CAPSTONE PROJECT -Weather Analysis

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Overview of the project

1.CITY DISTRIBUTION ON MAP.

2.TOP 10 COUNTRIES WITH MOST CITIES .

3.LATITUDE DISTRIBUTION BY CONTINENT.

4. CITY ATTRIBUTES ANALYSIS .

5.TEMPERATURE TREND OVERTIME .

6.. HUMIDITY VARIATION ACROSS CITITES

7.WIND SPEED AND AIR PRESSURE RELATION SHIP .

8. OVERALL TEMPERATURE TREND .

9.BUSIEST HOUR FOR WEATHER COMDITION.

10. WIND SPEED VARIATION THROUGH OUT THE DAY.

11. TEMPERATURE COMPARISION BETWEEN CITIES.

12.CITIES WITH HIGHEST AND LOWEST TEMPERATURE.

Process

1.**Data Acquisition from GitHub:**

Obtain the requisite dataset from a designated GitHub repository.

2. **Data Transformation and Enhancement:**

If necessary, execute data transformation procedures to ensure data quality and consistency. Additionally, consider augmenting the dataset with new problem statements to enrich the analysis potential.

3. **Connecting with Tools:**

Establish connections between the dataset and various analytical tools. Interface the dataset with Power BI, Excel, and MySQL Workbench, facilitating seamless data integration and processing.

4. **Problem Statement Solution in Power BI:**

Utilize Power BI to delve into the specified problem statements. Employ its robust features for data visualization, exploration, and analysis, effectively deriving insights and solutions

5**. Exploratory Data Analysis (EDA):**

Perform exploratory data analysis using either Excel or SQL Workbench, depending on the complexity of the analysis. Extract meaningful patterns, relationships, and trends from the data to inform subsequent decision-making.

6. **Creation of Visual and Insightful PowerPoint**:

Develop a comprehensive PowerPoint presentation that encapsulates the project's objectives, methodologies, problem statement solutions, and key visualizations. Each problem statement should be accompanied by a dedicated section with pertinent conclusions and insights.

7. Detailed Documentation:

Compile a detailed report that meticulously documents the entire project lifecycle. Include sections on data collection, transformation, problem statement formulation, tools integration, Power BI solutions, EDA insights, and PowerPoint visualizations.

Objectives:

1.Understand Historical Weather Patterns: The primary objective is to gain a deeper understanding of historical
weather patterns, trends, and variations over the specified time range and geographical areas.
2.Identify Extreme Weather Events: Uncover extreme weather events or anomalies in the dataset, such as heatwaves, cold spells, or heavy storms, to help stakeholders prepare for and respond to such events.
3.Support Decision-Making: Provide actionable insights and recommendations to support decision-makers, including local authorities, urban planners, and meteorologists, in making informed decisions regarding weather-related concerns in the selected regions.

Insights:

1. Seasonal Temperature Variations: Analyze temperature data to identify seasonal variations in the selected cities. Determine which regions experience the most significant temperature fluctuations.
2. Correlation Between Wind Speed and Air Pressure: Explore the relationship between wind speed and air pressure, and identify any correlations or patterns that may help in forecasting weather conditions.
3. Humidity Trends Over Time: Examine humidity levels over the specified time range to understand how humidity changes and whether there are any long-term trends or
patterns.

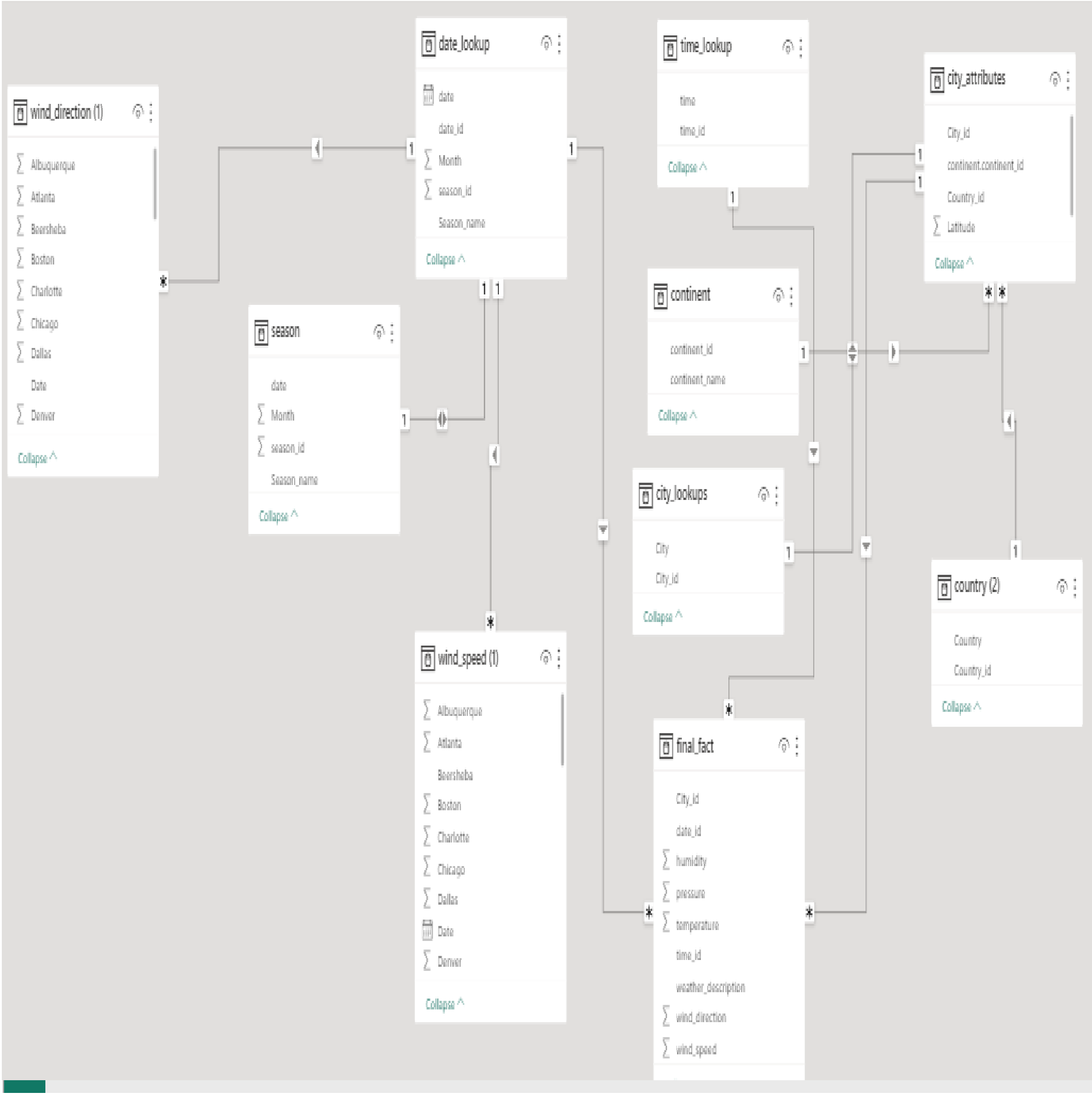
4. Geographical Distribution of Cities: Visualize the geographical distribution of cities based on latitude and longitude. Identify areas with higher concentrations of cities.

5. Comparison of Two Selected Cities: Conduct a detailed comparison of key weather
parameters, such as temperature, humidity, wind speed, or air pressure, between
two specific cities over a defined time frame.

6. Recommendations for Preparedness: Based on the analysis findings, provide recommendations for strategies and measures that stakeholders can take to mitigate the
impact of extreme weather events.

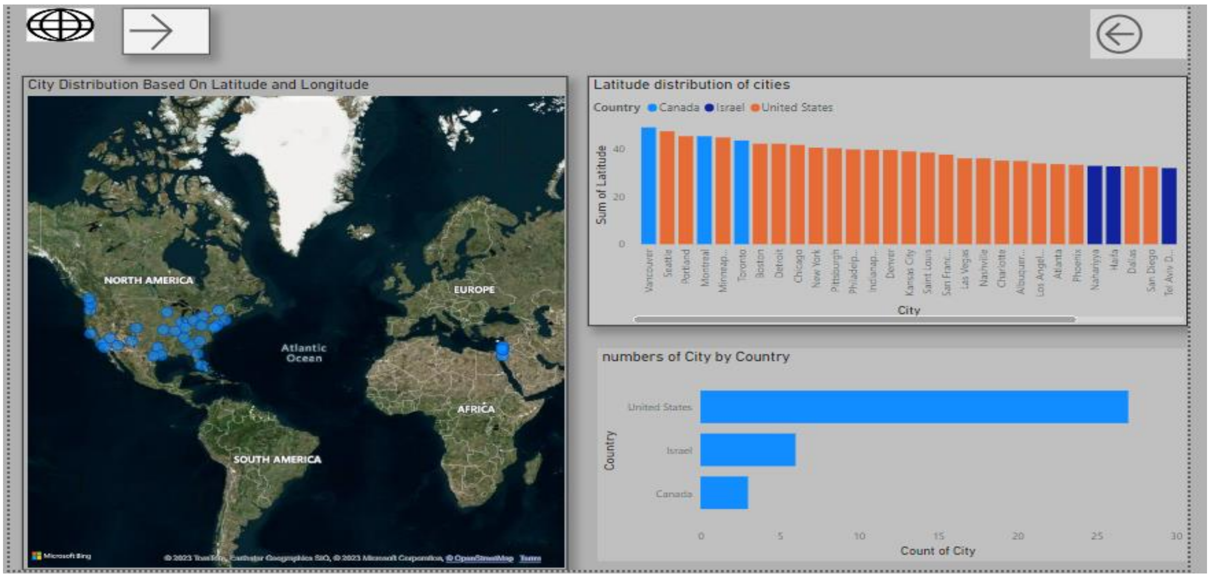
7. Data Visualization for Insights: Create a range of visualizations, including maps, line charts, scatter plots, and heatmaps, to effectively communicate the insights and patterns discovered in the data.

