SIO223A, Lecture 2, 01/9/2020

Probability, Statistics, and Reality

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Today's Goals

- Why are we here? Need for statistics
- Geophysical Examples -
  I. magnetic reversals, II. earthquakes
- Distances and error bounds
- Predicting Earthquakes

If your experiment needs statistics, you ought to have done a better experiment

- Geophysics - often uses observations rather than doing experiments
- Many natural processes have an inherent statistical part
- But statistical methods require careful application and interpretation

What math will you need?

- Calculus, familiarity with multivariate
- Vectors, Vector spaces, and Matrices
- Probability and Statistics

Terminology- Chapter 1

- histogram
- probability model
- stochastic model
- random variable
- probability theory
- statistics
- mean
- standard deviation
- estimates
- estimation theory
- point estimation
- robust estimation
- hypothesis test
- null hypothesis
- point process
- Poisson process
- Coxcomb plot
- confidence interval

Show What You Want to Show

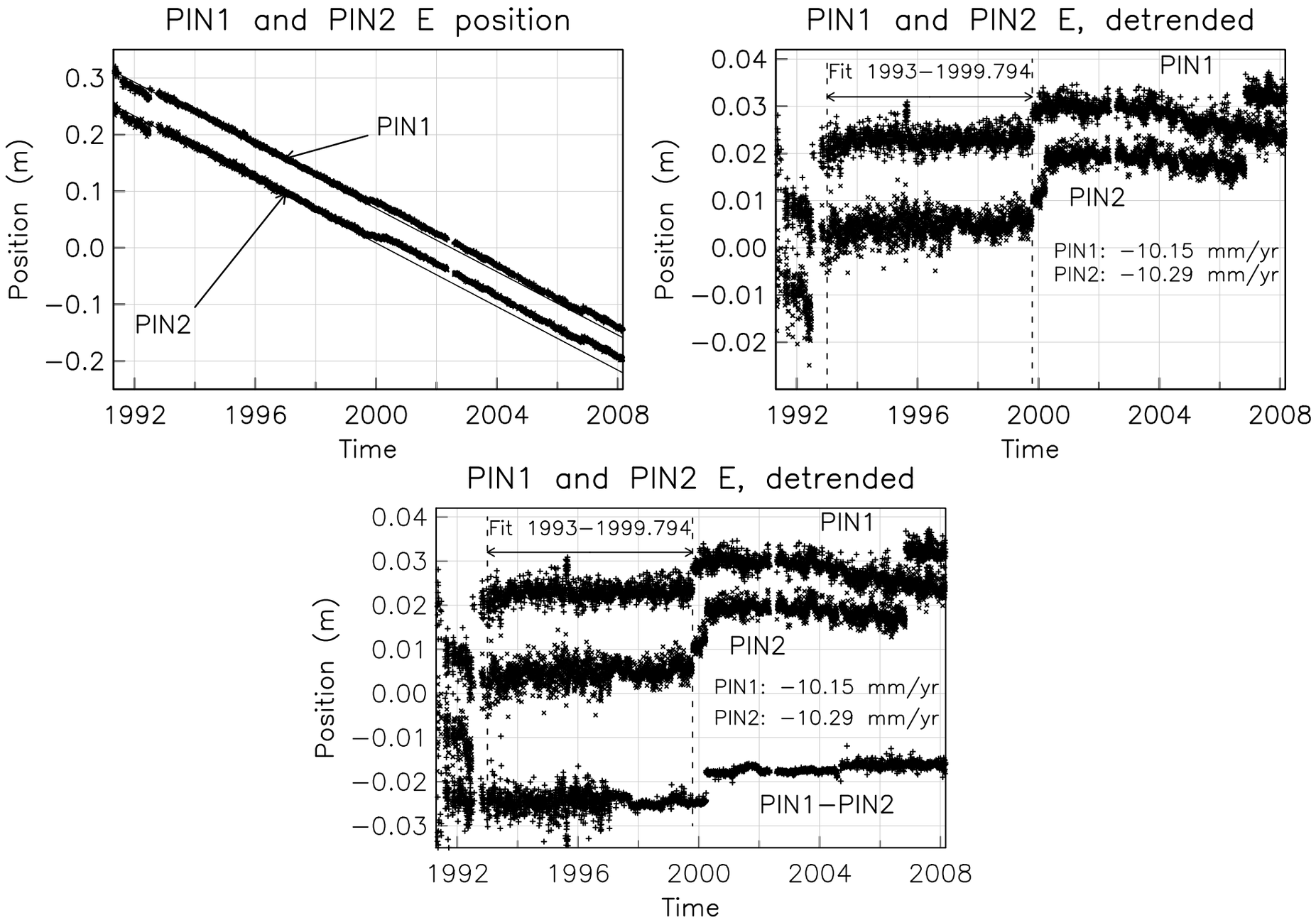
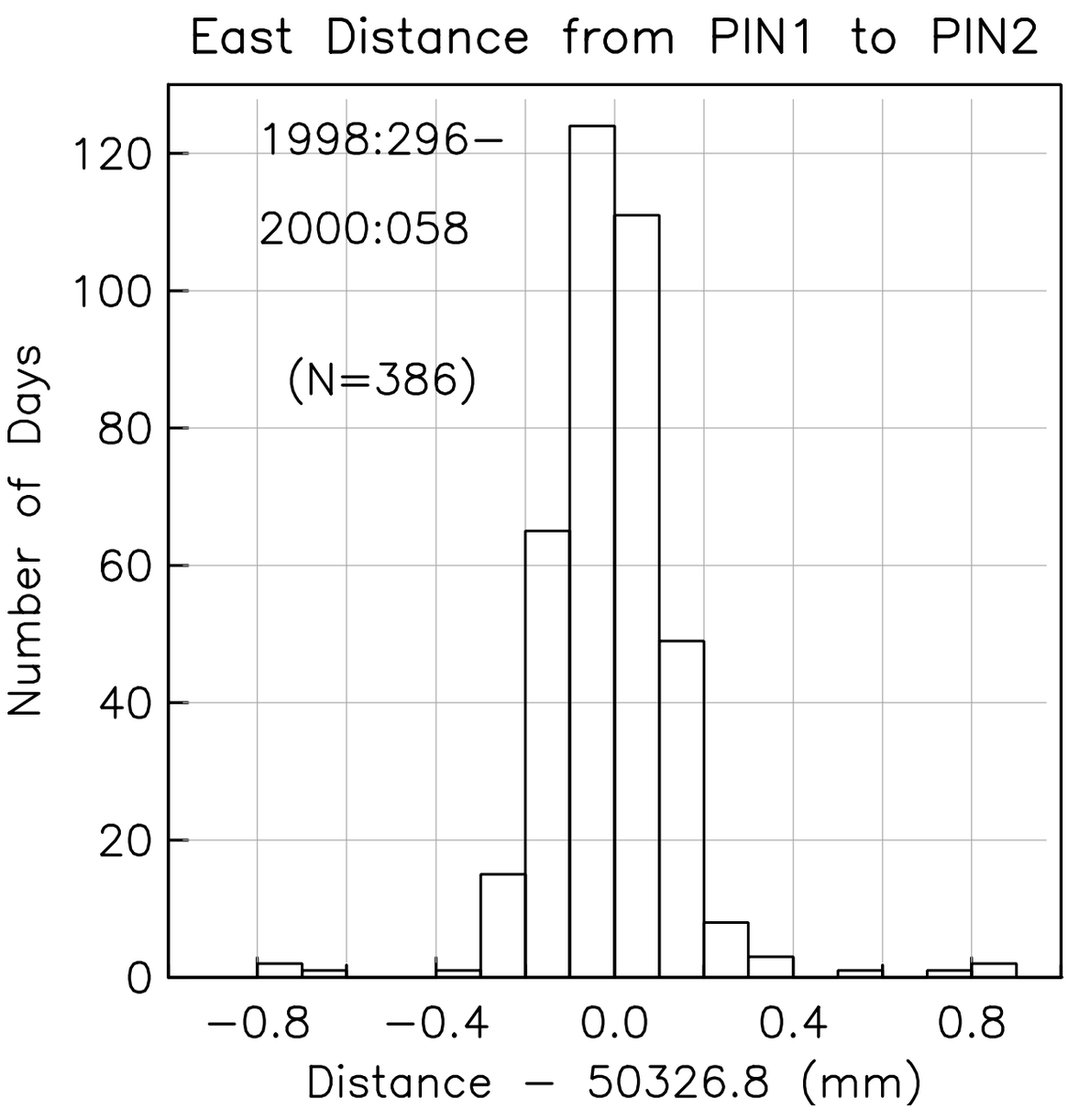
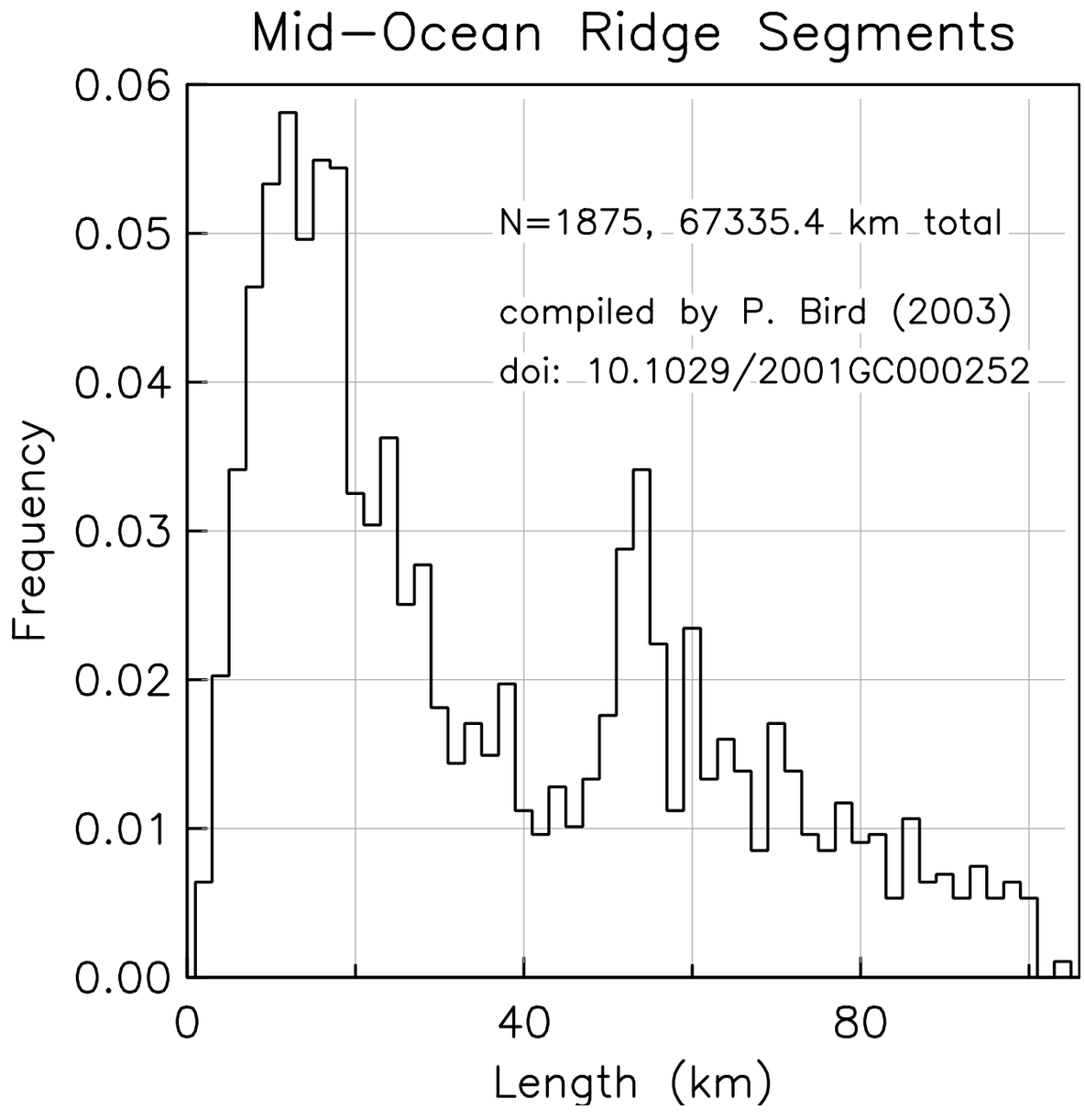


