Exploring Autumnal Heatwaves in Buffalo, NY using NY State Mesonet Data

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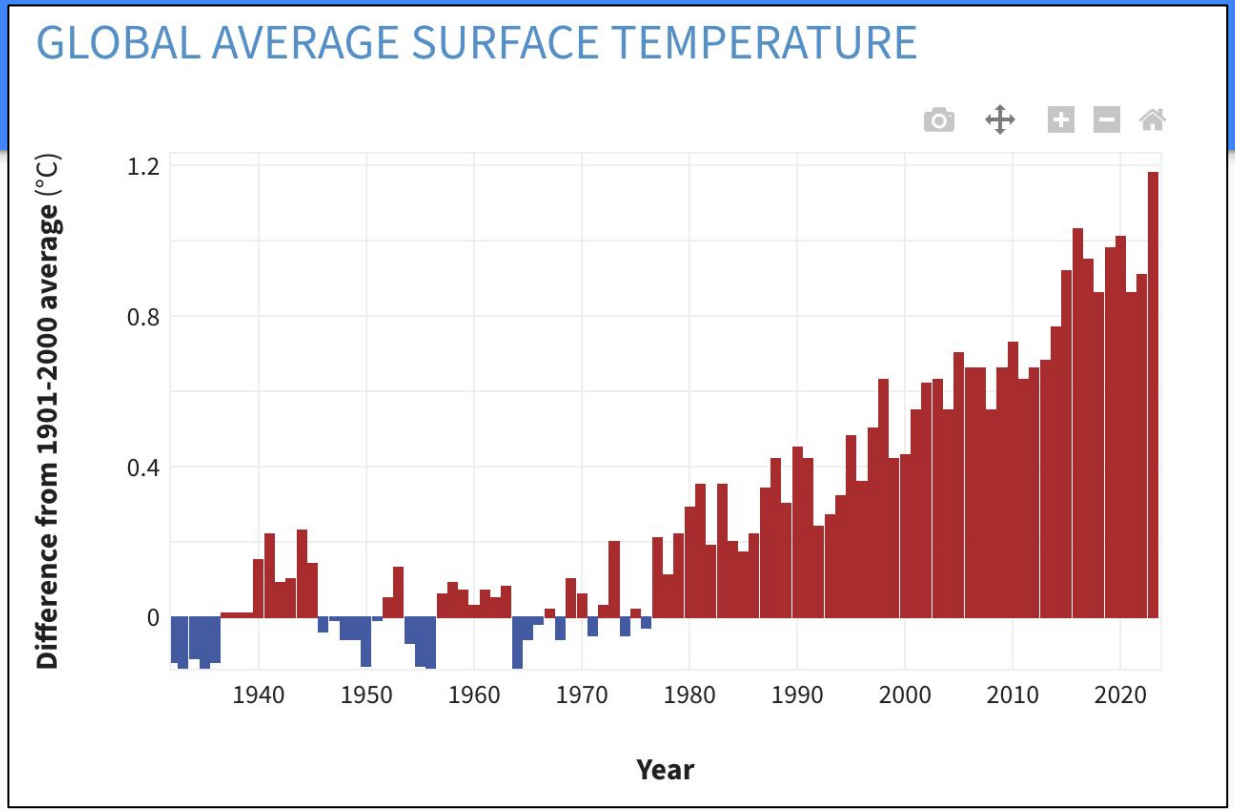
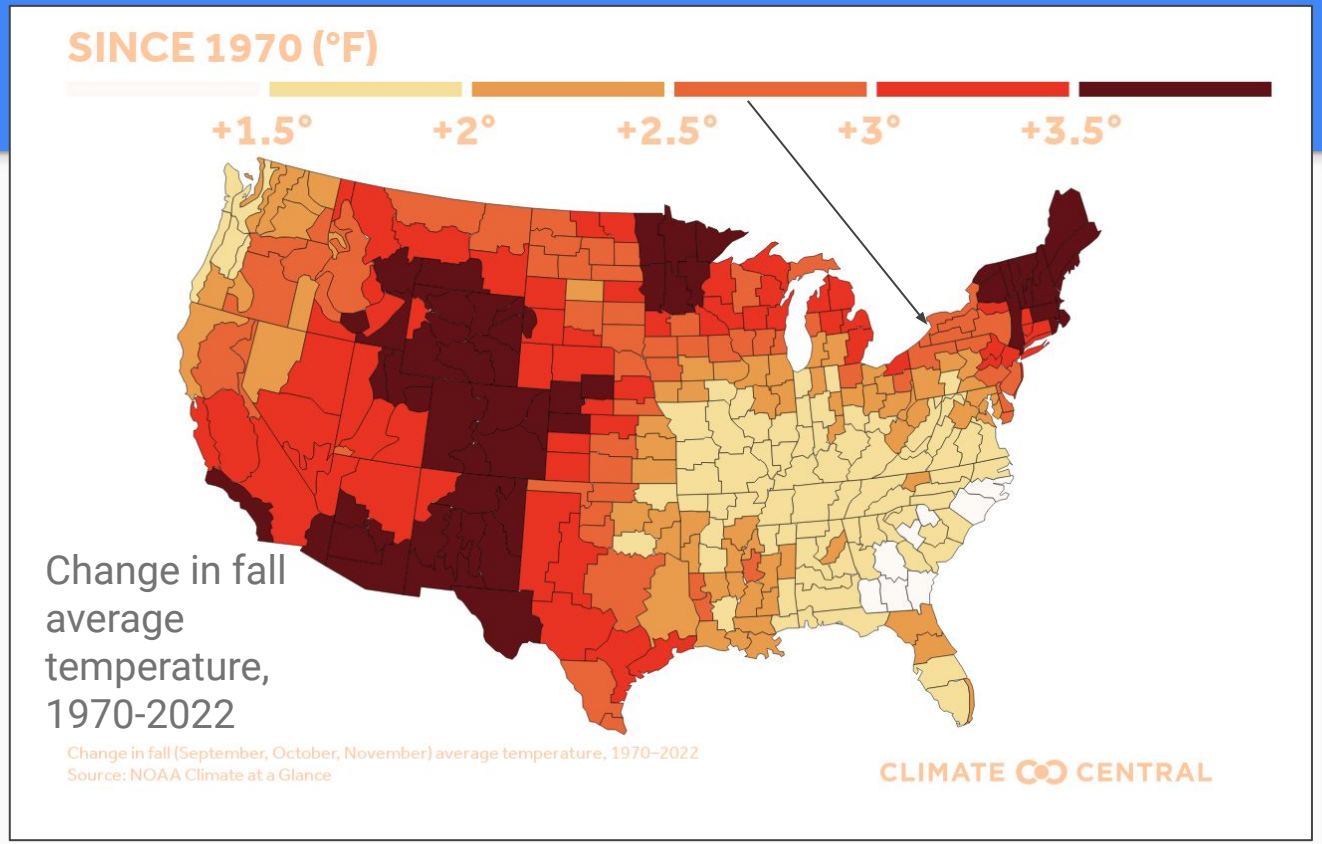
Previous studies on heat waves/why heat waves?



https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature

Why Autumnal Heatwaves?



Change in fall average temperature, 1970-2022

- In the fall students and teachers are in classrooms, usually without air conditioning
- Impacts crops & agriculture
- Impact lake-effect snow as Lake Erie stays warmer

Heatwave definition

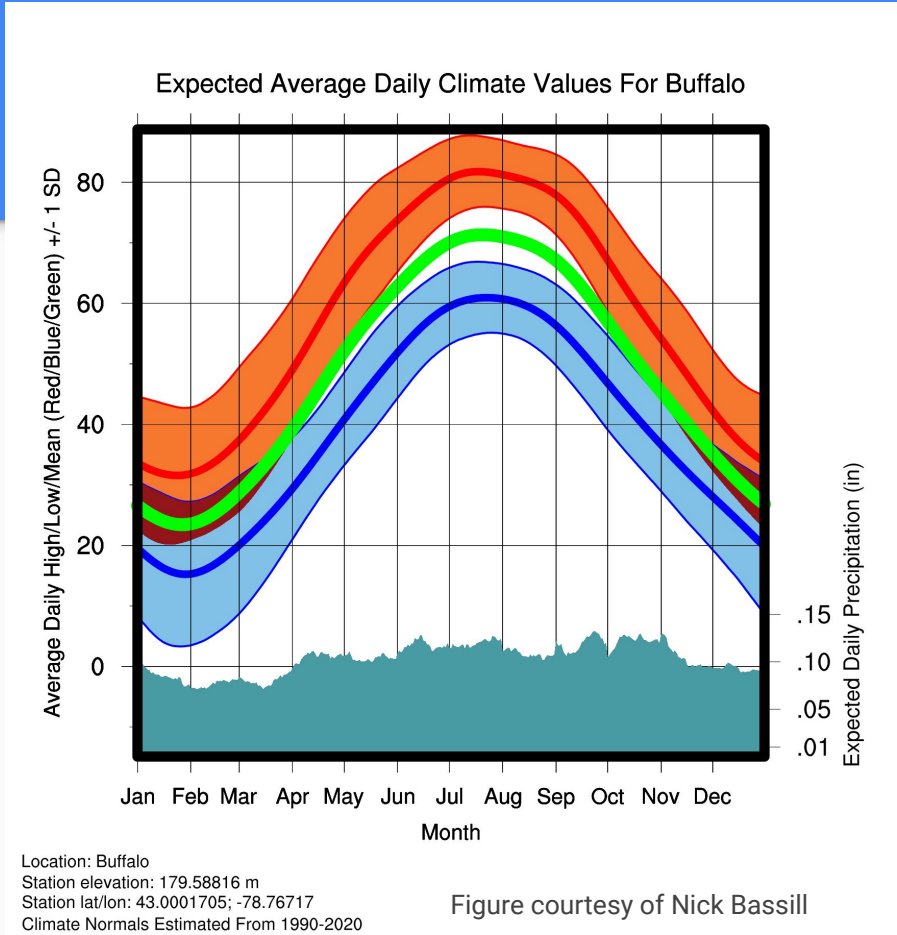


Figure courtesy of Nick Bassill

- **Temperature threshold**: daily high temperature is at least 5℃ higher than the climatological mean high temperature
- **Temporal threshold**: temperature threshold is reached for more than 2 consecutive days

