

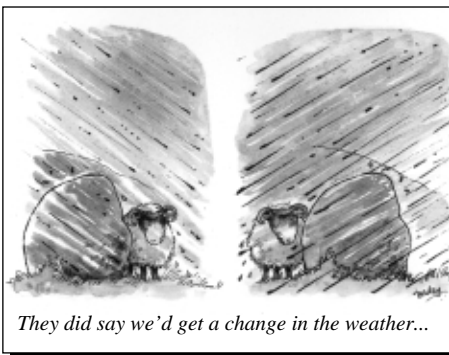


Education Service

Weather and Climate Factsheet

The British Isles are famous for their weather. They have constantly changing weather, associated with their location between the North Atlantic Ocean and the European continent. The Lake District, in north-west England, has all types of weather from rain and gale force winds to cloudless sunny spells, sometimes all on the same day! High up on the Lake District's fells there could be a blizzard blowing while further to the west on the coast the sun may be shining making it feel pleasantly warm.

Many of the 12 million visitors per year to the Lake District National Park will associate the region with changeable weather. Seathwaite at the head of Borrowdale is known as the wettest inhabited settlement in England – over 3 metres of rain each year!



The Lake District National Park contains a range of landscapes from low-lying coastal areas to the mountains (locally called **fells** - 102 of them rise above 600m). This means that there are a number of local weather processes that also occur. For these reasons the National Park is an ideal place for people of any age and ability to study the climate and the weather (meteorologists).

Weather and Climate

It is important to know the difference between the terms '**weather**' and '**climate**'. Both refer to what happens in the atmosphere.

Some simple definitions will help:

- **Weather** is the condition of the atmosphere over a short period of time (what happens on a day to day basis).
- **Climate** is the average expected weather over the seasons for a region (the long-term pattern).

Climate is what you expect and weather is what you get!

The Maritime Climate of the Lake District is generally wet and mild but it can also have hot and dry weather causing droughts, or cold periods with snow and ice.

The weather plays an important part in our lives; it will make us decide what clothes to wear and what to do with our leisure time. It also influences where people decide to take their holidays. This can have an effect on tourism in the National Park.

Climate affects the land use in the Lake District, determining the type of farming that can be practised and the erosion processes that are working to change the landscape. One of the reasons that sheep farming is the best agricultural use of the land in the Lake District, is that plants have a short growing season of mid-April through to November due to the temperature. Heavy rain causes water-logging of the ground so cattle are usually moved indoors during the wet winter months.

In the distant past (20,000 years ago) the Lake District had a much colder climate when glaciers (rivers of ice) filled the valleys and shaped the mountains and valleys we see today. The action of frost and rain is continuing to slowly change the landscape today ('weathering') and occasionally there are dramatic events. For example, heavy rain in November 1927 caused the Kepple Cove dam to burst, sending a flood down the valley to form new land on Glenridding Spit.

What Causes the Weather & Climate?

The real driving force behind weather and climate is the sun. The heat it produces warms the Earth's surface, which in turn warms the surrounding air. Some of the air is warmed more than the rest causing it to expand and rise, giving differences in air pressure. These differences cause the air in the atmosphere to move, creating the winds. Water also plays a very important part in the weather. The sun evaporates water, producing moisture which condenses to form clouds, rain, snow, fog and mist.

Other factors influencing weather and climate include the latitude of a region, the tilt of the earth (giving rise to the seasons) and the direction the wind comes from (bringing the weather with it). More local factors, such as the shape and height of the land and the effect of the sea play a role in the local climate, particularly in the case of the Lake District.

