

ERDDAP – Behold the Beauty

One of our major goals is to use drifters to better understand oceanographic processes and the relationships between them. In order to do this we need to display oceanographic data and visualize the oceanographic conditions that occurred at the same time our drifters were floating on the water. We need easily accessible data at a variety of scales and a variety of times. But where do we find this data? ERDDAP answers the need.

So what is ERDDAP? A screen shot from its home page explains it best:

ERDDAP

ERDDAP (the Environmental Research Division's Data Access Program) is a data server that gives you a simple, consistent way to download subsets of scientific datasets in common file formats and make graphs and maps. This particular ERDDAP installation has oceanographic data (for example, data from satellites and buoys).

Easier Access to Scientific Data

Our focus is on making it easier for you to get scientific data.

Different scientific communities have developed different types of data servers, for example, OPeNDAP, WCS, SOS, OBIS, and web pages. Each is great on its own. But without ERDDAP, it is difficult to get data from different types of servers:

- Different data servers make you format your data request in different ways.
- Different data servers return data in different formats, usually not the common file format that you want.
- Different datasets use different formats for time data, so the results are hard to compare.

ERDDAP unifies the different types of data servers so you have a consistent way to get the data you want, in the format you want.

Start Using ERDDAP: Search for Datasets of Interest

- [View a List of All 385 Datasets](#)
- **Do a Full Text Search for Datasets**

- **Search for Datasets by Category**

Datasets can be categorized in different ways by the values of various metadata attributes. Click on an attribute ([cdm_data_type](#), [institution](#), [loos_category](#), [long_name](#), [standard_name](#)) to see a list of categories (values) for that attribute. Then, you can click on a category to see a list of relevant datasets.

- **Search for Datasets with [Advanced](#)**

Source: <http://coastwatch.pfeg.noaa.gov/erddap/index.html>

Bottom line: ERDDAP makes a whole bunch of data really easy to download and manipulate. It's a beautiful thing to behold. You'll see.

We are grateful for our collaboration with Bob Simons, Lynn Dewitt, Cara Wilson, and Dave Foley at the National Marine Fisheries Service (NMFS) Southwest Fisheries Science Center (SWFSC) Environmental Research Division (ERD). Now you should be able to interpret some of the many acronyms featured on this web site. All of these folks have been instrumental in teaching us how to access and manipulate this data.

This section is the pièce de résistance of the data/Google-Earth part of the workshop. We'll cover how to download spatial data and corresponding legends in transparent PNG image files, and then upload them into Google Earth in one combined kml file. In following sections we'll cover the glue that holds it all together: animations, as well as Curl, a very simple command-line program that will enable the downloading of multiple PNG files that will power the animations. Let's get started!

Downloading Data from the ERDDAP Portal

Go to the [ERDDAP home page](#). Immediately add it to your browser's favorites. You'll be back again.

In the search box, enter "SST", and press "Search".

Check out the page that comes up. Overwhelmed yet? Good.

Scroll down and look for the data set that says "Global 1-km Sea Surface Temperature (G1SST)". It's about ¾ of the way down.

Click on the word "graph"... and there's your data. If you ever want to do a study on well-designed websites, this is my candidate for a great example.

Your task for the next few minutes is to play with the buttons and sliders to manipulate what data is shown and what it looks like.

- Do click on the map to specify a new center point.
- Do zoom in using both the In2X/In8X buttons and the bounding latitude/longitude boxes to show a region you're interested in.
- Do remember to press the "Redraw the Graph" after you've made a change.
- Do play with the settings for the Graph settings, such as the color bar and the minimum and maximum for zoomed in views; note that blank boxes bring up the default.
- Do try to find the data for yesterday, last week, and the earliest date available.
- Do become an expert at manipulating what the map looks like.

