Analyzing Weather Data for Climate Change Trends

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Can we make a case for climate change by reviewing hurricane, temperature and droughts data for the past 50 years?

Setting Context

The urgency of the climate change question

Climate scientists have been warning us of a global rise in temperature

Increased carbon emissions over the post industrial revolution and in 20th century

Greenhouse effect and its effects: ozone, rising temps, floods

How easily can we infer this from weather data of last few decades?

1.5 C

Temperature change in last 6 decades

2001-2010

The warmest decade on record

Strange weather patterns

42108/150388

No of threatened marine life

Overview of our analysis

Hurricanes

- We will use 50 years data
- Atlantic Ocean
- Review hurricane category
- Look at the location distribution for landfall events
- Identify frequency over time
- See how this can impact commodities

Droughts

- We will use 50 years data
- Continental United States
- Review droughts by severity
- Look at the location distribution
- Identify frequency over time
- See how droughts can impact commodities

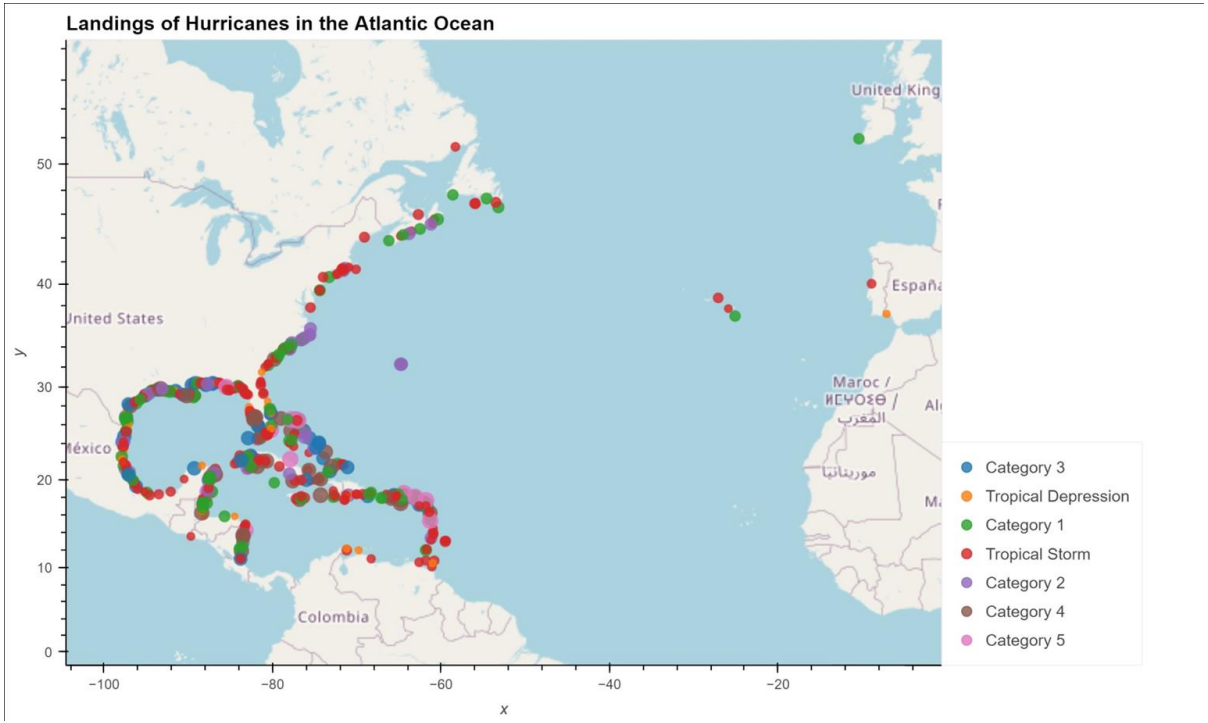
Temperature Extremes

- We will use 50 years' temp data
- British Columbia
- Review the variance in extreme temps over time
- Cross-reference heat data with occurrence of wildfires

Data Analysis - Hurricane

Hurricanes in Atlantic

Figure 1. Shows the occurrence of hurricanes in the Atlantic ocean, if and where they make landfall. The vast majority of hurricanes hit the east coast of US and Mexico.



