Forecasting El Niño

Solomon Klein

What is El Niño?

Warm waters in the central-east Pacific increase evaporation

Pacific storms move eastwards, following evaporation.

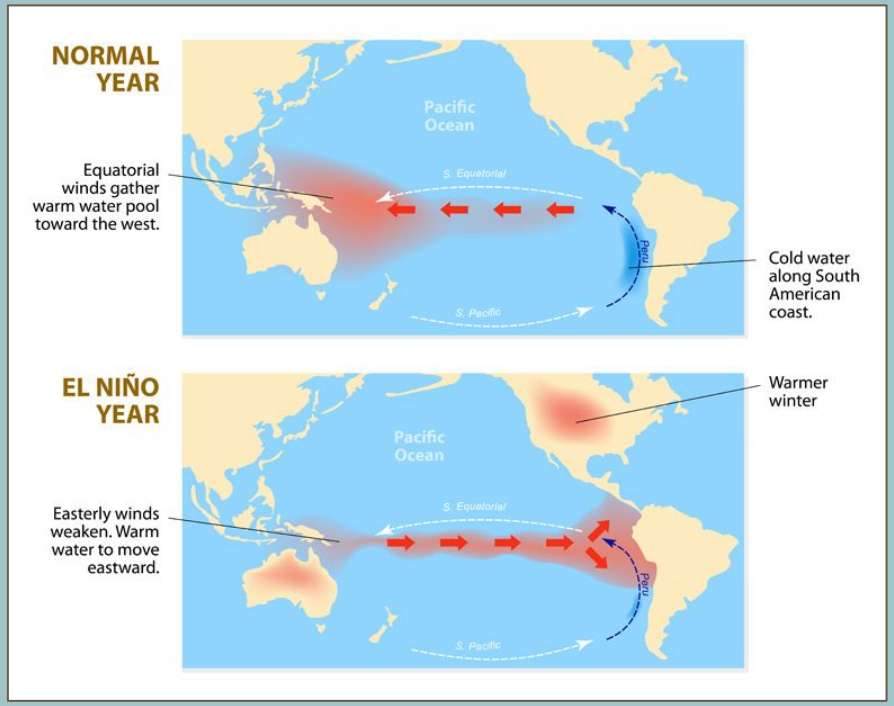


Image credit: https://www.futuretimeline.net/blog/2015/05/14.htm

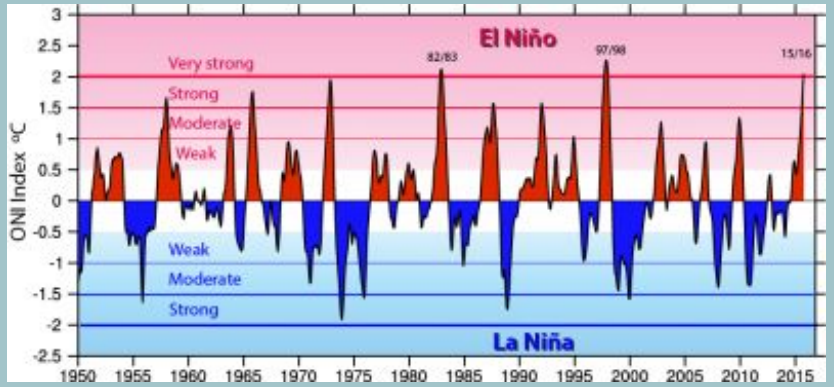
Impact on Humanity:

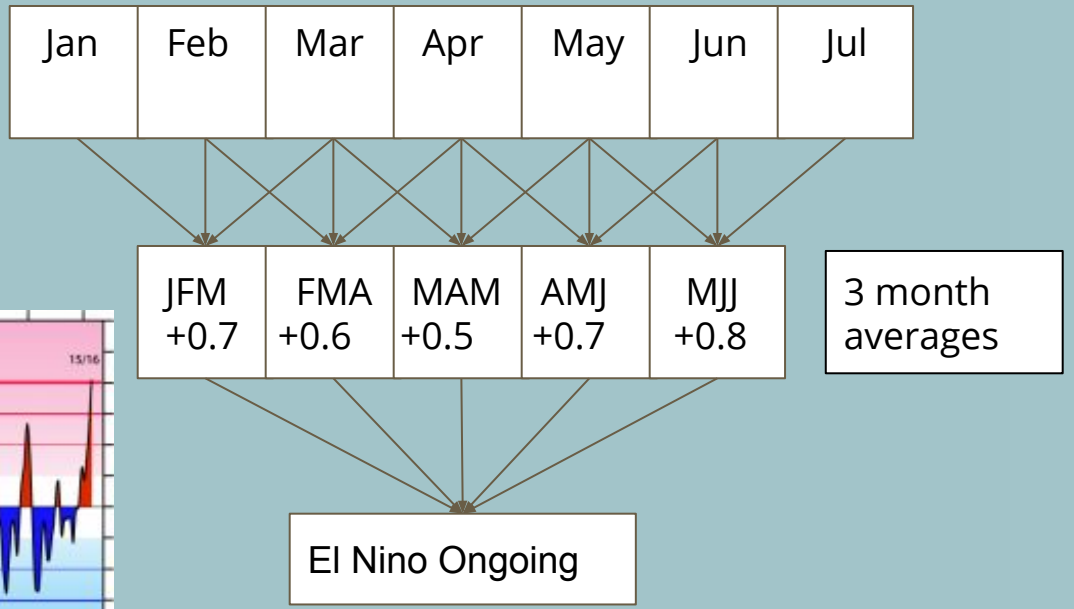
Drought in the western Pacific

Rainstorms and flooding impact the Americas

Fish migrate due to the change in temperature

Oceanic Niño Index (ONI)





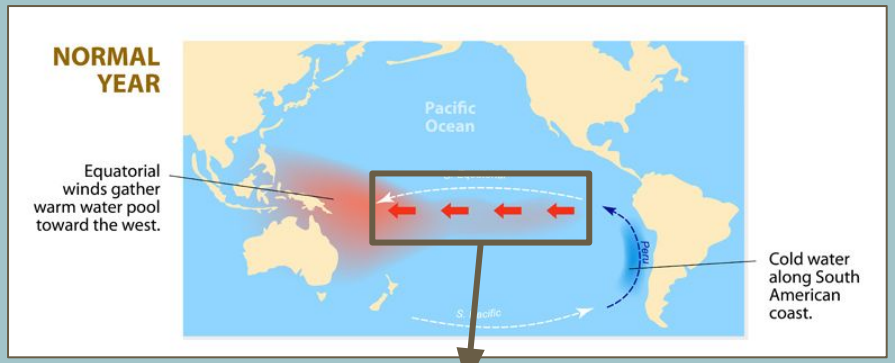
Workflow

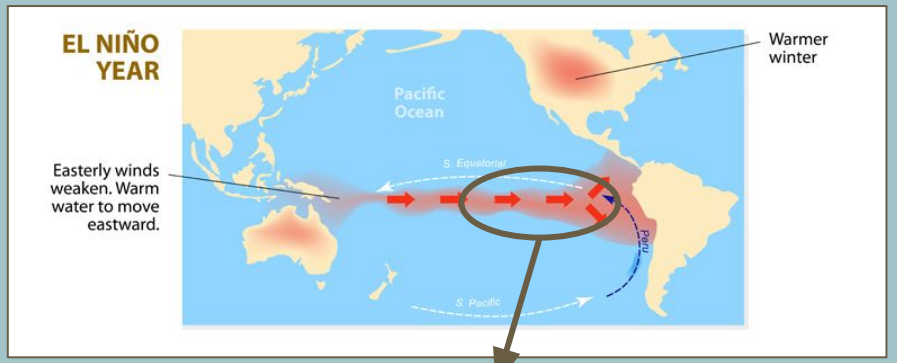
- Data from buoys in the Pacific
- Collected by the National Oceanic and Atmospheric Administration

Preprocessing in Python
Pandas dataframe

- Prophet time-series prediction model
- Developed by Facebook

Process





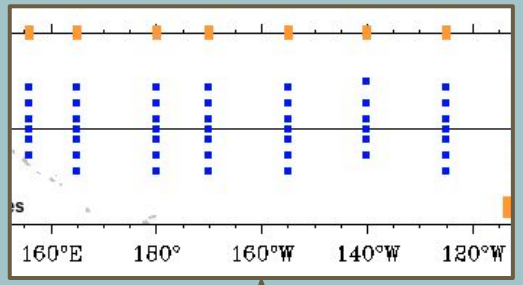
Year N: Salinity, Surface temperature, wind, humidity, air temperature

Year N+1: Oceanic Niño Index (ONI) of temperature anomalies

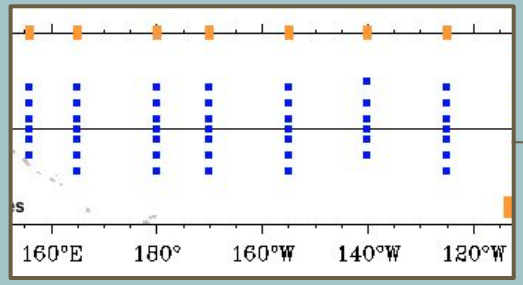
Prophet Model

Rolling Predictions:

Ocean in 2010



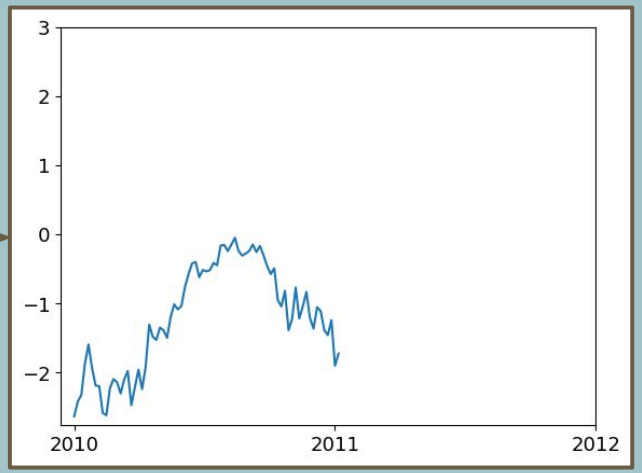
Ocean in 2011

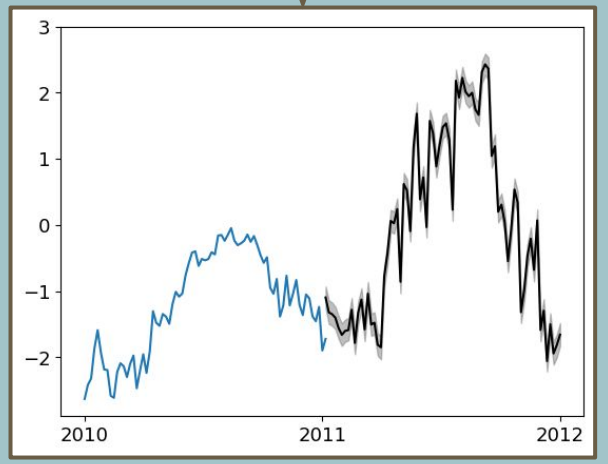


Predictions for 2012

Test data

Training data



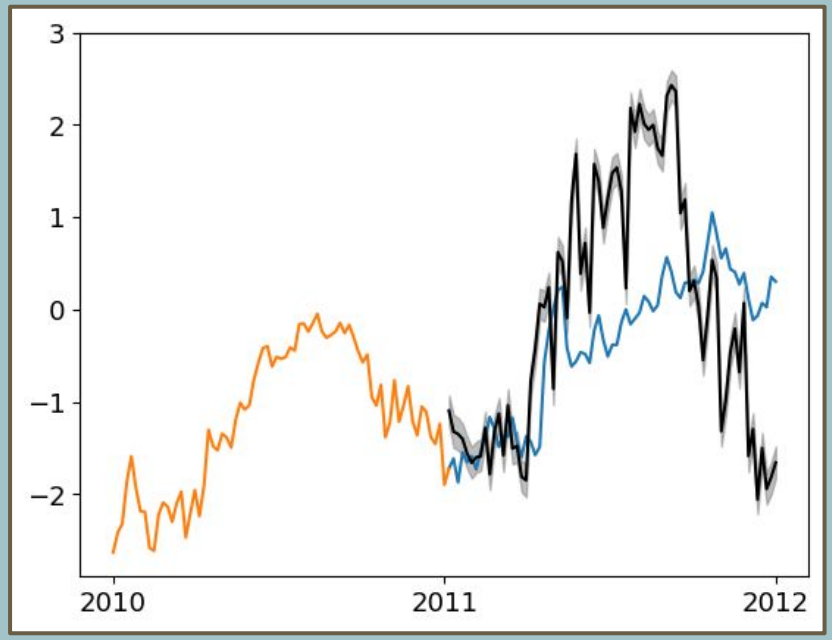


Average error is high

Currently, the model is not very effective at predicting ONI.

Prophet and other time-series models are not well suited to dealing with this problem:

- Long lag time before prediction
- High variance from trends in the last months of the training data
- Nonlinear interactions



Next Steps

- Build a neural network to capture nonlinear relationships
- Draw data from the Simple Ocean Data Assimilation dataset
- Remove seasonal aspects from data to identify non-seasonal anomalies.

Bibliography

Data provided by https://www.pmel.noaa.gov/tao/drupal/disdel/index.html

US Department of Commerce, National Oceanic and Atmospheric Administration. “What Are El Nino and La Nina?” NOAA's National Ocean Service. National Ocean Service, March 26, 2009. https://oceanservice.noaa.gov/facts/ninonina.html.