Northern Scotland: climate

This describes the main features of the climate of Northern Scotland, comprising Highland Region, the Western Isles, Orkney and Shetland.

The principal mainland geographic features comprise the Grampian Mountains and the northern Highlands, which rise steeply from the glens and fjord-like sea lochs. These mountainous areas include the Great Glen, running from Fort William north-eastwards to Inverness and containing Loch Ness. The region therefore has extensive areas of high ground and includes the highest point in the UK - Ben Nevis (1344 metres), near Fort William. There is little urban development, the main towns being Inverness, Fort William, Wick, Kirkwall (Orkney) and Lerwick (Shetland).

Temperature

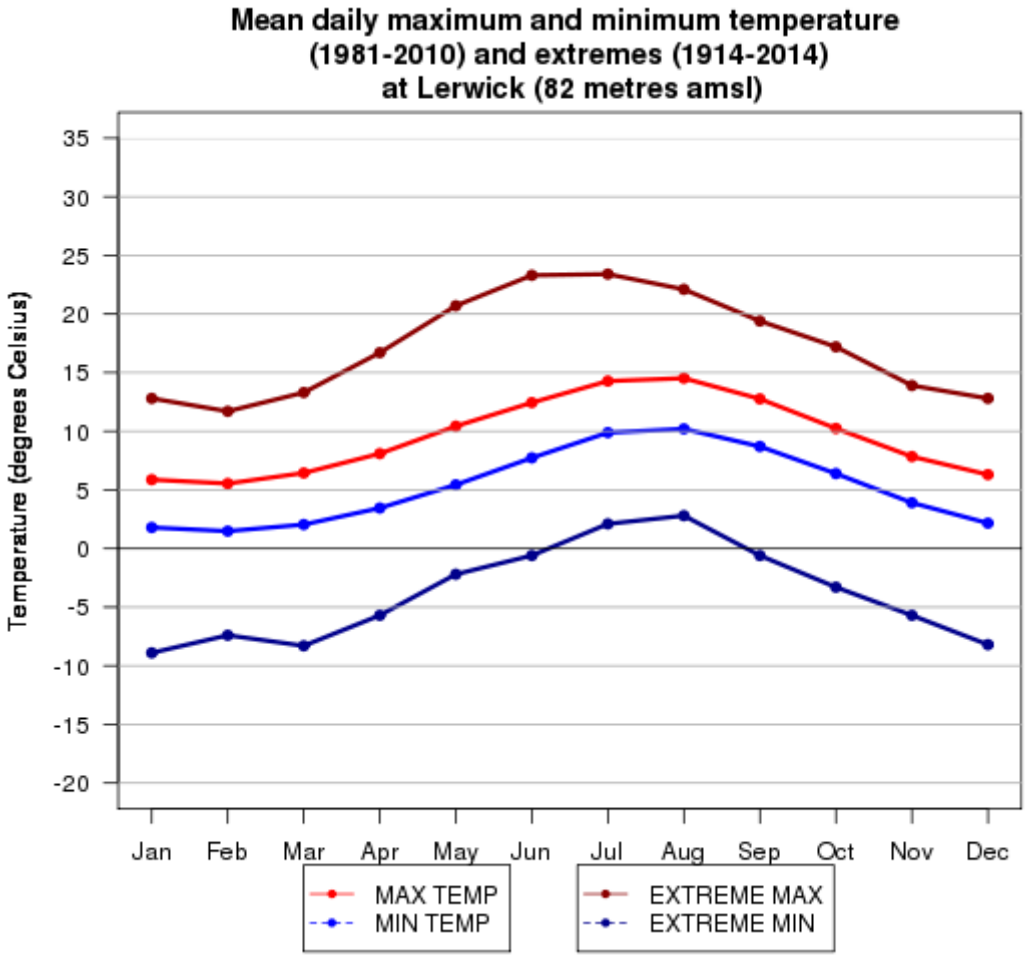
Mean annual temperatures over the region at low altitude vary from about 9 °C close to the Moray Firth and on the westernmost isles to about 7 °C on Shetland, but over the higher ground temperatures are generally lower so that at Cairngorm Summit the annual mean is just below 1 °C. Elsewhere in the UK, mean annual temperatures reach over 11 °C in Cornwall and the Channel Islands. Within the region, significant variations in temperature arise from the combined effects of proximity to the coast and topography.

