Final Project

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Overview

We were trying to identify the relationship between climate change the rise of city temperatures across the United States.

Temperature Analysis of Major US Cities

To visualize the temperature trends in major US cities over time, we analyzed the "Climate Change: Earth Surface Temperature Data" dataset (Earth). We focused on six major cities: New York, San Francisco, Los Angeles, Houston, Philadelphia, and Chicago. The analysis involved filtering the data for these cities within the United States, ensuring we had temperature readings from January 1, 1913, onwards. We then calculated the yearly average temperature in Fahrenheit for each city.

The following plots illustrate the average yearly temperature for each of the selected cities, along with a smoothed trend line to highlight the overall temperature progression.

Provenance of Data

Our data set came from Kaggle. There is no author listed for this data source, no sources or collection methodology listed.

FAIR/CARE Principles

FAIR Principles

The data was Findable, Accesable, Interoperable, and Reusable

CARE Principles

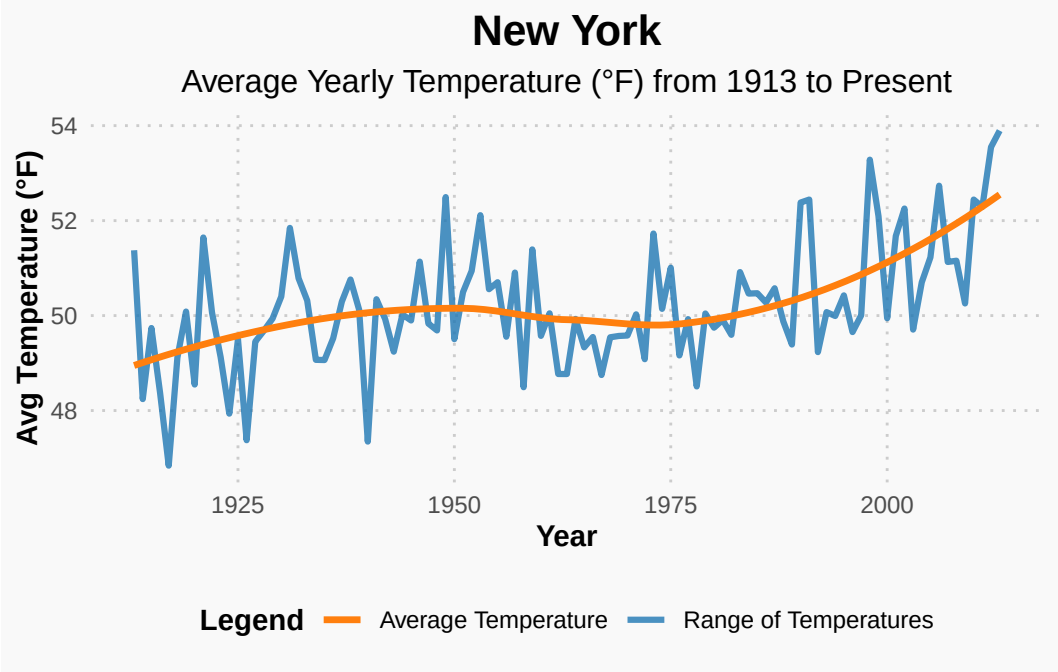
The data benefits the collective benefit; Kaggle does not allow editing of the dataset itself; the data SHOULD have been easy to get without ethical violations

