IT'S HOT IN HERE:
EXAMINING 100M TEMPERATURE READINGS TO UNDERSTAND GLOBAL WARMING

alteryx | The Thrill of Solving

PRESENTED BY

Ken Black

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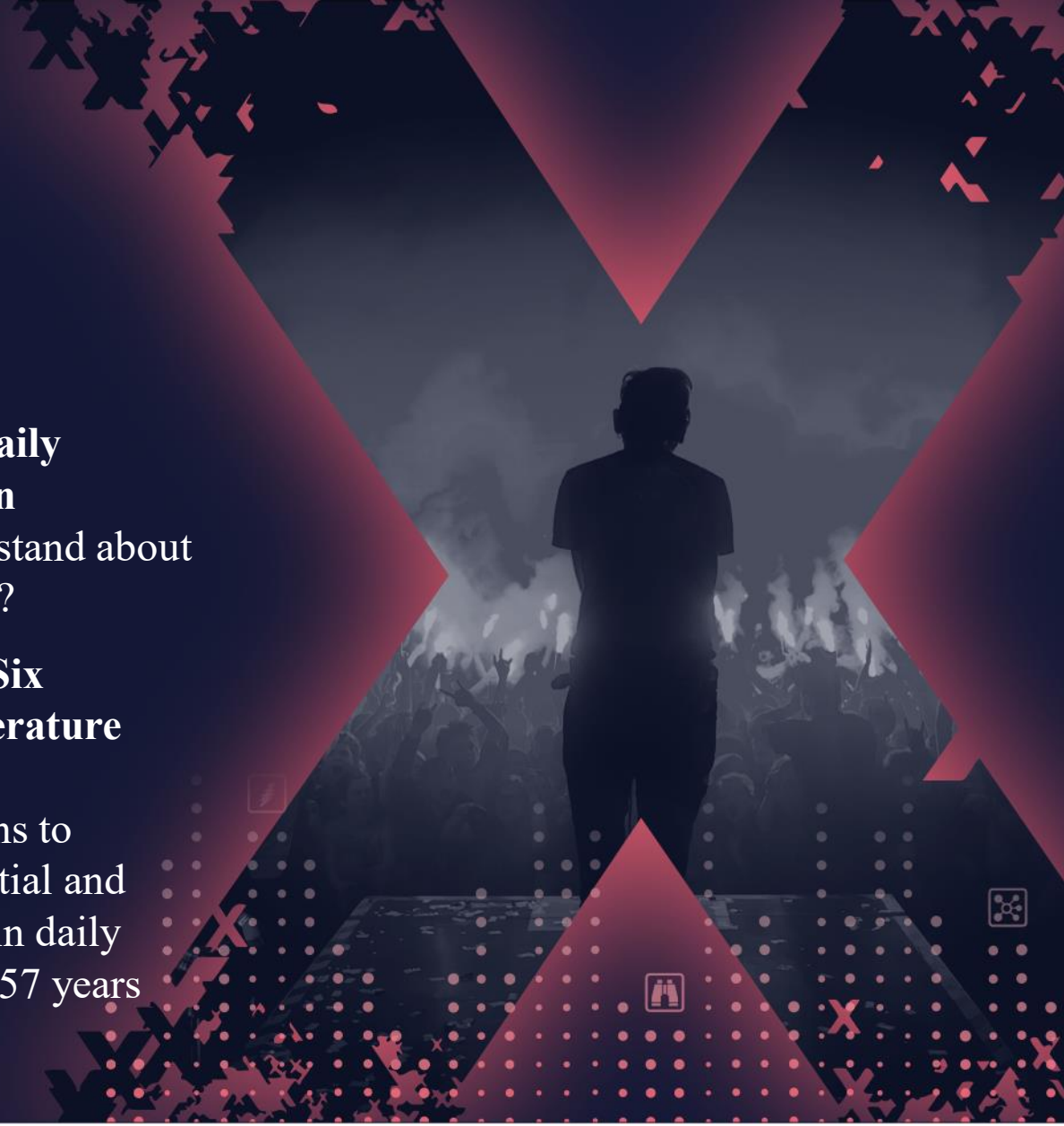
TODAY'S AGENDA

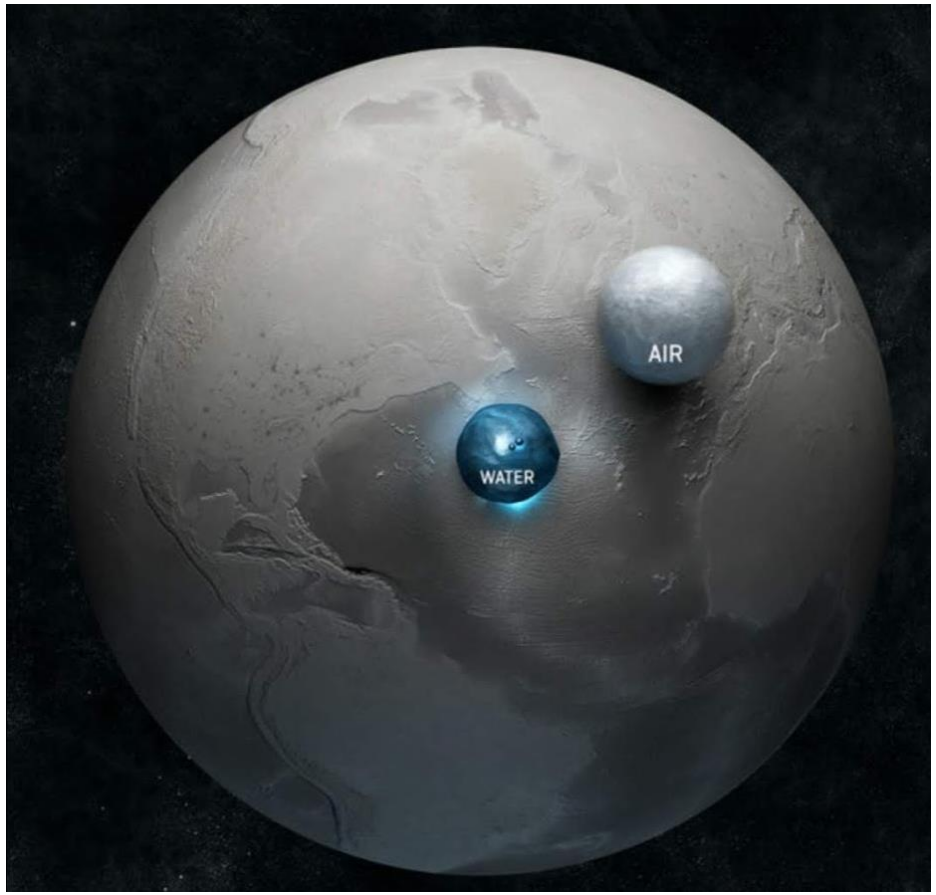
1. **Introductions**
   Who **is** Ken?
2. **Global Warming Definition**
   What do people think they know about this topic?
3. **Temperature Data Basics**
   The data used for this study.
4. **The Role of Alteryx**
   Transforming >100M temperature readings.
5. **Understanding Daily Weather Variation**
   What do we understand about daily temperatures?
6. **Comprehending Six Decades of Temperature Change**
   Using visualizations to understand the spatial and temporal changes in daily temperatures over 57 years



WHO IS KEN?

Background

- Geologist/Hydrogeologist
- Computer Programmer
- Applied Mathematician/Numerical Computations
- Process Improvement
- Alteryx ACE
- Tableau Zen Master
- Data Scientist/Advanced Analytics at General Motors
- Independent Global Warming Researcher

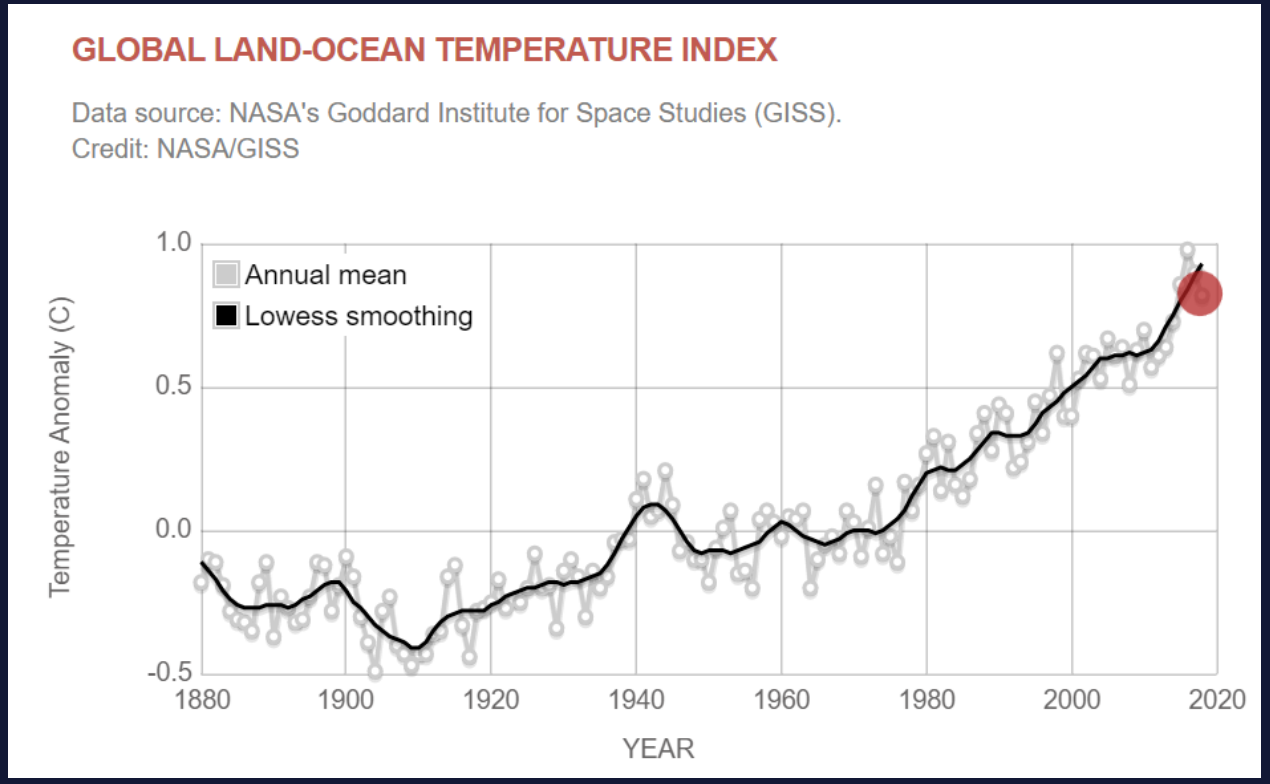


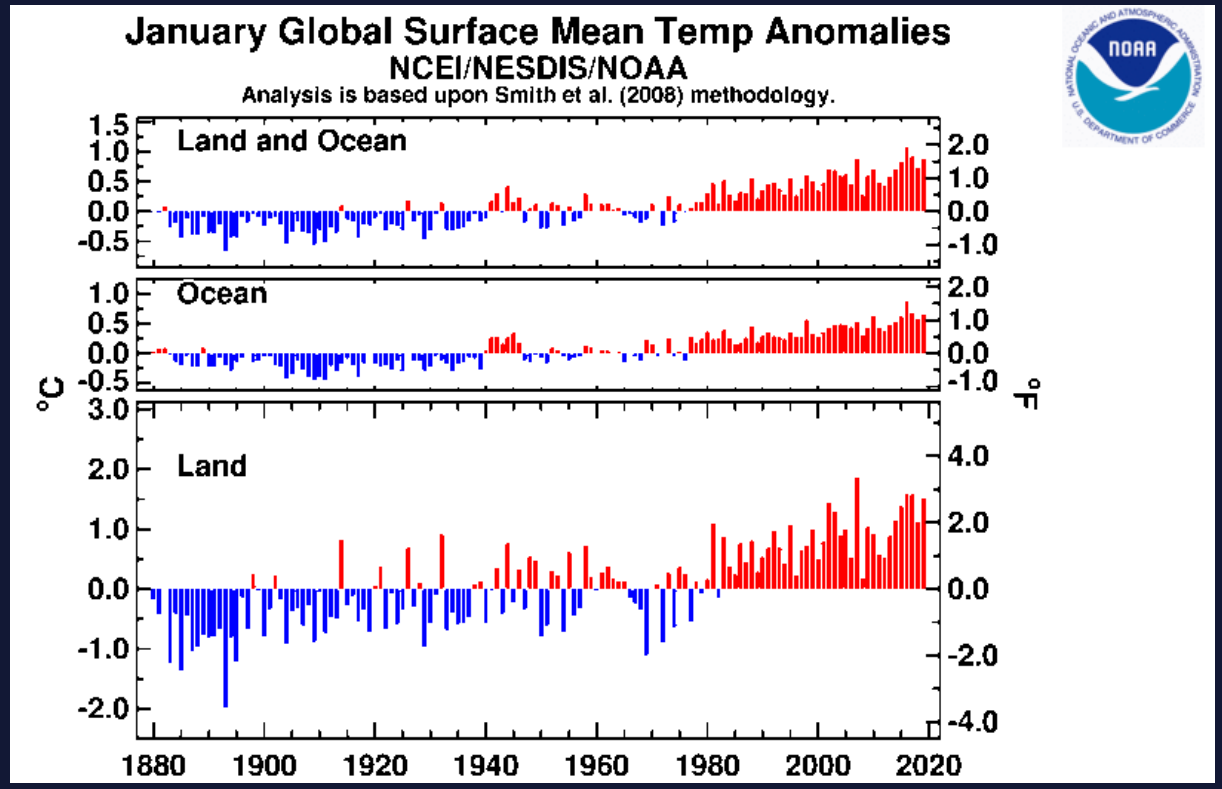
GLOBAL WARMING DEFINITION

Q: What is global warming?
A: Here's a simple definition of global warming. (And yes, it's really happening.) Over the past 50 years, the average global temperature has increased at the fastest rate in recorded history. And experts see the trend is accelerating: All but one of the 16 hottest years in NASA's 134-year record have occurred since 2000.

National Defense Research Council

GLOBAL WARMING TRENDS





Source NASA

Source NOAA

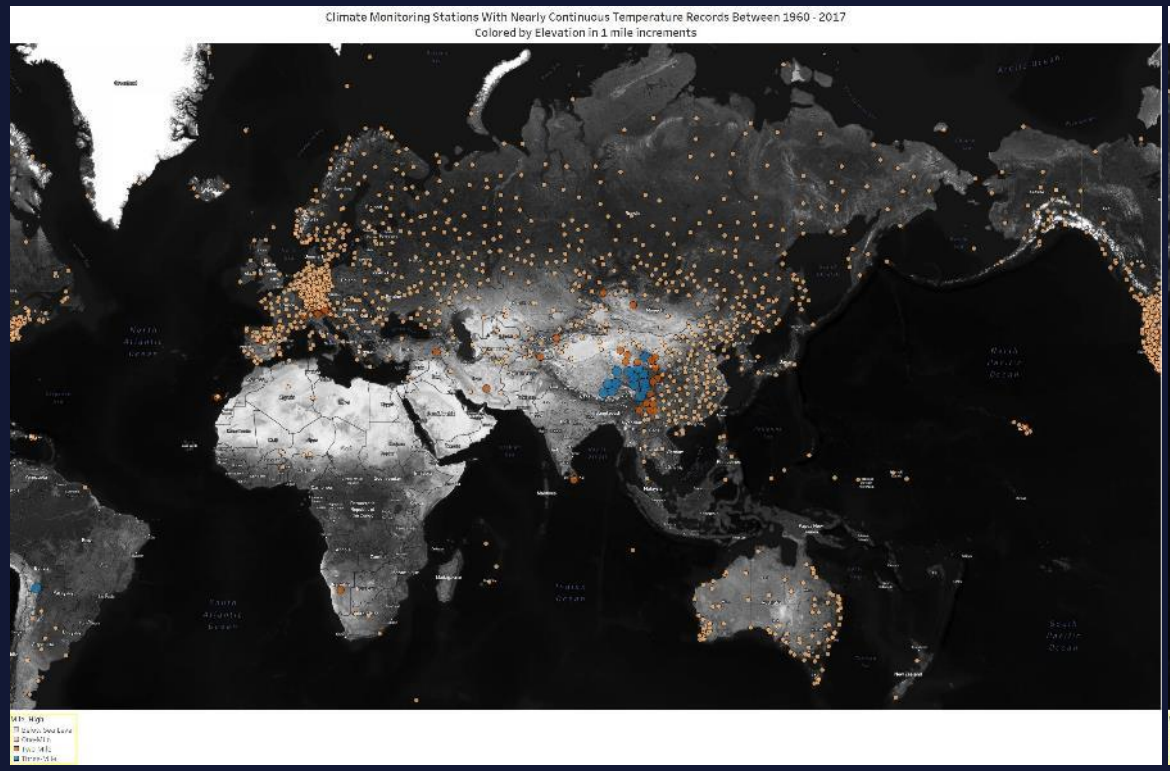
GLOBAL WARMING IMPACTS

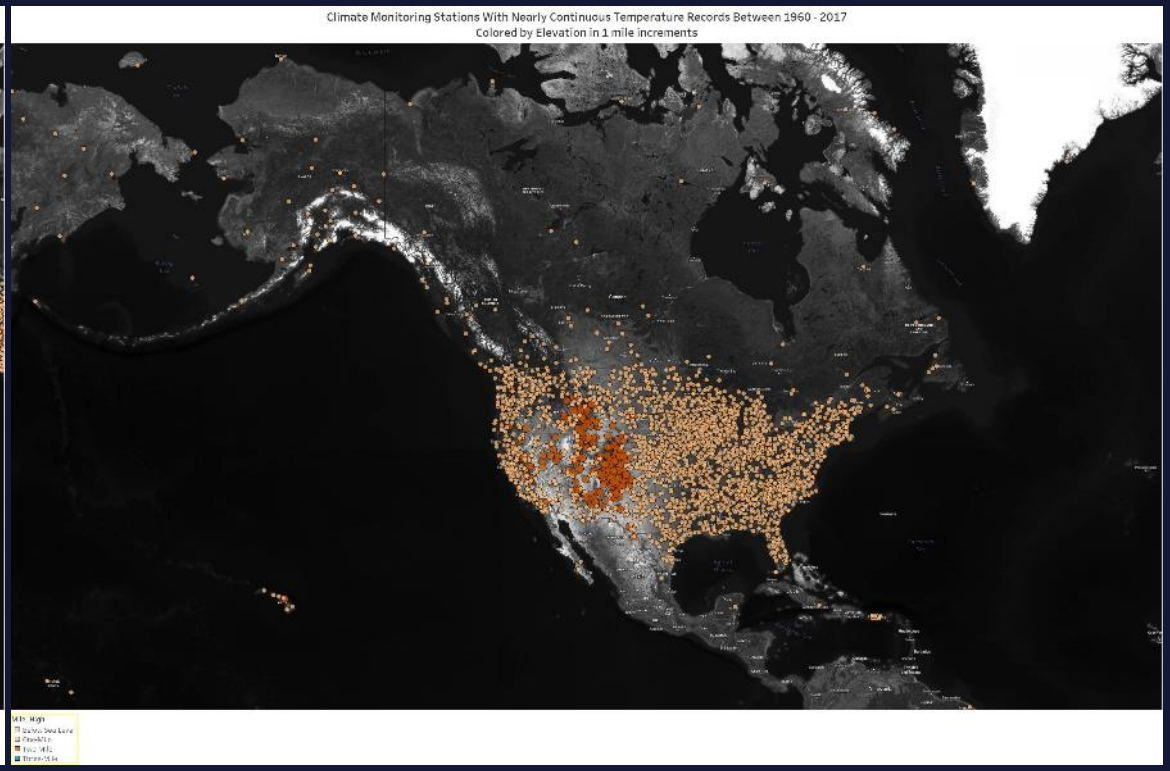
[The Most Comprehensive Analysis of Global Warming Impacts]

SPECIFIC GLOBAL WARMING IMPACTS

TEMPERATURE DATA BASICS

Daily Maximum and Minimum Temperatures are measured from monitoring stations all around the world. Data from >5,000 stations (1960-2018) is used to uncover the insights in this study. Monitoring station elevations exceed 3 miles high (big blue dots).





