

# What are glaciers?

**A** glacier is a large body of snow and ice. We find them in high-up places (the Swiss alps) and in places that are far north or south, like the Arctic and Antarctic.

Each glacier has built up over many years in places where snow has fallen but not melted. Snow turns to ice as

it collects in layers. The weight of the ice means that it starts to slip down mountain sides over time.

As moving ice creeps into the warmer climate of lowland regions, melting takes place. The front of the glacier is called its **snout** and you can see one in Photograph 1.

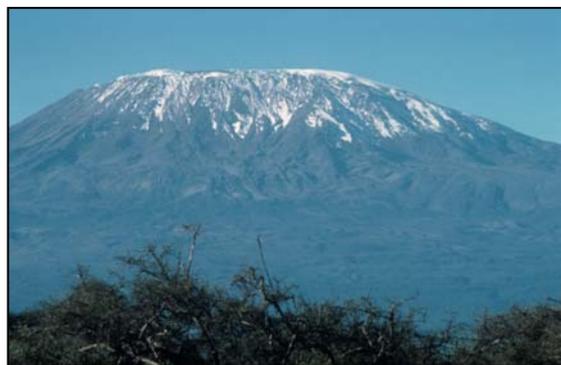


*Photograph 1 Glacier snouts*

Scientists often describe a glacier as a **system** with **inputs** (fresh snowfall and avalanches) and **outputs** (meltwater and evaporation). If the rate of **accumulation** (new inputs) is equal to the rate of **ablation** (outputs) then the glacier is in an overall state of balance.

There are different scales of glacier. These include:

<b>Ice sheets</b>	Look at a world map and you will see Antarctica and Greenland covered white. These are <b>enormous ice sheets</b> . If both melted completely, sea-levels around the world would rise by tens of metres!
<b>Ice caps</b>	Find the Himalayas on a world atlas. Mount Everest is located there. It forms part of a high uplands regions with a <b>very large amount</b> of ice present. Meltwater from this region provides hundreds of millions of people in Asia with their drinking water supplies!
<b>Valley glaciers</b>	On a <b>smaller scale</b> still, the Alps and Kilimanjaro in Kenya are home to ice-capped mountains and valley glaciers. Local glaciers can develop anywhere on Earth where the land is high and cold enough, including central Africa!
<b>Snow patches</b>	The <b>smallest glaciers</b> are little more than snow patches on mountain sides. They tend to be found on north-facing slopes where there is less sunlight received to melt the ice. The Highlands of Scotland has snow patches that last for much of the year, but no real glaciers (although there were many 10,000 years ago when the world was colder.)



*Clockwise (from top left): Antarctic ice sheet, Mountain ice cap, Kilimanjaro glaciers, a winter snow-patch*

## Why do glaciers advance and retreat?

If annual rates of snowmelt begin to exceed annual melting rates, then a glacier will increase in size and it will advance down-valley under gravity. This is what happens during Ice Ages.

However, if the reverse occurs and annual melting begins to exceed fresh snowfall, then the glacier will shrink, causing the snout (end) of the glacier to appear to retreat up-slope. This is happening to many glaciers today, on account of global warming.



*Photograph 6 Glaciated landscape*

## Some natural causes of glacial retreat and advance

### *Sunspot activity*

The sun's output varies slightly between decades, due to the existence of sunspots. Cycles of eleven and twenty-two years have been suggested.

High levels of sunspot activity actually increase annual rates of melting.

### *Volcanic eruptions*

The eruption of Tambora in the spring of 1815 in Indonesia is thought to have ejected an amazing 200 cubic kilometre of dust into the atmosphere.

This insulated the earth from the sun's rays, causing temperatures in the Alps to fall by 1°C, leading to a short period of glacial advance across the world.

### *Ice Ages*

On a much longer time-scale, changes in the earth's orbit around the sun are thought to contribute to the onset of Ice Ages - periods of Earth history where ice advances into region such as the UK that are not normally glaciated.

These cycles last for tens of thousand of years or longer. First suggested by a man called Milankovitch, these periods of orbital change trigger a series of climatic impacts that in the past resulted in much of the world becoming covered with ice.

## The global warming problem

Most of the world's scientific community now believe that human use of fossil fuels has lead to a measurable global rise in temperatures and rates of melting of ice.

Glaciers in Argentina and Chile are melting at double the rate of 1975 due to global warming, according to Californian researchers.

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