



# GLOBE's April 2024 Solar Eclipse Research



# Ashlee – Data Scientist

- Grew up in (rural) NJ
- Originally went to University of Delaware for Biomedical Engineering
  - Switched sophomore year to Meteorology & Climatology
- Master's & GIS Certificate at LSU
- Internship with SSAI → full time contracting position with NASA
  - Now I'm a data scientist & web developer



master's thesis



# The GLOBE Program



The Global Learning and Observations to Benefit the Environment (GLOBE) Program is an almost 30 year old international science and education program. Participants in 127 countries can collect data and upload their observations to a freely accessible database.

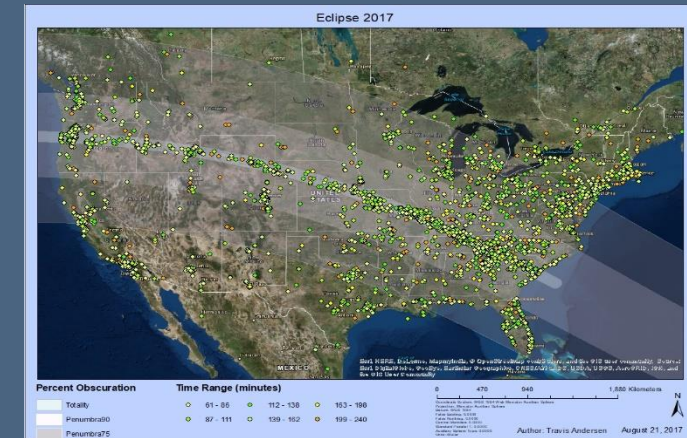


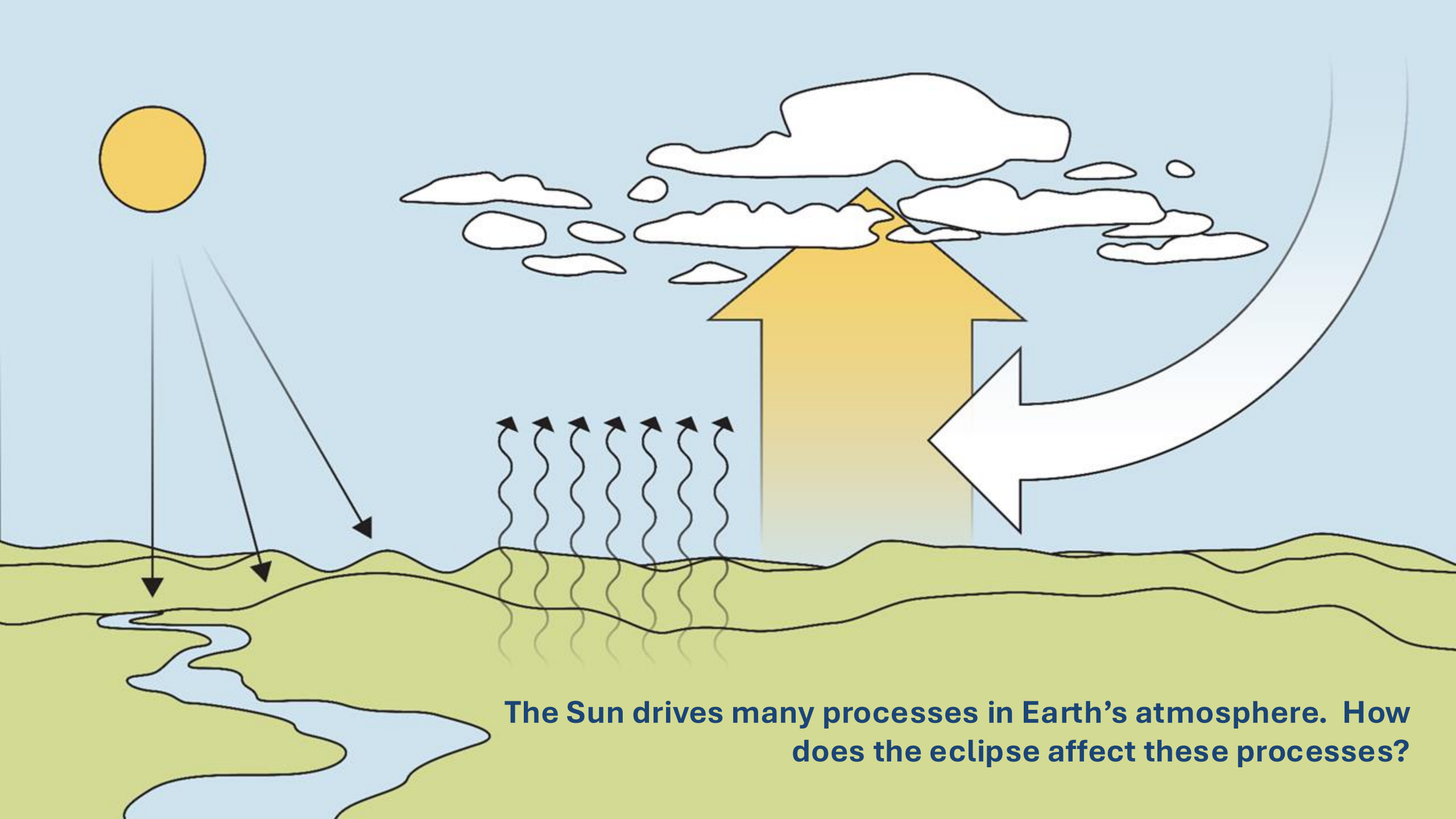
In 2016, GLOBE released a mobile app called GLOBE Observer to make getting involved even easier. There are currently four regular tools in the app (plus the occasional Eclipse tool) and over 287,000 users.