Climatological Mean Data

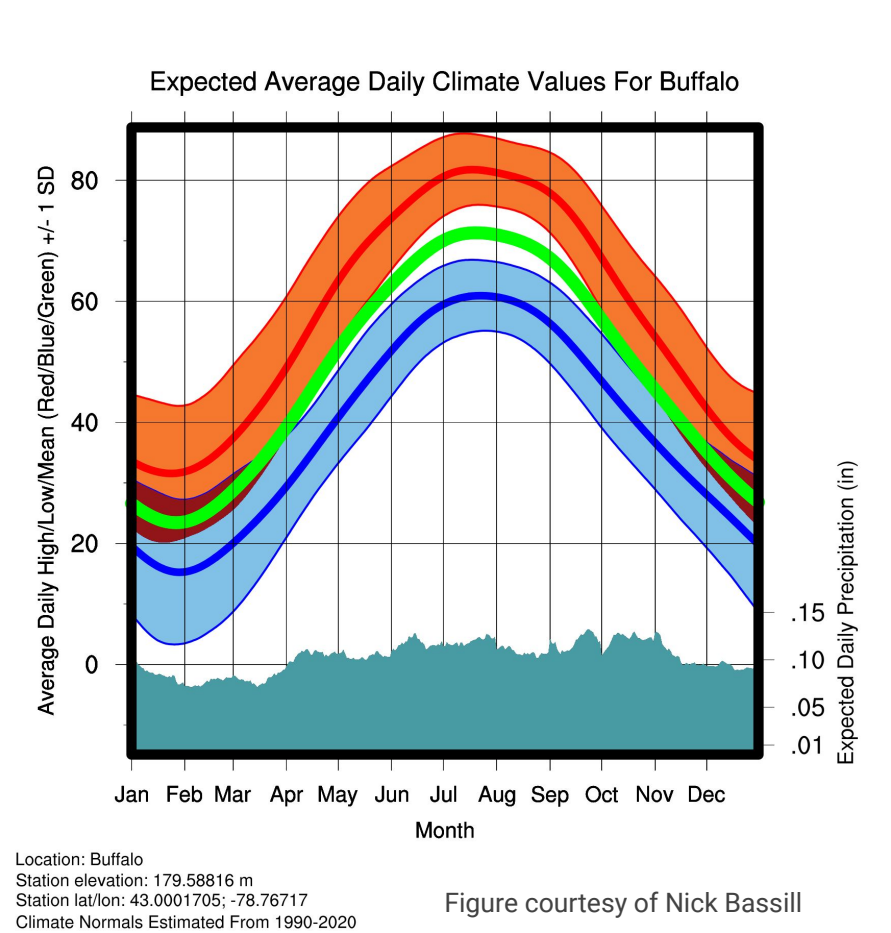
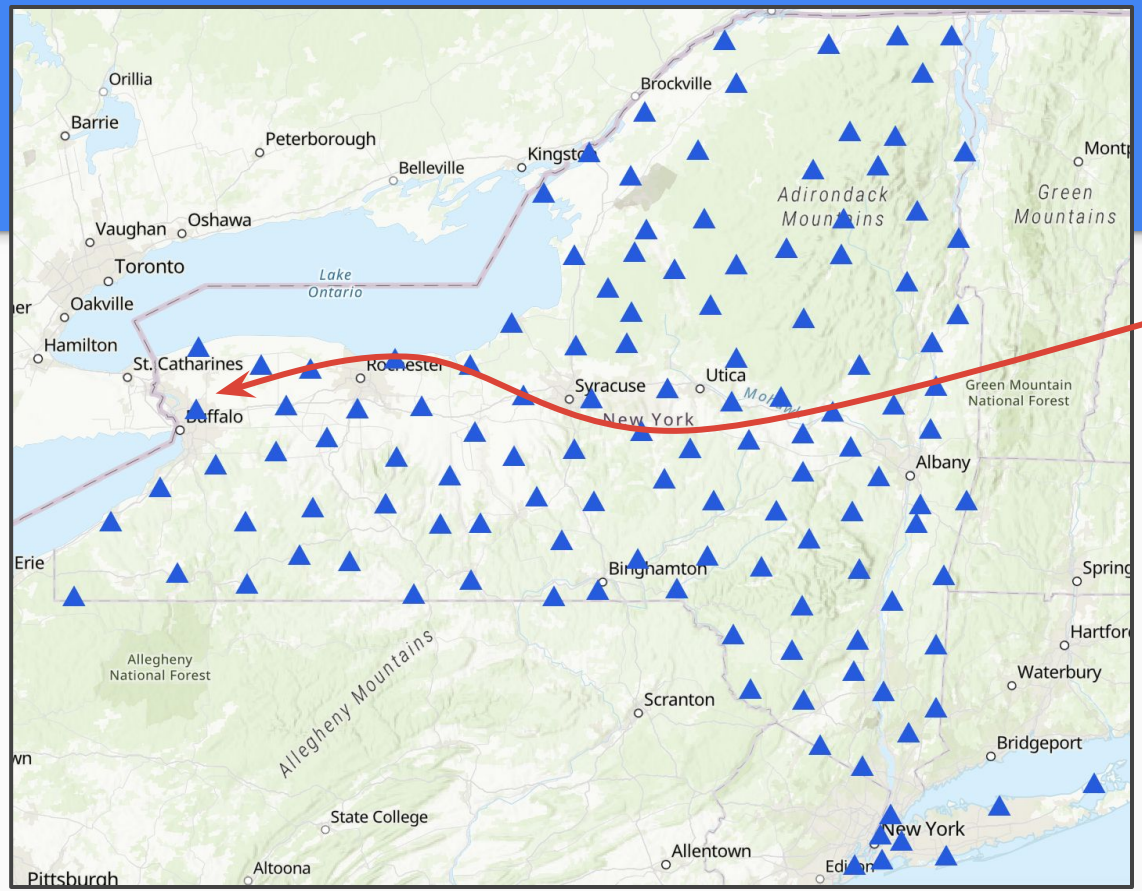


Figure courtesy of Nick Bassill

- A regression model for the BUFF mesonet site
  - built on the average and standard deviation temperature values from long-running sites in the NCEI NY archive.
  - Uses lat, lon, elevation, and distance to a large water body as inputs to estimate the theoretical climo for the NYS Mesonet sites.
- Data and code from Nick Bassill

Mesonet Data

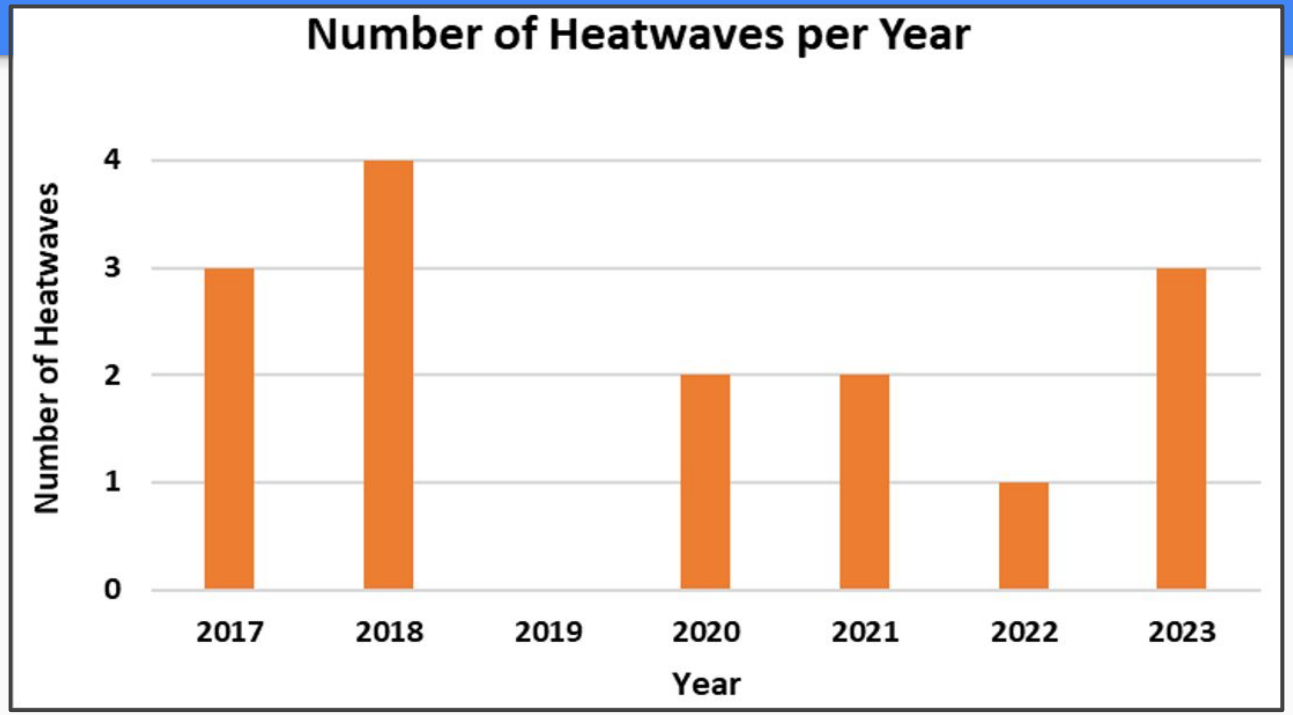


BUFF station

- Hourly maximum 2-m temperature data
- 2017-2023
- May - October

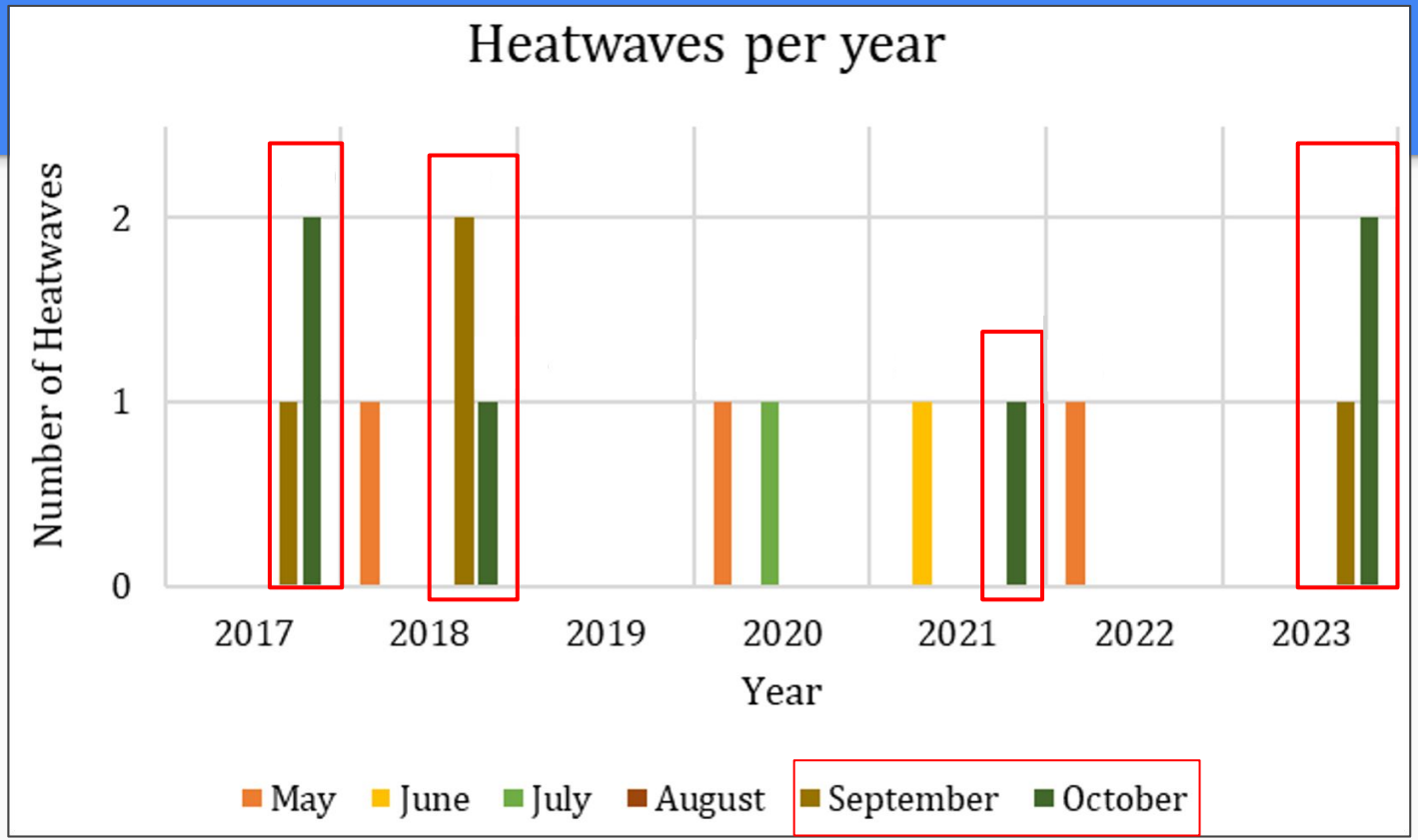
https://www.arcgis.com/apps/mapviewer/index.html?layers=3a68bbb9003a4f1e91fd5af64c3bf1a5

