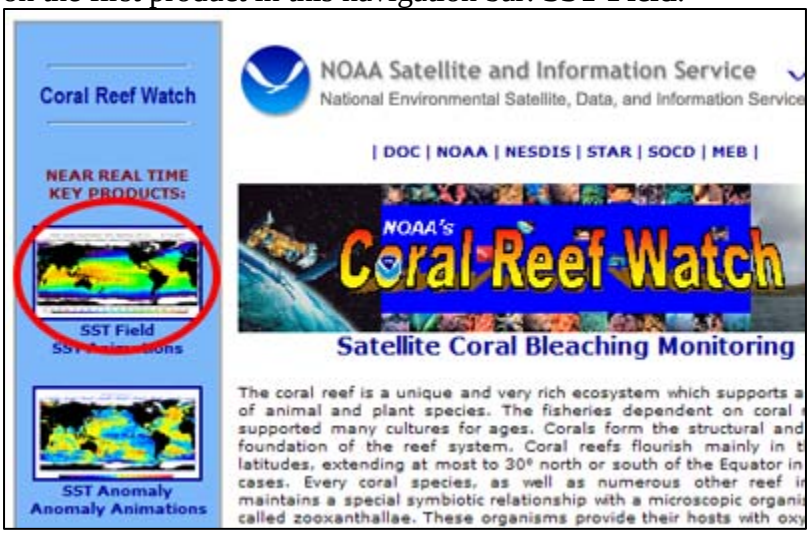
The goal of these hands-on exercises is to reinforce the concepts taught in the online tutorial, using simple examples, and to familiarize users with our website so they will know where to find each of the products. For each exercise, please follow along, starting from the main page of the NOAA Coral Reef Watch website: http://coralreefwatch.noaa.gov/satellite.

SST product exercises

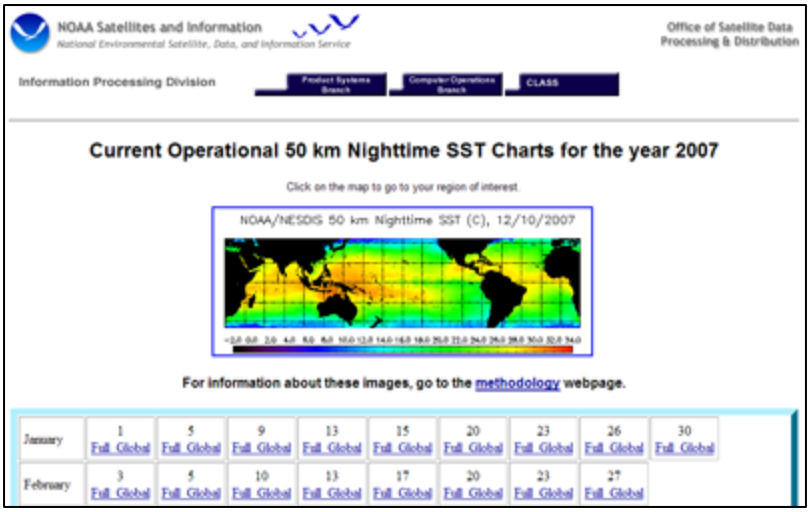
1. What was the temperature around the Galapagos Islands on March 4th, 2006?

a. On the front page of the CRW website, look for the blue navigation bar on the left-hand side. Each of the operational products is listed here: images and animations for the global products, plus Virtual Station data products.

b. Click on the first product in this navigation bar: **SST Field**.

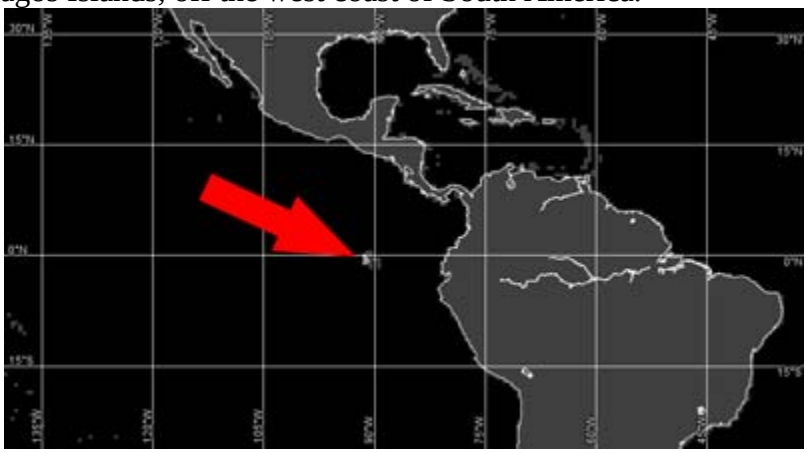


c. This takes you to this year's page for the sea surface temperature product. The image at the top will show the latest global SST, and the table underneath links to archived images for the current year.



