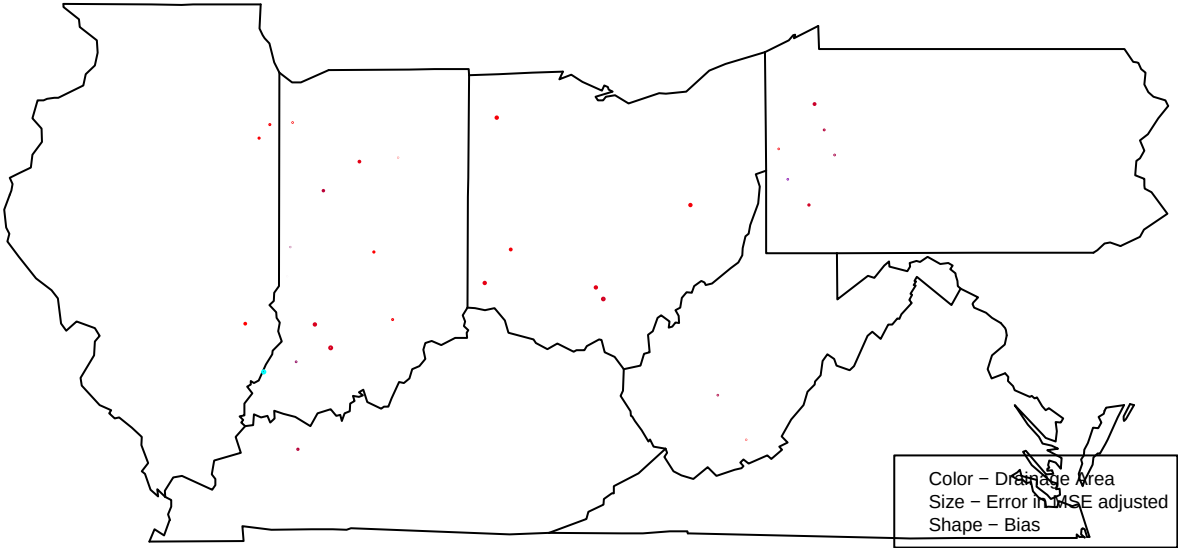
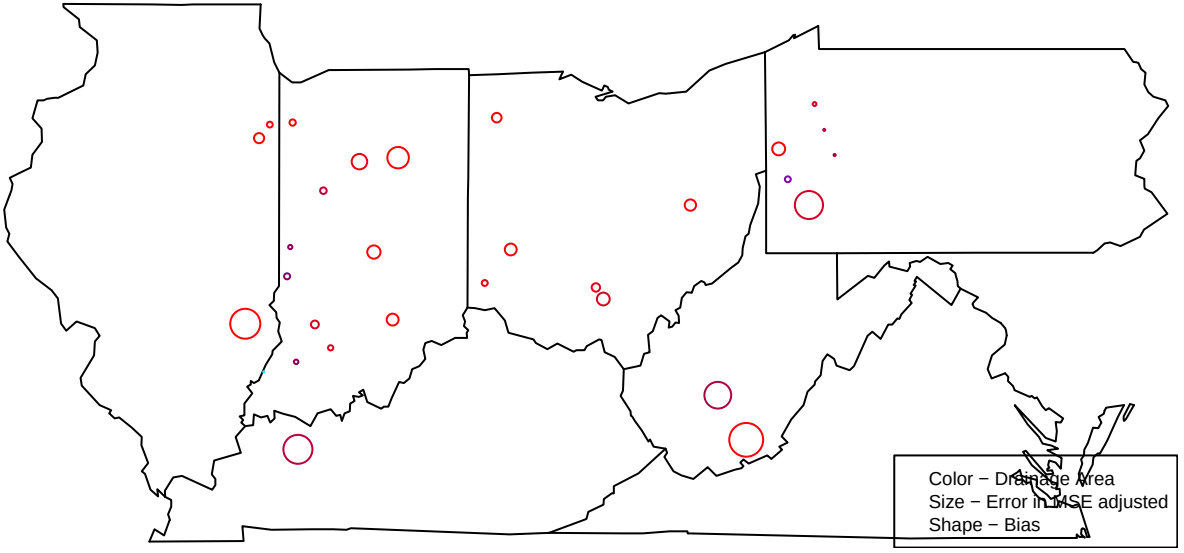
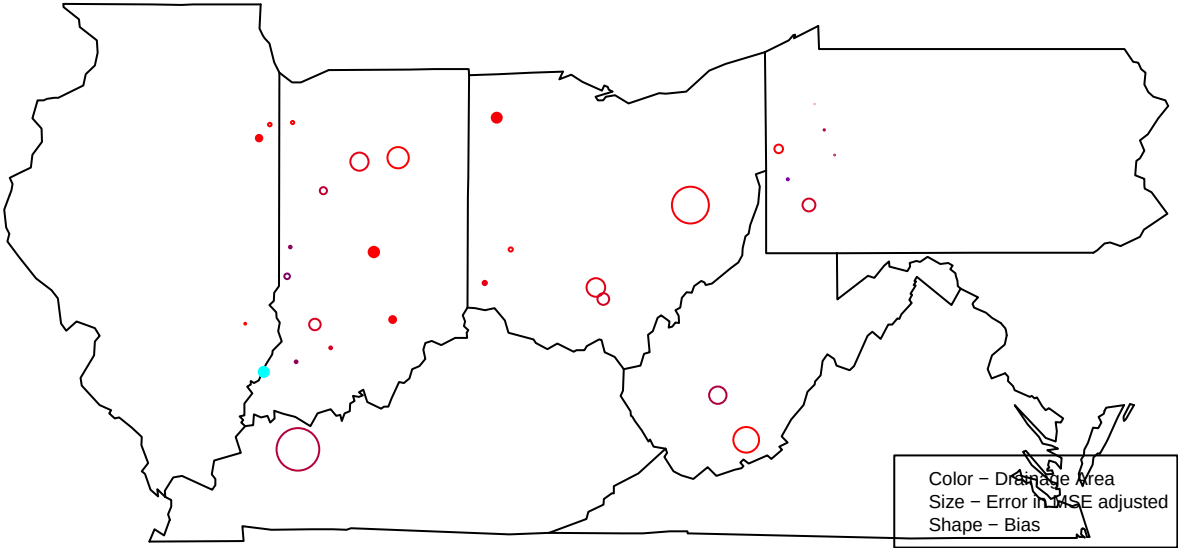
Error in Mean Streamflow Prediction



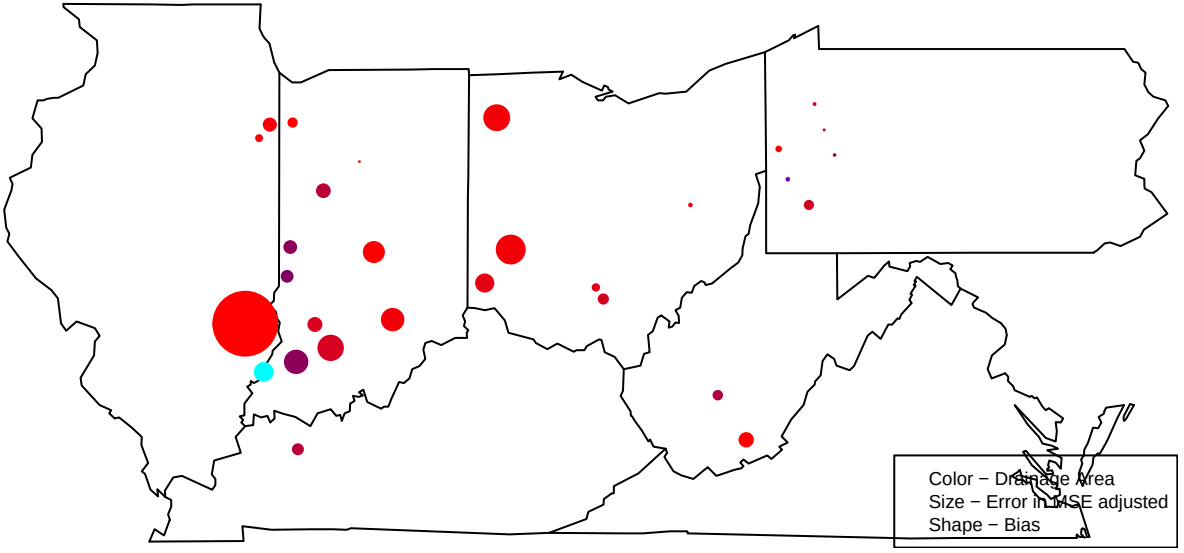
Error in Standard Deviation Streamflow Prediction

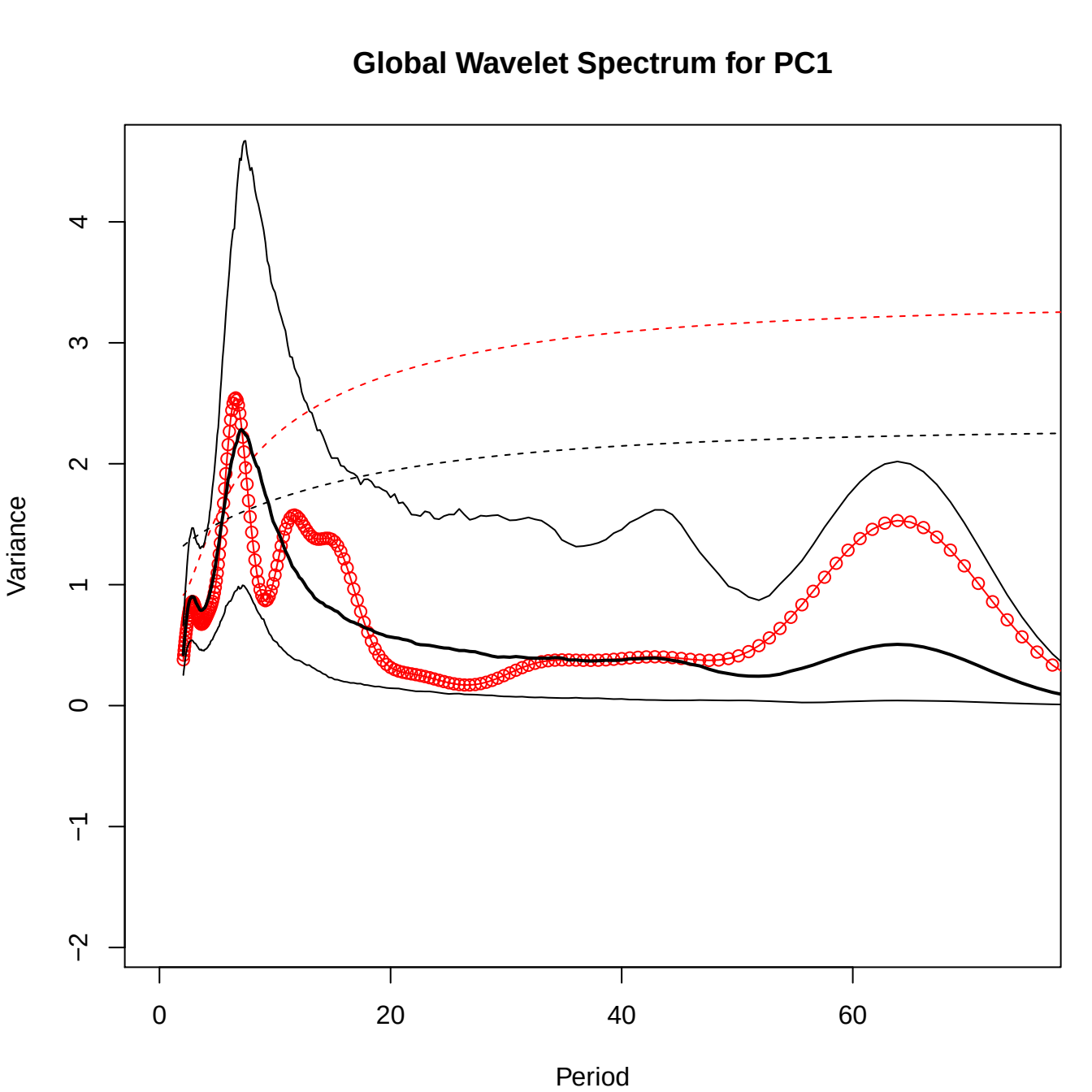


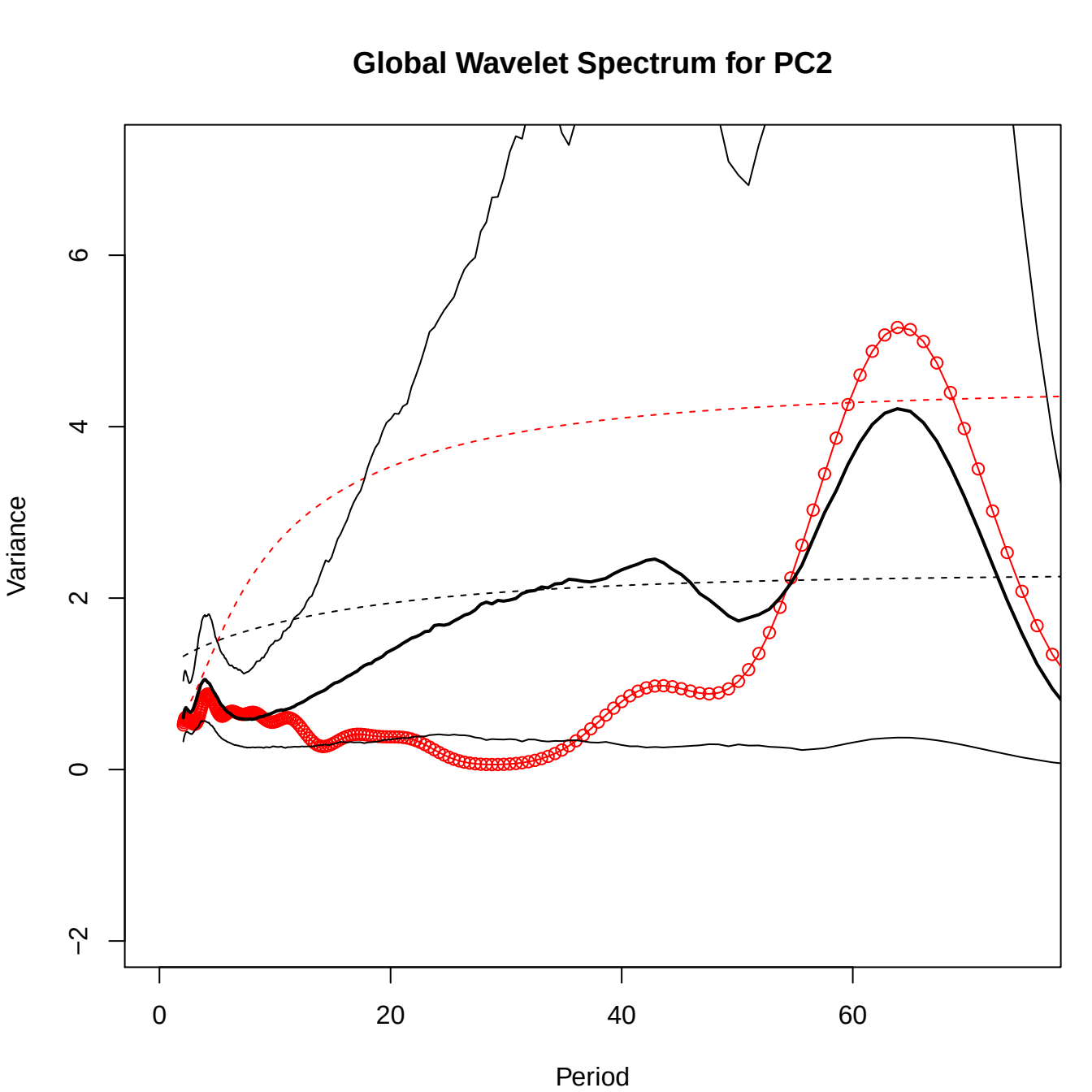
Error in Maximum Deviation Streamflow Prediction

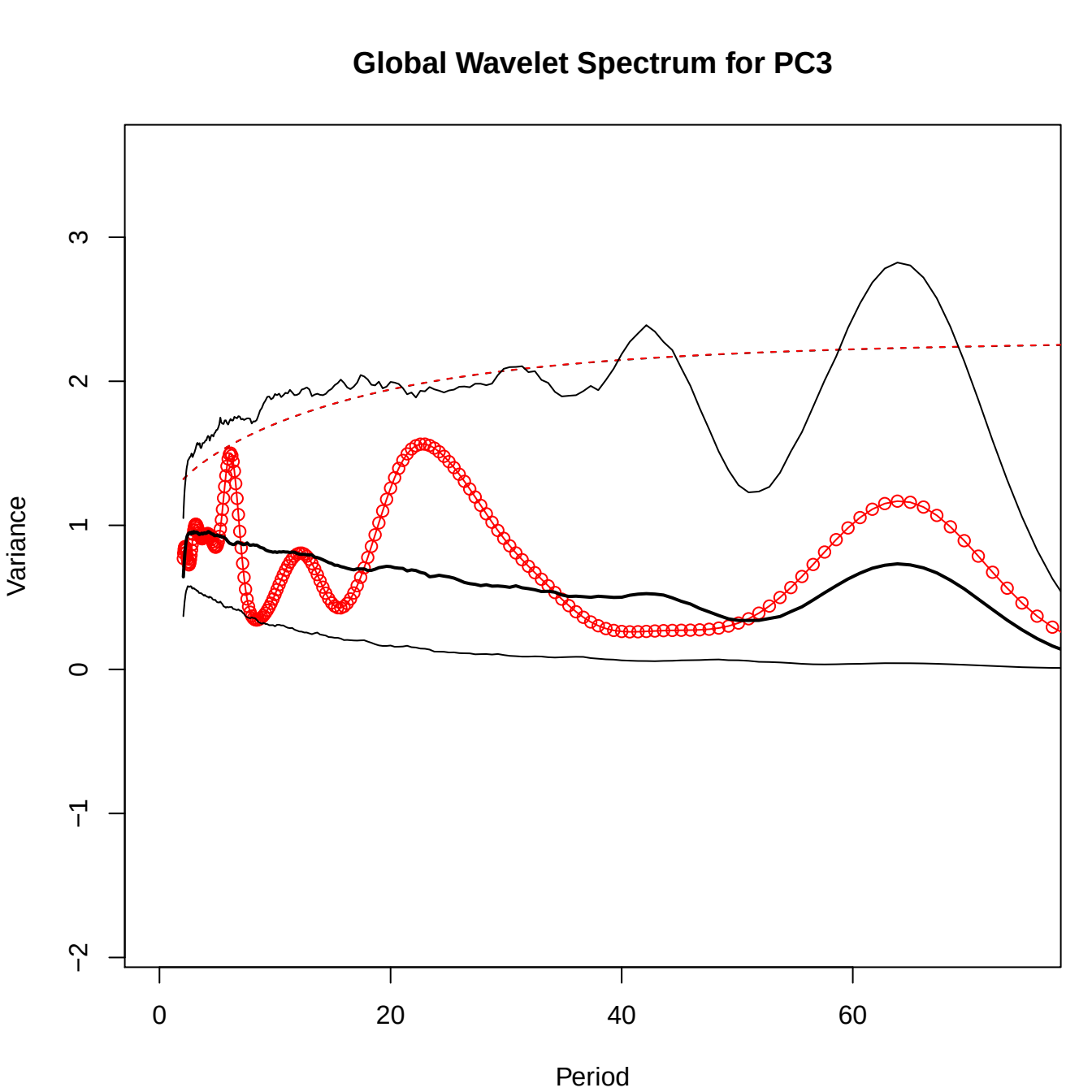


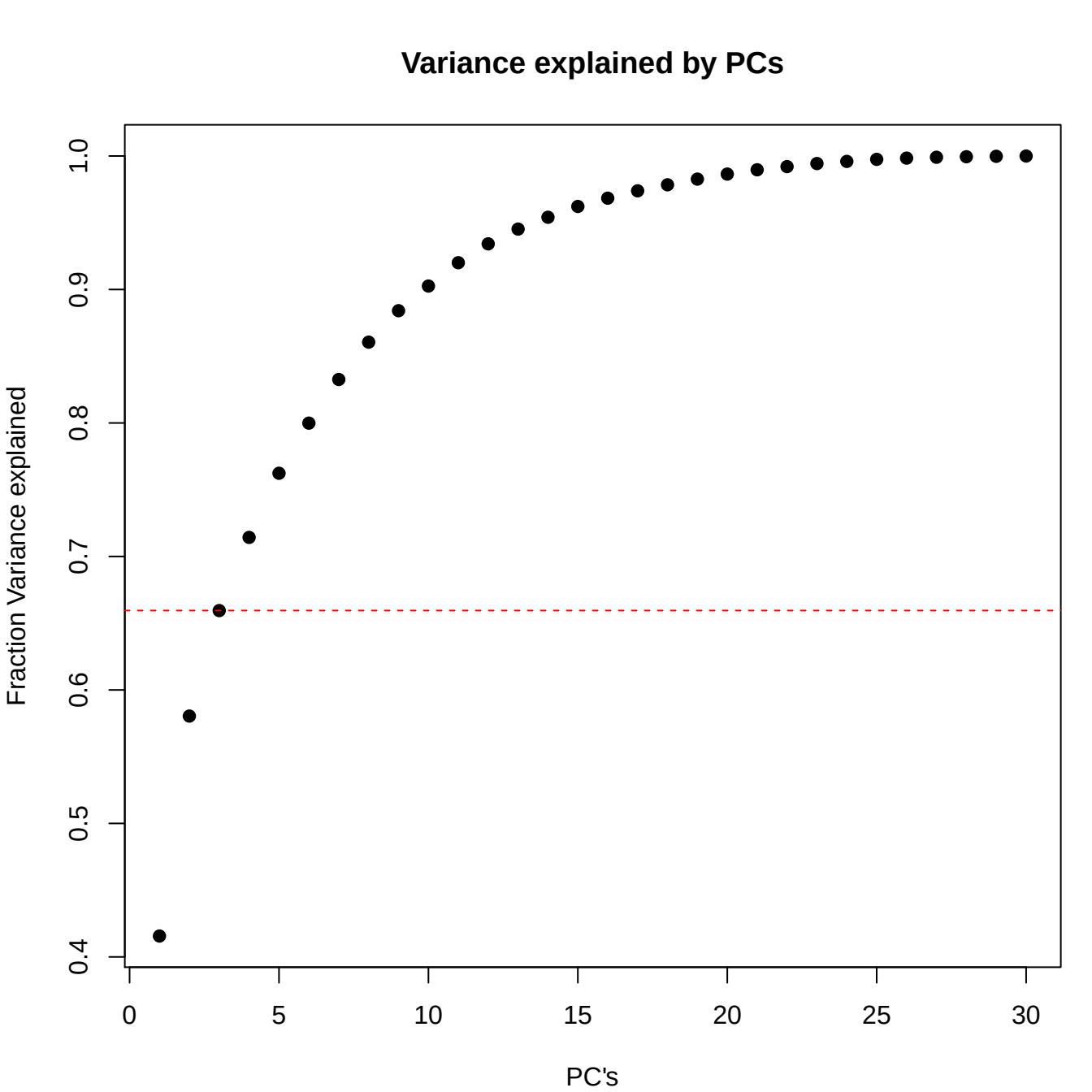
Error in Minimum Deviation Streamflow Prediction

