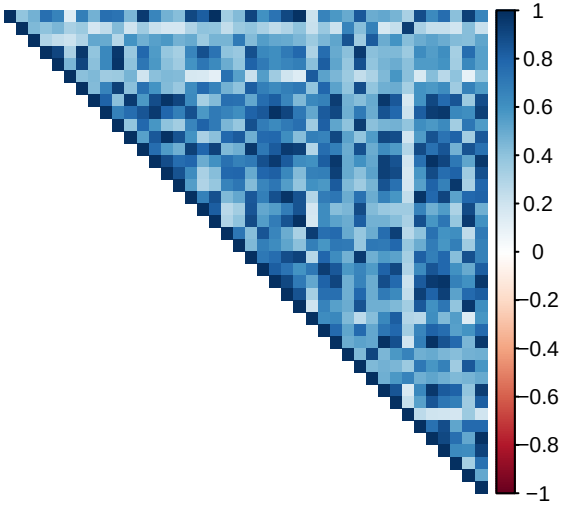
Mean − Wind
W/m2
0.15
0.20
0.25
0.30
0.35

Stan Dev − Wind
W/m2
0.16
0.18
0.20
0.22
0.24

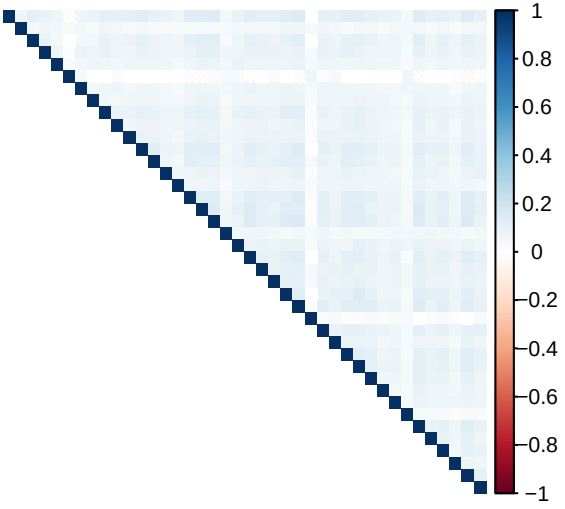
Maximum − Wind
W/m2
0.94
0.96
0.98
1.00

Minimum − Wind
W/m2
0e+00
2e−04
4e−04
6e−04

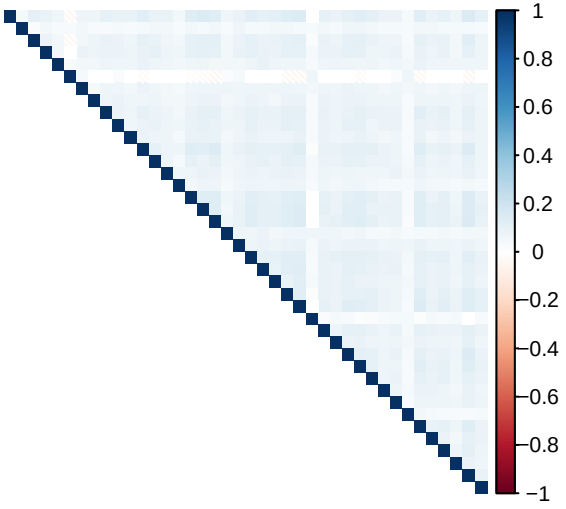
Cross Correlation Data



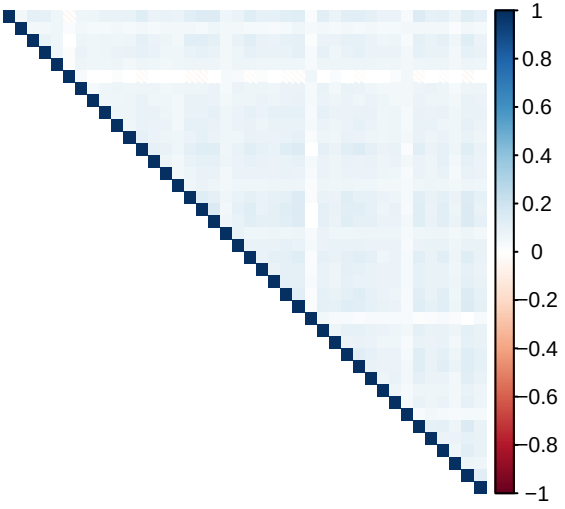
Cross Correlation Simulation Run − 13

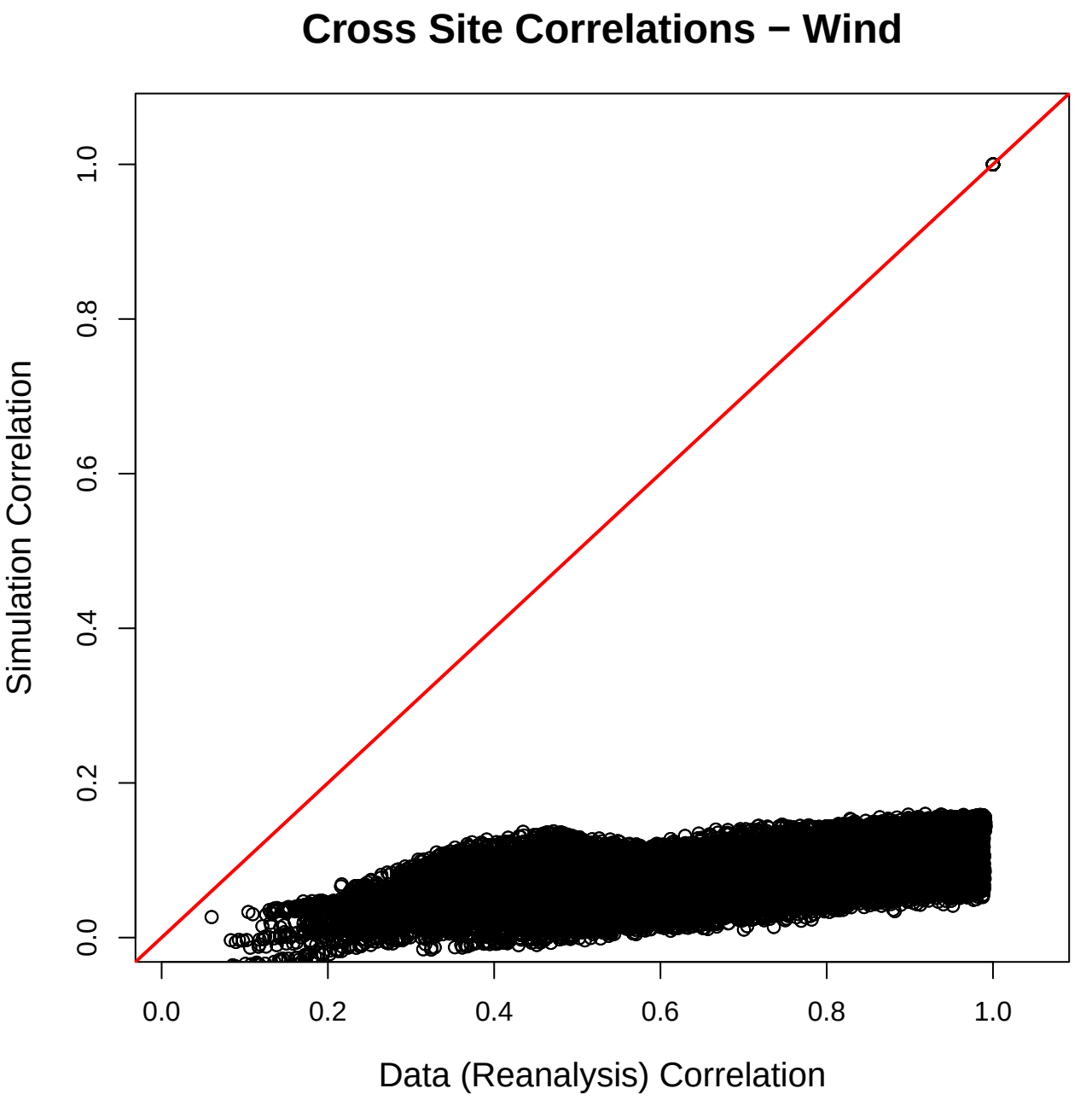


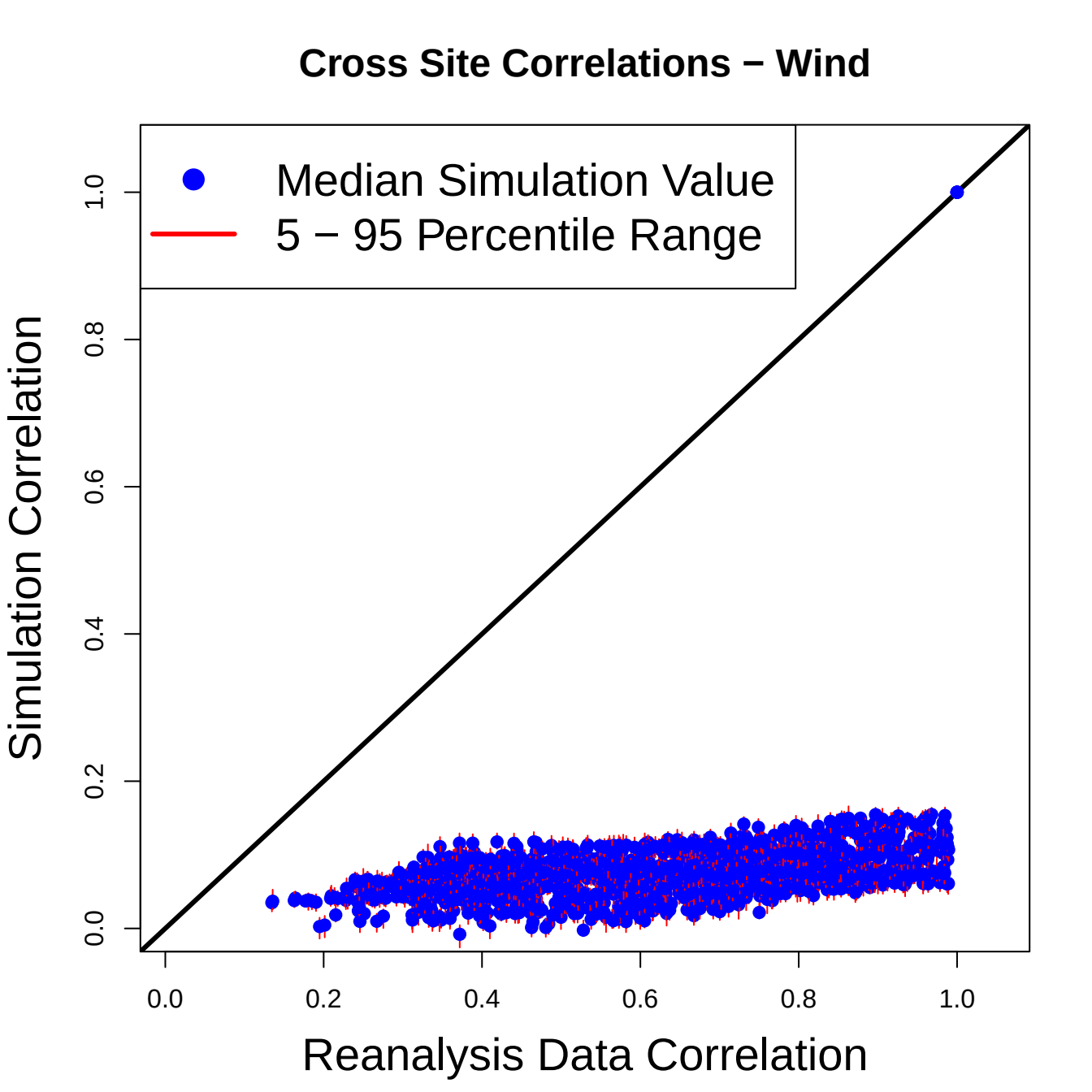
Cross Correlation Simulation Run − 23

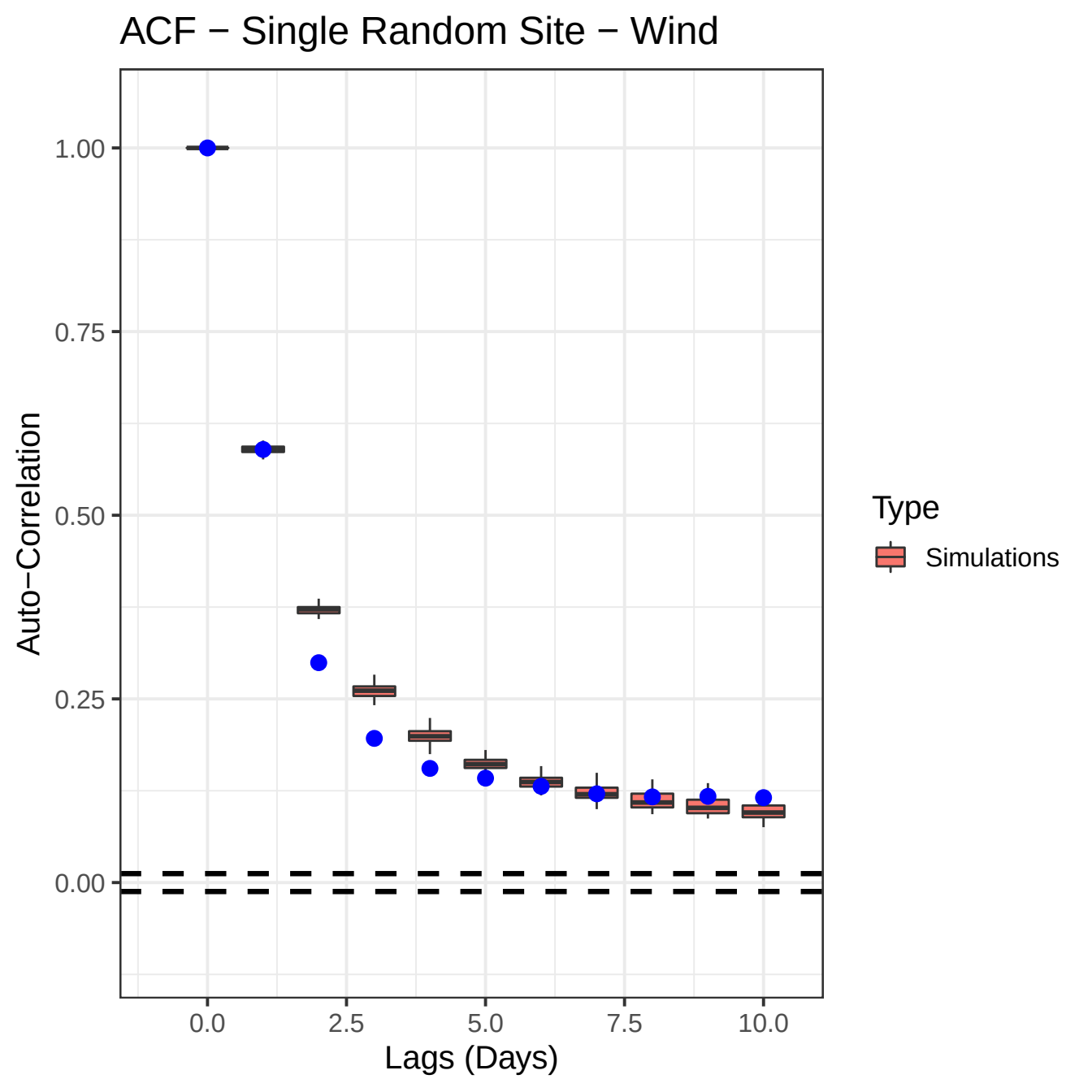


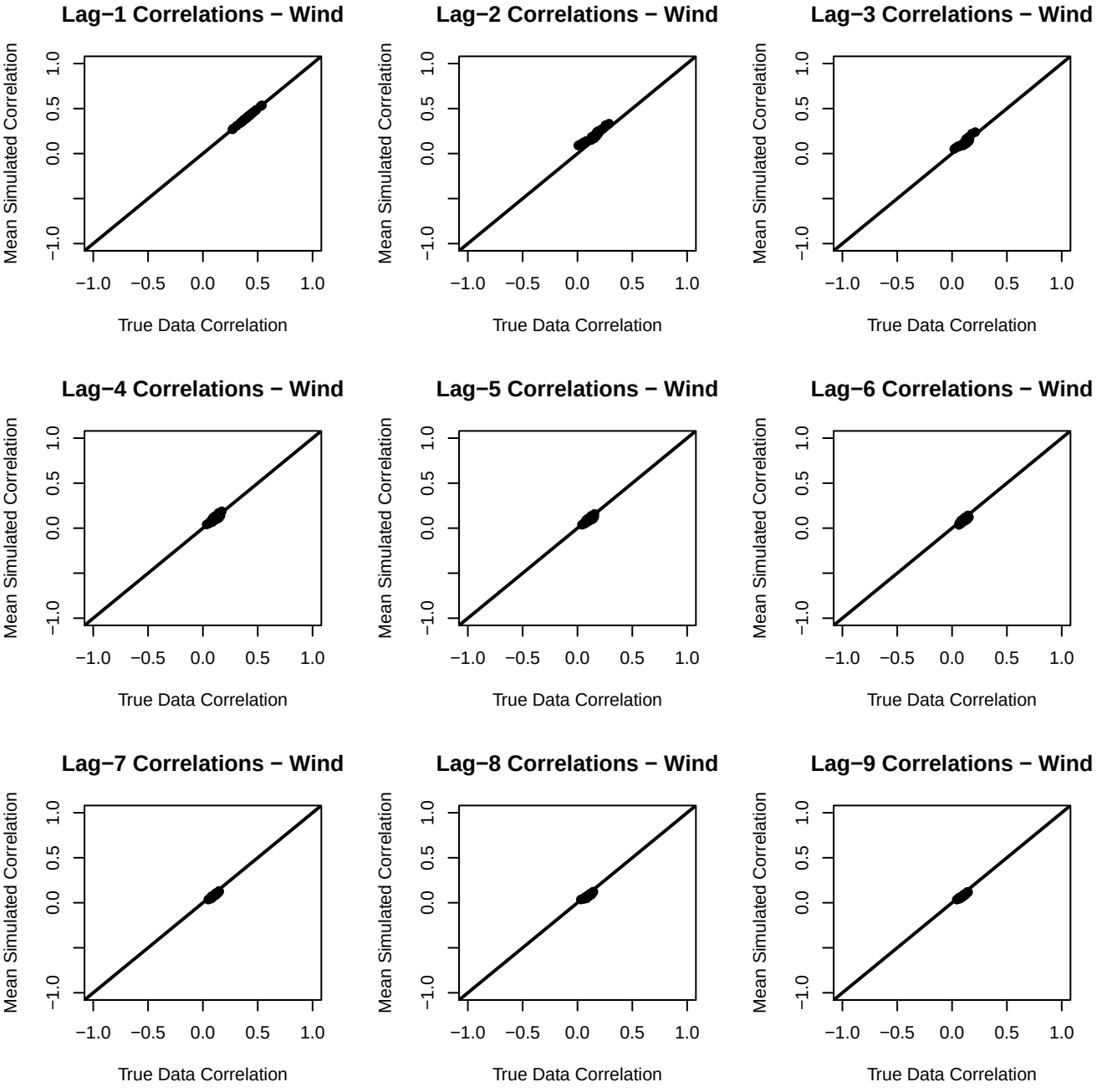
Cross Correlation Simulation Run − 29

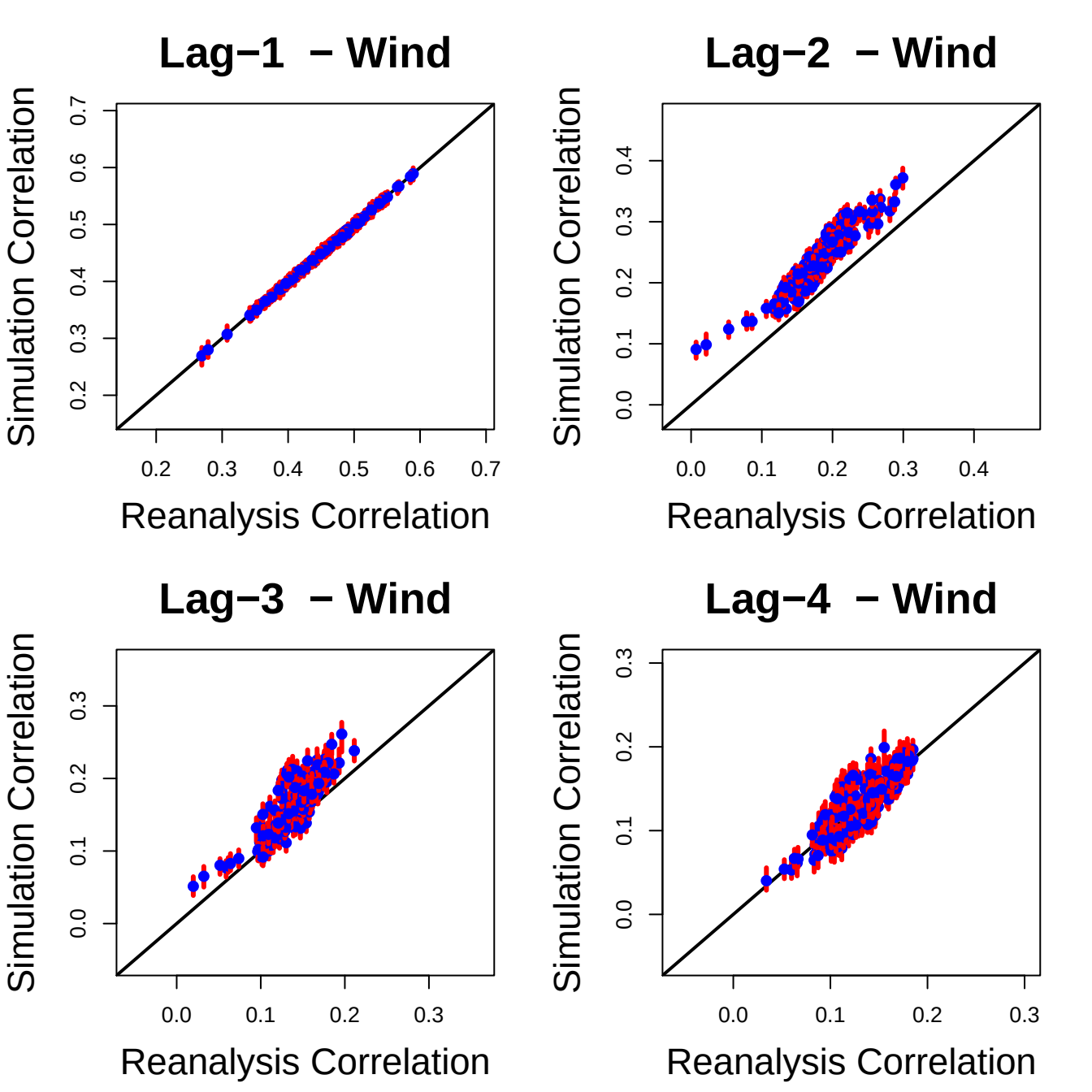


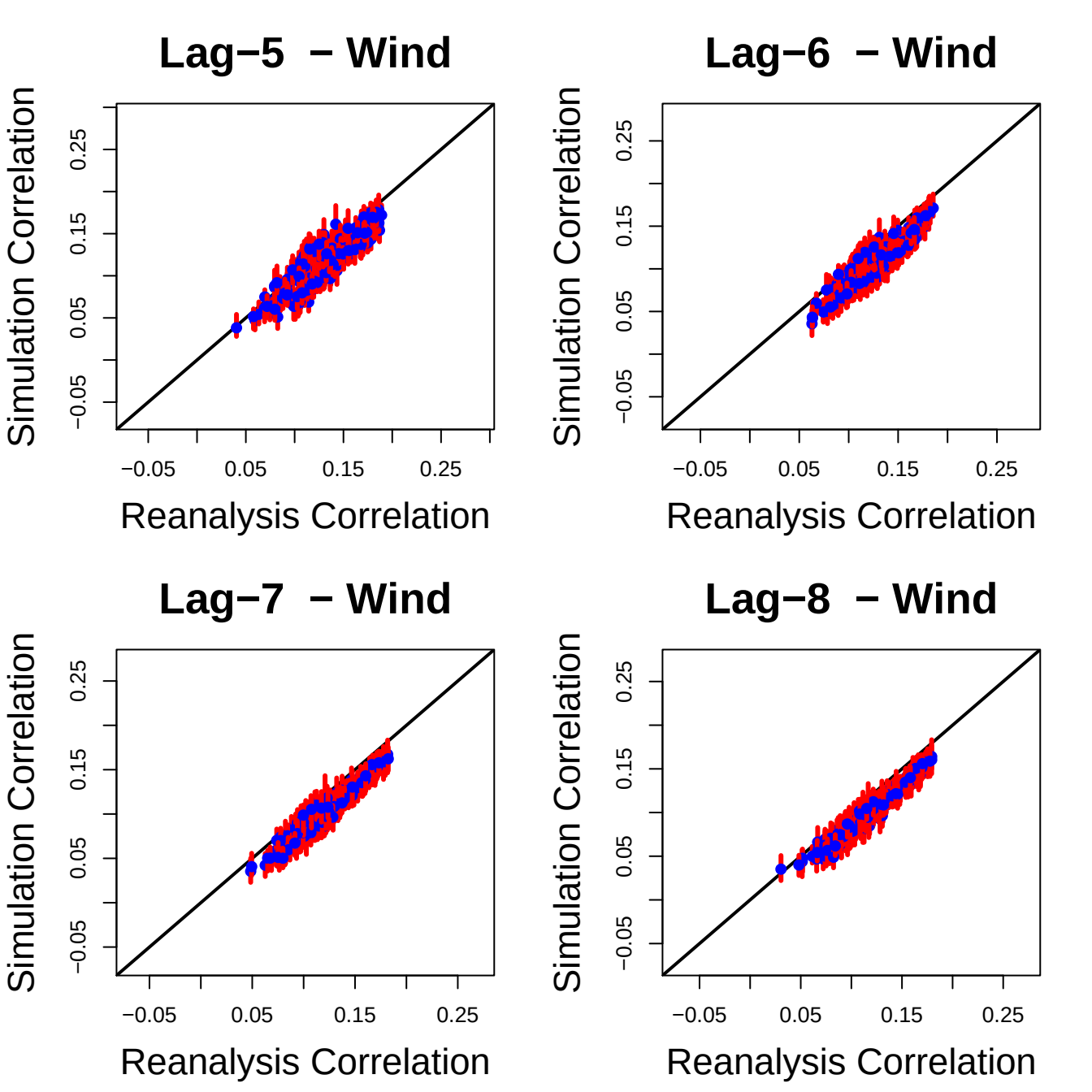

Cross Site Correlations − Wind
Simulation Correlation
Data (Reanalysis) Correlation
0.0
0.2
0.4
0.6
0.8
1.0

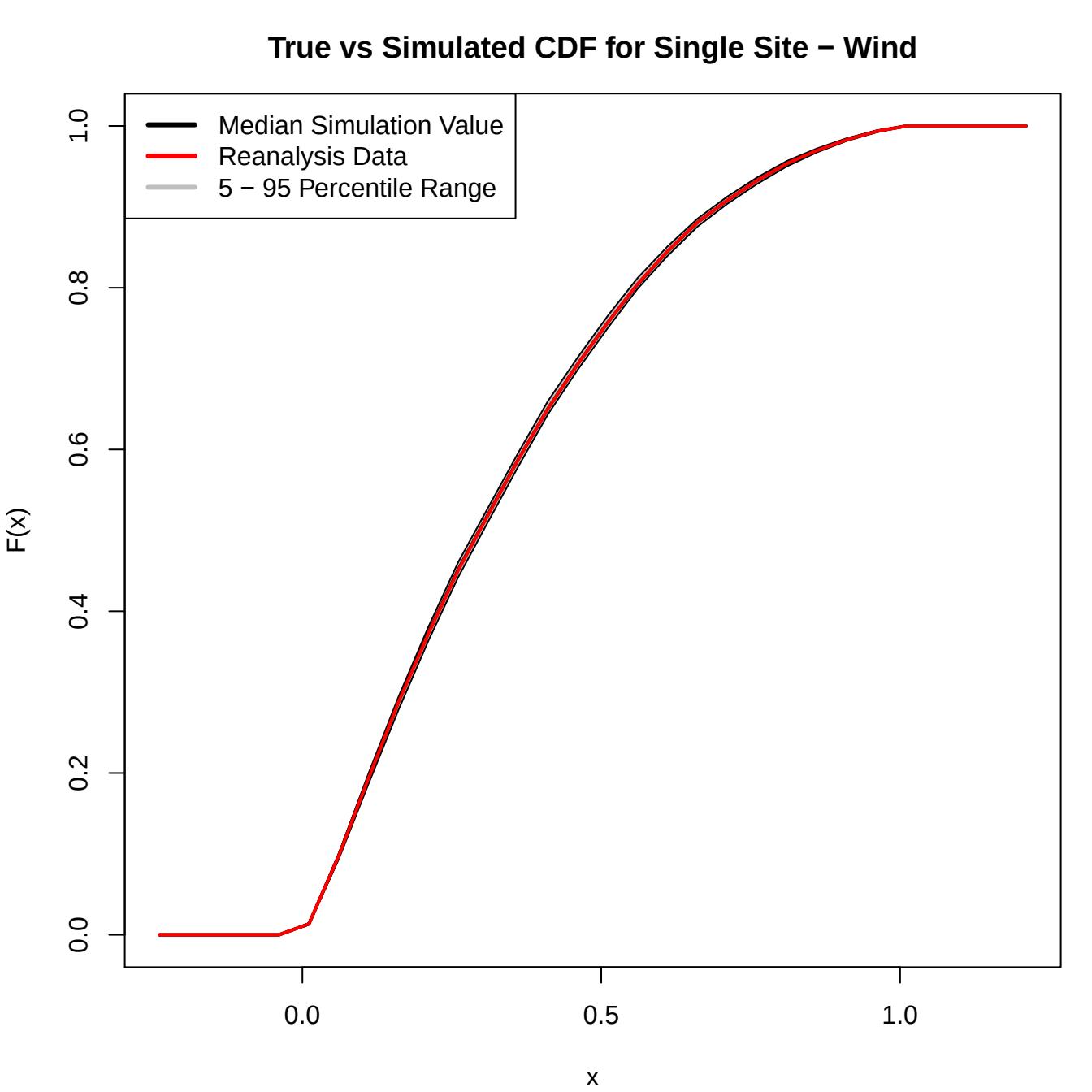

Cross Site Correlations − Wind
Median Simulation Value
5 − 95 Percentile Range
Simulation Correlation
Reanalysis Data Correlation
0.0
0.2
0.4
0.6
0.8
1.0