ER Diagram:

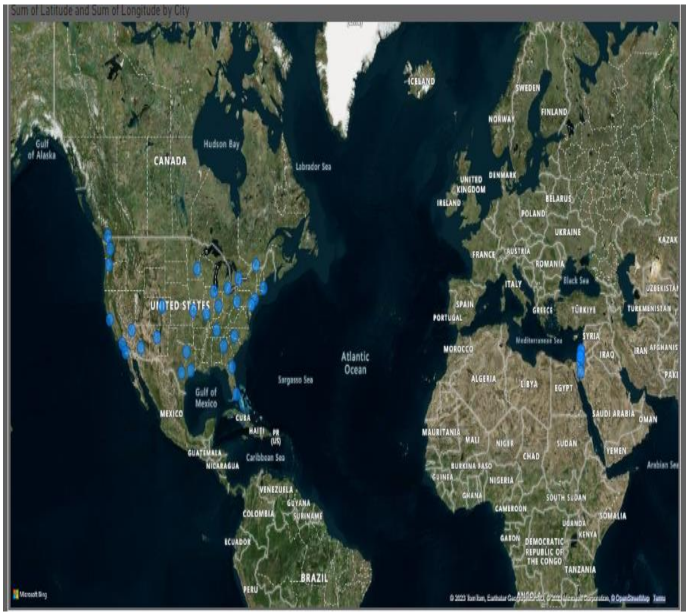


Power bi Problem Statements

Geographical Analysis

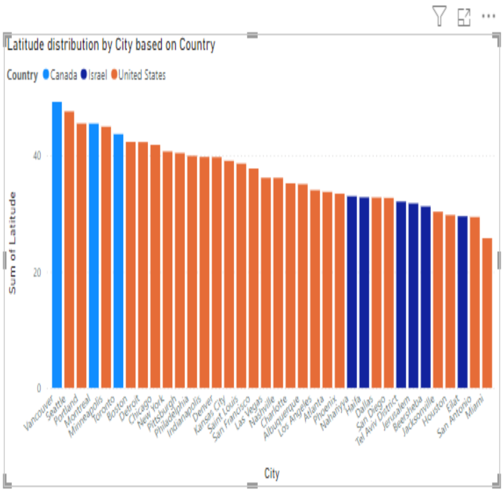


1. Can you create a geographical map in Power BI showing the distribution of cities in the dataset based on their latitude and longitude?

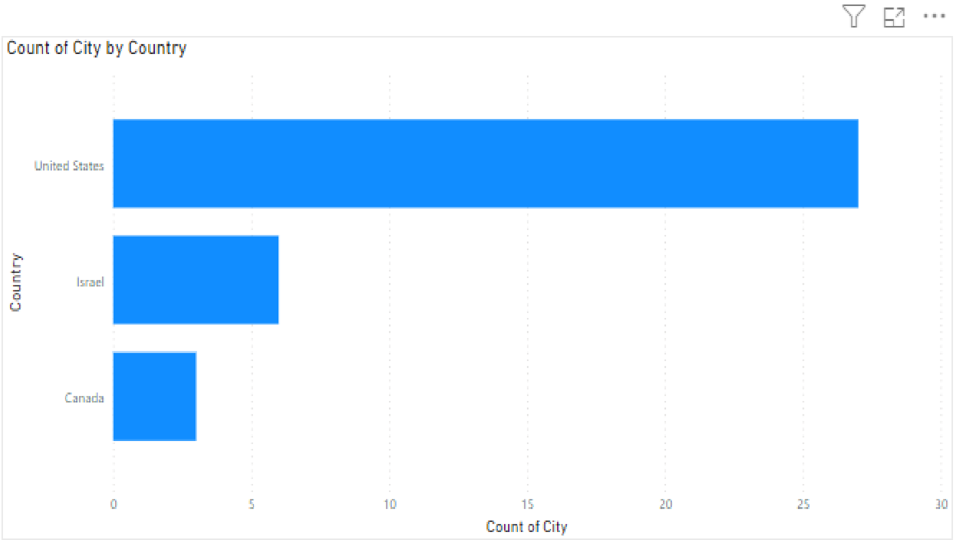


In the first Map chart New York City is located at a relatively high latitude, meaning that it experiences colder winters and warmer summers than cities located closer to the equator. Los Angeles, on the other hand, is located at a much lower latitude, and therefore has a more Mediterranean climate, with mild winters and dry summers.

Similarly, the longitude of North American cities also affects their climate. For example, cities located on the western side of the continent, such as Vancouver and Los Angeles, tend to be wetter than cities located on the eastern side, such as New York City and Montreal. This is because the prevailing winds in North America blow from west to east, carrying moisture from the Pacific Ocean to the Atlantic Ocean.



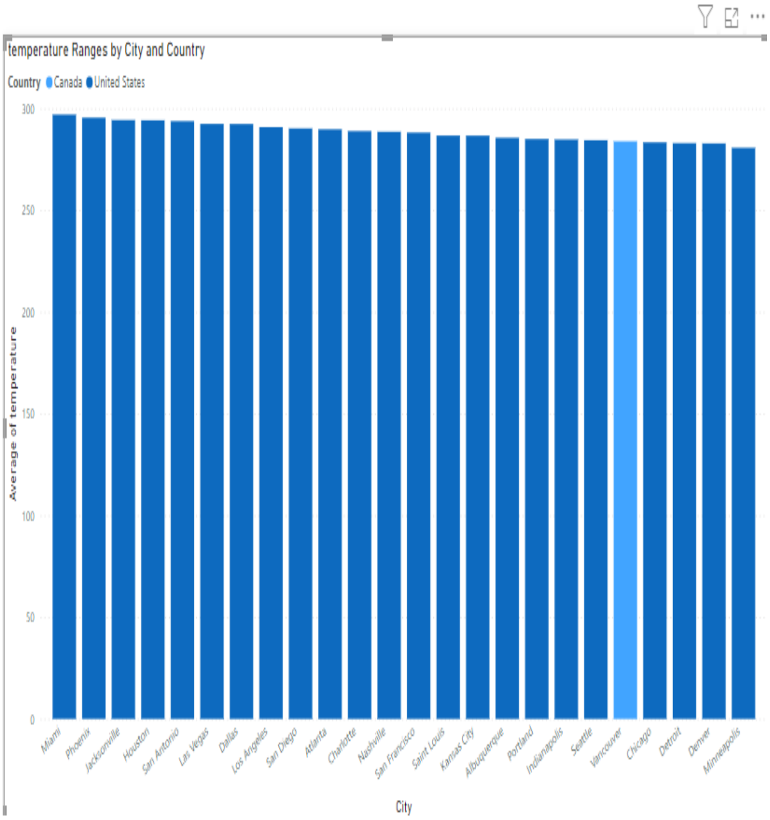
2. The 2nd chart is showing the latitude distribution of cities based on countries so here I have use color coding .



3.The 3rd Chart Is showing the Number of cities based on country.

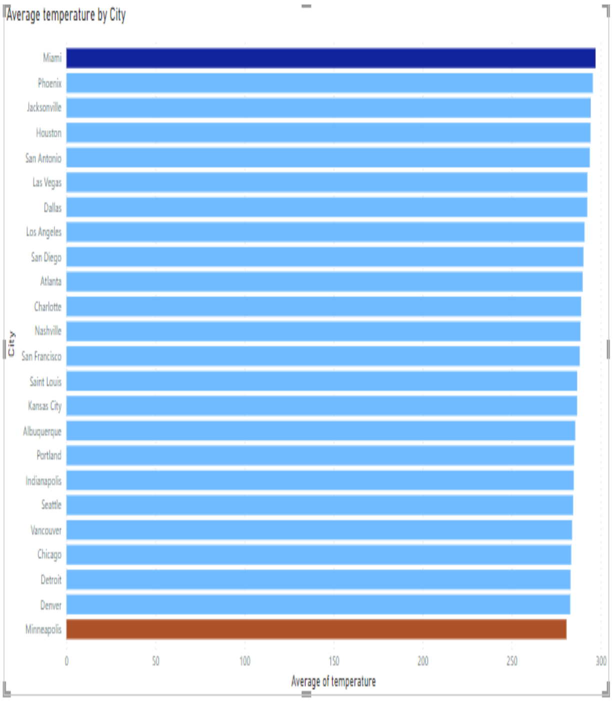
United State has Maximum number of cities and Canada has the least number of cities.

Temperature Analysis

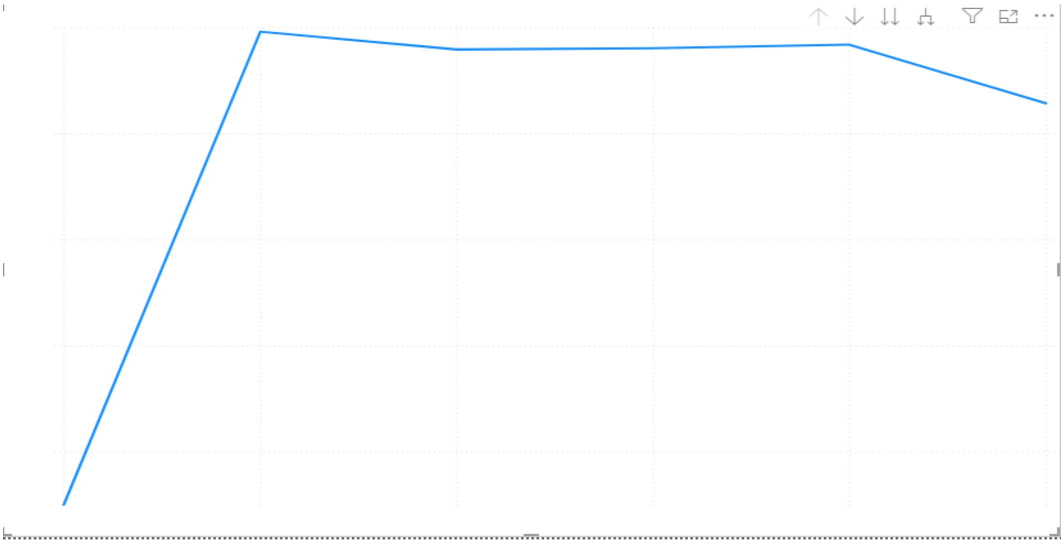


1. The 1st Chart Is showing The temperature range for a city is the difference between the highest and lowest temperatures that are typically experienced in that city throughout the year. For example, the temperature range for New York City is the highest temperature and the lowest temperature that is typically experienced in New York. The temperature range for a city is influenced by a variety of factors, including its latitude, longitude, elevation, and proximity to large bodies of water. Cities that are located at higher latitudes tend to have wider temperature ranges than cities that are located at lower latitudes. This is because cities at higher latitudes receive less sunlight than cities at lower latitudes, which means that they tend to be colder in the winter and warmer in the summer.

