OCN 390: Field Methods

Week 11

Data Analysis in Python

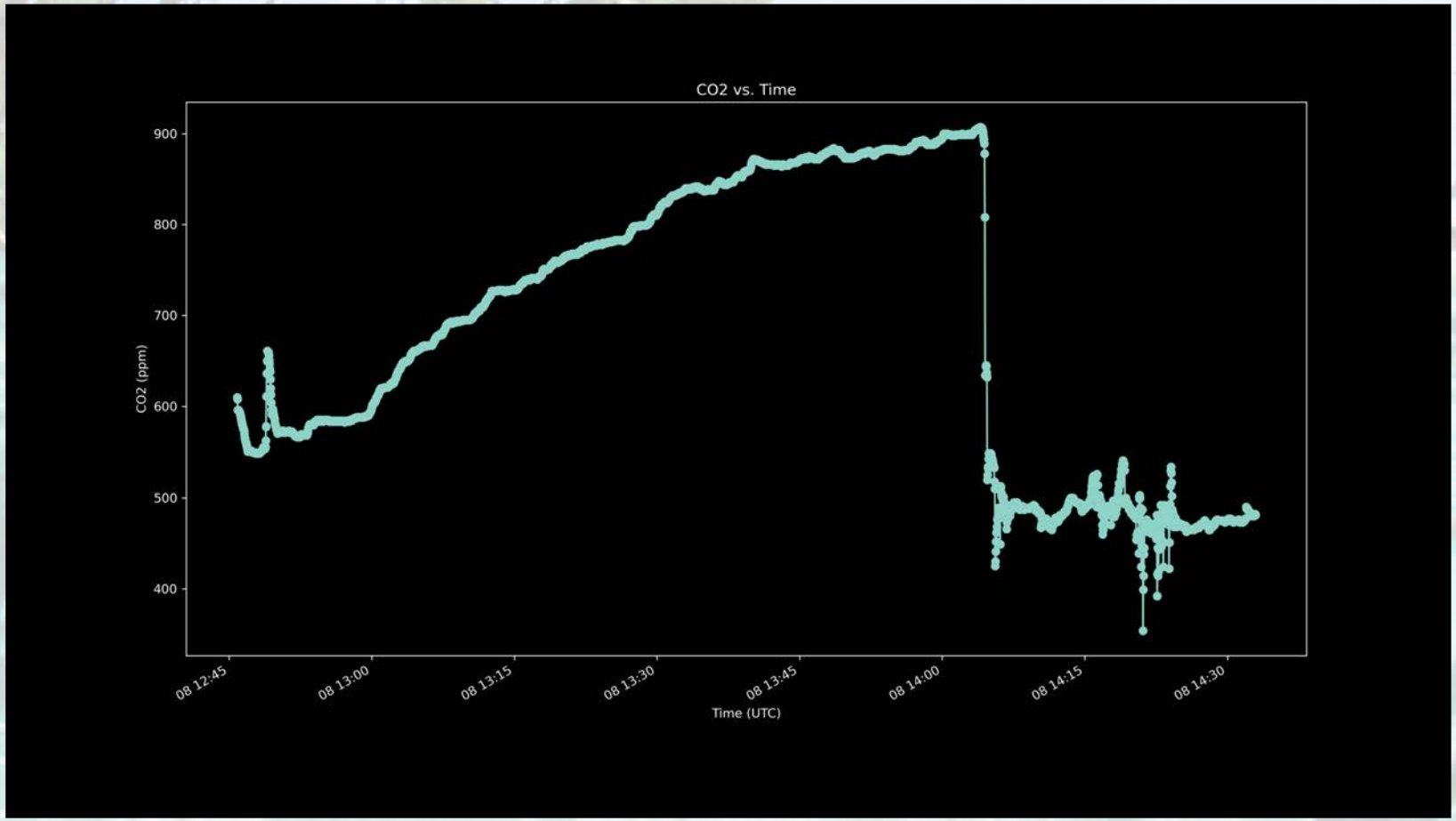
Group Project Check-ins

What are current plans? How will you analyze and visualize data? Have you already collected data? Analyzed it? Started Story Map?

Python for Earth Science

Figure Markup

- What features do you see in this figure?