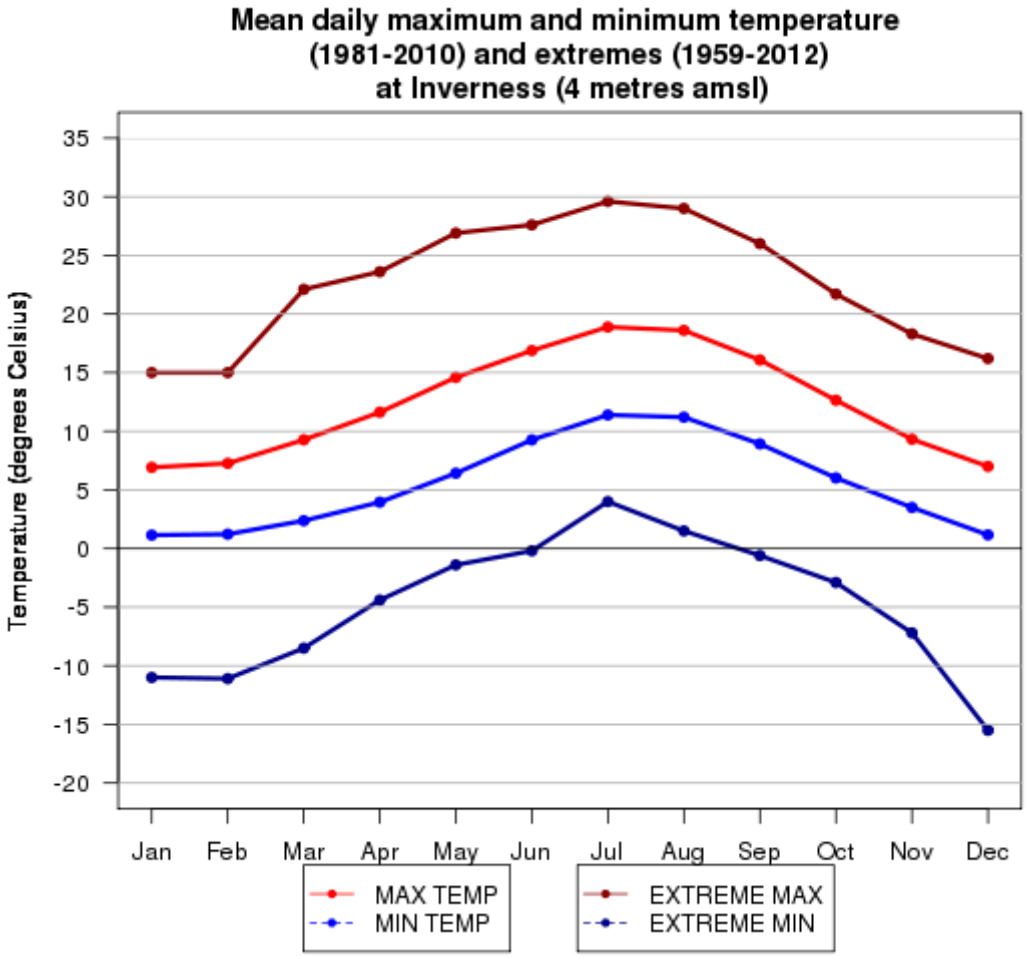
Temperature shows both a seasonal and a diurnal variation. Minimum temperatures usually occur around sunrise and maximum temperatures are normally 2 to 3 hours after midday.

January or February is the coldest month, with mean daily minimum temperatures varying from about 2 °C on west-facing coasts and in the Western and Northern Isles, to less than -1 °C over higher ground. Extreme minimum temperatures can occur in winter; examples include -27.2 °C at Altnaharra (Highland) on 30 December 1995 (the UK record low temperature, shared with Braemar, Grampian). Conversely, occasionally to the lee of high ground temperatures can reach up to 15 °C in winter when a south or SW airstream warms up after crossing upland - an effect known as a fohn wind.

July or August is the warmest month, with mean daily maximum temperatures at low levels around 19 °C in areas close to the Moray Firth. Elsewhere in northern Scotland the mean daily maxima are somewhat lower, and are less than 16 °C over the higher ground and the islands. Extreme maximum temperatures can occur in July or August, and are usually associated with heat-waves. On the larger Western Isles and in sheltered places, temperatures can exceed 28 °C. For example, 32.1 °C was recorded at Onich (Highland) on 1 August 1995. In contrast, over Shetland high maxima are not achieved and the record is only 25 °C, set at Baltasound on 2 July 1958.

The variation of mean daily maximum and minimum temperatures month by month, together with the highest and lowest temperatures recorded, is shown for Lerwick and Inverness.