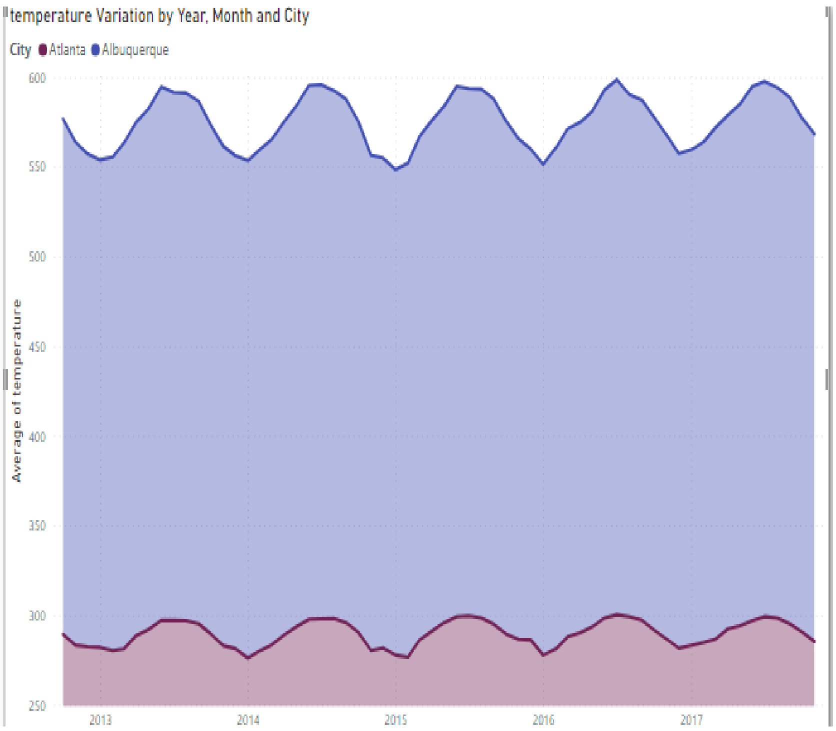
Cities that are located at higher elevations also tend to have wider temperature ranges than cities that are located at lower elevations. This is because the air pressure is lower at higher elevations, which means that the air temperature can fluctuate more easily.



2. The 2nd chart is showing average temperature by cities .The highest average temperature is denote as dark blue color and lowest average temperature is denoted as red color. Average temperature in the US varies significantly by region, with colder average temperatures in the north and northeast and warmer average temperatures in the south and southwest. This is due to factors such as latitude, elevation, and proximity to large bodies of water.



3. The 3rd chart shows the average temperature trend From 2012 to 2017. The trend is upward, indicating that the global average temperature has been increasing over time but In 2017 the Temperature decrease again



4. The 4th Chart shows that the temperature Variation in Altana and Albuquerque varies throughout the year. The highest temperatures in both cities occur during the summer

months, while the lowest temperatures occur during the winter months.

Windspeed Analysis

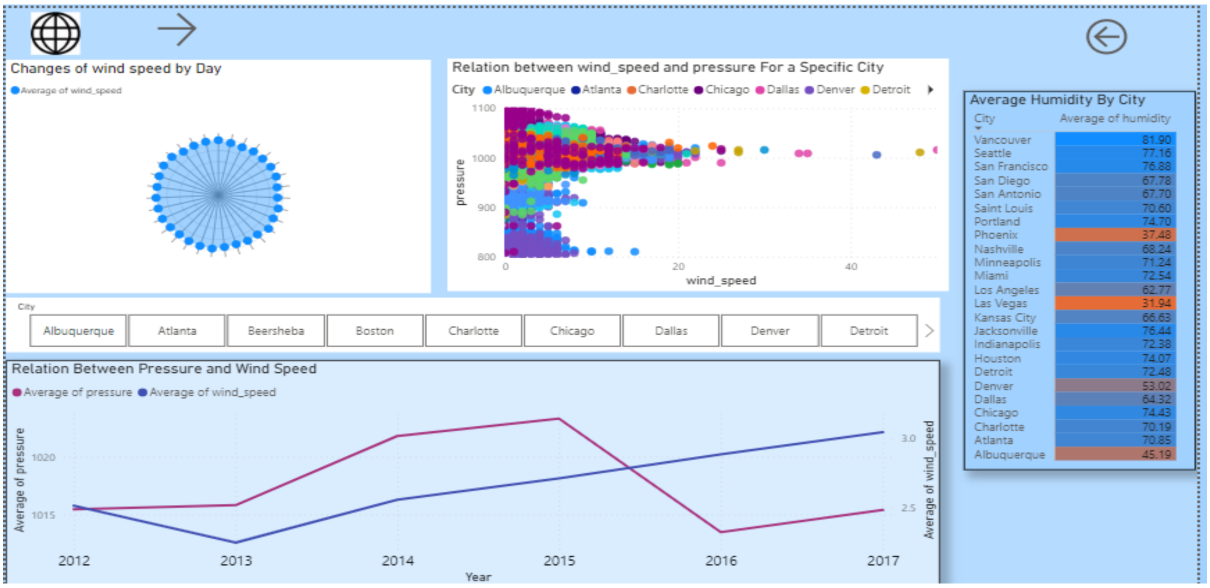
The heatmap is color-coded, with darker colors indicating higher wind speeds. The higher the wind speed, the greater the potential for wind energy generation.

The heatmap shows that the highest average wind speeds are found in the pacific northwest (vancouver, portland, and seattle), the midwest (kansas city, minneapolis, saint louis, and chicago), and the northeast (pittsburgh, toronto, philadelphia, new york, and montreal). These cities are all located in regions with strong pressure gradients, which create high winds.

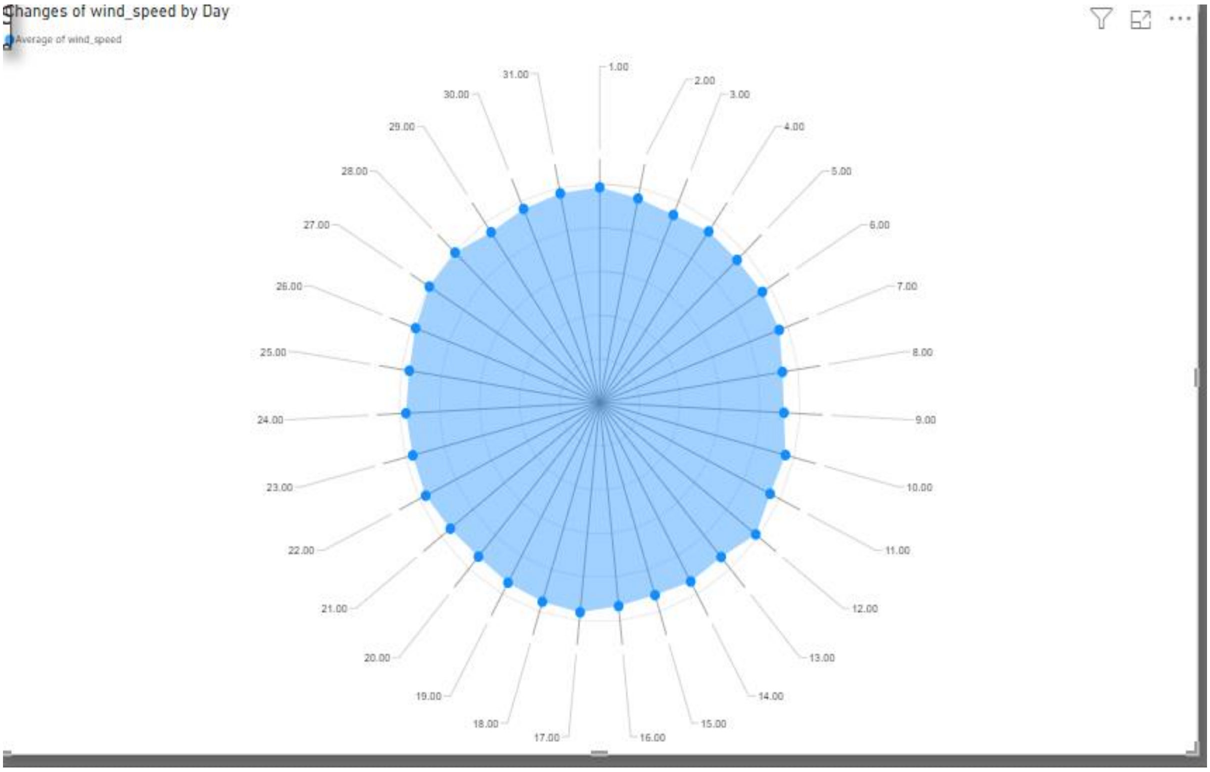
The lowest average wind speeds are found in the southwest (las vegas, phoenix, and albuquerque) and the southeast (miami). These cities are all located in regions with weak pressure gradients, which create low winds.

