What you should be doing

- Read Chapter 2 & 3a Notes
- Assignment 4 due November 6. Finish it today
- Assignment 5 Extra Credit . Due Nov. 15

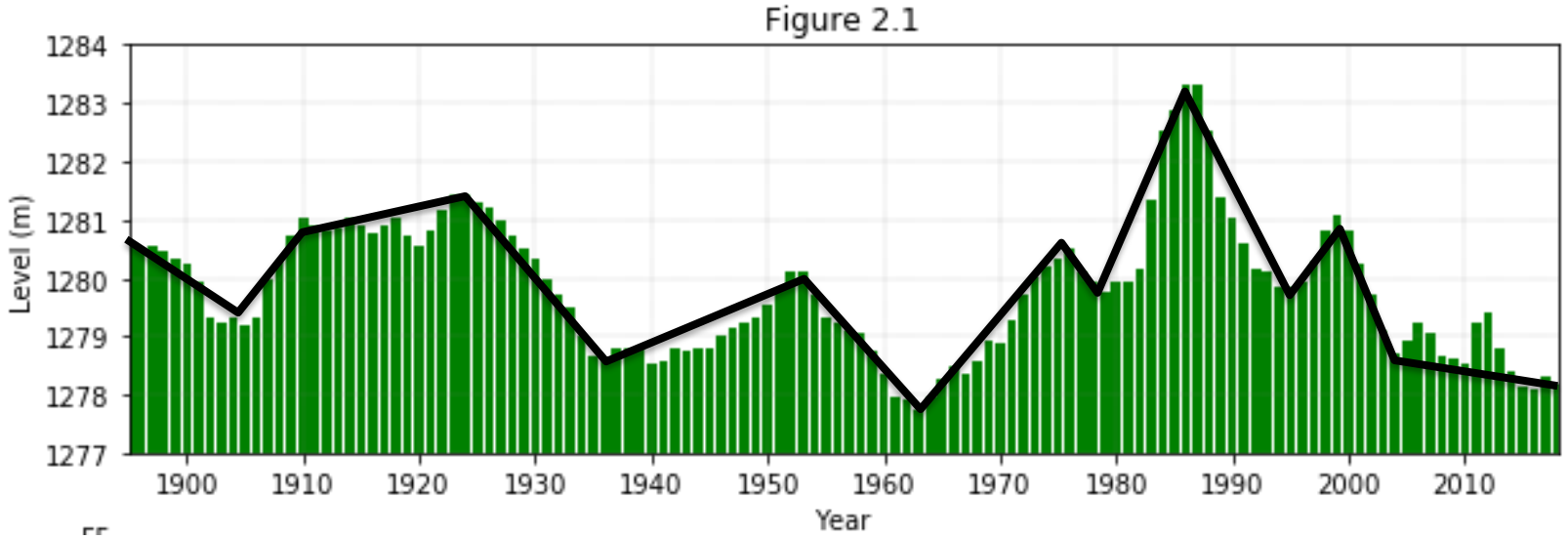
Exploratory Empirical Analyses

- Objective is to reduce the complexity (dimensionality) within a large data set
- What is a value commonly observed?
- How much variability is there among all the values?
- What are extreme cases that have been observed?

Exploring Data: What is the Objective?

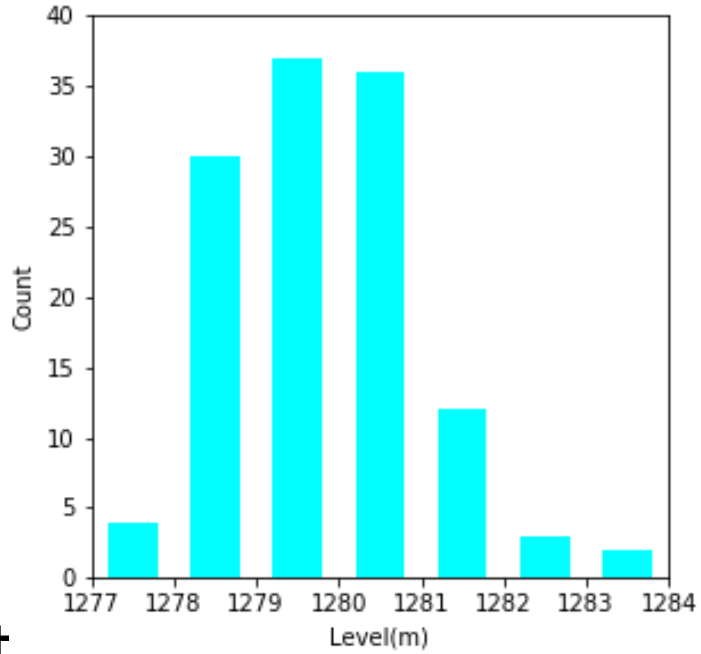
- Summarizing some of the typical characteristics of the data
- How often are critical thresholds for specific applications reached?
  - Road temperature below freezing point
  - Hot, dry, windy conditions potentially leading to wildfires
- Approach to be used will depend on what is considered important to know to address the objective

