

3-D Performance Assessment

Performance Expectation: **HS-ESS2-4**

Grade Level: **High School**

Title	Microclimate Change, or...watch your ash!		
Designed by	Courtney Deming and Becky Remis	Course(s)	Earth Science

Performance Expectation	<p>HS-ESS2-4: Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.</p> <p>Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.</p> <p>Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.</p>
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Science and Engineering Practice	<p>Developing and Using Models</p> <ul style="list-style-type: none"> Use a model to provide mechanistic accounts of phenomena.
Disciplinary Core Ideas	<p>ESS1.B: Earth and the Solar System</p> <ul style="list-style-type: none"> Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. (secondary) <p>ESS2.A: Earth Materials and System</p> <ul style="list-style-type: none"> The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. <p>ESS2.D: Weather and Climate</p> <ul style="list-style-type: none"> The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re- radiation into space.
Crosscutting Concept	<p>Cause and Effect</p> <ul style="list-style-type: none"> Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Student Performance	<ol style="list-style-type: none"> Components of the model Relationships Connections
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Performance Assessment

Phenomenon

A huge cloud of volcanic ash and gas rises above Mount Pinatubo, Philippines, on June 12, 1991. Three days later, the volcano exploded in the second-largest volcanic eruption on Earth in this century. Timely forecasts of this eruption by scientists from the Philippine Institute of Volcanology and Seismology and the U.S. Geological Survey enabled people living near the volcano to evacuate to safer distances, saving at least 5,000 lives.

<https://pubs.usgs.gov/fs/1997/fs113-97/>

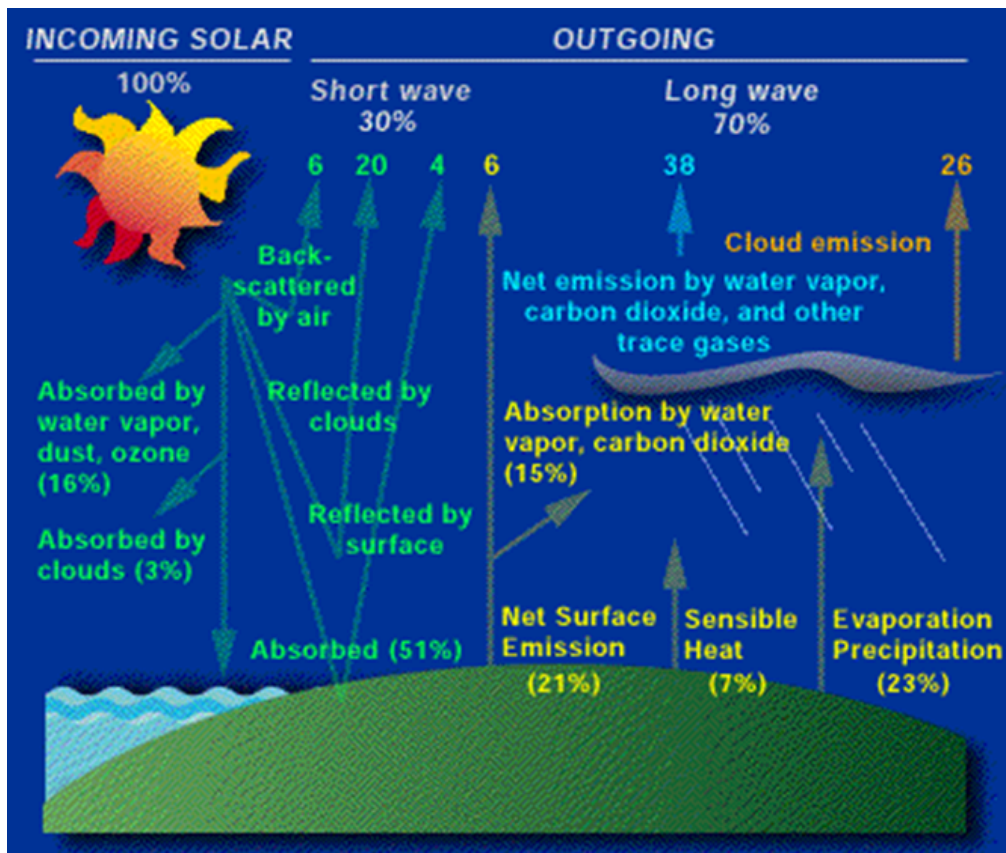


<https://bigthink.com/eruptions/the-20th-anniversary-of-the-eruption-of-pinatubo-in-the-philippines>