The heatmap also shows that the wind speed varies seasonally in most cities. The wind speeds are typically highest in the spring and fall months, when the pressure gradients are strongest. The wind speeds are typically lowest in the summer and winter months, when the pressure gradients are weakest.

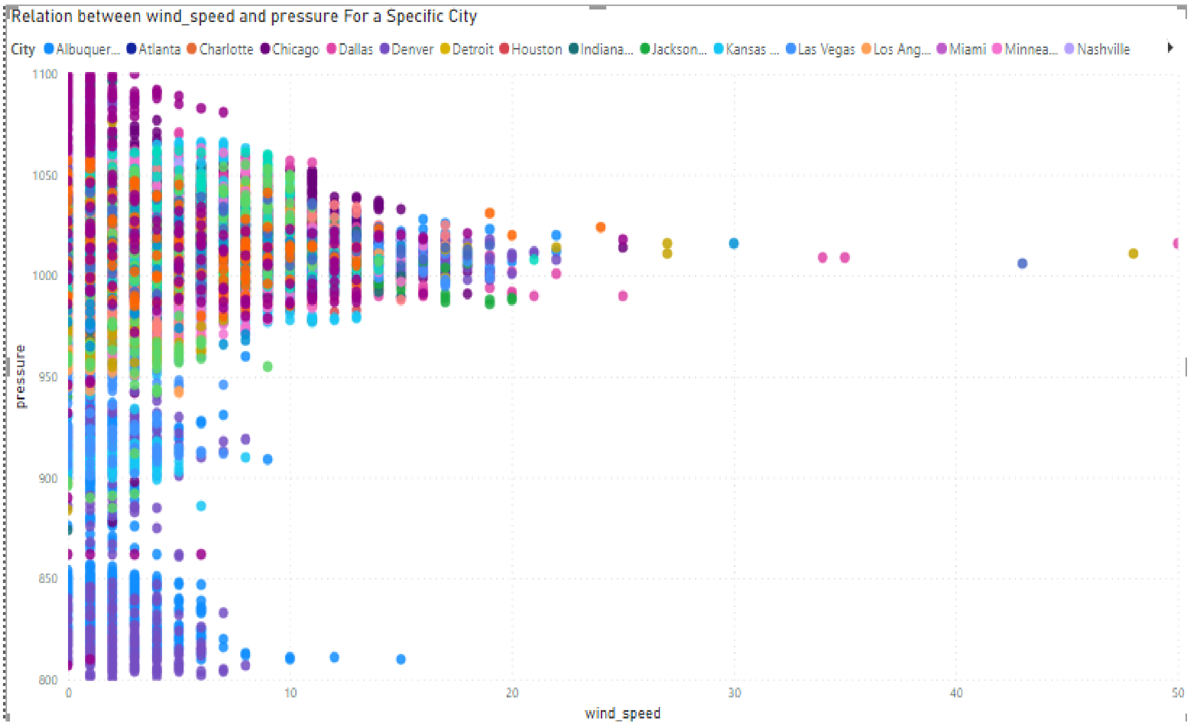
Wind speed and pressure Analysis



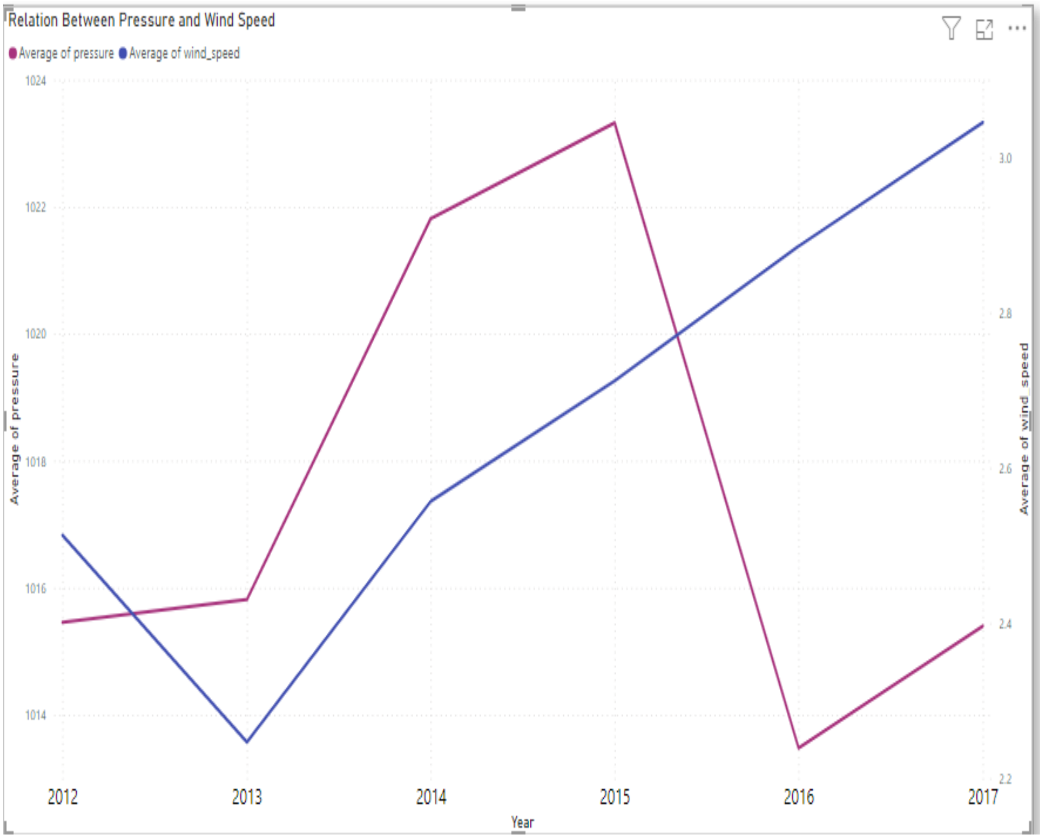
This Dashboard focuses on the wind speed humidity and pressure.



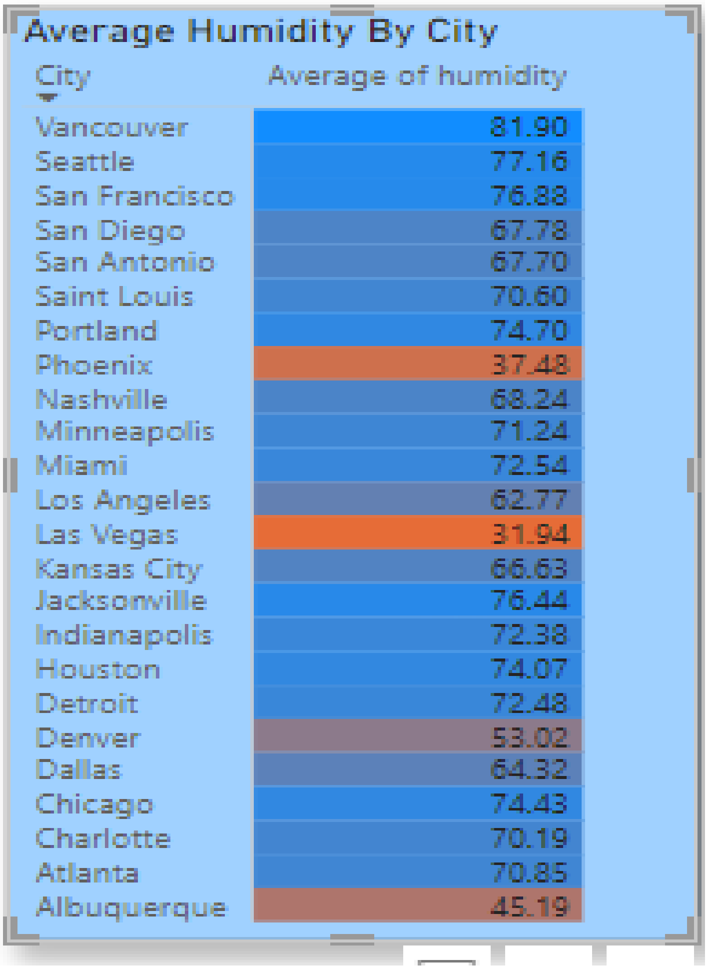
1.In the 1st chart shows the average wind speed varies from day to day. The highest wind speed is on day 27, and the lowest wind speed is on day 9. The wind speed also varies throughout the day. The highest wind speed is typically in the afternoon, and the lowest wind speed is typically at night.



2. The 2nd chart, scatter plot shows a clear inverse correlation between wind speed and air pressure. This means that as the air pressure increases, the wind speed decreases, and vice versa. This is because the pressure gradient force, which drives the wind, is inversely proportional to the air pressure.



3.The 3rd chart, line chart is showing There is a negative relationship between wind speed and air pressure. This means that as the air pressure increases, the wind speed decreases, and vice versa. This is because the pressure gradient force, which drives the wind, is inversely proportional to the air pressure.