ERDDAP
 Easier access to scientific data
 Brought to you by

ERDDAP > [griddap](#) > Make a Graph

Dataset Title: **Global 1-km Sea Surface Temperature (G1SST)** [RSS](#)

Institution: NASA JPL (Dataset ID: jplG1SST)

Information: [Summary](#) | [License](#) | [Metadata](#) | [Background](#) | [Data Access Form](#)

Graph Type: surface

X Axis: longitude

Y Axis: latitude

Color: SST

Dimension Ranges

time (UTC) specify just 1 value → 2011-07-07T12:00:00Z

latitude (degrees_north) -79.995 79.995

longitude (degrees_east) -179.995 179.995

Graph Settings

Color Bar: Continuity: Scale:

Min: Max: N Sections:

Draw the land mask:

Redraw the Graph (Please be patient. It may take a while to get the data.)

Optional:

Then set the File Type: .htmlTable and [Download the Data or an Image](#)

or view the URL: <http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.htmlTable>

[\(Documentation / Bypass this form\)](#) [\(File Type information\)](#)

Click on the map to specify a new center point.

Zoom: Data Out 8x Out 2x Out In In 2x In 8x

-135° -90° -45° 0° 45° 90° 135°

45° 0° -45°

0 4 8 12 16 20 24 28 32

Sea Surface Temperature (degree C)
 Global 1-km Sea Surface Temperature (G1SST)
 (2011-07-07T12:00:00Z)
 Data courtesy of NASA JPL

Downloading ERDDAP Data in PNG Format

And now comes one of the most beautiful aspects of the ERDDAP website. In order to view this data on Google Earth, we need it in a graphic image format. The PNG format is useful because areas without data, like continents, can be transparent so that the continents will show through as they usually do on Google Earth.

Use the controls on the ERDDAP SST website to produce a map of SSTs for a region that interests you. Try to make the latitudes and longitudes relatively rounded numbers. Be sure that the colors representing the min and max temperatures in the legend roughly match the min and max temperatures shown in the map.

Take note of the bounding latitudes and longitudes. Write them down.

Set the File Type to ".transparentPng", and then press the "Download the Data or an Image" button.

Graph Settings

Color Bar: Continuity: Scale:

Min: Max: N Sections:

Draw the land mask:

(Please be patient. It may take a while to get the data.)

Optional:

Then set the File Type: and

or view the URL: <http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transpa>

([Documentation / Bypass this form](#)) ([File Type information](#))

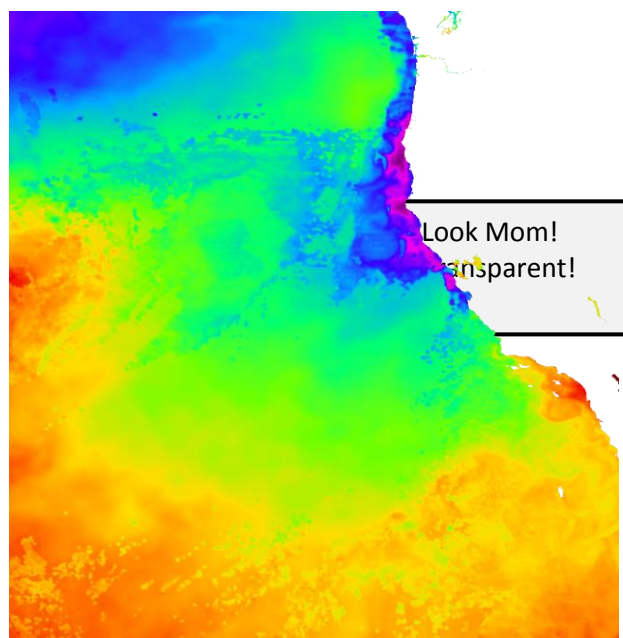
This may take a minute. Patience is good.

An example of a downloaded PNG file is shown in at right. Note that it is transparent (not opaque white).

In your browser, you could save this image to your hard drive, or to an Internet server, by right clicking it, choosing "Save Picture As..." and saving it to a folder that you will remember.