Figure 13.6

Probability or Stochastic Models

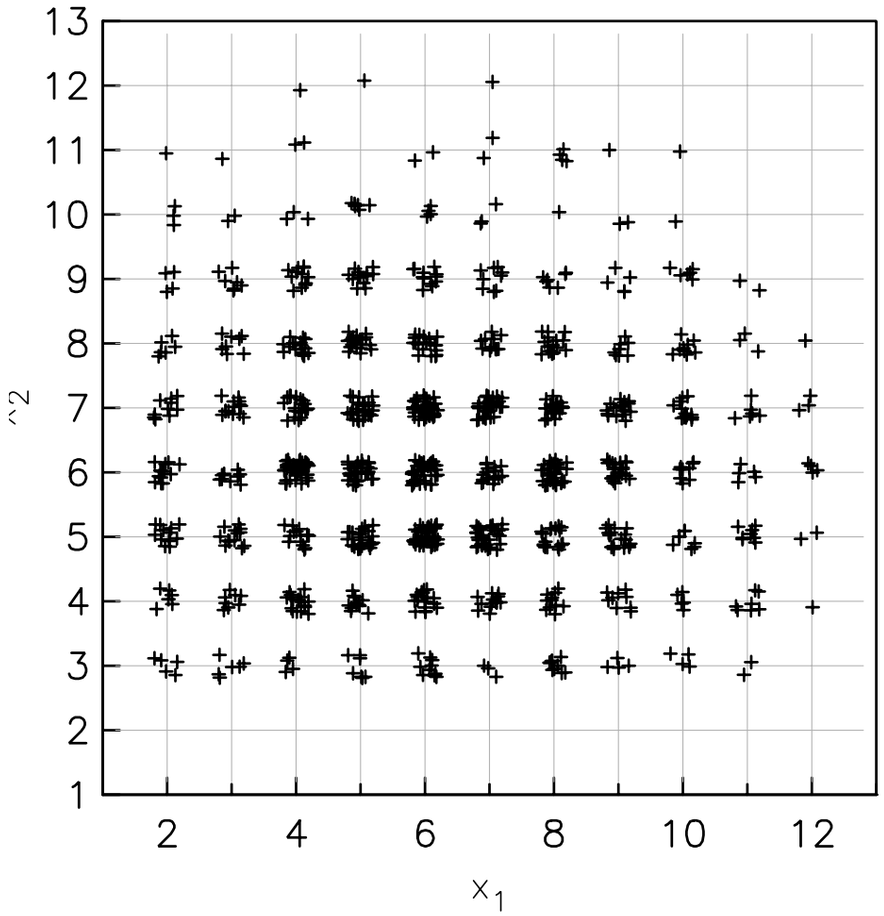
- Physics view - underlying truth
- Probability model with no true length

