THE CLIMATE OF GREAT BRITAIN

TRENT VALLEY

Climatological Memorandum 131

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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 airstream covered Britain. The alignment of the clouds with the surface wind is clearly seen. The Trent Valley has between 5 and 11 hours of sunshine with maximum afternoon temperatures around 12 ^{o}C. There were scattered showers during the day with isolated thunderstorms during the early evening.

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Climatological Memorandum 131

Trent Valley

INTRODUCTION

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 19.

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Advisory Services
February 1990

THE AREA

This memorandum describes the main features of the climate of the Trent Valley. The area comprises Nottinghamshire together with parts of Staffordshire, Derbyshire, South Yorkshire, south Humberside and Leicestershire.

The area lies on the southern and south-eastern flank of the Pennines with much of the ground above 60 metres, the highest point being around 250 metres on Fulford Moor to the north-east of Stone. The river Trent rises near Biddulph Moor, Staffordshire and flows into the Humber to the east of Goole. For much of the latter part of its course the Trent flows through a wide valley, much of it below 30 metres above mean sea level, with deep and heavy soils. The heaviest soils provide pasture for cattle including some dairy herds, and among the crops grown are potatoes and celery.

The area is on the eastern and southern part of the Yorkshire, Nottinghamshire and Derbyshire coalfield which is the largest and most important in Britain, with the most productive section being the part in Nottinghamshire and Derbyshire.

A great variety of industries have developed, mainly centred around Nottingham and Derby. Textiles are the largest single manufacturing industry producing a wide variety of products including clothing, fabrics and lace.

Nottingham is the largest town in the area and is situated where the river Trent is easily crossed. Its main industries are textiles, tobacco, bicycles and pharmaceuticals. Derby is known for aero engines as well as for textiles.

The map below shows the topography of the region and the locations of the climatological and rainfall stations for which data are given in this memorandum.

Details of the southern section of this region are also included in Climatological Memorandum 132: The Midlands.

Topography of the Trent Valley area and locations and altitudes (in metres) of the stations. Coordinates are national grid references.

TEMPERATURE

The mean annual temperature over the Trent Valley is around 9.5 °C but with slightly lower values over the higher-ground areas. Over the British Isles mean annual temperatures range from about 7 °C in Shetland to over 11 °C in the extreme south-west of England and the Channel Islands.

Temperature shows both seasonal and diurnal variations. January is on average the coldest month with mean daily minimum temperatures about 0.5 °C to 1.0 °C but with some sheltered locations having values close to or just below zero. This compares with −1.0 °C in parts of Tayside and Grampian to over 5.5 °C in the Isles of Scilly.

Minimum temperatures normally occur around sunrise and extreme minimum temperatures usually occur in January but have occurred in December and February in the area. The lowest recorded temperature in the area was −19.6 °C at Stone on 13 December 1981.

July is the warmest month with mean daily maximum temperatures in the Trent Valley around 20.5 °C. The highest mean daily temperatures in the British Isles of 22.5 °C occur in the London area and the lowest of 15 °C in Shetland. Maximum temperatures normally occur two to three hours after midday and extreme maximum temperatures usually occur in July or August. The highest known temperature recorded in the area this century was 34.4 °C on 9 August 1911 at Nottingham.

The variation of mean maximum and mean minimum temperatures together with the extreme temperatures recorded at four locations in the area are shown in Figure 1. There is a marked similarity between the curves of mean values but more variation in the extremes which reflect the differing topographical features of the locations as well as the period over which the data were recorded.

FIGURE 1 Annual variation of maximum and minimum temperatures with extreme temperatures for the stated periods.

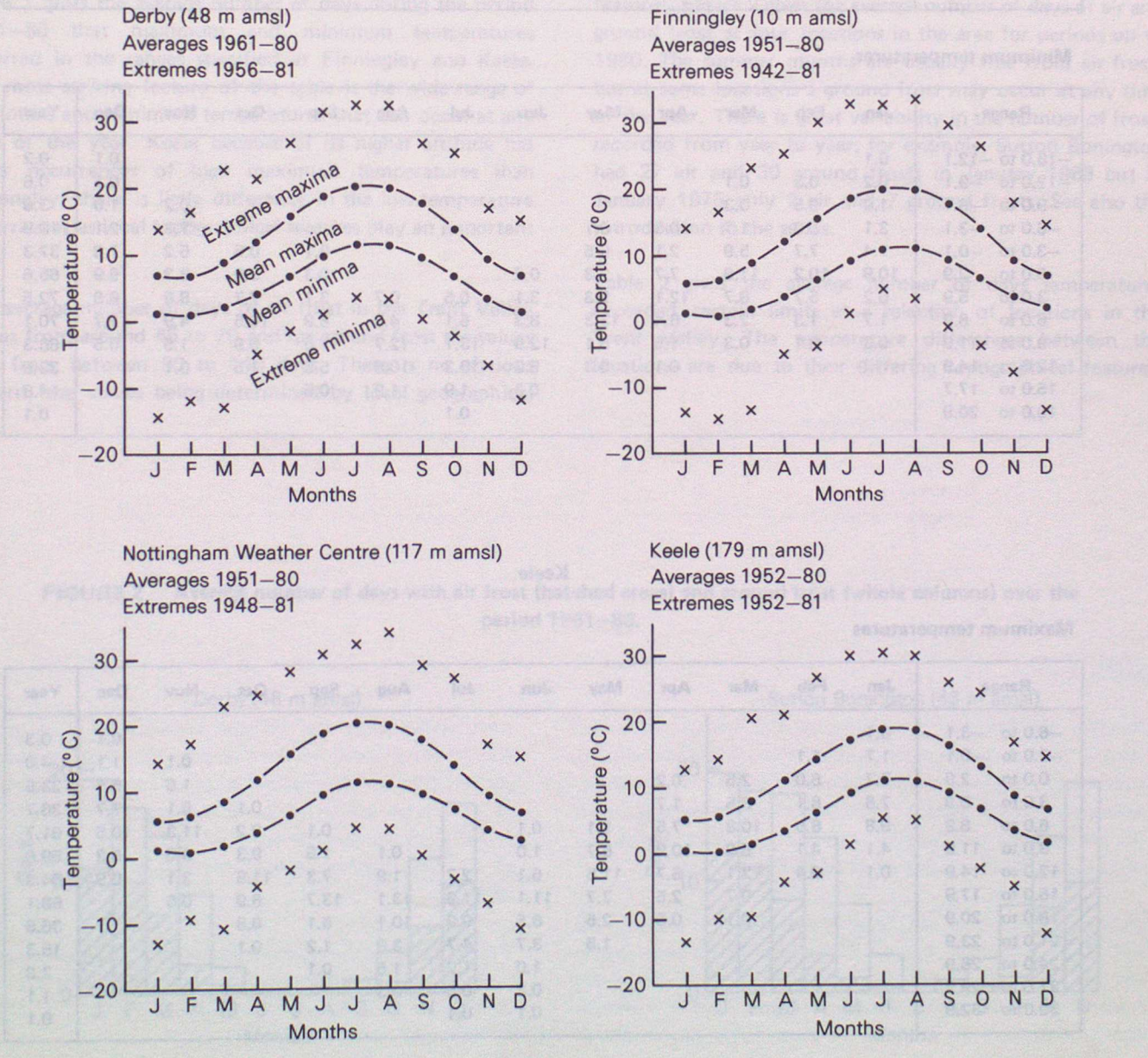


TABLE 1 Average number of days of maximum and minimum temperatures (°C) in ranges specified for the period 1961–80

Finningley

Maximum temperatures

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
−6.0 to −3.1											0.1	0.1	0.1
−3.0 to −0.1	0.7	0.5										0.6	1.8
0.0 to 2.9	5.8	3.7	1.1								0.8	3.1	14.5
3.0 to 5.9	7.8	7.9	4.8	0.9	0.1					0.1	3.5	8.5	33.5
6.0 to 8.9	8.9	7.9	7.5	4.5	0.3				0.1	0.8	9.3	8.5	47.8
9.0 to 11.9	6.8	5.9	10.7	9.5	3.3	0.3			0.1	5.2	9.7	7.5	58.9
12.0 to 14.9	1.1	2.1	5.7	8.5	9.1	2.7	0.9	0.5	3.9	11.3	5.3	2.7	53.7
15.0 to 17.9		0.1	1.0	4.7	10.4	7.6	5.9	5.7	10.1	10.4	1.2	0.1	57.1
18.0 to 20.9			0.3	1.7	4.9	10.3	11.1	12.3	10.5	2.7	0.1		53.7
21.0 to 23.9			0.1	0.1	2.4	5.3	7.9	7.9	4.3	0.5			28.5
24.0 to 26.9					0.6	2.8	3.9	2.9	1.1	0.1			11.3
27.0 to 29.9						0.9	1.0	1.3					3.1
30.0 to 32.9						0.2	0.4	0.4					1.0
33.0 to 35.9								0.1					0.1