Note the utility of this format. The boundaries of the image are exactly what you specified in the ERDDAP form (or very, very, close to it). Thinking about Google Earth, you should be thinking about how we could easily write KML code to insert this image as an image overlay. Why will it be so easy?

You may notice that your PNG file might be quite large; the one at right was. We'll learn how to fix this in a few steps.



More Reasons ERDDAP is So Damn Cool

Look at the URL for this PNG image. It's long, but incredibly useful, and worth looking into. Here it is in all its glory:

[http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST\[\(2011-07-07T12:00:00Z\)\]\[\(23.005\):\(48.005\)\]\[\(-139.995\):\(-115.995\)\]&.draw=surface&.vars=longitude|latitude|SST&.colorBar=||7|25|](http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST[(2011-07-07T12:00:00Z)][(23.005):(48.005)][(-139.995):(-115.995)]&.draw=surface&.vars=longitude|latitude|SST&.colorBar=||7|25|)

Please note that this is all one line—there are no spaces. (Because the URL was altered slightly for formatting reasons, it won't work if you click on it.)

Why is this so cool? Because all the information about the data type, boundaries, color scale, etc is embedded in the URL. This is incredibly handy because it makes it very easy to write simple scripts or batch files to download a whole bunch of these files at once and save them to your hard disk or server. You don't have to memorize the format; you can always just download one image and then copy the URL to your batch file, script or whatever you're using, and then just alter it for each image you want.

Let's take a closer look at each segment of the URL.

URL Segment	Description
http://coastwatch.pfeg.noaa.gov/erddap/griddap/	The server information.
/jplG1SST.transparentPng?SST	The data set ID, and the data set parameter
[(2011-07-07T 12:00:00Z)]	The date and time of the desired data
[(23.005):(48.005)][(-139.995):(-115.995)]	The bounding latitude and longitude, respectively
&.draw=surface&.vars=longitude latitude SST	Commands to draw a map, with the variables
&.colorBar= 7 25 	The min and max values for the color scale
Additional Useful Segments &.size=width height	To be added at the end of the URL "width" and "height" describe the size of the image in pixels

For Google Earth, I find that PNG images on the order of just a few hundred pixels wide or high work well. Experiment with your images to find the smallest number of pixels that will still deliver the degree of resolution you require. Example: the following URL will deliver the same PNG image as the URL above, but the image will be *a lot* smaller and easier load into Google Earth and other applications:

[http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST\[\(2011-07-07T12:00:00Z\)\]\[\(23.005\):\(48.005\)\]\[\(-139.995\):\(-115.995\)\]&.draw=surface&.vars=longitude|latitude|SST&.colorBar=||7|25|&.size=300|300](http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST[(2011-07-07T12:00:00Z)][(23.005):(48.005)][(-139.995):(-115.995)]&.draw=surface&.vars=longitude|latitude|SST&.colorBar=||7|25|&.size=300|300)

In the manner shown above, try adding the `&.size=width|height` to the end of the URL that fetches your PNG image. Once downloaded, right click on it and choose properties to see the size of the image.

More info: <http://coastwatch.pfeg.noaa.gov/erddap/griddap/documentation.html#GraphicsCommands>

Displaying the PNG in Google Earth

In this section we'll combine our newly acquired skills of downloading transparent PNG files from the ERDDAP website and writing KML scripts that describe image overlays in Google Earth. Key numbers and phrases are color coded throughout this page so that you can follow the flow of information from ERDDAP to KML and Google Earth.

1. Download an SST PNG file from the ERDDAP website and save it to your hard disk.

Give the file a name that is descriptive of the region and the date (+/- time) that the data depicts.

