Better Data Visualisation

Doug McNeall

Met Office Hadley Centre
betterfigures.org

Contents

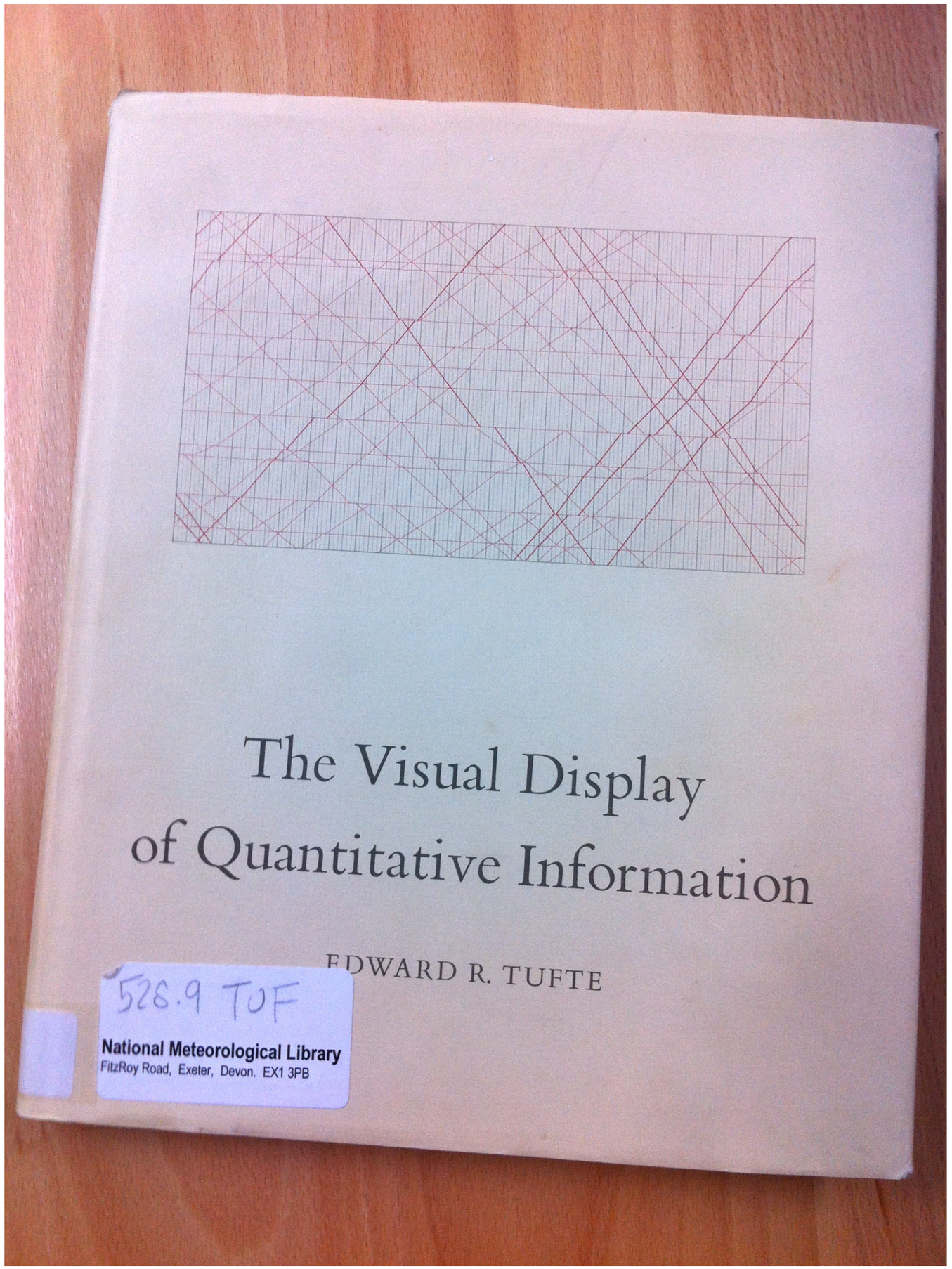
- Some historical data visualisation
- Some terrible (evil?) data visualisation
- Some great data visualisation
- A few principles and practical hints

Note

- I'm an amateur
- This talk is about statistical graphics NOT infographics
- Things are getting better
- Really, this talk is for your supervisors/ bosses.

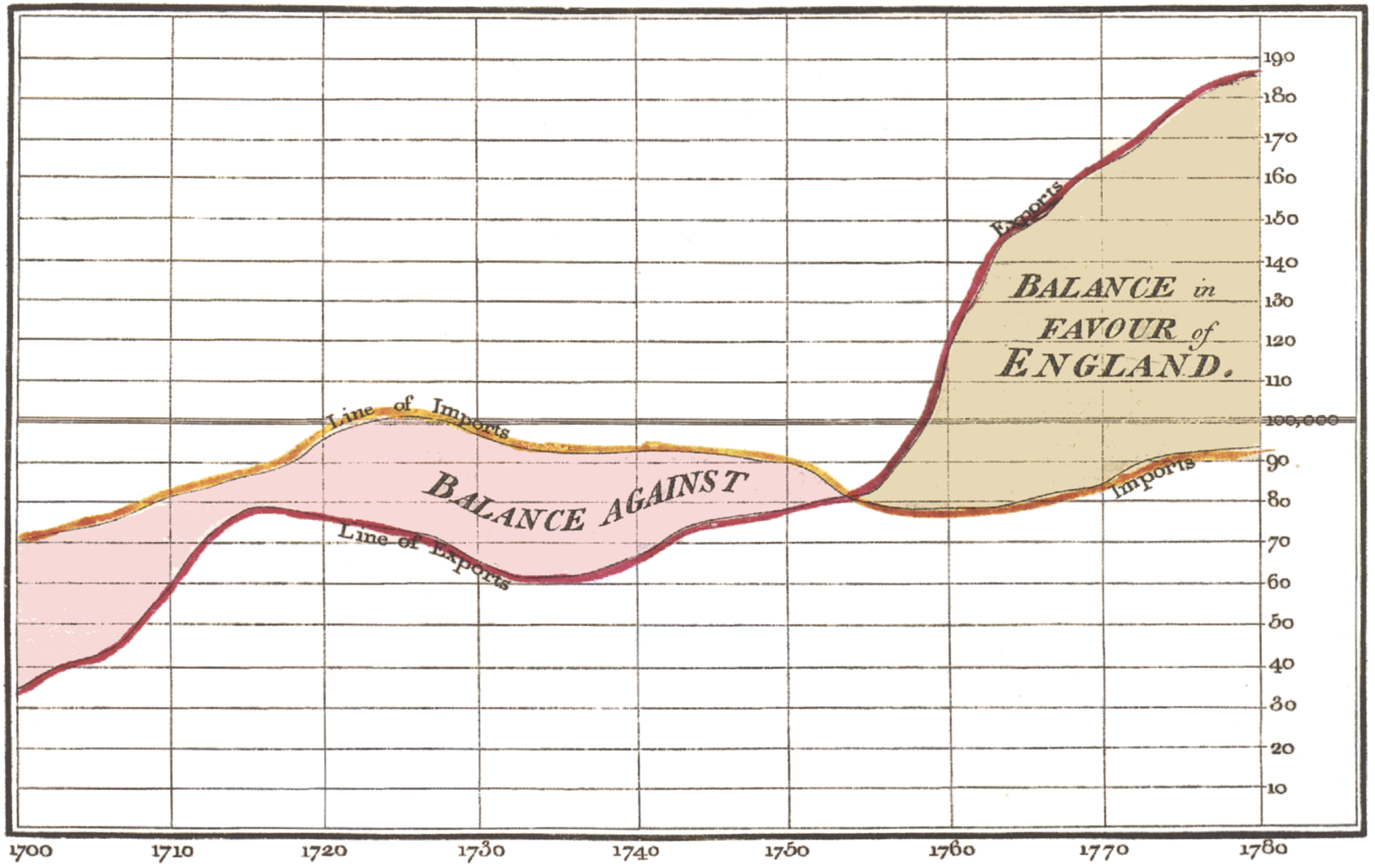
The Met Office

RECONSTRUCTION


The Visual Display
of Quantitative Information
EDWARD R. TUFTE
528.9 TUF
National Meteorological Library
FitzRoy Road, Exeter, Devon. EX1 3PB

Some history

Exports and Imports to and from DENMARK & NORWAY from 1700 to 1780.



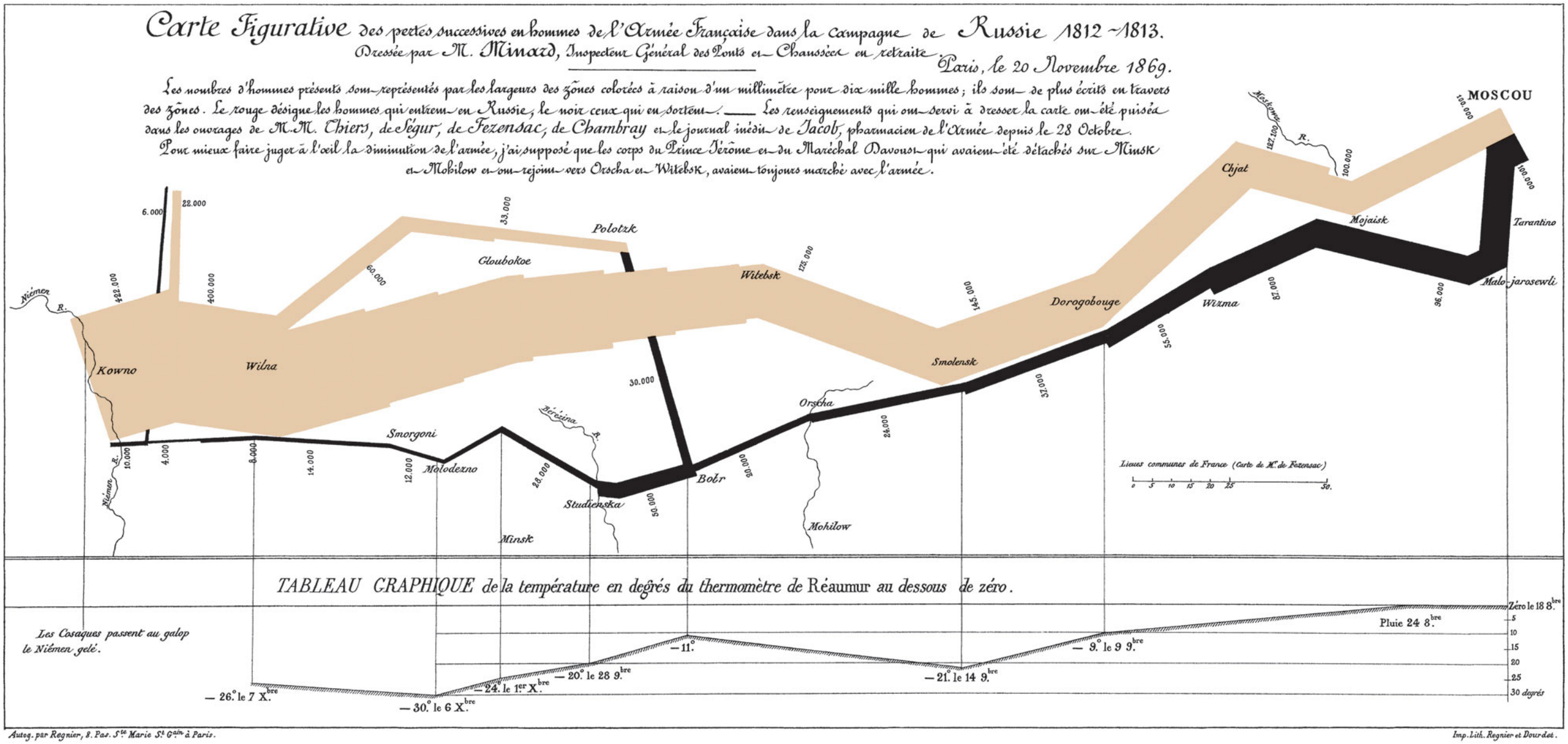
The Bottom line is divided into Years, the Right hand line into £10,000 each.