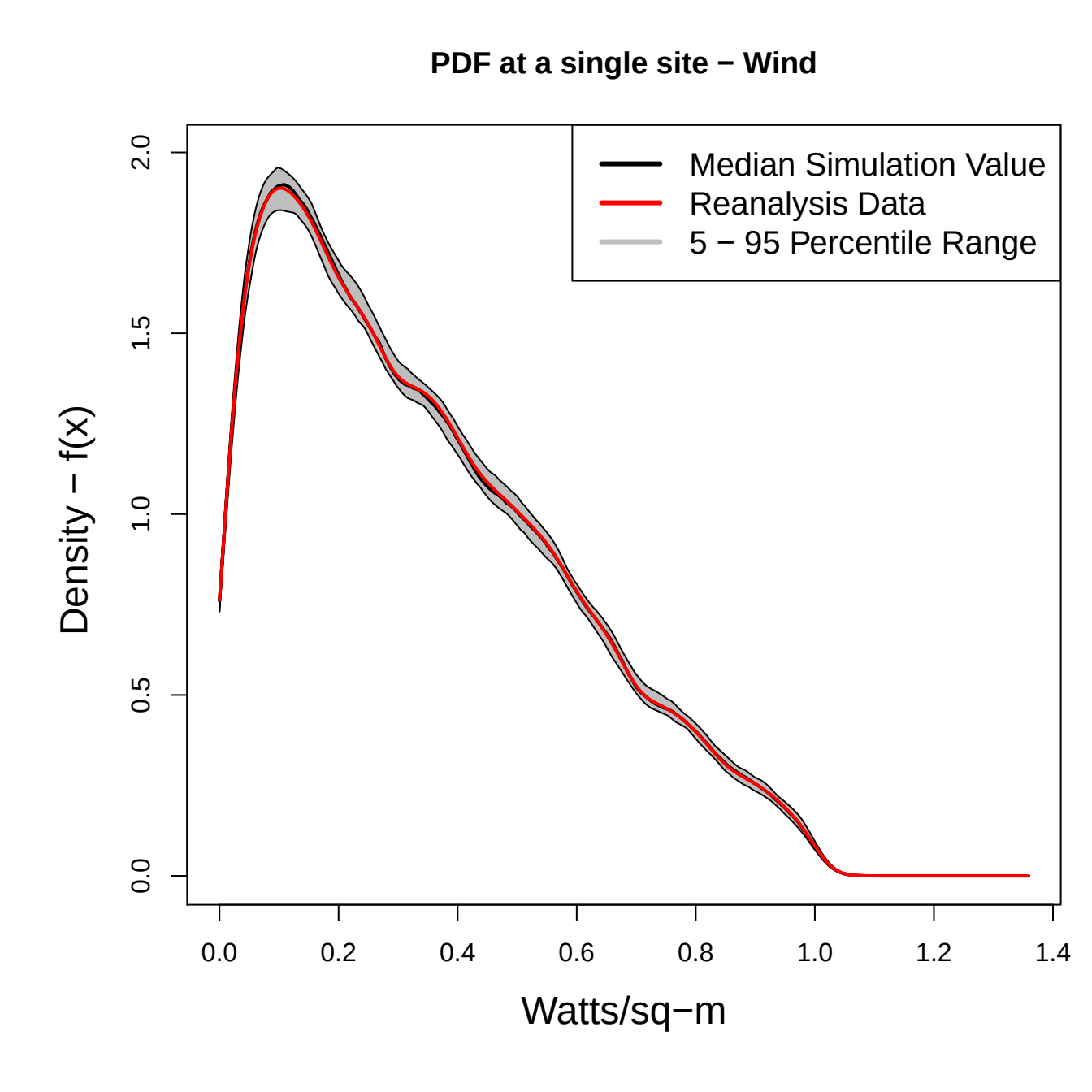

ACF − Single Random Site − Wind
1.00
0.75
0.50
0.25
0.00
Auto−Correlation
0.0
2.5
5.0
7.5
10.0
Lags (Days)
Type
Simulations

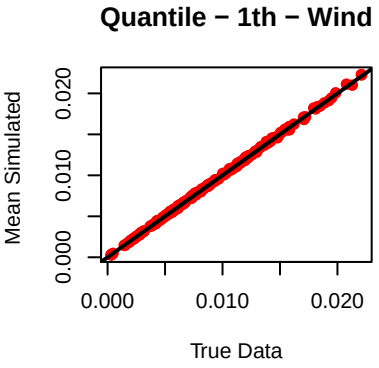

Lag−1 Correlations − Wind
Lag−2 Correlations − Wind
Lag−3 Correlations − Wind
Lag−4 Correlations − Wind
Lag−5 Correlations − Wind
Lag−6 Correlations − Wind
Lag−7 Correlations − Wind
Lag−8 Correlations − Wind
Lag−9 Correlations − Wind
Mean Simulated Correlation
True Data Correlation
−1.0
−0.5
0.0
0.5
1.0

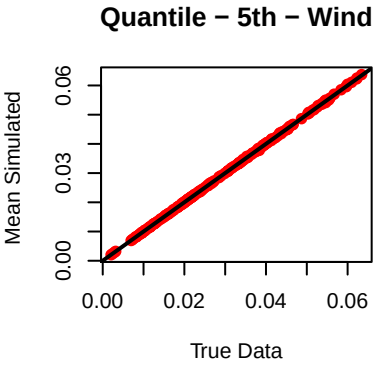

Lag−1 − Wind
Simulation Correlation
Reanalysis Correlation
0.2
0.3
0.4
0.5
0.6
0.7
Lag−2 − Wind
Simulation Correlation
Reanalysis Correlation
0.0
0.1
0.2
0.3
0.4
Lag−3 − Wind
Simulation Correlation
Reanalysis Correlation
0.0
0.1
0.2
0.3
Lag−4 − Wind
Simulation Correlation
Reanalysis Correlation
0.0
0.1
0.2
0.3

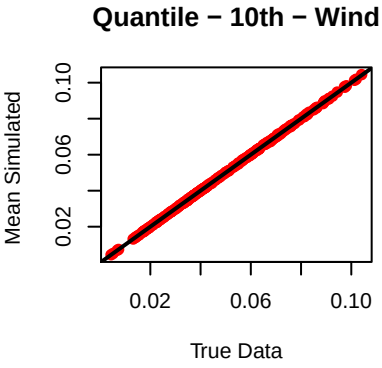

Lag−5 − Wind
Lag−6 − Wind
Lag−7 − Wind
Lag−8 − Wind
Simulation Correlation
Reanalysis Correlation
−0.05
0.05
0.15
0.25

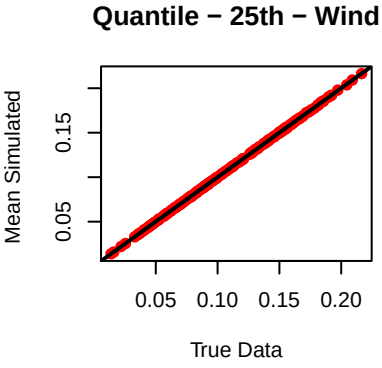

True vs Simulated CDF for Single Site − Wind
Median Simulation Value
Reanalysis Data
5 − 95 Percentile Range
F(x)
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.5
1.0
x

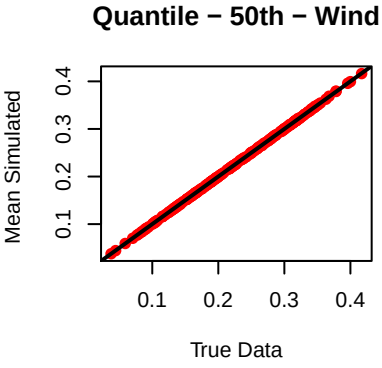

PDF at a single site − Wind
Median Simulation Value
Reanalysis Data
5 − 95 Percentile Range
Density − f(x)
0.0
0.5
1.0
1.5
2.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
Watts/sq−m

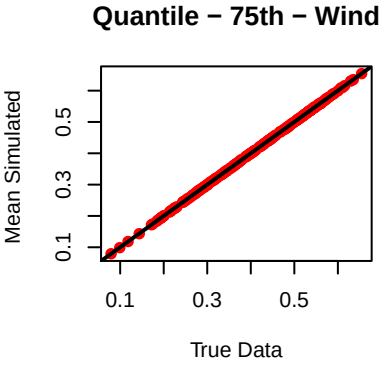

Quantile − 1th − Wind
Mean Simulated
0.000
0.010
0.020
0.000
0.010
0.020
True Data

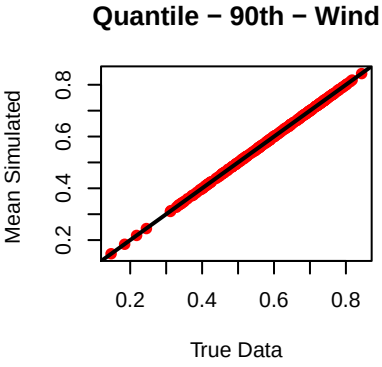

Quantile − 5th − Wind
Mean Simulated
0.00
0.03
0.06
0.00
0.02
0.04
0.06
True Data

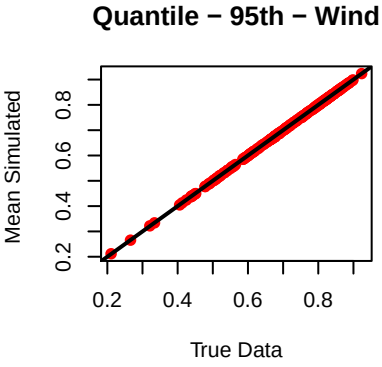

Quantile − 10th − Wind
Mean Simulated
0.02
0.06
0.10
0.02
0.06
0.10
True Data

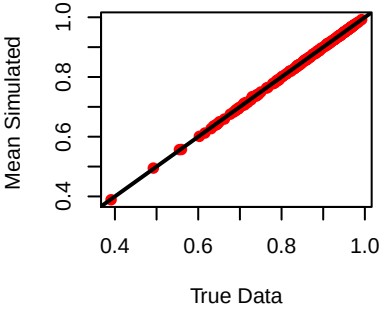

Quantile − 25th − Wind
Mean Simulated
0.05
0.15
0.05
0.10
0.15
0.20
True Data


Quantile − 50th − Wind
Mean Simulated
0.1
0.2
0.3
0.4
0.1
0.2
0.3
0.4
True Data

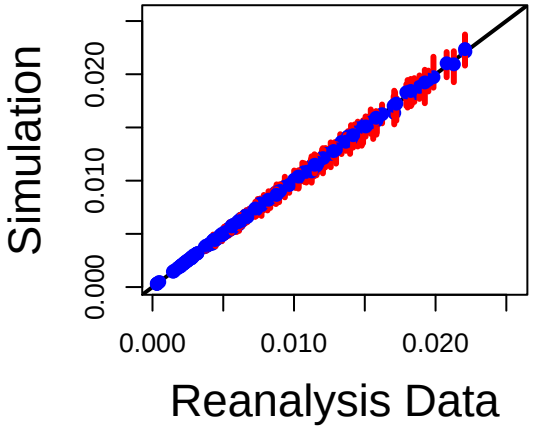

Quantile − 75th − Wind
Mean Simulated
0.1
0.3
0.5
0.1
0.3
0.5
True Data


Quantile − 90th − Wind
Mean Simulated
0.2
0.4
0.6
0.8
0.2
0.4
0.6
0.8
True Data

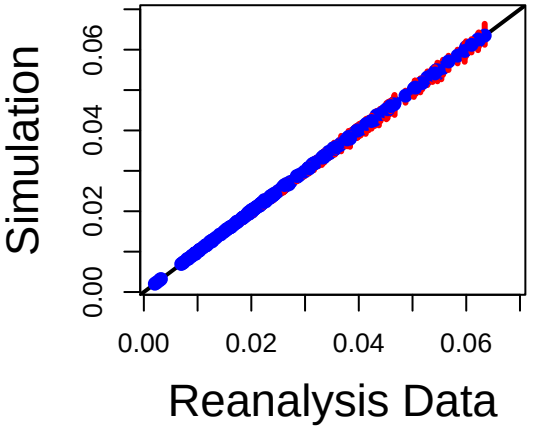

Quantile − 95th − Wind
Mean Simulated
0.2
0.4
0.6
0.8
0.2
0.4
0.6
0.8
True Data


Quantile − 99th − Wind
Mean Simulated
0.4
0.6
0.8
1.0
0.4
0.6
0.8
1.0
True Data

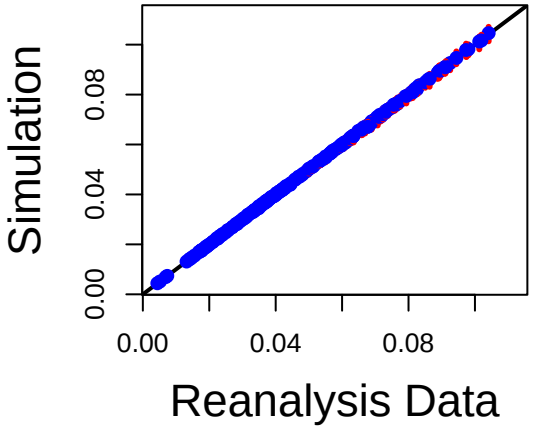
1th Quantile − Wind



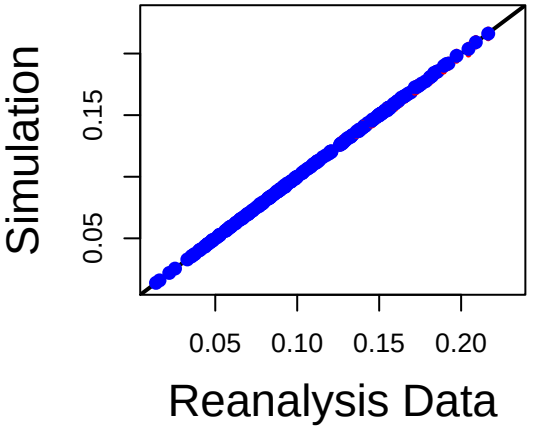
5th Quantile − Wind



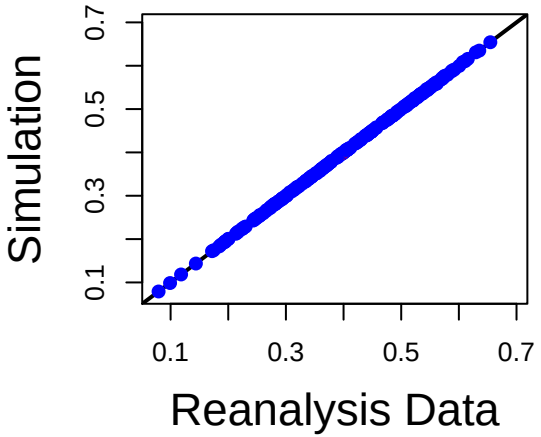
10th Quantile − Wind



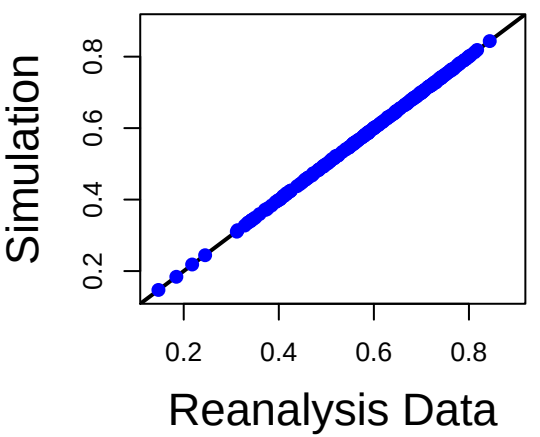
25th Quantile − Wind



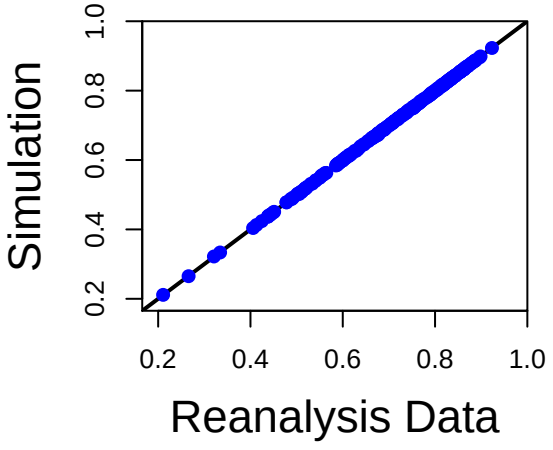
75th Quantile – Wind



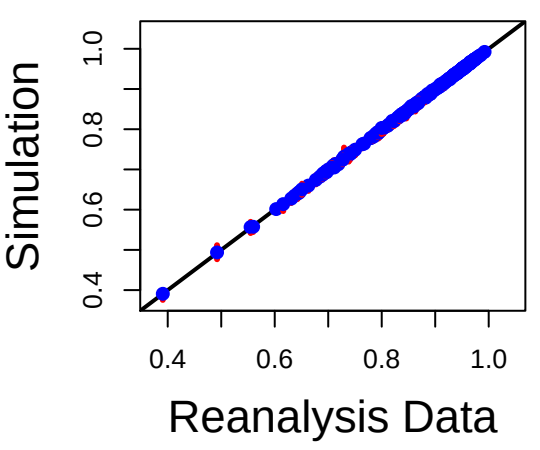
90th Quantile – Wind



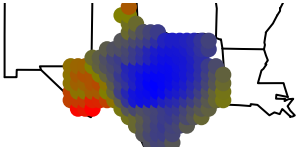
95th Quantile – Wind



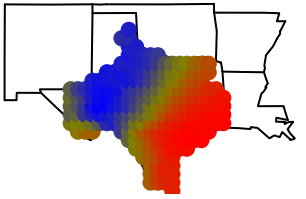
99th Quantile – Wind



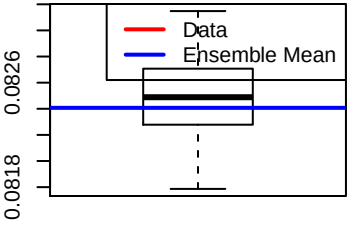
PC−1 − Wind−63%



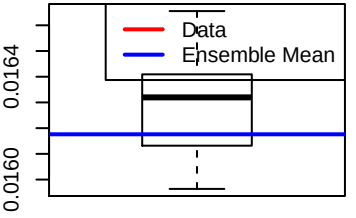
PC−2 − Wind−13%



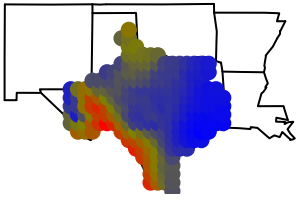
Simulated PC−1 Variance Wind



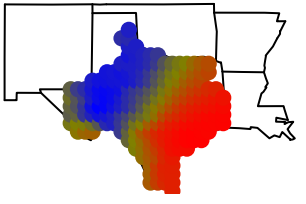
Simulated PC−2 Variance Wind

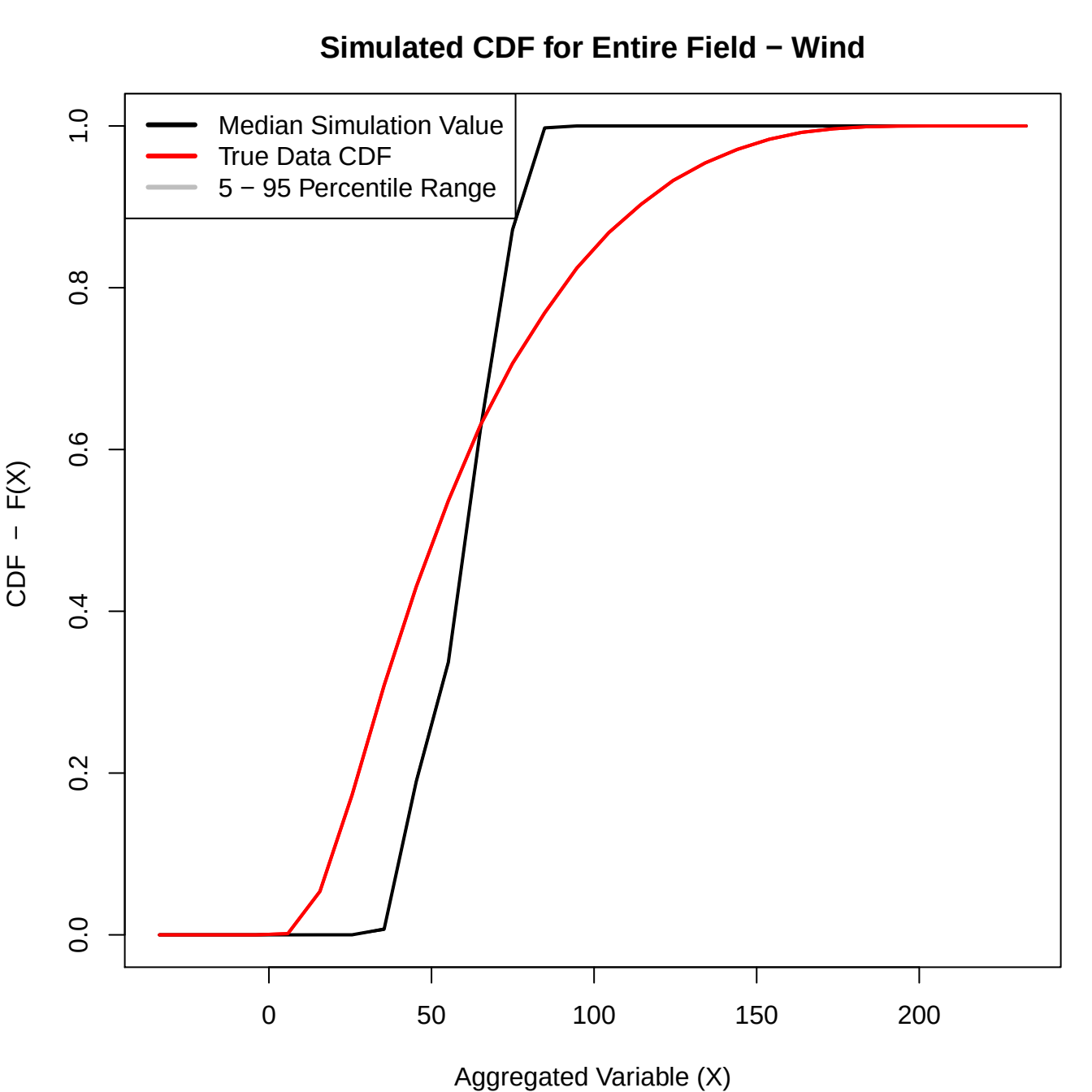


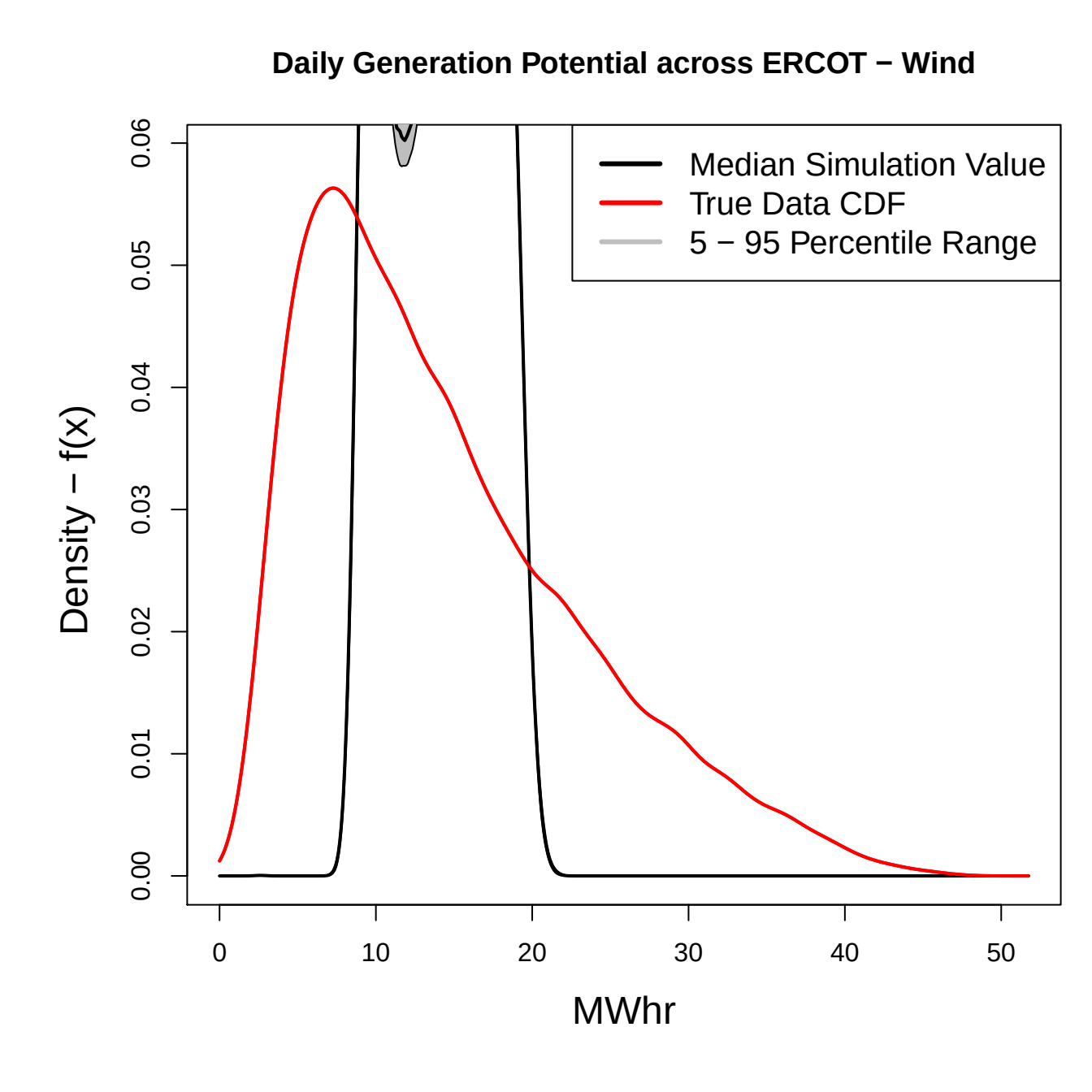
Ensemble Mean PC−1 − Wind−8%

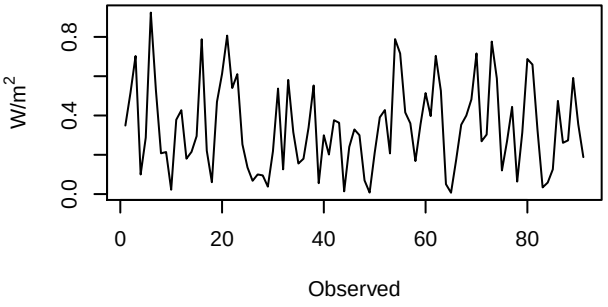


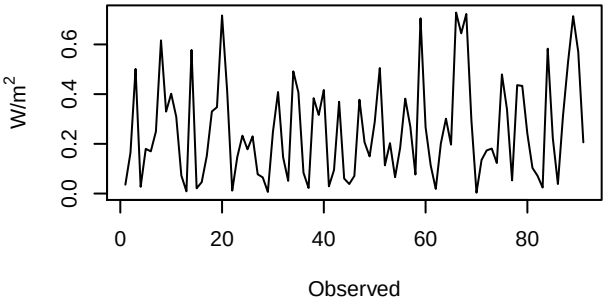
Ensemble Mean PC−2 − Wind−2%

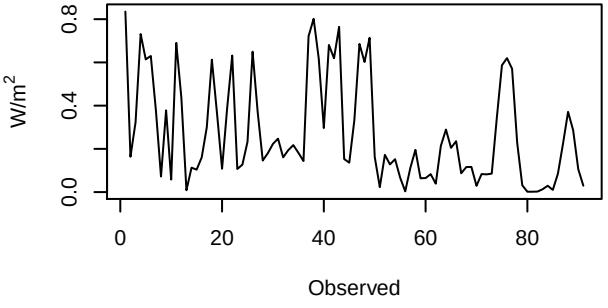


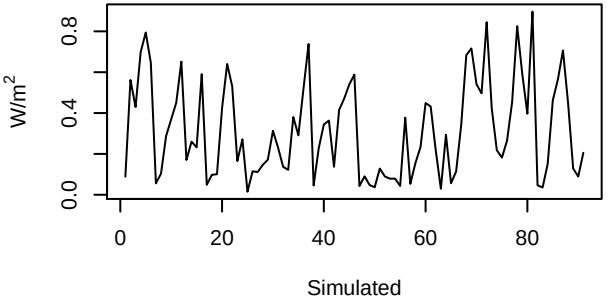

Simulated CDF for Entire Field − Wind
Median Simulation Value
True Data CDF
5 − 95 Percentile Range
CDF − F(X)
0.0
0.2
0.4
0.6
0.8
1.0
0
50
100
150
200
Aggregated Variable (X)

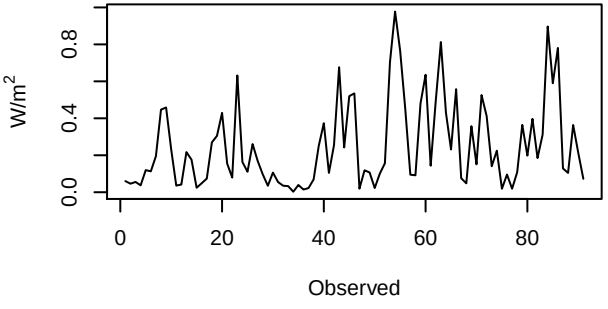

Daily Generation Potential across ERCOT − Wind
Median Simulation Value
True Data CDF
5 − 95 Percentile Range
Density – f(x)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0
10
20
30
40
50
MWhr

