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CERSER
SeaSpace Training Essay
December 2016- January 2017

SeaSpace

SeaSpace is a remote sensing corporation which was founded in 1982. Their office is located in Poway, California. They have been dominating the remote sensing field for 30 years, reaching out to over 47 countries. Along with being at the top of the field, SeaSpace has created software that can be used to analyze, modify, and observe data collected from their satellites. These two software systems are TeraScan which was created in 1990, and TeraVision (TVIS) which was created in 1995. SeaSpace is used around the world at many businesses, organizations, and universities. Over the course of two separate weeks, I was able to have hands on experience and training with the systems created by SeaSpace.

During December 2016 and January 2017, a SeaSpace training workshop was held at Dixon hall. There were two sessions; one at the end of December and the other at the beginning at January. During the training sessions, I learned what SeaSpace created, how to use their programs and systems, how to maneuver the programming terminal, and how to summarize the data collected. In the past, the Center of Excellence in Remote Sensing Education and Research (CERSER) has provided me with training for the Terminal application on the Linux computers. Based on the SeaSpace training, many of the skills I have learned have been built upon and will be used in the future.

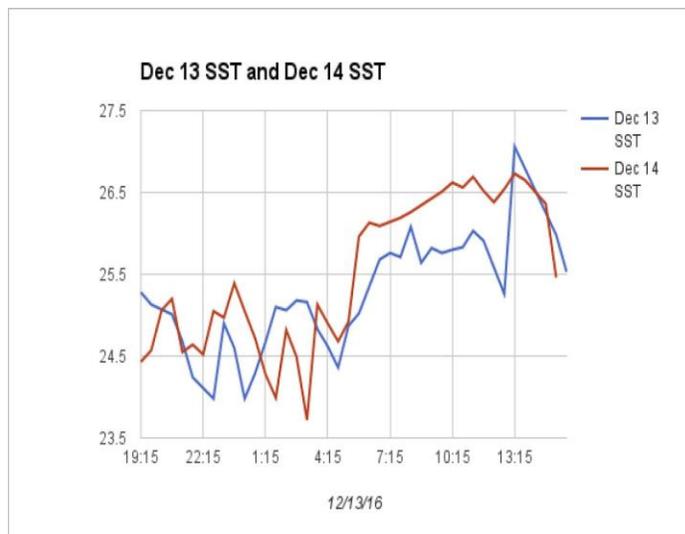
On the first day of training, the facilitator Andrew Brumfield showed all of the students the TeraScan system used for all of the SeaSpace data. The set up included multiple processors which included: NOAA, GOESeast- data from the eastern satellite, GOESwest- data from the western satellite, TREX- all of the processing, and TeraVault- archived data. The system also uses TeraScan for creating data shelves to view an image of the data collected. To become more familiar with using terminal, I learned many of the basic commands that would be needed to maneuver through the data. Some of these commands included: ls-list, cd-change directory, vi-text editor, wq-save and quit (when terminal is in use), pwd-print working directory, mv- move a file, and mkdir-make directory.

Along with viewing the data on the monitor, it was important to know what was displayed on the screen. One of the main factors that I viewed was the various types of temperatures. This included land surface, normalized difference vegetation index (NDVI), and sea surface temperatures. Using this data, we were able to create various levels; global and local. The global level includes an overview of the whole United States while the local level focuses on a specific area. During our training, the local areas that we focused on were the Gulf Stream and the Gulf of Mexico.

Once we were able to view the global and local areas, we began to pick points in the map. To keep our points separate from the points that others would pick, we created files with our name as the file name. There were also various pathways and codes that were being used to save our data: images- /Nexus/Data1/products/training/yourname, scripts- /opt/terascan/pass/configproc/gvar.train, and masters- /opt/terascan/pass/Nexus. The points that we picked were near the coasts since we wanted to be near the water. The reason for picking these points was so that we could get a reading of the sea surface temperature (SST). Once we picked our points, we

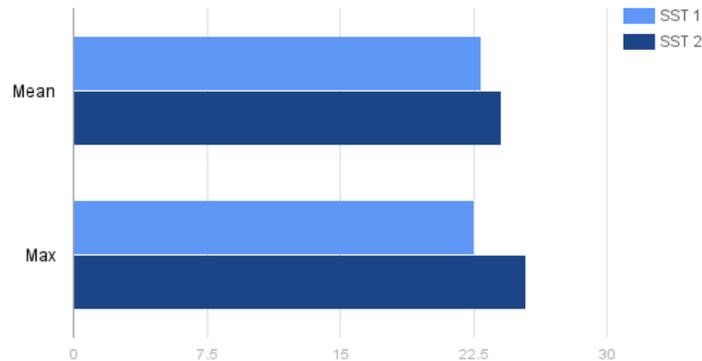
recorded the longitude and latitude. The next step was to open TeraVision in order to create the data shelves that would be needed to open the list of SST's around the point we selected. TeraVision is computer software that is used to process images. In this software, we were able to edit the images that were produced from the points that were picked in the global and local areas. We were able to edit the images by including steps such as enhancing, adding a grid overlay, adding a coastal overlay, graphs, and also annotating the image by including lines, symbols and text with various colors. Also, we were able to save the images we edited for later reference a a jpeg.

While we were in the TeraVision (TVIS) we selected two points; one point at the Gulf of Mexico and the other point on at the Gulf Stream. For both of these locations a list of SST's was generated for the two points. Depending on where we picked our two points determined how many SST's would have a value instead of no data (**). Once all of the SST's were written down, we then recorded them into a chart to compare them in a graph. Below is the comparison of the SST's for the two points from December 13, 2016 and December 14, 2016.