THE ROLE OF ALTERYX

Alteryx has been the data engine on this study for five years. Without Alteryx, I would not have been able to gain these insights. Alteryx has literally completed trillions of calculations to answer the questions I have created. About 70 workflows have been built over time.

Phase I (2014) – My Alteryx Manifesto

When I first started learning Alteryx, I wanted to give myself a grand challenge. I wanted to give a gift to college professors that are teaching analytics. I wanted to create a project that could be emulated within a semester, using great software like Alteryx and Tableau. I wanted to design and complete a full-spectrum analytics project that could serve as a teaching tool and one in which would educate our students. I believe I have accomplished this by developing my "Alteryx Manifesto".

I started the work in late 2014 and I first documented the preliminary work in a series of five articles in early 2015. These articles explain in detail how components of daily weather data can be accessed, processed in Alteryx, and visualized in Tableau. With easily over 100 hours of work invested in this series of articles, it was a great reference for me to be able to continue the work a couple of years later. You can access the articles by clicking the blue text.

1. Part 1 – Project Introduction
2. Part 2 – The Source of Climate Data
3. Part 3 – Reading Weather Station Data
4. Part 4 – Alteryx Workflow Details For Reading Data
5. Part 5 – Using Tableau To Examine Texas Temperature and Precipitation Data

Phase II (2016-2017)

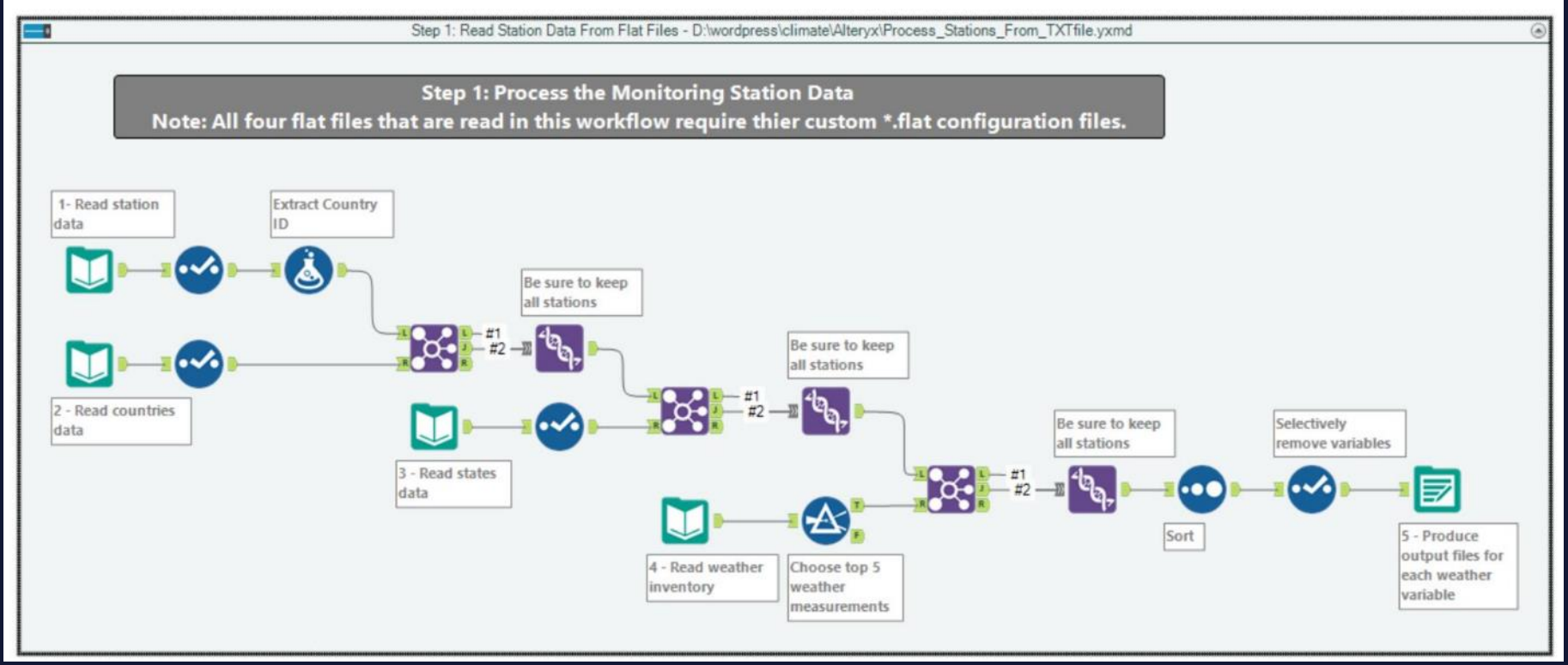
After moving to Texas and then back to Tennessee and Georgia, I finally found some time to revisit this work. After a couple of years of record high temperatures, I decided to attack this work with renewed enthusiasm. The following articles are the result of this work.

1. Investigating Global Climate Change
2. Uncovering Surprising Temperature Changes
3. Visualizing Worldwide Air Temperature Changes
4. Visualizing Warming and Cooling Patterns in North America
5. Descriptive and Predictive Study of North American Air Temperature Changes
6. Do You Live In An Area Impacted By Global Warming?
7. How I Use Alteryx and Tableau to Comprehend Climate Change
8. How To Achieve Better Data Comprehension (Climate Case Study)
9. My 2017 Alteryx Inspire Climate Change Presentation
10. Global Climate Data Set 1 – Daily Temperatures
11. Global Climate Data Set 2 – Monthly and Decade Average Temperatures
12. Temperature Changes Over the Past 50 Years: A Visual Tour Country by Country
13. Buckled Roads and Melting Permafrost in Bethel, Alaska
14. Using Temperature Anomalies to Visualize Global Warming Via #Alteryx, #Tableau, and #Mapbox

https://datablends.us/climate-change-quantified/

THE ROLE OF ALTERYX

An Example Workflow



https://datablends.us/climate-change-quantified/

UNDERSTANDING DAILY WEATHER VARIATION

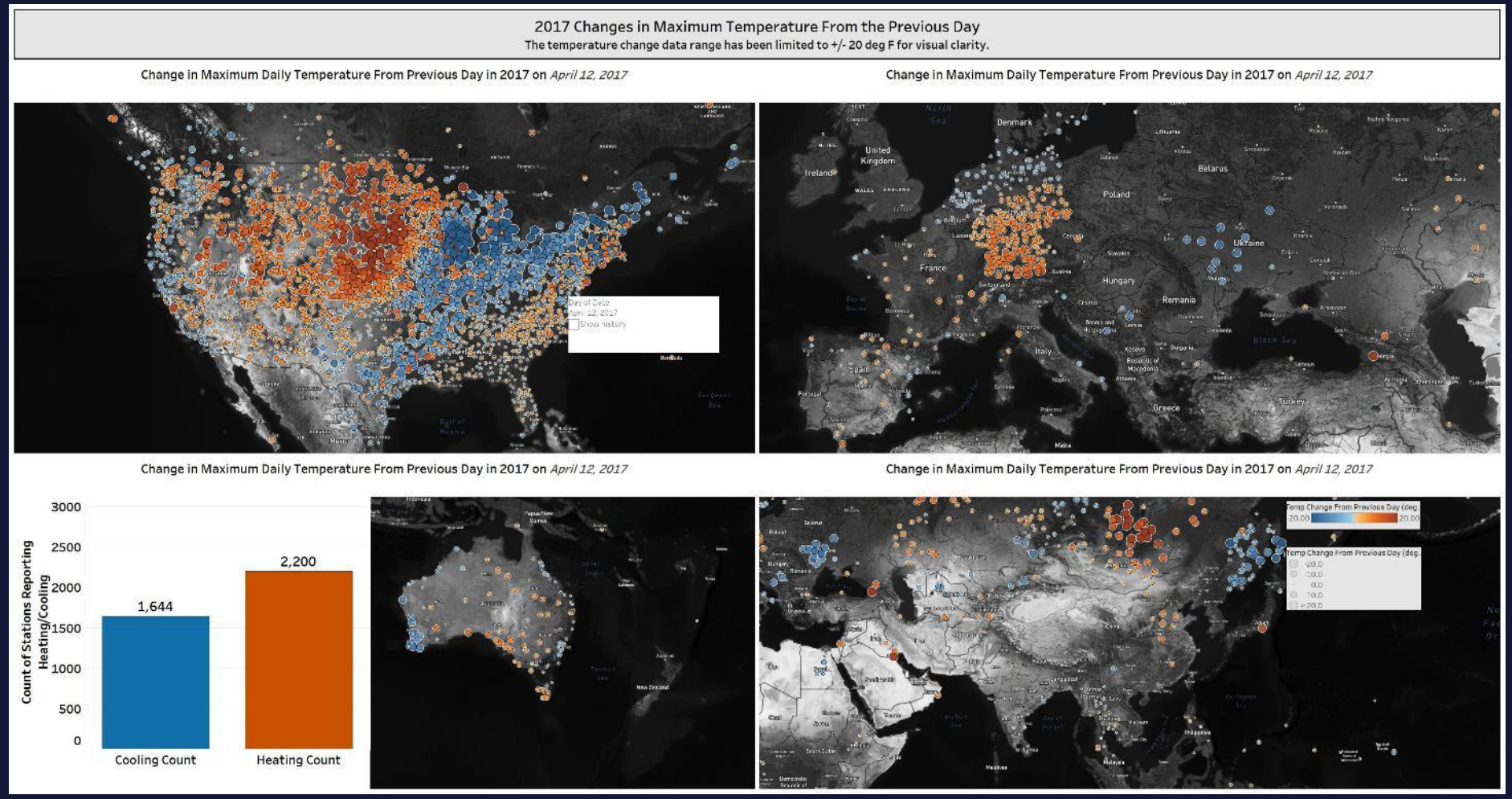
We all realize that weather can change dramatically from day to day.

In the following 4 slides, 4 consecutive days of worldwide weather are shown

Notice how hot zones and cold zones move across space and time

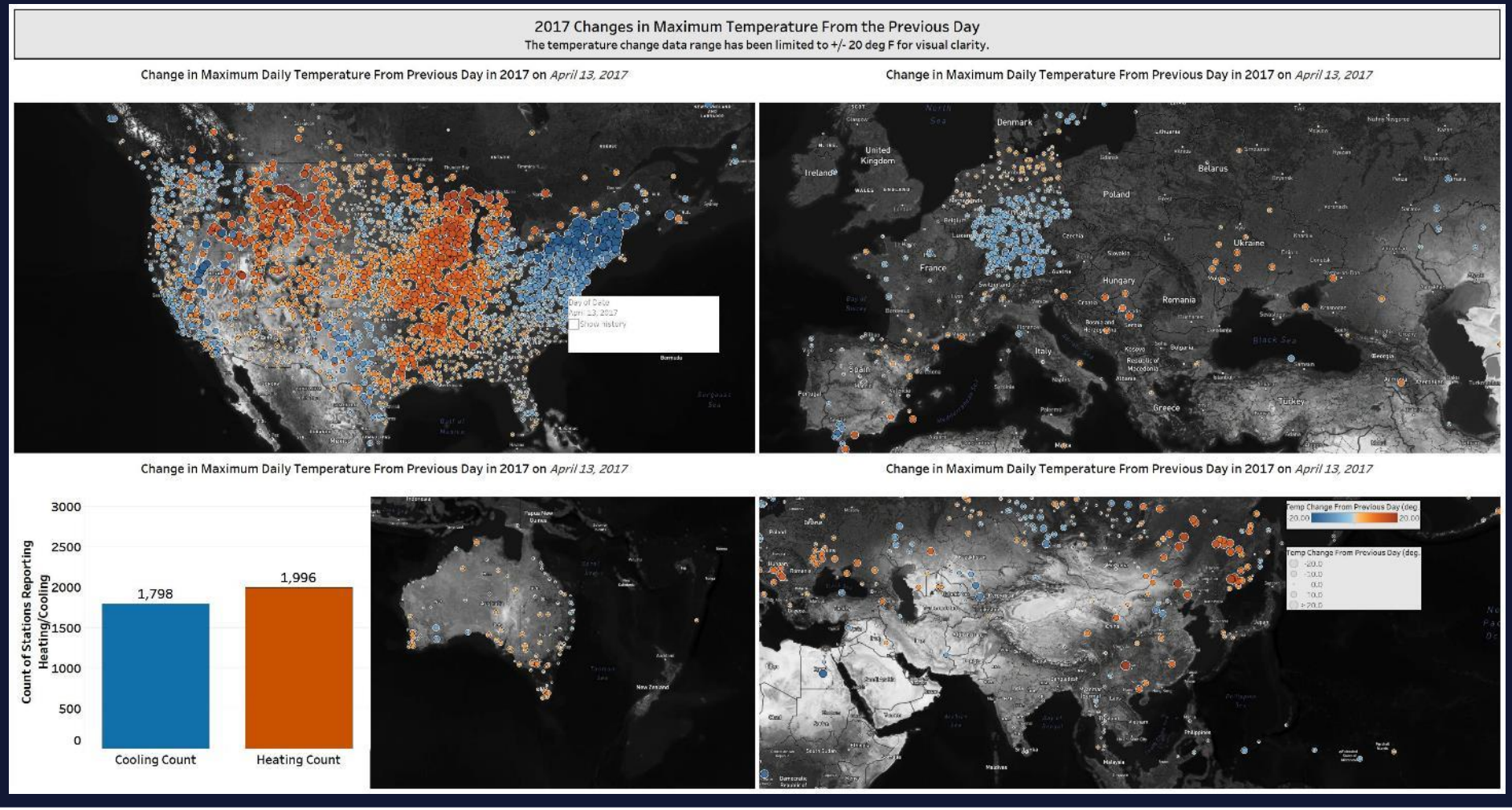
APRIL 12, 2019 WEATHER

We all realize that weather can change dramatically from day to day.



