

A high-resolution image of Earth from space, centered on the African continent. Australia is visible in the lower half of the frame. The image shows the curvature of the planet, with blue oceans, brown and green landmasses, and white cloud patterns. The background is a deep black space filled with numerous small, distant stars.

RAINFALL IN AUSTRALIA

Project on Data Cleaning and Visualization

WELCOME TO THE PRESENTATION ON THE AUSTRALIAN WEATHER CHANGE OVER 8 YEARS FROM 2009 TO 2016

Introduction to the Project:

Source: <https://www.kaggle.com/jsphyg/weather-dataset-rattle-package>

The dataset has 23 columns and 145,460 rows

The columns used in this project:



```
1 df_group.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 4416 entries, 0 to 4415
Data columns (total 21 columns):
 #   Column                Non-Null Count  Dtype  
---  -
 0   Date                  4416 non-null   datetime64[ns]
 1   MinTemp               4416 non-null   float64
 2   MaxTemp               4416 non-null   float64
 3   Rainfall              4416 non-null   float64
 4   WindGustDir           4416 non-null   object  
 5   WindGustSpeed         4416 non-null   float64
 6   WindDir9am            4416 non-null   object  
 7   WindDir3pm            4416 non-null   object  
 8   WindSpeed9am          4416 non-null   float64
 9   WindSpeed3pm          4416 non-null   float64
10  Humidity9am           4416 non-null   float64
11  Humidity3pm           4416 non-null   float64
12  Pressure9am           4416 non-null   float64
13  Pressure3pm           4416 non-null   float64
14  Temp9am               4416 non-null   float64
15  Temp3pm               4416 non-null   float64
16  RainToday             4416 non-null   object  
17  RainTomorrow          4416 non-null   object  
18  Year                  4416 non-null   int64  
19  Month                 4416 non-null   int64  
20  AvgTemp               4416 non-null   float64
dtypes: datetime64[ns](1), float64(13), int64(2), object(5)
memory usage: 724.6+ KB
```



Target Questions for The Project:

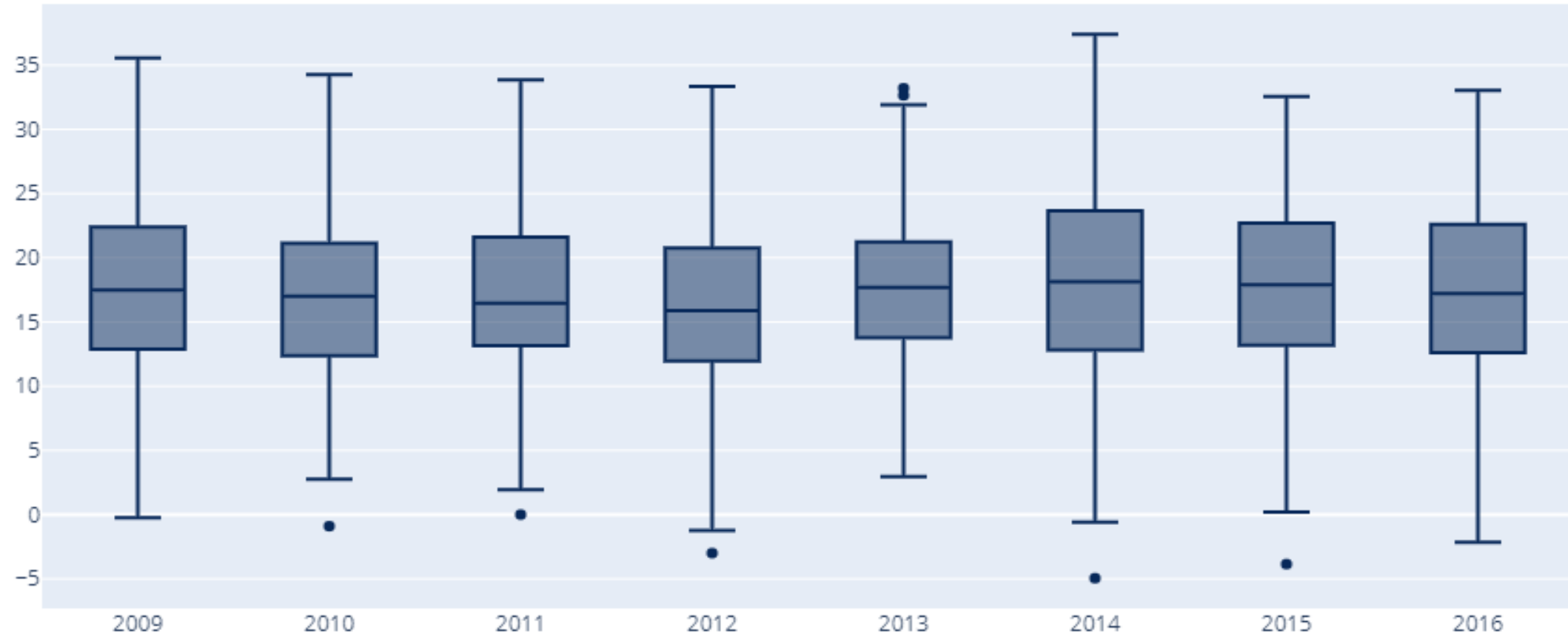
- Does the change in temperature and humidity, over the 8 years have led to higher or lower rainfall?
- How do the wind speed, and wind direction affect the rainfall?
- Is the change in pressure level, over the 8 years, led to higher or lower rainfall?
- How do the humid level and pressure impact the rainfall and prediction?
- How does the change in pressure, temperature, and humidity affect rainfall?
- Changes in wind gust direction and speed impacting rainfall



DOES THE CHANGE
IN TEMPERATURE
AND HUMIDITY,
OVER THE 8 YEARS
HAVE LED TO
HIGHER OR LOWER
RAINFALL?

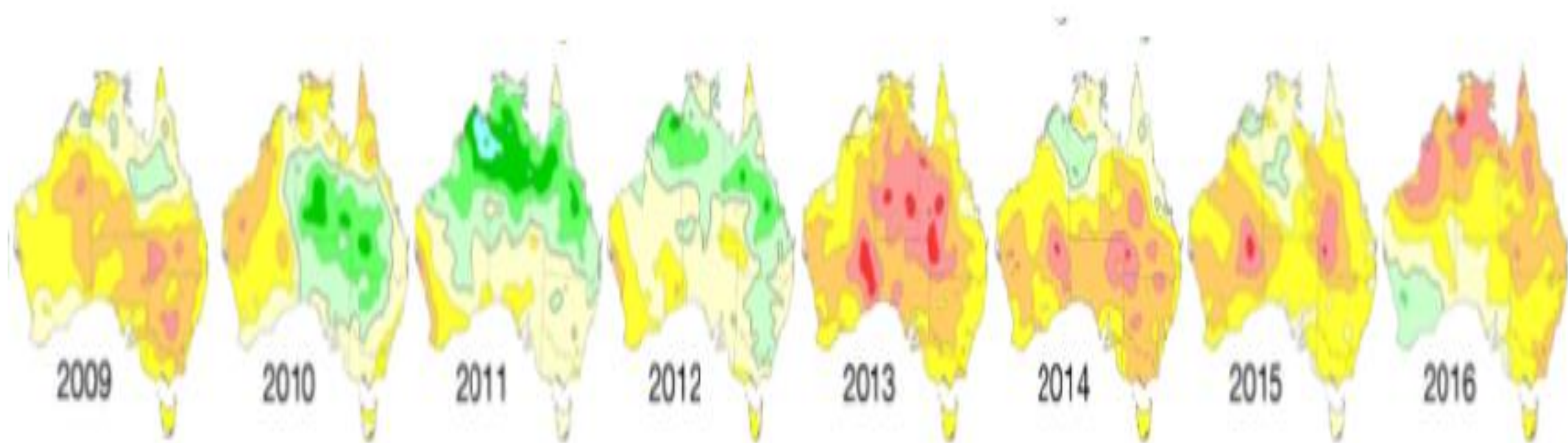


Avg Temperature change over 8 Years



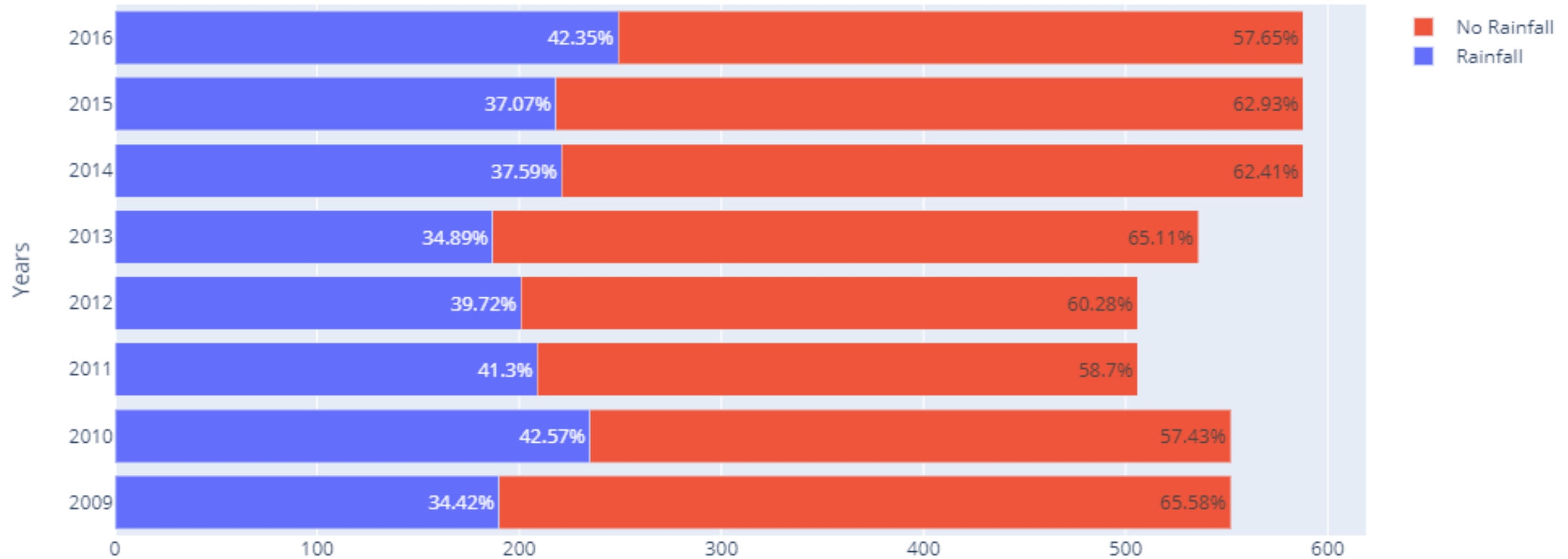
Year 2012 - 2013 increase in the median of 1.80