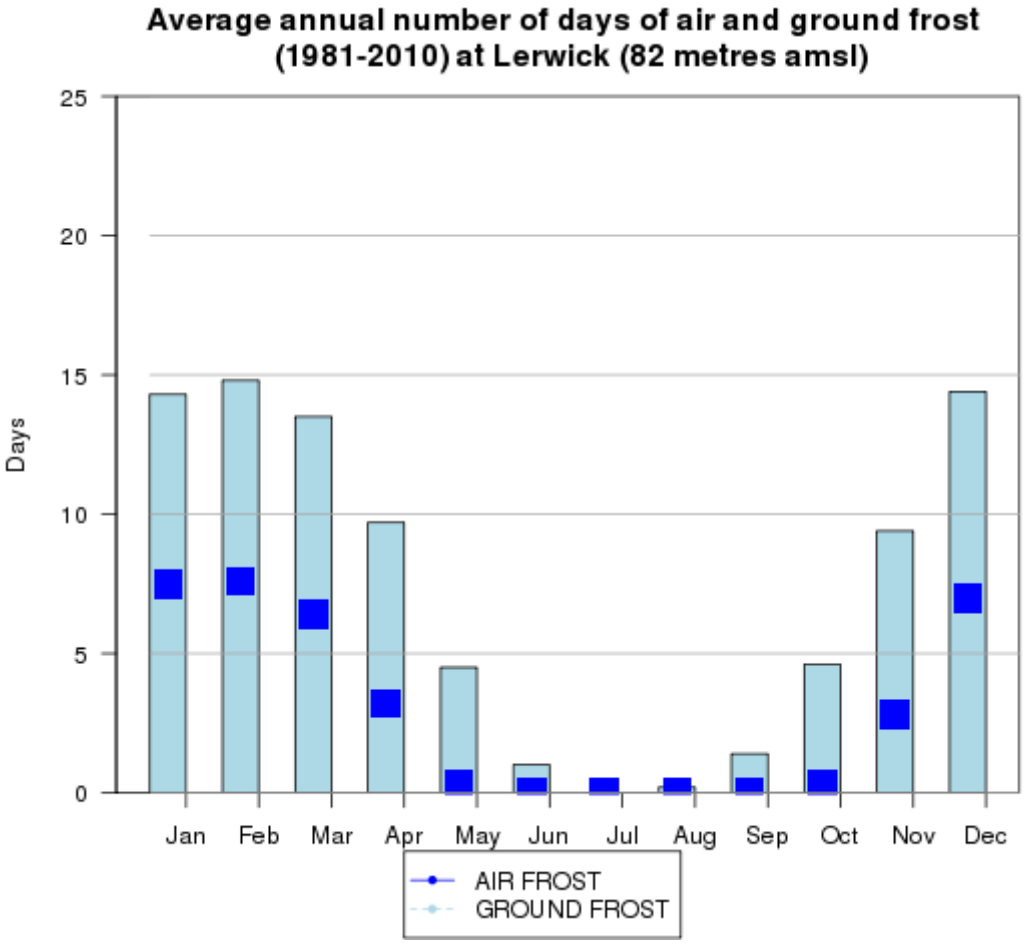


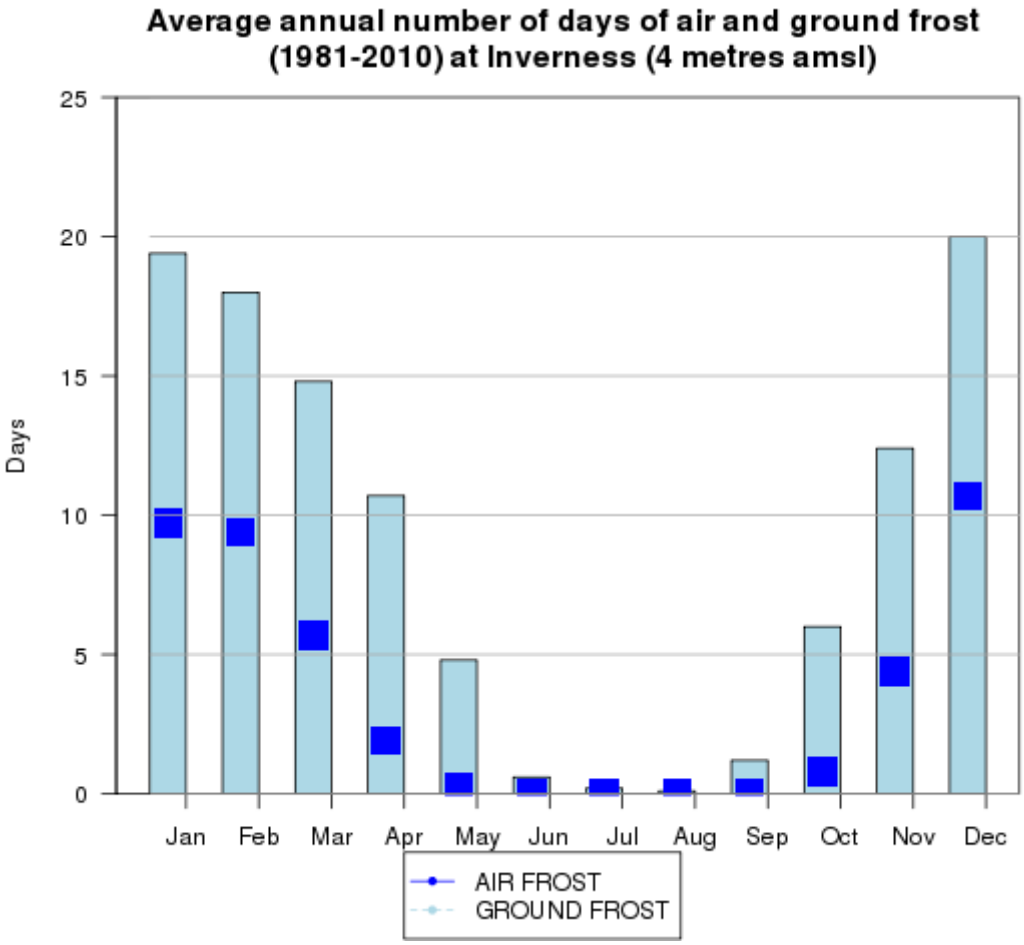


An 'air frost' occurs when the temperature at 1.25 metres above the ground falls below 0 °C, whereas incidence of a 'ground frost' refers to a temperature below 0 °C measured on a grass surface. The average

number of days with air frost in Northern Scotland varies from less than 40 a year on west-facing coasts and the Western Isles to more than 80 a year over the mountains. Ground frost averages range from less than 90 days per year to over 140 days, with a similar distribution to air frost. However, those places into which cold air can drain are particularly prone to frost. Examples include Altnaharra (Highland) with an average of 73 air frosts per year.

In Northern Scotland the frost-free season is often as little as 3 months, as shown by the average frequencies of air and ground frost at Lerwick and Inverness.