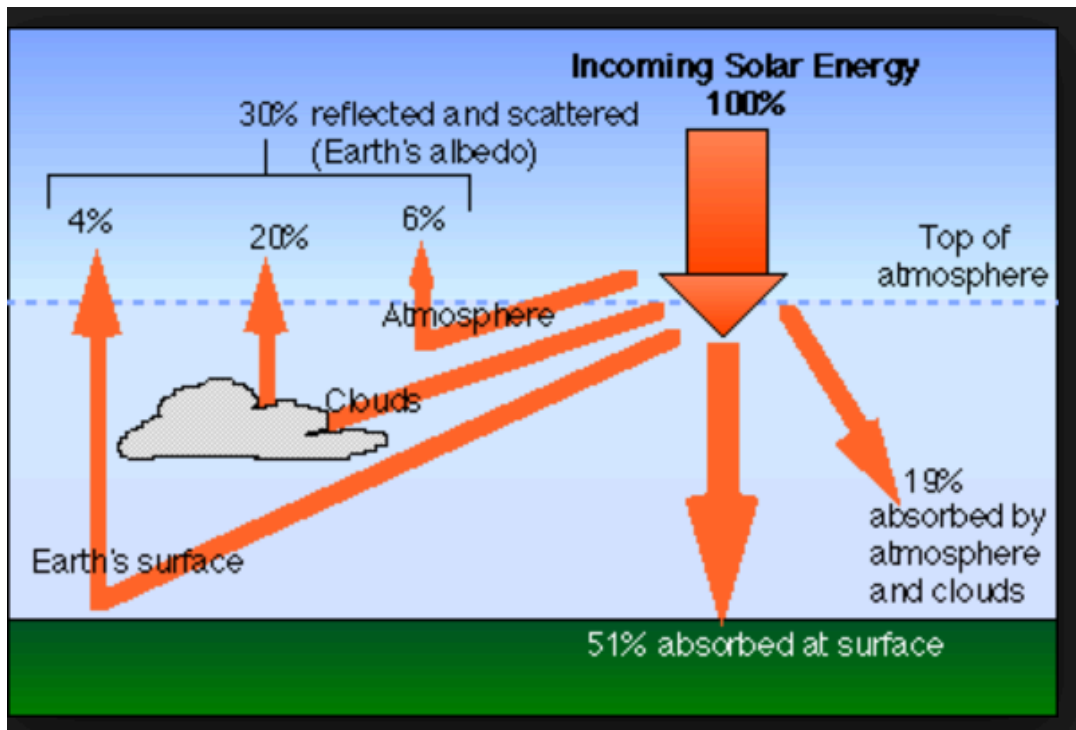
Watch this video of actual eruption footage....

<https://www.youtube.com/watch?v=WecgO8cBcZY>

Earth's Energy Balance: (possibly change the diagram)



http://pages.csam.montclair.edu/~chopping/es/ESE_CDROM/htmfiles/air/radiat.htm

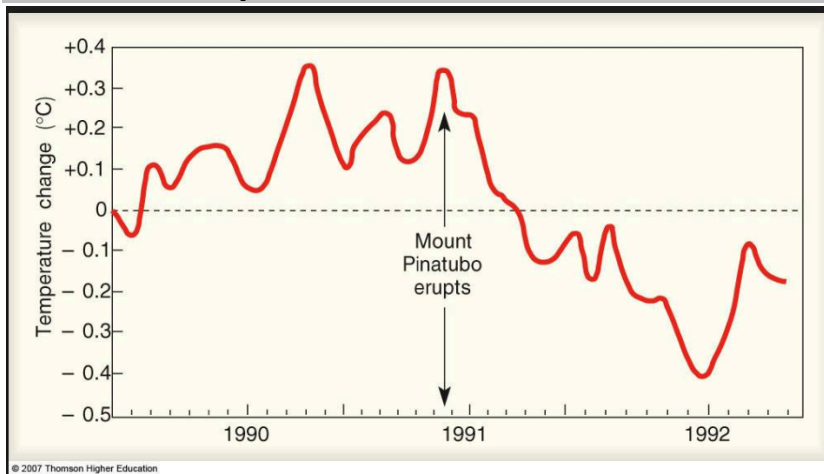


<https://www.shodor.org/os411/courses/411b/module03/unit03/page09.html>

Map of the Philippines:



Global air temperature before and after Mt. Pinatubo



Source: Apollo.lsc.vsc.edu

Prompt

1. Describe the effect of the volcanic eruption on global temperatures by citing specific temperature change evidence from the graph.
2. Explain the mechanism that caused the variation in energy flow after the eruption.
(POSSIBLY ADD Graphic organiser box arrow box)
3. Identify the components of the model of Earth's Energy Budget that would be (contribute to or interating with) affected by the mechanism stated in #2.
4. Describe how the components of the model of Earth's Energy Budget would be affected by the mechanism stated in #2.
5. The observed changes in global temperature as a result of the eruption were temporary. By 1994, temperatures returned to pre-eruption levels. Describe one mechanism that would allow the temperatures to change by referring to specific model components.

Assessment Rubric* - Question 1

	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

Assessment Rubric* - Question 2

	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

*Assessment rubric adapted from the Stanford NGSS Assessment Project <http://snapgse.stanford.edu/>

¹Wiggins, G. P. (1993). Assessing student performance. San Francisco: Jossey-Bass Publishers.