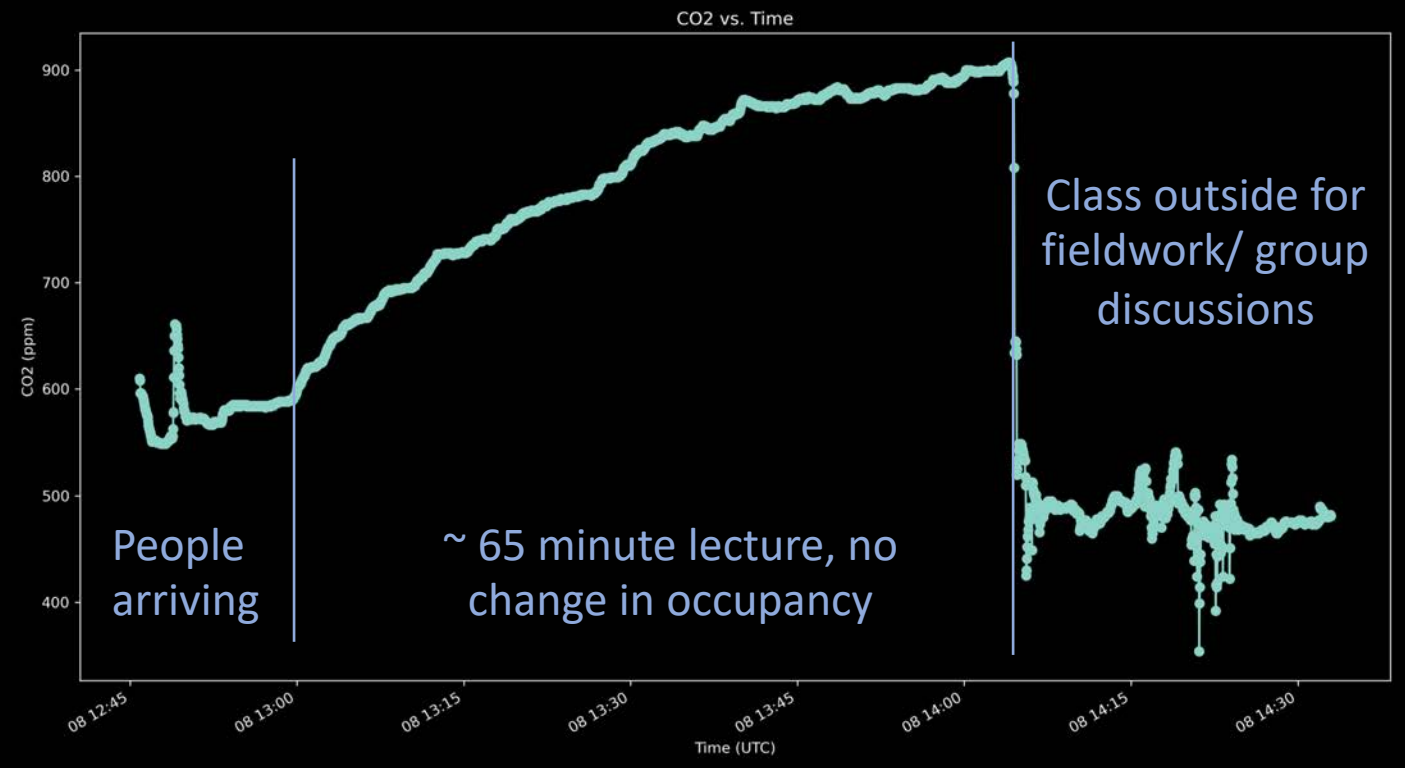


K-30 test 8 Mar 2020

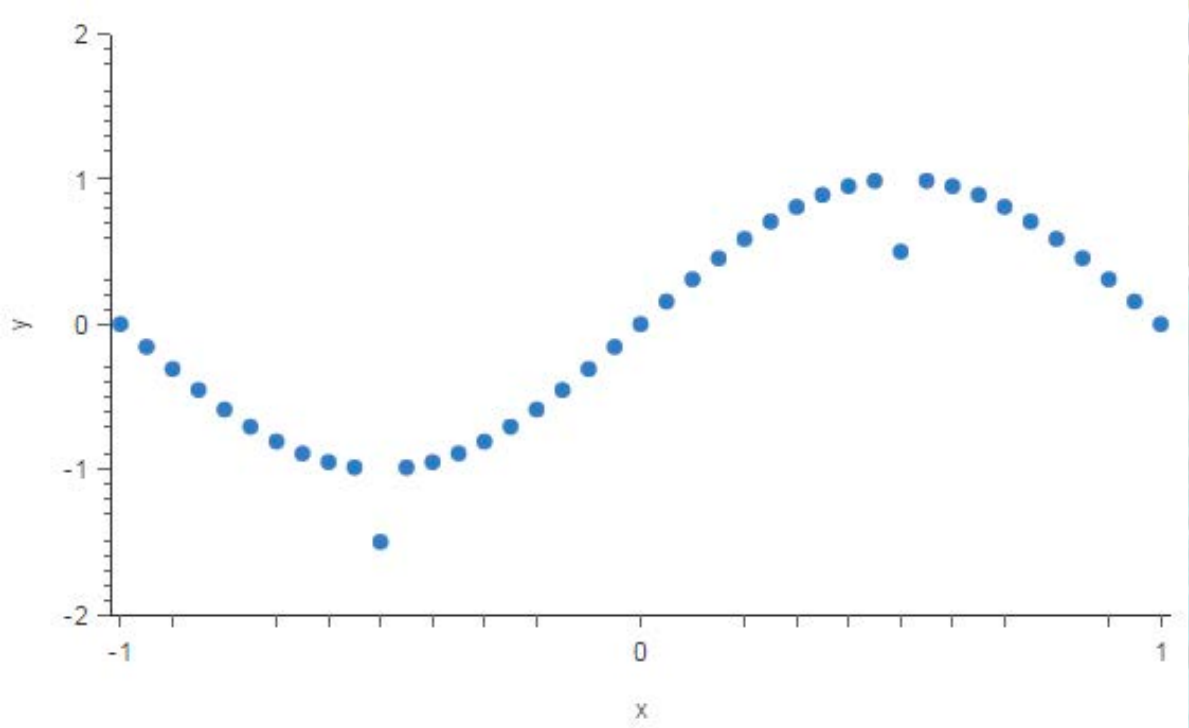
- Plugged K-30 into power in DL 114 @ 12:45:47 pm (EST). Me + one other student in room
- 2nd student (3rd person in room) arrives at 12:48.