# Solar Eclipses and NASA

- Solar eclipses have provided scientists a wealth of information about the Sun and the Earth
- NASA has researched solar eclipses since its earliest days
- Research has involved ground sensors, high altitude aircraft, and rocketry

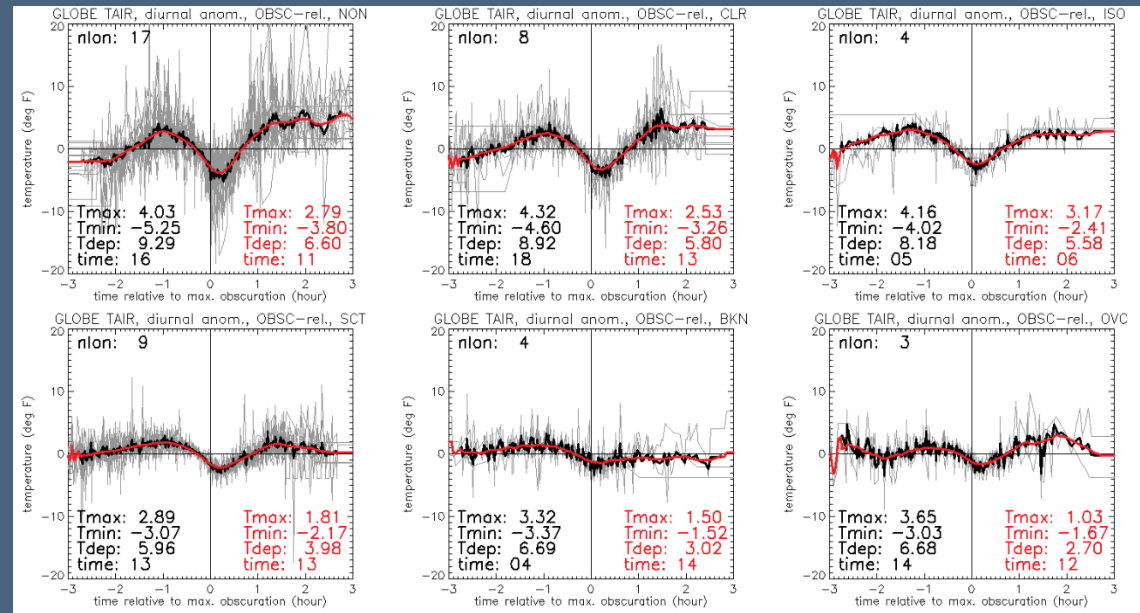
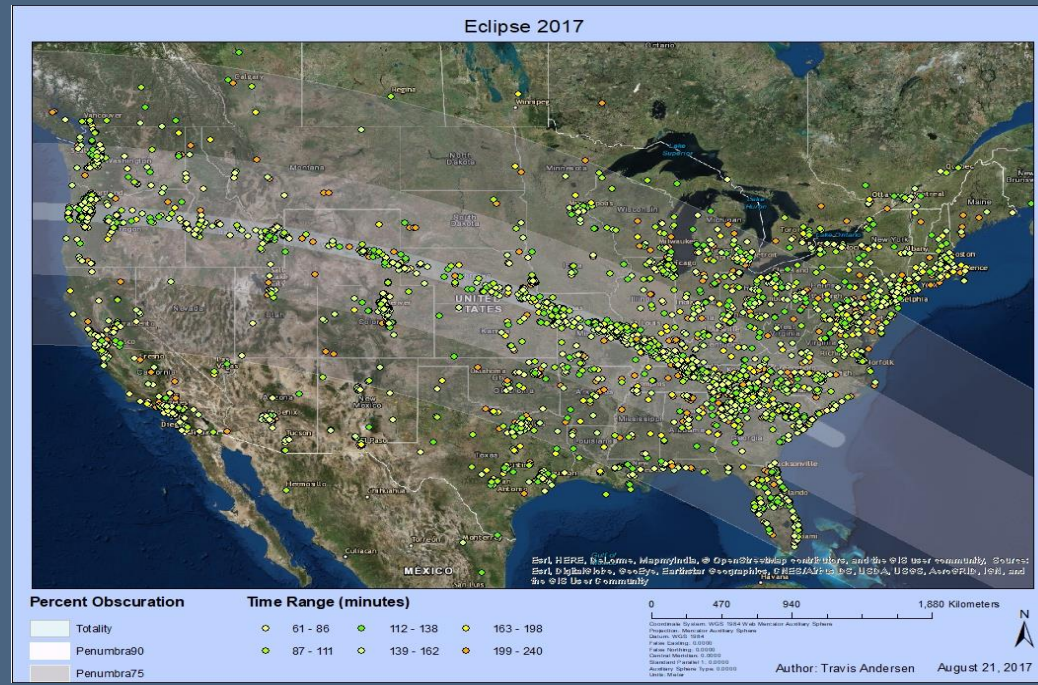




**The Sun drives many processes in Earth's atmosphere. How does the eclipse affect these processes?**

# 2017 Solar Eclipse

- 17,000 participants in U.S.
- 75,000 temperature observations
- 20,000 cloud observations
- Dr. Brant Dodson used the data to study the effect of cloud cover on temp changes induced by the eclipse
- Matched GLOBE data with satellite observations and weather station data
- NASA LaRC and GLOBE Clouds continued using GLOBE data from the 2024 eclipse