Published as the Act directs, 14th May 1786. by Wm Playfair

Neele sculpt 352, Strand, London.

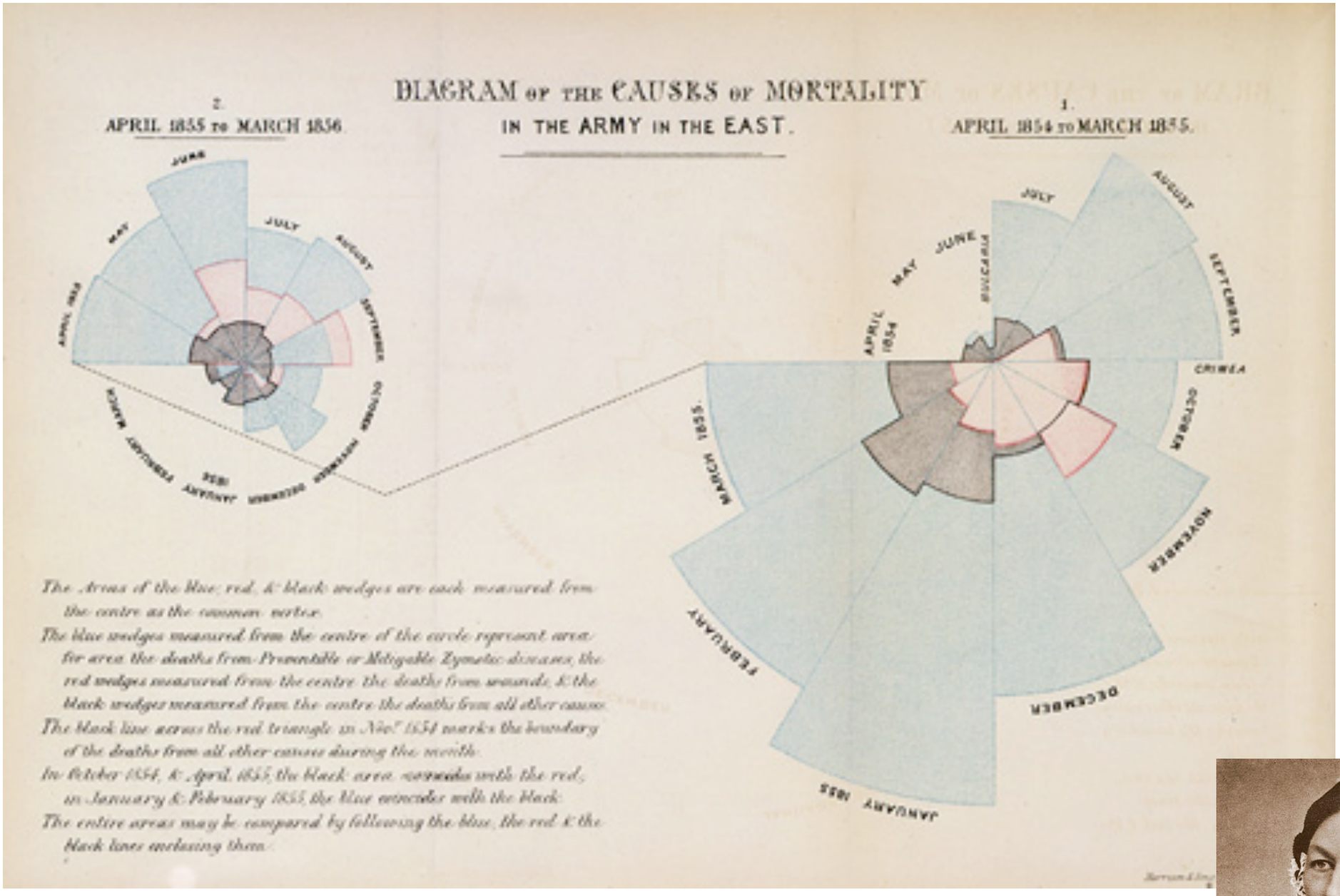
http://en.wikipedia.org/wiki/File:Playfair_TimeSeries-2.png

William Playfair (1759-1823)



Charles Joseph Minard (1781-1870)

Source: http://en.wikipedia.org/wiki/File:Minard.png



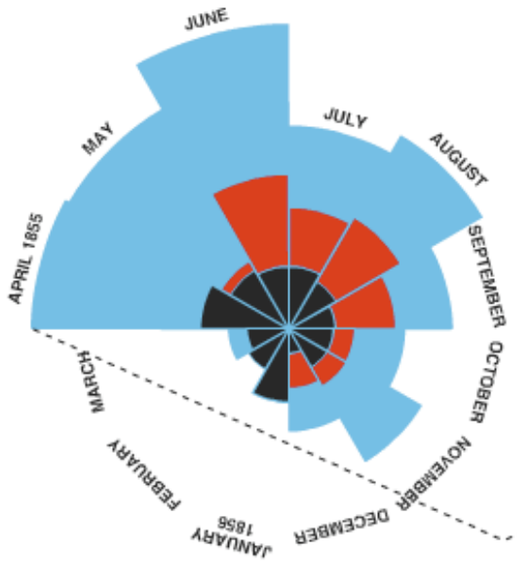
http://understandinguncertainty.org/coxcombs

Florence Nightingale (1820-1910)

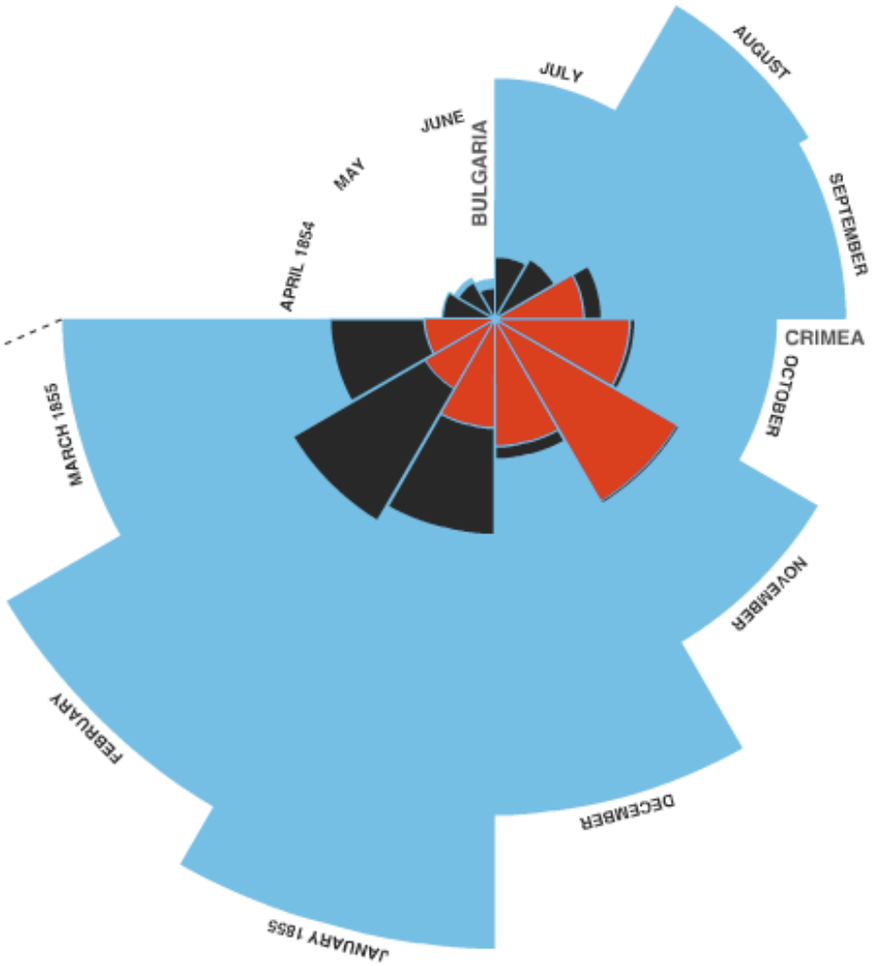
http://en.wikipedia.org/wiki/File:Florence_Nightingale_CDV_by_H_Lenthall.jpg

DIAGRAM OF THE CAUSES OF MORTALITY
IN THE ARMY IN THE EAST .

2 .
APRIL 1855 TO MARCH 1856 .



1 .
APRIL 1854 TO MARCH 1855 .



The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex

The blue wedges measured from the centre of the circle represent area for are the deaths from Preventible or Mitigable Zymotic Diseases, the red wedges measured from the centre the deaths from all other causes

The black line across the red triangle in Nov' 1854 marks the boundary of the deaths from all other causes during the month

In October 1854, & April 1855, the black area coincides with the red, in January & February 1856, the blue coincides with the black

The entire areas may be compared by following the blue, the red & the black lines enclosing them.

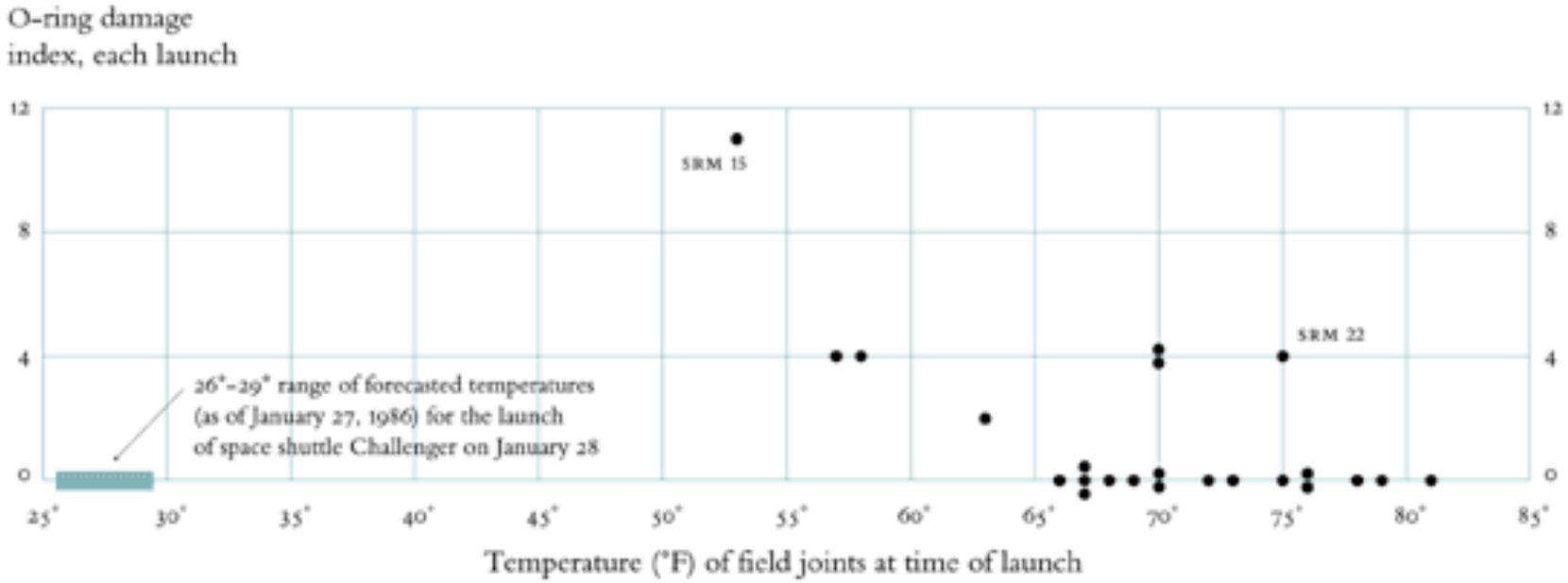
http://indiemaps.com/blog/2008/10/nightingales-roses-in-actionscript-3/

http://en.wikipedia.org/wiki/File:Snow-cholera-map-1.jpg

John Snow (1813-1858) & the Broad Street cholera outbreak

http://en.wikipedia.org/wiki/File:John_Snow.jpg

The Space Shuttle Challenger disaster, 1986



http://www.edwardtufte.com/tufte/books_textb

STS-51-L crew: (front row) Michael J. Smith, Dick Scobee, Ronald McNair; (back row) Ellison Onizuka, Christa McAuliffe, Gregory Jarvis, Judith Resnik.