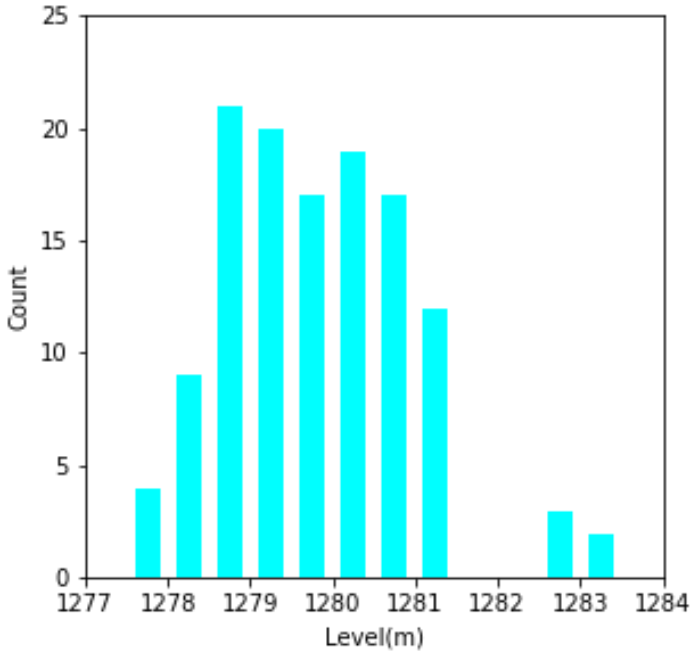
Great Salt Lake Level

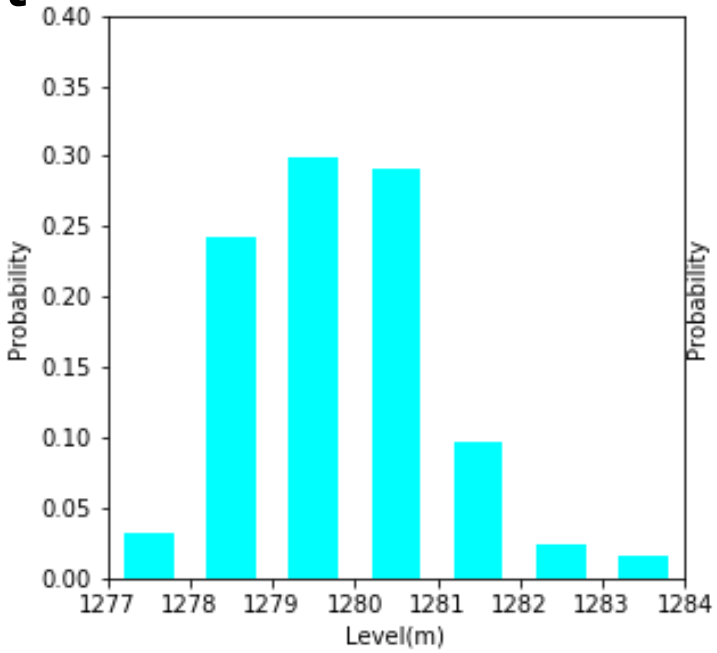


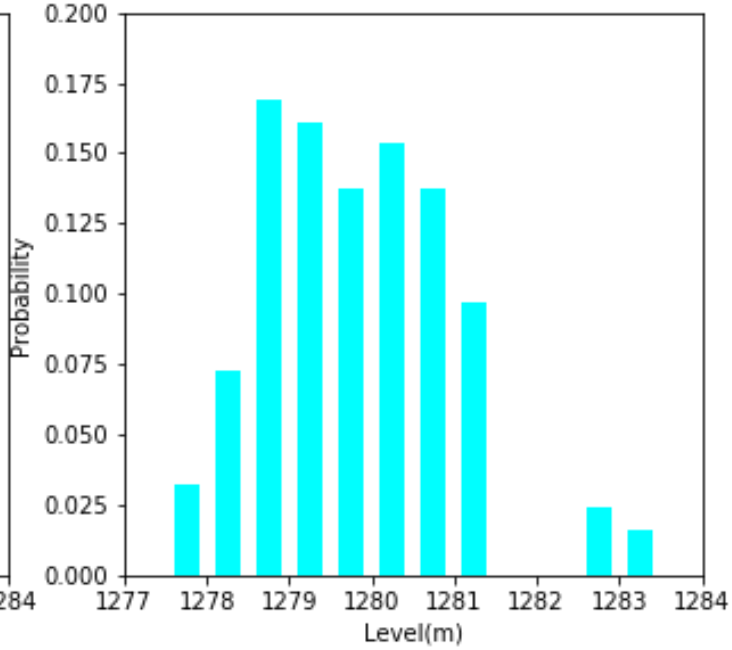
Lake Level Histograms

not every observation in independent of the others

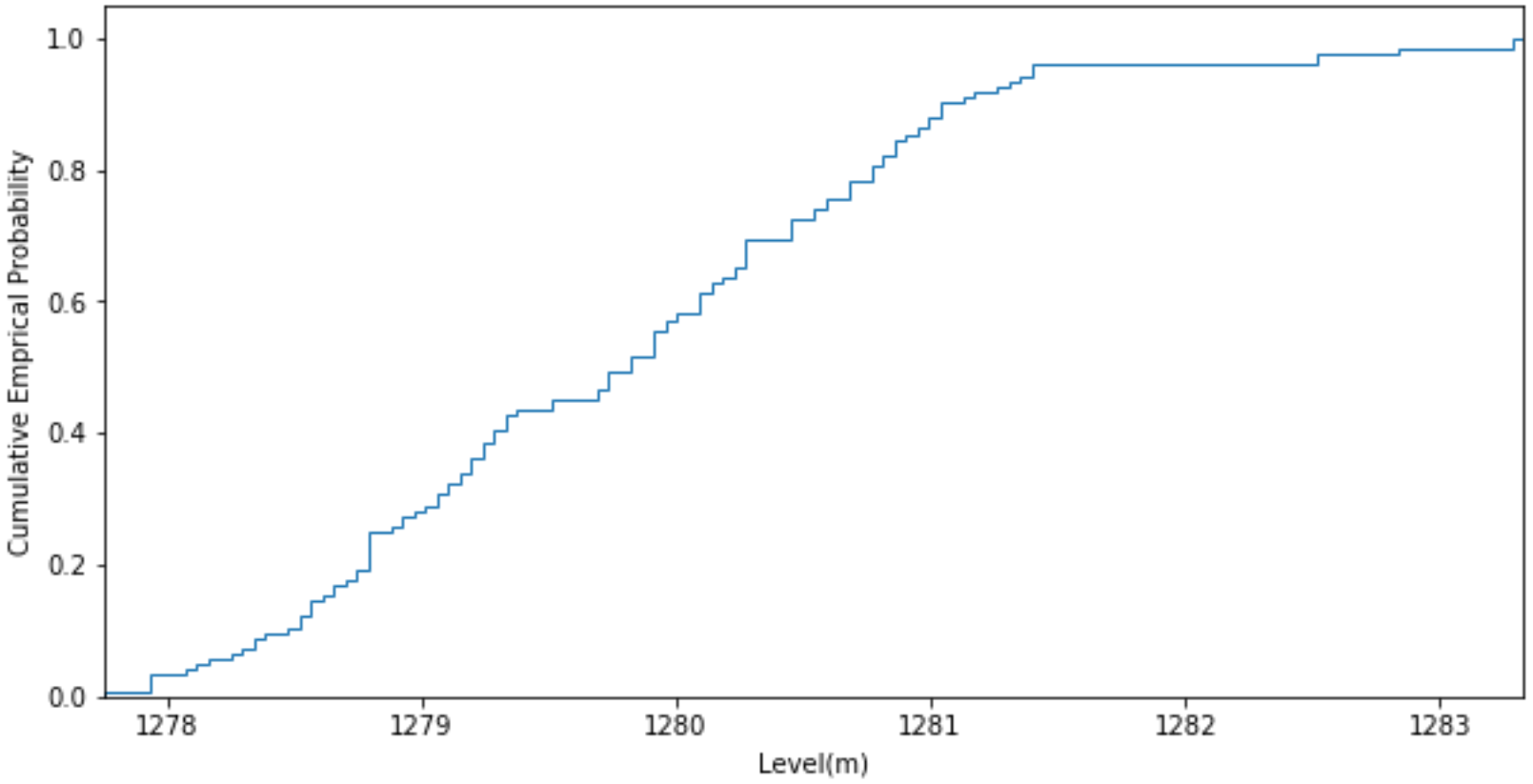








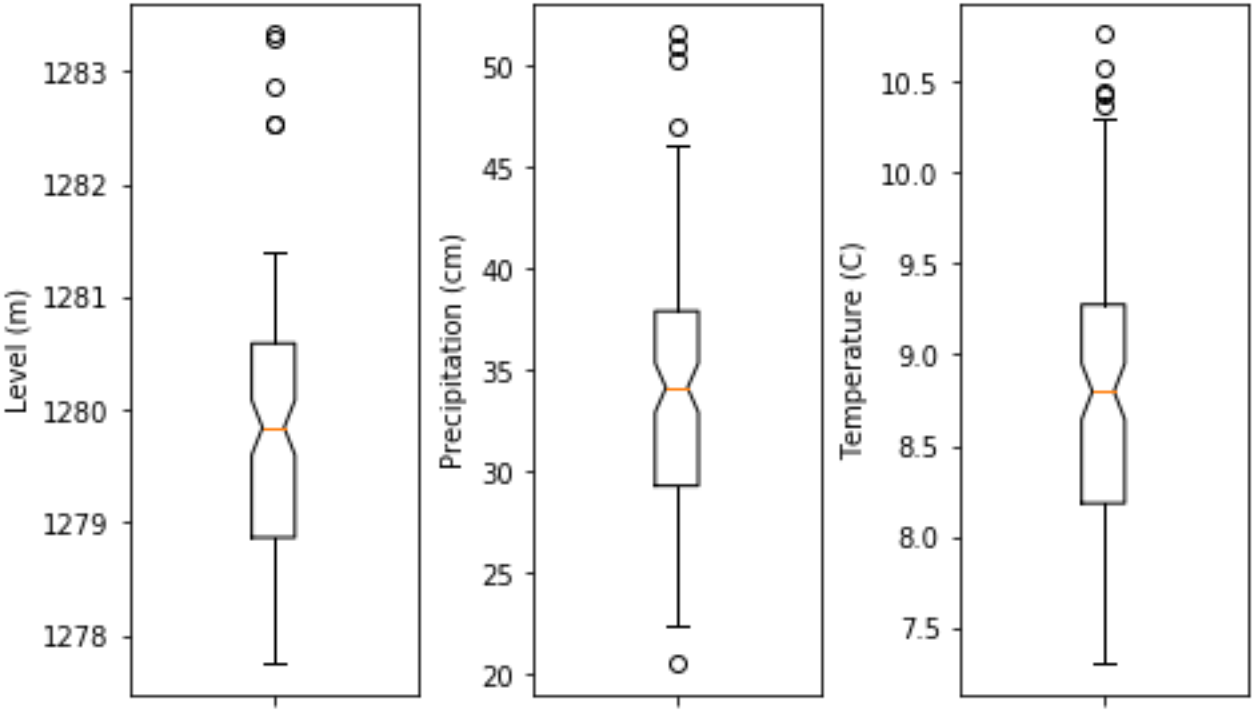
Empirical Cumulative Distribution Function Lake Level



