**Exercises on Coastal Resources**

# Exercise 1: Tide Predictions

The objective is to show you that how we can use some available web-based resources to generate important predictions, graphs etc. NOAA's web site for tides and currents (available at <http://tidesandcurrents.noaa.gov/station_retrieve.shtml?type=Tide+Predictions>) are used here to generate high and low water-level plots for 3-month periods. Based on availability of data, currently we are preparing 3-months high and low water-level plots for three to five USAPI stations. This information is distributed through the web version of PEAC’s newsletter.

# Instructions Exercise 1:

To become familiarized with tide data and Tide Predictions (H/L WL), go to the following web site:

http://tidesandcurrents.noaa.gov/station\_retrieve.shtml?type=Tide+Predictions

1. Click to “Other Areas”
2. Choose your area of interest (e.g., stations) from the list of stations, (e.g., Barbuda)
3. Go to Tide/Water Level data
4. Plot historic observed and predicted tide level
5. Plot/generate extremes of tides

# Exercise 2: Basics of El Nino/La Nina

The objective is to provide the very basics of El Niño and La Niña; how are specific "ENSO events" defined? How different from neutral conditions do things have to be to qualify as an event, since things will never be perfectly neutral? The definition of an El Niño or La Niña event is based on one (or more) of the standard indices used in monitoring and involves both the magnitude (value) of the index as well as how long it persists.

But just how large must the value of the index be, and for how long must it persist in order for an El Niño or La Niña to be identified? On these points different researchers have different ideas and there is no single method used to identify events. However, a common method in use is based on the NINO 3.4 Index, which is the departure in monthly sea surface temperature from its long-term mean averaged over the NINO 3.4 region. In this method, an El Niño or La Niña event is identified if the 5-month running-average of the NINO 3.4 Index exceeds +0.4 deg. C (for El Niño; -0.4 deg. C for La Niña) for at least 6 consecutive months (see Trenberth, 1997 in Links and References). The 5-month running-average (data is averaged over 5-month, overlapping periods incrementing one month at a time) is used to smooth out variations in sea surface temperature not associated with ENSO.

# Instructions Exercise 2:

1. For our exercise, let us take 6 strongest El Niño (EN) and La Niña (LN) years. According to IRI website

(http://iri.columbia.edu/climate/ENSO/background/pastevent.html),

the six strongest EN years are: 1997-98, 1991-92, 1986-87, 1982-83, 1972-73, and 1957-58, and six strongest LN years are: 1998-99, 1988-89, 1970-71, 1973-74, 1975-76, and 1954-55.

1. Just to familiarize with the EN and LN years, see how the value of the NINO 3.4 Index (in units of degrees C) varied over time for the 6 strongest EN and LN years. All of the plots start in January of the year in which EN or LN conditions were first observed (Jan(0)) and run through to January two years later (Jan (+2)). The charts show some interesting features of El Niño and La Niña events:
2. El Niño and La Niña typically develop between April and June (that is, around spring in the Northern Hemisphere and autumn in the Southern Hemisphere), although there is considerable variation between events;
3. The largest (positive or negative) values of the NINO 3.4 Index tend to be observed during the December to February period;
4. The duration of El Niño and La Niña events can vary substantially from event to event;
5. The strongest El Niño events have larger (positive) values of the NINO 3.4 index than the strongest La Niña events (with negative index values).

# Exercise 3: SST and Wind Composites in Strong El Niño or La Niña years

The objective here is to show how to plot seasonal composites (averages) of the mean or anomalies (mean - total mean) of variables from the NCEP reanalysis and other datasets. NCEP data is available from Jan 1948 to Jun 2012. Other datasets have different time ranges. Note the climatology used for the anomaly and long term mean plots is now 1981-2010 to match the new climate normal time period.

# Instructions Exercise 3:

1. Please take the six strongest El Nino/La Nina years from Exercise 2;
2. Go to the following website:
3. http://www.cdc.noaa.gov/cgi-bin/data/composites/printpage.pl
4. Now think about your own area of interest—here in this case
5. tropical Pacific,
6. Caribbean Island, and
7. South America.