Our Approach - I

We analyzed hurricane data for the Atlantic over last 50 years

Hurricanes have 7 classifications based on wind speed

We constructed a function to categorize the hurricanes data

We then created a chart to select the hurricane by name to view its progression as it lands in different spots

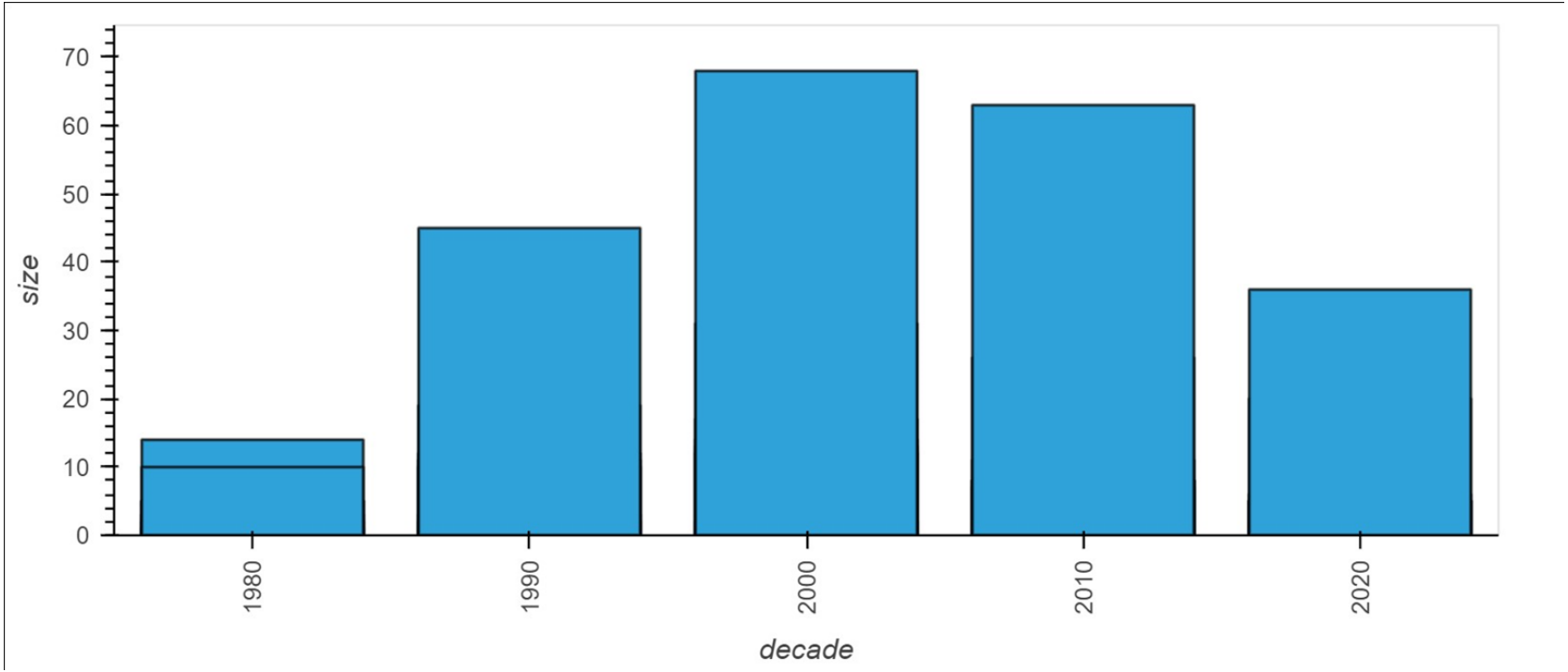
Our Approach - II

We then grouped the data by decade and category of storm

The final dataframe shows the frequency of hurricanes by decade for each category

The final data set was used to create a bar plot to reflect the frequency against the decade

Our findings - I



Our findings - II

The frequency of hurricanes peaked in 2000s slightly dipping in 2010s

Over time the frequency has increased

It’s already halfway the 2000s peak value and we are in early 2020s

Corroborates the fact that hurricanes are caused by warm ocean air rising to create low pressure “vacuum” areas

