USING OCTAVE TO ANALYZE BEACH PROFILE DATA

You will use the GNU Octave program to create a visual representation of the beach profile data that has been collected along Crystal Cove State Park's North Beach. This visual representation will help us see what the area in front of North Beach looks like on a three-dimensional scale. You will also be able to use Octave to calculate how the volume of sand changes from month to month.
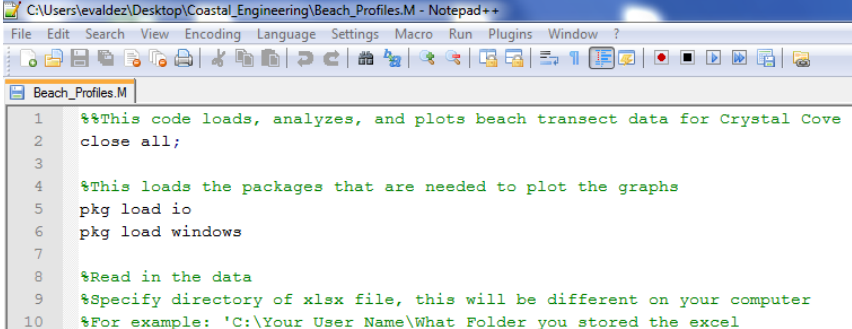
Before you Begin

You will need to download GNU Octave and the GNU Octave files before you begin. You can visit our Voicethread to learn how to install GNU Octave and receive the files. Once you have GNU Octave installed and the files downloaded, follow the steps below to construct your own beach profile visualization.

Part 1: Getting Started in Octave

Before working with the Beach Profile data, you will need to make sure that Octave is pulling its data from the correct folder. Follow the steps below to open Octave and set up your directory.
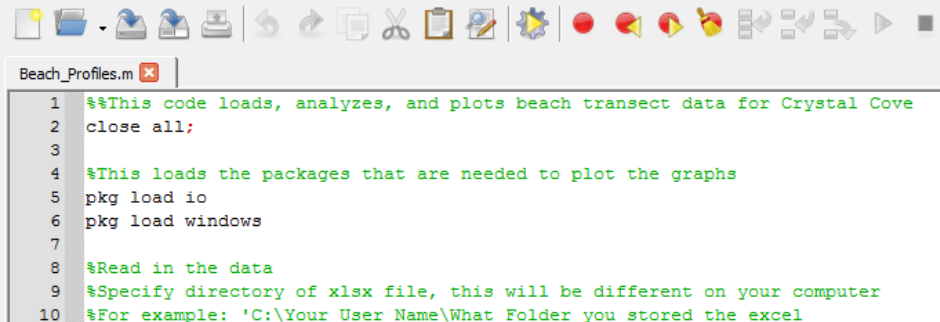
1) On your desktop, open the folder you download from the dropbox called "Beach Profiles".

2) Double click and open the file called "Beach_Profiles.m". This will open up both an **Octave Command Window** and a **code file**.

3) The **code file** will appear in one of two formats: Notepad++ or in Octave under the editor. (Either of these is okay! You will just need to know which one you will be working in.)

   A. If the code opens in **Notepad++**, a new window will open up alongside Octave. It should look like the following:

   B. If the code opens in under the editor tab in **Octave**, only Octave will open. It should look like the following:


Part 2: Setting Your Directory

Your first task when running code on Octave is to set up your directory. A directory will tell Octave where it should be reading the files from. This may already be set correctly, but it is always good practice to check your directories before you start working.