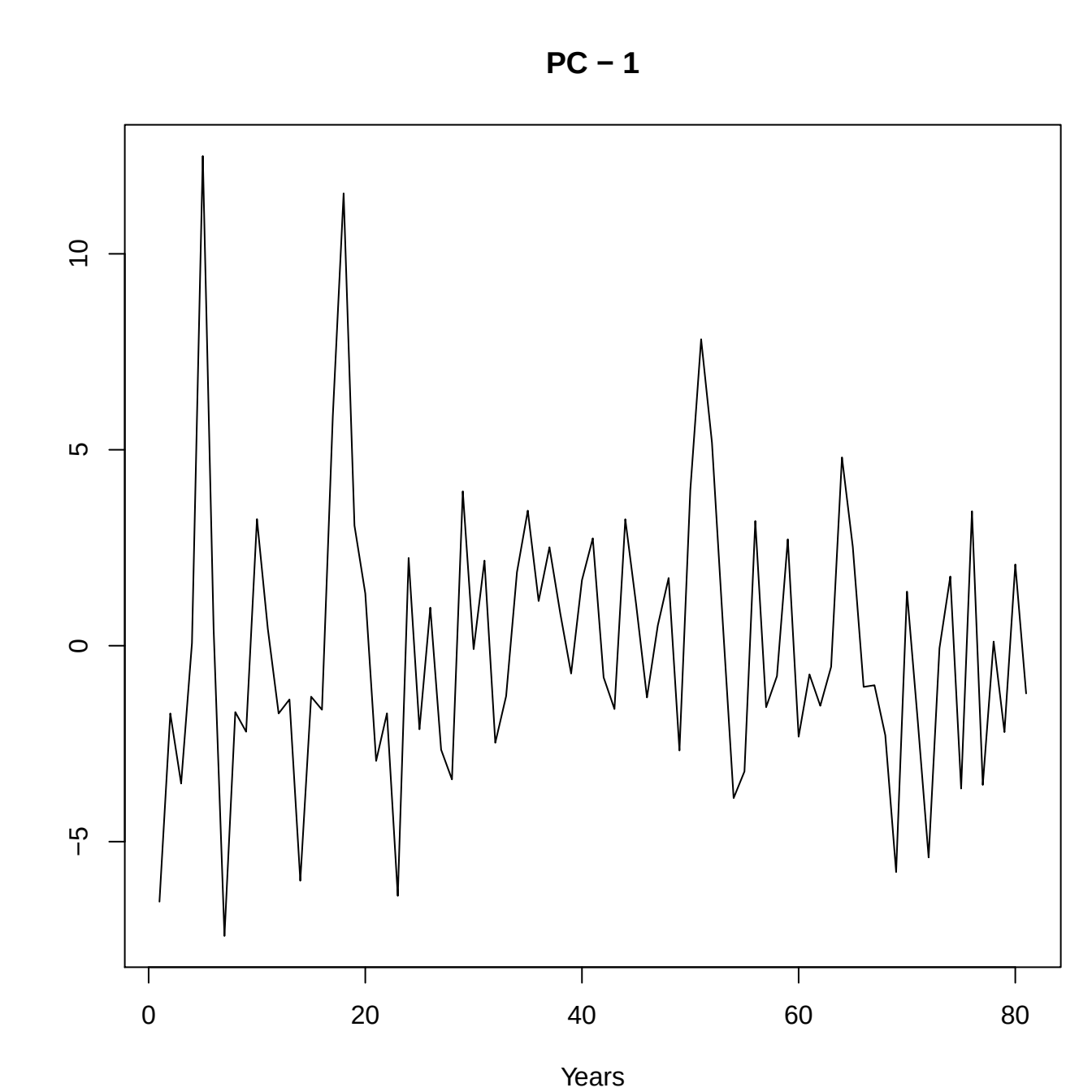


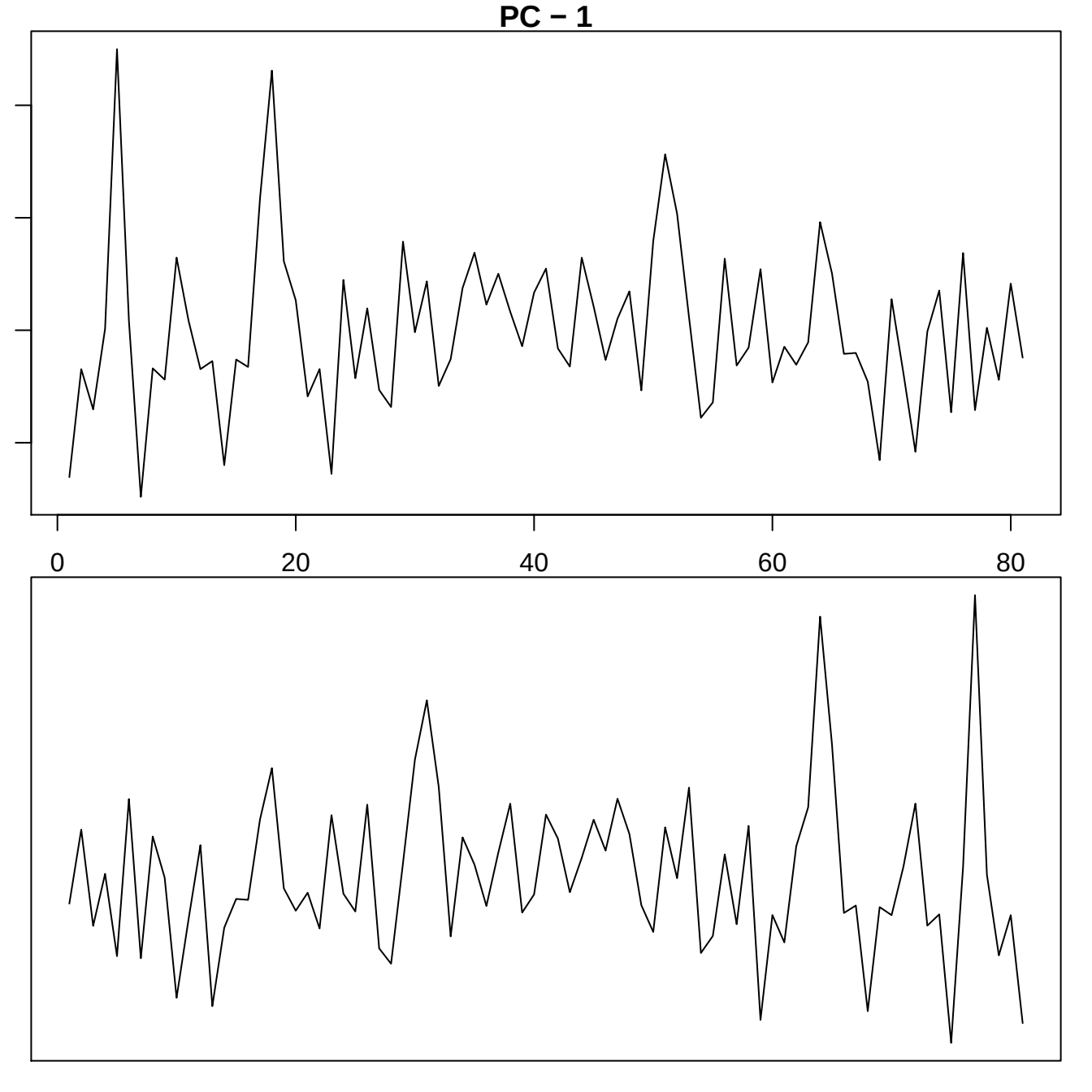

Global Wavelet Spectrum for PC1
Variance
Period
4
3
2
1
0
−1
−2
0
20
40
60

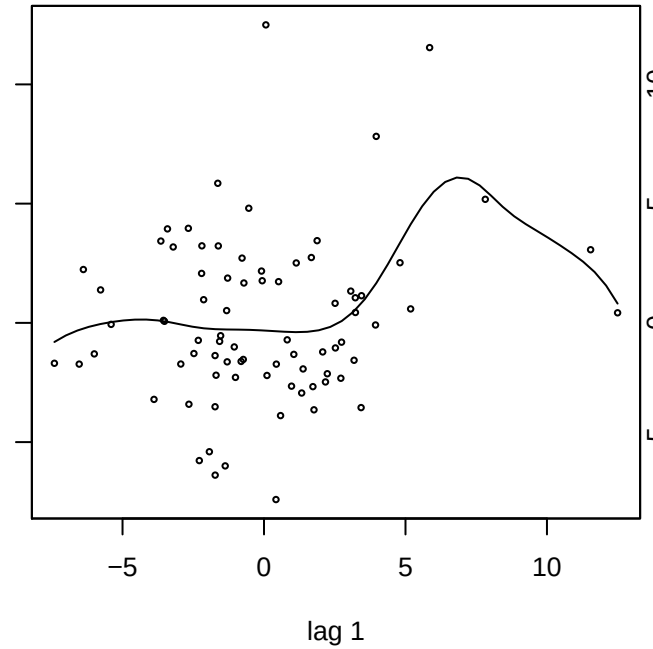

Global Wavelet Spectrum for PC2
Variance
6
4
2
0
−2
0
20
40
60
Period

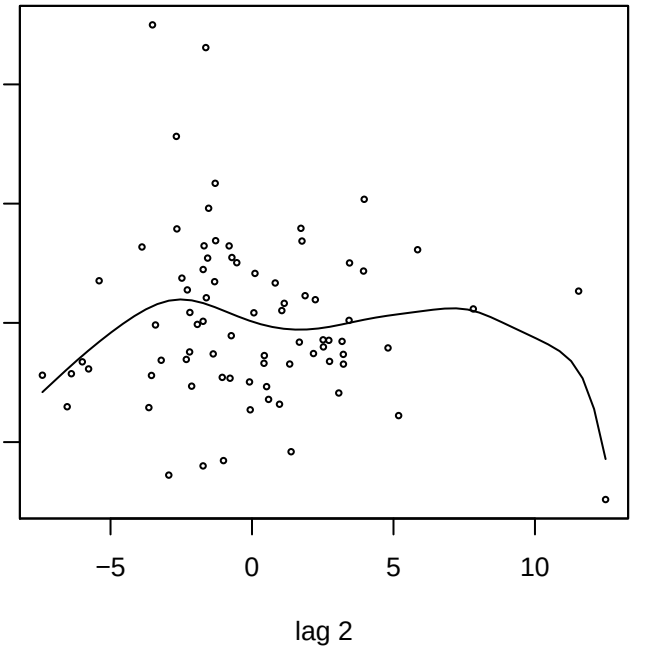

Global Wavelet Spectrum for PC3
Variance
Period
3
2
1
0
−1
−2
0
20
40
60

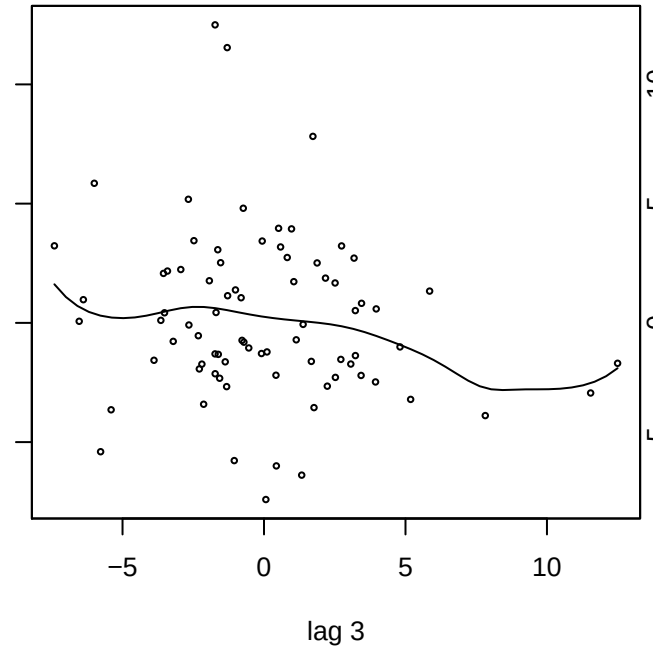

Variance explained by PCs
Fraction Variance explained
PC's
0.4
0.5
0.6
0.7
0.8
0.9
1.0
0
5
10
15
20
25
30

