Weather & Climate: What Is the Difference between Them?

Weather and climate are very complex systems that impact us daily and over many centuries. These complex systems determine where our food supply comes from, where we live, and where we recreate. Ultimately, they influence the economies of every country on Earth. As you proceed through the lesson, keep this focusing question in mind:

? What is the difference between weather and climate,

and how do greenhouse gases influence them **?**

MATERIALS
Greenhouse Effect Diagram (PDF)
Greenhouse Effect Animated Diagram
GLOBE World Maps of Climate Data (PDF)
Sample Climate Facts

PROCEDURE
1. Study the Greenhouse Effect Diagram (PDF) and the Greenhouse Effect Animated Diagram. Answer the following questions.
   - What objects on Earth's surface reflect incoming solar radiation?
   - What objects on Earth's surface absorb incoming solar radiation?
   - Name several greenhouse gases that absorb and re-emit outgoing infrared radiation.

2. Think about what are the tools used by meteorologists to record these weather components.

3. The GLOBE program uses the Earth System Posters that allows students to explore the connections of various weather and ecosystem functions throughout the year. If your students have access to tablets or computers, they can step through the digital version. If they do not, you can print out the images from the interactive version.

   Break your students up into 5 student teams and let them explore the following: Insolation, Surface Temperature, Cloud Fraction, Precipitation and Biosphere. Each group should be prepared to share the following information with the other teams in the class, as part of a jigsaw (each student within a group will be in charge of one parameter for reporting out).

   - What changes do you see throughout the year?
   - What season and annual cycles emerge?
   - How can you explain the patterns you observe?

- Pick a location in North America, South America and Africa. What months have high values? Low values? Explain?
- Do your data indicate variations over ocean water versus land?
- Are there regions that show no changes over the year? How can you explain this?

4. Each group will be assigned to discuss on e month of all the data represented. Have the experts for each set of data discuss some of the patters the previously identified. Once all of the data are discussed, have them draw some conclusions by using the following questions:
   - What patterns in the data do you see?
   - How do the data support season in the Northern and Southern Hemispheres?
   - Do the dat support what you learned about solar heating in the land versus water?

5. Study the Sample Climate Facts handout and answer the following questions.
   - Miami, Houston and San Diego are all located at or near sea level. How can you explain Miami's higher average annual temperature?
   - Review the entire charge and identify the city that has the largest temperature range. How can you explain this temperature range?
   - Study the pattern of average morning and afternoon humidity for all of the cities. What weather variable is related to relative humidity throughout the day?
   - Omaha and Minneapolis have large temperature ranges. What do these cities have in common to explain this large temperature range?
   - Compare the climate data for Miami and New York City. Describe the similarities and differences based on what you've learned about atmospheric and oceanic factors affecting climate.

ANALYSIS QUESTIONS
   1. Describe how a smaller Arctic icecap might influence global climates (use the Greenhouse Effect Diagram (PDF) to discuss this possibility.
   2. Water vapor is one of the major greenhouse gases. If the Earth heats up 1°C, how might that change the amount of water vapor in the atmosphere? Would that affect climate?
   3. Describe the major variables that affect the climate of a particular region.

CONCLUSION
Use what you learned in this lesson to write a conclusion to the focusing question.