

## Calculating and Mapping seasonal SST differences LAB 8

**Objective:** to identify the SST differences from the same location during a season from two different years. For example, What was the SST difference in the South Asian Sea between winter 2000 and winter 2010?

To do this you need to identify 2 parts: 1) the season of interest and 2) the region of interest. Seasons can be either winter (December, January, February), spring (March, April, May), summer (June, July, August), or fall (September, October, November). Zoom into any region of interest.

### GENERAL DIRECTIONS:

- 1) Select SST dataset from the data library
- 2) Subset the season 1 period
- 3) Subset the region
- 4) Subset the season 2 period
- 5) Subset the region
- 6) Subtract the two seasons
- 7) Plot a difference map

# DETAILS:

1. Click here to select the SST dataset:

[https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.EMC/.CMB/.GLOBAL/.Reyn\\_SmithOlv2/.monthly/.sst/](https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.EMC/.CMB/.GLOBAL/.Reyn_SmithOlv2/.monthly/.sst/)

2. Click on the Data Selection tab near the top

3. Enter your longitude, latitude, and time. Your longitude and latitude will determine your regional subset. The time will identify your season of interest. For the time, if you want to look at summer 1995 then the time selection would be , **Jun 1995 to Aug 1995**. (DO NOT USE THIS EXAMPLE, PICK YOUR OWN)

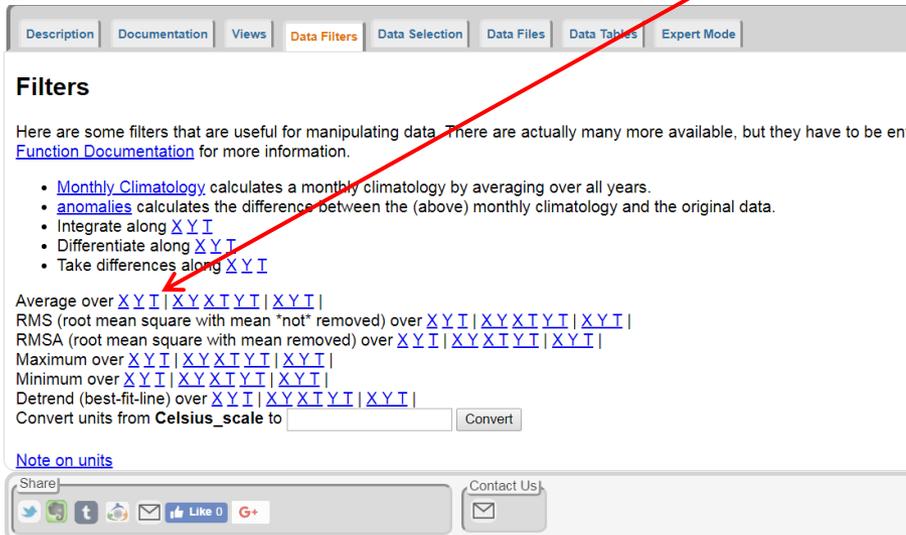
4. Click on the **Restrict Ranges** link at the bottom of the setting ranges section

5. Click **Stop Selecting** from the Data Selection section.

Now you have subsetted your region and season.

6. Click on the **Data Filters** tab near the top of the page.

7. Locate where you see the words, **Average over**. Click on the **T**.



The screenshot shows the 'Data Filters' tab in the Iridl interface. The 'Filters' section contains a list of filter options: 'Monthly Climatology', 'anomalies', 'Integrate along X Y I', 'Differentiate along X Y I', and 'Take differences along X Y I'. Below this list, there are several filter options with a 'T' button next to them: 'Average over X Y I | X Y X T Y I | X Y I |', 'RMS (root mean square with mean "not" removed) over X Y I | X Y X T Y I | X Y I |', 'RMSA (root mean square with mean removed) over X Y I | X Y X T Y I | X Y I |', 'Maximum over X Y I | X Y X T Y I | X Y I |', 'Minimum over X Y I | X Y X T Y I | X Y I |', and 'Detrend (best-fit-line) over X Y I | X Y X T Y I | X Y I |'. A red arrow points from the 'T' button in the 'Average over' option to the 'T' in the instruction text above. At the bottom, there is a 'Convert' button and a 'Note on units' link.