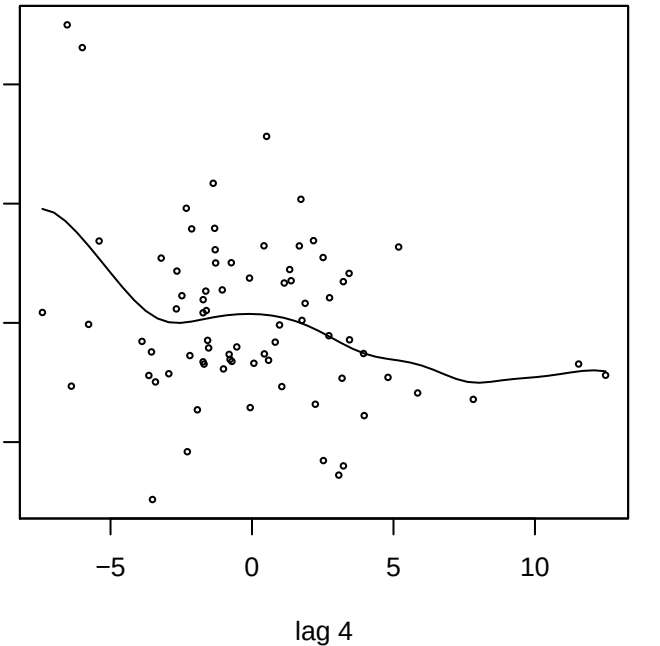

PC − 1
10
5
0
−5
0
20
40
60
80
Years

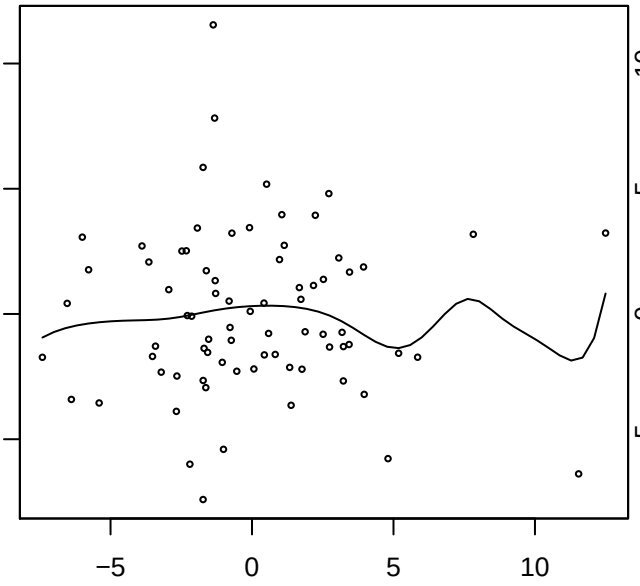

PC − 1
0
20
40
60
80


−5
0
5
10
lag 1

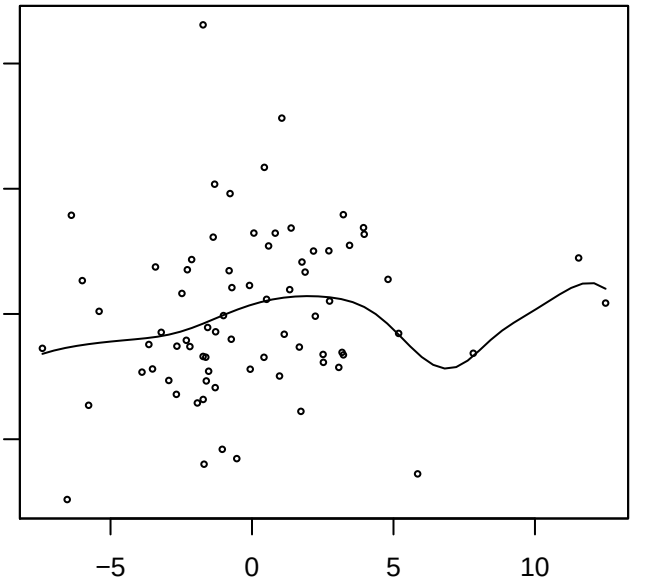

10
5
0
−5
−5
0
5
10
lag 2


−5
0
5
10
lag 3

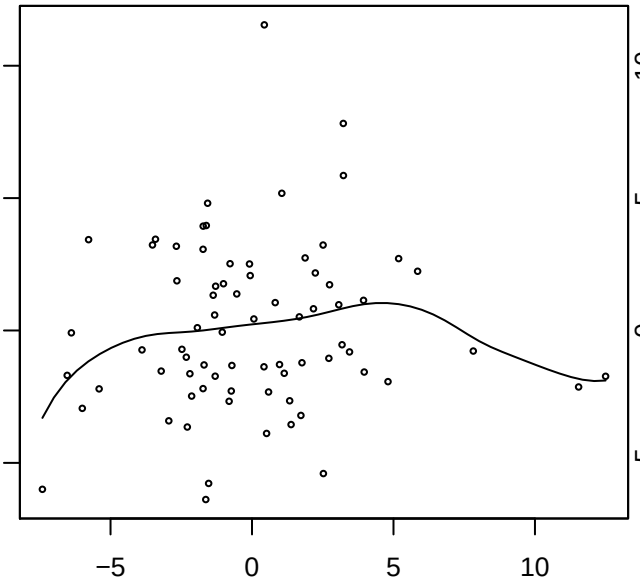

10
5
0
−5
−5
0
5
10
lag 4



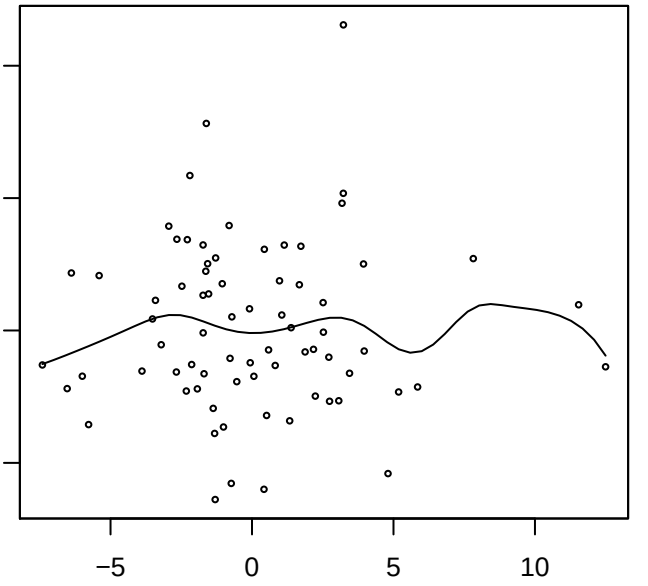
lag 5



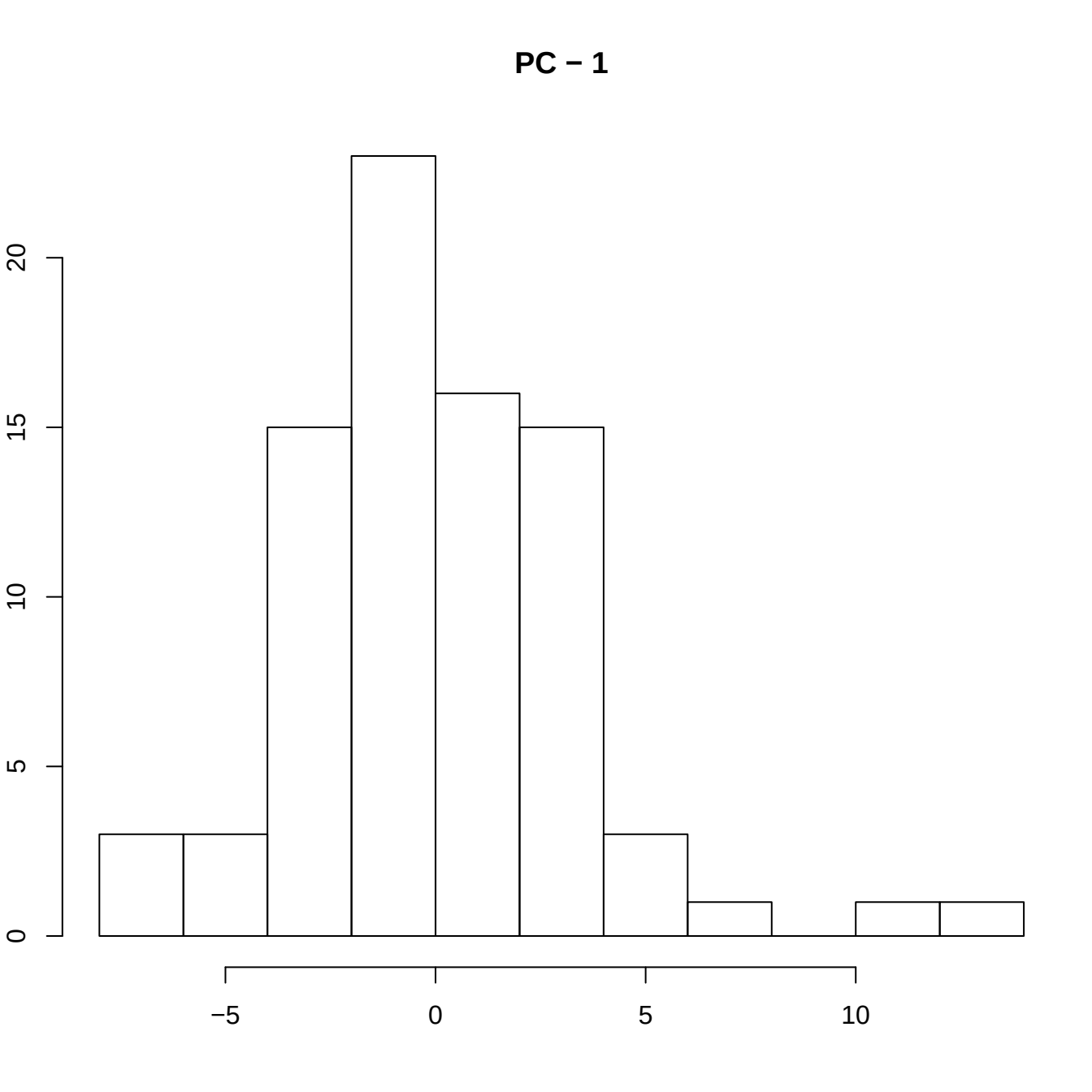
lag 6

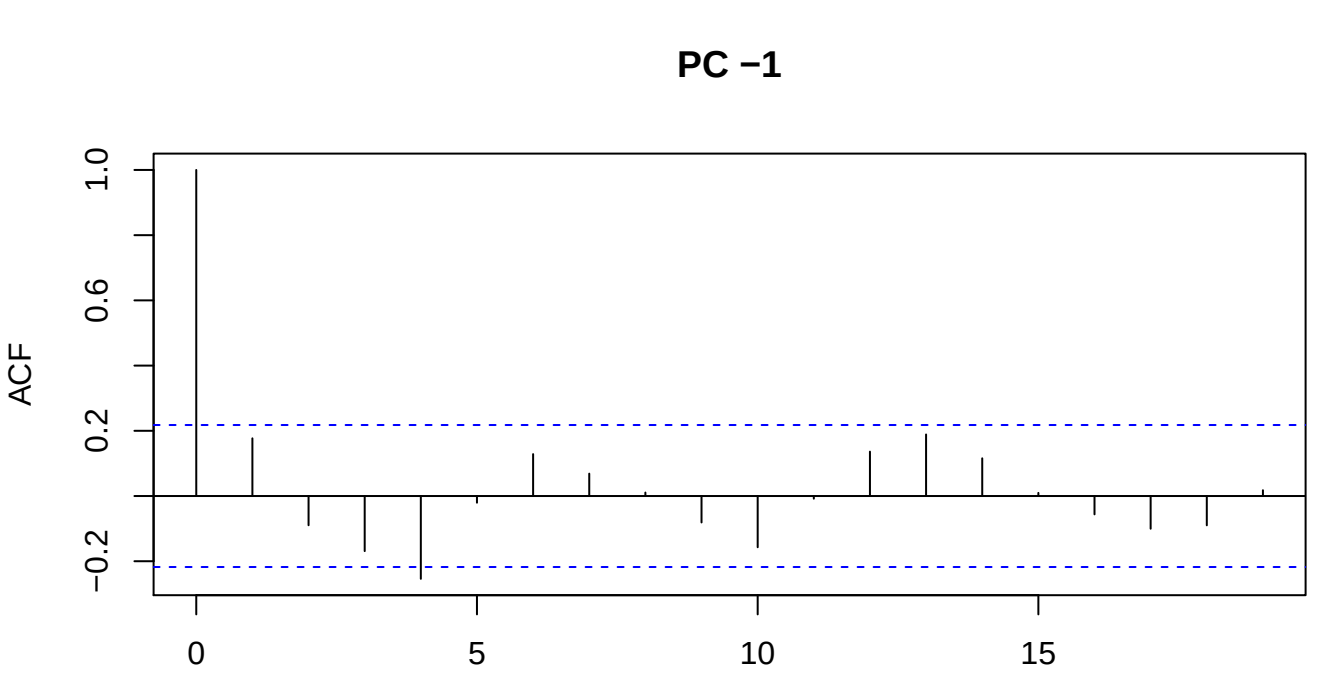


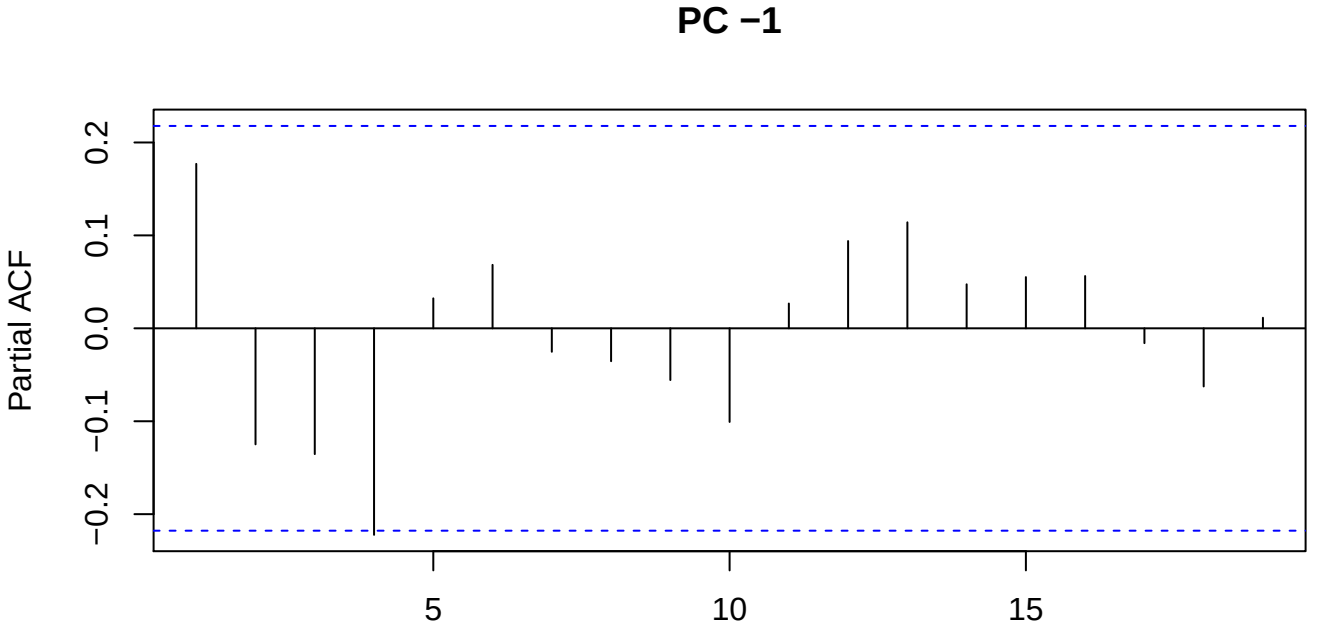
lag 7

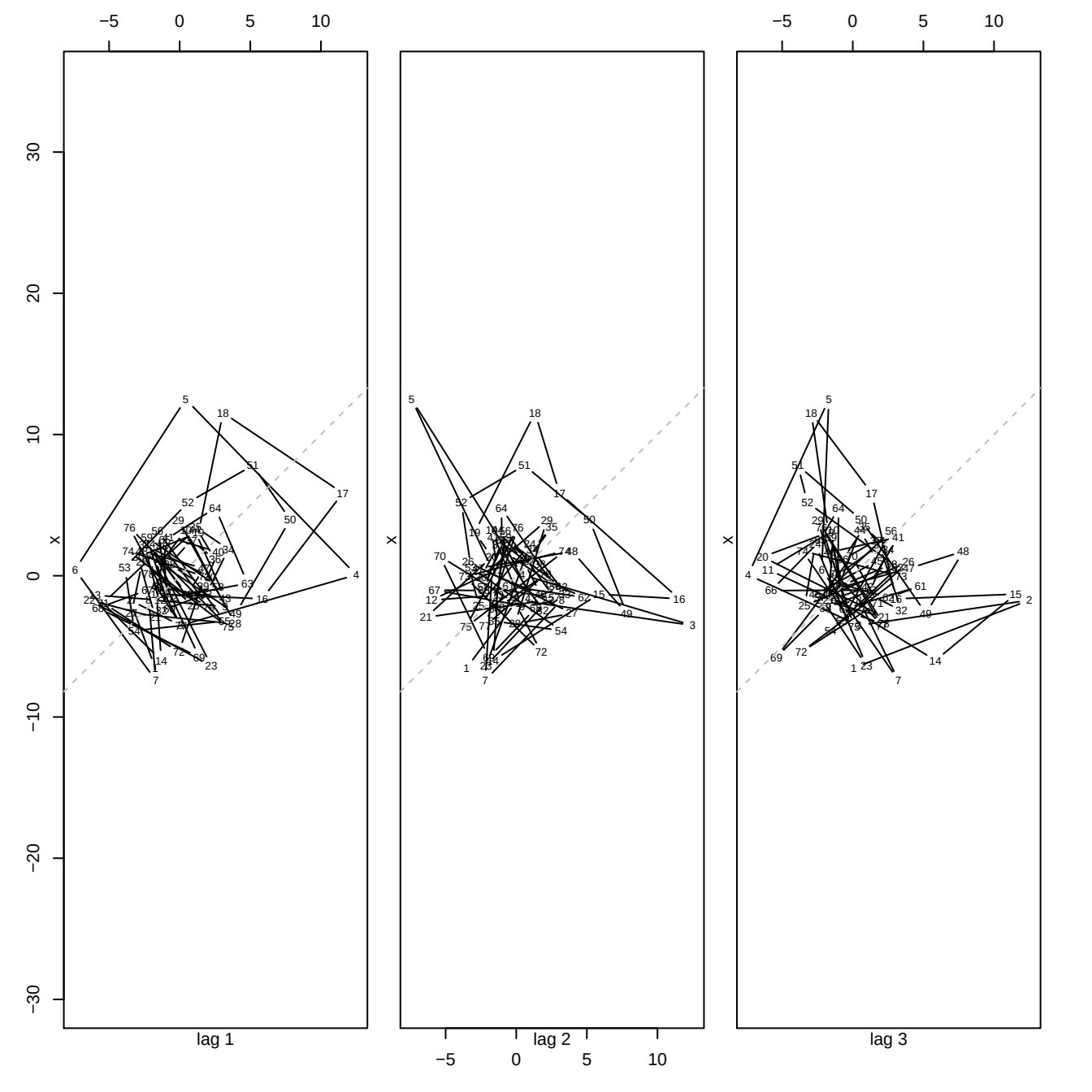


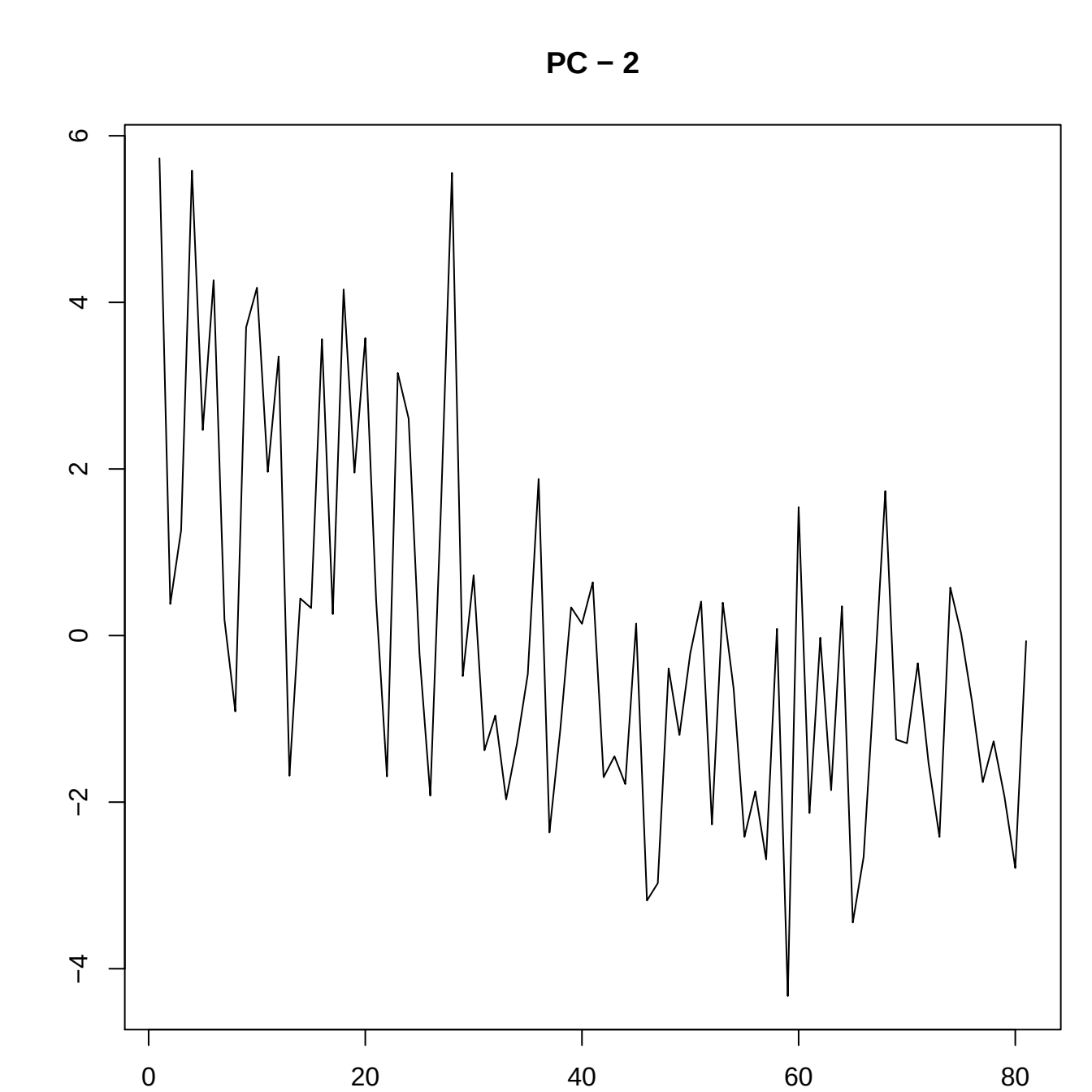
lag 8

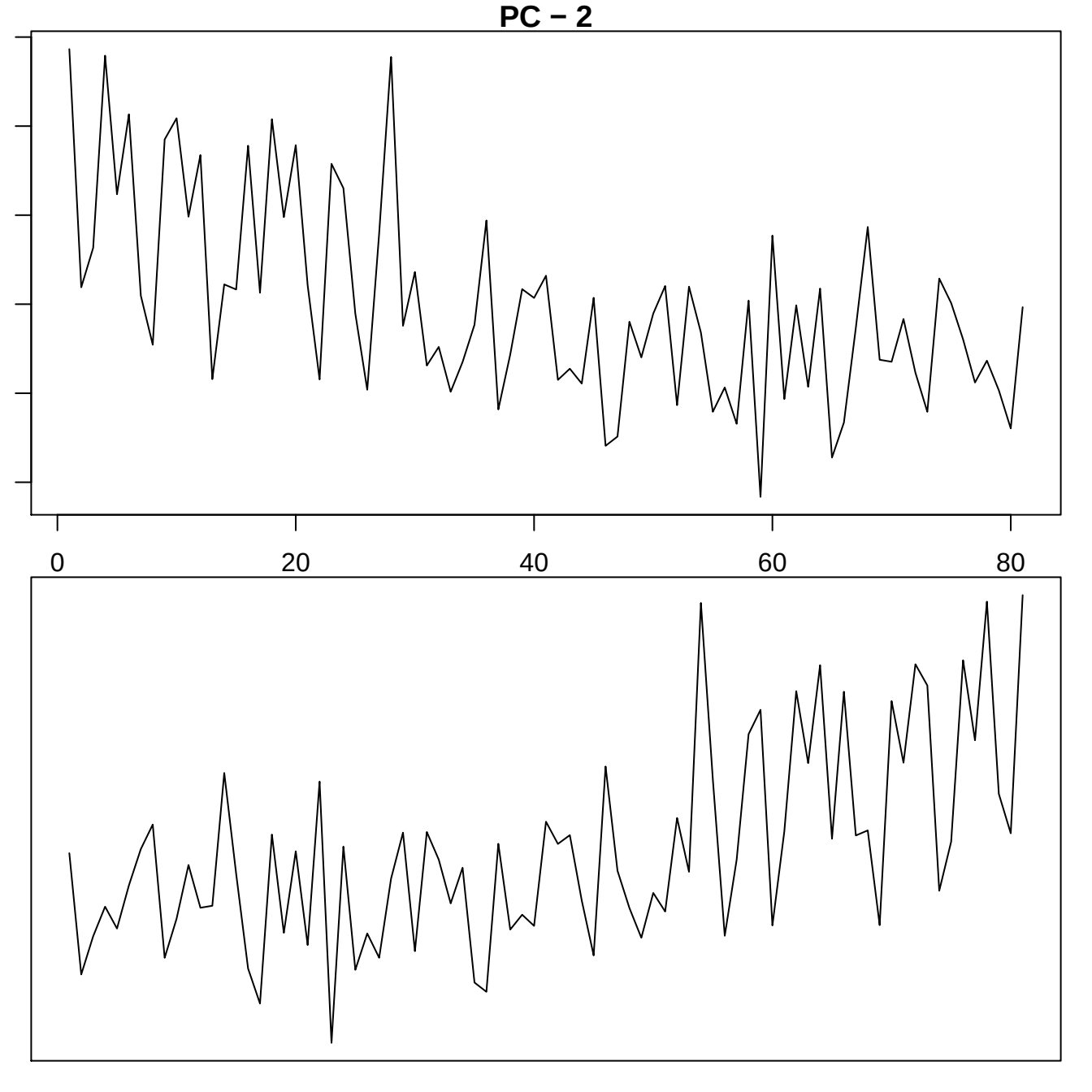

PC − 1
0
5
10
15
20
−5
0
5
10

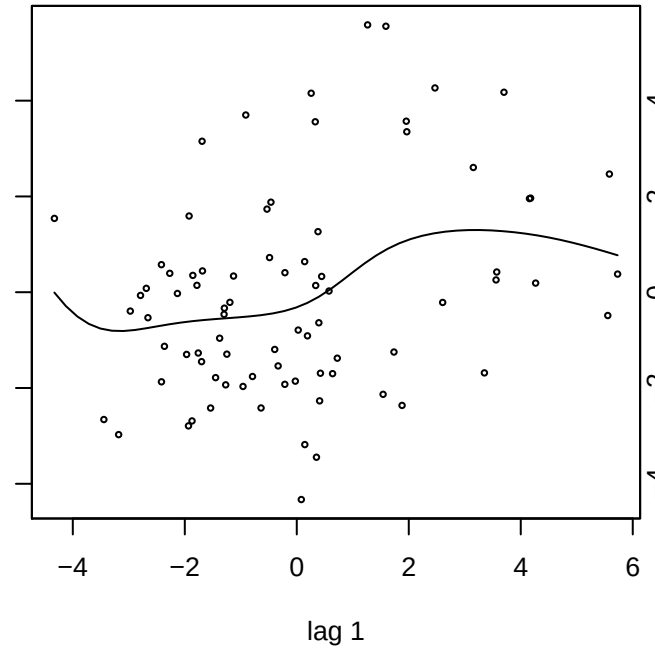

PC −1
ACF
1.0
0.6
0.2
−0.2
0
5
10
15


PC −1
Partial ACF
0.2
0.1
0.0
−0.1
−0.2
5
10
15

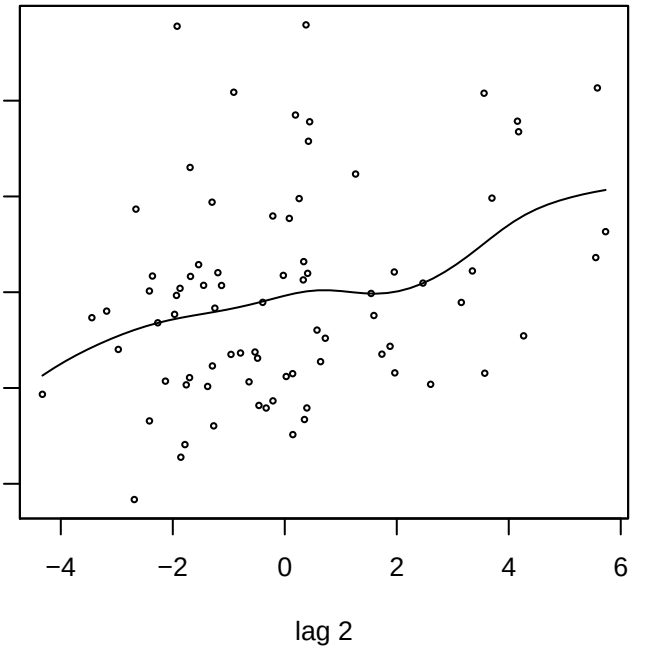

−5
0
5
10
30
20
10
0
−10
−20
−30
x
lag 1
lag 2
lag 3


PC − 2
6
4
2
0
−2
−4
0
20
40
60
80


PC − 2
0
20
40
60
80



lag 1



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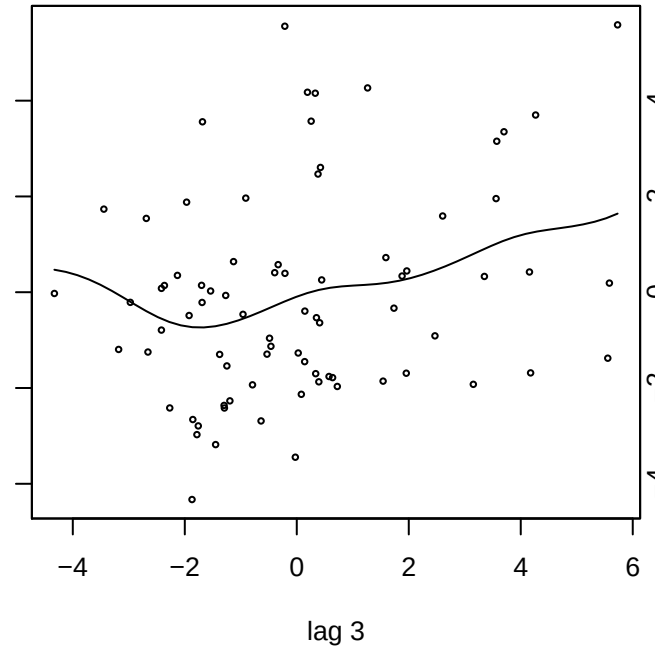

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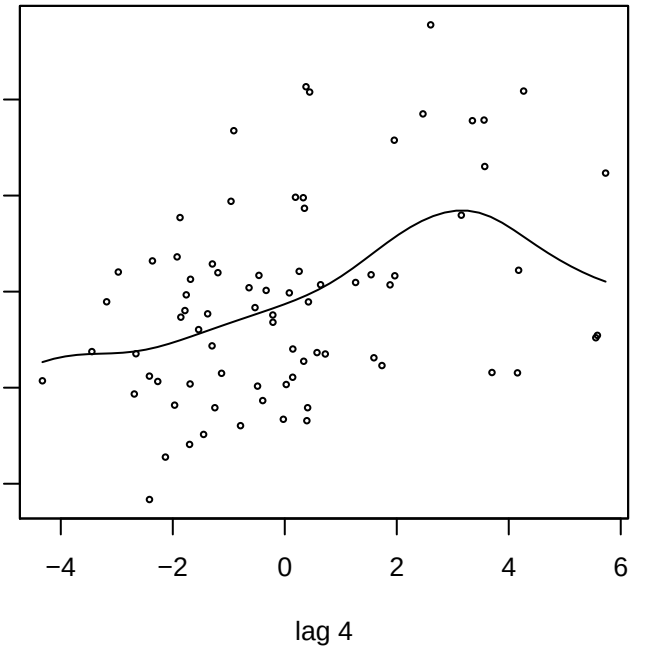

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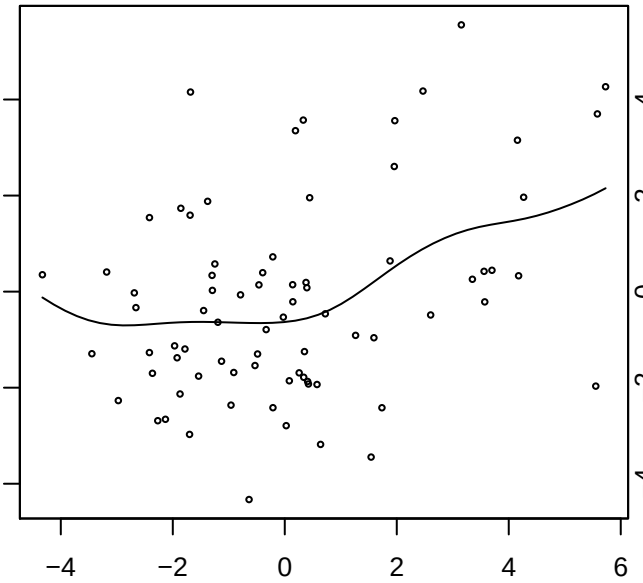

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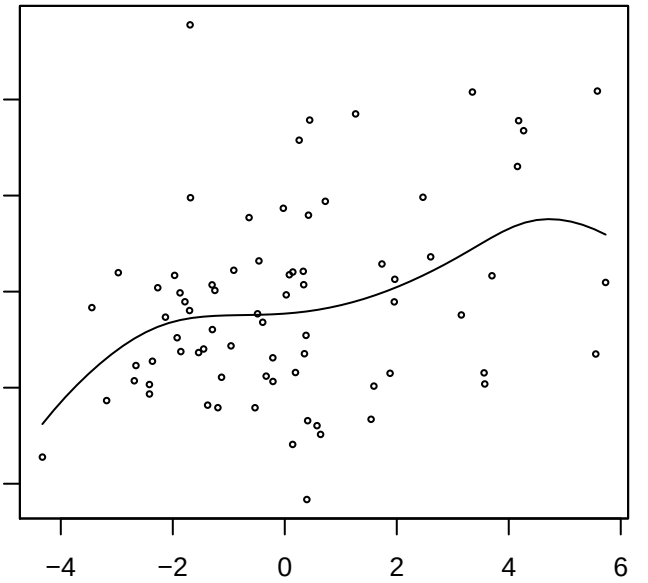
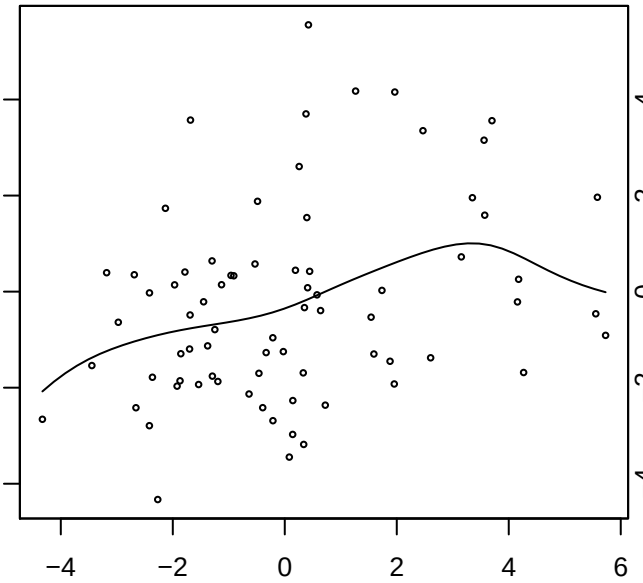
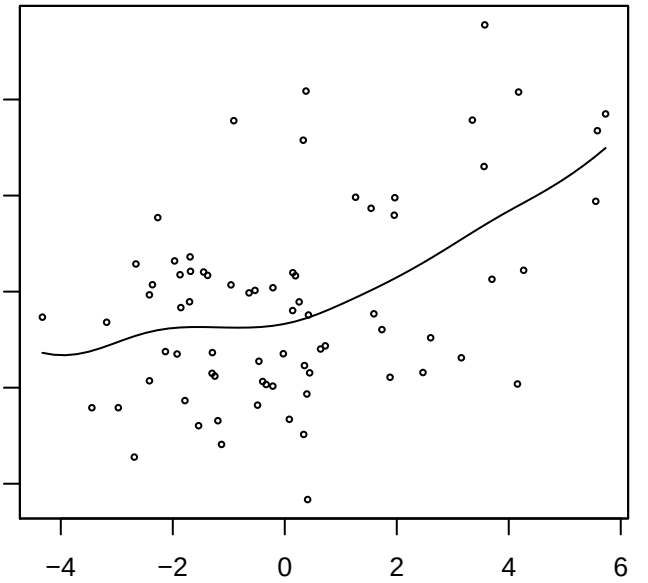