Here's the ERDDAP file name from the previous page:

[http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST\[\(2011-07-07T12:00:00Z\)\]\[\(23.005\):\(48.005\)\]\[\(-139.995\):\(-115.995\)\]&.draw=surface&.vars=longitude|latitude|SST&.colorBar=||7|25|&.size=300|300](http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST[(2011-07-07T12:00:00Z)][(23.005):(48.005)][(-139.995):(-115.995)]&.draw=surface&.vars=longitude|latitude|SST&.colorBar=||7|25|&.size=300|300)

The local hard disk name for this file will be "**EastPacSST-2011-07-07.png**"; note its descriptive nature including the date.

Remember the bounding latitudes and longitudes for the data—you can read them right from the ERDDAP URL:

South: 23.005 (or 23) (this much rounding is fine for the scale of these images)

North: 48.005 (or 48)

West: -139.995 (or -140)

East: -115.995 (or -116)

2. Recall the KML format for image overlays, and that "ground" and "image" overlays are synonymous. Open Notepad++ and open the file you saved called "ImageOverlaySimple.kml".

Or

Go to http://code.google.com/apis/kml/documentation/kml_tut.html and scroll down to the "Ground Overlay" section. Copy the kml example in green font and paste it into Notepad++.

In Notepad++, edit the KML file so that it references the PNG file you downloaded from ERDDAP and the latitudes and longitudes of the boundaries of your map. For our example, the KML would look like this:

(first few lines deleted for clarity)

```
<GroundOverlay>
  <name>SST Data</name>
  <Icon>
    <href>C:\Fred\MATE2011\EastPacSST-2011-07-07.png </href>
  </Icon>
  <LatLonBox>
    <north>48.005 </north>
    <south>23.005 </south>
    <east>-115.995 </east>
    <west>-139.995 </west>
  </LatLonBox>
</GroundOverlay>
```

(last few lines deleted for clarity)

Note that the value in the <name> element was changed to "SST Data".

Save this KML file as "EastPacSST.kml" and then open it in Google Earth.

You should like what you see.

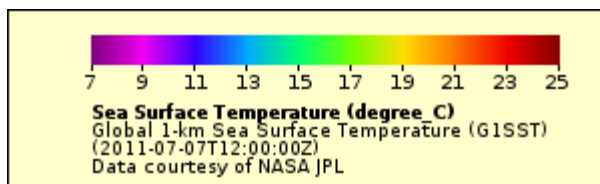
Legends – More Reasons that ERDDAP Rocks

Legends are easy with ERDDAP. Just append a “.&legend=Only” to any URL. ERDDAP will only produce the legend.

Here’s an example:

[http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST\[\(2011-07-07T12:00:00Z\)\]\[\(23.005\):\(48.005\)\]\[\(-139.995\):\(-115.995\)\]&.draw=surface&.vars=longitude|latitude|SST&.colorBar=||7|25|&.size=300|300&.legend=Only](http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST[(2011-07-07T12:00:00Z)][(23.005):(48.005)][(-139.995):(-115.995)]&.draw=surface&.vars=longitude|latitude|SST&.colorBar=||7|25|&.size=300|300&.legend=Only)

Note the “.&legend=Only” at the end. Try entering this into your browser (deleting any spaces that have been added here in formatting). You should get a legend that looks like this:



Note that the min and max in the “&.colorBar=||7|25|” graphic command were used to construct the legend. Like all graphic commands in the ERDDAP system, this one is case sensitive.

In the browser, right-click the image and choose “Save Picture As...” Save the file as “**SSTlegend.png**” to your hard disk in the same folder as your **EastPacSST-2011-07-07.png** file. (Note that this URL may return a .bmp image file rather than a .png file. Paint will convert .bmp files to .png files. Google Earth reads both .png files and .bmp files.)

Placing the Legend in Google Earth

Remember the techniques we used for screen overlays. Open your KML file called “ScreenOverlay.kml” in Notepad++.