d. Scroll down this page, until you get to the bottom of the archive table. You will see links to previous years; click on **2006 50km Nighttime SSTs** to navigate to that year.

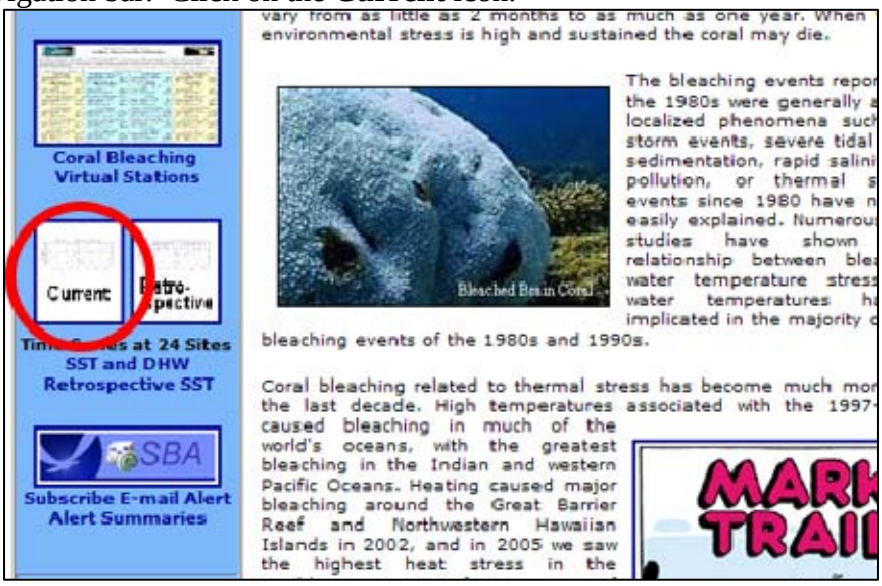
e. Here you will see links to the global images, two per week for the whole year. Find the link for **March 4th**, and click to access the global image. Locate the Galapagos Islands, off the west coast of South America.



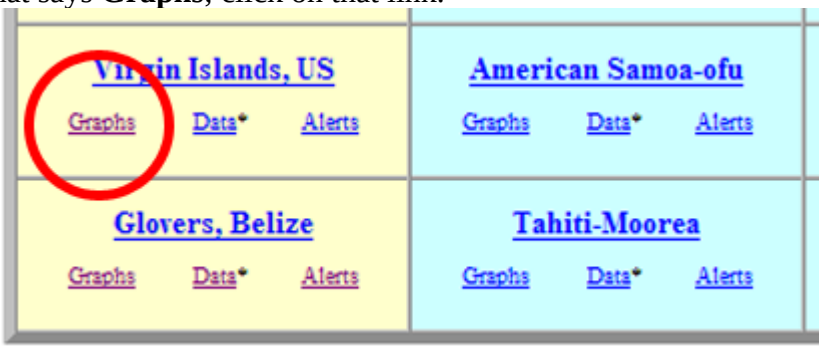
f. Using the color bar at the bottom of the image, determine the sea surface temperature in the pixels closest to the Galapagos Islands. (*Look at Answer #1 on the answer sheet to see if you got it right!*)

2. Which summer was hotter in US Virgin Islands: 2004 or 2005? Look at the entire summer season, not just the maximum temperature.

a. The easiest way to answer this question is to use the time series graphs for the USVI Virtual Station. Return to the website's front page using your browser's "Back" button, and scroll down to find **Time Series at 24 Sites** in the left-hand navigation bar. Click on the **Current** icon.



b. This takes you to a page that lists our 24 Virtual Station sites around the world. Find the cell in the table that says **Virgin Islands, US**. Below the title will be a link that says **Graphs**; click on that link.

