

# Creating Time Animations in Google Earth

It's time to string several SST PNG images together to make a time animation. The drifter tracks can then be played on top of the SST PNG files to show drifter motion and changes in the SSTs at the same time.

The basic idea is to string together several <GroundOverlay> elements in a single KML file. The key is that the period of time for which each particular PNG image is visible is defined using the <TimeSpan> element within the <GroundOverlay> element where the PNG image resides.

## Basic Definitions and Conventions

This <TimeSpan> element has the following format:

```
<TimeSpan>
  <begin>datetime</begin>
  <end>datetime</end>
</TimeSpan>
```

The *datetime* value within the <begin> and <end> elements specifies the date +/- time in UTC (Coordinated Universal Time, the same as GMT). As nicely explained on pages 195-200 of "The KML Handbook", *datetime* has the following format:

yyyy-mm-ddThh:mm:ss

Where:

- yyyy is a four-digit value that specifies the year (like 2011).
- mm is a two-digit value that specifies the month between 01 and 12 (like 08 for August).
- dd is a two-digit value that specifies the day of the month between 01 and 31 (like 03 for the third day of the month).
- T is the separator between the date and the time.
- hh is a two-digit value for hours between 00 and 24.
- mm is a two-digit value for minutes between 00 and 60.
- ss is a two-digit value for seconds between 00 and 60.

Additional digits can be added to describe a local time. See "The KML Handbook" for more details. In our application we will use UTC exclusively. You may notice that, conveniently, the convention is the same as that used in the ERDDAP URLs.

In the format used here, the <begin> date will be the date of the SST data, as given in the ERDDAP URL. The <end> date will be the next day, or the date of the following SST PNG file.

## Writing the KML

In Notepad++, open the last KML file you made, which was the combined GroundOverlay and ScreenOverlay file called “EastPacSST-DataLegend.kml”, which contains an SST PNG called “EastPacSST-2011-07-07.png”, or something similar.

To this KML file, please add at least two more <GroundOverlay> elements, each of which reference similar PNG files, but for successive days. You may have created these PNG files at the end of the last session (ERDDAP).

**Save this file as “EastPacSST-DataLegend-Animate.kml”.**

At this point, two of the three <GroundOverlay> elements should look something like this:

```
(...preceding KML code deleted for brevity..)
<Folder>
  <name>SST Data</name>
  <GroundOverlay>
    <name>SST Data</name>
    <Icon>
      <href>C:/Fred/MATE2011/EastPacSST-2011-07-05.png </href>
    </Icon>
    <LatLonBox>
      <north>48.005 </north>
      <south>23.005 </south>
      <east>-115.995 </east>
      <west>-139.995 </west>
    </LatLonBox>
  </GroundOverlay>

  <GroundOverlay>
    <name>SST Data</name>
    <Icon>
      <href>C:/Fred/MATE2011/EastPacSST-2011-07-06.png </href>
    </Icon>
    <LatLonBox>
      <north>48.005 </north>
      <south>23.005 </south>
      <east>-115.995 </east>
      <west>-139.995 </west>
    </LatLonBox>
  </GroundOverlay>
</Folder>
(...following KML code deleted for brevity...)
```

Continue to edit your KML file in Notepad++ by doing the following:

- Give each <GroundOverlay> a distinctive name, including the date, in its child <name> element.
- Enclose *all* of the <GroundOverlay> elements within a <Folder> element. Remember to include the </Folder> at the end.
- Give the <Folder> a distinctive name, including the term “SST Data”, in its child <name> element.

- Insert the <TimeSpan> element into each of the <GroundOverlay> elements.
  - The <TimeSpan> element should be inserted between the <name> and <Icon> elements.
  - To accomplish this, you'll probably want to do a lot of copy and paste.

The entire KML code should look something like the following:

```
<?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>

  <Folder>
    <name>SST Data</name>
    <GroundOverlay>
      <name>2011-07-05 Data</name>
      <TimeSpan>
        <begin>2011-07-05T00:00:00</begin>
        <end>2011-07-06T00:00:00</end>
      </TimeSpan>
      <Icon>
        <href>C:/Fred/MATE2011/EastPacSST-2011-07-05.png</href>
      </Icon>
      <LatLonBox>
        <north>48.005</north>
        <south>23.005</south>
        <east>-115.995</east>
        <west>-139.995</west>
      </LatLonBox>
    </GroundOverlay>
    <GroundOverlay>
      <name>2011-07-06 Data</name>
      <TimeSpan>
        <begin>2011-07-06T00:00:00</begin>
        <end>2011-07-07T00:00:00</end>
      </TimeSpan>
      <Icon>
        <href>C:/Fred/MATE2011/EastPacSST-2011-07-06.png</href>
      </Icon>
      <LatLonBox>
        <north>48.005</north>
        <south>23.005</south>
        <east>-115.995</east>
        <west>-139.995</west>
      </LatLonBox>
    </GroundOverlay>
  </Folder>
</Document>
```

(continued.....)

