

Performance Task/Case Study: BERING GLACIER

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I. The Relevant Issue

The United States Geological Survey (USGS) has identified the Bering Glacier, located in southeast Alaska, for long term ecological monitoring as an indicator of climate change. It is the largest and longest glacier in the continental North America. The USGS needs to identify historical and current ecological conditions of the glacier and surrounding area to develop baseline data.

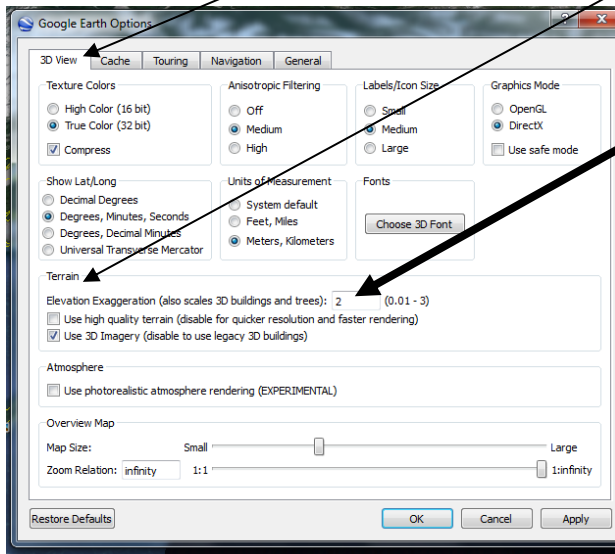
As a scientist, you will use 25 years of satellite data and imagery to create maps showing area features, glacier changes, and quantitative measurements. Your conditions report should be clearly supported by data (qualitative and quantitative) and have a conclusion about the ecological trends occurring at the Bering Glacier.

II. Performance Task

Using the data set, you will be looking at images from four different years and studying the terminus of the glacier.

STARTUP – settings to use for the overall activity

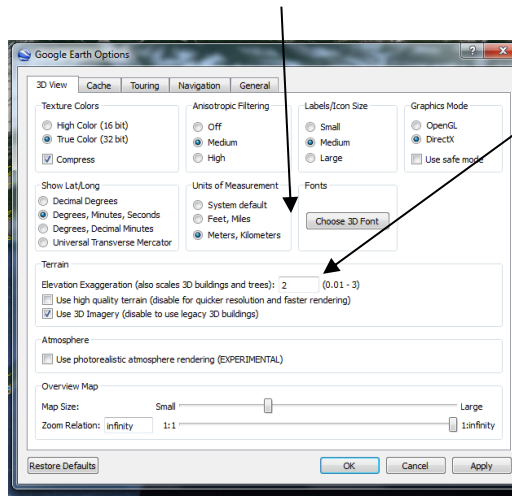
1. Obtain a flash drive with the Bering Glacier data, and copy the files from the flash drive to your computer.
2. Open “GOOGLE EARTH.”
 - a. When the “start-up tip” of the day shows on the screen close it.
 - b. Then go to “FILE” and click “OPEN.” Find and open the “Bering Glacier KMZ” file.
 - c. The file will automatically load the data into Google Earth for you.
3. Click on the “TOOLS” tab in the menu at the top of the page. Select “OPTIONS,” and stay on the “3D View” tab. In the “TERRAIN” change the “ELEVATION” to 2. (This will help you see differences in land formation.)



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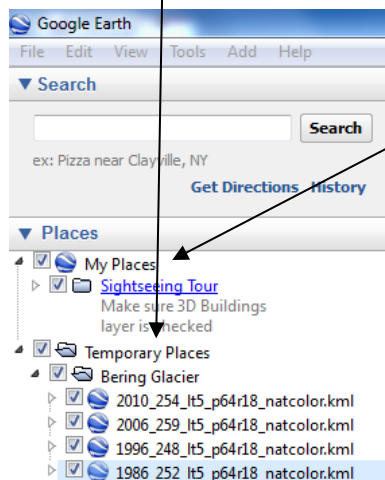
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- a. In the “UNITS OF MEASUREMENT,” change to METERS, KILOMETERS.

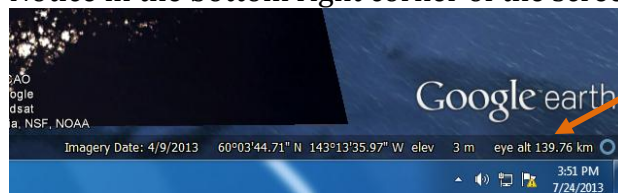


- b. Now click “OK.”

4. On the left of the screen, you will see the Bering glacier data located under the “Temporary Places,” which is located under “My Places.”



