



NSDL/NSTA Web Seminar
Beyond Penguins and Polar Bears:
Energy and the Polar Environment



Thursday, November 13, 2008

Today's NSDL Experts



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<http://beyondpenguins.nsdl.org>




Overview of Presentation

1. Seasons, a refresher
2. Earth's energy balance
3. Albedo & sea ice, a climate feedback
4. Teaching strategies and K-5 resources
from *Beyond Penguins and Polar Bears*

Featuring material related to: “Energy and the Polar Environment” Issue 7, October, 2008




**BEYOND PENGUINS
AND POLAR BEARS**
an online magazine for k-5 teachers

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PROFESSIONAL LEARNING	SCIENCE AND LITERACY	ACROSS THE CURRICULUM	IN THE FIELD: SCIENTISTS AT WORK	POLAR NEWS AND NOTES
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**ENERGY AND THE POLAR ENVIRONMENT - ISSUE 7,
OCTOBER 2008**

In this issue's Science and Literacy department, we discuss the Sun's role in warming Earth, the albedo (reflectivity) of Earth's diverse surfaces, and how the decline of Arctic sea ice is affecting Earth's energy balance. Science lessons introduce the concepts of solar energy, reflection, and absorption to elementary students. In our Across the Curriculum department, we focus on another common concept: natural resources. We provide an overview of the natural resources and energy sources found in the polar regions. Lessons allow students to develop the concepts of natural resources, energy sources, and energy efficiency.

Photo: A polar bear in Churchill, Manitoba, at sunset. Copyright Greg W. Lasley, www.greglasley.net.

