How is Global Warming Making El Niño/Southern Oscillation Stronger?



# Benjamin Goldman

# White Plains High School

# Science Research Symposium

# Conclusion

* ENSO variance increases significantly over the 21st century
* The major factor contributing to this increase is greenhouse gasses, with aerosol emissions playing a secondary role.

# Application

* Prediction of increased extreme weather
* Increased emphasis on climate variability in education

# Future Research

* Continue analysis of CESM2 output
* Mixed layer heat budget analysis

A group of people posing for a photo

Description automatically generated

I carried out this project because I am really passionate about solving climate change. I enjoyed doing it because it was a great way to learn about data science.

Under the guidance of:

Dr. John Fasullo, National Center for Atmospheric research



I am interested in majoring in physics with the intent of becoming a data scientist.

For more information contact: bngldmn@gmail.com

# Introduction

## Climate Change



Climate change is both long and short term.

Causes of long-term climate change:

* Greenhouse gasses (CO2)
* Aerosols
* Biomass burning
* Land use and cover

## El Niño/Southern Oscillation (ENSO)

* Causes short-term climate change
* Temperature of the tropical Pacific Ocean
* Need to improve predictions

|  |  |
| --- | --- |
| El Niño | La Niña |
| Warm | Cool |
| South American Flooding | Wildfires in California |
| Decreased fish populations | Flooding in Indonesia |

# Research Questions:

1. Do the CESM1 and CESM2 climate models predict increased or decreased ENSO intensity in the future?
2. Which factor (greenhouse gasses, aerosols, etc) contributes the most to ENSO intensity?

# Methods and Results

## Raw Data

* Community Earth System Model (CESM) is a computer simulation of the earth’s climate
* Receives input data of external forcing records
* Outputs sea surface temperature for time 1800-2100.
* Run repeatedly
* Specialized simulations that receive only greenhouse gasses or aerosols as input

## ENSO Variance Calculation

* Calculated average sea temperature in equatorial Pacific to represent ENSO
* Derived long term changes to ENSO record through variance calculation

## Future ENSO Intensity



* Increased ENSO activity throughout 20th and 21st centuries
* Decreased activity after around 2060

## Contribution of Greenhouse Gasses and Aerosols



* Increased ENSO activity in greenhouse simulation shows that greenhouse gasses are main contributor