

Comparison of Historical Sounding Data to the April 8th Total Eclipse: A Localized Variation Study

Delgado Community College in partnership with Nation Wide Eclipse Ballooning Project, Montana Space Grant, and Dillard University 2023/2024
New Orleans, Louisiana

Abstract

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Delgado Community College and Dillard University, Atmospheric teams worked with the Nationwide Eclipse Ballooning Project on April 8, 2024. We launched every 30 minutes over 30 hours prior to and after the total eclipse. Our launch location was Petit Jean Mountain State Park in Morrilton, Arkansas. This poster presents our early results from the flights surrounding the eclipse in comparison to data collected by radiosonde from the weather station in Little Rock, Arkansas.

We are interested in exploring differences seen in the upper atmosphere from the edge of the eclipse coverage to the centerline where we experienced totality. Data collected from the Wyoming University Weather Web radiosonde archive from the week surrounding April 8th will be taken from 2018-2023 and compared to flights from the April 8th eclipse. These eclipse day flights from the edge of the eclipse coverage will be compared to the flights launched by Dillard University and Delgado Community College. Variations in localized temperature are hoped to be observed. This research hopes to illuminate the effects of the solar eclipse on atmospheric conditions.

Student Ballooning

Our participation in the Nationwide Eclipse Ballooning Project was done over a two-semester period from August '23 to May '24 with launch sites in San Antonio, TX (October 2023) & Morrilton, AR (April 2024). This work is supported by Montana Space Grant and the Nationwide Eclipse Ballooning Project

April 8, 2024 Comparison of Little Rock and Morrilton Soundings During Total Eclipse

Figure 1. Flights from Arkansas just before totality
Altitude vs. Temperature April 8 1630-1730
Launches

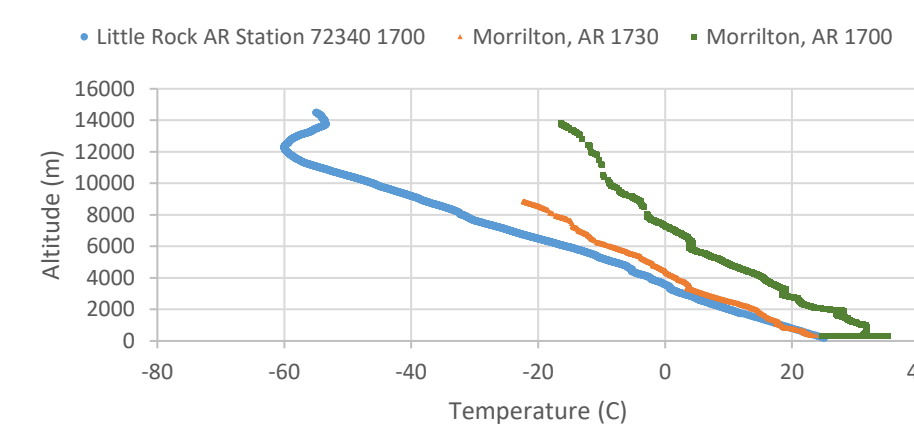


Figure 1. Balloons launched from Morrilton Arkansas and Little Rock just prior to totality. Discrepancies in temperature measurements noted as climb rate from Morrilton Balloons was much slower than radiosonde launched in Little Rock. Little Rock Flight reached altitude and was terminated at 17:25. Both Morrilton flights were terminated at 18:30