<http://beyondpenguins.nsdl.org>

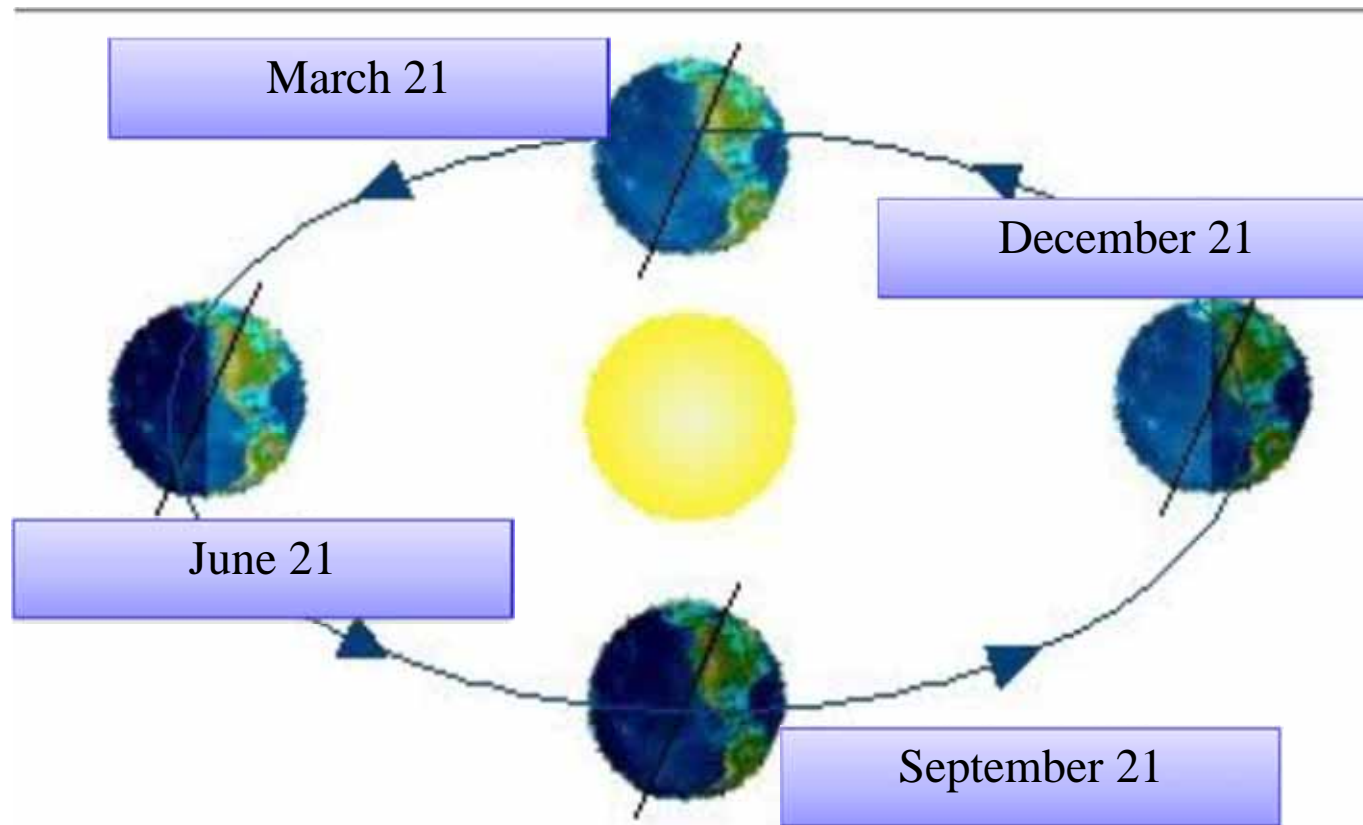


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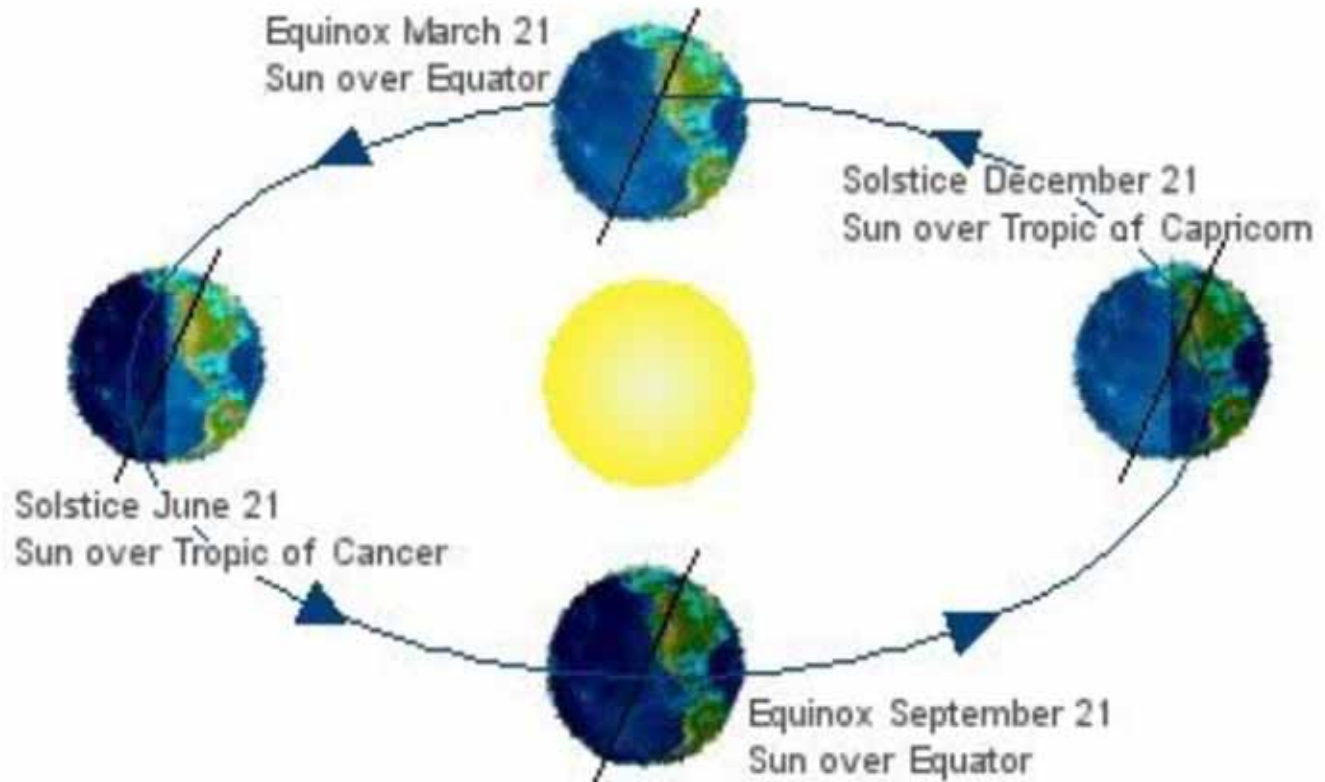


Earth's seasons: Stamp on the