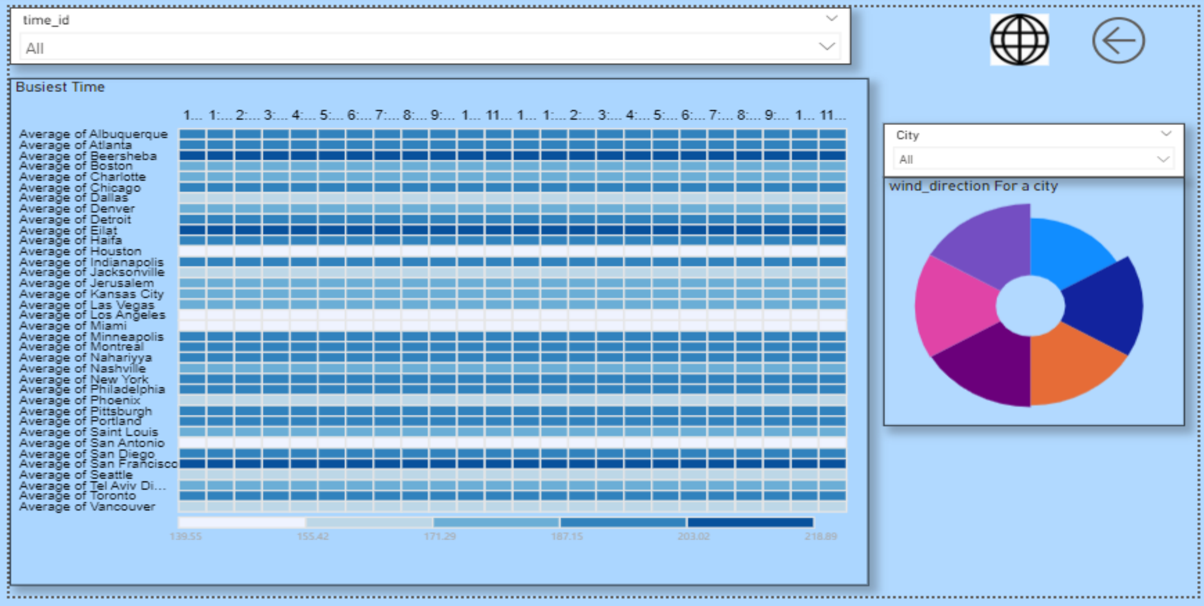


Average Humidity By City

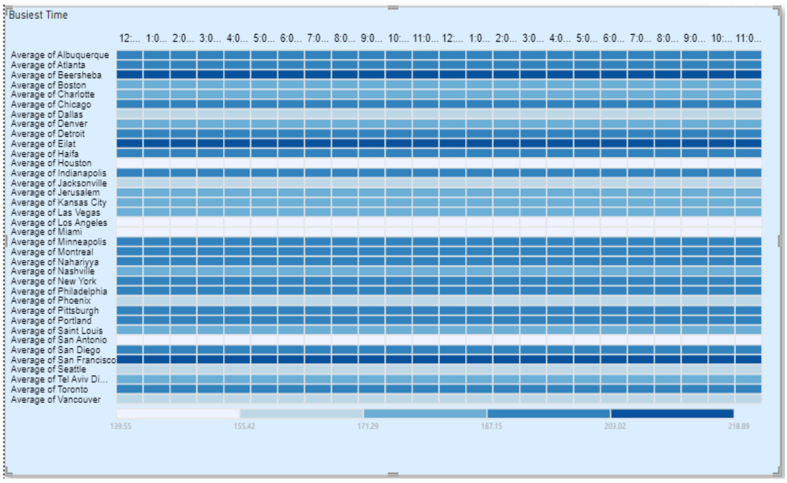
City	Average of humidity
Vancouver	81.90
Seattle	77.16
San Francisco	76.88
San Diego	67.78
San Antonio	67.70
Saint Louis	70.60
Portland	74.70
Phoenix	37.48
Nashville	68.24
Minneapolis	71.24
Miami	72.54
Los Angeles	62.77
Las Vegas	31.94
Kansas City	66.63
Jacksonville	76.44
Indianapolis	72.38
Houston	74.07
Detroit	72.48
Denver	53.02
Dallas	64.32
Chicago	74.43
Charlotte	70.19
Atlanta	70.85
Albuquerque	45.19

4.The 4th chart I have use matrix table and then use conditional formatting to highlight the highest and lowest values.

Wind Direction Analysis

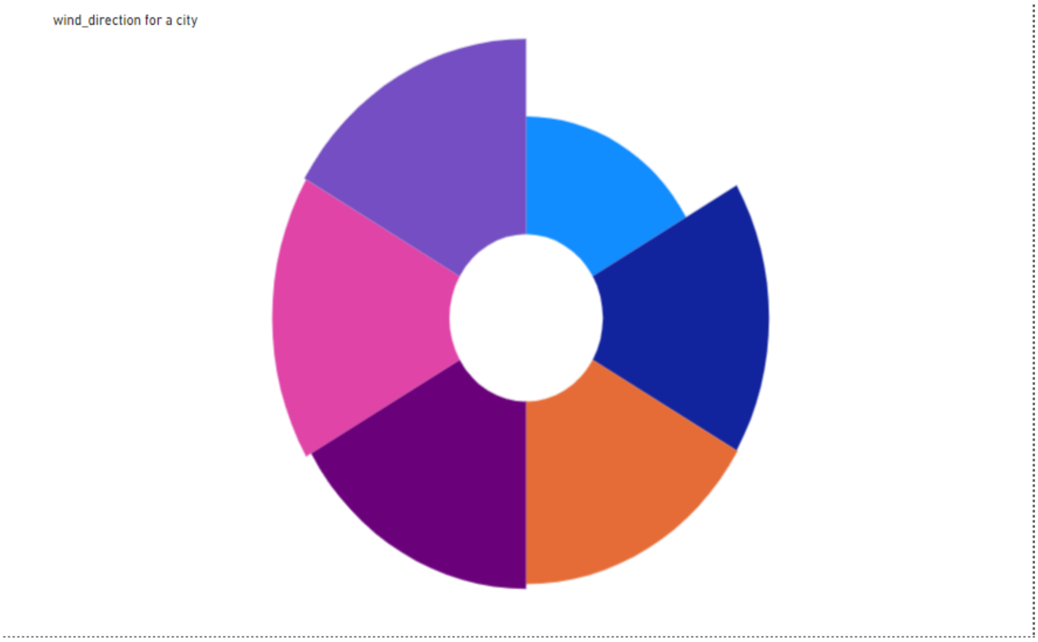


This Dashboard is showing the analysis of wind Direction



1.This 1st heatmap is showing the average wind direction by time, the busiest hour of the day is likely to be between 2:00 PM and 3:00 PM.

This is because the wind direction is most consistent and has the highest magnitude during this time, with the average wind direction blowing from the west to the east. This suggests that the sea breeze is strongest during this time, which would make it a good time for wind sports activities or for designing wind turbines and other structures that are exposed to the wind.



2. This 2nd Chart is Showing the wind Direction from 2012 to 2017.

EDA PROBLEM STATEMENT

Are there any countries with cities located at extreme latitudes, and how might this impact their climate?

```
select country,city,max(latitude)
from city_attribute
group by 1,2
limit 1;
```

OUTPUT

country	city	latitude
Canada	Vancouv er	49.24966

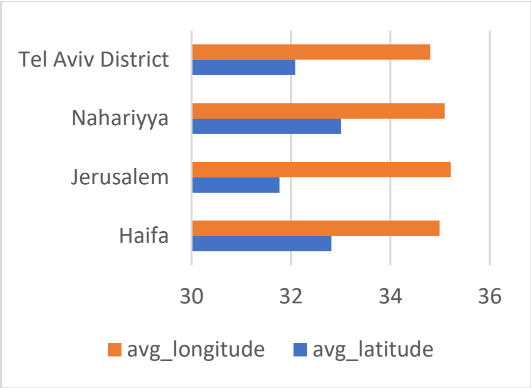
Highest latitude is above 60 for North and below 60 for southern pole but in this dataset Vancouver's latitude, which is relatively high in northern North America, impacts its weather in the following ways: It contributes to a mild and temperate climate with mild winters. Vancouver receives ample rainfall, particularly in the fall and winter. Seasonal temperature extremes are limited, leading to a relatively comfortable climate. The mild weather influences outdoor activities, clothing choices, and energy usage in the city.

identify any clusters of cities with similar latitude and longitude values

```
SELECT
city,
  ROUND(latitude) AS avg_latitude,
  ROUND(longitude) AS avg_longitude,
  COUNT(*) AS num_cities
FROM
  city_attribute
GROUP BY
city
HAVING
  COUNT(*) > 1
ORDER BY
  COUNT(*) DESC;
```

OUTPUT

City	avg_latitude	avg_longitude
Haifa	33	35
Jerusalem	32	35
Nahariyya	33	35
Tel Aviv District	32	35



The clustering of cities with similar latitude and longitude values in Israel is primarily due to:

Geographic Proximity: Haifa and Nahariyya are coastal cities in the north, while Jerusalem and Tel Aviv District are inland cities in the central part of Israel. Their geographic proximity results in similar coordinates.

Administrative Boundaries: Jerusalem and Tel Aviv District are distinct administrative regions within Israel, and their proximity is reflected in similar coordinates.

Coastal vs. Inland Locations: Coastal cities (Haifa and Nahariyya) share similar coordinates due to their coastline, while inland cities (Jerusalem and Tel Aviv District) also have similar coordinates within their regions

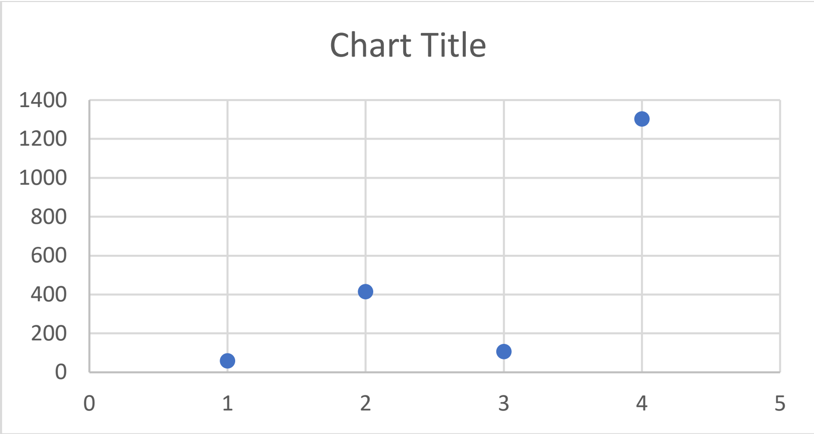
correlations between a city's geographical location (latitude and longitude) and its weather attributes, such as temperature or humidity

```
WITH AvgValues AS (
  SELECT
    AVG(f.temperature) AS AvgTemp
  FROM city_attributes AS c
  JOIN final_fact AS f ON f.city_id = c.city_id
)
  (SUM(POW(c.Latitude - a.AvgLat, 2) * POW(f.Temperature - a.AvgTemp, 2)) /
    (SQRT(SUM(POW(c.Latitude - a.AvgLat, 2)) * SUM(POW(f.Temperature - a.AvgTemp, 2))))) AS Correlation_Lat_Temperature,
  (SUM(POW(c.Longitude - a.AvgLon, 2) * POW(f.Temperature - a.AvgTemp, 2)) /
    (SQRT(SUM(POW(c.Longitude - a.AvgLon, 2)) * SUM(POW(f.Temperature - a.AvgTemp, 2))))) AS Correlation_Lon_Temperature,
  (SUM(POW(c.Latitude - a.AvgLat, 2) * POW(f.Humidity - a.AvgHumidity, 2)) /
    (SQRT(SUM(POW(c.Latitude - a.AvgLat, 2)) * SUM(POW(f.Humidity - a.AvgHumidity, 2))))) AS Correlation_Lat_Humidity,
  (SUM(POW(c.Longitude - a.AvgLon, 2) * POW(f.Humidity - a.AvgHumidity, 2)) /
    (SQRT(SUM(POW(c.Longitude - a.AvgLon, 2)) * SUM(POW(f.Humidity - a.AvgHumidity, 2))))) AS Correlation_Lon_Humidity
FROM city_attributes AS c
JOIN final_fact AS f ON f.city_id = c.city_id
JOIN AvgValues AS a;
```

OUTPUT

Correlation_Lat_Temperature	Correlation_Lon_Temperature	Correlation_Lat_Humidity	Correlation_Lon_Humidity
59.19590142	414.0227927	106.7115458	1303.231071

CHART



its showing positive relation

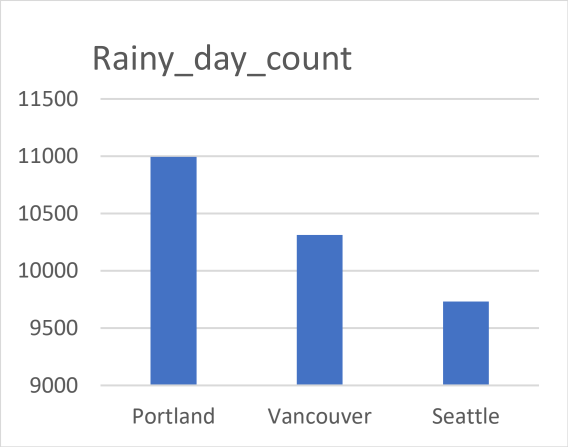
top three cities with the most frequent occurrence of rainy weather based on weather descriptions

```
WITH rainy_days AS (
    SELECT
        c.city,
        COUNT(*) AS rainy_days_count
    FROM
        final_fact as f
                    join city_lookup as c
    on c.city_id = f.city_id
    WHERE
       weather_description LIKE '%rain%'
    GROUP BY
                    1
                        order by count(*) desc
)
                        SELECT
                            city,
                            rainy_days_count
                            from rainy_days
                            limit 3;
```

OUTPUT

city	Rainy_day_count
Portland	10994
Vancouver	10312
Seattle	9731

Chart



The chart shows the number of rainy days in Portland, Vancouver, and Seattle over the past year.

Portland has the most rainy days, with an average of 161 days per year. Vancouver has the second most rainy days, with 155 days per year. Seattle has the fewest rainy days, with 150 days per year.

The chart also shows that the number of rainy days has fluctuated over the past year. For example, Portland had more rainy days in the winter than in the summer. Vancouver had a similar pattern, with more rainy days in the winter and fewer rainy days in the summer.

Overall, the chart shows that Portland is the rainiest city in the Pacific Northwest, followed by Vancouver and Seattle.

correlation between humidity levels and air pressure

humidity	pressure				
76					
76			=CORREL(A:A,B:B)		
76			CORREL(array1, array2)		
77					
78					
78					
79					
79					
80					
81					
81					
82					
83					
83					
84					
84					
85					

OUTPUT

humidity	pressure		
76			
76			0.098011
76			
77			
78			
78			
79			
79			
80			
81			
81			
82			
83			
83			
84			
84			
85			

There is a weak positive correlation between humidity and pressure. This means that, on average, as humidity levels increase, atmospheric pressure tends to increase slightly. This is because warmer air can hold more water vapor than cooler air. When air is heated, it expands and becomes less dense. This allows more water vapor molecules to be present in the air without exceeding the maximum capacity of the air. As a result, the relative humidity (RH) increases.

Similarly, when air is cooled, it contracts and becomes more dense. This forces some of the water vapor molecules to condense into liquid water, such as dew or fog. As a result, the RH decreases.

However, the relationship between humidity and pressure is not always consistent. Other factors, such as the amount of solar radiation, the amount of moisture in the air, and the location of the air parcel, can also affect the relationship.

In general, there is a weaker correlation between humidity and pressure at higher altitudes. This is because the air is thinner at higher altitudes, so there is less water vapor present to influence the pressure.

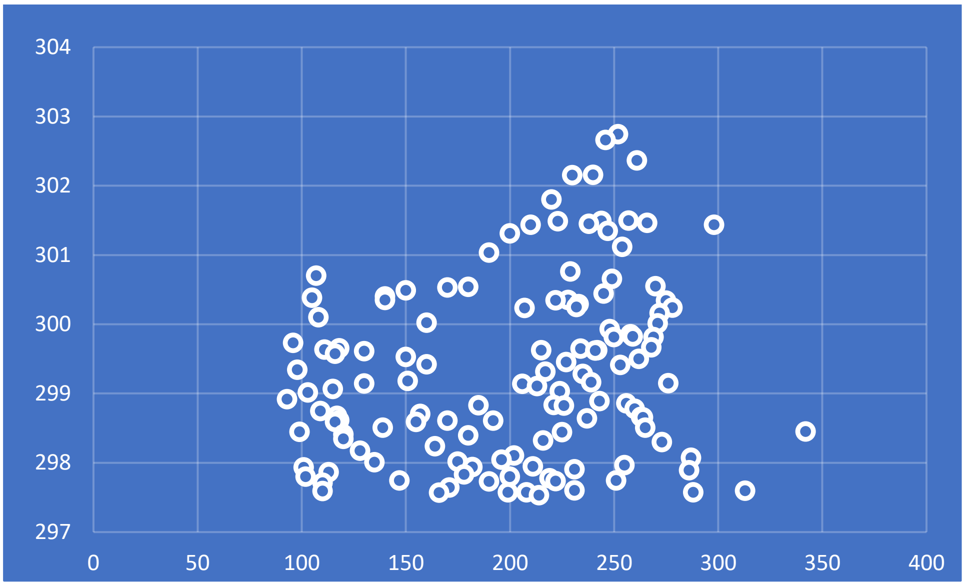
impact of wind direction on temperature for coastal cities

```
select city,country,wind_direction,avg(temperature) as ag
from( select city,country,wind_direction,temperature
 from city_attribute as c
   join final_fact as f
   on c.city_id = f.city_id
   where( country = 'canada' and latitude between '45' and '49')
   or (country = 'united states' and latitude between '32' and '49')
   or (country = 'isreal' and latitude between 30 and 33)
   ) as coastal
   group by 1,2,3
   order by 4 desc;
```

OUTPUT

	P	Q	R	S	T	U
	city	country	wind_spe	ag		
	Phoenix	United States	252	302.7422		
	Phoenix	United States	246	302.6595		
	Phoenix	United States	261	302.3637		
	Phoenix	United States	240	302.1555		
	Phoenix	United States	230	302.1508		
	Phoenix	United States	220	301.8008		
	Phoenix	United States	257	301.4939		
	Phoenix	United States	244	301.4903		
	Phoenix	United States	223	301.4856		

Chart



Based on the chart wind speed does have an impact on temperature. The chart shows that as the wind speed increases, the apparent temperature decreases. This is because the wind blows away the warm air layer that surrounds your body, and the colder air that replaces it must be warmed up by your body heat.

The chart also shows that the impact of wind speed on temperature is greater at lower temperatures

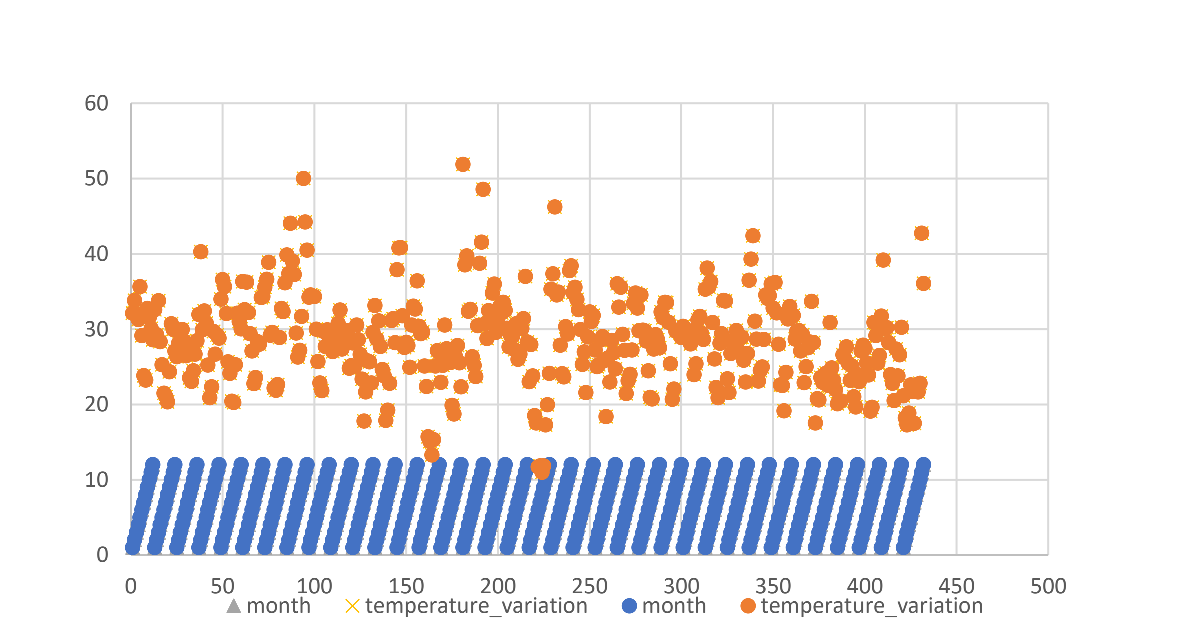
Are there specific months when cities experience significant temperature fluctuations

```
WITH MonthlyVariations AS (
   SELECT
      city,
      YEAR(date) AS year,
      MONTH(date) AS month,
      MAX(temperature) - MIN(temperature) AS temperature_variation,
      row_number() over(partition by city, Month(date) order by MAX(temperature) -
MIN(temperature) desc) as rn
   FROM
     final_fact as f
     join date_lookup as d
     on f.date_id = d.date_id
     join city_lookup as c
     on c.City_id= f.City_id
     GROUP BY
      city, year, month
)
SELECT city,
month,temperature_variation
FROM
   Monthlyvariations
where rn = 1;
```

