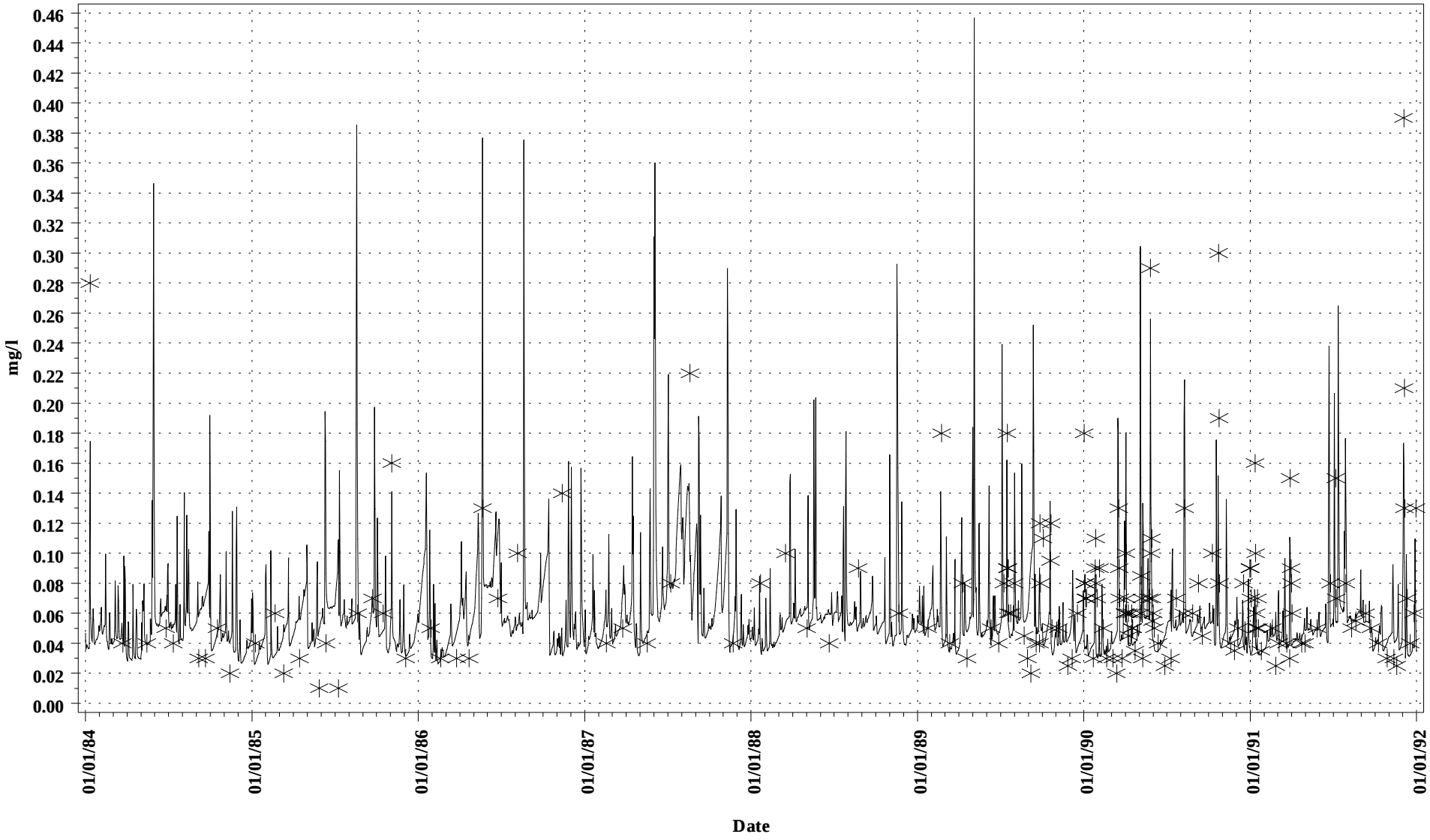
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(pamun260.drv 29JUN98 11:31)

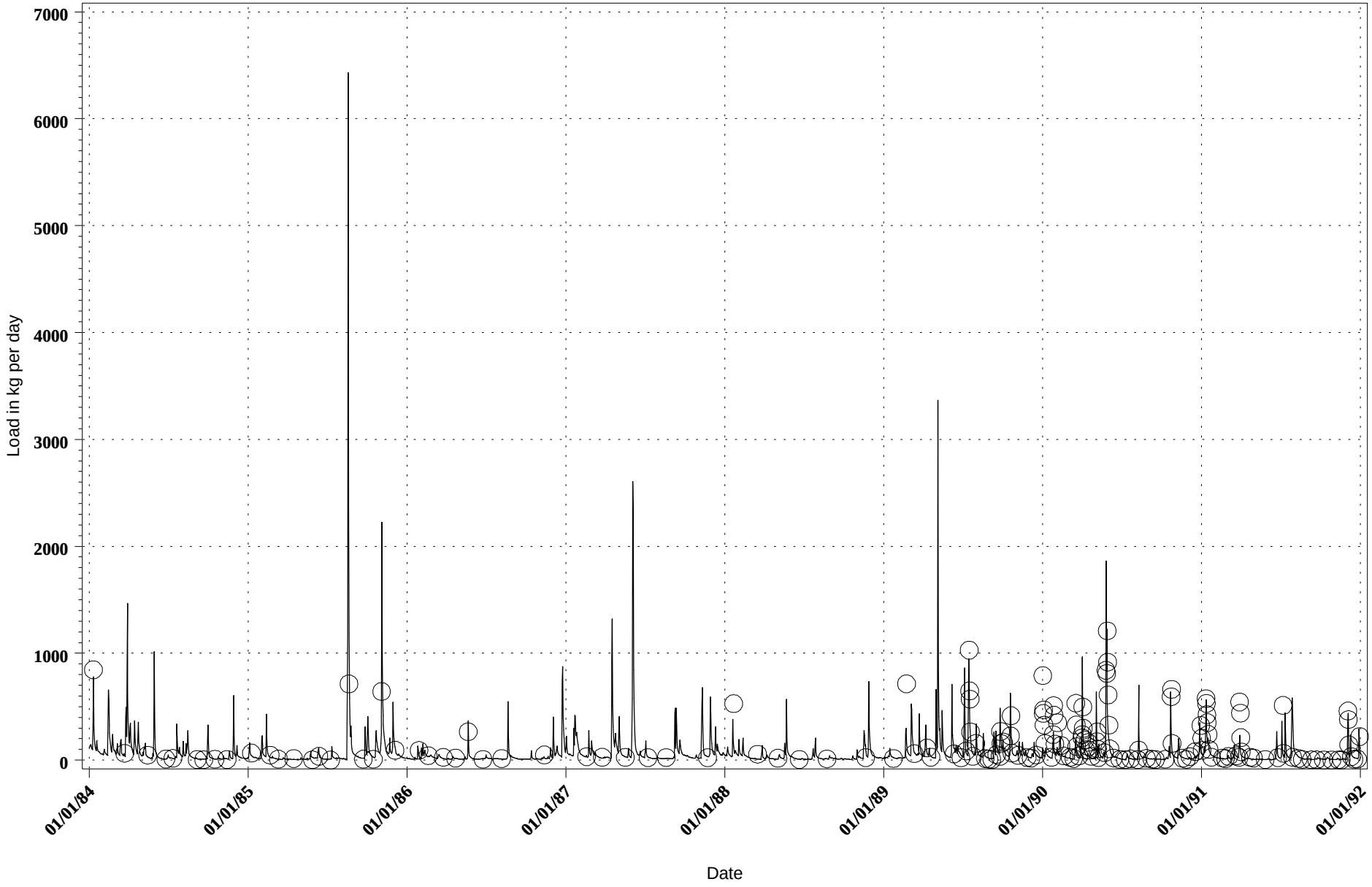
# Pamunkey River at Segment 260
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

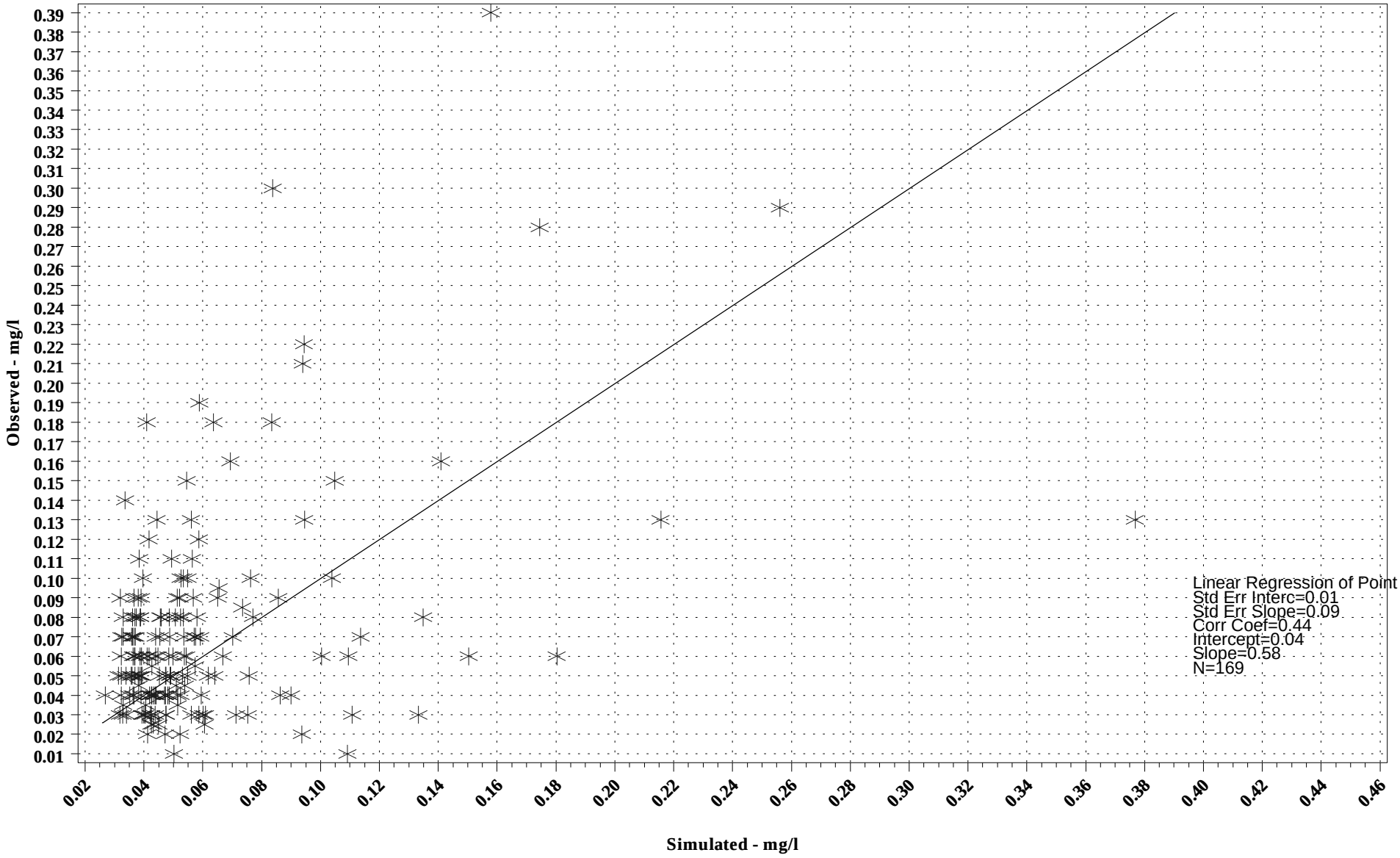



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260

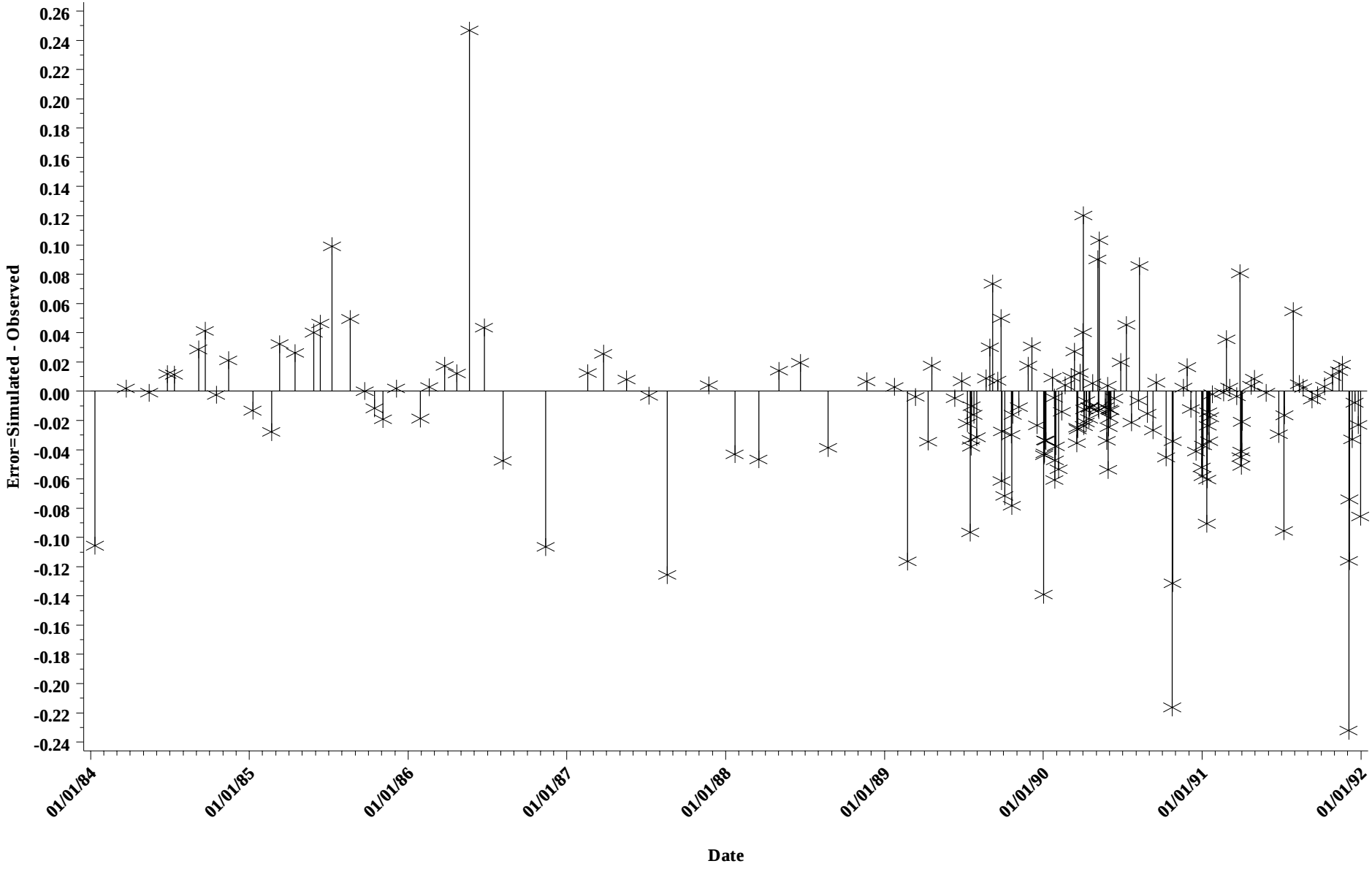
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



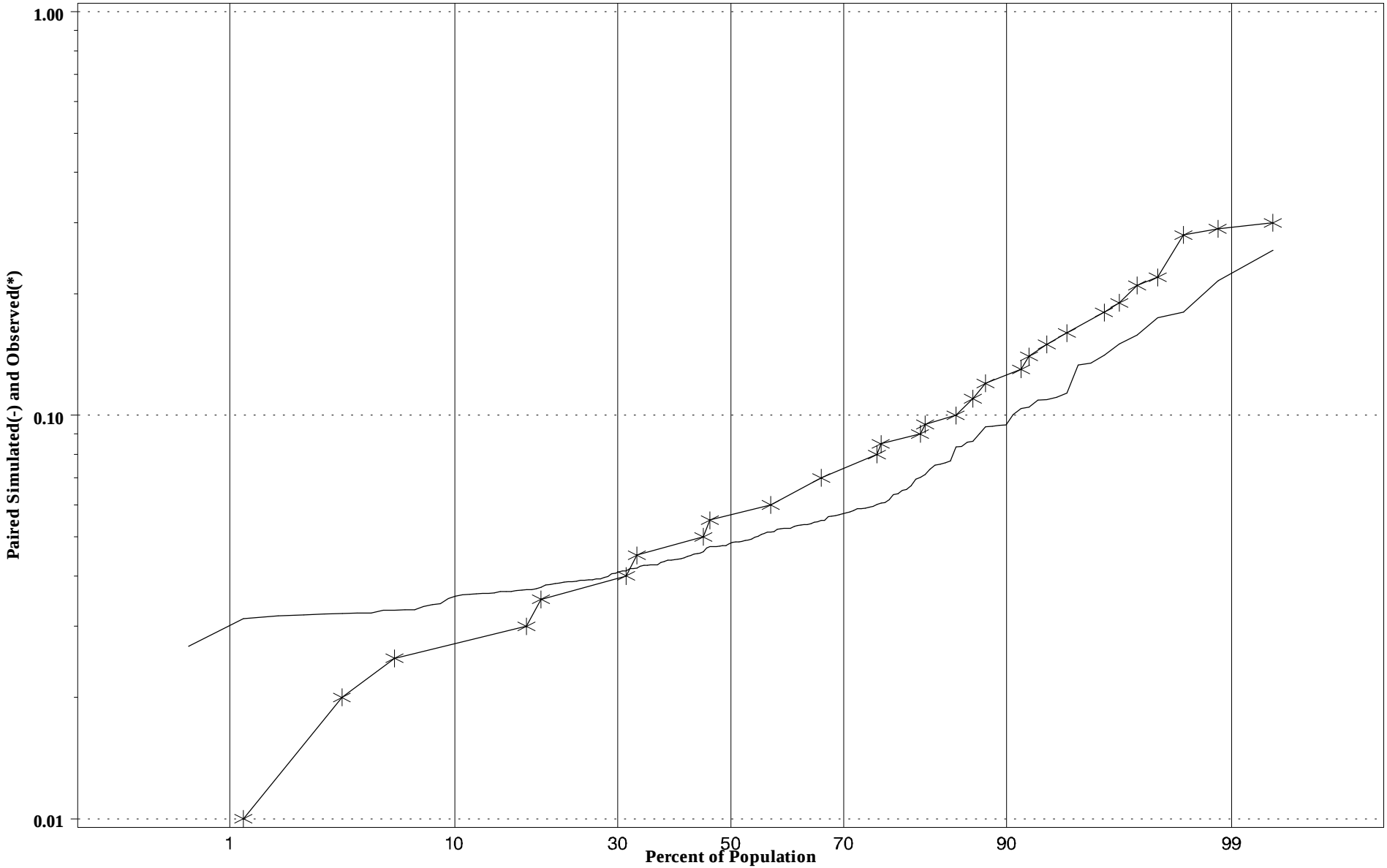

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(pamun260.drv 29JUN98 11:31)

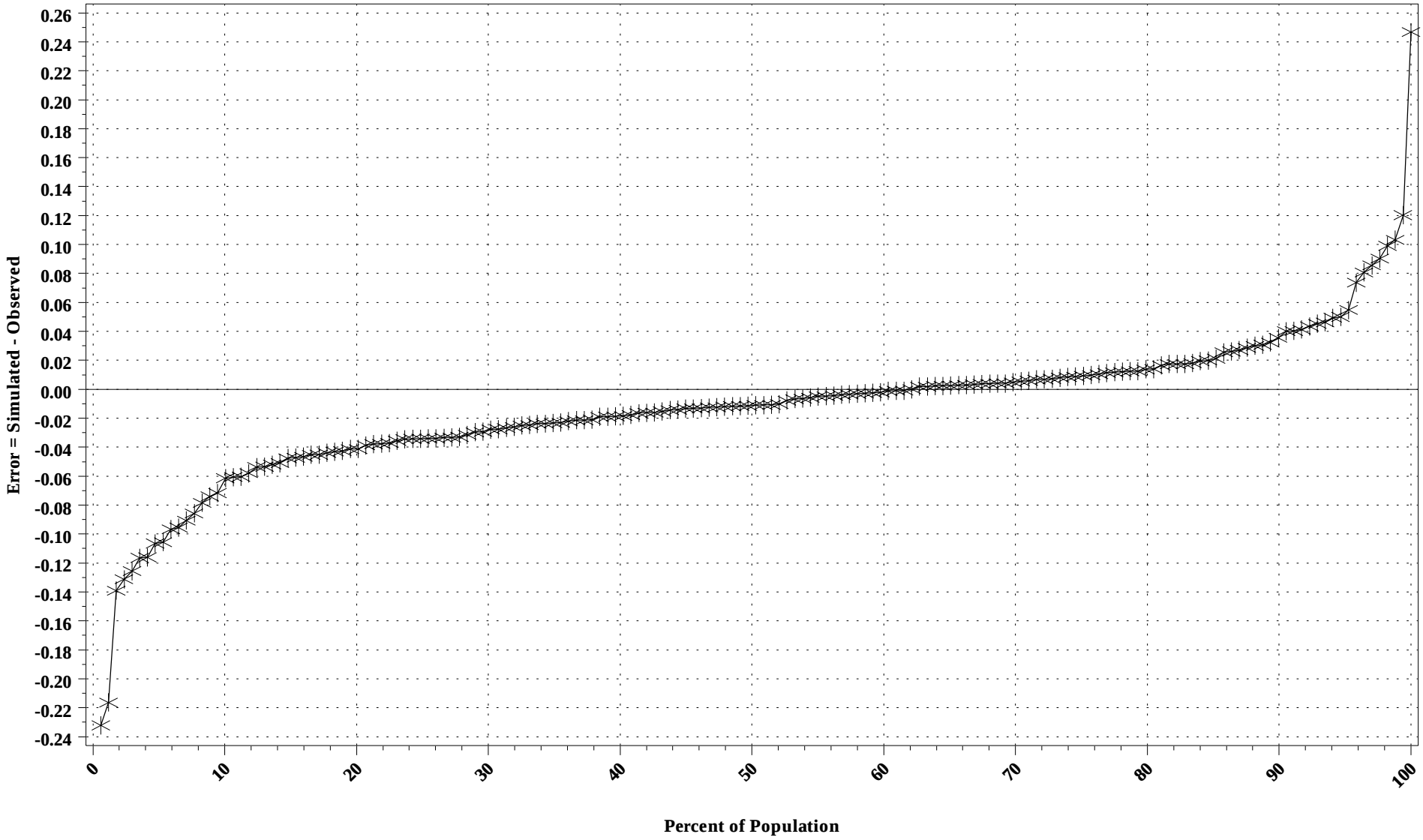
# Pamunkey River at Segment 260
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Actual error versus Percentile Sample Population
## Total Phosphorus

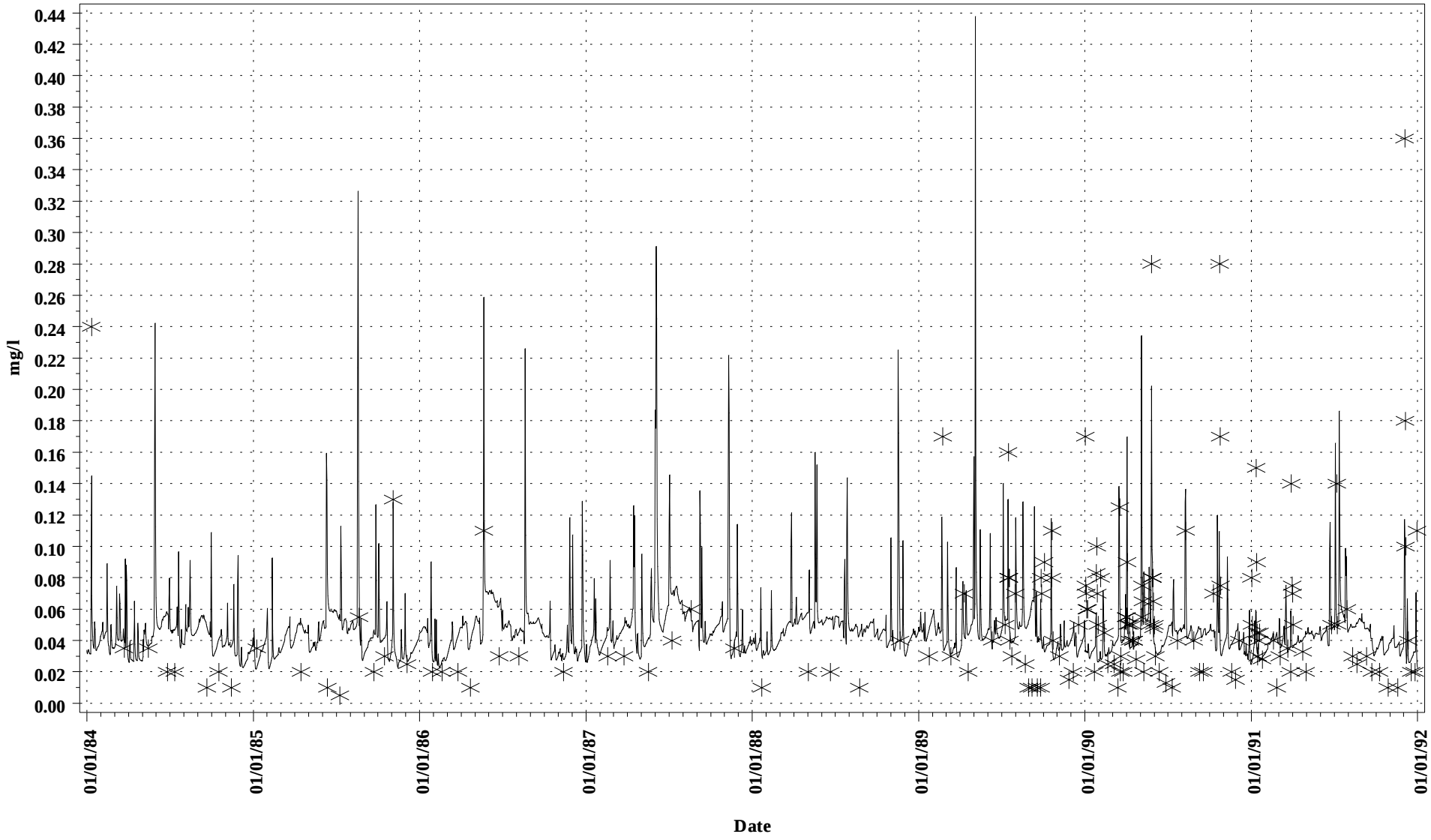
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

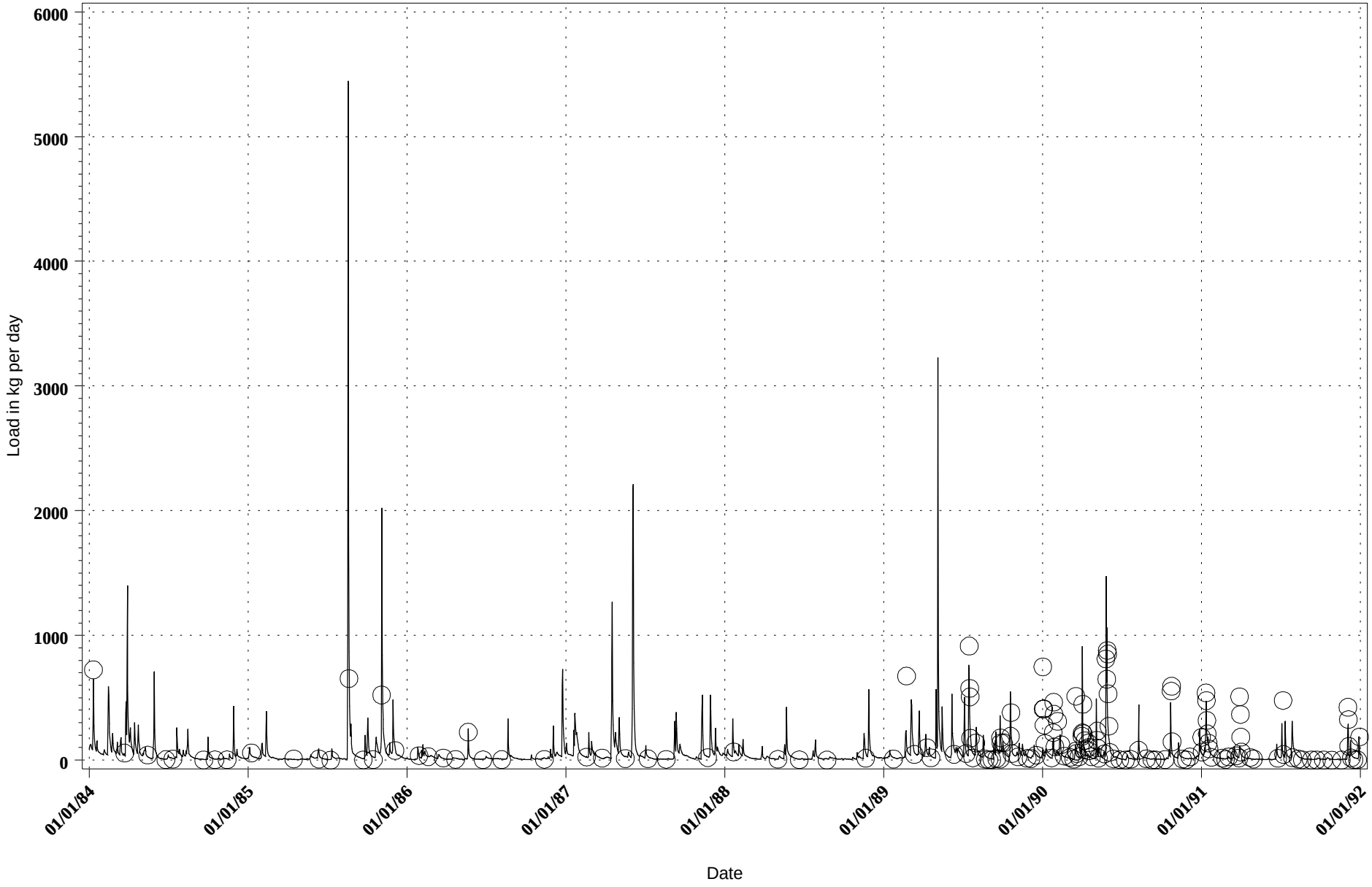



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

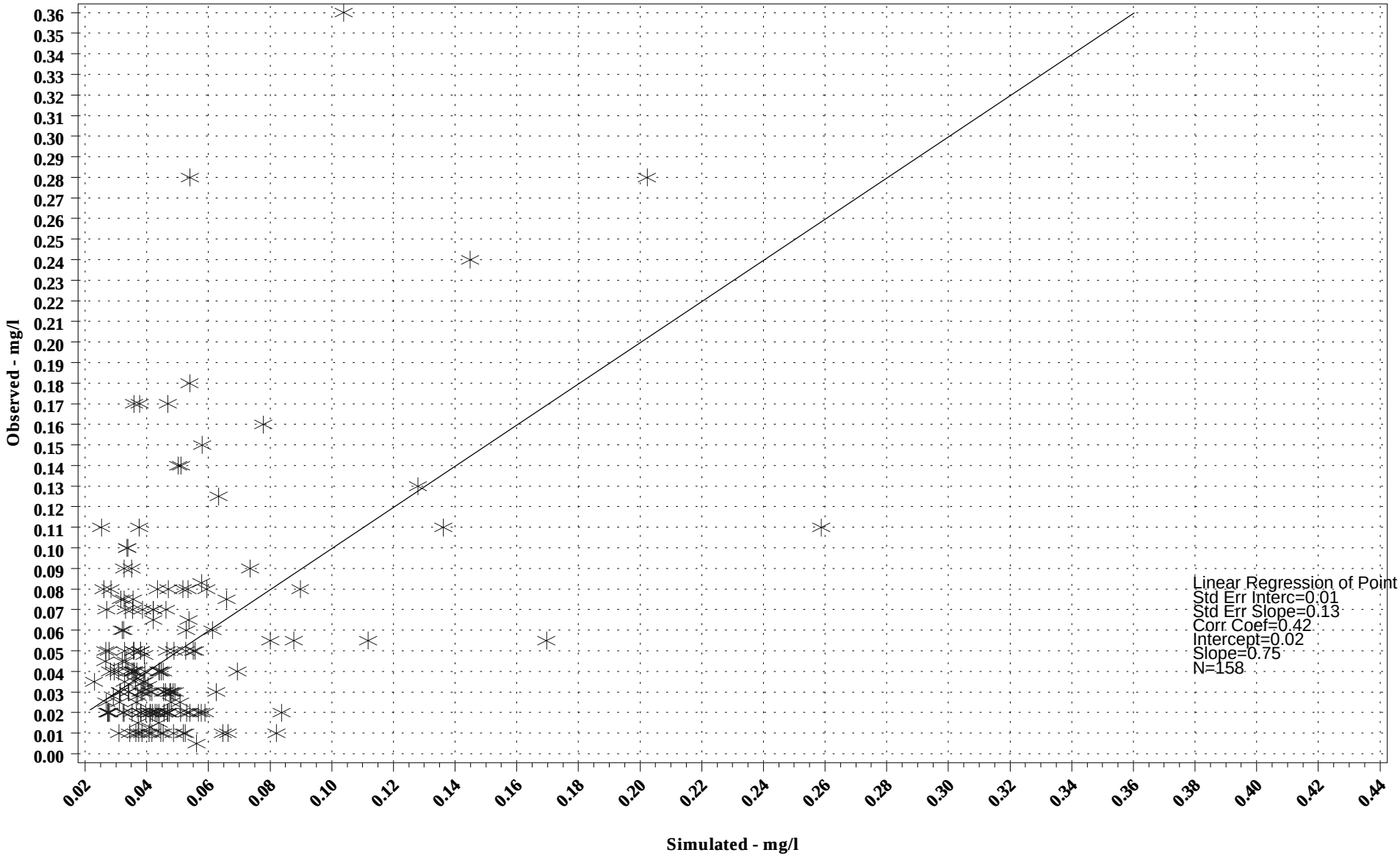



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260

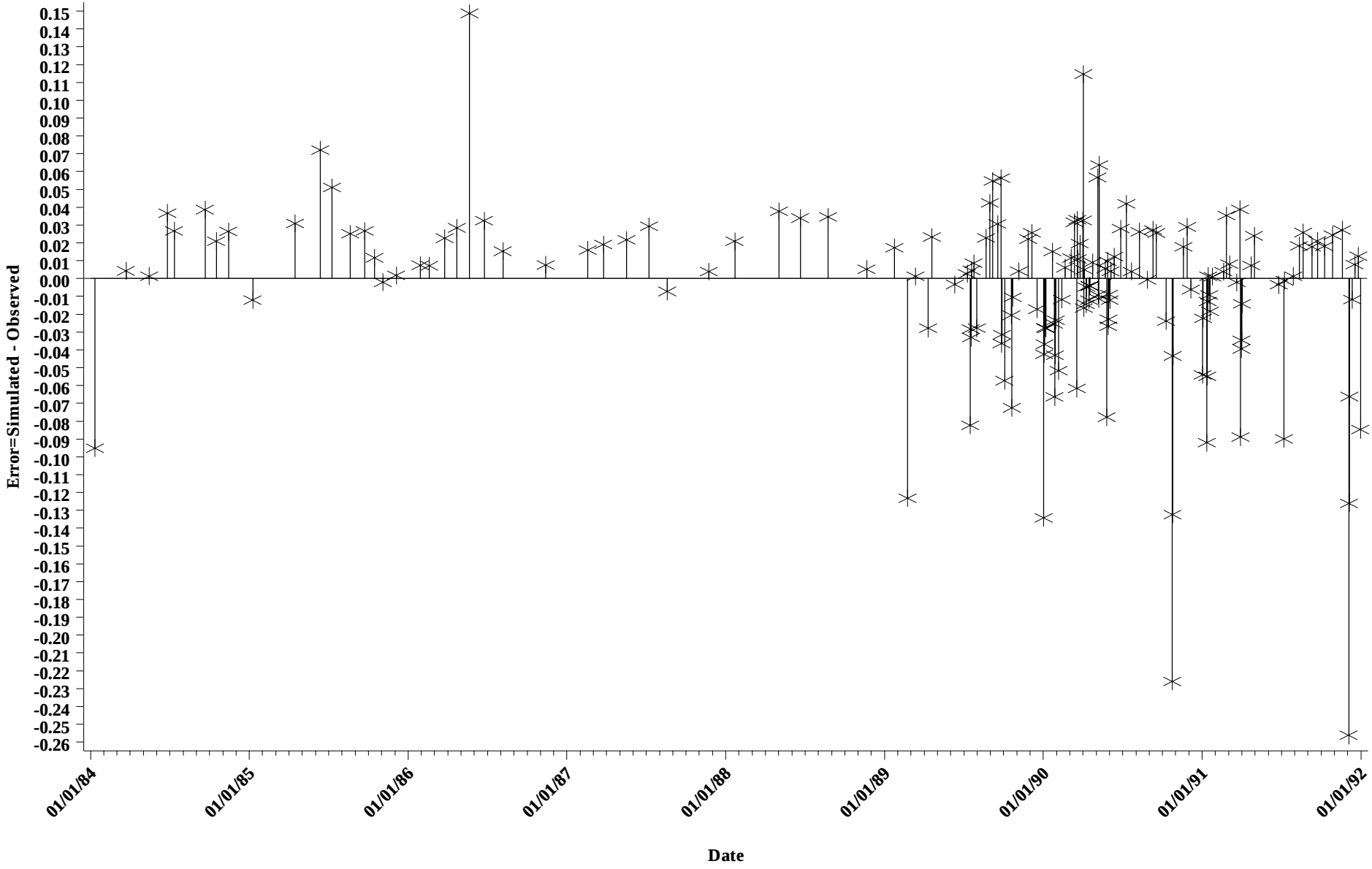
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260
## Actual Error versus Time
## Organic and Particulate Phosphorus

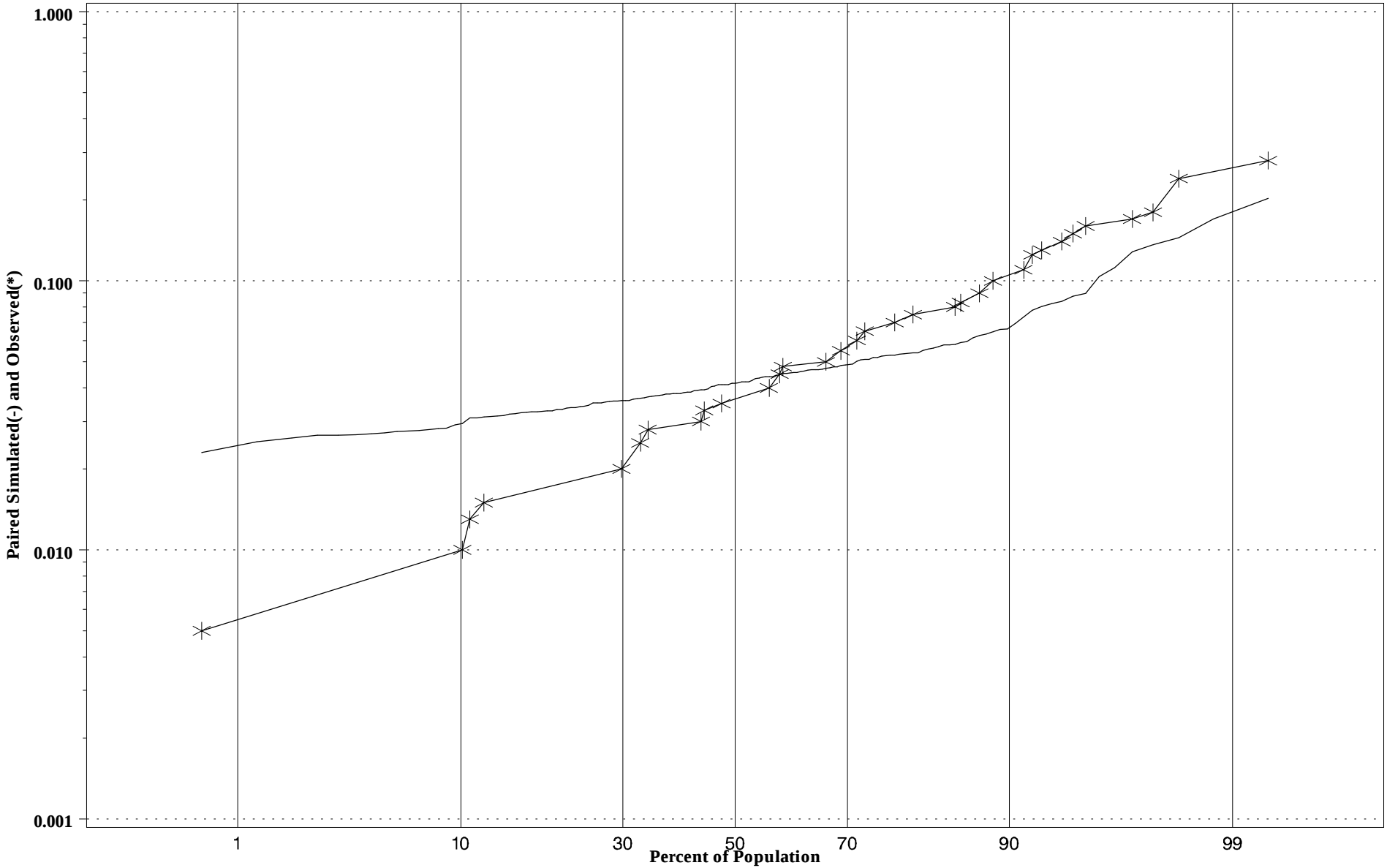



(y21_plotb.sas model3d:[pwang.dt] omerr)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260

## Organic and Particulate Phosphorus

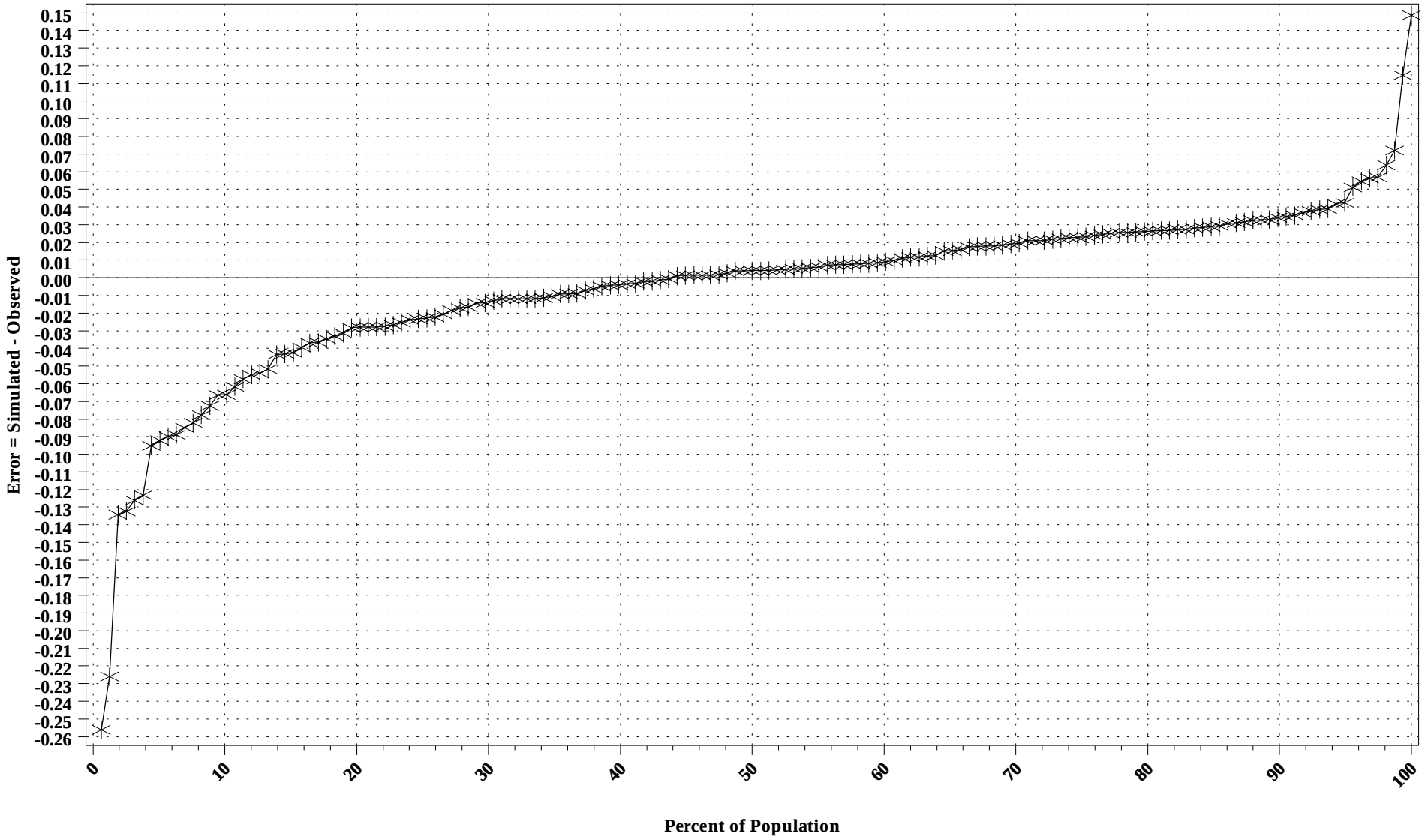
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

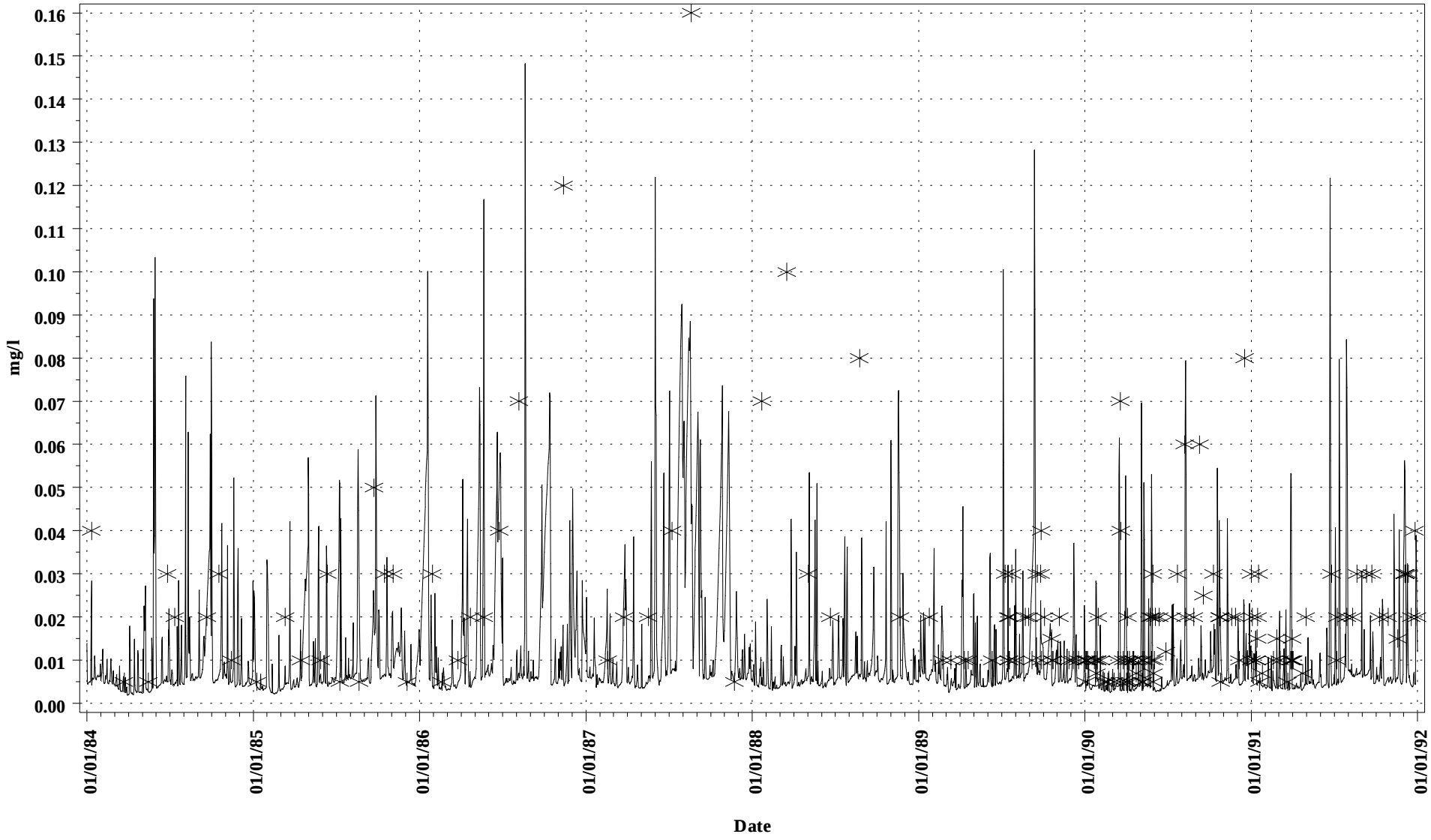
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Observed and Simulated versus Time
## Dissolved Phosphorus

**(*=Observed, -=Simulated)**

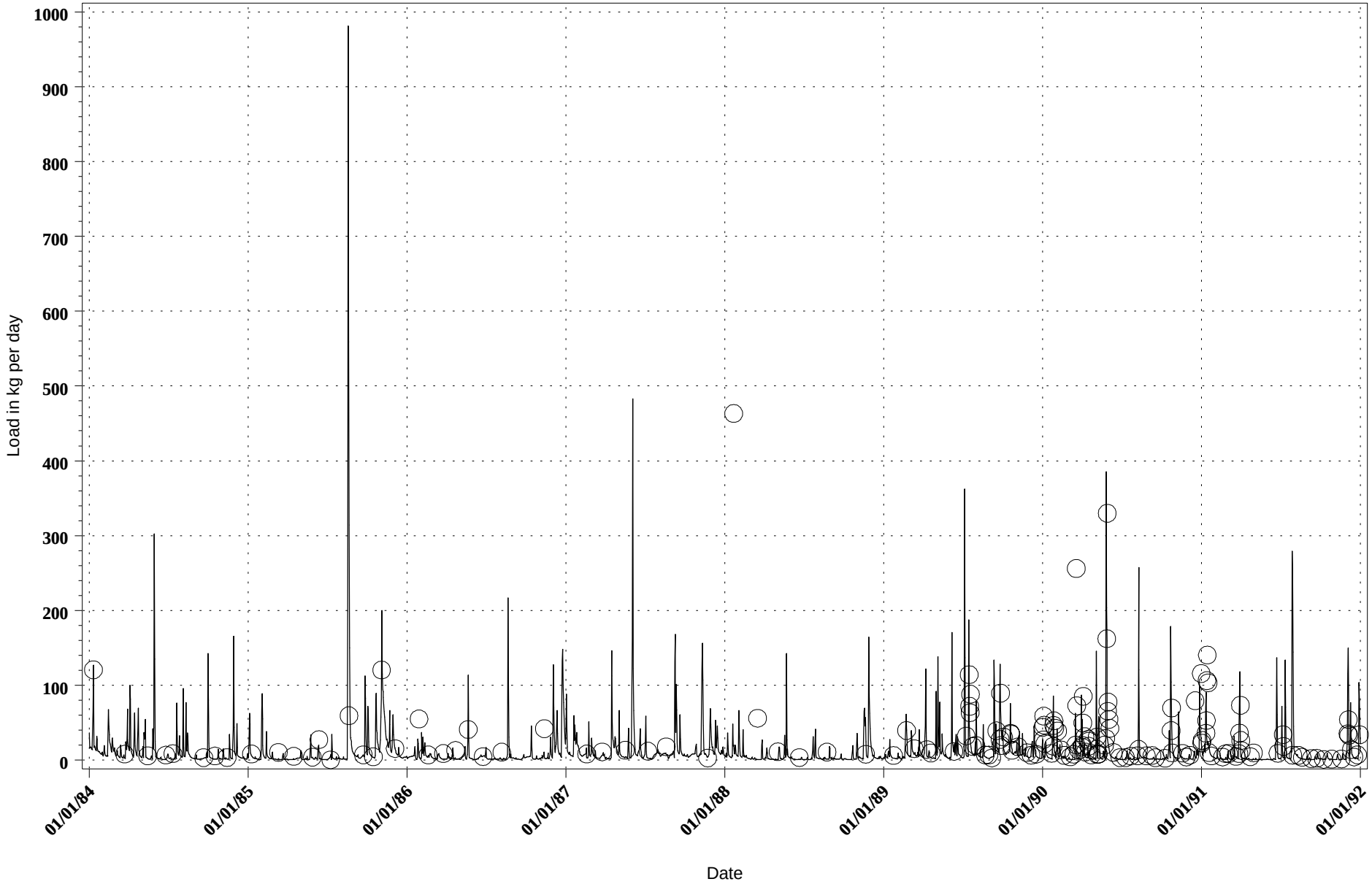



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260

## Dissolved Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

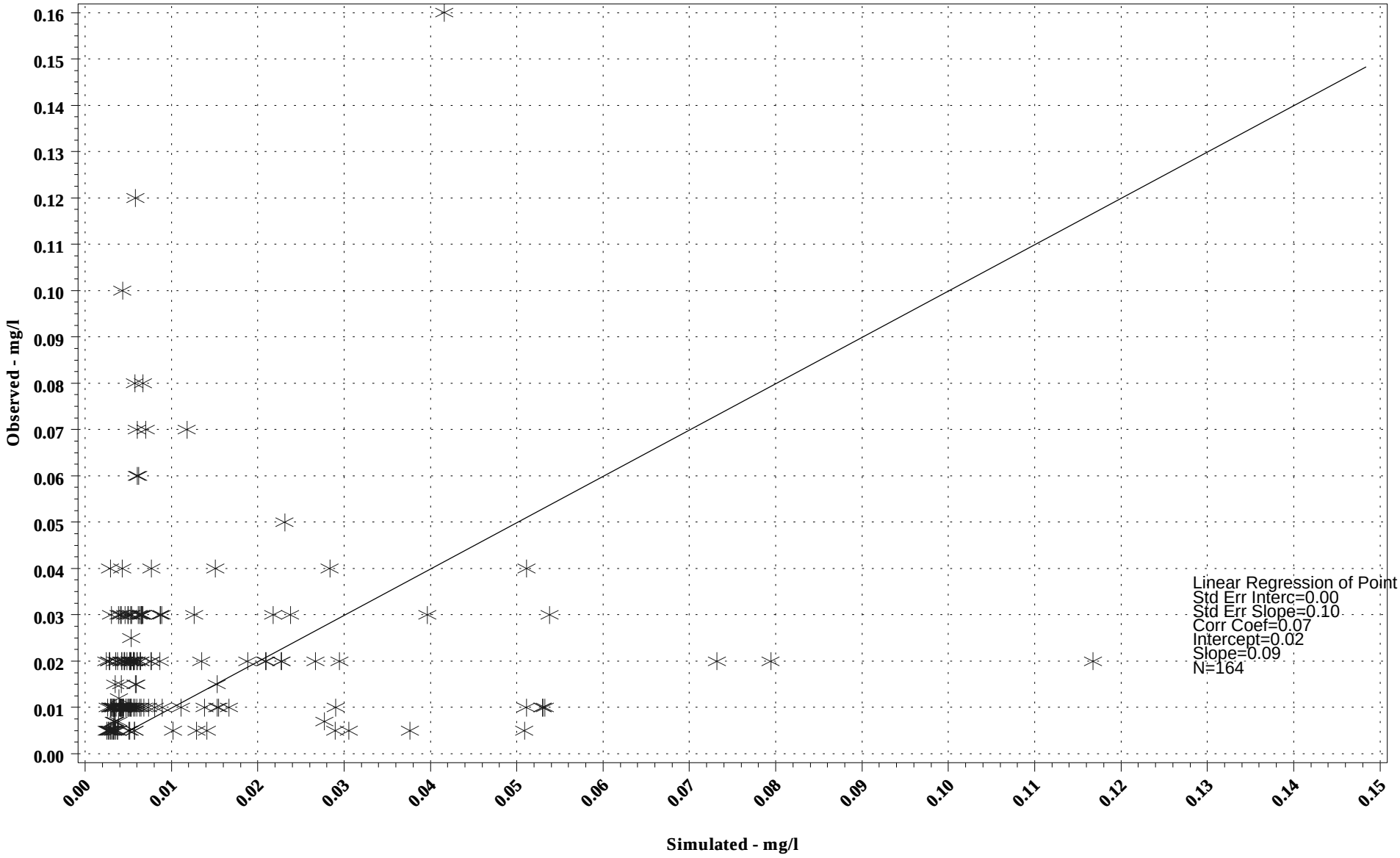



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260

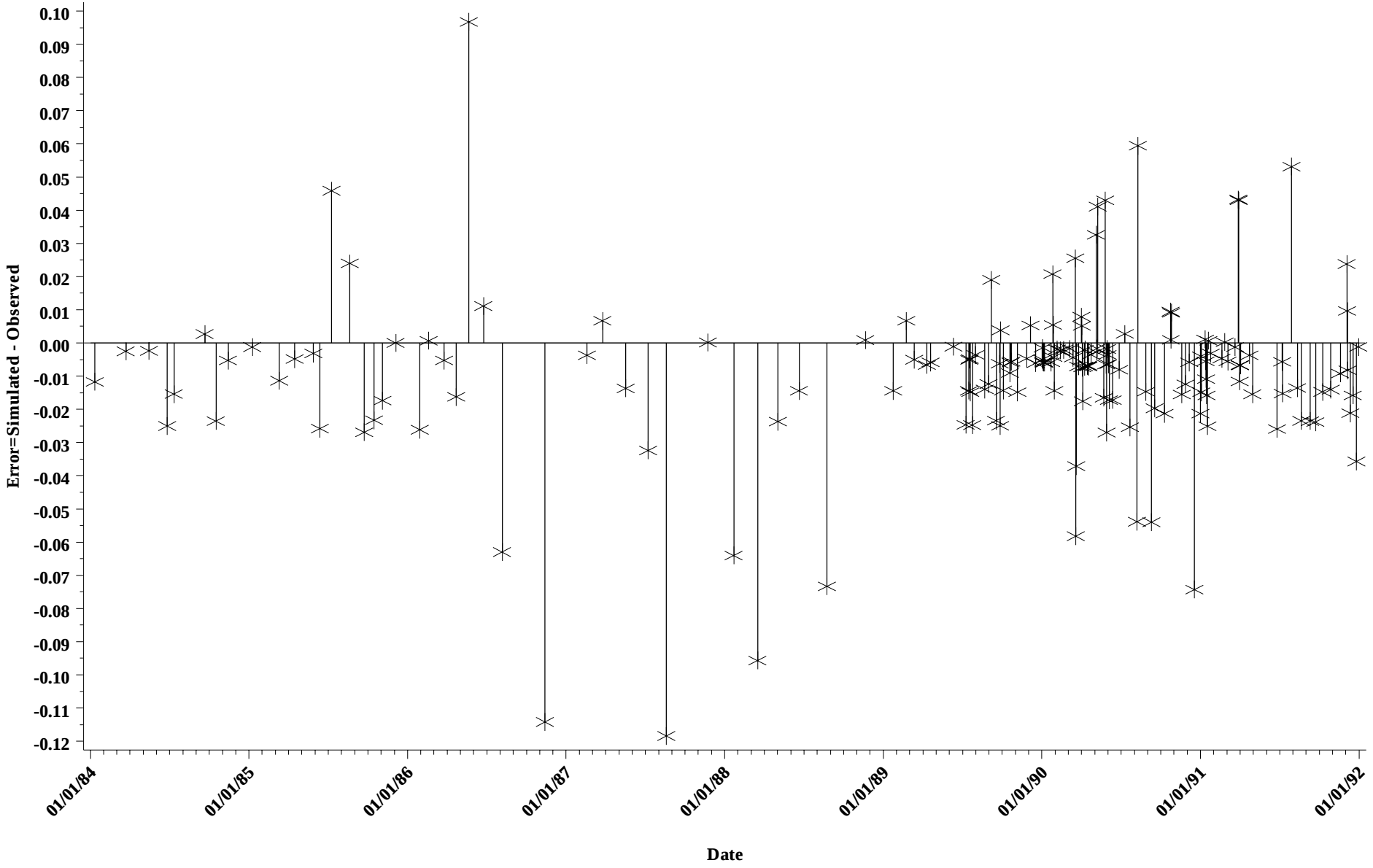
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



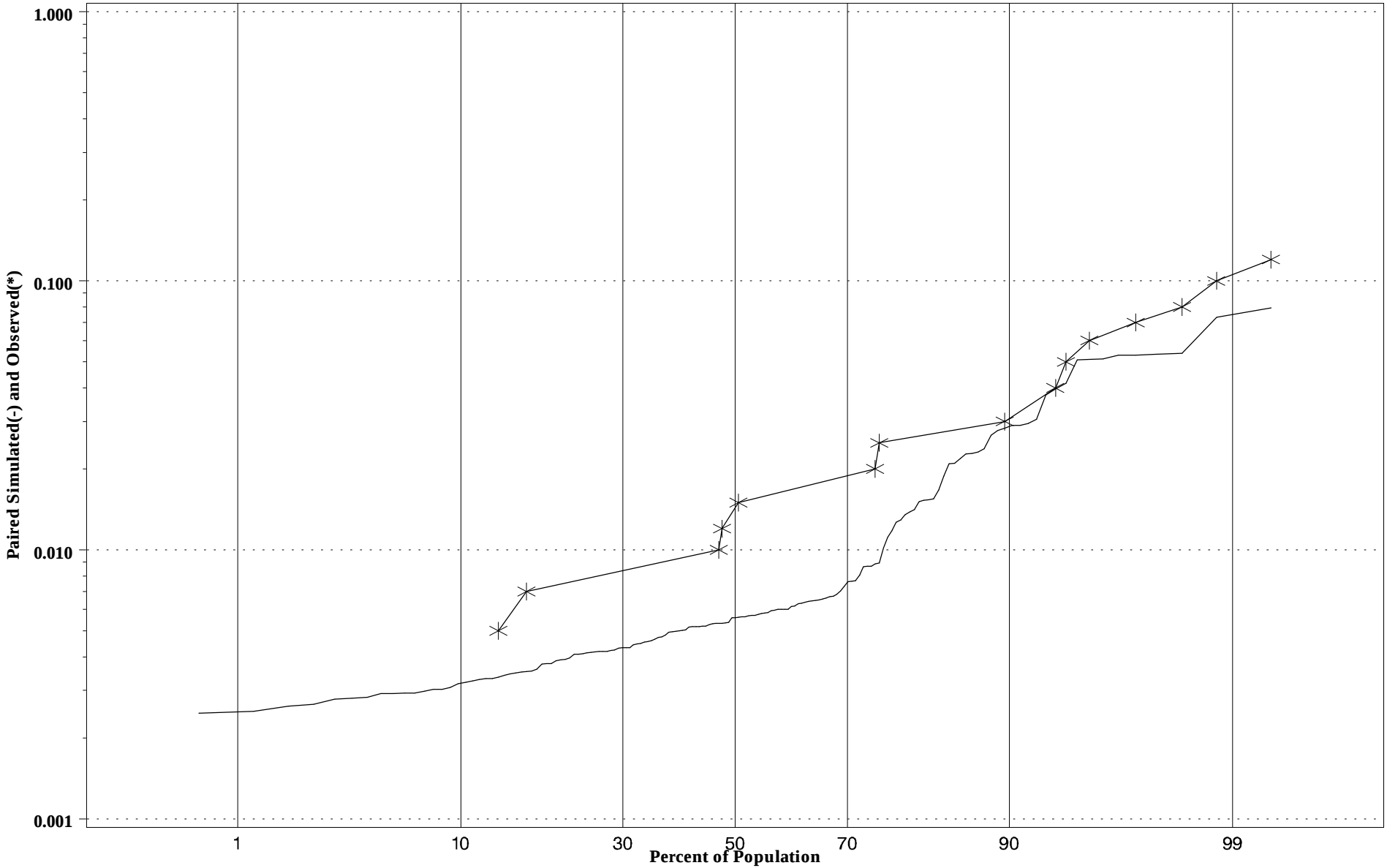

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(pamun260.drv 29JUN98 11:31)

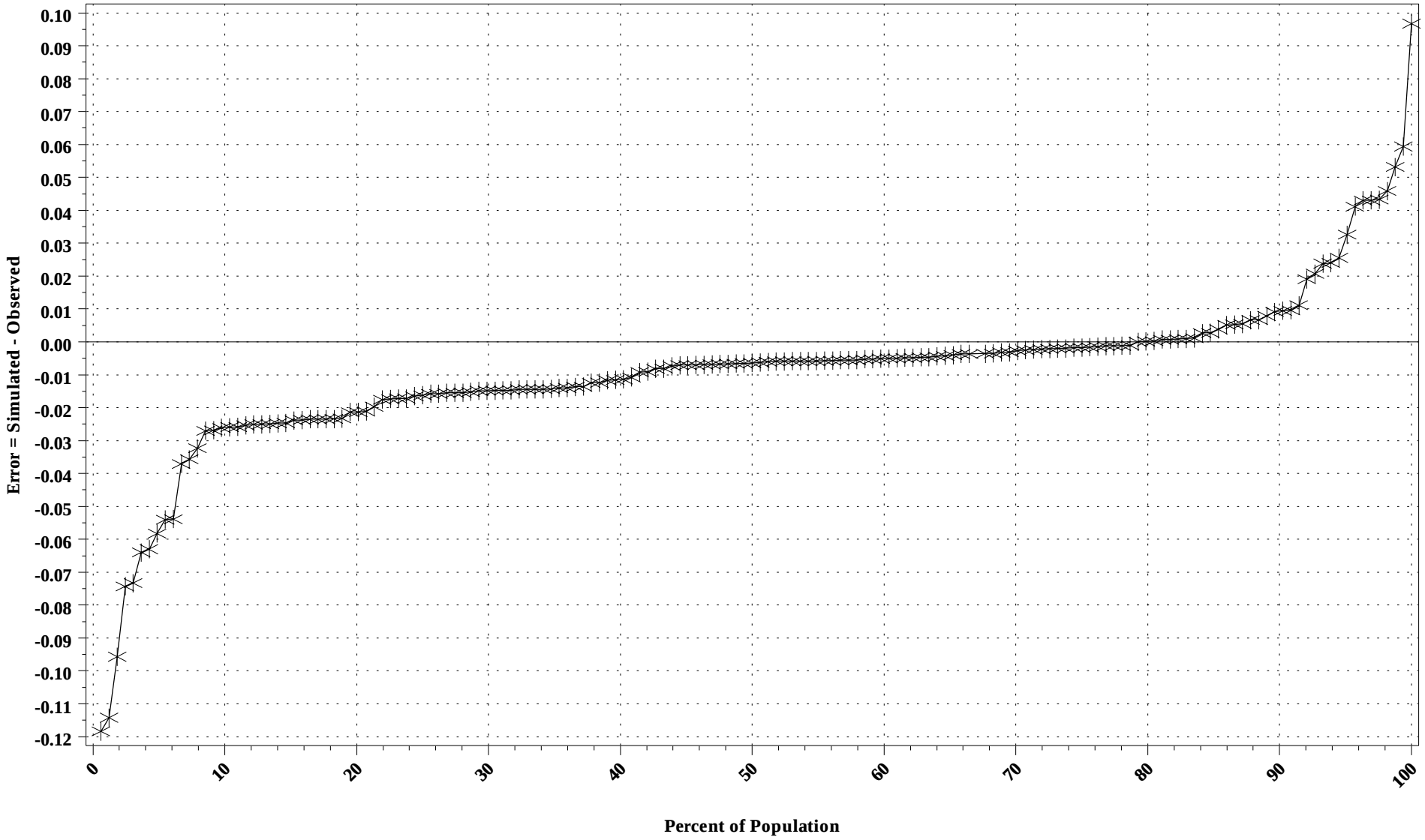
# Pamunkey River at Segment 260
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

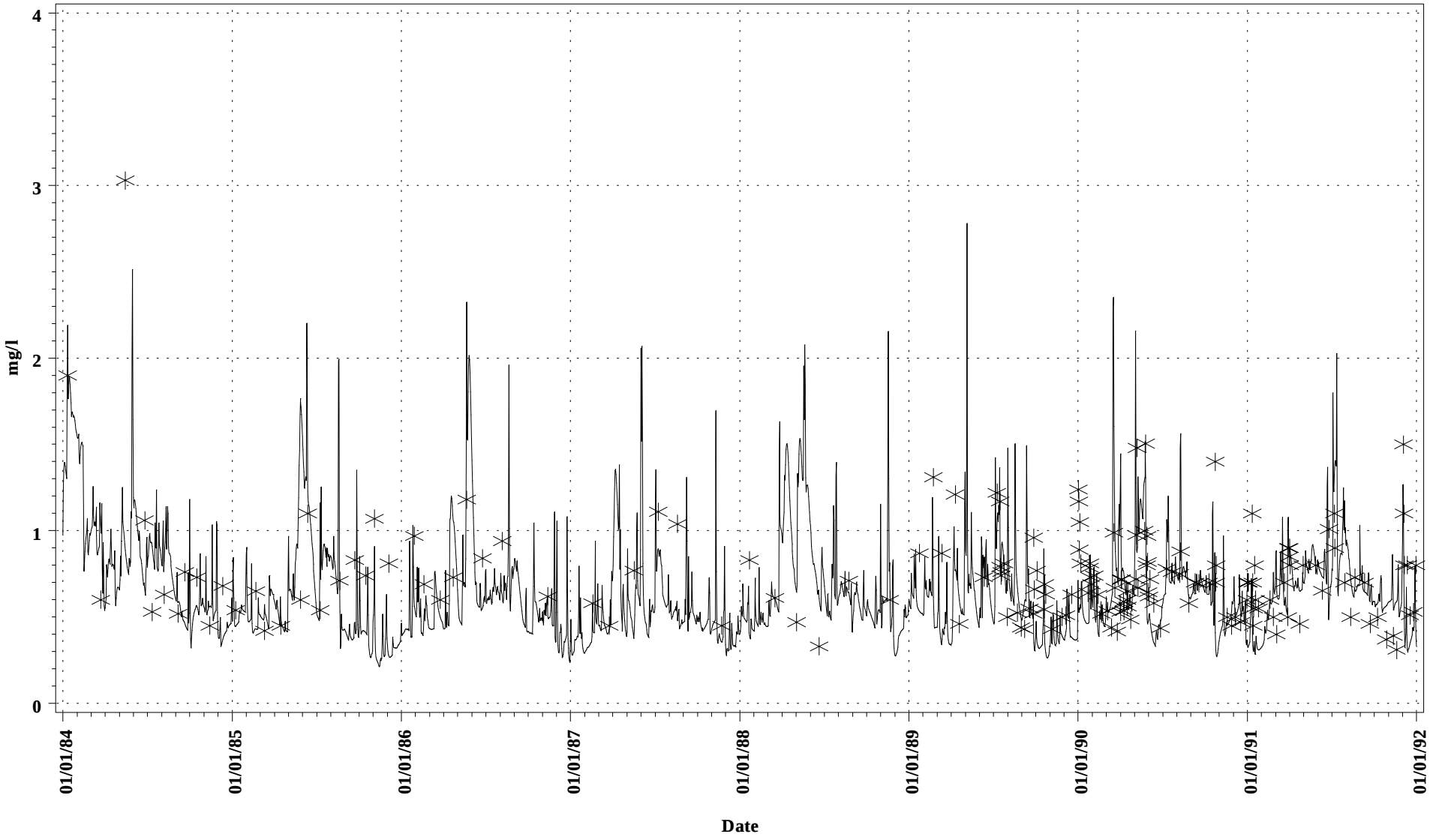
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**

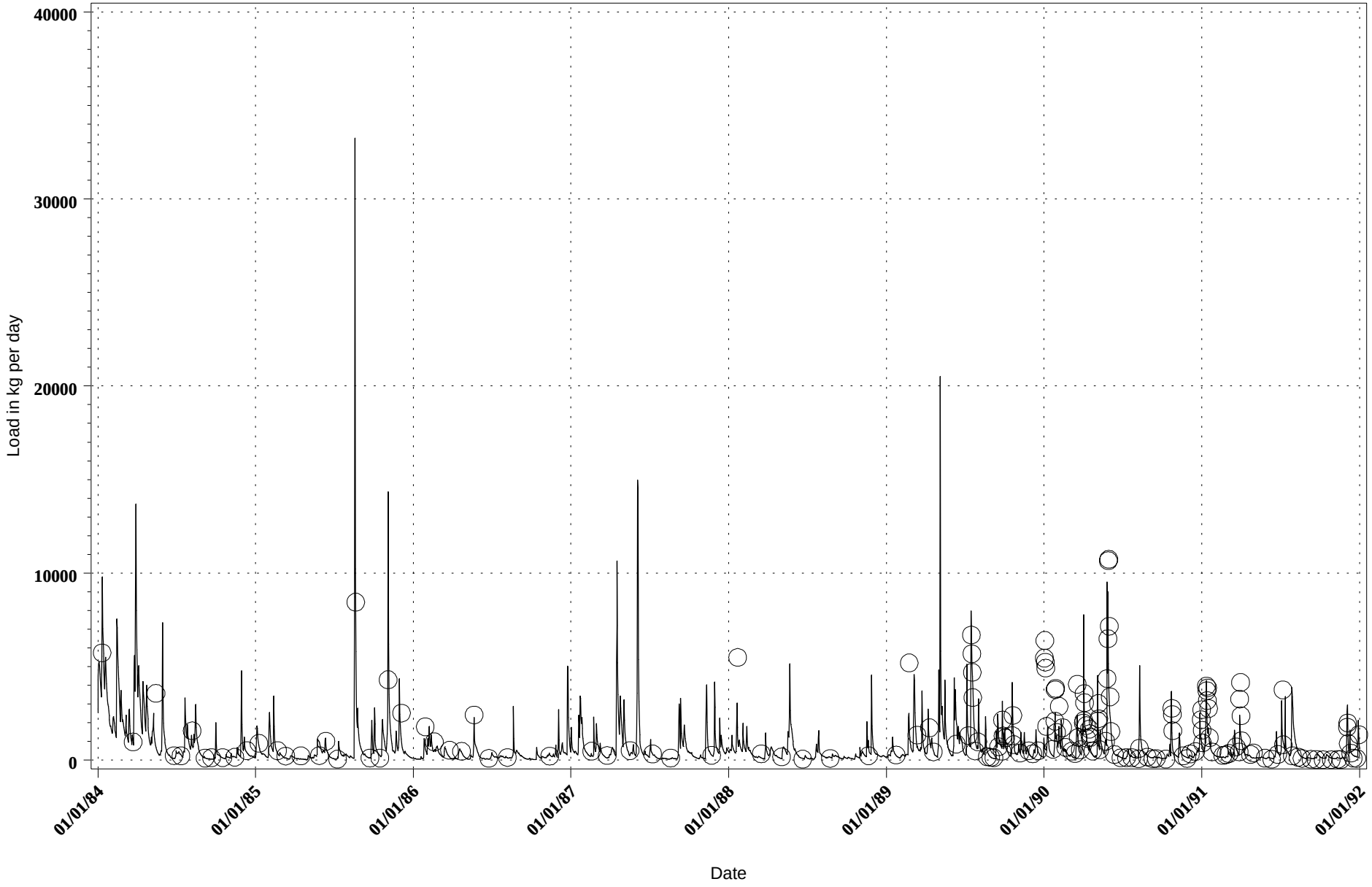



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260

## Total Nitrogen Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

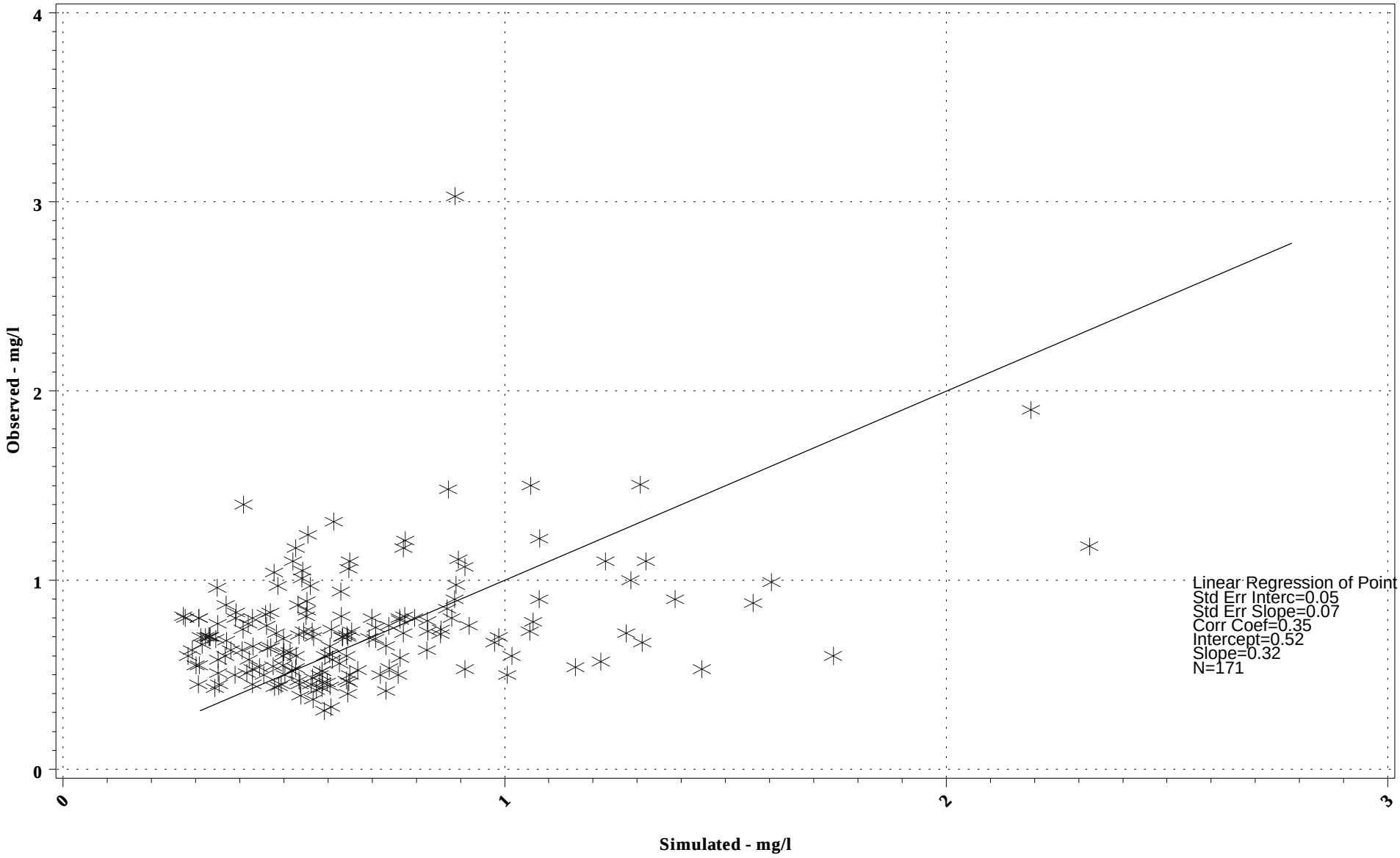



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260

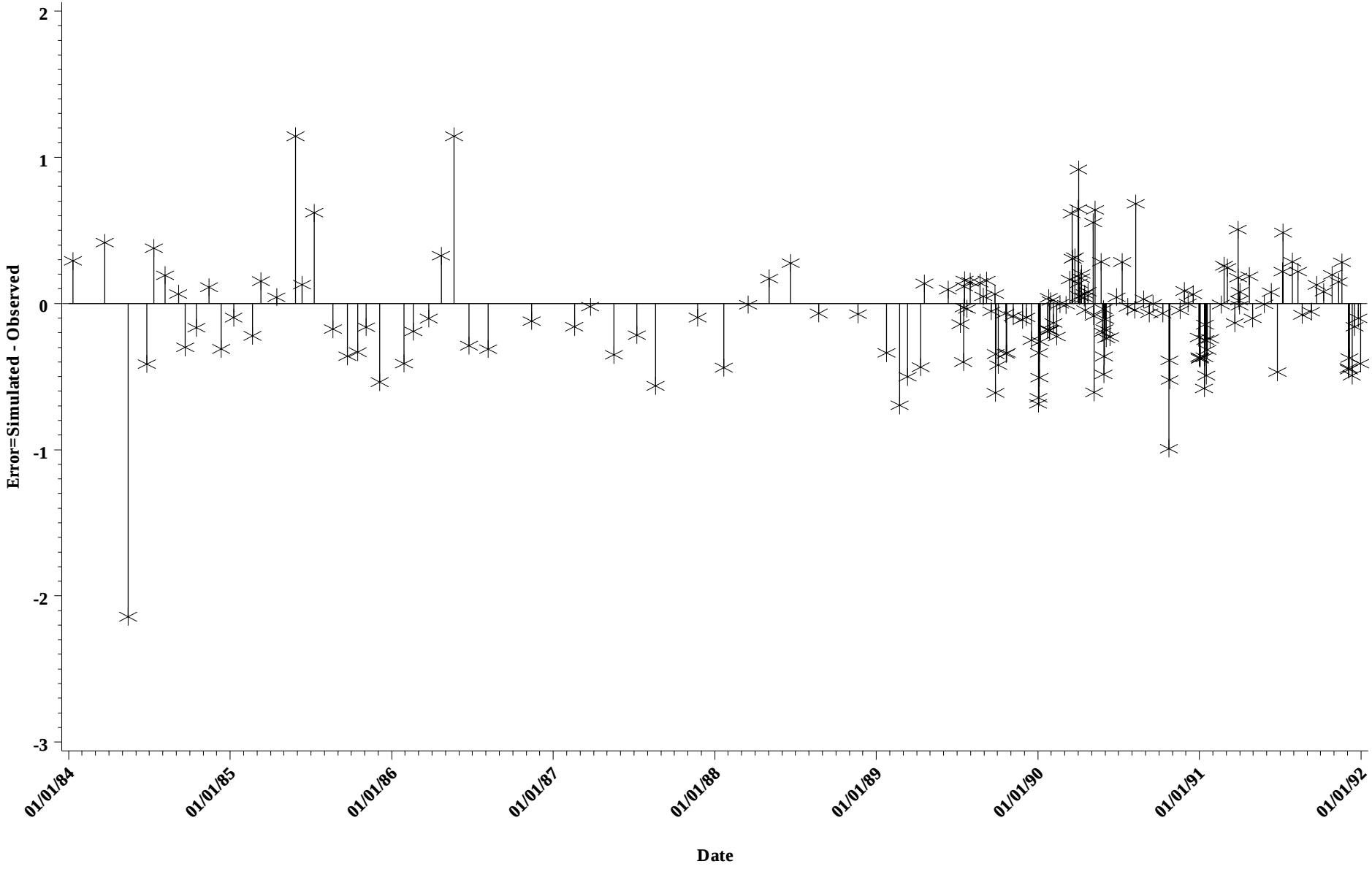
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92



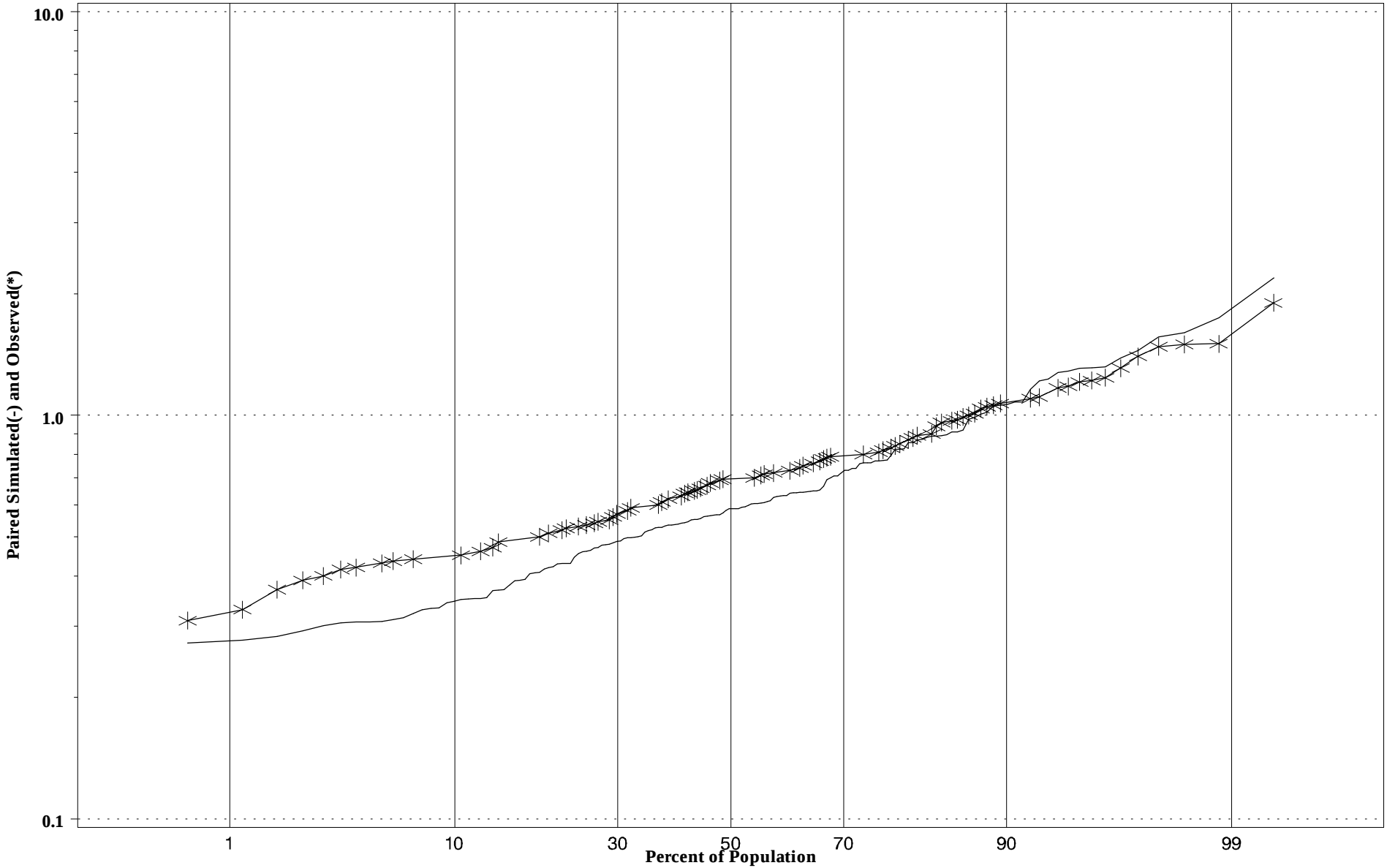

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260
## Actual Error versus Time
## Total Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(pamun260.drv 29JUN98 11:31)

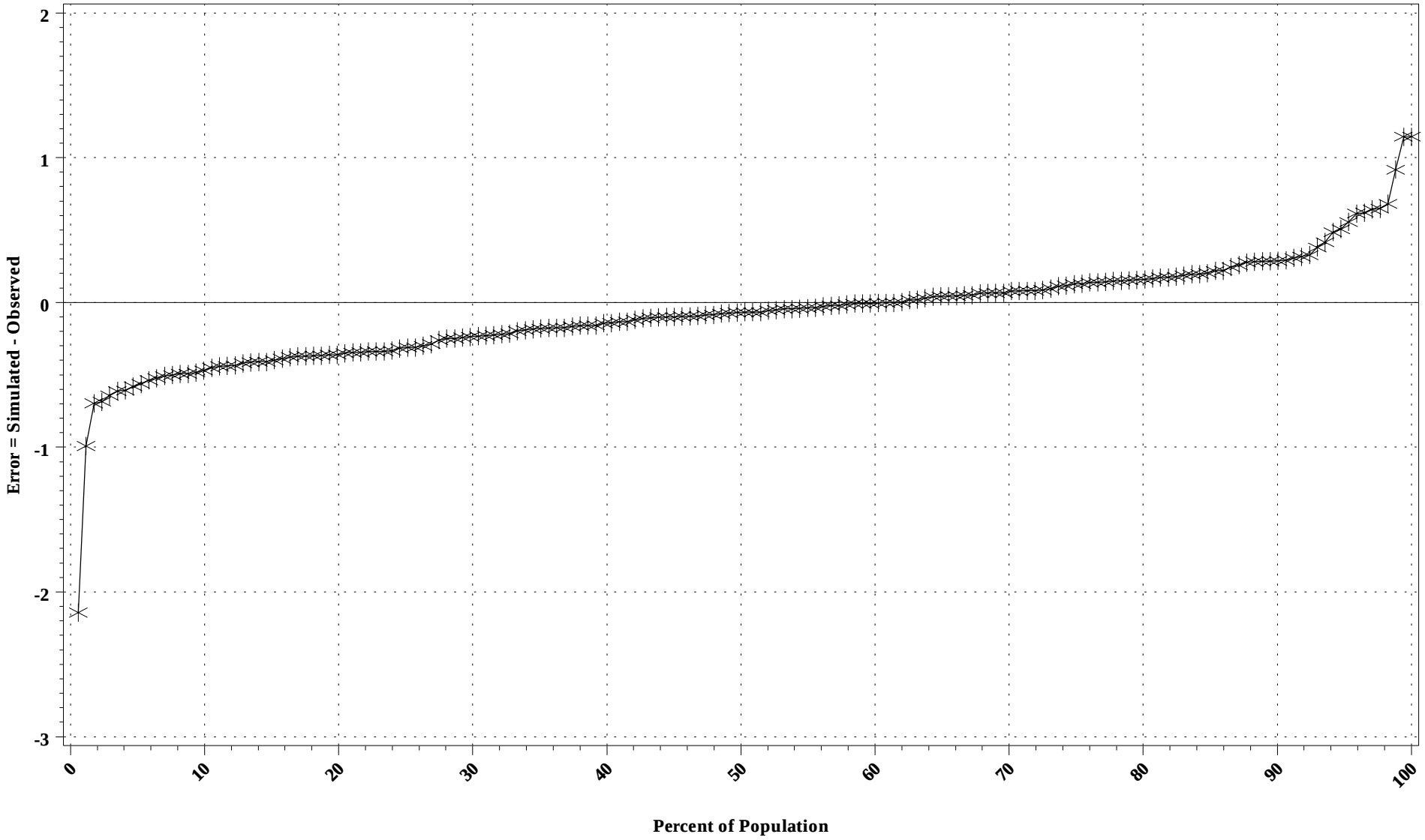
# Pamunkey River at Segment 260
## Total Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Actual error versus Percentile Sample Population
## Total Nitrogen

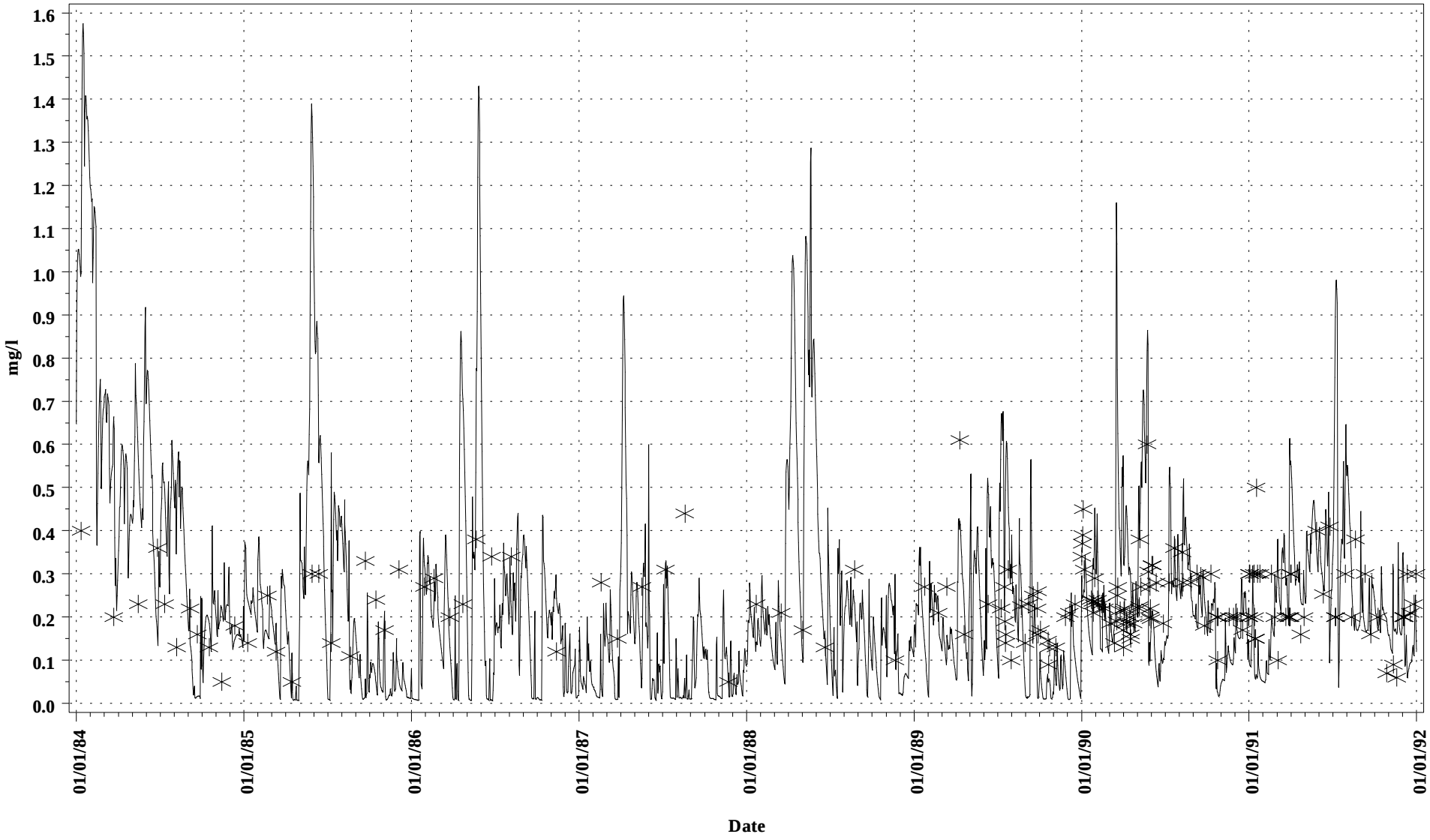
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

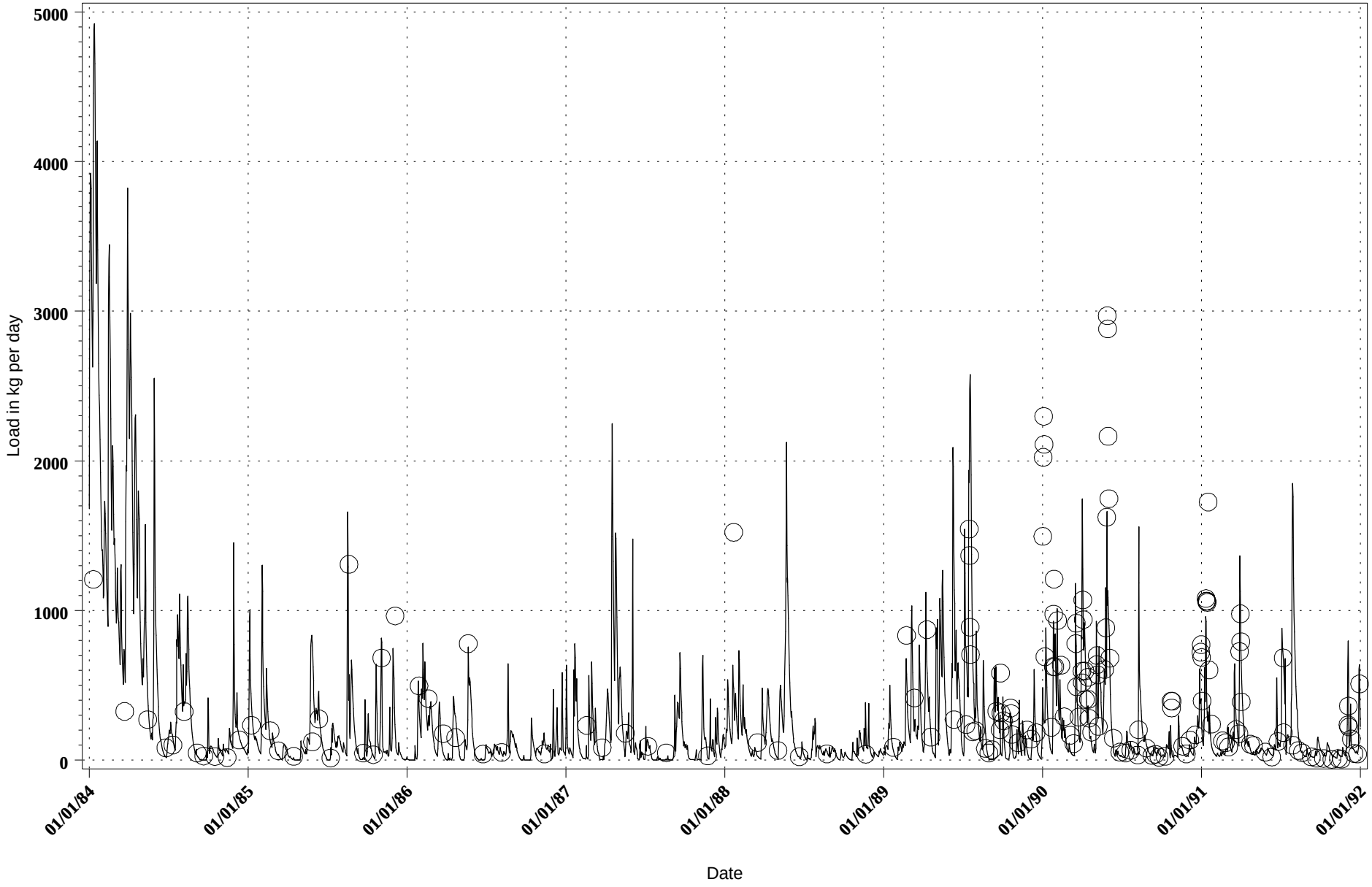



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260

## NO3 Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

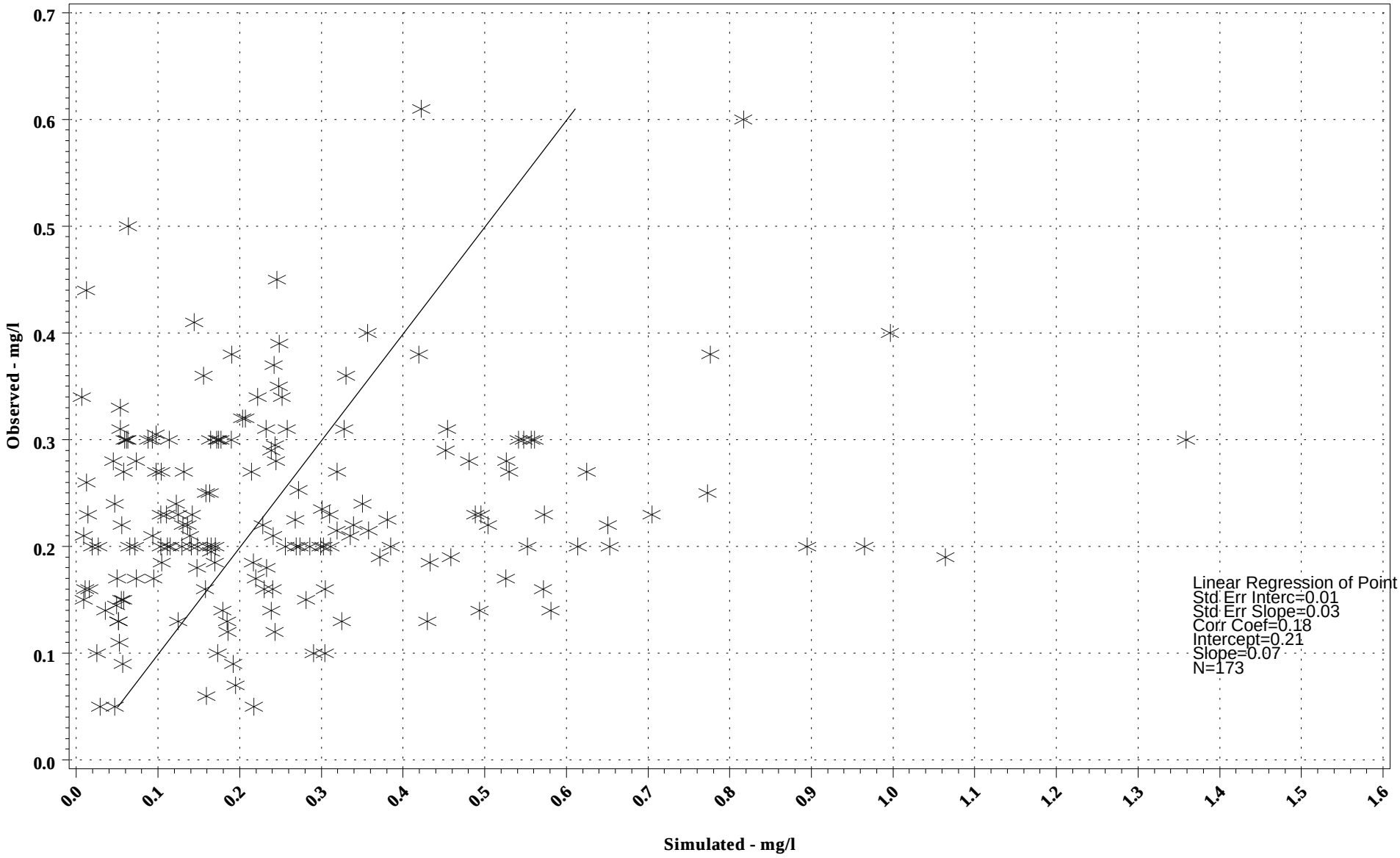



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260

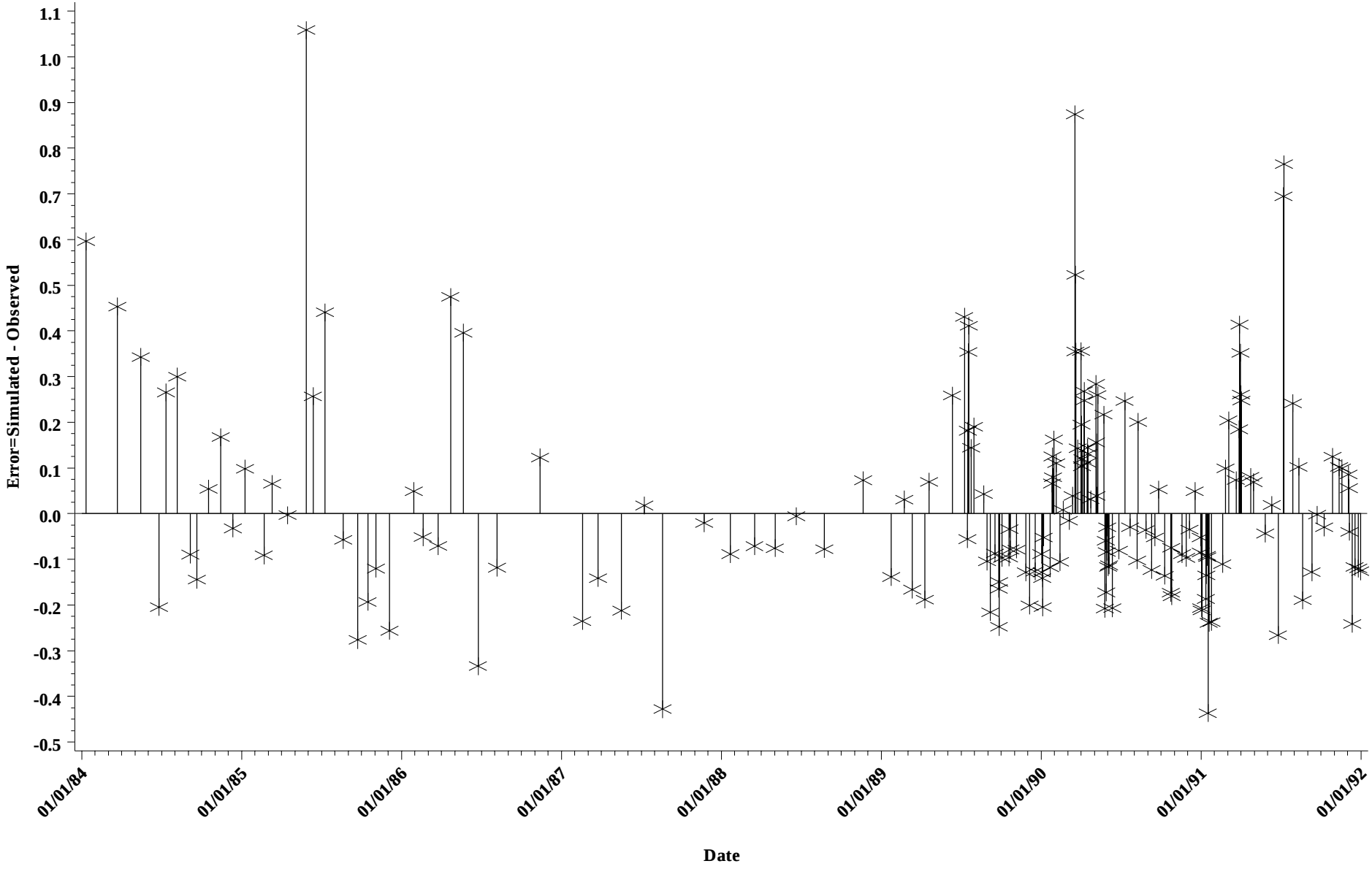
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260
## Actual Error versus Time
## NO3