Year 2013 - 2014 increase in the median of 0.45



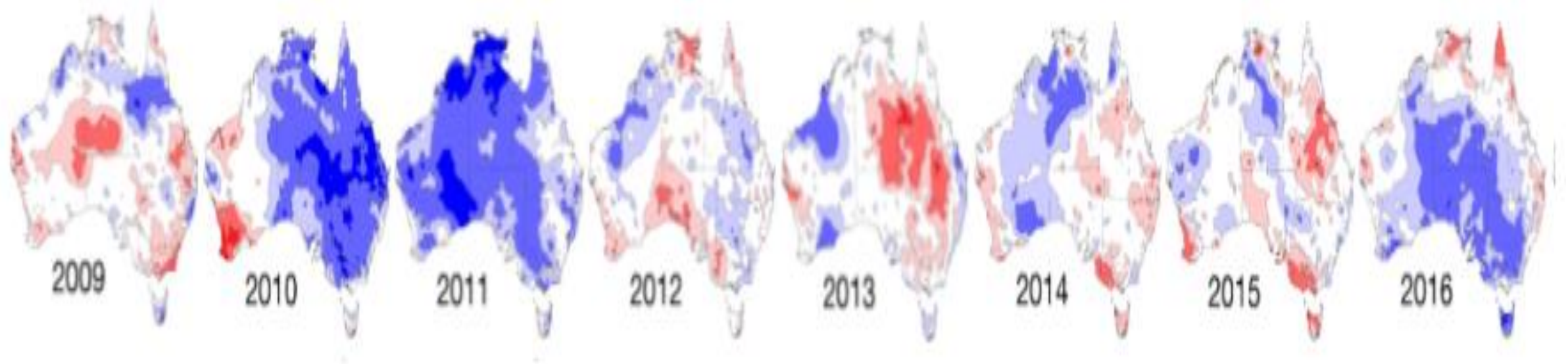
Source: <http://www.bom.gov.au/climate/history/temperature/>

Actual Rainfall Count vs Zero Rainfall Count over 8 Years



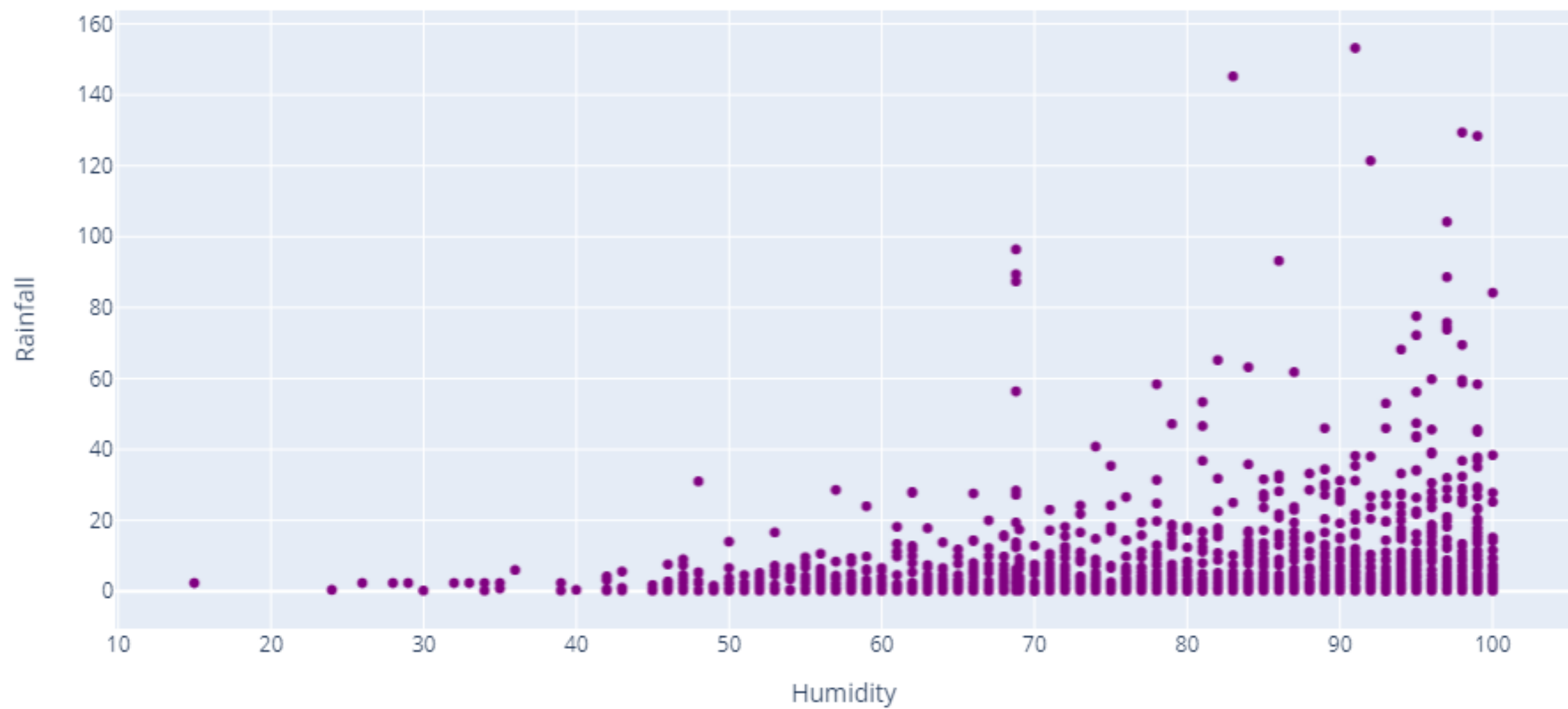
Year 2009-2010 rainfall count increased by 24%.