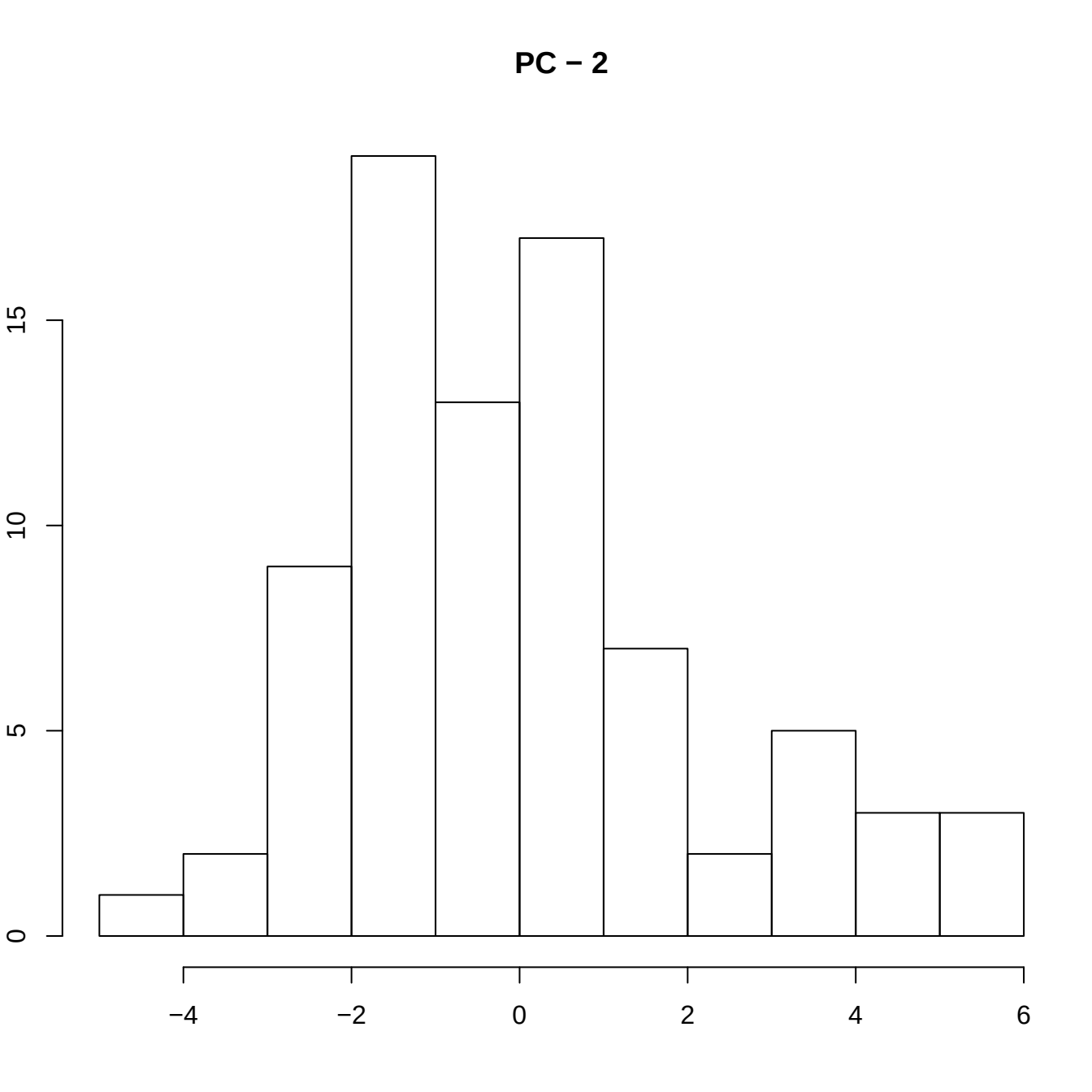
lag 6

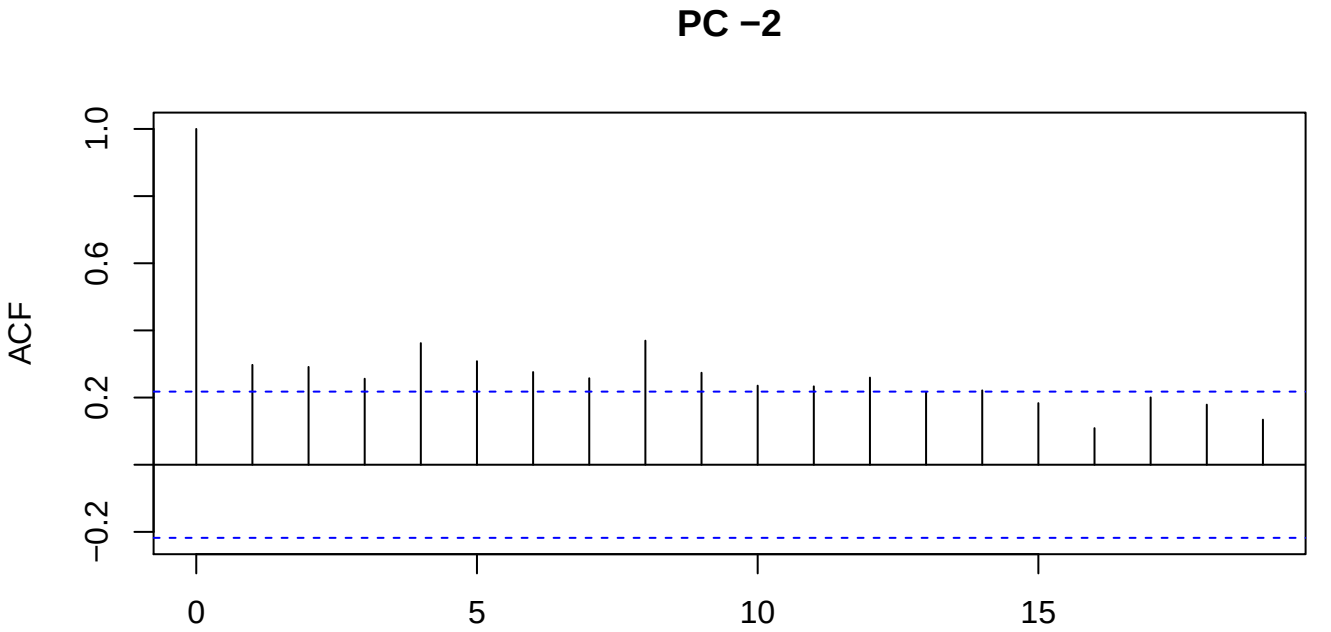


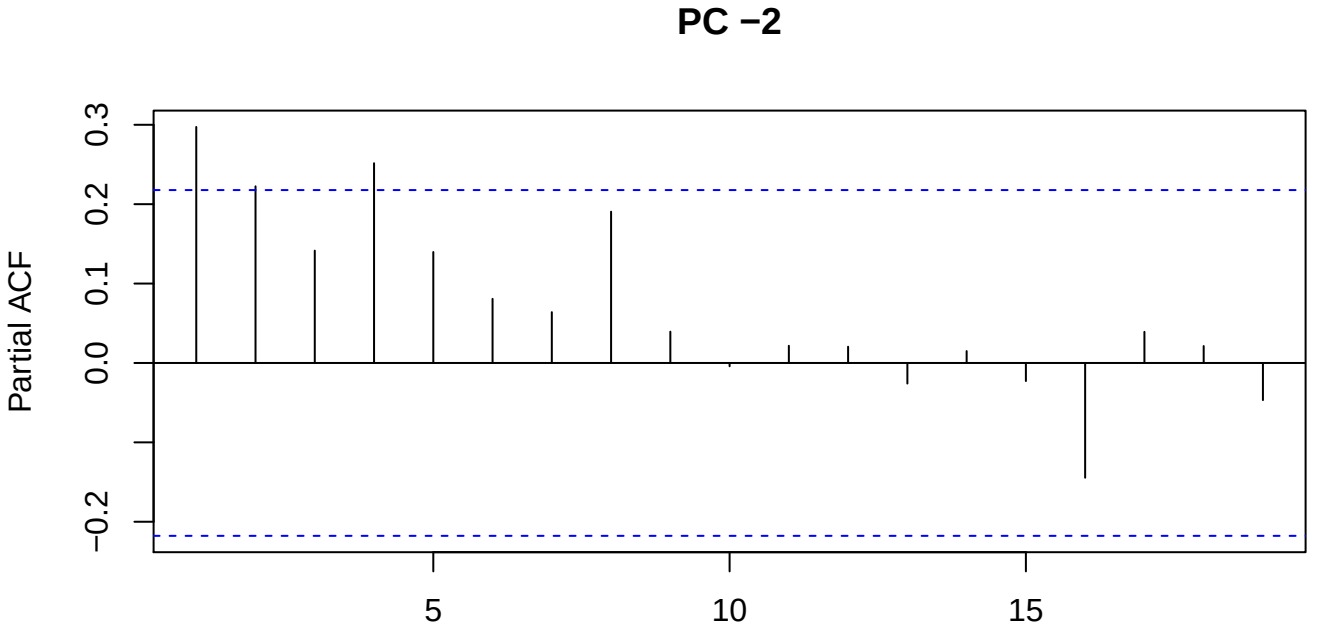
lag 7

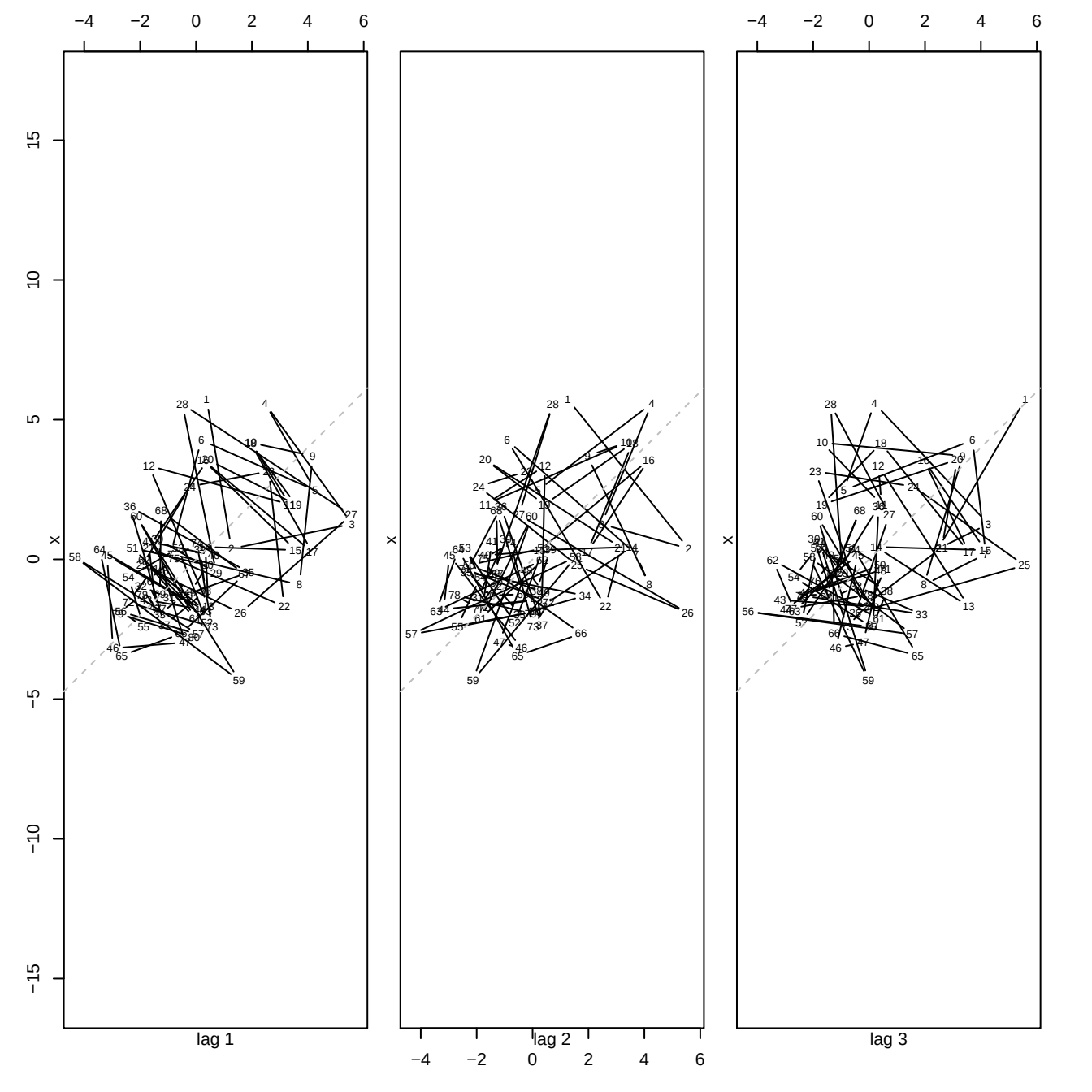


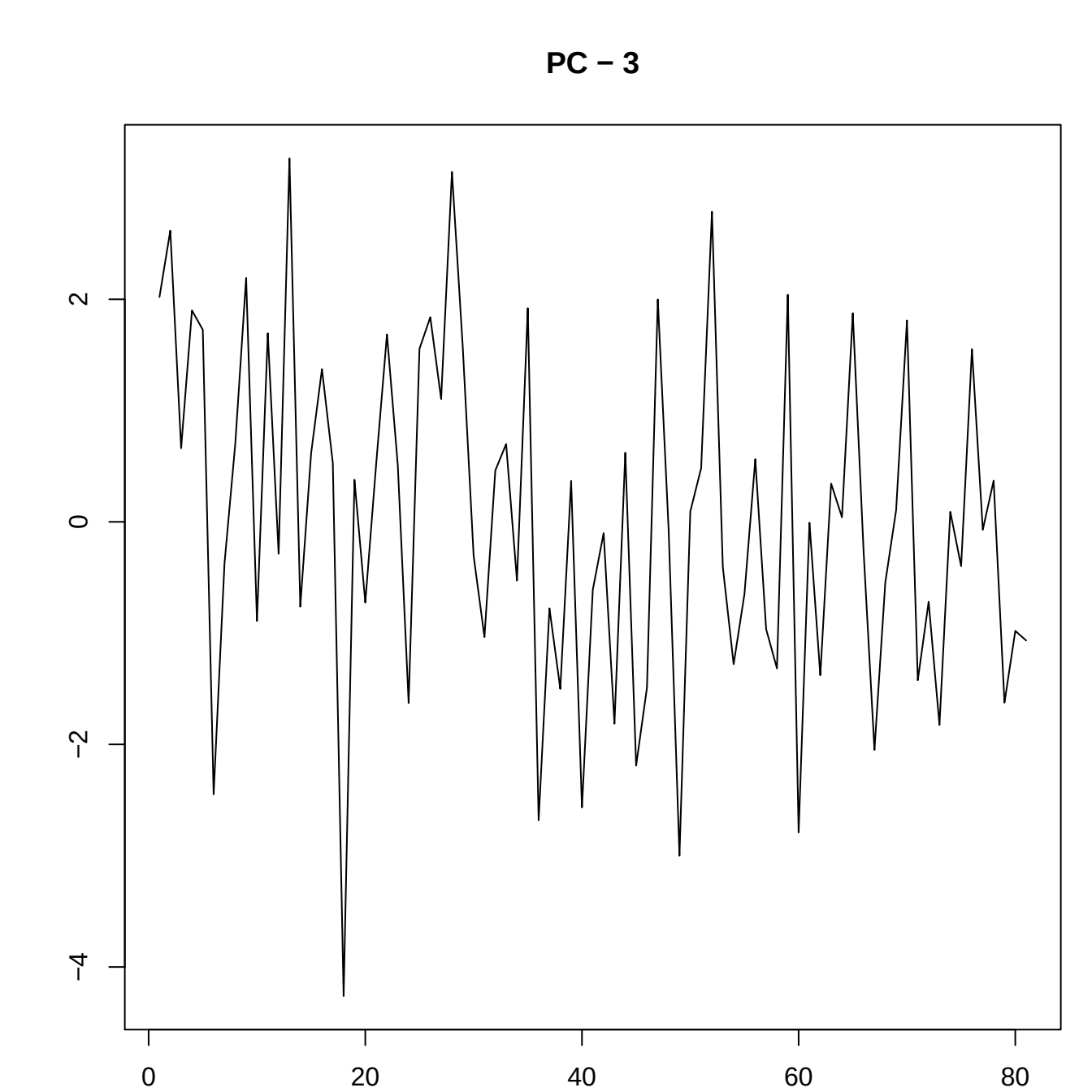
lag 8

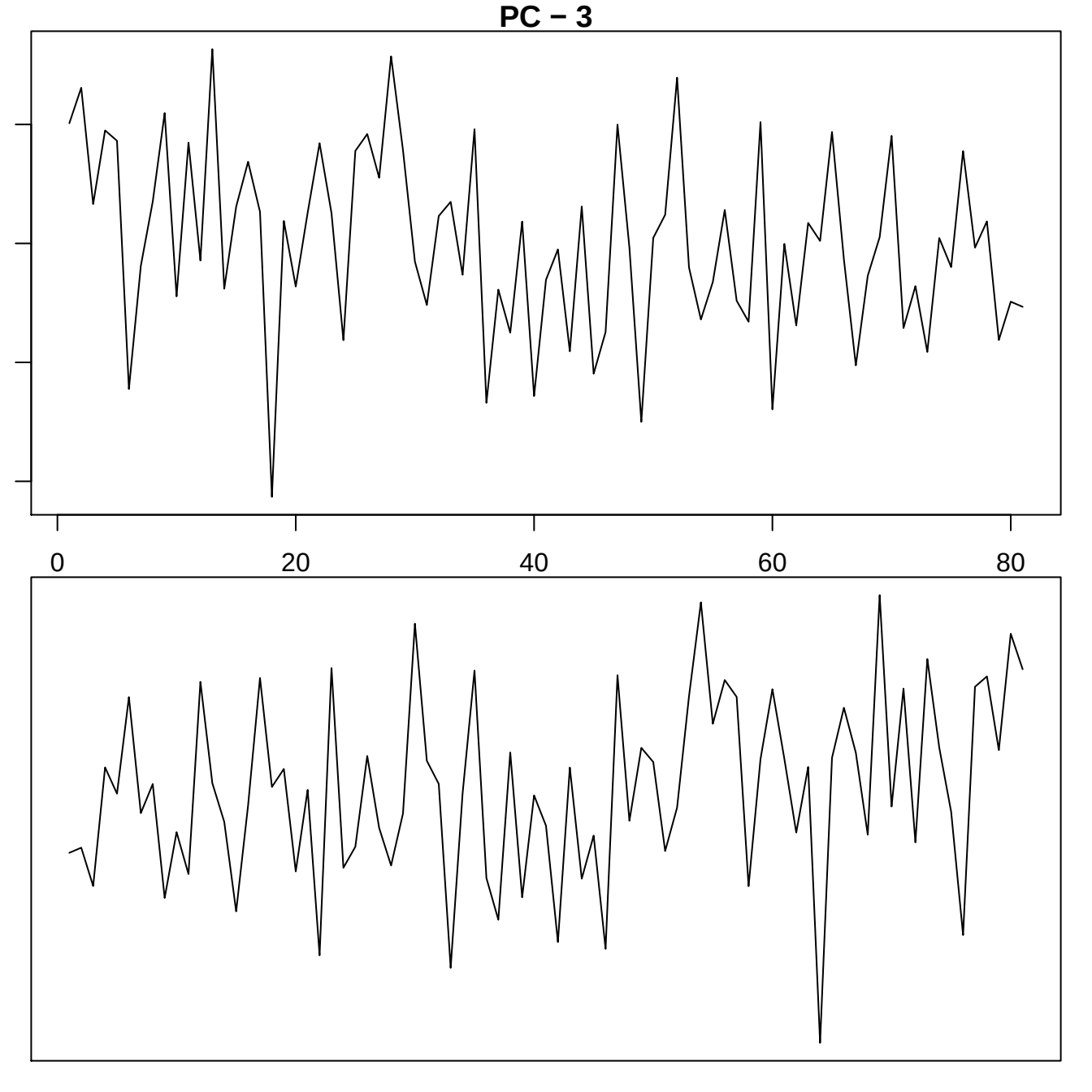

PC − 2
0
5
10
15
−4
−2
0
2
4
6

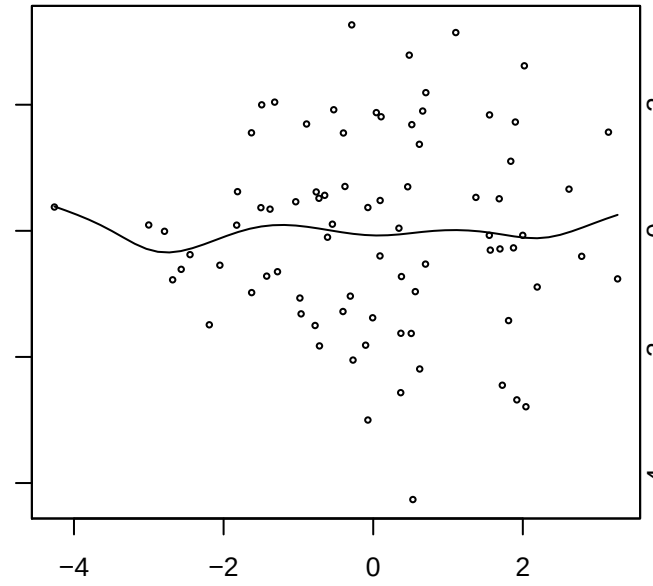

PC −2
ACF
1.0
0.6
0.2
−0.2
0
5
10
15


PC −2
Partial ACF
0.3
0.2
0.1
0.0
−0.2
5
10
15

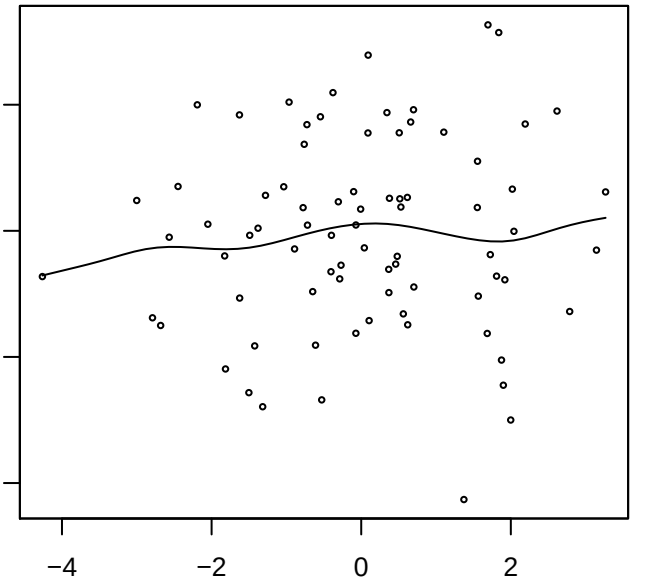

lag 1
lag 2
lag 3
X
−4
−2
0
2
4
6
15
10
5
0
−5
−10
−15


PC − 3
2
0
−2
−4
0
20
40
60
80

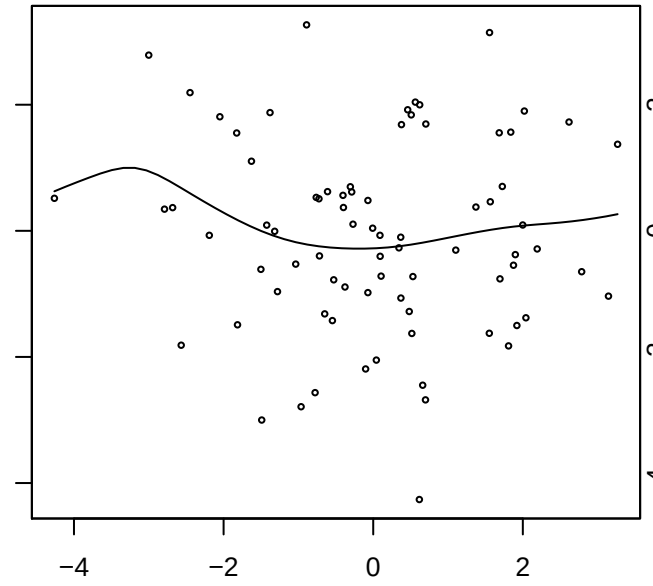

PC − 3
0
20
40
60
80



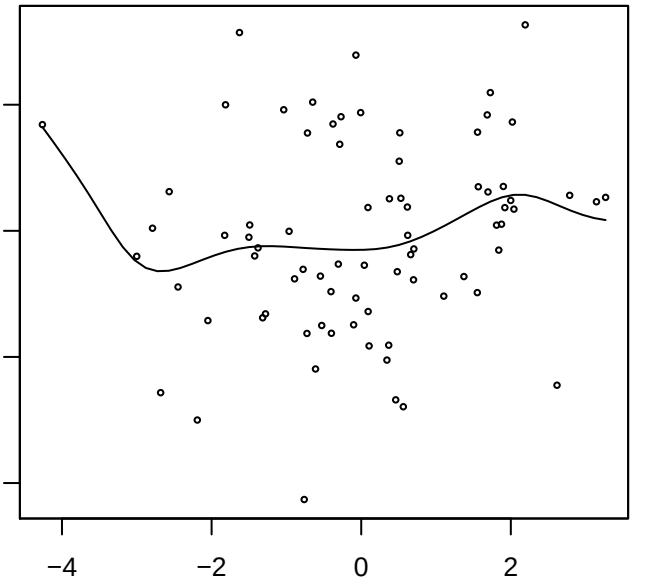
lag 1



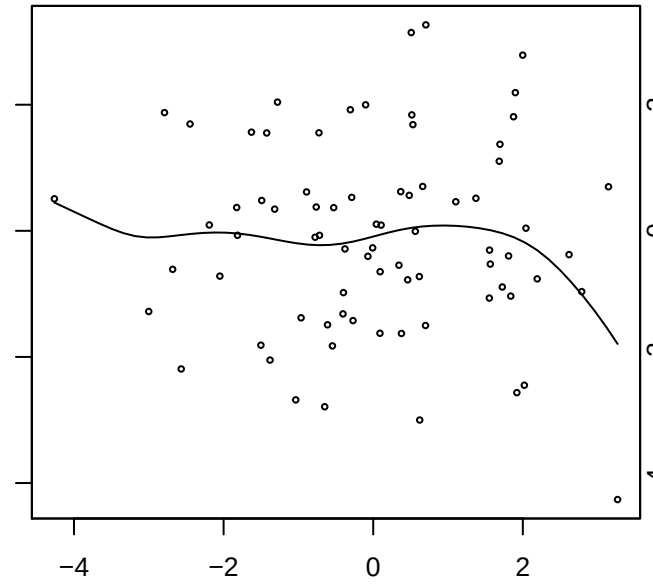
lag 2



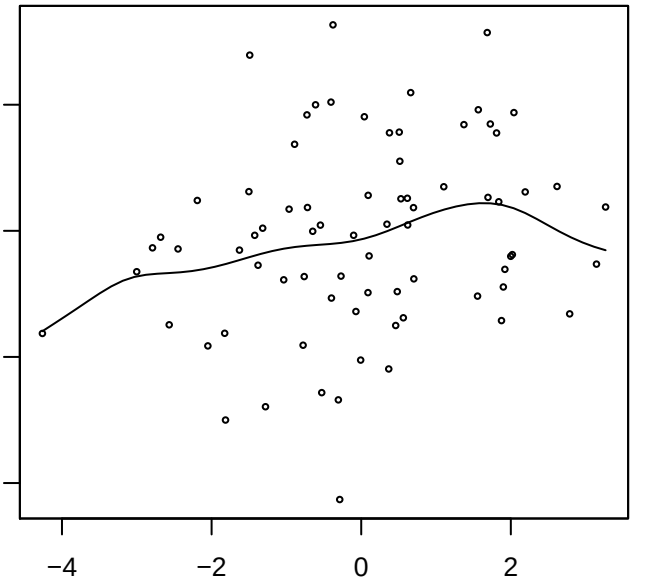
lag 3



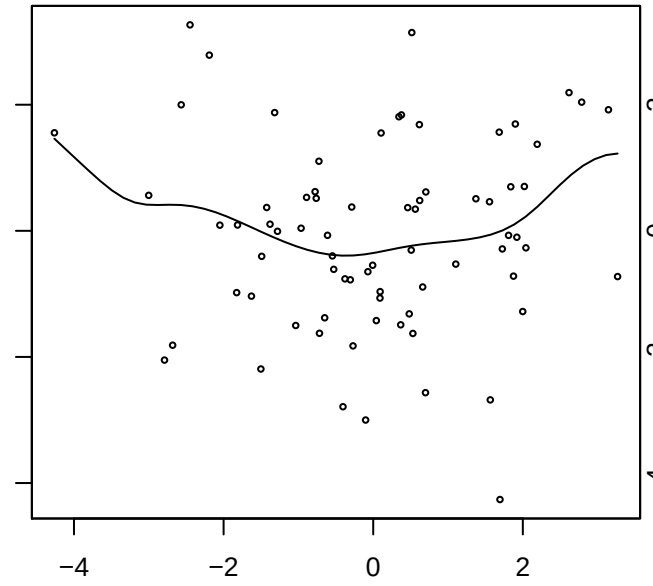
lag 4



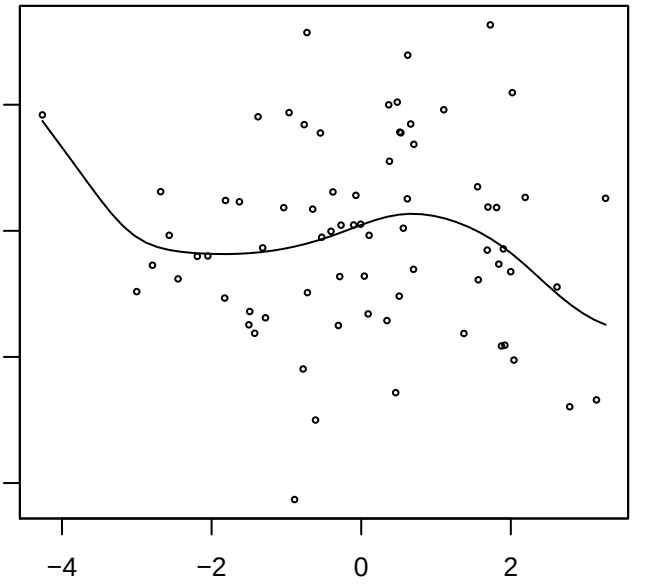
lag 5



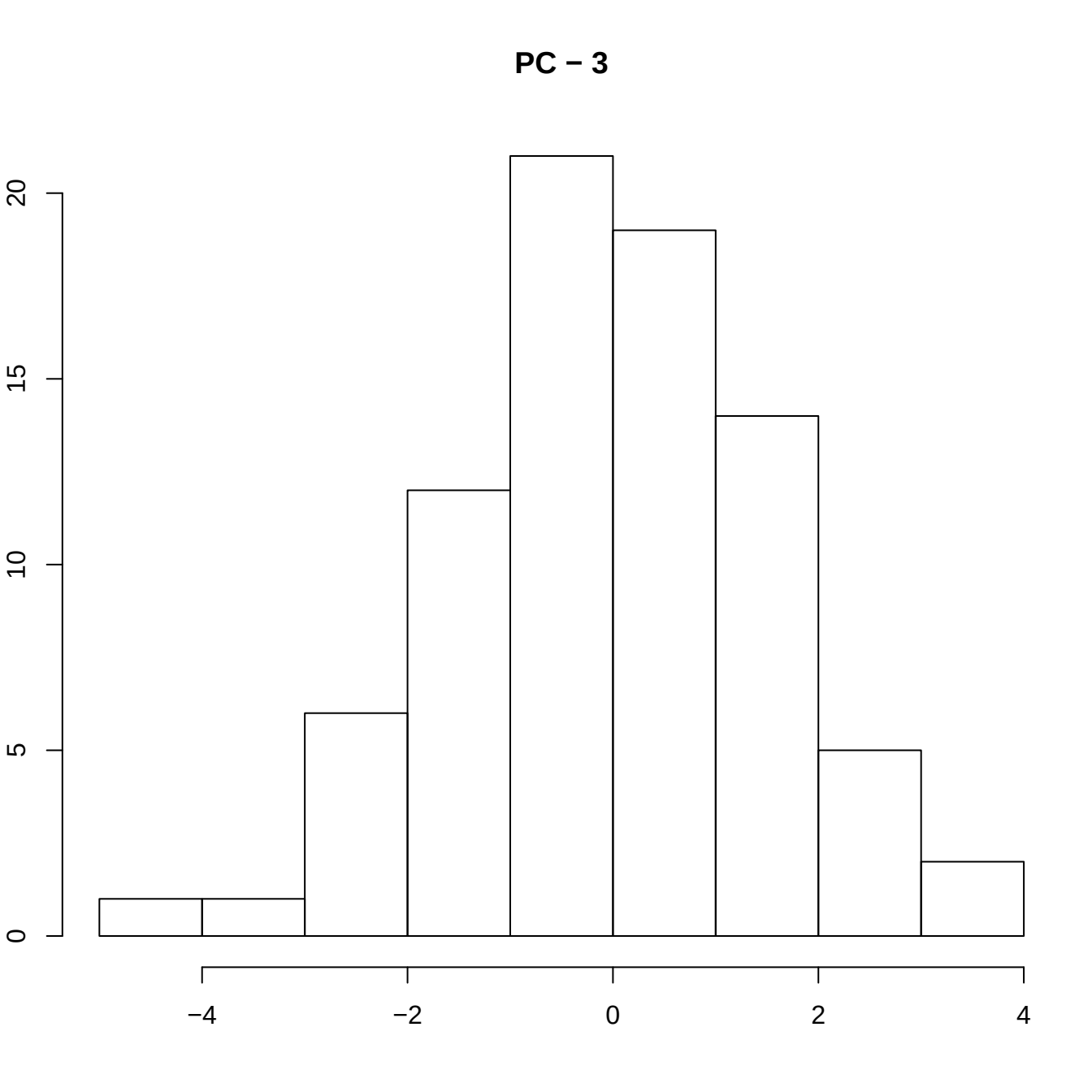
lag 6

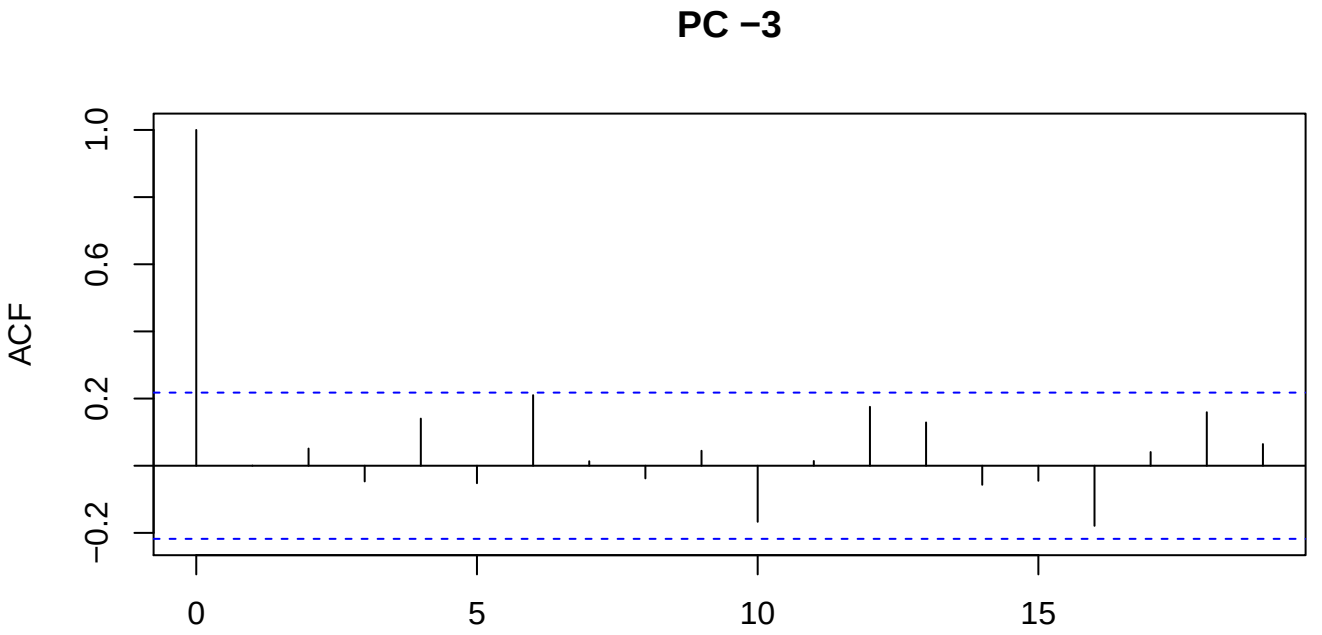


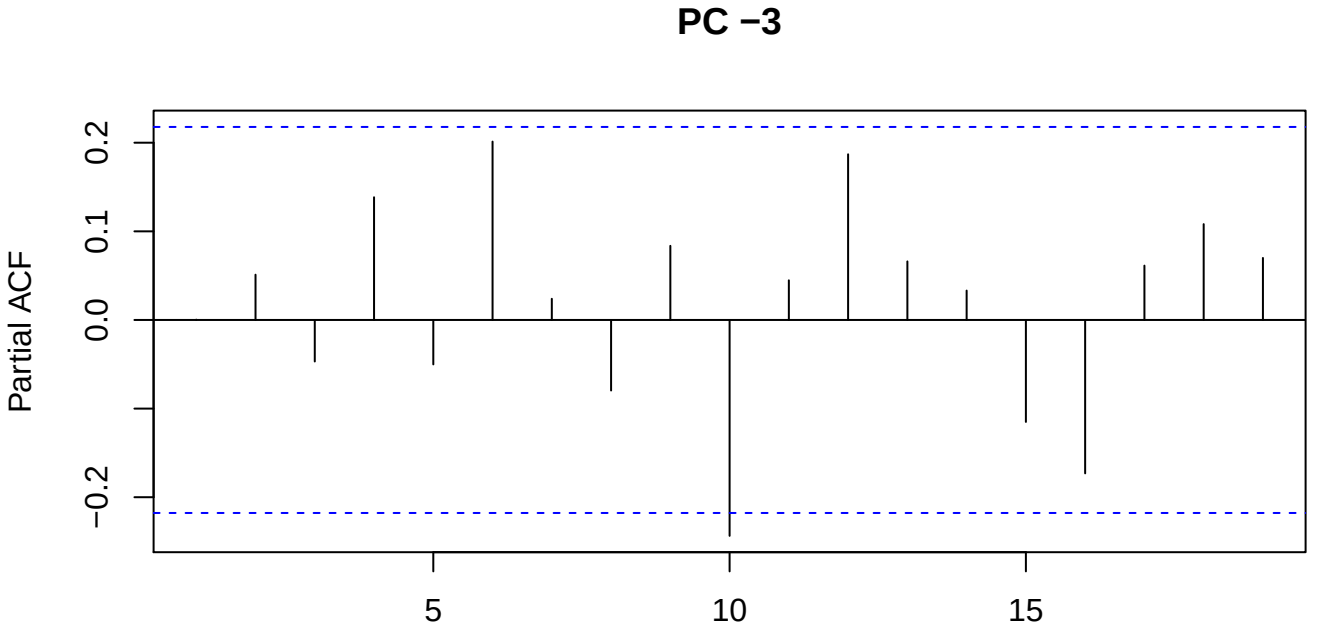
lag 7

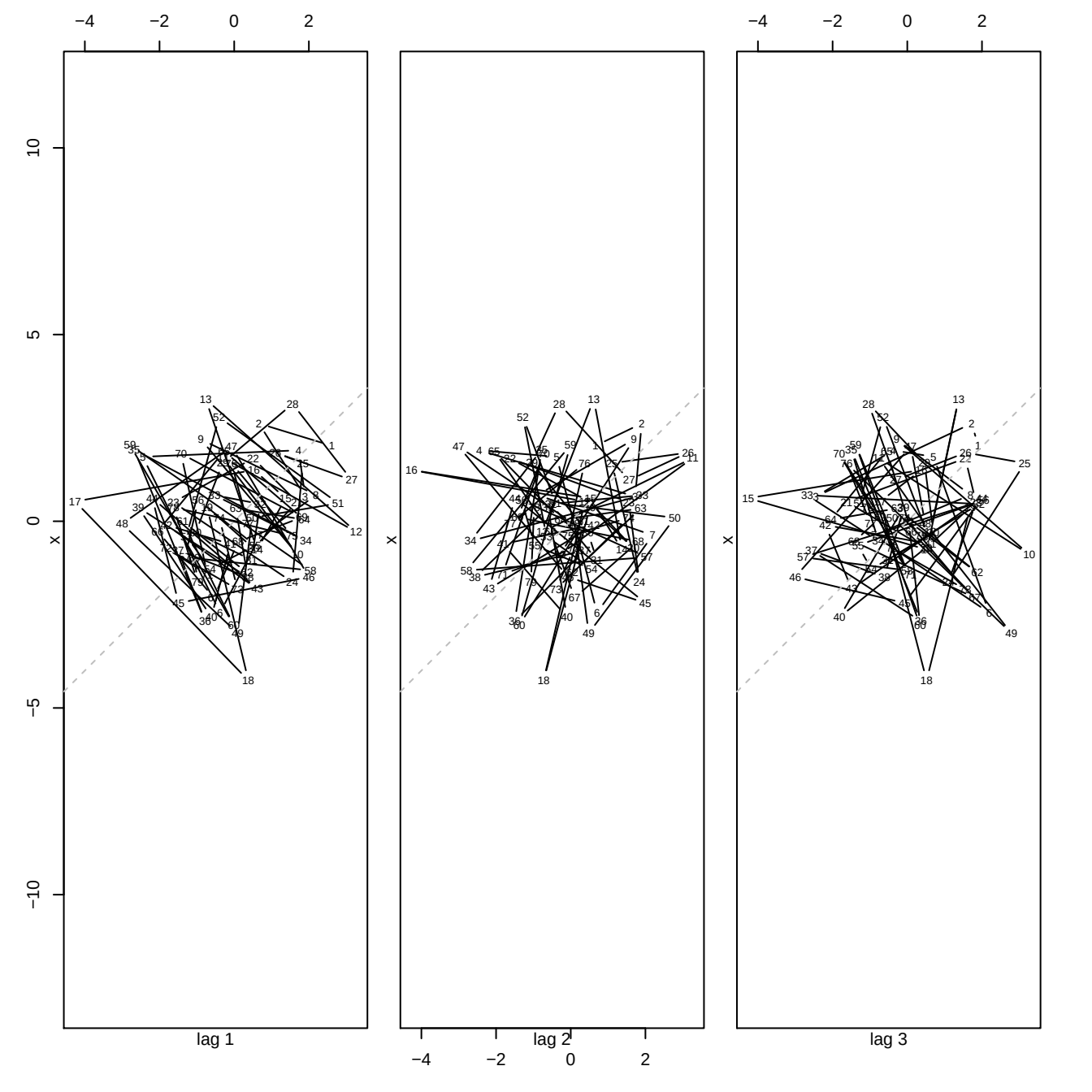


lag 8


PC − 3
0
5
10
15
20
−4
−2
0
2
4


PC −3
ACF
1.0
0.6
0.2
−0.2
0
5
10
15


PC −3
Partial ACF
0.2
0.1
0.0
−0.2
5
10
15


−4
−2
0
2
10
5
0
−5
−10
X
lag 1
lag 2
lag 3

Mu−PC1emd=1
SD − PC 1
Max − PC 1
Min − PC 1
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mu−PC1emd=2
−1.0
−0.5
0.0
0.5
1.0
SD − PC 1
0.5
1.0
1.5
2.0
2.5
3.0
Max − PC 1
0
5
10
15
20
Min − PC 1
0
−5
−10
−15
−20

Mu−PC1emd=3
SD − PC 1
Max − PC 1
Min − PC 1
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mu−PC1emd=4
SD − PC 1
Max − PC 1
Min − PC 1
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mu−PC1emd=5
SD − PC 1
Max − PC 1
Min − PC 1
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mu−PC2emd=1
SD − PC 2
Max − PC 2
Min − PC 2
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mu−PC2emd=2
SD − PC 2
Max − PC 2
Min − PC 2
