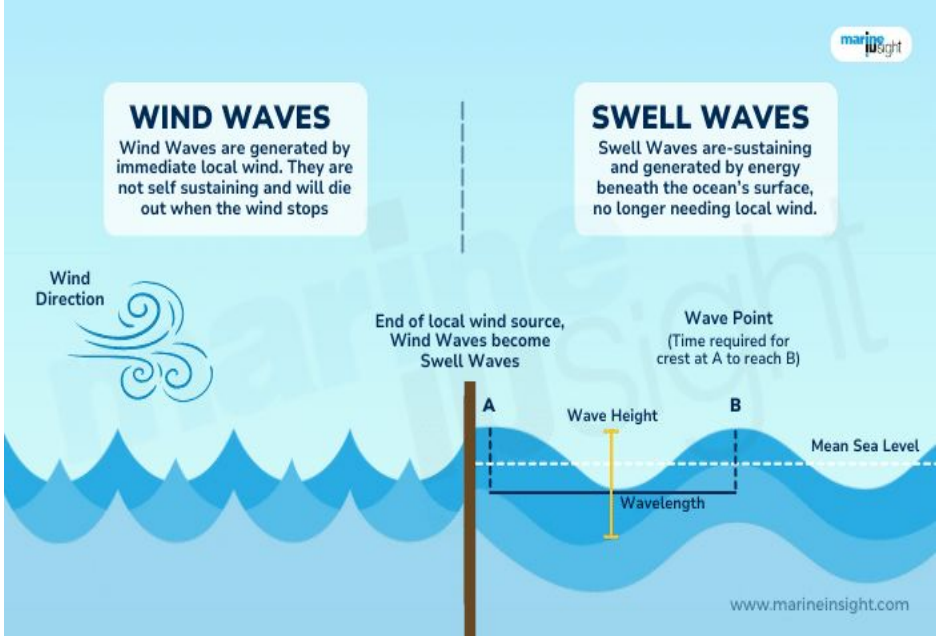
Wave Energy Prediction: A Machine Learning Approach

BrainStation Capstone Project

Subject Area Overview

Problem Statement/Opportunity

Employ machine learning to predict/forecast wave energy that is as accurate as existing models and provides a computationally efficient alternative to numeric and physics based models.



- Wave power is the energy derived from ocean waves.
- Swell, generated from wind and weather patterns.
- The prediction of wave power and other wave characteristics traditionally relies on established methods, such as numerical and physics based mathematical models.

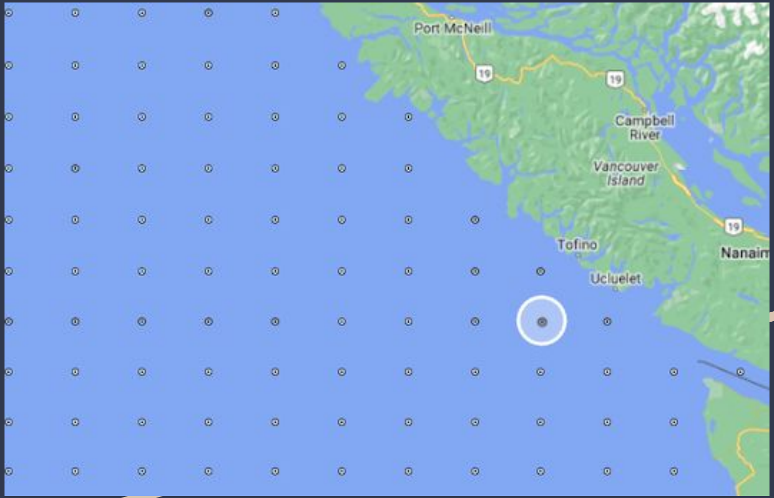
Vision for Tackling the Problem

- Use Data Science and machine learning, to better understand complex interactions between environmental variables and wave power generation.
- Use machine learning to build a robust model to predict wave power available. Possibly Random Forest and Time Series analysis.
- Build a live forecasting model to provide real time insight.

Potential Impact

- Being able to accurately predict wave energy has implications in renewable energy, recreational activities as well as maritime safety operations.
- Running simulations of models such as the SWAN forecasting or Hindcast model may require supercomputing facilities or specialized high-performance computing clusters.

