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NOAA Ocean Satellite Data Course
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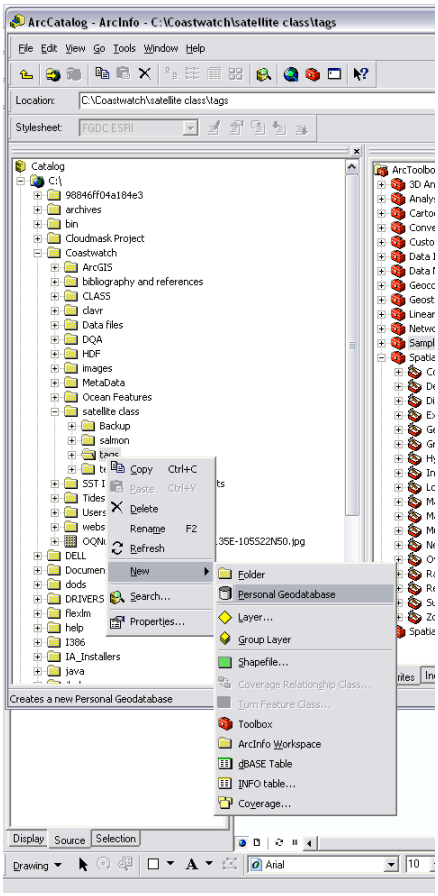
Oregon State University
Corvallis, Oregon

# Using Satellite Ocean Data in ArcGIS

1. First, create a working directory with write access. Copy the file "tracks.csv" to your working directory. This file contains data on a fictitious animal that has been tagged and is sending back data via satellite. Open ArcCatalog, and in your working directory, create a Personal Geodatabase. Whenever possible, use this personal geodatabase to save the raster layers and features for this project.



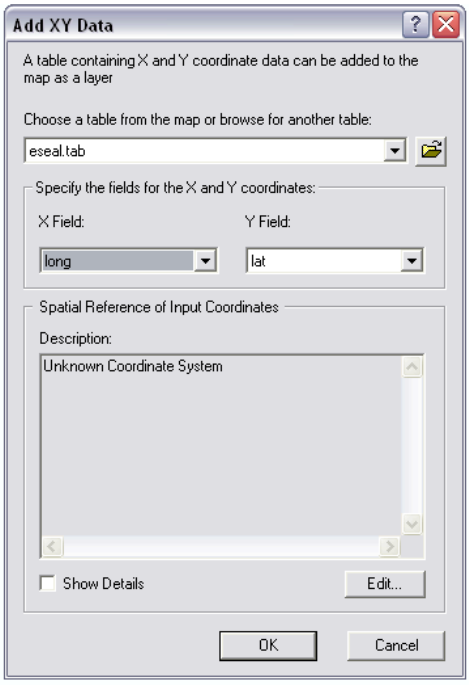

**-To Create a Personal Geodatabase**:
In ArcCatalog, in the file tree on the left hand side of the screen, right click on your working folder. Select "New – Personal Geodatabase".

2. Open ArcMap, and open a new, empty map. Add the file "tracks.csv" to your map. Then view the data you have added. Notice the different fields present in the table and their values. What is the date range of the animal track?

- **To Add Data to a Map:** In ArcMap, click on "File – Add Data". Navigate to your working folder and select the file that you want to add. Notice that the file is added under the "Layers" frame on the left hand side of the screen.

- **To View the Table You Just Added:** Right click on the name of the table on the left hand side of your screen. Click "Open". A box will appear showing the different rows and columns of data in the table.

