HOW ACCURATE ARE THEY?
A RAIN GAUGE QUALITY COMPARISON

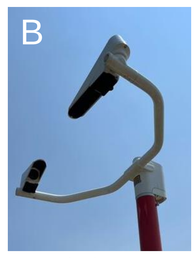
Cassie Isenberger [1] [2], Maggie Zoerner [1] [3], Matt Tuftedal [1], Maxwell Grover [1]

[1] Argonne National Laboratory Environmental Science Division, [2] Central Michigan University, [3] Florida State University

MOTIVATION:

- The Community Research on Climate and Urban Science (CROCUS) aims to study how climate change will impact the city of Chicago.
    - Many locations in the underserved communities of Chicago do not report rainfall data due to the cost of installing rain gauges.
- As rainfall and flooding can have major environmental and societal impacts, it is important to be able to measure it accurately
- Rainfall is measured using several different rain gauges including:
    - Tipping Bucket Rain Gauges (A, D, G, H, I)
    - Weighted Bucket Rain Gauges (E)
    - Optical Rain Gauges (B, C)
    - Standard Rain Gauges (F)
- The primary goal of this study was to determine the accuracy of consumer-grade rain gauges (A), when compared to research-grade rain gauges

A: Ambient Weather Sensor



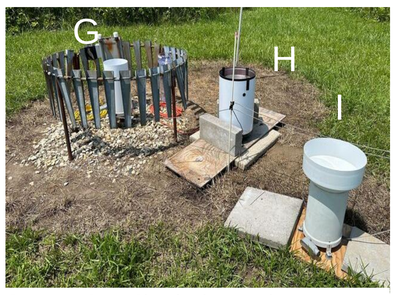
B: Vaisala FD70

C: OSI ORG (far) and APG (near)

D: MET ONE 8in Tipping Bucket

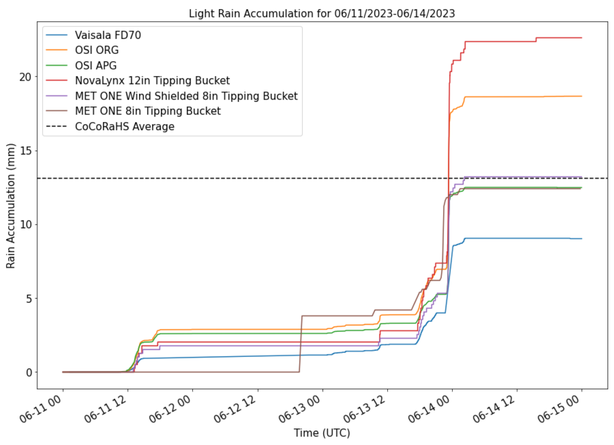
E: Belfort Weighted Bucket

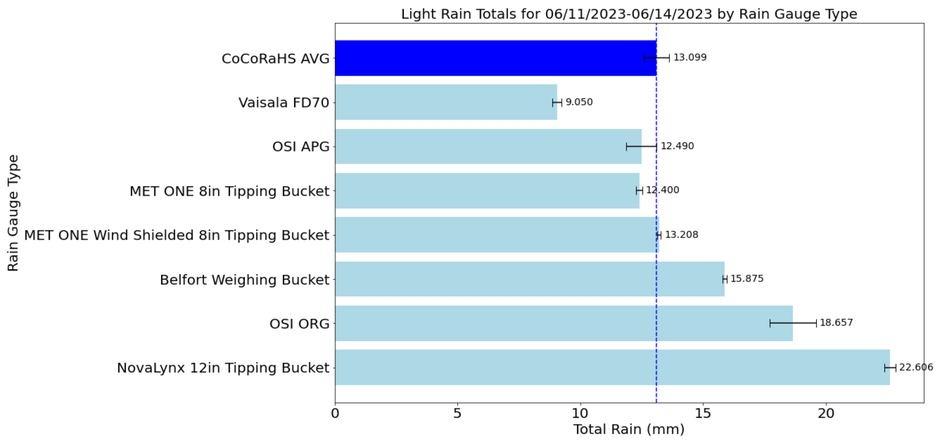
F: Standard 4in Rain Gauge (CoCoRaHS)