Heat Waves in Buffalo, NY from 2017-2023 May - October



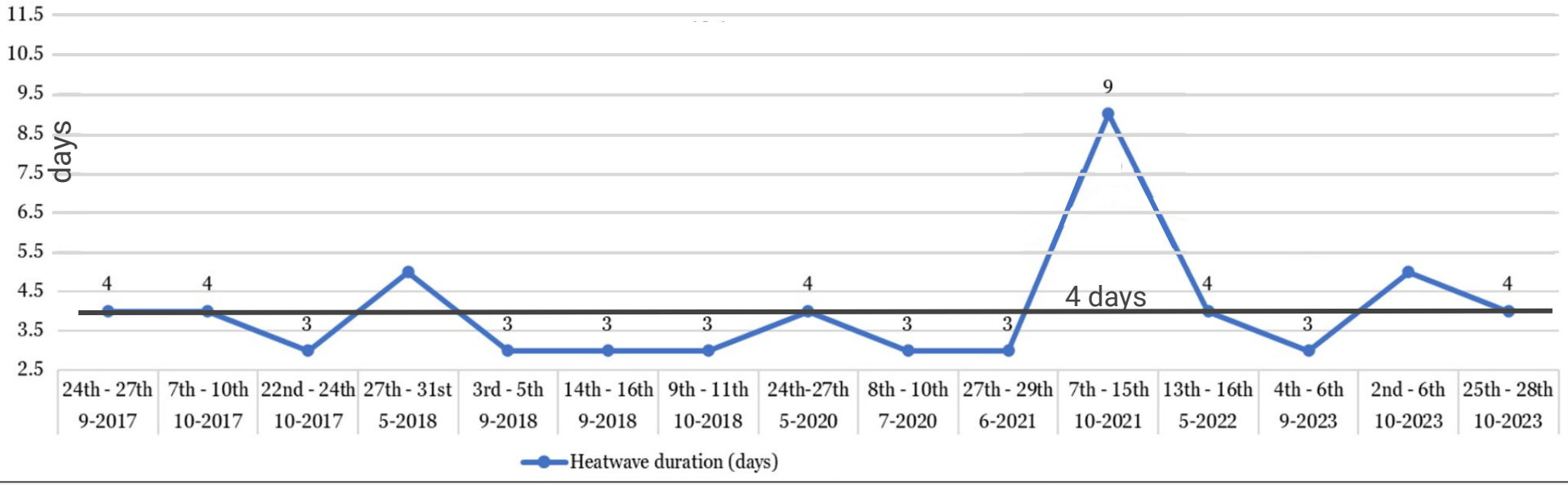
- 15 heatwaves identified
- Every year except 2019 had at least 1 heat wave

Heat Waves in Buffalo, NY from 2017-2023

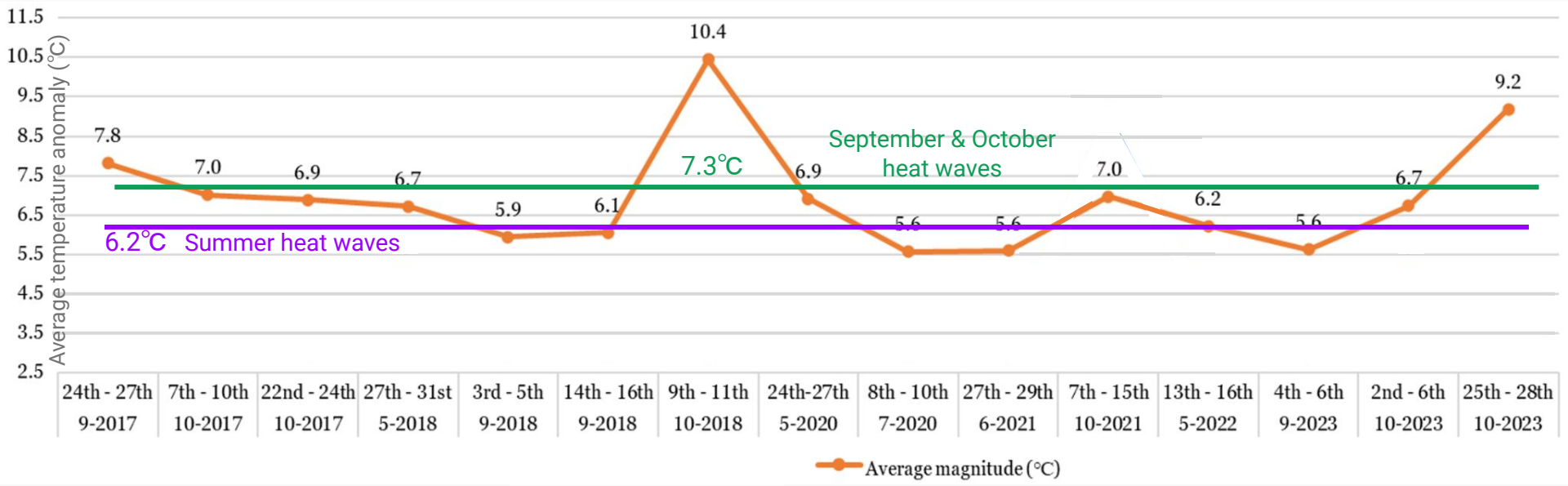


- 15 heat waves identified
- 5 heat waves in May - August
- 10 heat waves in September or October

