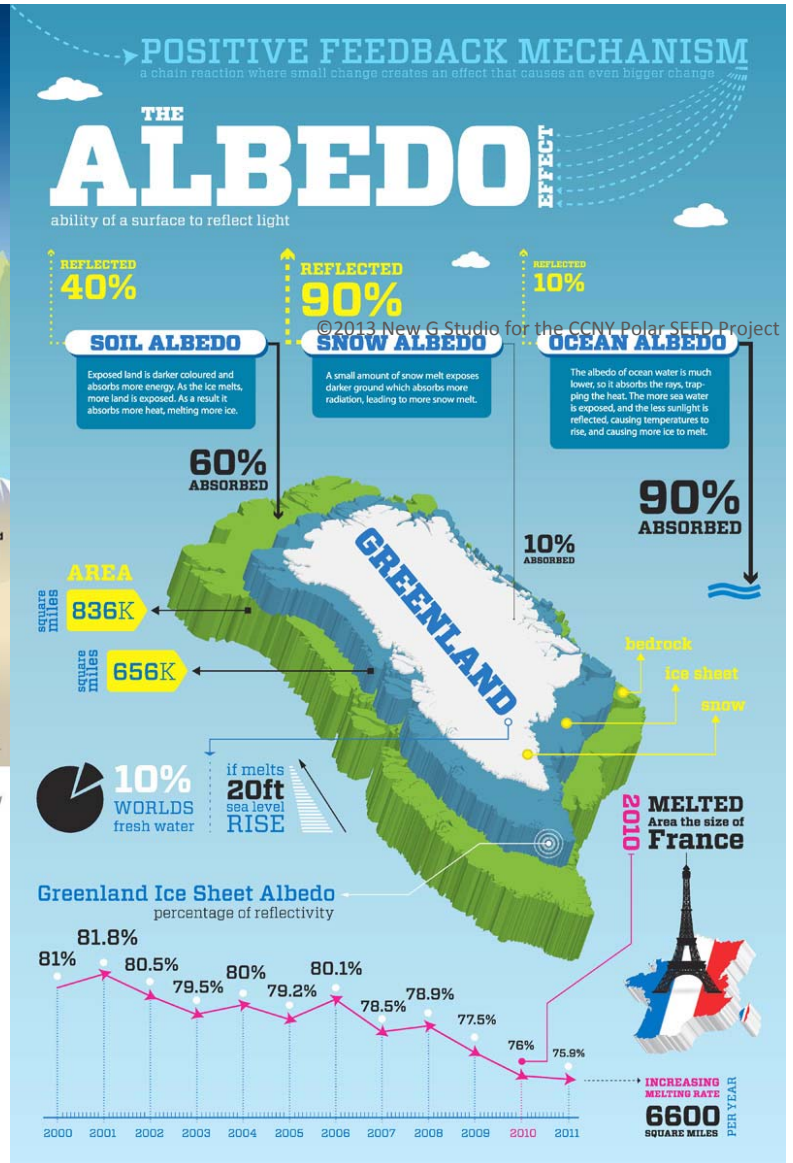
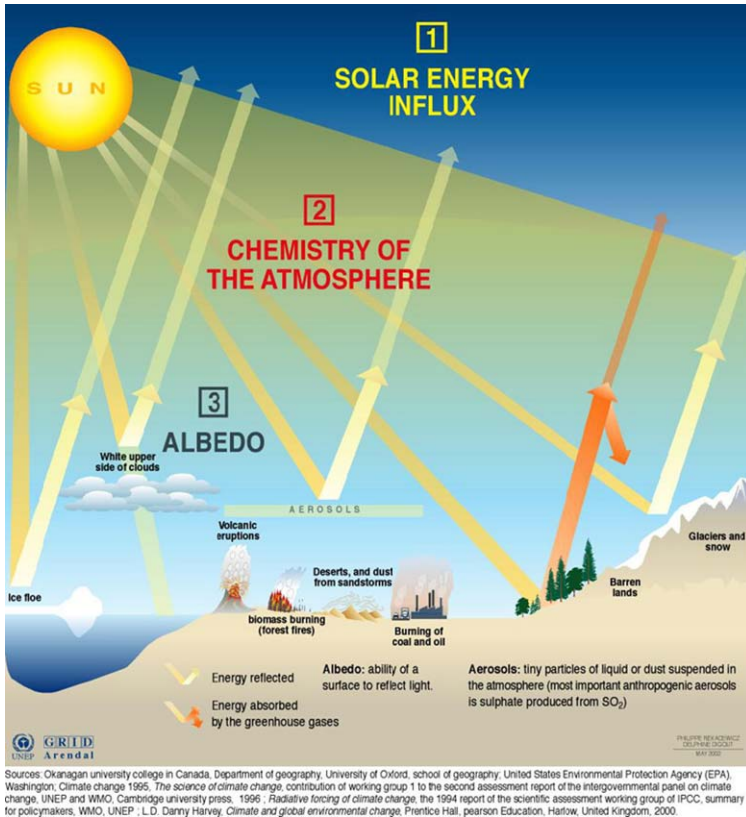