Note the <Folder> element

Note relationship between the values in <name>, <begin>, <end>, and the PNG file in <href>.

End of the first <GroundOverlay> and beginning of the second <GroundOverlay>.

Note the repetitive pattern.

(....continued from previous page)

```
<GroundOverlay>
  <name>2011-07-07 Data</name>
  <TimeSpan>
    <begin>2011-07-07T00:00:00</begin>
    <end>2011-07-08T00:00:00</end>
  </TimeSpan>
  <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>
```

Beginning of third  
<GroundOverlay>, same as  
the first two.

```
</Folder>
```

Note end of the <Folder>  
element, containing all of the  
<Groundoverlay> elements.

```
<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>
```

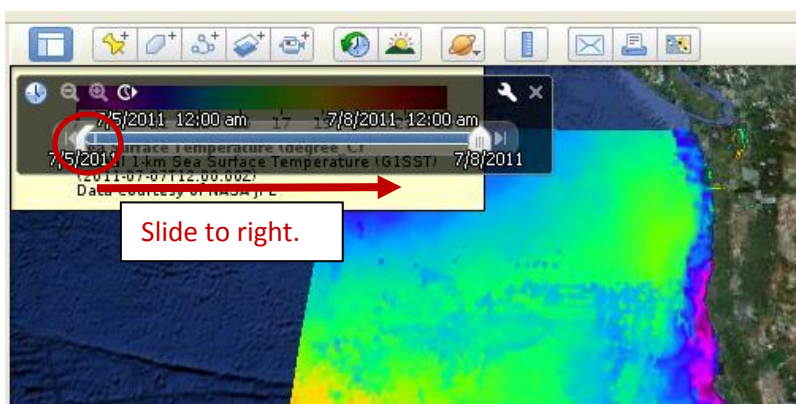
<ScreenOverlay> element,  
end of <Document>, and end  
of <kml>.

**Again save this file as “EastPacSST-DataLegend-Animate.kml”.**

**Open your KML file in Google Earth.**

Upon opening the KML file in Google Earth, a black box should appear in the upper left of the screen.

As we saw when we displayed the drifter tracks, slide the left-side button all the way to the right so that it touches the right-side button.



Click the little clock to start the animation. If it doesn't work, go back to your KML file and proof read your script.

As with the drifter tracks, click the little wrench to find controls that make the animation run in a loop, ensure the time is set to UTC, and control the speed of the animation.

**Using What You've Learned**

As usual, go back to the KML and play with the various values, changing only one or two at a time. Save the KML file to the same name. Go to the Places panel in Google Earth, right click on your KML file, and choose "Revert". After affirming that you really want to do it, you should see your changes take effect.

Some beginning ideas:

- Put new values in the various <name> elements, and or in the <begin> and <end> elements.
- Change the location of the legend <ScreenOverlay> so that it doesn't interfere with the slider.

Some intermediate ideas:

- Experiment again with the "&.size" command, trying to find the smallest files that give acceptable resolution for your purposes.
- Experiment with using the <TimeStamp> element instead of the <TimeSpan> element. It might work better. Tell us about the results.

Achieving the main goal:

- Go to the ComTech website and download the data for a previously deployed drifter that interests you. Create a KML file that shows the drifter motion by following instructions in a previous tutorial.
- Note the beginning and end dates.
- Go the ERDDAP website and download SST PNGs—using the smallest file size that still gives reasonable resolution—for the same time period that your chosen drifter is in the water.
- Make an SST KML file out of these SST PNGs.
- Open both the drifter KML and the SST KML in Google Earth at the same time.
- If it works, you have achieved one of the main goals of this workshop. WaHooo!

Pretty cool, eh?

It blows my mind more than those Grateful Dead concerts at the Shoreline Amphitheater ever did.

## Using Curl

As you’ve probably noticed, there is a lot of repetition here. One of the most repetitious tasks is downloading all of the PNG files by changing one number in the middle of the URL.

