POLAR TREC
Learning Resources

Details

Completion Time: About one period

Permission: Download, Share, and Remix

Identifying Sea Ice

Overview
Students will undertake three different activities to help them identify a variety of Antarctic ice types.

Objectives
To provide sensory experiences that will move students toward conceptual understanding of the types of sea ice found in Antarctica.

Lesson Preparation
It is suggested that teachers survey the Resources section before beginning this series of three classroom activities for background information.

Preparation for Activity I: Use different sizes of containers to freeze ice into different thicknesses and shapes, as well as packaged ice. I used Styrofoam meat trays and bowls, crushed ice, and block ice. You may have to experiment well ahead of time to find what works best.

Procedure
Activity I. Observations of ice in the classroom. (Adapted activity from MESSENGER Exploring Ice in the Solar System)

All ice is put into a large plastic container with 3-5 cm of water to represent the sea. The amount of water will depend on the size of the container you use. Students are given ample time to observe the ice and record observations about size, shape, thickness, the feel of the ice etc. I had students use their science journals to record observations and make drawings about what they saw. A sample data sheet is attached if preferred. After observations are complete, discuss what they recorded. Observations should initiate commentary and raise questions about the experience.

Activity II. Introduce The AsPect Sea Ice Observation

Materials

- Containers of various sizes and thicknesses
- Crushed ice
- Block ice
- Large plastic container to simulate the sea
- Computer with Internet access
- Modeling clay

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program of SCAR GLOCHANT (Global Change and the Antarctic). See the Resources section.

Discuss how this program ground truths what satellites are seeing from space. Explain how this was used in the Antarctic expeditions to collect data about the characteristics and distribution of sea ice around Antarctica. Use the tutorial and image library to show the students the different types of sea ice found in Antarctica. Images are also available in the downloadable PowerPoint presentation available with this lesson. The images are great for stimulating discussion and raising questions about how each different type forms. The ASPect program has considerable information on sea ice processes. As you move through the images, ask them if there was anything like the photo examples in their classroom "sea". After this class discussion, assign individuals or teams to research particular sea ice types.

Activity III. Creating Models of Sea Ice

Crayola Modeling clay works really well for this activity because it is easily molded and dries quickly, however, any molding clay or material can work. (Be creative!) Students or teams will build models of their ice type. (My students told me that this part was very important in helping them understand and remember the different types of ice. It moved them from a concrete experience to conceptual understanding!) When models are completed, allow them to air dry overnight, or as long as needed, depending on materials used. Students will use their research and models to explain the different types of sea ice.

Extension
N/A

Resources
Exploring Ice in the Solar System Curriculum Module, http://montana.jhuaple.edu
ASPect Antarctic Sea Ice Processes and Climate, www.aspect.aq/science .html
Antarctic Expeditions, www.polartrec.com

Assessment
Students are given photographs of sea ice from the expedition to identify the primary, secondary, and tertiary types; and to estimate the percentage of the photo that the sea ice covers. On-going assessment included communicated knowledge, journal work (or data sheet completion), accuracy of models, written summary of research on sea ice types, and presentation.

Credits
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Learning Resources

National Science Education Standards (NSES):

Content Standards, Grades 5-8

Content Standard A: Science As Inquiry
a. Abilities necessary to do scientific inquiry
b. Understandings about scientific inquiry

Content Standard B: Physical Science
a. Properties and changes of properties in matter

Content Standard G: History and Nature of Science
a. Science as a human endeavor

Other Standards:
N/A

Identifying Sea Ice – Outline for Sea Ice Types

This outline was created from information from the ASPeCt (Antarctic Sea Ice Processes and Climate) tutorial at www.aspect.aq/index.html More information and a downloadable CD ("Observing Antarctic Sea Ice") with ice images can be found at that site. My purpose for including this outline is to give the classroom teacher an organizational tool that can be used with the activity.

