POLAR TREC
Learning Resources

Details

Completion Time: More than a week

Permission: Download, Share, and Remix

Model Making Mania!

Overview

During this lesson, students will learn basic glacial features and how to interpret Topographic maps and satellite images in order to create a model replica of a glacier valley. The Dry Valleys of Antarctica have classic glacial features, both in the barren valleys and in the remaining glaciers in the area. The glaciers are a major contributor to lake levels in the local lakes as well as to the biological makeup within the lakes. As such, it is helpful for students to understand glacial features. Creating models and interpreting maps are practical skills that dovetail nicely with this project. Glaciology, model making, and map interpretation combine to make this an effective, and fun (although potentially messy!) lesson.

Objectives

- Students will learn how to use satellite images and topo maps to create a scaled model of Taylor Valley; students will learn how to read topo maps.
- Students will be able to identify at least 6 main features of glaciers (Moraines: terminal, lateral, and medial; Cirque; Moulin; Esker; Erratic; U-shaped Valley).
- Students will be able to recognize glacial features in NH (U-shaped valleys, glacial scarring, erratics).
- Students will be able to identify basic glacial features and will be able to recognize environmental evidence of past glaciers.
- Students will recognize how satellite images can assist us in determining local environmental conditions.
- Students will work collaboratively in small groups to create a final project.

Lesson Preparation

I begin this lesson with a brief introduction to basic glacial features using a Power Point presentation. Students write down information and definitions about various glacial features (moraines, moulins, U-shaped valleys,

Materials

- Power Point of basic glaciology (terms, images – local and "typical")
- Pictures of features (U-shaped valleys, erratics, etc) for discussion
- Students will bring in cardboard for model base and cans/soda bottles/newspaper for construction of mountains
- School will provide "rigid wrap" or comparable material for model building
- School will provide Plaster of Paris for creating glaciers
- Topo maps of Taylor Valley (or valley being created!)
- Satellite images of Taylor Valley (or valley being created!)
- Access to a digital camera

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eskers, etc.) as we review images of glaciers that depict each feature. We also look at pictures of our local area that show evidence of prior glacial activity (such as U-shaped valleys, eskers, erratics, glacial scouring, etc.).

Time Frame: (about 7 class periods for it's entirety – can be more or less depending on groups and how much of the plan is used – parts can be done without others!)

- one 45 minute class period for basic glacial introduction – ppt
- one 45 minute class period for practice/intro reading Topo maps
- three 45 minute class periods for Constructing Taylor valley Models
- one 45 minute class period for downloading camp/mountain pictures and making signs/labels for the model
- one 45 minute class period for downloading pictures and posting to blog pages.

Procedure

- Begin this lesson with an overview of glaciology: what is a glacier, why do they move, what are common features, what evidence can indicate prior glacial activity, etc.
- Begin using topographic maps. Depending on the age and experience of the group, it may be necessary to start with a couple of very simple topo maps (include only 1 or 2 hills) and have students create clay representations of the maps. Once the basics are understood, a topographic map of Taylor Valley, Antarctica should be distributed to each group (topo maps can be retrieved from the web site listed below).
- Give students time to "get a sense" of what the valley looks like based on their understanding of the topo map. A class discussion is quite helpful. Probing questions such as: how many mountains are there, how tall are the mountains, how steep are their sides, is one side steeper than another, what does the space between the mountains look like, is the valley V-shaped or U-shaped, etc.
- Once students have a fairly good understanding of what the valley looks like, show satellite images of the area (also found on web site below).
- Also include images from people in the valleys (Robin Ellwood's PolarTREC journal, Dr. Doran's web site, the LTER website – all links are listed below under Resources)
- Explain that students will be building a 3-D model of this valley including the valley glaciers that seep in from the sides.
- Distribute the rubric for building the model (included below) and review with the students. Students will need to bring in a piece of cardboard for the model base, newspaper, and empty soda bottles for the model making (a visit to the school recycling area usually yields more than enough cardboard, newspaper, and bottles – in fact, you may wish to have the students get their supplies from there rather than bringing in more from home).
- Students typically take 2 class periods to get the mountains and valley to the correct proportion, heights, etc. I have found that "Rigid Wrap" is a great material to use for the forming of accurate mountains.
- Once the valley and mountains are created, the glaciers can be poured.
- Students should make cardboard borders that mark where the edges of the glaciers are in the valley – this will stop the plaster from flowing too far!

- Use a 16 oz. cup (or if you want the models to be larger – go for it…. it tends to get messier as the models gets bigger!). Fill the cup about ½ full with Plaster of Paris and fill the rest with water. Mix until there is a consistency of a fairly thick milk shake. Have the students pour the plaster into the valley from the appropriate spot for each of the required glaciers. The plaster flows in the same way the ice does – moraine lines, etc can be seen in the plaster.
- Once the plaster is fairly dry, have students remove the "barrier" cardboard to leave the exposed edge of the glacier.
- Students can then make the labels and download/print pictures for the various glacial features as well as research camp sites etc.
- It's Fun!