Back to top

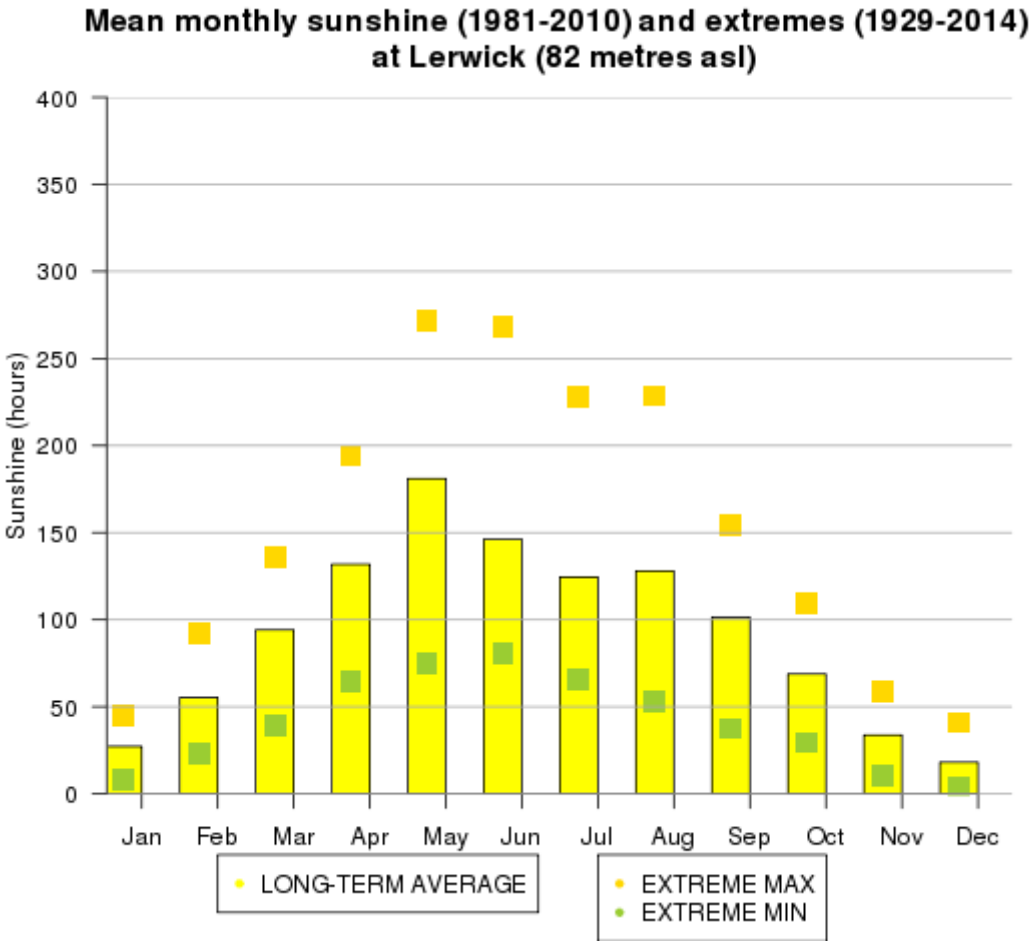
Sunshine

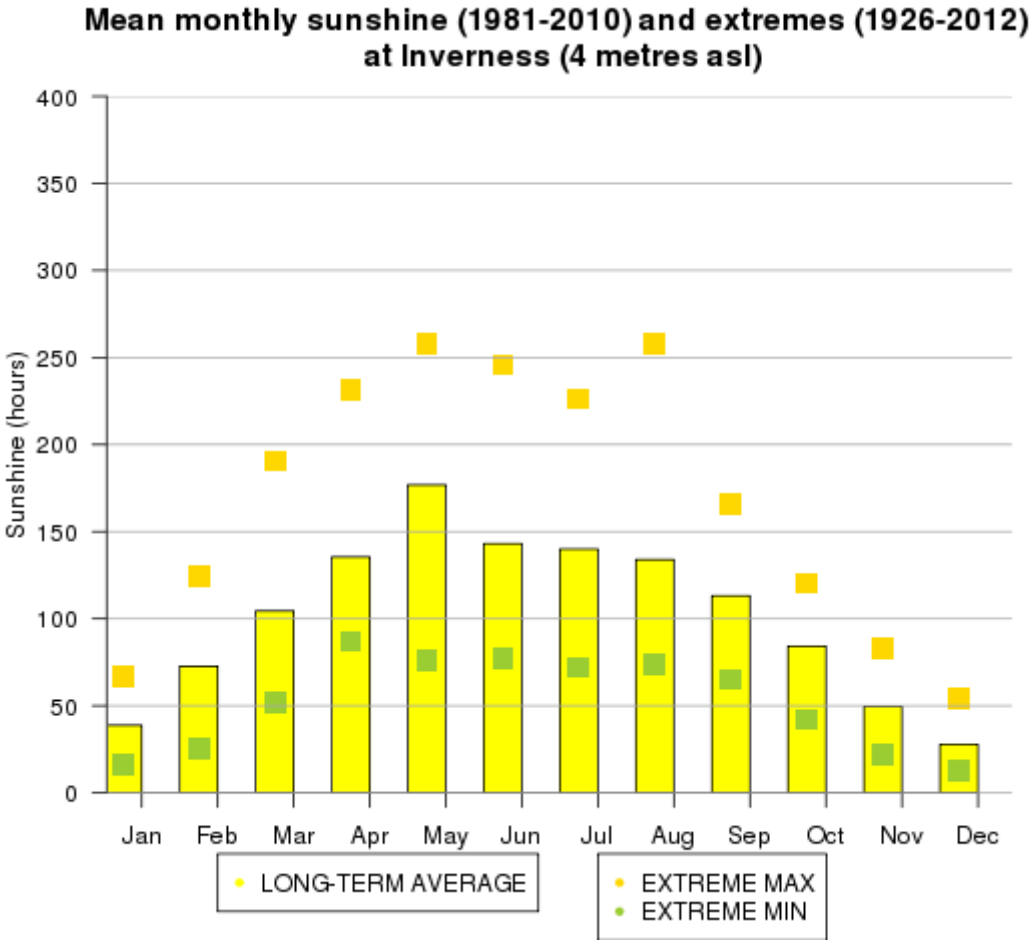
The number of hours of bright sunshine is controlled by the length of day and by cloudiness. In general, December is the dullest month and May or June the sunniest.

Sunshine duration decreases with increasing altitude, increasing latitude and distance from the coast. Local topography also exerts a strong influence and in the winter deep glens and north-facing slopes can be in shade for long periods.

In Northern Scotland the sunniest places are close to the Moray Firth and in the southern Outer Hebrides, where the annual average approaches 1300 hours. Many other coasts average about 1200 hours but sunshine averages are lower inland, and are lowest over the mountains and Shetland (less than 1100 hours). The sunniest places on mainland UK are along the south coast of England, with over 1750 hours each year on average, whilst the Channel Islands enjoy over 1900 hours.

The average monthly sunshine totals for Lerwick and Inverness are shown, together with the highest and lowest totals recorded in the stated periods. The sunniest month of the year is normally May, rather than June, because of the tendency for settled anticyclonic weather in late spring. The Western Isles in particular can experience sunny conditions in May and record high values have been achieved, such as the 300 hours at Prabost (Skye) in May 1975.


