Lauren Wong
INFO 474
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Final Project Overview

User Tasks:

1. As a policy maker, I want to show how the difference between the actual daily mean temperatures from July 2014 to June 2015 and the average daily mean temperatures has changed in cities across the US so that I can call more attention to the worsening effects of climate change and persuade others about the need to implement more policies to combat and reduce these effects.
   a. Abstract Task: Present trends on the daily temperature anomalies .
2. As a climatologist, I want to use temperature data from July 2014 to June 2015 to get the daily temperature anomalies for cities across the US so that I can better understand how the temperature anomalies have changed in that time frame and use this knowledge to inform areas for future research focused on investigating the effects of climate change and how extreme the temperatures are compared to the average daily temperatures.
   a. Abstract Task: Derive trends for the daily temperature anomalies using the daily average mean temperatures and actual mean temperatures.
3. As a weather forecaster, I want to see the times of the year when our city was abnormally hot or cold by looking for periods when the temperature anomalies were significantly large (either positive or negative) so that I can better inform those living within my local community about the variation between the actual temperatures and the average temperatures.
   a. Abstract Task: Discover features (days of the year that were warmer or cooler) in the temperature anomalies.
4. As a climatologist, I want to summarize the daily temperature anomaly trends for the whole year or specific portions of it (e.g. month(s), week(s), etc.) so that I have a better sense of what the overall average temperature anomaly is and what is the range (min and max) of the temperature anomalies within those periods.
   a. Abstract Task: Summarize trends for the daily temperature anomalies for different parts of the year or the entire year.
5. As a climate activist, I want to compare the daily temperature anomaly trends between major US cities so that I am more informed on the effects that climate change and global warming has had on the US as a whole and so that I can work with fellow activists across the US to call for better and stronger actions and policies that fight against the negative impacts from the climate crisis.
   a. Abstract Task: Compare trends for the daily temperature anomaly in major US cities
6. As a climatologist, I want to look for specific times of the year when multiple US cities were warmer or cooler than average by looking for larger positive and negative temperature anomalies so that I can understand which parts of the US reached

abnormally warm or cool temperatures that year, when they reached those temperatures, and make comparisons between the cities to understand how climate change impacts parts of the US differently than others.
   a. Abstract Task: Compare features (days of the year that were warmer or cooler) in the temperature anomalies between different US cities
7. As a weather forecaster, I want to look at the days when we had extreme temperature anomalies in my city so that I can help those living within my local community stay informed about these extreme weather events and help them better prepare for more extreme weather events in the future.
   a. Abstract Task: Identify outliers and extremes in the temperature anomalies
8. As a student learning about climate change, I want to explore how the difference between the actual daily mean temperatures from mid 2014 to mid 2015 and the average daily mean temperatures has changed so that I can gain a better understanding of how climate change is impacting the city I live in.
   a. Abstract Task: Explore trends in the temperature anomalies
9. As a weather forecaster, I want to look up the temperature anomalies and the average and actual mean daily temperature for specific days of that year so that I can use those values to show viewers just how extreme the temperatures are getting in our city.
   a. Abstract Task: Lookup specific values in the data.

Design Overview:

The communicative objective of this visualization is to show how the difference between the average daily mean temperature since 1880 and the actual mean temperature has changed in cities across the United States for each day between July 2014 and June 2015. This difference between the average and actual mean temperature recorded on that day is the temperature anomaly. In particular, I wanted to make sure that this visualization would help users understand the overall trends in the temperature anomalies within that year and how much the actual temperatures differed from the average. I also wanted to help them gain additional insight into which months, weeks, or days were significantly warmer or cooler than usual and get a sense of how big or small these temperature anomalies are. This is why, in addition to the graph itself, I added the tooltip functionality and the brushing/summary functionality to help them get values that they can use to understand the data better.

