GLOBAL WARMING &

TROPICAL CYCLONE IMPACT

TOM HINMAN

- Bachelors Degree in Hotel Restaurant Management, Ferris State University
- Bethel Tech Data Science Certificate
- Worked as a Small Business and Entrepreneur Developer for five years at Ludington Chamber of Commerce, Michigan
- Small Business Owner for 7 years (Coffee Company)
- Concerned citizen of earth

PROJECT BACKGROUND

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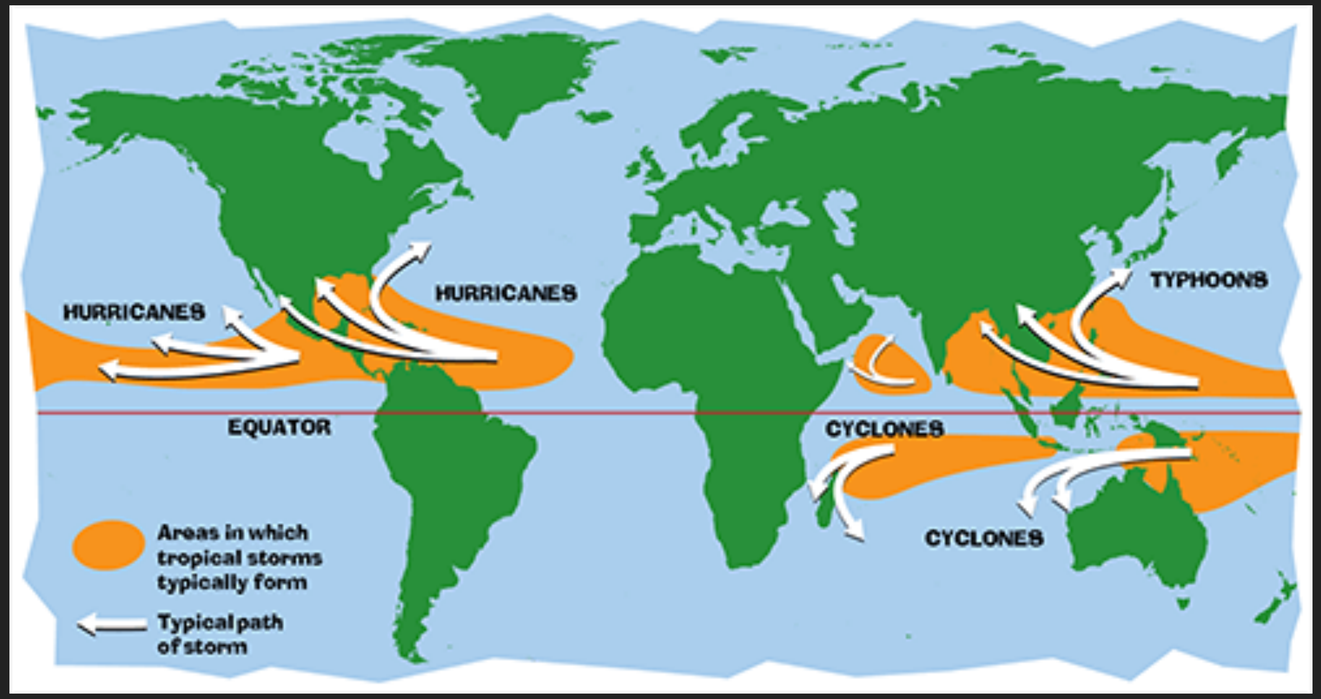
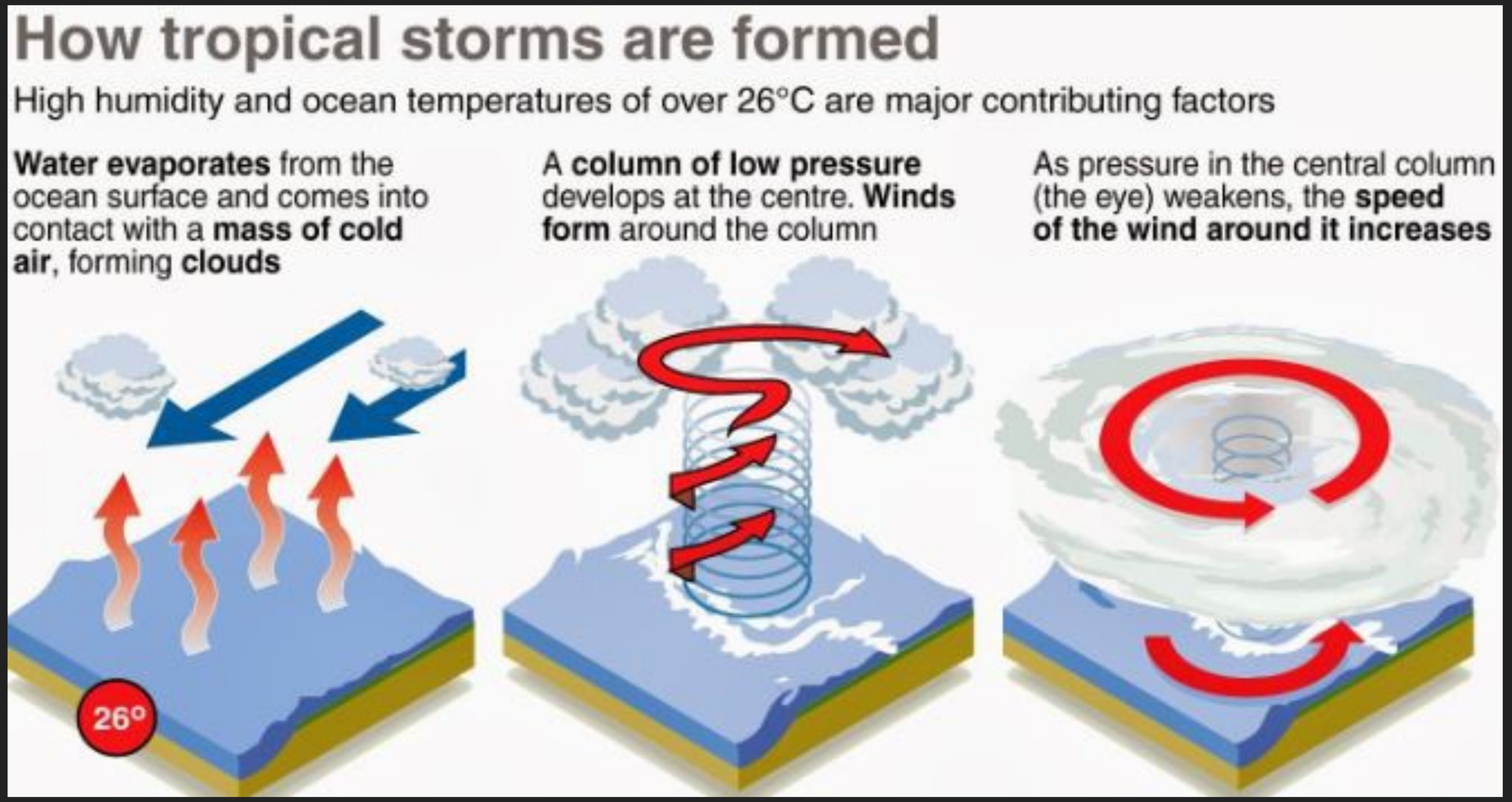


