



# Wildfires, Weather, and Climate Change in the Mid-Atlantic

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## Motivation

- Lack of studies on wildfires in the mid-Atlantic US
- High wildland-urban interface on east coast puts more people at risk when a wildfire occurs
- Climate change uncertainty in precipitation patterns

## Objectives

- Find patterns in specific weather variables leading up to historic wildfire events
- Compare fire weather risk indices to see if fires were forecasted

## Methods

- 28 naturally occurring fires that burned 50+ acres (Short, 2022), ranging from 80 to 6574 acres (mean size = 1048 acres)
- Mid-Atlantic states: NY, PA, NJ, MD, VA, WV (Fig. 1)
- Variables analyzed: Max/min/mean temperature, mean dewpoint, precipitation, and max/min vapor pressure deficit (PRISM Climate Group, Oregon State University, accessed 2023)
- Relative humidity calculated with max temperature and mean dewpoint (Lawrence, 2005)
- Time series to show conditions in the year preceding each fire (Fig. 2 and 3)
- Student's t-test to compare means of the measured versus 30-year normals
- Examined the Storm Prediction Center's (SPC) fire forecast criteria and NOAA archives to see if fire risk was forecasted for the day of the fire (SPC Product & Report Archives)

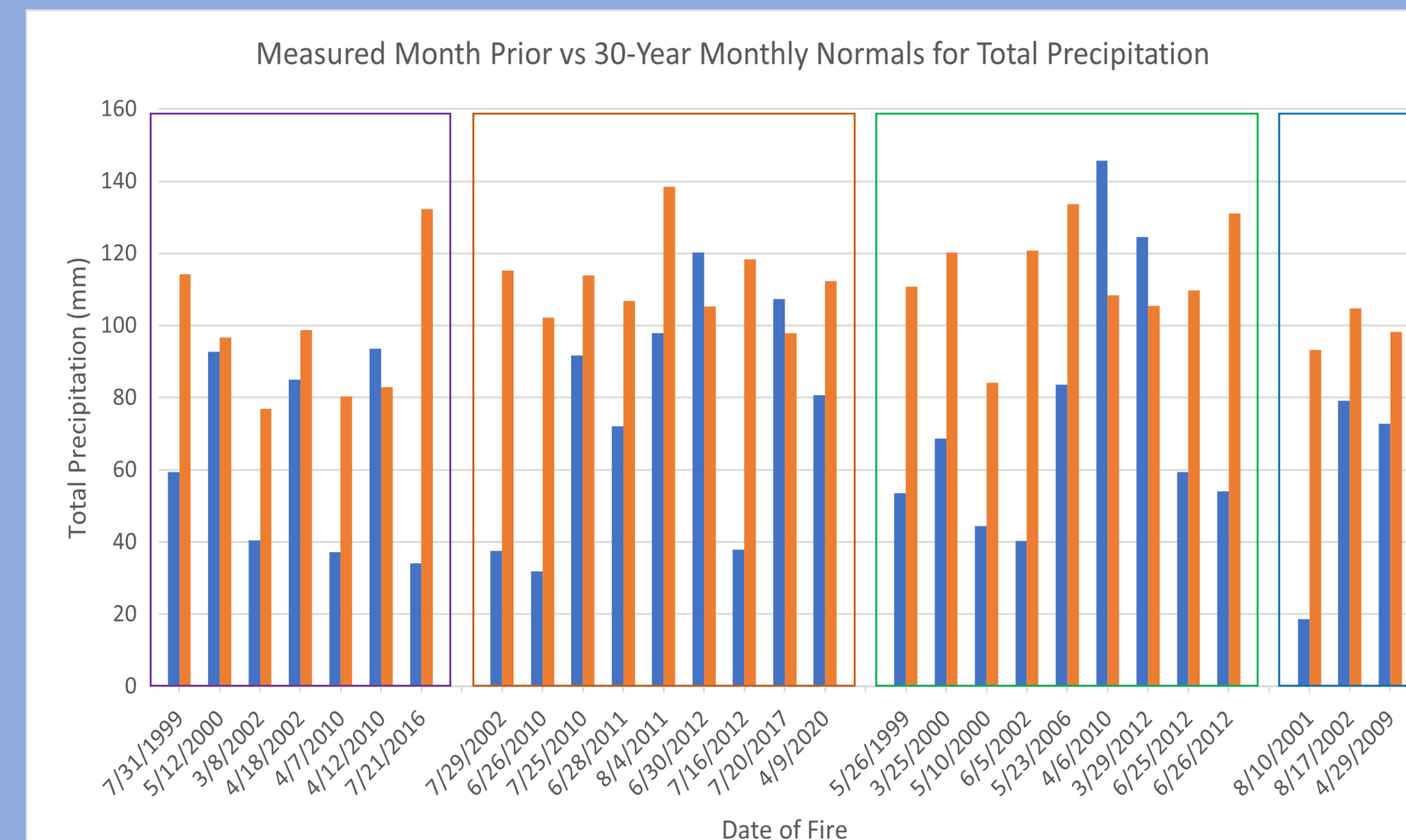
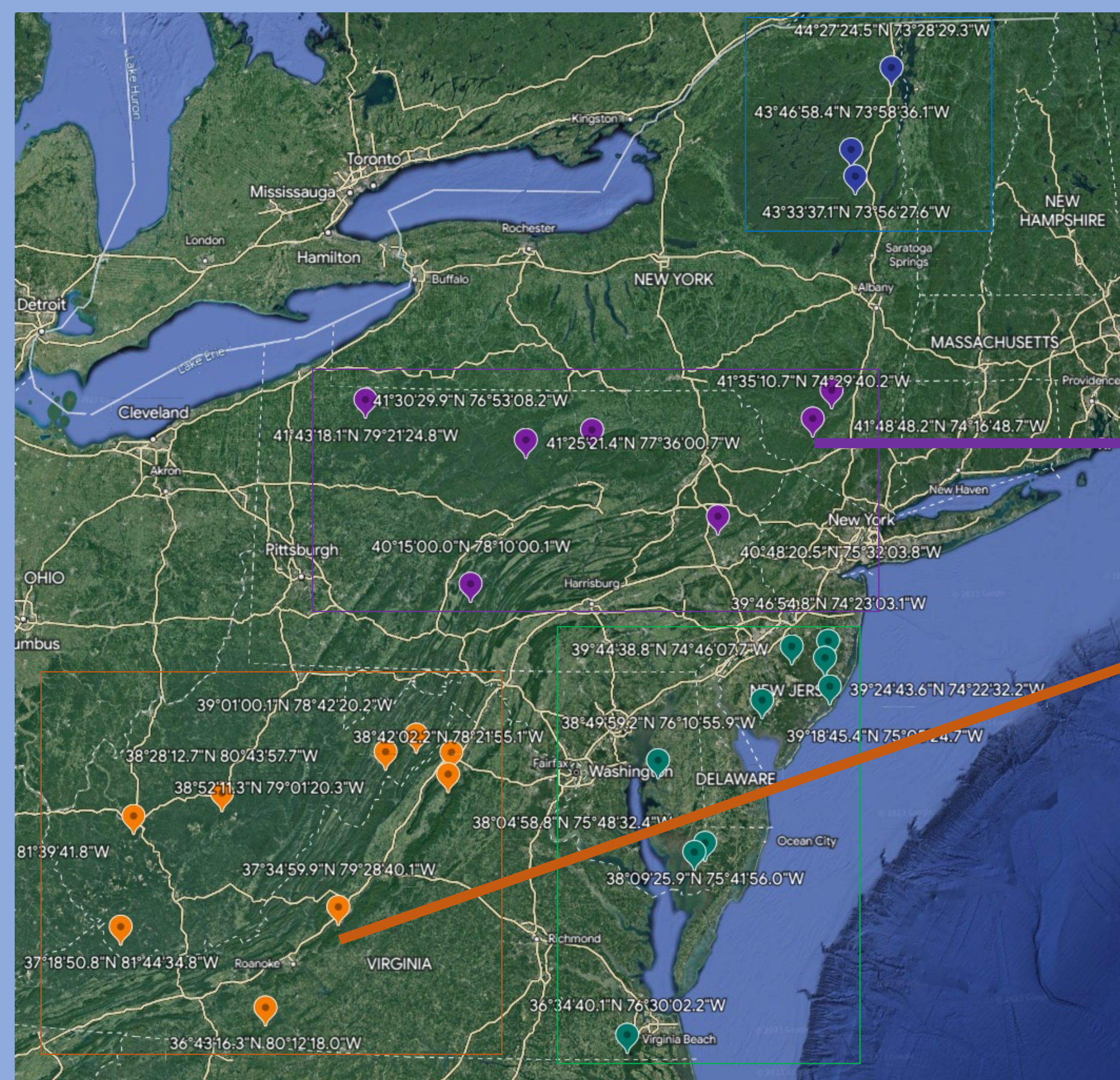