Year 2015-2016 rainfall count increased by 14%

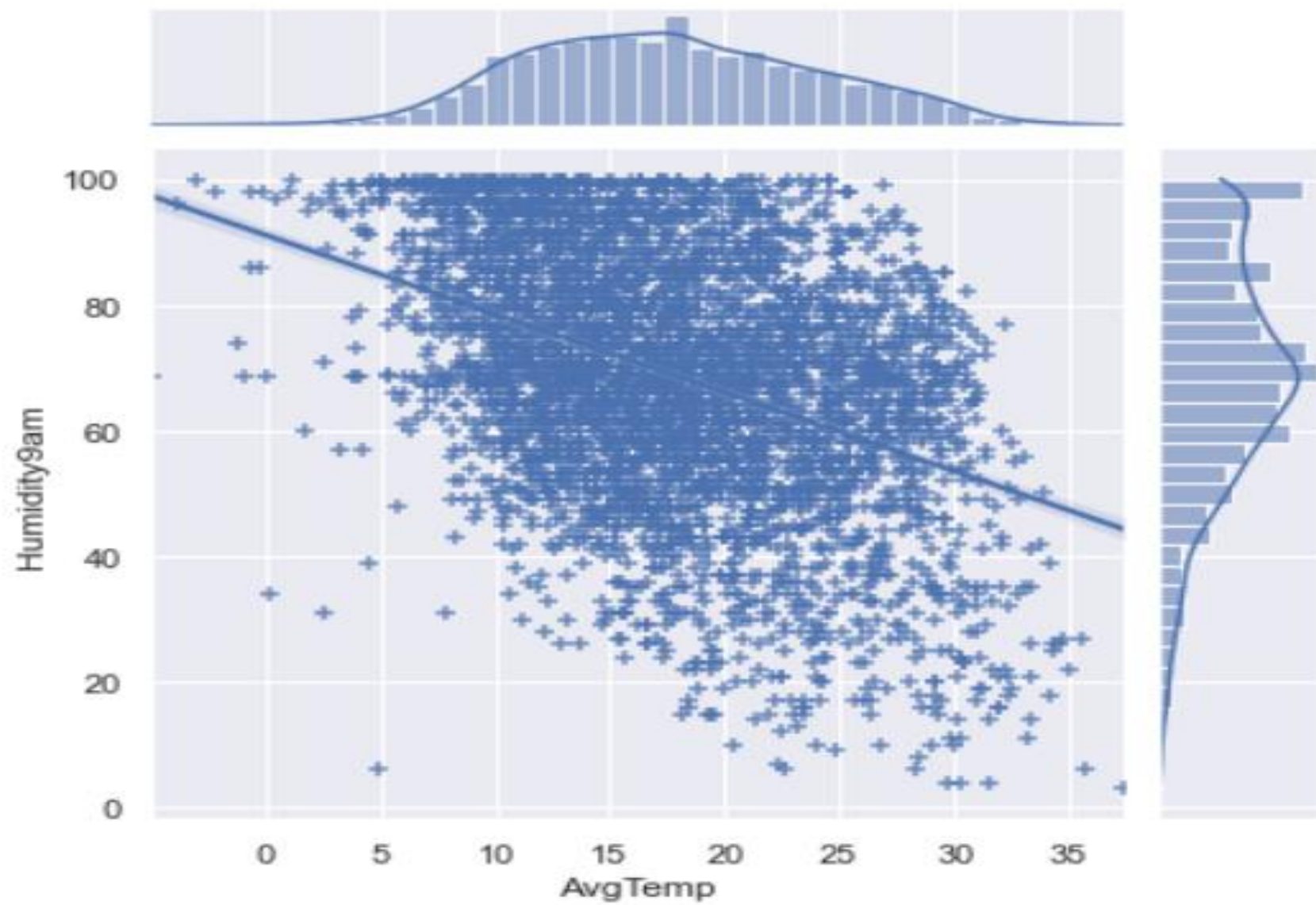


Source: <http://www.bom.gov.au/climate/history/temperature/>

Humidity vs Rainfall



Avg Temp vs Humidity

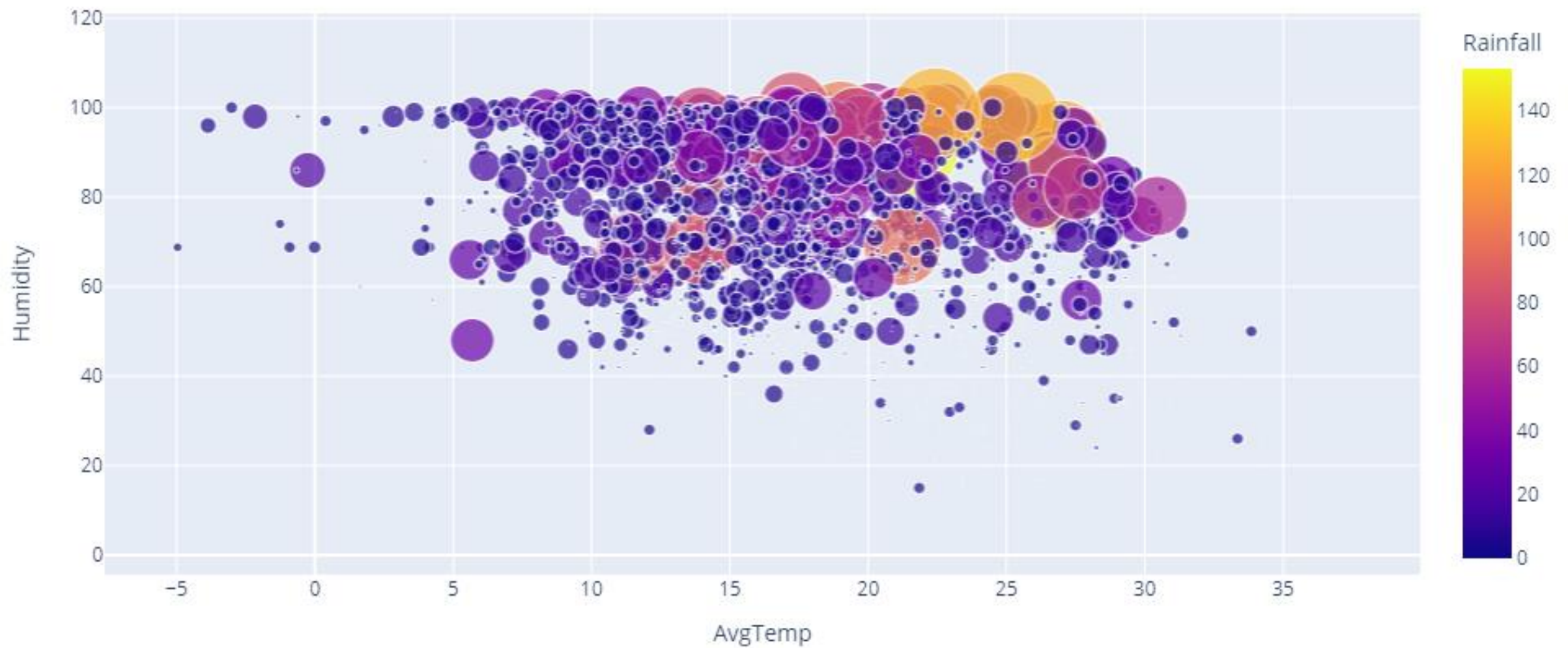


Relation Between Relative Humidity and Temperature

We have already learned what is temperature and what is humidity and we have also learned two types of humidity. As we know, both these two concepts ie. Temperature and Humidity are different but they are related to each other. The relation between humidity and temperature formula simply says they are inversely proportional. If temperature increases it will lead to a decrease in relative humidity, thus the air will become drier whereas when temperature decreases, the air will become wet means the relative humidity will increase.

Source: <https://www.vedantu.com/geography/relation-between-temperature-and-humidity>

Avg Temperature & Humidity vs Rainfall over the 8 Years



Observation:

The weather elements – Temperature, Humidity & Rain have direct or indirect impact each other.

Average temperature ranges between 10 to 30 degree Celsius and Humidity ranges between 60 to 100 the occurrence of rainfall high

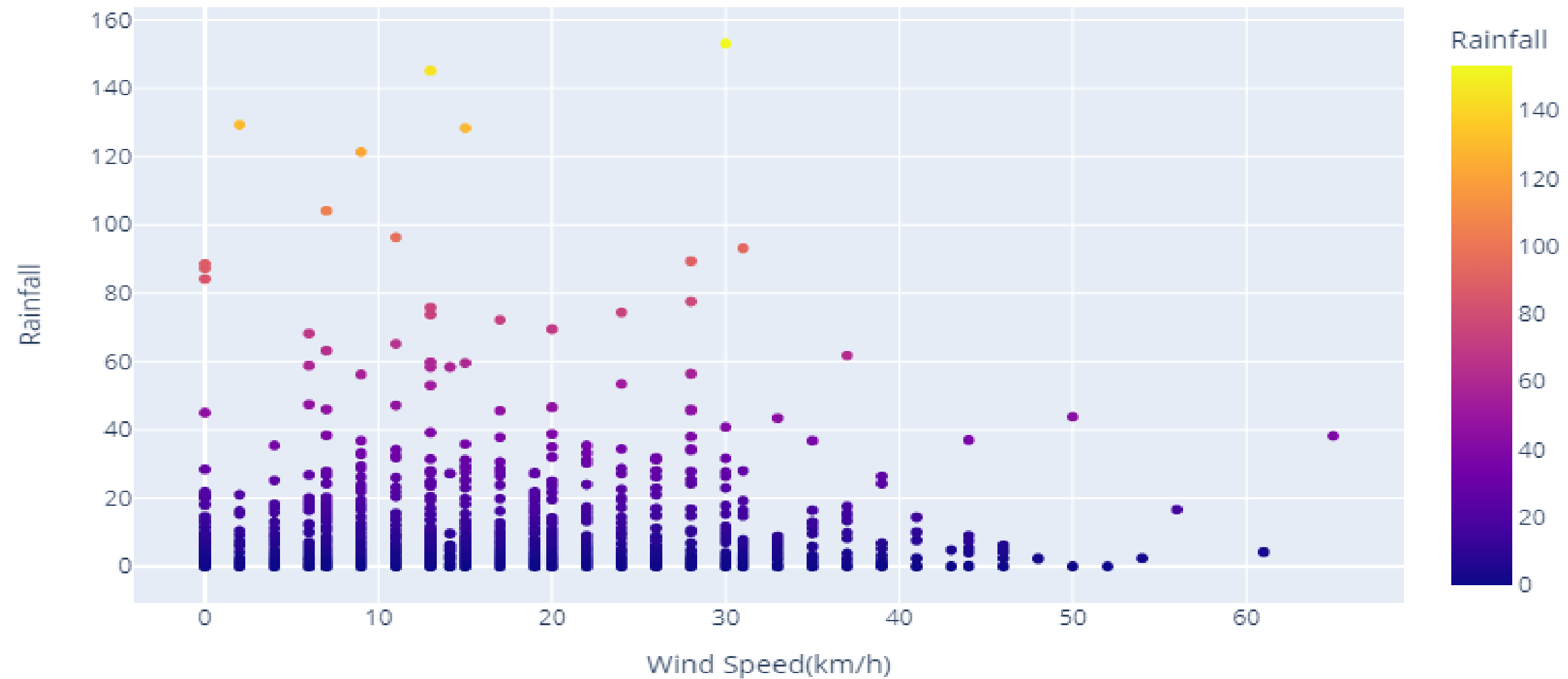
Australia have four seasons, with a very pleasant weather. But in year 2013 & 2014 the temperature increased making the hottest years among 8 years.

This gives us a hint that one or more factors affecting weather in Australia. Parts of Australia vary in climates due to its large geographical size. The reason for the increase in temperature can be established further with a bigger dataset and area wise analysis.

- HOW DO THE WIND SPEED, AND WIND DIRECTION AFFECT THE RAINFALL?



