Poster 552

# Using Analog Methods to Illustrate Possible Climate Change for Agricultural Producers

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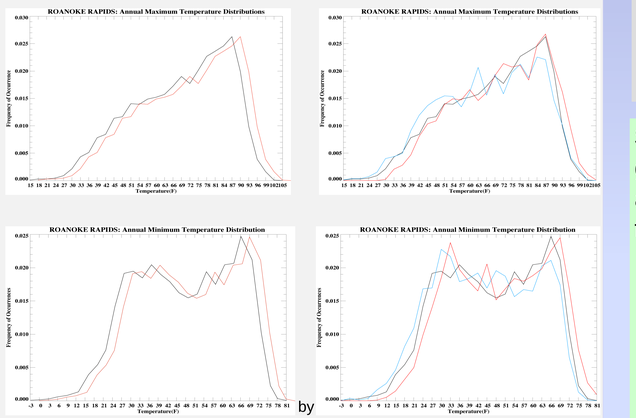
## Introduction:

In talks to farmers we are often asked “What does a 1 degree change in temperature mean? Is it higher daytime temperatures, higher nighttime temperatures, or differences in the distribution of temperature extremes?” We attempted to answer this by determining how hot years compared to normal and cold years in terms of temperature distributions.

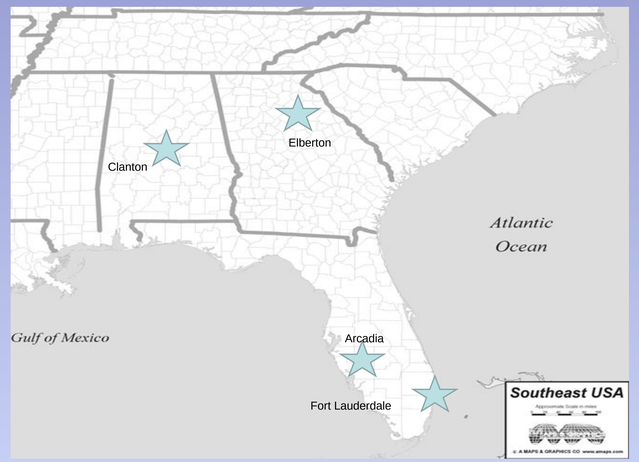



Black=Current distribution
Red=Shifted distribution

by

Black=average years
Blue=Cold years
Red=Warm years

A simplistic approach would seem to be to add a degree to each day’s temperature to represent the new climate. But is this realistic? Probably not. Instead we broke the years into three categories: near normal, at least one degree above normal for the year, and at least one degree below normal for the year. The distribution of temperatures by categories using this analog technique was expected to give a more realistic answer to what types of temperature distributions to expect in future climate regimes.



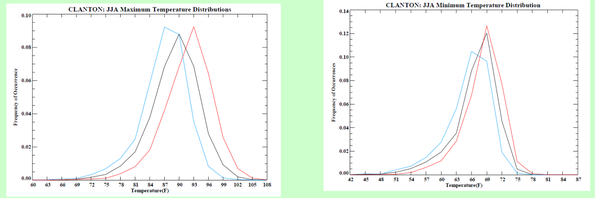

## Methodology:

Using 100 NWS coop stations with records from at least 1948 to present, we assessed the temperature distributions of max and min temperature using three categories (more than 1℉ above the long-term average, within 1℉ of average, and more than ℉ below average) to identify differences in the distributions. Three representative stations are listed below. Temperatures were put into 3- degree bins to allow sufficient numbers in each bin for statistical analysis.

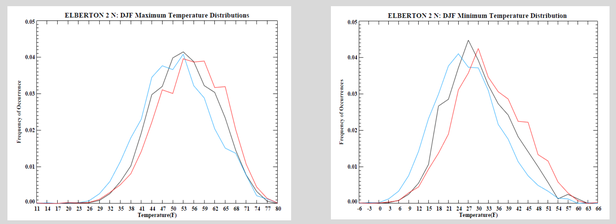
## Growing Season Changes:

Here we will show changes in growing season length.

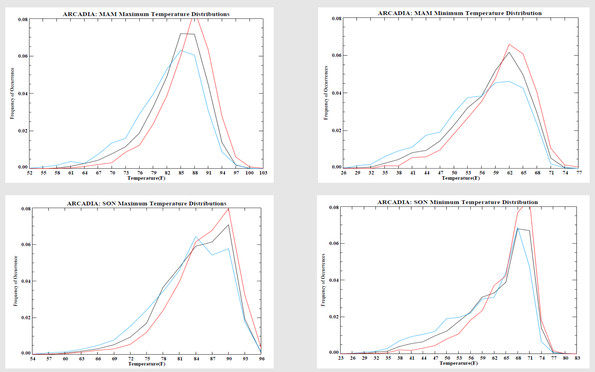
**Summer:** The June-August period showed the greatest similarity to a simple shift in temperature to a higher value across the region, especially for high temperatures. This was true across the entire region.



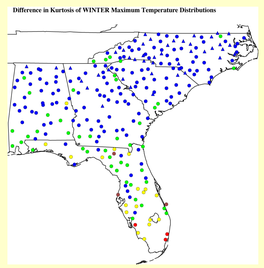

**Winter:** Winter temperature patterns were more spread out and variable across the region. Max and min temperature distributions were more skewed towards higher values in Florida but towards lower values in more northern locations.

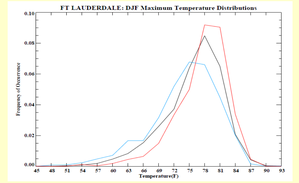



**Spring and fall:** Transitional seasons displayed similar temperature distribution patterns to winter.




**North-South Differences:** The kurtosis (sharpness of peak) of the temperature distributions changed more in Florida and coastal areas, with more change in the frequency of low temperatures than high temperatures tightening the range of temperatures. This could be due to the controlling influence of coastal water temperatures.




Compare the change in peak in Fort Lauderdale below with Elberton above. The lower values of the distribution are reduced much more than the higher values, concentrating temperatures in a narrower range.

**Conclusions:** In our work so far, we have found the following:

- Extreme low temperatures become more rare but still occur in the distributions, indicating that damaging late frosts are likely to occur occasionally even in a warmer climate
- In areas near water, frequency of extreme high temperatures did not increase substantially while extreme lows occurred less often, leading to a compression in distribution. However, if the ocean becomes warmer this may change.
- Warm analog years showed an increase in growing season that depended on its location with respect to latitude and proximity to the coast

**Future Work:** We will continue to analyze distinctions in growing season based on analogs, in particular in describing the extreme tails of the distributions where impacts are most concentrated. We will also explore using this technique on precipitation distributions.

USDA United States Department of Agriculture — National Institute of Food and Agriculture — NIFA