Heatwave Duration in Buffalo, NY



Heatwave Magnitude in Buffalo, NY



Composite mean & anomaly maps

NOAA Physical Sciences Laboratory
NCEP/NCAR Reanalysis
1991-2020 Climatology

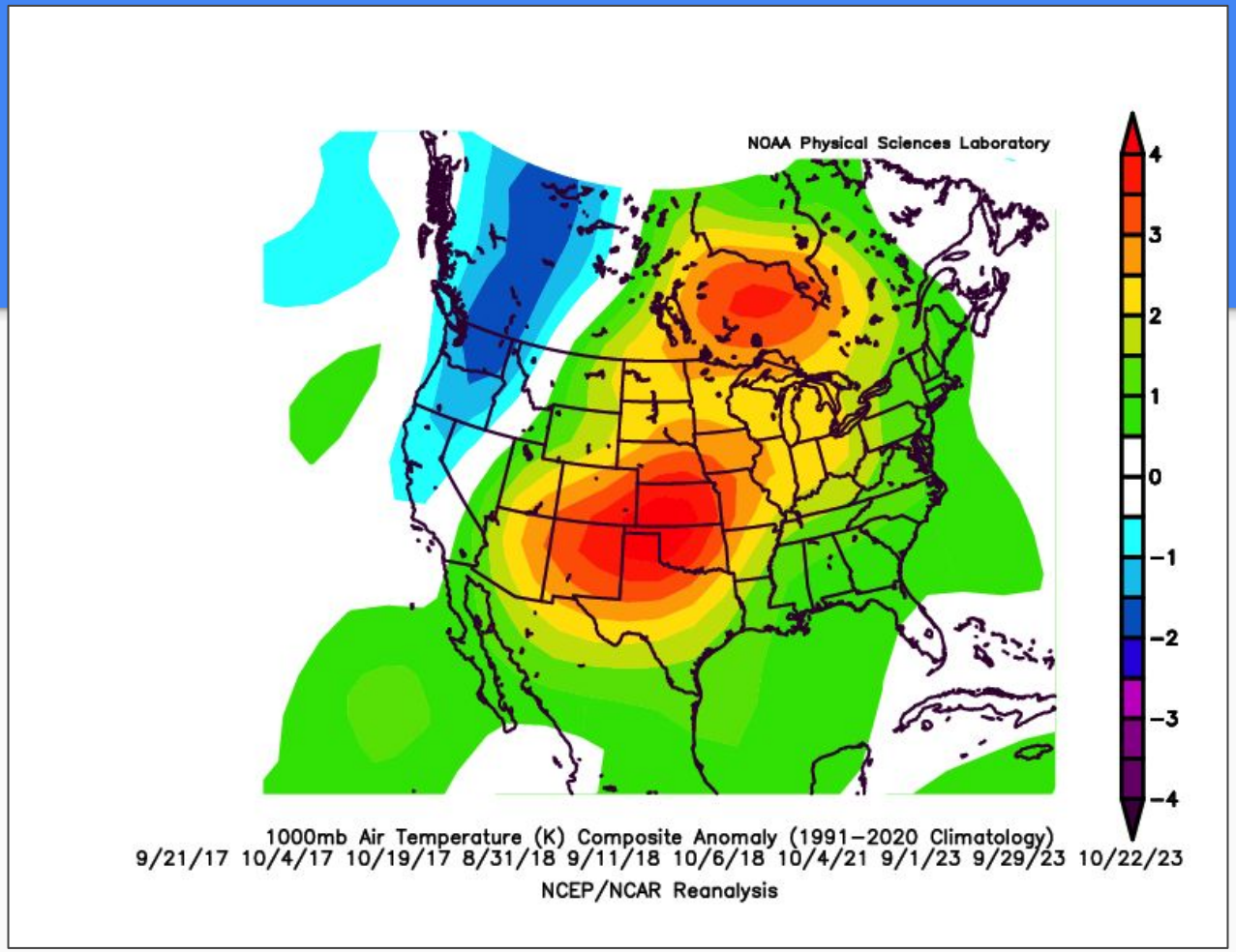
September & October heat waves

1000 hPa Temperature Anomaly

September & October heat waves

1000 hPa Temperature Anomaly

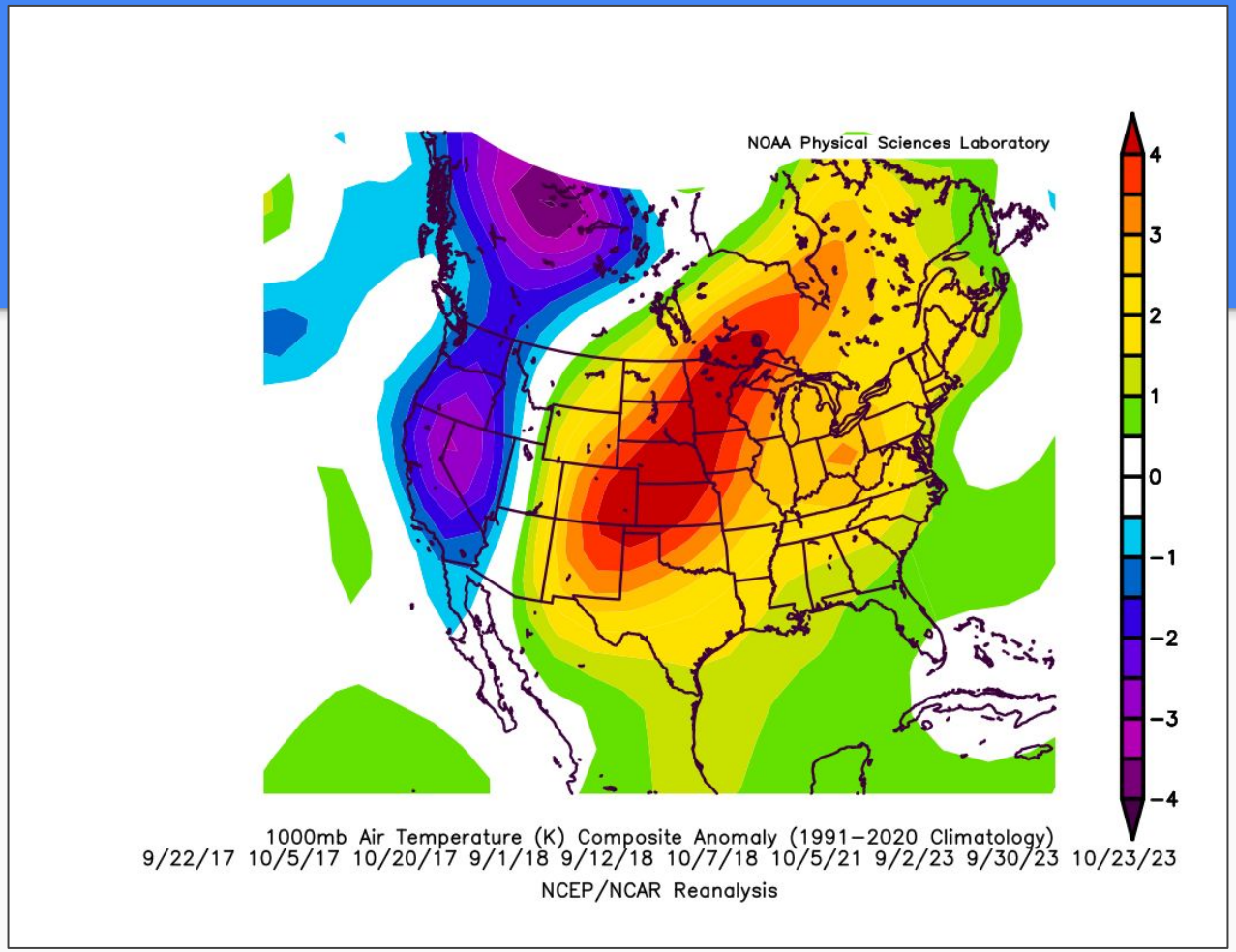
Day -3



September & October heat waves

1000 hPa Temperature Anomaly

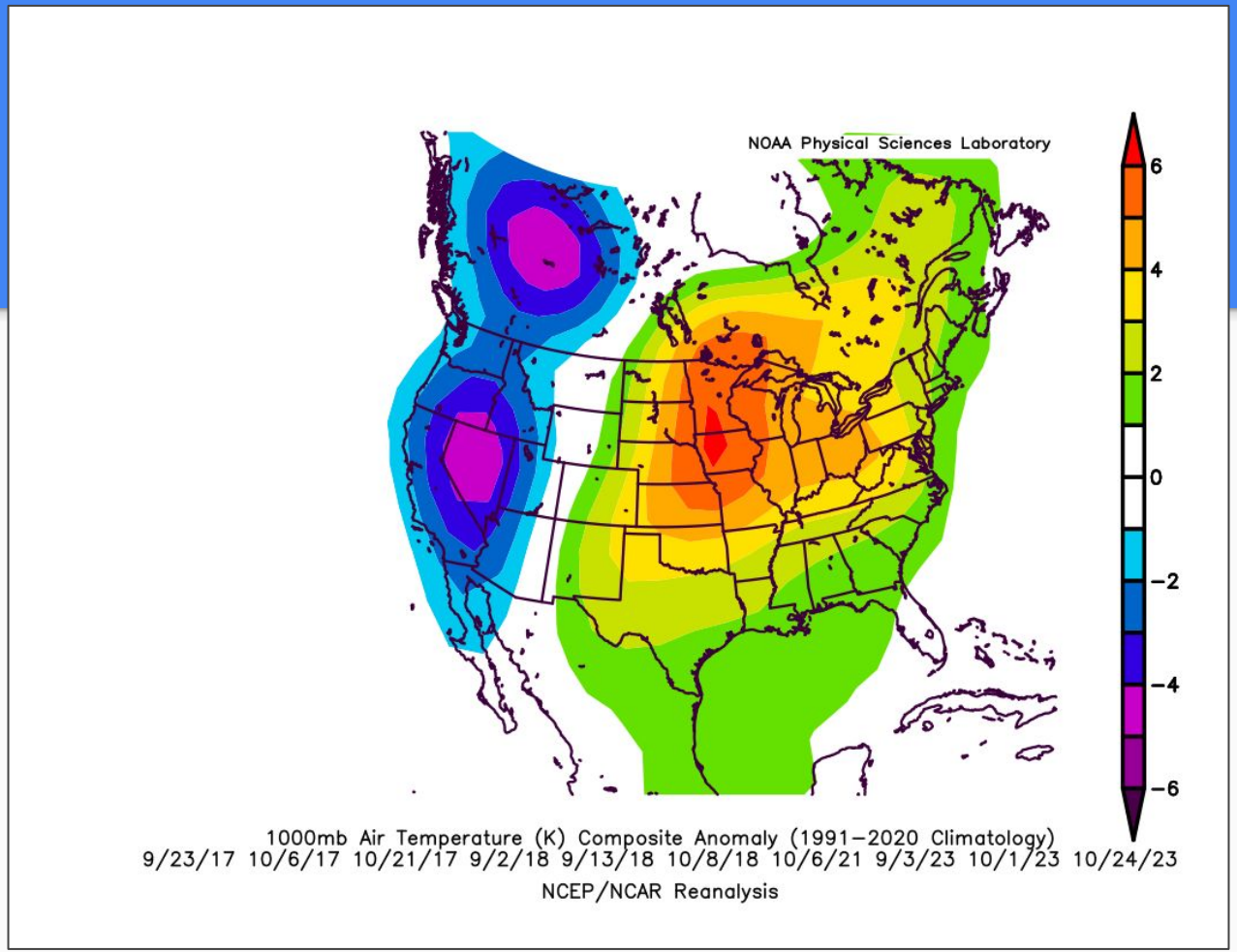
Day -2



September & October heat waves

1000 hPa Temperature Anomaly

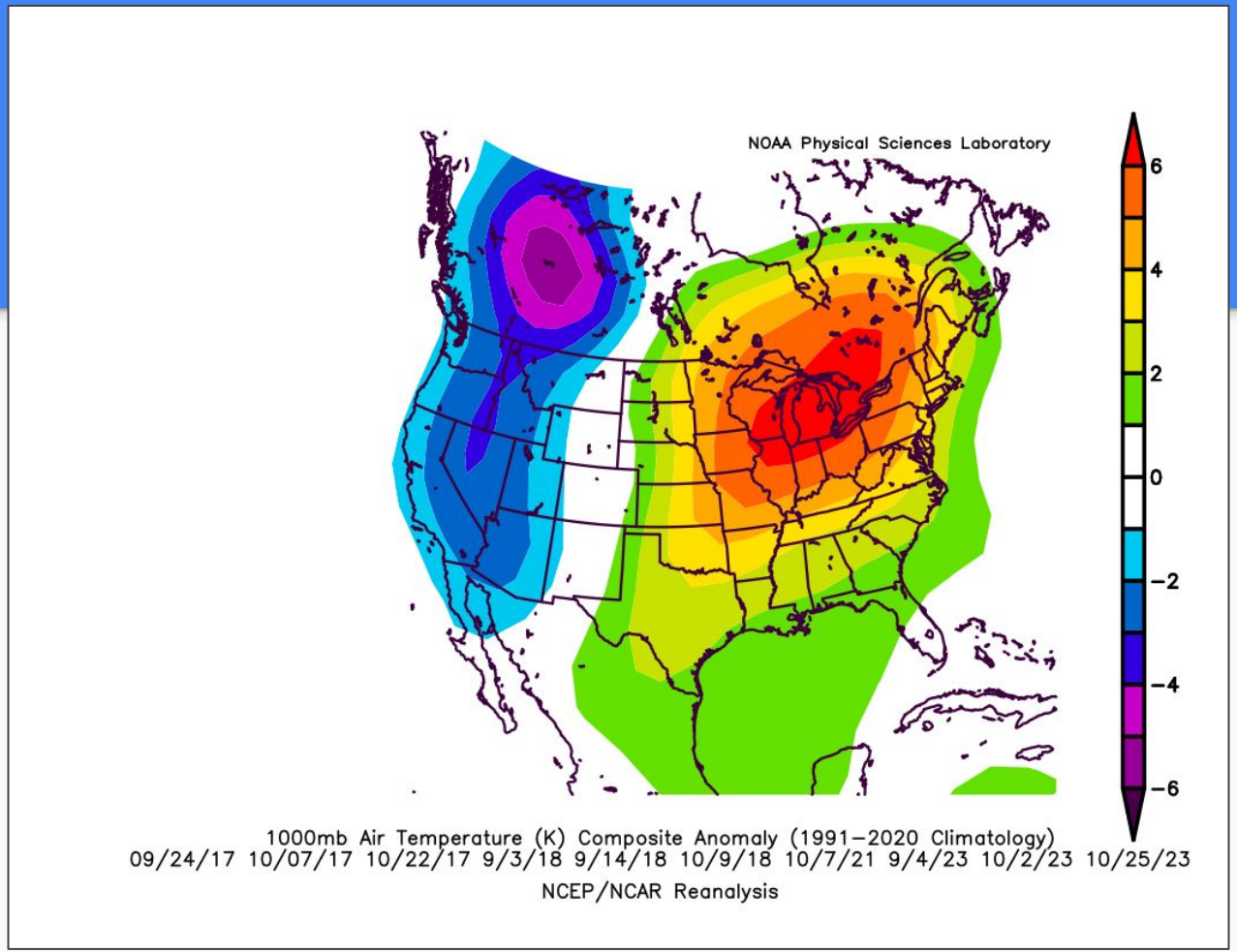
Day -1