8. Now you have average the three months of your first season to calculate the seasonal average SST
9. Click on **Expert Mode** tab from above
10. Copy and past the lines of code just below the original lines of code

The screenshot shows the IRI Data Library interface. At the top, there is a search bar with the text "mean [ NOAA NCEP EMC CMB GLOBAL Reyn\_SmithOlv2 monthly sst ]" and two coordinate range boxes: "X 110W - 50W" and "Y 5N - 35N". Below the search bar is a navigation menu with tabs: "Description", "Documentation", "Views", "Data Filters", "Data Selection", "Data Files", "Data Tables", and "Expert Mode". The "Expert Mode" tab is selected. Below the navigation menu, there is a code editor area. The code editor contains two identical blocks of source code. Each block starts with "SOURCES .NOAA .NCEP .EMC .CMB .GLOBAL .Reyn\_SmithOlv2 .monthly .sst" followed by "X (110W) (50W) RANGEEDGES", "Y (5N) (35N) RANGEEDGES", and "T (Jun 1995) (Aug 1995) RANGEEDGES". Below each block, there is a "[T]average" line. Red arrows point to the first five lines of each code block, indicating they were copied and pasted. At the bottom of the code editor, there are "OK" and "reset" buttons. Below the code editor, there is a "Share" section with social media icons (Twitter, Facebook, LinkedIn, Email) and a "Like 0" button, and a "Contact Us" section with an email icon.

Copied these 5 lines  
 pasted these 5 lines

11. Now, change the dates in the pasted rows for a NEW season. Before we had Jun-Aug 1995. Now we want Jun – Aug 2015 (PICK YOUR OWN DATES!). Simply change the dates as you would normal text.

12. The new codes should look like this now. NOTICE new dates in the second section of lines. You must type them EXACTLY as above, don't forget the space between the month and year!

The screenshot shows the IRI Data Library interface. At the top, there is a search bar with the text "mean [ NOAA NCEP EMC CMB GLOBAL Reyn\_SmithOlv2 monthly sst ]". To the right of the search bar are two input fields: "X" with the value "110W - 50W" and "Y" with the value "5N - 35N". Below the search bar is a navigation menu with tabs: "Description", "Documentation", "Views", "Data Filters", "Data Selection", "Data Files", "Data Tables", and "Expert Mode". The main content area displays the search results in a code-like format. It shows two sections of data, each starting with "SOURCES" and listing various data sources and parameters. The first section is for the period (Jun 1995) to (Aug 1995), and the second section is for the period (Jun 2015) to (Aug 2015). Both sections list the same sources: .NOAA, .NCEP, .EMC, .CMB, .GLOBAL, .Reyn\_SmithOlv2, .monthly, and .sst. The parameters listed are X (110W) (50W) RANGEEDGES, Y (5N) (35N) RANGEEDGES, and T (Jun 1995) (Aug 1995) RANGEEDGES for the first section, and X (110W) (50W) RANGEEDGES, Y (5N) (35N) RANGEEDGES, and T (Jun 2015) (Aug 2015) RANGEEDGES for the second section. Below the search results is an "OK" button and a "reset" button. At the bottom of the interface, there is a "Share" section with social media icons for Twitter, Facebook, and Google+, and a "Contact Us" section with an email icon.

IRI Data Library

mean [ NOAA NCEP EMC CMB GLOBAL Reyn\_SmithOlv2 monthly sst ] X 110W - 50W Y 5N - 35N

Description Documentation Views Data Filters Data Selection Data Files Data Tables Expert Mode

X Y

mean [ NOAA NCEP EMC CMB GLOBAL Reyn\_SmithOlv2 monthly sst ] [ X Y ] M M

```
SOURCES .NOAA .NCEP .EMC .CMB .GLOBAL .Reyn_SmithOlv2 .monthly .sst
X (110W) (50W) RANGEEDGES
Y (5N) (35N) RANGEEDGES
T (Jun 1995) (Aug 1995) RANGEEDGES
[T]average

SOURCES .NOAA .NCEP .EMC .CMB .GLOBAL .Reyn_SmithOlv2 .monthly .sst
X (110W) (50W) RANGEEDGES
Y (5N) (35N) RANGEEDGES
T (Jun 2015) (Aug 2015) RANGEEDGES
[T]average
```