Wind Speed vs Rainfall





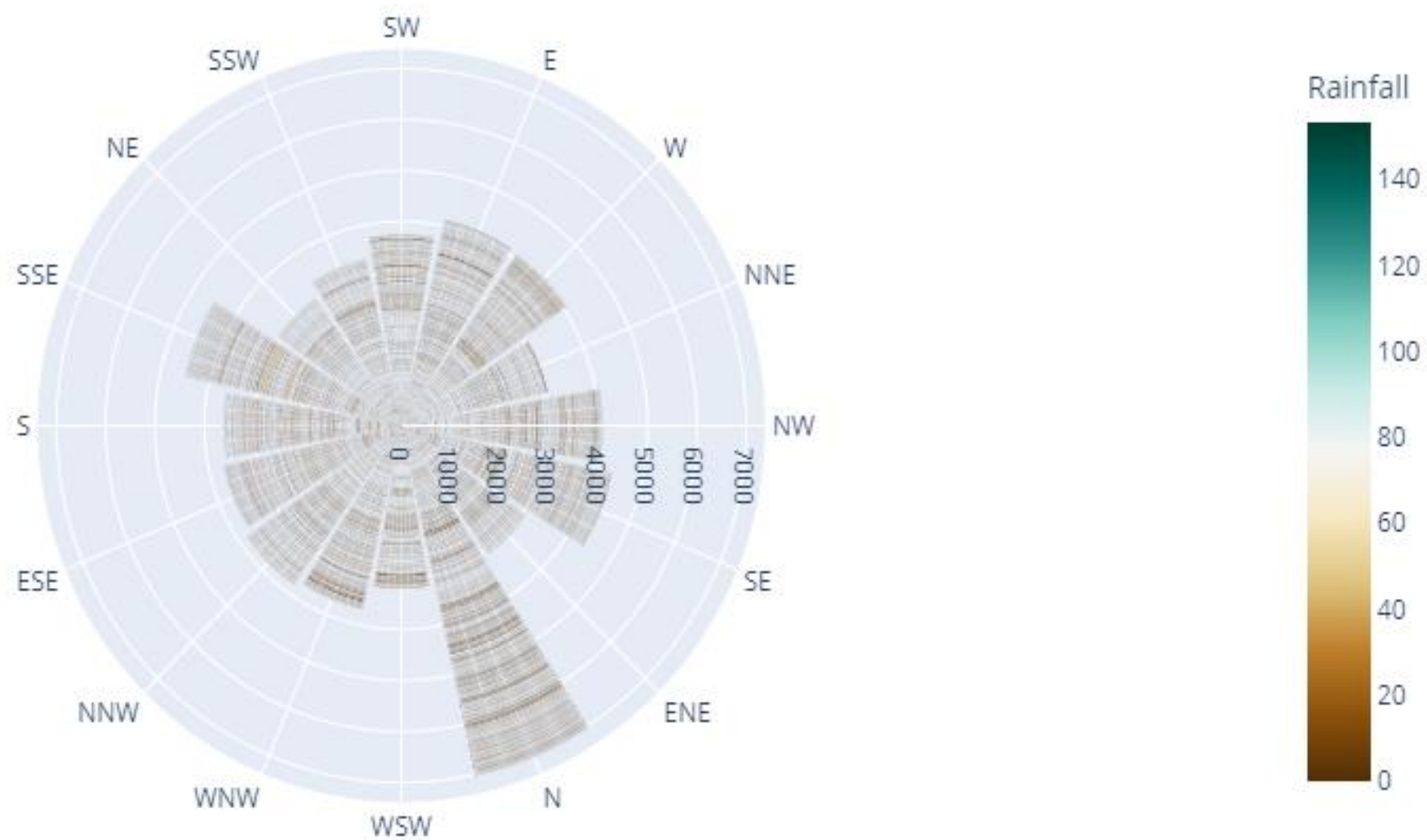
What effect does wind have on precipitation?

The observed increases in precipitation are much greater than evaporation changes associated with the increased wind speed; this implies a convergence feedback by which evaporation induces **moisture convergence** that feeds increases in precipitation.

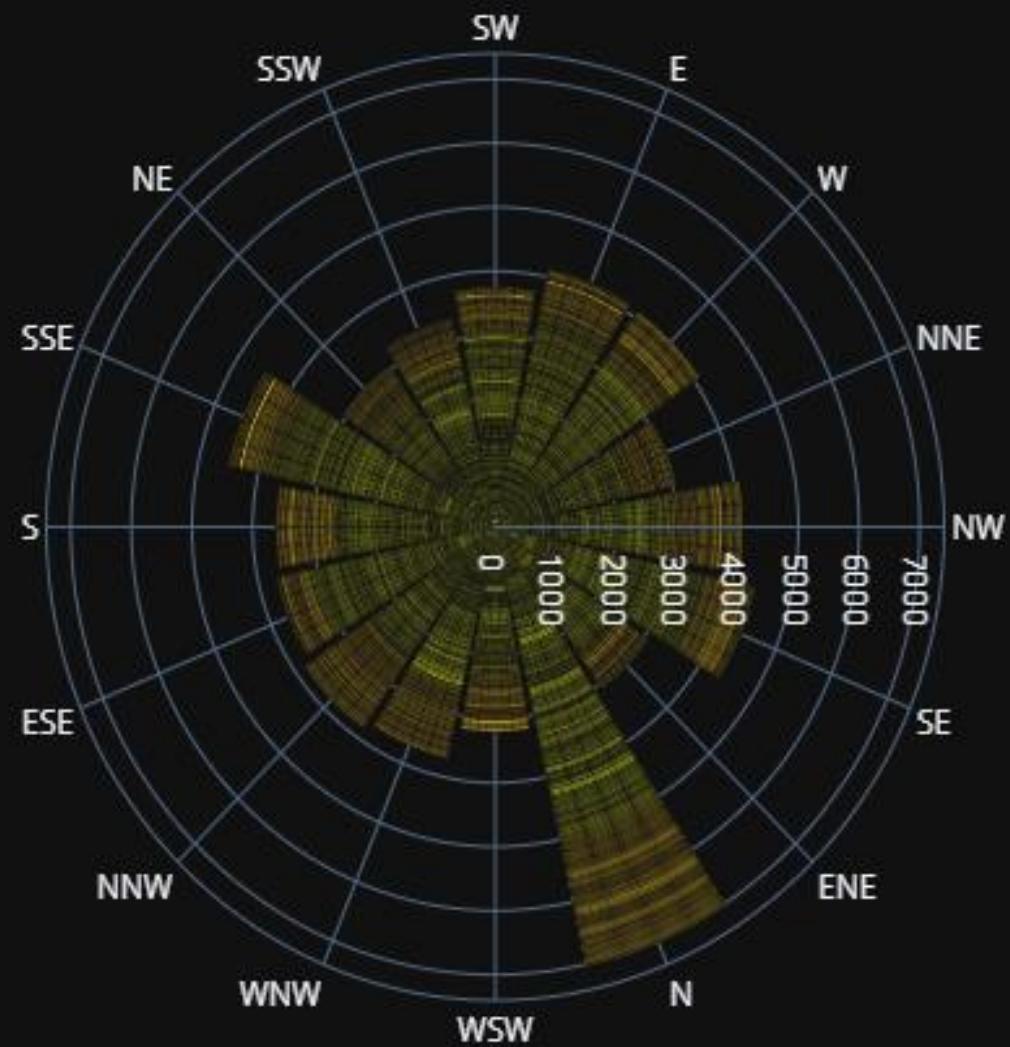
Source:

<https://journals.ametsoc.org/view/journals/clim/18/20/jcli3519.1.xml#:~:text=The%20observed%20increases%20in%20precipitation,that%20feeds%20increases%20in%20precipitation.>

Wind Speed and Direction vs Actual Rainfall



Wind Speed and Direction vs Rainfall Prediction



RainTomorrow

☐ No☒ Yes

Observation:

Wind speed and direction impact the rainfall.