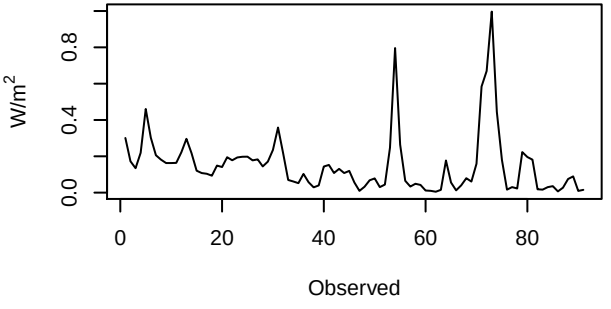

W/m2
0.0
0.4
0.8
0
20
40
60
80
Observed

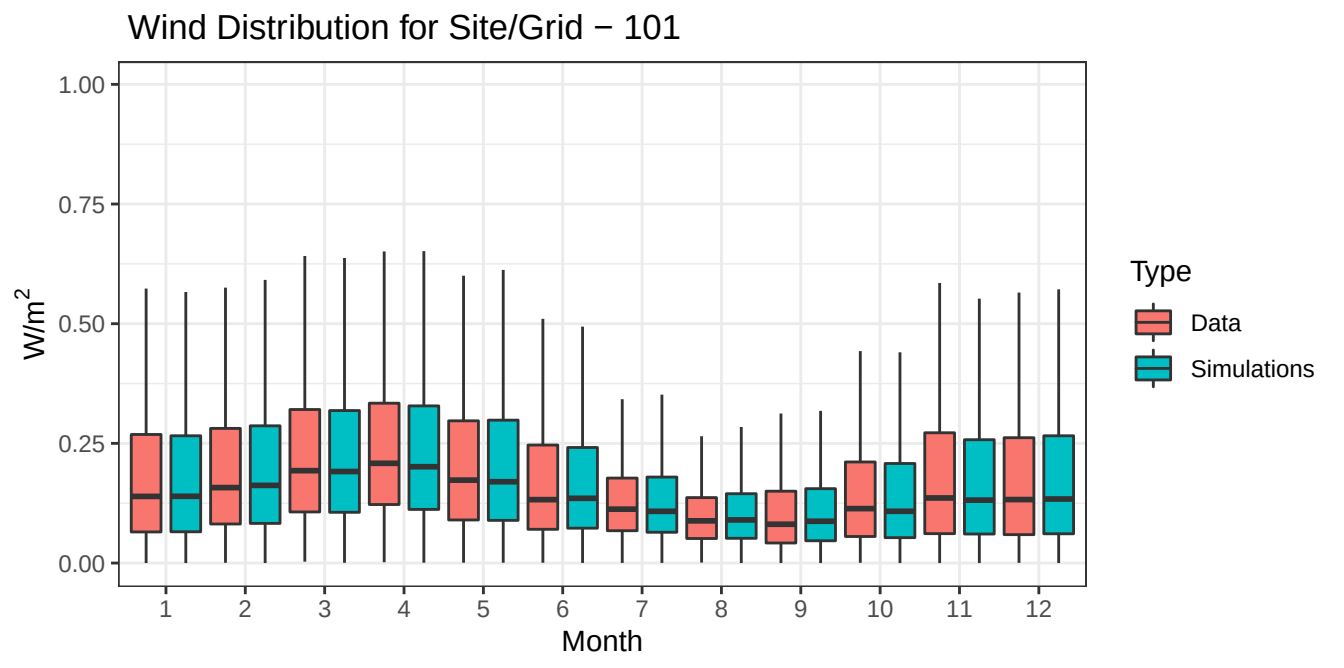

W/m2
0.0
0.2
0.4
0.6
0
20
40
60
80
Observed

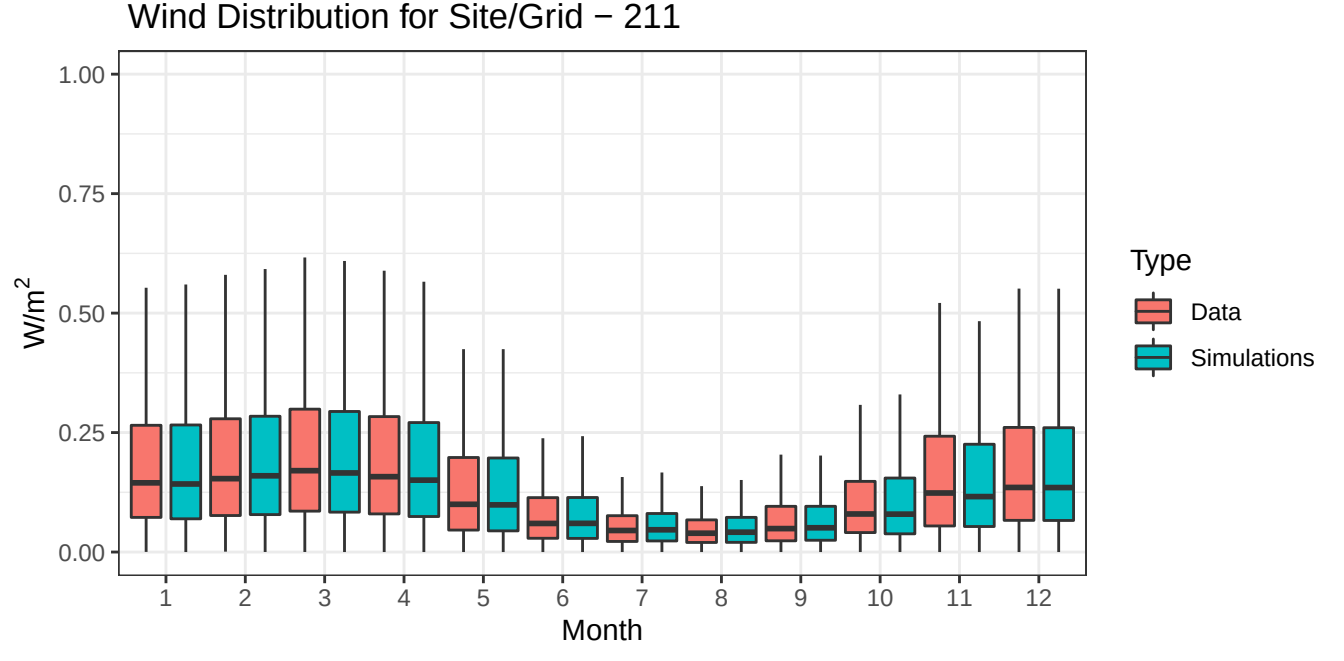

W/m2
0.0
0.4
0.8
0
20
40
60
80
Observed

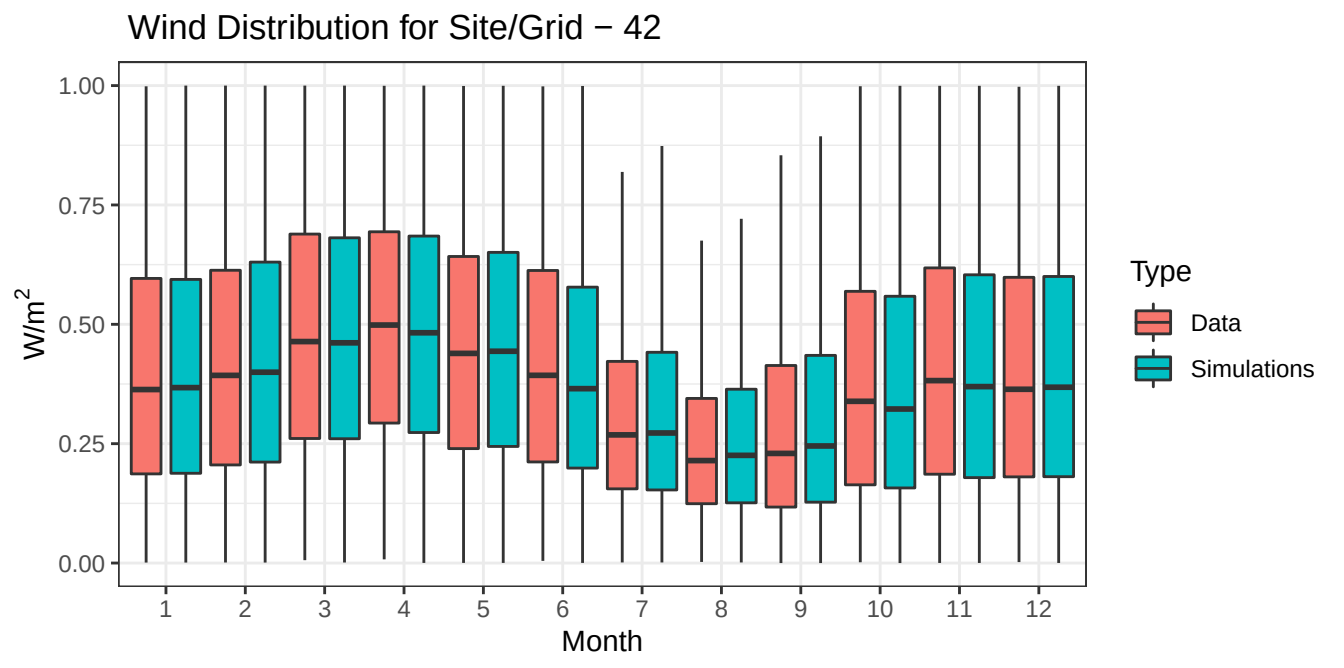

W/m2
0.0
0.4
0.8
0
20
40
60
80
Simulated

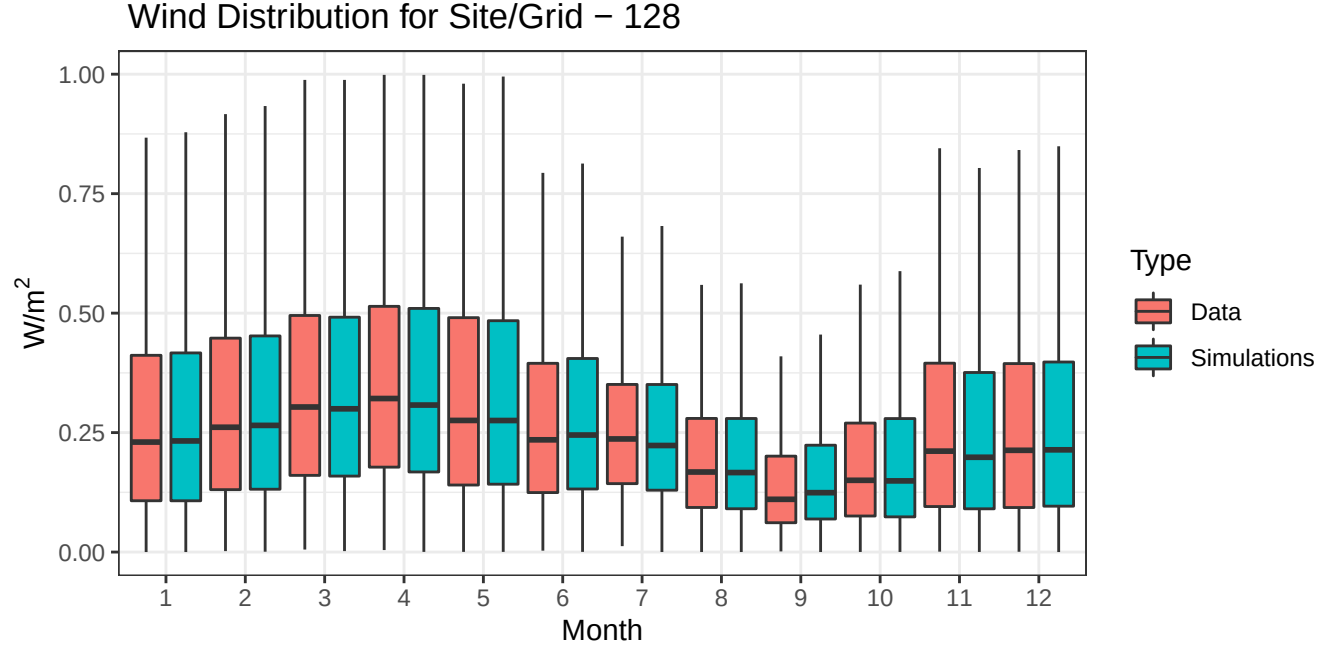

W/m2
0.0
0.4
0.8
0
20
40
60
80
Observed

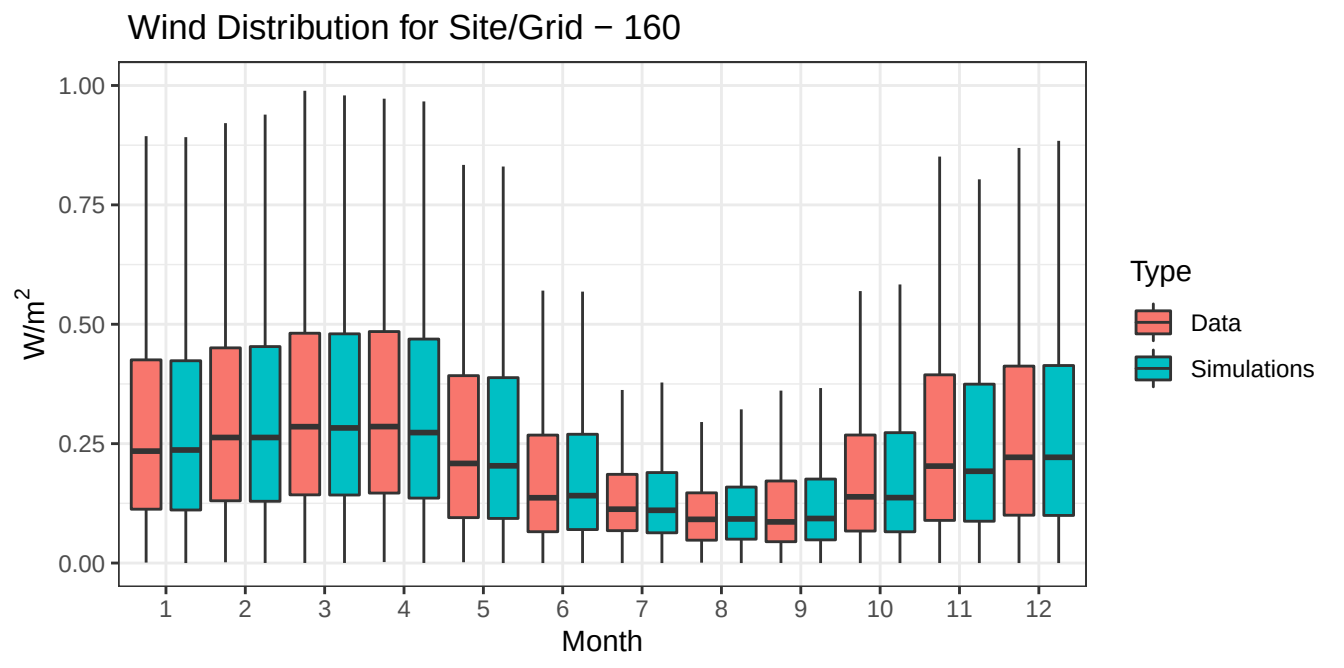

W/m2
0.0
0.4
0.8
0
20
40
60
80
Observed

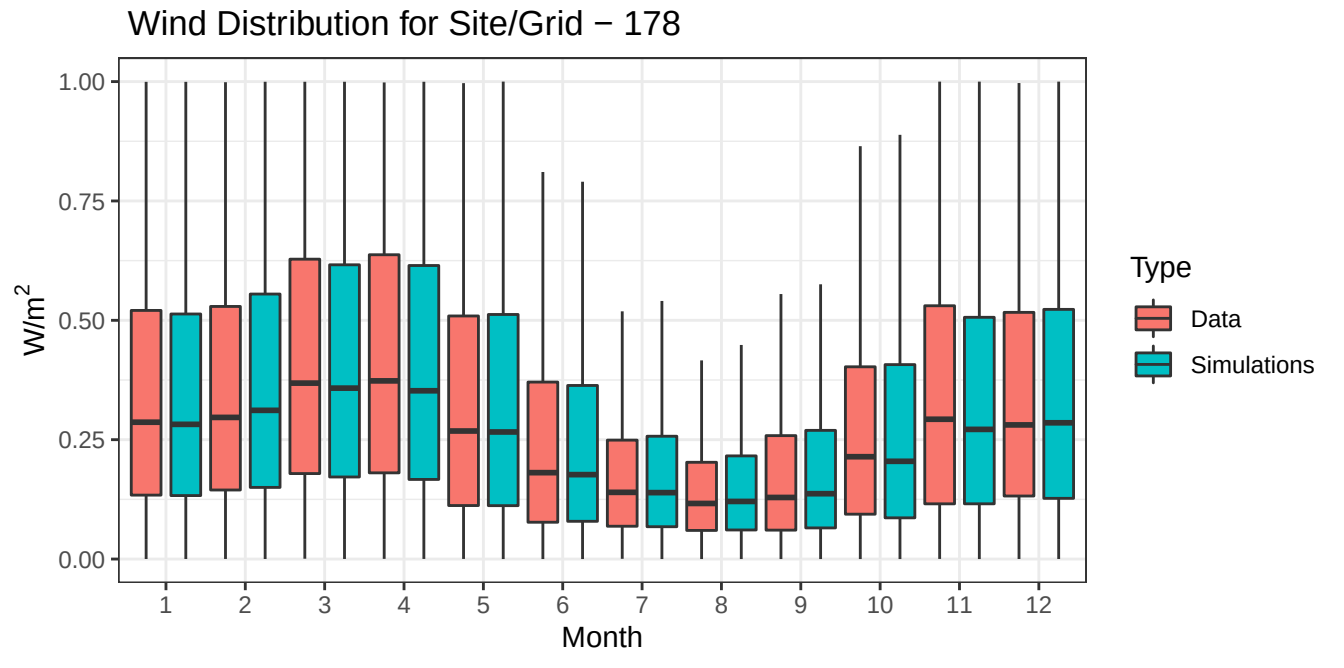

Wind Distribution for Site/Grid − 101
W/m2
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations

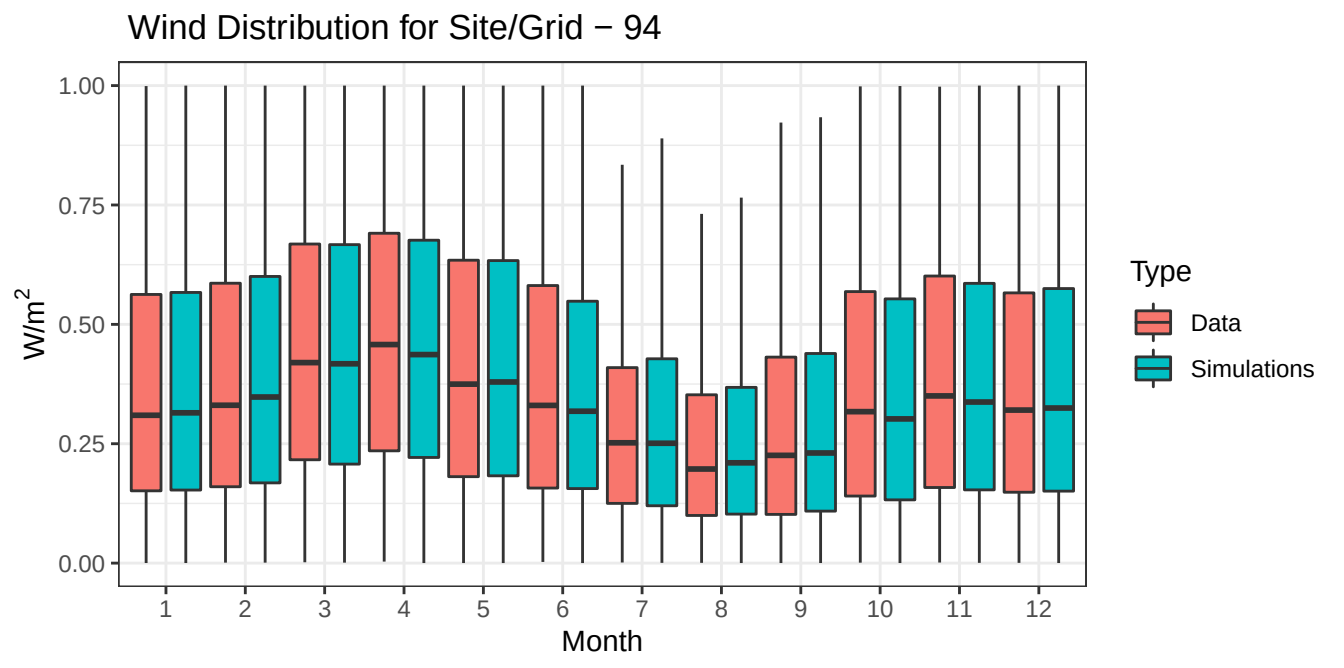

Wind Distribution for Site/Grid − 211
W/m2
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations

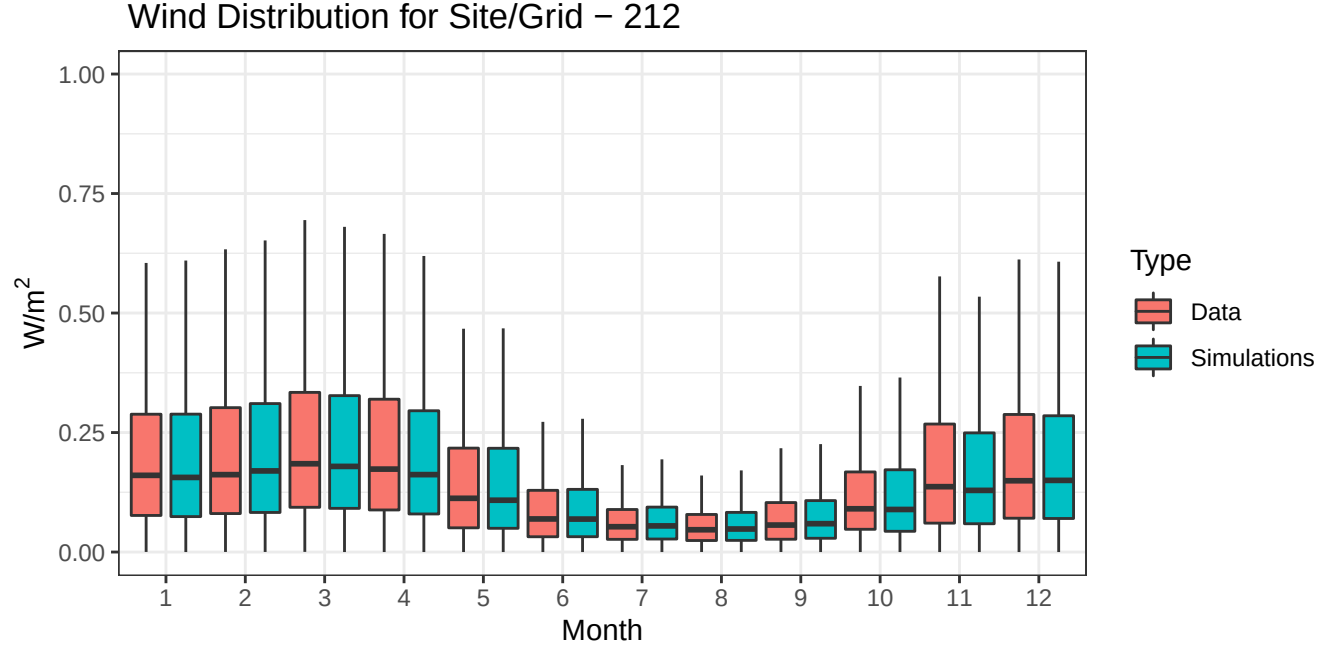

Wind Distribution for Site/Grid − 42
W/m2
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations


Wind Distribution for Site/Grid − 128
W/m2
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations


Wind Distribution for Site/Grid − 160
W/m2
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations

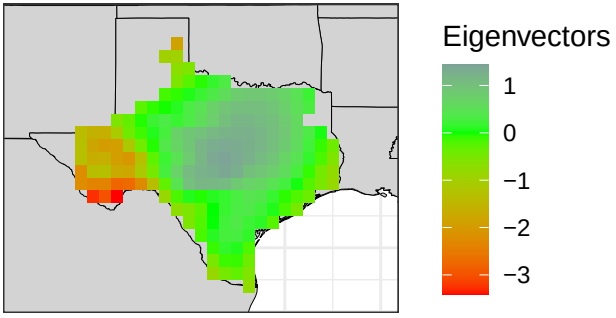

Wind Distribution for Site/Grid − 178
W/m2
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations


Wind Distribution for Site/Grid − 94
W/m2
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations


Wind Distribution for Site/Grid − 212
W/m2
1.00
0.75
0.50
0.25
0.00
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations

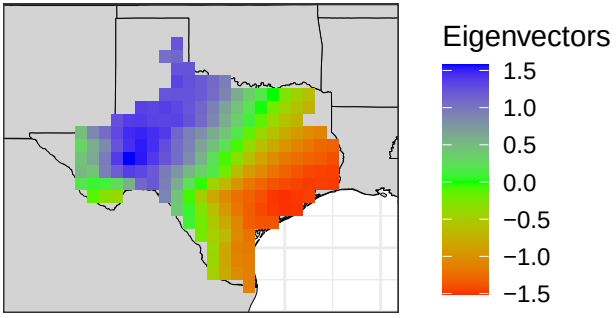
Data PC−1 Wind

Fractional Variance − 63%

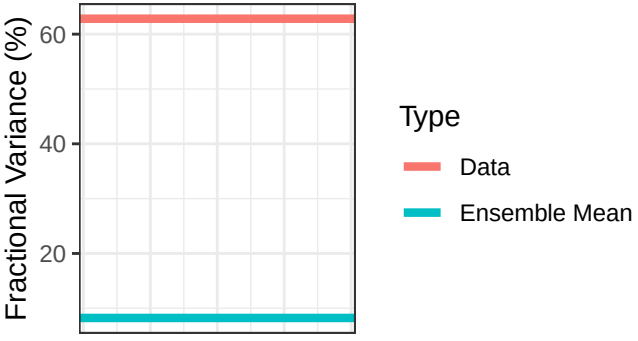


Data PC−1 Wind

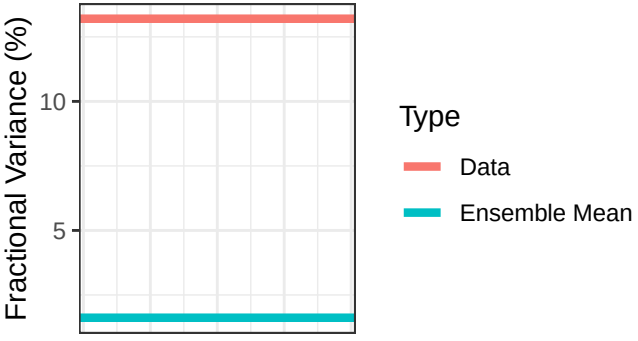
Fractional Variance − 13%



Simulated PC−1 Variance Wind

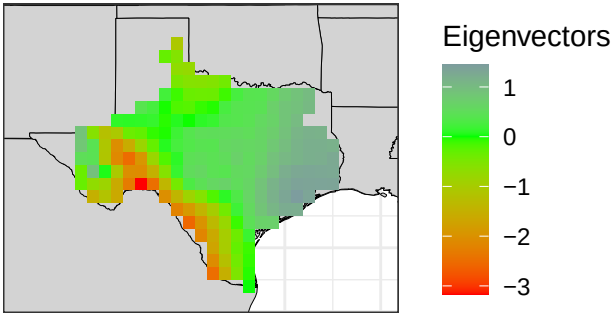


Simulated PC−2 Variance Wind



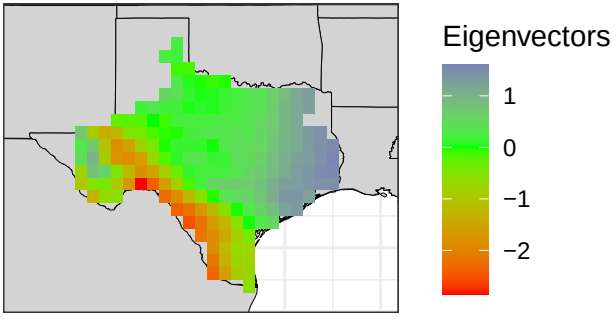
Ensemble Mean PC−1 Wind

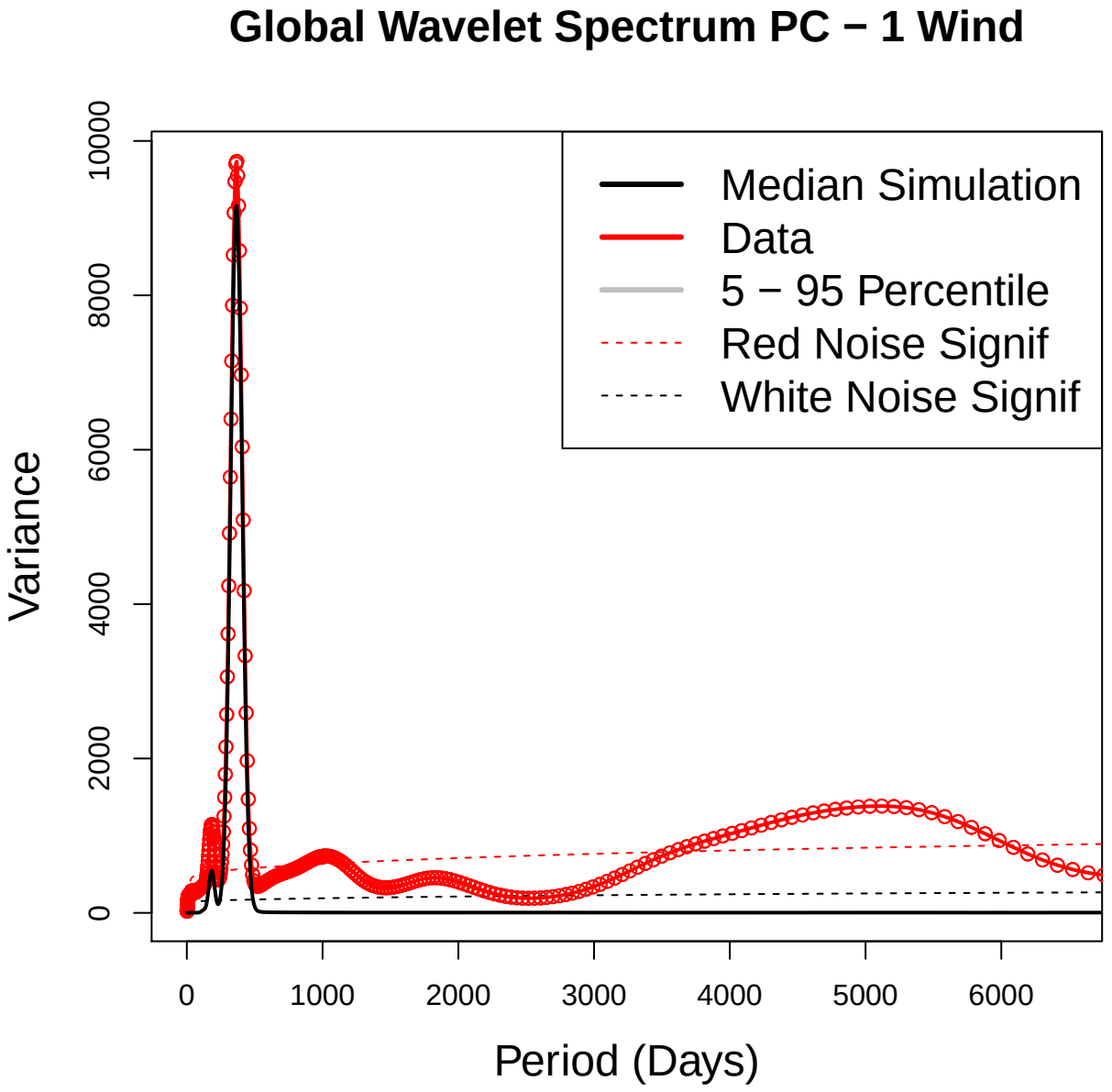
Fractional Variance − 8%

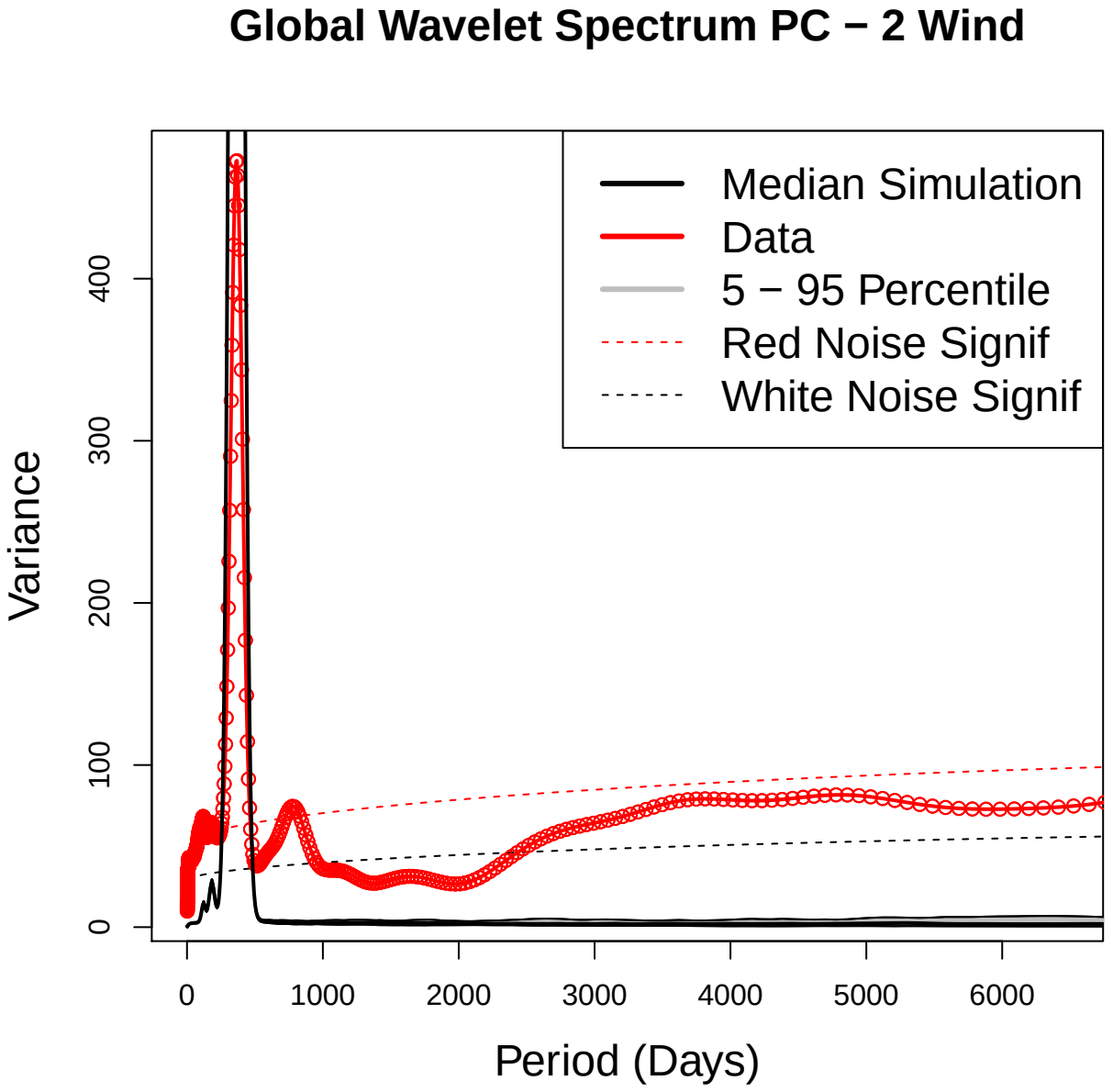


Ensemble Mean PC−2 Wind

Fractional Variance − 2%




Global Wavelet Spectrum PC − 1 Wind
Median Simulation
Data
5 − 95 Percentile
Red Noise Signif
White Noise Signif
Variance
0
2000
4000
6000
8000
10000
0
1000
2000
3000
4000
5000
6000
Period (Days)