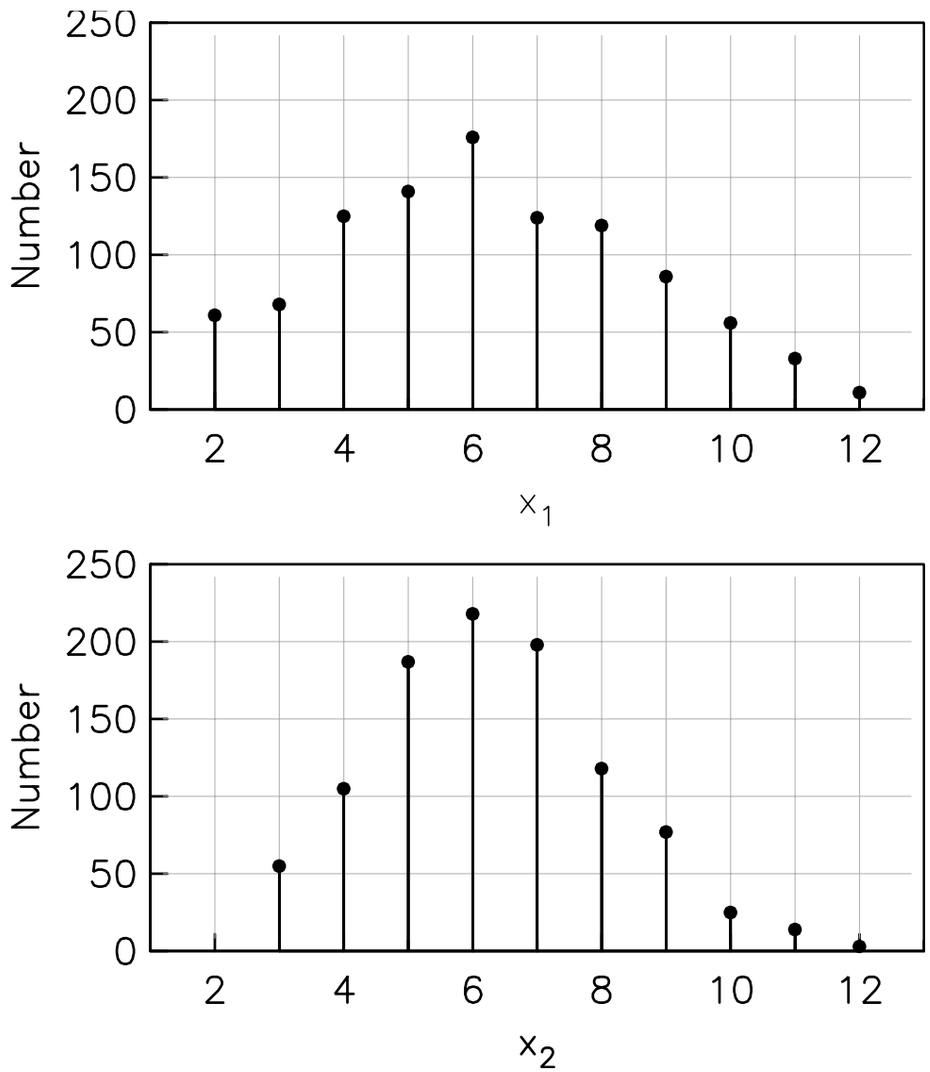




Toy Probability Model

random variables and probability theory

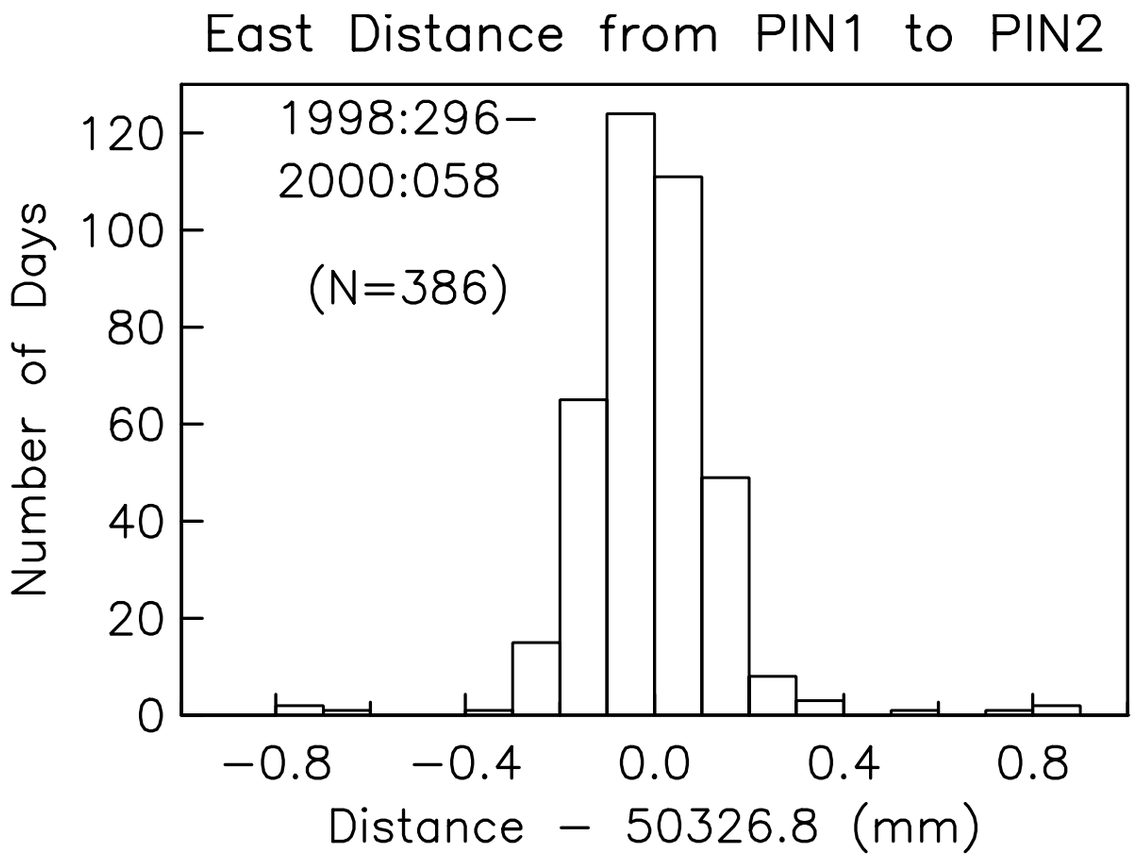


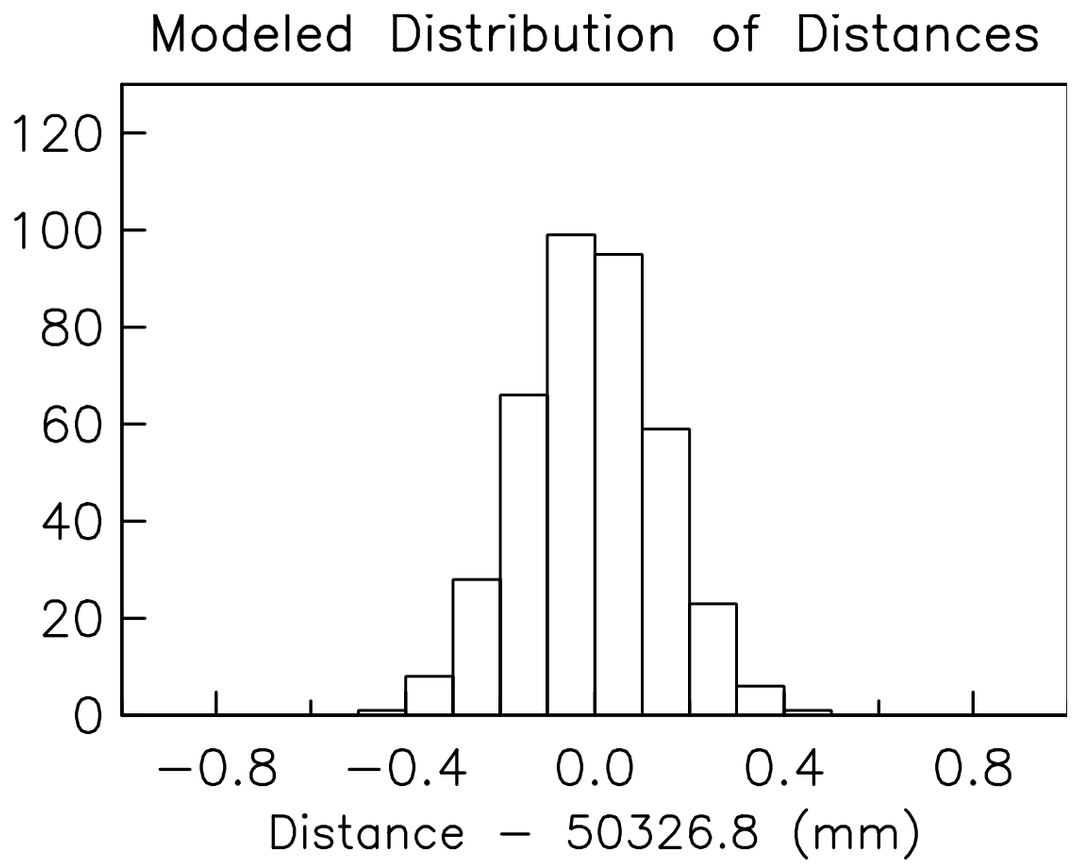


Probability vs Statistics

