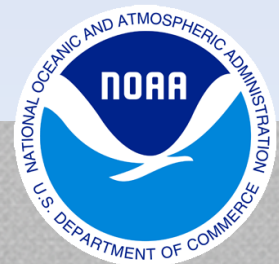


# Frost and Freeze Data and Impacts to the Agriculture, Construction and Transportation Industry



Drs. Jesse E. Bell &  
Jessica L. Matthews  
Growing Season Analysis

March 21, 2013



# What is the best way to measure the start of the growing season?



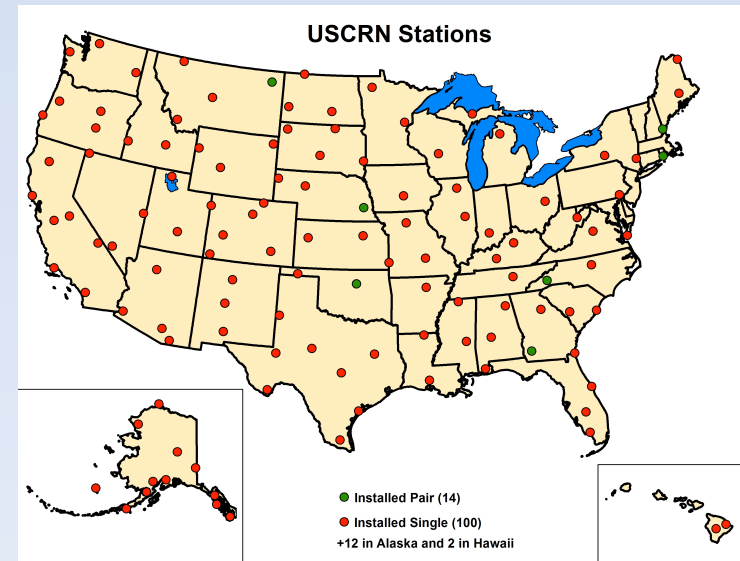
**US Climate Reference Network**

# Is soil or air temperature better for predicting the start of the growing season?

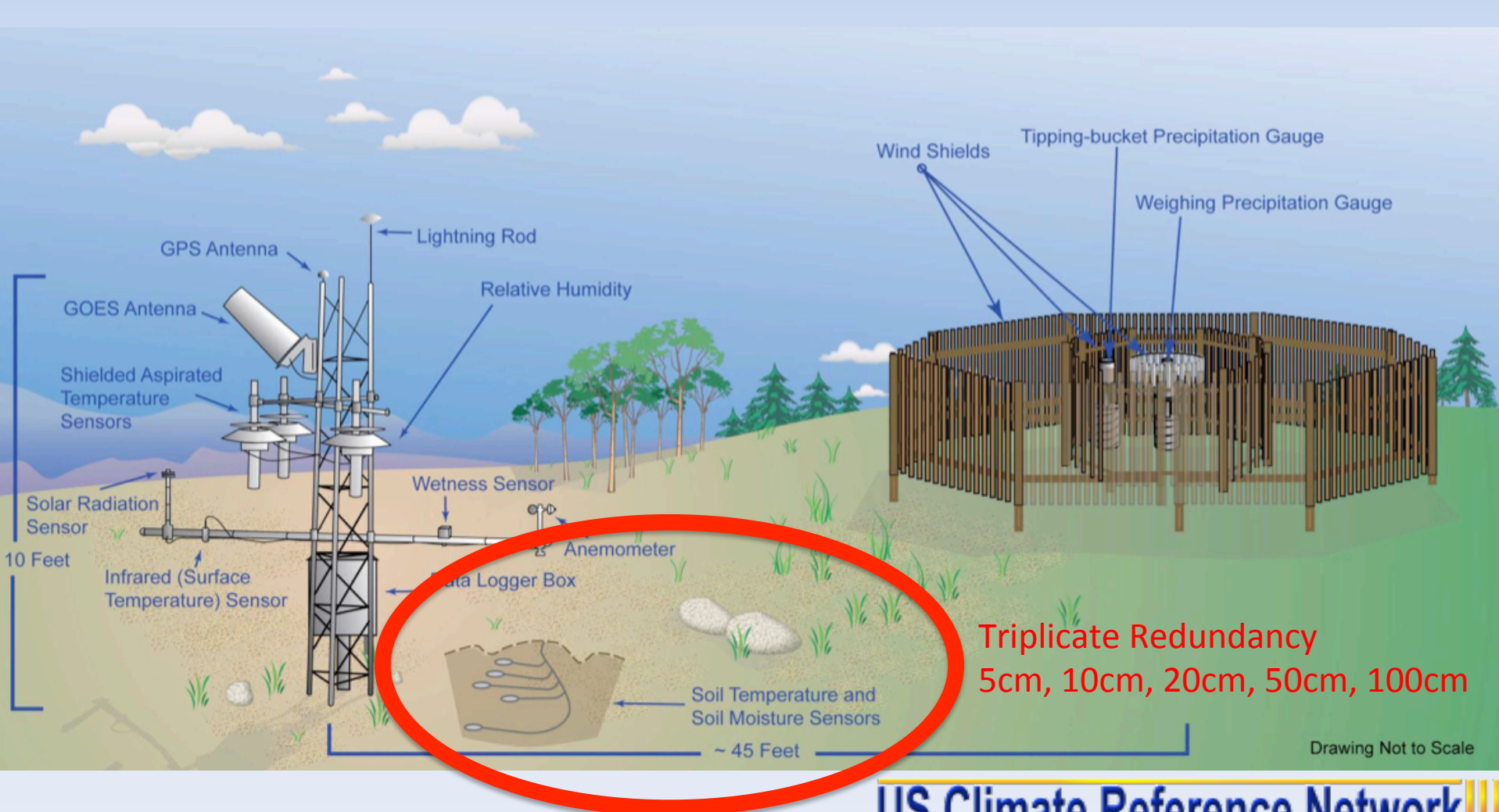
- Determining the onset of plant growth has many agricultural and environmental applications
- ***Climatic Growing Season*** is commonly used when actual plant measurements are not available
  - Temperature thresholds
  - North America generally defines the *frost free period*
    - first day of the year above 0°C and last day above 0°C
  - **Soil temperature**