Intensity has been increasing as well

Data Analysis - Droughts

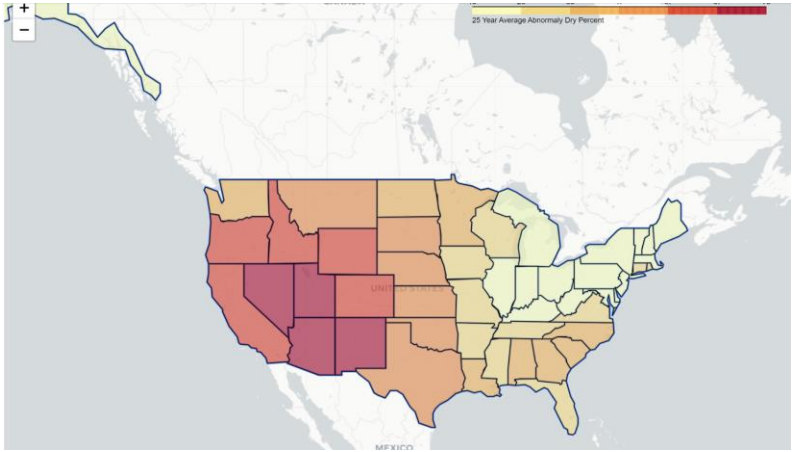
Droughts in United States

We look at historical droughts data to identify trends over time by state to see if:

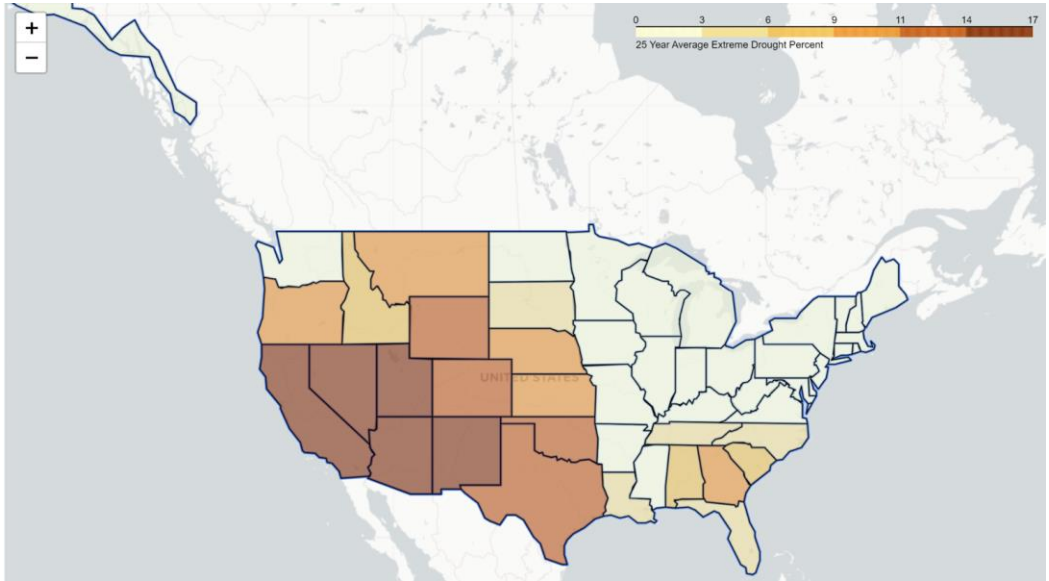
a) Drought intensity has increased over time
b) Where these changes have occurred
c) Drought occurrence has increased over time

Our approach

- Categorize the drought data into 3 types: Abnormally dry, severe drought, extreme drought
- Show the trends over time for each state
- Calculate the mean of the droughts