3rd @ 12:48.
4th @ 12:52
5th @ 12:54
6th @ 12:55
7th @ 12:56
8th @ 12:56
9th @ 12:57
10th @ 12:58
11th @ 12:58
12th 13th @ 13:00
Exam on Zoom

Class end @ 1400
outside by 1405
power off @ 1432



Outlier Detection

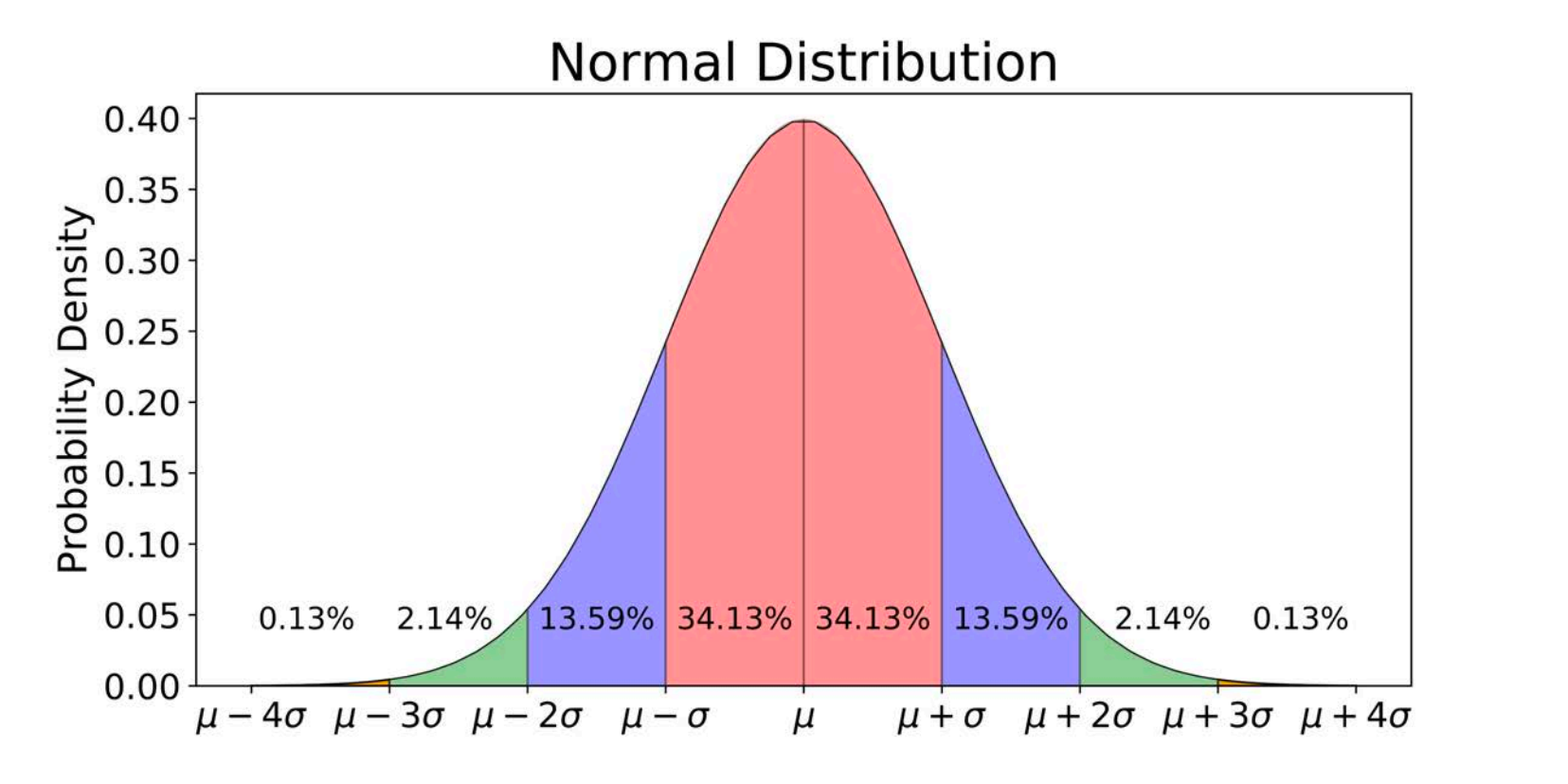


https://www.kdnuggets.com/2017/01/3-methods-deal-outliers.html

- Simply plotting all of your data without describing it is insufficient
- How do we know if a point counts as an outlier (as opposed to being an actual, natural deviation)?