Introduction to Dataset



Data collected from 4 Different Sources:

- Historical buoy Data:
  - Laperouse buoy
  - MEDS Tofino
- HINDCAST MSC50 numerical model
- Tidal Data, station 8615 Tofino

Data Types

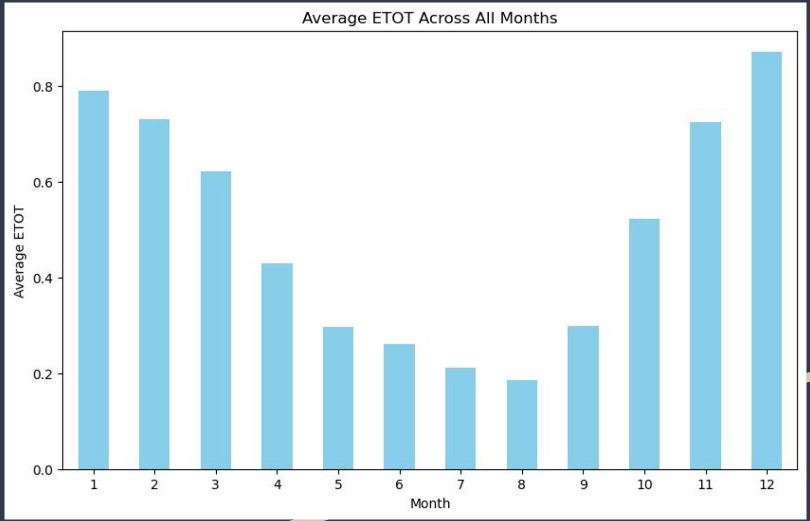
- Continuous numerical
- Directional
- Date time

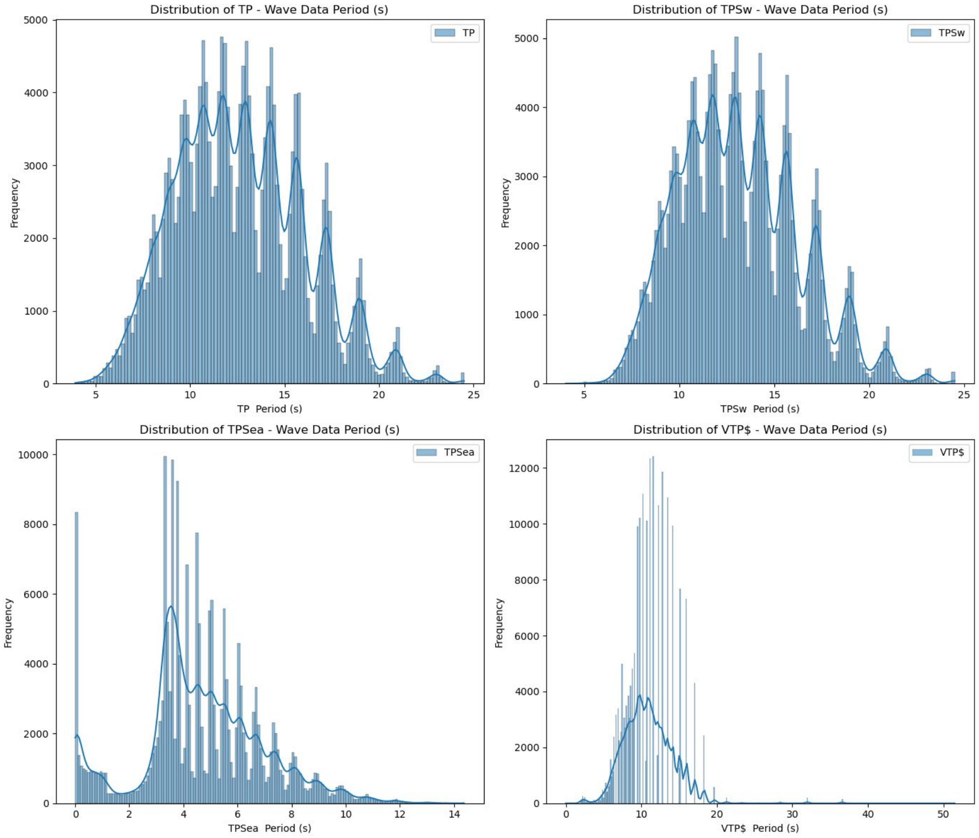
DataFrame shape: (199026, 38)