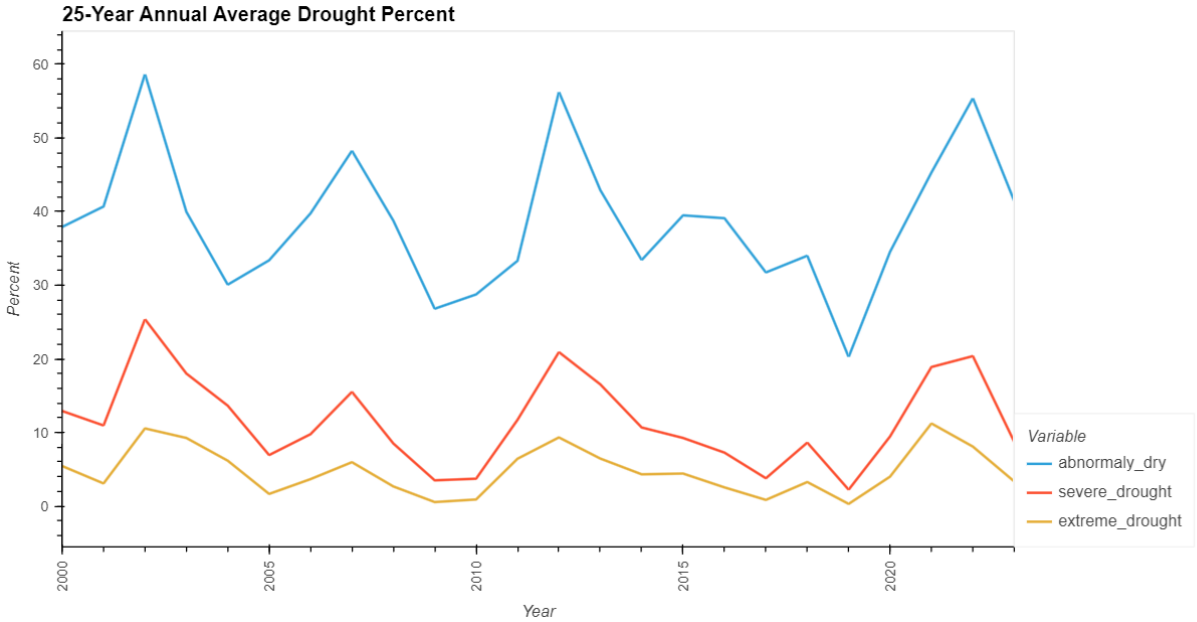


Findings - I



The states that have the highest extreme drought percentage are the Southwestern States and California.

Findings - II



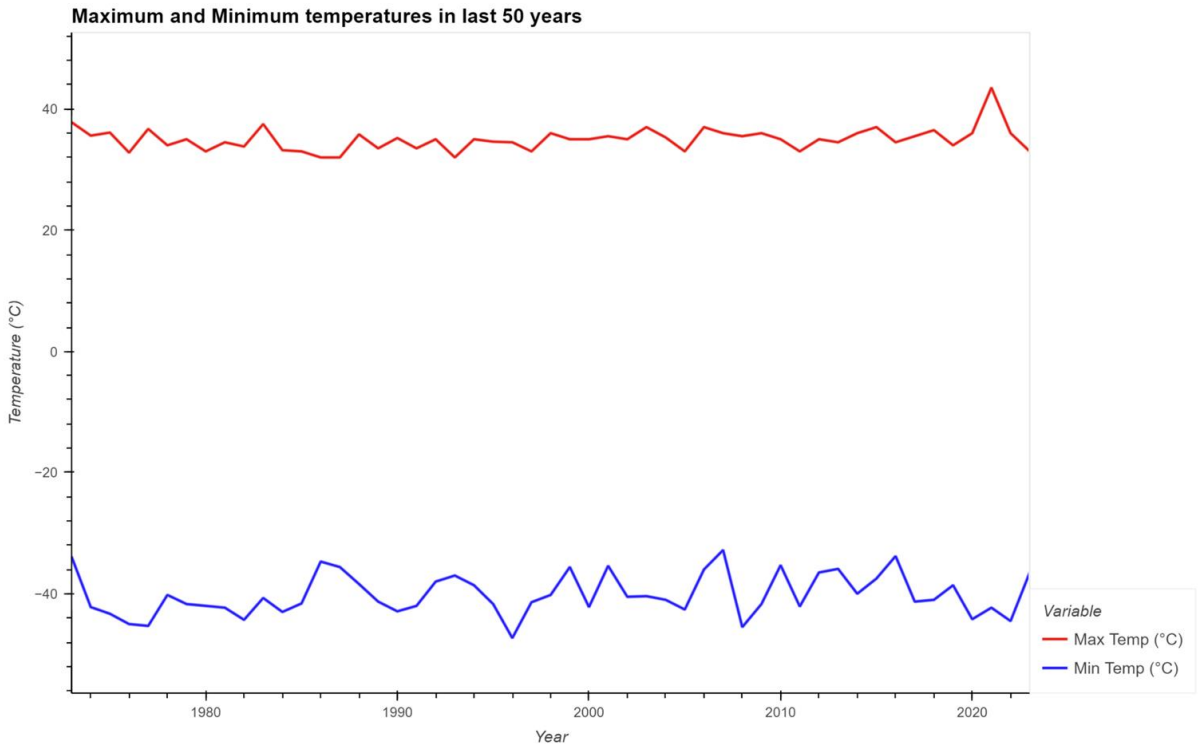
There isn't a marked change in droughts that can be observed from the data over past 23 years