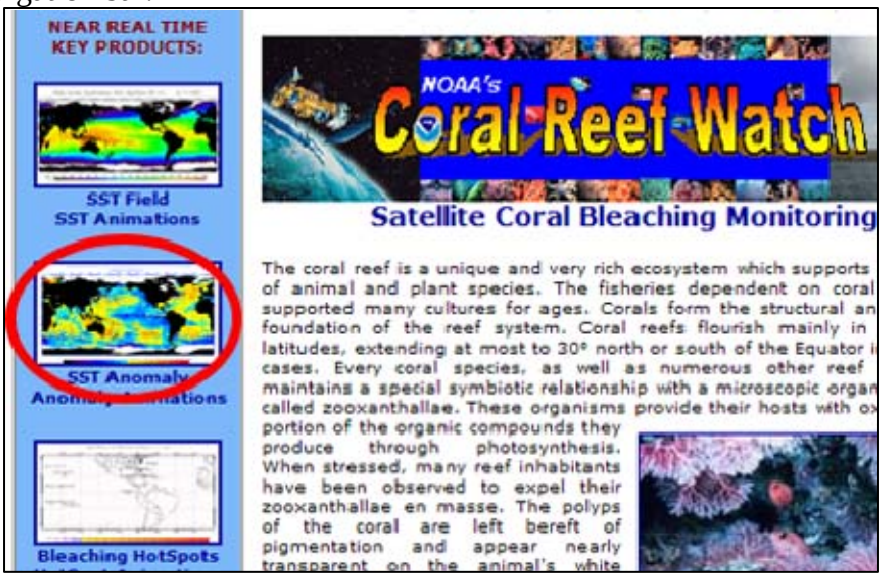


c. This page shows time series graphs for the US Virgin Islands pixel, starting in 2000. Find the 2004 and 2005 graphs, and compare the summer seasons. Remember that the dark-blue line shows the sea surface temperature from NOAA satellites. Which year had the warmer summer? (*See #2 on the answer sheet.*)

SST anomaly exercises

3. For the Caribbean image, 01 November 2007, which areas were anomalously warm/cool?

a. Return to the CRW front page, and look for **SST Anomaly** in the left-hand navigation bar.



b. This takes you to the page for the current year of the SST Anomaly product: the latest image at the top, and an archive table below. Scroll down below this archive table, to find the link to 2007 data.

c. There will be an image at the top of the page, with an archive table below. Scroll down in the table to find November 1st, then click on **Caribbean**.

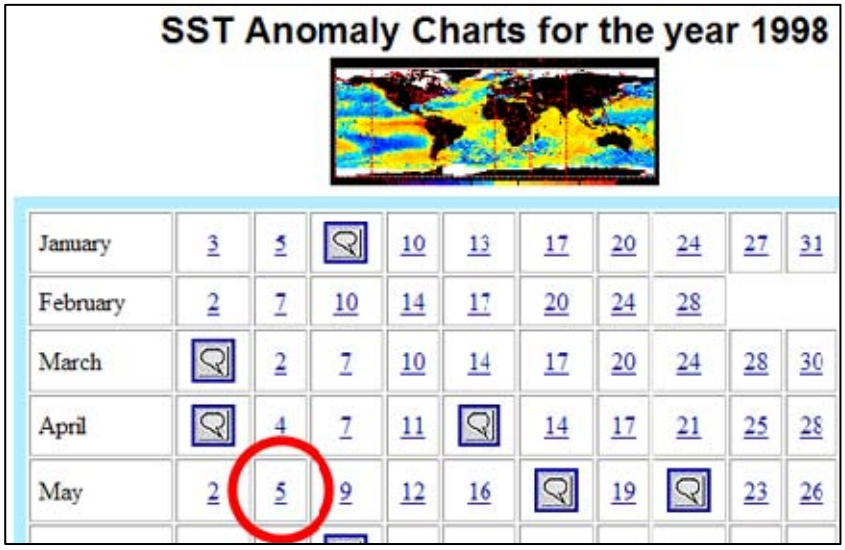
	W.Hemi	W.Hemi	W.Hemi	W.Hemi
November	1 Caribbean E.Hemi Global Full Global Pacific W.Hemi	5 Caribbean E.Hemi Global Full Global Pacific W.Hemi	8 Caribbean E.Hemi Global Full Global Pacific W.Hemi	12 Caribbean E.Hemi Global Full Global Pacific W.Hemi
December	3 Caribbean E.Hemi Global	6 Caribbean E.Hemi Global	10 Caribbean E.Hemi Global	13 Caribbean E.Hemi Global

d. What areas are warmer than the long-term mean? Which areas are cooler? (*See #3 on the answer sheet.*)

