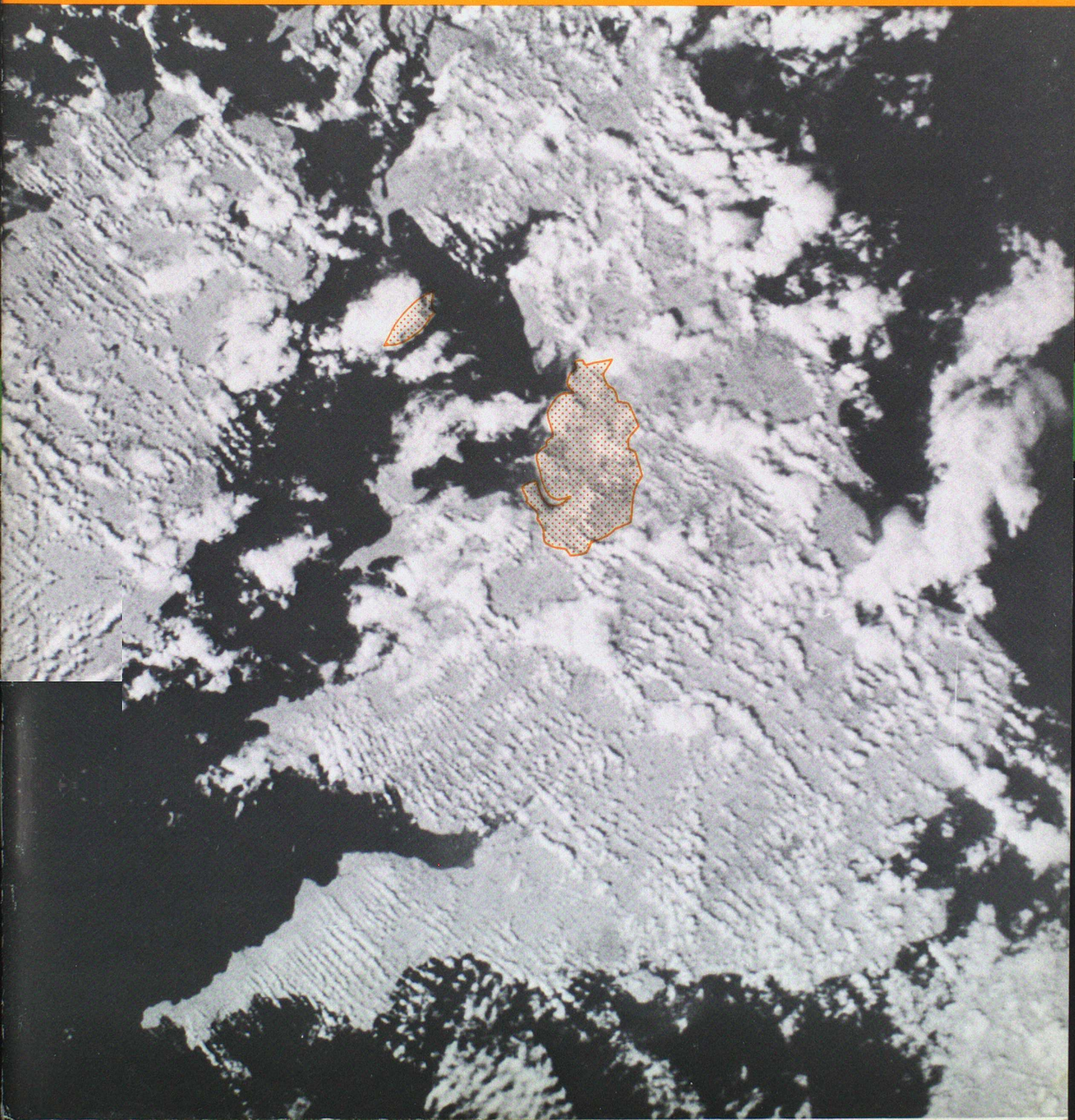




# THE CLIMATE OF GREAT BRITAIN LANCASHIRE AND CHESHIRE AND ISLE OF MAN

Climatological Memorandum 130





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The front cover shows a view of England and Wales from the satellite Tiros N taken at 1518 GMT on Wednesday 2 April 1980 — photograph by courtesy of the Department of Electrical Engineering and Electronics, University of Dundee.

An anticyclone was situated to the south-west of the British Isles and a showery north-westerly air-stream covered Britain. The alignment of the clouds with the surface wind is clearly seen. The Isle of Man had 10 to 11 hours of sunshine with a few showers of rain and hail, and a maximum temperature around 10°C. In Lancashire and Cheshire the weather was similar but the maximum temperature reached 12°C to 13°C with 8 to 9 hours of sunshine.





# THE CLIMATE OF GREAT BRITAIN

Climatological Memorandum 130

## Lancashire and Cheshire and Isle of Man

This memorandum is one of a series which will cover the whole of Great Britain and seeks to present the main features of the climate of the area in a form suitable for use in schools and by members of the general public.

There is an Introduction to the series (Climatological Memorandum 113) which explains how the various weather elements are measured and defines some of the more common terms.

Industrial and commercial interests who are concerned with meteorological information for planning and design will probably require more complex analyses of the available data, and details of the services offered by the Meteorological Office to meet those needs are given on page 16.

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## THE AREA

This memorandum describes the main features of the climate of Lancashire, Cheshire, Merseyside, Greater Manchester and the Isle of Man.

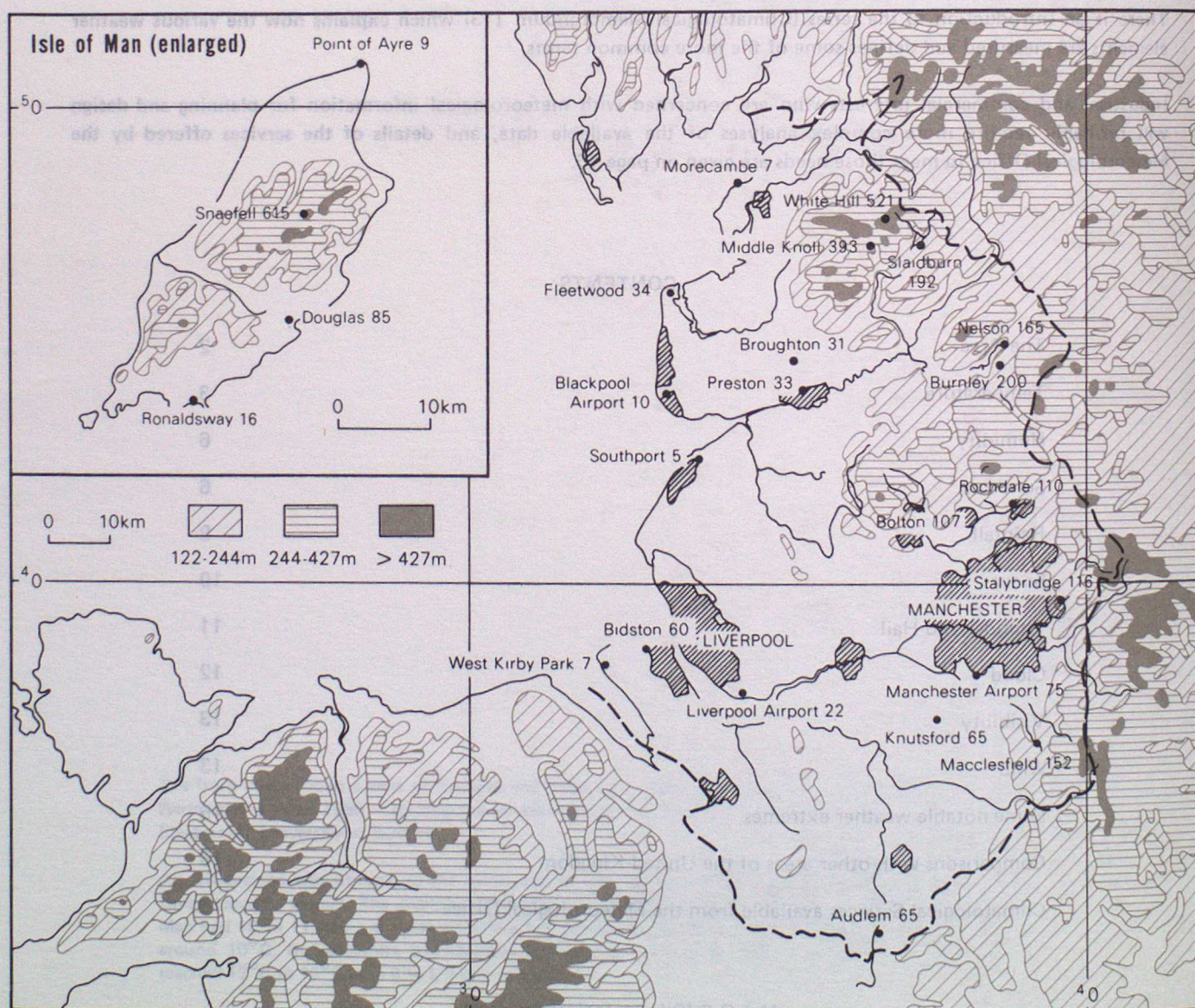
Three-quarters of the Isle of Man consist of a central mountain mass, rising to 621 m on Snaefell, which is divided into northern and southern sections by a central transverse valley. To the north is a well-defined lowland region composed of glacial drift and alluvium. This northern plain comprises one fifth of the island's area and there is very little flat ground on the island outside of this area. On the eastern side of the highlands there is a gradual slope to the coastal plateau, which is at a lower altitude and wider than on the western coast. Douglas is the main town and is the centre of the tourist industry.

Much of Lancashire, Cheshire, Merseyside and Greater Manchester form part of a plain, mainly below 150 m, lying between the Pennines and the mountains of North Wales. In

the east there are two spurs of highland extending westwards from the Pennines; the Rossendale Forest and the Bowland Fells which rise to a peak of 560 m at Wards Stone. The general drainage of the area is mainly westward from the Pennines by rivers such as the Lune, Ribble and Mersey to drowned estuaries in the west. Great thicknesses of salt, which were laid down in Triassic times, occur under the Weaver valley. This salt, which is still extracted, formed the basis of the chemical industry of the area. Many of the towns in the area grew up during the 19th century with the cotton and coal-mining industries. Both these industries have since declined and today engineering, in a variety of forms, is the main employer. Liverpool, the second largest seaport in Britain, and Manchester are the main centres of population.