Minimum temperatures

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
−15.0 to −12.1	0.1											0.1	0.2
−12.0 to −9.1	0.2	0.3	0.1									0.1	0.6
−9.0 to −6.1	1.0	0.5	0.3								0.2	1.0	3.0
−6.0 to −3.1	3.1	2.3	1.7	0.3	0.1						1.3	2.1	10.9
−3.0 to −0.1	7.4	7.7	5.9	2.1	0.5				0.1	0.5	5.2	7.8	37.3
0.0 to 2.9	10.9	10.2	11.9	7.7	2.3	0.2			0.3	3.9	8.3	9.9	65.6
3.0 to 5.9	6.2	5.7	8.7	12.1	9.3	3.1	0.5	0.7	3.1	7.7	8.6	6.8	72.5
6.0 to 8.9	1.7	1.3	2.3	6.4	13.3	8.3	5.1	4.9	8.9	10.5	4.9	2.7	70.1
9.0 to 11.9	0.3	0.1	0.3	1.5	5.1	12.9	13.1	12.7	11.5	6.9	1.5	0.5	66.3
12.0 to 14.9				0.1	0.3	5.2	10.3	10.8	5.5	1.5	0.1		33.9
15.0 to 17.7						0.3	1.9	1.9	0.5				4.8
18.0 to 20.9							0.1						0.1

Keele

Maximum temperatures

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
−6.0 to −3.1	0.1											0.1	0.3
−3.0 to −0.1	1.7	1.1									0.1	1.1	4.0
0.0 to 2.9	7.7	6.0	2.5	0.2							1.6	5.5	23.5
3.0 to 5.9	7.6	8.1	6.5	1.7						0.1	5.1	7.7	36.7
6.0 to 8.9	9.8	8.5	10.8	7.5	1.1	0.1			0.1	2.2	11.3	10.5	61.7
9.0 to 11.9	4.1	4.1	8.2	10.9	6.7	1.0		0.1	1.5	9.3	8.5	5.3	59.6
12.0 to 14.9	0.1	0.4	2.1	6.7	11.5	6.1	2.7	1.9	7.3	11.5	3.1	0.9	54.3
15.0 to 17.9			0.7	2.5	7.7	11.1	11.9	13.1	13.7	6.9	0.5		68.1
18.0 to 20.9			0.1	0.5	2.5	6.5	9.9	10.1	6.1	0.8			36.6
21.0 to 23.9					1.5	3.7	4.7	3.9	1.2	0.1			15.3
24.0 to 26.9						1.0	1.2	1.5	0.1				3.8
27.0 to 29.9						0.3	0.5	0.3					1.1
30.0 to 32.9						0.1	0.1						0.1

TABLE 1 CONTINUED

Minimum temperatures

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
−15.0 to −12.1	0.1												0.1
−12.0 to −9.1	0.3	0.1	0.1									0.1	0.5
−9.0 to −6.1	1.1	0.7	0.1									0.9	2.9
−6.0 to −3.1	2.9	2.9	1.3	0.2							1.1	3.5	11.9
−3.0 to −0.1	8.5	8.4	7.7	3.3	0.3					0.3	5.5	6.8	40.7
0.0 to 2.9	10.9	10.5	12.3	8.5	2.5	0.4			0.5	2.9	9.5	10.7	68.8
3.0 to 5.9	5.3	4.9	8.1	12.1	10.7	2.7	0.3	0.2	3.5	8.8	8.1	6.1	70.6
6.0 to 8.9	1.8	0.7	1.3	5.2	13.7	11.3	6.3	6.6	10.9	12.0	4.7	2.8	77.1
9.0 to 11.9				0.7	3.6	11.7	14.6	14.3	11.1	5.9	1.1	0.3	63.3
12.0 to 14.9					0.3	3.5	8.5	8.9	3.9	0.9	0.1		26.2
15.0 to 17.9						0.4	1.3	1.0	0.2				2.9
18.0 to 20.9								0.1					0.1

Table 1 gives the average number of days during the period 1961–80 that maximum and minimum temperatures occurred in the ranges specified at Finningley and Keele. The most striking feature of the table is the wide range of maximum and minimum temperatures that can occur at any time of the year. Keele because of its higher altitude has fewer occurrences of high maximum temperatures than Finningley; there is little difference in the low-temperature occurrences as local topographical features play an important role.

The average number of days of air frost in the Trent Valley ranges from around 45 to 70 and for ground frost the values vary from between 90 to 140 days. There is no obvious pattern, the values being determined by local geographical features. Figure 2 gives the average number of days of air and ground frost at four locations in the area for periods up to 1980. The summer months are usually free from air frosts but at some locations a ground frost may occur at any time of the year. There is great variability in the number of frosts recorded from year to year; for example, Sutton Bonington had 27 air and 30 ground frosts in January 1963 but in January 1975 only 2 air and 7 ground frosts. See also the Introduction to the series.

Table 2 gives the average number of days temperatures exceeded certain limits at a selection of locations in the Trent Valley. The temperature differences between the locations are due to their differing topographical features.

FIGURE 2 Average number of days with air frost (hatched areas) and ground frost (whole columns) over the period 1961–80.

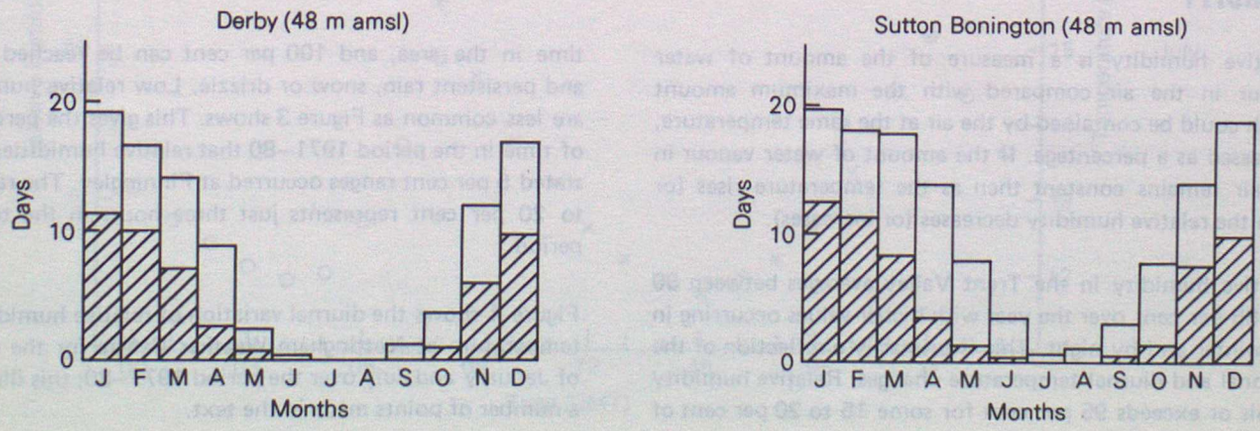


FIGURE 2 CONTINUED Average number of days with air frost (hatched areas) and ground frost (whole columns) over the period 1961–80.

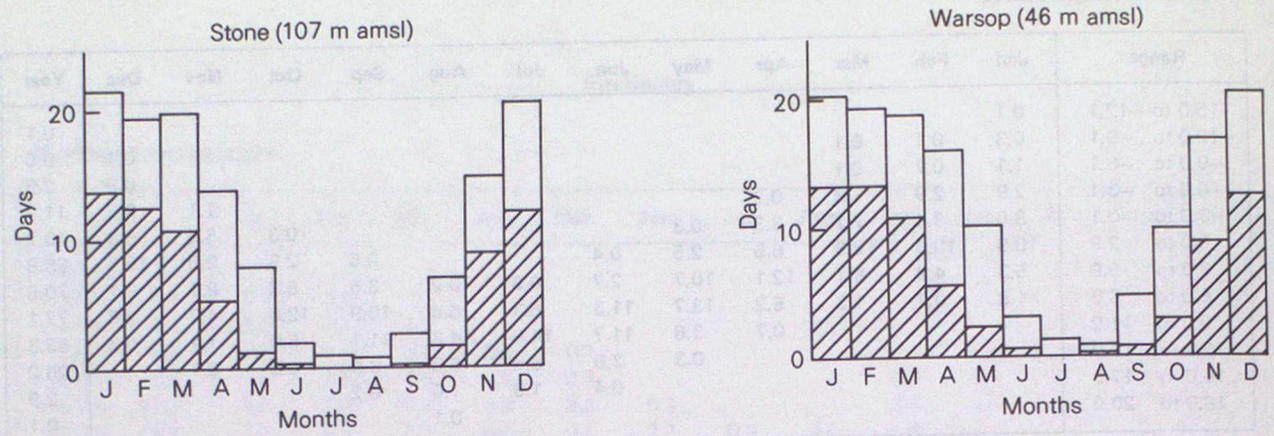


TABLE 2 Average number of days (1961–80) with maximum and minimum temperatures exceeding the specified limits at selected sites