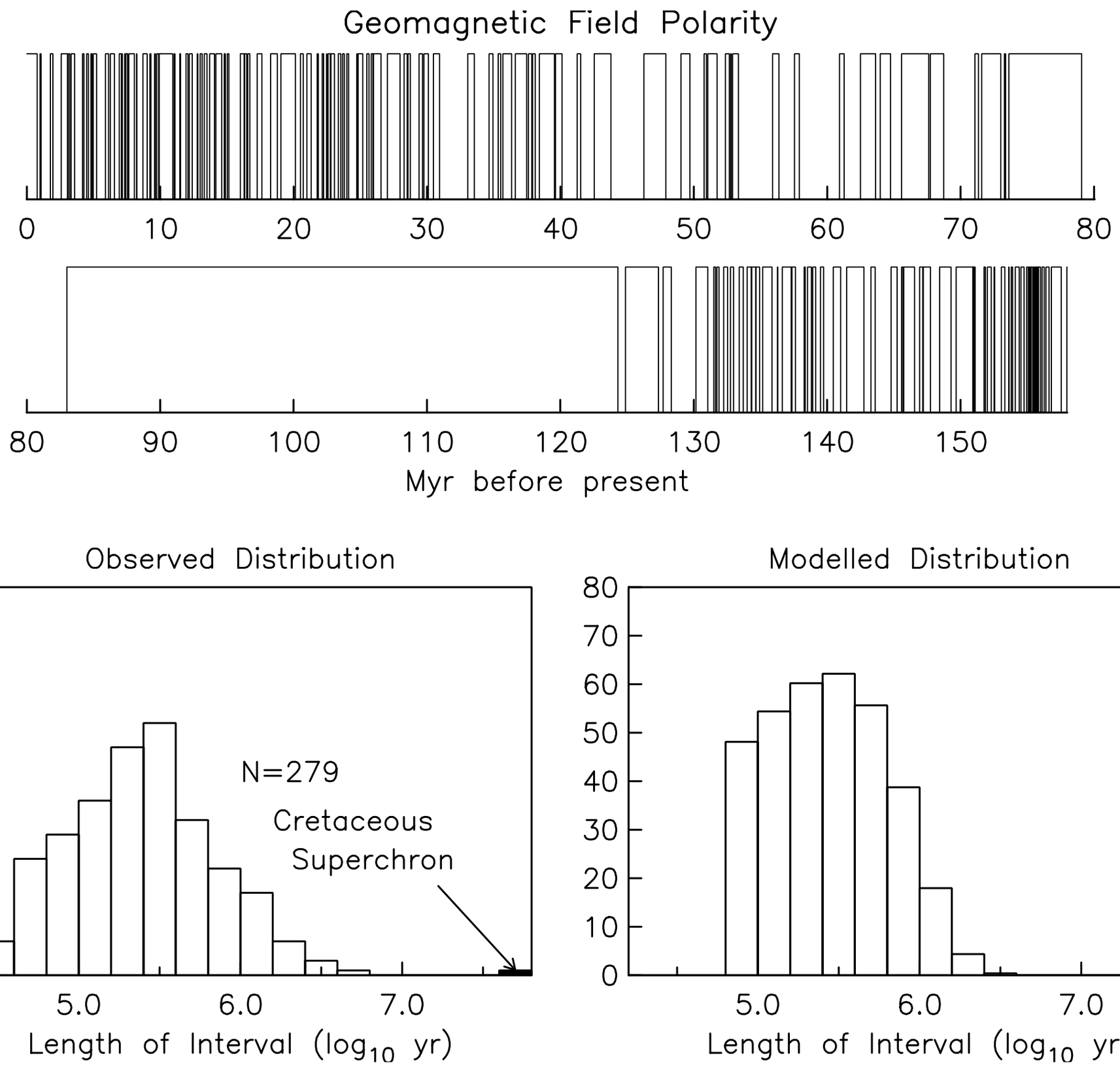
- Probability theory is math
- Statistics is applied math - used to make inferences
- e.g. ,Use estimation theory to answer What are mean and standard deviation of distance between PIN1 and PIN2?

