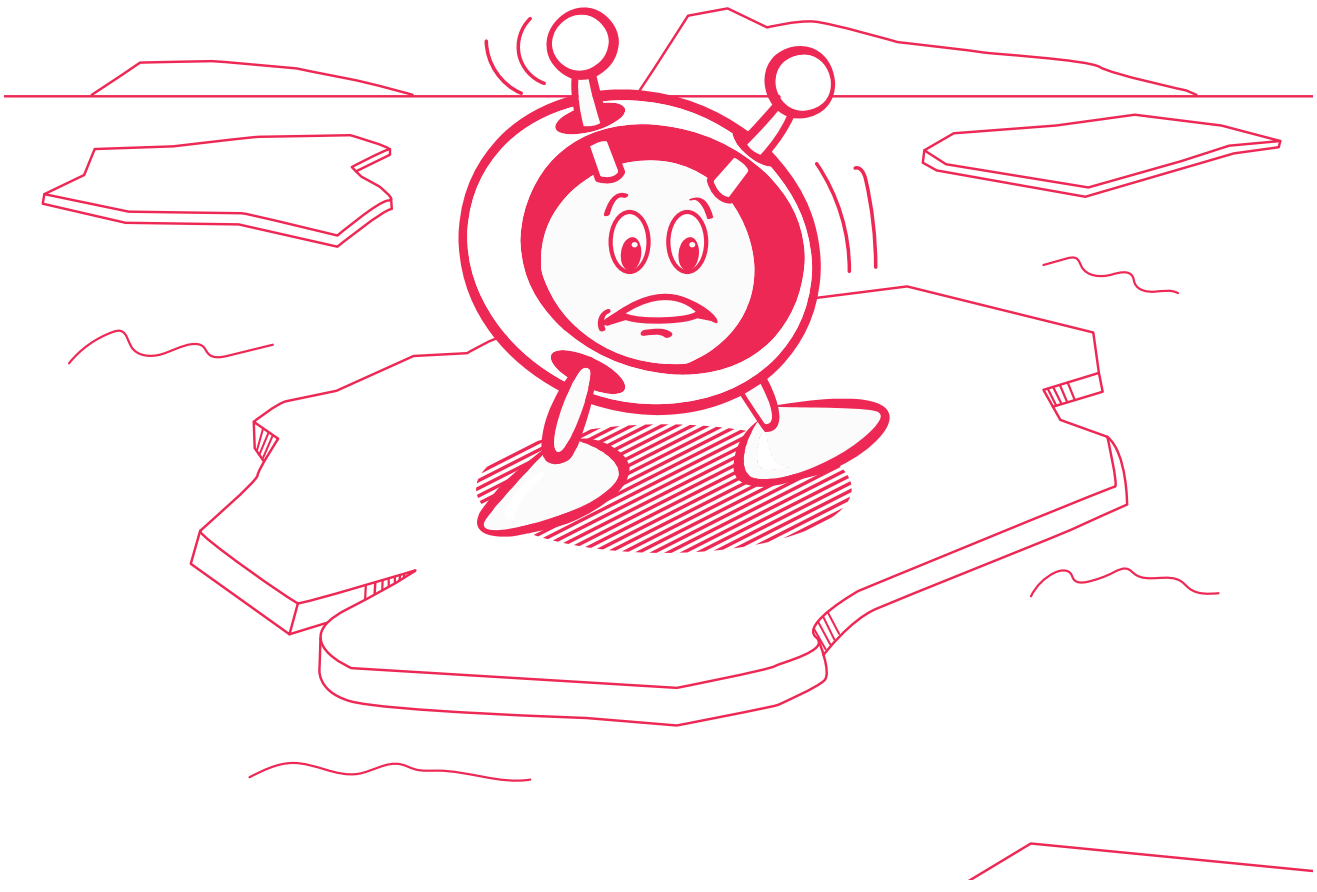
teach with space

→ THE ICE IS MELTING

How can we investigate the effects of melting ice?



European Space Agency

→ ACTIVITY 1: INTRODUCING ICE

In this introductory activity you will think about ice, and research the difference between land ice and sea ice. Later on you might carry out practical activities to test your ideas.

Did you know?