# U.S. Climate Reference Network

- Long-term, accurate, and unbiased observations are essential to define the state of the global integrated Earth system, its history, and its future variability and change.
- *“How has the climate of the U.S. changed in the last 50 years?”*

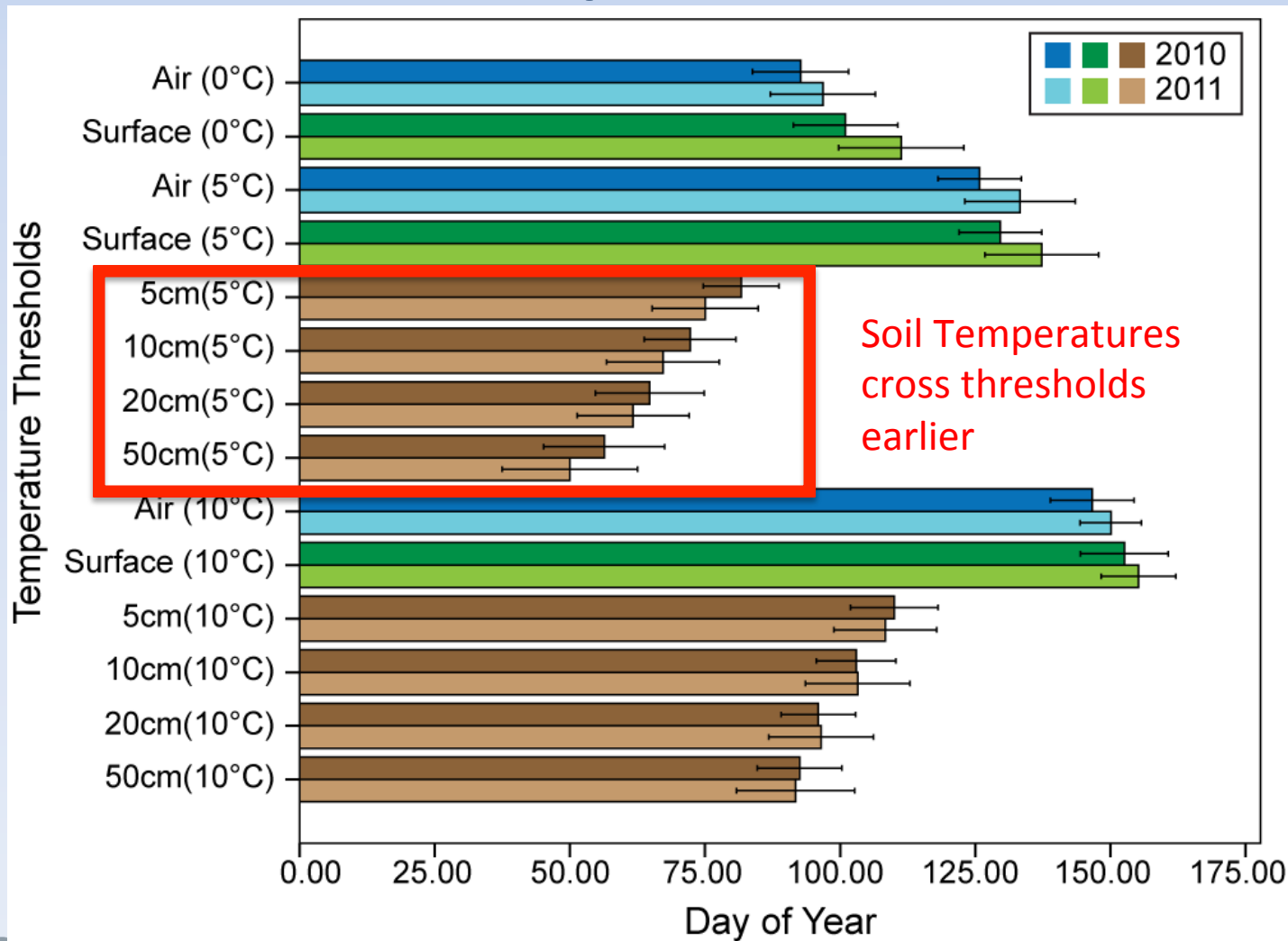


# U.S. Climate Reference Network



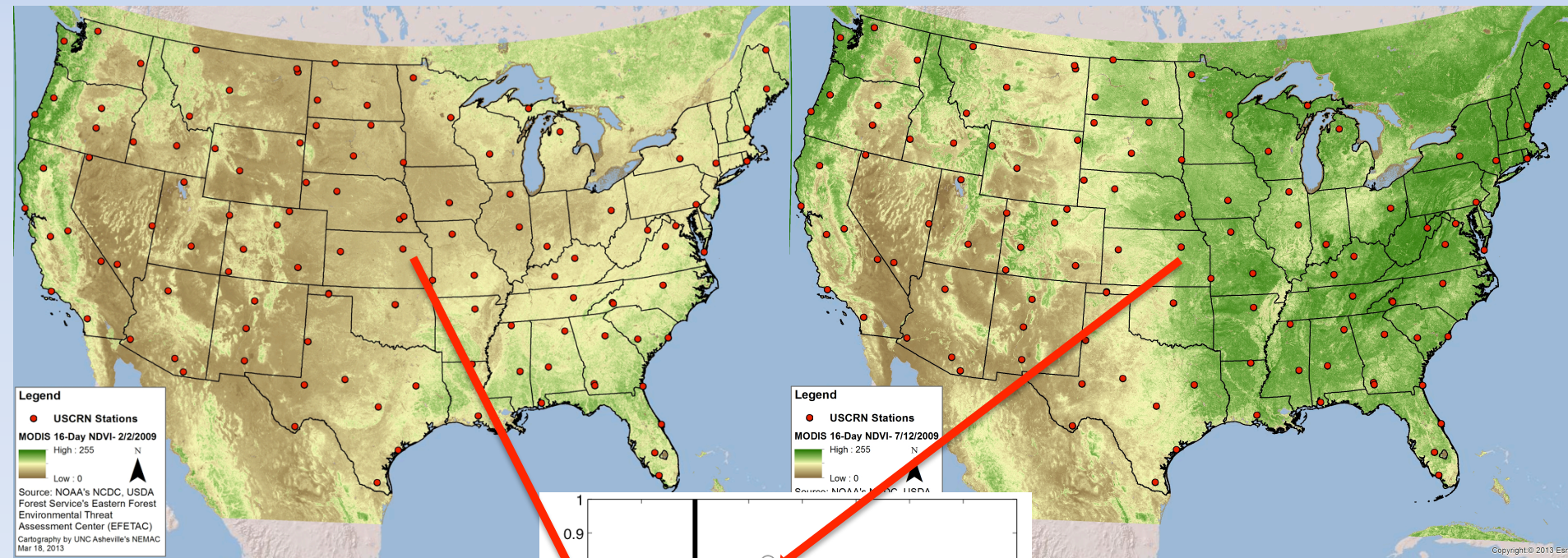
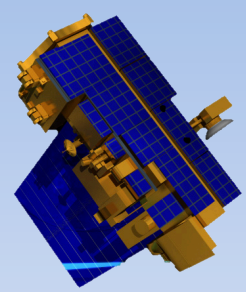
**Triplicate Redundancy**  
5cm, 10cm, 20cm, 50cm, 100cm