Data Analysis - Temperature

Analyzing temperature data for BC

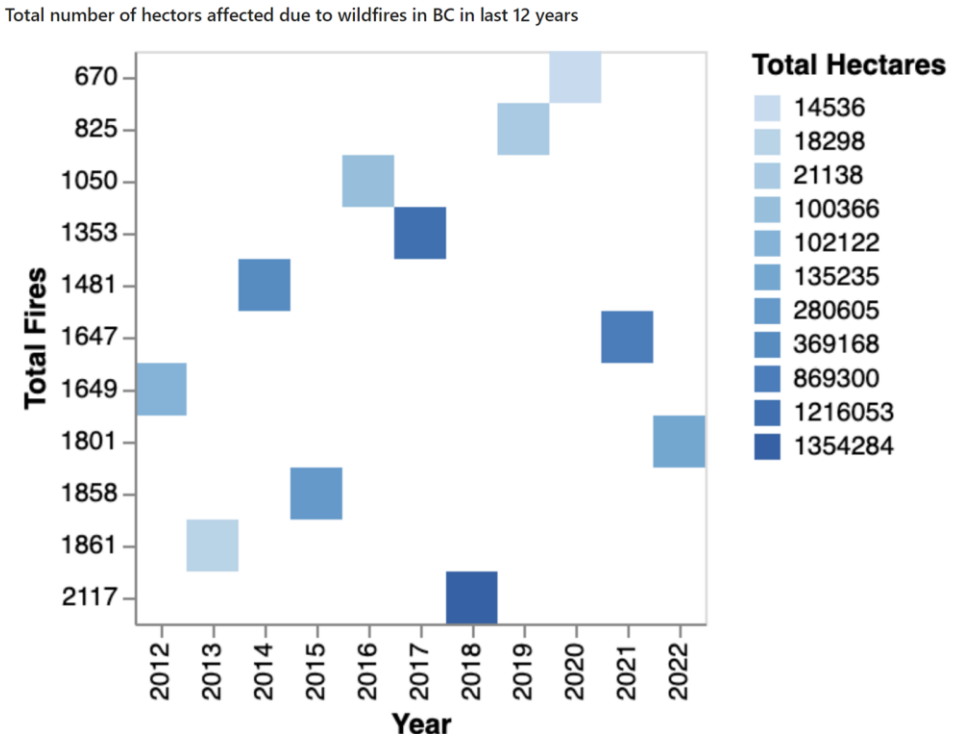
- BC has come under scrutiny of late for extreme temps and we wanted to analyze 50 years of daily temp data to see whether there has been increase in temperature extremes there
- We also see what the trend for wildfires is over last decade in light of temperature data
- Try to identify correlations between seasons and temperature extremes