Mean monthly sunshine (1981-2010) and extremes (1929-2014)
at Lerwick (82 metres asl)
Sunshine (hours)
400
350
300
250
200
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
LONG-TERM AVERAGE
EXTREME MAX
EXTREME MIN


Mean monthly sunshine (1981-2010) and extremes (1926-2012)
at Inverness (4 metres asl)
Sunshine (hours)
400
350
300
250
200
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
LONG-TERM AVERAGE
EXTREME MAX
EXTREME MIN

Back to top

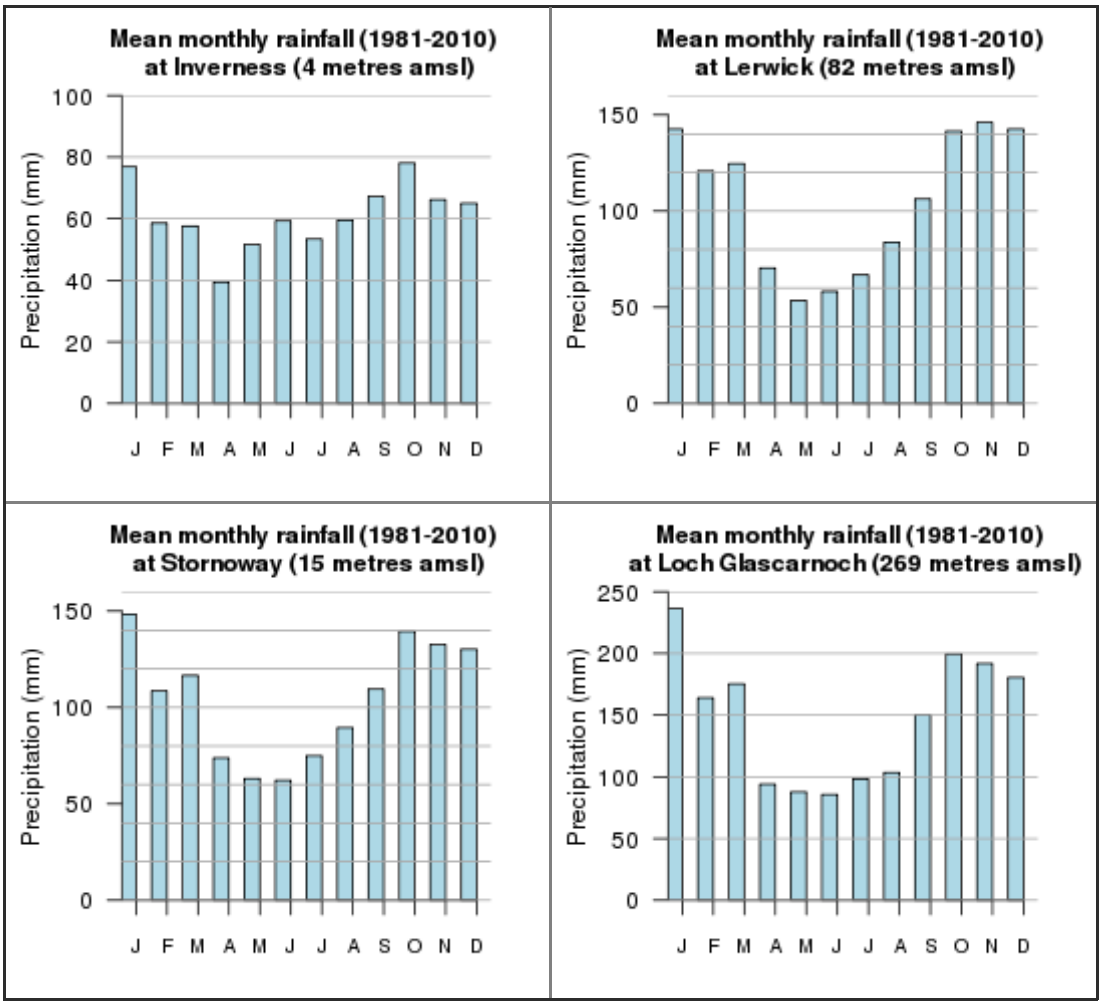
Rainfall

Rainfall is caused by the condensation of the water in air that is being lifted and cooled below its dew point. Rainfall tends to be associated with Atlantic depressions or with convection. The Atlantic Lows are more vigorous in autumn and early winter and bring most of the rain that falls in these seasons. In summer, convection caused by solar surface heating sometimes forms shower clouds.

A further factor that greatly affects the rainfall distribution is altitude. Moist air that is forced to ascend hills may be cooled below the dew point to produce cloud and rain. A map of average annual rainfall therefore looks similar to a topographic map.

Much of Northern Scotland is exposed to the rain-bearing westerly winds, particularly the Western Isles and the west coast. As a result, most of the western half of the region has an average annual rainfall of at least 1700 mm. The highest average annual rainfalls occur over the higher, west-facing slopes, with the wettest area being to the northwest of Fort William (over 4000 mm per year). Over the lower lying islands the average is less than about 1600 mm whilst near the Moray Firth, to the lee of the mountains, it is only about 700 mm. These values can be compared with annual totals around 500 mm in the driest parts of eastern England.

Rainfall is generally well-distributed throughout the year. The frequency of Atlantic depressions is normally greatest during the autumn and winter but, unlike other parts of the UK, Scotland tends to remain under their influence for much of the summer too. In the western and northern areas there is an autumn/early winter maximum, whereas places close to the Moray Firth tend to have a more even distribution through the year. Late spring and early summer is normally the driest part of the year. The course of mean monthly rainfall for 1981-2010 for 4 sites is shown below.



Over much of Northern Scotland, the number of days with rainfall totals of 1mm or more ('wet days') tends to follow a pattern similar to the monthly rainfall totals. In winter (December to February), there are fewer than

40 wet days on average close to the Moray Firth, rising to over 60 days in much of the western half of the region and in Shetland. In summer (June to August) the Moray Firth area has about 30 wet days and the western areas over 45 days.

