# 36-315: Statistical Graphics and Visualization

**Handout 10**
**Date: February 19, 2003**

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Time-series plots

Time-series plot is like a scatterplot
- with very different scale and smoothing requirements!
- prediction line (large span) shows long-range trend
- connected points (small span) show local oscillation

Things to find in a time-series plot:

- Trend, oscillation
- Outliers
- Change points

Vertical bars: Good for high outliers and large residuals, bad for trend

Often best to break time-series into components:
trend + residual, or
trend + oscillation + residual

Superposition - Drawing curves on top of each other.

Raw superposition - Curves drawn in same units. Used for qualitative comparisons of height ("which one is higher?", "when do they cross?"). *Not* good for showing quantitative difference of height (curve illusion).

Standardized superposition - Curves drawn in different units to line up their features. Used for time comparisons ("do oscillations match?", "are outliers in the same place?").

It is common to mistake the purpose of these plots.

Growth chart - Curves represent percent change from a given time. Same uses as standardized superposition, but often more interpretable.

Rate of change - Curves represent percent change from the previous time. Used for comparing trends ("which one is growing faster?").

List of figures:

1. Sunspots; different aspect ratios
2. Ozone in Stamford, CT (Chambers et al, 1983)
3. Residuals from ozone trend
4. Carbon dioxide time-series; decomposition and different aspect ratios (Cleveland, 1994)
5. Stamford vs. Yonkers; raw vs standardized superposition
6. Superposition of residuals
7. Scatterplot of residuals
8. Expenditures vs. SAT scores (3 plots) (Wainer, 1984)
9. NYT growth chart
10. Ozone growth chart; from time 1 and from time 90