**Reflection:**

Name: \_\_\_\_\_

**Does Greenland have a healthy albedo?**



Our greenhouse gas blanket is a wonderful thing! It protects us from the Solar Wind and makes the surface of the Earth a warm and hospitable place for life, but like a living thing it does not exist in isolation or stay the same for very long. The three factors affecting the atmosphere's ability to retain heat (or its radiative forcing) are insolation (incoming solar radiation), atmospheric chemistry, and surface albedo (or reflectivity). When these factors change (either individually or in concert) the greenhouse has the ability to lose or gain radiative forcing power, making our Earth a cooler or warmer place.

Greenland is one of our two remaining continental glaciers. As a large, reflective surface, it impacts the albedo of the northern Atlantic region. In this exercise you will:

- ✿ Identify factors that contribute to differences in reflectivity on the Greenland ice sheet,
- ✿ Analyze 2000-2012 reflectivity data from a variety of elevations on the Greenland ice sheet to determine spatial & temporal reflectivity changes,
- ✿ Assess qualitatively how reflectivity of the Greenland ice sheet has changed from 2000-2012, &
- ✿ Reflect on processes and system attributes that could be playing a role in the observed changes.

**Reflectivity**

An example of a material with a high albedo (high reflectivity) is fresh snow, whose albedo is approximately 0.84. In other words, fresh snow reflects approximately 84% of the incoming sunlight that strikes it. In contrast, glacial ice not covered with snow exhibits an albedo range of 0.2 to 0.6 (20%-60%).

1. During which months of the year would you expect the Greenland ice sheet to exhibit the highest albedo? What about the lowest albedo? Why?
  
2. During a given month, would you expect all parts of Greenland to exhibit the same albedo? Why or why not?
  
3. You have satellite data of Greenland’s albedo from four different elevations from 2000 to 2012. Do the data trends on the graphs match your predictions from #1? Explain.
  
4. Study your data to answer the following questions:
  - a. What do the different colors on the graph represent?
  
  - b. Why does the black curve end in the middle of the graph?
  
5. Complete the tables:

<b>Table 1. Lowest albedo, April 1-July 1.</b>			
Elevation (m)	Lowest Albedo		
	Year	Month	Albedo (%)
500-1000			
1000-1500			
2000-2500			
2500-3200			

<b>Table 2. Comparison of 2012 albedo with 2000-2011 albedo.</b>			
Elevation (m)	April 1- May 1	May 1- June 1	June 1- July 1
500-1000			
1000-1500			
2000-2500			
2500-3200			

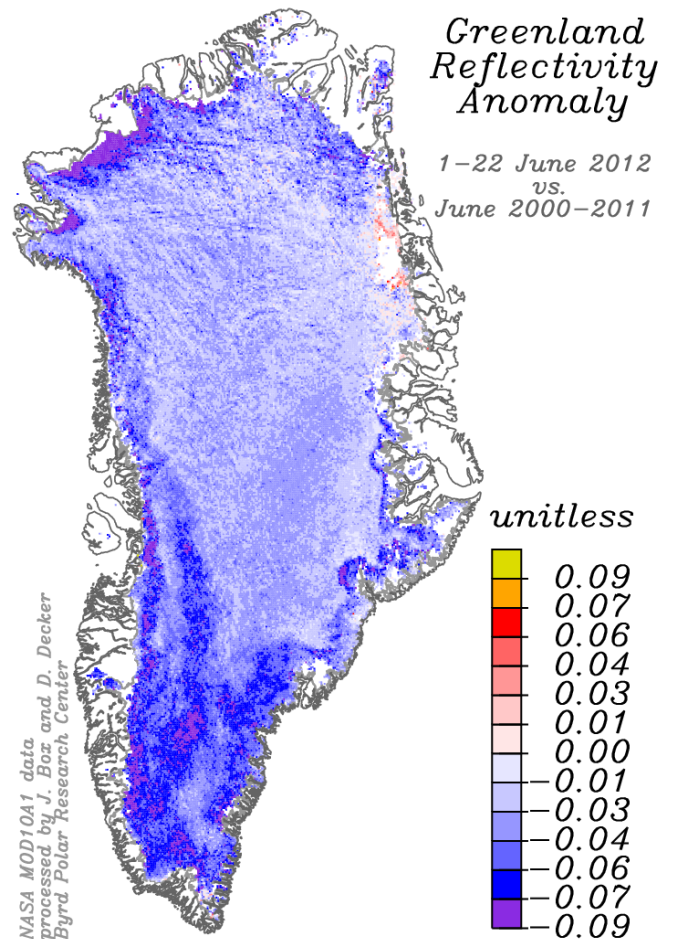
6. Use your group's data to answer the following questions:
  - a. Based on the overall data, do the higher or lower elevation areas in Greenland have the greatest albedo? Why?
  