4. Compare the global SST anomaly on May 5th, 1998, to the SST anomaly one year later. What change do you see in the global anomaly patterns? What might have caused this change?

a. Navigate back to the 2007 SST anomaly page, then scroll down below the archive table until you see other years. Click on **1998 Anomalies**.

b. This takes you to the archive page for 1998. Right-click on the link for May 5th and open the image into a new browser window or tab.



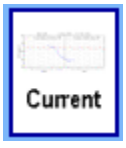
c. Now go to the SST anomaly archive page for 1999. Right-click on the link for May 4th and open the image in a new browser window or tab.

d. Compare these two global images, one year apart. What changes do you see in the SST anomaly patterns? What might have caused these changes? (*#4 on the answer sheet.*)

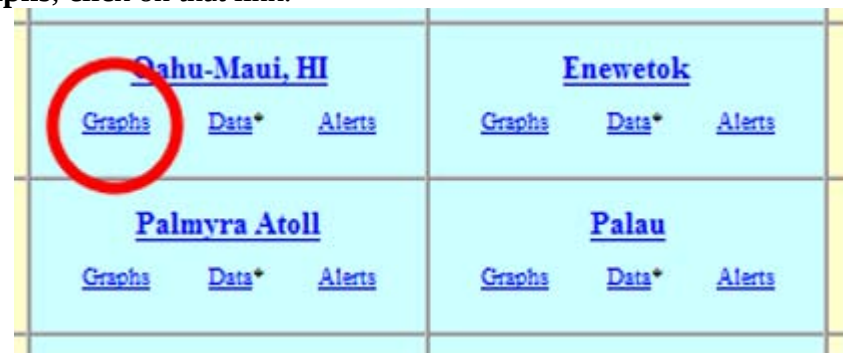
Bleaching Threshold exercise

5. For the Oahu/Maui Virtual Station, which month is the warmest? What is the maximum monthly mean and what is the bleaching threshold temperature?

a. We will answer this question by looking at the time series graphs. Return to the website's front page, and scroll down to find **Time Series at 24 Sites** in the left-hand navigation bar. Click on the **Current** icon.



b. On this page, you will see each of the operational Virtual Stations listed. Find the cell in the table that says **Oahu-Mau, HI**. Below the title will be a link that says **Graphs**; click on that link.



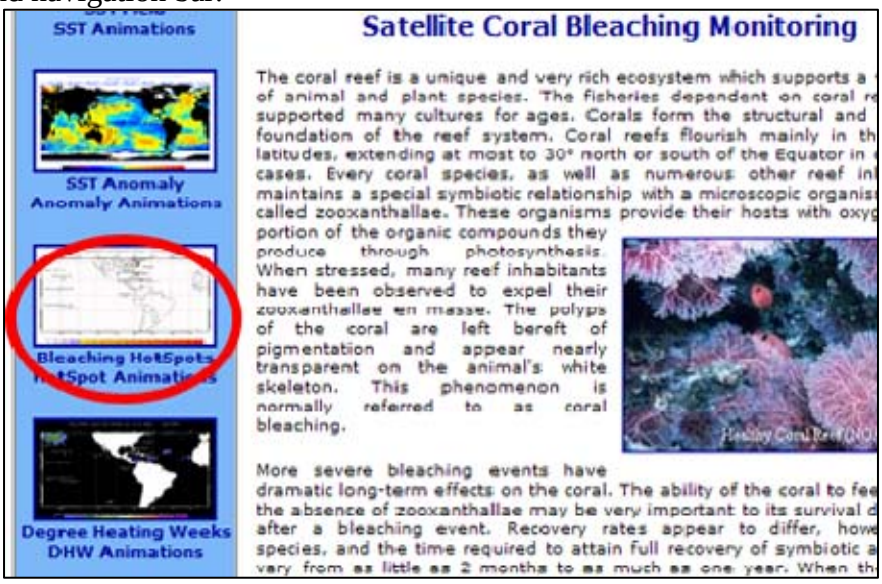
c. These graphs show the time series data at this station, with the mean for each month plotted as a light-blue cross. Use the graphs to answer these questions: Which month is the warmest on average? What is the maximum monthly mean? What is the bleaching threshold temperature? Hint: try using the 2000 graph at the bottom of the page, so you can clearly see the monthly means. Note that these values are fixed in that they do not change from year to year. (*#5 on the answer sheet.*)