Edit this KML file to accept your recently downloaded legend. Example KML code would look like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
  <ScreenOverlay>
    <name>SST Legend</name>
    <Icon>
      <href> C:\Fred\MATE2011\SSTlegend.png </href>
    </Icon>
    <overlayXY x="0" y="1" xunits="fraction" yunits="fraction"/>
    <screenXY x="0" y="1" xunits="fraction" yunits="fraction"/>
    <rotationXY x="0" y="0" xunits="fraction" yunits="fraction"/>
    <size x="0" y="0" xunits="fraction" yunits="fraction"/>
  </ScreenOverlay>
</kml>
```

Note that the values for only two elements were changed: <name> and <href>.

Save this file as “SSTlegend.kml”.

Combining the Data and Legend into One kml File

You'll probably want to include the legend every time you insert some SST data into Google Earth. It makes sense to write just one KML script to do this.

Open your most recent image overlay and screen overlay kml files into Notepad++; these should be "EastPacSST.kml" and "SSTlegend.kml".

In SSTlegend.kml, copy the entire <ScreenOverlay> element, everything from "<ScreenOverlay>" to "</ScreenOverlay>". Paste this section into EastPacSST.kml. Paste it anywhere within the <kml> element, but outside the <GroundOverlay> element. A good place is right after </GroundOverlay>.

Enclose both the <GroundOverlay> and <ScreenOverlay> elements in a <Document> element. Add a descriptive <name> to the <Document> element. Why KML requires the <Document> element is still vague to me. It should look like this:

```
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns=http://www.opengis.net/kml/2.2 xmlns:gx="http://www.google.com/kml/ext/2.2"
xmlns:kml="http://www.opengis.net/kml/2.2" xmlns:atom="http://www.w3.org/2005/Atom">

<Document>
  <name>EastPac SST Data and Legend</name>

  <GroundOverlay>
    <name>SST Data</name>
    <Icon>
      <href>C:/Fred/MATE2011/ EastPacSST-2011-07-07.png </href>
    </Icon>
    <LatLonBox>
      <north>48.005 </north>
      <south>23.005 </south>
      <east>-115.995 </east>
      <west>-139.995 </west>
    </LatLonBox>
  </GroundOverlay>

  <ScreenOverlay>
    <name>SST Legend</name>
    <Icon>
      <href> C:\Fred\MATE2011\SSTlegend.png </href>
    </Icon>
    <overlayXY x="0" y="1" xunits="fraction" yunits="fraction"/>
    <screenXY x="0" y="1" xunits="fraction" yunits="fraction"/>
    <rotationXY x="0" y="0" xunits="fraction" yunits="fraction"/>
    <size x="0" y="0" xunits="fraction" yunits="fraction"/>
  </ScreenOverlay>