  - b. Do the higher or lower elevations have 2012 data most similar to the 2000-2011 data?
  
  - c. Do the higher or lower elevations have 2012 data most different from the 2000-2011 data? For the elevation with the biggest difference, explain how the albedo in 2012 differed from the albedo measured from 2000-2011.

7. What do these data and your analysis suggest concerning change in the Greenland ice sheet over time? How certain would you be if you were asked to predict what the data for the rest of 2012 would look like? How certain would you be predicting what the data for 2013 would look like?
  
8. Could the albedo graphs be providing information about components of the system other than the Greenland ice sheet itself? (In other words, are the albedo graphs providing information only about the ice?) Explain.
  
9. What other information would you want to be more certain that you are interpreting the albedo graphs correctly?

**Reflectivity Anomaly**

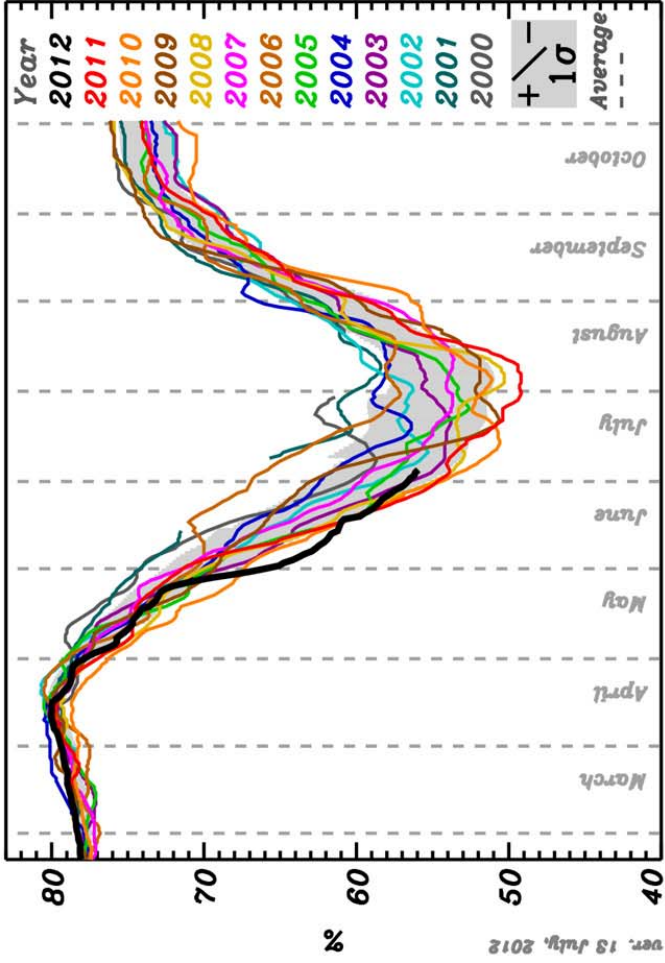
The map below illustrates the reflectivity anomaly in Greenland in June 2012 vs. 2000-2011. The measurements on the map are unitless but can be converted to albedo percentages (like the graphs you already analyzed) by multiplying by 100.

10. What does an anomaly of zero mean?
  
11. What areas of Greenland show the most pronounced positive anomalies in 2012?
  
12. Which areas in Greenland show the most pronounced negative anomalies in 2012?
  
13. Briefly summarize what the reflectivity anomaly map suggests is happening to the Greenland ice sheet. Use evidence from the map in your answer.
  