1) To change your directory, first pull up the Octave window and click on the **"Command Window"** menu at the bottom of the window.
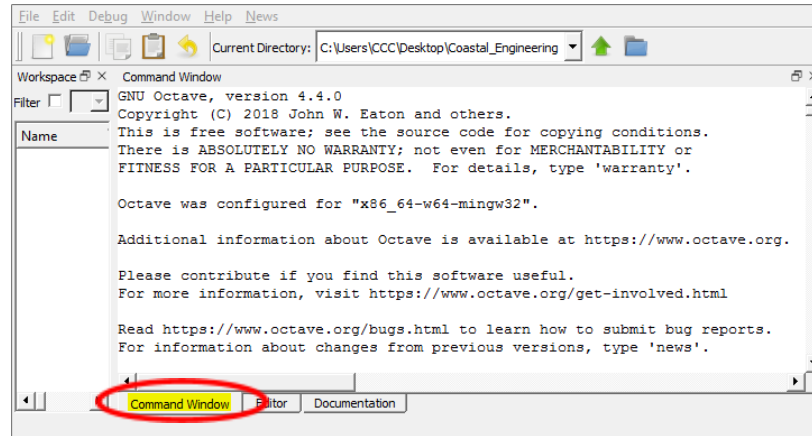
2) Look for the blue folder icon near the top of the Octave window to browse directories. Browse through your computer until you find the folder called "Beach Profiles". (This is the folder you downloaded from our Dropbox.)
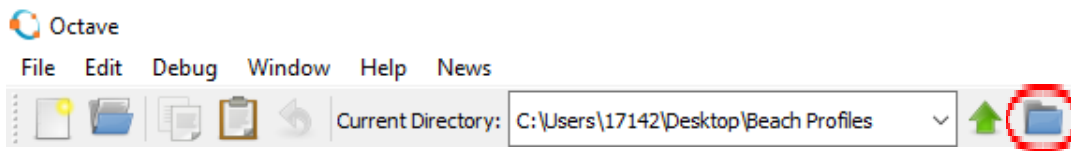
3) Open the "Beach Profiles" folder and click on "Choose". This will set the directory pathway to the correct folder.

4) Next, you will need to copy over the directory pathway to the code file, so that the code is drawing from the correct file. Highlight and copy the path of the **Current Directory.**
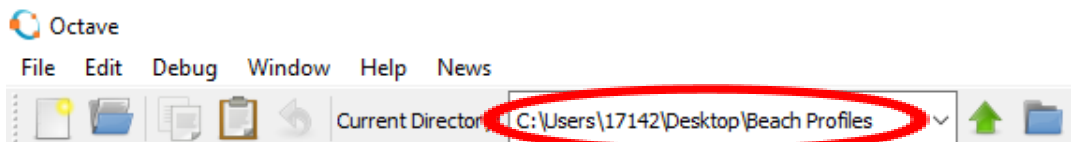
5) Open your **code file**, which will be located in either the **Editor tab in Octave** or on **Notepad ++**.

6) **In your code file**, go to **line 12** and paste your Current Directory path to the area that reads "[ADD YOUR CURRENT DIRECTORY PATH HERE]". Make sure that you do not erase the apostrophes or "/BeachTransectDataEdit.xlsx';" Your result should look similar to the following:

```
12    dir = 'C:\Users\17142\Desktop\Beach Profiles\BeachProfileData.xlsx';
```

7) **Stop!** Before you continue, ask your teacher to check your progress this far.

Part 3: Creating a Single Three-Dimensional Data Visualization

*Next, you will use Octave to create a visual representation showing what the beach looked like on specific day.*

1) While in the **code file,** go down to **line 17**. Line 17 will show all the days that we have collected data, which also indicates the date of each data set that you can graph using Octave.

2) Find the date that you want to graph. Copy that date and paste it into **line 19** where it says "[ADD DATE(S) HERE]". Make sure to not erase the apostrophes or any text before or after that text.

   Your result should look similar to the following:

   ```
   19        sheetname = {'1-8-19'};
   ```

3) Once you have input the day of your trip, highlight your entire code **(lines 1 – 77)** and copy it.

4) Paste the code that you copied into the Octave Command Window.