</Document>
</kml>
```

New <Document> and child <name> elements; note that <GroundOverlay> and <ScreenOverlay> also have child <name> elements

The <GroundOverlay> element copied exactly from EastPacSST.kml

The <ScreenOverlay> element copied exactly from SSTlegend.kml

Save this file as "EastPacSST-DataLegend.kml" and open in Google Earth. Nice.

Resources/Documentation

On the ERDDAP web pages, immediately below the “Download the Data or an Image” button, is a link for further documentation on using this system (which is called grddap, by the way) to request gridded data sets such as SSTs.

Graph Settings

Color Bar: Min: Max: Continuity: Scale: N Sections:

Draw the land mask: ☐

Redraw the Graph (Please be patient. It may take a while to get the data.)

Optional:

Then set the File Type: and **Download the Data or an Image**

or view the URL: [http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST\[...\]\(Documentation / Bypass this form\) File Type information](http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST[...](Documentation / Bypass this form) File Type information)

URL: <http://coastwatch.pfeg.noaa.gov/erddap/griddap/documentation.html>

This documentation site explains all aspects of using URLs to query the various data sets on ERDDAP and download them in useful formats such as graphic images or arrays for use in programs such as MatLab. We have covered just a few of the many options available in this powerful tool. Check it out.

Preparation for the Next Section / Using What You’ve Learned

In preparation for the next section, please download at least three different PNG files for the same region that represent successive dates, like July 5, 6, and 7th. Save these files to your hard disk using names that incorporate the date.

Some beginning ideas:

- In the EastPacSST-DataLegend.kml file, change the <name> value in the <Document>, <GroundOverlay>, and <ScreenOverlay> elements, making sure that you see how these changes appear when the file is opened in Google Earth.
- Experiment with the &.size command by using different values after the “=” sign for the same data. Save each into a different file and then load them into Google Earth. What is the smallest file you can use that still gives reasonable resolution?

Some intermediate ideas:

Go explore the ERDDAP site and find a different data set that interests you and will download in transparent PNGs. There are 385 of them! Create a KML file with a legend that displays your new data and then show it to the rest of us.

Some advanced ideas:

Refer to the documentation page referenced at the top of this page and add different commands (the “&.___=__” part of the URL) to the query. These will make the resulting PNG image look different. See what you can come up with and show it to the rest of us.

Some ERDDAP Data Sets We've Found Useful

There are lots of data sets. We've only investigated a fraction of them, and we're far from experts on the vagaries of their idiosyncrasies, but here are some notes on what we've found. We encourage you to investigate the utility of all the various data sets for your specific project. This eclectic list is only intended to get you started.

Sea Surface Temperature—Global 1-km Sea Surface Temperature (G1SST)

This is the data set described here. It has consistent coverage through a long time frame, has 1-km resolution, and is blended from many different primary data sets. Since it is a blended product, and because of the way that the data is combined and calculated, it doesn't have any regions of no data because of cloud cover. This is good because it makes nice pretty images, but can be bad because the data in these interpolated regions might not be very good. There are many other SST data sets, including SST anomalies.

Sea Surface Height—Sea Surface Height, Aviso, Global, Science Quality (1 Day Composite)

The Aviso products are definitely the ones to use. Unfortunately, the data stops in April 2010 and there are no signals that it will come back soon.

Sea Surface Height—NCOM Global Ocean Model Best Time

This one is on a different server. This data starts in April 2011, but is of limited utility for our purposes because the tides have not been removed from this data set. I thought it might be interesting to show tidal motion, but the frequency of the data set is every 3 hours, which is not frequent enough to adequately show the tides. This data is on an alternative server.

http://ec2-50-17-167-2.compute-1.amazonaws.com/erddap/griddap/hawaii_2836_28f2_b1b1.graph

Note: change the min and max to -1.0 and +1.0 to see the variation in this data set.

Sea Surface Height—HYCOM GOMI0.04

This data looks really good if you're interested in the Gulf of Mexico, because that's the extent of the data. This data has a frequency of 24 hours and appears to be partially a prediction rather than a measurement. This data is currently on an alternative server.

<http://ec2-50-17-167-2.compute-1.amazonaws.com/erddap/search/index.html?searchFor=hycom+gom+%5bttime%5d%5blat>

HF Radar Surface Currents (search on HF) on the regular ERDDAP website

There are a lot of these data sets, and they can be spotty. I've had good luck with the Monterey Bay and San Francisco Bay data sets. The key is to change the "Graph Type" from "surface" to "vector". Lots of these are updated every hour. The SF Bay data set is especially good for seeing tidal flow.

Sea Level Atmospheric Pressure—FNMOC Sea Level Pressure, 360x180, 6-hourly

For this data set, it is useful, under "Graph Settings", to "Draw the land mask" "under the data". Data is present up to the last day of the previous month. The current month's data is elsewhere.

Winds—NDBC Standard Meteorological Buoy Data

We've been using the buoy data for winds. Instead of PNG files, tabular data can be downloaded which is manipulated into arrows of differing length and orientation to represent the winds at the buoys. The buoys are a great data set with many more variables than we have yet to explore. More info:

<http://www.ndbc.noaa.gov/>