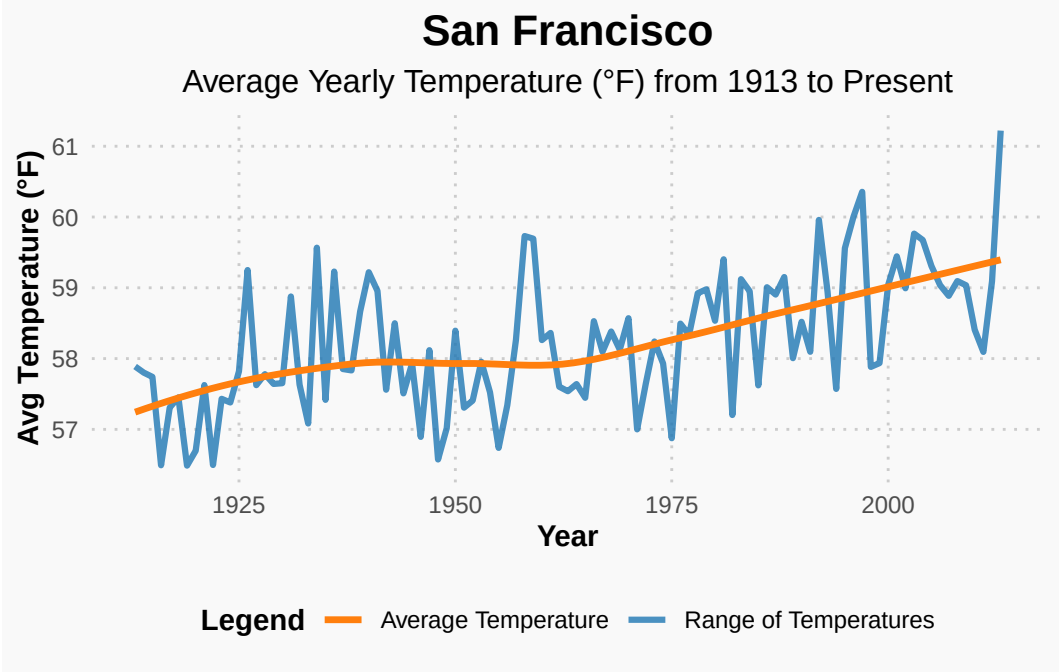
Attributes

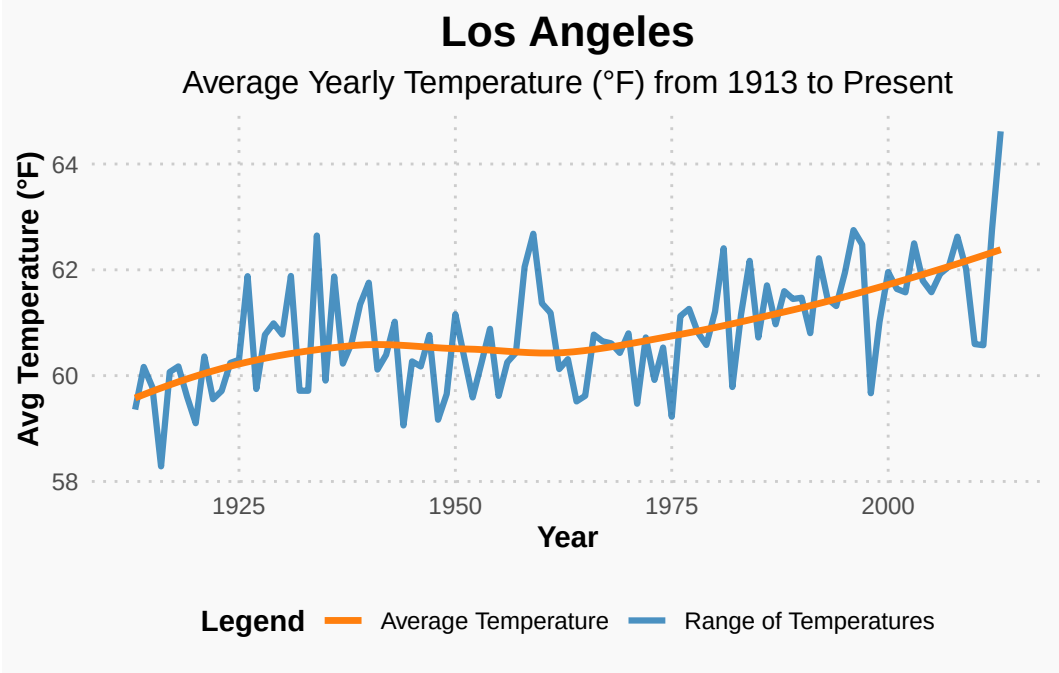
We will focus on the averages over time of 6 cities across the US: Los Angeles, Chicago, San Francisco, Philadelphia, Houston, and New York. We converted the temperatures to Fahrenheit from Celsius, and calculated the averages from there.

