MEASURING METHANE CONCENTRATION USING A HIGH ALTITUDE BALLOON

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Abstract

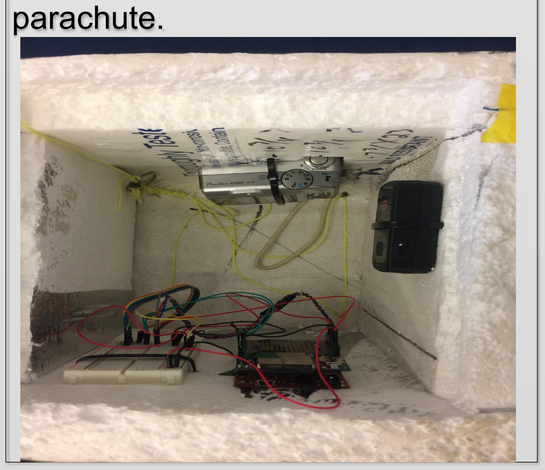
The task of sending satellites into outer-space has traditionally required an experienced team of engineers, and endless funding. However, Cube Satellites have made the mission possible for aspiring engineers. This BalloonSat is a cost-efficient method of carrying small payloads to altitudes ranging from 80,000 to 100,000 feet. In response to the deteriorated Salton Sea, the Balloon Sat was constructed to record values of methane, pressure, altitude, and temperature. Monitoring the emission of methane particles from the Salton Sea can spark solutions for the Green House Effect.

Objective

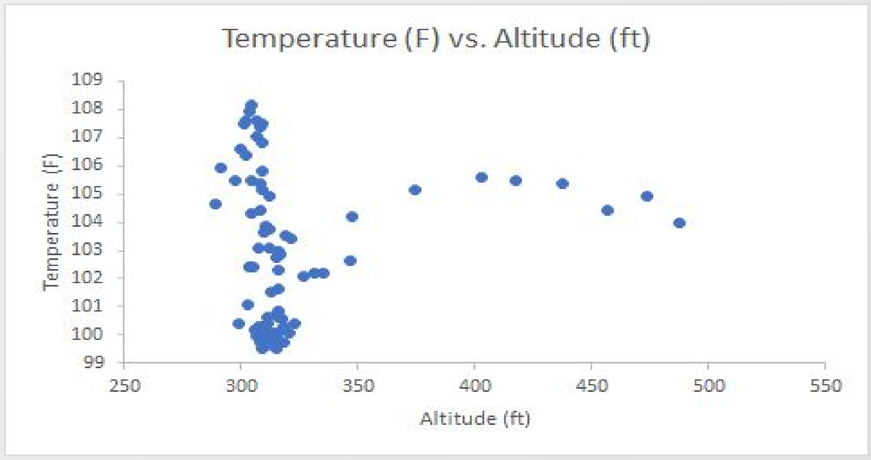
The original goal of the BalloonSat was to fly above the Salton Sea to record the atmospheric methane concentration with respect to altitude and pressure. The overall expectation of this research is to investigate the amount of methane released from the Salton Sea.