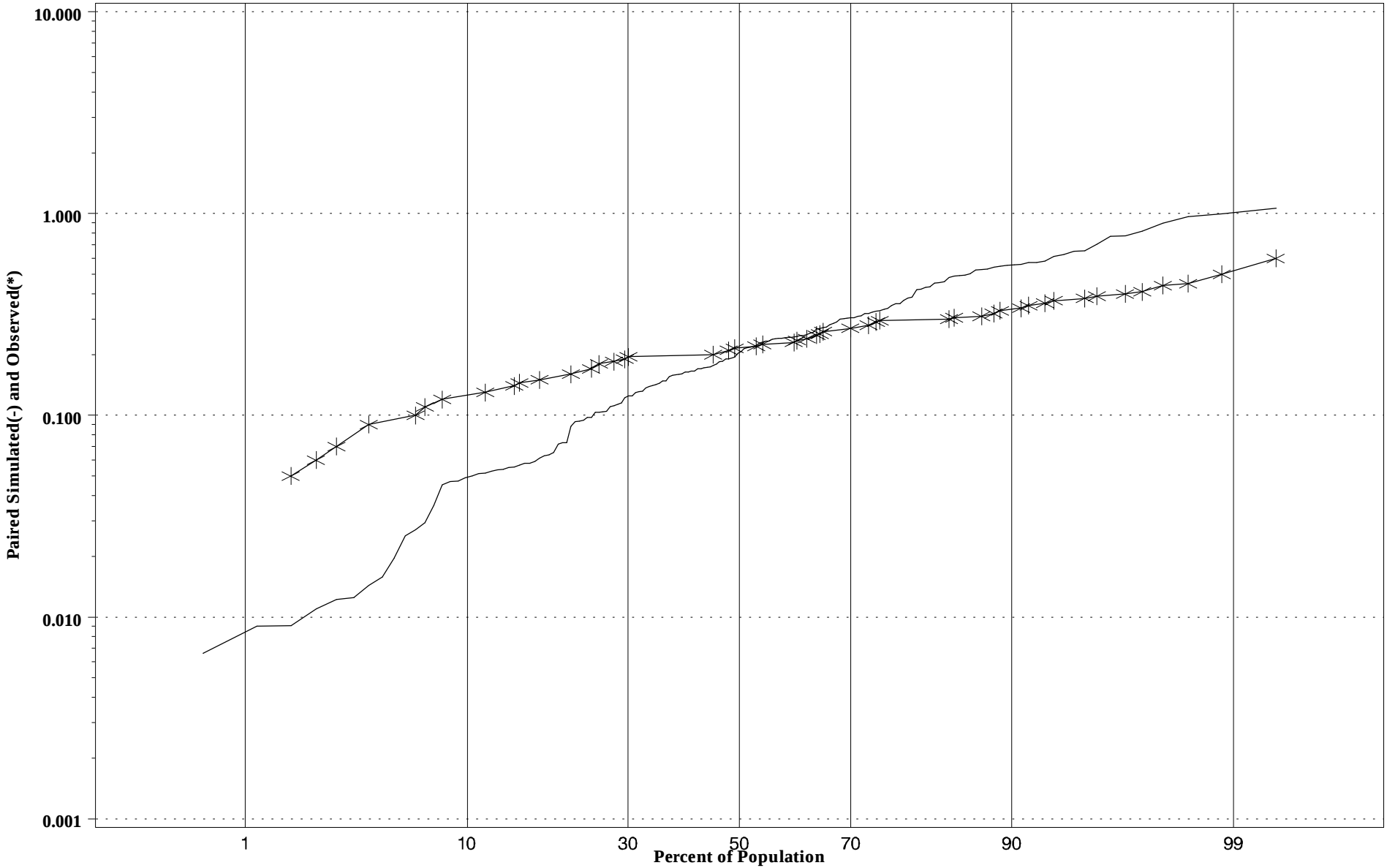



(y21_plotb.sas model3d:[pwang.dt] omerr)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260

## NO3

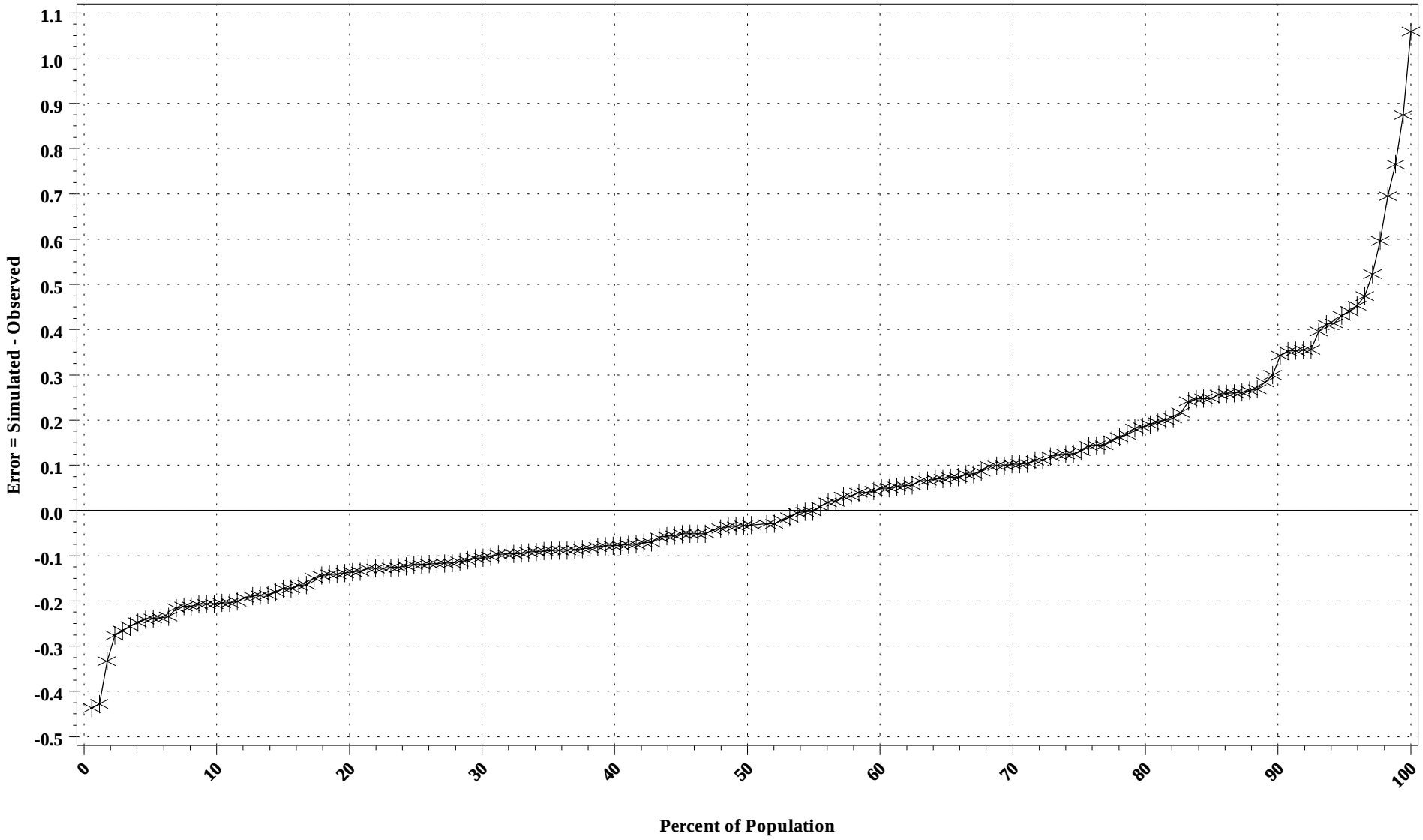
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Actual error versus Percentile Sample Population
## NO3

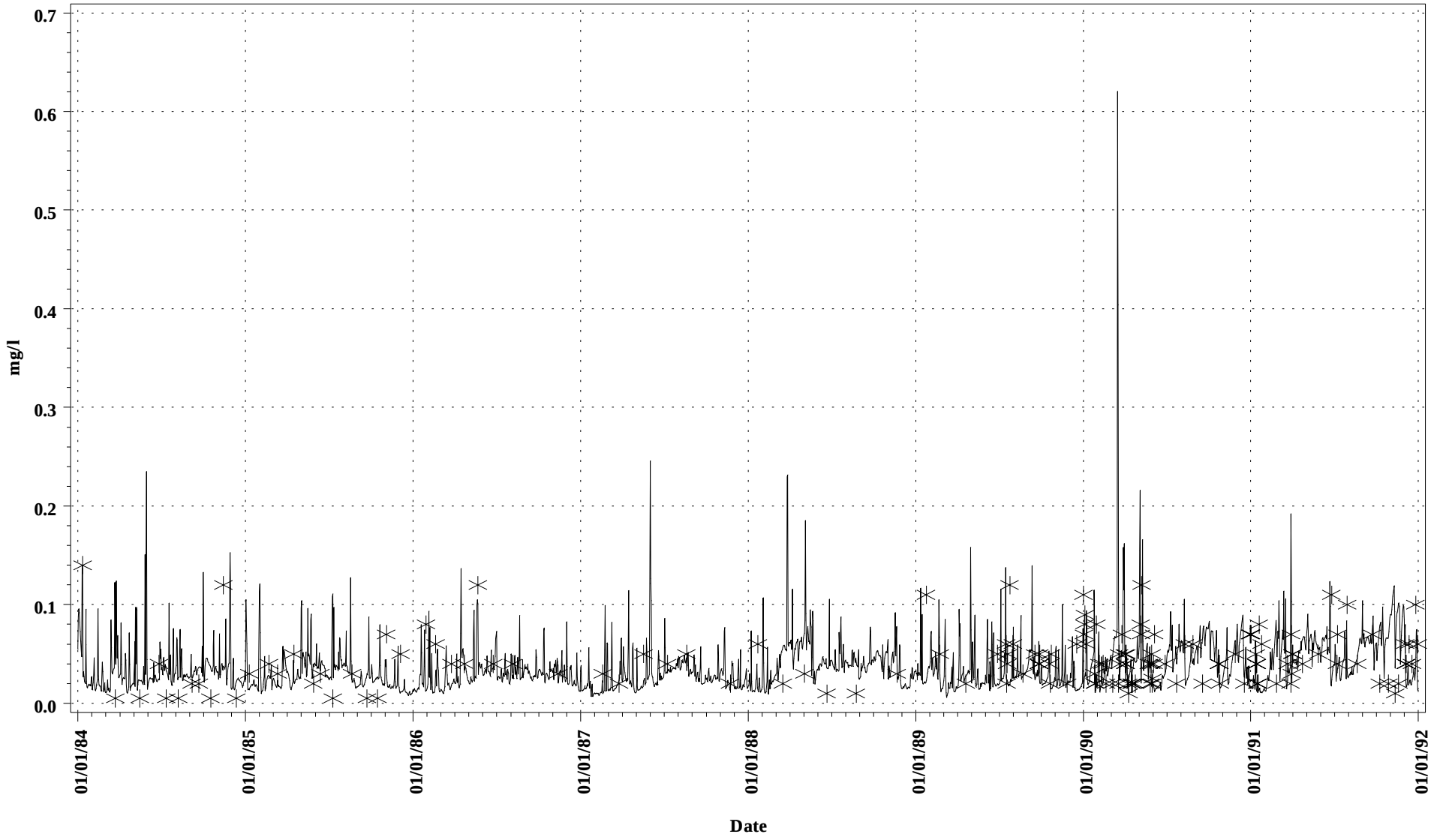
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(pamun260.drv 29JUN98 11:31)

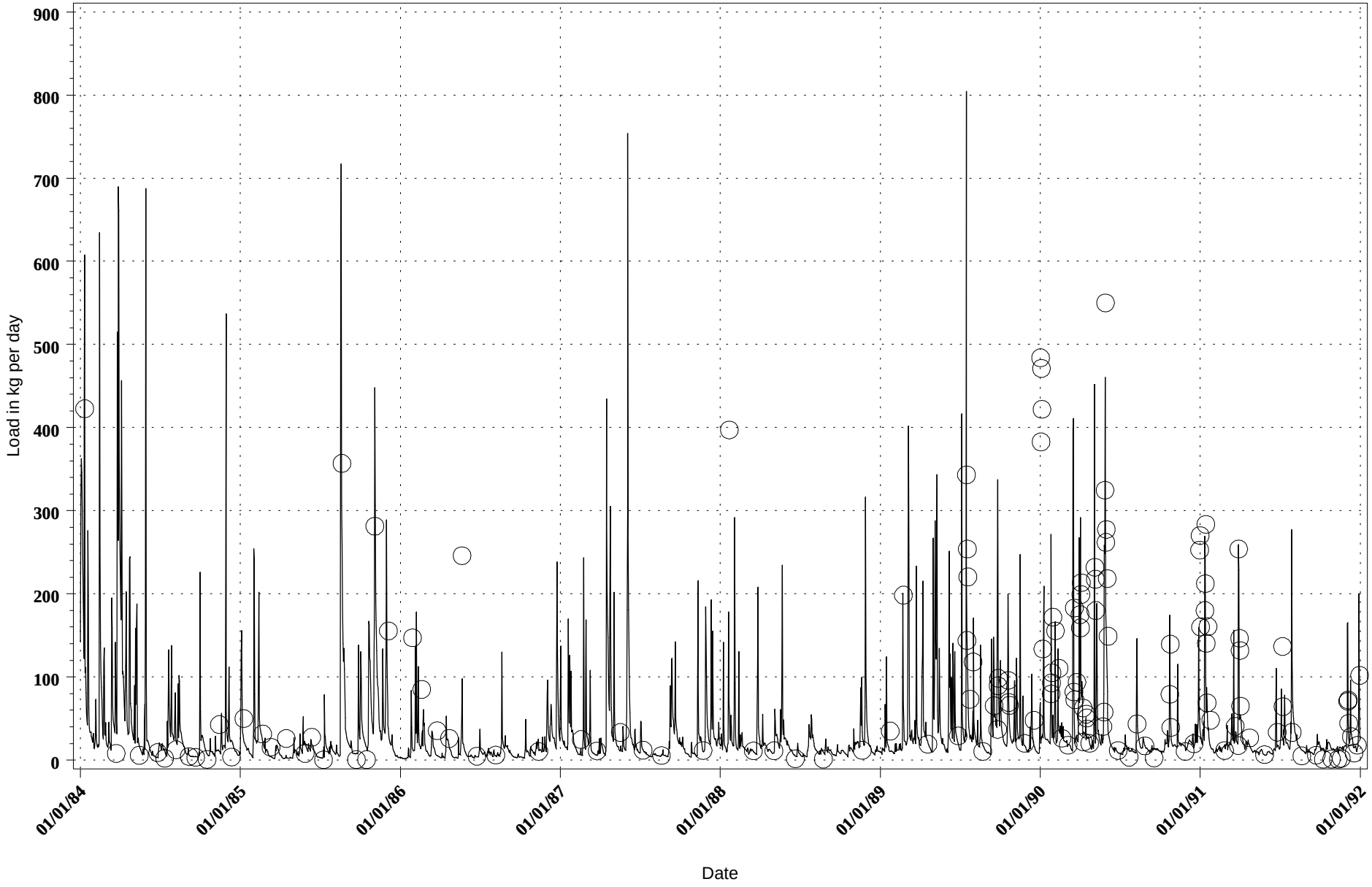
# Pamunkey River at Segment 260
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Total Ammonia Observed and Simulated Load vs Time
### (line = simulated, O = observed)

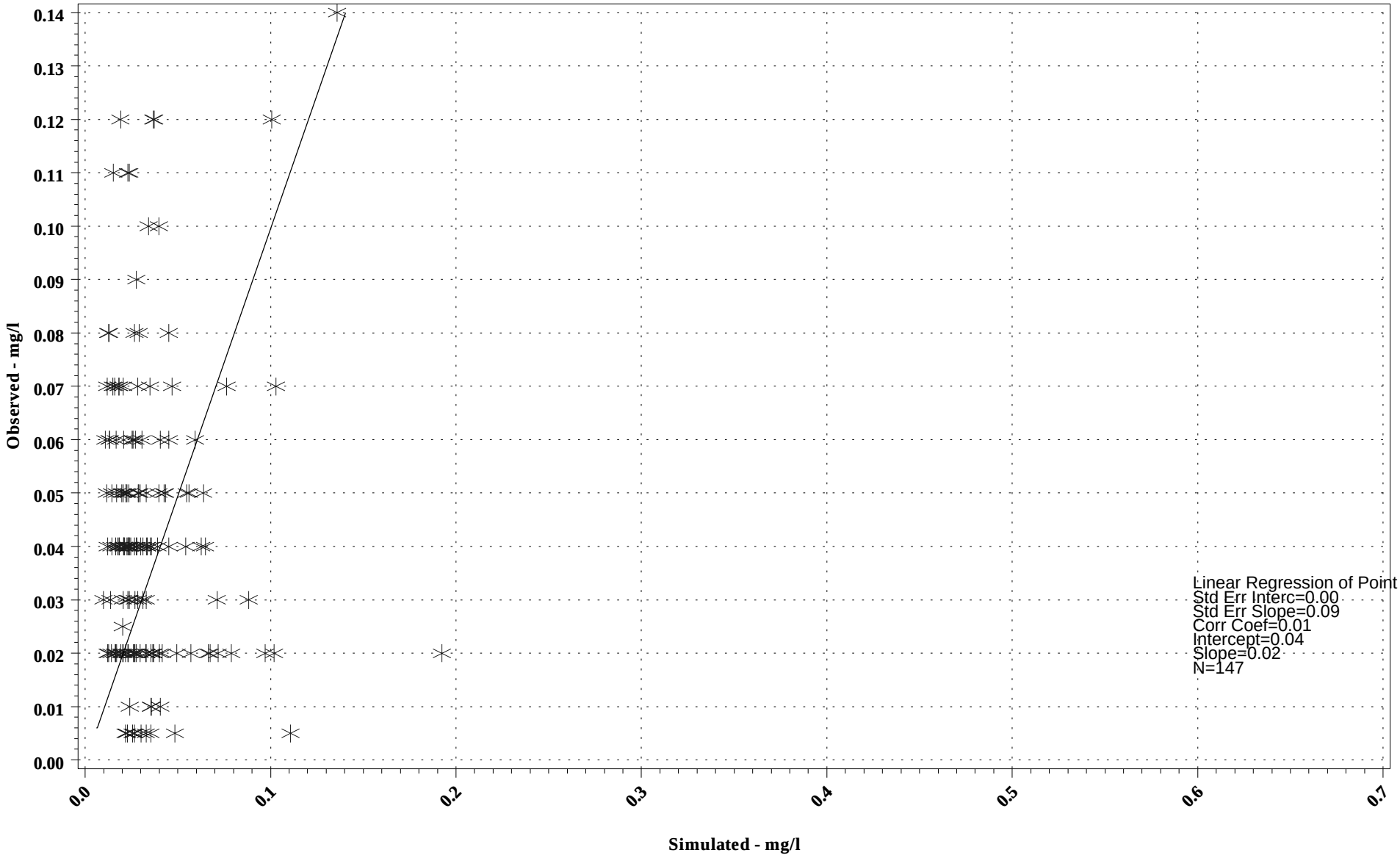



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260

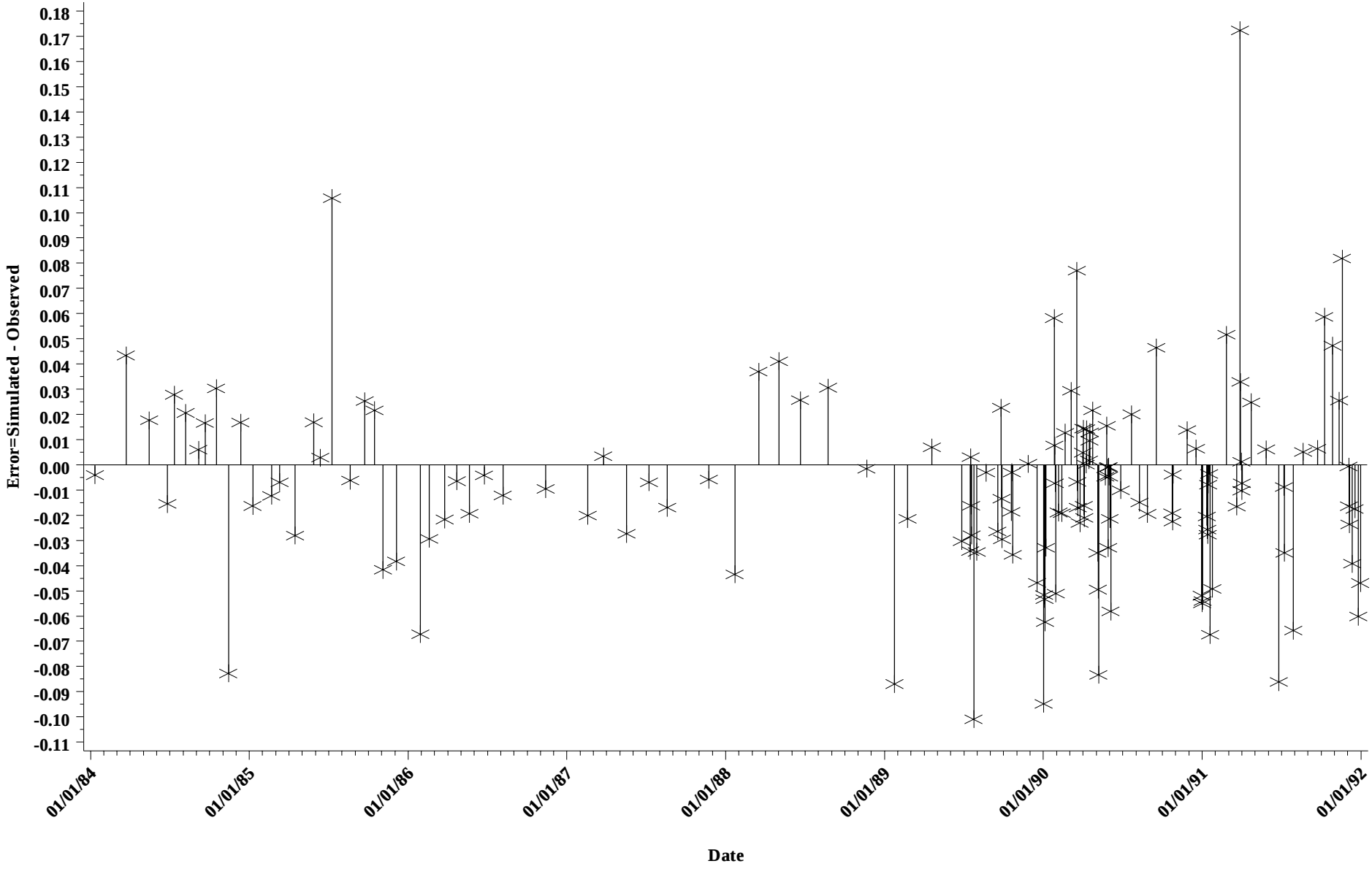
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92



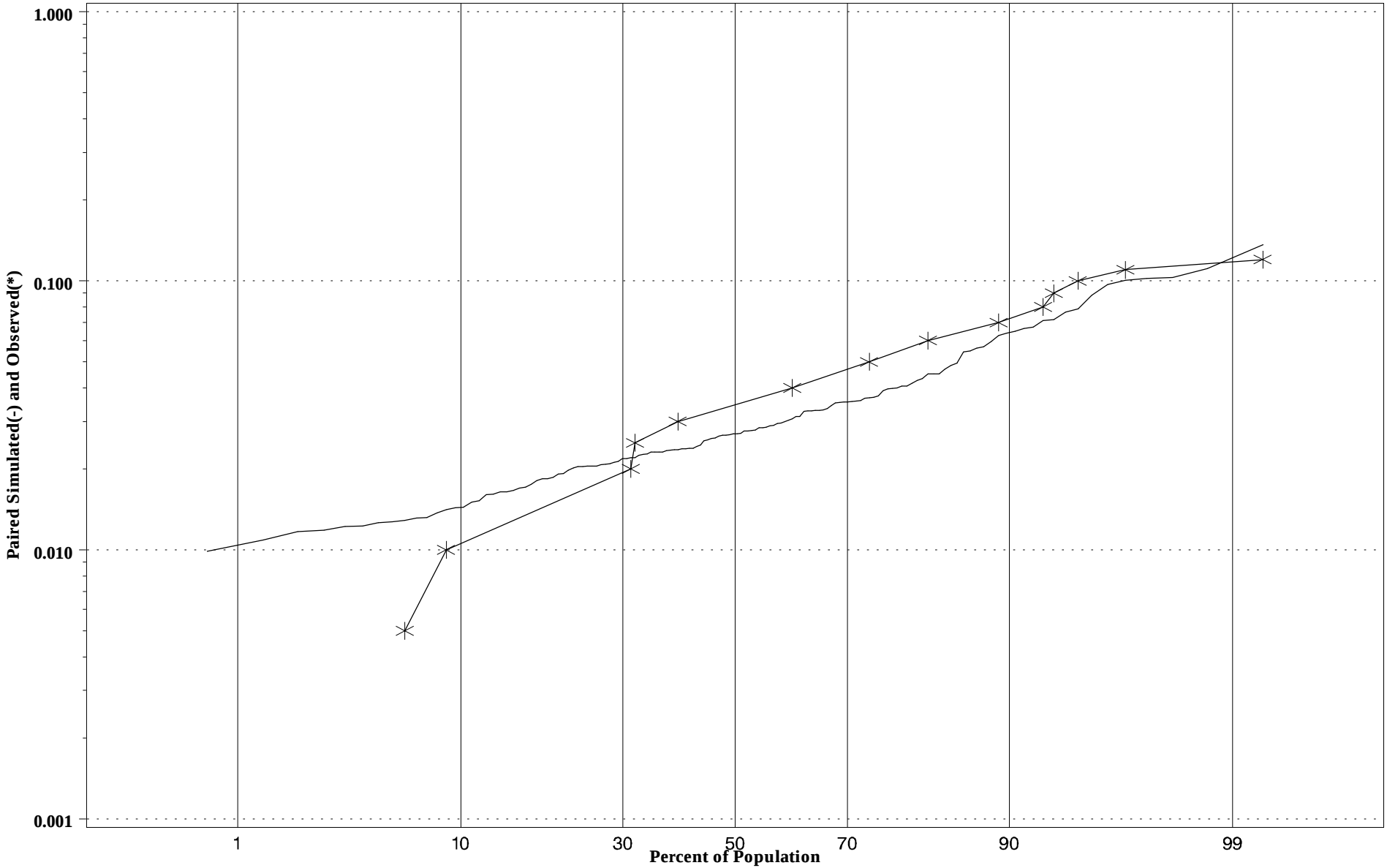

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260
## Actual Error versus Time
## Total Ammonia




(y21_plotb.sas model3d:[pwang.dt] omerr)
(pamun260.drv 29JUN98 11:31)

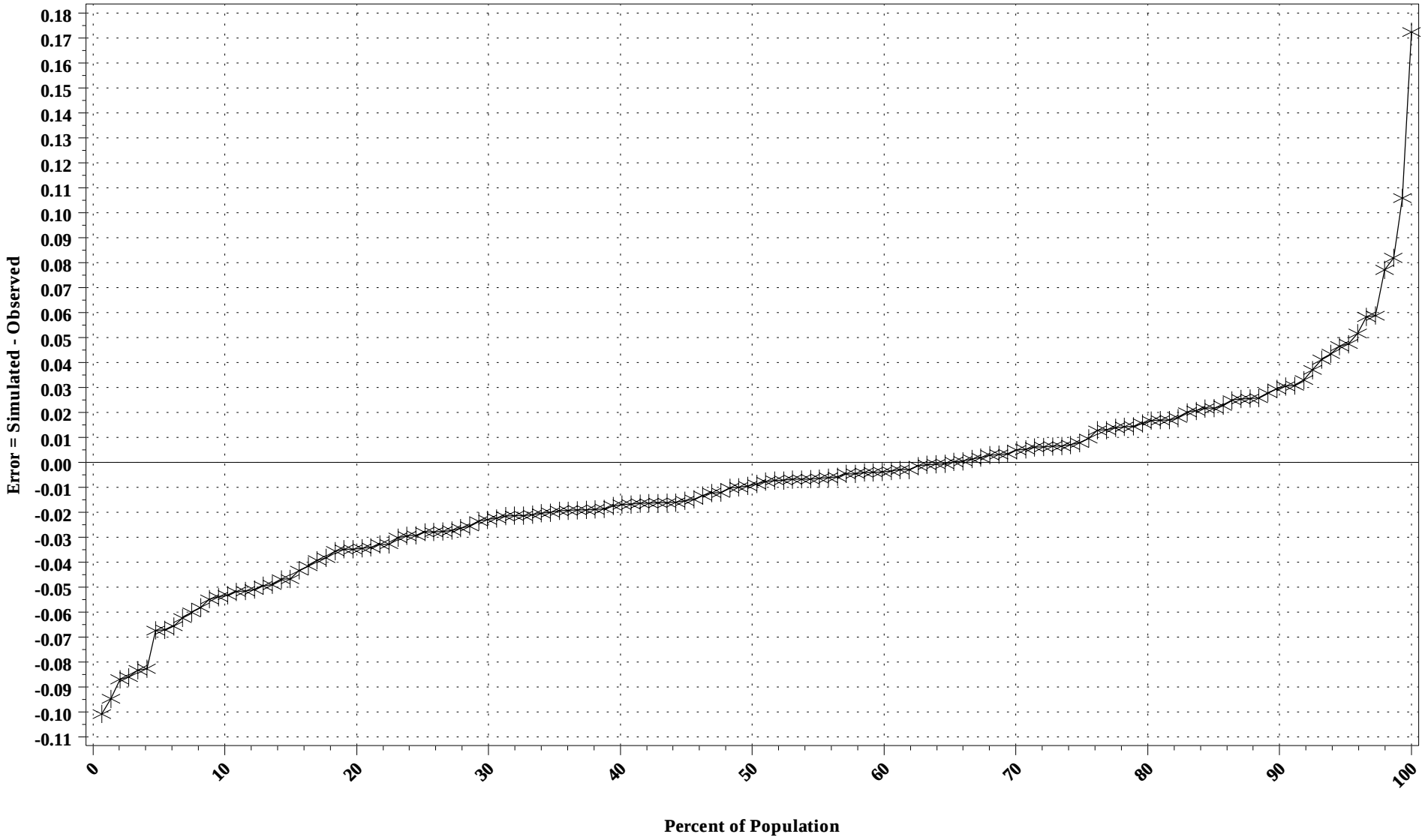
# Pamunkey River at Segment 260
## Total Ammonia
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(pamun260.drv 29JUN98 11:31)

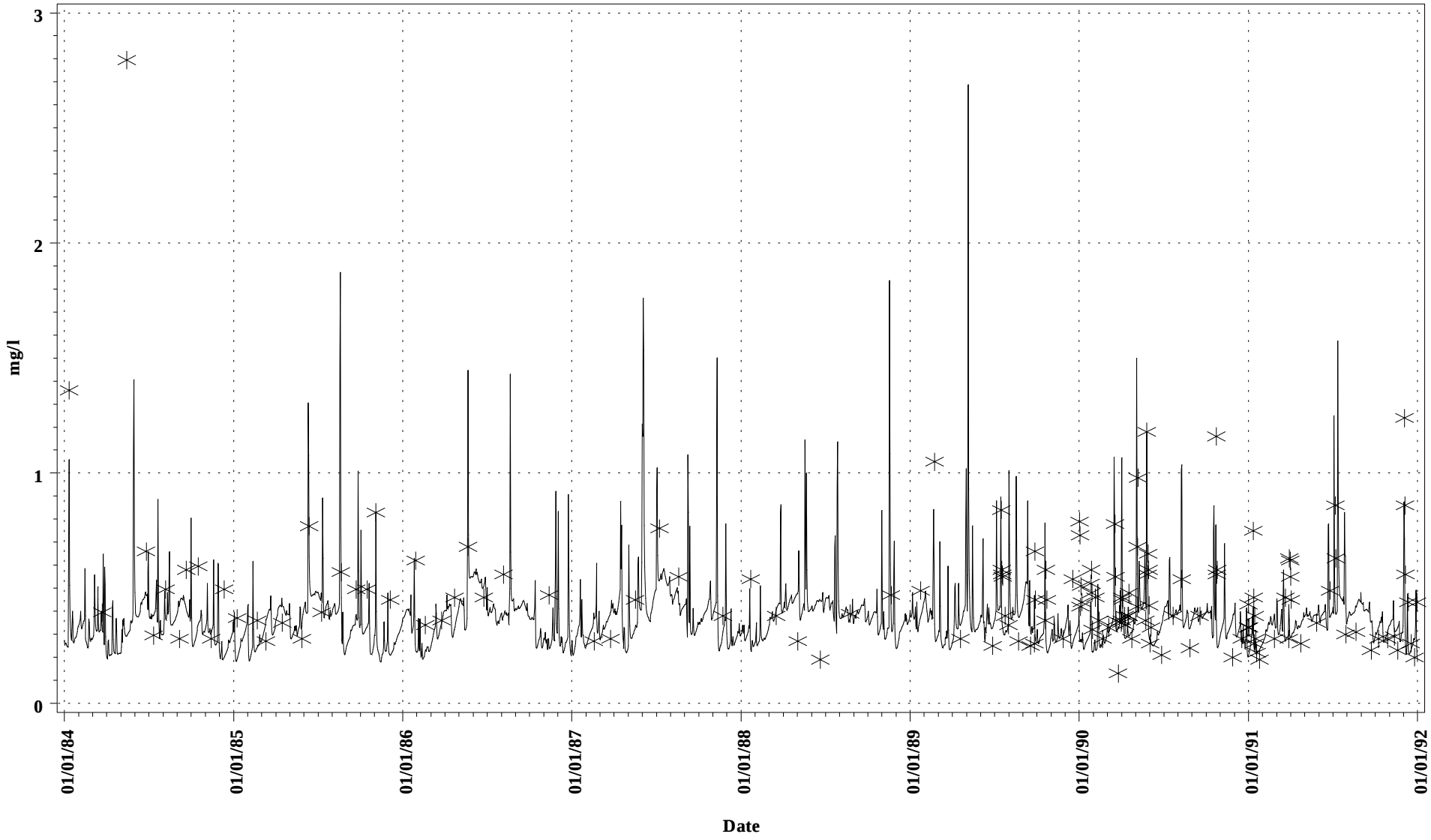
# Pamunkey River at Segment 260
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**

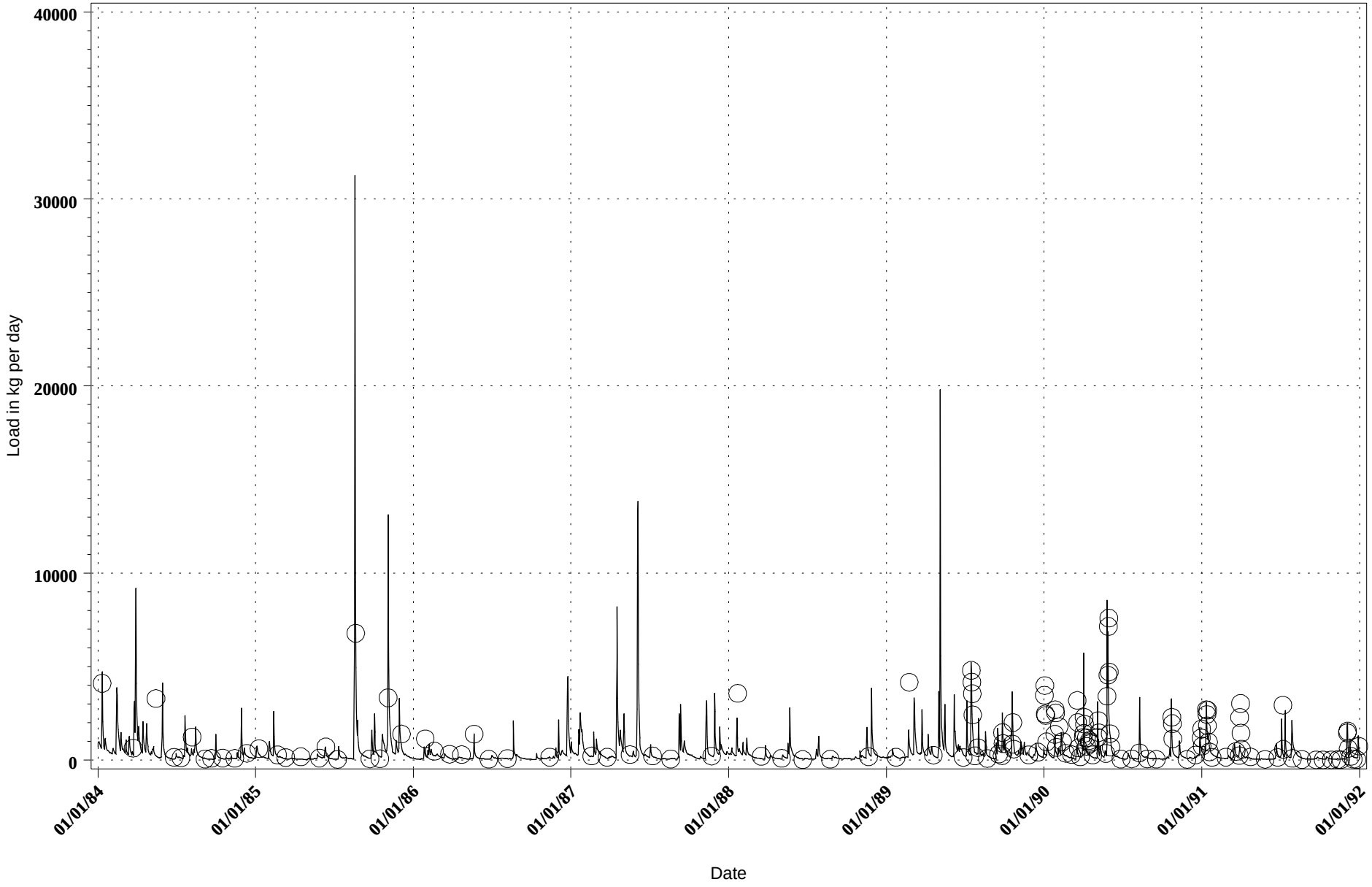



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260

## Organic Nitrogen Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

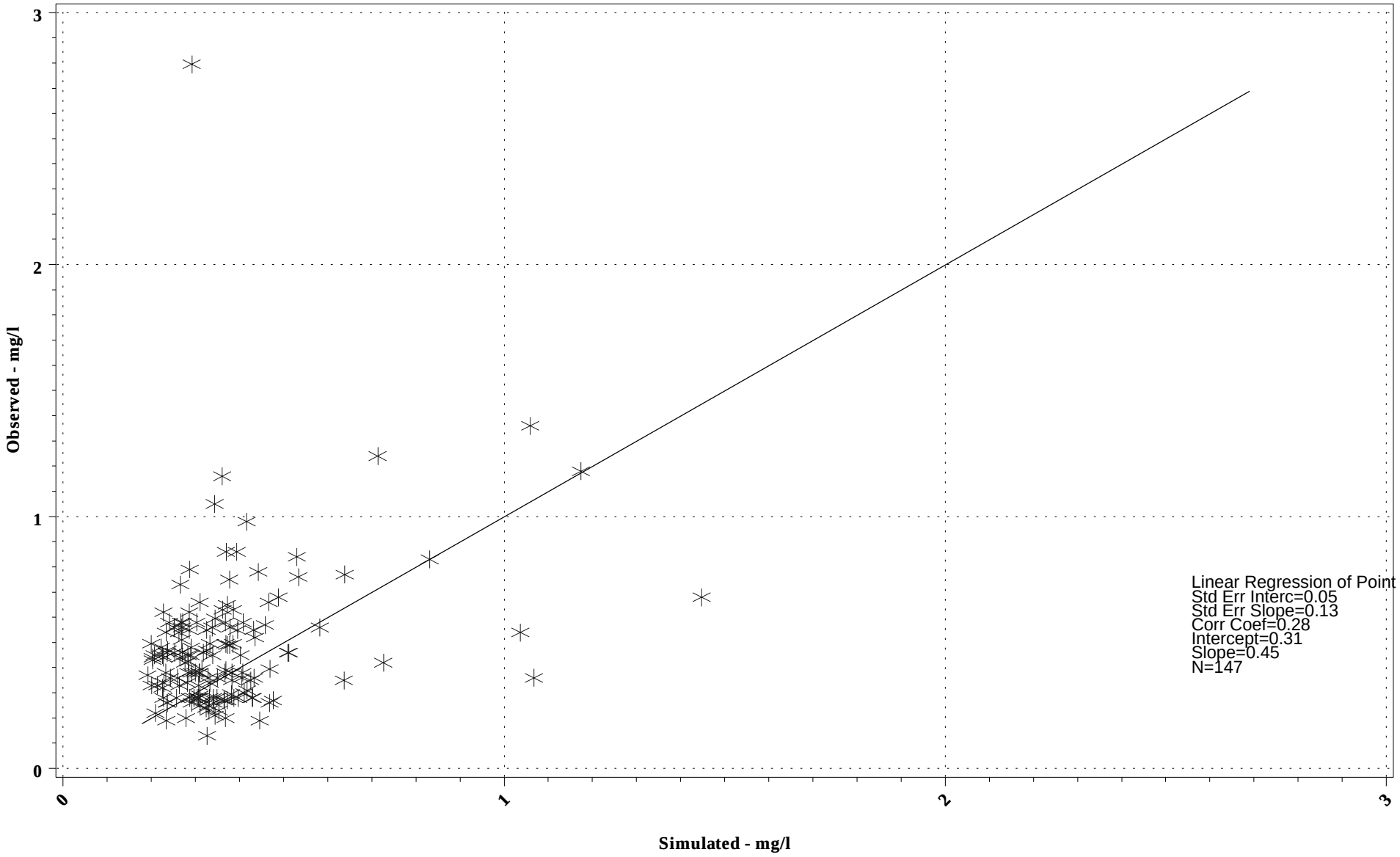



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260

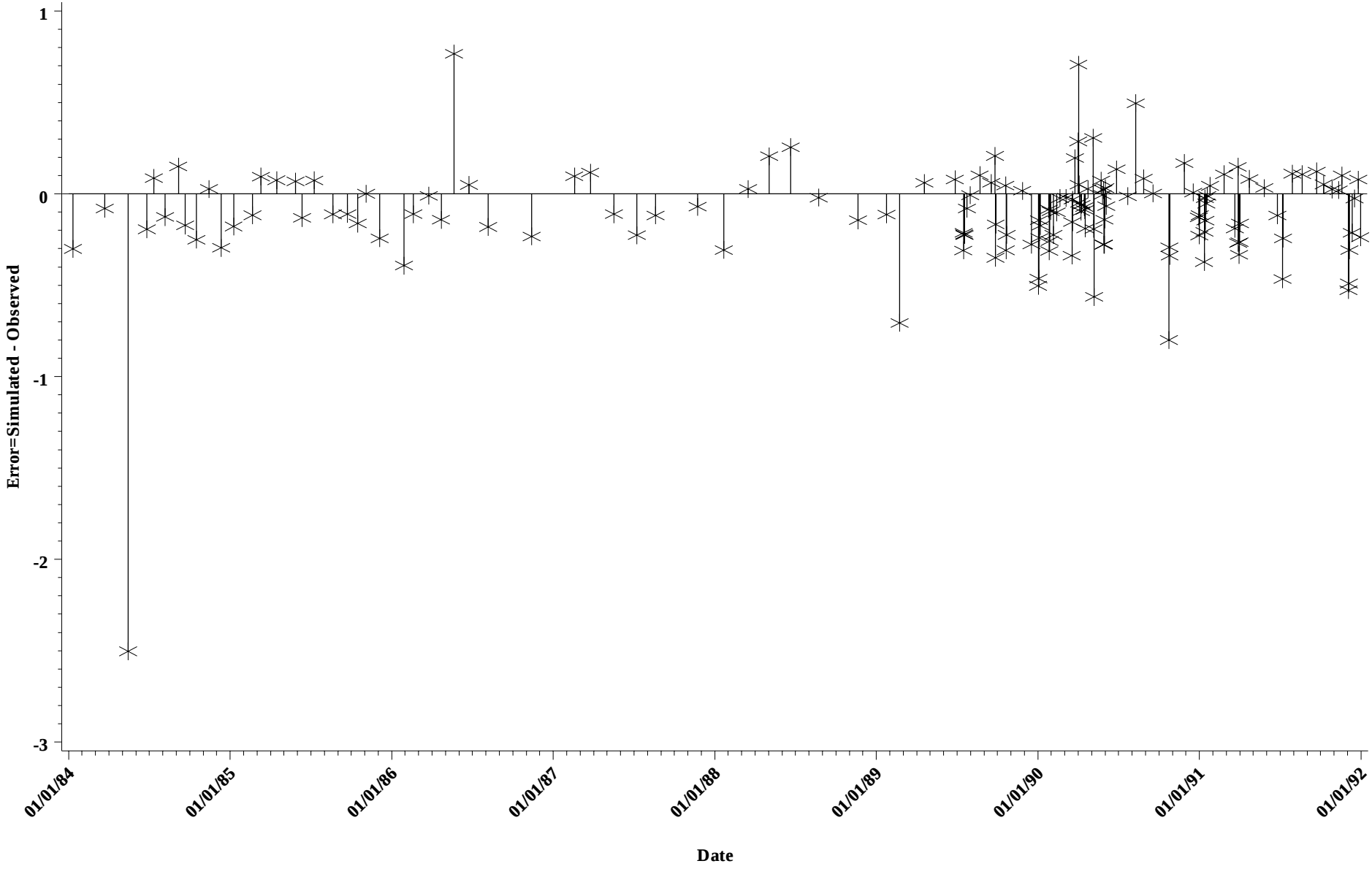
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(pamun260.drv 29JUN98 11:31,proc reg,model y=x)

# Pamunkey River at Segment 260
## Actual Error versus Time
## Organic Nitrogen

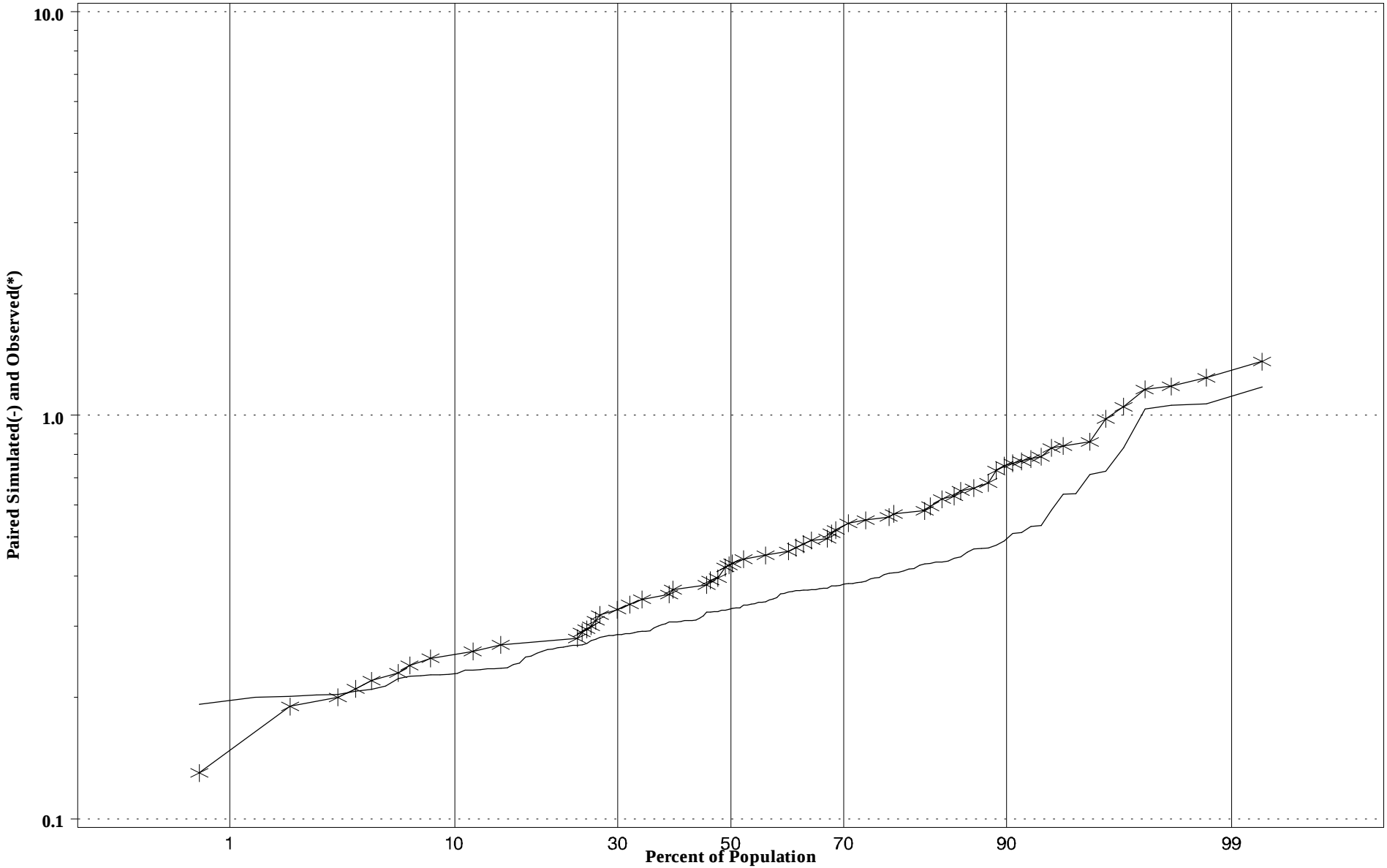



(y21_plotb.sas model3d:[pwang.dt] omerr)
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260

## Organic Nitrogen

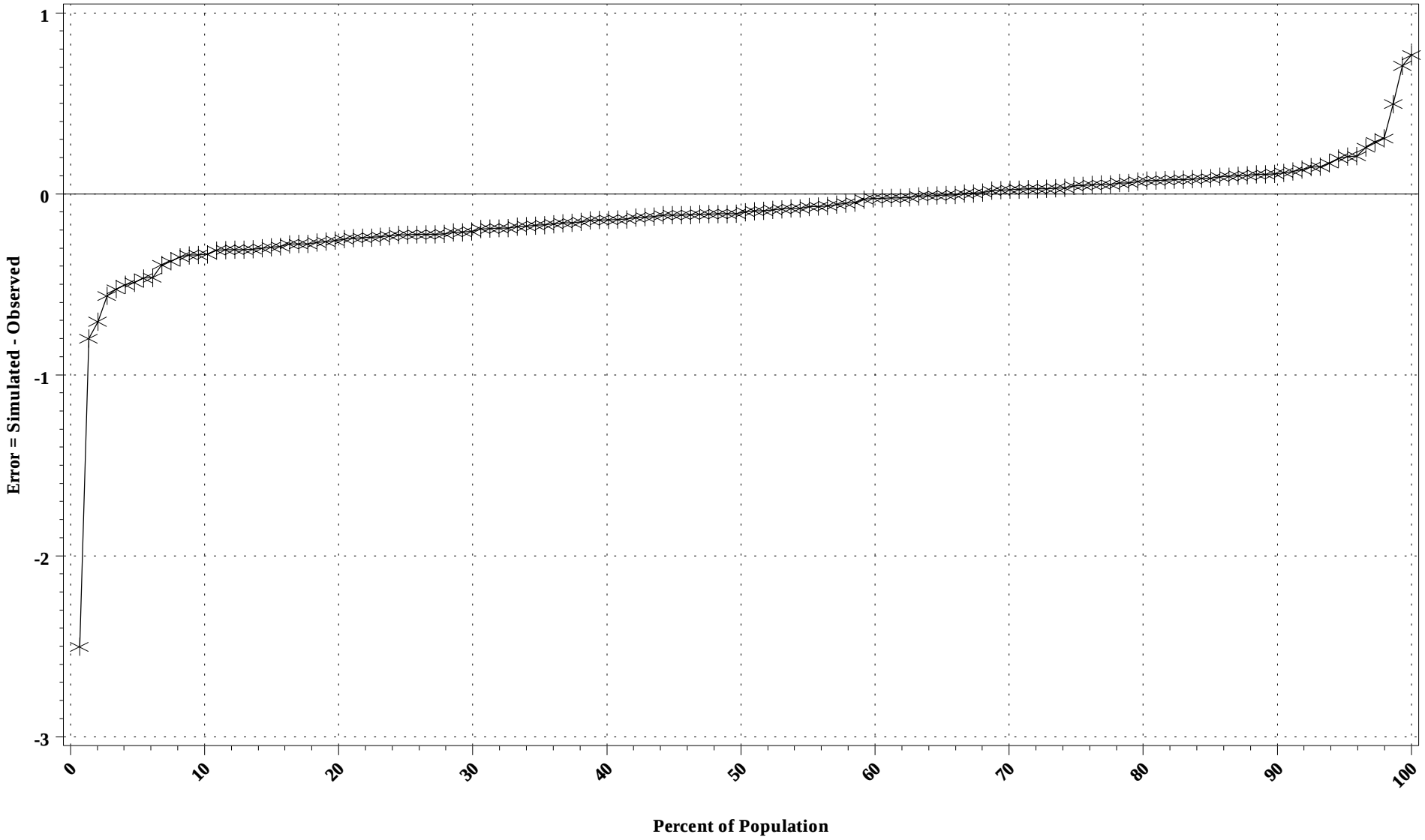
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(pamun260.drv 29JUN98 11:31)

# Pamunkey River at Segment 260
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(pamun260.drv 29JUN98 11:31)

# B.6.0 James River Basin

***Basin Segments:***

Above Fall Line Basin Segments: 265, 270, 280, 290, 300, and 310
Below Fall Line Basin Segments: 600, 610, 620, and 630

***Section Contents:***

### *B.6.1 James River at Cartersville, VA at Segment 280 (Monitoring Station: 2035000) (Above Fall Line Basin Segments: 265, 270, 280, and 290)*

**Section Summary:**

The James basin water quality gage is at Cartersville, VA, about 40 miles above the fall line at Richmond, VA. Above the gage at Cartersville, the James basin is largely rural and forested. Water quality observations increased and were oriented toward storm weighted sampling after 1989. Model calibration focused primarily on the refined, storm weighted sampling after 1989.

The James basin above the gaged site covers an area of 6,810 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 75% forest land, 2% cropland, 16% other agricultural areas, 6% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage decreased from 8.2 million pounds in 1985 to 7.9 million pounds in 1996. Total phosphorus loads over the same time period decreased from 2.4 million pounds to 2.3 million pounds. In general, point source loads above the gage site decreased. In 1996, the total nitrogen point source load was 14% of the total load and the total phosphorus point source load was 20% of the total load. Estimated septic system total nitrogen loads increased 13%, from 0.41 million pounds in 1985 to 0.46 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 13%, and other agricultural loads (primarily pasture and manure loads) by 12%. Total phosphorus decreased for these land uses by 10% and 7% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 14% for total nitrogen and 11% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen

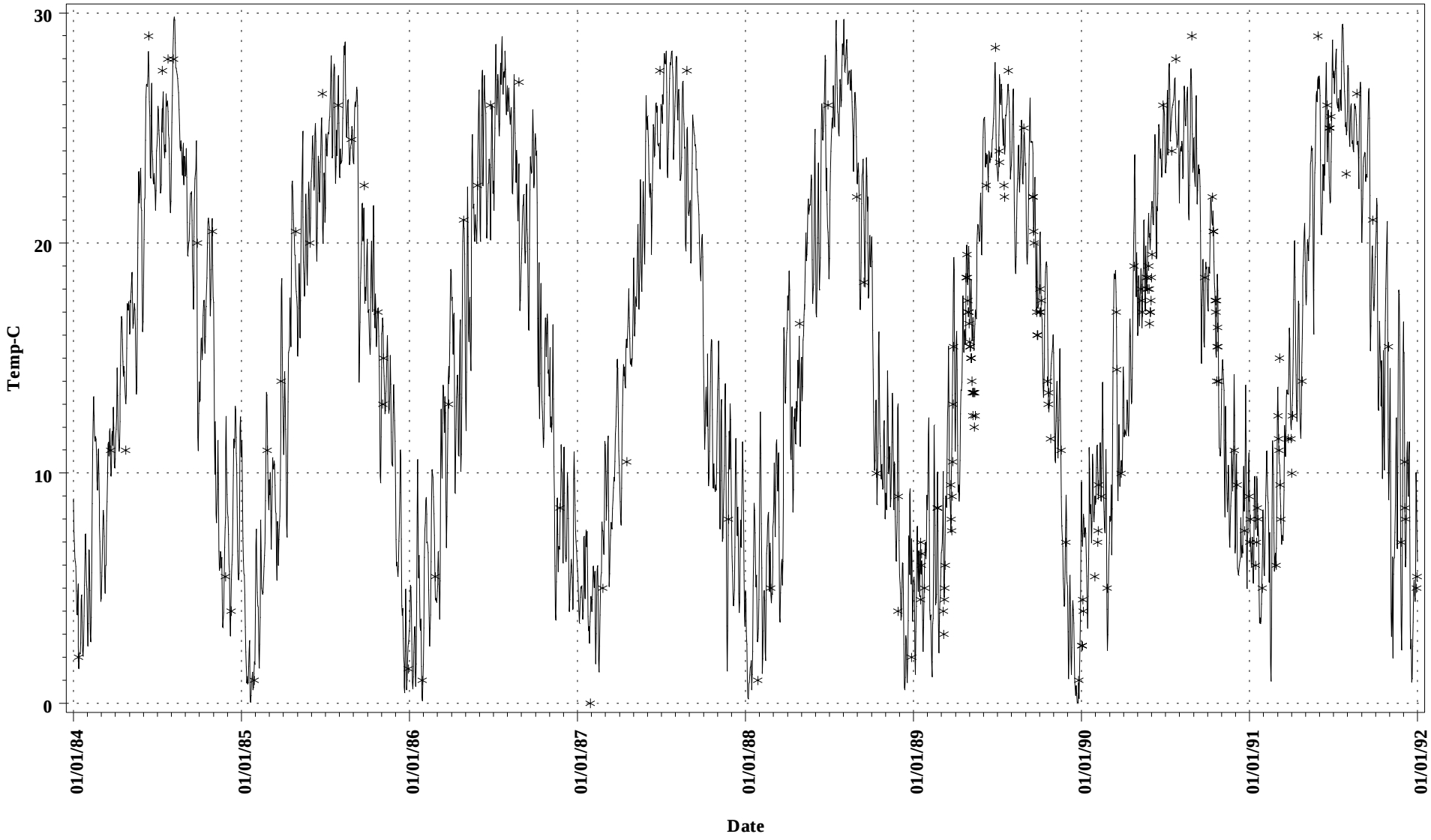
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# James River at Segment 280
## Observed and Simulated versus Time
## Temperature-C

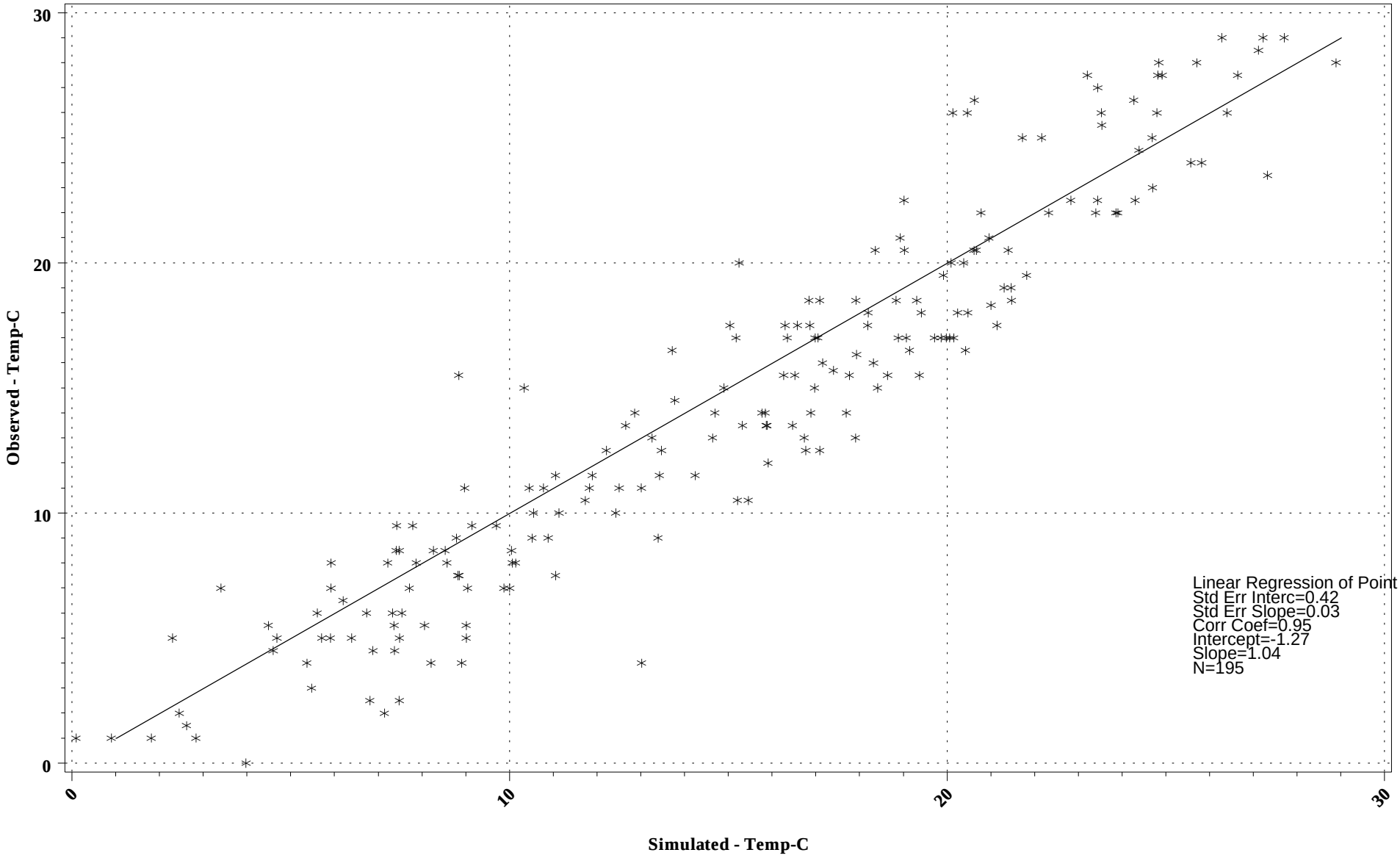
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(j2.drv 29JUN98 10:22)

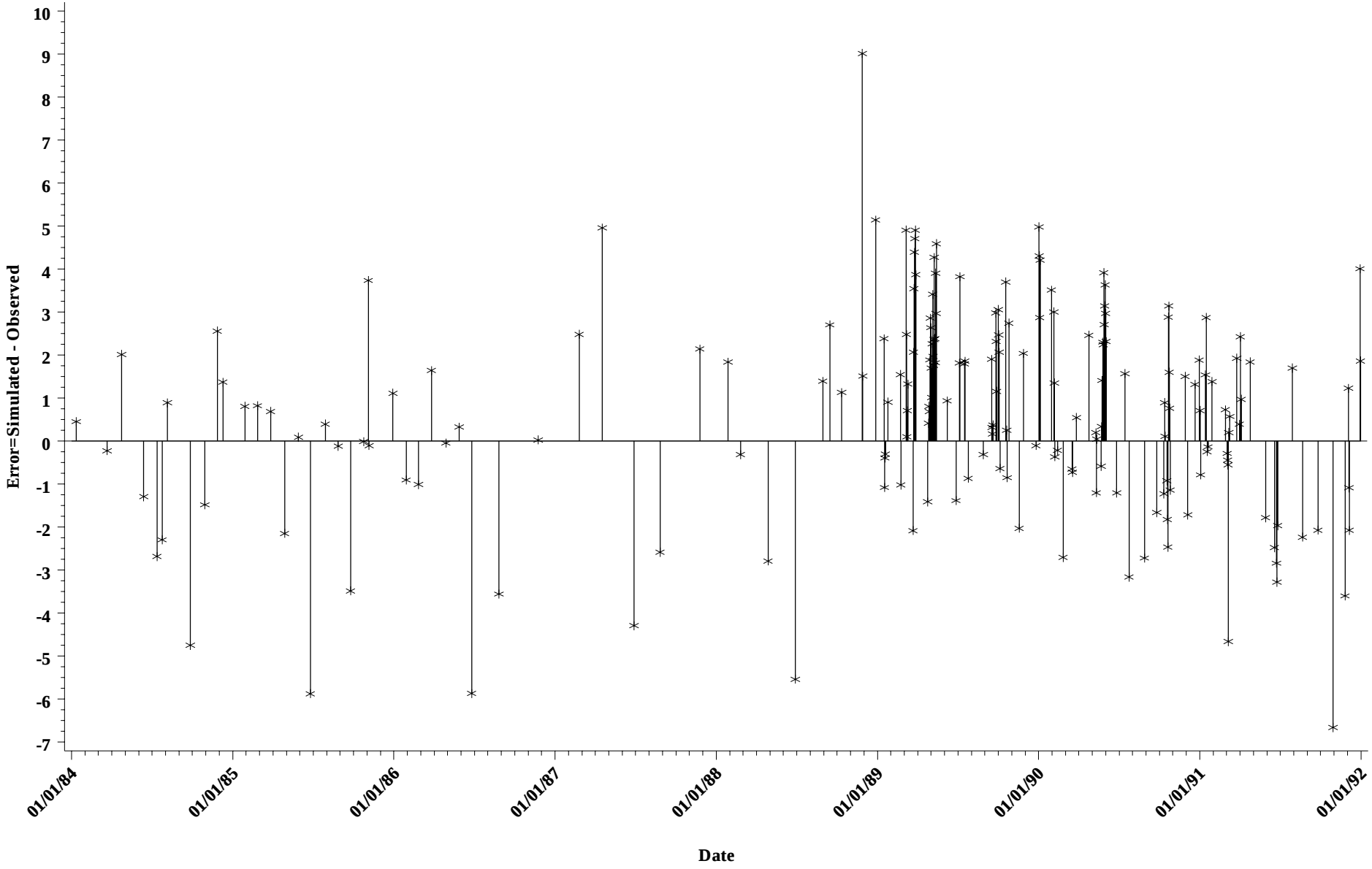
# James River at Segment 280

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92



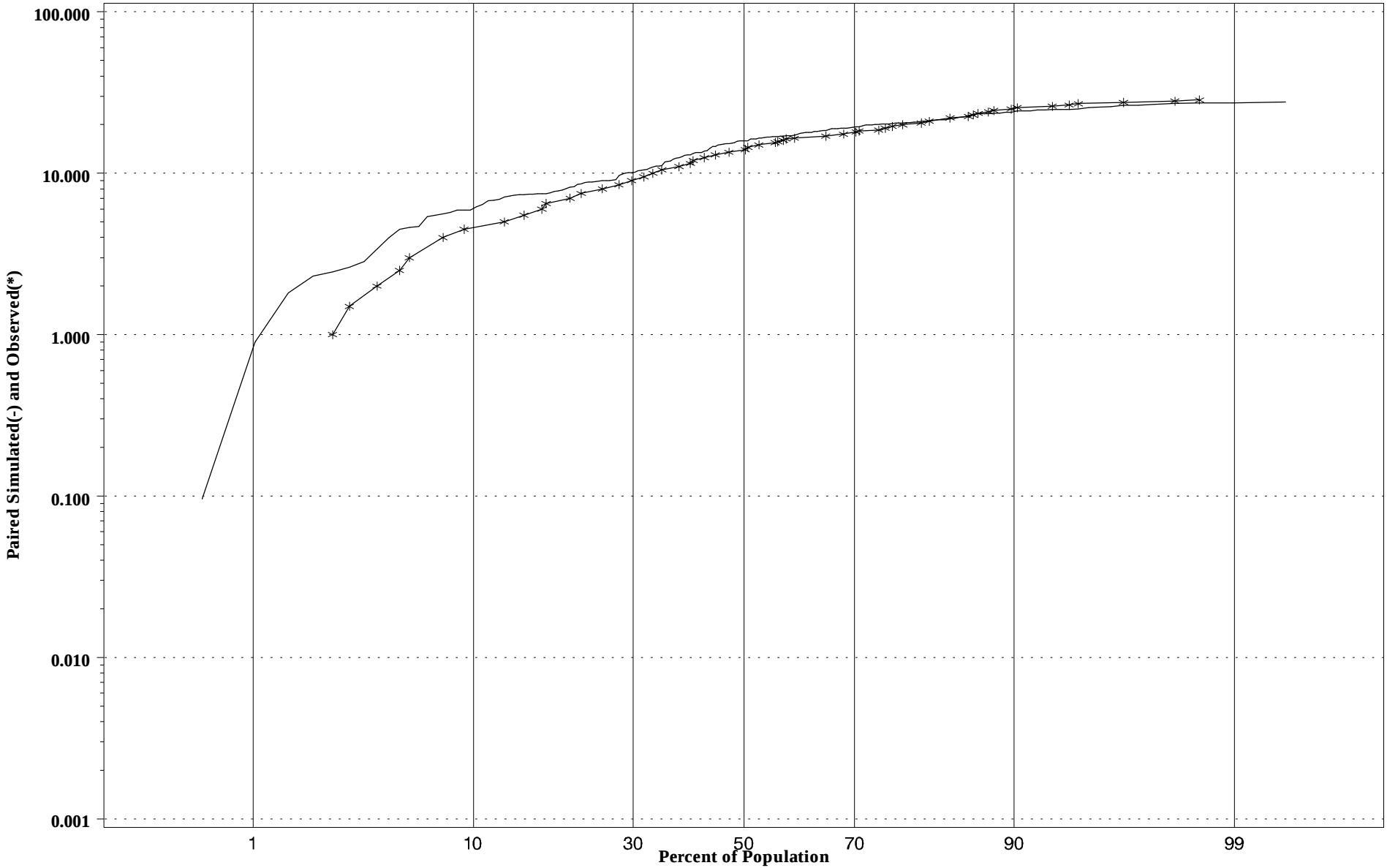

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280
## Actual Error versus Time
## Temperature-C




(y21_plotb.sas model3d:[pwang.dt] omerr)
(j2.drv 29JUN98 10:22)

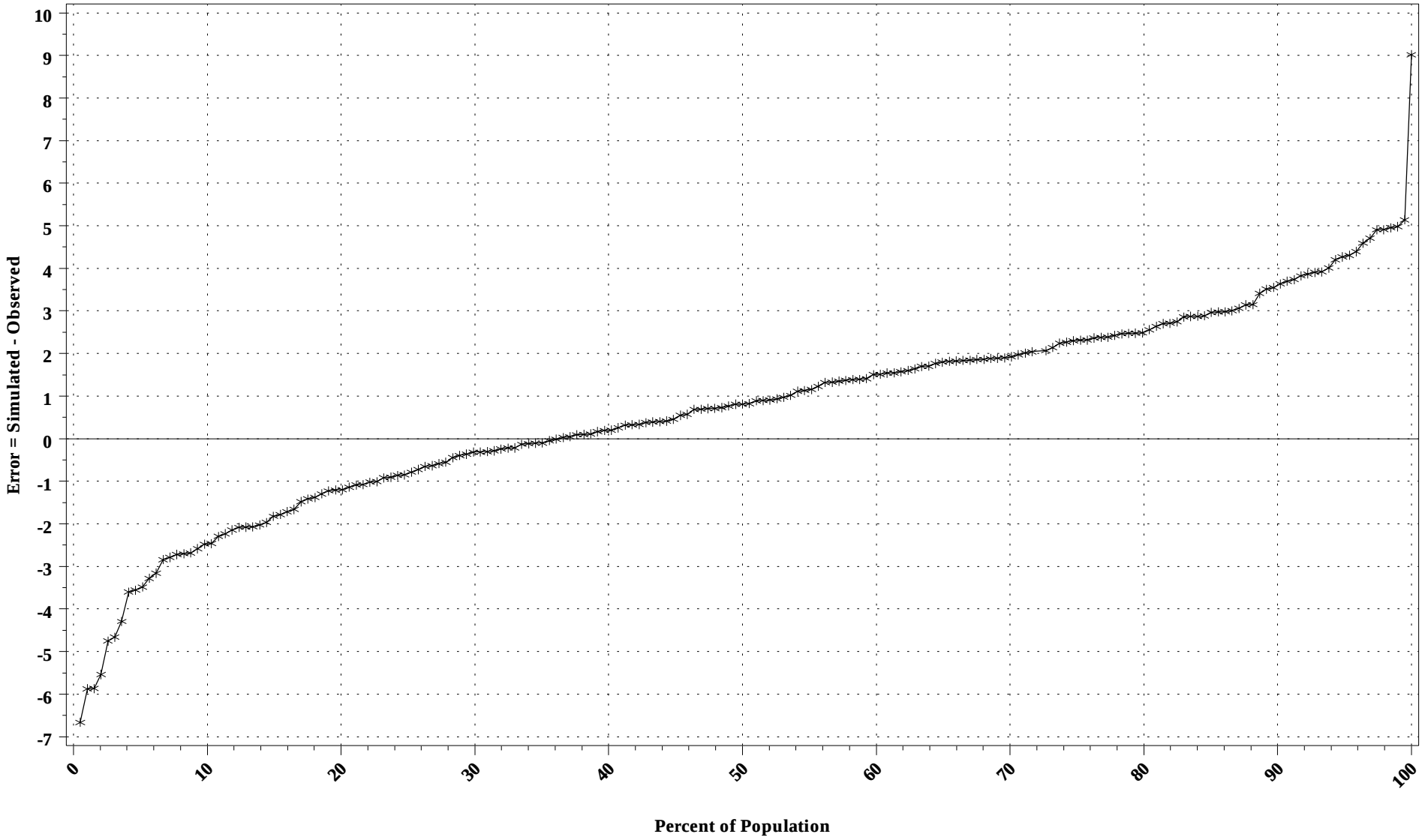
# James River at Segment 280
## Temperature-C
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Actual error versus Percentile Sample Population
## Temperature-C

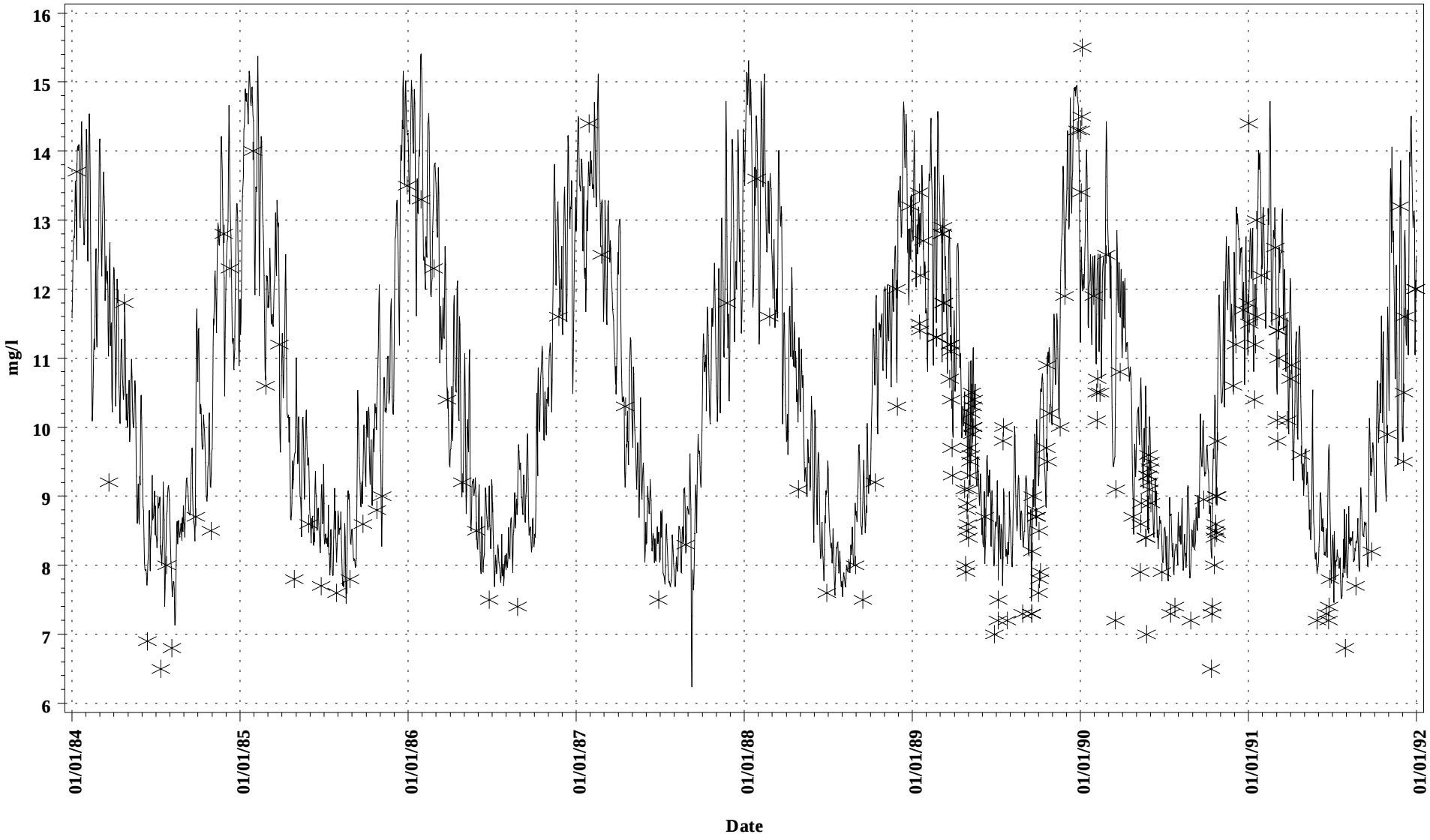
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(j2.drv 29JUN98 10:22)

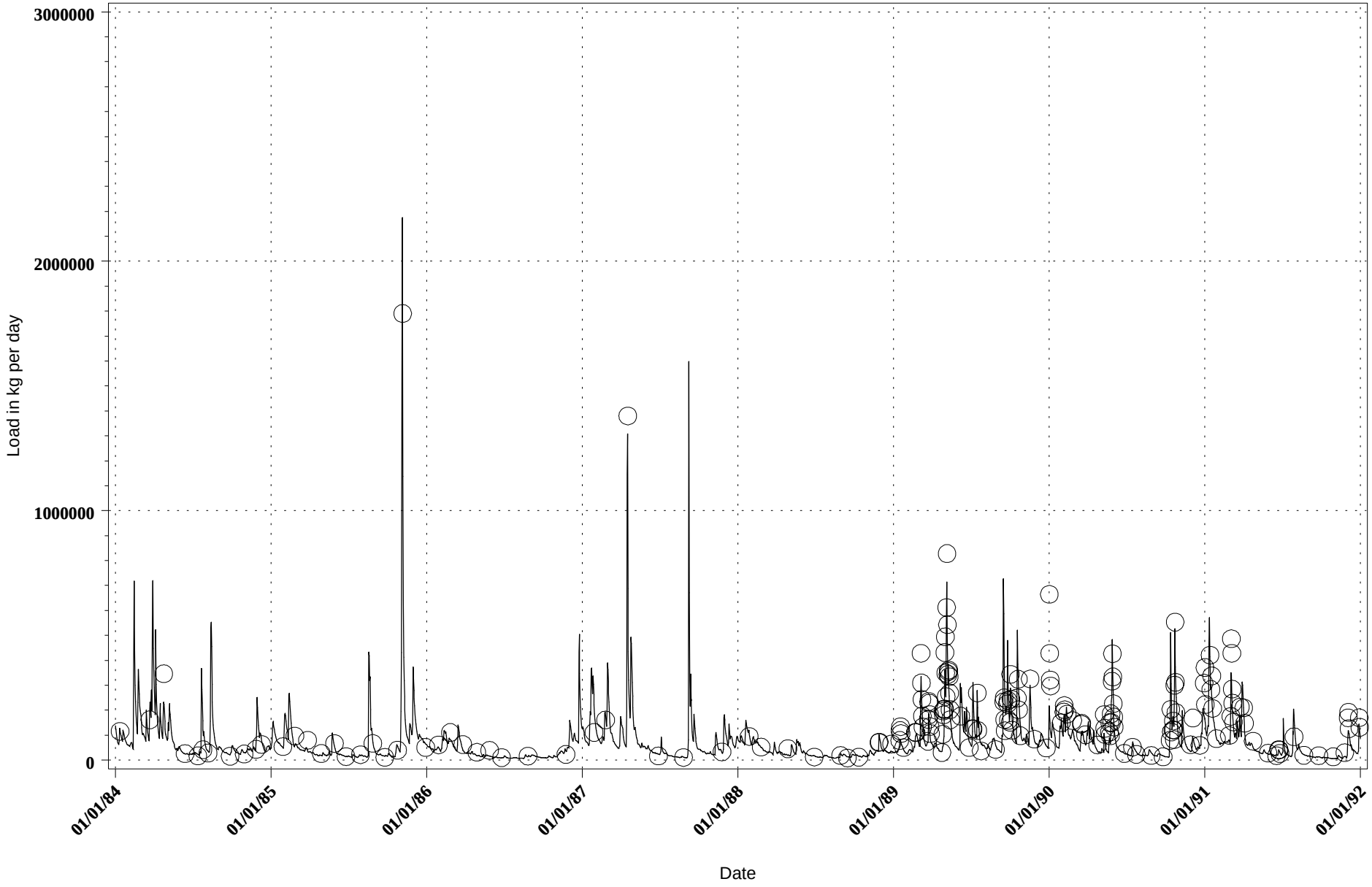
# James River at Segment 280
## Observed and Simulated versus Time
## Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(j2.drv 29JUN98 10:22)

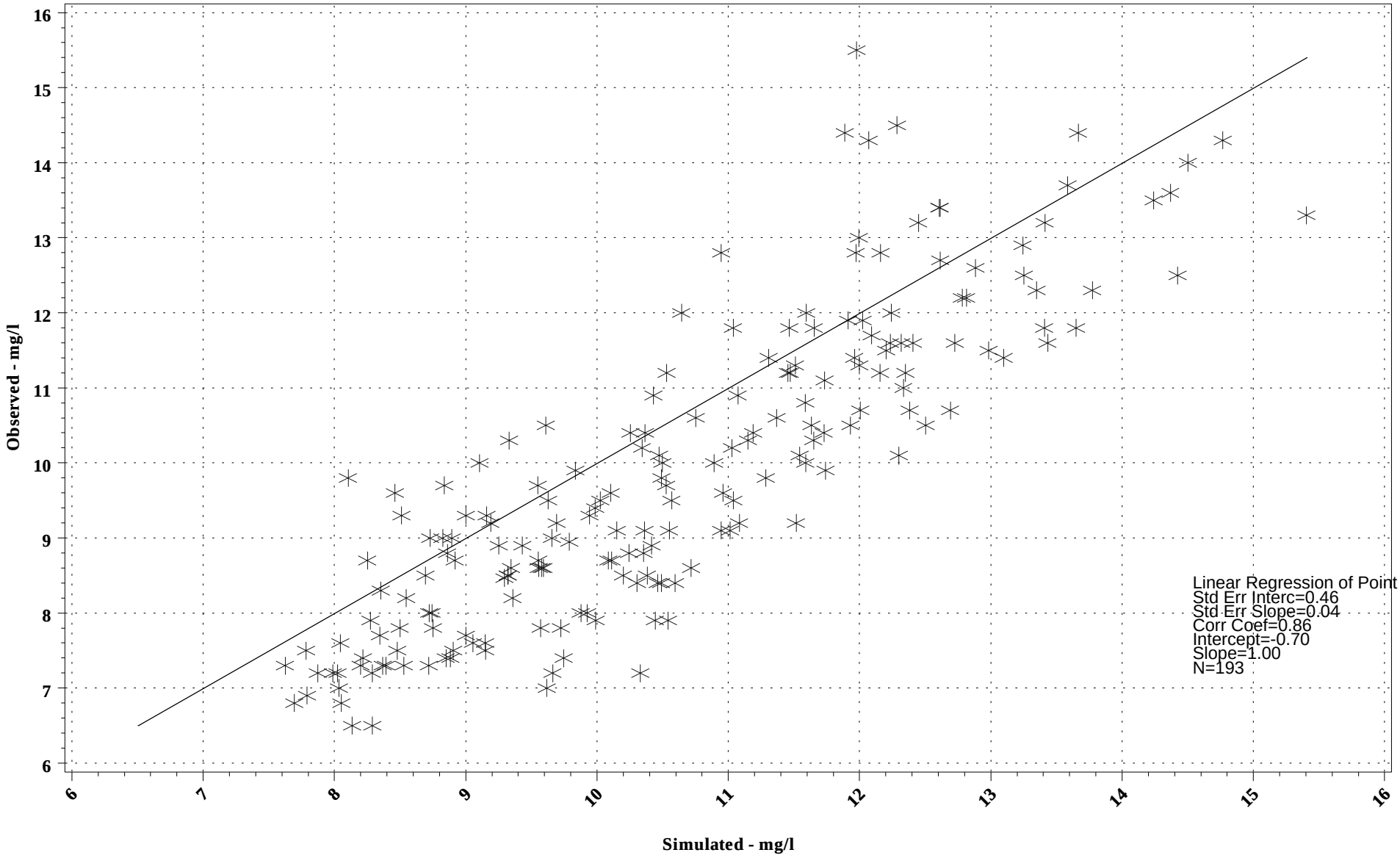
# James River at Segment 280
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)




(y21_plotb.sas model3d:[pwang.dt] lldflas)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

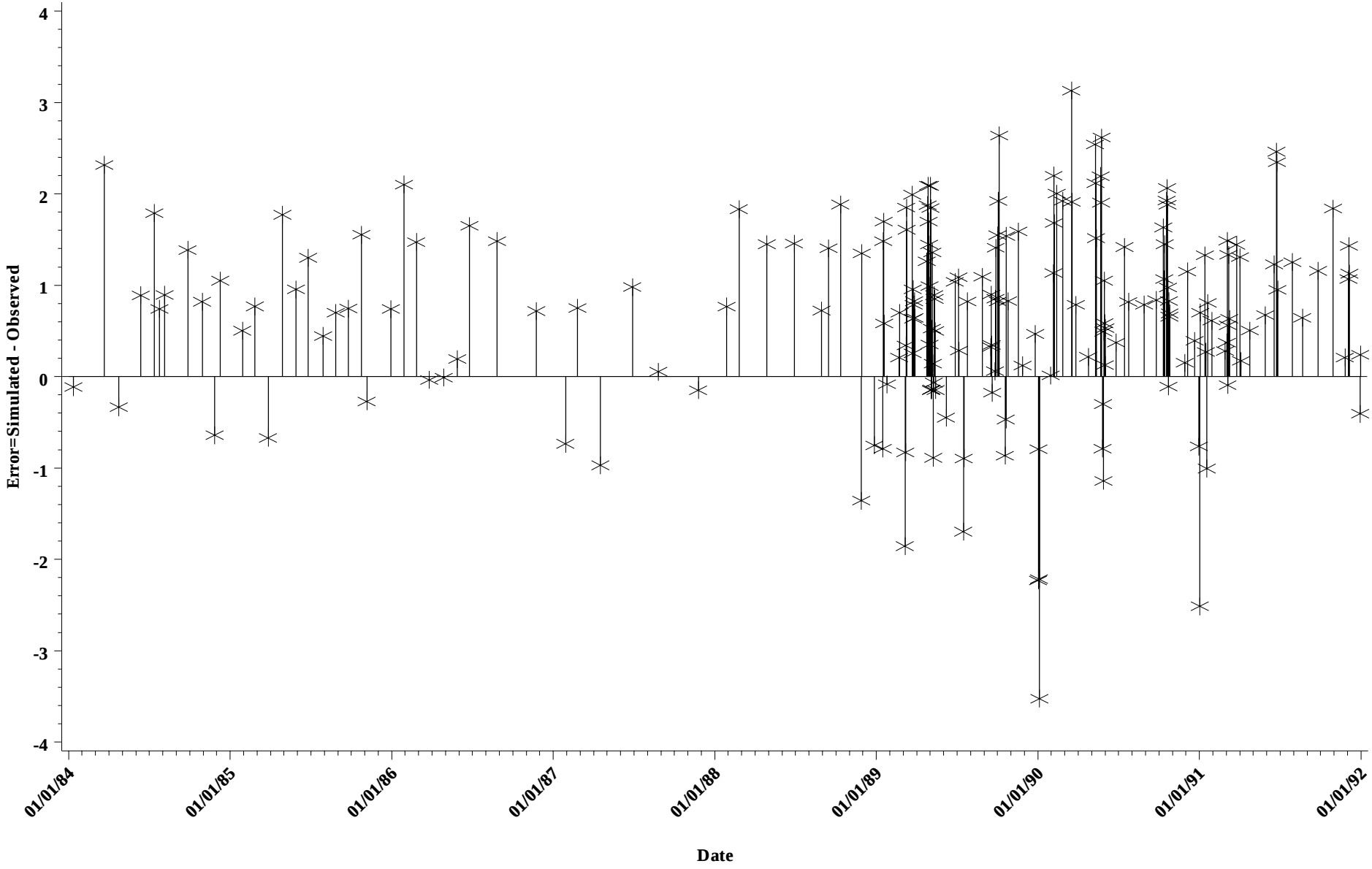
# James River at Segment 280

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Dissolved Oxygen: 01JAN84 - 01JAN92



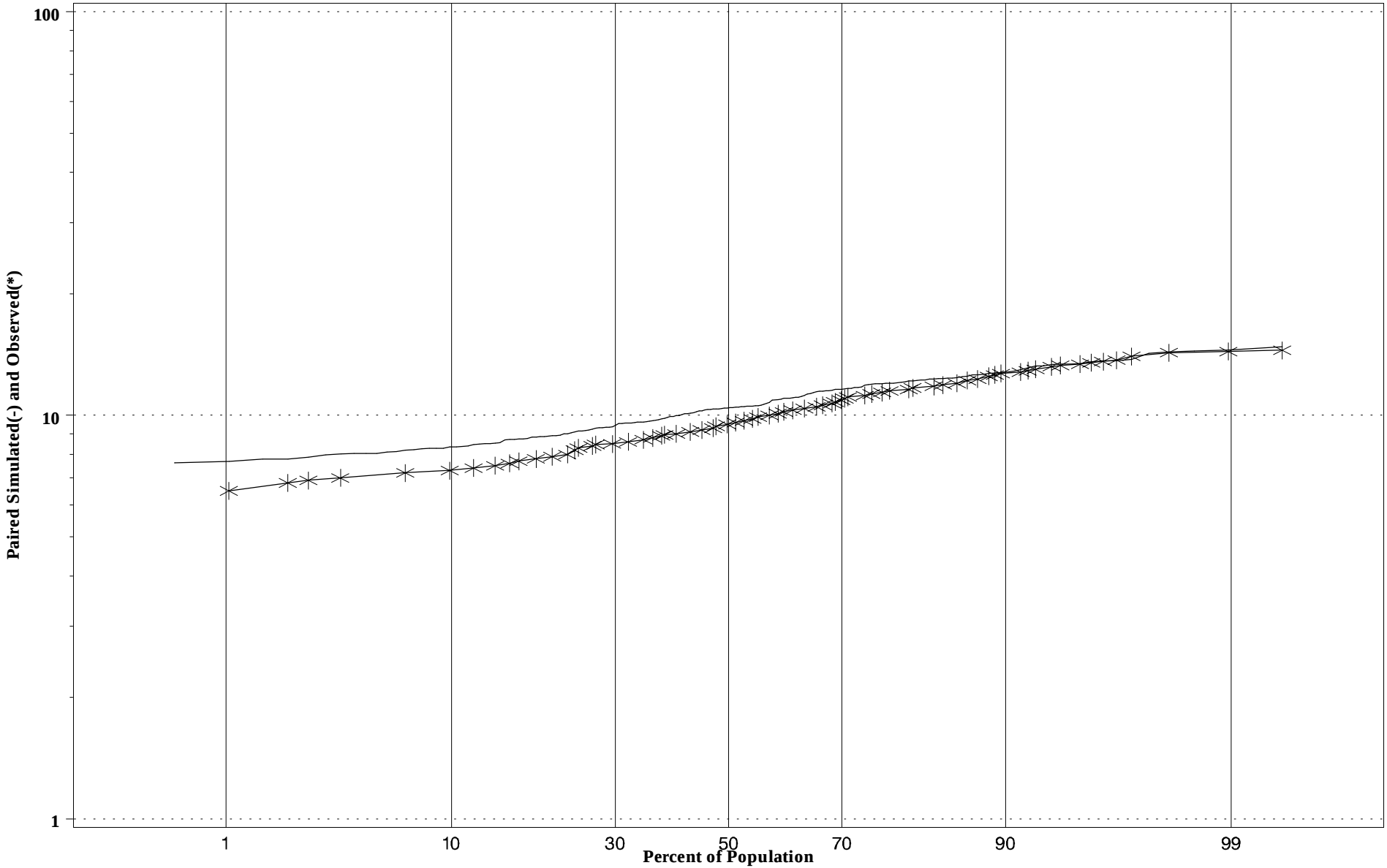

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(j2.drv 29JUN98 10:22)

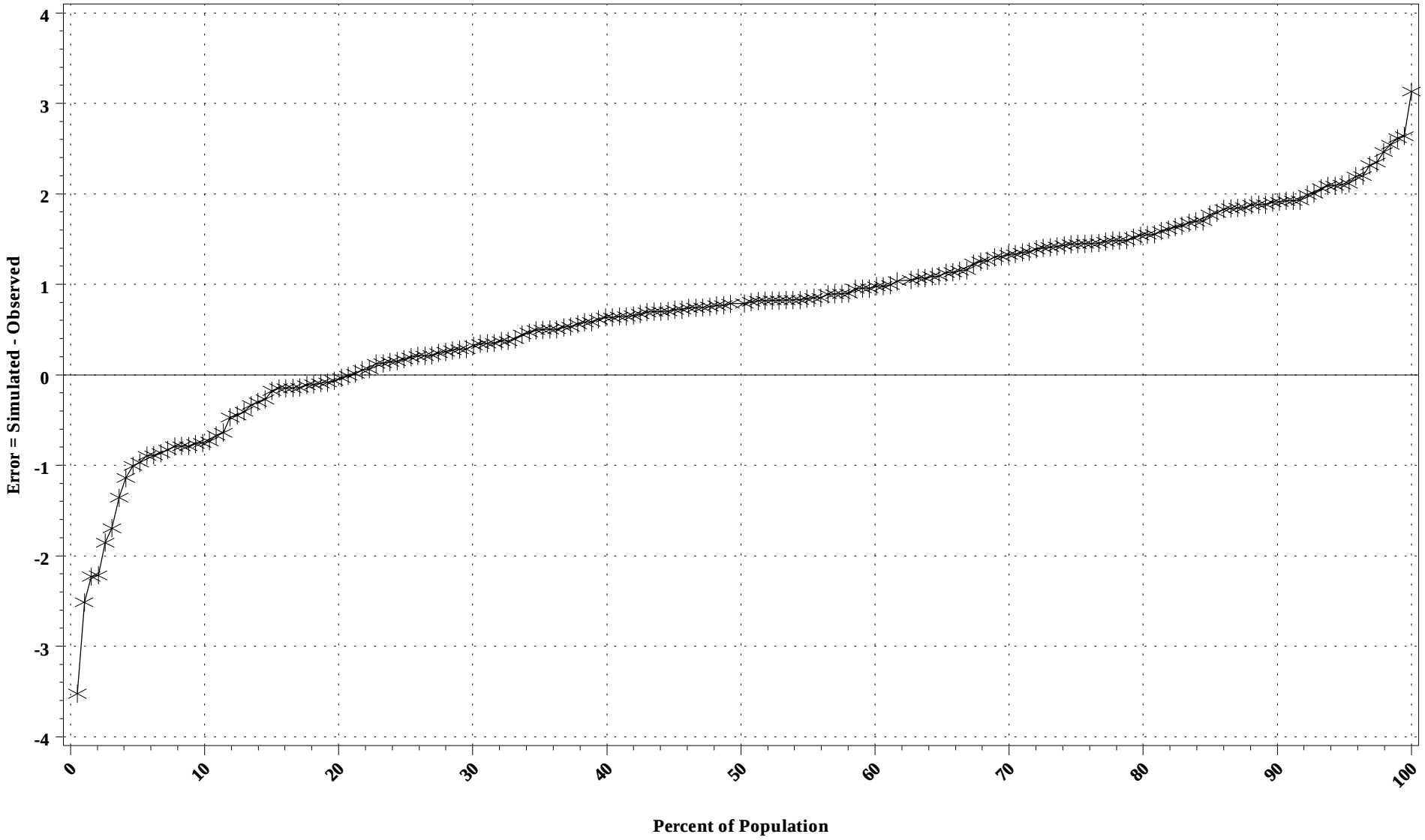
# James River at Segment 280
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

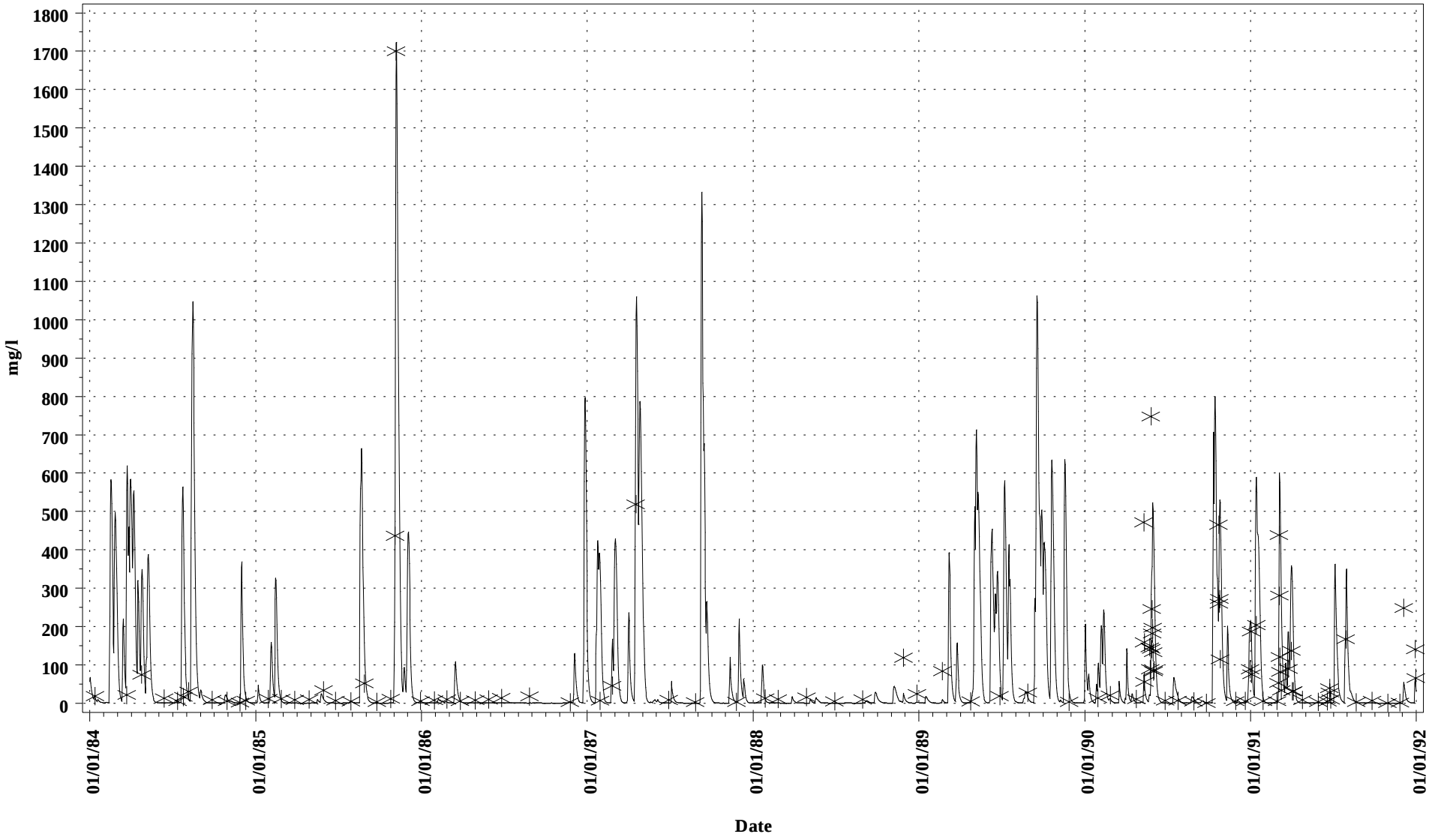
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(j2.drv 29JUN98 10:22)

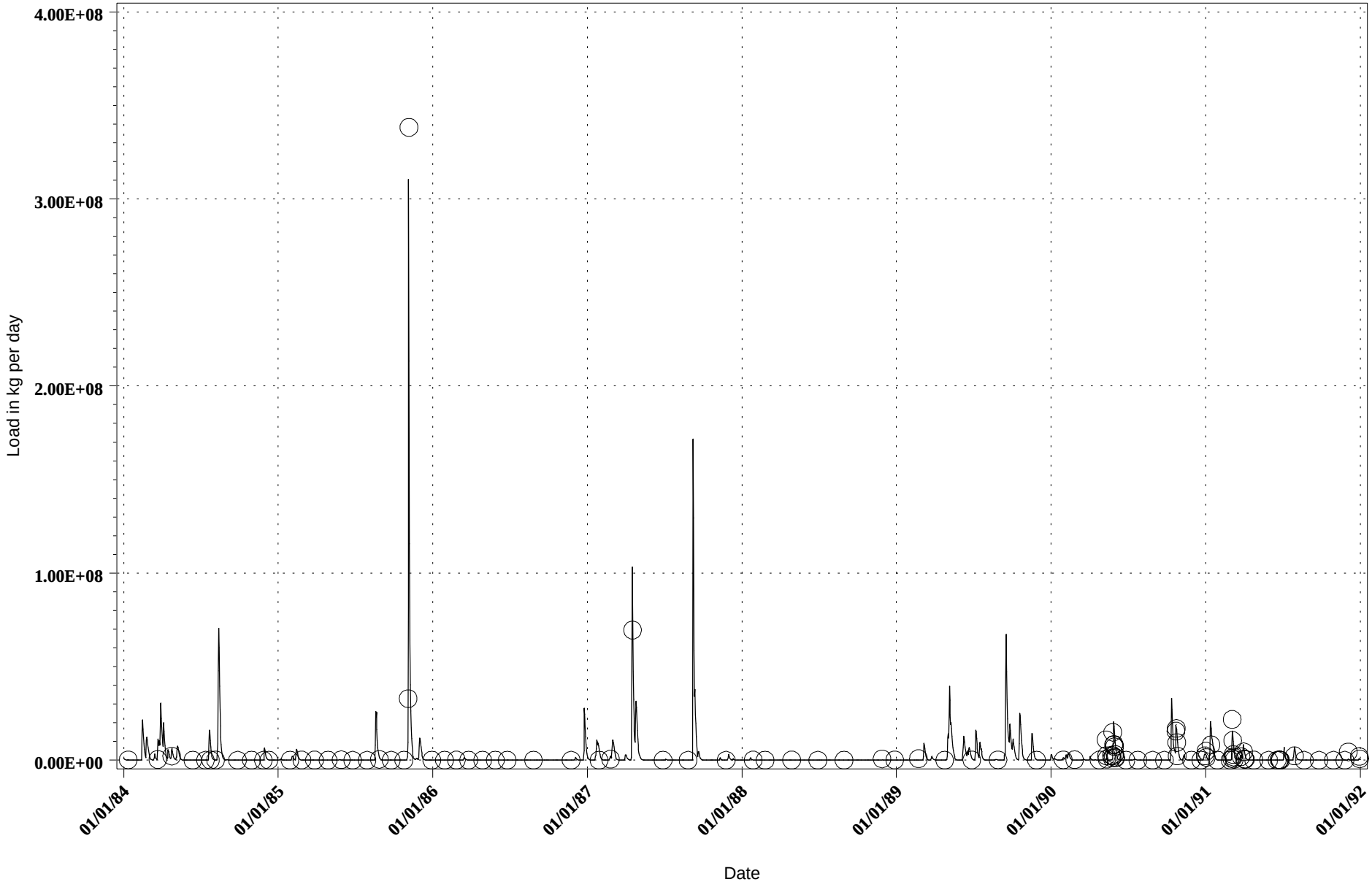
# James River at Segment 280
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Total Suspended Sediment Observed and Simulated Load vs Time
### (line = simulated, O = observed)