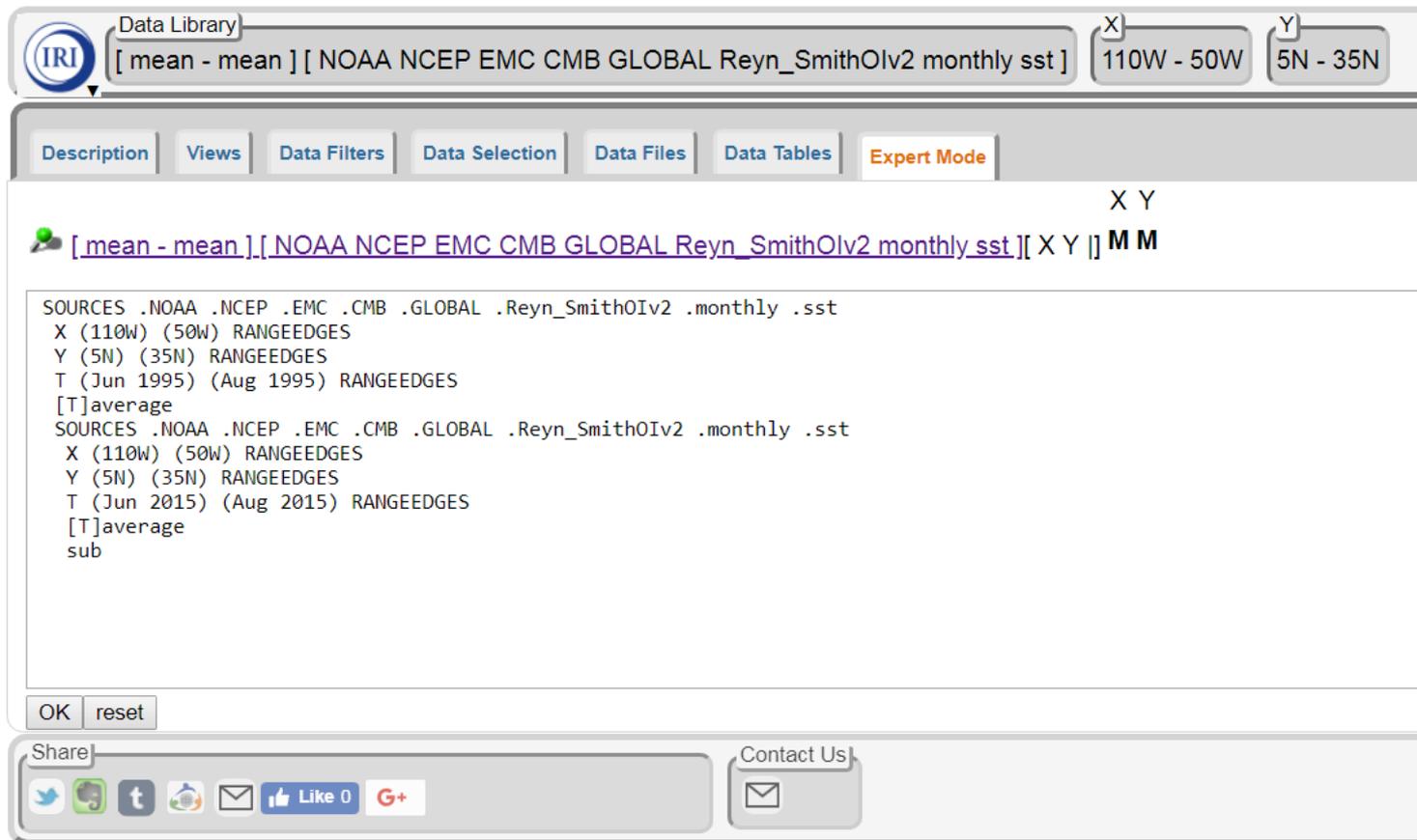
OK reset

Share Contact Us

Like 0

13. Click **OK** near the bottom

14. Now simply write the word, **sub** on a new line at the bottom of the lines of code. It should look like the below. The sub keyword calculates the difference between the two seasons.



