



## Glacial environments

### Lesson 1: Where in the world is the ice?

#### Key questions:

- How is ice cover distributed across the world?
- How has ice cover changed over time?
- What are the different types of glacier that exist today?

#### Starter activity:

*Where is all the ice?*

Students can examine a map of the world's continents to identify and explore the ice cover in each region. Existing classroom atlases or world maps can be used for this, alongside the PowerPoint presentation 'Where is the ice?' provided. Students identify how ice cover is distributed across the world and become spatially aware of (i) which regions have the most ice and which have the least, and (ii) the different sizes of glacier that exist. The fact sheet provides information about the ice cover of different regions, and facts about Antarctica and Africa may bring surprises.

*What does the ice sound like?*

To liven up the unit starter, the sound of moving ice could be played while students complete the task (see web-link on module plan).

#### Main activity:

*How has ice cover changed over time?*

The main activity is structured around 3 key questions, with a range of downloadable resources available to support teaching. Third party web sites give access to impressive photographs and films for projection (see module plan for details). By the end of the main activity, students will have learned about how ice is made and moves forwards; and have also learned under what conditions a glacier will advance or retreat. They should come to appreciate that the physical world is highly dynamic and that physical processes are often changing (sometimes over very long time-scales).

#### 1. What types of glaciers are there and how do they change over time?

This starts with a look at some of the different types of glacier that exist: ice sheets, ice caps, valley glaciers and snow patches. Students read the 'Types of glaciers' Word document provided to find out about these glaciers, and additional examples could be identified using *Google Earth*.

#### 2. How do glaciers change in size over time?

The way in which ice grows needs to be carefully explained to students. Whenever snowfall exceeds rates of melting, a substance called **firn** develops as snow is compressed to eventually become dense ice. This is helped by melting and re-freezing (the same way ice on roads sometimes develops) so that most (but not all) air is removed. Rivers of ice begin to flow downhill under gravity. Glaciers move forwards into lowland regions where warmer air brings melting. The size of the glacier is thus a function of snowfall and air

temperatures. Students can consult the online interactive activity for a visual representation of how this works.

*3. What is an Ice Age, what causes it and how was the UK affected by the last Ice Age, which ended 10,000 years ago?*

A series of suggestions about the causes of Ice Ages – three true and one false – is provided on the 'Ice Ages' Word document and can be discussed with the class in a 'call my bluff' style. The correct explanations involve sunspots, changes in the earth's orbit and (possibly) the uplift of the Himalayas. The false explanation is a suggestion that higher levels of CO<sub>2</sub> can cause atmospheric cooling (the opposite is of course true, as will be demonstrated in the next lesson). The fact sheet provides further information about each of the propositions.

For the final part of the investigation (which could be given as a homework task), students should investigate the extent of ice cover during the last Ice Age. Again, website links are provided on the module plan. Students should draw their own line on a map showing the maximum extent of the Pleistocene ice sheet in the UK – there is a map for this purpose on the 'Ice Ages' Word document.

### **Plenary**

#### *Ice Age history*

For the final part of the lesson, students should be told that the UK and France used to be joined together 18,000 years ago - a surprising idea if they have never heard of it before! They can have a robust and fun discussion imagining what language, food, music and fashion would be like if the two nations were joined at the hip! – before ending the lesson on a serious note, with students considering what has happened since then to separate the countries, acknowledging that the changing depth of the English Channel is related to an increased amount of ice on the land in the past (thereby concentrating their minds on the fact that there is a fixed amount of water on the planet).

### **Further research**

The sounds of cold environments are heard at:

[www.antarctica2000.net/sounds/other.html](http://www.antarctica2000.net/sounds/other.html)

Online information about the distribution of ice at:

- SwissEduc website [www.swisseduc.ch/glaciers/earth\\_icy\\_planet/glaciers02-en.html](http://www.swisseduc.ch/glaciers/earth_icy_planet/glaciers02-en.html)
- Nsidc.org website (for use with Google Earth) [http://nsidc.org/data/google\\_earth/](http://nsidc.org/data/google_earth/)

The story of how ice forms is also told at: <http://nsidc.org/glaciers/story/>

Interactive exercise on seasonal changes in sea-ice cover at:

[www.discoveringantarctica.org.uk/multimedia/flash/3\\_seasonal\\_change.html](http://www.discoveringantarctica.org.uk/multimedia/flash/3_seasonal_change.html)