   This will take a while to load. Once it has finished loading, a 3-Dimensional visual representation of your data will appear in a different window.
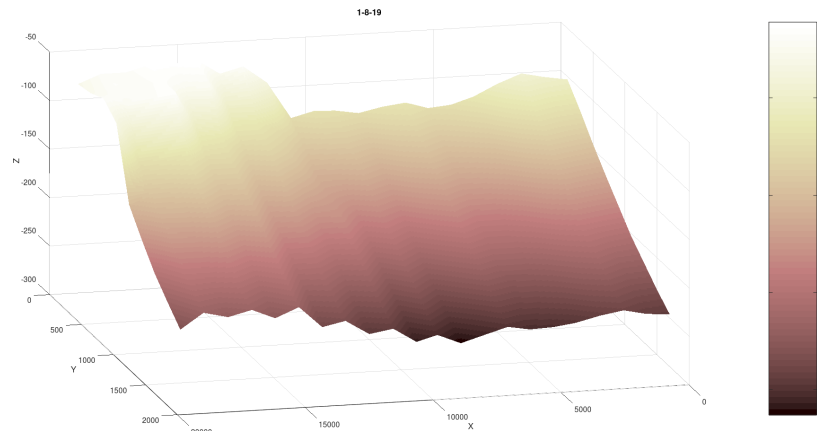
5) Click on the square in the upper right-hand corner of the window to enlarge the graph's window. The image should automatically enlarge itself to fit on the screen, but if that does not happen, you could click the button that says "Autoscale".
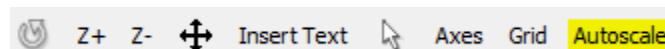
   Note: If you close the image at any point, all you need to do is copy your code, and re-paste it into the command window to create another graph. You do not have to delete any text from the command window.

Part 4: Creating a MultipleThree-Dimensional Data Visualizations

Next, you will choose data sets from two different days and graph them next to each other in Octave so that you can visually compare them.

4A. Choose Two Dates to Graph

1) Close the graph window that was produced by Octave and then reopen the **code file**.

2) Go back to **line 17** and look at the possible days that you could graph. Choose another data set that you are interested in looking at.

3) In **line 19**, add a comma after the apostrophe of your first date. Paste the second date after the comma. Make sure each date has apostrophes around it.

   Your code for line 19 should look something like the following:

   ```
   19      sheetname = {'1-8-19','2-28-18'};
   ```

   This line is now telling Octave that you want to plot two graphs, such as, January 8, 2019 and February 28, 2018, in that order.

4B. Hide the Colorbar

When plotting multiple graphs, it is also best to remove the color bar from the graphs. This will allow for better comparisons between the days being plotted.

4) To remove the colorbar, scroll down to **line 62** and add a "%" in front of the code in that line. **Line 62** should look like the following:

   ```
   62      %colorbar;
   ```

   The "%" in front of any line of code tells Octave not to execute that code. As a result, your colorbar will no longer appear when you run the code.

4C. Determine how the Graphs will be Plotted

Our code was previously set so that it only created one graph. Now that we have chosen two days, we have to rewrite the code to tell Octave to plot two graphs.

5) **In your code,** scroll down to **line 50**. This line of code tells Octave how many graphs we want to plot, and how we want them oriented and spaced.

6) Take a look at the following code:

   ```
   50  |     h1 = subtightplot(X,Y,k,[0.090 0.085], [0.07 0.05], [0.07 0.05]);
   ```

   We only need to concern ourselves with the highlighted values, **X** and **Y**. **X** will tell Octave how many columns we want (up to down), while **Y** will tell Octave how many rows we want (left to right). When you plotted a single graph, the value was set to **1,1.** In other words, the original code created one column and one row.

7) Since you are plotting two graphs, you now have two options to plot your data. Look at the following options and decide how your group would like to plot your graphs:

A) **Vertical Display:** If you want to plot one graph on top of another (i.e., two graphs in one column), edit **line 50** to look like the following:

```
50    h1 = subtightplot(2,1,k,[0.090 0.085], [0.07 0.05], [0.07 0.05]);
```