The screenshot shows the IRI Data Library interface. At the top, there is a search bar with the text "[ mean - mean ] [ NOAA NCEP EMC CMB GLOBAL Reyn\_SmithOlv2 monthly sst ]". To the right of the search bar are two input fields for X and Y coordinates: "X 110W - 50W" and "Y 5N - 35N". Below the search bar is a navigation menu with tabs: "Description", "Views", "Data Filters", "Data Selection", "Data Files", "Data Tables", and "Expert Mode". The "Expert Mode" tab is currently selected. Below the navigation menu is a text area containing the following code:

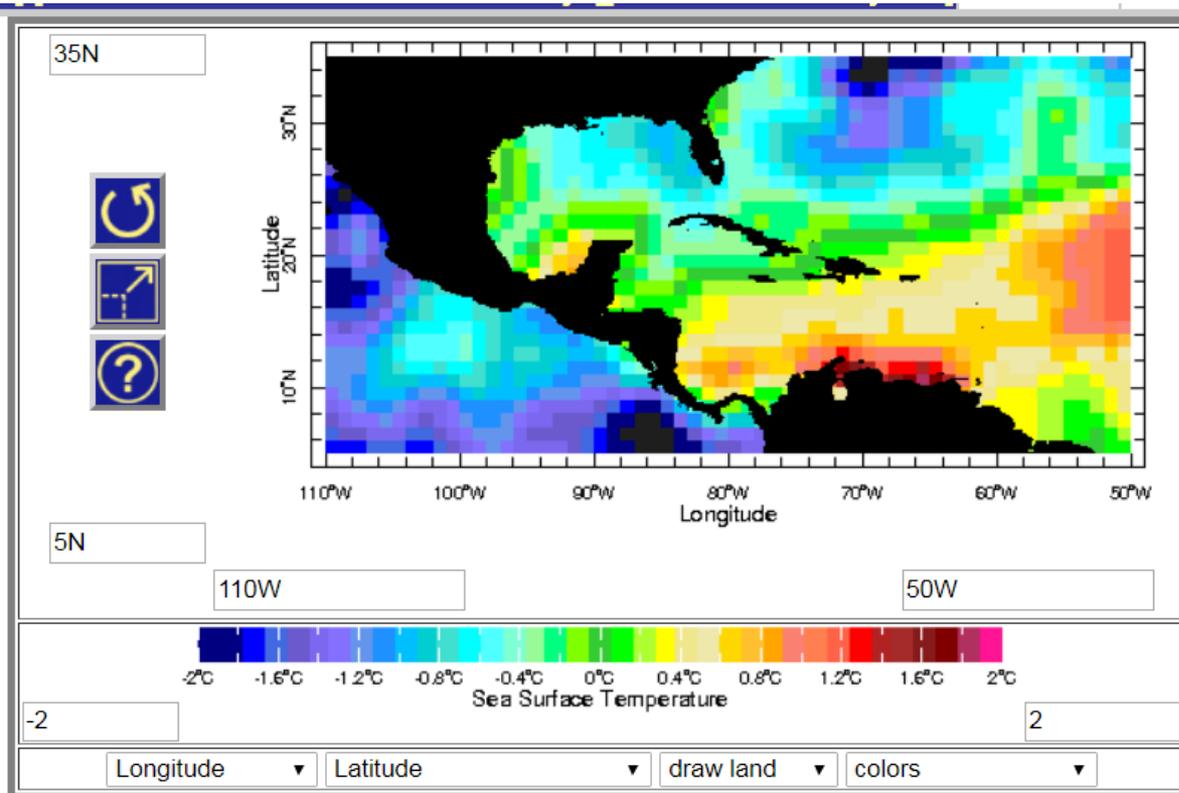
```
X Y  
[ mean - mean ].[ NOAA NCEP EMC CMB GLOBAL Reyn_SmithOlv2 monthly sst ][ X Y ] M M  
  
SOURCES .NOAA .NCEP .EMC .CMB .GLOBAL .Reyn_SmithOlv2 .monthly .sst  
X (110W) (50W) RANGEEDGES  
Y (5N) (35N) RANGEEDGES  
T (Jun 1995) (Aug 1995) RANGEEDGES  
[T]average  
SOURCES .NOAA .NCEP .EMC .CMB .GLOBAL .Reyn_SmithOlv2 .monthly .sst  
X (110W) (50W) RANGEEDGES  
Y (5N) (35N) RANGEEDGES  
T (Jun 2015) (Aug 2015) RANGEEDGES  
[T]average  
sub
```