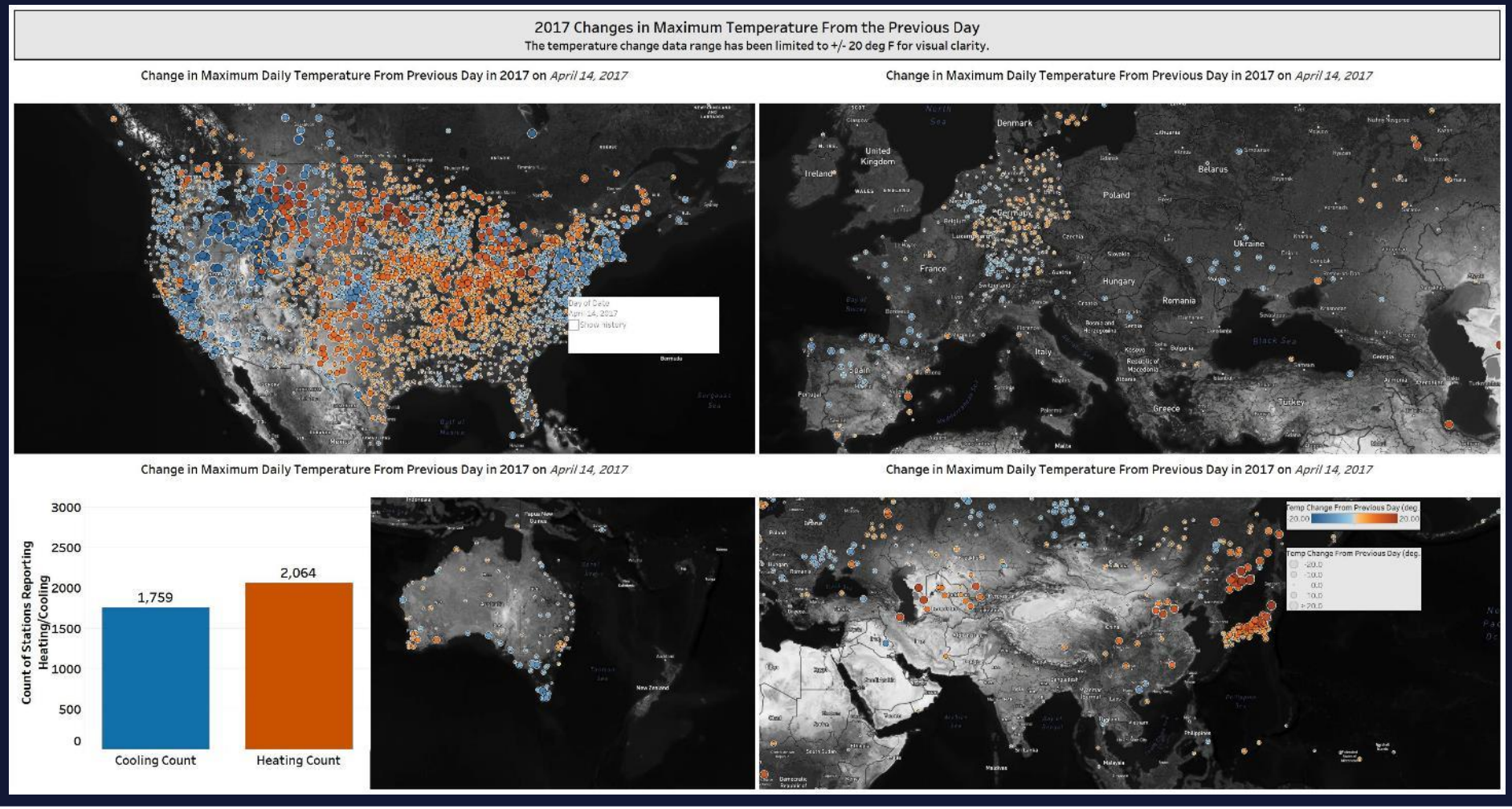
APRIL 13, 2019 WEATHER

The next day…



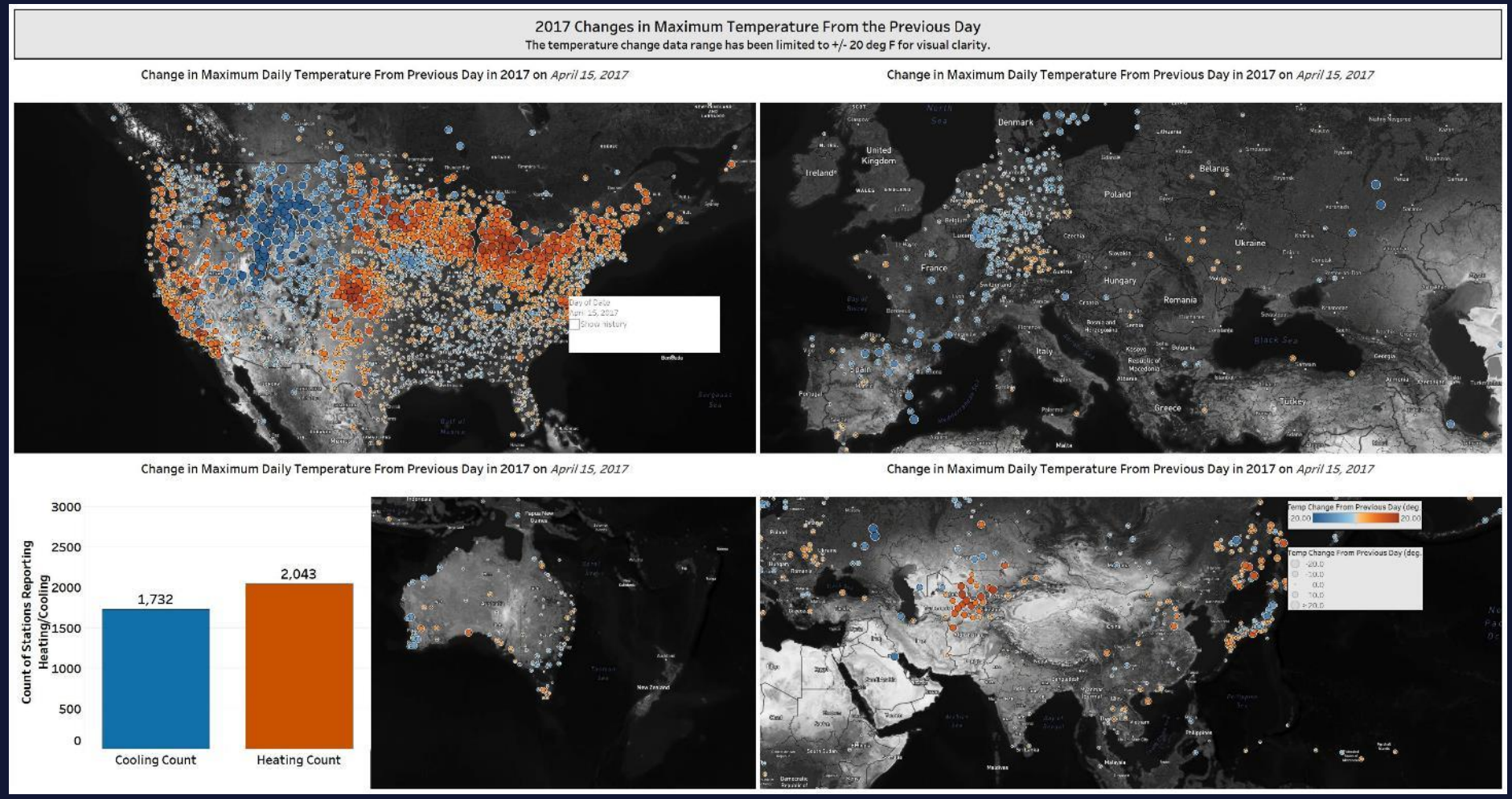
APRIL 14, 2019 WEATHER

The next day…



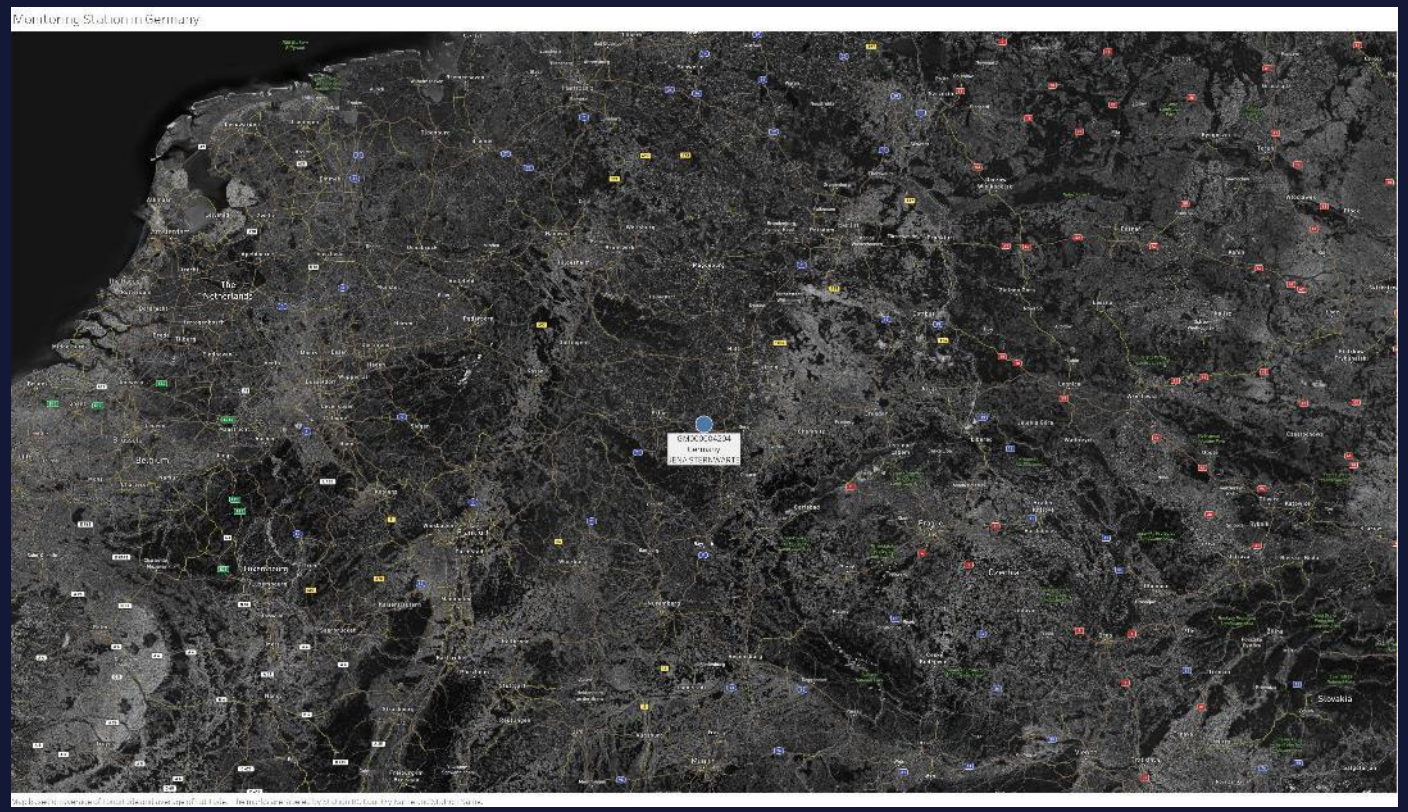
APRIL 15, 2019 WEATHER

And the next day…



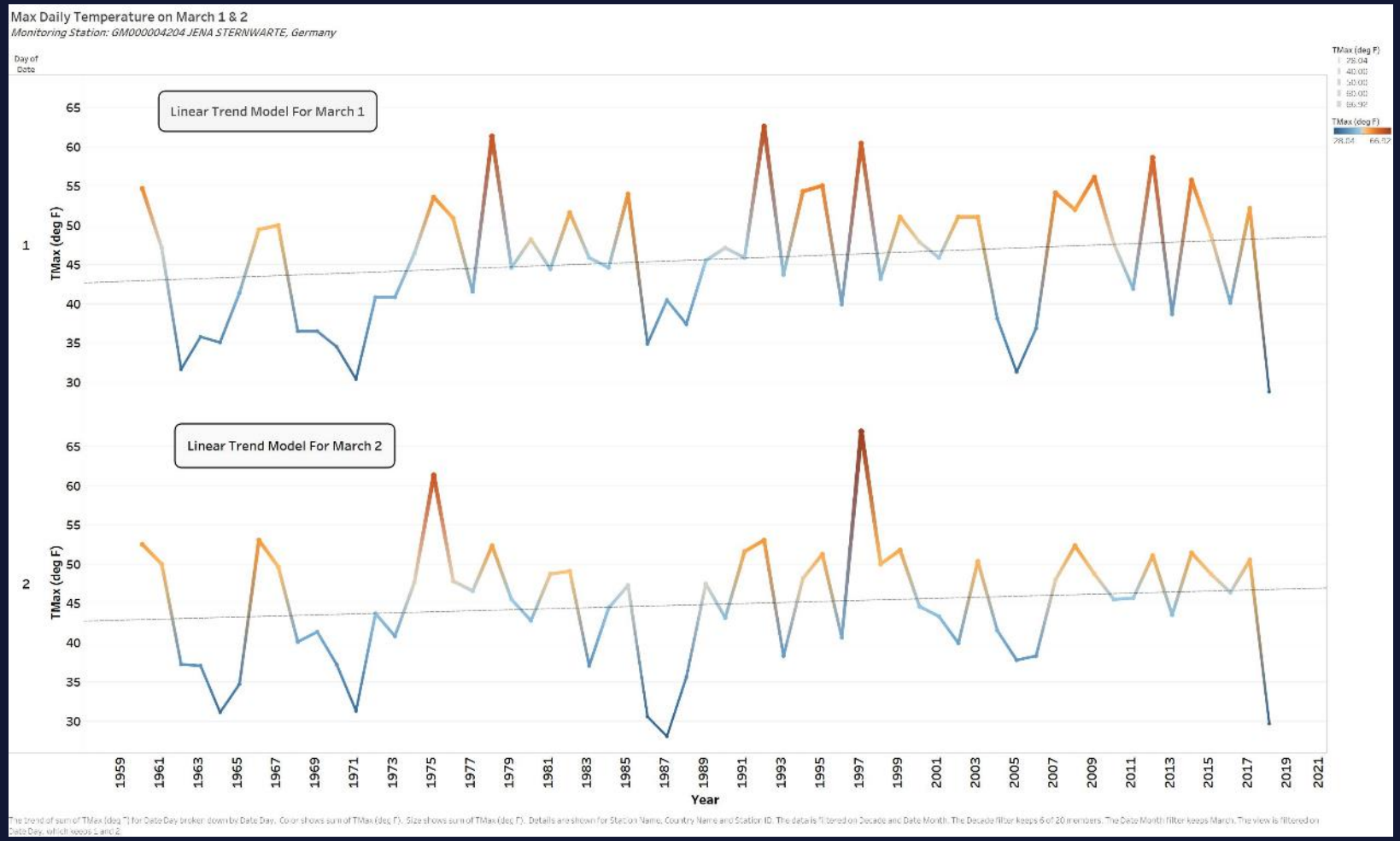
UNDERSTANDING DAILY WEATHER ACROSS TIME

Now imagine you could stop on any day of the year and look at what happens the following year, and another year…



LOCAL WEATHER VARIATION

Here are two days in March as an example from that monitoring station …

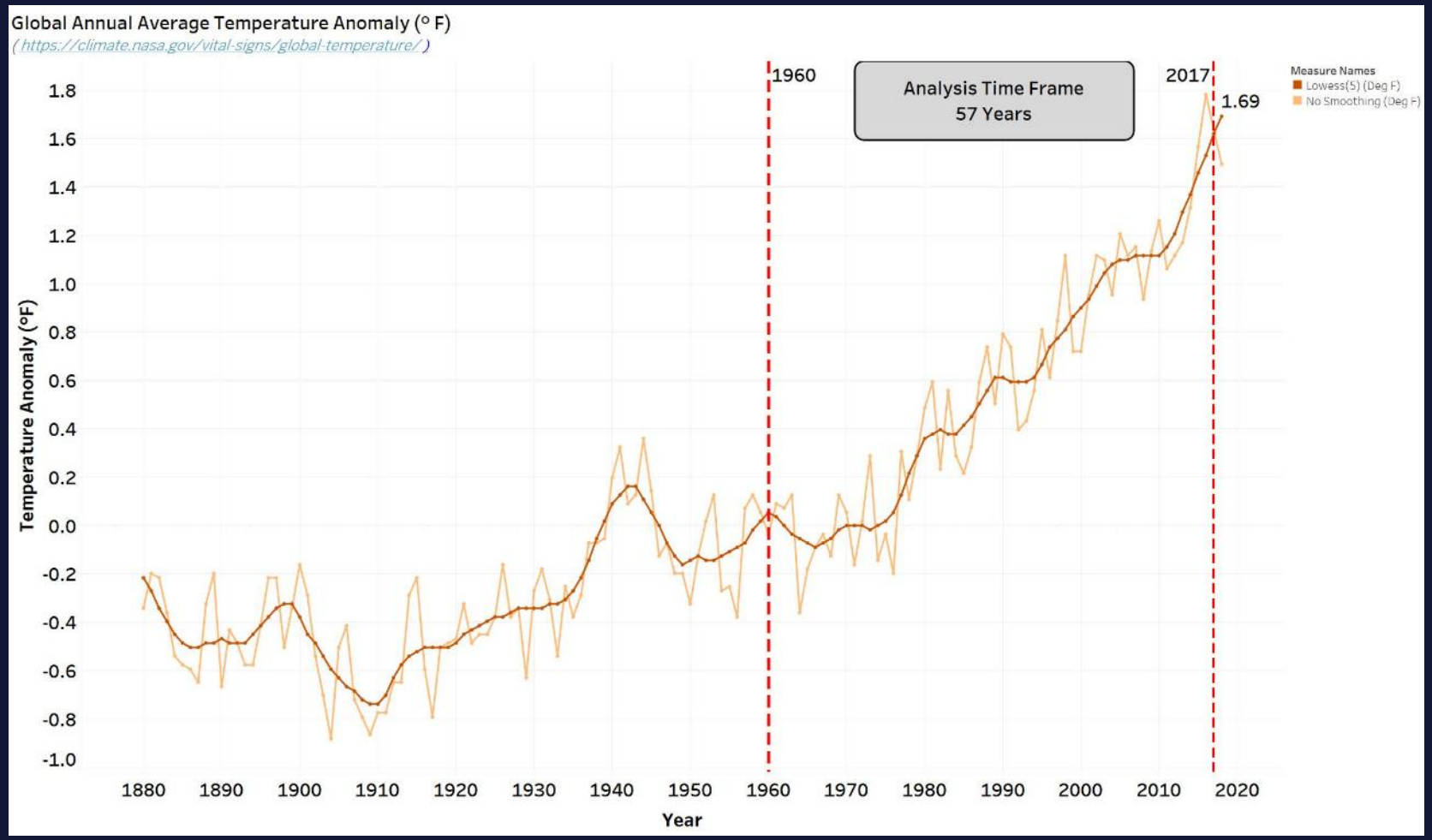


The linear trend lines show that both March 1 and 2 have experienced about 3-4 deg F of warming in 57 years.

Some stations are warmer, some are cooler across this timeframe.

