

Name:

Date:

Class:

Student Sheet

[Earth's Energy Budget Story Map](#) Student Sheet

Part 1: Engage

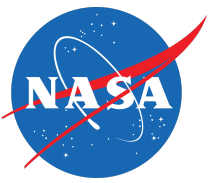
1-1. How do you interact with the Sun?

1-2. What parts of the Earth System also interact with the Sun?

1-3. What changes can we observe during the day? month? year?

1-4. What forms does energy from the Sun come in?

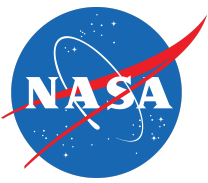
1-5. What is the range of wavelengths of the visible portion of the electromagnetic spectrum?



1-6. In this model, does the Sun appear to heat evenly? Explain.

1-7. In the diagram of Earth's axis above, is the Northern Hemisphere or the Southern Hemisphere experiencing summer?

1-8. During which month does the Northern Hemisphere receive the most concentrated energy from the Sun?



Part 2: Explore

2-1. What are the most notable features of Earth?

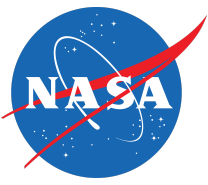
2-2. Analyze the legend for incoming solar radiation (radiative flux) shown above. What color represents the minimum? What color represents the maximum?

2-3. Describe the patterns that occur in the data over time.

2-4. Does the location of the maximum incoming solar radiation change throughout a year? Explain.

2-5. Why is the amount of shortwave radiation absorbed at the surface less than the amount of incoming shortwave radiation?

2-6. How much shortwave radiation is reflected in the diagram?



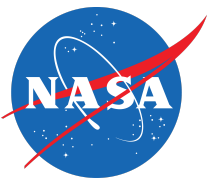
2-7. Does the amount of reflected shortwave radiation vary by location and season? How do you know?

2-8. Which locations experience the most reflected shortwave radiation?

2-9. What form of energy is received by Earth? What form of energy leaves the Earth?

2-10. Where on Earth is the most outgoing longwave radiation emitted?

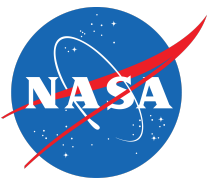
2-11. Based on the diagram, how much outgoing longwave radiation is emitted back out to space?



2-12. How much longwave radiation is emitted by the Atmosphere back to Earth's surface?

2-13. Use the equation for balancing the Earth's Energy Budget and the values shown on the diagram to determine the difference between the energy absorbed and the energy emitted at the surface. What is this difference? Is more energy being absorbed or emitted at the surface? (*Hint: Compare 'Energy In' to 'Energy Out'*)

2-14. What ideas do you have about why this imbalance is happening?



Part 3: Explain

3-1. How much energy from the Sun is absorbed? How much energy from the Sun is reflected?

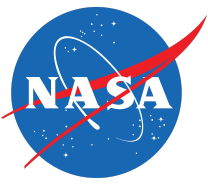
3-2. What impacts can imbalances in Earth's Energy Budget have for Earth's climate?

3-3. Revisit the diagram of Earth's Energy Budget. Where on the diagram is solar radiation, or sunlight, being reflected?

3-4. In the animation, which land cover type reflected the most light? Why is this?

3-5. Brainstorm what these colors represent in the Earth System. What sphere (Atmosphere, Biosphere, Cryosphere, Geosphere, Hydrosphere) in the Earth System do they each belong to?

3-6. How might these colors and spheres affect the solar energy received on Earth?



3-7. How is the amount of solar energy absorbed by Earth affected by albedo?

3-8. What changes to the land surface could affect Earth's albedo, and consequently, Earth's Energy Budget?

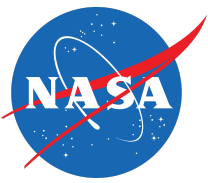
3-9. Revisit the diagram of Earth's Energy Budget. Where on the diagram is solar radiation, or sunlight, being absorbed?

3-10. How is this similar to a model of Earth's Atmosphere?

3-11. How do greenhouse gasses affect Earth's temperature?

3-12. About what year do the data values change significantly?

3-13. What factors do you think contributed to this change? Explain.



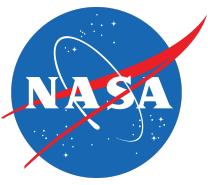
3-14. Compare and describe the different gasses and their trends over time.

3-15. Describe the following:

A. What do you see?

B. What does it mean?

C. Write your own header and caption describing the data you see here.



Part 4: Elaborate

4-1. What effect do you expect these clouds to have in the daytime on the land and living things found below?

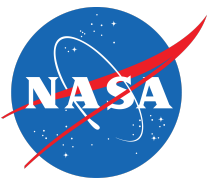
4-2. What other ways can clouds affect the Earth System?

4-3. What can you infer about the flow of energy based on the width of the arrows?

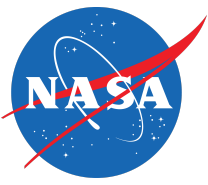
4-4. Imagine that cloud cover increased around the world. How would this increase affect the amount of incoming energy on Earth?

4-5. Why do some clouds increase the flow of longwave energy from the Atmosphere back to the surface?

4-6. How do aerosols interact with the Earth System?



4-7. What is happening in the animation in the panel?



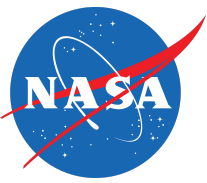
Part 5: Evaluate

5-1. Describe the net energy flow trends of the following latitudes:

- A. Around the equator
- B. Near the poles
- C. In-between the equator and poles

5-2. Compare the areas of negative and positive net energy on the map. Do these values appear to be balanced? Describe and compare their distribution and surface areas on the map.

5-3. Use the template in your student sheet to complete your own diagram of the Earth's Energy Budget.



5-4. Fill in Table 1 with evidence and scientific reasoning that supports your claim for why the Earth's Energy Budget is currently out of balance. Refer to the previous examples of data provided in the lesson.

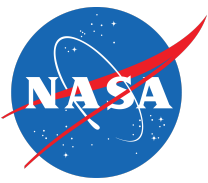


Table 1. Claims, Evidence, Reasoning

State Your Claim: Why is Earth's Energy Budget out of balance?

Provide Evidence: How does the data provided in this lesson support your claim?

Scientific Reasoning: Explain how your evidence proves your claim is correct.