SIOG 223A
Geophysical Data Analysis

Tues/Thurs 9-10:20am IGPP Munk 303

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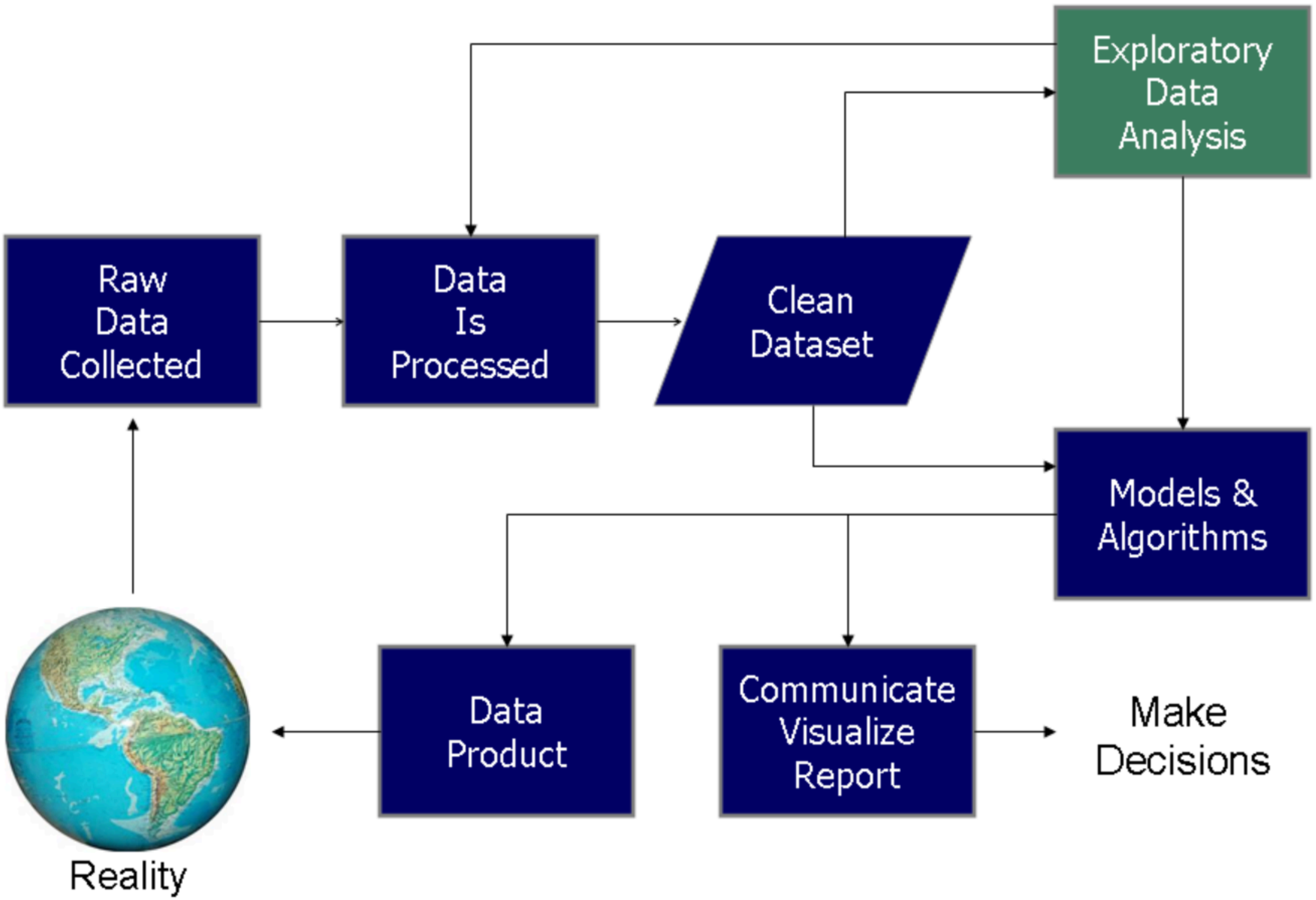
Today's Topics

- Why are we here?
- Course Goals Outline
- Expectations
- Communication

Data Science Process



https://en.wikipedia.org/wiki/Data_visualization#cite_note-O'Neil_and_Schutt_2014-1

Course Goals

- Acquire enough skill in data analysis to facilitate your graduate research work
- Understand basic theory and implementation methods behind probability and statistics
- Appreciate the role of simulation in testing scientific models
- Learn how and when to use statistical methods on geophysical data

Expectations

- ~10 hours /week on average
- 2. 7 hours in class
- 3 hours reading
- 3-4 hours homework/ experimentation

Communication

- Language - spoke or written
- Equations and other mathematics
- Pictures, diagrams, and graphs

Academic science is a social institution devoted to the construction of a rational consensus of opinion over the widest possible field.

JOHN ZIMAN *An Introduction to Science Studies* (1984)

They [*sc.* the Royal Society] have exacted from all their members, a close, naked, natural way of speaking; positive expressions; clear senses; a native easiness; bringing all things as near the Mathematical plainness, as they can: and preferring the language of Artizans, Countrymen, and Merchants, before that, of Wits, or Scholars.

THOMAS SPRAT *The History of the Royal-Society of London, for the Improving of Natural Knowledge* (1667)

The advantages proposed by this [*sc.* graphical] mode of representation, are to facilitate the attainment of information, and aid the memory in retaining it: which two points form the principal business in what we call learning, or the acquisition of knowledge. Of all the senses, the eye gives the liveliest and most accurate idea of whatever is susceptible of being represented to it.

WILLIAM PLAYFAIR *The Statistical Breviary; Shewing, on a Principle Entirely New, The Resources of Every State and Kingdom in Europe* (1801)

- All plots encode your data into some visual variable

- Some encodings work better than others, because of how our visual system operates.

- Make your plots easy to decode.

The greatest value of a picture is when it forces us to notice what we never expected to see.
John Tukey - Exploratory Data Analysis

Human visual processing is efficient in detecting changes and making comparisons between quantities, sizes, shapes and variations in lightness.

