Identifying How Outgoing Longwave Radiation Patterns Differ Between Warm and Cold ENSO Events

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Research Experiences for Community College Students

Introduction

Cold or warm sea-surface temperatures (SSTs) over the tropical Pacific in association with the El Niño Southern Oscillation (ENSO) influence seasonal weather and climate around the world. Since the early 1980s, NOAA's polar orbiting satellites have recorded changes in patterns of outgoing longwave radiation (OLR) during several large-amplitude warm and cold ENSO events. The goal of this project is to characterize the nature of these changes in terms of the behavior of weather patterns over the central and eastern tropical Pacific.

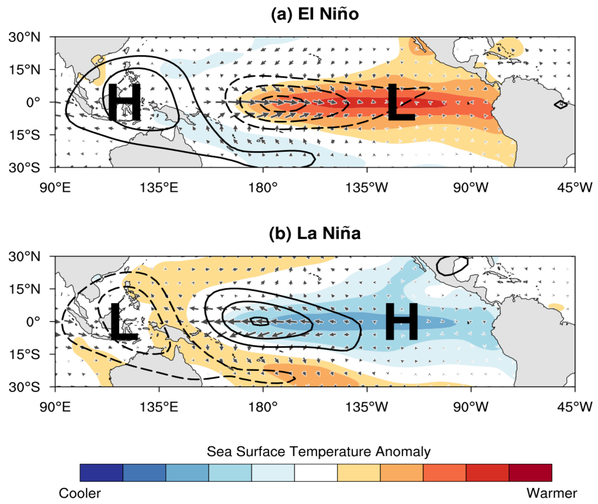


Image from National Oceanic and Athomosferic Administration website.

Fig. 1: Schematic diagram showing the physical mechanisms by which the SST (shaded), OLR (contours), surface zonal and meridional winds (vectors), and sea level pressure (represented by "H" and "L" which indicate the high and low pressure center, respectively) determine the wintertime Multivariate ENSO Index (MEI) during (a) El Niño and (b) La Niña events.

Data Set

The data analysis is based on the following:

- ❑ With respect to the reference period of 1979-2018
- ❑ The radiation data was collected over a two-month period and then correlated with the long wave radiation data collected every 12 hours over the same time period
- ❑ Latitude-Longitude coordinates are 30°S-30°N and 100°E-70°W.
- ❑ Multivariate ENSO Index (MEI) derived based on 5 variables: (sea level pressure (SLP), sea surface temperature (SST), surface zonal winds (U), surface meridional winds (V), and Outgoing Longwave Radiation (OLR)

Methods

- ❑ All data was obtained from NOAA Climate Data Record (CDR) of Monthly Outgoing Longwave Radiation (OLR)
- ❑ Understand that we choose only two months out of twelve to compare the events
- ❑ MEI.V2 values are focused on the data plotted at the large amplitude, to compare El Nino Vs. La Nina
- ❑ We choose the periods of summer because the ocean surface reaches its maximum temperature several weeks after the solar radiation maximum, most tropical cyclones occur during the late summer to early fall
- ❑ We examined the OLR data in several different ways including diagrams that show the evolution of tropical cloudiness in the longitude-time domain
- ❑ We examined how synoptic-scale weather patterns, as seen in NOAA Outgoing Longwave Radiation data, different between warm and cold ENSO events