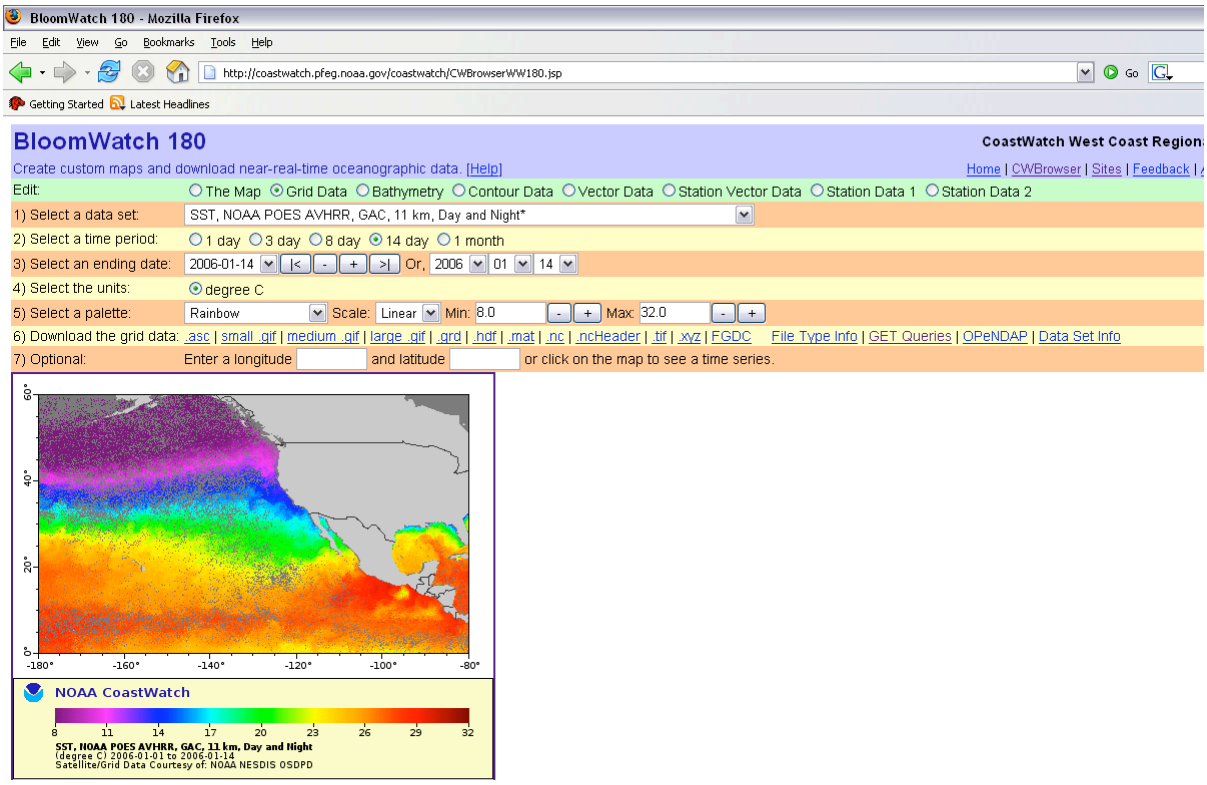
3. So far we have added the table of data to our map, but we haven't displayed the XY points. Add the XY data to the map using the "Add XY Data…" tool. You can now see the shape of the animal's track, but without a visual reference it is difficult to tell anything more about it. From the latitude and longitude points in the table, can you tell approximately where the animal is moving?



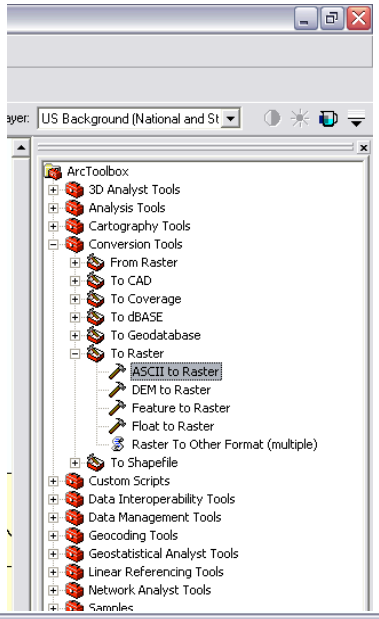

**- To Add XY Points to the Map:** Click on "Tools – Add XY Data…" Choose the "tracks.csv" file in the dropdown list. Select the "long" field as the X field and "lat" as the Y Field.

4. Now download some satellite sea surface temperature data that corresponds to the dates of the beginning of the animal track. Open an internet browser, and navigate to the CoastWatch 180 browser at http://coastwatch.pfel.noaa.gov/coastwatch/CWBrowserWW180.jsp . The CoastWatch Browsers were developed by Bob Simons of the CoastWatch West Coast Regional Node to distribute the many datasets that CoastWatch handles from one easy data browser. This browser distributes data for the entire world using longitude values from -180 to +180. This longitude format is preferred for importing data into Arc software. Other data browsers developed by CoastWatch include
the West Coast Browser at http://coastwatch.pfel.noaa.gov/coastwatch/CWBrowser.jsp,
the Alaska Browser at http://coastwatch.pfel.noaa.gov/coastwatch/CWBrowserAK.jsp, and
the CoastWatch 360 Browser at http://coastwatch.pfel.noaa.gov/coastwatch/CWBrowser360.jsp.