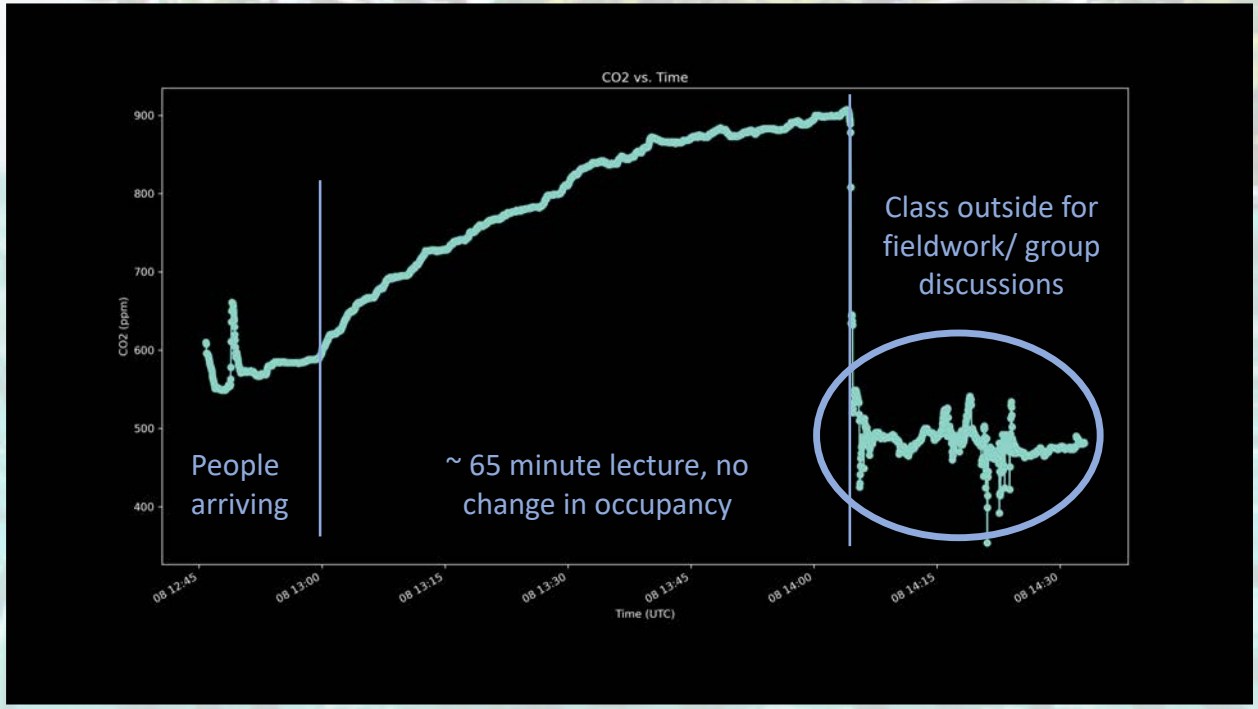
One method: local standard deviation

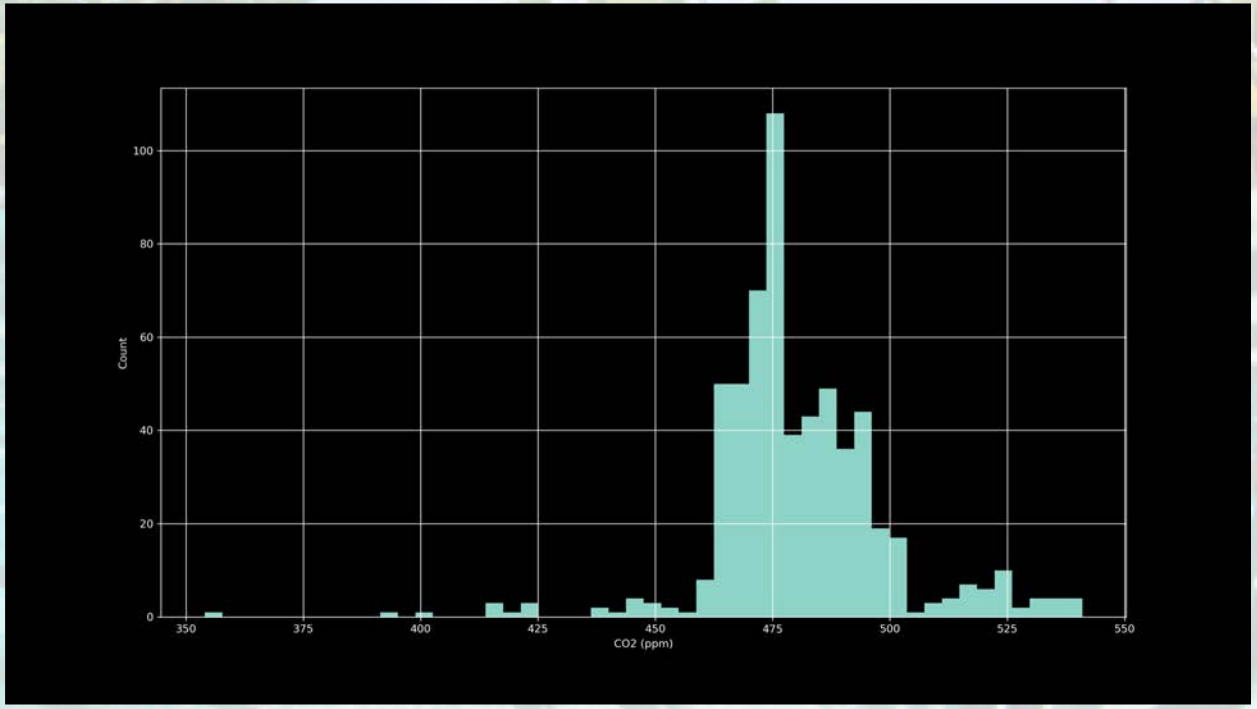
- if point is > 2 standard deviations from (local) mean, remove
- why 2 x standard dev?
- μ = mean
- σ = standard dev