# Start of Season Based on Temperature



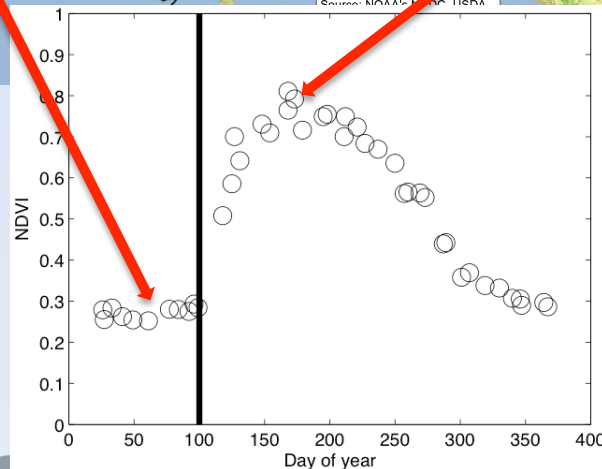
# NASA's Satellite Images of Vegetation

## Normalized Difference Vegetation Index (NDVI)

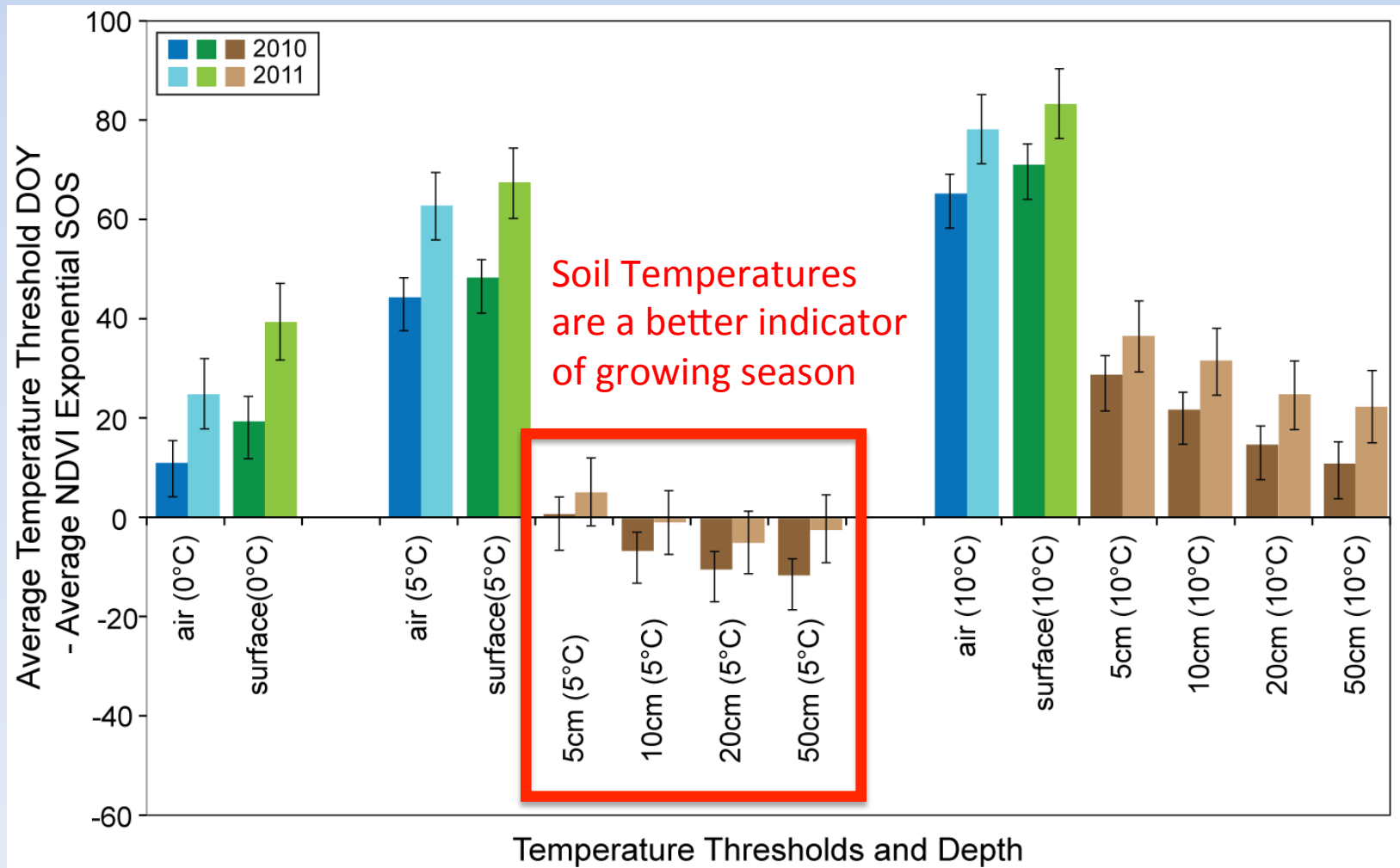


Winter

Summer



# Soil Temperature are a better indicator of the Start of the Growing Season





# Conclusions

- **Soil Temperature** at 5°C is a better indicator of start of season
- This work will help in developing **drought-monitoring products**
- Shows connection between ground measurements and satellite measurements



# Thank you!

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**US Climate Reference Network**

