

Western Scotland: climate

This describes the main features of the climate of Western Scotland, comprising the former regions of Strathclyde, Central (except for Clackmannanshire and Falkirk) and Dumfries and Galloway. It includes the Argyll islands, such as Arran, and the southern Hebrides such as Tiree, Mull, Jura and Islay. The region covers the western half of both the Central Lowlands and the Southern Uplands.



Much of the landscape of Western Scotland consists of high ground, i.e. more than 200 metres above sea level, especially in the north, where there are many peaks that exceed 1000 metres. Fjord-like sea lochs and the islands of the Hebrides characterise the west of the region, while the south contains the Southern Uplands. The major estuary is that of the Clyde, but the southern part of the area borders the Solway Firth. The highest peaks of the two main upland regions are Merrick (843 metres) in Galloway in the Southern Uplands and Ben More (1174 metres) in the southern Highlands. Many of the islands also contain substantial peaks; the highest point on any of the islands is Ben More on Mull at 967 metres. There are several large towns in the region, but the only city is Glasgow (UK's fourth largest), which has several substantial towns surrounding it. The largest of the islands is Mull.

Temperature

The climate of Western Scotland is milder than that of Eastern Scotland due to the stronger maritime influence, as the prevailing winds blow from the sea. The warm Gulf Stream also has a strong influence on Western Scotland. With winds mainly blowing from the sea the annual mean temperatures are in the range 9.5 to 9.9 °C in coastal areas such as Ayrshire, Bute and Kintyre. This mean temperature is also reached in central Glasgow, due to the urban heat island effect. The annual mean temperature tends to fall towards the south and north parts of the region due to altitude, as well as inland where 8.0 to 9.4 °C is more typical. The lowest annual mean temperature for low lying areas in the UK is about 7 °C in the Shetlands.

The strong maritime control of temperature is best seen in the annual temperature range, the difference between the mean temperature of the warmest and coldest months. The smaller the temperature range, the greater the maritime influence. In parts of Galloway, Kintyre and the Hebrides the annual temperature range is about 9 °C, which is similar to that found in western Ireland; for comparison the annual temperature range increases to about 14 °C in the English Midlands as the maritime influence decreases.

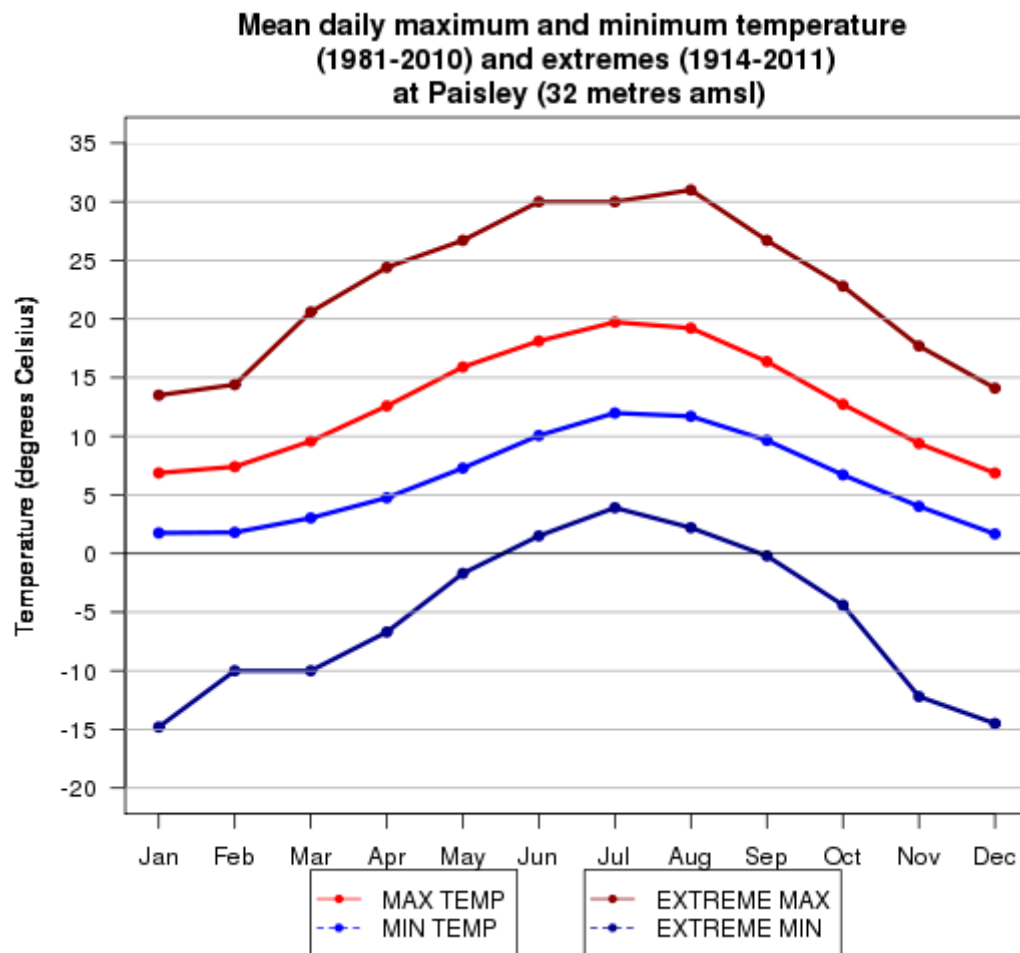
The sea reaches its lowest temperature in February or early March so that on average February is the coldest month in some coastal parts of Ayrshire, the Rinns of Galloway, Kintyre and the Hebrides. In February the mean daily minimum temperature varies from about 2 °C in most of the islands, 1 to 2°C along most of the Solway Firth and lowland inland areas, but less than -1 °C in parts of the Southern Uplands and central Highlands. Inland, where the influence of the sea is less, January is the coldest month with mean daily minimum temperatures generally between -3 and 0 °C.