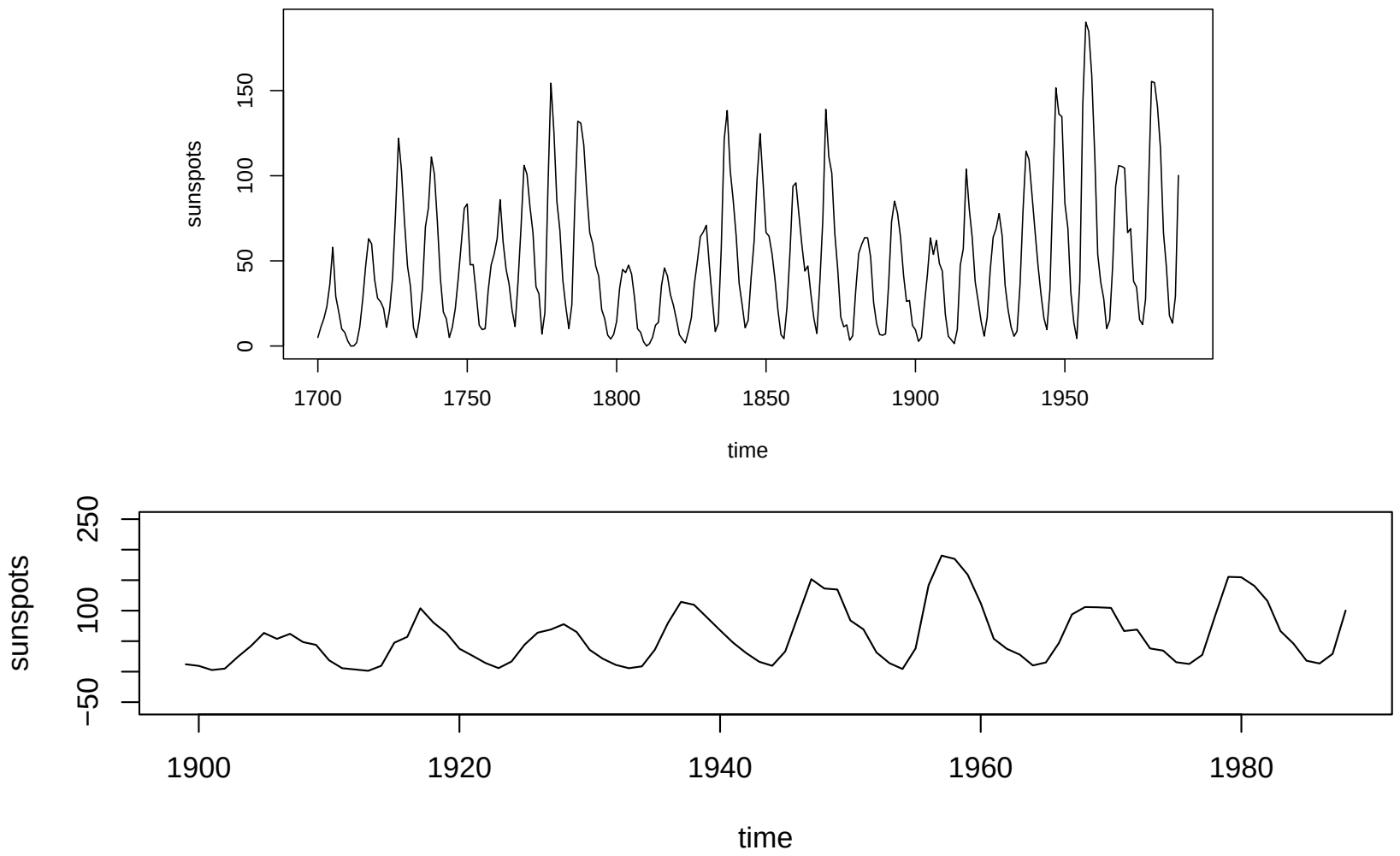
# References

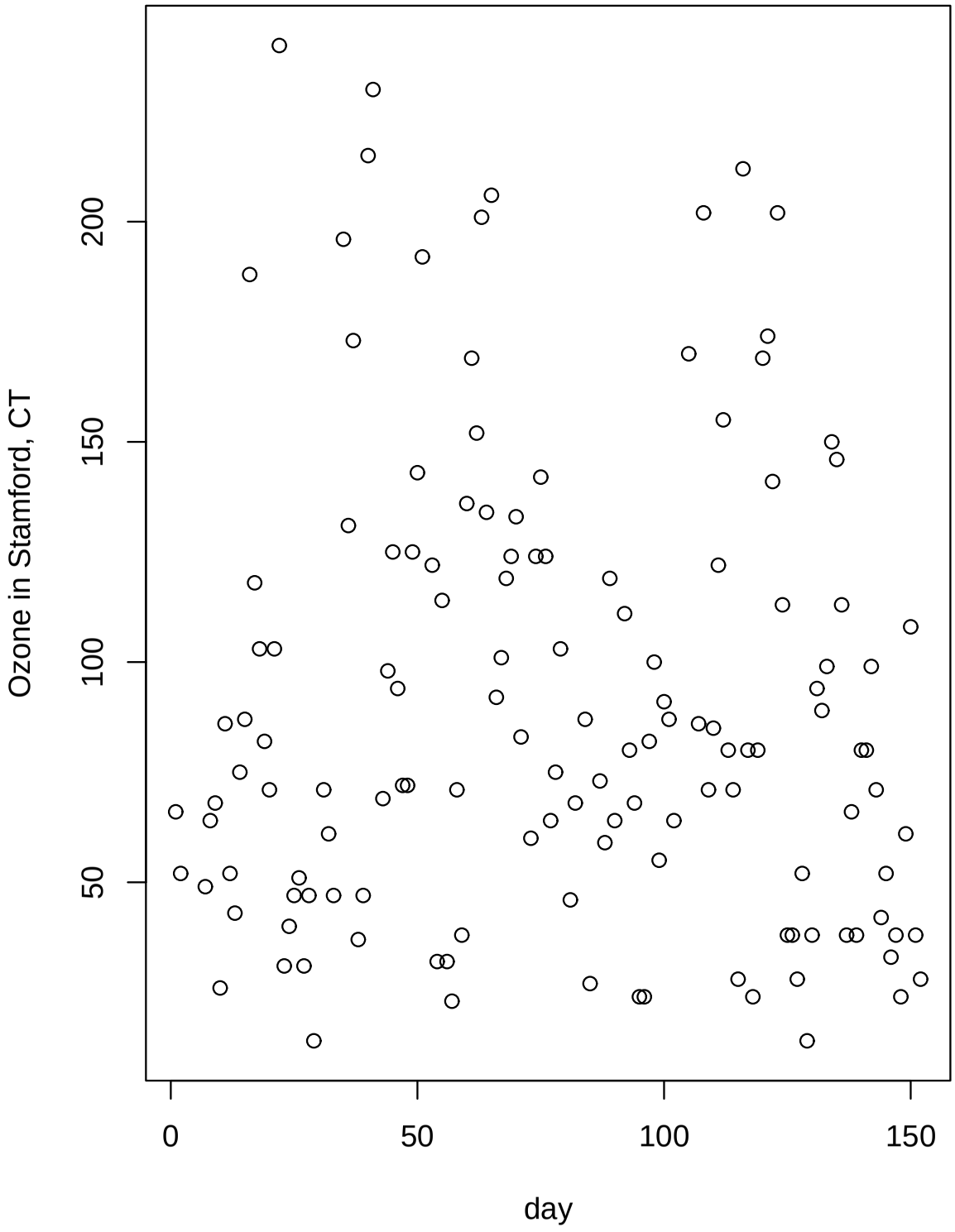

[1] J. M. Chambers, W. S. Cleveland, B. Kleiner, and P. A. Tukey. *Graphical methods for data analysis.* Wadsworth, 1983.