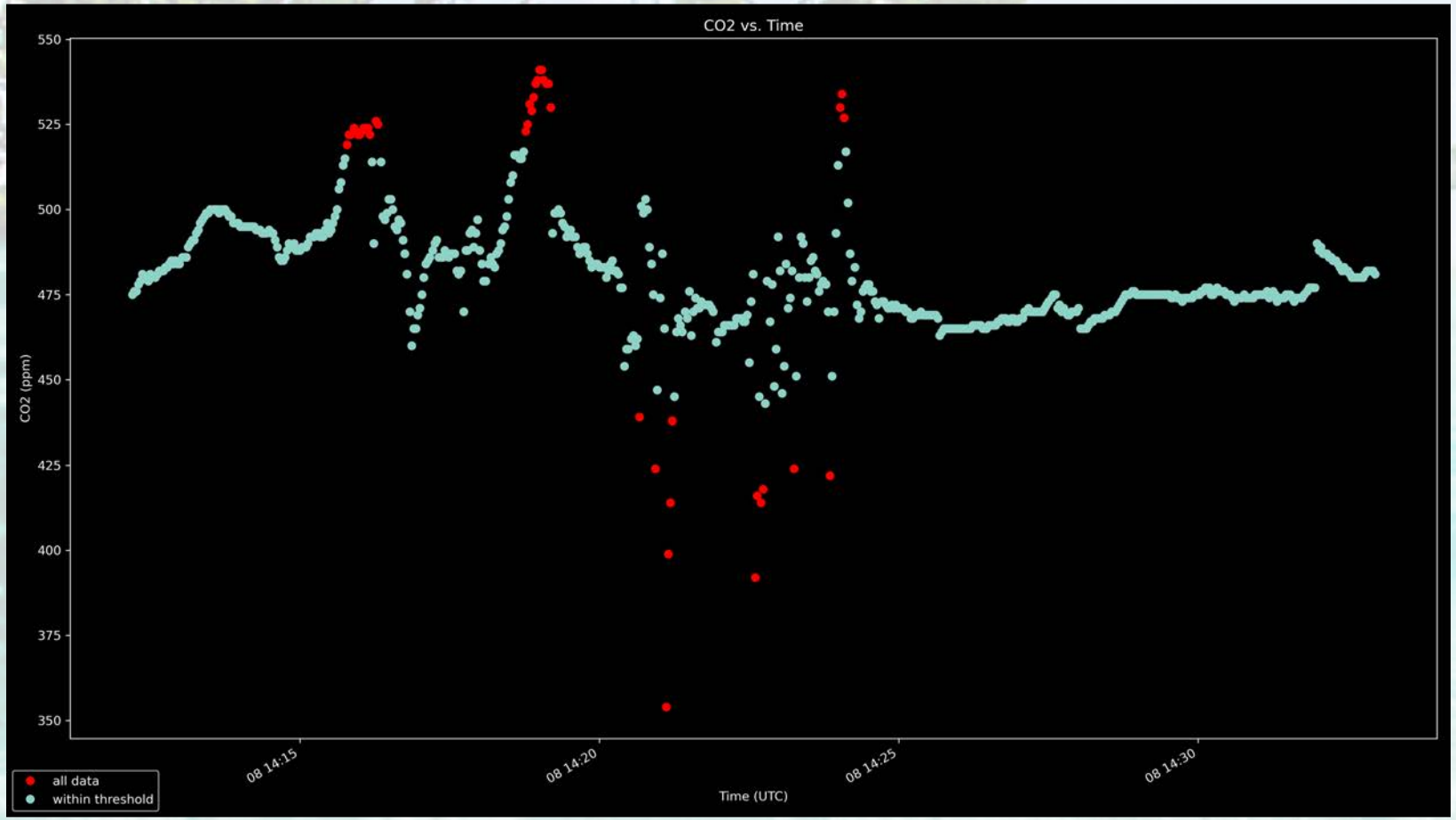
https://towardsdatascience.com/understanding-the-68-95-99-7-rule-for-a-normal-distribution-b7b7cbf760c2