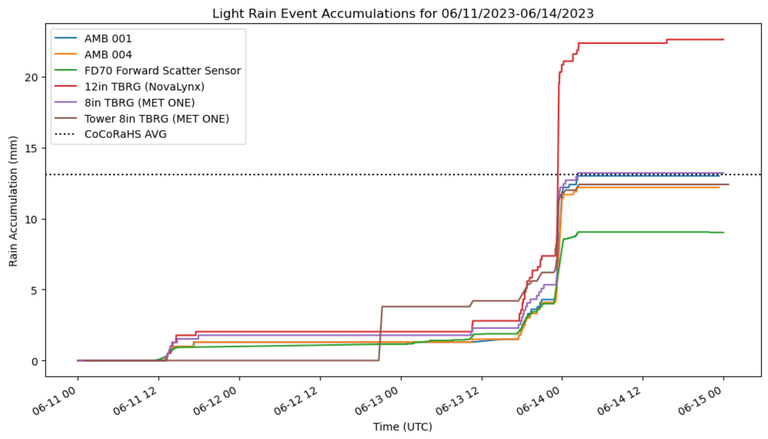


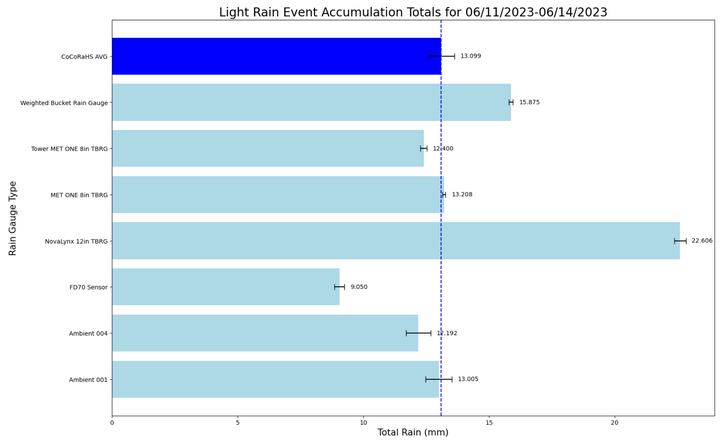
G: MET ONE 8in Tipping Bucket
H: NovaLynx 12in Tipping Bucket
I: MET ONE 12in Tipping Bucket

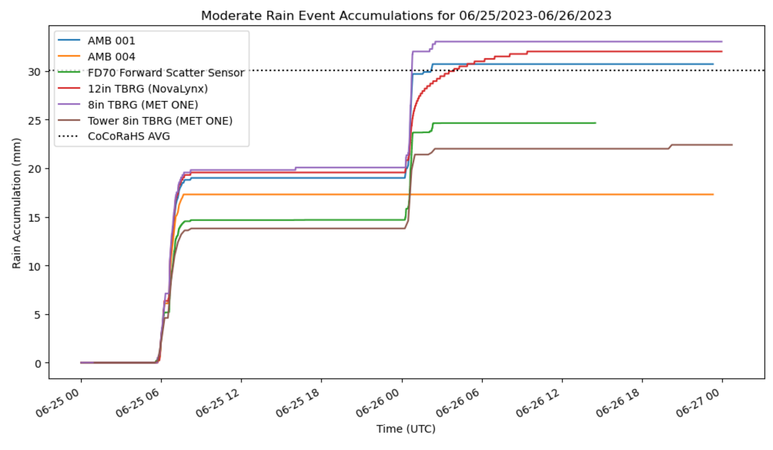
RESULTS:

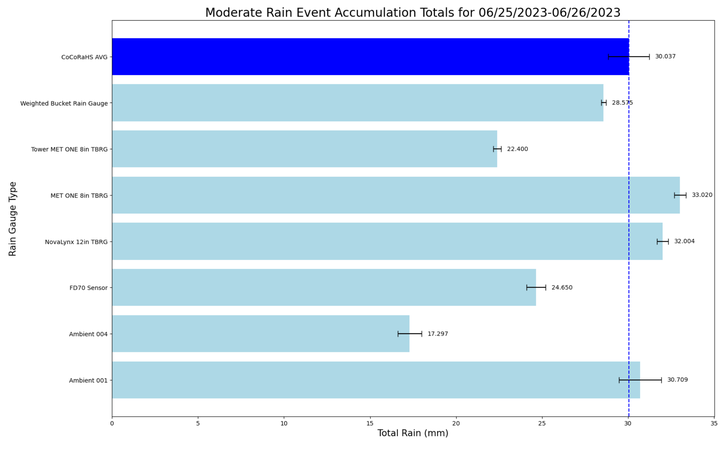


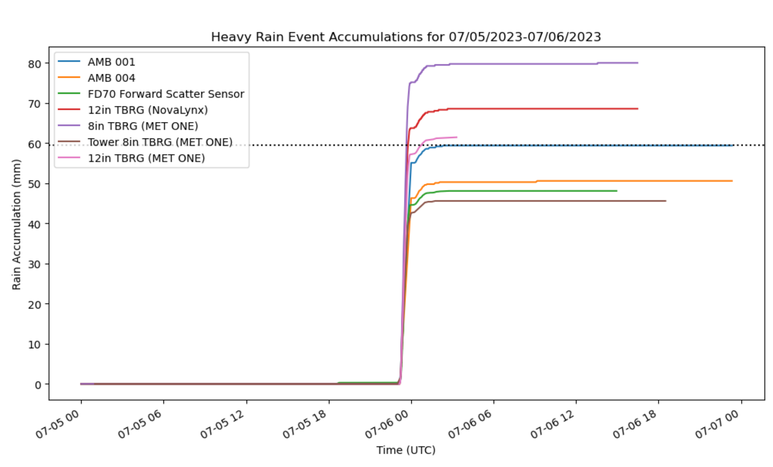


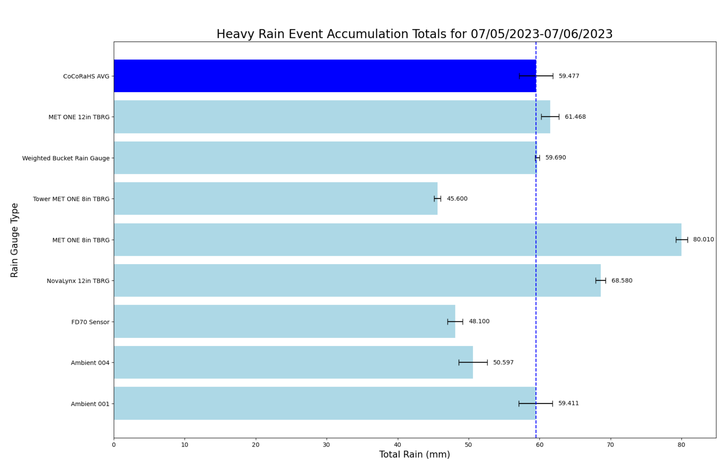












IMPACT:

- For 7 of the 8 cases studies over the summer, at least one of the two low-cost Ambient Weather Sensors measured the total rain accumulation within its own percent error
    - If the Ambient weather stations continue to prove to be accurate, they have potential uses for studying micro-climates in the Chicagoland area
    - With Ambient price-tags being much lower than other research-grade rain gauges, it allows for more instruments to be deployed and more data collected
- The more rainfall data that is available helps for modeling purposes and in the long-term, flood mitigation in the communities of Chicago

FUTURE DIRECTIONS:

- While the Ambients fared well over the summer of 2023, going forward, there are many other things that should be explored such as:
    - The accuracy over a longer period, will they remain accurate over a full month, or just the case-by-case rainfall events?
    - The accuracy under different conditions, will they remain accurate under conditions not experienced yet such as hail, sleet, and freezing rain?
    - The longevity of the instruments, will they continue to measure well after a few months?

Acknowledgements

This work was supported in part by the U.S. Department of Energy, Office of Science, Office of Workforce Development for Teachers and Scientists (WDTS) under the Science Undergraduate Laboratory Internships (SULI) program.

Special thanks to my mentors Matt Tuftedal and Max Grover for all their support.