Examples of extreme low temperatures that have occurred in the region are -18.3 °C at Glenlee (Dumfries and Galloway) in January 1940 and -24.8 °C at Carnwath (South Lanarkshire) on 11 January 1982. Unusually cold weather was experienced in the last week of December 1995 with, for example, a minimum temperature of -20 °C and a maximum of -12 °C at Glasgow airport on 29th. These very cold conditions coincided with the

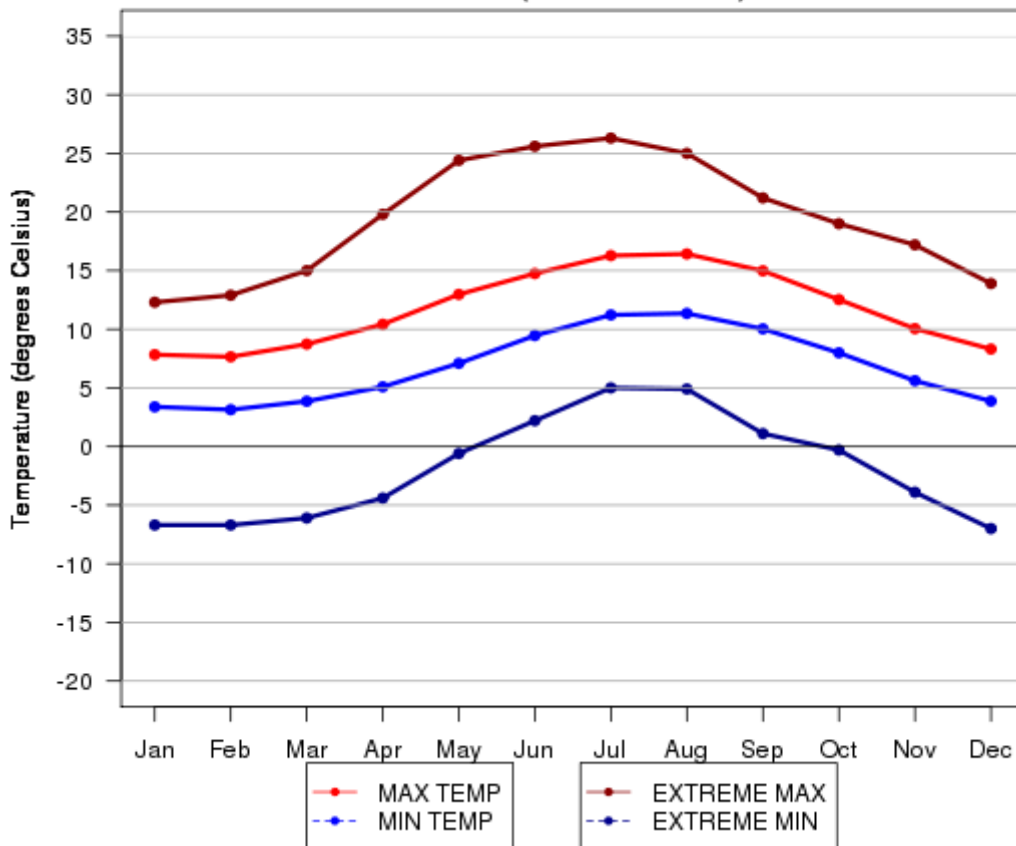
Christmas/New Year holidays and resulted in burst water pipes and severe flooding in unoccupied homes and commercial properties.

July and August are the warmest months in the region with mean daily maxima ranging from less than 15 °C on the highest ground to more than 19 °C in southern Dumfries and Galloway and the Clyde valley. These may be compared with 23.5 °C in the London area. Instances of extreme high temperatures are rare and are associated with hot air brought from mainland Europe on south easterly winds, accompanied by strong sunshine. The highest temperature ever recorded in the whole of Scotland was 32.9 °C at Greycrook (Borders) on 9 August 2003. The previous record of 32.8 °C was set almost a century before in Dumfries on 2 July 1908. Other examples of extreme high temperatures that have occurred in the region are 32.2 °C at Prestwick and Kilmarnock on 29 July 1948, and 31.7 °C at Buchlyvie (west of Stirling) on 12 July 1911.

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



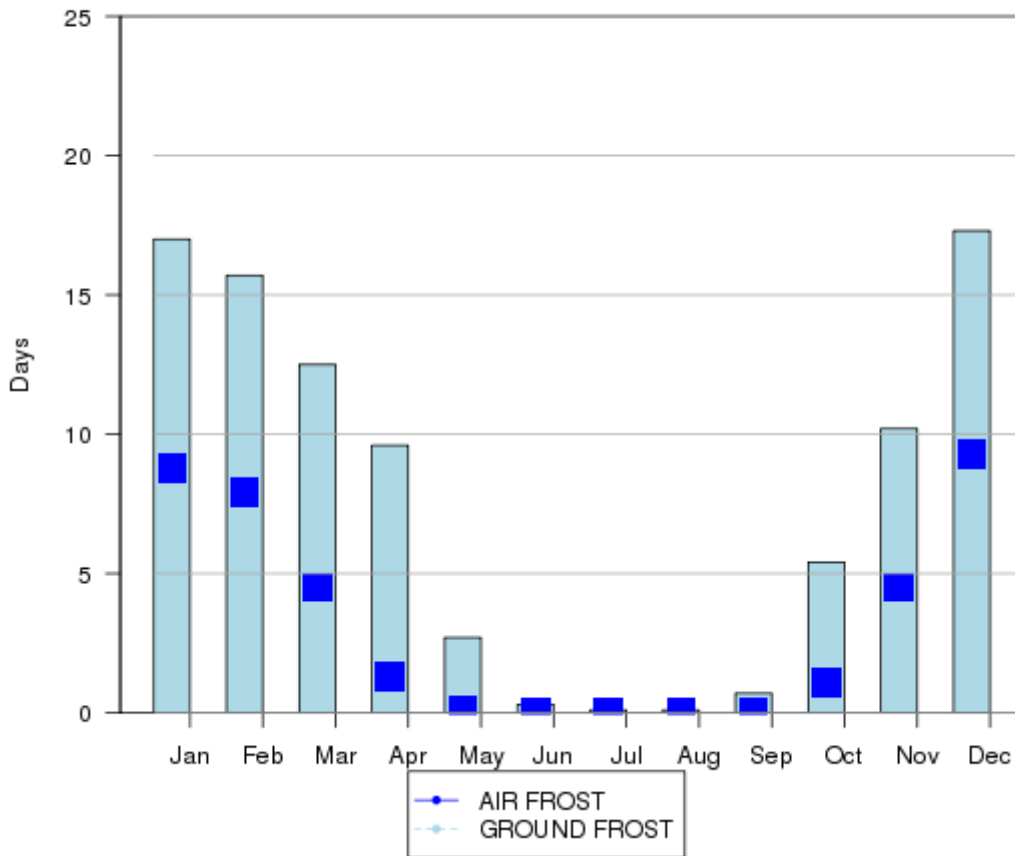
**Mean daily maximum and minimum temperature
(1981-2010) and extremes (1927-2014)
at Tiree (12 metres amsl)**