September & October heat waves

1000 hPa Temperature Anomaly

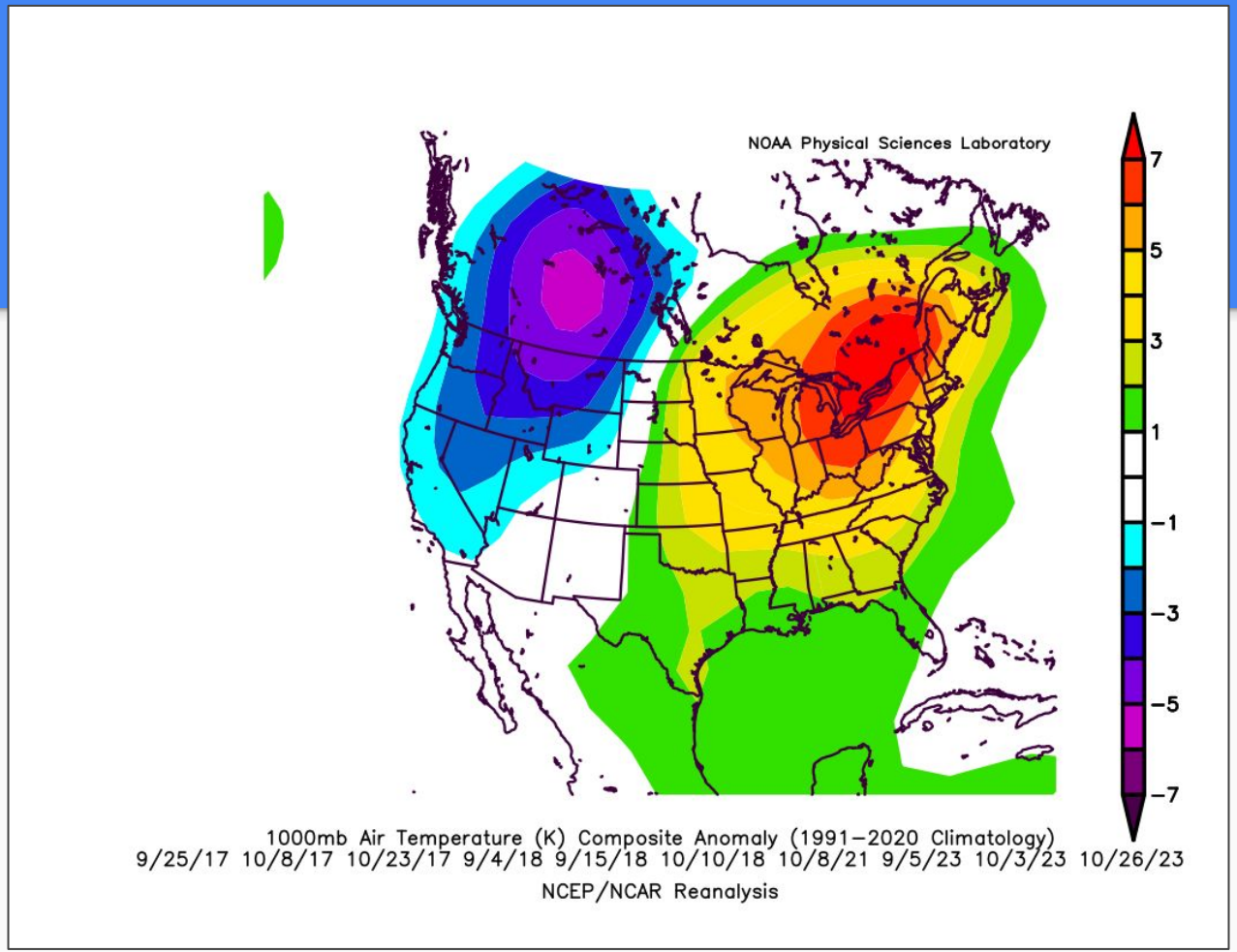
Day 0



September & October heat waves

1000 hPa Temperature Anomaly

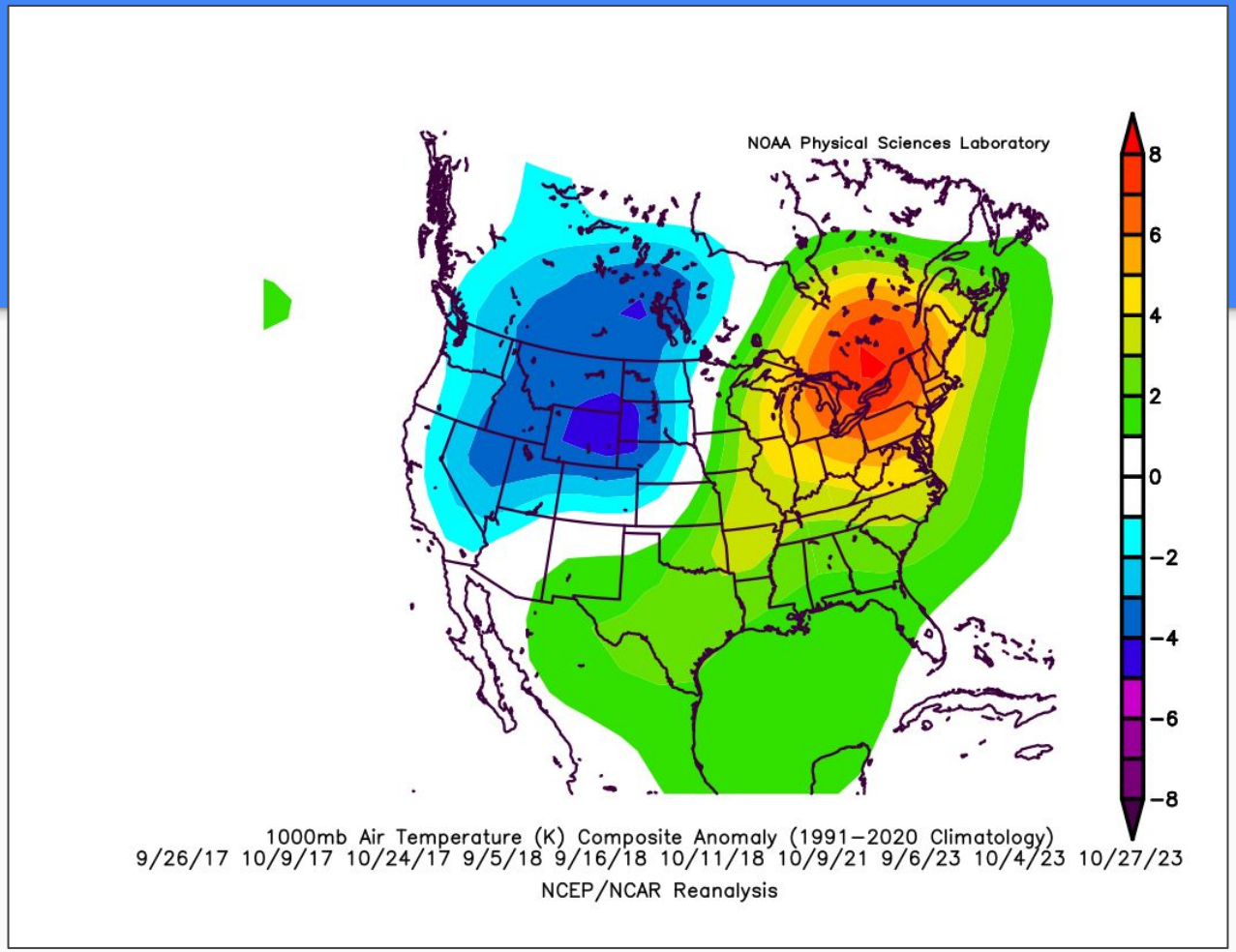
Day +1



September & October heat waves

1000 hPa Temperature Anomaly

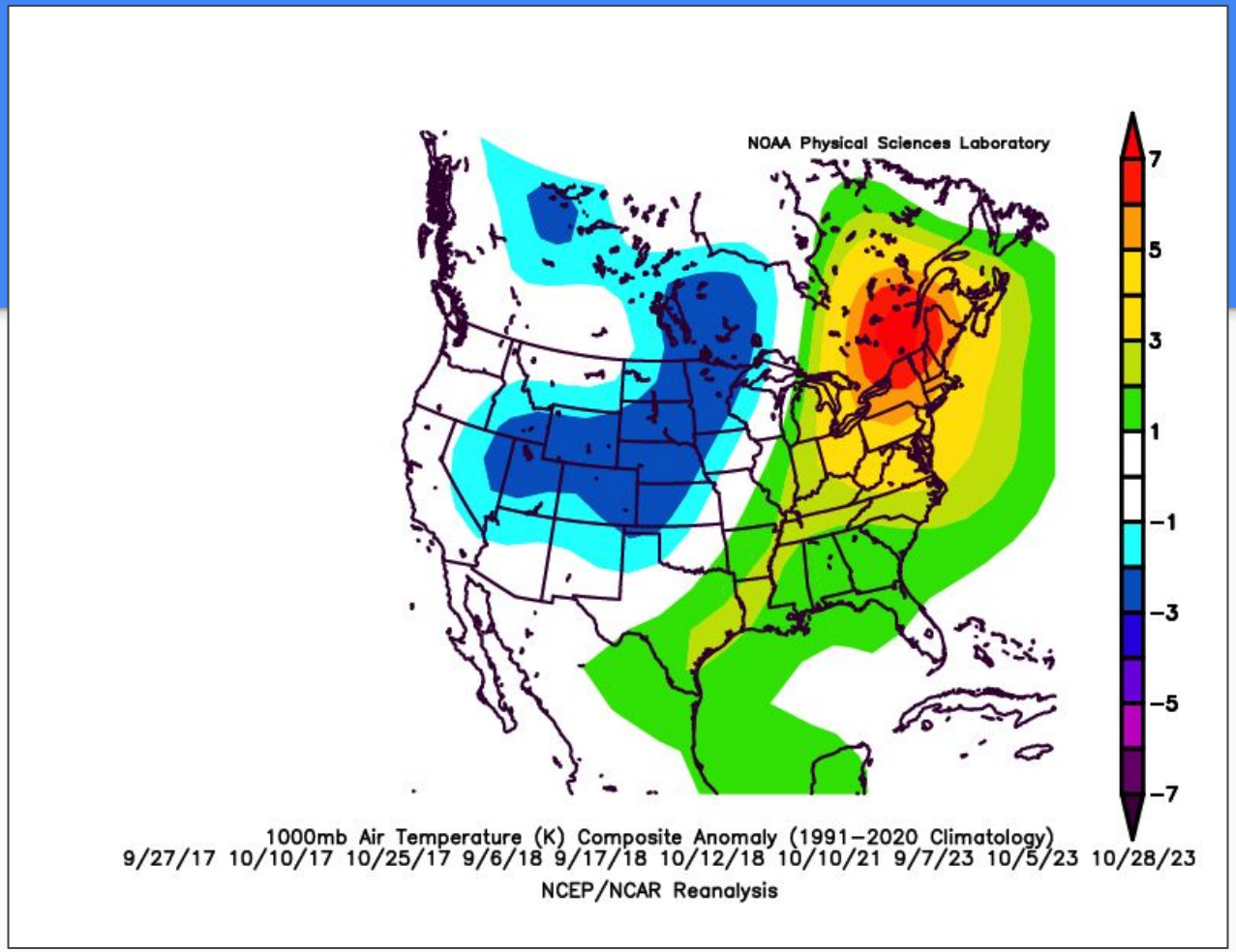
Day +2



September & October heat waves

1000 hPa Temperature Anomaly

Day +3



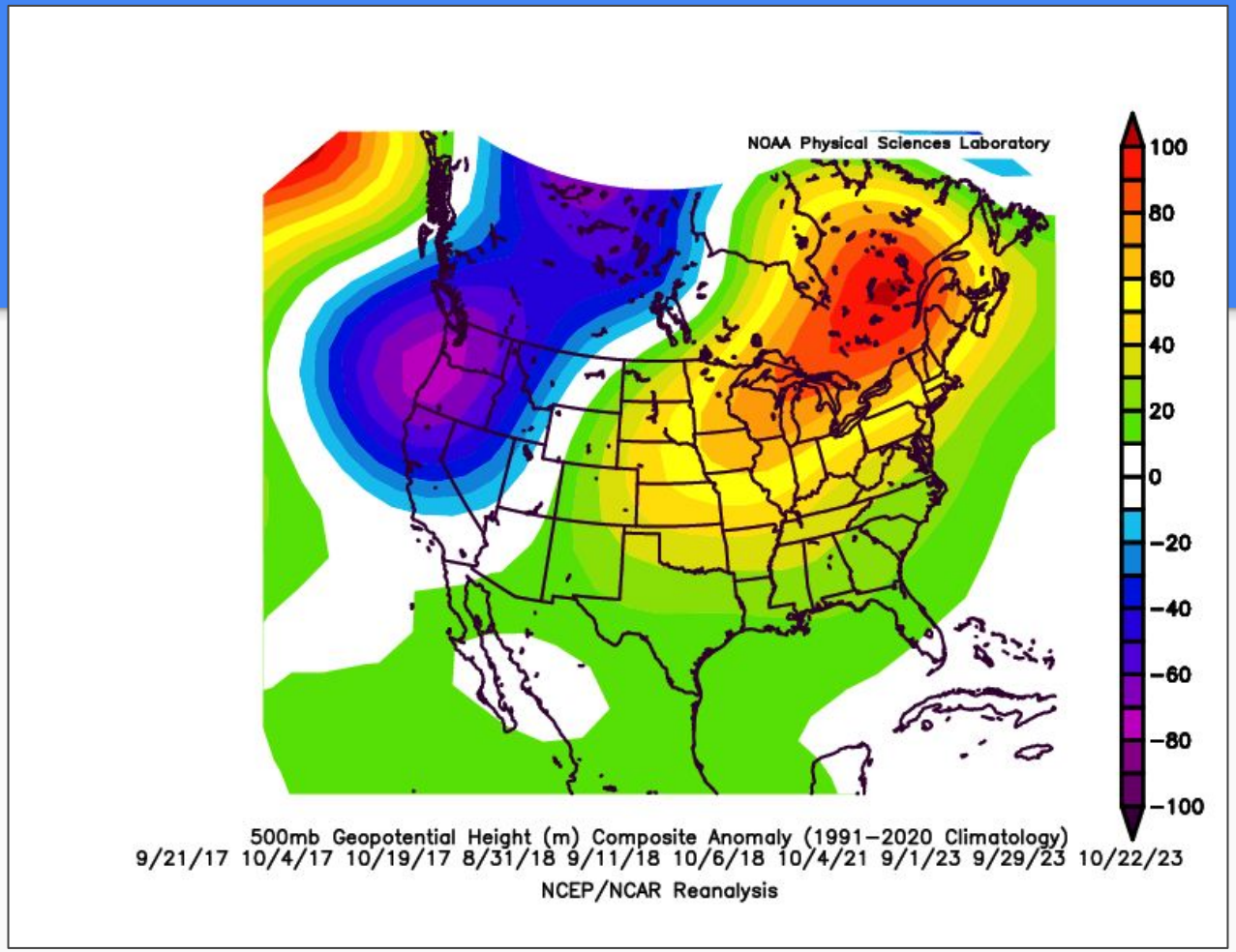
September & October heat waves

500 hPa Geopotential Height Anomaly

September & October heat waves

500 hPa Geopotential Height Anomaly

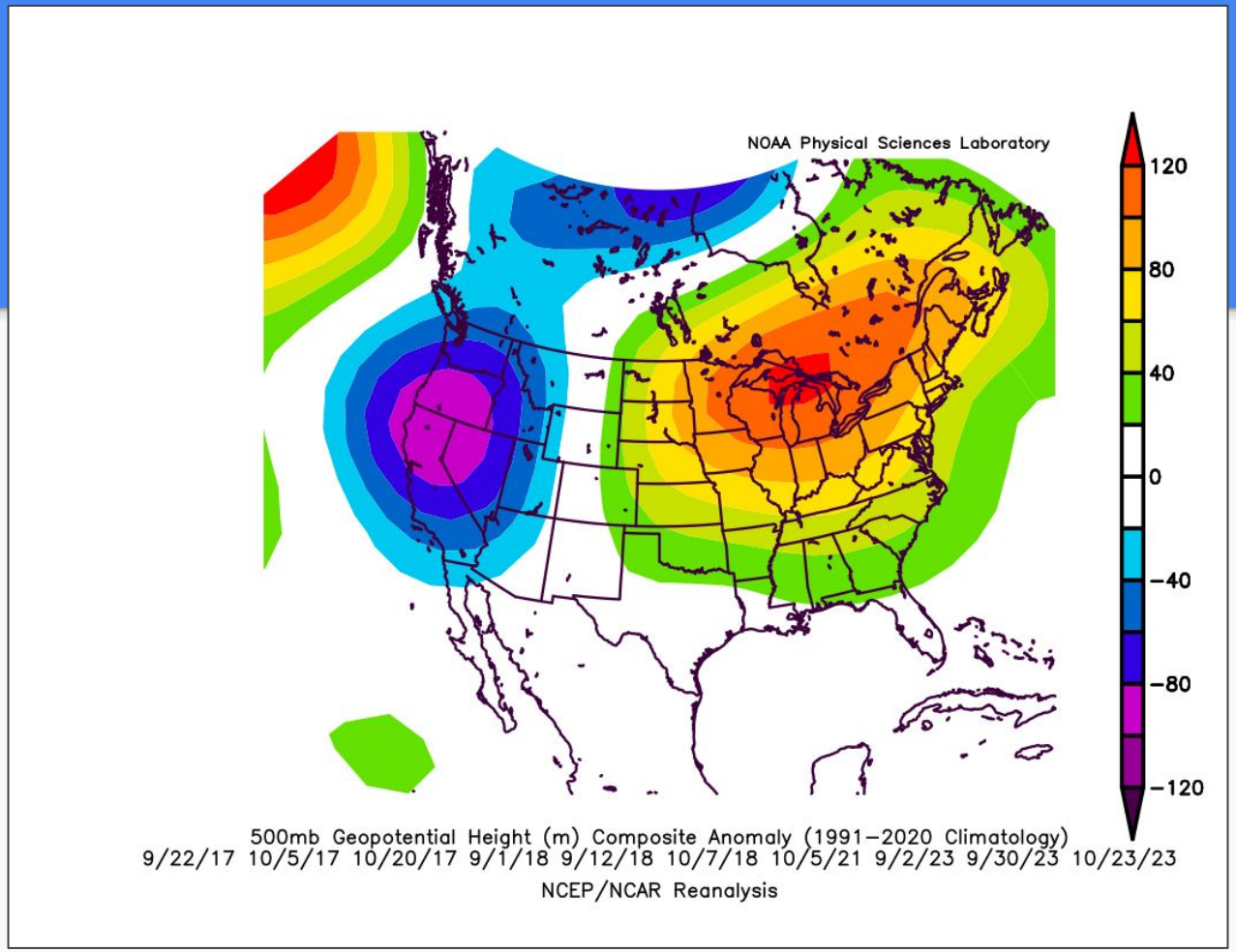
Day -3