I. What is sea ice?

A. Sea Ice is frozen sea water.

B. It is found in the Polar regions/oceans

II. Categorized by size and age

A. New ice is < 10 cm thick. It is recently formed ice. Includes:

1. Frazil

2. Grease

3. Shuga

4. Nilas

5. Pancake (may be > 10 cm)

B. Young ice is 10-30 cm thick. Includes:

1. Grey ice- 10-15 cm

2. Grey-white ice- 15-30 cm

C. First year ice > 30 cm up to 120 cm; has no more than one winter's growth

D. Old ice includes:

1. Second year ice- survives one summer- most common in Antarctica

2. Multi-year ice- survives at least two summers- most common in the Arctic

III. Descriptions of ice types

A. Brash ice

1. Accumulations of floating ice

2. The "wreckage" of ice

3. Pieces not more than 2m across

4. Common between colliding floes or collapsed pressure ridges

B. Shuga

1. Spongy white lumps

2. Few cm across

3. Comes from grease ice, slush (snow saturated and mixed in water), or anchor ice that rises to the surface

4. Forms in bands along the direction of the wind; formed by wind and water action.

C. Hummock

1. Caused by convergence of ice floes

2. Similar to ridging but not linear

D. Ridging

1. Pressure pushes ice together and upward forming ridges

2. Antarctic has point features

3. Arctic has linear features

E. Pancake

1. Floes begin with circular diameters of tens of cm

2. Wind and wave action aggregates loose frazil and increases diameter

3. Sizes range from 30 cm- 3M

4. Raised rims caused by pieces striking against each other

F. Icebergs

1. Massive pieces of ice broken away from glacier or ice shelf

2. May be afloat or aground

3. More than 5M above sea level

4. Varying shapes

5. They are NOT sea ice- they originate from the ice mass on the continent-thousands of years old

G. Leads

1. Fracture or passage way through ice-navigable by vessels

2. Area of open water or new ice between ice floes

3. “Coastal “ lead- between the shore and pack ice

4. “Flow” lead- between fast ice and pack ice

H. Frazil Ice

1. Fine spicules or plates of ice suspended in water

2. The first stage in sea ice growth

3. Crystals are suspended in the top centimeters of the ocean surface

4. Gives water a “soupy” appearance

I. Grease Ice

1. A later stage of freezing than frazil ice

2. Reflects little light- has a matte appearance

3. Behaves in fluid-like manner

4. Does not form ice floes

J. Fast Ice

1. Sea ice that remains attached to shore, ice wall, ice front, coast, or icebergs

2. Formed by sea water or ice pack

3. Can extend up to several hundred KM from the coast

4. May be more than one year old

K. Pack Ice

1. Any area of sea ice except pack ice

2. Very open: ice concentration 1/10 - 3/10

3. Open: ice concentration 4/10 – 6/10; many leads; polynas; floes not in contact with each other

4. Close: ice concentration 7/10 – 8/10; floes mostly in contact

5. Very close: ice concentration 9/10-10/10

6. Compact: ice concentration 10/10; no water visible; called consolidated if packs are frozen together

L. Floes

1. Any contiguous piece of ice of similar ice type

2. Small floes: 20-100m

3. Medium floes: 100-500m

4. Large floes: 500-2000m

5. Vast floes- no visible breaks

M. Fractures:

1. Breaks in close pack ice, consolidated ice, ice floes, or fast ice

2. Narrower than leads

3. Do not aid in navigation of vessels

4. Facilitate high heat transport between ocean and atmosphere

5. Sea smoke (water vapor) can often be seen

N. Rafting

One piece of ice overrides another

2. Finger thrusting: interlocking “fingers” of ice are thrust over and under each other

O. Ridging

1. A line or wall of broken ice forced upward by pressure

2. Consolidated ridging: contains a considerable % of ice mass from ice that has frozen together

3. Old weathered ridge: consolidated and weathered

P. Snow Ice

1. Refrozen flooded snow

2. Forms ice layer on the top surface of a floe

Q. Polynas

1. Non-linear openings enclosed by ice

2. Submarines called them “skylights”

3. Shore Polyna: bounded on one side by the coast

4. Flow Polyna: bounded by fast ice

5. Recurring Polyna: recurs in same position/location every year

6. Size: small to enormous

7. Largest: Weddell Polyna (75-77)- $2x10^5 KM^2$

8. Latent heat polynas: maintained by Katabatic winds; newly formed ice advected away; source of new ice formation

9. Sensible heat polynas: maintained by upwelling warm waters; supplies heat flux to base of ice; does not produce lots of new ice

Identifying Sea Ice – Student Data Sheet

Record your observations of the “sea ice” on the following table. Give as much detail and information as possible.

Draw what you see	Describe what you see