3 Basic Statistical Characteristics

- Central value: mean, median, mode, trimmed mean
- Spread: range, standard deviation, variance, mean absolute deviation, interquartile range
- Shape: skewness

Boxplots


Level (m)
1283
1282
1281
1280
1279
1278
Precipitation (cm)
50
45
40
35
30
25
20
Temperature (C)
10.5
10.0
9.5
9.0
8.5
8.0
7.5

Transforming Data

- Examining data from alternative perspectives
  - Anomalies from long term mean
  - Anomalies from arbitrary period (“normal”)
  - Anomalies from seasonally evolving long term means
  - Standardized anomalies (non-dimensional)
  - Low/high pass filters

Time Series

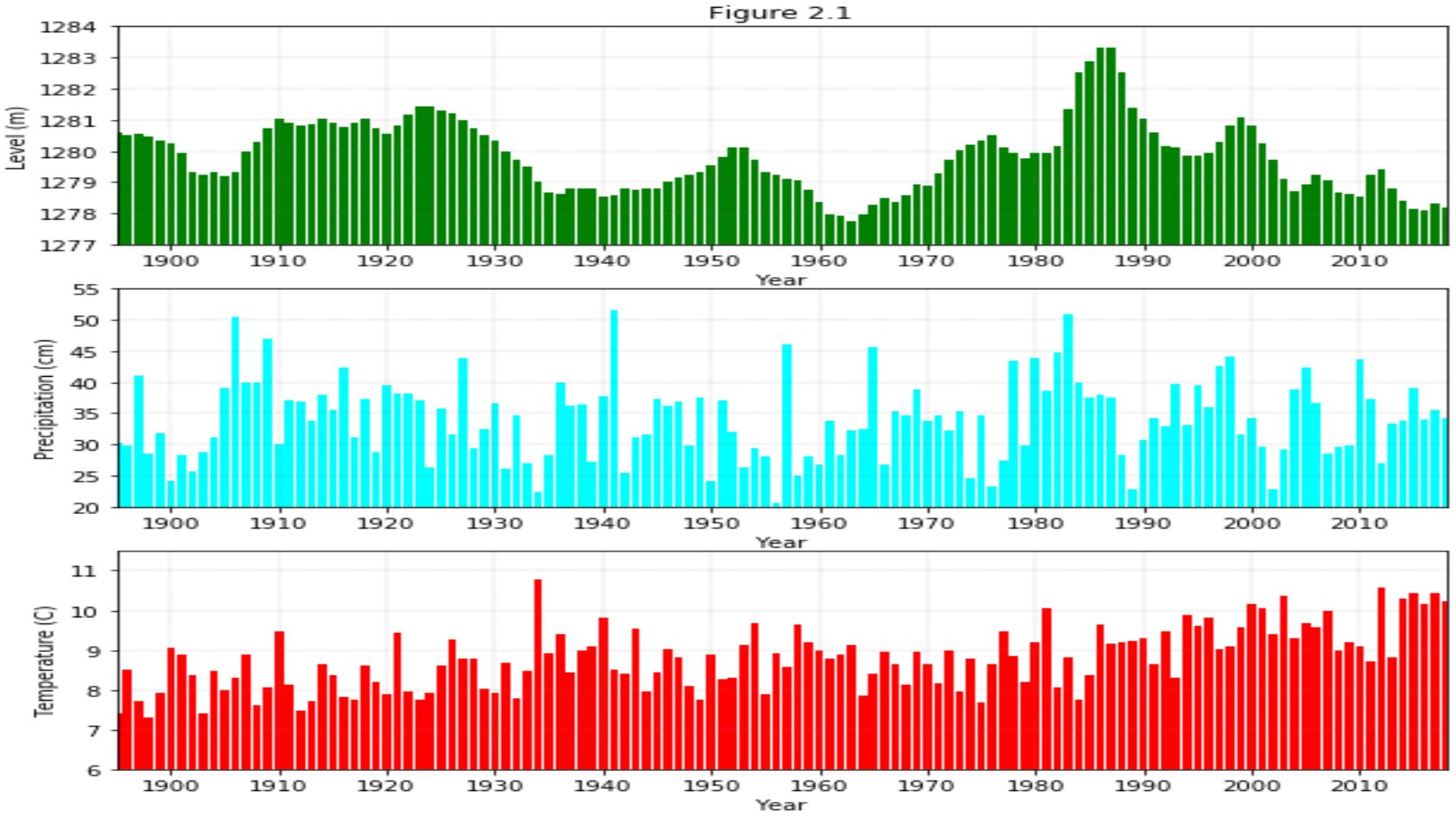
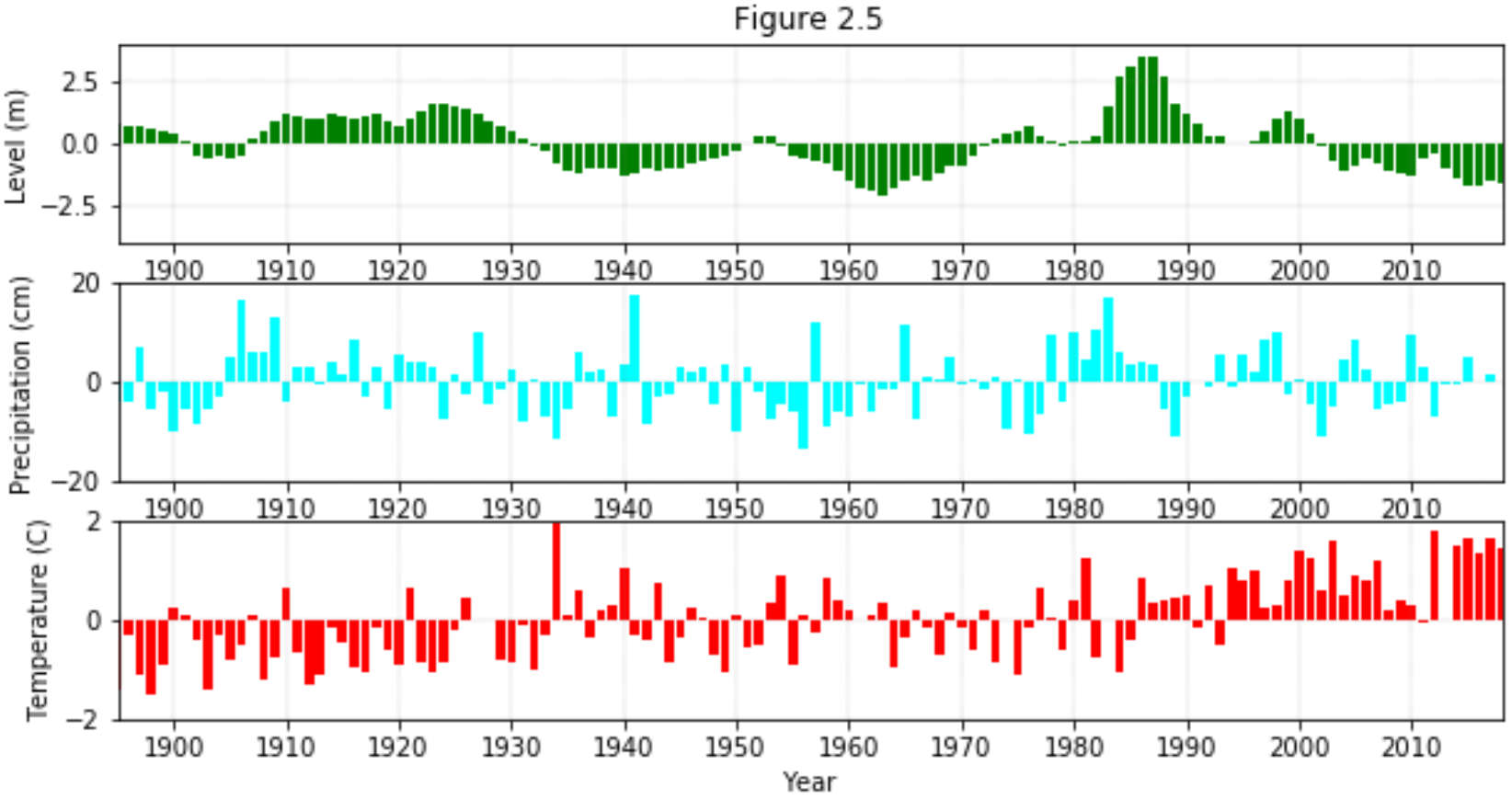