Periods of prolonged rainfall can lead to widespread flooding, especially in winter and early spring when soils are usually near saturation and snowmelt can be a contributing factor. An example was 5-6 February 1989, when prolonged rainfall occurred over the western Highlands including the headwaters of rivers such as the Ness and Spey. In a 48 hour period over 200 mm of rain fell, with a new Scottish record for a 2-day total of 306 mm at Kinloch Hourn. This, combined with high tides, led to considerable flooding in the Inverness area and the destruction of a railway bridge over the River Ness that had stood since 1862. The Inverness area was also flooded on 7-8 September 2002 after heavy thunderstorms. These produced 84 mm of rainfall at Allanfearn, east of Inverness, of which 61 mm fell in 5 hours and 31 mm in 1 hour.

Back to top

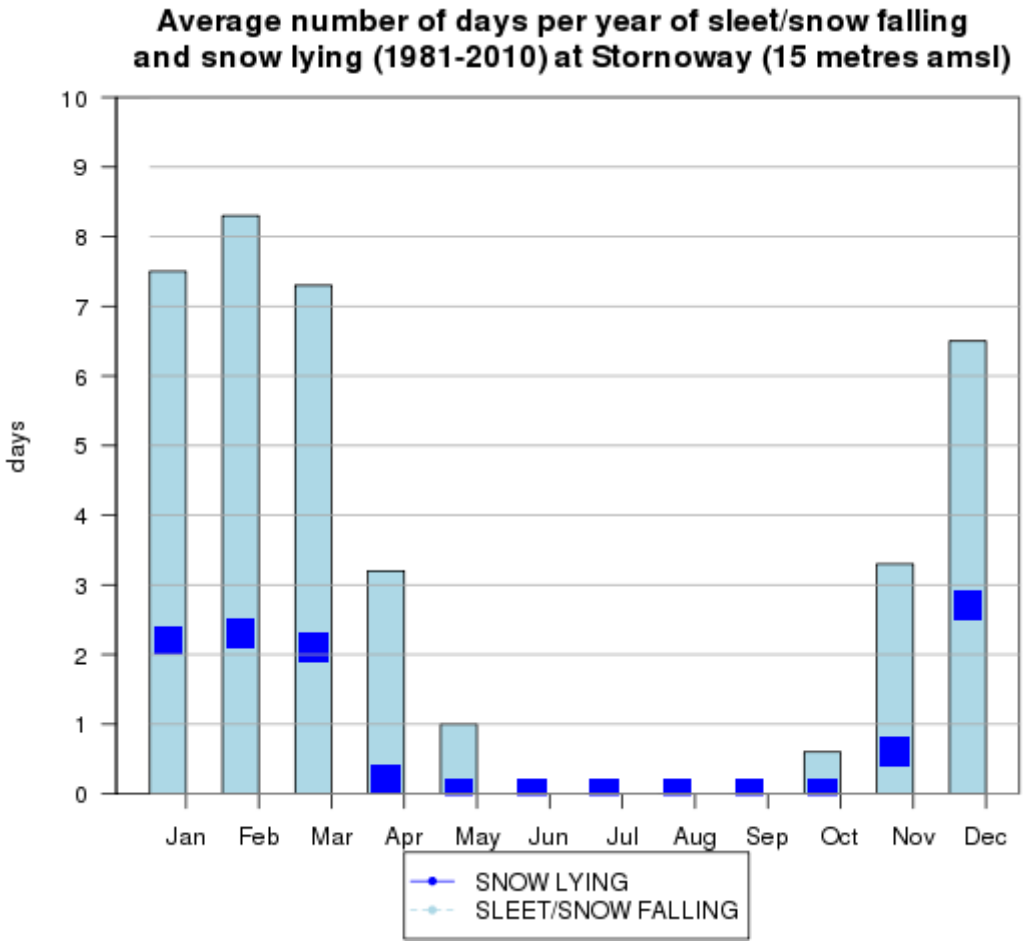
Snowfall

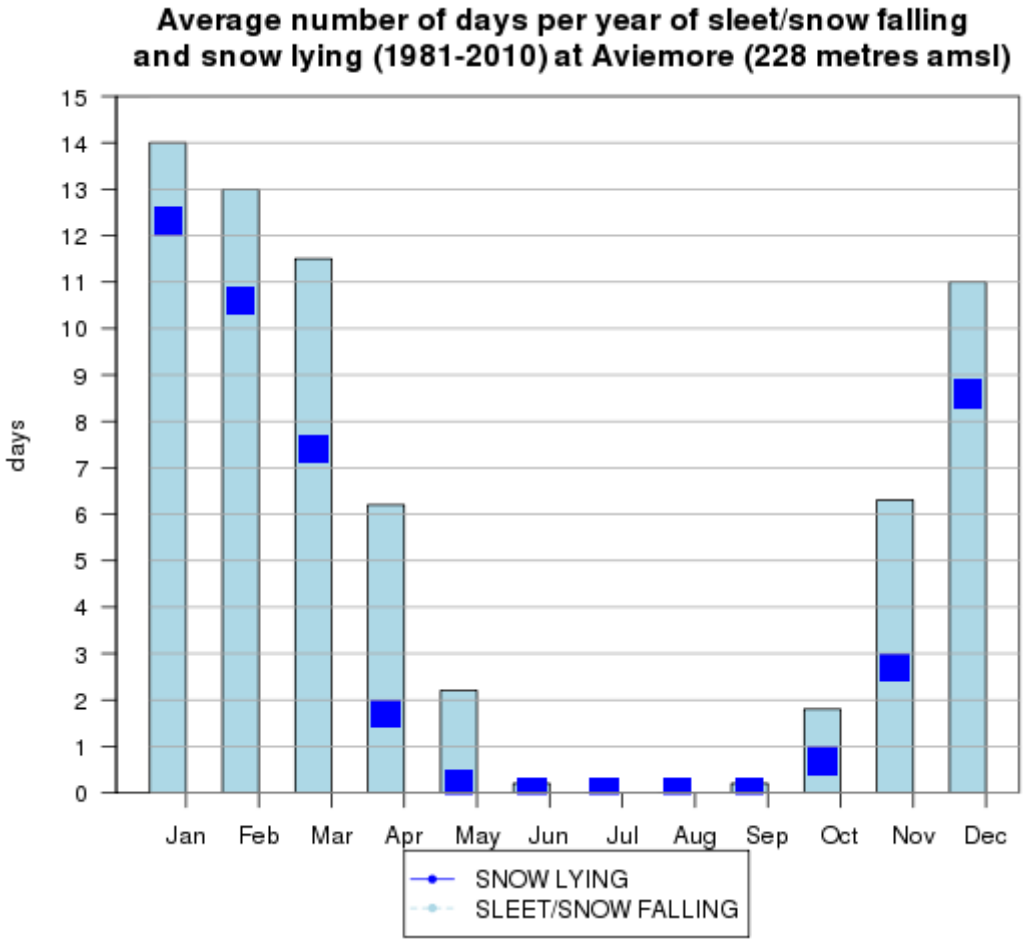
The occurrence of snow is linked closely with temperature, with falls rarely occurring if the temperature is higher than 4 °C. For snow to lie for any length of time, the temperature normally has to be lower than this. Over most of the area, snowfall is normally confined to the months from November to April, but upland areas often have brief falls in October and May. Snow rarely lies at lower levels outside the period from November to April.