September & October heat waves

500 hPa Geopotential Height Anomaly

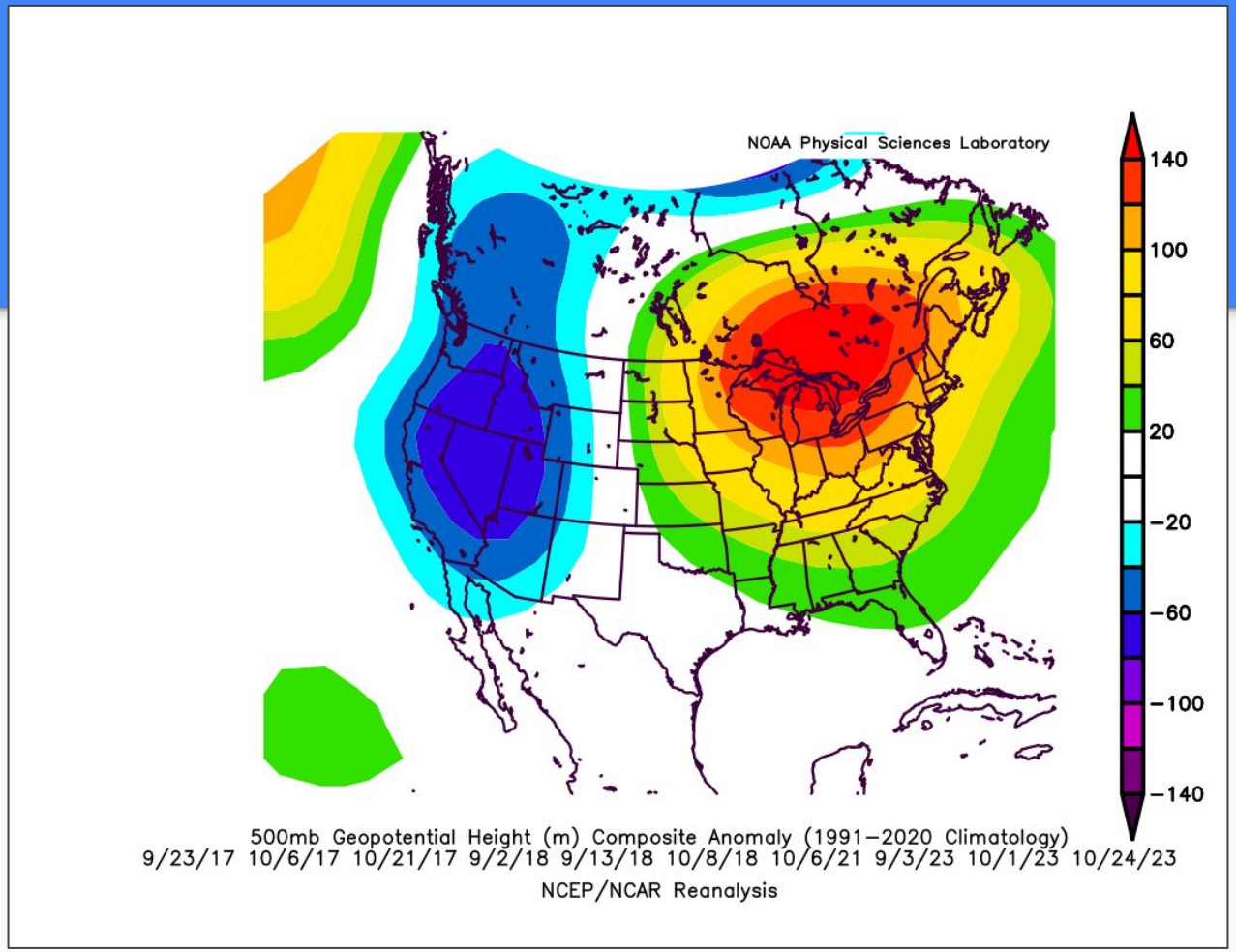
Day -2



September & October heat waves

500 hPa Geopotential Height Anomaly

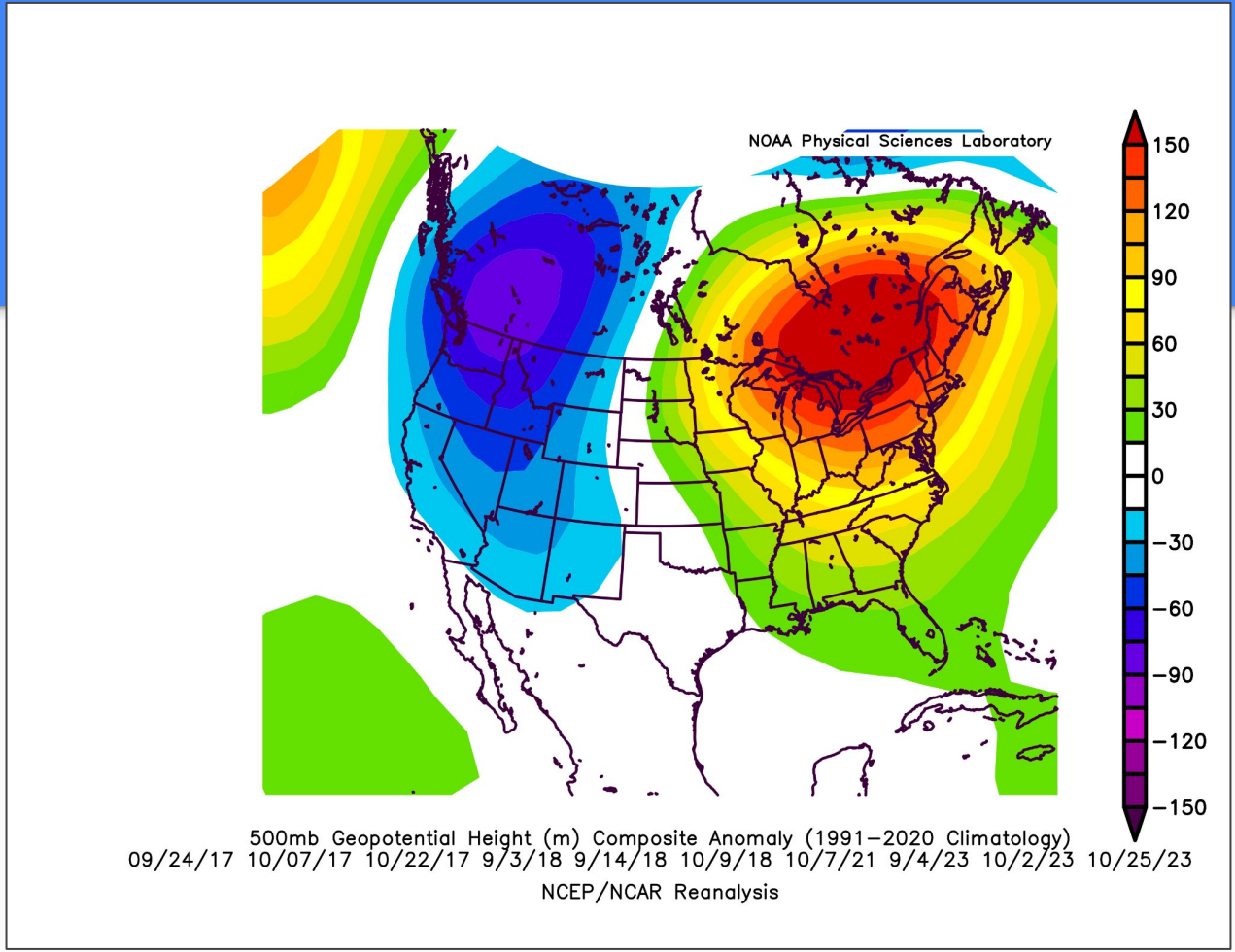
Day -1



September & October heat waves

500 hPa Geopotential Height Anomaly

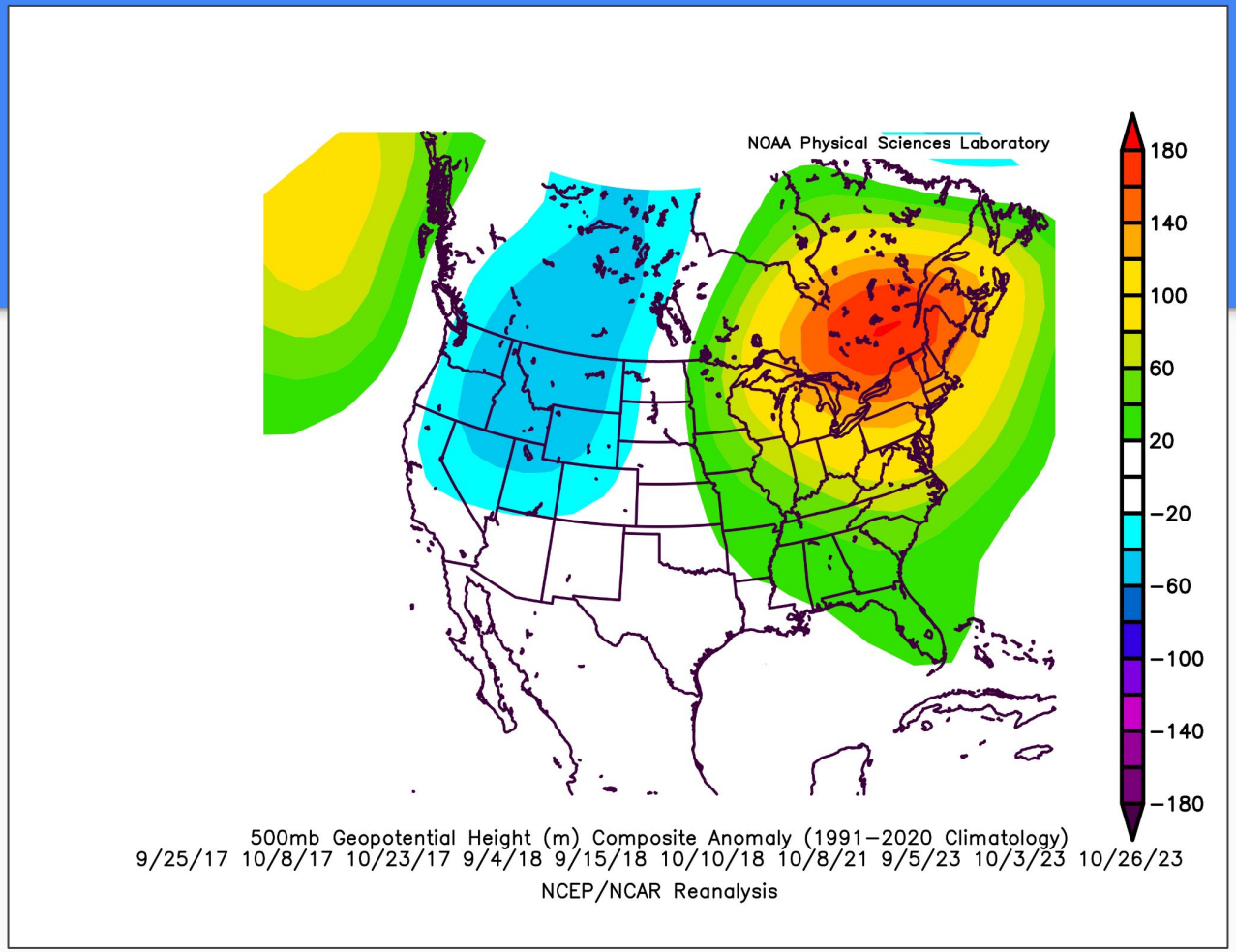
Day 0



September & October heat waves

500 hPa Geopotential Height Anomaly

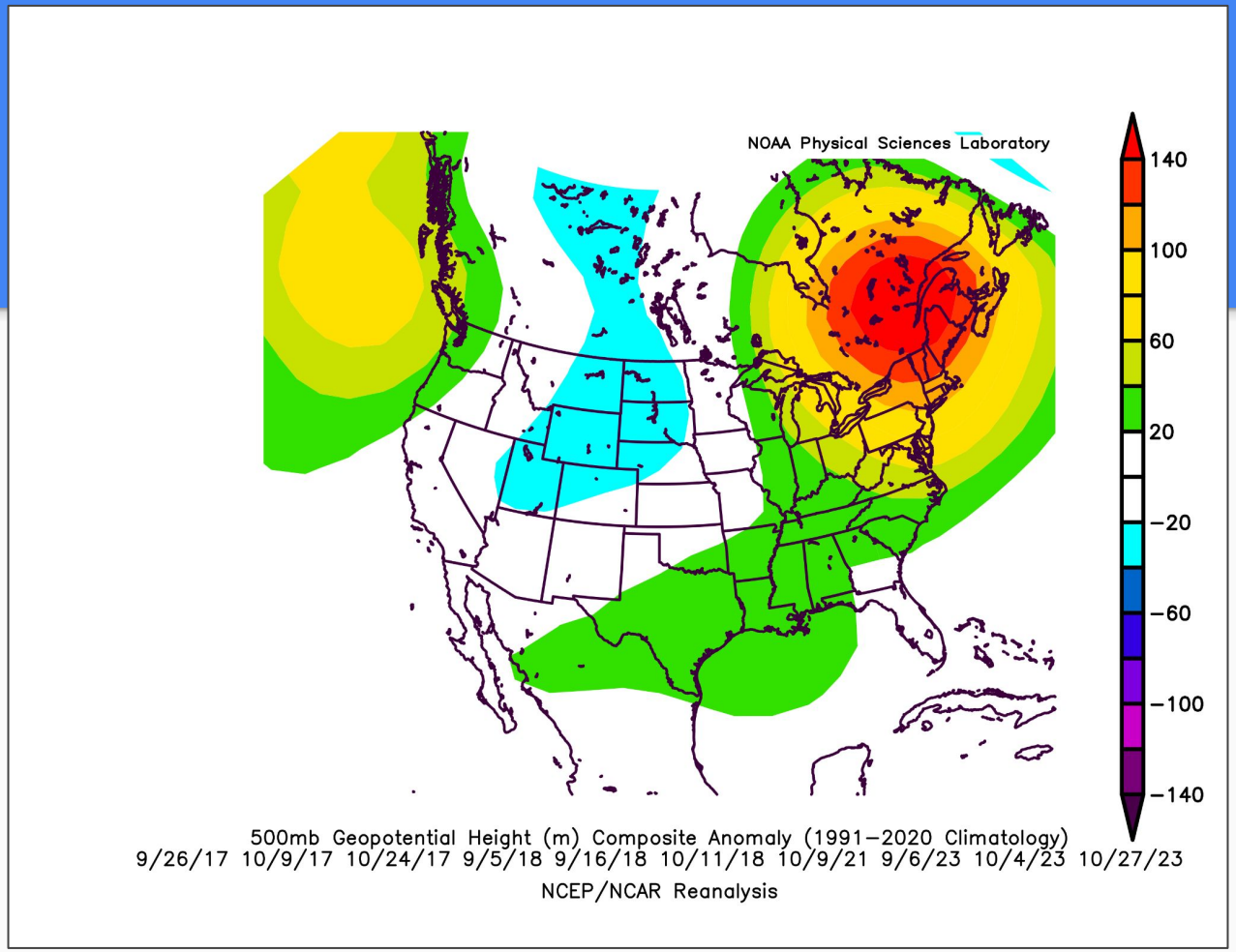
Day +1



September & October heat waves

500 hPa Geopotential Height Anomaly

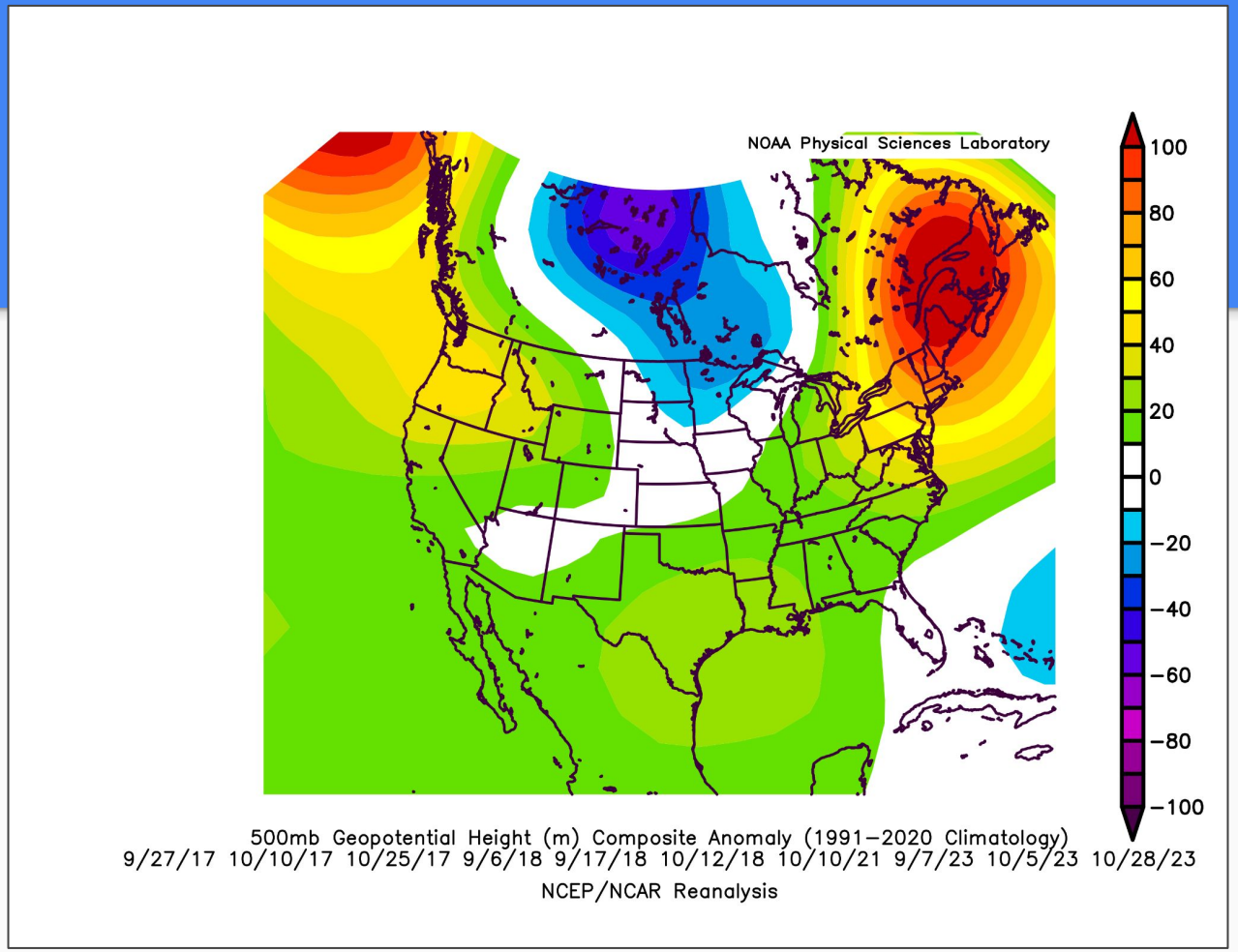
Day +2



September & October heat waves

