Development of Weather Balloon Package for Vertical Profiling of Carbon Dioxide

Michael Witherspoon, Dr. David Delene, Dr. Ronald Fevig, Shawn Wagner

Atmospheric Science Department & Space Studies, University of North Dakota, Vanderbilt University

INTERDISCIPLINARY RENEWABLE & ENVIRONMENTAL CHEMISTRY REU

OBJECTIVE & GOALS

Develop a weather balloon package that includes sensors that measure carbon dioxide, temperature, humidity, and pressure.

This year's project includes an additional sensor: PyCOZIR and SPG30 to measure carbon dioxide.

BALLOON PACKAGE SENSORS

CozIR®-A: Measures carbon dioxide in ppb (parts per billion)

HTU21D-F: Measures humidity

BMP280: Measures pressure and temperature

SGP30: Measures carbon dioxide and Total Volatile Organic Compounds (TVOC)

iMet-XQ2: Measures pressure, humidity, temperature, and altitude

METHODOLOGY

- Install the needed programs on the Raspberry Pi
- Developed wiring for sensors to connect and communicate with the Raspberry Pi
- Coded the sensors to take measurements automatically at the startup of the Raspberry Pi
- Conducted outside testing of sensors multiple times
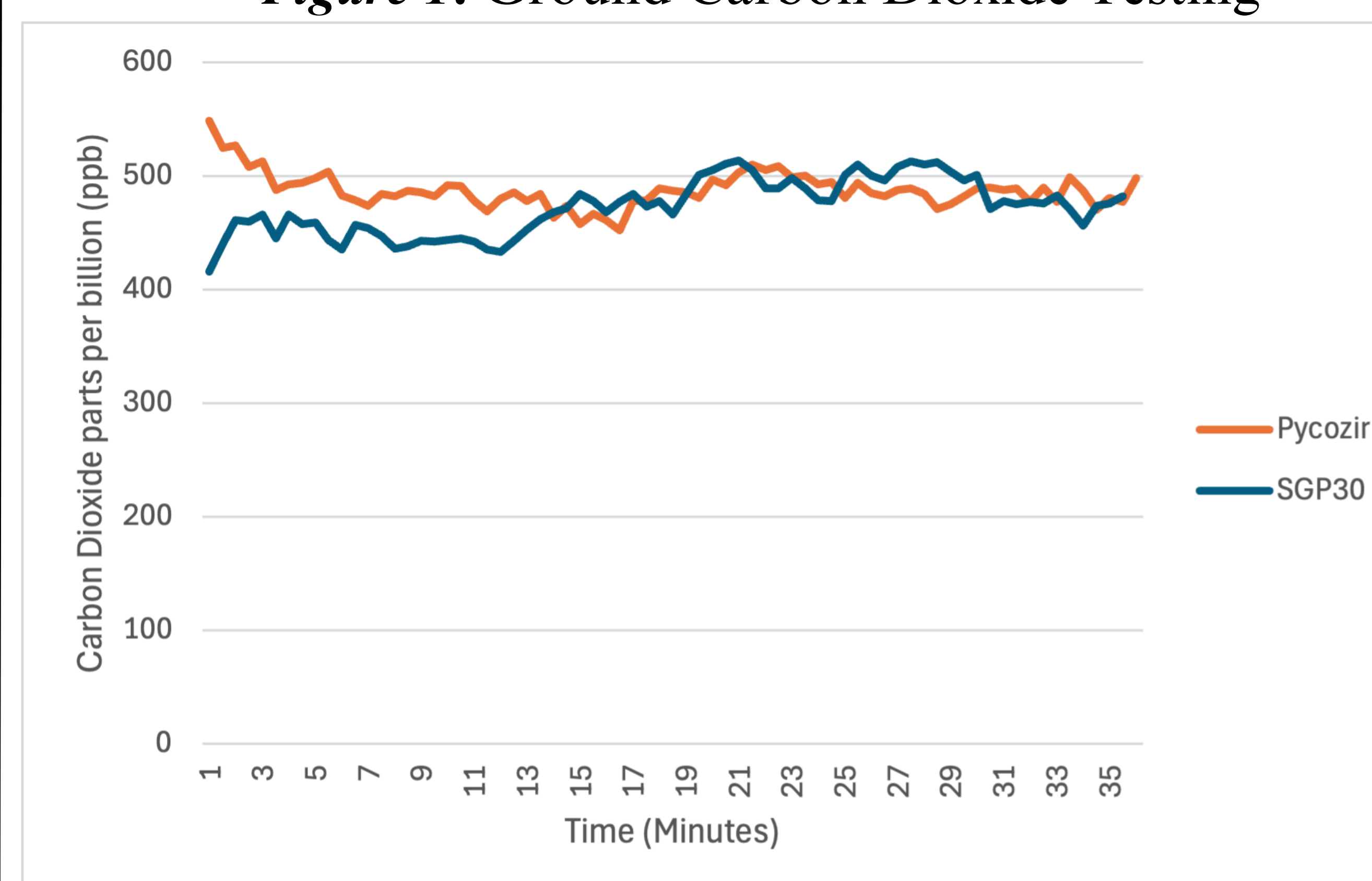- Prepared to launch the weather ballon

Fully developed balloon package

Weather Ballon Launch

Figure 1: Ground Carbon Dioxide Testing

RESULTS

While the launch and flight retrieval were successful, this project will help inform future weather balloon launch projects through error analysis. Ground testing at Clifford Hall confirms the disagreements the sensors had with one another.

CONCLUSION

- Future improvements should include a built-in SSD with Raspberry Pi, a shock cable, a bigger parachute, and a different storage method for data.
- Ground tests confirm that the SGP 30 and PyCOZIR sensors, on average, disagree by 26 parts per billion.
- Development of a different approach for data retrieval is needed for future projects.
- Additional sensors are recommended for future work, as they would help draw an in-depth analysis of each sensor.

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