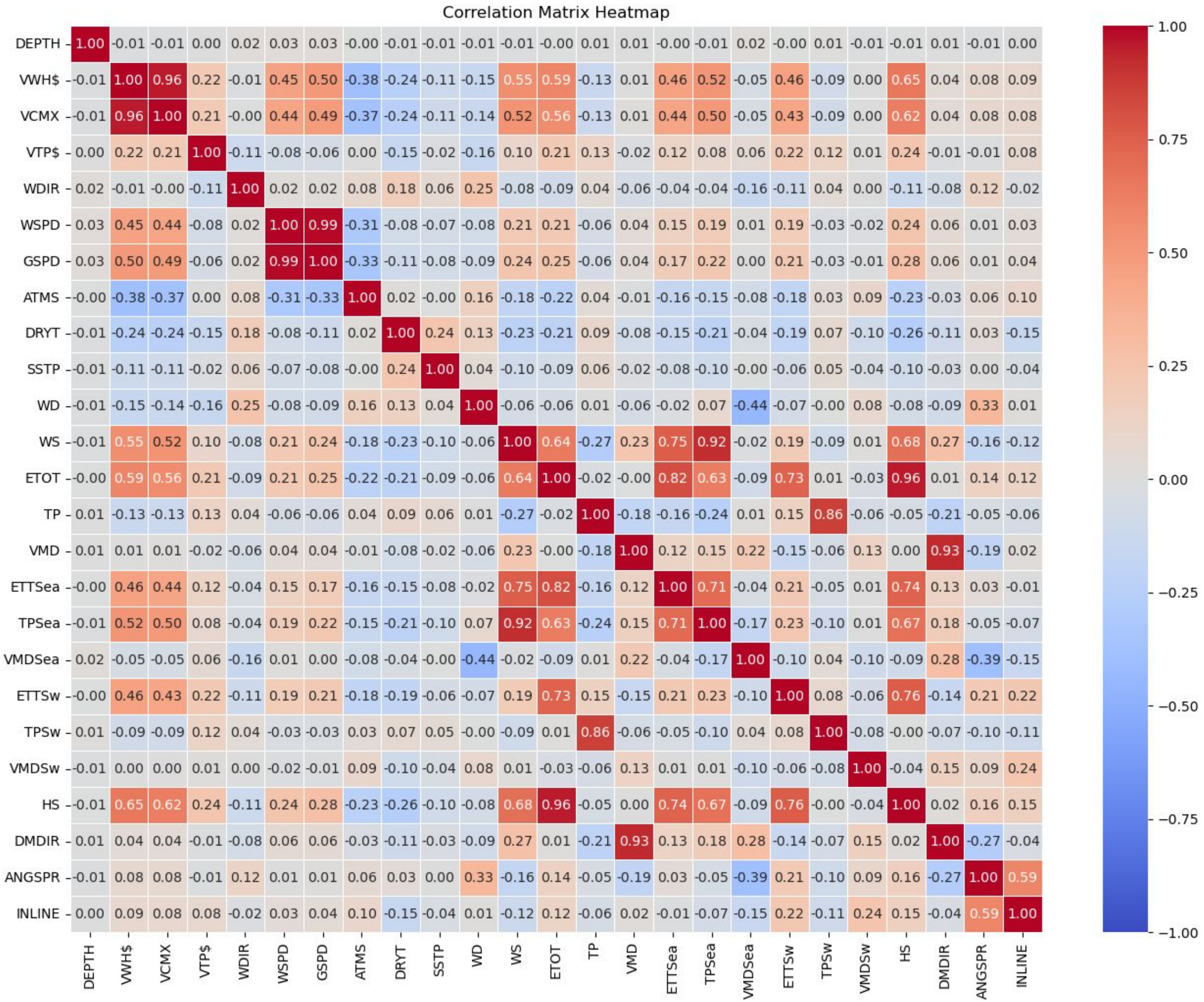
- Combined historical buoy data and Hindcast gridpoint.
- Possible inclusion of other data, or working with other data frames, taking distance into account.

Data Quality: Possible concerns, Q-flag values

Preliminary EDA and Next Steps







- Lasso Regression

- Next Steps:
  - Time Series Analysis
  - What influences Sea State and Swell?
  - Possible inclusion of other features.