14. What other information would you want to be more certain you're interpreting the map correctly?

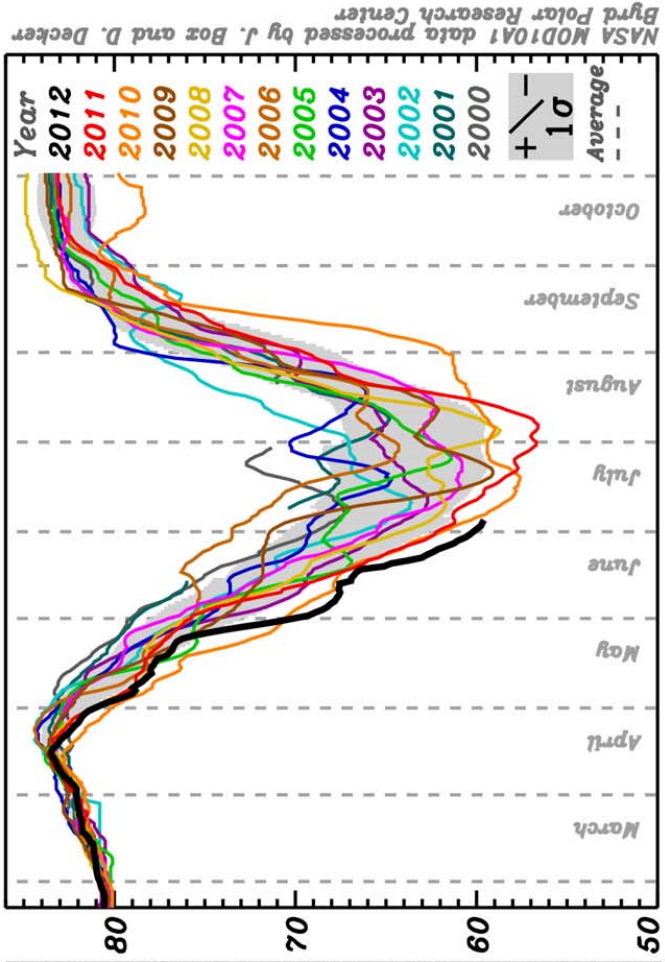




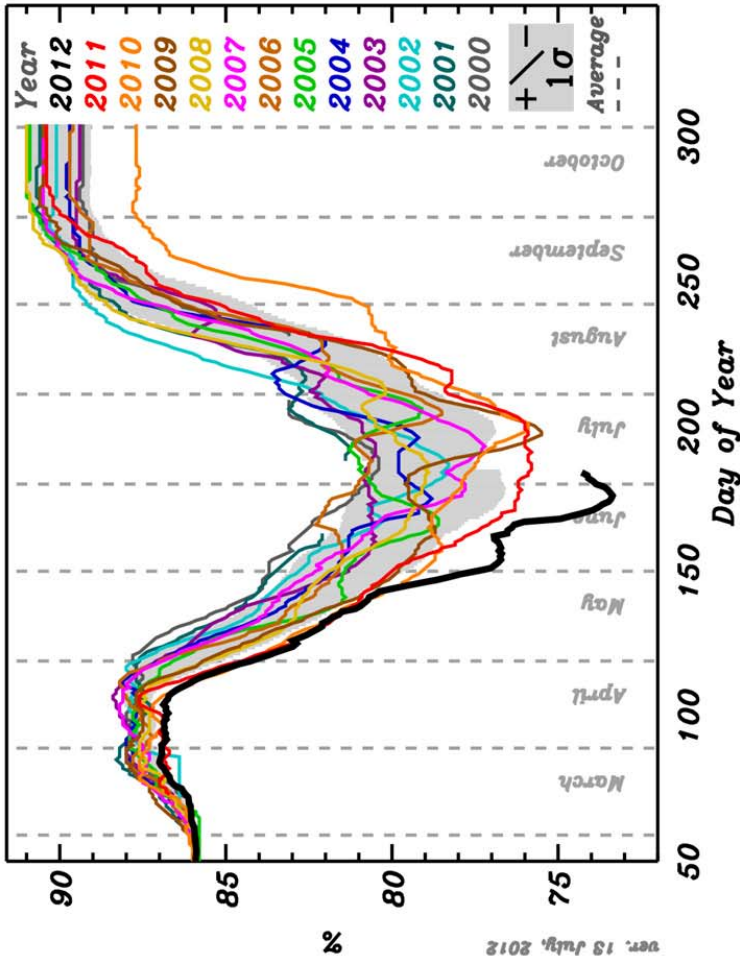
Greenland Ice Sheet Albedo: 500–1000m



Greenland Ice Sheet Albedo: 1000–1500m



Greenland Ice Sheet Albedo: 2000–2500m



Greenland Ice Sheet Albedo: 2500–3200m