HOW TROPICAL CYCLONES ARE FORMED

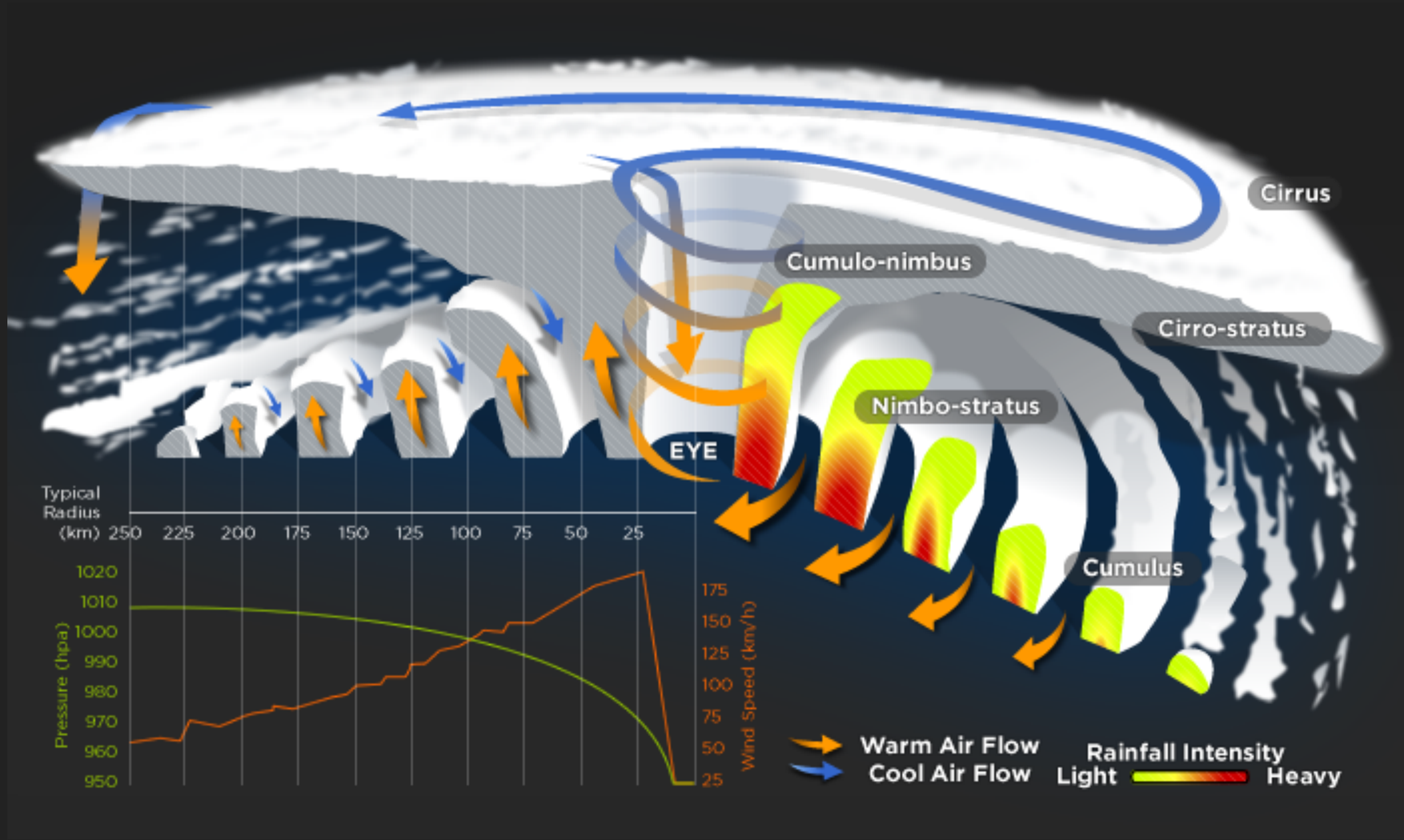


TROPICAL CYCLONE BREAKDOWN

- There are four classifications of Tropical Cyclones
  - Tropical Disturbance: a low pressure column and rotating weather pattern
  - Tropical Depression: wind speeds 25-38mph
  - Tropical Storm: wind speeds between 39mph and 74mph
  - Hurricane or Typhoon: wind speeds above 74mph

HURRICANE CATEGORIES

ANATOMY OF A TROPICAL CYCLONE



WHAT DATA ARE WE USING

- Global Temperature Data was gathered from Berkley University, Berkley Earth, This data is a collection of data from 1750-2016
- Cyclone Data is from NOAA, HURDAT this is a collection of all Tropical Cyclones, in the Atlantic and Pacific Oceans 1851-2015
- Global Storm Surge Data, From SURGEDAT Louisiana State University, 1850-2015
- Sea Level Rise Data from NOAA, Laboratory of Satellite Altimetry, 1992-2021
- Population Data from United Nations, Population Division, 1950-2019
- Land and Ocean Temperature Anomalies, NOAA (NCEI), 1880-2021

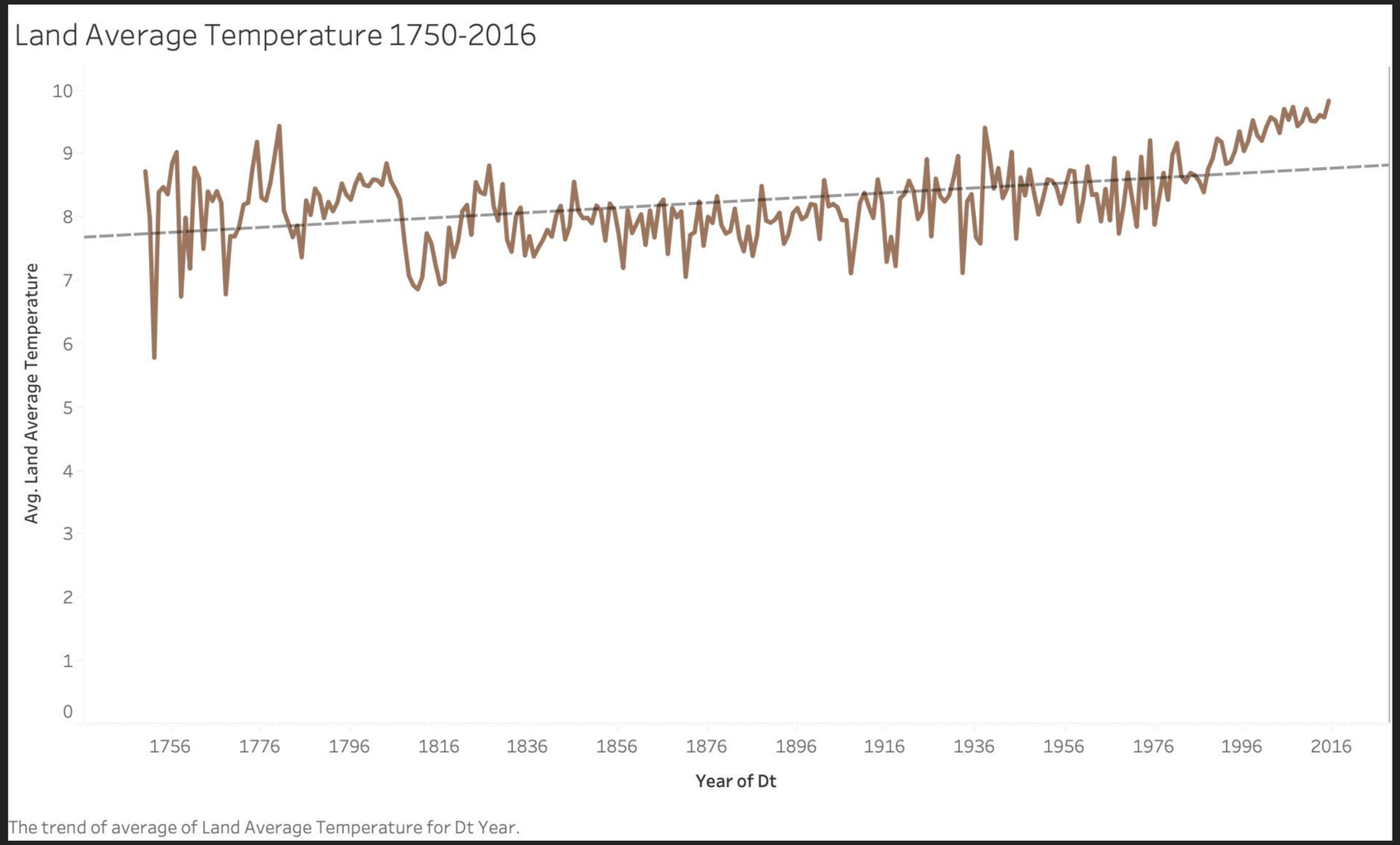
DATA WRANGLING

WHAT IS THE DATA LIKE

- Most of this data is dates and numbers, readings of temperatures and looking at variations in reading from minimum pressure, max, winds, ocean levels and temperatures.
- Natively this is easy data to work with, but the trick is seeing the relationships and reading between the lines.
- These are scientific readings and understanding the parameters of how it is recorded is also crucial in fully understanding what this data means.