I think that presenting this information as a visualization is important and useful because extreme weather is becoming more common as a result of climate change and global warming. Additionally, using temperature anomalies are a good way for us to better understand, describe, and compare abnormally warm or cool temperatures because they compare it to some baseline for each city rather than using absolute temperatures. This is useful so that we can be more informed and work towards more ways to address the issue of extreme temperatures and climate change.

I chose to represent this information using a bar chart with one bar for each day so that I could clearly show the differences between the positive and negative daily temperature anomalies. The heights of the bars correspond to their temperature anomaly measured in ℉. They also have a 0 baseline, where if it is above the line it is a positive temperature anomaly and if it is below the line it is a negative temperature anomaly. I purposefully chose to use red for above average temperatures and blue for below average temperatures because those colors align with what we would typically associate with hot and cold temperatures. I also kept the colors used in the summary box on the right similar so that it remains consistent for users to easily identify whether it is a positive or negative temperature anomaly.

In terms of interactivity, I included three main features to allow for comparison between cities, help make the chart easier to read, and help users gain additional insights. First, I wanted to ensure that users could view and compare the temperature anomaly trends for different cities across the US, so I added a dropdown for users to select which cities they want to display. Second, I knew that it would be difficult to determine the exact dates and temperature anomaly values for the bars just using the axes alone, so I included tooltips to provide specific information for that day. These tooltips include information on the date and the temperature anomaly, average temperature, and actual temperature on that day. Finally, I chose to add a summary box on the right to provide some simple, yet useful statistics on their selected date range (where the default is the entire year). I did this because this information would be useful for viewers to get a general understanding of the values in the data and in the time frame they select without needing to hover over each of the bars to get that information. These summary statistics include the average temperature anomaly and the warmest and coldest temperature anomaly for the range.

There are several analytical questions that can be addressed with this design, such as: How has the trend in the temperature anomalies changed from July 2014 to June 2015? When has a certain city experienced abnormally warm or cold temperatures? When have multiple cities experienced more extreme temperatures than usual? What was the temperature anomaly, average mean temperature, and actual mean temperature on this day? What was the average and range of temperature anomalies for the whole year? What was the average and range of temperature anomalies from date A to date B? Which day was the warmest in comparison to the average? Which day was the coldest in comparison to the average? How do the temperature anomaly trends between these US cities compare to each other? How do the average and range of temperature anomalies for a specific time frame compare to each other? How does the temperature anomaly, average mean temperature, and actual mean temperature on this day compare to those in other cities?

User Interface:

    1. **Overview of the layout**
This screenshot shows the page when it is first loaded. Towards the top, we have a dropdown menu for users to choose whether they want to display all cities on one page or they want to