On average, the number of days with snow falling varies from less than 30 per year along the west coast to over 100 days over the Grampians. The number of days with snow lying has a similar distribution, with less than 6 over the westernmost islands, about 20 in Shetland and more than 50 days over the higher ground. On the highest summits, such as Ben Nevis, snow cover typically persists for 6 or 7 months each year.

The relatively plentiful supply of snow over the highest ground has led to the development of skiing areas such as Glencoe and the Nevis Range (Aonach Mor), both near Fort William, and the Cairngorms near Aviemore.

The monthly averages of days with sleet/snow falling and lying at Stornoway and Aviemore are shown below (a day of lying snow is counted if the ground is more than 50% covered at 0900).





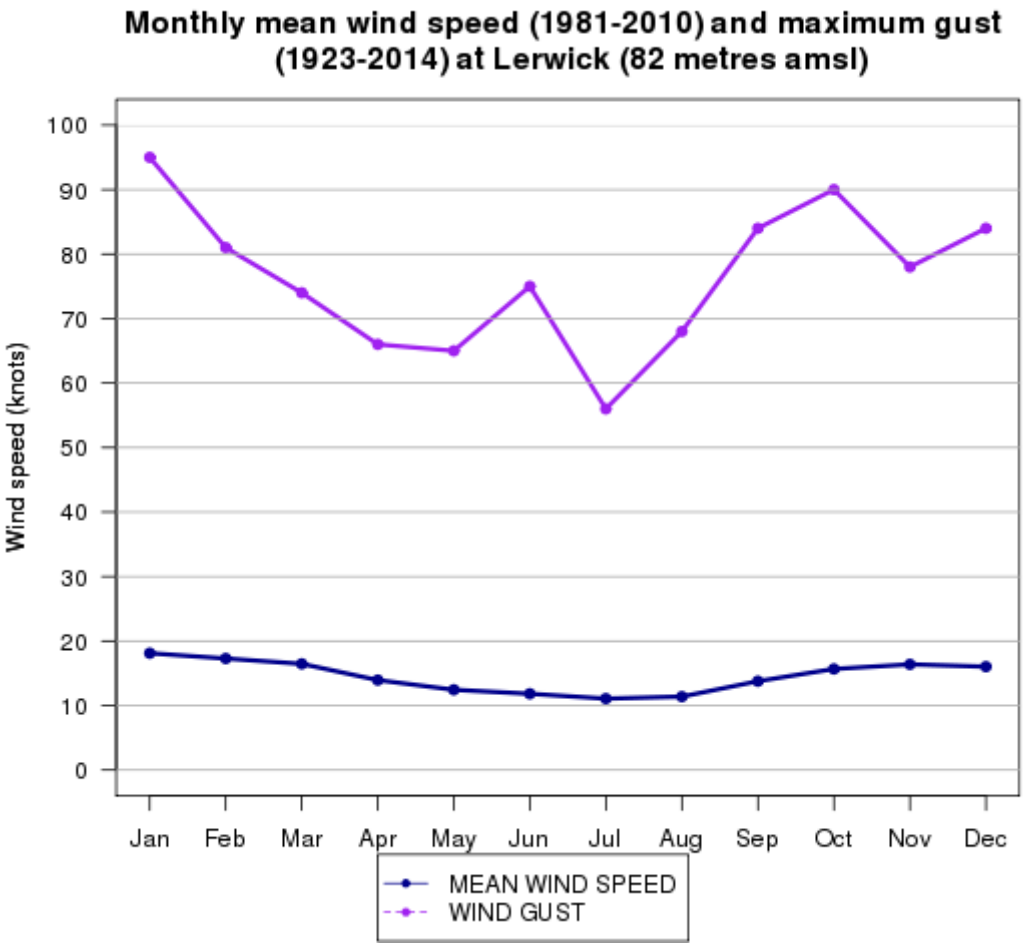
Heavy snowfalls can cause travel and power supply disruption. Examples include 28-29 January 1978 when strong NE winds and persistent snow lasting over 24 hours resulted in 40-60 cm of level snow over a wide area

with drifts several metres deep. This brought severe disruption to road and rail transport and to power and telephone services, with some loss of life.

Wind

The western and northern parts of Northern Scotland are, on average, the windiest in the UK, being fully exposed to the Atlantic and closest to the passage of areas of low pressure. The frequency and depth of these depressions is greatest in the winter half of the year, especially from December to February, and this is when mean speeds and gusts (short duration peak values) are strongest.

The variation in monthly mean speeds (average of a continuous record) and highest gusts ('instantaneous' speed averaged over about 3 seconds) at Lerwick is shown below.