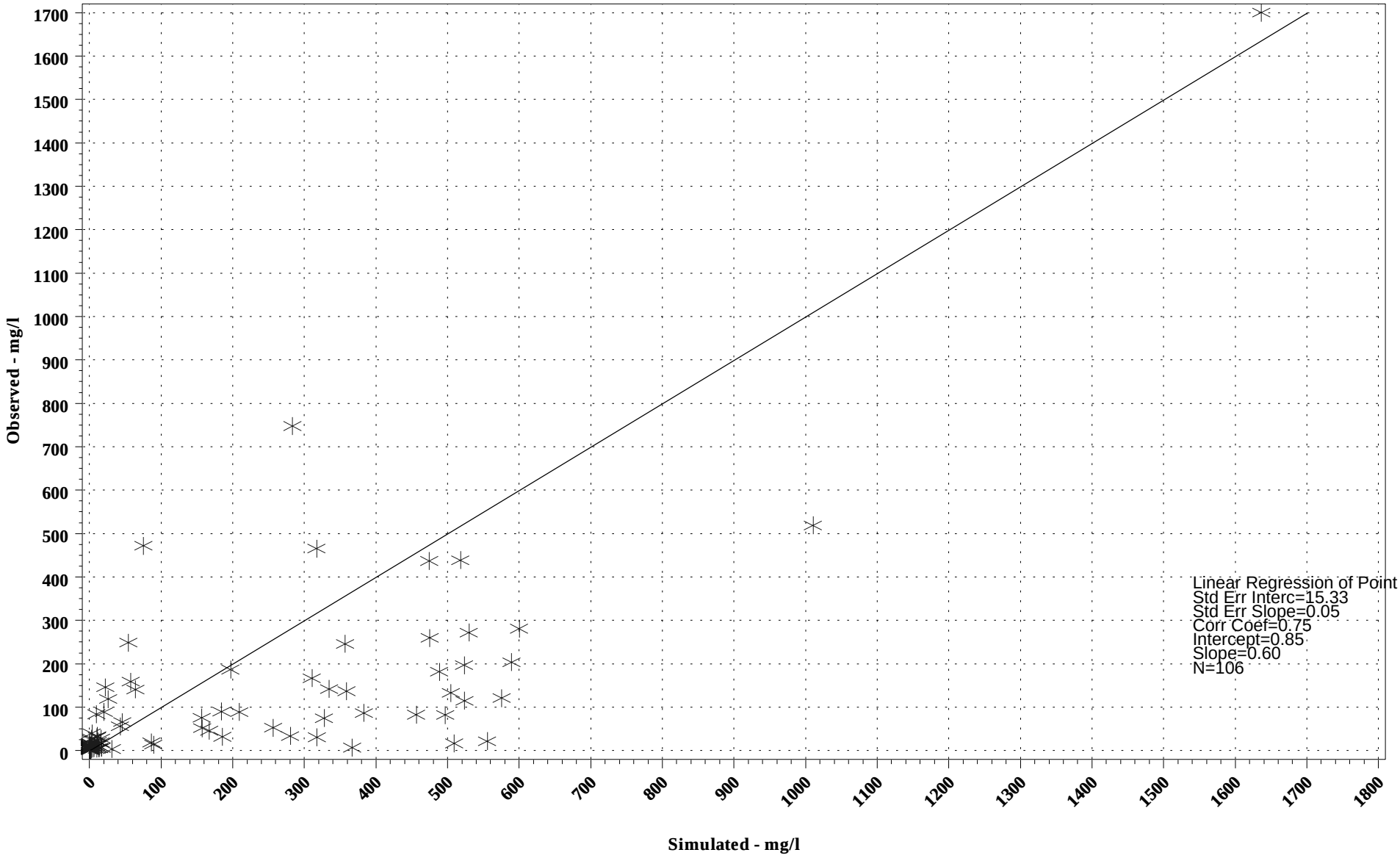



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280

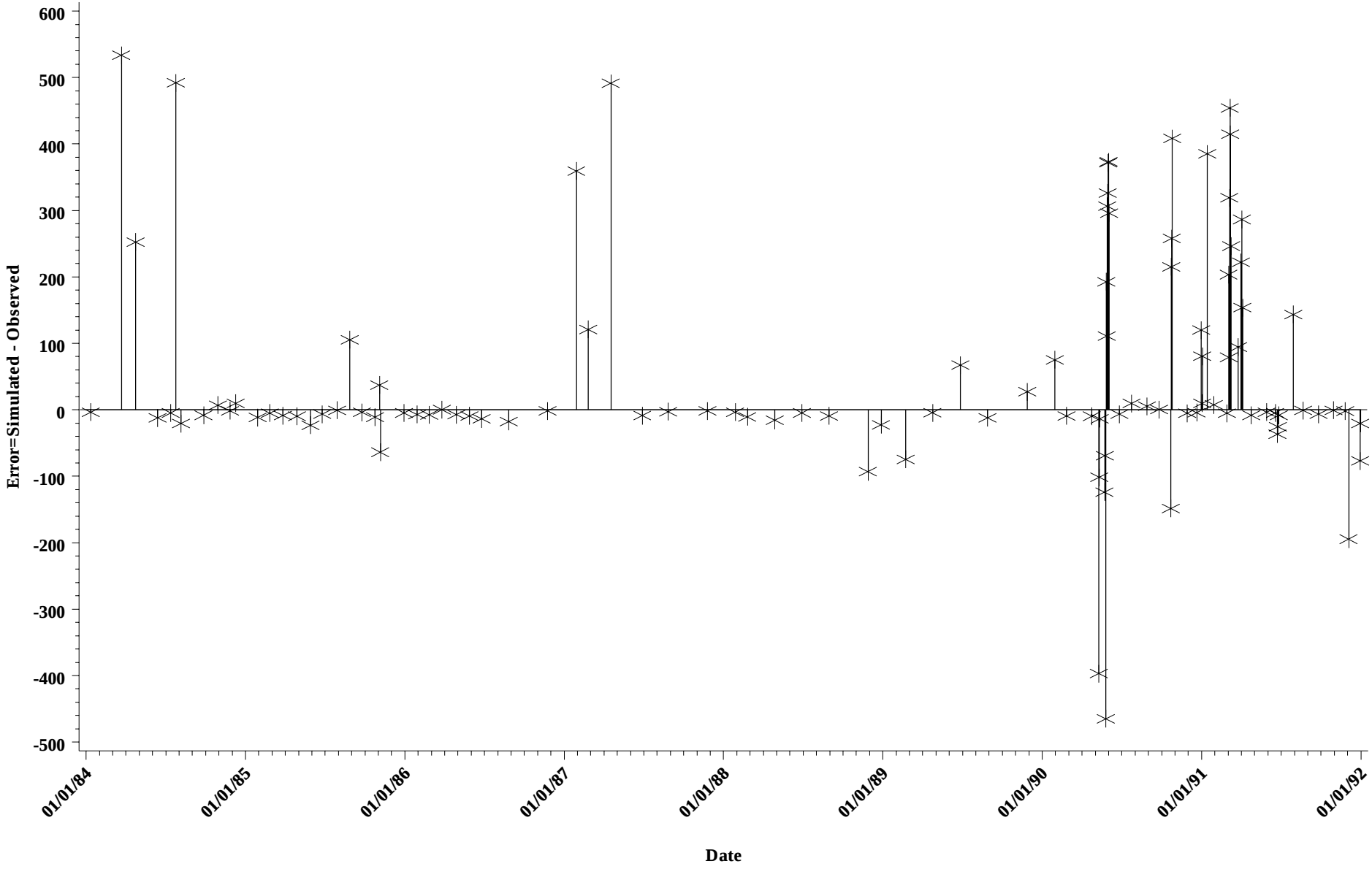
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



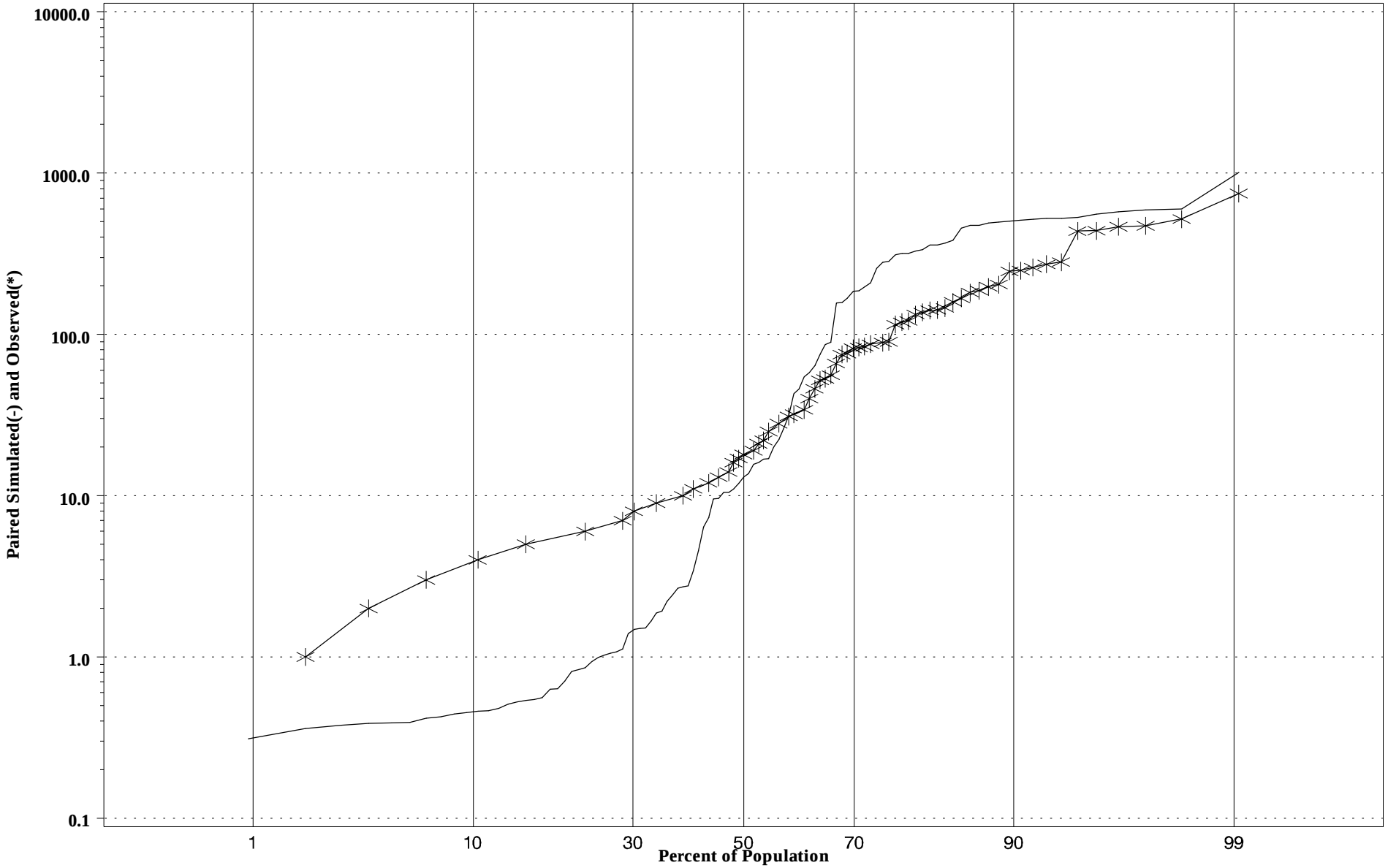

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(j2.drv 29JUN98 10:22)

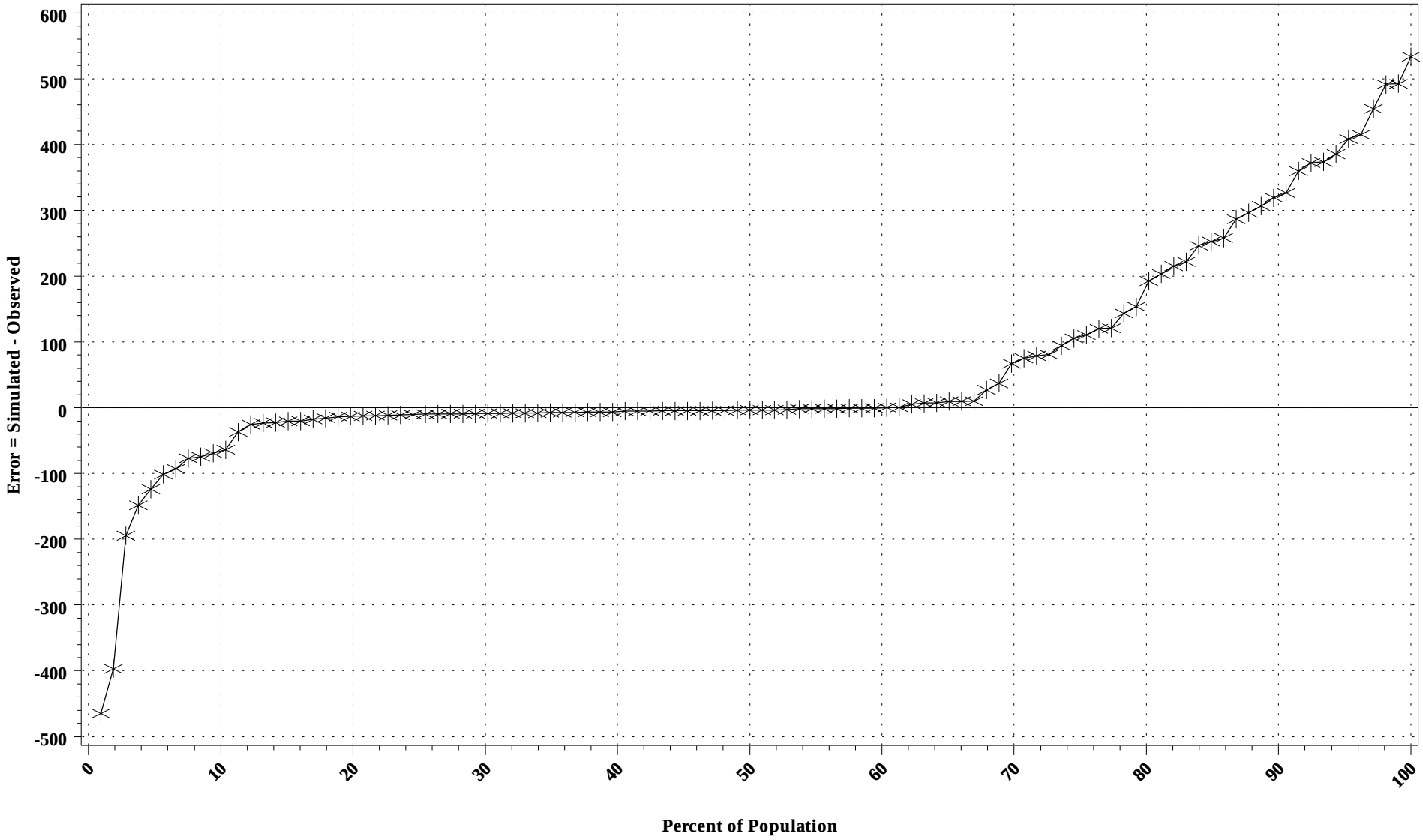
# James River at Segment 280
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

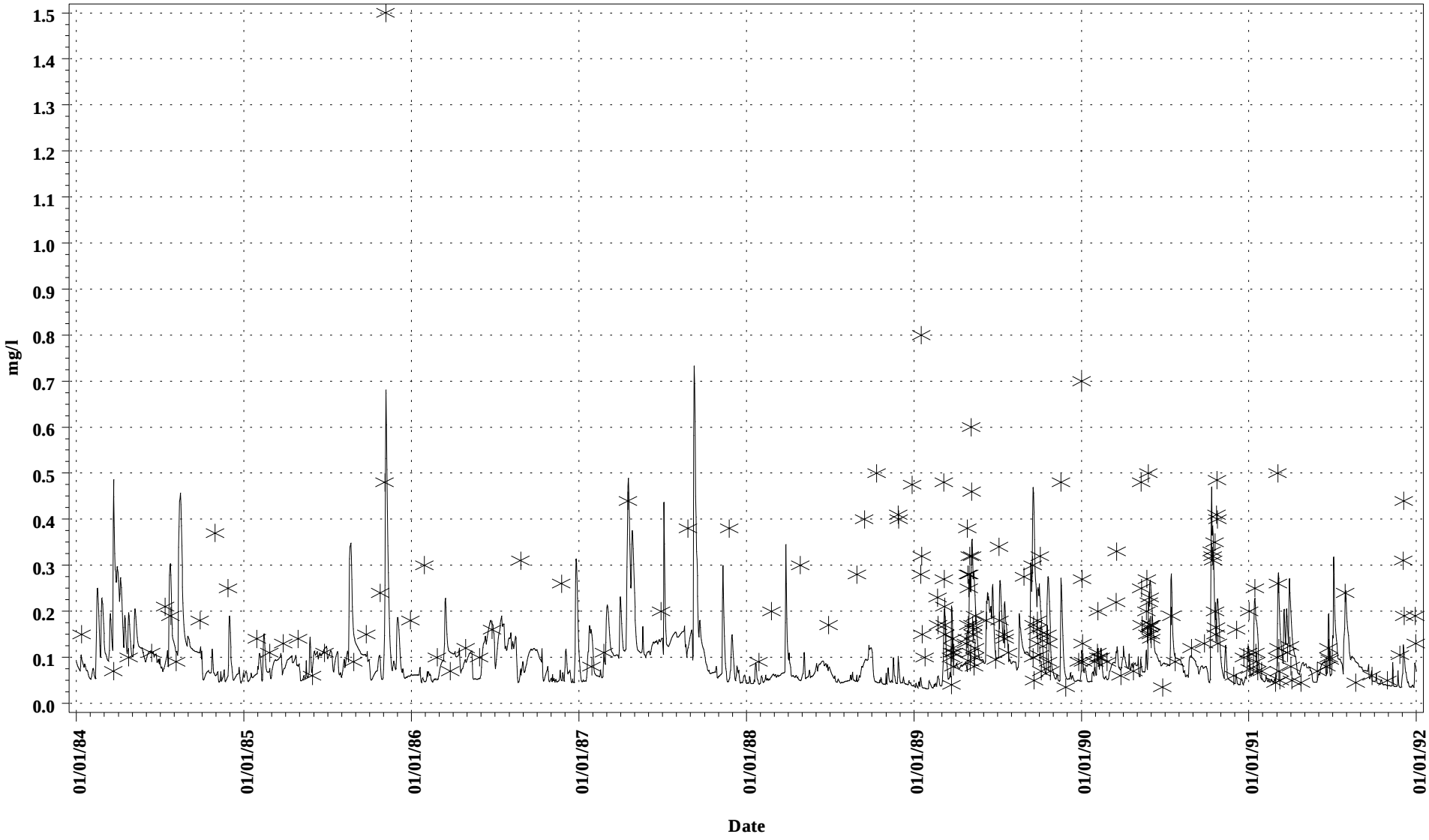
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(j2.drv 29JUN98 10:22)

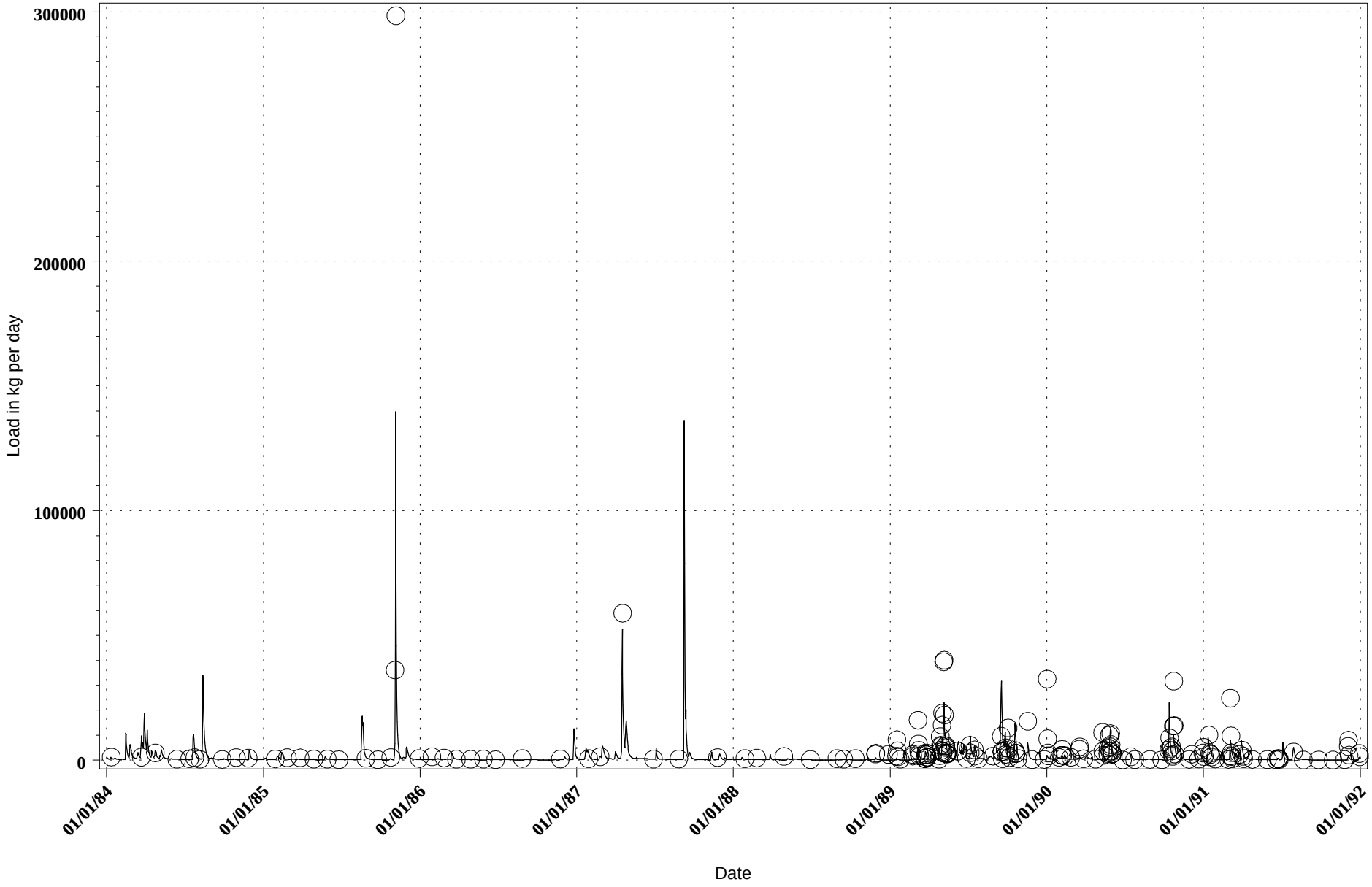
# James River at Segment 280
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

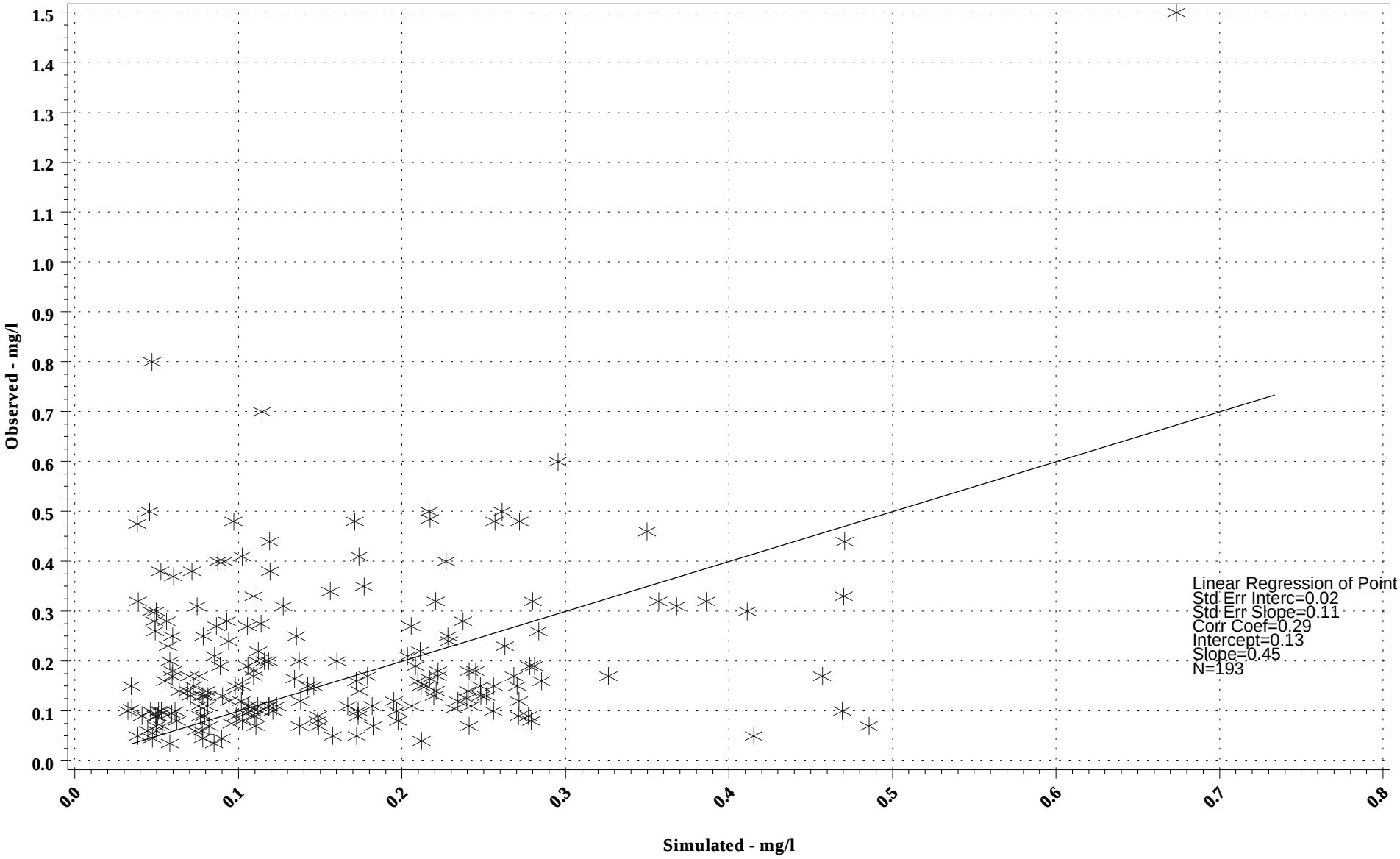



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280

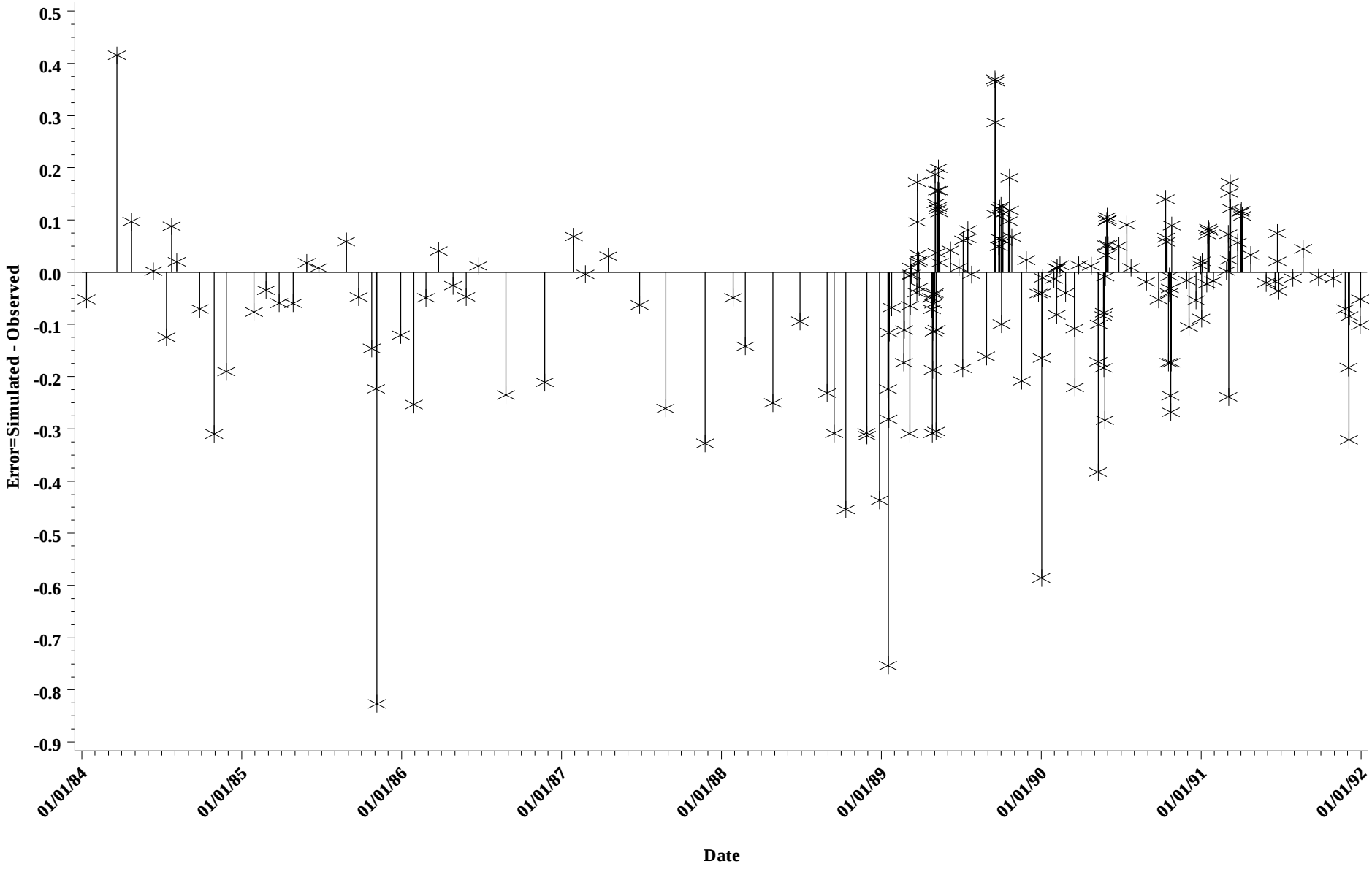
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



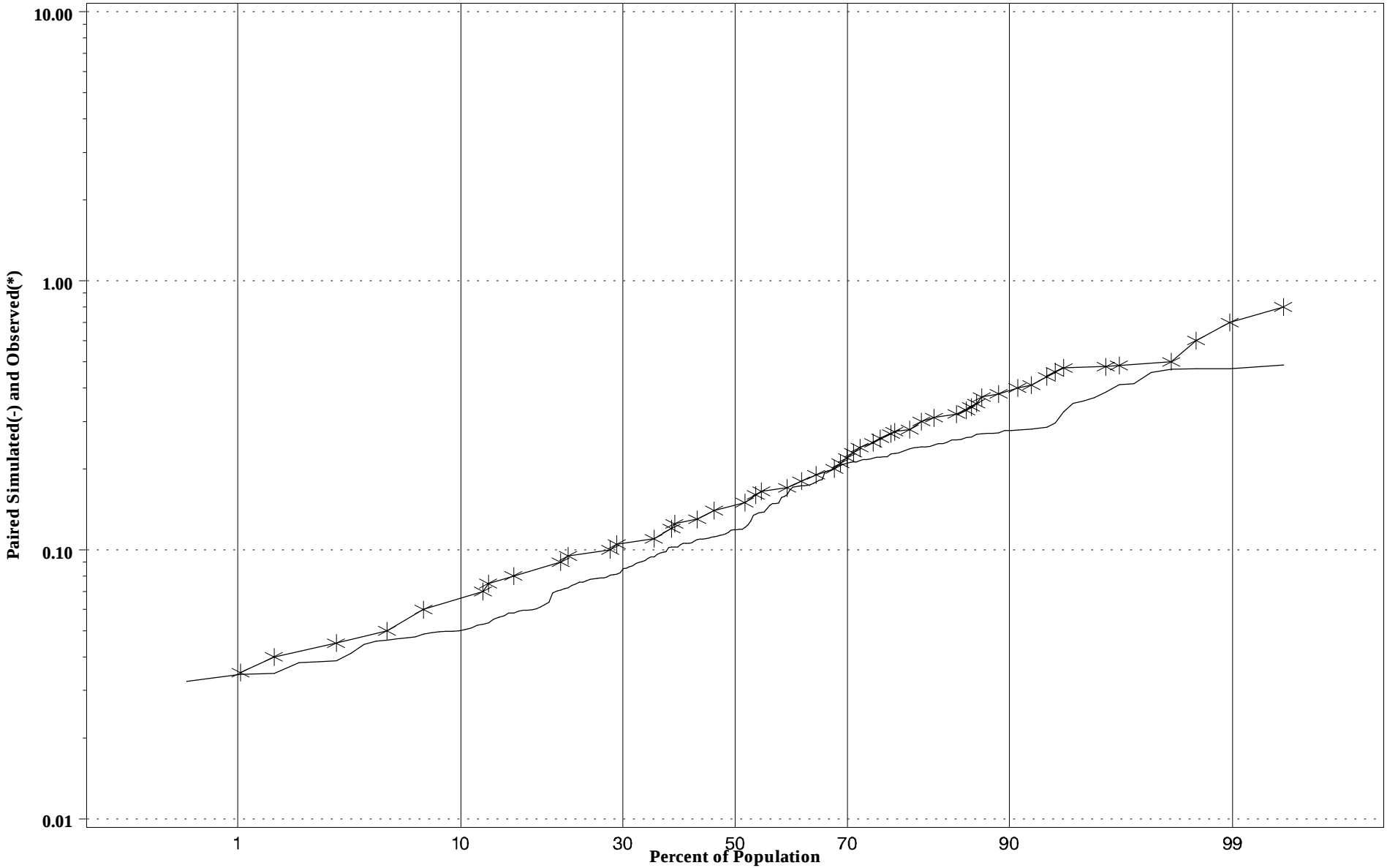

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(j2.drv 29JUN98 10:22)

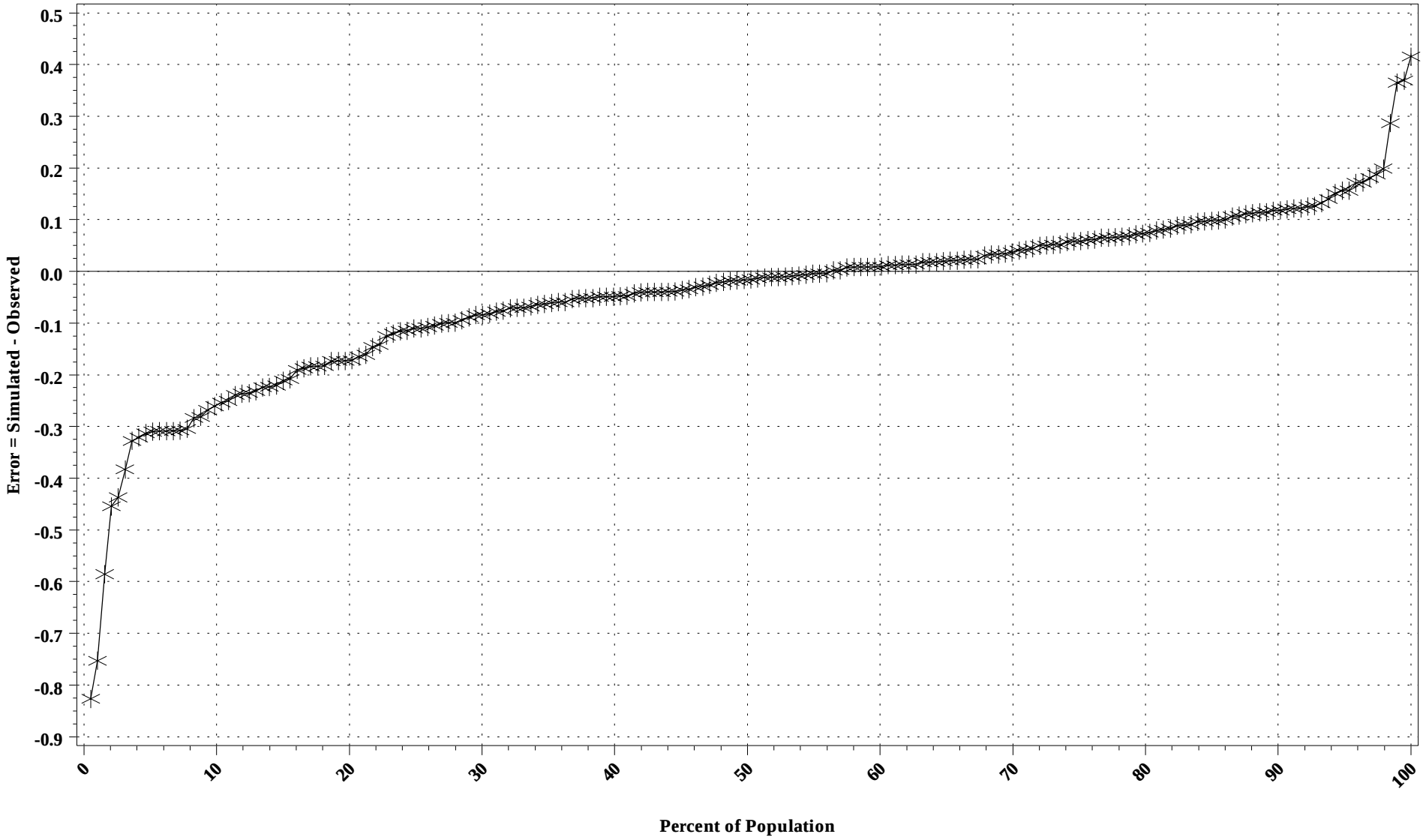
# James River at Segment 280
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Actual error versus Percentile Sample Population
## Total Phosphorus

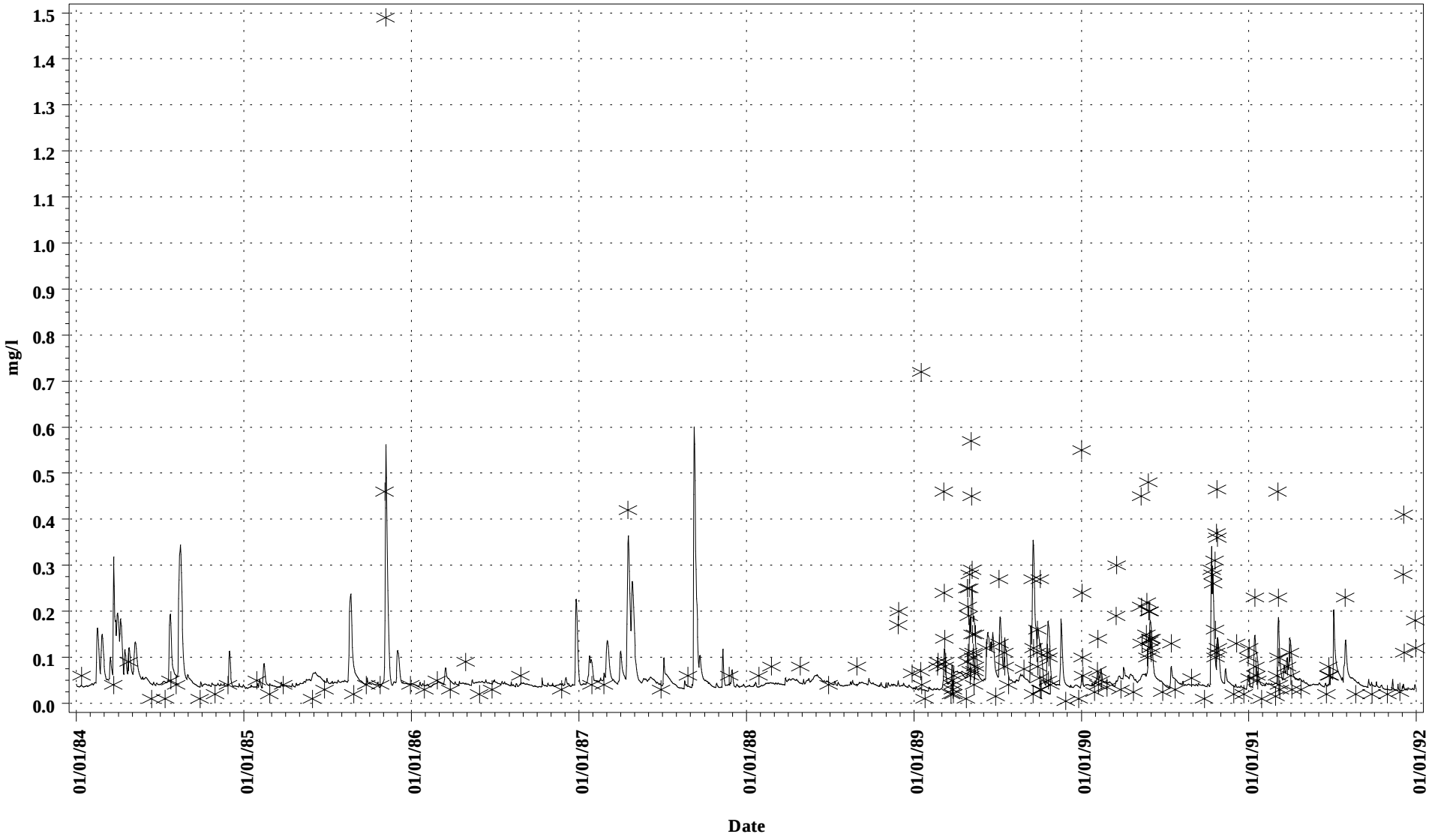
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

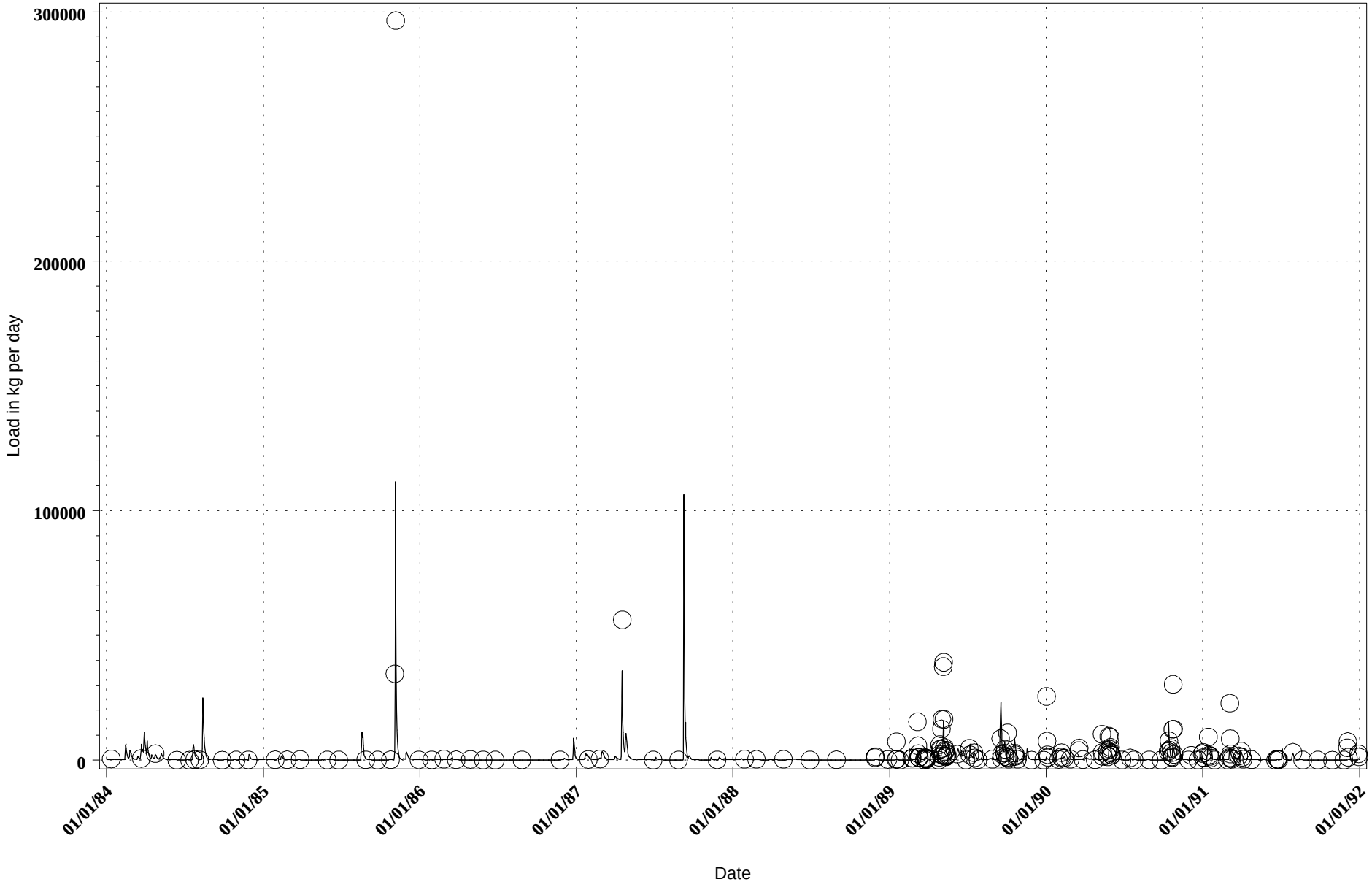



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(j2.drv 29JUN98 10:22)

# James River at Segment 280

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

### (line = simulated, O = observed)

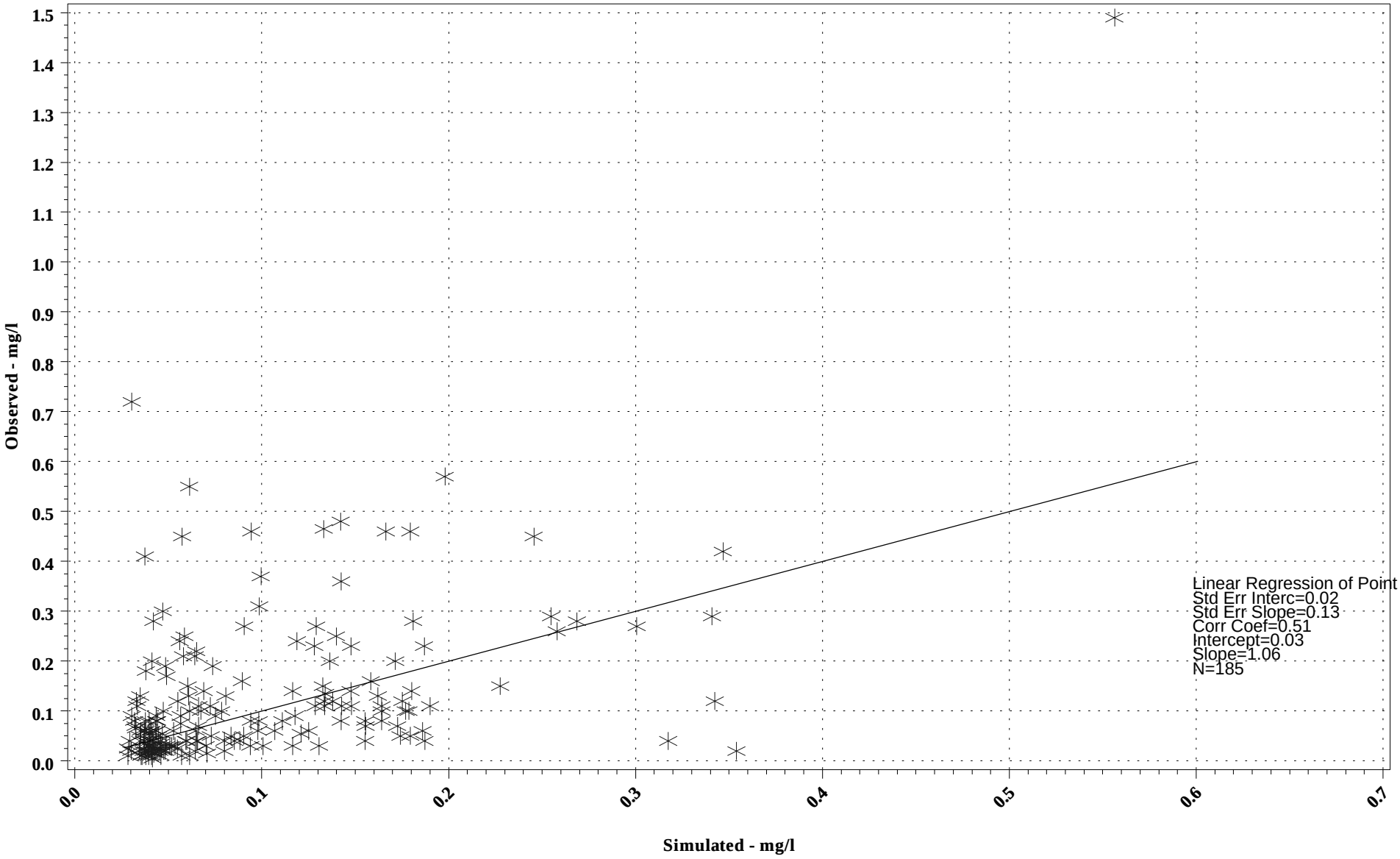



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280

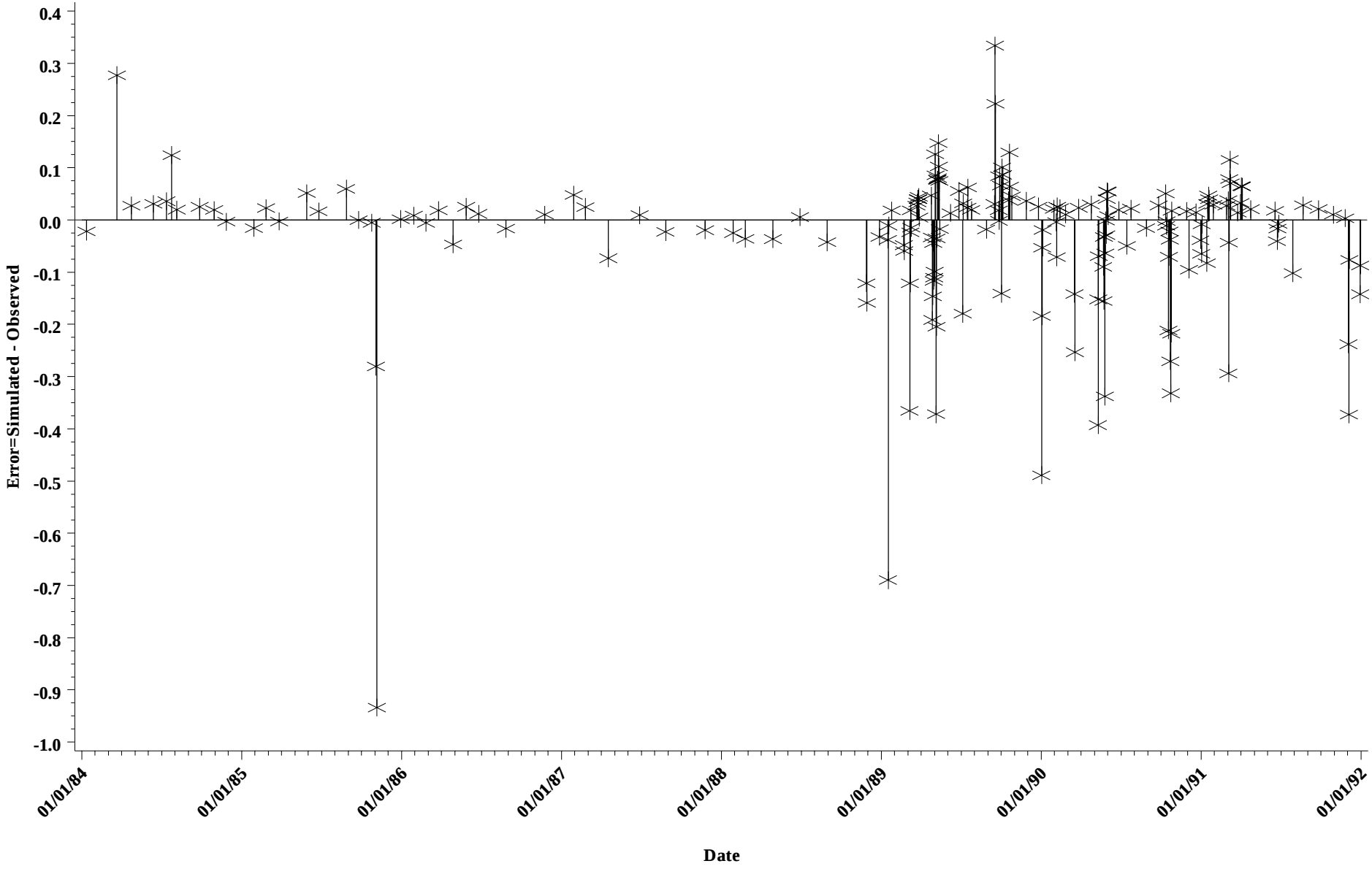
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92



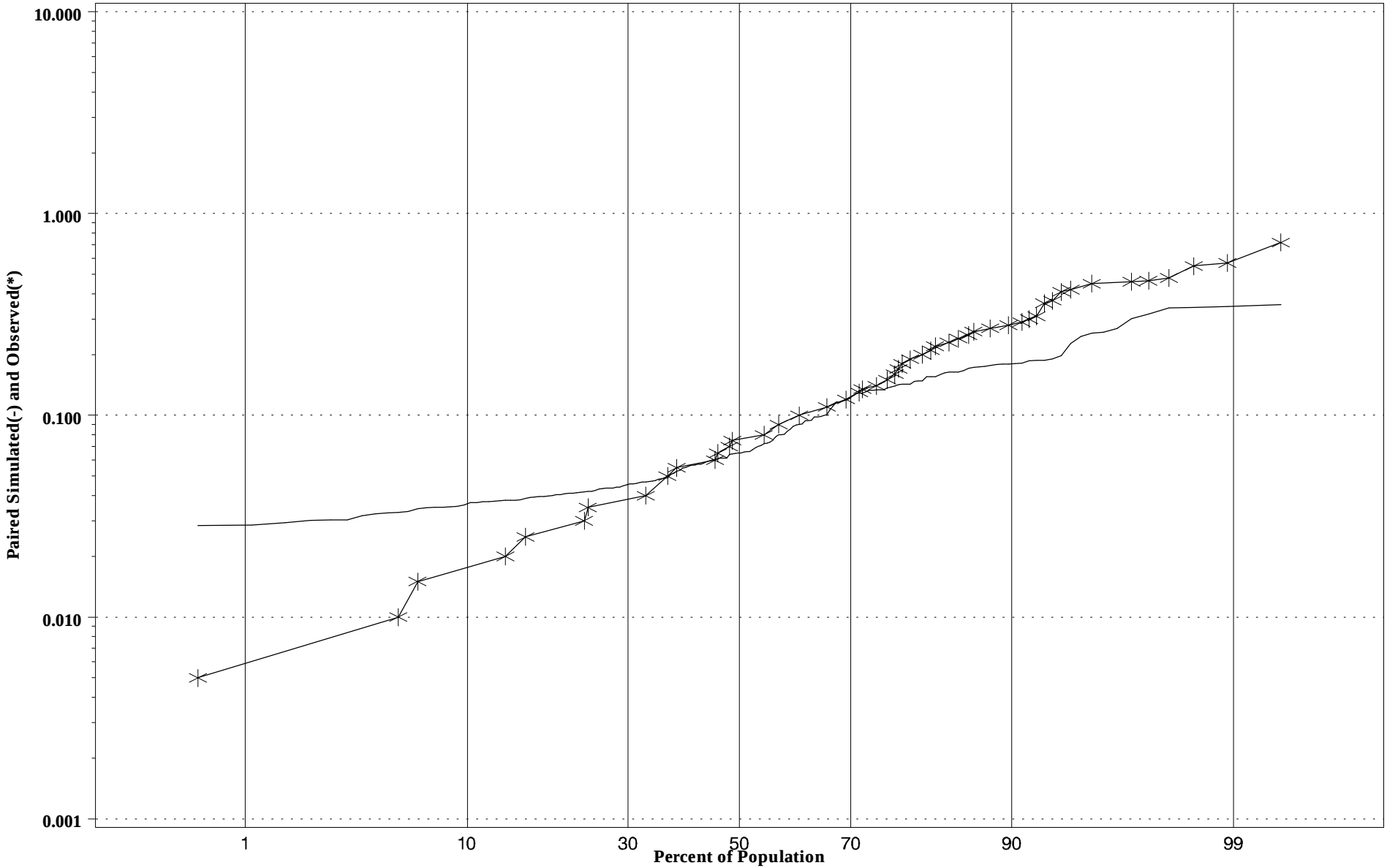

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280
## Actual Error versus Time
## Organic and Particulate Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(j2.drv 29JUN98 10:22)

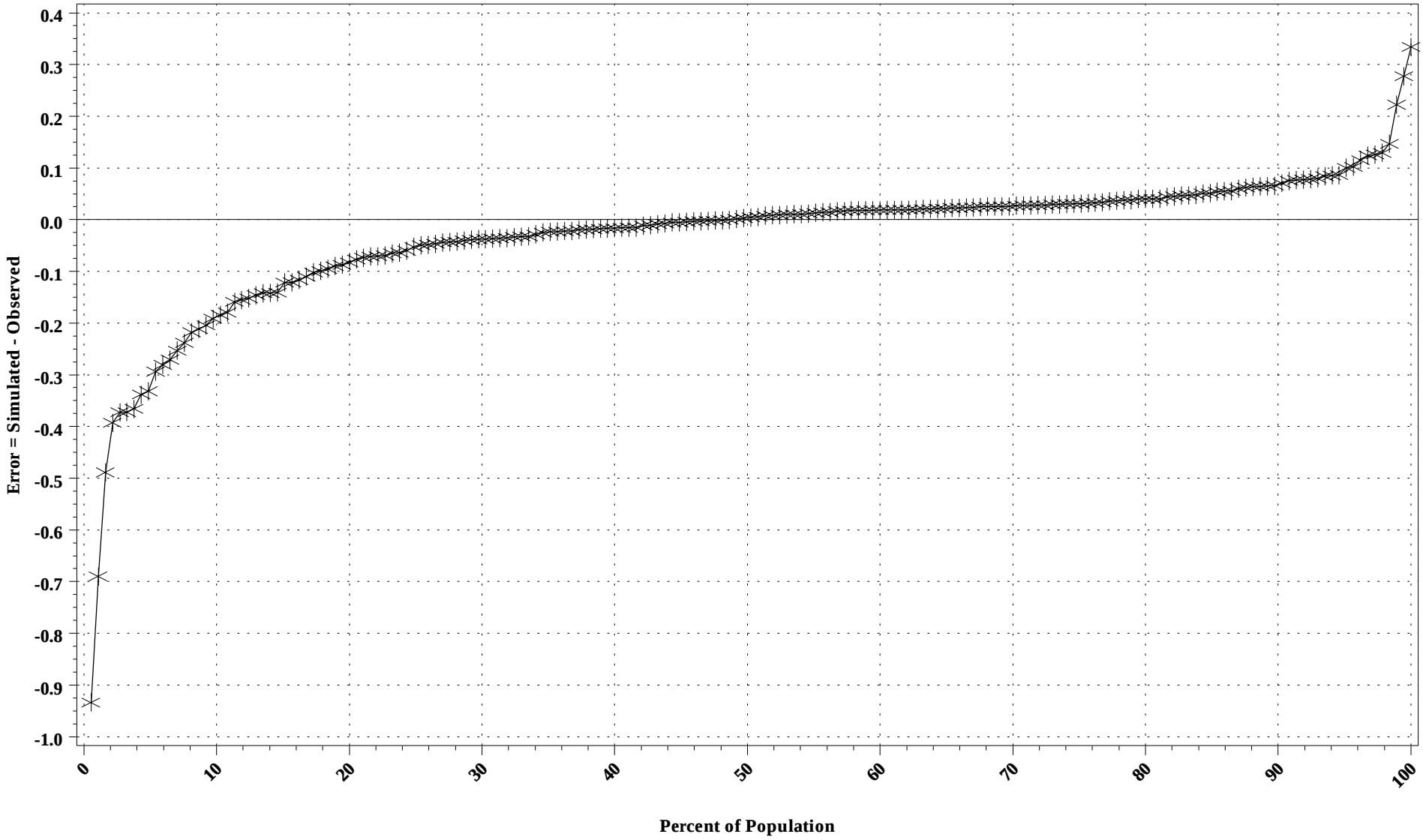
# James River at Segment 280
## Organic and Particulate Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

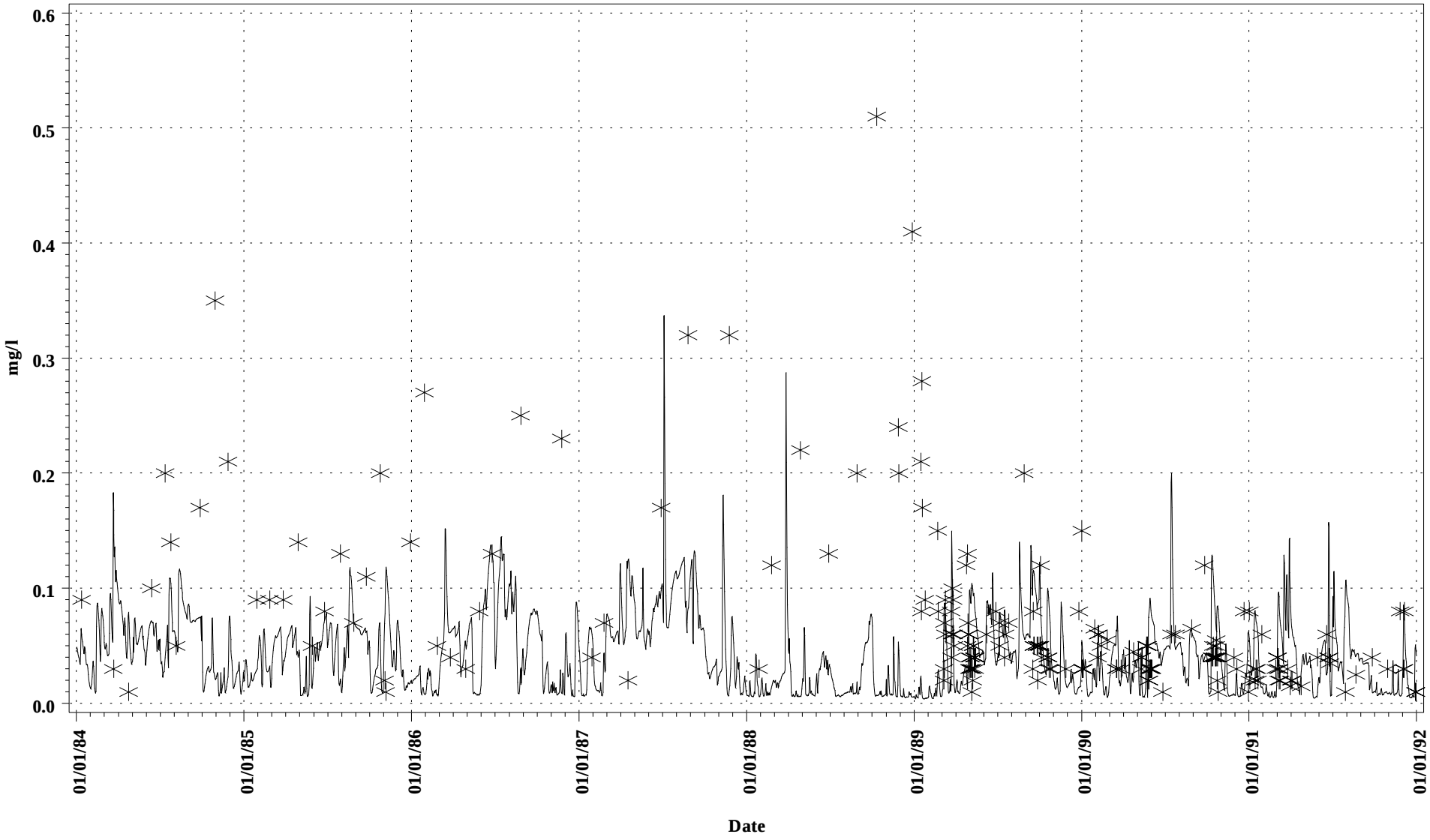
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(j2.drv 29JUN98 10:22)

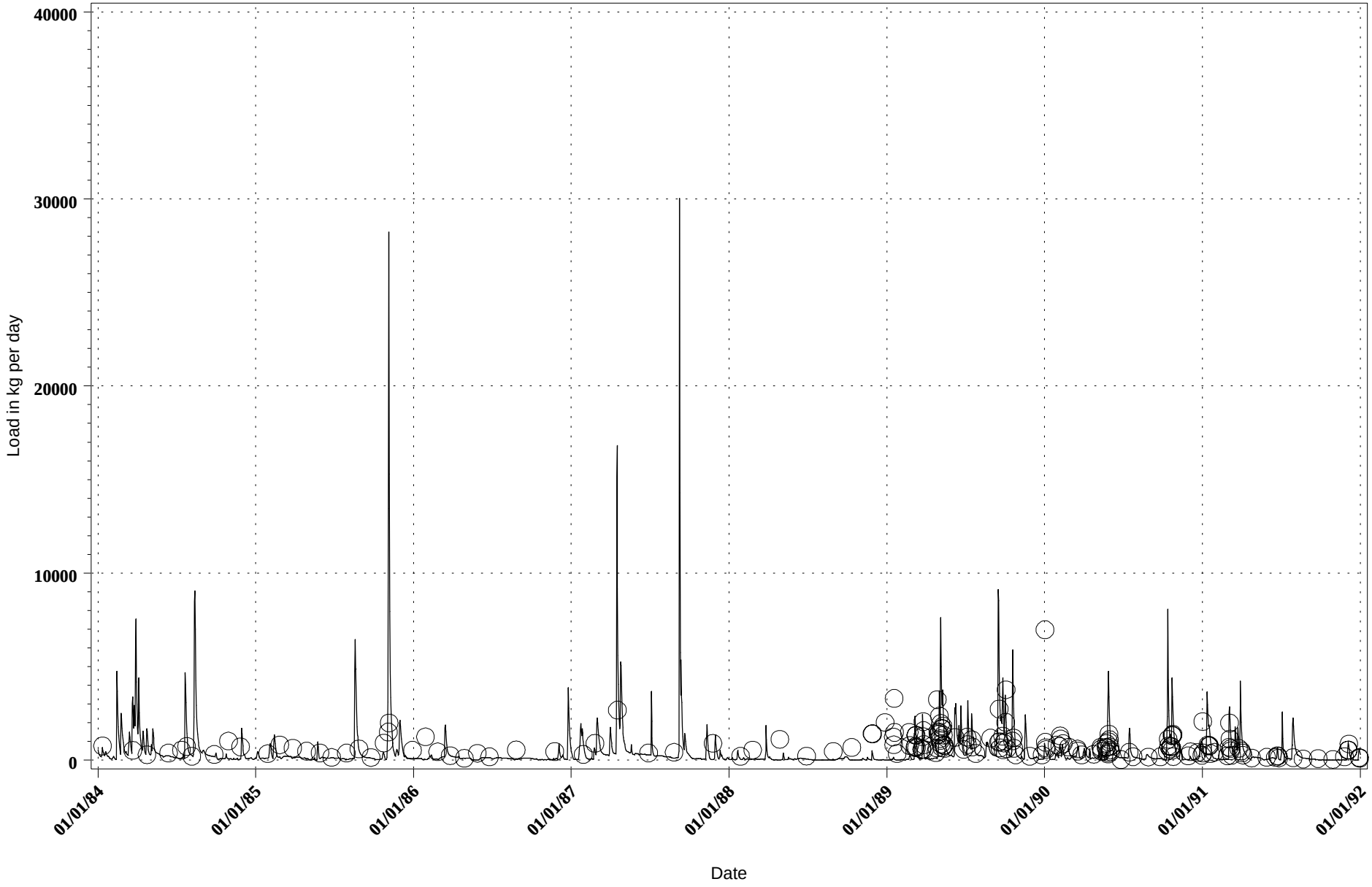
# James River at Segment 280
## Observed and Simulated versus Time
# Dissolved Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Dissolved Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

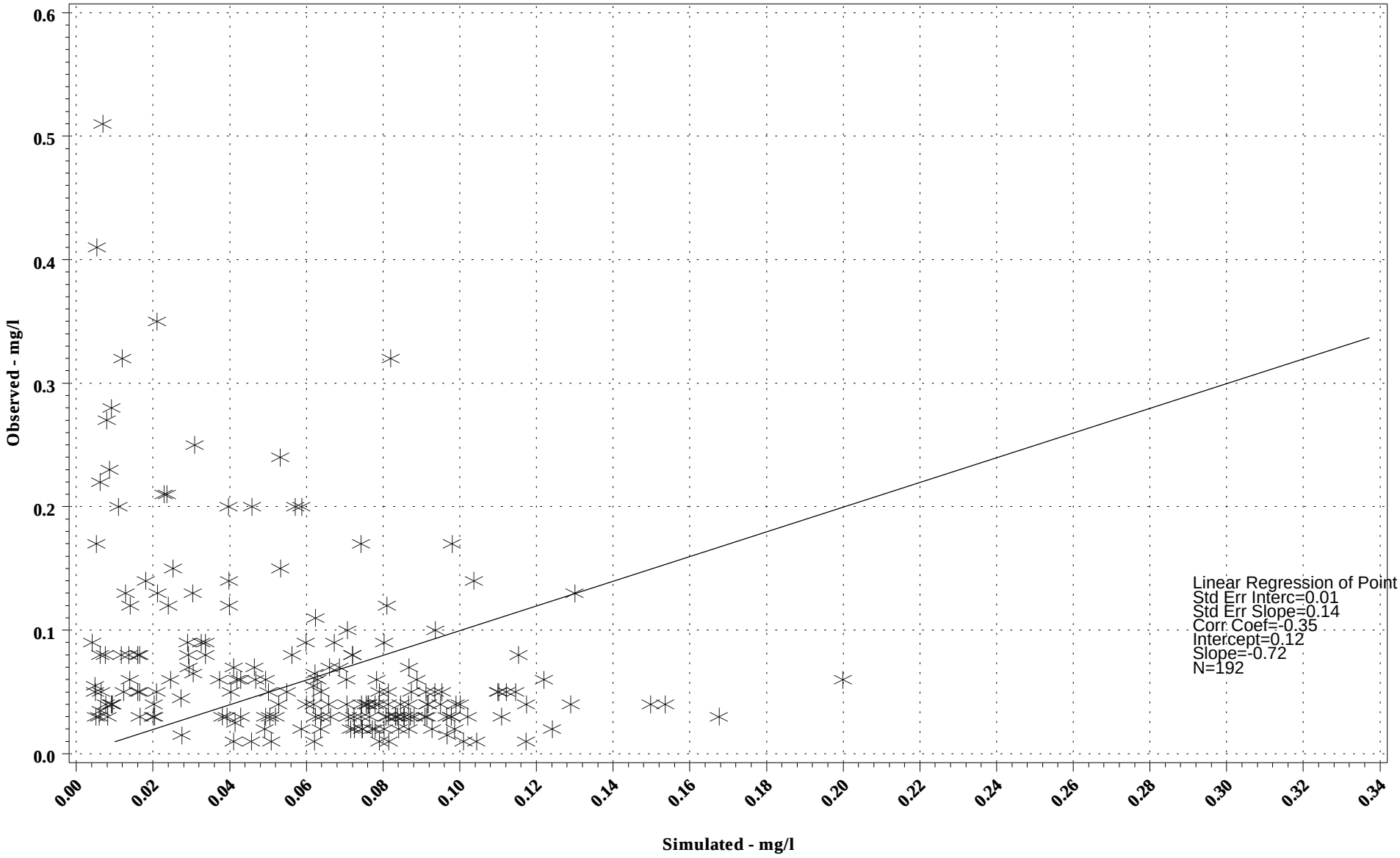



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280

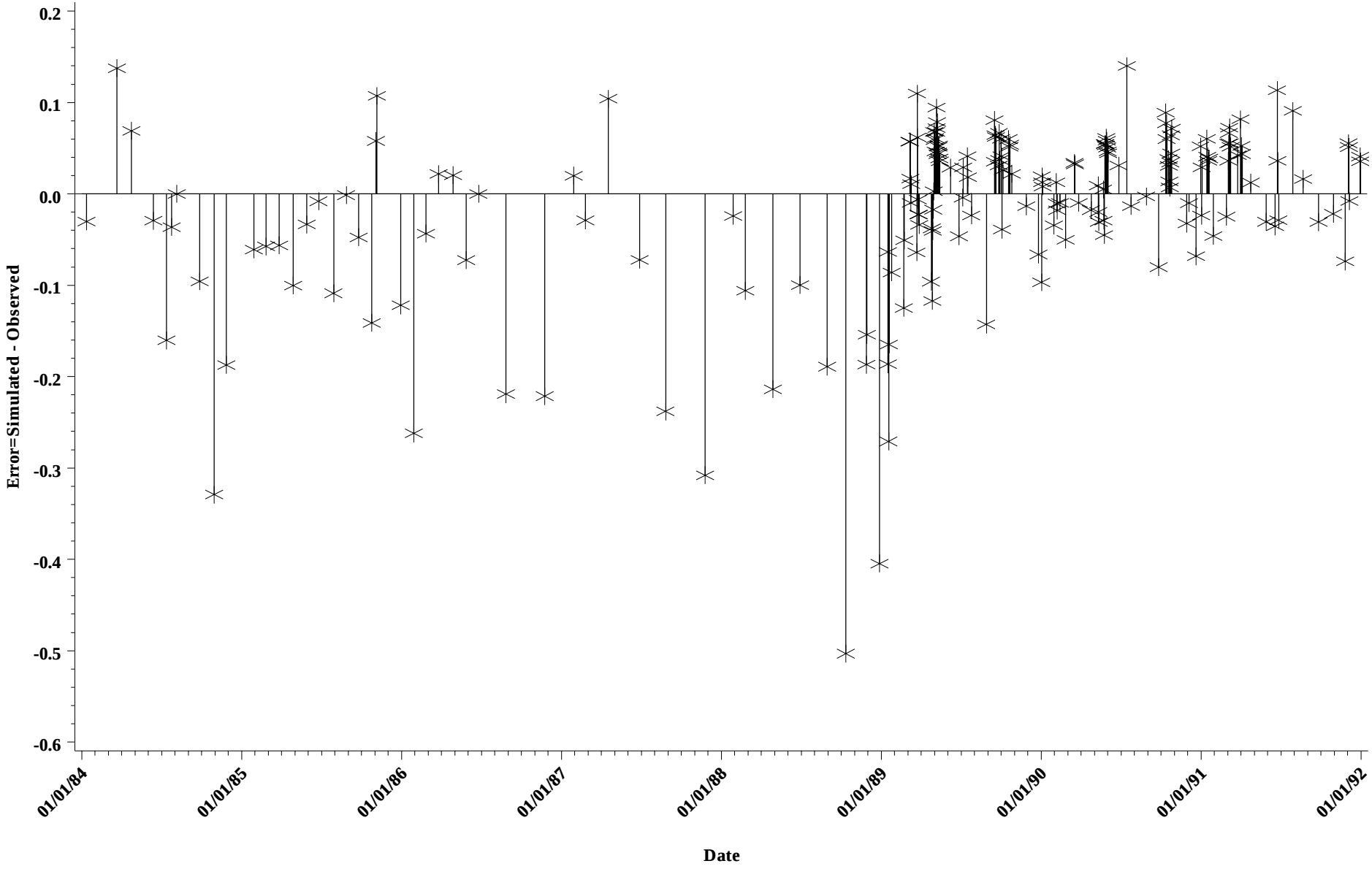
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



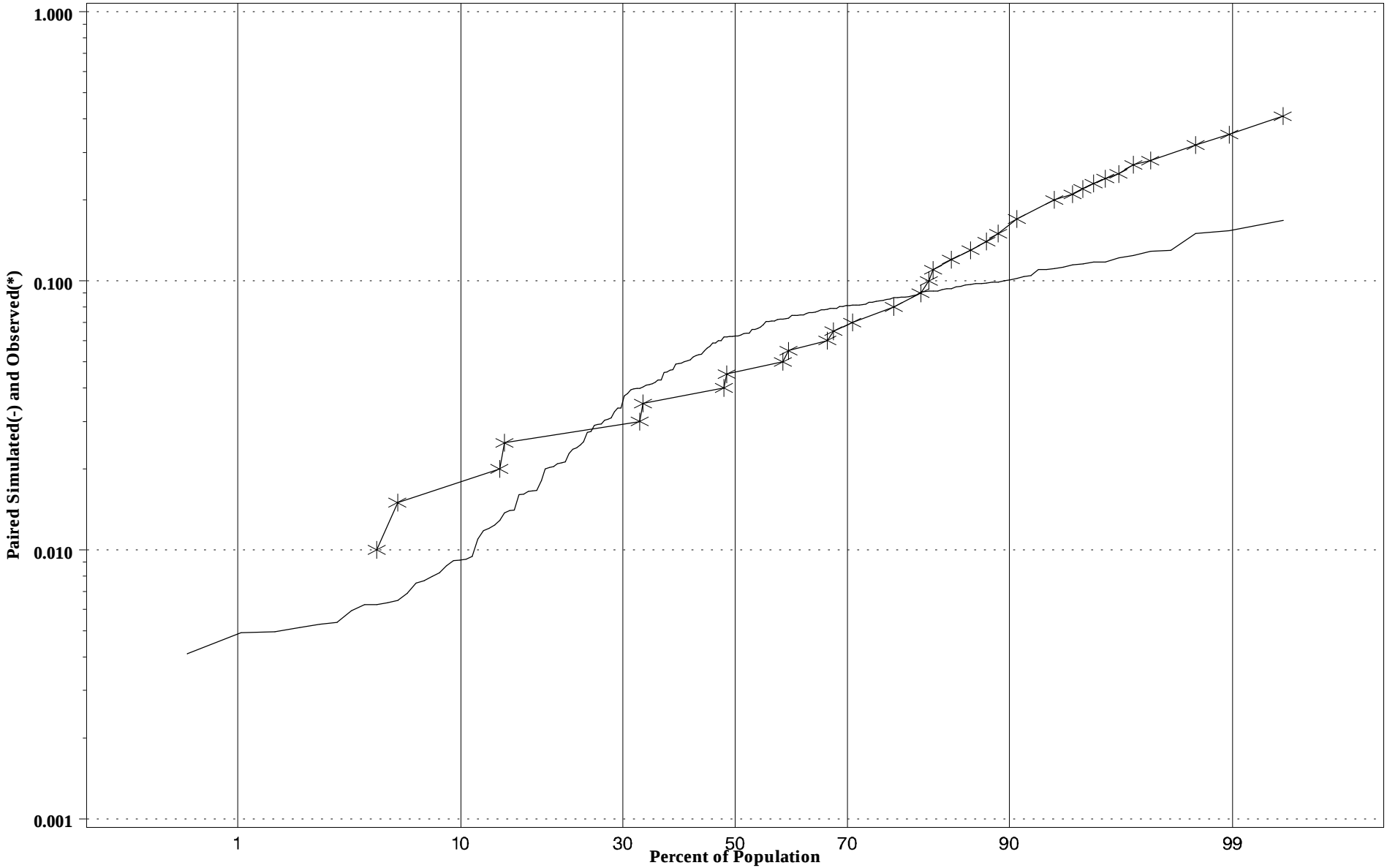

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(j2.drv 29JUN98 10:22)

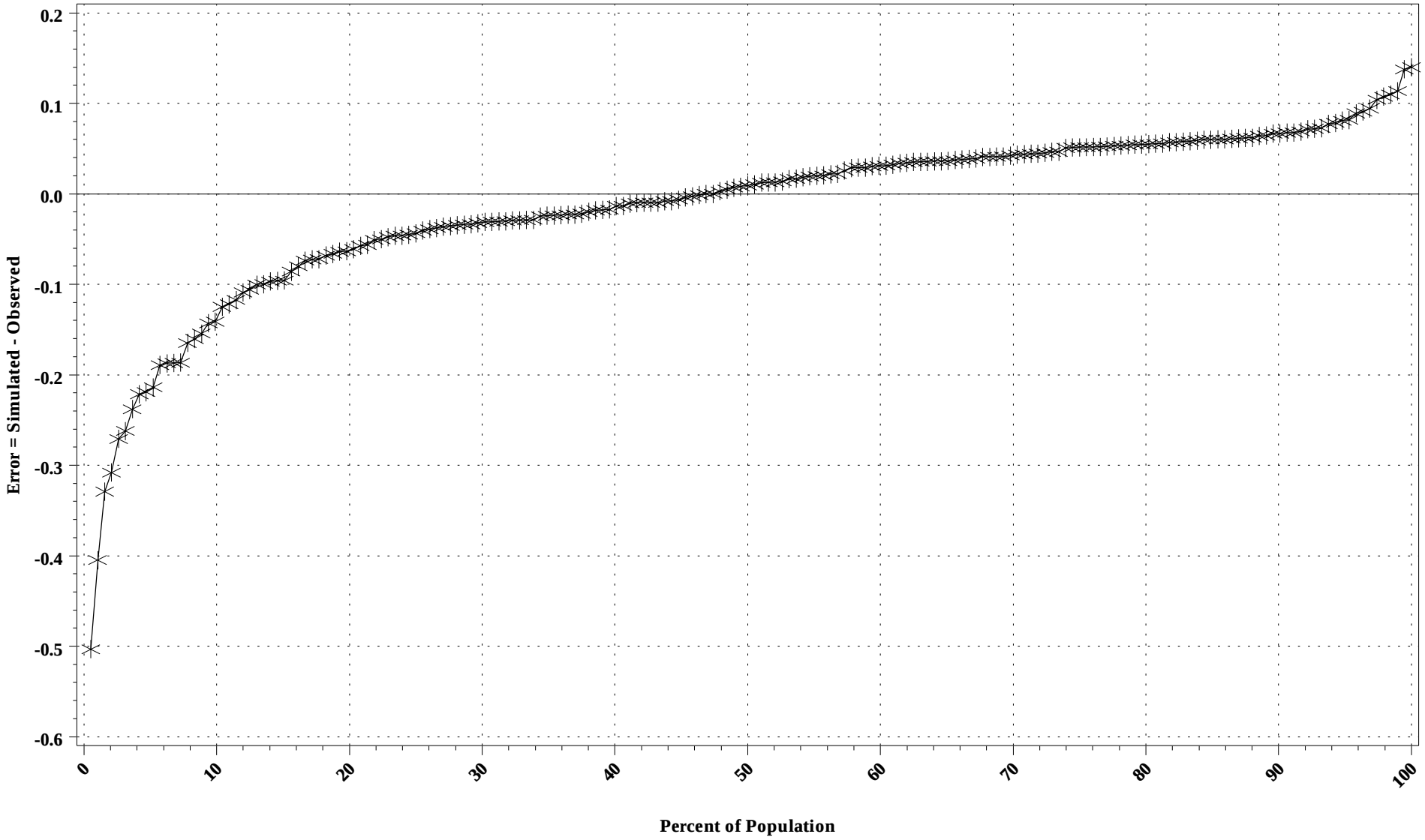
# James River at Segment 280
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(j2.drv 29JUN98 10:22)

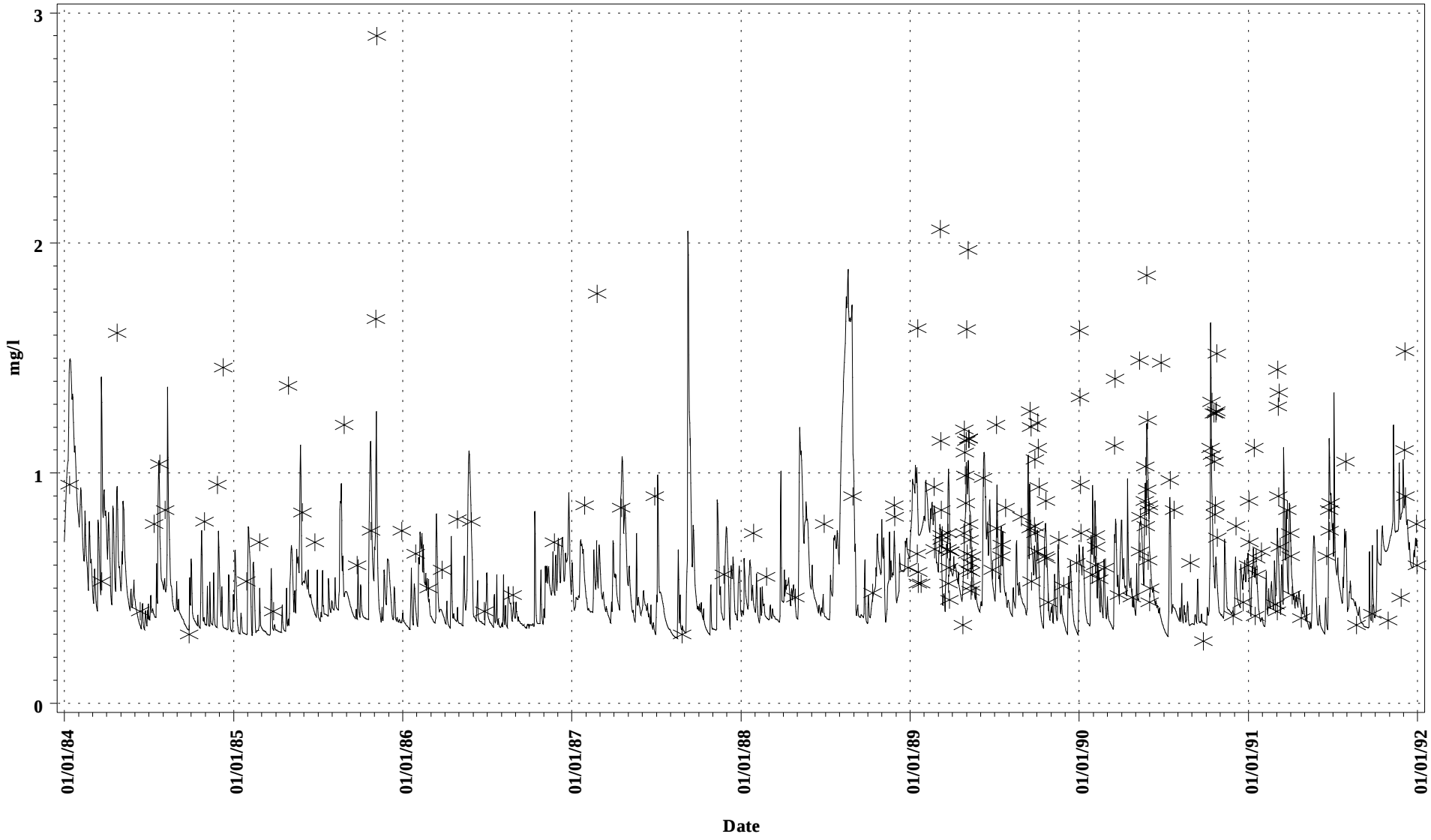
# James River at Segment 280
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

### Frequency Distribution - All Simulated and Observed Data



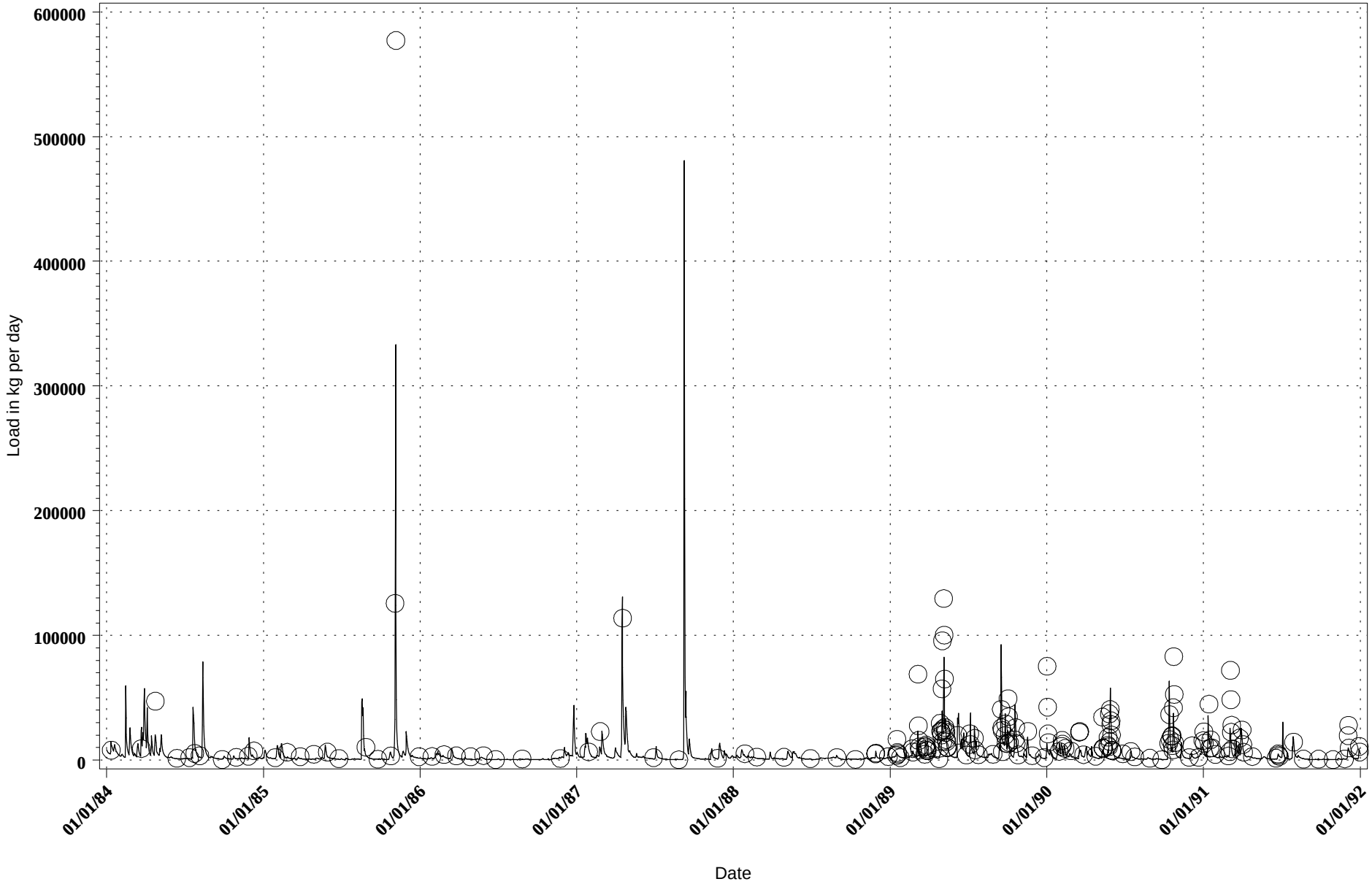

(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Observed and Simulated versus Time
# Total Nitrogen
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

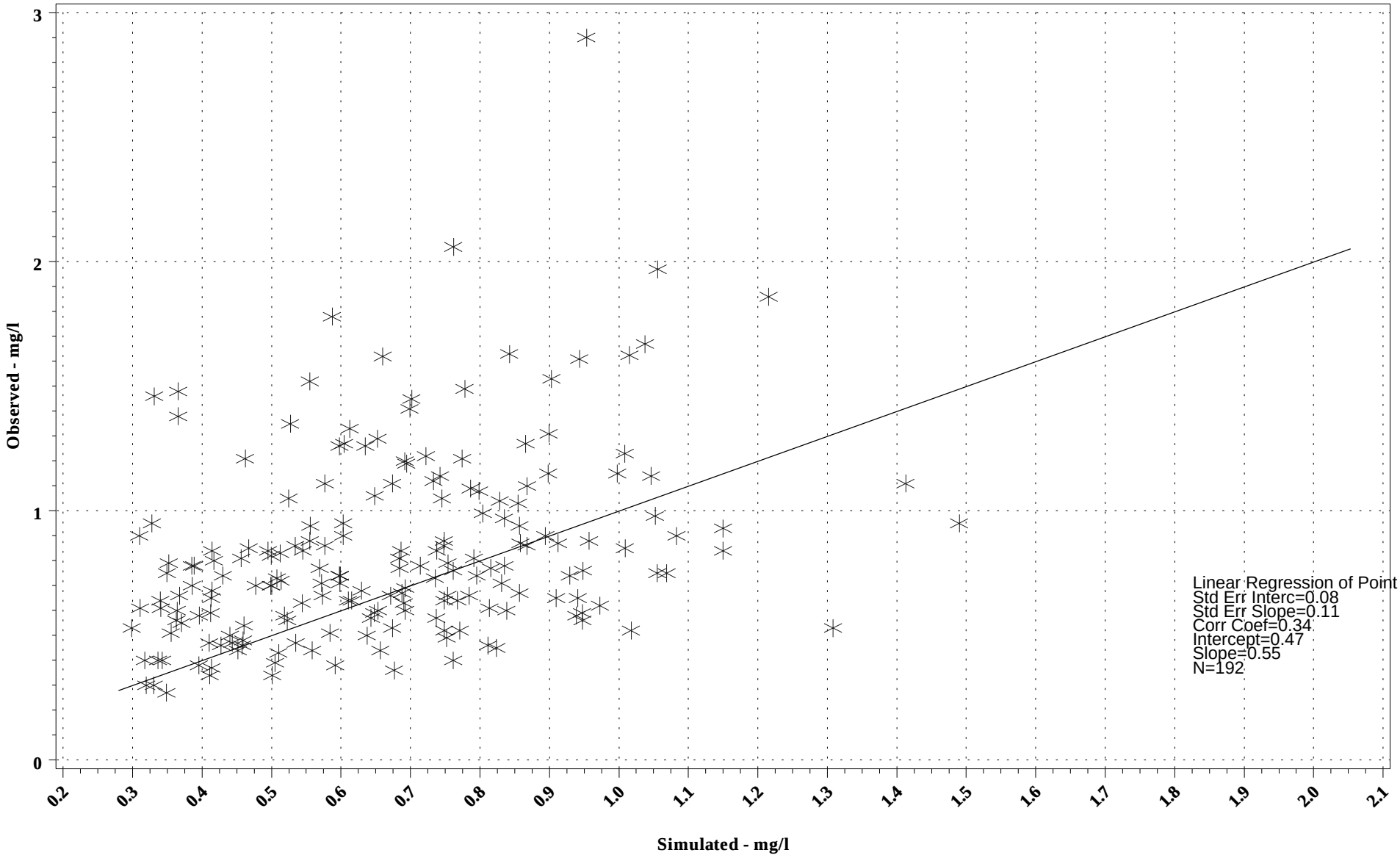



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280

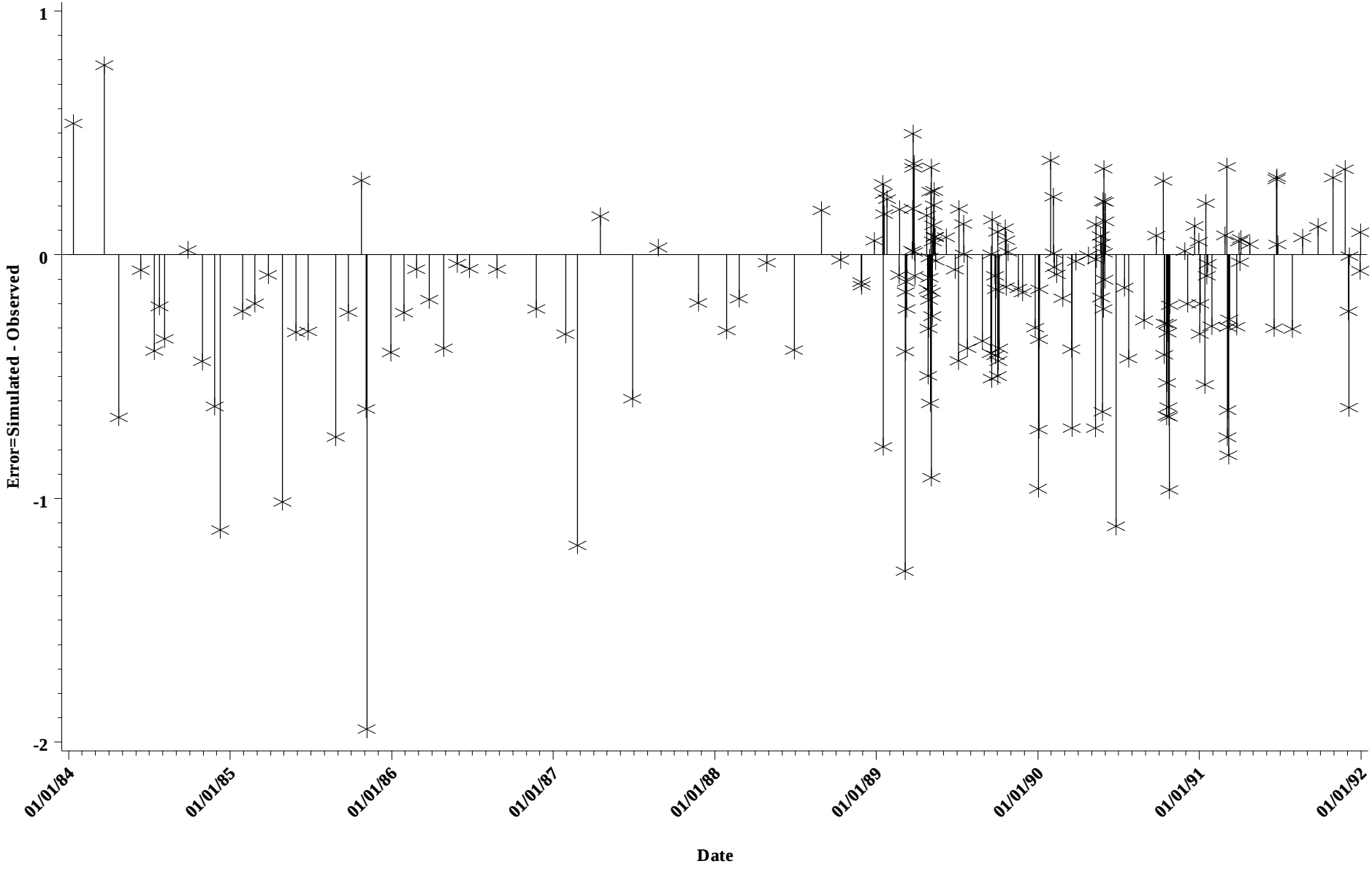
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92



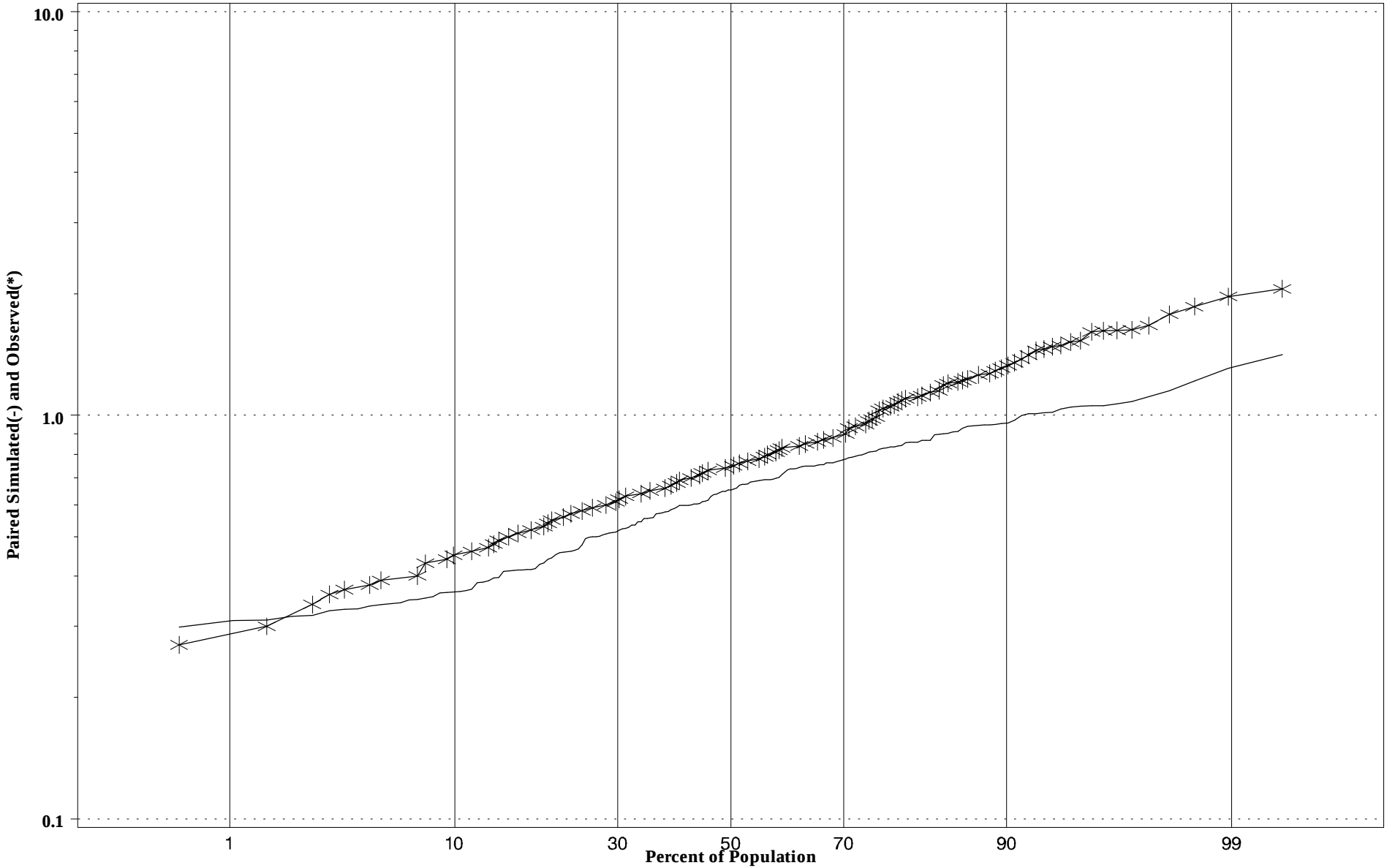

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280
## Actual Error versus Time
## Total Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(j2.drv 29JUN98 10:22)

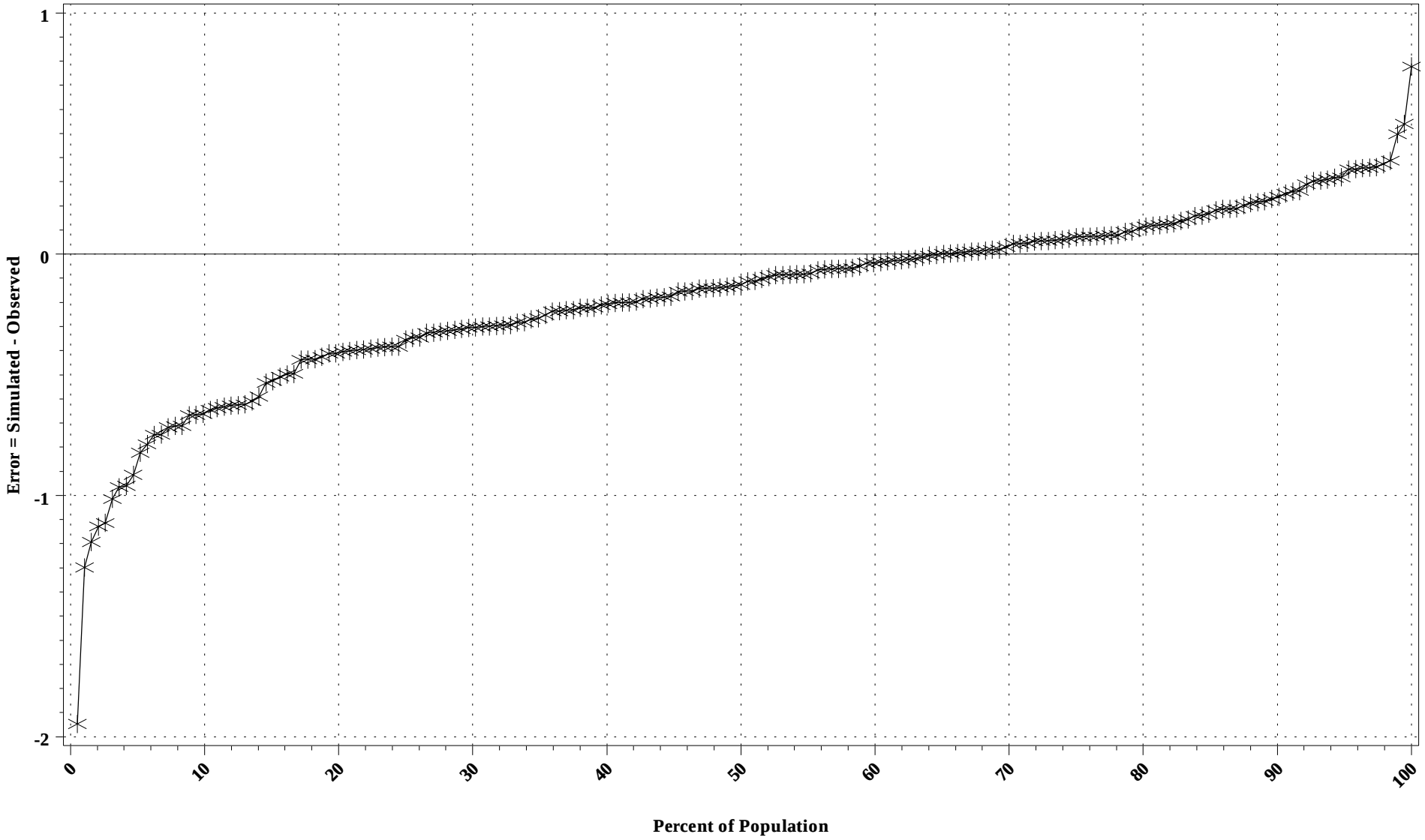
# James River at Segment 280
## Total Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Actual error versus Percentile Sample Population
## Total Nitrogen