Global Wavelet Spectrum PC − 2 Wind
Median Simulation
Data
5 − 95 Percentile
Red Noise Signif
White Noise Signif
Variance
0
100
200
300
400
0
1000
2000
3000
4000
5000
6000
Period (Days)

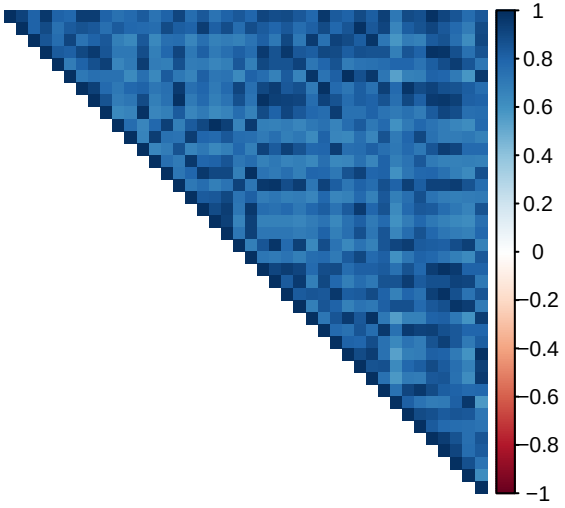
Mean − Solar
W/m2
0.17
0.18
0.19
0.20
0.21

Stan Dev − Solar
W/m2
0.060
0.065
0.070
0.075

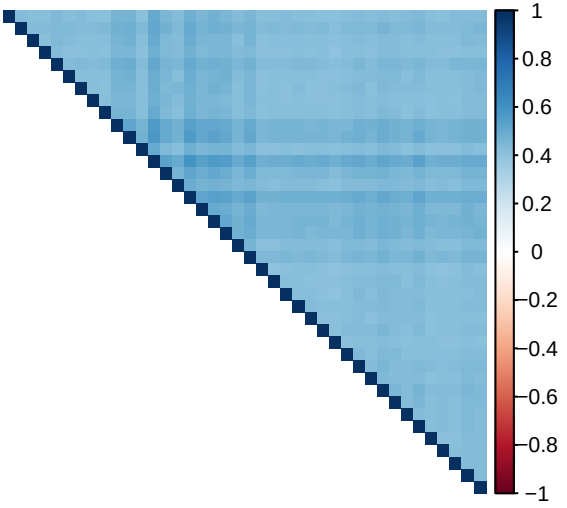
Maximum − Solar
W/m2
0.305
0.315
0.325

Minimum − Solar
W/m2
0.006
0.010
0.014

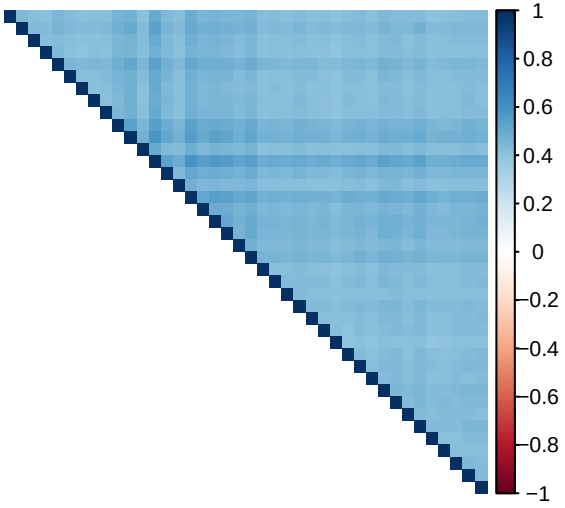
Cross Correlation Data



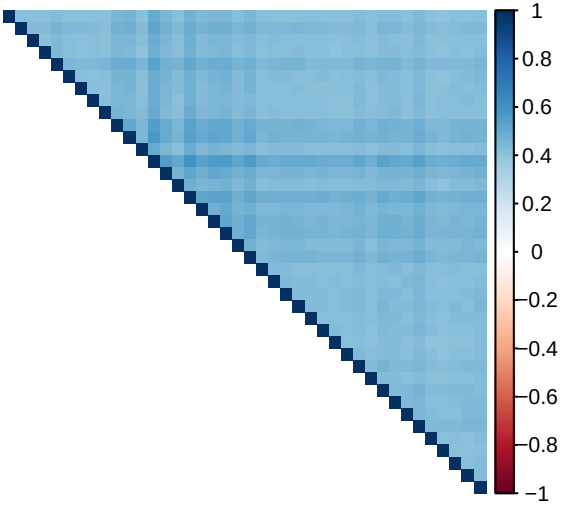
Cross Correlation Simulation Run − 3

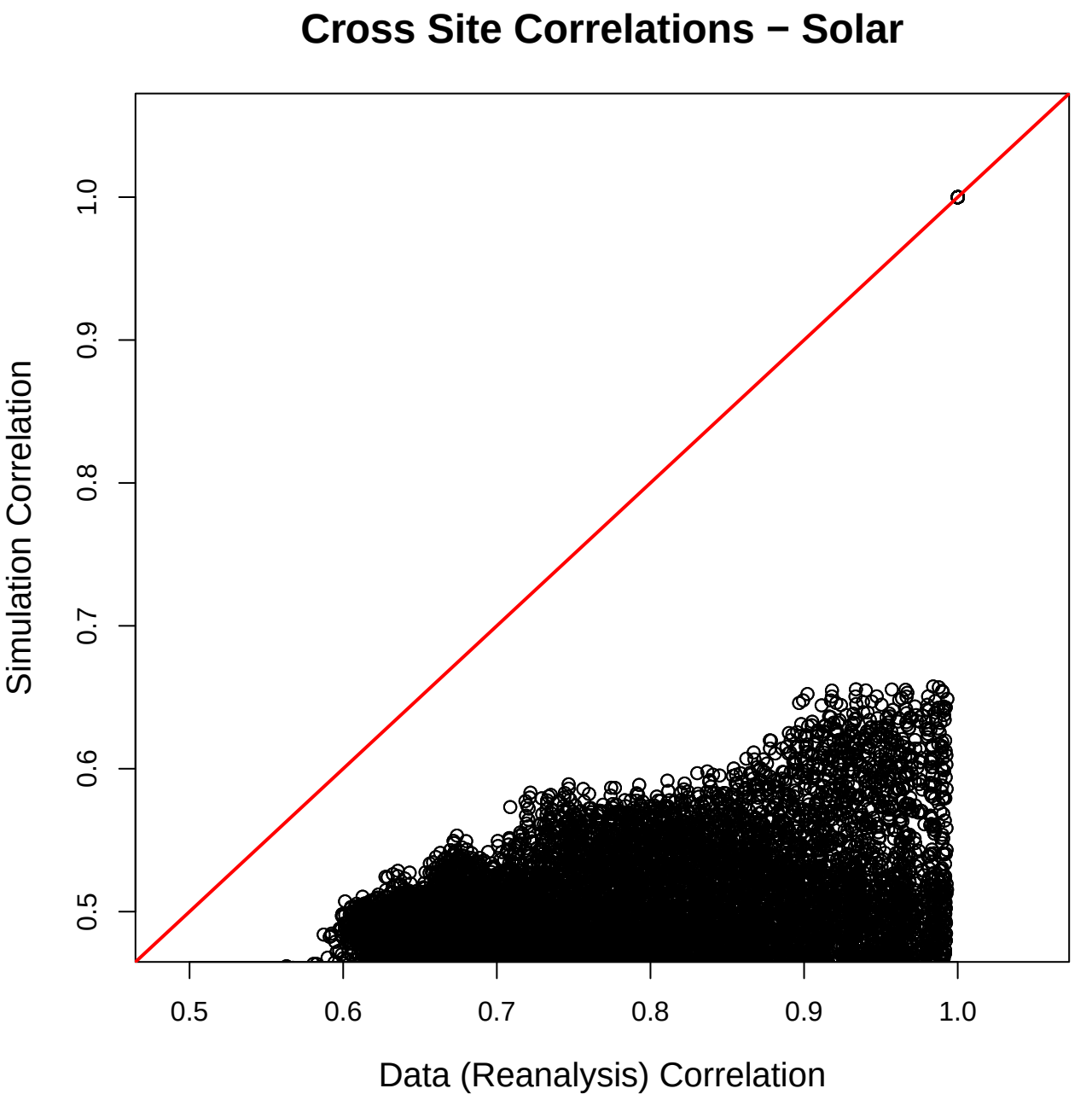


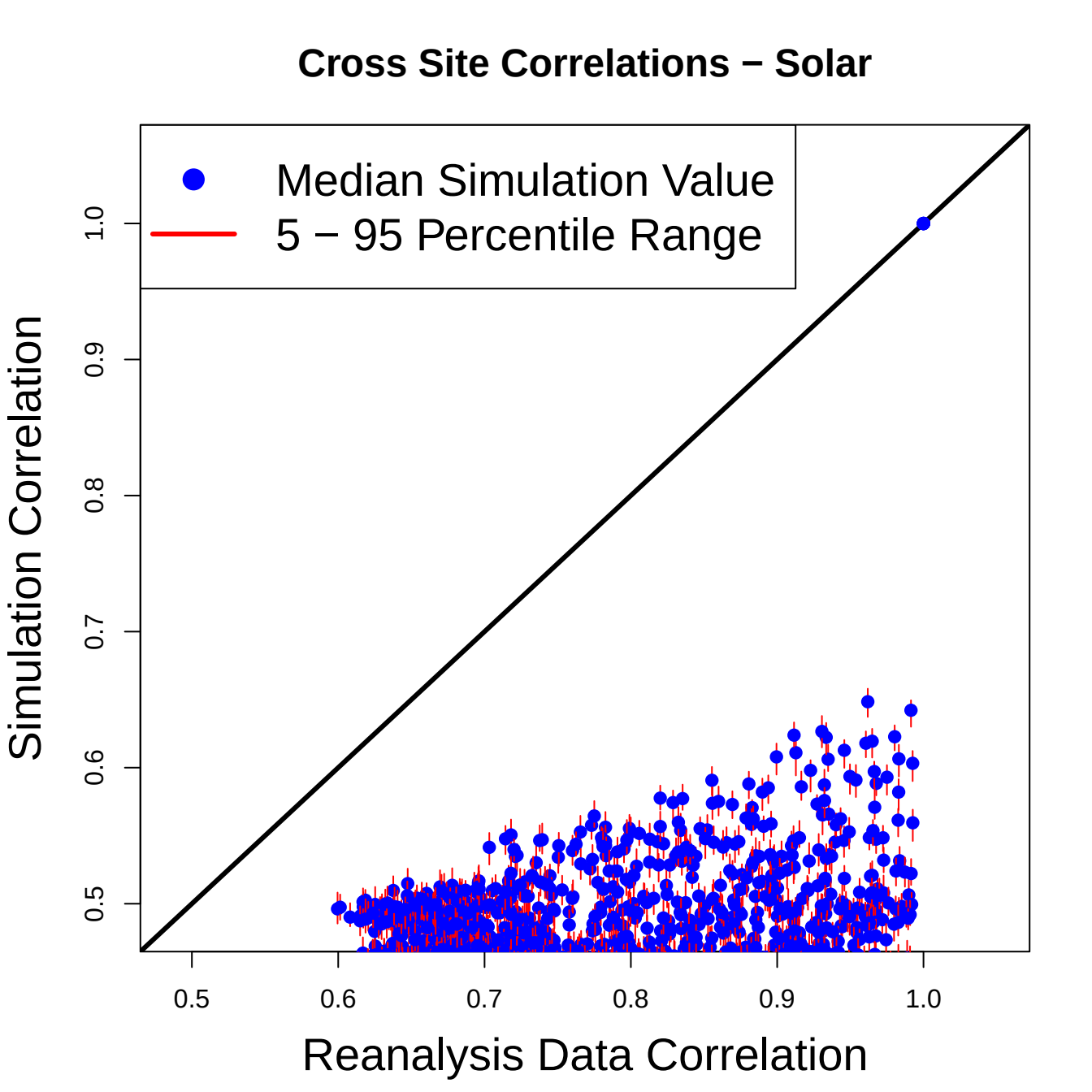
Cross Correlation Simulation Run − 38

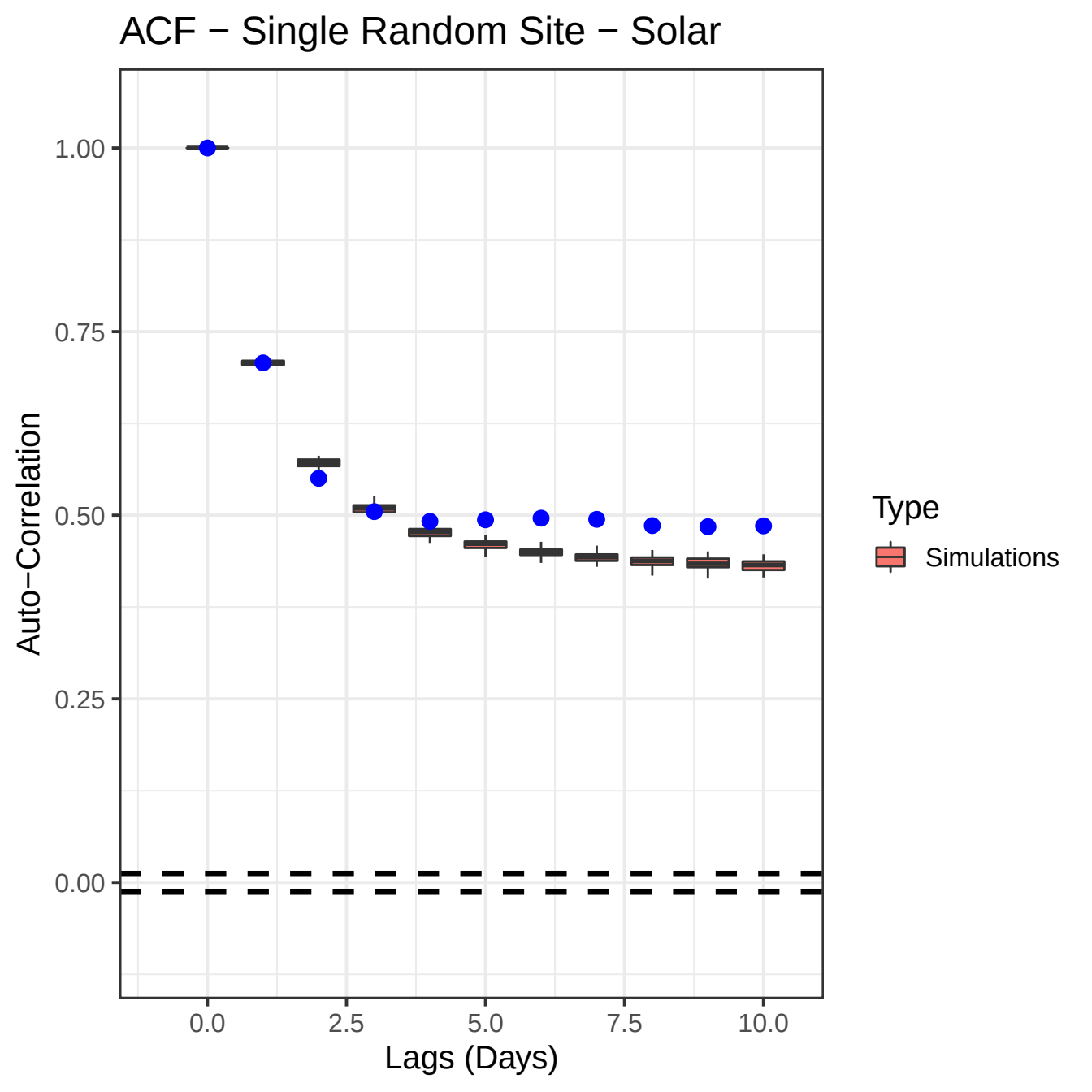


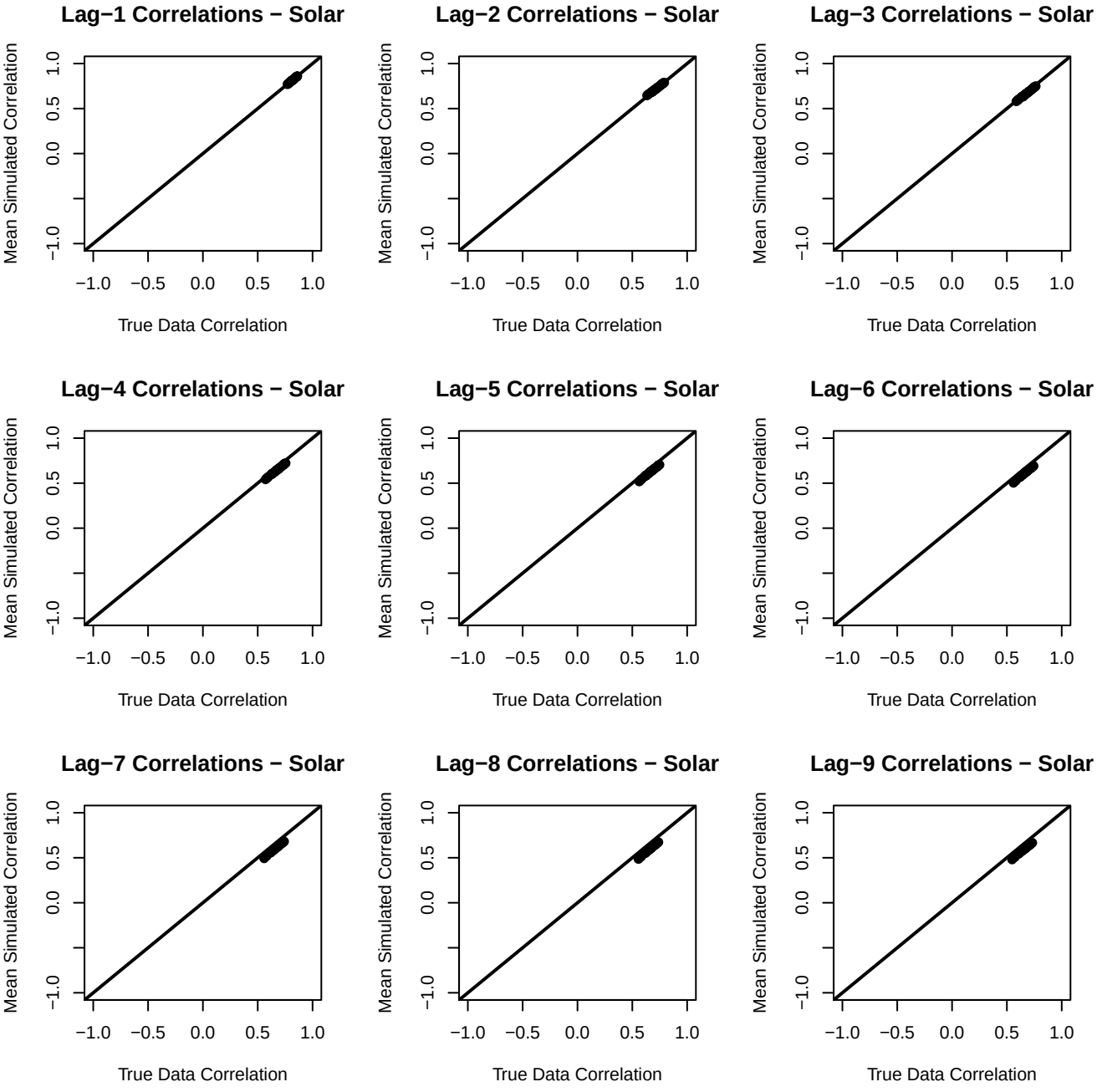
Cross Correlation Simulation Run − 2

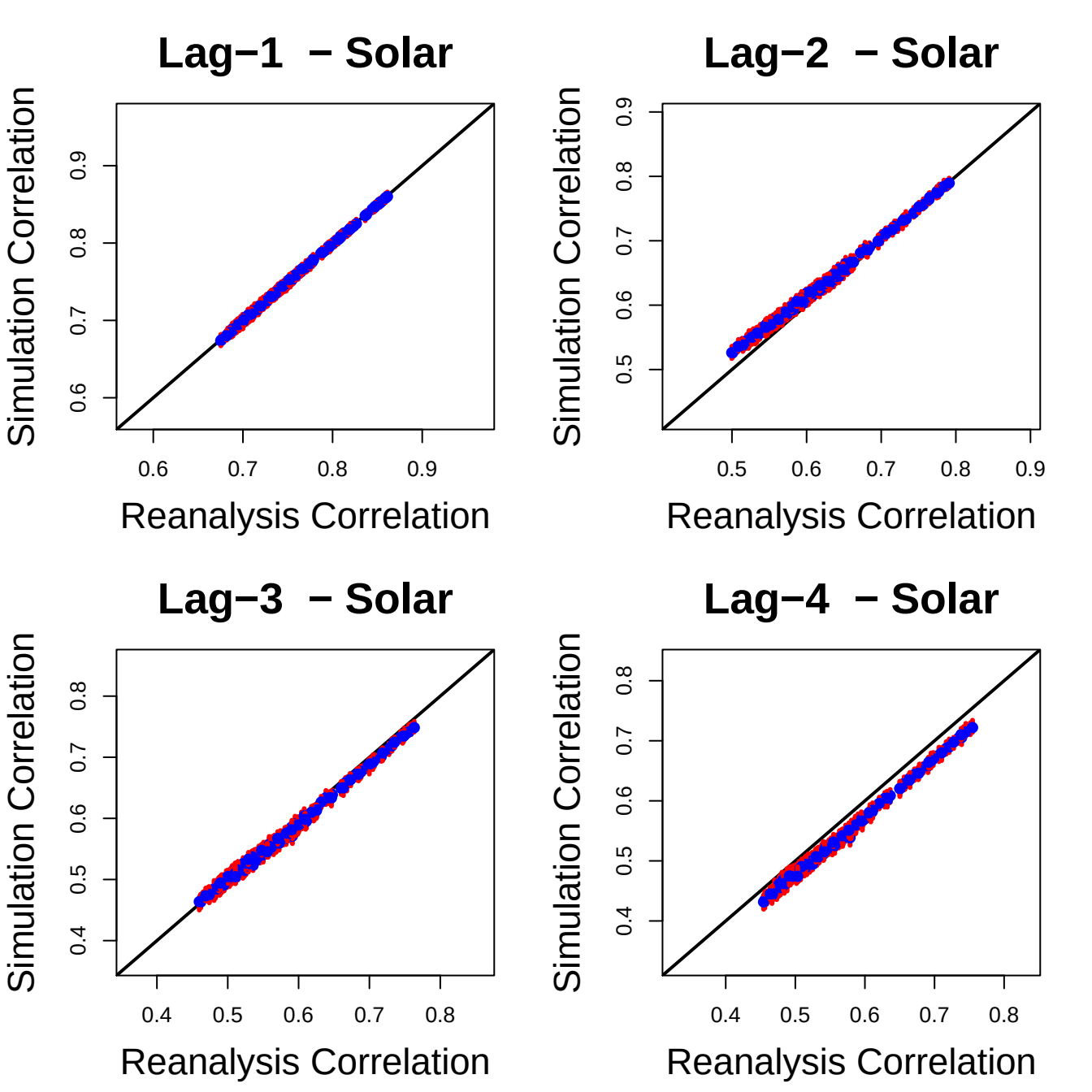


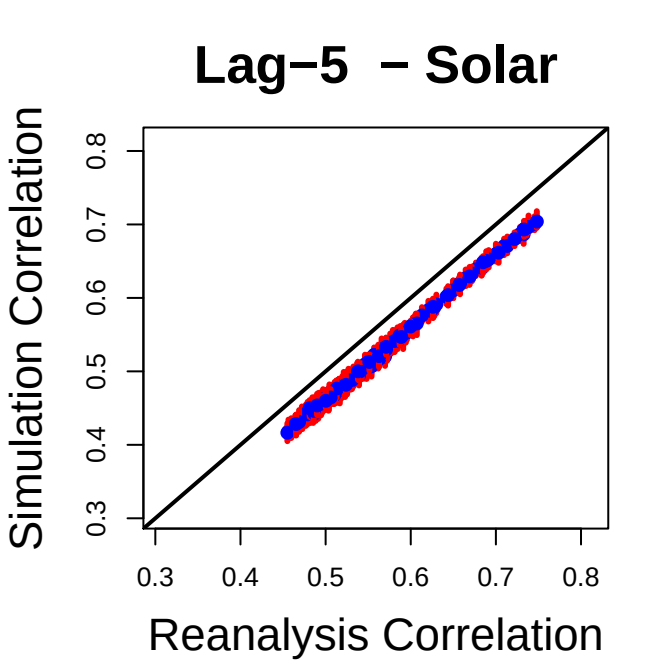

Cross Site Correlations − Solar
Simulation Correlation
Data (Reanalysis) Correlation
0.5
0.6
0.7
0.8
0.9
1.0

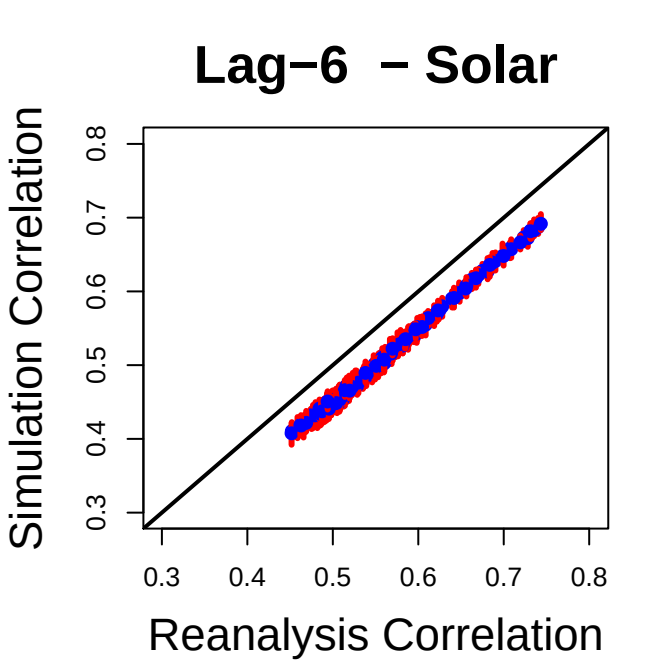

Cross Site Correlations − Solar
Median Simulation Value
5 − 95 Percentile Range
Simulation Correlation
Reanalysis Data Correlation
0.5
0.6
0.7
0.8
0.9
1.0

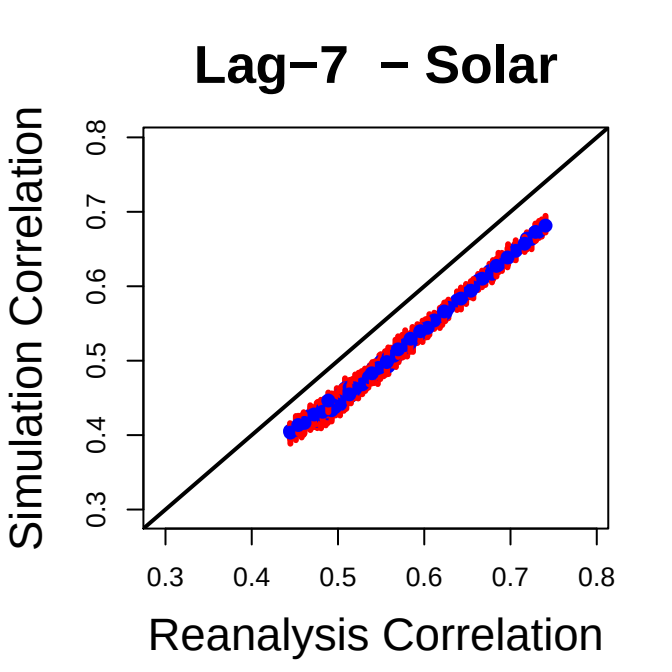

ACF − Single Random Site − Solar
1.00
0.75
0.50
0.25
0.00
Auto−Correlation
0.0
2.5
5.0
7.5
10.0
Lags (Days)
Type
Simulations