10% of the Earth's surface is covered in ice, but it hasn't always been this way. During the Earth's history there have been several 'ice ages' which happen when the Earth's temperature drops and ice covers much more of its surface. The temperature of the Earth naturally changes over time. Currently it is increasing, but this time the change is not entirely natural, it is due to human activity. The picture on the right shows the ice at the North Pole.

Exercise

1. Explain in your own words how ice is made.

_____

_____

2. At what temperature does water normally freeze?

_____

3. List some different forms of frozen water.

_____

_____

4. Give some examples of where on Earth we can find ice.

_____

_____

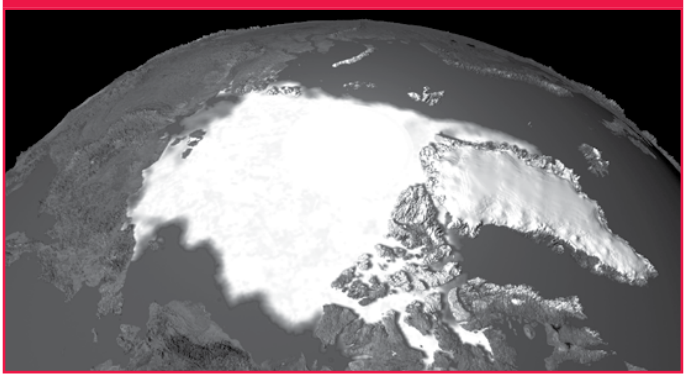
5. On Earth we can find ice on the land and in the sea. Give some examples of where each of these types of ice can be found.

Land ice: _____

Sea ice: _____

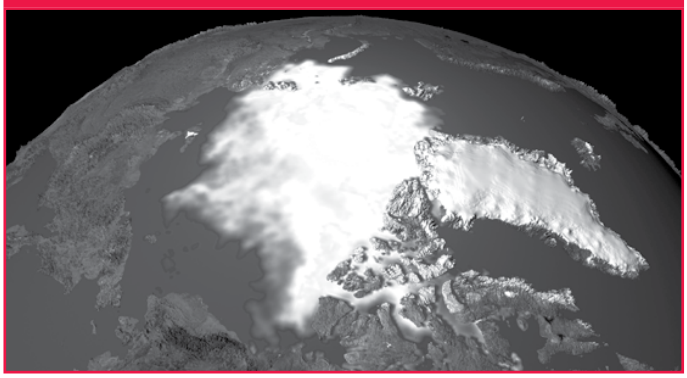
5. On Earth we can find ice on the land and in the sea. Give some examples of where each of these types of ice can be found.

Figure A1.1



↑ The North Pole in 1979

Figure A1.2



↑ The North Pole in 2003

→ ACTIVITY 2: WILL SEA LEVELS CHANGE?

Do you know what happens when land ice melts? What about when sea ice melts? In this activity, you will work in groups of four to carry out a practical experiment to investigate these questions.

Prediction

1. Describe what you think will happen to sea levels when the ice melts, and explain whether you think that melting of sea ice will have a different effect on sea levels to the melting of land ice.

_____

_____

Equipment (per group)

- 2 small plastic cups
- 2 small plastic plates
- 2 ice cubes
- Enough water to fill the two cups
- Modelling clay

Exercise

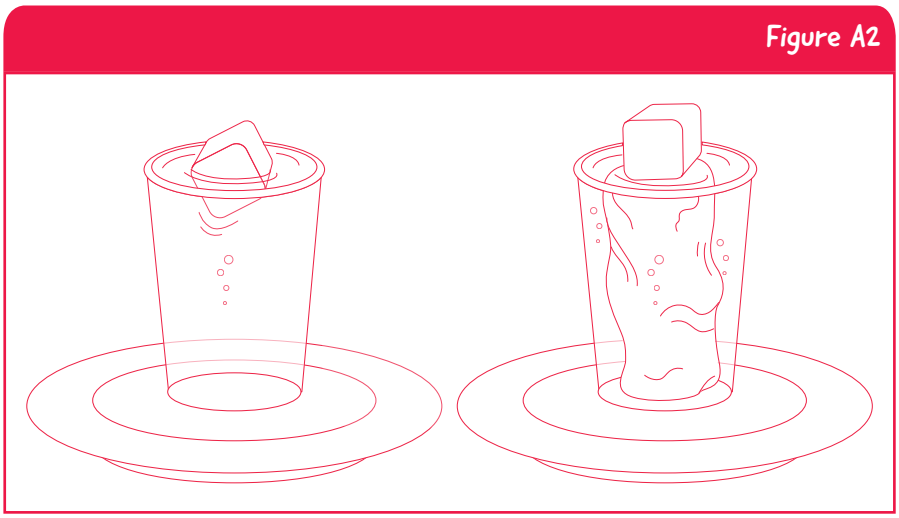
Cup 1 (Figure A2)