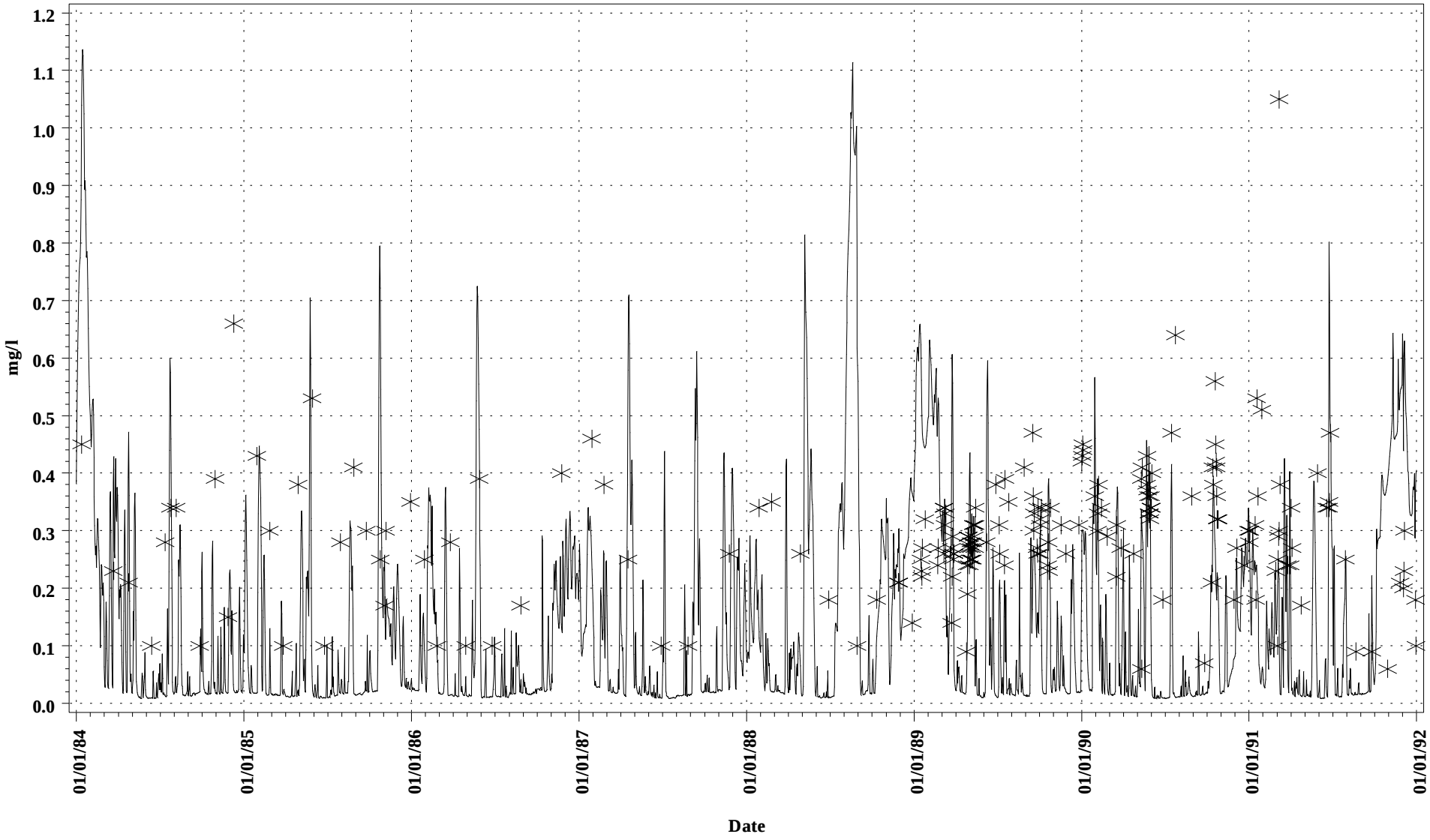
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(j2.drv 29JUN98 10:22)

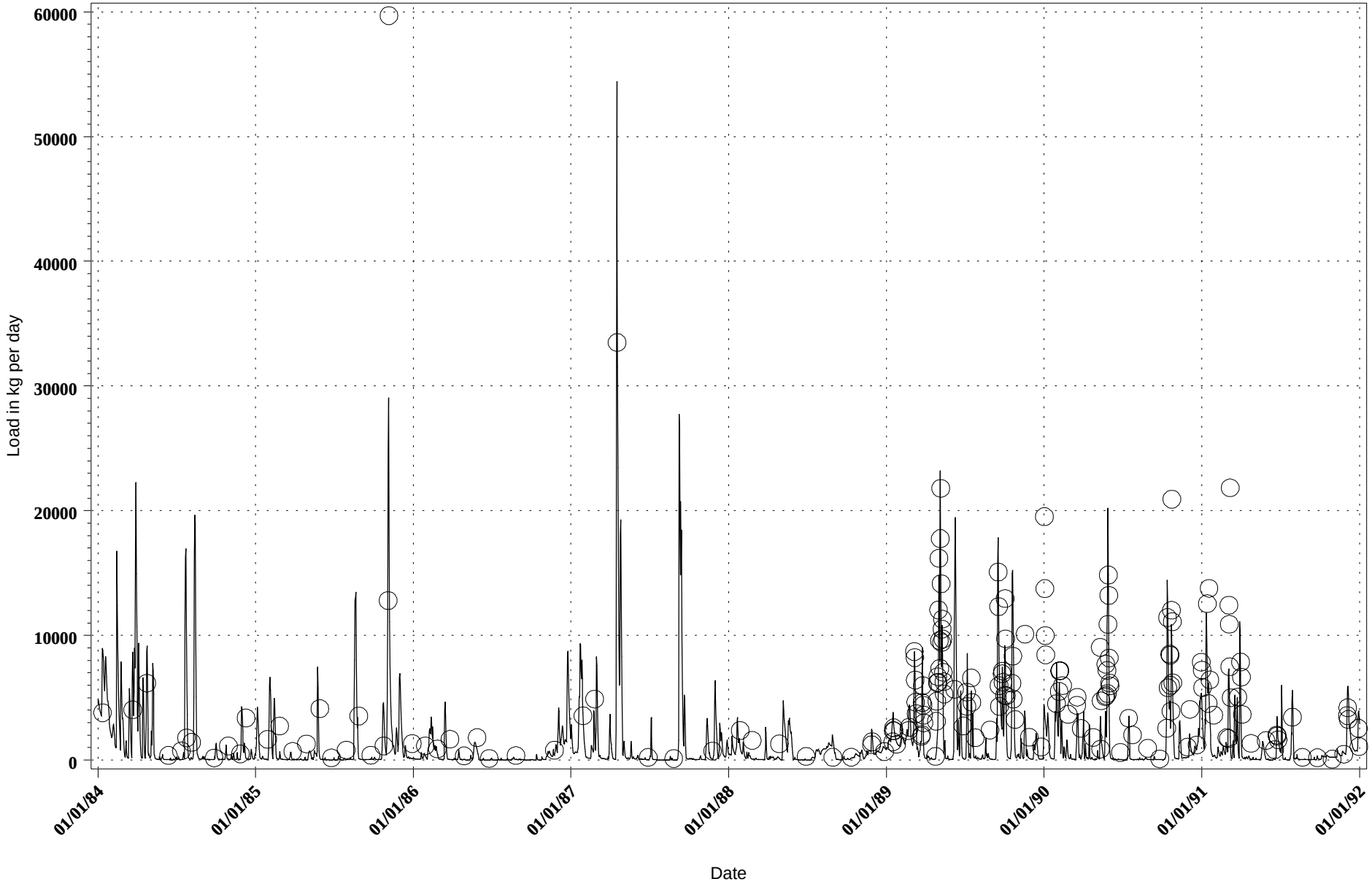
# James River at Segment 280
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## NO3 Observed and Simulated Load vs Time
### (line = simulated, O = observed)

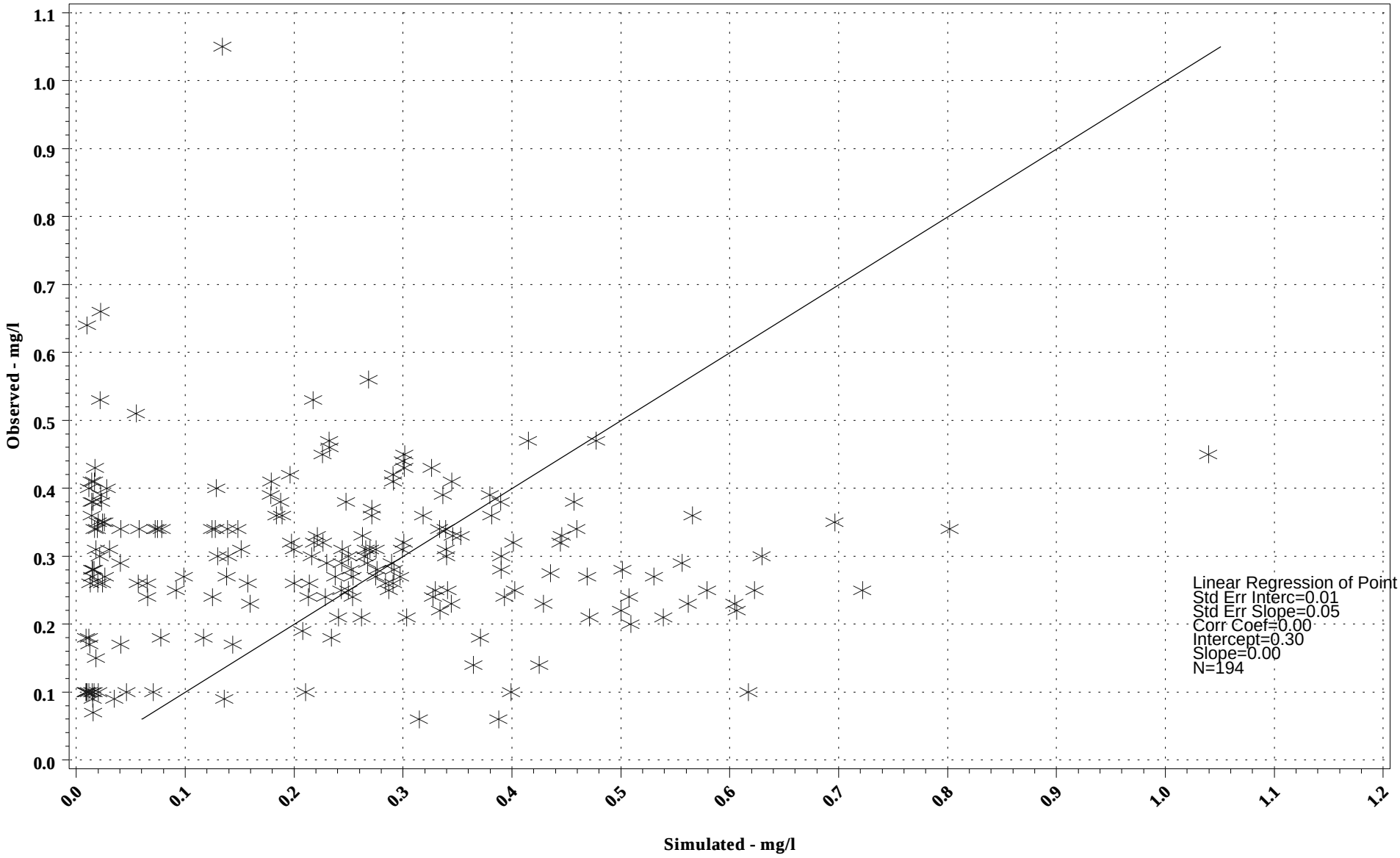



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280

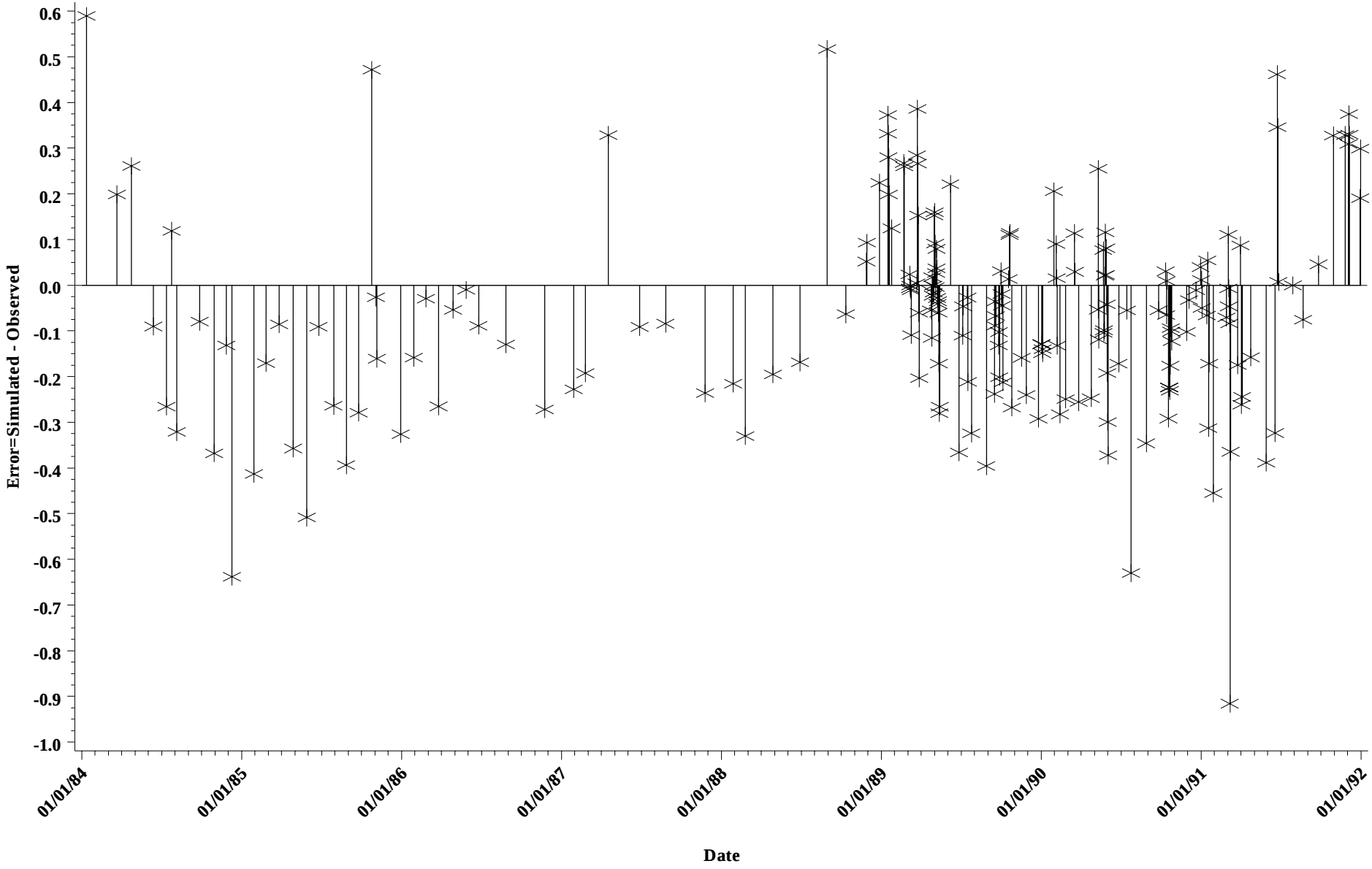
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280
## Actual Error versus Time
## NO3

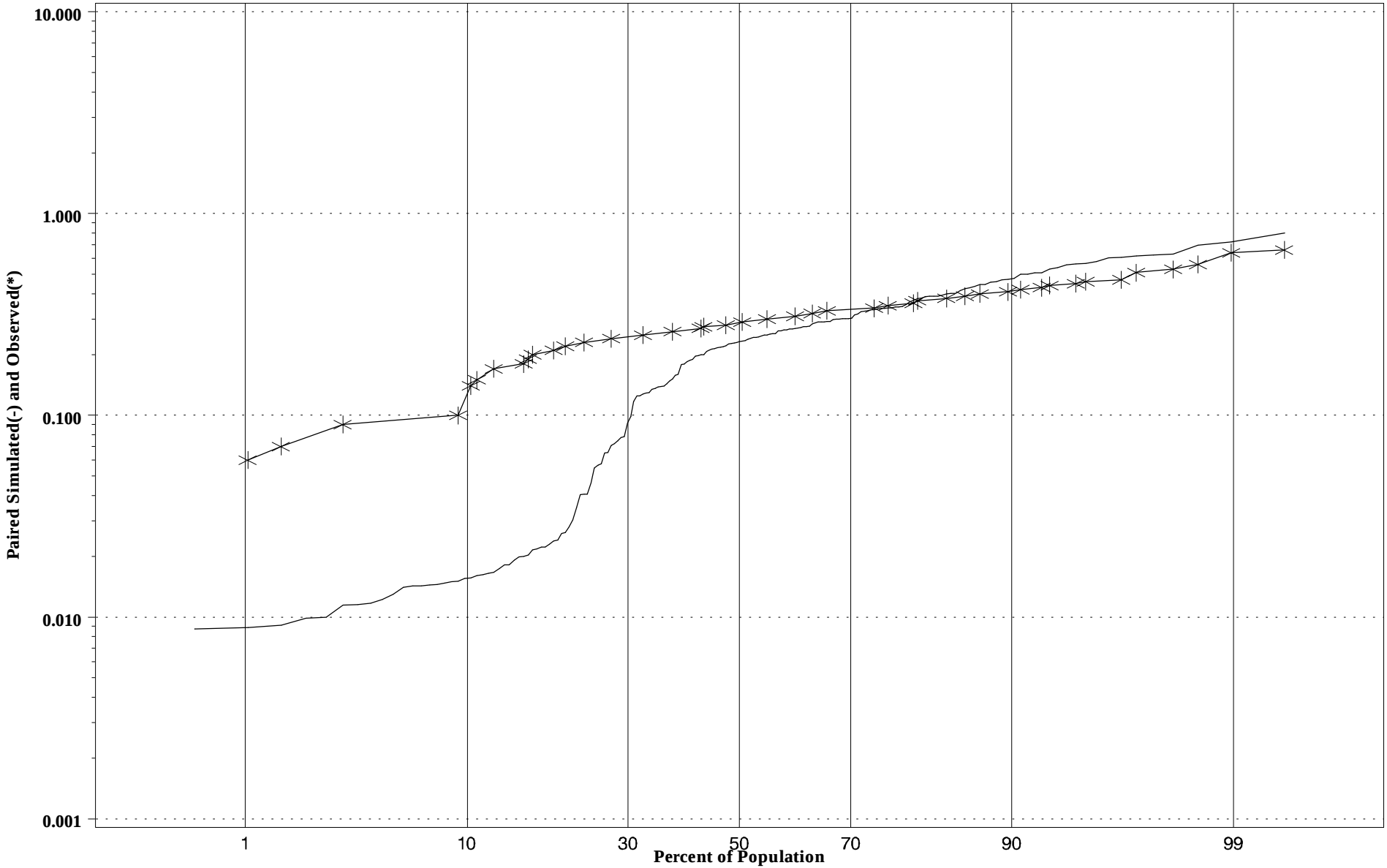



(y21_plotb.sas model3d:[pwang.dt] omerr)
(j2.drv 29JUN98 10:22)

# James River at Segment 280

## NO3

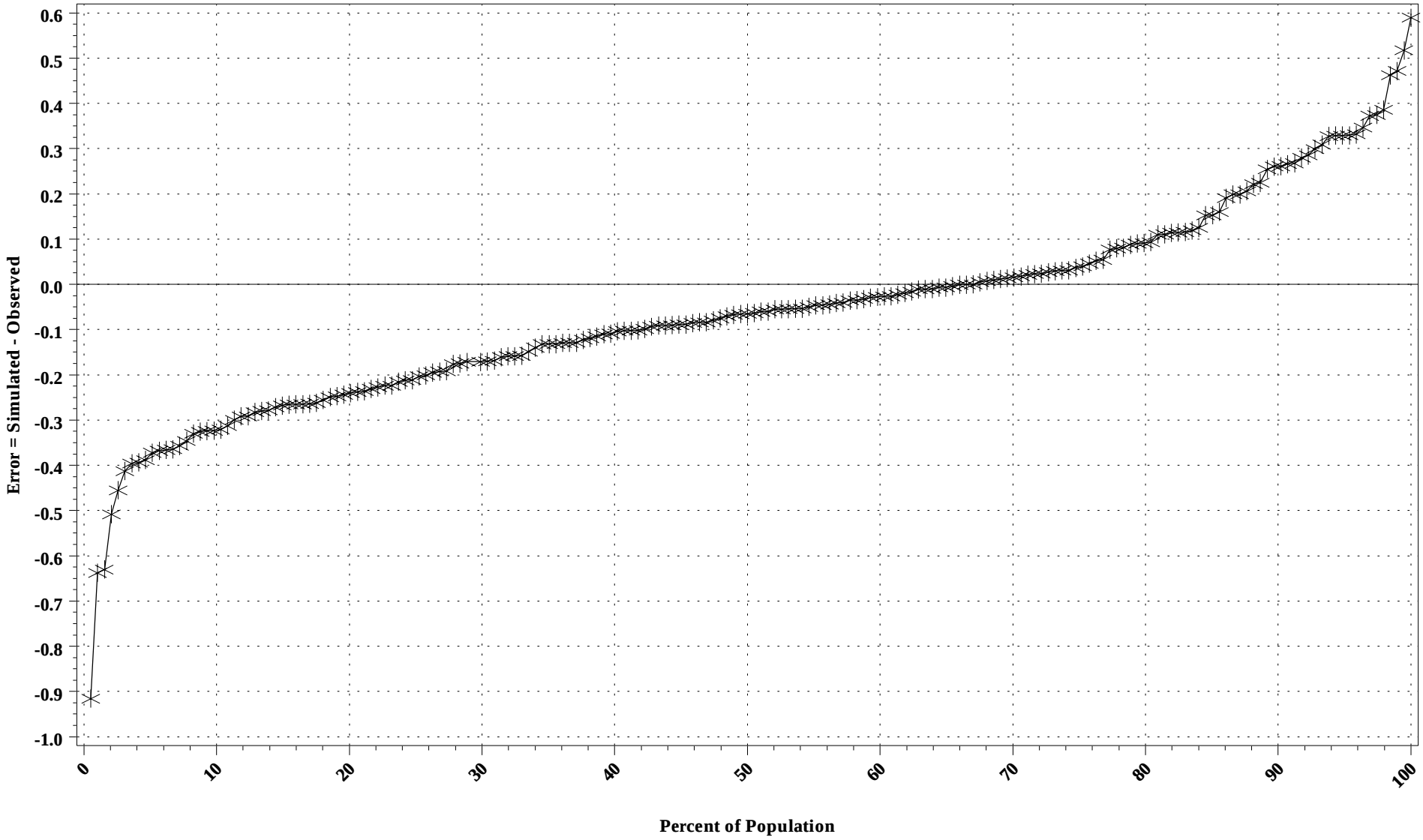
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Actual error versus Percentile Sample Population
## NO3

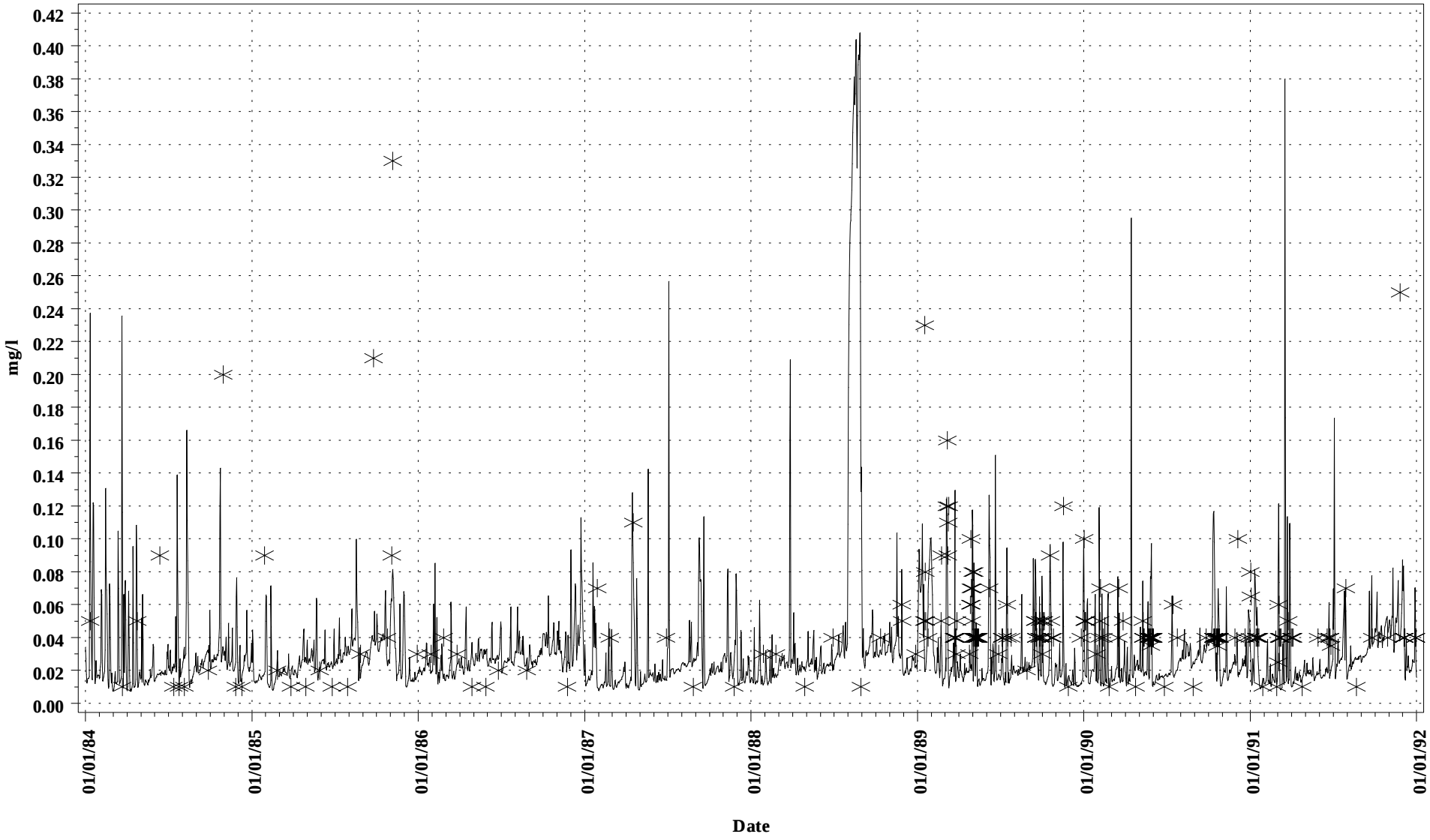
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(j2.drv 29JUN98 10:22)

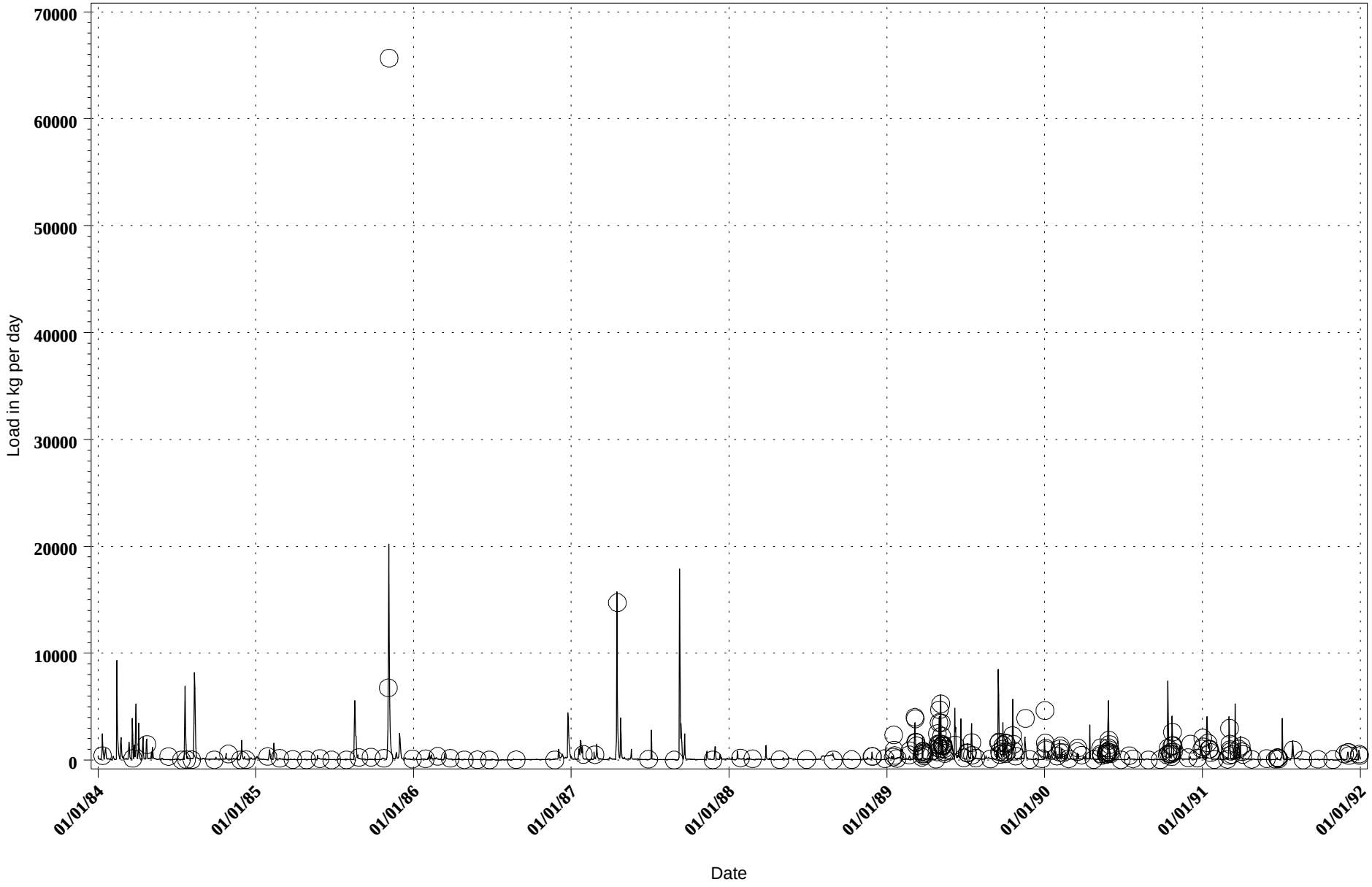
# James River at Segment 280
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Total Ammonia Observed and Simulated Load vs Time
### (line = simulated, O = observed)

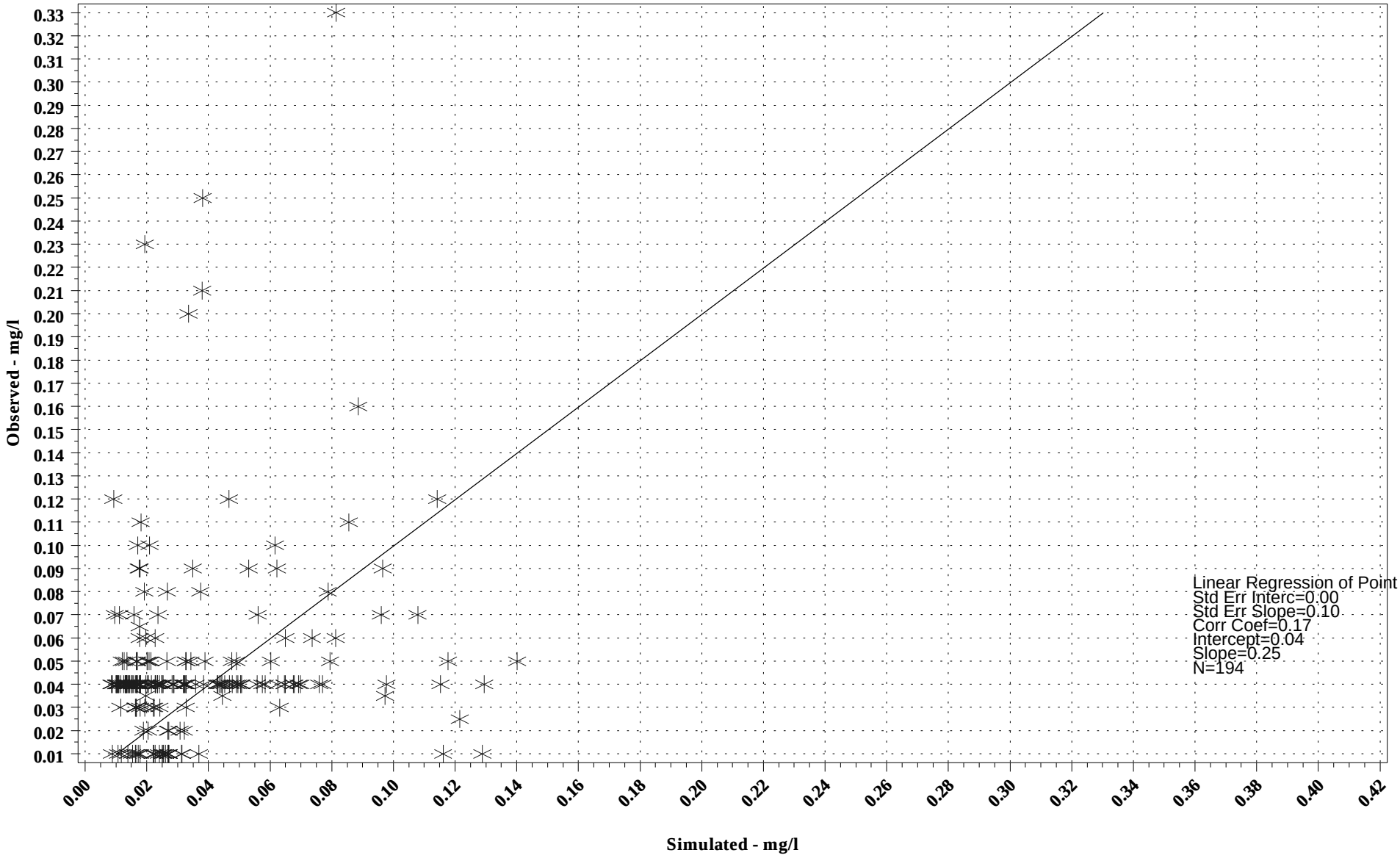



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280

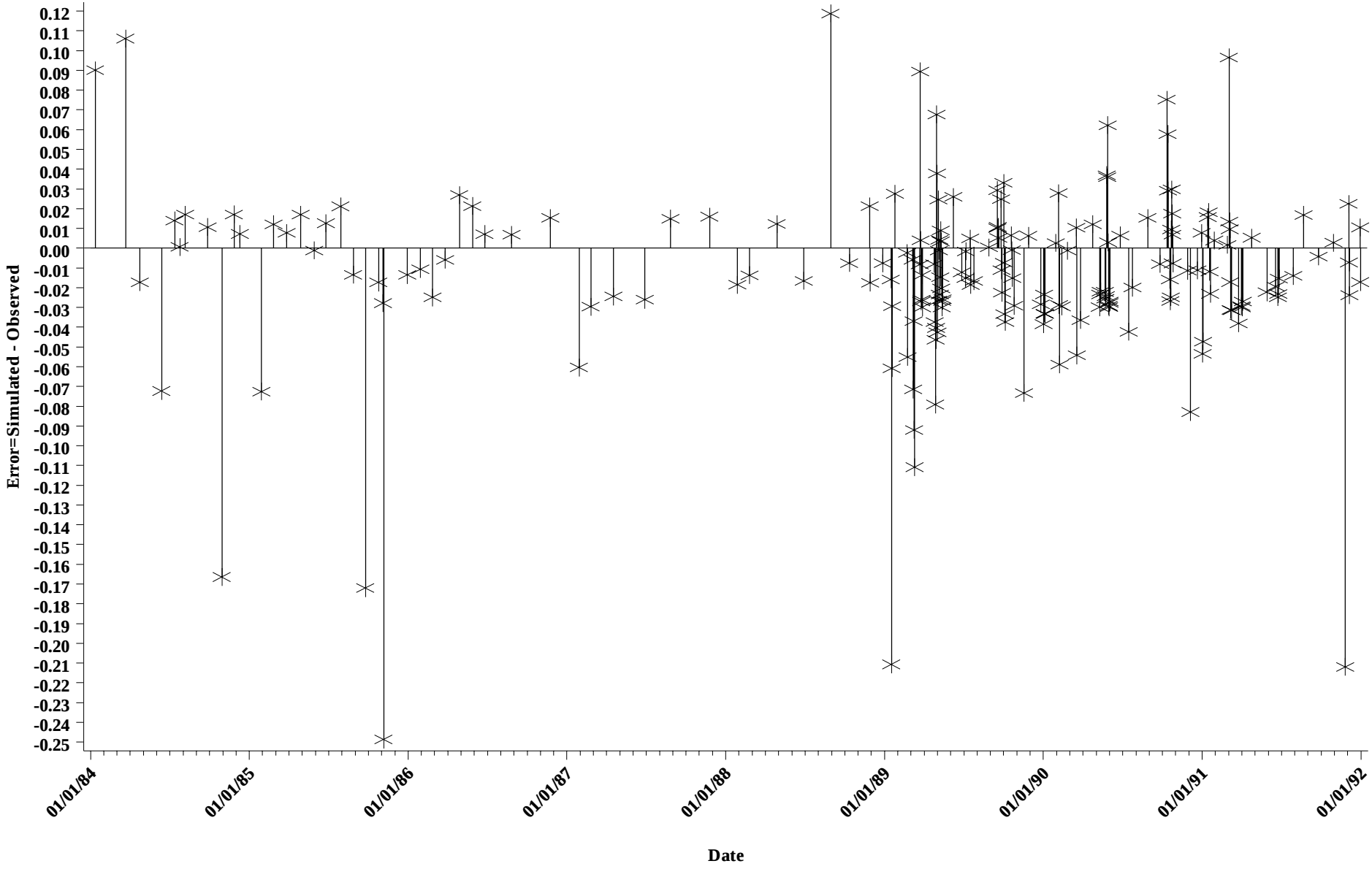
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92



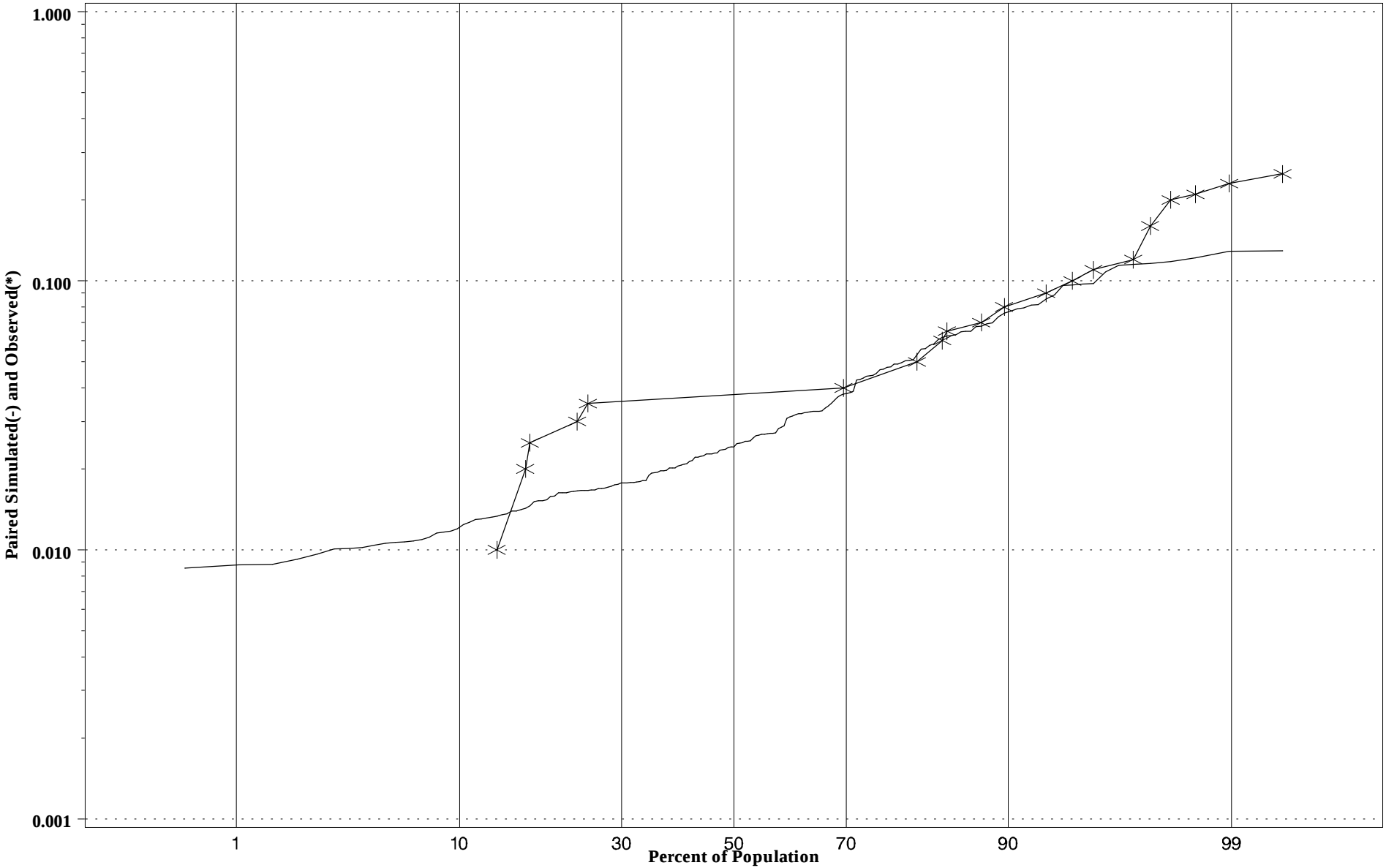

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280
## Actual Error versus Time
## Total Ammonia




(y21_plotb.sas model3d:[pwang.dt] omerr)
(j2.drv 29JUN98 10:22)

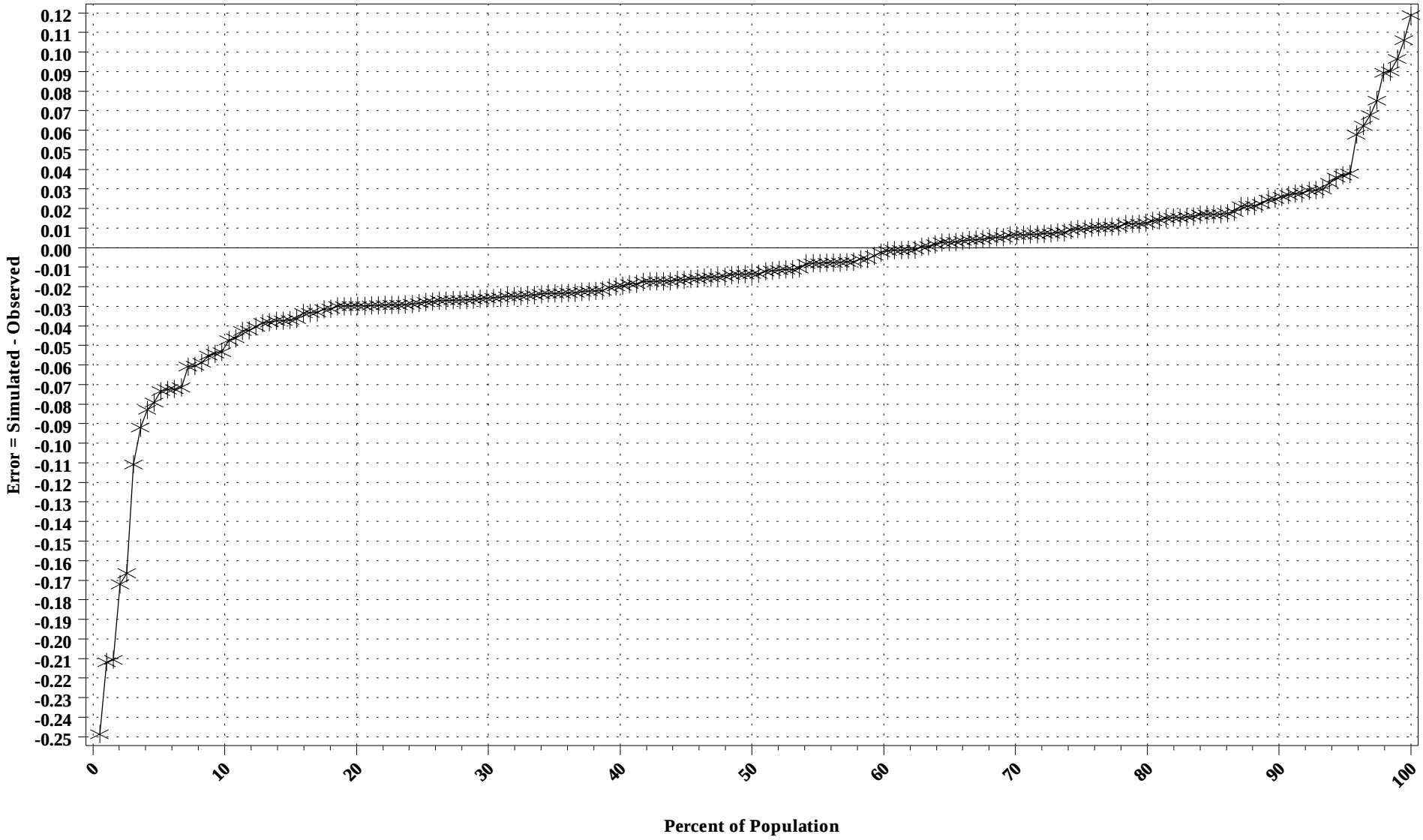
# James River at Segment 280
## Total Ammonia
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(j2.drv 29JUN98 10:22)

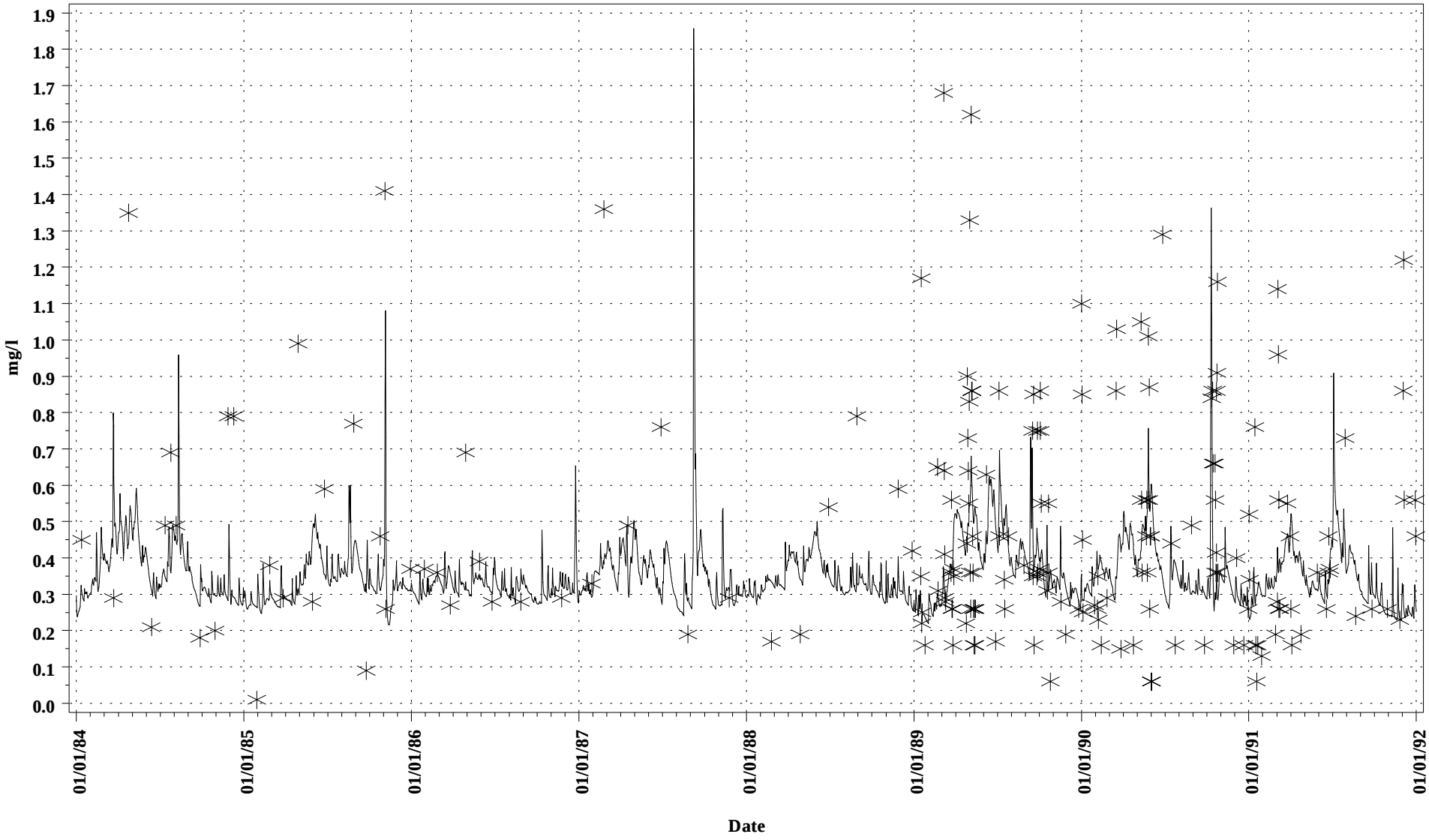
# James River at Segment 280
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data



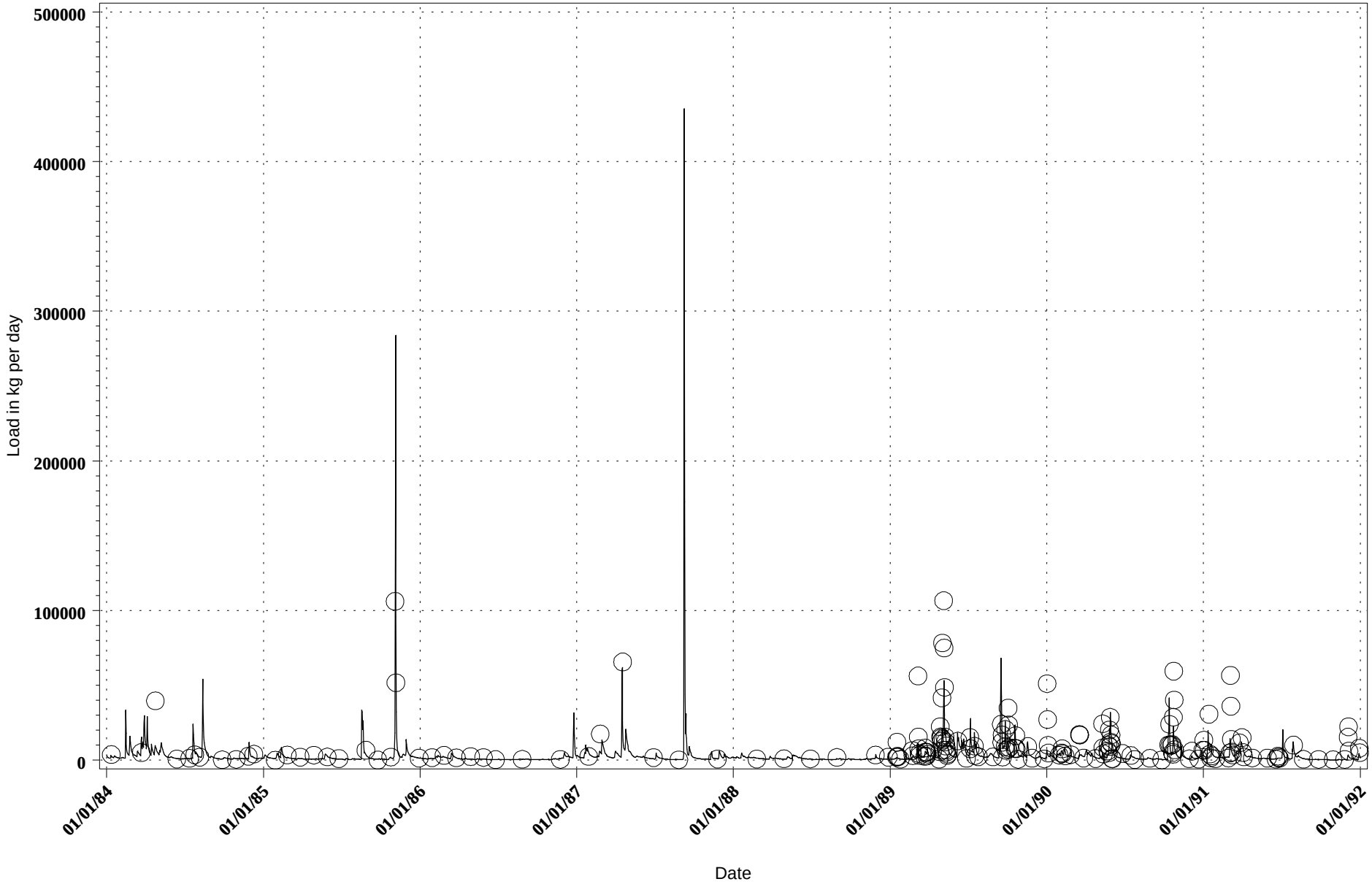

(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Organic Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

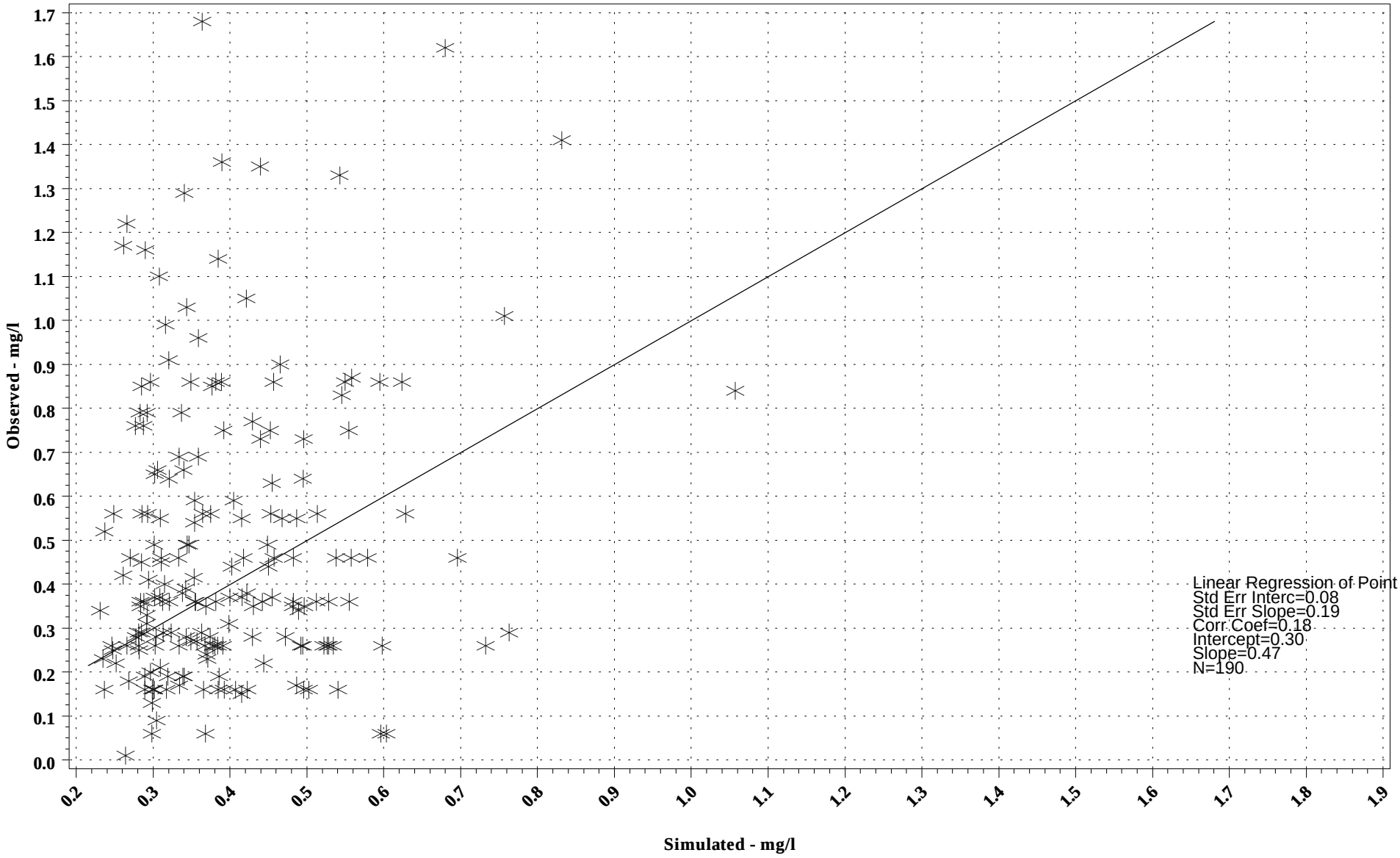



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280

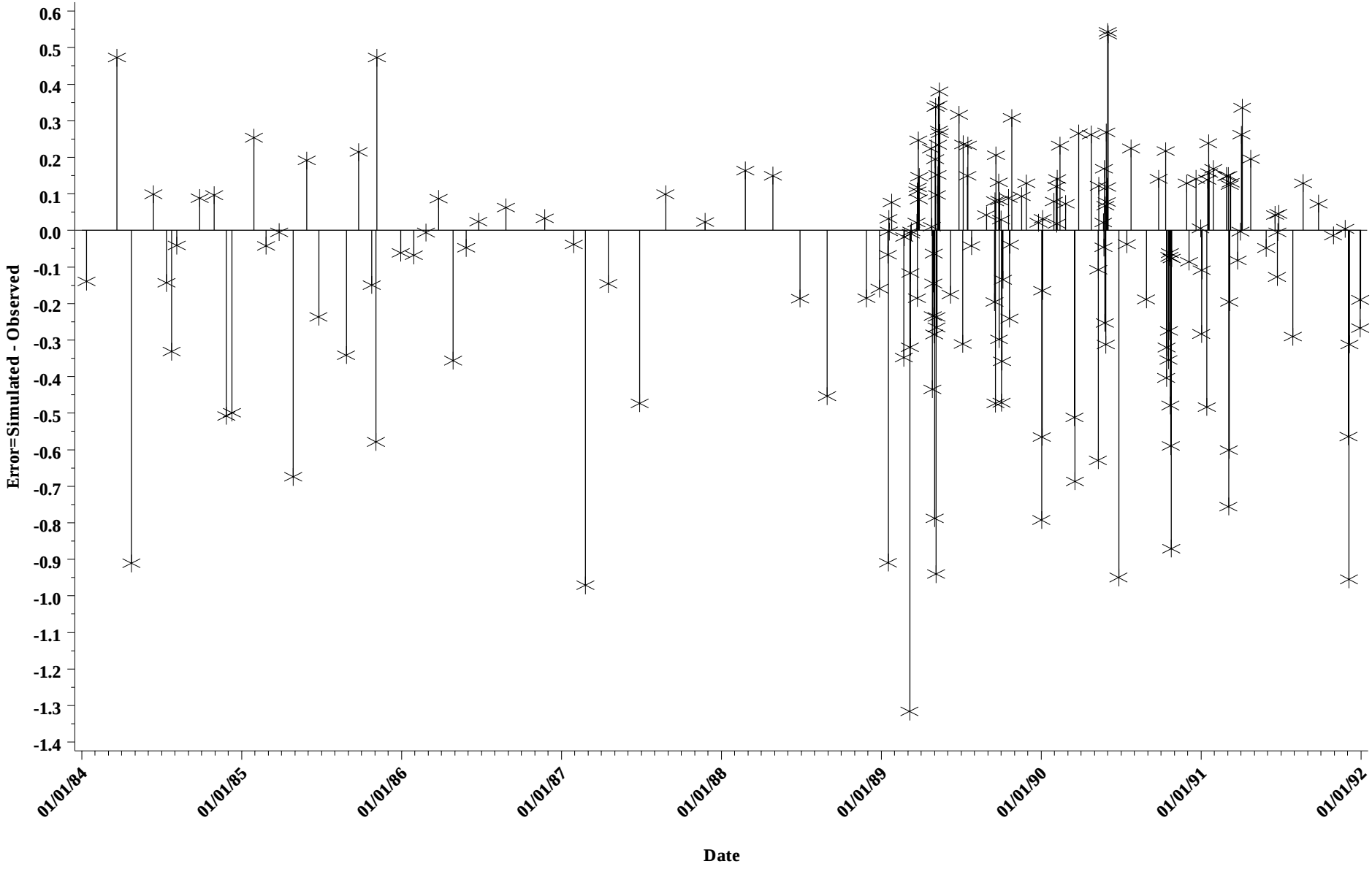
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92



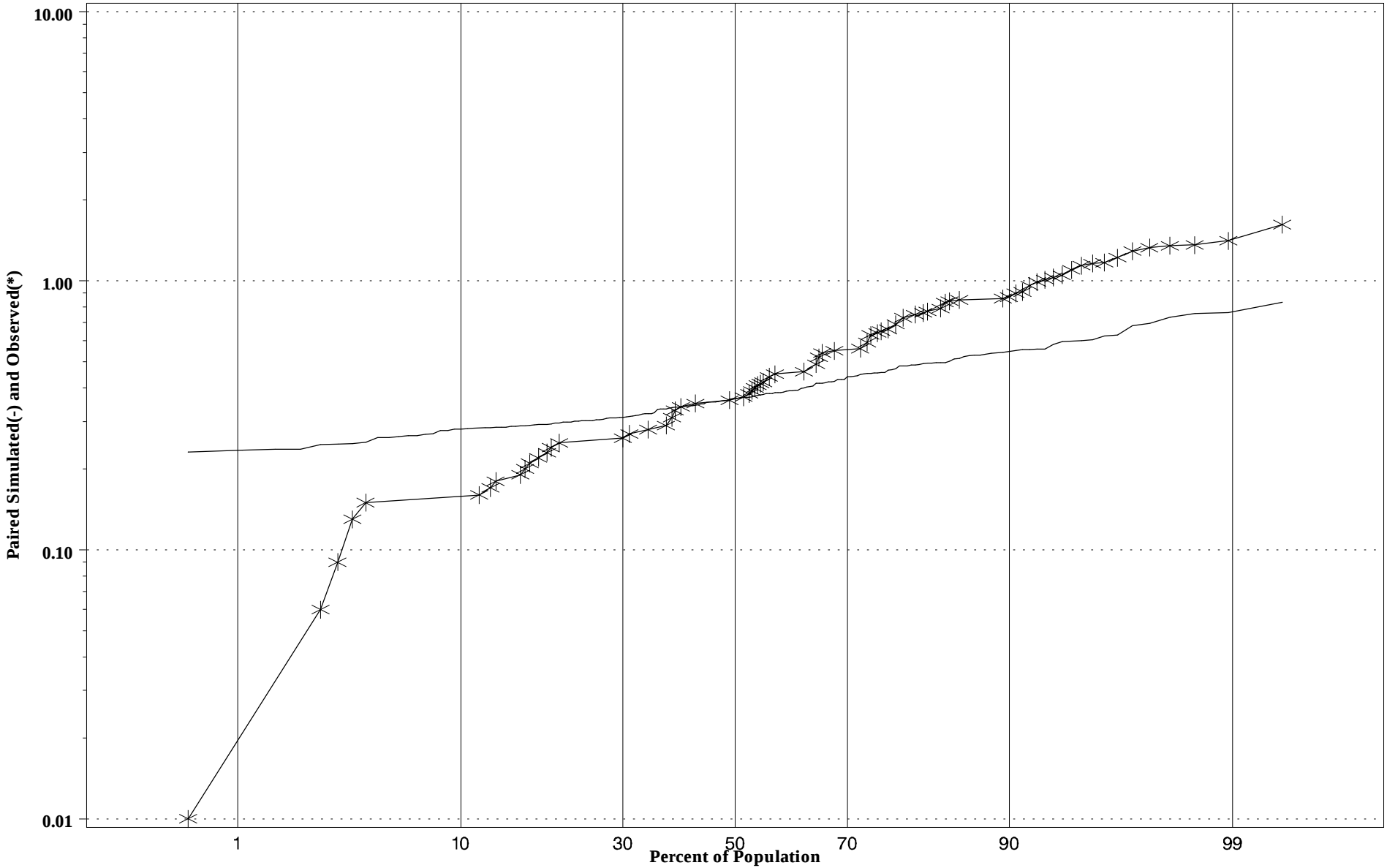

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(j2.drv 29JUN98 10:22,proc reg,model y=x)

# James River at Segment 280
## Actual Error versus Time
## Organic Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(j2.drv 29JUN98 10:22)

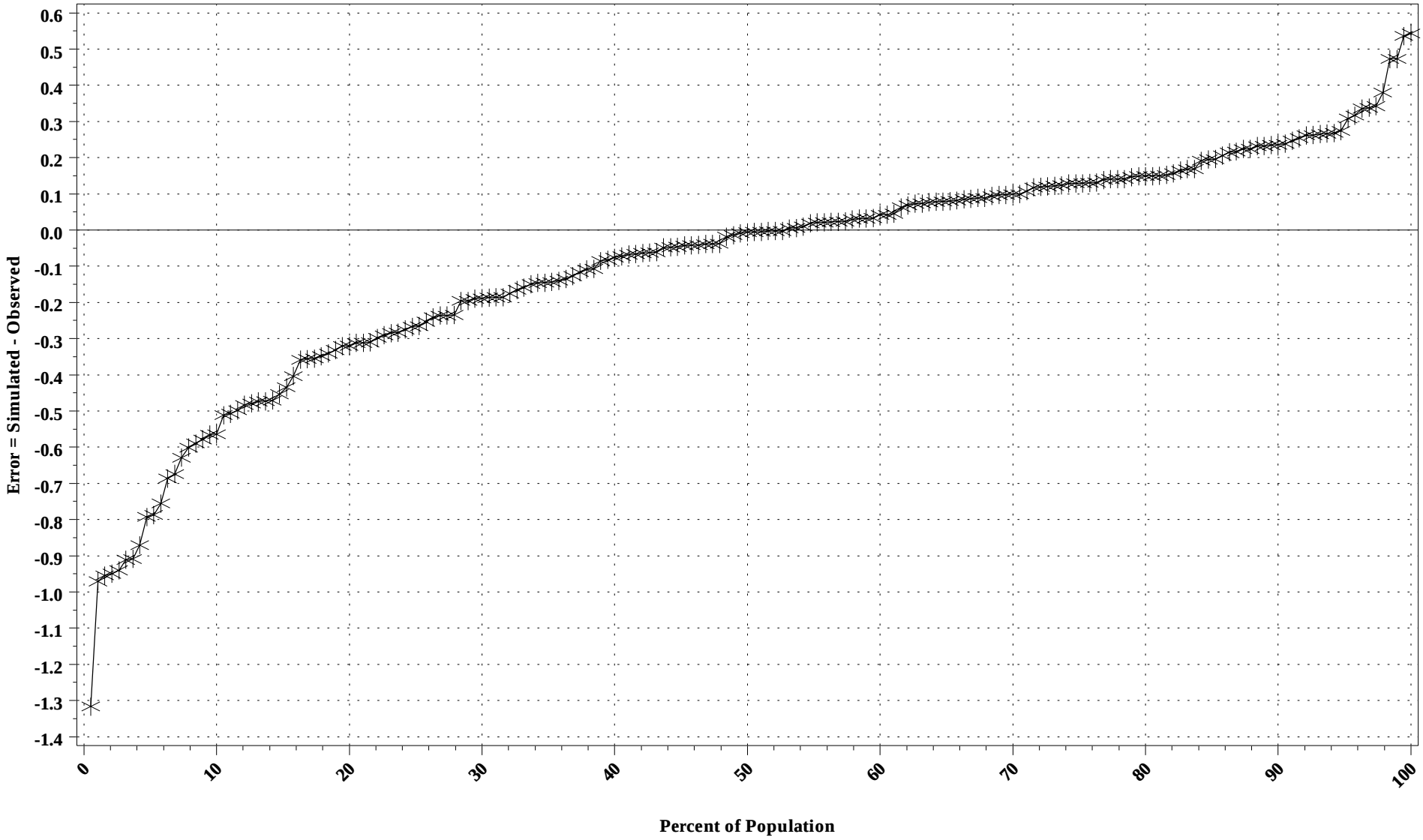
# James River at Segment 280
## Organic Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(j2.drv 29JUN98 10:22)

# James River at Segment 280
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(j2.drv 29JUN98 10:22)

### *B.6.2 Appomattox River at Matoaca, VA at Segment 310 (Monitoring Station: 2041650) (Above Fall Line Basin Segments: 300 and 310)*

**Section Summary:**

The Appomattox basin water quality gage is below a series of reservoirs, which influence water quality at the gage. As with other Virginia tributaries, water quality observations increased and were oriented toward storm weighted sampling after 1989. Model calibration focused primarily on the refined, storm weighted sampling after 1989.

The Appomattox basin above the gaged site covers an area of 1,352 square miles. At the midpoint of the simulation, 1990, the land use for the basin was composed of 70% forest land, 8% cropland, 16% other agricultural areas, 6% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage decreased from 2.3 million pounds in 1985 to 2.1 million pounds in 1996. Total phosphorus loads over the same time period decreased from 0.20 million pounds to 0.18 million pounds. In general, point source loads above the gage site decreased. In 1996, the total nitrogen point source load was 2% of the total load and the total phosphorus point source load was 4% of the total load. Estimated septic system total nitrogen loads increased 11%, from 0.10 million pounds in 1985 to 0.11 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 16%, and other agricultural loads (primarily pasture and manure loads) by 11%. Total phosphorus decreased for these land uses by 26% and 12% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 12% for total nitrogen and 14% for total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

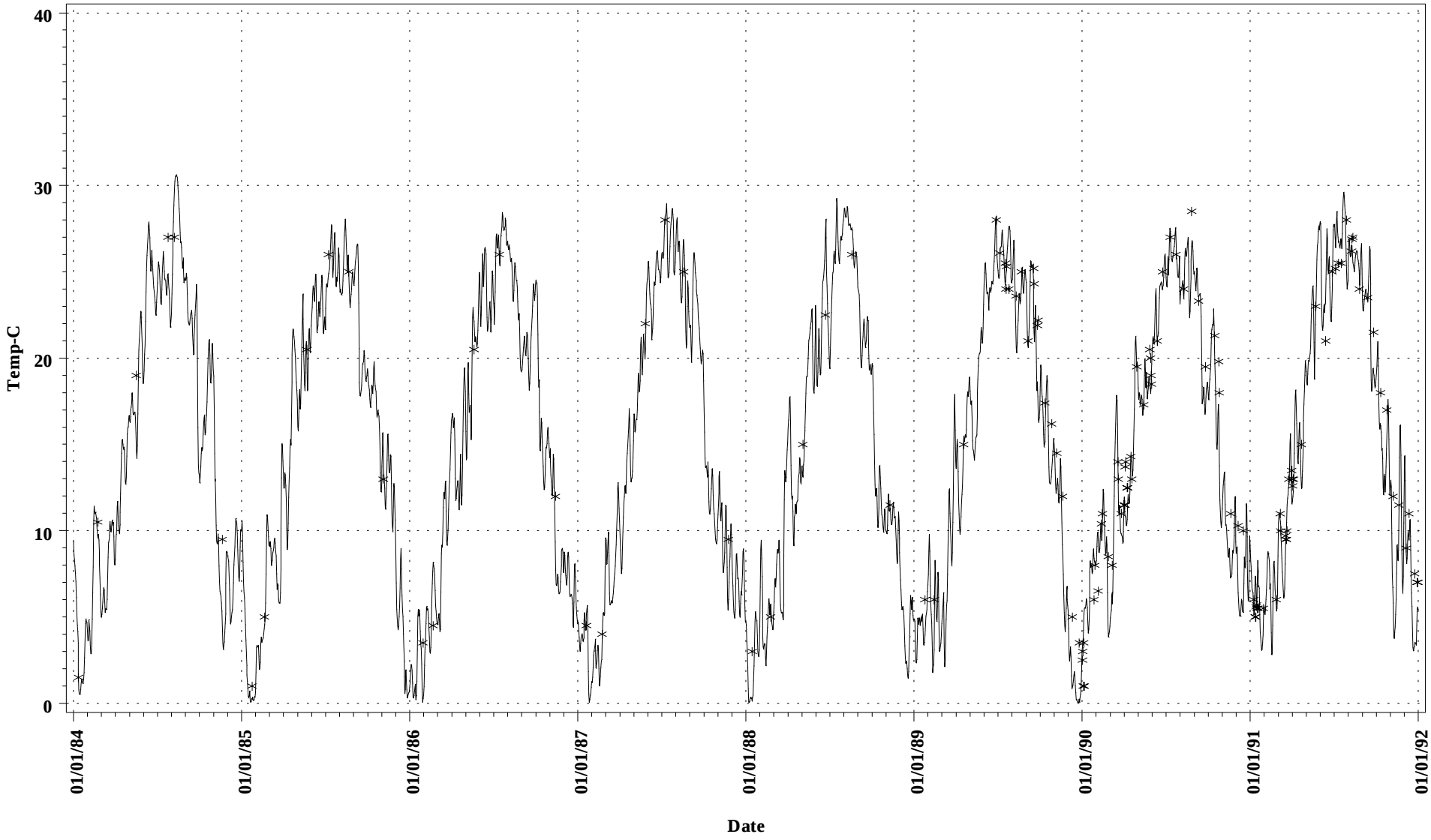
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# Appomattox River at Segment 310
## Observed and Simulated versus Time
# Temperature-C

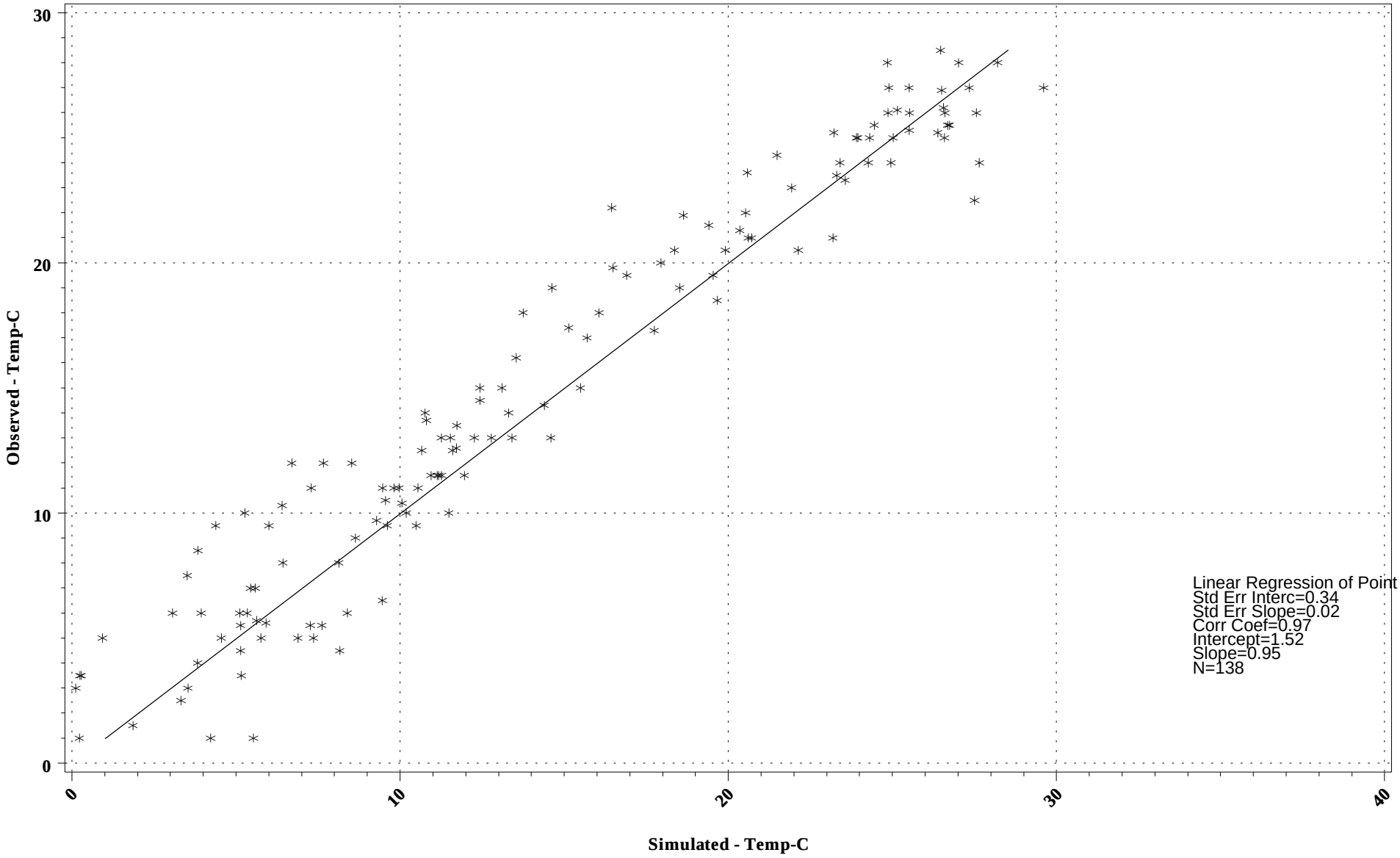
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(appom.drv 29JUN98 14:42)

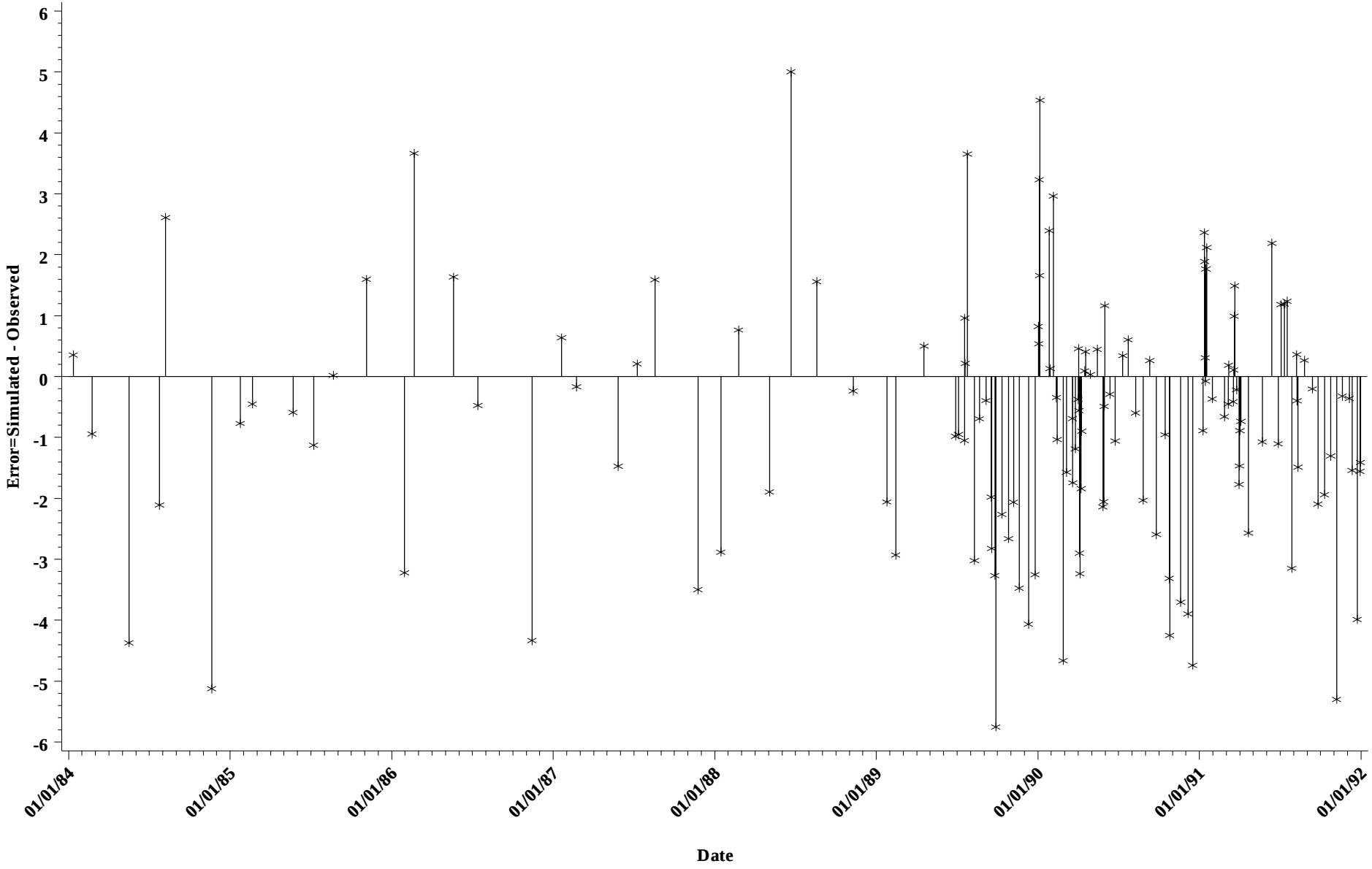
# Appomattox River at Segment 310

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Temperature-C: 01JAN84 - 01JAN92



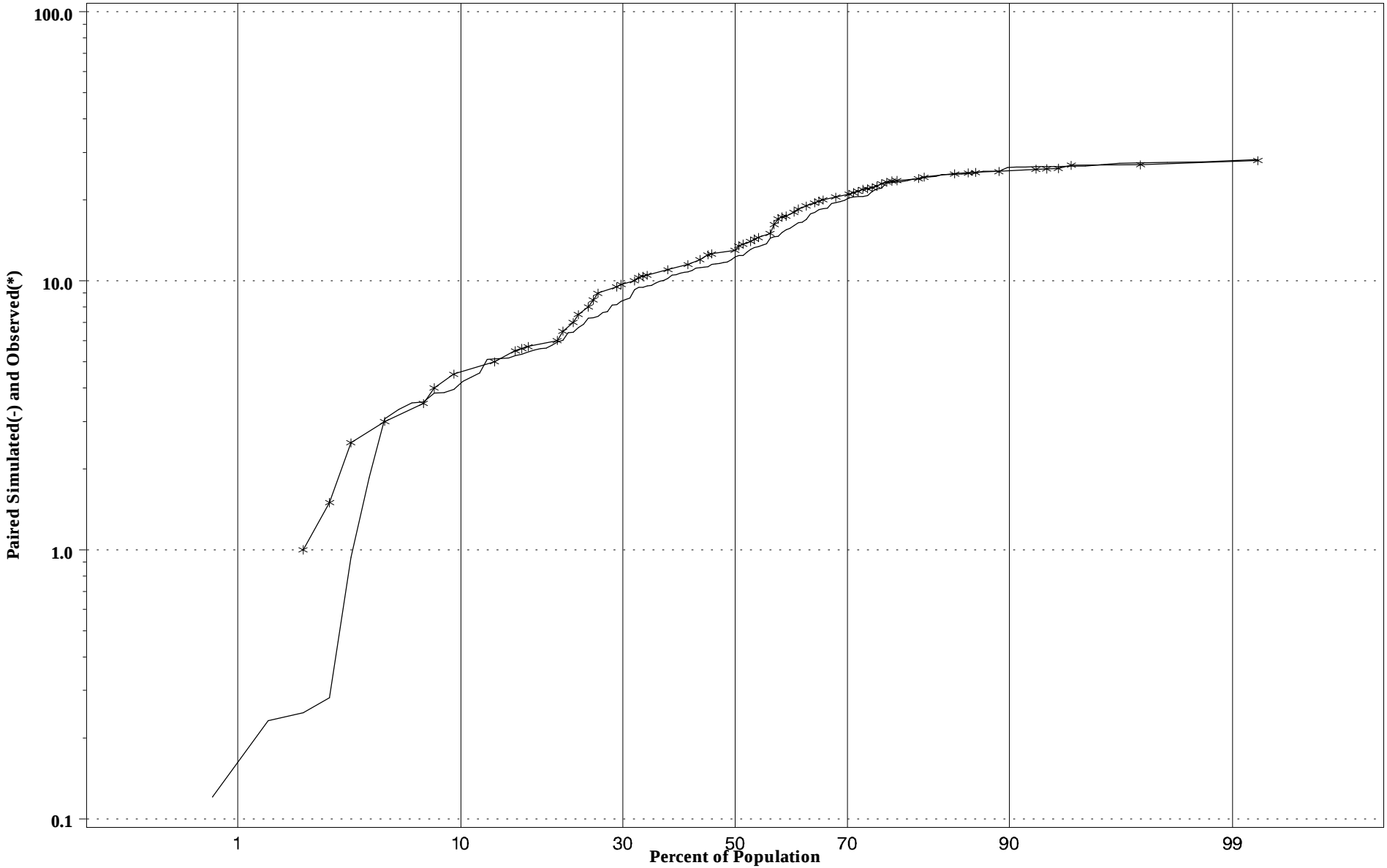

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310
## Actual Error versus Time
## Temperature-C




(y21_plotb.sas model3d:[pwang.dt] omerr)
(appom.drv 29JUN98 14:42)

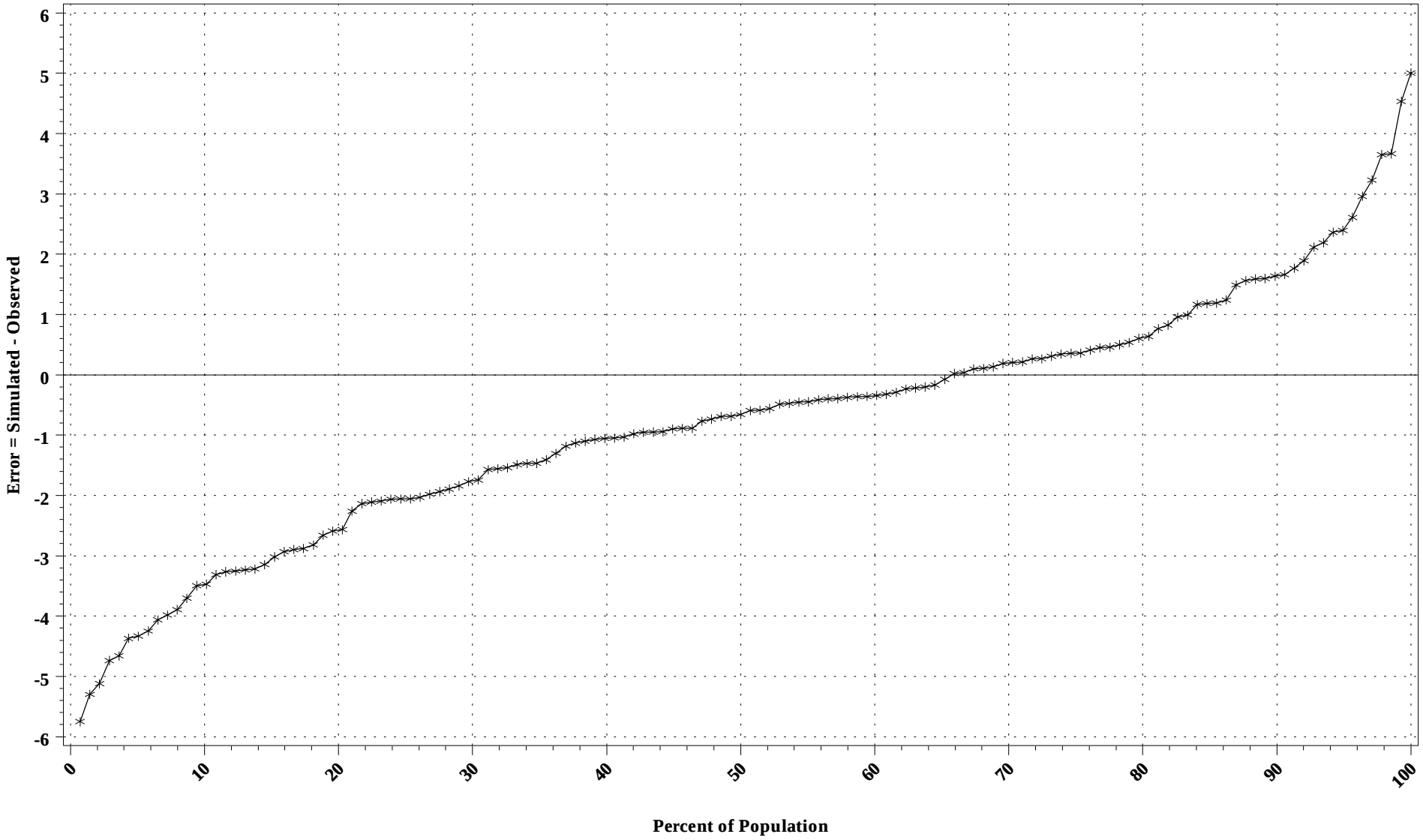
# Appomattox River at Segment 310
## Temperature-C
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Actual error versus Percentile Sample Population
## Temperature-C

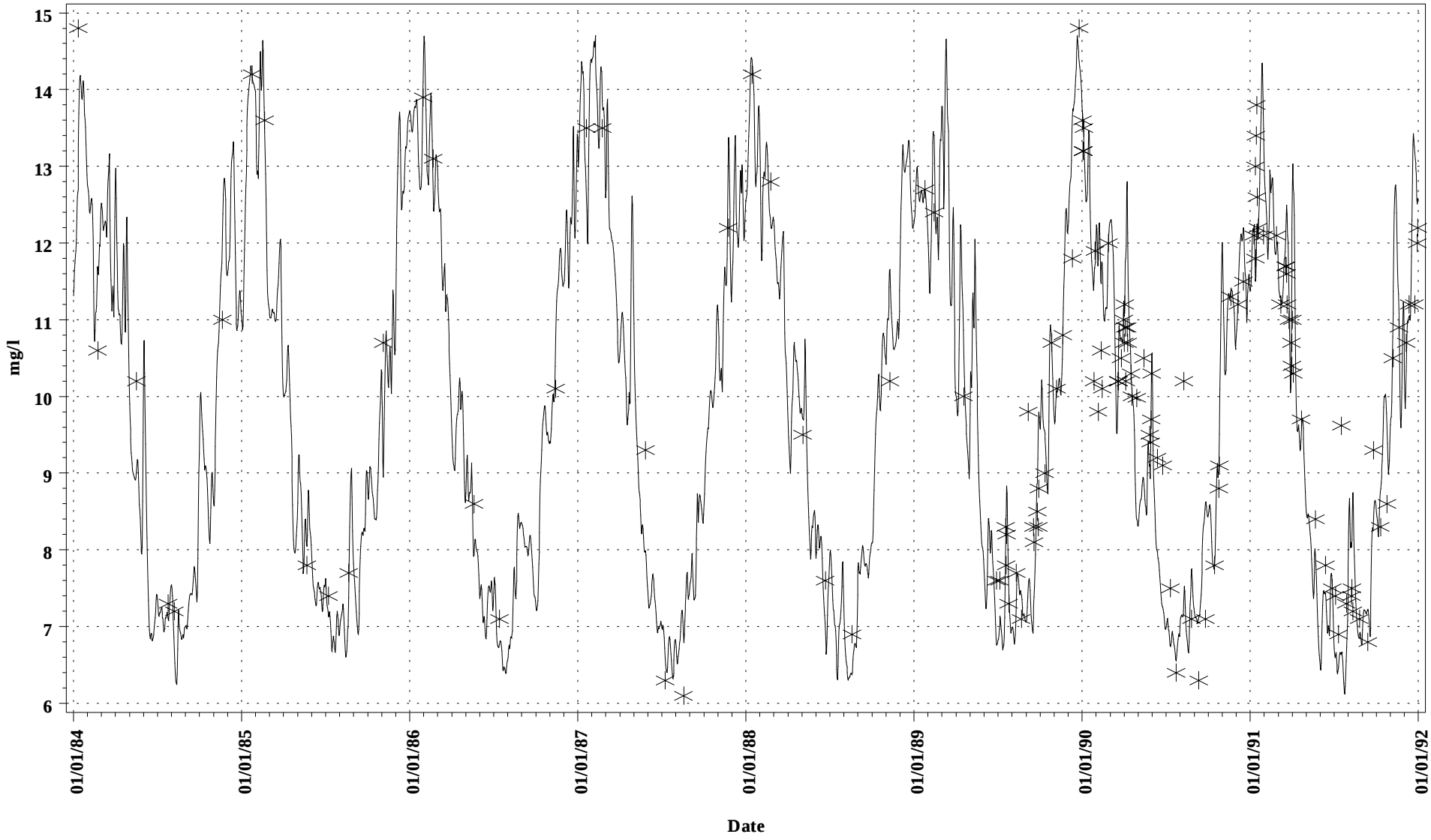
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(appom.drv 29JUN98 14:42)

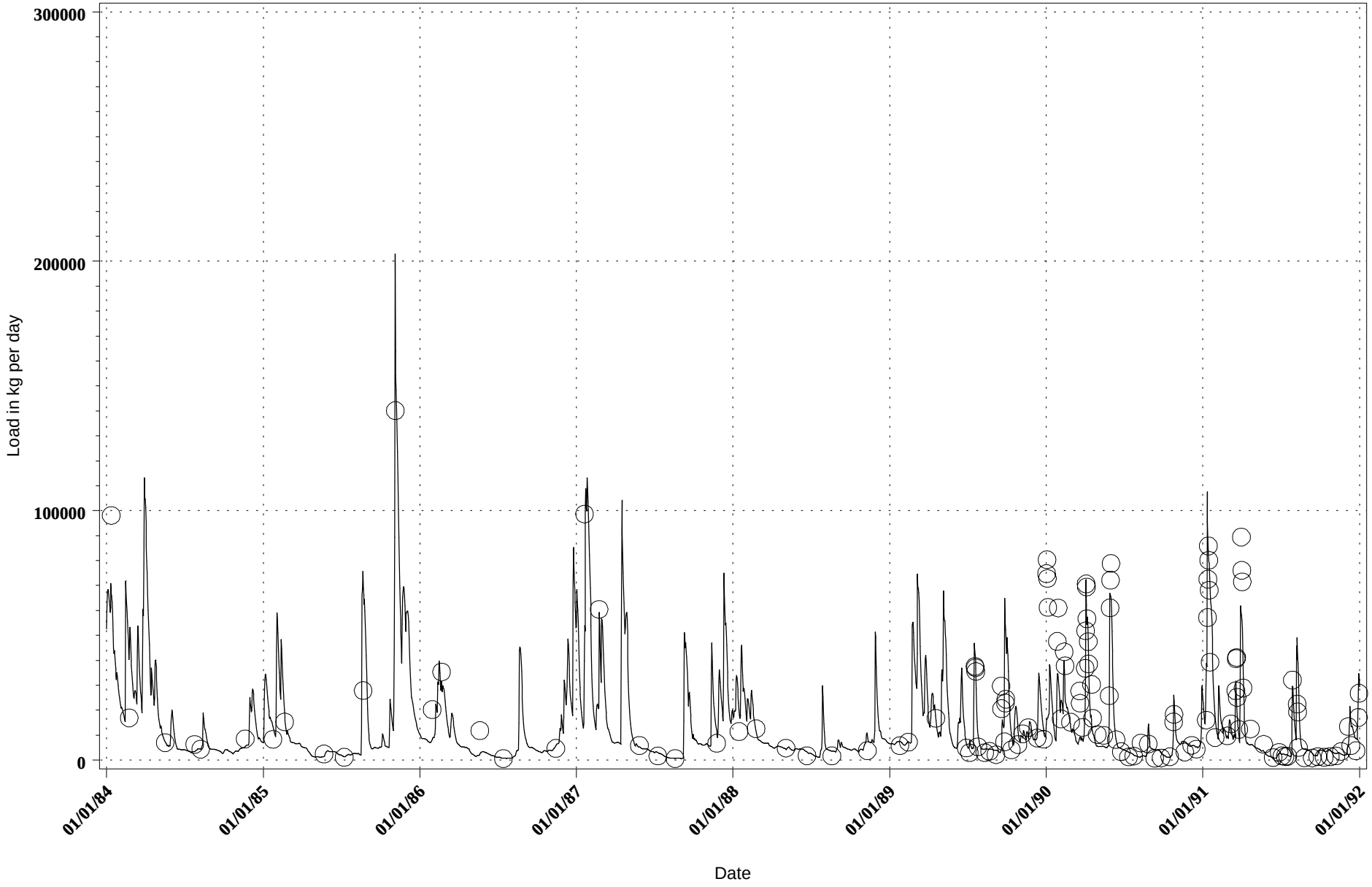
# Appomattox River at Segment 310
## Observed and Simulated versus Time
# Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

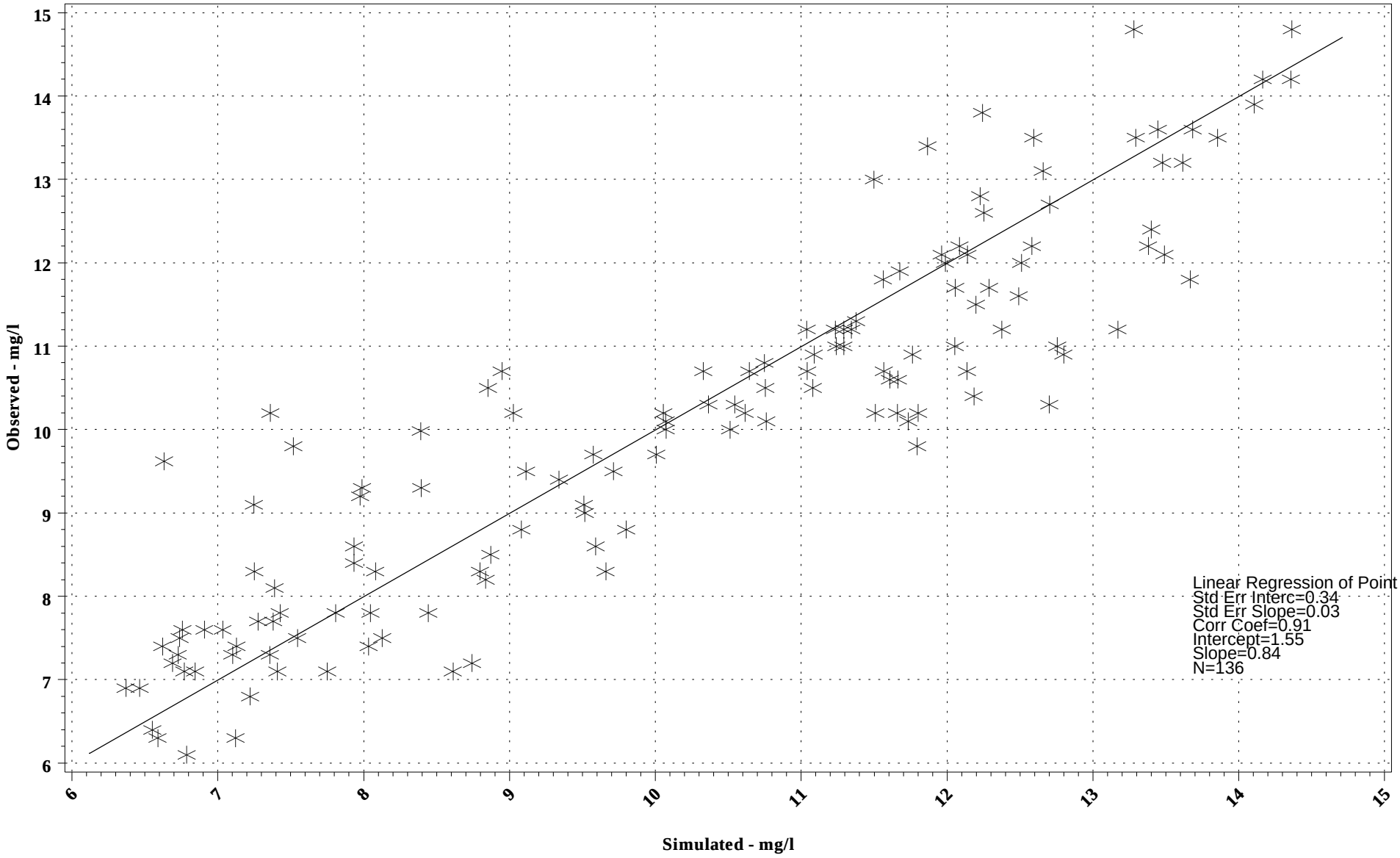



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310

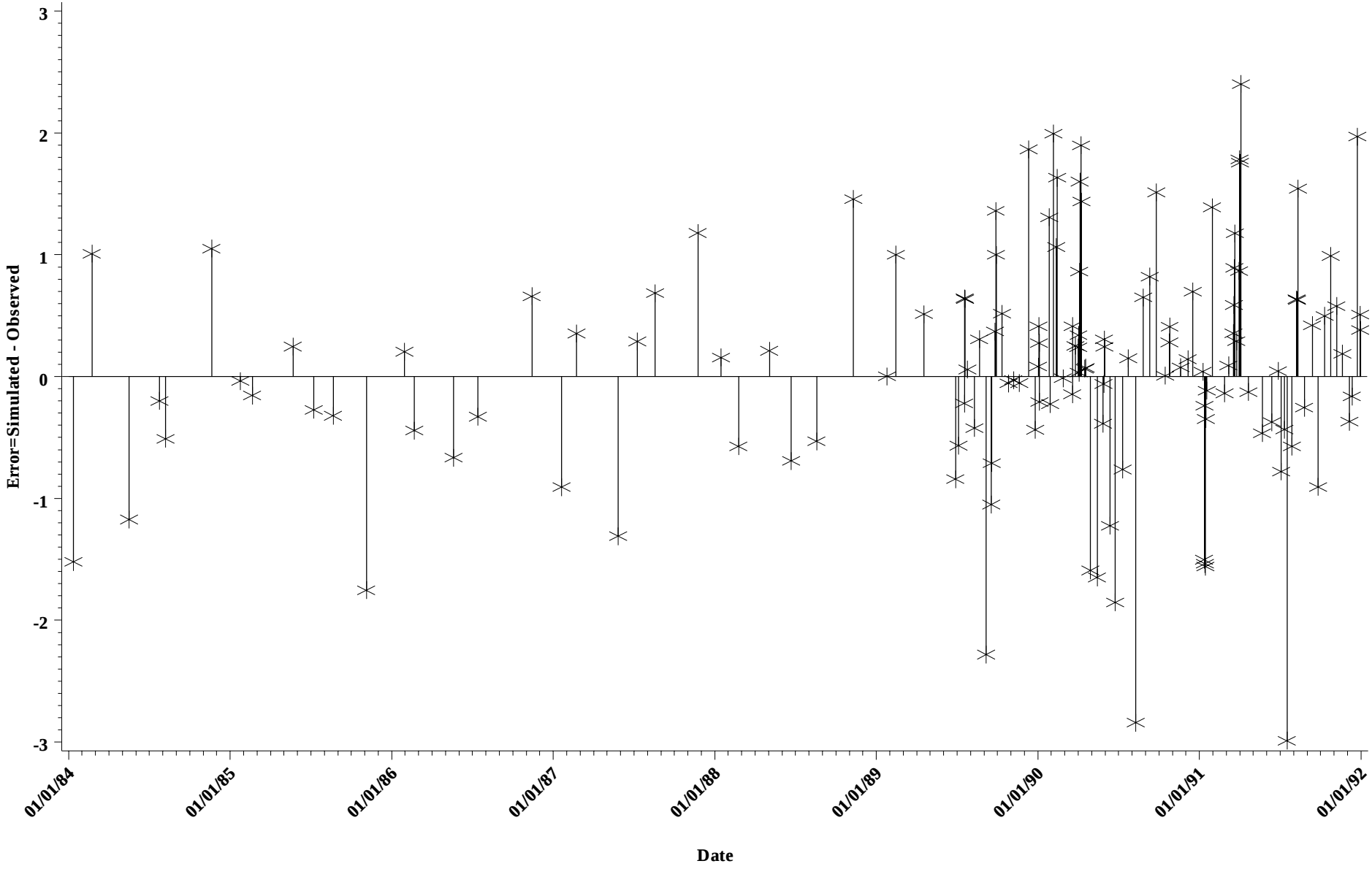
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Oxygen: 01JAN84 - 01JAN92