5. Notice in the bottom right corner of the screen, the “eye altitude.”



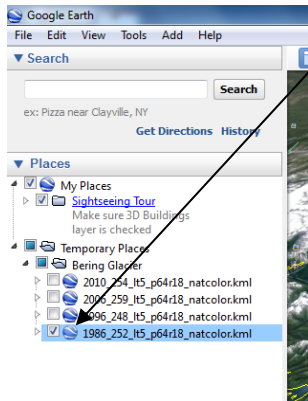
- a. “Zoom In” until the eye altitude is between 35 and 40. If you forgot how to zoom in check the reference sheet. Also, hit letter “U” to make sure Google Earth is not tilted.

6. Uncheck all of the Bering Glacier images by checking next to “Bering Glacier.” You will see no checked boxes under the “Temporary Places” folder.

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A. DATA - 1986

7. Click or check on the **1986** data. This is the natural color image that the satellite took in 1986.



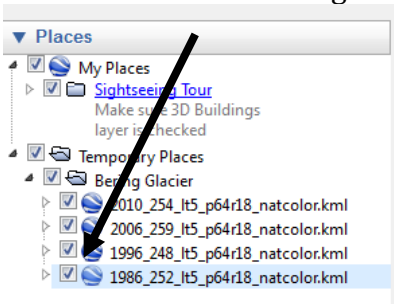
- a. Draw a line using the “PATH” tool to trace the terminus of the glacier.




Click the “PATH” tool. Name it “**TERMINUS 1986,**” color it **YELLOW** and make the width **3.0**. **Do not close the properties box.** Click “OK” once the line is drawn.

B. DATA - 1996

8. Now, you will be looking at the data from 1996.
b. Uncheck the 1986 Bering Glacier image.




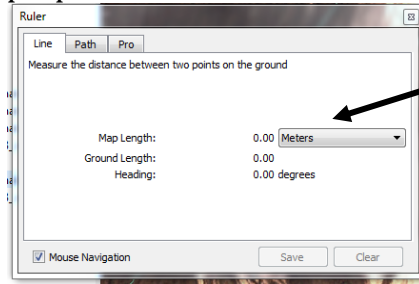
- c. Click on the **1996** data. This is the natural color image that the satellite took in 1996.
d. Draw a line (as you did for 1986) using the “PATH” tool to trace the terminus of the glacier.  Click the “PATH” tool. Name it “**TERMINUS 1996,**” color it **RED** and make the width **3.0**. **Do not close the properties box.**
e. Click “OK” once the line is drawn.

C. GATHERING DISTANCE DATA - 1986 vs. 1996

9. Make sure both of your terminus lines for 1986 and 1996 are showing. Click on the **1986 (yellow)** and **1996 (red)** data, in the left-hand “My Places” area.
a. Locate the longest distance between the two termini lines.

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- b.  Click the ruler tool to measure in meters. Change the units in your properties box to meters.



- c. Draw a line between the two termini where they appear to be farthest apart. Your image should look a little like the image below.



- d. Record your longest measurement to the hundredths place:

- d. Click "CLEAR" to do the next measurement. **Do not close the properties box.**

LONGEST DISTANCE

meters

10. Locate the shortest distance between the two [1986 (yellow) and 1996 (red)] terminus lines.

- a. Draw a line between the two termini where they appear to be nearest to each other. Your image should look a little like the image below.



- b. Record your shortest measurement to the hundredths place
IN THE BOX BELOW:

SHORTEST DISTANCE

meters

- c. Close the Ruler Properties Box. You do not have to save it.

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D. AVERAGE AND COMPARE DISTANCE DATA - 1986(yellow) vs. 1996(red)

11. Calculate the average distance between the two termini in meters to the hundredths place.

Longest Distance 86(yellow) to 96(red)	Shortest Distance	Average Distance
meters	meters	meters

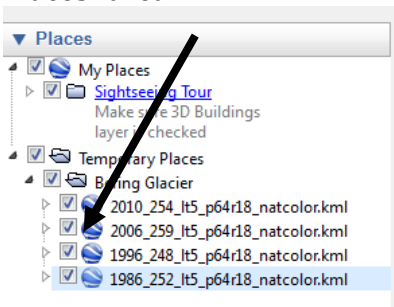
12. From the information you gathered did the glacier appear to grow/advance (surge) or melt/retreat (ablate)?

What is your evidence? _____

E. DATA - 2006

13. Now, you will be looking at the data from 2006.

- a. Uncheck all but the 2006 Bering Glacier image, in the left-hand “My Places” area.



- b. Draw a line (as you did for 1986 and 1996) using the “PATH” tool to trace the terminus of the glacier.



- Click the “PATH” tool. Name it “**TERMINUS 2006**,” color it **PURPLE** and make the width **3.0**. **Do not close the properties box.**
- c. Click “OK” once the line is drawn.