HotSpot exercise

6. In question #3, you looked at a SST anomaly image for the Caribbean region, 01 November 2007. Compare that image to the HotSpot data for the same date and area. Look for areas that are unusually warm in the anomaly image—were they warm enough to be above the MMM? What areas did have HotSpots, and where were they the highest? Were any areas above the bleaching threshold?

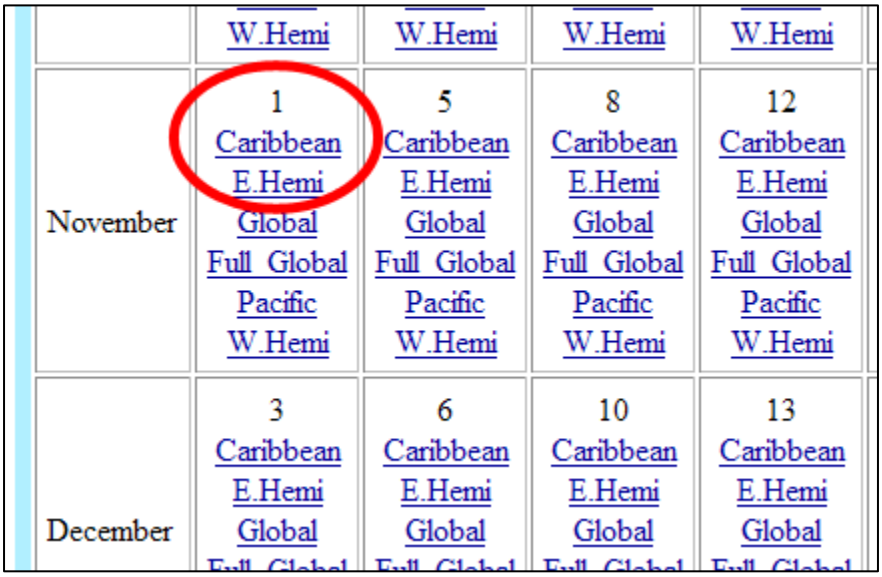
a. Go back to the home page, then find **SST Anomaly** in the left-hand navigation bar. Scroll down below the current year's data chart to find other years; choose **2007 Anomalies**. Right-click on the link for the November 1st Caribbean image, and open the image in a new browser window or tab.

b. Navigate back to the home page again. Click on **Bleaching HotSpots** in the left-hand navigation bar.



c. This takes you to the HotSpots page for the current year. Again, scroll down below the table of this year's data to find links to past years and click on **2007 HotSpots**.

d. The 2007 page has an image at the top, then a table of links to archived images. Find November 1st and click on the **Caribbean** link.



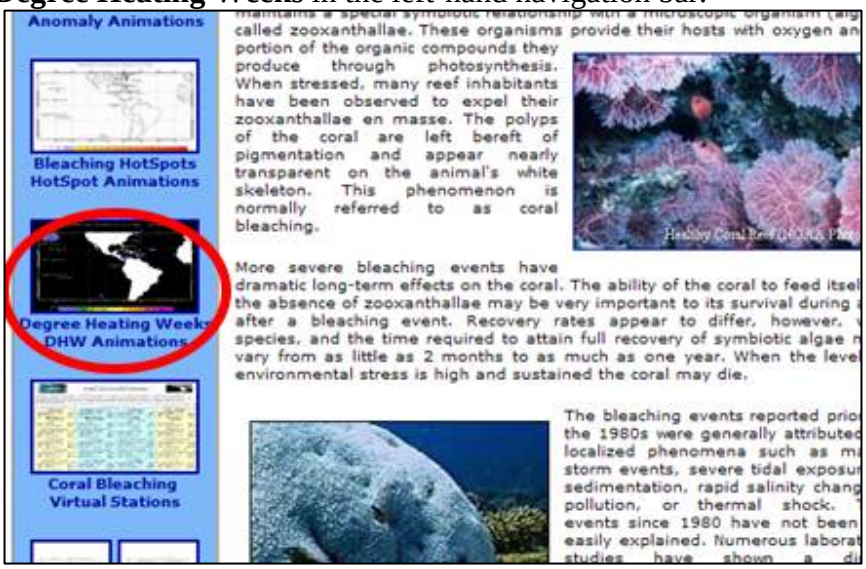
	W.Hemi	W.Hemi	W.Hemi	W.Hemi
November	1 Caribbean E.Hemi Global Full Global Pacific W.Hemi	5 Caribbean E.Hemi Global Full Global Pacific W.Hemi	8 Caribbean E.Hemi Global Full Global Pacific W.Hemi	12 Caribbean E.Hemi Global Full Global Pacific W.Hemi
December	3 Caribbean E.Hemi Global	6 Caribbean E.Hemi Global	10 Caribbean E.Hemi Global	13 Caribbean E.Hemi Global