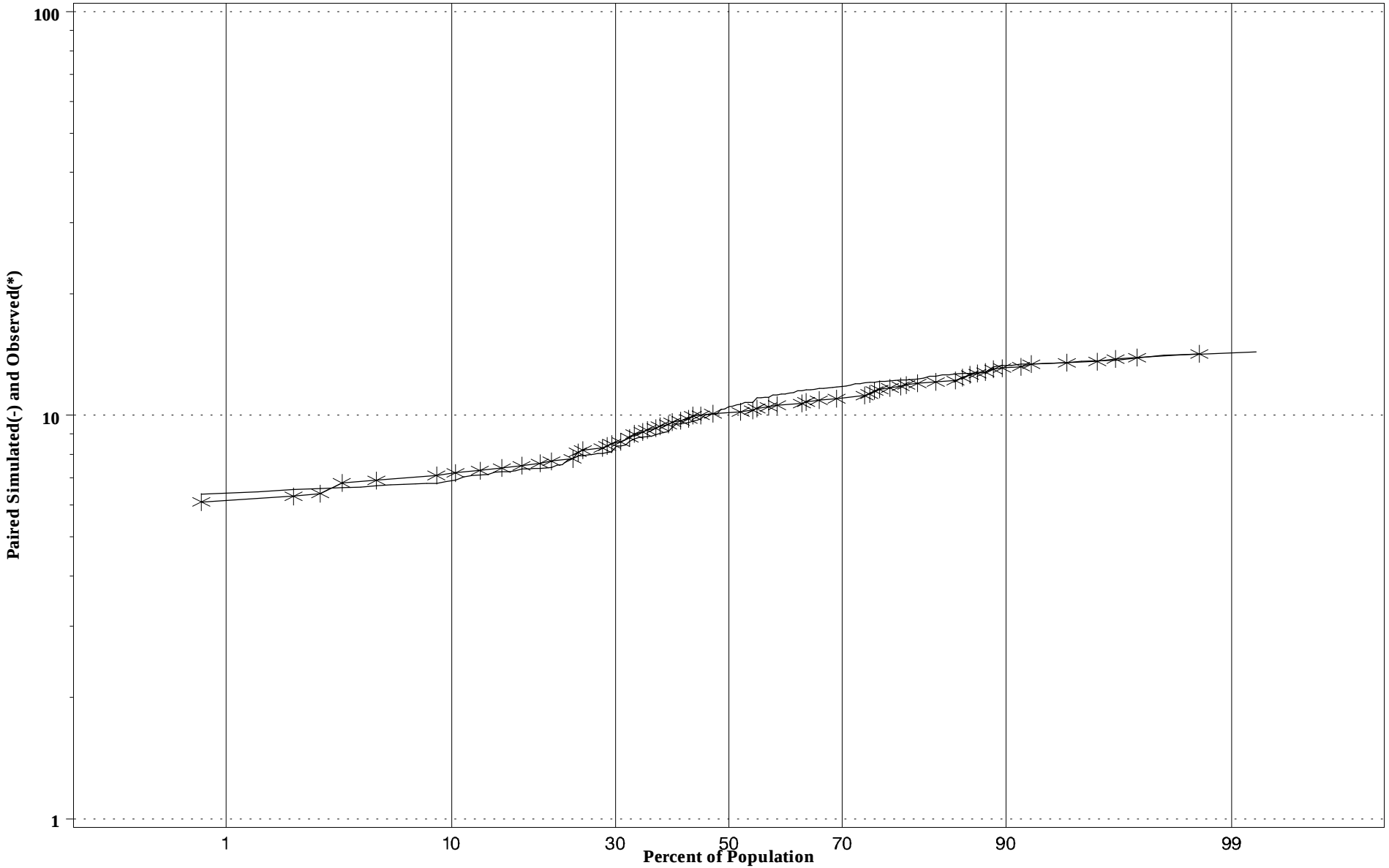

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(appom.drv 29JUN98 14:42)

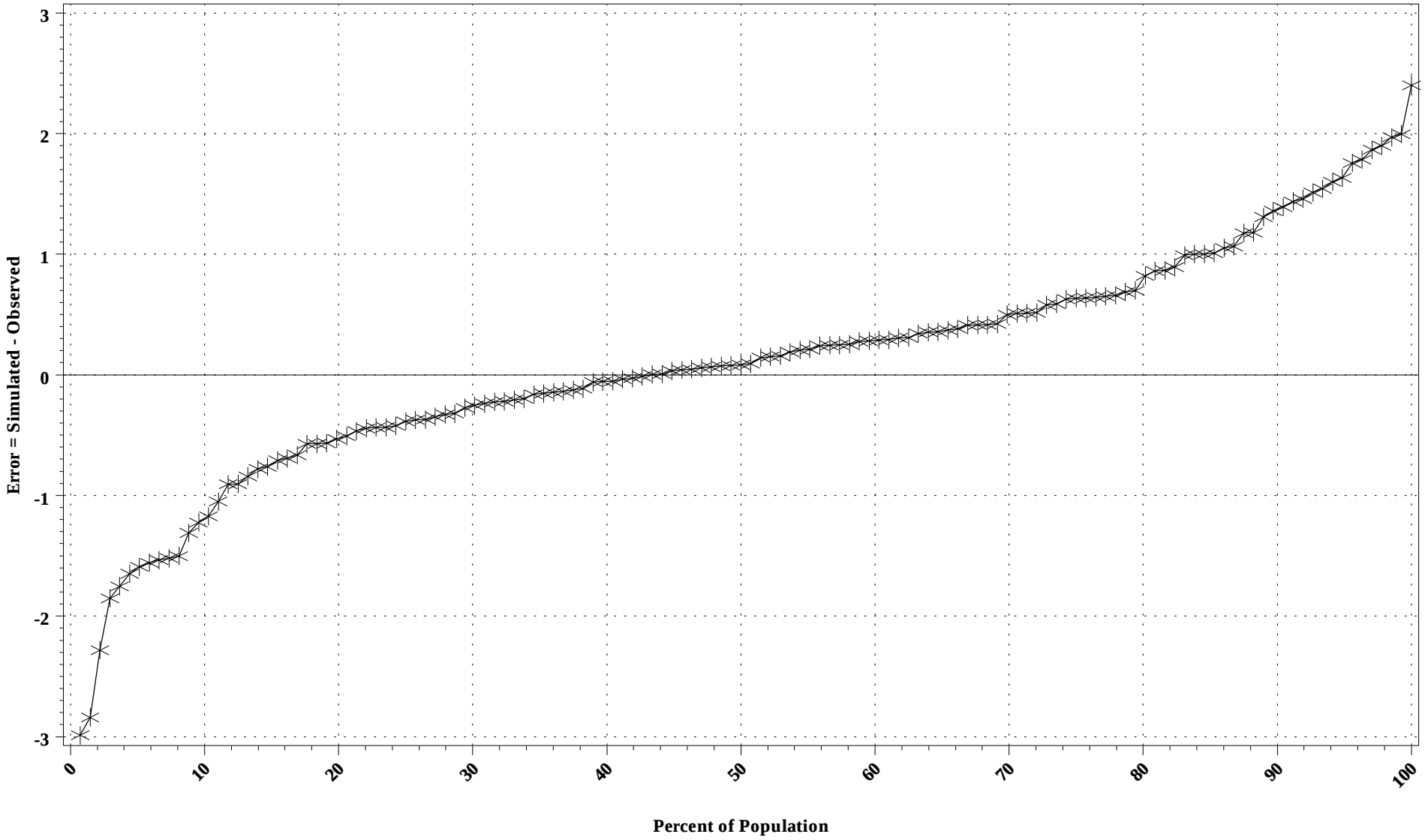
# Appomattox River at Segment 310
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

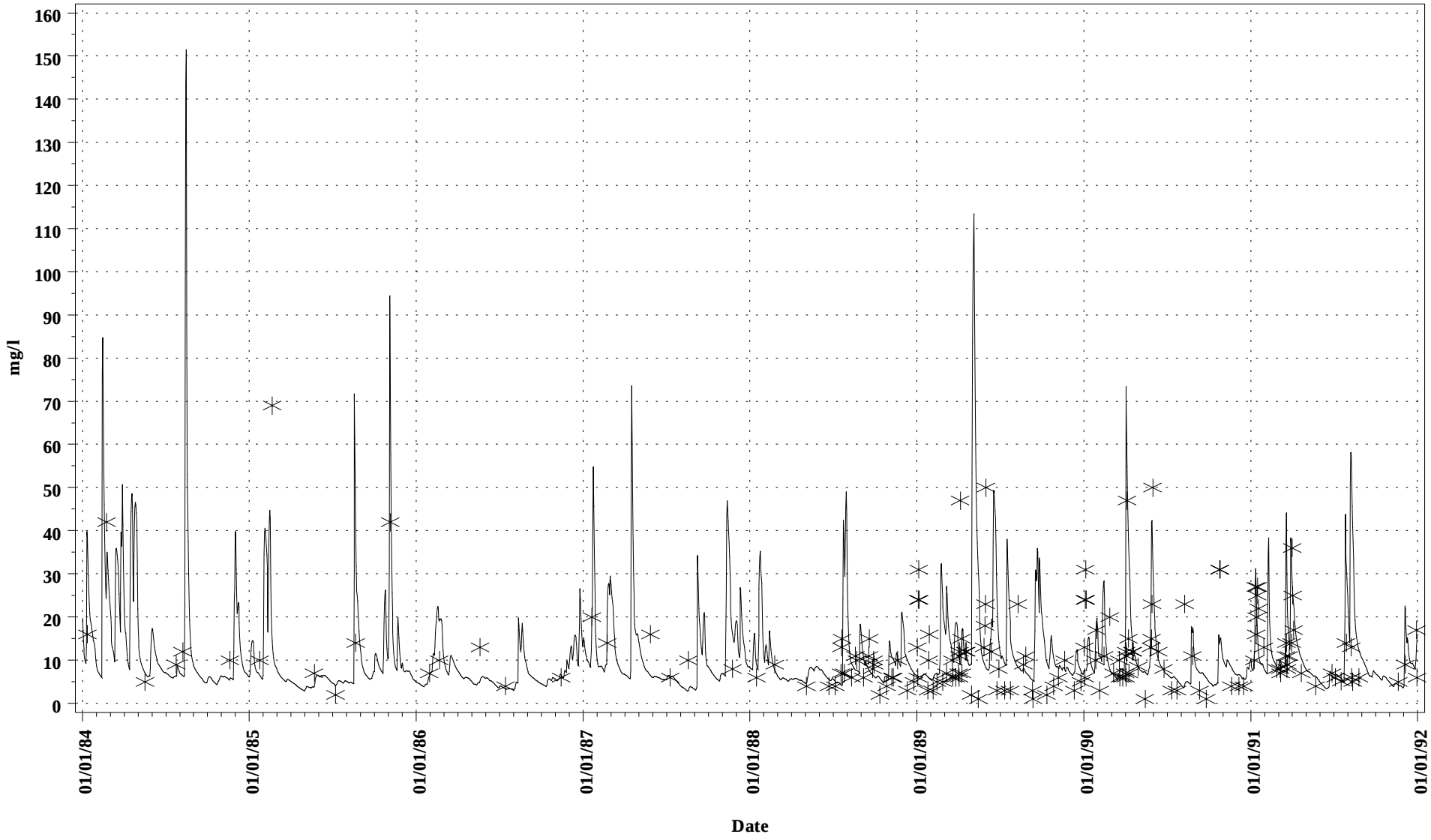
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**

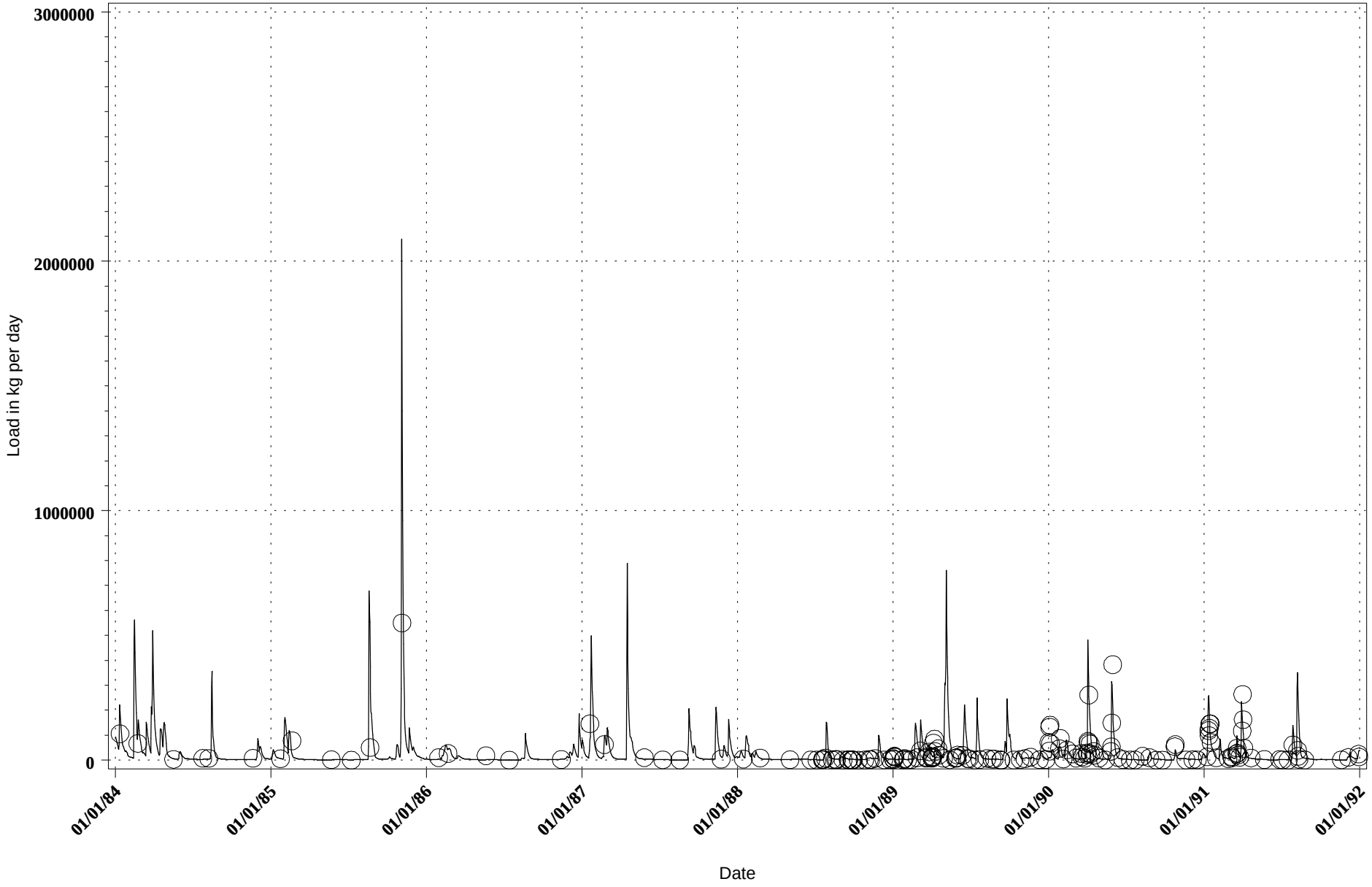



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310

## Total Suspended Sediment Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

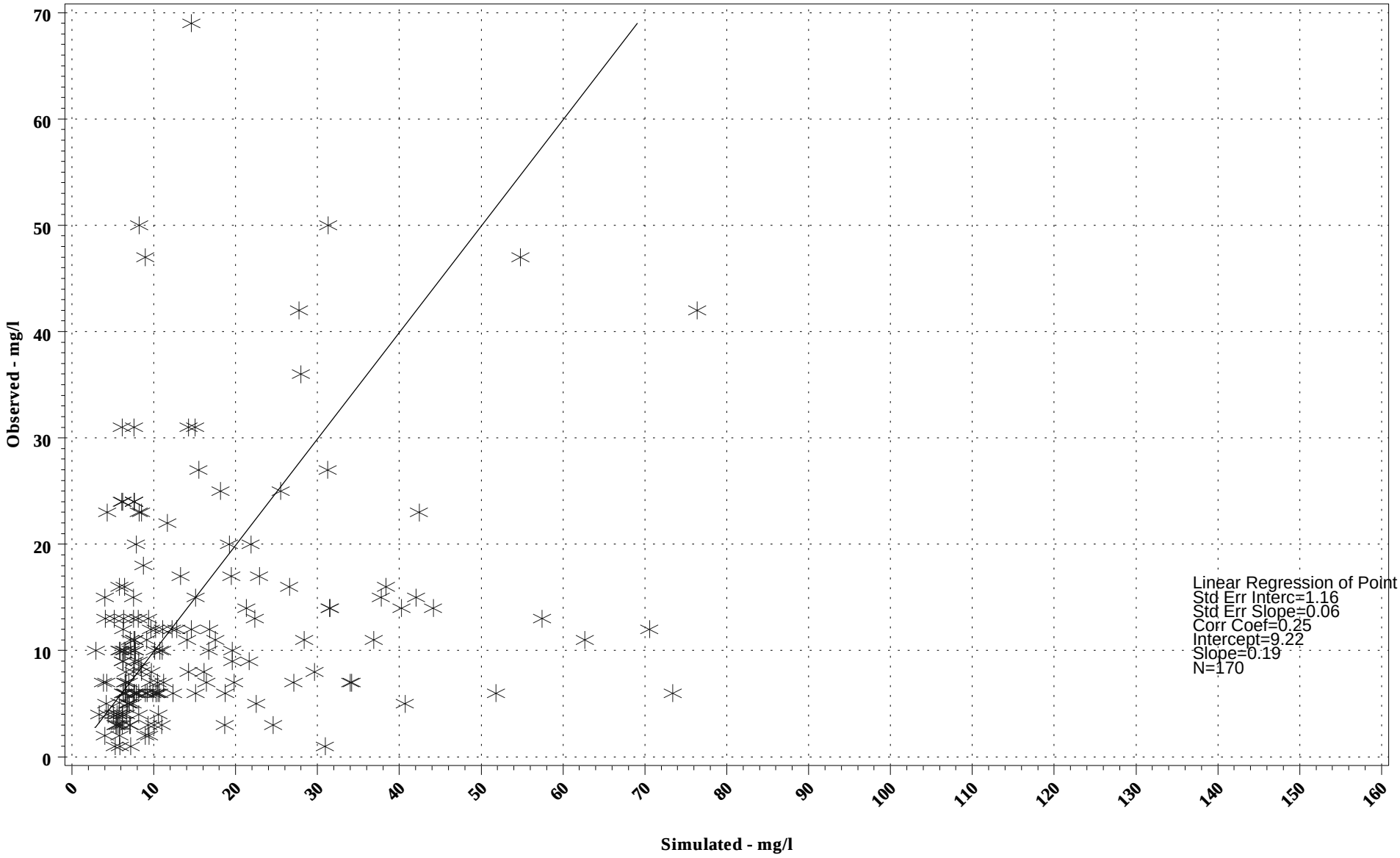



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310

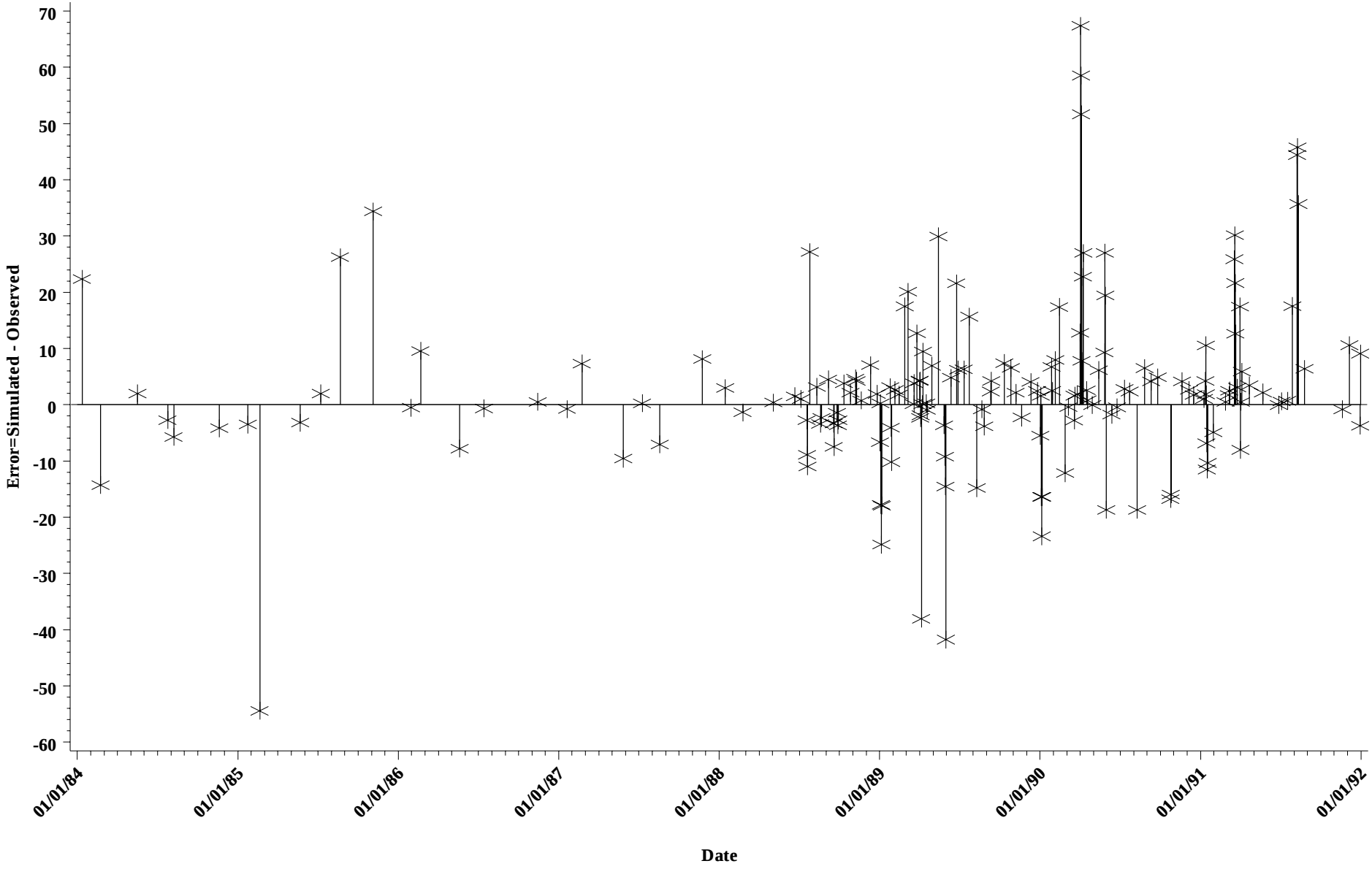
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



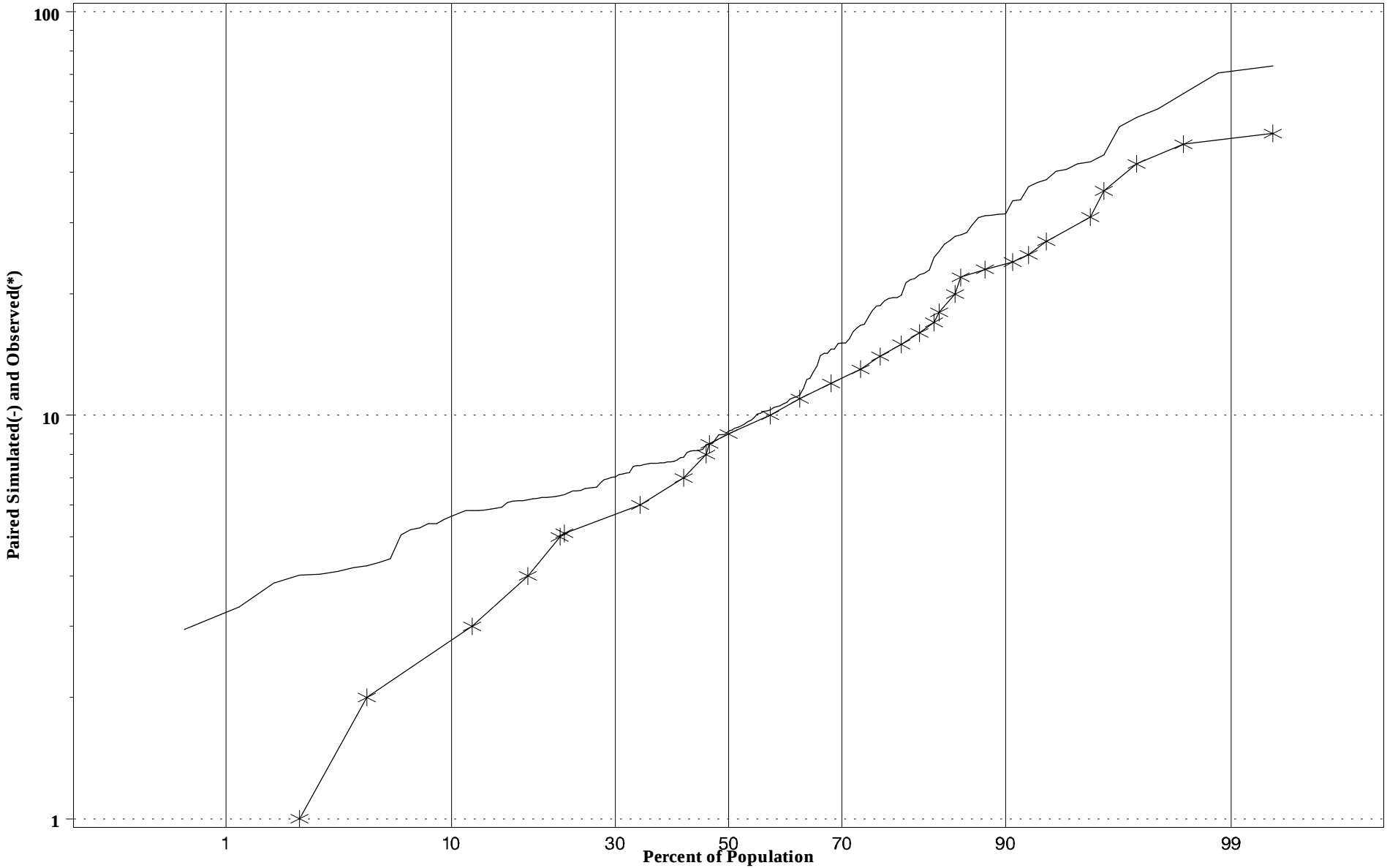

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(appom.drv 29JUN98 14:42)

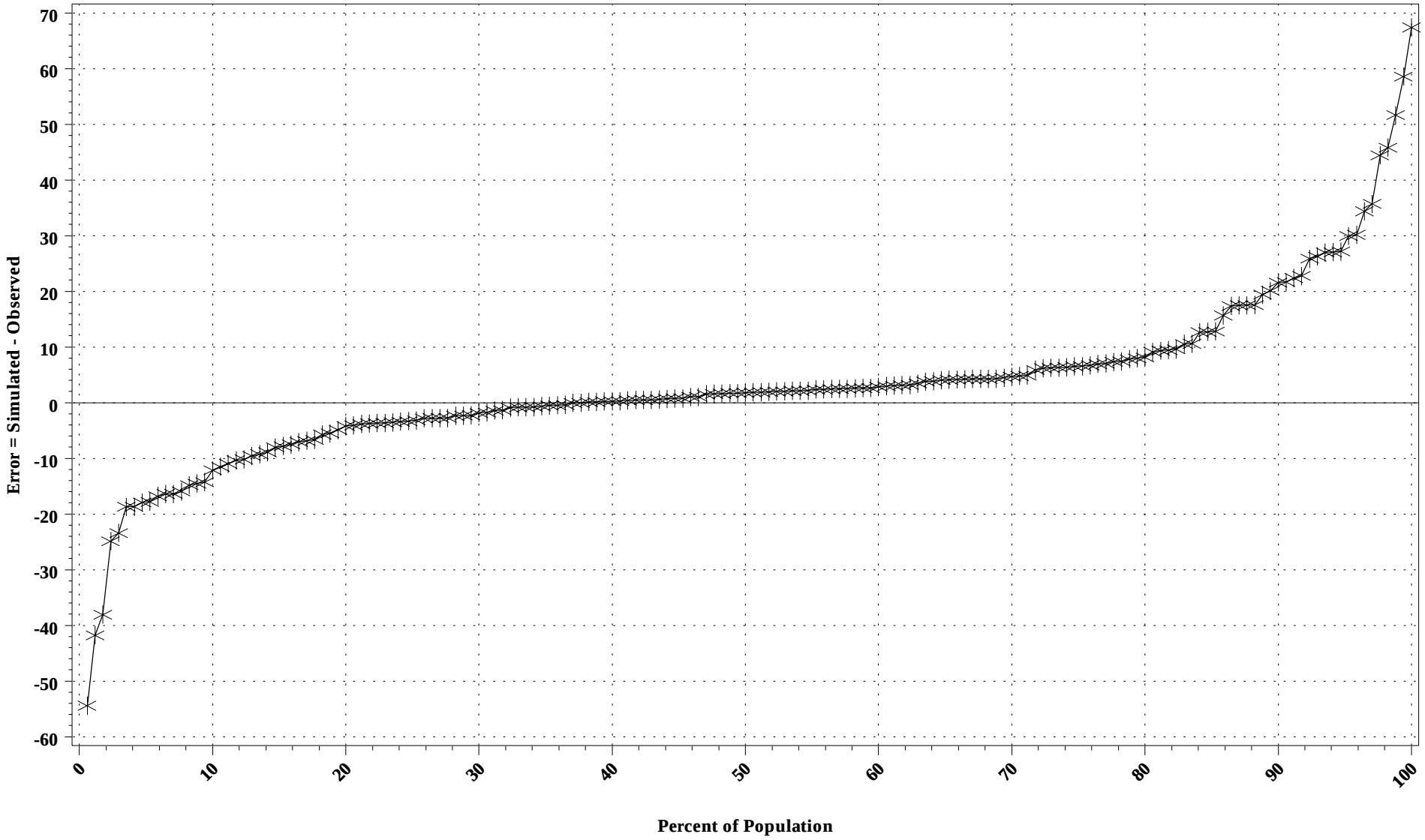
# Appomattox River at Segment 310
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

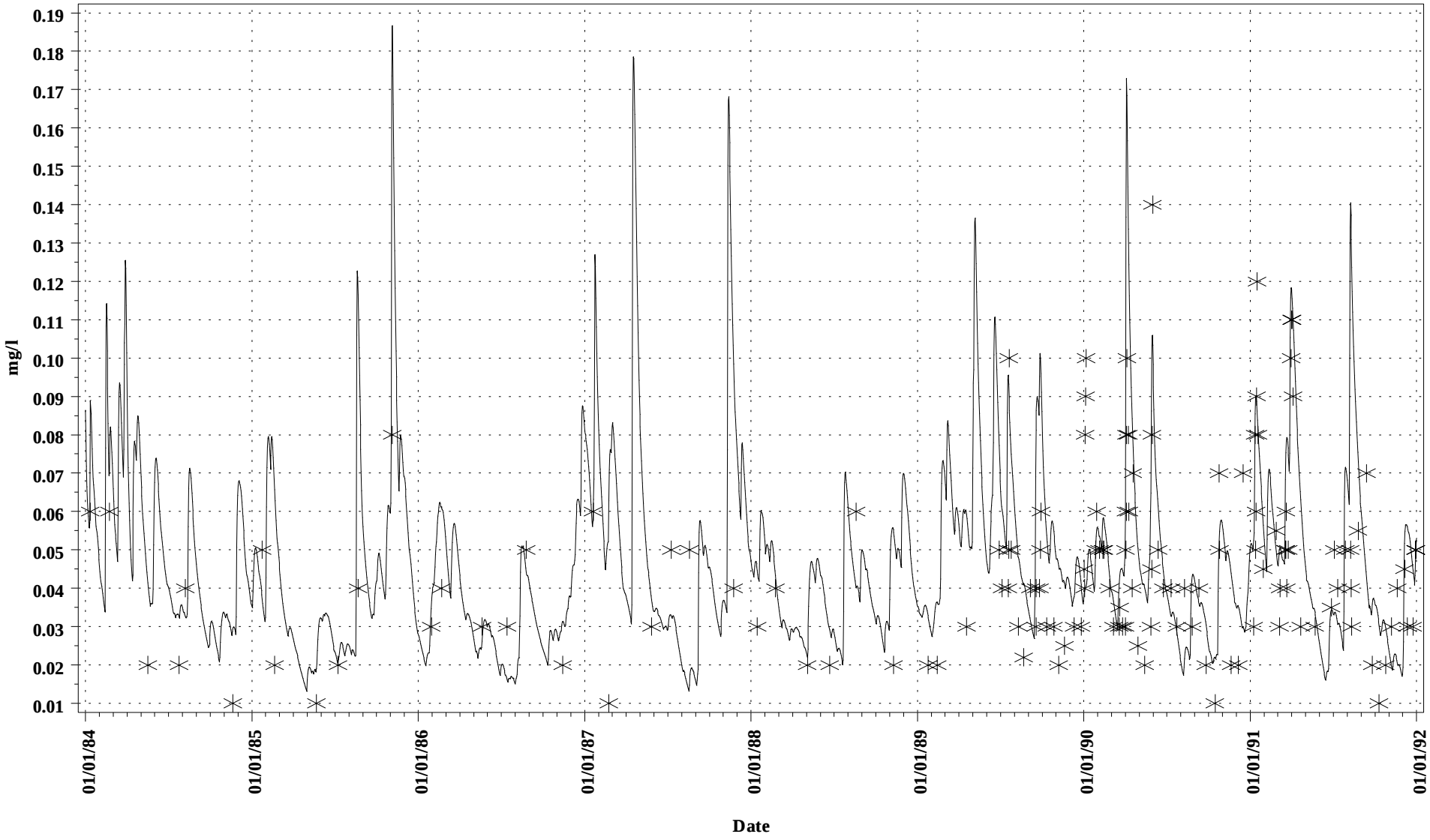
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(appom.drv 29JUN98 14:42)

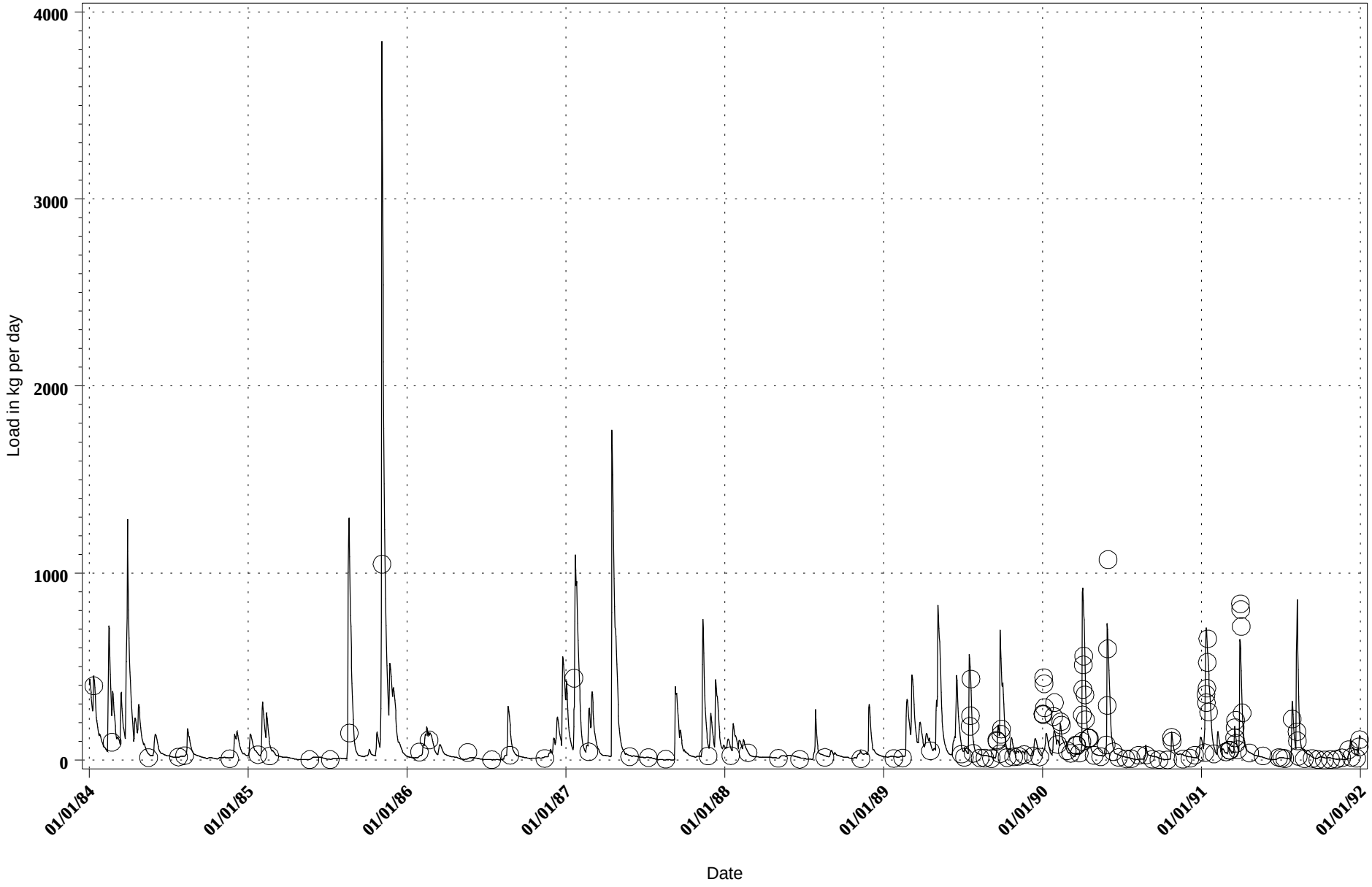
# Appomattox River at Segment 310
## Observed and Simulated versus Time
# Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

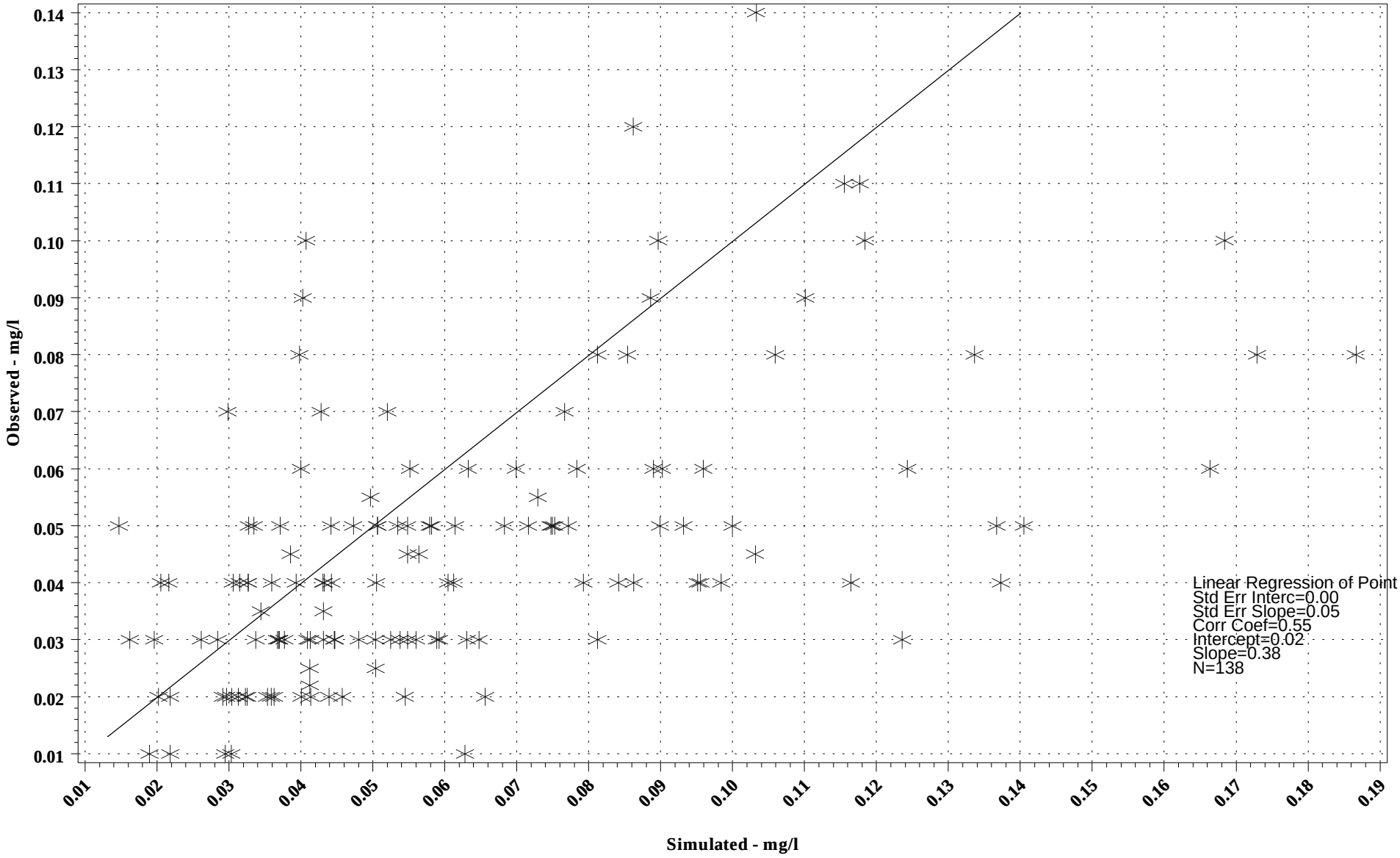



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310

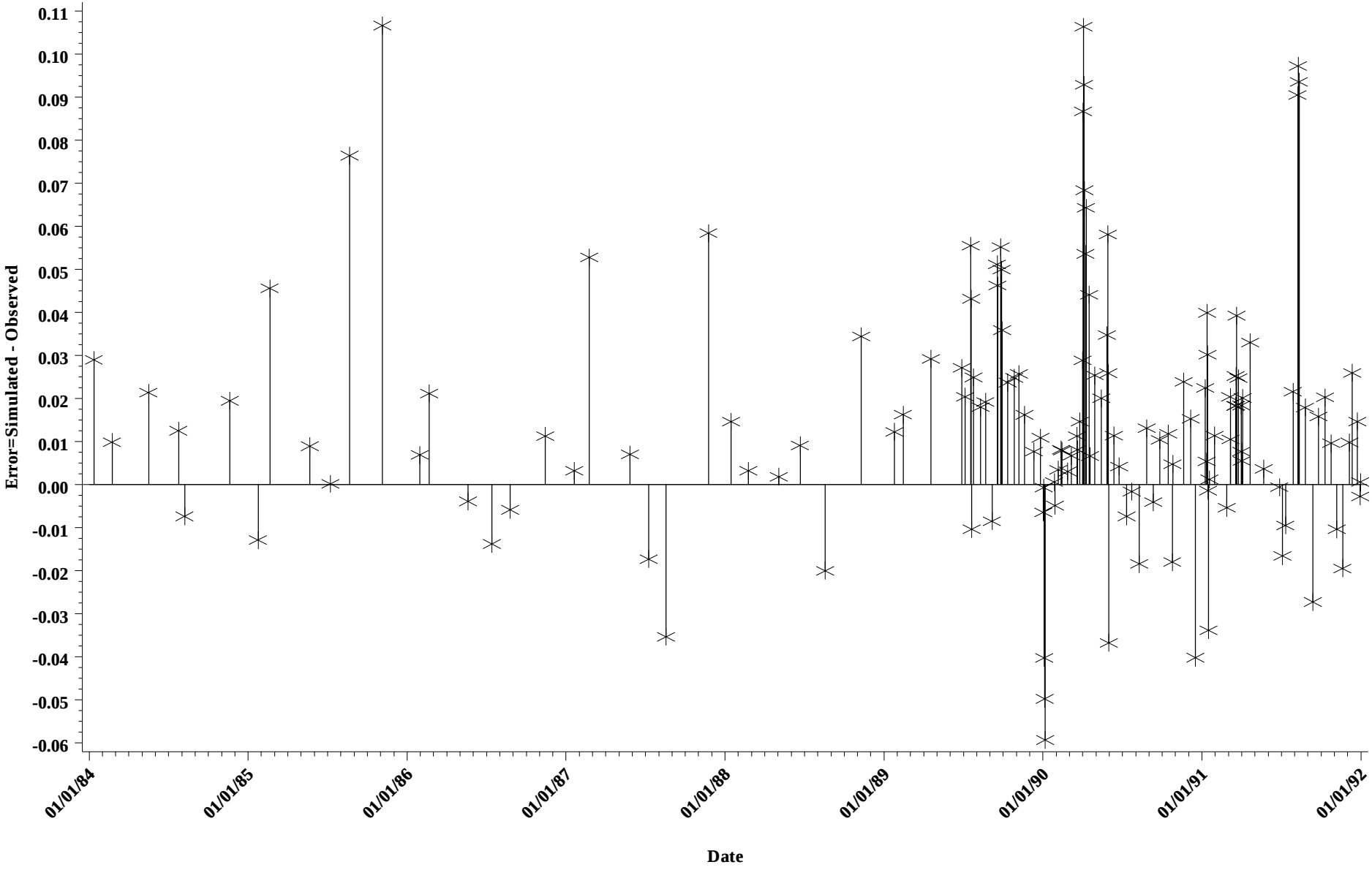
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



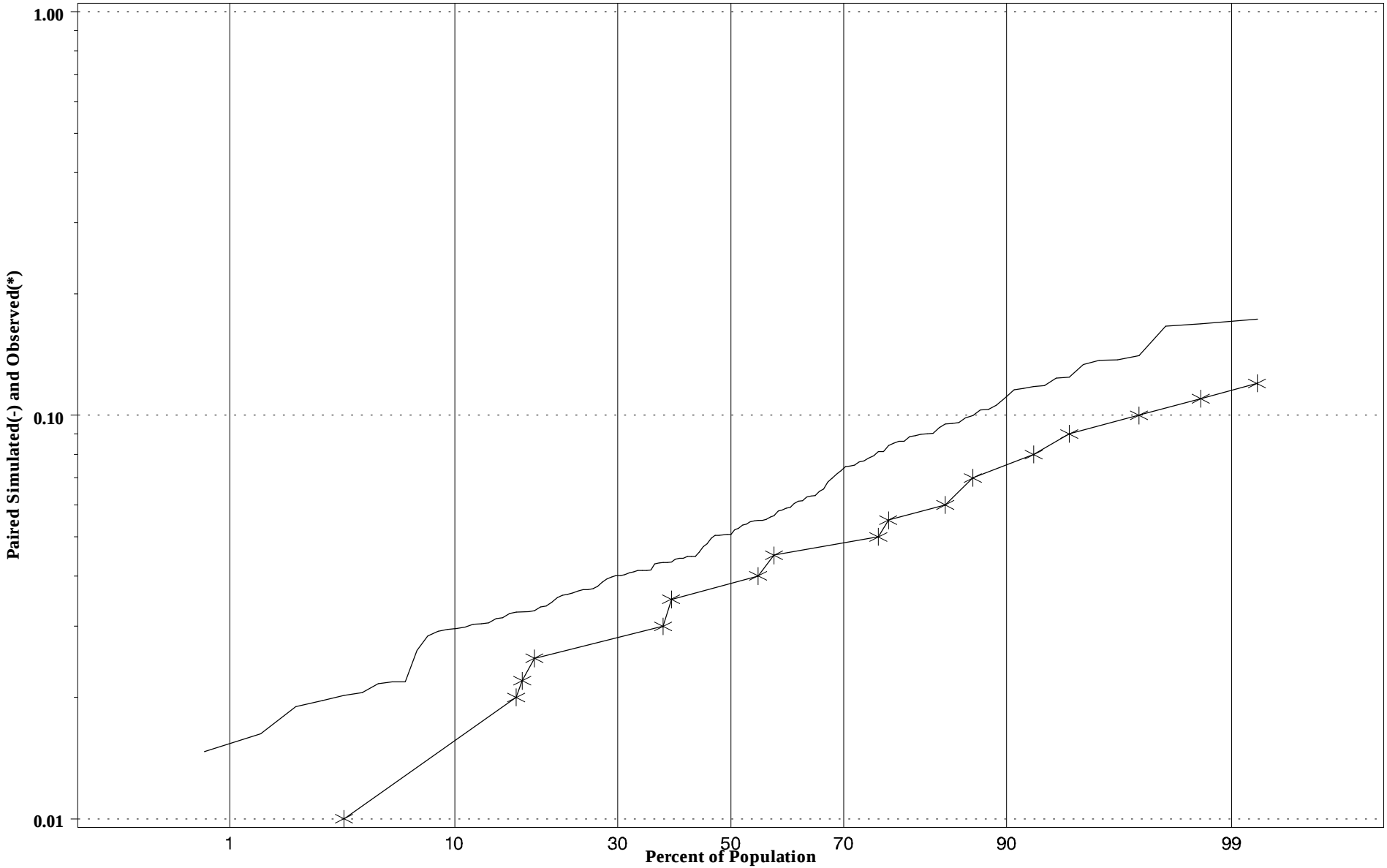

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(appom.drv 29JUN98 14:42)

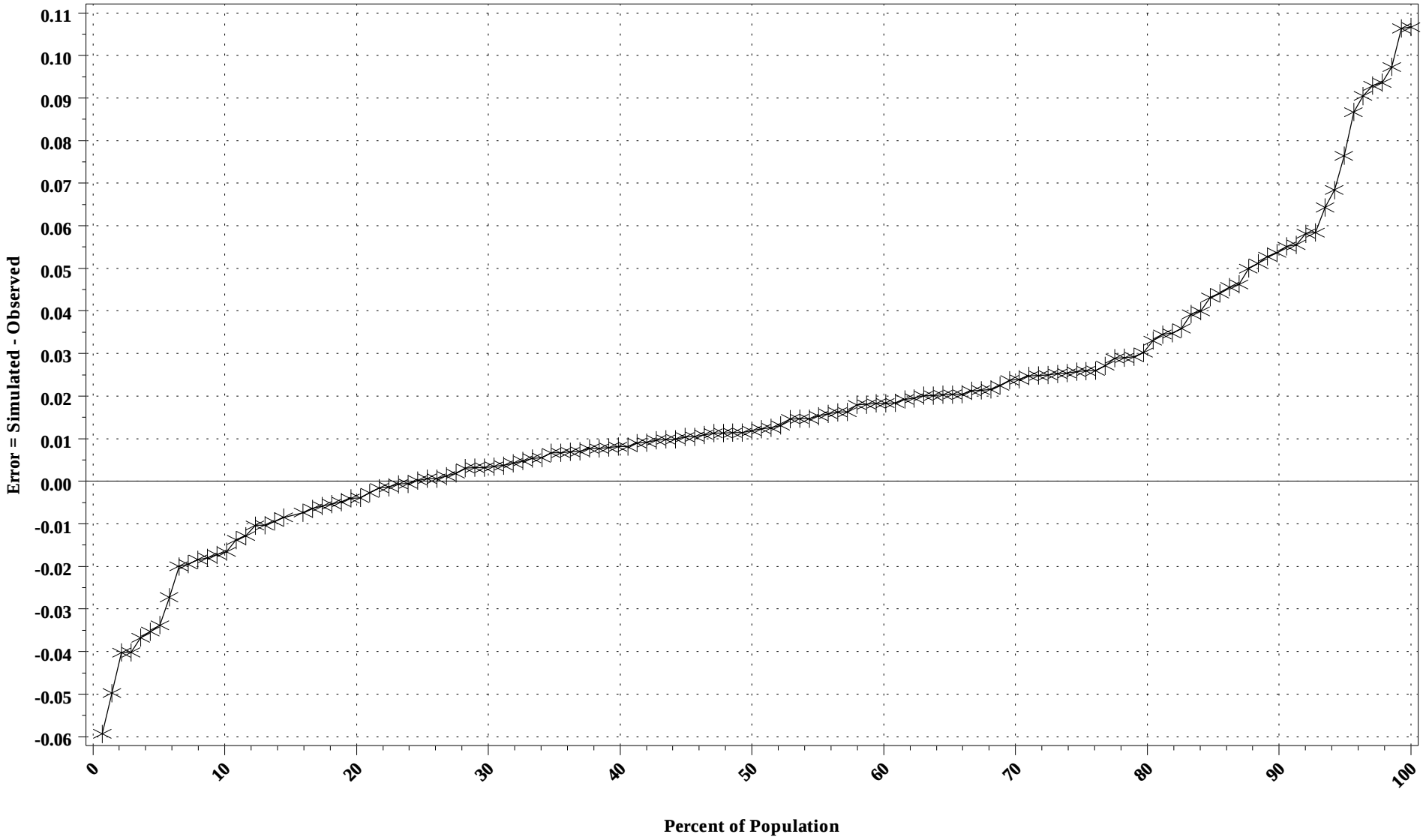
# Appomattox River at Segment 310
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Actual error versus Percentile Sample Population
## Total Phosphorus

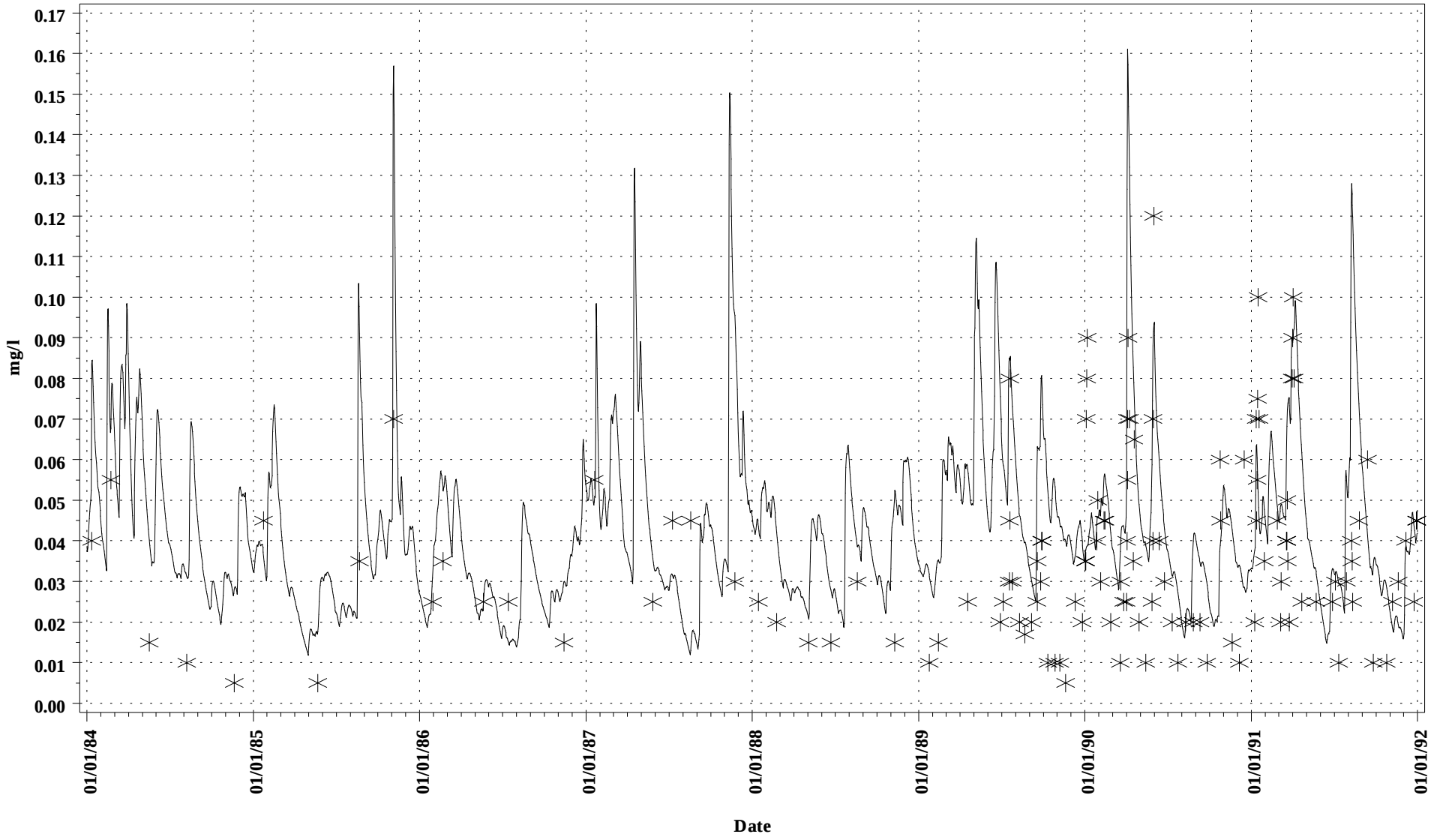
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

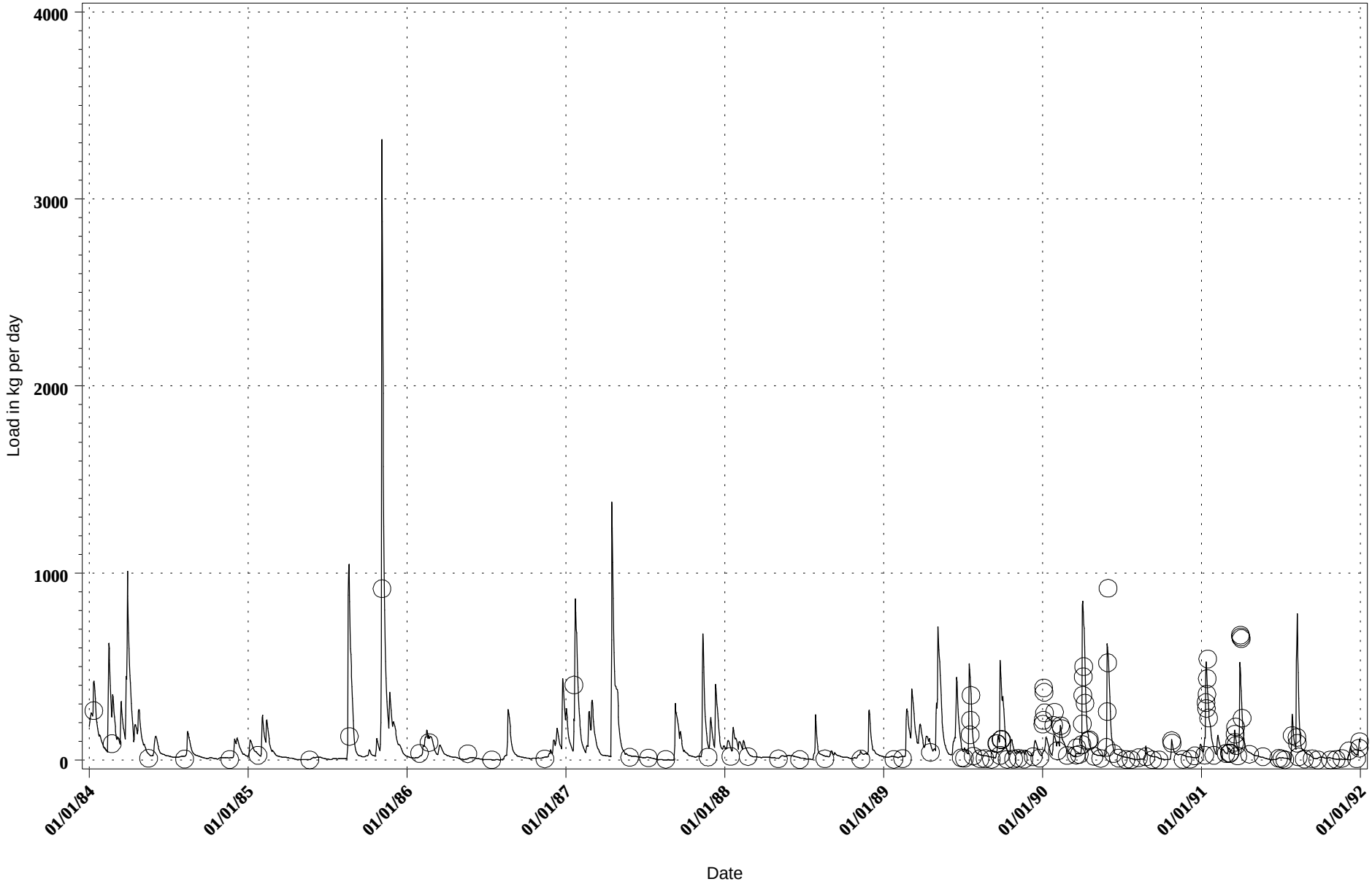



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

### (line = simulated, O = observed)

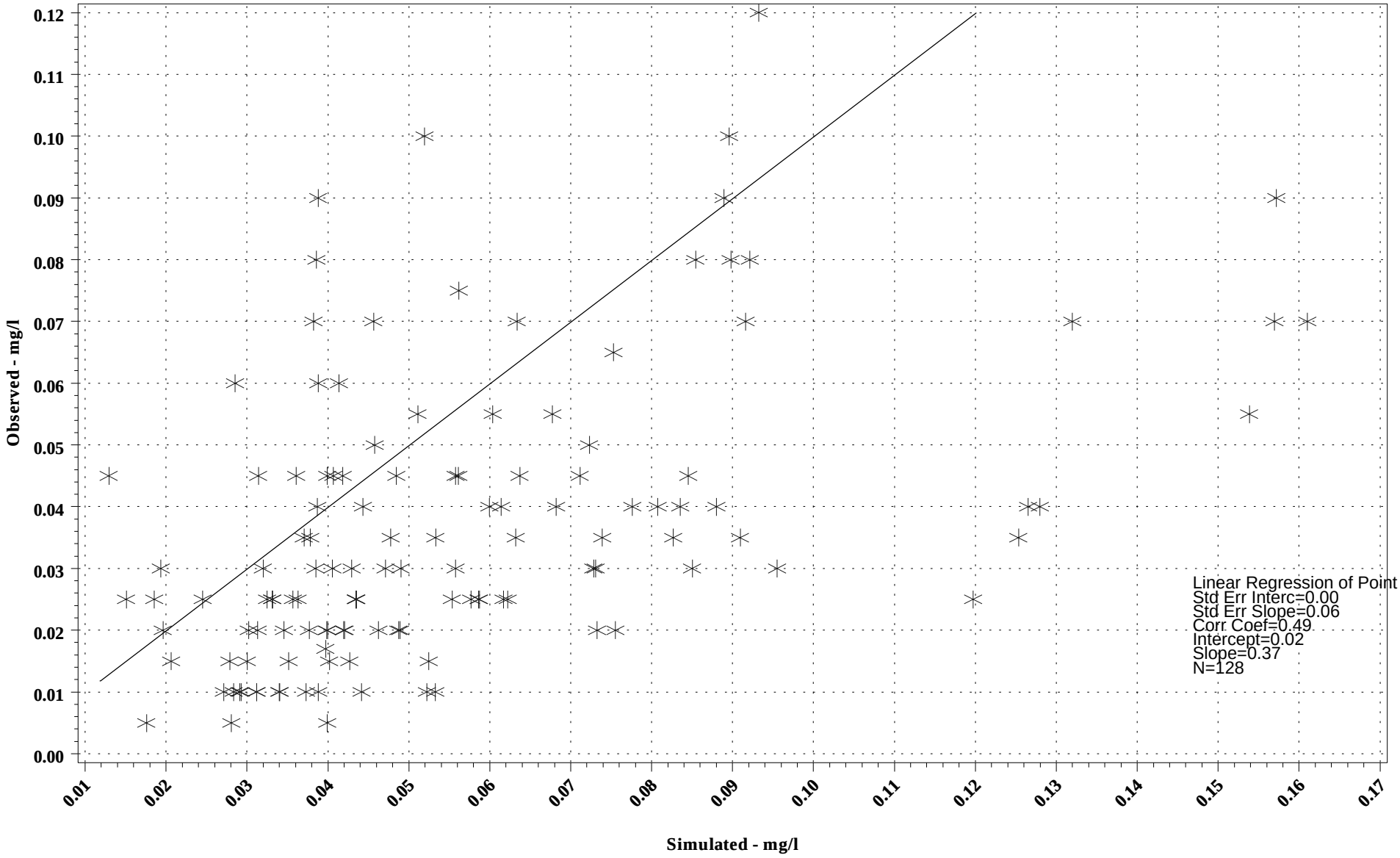



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310

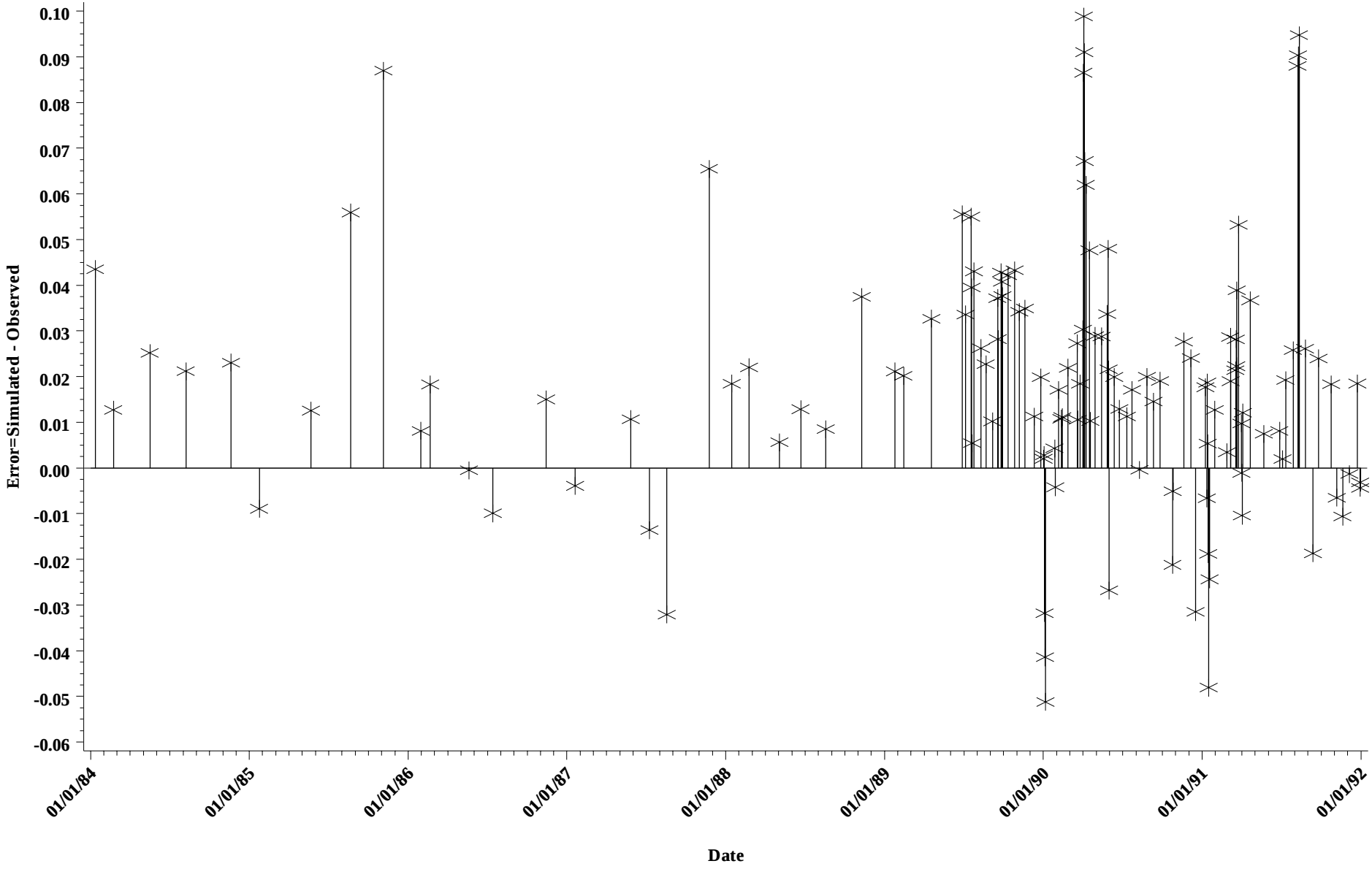
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92



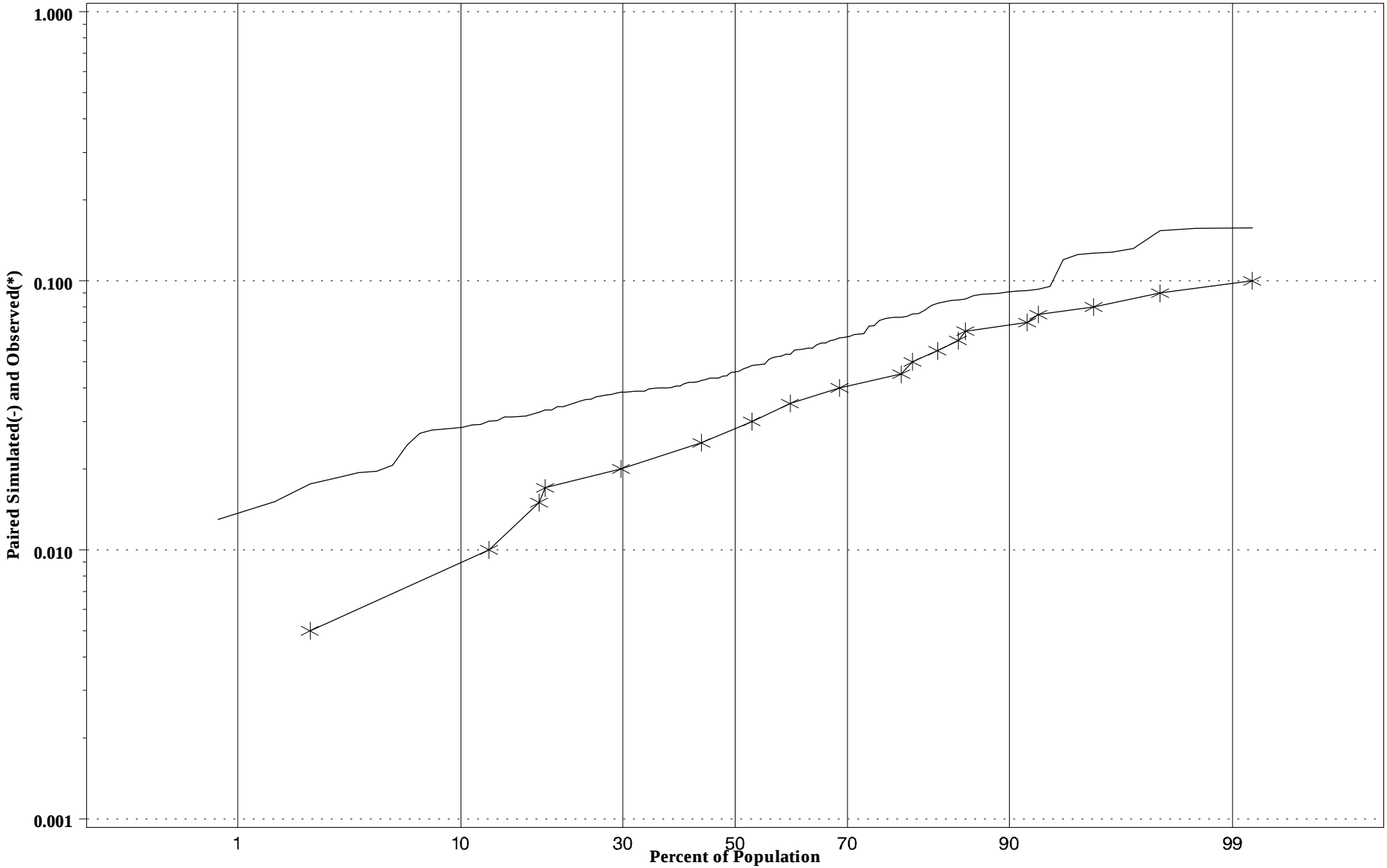

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310
## Actual Error versus Time
## Organic and Particulate Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(appom.drv 29JUN98 14:42)

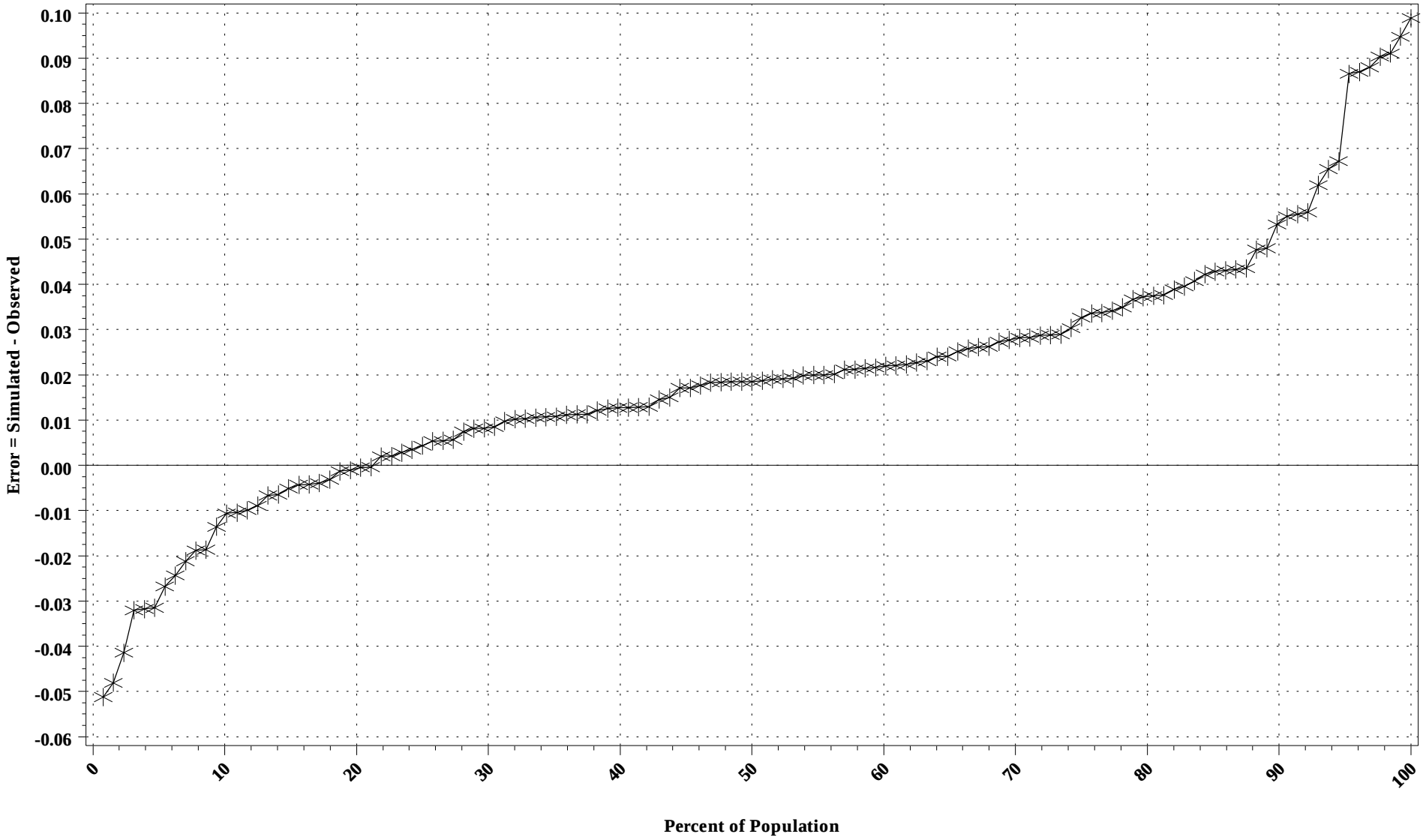
# Appomattox River at Segment 310
## Organic and Particulate Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

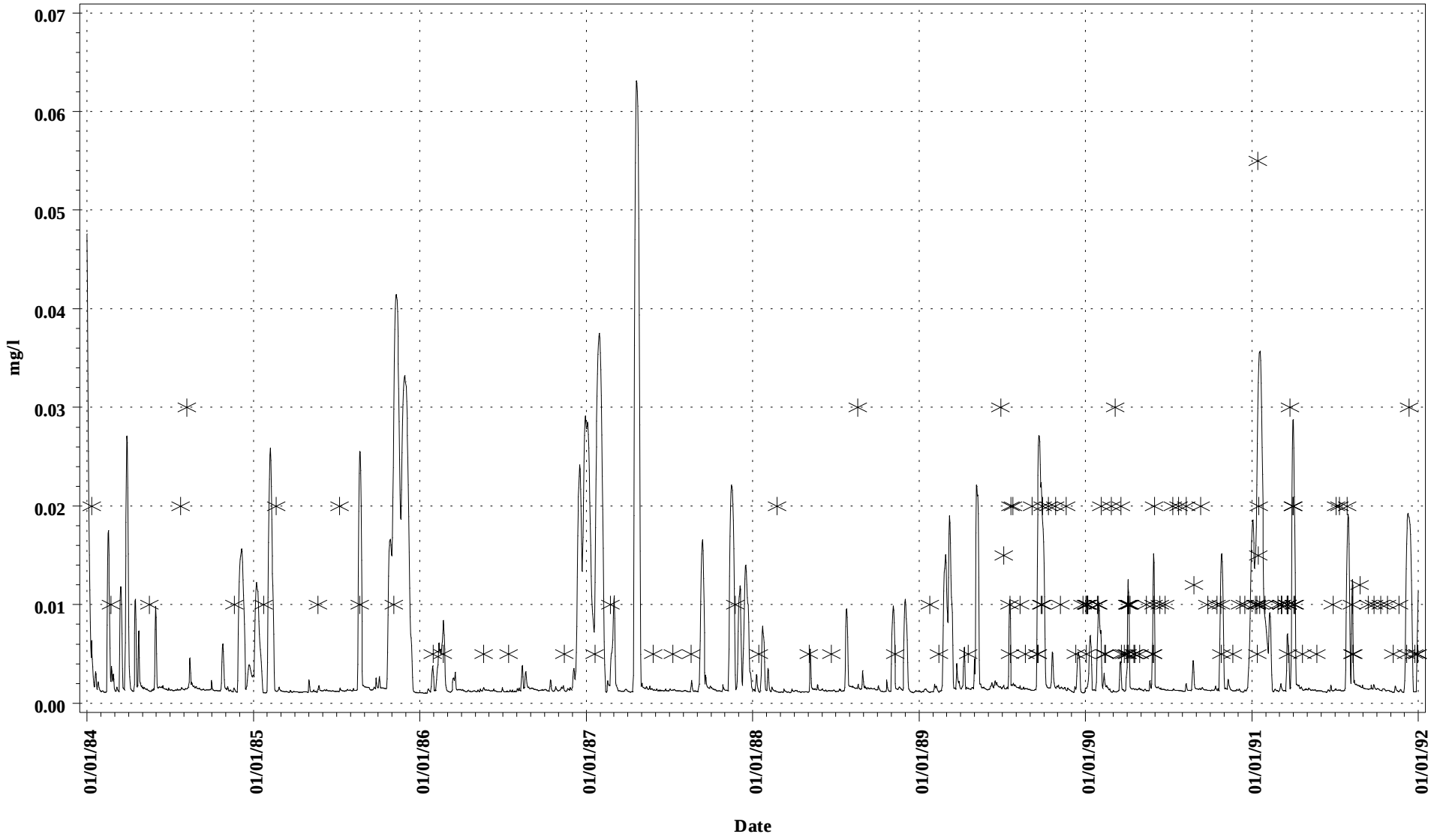
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(appom.drv 29JUN98 14:42)

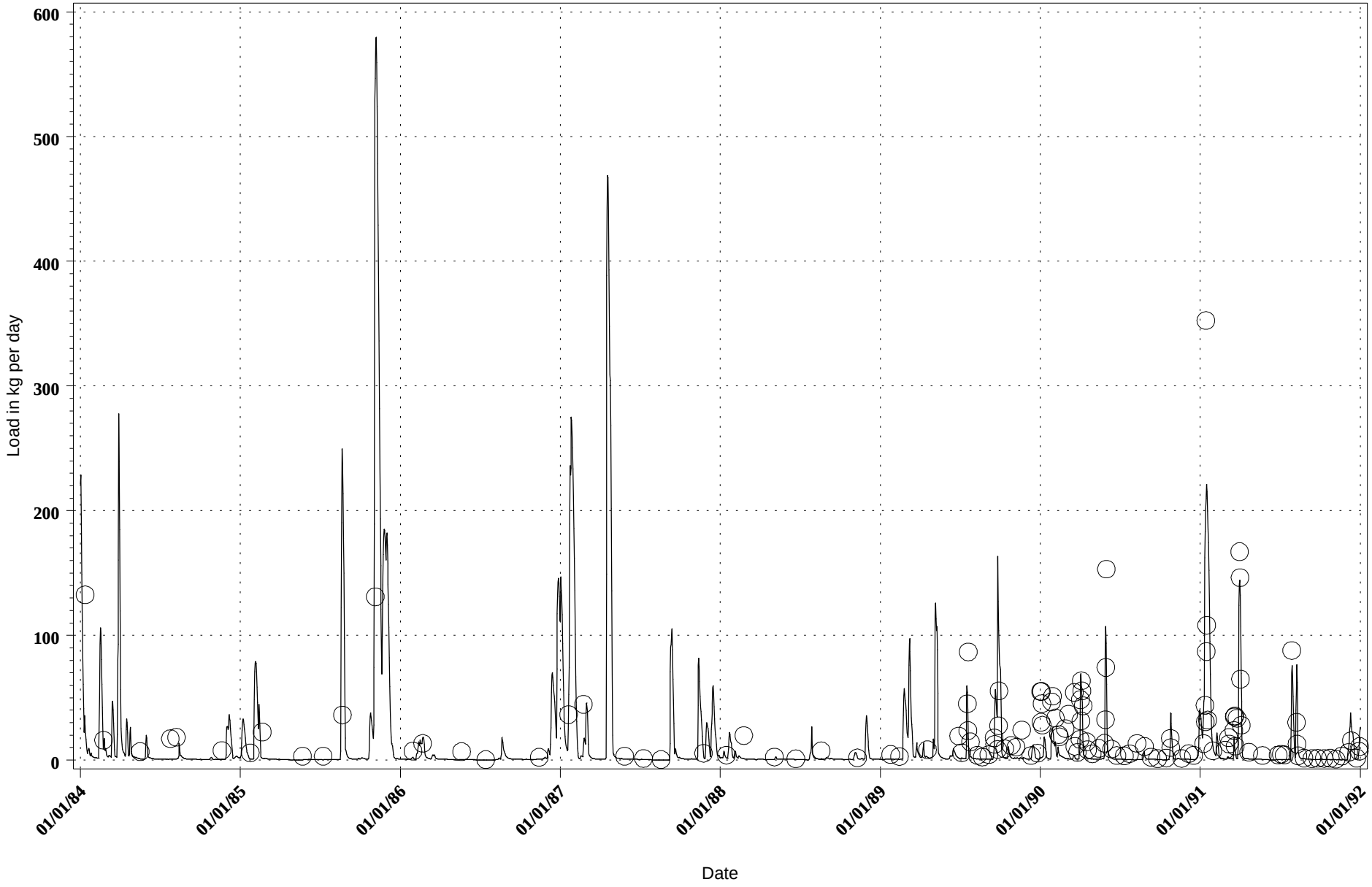
# Appomattox River at Segment 310
## Observed and Simulated versus Time
# Dissolved Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Dissolved Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

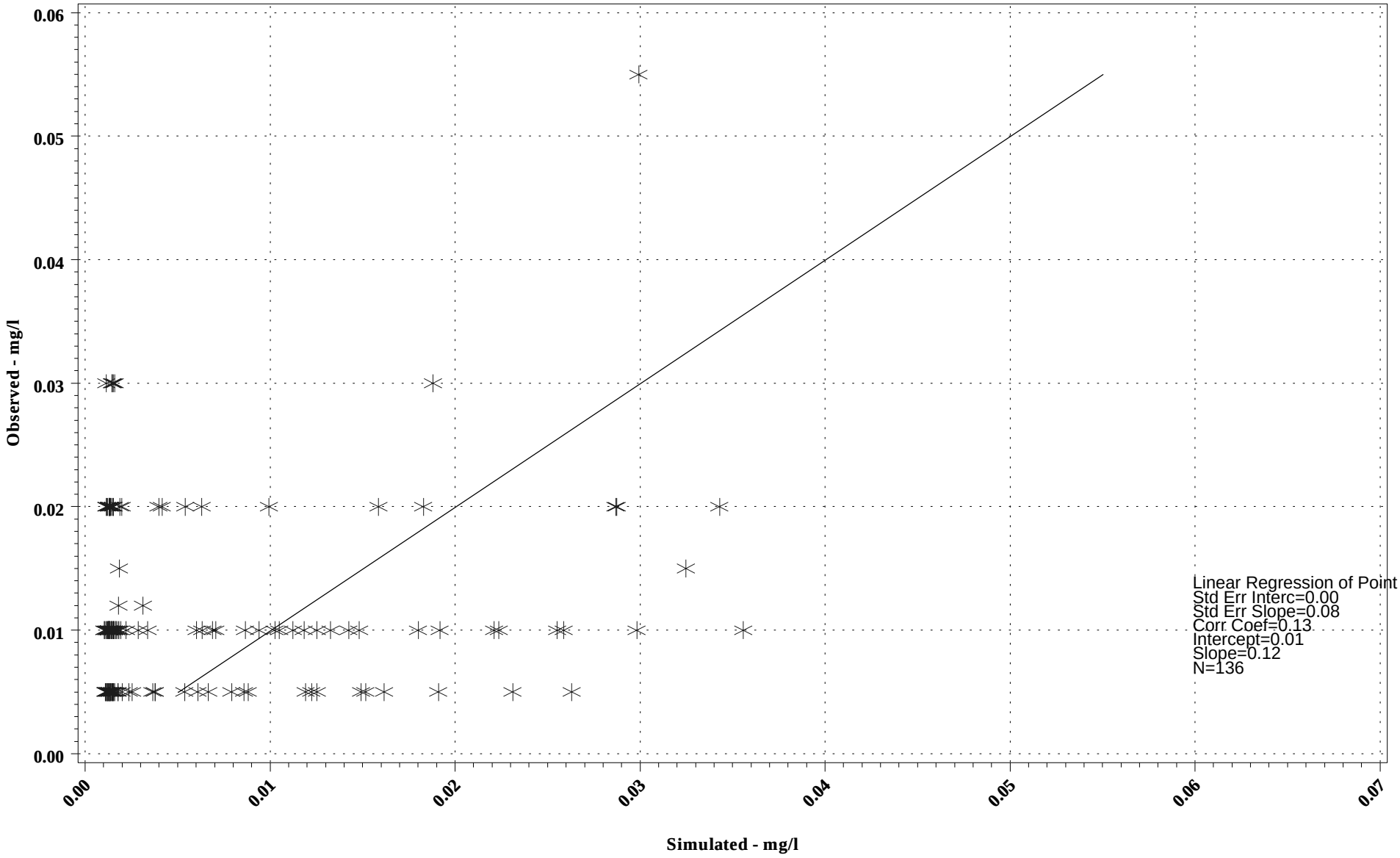



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310

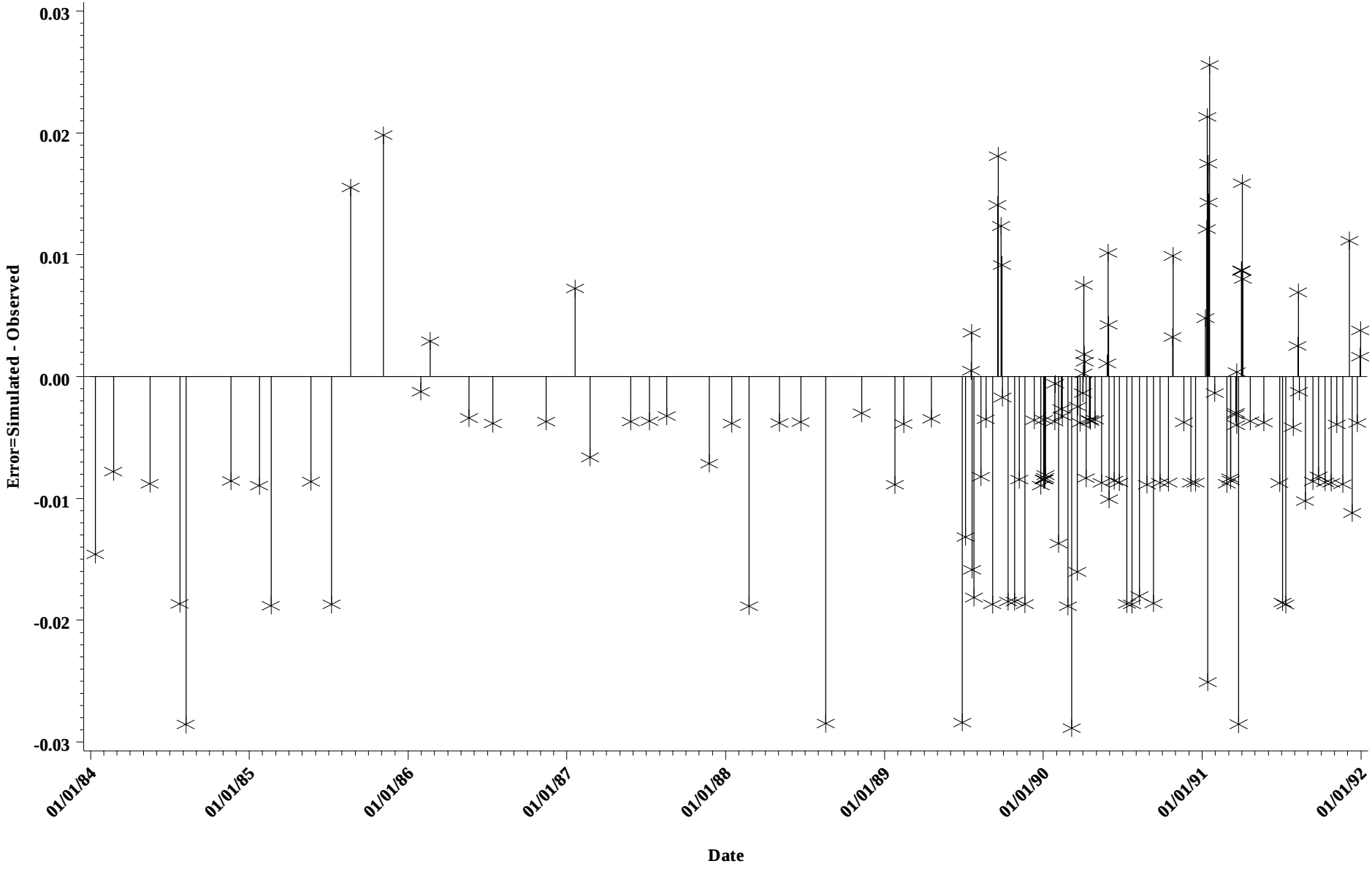
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



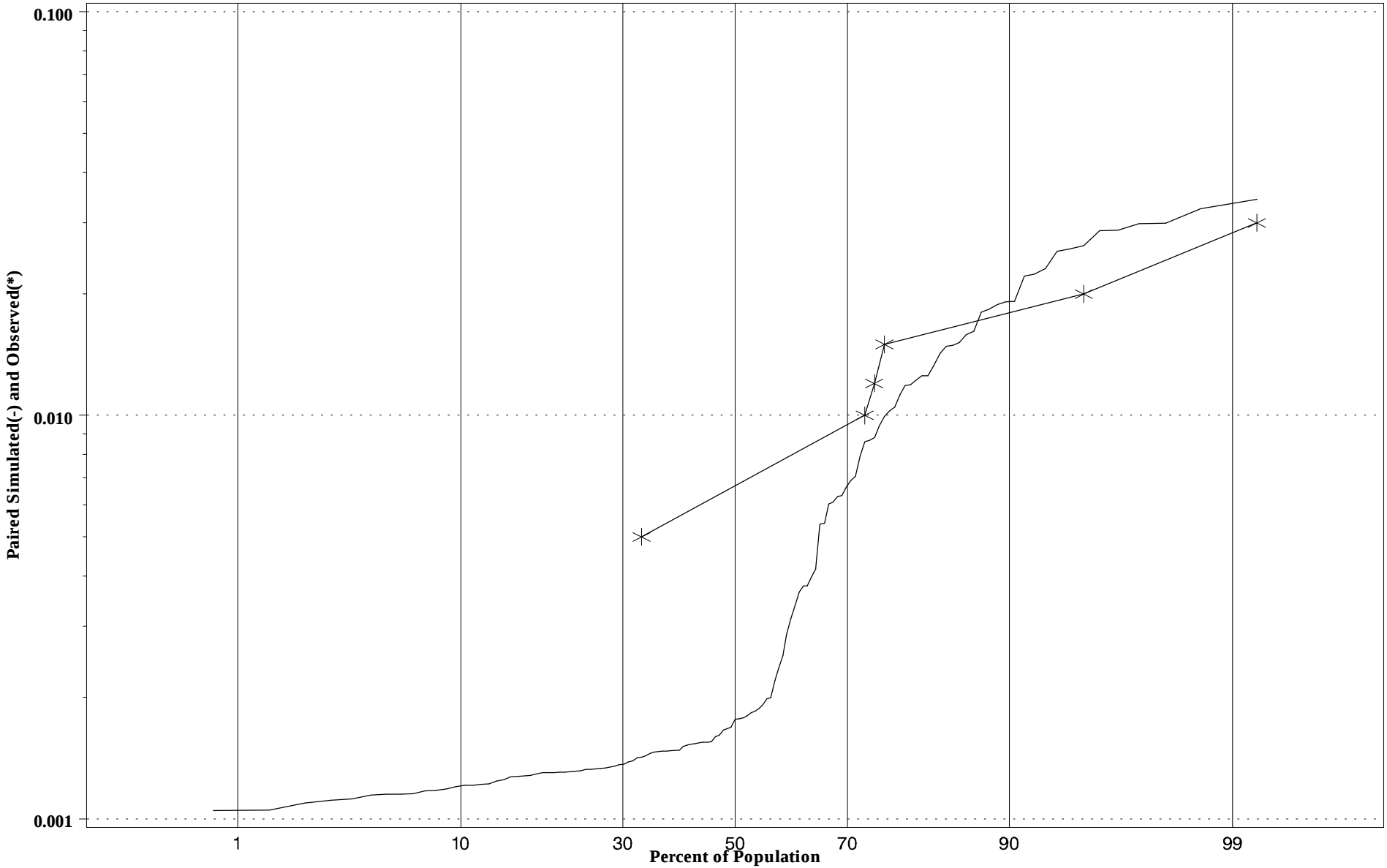

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(appom.drv 29JUN98 14:42)

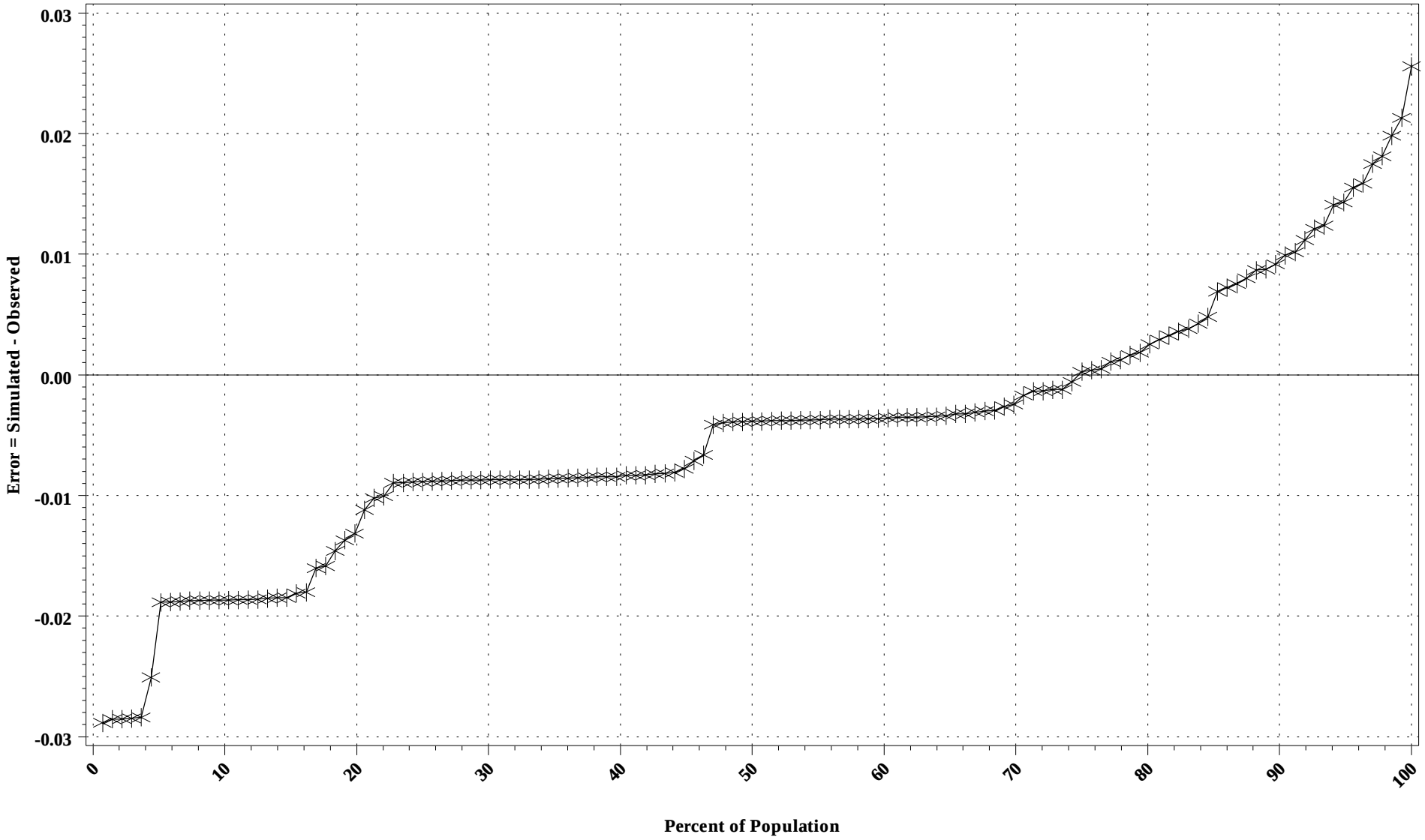
# Appomattox River at Segment 310
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

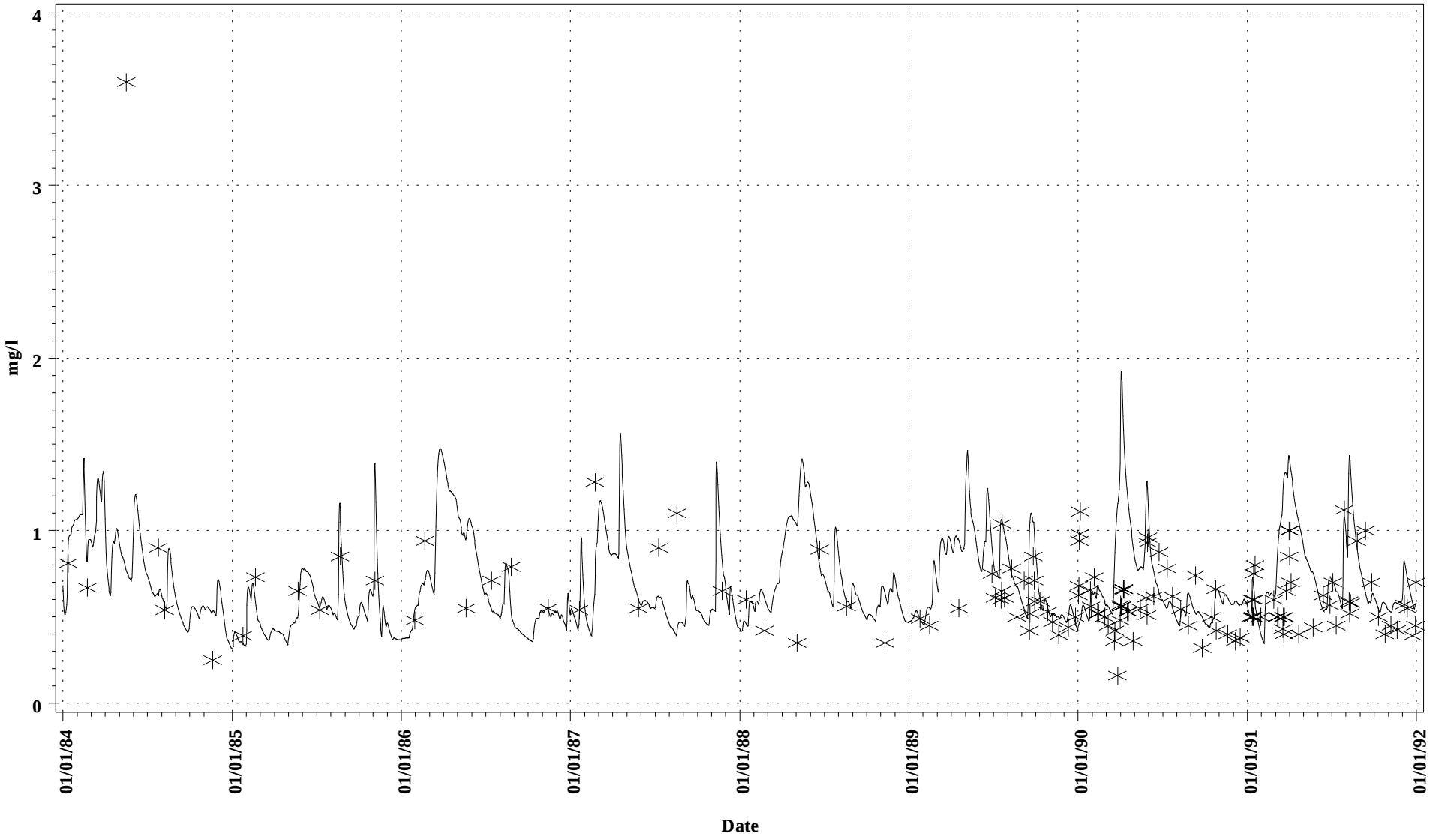
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(appom.drv 29JUN98 14:42)

