

GIS, Satellite Remote Sensing, and Oceanography
Part 1
The SMILE Program
Teacher Handout

1. Intro to GIS
 - a. What is a GIS?
 1. Geographic Information System
 2. Storage system for data that has a geographic component
 3. A GIS allows you to search data with both text and by geographic area.
 4. A tool for making spatial studies (**Class brainstorm Spatial Questions**)
 5. A computer map-making program
 - b. Point, Lines, Areas, Layers
 1. Points (how stored)
 2. Lines (how stored)
 3. Area (how stored)
 4. Idea of data layers
Data Layers allow us to look at many types of data at the same time and make spatial studies possible.
 - c. What is an IMS?
 - a. A GIS accessible via the internet
 - b. Display for data/info to the public in a dynamic environment
 1. User controls data viewed
 2. A way of making simple GIS maps via Internet
 - c. All data pre processed for the user
 1. Some sites users can add data
 2. Some sites user cannot add data

To start, bring up the IMS site from the website:

<http://scallywag.science.oregonstate.edu/website/OcIMS/viewer.htm>

The first thing you will notice is a large map located in the center with a smaller view in the upper left-hand corner. The main map is the working map and the one in the top left corner is the overview map, showing the zoomed-in area of the working map.

Look at the right panel. This is the Layers and Legend Panel; it acts like a Table of Contents. Here you can click on and off the layers of data you would like to see.

Follow these steps to practice using some of the tools in the tool bar on the left side of the site:

First turn on the layer that is named OREGON CITES
(Make sure it's selected with the active layer button right next to the Visible Column)

Next select the **Zoom In** tool.

Draw a rectangle around your city.

If you can't see the labels of your city zoom in farther.

Next hit the **Active Layer** button

If you get lost you can hit the Active Layer button and you will see all the Oregon Cities (or whichever layer is set to active) at a good scale for viewing.

Press the **Full Extent** button

This tool zooms the view all the way out so you can see the entire map and all the data.

Next select the **Pan** tool

This tool allows you to move around the map without zooming in or out.

Pan from your town to the coast

Zoom Out so you can see your town and the coast at the same time

Then click on the **Measure** tool

Measure the distance from your town to the coast.

Now click the **Set Units** tool: Change the option to *Kilometers* then press the other **Set Units** button inside the gray window.

Again **Measure** the distance from the Coast to your town and you will see how many kilometers it is to the ocean.

Turn on the **June Mammals** layer

Zoom in to a small number of the mammal points, press the **Select** button and draw a box around one of the point.

A data table will show up in the information window under the current map view.

Scroll down the list to a mammal you're interested in, copy the animal's name by highlighting the text and copy from the edit menu or press **Ctrl + c**.

Now press the **Find** button and paste by right clicking or pressing **Ctrl + v** (the name must be typed in the box exactly as it appears in the information window, ex: Dalls_porpoise).

You should now see all the places highlighted where your animal was sited on the research cruise.

The **Identify** tool has the same features as Select except it works for a single point.

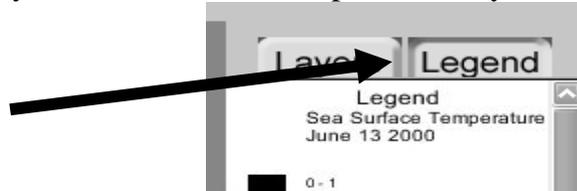
Zoom into a few points and then select the Identify tool. After selecting one of the points the data table will show up. If you scroll to the bottom of the data table there is a link to more records if more than 25 are in the data table.

If you hit the **Clear Selection** button all your previously highlighted points will now become unselected.

Looking at the Sea Surface Temperature (SST) images:

Click on the June SST image, turn it off and then look at the August SST image.

With only one Sea Surface Temperature Layer visible click the **Legend** tab.



Complete the following:

In the space below write the numbers for each image at the beginning of the legend (For Low write the first number > 1 for High write the first number < 255)

June: Low 23
High 151

August: Low 36
High 202

Discussion Question: What are some of the differences between the two sea surface temperature maps?

In the June image you should see that most of the water just off the coast is bright red to yellow showing that it is fairly warm (comparatively off the Oregon coast) as compared to the water farther up the coast off the shore of British Columbia and Washington.

In the August image you should be able to see a more defined band of cold water directly off the coast of Oregon. This is especially pronounced off the southern Oregon coast.

The values for SST in June are lower 2.3° – 15.1° Celsius, compared to August 3.6° - 20.2°. These images look similar due to Contrast stretching. We only have limited numbers of colors to use so between the images different values have the same color to highlight were the differences in temperature exist.

Discussion Question: Why is the cold water coming up to the surface close to the coast?

The winds are the major driving force behind the differences during the summer. The winds that blow push the warmer water from the surface (heated by the intense sun during the summer months) off shore. The resulting effect brings up cold water from the ocean floor. This process is called Upwelling, or Cold Water Upwelling.

Next look at the Ocean Color or Chlorophyll concentration.

This data has been processed to show the concentration of chlorophyll in milligrams per cubic meter at a resolution of 4km.

Discussion Question: How do we know that what the satellite is telling us is accurate?

We need something for calibrating the sensors output. This process is called ground truthing and is very important to keep. This means we collect data on the ground and compare it to satellite images of the same period of time to calibrate what the sensor is recording. In looking at the data we have available on the IMS site the plankton point data when overlaid on top of the ocean color images should look similar to the ocean color images.

Click on the June Ocean Color image study it and then switch to the August Ocean Color image.

Click on the plankton Layer for June and the Ocean Color image for June

Click all off

Click on the plankton Layer for August and the Ocean Color image for August

Discussion Question: What is the appropriate resolution for your study?

The SST images have a resolution of 1 Km (the size of this image is 3.3MB)
The Ocean Color Images have a resolution of 4Km.

In the ocean, conditions are constantly changing; a high-resolution image of an area would only be valid for a brief moment in time. Researchers may be interested in a particular phenomena but capturing such fine scale interactions multiple times would be very difficult to capture and analyze due to the dynamic nature of the ocean. Ocean researchers are more interested in learning about large-scale ocean processes. Over an expanse such as an ocean where conditions are constantly changing, lower resolutions are sufficient for large-scale research.