Extension
I have also had groups make one giant glacier instead of the Taylor Valley. Each group makes a large mountain with various pitches, ledges, valleys, etc. A bucket full of plaster is poured onto each of these mountains. The moraine lines show up really well. I have then had students put sand/gravel along the moraine lines. We have even put straws onto the mountain before the plaster is poured which can then simulate moulins once the project is complete.

Thermodynamics of chemical reactions can also be studied. Students can place temperature probes into the plaster as it is poured – this will record the cooling, heating, and eventual cooling of the plaster as the chemical reactions take place.

A unit on Climate Change is also relevant here – discussing the movements of glaciers based on climate and the resulting impact on environmental features and ecosystems.

Resources
Dr. Peter Doran's Home Page:
http://tigger.uic.edu/~pdoran/home.htm

McMurdo Dry Valley Long Term Ecological Research (LTER) Site:
http://www.mcmlter.org/

Robin Ellwood's PolarTREC Journal:
http://www.polartrec.com/lake-ecosystems-in-antarctica

Topo Map (this map is interactive and can be modified to desired scales)
http://www.mcmlter.org/mapping.htm (click on "Launch Online Map Now")
You will be able to create the map you desire by clicking on the "+" boxes and checking off the features you wish to have. I have included an example of the map I use in class (attached).

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Assessment
Student content understanding is assessed through post quizzes and tests.
Student models are assessed based on the attached rubric.

Credits
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Learning Resources

National Science Education Standards (NSES):

Content Standards, Grades 5-8

Content Standard A: Science As Inquiry
b. Understandings about scientific inquiry

Content Standard B: Physical Science
b. Motions and forces

Content Standard D: Earth and Space Science
b. Earth's history

Content Standard E: Science and Technology
b. Understandings about science and technology

Content Standard G: History and Nature of Science
b. Nature of science

Other Standards:
NH State Standards (grade 7-8; ES = Earth Science):

ESS1.1.2 ~ Identify and describe the impact certain factors have on the Earth's climate, including changes in the oceans' temperature, changes in the composition of the atmosphere, and geological shifts due to events, such as volcanic eruptions and glacial movements.
ESS1.7.0 ~ WATER- Describe how water flows into and through a watershed, falling on the land, collecting in rivers and lakes, soil, and porous layers of rock, until much of it flows back into the ocean.
ESS1.7.3~ Explain the processes that cause cycling of water into and out of the atmosphere and their connections to our planet's weather patterns.
ESS4.0 ~ The growth of scientific knowledge in Earth Space Science has been advanced through the development of technology and is used (alone or in combination with other sciences) to identify, understand and solve local and global issues.
ESS4.1.1 ~ DESIGN TECHNOLOGY- Describe ways in which technology has increased our understanding of the world in which we live.
ESS4.2.3 ~ Describe how man uses land based light telescopes, radio telescopes, satellites, manned exploration, probes and robots to collect data.
SPS3.1.2 ~ Work collectively within a group toward a common goal.

I have included an example of the map I use in class here:

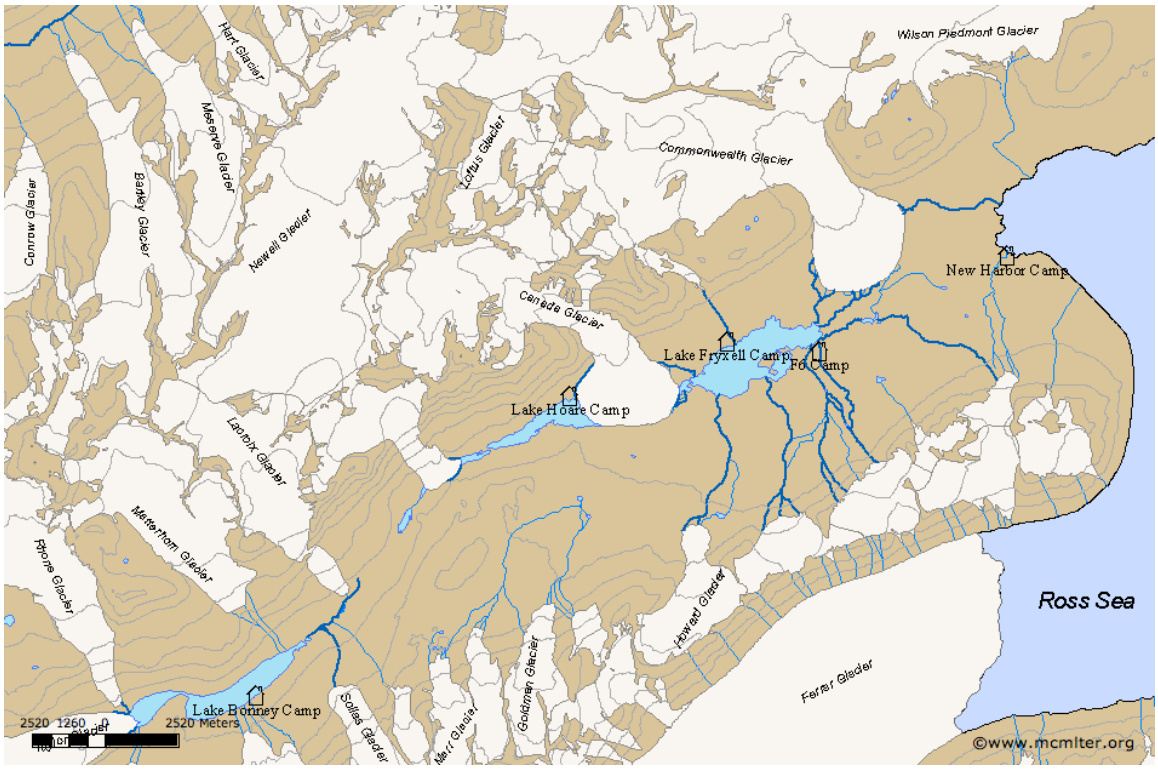

Photo Credit: www.mcmlter.org - online mapping for the McMurdo Dry Valleys LTER (©2006 McMurdo Dry Valleys LTER)

Examples of satellite images are also included here:

http://lima.nasa.gov/view/

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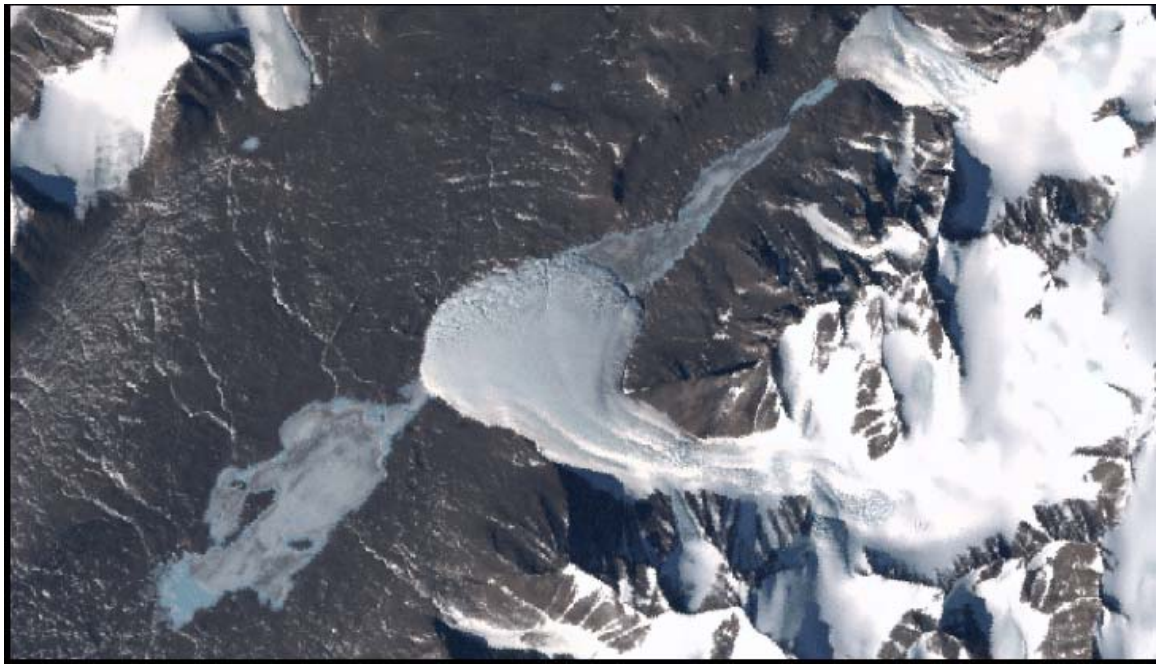

http://lima.nasa.gov/view/

Another helpful map site:
http://geology.com/world/antarctica-satellite-image.shtml

Model Making Mania!
Rubric

Scaled Model of Taylor Valley:

Requirements:	Points Possible:	Points Received:
Title	5	
3 Mtn peaks on each side of valley (name and elevation)	20	
Glaciers and Labels: Taylor, Commonwealth, Suess, and Lacroix. Plaster pour for each glacier – proper distributions	30	
McMurdo Sound, Lake Fryxel, Lake Hoare, Lake Chad, Lake Bonney, and Mummy Pond – each labeled appropriately	12	
Camp Site Pictures and Labeles: Hoare, Fryxel, Bonney	9	
Repeater Station labeled (Mt. Coates)	4	
Correct scale distribution (1 cm = 100m vertical)	20	
Total:	100	

- Students are also asked to post the projects to their blog sites; the following rubric is used:

Blog:

Blog Requirements:	Points Possible	Points Received:
Picture of Finished project	10	
2 Close up pictures of any model section	20	
3 Pictures of the building process	30	
2 Pictures of the plaster pouring	20	
Minimum of One paragraph about the process	20	
Total:	100	