Document the surrounding landscape and include the thermometer in one photo

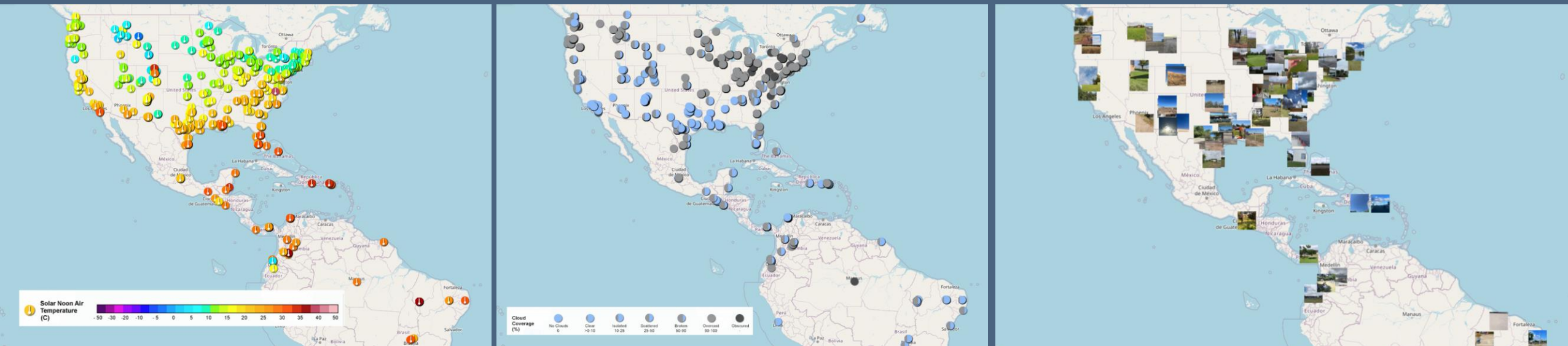


Observe the clouds every 15 – 30 minutes or anytime there is a change



Record the air temperature every 5 – 10 minutes for 2 hours before and after eclipse max

# Data collected 14 October 2023

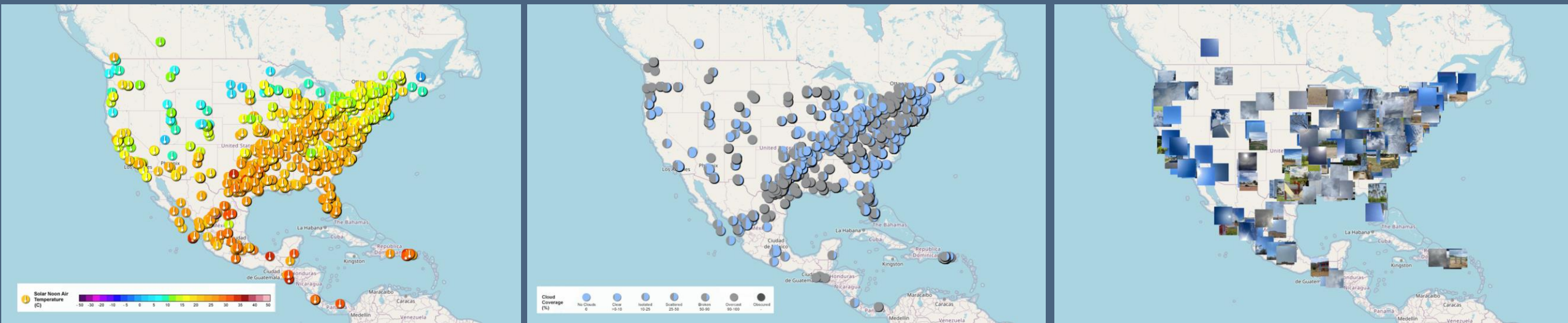


17,808 air temperature data points, 2,261 clouds observations, and 131 land cover observations from the day of the eclipse in areas experiencing any obscuration

Total of 546 unique user IDs submitting data from 1,169 different site IDs, about 52% of users and 32% of sites with at least two of the three types of data



# Data collected 08 April 2024



In the database: 32,385 air temperature data points, 7,009 clouds observations, and 632 land cover observations from the day of the eclipse in areas with partial and total obscuration