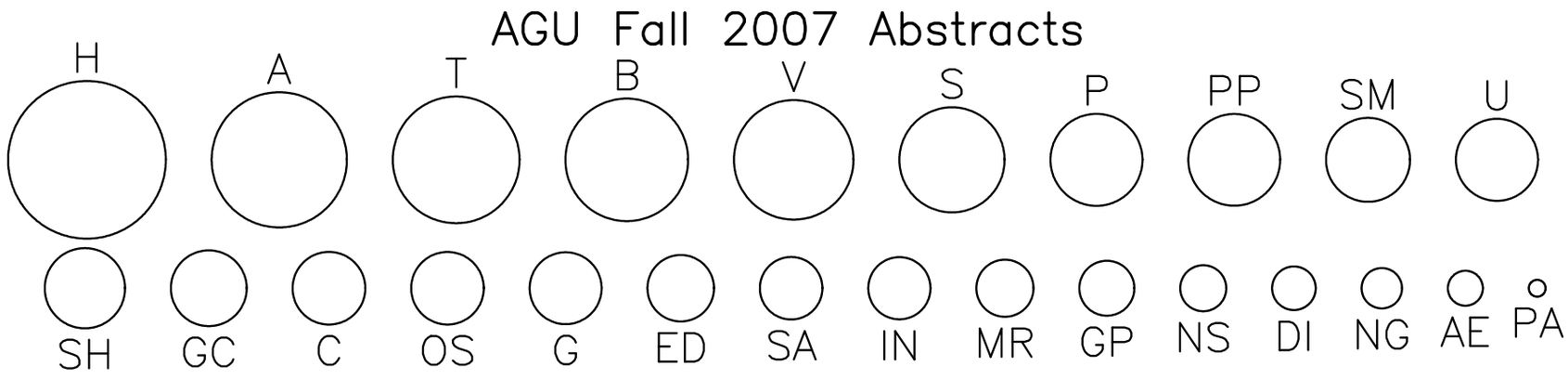


Figure 13.1

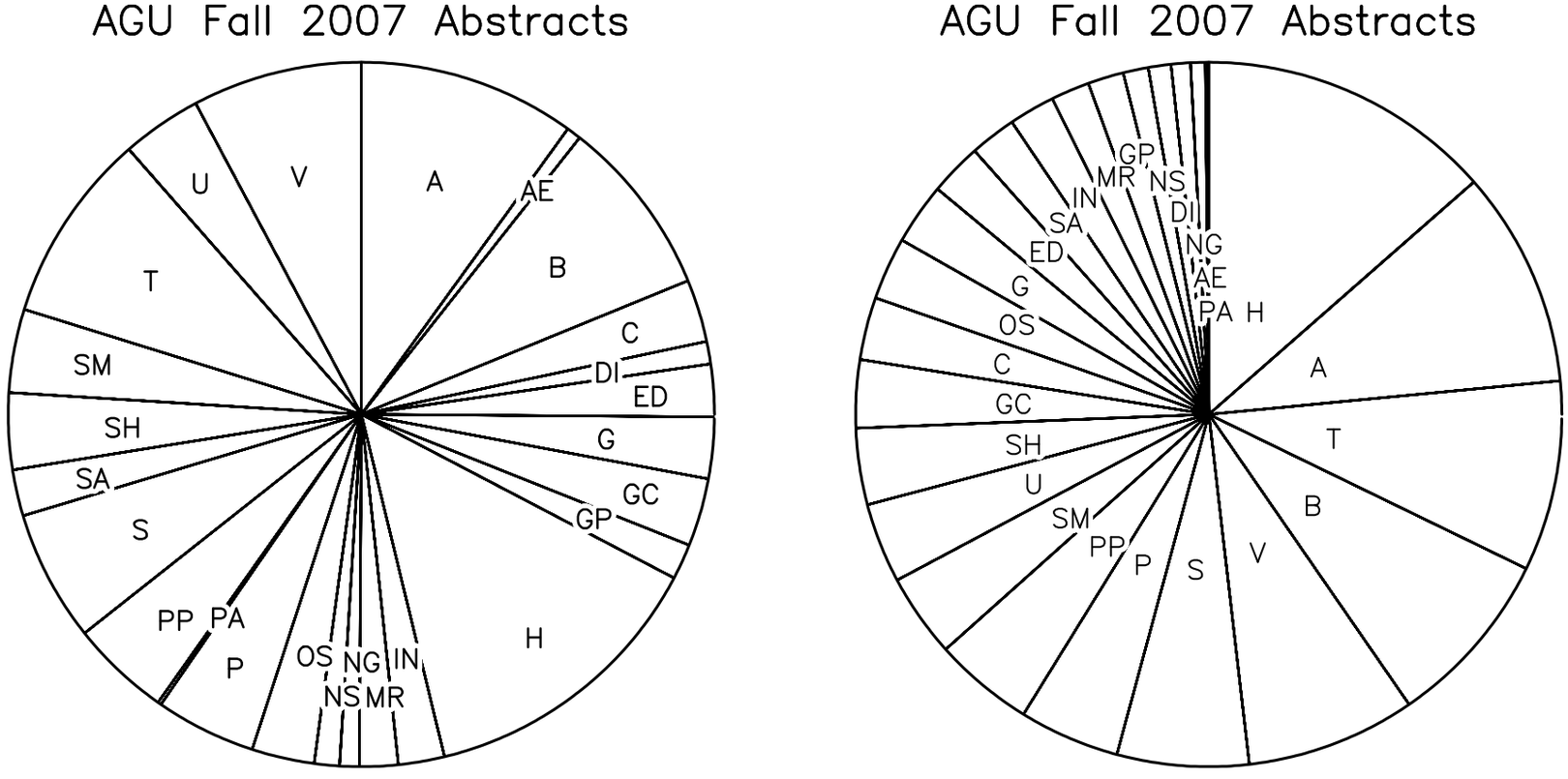


Figure 13.2

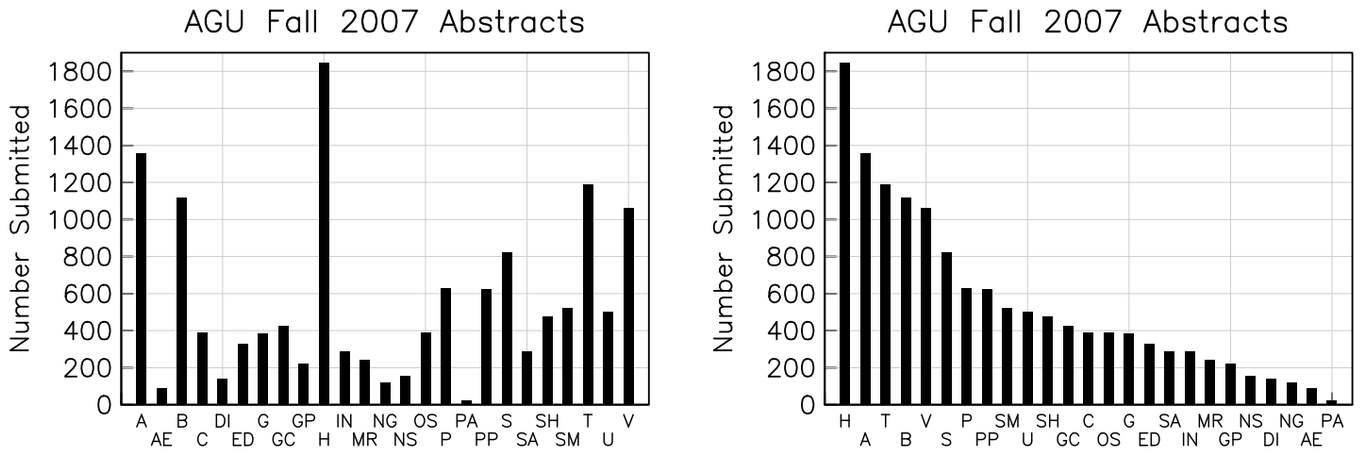


Figure 13.3

arrangements (alphabetical and numerically sorted) in Figure 13.3.

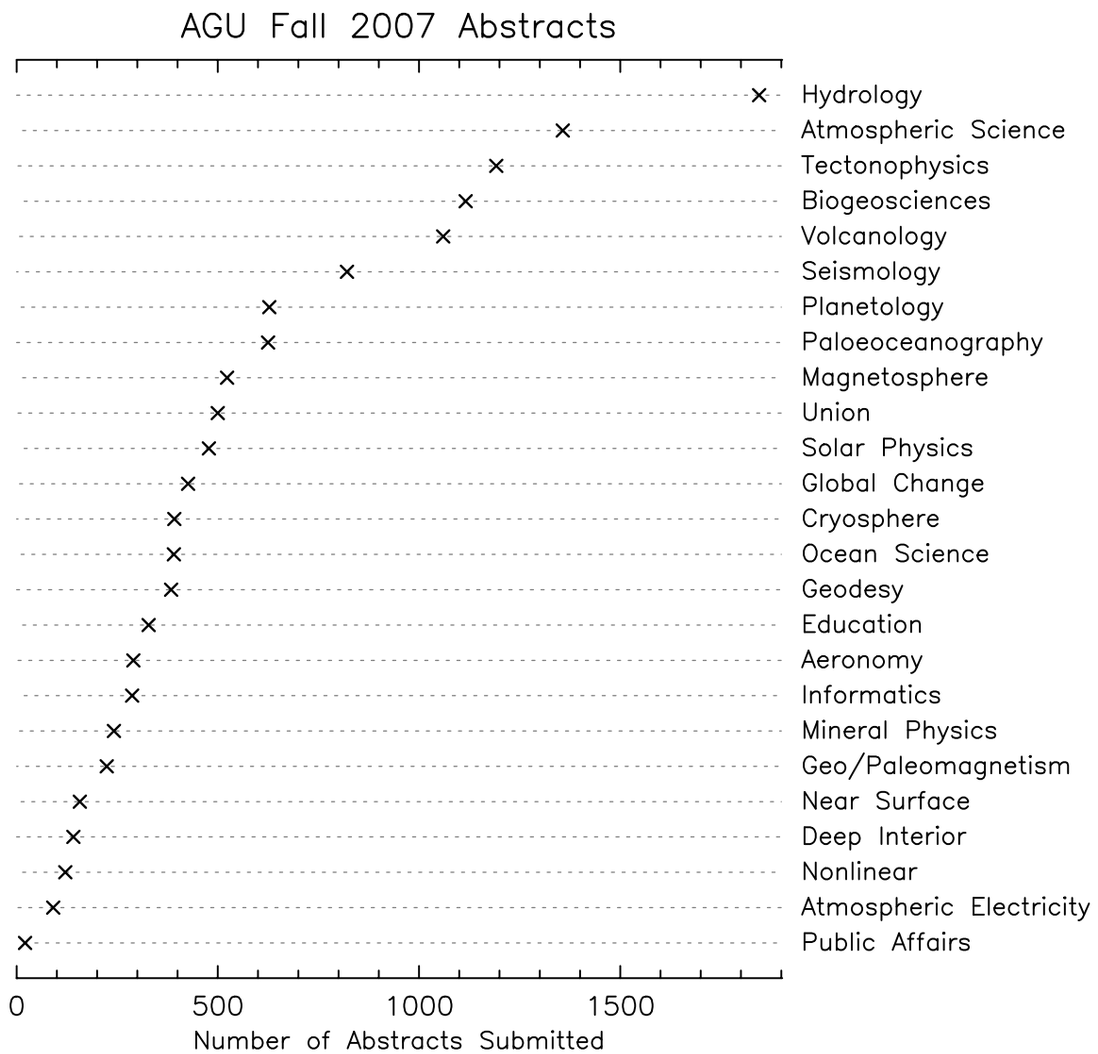


Figure 13.4

Table 1: Possible Encodings, Best to Worst

- Positions along common and aligned scales.
- Positions along common but unaligned scales.
- Lengths.
- Angle, or slope of a line.
- Areas of similar figures (areas of dissimilar figures cannot be decoded with any accuracy).
- Apparent volumes of similar solids shown by 2-D pictures.
- Color (hue, saturation, or brightness).