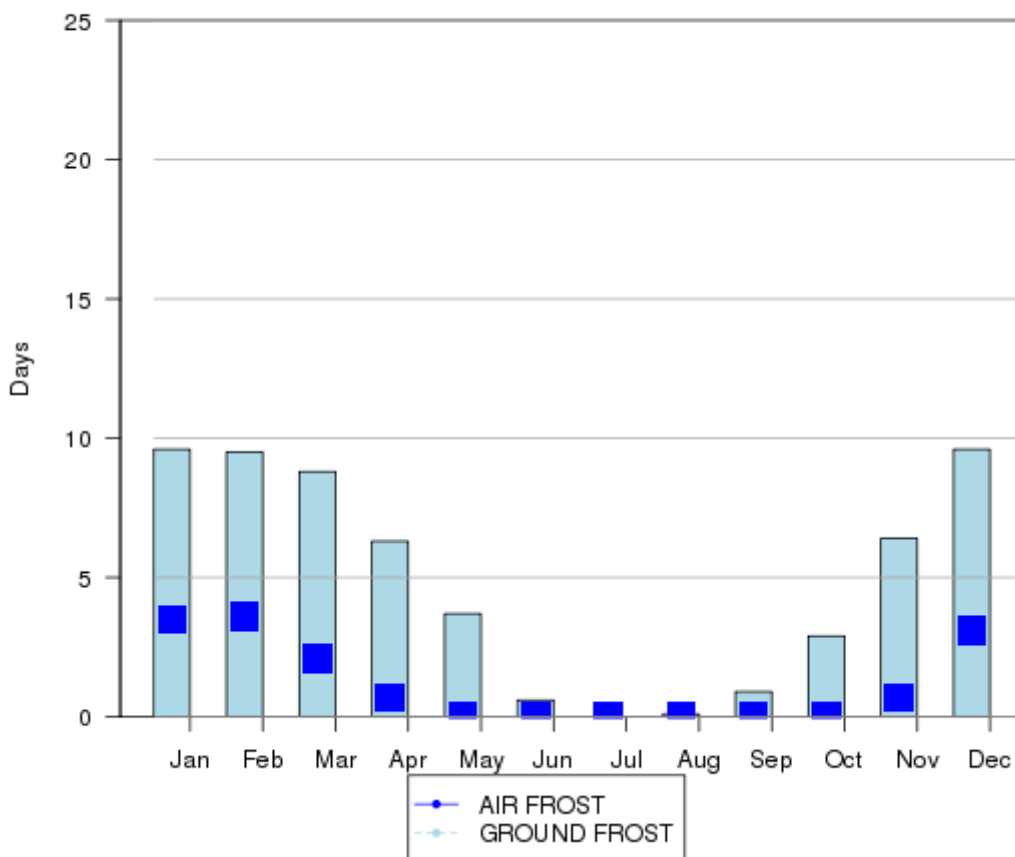
An 'air frost' occurs when the temperature at 1.25 metres above the ground falls below 0 °C, whereas incidence of a 'ground frost' refers to a temperature below 0 °C measured on a grass surface. The average number of days with air frost in Western Scotland varies from less than 25 a year in the Hebrides to about 40 on the coast of the mainland to more than 80 a year over the higher ground of the Southern Uplands and Highlands. Ground frost averages range from less than 60 to over 140 days per year, with a similar distribution to air frost. However, valleys and hollows into which cold air can drain off hills are particularly prone to frost.

The average frequency of air and ground frost at Paisley and Tiree are shown in the following graphs. Although the summer months are usually free of air frost, a ground frost is possible in almost any month especially at sheltered inland sites.

Average annual number of days of air and ground frost (1981-2010) at Paisley (32 metres amsl)



Average annual number of days of air and ground frost (1981-2010) at Tiree (12 metres amsl)



Sunshine

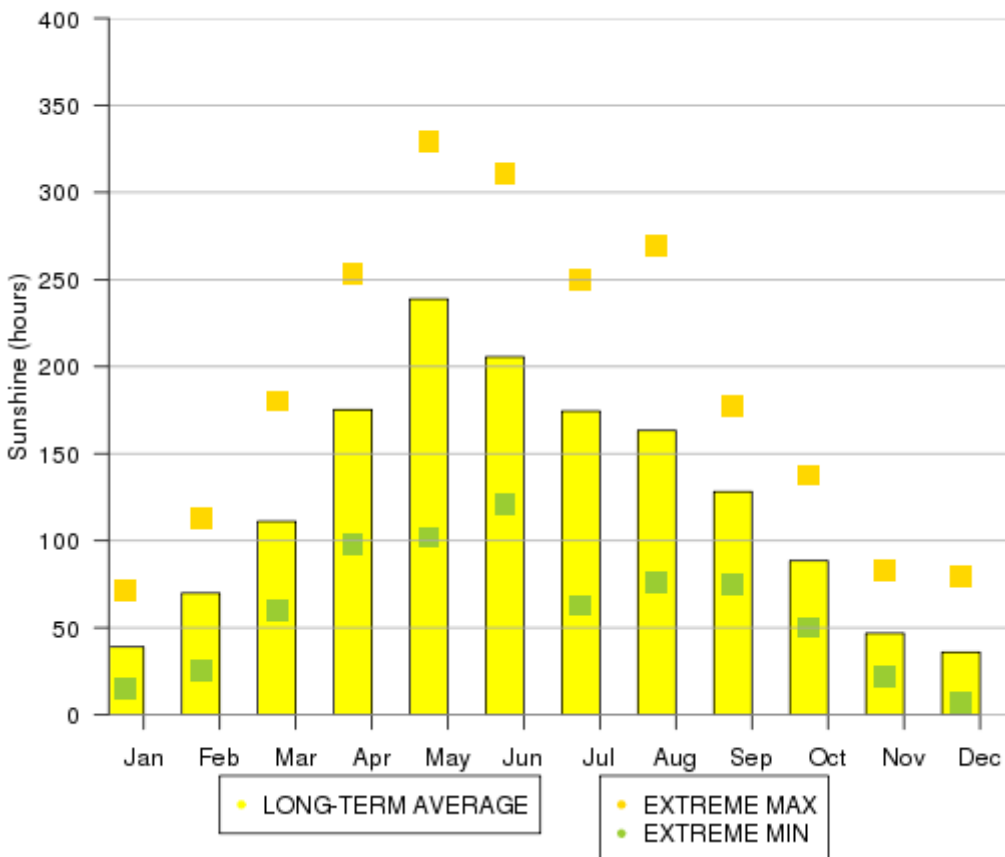
The number of hours of bright sunshine is controlled by the length of day and by cloudiness. In general, December is the dulllest month and May or June the sunniest.