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mu−PC2emd=3
SD − PC 2
Max − PC 2
Min − PC 2
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mu−PC2emd=4
SD − PC 2
Max − PC 2
Min − PC 2
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mu−PC2emd=5
SD − PC 2
Max − PC 2
Min − PC 2
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mu−PC3emd=1
SD − PC 3
Max − PC 3
Min − PC 3
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

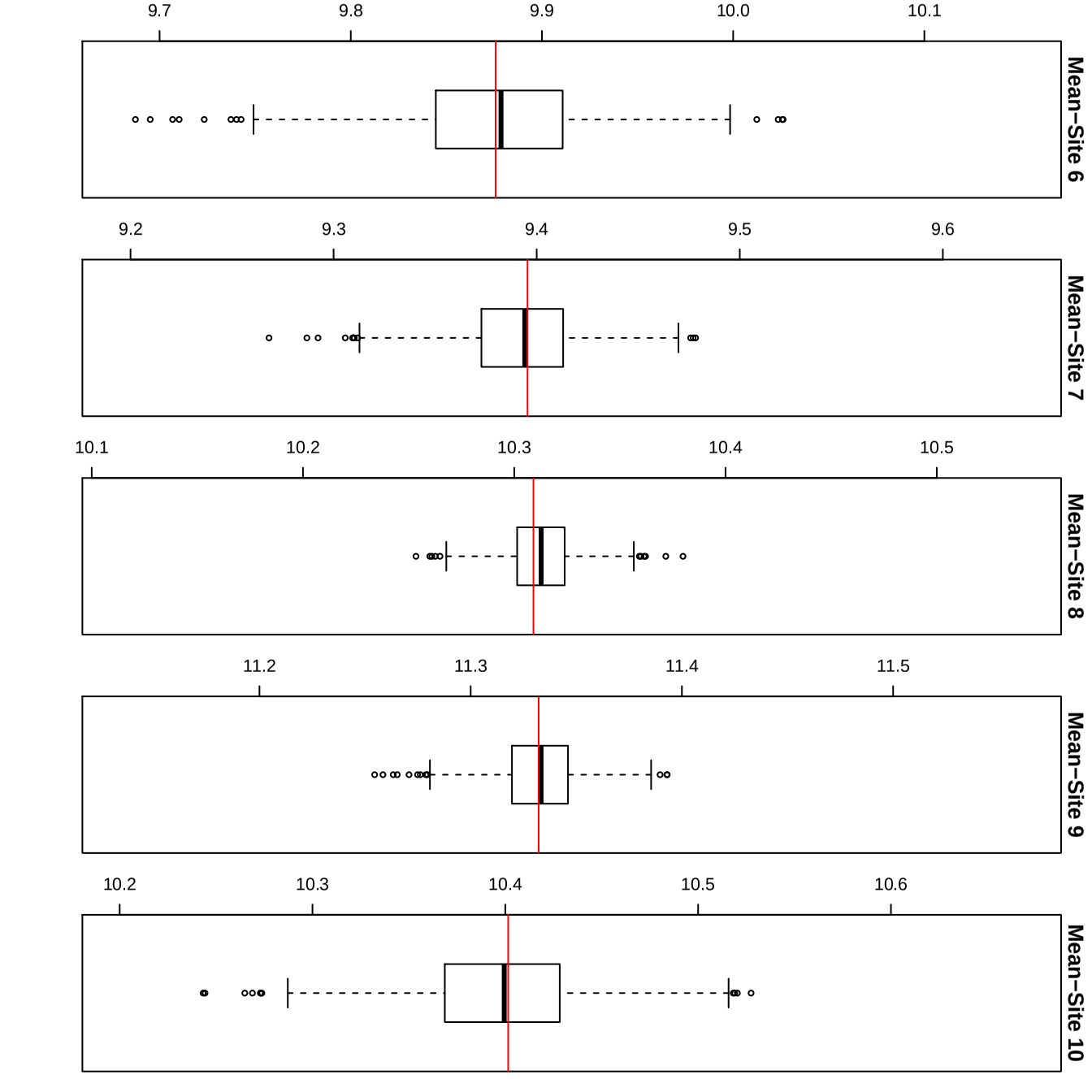
Mu−PC3emd=2
SD − PC 3
Max − PC 3
Min − PC 3
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

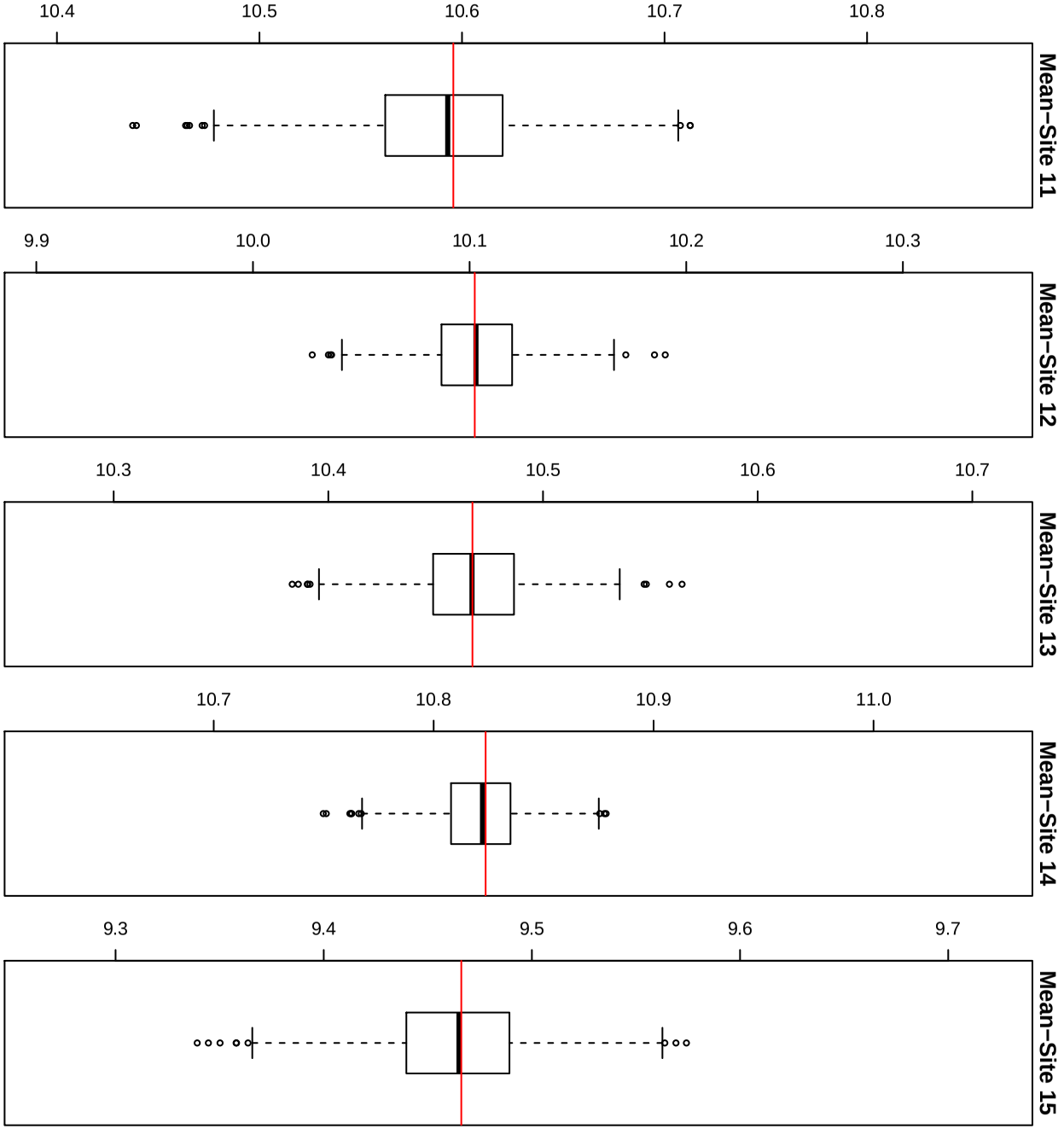
Mu−PC3emd=3
SD − PC 3
Max − PC 3
Min − PC 3
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

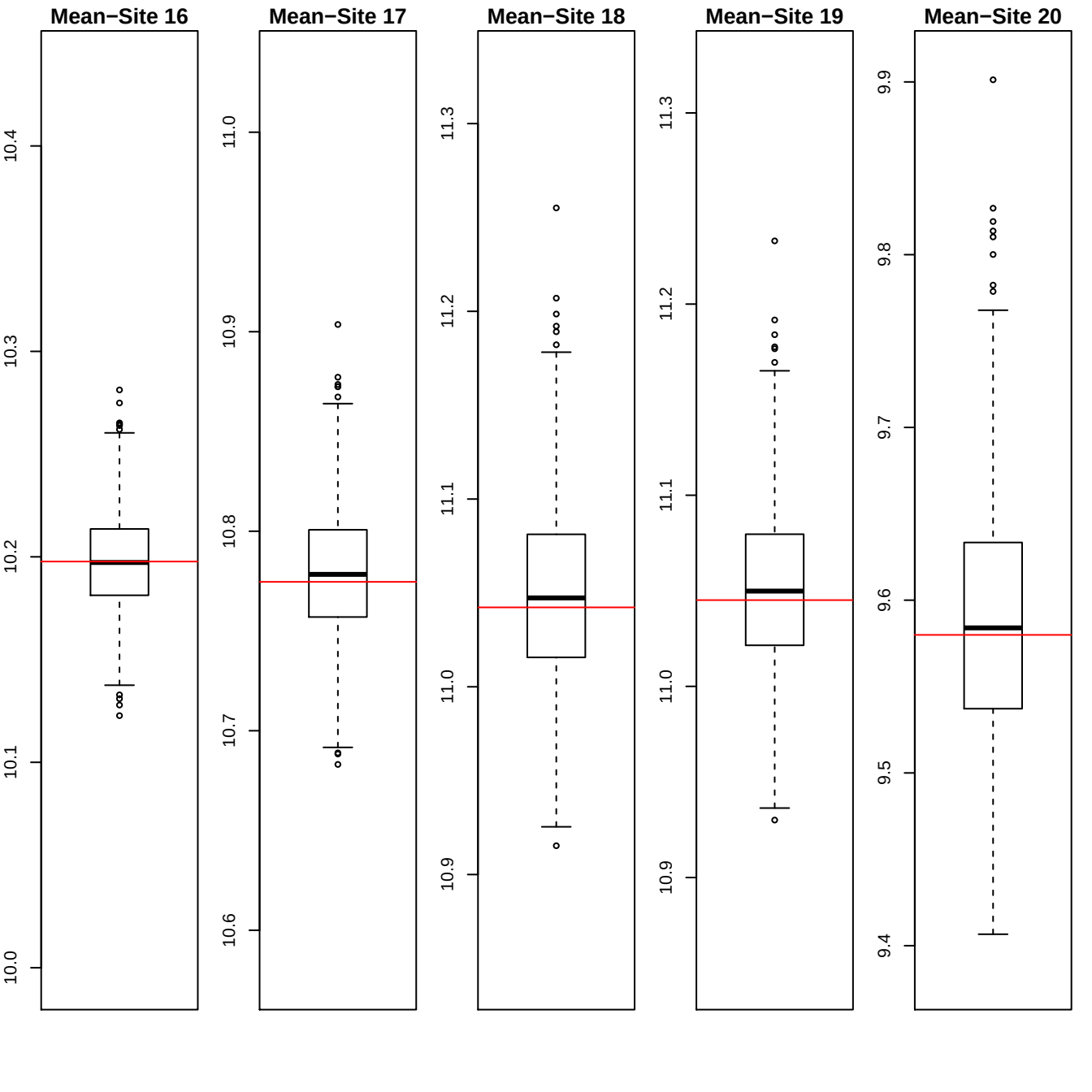
Mu−PC3emd=4
SD − PC 3
Max − PC 3
Min − PC 3
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mu−PC3emd=5
SD − PC 3
Max − PC 3
Min − PC 3
−1.0
−0.5
0.0
0.5
1.0
0.5
1.0
1.5
2.0
2.5
3.0
0
5
10
15
20
−20
−15
−10
−5
0

Mean−Site 1
Mean−Site 2
Mean−Site 3
Mean−Site 4
Mean−Site 5
10.8
10.9
11.0
11.1
11.2
11.1
11.2
11.3
11.4
11.5
11.2
11.3
11.4
11.5
11.6
11.7
11.0
11.1
11.2
11.3
11.4
11.9
12.0
12.1
12.2
12.3


9.7
9.8
9.9
10.0
10.1
Mean−Site 6
9.2
9.3
9.4
9.5
9.6
Mean−Site 7
10.1
10.2
10.3
10.4
10.5
Mean−Site 8
11.2
11.3
11.4
11.5
Mean−Site 9
10.2
10.3
10.4
10.5
10.6
Mean−Site 10


10.4
10.5
10.6
10.7
10.8
Mean−Site 11
9.9
10.0
10.1
10.2
10.3
Mean−Site 12
10.3
10.4
10.5
10.6
10.7
Mean−Site 13
10.7
10.8
10.9
11.0
Mean−Site 14
9.3
9.4
9.5
9.6
9.7
Mean−Site 15


Mean−Site 16
10.0
10.1
10.2
10.3
10.4
Mean−Site 17
10.6
10.7
10.8
10.9
11.0
Mean−Site 18
10.9
11.0
11.1
11.2
11.3
Mean−Site 19
10.9
11.0
11.1
11.2
11.3
Mean−Site 20
9.4
9.5
9.6
9.7
9.8
9.9

Mean−Site 21
Mean−Site 22
Mean−Site 23
Mean−Site 24
Mean−Site 25
10.0
9.9
9.8
9.7
9.6
10.7
10.6
10.5
10.4
10.6
10.5
10.4
10.3
10.2
10.7
10.6
10.5
10.4
11.4
11.3
11.2
11.1
11.0