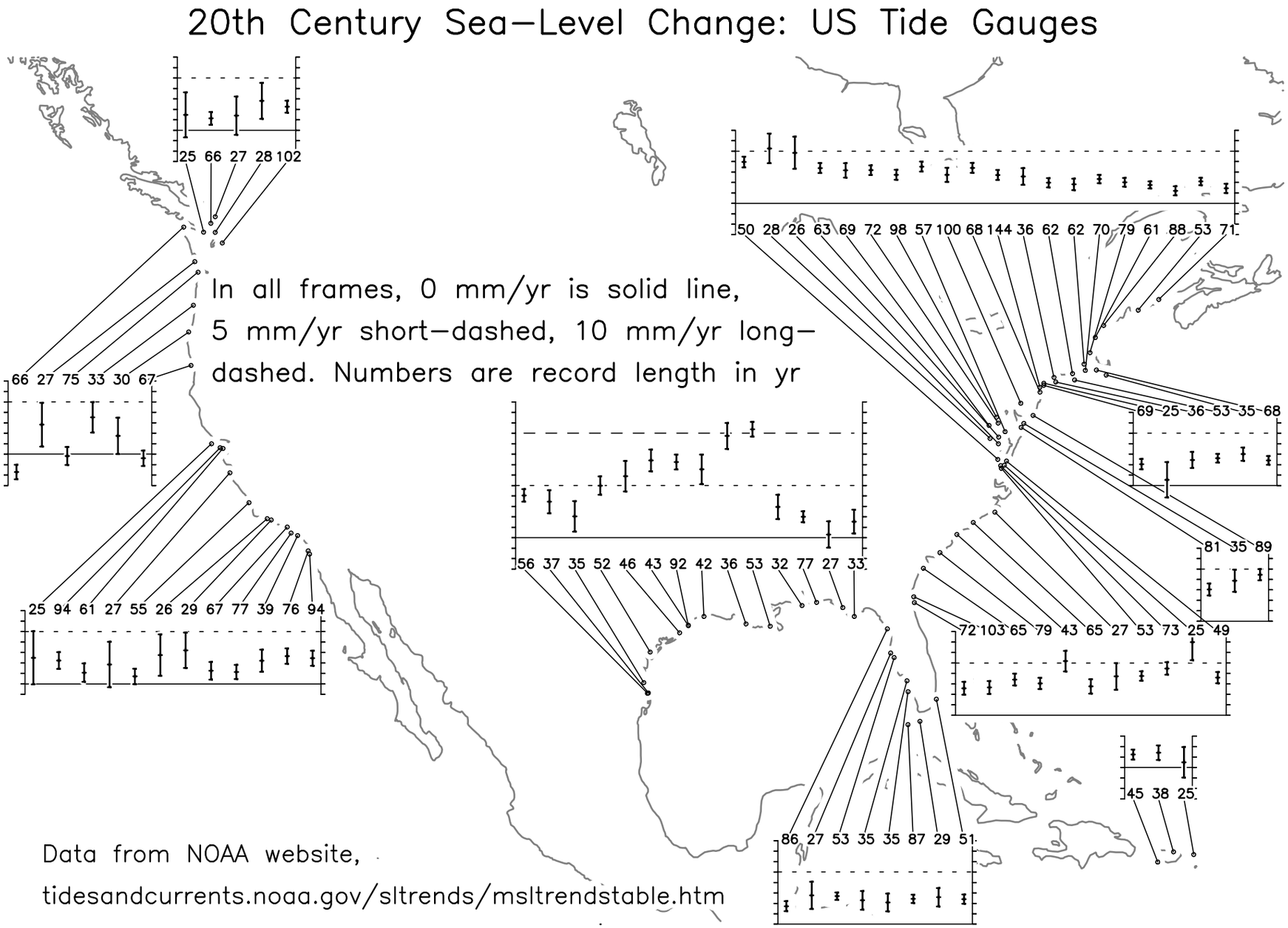


Figure 13.5

Show What You Want to Show

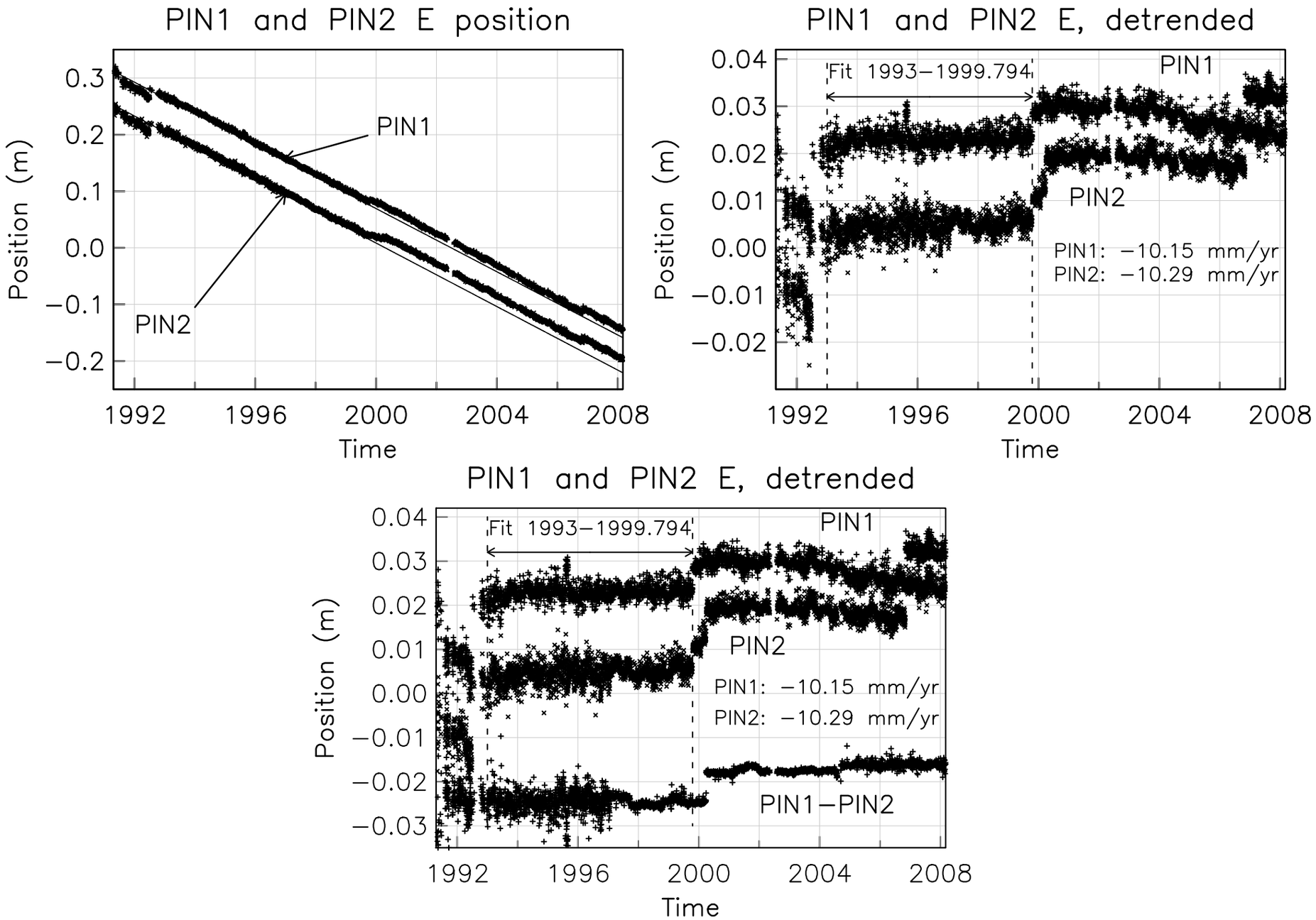