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F. GATHER DISTANCE DATA – 1996 vs. 2006

14. Make sure both of your terminus lines for 1996 and 2006 are showing. Click on the **1996(red)** and **2006(purple)** data, in the left-hand “My Places” area.

a. Locate the longest distance between the two termini.



b. Click the ruler tool to measure in meters.

c. Draw a line between the two termini where they are farthest apart. Your image should look a little like the image below.



d. Record your longest measurement to the hundredths place (TERMINUS 1996(red) -TERMINUS 2006(purple)) **IN THE BOX:**

e. Click “CLEAR” to do the next measurement. **Do not close the properties box.**

Longest measurement (1996 to 2006)	Shortest measurement (1996 to 2006)	Average difference
meters	meters	meters

15. Locate the shortest distance in between the two termini (red and purple lines).

a. Draw a line between the two termini where they are farthest apart.

b. Record your shortest measurement to the hundredths place (**TERMINUS 1996(red) - TERMINUS 2006(purple)**) **IN THE BOX ABOVE.**

c. Close the Ruler box. You do not have to save it.

G. AVERAGE AND COMPARE DISTANCE DATA – 1996(red) vs. 2006(purple)

16. Determine the *average* distance between the two termini and record your answer in meters to the hundredths place **IN THE BOX ABOVE.**

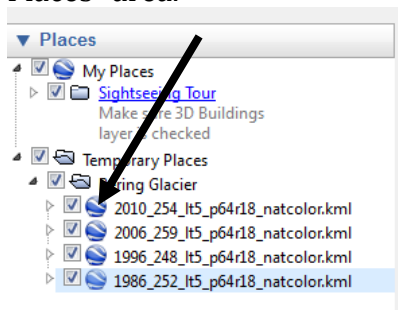
17. From the information you gathered with your measurements, did the glacier appear to grow/advance (surge) or melt/retreat (ablate)?

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What is your evidence? _____

H. DATA - 2010

18. Now, you will be looking at the data from 2010..
- Uncheck all but the 2010 Bering Glacier image, in the left-hand “My Places” area.



- Draw a line (as you did for the other years’ data) using the “PATH” tool to trace the terminus of the glacier.



- Click the “PATH” tool. Name it “**TERMINUS 2010**,” color it **GREEN**, make the width **3.0**. **Do not close the properties box.**
- Click “OK” once the line is drawn.

18. What changes in the location or movement of the terminus do you notice?

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I. GATHERING DISTANCE DATA – 2006 vs. 2010

19. Make sure both of your terminus lines for 2006 and 2010 are showing. Click on the **2006(purple)** and the **2010 (green)** data, in the left-hand “My Places” area.

d. Locate the longest distance between the two termini.



e. Click the ruler tool to measure in meters.

f. Draw a line between the two termini where they are farthest apart. Your image should look a little like the image below.



g. Record your longest measurement to the hundredths place (TERMINUS 2006(purple) -TERMINUS 2010(green)) **IN THE BOX:**

Longest measurement 06 (purple) to 10(green)	Shortest measurement	Average difference
meters	meters	meters

h. Click “CLEAR” to do the next measurement. **Do not close the properties box.**

20. Locate the shortest distance in between the two termini (purple and green lines).

a. Draw a line between the two termini where they are farthest apart.

b. Record your shortest measurement to the hundredths place [TERMINUS 2006(purple) - TERMINUS 2010(green)] **IN THE BOX ABOVE.**

c. Close the Ruler box. You do not have to save it.

d.

I. AVERAGE AND COMPARE DISTANCE DATA – 2006(purple) vs. 2010(green)

a. Determine the *average* distance between the two termini and record your answer in meters to the hundredths place **IN THE BOX ABOVE.**

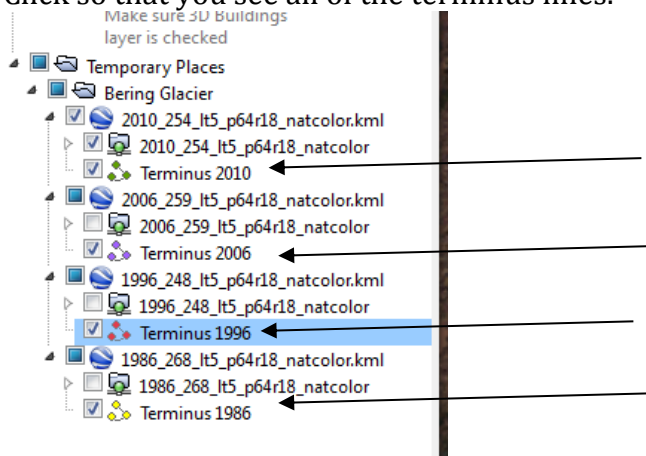
b. From the information you gathered did the glacier appear to grow/advance (surge) or melt/retreat (ablate)?

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What is your evidence? _____

III. For ANALYSIS

A. Click so that you see all of the terminus lines.



B. Your image should look like this:

