OCN 390: Field Methods

Week 14

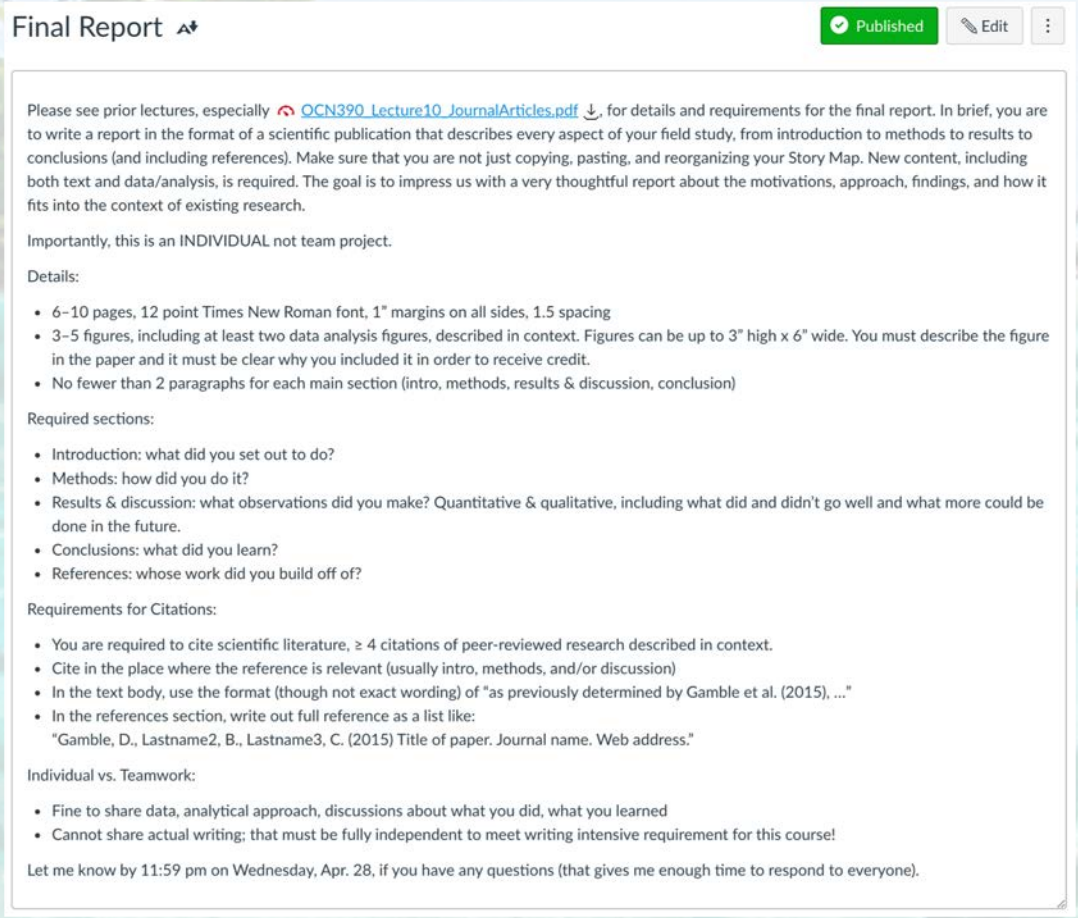
Final Projects & Course Wrap-Up

Calendar

- ~~4/12/21: Today, presentations~~
- 4/19/21: ~~Next week~~ today, in person, discussion of final objectives, feedback on Story Maps, course wrap-up. BRING COMPUTERS IF POSSIBLE.
- 4/26/21: Return components, 1-on-1 or group discussions if needed (no lecture)
- 4/30/21: Final report due on Canvas by midnight! -20% per day late.

Final Project: due by 11:59 pm on Apr. 30

- **Goal: summarize everything we did this semester**
- Intro: why do these measurements matter?
- Methods: how did you make the measurements? Could others follow your work?
- Results/discussion: how did it go? What did you learn? What would you do next time or recommend that the scientists who come after you try? How does it compare to other results in the literature?
- Conclusion: tie it all up. Summarize what you told us in the prior sections and what you learned.
- Read questions to your group in Canvas discussion and try to address these.



Final Report

Published | Edit

Please see prior lectures, especially OCN390_Lecture10_JournalArticles.pdf, for details and requirements for the final report. In brief, you are to write a report in the format of a scientific publication that describes every aspect of your field study, from introduction to methods to results to conclusions (and including references). Make sure that you are not just copying, pasting, and reorganizing your Story Map. New content, including both text and data/analysis, is required. The goal is to impress us with a very thoughtful report about the motivations, approach, findings, and how it fits into the context of existing research.

Importantly, this is an INDIVIDUAL not team project.

Details:

- 6–10 pages, 12 point Times New Roman font, 1" margins on all sides, 1.5 spacing
- 3–5 figures, including at least two data analysis figures, described in context. Figures can be up to 3" high x 6" wide. You must describe the figure in the paper and it must be clear why you included it in order to receive credit.
- No fewer than 2 paragraphs for each main section (intro, methods, results & discussion, conclusion)

Required sections:

- Introduction: what did you set out to do?
- Methods: how did you do it?
- Results & discussion: what observations did you make? Quantitative & qualitative, including what did and didn't go well and what more could be done in the future.
- Conclusions: what did you learn?
- References: whose work did you build off of?

Requirements for Citations:

- You are required to cite scientific literature, ≥ 4 citations of peer-reviewed research described in context.
- Cite in the place where the reference is relevant (usually intro, methods, and/or discussion)
- In the text body, use the format (though not exact wording) of "as previously determined by Gamble et al. (2015), ..."
- In the references section, write out full reference as a list like:
  "Gamble, D., Lastname2, B., Lastname3, C. (2015) Title of paper. Journal name. Web address."

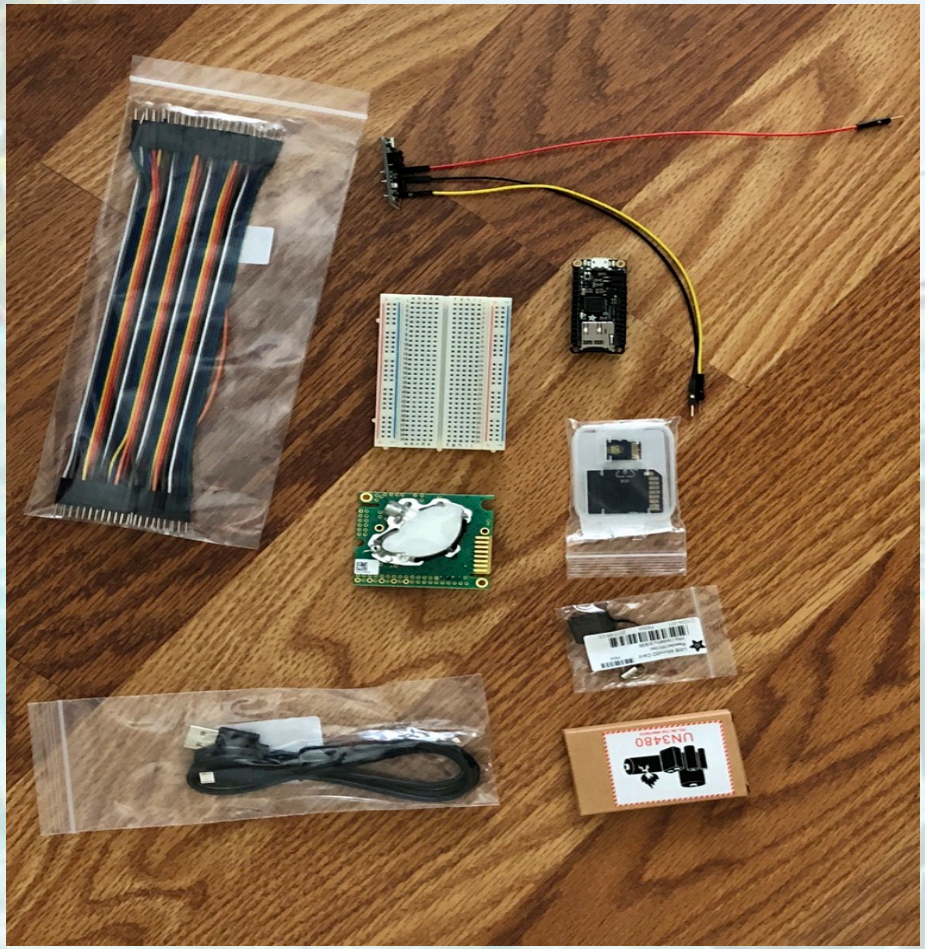
Individual vs. Teamwork:

- Fine to share data, analytical approach, discussions about what you did, what you learned
- Cannot share actual writing; that must be fully independent to meet writing intensive requirement for this course!

Let me know by 11:59 pm on Wednesday, Apr. 28, if you have any questions (that gives me enough time to respond to everyone).

Course Overview

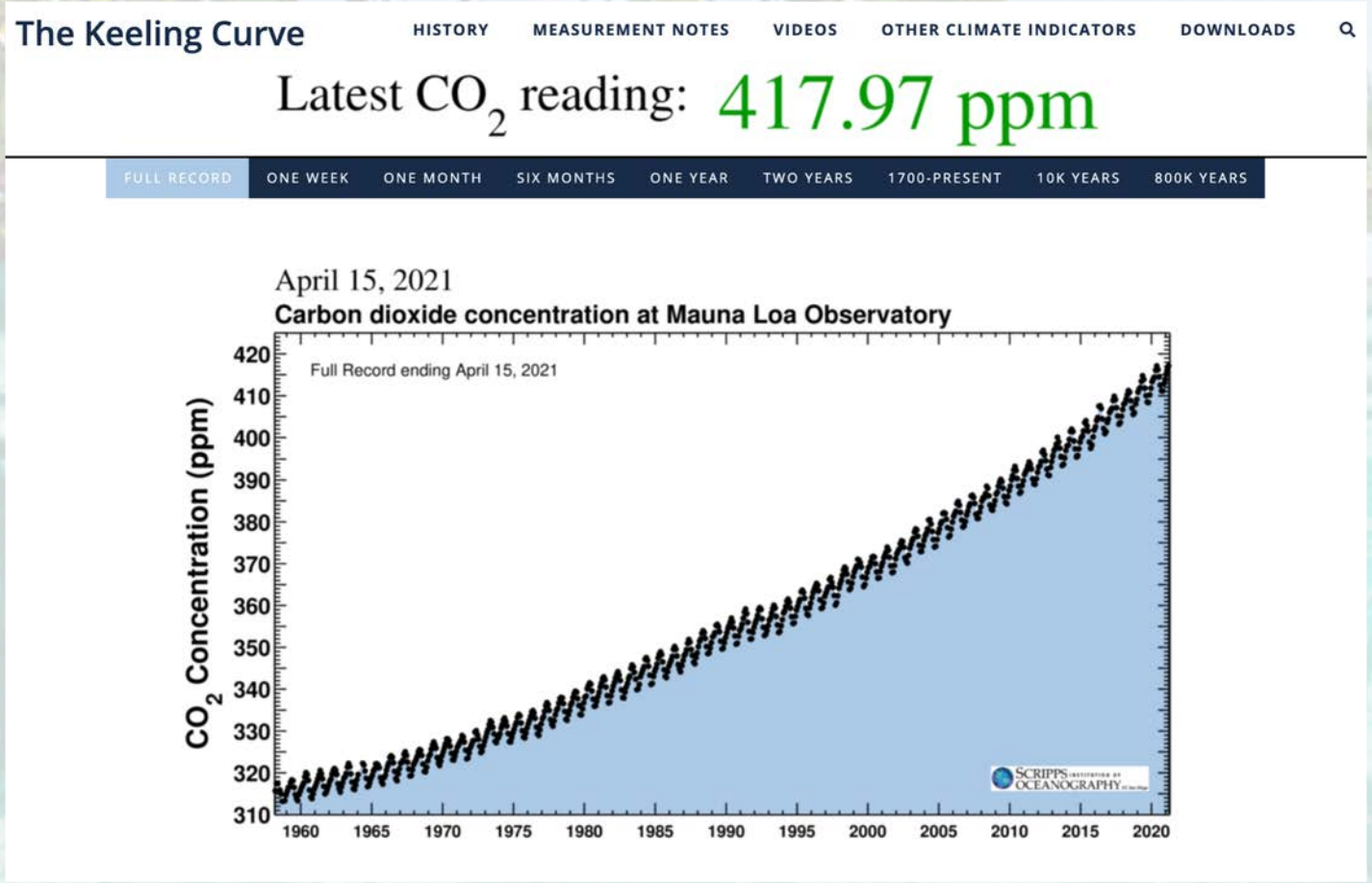
- Probably not your ideal vision of oceanographic field methods… Hope you agree we did our best given another whacky semester
- Goal was to give you a taste for a few different aspects of field methods and how to design a sensor if an “off the shelf” one doesn’t exist



Today's lecture

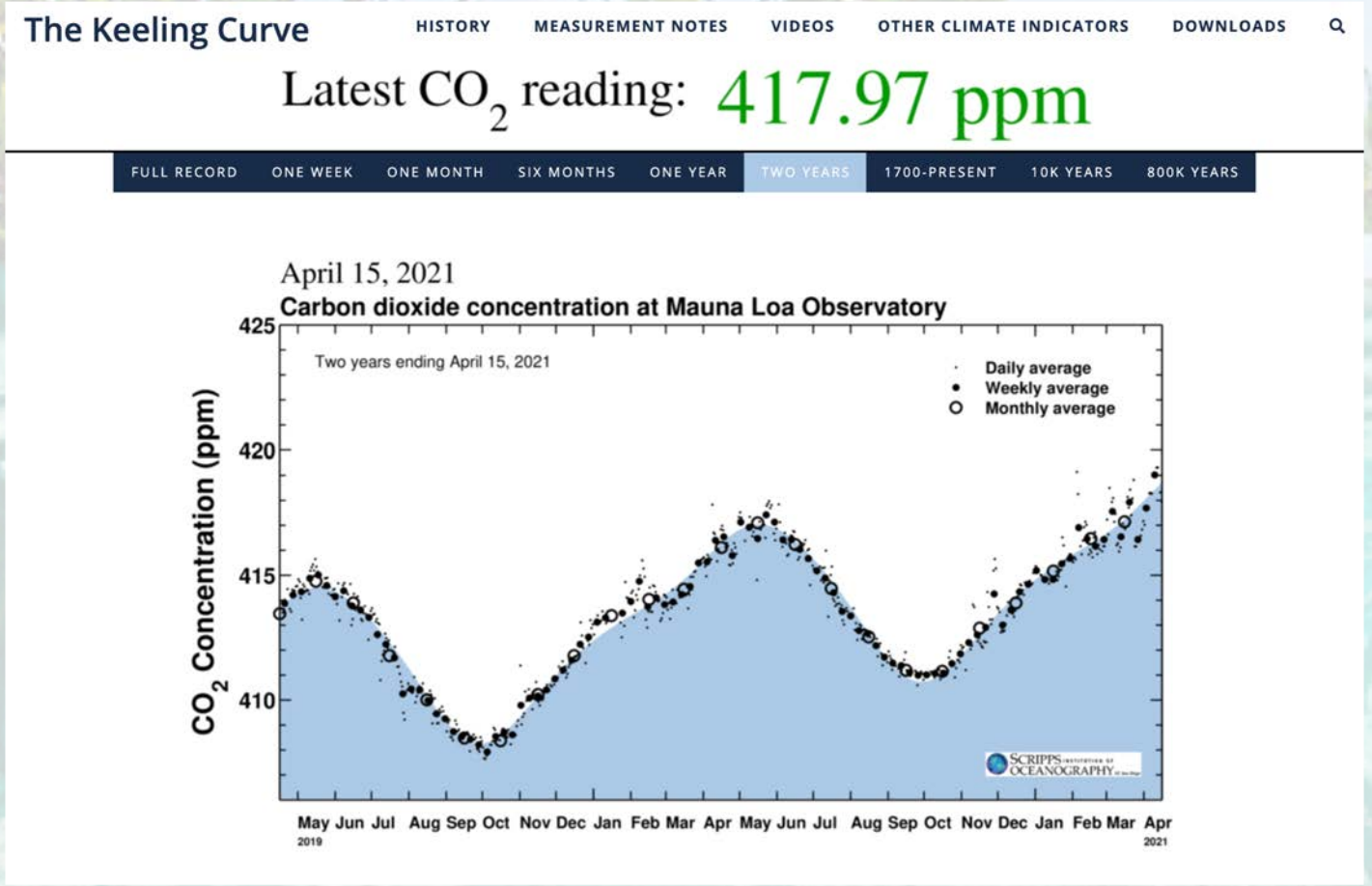
- Looking for feedback, what worked/what didn't. Respectful critiques will not harm your grade but if you're uncomfortable criticizing someone in charge of your grade, please at least put it in IDEA!
- Help summarize the high level picture (or at least the picture I have) of the class as you put together your final reports.
- I will grade final reports for accuracy in description of these components.

Goal: Study changes in CO2



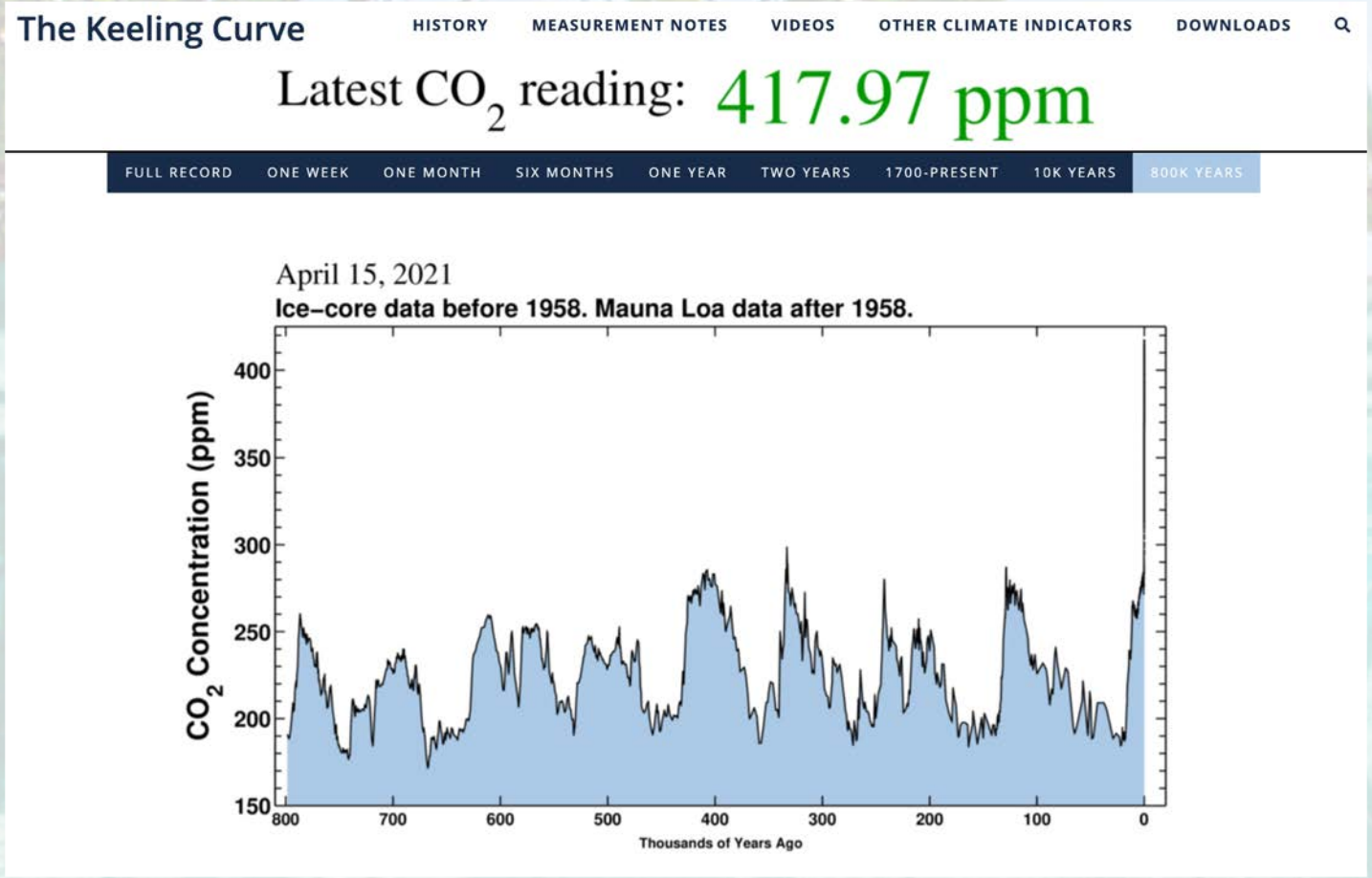
https://keelingcurve.ucsd.edu/

Two years



https://keelingcurve.ucsd.edu/

800,000 years



https://keelingcurve.ucsd.edu/

Need an almost daily measurement?

The greenhouse effect has been studied for > 150 years!

First publication on record by Eunice Foote

Overlooked No More: Eunice Foote, Climate Scientist Lost to History

Foote's ingenious experiment more than 150 years ago yielded a remarkable discovery that could have helped shape modern climate science had she not been overshadowed.

Eunice Foote's experiment for her studies on greenhouse gases, as recreated in the 2018 short film "Eunice." Paul Bancilhon and Matteo Marcolini

On the Heat in the Sun's Rays.

ART. XXXI.—*Circumstances affecting the Heat of the Sun's Rays;* by EUNICE FOOTE.

(Read before the American Association, August 23d, 1856.)