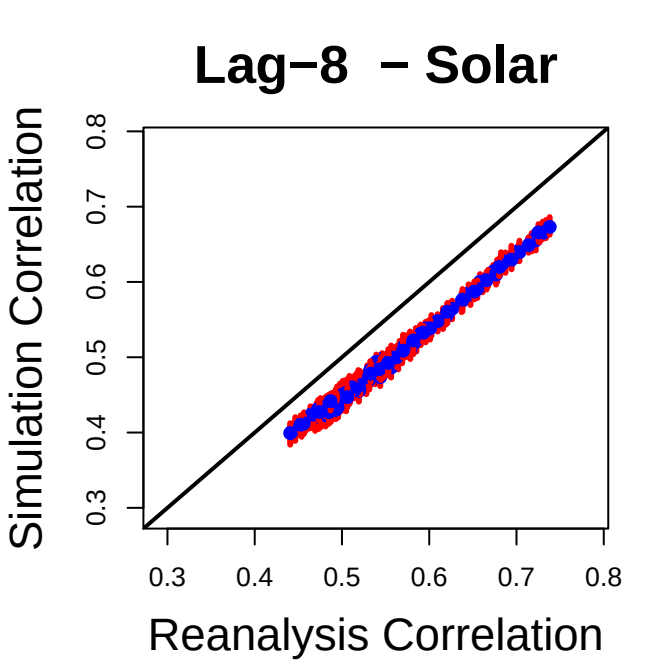

Lag−1 Correlations − Solar
Lag−2 Correlations − Solar
Lag−3 Correlations − Solar
Lag−4 Correlations − Solar
Lag−5 Correlations − Solar
Lag−6 Correlations − Solar
Lag−7 Correlations − Solar
Lag−8 Correlations − Solar
Lag−9 Correlations − Solar
Mean Simulated Correlation
True Data Correlation
−1.0
−0.5
0.0
0.5
1.0

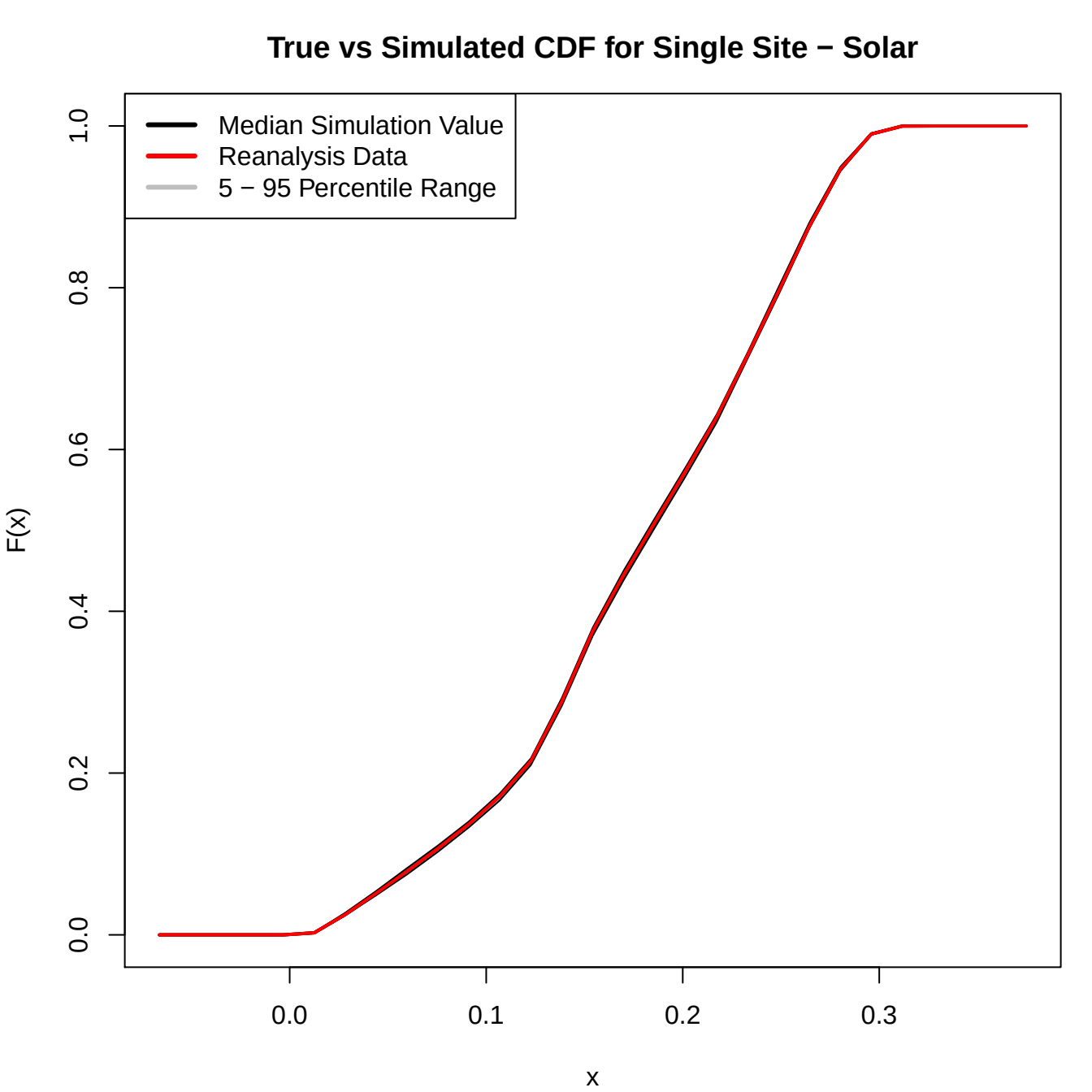

Lag−1 − Solar
Simulation Correlation
Reanalysis Correlation
0.6
0.7
0.8
0.9
Lag−2 − Solar
Simulation Correlation
Reanalysis Correlation
0.5
0.6
0.7
0.8
0.9
Lag−3 − Solar
Simulation Correlation
Reanalysis Correlation
0.4
0.5
0.6
0.7
0.8
Lag−4 − Solar
Simulation Correlation
Reanalysis Correlation
0.4
0.5
0.6
0.7
0.8

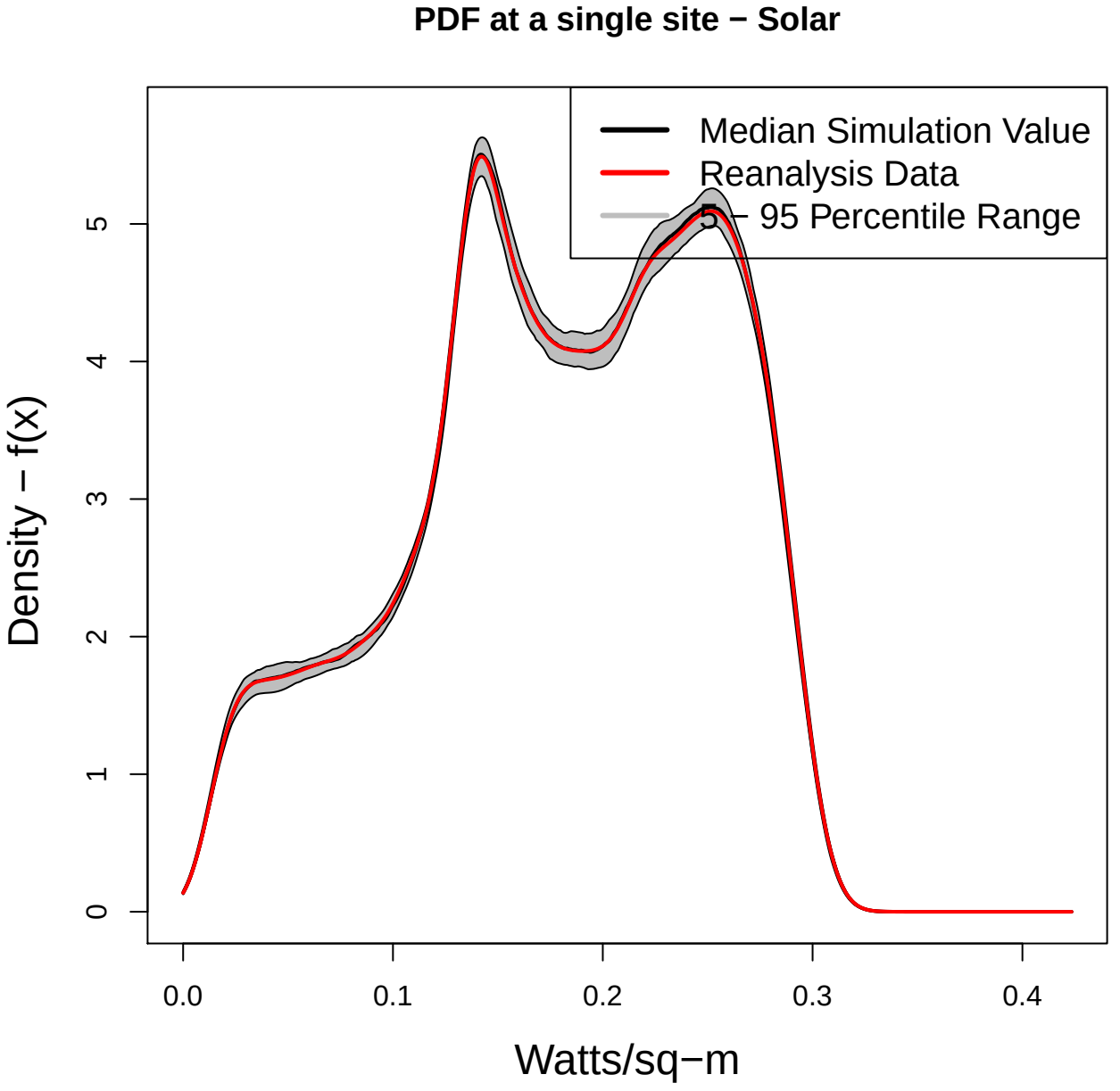

Lag−5 − Solar
Simulation Correlation
Reanalysis Correlation
0.3
0.4
0.5
0.6
0.7
0.8

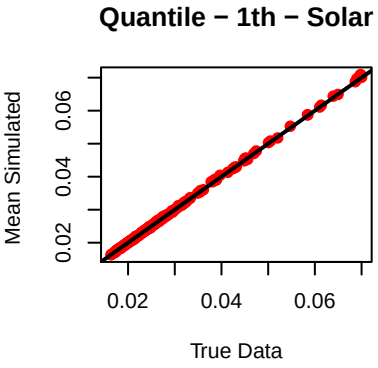

Lag−6 − Solar
Simulation Correlation
Reanalysis Correlation
0.3
0.4
0.5
0.6
0.7
0.8

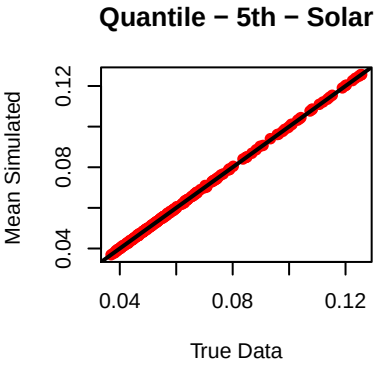

Lag−7 − Solar
Simulation Correlation
Reanalysis Correlation
0.3
0.4
0.5
0.6
0.7
0.8

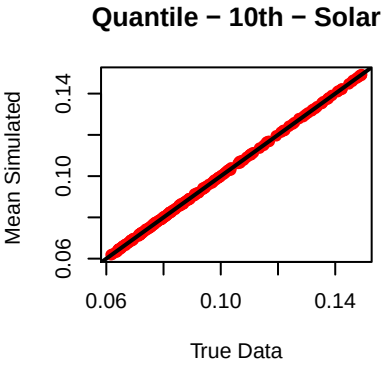

Lag−8 − Solar
Simulation Correlation
Reanalysis Correlation
0.3
0.4
0.5
0.6
0.7
0.8

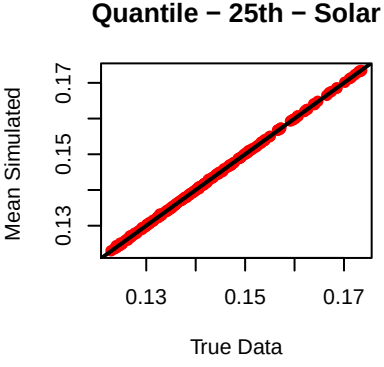

True vs Simulated CDF for Single Site − Solar
Median Simulation Value
Reanalysis Data
5 − 95 Percentile Range
F(x)
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.1
0.2
0.3
x

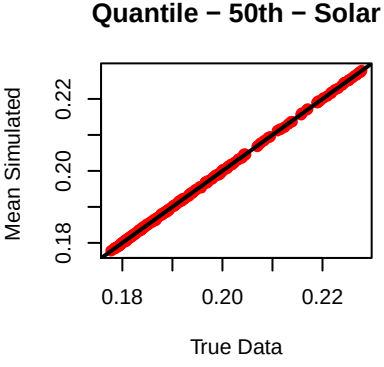

PDF at a single site − Solar
Median Simulation Value
Reanalysis Data
5 − 95 Percentile Range
Density − f(x)
0
1
2
3
4
5
0.0
0.1
0.2
0.3
0.4
Watts/sq−m

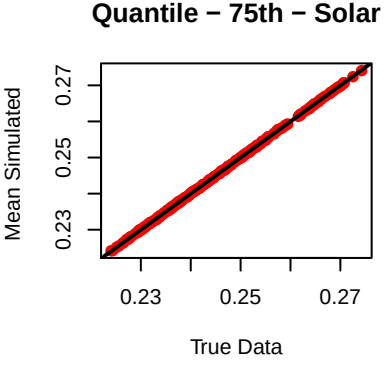

Quantile − 1th − Solar
Mean Simulated
0.02
0.04
0.06
0.02
0.04
0.06
True Data

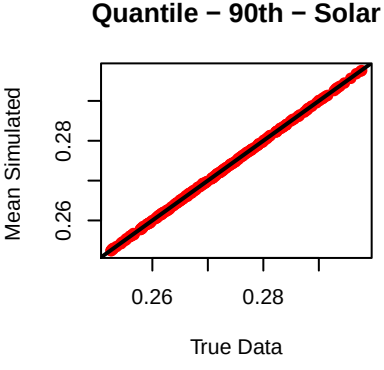

Quantile − 5th − Solar
Mean Simulated
0.04
0.08
0.12
0.04
0.08
0.12
True Data

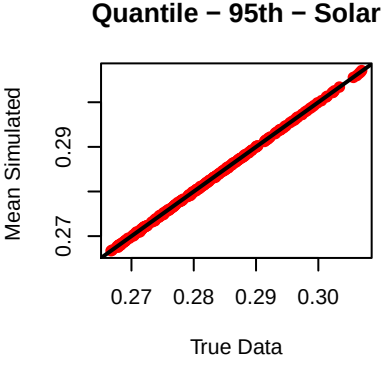

Quantile − 10th − Solar
Mean Simulated
0.06
0.10
0.14
0.06
0.10
0.14
True Data

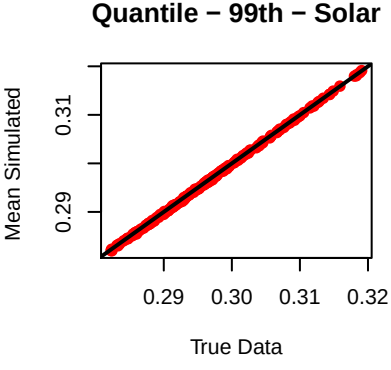

Quantile − 25th − Solar
Mean Simulated
0.13
0.15
0.17
0.13
0.15
0.17
True Data


Quantile − 50th − Solar
Mean Simulated
0.18
0.20
0.22
0.18
0.20
0.22
True Data

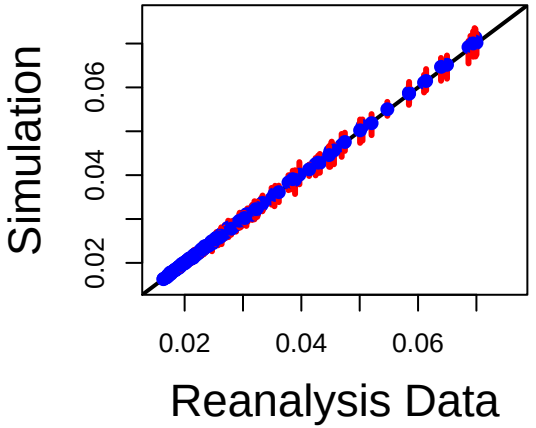

Quantile − 75th − Solar
Mean Simulated
0.23
0.25
0.27
0.23
0.25
0.27
True Data


Quantile − 90th − Solar
Mean Simulated
0.26
0.28
0.26
0.28
True Data

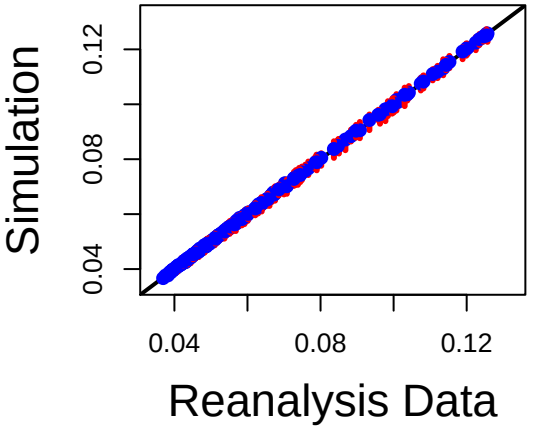

Quantile − 95th − Solar
Mean Simulated
0.27
0.29
0.27
0.28
0.29
0.30
True Data


Quantile − 99th − Solar
Mean Simulated
0.29
0.31
0.29
0.30
0.31
0.32
True Data

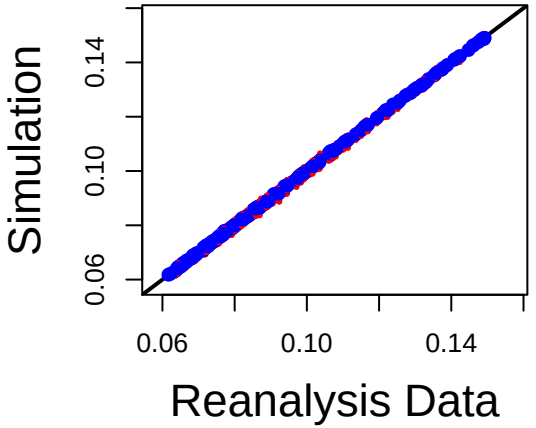
1th Quantile − Solar



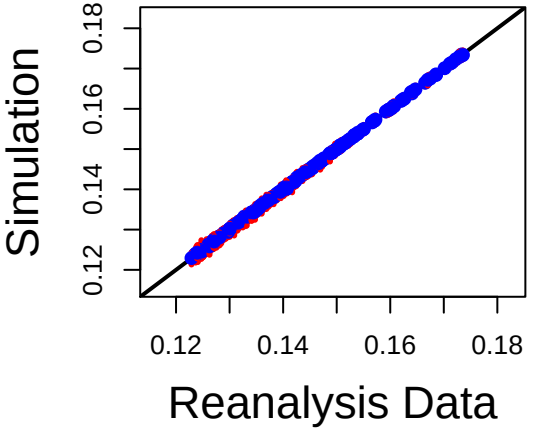
5th Quantile − Solar



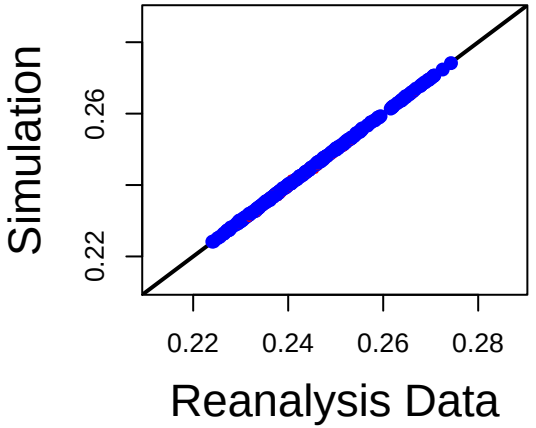
10th Quantile − Solar



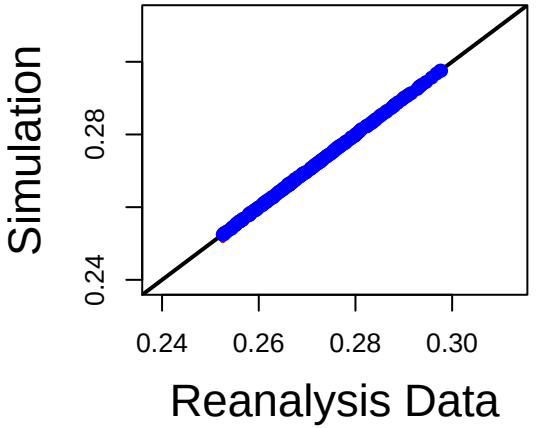
25th Quantile − Solar



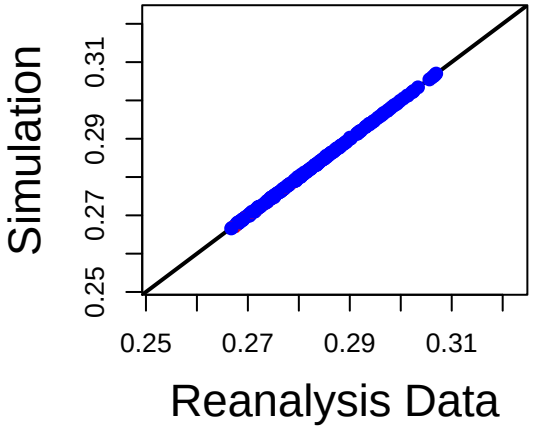
75th Quantile − Solar



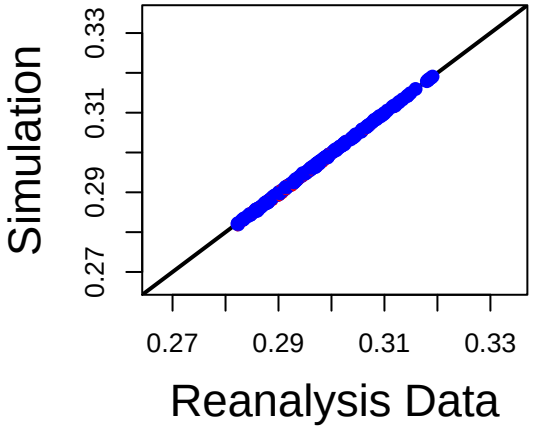
90th Quantile − Solar



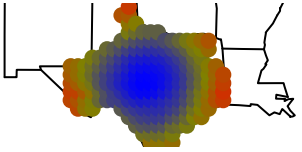
95th Quantile − Solar



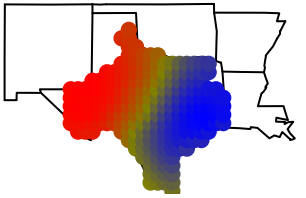
99th Quantile − Solar



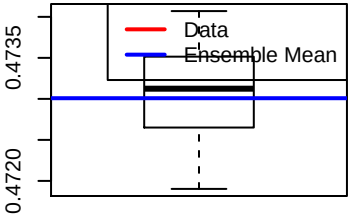
PC−1 − Solar−79%



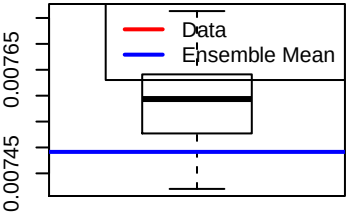
PC−2 − Solar−7%



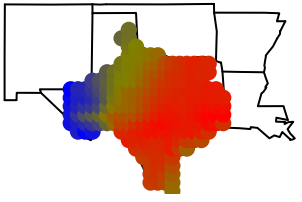
Simulated PC−1 Variance Solar



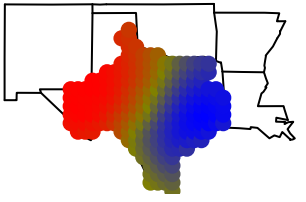
Simulated PC−2 Variance Solar

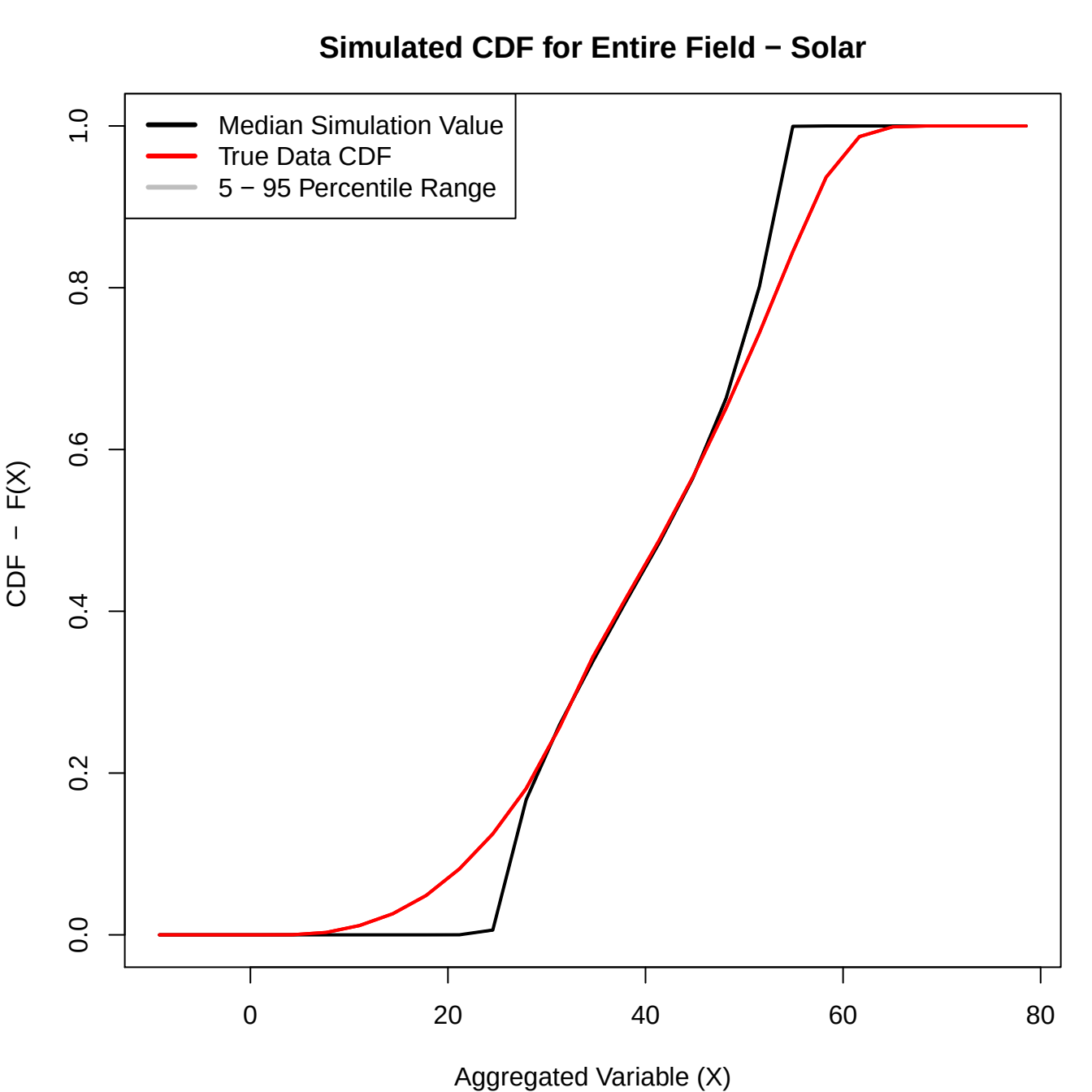


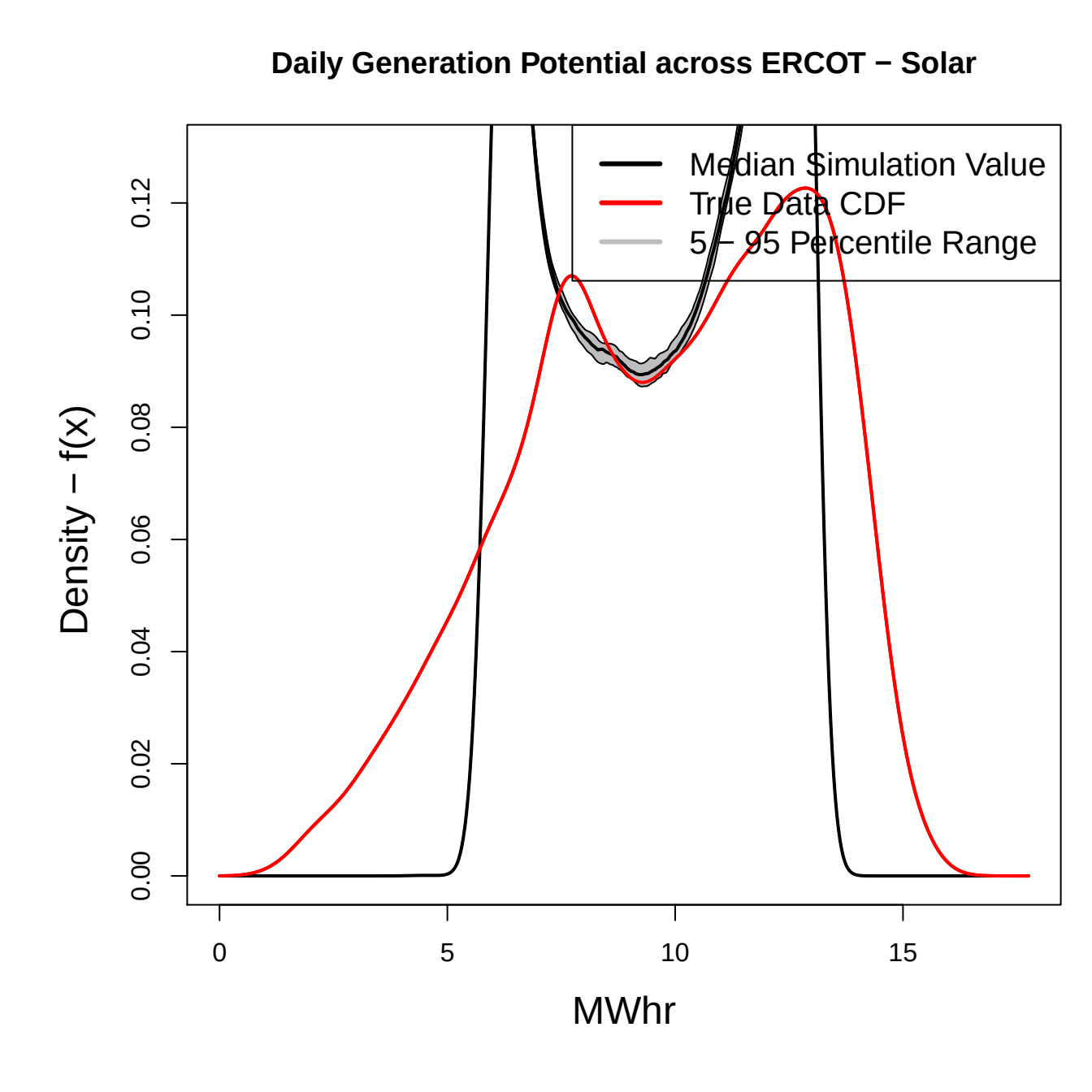
Ensemble Mean PC−1 − Solar−47%

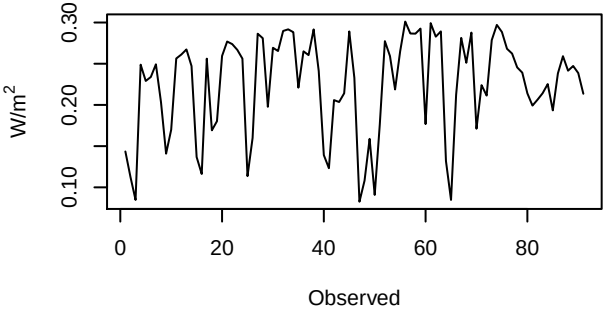


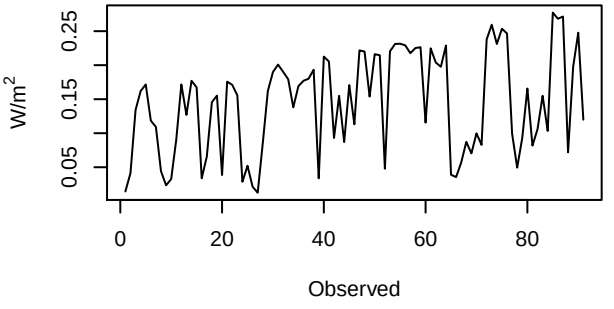
Ensemble Mean PC−2 − Solar−1%

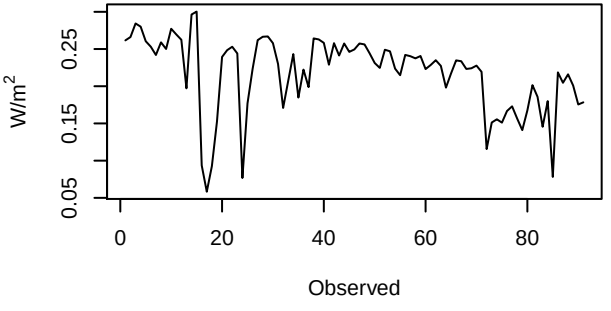


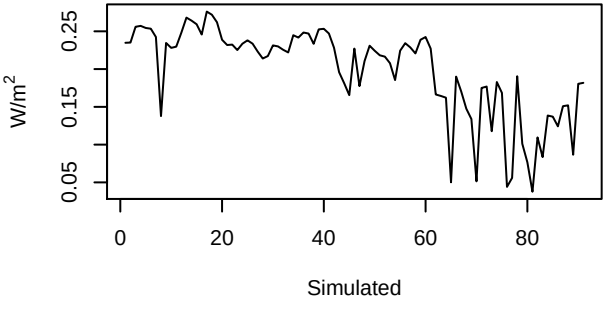

Simulated CDF for Entire Field − Solar
Median Simulation Value
True Data CDF
5 − 95 Percentile Range
CDF − F(X)
0.0
0.2
0.4
0.6
0.8
1.0
0
20
40
60
80
Aggregated Variable (X)