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. Industrial pollution and smoke haze can also reduce sunshine amounts, but the decline in heavy industry in the Clyde valley has resulted in an increase in sunshine duration particularly in the winter months.

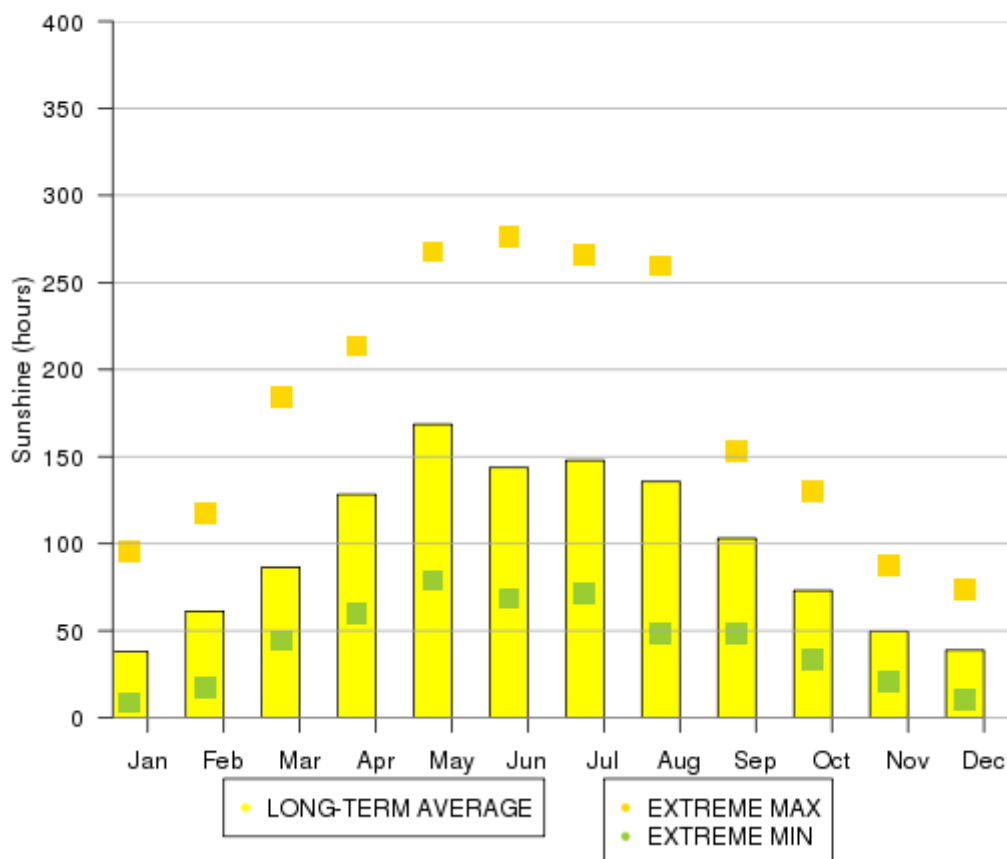
The sunniest parts of Western Scotland are the Solway coast, Kintyre and the low-lying islands, where the average annual sunshine totals approach 1450 hours. Close to the other coasts, 1350 hours is typical whilst the averages decrease with altitude and to the north so that the Southern Uplands receive less than 1200 hours and the west Highlands less than 1100 hours. The sunniest places on mainland UK are along the south coast of England, with over 1750 hours per year on average, whilst the Channel Islands enjoy over 1900 hours.

The average monthly sunshine totals for Tiree and Eskdalemuir are shown, together with the highest and lowest totals recorded in the stated periods.

Mean monthly sunshine (1981-2010) and extremes (1929-2014) at Tiree (12 metres asl)



Mean monthly sunshine (1981-2010) and extremes (1910-2014) at Eskdalemuir (242 metres asl)



The graphs show that Tiree has more sunshine than Eskdalemuir in almost every month. Both places have least sun in December and most in May, due to the greater tendency for anticyclonic conditions in May often with easterly winds. The highest known monthly sunshine total in the area is 329 hours at Tiree in May 1975. The highest UK monthly total is 383.9 hours in July 1911 at Eastbourne, Sussex. In the dullest winter months less than 20 hours have been recorded on occasion, with only 8.6 hours of sunshine at Eskdalemuir in January 1996.

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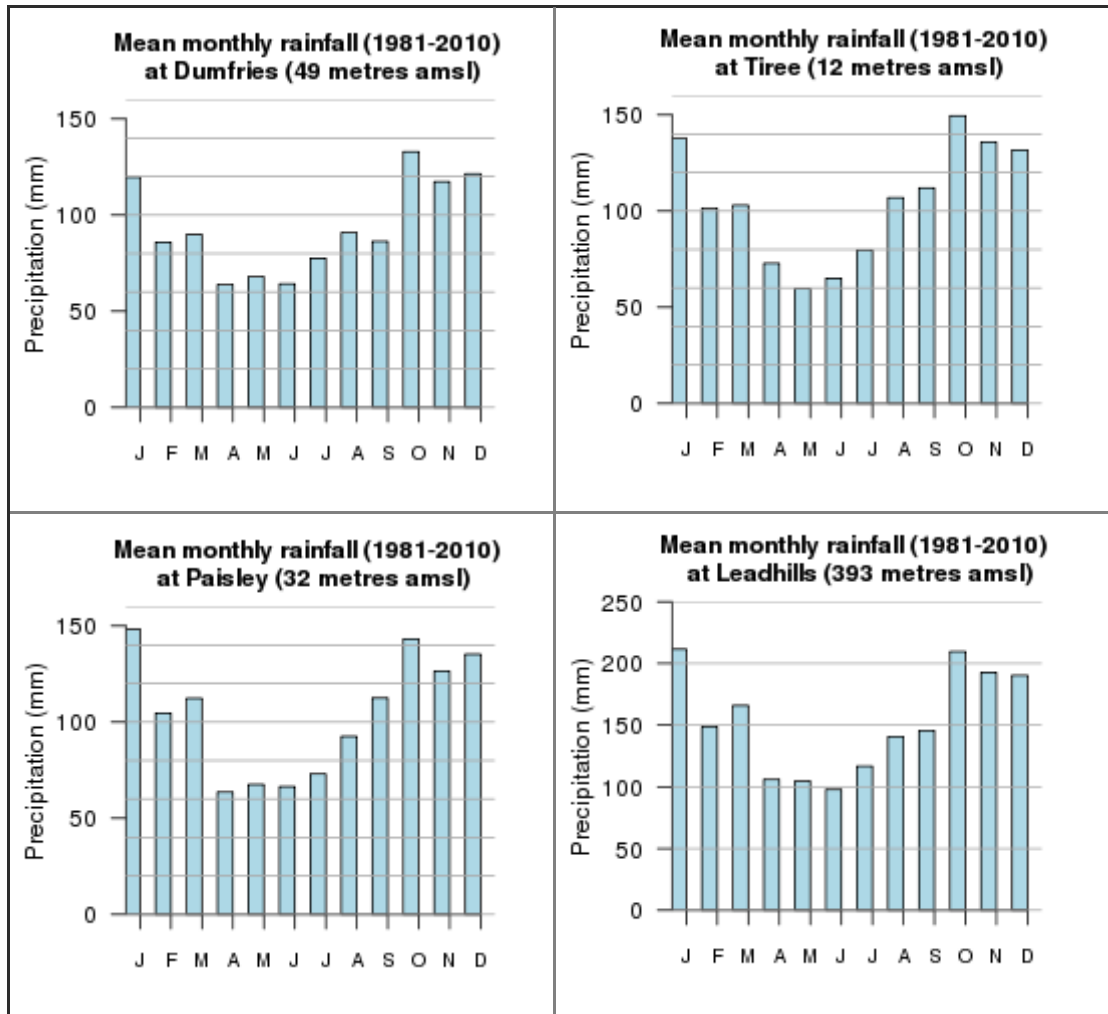
Rainfall

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 depressions are more vigorous in autumn and winter and most of the rain which falls in those seasons is from this source. However, in autumn and winter the islands and western coastal areas are also prone to convective showers caused by the relatively warm sea. In spring and summer, convection caused by heating of the land can form showers inland in the region.

A further factor which greatly affects the rainfall distribution is altitude. Moist air which 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 very similar to a topographic map.

Average annual rainfall totals range from less than 1000 mm in the upper Clyde valley and along the coasts of Ayrshire and Dumfries and Galloway to over 3500 mm over the higher parts of the west Highlands, approaching the maximum values found in the UK (over 4000 mm further north). These averages can be compared to annual totals around 500 mm typical of the driest parts of Eastern England.

Rainfall is generally well-distributed throughout the year but there is a marked seasonal variation. The frequency of Atlantic depressions is normally greatest during the winter but, unlike other areas of the UK, Scotland tends to remain under their influence for much of the summer too. Autumn and early winter are the wettest seasons, especially from October to January, and spring and early summer is normally the driest part of the year, especially from April to June. The average monthly rainfall for 4 sites is shown below.



The numbers of days with rainfall totals of 1 mm or more ('wet days') tend to follow a similar pattern to the monthly rainfall totals. In coastal areas from Ayrshire southwards about 45 wet days is the norm in each of the autumn (September to November) and winter (December to February) seasons, rising to over 55 days over the higher ground. In each of spring and summer, there are about 35 wet days on the coasts and over 40 over high ground.

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 10-11 December 1994 when a slow-moving frontal zone resulted in unusually high rainfall totals in the Glasgow-Irvine areas. For example, at Paisley, 88 mm was recorded on 10th with about 133 mm over the 2 days. Flooding occurred in the River Irvine catchment and there was disruption to rail travel in Glasgow. The highest Scottish daily rainfall total (238 mm) was recorded in the region at Sloy, Loch Lomond on 17 January 1974. This may be compared with the highest daily UK total of 279 mm recorded at Martinstown in Dorset on 18 July 1955.

Snowfall

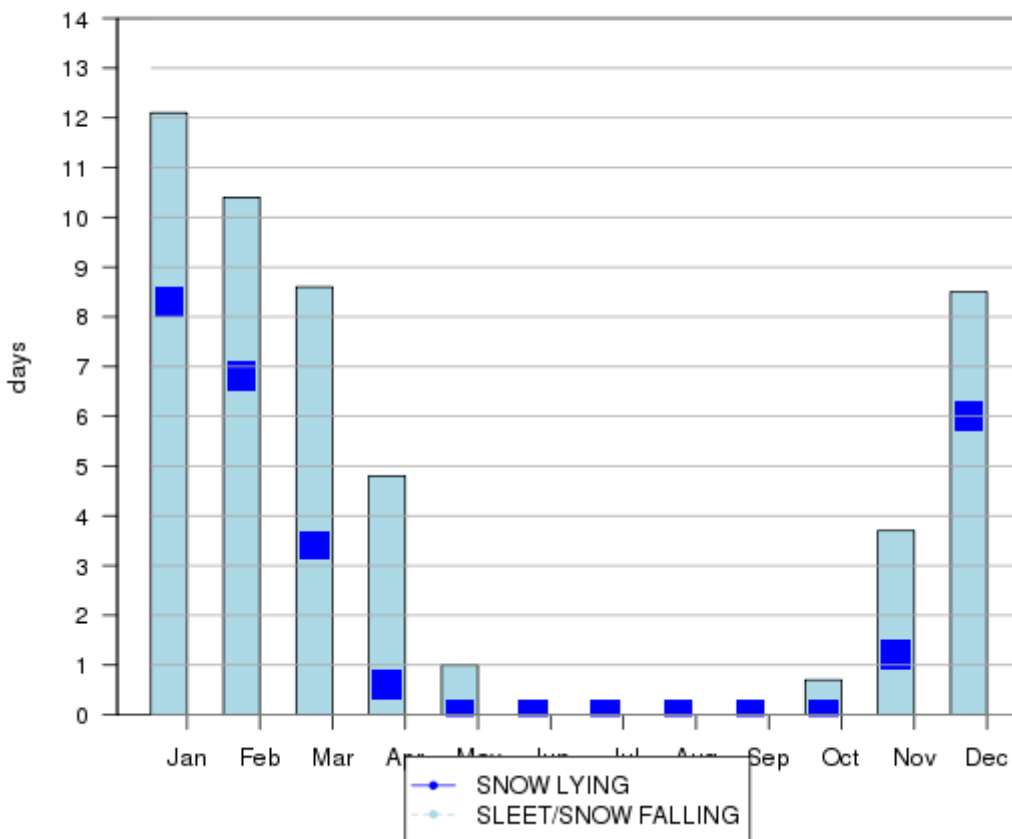
The occurrence of snow is linked closely with temperature, with falls rarely occurring if the temperature is higher than 4 °C. For snow to lie for any length of time then the temperature normally has to be lower than this. Over most of the area, snowfall is normally confined to the months from November to April, but upland

areas often have brief falls in October and May. Snow rarely lies at lower levels outside the period December to March.

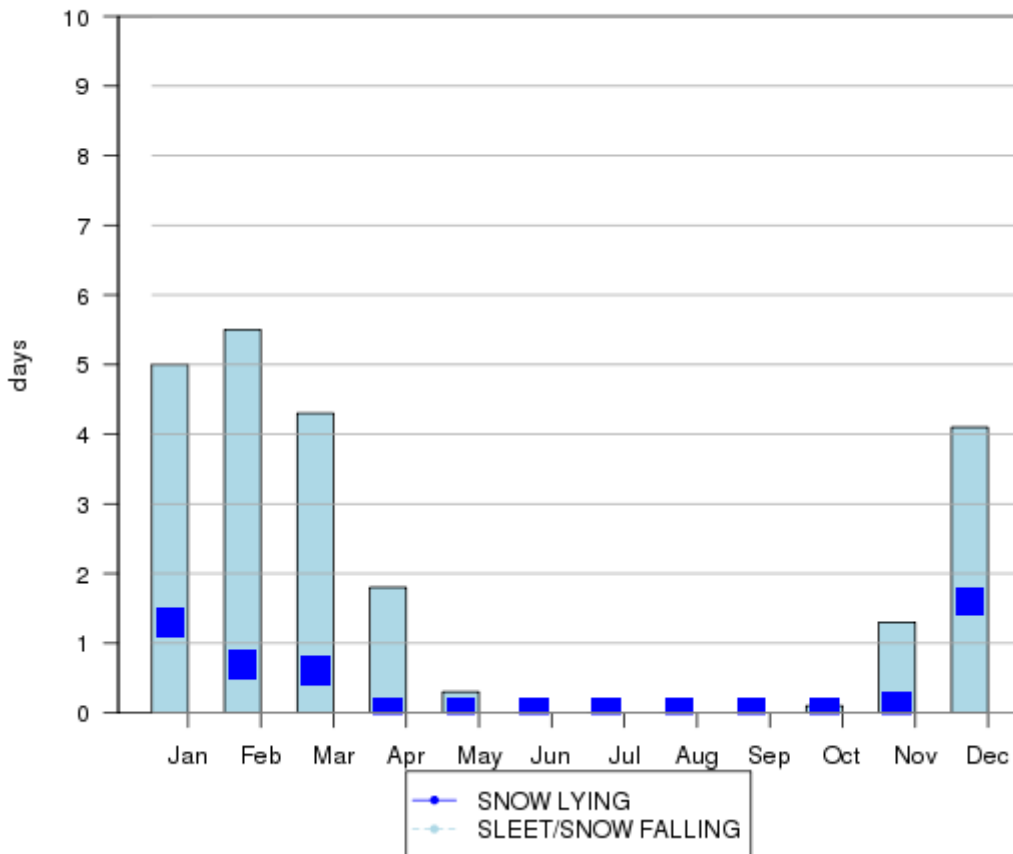
On average, the number of days with snow falling is less than 10 per winter in the Hebrides and about 20 near the Ayrshire and Galloway coast. Over 60 days is typical over the highest ground of the west Highlands. The number of days with snow lying has a similar distribution, with less than 5 in the islands and along the coast but over 30 days over the higher ground. These averages can be compared with the coasts of SW England where less than 3 days per year with lying snow.

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

Average number of days per year of sleet/snow falling and snow lying (1981-2010) at Eskdalemuir (242 metres amsl)



Average number of days per year of sleet/snow falling and snow lying (1981-2010) at Tiree (12 metres amsl)



Occasionally, a combination of snow and strong winds can cause transport disruption. For example, frequent snow showers on 13 January 1984 in a very cold westerly airstream resulted in undrifted snow 20-30 cm deep in Argyll and over 40cm at higher altitudes in the Southern Uplands. Strong winds and further snowfalls later in January 1984 led to considerable drifting with road transport and trains stranded. Level snow lay 25-30 cm deep at lower levels inland whilst the greatest depth reported was a remarkable 112 cm at Leadhills (393 metres) in the Southern Uplands.

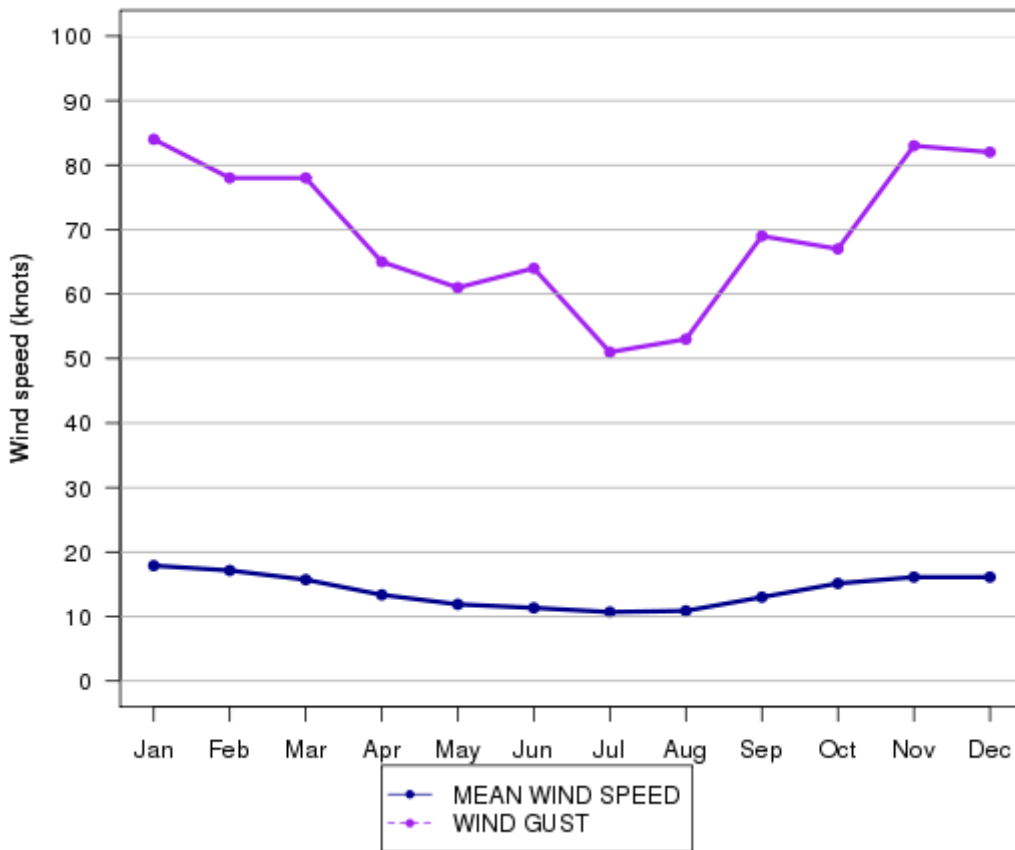
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Wind

West Scotland is one of the more exposed areas of the UK, being close to the Atlantic. The strongest winds are associated with the passage of deep depressions close to or across the UK. The frequency and strength of depressions is greatest in the winter half of the year and this is when mean speeds and gusts are strongest. The graph for Tiree shows a typical variation of the monthly mean speed and highest gust. November to March have the highest mean speeds with June to August the lightest winds.

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

Monthly mean wind speed (1981-2010) and maximum gust (1927-2014) at Tiree (12 metres amsl)



Another measure of wind exposure is the number of days when gale force is reached. If the wind reaches a mean speed of 34 knots or more over any ten consecutive minutes, then that day is classed as having a gale. Over most inland, sheltered areas of the region the average is around 5 days per year but the coasts, islands and well exposed upland areas have more, with over 25 days with gale in the Hebrides in an average year. Wind speed is sensitive to local topographic effects and land use. Exposed places on coasts and hills will experience stronger wind speeds and more days of gale.

There have been several noteworthy gales affecting Western Scotland, accompanied by property damage and disruption to travel and power supplies. Examples include an intense depression on 15 January 1968 that produced an hourly mean speed of 53 knots and a gust of 89 knots at Glasgow airport and resulted in 20 fatalities and 2000 people being made homeless in Glasgow. The 'Boxing Day Storm' of December 1998 that tracked north-eastwards across Scotland produced a gust of 80 knots at Prestwick.

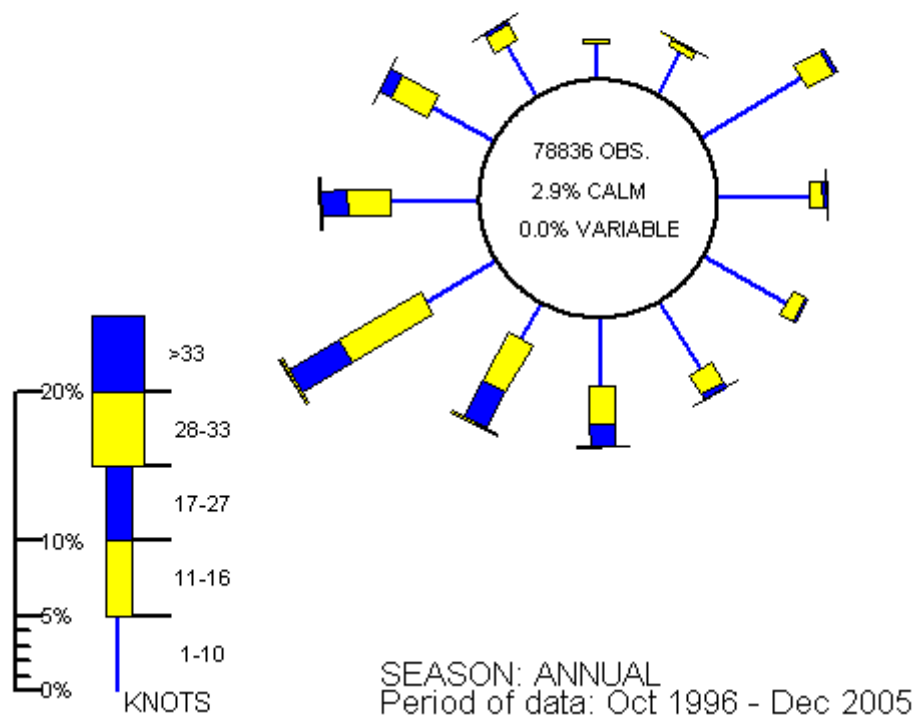
The direction of the wind is defined as the direction from which the wind is blowing. As Atlantic depressions pass by the UK the wind typically starts to blow from the south or south west, but later comes from the west or north-west as the depression moves away. The range of directions between south and north-west accounts for the majority of occasions and the strongest winds nearly always blow from this range of directions. Spring time also tends to have a maximum of winds from the north east, due to the build up of high pressure over Scandinavia at this time of year.

The wind rose for Prestwick illustrates the typical frequency of speeds and directions during the year through the Central Lowlands, with the enhanced SW direction that occurs there. In contrast the wind rose for Tiree is typical of sites on the islands, with topographic features generally absent and frequent strong winds.

WIND ROSE FOR PRESTWICK, GANNET

N.G.R: 2369E 6276N

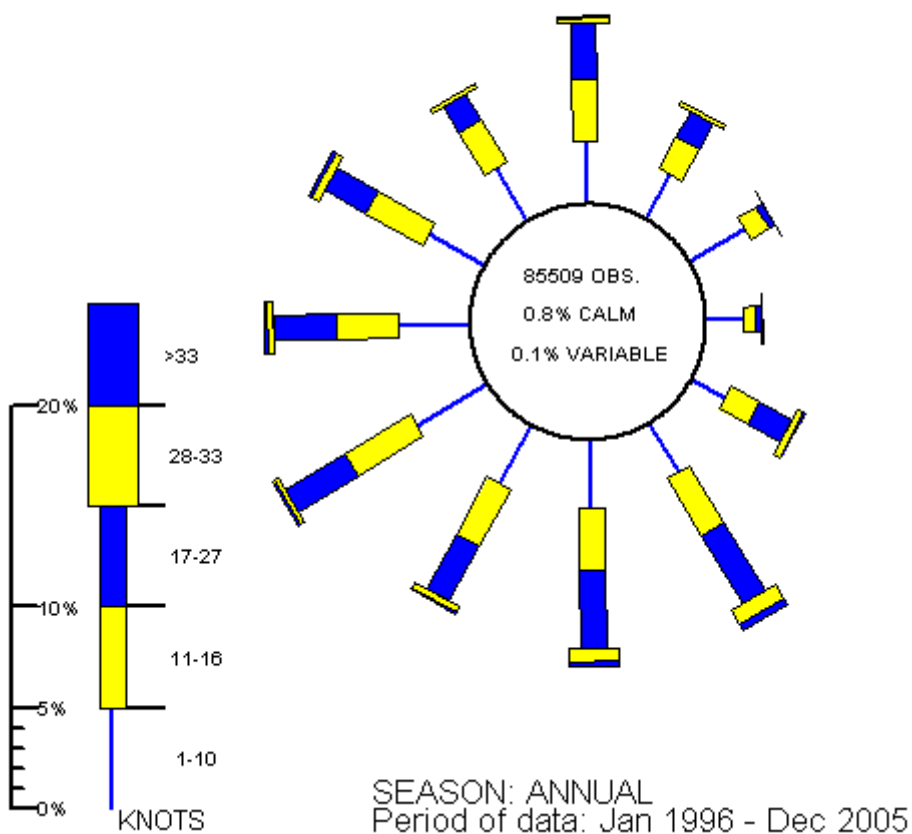
ALTITUDE: 27 metres a.m.s.l.



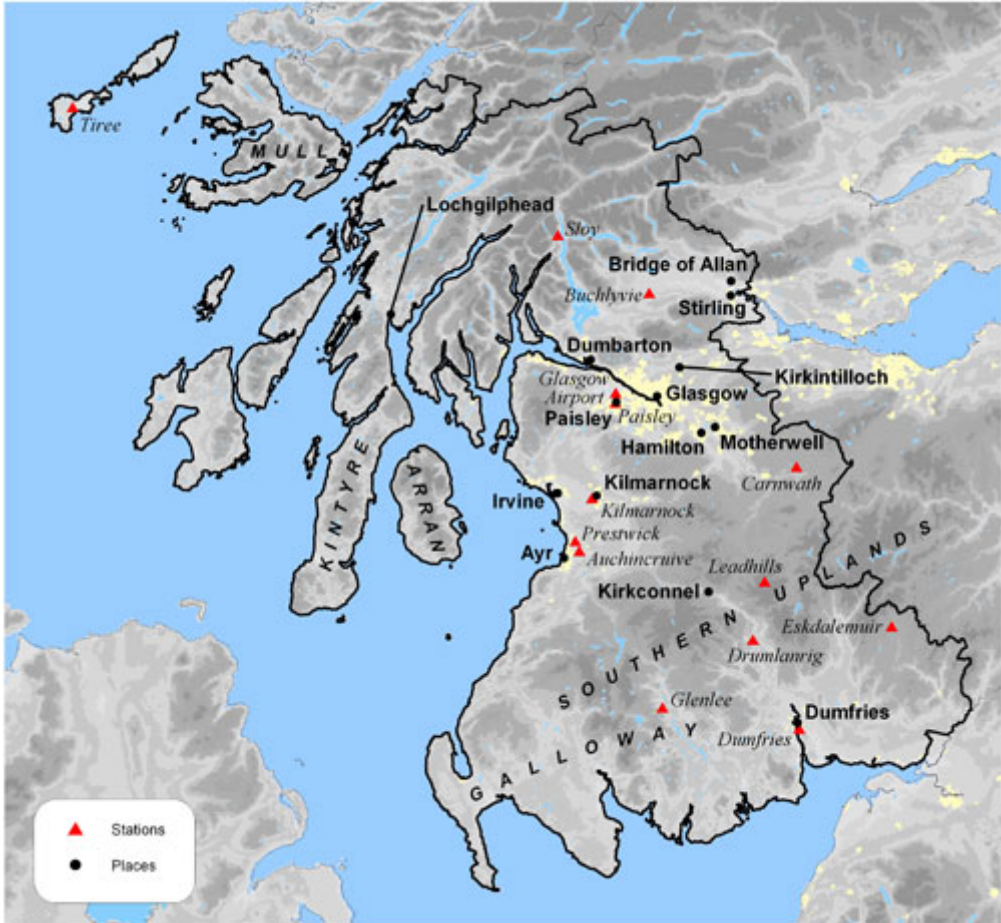
WIND ROSE FOR TIRRE

N.G.R: 997E 7448N

ALTITUDE: 9 metres a.m.s.l.



Location map



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