diagram where the Sun is overhead on the Equator





Earth's seasons



Sun overhead on the Equator at the equinoxes

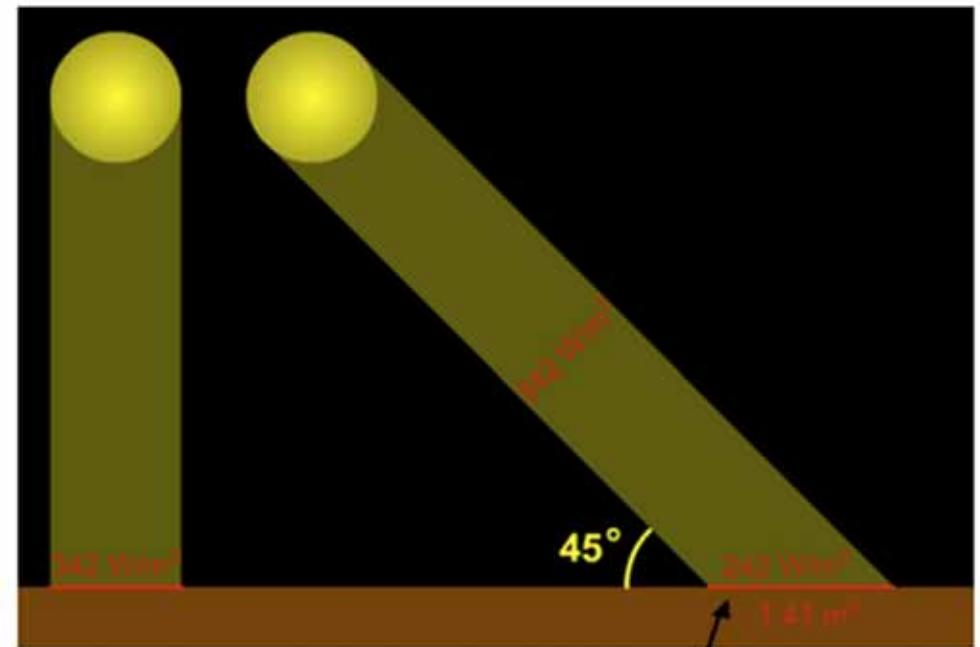
Sun overhead at 23.5 N or S at the solstices