Results & Observations

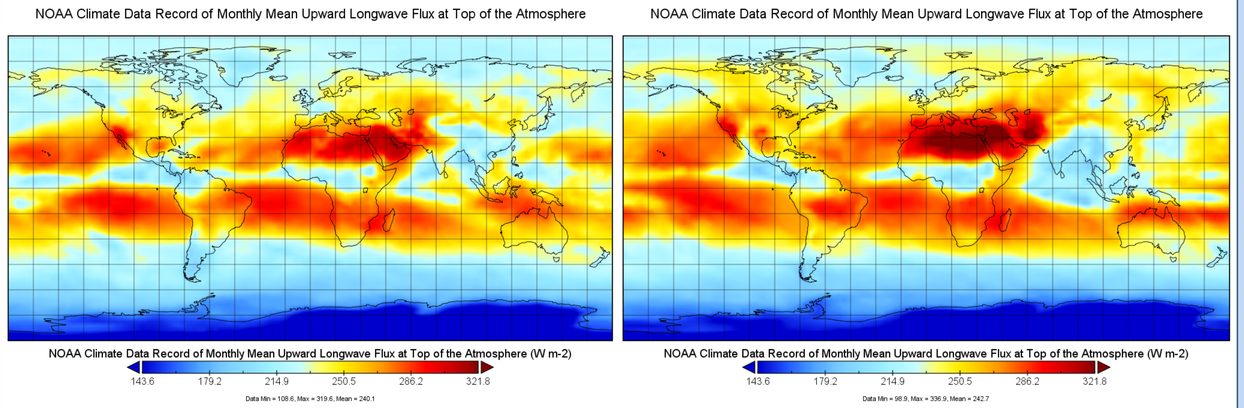


Fig. 1 Corresponds to the period between 1977-06-01 to 1987-07-01.

EL Nino

Fig, 4 shows the Longwave Radiation between the periods 1997-05-01 through 1997-06-30.

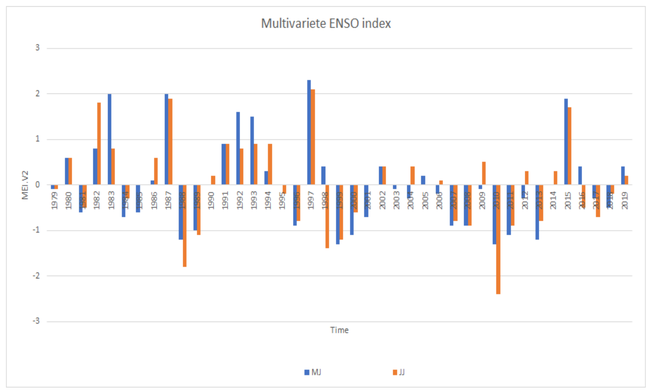
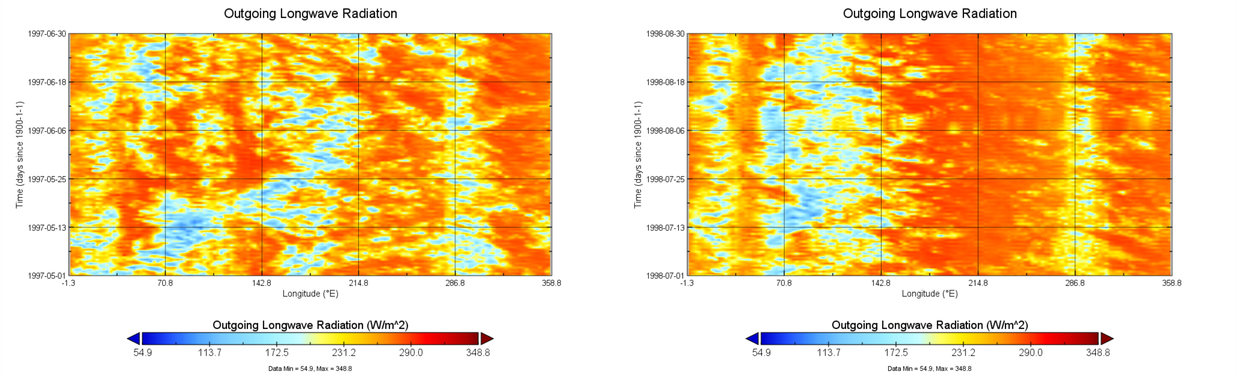


Fig. 3 Shows the bi-monthly multivariate ENSO index is the time series of the leading of five different variables (MEI.V2) We chose MJ (May – June) and JJ (June –July) months because is know there is more activity in El nino and La nina events

La Nina

Fig, 2 Corresponds to the period between 1998-07-01 to 1998-08-01.

Fig. 5 shows the Longwave Radiation between the periods 1998-07-01 through 1998-08-30



Conclusions & Future Work

- ❑ The daily data showed how the clouds changed in daily time scales.
- ❑ Exploring more big events in the last 40 years would give us a better understanding of the patterns that we want to find.
- ❑ Important events to consider and look at is 1982-83 and 1986-87 to compare El Nino and La Nina.
- ❑ Common season trends are not observed; for that we cannot predict what effect will follow in the future.
- ❑ This could help us to understand how sea-surface temperatures affect the presence of clouds and Outgoing Longwave Radiation.

References

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