This will produce the following display when the code is executed in the Command Window of Octave:
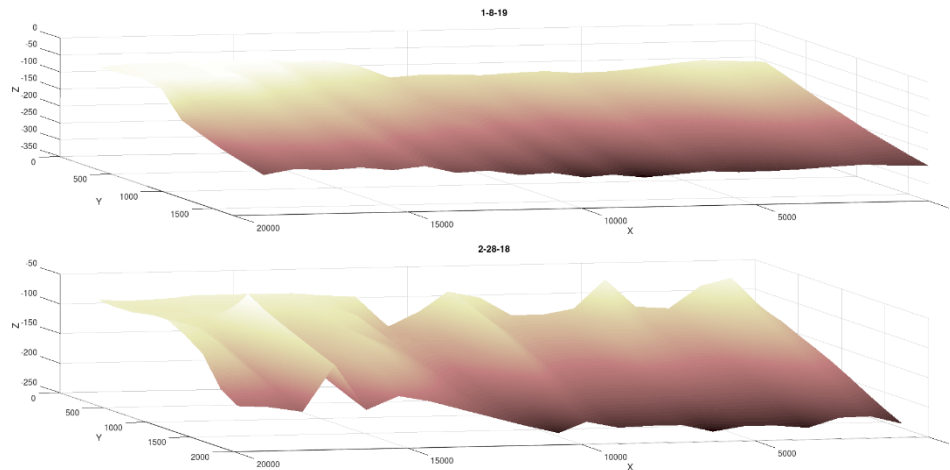
B) **Horizontal Display:** If you want to plot two graphs next to each other horizontally (i.e., two graphs in one row), edit **line 50** to look like the following:

```
50    h1 = subtightplot(1,2,k,[0.090 0.085], [0.07 0.05], [0.07 0.05]);
```

This will produce the following display when the code is executed in the Command Window of Octave:
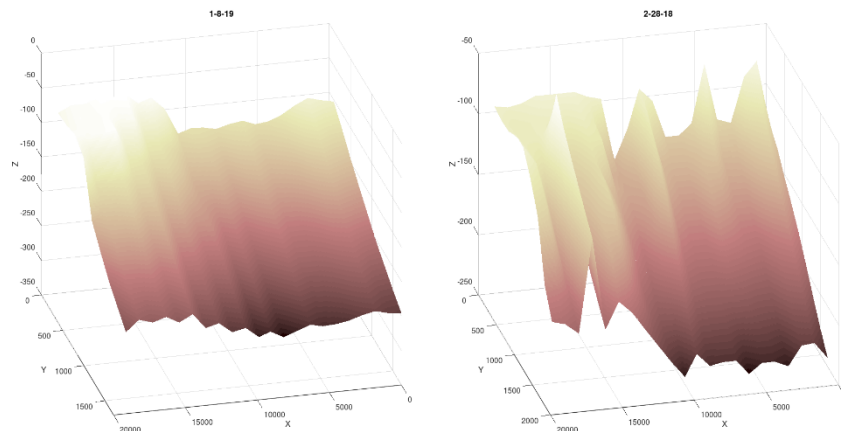
4D. Choosing More than Two Days to Plot (Optional)

*You may also want to graph more than two days at a time. If that is the case, make sure that you go back and change **line 19** to include all the days you want to graph.*

1) Choose as many days as you want to plot. For the following example, we wanted to graph 4 days at once, therefore, **line 19** may look like the following:

```
19      sheetname = {'1-8-19','2-28-18','5-30-18','6-20-18'};
```

2) Go back to **line 50** and make sure your columns and rows will fit those graphs. For example, you can display four graphs in a 2 x 2 square with the following code:

```
50   |      h1 = subtightplot(2,2,k,[0.090 0.085], [0.07 0.05], [0.07 0.05]);
```