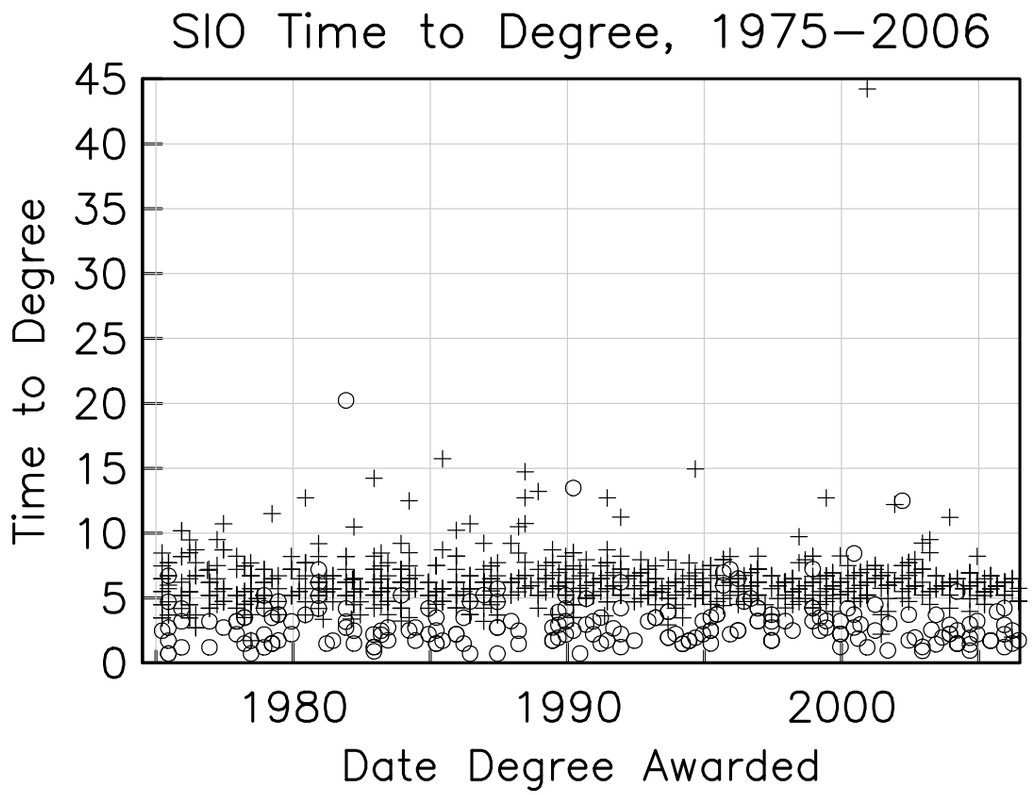
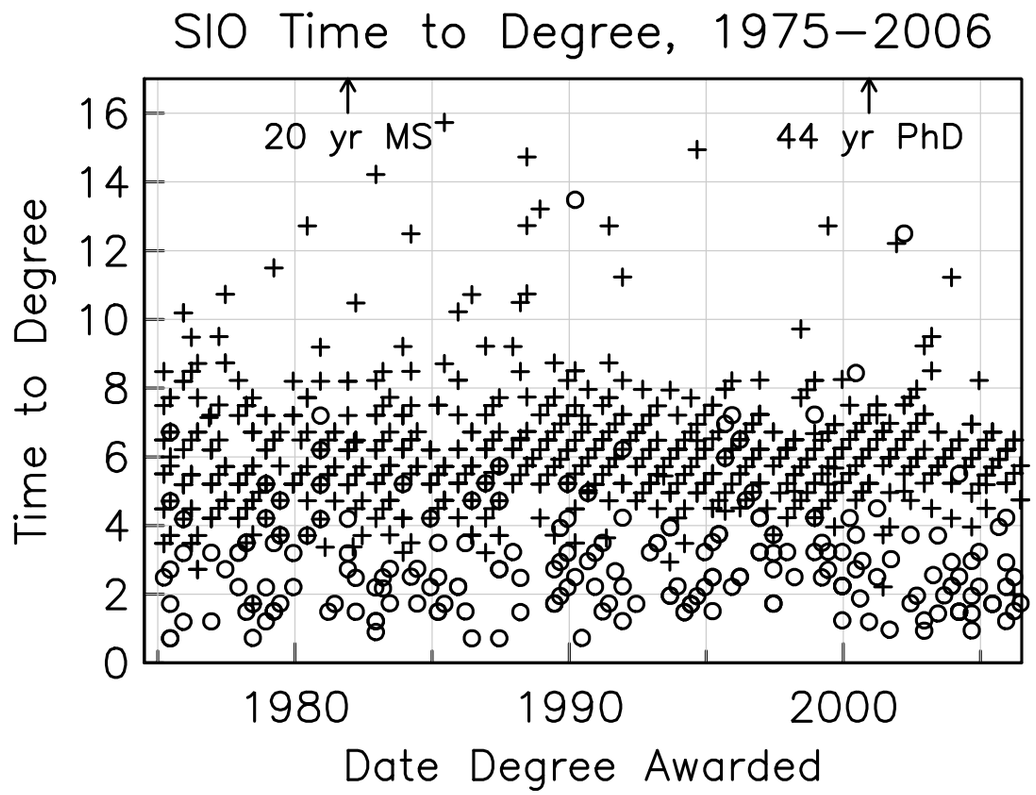
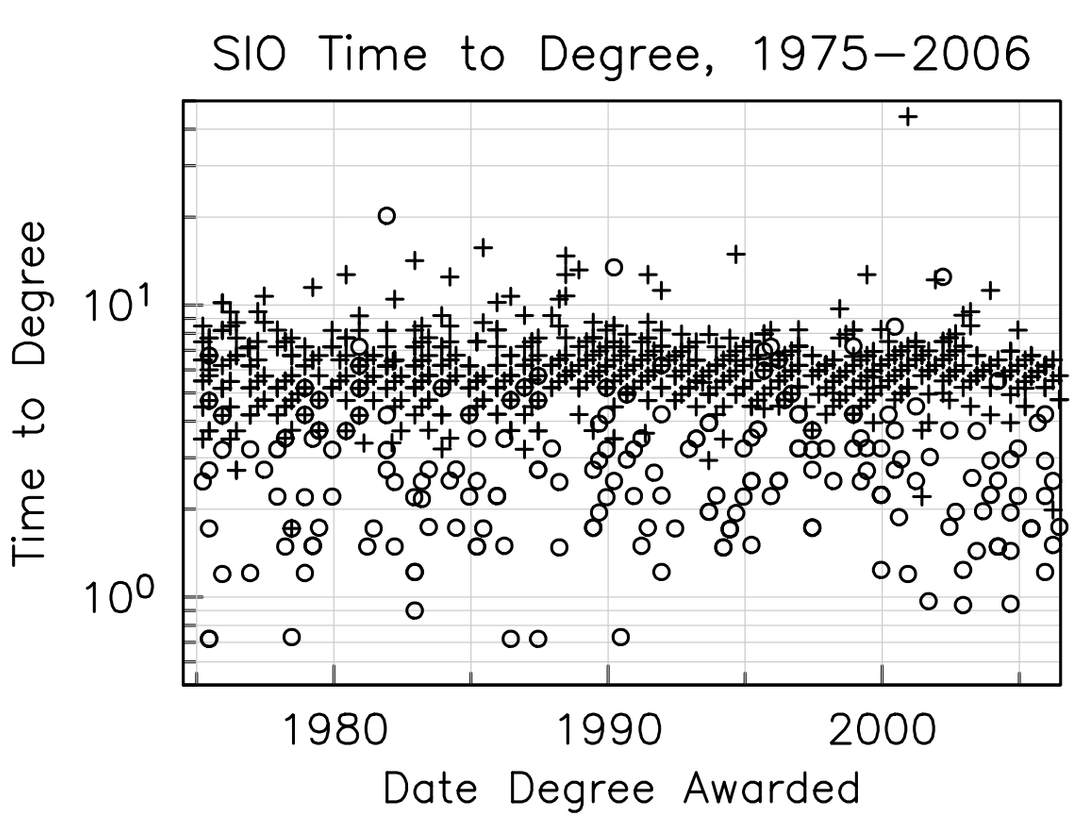