Maximum temperature	25°C or more					30°C or more		
	May	Jun	Jul	Aug	Sep	Jun	Jul	Aug
Derby	0.3	1.7	3.1	3.5	0.4	0.3	0.5	0.3
Warsop	0.1	2.3	2.5	2.8	0.3	0.3	0.3	0.2
Sutton Bonington	0.1	1.9	2.2	2.6	0.3	0.2	0.3	0.1
Mansfield	0.3	1.7	1.9	2.4	0.1	0.2	0.2	0.1
Stone		1.2	1.6	1.5	0.1		0.1	0.2
Keele		0.9	1.3	1.3	0.1	0.1	0.1	

Minimum temperature	−5°C or less						−10°C or less			
	Nov	Dec	Jan	Feb	Mar	Apr	Dec	Jan	Feb	Mar
Derby		1.7	2.0	1.1	0.7	0.1	0.1	0.4	0.1	0.1
Warsop	0.9	2.7	3.7	2.5	1.5	0.1	0.7	1.3	0.5	0.1
Sutton Bonington	0.7	2.5	2.9	1.7	0.9	0.1	0.1	0.8	0.1	0.1
Mansfield	0.1	0.9	2.1	1.3	0.5		0.1	0.3	0.1	
Stone	1.2	3.2	3.5	1.8	1.3		0.2	0.6	0.3	0.3
Keele	0.1	1.7	2.4	1.1	0.4		0.1	0.3	0.1	

HUMIDITY

Relative humidity is a measure of the amount of water vapour in the air compared with the maximum amount which could be contained by the air at the same temperature, expressed as a percentage. 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 in the Trent Valley averages between 80 and 85 per cent over the year with higher values occurring in the winter and by night. This is primarily a reflection of the seasonal and diurnal temperature changes. Relative humidity equals or exceeds 95 per cent for some 15 to 20 per cent of time in the area, and 100 per cent can be reached in fog and persistent rain, snow or drizzle. Low relative humidities are less common as Figure 3 shows. This gives the percentage of time in the period 1971–80 that relative humidities in the stated 5 per cent ranges occurred at Finningley. The range 16 to 20 per cent represents just three hours in the ten-year period.

Figure 4 shows the diurnal variation of relative humidity and temperature at Nottingham Weather Centre for the months of January and July over the period 1971–80; this illustrates a number of points made in the text.

FIGURE 3 Percentage of the time humidity in stated ranges occurred at Finningley over the period 1971–80.

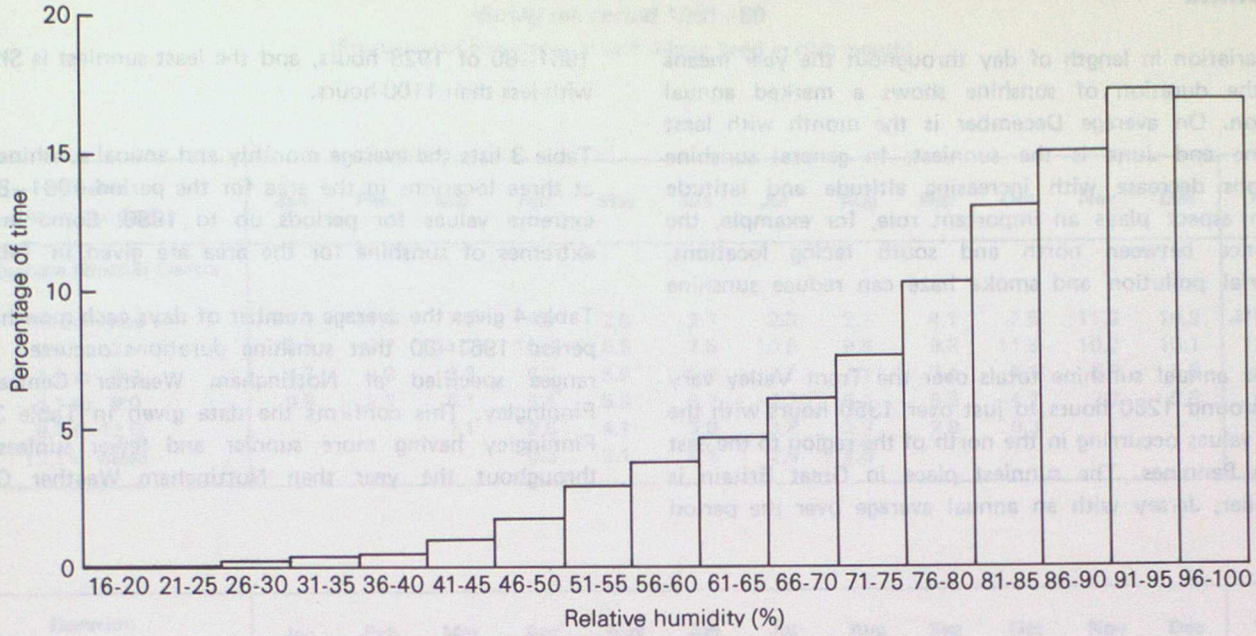
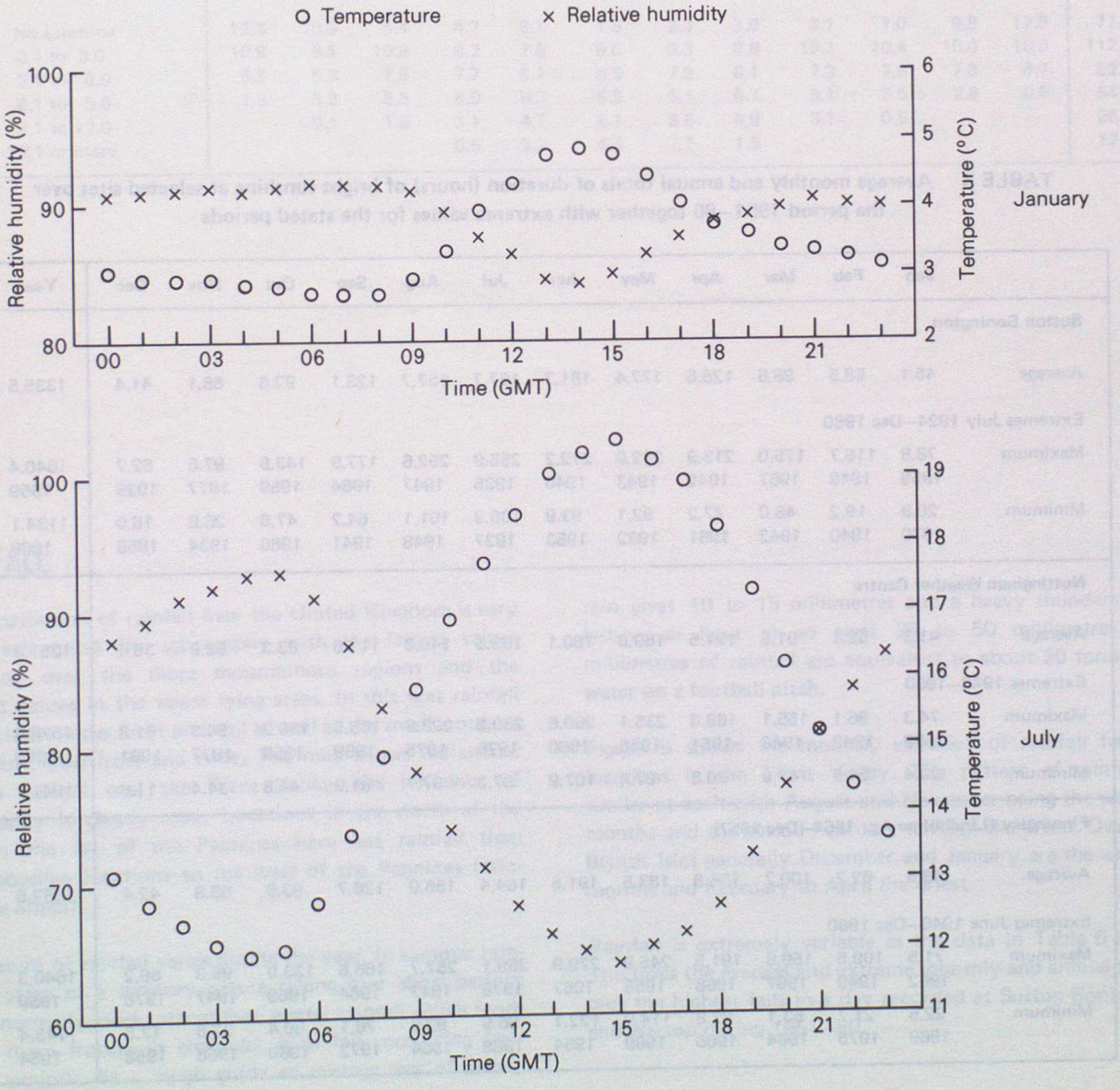


FIGURE 4 Average diurnal variation of temperature and relative humidity at Nottingham Weather Centre for January and July over the period 1971–80.