Once the Browser is open, click on "The Map" button on the top row to access the map editing screen. Select an area that is large enough to cover your animal track (you may have to go back to ArcMap and open the animal track data again to see what spatial extent you need). Click on the "Grid Data" button on the top row to select the dataset and time period to download. Select the "SST, NOAA POES AVHRR, GAC, 11km, Day and Night" dataset from the dataset dropdown list. This is the global area coverage dataset for sea surface temperature from the AVHRR sensor. Select the 14-day composite, and select Jan-14-2006 for the ending date. This 14-day composite will cover the first 14 days of the animal track (Jan. 1 to Jan. 14). Click on the ".asc" link to download the ASCII file. These file types were added specifically to load into ArcGIS software. Save the .asc file into your working folder.

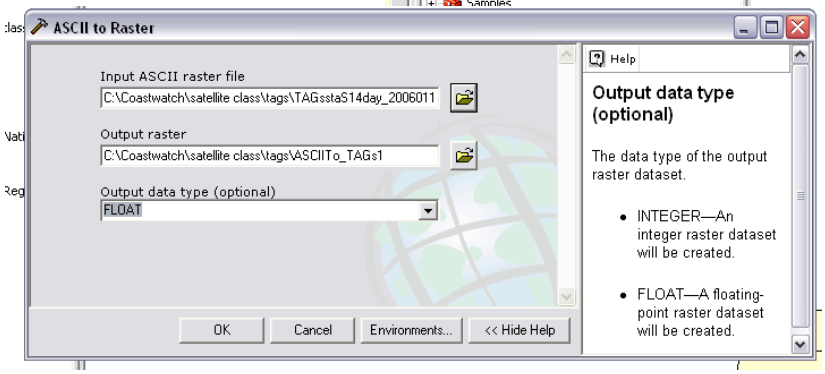


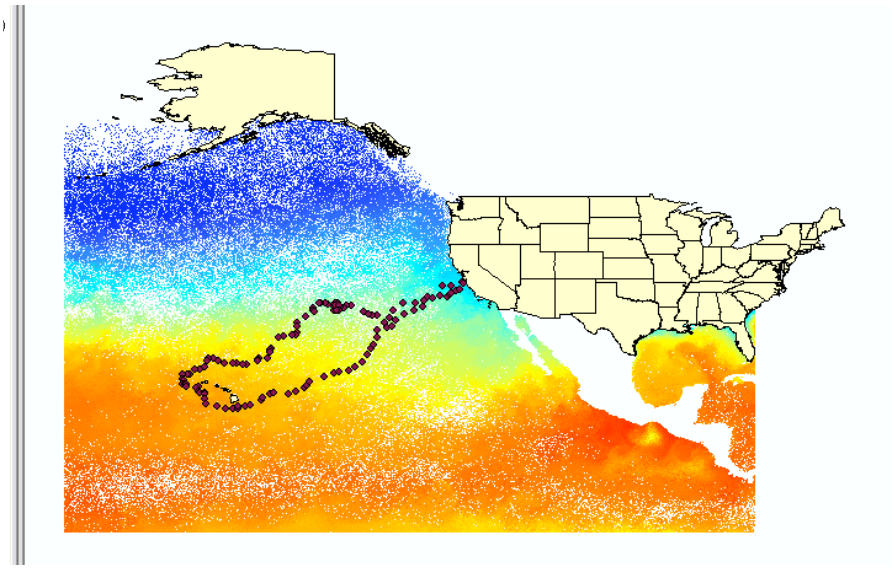

5. Run the "ASCII to Raster" tool to convert the .asc file you just downloaded into a ArcGIS raster file. Once you have converted the file, add the background layer "US Background.lyr" to ensure that the raster is properly geolocated.