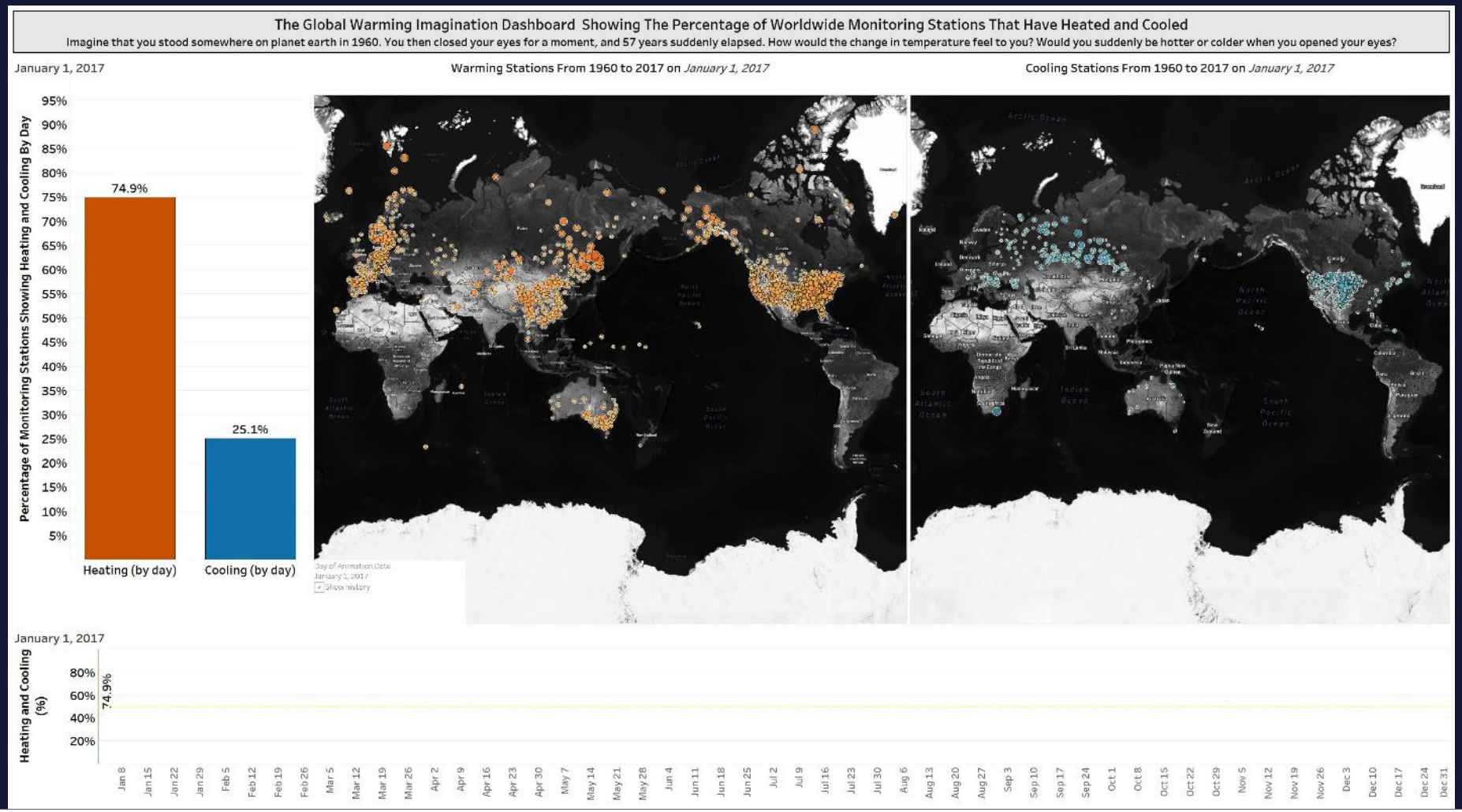
GLOBAL VARIATION

Now imagine we compute a couple of million linear models across 57 years…



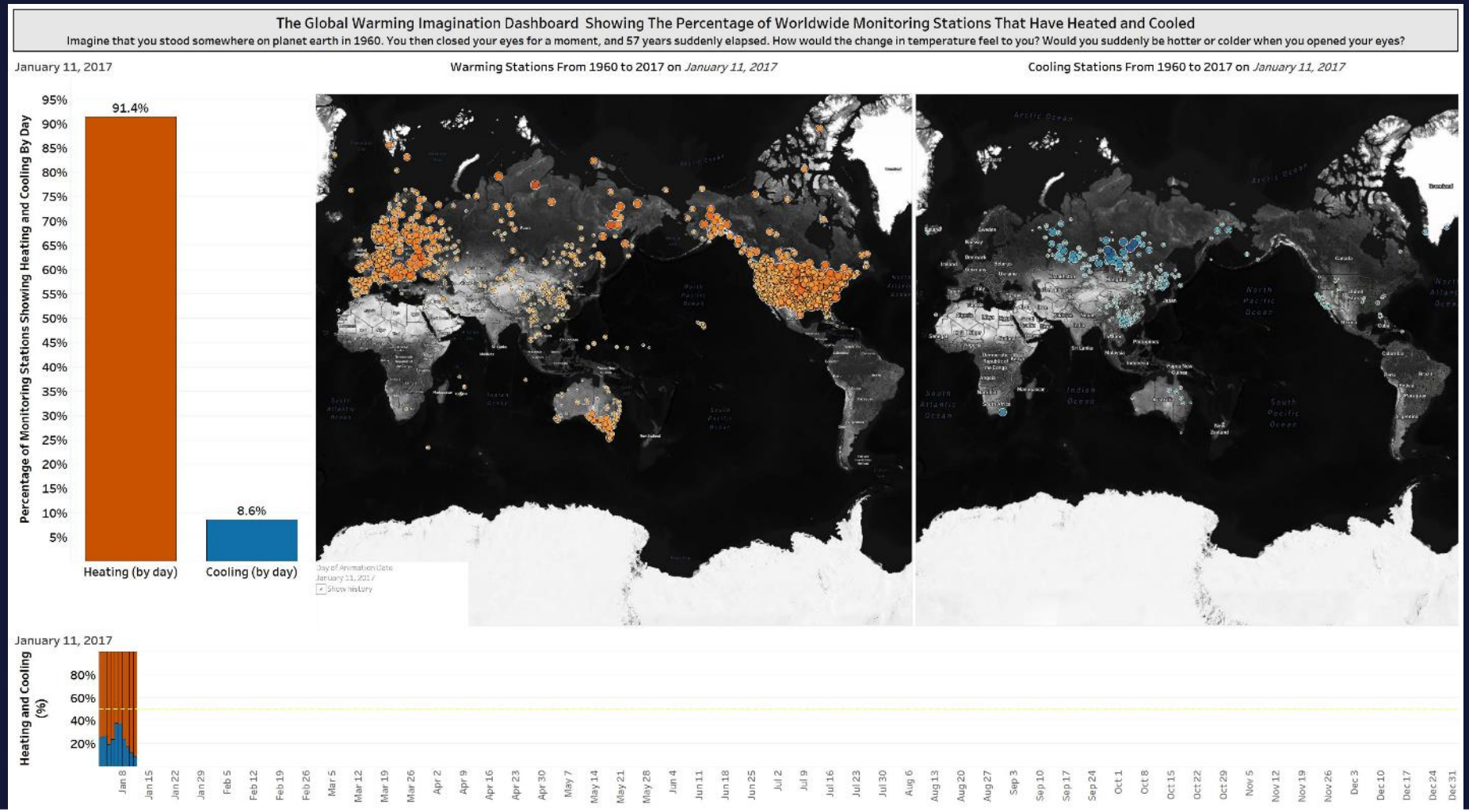
These linear models can be visualized in map form. We can now begin to understand how the spatial and temporal changes across the world have lead to this global average temperature anomaly.