SUNSHINE

The variation in length of day throughout the year means that the duration of sunshine shows a marked annual variation. On average December is the month with least sunshine and June is the sunniest. In general sunshine durations decrease with increasing altitude and latitude though aspect plays an important role, for example, the difference between north and south facing locations. Industrial pollution and smoke haze can reduce sunshine amounts.

Average annual sunshine totals over the Trent Valley vary from around 1250 hours to just over 1350 hours with the higher values occurring in the north of the region to the east of the Pennines. The sunniest place in Great Britain is St. Helier, Jersey with an annual average over the period 1951–80 of 1928 hours, and the least sunniest is Shetland with less than 1100 hours.

Table 3 lists the average monthly and annual sunshine totals at three locations in the area for the period 1951–80 plus extreme values for periods up to 1980. Some monthly extremes of sunshine for the area are given in Table 10.

Table 4 gives the average number of days each month in the period 1961–80 that sunshine durations occurred in the ranges specified at Nottingham Weather Centre and Finningley. This confirms the data given in Table 3 with Finningley having more sunnier and fewer sunless days throughout the year than Nottingham Weather Centre.

TABLE 3 Average monthly and annual totals of duration (hours) of bright sunshine at selected sites over the period 1951–80 together with extreme values for the stated periods

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Sutton Bonington													
Average	45.1	58.5	98.6	128.5	177.4	181.7	167.7	157.7	128.1	92.6	58.1	41.4	1335.5
Extremes July 1924–Dec 1980													
Maximum	78.8	116.7	175.0	213.9	242.9	272.2	255.9	252.6	177.9	143.9	97.6	62.7	1640.4
	1959	1949	1967	1942	1943	1940	1935	1947	1964	1959	1977	1929	1959
Minimum	20.9	19.2	46.0	77.2	92.1	93.9	106.3	101.1	64.2	47.0	26.6	16.0	1134.1
	1970	1940	1942	1961	1932	1953	1937	1948	1941	1960	1934	1958	1968
Nottingham Weather Centre													
Average	41.3	52.1	91.5	121.5	169.0	180.1	158.5	149.3	117.6	83.3	53.8	39.4	1257.3
Extremes 1948–1980													
Maximum	74.3	96.1	155.1	168.8	235.1	260.6	250.5	223.6	165.5	130.2	84.8	61.8	1578.9
	1952	1949	1948	1951	1956	1960	1976	1975	1959	1959	1977	1961	1959
Minimum	20.4	24.5	47.9	70.8	97.4	107.9	87.3	97.7	81.9	44.8	34.4	11.6	1047.1
Finningley (Lindholme Apr 1954–Dec 1957)													
Average	48.5	62.2	100.7	136.8	183.5	191.5	164.4	156.0	126.7	93.9	60.8	42.4	1367.5
Extremes June 1946–Dec 1980													
Maximum	71.5	109.5	159.6	191.5	245.9	279.9	259.1	257.7	166.6	133.0	95.3	66.2	1640.3
	1962	1949	1967	1968	1956	1957	1976	1947	1964	1959	1947	1976	1959
Minimum	22.5	21.7	53.1	83.8	114.9	122.1	96.9	92.8	76.1	50.4	33.6	13.8	1143.4
	1969	1975	1964	1966	1969	1954	1968	1954	1972	1960	1968	1958	1954

TABLE 4 Average number of days of sunshine duration at Nottingham Weather Centre and Finningley during the period 1961–80

(Frequency of occurrence in each 3-hour band in each month)

Duration (Hours per day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Nottingham Weather Centre													
No sunshine	15.0	11.4	7.2	4.9	2.5	2.7	2.3	2.7	4.1	7.5	11.3	14.9	86.5
0.1 to 3.0	10.3	9.7	11.2	10.5	9.5	7.5	10.0	9.5	9.8	11.3	10.2	10.1	119.8
3.1 to 6.0	4.7	4.9	6.3	6.3	6.5	5.6	7.7	7.1	7.4	7.1	5.8	5.6	75.1
6.1 to 9.0	0.9	2.3	5.1	5.4	5.3	5.7	4.7	6.4	5.9	4.7	2.7	0.3	49.5
9.1 to 12.0			1.1	2.5	4.1	3.9	3.8	3.9	2.8	0.3			22.4
12.1 or more				0.3	3.1	4.5	2.5	1.5					11.9

Duration (Hours per day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Finningley													
No sunshine	12.5	10.5	6.4	4.7	3.1	1.8	2.3	3.0	3.1	7.0	9.9	12.9	77.1
0.1 to 3.0	10.9	9.1	10.3	8.2	7.5	6.6	9.3	8.8	10.3	10.4	10.0	10.9	112.3
3.1 to 6.0	6.3	5.3	7.5	7.7	6.1	6.5	7.9	6.1	7.3	7.6	7.3	6.7	82.3
6.1 to 9.0	1.3	3.3	5.3	5.9	6.3	5.5	5.1	6.7	6.1	5.5	2.9	0.5	54.6
9.1 to 12.0		0.1	1.5	3.1	4.7	5.1	3.5	4.9	3.1	0.5			26.5
12.1 or more				0.5	3.3	4.5	2.7	1.5					12.5

RAINFALL

The distribution of rainfall over the United Kingdom is very much influenced by topography with the largest values occurring over the more mountainous regions and the smallest values in the lower 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 map shows the annual average rainfall over the Trent Valley; the influence of topography is clearly seen. Locations in the north of the area in the lee of the Pennines have less rainfall than corresponding locations to the west of the Pennines (rain-shadow effect).

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 with falls occurring 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 gives 25 to 50 millimetres: 25 millimetres of rainfall are equivalent to about 20 tonnes of water on a football pitch.

Figure 5 shows the monthly variation of rainfall for six locations in the Trent Valley. The pattern of rainfall is similar at each with August and November being the wettest months and the period February to April the driest. Over the British Isles generally December and January are the wettest months and February to April the driest.

Rainfall is extremely variable as the data in Table 5 show. This gives the average and extreme monthly and annual totals plus the highest falls in a day recorded at Sutton Bonington and Warsop during 1951–80.

Average annual rainfall (mm) over the period 1941–70. Coordinates are national grid references.