Figure 13.6


SIO Time to Degree, 1975–2006
Time to Degree
0
5
10
15
20
25
30
35
40
45
1980
1990
2000
Date Degree Awarded


SIO Time to Degree, 1975–2006
Time to Degree
0
2
4
6
8
10
12
14
16
20 yr MS
44 yr PhD
1980
1990
2000
Date Degree Awarded


SIO Time to Degree, 1975–2006
Time to Degree
10^0
10^1
1980
1990
2000
Date Degree Awarded

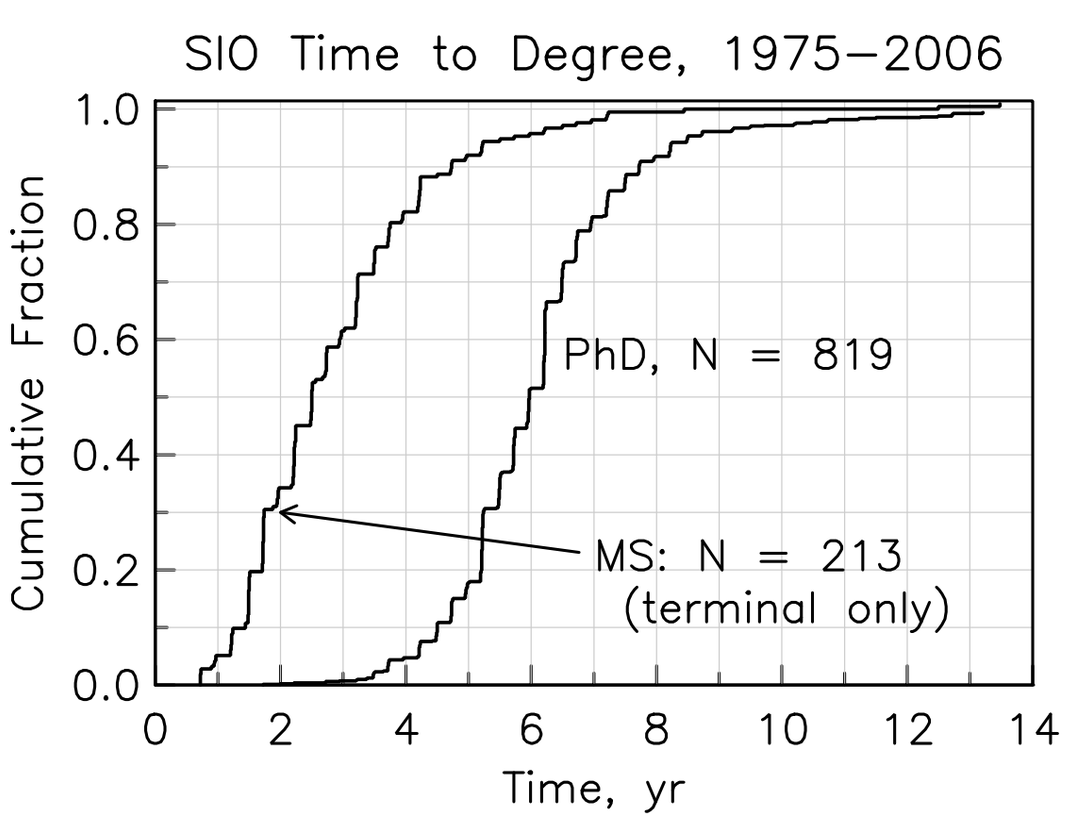

SIO Time to Degree, 1975–2006
Cumulative Fraction
0.0
0.2
0.4
0.6
0.8
1.0
PhD, N = 819
MS: N = 213
(terminal only)
0
2
4
6
8
10
12
14
Time, yr