Figure 2.1
Level (m)
1284
1283
1282
1281
1280
1279
1278
1277
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
Year
Precipitation (cm)
55
50
45
40
35
30
25
20
Year
Temperature (C)
11
10
9
8
7
6
Year

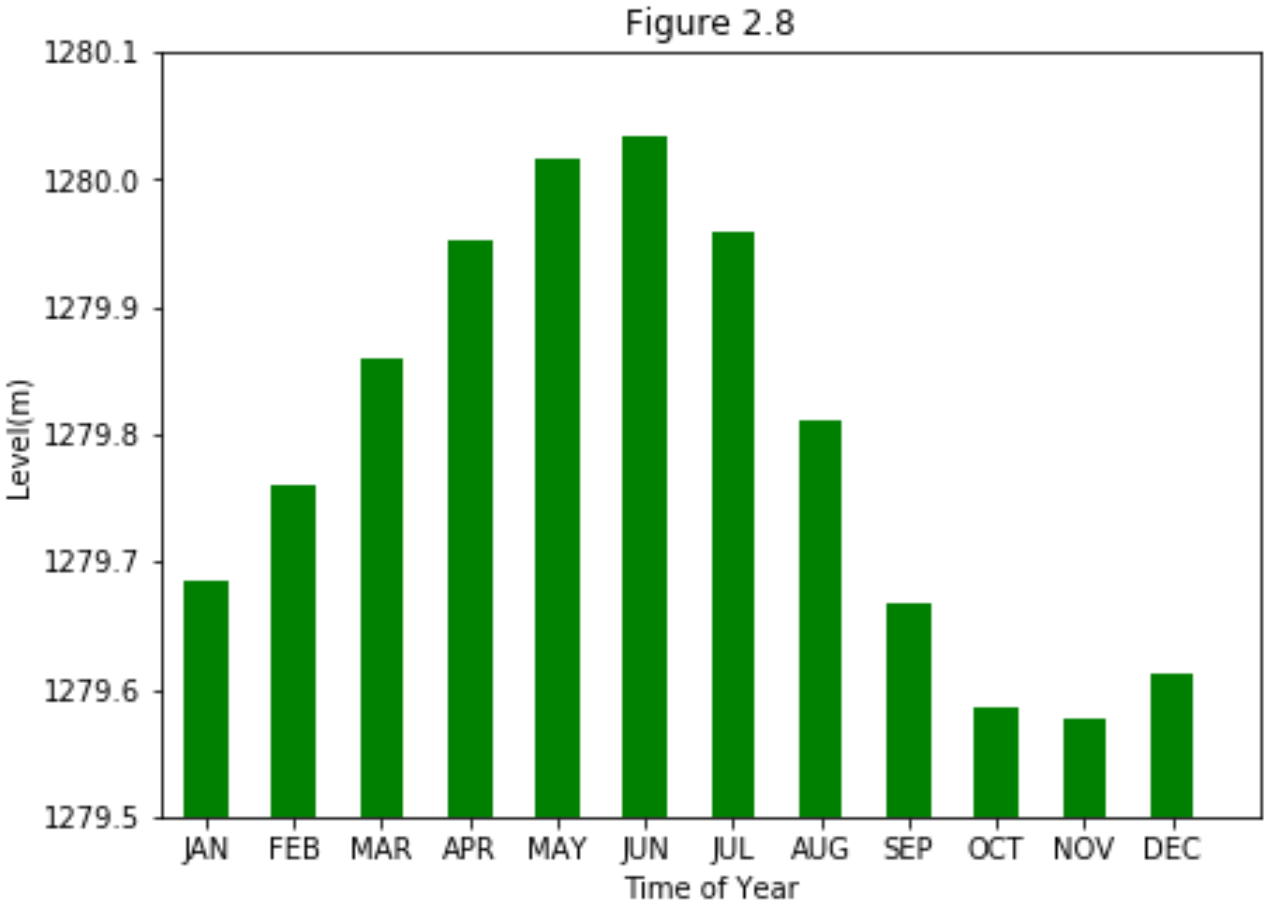
Transforming Data

- Anomalies: departure from long-term mean



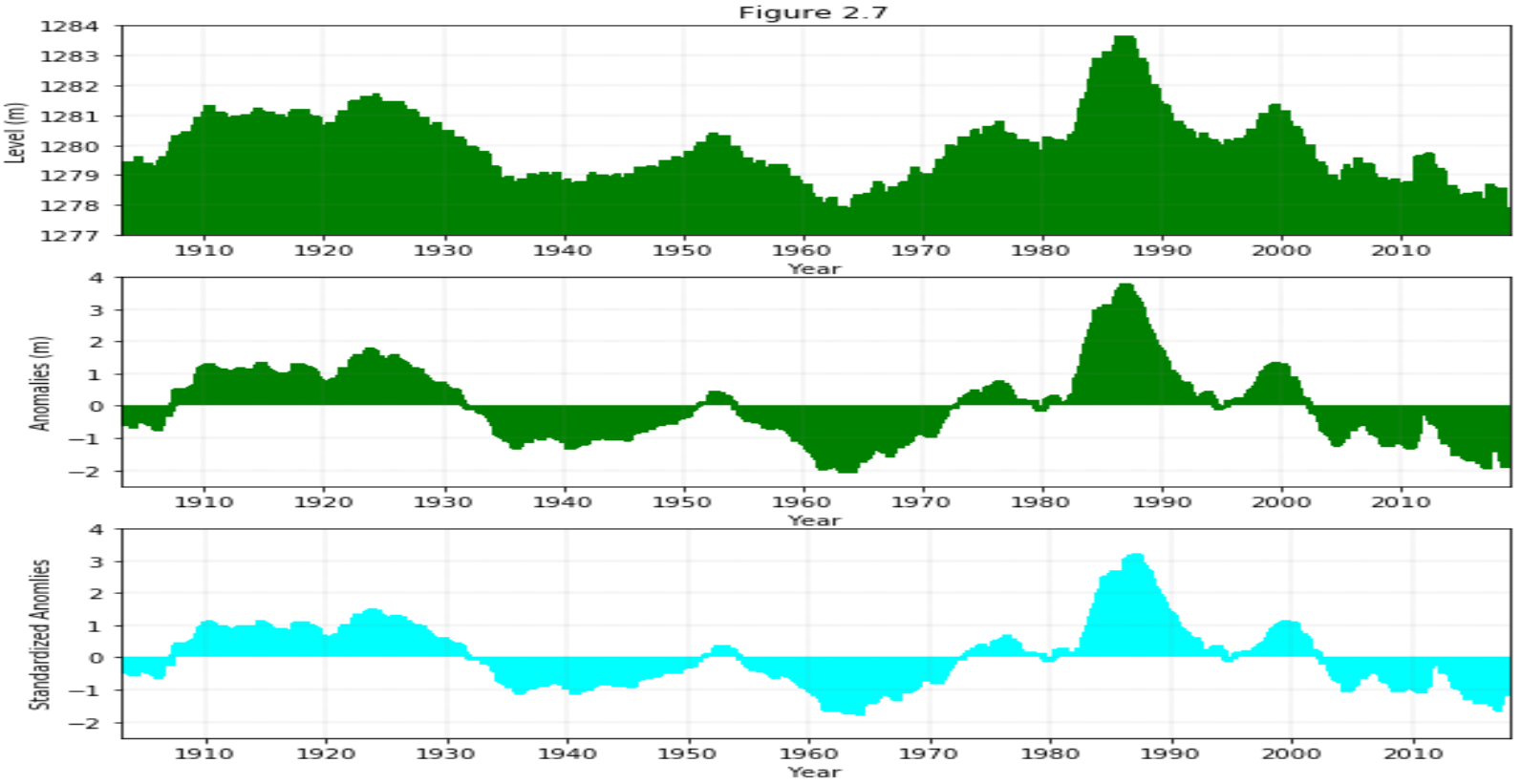
Transforming data

- Removing climatological seasonal cycle

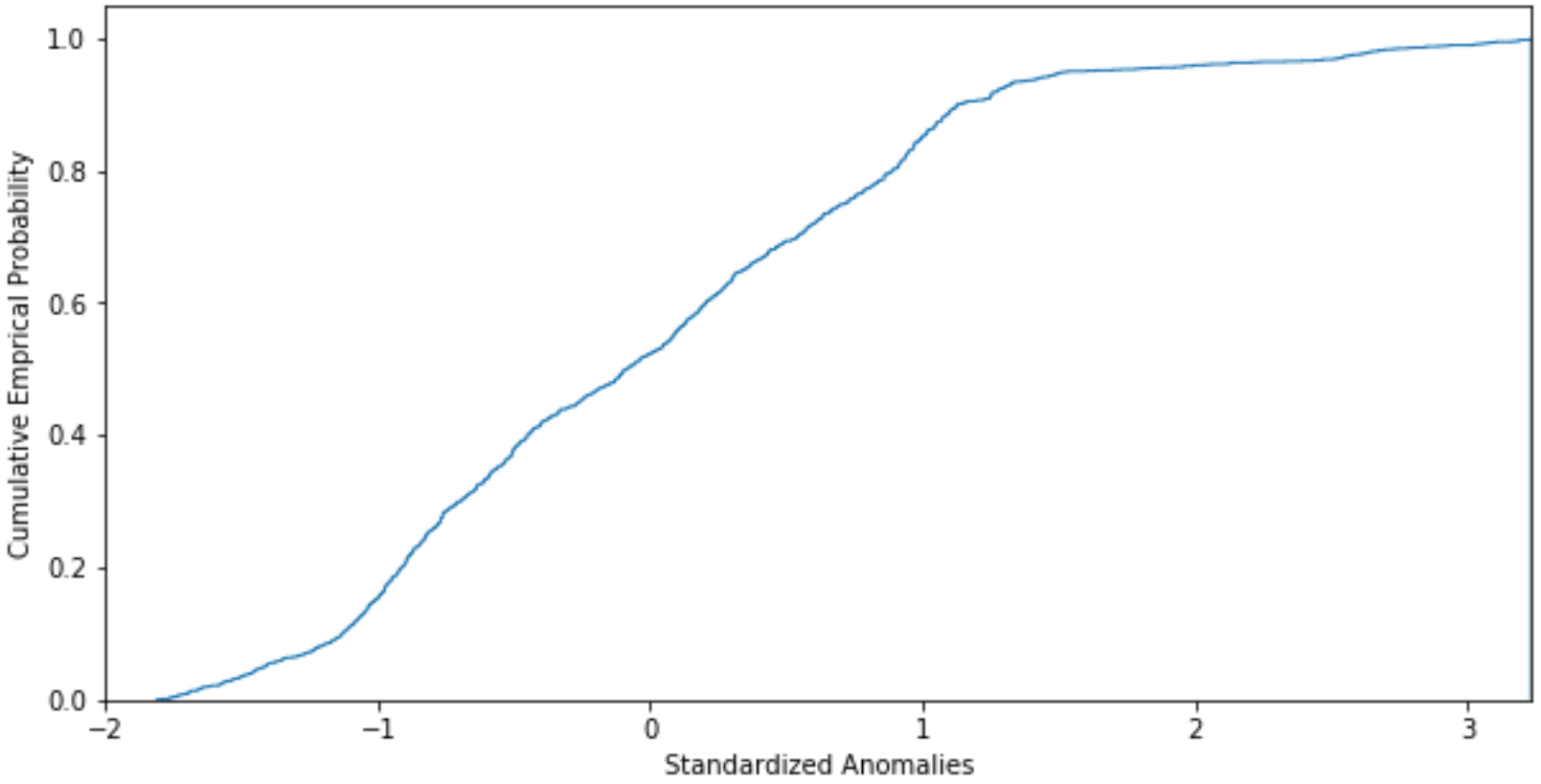


Transforming data

- Removing climatological seasonal cycle
- Computing standardized (non-dimensional) anomalies