focus on just one. Directly underneath that, we have a legend to clearly indicate which colors are associated with whether we had a positive temperature anomaly or a negative one in case the color choices were not very clear. The rest of the page is filled with the daily temperature anomaly charts for each city and the summary statistics for each of them on the right in a gray box. By default, the gray box will show the average and the range of temperature anomalies for the entire year. But, as I explain later, those values can be changed to show the average and range of temperature anomalies for parts of the year a user selects using a d3 brush.
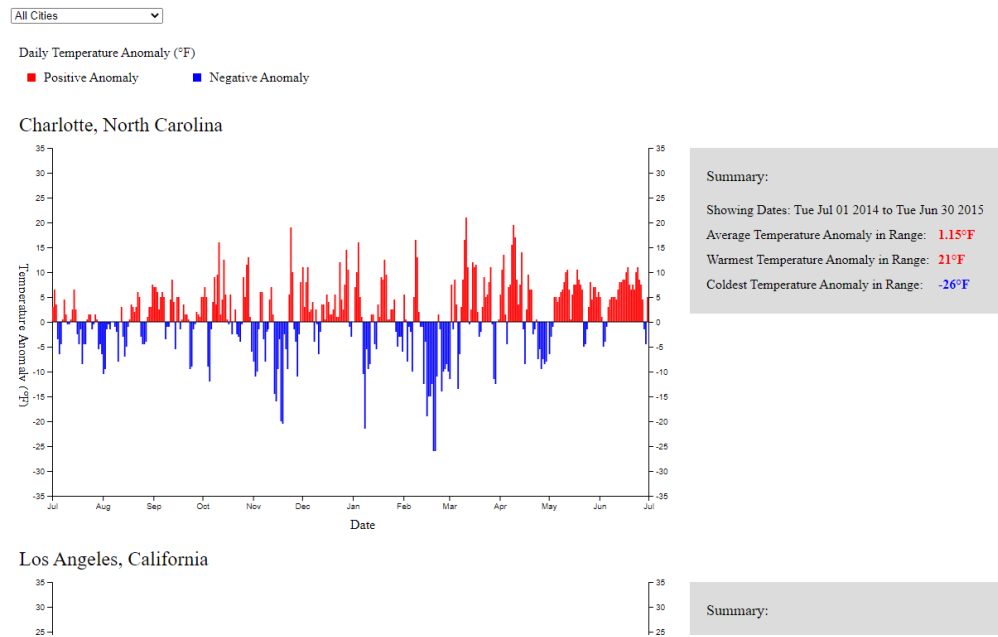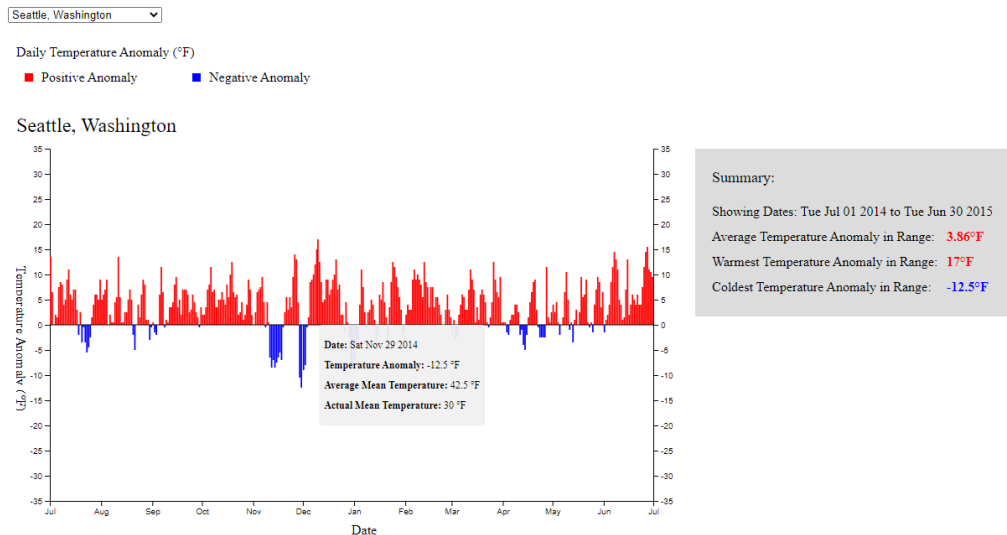

2. Tooltips

This is a screenshot showing what the visualization looks like when the user hovers over a bar in the chart for a certain day and a tooltip pops up. The tooltip will show the date as well as the temperature anomaly, average mean temperature, and actual mean temperature for that day.

In cities across the United States, how have the actual daily temperatures from July 2014 to June 2015 differed from the average daily temperatures?

This is an interactive visualization showing the daily temperature anomaly between July 2014 to Jun 2015 for various cities across the US. The daily temperature anomaly is the difference between the actual mean temperature for each day between July 2014 to Jun 2015 and the average mean temperature on that day since 1880.