COMPREHENDING SIX DECADES OF TEMPERATURE CHANGE



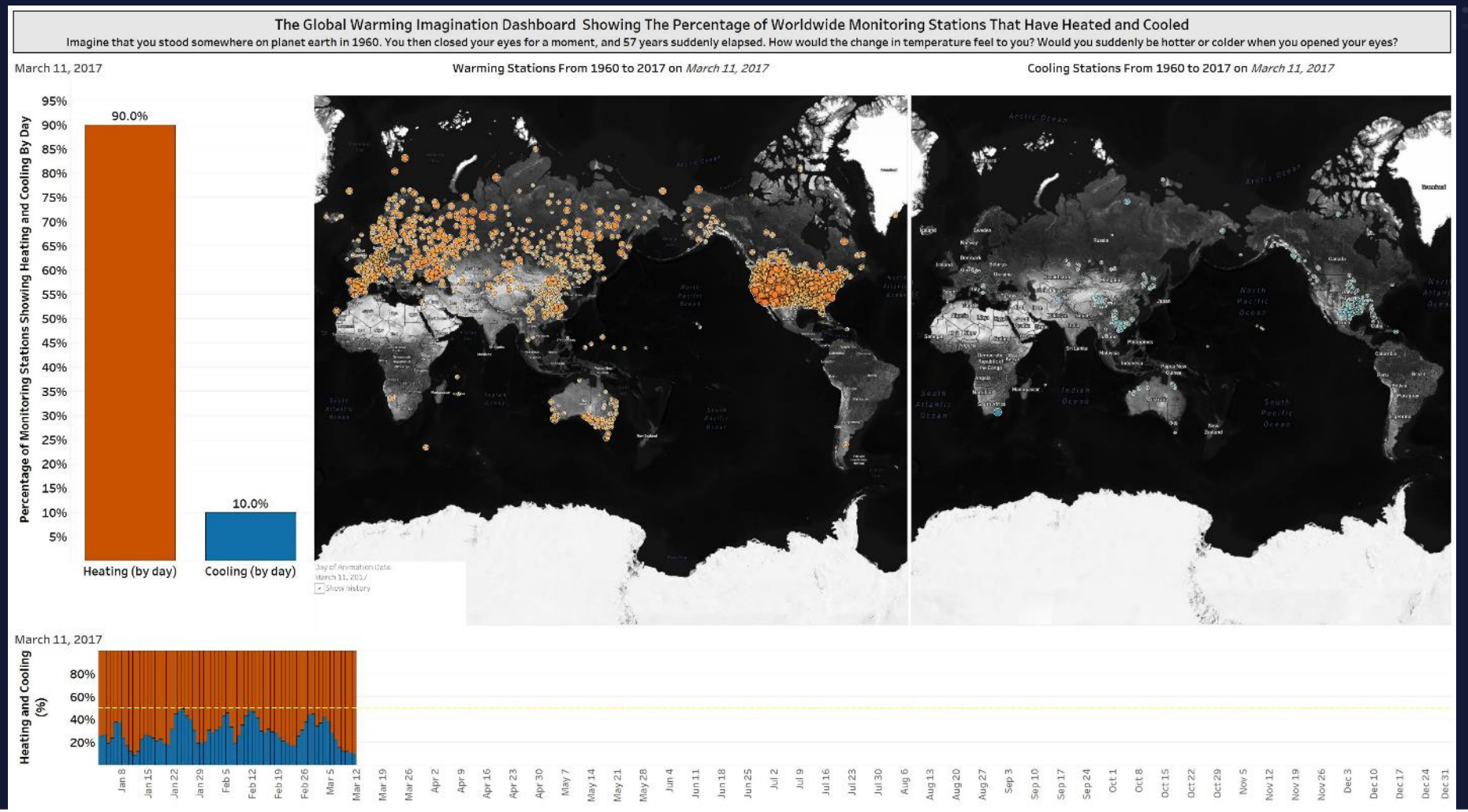
January 1

COMPREHENDING SIX DECADES OF TEMPERATURE CHANGE



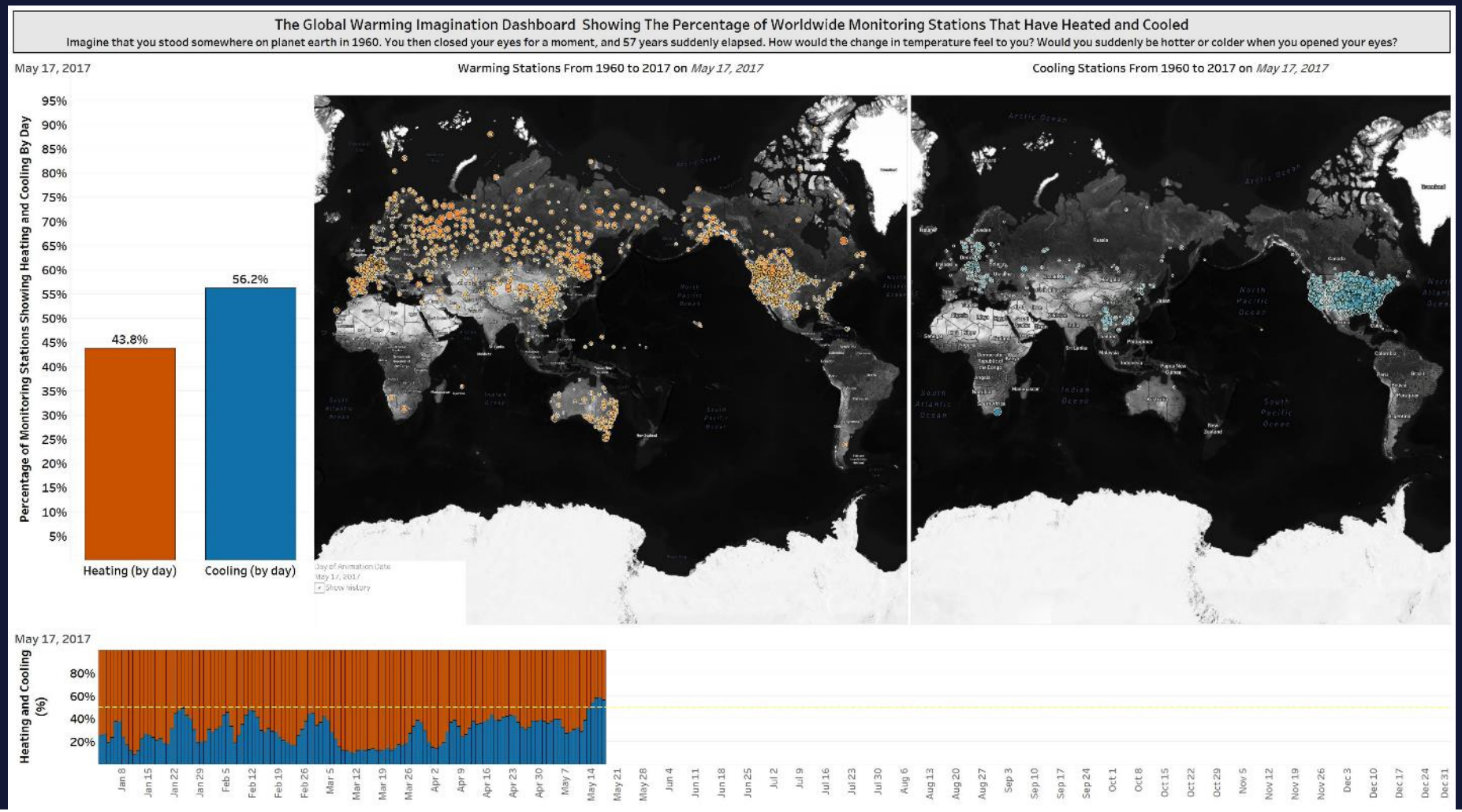
January 11

COMPREHENDING SIX DECADES OF TEMPERATURE CHANGE



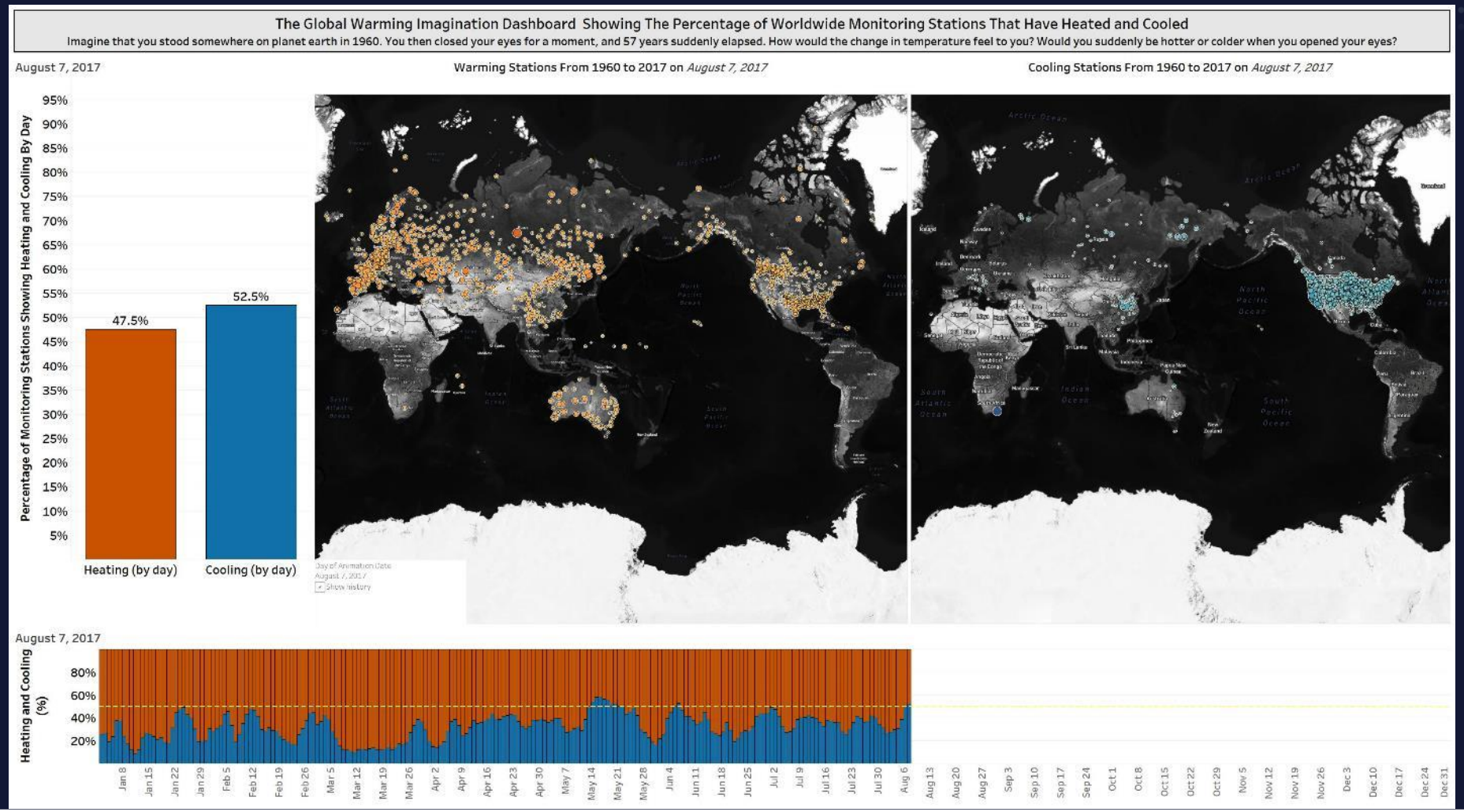
March 11

COMPREHENDING SIX DECADES OF TEMPERATURE CHANGE



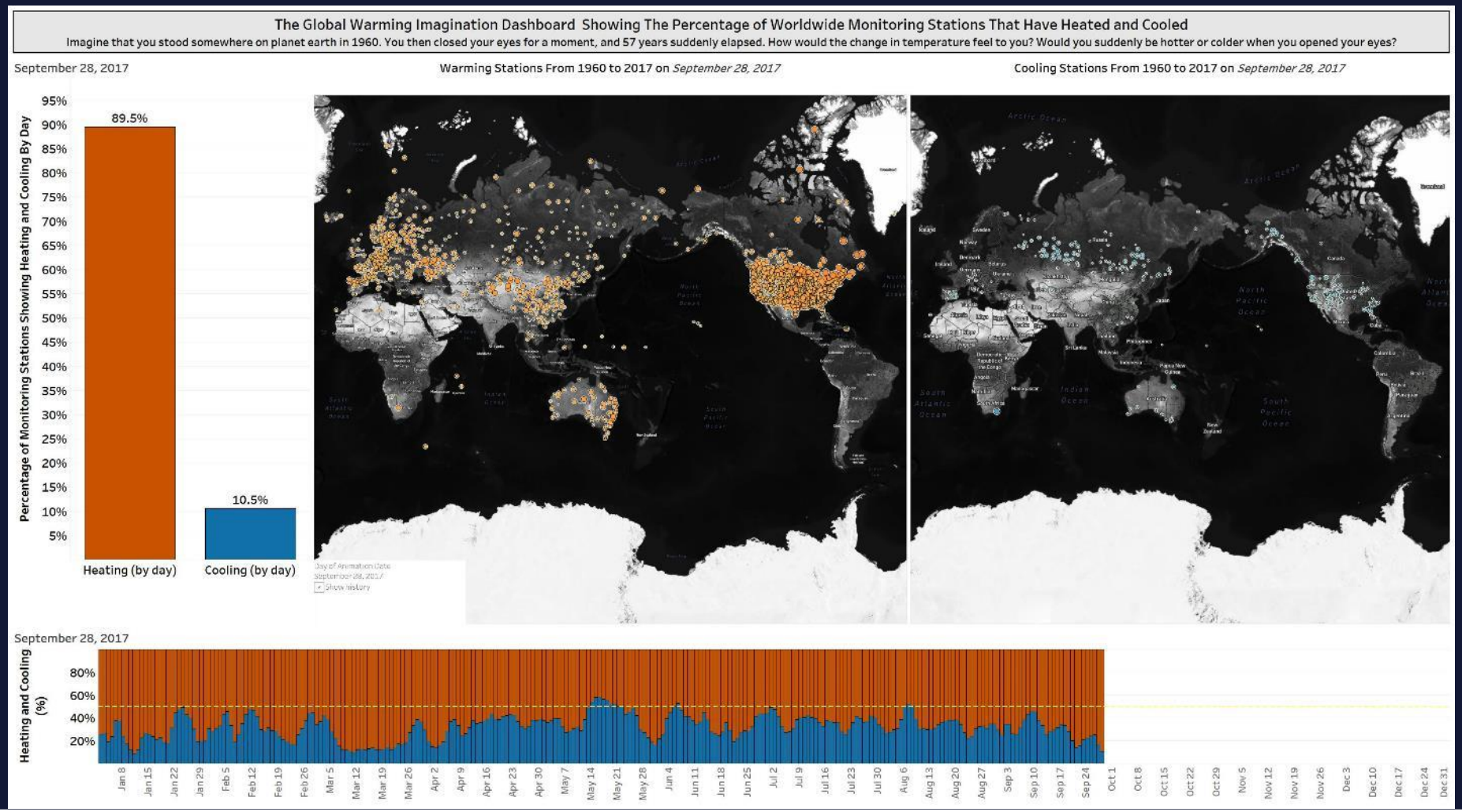
May 17

COMPREHENDING SIX DECADES OF TEMPERATURE CHANGE



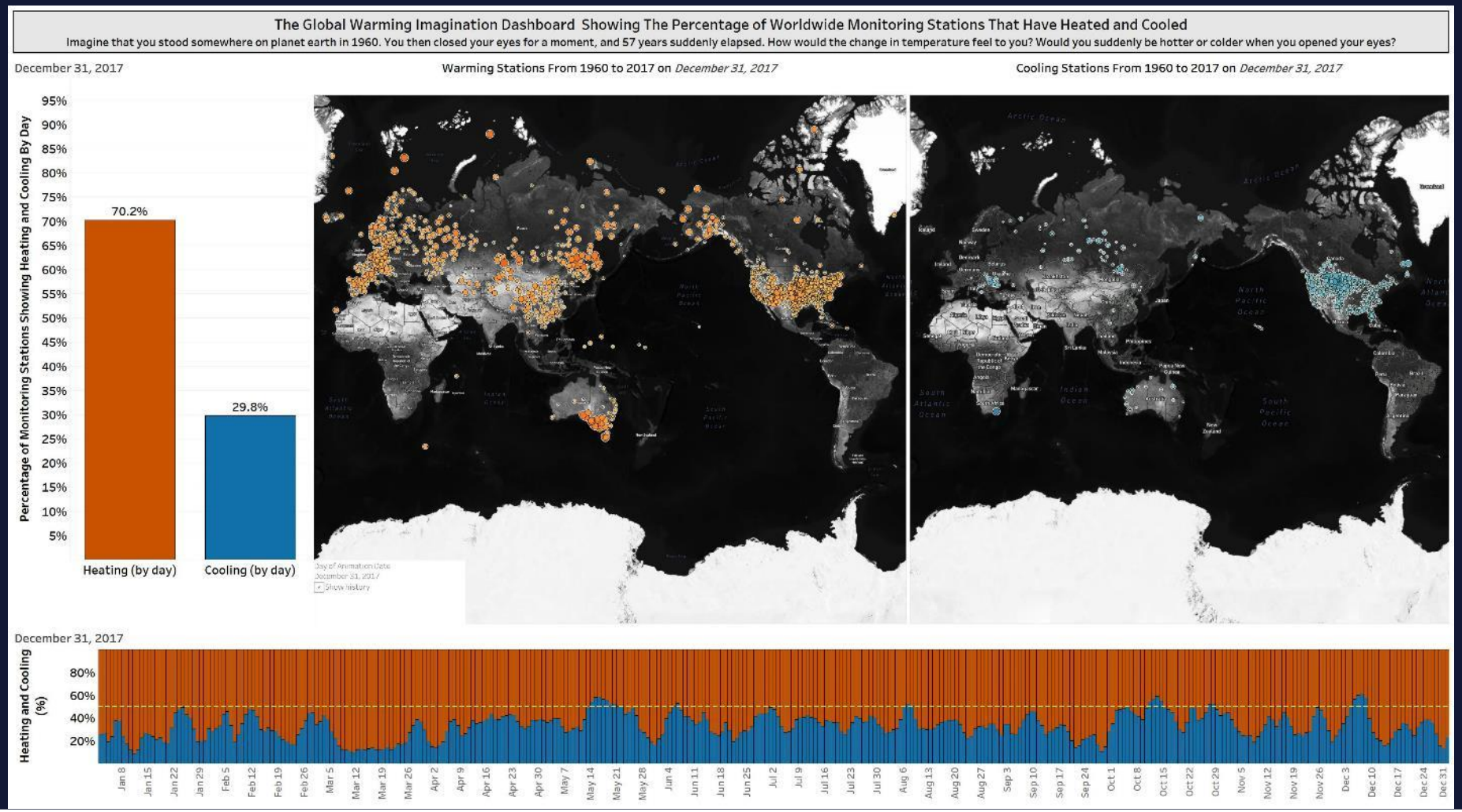
August 7

COMPREHENDING SIX DECADES OF TEMPERATURE CHANGE



September 28

COMPREHENDING SIX DECADES OF TEMPERATURE CHANGE



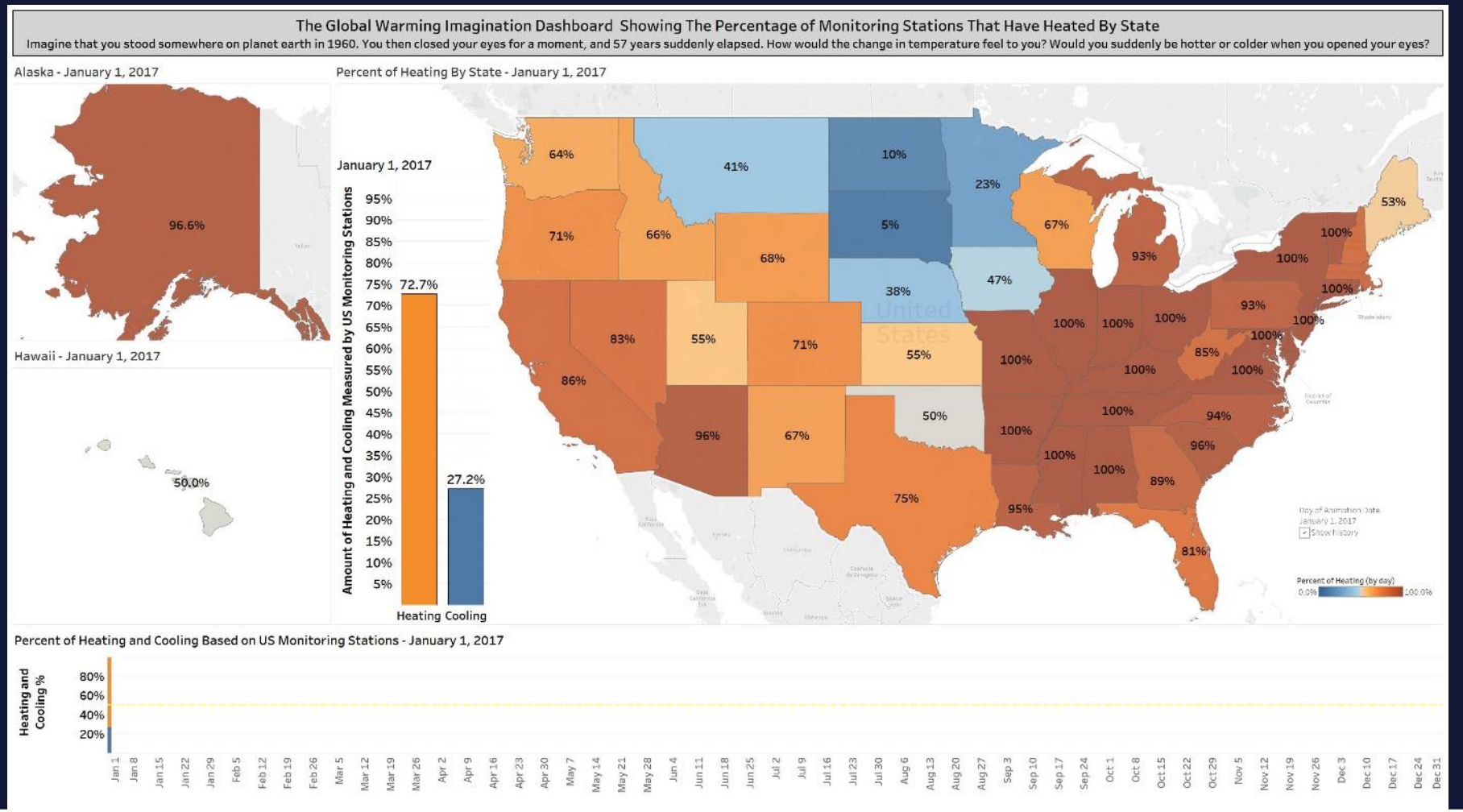
December 31

SIX DECADES OF NORTH AMERICAN TEMPERATURE CHANGES

Now the focus will shift to North America

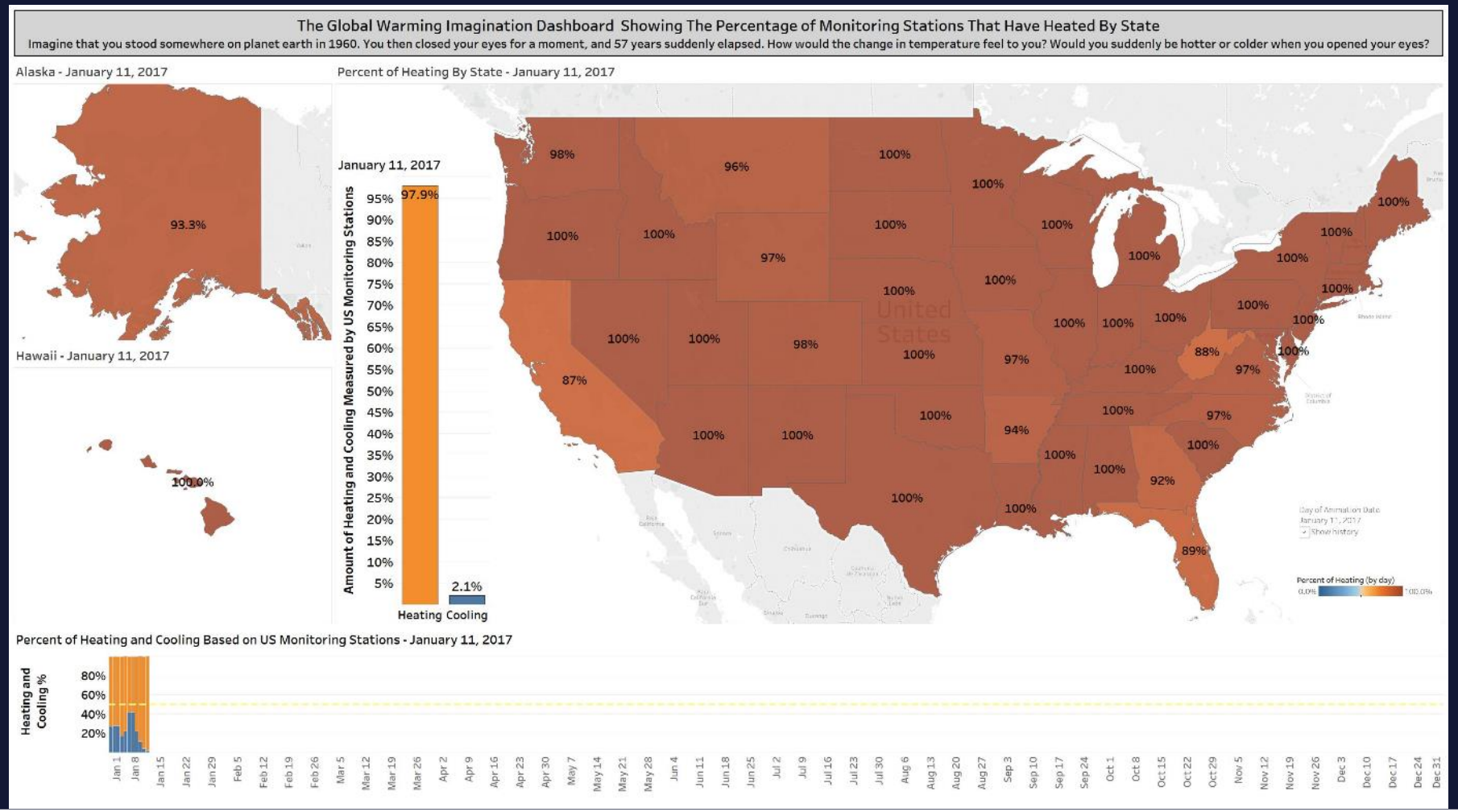
Temperature changes are still shown as percentages