Figure 13.7

Don’t Include Unnecessary detail

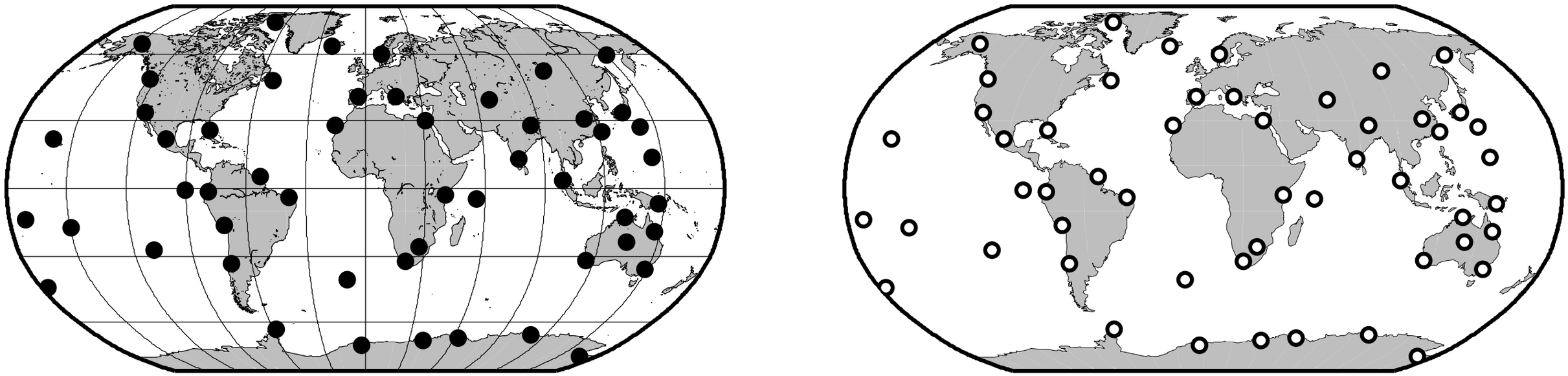


Figure 13.8

Black & White or Color

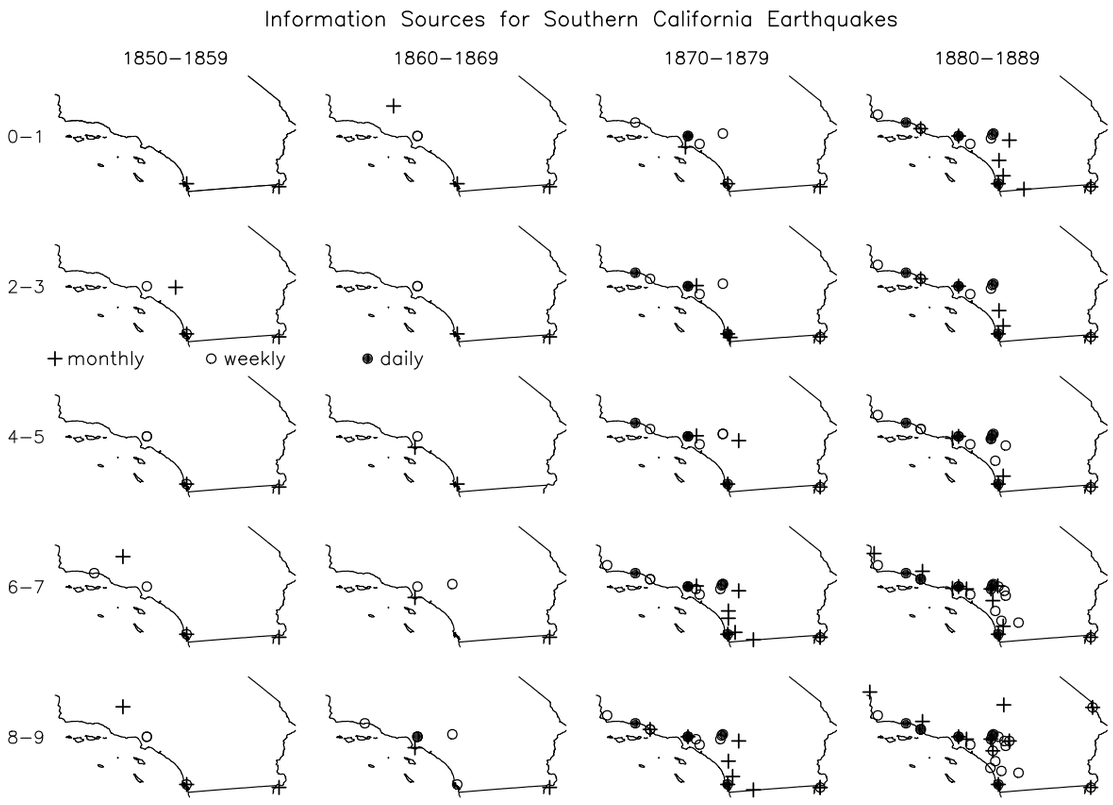


Figure 13.10

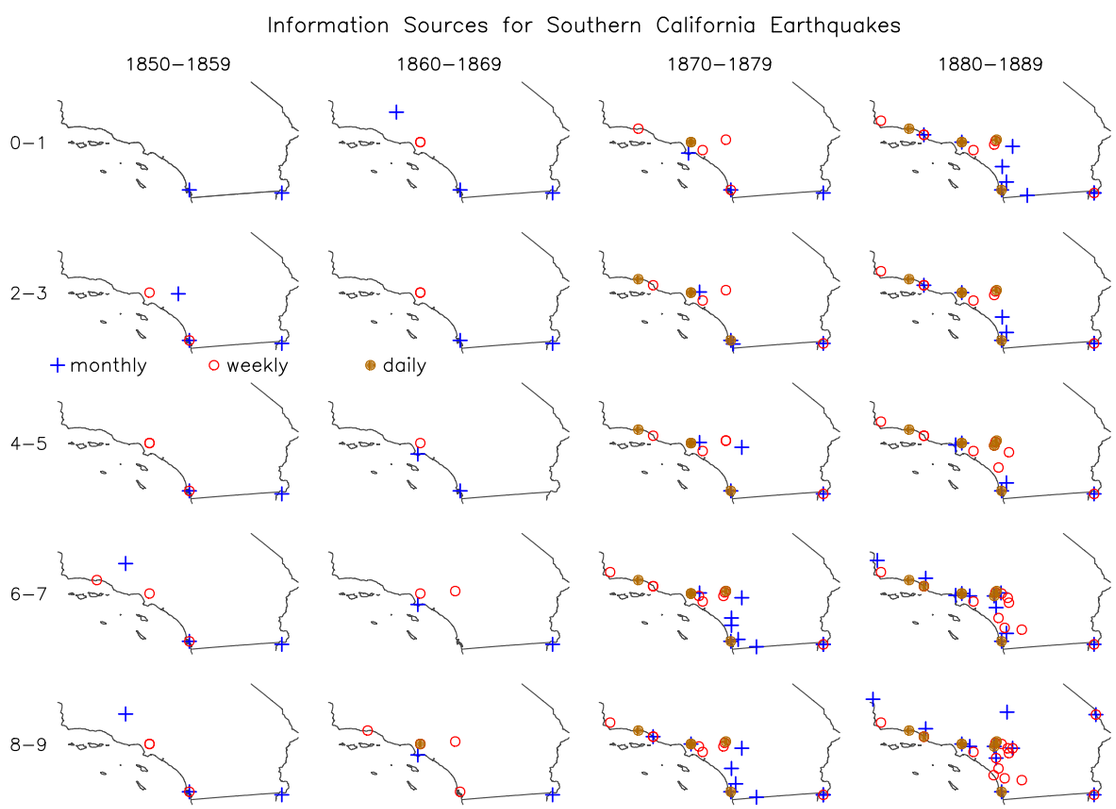


Figure 13.11

Bright vs Less-Bright
pastels de-emphasize areas of less interest

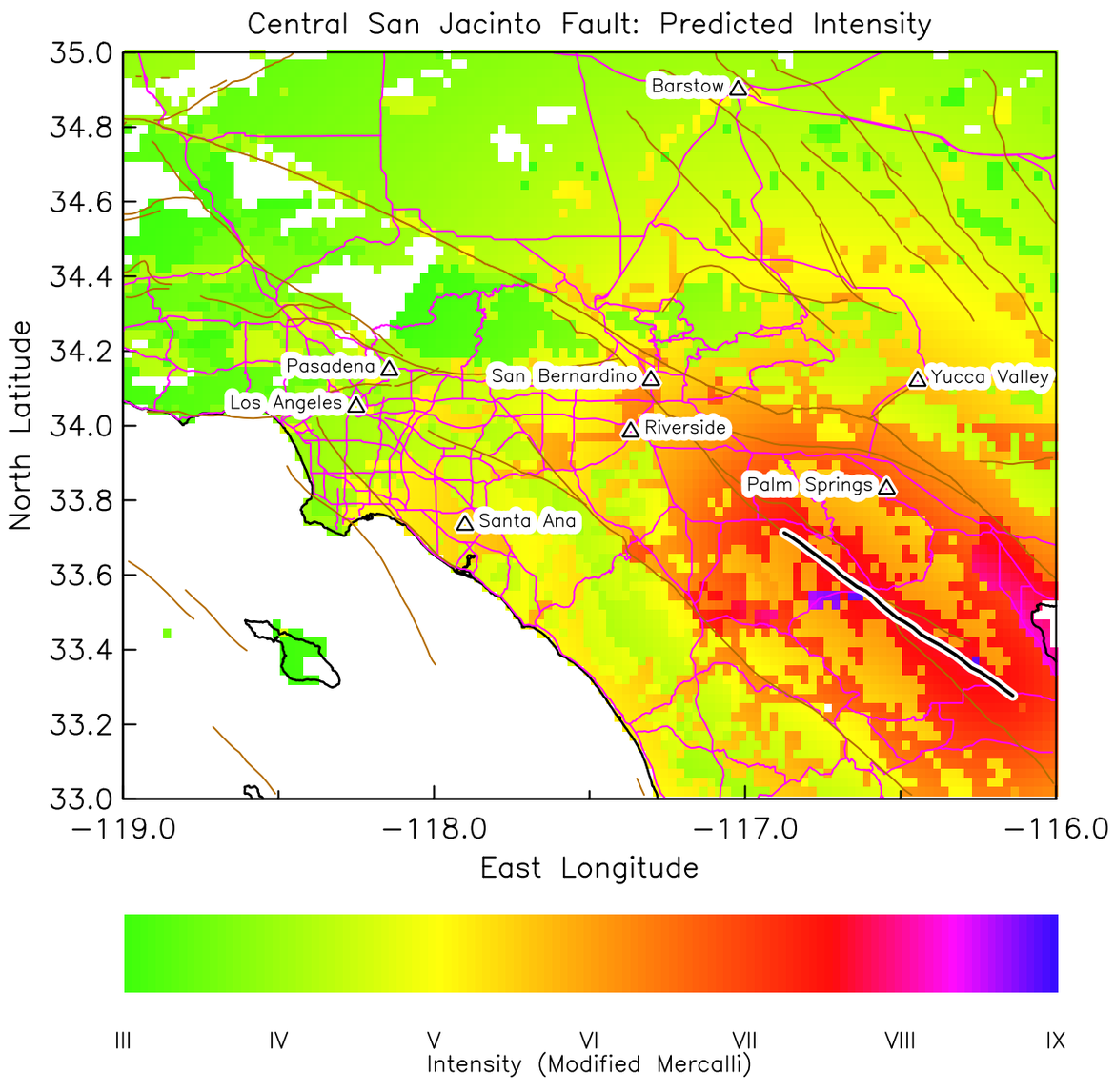