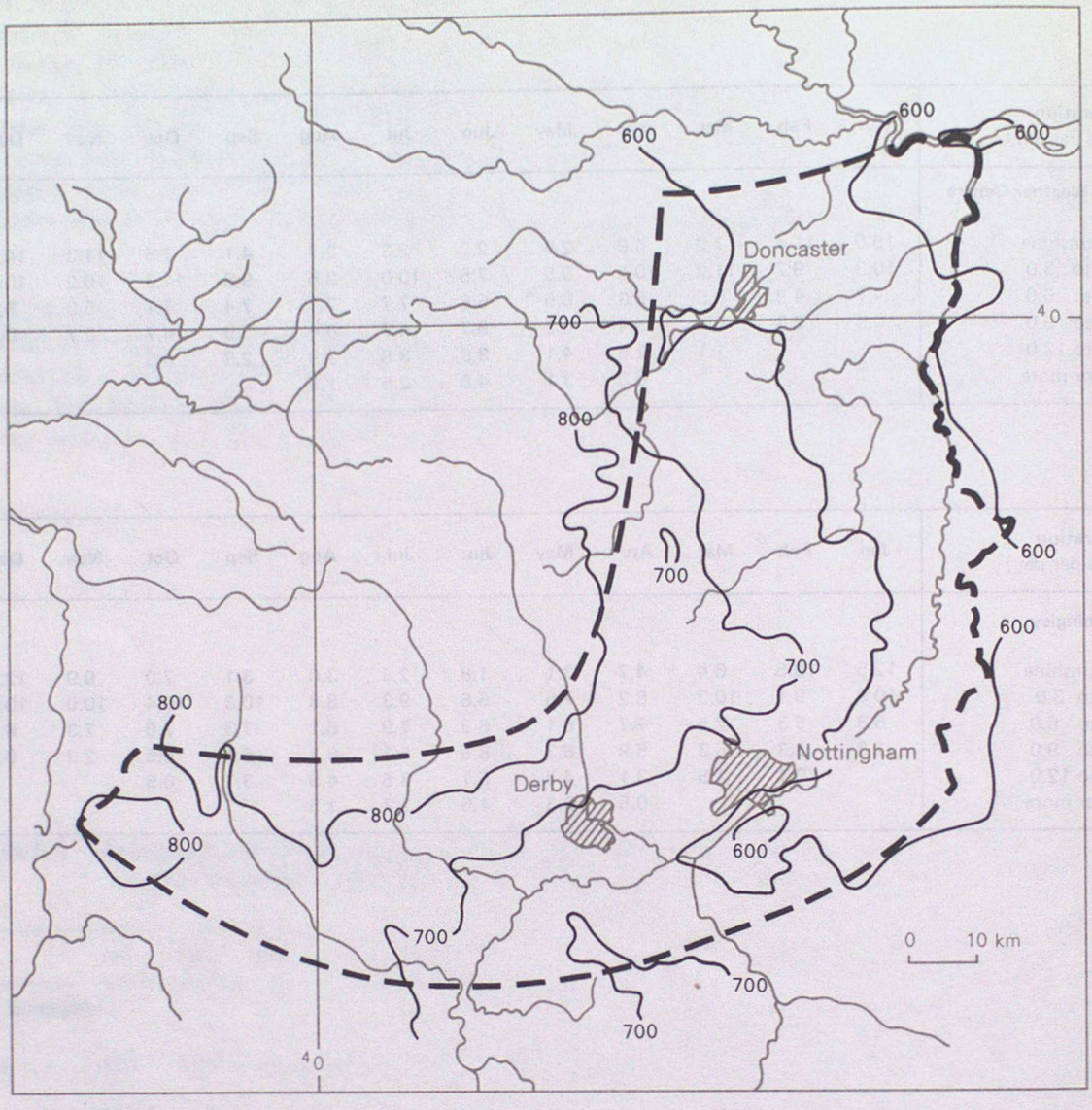
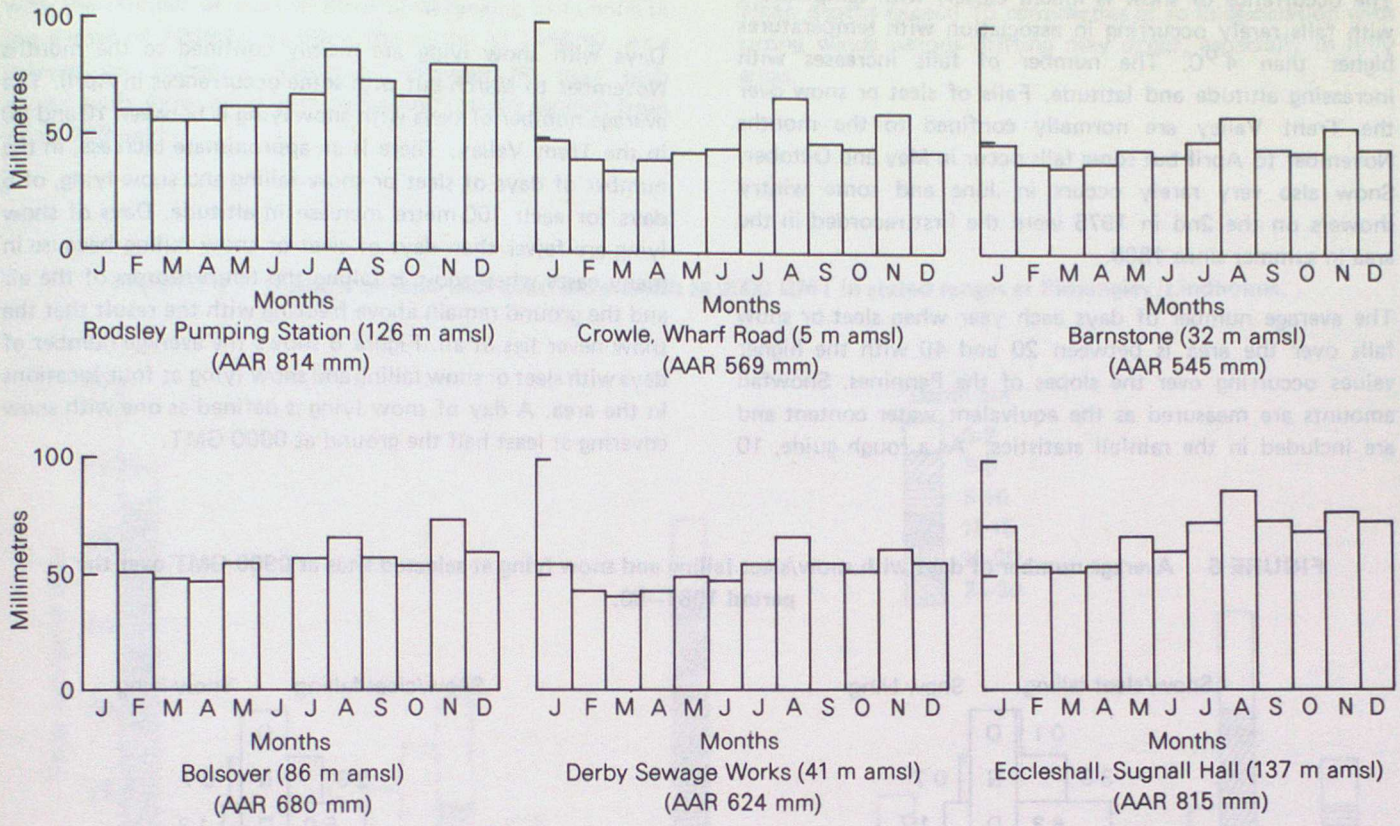


FIGURE 5 Average monthly rainfall over the period 1941–70.



AAR = Average annual rainfall

TABLE 5 Average monthly and annual rainfall (mm), with daily, monthly and annual extremes, at Sutton Bonington and Warsop for the period 1951–80

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Sutton Bonington													
Average	52	43	43	39	49	52	51	62	51	48	56	54	600
Maximum	107.0	176.5	90.2	100.4	110.3	109.5	111.5	109.2	141.5	136.0	142.7	142.9	828.0
Minimum	15.9	2.5	7.0	5.1	7.7	7.5	10.9	7.0	0.3	7.8	17.5	10.1	402.1
Most in a day	35.1	39.6	65.5	36.0	71.4	45.7	55.4	36.6	54.0	56.4	25.4	41.1	
Warsop													
Average	52	46	47	42	51	52	57	60	51	49	62	55	624
Maximum	109.5	146.7	99.4	101.9	134.5	134.1	161.2	144.5	145.3	136.6	146.5	182.9	817.1
Minimum	14.0	3.5	8.8	6.1	8.1	5.2	6.1	4.8	0.0	4.7	16.0	11.1	390.7
Most in a day	31.2	26.7	28.7	34.5	44.2	35.1	61.3	37.4	47.0	40.1	39.6	32.5	

SNOW

The occurrence of snow is linked closely with temperature with falls rarely occurring in association with temperatures higher than 4 °C. The number of falls increases with increasing altitude and latitude. Falls of sleet or snow over the Trent Valley are normally confined to the months November to April but some falls occur in May and October. Snow also very rarely occurs in June and some wintry showers on the 2nd in 1975 were the first recorded in the area in summer since 1888.

The average number of days each year when sleet or snow falls over the area is between 20 and 40 with the higher values occurring over the slopes of the Pennines. Snowfall amounts are measured as the equivalent water content and are included in the rainfall statistics. As a rough guide, 10 centimetres of snow are equivalent to 1 centimetre of rainfall.

Days with snow lying are mainly confined to the months November to March but with some occurrences in April. The average number of days with snow lying is between 10 and 20 in the Trent Valley. There is an approximate increase, in the number of days of sleet or snow falling and snow lying, of 5 days for each 100-metre increase in altitude. Days of snow lying are fewer than days of sleet or snow falling because in many cases when snow is falling the temperatures of the air and the ground remain above freezing with the result that the snow never lies at all. Figure 6 shows the average number of days with sleet or snow falling and snow lying at four locations in the area. A day of snow lying is defined as one with snow covering at least half the ground at 0900 GMT.

FIGURE 6 Average number of days with snow/sleet falling and snow lying at selected sites at 0900 GMT over the period 1961–80.

