

The Impact of Anthropogenic Forcing on ENSO Amplitude

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Introduction

Climate Change

- The earth is getting warmer.
(Pachauri et al., 2014)
- Climate varies on different scales.
- Long-term trends and short-term noise.
- Forcing: any external factor that affects climate
 - Greenhouse gasses
 - Aerosols (natural: volcanic ash, artificial: smoke)
 - Biomass burning
 - Land use/cover (deforestation, desertification)

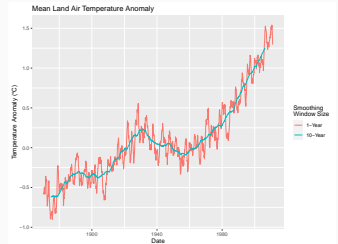
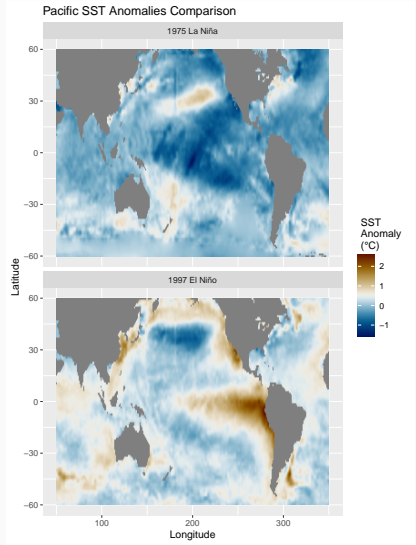


Figure 1: Global mean land air temperature in GISSTEMP 4 dataset. (Team et al., 2019) and (Lenssen et al., 2019)

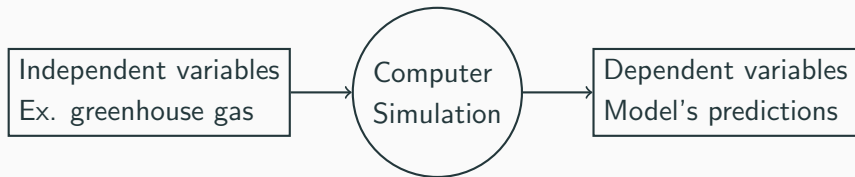
El Niño

- Warming and cooling of the Pacific Ocean.
- Affects human societies through temperature and rainfall. (Ropelewski and Halpert, 1987)
- May be affected by climate change.

Figure 2: Comparison of SST anomaly between 1975 La Niña event and 1997 El Niño event in HadISST 1 dataset. (Rayner et al., 2003)



Climate Simulation



ENSO in the Future

Gap and Goal

Research Questions

Data and Methods

Ensembles: CESM1 and CESM2

Analysis Tools

R:

- ncdcf4
- zoo
- dplyr
- ggplot2
- WaveletComp
- reshape2

Python:

- numpy
- pandas
- scipy
- matplotlib
- netCDF4

Other:

- nco

Role of Mentor and Student

Mentor:

- Suggest future methods
- Conduct parallel analysis to complement student work
- Provide raw precollected data
- Interpret data produced by student
- Review student writing

Student:

- Analyze data on computer
- Produce graphics for analysis and publication
- Write documentation
- Suggest interpretations of data

Model Setup

Input:

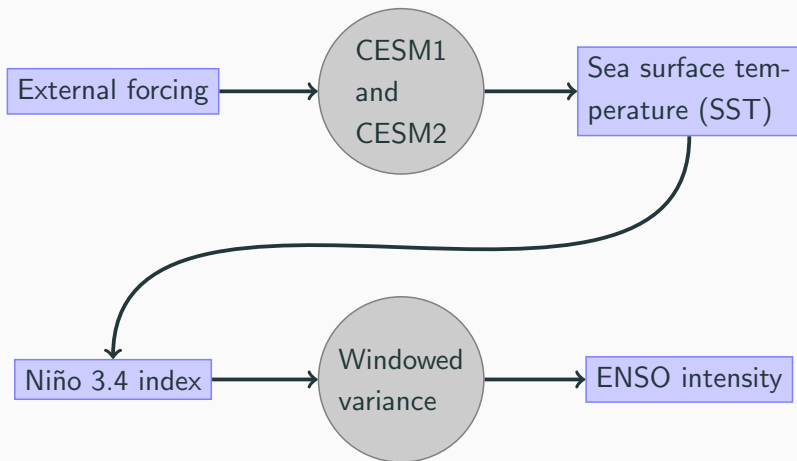
- Observed forcing levels from 1850-2005
- Predicted forcing levels from 2005-2100
- **Simulation ran a total of 40 times with slightly different starting point**
- Control simulation with pre-1850 forcing levels

Model:

- CESM1 (Kay et al., 2015)
- CESM2 (Danabasoglu et al., 2020)

Output: Sea Surface Temperature (SST)

Measuring ENSO Intensity



ENSO is Becoming Stronger

Single Forcing Ensembles

Influence of Aerosols and Greenhouse Gasses

Correlation With Ocean Temperature

Conclusion

Acknowledgments

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