Learning Objectives

This exercise is designed to put what you’ve learned over the last few weeks (about wind, upwelling, and productivity) into a larger/longer term climatic context. When we reach the end of the activity today, you will be able to:

● Describe the atmospheric and oceanographic conditions related to El Niño and La Niña events

● Describe how these events are connected to upwelling and productivity

Exercise Instructions and Questions

In this exercise you will be looking at conditions in the tropical Pacific for the time period you previously selected (for exercises A and B), as well as current conditions.



1. How is the Oceanic Niño Index (ONI) defined? Read about climate indices here: <https://www.ncl.ucar.edu/Applications/indices.shtml> or <https://climatedataguide.ucar.edu/climate-data/overview-climate-indices> .

2. Using the graph above, count the number of El Niño years since 1965. What is the average recurrence interval for strong El Ninos based on this historic dataset?

3. Use the chart above to determine a “normal” year between 1984 and 1998. Take a look at the SST Anomalies in the equatorial Pacific during January of the year you’ve chosen (<https://www.ospo.noaa.gov/Products/ocean/sst/monthly_mean.html> ). Based on this graph, during normal years, are surface waters warmer in the western or eastern Pacific? Why?

4. Now look at SST **anomalies** (difference from average values) (<https://www.ospo.noaa.gov/Products/ocean/sst/monthly_mean_anom.html> ) from a strong La Niña episode (use the historical month/year from the chart above). What process is responsible for the\_\_\_\_\_\_\_\_\_\_\_\_ [colder/warmer] **than average** surface temperatures at the equator during La Niña years?

5. Finally, choose a strong El Niño episode and look up the SST anomalies for the relevant month/year (<https://www.ospo.noaa.gov/Products/ocean/sst/monthly_mean_anom.html> ). Contrast SSTs during El Niño episodes to those during La Niña years.

 6. Look back at your prelab/exercise from last week-- based on the chart above, what conditions existed during the month/year of the buoy data you looked at previously? How did these conditions likely influence the data you observed (SST and chlorophyll)?

**Current Conditions**

Navigate to: <https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_update/sstanim.shtml> and scroll down to the second animation to see current SST **anomalies** in the tropical pacific.

7. Are the **current** SST conditions in the tropical Pacific more consistent with La Niña or El Niño conditions? Paste a snapshot below and describe what evidence it shows to support your interpretation.

Navigate here: <https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_update/wkxzteq.shtml> to see a cross section (the temperature conditions with depth) of the tropical Pacific.

8. On the still image below, either draw in or describe the location of the base of the thermocline and how it varies across the Pacific. How does this plot support your interpretation in question 6 above?



Once you’ve answered all the questions above, check your answers with the following resources:

<https://www.climate.gov/enso>

<https://www.climate.gov/news-features/blogs/enso/winter-outlook-2020-2021-look-back>

9. Read the most recent blog post (linked above). What are a few areas that were expected to experience drier-than-average conditions this winter? Where was it expected to be wetter? What were some reasons given in the article for why observed conditions deviated from predicted? [If you were wondering why there are so many difference indices all for the same phenomenon, some of the variability/complexity described in this post may help explain]