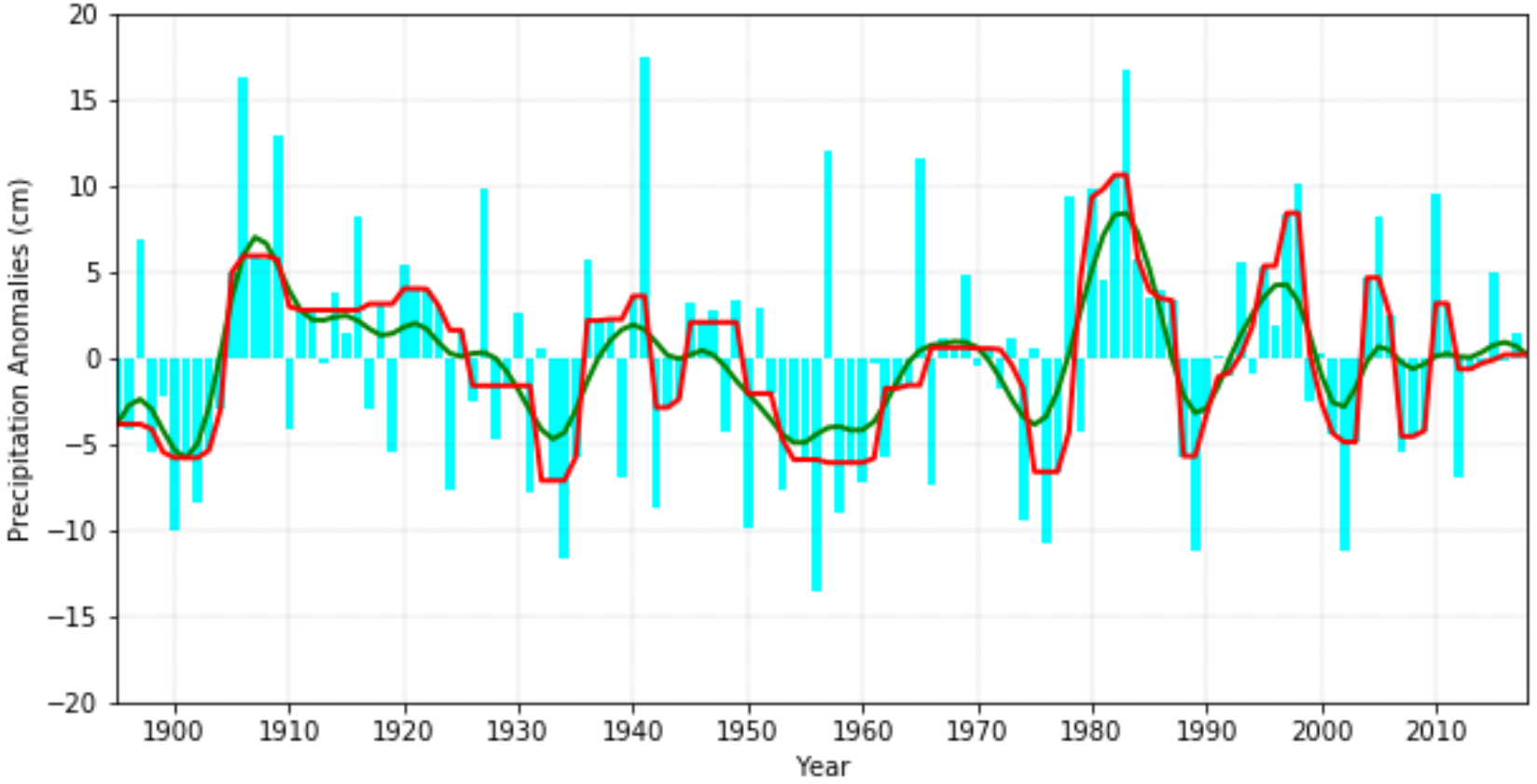


CDF of Monthly Standardized Anomalies



Transforming Data

- Low pass filter: keep slow variations, remove fast ones



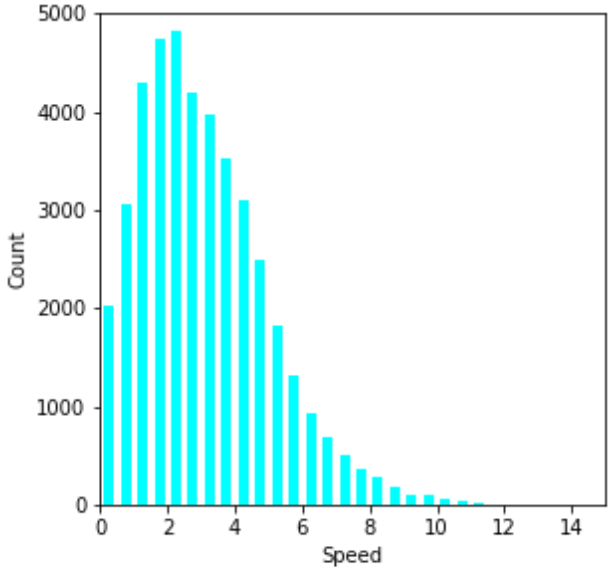
Basic Statistical Methods for Fluid Flow

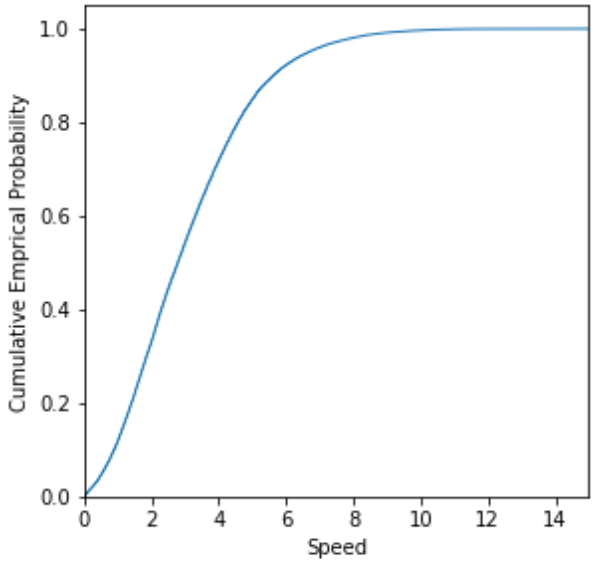
- horizontal speed V and direction (θ)
- θ is the direction from which the wind blows: north wind is 0; east wind is 90; south wind is 180; west wind is 270
- horizontal Cartesian components,
  - zonal *u* (east-west with *u* positive when fluid motion is from west to east)
  - meridional *v* (north-south with *v* positive when fluid motion is from south to north)
- $\vec{V} = u\hat{i} + v\hat{j}$ and $\vec{V} = \left|\vec{V}\right| \hat{t}$
  - $V = \left|\vec{V}\right| = \sqrt{u^2 + v^2}$
  - $\theta = 180 + tan^{-1}\, u\,/v$