The next step was to use two points from the Gulf of Mexico to collect the average mean and max for the SST's from December 15, 2016. We recorded and analyzed all of the values for this day. Once all of the points were selected, we made a composite of the SST's using the code: `composite_2016.1215*goes.sst_allyyy15.sst`. This command allowed the systems to combine the scores for each if the two days to come up with an average mean and max value. Once the system analyzed all of the SST's, it printed out the average mean and max values for the two points. We wrote these down to bring back to our workstation to create a bar graph comparing the data of the two days. Before creating the bar graph, the image with the average mean and max value had to be annotated, combined with an overlay, edited with the palette, enhanced, and exported as a jpeg. This bar graph is a representation of the comparison of the average mean and max value for the two points on the Gulf of Mexico.

Dec 15 SST 1 and Dec 15 SST 2 Mean and Max

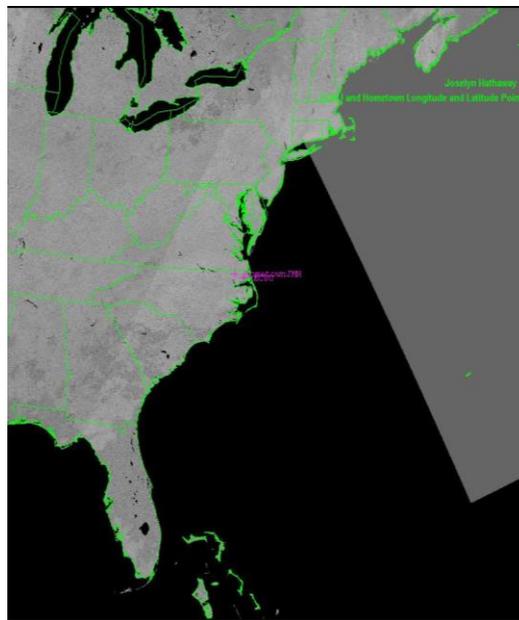


During January, David Mobley from the SeaSpace office led the second training session. At the start of this session, Mr. Mobley extended the list of commands that would be used in terminal. Some of these commands included: `lspass`- lists all of the passes in TeraScan system, `mkdir goes`- makes a new directory for the passes, `cd goes`- changes the directory of the passes, and `tview`- shows a quick view of how the map from the pass will look. Since many of the commands were unfamiliar, the most helpful command was `help`. This command opens the description of commands in an internet browser. He also taught us about the electromagnetic spectrum and how it is important while creating images and projecting data in the TeraVision and TeraScan system. The electromagnetic spectrum is a range of waves in which radiation and color flow. There are four different types of rays: ultraviolet (UV), reflective or visible light (VIS), infrared, and emissive. Some of these are also broken down into sections or blocks. VIS is broken down into blue, green and red which is the only type that we can see. Infrared is broken into two detectable sections, fire and water vapor. Emissive is one large section that detects temperature or heat. Some of the files we created were linked to the Advanced Very High Resolution Radiometer (AVHRR) satellite. This satellite detects all of the spectral bands and light. When it comes to detecting weather, the weather satellites view red mostly because blue and green are harder to see.

A majority of the training included using the TeraVision (TVIS) command. TVIS is used to view images, open data shelves, and select images. Once the images are opened they can be edited. One of the first things that we did was add layers including a coastal overlay, grid overlay, and topographical overlay. Also, when multiple images are opened, a time lapse could be created using `animate` which is similar to a weather report. We also used the palette select under tools to add color to the images. The palette that we used the most was the `evi.8bit`. Using this palette puts the image into a more realistic view with blue as the water and green as the land. We were also able to export the images that were generated into `jpeg` files so that it would be able to be viewed on other computers and laptops. Since we focused on the ocean, we used `nitpix` which calculated the SST. Mr. Mobley also taught us how to execute mathematical equations in the terminal. By using the `emathp` command, the terminal generates modules for an expression or expressions.

On the last day of training, we went more in depth with the GOES data which is the data dealing with weather. To access and manipulate the files, we used a series of commands including: `lspass | grep goes`- lists all of the goes files, `gvar_sst`- calculates sea surface

temperature, gvarin- creates a data set for the GOES data, gavr_sst_new- creates a sst file, cat- text editor, and ctrl + d- exits the text editor (cat) and returns to the programming terminal. Applying all that we learned in the previous sessions, we were able to create a map with two points of our own: Elizabeth City State University (ECSU) and our hometown. The goal for this was to be able to enter the coordinates of the two locations and have them plotted on the map in TeraVision. The first step was to use cat points.csv which allowed us to enter our coordinates for latitude and longitude and the name of where the coordinates are located. The second step was to import the points we had selected using the impasc command. Impasc allows several variables to be imported at one time with data that is 1D, 2D, or 3D. Using this command allows the user to enter how many points they have, label what the order is for the coordinates and name, and label which variables are floats or strings and the string length. Once the data is connected to the points files, we were then able to use the sample command to list the points in a dataset. This step allowed the points to be added to another file that would be later accessed to plot the two points chosen. The final step was to use the expasc command to export the files we created with the two points. The image below shows a representation the two points that were selected and plotted based on the coordinates that were entered into the points files. The two small plus symbols in the pink, near the coast of North Carolina, represent the two points whose coordinates were entered to be plotted.



During the SeaSpace training, I learned many new commands that can be used in terminal and how to access other files that led to geographical maps. Also, I was able to learn how weather maps accessed, generated, and edited. Going through the training taught me that the software can be used to research multiple factors such as temperature and climate, land surface, and sea surface. The TeraScan system is very beneficial for researching how a particular area had changed or is changing, including or local area or the United States a whole. I also learned that the system can also be used to track currents changes. Since the system is always up and running, there are many passes that are sent from the SeaSpace satellite to the operating system throughout the day which can show the constant changes that are happening to global and local areas.