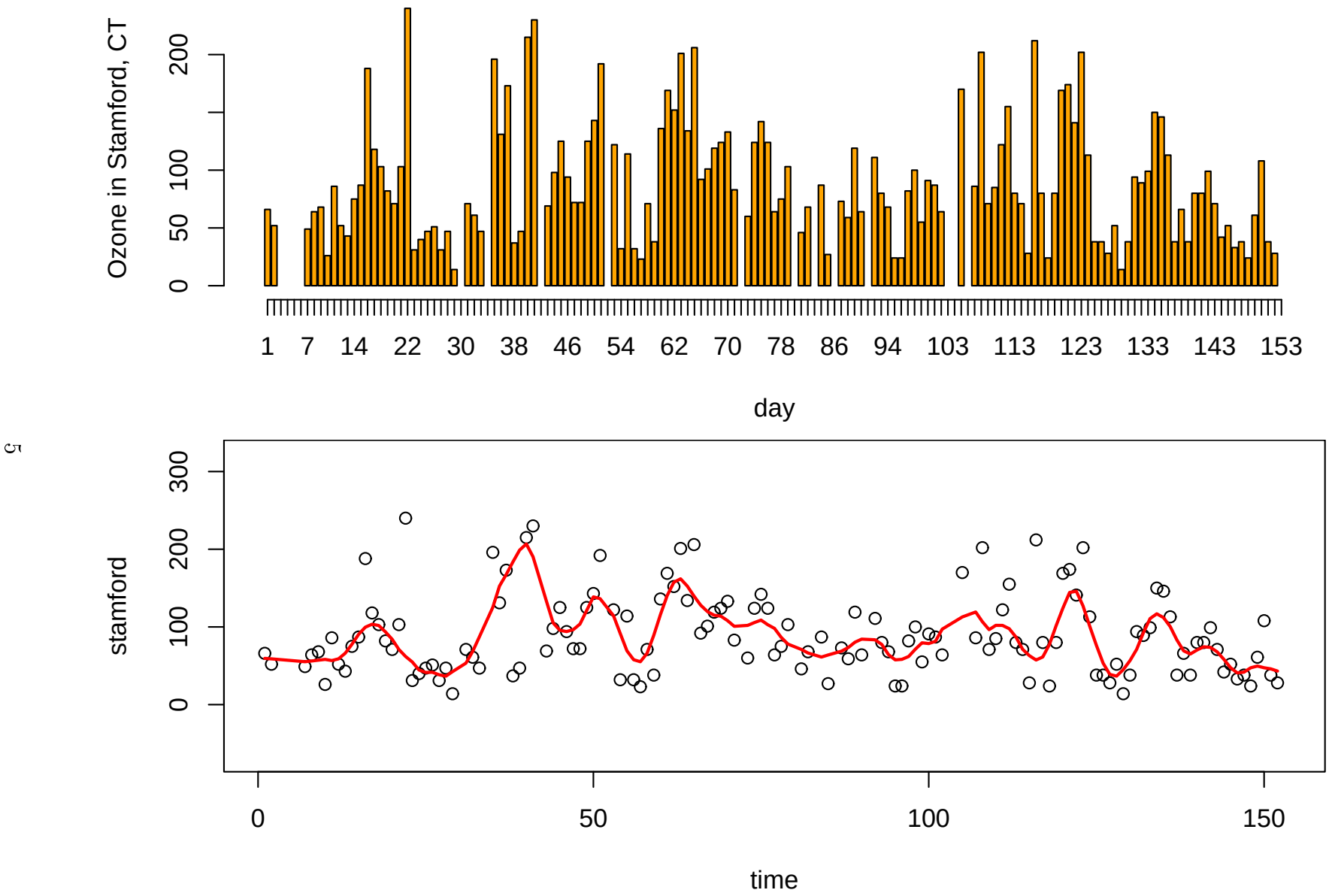
[2] William S. Cleveland. *The Elements of Graphing Data.* Hobart Press, NJ, 1994.

[3] Gary Klass. "Constructing Good Charts and Graphs", 2002 `http://lilt.ilstu.edu/gmklass/pos138/datadisplay/goodcharts.htm`

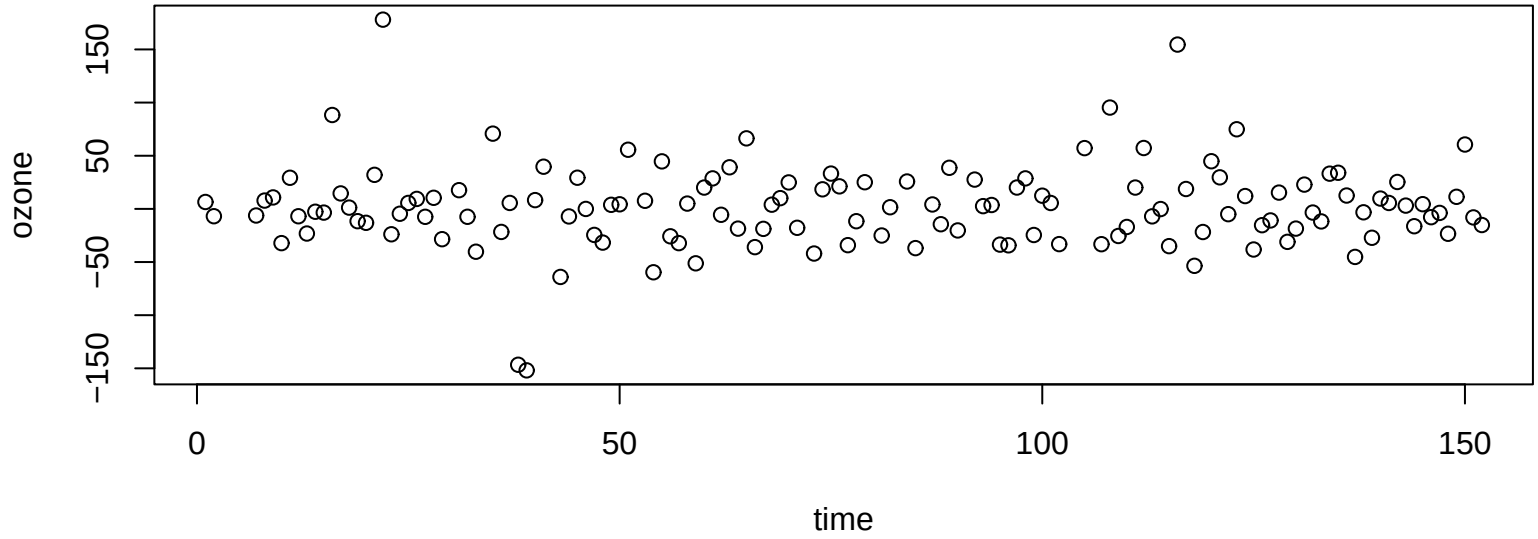
[4] Howard Wainer. How to display data badly. *Chance Workshop Lectures.* `http://www.dartmouth.edu/ chance/ChanceLecture/AudioVideo.html` Also an article in *The American Statistician* 38:137–147, 1984.

