I. Objectives

1. Use Google Earth (GE) to explore glacial features.
2. Connect glacial processes with glacial shapes.

II. Introduction

Areas of glaciation may cover continents, yet many features, such a parallel striations on bedrock outcrops, are only visible on the scale of one meter. While disappearing glacier may be the poster child for global warming impacts, this phenomenon is difficult to study without years of accurate observations. Discerning dynamic impacts, including global warming, is difficult in isolated images. It may also be difficult to separate long-term effects from seasonal mass balance affects.

Glacial terrains host multiple illustrations of the incredible erosive power they have on surrounding areas and the sharp contrast between the bright snow and surrounding forests and mountains results in interesting images. Although ice sheets and glaciers only hold 2% of Earth's surface water supplies, this represents about 77% of the total fresh water on the planet. They are incredibly important as a source of drinking water and as a factor in sea level elevation.

III. Materials

Internet and Google Earth

Figure 2: Alaskan Glacier and braided stream

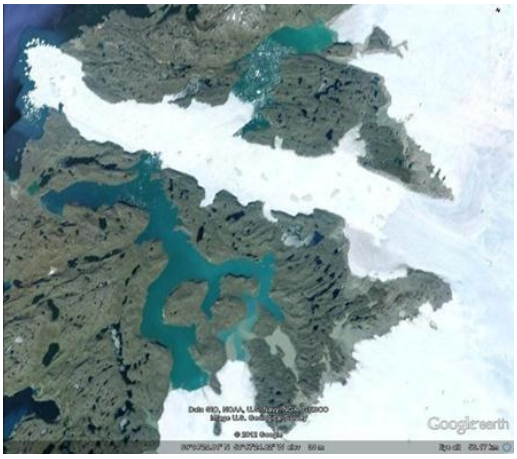

Figure 1: Greenland tide water glacier

IV. Prelab Definitions

1. glacier

2. ice shelf

3. ice sheet

4. cirque

5. terminal moraine

6. lateral moraine

7. crevasse

8. esker

9. drumlin

10. kettle lake

11. firn line

12. accumulation zone

13. ablation zone

V. Lab Procedure

1. Working in groups of 2, use Google Earth, Google Maps or NASA's Earth Observatory, explore four different glacial environments, as described below.

2. Investigate four glacial environments around the world. Divide the four views into two different groups, from different parts of the world. Each of these groups should be of similar types of features (such as listed in Table1a) or related to similar processes (such as listed in Table 1b) so that you can compare and contrast what you find from different locations around the Earth.

Table 1: World-wide Glacial Features & Localities

a. Features	b. Processes	c. Localities
alpine glacier tide-water glacier ice shelf/sheet fjord terminal moraine lateral moraine crevasse firn line cirque esker drumlin kettle lake braided stream works of man	indications of growth indications of contraction erosion isostatic rebound evidence of melting seasonal effects recent global warming change over time (eons)	Alaska, US British Columbia, Canada Greenland Himalayans-Tibet Patagonia (S. Chile) Antarctica New Zealand (S. Island) Norway

3. For each profile, copy and paste an image similar to Figure 1 above into a Powerpoint or Word document.

4. Resize the images so that there are two images per page.

5. Label any features you find particularly interesting using the Word *Insert Text Box* tool.

6. Use the 'Ruler' tool to measure the width or length (or slope) of your feature in kilometers (or %).

7. Include your name on the first page and as part of the filename, for example, lastname_glacial.doc.

8. Submit the document into the MyPima class folder labeled "Glacial_Processes."

9. Complete Table 2 below and answer the discussion questions for each image.

Table 2: Physical Characteristics of Glacial Location						
Descriptive name	Start point latitude	Start point longitude	Mountain range	Features	Processes	Length or width in km

VI. Lab Discussion

1. Compare and contrast the prominent features in your <u>first group</u> of images – How do they differ? How are they similar?

2. What visual clues suggest different processes at work (be specific)?

3. How might this area be affected by global warming?

4. What would this area look like with the glacier removed? Be specific.

5. Propose two questions that could be investigated about the features you selected if you had more time.
   a.

   b.

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

7. How are they similar?

8. What visual clues suggest different processes at work? Be specific.

9. How might this area be affected by global warming?

10. What would this area look like with the glacier removed? Be specific.

11. Propose two questions that could be investigated about the features you selected if you had more time.
    a.

    b.

Lab courtesy of Dr. Jim Washburne