1 Variable Selection

2 Objective

The purpose of this document is to identify key predictors for our variable of interest through visual scatter plot analysis. This method helps in understanding the linear or non-linear relationships and potential clustering patterns between the variable of interest and each predictor.

3 Methodology

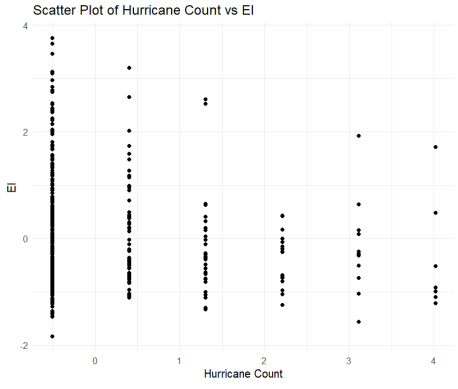
For each potential predictor, a scatter plot was generated against our variable of interest. These plots serve as a preliminary step in our variable selection process, allowing for an intuitive assessment of the relationship dynamics. The analysis focuses on detecting trends, patterns, and anomalies that could suggest meaningful correlations or identify outliers that may influence model performance. This document contains 19 scatter plot with a details comment for each one of them.

4 Visual Explorations

4.1 Precipitation index scatterplots

The ENSO Precipitation Index typically refers to measures that specifically track changes in precipitation patterns related to ENSO phases (El Niño or La Niña). This index helps in predicting and analyzing the impacts of ENSO on global precipitation, crucial for agricultural planning, water resource management, and disaster preparedness. These indices are critical tools for meteorologists, climate scientists, and researchers, providing essential data for predicting weather patterns and making informed decisions about climate-related risks. They are used in various applications, from long-term climate modeling to short-term weather forecasting.

1. EI is the El Nino precipitation index
2. LI is La Nina preicipitation index
3. ESPI is a normalized combination of the two.



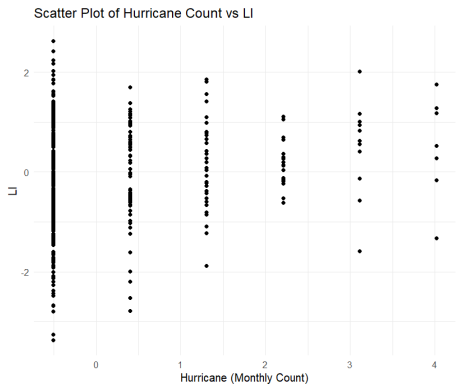


Figure 3: Plot of the standarized version of the hurricane counts vs the standardized EI index.

Comment precipitation indexes

The 3 plots present similar behaviour (as expected), with slighted positive the trend between the of LI and ESPI index when plotted against the standardized counts of hurricanes , and a light negative trend with the EI index. In terms of variablity, lower values for all three indexes seem to have a much higher variability. Meaning that when there are few hurricanes these indexes are little significant, no evident outliers are found.

4.2 Heat content indexes

These heat content indices are typically used by meteorologists and oceanographers to monitor and forecast the thermal state of the Pacific Ocean, which plays a critical role in global climate dynamics. By analyzing changes in these indices, scientists can predict ENSO events more accurately and assess their likely impact on weather patterns worldwide

1. **X130E.80W** This index measures the heat content from 130 degrees East to 80 degrees West. This expansive longitudinal range covers a significant part of the Western and Central Pacific Ocean, which are critical areas for the development of El Niño events.

2. **X160E.80W** This index spans from 160 degrees East to 80 degrees West, focusing slightly more on the Central Pacific. It captures ocean heat content that is crucial for the modulation of ENSO cycles.

3. **X180W.100W** This index measures the heat content between 180 degrees West and 100 degrees West, covering an area predominantly in the Eastern Pacific Ocean. This region is particularly important for studying the effects of La Niña events, which are characterized by cooler sea surface temperatures in the Eastern Pacific.

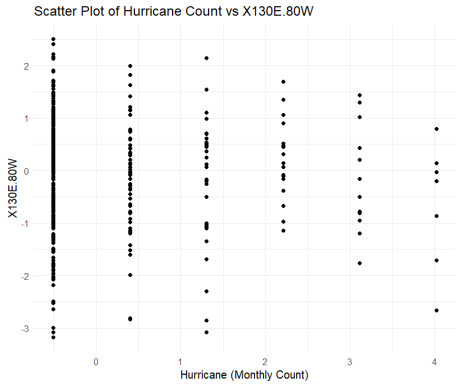


Figure 4: Plot of the standarized version of the hurricane counts vs X130E80W index.