Mean−Site 26

12.1
12.0
11.9
11.8
11.7

Mean−Site 27

10.4
10.3
10.2
10.1
10.0

Mean−Site 28

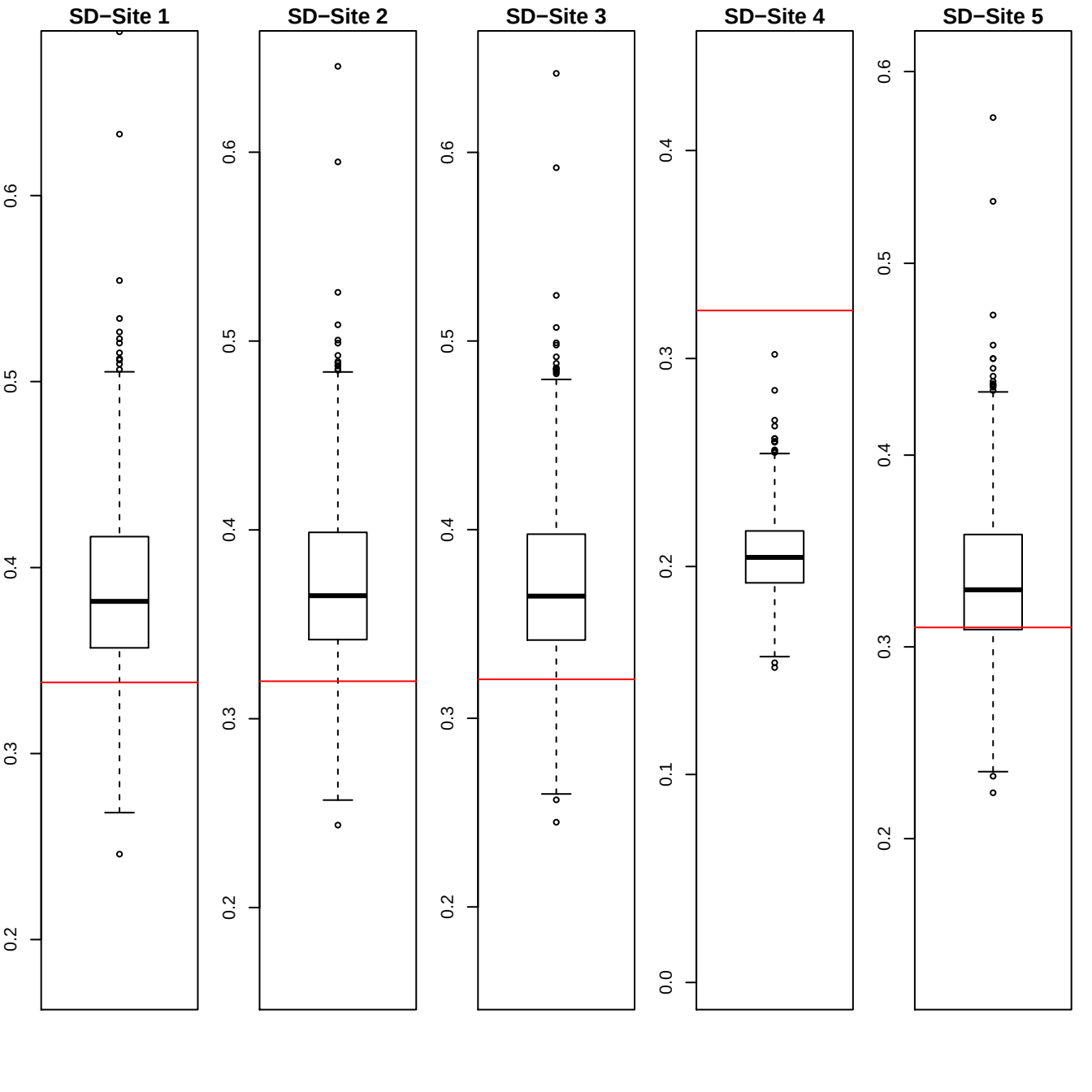
8.6
8.5
8.4
8.3
8.2

Mean−Site 29

9.1
9.0
8.9
8.8
8.7

Mean−Site 30

9.8
9.7
9.6
9.5
9.4


SD−Site 1
SD−Site 2
SD−Site 3
SD−Site 4
SD−Site 5
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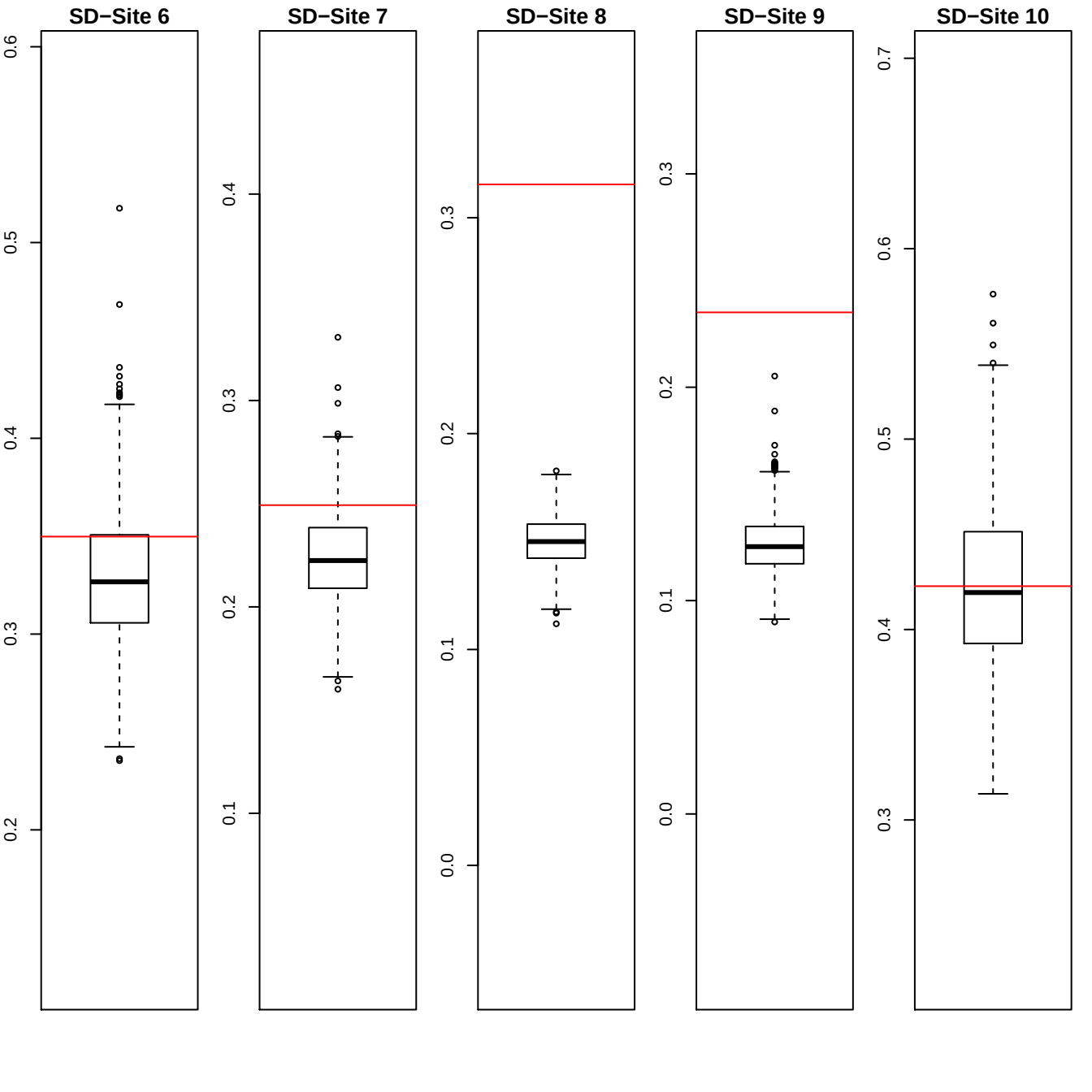
0.1
0.2
0.3
0.4
0.5
0.6


SD−Site 6
SD−Site 7
SD−Site 8
SD−Site 9
SD−Site 10
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0.3
0.4
0.5
0.6
0.1
0.2
0.3
0.4
0.0
0.1
0.2
0.3
0.0
0.1
0.2
0.3
0.3
0.4
0.5
0.6
0.7

SD−Site 11

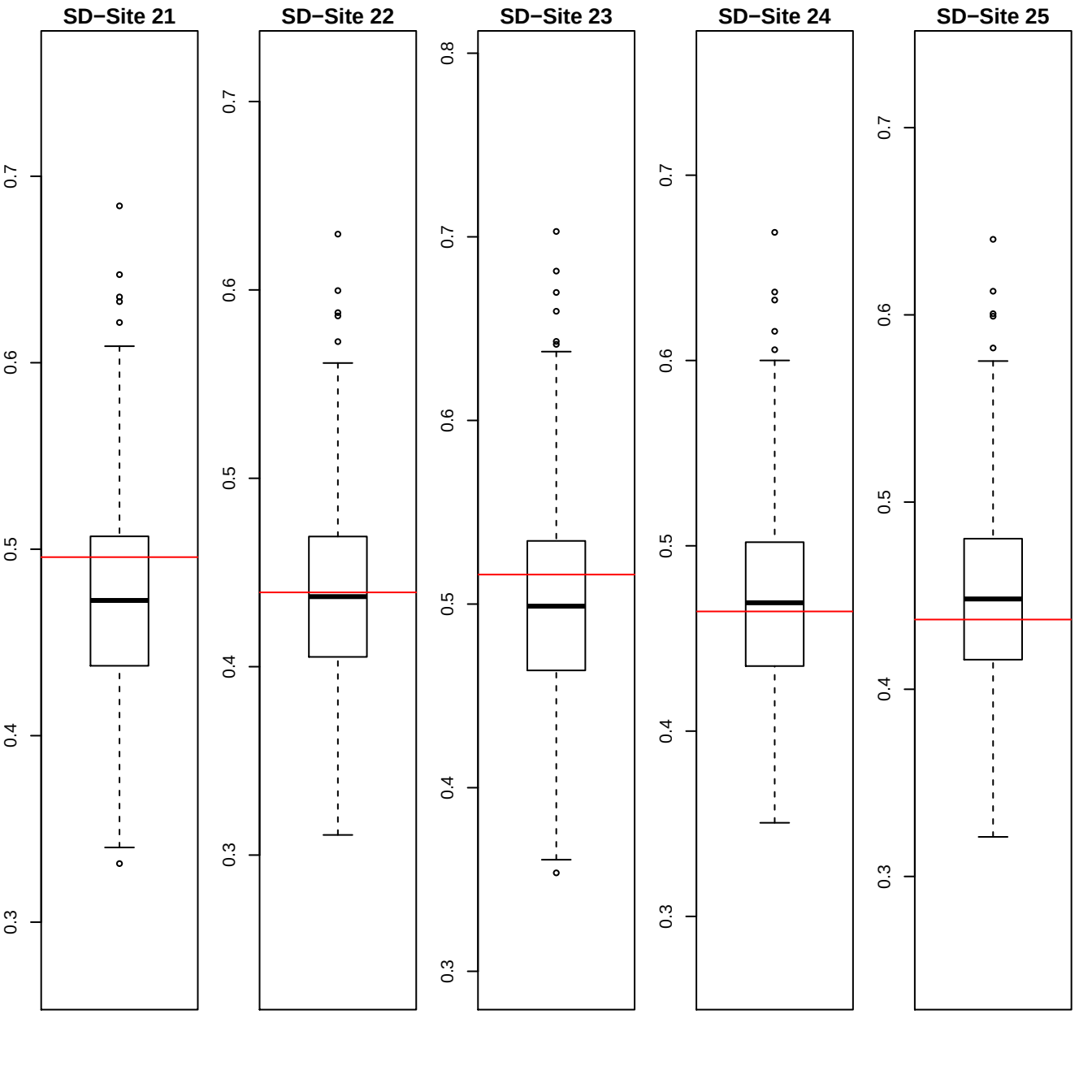
SD−Site 12

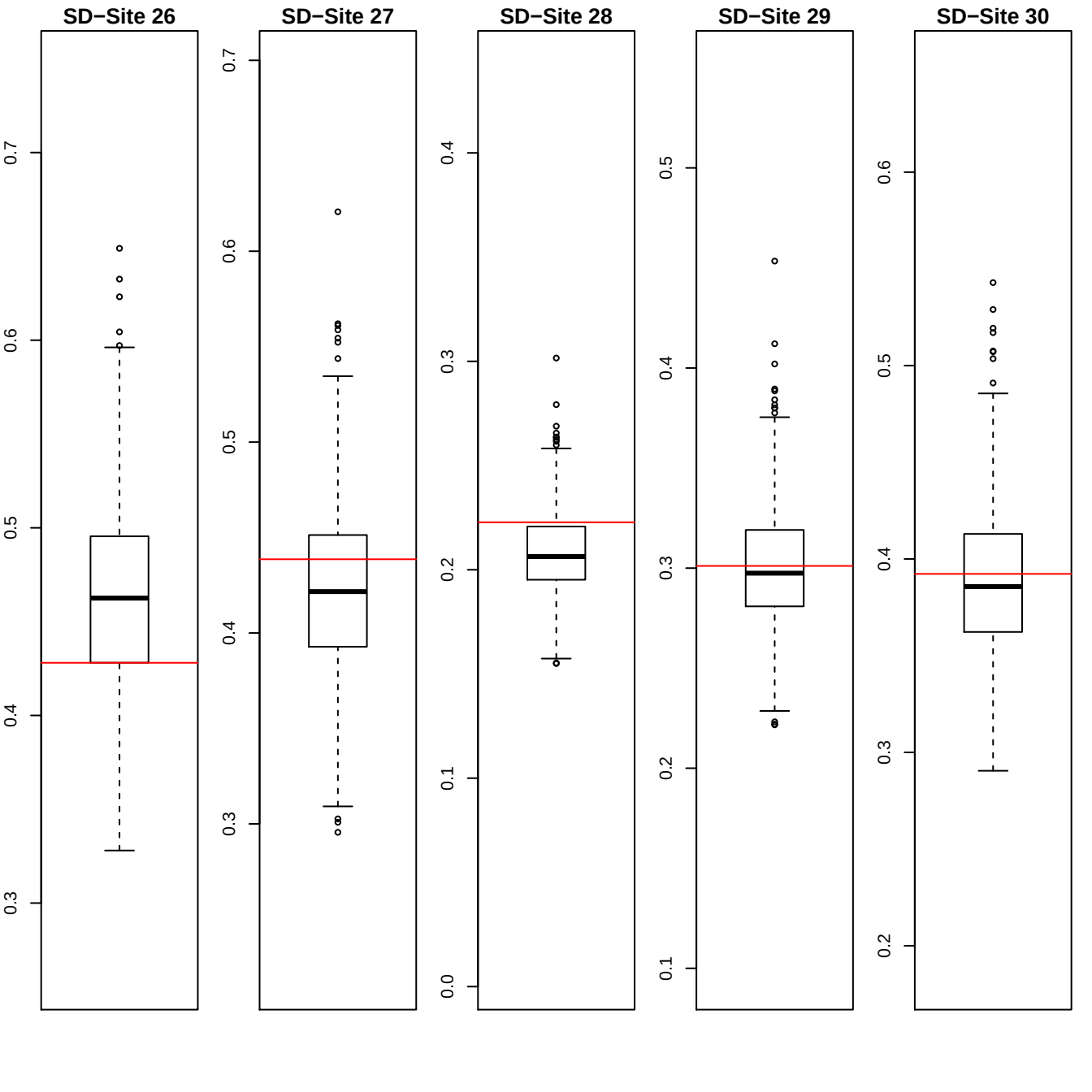
SD−Site 13

SD−Site 14

SD−Site 15

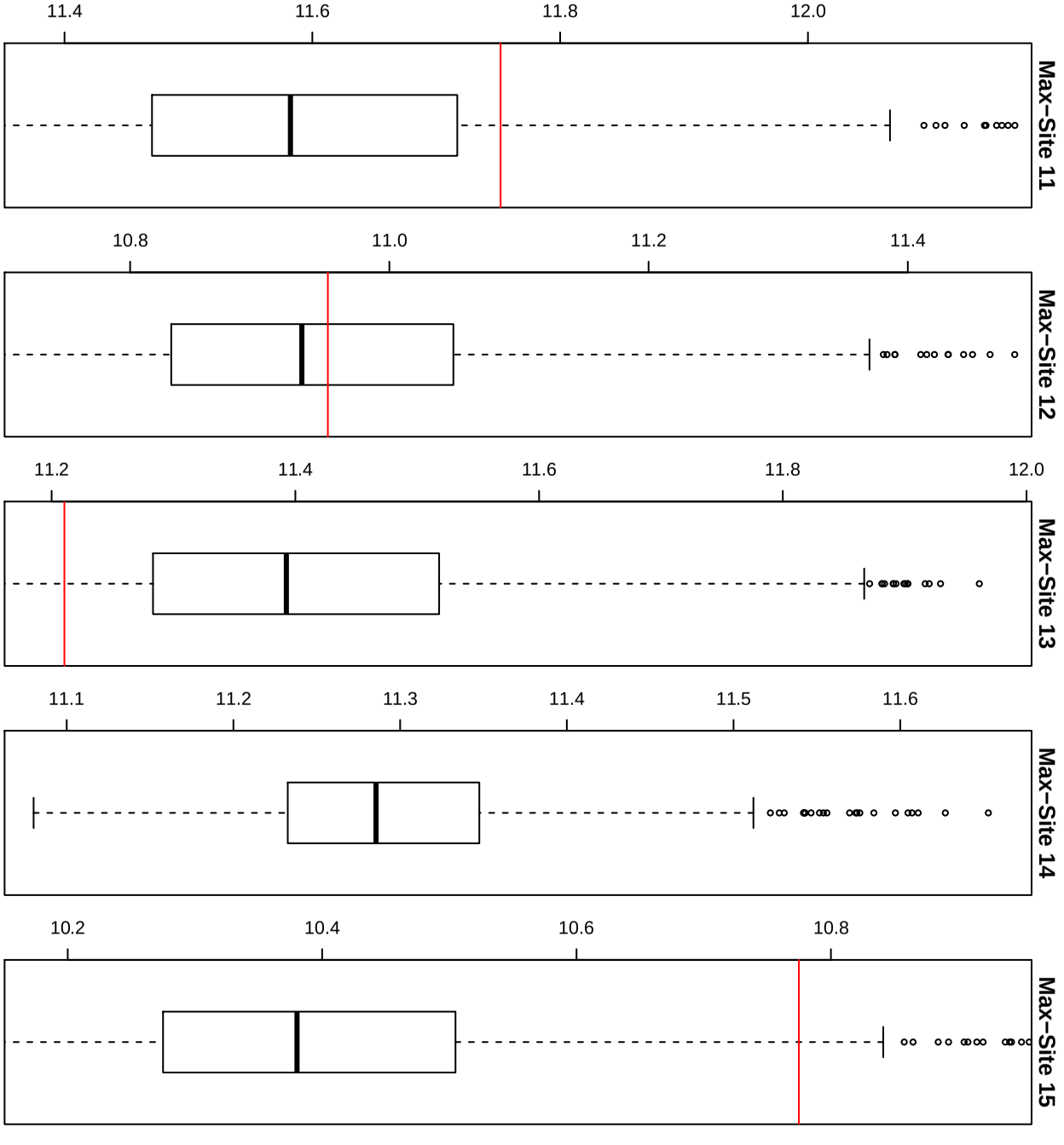
SD−Site 16
SD−Site 17
SD−Site 18
SD−Site 19
SD−Site 20


SD−Site 21
SD−Site 22
SD−Site 23
SD−Site 24
SD−Site 25
0.3
0.4
0.5
0.6
0.7
0.8


SD−Site 26
SD−Site 27
SD−Site 28
SD−Site 29
SD−Site 30

Max−Site 1
Max−Site 2
Max−Site 3
Max−Site 4
Max−Site 5
11.8
12.0
12.2
12.4
12.6
12.2
12.4
12.6
12.8
12.2
12.4
12.6
12.8
13.0
11.6
11.7
11.8
11.9
12.0
12.1
12.8
13.0
13.2
13.4

Max−Site 6
Max−Site 7
Max−Site 8
Max−Site 9
Max−Site 10
11.2
11.0
10.8
10.6
10.4
10.3
10.2
10.1
10.0
9.9
9.8
11.0
10.9
10.8
10.7
10.6
10.5
12.0
11.9
11.8
11.7
11.6
11.5
12.0
11.8
11.6
11.4


11.4
11.6
11.8
12.0
Max−Site 11
10.8
11.0
11.2
11.4
Max−Site 12
11.2
11.4
11.6
11.8
12.0
Max−Site 13
11.1
11.2
11.3
11.4
11.5
11.6
Max−Site 14
10.2
10.4
10.6
10.8
Max−Site 15