SIX DECADES OF NORTH AMERICAN TEMPERATURE CHANGES



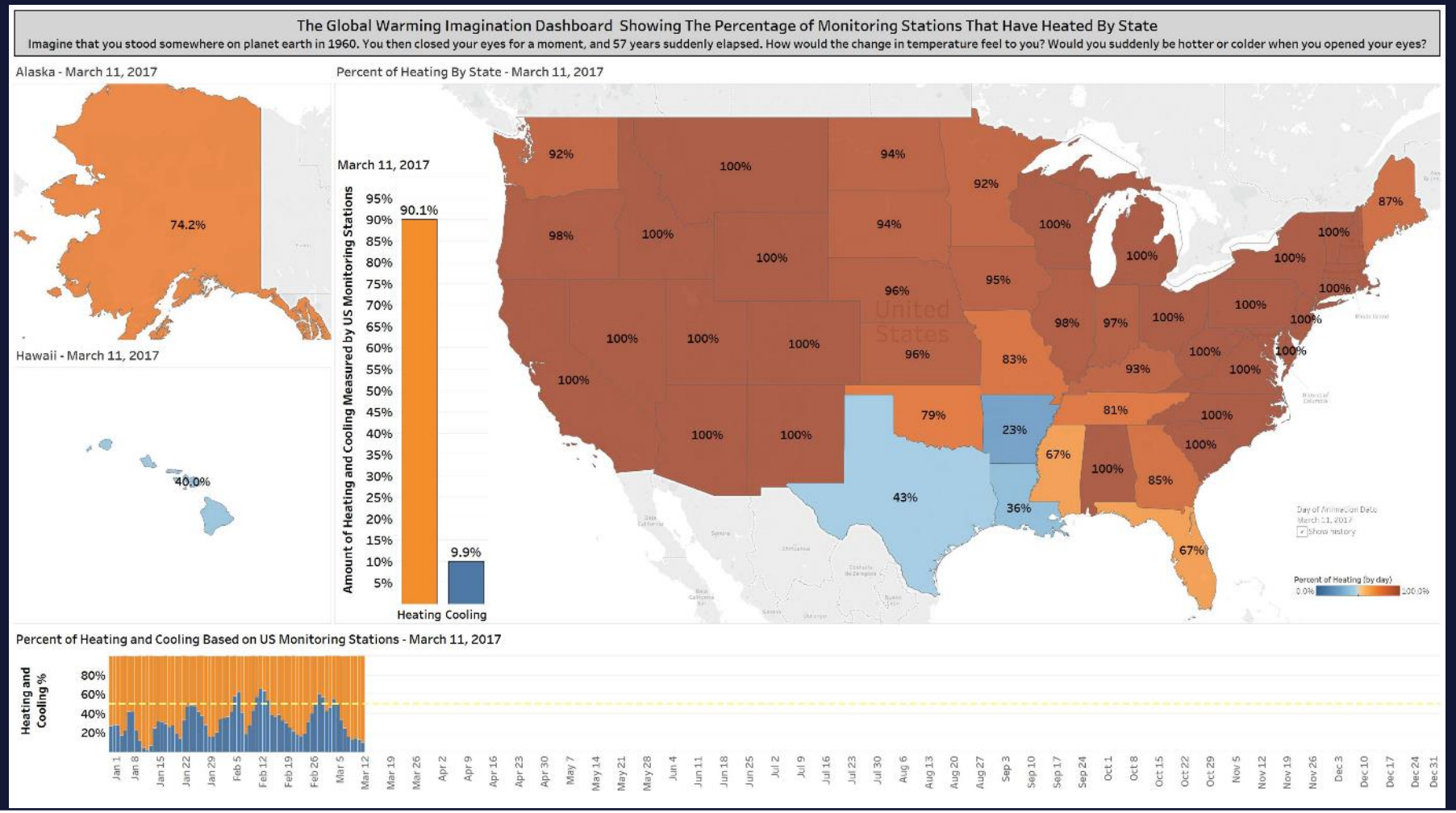
January 1

SIX DECADES OF NORTH AMERICAN TEMPERATURE CHANGES



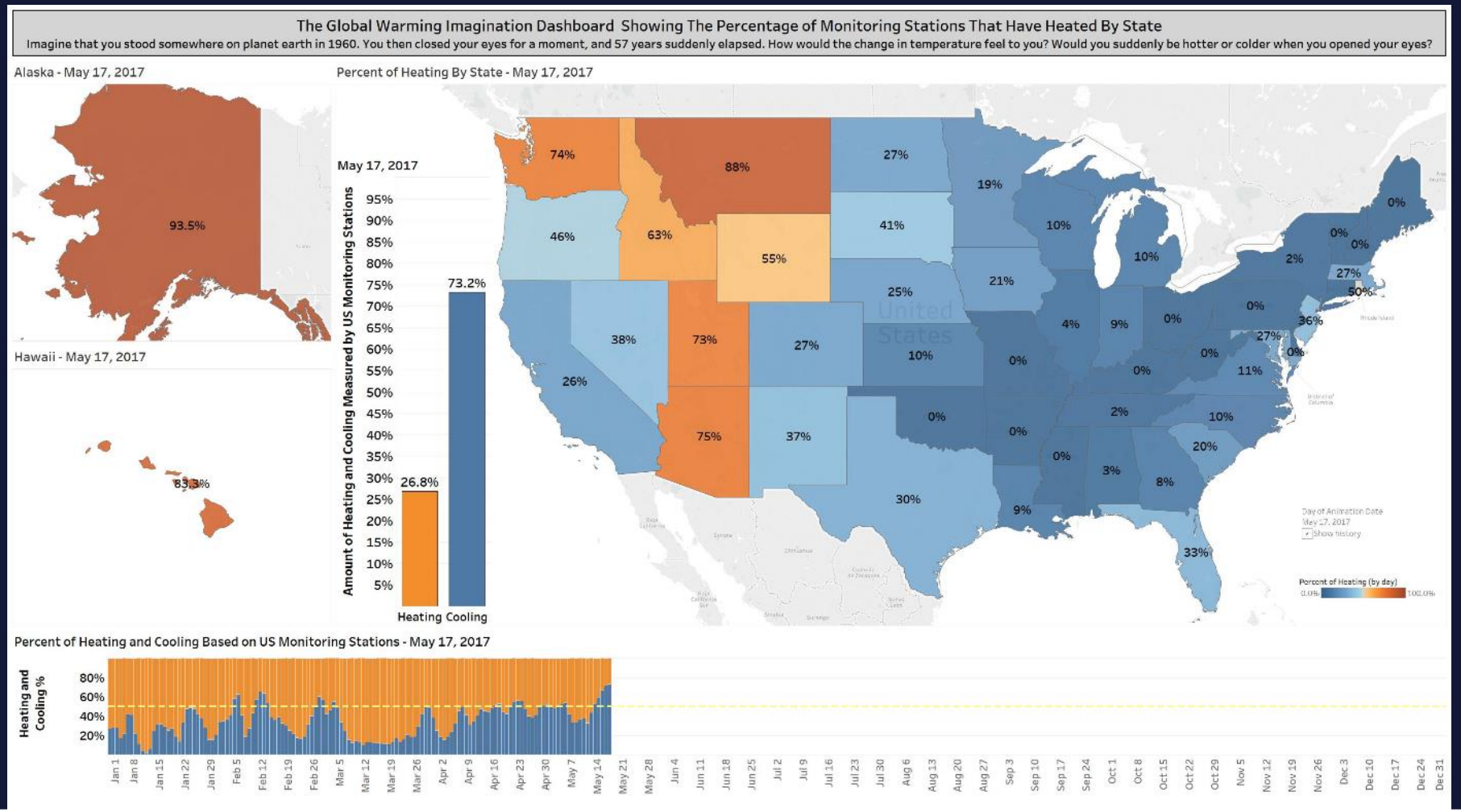
January 11

SIX DECADES OF NORTH AMERICAN TEMPERATURE CHANGES



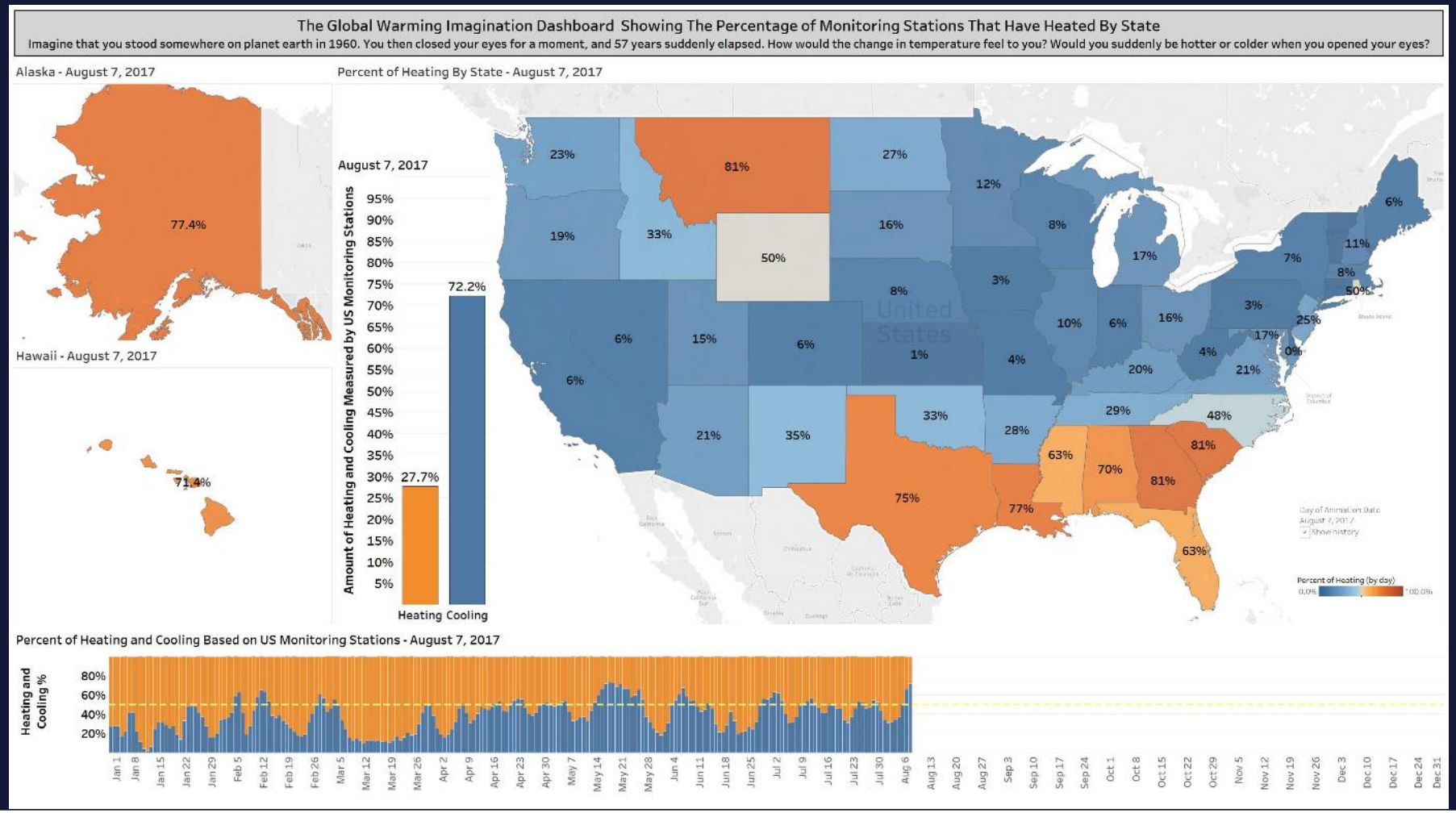
March 11

SIX DECADES OF NORTH AMERICAN TEMPERATURE CHANGES



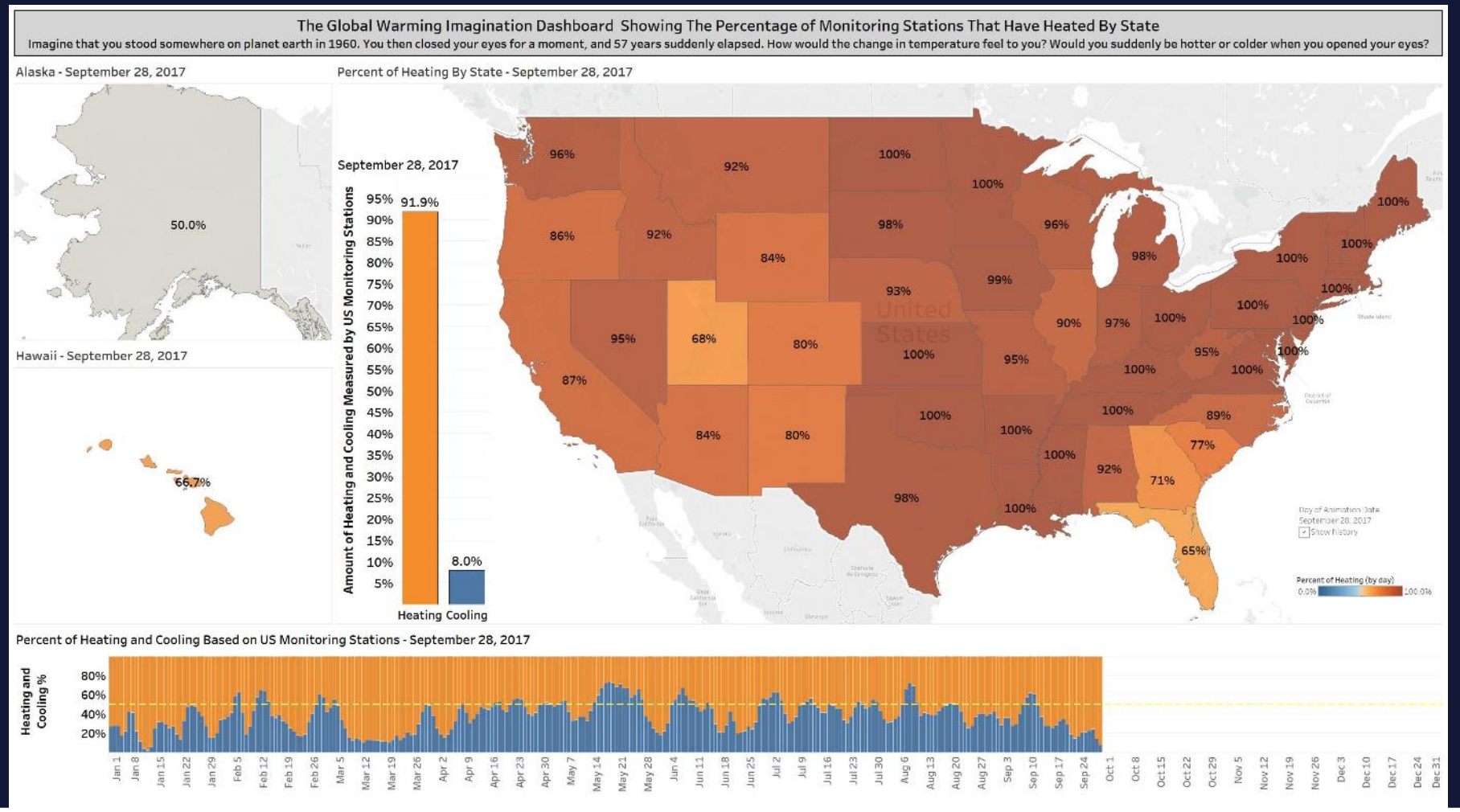
May 17

SIX DECADES OF NORTH AMERICAN TEMPERATURE CHANGES



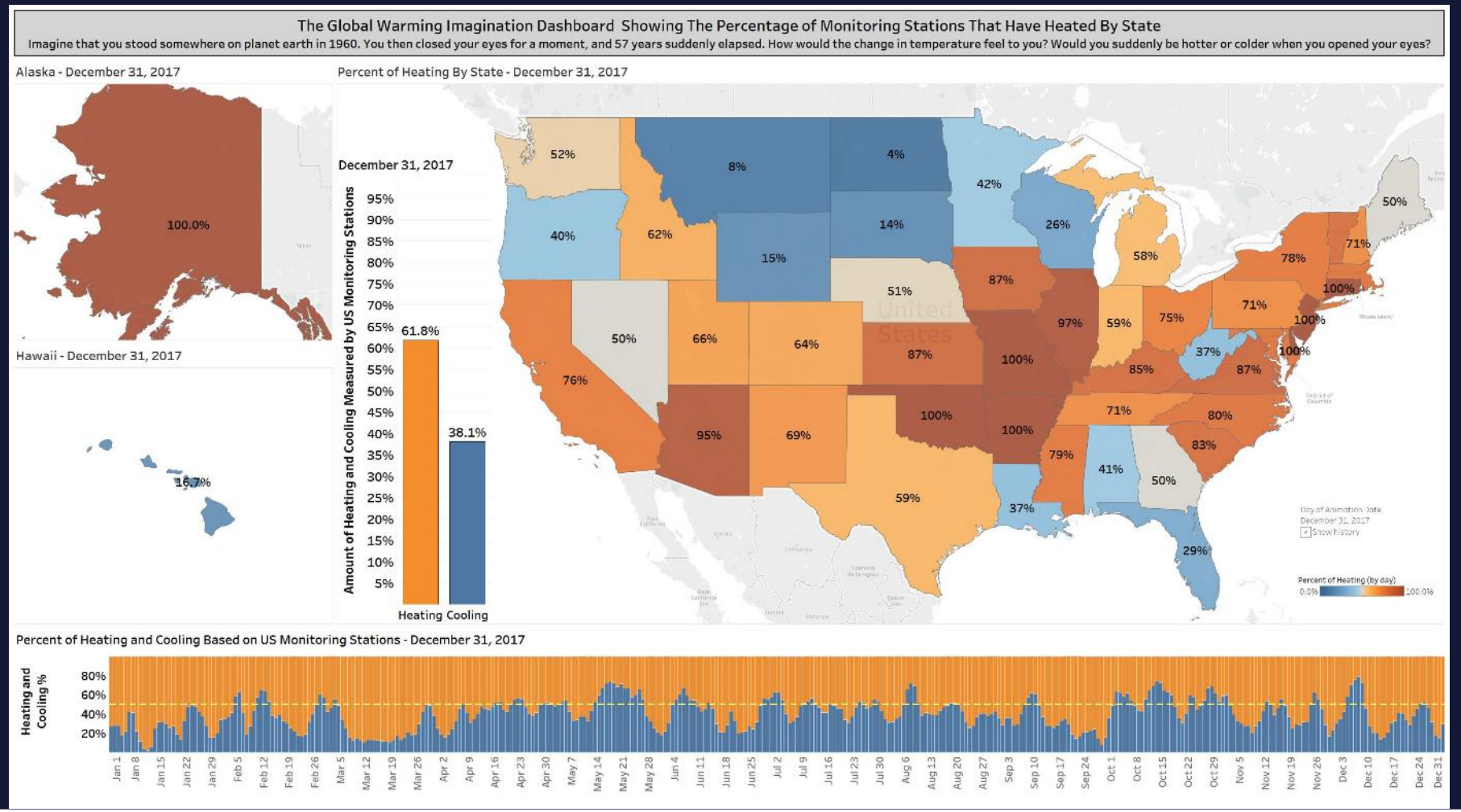
August 7

SIX DECADES OF NORTH AMERICAN TEMPERATURE CHANGES



September 28

SIX DECADES OF NORTH AMERICAN TEMPERATURE CHANGES



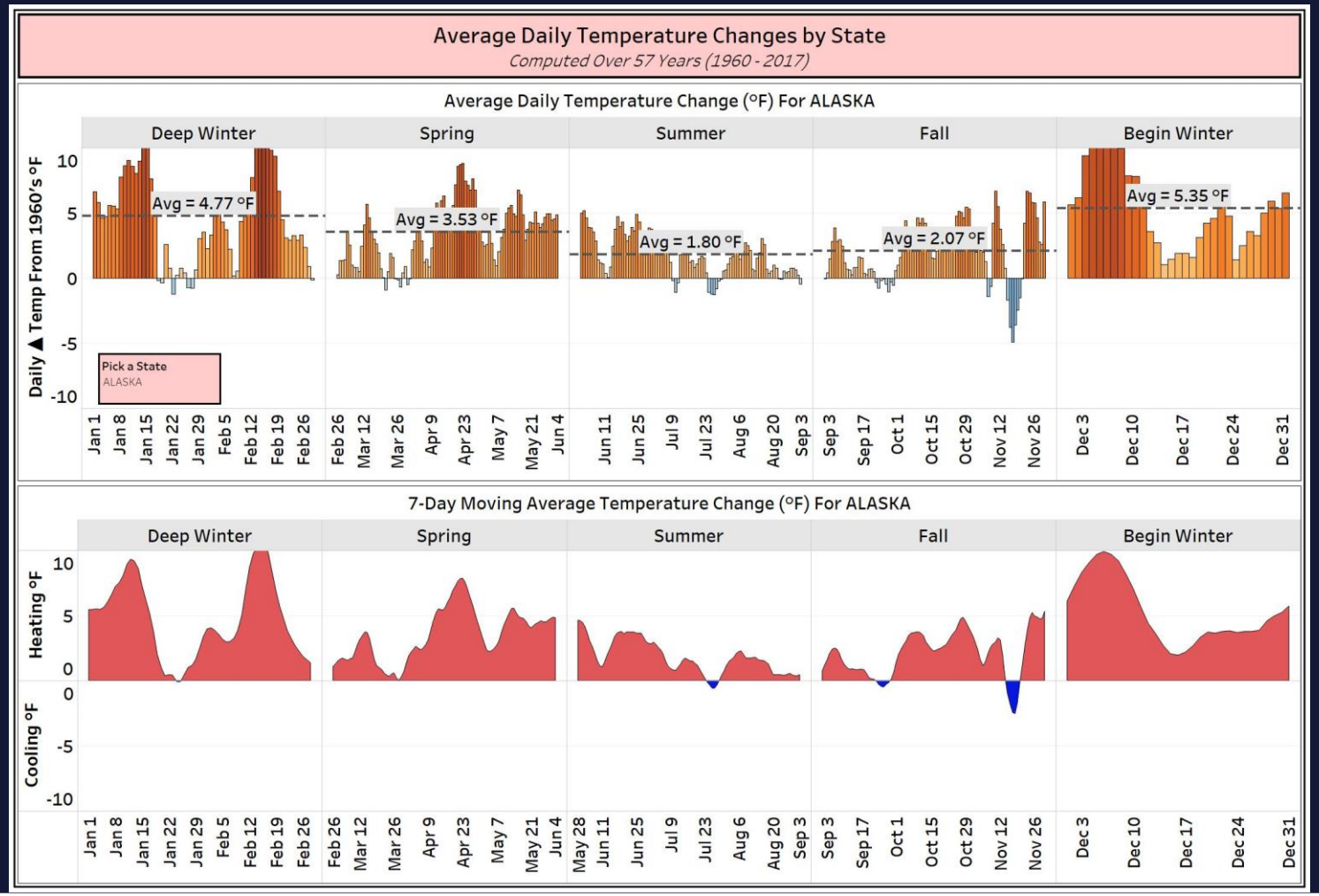
December 31

SIX DECADES OF NORTH AMERICAN TEMPERATURE CHANGES

Now the focus will stay in North America

Temperature changes are now shown as actual values and as 7-day moving averages

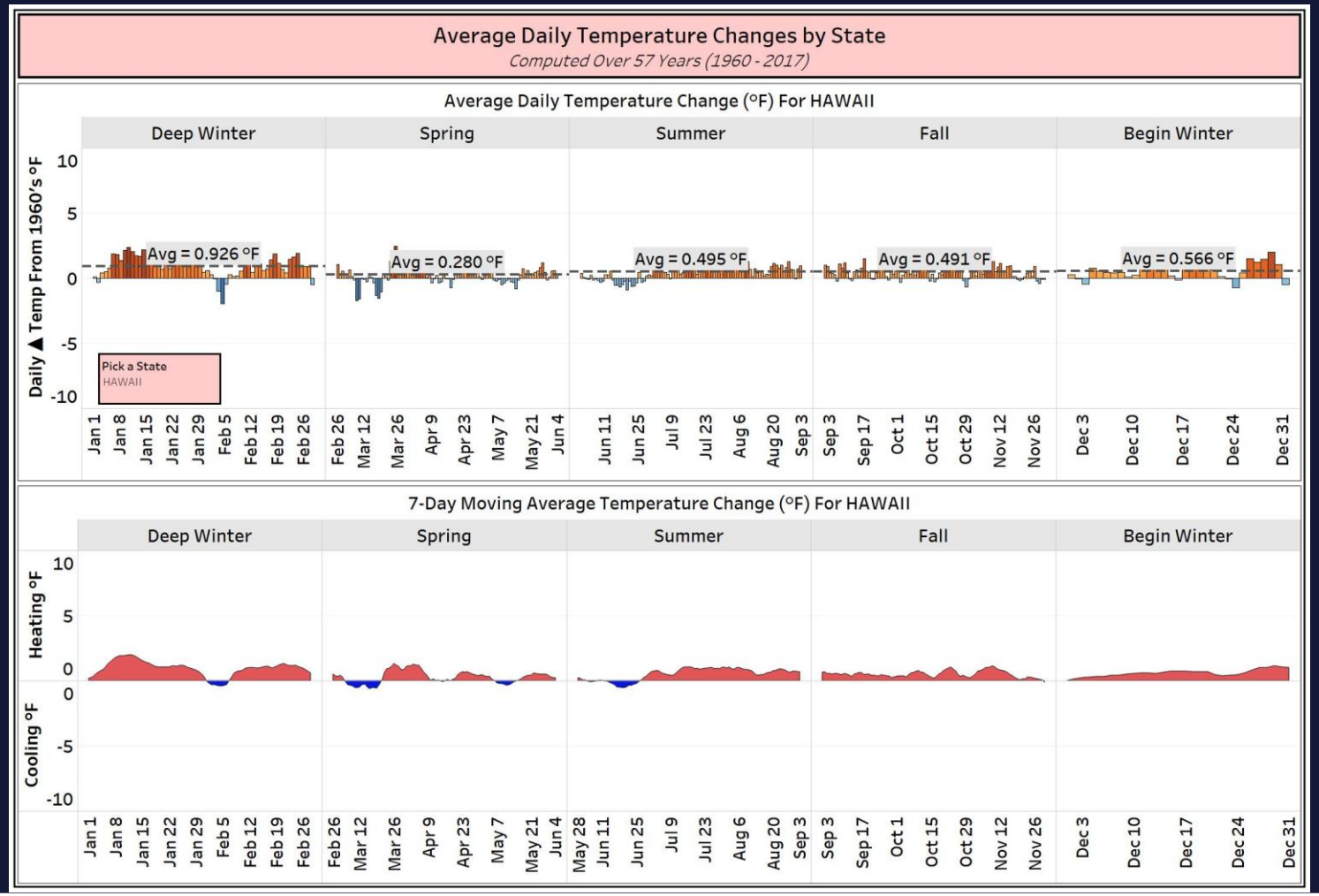
SEASONAL NORTH AMERICAN TEMPERATURE CHANGES