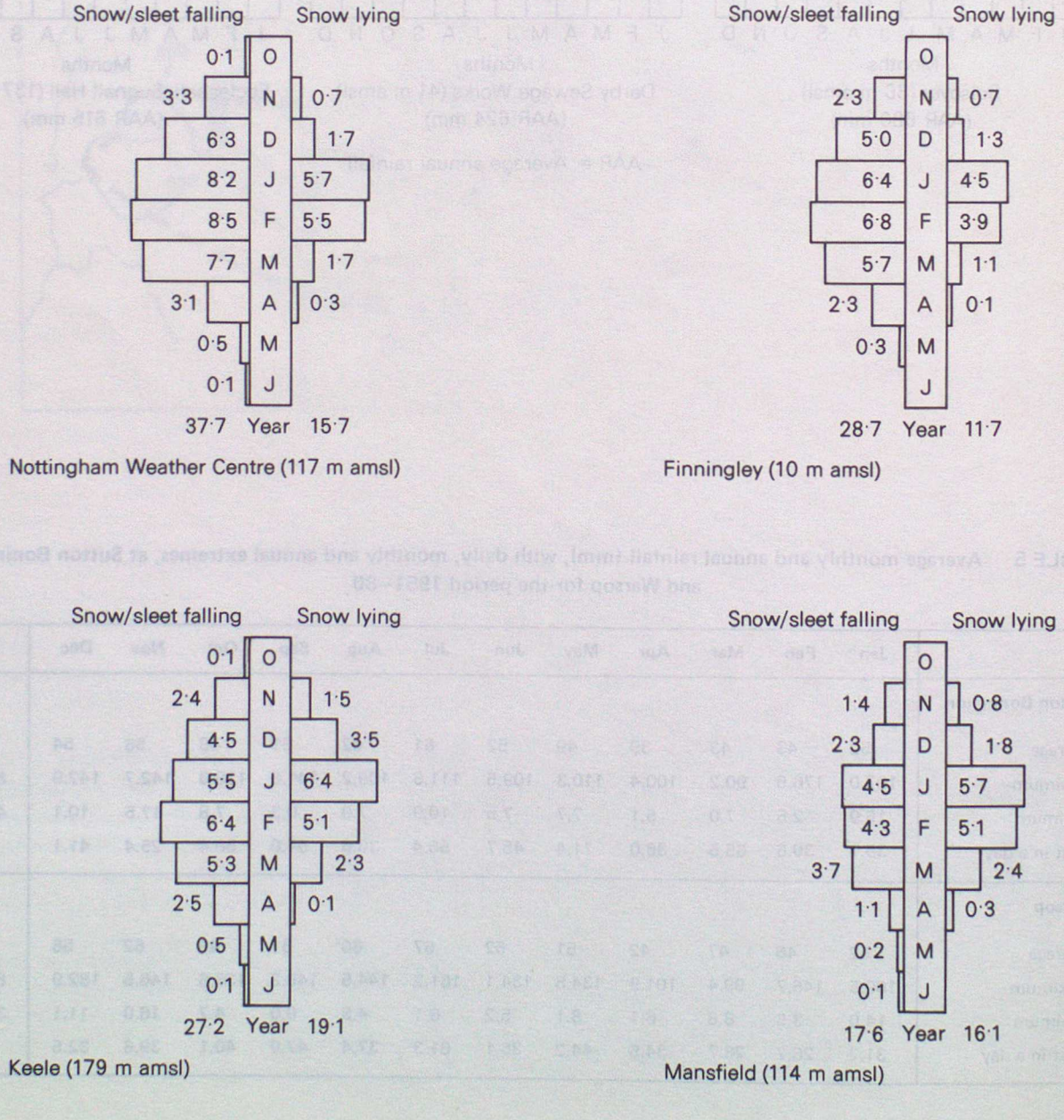
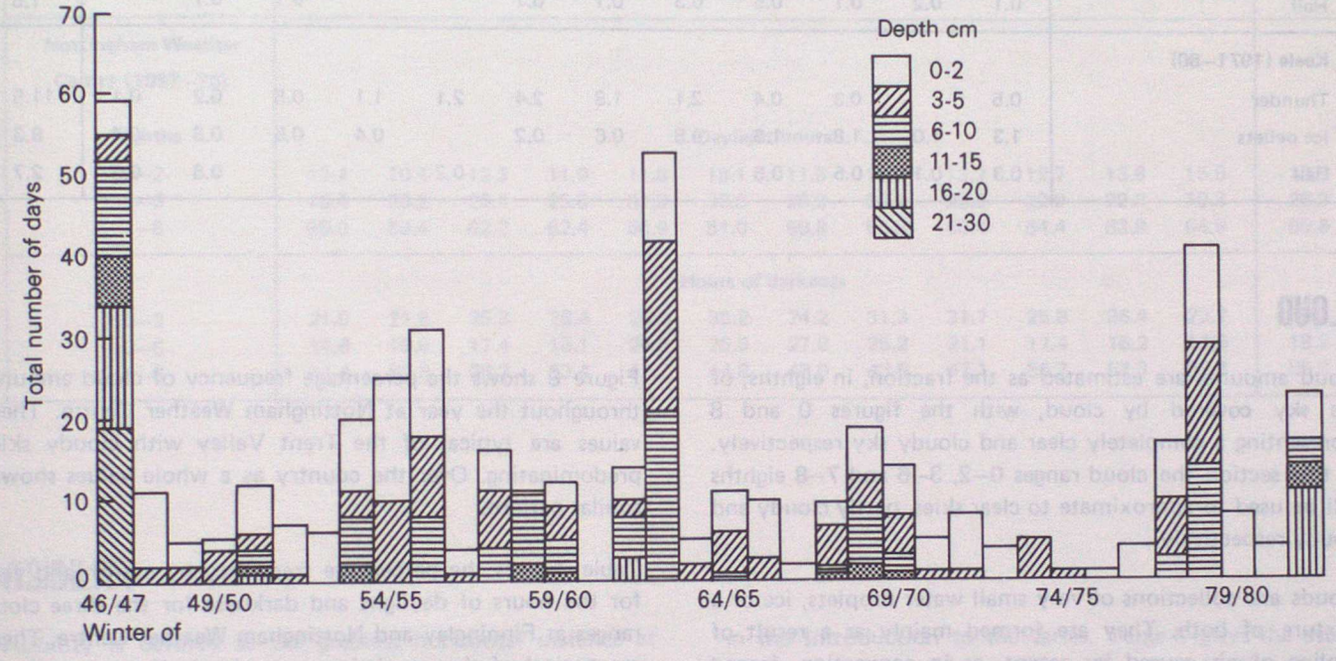


Figure 7 shows the number of days with snow in various depth ranges at Finningley/Lindholme since the winter of 1946/47. This illustrates the great variability which occurs with the number of days of snow lying ranging from none in the winter of 1960/61 to 59 in the winter of 1946/47. As a comparison Balmoral, Grampian averages 60 days each winter with snow lying 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 centimetres or so may fall over a wide area. When depths exceed 15 centimetres or so in association with strong winds serious drifting may occur, especially in hilly areas.

FIGURE 7 Number of days with total snow depth at 0900 GMT in stated ranges at Finningley/Lindholme.



THUNDER AND HAIL

Thunder and hail are phenomena associated with cumulonimbus clouds, which are clouds of great vertical extent. A typical thundercloud normally reaches at least 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 the air along the path of the lightning.

Thunder can occur at any time of the year but is more frequent during the summer months. Over the Trent Valley the average number of days each year with thunder is around 10 to 15, but in the north of the region adjoining the Vale of York the average is around 20. There is great variability in individual years; for example, Nottingham Weather Centre had 23 days with thunder in 1975 but only 7 in 1978. The majority of thunderstorms are triggered by convective processes either over land in summer or over a comparatively warm sea in the winter.

In thunderstorms or heavy showers at any time of the year the precipitation may be of hail or ice pellets. Both are in the form of hard, clear or opaque ice the criterion between them being one of size. Hail has a diameter of 5 millimetres or more and ice pellets a diameter of less than 5 millimetres. Ice pellets are essentially a winter phenomenon and are more frequent around coasts than inland. Hail tends to have a spring maximum as it generally melts before reaching the ground in summer. Table 6 gives the average number of days of thunder, hail and ice pellets for three locations in the area.

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 thundery situations. One notable fall over the area occurred in a thundery situation when 152 millimetres fell at Rodsley, Derbyshire on 5 August 1957 which just happened to be a bank holiday.

TABLE 6 Average number of days of thunder and hail over the periods stated

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Nottingham Weather Centre (1961–80)													
Thunder	0.2	0.3	0.7	0.9	3.1	2.3	2.5	2.7	1.6	0.5	0.1	0.1	14.9
Ice pellets	2.9	3.1	2.3	1.1	0.3	0.1	0.1	0.1	0.1		0.8	1.4	12.0
Hail	0.5	0.5	1.4	1.5	1.2	0.4	0.2	0.3	0.1	0.1	0.3	0.5	6.9
Finningley (1961–80)													
Thunder	0.2	0.2	0.2	0.7	2.5	2.2	2.7	2.1	1.2	0.3	0.1		12.3
Ice pellets	1.0	0.9	1.9	1.9	0.7	0.3	0.1	0.1	0.1	0.5	0.5	0.6	8.5
Hail	0.1	0.2	0.1	0.5	0.3	0.1	0.1			0.1	0.1		1.5
Keele (1971–80)													
Thunder	0.5		0.3	0.4	2.1	1.8	2.4	2.1	1.1	0.5	0.2	0.1	11.5
Ice pellets	1.3	1.0	1.8	1.5	0.8	0.6	0.2		0.4	0.5	0.8	0.4	9.3
Hail	0.3	0.1	0.5	0.5				0.2			0.8	0.3	2.7

CLOUD

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 cloud ranges 0–2, 3–6 and 7–8 eighths will be used to approximate to clear skies, partly cloudy and cloudy respectively.