Wind speed increases the precipitation

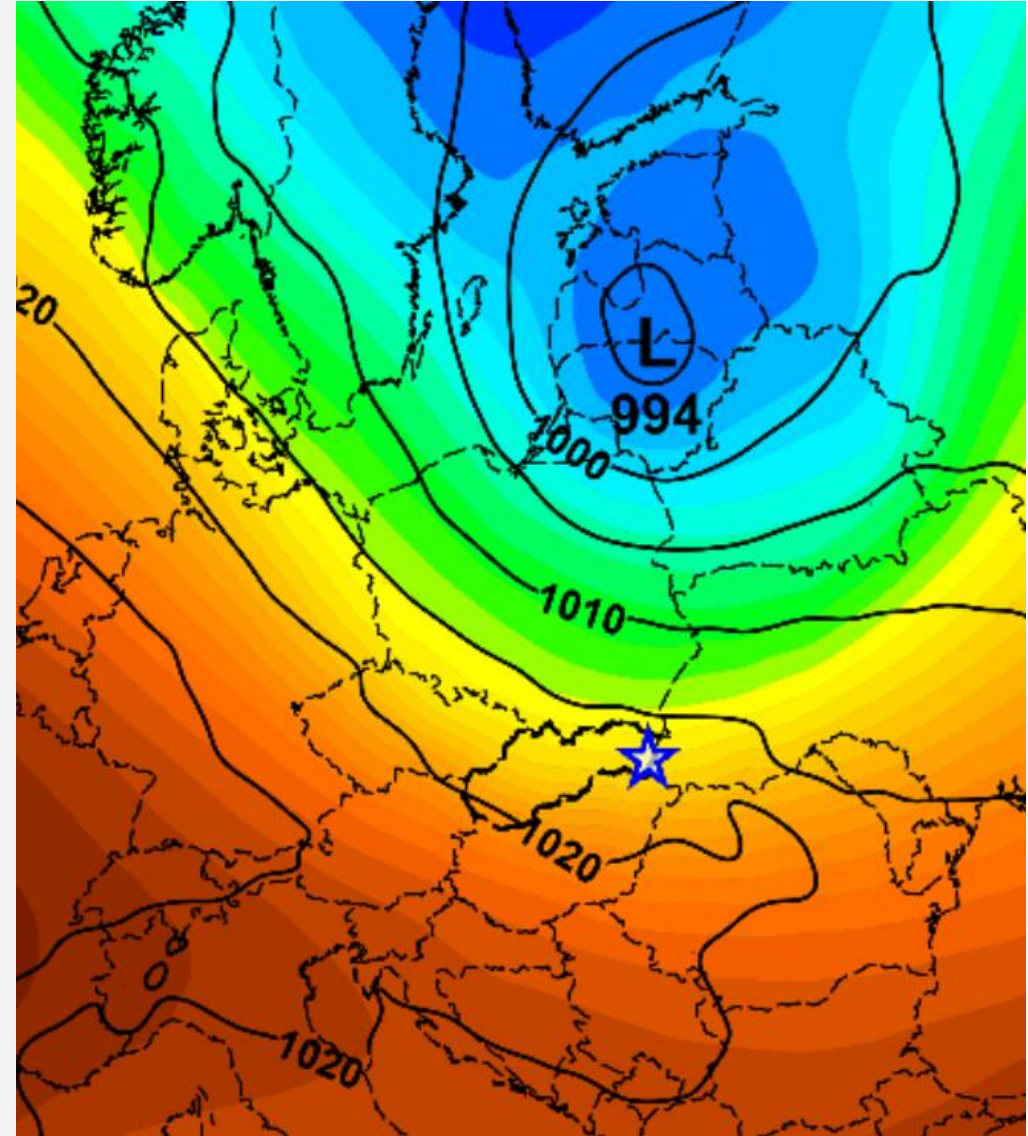
Wind speed and direction get affected by other factors such as sea and land altitude

Northern part of Australia have very high wind compared to other parts of Australia. To look in to the reason we need details of the land scape.

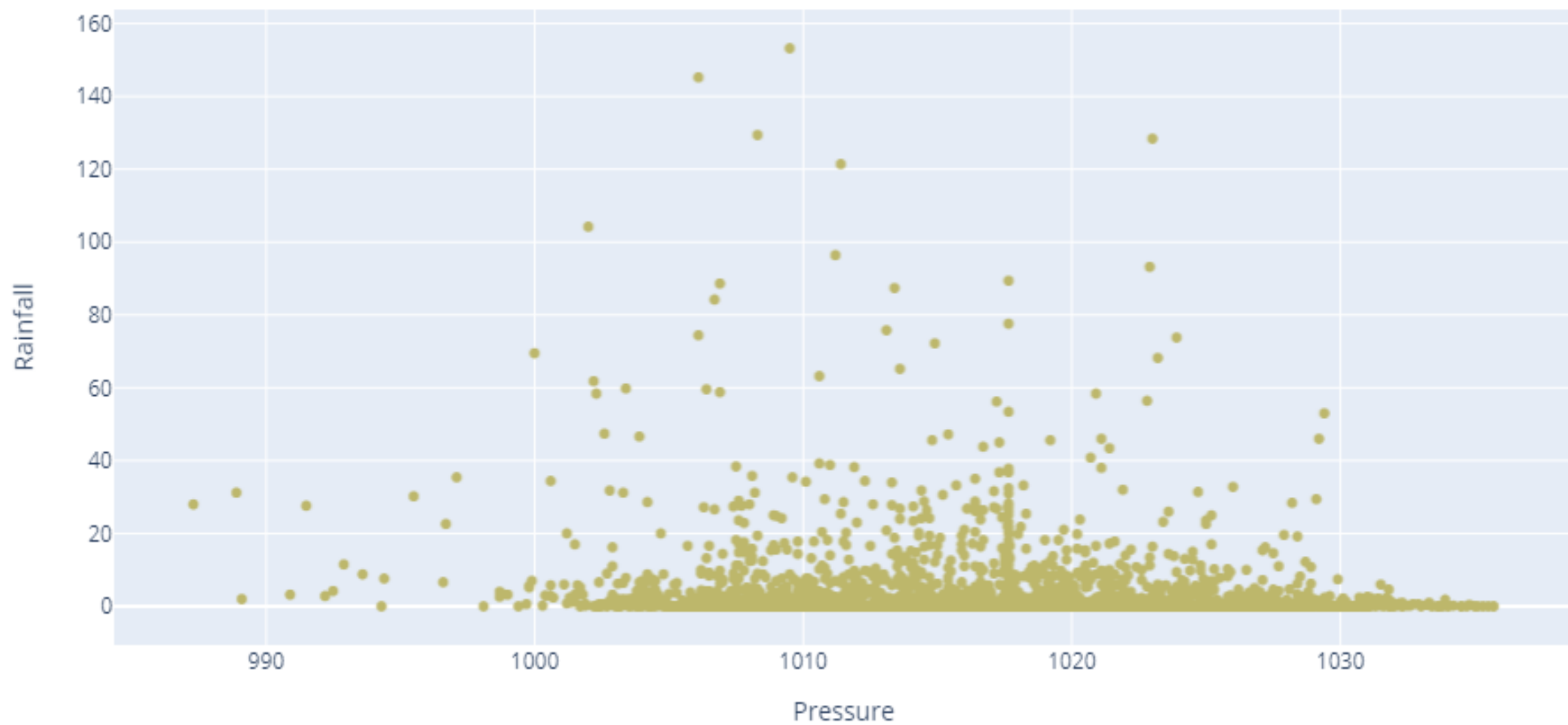
Further Australia can consider using wind power and construct wind turbine to reduce the use of the natural gas and oil

This will help to preserve the natural resources

- IS THE CHANGE IN PRESSURE LEVEL, OVER THE 8 YEARS, LED TO HIGHER OR LOWER RAINFALL?



Pressure vs Rainfall

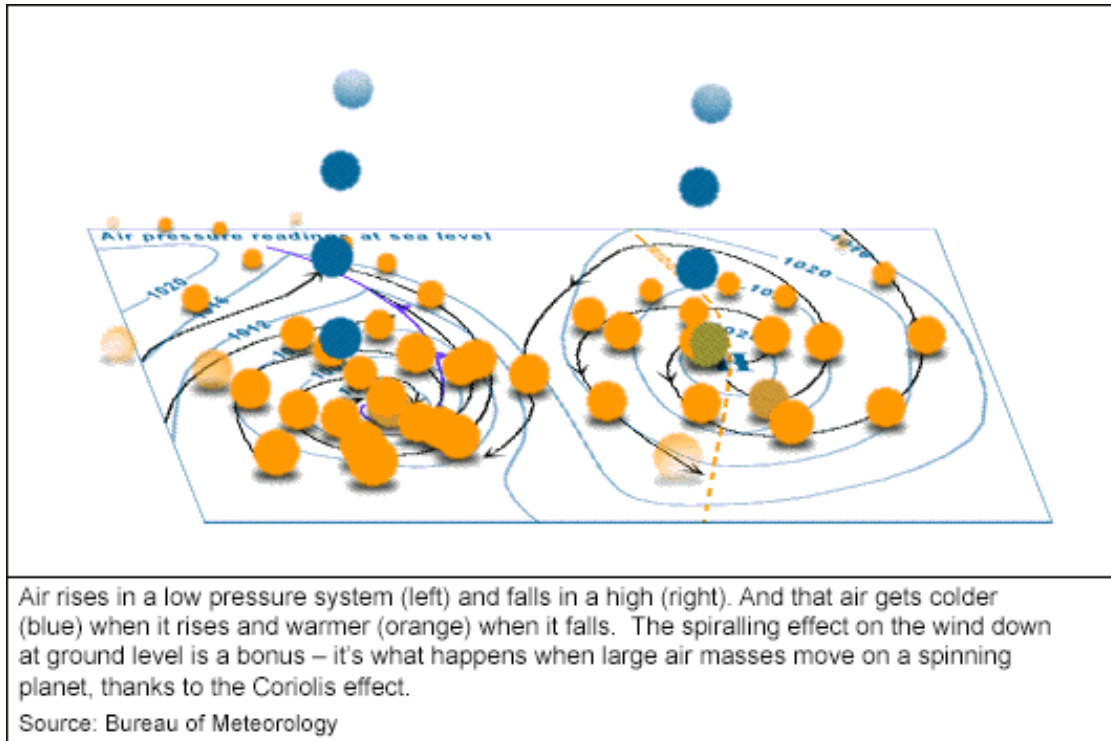


Kelly Reardon, cleveland.com

Low pressure

Low pressure is caused by upward moving air. As the air is forced upward, it cools to its dew point forming condensation and rain.