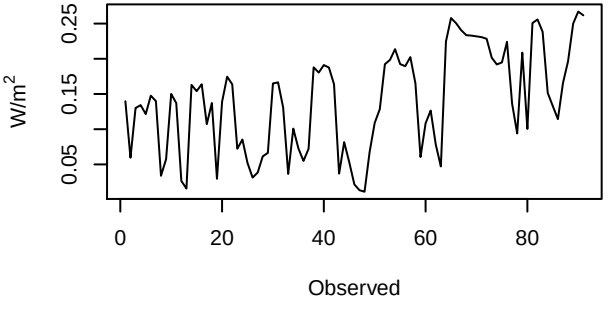

Daily Generation Potential across ERCOT − Solar
Median Simulation Value
True Data CDF
5 − 95 Percentile Range
Density − f(x)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0
5
10
15
MWhr

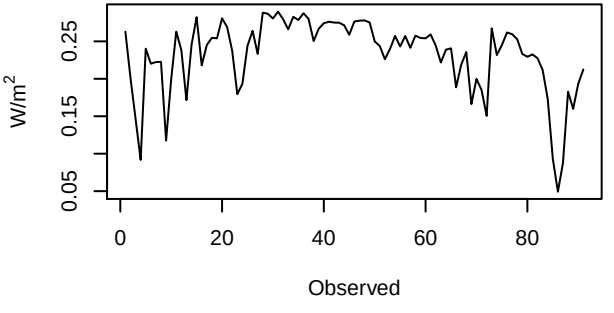

W/m2
0.10
0.20
0.30
0
20
40
60
80
Observed

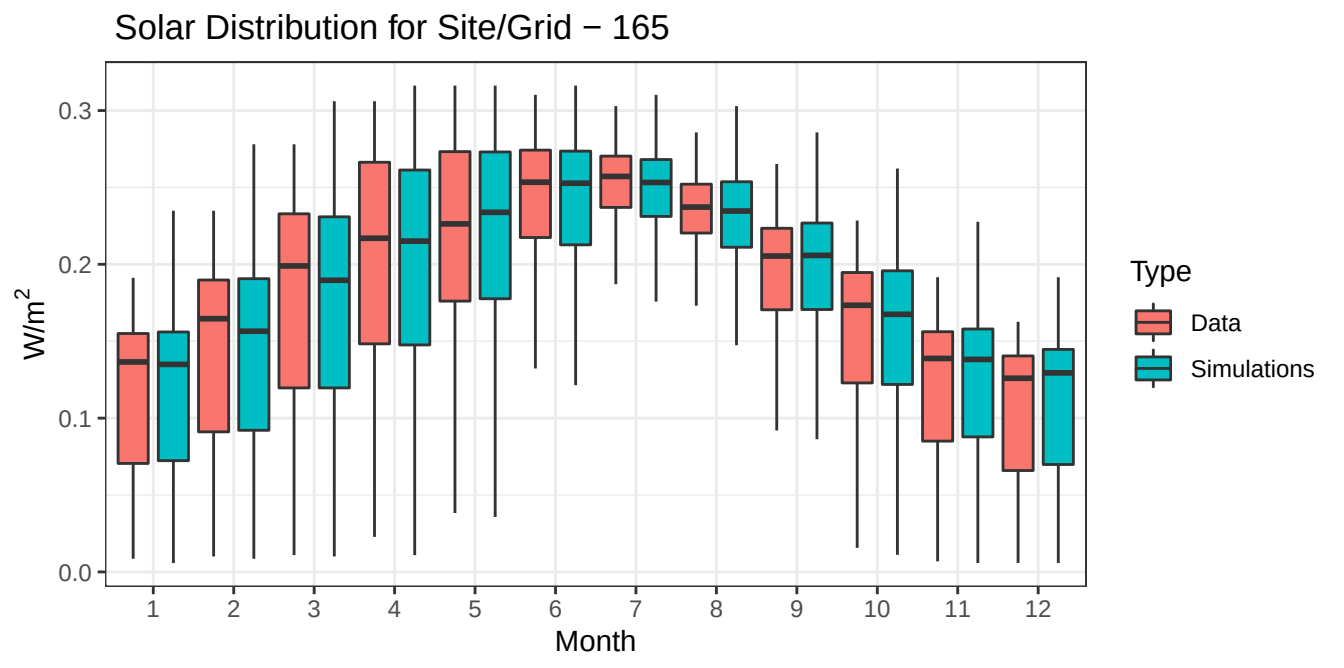

W/m2
0.05
0.15
0.25
0
20
40
60
80
Observed

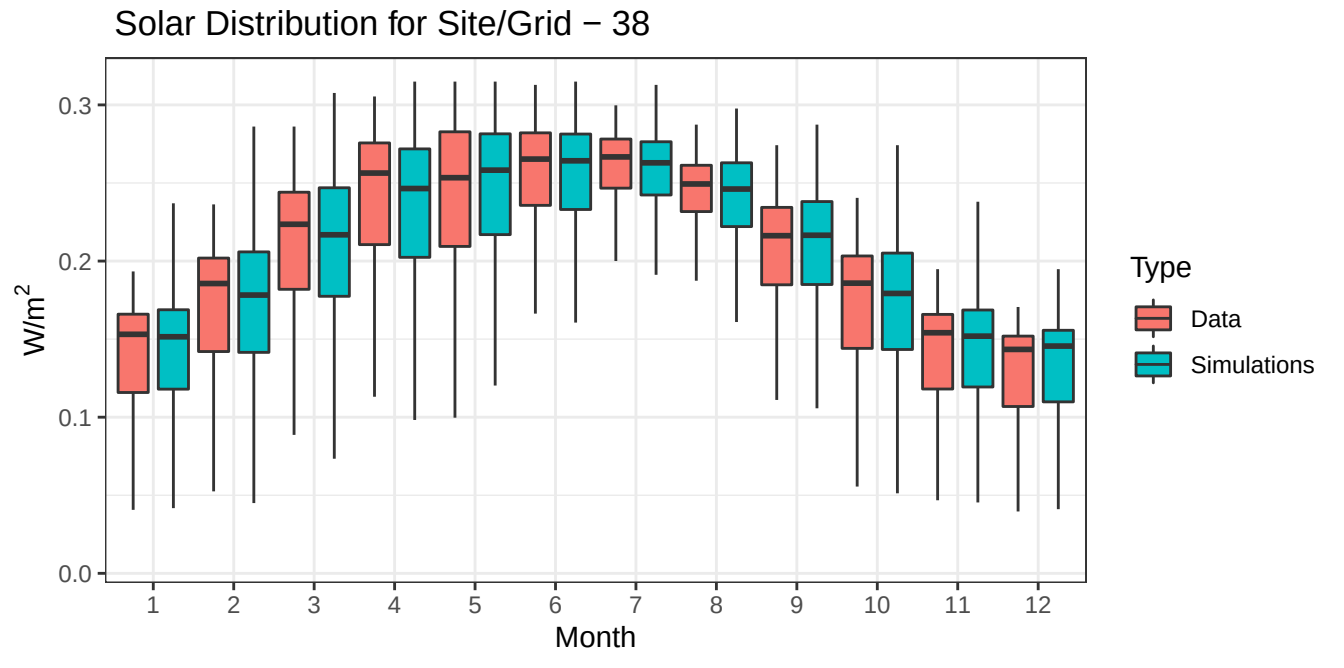

W/m2
0.05
0.15
0.25
0
20
40
60
80
Observed

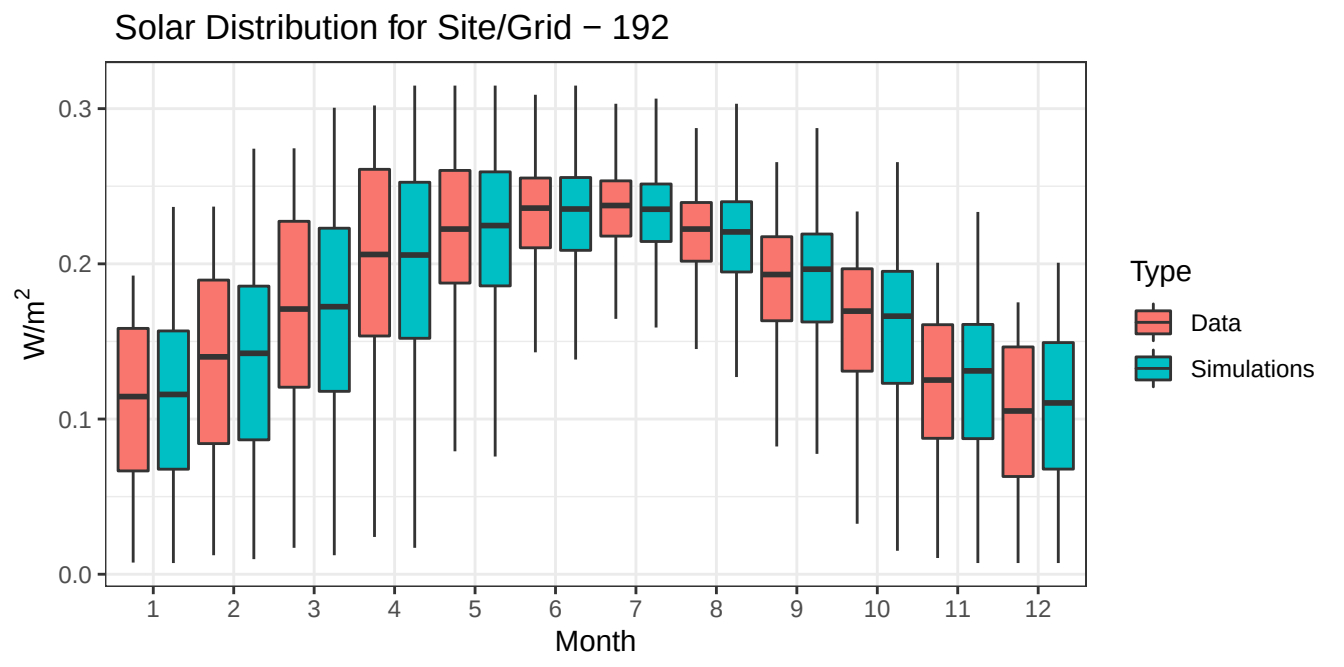

W/m2
0.05
0.15
0.25
0
20
40
60
80
Simulated

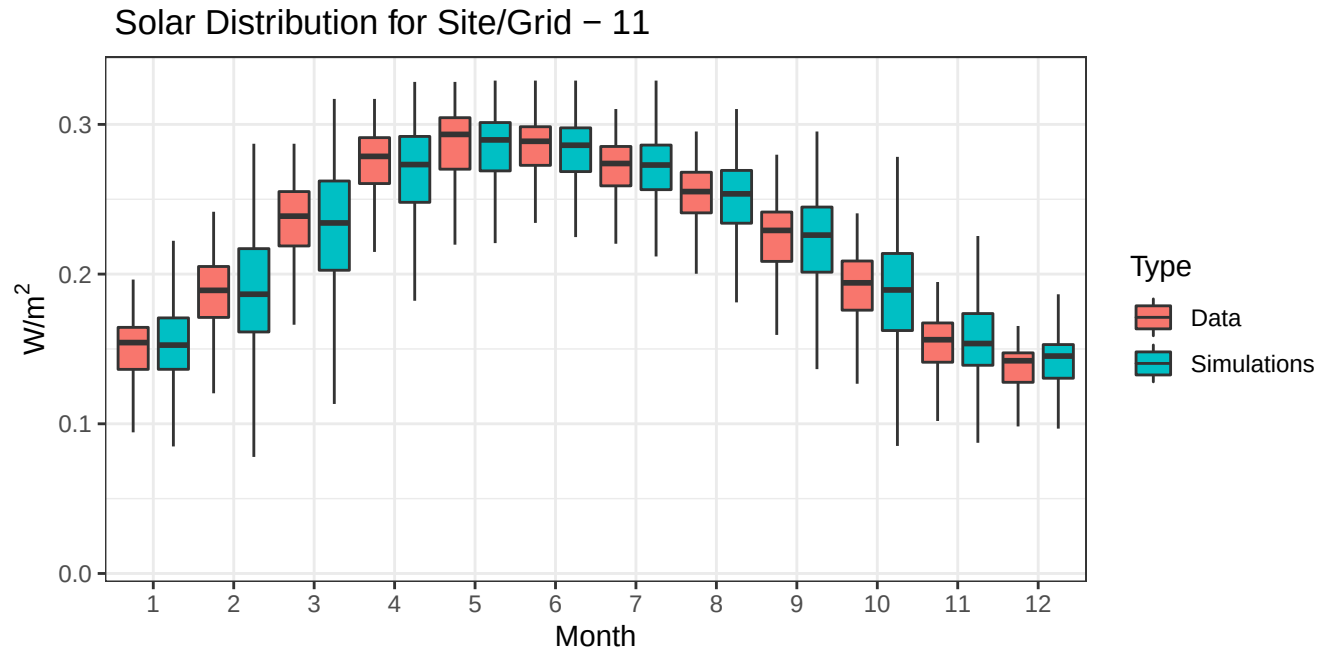

W/m2
0.05
0.15
0.25
0
20
40
60
80
Observed

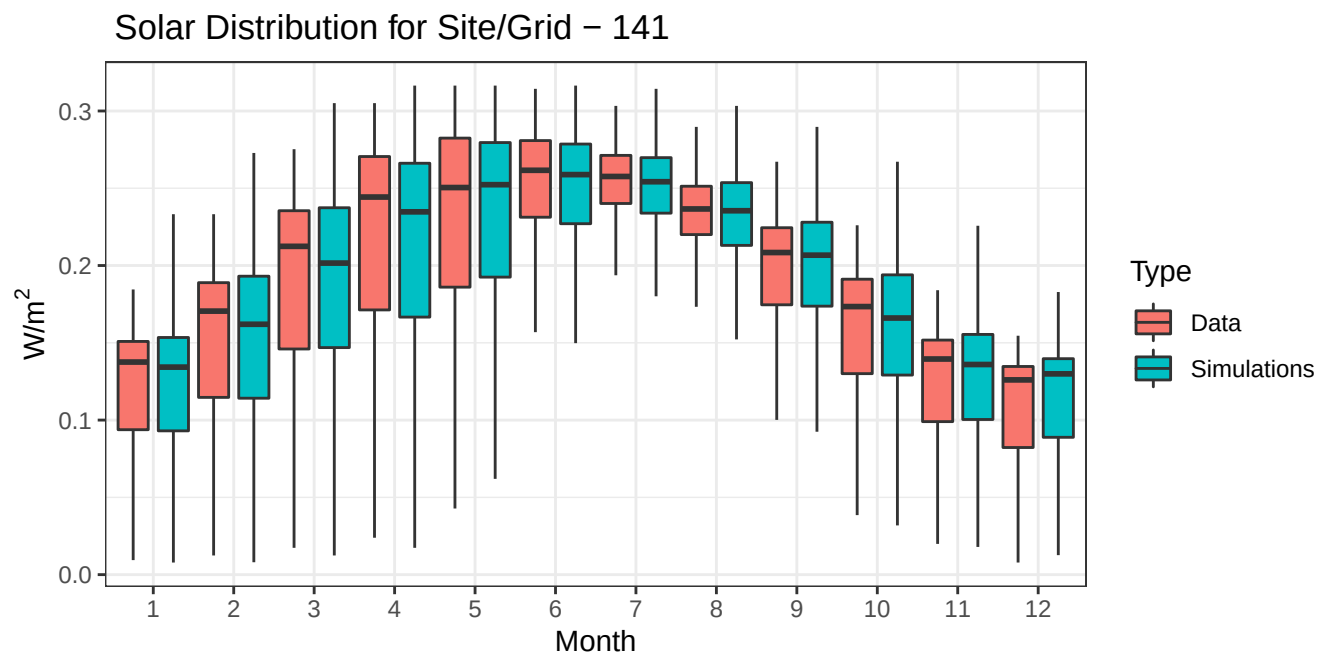

W/m2
0.05
0.15
0.25
0
20
40
60
80
Observed

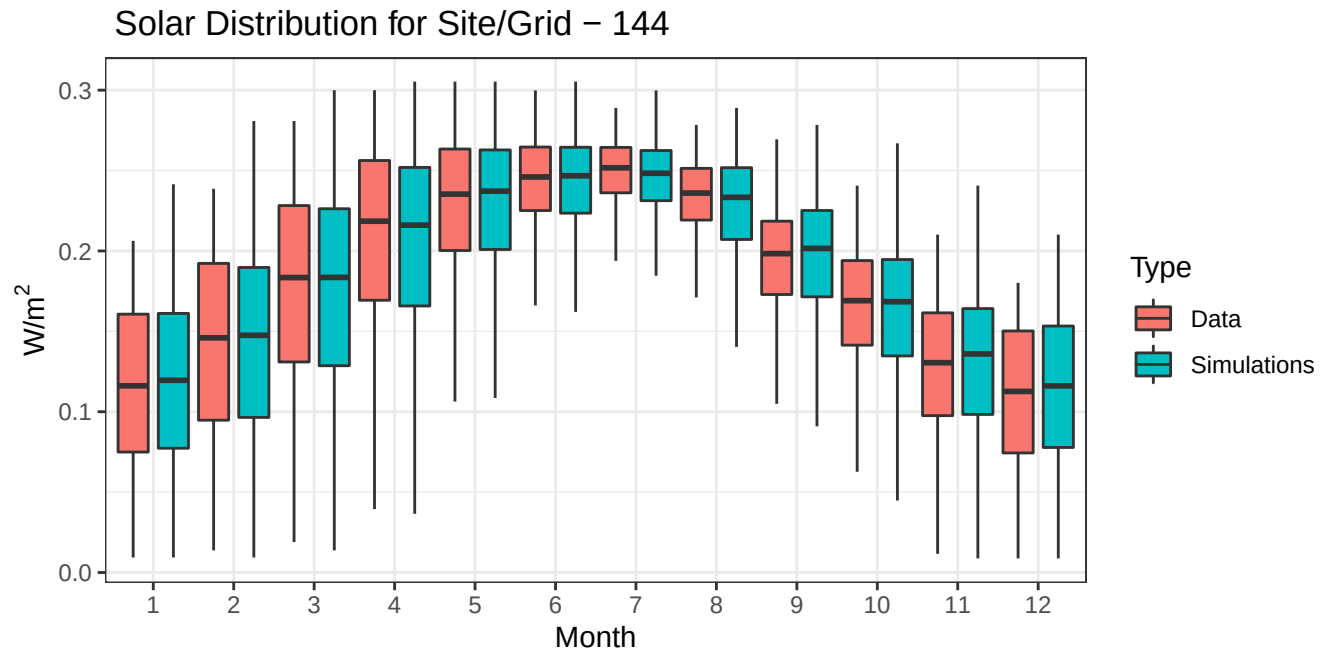

Solar Distribution for Site/Grid − 165
W/m2
0.0
0.1
0.2
0.3
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations

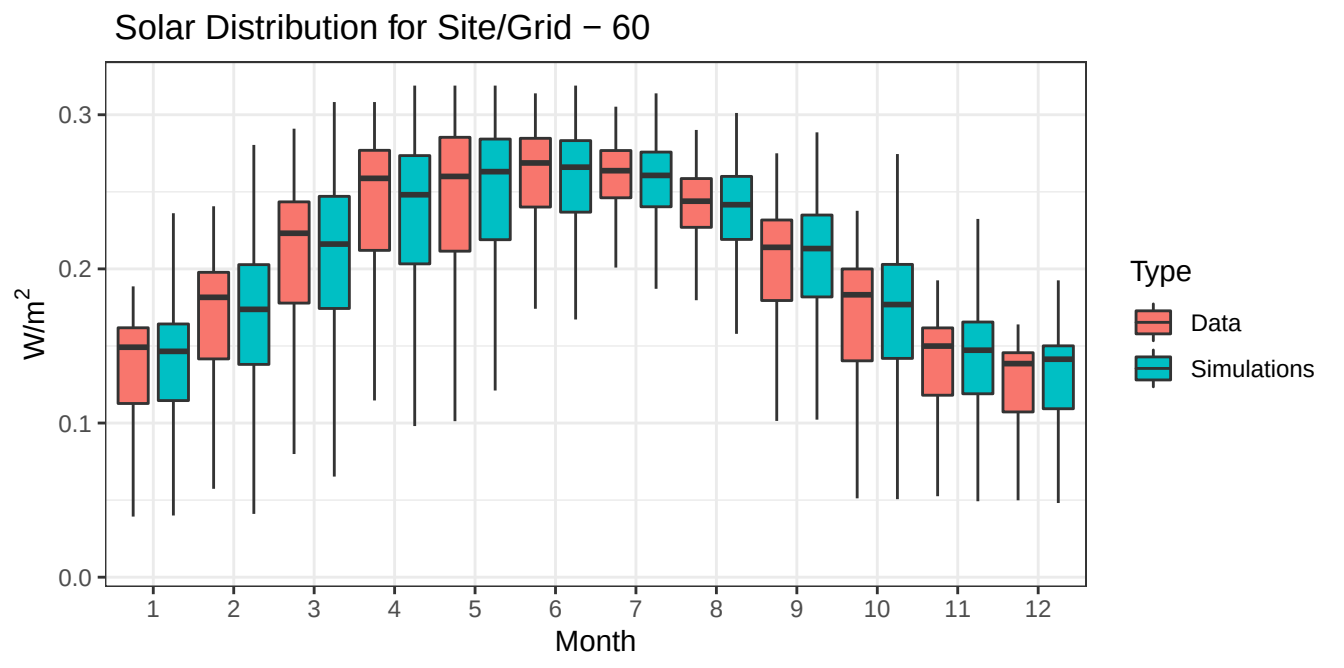

Solar Distribution for Site/Grid − 38
W/m2
0.0
0.1
0.2
0.3
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations

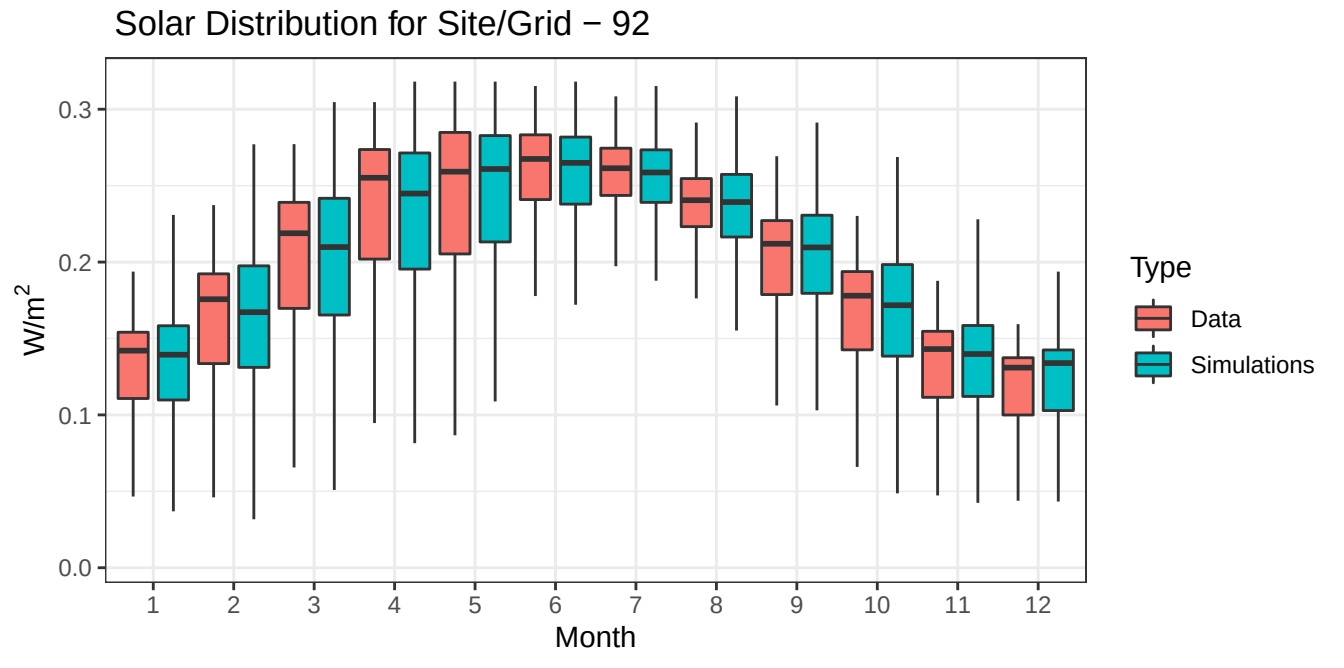

Solar Distribution for Site/Grid − 192
W/m2
0.0
0.1
0.2
0.3
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations


Solar Distribution for Site/Grid − 11
W/m2
0.0
0.1
0.2
0.3
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations


Solar Distribution for Site/Grid − 141
W/m2
0.0
0.1
0.2
0.3
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations

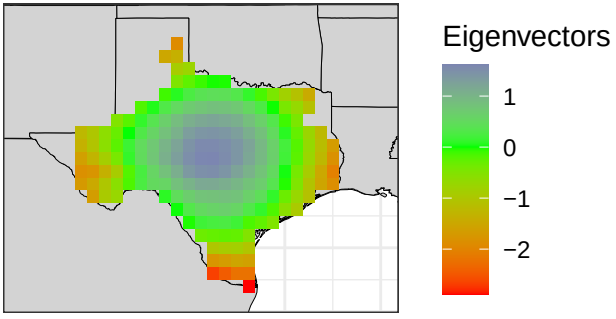

Solar Distribution for Site/Grid − 144
W/m2
0.0
0.1
0.2
0.3
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations


Solar Distribution for Site/Grid − 60
W/m2
0.0
0.1
0.2
0.3
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations


Solar Distribution for Site/Grid − 92
W/m2
0.0
0.1
0.2
0.3
1
2
3
4
5
6
7
8
9
10
11
12
Month
Type
Data
Simulations