Output

city	month	temperature_variation
Albuquerque	1	32.107
Albuquerque	2	33.8065
Albuquerque	3	32.09066667
Albuquerque	4	31.265
Albuquerque	5	35.62
Albuquerque	6	29.13633333
Albuquerque	7	23.83733333
Albuquerque	8	23.215
Albuquerque	9	32.748

Chart



There are a few months that face significant fluctuation in temperature according to the chart. These months are:

- April
- May
- October
- November

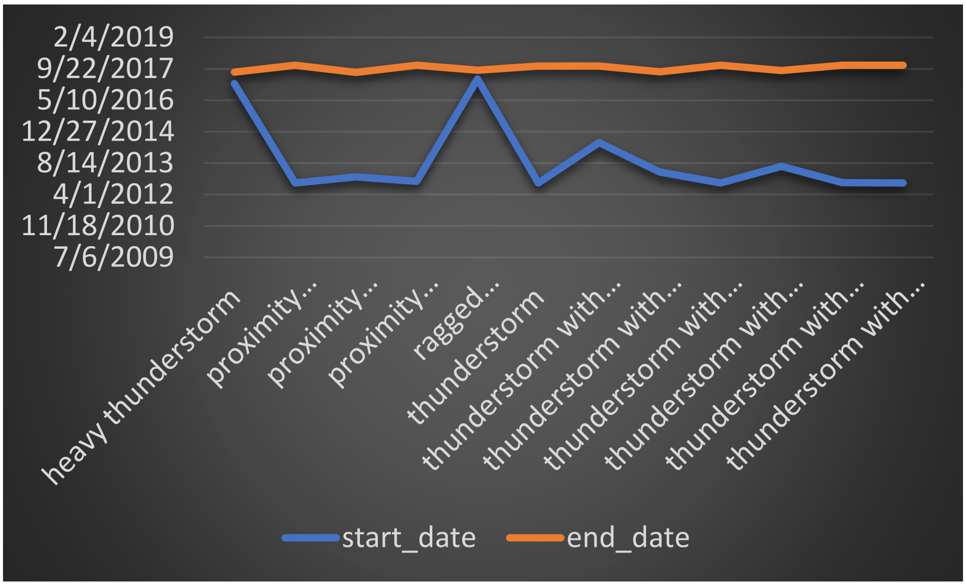
During these months, the temperature can vary by as much as 10 degrees Fahrenheit from day to day. This is because these months are transitional months, meaning that the weather is changing from one season to another. During these months, the jet stream can also be more active, which can lead to more variable weather conditions

Identify periods of extreme weather events, such as storms or heatwaves

```
WITH StormEvents AS (
    SELECT
        date,
        weather_description
    FROM
      final_fact as f
      join date_lookup as d
      on d.date_id = f.date_id
      where weather_description like '%thunderstorm%'
),
EventGroups AS (
    SELECT
        date,
        weather_description,
        ROW_NUMBER() OVER (ORDER BY date),
        ROW_NUMBER() OVER (PARTITION BY weather_description ORDER BY
date) AS group_id
    FROM
        StormEvents
```

OUTPUT

M	N	O	
weather description	start_date	end_date	
heavy thunderstorm	01/31/2017	08/02/2017	
proximity thunderstorm	10/03/2012	11/18/2017	
proximity thunderstorm with drizzle	01/09/2013	07/27/2017	
proximity thunderstorm with rain	10/26/2012	11/18/2017	



The Chart provides a list of different weather descriptions and their respective start and end dates. These descriptions are related to various extreme weather events, such as thunderstorms and associated conditions like drizzle or heavy rain. The objective is to identify patterns in the time-based data that can help us understand when these extreme weather events occurred.

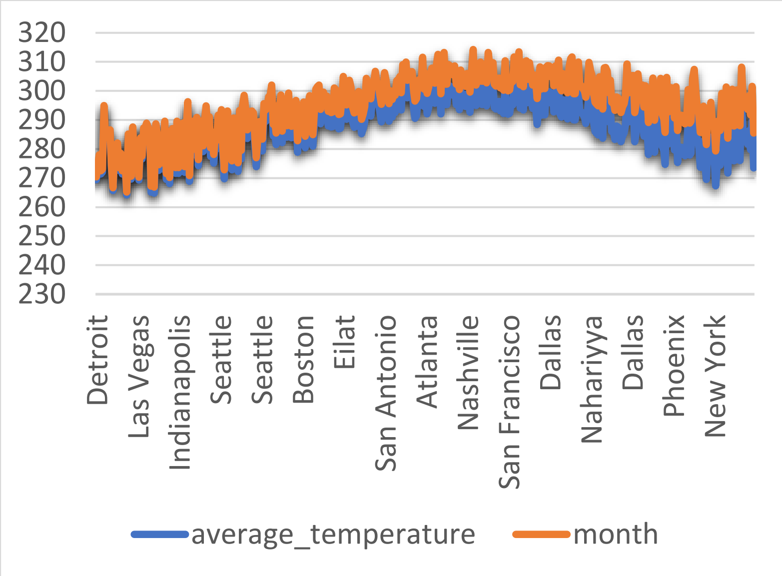
From the data, we can see the start and end dates for each weather description. By analyzing this information, we can identify periods when specific weather events occurred. For example, we can determine the duration of a heavy thunderstorm event that started on January 31, 2017, and ended on August 2, 2017.

Are there any notable differences in temperature trends between northern and southern hemisphere cities over the year

```
SELECT
  city,
  country,
  CASE WHEN latitude < 0 THEN 'Southern' ELSE 'Northern' END AS hemisphere,
  AVG(temperature) AS average_temperature,
  MONTH(date) AS month
FROM final_fact AS f
join date_lookup as d
on d.date_id = f.date_id
join city_attribute as c
on c.city_id = f.city_id
GROUP BY city, country, CASE WHEN latitude < 0 THEN 'Southern' ELSE
'Northern' END, month
ORDER BY hemisphere, month;
```

OUTPUT

M	N	O	P	Q
city	country	hemisphere	average_temperatu	month
Detroit	United States	Northern	269.3861876	1
Denver	United States	Northern	272.3391144	1
Nashville	United States	Northern	277.0297715	1
Pittsburgh	United States	Northern	271.4461554	1
Boston	United States	Northern	272.0207119	1
Miami	United States	Northern	293.9086326	1
Houston	United States	Northern	284.9159319	1
San Francisco	United States	Northern	283.4563868	1
San Diego	United States	Northern	285.4442584	1



The Chart shows the average monthly temperature cities in different hemispheres,latitudes less than 0 are generally found in the Southern Hemisphere but in This dataset Latitude Less than and equal to 0 is not present The city in the Northern hemisphere is located in a temperate climate, while the city in the Southern hemisphere is located in a subtropical climate.

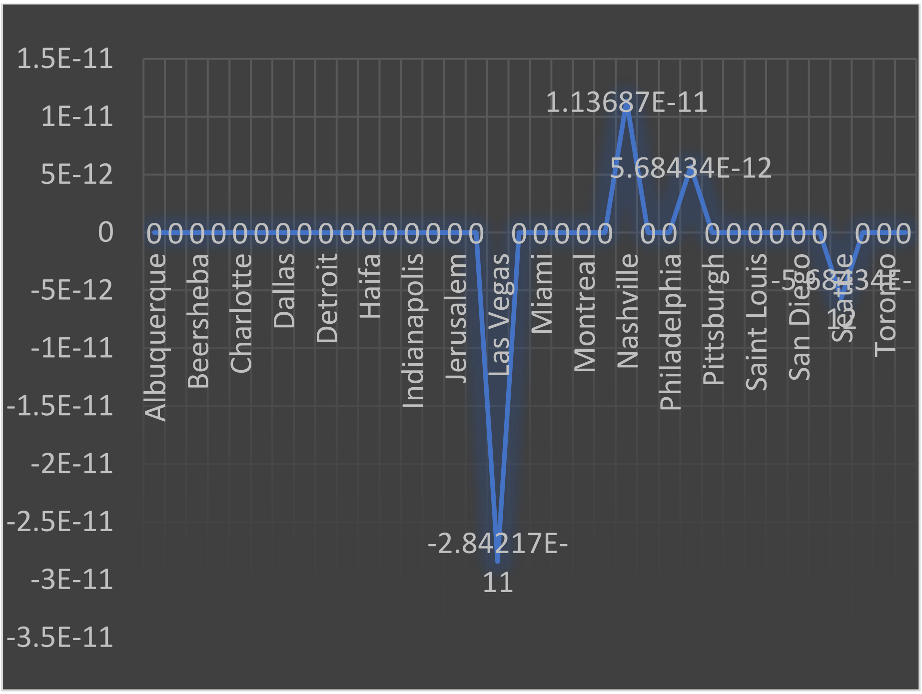
The city in the Northern hemisphere has a warm summer and a cold winter. The temperature trend shows that the temperature in the city in the Northern Hemisphere rises from a low in January to a high in July, and then falls again to a low in January. This is because the Northern Hemisphere is tilted towards the sun during the summer months, and away from the sun during the winter months. As a result, the city in the Northern Hemisphere receives more direct sunlight during the summer months, and less direct sunlight during the winter months