Intensity of solar radiation



Image adapted from Wikipedia

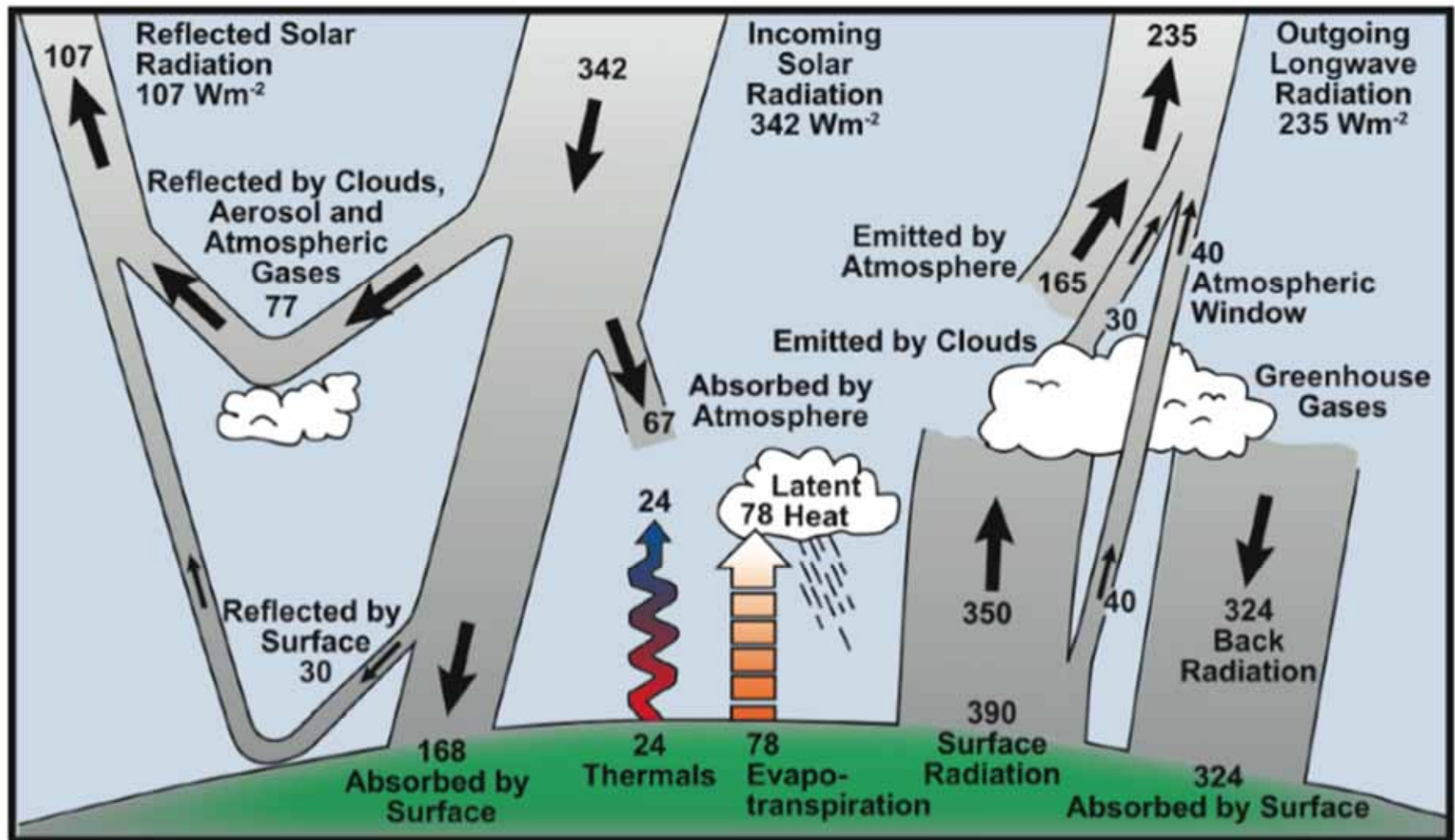


Most direct rays = most intense energy per unit of area

Less direct = less energy per unit of area on the Earth's surface

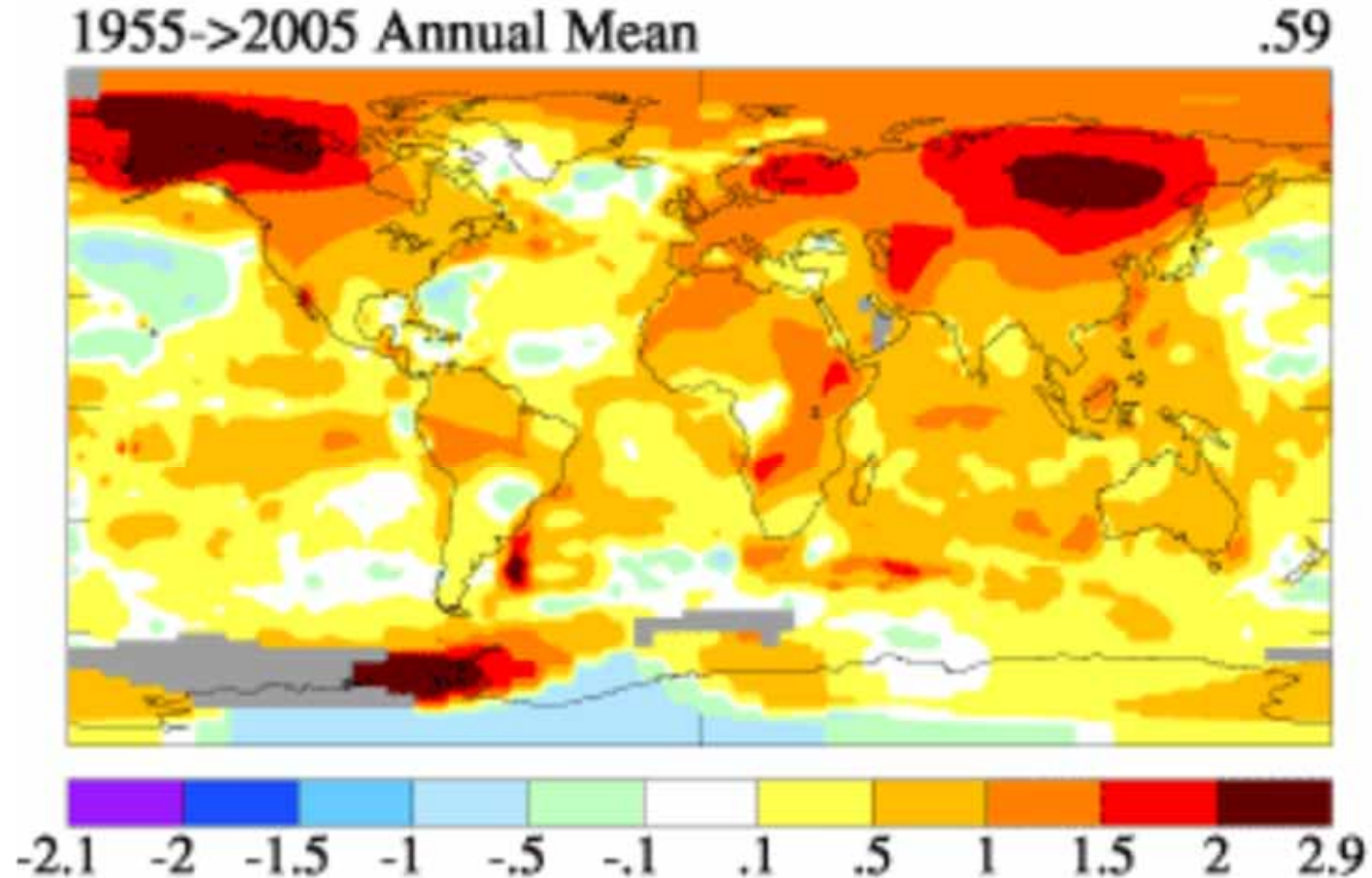


Earth's Energy Balance (the global picture)





Regional Differences



Annual temperature change over the last 50 years, based on station data (NASA GISS)



Let's pause for
questions from
the audience....