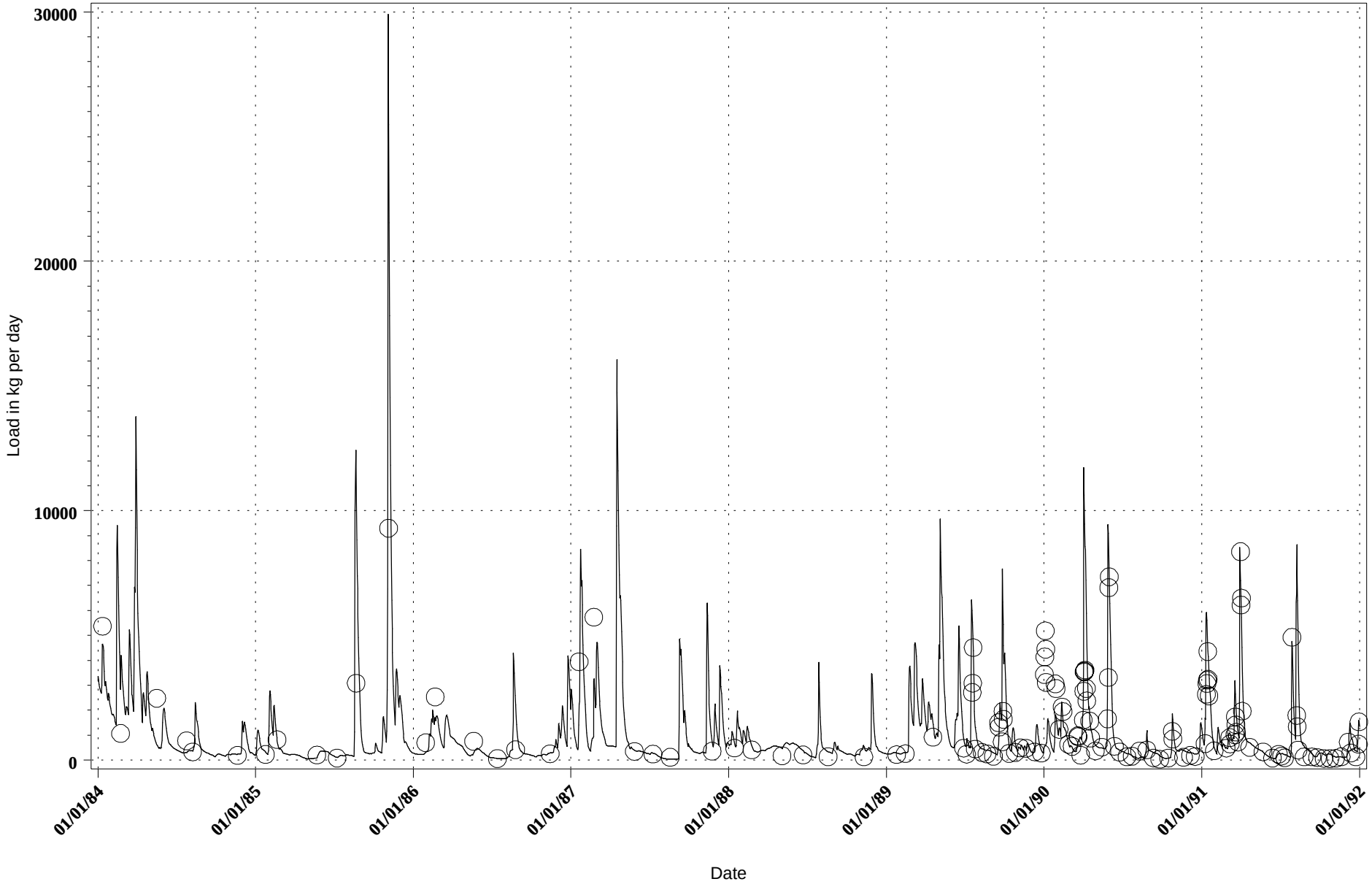
# Appomattox River at Segment 310
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

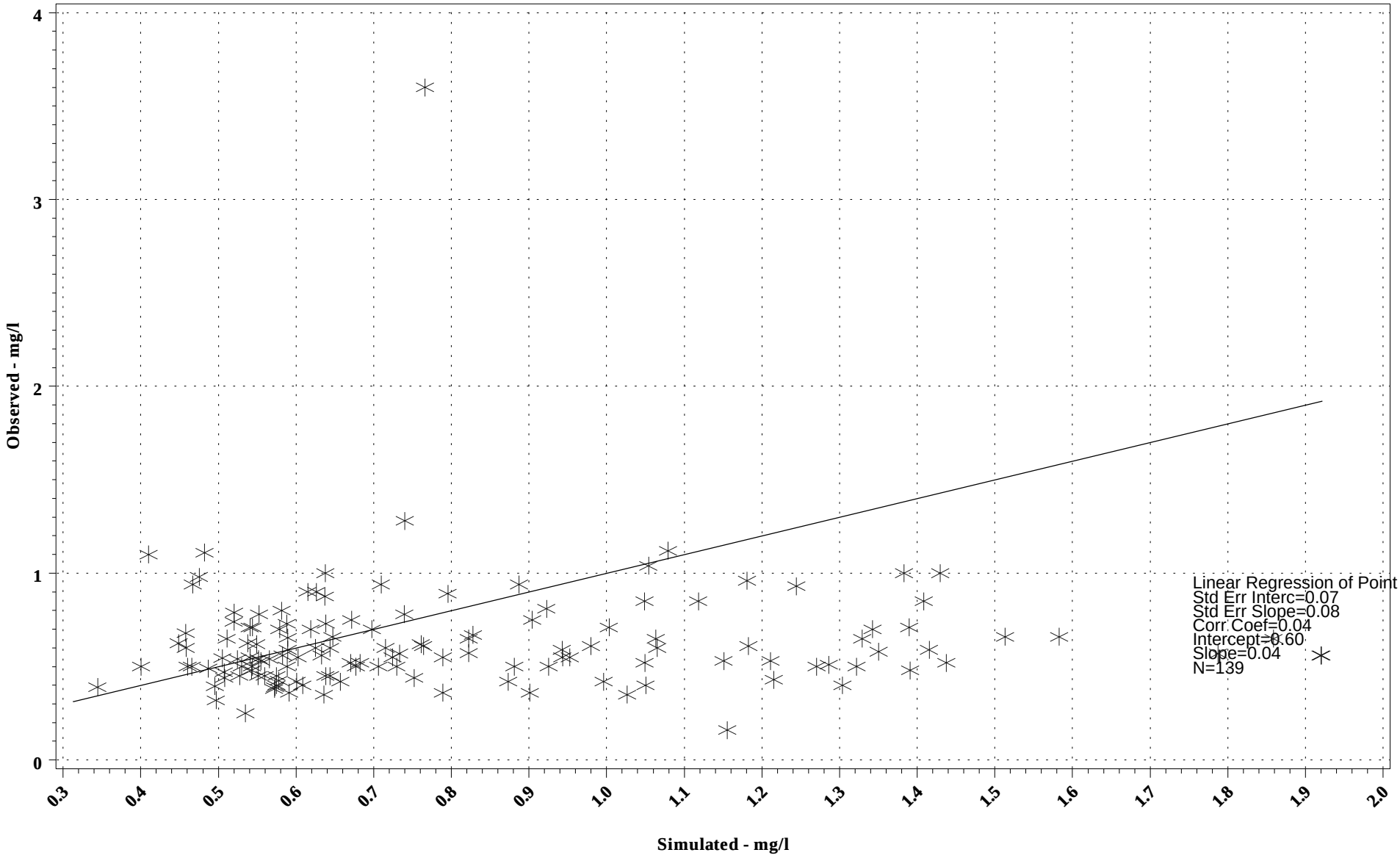



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310

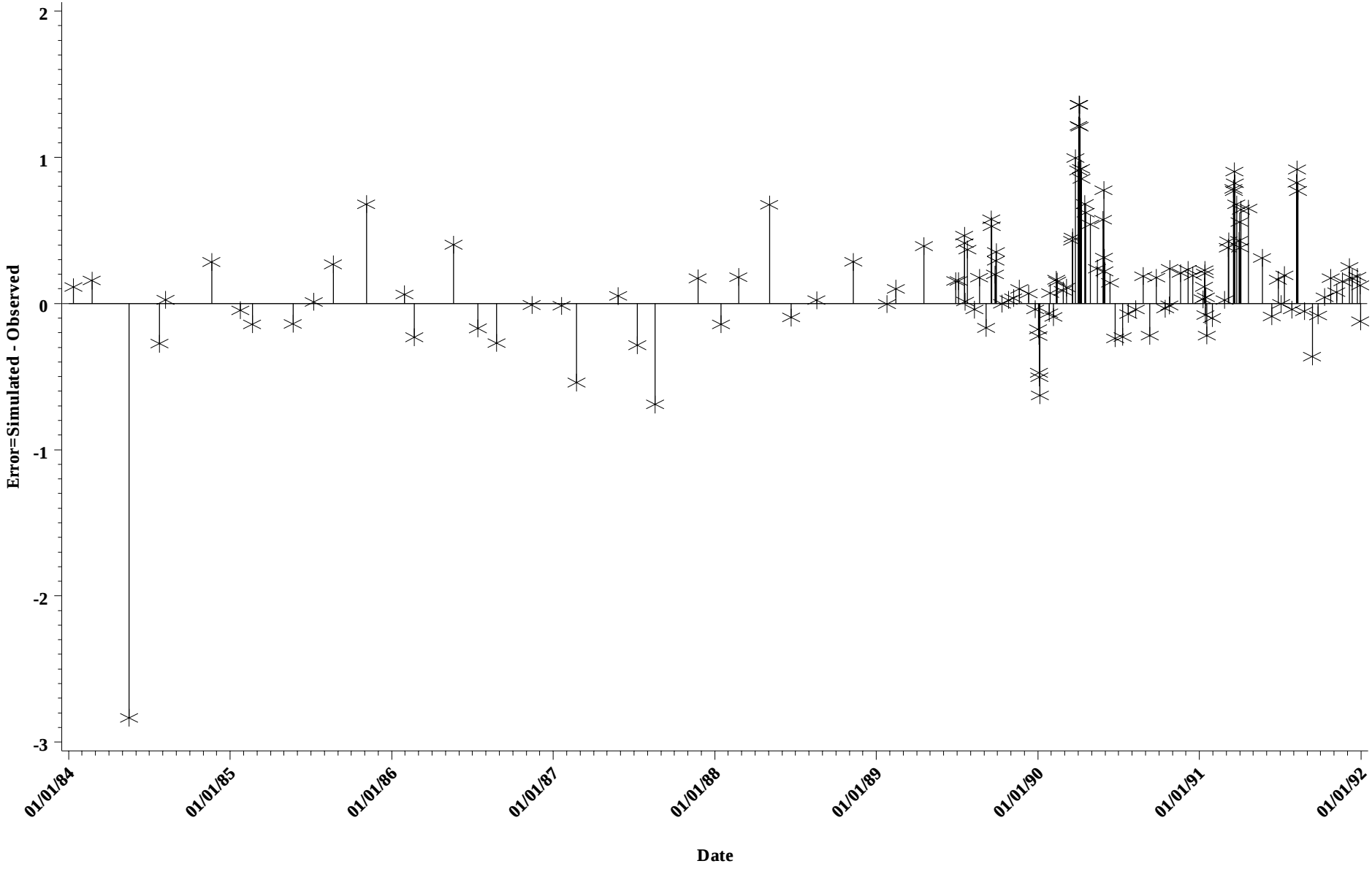
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92



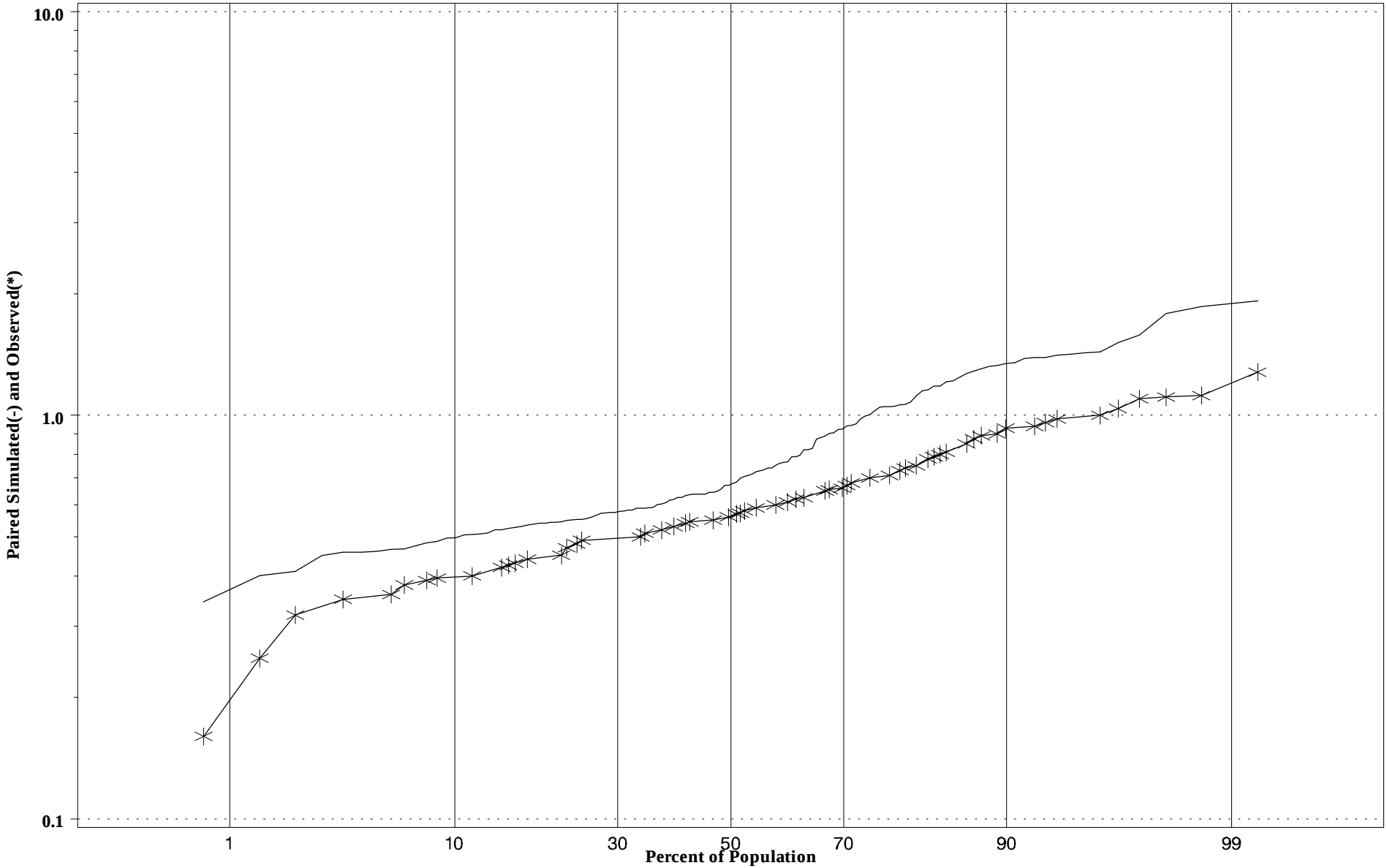

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310
## Actual Error versus Time
## Total Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(appom.drv 29JUN98 14:42)

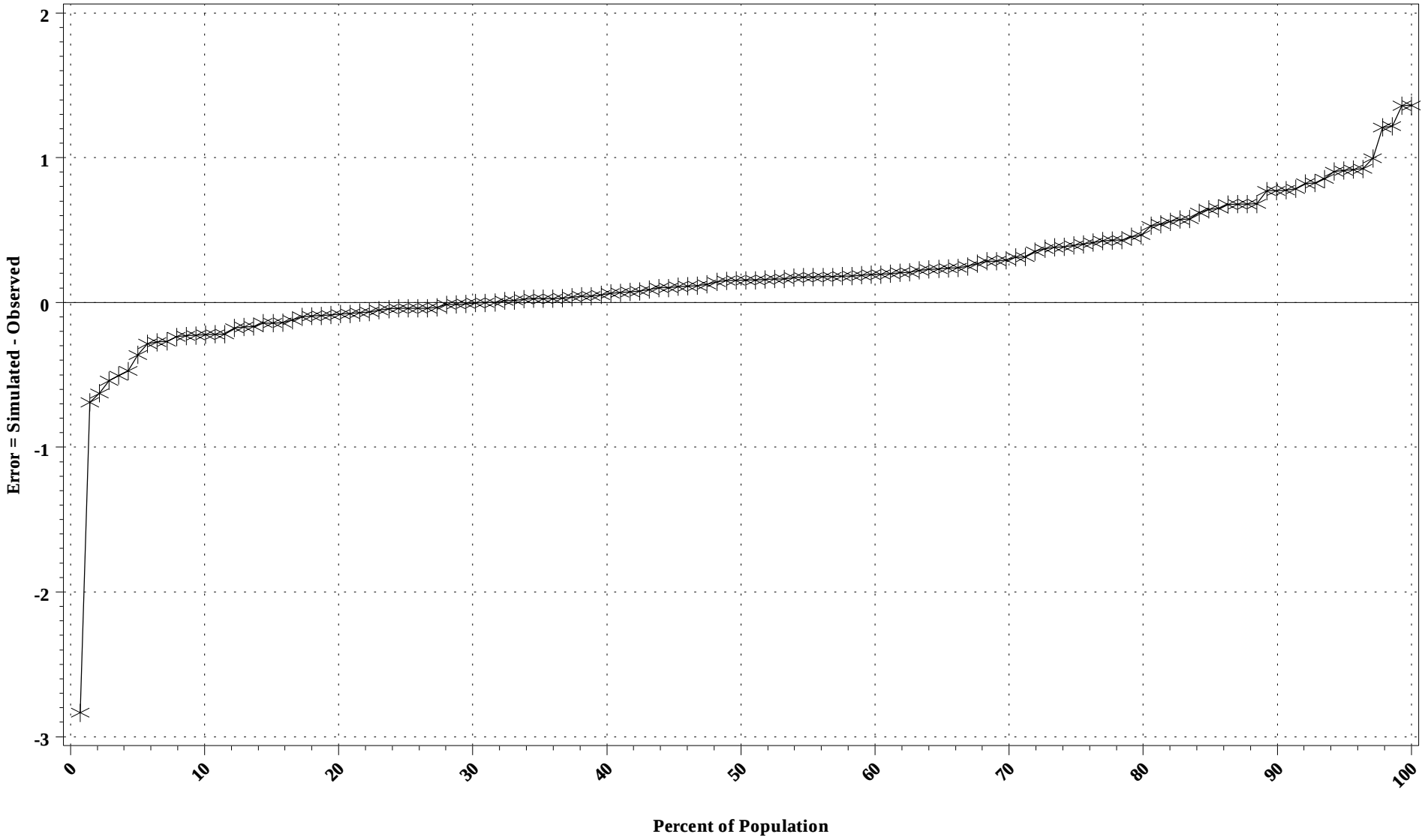
# Appomattox River at Segment 310
## Total Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Actual error versus Percentile Sample Population
## Total Nitrogen

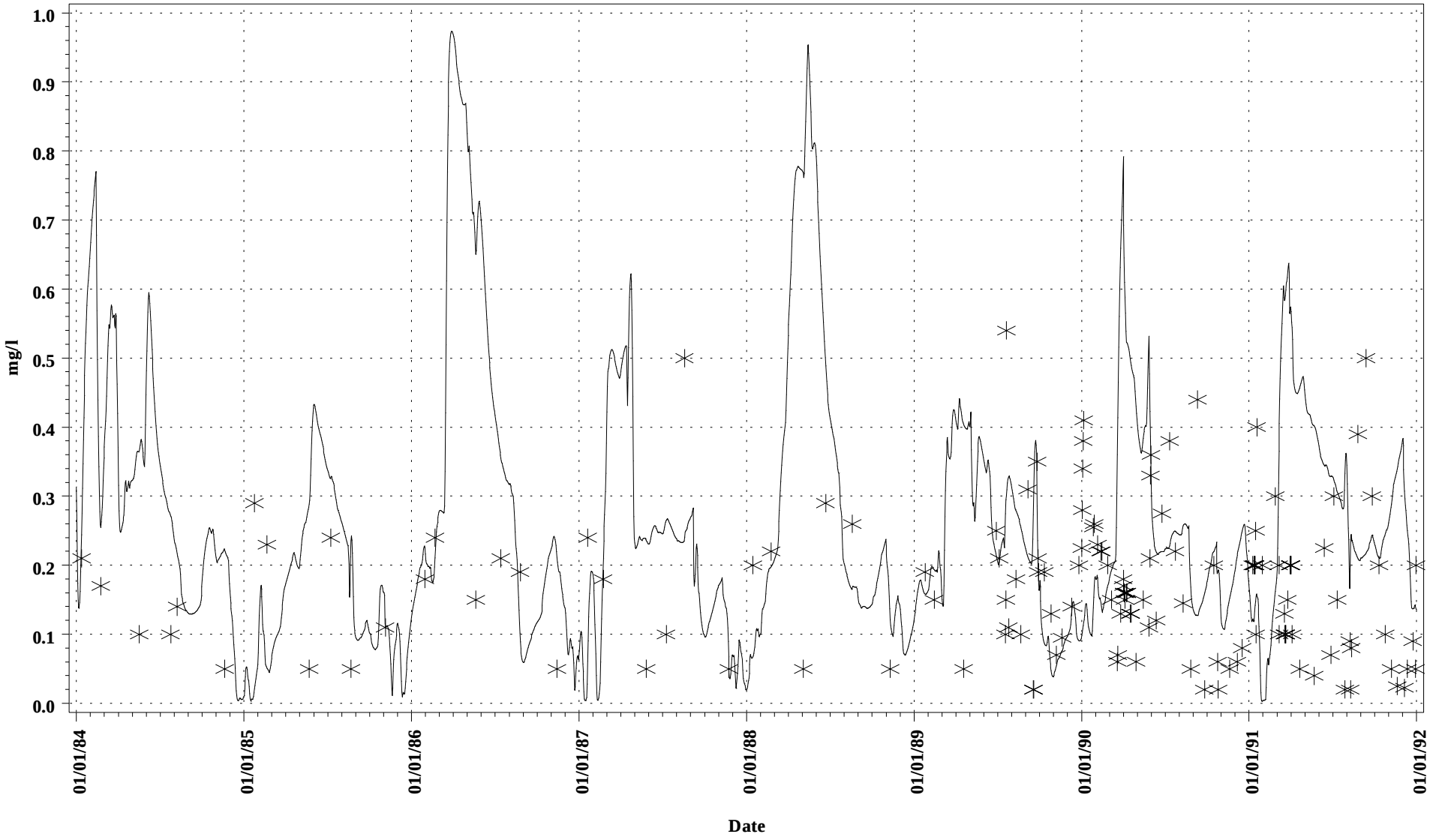
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(appom.drv 29JUN98 14:42)

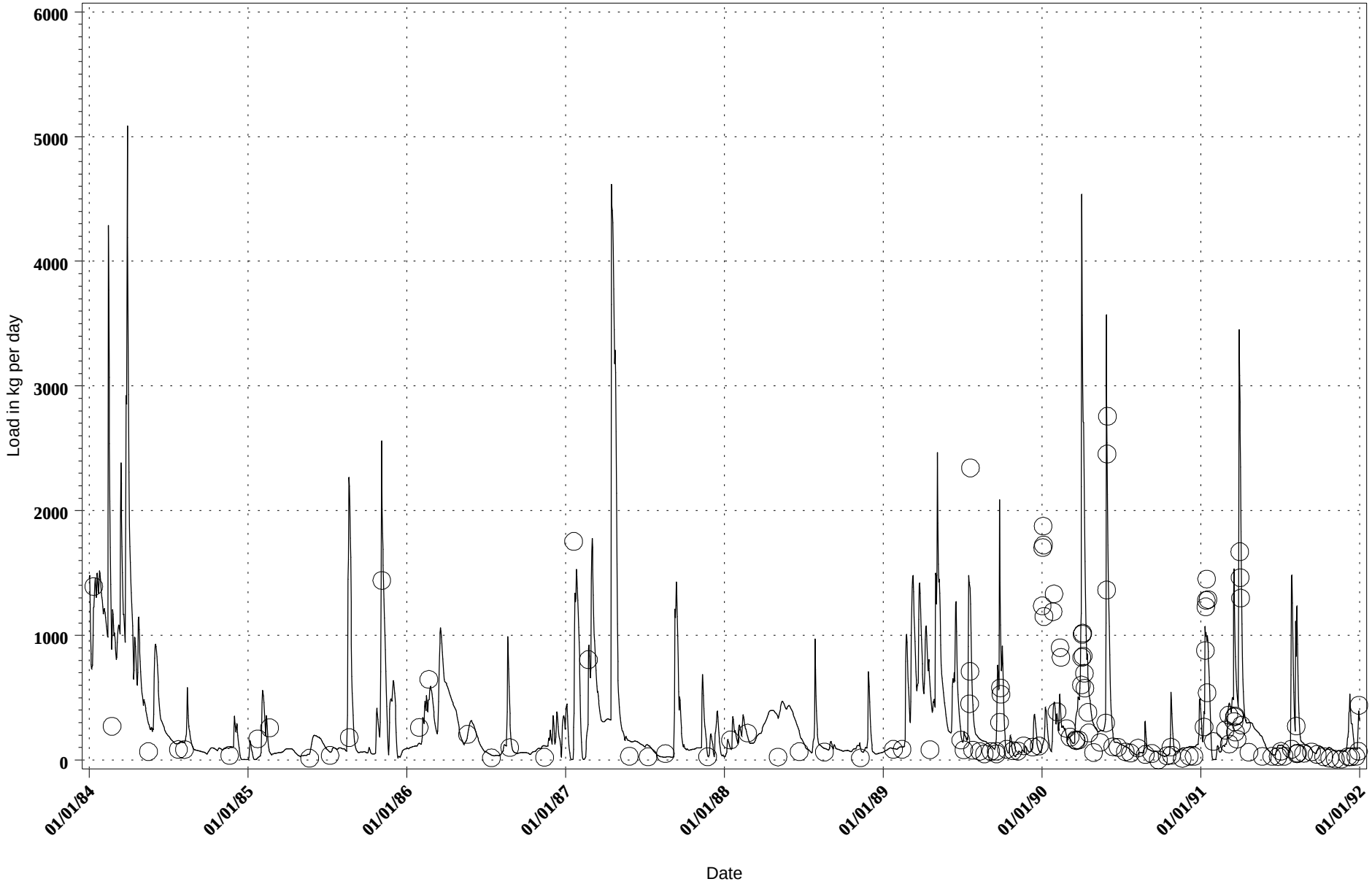
# Appomattox River at Segment 310
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## NO3 Observed and Simulated Load vs Time
### (line = simulated, O = observed)

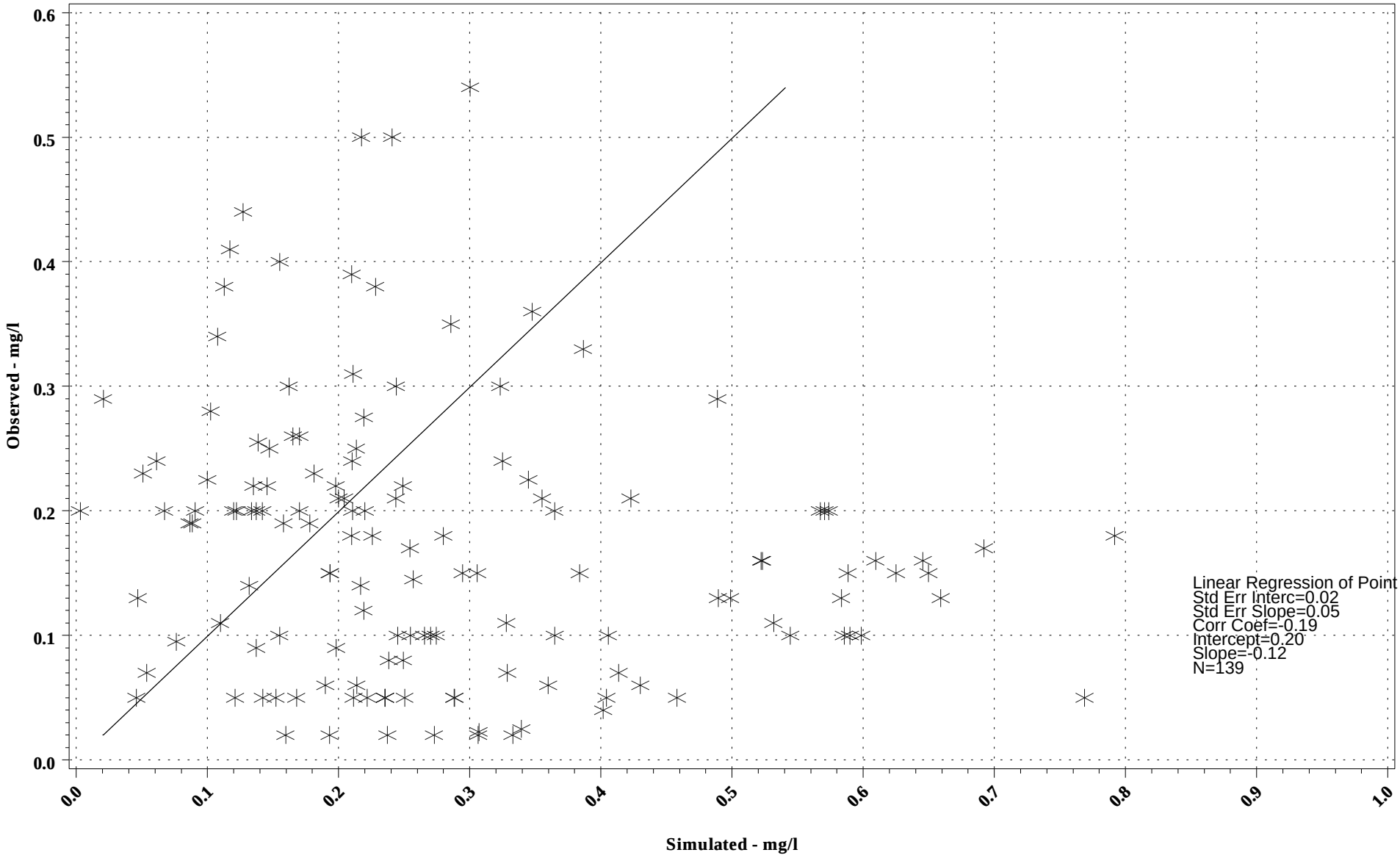



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310

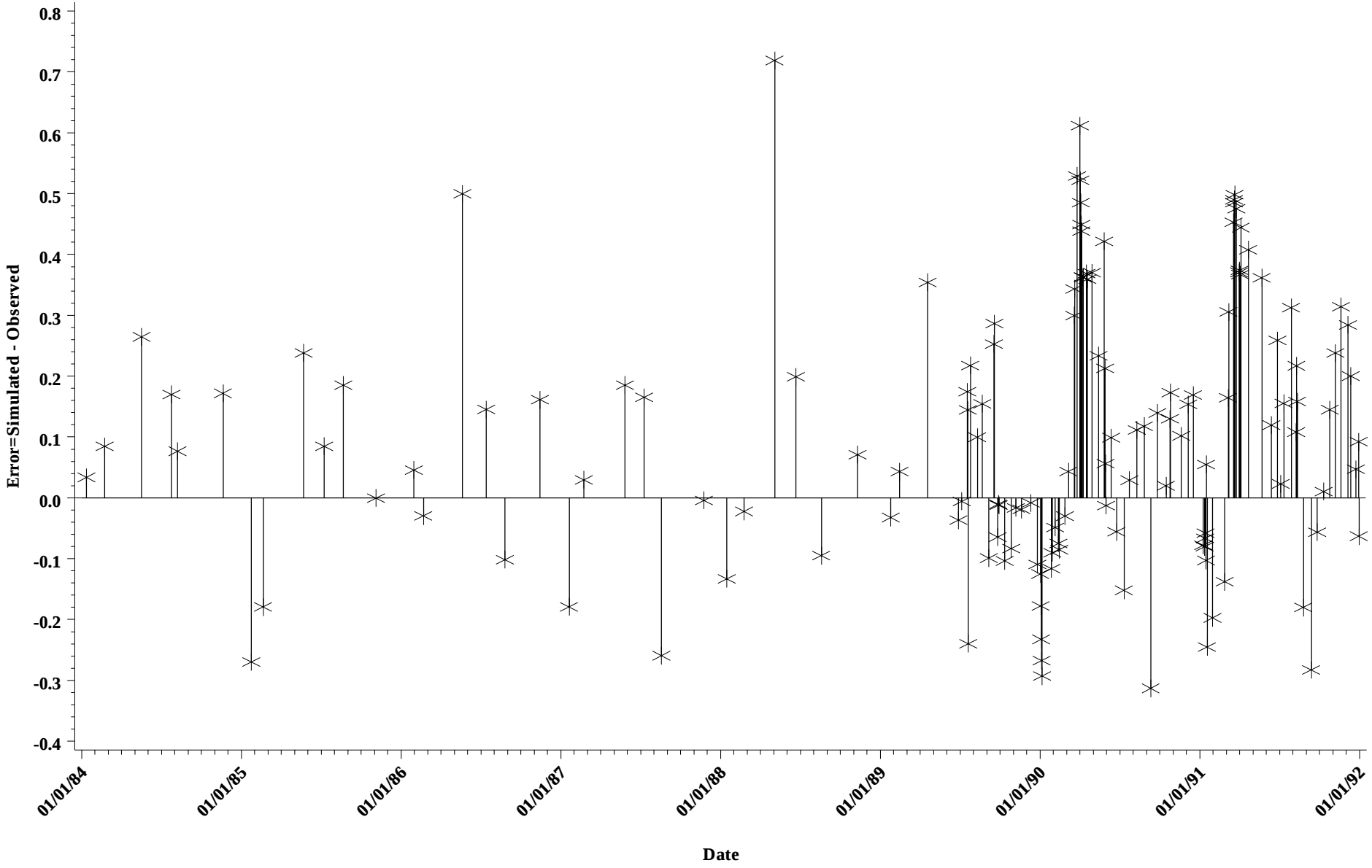
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310
## Actual Error versus Time
## NO3

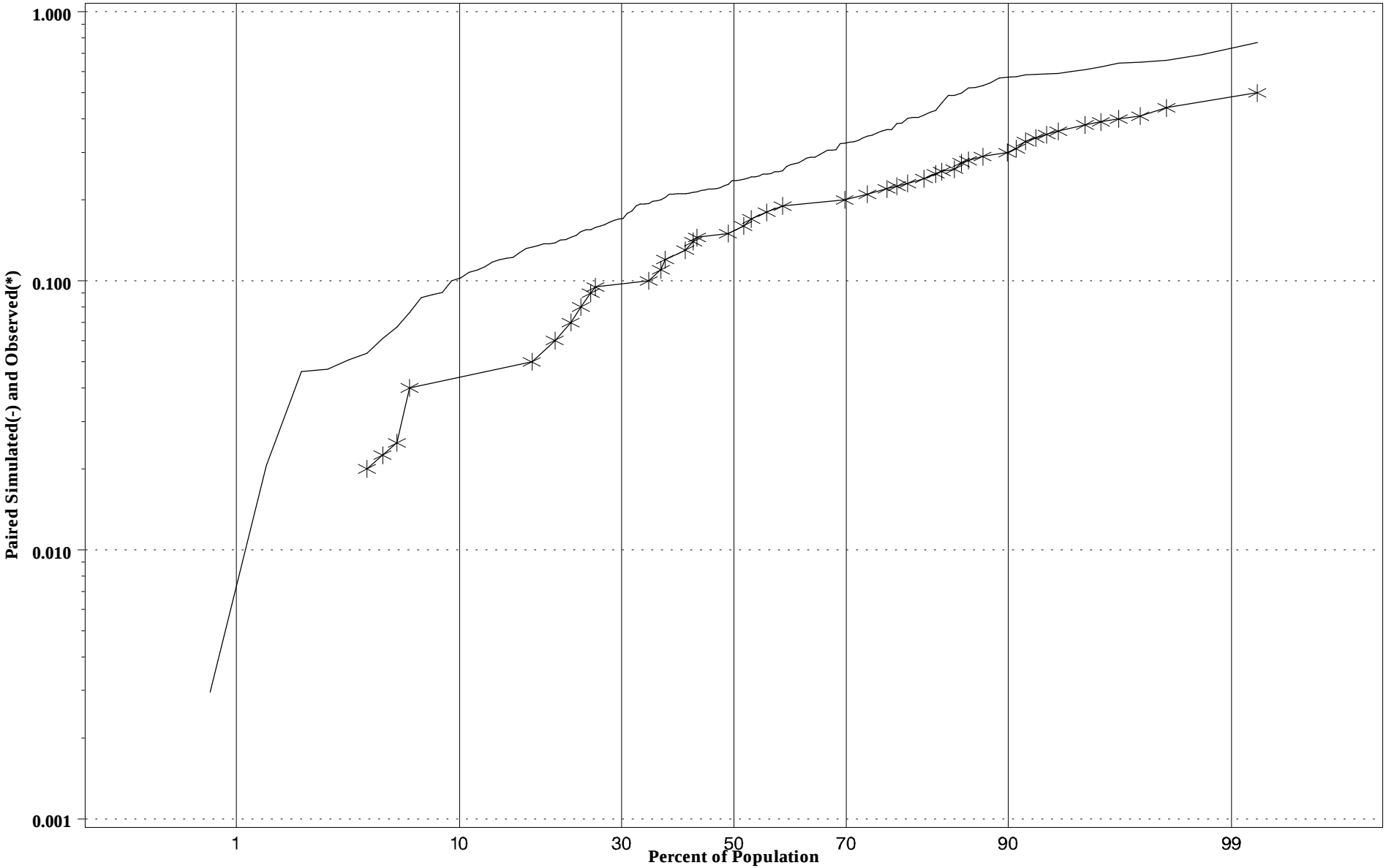



(y21_plotb.sas model3d:[pwang.dt] omerr)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310

## NO3

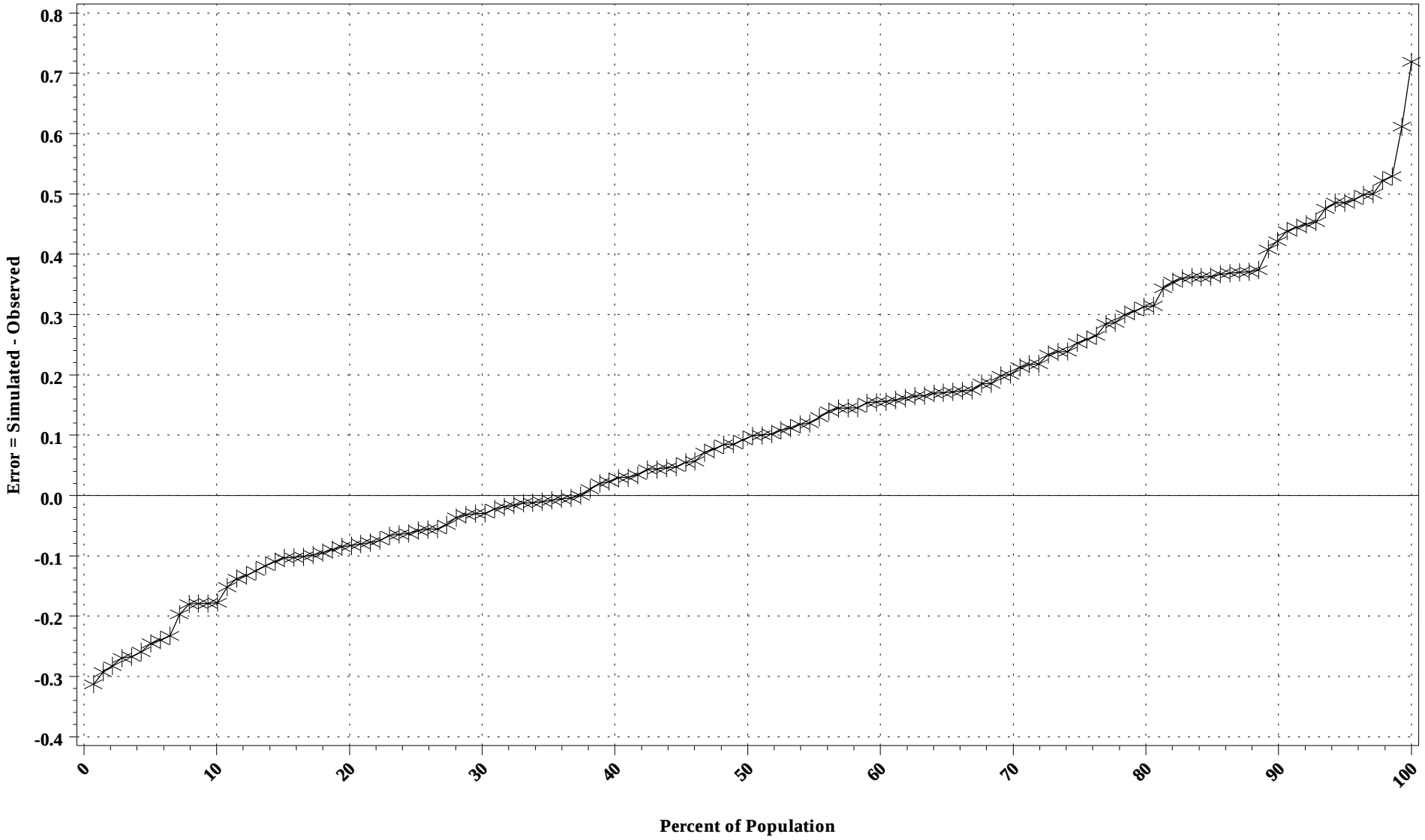
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Actual error versus Percentile Sample Population
## NO3

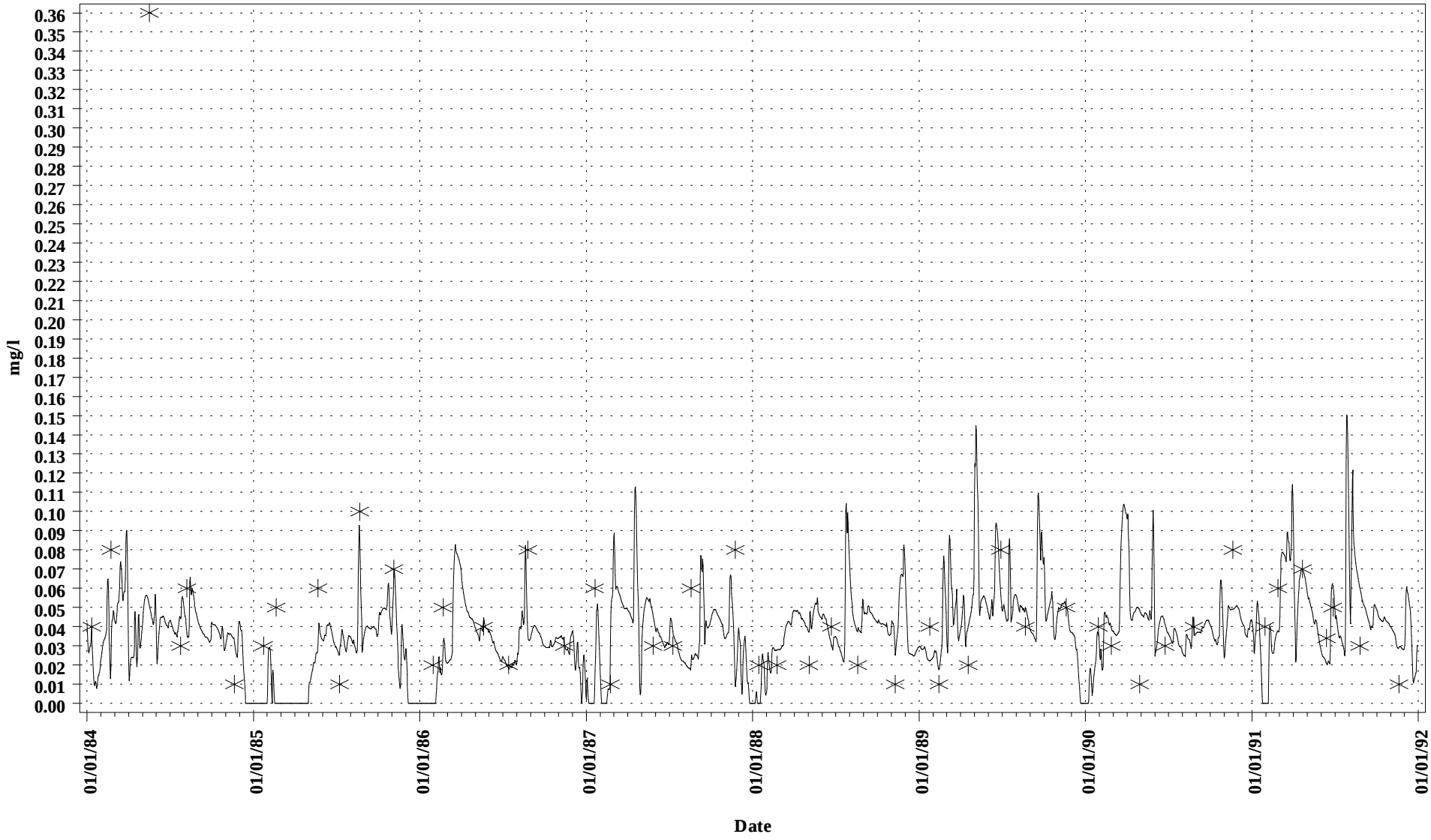
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(appom.drv 29JUN98 14:42)

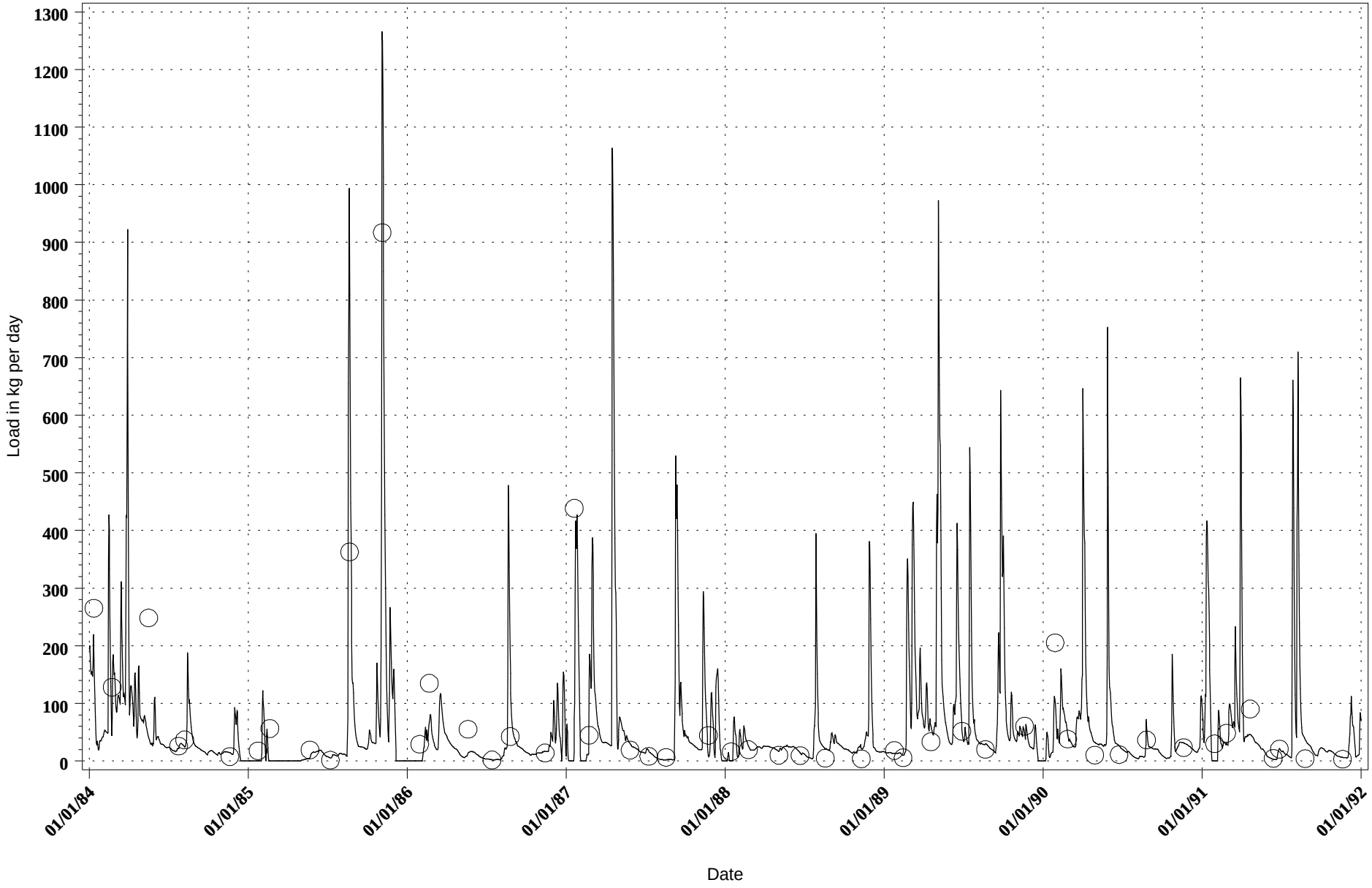
# Appomattox River at Segment 310
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Total Ammonia Observed and Simulated Load vs Time
### (line = simulated, O = observed)

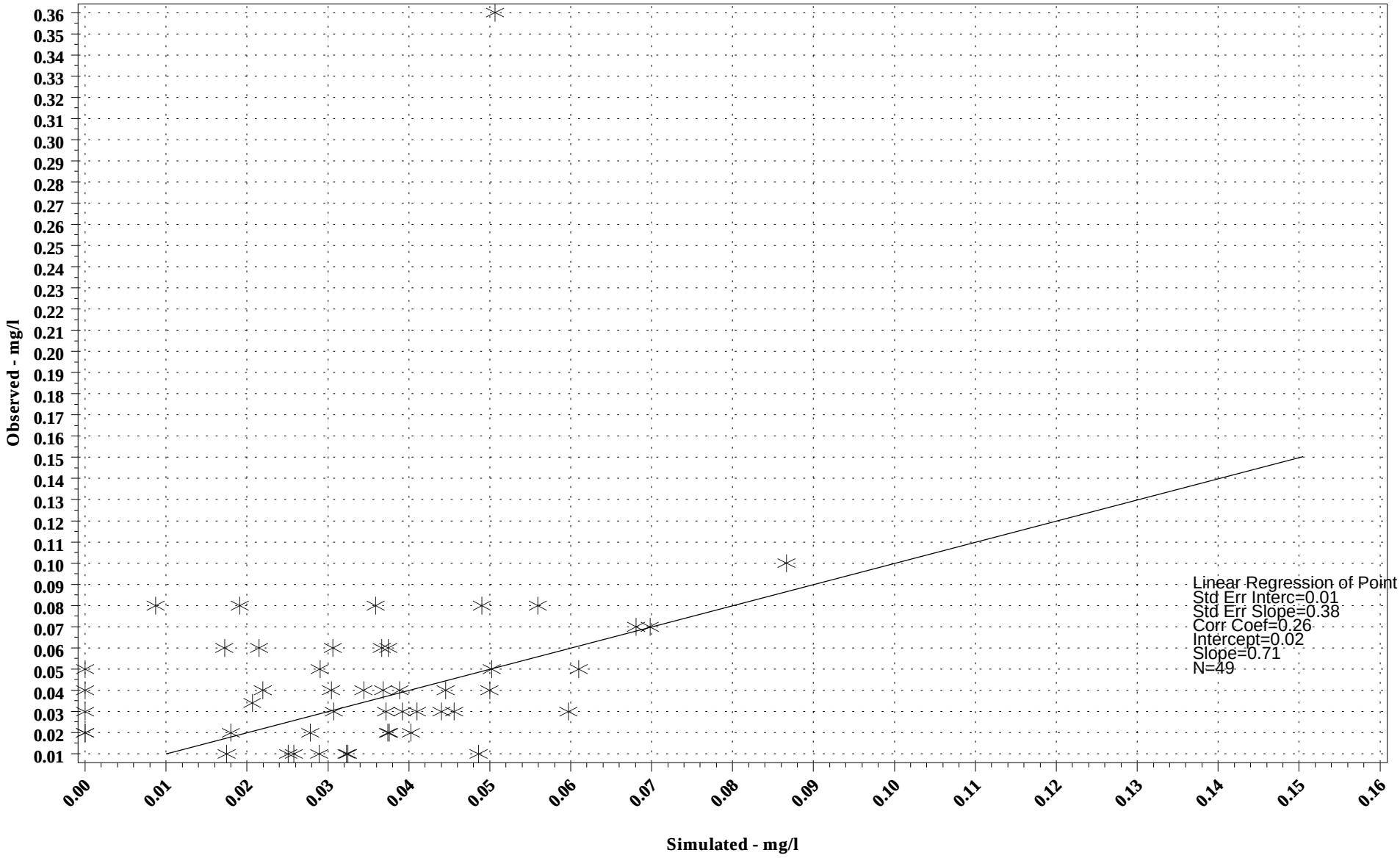



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310

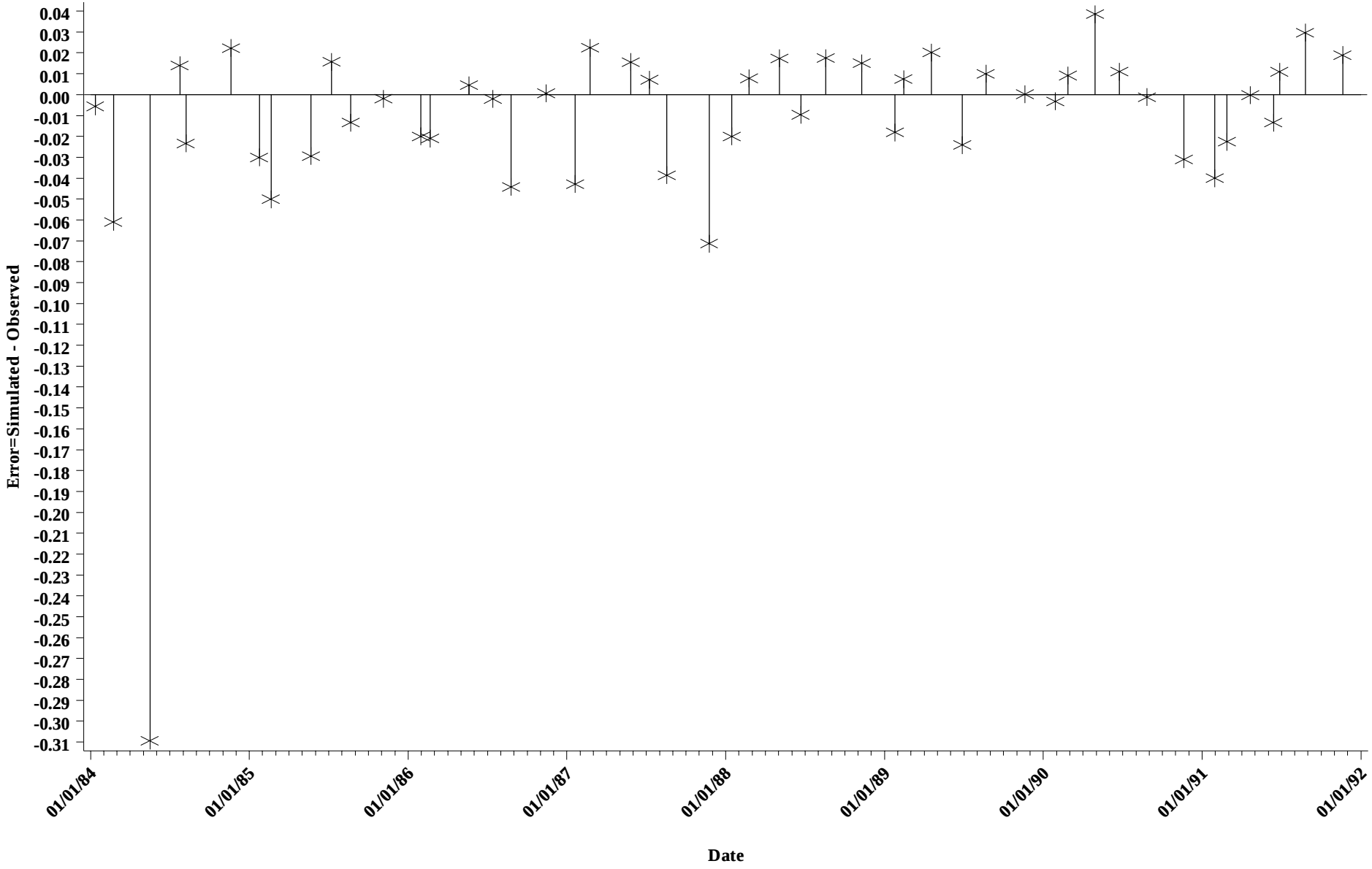
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310
## Actual Error versus Time
## Total Ammonia

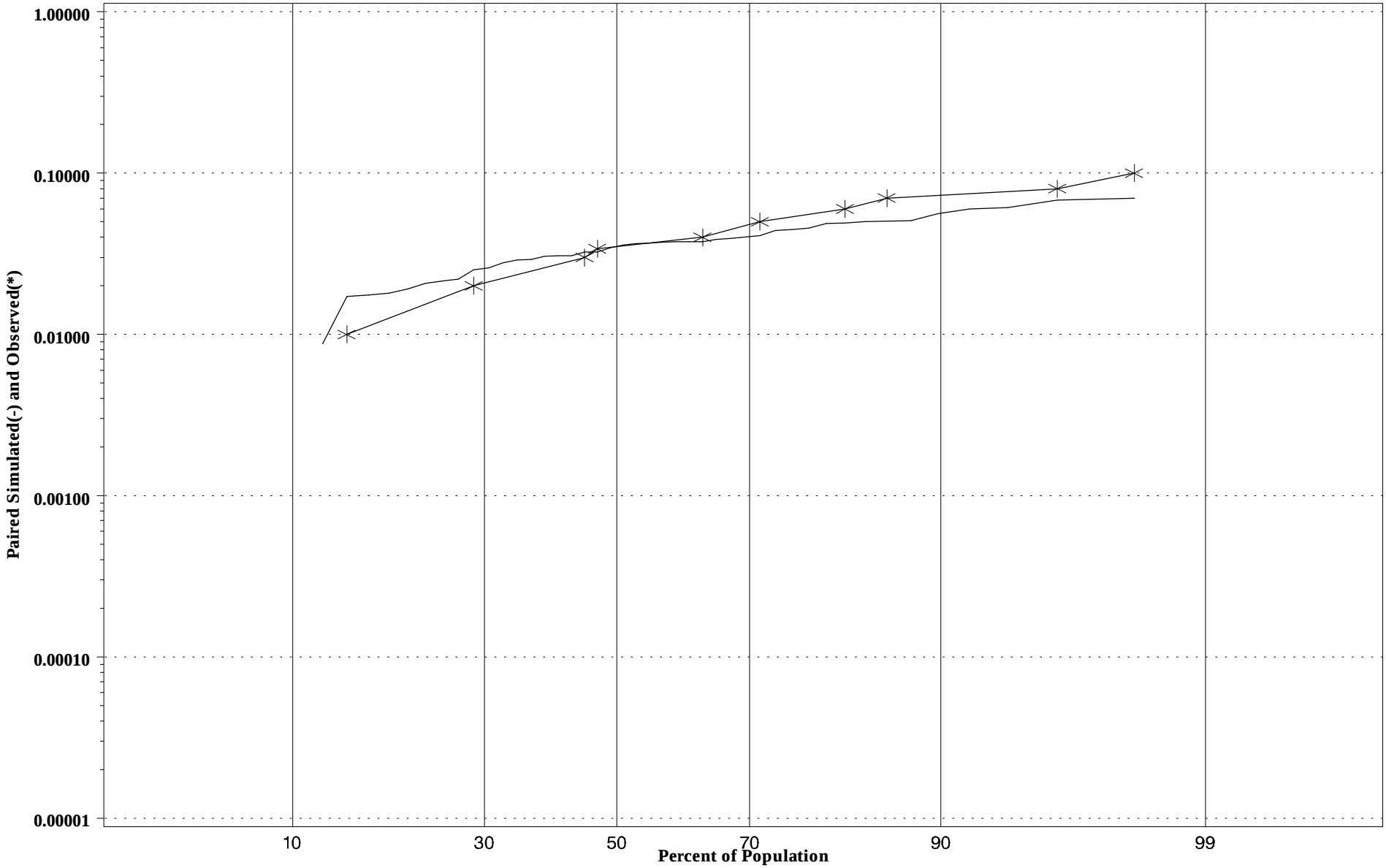



(y21_plotb.sas model3d:[pwang.dt] omerr)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310

## Total Ammonia

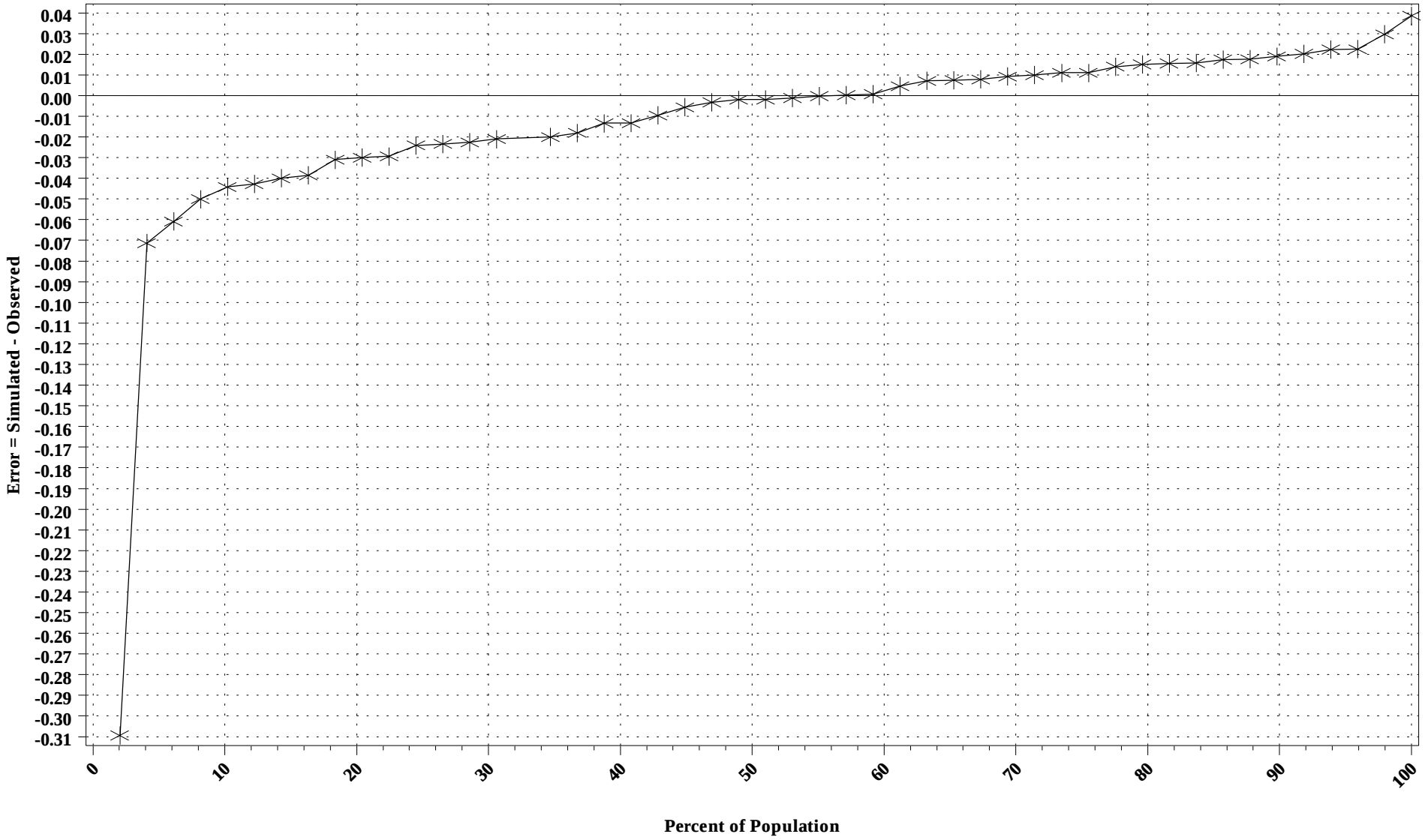
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(appom.drv 29JUN98 14:42)

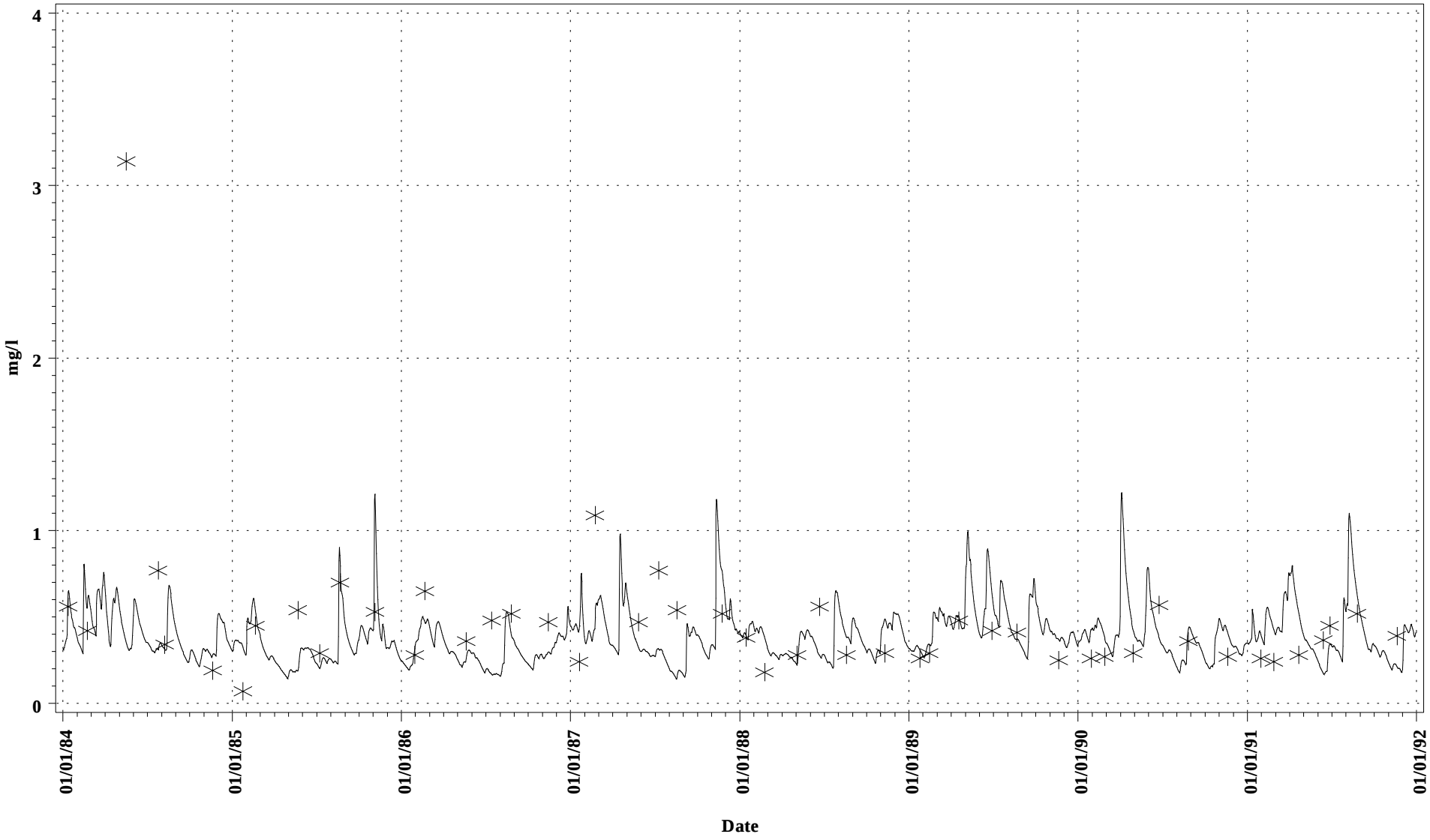
# Appomattox River at Segment 310
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data



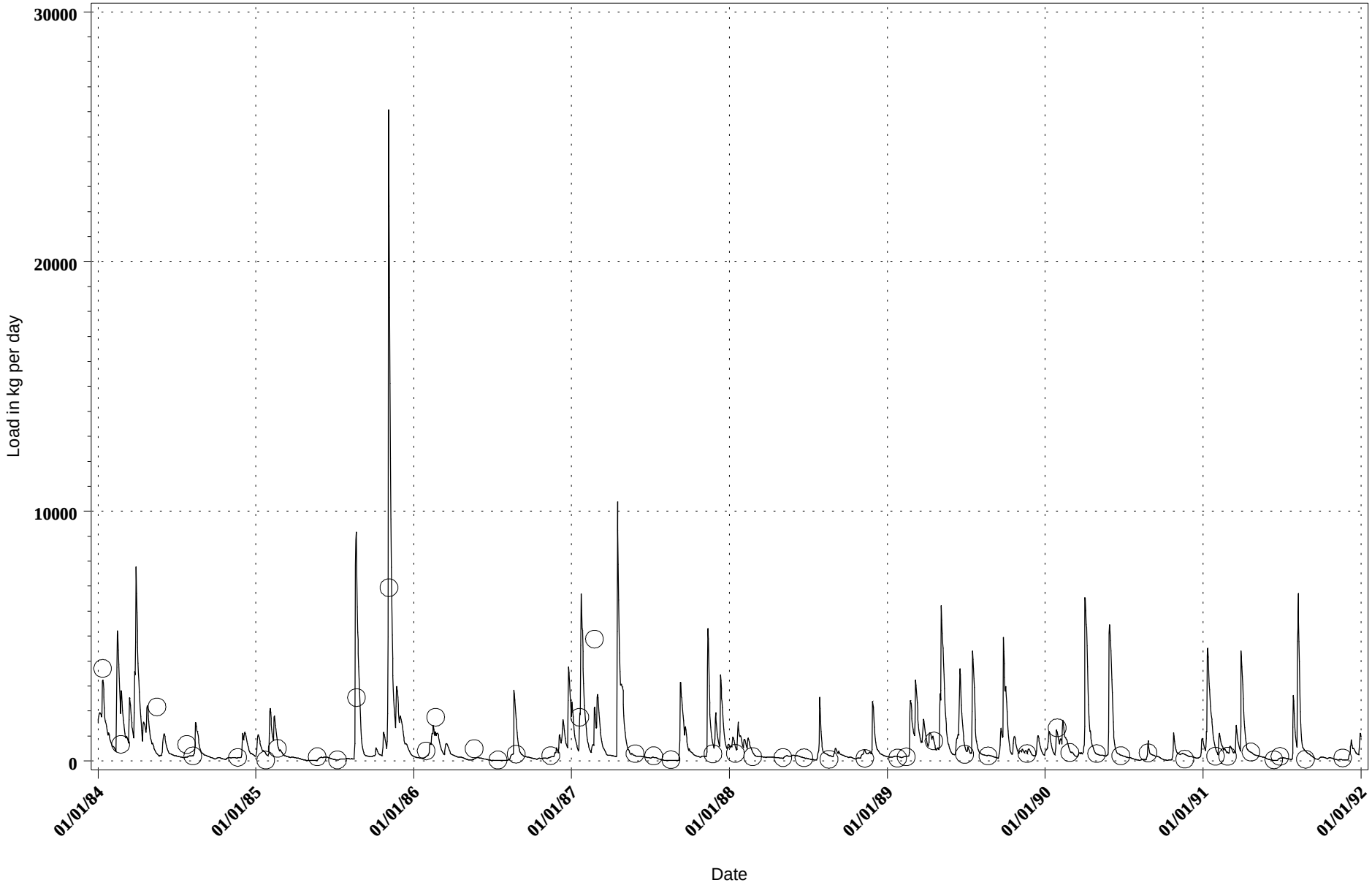

(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Organic Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

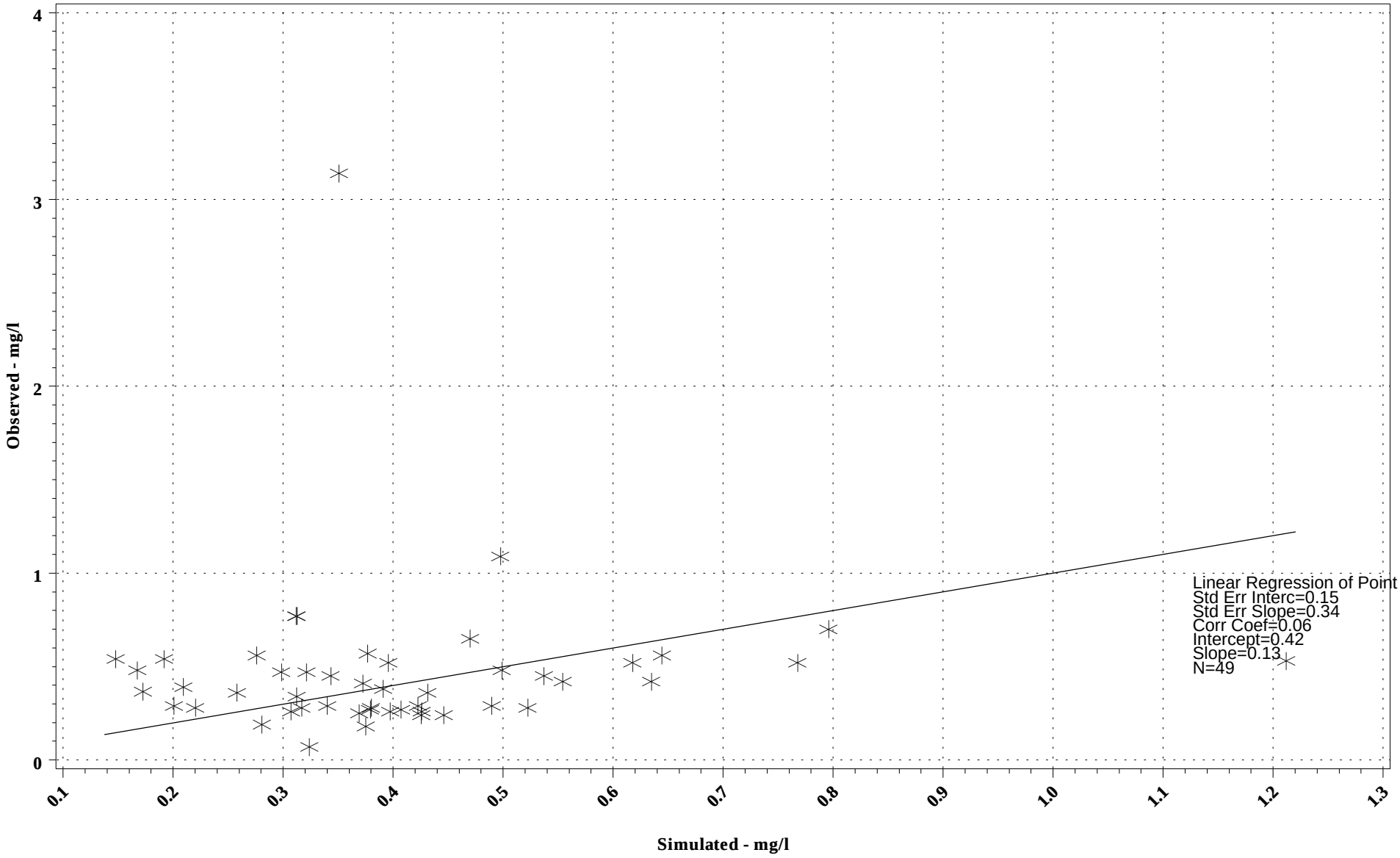



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310

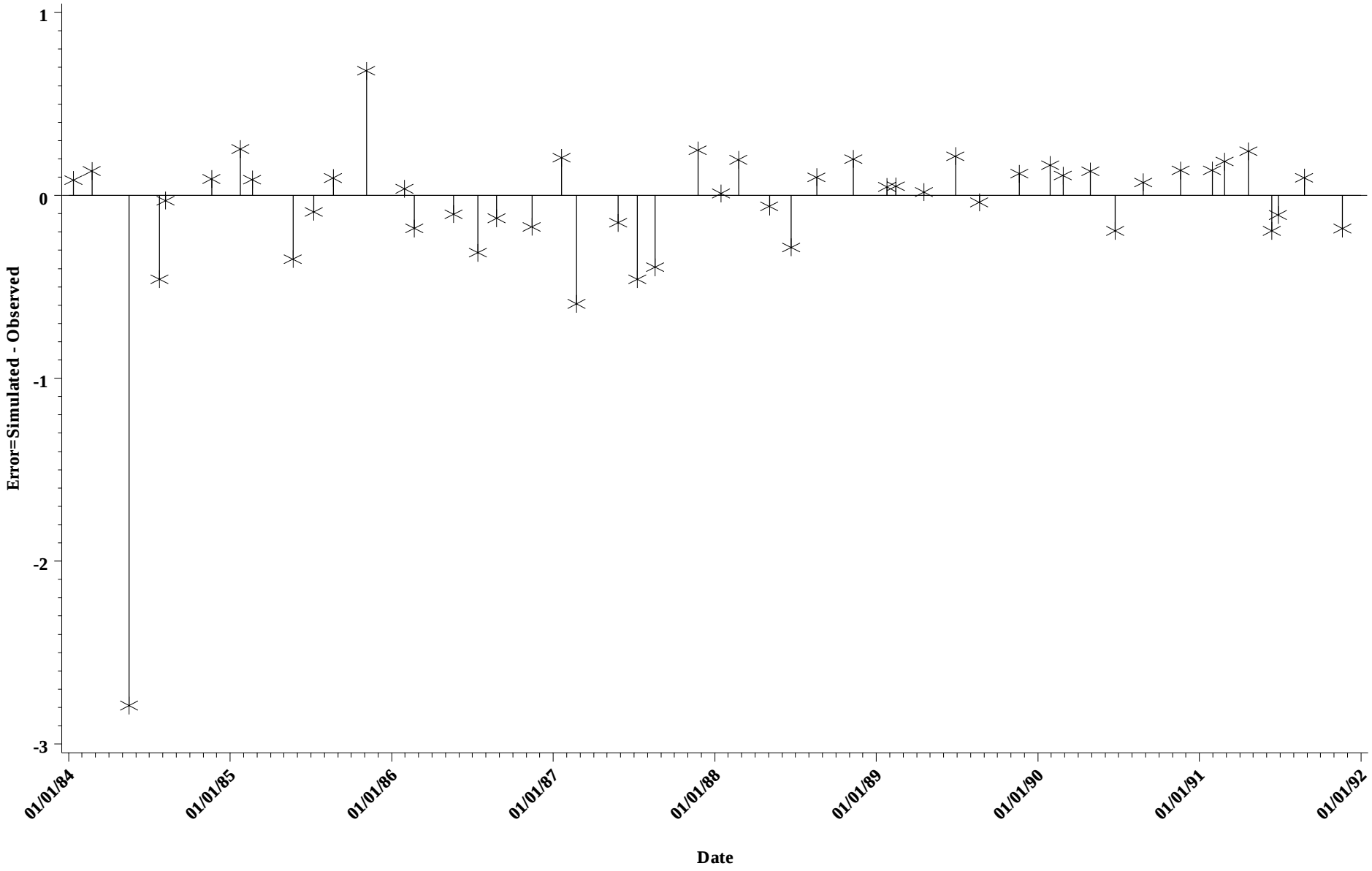
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(appom.drv 29JUN98 14:42,proc reg,model y=x)

# Appomattox River at Segment 310
## Actual Error versus Time
## Organic Nitrogen

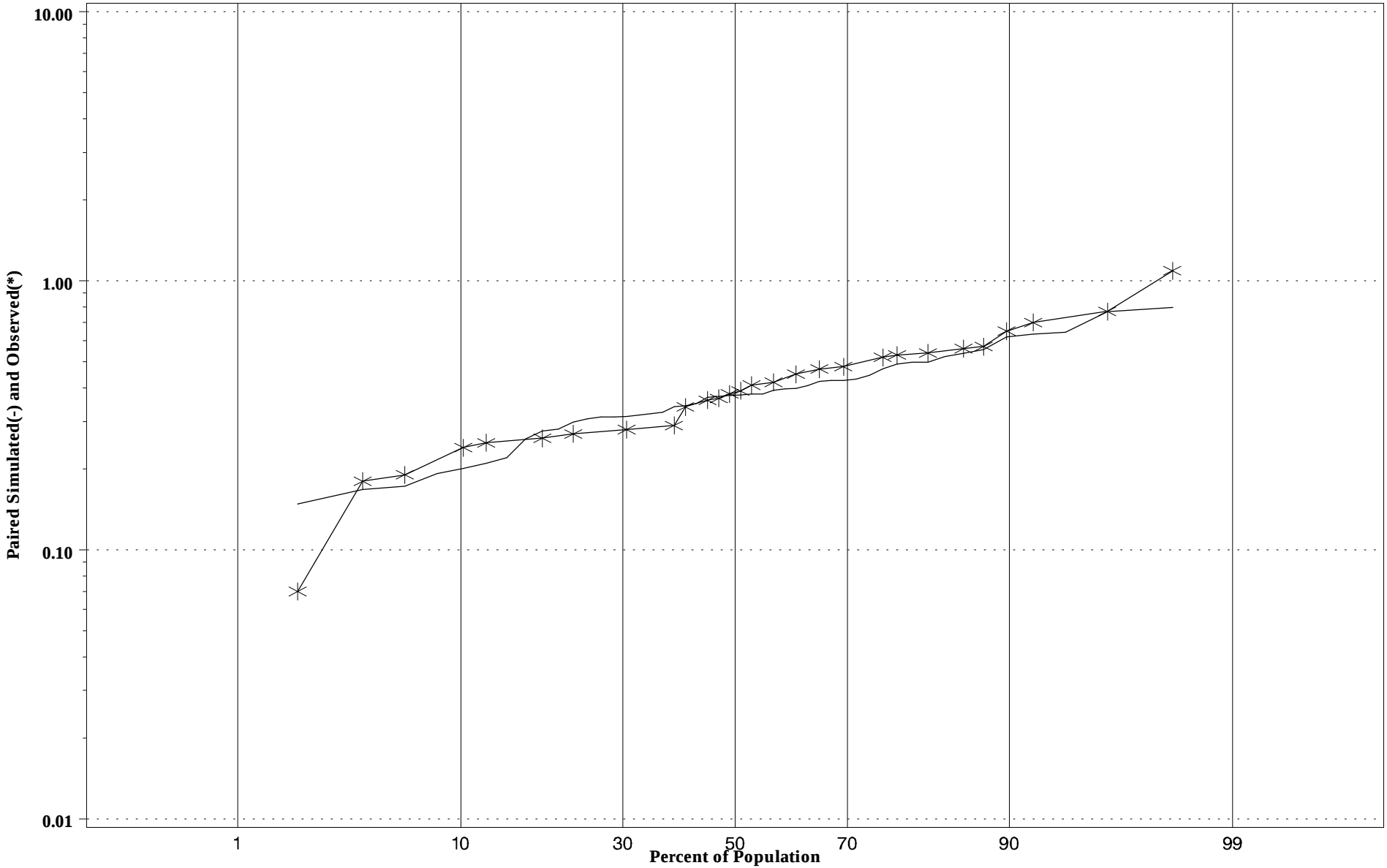



(y21_plotb.sas model3d:[pwang.dt] omerr)
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310

## Organic Nitrogen

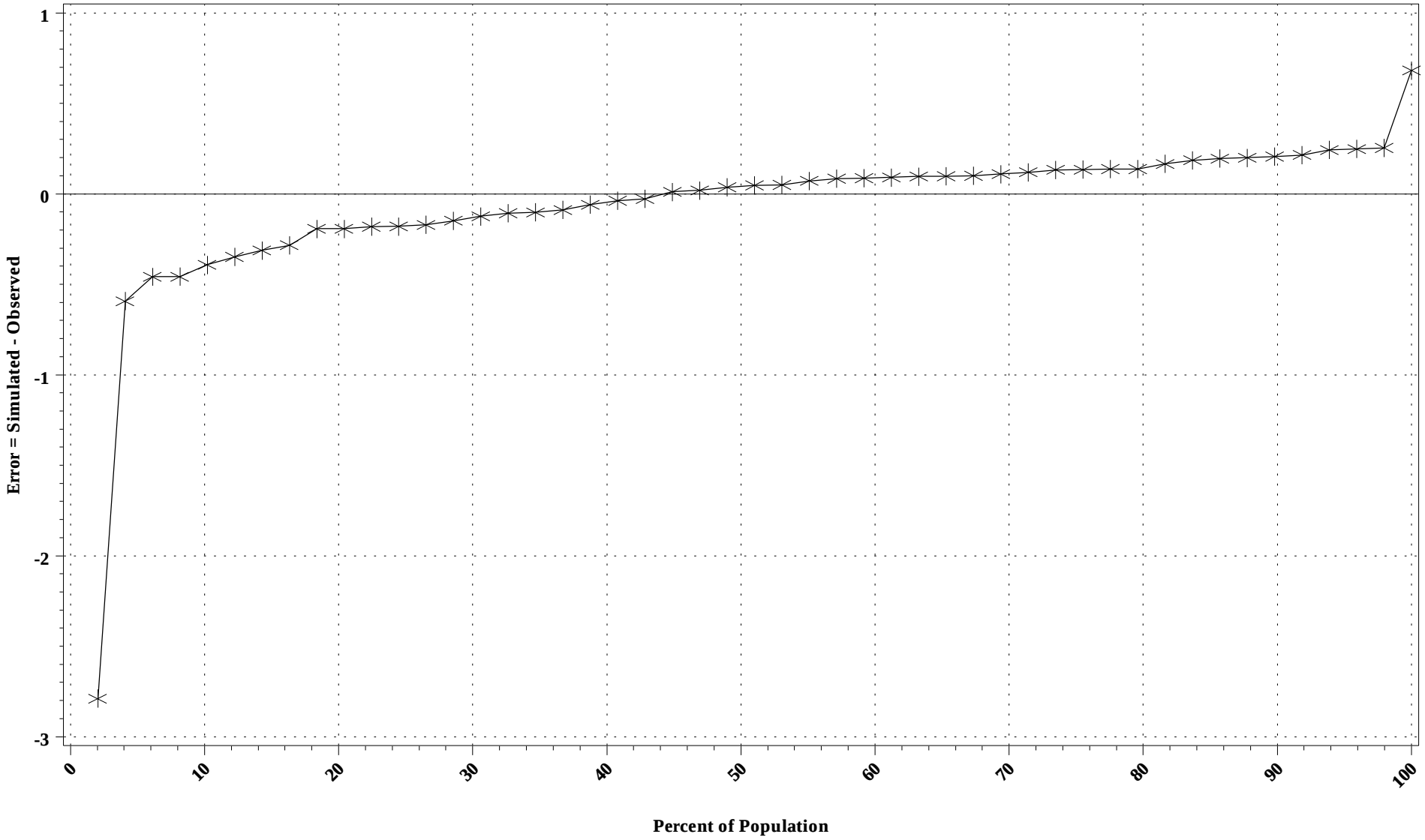
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(appom.drv 29JUN98 14:42)

# Appomattox River at Segment 310
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(appom.drv 29JUN98 14:42)

# B.7.0 Choptank River Basin

***Basin Segments:***

Above Fall Line Basin Segments: 770
Below Fall Line Basin Segments: 400

***Section Contents:***

### *B.7.1 Choptank River near Greensboro, MD at Segment 770 (Monitoring Station: 1491000) (Above Fall Line Basin Segments: 770)*

**Section Summary:**

The Choptank basin water quality gage is in the upper reaches of the Choptank river in land characterized as poorly drained and with less agriculture than in the downstream areas of the Choptank. The Choptank basin above the gaged site covers an area of 582 square miles. At the midpoint of the simulation period, 1990, the land use for the basin was composed of 31% forest land, 54% cropland, 10% other agricultural areas, 4% urban areas, and 1% water (river and lake) surface area.

Based on an average hydrology used in a 1985 Reference scenario and a 1996 Nutrient Reduction Progress scenario estimated total nitrogen delivered to the gage decreased from 4.0 million pounds in 1985 to 3.6 million pounds in 1996. Total phosphorus loads over the same time period decreased from 0.36 million pounds to 0.28 million pounds. In general, point source loads above the gage site decreased. In 1996, the total nitrogen point source load was 5% of the total load and the total phosphorus point source load was 17% of the total load. Estimated septic system total nitrogen loads increased 16%, from 0.11 million pounds in 1985 to 0.12 million pounds in 1996.

Over the 1985 to 1996 period, changes in the land use and BMP simulation decreased estimated cropland total nitrogen loads by 20%, and other agricultural loads (primarily pasture and manure loads) by 32%. Total phosphorus decreased for these land uses by 21% and 43% respectively. Urban loads were estimated to have increased over the 1985 to 1996 period by 10% for both total nitrogen and total phosphorus due to increases in population and urban land use area.

## Graphs

Observed and Simulated Concentrations versus Date
Observed and Simulated Loads versus Date
Scatter Plot and Regression of Simulated versus Observed
Actual Error versus Date
Relative Error versus Percentile Sample Population
Actual Error versus Percentile

## Parameters

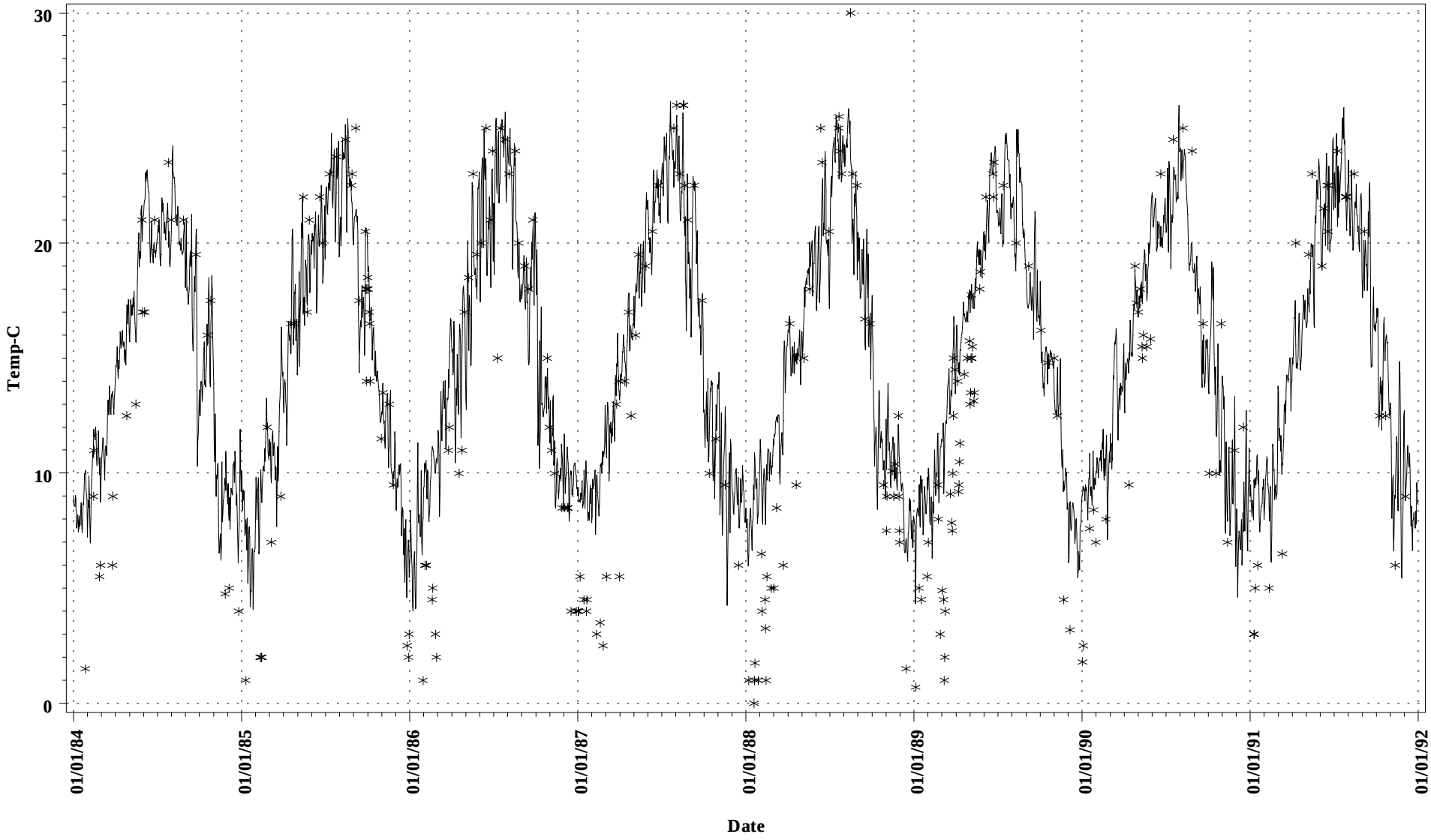
Temperature
Dissolved Oxygen
Total Suspended Sediment
Total Phosphorus
Organic and Particulate Phosphorus
Phosphate
Total Nitrogen
Nitrate
Total Ammonia
Organic Nitrogen

## Exceptions

Observed and Simulated Loads versus Date -- Temperature

# Choptank River at Segment 770
## Observed and Simulated versus Time
## Temperature-C

**(*=Observed, -=Simulated)**

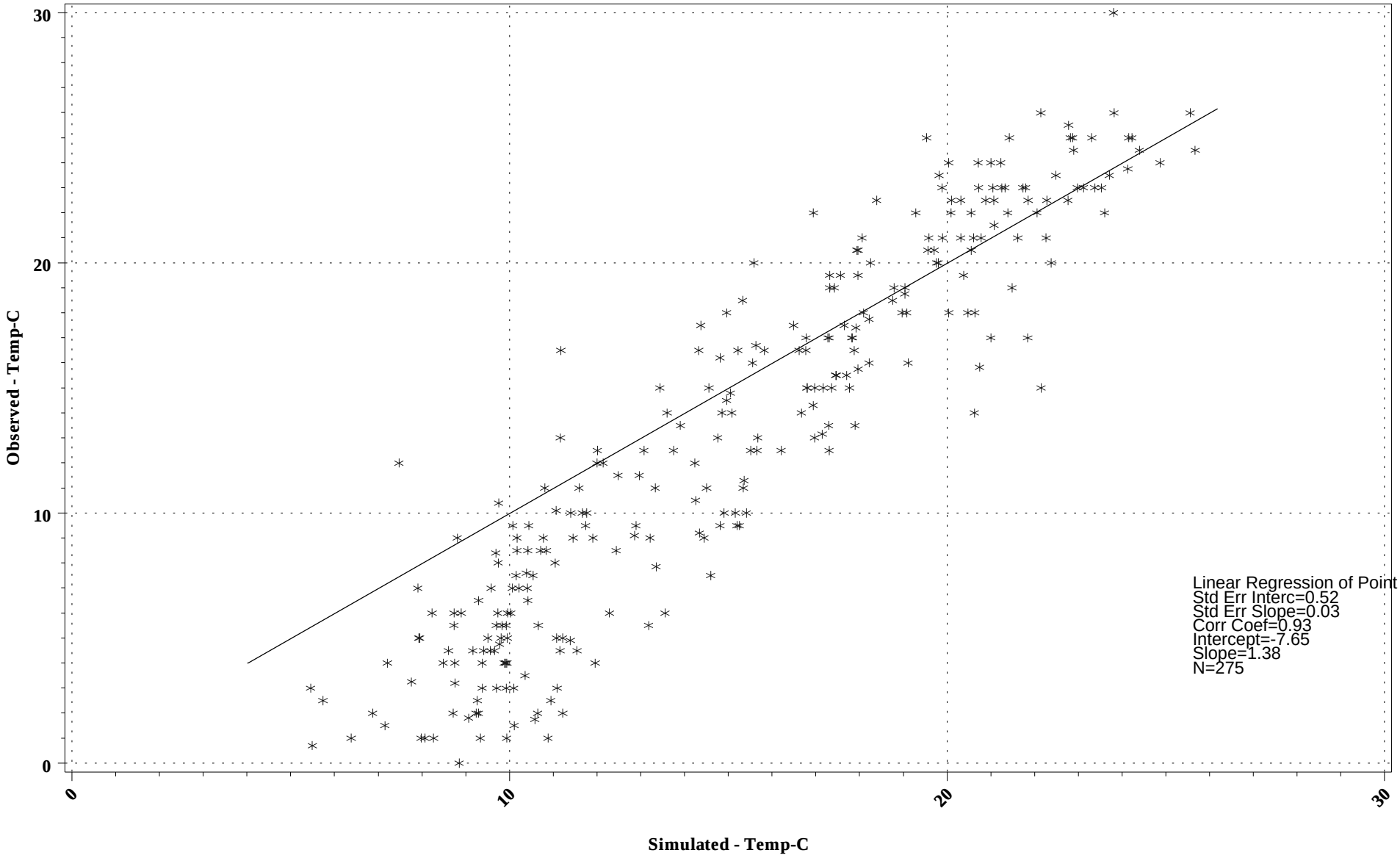



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770

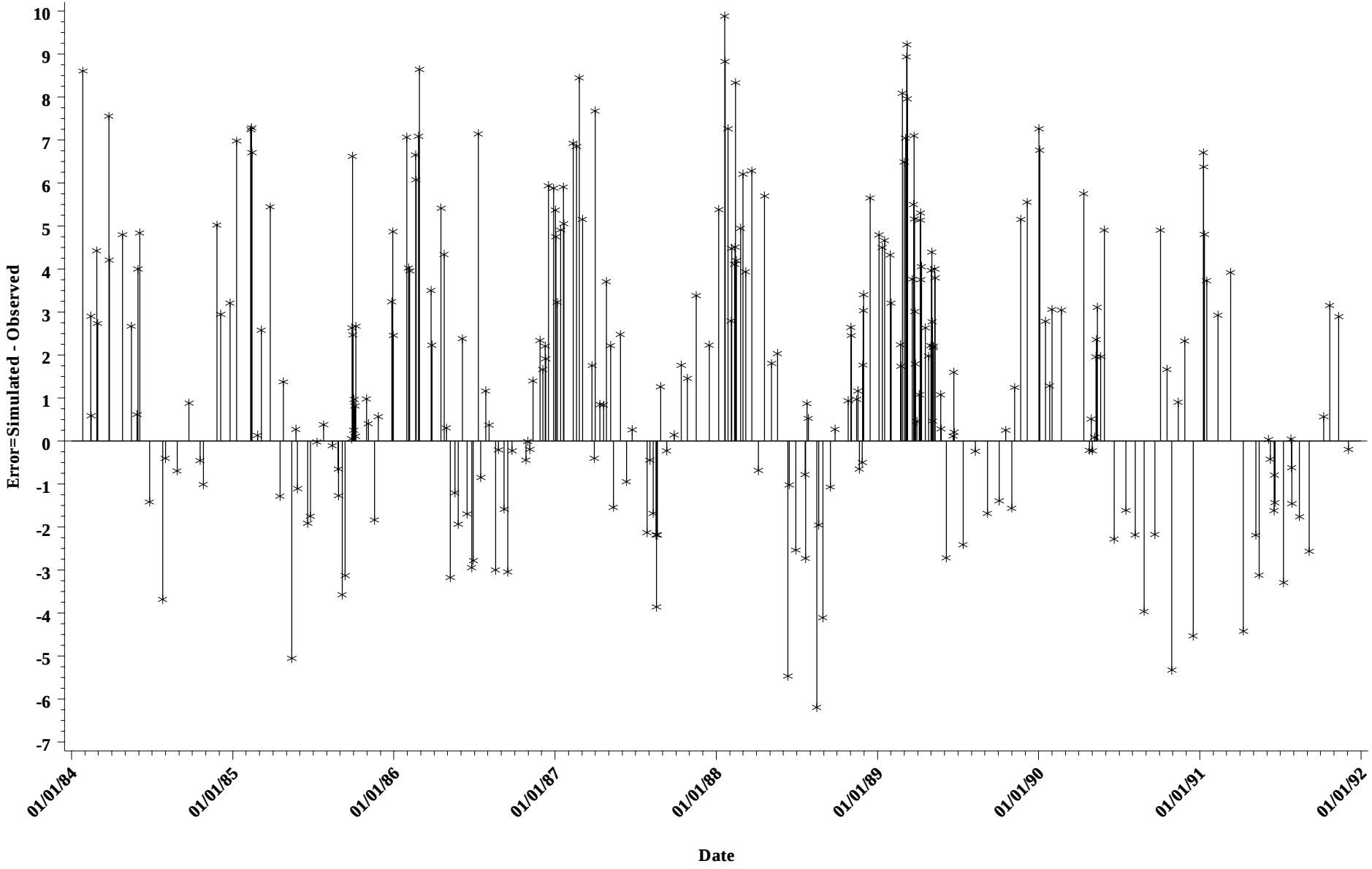
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Temperature-C: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770
## Actual Error versus Time
## Temperature-C

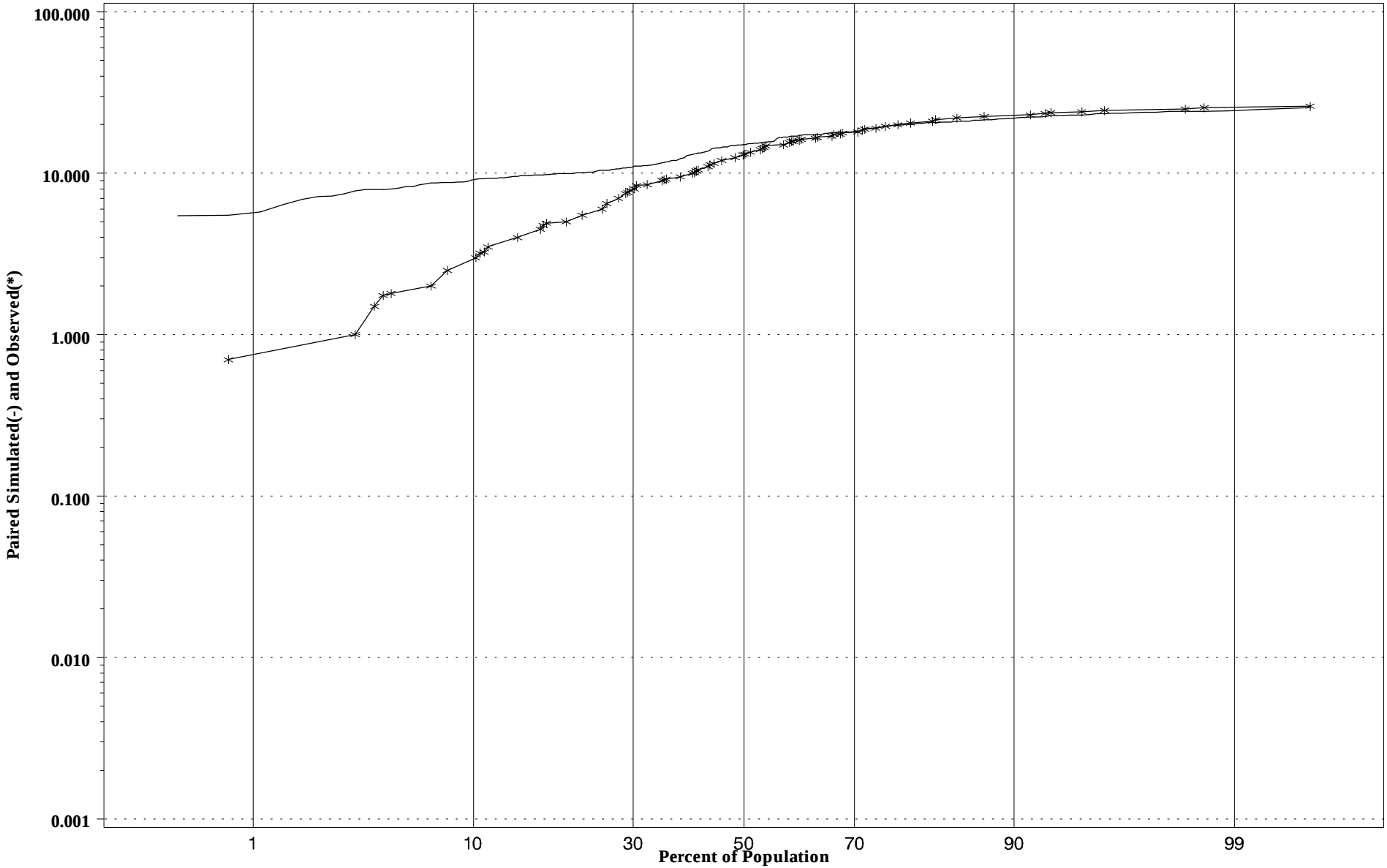



(y21_plotb.sas model3d:[pwang.dt] omerr)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770