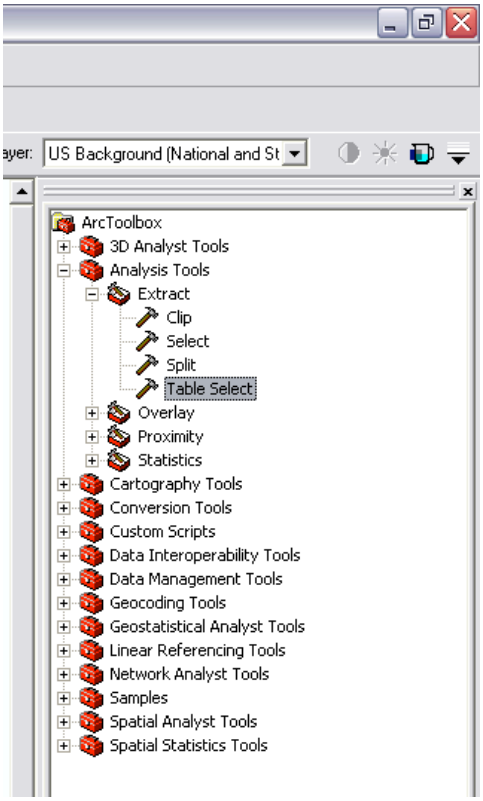

**-To Convert an ASCII file to a Raster:** Make sure the ArcToolbox is open. If it isn't, click on the Window Menu, and select "ArcToolbox". In the ArcToolbox, open "Conversion Tools – To Raster – ASCII to Raster". Select the .asc file you just downloaded as your input file. For the output raster, navigate to your Personal Geodatabase, and choose a name for your raster. Change the "Output data type" to FLOAT. Click OK to run the tool. To add the background layer, click on "File – Add Data". Select the "US Background.lyr" file to add.

Once the raster file has loaded into your screen, you can change the colorbar format by clicking on the raster's colormap on the left side of the screen. Zoom out to view the full extent of the SST data you just added.