Ref Source: https://www.cleveland.com/weather/blog/2016/09/why_does_high_pressure_mean_ni.html



Ref Source:
<https://www.abc.net.au/science/articles/2014/10/15/4074902.htm>

Observation:

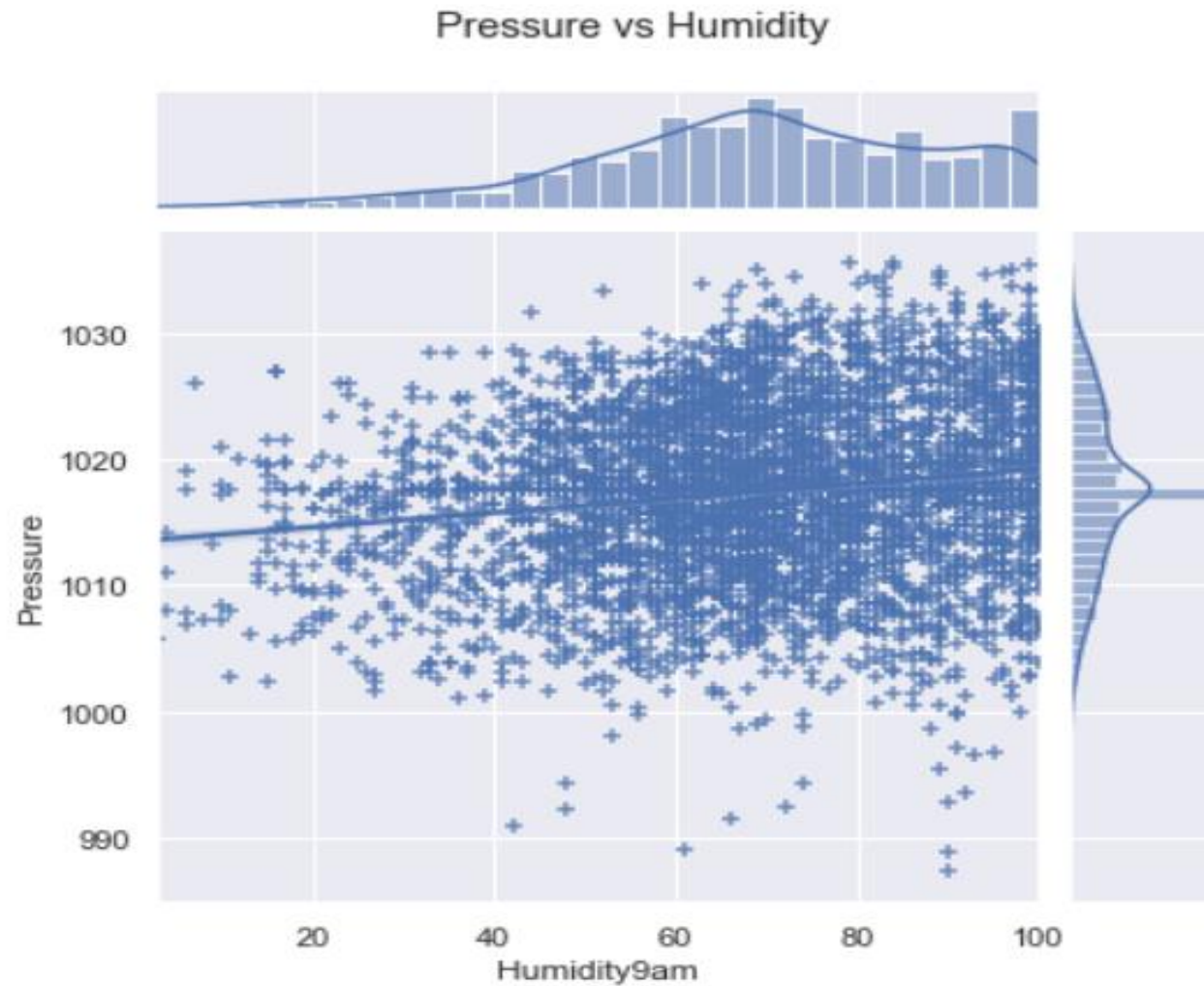
Warm or hot air is forced to move upwards and it carries water vapor

Upward moving air will cause low pressure

Air in the upper atmosphere cools and water vapor condenses to cloud and rain

- How do the humid level and pressure impact the rainfall and prediction?

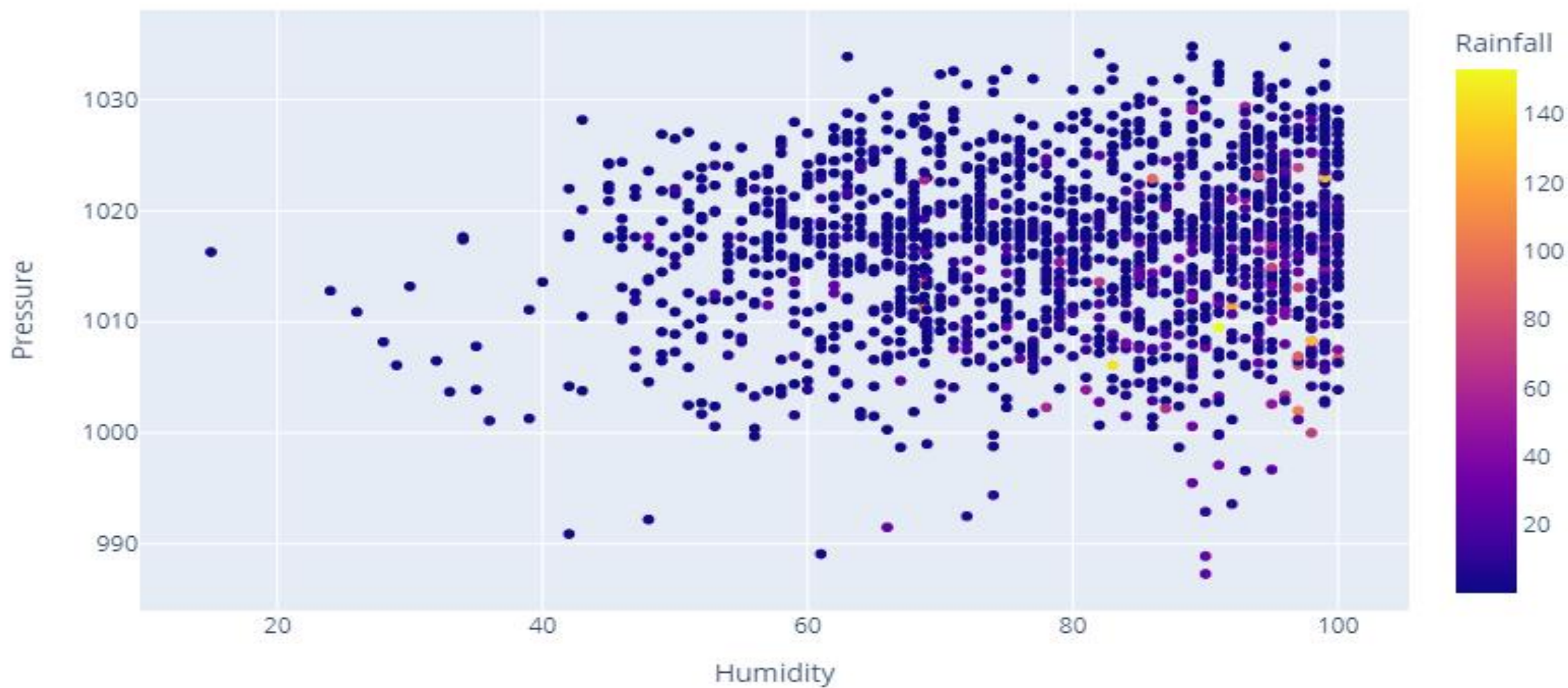




2. As the total pressure of a system decreases, the relative humidity will decrease because p will decrease but p_s will not change because the temperature has not changed. Likewise, as the total pressure of a system increases, the relative humidity will increase until eventually saturation is reached.

Ref Source: <https://www.processsensing.com/en-us/blog/effect-of-temperature-and-pressure-on-rh%20.htm#:~:text=2.,until%20eventually%20saturation%20is%20reached>.