3) Copy the entire code **(line 1-77)** and paste it in Octave's Command Window below the code you executed before. The result will look similar to the following:
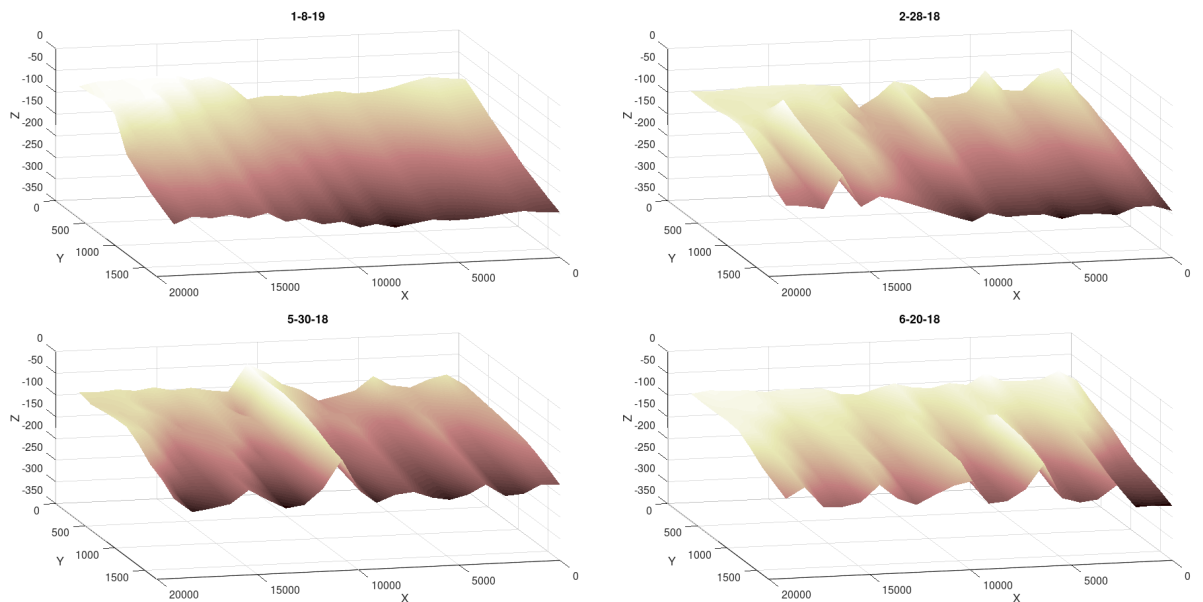
Part 5: Calculating Sand Volume (Optional)

You can also use Octave to calculate the area under the beach profile, giving you the volume of sand in a defined area of the beach. Note that when you are calculating sand volume, the code will only calculate sand volume for one day at a time. This means that you will have to run the code separately for each beach profile.
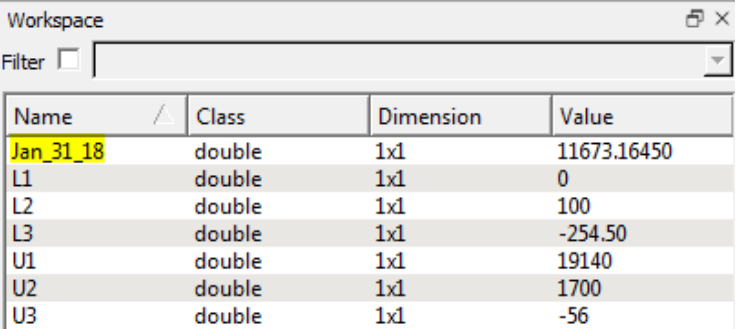
1) If you have multiple graphs plotted, make sure you go back and change your code **(line 19)** so that it only is drawing data from one day.

2) Scroll down to **line 50** and check that the dimensions are set to create a single graph.

3) Next, you will set a variable in the code to represent the volume of sand on that particular day. On **line 76** of the code, replace "[ADD DATE FOR SAND VOLUME HERE]" with the date of the graph you plotted in the format "Month_Day_Year" **Line 76** should look like the format below:

```
76     Jan_31_18 = (system .- vol_sand);
```

4) Copy your entire code **(lines 1-77)** and paste it in Octave's Command Window. After your code has loaded, a graph will be produced.

This will also create a variable in Octave's Workspace. Variables that are in the workspace are put into Octave's memory and can be recalled back at any time by simply typing out the name of the variable in **Octave's Command Window**.

For example, if **line 76** looks like the picture above, you will create a variable called "Jan_31_18" in your workspace. It will look like the following:

Name	Class	Dimension	Value
Jan_31_18	double	1x1	11673.16450
L1	double	1x1	0
L2	double	1x1	100
L3	double	1x1	-254.50
U1	double	1x1	19140
U2	double	1x1	1700
U3	double	1x1	-56

Note that if you open a new Octave or close the current one, the workspace will be deleted and you will need to recreate each variable.

6) To recall the volume of sand present on a given day, type the name of your new variable in Octave's Command Window and press enter.   **The units of the value reported back is in cubic meters (m³).** The result will look similar to the following:

```
>> Jan_31_18
Jan_31_18 =  11673.16450
```

The **>>** is what you typed and executed. Under it is Octave's response, which represents the volume of sand on the beach on January 31, 2018, according to our data set.