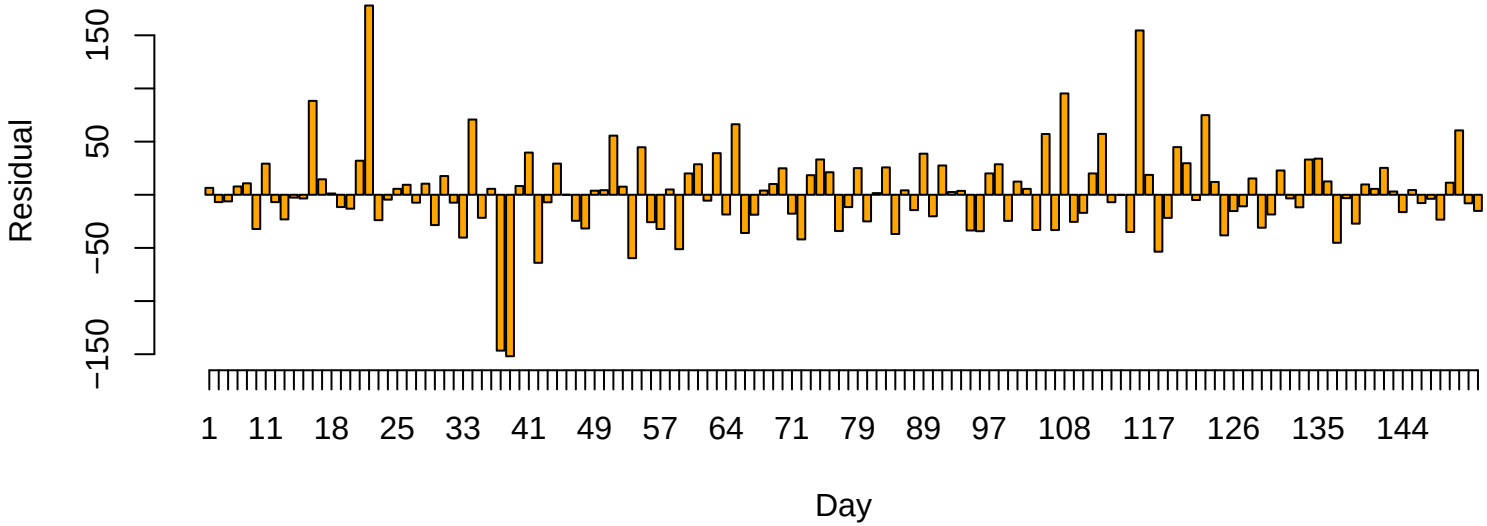

sunspots
0
50
100
150
1700
1750
1800
1850
1900
1950
time
sunspots
−50
100
250
1900
1920
1940
1960
1980
time