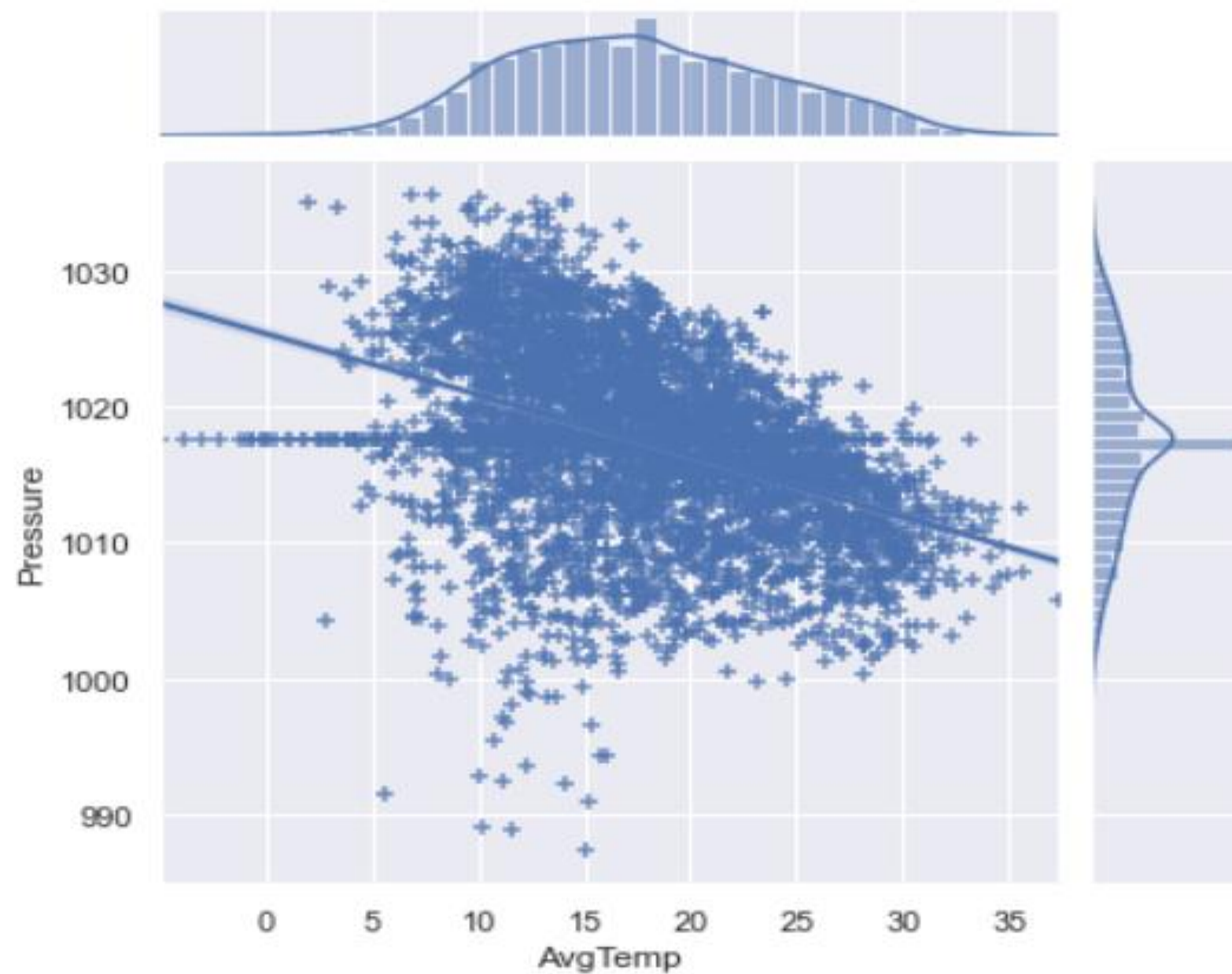
Humidity & Pressure vs Rainfall



- HOW DOES THE CHANGE IN PRESSURE, TEMPERATURE, AND HUMIDITY AFFECT RAINFALL?



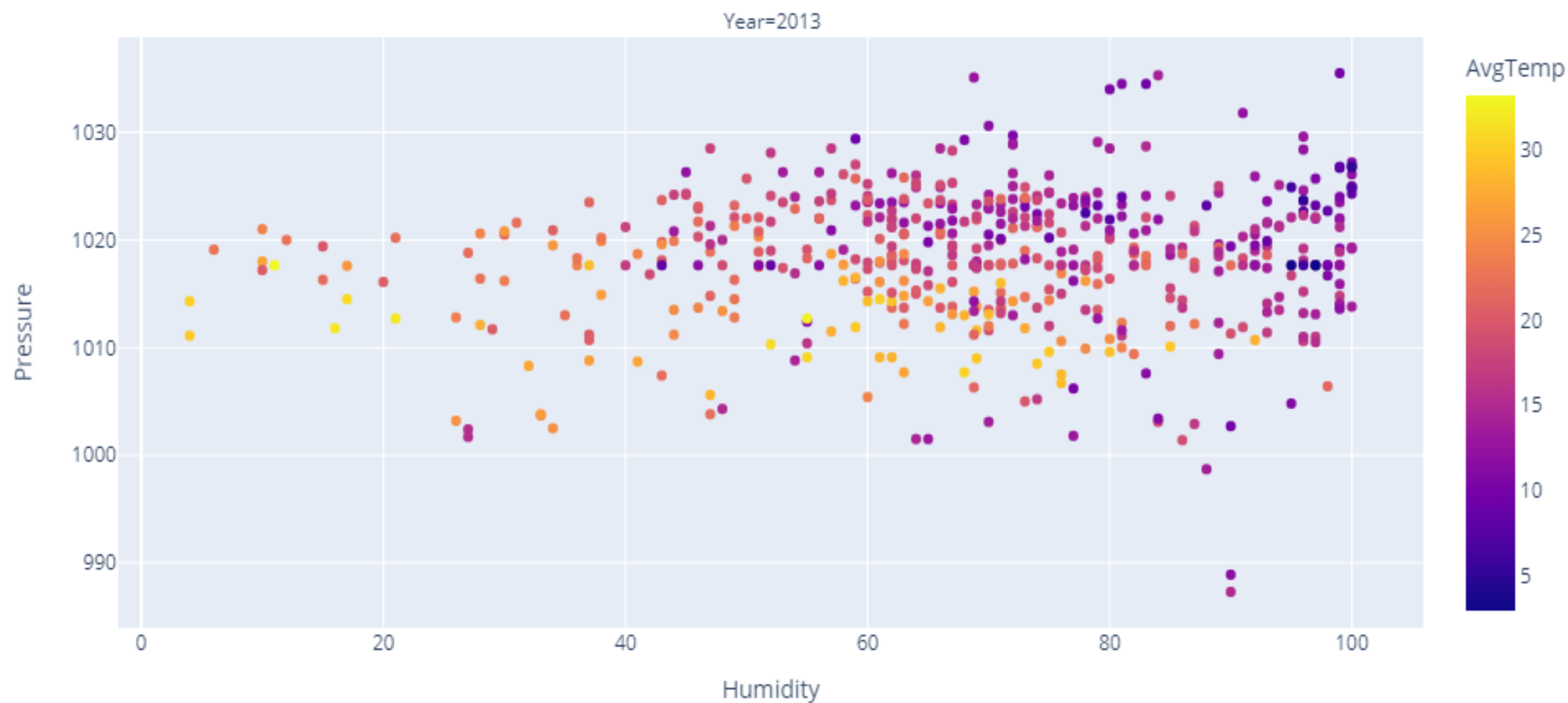
Pressure vs Avg Temperature



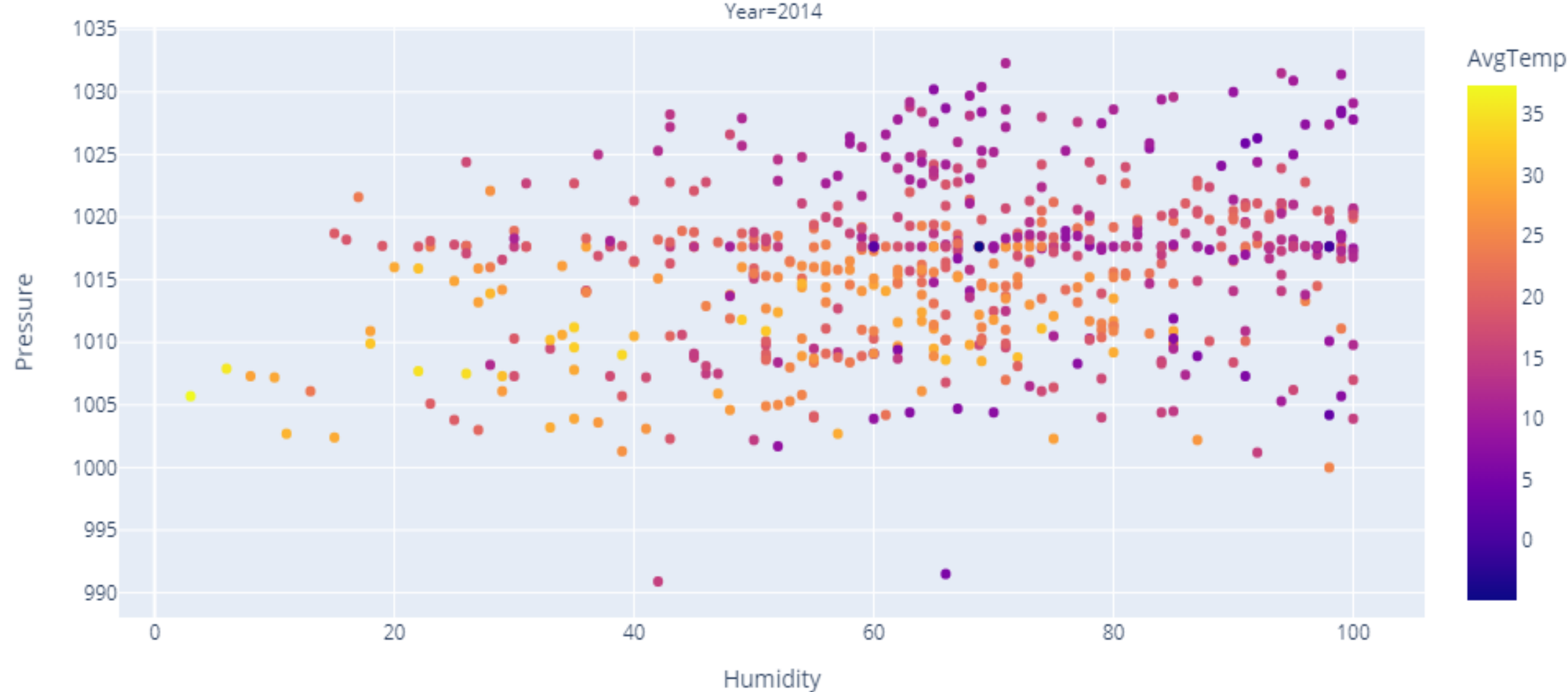
Pressure varies from day to day at the Earth's surface – the bottom of the atmosphere. This is, in part, because the Earth is not equally heated by the Sun. Areas where the air is warmed often have lower pressure because the warm air rises. These areas are called low pressure systems. Places where the air pressure is high, are called high pressure systems.

