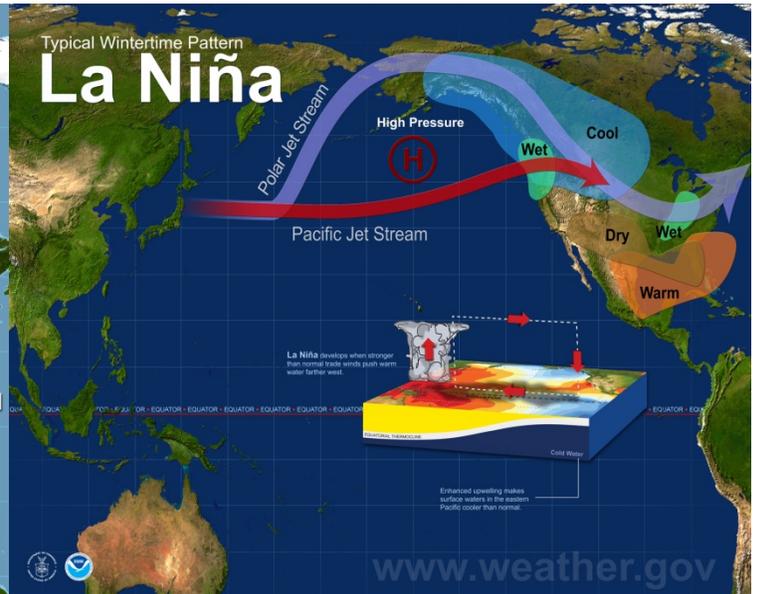
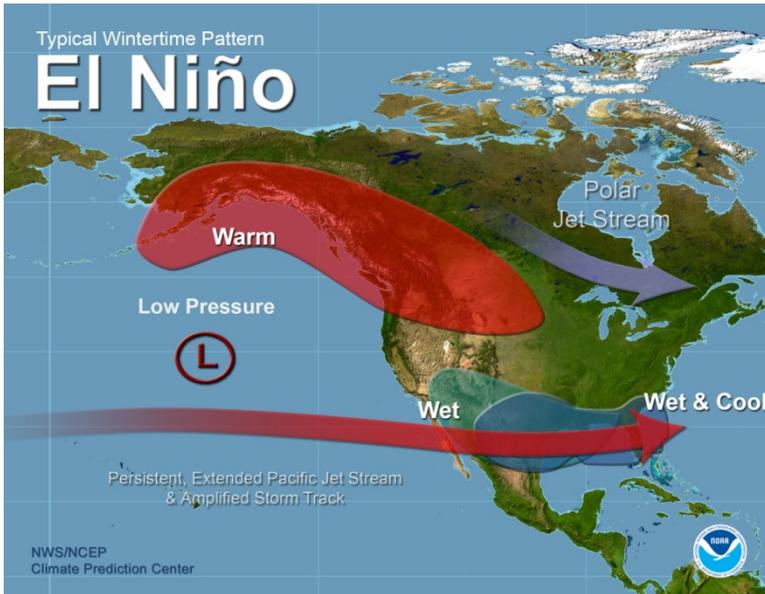