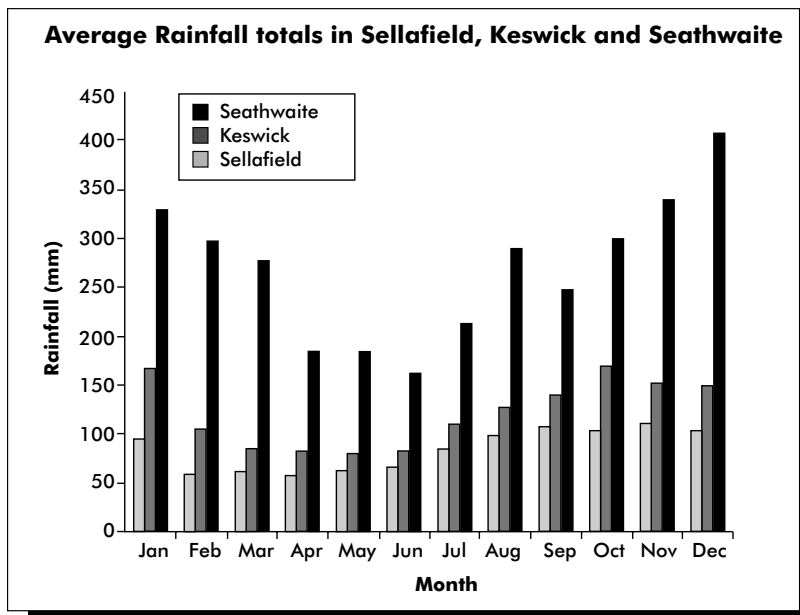
Air Temperature

Maritime (Sea) Effects

For a region lying between latitudes 54° and 55°N, the Lake District has milder winters and cooler summers than should be expected. The reason for this is the nearness of the Lake District to the sea. The sea warms up and cools down more slowly than the land as the seasons change, moderating temperatures on land. The British Isles lie in the warming Gulf Stream current. This warm water current, which originates in the Gulf of Mexico, keeps much of coastal north western Europe relatively mild. For example, Moscow lies on a similar latitude to the Lake District but Moscow's average January temperature is -10°C, compared with Keswick which averages 3.7°C in January. In summer the effect of the sea is to cool the temperature; the mean average temperature for Keswick in July is 15°C whereas in Moscow it is nearly 19°C.

The sea also affects the air temperature on a more local level. Coastal areas of the Lake District will see milder winters than the central fells. For example the average December temperature for Keswick is 4.7°C, whereas along the coast the average is 5.8°C. In summer you would expect coastal areas to be cooler than the central Lake District from the effect of the sea. However, in the Lake District this is not the case because there is greater cloud cover over the central fells than over the coast, reducing the direct sunshine available to warm the fells.

Weather Data for Keswick



Height Effects

The height of the land (**altitude**) plays a large part in the variation in temperatures across the Lake District. When the air itself is forced to move up over the fells, the temperature falls by 1°C per 100m (the dry **adiabatic lapse rate**). This can give a mild day in the valleys while high up on the summits of the fells it could be cold enough to snow. To illustrate this the mean annual temperature on the summit of Helvellyn (950m above sea level) is only 3°C, whereas in Keswick (80m above sea level) the average is 9°C.

Landscape Effects

The shape of the land (**topography**) is also an important factor in the temperatures experienced. In periods of settled clear weather the air cools at night; the cold dense air trickles down into valleys and hollows. Places where this cooler air collects are called **frost hollows**. It was in one of these **frost hollows** that a temperature of -21.1°C was recorded in Ambleside in 1940. Sometimes this cool air moves over the warmer water in the lakes and mist forms. On Windermere it is known as the 'Windermere blanket'.

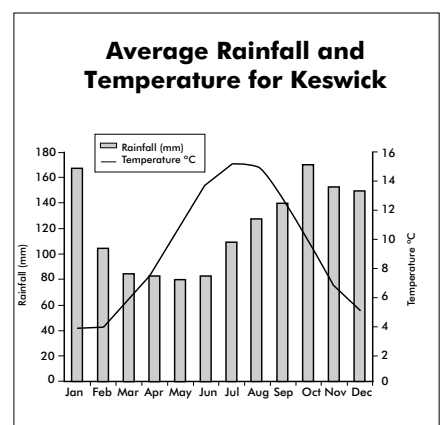
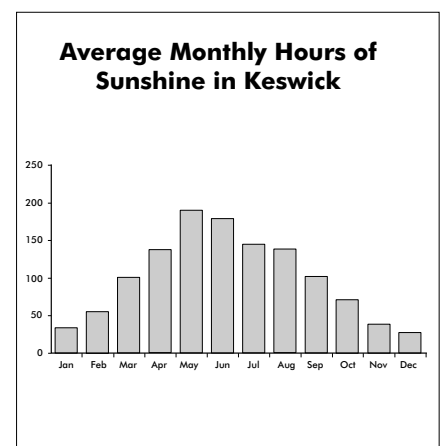
The direction a slope faces (the slope's **aspect**) also influences the local temperature. South facing slopes have higher average temperatures than north facing ones, because they receive more direct sunshine. Snow can linger longer on north facing slopes, in some years into June or July.