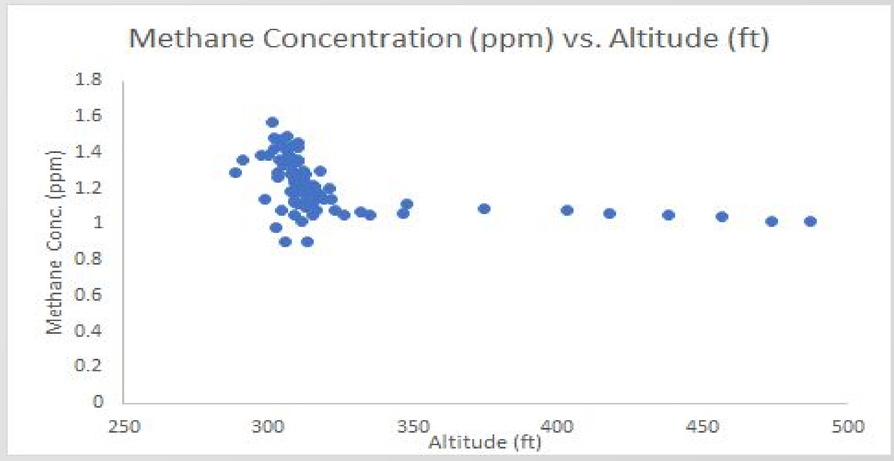
Experimental Method

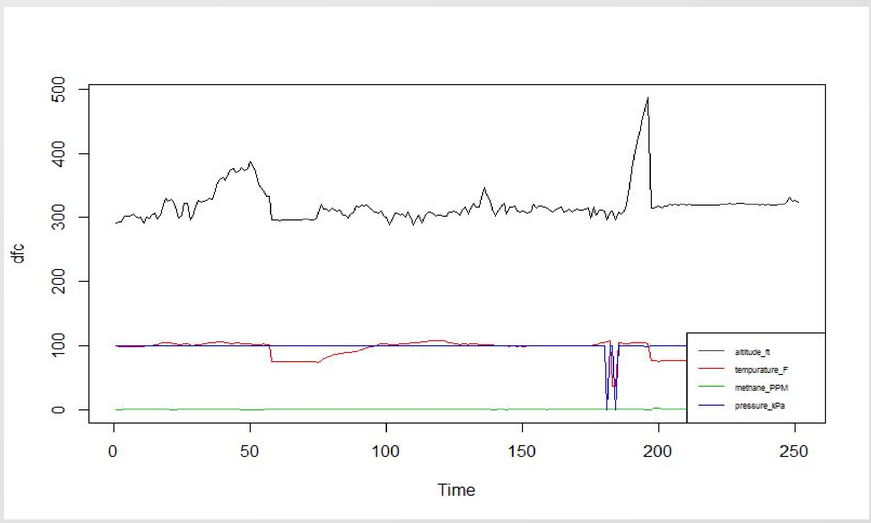
In this experiment, the BalloonSat measured methane, pressure, altitude, and temperature. The Arduino Uno microcontroller paired with an MQ-4 methane sensor, MPL3115A2 pressure, altitude and temperature sensor, and Micro SD shield were used for finding these measurements. A Canon Powershot A560 with CDHK upgraded firmware seen on the top of the picture was used to take video as it ascends from the BalloonSat. For data gathering, the payload was flown twice using five helium-filled 36” balloons. A DC motor programmed to engage after a specified time was used to cut the string connecting the BalloonSat to the balloons, deploying the parachute.

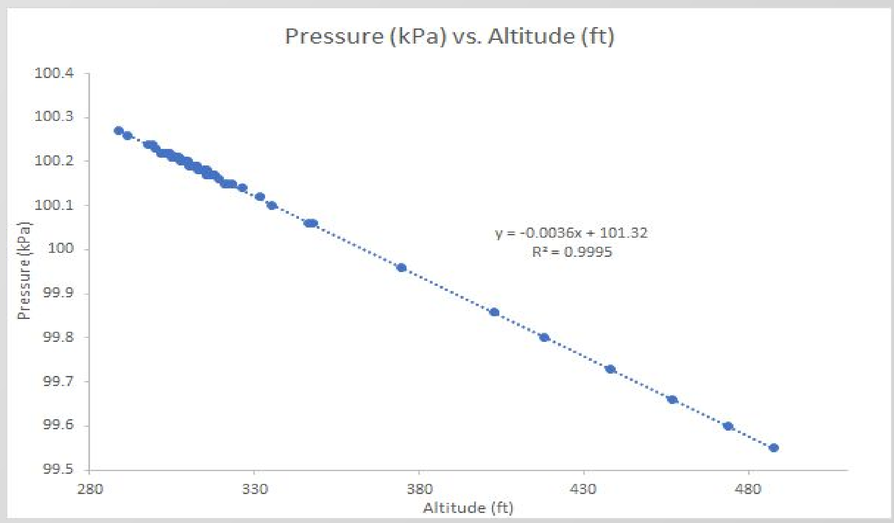


Experimental Results









Summary of Results

Above are four graphs of the data retrieved by the BalloonSat. The graphs display temperature, methane concentration, and pressure, each as a function of altitude, and on the bottom left each variable is shown over time. In this graph [bottom left] two test flights are clearly visible. In the first flight, an altitude of about 100ft was achieved, and in the second flight, an altitude of approximately 200 ft was achieved. The MPL3115A2 sensor measures altitude above sea level with Palm Desert, our testing location at an altitude of approximately 290 ft above sea level. While trends in methane concentration and temperature are barely visible over such a short change in altitude, they would be clearer over a more drastic change in altitude.

Conclusion

- **Methane concentration in the low troposphere showed little to no variation.**
- **Pressure showed a linear decrease as altitude increased.**
- **Temperature showed little to no variation within the range of 290 - 500 feet above sea level.**

Acknowledgements

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