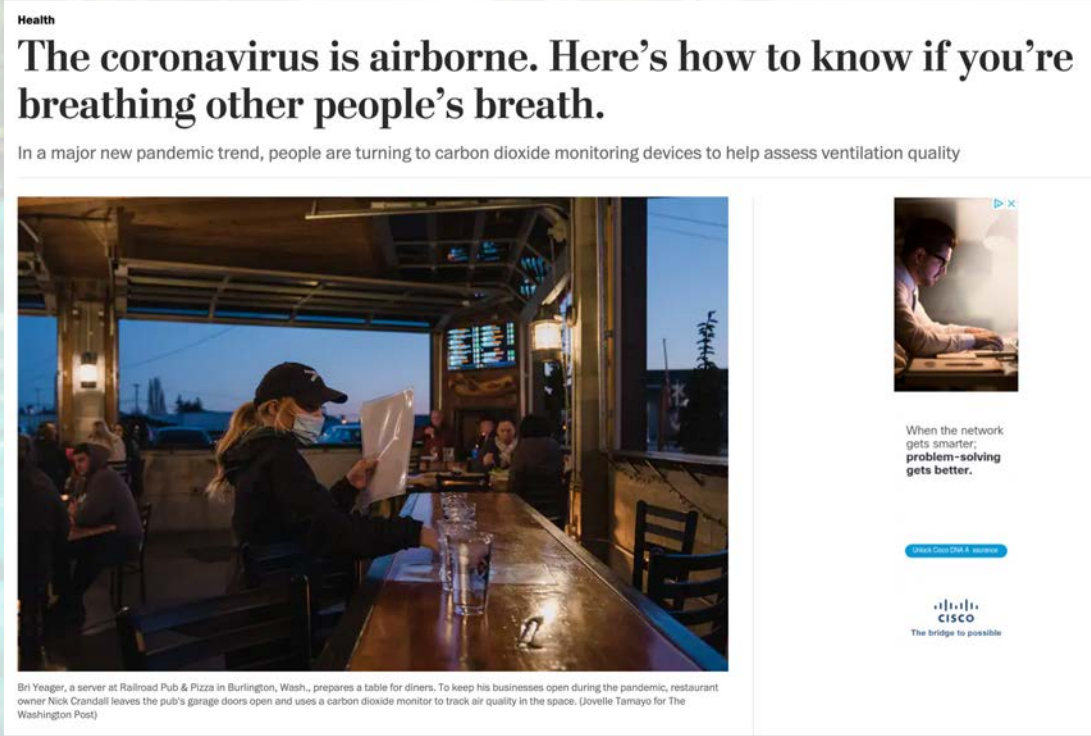
MY investigations have had for their object to determine the different circumstances that affect the thermal action of the rays of light that proceed from the sun.

Several results have been obtained.

https://www.nytimes.com/2020/04/21/obituaries/eunice-foote-overlooked.html

A few reasons to measure CO_2

- Respiration/photosynthesis of planet/ecosystem/individual
- Air quality for health
- Indoor air quality (circulation/ventilation)
- Atmospheric changes due to humanity
- Emissions monitoring: regional/site-specific
- Air–water flux: how much CO_2 is coming out of/going into water
- Hypercapnia: too much CO_2 in bloodstream
- Professor told you to



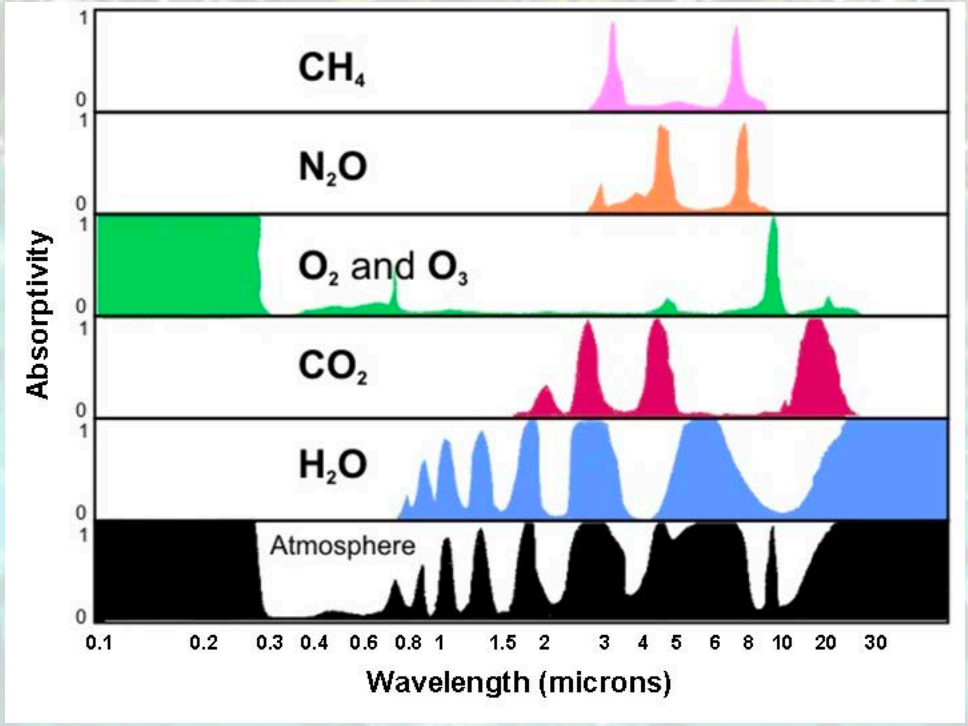
Health

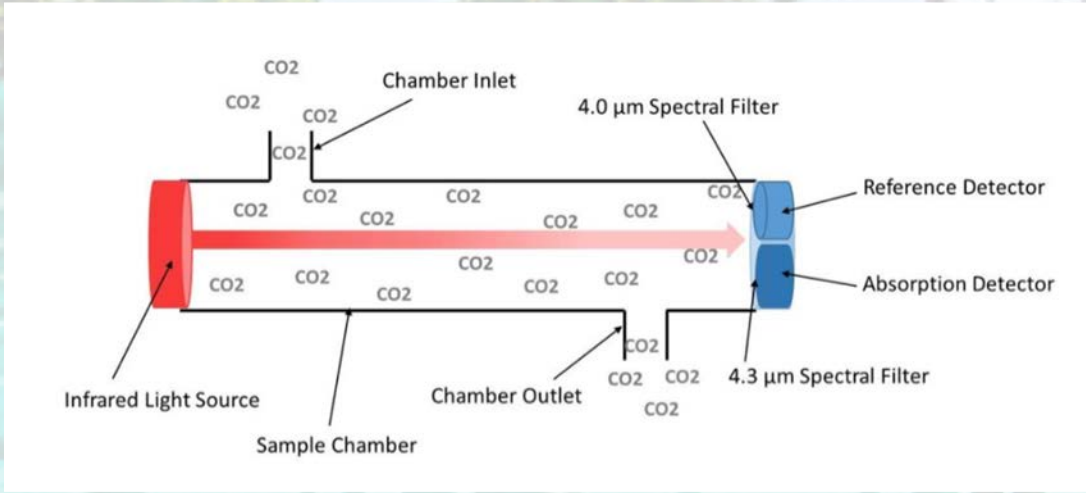
The coronavirus is airborne. Here's how to know if you're breathing other people's breath.