Fig. 4

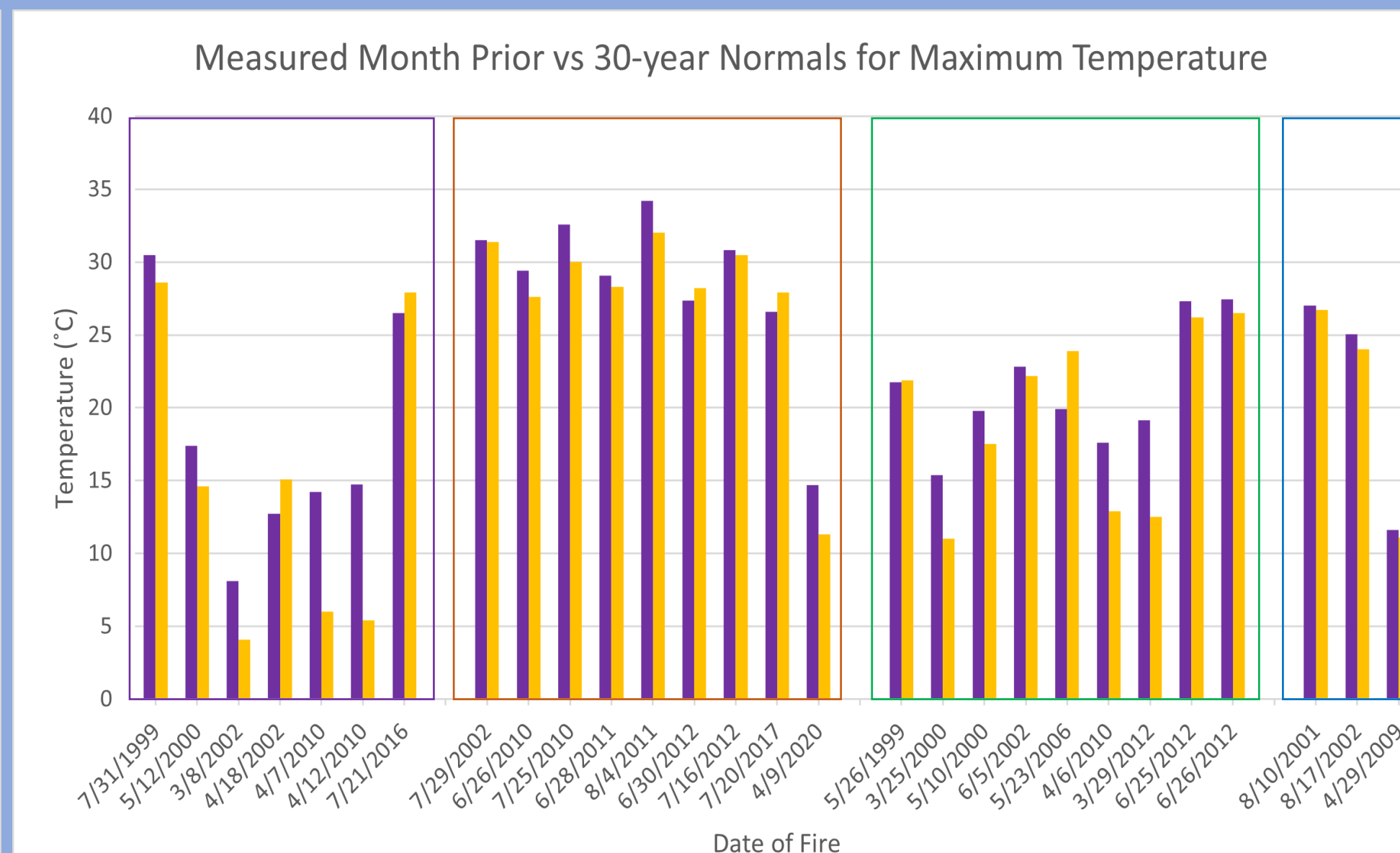


Fig. 5

## Results

### Weather Variables:

- Precipitation one and two months prior to the fire was the only variable with a clear departure from the expected totals from the 30-year normal
- Figure 4 shows the general precipitation deficit for the month leading up to the fire compared to the 30-year normal precipitation total for that same month
- Student's t-test P value was below 0.05 for one and two months prior total precipitation
- All other variables had a P value above 0.05
- Figure 5 shows the graph of measured max temperature versus the 30-year max temperature normal for that month, differences are harder to see compared to the precipitation graph

### Fire Weather Forecasting:

- Archive for SPC fire forecasting started June 4<sup>th</sup>, 2002
- Eight of our fires occurred before this date, so only 20 fires were looked at with this database
- Forecasting includes circled areas of concern, with a synopsis below the product that summarizes the conditions that day
- Four fires had a "SEE TEXT" as seen in figure 6, where potential concern for fire weather was discussed but was not serious enough for an official warning such as the circled "critical" area over parts of Texas and New Mexico
- Two fires had something mentioned in the synopsis underneath the image, but no "SEE TEXT" on the map
- The other 14 fires had no warning or mention in the synopsis