http://en.wikipedia.org/wiki/File:Challenger_flight_51-l_crew.jpg

Some principles and tips

“Graphical displays should

Quotes from Edward Tufte: The Quantitative Display of Information

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- avoid distorting what the data have to say
- present many numbers in a small space

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- encourage the eye to compare different pieces of data
- reveal the data at several levels of detail, from a broad overview to the fine structure

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- present many numbers in a small space
- encourage the eye to compare different pieces of data
- reveal the data at several levels of detail, from a broad overview to the fine structure
- serve a reasonably clear purpose: description, exploration, tabulation, or decoration

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- avoid distorting what the data have to say
- present many numbers in a small space
- encourage the eye to compare different pieces of data
- reveal the data at several levels of detail, from a broad overview to the fine structure
- serve a reasonably clear purpose: description, exploration, tabulation, or decoration
- be closely integrated with the statistical and verbal descriptions of a data set.”

Quotes from Edward Tufte: The Quantitative Display of Information

"...better to violate any principle than to put graceless or inelegant marks on paper."

Quotes from Edward Tufte: The Quantitative Display of Information

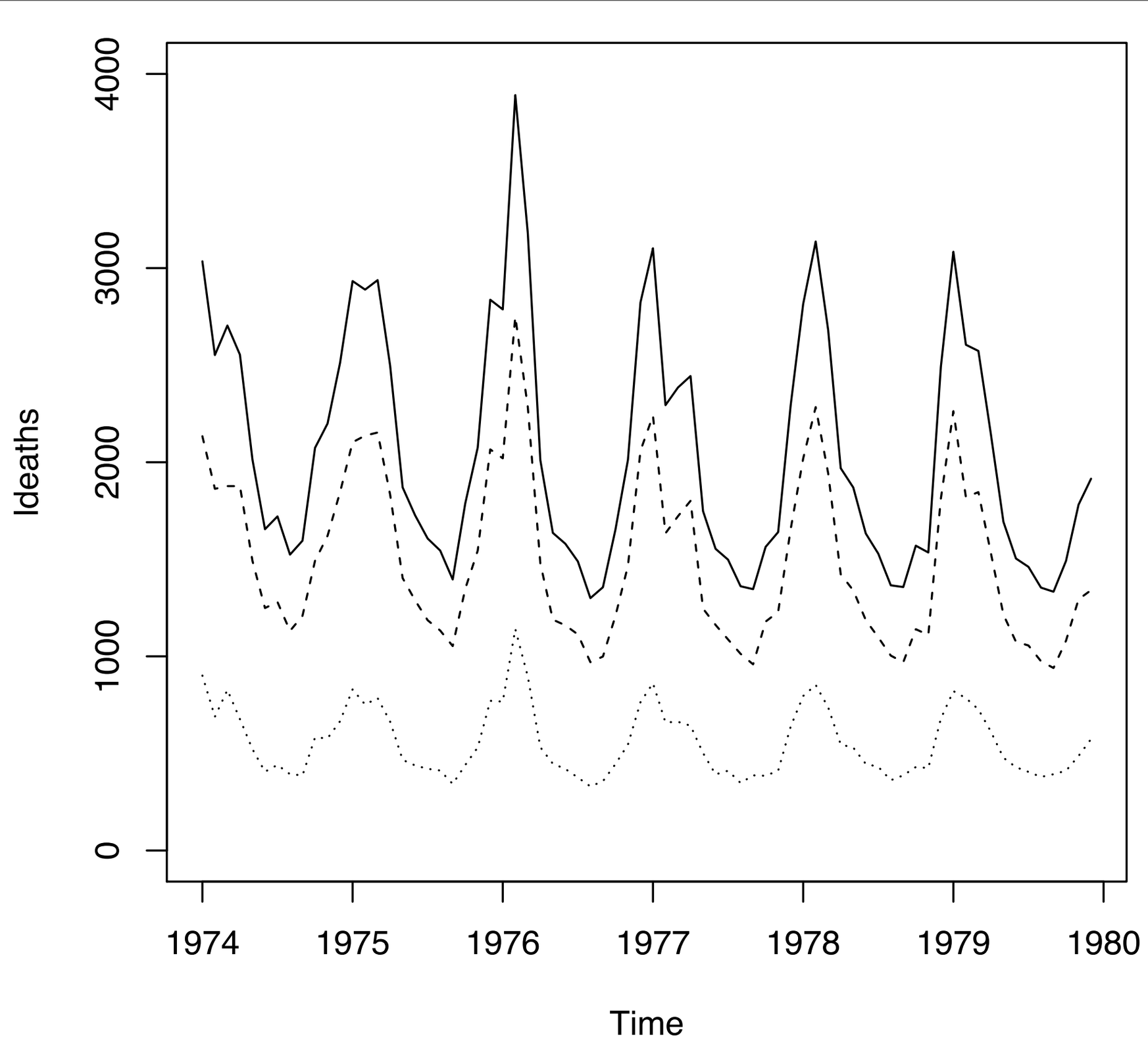
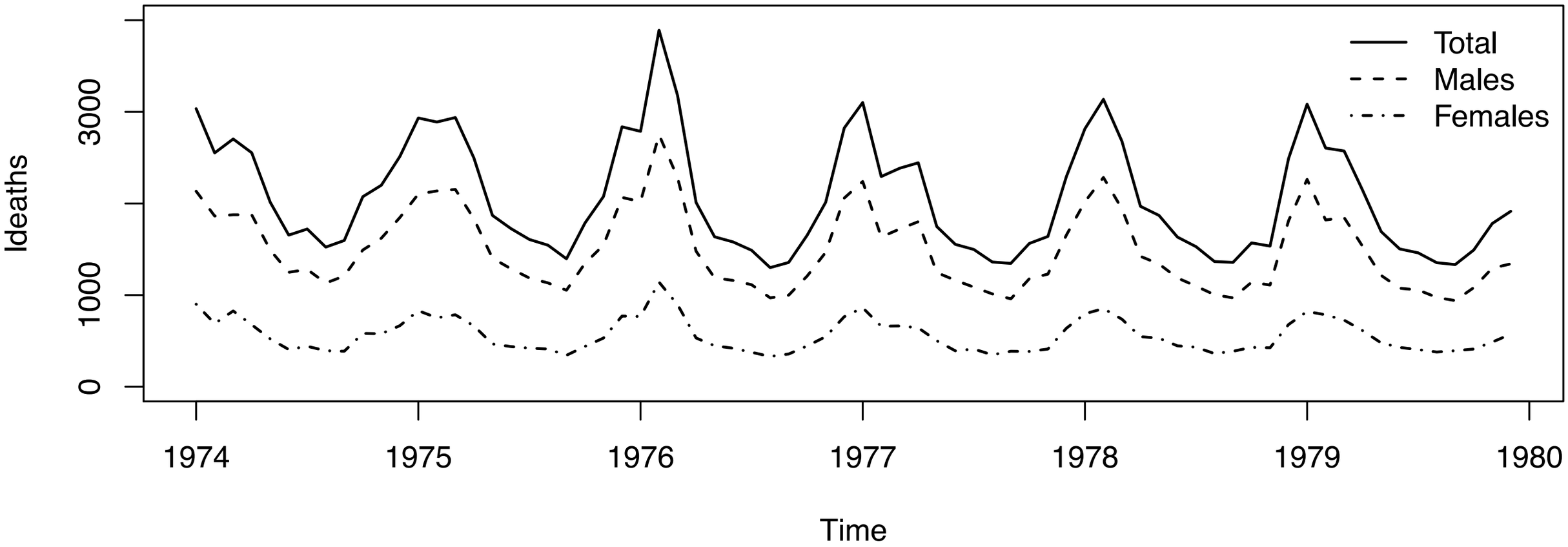
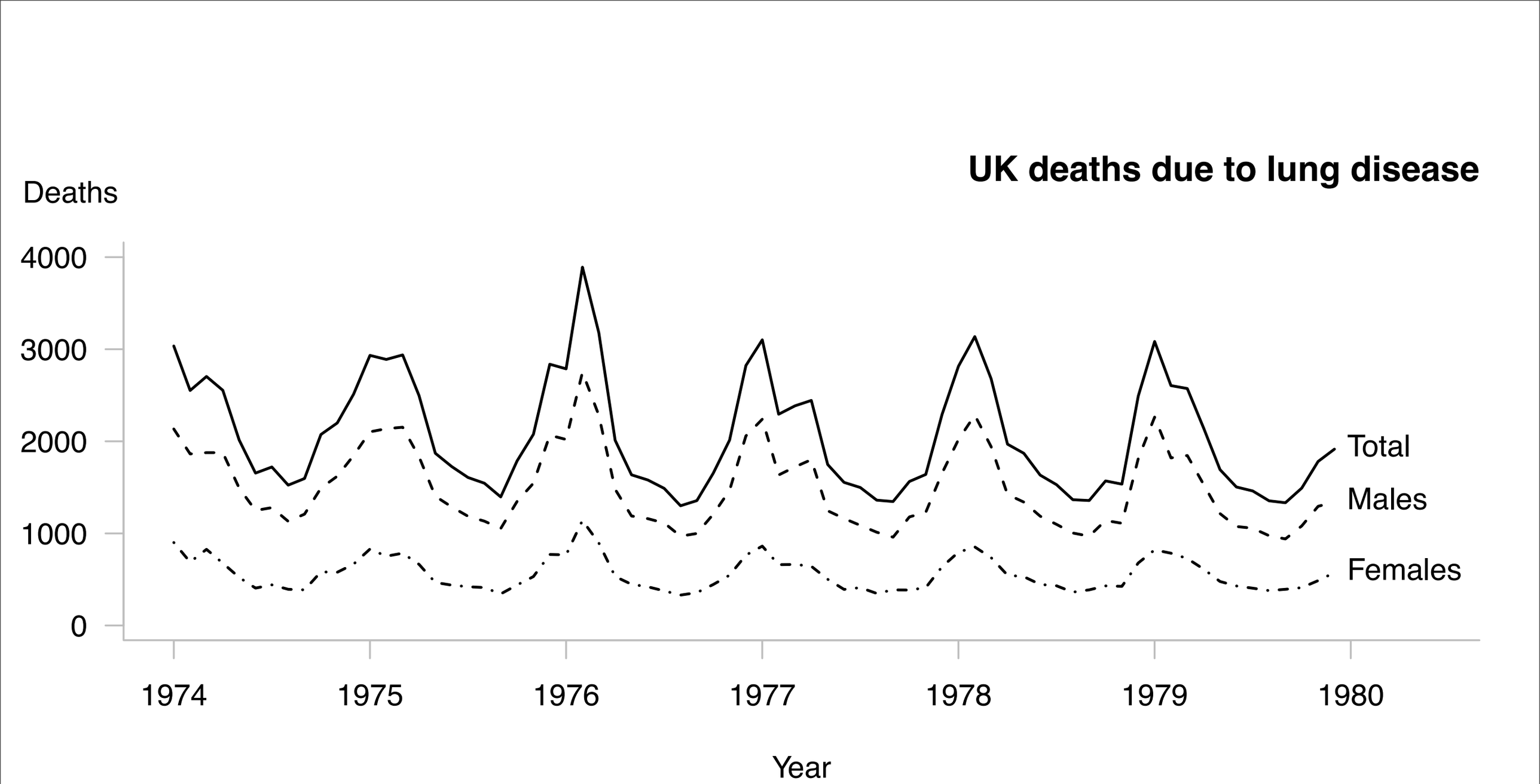
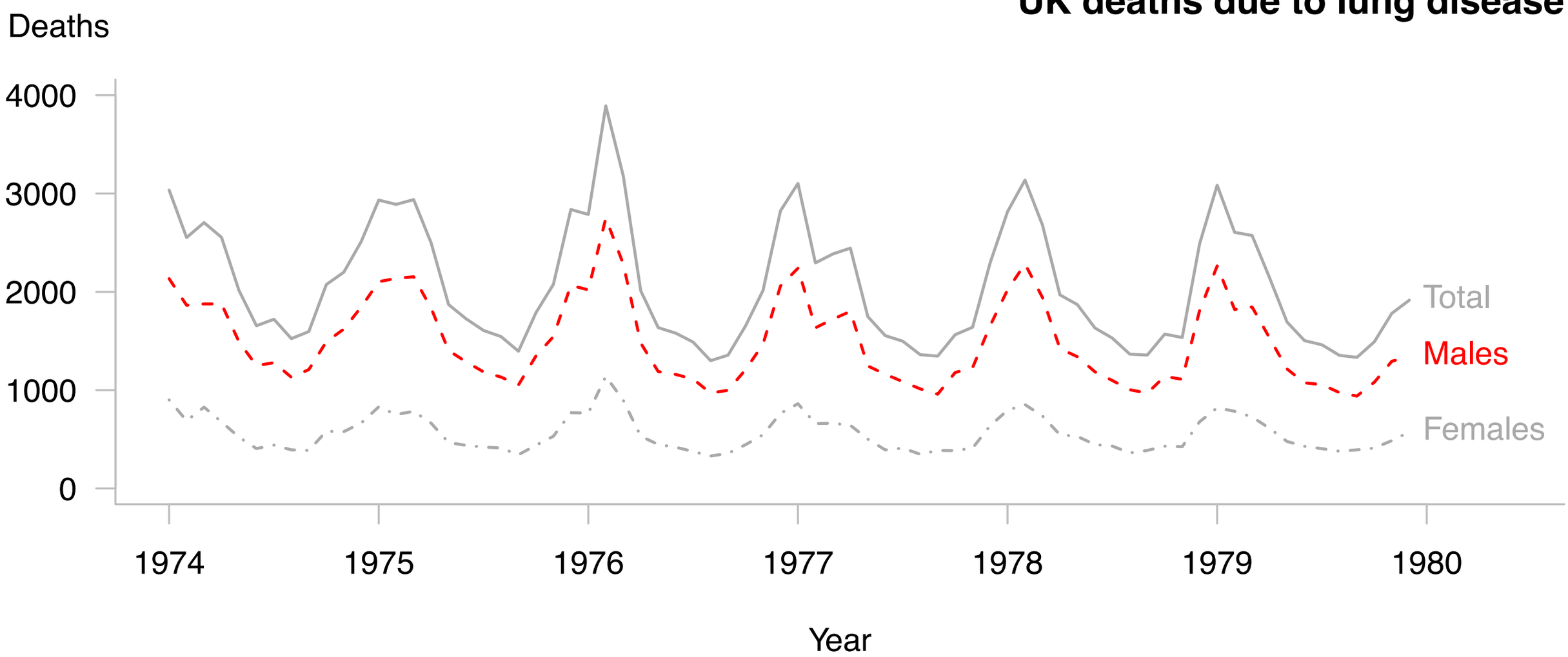