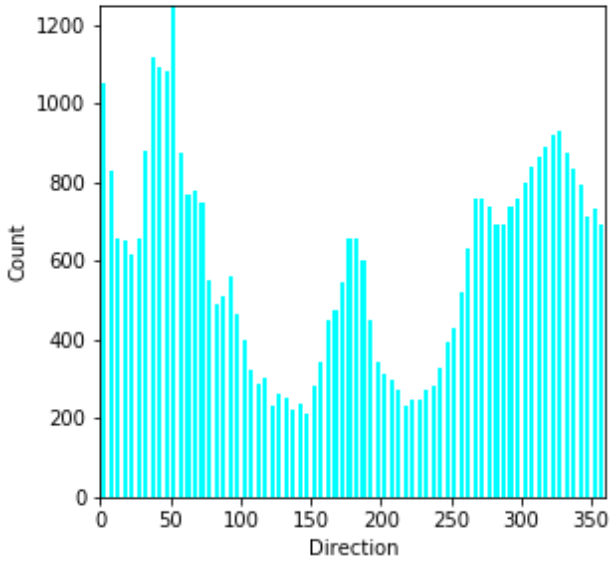
Basic Statistical Methods for Fluid Flow

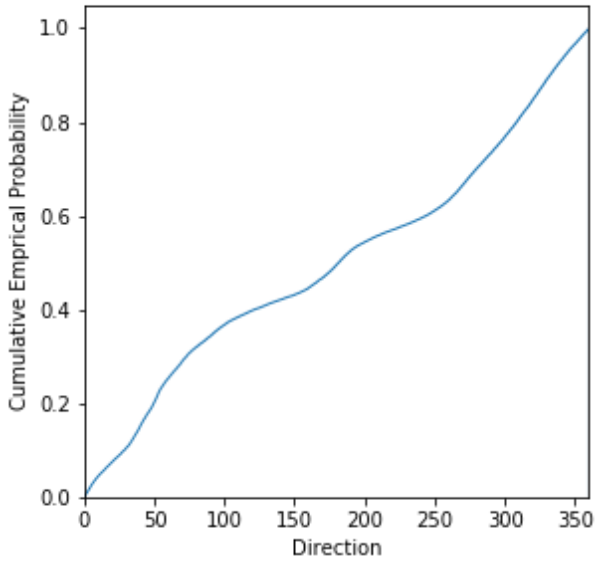
- Horizontaal fluid motion can be described as:
  - speed $\left|\vec{V}\right|$ and direction (θ)
  - Cartesian components, zonal *u* (east-west with *u* positive when fluid motion is from west to east) and meridional *v* (north-south with *v* positive when fluid motion is from south to north
-