## Temperature-C

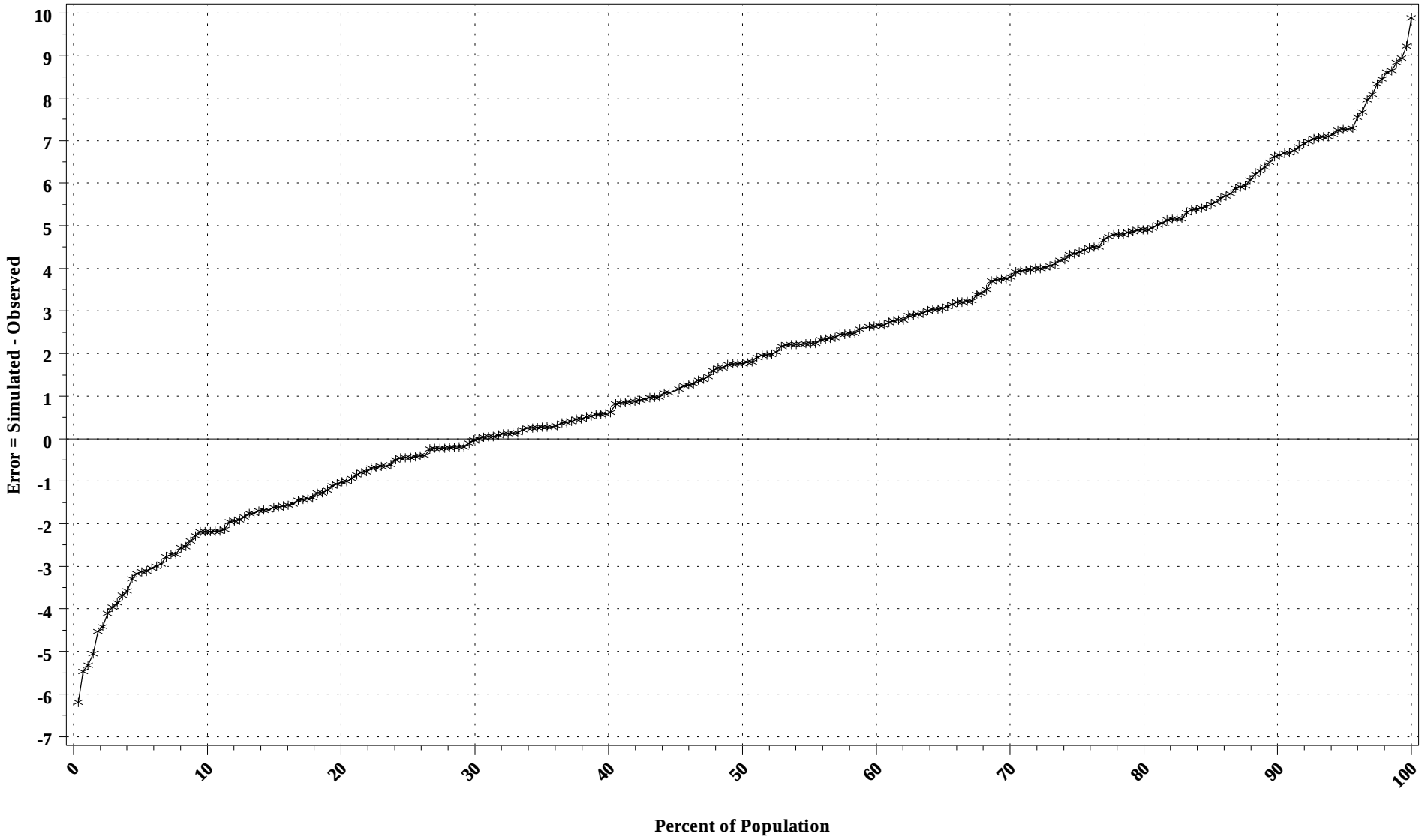
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Actual error versus Percentile Sample Population
## Temperature-C

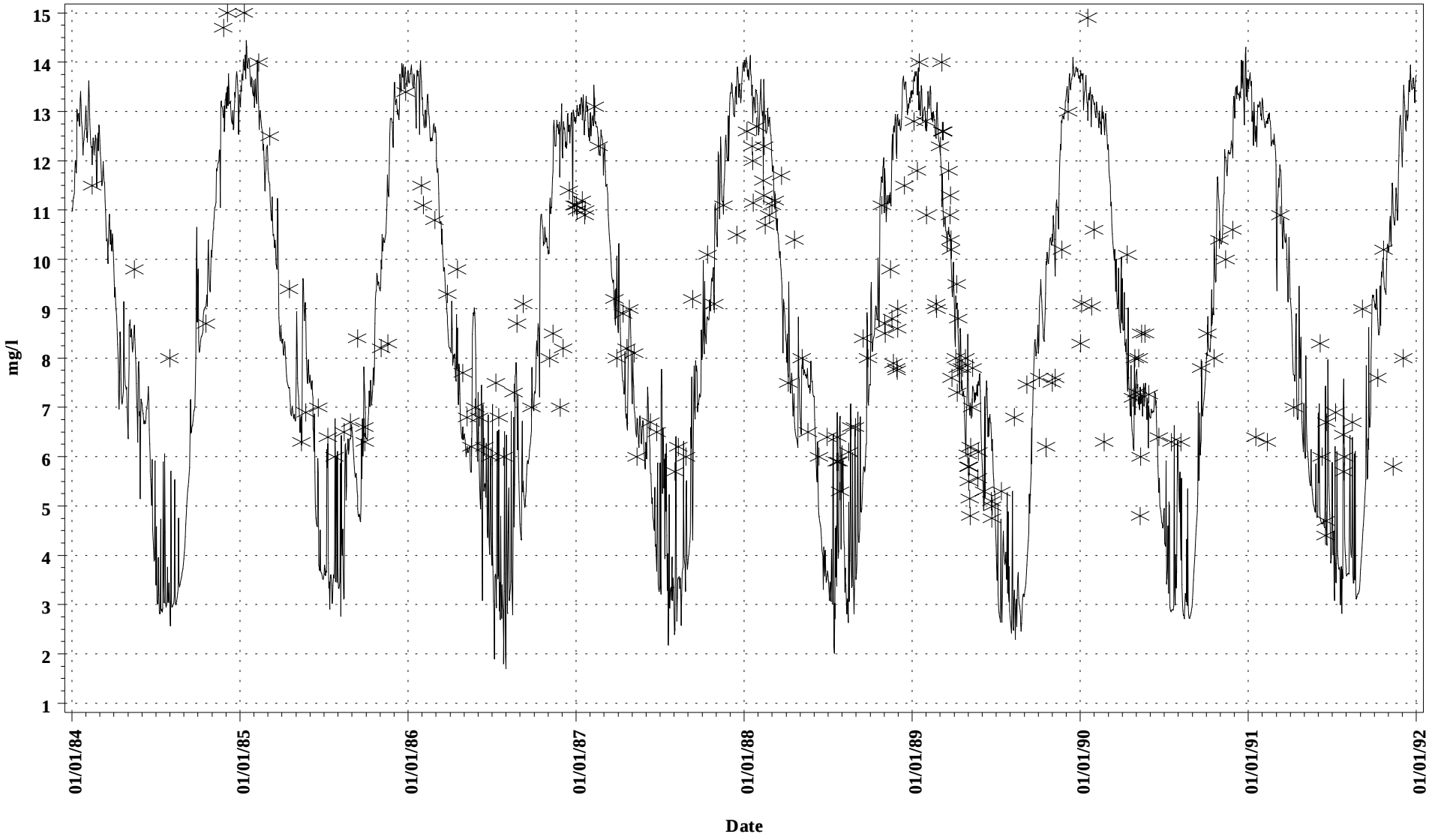
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(choptank.drv 29JUN98 14:42)

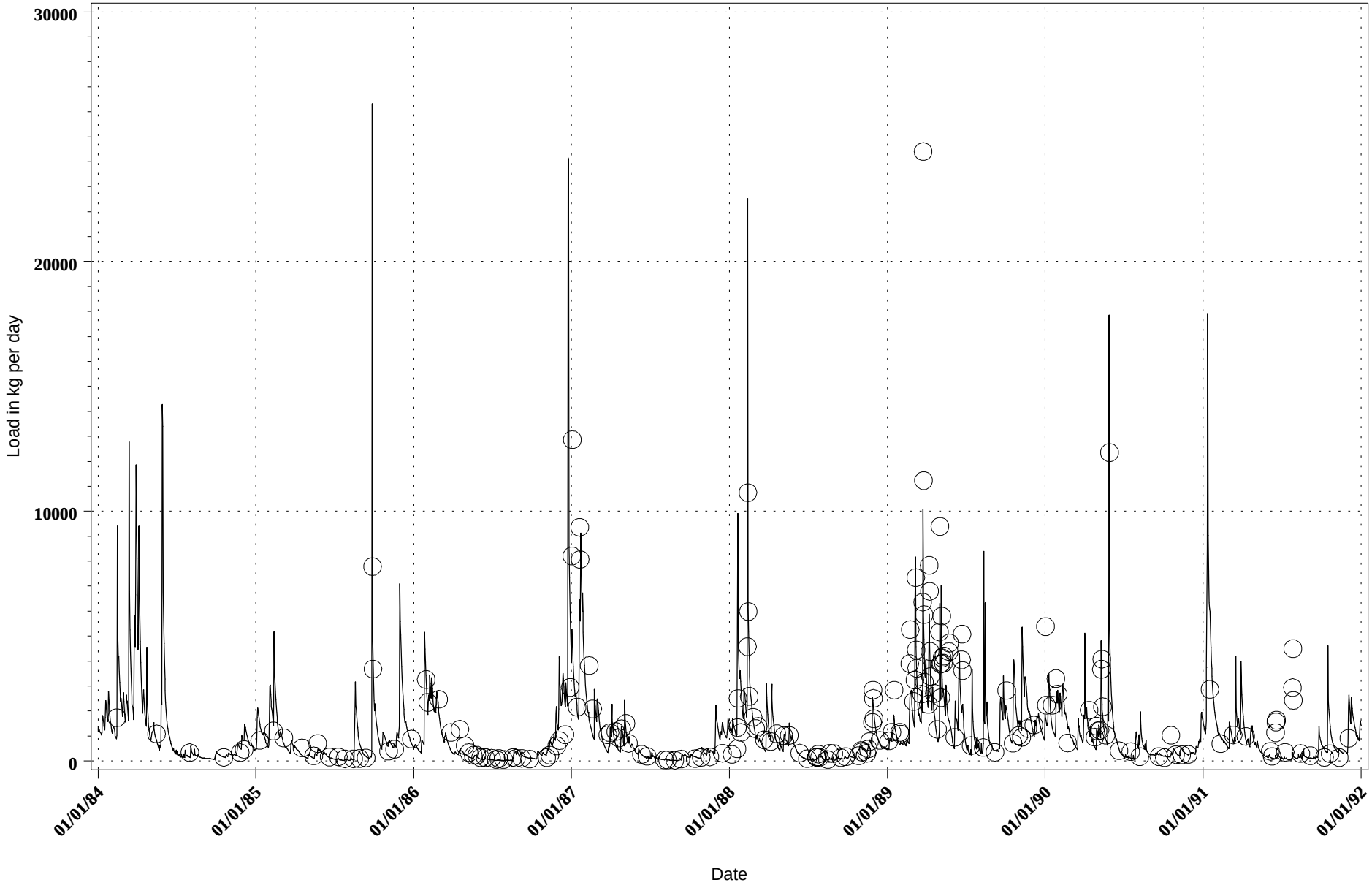
# Choptank River at Segment 770
## Observed and Simulated versus Time
## Dissolved Oxygen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Dissolved Oxygen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

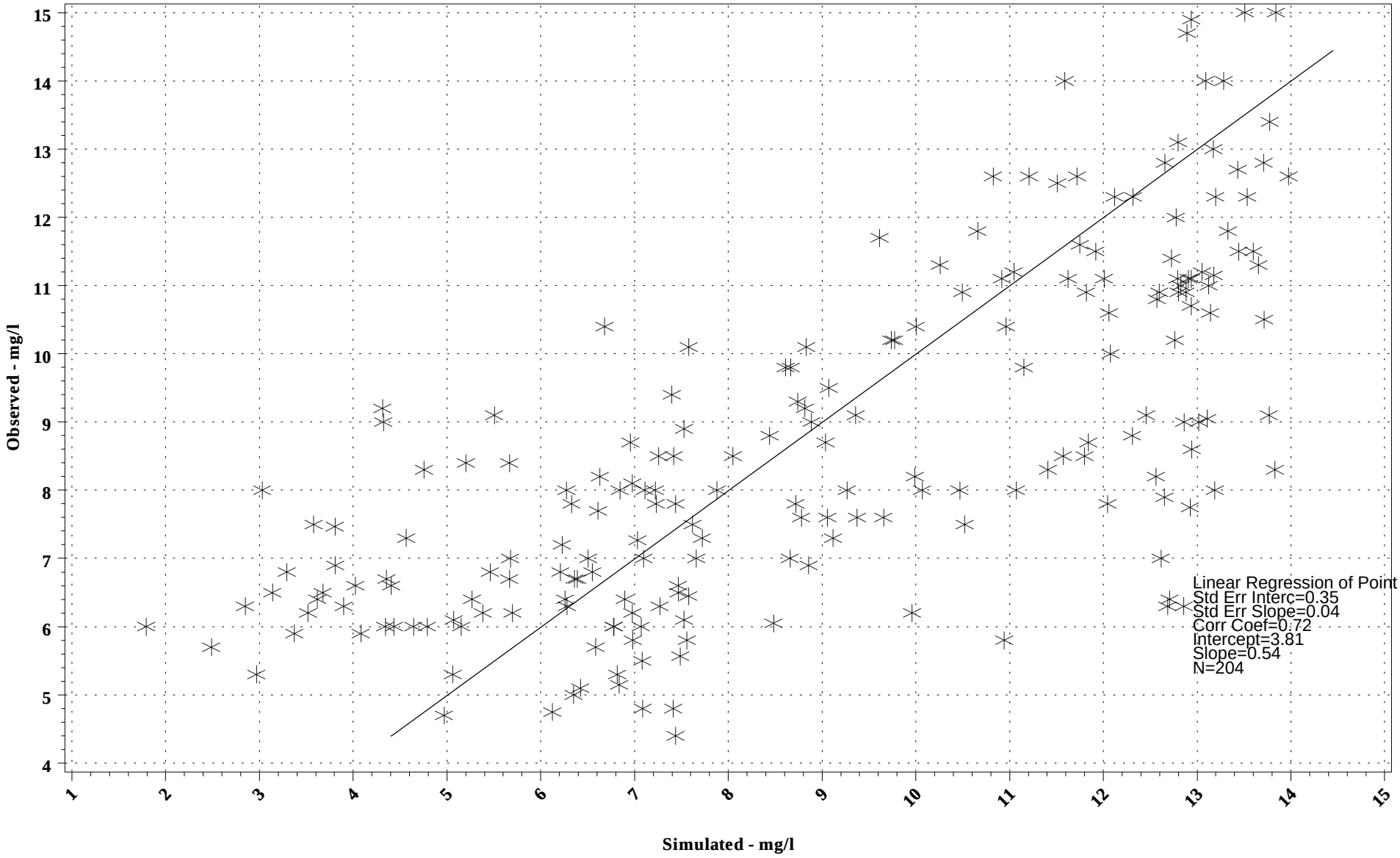



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770

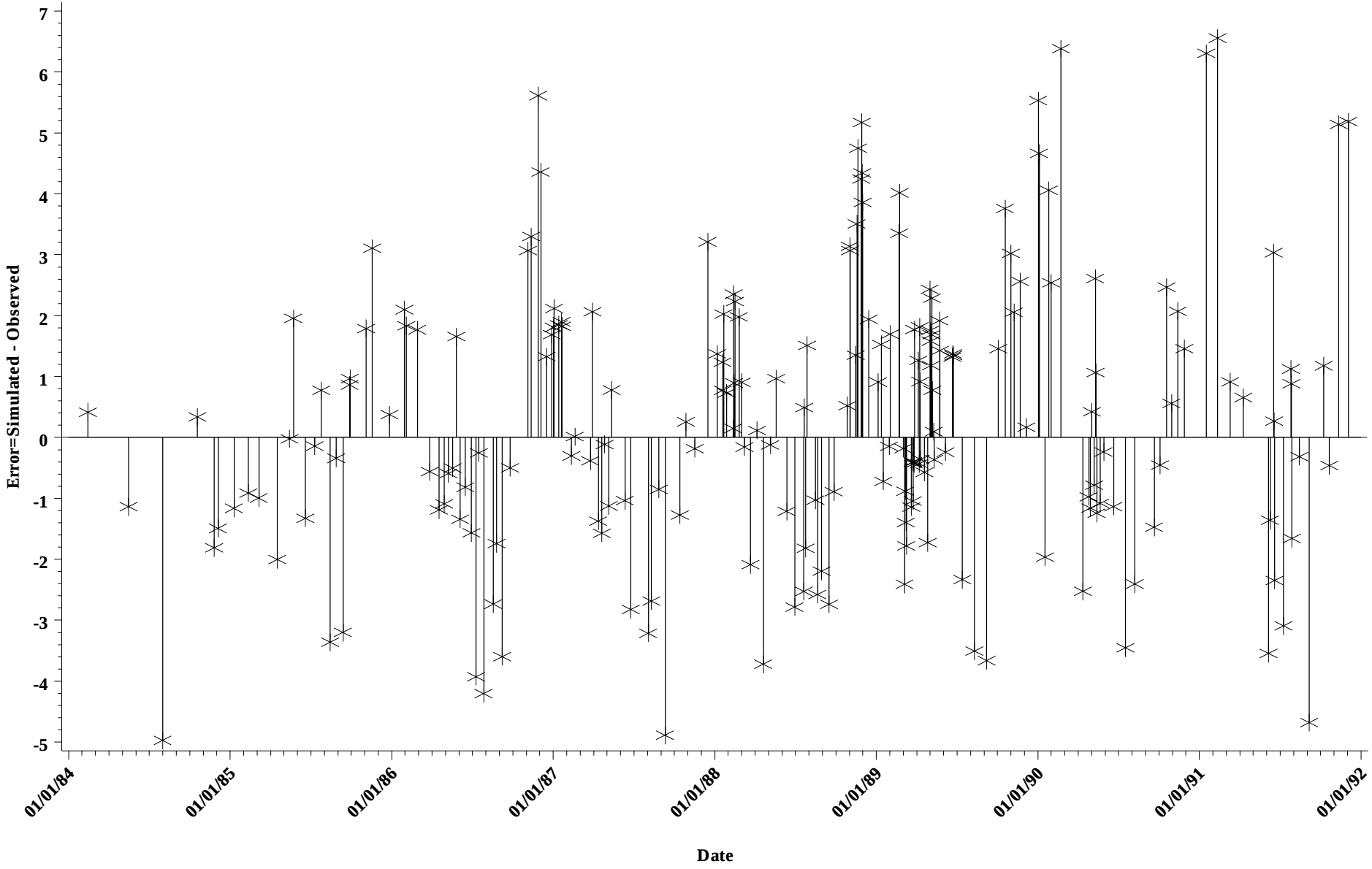
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Oxygen: 01JAN84 - 01JAN92



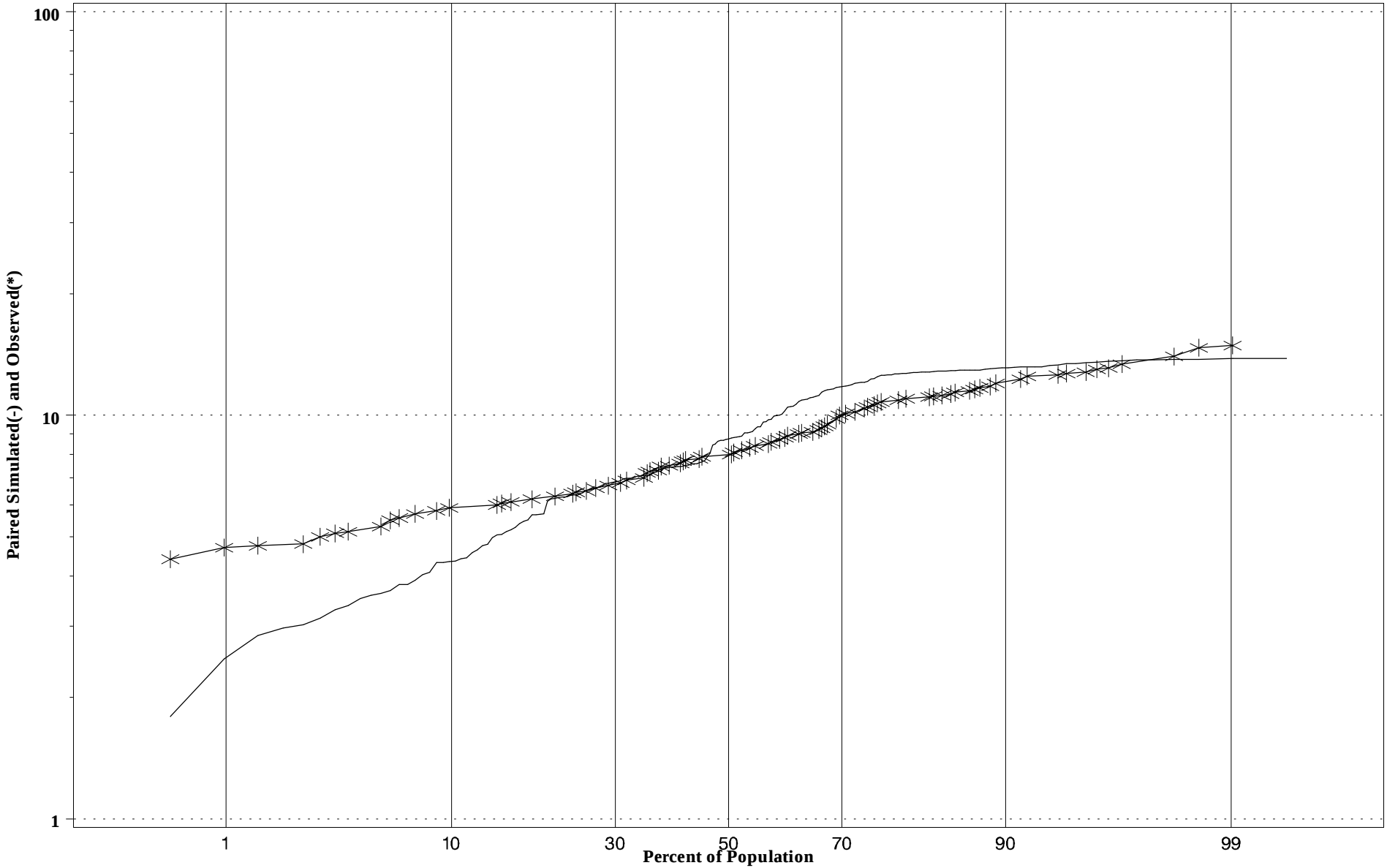

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770
## Actual Error versus Time
## Dissolved Oxygen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(choptank.drv 29JUN98 14:42)

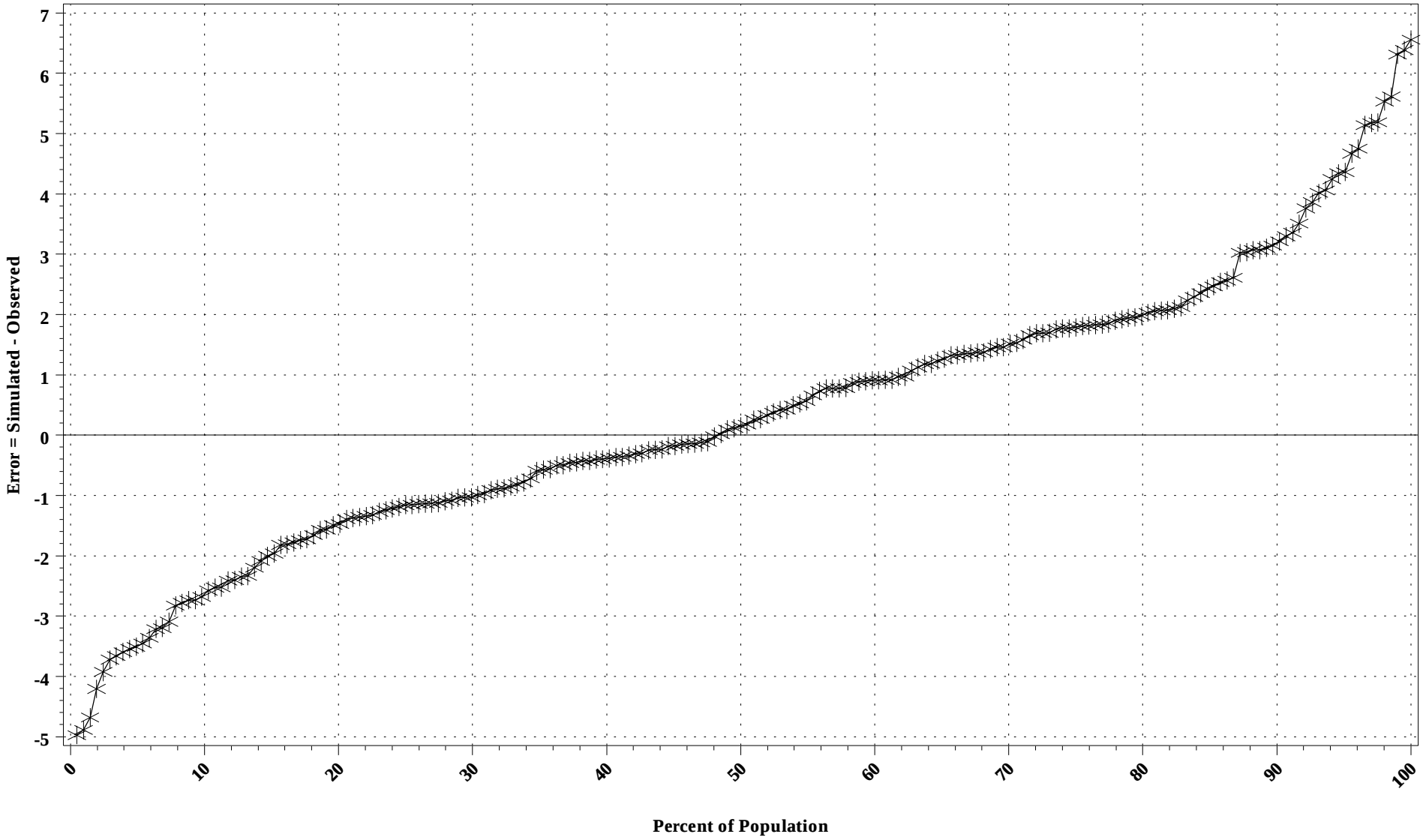
# Choptank River at Segment 770
## Dissolved Oxygen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Actual error versus Percentile Sample Population
## Dissolved Oxygen

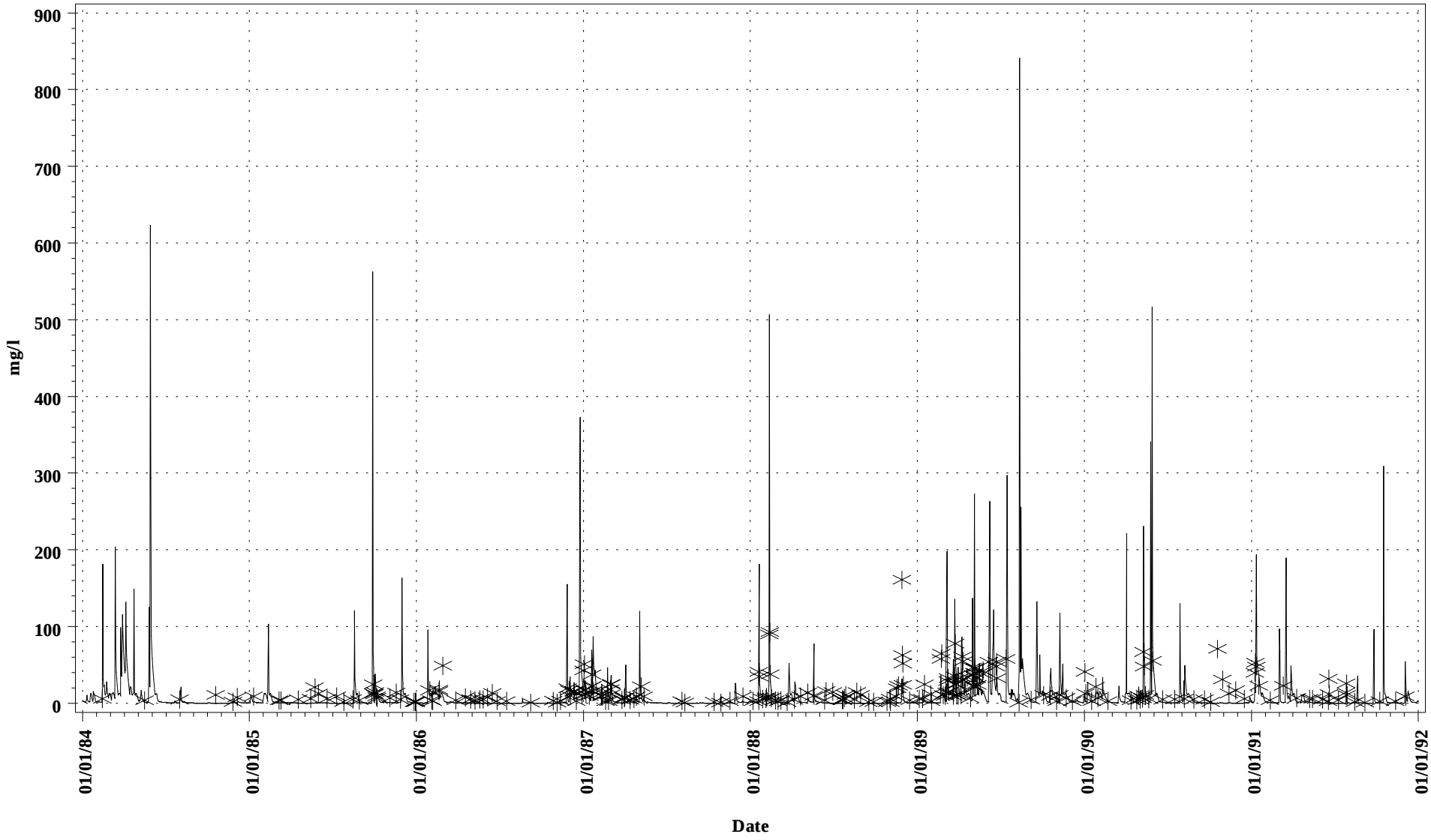
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Observed and Simulated versus Time
## Total Suspended Sediment

**(*=Observed, -=Simulated)**

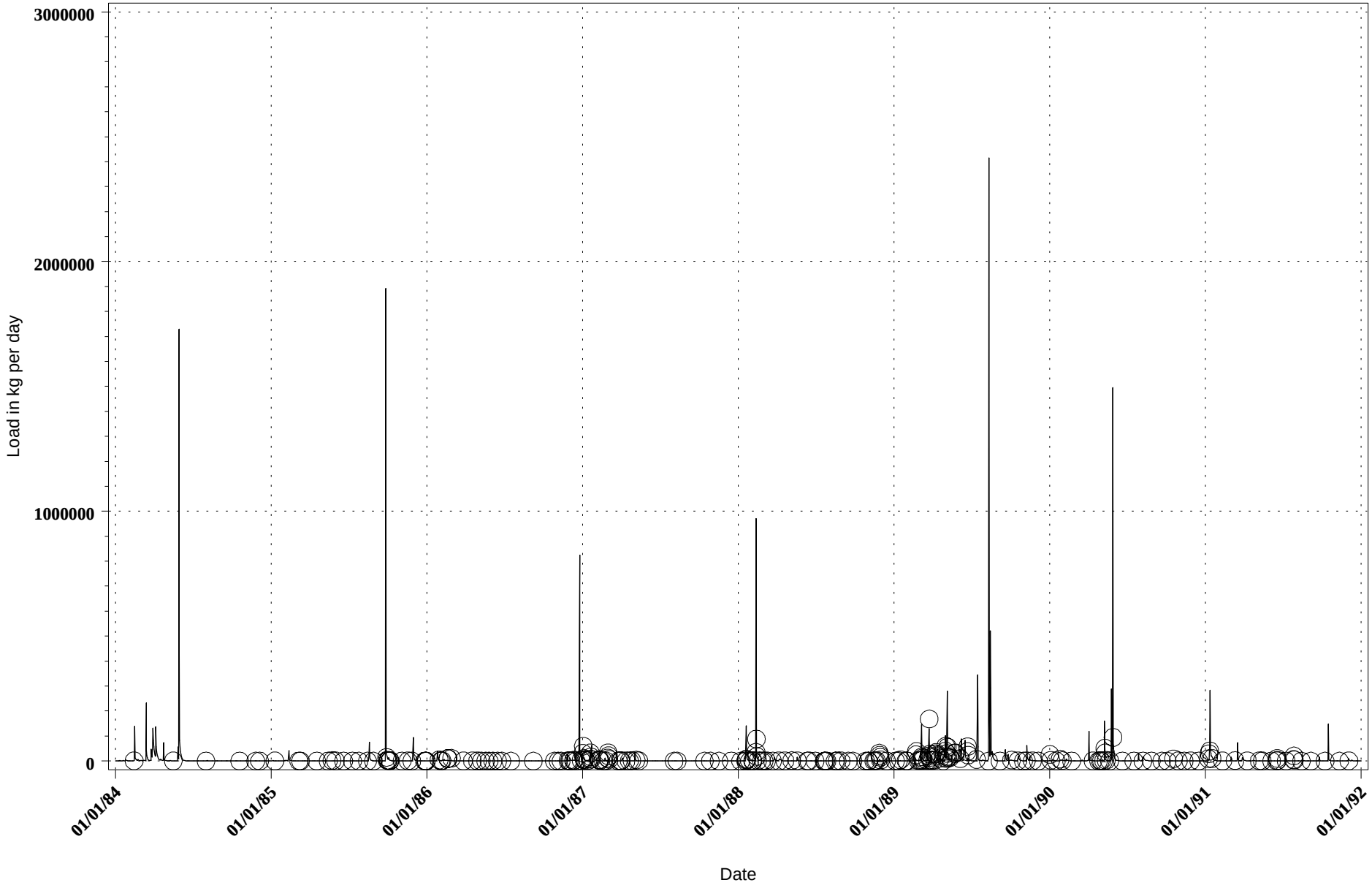



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770

## Total Suspended Sediment Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

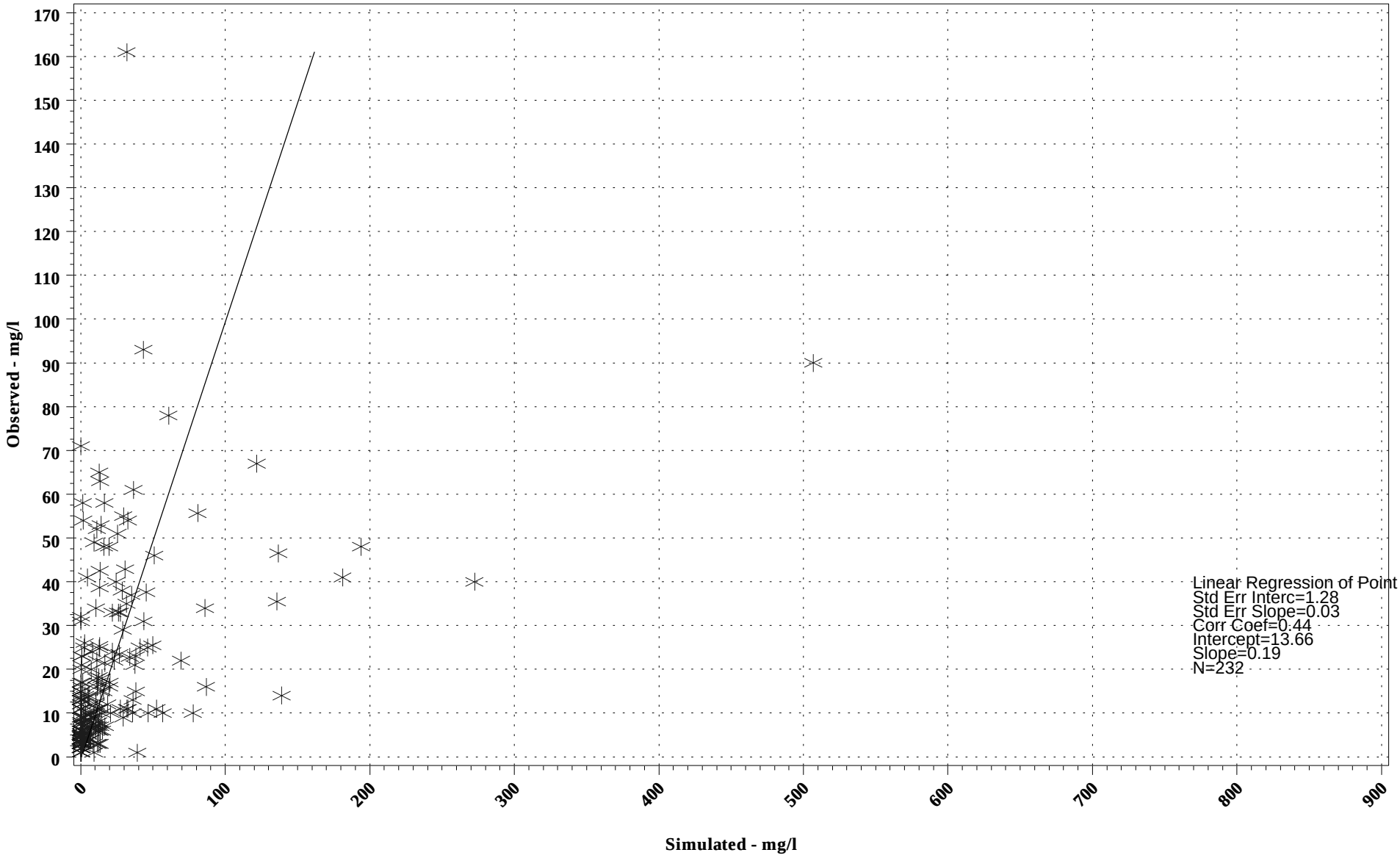



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770

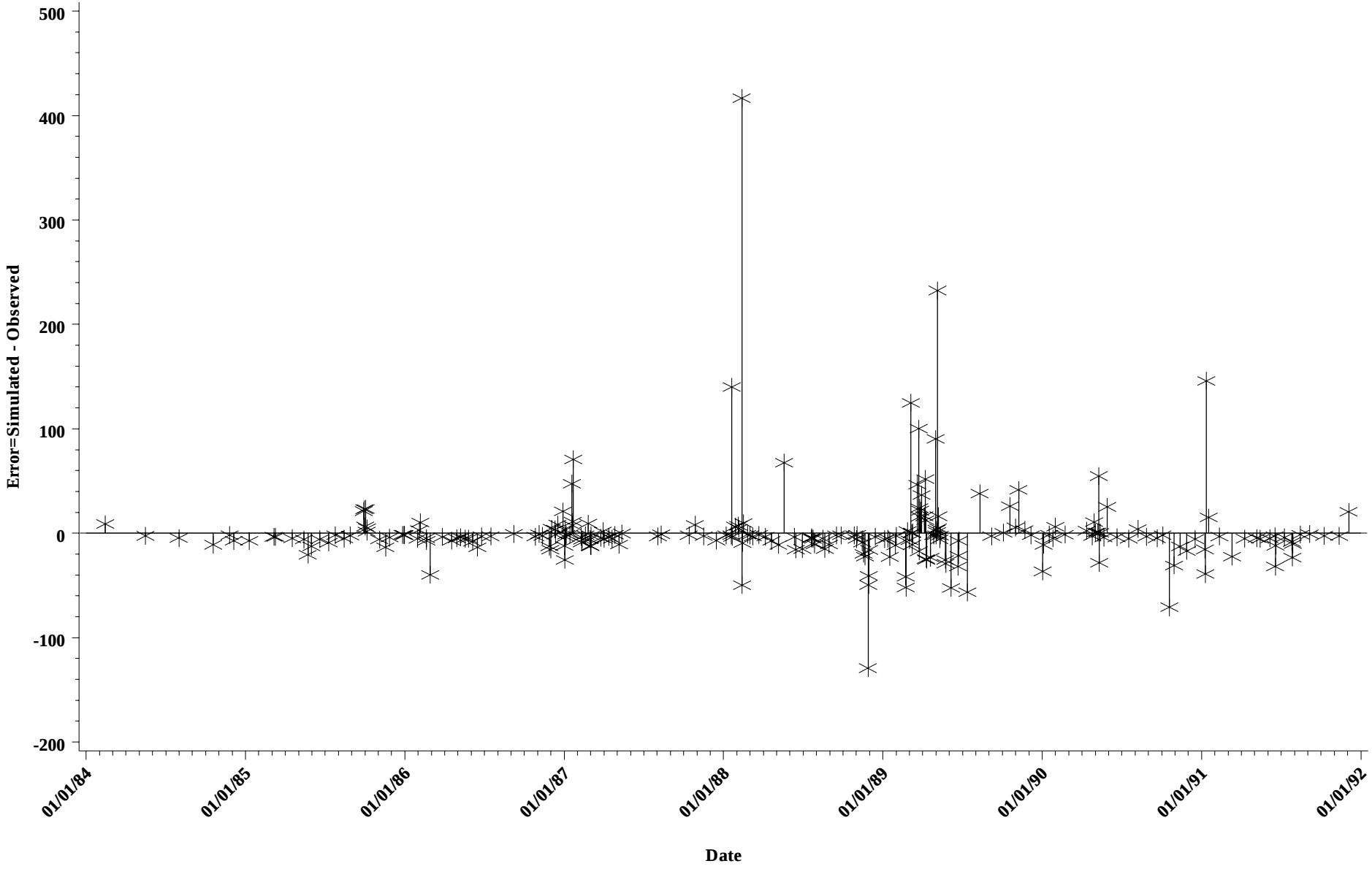
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Suspended Sediment: 01JAN84 - 01JAN92



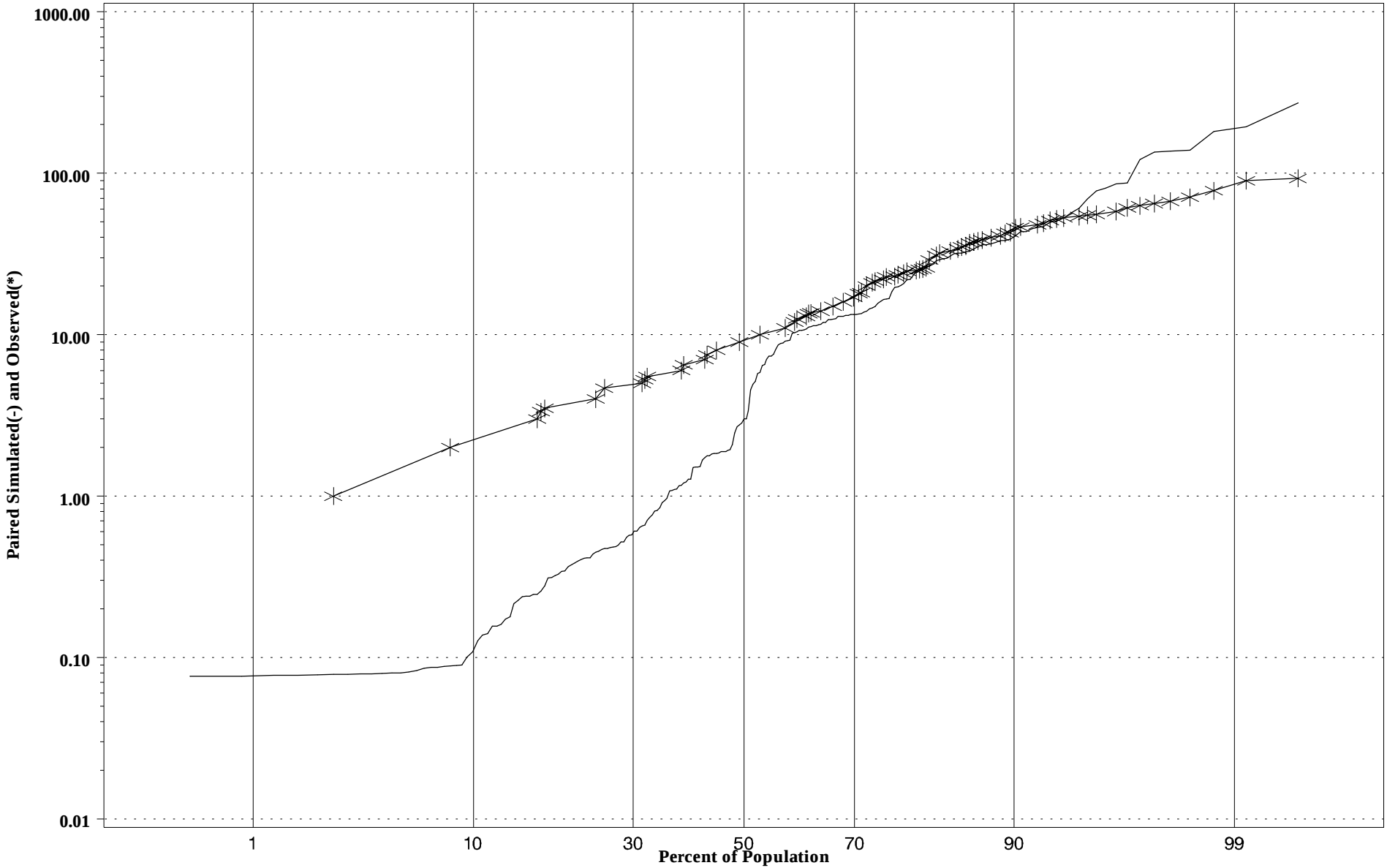

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770
## Actual Error versus Time
## Total Suspended Sediment




(y21_plotb.sas model3d:[pwang.dt] omerr)
(choptank.drv 29JUN98 14:42)

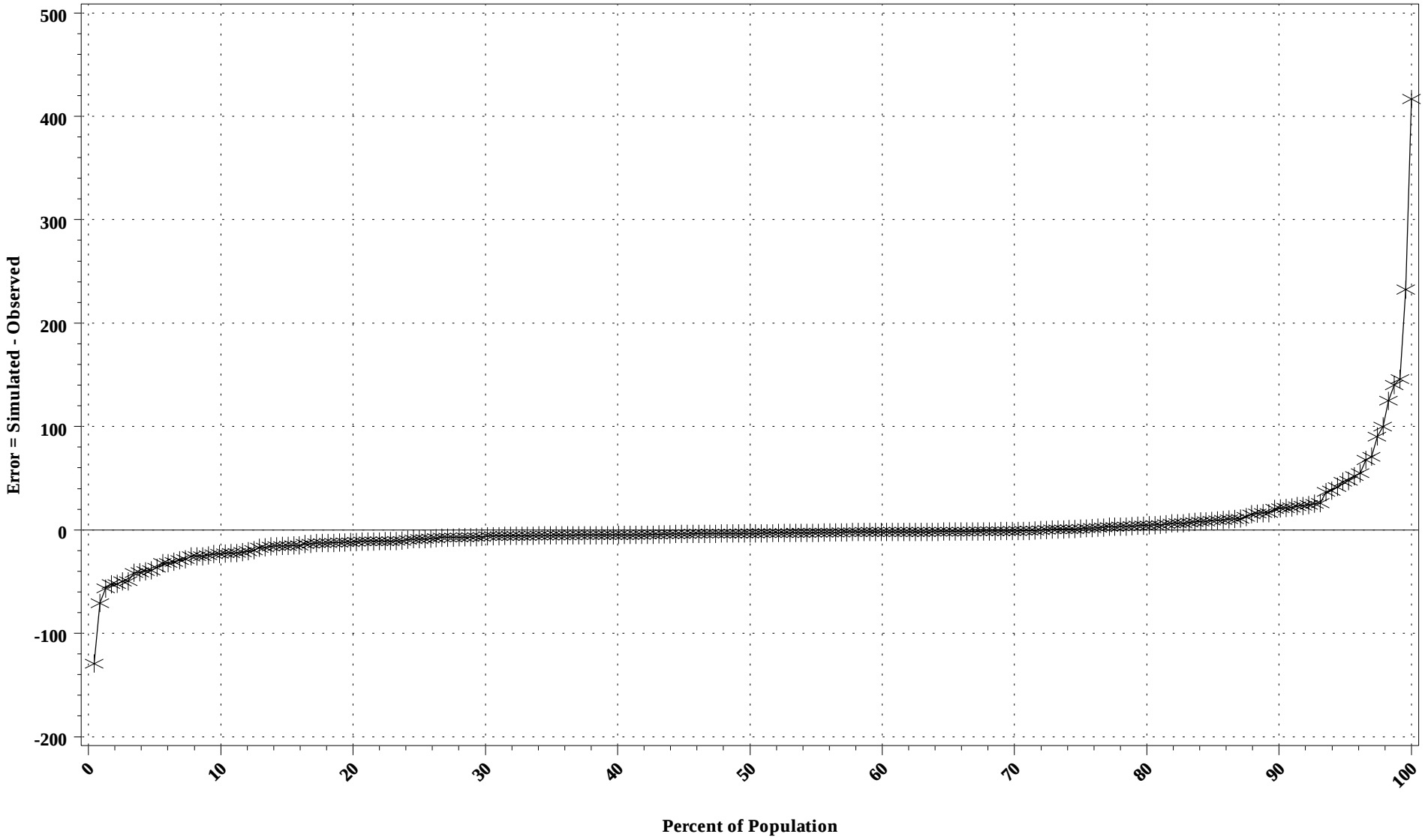
# Choptank River at Segment 770
## Total Suspended Sediment
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Actual error versus Percentile Sample Population
## Total Suspended Sediment

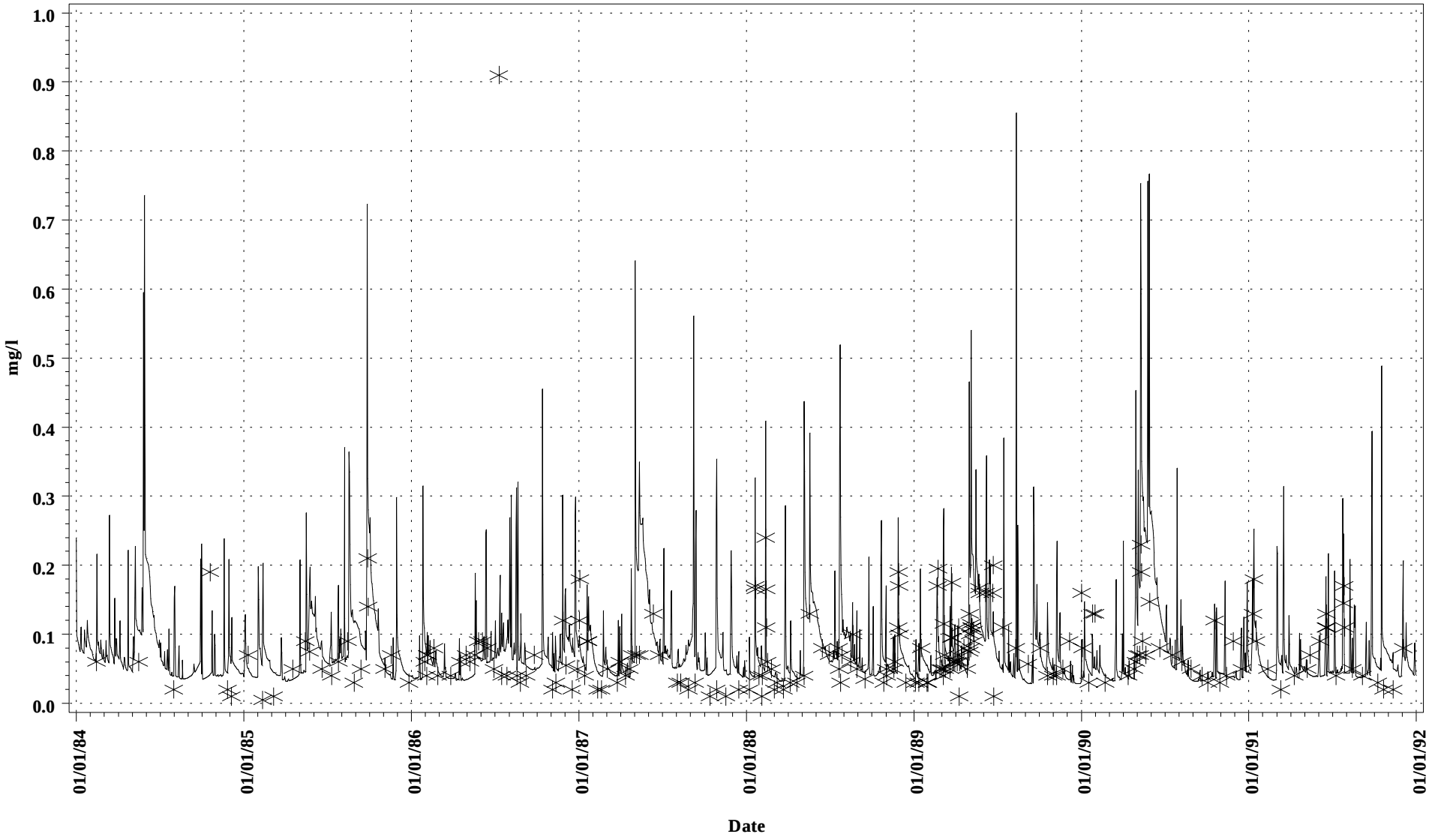
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(choptank.drv 29JUN98 14:42)

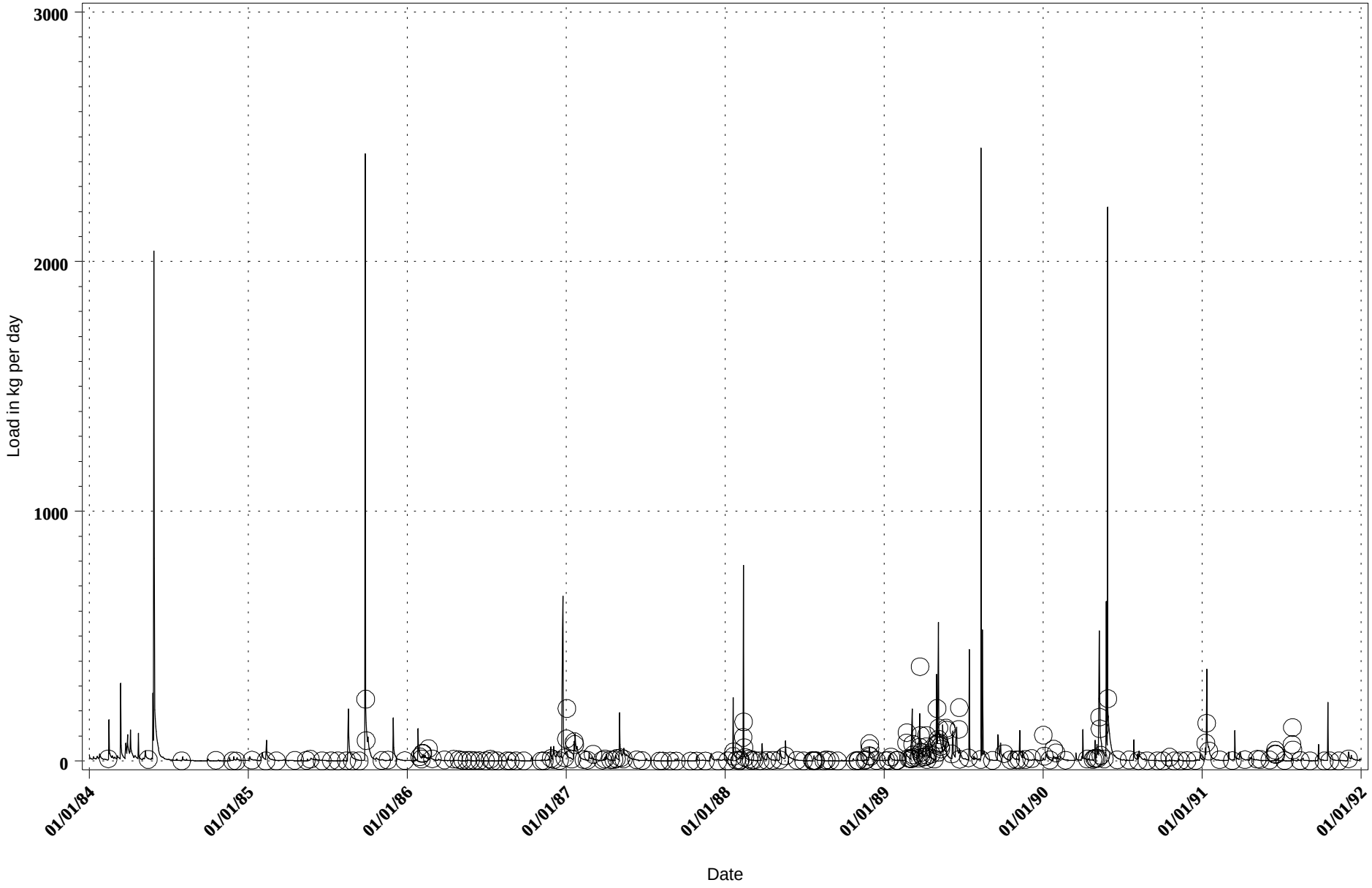
# Choptank River at Segment 770
## Observed and Simulated versus Time
## Total Phosphorus

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Total Phosphorus Observed and Simulated Load vs Time
### (line = simulated, O = observed)

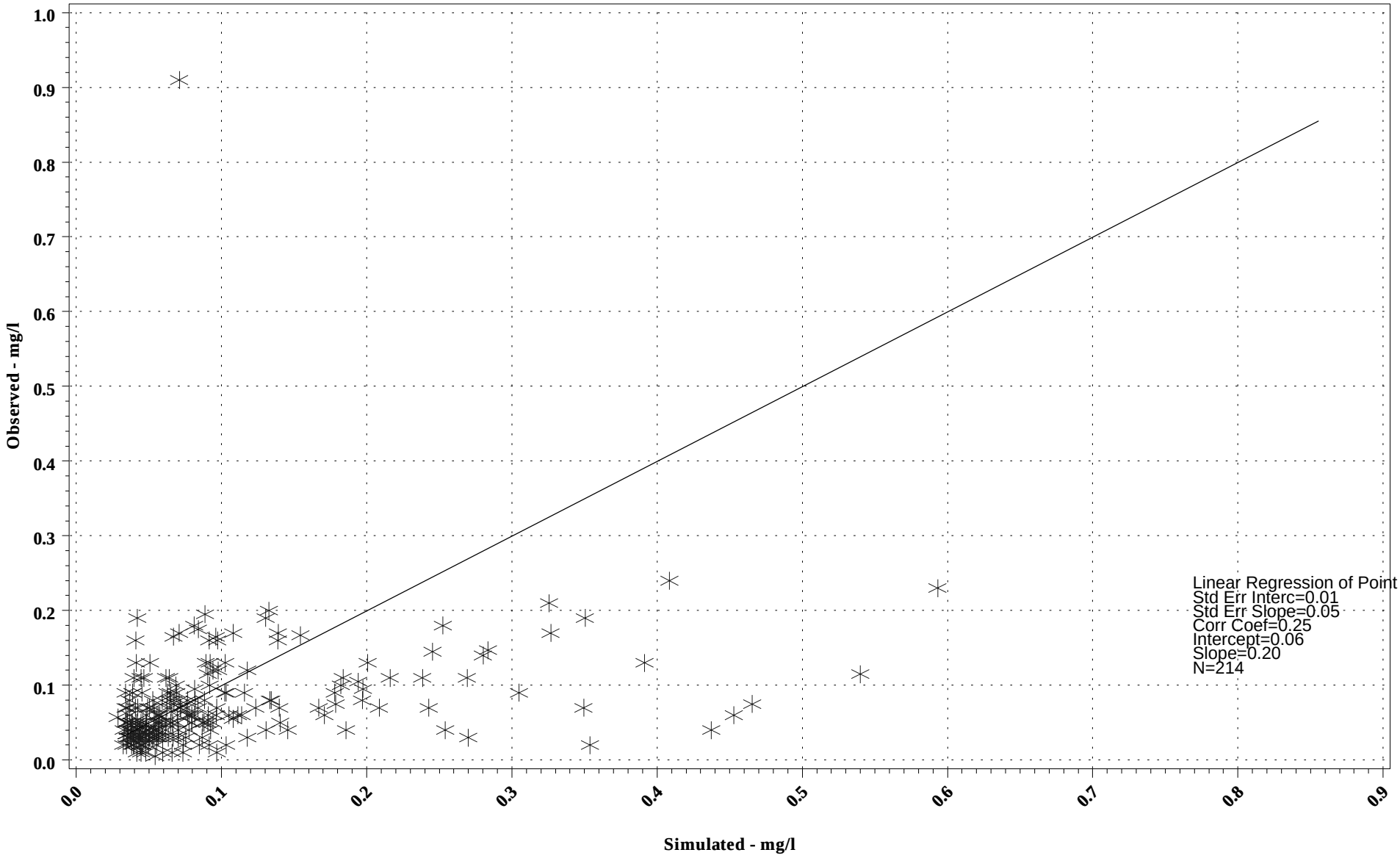



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770

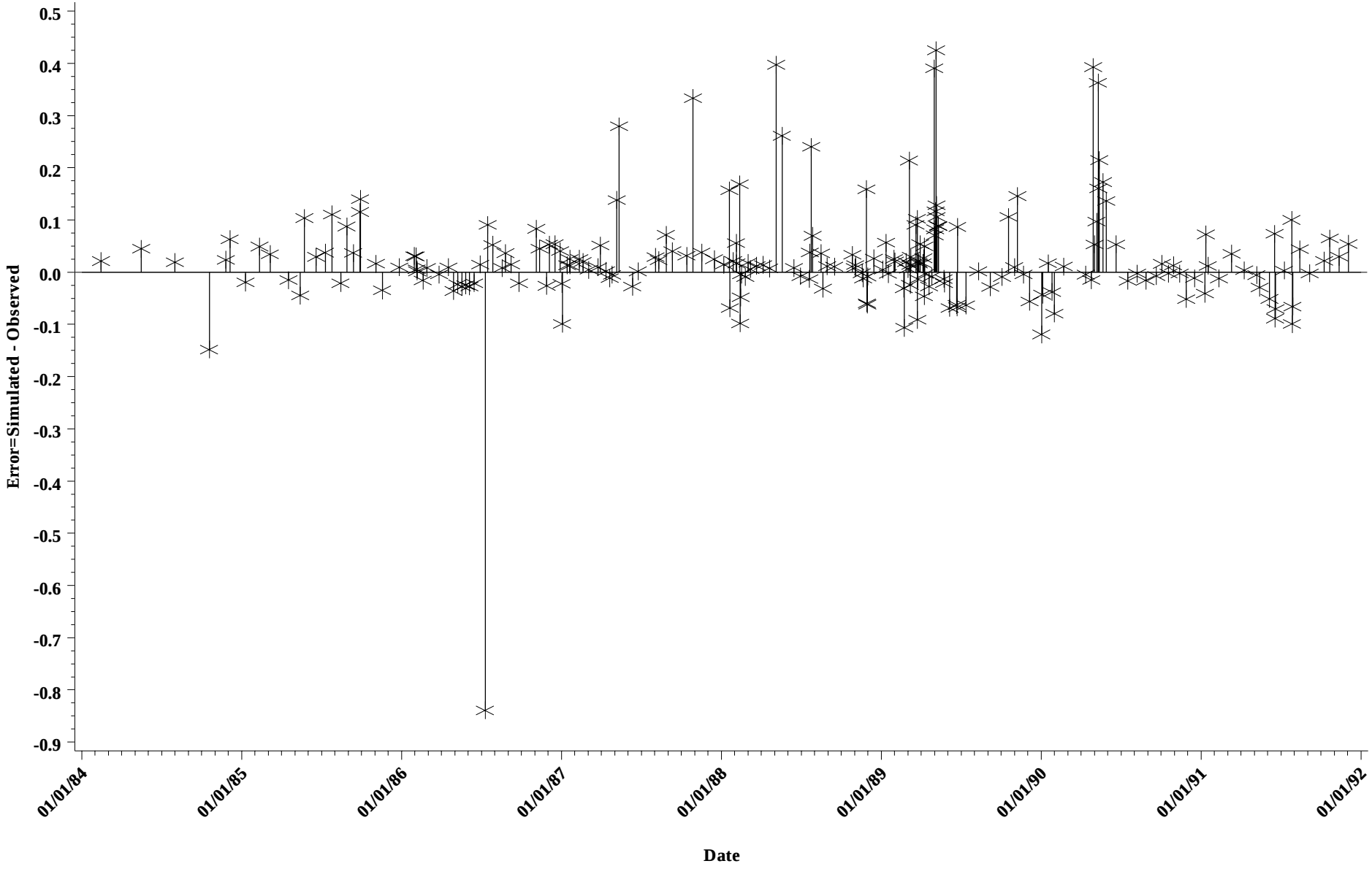
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Phosphorus: 01JAN84 - 01JAN92



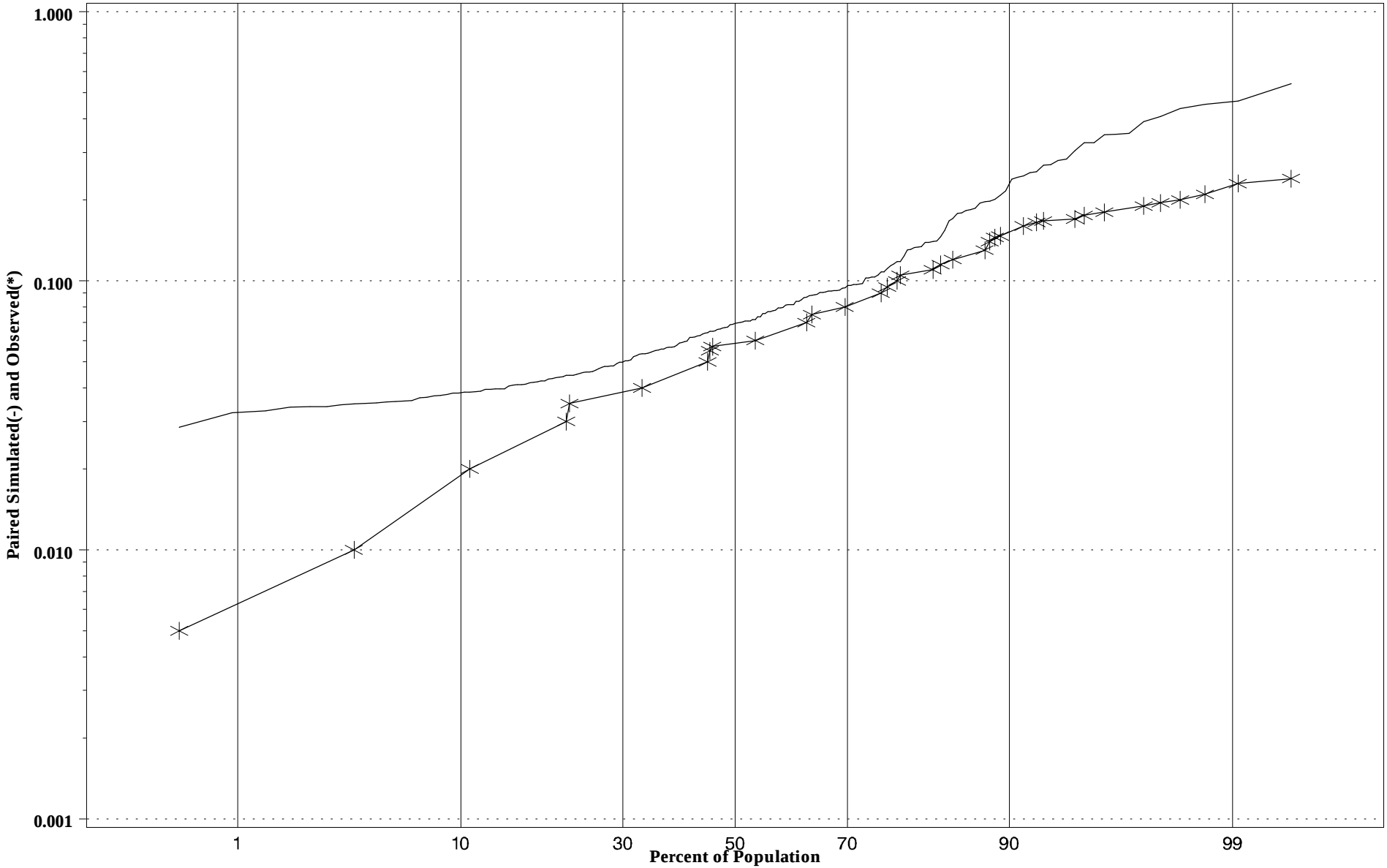

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770
## Actual Error versus Time
## Total Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(choptank.drv 29JUN98 14:42)

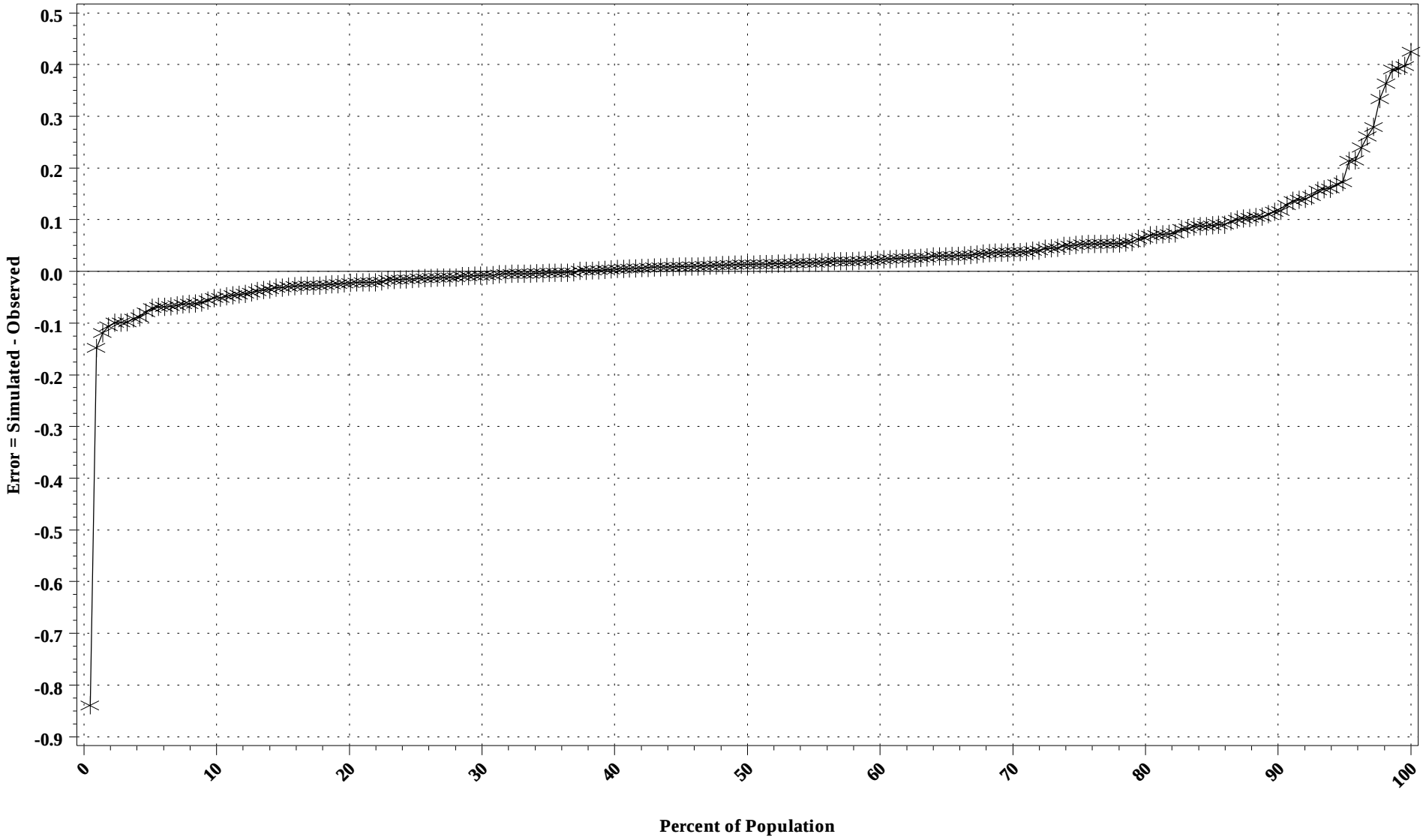
# Choptank River at Segment 770
## Total Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Actual error versus Percentile Sample Population
## Total Phosphorus

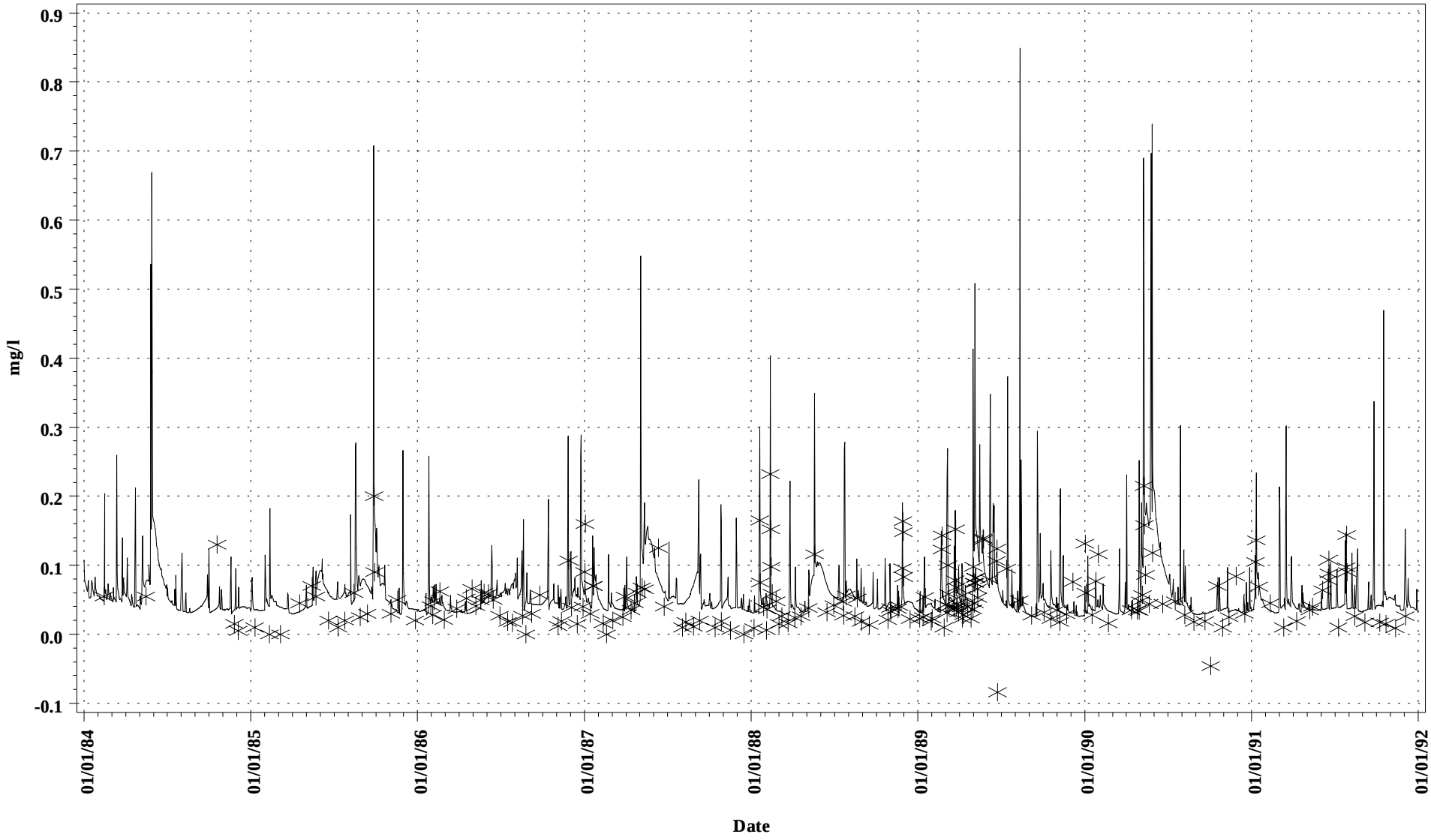
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Observed and Simulated versus Time
# Organic and Particulate Phosphorus

**(*=Observed, -=Simulated)**

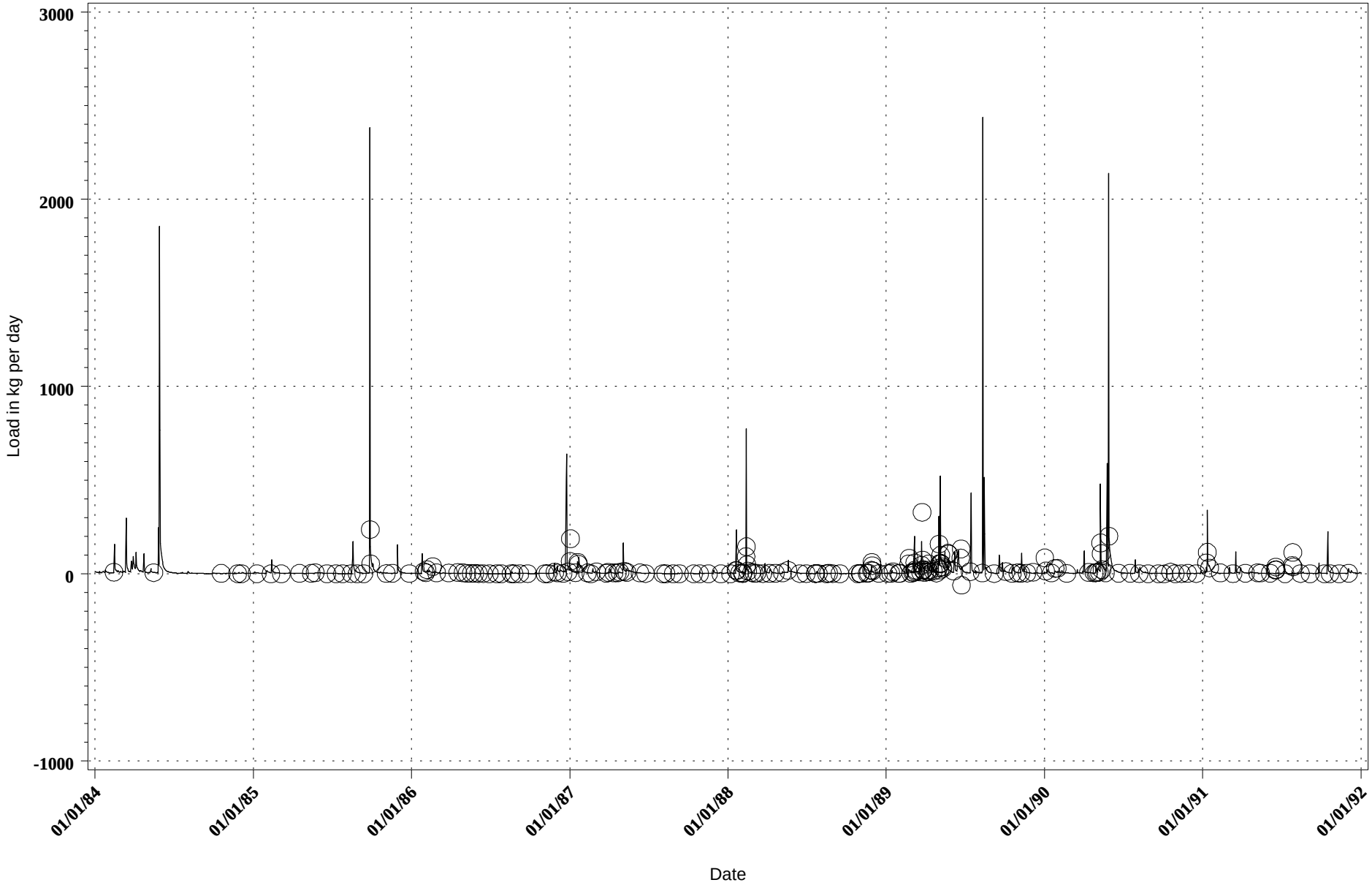



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770

## Organic and Particulate Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

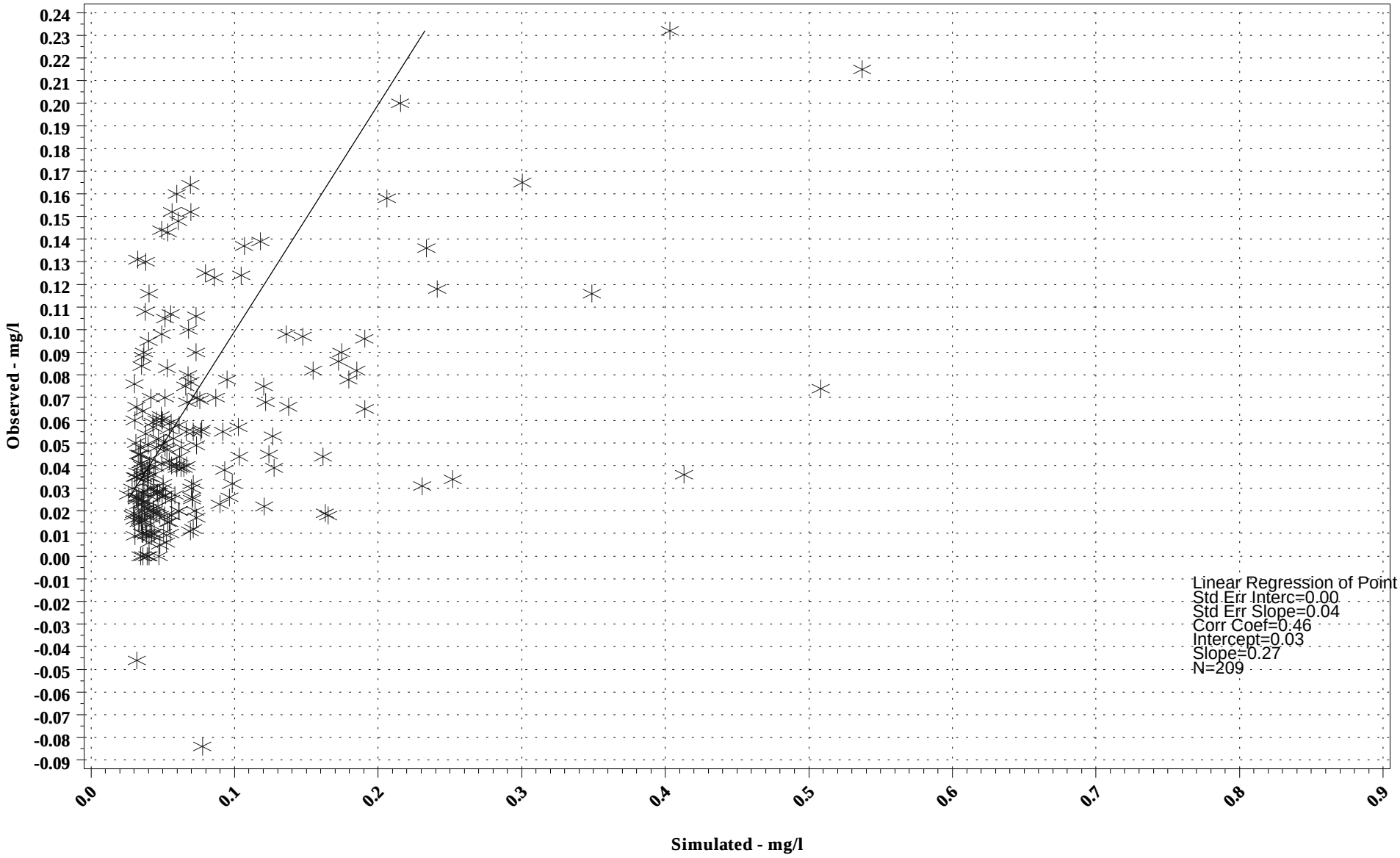



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770

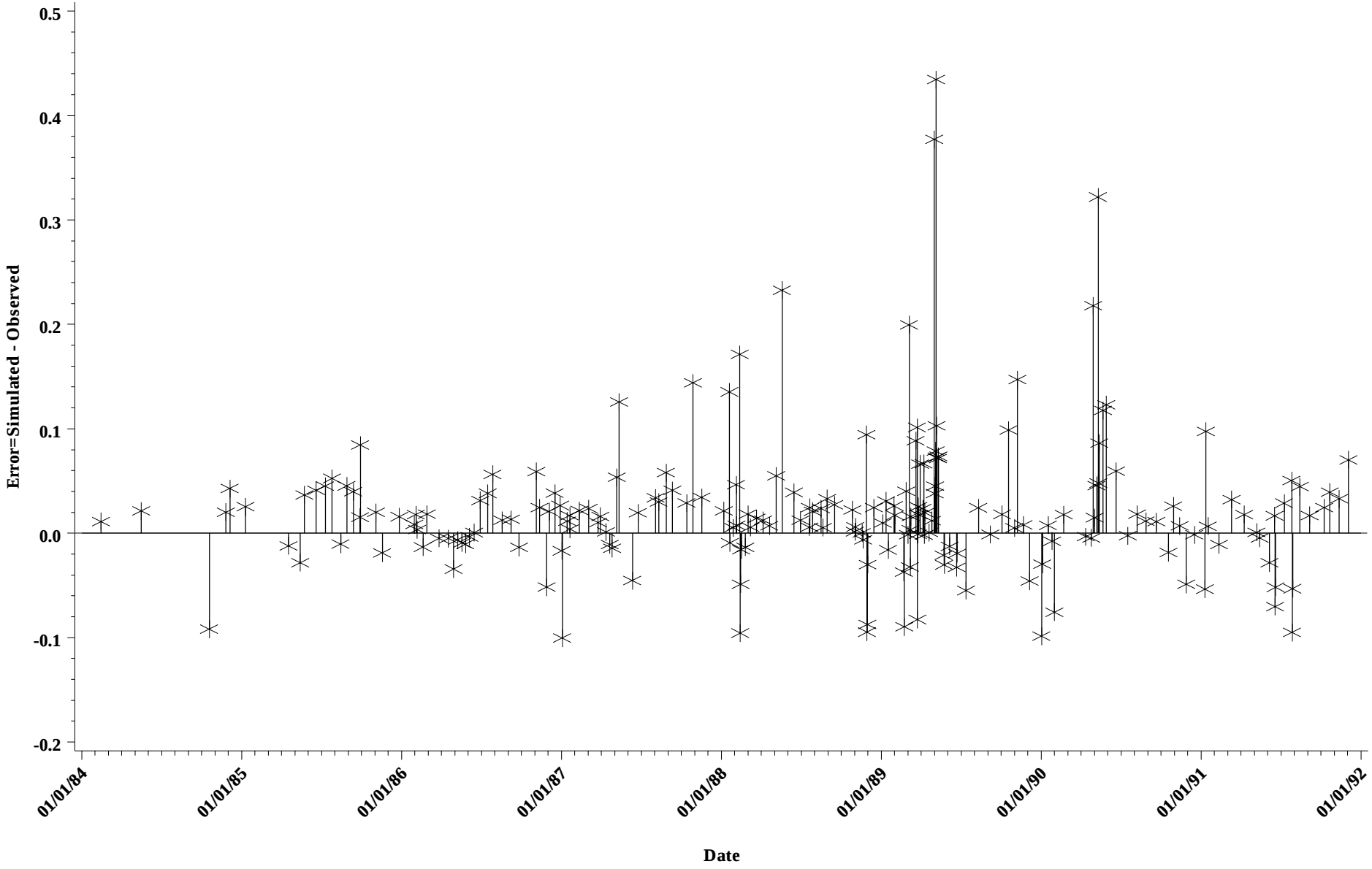
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic and Particulate Phosphorus: 01JAN84 - 01JAN92



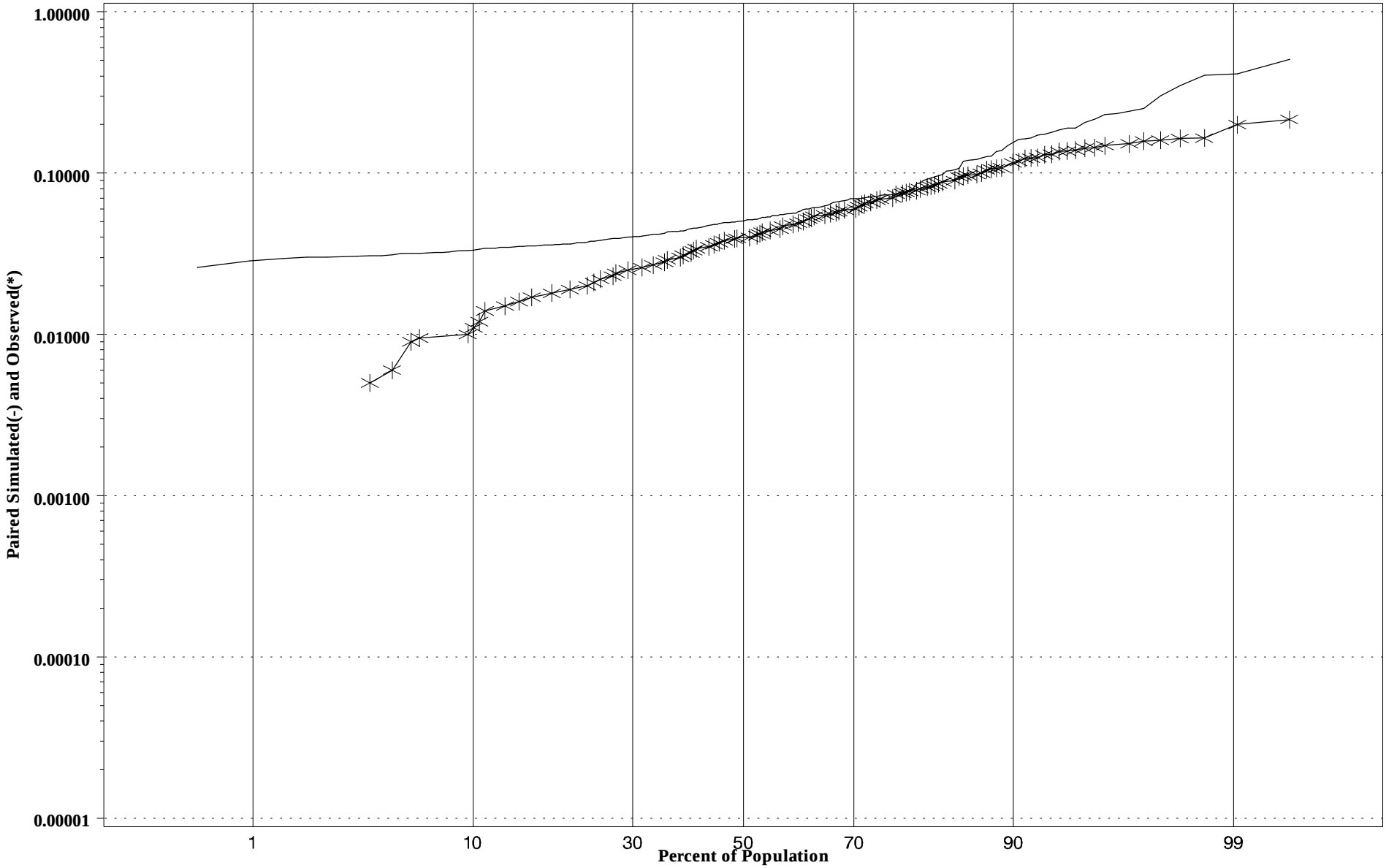

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770
## Actual Error versus Time
## Organic and Particulate Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(choptank.drv 29JUN98 14:42)

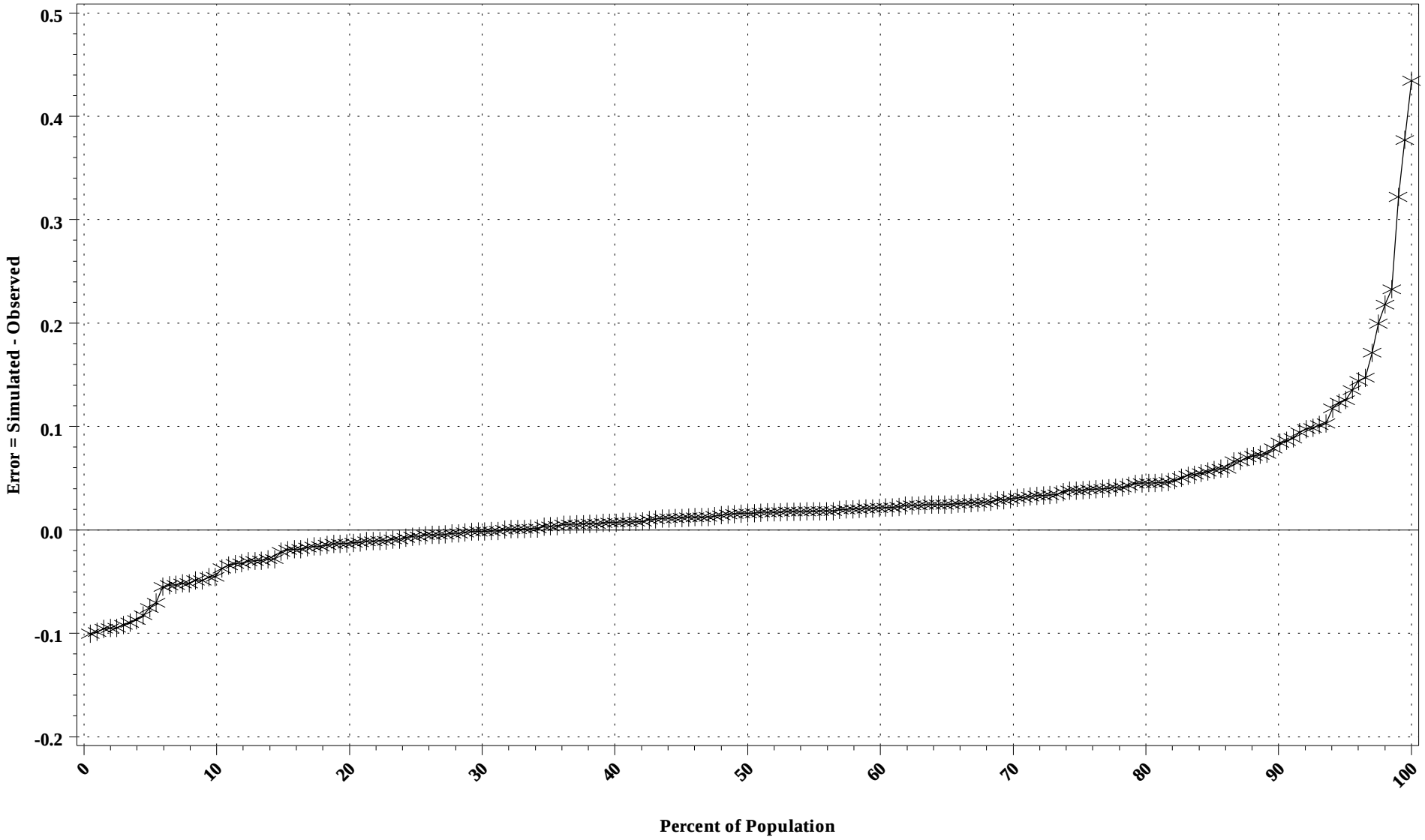
# Choptank River at Segment 770
## Organic and Particulate Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Actual error versus Percentile Sample Population
## Organic and Particulate Phosphorus

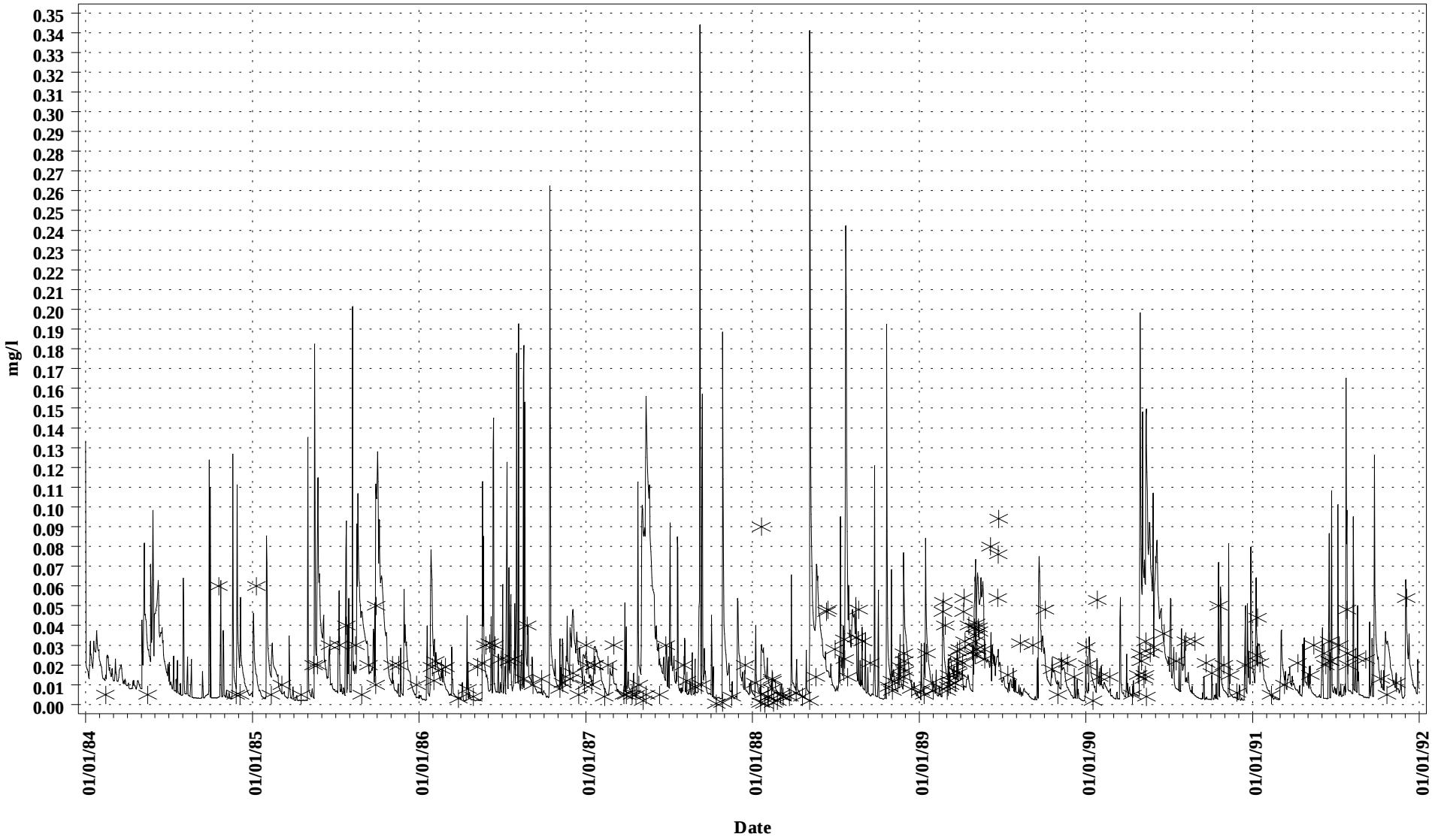
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Observed and Simulated versus Time
# Dissolved Phosphorus

**(*=Observed, -=Simulated)**

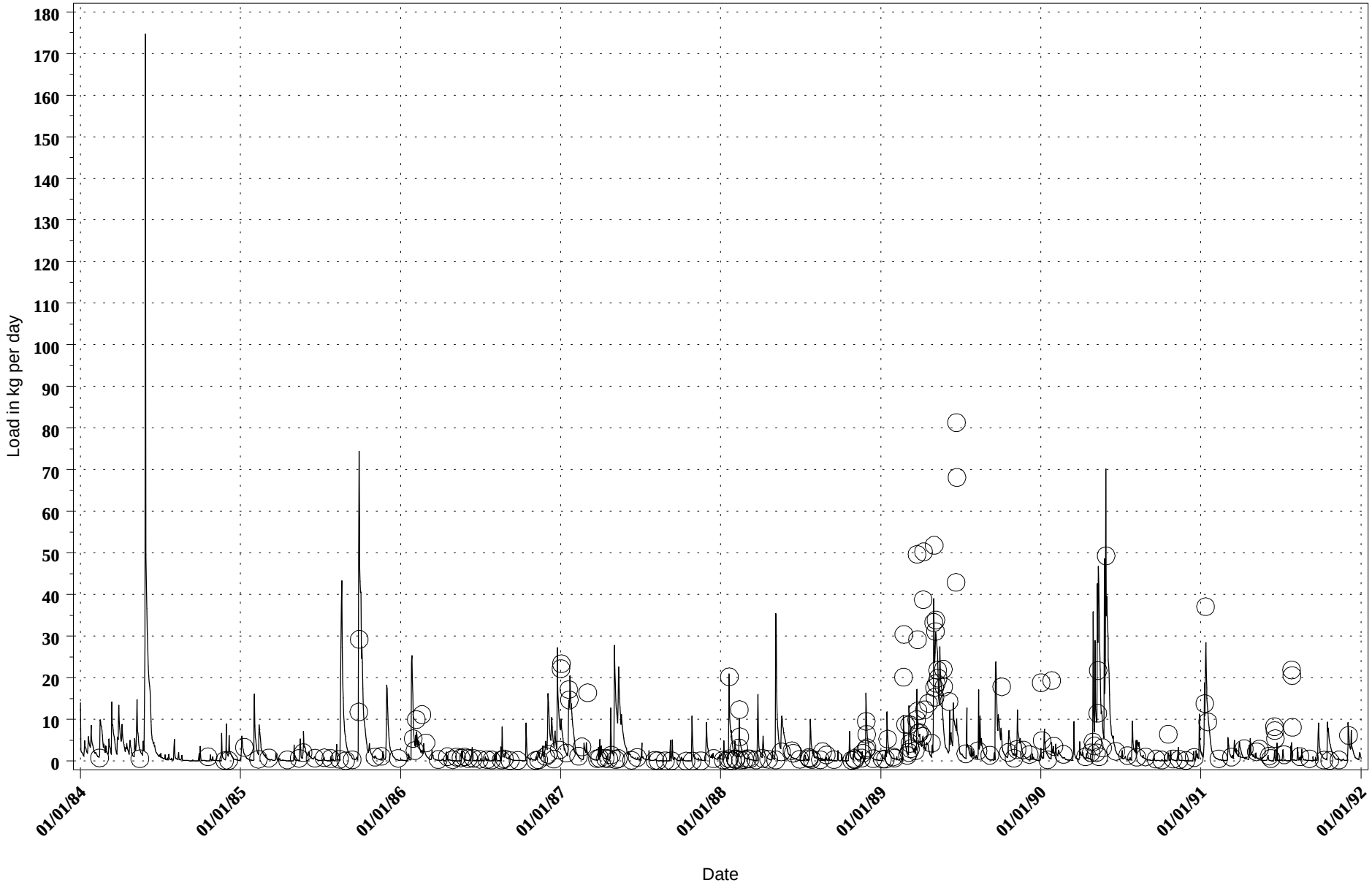



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770

## Dissolved Phosphorus Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

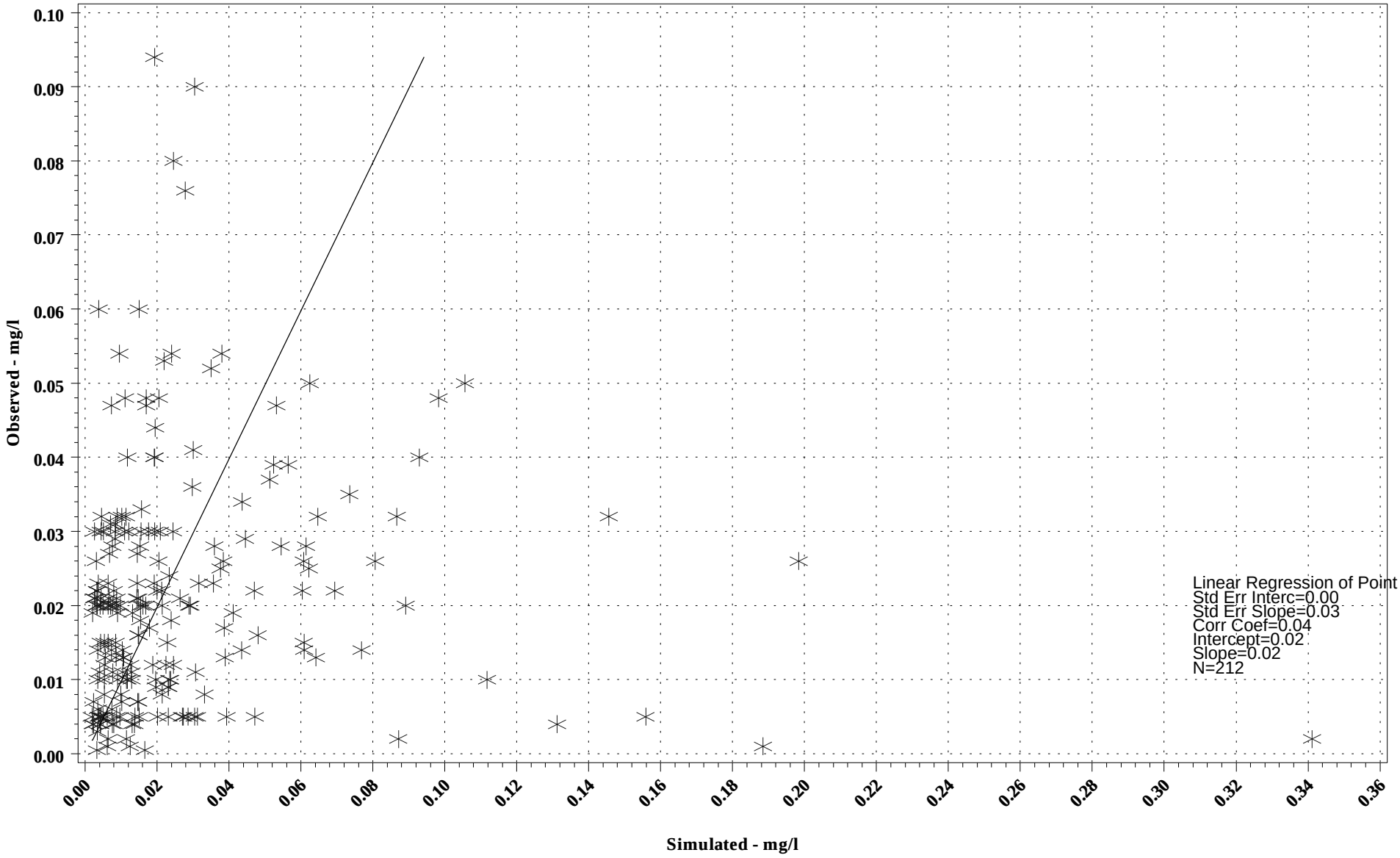



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770

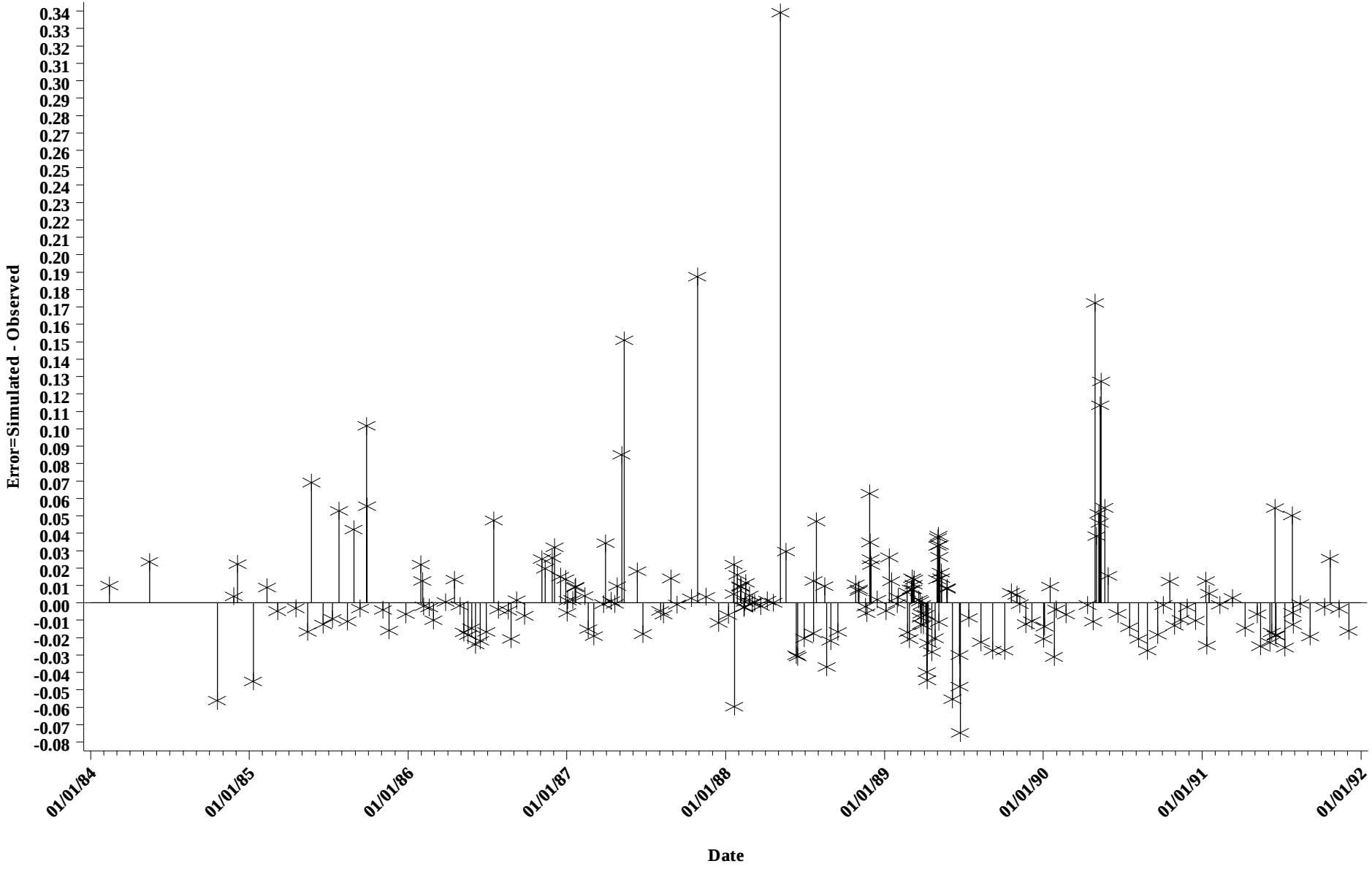
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Dissolved Phosphorus: 01JAN84 - 01JAN92