Clouds are collections of very small water droplets, ice or a mixture of both. They are formed mainly as a result of 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.

Figure 8 shows the percentage frequency of cloud amounts throughout the year at Nottingham Weather Centre. These values are typical of the Trent Valley with cloudy skies predominating. Over the country as a whole values show a similar pattern.

Table 7 gives the percentage frequency by month and year for the hours of daylight and darkness for the three cloud ranges at Finningley and Nottingham Weather Centre. These are typical of the area being more cloudy in winter than in summer, and more cloudy by day than by night.

FIGURE 8 Frequency of total cloud amount at Nottingham Weather Centre over the period 1957–76.

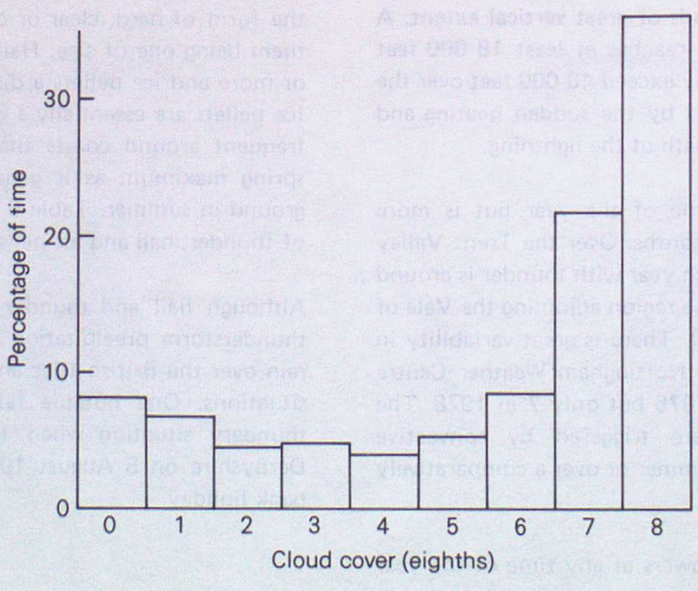


TABLE 7 Percentage frequency of hours with total cloud amount in selected ranges over the periods stated

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Finningley (1957–72)													
Eighths						**Daylight hours**							
0–2	15.0	13.1	13.1	12.7	12.7	17.1	12.9	16.0	15.4	14.8	16.6	17.8	14.6
3–6	19.7	19.2	25.0	25.5	31.3	31.2	28.4	28.3	27.7	23.6	20.9	19.6	25.9
7–8	65.5	67.5	61.8	61.8	56.1	51.8	58.9	55.8	57.1	61.6	62.5	62.7	59.4
						Hours of darkness							
0–2	23.6	23.9	26.9	27.2	27.3	29.2	25.1	31.4	31.3	25.4	26.9	24.9	26.5
3–6	15.4	14.9	16.4	17.0	23.2	24.2	23.7	22.1	20.8	19.0	17.8	16.4	18.7
7–8	61.1	61.2	56.8	55.8	49.4	46.6	51.3	46.5	47.9	55.5	55.3	58.8	54.8
Nottingham Weather Centre (1957–76)													
Eighths						**Daylight hours**							
0–2	13.4	10.4	12.3	11.9	11.8	18.1	11.9	14.0	13.2	12.7	13.8	15.8	13.3
3–6	18.4	20.2	25.4	25.8	31.3	30.8	28.3	30.1	28.3	22.9	22.3	19.3	26.3
7–8	68.0	69.4	62.2	62.4	56.9	51.0	59.8	55.8	58.4	64.4	63.9	64.9	60.5
						Hours of darkness							
0–2	21.0	21.6	26.3	28.4	28.0	30.2	24.2	31.3	31.7	25.8	26.4	23.2	26.0
3–6	14.6	15.6	17.4	18.1	24.3	25.0	27.8	25.2	21.1	17.4	16.2	14.5	18.9
7–8	64.4	62.8	56.3	53.4	47.7	44.8	48.0	43.6	47.1	56.7	57.3	62.3	55.2

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 community 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, drizzle and snow, as well as atmospheric pollution due to smoke and dust, but the really poor visibilities are due mainly 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 affect fog and fog formation and these are discussed in the Introduction to the series. Table 8 gives the average number of days of fog, visibility less than 1000 metres, for four locations in the area and this gives an indication of the variability which occurs.

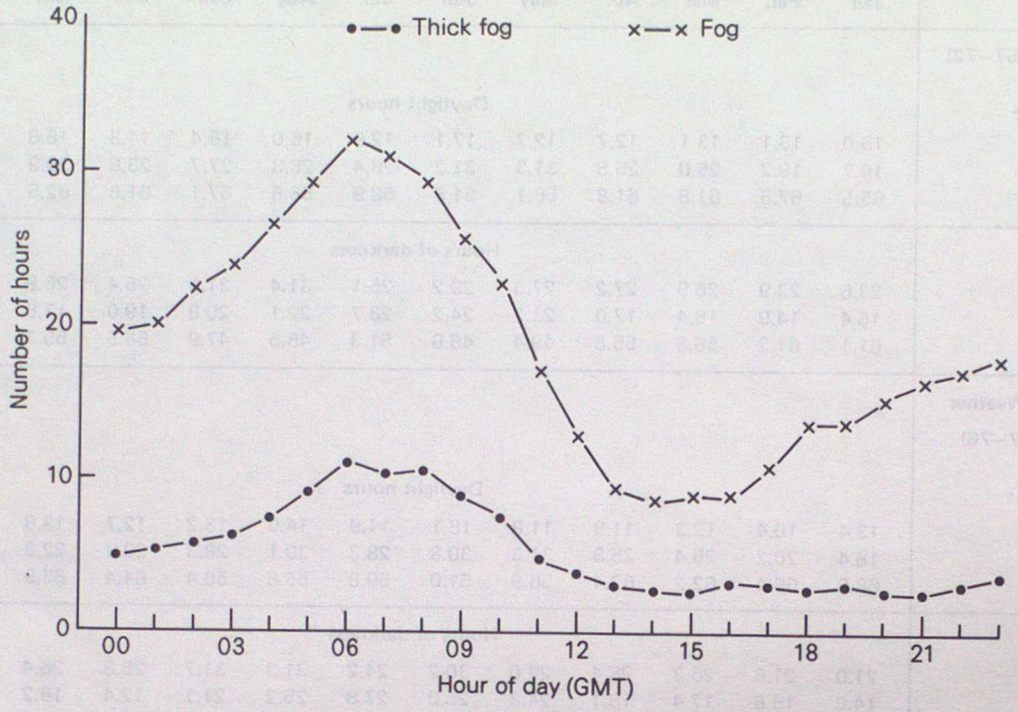
Figure 9 shows the diurnal variation of fog and thick fog at Nottingham Weather Centre during the period 1971–80 and clearly illustrates points made in the text.

The occurrence of fog is extremely variable and wide variations occur by month and year; for example, Finningley had 90 hours of thick fog in December 1982 but only 52 hours during the whole of 1980.

TABLE 8 Average number of days of fog, visibility less than 1000 metres, at 0900 GMT over the period 1961–80

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Sutton Bonington	2.1	1.3	1.1	0.3	0.1			0.1	0.9	2.9	2.1	2.3	13.1
Warsop	4.6	4.7	2.9	0.7	0.1	0.1	0.2	0.3	1.1	4.3	4.5	5.9	29.6
Finningley	3.5	3.1	2.1	0.8	0.3	0.1	0.1	0.3	0.9	4.1	3.3	3.9	22.5
Stone	4.9	4.1	2.7	1.3	0.1	0.4	0.5	1.3	2.3	5.1	4.3	5.7	32.8

FIGURE 9 Average annual number of hours of fog (visibility less than 1000 m) and thick fog (visibility less than 200 m) at Nottingham Weather Centre over the period 1971–80.



WIND

The wind direction is that from which the wind blows recorded either as a compass point or degrees from true north. Wind speeds are measured in knots (1 knot = 1.15 miles per hour, 1 metre per second = 1.94 knots) and are closely related to the pressure distribution. The strongest winds are associated with the passage of deep 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 because temperature rise causes increased turbulence 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. Over the Trent Valley gales occur infrequently, the average being less than two a year. As a comparison Shetland has on average 50 days of gale a year.

Table 9 gives the annual percentage frequency of hourly mean wind speeds and direction for Nottingham Weather Centre for the period 1970–80. These data are fairly typical of the area with the south-westerly winds predominating. The extremely low percentage of gale force winds is apparent; there was in fact only one gale recorded at Nottingham Weather Centre in this period.

The wind roses for Finningley illustrate how the wind varies throughout the year, differences being due to the different weather patterns which predominate during the year.