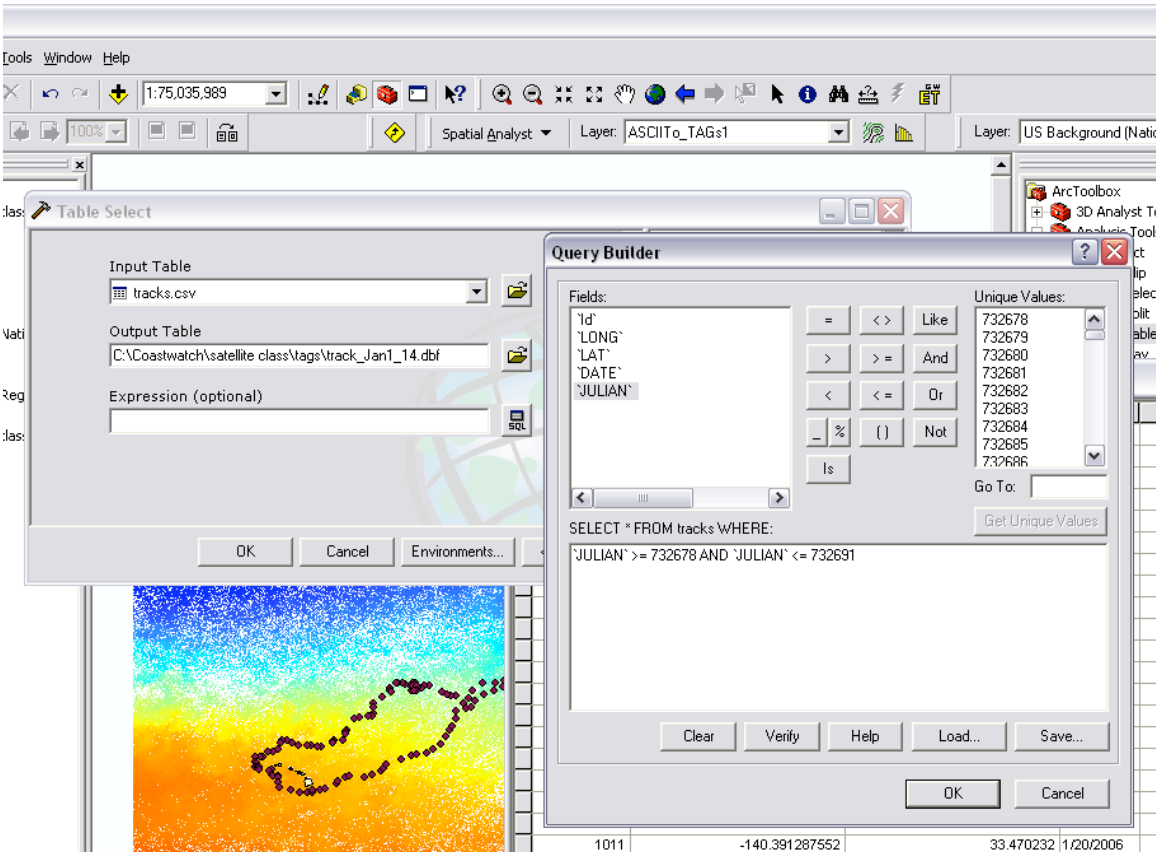


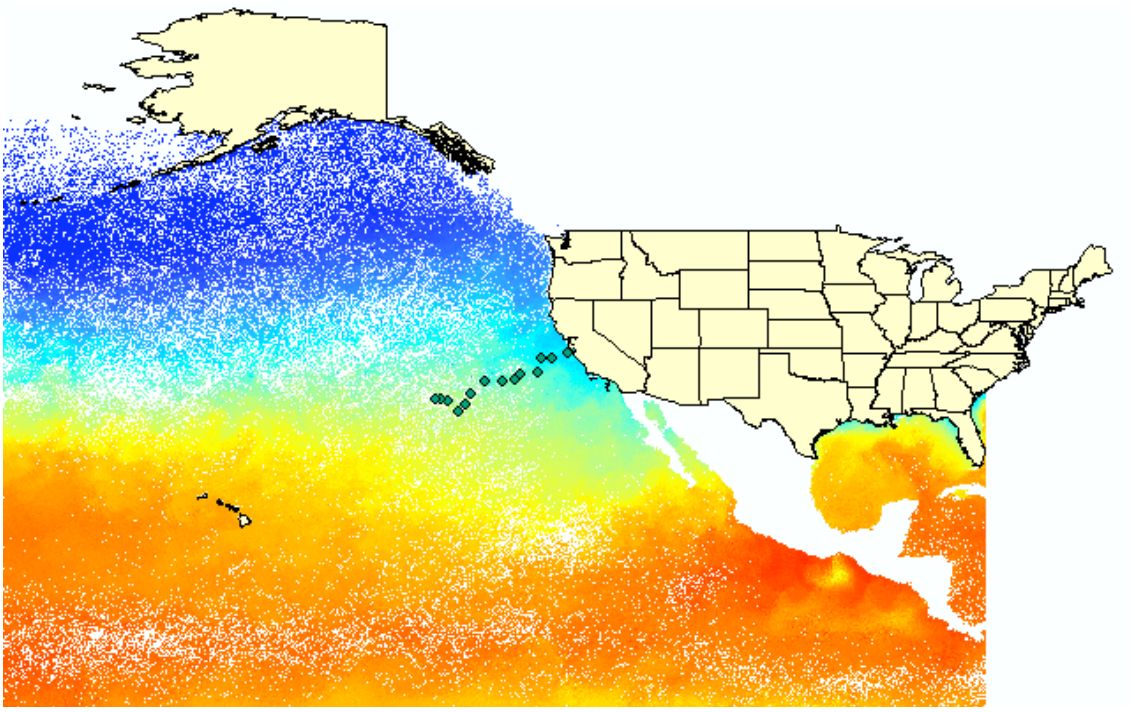
6. Remember that this SST data that we've loaded is a 14-day composite ending at Jan 14, 2006. The time period from our animal track extends beyond the time period of our SST data. Before we extract the data, view the data within the table once again, and write down the Julian dates that correspond to the dates of the SST composite. We will use these dates in our extraction. Now extract the track data that is within the time period of our SST data using the "Table Select" tool. Display the new track as XY points on the map.