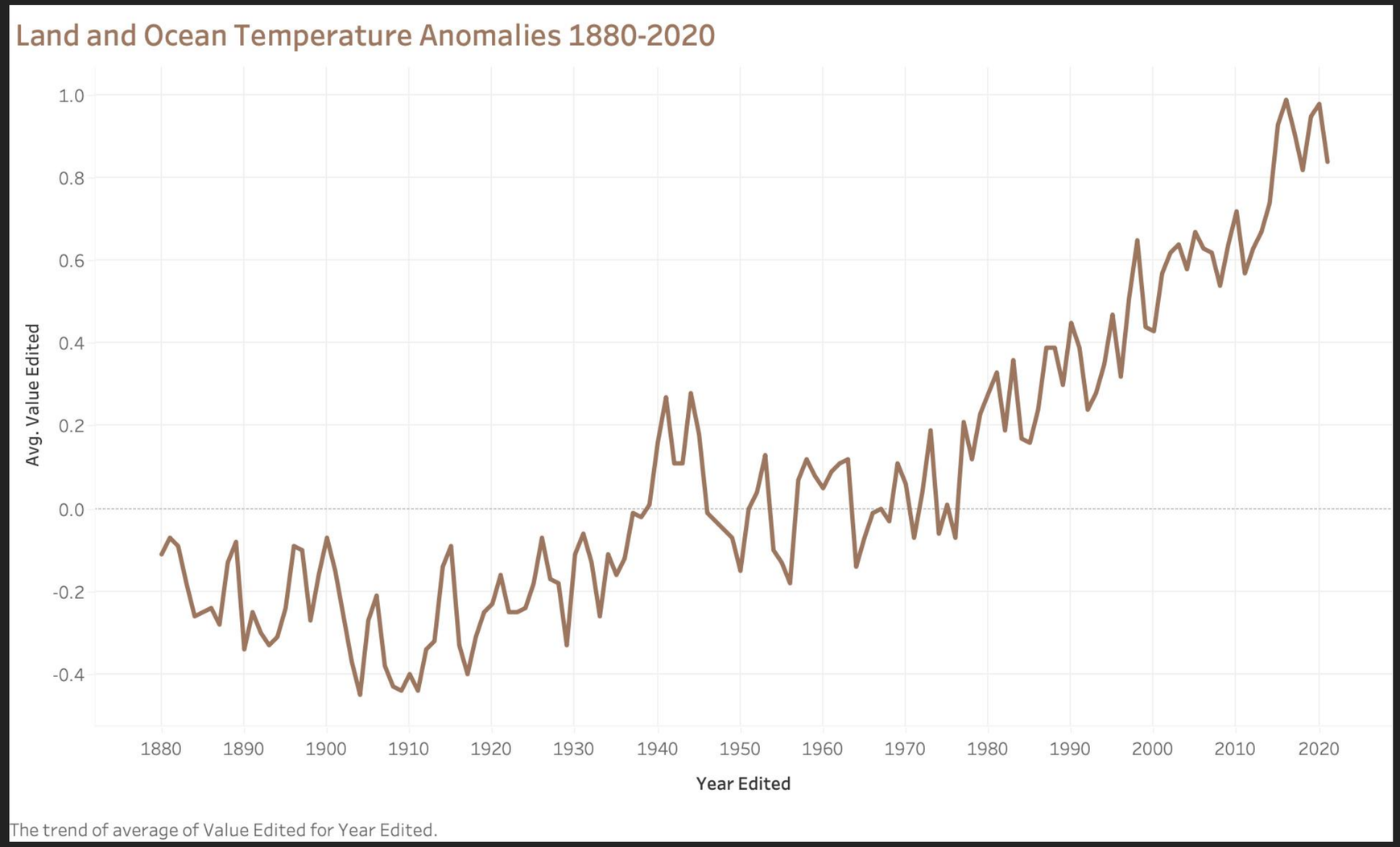
IS THE EARTH WARMING

- This is the Global Land Temperature Average in Celsius

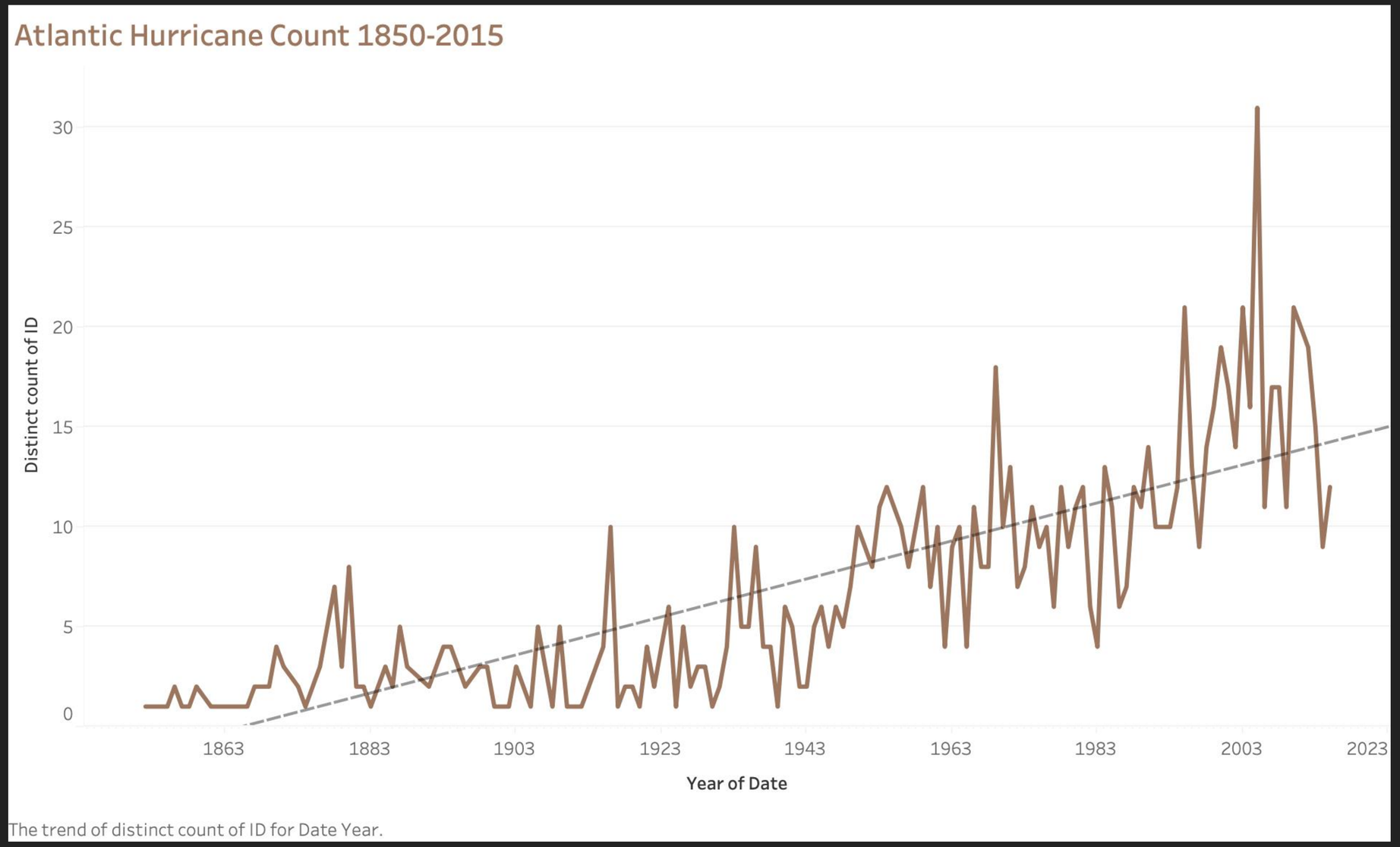


IS THE EARTH WARMING CONTINUED

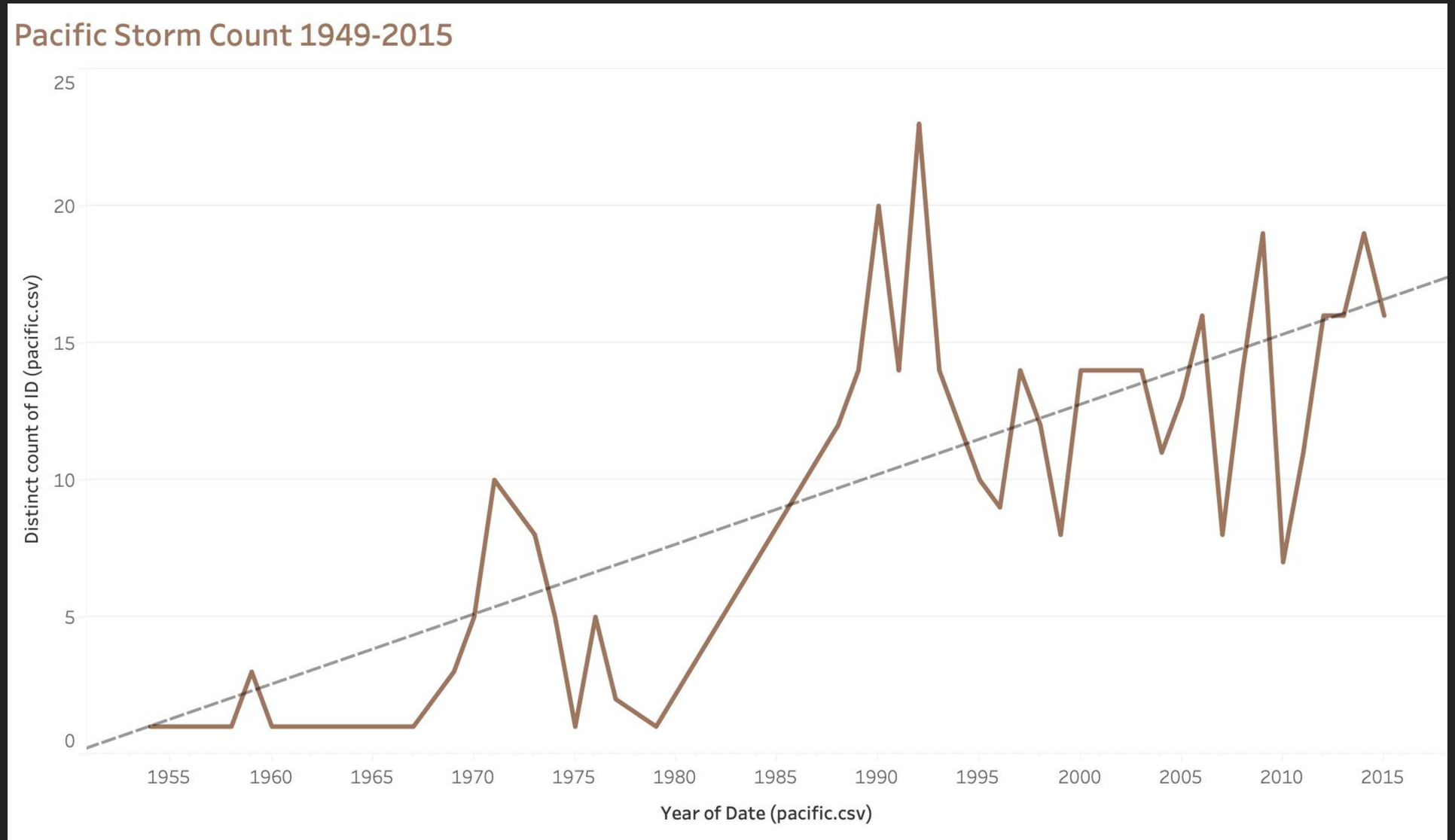
- This is Land and Ocean Temperature Anomalies from 1880-2020



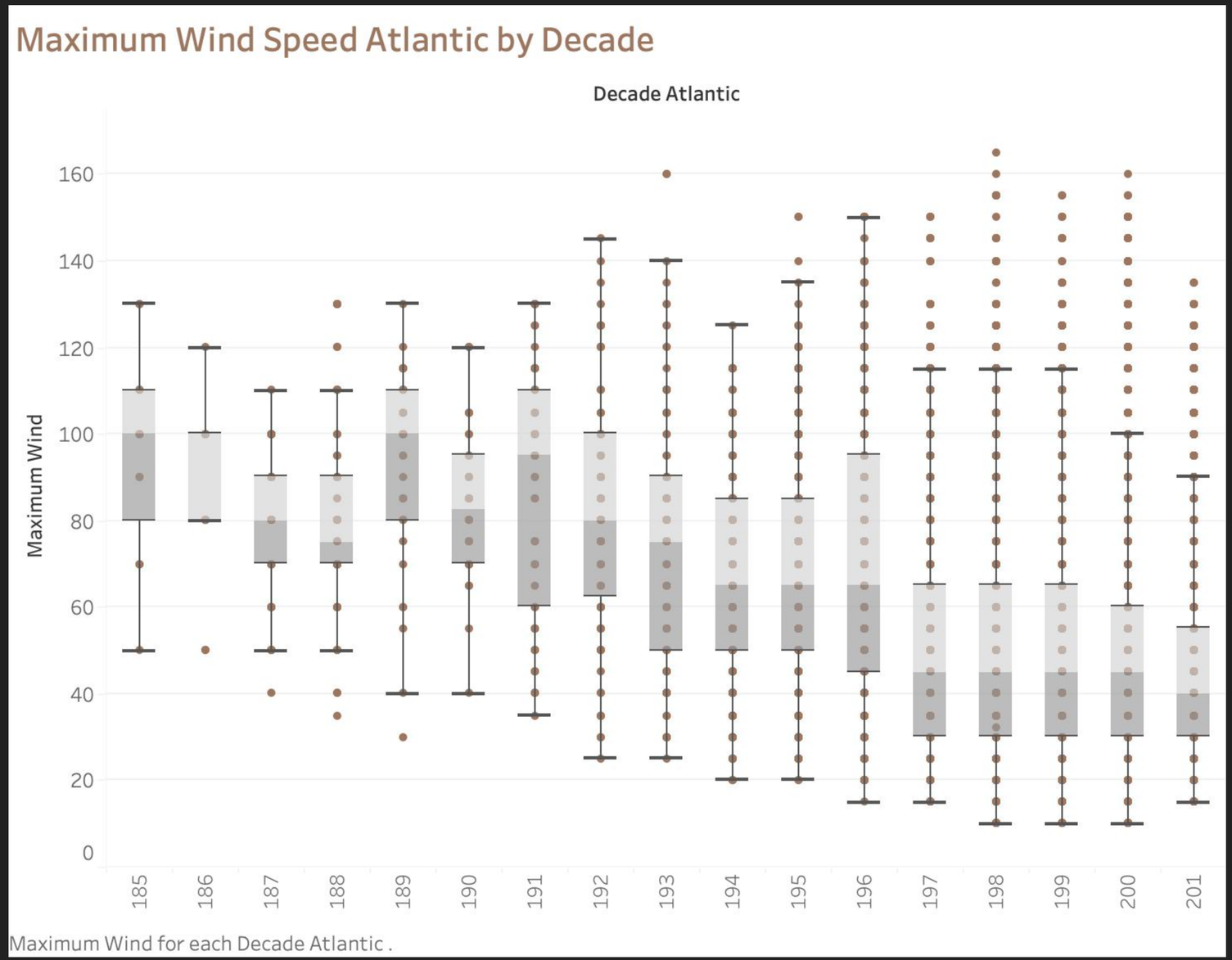
ATLANTIC HURRICANE COUNTS



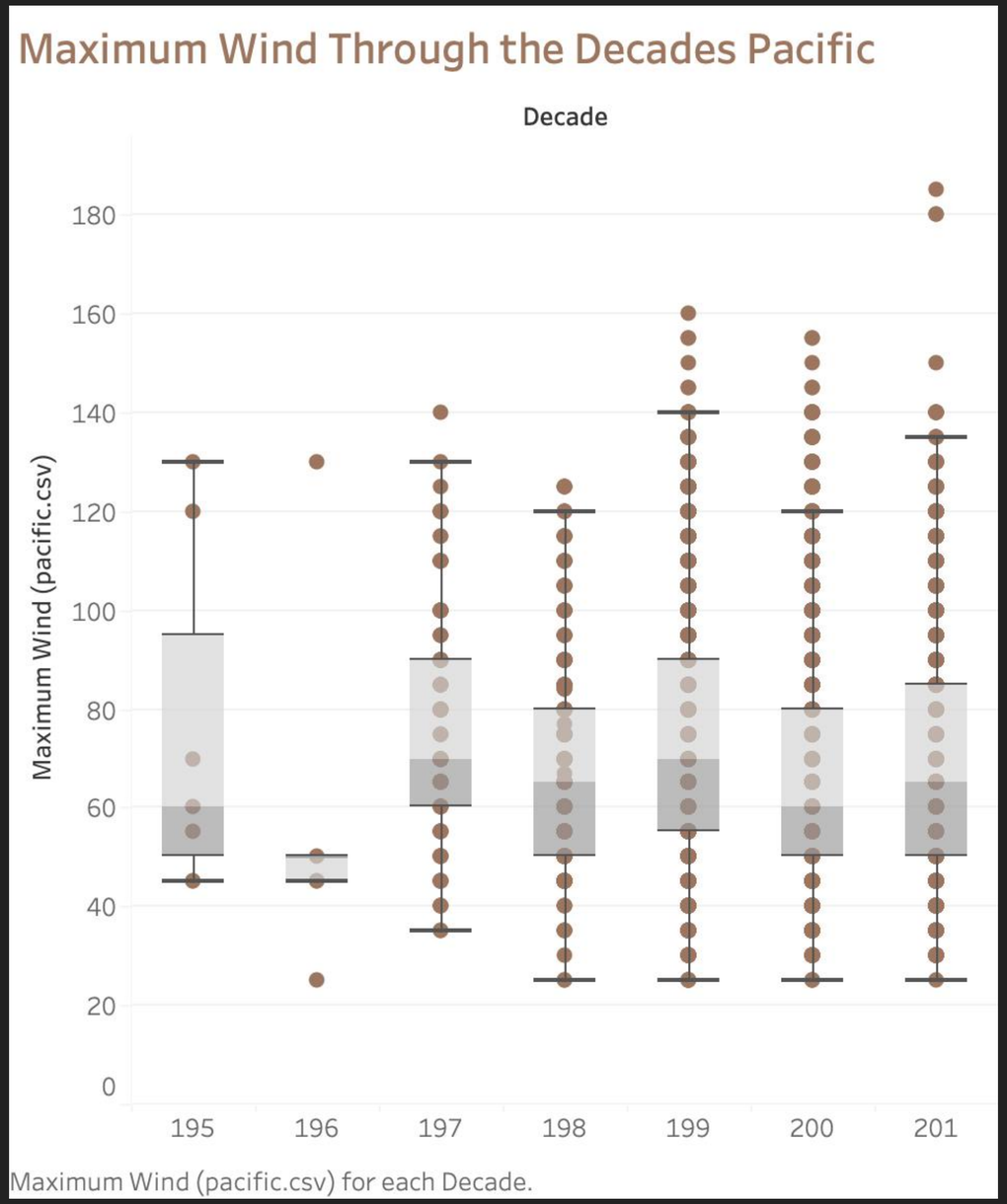
PACIFIC CYCLONE COUNT



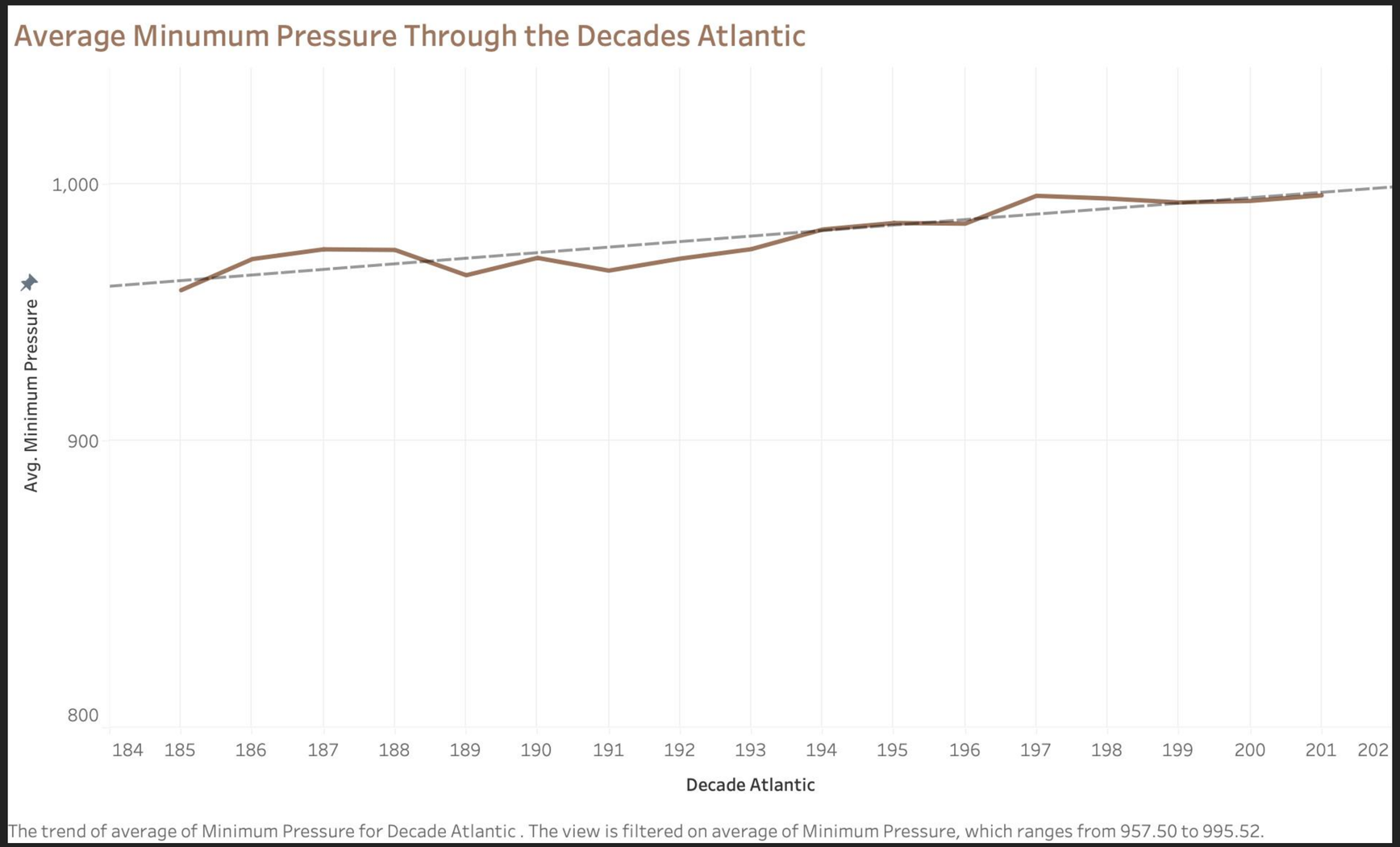
MAX WIND SPEED ATLANTIC



MAX WIND SPEED PACIFIC

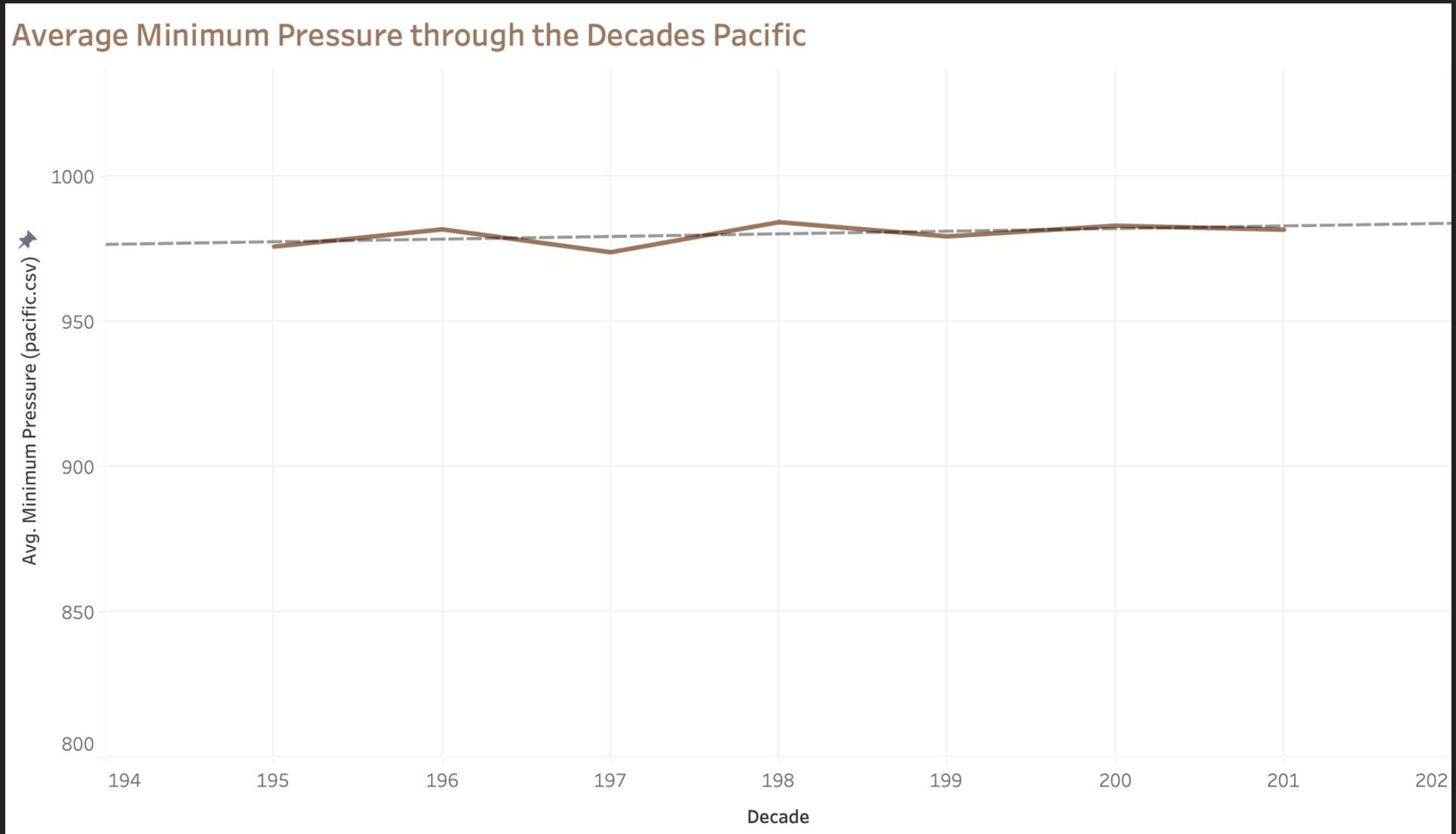


MINIMUM PRESSURE ATLANTIC



The trend of average of Minimum Pressure for Decade Atlantic . The view is filtered on average of Minimum Pressure, which ranges from 957.50 to 995.52.

MINIMUM PRESSURE PACIFIC



The trend of average of Minimum Pressure (pacific.csv) for Decade. The data is filtered on average of Minimum Pressure, which ranges from -999 to 0 and keeps Null values.

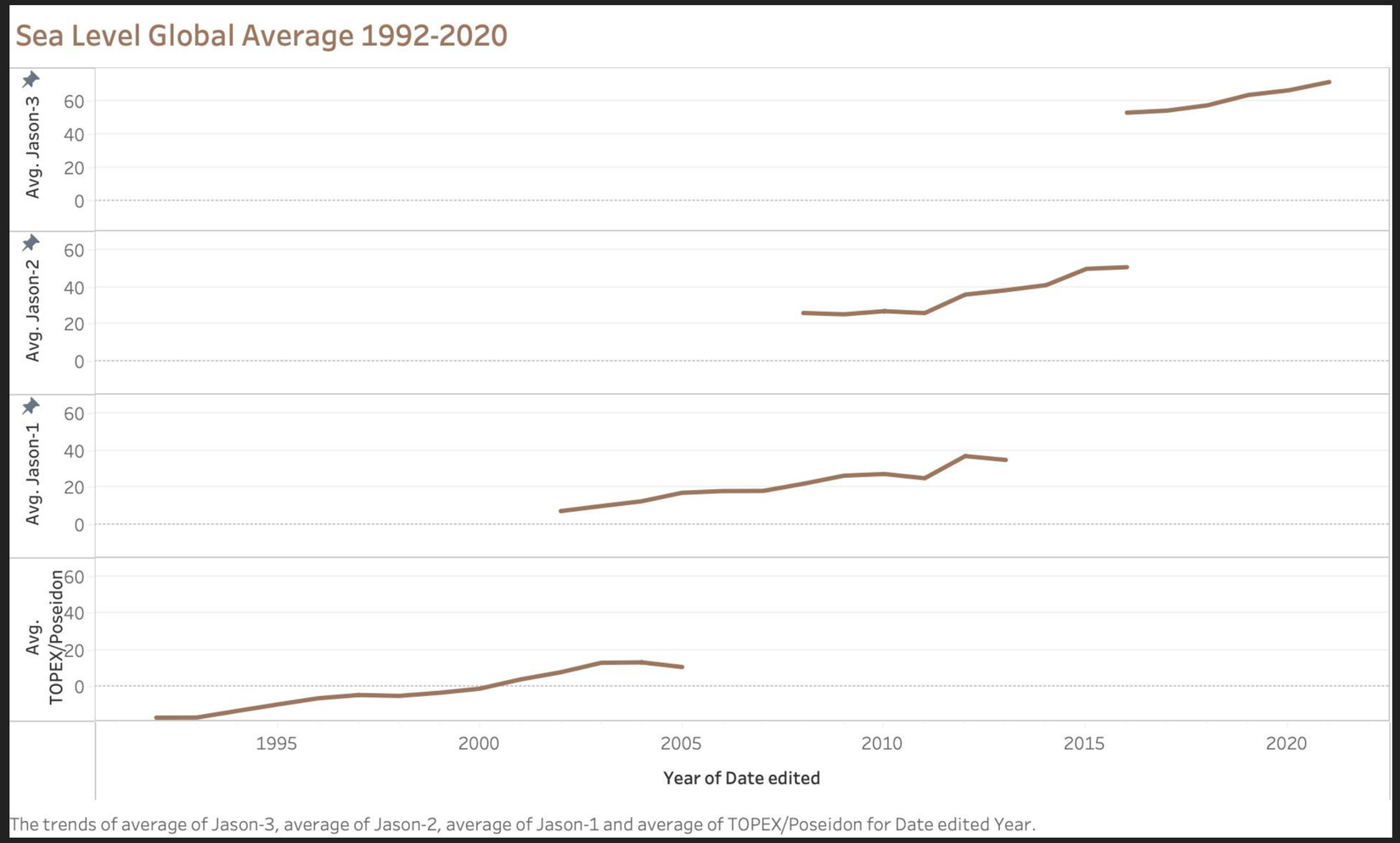
WHAT DOES THIS MEAN

- There is some evidence to global warming having an impact on Tropical Cyclones.
- How much of this is an impact and or normal weather cycles?
- Are storms worse now, or in the past?

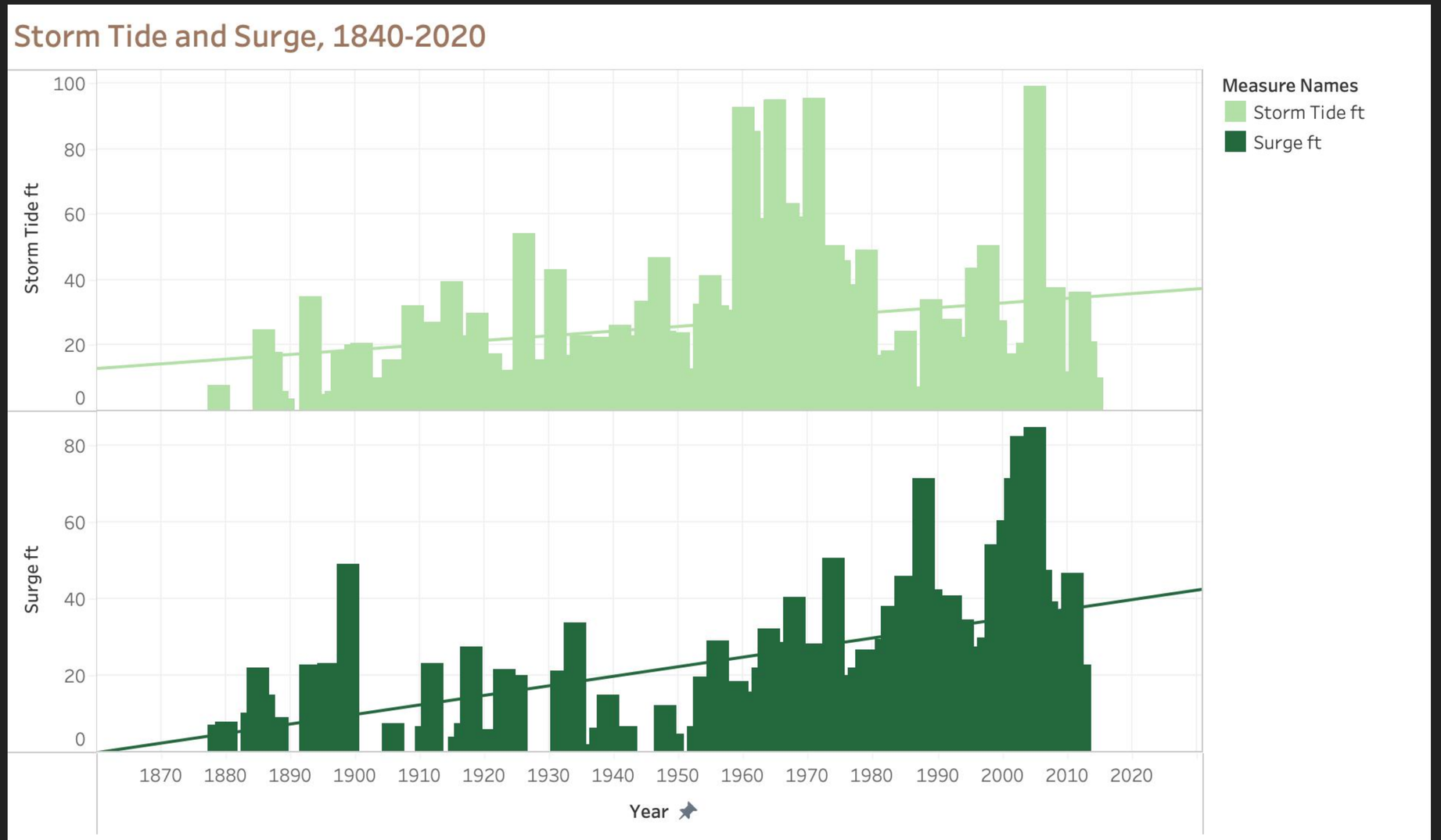
ARE STORMS WORSE NOW ?

- The last 20 years have seen some of the strongest storms in each of the global basins 6 out of 8 basins had the strongest storms since 2000.
- On record the strongest storm in history is Typhoon Tip, Philippines 1979
- Loss of life, The Great Bhola Cyclone, 300,000-500,000, Bangladesh 1970
- Strongest in terms of wind is Hurricane Patricia 215MPH, 2015 gulf of Mexico

SEA LEVEL INCREASE



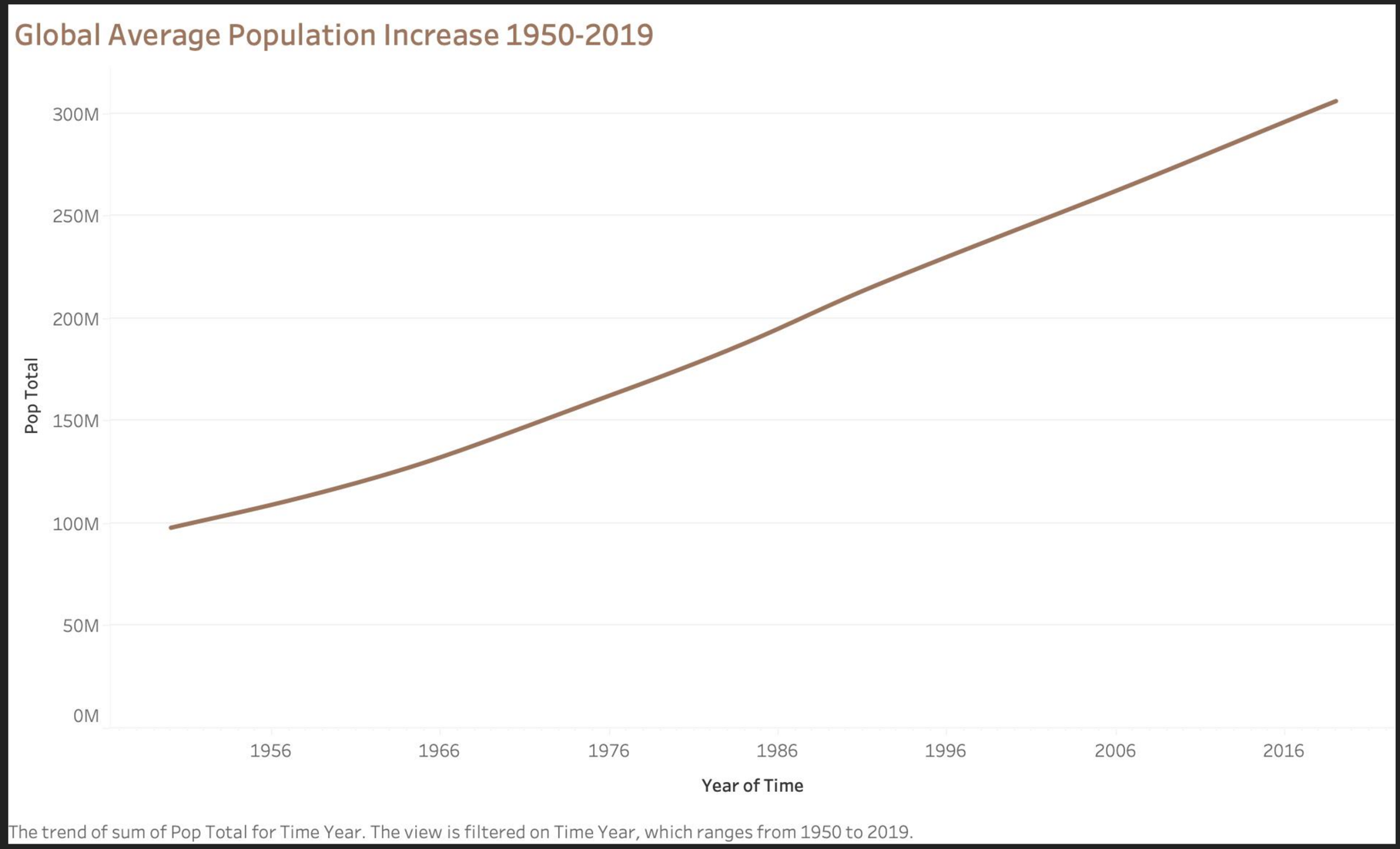
STORM SURGE


Storm Tide and Surge, 1840-2020
Storm Tide ft
100
80
60
40
20
0
Surge ft
80
60
40
20
0
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
2020
Year
Measure Names
Storm Tide ft
Surge ft