Distribution of our outdoor data

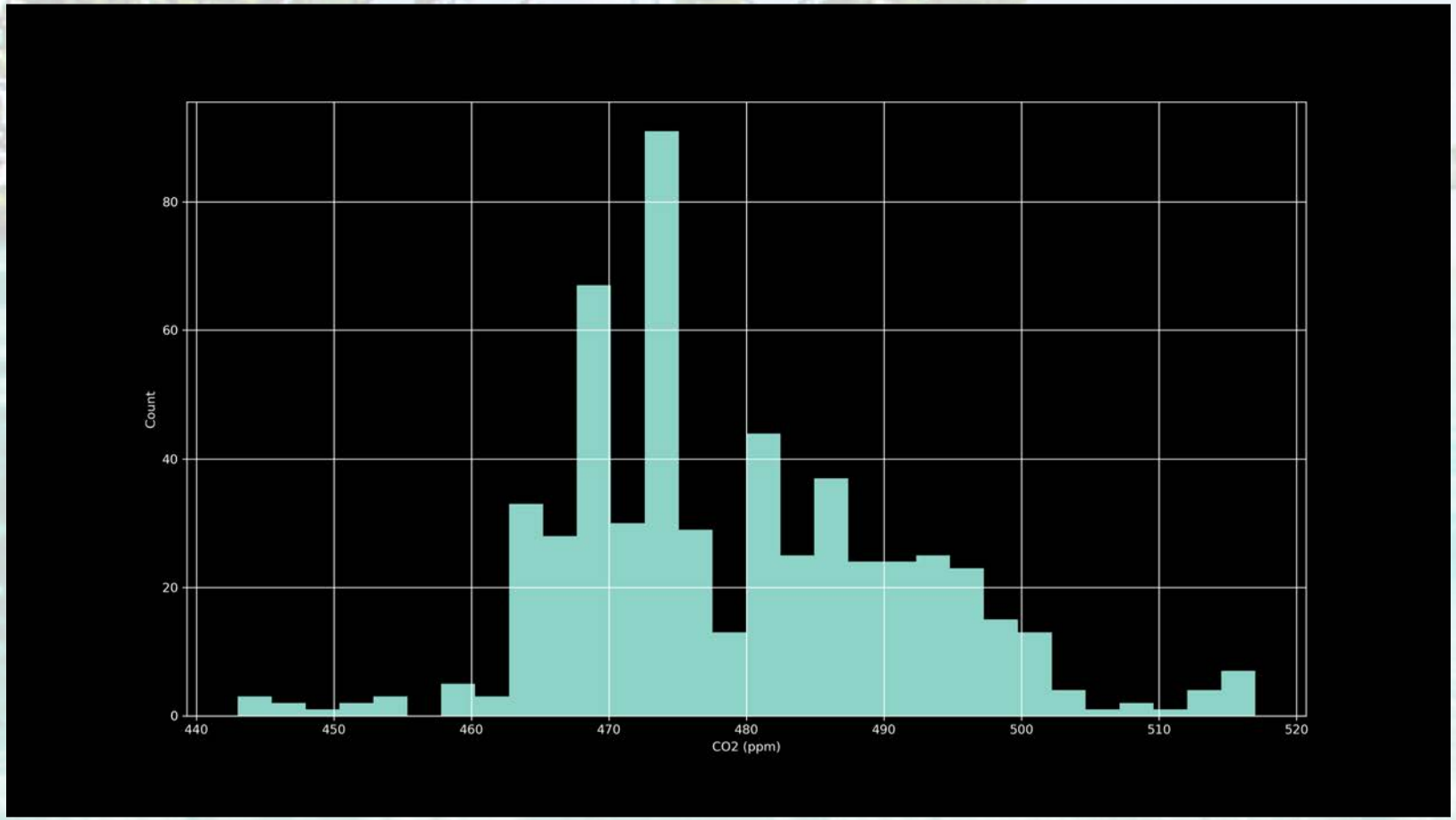




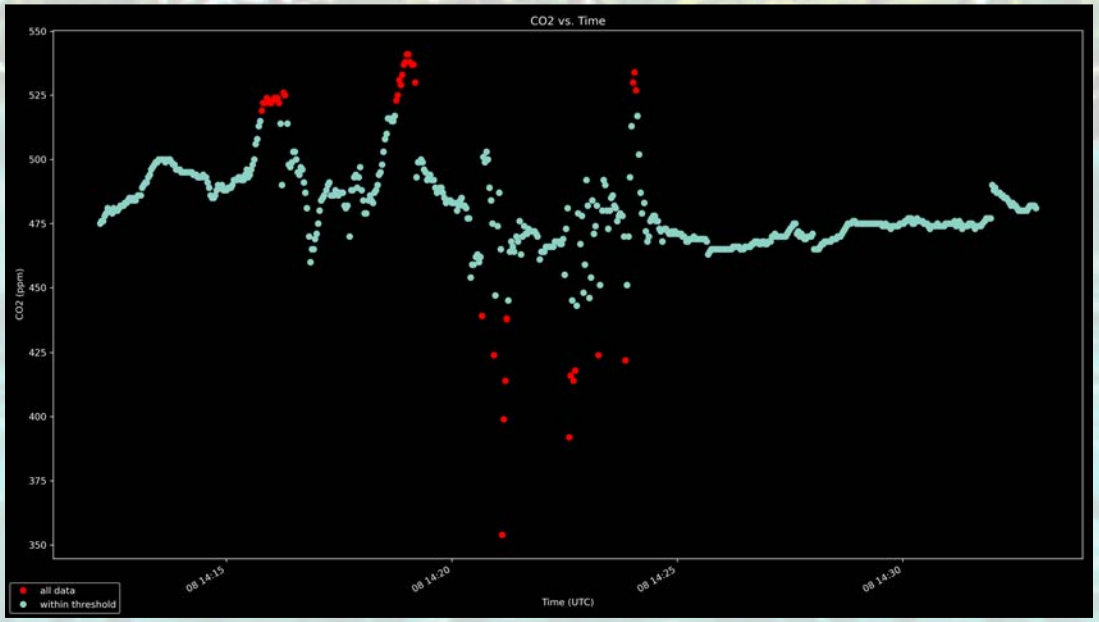
Identifying data for further processing



Histogram after outlier removal



Notes of Caution



1. It *could* be “good” data so chosen approach merits thoughtfulness
2. NEVER remove data without justifying having done so. It could look like (or actually be) improper manipulation.

Python vs. Jupyter

- Python is the actual coding language:

```
df_CO2 = pd.read_csv(CO2_filename)
elapsed_time_sec = df_CO2.iloc[:, 0] # insensitive to column name
CO2 = df_CO2.iloc[:, 1]
```

- Jupyter is the interface, which provides places for input (like code, other text) and output (like tables, figures, results)
- Python works without Jupyter and vice versa, but it's a powerful combo

Getting started

Before executing any analysis in Python, save the file from the K-30 as a .csv file (rather than .txt) and add a header row of *elapsed time (sec),CO2 (ppm)*

[2]:
```
# Read in data
df_CO2 = pd.read_csv('2021-03-15_CO2SensorUpload.csv')

# Time when I noted that CO2 logging began *** in UTC ***
# Year, month, day, hour (24 hr format), minute, second
starttime_est = datetime.datetime(2021, 3, 8, 12, 45, 47)
df_CO2.head()
```

[2]:

	elapsed time (sec)	CO2 (ppm)
0	2	0
1	4	610
2	6	608
3	8	596
4	10	596

Why Python in the first place?