Figure 13.12

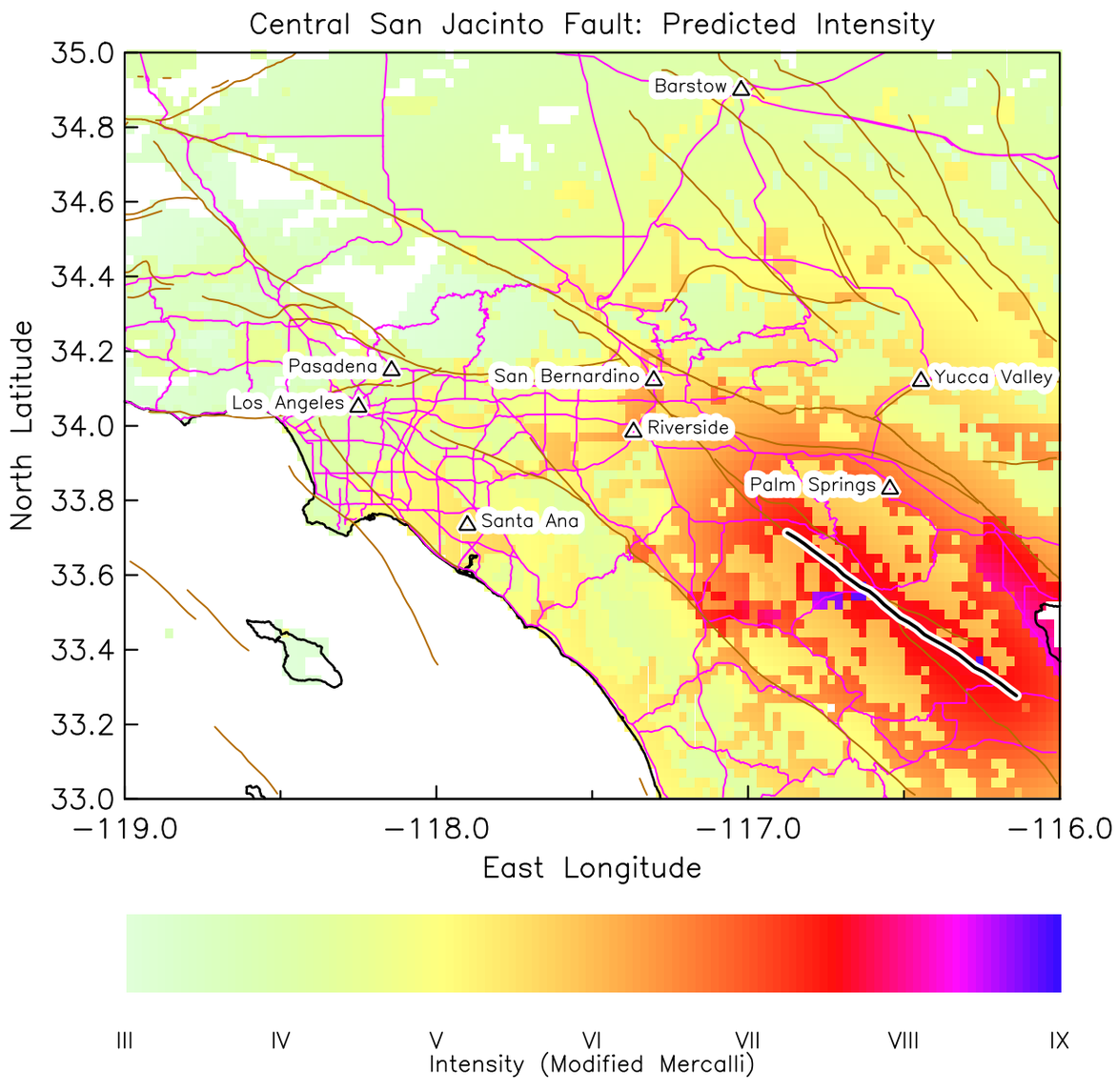


Figure 13.13

Perspective vs Contour

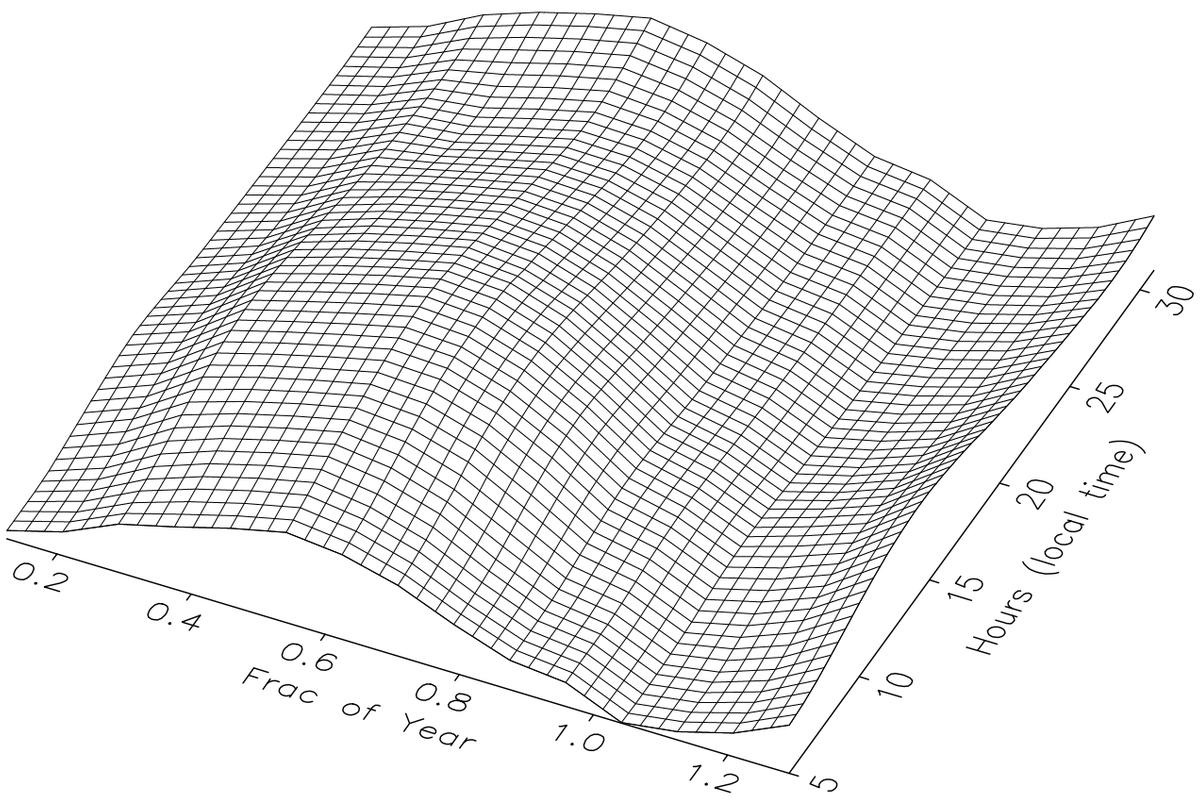


Figure 13.14

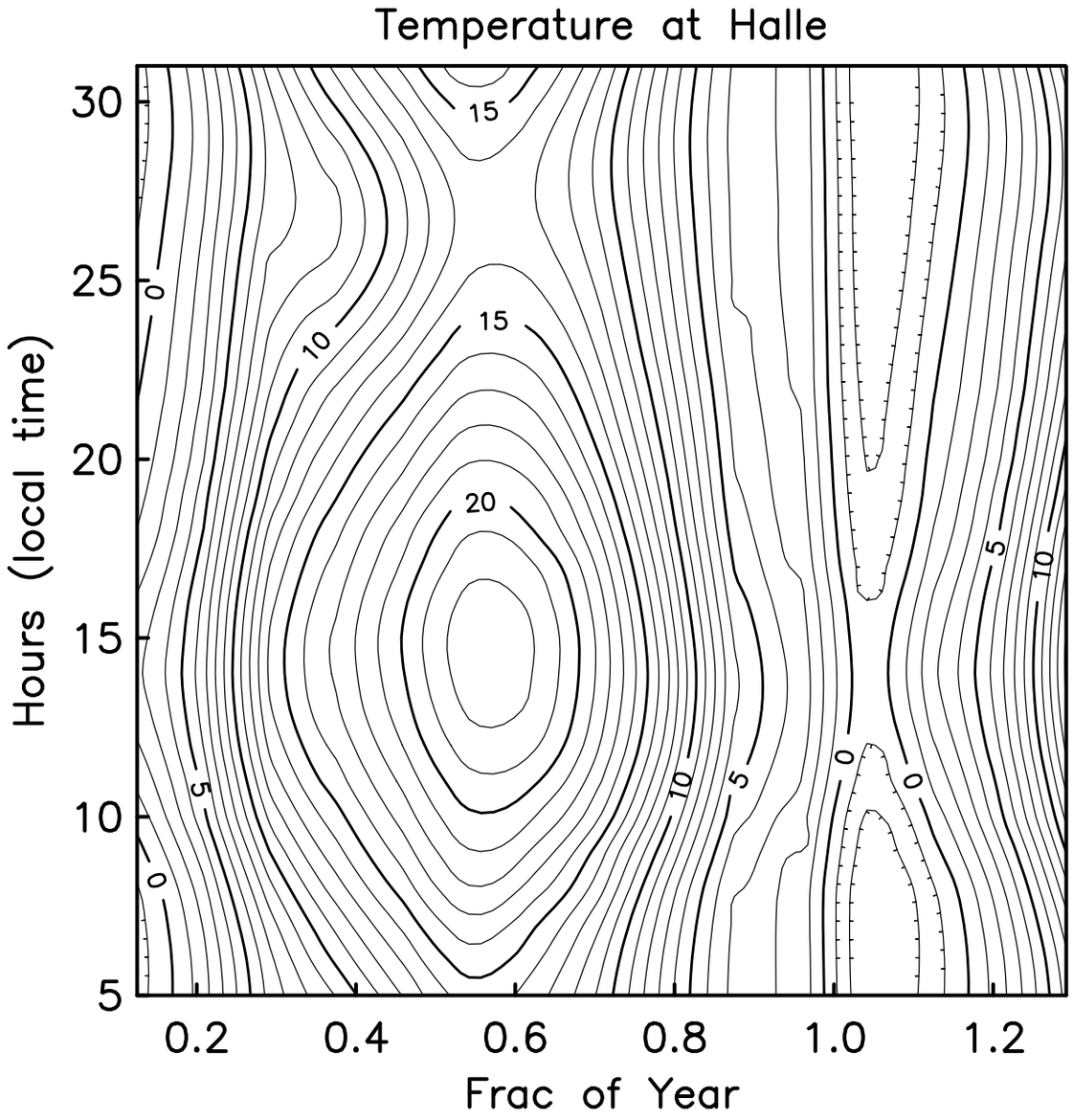


Figure 13.15

Glendale-Verdugo LSM Site

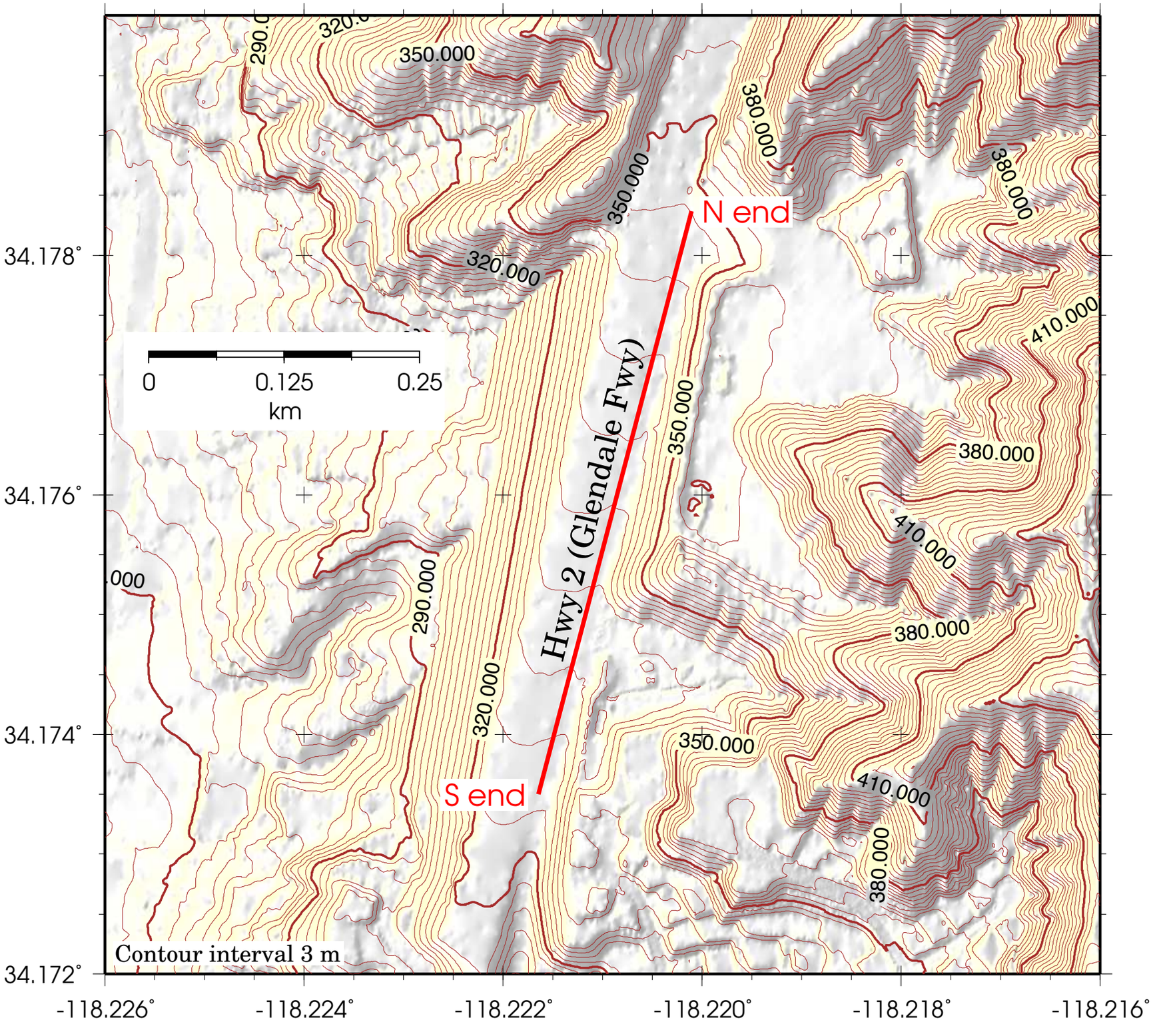
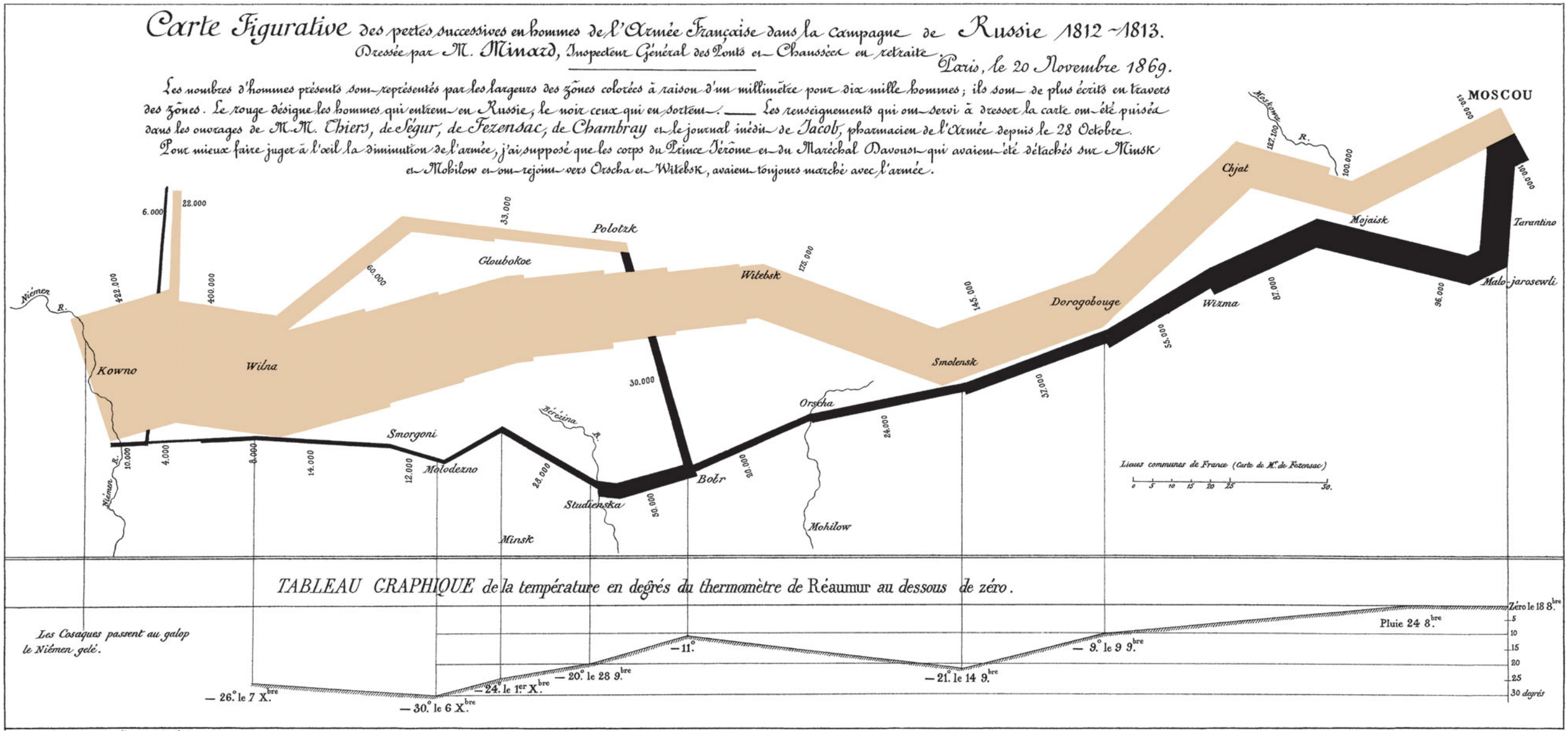


Figure 13.16

Charles Joseph Minard's 1869 diagram of Napoleonic France's invasion of Russia, an early example of an information graphic



https://en.wikipedia.org/wiki/Data_visualization

Homework 1

- Find and bring to next class one example of what you consider a highly informative graphic, along with your rationale for the choice.