

I. Objectives

1. Use the topographic profile feature of Google Earth (GE).
2. Utilize this tool to study ocean and coastal topographic profiles.

II. Introduction

Oceans cover 70% of Earth's surface and often mask topographic features that are every bit as dramatic as the Rocky Mountains or Grand Canyon. As we learned while studying plate tectonics, many of the most dramatic ocean and continental features are related to Earth's major convergent and divergent plate boundaries. But many other processes shape the sea floor, particularly adjacent to the continental margins, such as river deltas, coral reefs, volcanoes and ice sheets. Continental margins and many island nations will be affected if sea level rises. Much of the data in the default Google Earth database cannot resolve changes on the order of one meter but a ten meter rise in sea level will affect some areas.

III. Materials

Calculator, .kmz files on the class web page are in the class server

IV. Theory and Calculations

You will need to calculate the average value of the continental slope in this exercise. Remember that slope is defined as "rise over run" and will be reported as a percent, in this case:

$$\text{slope [\%]} = (\text{highest-lowest elevation [km]} / (\text{distance between these two points [km]})) \times 100$$

Note that if your elevation difference is in meters, applying a unit conversion to the above formula yields:

$$\text{slope [\%]} = (\text{highest-lowest elevation [m]} / (\text{distance between these two points [km]})) / 10$$

V. Prelab Definitions

1. bathymetry
2. coastal plain
3. continental margin
4. continental slope
5. mid-ocean rise
6. relief

VI. Lab Procedure

Part A: Become Familiar with Google Earth

1. From the Geo102-Lab folder on MyPima download the file Earths_Tectonic_Plates.kmz and open it in GE.
2. Once opened, the *Places* box on the left hand side of GE will include Earths_Tectonic_Plates. You can turn on/off various layers. Turn on “Earth’s Tectonic Plates” if it is not already visible, by clicking the check box next to it. The colored lines represent tectonic plate boundaries.
3. You may want to turn off other layers in the lower-left panel so that only the Earth’s Tectonic Plates layer is visible.
4. Navigate the Earth using the navigation tools in upper right corner, or by using the “grabber” hand icon. Observe various plate boundaries, especially convergent and divergent boundaries. You will already be familiar with this kmz overlay if you have done the tectonics lab on plate boundaries.

Part B: Become Familiar with the GE Ruler/Transect Tool

Google earth allows you to explore topographic profiles using the ‘*Ruler*’ tool. Follow these simple steps to draw a transect line across the Mississippi Delta:

5. Zoom into the Gulf Coast adjacent to New Orleans.
6. Select the *Ruler* icon from the toolbar. A square cursor box will appear over the image.

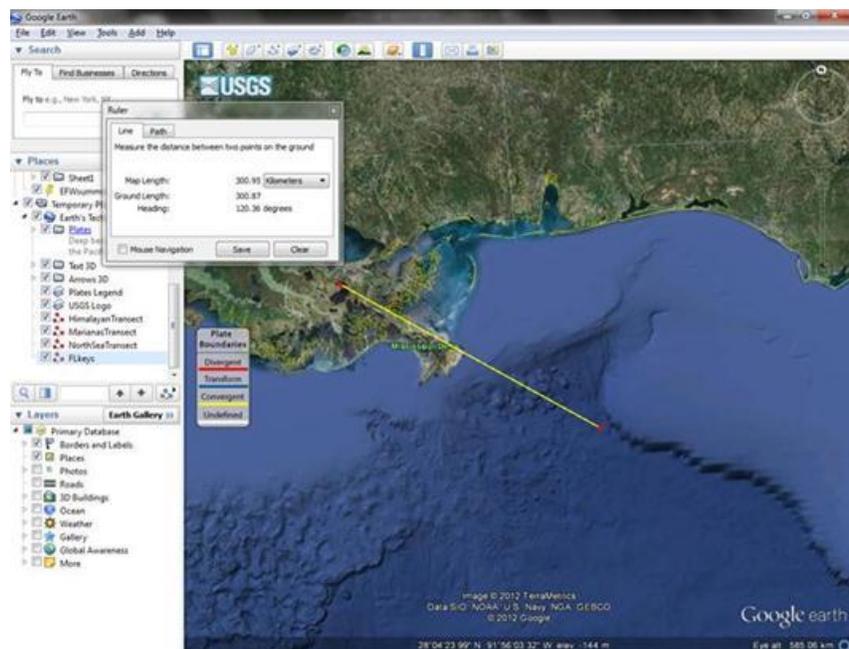


Figure 1: Mississippi Delta

7. Click on the image just south of New Orleans to initiate your line and use the cursor to draw a ~300 km line out into the Gulf of Mexico so that it passes over at least one of the off-shore circular features as shown in Figure 1.
8. After completing the line save it using the *Ruler* pop-up window, as shown in Figure 1.
9. A new pop-up window called *New Path* should appear. Use a descriptive line name.
10. Select the *Altitude* tab in the same box and select *clamp to seafloor*. It is important to actually see the sea floor transect relative to sea level for the next step.
11. Your transect name will appear under *Temporary Places* in the directory listing on the left-side of the GE window.