a. Put a cup onto a plate
b. Wet your hands! Put one ice cube into the cup.
c. Fill the cup to the very top with water

Cup 2 (Figure A2)

a. Put the second cup onto a plate
b. Put a cylinder of modelling clay into the cup, making sure that the tip of the clay is just above the rim of the cup. Make a small dent at the top of the clay for the ice cube to sit in.
c. Place an ice cube on top of the modelling clay.
d. Fill the cup to the very top with water.

Figure A2



↑ The set-up of the experiment

Wait a few minutes for the ice to start melting. Whilst you wait, answer the following questions.

2. Circle the kind of ice that you think is represented in cup 1.
land ice sea ice

3. Circle the kind of ice that you think is represented in cup 2.
land ice sea ice

4. Explain what you expect to happen in cup 1, e.g. with the ice cube and the water level.

5. Explain what you expect to happen in cup 2, e.g. with the ice cube and the water level.

Prediction

After ten minutes, examine your cups.

Is cup 1 overflowing? yes / no
Is cup 2 overflowing? yes / no

6. Based on your previous answers, do you think that sea levels will rise if the sea ice melts? Explain your answer.

7. Will sea levels rise if the land ice melts? Explain your answer.

Did you know?

If the ice in Greenland ice melted, the sea levels would rise by an average of 7 metres worldwide. In some places this value would be higher, and in some places lower. Many cities and towns on the coast would be submerged. In the very unlikely case that all of Earth's land ice melted, the sea levels would rise by an average of 70 metres worldwide!

→ ACTIVITY 3: WILL THE TEMPERATURE CHANGE?

Do you think that melting ice directly affects the temperature of the Earth? In this activity, you will work in groups to investigate whether the temperature will rise if the ice melts.

Equipment (per group)

- Shoebox
- One A4 piece of stiff card
- Two A4 pieces of black paper
- Two A4 pieces of white paper
- Scissors
- Glue
- Clingfilm
- 2 thermometers
- Sunlight or powerful lamp

Exercise

1. Using the equipment listed above, design an experiment to investigate whether the Earth is warmer over the ice (which is a light colour) or over the land and water (which are dark colours).

Before you set-up your experiment, draw a labelled diagram of your idea and list the steps you will take to carry out your experiment.

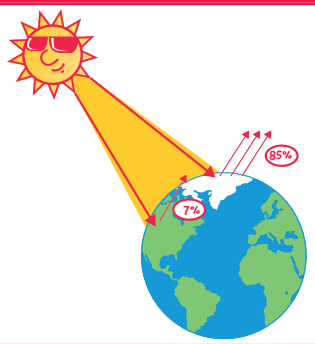
2. Now collect the equipment and build your set-up. Adapt your initial idea if you need to.

3. Describe and explain your results and observations.

4. Now explain the effect of the ice melting on the temperature of the Earth, remembering that ice is light and land/water are dark.

Did you know?

Ocean water reflects 7% of the sunlight it receives, whereas sea ice reflects about 85% of its received sunlight. This means that the ocean water warms up much more quickly than the sea ice.