At the bottom of the interface, there are two buttons: "OK" and "reset". Below the buttons is a "Share" section with social media icons for Twitter, Facebook, and Google+, and a "Contact Us" section with an email icon.

15. Click **OK** at the bottom

16. Click on **Views** tab from the above, then select the **Colors with Land** option.

17. Now you should have a map that looks like this. Be sure to adjust the color scale values so that 0 is in the middle. In this example, I entered -2 and 2.



18. ***There is one thing I do not like about the map above.*** The greens are both positive and negative values. It is hard to tell where is positive and where is negative. To fix this, I add a different color bar.

19. I added a new line at the bottom of the lines of code to add a new color bar! The new line is:  
**std\_anomaly\_colors XY fig: colors land :fig**

20. The new code is below. NOTICE THE **NEW LINE AT THE BOTTOM**. Be sure to copy and past this line at the bottom of your code.

```
SOURCES .NOAA .NCEP .EMC .CMB .GLOBAL .Reyn_SmithOlv2 .monthly .sst
X (110W) (50W) RANGEEDGES
Y (5N) (35N) RANGEEDGES
T (Jun 1995) (Aug 1995) RANGEEDGES
[T]average
SOURCES .NOAA .NCEP .EMC .CMB .GLOBAL .Reyn_SmithOlv2 .monthly .sst
X (110W) (50W) RANGEEDGES
Y (5N) (35N) RANGEEDGES
T (Jun 2015) (Aug 2015) RANGEEDGES
[T]average
sub
```

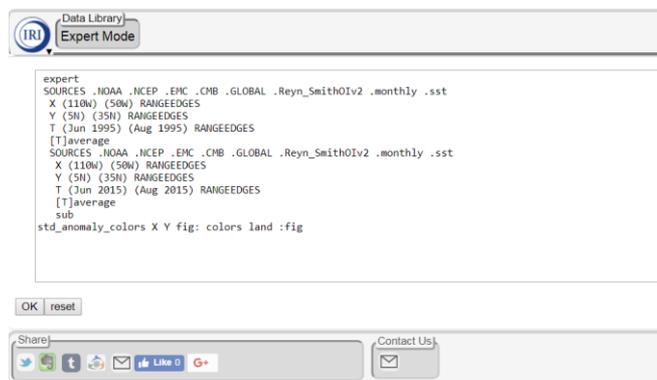
**std\_anomaly\_colors X Y fig: colors land :fig**

21. Now what I do is copy all of the lines from above and paste them into a new “expert window”

22. Type this code into a web browser:

<https://iridl.ldeo.columbia.edu/expert/>

23. Now, paste all of the lines above including the new final line into the blank window. It should now look like this below. Select **OK**