Most Heating

Alaska

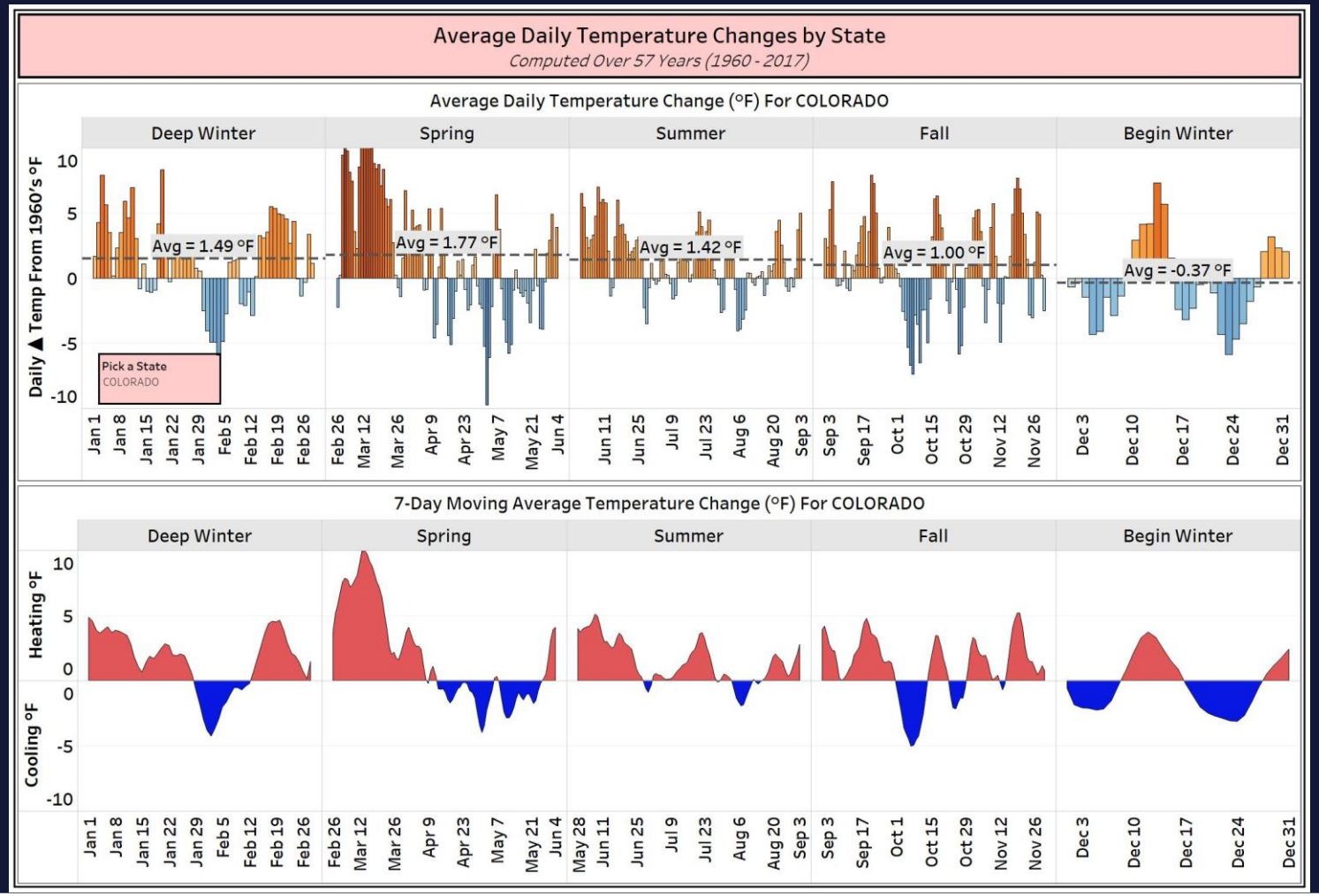
SEASONAL NORTH AMERICAN TEMPERATURE CHANGES



Least Heating

Hawaii

SEASONAL NORTH AMERICAN TEMPERATURE CHANGES



Interesting Effect:
Late Season Snowfall

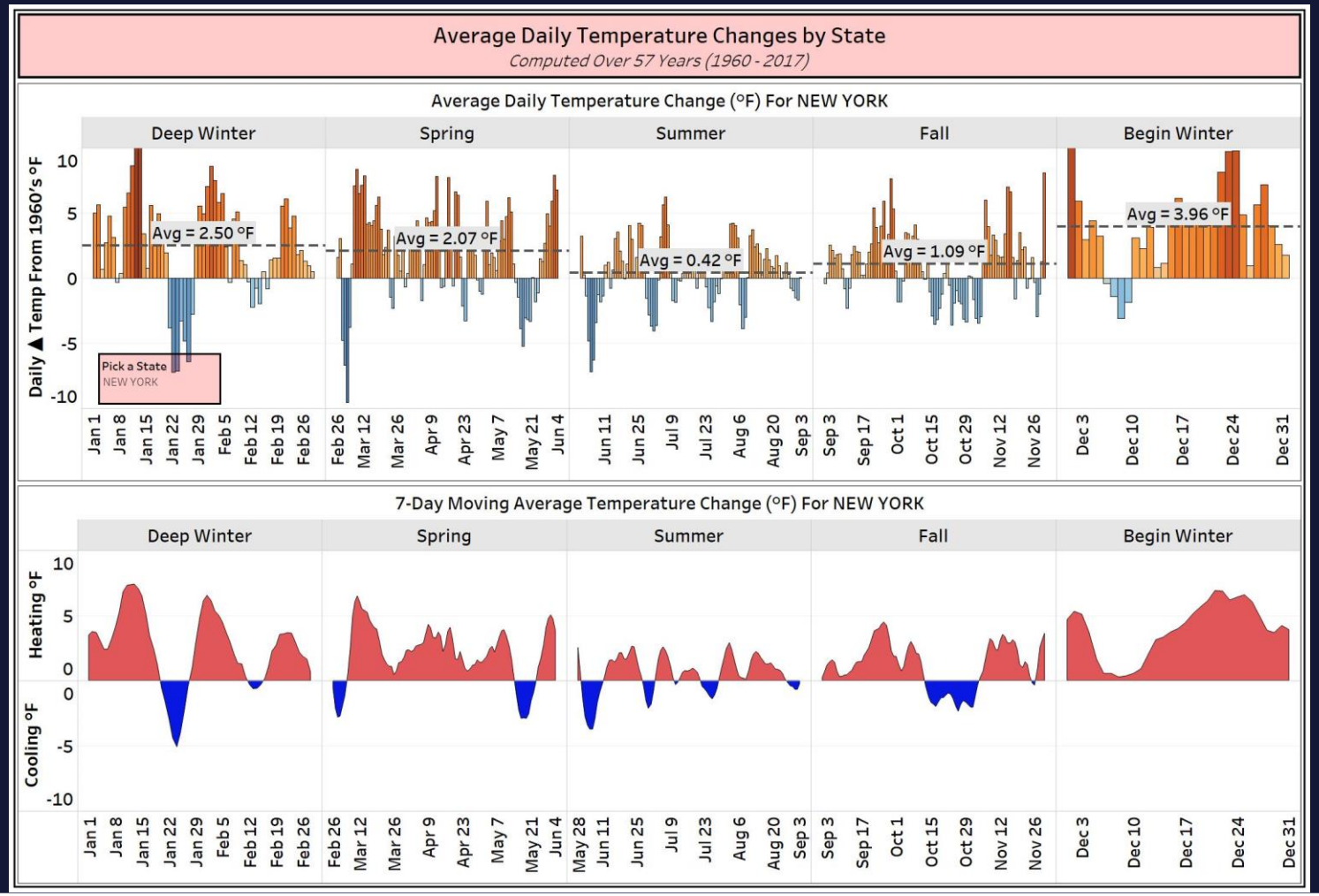
Colorado

SEASONAL NORTH AMERICAN TEMPERATURE CHANGES

Interesting Effect:
Late Season Snowfall
On May 23rd Rocky Mountain NP

Colorado

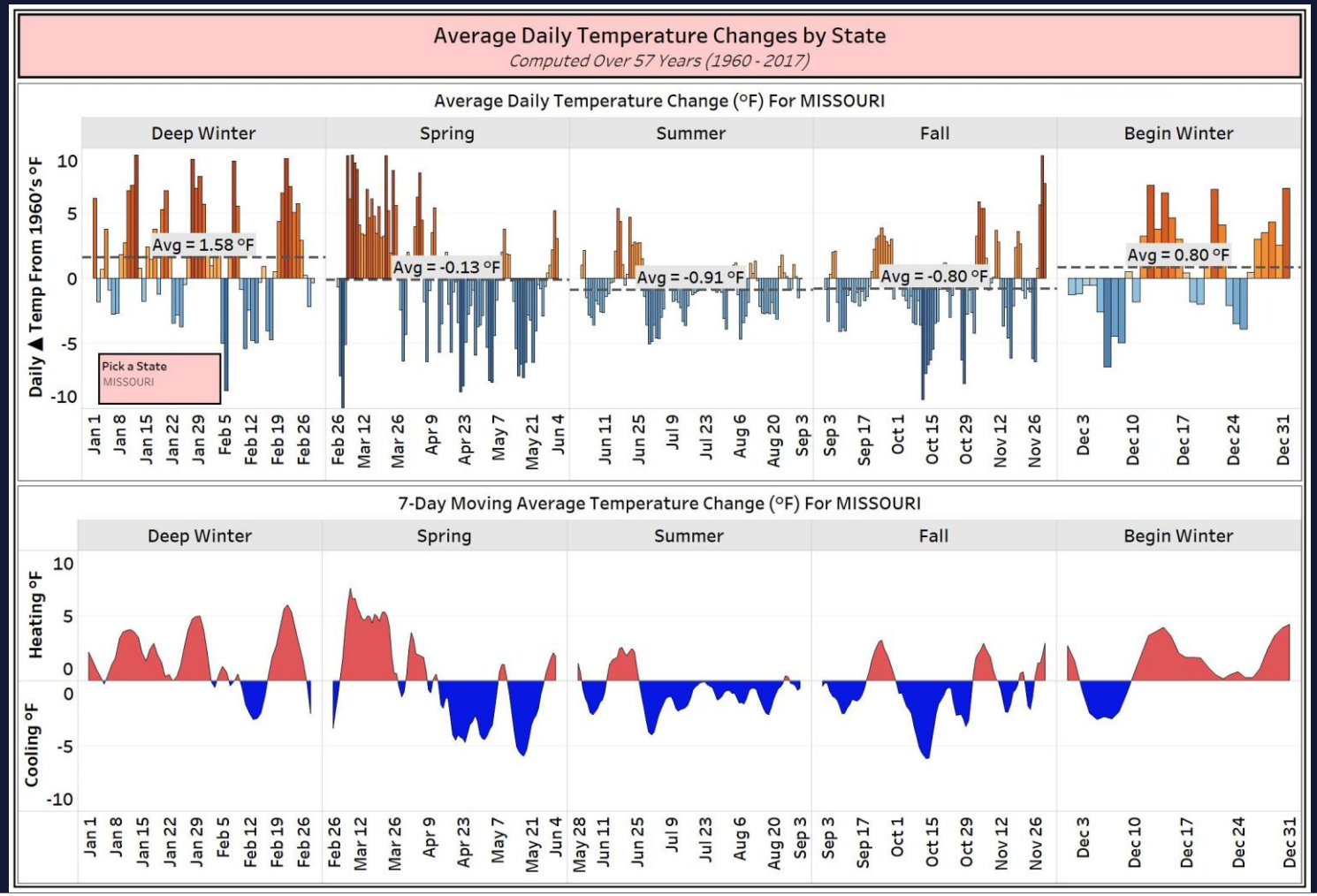
SEASONAL NORTH AMERICAN TEMPERATURE CHANGES



Interesting Effect: Significant Winter Heating

New York

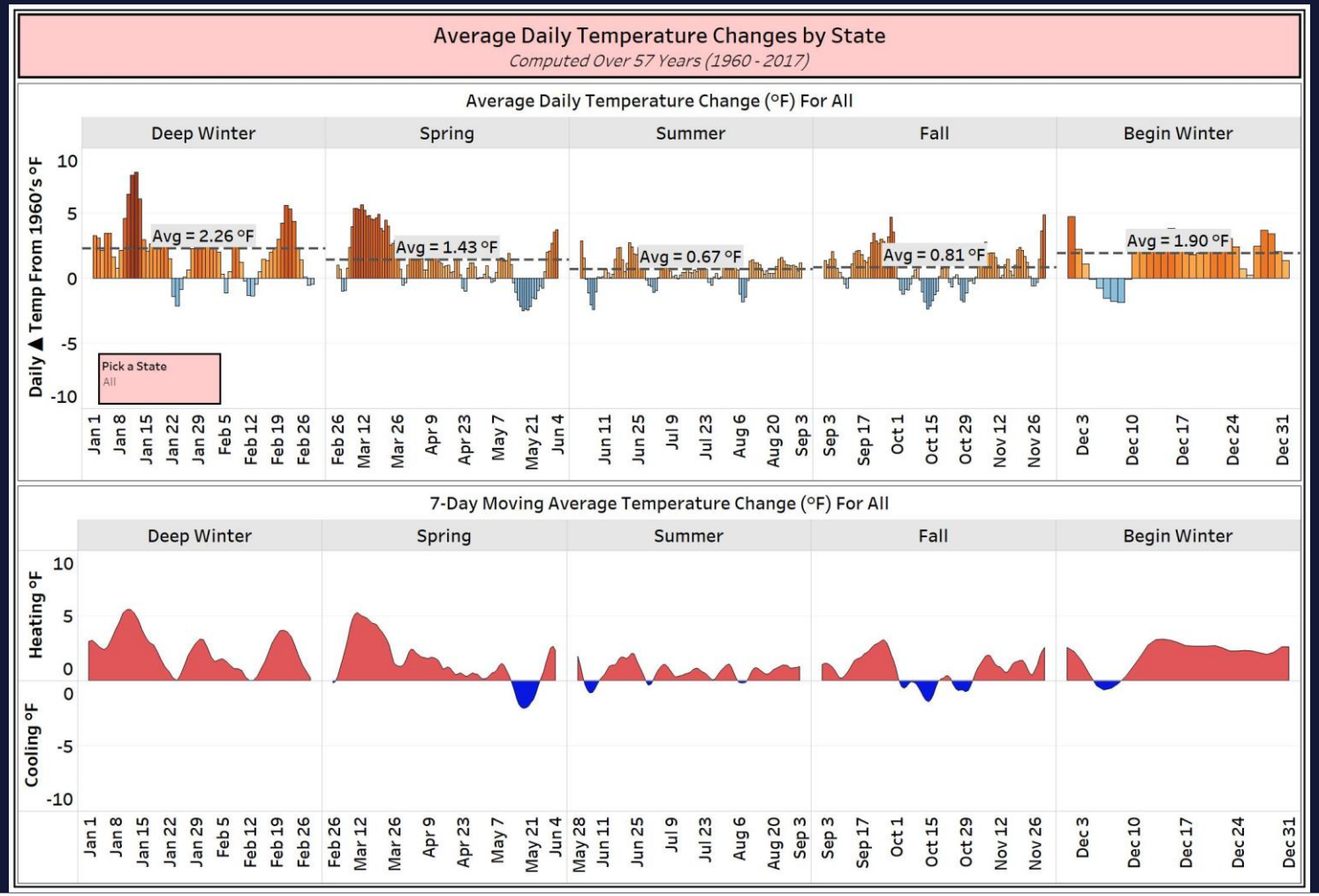
SEASONAL NORTH AMERICAN TEMPERATURE CHANGES



Interesting Effect:
Cooling Summers

Missouri

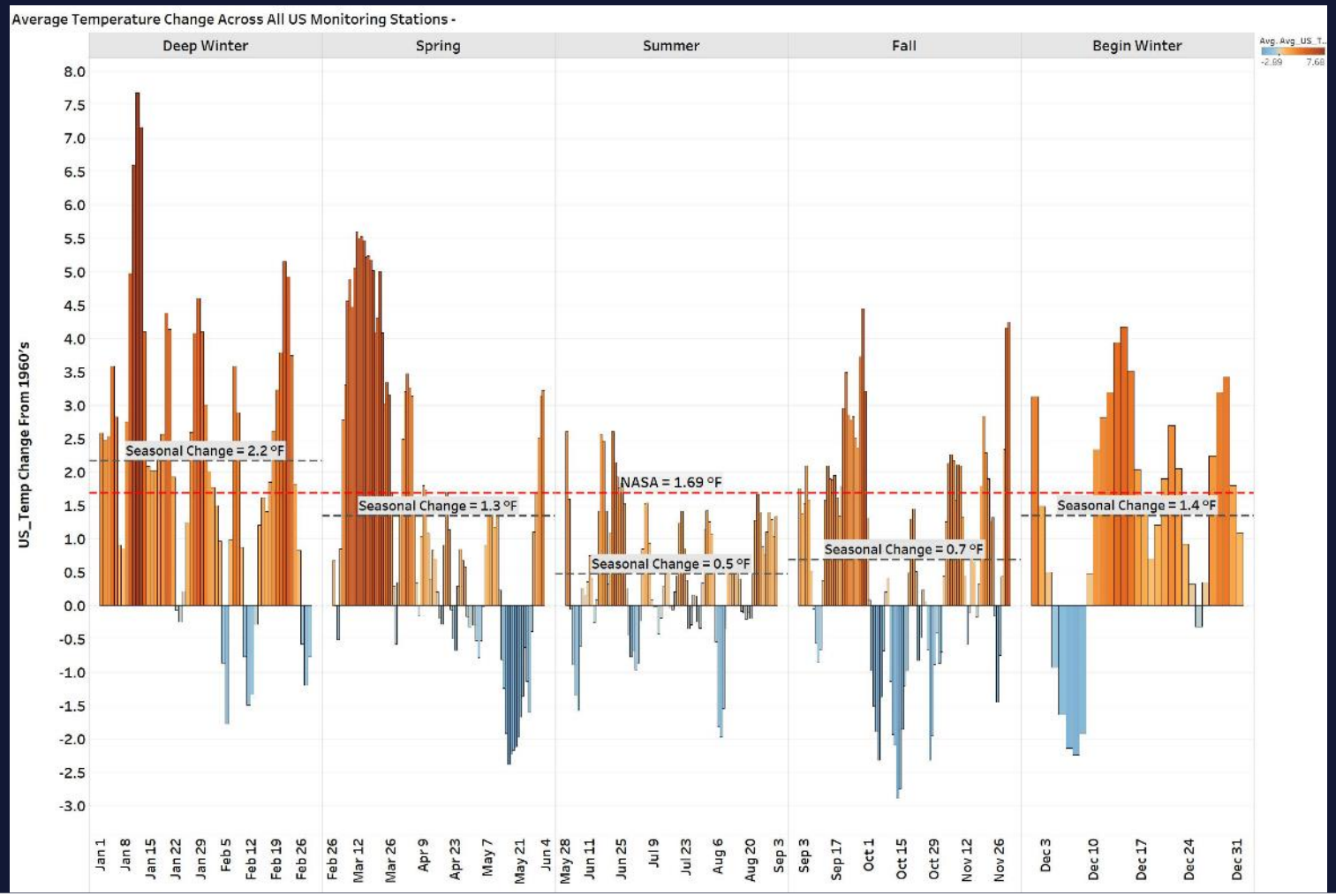
SEASONAL NORTH AMERICAN TEMPERATURE CHANGES