→ ACTIVITY 4: WATCHING A GLACIER

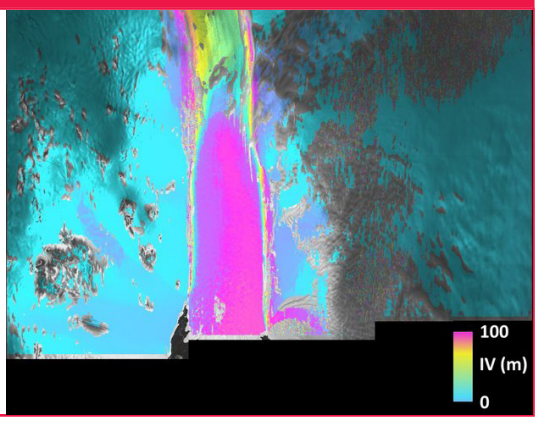
In this activity, you will look at a specific case of melting ice. You are going to analyse images of a glacier to consider why images from space can provide a unique and useful view of the Earth.

Figure A3

↑ The Margerie glacier in North America is a huge river of ice travelling between mountains

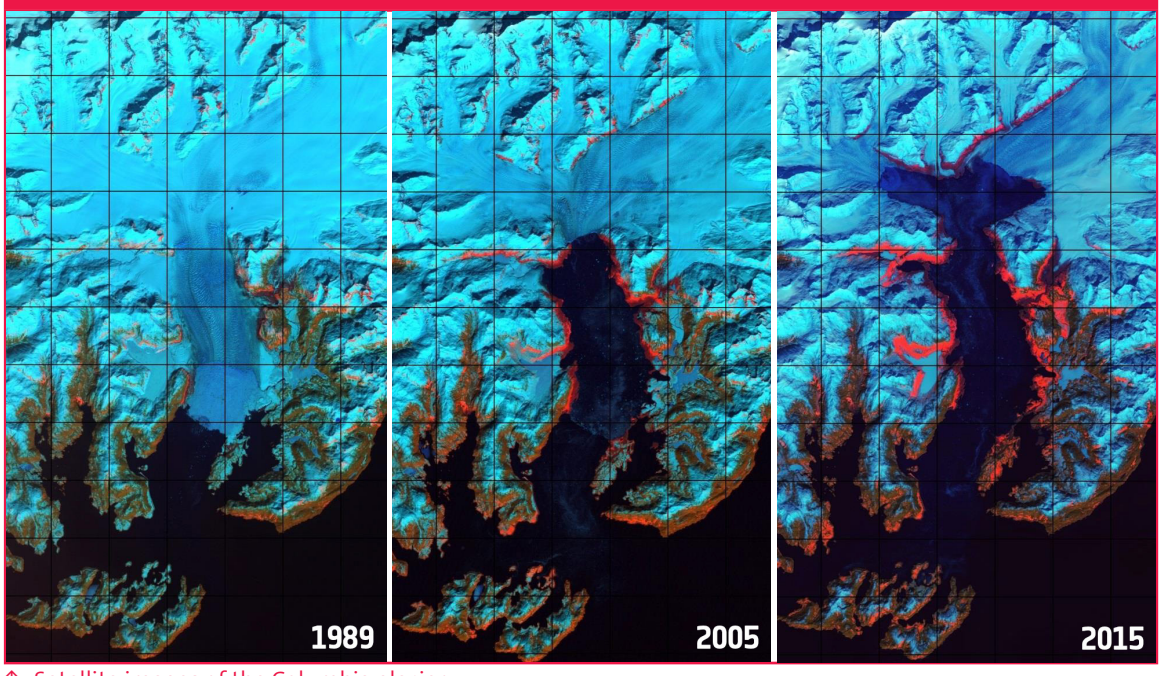
Did you know?

A glacier is a huge slowly moving block of ice. ESA Earth Observation satellites, such as Sentinel-1A, can produce useful images of glaciers. These images often look a bit strange because scientists falsely colour them to highlight certain points. Look at the Sentinel-1A image on the right, showing Pine Island glacier in Alaska. The colours show the amount of movement of the ice in 12 days. The blue areas have moved 0 m, whereas the pink areas have moved 100 m. This tells us that the pink area is the moving glacier.



The satellite images below show the Columbia glacier in Alaska in three different years. Each image was taken at the same time each year.

Figure A4



↑ Satellite images of the Columbia glacier.

1. Describe how the glacier changed between 1989 and 2015.

2. Each square on the grid represents 4 km x 4 km. Calculate approximately how much the surface area of the glacier shrank by in 26 years.

3. Suggest why the glacier shrank so much in 26 years.

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