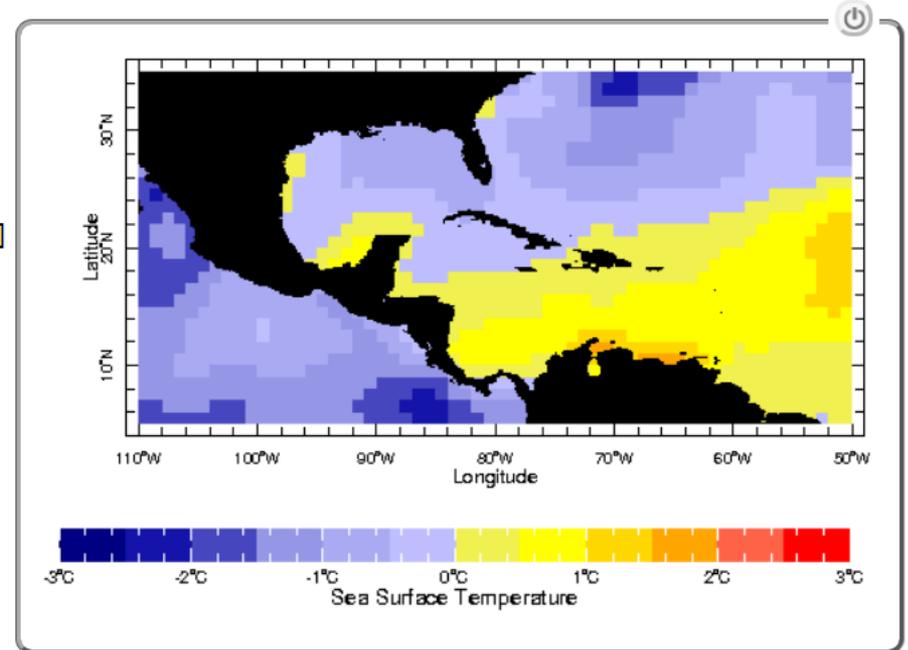
24. Your difference map should look like the below now. It is easy to tell where the positive and negative values are. Blues are negative and yellow / red is positive.

### [ mean - mean ] [ NOAA NCEP EMC CMB GLOBAL Reyn\_SmithOlv2 monthly sst ]

mean [ NOAA NCEP EMC CMB GLOBAL Reyn\_SmithOlv2 monthly sst ],Averaged over T[Jun 1995, Aug 1995],mean [ NOAA NCEP EMC CMB GLOBAL Reyn\_SmithOlv2 monthly sst ],Averaged over T[Jun 2015, Aug 2015]