Fig 1. Monthly deaths due to lung disease in the UK. The dotted line shows number of female deaths, the dashed line shows male deaths, with the total shown by the solid line.

- Remove non-data ink (or pixels), where possible
- Don’t make the reader work too hard
- Design is choice: *what is it you are trying to say?*


ldeaths
0
1000
3000
Total
Males
Females
1974
1975
1976
1977
1978
1979
1980
Time


UK deaths due to lung disease
Deaths
4000
3000
2000
1000
0
Total
Males
Females
1974
1975
1976
1977
1978
1979
1980
Year


UK deaths due to lung disease
Deaths
4000
3000
2000
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Total
Males
Females
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1975
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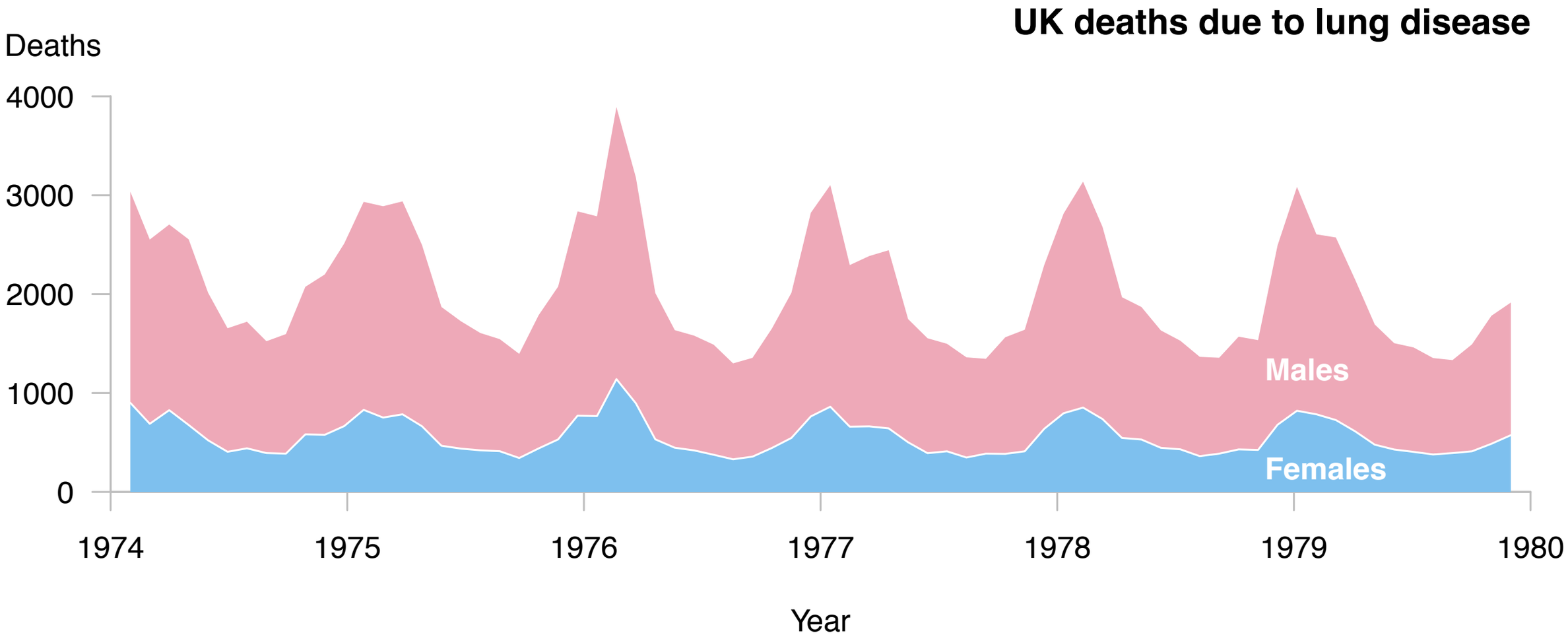
Year