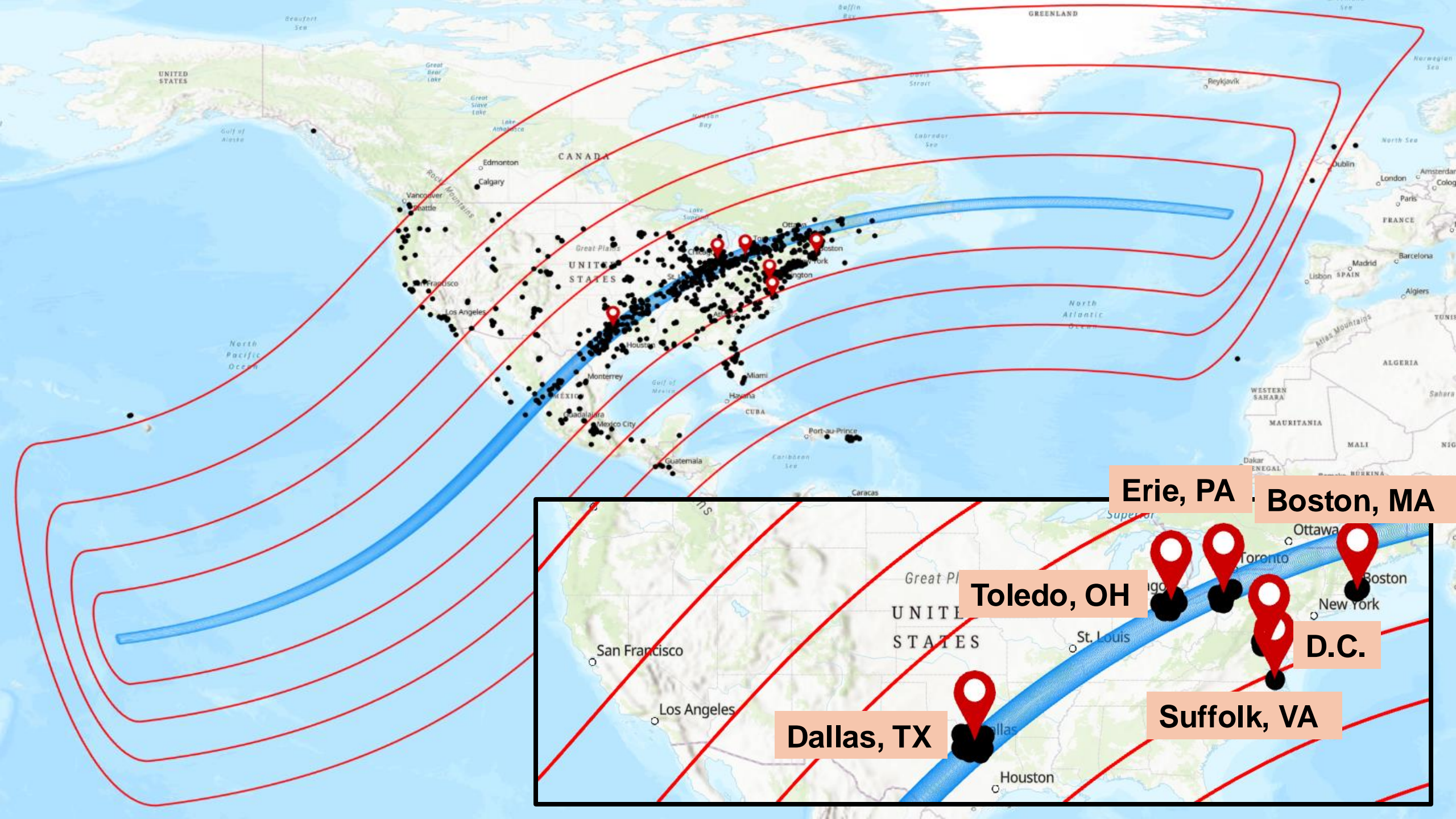
Still pending: 10,420 air temperature data points, 16,151 clouds observations, 5,842 precipitation measurements, and 10,569 wind measurements

Total of 2,153 unique user IDs submitting data from 2,812 different site IDs, about 47% of users and 33% of sites with at least two of the three types of data

About 30% of the user IDs collecting data in October also collected data in April – a total of 2,532 unique IDs between the two eclipses

# 2024 Solar Eclipse





Erie, PA Boston, MA

Toledo, OH

D.C.

Dallas, TX

Suffolk, VA

# Research Focus: High-Level Clouds

- Specifically, cirrus and contrails
- High & thin clouds have net warming effect
- 20 – 30% of globe is regularly covered by high-level clouds
- High-level cloud presence has been increasing between 30 – 65 °N
  - Particularly related to aviation
- Contrails can persist and grow into cirrus clouds
  - Depends on several factors, including RHI



# How'd We Choose High-Level Clouds?

- Past eclipse research studied temperature & low-level cloud changes
- Looked for patterns in data after narrowing down locations by number of observations
- Considered the physical processes of the changes
  - Is a correlation between high-level clouds & the eclipse possible?

# What Did the Volunteers See in Toledo?



a) photo submitted 17:19 UTC



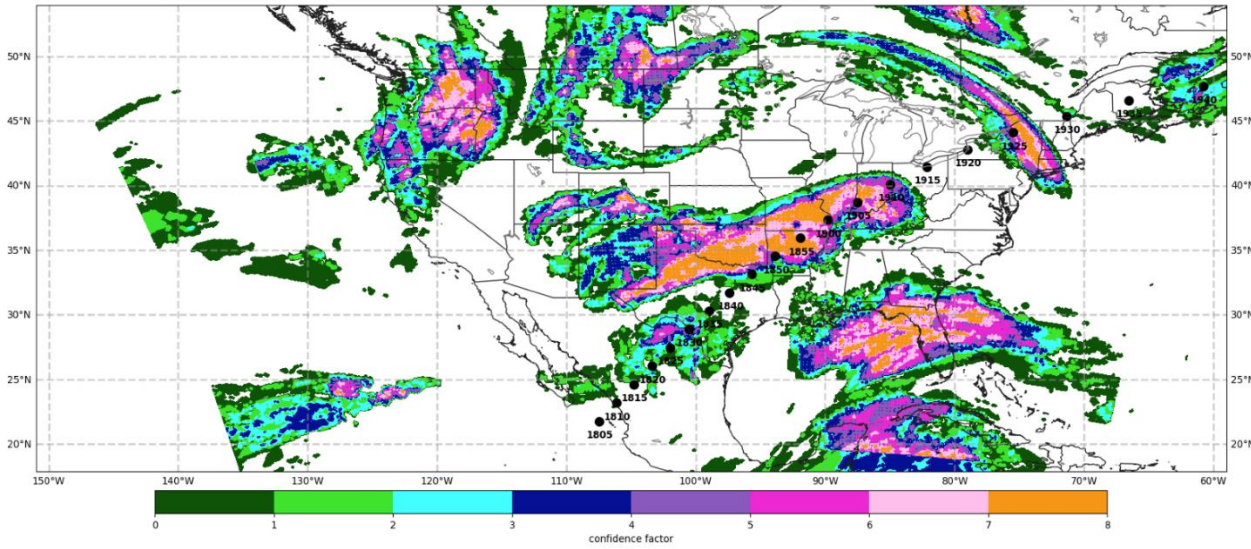
b) photo submitted 19:10 UTC



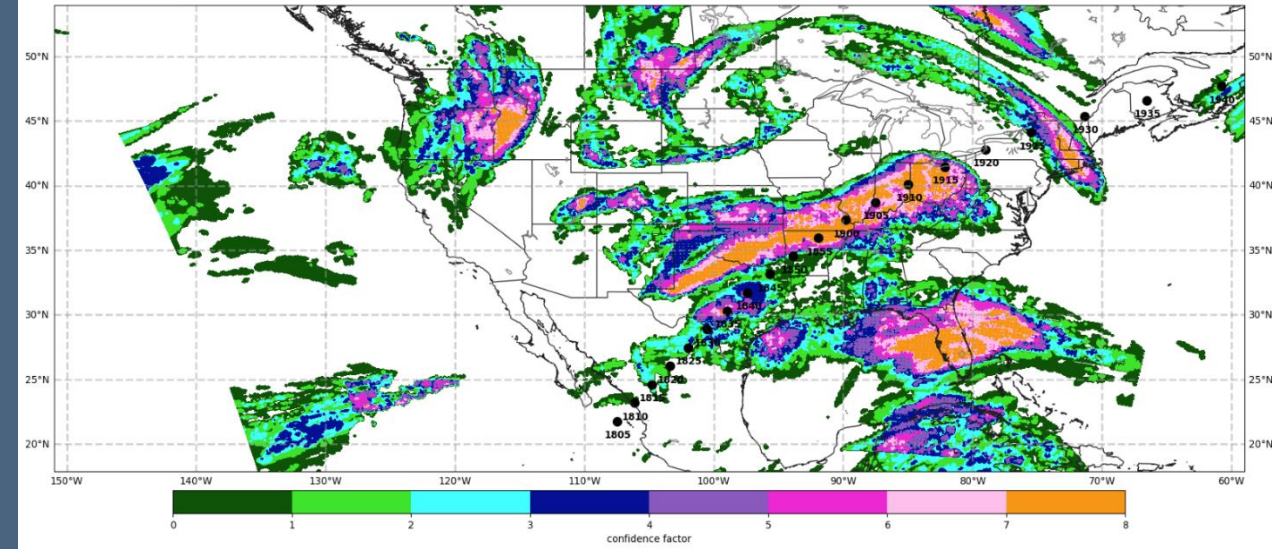
c) photo submitted 20:19 UTC

# What Did the Contrail Models Show?

Compound Filtered (model 3) Contrail Formation Potential Forecast valid 15 UT 08 Apr 2024