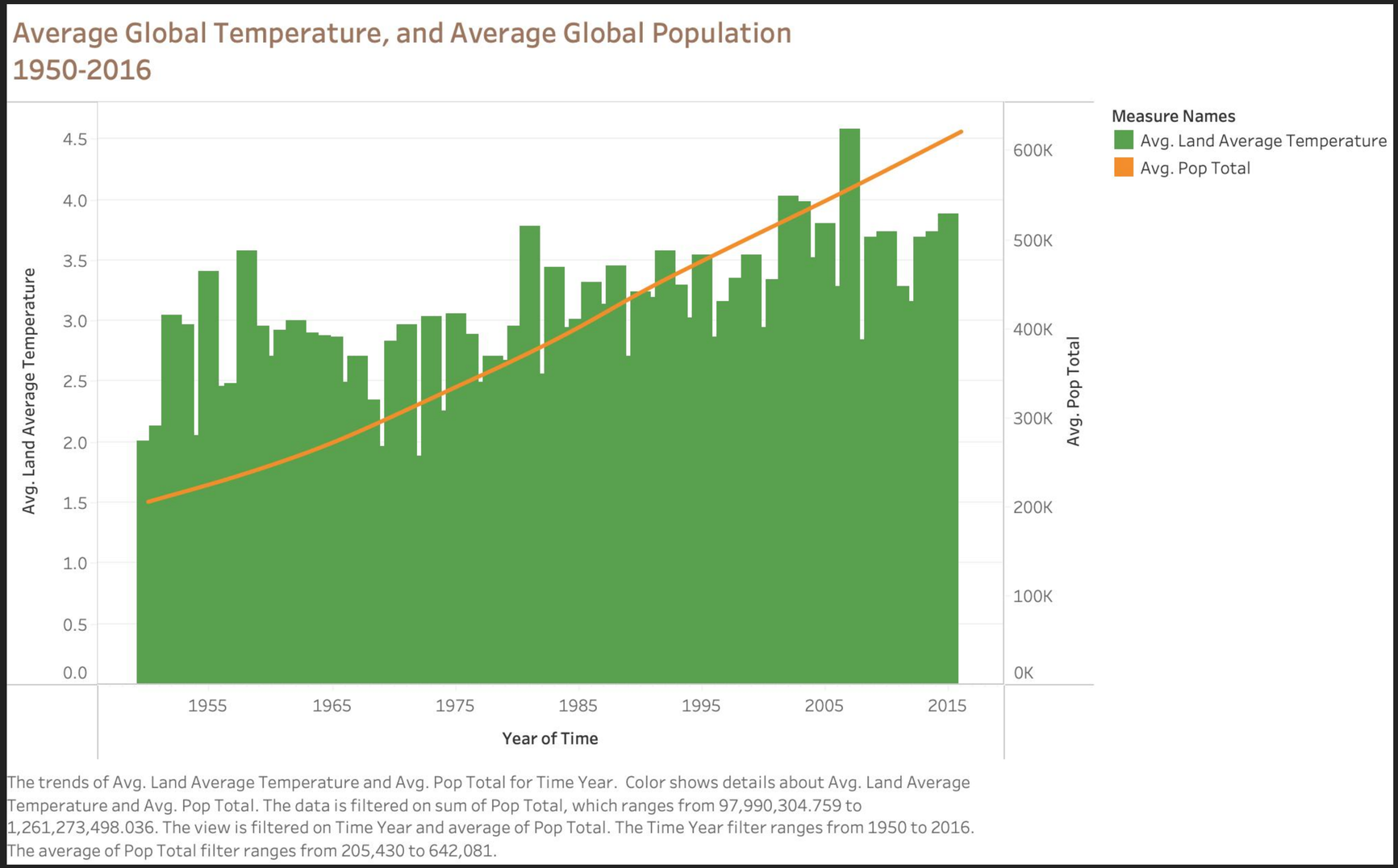
LETS LOOK AT THE COST OF HURRICANES (UNITED STATES)

- On average a single Hurricane can cost $19 Billion in damages in the U.S.
  - Hurricane Katrina in 2005 cost $125 Billion
  - Harvey and Irma in 2017 Cost over $240 Billion
- 1880-2020 Hurricanes have cost the U.S. $997 Billion
- Since 1880 Hurricane Death Toll in the U.S. is at 6,593

GLOBAL POPULATION INCREASE



GLOBAL POPULATION INCREASE



The trends of Avg. Land Average Temperature and Avg. Pop Total for Time Year. Color shows details about Avg. Land Average Temperature and Avg. Pop Total. The data is filtered on sum of Pop Total, which ranges from 97,990,304.759 to 1,261,273,498.036. The view is filtered on Time Year and average of Pop Total. The Time Year filter ranges from 1950 to 2016. The average of Pop Total filter ranges from 205,430 to 642,081.

POPULATION INCREASE

- According to the United Nations 40% of the global population live within 100 km off a coast.
- 29.1% of Americans live within a Coastline County, 64% of that population living within a Hurricane effected area
  - 15% growth since 2000
- People are continuing to populate near coastal regions, and sea levels are continuing to rise.

CONCLUSION

- The earth is warming
- The sea level is rising
- Population is increasing, and developing near the coastlines
- Storms may be getting stronger, there is a definite increase in number of storms, but the severity is not the alarming part.
- The storm surge and storm tide is what is causing the alarming rate of damage, and economic impact.

WHERE TO GO FROM HERE?

- This is a highly complex issue
- Looking at carbon emissions
- Looking into Thermal Expansion of Ocean Waters
- Digging deeper into population and coastal region development
- Looking into impacts of COVID and our global temporary break from mass travel
- Is there a way that we can change, that can have a positive effect?

SOURCES (DATA)

- Global Temperature Data was gathered from Berkley University, Berkley Earth, This data is a collection of data from 1750-2016 (http://berkeleyearth.org/data/)
- Cyclone Data is from NOAA, HURDAT this is a collection of all Tropical Cyclones, in the Atlantic and Pacific Oceans 1851-2015 (https://www.kaggle.com/noaa/hurricane-database?select=pacific.csv)
- Global Storm Surge Data, From SURGEDAT LSU, 1850-2015 (http://surge.climate.lsu.edu/data.html)
- Sea Level Rise Data from NOAA, Laboratory of Satellite Altimetry, 1992-2021 (https://www.star.nesdis.noaa.gov/socd/lsa/SeaLevelRise/LSA_SLR_timeseries.php)
- Population Data from United Nations, Population Division, 1950-2019 (https://population.un.org/wpp/Download/Standard/CSV/)
- Land and Ocean Temperature Anomalies, NOAA (NCEI), 1880-2021 (https://www.ncdc.noaa.gov/cag/global/time-series/globe/land_ocean/ann/1/1880-2021?trend=true&trend_base=10&begtrendyear=1880&endtrendyear=2021)

SOURCES (IMAGES)

- Project background images (https://unsplash.com/s/photos/global%20warming)
- Tropical cyclone Tracts (https://scijinks.gov/hurricane/)
- Hurricane picture (https://oceanservice.noaa.gov/facts/cyclone.html)
- How are hurricanes formed (https://www.quora.com/How-are-tornadoes-hurricanes-and-cyclones-formed)
- Saffir-Simpson Hurricane Scale (https://hurricanedamage.com/blog/saffir-simpson-wind-scale/)
- Anatomy of a Tropical Cyclone (https://www.abc.net.au/news/2011-02-01/tropical-cyclones-explained/1926870)

SOURCES (ADDITIONAL RESEARCH)

- https://www.gfdl.noaa.gov/global-warming-and-hurricanes/
- https://coast.noaa.gov/states/fast-facts/hurricane-costs.html
- https://www.nhc.noaa.gov/help/tcm.shtml?PRESS#MOTION
- https://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/oceans_seas_coasts/pop_coastal_areas.pdf
- https://www.census.gov/library/stories/2019/07/millions-of-americans-live-coastline-regions.html
- https://www.climate.gov/maps-data/dataset/global-temperature-anomalies-graphing-tool
- https://www.ncdc.noaa.gov/billions/dcmi.pdf
- https://en.wikipedia.org/wiki/List_of_the_most_intense_tropical_cyclones
- https://coast.noaa.gov/states/fast-facts/hurricane-costs.html
- https://oceanservice.noaa.gov/facts/cyclone.html
- https://www.ncdc.noaa.gov/monitoring-references/dyk/anomalies-vs-temperature