UK deaths due to lung disease
Deaths
4000
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2000
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Males
Females
1974
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1976
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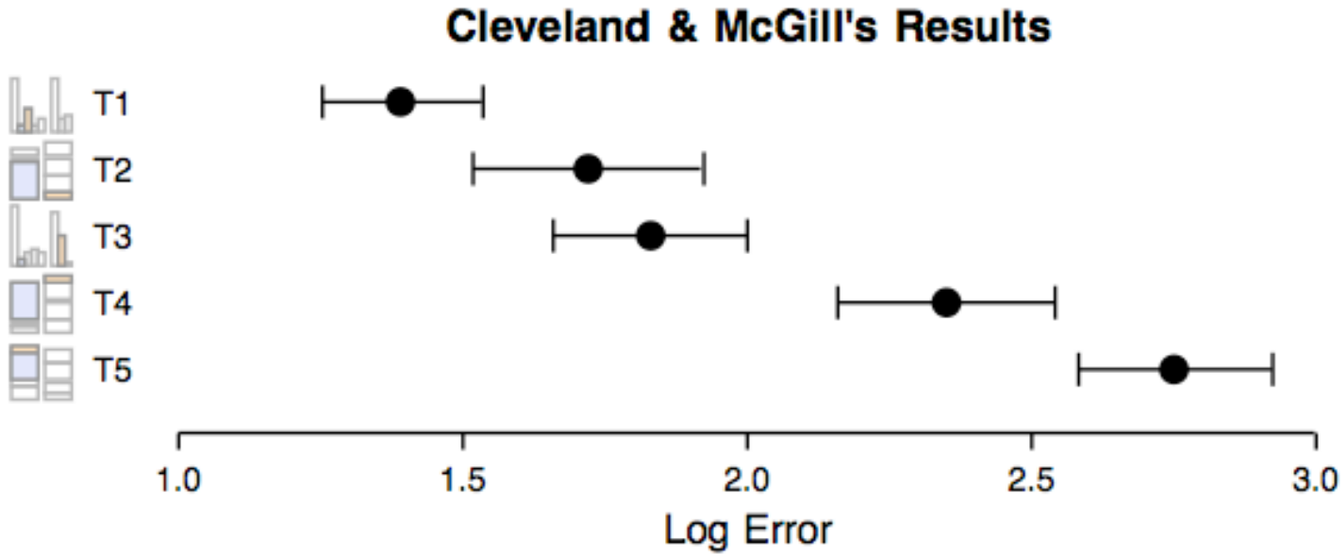
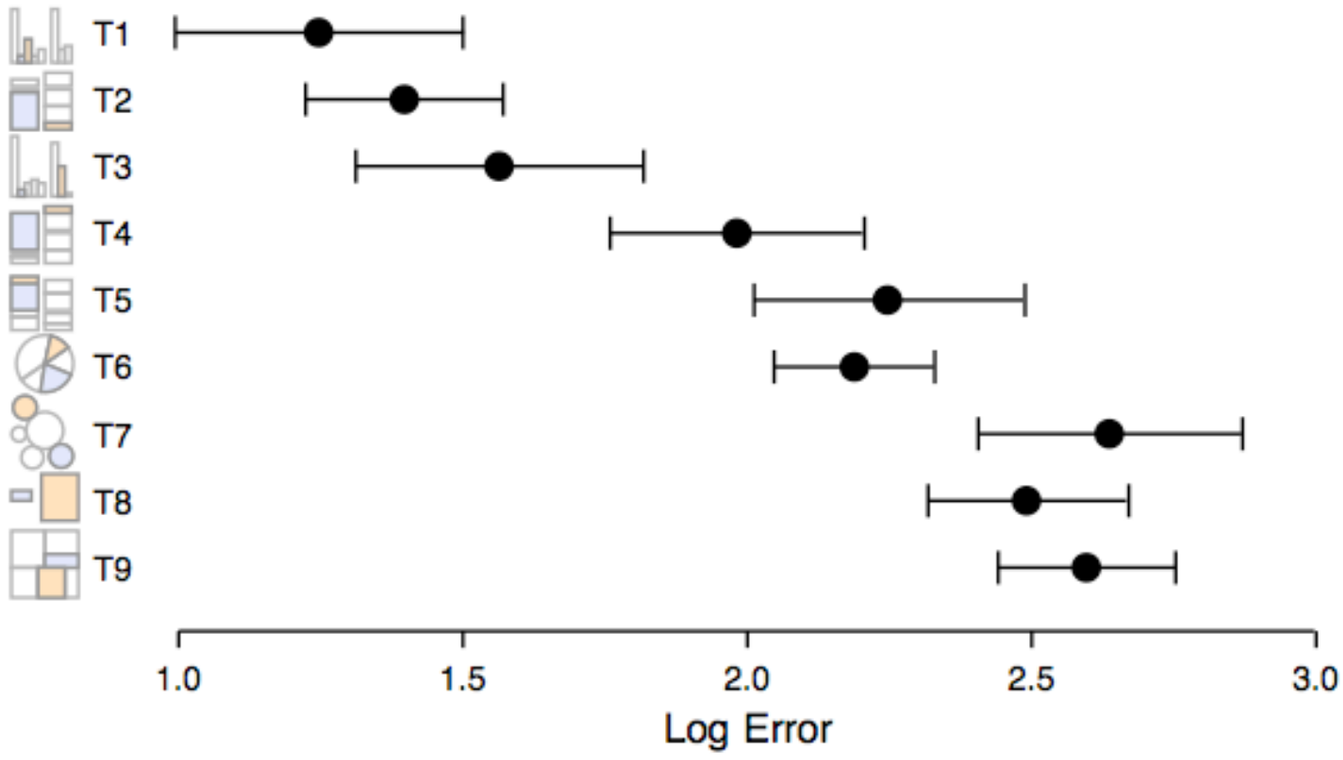
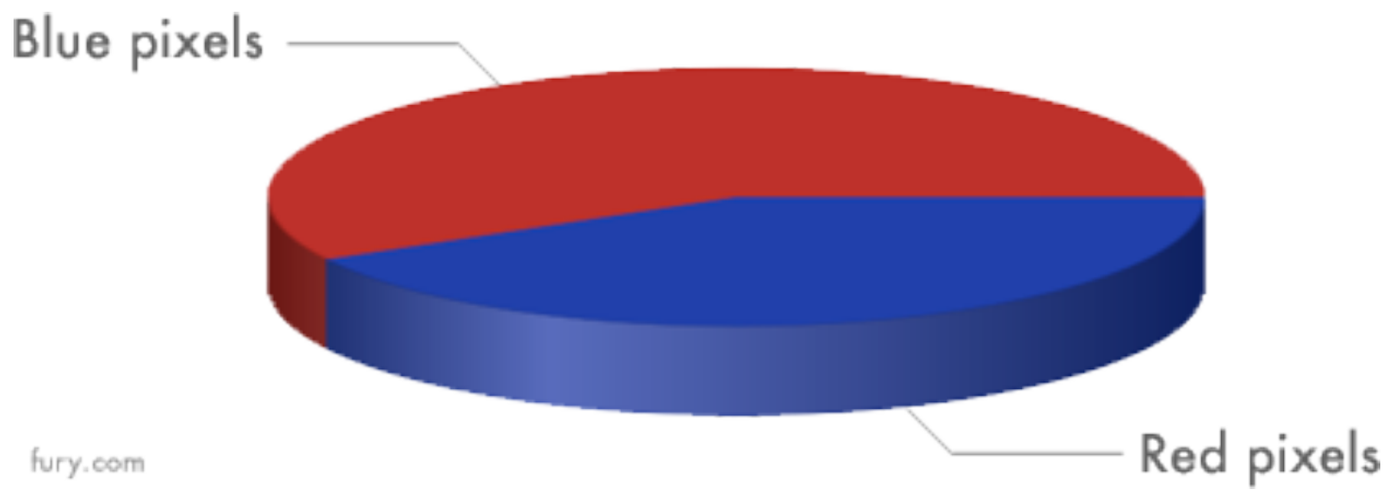
1980
Year





Crowdsourcing Graphical Perception: Using Mechanical Turk to Assess Visualization Design

Jeffrey Heer and Michael Bostock



Why 3d pie charts are bad

THE GLOBAL WARMING POLICY FOUNDATION

DIRECTOR: DR BENNY PEISER

GWPF

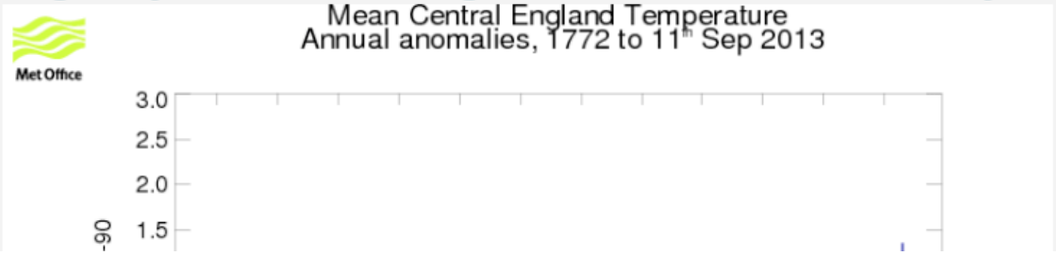
Restoring balance and trust to the climate debate

BEST OF BLOGS

UK ANNUAL TEMPERATURE PLUNGES BY ALMOST 1° CELSIUS, BACK TO 1940S LEVELS

Date: 12/09/13 | P Gosselin, No Tricks Zone blog

Looking at the temperature data for the last decade or so, one thing stands clear: Global temperatures have been showing many more signs of cooling than warming. Britain's annual temperature has plunged by almost a full degree Celsius over the last 13 years.



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DIRECTOR: DR BENNY PEIS

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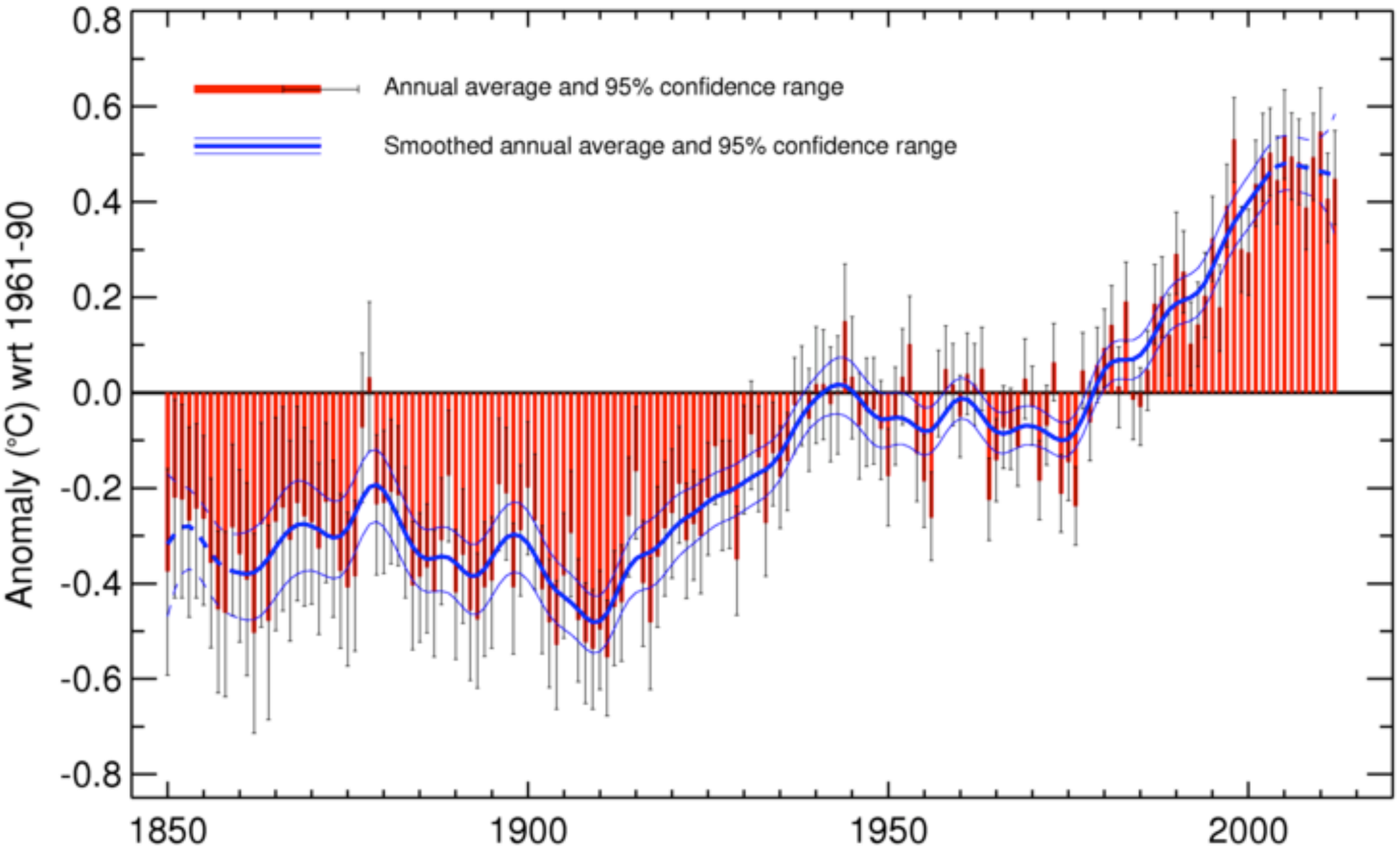
You are here: Home › Topics › Best of Blogs › UK Annual Temperature Plunges By Almost 1° Celsius, Ba