- (or R, Octave, MATLAB, …)
- Next portion of lecture courtesy of Earth Lab at the University of Colorado, Boulder https://www.earthdatascience.org/about/
- Specific resources:
  - https://www.earthdatascience.org/courses/intro-to-earth-data-science/open-reproducible-science/get-started-open-reproducible-science/
  - https://www.youtube.com/watch?v=NGFO0kdbZmk (NOVA)
  - https://www.earthdatascience.org/courses/intro-to-earth-data-science/open-reproducible-science/jupyter-python/

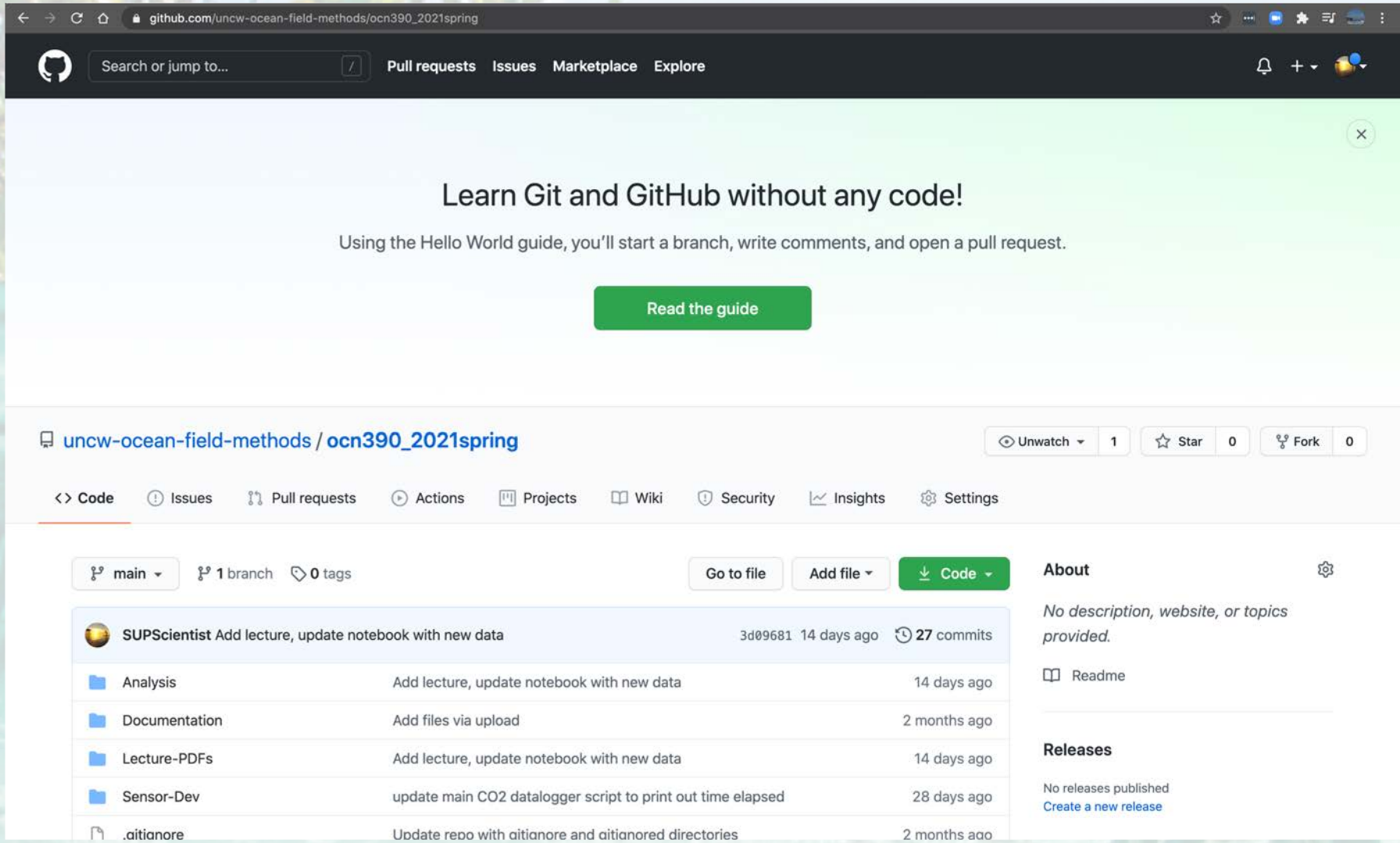

Elizabeth Iorns
SCIENCE EXCHANGE
NOVA
0:48 / 14:59

Why Python

- Free
- Reproducible analyses
- Relatively easy to share (Jupyter notebooks, code, etc.) because others can install software
- Great user community, eager to help (lots of good online assistance)