12. Right click on the transect name to reveal a *Menu* box.
13. Select the second to last item *Show Elevation Profile*.
14. While scrolling across the Topographic Profile, Figure 2, you will see a red arrow moving along the ruler line and a vertical line on the profile labeled with elevation, slope and relative position.
15. Be able to identify the steepest slope along your profile.

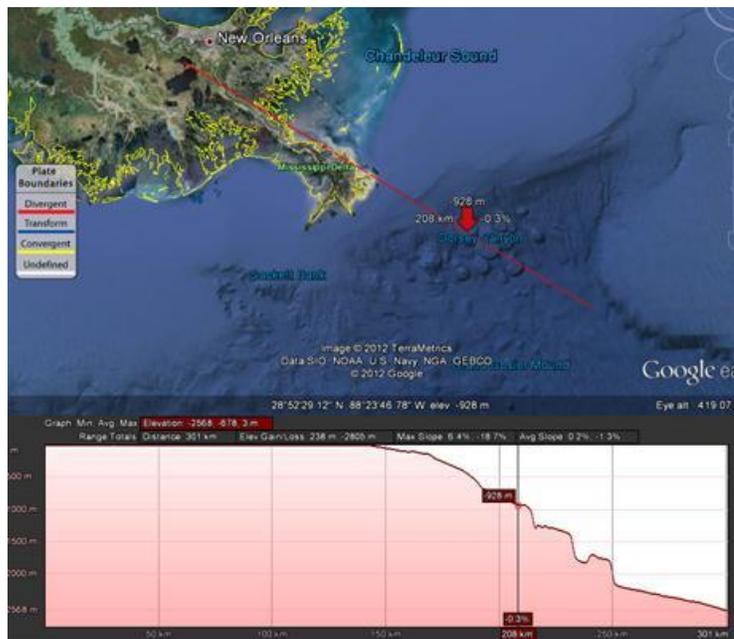


Figure 2: Delta map with topographic profile

16. Be able to find the average value of the continental slope.
17. Think about what might be responsible for the circular structures in the deeper part of this transect (near red arrow in Figure 2).

Part C: Investigation of Coastal Topographic Profiles

18. Investigate at least four coastal and oceanic topographic profiles around the world, other than the example above. Divide the four profiles into two different groups, each with two profiles. Each of these groups should be of similar types of structures or environments (such as listed in Table 1a) so that you can compare and contrast what you find from different locations around the Earth.

Table 1: Examples of Different Structures & Areas to be Investigated		
a.Structures	b. Areas	
continental convergent boundaries & adjacent mountain ranges	Marianas Trench	1500 km transect through Tonga & Fiji, SW Pacific
back arc convergent boundaries & adjacent mountain ranges	Himalayans-Indian Ocean	1200 km transect through Bhutan & Dhaka, SE Asia
divergent boundaries	Florida Gulf	1500 km transect from NW of Cuba through Bahamas
deltaic environments		
island hot spots		
offshore areas of petroleum exploration or accumulation		
continental shelves and slopes	Hawaiian Sea Mount	150 km transect through Mauna Kea to ocean deep

19. For each profile, copy (Ctrl-Alt-c) and paste (Ctrl-v) an image similar to Figure 1 above into a Powerpoint or Word document Resize the images so that there are two images per page. Label any features you find particularly interesting using the Word *Insert Text Box* tool.
20. For each profile, copy and paste an image similar to Figure 1 above into a Powerpoint or Word document.
21. Resize the images so that there are two images per page.
22. Label any features you find particularly interesting using the Word *Insert Text Box* tool.
23. Use the ‘Ruler’ tool to measure the width or length (or slope) of your feature in kilometers (or %).
24. Include your name on the first page and as part of the filename, for example, lastname_ocean_profiles.doc.
25. Submit the document into the MyPima class folder labeled “Ocean Profiles.”
26. Complete Table 2 below and respond to the discussion questions below for each profile.

Table 2: Physical Characteristics of Transect Location							
Descriptive name	Start point latitude	Start point longitude	Total distance in km	Greatest slope	Relief: max-min elevation in m	Distance between max, and min in km	Average slope %

27. Show one of your slope calculations below.

VII. Lab Discussion

1. Compare and contrast the prominent features in your first group of images.
How do they differ?

2. How are they similar?

3. What do these indicate about land-forming processes?

4. What causes these steep slopes?

5. What causes these low slopes?

6. Describe how a 10 m change in sea level would affect these areas

7. Propose three questions that could be investigated about the features you selected
 - a.
 - b.
 - c.

8. Compare and contrast the prominent features in your second group of profiles.
How do they differ?

9. How are they similar?

10. What do these indicate about land-forming processes?

11. What causes these steep slopes?

12. What causes these low slopes?

13. Describe how would a 10 m change in sea level affect these areas?

14. Propose three questions that could be investigated about the features you selected

a.

b.

c.

Lab courtesy of Dr. Jim Washburne