Sunshine

The amount of sunshine the Lake District receives varies throughout the year. Its northerly latitude means a much higher amount of sunshine during the summer months than winter months.

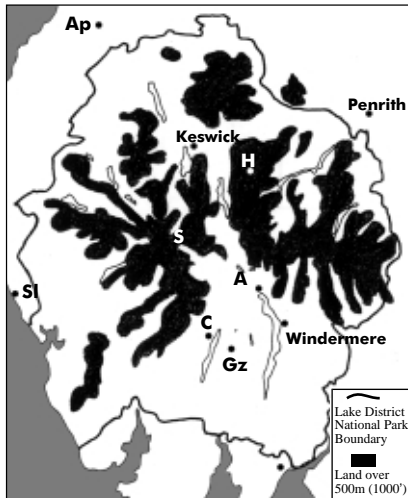
There is also a contrast between different locations in the Lake District. Coastal districts can be expected to receive on average 1500 hours of sunshine a year (4.1 hours/day). On the fell tops less than 1000 hours a year (2.7 hours/day) can be expected. This is due to the increased cloud cover over the fells.

The direction a valley runs (its **orientation**) can give differences of sunshine and temperature between each side of the valley. Those parts of the valley in shadow are cooler. An east-west valley will have more sunshine on its north side (with a southerly aspect). Direct sunshine may not reach parts of some valleys due to the shadows of the surrounding fells. This occurs more in winter when the sun is lower in the sky. Generally there will be more varied vegetation, better farming and more settlements on the sunnier valley sides.



Maps

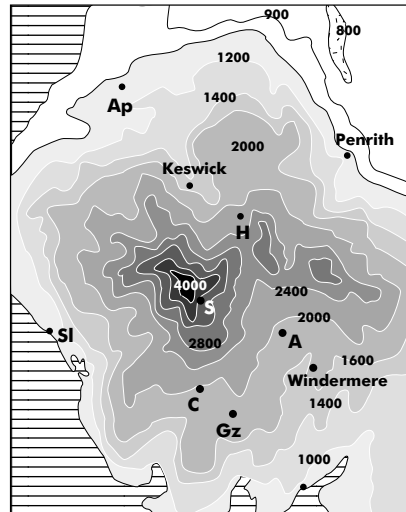
Topography



Key:

A Ambleside	G Grange-over-Sands
Ap Aspatria	H Helvellyn
C Coniston	S Seathwaite
Gz Grizedale	SI Sellafield

Annual Rainfall



Source: Climatological Memorandum 128, Meteorological Office

Surprisingly the Lake District does not receive as much snow as people may think (or wish!). On average in the valleys there are about 20 days per year when precipitation falls as snow. This changes with an increase in altitude. The general rule is that the number of days with snow lying on the ground increases by about 5 days for every 100m increase in altitude. Helvellyn has on average 67 days with snow on its summit.

The length of time snow lies on the ground (snow cover) varies from year to year. In a severe winter snow cover may last for 60 days in the valleys and up to 180 days on the fell summits. In some mild winters there may be only 1 to 2 days snow cover in the valleys.

Precipitation

Precipitation is all the rain, snow, sleet, hail and dew reaching the ground. The Lake District has a lot of precipitation and as mentioned contains the wettest inhabited place in England; Seathwaite in Borrowdale.

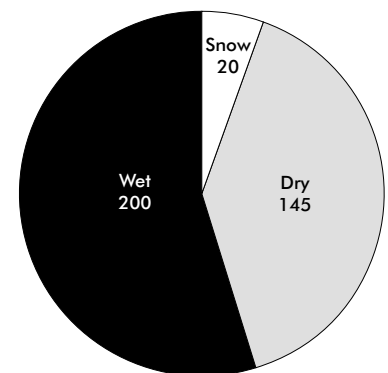
The west of the British Isles is kept fairly wet all year round because it receives moist air first. Low pressure systems (**depressions**) form over the North Atlantic Ocean and on the way to the British Isles the air becomes full of moisture. [Depressions are areas of rising air and usually have fronts. Fronts are the boundaries between warm and cold air where precipitation is heaviest.] **Rainfall** amounts vary considerably across the Lake District. Seathwaite receives an average of 3300mm per year while just 10km down the valley Keswick receives about 1470mm per year. In terms of rain days (a day when more than 0.2mm rain falls), the Lake District is similar to the rest of the country. What is different is the intensity of the rain.

What makes the Lake District especially wet is the process of **relief** (orographic) **rainfall** caused by the upland area of fells. Relief rain is caused when air is forced to rise over high land. The air cools and at a certain temperature (the **dew point**)

moisture condenses to form clouds leading to precipitation. This relief rainfall can be very heavy. The highest rainfall amounts are found on the high central fells at the heads of the Coniston, Eskdale and Wasdale valleys in the west of the Lake District.

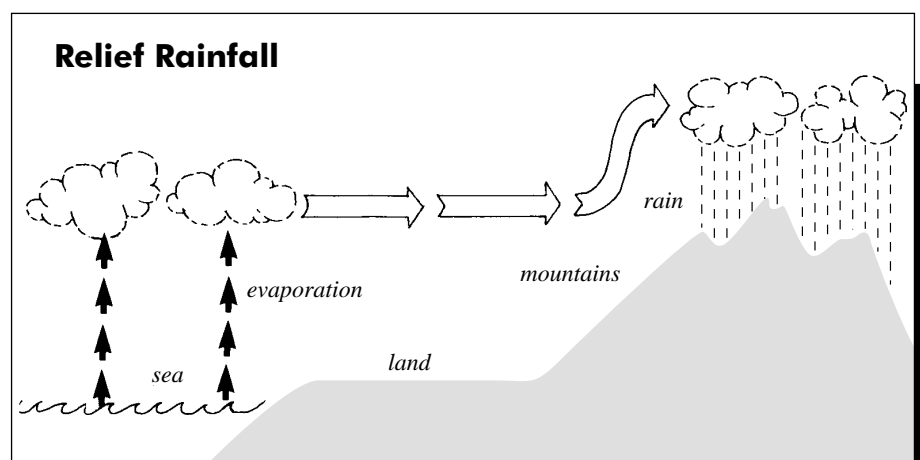
Precipitation removes most of the moisture from the air as it moves across the Lake District. The fells create a **rain shadow** effect where areas east of the high ground (down wind) receive much lower rainfall. Penrith lying just outside and to the east of the National Park receives an annual rainfall total of 860mm, 25% of Seathwaite's rainfall and 85% of Sellafield's rainfall on the west coast of Cumbria.

Average number of dry, wet or snowy days a year in the Lake District



It is important to remember that snowfall adds to the rainfall statistics of an area, with approximately 100mm of fresh snow being the equivalent to 10mm of rainfall.

Keen skiers should find an area where they can pursue their sport for a few days a year, but they must remember the snow can go as quickly as it arrives.



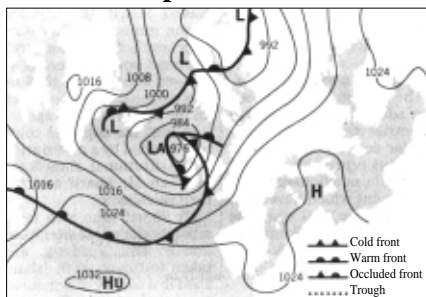
Wind

Most of the winds in the Lake District are associated with the passing of depressions and their fronts over the region, although there are also more local effects causing wind.

Winds can make the temperature feel lower than the true air temperature in the same way as you can cool something by blowing on it. This is known as the **wind-chill** effect and when combined with rain can make fell weather conditions dangerously cooling for people outside.

The strongest winds occur when there is a large pressure difference between areas of high and low pressure. Strong winds are shown on a weather map (**synoptic chart**) by tightly packed **isobars**. When there is a wind it will be greater on the fell tops (at greater altitude) than in the valleys. Sheltered valleys experience gales on 5 days a year while on the tops of the fells this may be up to a 100 days a year. On the coast, gales blow on 20 days a year on average. A gale is when the average wind speed is more than 63.0 kmph (39 mph) for ten minutes.

Weather Map: Noon 8-12-1999



Source: Met. Office

Local valley winds also form in the Lake District. In the daytime, sunshine warms the valley sides and bottoms, in turn warming the surrounding air. The air then rises and forms an uphill breeze known as an **anabatic** wind. The air cools as it rises and clouds may form on the fell tops. The air that has cooled descends back into the valley keeping the sky above the valley clear.

At night the reverse occurs, air cools, becomes more dense and sinks due to gravity. This creates a breeze that moves downwards and out of the valleys known as a **katabatic** wind. Any moisture in this air will condense to form **fog** as the air cools and descends. Places where this cooler air collects can be come **frost hollows**.