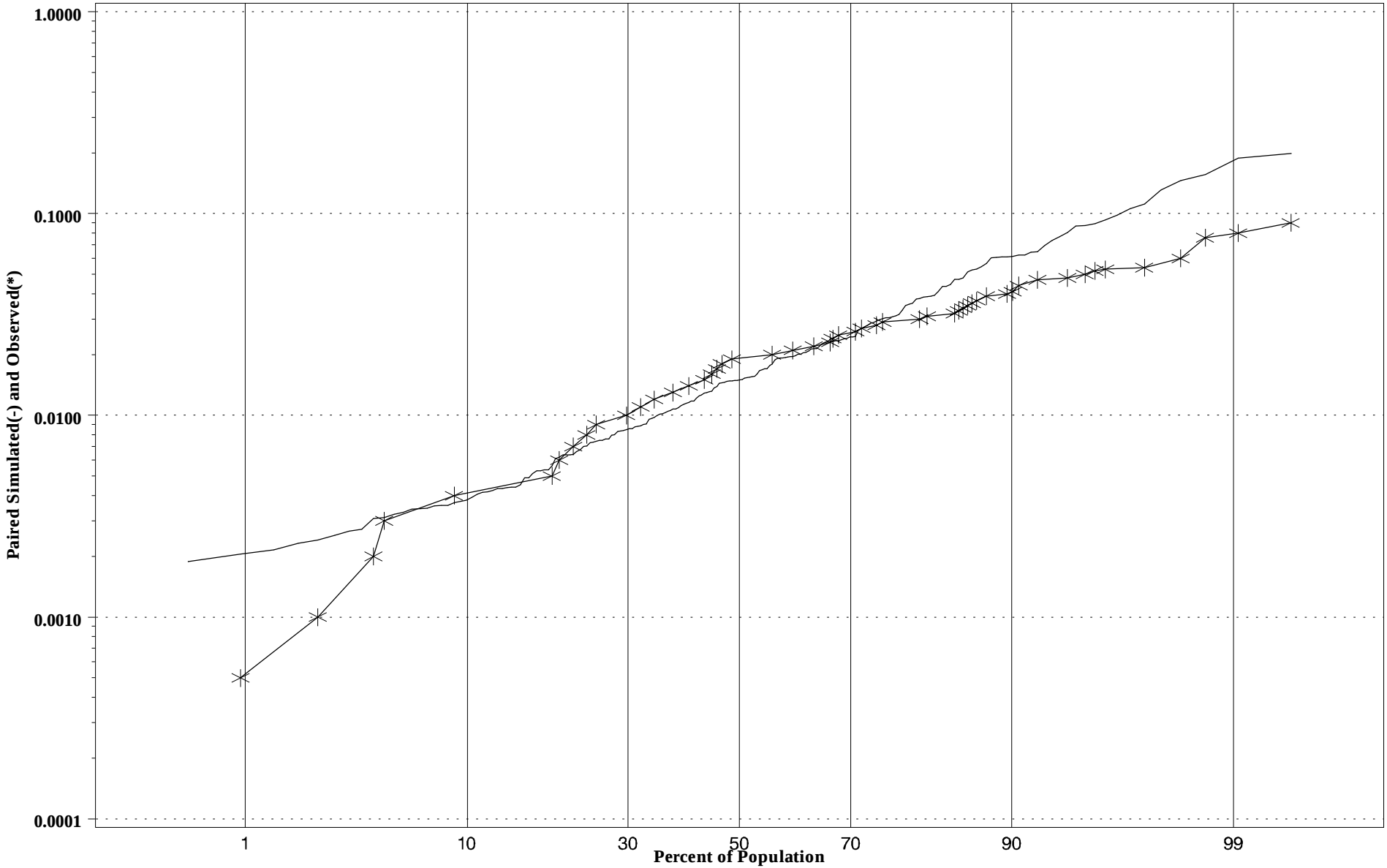

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770
## Actual Error versus Time
## Dissolved Phosphorus




(y21_plotb.sas model3d:[pwang.dt] omerr)
(choptank.drv 29JUN98 14:42)

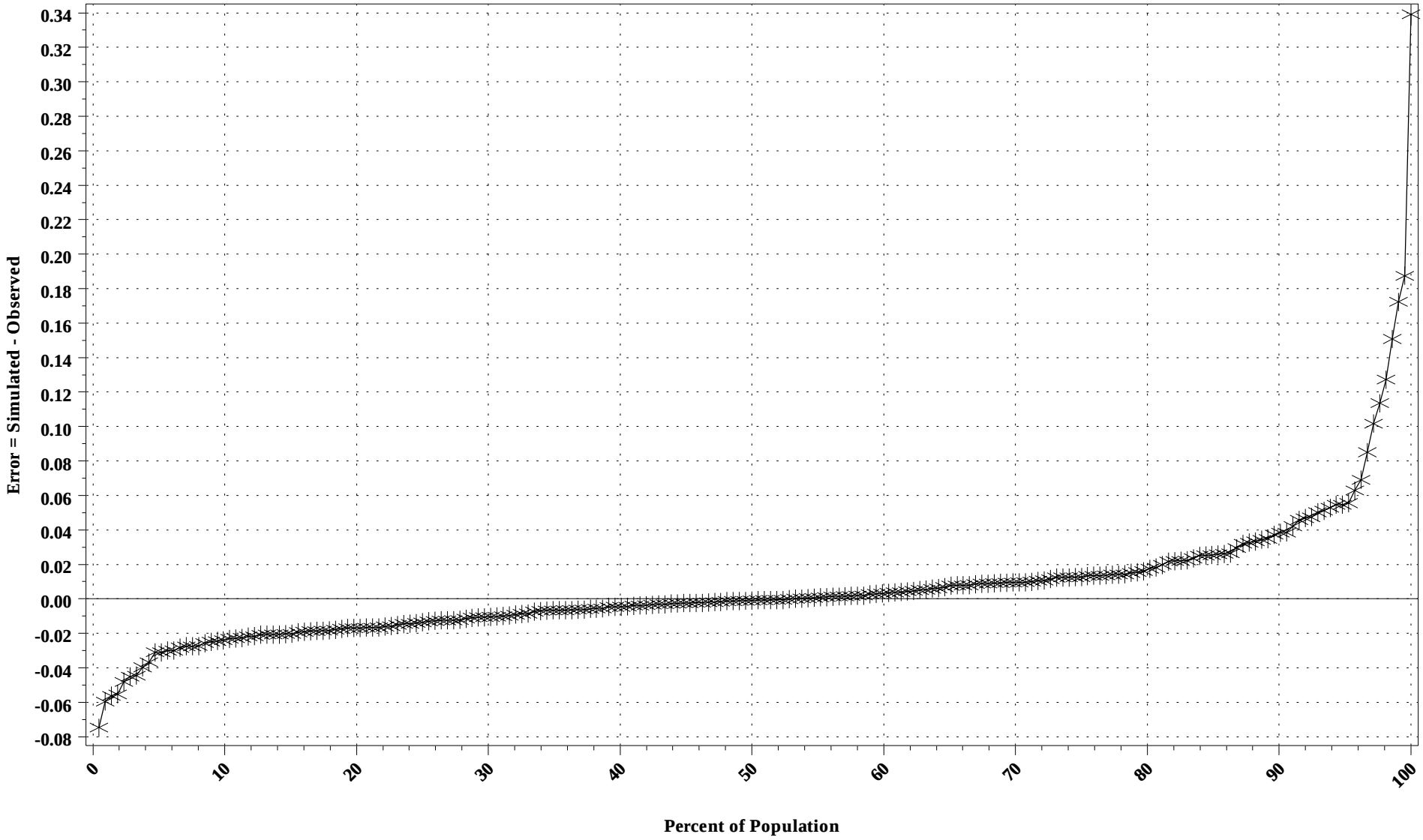
# Choptank River at Segment 770
## Dissolved Phosphorus
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Actual error versus Percentile Sample Population
## Dissolved Phosphorus

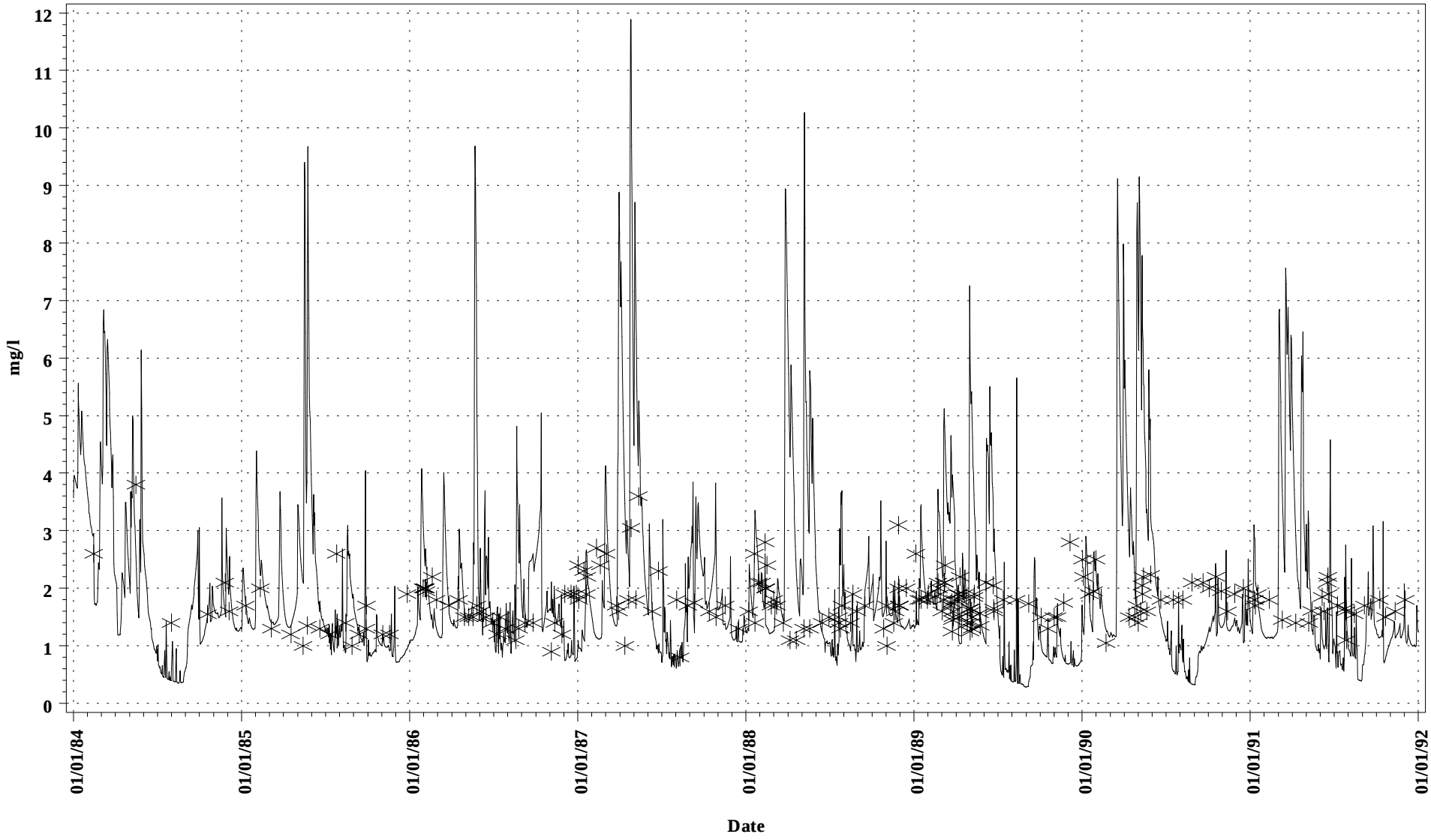
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(choptank.drv 29JUN98 14:42)

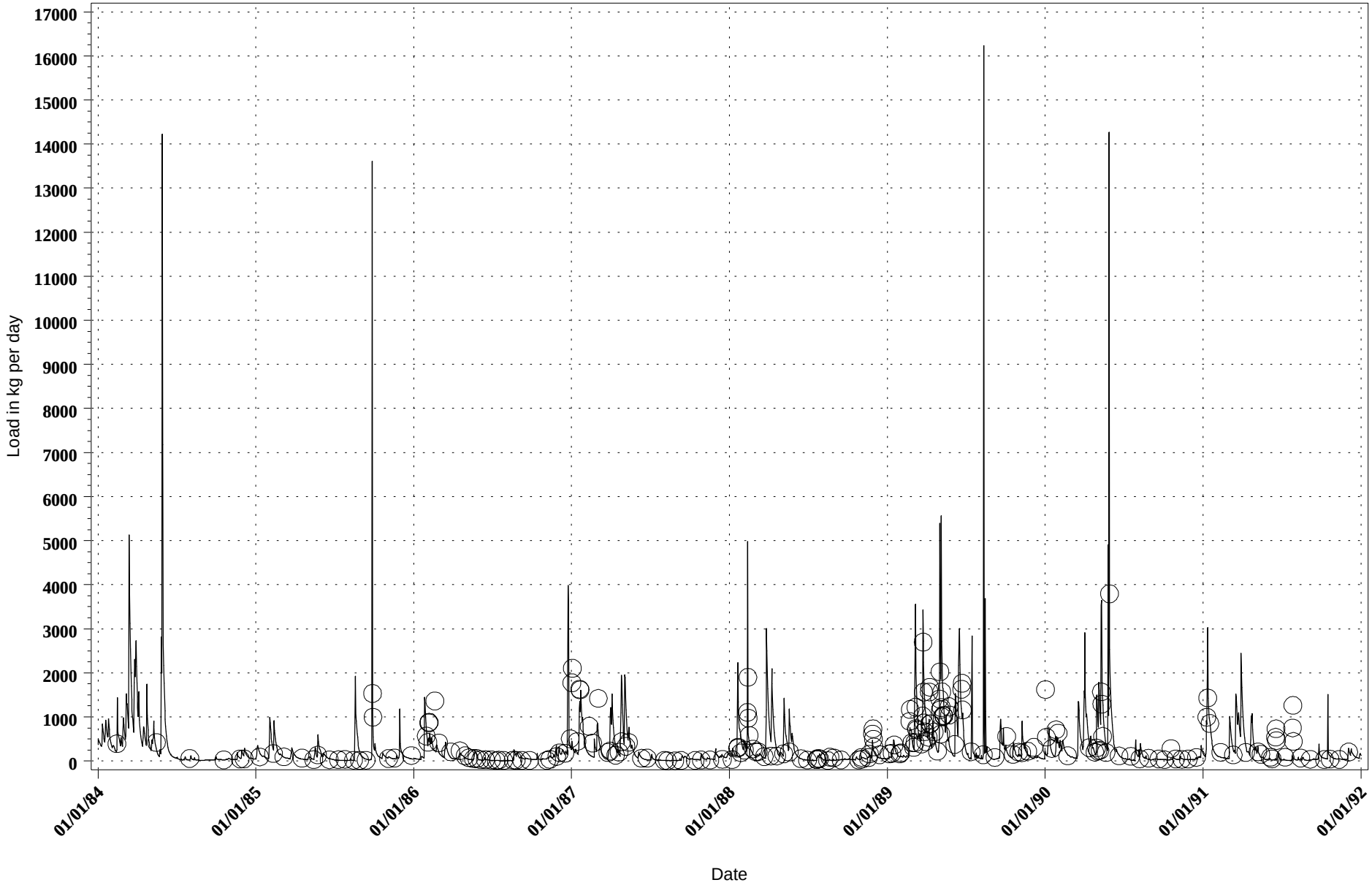
# Choptank River at Segment 770
## Observed and Simulated versus Time
# Total Nitrogen

**(*=Observed, -=Simulated)**




(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Total Nitrogen Observed and Simulated Load vs Time
### (line = simulated, O = observed)

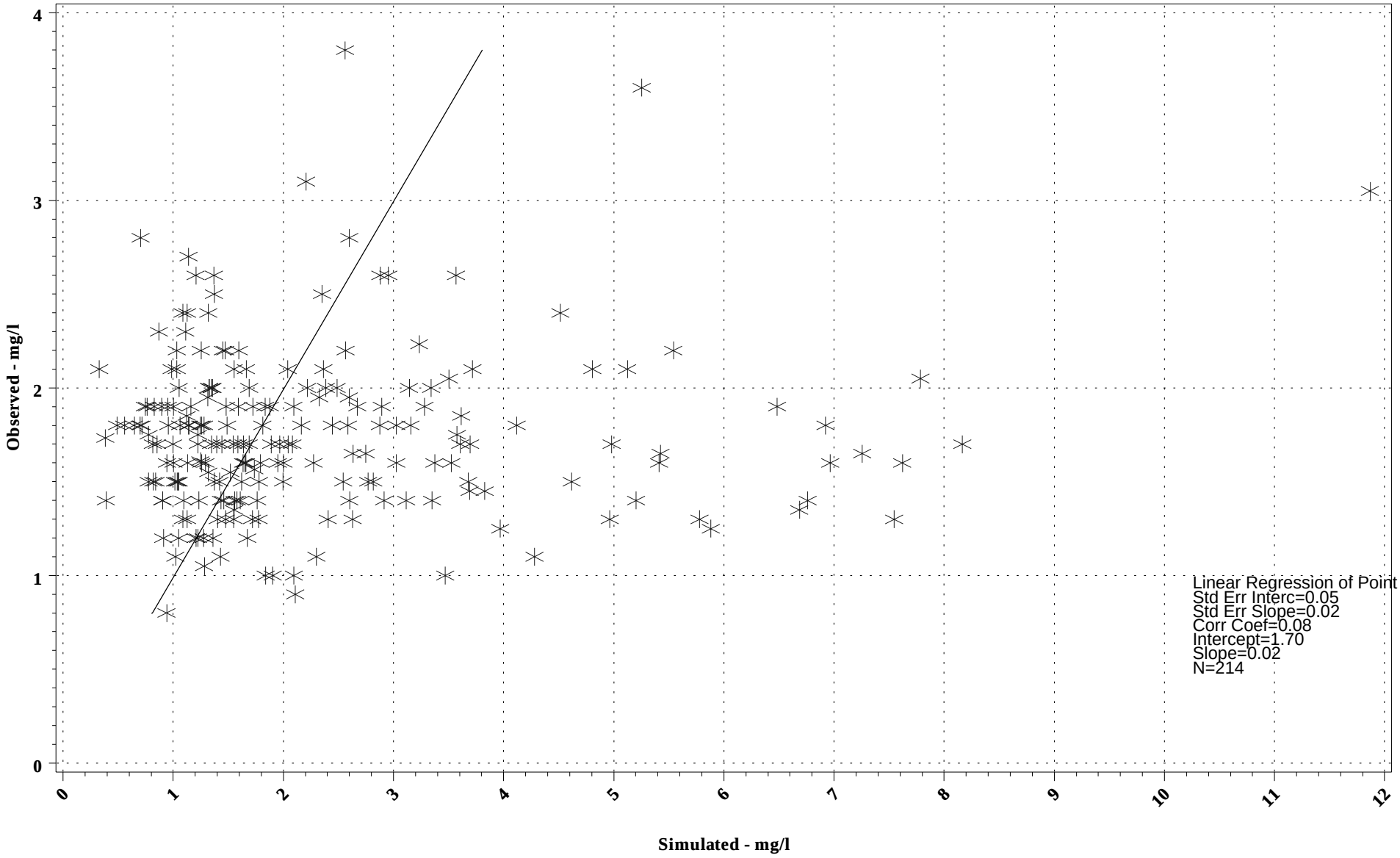



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770

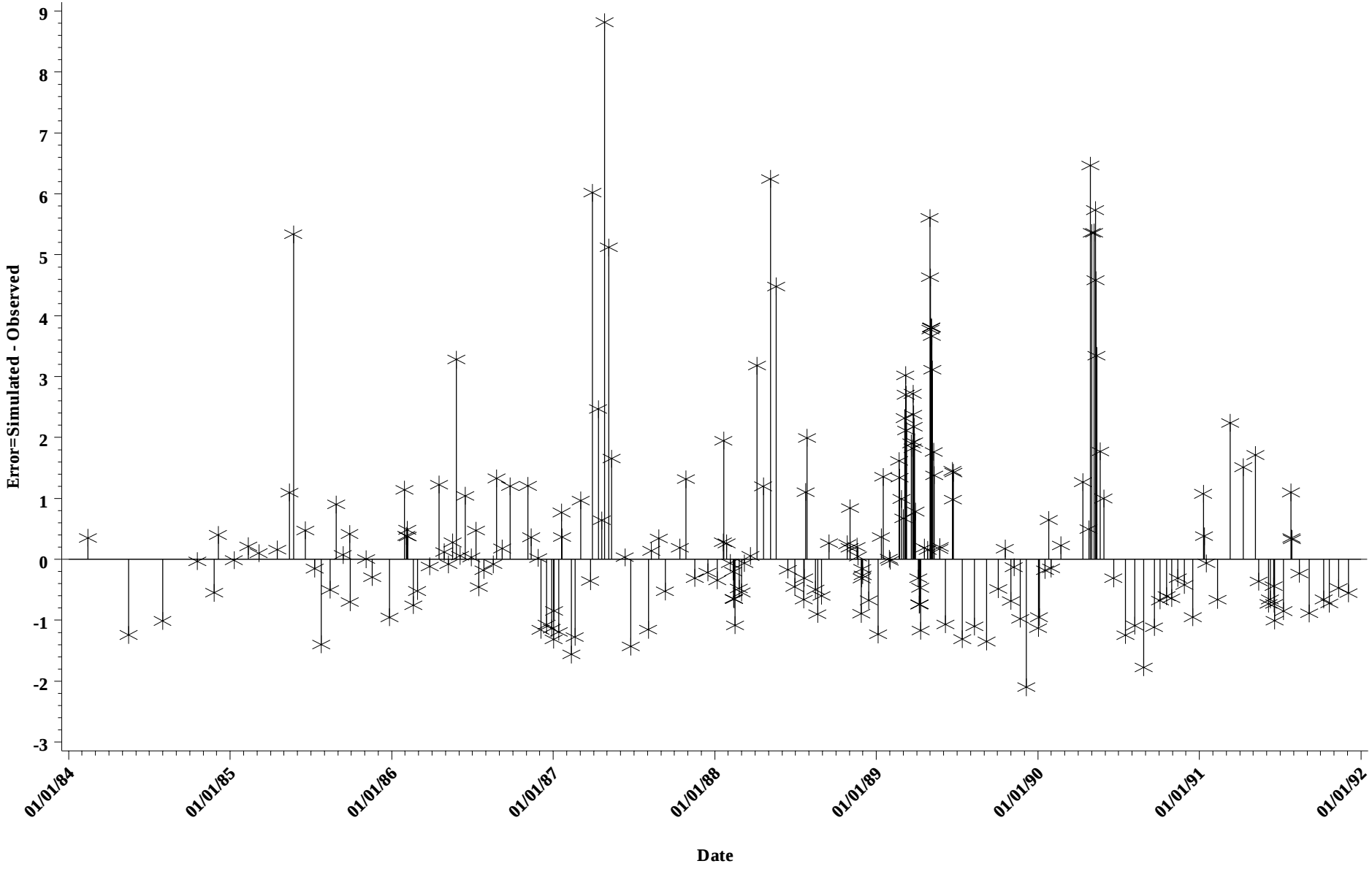
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Nitrogen: 01JAN84 - 01JAN92



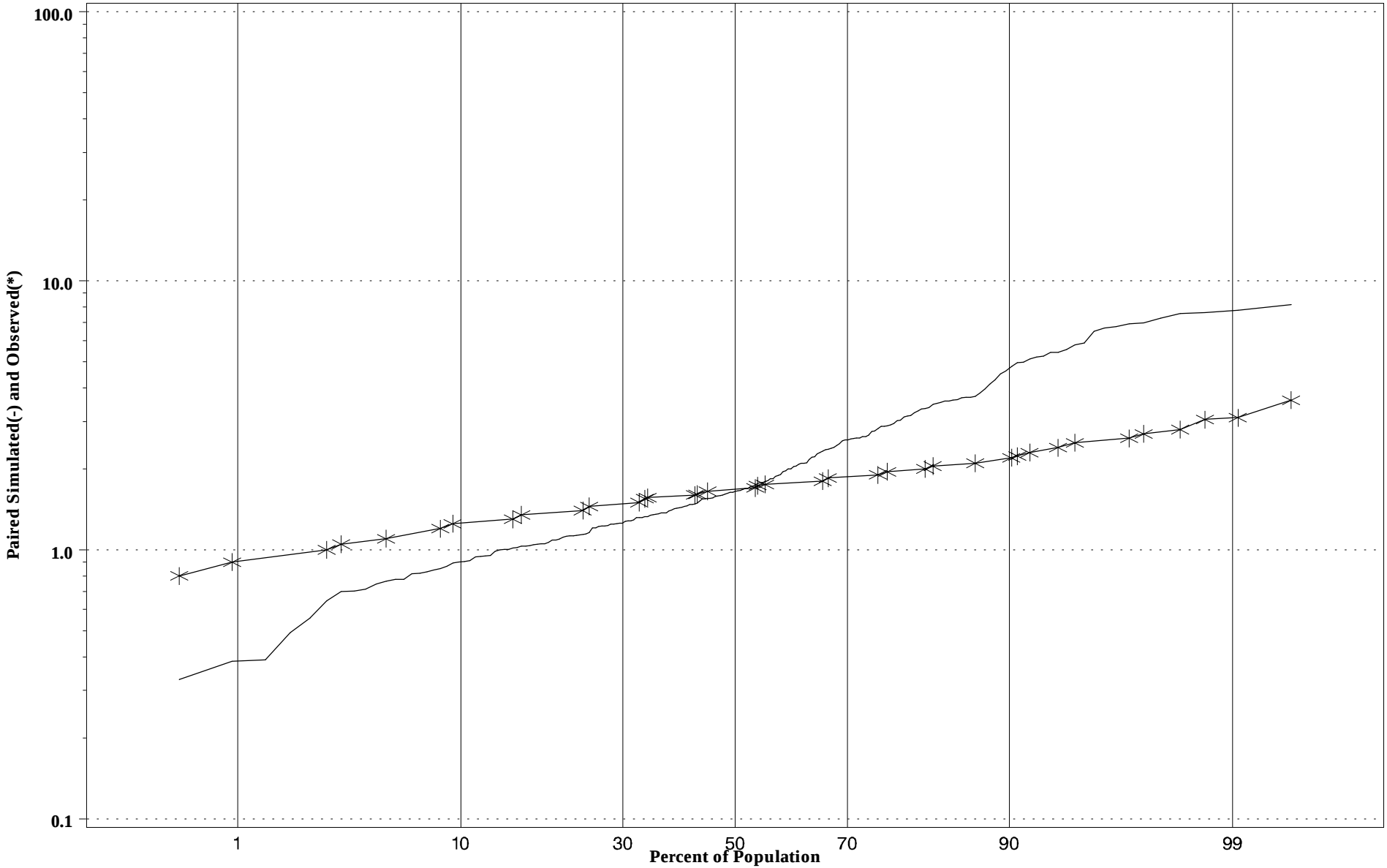

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770
## Actual Error versus Time
## Total Nitrogen




(y21_plotb.sas model3d:[pwang.dt] omerr)
(choptank.drv 29JUN98 14:42)

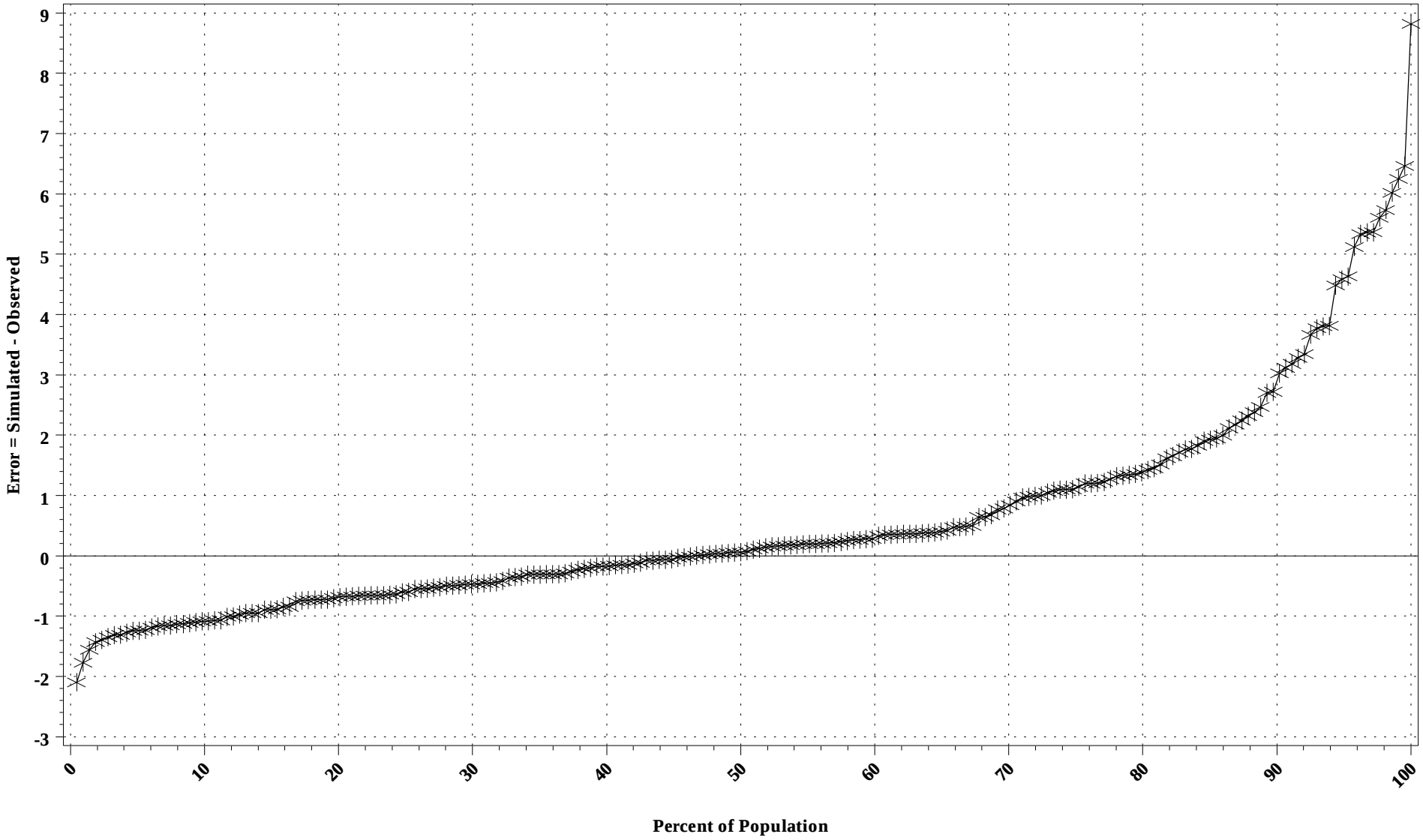
# Choptank River at Segment 770
## Total Nitrogen
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Actual error versus Percentile Sample Population
## Total Nitrogen

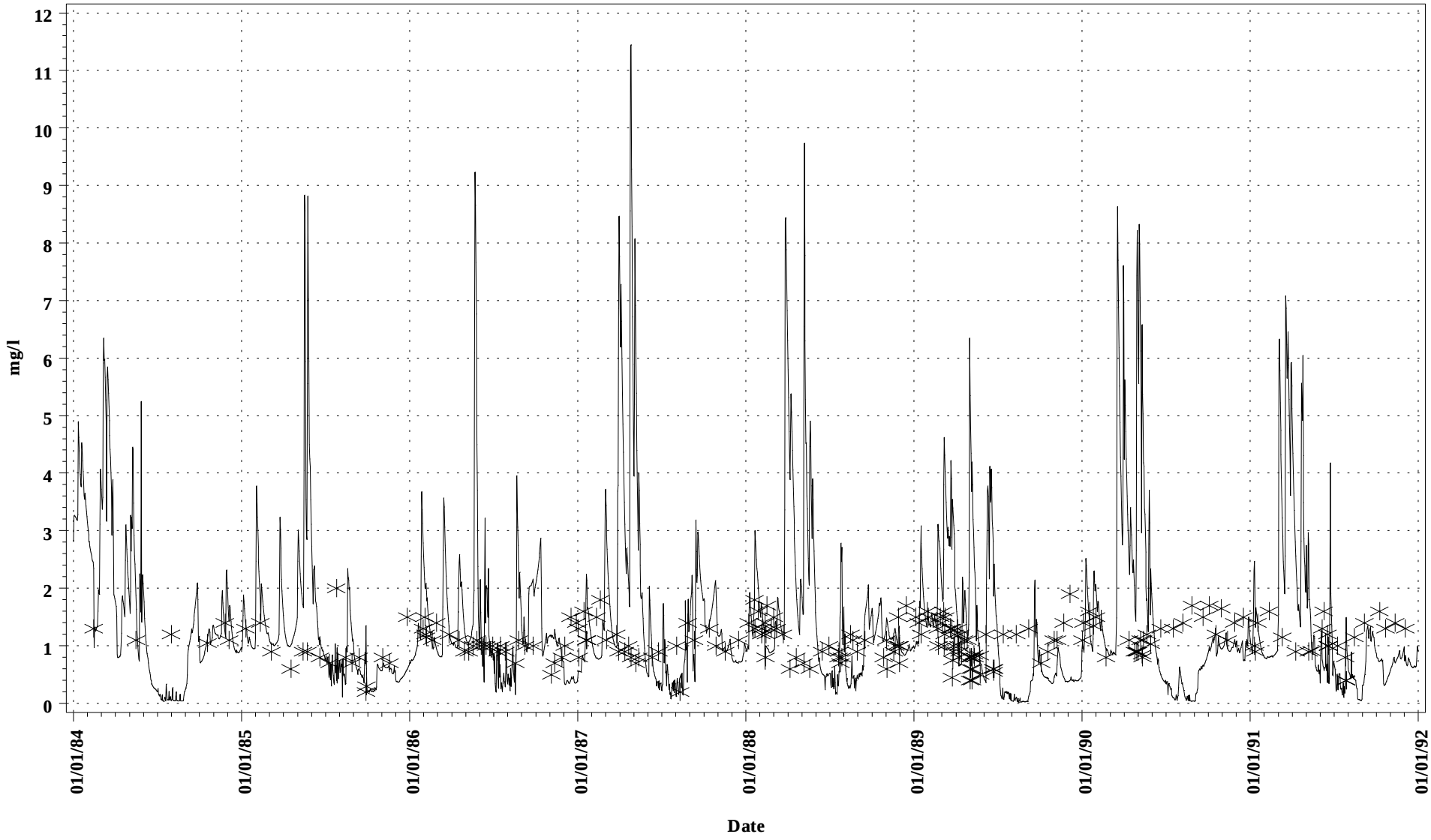
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Observed and Simulated versus Time
## NO3

**(*=Observed, -=Simulated)**

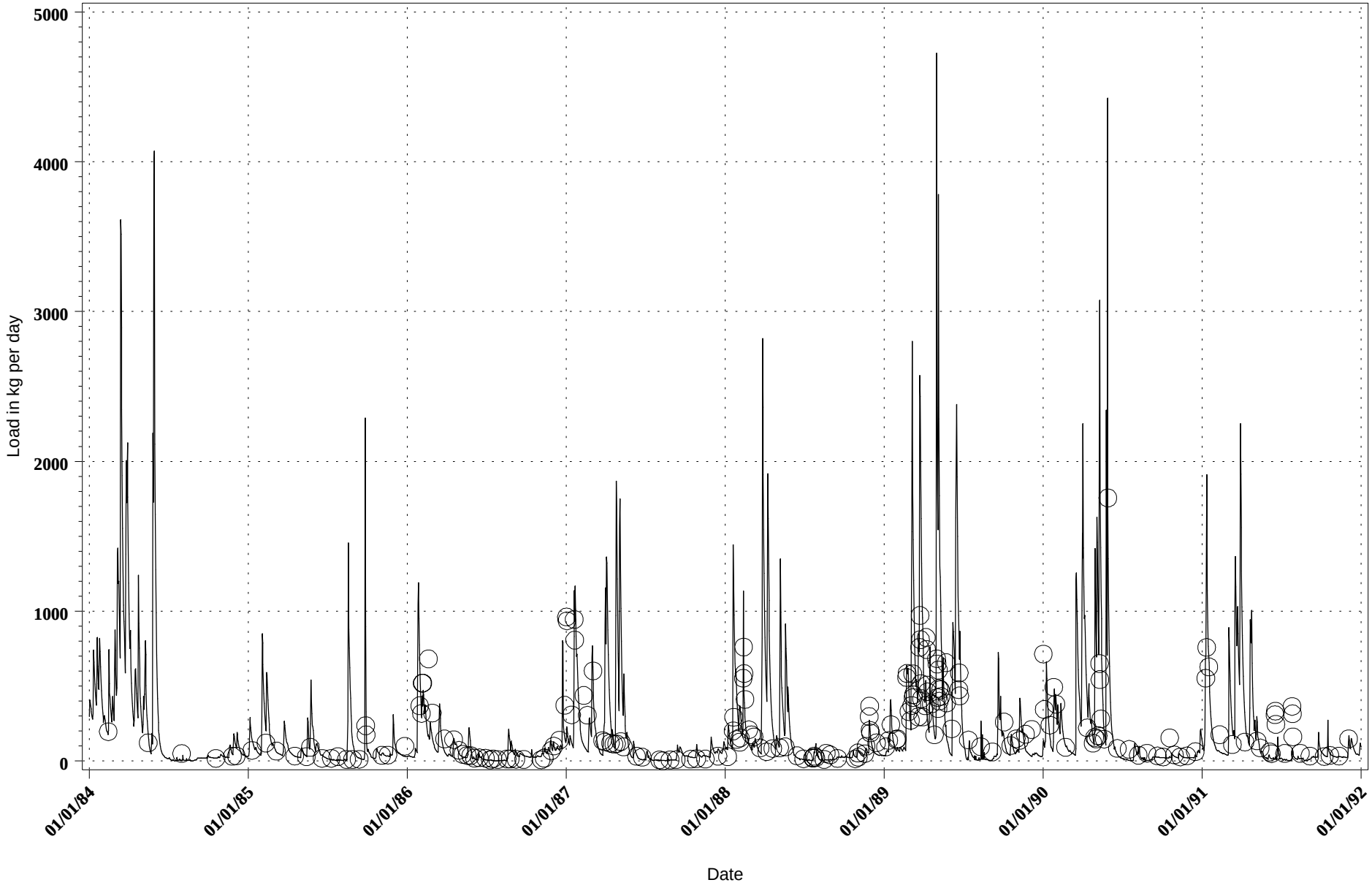



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770

## NO3 Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

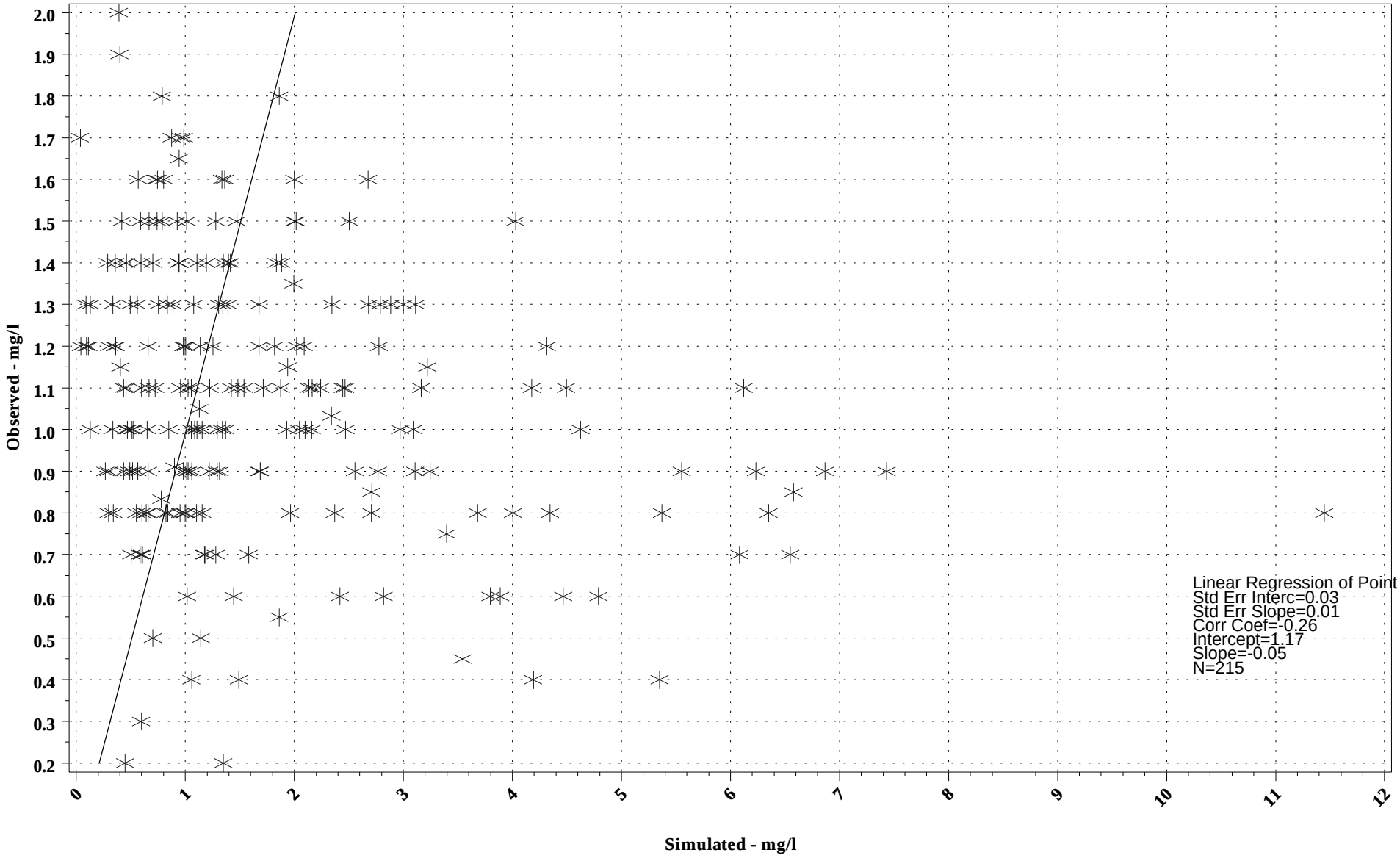



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770

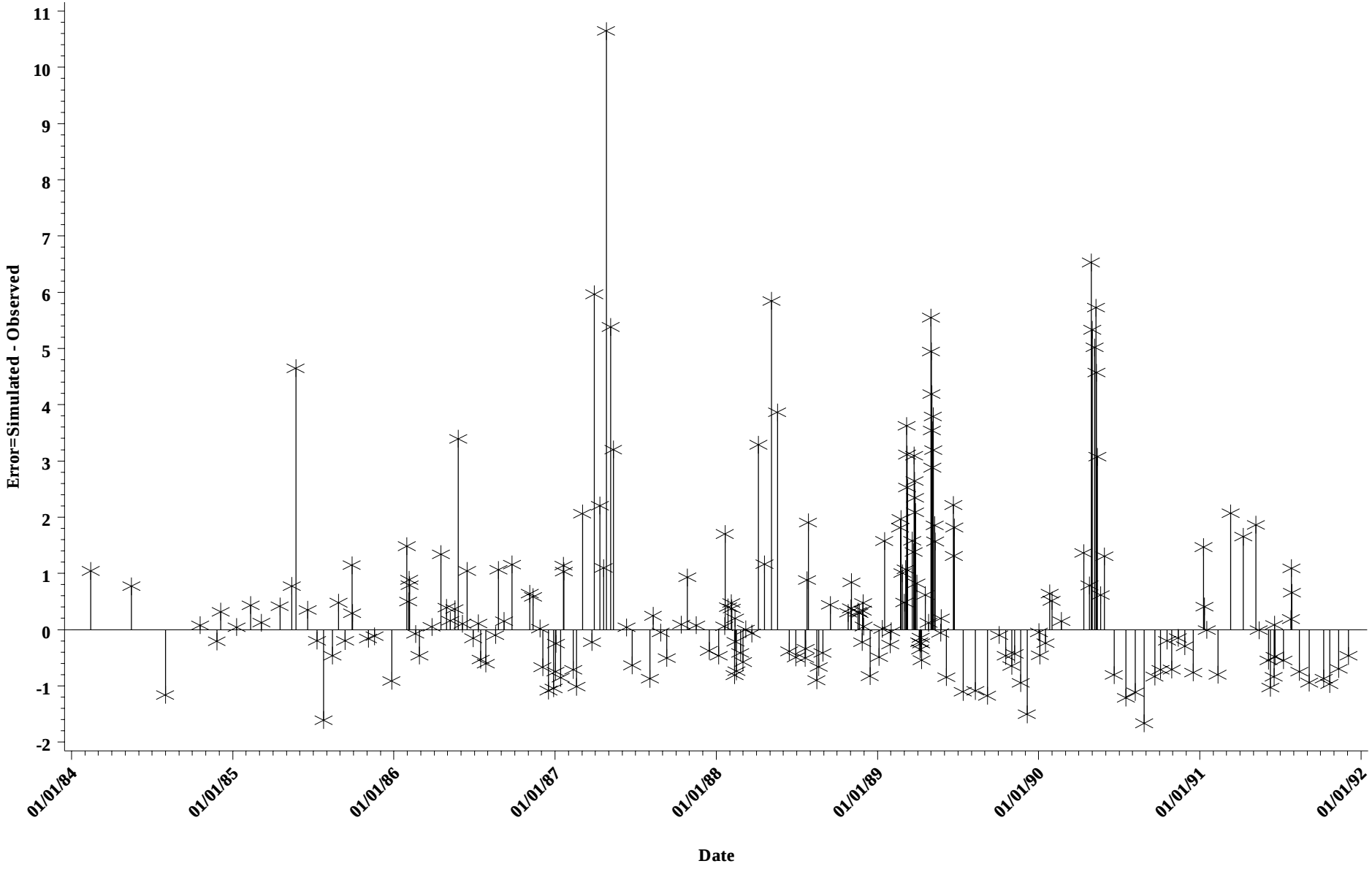
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## NO3: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770
## Actual Error versus Time
## NO3

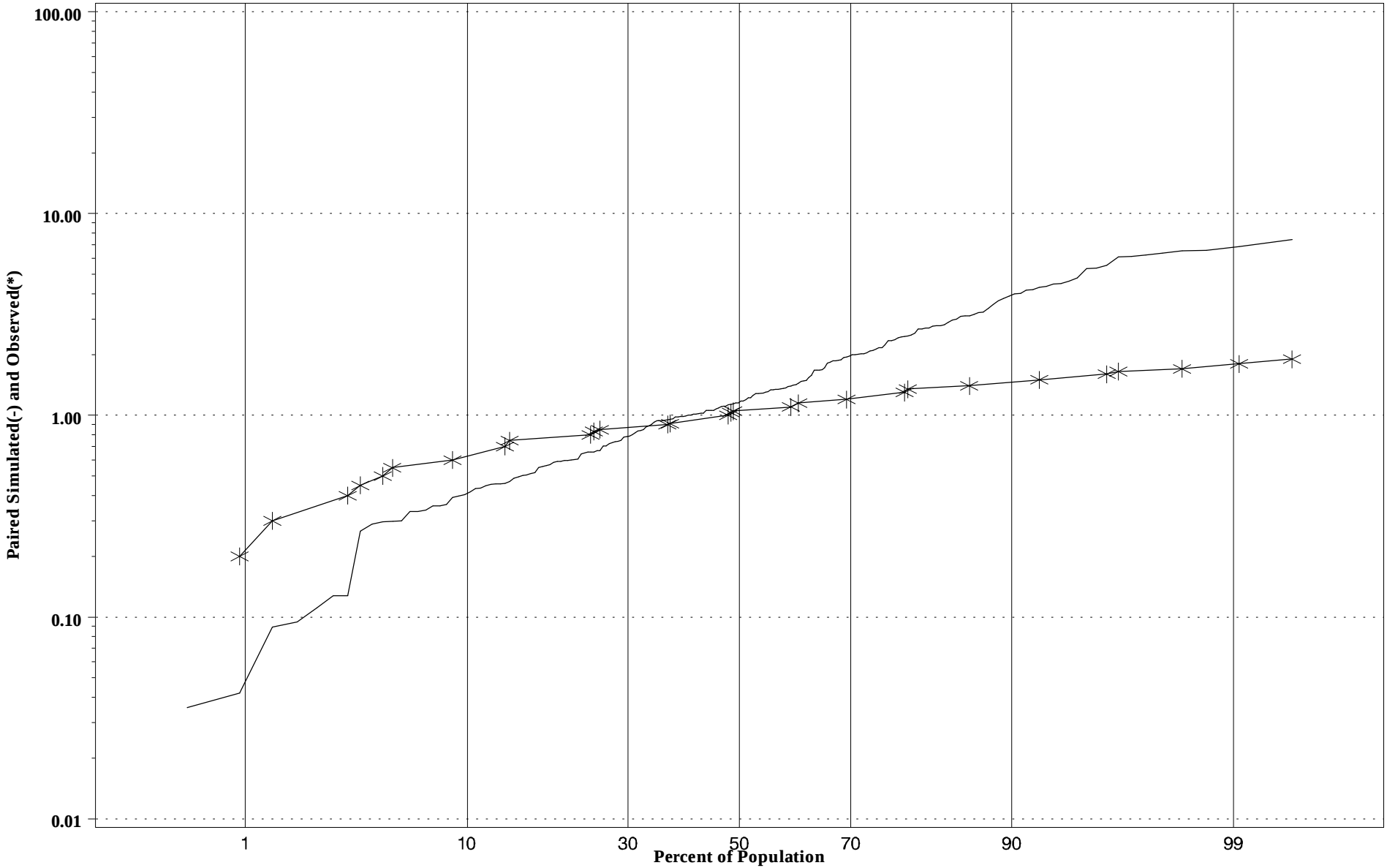



(y21_plotb.sas model3d:[pwang.dt] omerr)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770

## NO3

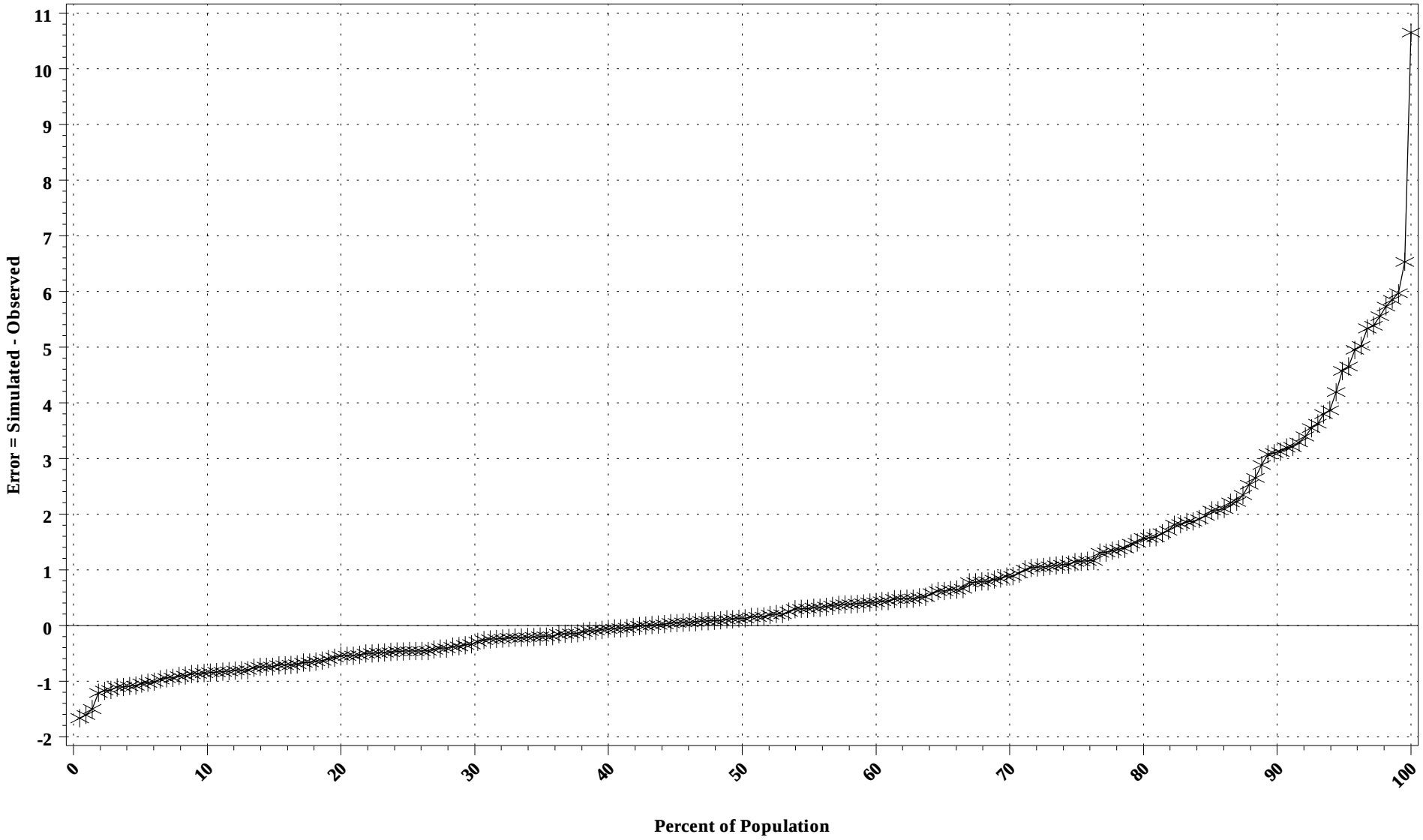
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Actual error versus Percentile Sample Population
## NO3

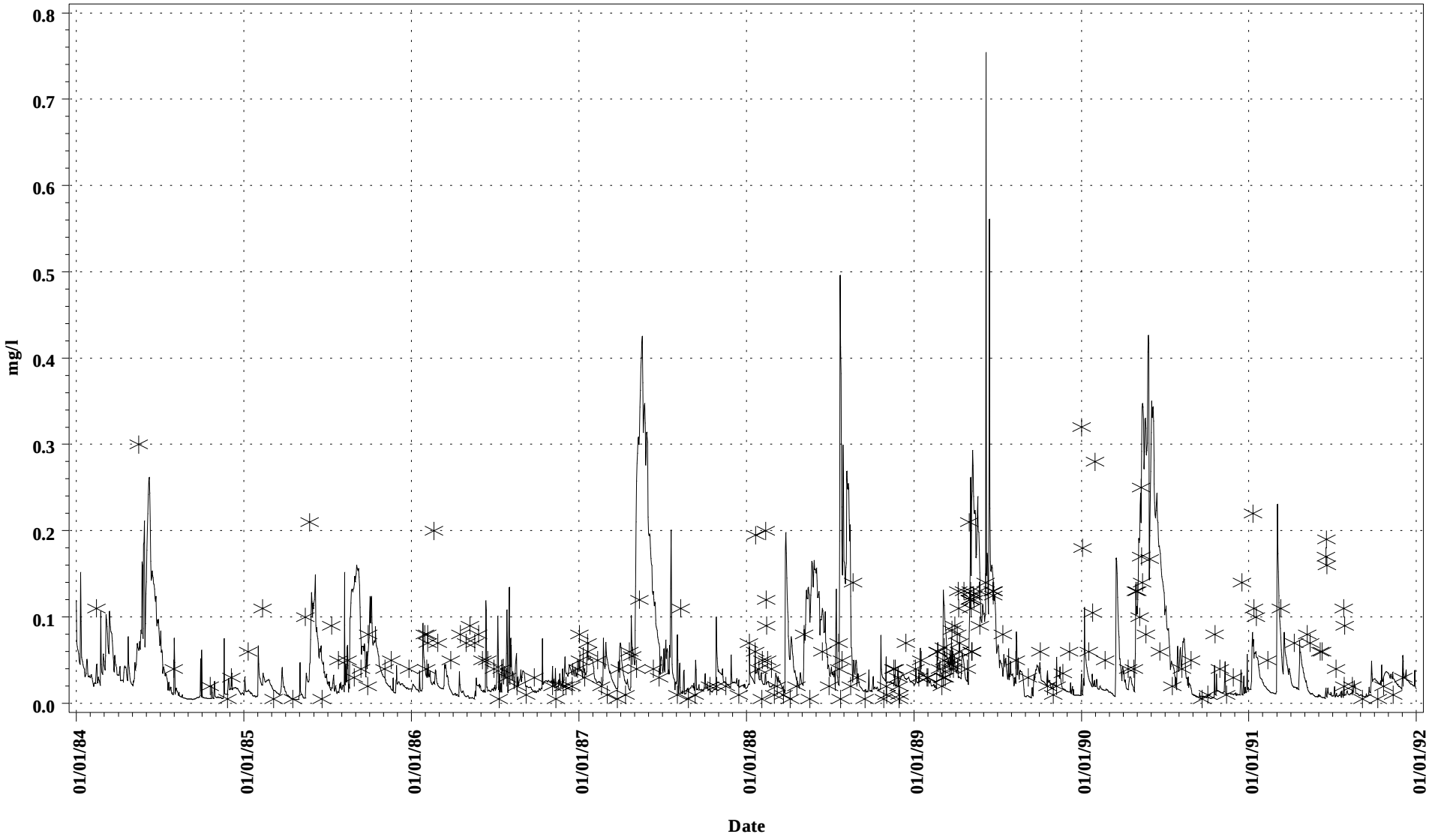
### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Observed and Simulated versus Time
# Total Ammonia

**(*=Observed, -=Simulated)**

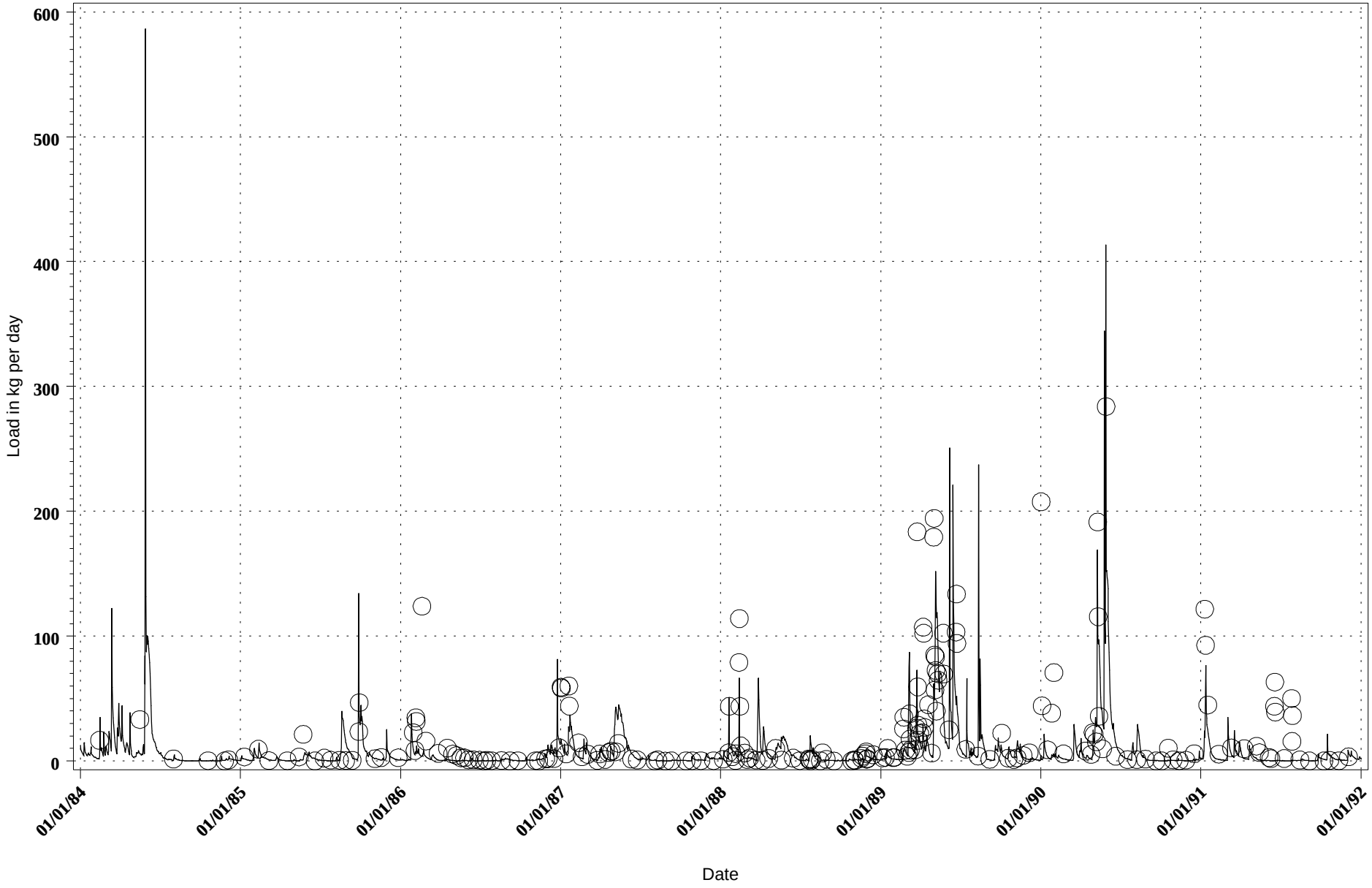



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770

## Total Ammonia Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

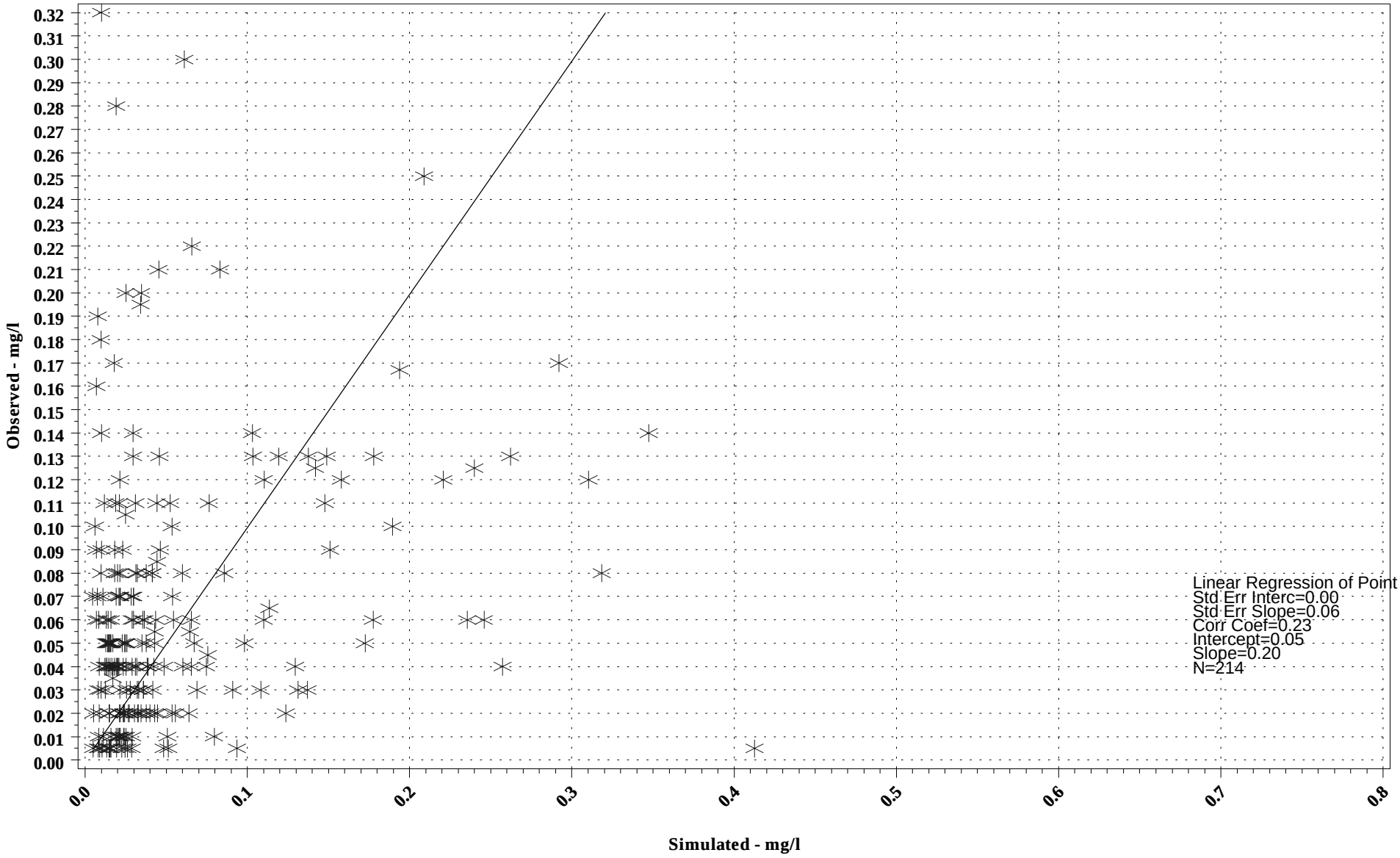



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770

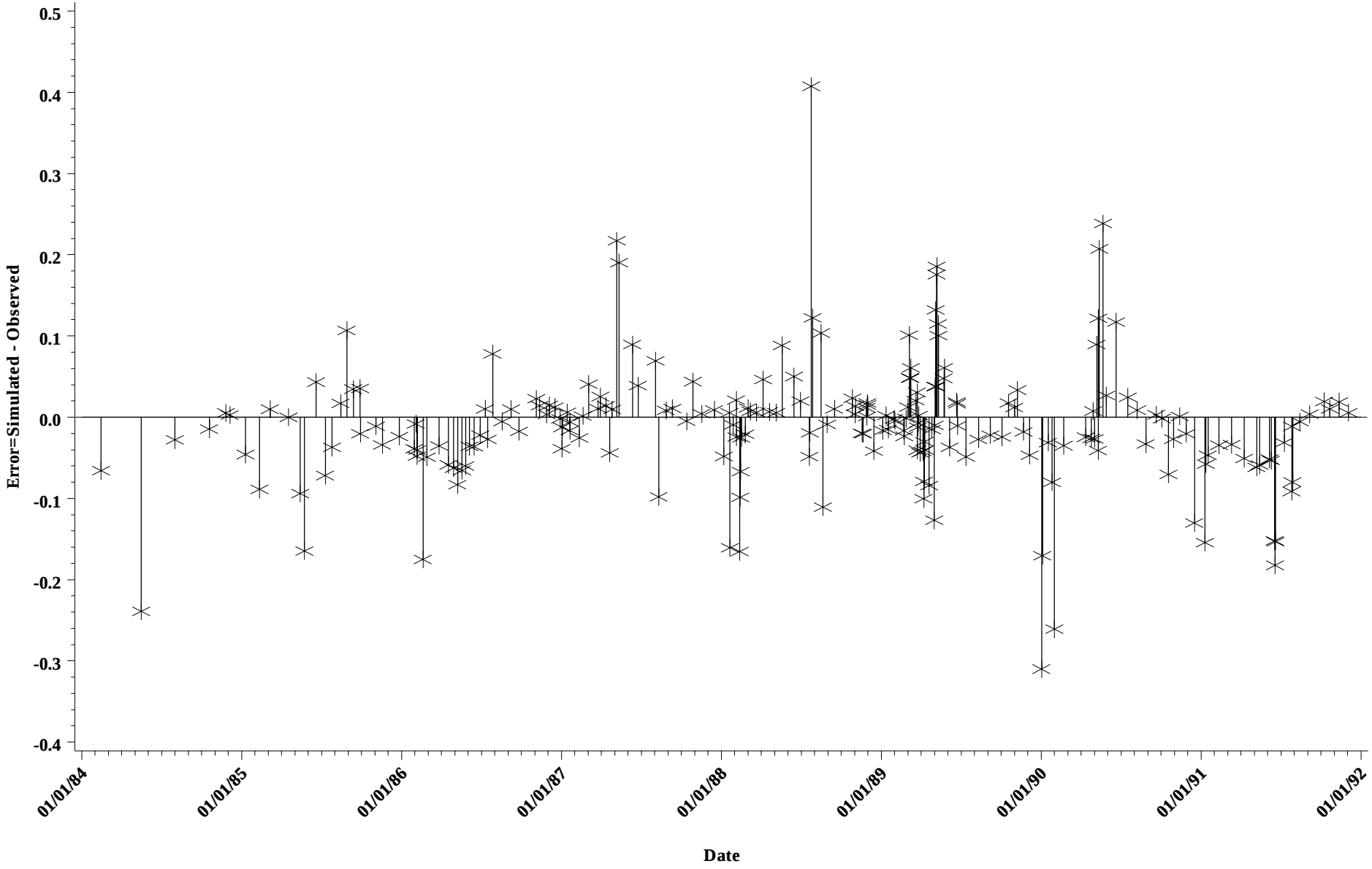
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Total Ammonia: 01JAN84 - 01JAN92



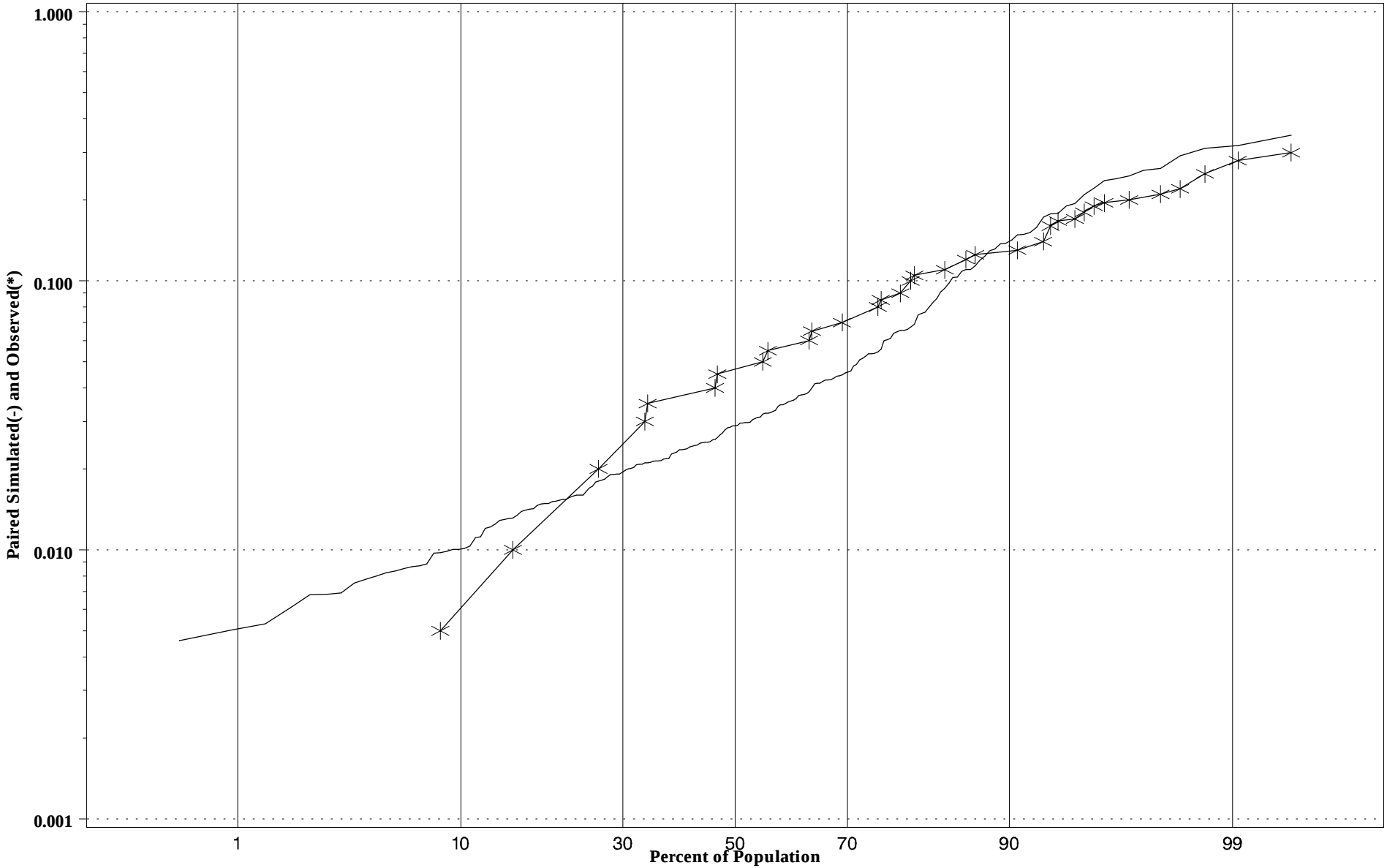

(y21_plotb.sas model3d:[pwang.dt] llomregr)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770
## Actual Error versus Time
## Total Ammonia




(y21_plotb.sas model3d:[pwang.dt] omerr)
(choptank.drv 29JUN98 14:42)

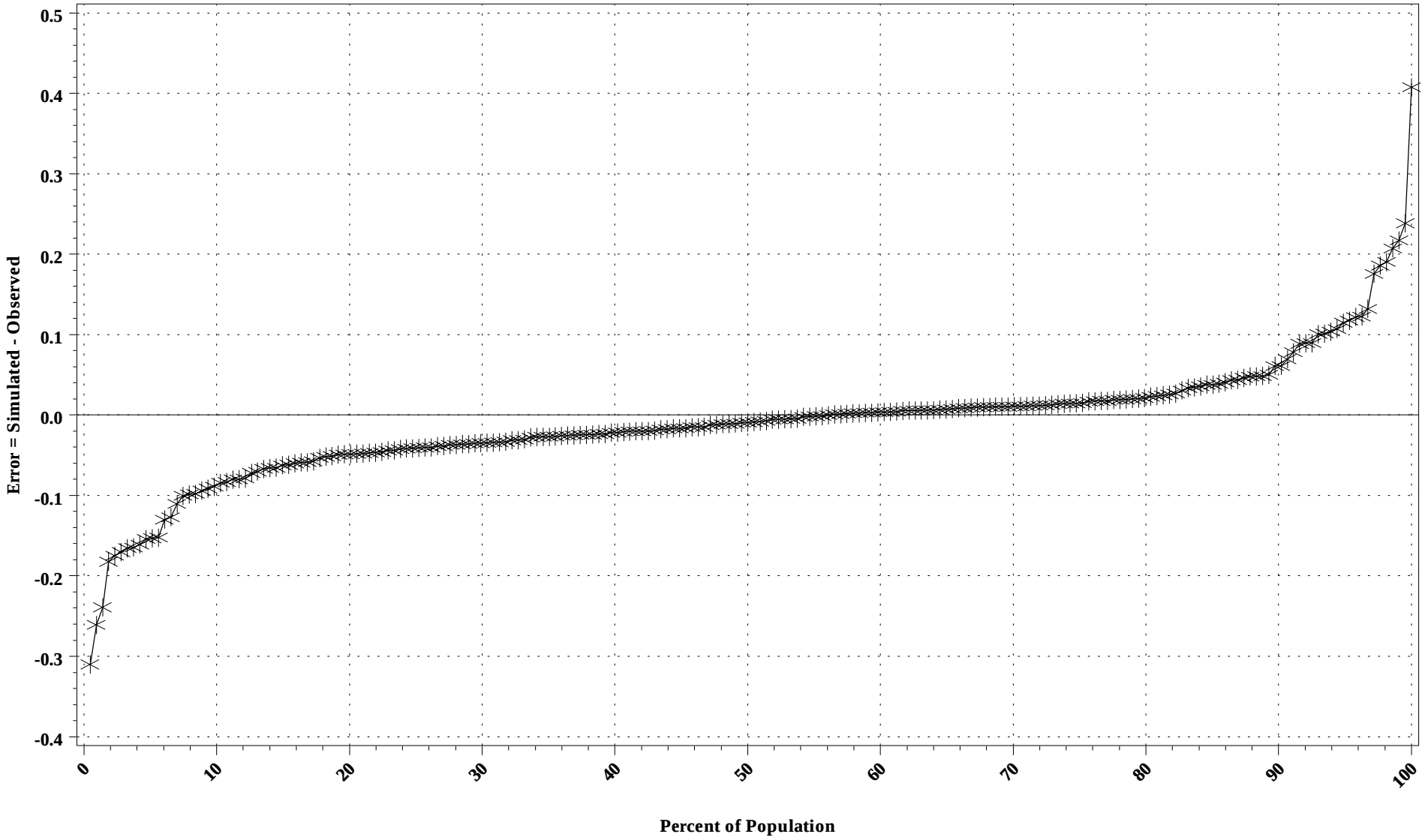
# Choptank River at Segment 770
## Total Ammonia
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(choptank.drv 29JUN98 14:42)

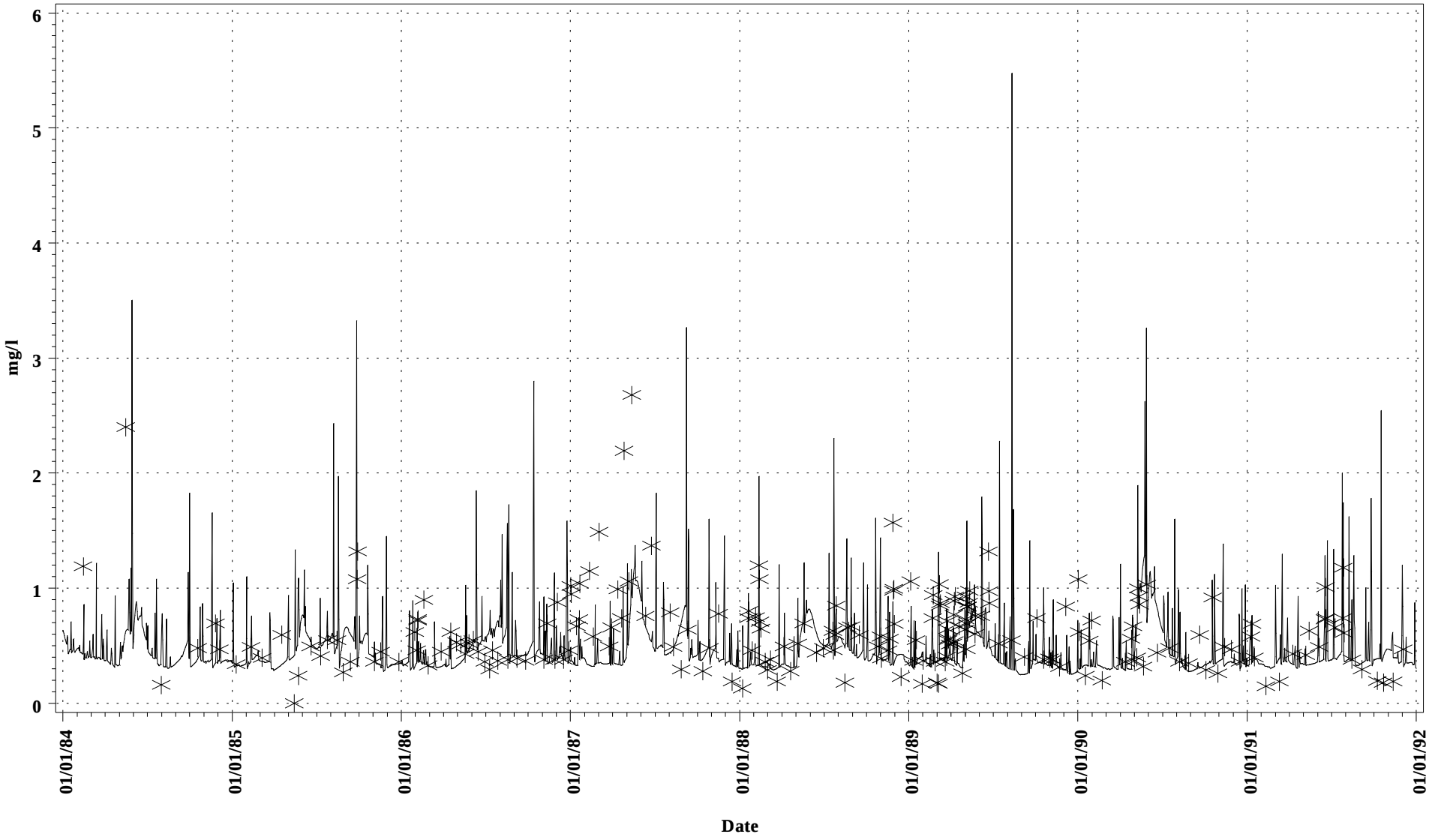
# Choptank River at Segment 770
## Actual error versus Percentile Sample Population
## Total Ammonia

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Observed and Simulated versus Time
# Organic Nitrogen
**(*=Observed, -=Simulated)**

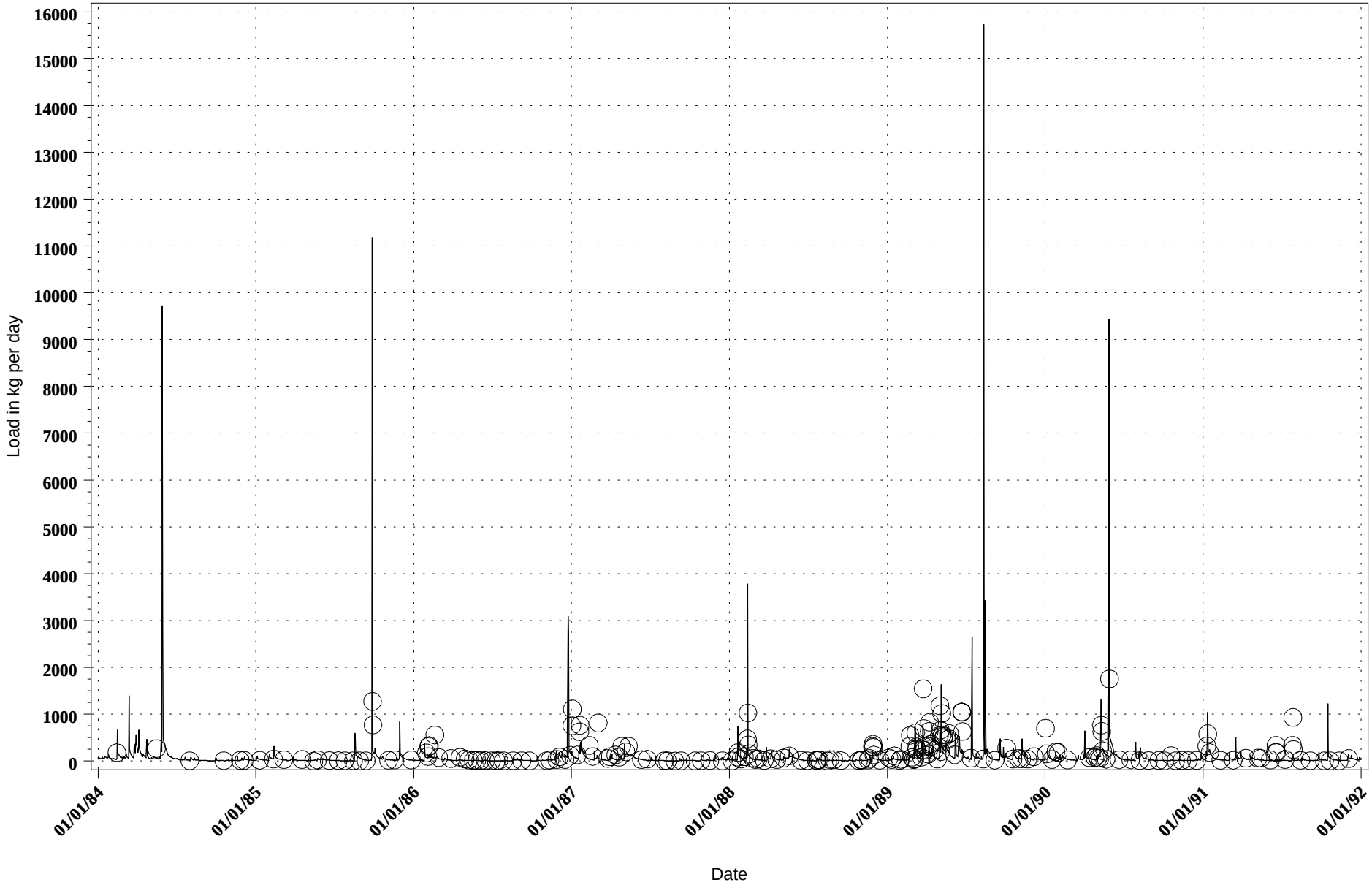



(y21_plotb.sas model3d:[pwang.dt] plotomt - omtime)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770

## Organic Nitrogen Observed and Simulated Load vs Time

**(line = simulated, O = observed)**

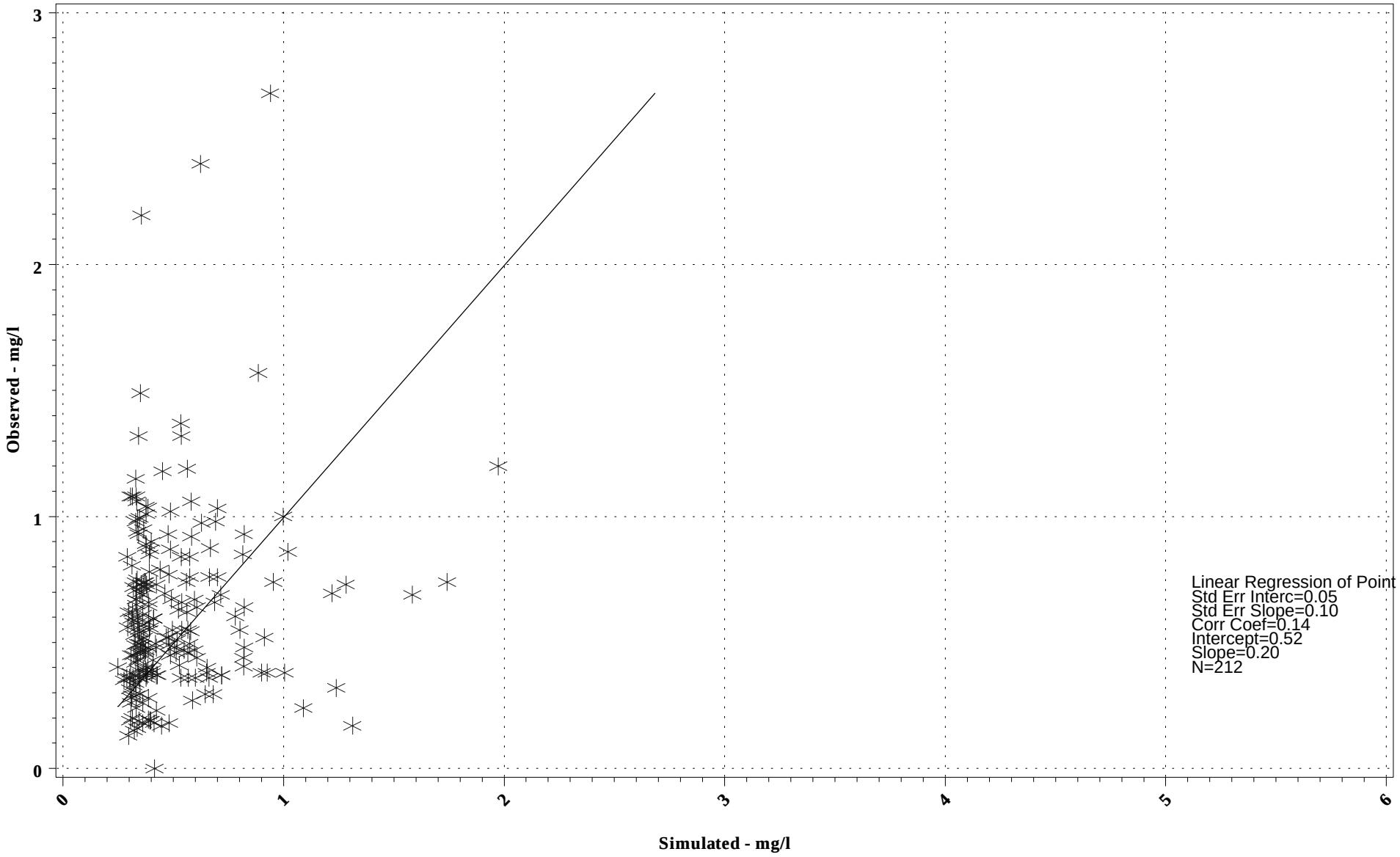



(y21_plotb.sas model3d:[pwang.dt] lldflas)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770

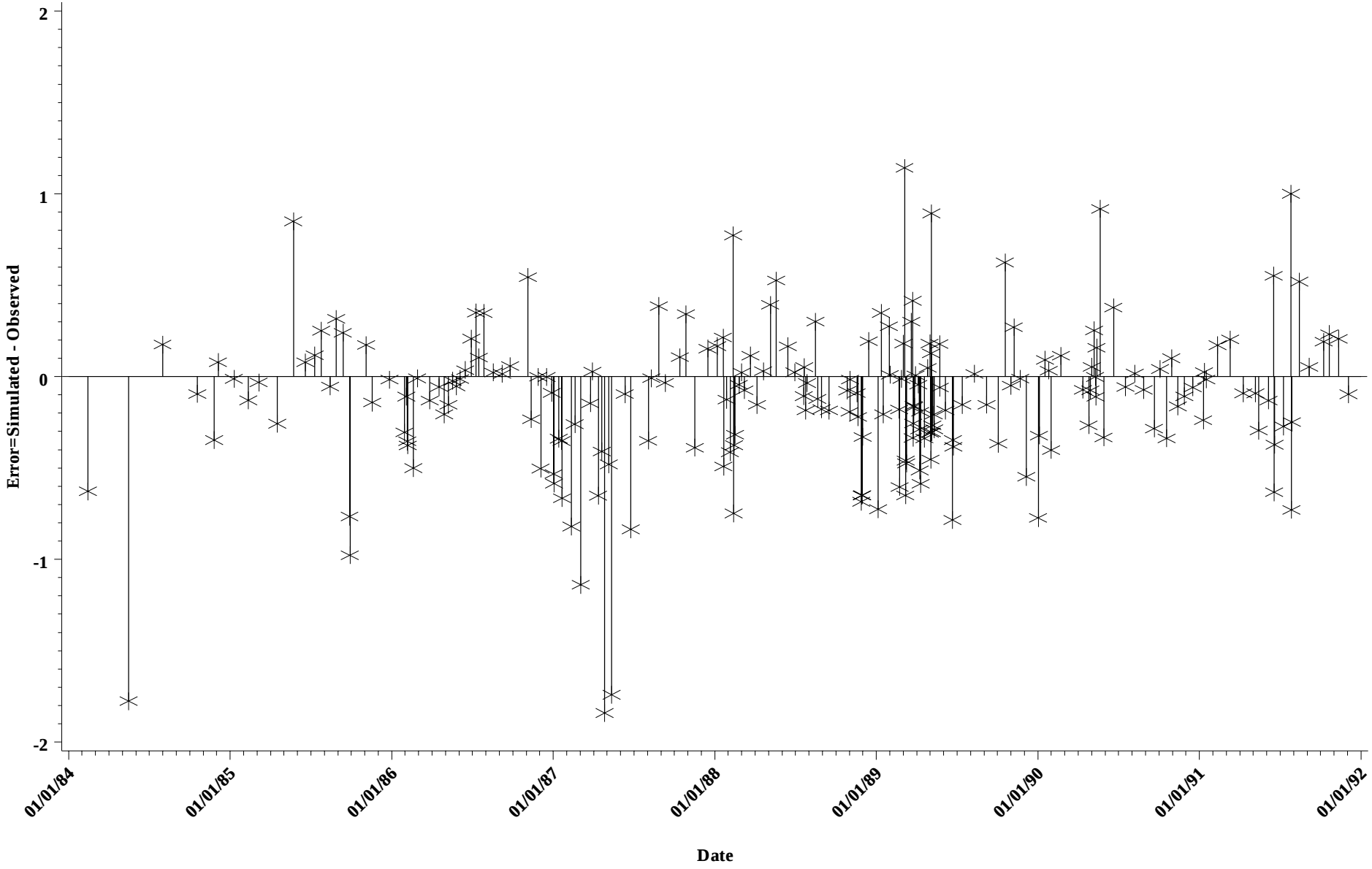
## Scatter Plot and Regression of Simulated versus Observed with Ideal Line

## Organic Nitrogen: 01JAN84 - 01JAN92




(y21_plotb.sas model3d:[pwang.dt] llomregr)
(choptank.drv 29JUN98 14:42,proc reg,model y=x)

# Choptank River at Segment 770
## Actual Error versus Time
## Organic Nitrogen

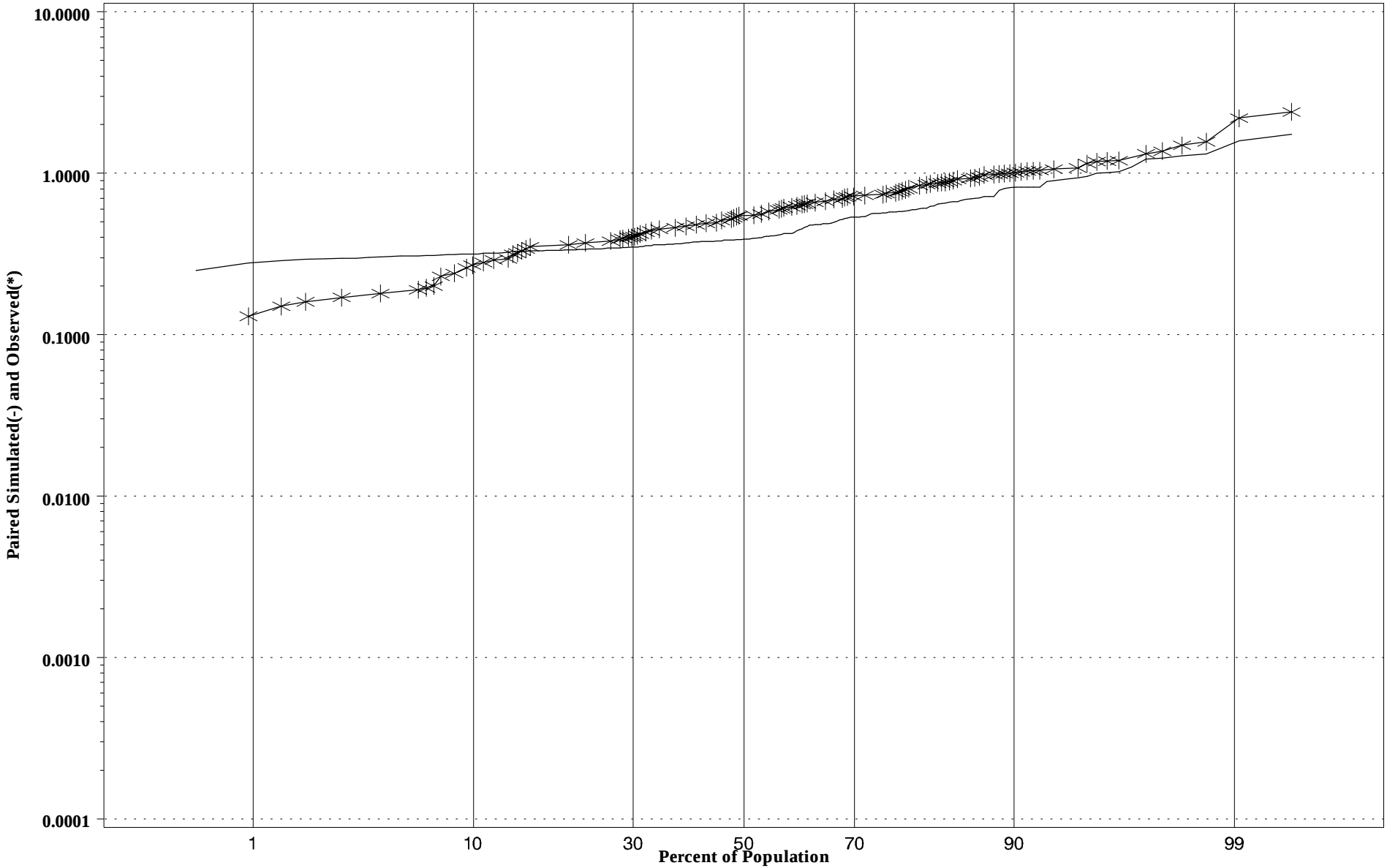



(y21_plotb.sas model3d:[pwang.dt] omerr)
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770

## Organic Nitrogen

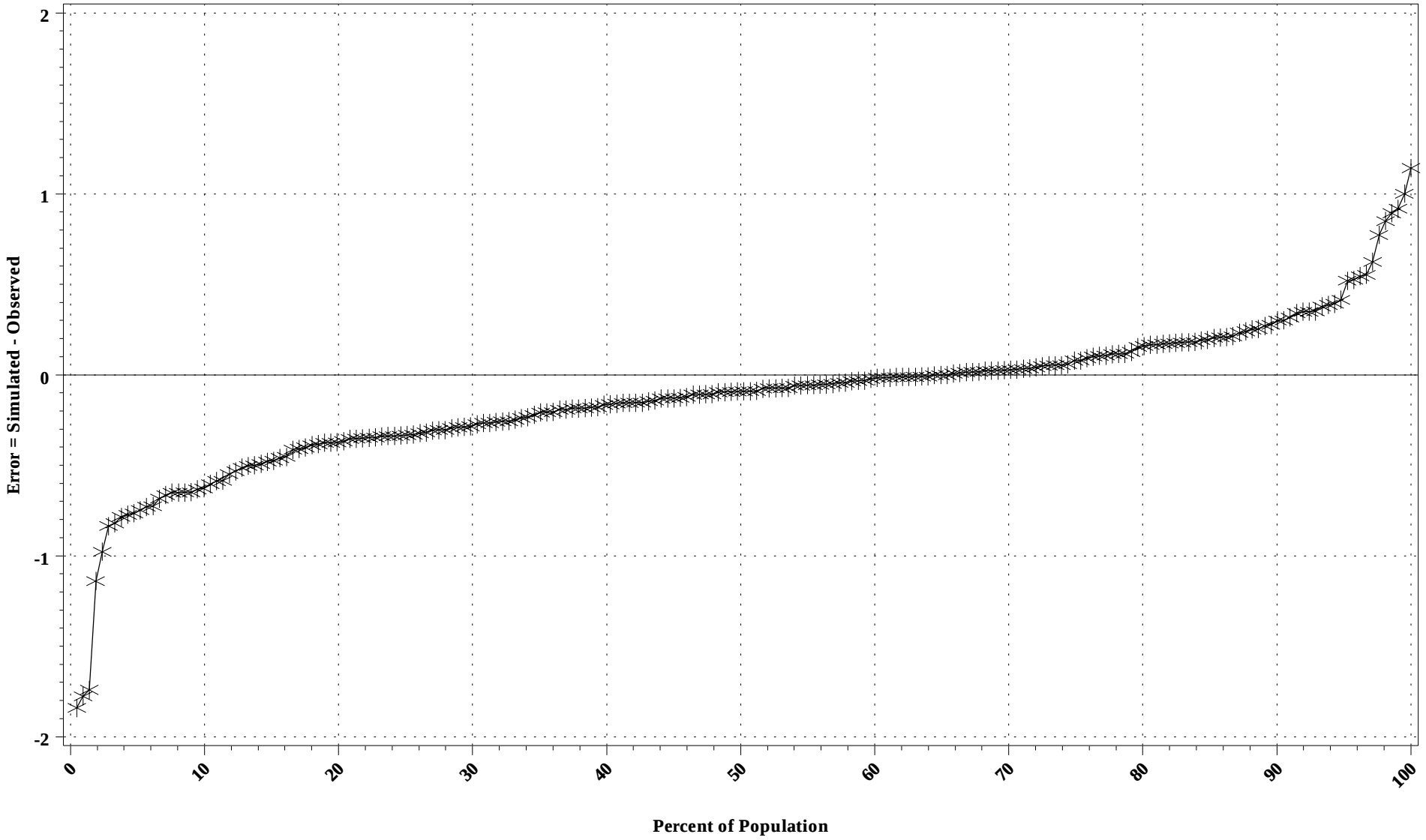
### Frequency Distribution - PAIRED Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt])
(choptank.drv 29JUN98 14:42)

# Choptank River at Segment 770
## Actual error versus Percentile Sample Population
## Organic Nitrogen

### Frequency Distribution - All Simulated and Observed Data




(y21_plotb.sas model3d:[pwang.dt] cmabserr)
(choptank.drv 29JUN98 14:42)

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