Figure 1 is a topographical map of the area giving locations and altitudes in metres of the stations in the text.

**Figure 1** Topography of the area giving locations and altitudes (in metres) of the stations. Co-ordinates are national grid references





## TEMPERATURE

Temperature shows both a seasonal and diurnal variation. The mean annual temperature over the area varies from around  $8^{\circ}\text{C}$  to  $10^{\circ}\text{C}$ . The highest values occur in the coastal regions of the Isle of Man, Lancashire, Cheshire and Merseyside and in low-lying areas of the Cheshire Plain. The lowest values occur over the higher ground towards the Pennines with the mean temperature decreasing by about  $0.6^{\circ}\text{C}$  for each 100 metres increase in altitude. Over the British Isles the annual mean temperature ranges from about  $7^{\circ}\text{C}$  in the Shetlands to over  $11^{\circ}\text{C}$  in the extreme south-west of England and the Channel Islands.

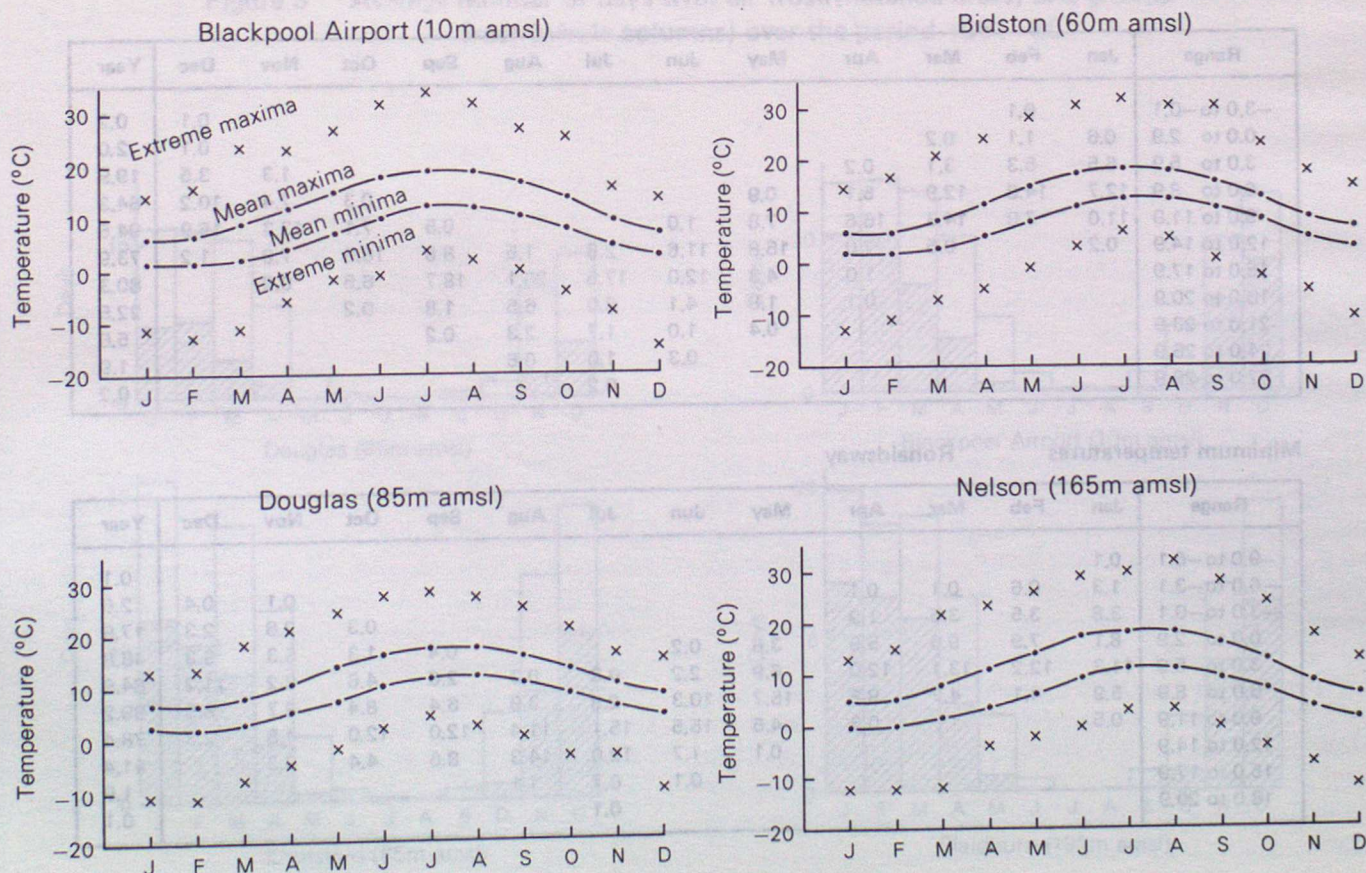
The Irish Sea has a modifying influence on the temperatures recorded on the Isle of Man compared to those on the mainland. The sea temperature reaches its lowest point during late February or early March so that while January is the coldest month on the mainland, with the mean daily minimum temperature between  $0^{\circ}\text{C}$  and  $1.5^{\circ}\text{C}$ , on the Isle of Man February is the coldest month with the mean daily minimum temperature around  $3^{\circ}\text{C}$ . Over the British Isles the mean daily minimum temperature varies from  $-1.0^{\circ}\text{C}$  in parts of Tayside and Grampian during January and February to over  $5.0^{\circ}\text{C}$  in the Isles of Scilly during February. The minimum temperature usually occurs about half-an-hour after sunrise. Extreme minimum temperatures normally occur in January and for three of the locations shown these are  $-11.7^{\circ}\text{C}$  at Douglas and  $-16.1^{\circ}\text{C}$  at both Southport and Burnley.

In the summer the influence of the sea is such that the mean daily maximum temperature on the Isle of Man is lower than on the mainland; in July this is  $17^{\circ}\text{C}$  to  $18.5^{\circ}\text{C}$  compared with  $18^{\circ}\text{C}$  to  $20.5^{\circ}\text{C}$ . The highest mean daily maximum temperature in July of  $22.5^{\circ}\text{C}$  occurs in the London area and the lowest of around  $15^{\circ}\text{C}$  in the Shetlands. The maximum temperature usually occurs two or three hours after midday. Extreme maximum temperatures normally occur in July or August, Douglas having an extreme maximum of  $27.8^{\circ}\text{C}$  compared with  $33.7^{\circ}\text{C}$  at Blackpool Airport.

The variation of mean maximum and mean minimum temperatures together with extreme temperatures recorded at four locations in the region is shown in figure 2. There is a marked similarity between the curves of mean values, but variation in the extremes which reflects the differing topographical features of the locations as well as the period during which the data have been recorded.

Table 1 gives the average number of days that the daily maximum and minimum temperatures occurred within the specified ranges at Manchester Airport and Ronaldsway during 1971–80. The most striking feature is the wide range of temperatures which can occur at any time of the year. A comparison of the two sets of data illustrates the difference between an inland and a coastal location with Manchester Airport having more occasions than Ronaldsway of both high and low temperatures.

**Figure 2 Annual variation of maximum and minimum temperatures over the period 1941–70 with extreme temperatures for the periods stated**





**TABLE 1** Average number of days (1971–80) at Manchester Airport and Ronaldsway with maximum and minimum temperatures ( $^{\circ}\text{C}$ ) in the ranges specified

**Maximum temperatures**

**Manchester Airport**

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
–3.0 to –0.1	0.7	0.2									0.1	0.4	1.4
0.0 to 2.9	4.1	2.4	0.6	0.1							0.8	1.5	9.5
3.0 to 5.9	8.6	7.4	4.2	0.3	0.1					0.1	4.6	8.1	33.4
6.0 to 8.9	9.4	10.9	10.6	5.5	0.5	0.1			0.1	1.4	8.2	8.7	55.4
9.0 to 11.9	7.4	6.8	12.0	12.5	4.6	0.7			1.1	8.2	9.4	8.9	71.6
12.0 to 14.9	0.8	0.6	2.7	8.2	11.6	7.8	1.8	0.7	6.8	12.0	5.7	3.3	62.0
15.0 to 17.9			0.8	2.3	7.9	9.4	9.3	9.2	12.4	7.2	1.2	0.1	59.8
18.0 to 20.9			0.1	1.0	3.6	5.7	9.6	12.4	6.9	1.8			41.1
21.0 to 23.9				0.1	2.1	2.9	6.6	5.2	2.4	0.3			19.6
24.0 to 26.9					0.6	2.5	2.5	2.0	0.3				7.9
27.0 to 29.9						0.7	0.6	1.1					2.4
30.0 to 32.9						0.1	0.6	0.4					1.1

**Minimum temperatures**

**Manchester Airport**

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
–12.0 to –9.1	0.3												0.3
–9.0 to –6.1	1.0	0.4									0.1	0.2	1.7
–6.0 to –3.1	1.8	1.3	0.2	0.3							1.0	1.2	5.8
–3.0 to –0.1	6.3	5.6	4.7	1.8	0.2					0.2	4.6	4.9	28.3
0.0 to 2.9	10.2	10.8	12.0	5.5	1.3	0.1			0.6	2.5	7.4	9.9	60.3
3.0 to 5.9	8.3	8.2	11.7	14.0	8.4	2.0		0.1	2.4	6.3	7.8	7.3	76.5
6.0 to 8.9	2.8	1.9	2.3	7.4	13.7	8.5	2.1	3.1	7.7	12.2	6.0	6.7	74.4
9.0 to 11.9	0.3	0.1	0.1	0.9	6.5	12.9	13.1	10.2	12.2	7.1	3.1	0.8	67.3
12.0 to 14.9				0.1	0.9	5.3	12.6	14.5	6.4	2.6			42.4
15.0 to 17.9						1.0	3.0	3.0	0.7	0.1			7.8
18.0 to 20.9						0.1	0.2	0.1					0.4

**Maximum temperatures**

**Ronaldsway**

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
–3.0 to –0.1		0.1										0.1	0.2
0.0 to 2.9	0.6	1.1	0.2									0.1	2.0
3.0 to 5.9	6.5	5.3	3.1	0.2									
6.0 to 8.9	12.7	14.8	12.9	5.1	0.9						1.3	3.5	19.9
9.0 to 11.9	11.0	7.0	14.3	16.6	7.8	1.0			0.5	7.1	13.3	15.9	94.5
12.0 to 14.9	0.2		0.5	7.0	15.8	11.6	2.6	1.5	8.8	16.9	7.8	1.2	73.9
15.0 to 17.9				1.0	4.3	12.0	17.5	20.1	18.7	6.5	0.2		80.3
18.0 to 20.9				0.1	1.8	4.1	8.0	6.5	1.8				22.5
21.0 to 23.9					0.4	1.0	1.7	2.3	0.2				5.6
24.0 to 26.9						0.3	1.0	0.6					1.9
27.0 to 29.9							0.2						0.2

**Minimum temperatures**

**Ronaldsway**

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
–9.0 to –6.1	0.1												0.1
–6.0 to –3.1	1.3	0.6	0.1	0.1							0.1	0.4	2.6
–3.0 to –0.1	3.8	3.5	3.5	1.9						0.3	2.6	2.3	17.9
0.0 to 2.9	8.1	7.9	9.6	5.9	3.8	0.2			0.4	1.3	5.3	6.3	48.8
3.0 to 5.9	11.3	12.2	13.1	12.0	6.9	2.2	0.3	0.3	2.6	4.6	8.2	11.2	84.9
6.0 to 8.9	5.9	4.1	4.7	9.8	15.7	10.3	2.8	3.9	6.4	8.4	8.7	8.5	89.2
9.0 to 11.9	0.5			0.3	4.5	15.5	15.1	11.4	12.0	12.0	4.8	2.3	78.4
12.0 to 14.9					0.1	1.7	12.0	14.3	8.6	4.4	0.3		41.4
15.0 to 17.9						0.1	0.7	1.1					1.9
18.0 to 20.9							0.1						0.1



Table 2 compares the number of days of relatively high and low temperatures at four locations in the region. Douglas has the least number of hot and cold days because of the influence of the sea. Slaidburn has the highest number of cold days because of its altitude. Blackpool Airport has a relatively high number of cold days for a coastal location this is because of the sandy nature of the soil.

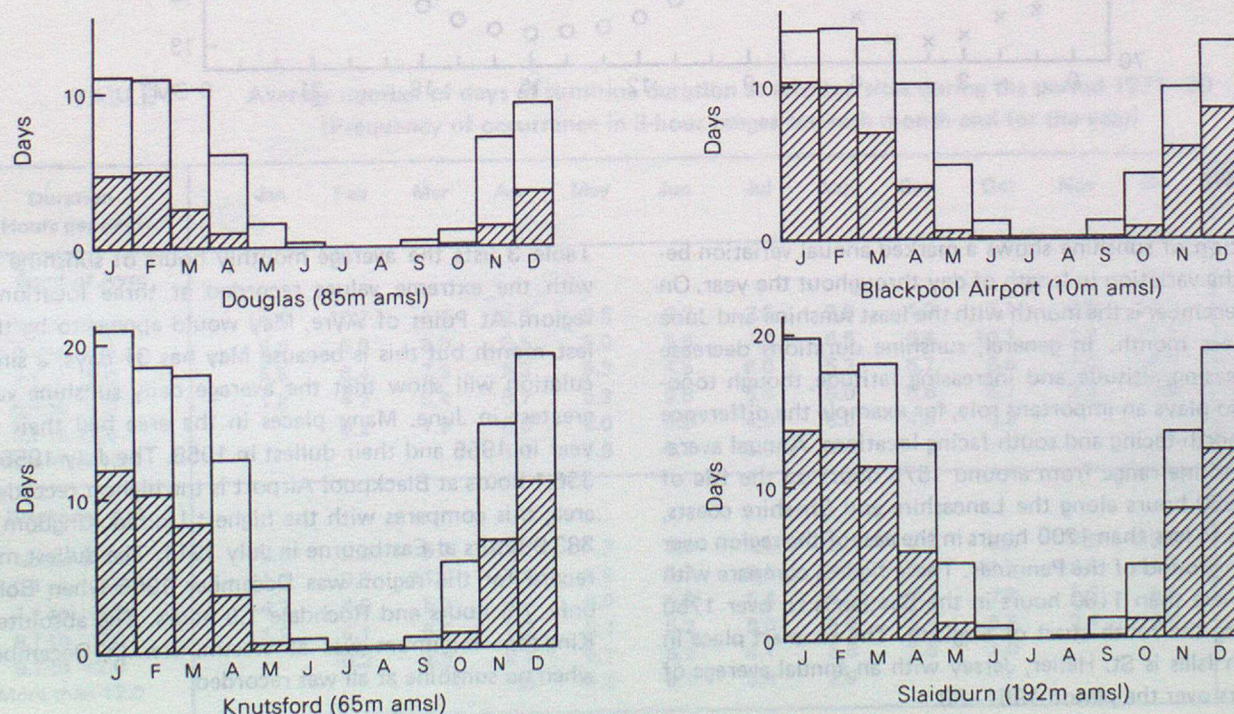
The average annual number of days with air frost varies from around 15 to 25 in the lower lying areas of the Isle of Man,

and from 25 to 75 on the mainland, the higher values occurring in the north-east of the region towards the Pennines. For ground frosts the figures are 55 to 60 days on the Isle of Man and 50 to over 120 days on the mainland. Figure 3 shows frost data for four locations. The incidence of frost is greatest in the winter months and the summer months are usually free of air frosts, although it can be seen that at some locations a ground frost may occur at any time of the year.

**TABLE 2** Average number of days (1961–80) with maximum and minimum temperatures exceeding certain limits at selected sites in Lancashire, Cheshire and the Isle of Man

Maximum temperature	25.0 °C or more					30.0 °C or more				
	May	Jun	Jul	Aug	Sep	Jun	Jul	Aug		
Slaidburn		0.7	0.9	0.9	0.1		Nil			
Douglas		0.2	0.3	0.3			Nil			
Blackpool A/p	0.4	1.1	1.7	1.3	0.1	0.1	0.3	0.1		
Manchester A/P	0.1	1.8	1.8	0.1		0.1	0.3	0.2		
Minimum temperature	Less than –5.0 °C						Less than –10.0 °C			
	Nov	Dec	Jan	Feb	Mar	Apr	Dec	Jan	Feb	Mar
Slaidburn	0.5	2.7	3.6	2.9	1.1	0.2	0.1	0.3	0.3	0.1
Douglas		0.1	0.9	0.3	0.1			0.4	0.1	
Blackpool A/P	0.4	2.3	3.5	1.7	0.7	0.1	0.1	0.4	0.1	
Manchester A/P	0.2	1.7	2.3	1.3	0.3		0.1	0.3	0.1	

**Figure 3** Average number of days with air frost (hatched areas) and ground frost (whole columns) over the period 1961–80





## HUMIDITY

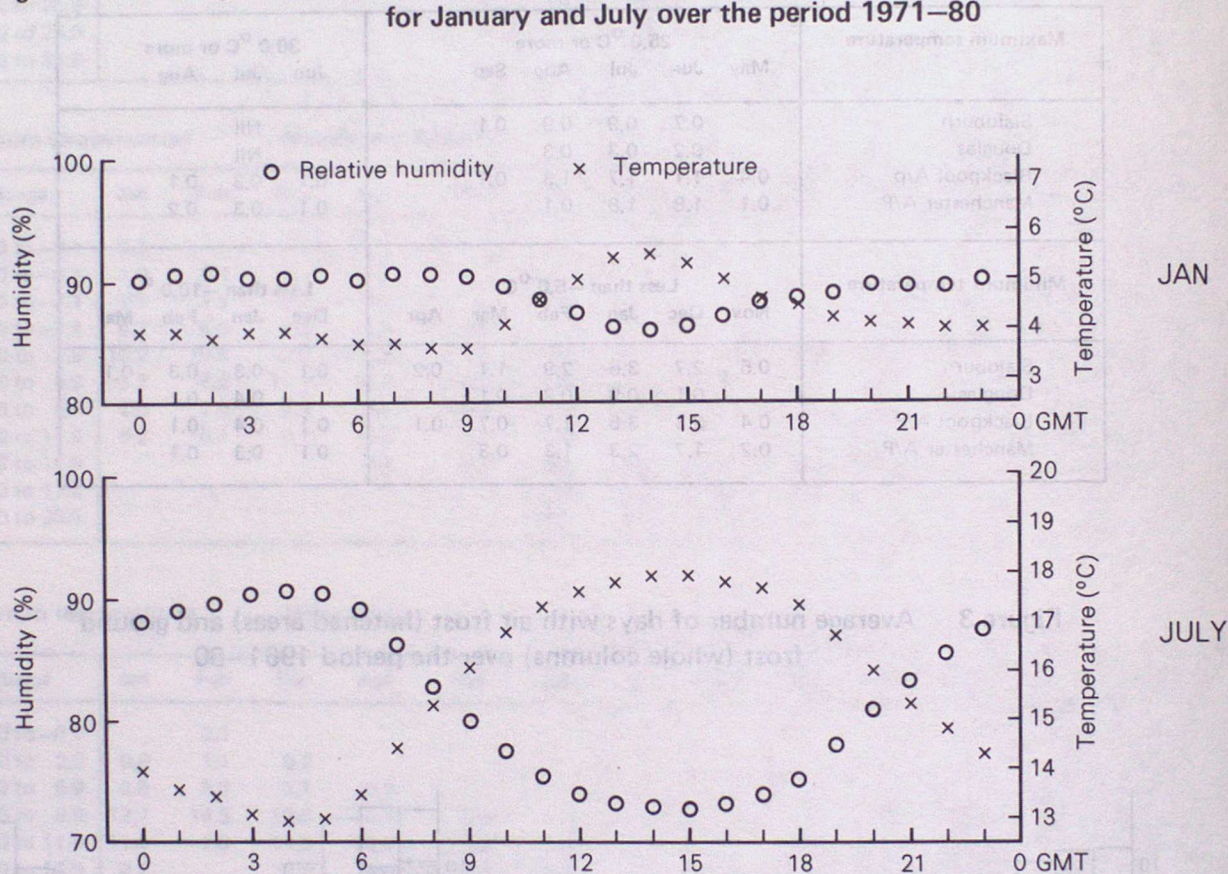
Relative humidity is a measure of the amount of water vapour in the air compared to the maximum amount which could be contained by the air at that temperature expressed as a percentage. It follows that if the amount of water vapour in the air remains constant, then, as the temperature rises (or falls) the relative humidity decreases (or increases).

Relative humidity averages around 80% for the year with higher values occurring in winter and at night. This is primarily a reflection of the seasonal and diurnal changes. Figure 4 shows

the average hourly relative humidity and temperatures for January and July for Blackpool Airport, thus illustrating these points.

Relative humidities equal or exceed 95% between 10 and 20% of the time in the region and 100% can be reached in fog and during persistent rain, drizzle, and snow. Low humidities are less common: the lowest value ever recorded in the United Kingdom was 4% at both Manchester Airport and Great Dun Fell, Cumbria, on 29 March 1965.

**Figure 4** Average diurnal variation of temperature and relative humidity at Blackpool Airport for January and July over the period 1971–80



## SUNSHINE

The duration of sunshine shows a marked annual variation because of the variation in length of day throughout the year. On average December is the month with the least sunshine and June the sunniest month. In general, sunshine durations decrease with increasing altitude and increasing latitude, though topography also plays an important role, for example the difference between north-facing and south-facing locations. Annual averages of sunshine range from around 1575 hours on the Isle of Man to 1550 hours along the Lancashire and Cheshire coasts, and falling to less than 1200 hours in the east of the region over the higher ground of the Pennines. These figures compare with values of less than 1100 hours in the Shetlands to over 1750 hours along the south coast of England. The sunniest place in the British Isles is St. Helier, Jersey with an annual average of 1928 hours over the period 1951–80.

Table 3 lists the average monthly hours of sunshine together with the extreme values recorded at three locations in the region. At Point of Ayre, May would appear to be the sunniest month but this is because May has 31 days; a simple calculation will show that the average daily sunshine values are greatest in June. Many places in the area had their sunniest year in 1955 and their dullest in 1958. The July 1955 total of 336.1 hours at Blackpool Airport is the highest recorded in the area, this compares with the highest United Kingdom total of 383.9 hours at Eastbourne in July 1911. The dullest month on record for the region was December 1956 when Bolton had only 1.5 hours and Rochdale 1.9 hours. The absolute United Kingdom minimum was at Westminster in December 1890 when no sunshine at all was recorded.



**TABLE 3** Average monthly and annual totals of duration (hours) of bright sunshine at selected sites over the stated periods together with extreme values

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<b>Blackpool A/P</b>													
Averages 1951-80	50.4	71.9	117.1	167.6	211.1	217.8	188.5	174.6	131.8	98.1	61.2	43.7	1534.0
Maximum 1947-80	80.1	113.6	180.7	222.6	302.7	306.3	336.1	288.6	191.7	131.0	88.3	72.2	1837.2
	1959	1963	1948	1954	1948	1975	1955	1947	1959	1965	1947	1962	1955
Minimum 1947-80	20.9	33.3	50.2	101.6	147.0	149.1	142.1	129.3	86.7	53.0	40.4	21.4	1365.7
	1950	1980	1964	1961	1976	1954	1957	1954	1969	1968	1953	1956	1958
<b>Manchester A/P</b>													
Averages 1951-80	42.3	62.2	106.6	140.1	184.5	189.7	160.3	156.8	122.6	95.6	57.5	41.4	1359.6
Maximum 1946-80	70.7	98.1	168.9	190.4	251.6	285.5	279.5	258.8	197.4	136.4	89.0	65.2	1657.2
	1959	1949	1948	1968	1977	1957	1955	1947	1959	1959	1975	1964	1959
Minimum 1946-80	10.7	33.7	63.3	94.5	119.6	119.1	101.9	88.8	68.8	62.0	24.1	16.4	1128.9
	1953	1980	1964	1961	1954	1964	1954	1948	1948	1960	1946	1947	1954
<b>Point of Ayre</b>													
Averages 1951-80	53.5	78.2	118.5	180.1	218.4	216.9	190.5	184.4	134.5	96.1	61.2	43.1	1575.7
Maximum 1936-80	76.0	118.0	187.3	234.5	300.1	305.3	311.2	311.8	184.7	139.8	89.7	65.1	1925.1
	1963	1963	1955	1974	1977	1957	1955	1947	1963	1936	1952	1960	1955
Minimum 1936-80	27.2	36.9	74.0	97.6	158.8	138.3	115.3	116.9	82.0	63.0	34.8	21.3	1319.0
	1947	1940	1942	1937	1976	1966	1944	1942	1976	1968	1945	1977	1958

Table 4 gives the average number of days with sunshine durations in specified ranges at Point of Ayre and Blackpool during 1971-80. The differences between individual months

are due to the variations in length of day as well as the weather types which predominate during the year.

**TABLE 4** Average number of days of sunshine duration at selected sites during the period 1971-80 (Frequency of occurrence in 3-hour ranges for each month and for the year)

Duration (Hours per day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<b>Point of Ayre</b>													
No sunshine	14.1	10.7	6.4	2.6	2.5	2.2	2.6	2.5	4.3	7.1	9.5	14.3	78.9
0.1 to 3.0	9.6	6.8	9.0	6.5	5.0	5.8	7.8	8.6	9.4	10.1	11.2	11.2	101.2
3.1 to 6.0	5.5	6.4	7.3	5.3	5.3	4.5	6.0	5.2	5.7	6.6	7.0	4.7	69.4
6.1 to 9.0	1.8	4.2	6.4	6.7	5.3	5.8	5.4	5.0	6.6	6.7	2.3	0.8	57.0
9.1 to 12.0		0.2	1.9	6.8	5.0	5.0	4.0	6.3	4.0	0.5			33.6
More than 12.0				1.9	7.9	6.7	5.2	3.4					24.8
<b>Blackpool A/P</b>													
No sunshine	12.7	9.2	5.3	3.2	1.3	2.0	1.6	2.2	2.9	5.6	7.9	13.1	66.8
0.1 to 3.0	11.7	9.9	11.4	7.4	6.6	6.7	9.5	8.9	9.4	11.1	12.5	11.9	116.9
3.1 to 6.0	4.7	4.9	5.3	6.0	6.0	4.8	5.4	5.6	8.7	7.8	7.2	5.1	71.6
6.1 to 9.0	1.9	4.1	6.5	7.2	5.7	5.2	5.0	5.9	5.4	5.5	2.4	0.9	55.5
9.1 to 12.0		0.2	2.5	5.2	5.1	5.2	4.1	5.5	3.6	1.0			32.5
More than 12.0				1.0	6.3	6.1	5.4	2.9					21.5



## RAINFALL

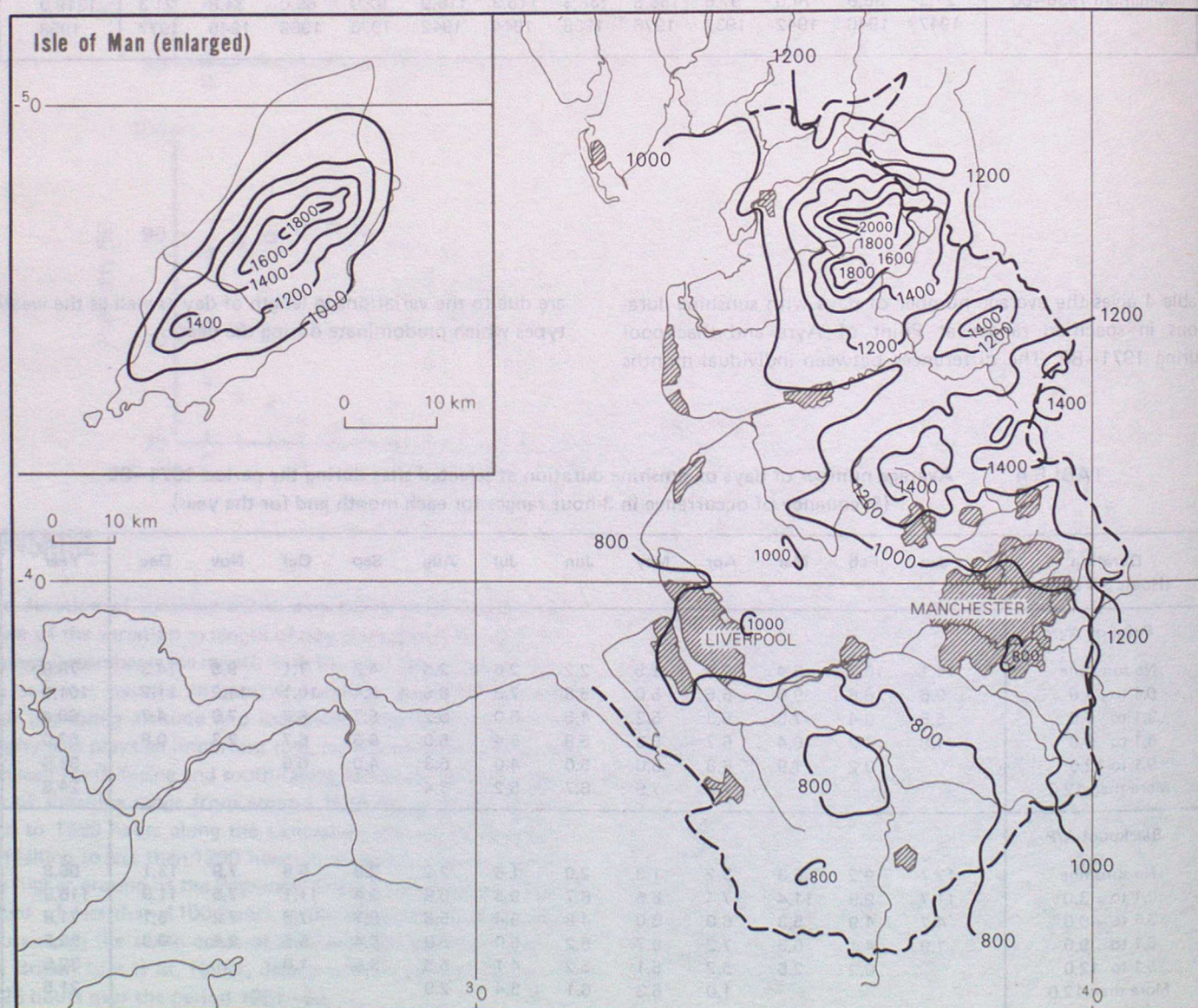
The distribution of rainfall over the United Kingdom is greatly influenced by topography with the largest amounts falling over the mountainous regions and the smallest amounts in the low-lying areas. In this text rainfall also includes snow, sleet and hail as well as the small amounts from dew, hoar-frost and rime.

The nature of rainfall varies during the year. In summer, rainfall is often of a showery nature, falling over short periods, and is normally more intense than winter rainfall which tends to be more frontal in character and falls over longer periods. As a rough guide an average day of steady rain gives 10 to 15 millimetres and a heavy thunderstorm, lasting an hour or so, 25 to 50 millimetres. 25 millimetres of rainfall is equivalent to about 200 tonnes of water on a football pitch.

Figure 5 shows the average annual rainfall over Lancashire, Cheshire, Merseyside, Greater Manchester and the Isle of Man. The effect of topography is clearly seen. Figure 6 shows the monthly variation of rainfall at six locations in the area. The pattern of rainfall is broadly similar for these locations, although the total rainfall covers a wide range. The driest months are February to April and the wettest months are August to December.

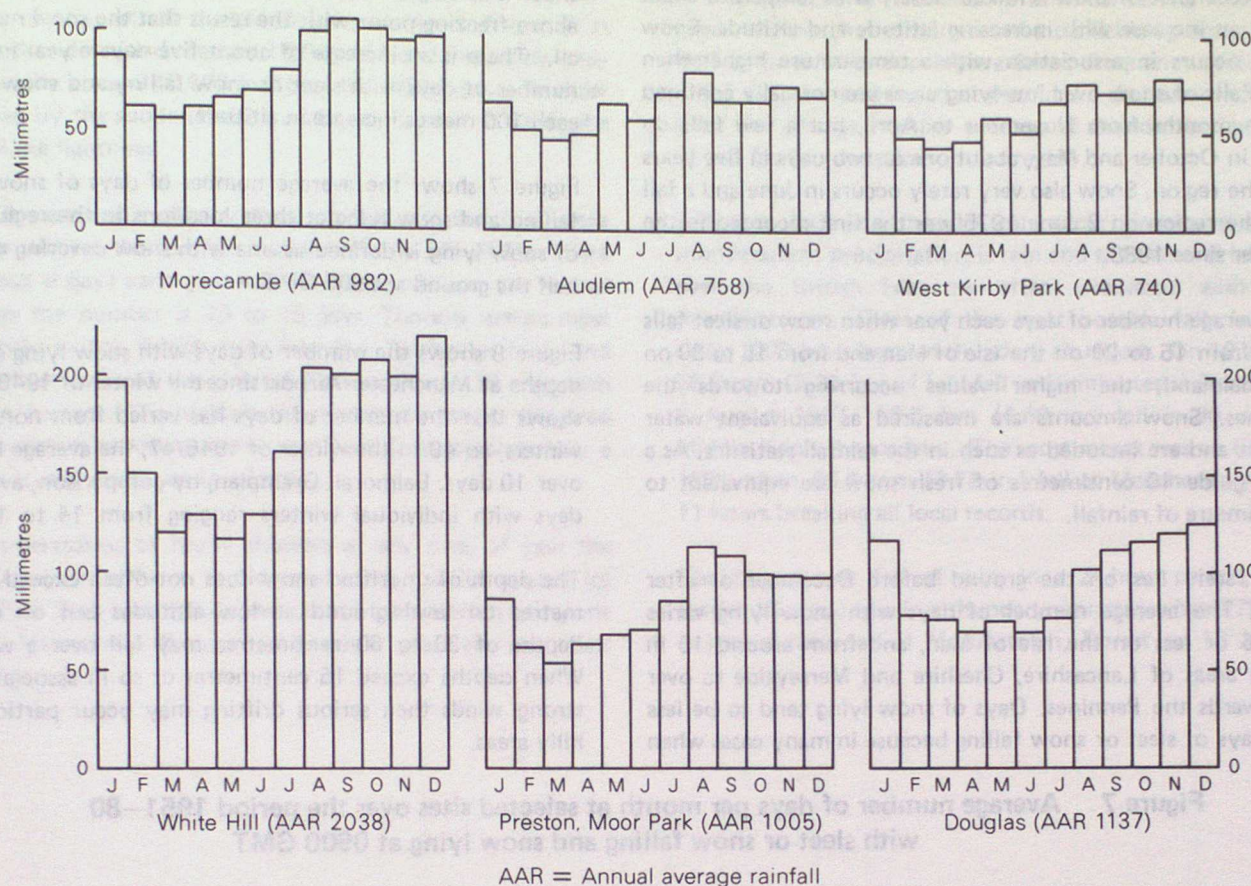
Rainfall is an extremely variable parameter. Table 5 lists the highest and lowest monthly totals of rainfall between 1951–80, with the averages for a comparison, for Preston, Moor Park. Table 6 gives the average number of days with daily rainfall in specified ranges from 1971–80 at Ronaldsway. There were 26 days in the period which had 25 millimetres or more, although the majority of days with rain had relatively small amounts.

**Figure 5** Average annual rainfall (mm) over the period 1941–70.  
Co-ordinates are national grid references





**Figure 6 Average monthly rainfall (mm) over the period 1941–70**



**TABLE 5 Monthly and annual extremes of rainfall (millimetres) at Preston 1951–80**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Averages	87	62	53	63	68	71	86	113	108	99	98	97	1005
Maximum	144.2 1975	163.8 1958	121.4 1951	107.7 1970	126.3 1979	126.4 1980	144.5 1960	314.7 1956	199.9 1968	253.9 1980	207.5 1960	219.5 1951	1374.4 1954
Minimum	11.4 1963	11.2 1963	22.3 1953	3.1 1980	13.6 1975	17.1 1976	28.2 1969	7.2 1976	11.7 1959	34.6 1975	32.8 1957	22.6 1971	736.3 1971

**TABLE 6 Average number of days of rainfall at Ronaldsway during the period 1971–80 in specified ranges for each month and for the year**

Total (Millimetres per day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
0.1 or less	11.3	12.4	14.7	17.6	18.0	17.2	17.2	16.9	15.1	15.0	10.6	11.7	177.7
0.2 to 0.9	3.8	3.2	4.9	4.2	3.6	3.8	4.4	4.6	3.5	4.3	4.5	5.5	50.3
1.0 to 4.9	9.0	7.7	6.6	5.3	6.8	5.6	6.5	4.8	6.0	6.5	7.6	8.5	80.9
5.0 to 9.9	3.6	3.2	3.4	1.9	2.1	2.5	1.7	2.6	2.9	2.9	4.9	3.1	34.8
10.0 to 14.9	1.6	1.1	0.6	0.5	0.5	0.4	0.8	1.2	1.4	1.1	1.5	1.2	11.9
15.0 to 19.9	0.9	0.4	0.3	0.3		0.4	0.1	0.8	0.4	0.5	0.3	0.5	4.9
20.0 to 24.9	0.7	0.2	0.3				0.2	0.1	0.3	0.1	0.2	0.1	2.2
25.0 to 49.9	0.1	0.1	0.2	0.2		0.1	0.1		0.4	0.4	0.4	0.3	2.3
50.0 to 74.9										0.2		0.1	0.3



## SNOW

The occurrence of snow is linked closely with temperature and shows an increase with increasing latitude and altitude. Snow rarely occurs in association with a temperature higher than 4°C. Falls of snow over low-lying areas are normally confined to the months from November to April, but a few falls do occur in October and May, about one or two days in five years over the region. Snow also very rarely occurs in June and a fall over the region on 2 June 1975 was the first recorded in the summer since 1888.

The average number of days each year when snow or sleet falls varies from 15 to 20 on the Isle of Man and from 15 to 30 on the mainland, the higher values occurring towards the Pennines. Snow amounts are measured as equivalent water content and are included as such in the rainfall statistics. As a rough guide 10 centimetres of fresh snow are equivalent to 1 centimetre of rainfall.

Snow rarely lies on the ground before December or after March. The average number of days with snow lying varies from 5 or less on the Isle of Man, and from around 10 in coastal areas of Lancashire, Cheshire and Merseyside to over 20 towards the Pennines. Days of snow lying tend to be less than days of sleet or snow falling because in many cases when

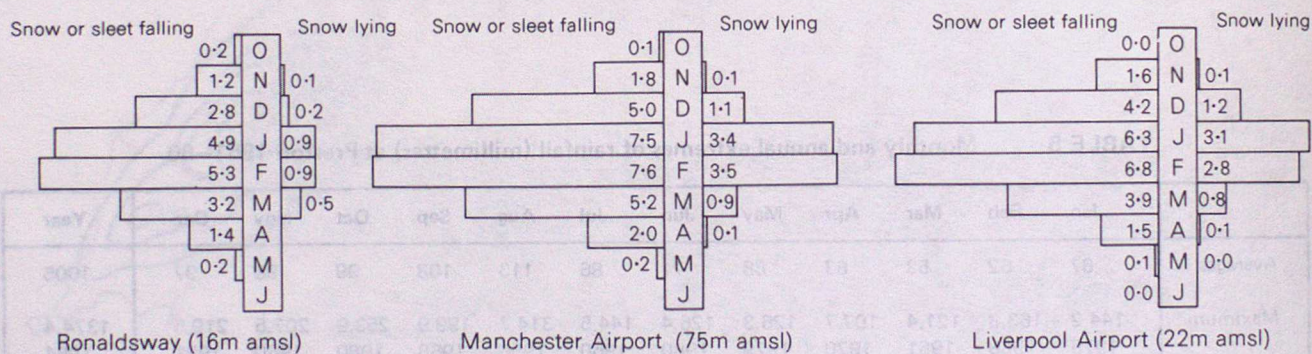
snow is falling the temperature of the air and ground remain above freezing-point with the result that the snow never lies at all. There is an increase of about five days a year in both the number of days with sleet or snow falling and snow lying for each 100 metres increase in altitude.

Figure 7 shows the average number of days of snow or sleet falling and snow lying at three locations in the region. A day of snow lying is defined as one with snow covering more than half the ground at 0900 GMT.

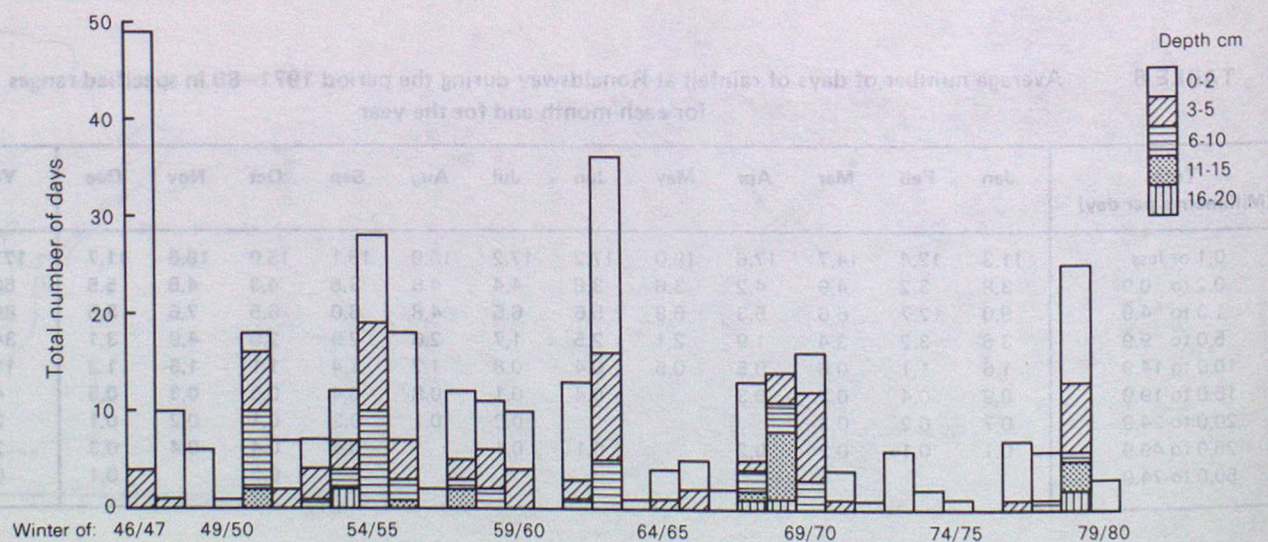
Figure 8 shows the number of days with snow lying at various depths at Manchester Airport since the winter of 1946/47. This shows that the number of days has varied from none, in two winters, to 49 in the winter of 1946/47, the average being just over 10 days. Balmoral, Grampian, by comparison, averages 60 days with individual winters ranging from 14 to 102 days.

The depth of undrifted snow does not often exceed 15 centimetres on level ground at low altitudes but on occasions depths of 30 to 60 centimetres may fall over a wide area. When depths exceed 15 centimetres or so in association with strong winds then serious drifting may occur particularly in hilly areas.

**Figure 7** Average number of days per month at selected sites over the period 1951–80 with sleet or snow falling and snow lying at 0900 GMT



**Figure 8** Number of days with total snow depths at 0900 GMT in stated ranges at Manchester Airport





## THUNDER AND HAIL

Thunder and hail are phenomena associated with cumulonimbus clouds, which are clouds of great vertical extent. A typical thunder-cloud reaches 18 000 feet and in summer may occasionally exceed 40 000 feet over the British Isles. Thunder is caused by the sudden heating and expansion of air along the path of the lightning.

Thunder can occur at any time of the year but it is more frequent during the summer months. In the Isle of Man there are about 6 days each year with thunder, while in the rest of the area the number is 10 to 15 days. Thunder occurs most frequently in the British Isles over the Trent river basin and the southern part of the Vale of York with over 20 days each year on average. The majority of thunderstorms are triggered by convective processes either over land in summer or over a comparatively warm sea in winter.

In thunderstorms or heavy showers at any time of year the precipitation may be in the form of hard, clear or opaque ice called hail. Two varieties are recognized the criterion being one of size. Hail with a diameter of 5 mm or more and ice pellets

with a diameter of less than 5 mm. Ice pellets are more frequent during the winter months particularly around coasts. Hail tends to have a spring maximum frequency as it generally melts before reaching the ground in the summer. Table 7 gives the average number of days of thunder and both types of hail for four locations in the region.

Although hail and thunder can occur simultaneously most thunderstorm precipitation is rain and the heaviest falls of rain over the British Isles are often associated with summer thunderstorms. Three of the most notable falls in the area since 1900 have been in thundery situations. On 18 July 1964 55.9 mm (2.20 in.) of rain fell in 15 minutes at Bolton and on 8 August 1967 116.8 mm (4.60 in.) fell in 90 minutes at Middle Knoll, Lancashire. The most recent was on 5/6 August 1981 when 95.9 mm (3.78 in.) fell at Manchester Airport in 11 hours breaking all local records.

The largest ever fall of rain, in a 24-hour period, over the British Isles was also in a thundery situation when 279 mm (11 in.) were recorded at Martinstown, Dorset on 18 July 1955.

TABLE 7 Average number of days of thunder, hail and ice pellets

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<b>Blackpool Airport 1957-80</b>													
Thunder	0.2	+	0.4	0.4	2.1	1.2	1.5	1.1	1.2	0.5	0.4	0.2	9.2
Hail	0.3	0.4	0.3	0.2	0.1	+		+		0.3	0.5	0.6	2.7
Ice pellets	1.7	1.7	1.1	0.7	0.2	+		+		0.5	1.9	1.3	9.3
<b>Liverpool Airport 1957-Aug 1977</b>													
Thunder	0.2	0.4	0.2	0.9	2.8	2.2	2.6	1.9	1.3	0.7	0.7	0.3	14.1
Hail	1.3	1.3	1.4	1.3	0.9	0.4	0.1	0.1	0.3	0.5	2.3	1.1	11.1
Ice pellets	1.5	1.3	1.1	0.9	0.2				0.1	0.5	0.5	0.8	6.9
<b>Manchester Airport 1951-80</b>													
Thunder	0.3	0.3	0.5	0.8	2.4	2.0	2.3	2.5	1.1	0.6	0.5	0.3	13.8
Hail	0.3	0.6	0.5	0.6	0.5	0.2	0.1	0.1	0.1	0.2	0.7	0.4	4.2
Ice pellets	1.9	1.2	1.3	1.1	0.6	0.3	0.1	0.1	0.2	0.5	0.8	1.4	9.5
<b>Ronaldsway 1957-80</b>													
Thunder	0.2	0.1	+	0.2	0.6	0.7	0.8	0.8	0.7	0.7	0.6	0.3	5.6
Hail	0.2	0.2	0.5	0.4	0.1	+			0.1	0.2	0.6	1.0	3.3
Ice pellets	2.4	2.3	2.1	1.6	0.4	0.1			0.2	0.8	2.5	2.0	14.4

+ = Some occasions but less than 0.05



## CLOUD

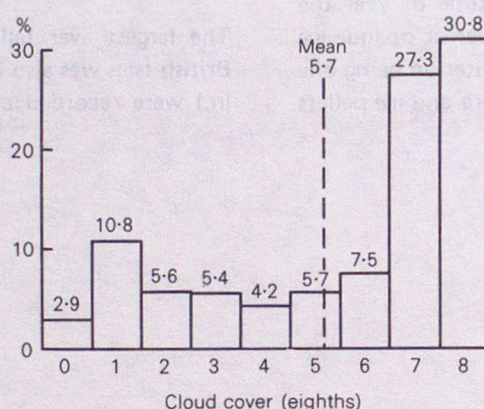
Clouds are composed of very small water droplets, ice, or a mixture of both. They are formed mainly as a result of the cooling of air caused by ascent, as in convection, forced lifting over high ground, or in large-scale upward motions associated with fronts and depressions.

Cloud amounts are estimated as the fraction, in eighths, of the sky covered by cloud, with the figures 0 and 8 representing a completely clear and cloudy sky respectively. In this section the ranges 0–2, 3–6 and 7–8 eighths will be used to approximate to clear skies, partly cloudy and cloudy respectively.

Figure 9 shows the percentage frequency throughout the year for cloud amounts at Ronaldsway. The values are typical of the region with on average cloudy skies predominating. The country as a whole shows a similar pattern of values.

Table 8 gives the percentage frequency by month and year for the hours of daylight and darkness for the three cloud ranges at Ronaldsway and Manchester Airport. These are typical of the region, being more cloudy in winter than summer and more cloudy by day than by night. June is the least cloudy month both by day and by night.

**Figure 9** Frequency of total cloud amount at Ronaldsway over the period 1957–76



**TABLE 8** Percentage frequency of hours with total cloud amount in selected ranges over the period 1957–76

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<b>Ronaldsway</b>													
<b>Daylight hours</b>													
<b>Eighths</b>													
0–2	11.1	12.1	12.8	12.0	11.8	18.3	10.1	13.3	12.9	14.2	12.6	14.9	13.1
3–6	20.5	22.5	25.9	27.8	32.0	30.1	27.7	29.9	29.2	25.5	23.4	20.4	27.2
7–8	68.3	65.5	61.3	60.1	56.3	51.7	62.1	56.8	58.0	60.3	64.1	64.8	59.7
<b>Hours of darkness</b>													
0–2	18.2	20.1	23.3	31.7	25.7	26.8	19.6	26.2	25.2	19.7	18.9	19.5	22.2
3–6	18.1	19.2	19.6	20.0	23.3	22.4	23.4	22.9	23.0	22.4	23.4	21.4	21.4
7–8	63.6	60.8	57.1	48.3	51.0	50.7	57.0	50.9	51.9	57.8	57.6	59.3	56.4
<b>Manchester A/P</b>													
<b>Daylight hours</b>													
<b>Eighths</b>													
0–2	12.1	13.4	15.7	21.0	19.1	21.5	14.5	17.6	17.1	13.1	11.1	12.2	16.4
3–6	19.7	20.4	22.3	24.2	26.7	25.8	24.7	26.5	23.0	22.9	24.6	23.0	24.0
7–8	68.3	66.2	62.0	54.8	54.3	52.7	60.6	55.8	59.8	64.2	64.2	64.8	59.7
<b>Hours of darkness</b>													
0–2	17.2	19.8	23.4	24.4	23.8	25.9	20.1	23.4	24.5	23.9	20.7	18.5	21.6
3–6	17.4	18.4	20.5	21.5	25.9	27.4	25.1	27.6	23.6	20.4	21.4	17.2	21.3
7–8	65.5	61.8	56.1	54.1	50.2	46.6	54.7	49.0	52.0	55.7	57.9	64.3	57.0



## VISIBILITY

Visibility is defined as the greatest horizontal distance at which an object can be discerned with the naked eye. It is of considerable importance to the country in general because the operation of various types of transport may be disrupted or stopped altogether if the visibility falls below certain limits. Variations in visibility occur with the different types of precipitation such as rain or snow, as well as with atmospheric pollution due to smoke and dust, but the really poor visibilities are mainly due to fog.

Fog is predominantly a winter phenomenon occurring generally at night or in the early morning though it does occasionally persist all day. There are a number of factors which effect

fog formation and as a consequence there is a wide variation in the number of days when fog occurs at locations in the region. Fog and fog formation processes are discussed in the Introduction to the series.

Table 9 lists the number of occasions in the period 1961–80 when Ronaldsway and Manchester Airport had visibilities of less than 200 m at various times during the day. The distribution for Manchester Airport is typical for an inland site where radiation fog is the most common type. Ronaldsway shows a completely different distribution because it is a coastal location with advection fog being the most common type this being most frequent in late winter, spring and early summer.

**TABLE 9** Number of occasions with visibility of less than 200 metres (thick fog) at selected sites over the period 1961–80

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<b>Ronaldsway</b>													
00		1	1	3	2	3	3	1	1	1			16
03		1	1	3	2	2	6	1	1				17
06	1		1	2	3	4	4	1	1	1			18
09		1	1	1	1				1				5
12	1	1											2
15	2	1			1	1							5
18	2	1				3			1	1	1	1	10
21			1	2	3	1				1		1	9
Total	6	6	5	11	12	14	13	3	5	4	1	2	82
<b>Manchester A/P</b>													
00	14	5	2						5	6	9	16	57
03	20	8	3	4	4		1	2	4	9	14	13	82
06	13	12	8	10	2	2	5	6	9	13	15	15	110
09	15	9	4	5					3	8	17	15	76
12	13	6	1							1	16	14	51
15	8	1									9	12	30
18	9	1		1							11	12	34
21	10									3	10	14	37
Total	102	42	18	20	6	2	6	8	21	40	101	111	477

## WIND

The wind direction is that from which the wind blows either as a compass point or in degrees clockwise from true north. Wind speeds are measured in knots (1 knot = 1.15 mph, 1 metre per second = 1.94 knots) and are closely related to the pressure distribution. The strongest winds are associated with the passage of depressions across or close to the United Kingdom. The frequency of depressions is greatest during the winter months so this is when the strongest winds normally occur.

Wind seldom occurs as a smooth flowing airstream and eddies give variations both in direction and speed. Winds are usually stronger by day than by night due to increased turbulence

caused by temperature rise by day making average speeds higher and the wind more gusty.

A day of gale is defined as a day on which the wind speed attains a mean value of 34 knots or more over any period of ten consecutive minutes. Around exposed coasts and over hills gales may occur at any time of year but inland they are usually confined to the months November to March. The Isle of Man has about 10 to 15 days of gale a year while on the mainland gales occur on 5 to 8 days along coasts but less than 2 days inland. Wind speeds normally increase with increasing altitude and this is dramatically illustrated by Snaefell which, at 615 m (2017 feet), averages over 200 days of gale a year.



Table 10 gives the percentage annual frequency of wind speeds in Beaufort force ranges against 30 degree sectors of wind direction for Ronaldsway for the years 1970–80. This distribution is reasonably typical of the region though the frequency of the stronger winds is higher than that of the more sheltered inland locations. The predominance of the west to south-westerly winds can be seen.

The wind-roses illustrate how the wind varies during the year at Blackpool Airport. The differences between the months shown are due to the different weather patterns which predominate at these times. The high incidence of north-westerly winds in July is due to the sea-breeze which blows most frequently from this direction at Blackpool Airport.

**TABLE 10 Annual percentage frequencies of hourly mean wind speed and direction for Ronaldsway 1970–80**

Knots	Beaufort force equivalent	30° sectors centred on												All directions
		360°	030°	090°	120°	120°	150°	180°	210°	240°	270°	300°	330°	
Calm	0													0.4
1–3	1	1.8	0.9	0.4	0.5	0.5	0.3	0.4	0.4	0.5	0.8	0.7	0.8	8.7
4–10	2–3	4.7	2.9	2.9	3.2	2.2	1.7	2.1	3.4	3.7	4.3	3.2	2.7	37.0
11–21	4–5	1.7	1.7	3.0	3.3	3.0	1.8	4.0	6.5	7.4	5.4	3.4	3.5	44.6
22–33	6–7	0.1	0.1	0.2	0.6	1.1	0.3	1.2	1.7	1.1	1.2	0.8	0.5	8.9
≥34	≥8			+	+	+	+	0.1	0.1	+	+	+	+	0.3
Total ≥4		6.5	4.7	6.2	7.2	6.3	3.7	7.3	11.7	12.3	10.8	7.4	6.7	90.9

+ Observations recorded in these categories but for less than 0.05 per cent of the time

**Wind-roses for Blackpool Airport (1970–80)**

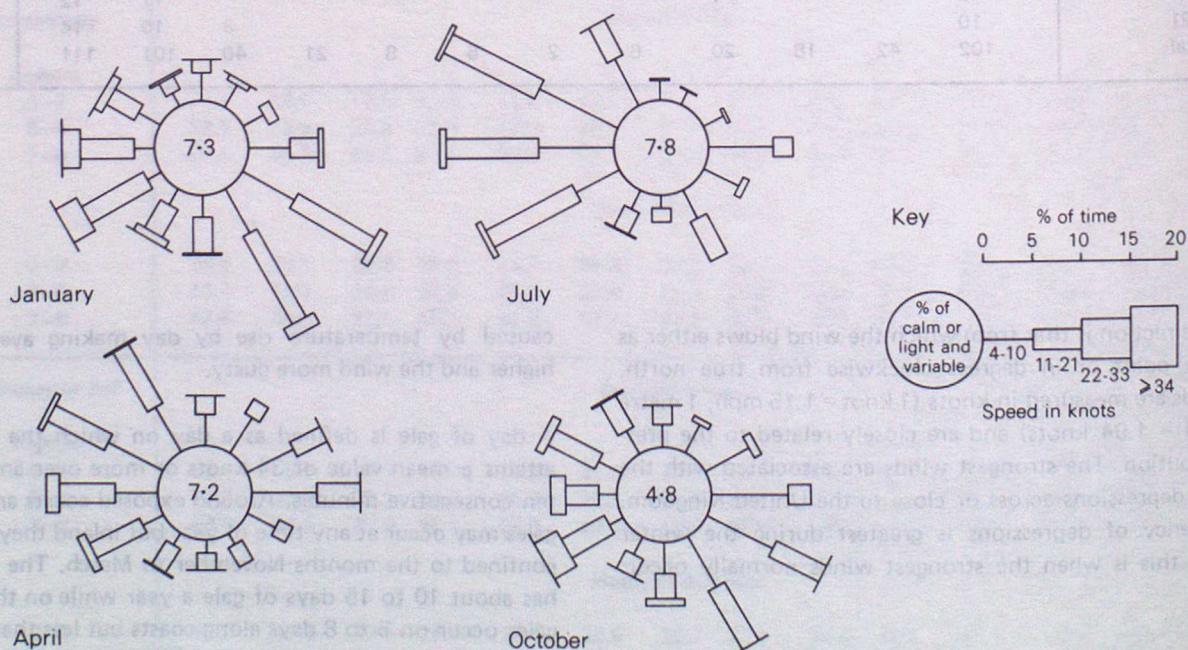




TABLE 11 Weather extremes

TEMPERATURE	Date records began	Maximum daily temperature (°C)	Date	Minimum daily temperature (°C)	Date
Lancashire, Cheshire and Isle of Man					
Douglas	1871	27.8	30 July 1948	-11.7	9/12 February 1895
Blackpool Airport	1942	33.7	3 July 1976	-15.1	12 December 1981
Burnley	1907*	30.6	12 August 1953	-16.1	21 January 1940
Southport	1901	32.8	6 June 1950	-16.1	16 February 1969
United Kingdom					
Raunds	}	36.7	9 August 1911	-27.2	{ 11 February 1895 10 January 1982
Epsom					
Canterbury					
Braemar	-				
SUNSHINE	Date records began	Maximum monthly duration (hours)	Date	Minimum monthly duration (hours)	Date
Lancashire, Cheshire and Isle of Man					
Blackpool Airport	1942	336.1	July 1955	20.9	January 1950
Douglas	1931	326.9	July 1955	16.9	December 1956
Bolton	1931	297.0	June 1940	1.5	December 1956
Rochdale	1947†	277.6	June 1957	1.9	December 1956
United Kingdom					
Eastbourne	-	383.9	July 1911	0	December 1890
London (Westminster)	-				
WIND	Date records began	Maximum hourly mean wind speed (knots)	Date	Maximum gust speed (knots)	Date
Lancashire, Cheshire and Isle of Man					
Southport	1909‡	61	28 October 1927	83	28 October 1927
Bidston	1929§	56	4 October 1938	88	4 October 1938
Ronaldsway	1901	56	7 December 1964	85	2 December 1966
Fleetwood	1923	53	16 April 1925	79	{ 6 November 1952 17 December 1952 2 January 1976
United Kingdom (Low-level sites)					
South Gare (Cleveland)	-	70	2 January 1976	118	7 February 1969
Kirkwall (Orkney)	-				
RAINFALL	Date records began	Maximum daily fall (mm)	Date		
Lancashire, Cheshire and Isle of Man					
Broughton	1918	118	29 July 1938		
Macclesfield	-	108	18 June 1872		
Stalybridge	1909	104	11 July 1932		
United Kingdom					
Martinstown (Dorset)	-	279	18 July 1955		

Records ceased: \*1971 †1974 ‡1972 §1970



**TABLE 12** Climatological data for places in the United Kingdom based on the period 1941–70 except where indicated

	Altitude (metres)	Average annual rainfall (mm)	Average daily temperatures (°C) #				Average annual duration of bright sunshine (hours)	Average annual no. of days with*	
			Minimum		Maximum			Air frost	Snow lying
			Jan.	July	Jan.	July			
<b>England</b>									
Abingdon (Oxfordshire)	69	605	0.3	11.6	6.3	21.6	1544	57	13
Acklington (Northumberland)	42	644	0.0	10.3	5.5	17.9	1429	60	20
Birmingham Airport (W. Midlands)	96	679	0.1	11.2	5.7	20.5	1385	62	15
London (Kensington Palace)	25	640	1.7	13.3	6.6	22.2	1384 <sup>x</sup>	35	7
Manchester Airport (Gr. Manchester)	75	819	0.5	11.7	5.8	19.6	1334	47	10
Plymouth/Mount Batten (Devon)	27	990	3.1	12.7	8.3	19.0	1678	25	3
Shawbury (Shropshire)	72	670	0.0	11.2	6.0	20.2	1368	63	17
Southsea (Hampshire)	2	702	2.4	13.9	7.1	20.7	1748	25	6
Waddington (Lincolnshire)	68	598	0.1	11.6	5.2	20.3	1503	54	18
<b>Wales</b>									
Cardiff/Wales Airport (S. Glamorgan)	67	947	1.3	11.9	6.6	19.3	1571	36	8
Valley (Gwynedd)	10	871	2.5	12.0	7.5	18.1	1612	27	3
<b>Northern Ireland</b>									
Belfast Airport (Antrim)	68	912	0.6	10.7	6.1	18.1	1281	53	9
<b>Scotland</b>									
Aberdeen Airport (Grampian)	58	872	−0.9	9.6	5.0	17.5	1341	75	30
Balmoral (Grampian)	283	834	−2.8	8.1	3.7	17.4	1120 <sup>†</sup>	116	63
Edinburgh Airport (Lothian)	35	677	−0.6	10.3	5.7	18.5	1294	66	14
Lerwick (Shetland)	82	1172	0.6	9.3	5.0	14.0	1067	53	32
Stornoway (Western Isles)	3	1094	1.3	10.1	6.4	15.7	1244	49	11
Glasgow Airport (Strathclyde)	5	991	0.1	10.8	5.8	18.6	1266	58	6

\* Based on 1956–70 only.

<sup>x</sup> For Regents Park.

<sup>†</sup> For Braemar.

# Referring to 24-hour (09–09 GMT) extremes. Adjustments have been made to those stations normally recording night minimum (21–09 GMT) and day maximum (09–21 GMT). See Introduction to the series.

## CLIMATOLOGICAL SERVICES AVAILABLE FROM THE METEOROLOGICAL OFFICE

The Meteorological Office collects and archives regular weather reports from a national network of observing stations, consisting of both Meteorological Offices manned by professional staff and co-operating stations operated by interested organizations or individuals. All these data are subjected to close scrutiny before being archived, to ensure consistency of standards, and are then available to meet the needs of the community.

Any undertaking which is at all weather-sensitive can benefit from a prior knowledge of the climate within which it is expected to operate. The building industry can use past weather statistics to estimate likely delays on contracts, architects and civil engineers need to know the likely extremes of weather which a design must withstand, and many industrial processes are dependent on atmospheric conditions for their success. The agricultural industry uses such information for a variety of purposes, many relating to the viability of new crops and the weather-related incidence and spread of pests and diseases.

In addition to special analyses of weather data for these purposes, the Meteorological Office can supply factual statements on weather conditions for legal or insurance purposes. Enquiries on all aspects of past weather data should be

directed to the appropriate address given on page 17. Charges for the supply of information depend mainly on the staff time taken to meet the request.

### Further information

Information leaflets and brochures describing in more detail the range of specialized services available from the Meteorological Office are available free from the same addresses. These leaflets and brochures also indicate the range of complex analyses that the Meteorological Office can undertake.

### Forecasting services

For the day-to-day planning of outdoor work, special weather forecasts and warnings can be arranged to cover specific weather elements at agreed sites. Details may be obtained from:

The Director-General  
Meteorological Office (Met O 7a)  
London Road  
Bracknell  
Berkshire RG12 2SZ.



# THE CLIMATE OF GREAT BRITAIN

This memorandum is one of a series which will cover the whole of Great Britain in due course, published in the Climatological Memoranda range. The Introduction (CM 113) to the series explains how various weather elements are measured. The areas to be covered are:

## SCOTLAND

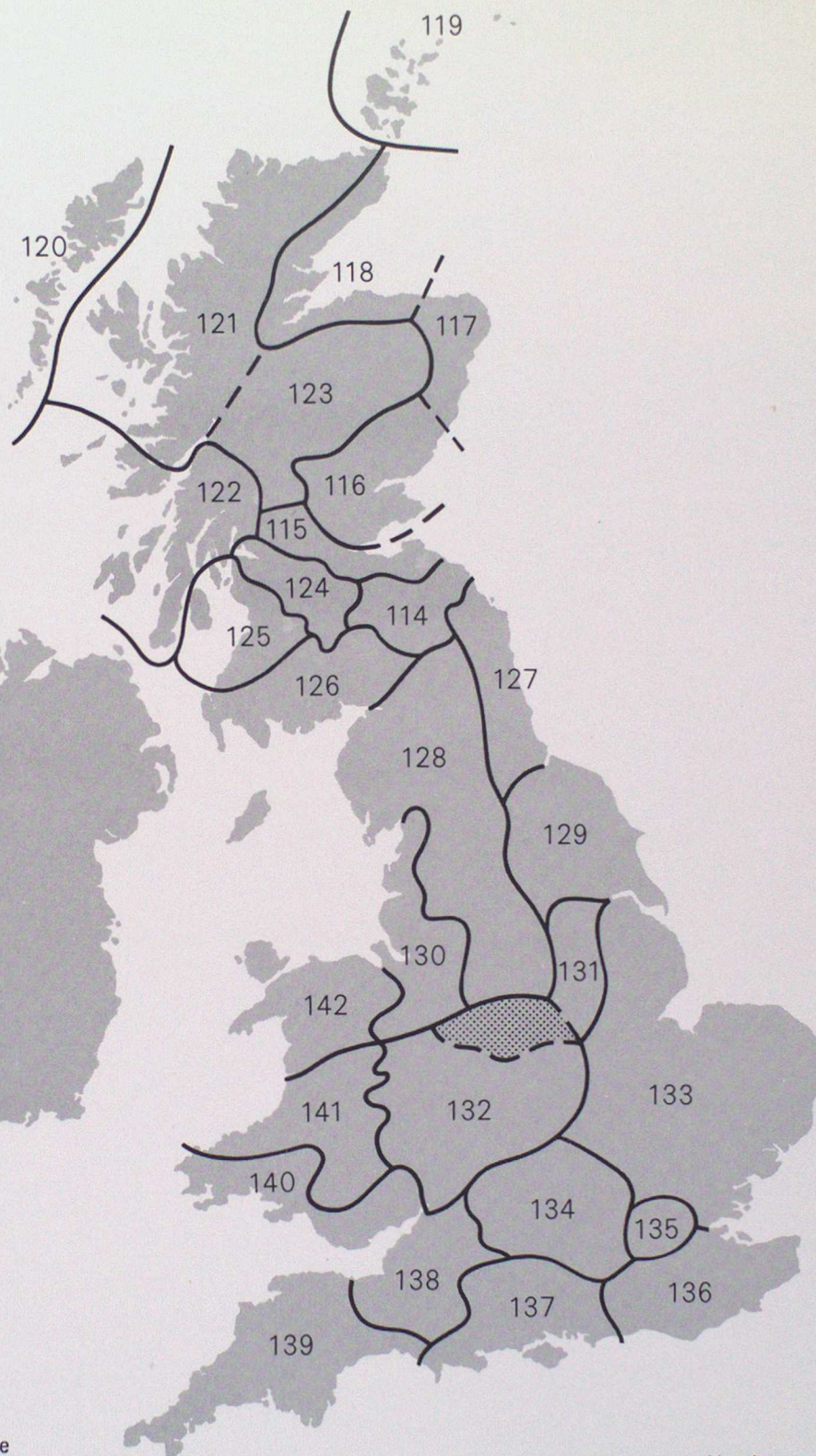
- 114 Borders Region
- 115 Edinburgh, Lothian Region and Stirling
- 116 Fife, Dundee and Perth
- 117 Aberdeen and Buchan
- 118 Moray Firth coastal Region
- 119 Northern Isles
- 120 Western Isles
- 121 Skye and the North-west
- 122 Argyll and the Inner Hebrides
- 123 The Grampians and Perthshire Highlands
- 124 Glasgow and the Clyde valley
- 125 Ayrshire and the Firth of Clyde
- 126 Dumfries and Galloway Region

## ENGLAND

- 127 North-east England
- 128 Pennines and Lake District
- 129 East Yorkshire and North Humberside
- 130 Lancashire and Cheshire and Isle of Man
- 131 Trent Valley
- 132 Midlands
- 133 East Anglia and Lincolnshire
- 134 Thames Valley
- 135 London
- 136 South-east England
- 137 South England
- 138 Somerset and Avon
- 139 South-west Peninsula and Channel Islands

## WALES

- 140 South Wales
- 141 Mid Wales
- 142 North Wales and Anglesey



Further details of these memoranda and of the services mentioned on page 16 can be obtained from:

### FOR ENGLAND AND WALES

The Director-General  
Meteorological Office (Met O 3b)  
London Road  
Bracknell  
Berkshire RG12 2SZ

### FOR SCOTLAND

The Superintendent  
Meteorological Office  
231 Corstorphine Road  
Edinburgh EH12 7BB

For information on the climate of Northern Ireland please contact:

The Senior Meteorological Officer  
Meteorological Office  
Progressive House  
1 College Square East  
Belfast BT1 6BQ