Extreme Weather in the Lake District

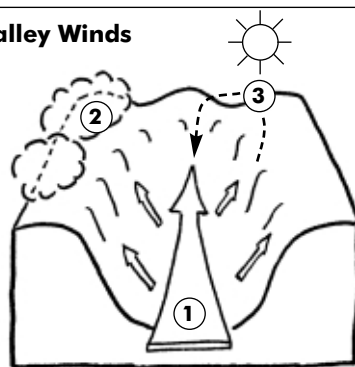
Occasionally like other areas of the British Isles, the Lake District sees weather conditions which even by its standards are out of the ordinary. The following table gives a number of examples of extreme weather events in the Lake District.

Date	Weather Event
Summer 1995	Drought year: Haweswater Reservoir 89% empty and the drowned village of Mardale visible.
31st Jan 1995	100mm of rain overnight cause floods that change the course of Raise Beck, Dunmail Raise, to flow to Grasmere instead of Thirlmere Reservoir.
July 1988	Grasmere had its wettest month this century.
Summer 1984	Drought year: drowned village of Mardale visible from the waters of Haweswater.
Feb 1984	Over 600 mm of snowfall in some areas of the District.
July 1983	Temperature in Ambleside reached 31.7°C, the same figure as in 1934.
1963	Windermere completely freezes over.
1962	Severe flooding in Langdale meant a huge landslide slid down the hillside.
Nov 1955	Seathwaite in Borrowdale received 204mm of rain within 24 hours, about one quarter of the annual rainfall of Penrith.
1954	Sprinkling Tarn near Sty Head received 6527.8mm of rain this year - the same height as 1.5 double-decker buses!
Sept 1953	160 mm of rain fell in Langdale in just 17 hours
Jan 1940	Temperature in Ambleside dropped to -21.1°C. Ice measuring over 305 mm thick was recorded on Derwentwater.
May 1935	Keswick in contrast to 1922 received 294.9 hours of sunshine in this month.
July 1934	The temperature in Ambleside reached 31.7°C.
Dec 1922	During this month Keswick only received 5.5 hours of sunshine.
Oct 1898	Flooding caused the level of Windermere to rise 2130 mm above its normal level.
Nov 1683-Feb 1684	Windermere frozen over, the longest recorded period for this event.

A Snapshot of the Weather – November 1995

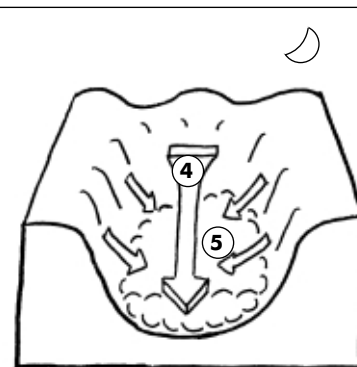
Weather Station	Height above Mean Sea Level	Air Temperature			Rainfall			Sunshine		
		Mean Daily Max. °C	Highest Recorded °C	Lowest Recorded °C	Monthly Total mm	% of long term Nov. Average	No. of Rain Days	Wettest Days Rainfall	Monthly Total Hours	% of long term Nov. Average
Ambleside	46 m	10.1	15.6	-2.2	157.0	72	13	31.0	—	—
Aspatria	62 m	10.5	13.3	-3.2	68.6	72	8	36.3	67.8	108
Coniston	—	9.4	13.5	-2.5	187.7	69	15	33.7	—	—
Grange-over-Sands	—	10.8	13.8	-1.6	89.9	73	—	26.5	—	—
Grizedale	91 m	10.8	14.0	-5.9	167.0	—	19	32.0	—	—
Keswick	81 m	10.2	14.3	-3.5	111.7	65	13	25.6	60.3	147
Penrith (Newton Rigg)	169 m	9.5	14.9	-2.8	87.1	88	10	32.0	36.8	69
Sellafield	22 m	11.2	16.9	-2.0	58.4	58	10	29.6	72.2	105

Valley Winds



Day (Anabatic)

- 1 Air warmed by the sun rises up the valley
- 2 Air cools and moisture condenses forming clouds
- 3 The cooled air descends back into the valley



Night (Katabatic)

- 4 Cold air is more dense and sinks into valleys
- 5 Moisture condenses to form fog

A daily weather forecast for the Lake District can be obtained from the Lake District National Park Weatherline:
Tel. 017687-75757

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