

## El Niño Lab - Worksheet

In the first two sections of today's lab, Sections A and B, we will work on the major oceanographic changes associated with an El Niño event: changes in sea surface height and sea surface temperature. The most dramatic El Niño of the last century was the 1997-98 event and many of the descriptions refer to that. In Section C, we will look at real-time observations and data posted on the internet hours or days after they were collected from satellites or oceanographic instruments. From these data and what we already know, we will guess whether there is an El Niño starting or not. We will compare our findings with the forecasts from the specialists and see how good our prediction was!

### A. Sea surface height (SSH)

(1) From your reading: how does the sea surface height (SSH) change on the Pacific coast of South America during an El Niño?

Go to the following web-page:

[http://topex-www.jpl.nasa.gov/science/enso97/el\\_nino\\_1997.html](http://topex-www.jpl.nasa.gov/science/enso97/el_nino_1997.html)

This site shows data from the TOPEX/Poseidon satellite altimeter indicating **sea surface height** changes in the period of time between March 1997 and December 2002. Look at the first few months of this time period (at the bottom of the page) and answer the following questions.

(2a) What happened in March of 1997 to trigger the onset of the El Niño event? Describe the changes in sea surface height after these triggering events.

(2b) When was the El Niño event strongest?

(2c) Estimate the duration of the 1997-98 El Niño event in months (note beginning and end dates). Did the conditions return to normal after this event?

### B. Sea surface temperature (SST)

Go to the following tutorial page:

[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/ensocycle/meansst.html](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensocycle/meansst.html)

It describes the average or "normal" **sea surface temperatures** in the Southern Pacific over a year's time.

(3a) Compare the sea surface temperatures along the equator going from west to east.

(3b) What process contributes to the low temperatures you observe in the eastern equatorial Pacific (this is described in your reading)?

(4) Look at the four diagrams carefully. Do you observe any differences between the various seasons? If yes, are they significant?

Look at the animations on the following web-page:

[http://www.cdc.noaa.gov/map/clim/sst\\_olr/old\\_sst/sst\\_anim\\_4panel.shtml](http://www.cdc.noaa.gov/map/clim/sst_olr/old_sst/sst_anim_4panel.shtml)

They show the **sea surface temperature (SST) anomalies** in the Southern Pacific before, during and after four recent El Niño events (the data originally come from the Along Track Scanning Radiometers, ATSRs). Red color represents positive anomalies (i.e., warmer than normal) while blue shows negative anomalies (i.e., colder than normal)

(5) Look carefully at every event. What happens on these graphs that tells you that there is an El Niño event taking place in every case?

(6) Which El Niño seems to be the strongest and which lasts the longest?

And a word about La Niña... Look at the images on the following web-site:

<http://www.pmel.noaa.gov/tao/elnino/la-nina-anomaly.html>

(7) How are La Niña conditions different from normal conditions? (Look again at question 2d)



(10a) In general, are the temperatures along the equator warmer, colder or close to normal? What is the direction of the wind anomalies?

(10b) Are your observations typical of an El Niño, a La Niña, or normal conditions?

Return to the web-page: <http://www.pmel.noaa.gov/tao/jsdisplay>. You will now plot the thermocline **across the equator in the Pacific**. Carry out the following steps:

- Click the blue-green button called “Section plots”
- Click the second orange button from the left called “Depth” right under the word “Section”
- Click the red button called “Make plot!”

(10c) Pay special attention at the surface water temperature and the depth of the thermocline. How similar or different are they between the eastern (100° W) and the western (140° E) part?

(11) Do your observations in exercise 10 indicate whether there is an El Niño in progress? Why or why not?

Look at the last two months' sea surface temperature data by going to the following page:  
[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/enso\\_update/index.html](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_update/index.html)

(12a) Select the "SST Animation - Tropical Pacific." Are the temperatures along the South American coast normal, warmer or colder than usual?

(12b) Now select the "T-Depth Animation – Equatorial Pacific" ("T" stands for "Temperature"). Is the water temperature very different from average? If yes, in what way?

(13) Summarize your observations on sea surface heights and temperatures over the past few weeks (your answers from exercise 8 onwards). Taking everything into consideration, what's your description of the conditions: normal or unusual? In other words, is there an El Niño happening, a La Niña, or are things normal?

Look at the El Niño Advisory by the Climate Prediction Center of NOAA:  
[http://www.cpc.ncep.noaa.gov/products/analysis\\_monitoring/enso\\_advisory/](http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/)

(14a) According to this agency, what is the prediction about this winter season? Is there an El Niño event under way? Does this prediction match yours?

(14b) What is the prediction about this winter season? How certain is the Prediction Center about their forecast?