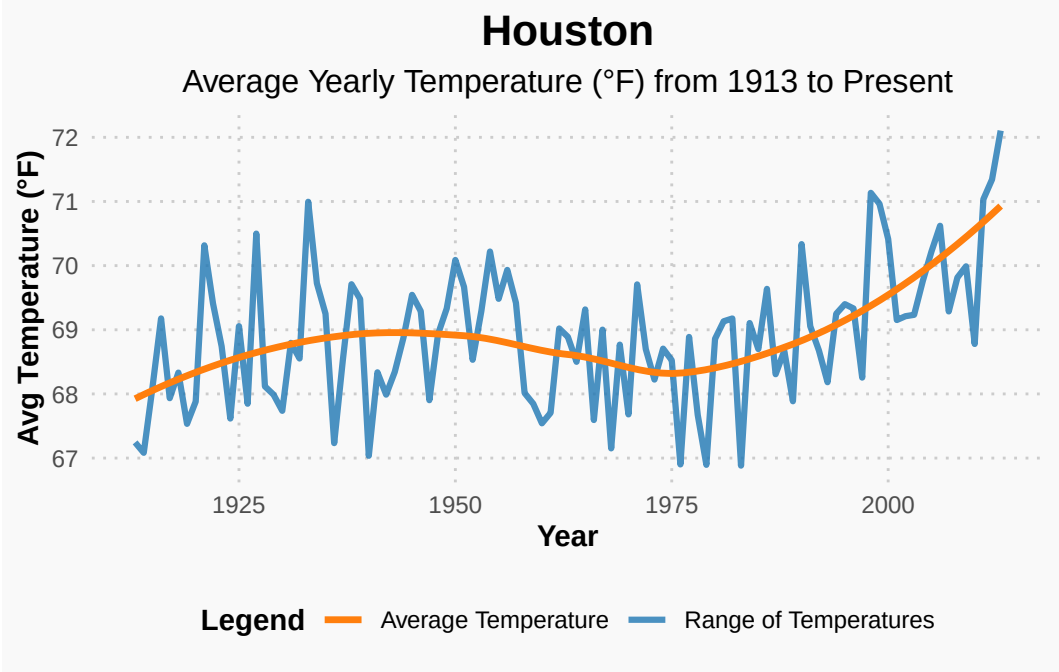
Narrative for Graphs

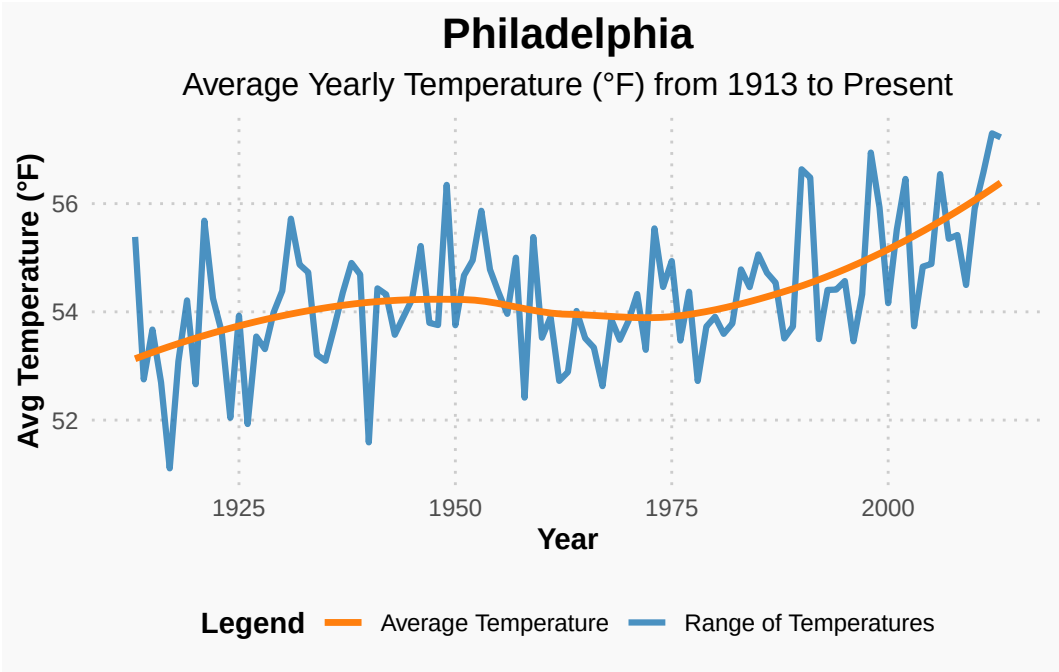
The 6 graphs show the upward trend of average temperatures(F) of the 6 cities across the US from 1913 to 2013. The blue line shows the range of the temperatures when they were taken (twice a year, 6 months apart), and the orange line shows the overall average temperature. Overall, we can see a gradual increase in temperatures over time, which can be caused by climate change, but as these cities grew over this time period, we cannot accurately calculate how much climate change played a role in these changes.

