

Lesson 15: Ice Ages & Climate Dynamics

Summary

Discuss the causes of ice ages on Earth and determine if Mars experiences similar climate dynamics as Earth.

Learning Goals

Students will be able to:

- Observe ice ages through time and provide explanations for icehouse/greenhouse periods.
- Determine if Mars goes through similar Earth climate changes
- Distinguish between different drivers of climate change at different scales
- Form an informed opinion regarding global warming

Context for Use

It is advisable that students are familiar with basic lithology and mineralogy to be successful in these activities and homework sets. This learning module may be utilized in any course where global warming and climate change are discussed.

Description and Teaching Materials

In-Class Activity

In-Class Activity 1: Ice Ages through time

Homework/Lab

Homework 1: Ice on Mars

Teaching Notes and Tips

1. Infuse data from <http://climate.nasa.gov/>
Students can make graphs of change over time, focus on a specific region, compare Arctic and Antarctic, etc.
They can also compare Earth's poles to Mars poles OR evidence of ice on both planets

2. It is advisable that students understand that Mars can change its axial tilt prior to completing *Homework 1*. This will enable students to properly evaluate the effect of Milankovitch cycles on Mars' climate.

Assessment

Methods of assessment are within each individual *In-Class Activity* and *Homework*.

Mars for Earthlings

References and Resources

1. Paleogeography through time YouTube video:
<http://www.youtube.com/watch?v=Q2dAmLnR3tA>
2. Ice age references: <http://www.pbs.org/wgbh/nova/earth/cause-ice-age.html>
http://geology.utah.gov/surveynotes/gladasked/gladice_ages.htm
3. Ted Talk 2009 on James Balog: <https://www.youtube.com/watch?v=DjeIpbhAqsM>
4. Extreme Ice Survey website: <http://extremeicesurvey.org>
5. Milankovitch cycle information:
http://www.indiana.edu/~geol105/images/gaia_chapter_4/milankovitch.htm
6. Mars Orbital Parameter reference: : <http://phoenix.lpl.arizona.edu/mars172.php#1>
7. SERC webpage: <http://serc.carleton.edu/climatechange/index.html>



Mars for Earthlings

Homework 1

Ice Ages_MFE

Ice on Mars

Objective: Find and understand terrains on Mars that contain or harbor ice.

Activity/Assignment:

1. Research regions on Mars that have been identified to have fretted terrain.

Hint: Fretted terrain is most common in northern Arabia, between latitudes 30°N and 50°N and longitudes 270°W and 360°W. Two good examples of fretted terrain are Deuteronilus Mensae and Protonilus Mensae.

2. Using JMARS, search for and capture images of the following:
 - a. Fretted terrain
 - b. Softened terrain
 - c. Lobate morphologies
 - d. Make note of the following for each captured image:
 - i. Lat/Long,
 - ii. Zoom increment
 - iii. Map used for each image captured (THEMIS, MOLA etc.)

What the students turn in:

3. Have students compile their findings into a .ppt presentation (Have them print out their slide presentation with speaker notes where they've indicated any important info)
 - a. Label all features.
 - b. For JMARS images, label the feature, Lat/Long, Zoom increment, and Map on each slide (with the image).
 - c. Use the "speaker notes" to further elaborate on their findings.
 - d. They should have at least 3 slides
 - i. Slide 1: fretted terrain
 - ii. Slide 2: softened terrain
 - iii. Slide 3: lobate morphology