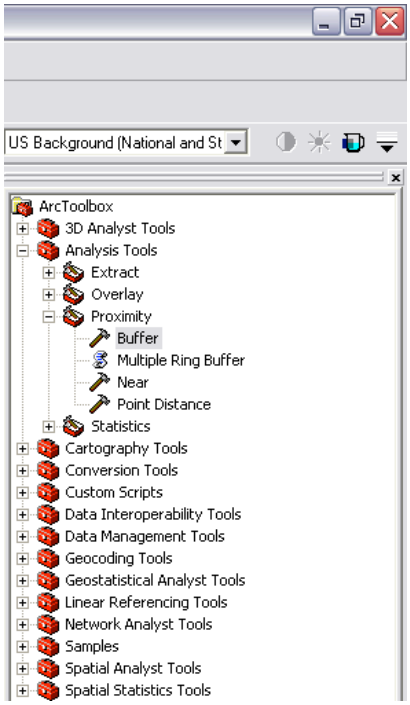

**-To Extract the Data from the Animal Track Table:**
Open the "Table Select" tool in the ArcToolbox by selecting "Analysis Tools – Extract – Table Select". Choose "tracks.csv" for your input table, and choose a name for your output table. Click on the "SQL" button next to the Expression line to define the expression that will extract the desired data from the "tracks.csv" table. Build an SQL Query that will extract the points from the table with dates between Jan. 1 and Jan. 14, 2006. It is easiest to use the "Julian" field in your query. And it also works best to use the mouse to build your query by selecting the fields, operators, and values. This way, Arc builds your query using the correct syntax. It can be picky otherwise. Use the "Get Unique Values" button to select values directly from the table you are querying. Click the "Verify" button to ensure your expression is valid, and then click OK to insert your expression into the "Table Select" tool. Run the tool.

Once the tool has finished, open the new table to be sure that it extracted the correct values. As before, you will have to "Add XY Data…" to view the data that you have extracted in your open map. You will probably not be able to distinguish between the data that you just extracted and displayed, and the original track data that was displayed. Click on the checkbox next to the original track data on the layer frame on the left side of the screen to temporarily disable that display. Now you can clearly see the track of your animal from Jan. 1 to Jan. 14, 2006.