Temperature Variance for 50 yrs

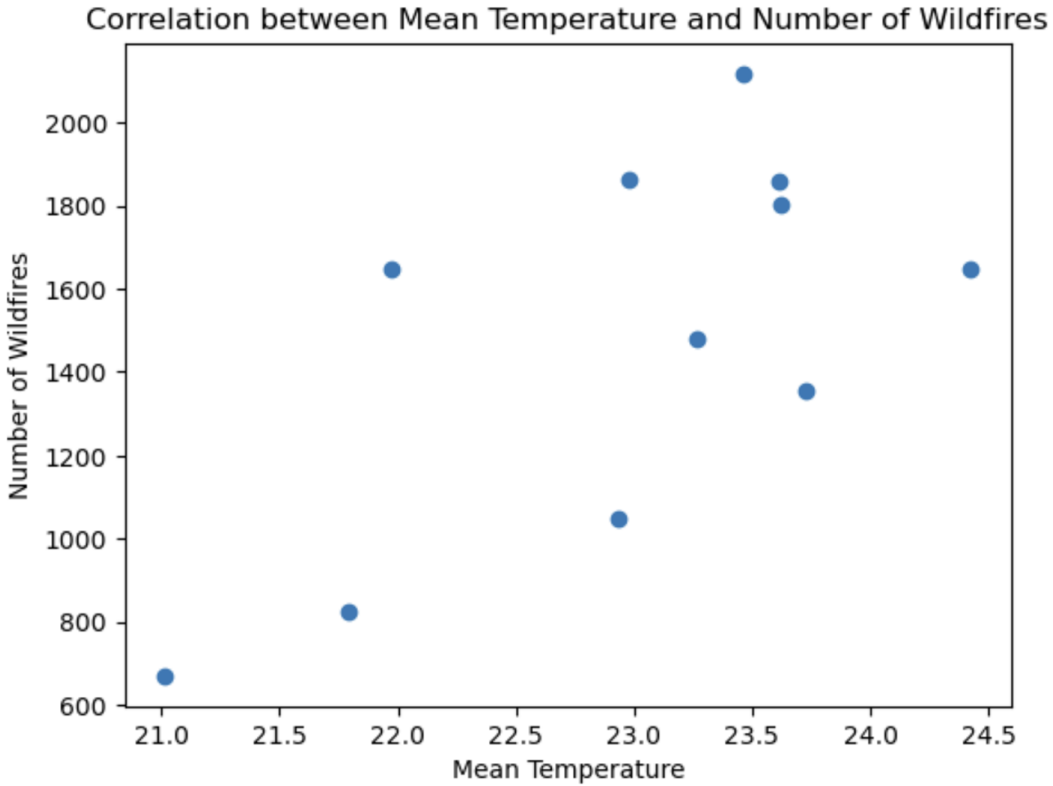


Temperature variations show small recent spikes but it's not sufficient to show major and steady changes

Wildfires Occurrence

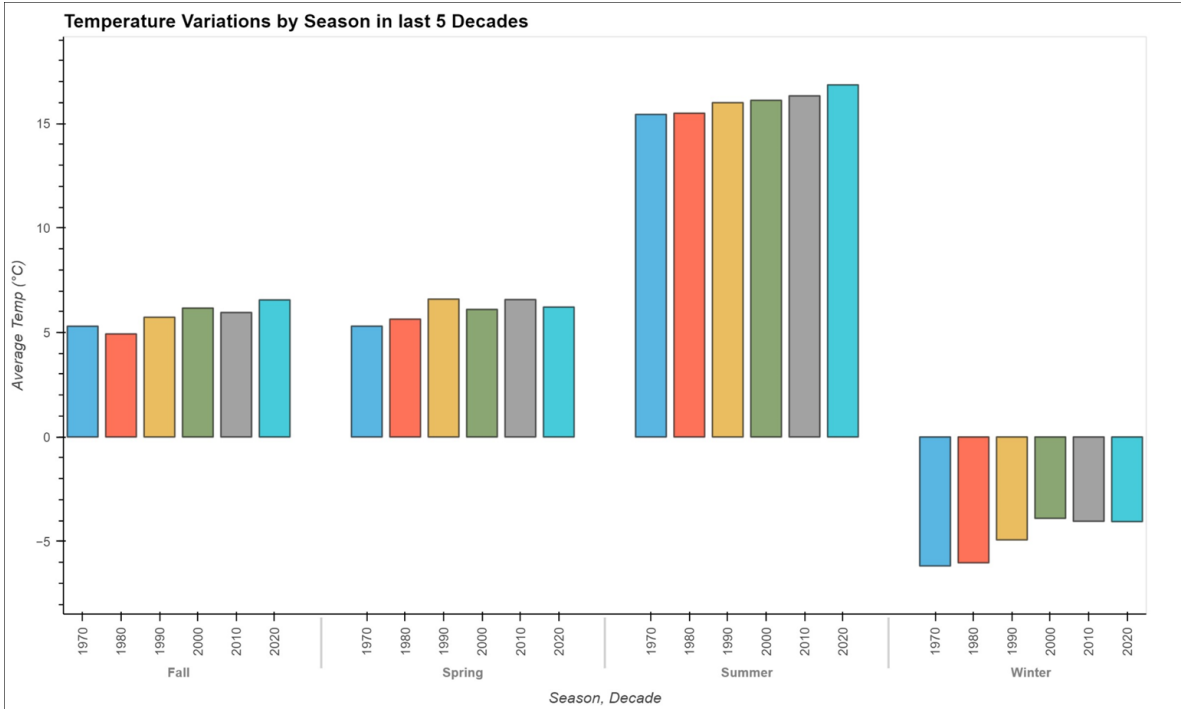


There seems to be some increase in severity of wildfires over time as the area (in hectares) affected seems to be increasing