In a major new pandemic trend, people are turning to carbon dioxide monitoring devices to help assess ventilation quality

Bri Yeager, a server at Railroad Pub & Pizza in Burlington, Wash., prepares a table for diners. To keep his businesses open during the pandemic, restaurant owner Nick Crandall leaves the pub's garage doors open and uses a carbon dioxide monitor to track air quality in the space. (Jovelle Tamayo for The Washington Post)

CO2 via NDIR

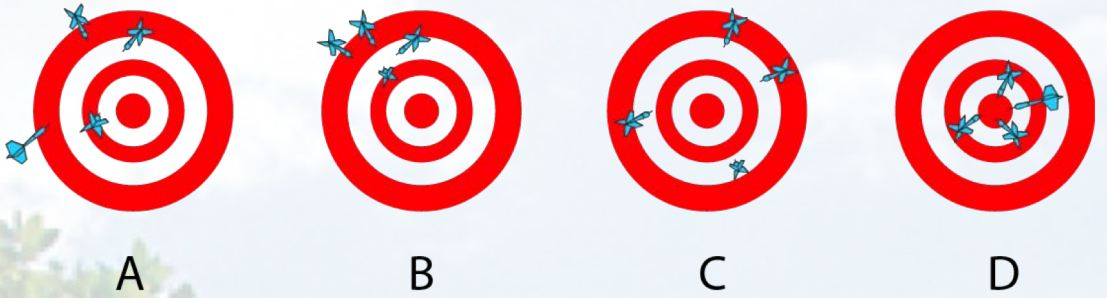




https://www.e-education.psu.edu/meteo3/l2_p7.html

Important Metrics

- Accuracy, precision, stability, resolution, response time
- Make sure you put your results in the context of the capabilities of the sensor!



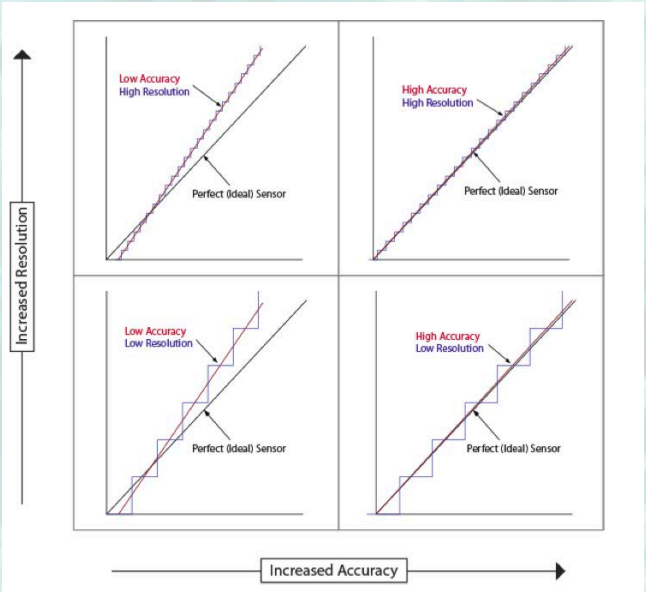
t = 0 min

B

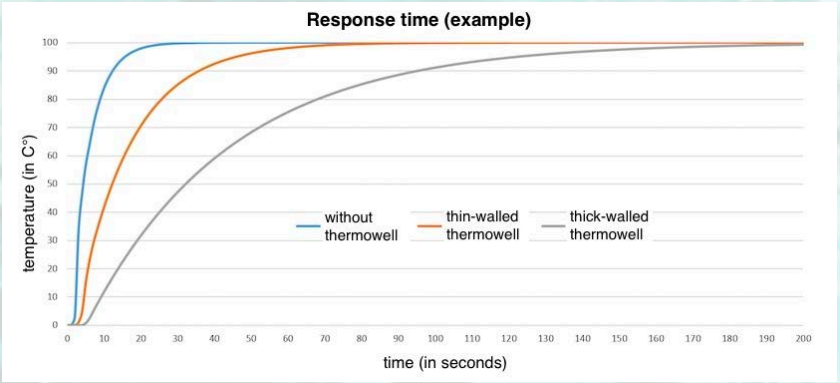
t = 10 min

t = 20 min

https://manoa.hawaii.edu/exploringourfluidearth/physical/world-ocean/map-distortion/practices-science-precision-vs-accuracy



https://www.allsensors.com/engineering-resources/white-papers/accuracy-and-precision-for-mems-pressure-sensors



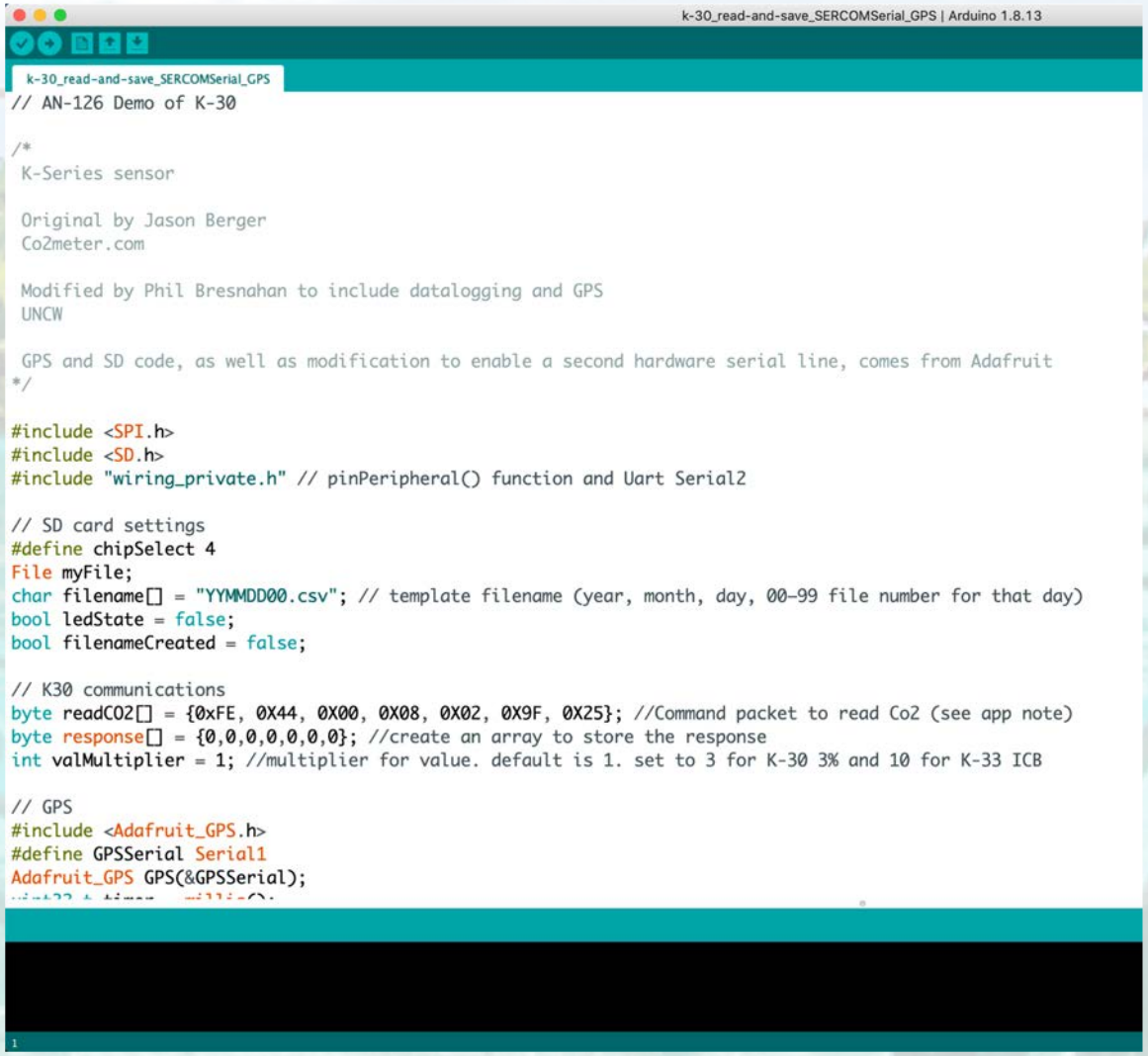
https://blog.wika.us/products/temperature-products/temperature-sensors-thermowells-and-response-times/

Field/Nature Journal

- Weekly nature journaling requirement
- Why?
  - Strengthen our connections to place
    - **Become better at taking relevant, helpful notes for the future**
    - Practice mindfulness and do something without electronics for a short bit
- https://www.youtube.com/watch?v=DqEx8JGLOIQ
- Keep a single notebook for everything in this class. I will ask to see it occasionally in class as part of your participation grade.