Figure 2. Flights from Arkansas just after totality
Altitude vs. Temperature

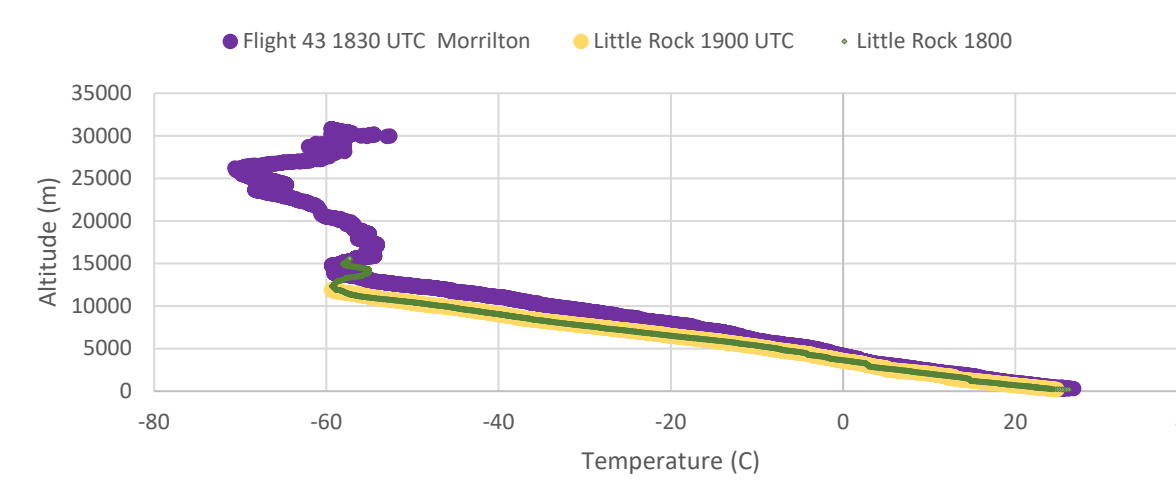


Figure 2. Balloons launched from Morrilton Arkansas and Little Rock just during and after totality. This Morrilton flight reached 30,000 m. Fewer discrepancies in this comparison as climb rate was closer.

Figure 4. Evening Temperature variations from Little Rock station

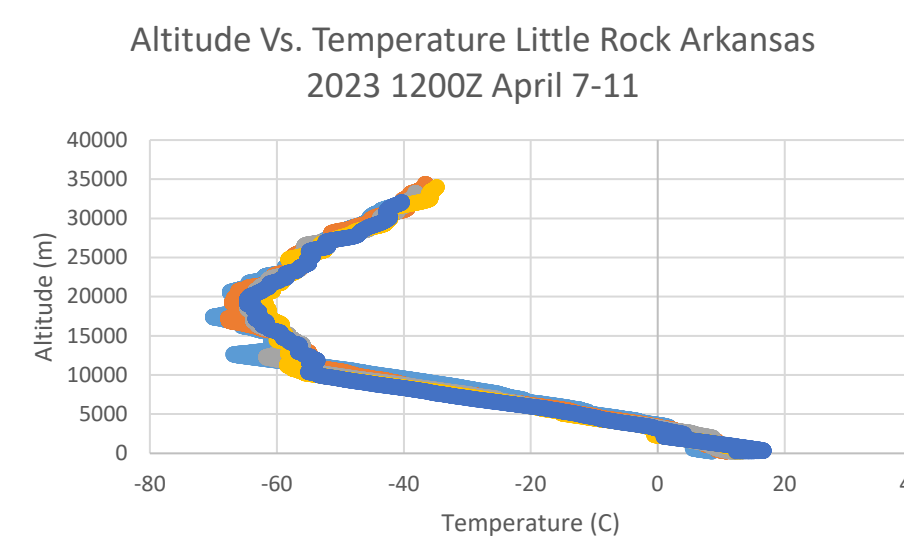


Figure 4. Variations in temperature of the tropopause 12Z Week of April 7-11 2023