Wind direction is defined as the direction from which the wind is blowing. As Atlantic depressions pass the UK the wind typically starts to blow from the south or south west, but later comes from the west or north-west as the depression moves away. The range of directions between south and north-west accounts for the majority of occasions and the strongest winds nearly always blow from these directions. Spring time tends to have a maximum frequency of winds from the north east.

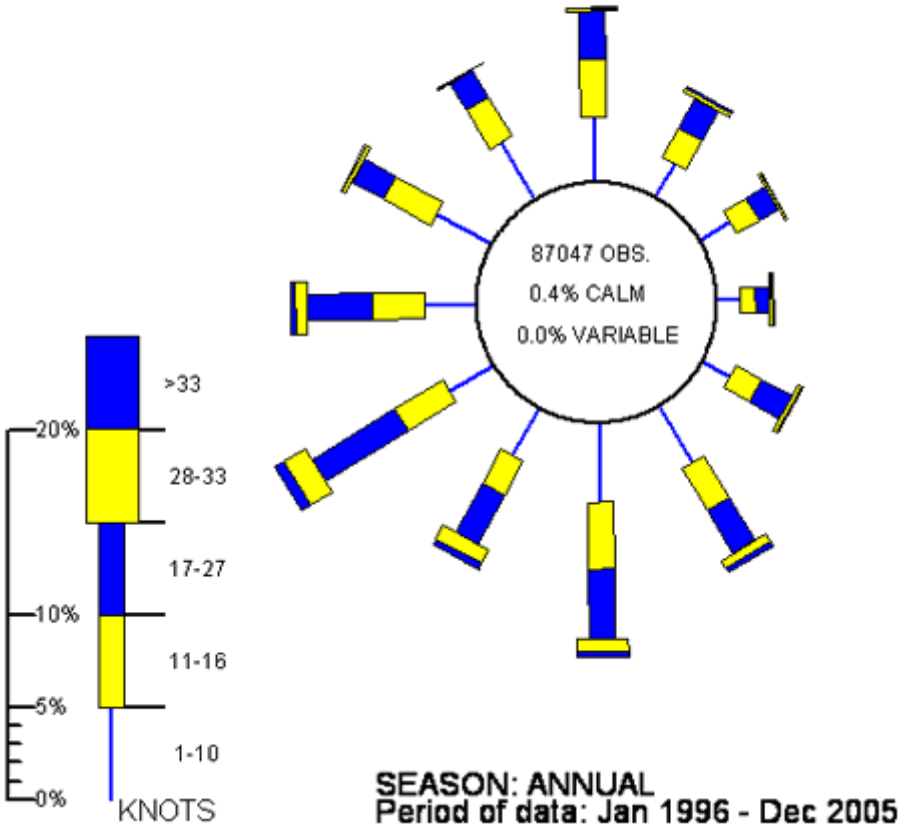
The annual wind rose for Lerwick is typical of open, level locations across the Northern and Western Isles, with a prevailing south-west wind direction through the year and frequent strong winds. In the Highlands, winds are much lighter and generally directed along valleys. For example, at Aviemore south-westerly winds are very dominant, influenced by the Spey valley.

Back to top

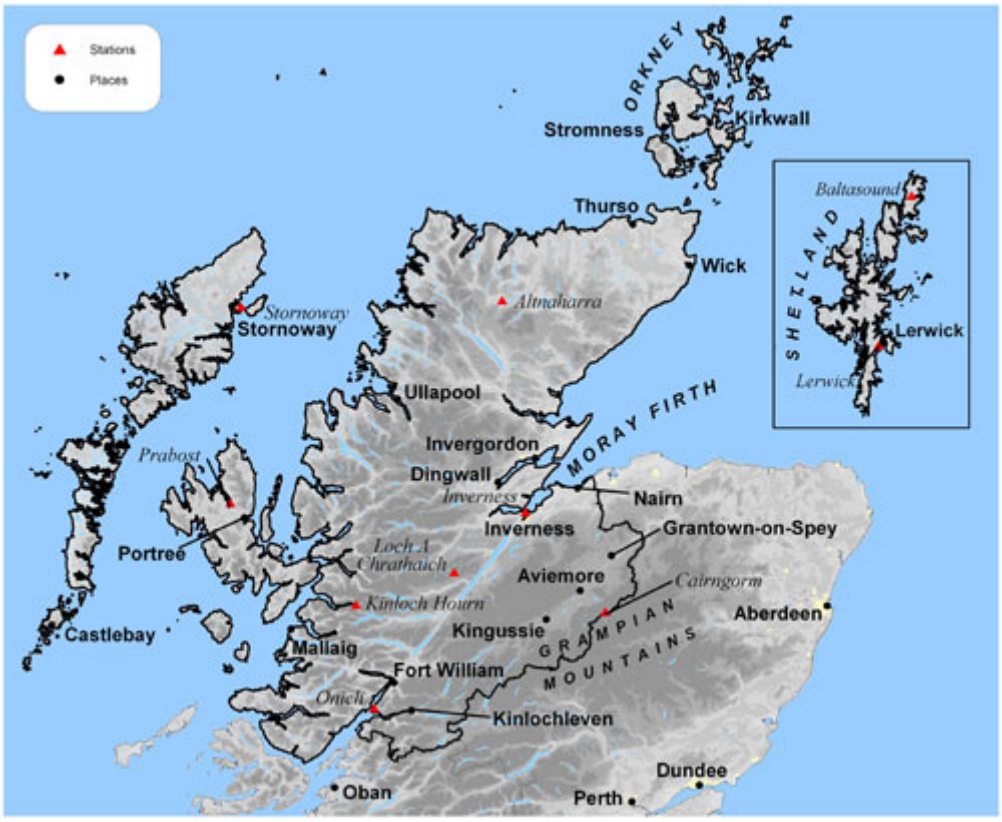
Location map

Back to top

WIND ROSE FOR LERWICK
N.G.R: 4453E 11396N ALTITUDE: 82 metres a.m.s.l.



SEASON: ANNUAL
Period of data: Jan 1996 - Dec 2005



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