Building a Model



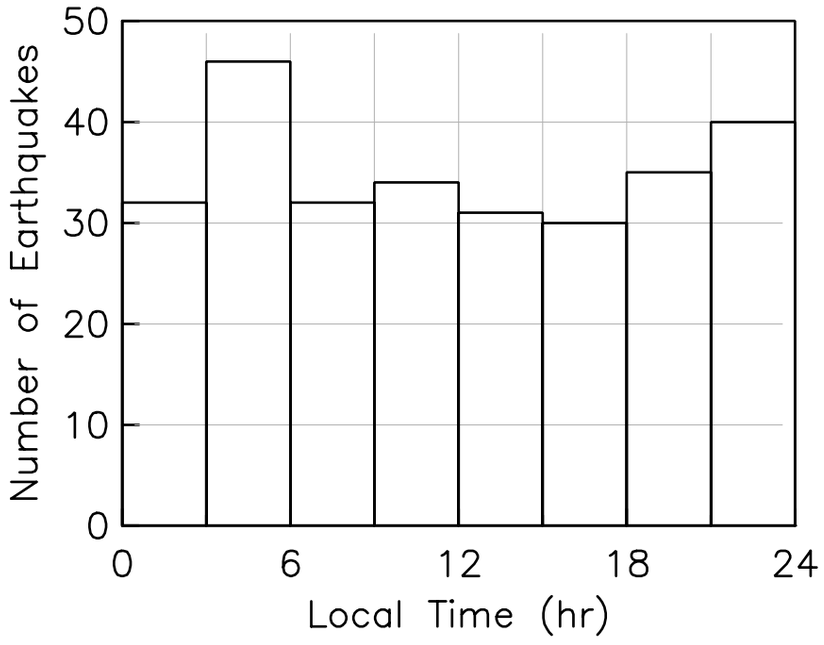


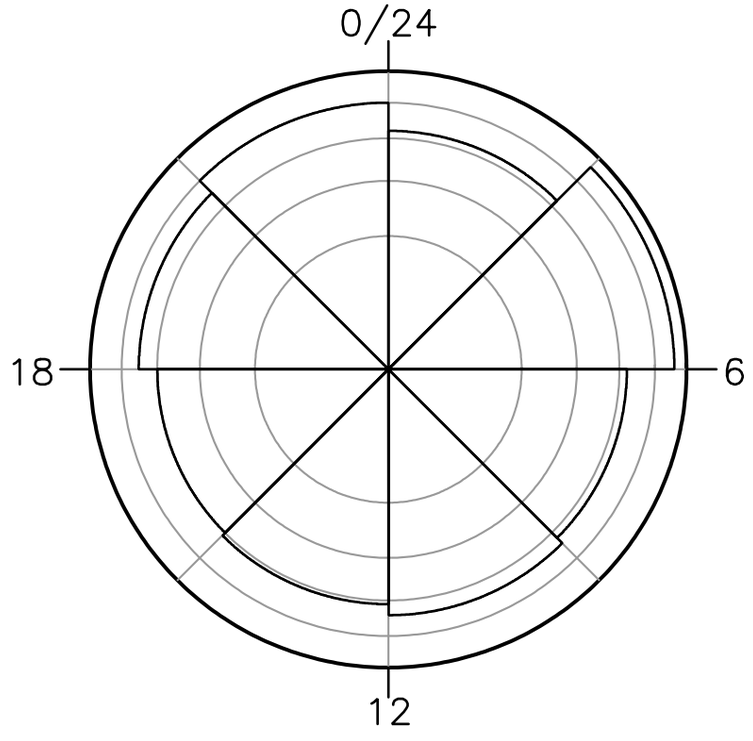
What function should we use to describe the histogram?