BEST OF BLOGS

Tw

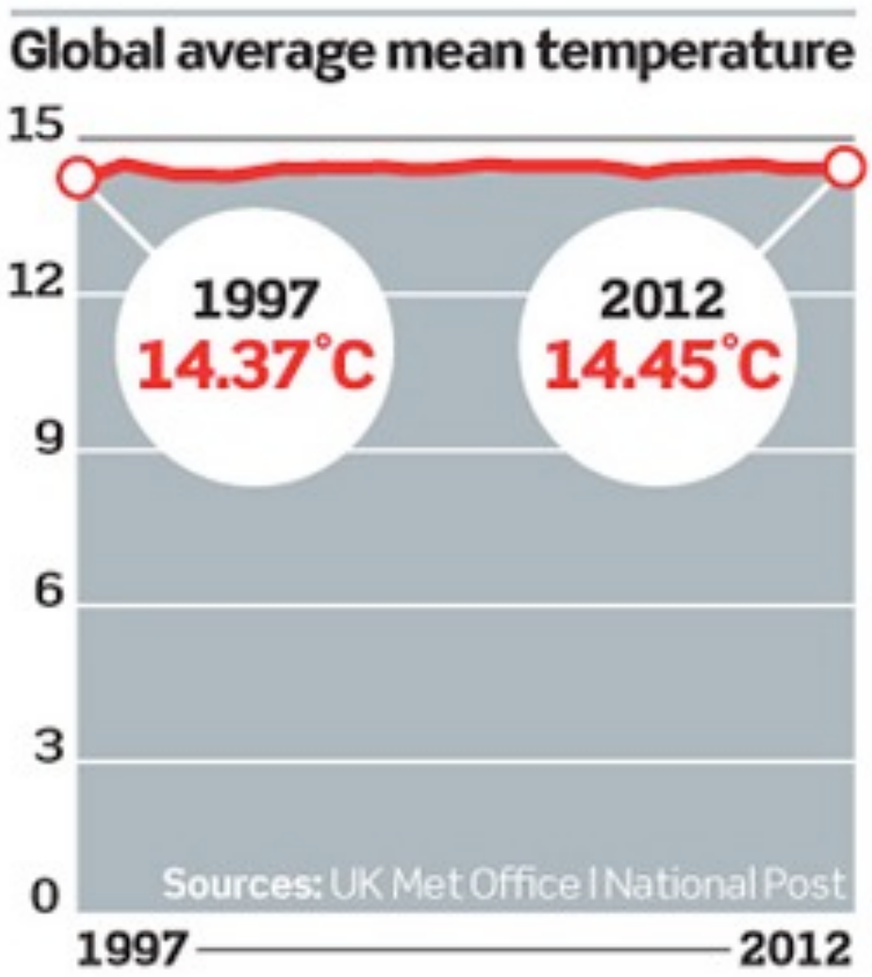
Global average temperature 1850-2012

Updated from Morice et al. 2012

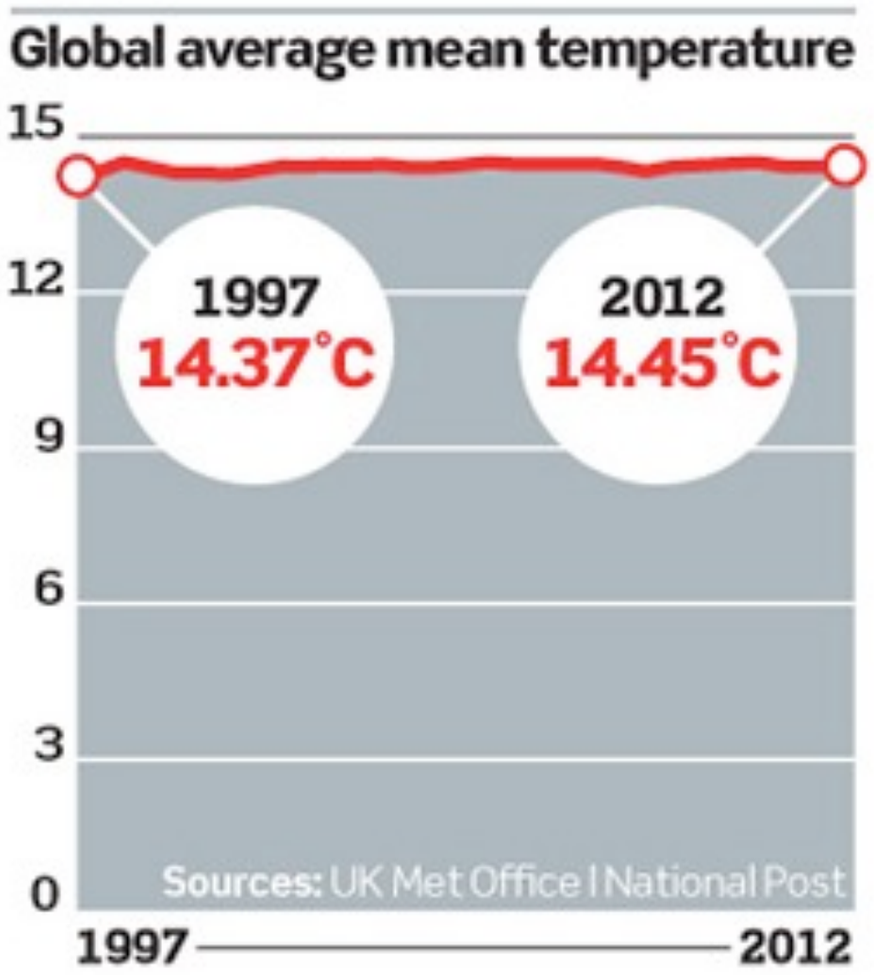


Met Office Hadley Centre

Source: www.metoffice.gov.uk/hadobs



Source: Christopher Booker, The Telegraph



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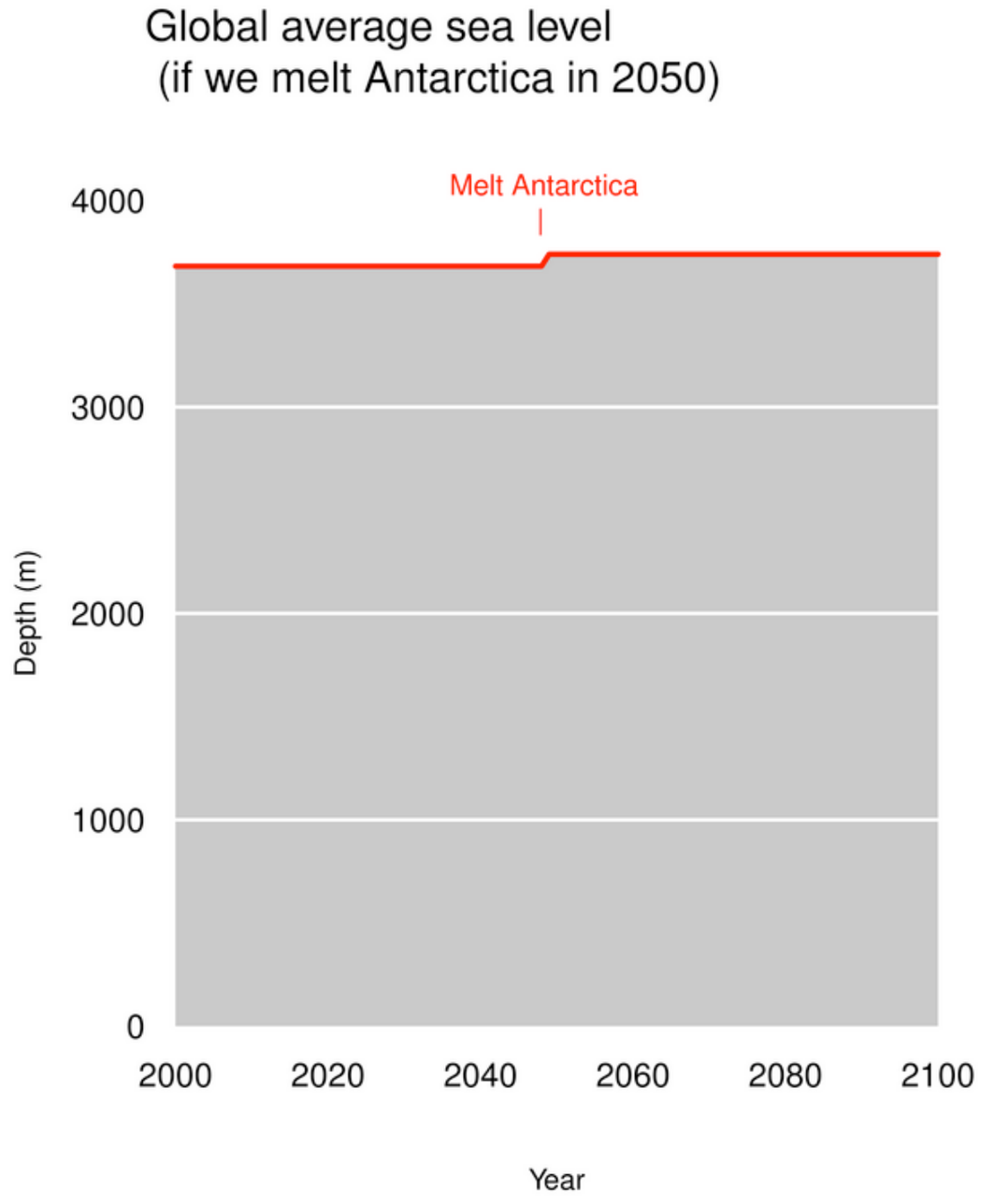
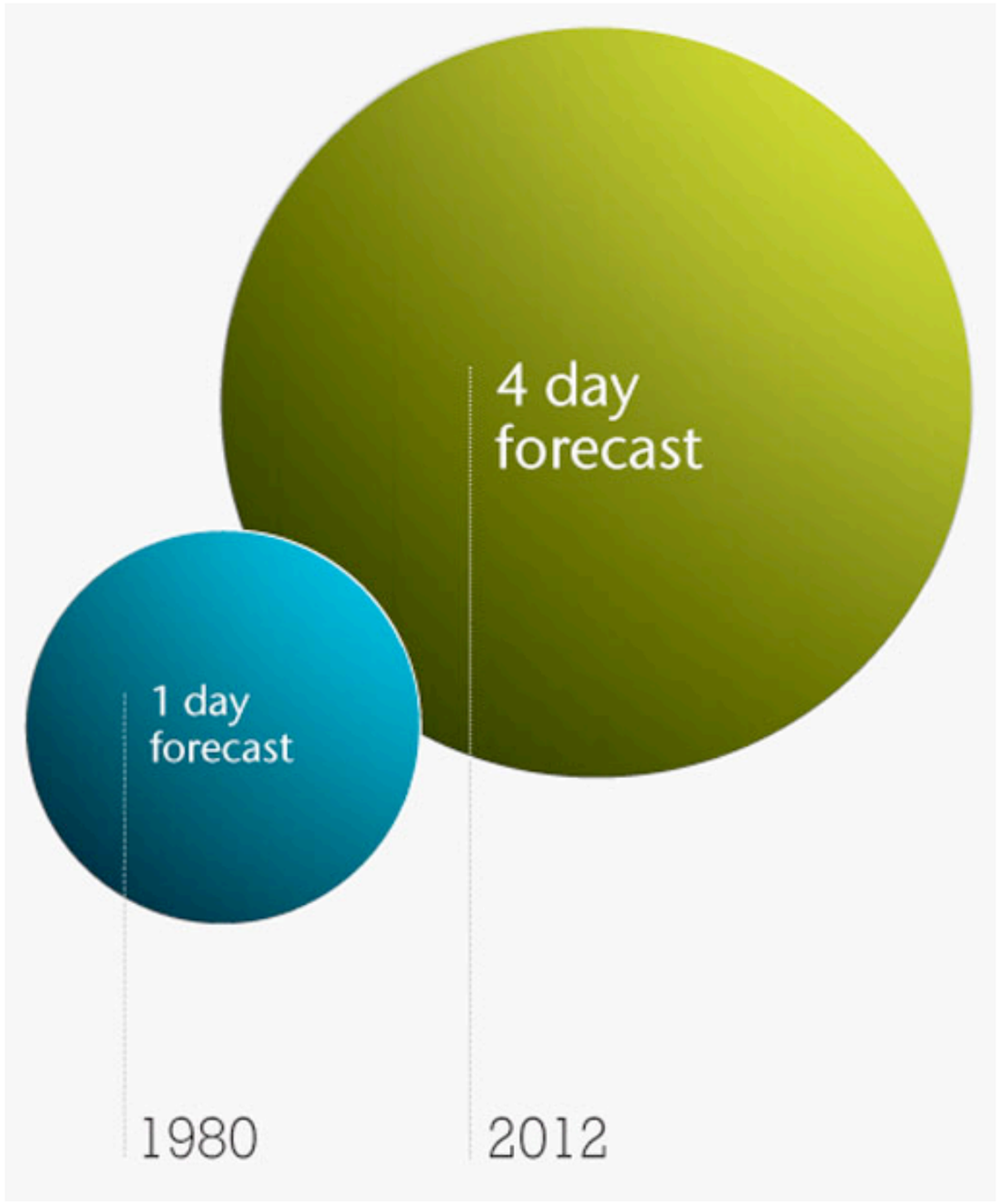