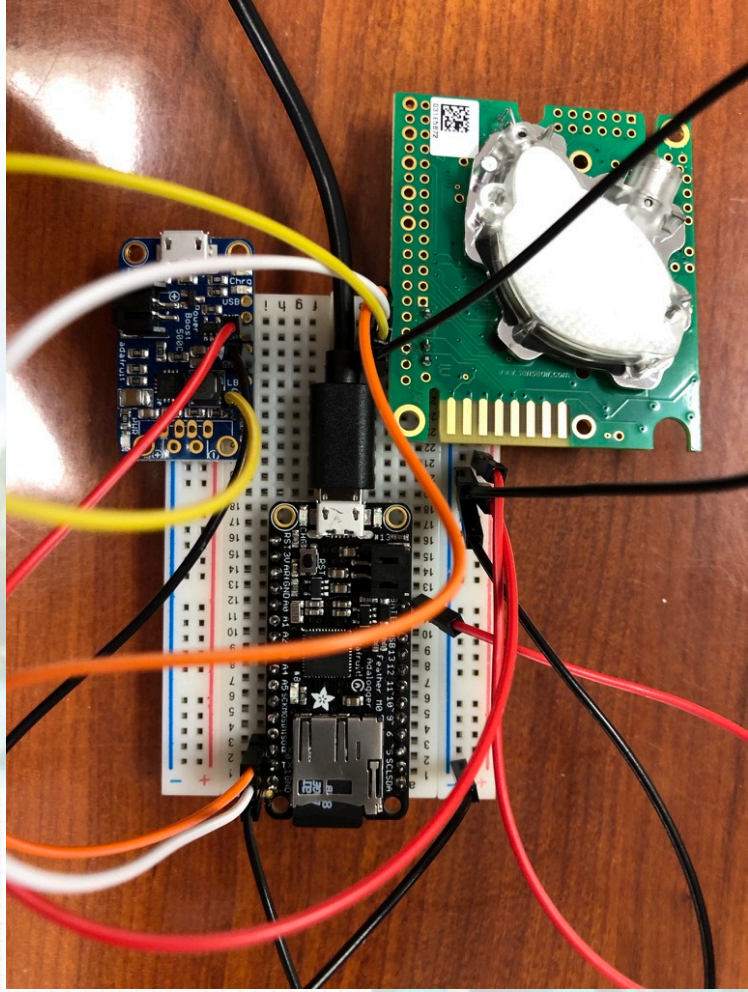
Sensor Skills: Arduino

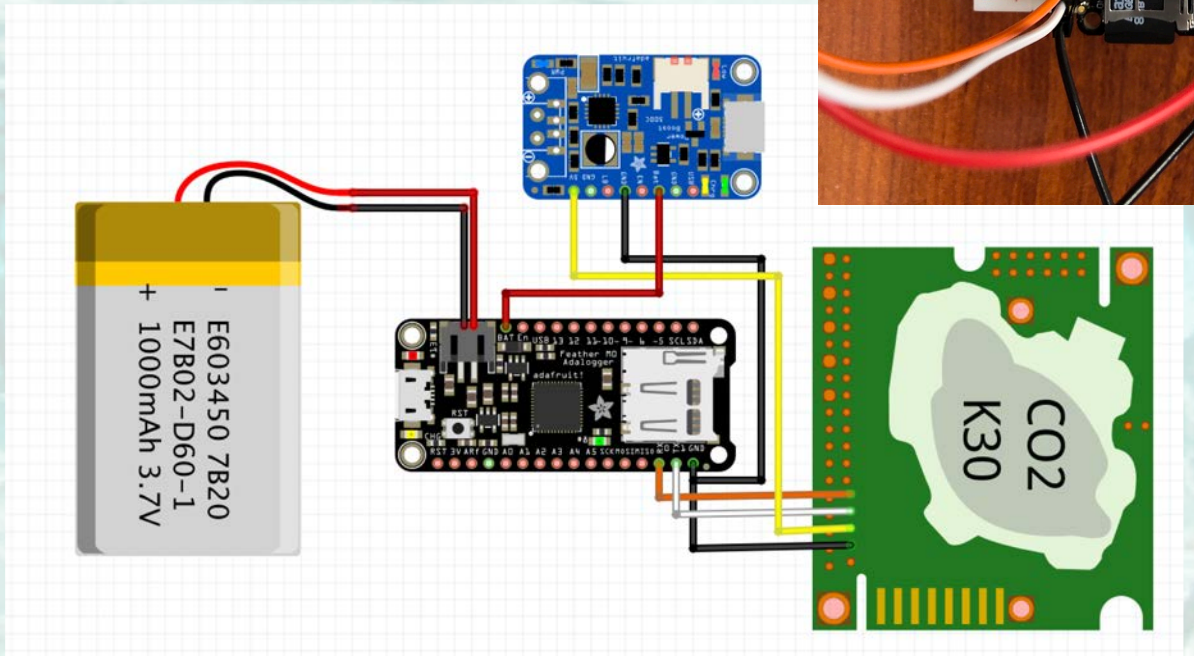
- Got LED to blink to prove it was alive and you could edit code
- Flashed CO2 measurement script in order to communicate with K-30 and save to SD card
- Vast amounts of freely available code to do just about anything imaginable; don't need to be expert coder to make measurements from a new sensor!