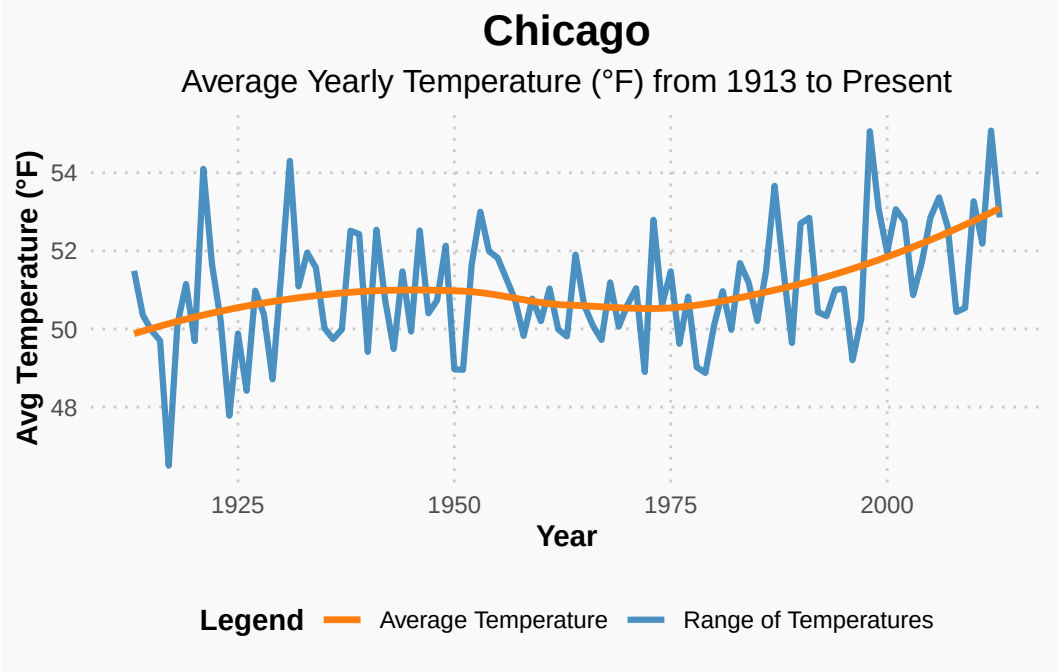



San Francisco
Average Yearly Temperature (°F) from 1913 to Present
Avg Temperature (°F)
61
60
59
58
57
1925
1950
1975
2000
Year
Legend
Average Temperature
Range of Temperatures


Los Angeles
Average Yearly Temperature (°F) from 1913 to Present
Avg Temperature (°F)
64
62
60
58
1925
1950
1975
2000
Year
Legend
Average Temperature
Range of Temperatures


Houston
Average Yearly Temperature (°F) from 1913 to Present
Avg Temperature (°F)
72
71
70
69
68
67
1925
1950
1975
2000
Year
Legend
Average Temperature
Range of Temperatures