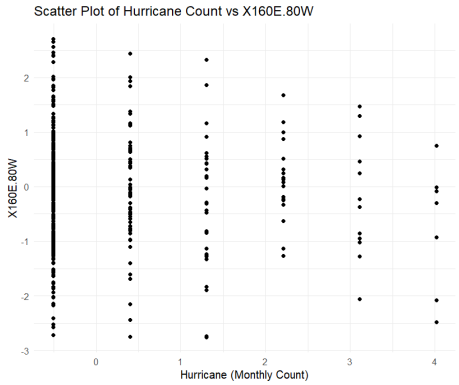


Figure 5: Plot of the standardized version of the hurricane counts vs X160E.80W

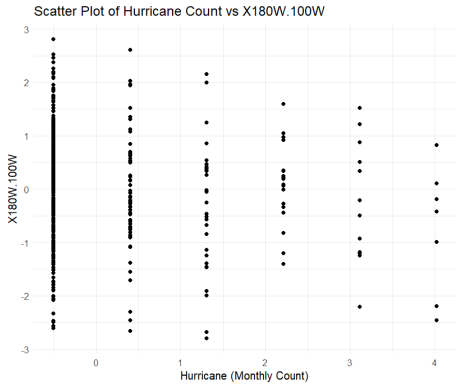


Figure 6: Plot of the standardized version of the hurricane counts vs the standardized X180W.100W index.

Comment heat content indexes

The 3 plots (figure 4, 5, 6) exhibit remarkably similar behaviors, characterized by high variability at lower hurricane counts and reduced variability at higher counts. None of the plots display any discernible trends. Consequently, it is improbable that these variables will provide useful information for hurricane forecasting.

4.3 Other climate indexes

1. TNI (Trans-Niño Index) Description: The Trans-Niño Index (TNI) is a climate index used to measure the temperature gradient between the central and eastern tropical Pacific Ocean. It is calculated based on sea surface temperature anomalies in these regions and is used to assess the intensity and phase of ENSO (El Niño Southern Oscillation) events, distinguishing between El Niño, La Niña, and neutral conditions.

2. SOI (Southern Oscillation Index) The Southern Oscillation Index (SOI) is one of the key indicators for monitoring the El Niño and La Niña phenomena. It measures the difference in air pressure between Tahiti and Darwin, Australia. Positive values of SOI generally indicate La Niña conditions (higher pressure over the western Pacific), while negative values suggest El Niño conditions (lower pressure over the western Pacific).

3. PNA (Pacific North American Pattern) The Pacific North American Pattern (PNA) is a climatological feature that describes the atmospheric circulation variability over the Pacific Ocean and North America. The PNA

index is characterized by a quadrupole pattern of pressure anomalies located in the vicinity of Hawaii, the Aleutian Islands, the southeastern U.S., and over the intermountain region of North America. This pattern influences the weather across North America, including temperature and precipitation patterns.

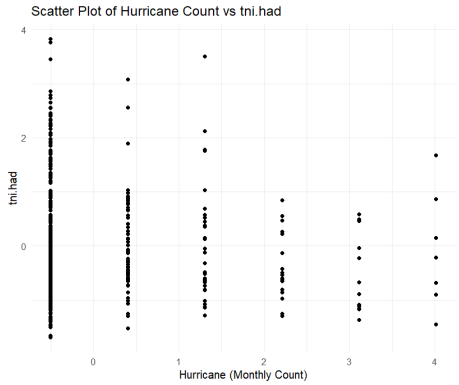


Figure 7: Plot of the standarized version of the hurricane counts vs tni.had.

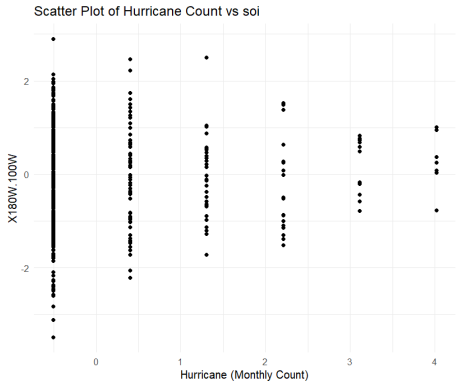


Figure 8: Plot of the standardized version of the hurricane counts vs Soi

Comment on SOI

The 3 plots (figure 7, 8, 9) are characterized high variability at lower hurricane counts and reduced variability at higher counts. tni.had is the only index that showed a trend, with a light negative direction.

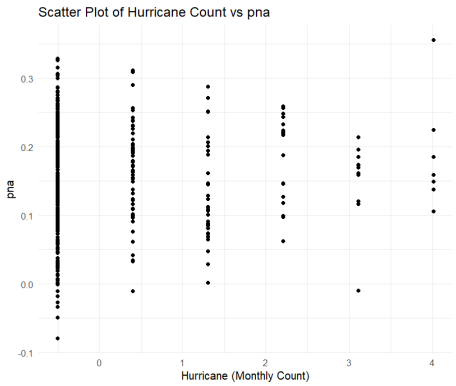


Figure 9: Plot of the standardized version of the hurricane counts vs the standardized pna.had index.