e. Use this HotSpot image and the SST anomaly image from the same date to answer these questions: Look for areas that are unusually warm in the anomaly image—were they warm enough to be above the MMM? What areas did have HotSpots, and where were they the highest? Were any areas above the bleaching threshold? (*#6 on the answer sheet.*)

DHW exercises

7. Using the Pacific Ocean's Degree Heating Weeks image from 20 Sept, 2002, was there bleaching in Hawaii? Compare the stress in the main Hawaiian Islands vs. the Northwest Hawaiian Islands—what pattern of bleaching would you expect?

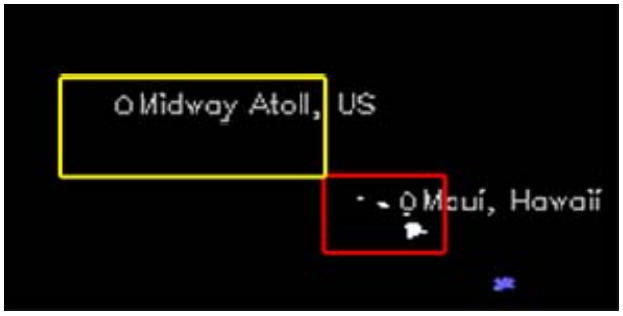
a. Use your browser's "Back" button to return to the CRW homepage. Now click on **Degree Heating Weeks** in the left-hand navigation bar.



b. Scroll down past the current image and the archive table of this year's data to find the links to past years. Click on **2002 Degree Heating Weeks**.

c. Find the cell for September 20th in the table of links. Click on **Pacific** to see the Pacific Ocean DHWs for that date.

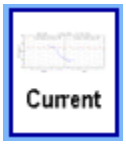
d. To locate Hawaii, look for the two Virtual Stations in this archipelago: Maui and Midway. In the image below, the red box shows the Main Hawaiian Islands and the yellow shows the Northwest Hawaiian Islands.



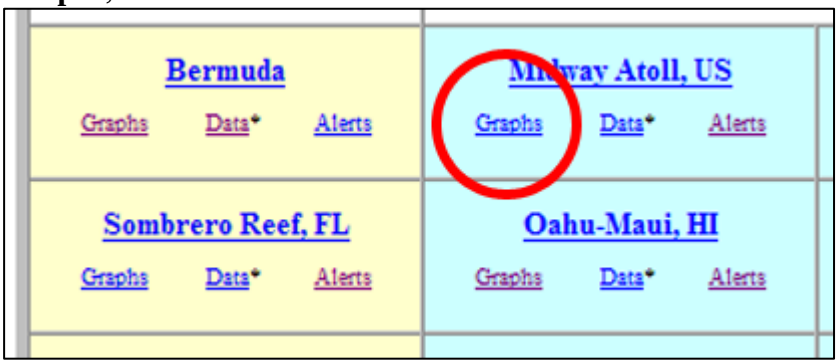
e. Now look at the DHWs in those areas for September 20th, 2002. Was there bleaching? Compare the Northwest Hawaiian Islands to the Main Hawaiian Islands. What pattern of bleaching severity would you expect? HINT: this page of the tutorial shows how DHWs relate to bleaching. (*#7 on the answer sheet.*)

8. Now we will look at this 2002 Northwest Hawaiian Islands thermal stress event in more detail by focusing on the Midway Atoll Virtual Station. When did thermal stress start and end? Over what time do you think significant bleaching occurred?

