Calculating Earth's Radiative Balance

Today you will be comparing several datasets of energy measurements to determine the implications for the Earth's climate system of a first-order estimate of the Earth's radiative balance. You will receive specific instructions from your instructor about how to proceed: if you are every unsure about what you are supposed to be doing, ask!

Phase 1:
Mark on this sheet the Data Group to which you have been assigned:

Incoming Solar (Shortwave) Radiation
Absorbed Shortwave Radiation
Outgoing Longwave Radiation

Meet with the other students in your Data Group and take a look at the global map that shows your data. These data were collected by satellites in the Earth Radiation Budget Experiment (ERBE) program in the 1980's. The scale on the bottom gives the values associated with the colors. The following questions may help you make sense of what you are seeing:

What are the units of the data shown on your map?

What measurements do the data shown on your map represent?

What is the highest value of your data shown on your map?

What is the latitude and longitude of this point?

What is the lowest value?

What is the latitude and longitude of this point?

Do your data vary with latitude? How? Can you think of any reasons why or why not?

Do your data vary with longitude? How? Can you think of any reasons why or why not?

Do your data vary with surface type (ocean or land)? How? Can you think of any reasons why or why not?

Your instructor will assign you to a particular longitude. Write it here:_____
Note the value of your data at the intersection of your longitude and the latitudes listed below:

Latitude:	Your data value:
0º	
20ºN	
40ºN	
60ºN	
80ºN	
20ºS	
40ºS	
60ºS	
80ºS	

When you finish, help the other members of your data group finish theirs. Compare notes to see how similar the data are at your different longitudes.

Take a few minutes to make sure you know as much as possible about the data on your map so that you can explain the major features of this dataset to fellow members of your new Longitude Group.

Phase 2:
Meet with the other students in your Longitude Group. You should have at least one student in your group who looked at each of the Data maps: Incoming Solar (Shortwave) Radiation, Absorbed Shortwave Radiation, and Outgoing Longwave Radiation. Take a few minutes to tell the other members of your group about the major patterns in the dataset you looked at.

Now create a graph showing the latitudinal pattern of all three datasets at your longitude. To do this, plot the numbers you wrote down on your map on the graph paper provided. Plot all three datasets on the same axes—note that you will have to choose ranges that will accommodate all values! Connect all the values in each dataset with a line: dashed for Incoming Solar (Shortwave) Radiation, solid for Absorbed Shortwave Radiation, and dotted for Outgoing Longwave Radiation.

Shade the region of "surplus" radiation with one color, shade the region of "deficit" radiation with another color. What does this first-order energy budget imply for the Earth's climate system?

The following questions may help you interpret this graph:

Rank the values of the three datasets at low latitudes.

Rank the values of the three datasets at high latitudes.

Are the values of the Incoming Solar (Shortwave) Radiation always higher than the values of the Absorbed Shortwave Radiation? Why or why not?

Are the values of the Absorbed Shortwave Radiation always higher than values of the Outgoing Longwave Radiation? Why or why not?

At what latitude is the value of the Absorbed Shortwave Radiation equal to the value of the Outgoing Longwave Radiation? What is the significance of this latitude?

Phase 3:
Your instructor will guide you through the process of sharing your graphs and discussing what these datasets mean for the planetary energy balance. Take some notes on this page if you would like.