Ref Source: <https://scied.ucar.edu/learning-zone/how-weather-works/highs-and-lows-air-pressure#:~:text=Pressure%20varies%20from%20day%20to,because%20the%20warm%20air%20rises.>

Humidity & Pressure vs Avg Temperature in Year 2013



Humidity & Pressure vs Avg Temperature in Year 2014



Observation:

There are more count of rainfall observed when humidity ranges from 60 - 100 , pressure level between 1000 –1030

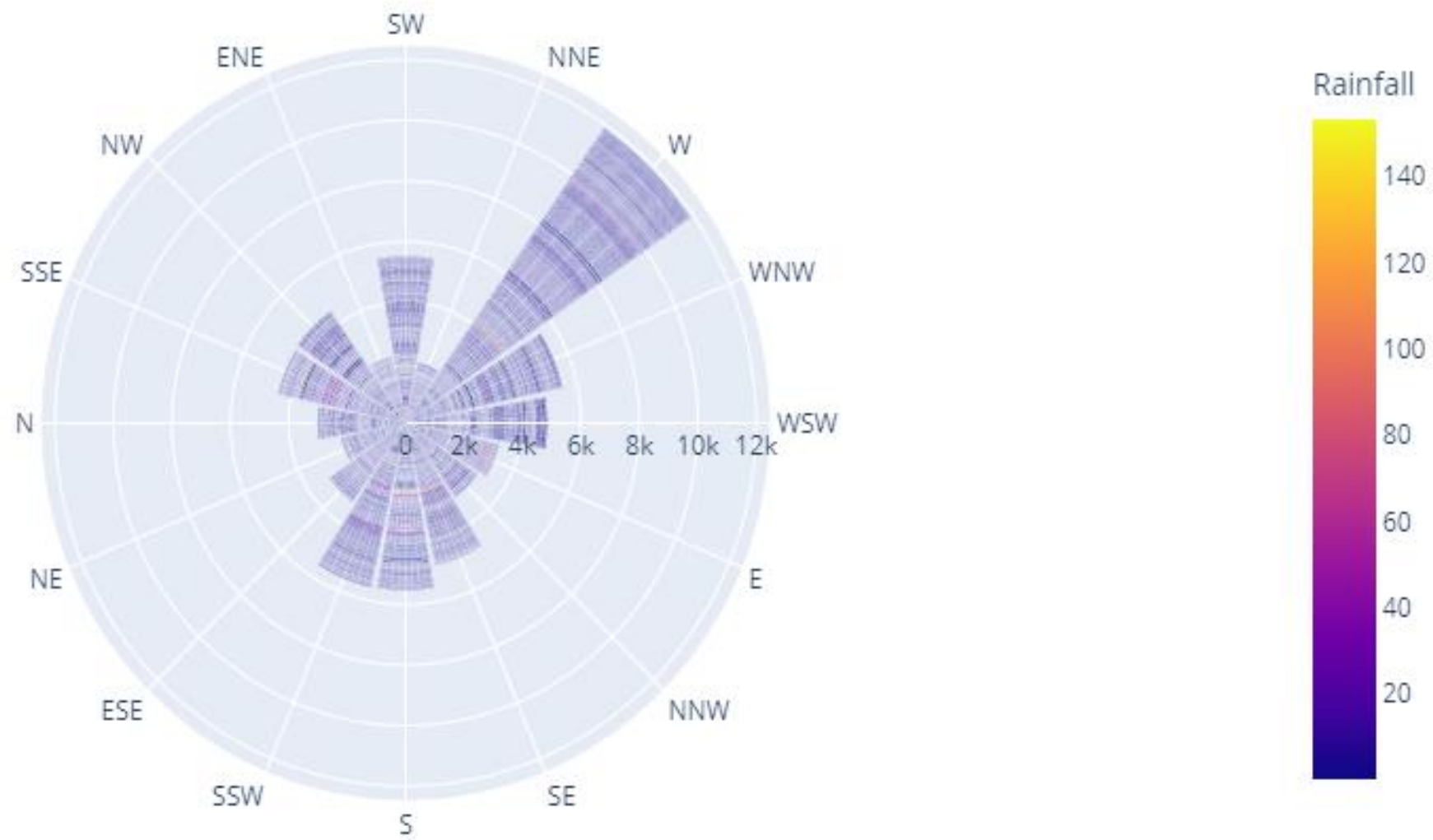
And temperature between 15 to 30 degree Celsius

To find how this pattern affect Australia we need more number of data with details on land scape

CHANGES IN WIND
GUST DIRECTION
AND SPEED
IMPACTING
RAINFALL



Wind Gust Speed & Wind Gust Direction vs Rainfall



Parameter of Comparison	Gust	Wind
Strength	30% stronger than wind	30% weaker than gusts
Duration	Less than 20 seconds	Flows continually
Caused by	When winds hit an obstacle such as a high ground or building	Flow of air from high pressure to low pressure area
Geographic location	Flows mostly above the ground and occasionally over water	Flows both above ground and water
Factors affecting	Height of the obstacle, dynamics of the terrain, average wind speed, etc.	Earth's rotation , heating by the Sun, pressure difference in atmosphere, etc.

<https://askanydifference.com/difference-between-gust-and-wind/>

“The other times when strong winds occur are during thunderstorms. Surface wind gusts are produced from thunderstorm downdrafts and from the passage of Sumatra squall lines,” said Prof Horton.

<https://www.todayonline.com/singapore/windy-day-singapore-experts-say-its-normal-time-year>

Observation:

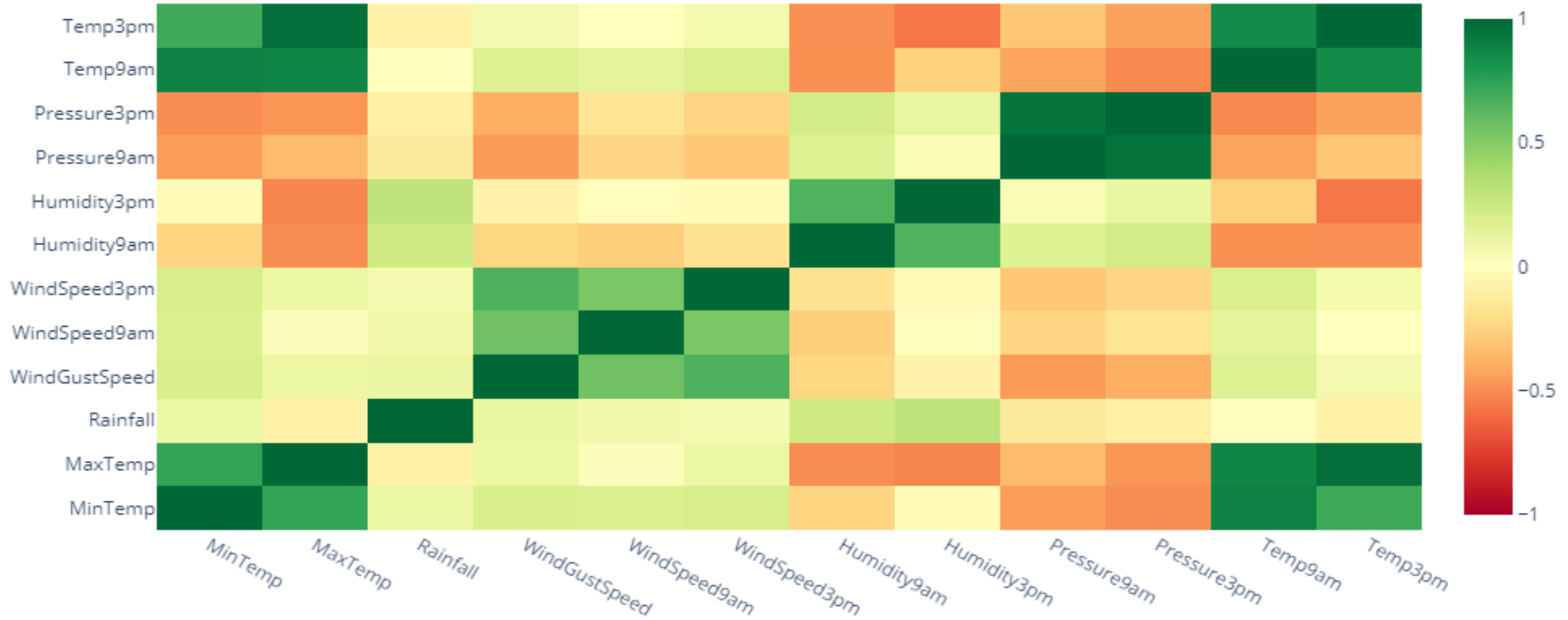
Wind gust is different from normal wind

Wind gust is coursed during thunderstorm

Western Australia have more wind gust, so this part of Australia could experience thunderstorm

Pearson correlation

Pearson correlation



Project finding summary:

Weather Elements & Impact on each other:

- Rainfall increases the humidity.
- Temperature increases will decrease the humidity
- Low Pressure will cause rain
- Wind speed or wind gust will cause rain

Is the temperature increase in Australia true?

- ☐ It could be true, but from this project, I could not accept or reject my hypothesis. Because the dataset is only for 8 years and needs to do further statistical analysis to conclude. But based on this project looking at the trend, there was increase in temperature until 2014 and started to decline afterward.

Do the environmental changes lead to extreme weather conditions?

- ☐ Possible, because looking at the dataset, there is a sudden increase in temperature in 2013 & 2014. It could be due to carbon emissions and greenhouse gases.