Sensor Skills: Breadboarding Circuits

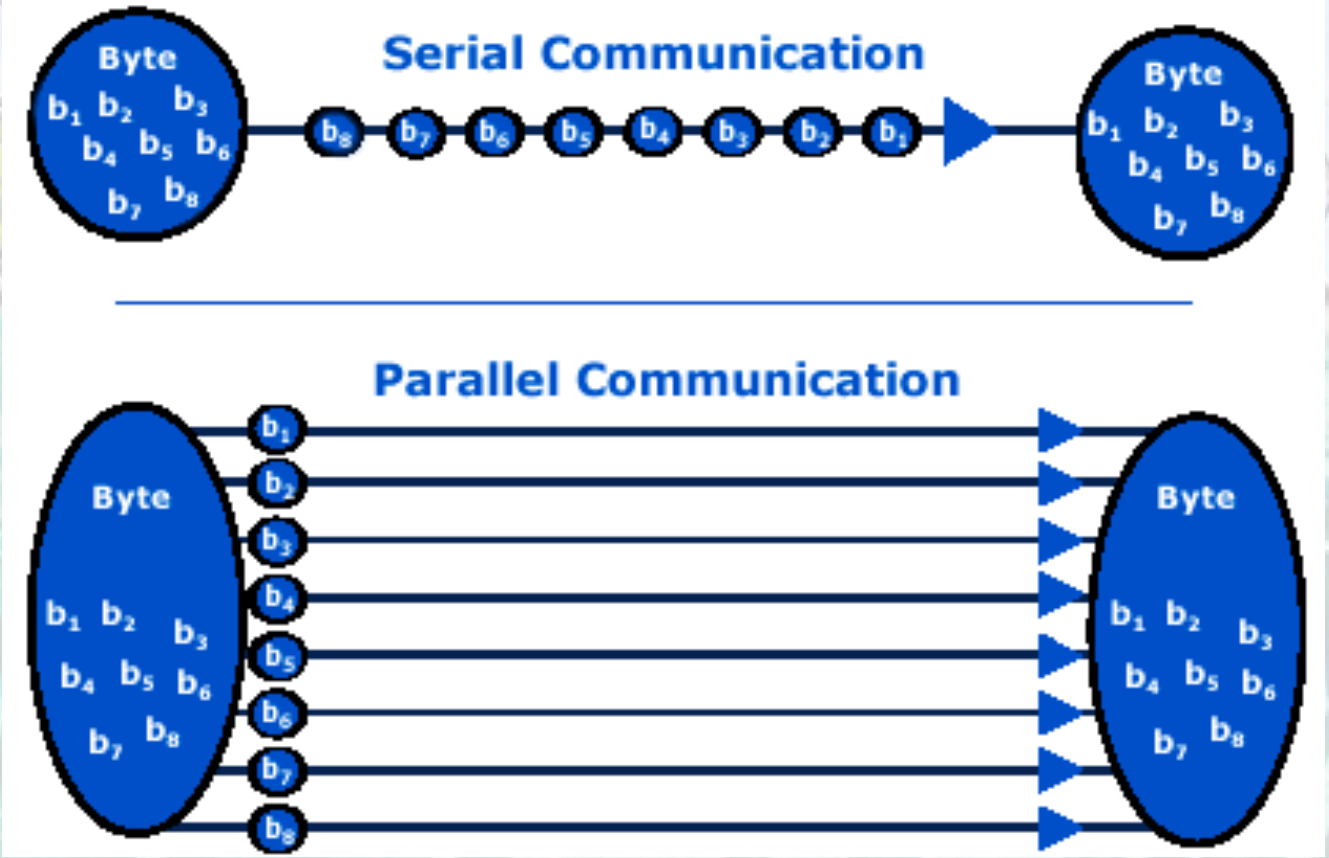
- Breadboard allows flexible iterations of circuitry without soldering
- Physically holds things in place





Sensor Skills: Serial Communication

- Many ways to communicate with sensors:
  - UART (Rx/Tx)
  - SPI
  - I2C
  - Analog



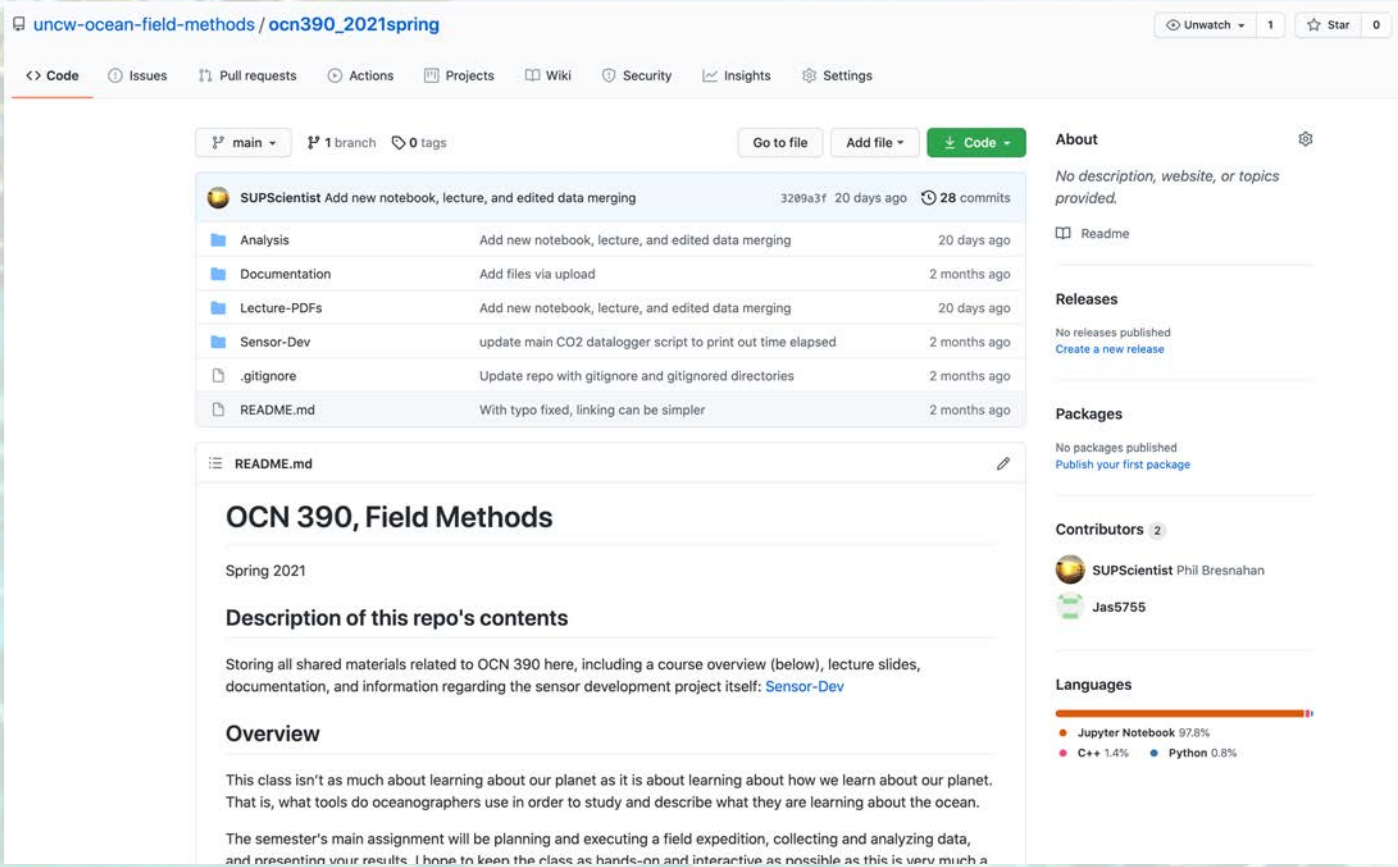
https://www.bb-elec.com/Learning-Center/All-White-Papers/Serial/Parallel-Communication-Overview.aspx

Data Analysis

- Python (scripting language) for more complicated and repeated analyses
- Excel for simple graphs, averages, editing data tables
- ArcGIS online for mapping data

Open-Source

- Advantageous for sharing/improving on each other's work
- Improving reproducibility
- Do you wish you did more or less customization of software (Arduino, Python, …)?