This section describes a somewhat easier way to automate the downloading of a series of PNG files and saving them to hard disk. It involves a simple command-line program called “cURL”. You will need to download Curl from the Internet and load it onto your computer. It comes as an executable .exe file, meaning that you don’t need administrator privileges to make it work.

Open a browser and Google for “Curl”. Isn’t it great how “Google” has become a verb?

Click on the first link that looks like it’s about a computer program that involves URLs, HTTP, and other Internet-type acronyms.

When you get to the home page, click on “Download”.



On the next page, choose “[curl Download Wizard](#)”.

Next page, under “Select Type of Package”, choose “curl executable”.

On the next few pages, make the following choices: Windows/Win32 > Generic > Unspecified

When you see “The Wizard Recommends...”, press “Download!”

On the next page, choose “Download WITHOUT SSL” (I have no idea what SSL is.)

You will be asked to save a zip folder. Save the zip folder to an area within your working files that you will remember—not in your program files.

Extract the file in the zipped folder—it is a single file called “curl.exe”.

Now here’s an important part.

Make a copy of the “curl.exe” file and paste the copy into the folder where you intend to save the PNG files that you download from ERDDAP.

The saved copy should be called “curl.exe” as well.

## One Single Curl Command

We will use a single Curl command to accomplish our task, but we will use it over and over again.

Here is our curl command:

```
curl -g "erddapUrl" -o fileDir/fileName.ext
```

where `-g` disables curl's globbing feature,

`erddapUrl` is any ERDDAP URL that requests a data or image file, and

`-o fileDir/fileName.ext` specifies the name for the file that will be created.

An example using the URLs and filenames from our examples would look like this (note this is all one line, not 3 lines):

```
curl -g "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" -o EastPacSST-2011-07-07.png
```

Thanks to Bob Simons at NOAA NMFS SWSC ERD ☺ for teaching us about Curl and writing a short tutorial which appears on the grddap documentation page (scroll down a ways):

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

## The Command Prompt – Ahh, the Memories!

Curl is a command line program. That means we have to go to the Command Prompt to use it. Remember DOS and command line programs? This is how all computer programs worked back around the time I was going to Grateful Dead concerts at the Shoreline Amphitheater. Well, command line programs never really died. They're alive and well, and used for many applications where it is quicker to type a command than it is to find and click through a multitude of windows. We can also write a batch file to enter many commands at once—very convenient and time saving.

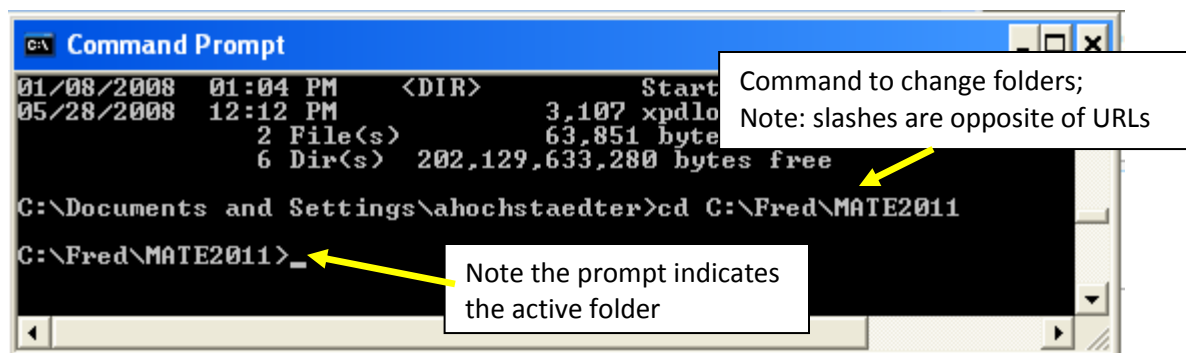
Open the Command Prompt. This is usually found under "Accessories" in the "All Programs" part of Window's Start menu.

Remember DOS? Good? We're about to use it.

Navigate to the folder where you want to put your downloaded PNG files.

Use the command "`cd path`", where *path* shows the location of your folder, or directory.

In creating this exercise, my working folder was "MATE2011", which was in a folder called "Fred", so the command I entered was "`cd C:\Fred\MATE2011`" (without the quotation marks).



## Using Batch files

We will use a batch file to enter the Curl command on the command line prompt. The reason is that because the ERDDAP URLs are so long, entering them by hand would be very tedious and prone to mistakes, which would frustrate all of us. All batch files have a .bat extension. It is important that you get this extension correct.

Open a text editor like Notepad++.