N & S Hemispheres are different in amounts of land vs. water

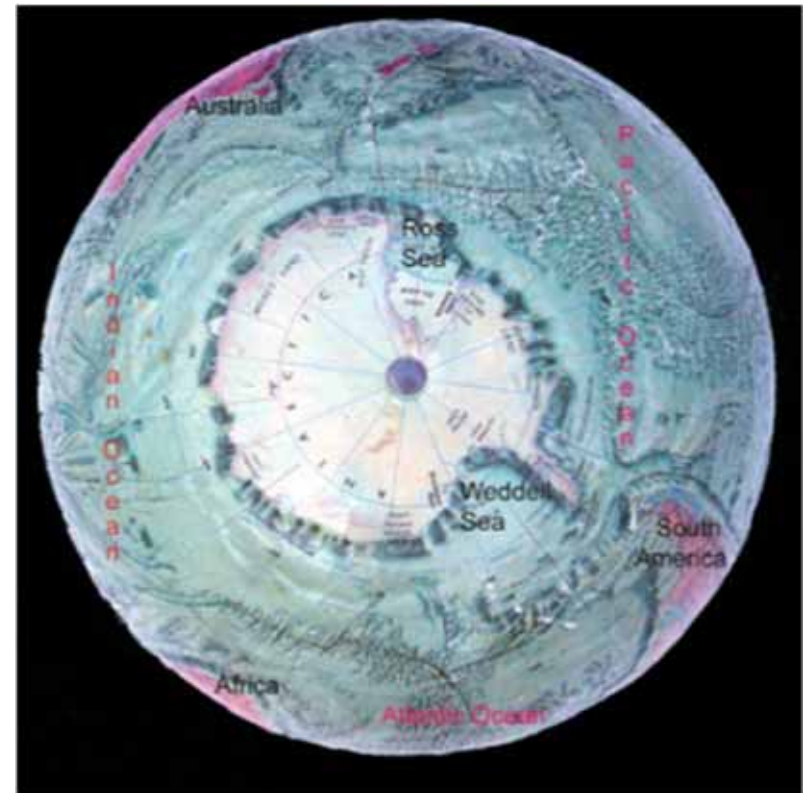
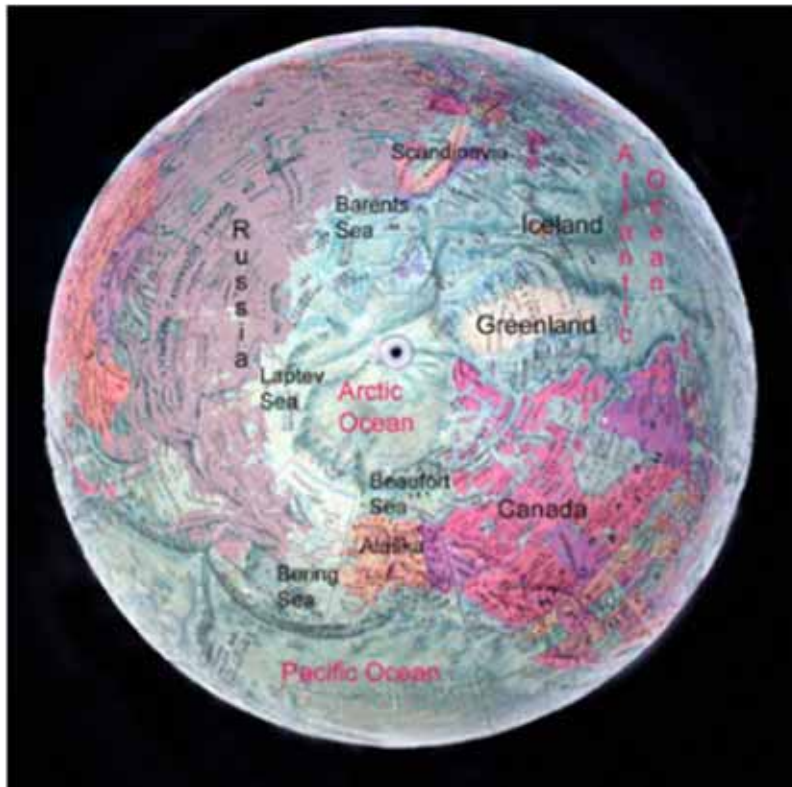


Image from: <http://www.marinebio.net/marinescience/01intro/woocan.htm>



Poll Question:

Why are the Polar Regions expected to warm more strongly in response to anthropogenic (human produced) climate change than the rest of the planet?

- A. The atmosphere is colder so even a slight warming will be obvious.
- B. The atmosphere there is colder and thus holds more water vapor, an important greenhouse gas. So the enhanced greenhouse effect is stronger there.
- C. They are more prone to positive (amplifying) feedbacks due to their more extensive snow and ice cover.
- D. The weather is usually more consistent there, so recent variations from the norm (average) are just more noticeable.



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Albedo - “Reflectivity” of a surface



<http://svs.gsfc.nasa.gov>



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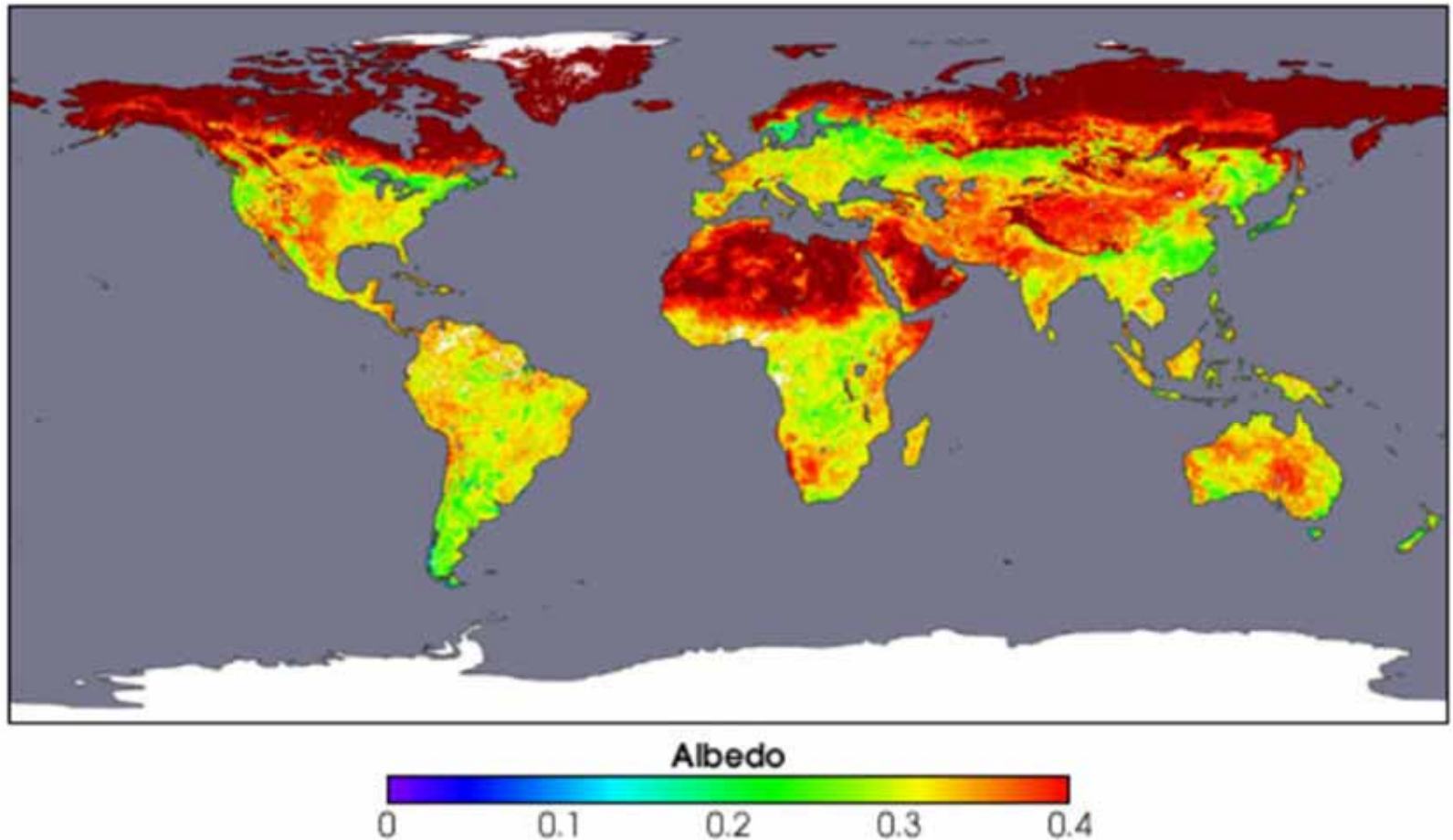


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Reflectivity of different surfaces



http://veimages.gsfc.nasa.gov/3411/modis_albedo.jpg



Lowered albedo in the Arctic- a positive feedback to climate

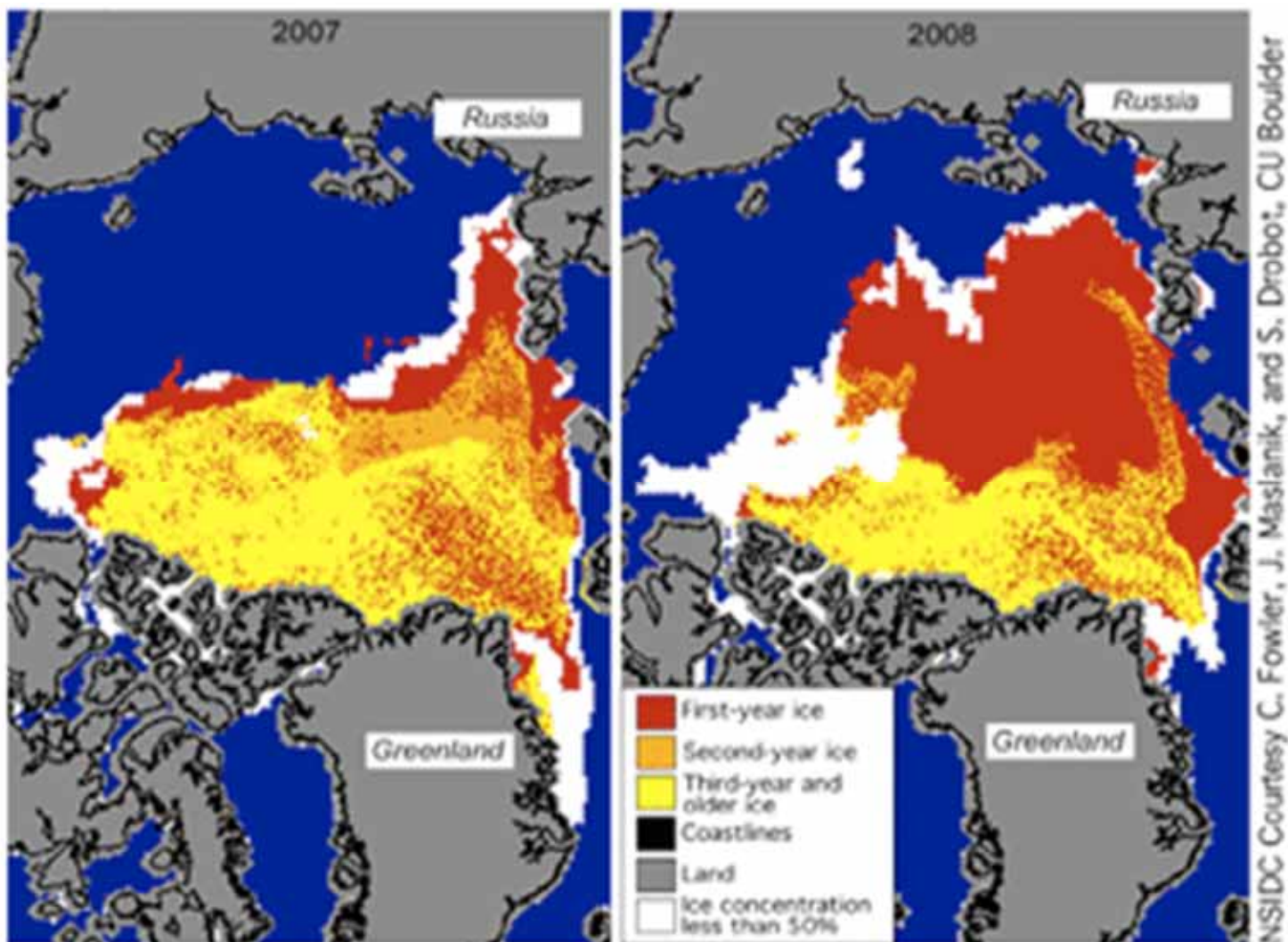


From: <http://svs.gsfc.nasa.gov/goto?10021>

As sea ice melts, the open ocean will absorb more of the Sun's energy, and then re-radiate heat back to the atmosphere.



Arctic sea ice age, at the end of the 2007 and 2008 melt seasons



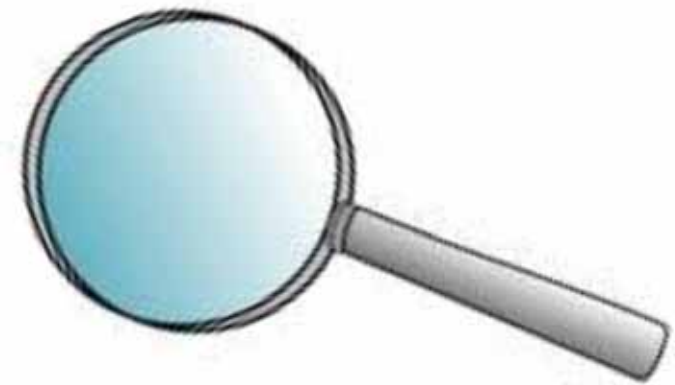
http://nsidc.org/news/press/20081002_seaice_pressrelease.html



Let's pause for
questions from
the audience....



Let's look at student misconceptions around these concepts and strategies for integrating science and literacy instruction...



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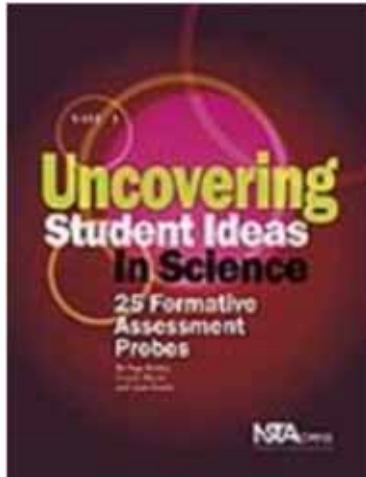
True or False: Stamp your answer



Only shiny objects reflect light.

True	False

Misconception: Only shiny objects reflect light.



Formative Assessment: “Can It Reflect Light?” (Vol. 1)

Instead: All visible objects reflect some amount of light. The amount of light reflected depends on the color and texture of the object. The **albedo** of an object is a measure of how much light it reflects.



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Target this misconception by...



Observing light reflecting off smooth and rough aluminum foil; compare to bouncing ball on smooth and rough pavement



List: What reflects light? Does not?
Explain your answers



Use lessons that introduce vocabulary such as *transparent*, *translucent*, *opaque*, *reflection*, and *refraction*

Teach Engineering: Investigating Light (Grades 3-5)

Teach Engineering: Light Scavengers (Grades 3-5)

Avoid talking about reflection only in the context of mirrors



True or False: Stamp your answer



The Earth does not receive heat from the Sun directly.

True	False

Misconception: The Sun directly heats the Earth.




Polar Science Assessment Probes

What Comes from the Sun?

 We know that the Sun is very important for life on Earth. What do we get from the Sun? Place an X next to each correct answer.

☐ Visible light

☐ Heat

☐ Ultraviolet (UV) radiation

Formative Assessment
Probe: “What Comes From
the Sun?”

In Energy and the Polar
Environment – Issue 7,
October 2008
(Misconceptions article)

Instead: Absorbed solar radiation is converted
to thermal energy.



At the elementary level, this explanation of the Sun's role in warming the Earth is developmentally appropriate.

Instead of expecting conceptual change:



www.psypress.com

Use a variety of objects and colors to show that objects absorb and reflect light differently



Use real world examples to help students connect light absorption and increase in temperature

Instead of "*The Sun heats the Earth*," say "*The Sun's energy heats the Earth*."



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Be mindful of your language and explanations

Lessons about Solar Radiation



The Warmth of the Sun:

Students in grades K-2 are introduced to the Sun's role in warming Earth's land, air, and water.

Our Super Star:

Students in grades K-5 learn about the Sun and create solar ovens to cook s'mores.

Using Thermometers:

Students in grades K-2 learn to use thermometers to measure temperature. Pair with *The Warmth of the Sun*.



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Absorption and Reflection: Light and Dark Colors



What Color Absorbs the Sun's Energy Best?

Students in grades K-2 place ice cubes on different colors of construction paper, set them in the sun, and see which ice cubes melt fastest.



Investigating Radiation

Students in grades 3-5 investigate how different surfaces (light and dark colored soil, water) absorb heat.



Poll Question



How do you integrate science and literacy?

- A. I introduce concepts with picture books
- B. My students read from a textbook and answer questions.
- C. My students use science notebooks.
- D. I teach reading strategies while reading science text.
- E. I don't integrate science and literacy.



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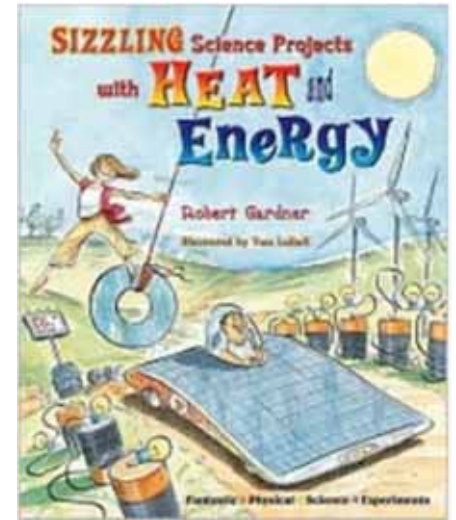
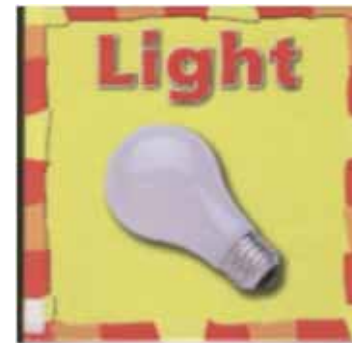
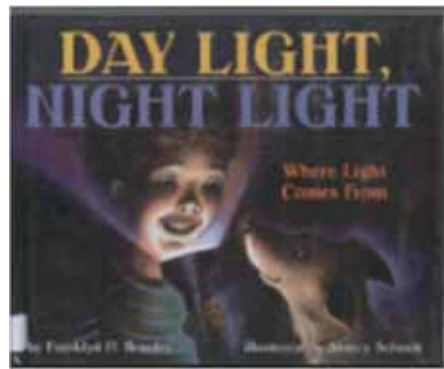
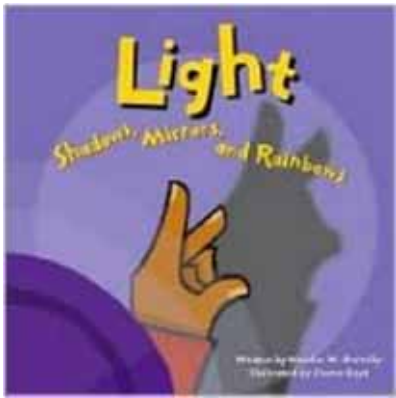
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Integrating Literacy



Content area reading: Virtual Bookshelf



Question-and-Answer books

- Gather information from nonfiction text and the Internet
- Organize with KWL charts, and create a book.

Nonfiction stories for students



Feature Story column of the magazine

Available at three grade levels (K-1, 2-3, and 4-5)

Available as text, illustrated book, and electronic book

Now paired with a nonfiction reading strategy each month



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Literacy Strategy: Note Taking



Teach students to take notes by recording key words, paraphrased definitions, and by creating graphic representations of information.

Template specifically designed for use with nonfiction stories for students

Content knowledge article available

 <http://beyondpenguins.nsd.org/>
Issue 7: Energy and the Polar Environment

Name: _____

Note It 3 Ways

Term	Meaning	Graphic Representation



Interested in learning more?



Beyond Penguins Web Seminar Series:
Next seminar: Spring 2009



Beyond Penguins and Polar Bears Blog
<http://expertvoices.nsdl.org/polar/2008/11/13/web-seminar-energy-and-the-polar-environment/>



Beyond Penguins and Polar Bears,
October 2008, Issue 7
<http://beyondpenguins.nsdl.org>



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