Last updated: *Mon, 05 Nov 2018 08:02:20 GMT*

Expires: *Mon, 03 Dec 2018 00:00:00 GMT*



Share

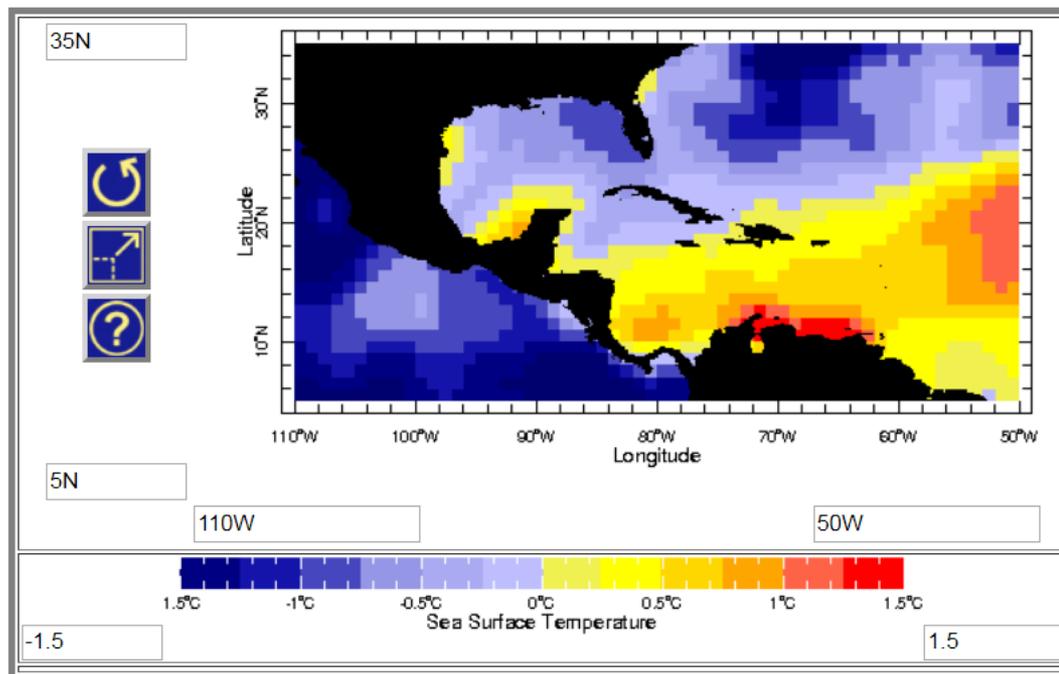


Contact Us



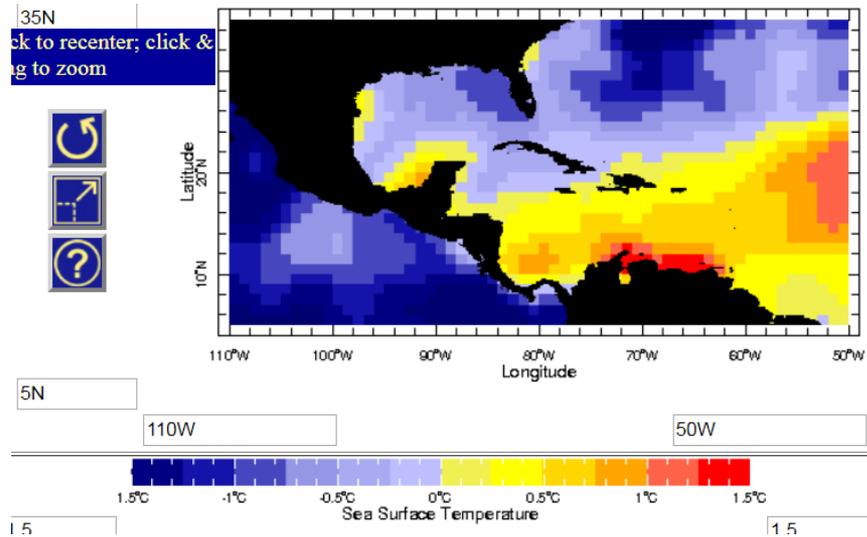
25. If you want, you can now click on the **Options** tab, then select **Viewer**. Now you can fine tune your color range values if necessary.

26. I changed the range from -3 to 3 for a new smaller range of -1.5 to 1.5.



27. Compare the new map with the old one. Same data, just different color scale. You can see much more variation with the smaller scale. Can you maximize your variation?

## INTERPRETATION



In order to properly interpret your **SST seasonal difference map**, you MUST know what season was subtracted from the other. Recall that I first entered summer 1995 and then entered summer 2015. So in my case, everything that is positive shows where it was warmer in 1995 compared to 2015. *(If you don't believe me, try a simple made up test. Pretend summer 1995 was 30C and summer 2015 was 20C, then 30-20 is POSITIVE, which means that 1995 was greater, or warmer and will be yellow or red. Positive values indicate that the first season was greater or warmer than the second season. This is VERY important. Please understand this. Failure to understand this concept may cause you to interpret your results incorrectly!)* Everywhere that is negative shows where it was cooler in 1995 compared to 2015. Also know, the blues mean that 1995 was cooler, which is the same thing as 2015 was warmer where the blues are. Reds / yellow means 1995 was warmer or 2015 was cooler....SAME THING!

## WHAT YOU NEED TO INCLUDE IN THE ASSIGNMENT:

### 1. Your entire lines of code (1pt)

```
SOURCES .NOAA .NCEP .EMC .CMB .GLOBAL .Reyn_SmithOlv2 .monthly .sst
X (110W) (50W) RANGEEDGES
Y (5N) (35N) RANGEEDGES
T (Jun 1995) (Aug 1995) RANGEEDGES
[T]average
SOURCES .NOAA .NCEP .EMC .CMB .GLOBAL .Reyn_SmithOlv2 .monthly .sst
X (110W) (50W) RANGEEDGES
Y (5N) (35N) RANGEEDGES
T (Jun 2015) (Aug 2015) RANGEEDGES
[T]average
sub
std_anomaly_colors X Y fig: colors land :fig
```

2. Your difference map (1pt). The map color scale MUST be centered on zero (1pt). Please understand why this is important for anomalies or differences!

3. Interpretation of your difference map (2pts). Tell me what season you picked and what years. Why did you pick them? Interpretation needs to include a few sentences that describe the variation. Where was warmer / cooler and when? DO NOT WRITE MORE THAN ONE PAGE, but you must write at least ½ page.