Fix the latitude and longitude in such a way so that your area of interest and Nino3 area (i.e., 40S-40N; 120E-60W) are enclosed;

1. For our exercise, let us take one season OND. This is the target season;
2. Chose the variable NOAA EXTENDED SST, \*\*
3. If the target season is OND then choose October as the beginning month and December as the ending month;
4. Put the 5 El Nino years in the box (later you will try with one year at a time, you can also try with one month at a time);
5. Follow other steps and draw the composite maps;
6. Repeat # 7 with 5 La Nina years in the box;
7. Now try to see El Nino-La Nina maps;.
8. Do the same work independently with other seasons JFM (-3), AMJ(-2), JAS(-1), and JFM(+1);
9. Save all SST files for JFM (-3), AMJ(-2), JAS(-1), and JFM(+1);
10. Compare the observe SST propagation patterns. Write your observation in your report.

* Now try with other variable like zonal wind\*\*.
* Now save all these SST and Wind composites and see how the SST did pattern changed from the time of onset. Look for tendencies in the maps; compare results and explain SST and atmospheric circulations development patterns from your observations (monitoring).

# Exercise 4: SST and Wind Composites in highest (HSL) and lowest (LSL) sea level years

Same as exercise 3, except for HSL and LSL [you will take your own time-series. Please choose one data file from the data directory then calculate the HSL and LSL]. Please use these years as the HSL and LSL years. The objective of this analysis is to check if HSL and LSL corresponds to similar SST/wind features in exercise 3 (LN or EN) or vice versa.

# Instructions Exercise 4:

1. Now take one set of your own sea-level data and chose the five lowest and highest sea level years;
2. Go to the following websites and chose your area of interest (i.e., Easter, Chile; Antofagasta, Chile; Santa Cruz, Ecuador; Majuro, RMI);
3. http://ilikai.soest.hawaii.edu/uhslc/data.html
4. ftp://ilikai.soest.hawaii.edu/islp/slpp.deviations
5. Now download data in EXCEL format and find the lowest and highest sea level years and seasons;
6. Prepare a seasonal average value from your time-series (i.e., JFM, AMJ, JAS, and OND) by using EXCEL;
7. Now chose the 5-highest and lowest values for each season. Compare the results (just for interest, try to investigate whether these years are El Nino/La Nina years?). Let us do the analysis based on season OND;
8. Follow steps in example 3.
9. Draw SST composites for low years and high years. Also draw wet minus dry;
10. Repeat with circulations (zonal wind) variables;
11. Look for tendencies in the maps; compare results and explain SST and atmospheric circulations development patterns from your observations in your area of interest.

.**Questions (Example 3 and 4)**

* What are the main features of SST for the high sea level years (HSL) and the low sea level (LSL) years (e.g., which features are consistent amongst the 5 extreme high years, and amongst the 5 extreme low years)?
* Where do the SSTs look different between HSL (wet) and LSL (dry) years?
* What are the main features of winds for the HSL (wet) years and the LSL (dry) years?
* Where do the winds look different between HSL (wet) and LSL (dry) years?

Please use Worksheet 3.3 to answer these questions.

# Exercise 5: Correlations between Your Time-series and SST/Wind (OPTIONAL)

The objective here is to show how to plot correlations of seasonally averaged variables from the NCEP reanalysis with specified teleconnections and ocean index time-series. Correlations are generally available from Jan 1948 to Jun 2012. Please know that this is a standard approach to study the relationship among the climate fields (such as SST) by correlating time-series at each geographical grid-point with the variable of interest (such as sea level of each year).

# Instructions Exercise 5:

1. Prepare your own data time-series;
2. Go to ftp ftp.cdc.noaa.gov (start/RUN)
3. Login: anonymous
4. Password:
5. For custom time-series, go to cd /Public/incoming/time series;
6. Put filename.txt (this file is the text file that you have prepared for this exercise);
7. Ls (check your file whether it is saved in Public/incoming/time series directory);
8. \*\*\*Note that your text file must be saved in C:\Documents and Settings\\_\_\_\_\_\_\_\_\_\_\_\ in your computer;
9. As before, let us take one season, say OND is our target season;
10. Go to the web site http://www.cdc.noaa.gov/Correlation/
11. Chose the variable SST, \*
12. If the target season is OND then choose October as the beginning month and December as ending month;
13. Put index time series leads (0) and lags (0), which means you doing correlation analysis between SSTs of OND and values of your time-series in OND (later you will try with lags (-3 to-1 and lead (+1 to +3);
14. Now time series; go to custom and write down the name of locations of your file: /Public/incoming/time series/\*\*\*\*\_dat.txt; (\*\*\*\* your own time series)
15. Choose your area or region of interest;
16. Follow steps 9-14 with lag and led seasons, say JFM(-3), AMJ (-2), JAS (-1), and JFM (+1);
17. Compare the observe SST evaluation patterns;