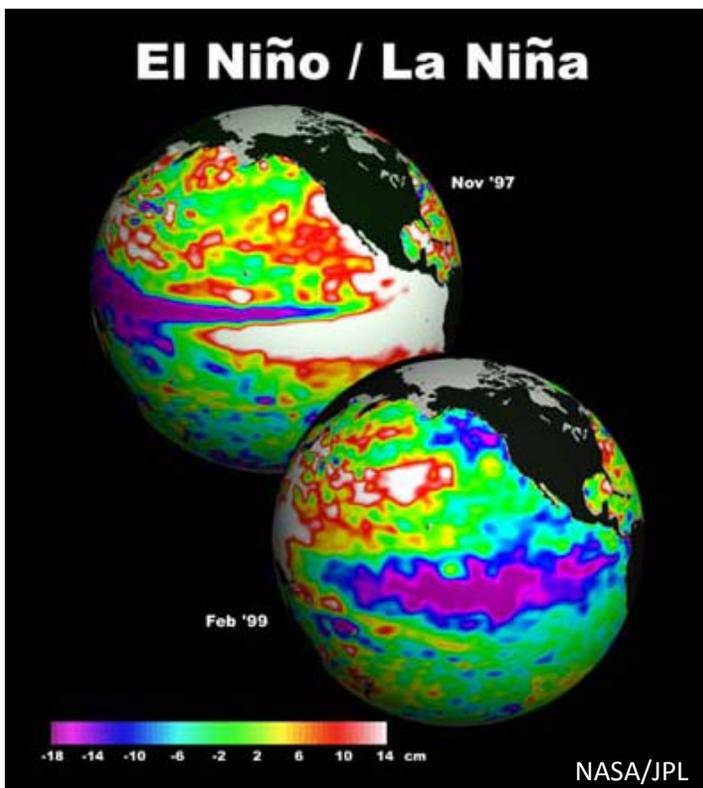
Name: \_\_\_\_\_

### Exploring Patterns: ENSO on the Global Stage



Above are depictions of how El Niño (ENSO+) and La Niña (ENSO-) affect conditions in North America. You may have heard about such impacts on the news, which can include things like low water availability and crop yields, or increased glacial melt. Along with ENSO there are other ocean surface anomaly systems, like the North Atlantic Oscillation (NAO) and Pacific Decadal Oscillation (PDO). Additionally, interactions between different ocean surface anomaly systems can cause the weather conditions we actually experience to vary from those we expect of the oscillation. For example, some expressions of NAO can be quite subtle, depending on the state of ENSO and its impact on the jet stream.

Some oscillations reoccur in a regular time cycle (e.g., every 10 yr or every 25 yr), called a *recurrence interval*. Understanding the recurrence interval of a climate phenomenon can help us to plan for and mitigate its impacts.

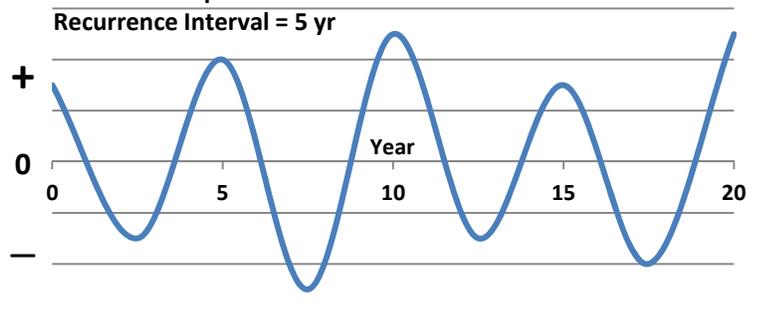


You will explore these concepts by:

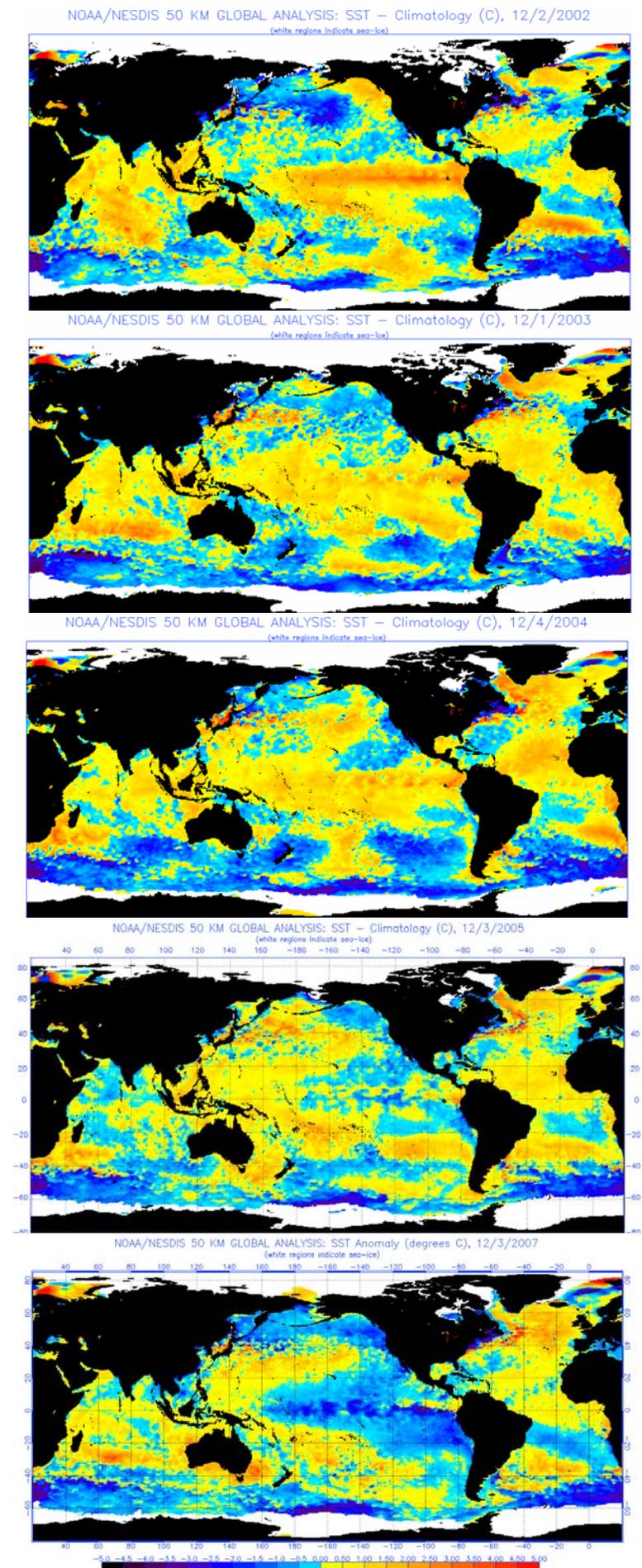
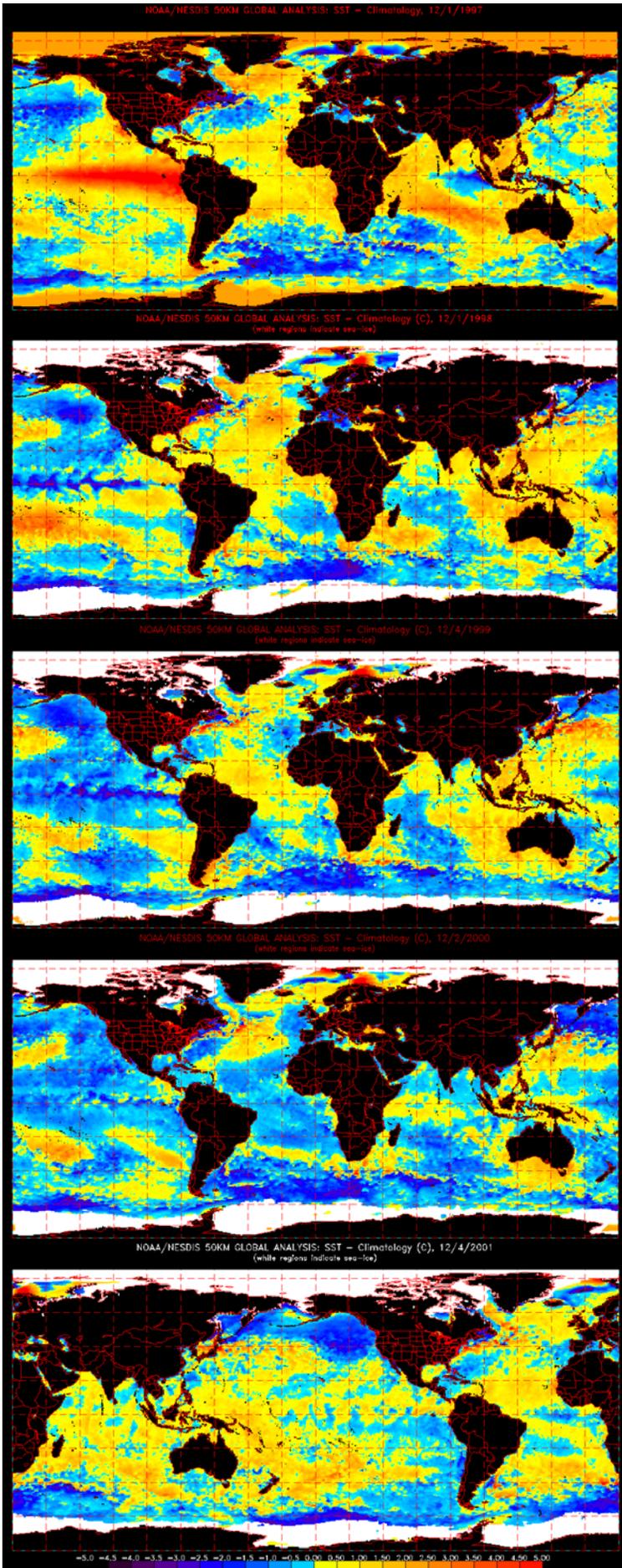
-  reading global sea surface temperature (SST) anomaly maps,
-  assessing the state of the El Niño Southern Oscillation from SST anomaly maps,
-  creating a timeline of changes in ENSO conditions, &
-  assessing the recurrence interval of the ENSO system.