The US temperature changes are shown across the seasons

All States

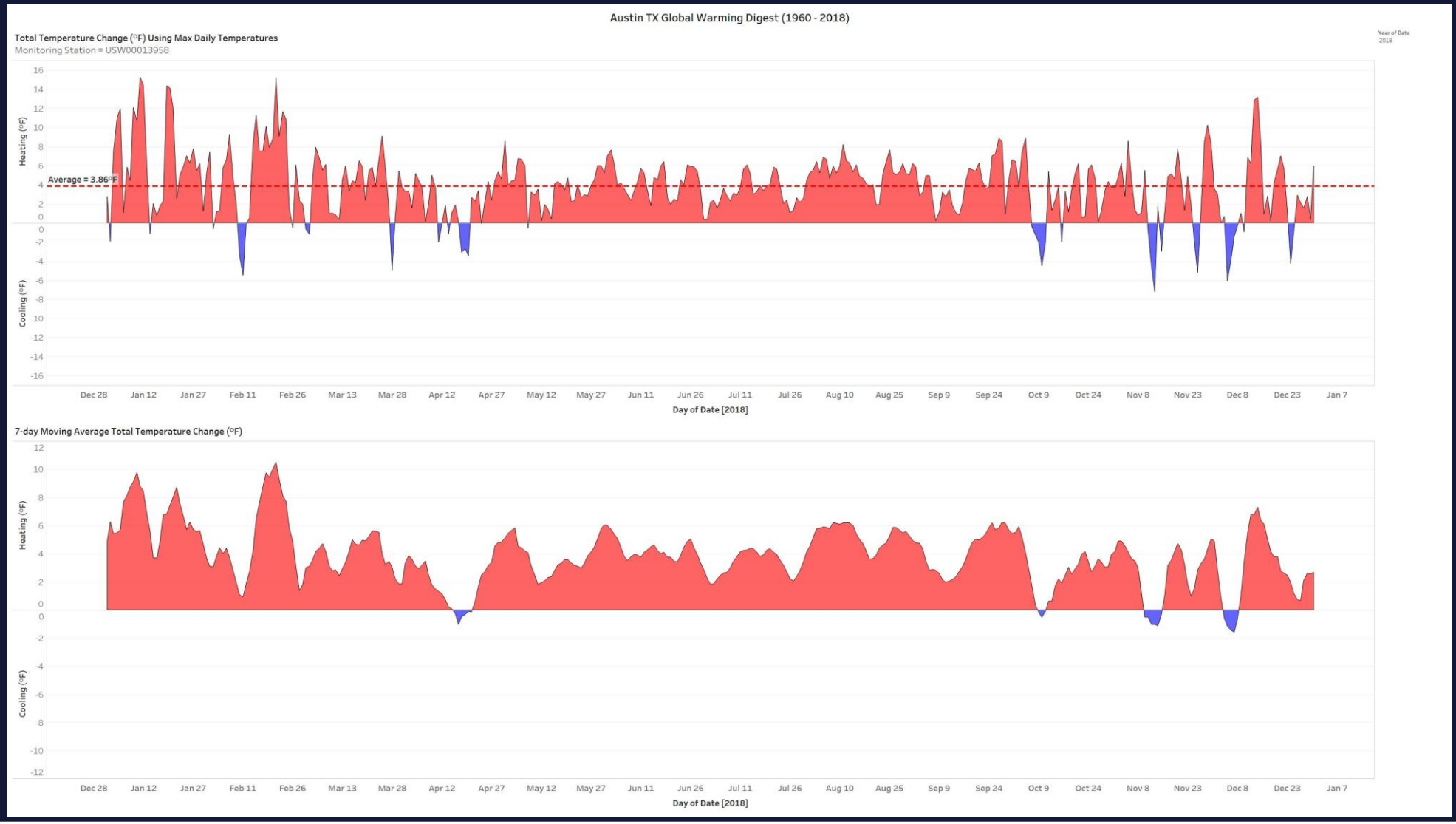
SEASONAL NORTH AMERICAN TEMPERATURE CHANGES



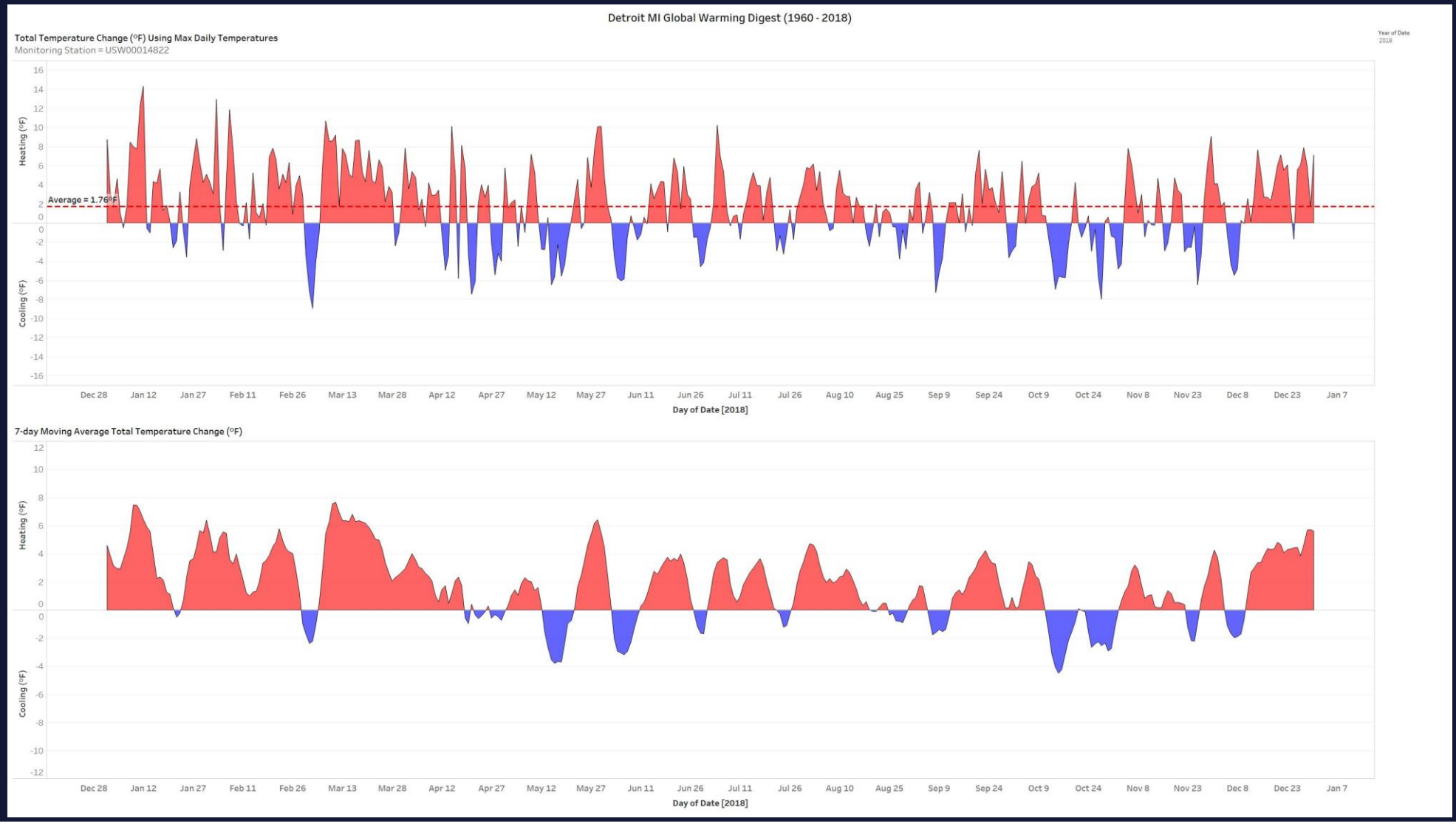
The US temperature changes are shown across the seasons

We can now understand how the daily variations relate to the NASA 1.69 degree F of global change

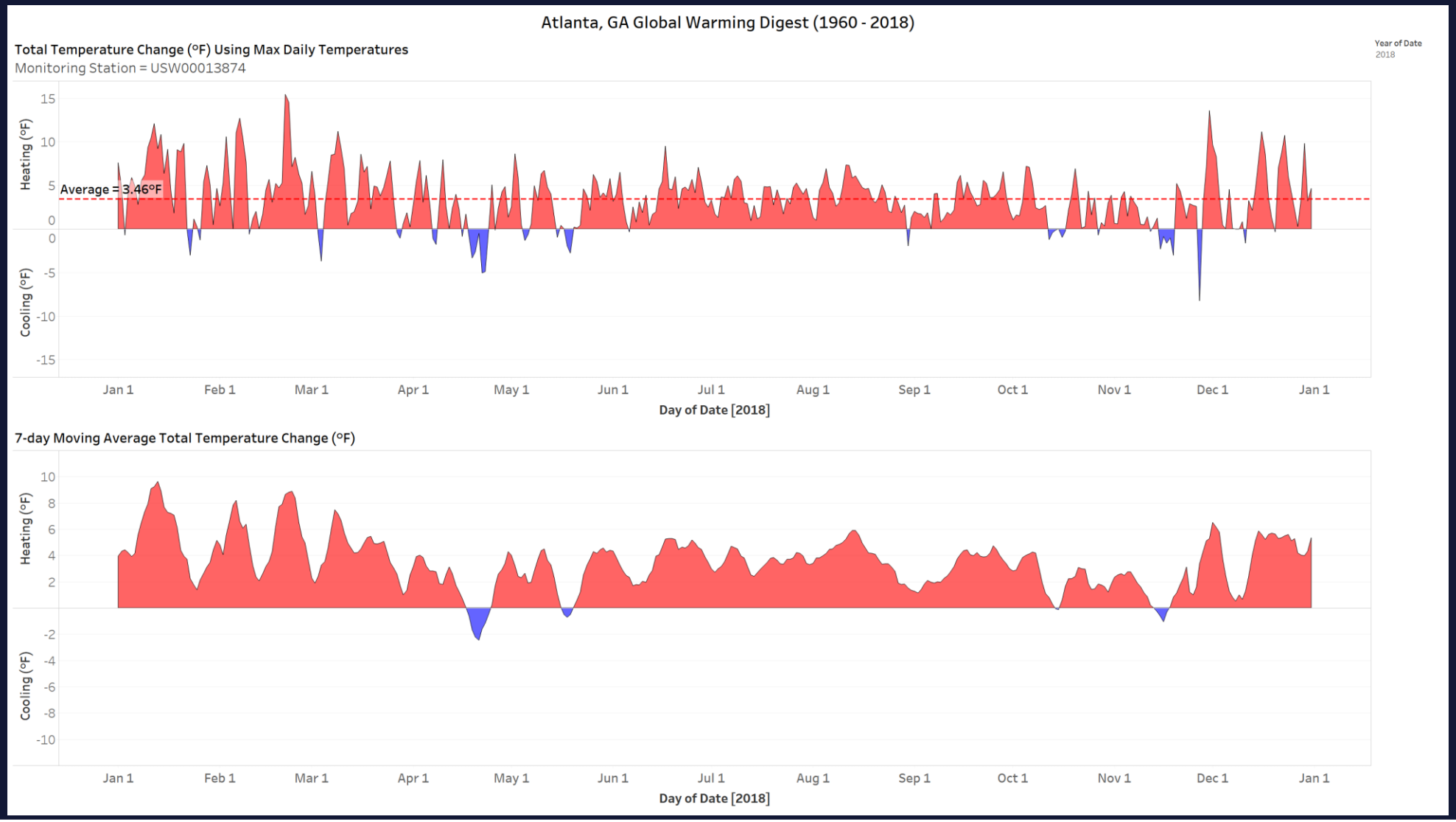
AUSTIN TEMPERATURE CHANGES



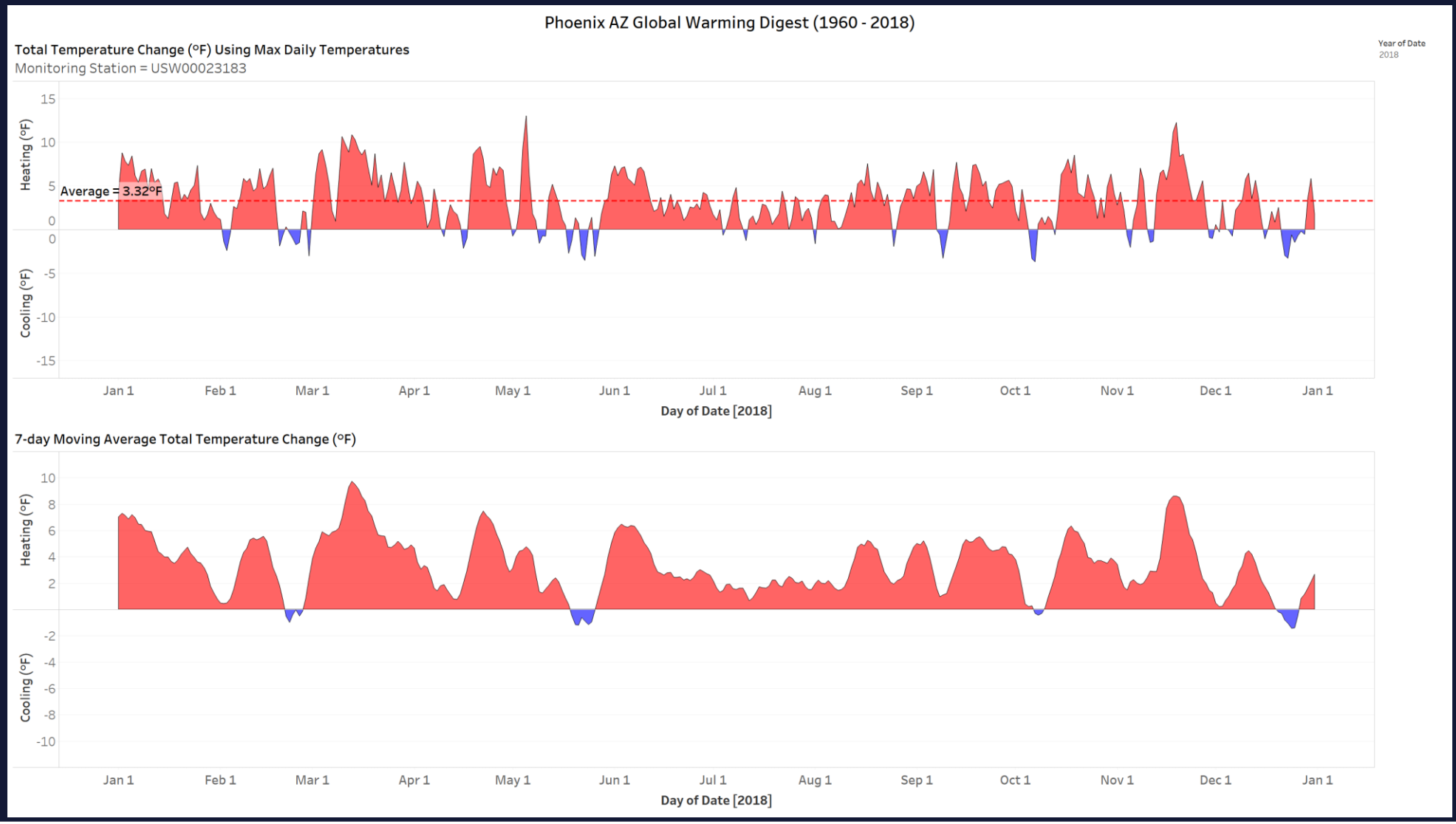
DETROIT TEMPERATURE CHANGES



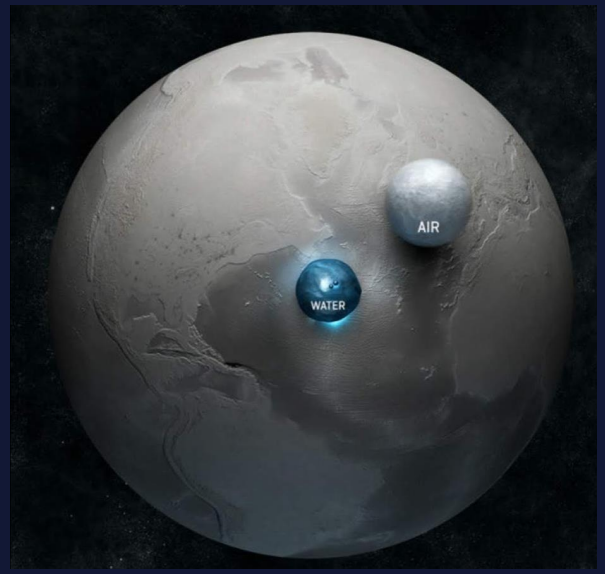
ATLANTA TEMPERATURE CHANGES



PHOENIX TEMPERATURE CHANGES



FIVE KEY POINTS



1. Global Warming Is Real
2. Warming and Cooling Are Spatially and Temporally Variable
3. Long-term Changes Can Be Understood at the Daily Level
4. Alteryx Crushes Massive Amounts of Data
5. Tableau is Superb At Helping Us Understand Our Data

GLOBAL WARMING IS REAL

- A lot of data was used to comprehend spatial and temporal changes in daily temperatures across the world
- Over 100M data points and 2M linear models tell the story
- There is a lot of consistency in what is happening over time
- What causes those changes is up for debate

THANK YOU

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