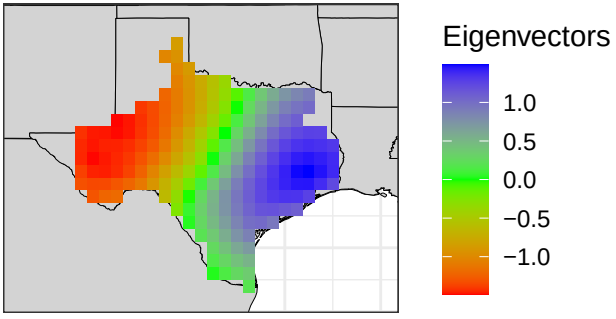
Data PC−1 Solar

Fractional Variance − 79%

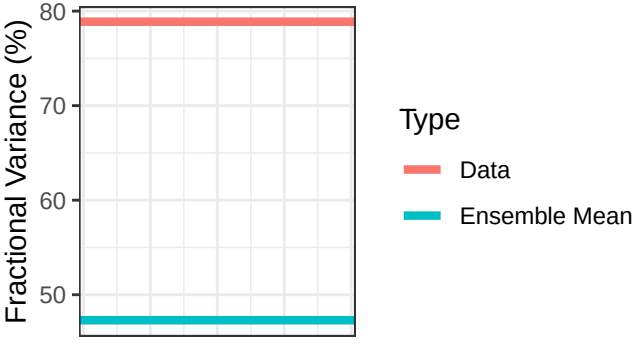


Data PC−1 Solar

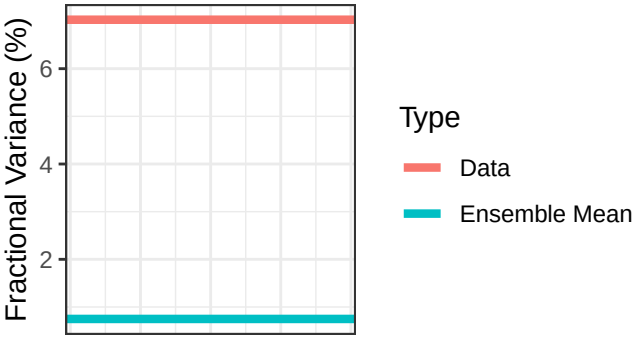
Fractional Variance − 7%



Simulated PC−1 Variance Solar

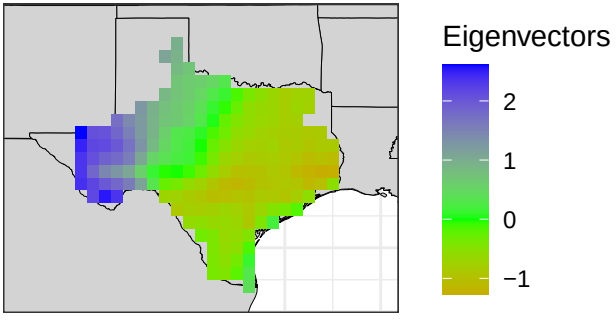


Simulated PC−2 Variance Solar



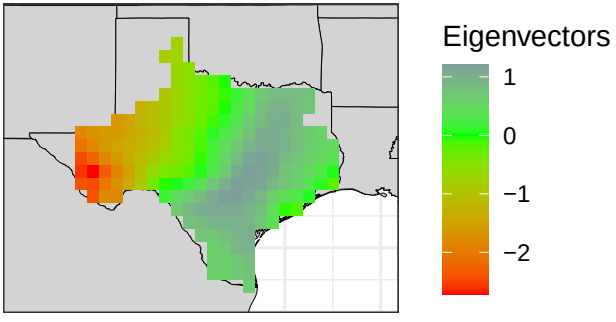
Ensemble Mean PC−1 Solar

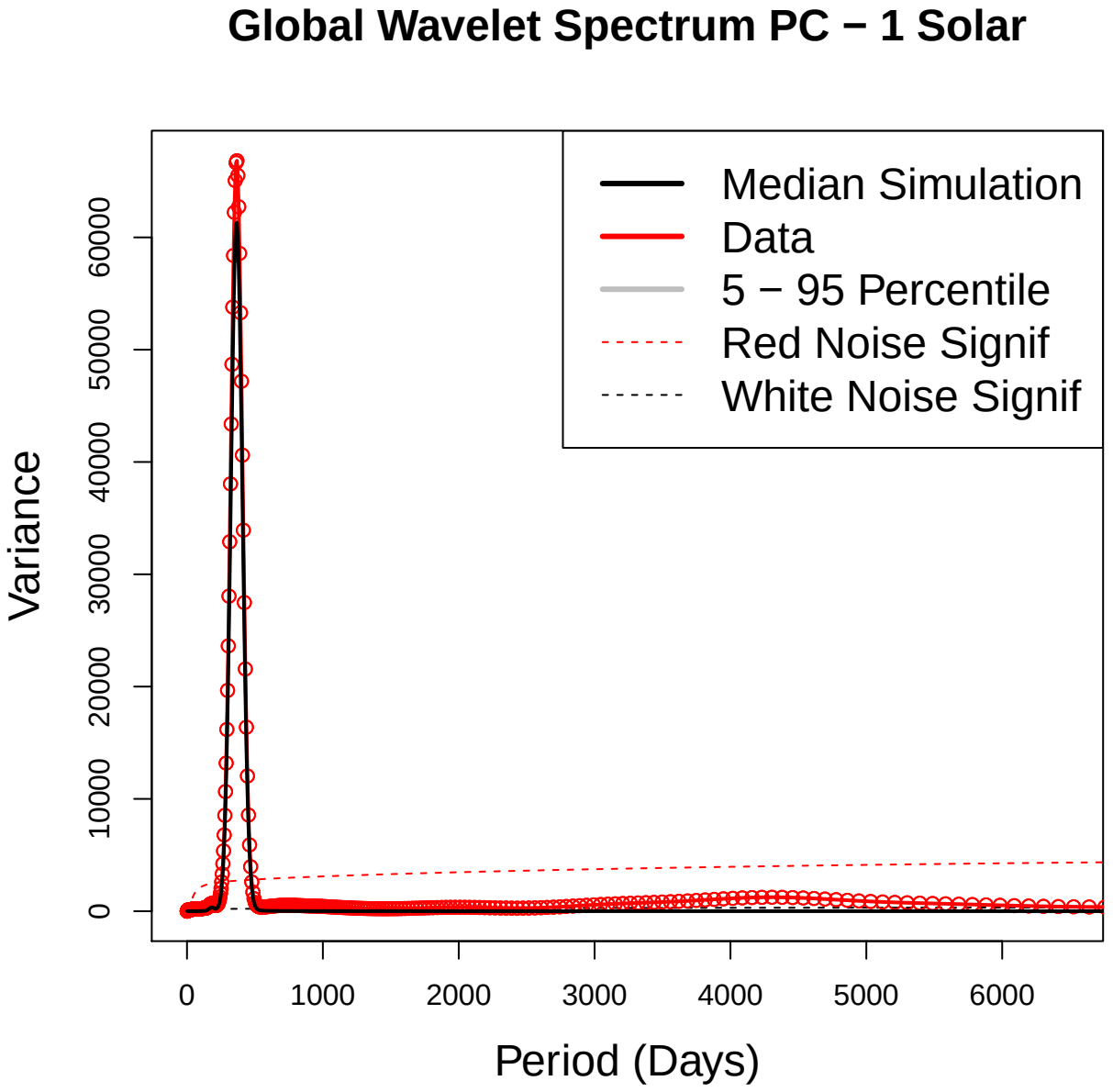
Fractional Variance − 47%

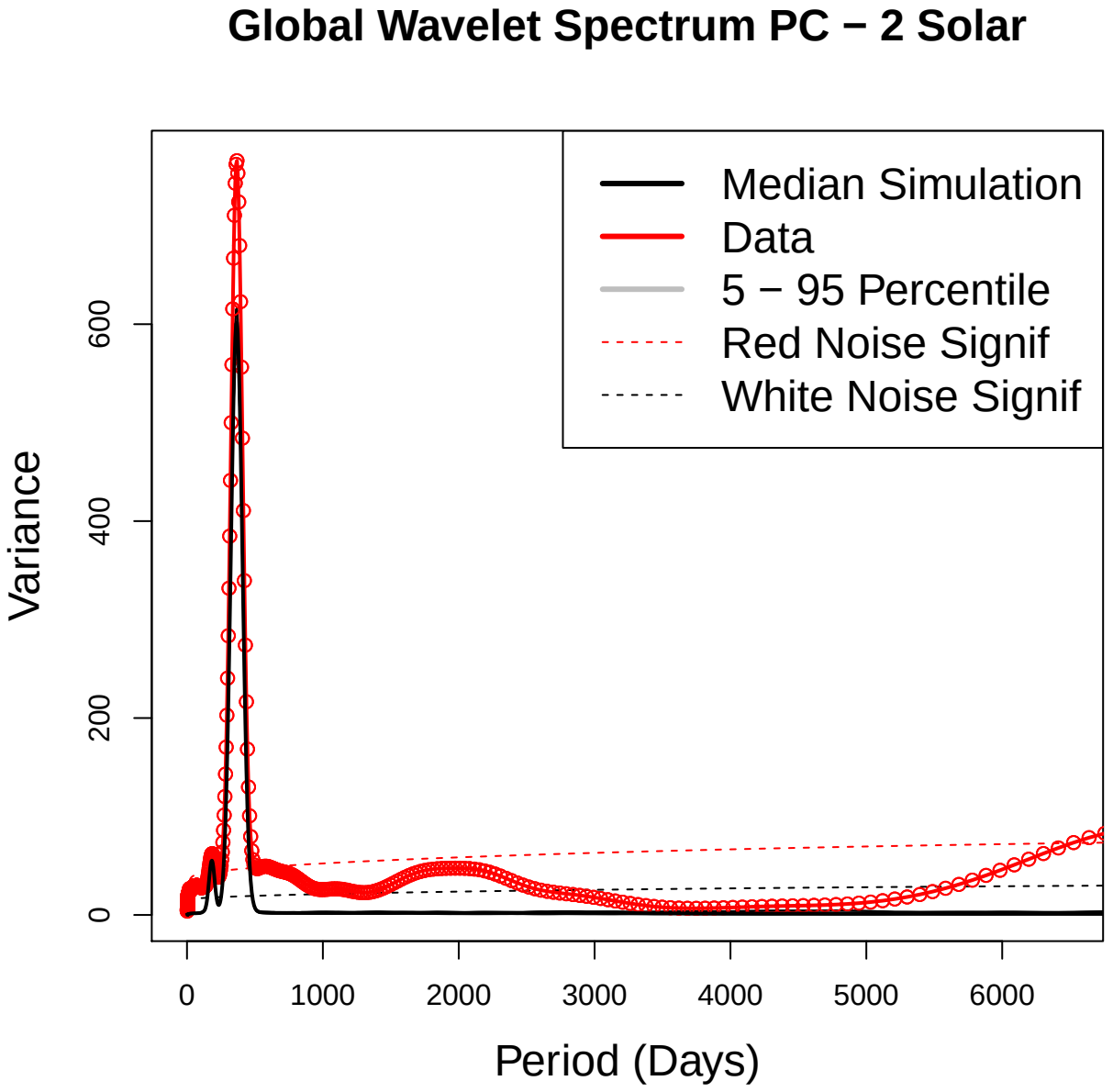


Ensemble Mean PC−2 Solar

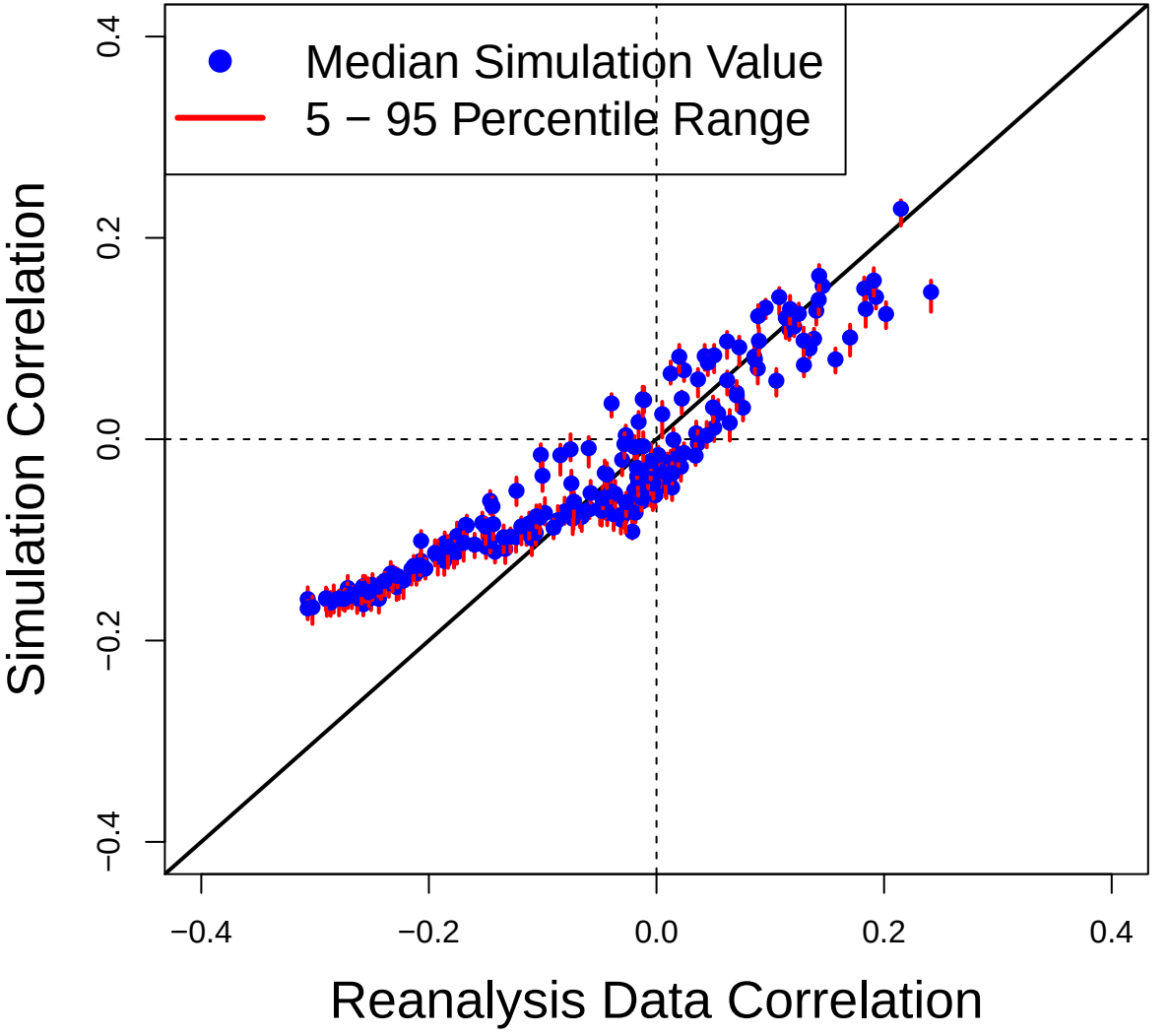
Fractional Variance − 1%



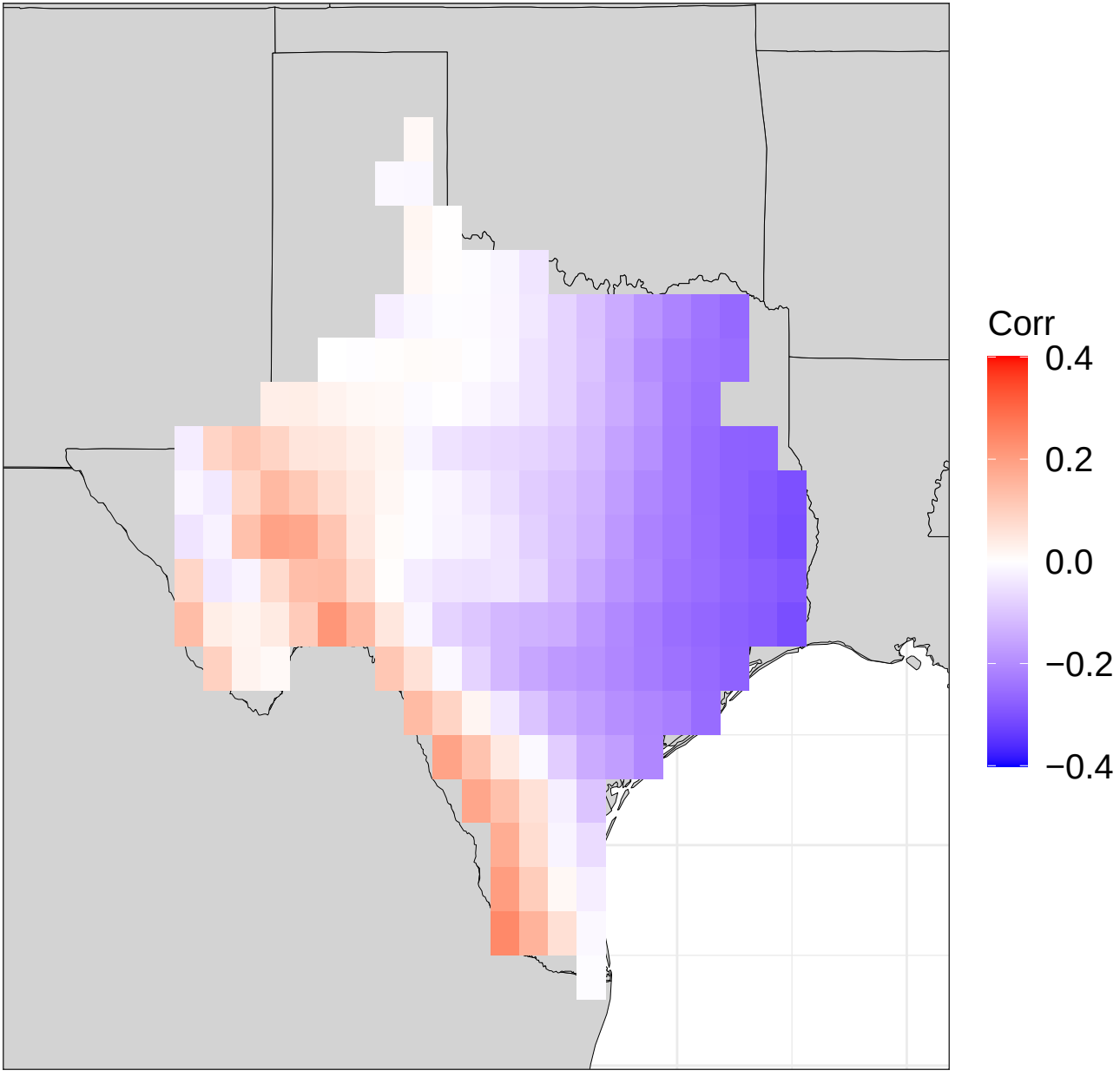

Global Wavelet Spectrum PC − 1 Solar
Median Simulation
Data
5 − 95 Percentile
Red Noise Signif
White Noise Signif
Variance
0
10000
20000
30000
40000
50000
60000
0
1000
2000
3000
4000
5000
6000
Period (Days)


Global Wavelet Spectrum PC − 2 Solar
Median Simulation
Data
5 − 95 Percentile
Red Noise Signif
White Noise Signif
Variance
0
200
400
600
0
1000
2000
3000
4000
5000
6000
Period (Days)

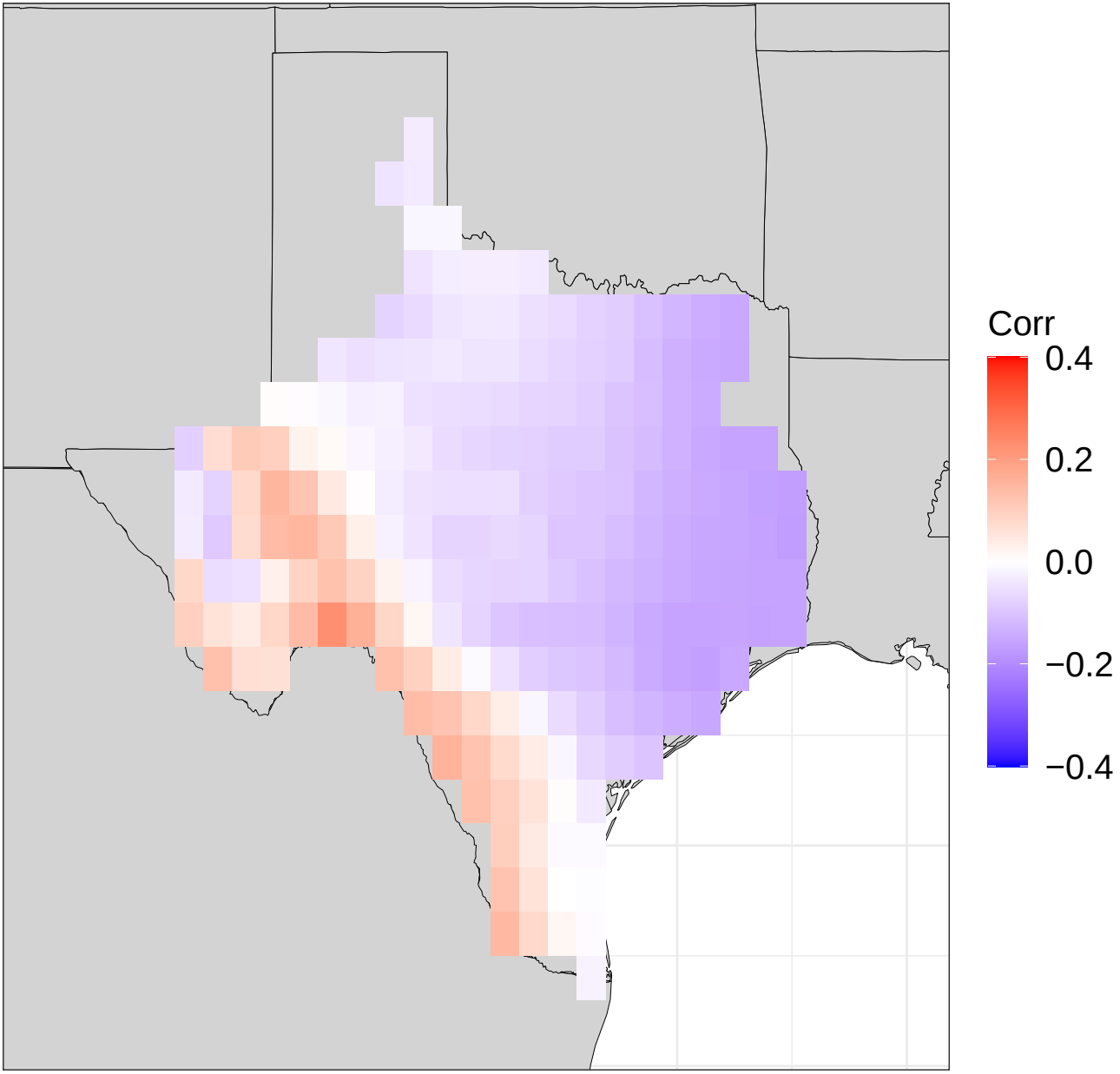
Simulation vs Data Correlation



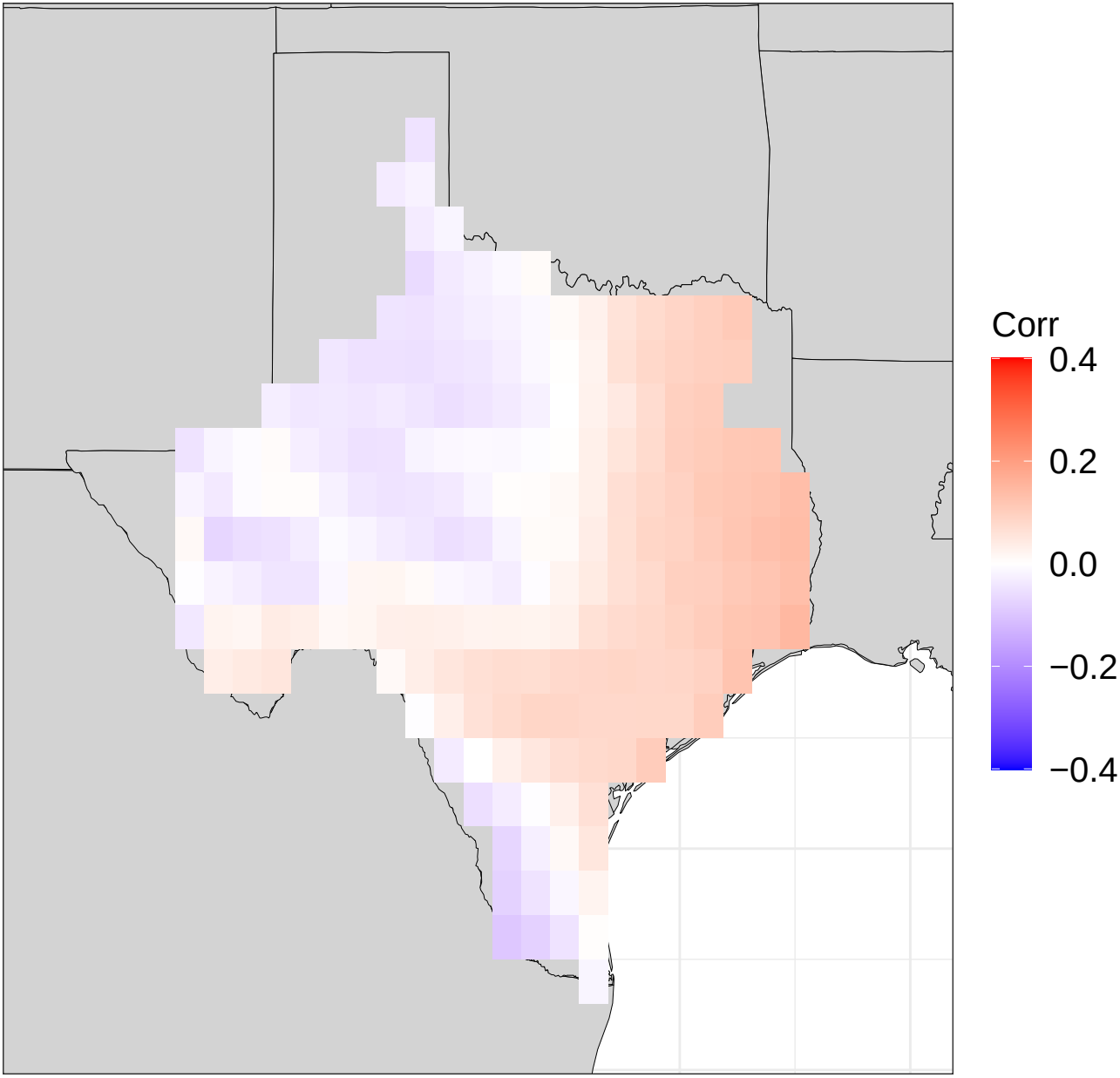
Reanalysis Data Correlation

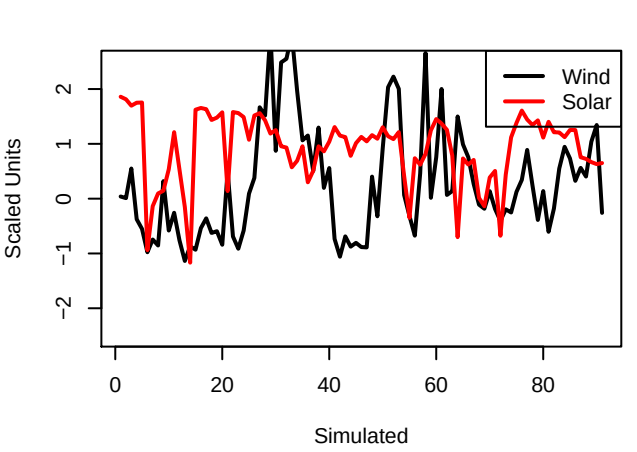


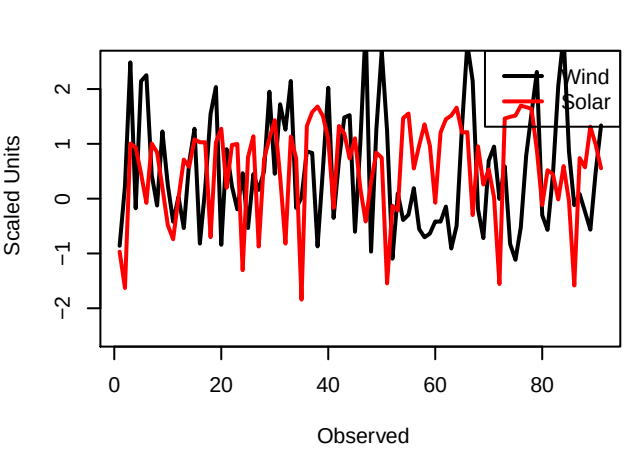
Median Simulation Correlation

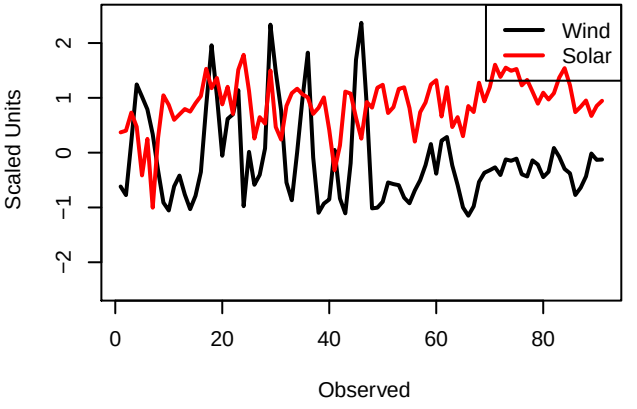


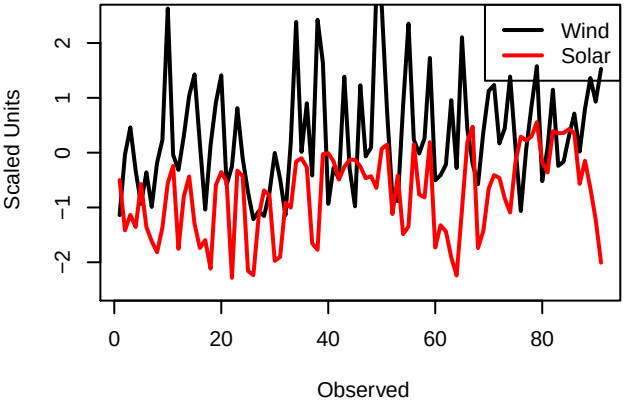
Difference between Renalysis Data and Simulations