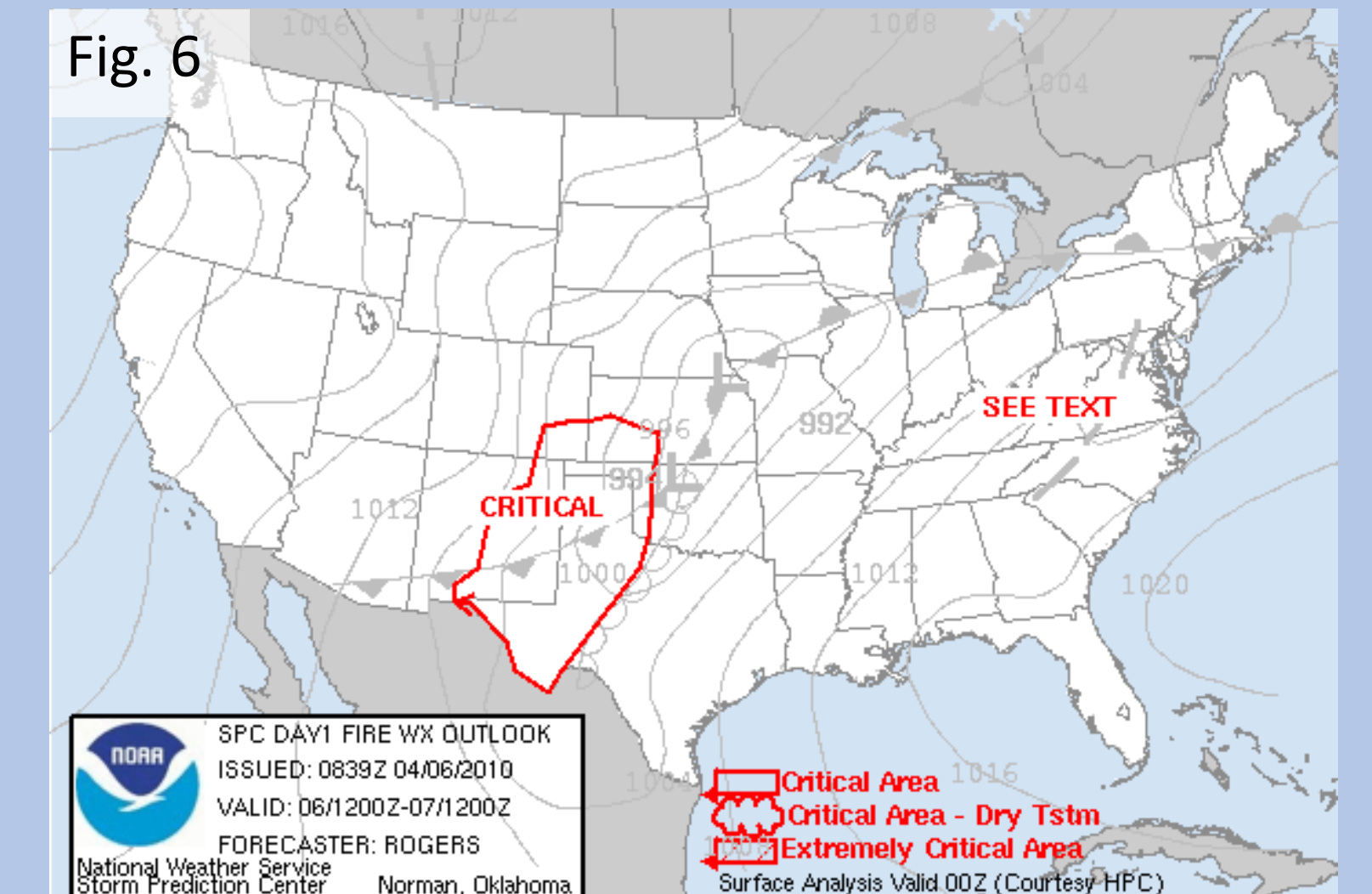
## Discussion

### Weather Variables:

- Across all variables, only precipitation showed a clear and significant pattern between the measured totals and 30-year normals
- Precipitation was significantly lower than the expected 30-year value both one and two months prior to fire occurrence across the study region
- Future work should include:
  1. Analyzing different time lags such as the day before and week prior, this would be practical for deciding how far back to look when determining fire risk
    - Different timescales could reveal the importance of the other variables, such as temperature
  2. Assessing wind speeds would also be valuable, but would require serious thought into the timescales

### Fire Weather Forecasting:

- None of the fires had risk officially forecasted by the SPC
- Understanding the limitations of national scale forecasting could explain how fire risks were missed



- Future work should include:
  1. A larger sample of fires; human and naturally caused
  2. Using the SPC fire forecast criteria to see if the conditions listed were met by the actual fire
  3. Expanding the study to look at more fire risk indices to provide insight into which are most reliable for the east coast, leading to potentially developing our own, east coast specific fire forecasting criteria

### Climate Change Uncertainties:

- Existing climate models suggest more precipitation in the winter, spring, and summer, and less in the fall for the east coast (Liu et al., 2013)
- Based on historical fire-precipitation patterns for this region, more research is needed to understand how projected periods of low precipitation could impact wildfire risk

## References



## Acknowledgements

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