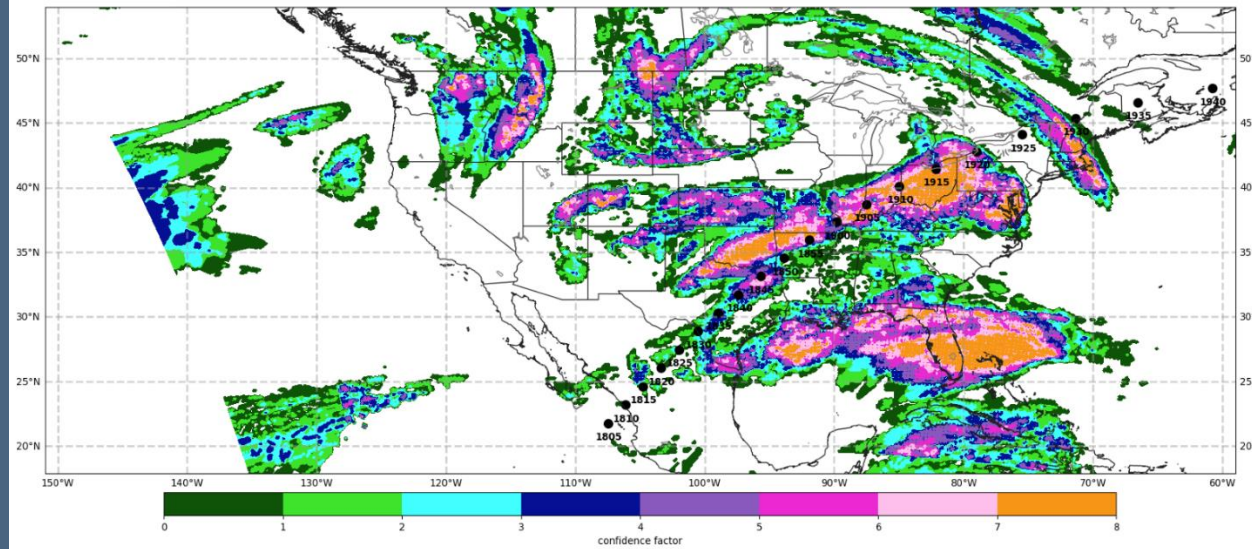
Compound Filtered (model 3) Contrail Formation Potential Forecast valid 18 UT 08 Apr 2024



a) Before Eclipse: 1500 UTC

b) During Eclipse: 1800 UTC

Compound Filtered (model 3) Contrail Formation Potential Forecast valid 21 UT 08 Apr 2024



c) After Eclipse: 2100 UTC

# So, Do Solar Eclipses Affect Cirrus Clouds & Contrails?

- No matter the overall contrail trends, short-lived contrails decreased the most leading up to the eclipse (compared to persistent contrails)
  - Decrease in short-lived may coincide with increase in persistent
- Decreases in contrails, with an increase in cirrus, may indicate contrails growing into cirrus
- Conditions typically grew more favorable for contrail formation, especially leading up to local eclipse max
- Using ground observations, it seems possible the eclipse could have affected the conditions for cirrus/contrail formation and made them more favorable

*\*paper submitted to the Bulletin of the American Astronomical Society*



# Eclipse Temperature Changes

- Which eclipse saw the largest temperature change, 2023 or 2024?
  - We didn't specifically look at this for 2024
  - Under the same conditions, a total eclipse would be expected to produce larger temperature drop than a partial
    - Depends on cloud coverage, weather fronts, time of day

**Scan for 2024  
eclipse page on  
GLOBE:**



**Scan for 2023  
eclipse page on  
GLOBE:**





Thank You! Any Questions?