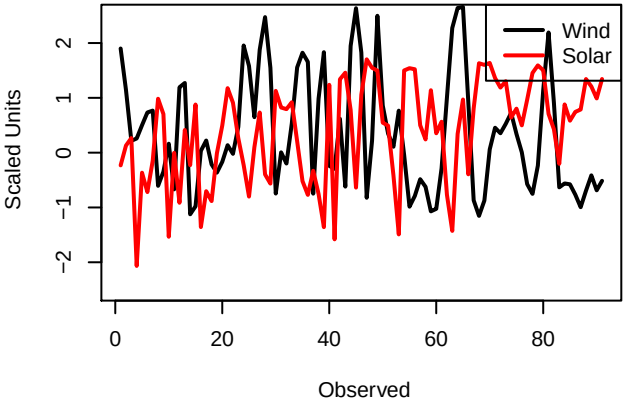


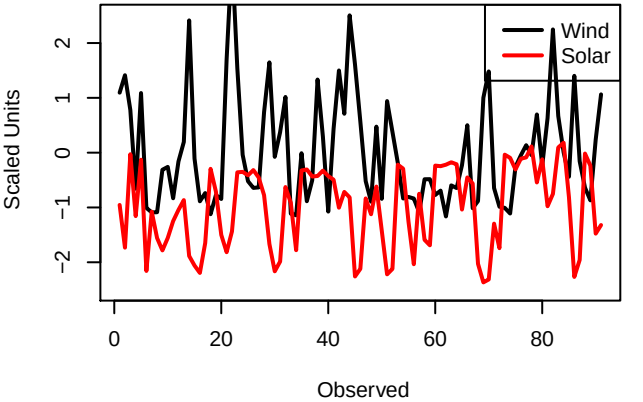

Wind
Solar
Scaled Units
Simulated

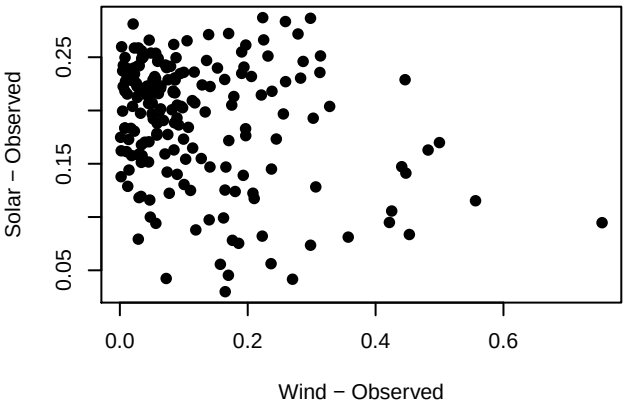

Wind
Solar
Scaled Units
Observed

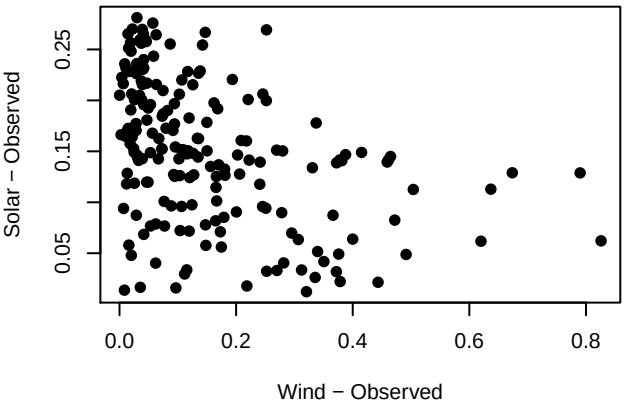

Wind
Solar
Scaled Units
Observed

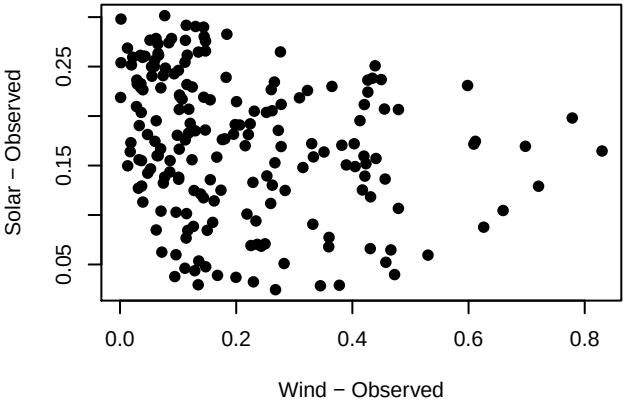

Wind
Solar
Scaled Units
Observed

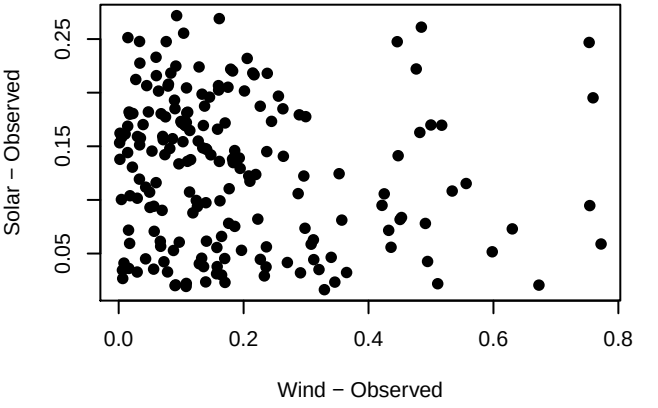

Wind
Solar
Scaled Units
Observed

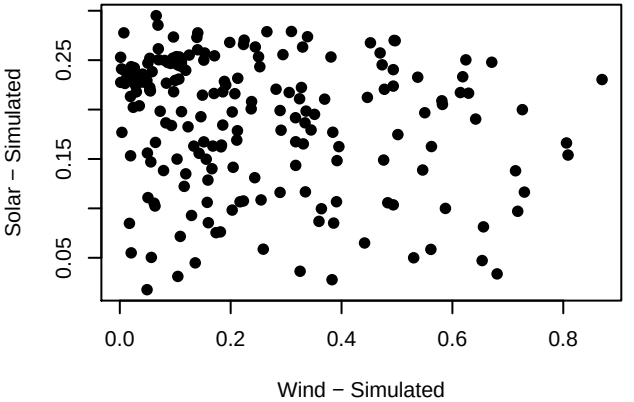

Wind
Solar
Scaled Units
Observed

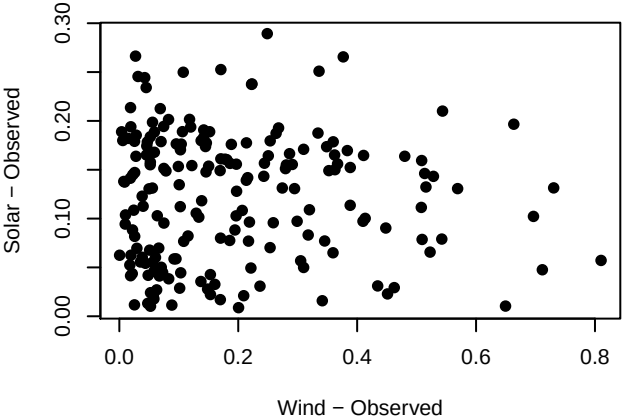

Solar − Observed
0.05
0.15
0.25
0.0
0.2
0.4
0.6
Wind − Observed

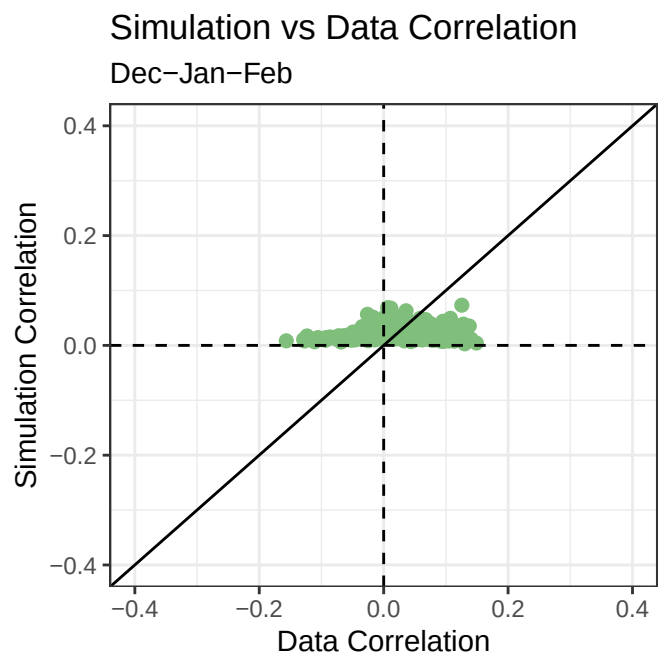

Solar − Observed
0.05
0.15
0.25
0.0
0.2
0.4
0.6
0.8
Wind − Observed

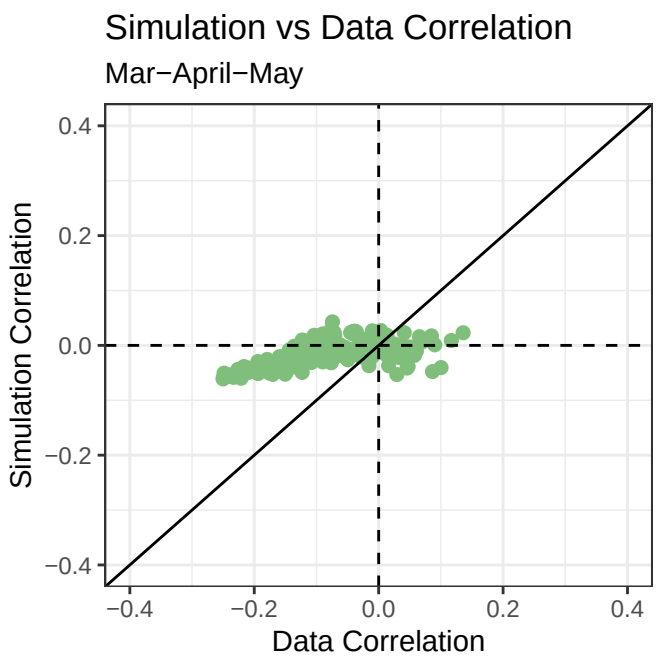

Solar − Observed
0.05
0.15
0.25
0.0
0.2
0.4
0.6
0.8
Wind − Observed

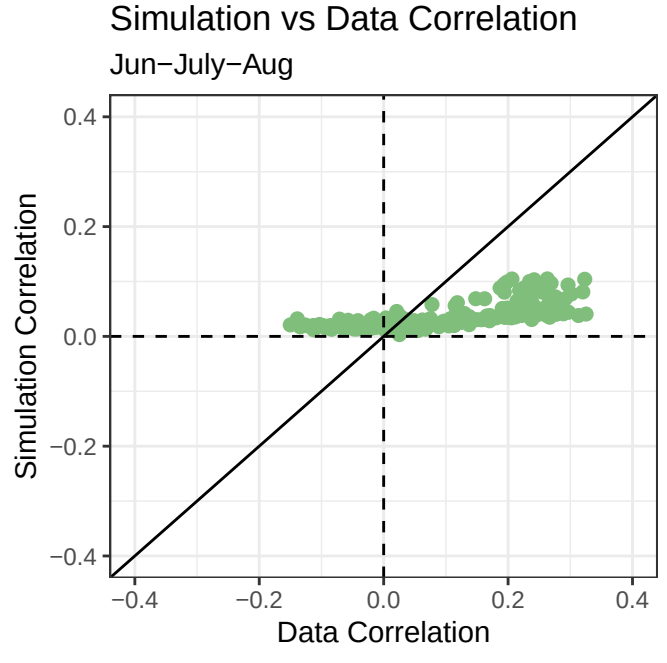

Solar − Observed
0.05
0.15
0.25
0.0
0.2
0.4
0.6
0.8
Wind − Observed

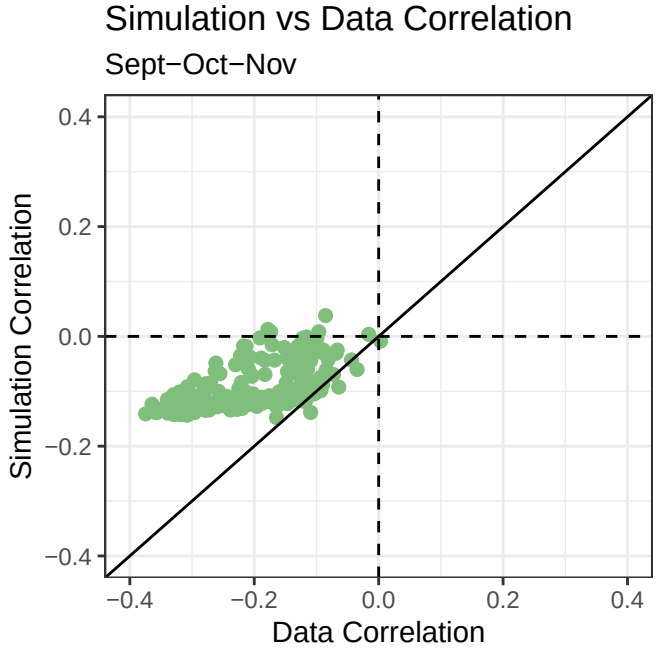

Solar − Simulated
0.05
0.15
0.25
0.0
0.2
0.4
0.6
0.8
Wind − Simulated

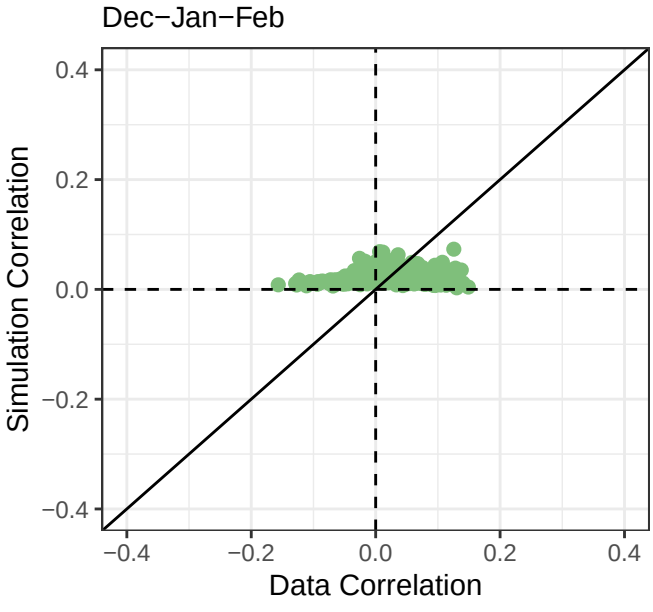

Solar − Observed
0.00
0.10
0.20
0.30
0.0
0.2
0.4
0.6
0.8
Wind − Observed

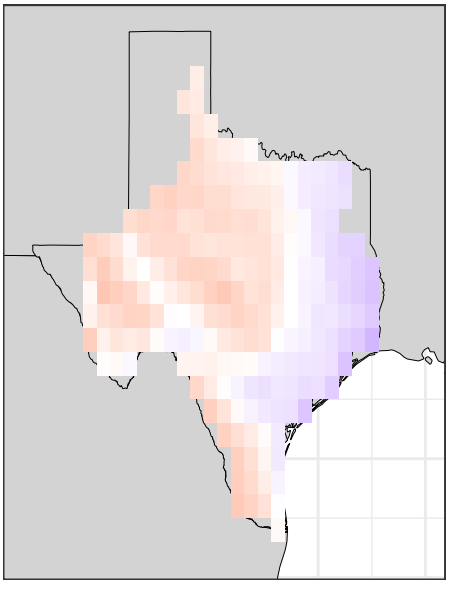

Simulation vs Data Correlation
Dec−Jan−Feb
Simulation Correlation
Data Correlation
0.4
0.2
0.0
−0.2
−0.4
−0.4
−0.2
0.0
0.2
0.4

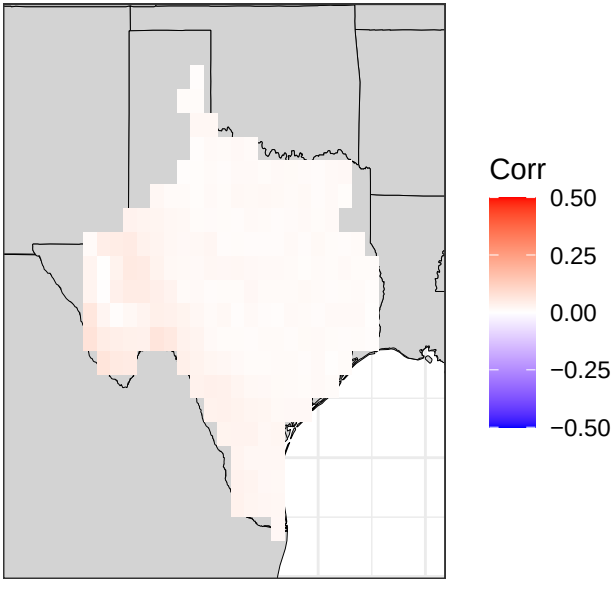

Simulation vs Data Correlation
Mar−April−May
Simulation Correlation
Data Correlation
0.4
0.2
0.0
−0.2
−0.4
−0.4
−0.2
0.0
0.2
0.4

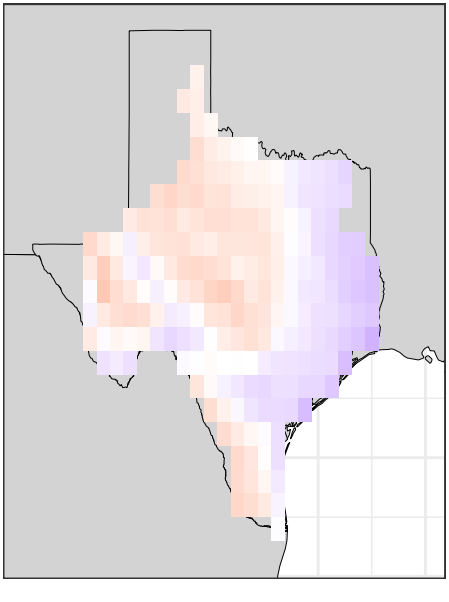

Simulation vs Data Correlation
Jun−July−Aug
Simulation Correlation
Data Correlation
0.4
0.2
0.0
−0.2
−0.4
−0.4
−0.2
0.0
0.2
0.4

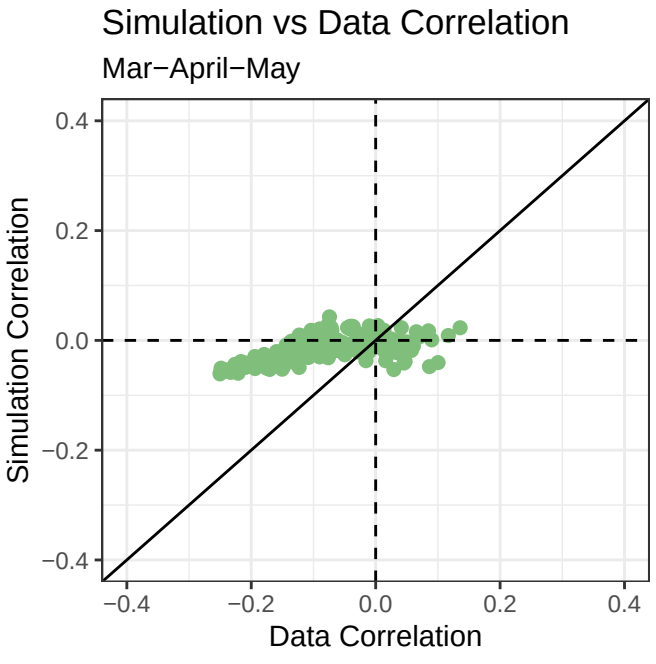

Simulation vs Data Correlation
Sept−Oct−Nov
Simulation Correlation
Data Correlation
0.4
0.2
0.0
−0.2
−0.4
−0.4
−0.2
0.0
0.2
0.4

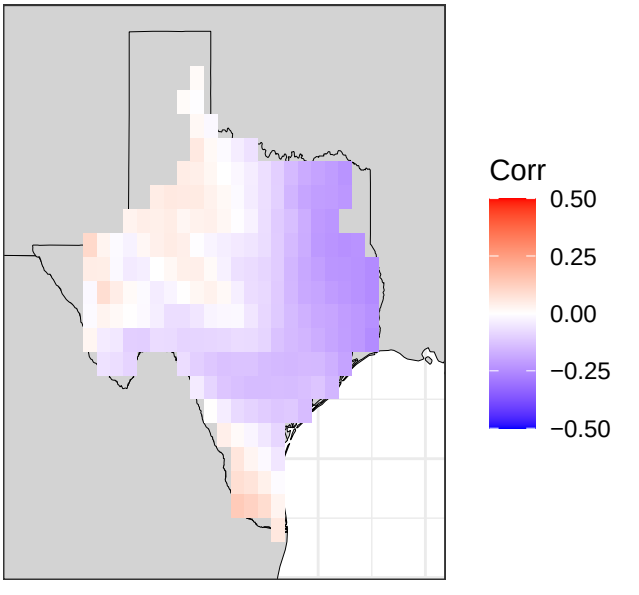

Simulation vs Data Correlation
Dec−Jan−Feb
Simulation Correlation
Data Correlation
0.4
0.2
0.0
−0.2
−0.4
−0.4
−0.2
0.0
0.2
0.4

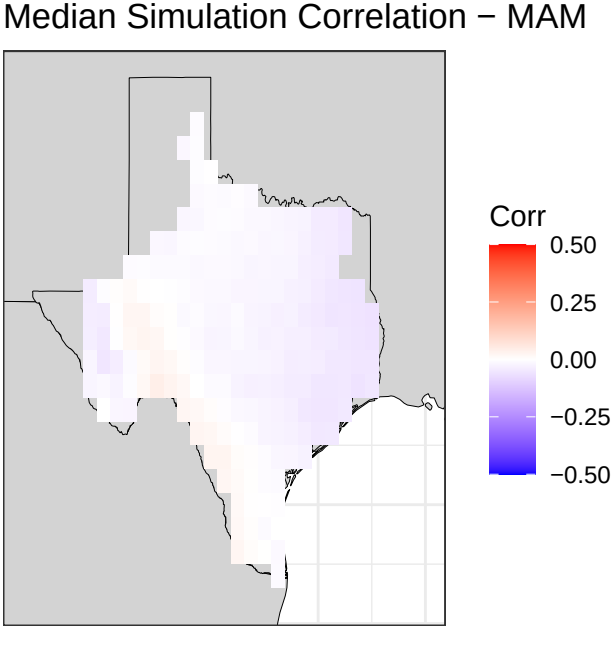

Reanalysis Data Correlation − DJF
Corr
0.50
0.25
0.00
−0.25
−0.50

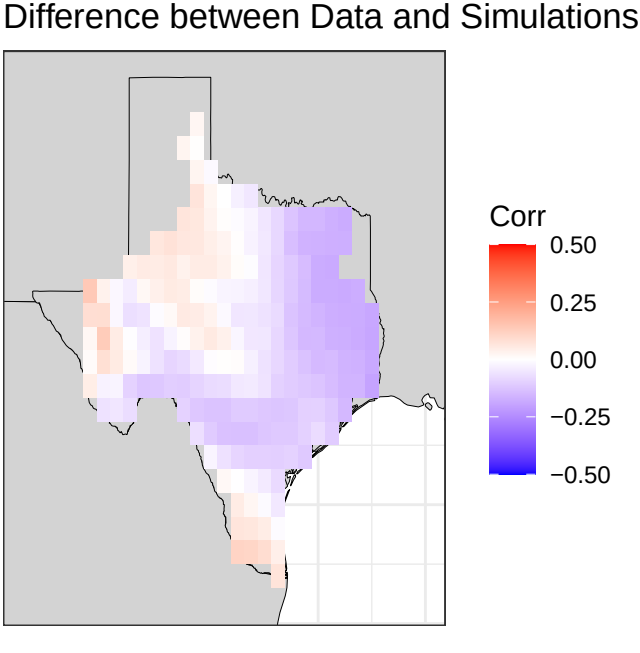

Median Simulation Correlation − DJF
Corr
0.50
0.25
0.00
−0.25
−0.50

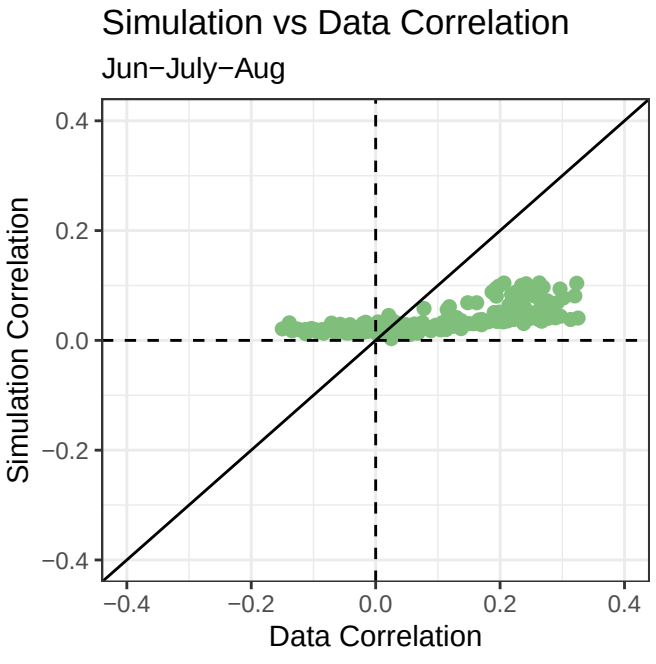

Difference between Data and Simulations
Corr
0.50
0.25
0.00
−0.25
−0.50

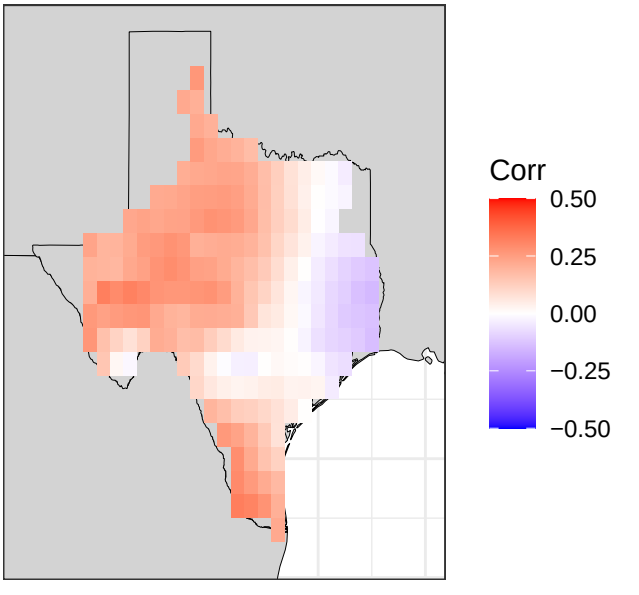

Simulation vs Data Correlation
Mar−April−May
Simulation Correlation
Data Correlation
0.4
0.2
0.0
−0.2
−0.4
−0.4
−0.2
0.0
0.2
0.4

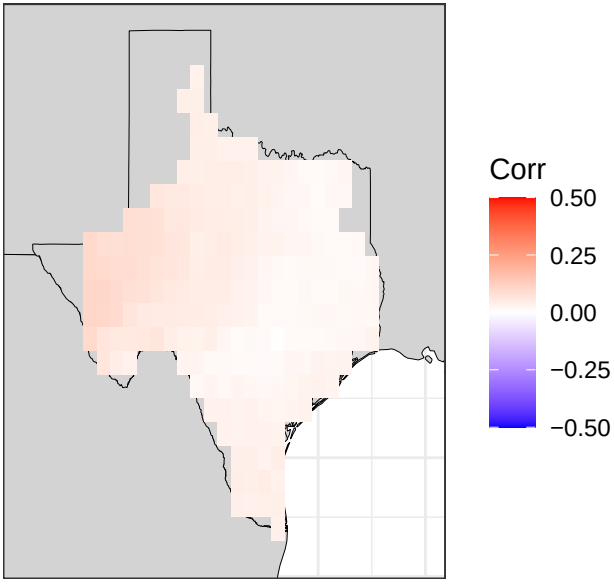

Reanalysis Data Correlation − MAM
Corr
0.50
0.25
0.00
−0.25
−0.50

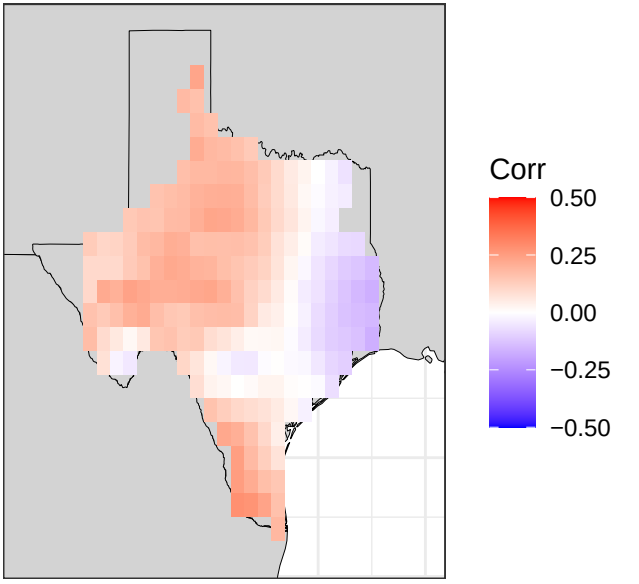

Median Simulation Correlation − MAM
Corr
0.50
0.25
0.00
−0.25
−0.50

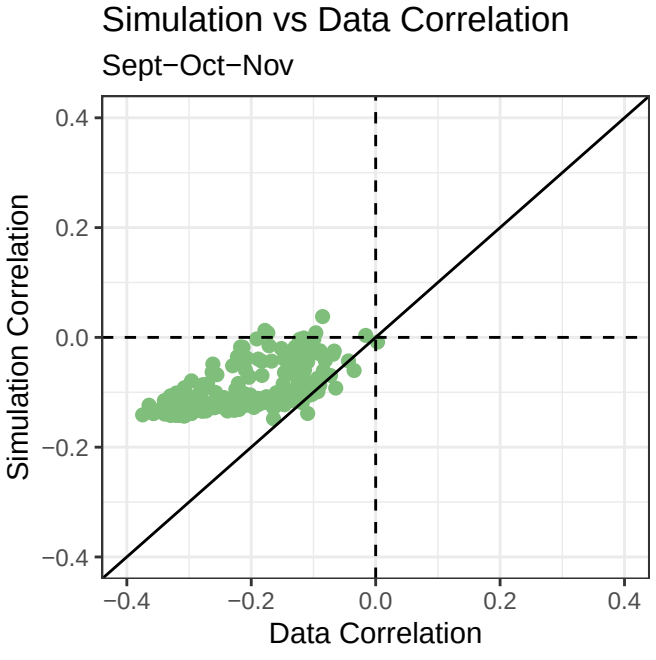

Difference between Data and Simulations
Corr
0.50
0.25
0.00
−0.25
−0.50

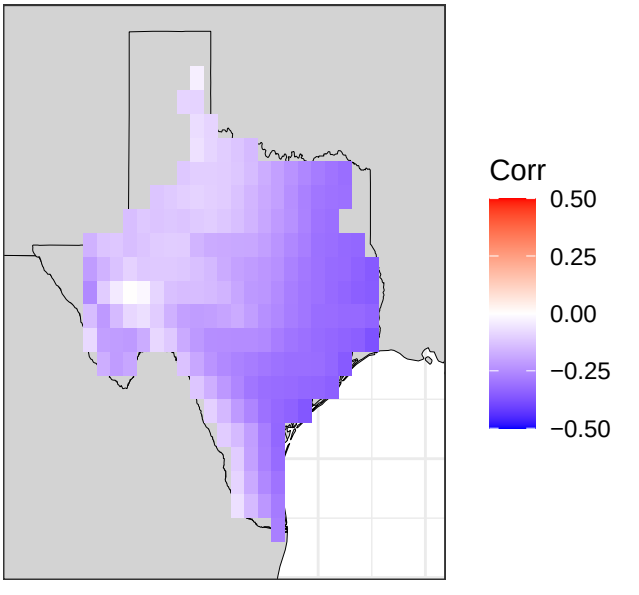

Simulation vs Data Correlation
Jun−July−Aug
Simulation Correlation
Data Correlation
0.4
0.2
0.0
−0.2
−0.4
−0.4
−0.2
0.0
0.2
0.4

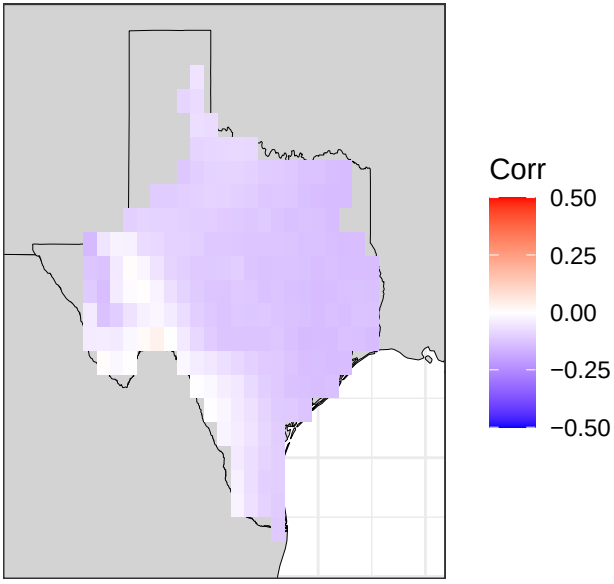

Reanalysis Data Correlation − JJA
Corr
0.50
0.25
0.00
−0.25
−0.50

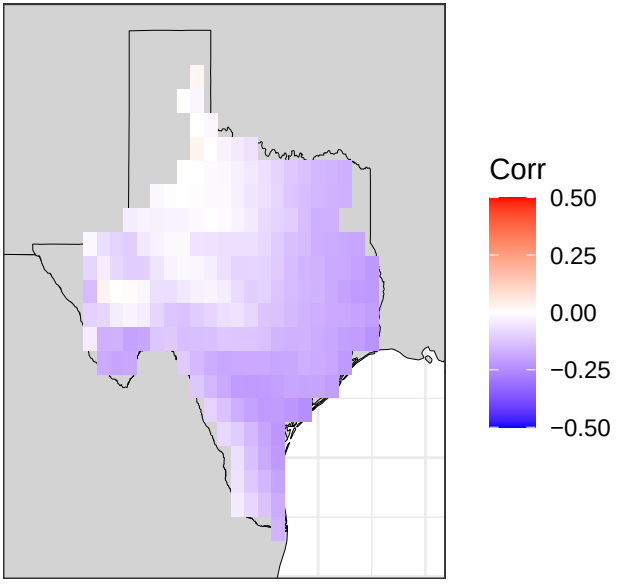

Median Simulation Correlation − JJA
Corr
0.50
0.25
0.00
−0.25
−0.50


Difference between Data and Simulations
Corr
0.50
0.25
0.00
−0.25
−0.50


Simulation vs Data Correlation
Sept−Oct−Nov
Simulation Correlation
Data Correlation
0.4
0.2
0.0
−0.2
−0.4
−0.4
−0.2
0.0
0.2
0.4


Reanalysis Data Correlation − SON
Corr
0.50
0.25
0.00
−0.25
−0.50


Median Simulation Correlation − SON
Corr
0.50
0.25
0.00
−0.25
−0.50


Difference between Data and Simulations
Corr
0.50
0.25
0.00
−0.25
−0.50