Max−Site 16

Max−Site 17

Max−Site 18

Max−Site 19

Max−Site 20

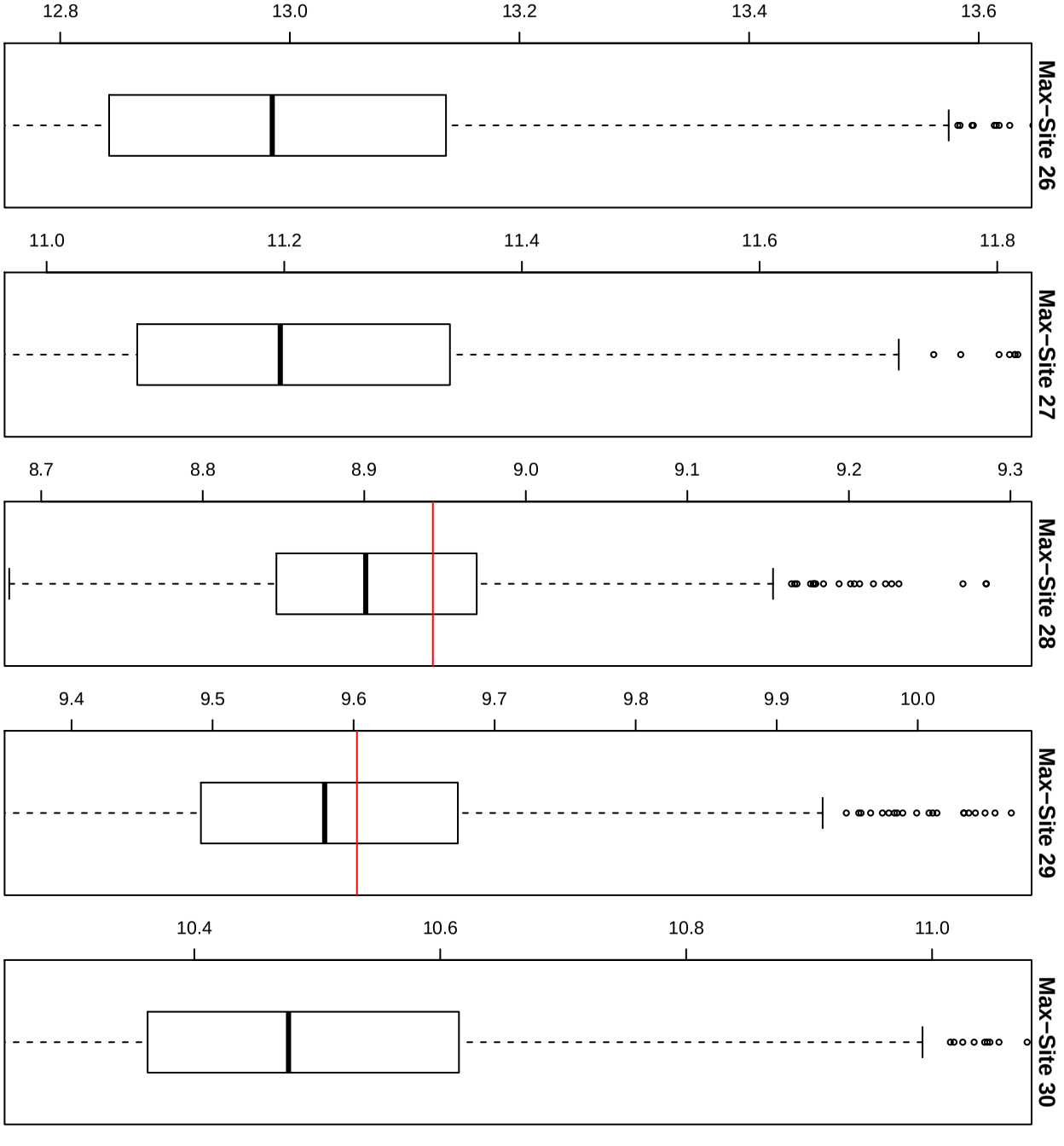
Max−Site 21

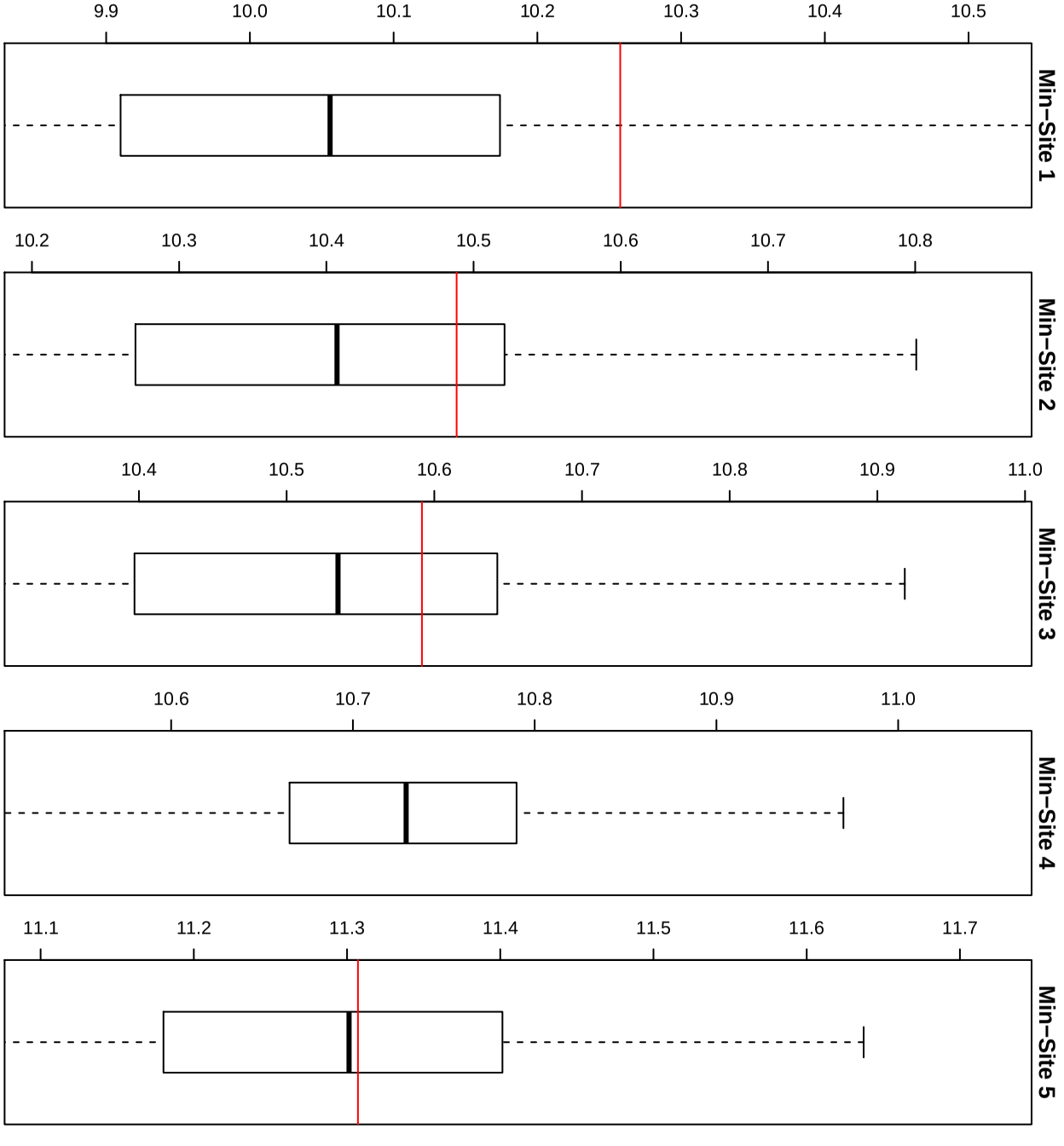
Max−Site 22

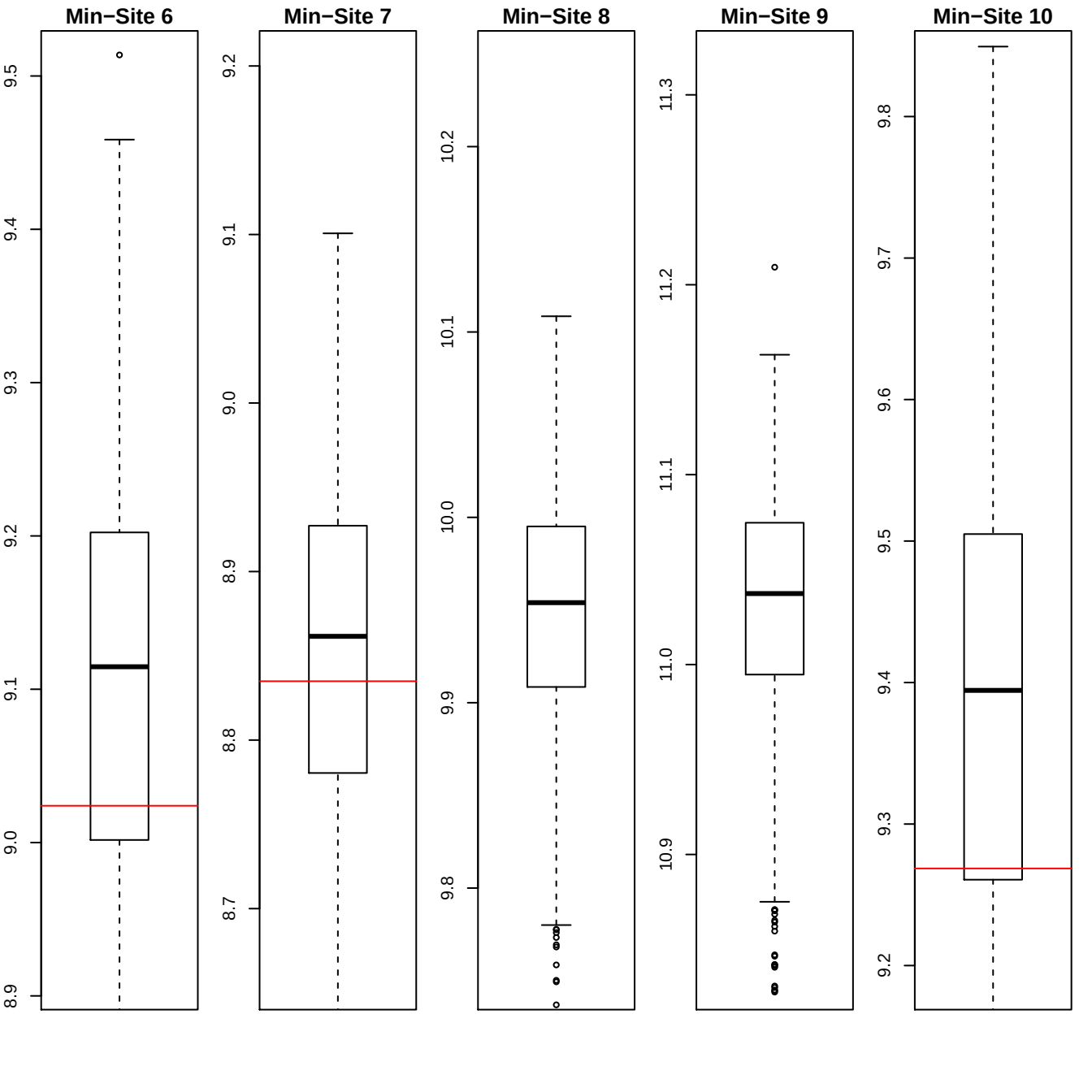
Max−Site 23

Max−Site 24

Max−Site 25


12.8
13.0
13.2
13.4
13.6
Max−Site 26
11.0
11.2
11.4
11.6
11.8
Max−Site 27
8.7
8.8
8.9
9.0
9.1
9.2
9.3
Max−Site 28
9.4
9.5
9.6
9.7
9.8
9.9
10.0
Max−Site 29
10.4
10.6
10.8
11.0
Max−Site 30


9.9
10.0
10.1
10.2
10.3
10.4
10.5
Min−Site 1
10.2
10.3
10.4
10.5
10.6
10.7
10.8
Min−Site 2
10.4
10.5
10.6
10.7
10.8
10.9
11.0
Min−Site 3
10.6
10.7
10.8
10.9
11.0
Min−Site 4
11.1
11.2
11.3
11.4
11.5
11.6
11.7
Min−Site 5


Min−Site 6
Min−Site 7
Min−Site 8
Min−Site 9
Min−Site 10
9.5
9.4
9.3
9.2
9.1
9.0
8.9
9.2
9.1
9.0
8.9
8.8
8.7
10.2
10.1
10.0
9.9
9.8
11.3
11.2
11.1
11.0
10.9
9.8
9.7
9.6
9.5
9.4
9.3
9.2

Min−Site 11
Min−Site 12
Min−Site 13
Min−Site 14
Min−Site 15
10.0
9.9
9.8
9.7
9.6
9.5
9.7
9.6
9.5
9.4
9.3
9.2
9.1
10.0
9.9
9.8
9.7
9.6
9.5
9.4
10.7
10.6
10.5
10.4
10.3
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9.0
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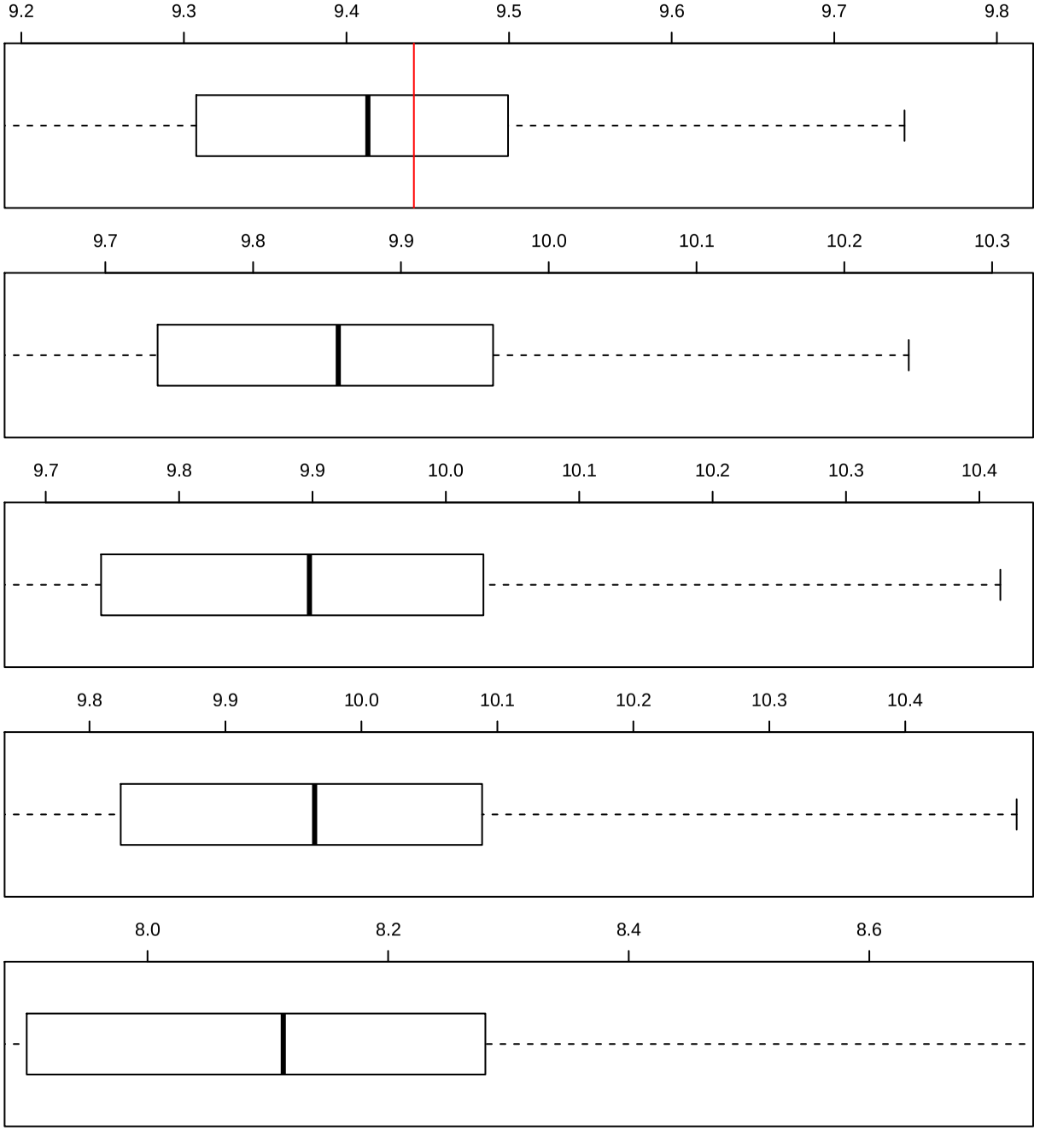
8.8
8.7
8.6
8.5
8.4


9.2
9.3
9.4
9.5
9.6
9.7
9.8
Min−Site 16
9.7
9.8
9.9
10.0
10.1
10.2
10.3
Min−Site 17
9.7
9.8
9.9
10.0
10.1
10.2
10.3
10.4
Min−Site 18
9.8
9.9
10.0
10.1
10.2
10.3
10.4
Min−Site 19
8.0
8.2
8.4
8.6
Min−Site 20

Min−Site 21
Min−Site 22
Min−Site 23
Min−Site 24
Min−Site 25
8.4
8.5
8.6
8.7
8.8
8.9
9.0
9.1
9.3
9.4
9.5
9.6
9.7
9.8
9.9
9.0
9.1
9.2
9.3
9.4
9.5
9.6
9.2
9.3
9.4
9.5
9.6
9.7
9.8
9.9
9.9
10.0
10.1
10.2
10.3
10.4
10.5
10.6

Min−Site 26

Min−Site 27

Min−Site 28

Min−Site 29

Min−Site 30

Mean−Site 1
SD−Site 1
Max−Site 1
Min−Site 1
10.8
10.9
11.0
11.1
11.2
0.2
0.3
0.4
0.5
0.6
11.8
12.0
12.2
12.4
12.6
9.9
10.0
10.1
10.2
10.3
10.4
10.5

Mean−Site 2
11.1
11.2
11.3
11.4
11.5
SD−Site 2
0.2
0.3
0.4
0.5
0.6
Max−Site 2
12.2
12.4
12.6
12.8
Min−Site 2
10.2
10.3
10.4
10.5
10.6
10.7
10.8

Mean−Site 3
11.2
11.3
11.4
11.5
11.6
11.7
SD−Site 3
0.2
0.3
0.4
0.5
0.6
Max−Site 3
12.2
12.4
12.6
12.8
13.0
Min−Site 3
10.4
10.5
10.6
10.7
10.8
10.9
11.0

Mean−Site 4
11.0
11.1
11.2
11.3
11.4

SD−Site 4
0.0
0.1
0.2
0.3
0.4

Max−Site 4
11.6
11.7
11.8
11.9
12.0
12.1

Min−Site 4
10.6
10.7
10.8
10.9
11.0

Mean−Site 5
SD−Site 5
Max−Site 5
Min−Site 5
12.3
12.2
12.1
12.0
11.9
0.6
0.5
0.4
0.3
0.2
13.4
13.2
13.0
12.8
11.7
11.6
11.5
11.4
11.3
11.2
11.1

Mean−Site 6

9.7
9.8
9.9
10.0
10.1

SD−Site 6

0.2
0.3
0.4
0.5
0.6

Max−Site 6

10.6
10.8
11.0
11.2

Min−Site 6

8.9
9.0
9.1
9.2
9.3
9.4
9.5

Mean−Site 7
SD−Site 7
Max−Site 7
Min−Site 7
9.2
9.3
9.4
9.5
9.6
0.1
0.2
0.3
0.4
9.8
9.9
10.0
10.1
10.2
10.3
10.4
8.7
8.8
8.9
9.0
9.1
9.2

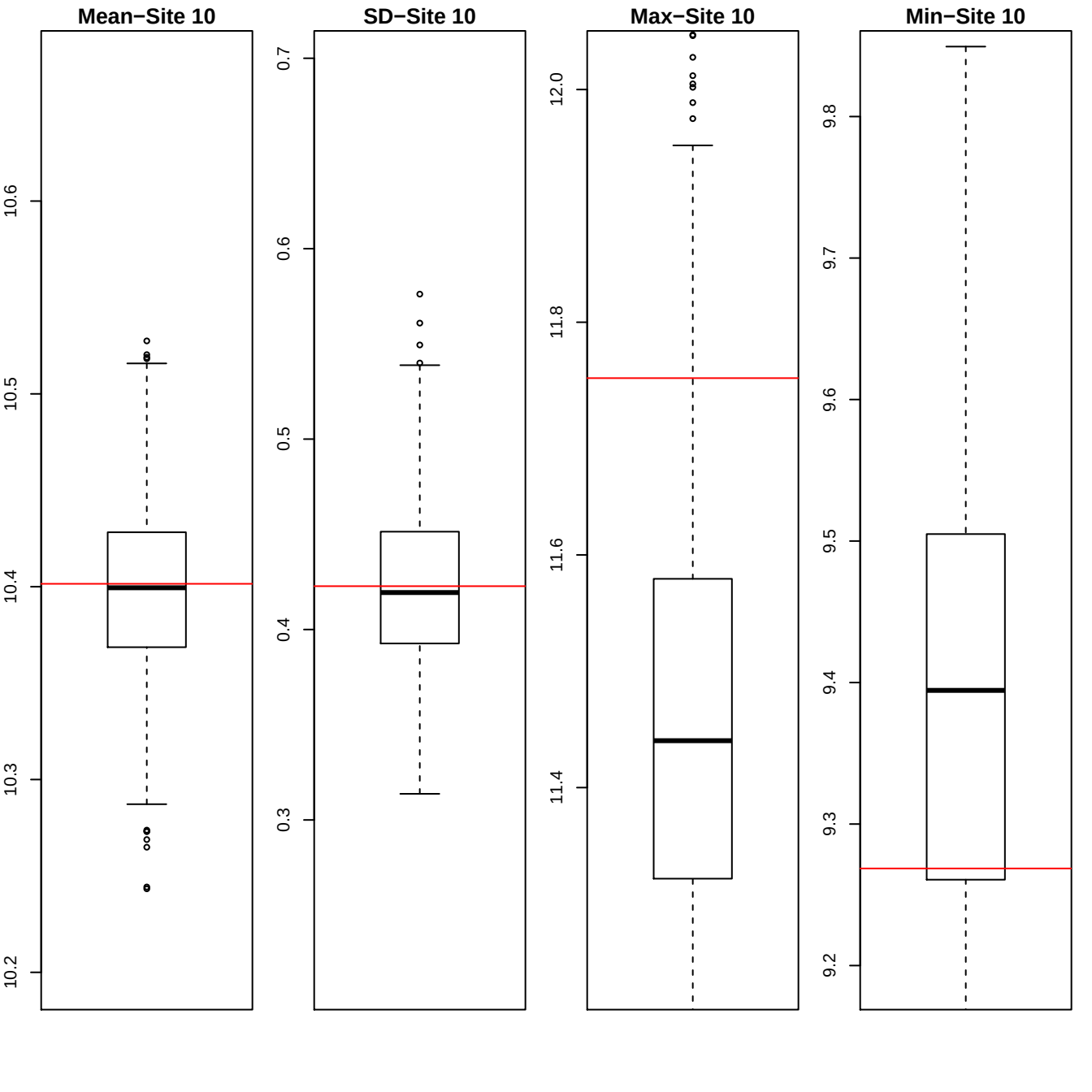
Mean−Site 8
10.1
10.2
10.3
10.4
10.5
SD−Site 8
0.0
0.1
0.2
0.3
Max−Site 8
10.5
10.6
10.7
10.8
10.9
11.0
Min−Site 8
9.8
9.9
10.0
10.1
10.2

Mean−Site 9
11.2
11.3
11.4
11.5

SD−Site 9
0.0
0.1
0.2
0.3

Max−Site 9
11.5
11.6
11.7
11.8
11.9
12.0

Min−Site 9
10.9
11.0
11.1
11.2
11.3


Mean−Site 10
10.2
10.3
10.4
10.5
10.6
SD−Site 10
0.3
0.4
0.5
0.6
0.7
Max−Site 10
11.4
11.6
11.8
12.0
Min−Site 10
9.2
9.3
9.4
9.5
9.6
9.7
9.8

Mean−Site 11
10.4
10.5
10.6
10.7
10.8
SD−Site 11
0.2
0.3
0.4
0.5
0.6
Max−Site 11
11.4
11.6
11.8
12.0
Min−Site 11
9.5
9.6
9.7
9.8
9.9
10.0

Mean−Site 12

10.3
10.2
10.1
10.0
9.9

SD−Site 12

0.6
0.5
0.4
0.3
0.2

Max−Site 12

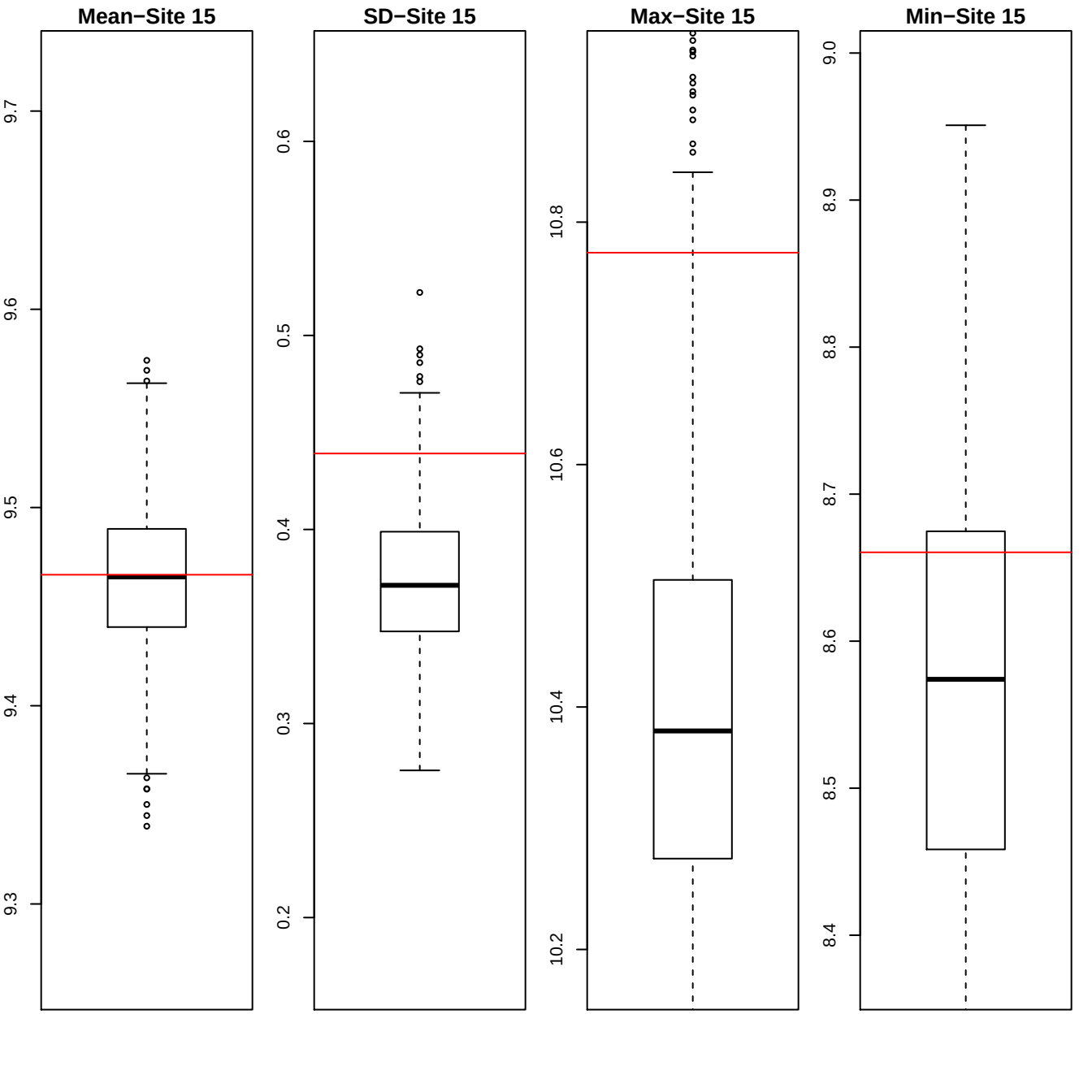
11.4
11.2
11.0
10.8

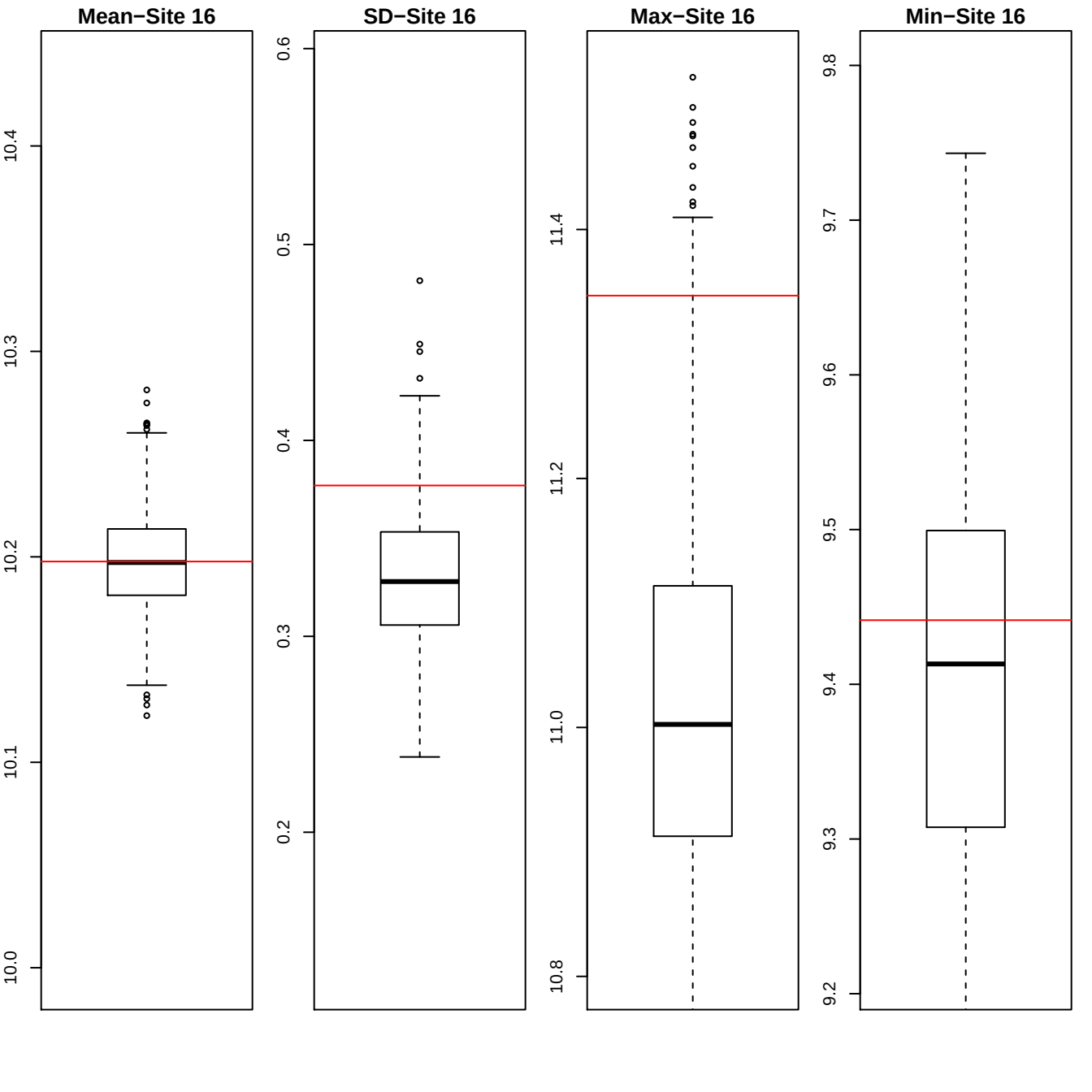
Min−Site 12

9.7
9.6
9.5
9.4
9.3
9.2
9.1

Mean−Site 13
10.3
10.4
10.5
10.6
10.7
SD−Site 13
0.2
0.3
0.4
0.5
0.6
Max−Site 13
11.2
11.4
11.6
11.8
12.0
Min−Site 13
9.4
9.5
9.6
9.7
9.8
9.9
10.0

Mean−Site 14
SD−Site 14
Max−Site 14
Min−Site 14
10.7
10.8
10.9
11.0
0.0
0.1
0.2
0.3
0.4
11.1
11.2
11.3
11.4
11.5
11.6
10.2
10.3
10.4
10.5
10.6
10.7


Mean−Site 15
9.3
9.4
9.5
9.6
9.7
SD−Site 15
0.2
0.3
0.4
0.5
0.6
Max−Site 15
10.2
10.4
10.6
10.8
Min−Site 15
8.4
8.5
8.6
8.7
8.8
8.9
9.0


Mean−Site 16
10.0
10.1
10.2
10.3
10.4
SD−Site 16
0.2
0.3
0.4
0.5
0.6
Max−Site 16
10.8
11.0
11.2
11.4
Min−Site 16
9.2
9.3
9.4
9.5
9.6
9.7
9.8

Mean−Site 17

10.6
10.7
10.8
10.9
11.0

SD−Site 17

0.2
0.3
0.4
0.5
0.6

Max−Site 17

11.6
11.8
12.0
12.2

Min−Site 17

9.7
9.8
9.9
10.0
10.1
10.2
10.3

Mean−Site 18
SD−Site 18
Max−Site 18
Min−Site 18
10.9
11.0
11.1
11.2
11.3
0.3
0.4
0.5
0.6
0.7
12.0
12.2
12.4
12.6
12.8
9.7
9.8
9.9
10.0
10.1
10.2
10.3
10.4

Mean−Site 19
SD−Site 19
Max−Site 19
Min−Site 19
10.9
11.0
11.1
11.2
11.3
0.3
0.4
0.5
0.6
0.7
12.0
12.2
12.4
12.6
9.8
9.9
10.0
10.1
10.2
10.3
10.4