Figure 3. Morning Temperature variations from Little Rock station

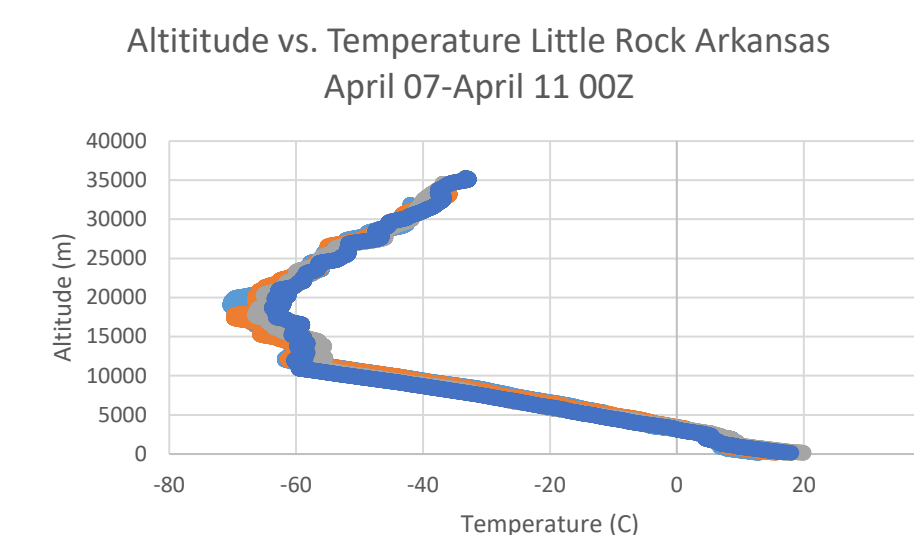
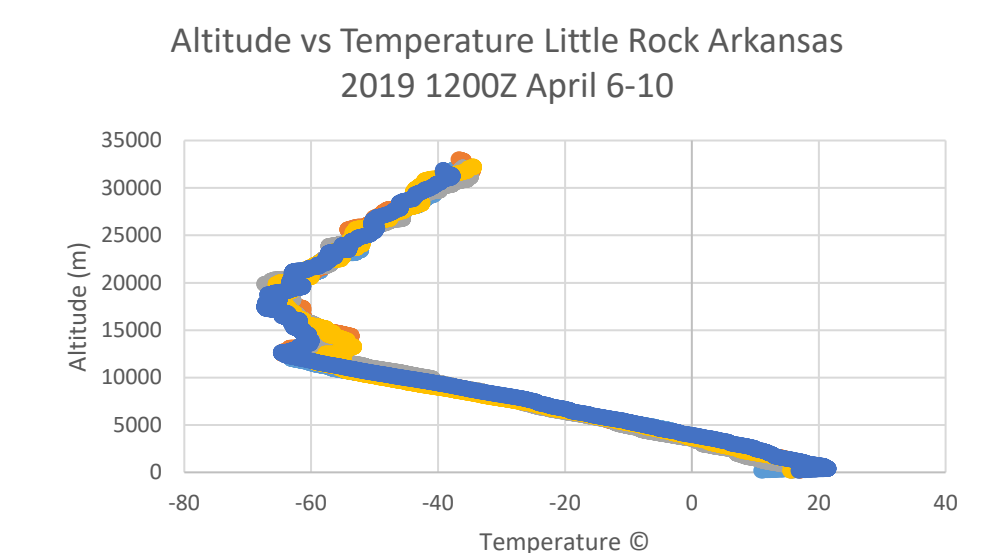
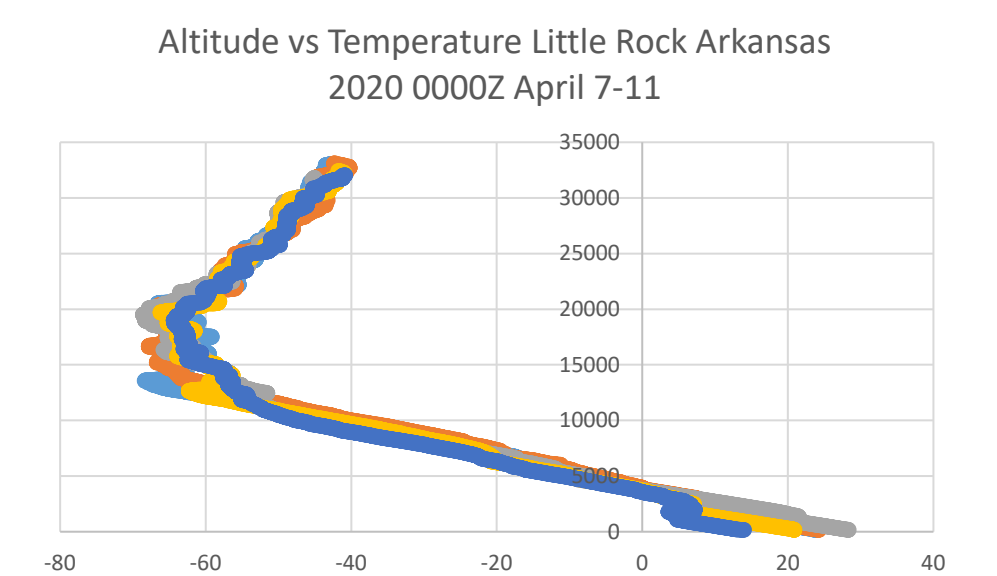
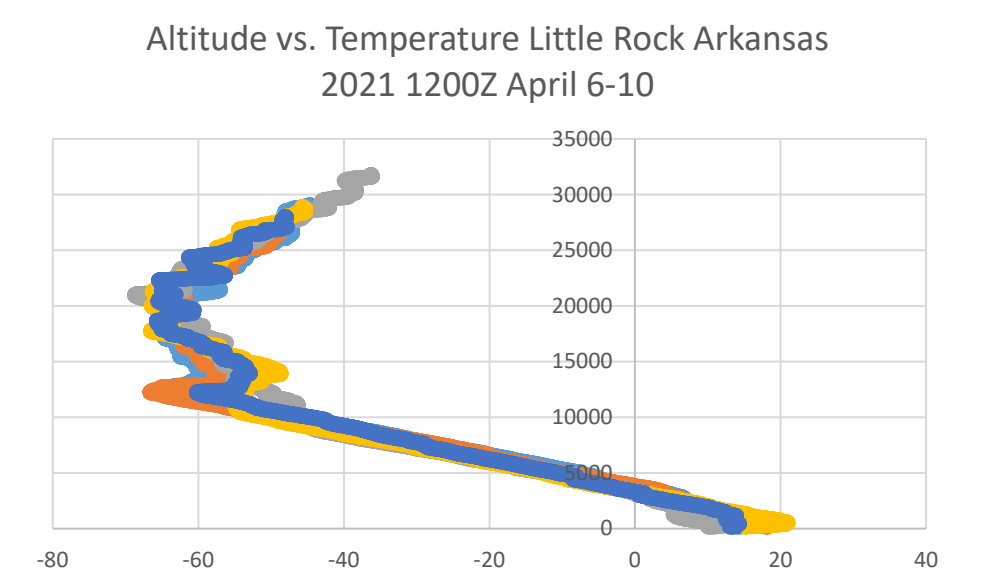
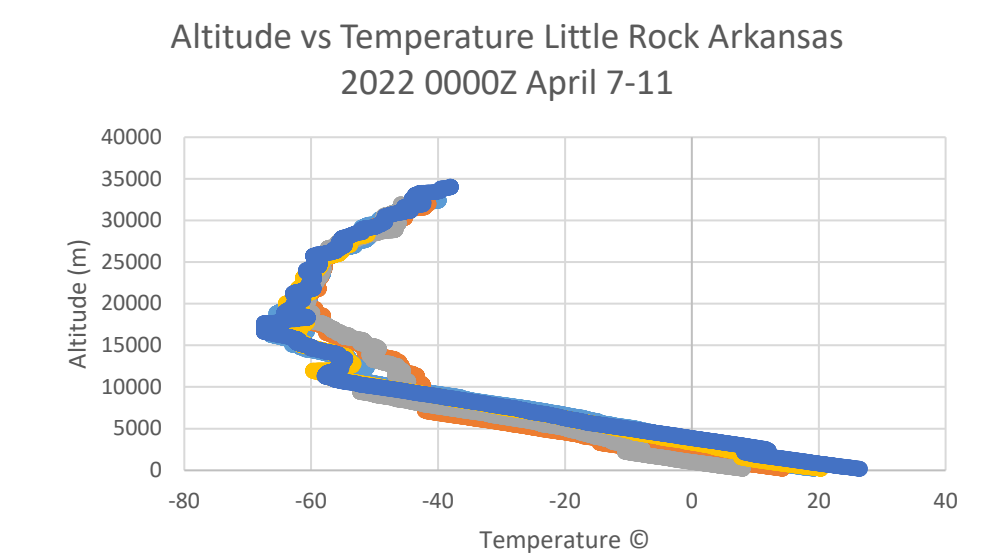


Figure 4. Variations in temperature at 00Z Week of April 7-11 2023

Additional Background Regional Atmospheric Temperature Radiation April 7-11, 2019, 2020, 2021, 2022



Further information

- Nasa Total Solar Eclipse 2024 <https://science.nasa.gov/eclipses/future-eclipses/eclipse-2024/>
- Introduction to RadioSonde <https://eclipse.montana.edu/education/science-course/sci-lesson11.html>
- University of Wyoming Sounding Archive

<https://weather.uwyo.edu/cgi-bin/bufr/raob.py?datetime=2024-04-08%2018:00:00&id=72340&type=INVENTORY>

- NASA Annual Solar Eclipse 2023 <https://science.nasa.gov/eclipses/future-eclipses/eclipse-2023/>

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Moving Forward

- Day to day variations in temperature at altitude greater than expected
- Uneven rise time delayed flights from Morrilton and temperature readings varied greatly by altitude
- Follow up with altitude, temperature, time stamp and location would be a next step
- Additional work needed to track temperature changes
- Better software for managing Morrilton data will be acquired