Histograms and cumulative frequency distributions of wind speed and direction

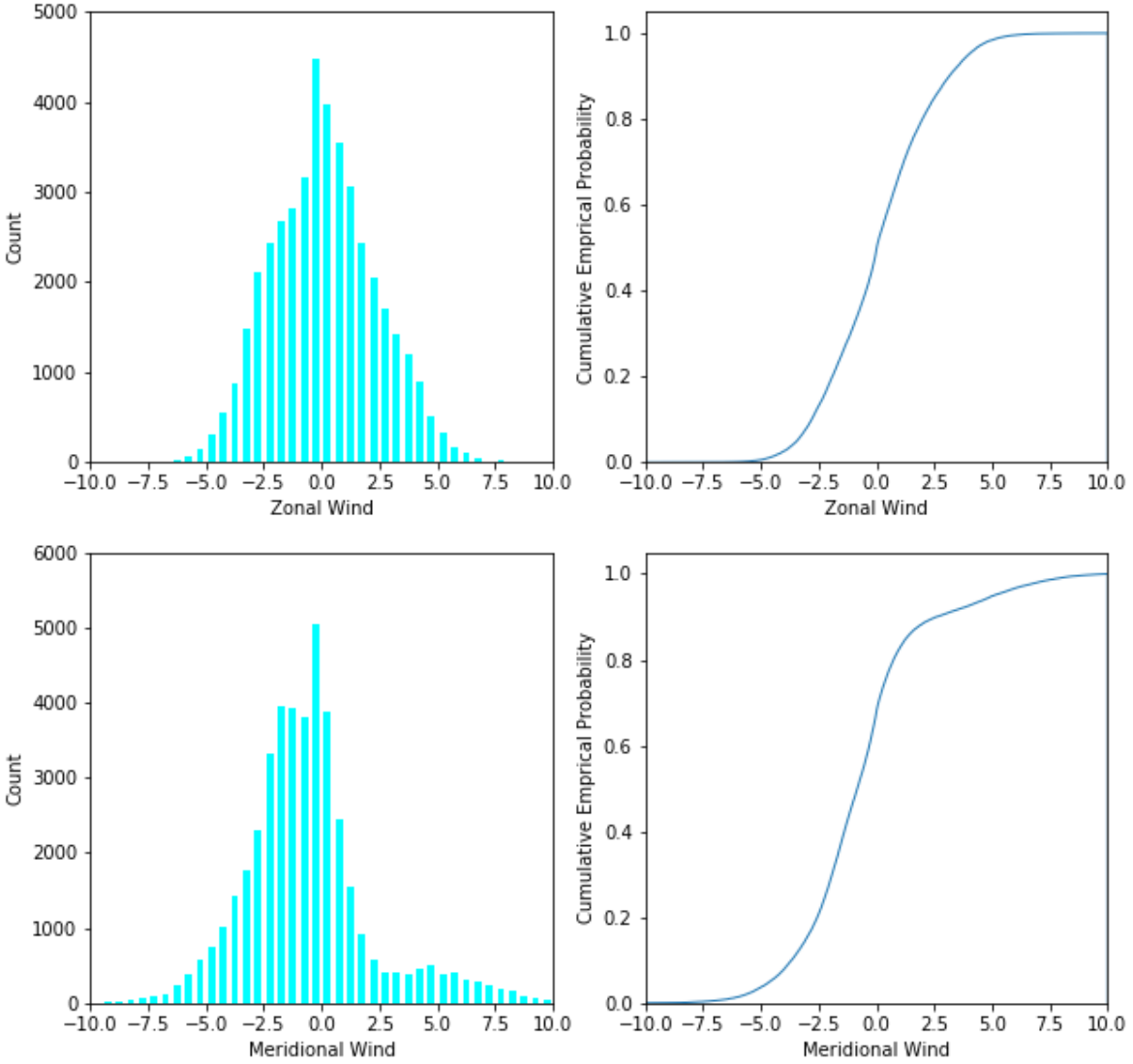




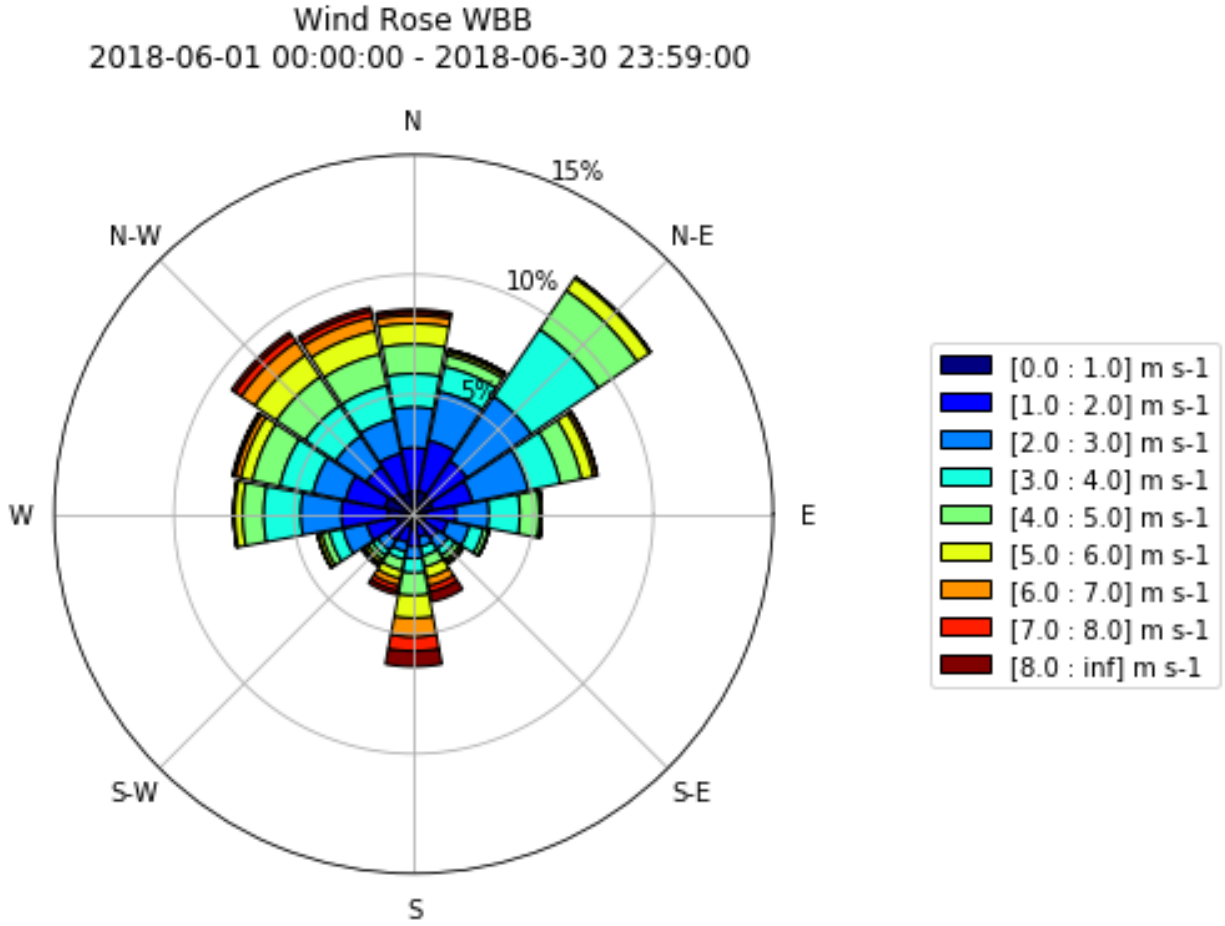




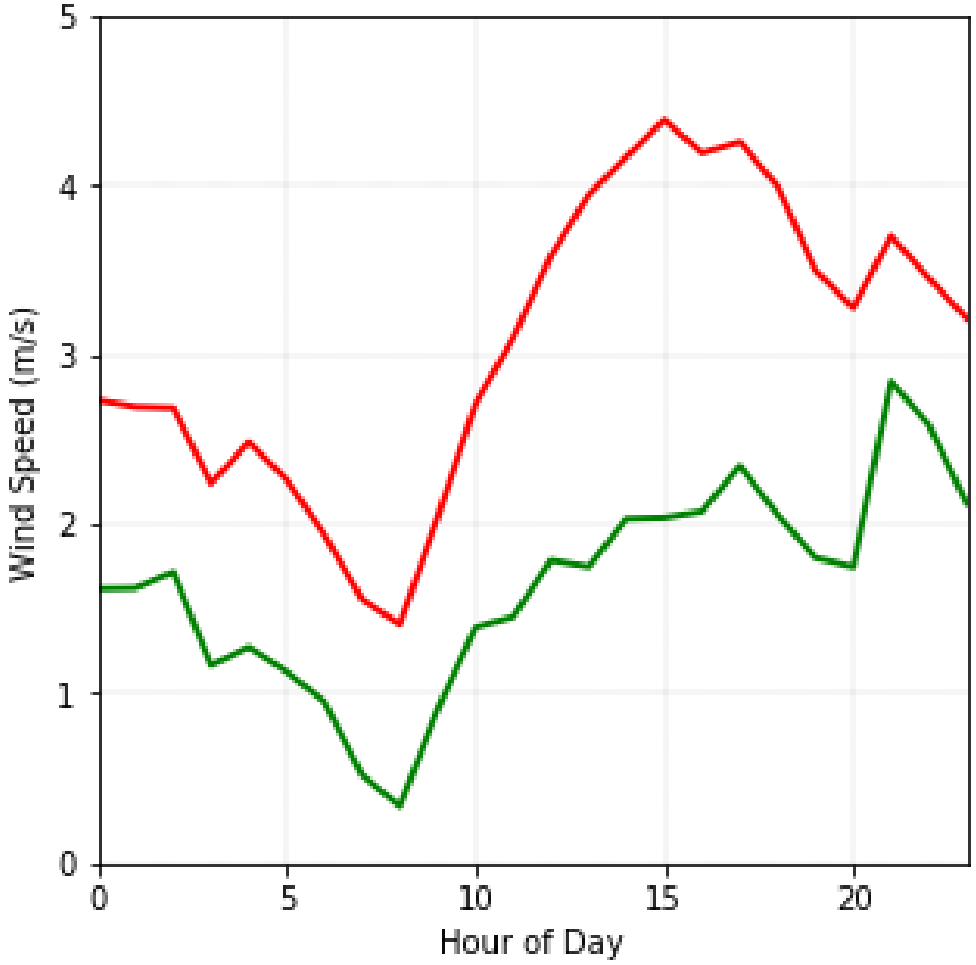
Histograms and cumulative frequency distributions of zonal and meridional wind components



Wind Rose: Counting Speed in Wind Direction Bins



Hourly mean wind speed (red line) and resultant wind speed (green line)



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