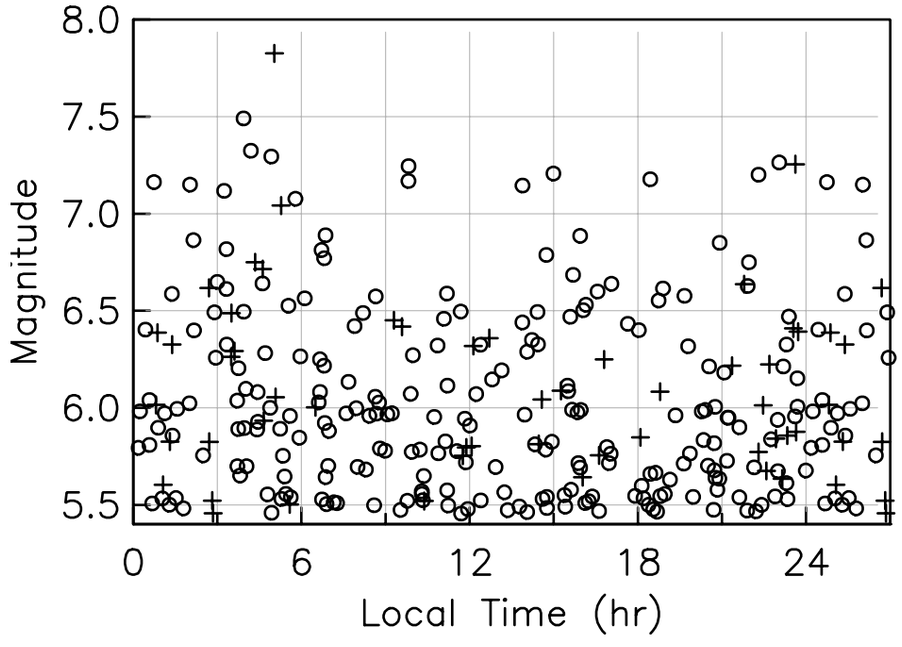

Geomagnetic Field Polarity
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
Myr before present
Observed Distribution
Number of Intervals
N=279
Cretaceous
Superchron
5.0
6.0
7.0
Length of Interval (log10 yr)
Modelled Distribution
5.0
6.0
7.0
Length of Interval (log10 yr)

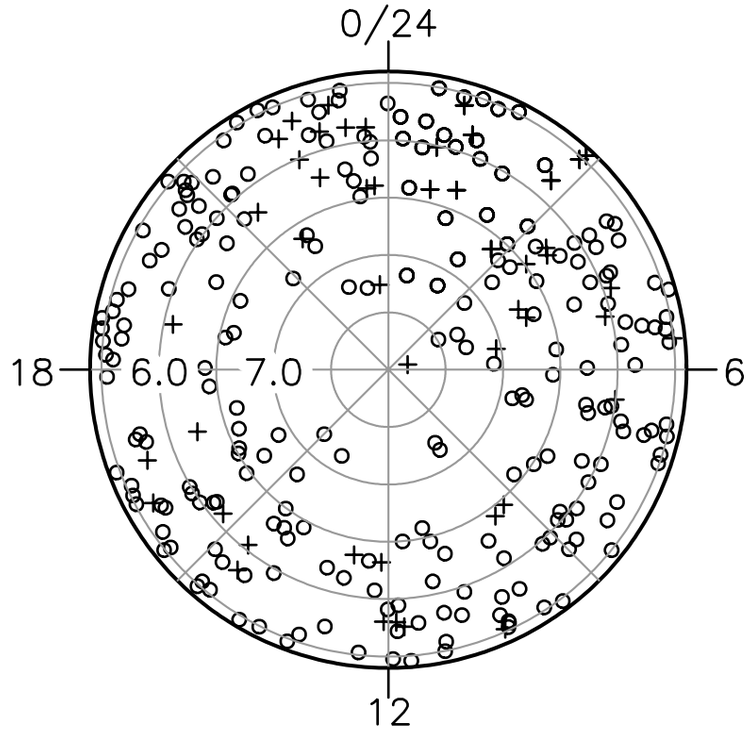
Times of California/Nevada Earthquakes

(1890–2012, magnitude 5.5 and above: 280 quakes)