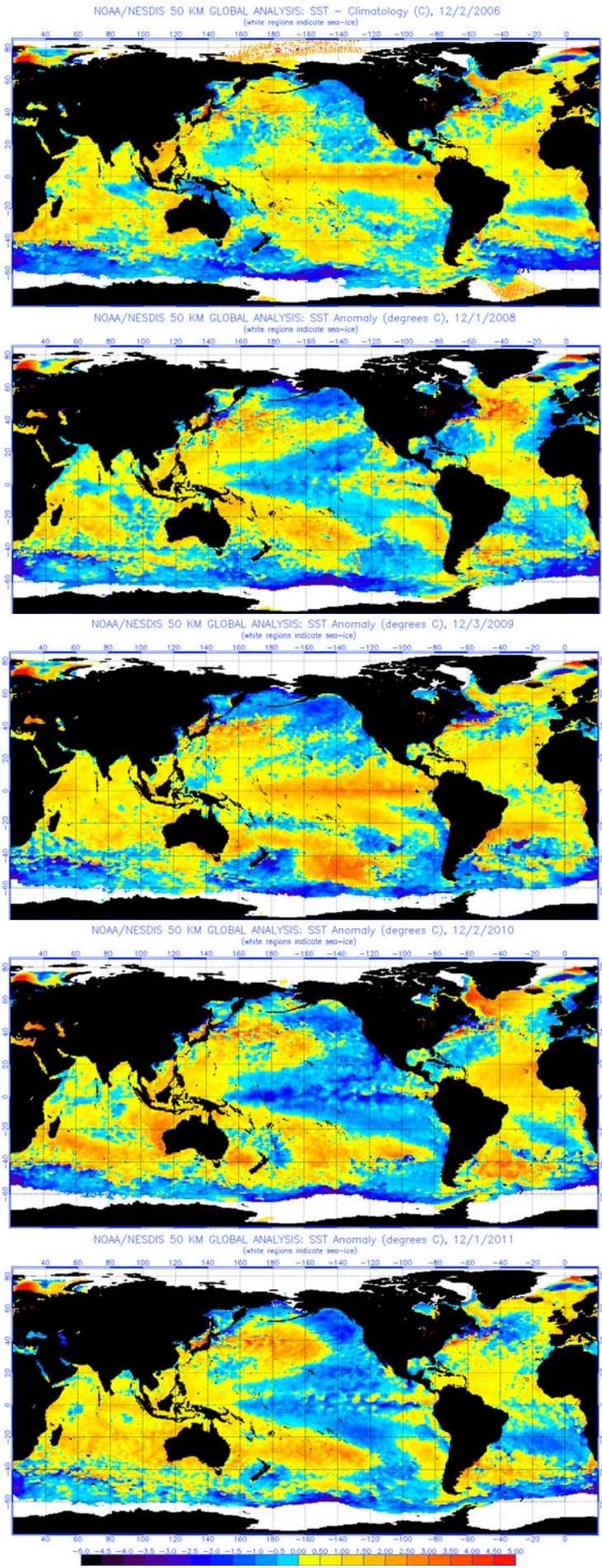
Example:

Recurrence Interval = 5 yr

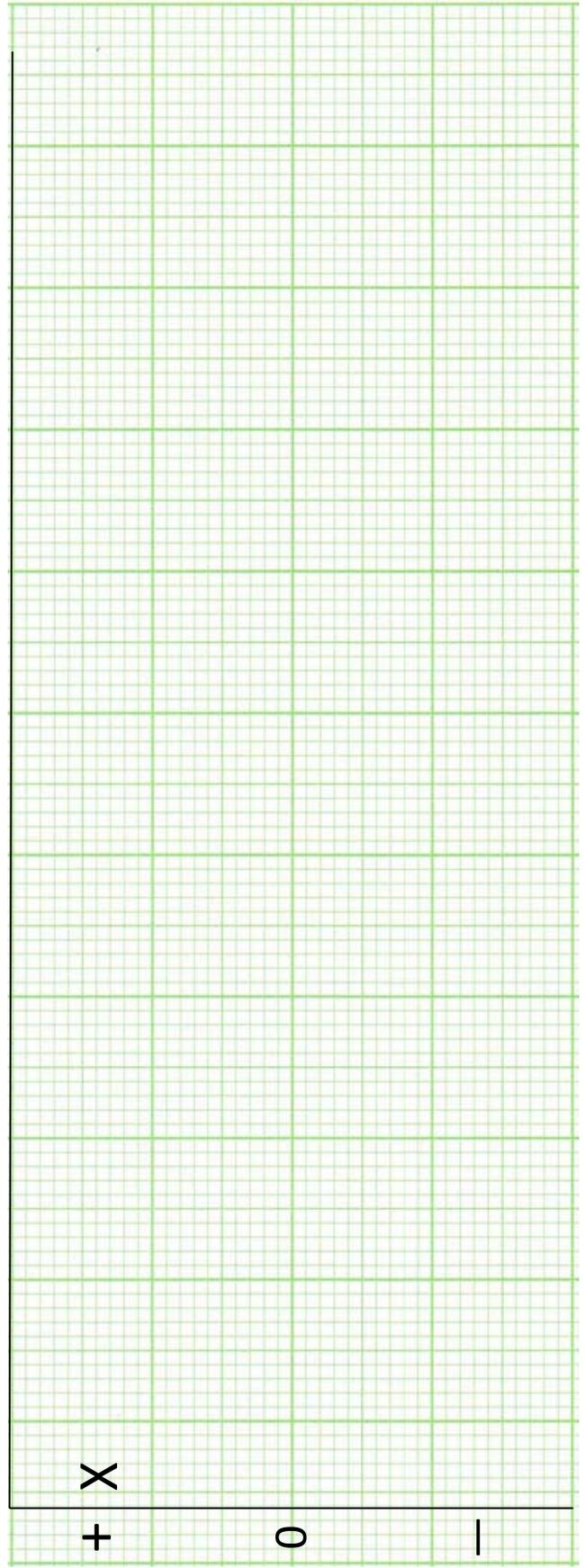


Maps of the sea surface temperature anomaly in early December from 1997-2011 created by the National Oceanic and Atmospheric Administration's Coral Reef Watch. SST Anomaly is produced by subtracting the long-term mean SST (for that location in that time of year) from the current value. A positive anomaly means that the current sea surface temperature is warmer than average, and *vice versa*.





1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013



- Using the SST anomaly map time series and graph provided on the previous pages, create a timeline of ENSO events from 1997-2011. Include El Niño (+), La Niña (-), and ENSO normal (0) ocean surface conditions. The assessment for 1997 is completed for you.
- What is the difference between SST and SST anomaly maps? Which type of map is more helpful for recognizing an SST oscillation pattern and why?
- According to your timeline graph, what is the recurrence interval of each anomalous ocean surface condition?

ENSO+

ENSO-

- Use your time series analysis to predict the ENSO condition in 2012 and 2013. How certain are you of your prediction?

+1 Extra credit: Perform an internet search for ENSO conditions in 2012 and 2013 to check your prediction. Were you correct or incorrect and why?

- What other oscillations/patterns of change in the global ocean do you observe? Where do they occur and how do they compare with ENSO?
- Below is a representation of variation in ENSO from 1950 to 2010. Do you observe a regular recurrence interval here? Does this graph change your interpretations above or confirm them? Explain.