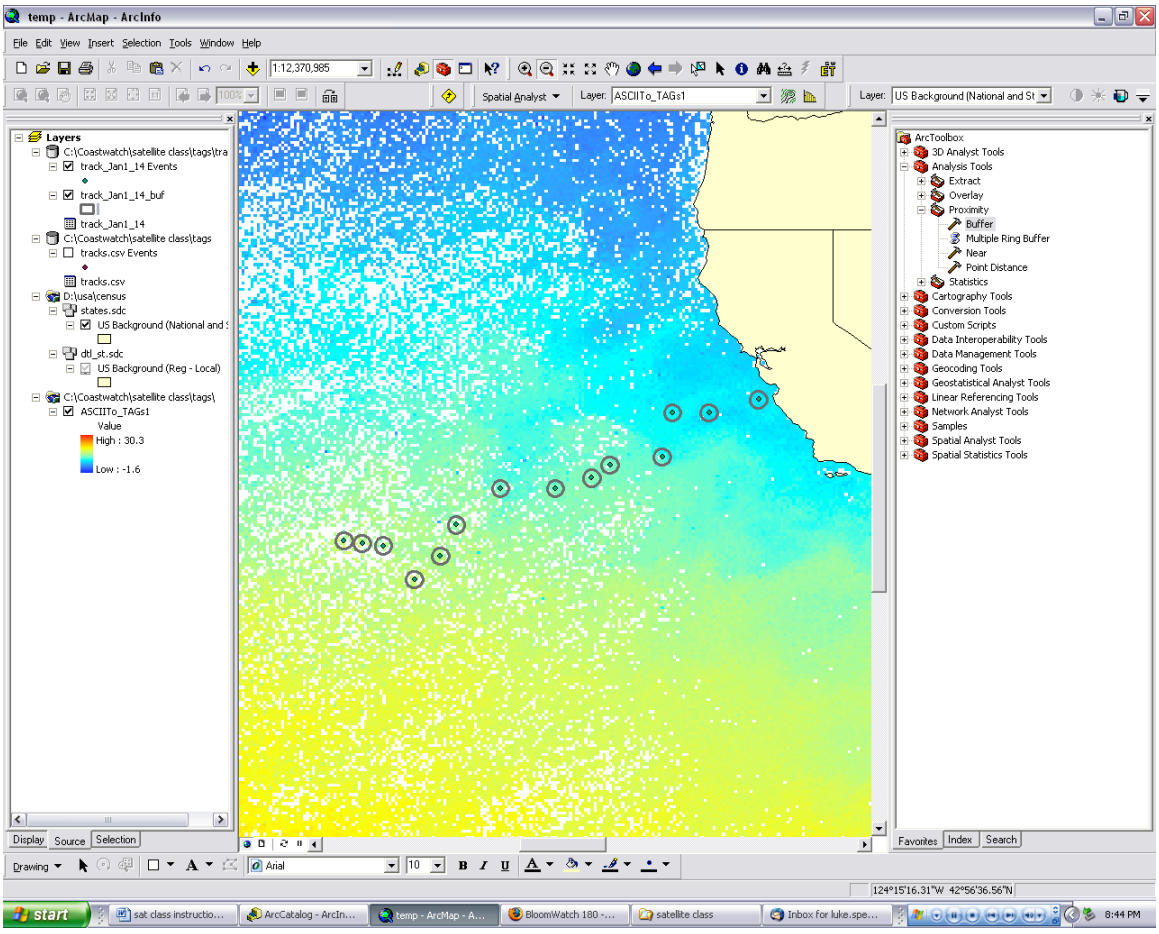



7. Now create a buffer zone around each point using the "Buffer" tool corresponding to the measurement error in the animal's position. You'll notice that the table of values for the animal track data has a field titled "error". This field shows the error (in decimal degrees) of the animal's position at that point. The errors range from 0.1° to 0.3°. Use the "Buffer" tool to create a buffer zone around each point that corresponds to the error for that position.



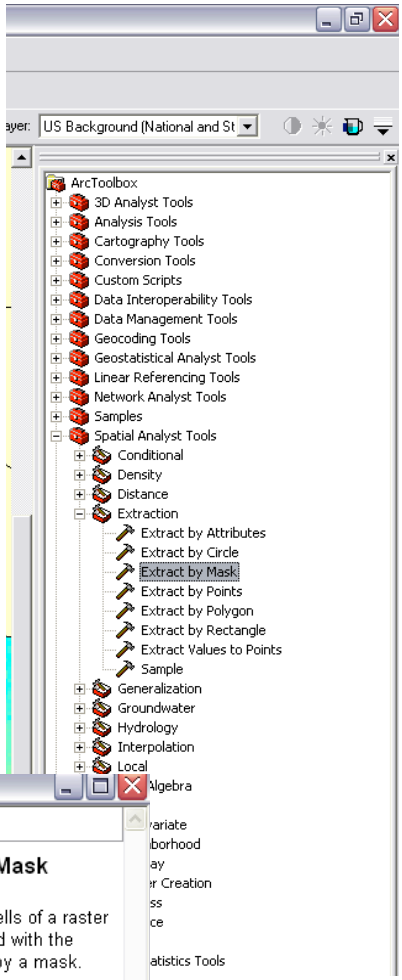

**-To Create a Buffer Around Each Point:** In the ArcToolbox, open "Analysis Tools – Proximity – Buffer". Choose the XY data that you just displayed on the map as the input, and choose a name for your output feature. For the buffer distance, choose the "field" option, and select the "error" field. The tool will look in the "error" field to find out how big to draw the buffer zone. Run the tool.

Once the buffer feature has been created, right click on the buffer feature's name and select "Zoom to feature". You can change the style of display of the buffer by clicking on the solid box under the buffer layer's name.



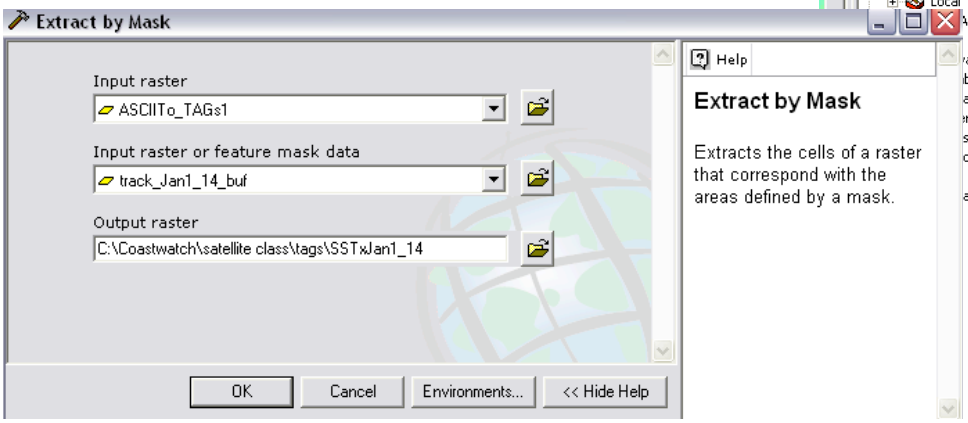
**NOTE: Spatial Analyst Extension required for the following step.**