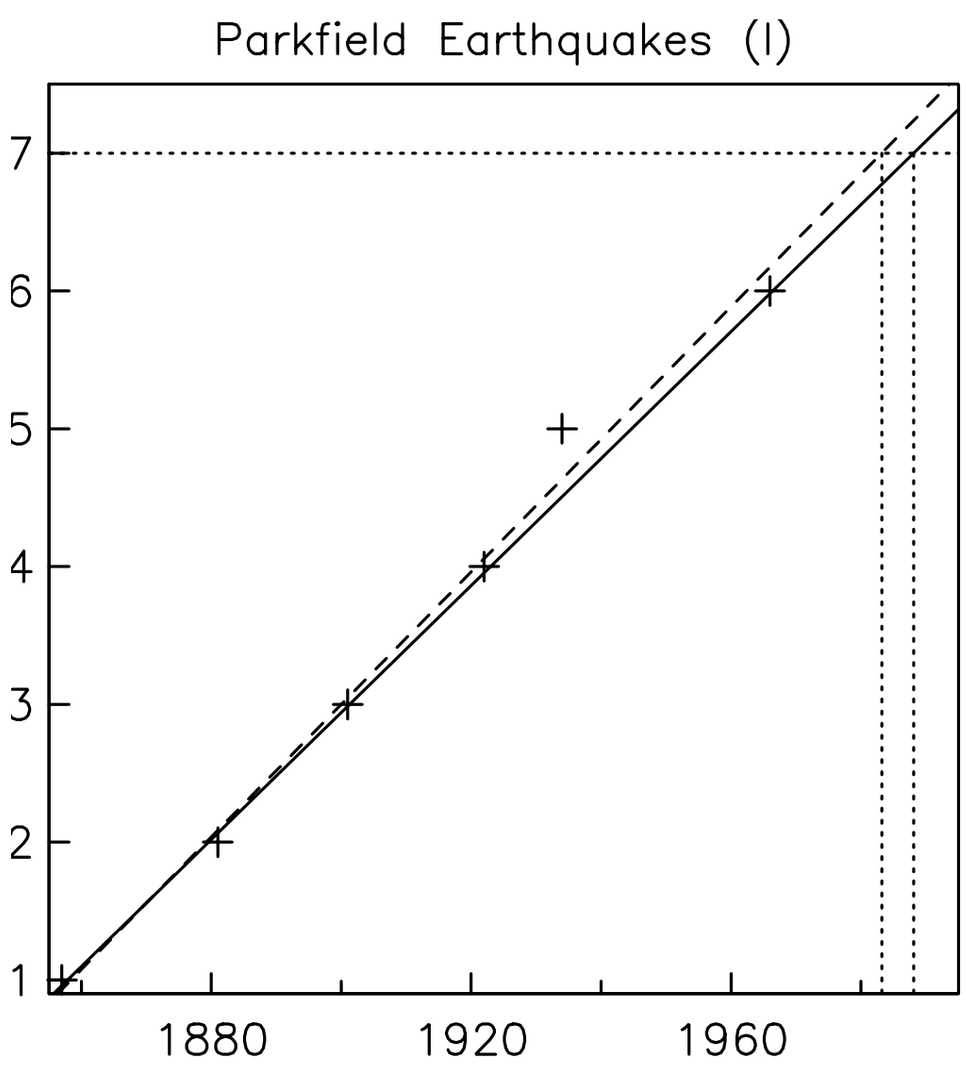


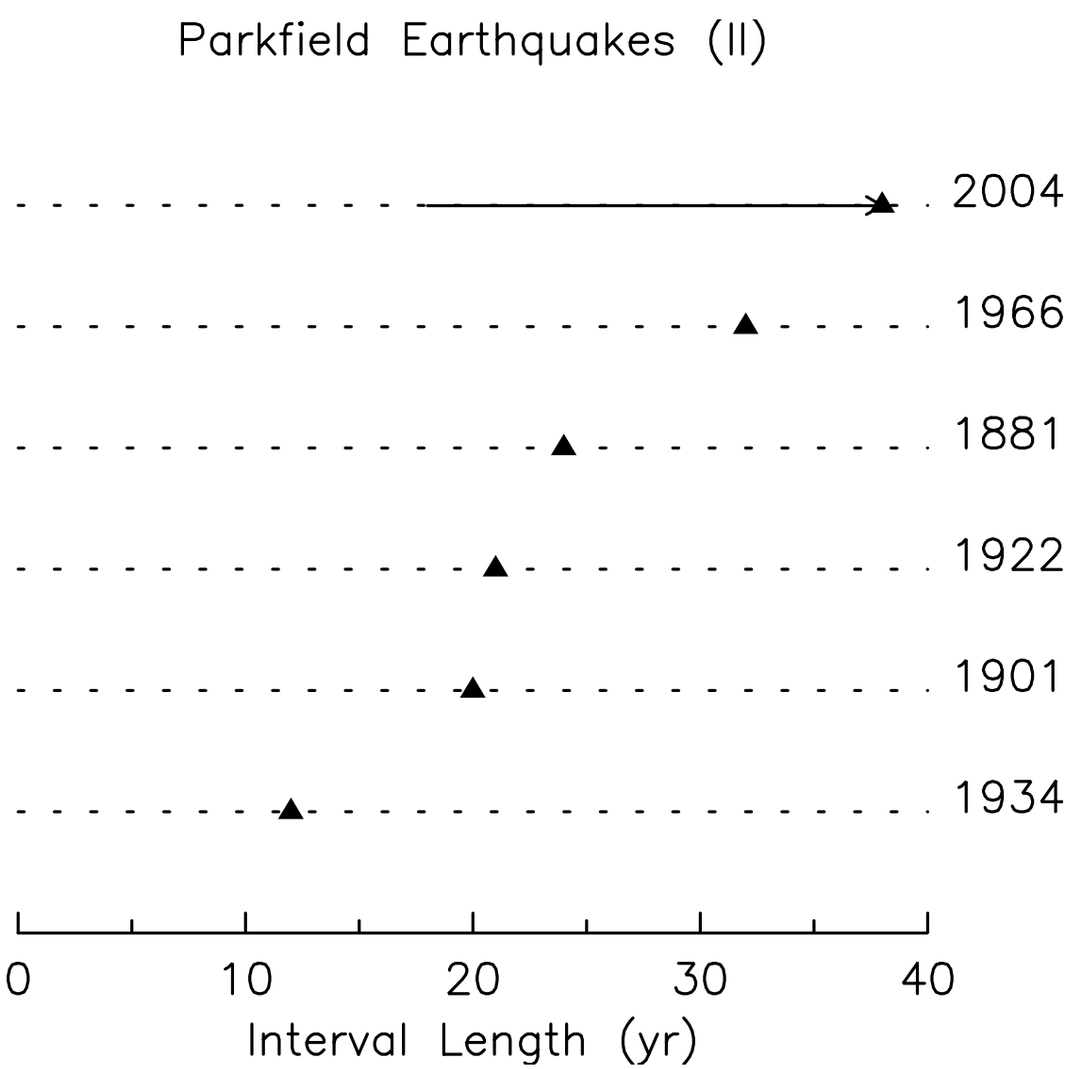






Predicting Earthquakes?





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