Ozone in Stamford, CT
50
100
150
200
0
50
100
150
day

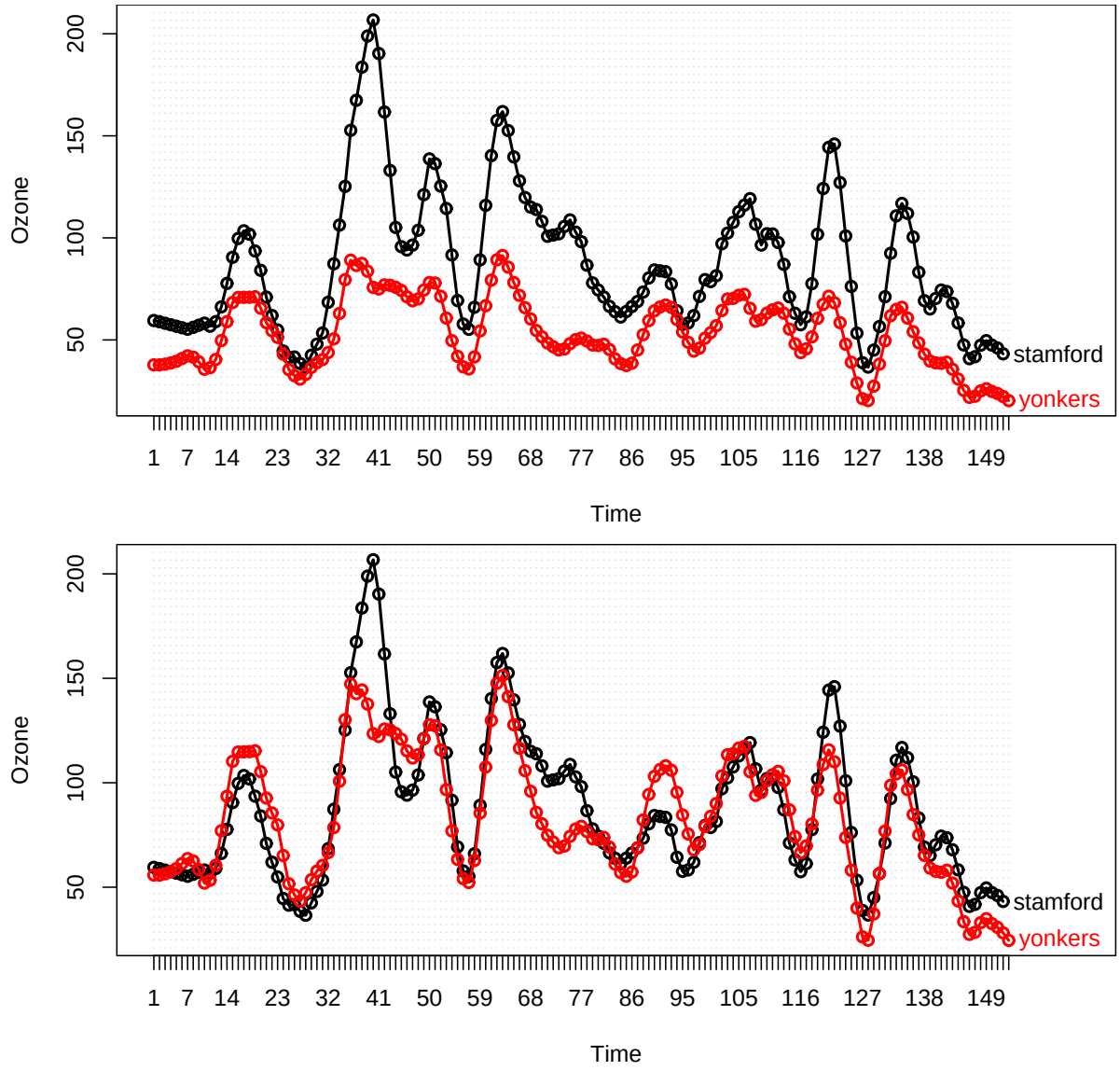

Ozone in Stamford, CT
0
50
100
200
1
7
14
22
30
38
46
54
62
70
78
86
94
103
113
123
133
143
153
day
stamford
0
100
200
300
0
50
100
150
time

Residuals:

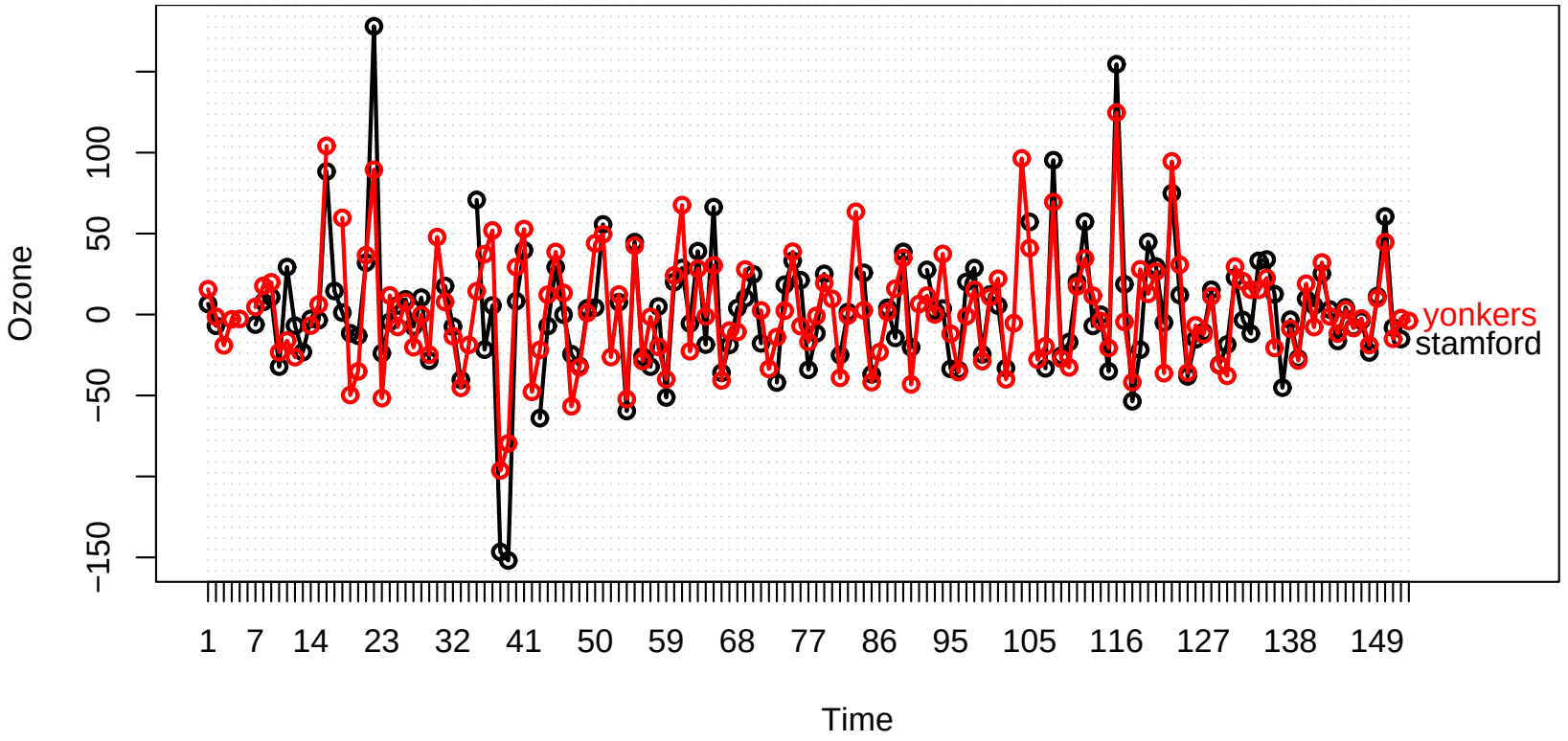

ozone
150
50
−50
−150
0
50
100
150
time

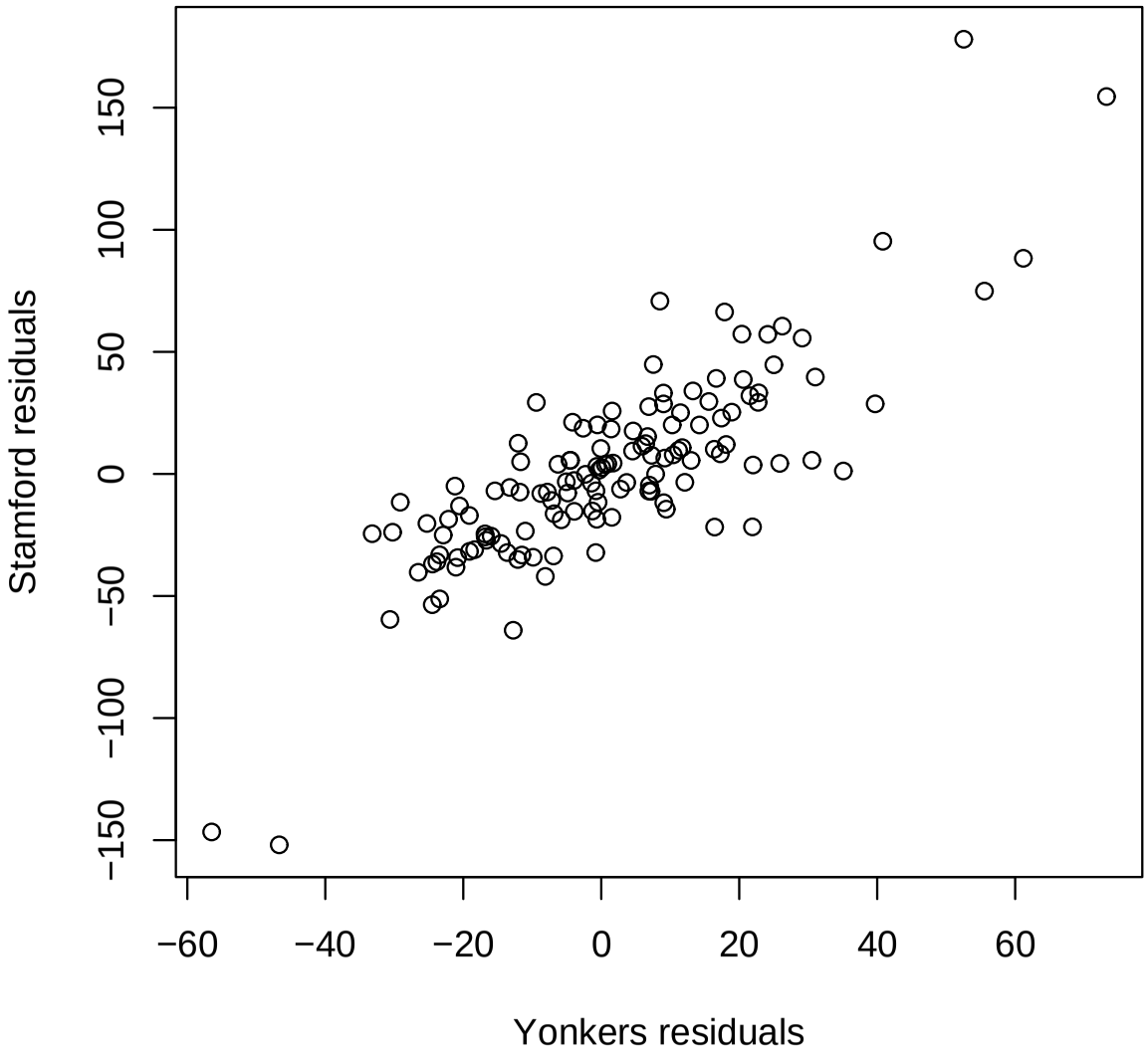
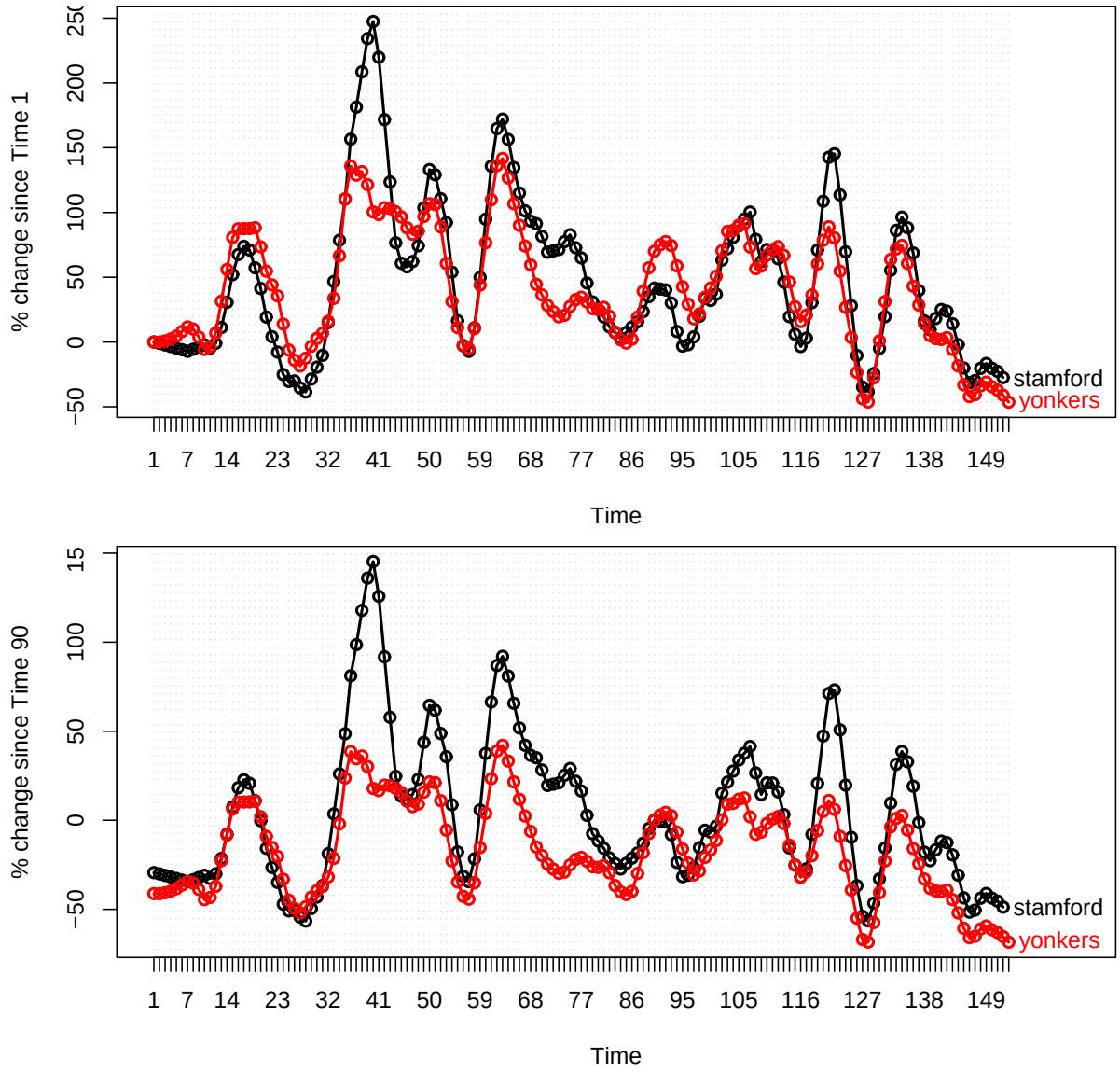

Residual
150
50
−50
−150
1
11
18
25
33
41
49
57
64
71
79
89
97
108
117
126
135
144
Day

Raw vs. standardized superposition:



Standardized superposition of residuals:




Stamford residuals
150
100
50
0
−50
−100
−150
−60
−40
−20
0
20
40
60
Yonkers residuals

Growth charts (from time 1 and from time 90):