Analyze the impact of temperature on energy consumption patterns in cities. Are there noticeable trends or correlations?

```
with cte as (SELECT distinct city,
  country,
  temperature,
  (temperature - AVG(temperature)) * 100 AS
estimated_energy_consumption,
  row_number()over(partition by  city, country) as
rn
FROM
  final_fact as f
  join city_attribute as c on c.city_id = f.city_id
WHERE temperature IS NOT NULL
group by 1,2,3
ORDER BY city, temperature)
select
city,country,estimated_energy_consumption
from cte
where rn = 1
```

OUTPUT

Q	R	S	T
city	country	estimated_energy_consumption	
Albuquerque	United States	0	
Atlanta	United States	0	
Beersheba	Israel	0	
Boston	United States	0	
Charlotte	United States	0	
Chicago	United States	0	
Dallas	United States	0	
Denver	United States	0	
Detroit	United States	0	
Eilat	Israel	0	



Most cities in the dataset have an estimated energy consumption of 0, indicating either extremely low or negligible energy use, likely due to efficient energy practices, alternative energy sources, or minimal energy demand in their specific circumstances.

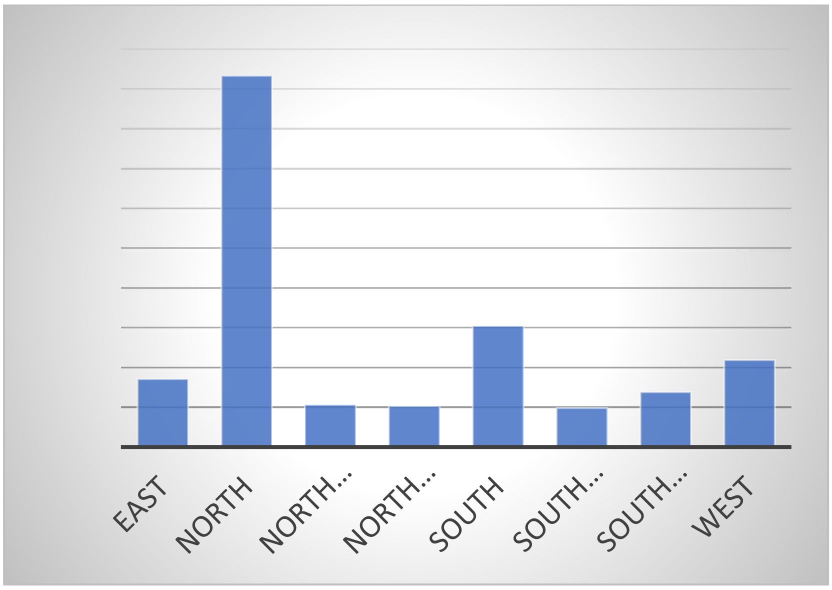
- **A few cities like "Las Vegas," "Nashville," and "Phoenix" have values close to zero but represented in scientific notation. These values suggest minimal energy consumption, with the negative sign possibly indicating a slight decrease in energy use over the specified period. However, the values are so small that their significance depends on specific measurement units and context. indicating that temperature anomalies are not significantly affecting energy consumption in these cities.**

How do specific wind patterns impact air quality and pollution dispersion in urban areas? Analyze wind direction data for insights.

```
SELECT
  city,
  country,
  wind_direction,
  COUNT(*) AS frequency,
  CASE
    WHEN wind_direction BETWEEN 0 AND 22.5 OR wind_direction >= 337.5 THEN 'North'
    WHEN wind_direction >= 22.5 AND wind_direction < 67.5 THEN 'Northeast'
    WHEN wind_direction >= 67.5 AND wind_direction < 112.5 THEN 'East'
    WHEN wind_direction >= 112.5 AND wind_direction < 157.5 THEN 'Southeast'
    WHEN wind_direction >= 157.5 AND wind_direction < 202.5 THEN 'South'
    WHEN wind_direction >= 202.5 AND wind_direction < 247.5 THEN 'Southwest'
    WHEN wind_direction >= 247.5 AND wind_direction < 292.5 THEN 'West'
    WHEN wind_direction >= 292.5 AND wind_direction < 337.5 THEN 'Northwest'
    ELSE 'Unknown'
  END AS wind_direction_category
FROM
  final_fact as f
  JOIN city_attribute as c ON c.city_id = f.city_id
GROUP BY
  city,
  country,
  wind_direction,
  wind_direction_category
ORDER BY
  frequency DESC;
```

OUTPUT

P	Q	R	S
country	wind_direction	frequency	wind_direction_category
Israel	0	8994	North
United States	0	6897	North
Israel	0	6707	North
Israel	360	4771	North
Israel	350	3803	North
United States	0	3620	North
United States	0	3478	North
United States	0	3402	North
United States	0	2895	North
United States	0	2811	North
Israel	0	2778	North
Israel	10	2770	North
Israel	0	2768	North



The Chart shows that the most common wind direction category in all of the cities listed is North. This means that the wind blows from north to south more often than in any other direction in these cities.

Here are some specific insights that can be drawn from the output:

The wind direction in Eilat, Israel is variable. This means that the wind does not blow from any one direction consistently in Eilat. This can make it difficult to predict how pollutants will be dispersed in Eilat.

The wind direction in the other cities listed is predominantly North. This means that pollutants emitted from sources in the northern part of these cities are likely to be transported to the southern part of the cities

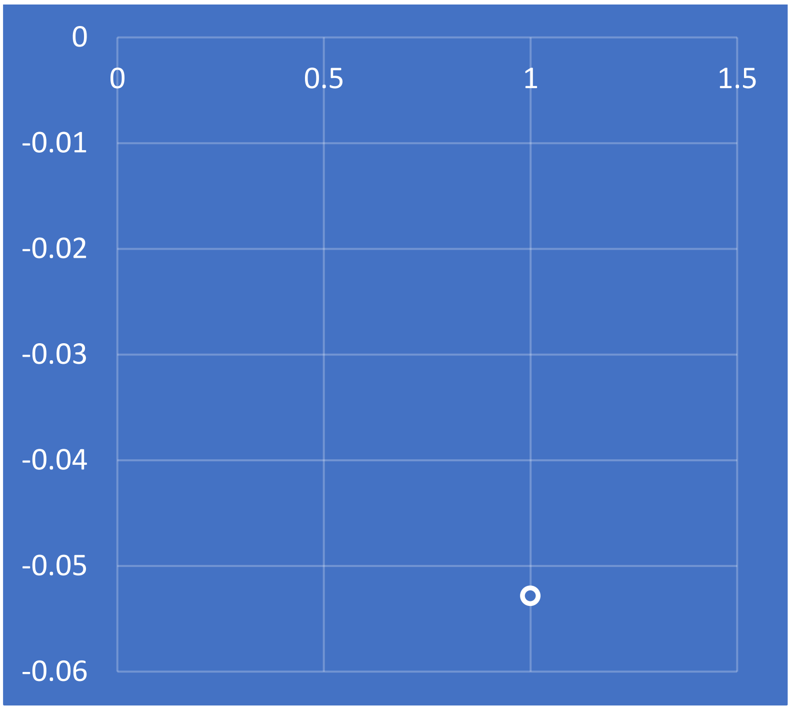
Explore whether wind speed and direction influence the frequency and severity of weather-related events (e.g., hurricanes, storms) in coastal cities.

```sql
WITH CoastalCities AS (
 SELECT DISTINCT
  city
 FROM
  city_attribute
 WHERE
  (country = 'Canada' AND latitude BETWEEN 45 AND 49)
  OR (country = 'United States' AND latitude BETWEEN 32 AND 49)
  OR (country = 'Israel' AND latitude BETWEEN 30 AND 33)
)

SELECT
 c.city,
 wind_speed,
 wind_direction,
 weather_description,
 COUNT(*) AS frequency
FROM
 final_fact AS f
 JOIN city_attribute AS c ON c.city_id = f.city_id
 JOIN CoastalCities AS coastal ON c.city = coastal.city
WHERE
 LOWER(weather_description) LIKE '%storm%'
 OR LOWER(weather_description) LIKE '%heavy rain%'
 OR LOWER(weather_description) = 'tornado'
GROUP BY
 c.city,
 wind_speed,
 wind_direction,
 weather_description
ORDER BY
 c.city,
 frequency DESC;
```

OUTPUT

N	O	P	Q	R	S	T	U
	city	wind_speed	wind_direction	weather_description	frequency		
	Albuquerque	2	0	proximity thunderstorm	5		
	Albuquerque	2	0	thunderstorm	5		
	Albuquerque	1	0	proximity thunderstorm	5		
	Albuquerque	5	220	proximity thunderstorm	4		
	Albuquerque	2	260	proximity thunderstorm	4		



This scatter is plot showing a negative correlation between wind speed and wind direction frequency in coastal areas suggests that certain combinations of wind conditions occur less frequently. This can influence the frequency and severity of weather events like storms or heavy rain. For instance, less common wind conditions may lead to fewer weather events, and when they do occur together, they could be more severe. Understanding this correlation is crucial for better forecasting and preparedness for extreme weather conditions in coastal regions.