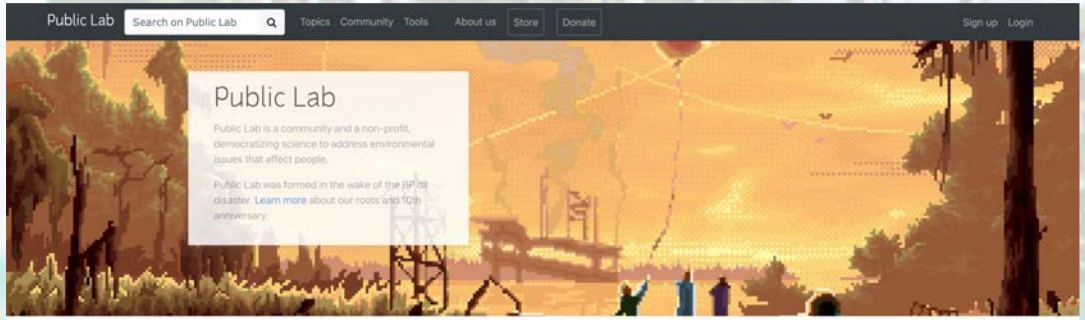


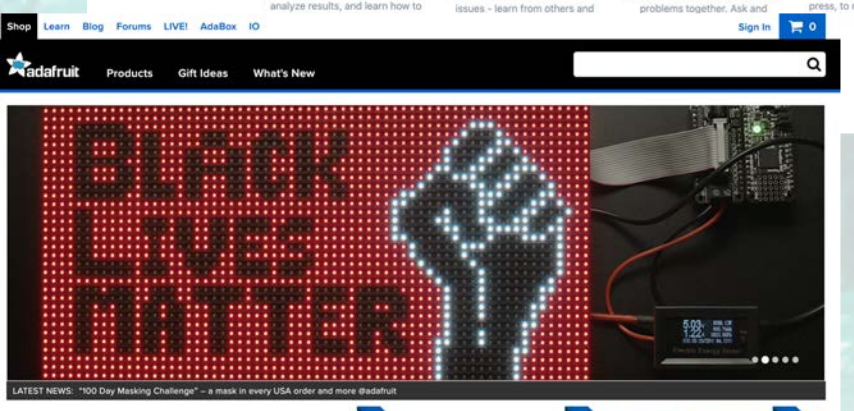
https://github.com/uncw-ocean-field-methods/ocn390_2021spring/tree/main/Sensor-Dev

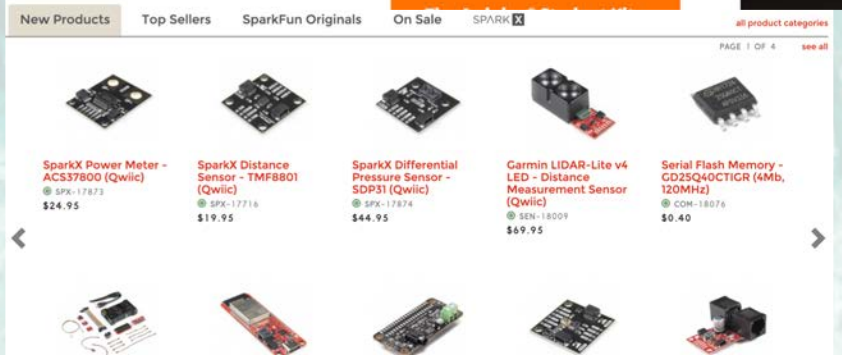
Next steps…

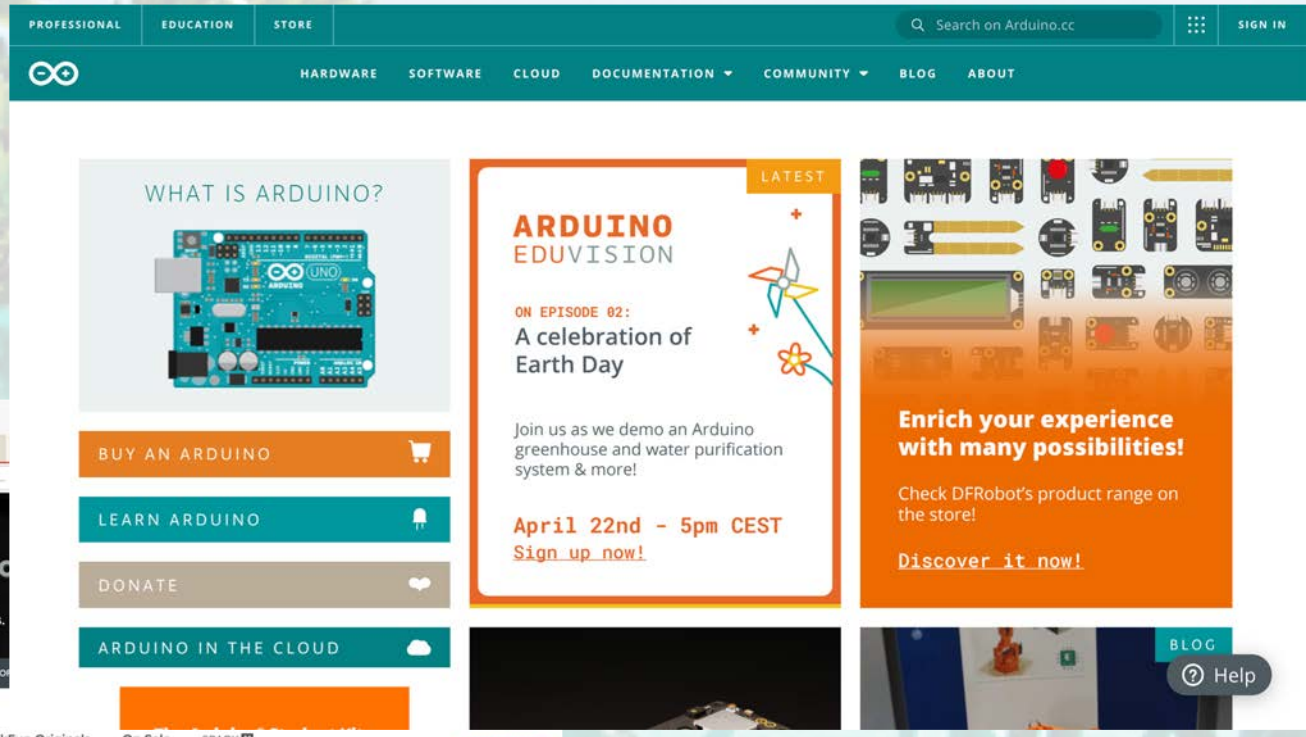
- Obviously this just scratches the surface of what can be done
- One of this course's goals was to get people more comfortable with basic sensor development—it is not just the realm of professional engineers!

Want to go further? Here are some (of the seemingly infinite) places you might look…









General feedback?

IDEA Surveys: Please take them!

- https://uncw.campuslabs.com/courseeval
- Also see new OCN 390 Canvas discussion for link

Notes from a Climate Victory Garden

Louise Maher-Johnson

Rebalance: Greenhouse Gases (CO_2,N_2O, CH_4, H_2O vapor) with photosynthesis.
Recognize: Plants cool by evaporation, ground cover, shade, and precipitation
Replant: Lawns with Victory Gardens, as in world war past.
Regenerate: Biodiverse farms with trees-flowers-herbs-pasture-animals.
Restore: Carbon out of air and back into soils, where it belongs.
Replace: Industrial monocultures with regenerative permacultures.
Revisit: Food production by many small farms, not a few megafarms.
Reject: Fossil fuel-based pesticides, plastics, and propaganda.
Rethink: Healthy ecosystems and economies for *all* life.
Relocalize: Slow food, slow lifestyles, and slow economies.
Rekindle: Simple and good, nature and nurture, feeling over thinking.
Refeel: Kinship with pivoting sunflowers and starry fireflies.
Revive: Wildness, woodlands, wetlands, wildlife, waterways.
Reestablish: Health of bees, butterflies, birds, bats, beetles.
Respect: Work of insects, both pollinating and recomposing life.
Remember: Everything is connected.
Everyone lives downstream and downwind.
Reimagine: Deep conservation, cooperation, and community.
Rebalance: Nature with nature. Mimic her. Sense her. Be her.

Louise Maher-Johnson is a retired English teacher who is currently a regenerative farmer at Skyhill Farm.

Themes

earth
environment
future
nature

About Louise Maher-Johnson >

https://poets.org/poem/notes-climate-victory-garden