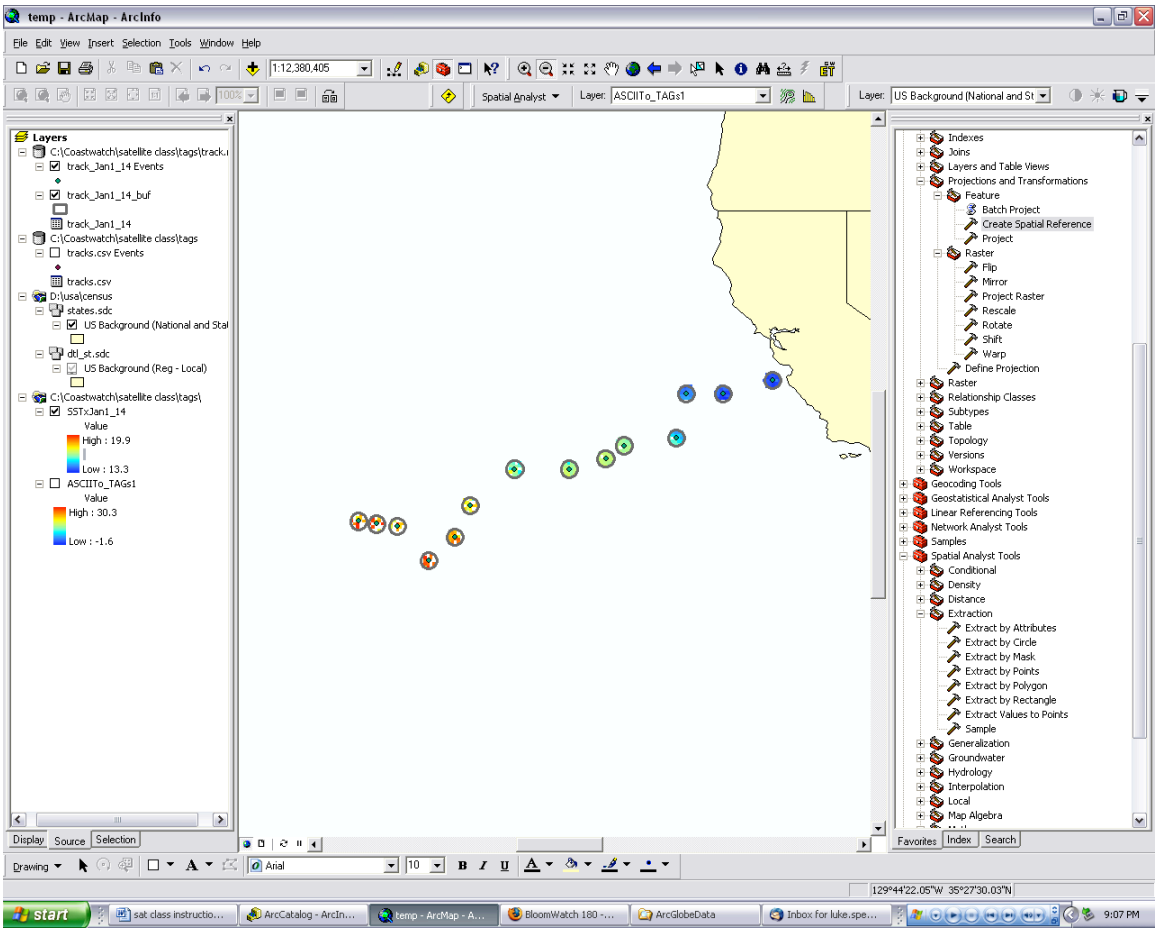
8. Extract the sea surface temperature under the buffered animal track using the "Extract by Mask" tool. This will create a new raster from the cells of the sea surface temperature that fall within the buffered zones of the animal track.




**-To Extract Sea Surface Temperature:** In the ArcToolbox, open "Spatial Analyst Tools – Extraction – Extract by Mask". Choose the SST raster as the input raster. Select the buffer layer just created for the "Input raster or feature mask data". Choose a name for the new raster extraction. Run the tool.

A new raster is added that only contains cells that fall within the buffer circles of the animal track. NOTE: I've noticed a slight offset between the cells of the extracted SST and the cells of the original SST layer. I haven't figured out how to fix this yet.






Additional projects:
-Try extracting the animal track for the next 14-day time period and downloading some chlorophyll data for that time period and spatial extent.
-Create a model that extracts the SST for each day's position, and then calculates statistics such as mean temperature and standard deviation for the extracted SST.