Philadelphia
Average Yearly Temperature (°F) from 1913 to Present
Avg Temperature (°F)
56
54
52
1925
1950
1975
2000
Year
Legend
Average Temperature
Range of Temperatures




```r
# Load required libraries
library(tidyverse)
library(lubridate)
library(ggplot2)
library(dplyr)

# Load the dataset
# The file is too big to link in the Git
file_path <- "~/Downloads/archive/GlobalLandTemperaturesByCity.csv"
GlobalLandTemperaturesByCity <- read_csv(file_path)

# Define the cities of interest
target_cities <- c("New York", "San Francisco", "Los Angeles",
                   "Houston", "Philadelphia", "Chicago")

# Filter and preprocess the data
majorCity_globalTemp <- GlobalLandTemperaturesByCity %>%
  filter(City %in% target_cities,
         Country == "United States",
         !is.na(AverageTemperature),
         dt >= as.Date("1913-01-01")) %>%
  mutate(
    Year = year(dt),
```

```
    AverageTemperatureF = (AverageTemperature * 9/5) + 32
  )

# Compute yearly average temperature
yearly_avg_temp <- majorCity_globalTemp %>%
  group_by(City, Year) %>%
  summarize(AvgTemperatureF = mean(AverageTemperatureF, na.rm = TRUE), .groups = 'drop')

# Fancy plotting function
plot_city_temp <- function(city_name) {
  city_data <- filter(yearly_avg_temp, City == city_name) %>%
    arrange(Year) %>%
    mutate(
      RollingAvg = (AvgTemperatureF +
                      lag(AvgTemperatureF, 1) +
                      lag(AvgTemperatureF, 2) +
                      lag(AvgTemperatureF, 3) +
                      lag(AvgTemperatureF, 4)) / 5
    )

  ggplot(city_data, aes(x = Year)) +
    geom_line(aes(y = AvgTemperatureF, color = "Range of Temperatures"), size = 1.1, alpha =
    geom_smooth(aes(y = AvgTemperatureF, color = "Average Temperature"), method = "loess", se
    scale_color_manual(
      name = "Legend",
      values = c("Range of Temperatures" = "#1f77b4", "Average Temperature" = "#ff7f0e")
    ) +
    labs(
      title = paste(city_name),
      subtitle = "Average Yearly Temperature (°F) from 1913 to Present",
      x = "Year",
      y = "Avg Temperature (°F)"
    ) +
    theme_minimal() +
    theme(
      plot.title = element_text(size = 16, face = "bold", hjust = 0.5),
      plot.subtitle = element_text(size = 12, hjust = 0.5),
      axis.title = element_text(size = 11, face = "bold"),
      axis.text = element_text(color = "gray30"),
      legend.title = element_text(face = "bold"),
      legend.position = "bottom",
      panel.grid.minor = element_blank(),
```

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      panel.grid.major = element_line(color = "gray80", linetype = "dotted"),
      plot.background = element_rect(fill = "#f9f9f9", color = NA),
      panel.background = element_rect(fill = "#f9f9f9", color = NA)
    )
}

# Display plots one after another
for (city in target_cities) {
  print(plot_city_temp(city))
}

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  mutate(
    Year = year(dt),
    AverageTemperatureF = (AverageTemperature * 9/5) + 32
  )

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    mutate(
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                      lag(AvgTemperatureF, 1) +
                      lag(AvgTemperatureF, 2) +
                      lag(AvgTemperatureF, 3) +
                      lag(AvgTemperatureF, 4)) / 5
    )

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    geom_smooth(aes(y = AvgTemperatureF, color = "Average Temperature"), method = "loess", se
    scale_color_manual(
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      values = c("Range of Temperatures" = "#1f77b4", "Average Temperature" = "#ff7f0e")
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      x = "Year",
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    theme_minimal() +
    theme(
      plot.title = element_text(size = 16, face = "bold", hjust = 0.5),
      plot.subtitle = element_text(size = 12, hjust = 0.5),
      axis.title = element_text(size = 11, face = "bold"),
      axis.text = element_text(color = "gray30"),
      legend.title = element_text(face = "bold"),
      legend.position = "bottom",
      panel.grid.minor = element_blank(),
      panel.grid.major = element_line(color = "gray80", linetype = "dotted"),
      plot.background = element_rect(fill = "#f9f9f9", color = NA),
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    )
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# Display plots one after another
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```

```
  print(plot_city_temp(city))
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Earth, Berkeley. *Climate Change: Earth Surface Temperature Data*. Kaggle, 2017, %5Bhttps://www.kaggle.com/datasets/berkeleyearth/climate-change-earth-surface-temperature-data%5D(https://www.kaggle.com/datasets/berkeleyearth/climate-change-earth-surface-temperature-data).