58 metres of sea level rise.
Source: betterfigures.org

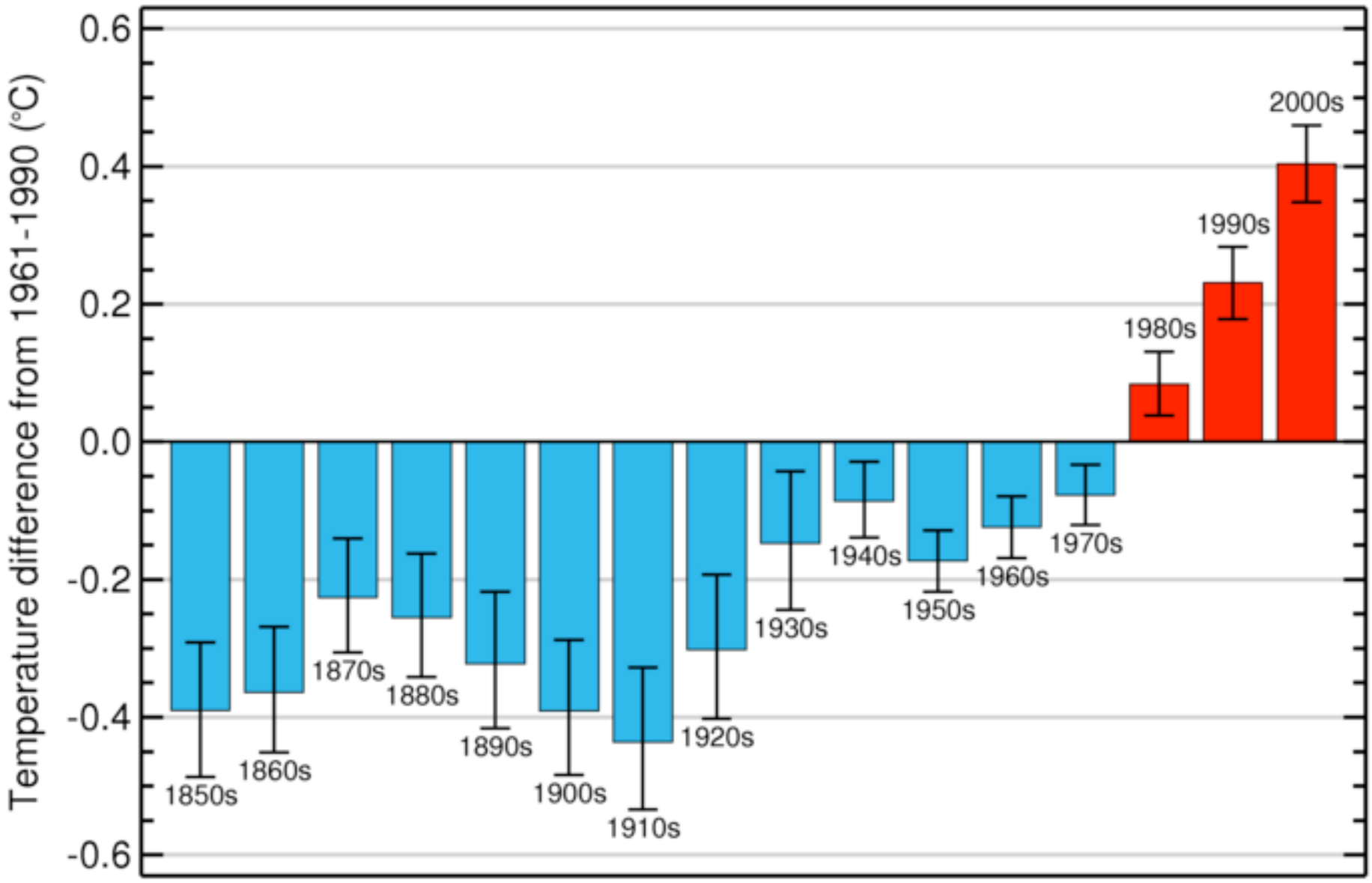
Even the Met Office can get it wrong sometimes...



Source: Barometer Magazine

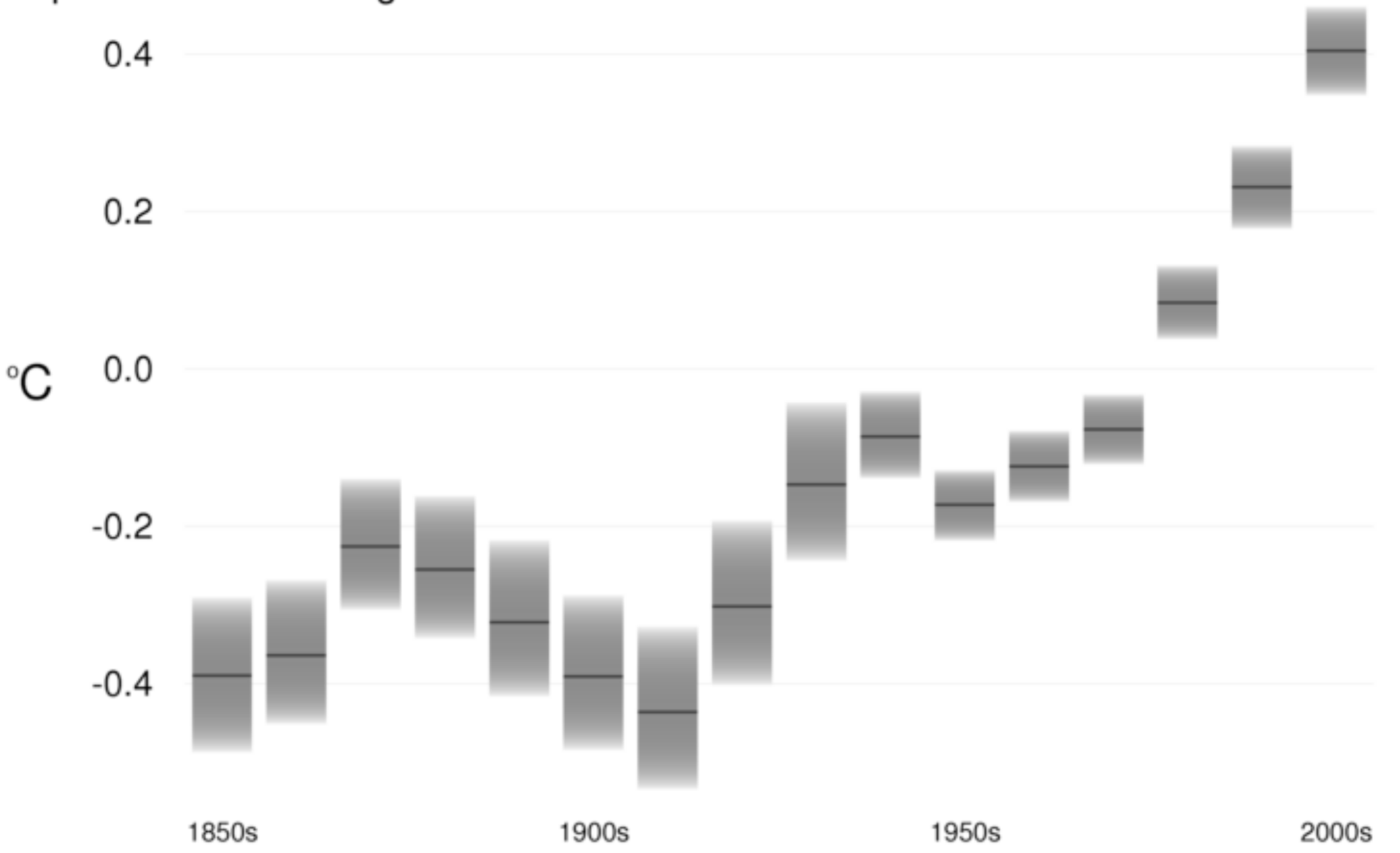
"Our four day forecasts today are as accurate as our one-day forecasts in 1980."