Mean−Site 20

9.9
9.8
9.7
9.6
9.5
9.4

SD−Site 20

0.9
0.8
0.7
0.6
0.5
0.4

Max−Site 20

11.8
11.6
11.4
11.2
11.0
10.8

Min−Site 20

8.6
8.4
8.2
8.0

Mean−Site 21

10.0
9.9
9.8
9.7
9.6

SD−Site 21

0.7
0.6
0.5
0.4
0.3

Max−Site 21

11.4
11.2
11.0
10.8

Min−Site 21

9.1
9.0
8.9
8.8
8.7
8.6
8.5
8.4

Mean−Site 22
10.4
10.5
10.6
10.7

SD−Site 22
0.3
0.4
0.5
0.6
0.7

Max−Site 22
11.4
11.6
11.8
12.0
12.2

Min−Site 22
9.3
9.4
9.5
9.6
9.7
9.8
9.9

Mean−Site 23
10.2
10.3
10.4
10.5
10.6

SD−Site 23
0.3
0.4
0.5
0.6
0.7
0.8

Max−Site 23
11.4
11.6
11.8
12.0
12.2

Min−Site 23
9.0
9.1
9.2
9.3
9.4
9.5
9.6

Mean−Site 24

10.4
10.5
10.6
10.7

SD−Site 24

0.3
0.4
0.5
0.6
0.7

Max−Site 24

11.6
11.8
12.0
12.2

Min−Site 24

9.2
9.3
9.4
9.5
9.6
9.7
9.8
9.9

Mean−Site 25
11.0
11.1
11.2
11.3
11.4

SD−Site 25
0.3
0.4
0.5
0.6
0.7

Max−Site 25
12.2
12.4
12.6
12.8

Min−Site 25
9.9
10.0
10.1
10.2
10.3
10.4
10.5
10.6

Mean−Site 26
SD−Site 26
Max−Site 26
Min−Site 26
12.1
12.0
11.9
11.8
11.7
0.7
0.6
0.5
0.4
0.3
13.6
13.4
13.2
13.0
12.8
11.2
11.1
11.0
10.9
10.8
10.7
10.6

Mean−Site 27
SD−Site 27
Max−Site 27
Min−Site 27
10.0
10.1
10.2
10.3
10.4
0.3
0.4
0.5
0.6
0.7
11.0
11.2
11.4
11.6
11.8
9.0
9.1
9.2
9.3
9.4
9.5
9.6

Mean−Site 28

8.2
8.3
8.4
8.5
8.6

SD−Site 28

0.0
0.1
0.2
0.3
0.4

Max−Site 28

8.7
8.8
8.9
9.0
9.1
9.2
9.3

Min−Site 28

7.7
7.8
7.9
8.0
8.1
8.2

Mean−Site 29

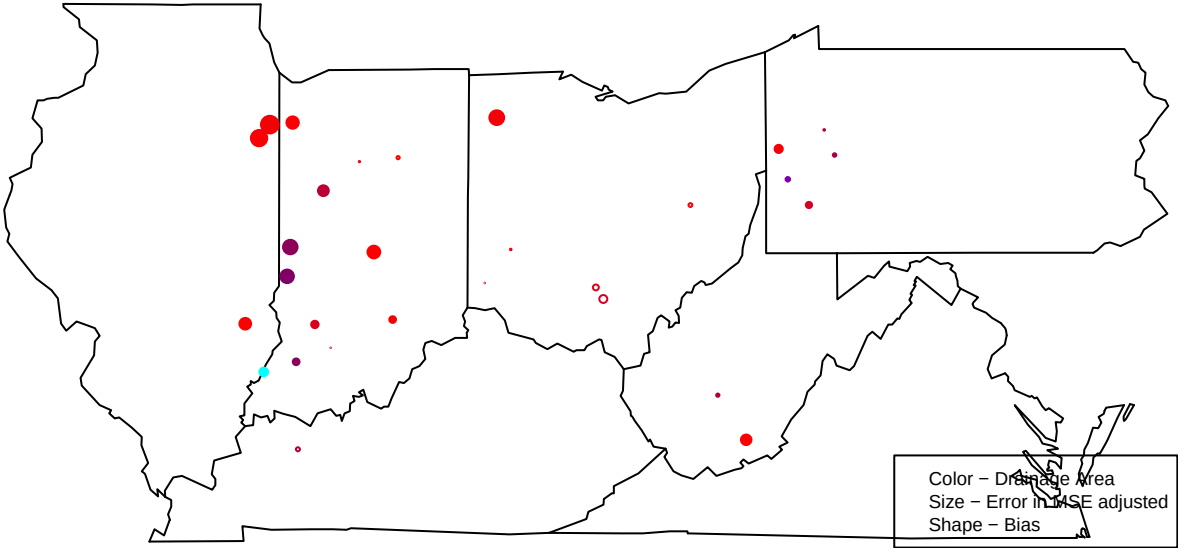
SD−Site 29

Max−Site 29

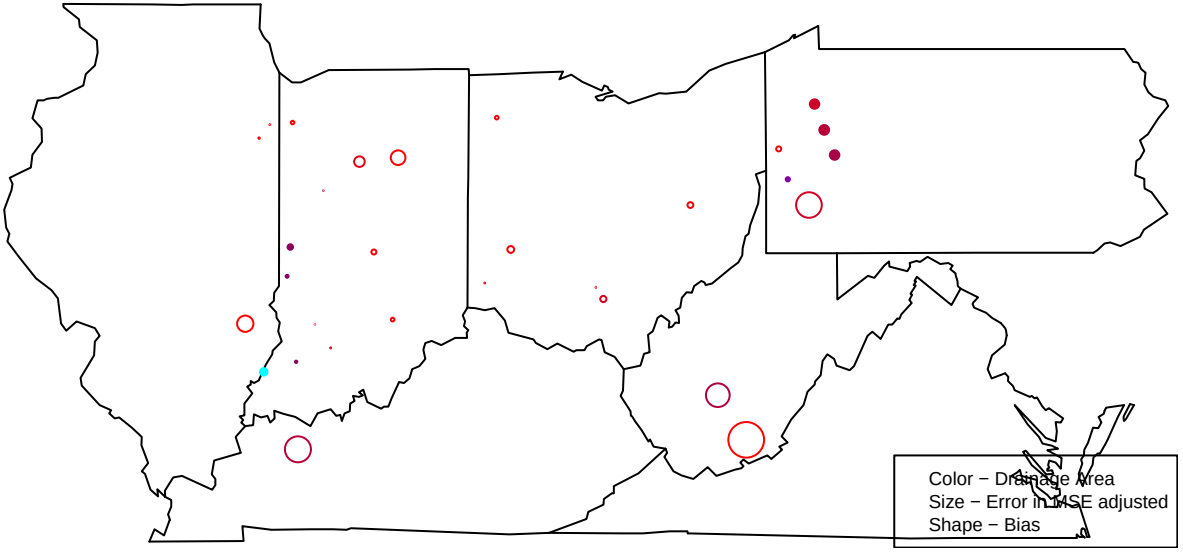
Min−Site 29

Mean−Site 30
9.4
9.5
9.6
9.7
9.8
SD−Site 30
0.2
0.3
0.4
0.5
0.6
Max−Site 30
10.4
10.6
10.8
11.0
Min−Site 30
8.4
8.5
8.6
8.7
8.8
8.9
9.0

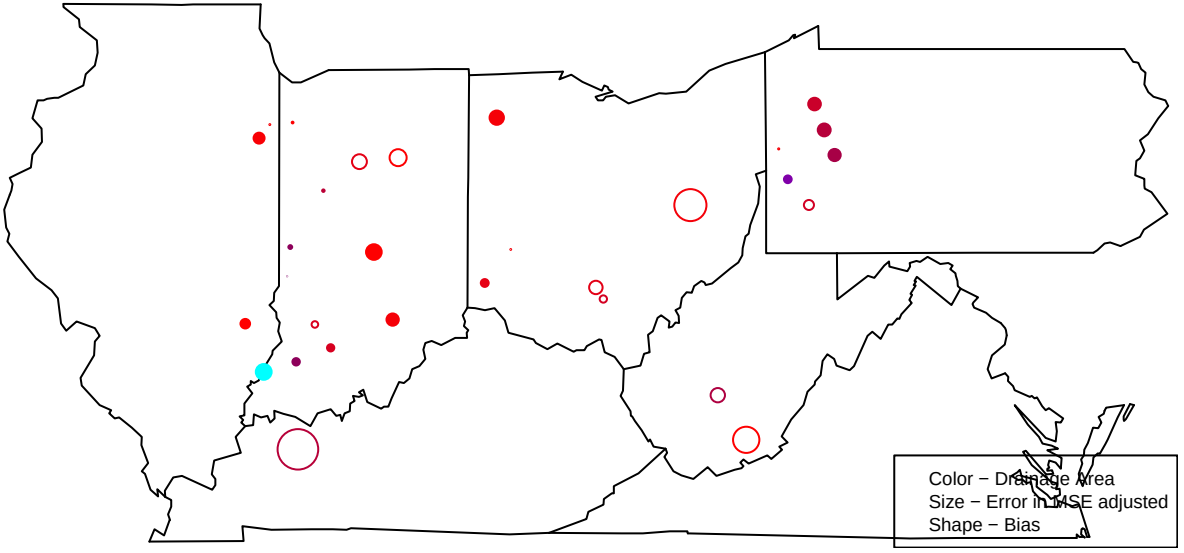
Error in Mean Streamflow Prediction



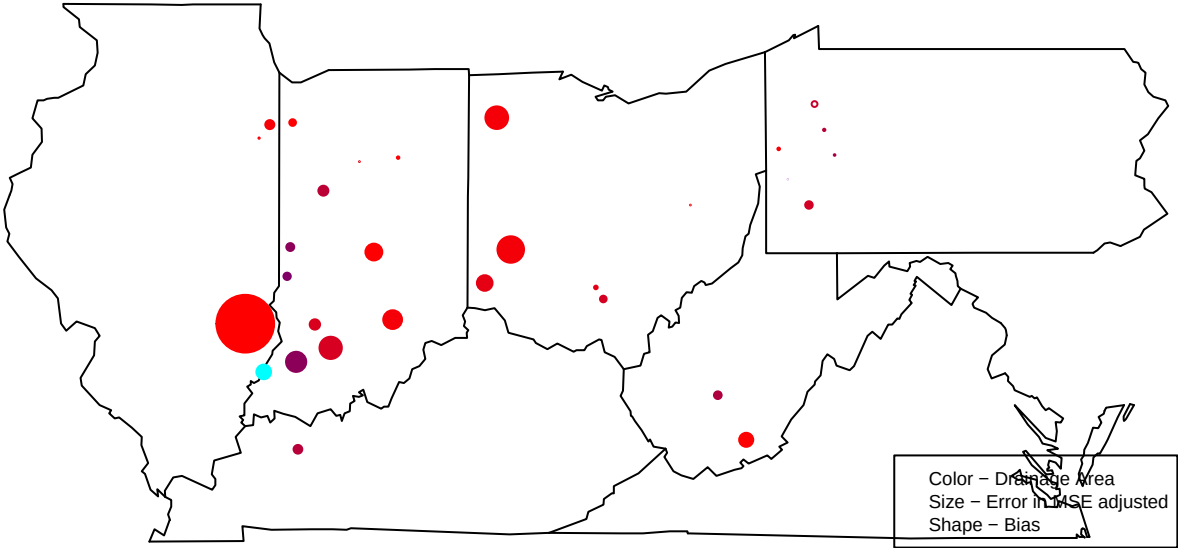
Error in Standard Deviation Streamflow Prediction

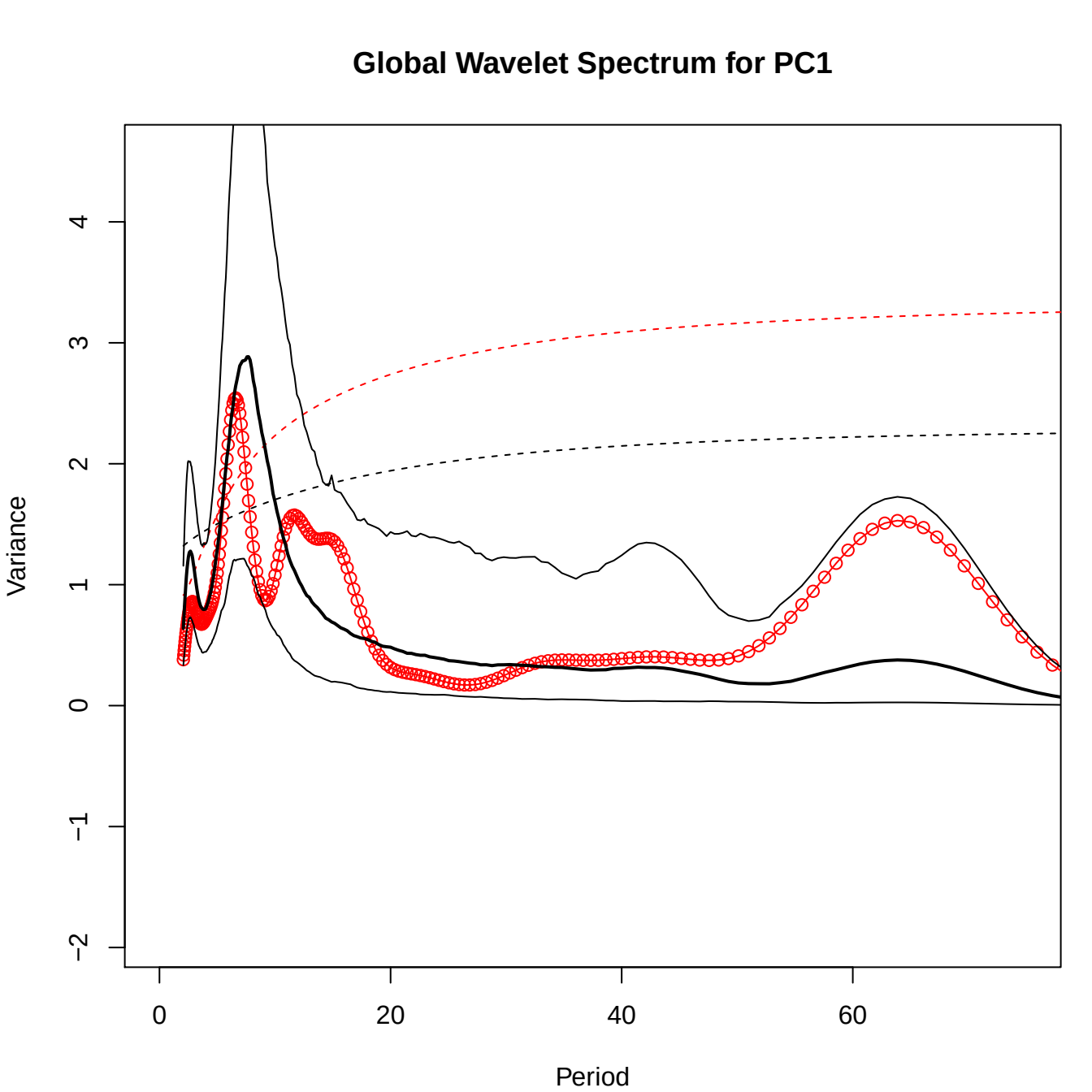


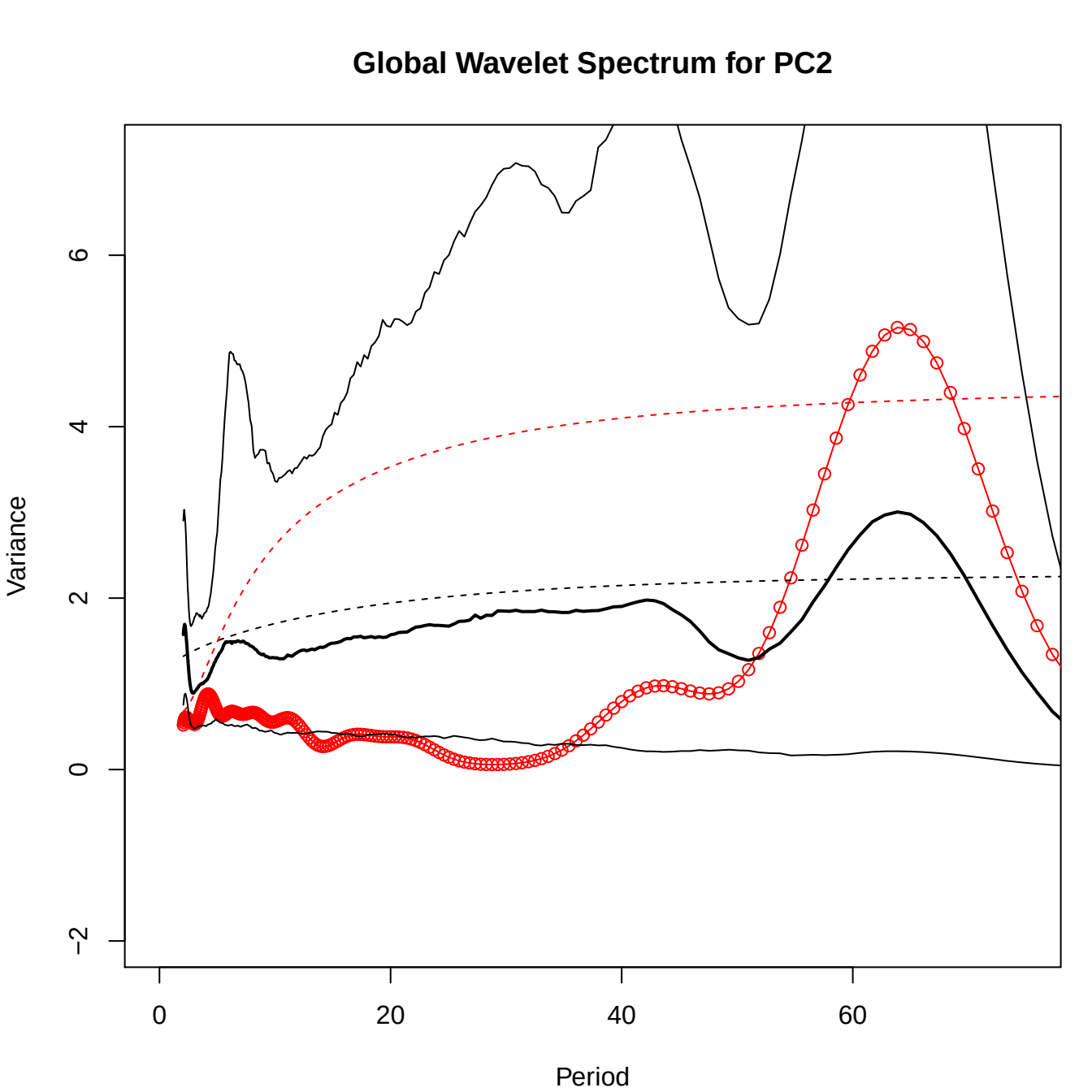
Error in Maximum Deviation Streamflow Prediction

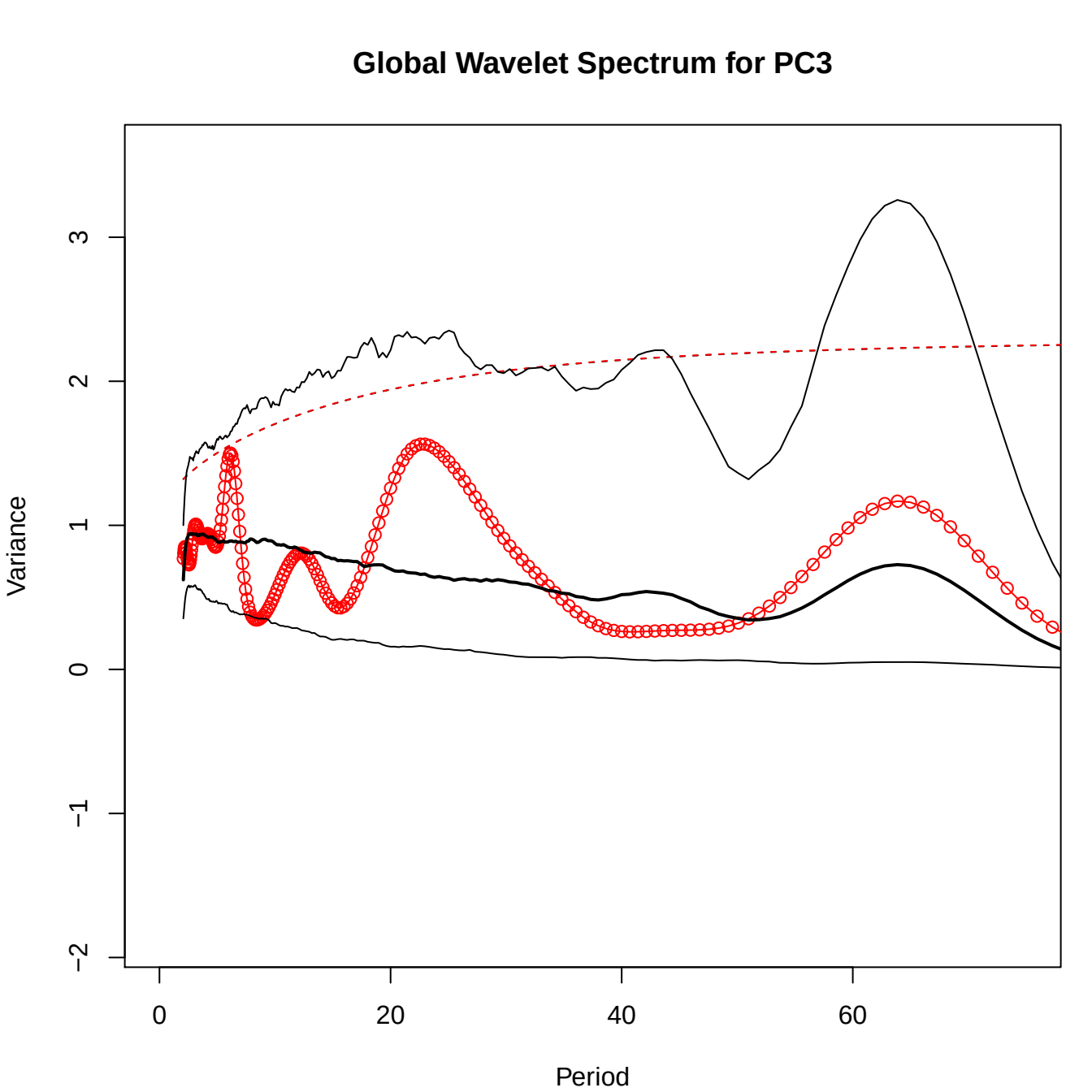


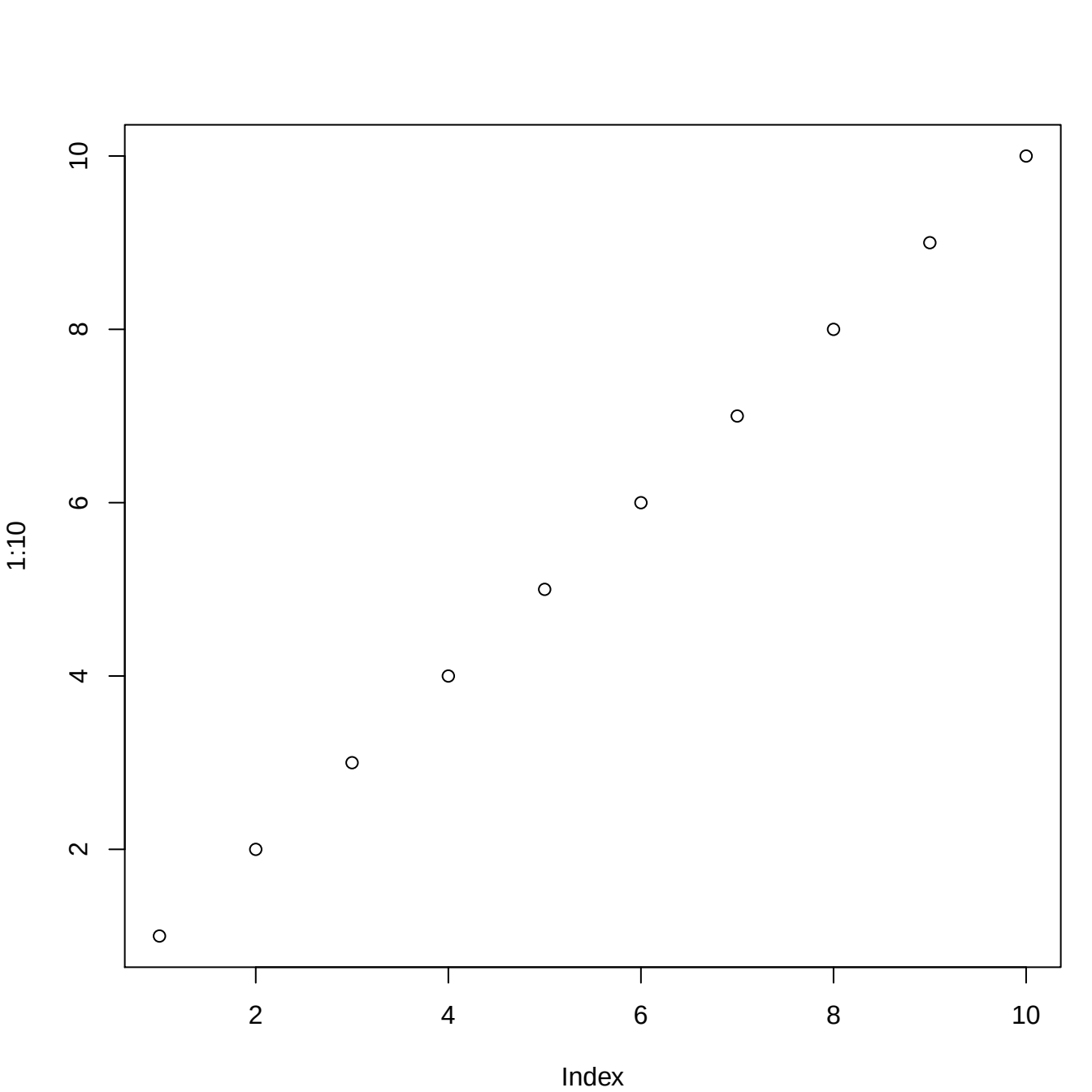
Error in Minimum Deviation Streamflow Prediction




Global Wavelet Spectrum for PC1
Variance
Period
4
3
2
1
0
−1
−2
0
20
40
60


Global Wavelet Spectrum for PC2
Variance
6
4
2
0
−2
0
20
40
60
Period


Global Wavelet Spectrum for PC3
Variance
3
2
1
0
−1
−2
0
20
40
60
Period


1:10
2
4
6
8
10
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