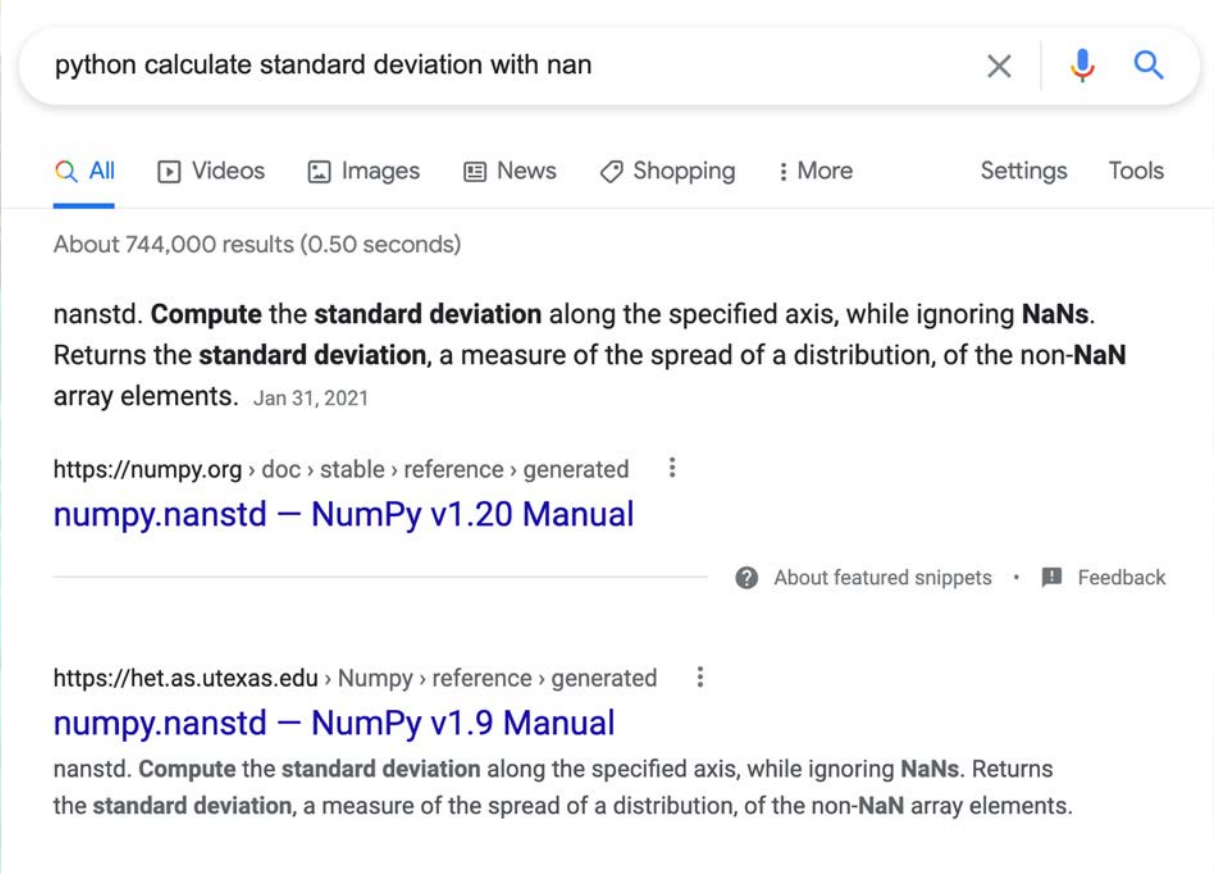
Why Git(Hub)?

- Build on others' projects
- Collaborate
- Track changes in code



How to code (for data analysis, sensor development, etc.)

- We haven't gone far enough to fairly call this even a crash course in Python or Arduino
- When taking the next steps in your projects (or careers), you may choose/have to code
- A couple suggestions:
  1. Google
  2. (Free!) online coding classes/tutorials
  3. Classes here

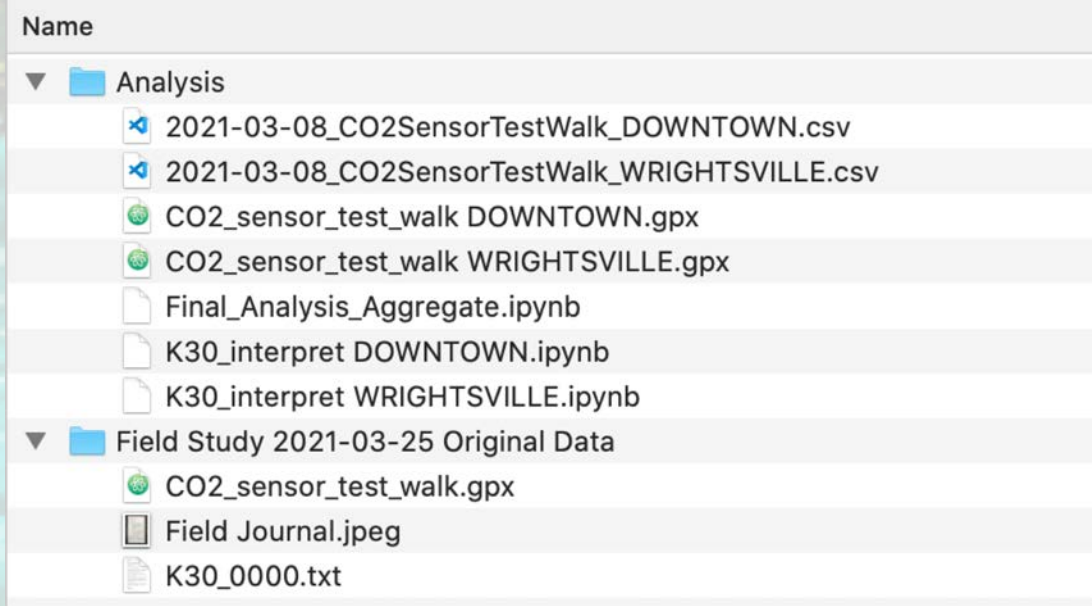


Recommendations (not requirements) for your projects

- Create a folder called **OCN390 Spring 2021 Project**
- Collect data in whatever way makes the most sense to you, given your project needs and goals
- Immediately save all output (e.g., K30_0000.txt, any GPX files, field notes) to a subfolder called **Field Study *2021-03-29* Original Data**
- Create a different subfolder called **Analysis** and COPY (don’t cut and paste) data and code for subsequent analysis into that

For example…

- DOWNTOWN.csv and WRIGHTSVILLE.csv files are both derived from K30_0000.txt
- Saved as different files so that we can easily take statistics of each, plot, etc. separately using associated .ipynb files



Your data, your responsibility!!!

Lost/overwritten data not an excuse for not submitting a complete project. Store data in the cloud (OneDrive/Sharepoint), email copies out to teammates, create your own GitHub project page repository, etc.

Next week

- Keep working on Story Maps. Story Maps (team assignment; **deadline Monday, Apr. 12, 12:00 pm**). Send to me if you want feedback by Monday, Apr. 5, 12:00 pm.
- Re-quiz: similar questions to last time + question about reproducibility
- Overview of Final Report