Seattle, Washington ▾

Daily Temperature Anomaly (°F)

■ Positive Anomaly   ■ Negative Anomaly

Seattle, Washington

Summary:

Showing Dates: Tue Jul 01 2014 to Tue Jun 30 2015
Average Temperature Anomaly in Range: **3.86°F**
Warmest Temperature Anomaly in Range: **17°F**
Coldest Temperature Anomaly in Range: **-12.5°F**

Date: Sat Nov 29 2014
Temperature Anomaly: -12.5 °F
Average Mean Temperature: 42.5 °F
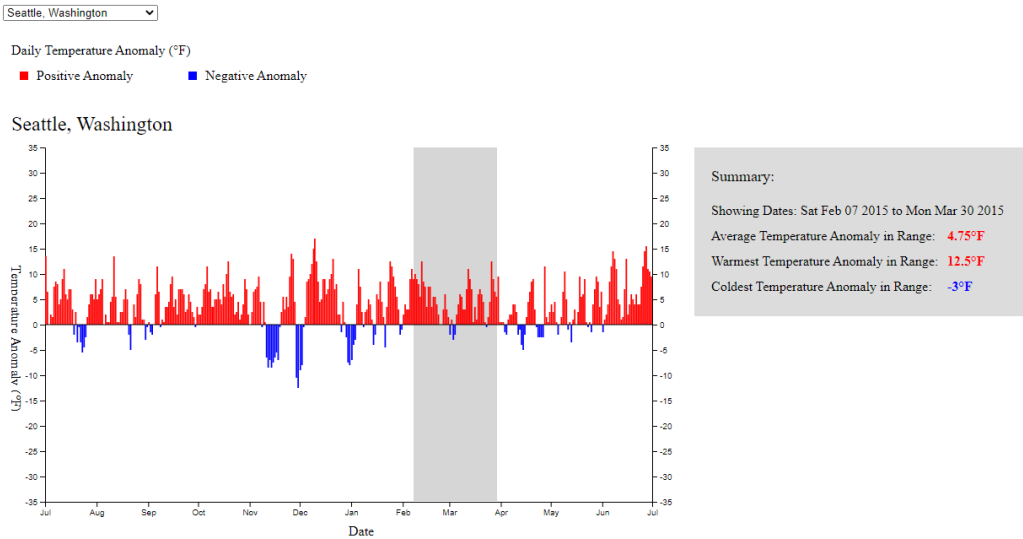Actual Mean Temperature: 30 °F

3. Selecting specific time frames

These are two screenshots showing the brushing functionality that allows users to select a certain range of time within the year and display the average and range for the temperature anomalies within the selected dates. If you compare the summary values in these screenshots (showing a specific time frame selected) with the screenshot for the tooltips in section 2 (showing the values for the entire year), you will see that the values have changed to reflect the average and range within the selected time frame. To make a selection, all the user needs to do is to click and drag to draw a box and select a time frame. Once the box is drawn, they can move that box to different dates or resize it if needed. They can also still access the tool tips of the bars within the selected section.

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Seattle, Washington ▾

Daily Temperature Anomaly (°F)

■ Positive Anomaly   ■ Negative Anomaly

Seattle, Washington

Summary:

Showing Dates: Sat Feb 07 2015 to Mon Mar 30 2015

Average Temperature Anomaly in Range: **4.75°F**

Warmest Temperature Anomaly in Range: **12.5°F**

Coldest Temperature Anomaly in Range: **-3°F**

In cities across the United States, how have the actual daily temperatures from July 2014 to June 2015 differed from the average daily temperatures?

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Seattle, Washington ▾

Daily Temperature Anomaly (°F)

■ Positive Anomaly   ■ Negative Anomaly

Seattle, Washington

Date: Wed Nov 26 2014
Temperature Anomaly: 13 °F
Average Mean Temperature: 43 °F
Actual Mean Temperature: 56 °F

Summary:

Showing Dates: Thu Nov 06 2014 to Sun Dec 07 2014

Average Temperature Anomaly in Range: **0.03°F**

Warmest Temperature Anomaly in Range: **14°F**

Coldest Temperature Anomaly in Range: **-12.5°F**