Plot of the correlation - moderate correlation of 0.67

Temperature Variance by Seasons

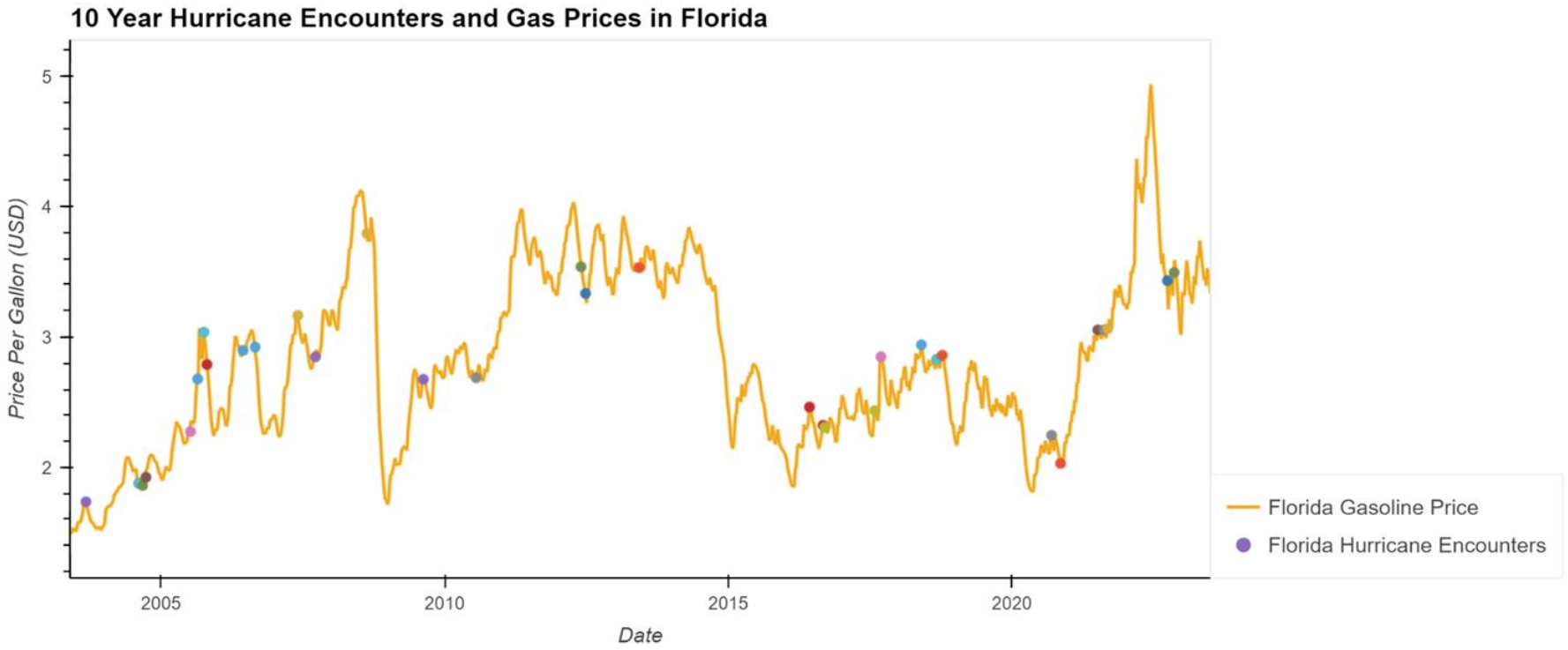


By examining the figure above, the average temperature for each season is increasing each decade.

Effects on Business

Effects of hurricanes on commodities

- Approach: We intook data for gas prices and cross-referenced it to the hurricane occurrences
- We found that there were instances where the prices were both negatively and positively correlated with the hurricane occurrence
- Conclusion: Other factors must be at play to affect the gas prices



There seems to be no determinate relationship between Hurricane & Gas Prices

Effects of wildfires on stocks

It is input driven and needs to be completed in Jupyter Notebook

The data doesn’t show a meaningful relationship between wildfires in BC and the regional prices of commodities