500 hPa Geopotential Height Anomaly

Day +3



September
& October
heat waves

Minus

May-August
Heat waves

Day 0

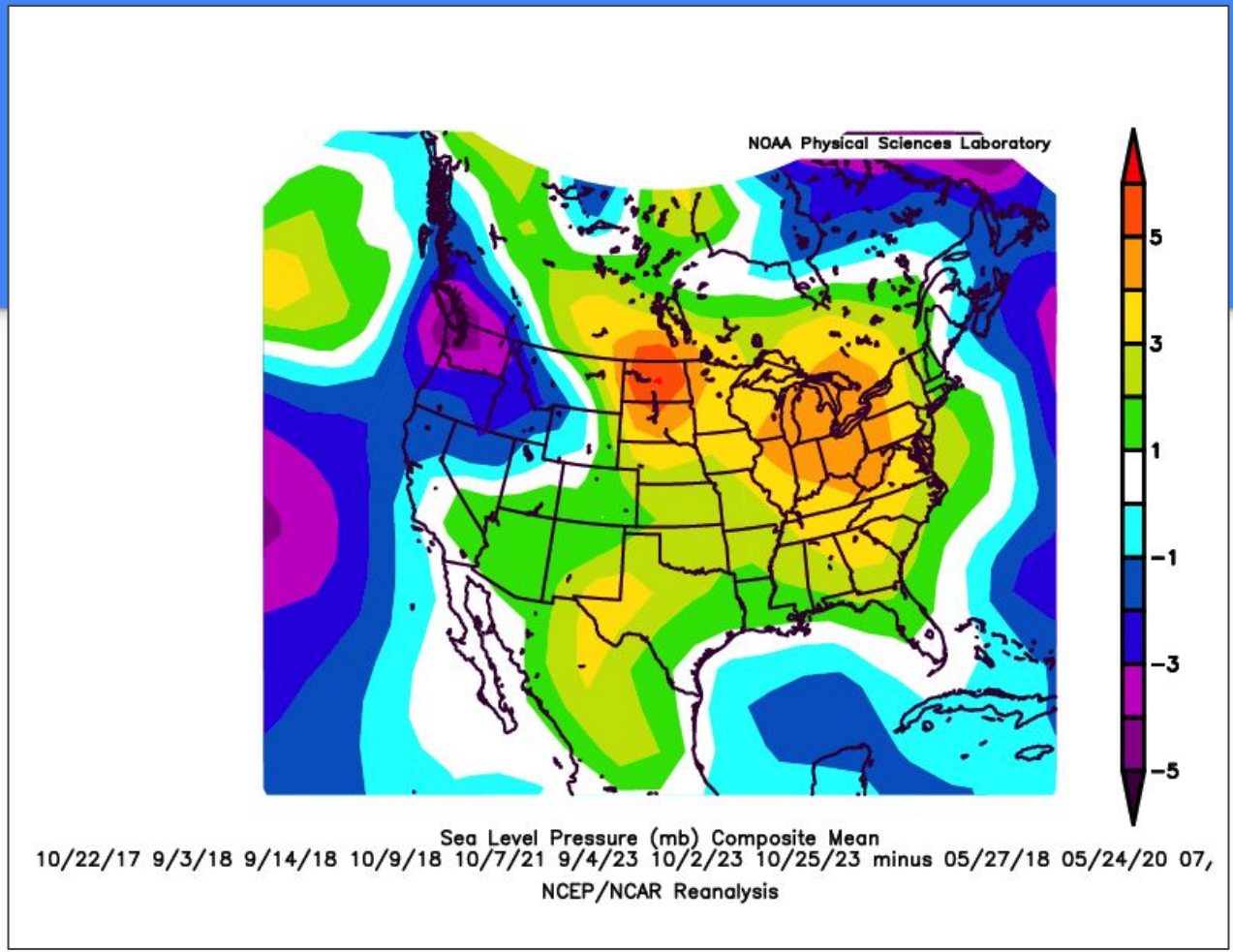
September & October heat waves

Minus

May-August Heat waves

Sea Level Pressure

Day 0



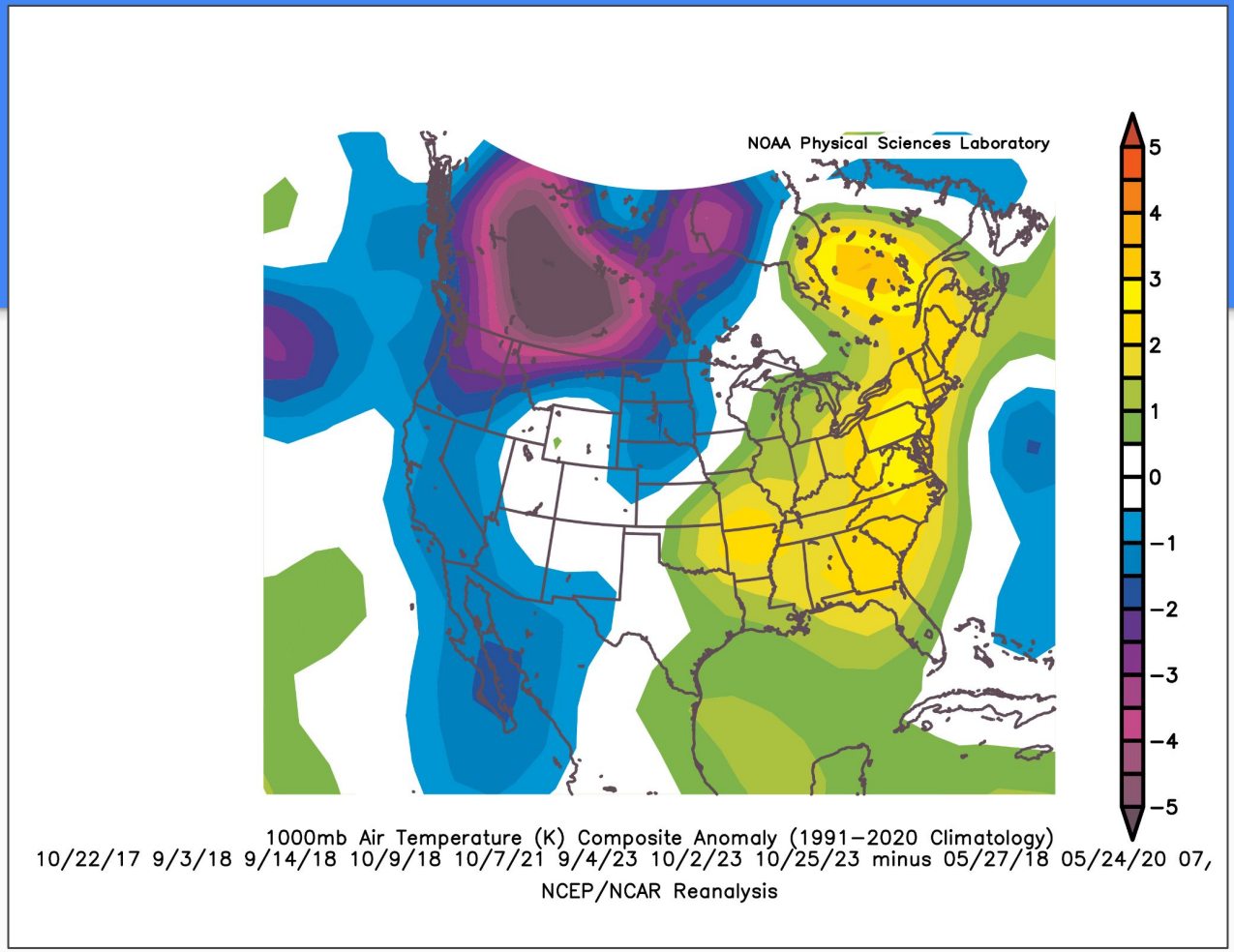
September & October heat waves

Minus

May-August Heat waves

1000 hPa Temperature Anomaly

Day 0

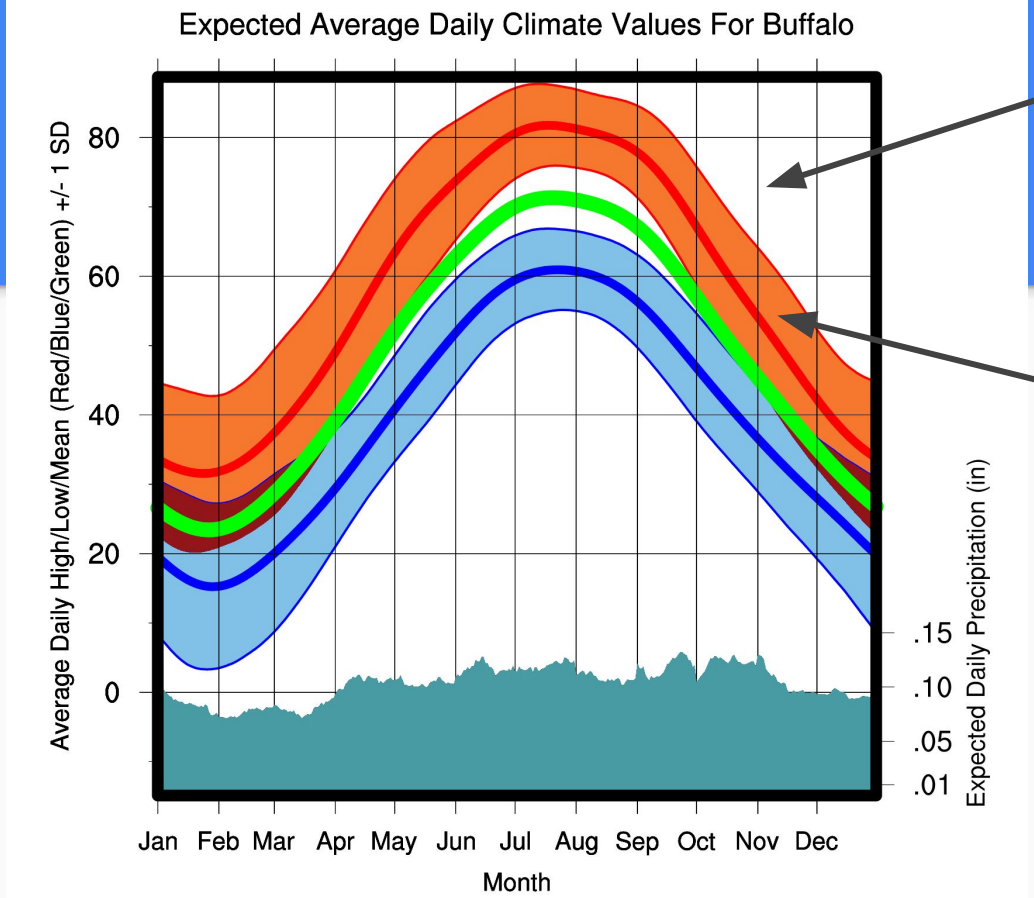


Takeaways

- BUFF heat waves are occurring in the Autumn
  - More heatwaves were identified in Sep-Oct than May - August
- Autumnal heat waves are have a larger average temperature anomaly than summer heat waves
- The longest heat wave was 9 days in October 2021
- Autumnal heat waves in Buffalo are on the southern edge of positive 500 hPa height anomalies
- Autumnal heat waves have higher SLP than summer heat waves

Future Work

- Extend the Autumn to include November
- Use reanalysis data to look at longer-term trends of autumnal heat waves
- Analyze different NYS mesonet sites to compare Autumnal heat waves across the state



Location: Buffalo
Station elevation: 179.58816 m
Station lat/lon: 43.0001705; -78.76717
Climate Normals Estimated From 1990-2020

Figure courtesy of Nick Bassill

5 November 2024
72℉

Climatological mean for 5 November 52℉