PROBLEM 1: Earth's radiative balance and temperature

Based on simple radiative balance (and ignoring greenhouse gases), calculate the temperature of the Earth for a 30% albedo.

By how much would the Earth's temperature change if the Earth's albedo rose to 40%? What if it fell to 20%? Explain and show your calculations.

In this range of albedos, for a 1% change in earth albedo, how much temperature change occurs?

(See class notes and the Kump reading for guidance if needed. Show all work – you can check the final result against the approximations I gave in class, but your final answer should be more precise.)
Name: __________________________

**Problem 2: Albedo change in a doubled-CO2 world**

Now, look at the map below. It shows the projected change in surface albedo for a high-emissions scenario by the end of the 21st century. (annual average)

Where are the largest areas of decrease? What is responsible for the changes in these areas?

Why are changes on land not more uniformly distributed? Think about the process involved.

The total change in global surface albedo is the number at the upper left (units in percent, not a fraction, i.e. this is not a 53% change). If you use the temperature-albedo relationship from the previous question, how much temperature change would albedo change alone explain? Is this a positive or negative feedback on climate change?

If this map interests you, you can make your own maps of climate projections at the following website: [http://data.giss.nasa.gov/modelE/transient/dangerous.html](http://data.giss.nasa.gov/modelE/transient/dangerous.html)