Design, and design again

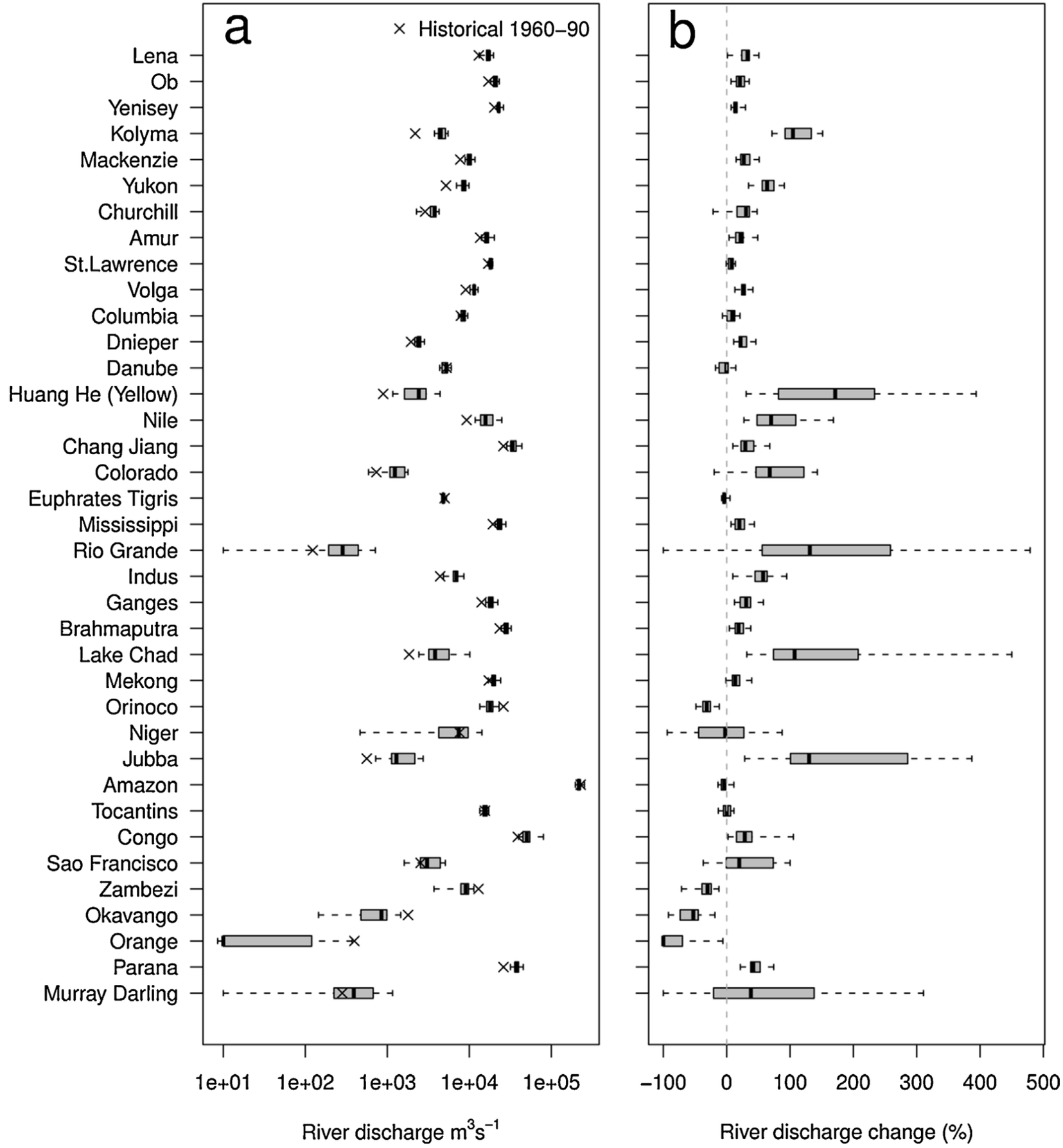

Temperature difference from 1961-1990 (°C)
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
1850s
1860s
1870s
1880s
1890s
1900s
1910s
1920s
1930s
1940s
1950s
1960s
1970s
1980s
1990s
2000s

Global average temperature anomaly by decade

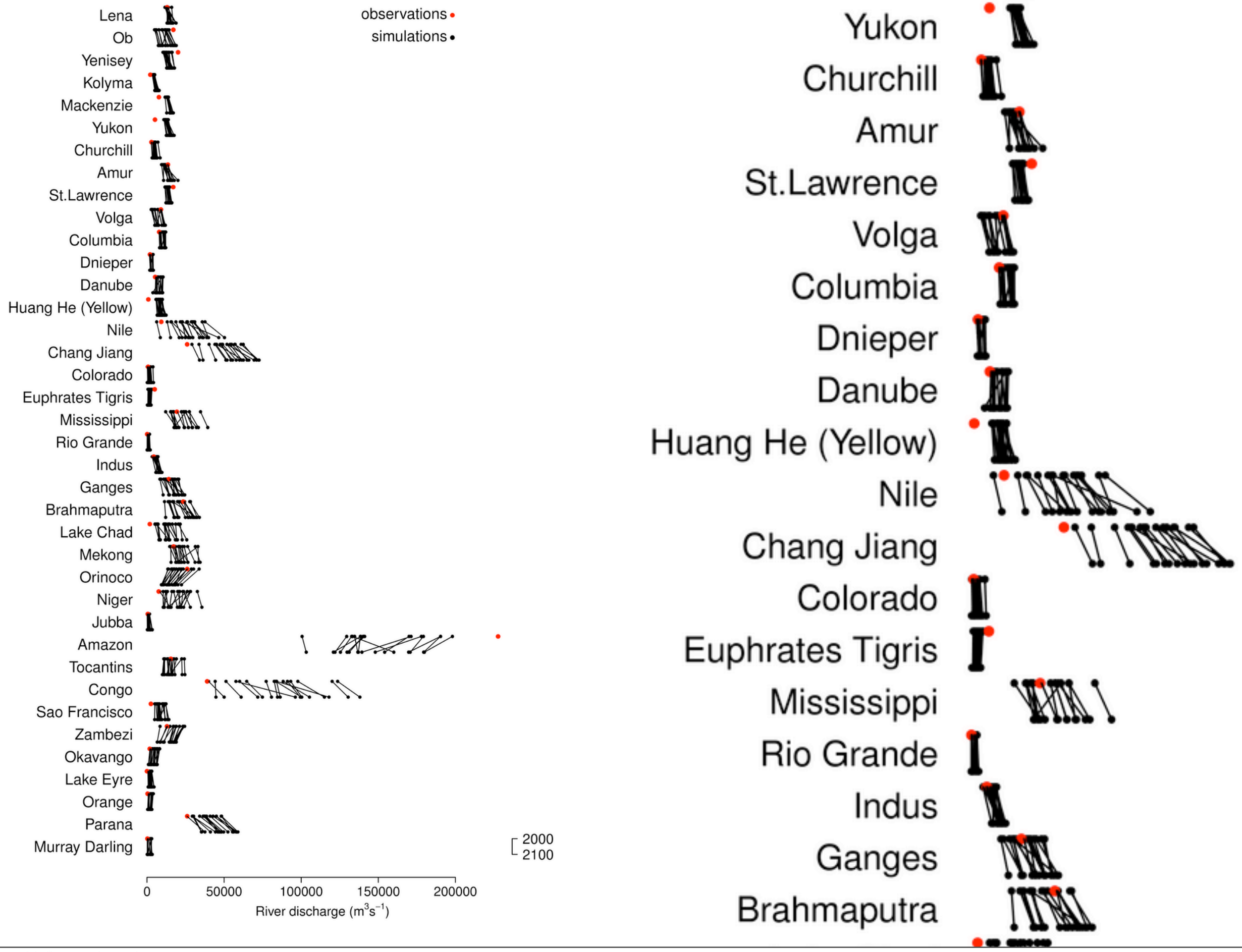
Expect decadal average to fall within shaded area 95% of the time



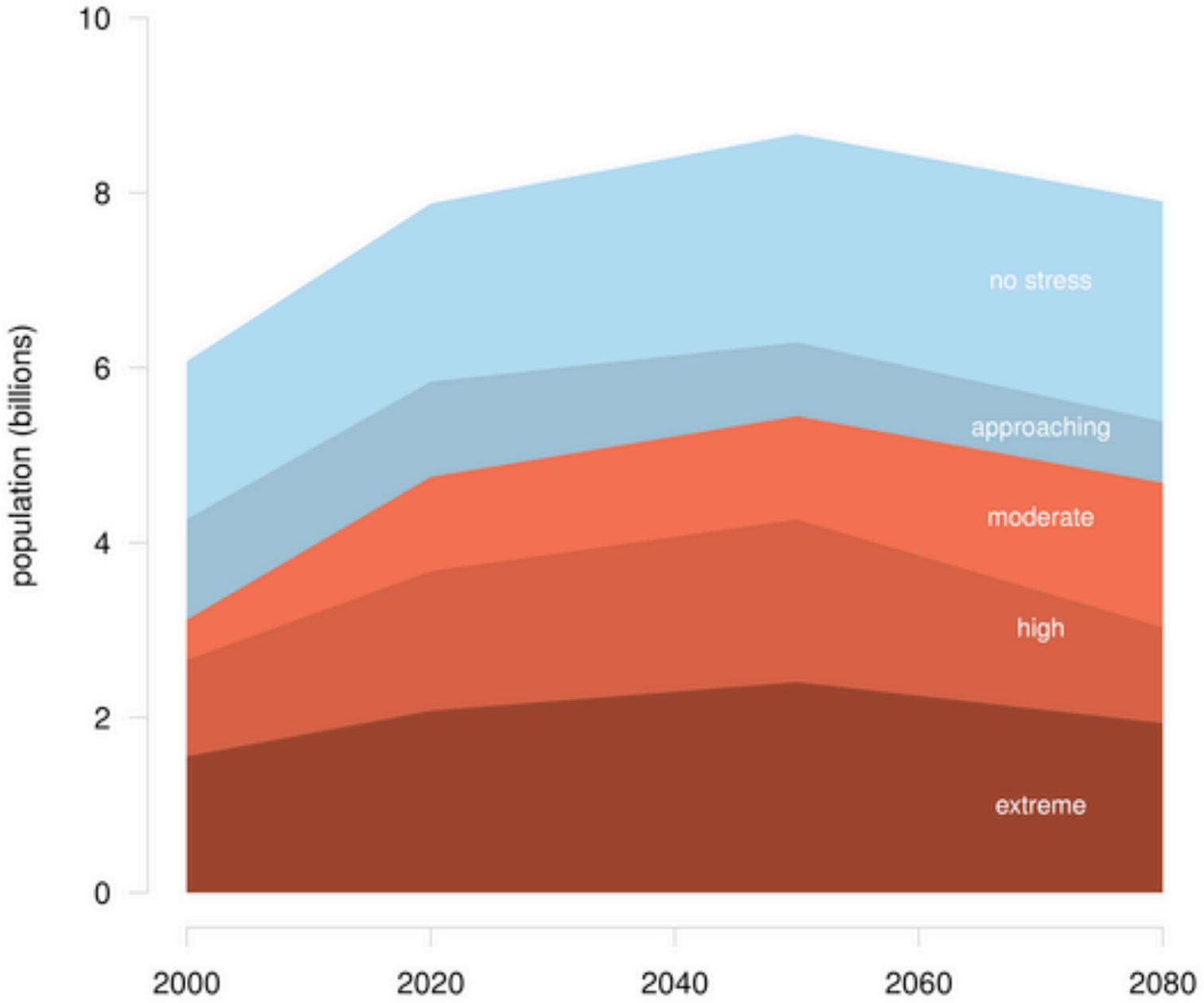
Source and methods: HadCRUT3, Brohan et al. (2006)



Wiltshire *et al.* (2013), Global Environmental Change


observations
simulations
Lena
Ob
Yenisey
Kolyma
Mackenzie
Yukon
Churchill
Amur
St.Lawrence
Volga
Columbia
Dnieper
Danube
Huang He (Yellow)
Nile
Chang Jiang
Colorado
Euphrates Tigris
Mississippi
Rio Grande
Indus
Ganges
Brahmaputra
Lake Chad
Mekong
Orinoco
Niger
Jubba
Amazon
Tocantins
Congo
Sao Francisco
Zambezi
Okavango
Lake Eyre
Orange
Parana
Murray Darling
2000
2100
0
50000
100000
150000
200000
River discharge (m^3s^{-1})

Global population under water stress



QUMP HadCM3 and TRIP, ensemble mean
SRES scenario A1B

And finally...

- Be creative
- Share your ideas
- Learn to code, use open source software, share your code

Tools, links and resources at betterfigures.org

Thanks for listening!

Favourites

- Hadley Whickham - R - ggplot2 http://had.co.nz
- R - googleviz http://code.google.com/p/google-motion-charts-with-r/
- Bostock http://bost.ocks.org/mike/ D3 http://d3js.org
- Ben Fry - Processing http://benfry.com
- Rob Simmon http://earthobservatory.nasa.gov/blogs/elegantfigures/
- Hans Rosling - gapminder http://www.gapminder.org