Write the Curl command you will use on the first line. You could copy it directly from the previous page of this handout.

- Remember there are no spaces in the ERDDAP URLs. If you find a space in your ERDDAP URL, fix it.
- Note: if you copy and paste from a word document (like this one) you may need to re-enter the dashes and quotation marks in the command line after pasting into Notepad++. Took me a while to figure that one out!

Save your new file as “downloadSST.bat” (without the quotation marks). In the Save Window, you may have to choose “All types (\*.\*)” in the “Save as type:” dropdown menu. Be sure to save your batch file in the same folder as your curl.exe program and where you want to save your PNG files.

Go back to the command prompt and enter “downloadSST” (without the .bat extension, and without the quotation marks). Press enter.

You should see something like the image below.

```

C:\Fred\MATE2011>downloadSST

C:\Fred\MATE2011>curl -g "http://coastwatch.pfeg.noaa.gov/erddap/griddap/jplG1SST.transparentPng?SST[<2011-07-07T12:00:00Z>]l<23.005>:<48.005>]l<-139.995>:<-115.995>l&.draw=surface&.vars=longitude!latitude!SST&.colorBar=!!!7!25!&.size=300!300!" -o EastPacSST-2011-07-07.png
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left     Speed
100 97466    0 97466    0     0    11995      0 --:--:--  0:00:08 --:--:-- 23452

C:\Fred\MATE2011>

```

Use Windows Explorer to confirm that a new PNG file, with the right name, has appeared in the folder you intended it to. Use the Details View and the Date Modified column to ensure that the file was indeed created moments ago.

Caution: there is no warning if a file name already exists and is about to be overwritten. File management skills are paramount in this portion of the project. Pay attention to your file names and where you’re putting them.

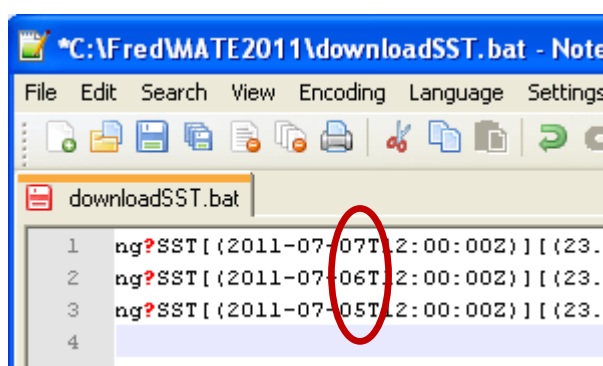
## Downloading More Than One PNG File at a Time

Remember, downloading multiple PNG files at a time was our original goal here.

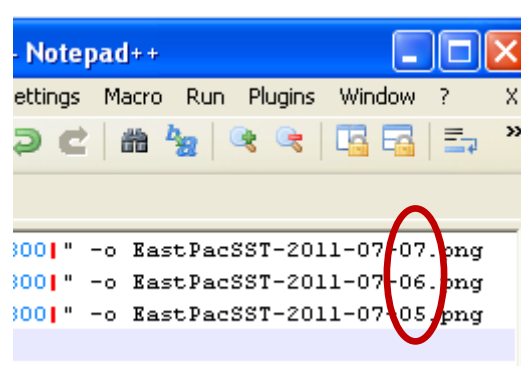
Go to your downloadSST.bat file opened in Notepad++.

- Copy the entire first line.
- Paste it into the second line and into the third line.
- Edit the second and third lines so different PNG images are downloaded from ERDDAP and so that they are saved to differently named files on your hard disk.
- See the example on the next page.

The images below show screen grabs of different parts of the downloadSST.bat batch file in the Notepad++ editor. The first line has been copied into the 2<sup>nd</sup> and 3<sup>rd</sup> lines. The 2<sup>nd</sup> and 3<sup>rd</sup> lines have been edited to so that they download different PNG images from ERDDAP and then to save them to different files.



Digits edited in the three URLs to download 3 different PNG images



Digits edited so that the PNG images would save to different files.

Now go back to the Command Prompt and enter your batch file in exactly the same manner as before.

You should soon see three more files downloaded into your folder.

## Other Techniques

There is more than one way of accessing the ERDDAP URLs.

Scripts in MatLab, Python, or any number of scripting languages can contain loops to access the ERDDAP server and download the images. Explaining the details of these scripts is beyond the scope of this workshop, but they can make these kinds of efforts much more efficient. The scripts can also generate the KML code that references the PNG images.

These and other suggestions are offered in the grddap documentation page:

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