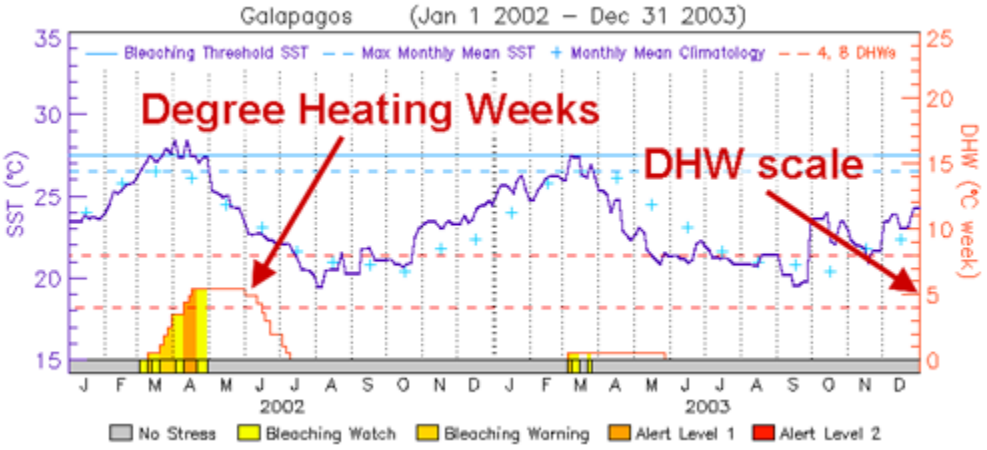
d. Return to the website's front page, and scroll down to find **Time Series at 24 Sites** in the left-hand navigation bar. Click on the **Current** icon.



e. On this page, you will see each of the operational Virtual Stations listed. Find the cell in the table that says **Midway Atoll, US**. Below the title will be a link that says **Graphs**; click on that link.



f. These graphs show the time series data at this station. SST and monthly means are shown at the top of the graph; Degree Heating Weeks are shown as a separate trace in the bottom section of each graph. Note that the DHW scale is on the right axis, as in this example from the Galapagos:



g. Use the 2002 Midway Atoll graph to answer these questions: When did thermal stress start and end—that is, when did DHWs begin to accumulate, and when did the SST drop below the bleaching threshold? Over what time do you think significant bleaching occurred? Hint: a text file of this data is available, if you want more precision in your answer. Go back one page to the Virtual Stations table, then click on **Data** under Midway Atoll. (*#8 on the answer sheet.*)

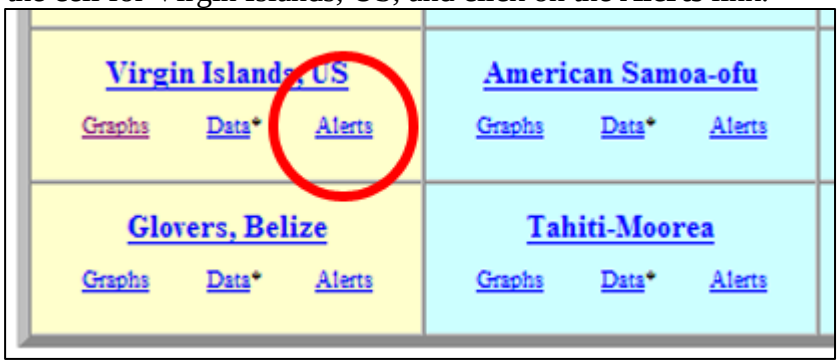
Satellite Bleaching Alert (SBA) exercise

9. What was the highest alert level for the Virtual Stations at the US Virgin Islands and Bermuda in 2005? Based on these alerts, was bleaching predicted at those two locations?

a. Return to the CRW homepage. Look for the SBA icon in the left-hand navigation bar, and click on **Alert Summaries** below the image.

b. You will notice that this page looks very familiar—it's the same Virtual Station page that allows access to time series graphs and data. The third dataset for each station is a listing of past Satellite Bleaching Alerts.

c. Find the cell for Virgin Islands, US, and click on the **Alerts** link.



d. Look through the alerts that were issued during 2005. What was the highest alert level? Would bleaching have been predicted at this station?

e. Go back one page to the Virtual Station table. Find the cell for Bermuda, and click on the **Alerts** link. Look through the 2005 alerts; what was the highest alert level? Would bleaching have been predicted at this station? (*#9 on the answer sheet.*)