TABLE 9 Annual percentage frequencies of hourly mean wind speed and direction for Nottingham Weather Centre over the period 1970–80

Knots	Beaufort force equivalent	30° sectors centred on 360°	030°	060°	090°	120°	150°	180°	210°	240°	270°	300°	330°	All directions
Calm	0													1.2
1–3	1	0.7	1.1	1.1	0.7	0.6	0.6	0.7	1.1	2.1	1.6	1.2	0.8	13.0
4–10	2–3	3.3	5.1	4.7	2.6	2.0	2.4	3.3	6.4	11.4	6.8	5.5	3.2	56.7
11–21	4–5	1.4	3.1	2.7	1.0	0.8	0.9	1.7	5.3	6.1	2.9	1.4	1.2	28.4
22–33	6–7	+	0.1	0.1	+		+	+	0.1	0.1	0.1	+	+	0.6
⩾34	⩾8										+			+
Total ⩾4	⩾2	4.8	8.3	7.6	3.6	2.7	3.2	5.0	11.9	17.7	9.7	6.8	4.3	85.8

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

1–3 knots total includes a small percentage light and variable.

FIGURE 10 Wind-roses for Finningley over the period 1970–80.

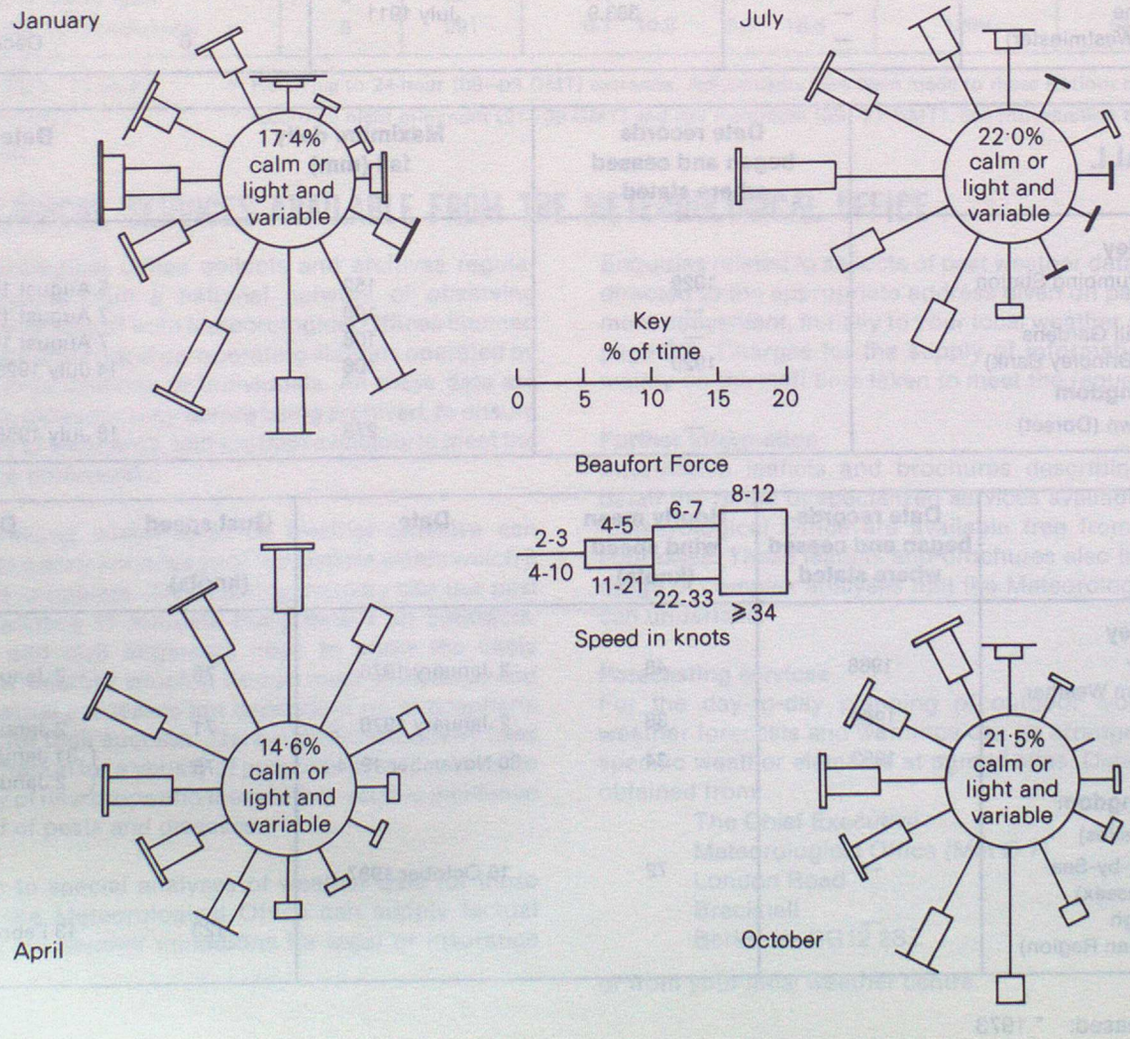


TABLE 10 Weather extremes

TEMPERATURE	Date records began and ceased where stated	Maximum daily temperature (°C)	Date	Minimum daily temperature (°C)	Date
Trent Valley					
Nottingham	1871	35.6 34.4	14 August 1876 9 August 1911	−18.9	8 December 1879
Finningley	1942	33.9	8 August 1975	−14.4	24 February 1947
Belper	1910*	33.9	9 August 1911	−17.8	21 January 1940
Warsop	1952	32.5	3 July 1976	−18.3	22 January 1963
Stone	1954	31.4	8 August 1975	−19.6	13 December 1981
United Kingdom					
Raunds Epsom Canterbury	—	36.7	9 August 1911		
Braemar	—			−27.2	11 February 1895 10 January 1982

SUNSHINE	Date records began and ceased where stated	Maximum monthly duration (hours)	Date	Minimum monthly duration (hours)	Date
Trent Valley					
Stone	1954	289.2	June 1957	15.2	January 1970
Derby	1955	284.1	June 1957	9.5	December 1956
Keele	1952	283.8	June 1957	18.8	December 1956
Nottingham	1925	263.8	June 1957	10.4	December 1956
Nottingham Weather Centre	1948	267.4	May 1989	11.6	December 1956
United Kingdom					
Eastbourne	—	383.9	July 1911		
London (Westminster)	—			0	December 1890

RAINFALL	Date records began and ceased where stated	Maximum daily fall (mm)	Date
Trent Valley			
Rodsley Pumping Station	1929	152	5 August 1957
Scrooby	—	108	7 August 1922
Bawtry Hall Gardens	—	108	7 August 1922
Rugeley (Brindley Bank)	1920	106	14 July 1923
United Kingdom			
Martinstown (Dorset)	—	279	18 July 1955

WIND	Date records began and ceased where stated	Hourly mean wind speed (knots)	Date	Gust speed (knots)	Date
Trent Valley					
Finningley	1968	48	2 January 1976	79	2 January 1976
Nottingham Weather Centre	1969	38	2 January 1976	71	2 January 1976
Keele	1953	34	30 November 1954	75	31 January 1953 2 January 1976
United Kingdom					
(Low-level sites)					
Shoreham-by-Sea (East Sussex)	—	72	16 October 1987		
Fraserburgh (Grampian Region)	—			123	13 February 1989

Records ceased: * 1973

TABLE 11 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) # Minimum Jan.	Minimum July	Maximum Jan.	Maximum July	Average annual duration of bright sunshine (hours)	Average annual no. of days with* Air frost	Snow lying
England									
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[x]	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
Wales									
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
Northern Ireland									
Belfast Airport (Antrim)	68	912	0.6	10.7	6.1	18.1	1281	53	9
Scotland									
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[†]	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.

[x] For Regents Park.

[†] 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 related to aspects of past weather data should be directed to the appropriate address given on page 21 or, if more convenient, initially to your local weather centre (see page 20). 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 Chief Executive
Meteorological Office (Met O 7)
London Road
Bracknell
Berkshire RG12 2SZ

or from your local weather centre.

WEATHER CENTRES AND PUBLIC SERVICE OFFICES

Weather Centres

Aberdeen
Seaforth Centre
Ltime Street
Aberdeen AB2 1BJ

Aberdeen (0224) 210571

Bristol
The Gaunts House
Denmark Street
Bristol BS1 5DH

Bristol (0272) 279272

Cardiff
Southgate House
Wood Street
Cardiff CF1 1EW

Cardiff (0222) 390420

Glasgow
33 Bothwell Street
Glasgow G2 6TS

041—248 7272

Leeds
Oak House
Park Lane
Leeds LS3 1EL

Leeds (0532) 457753

London
284–286 High Holborn
London WC1V 7HX

071—430 5627

Manchester
Applicon House
Exchange Street
Stockport SK3 0ER

061—477 1017

Newcastle
7th Floor
Newgate House
Newgate Street
Newcastle-upon-Tyne NE1 5UQ

091—232 3808

Norwich
Rouen House
Rouen Road
Norwich NR1 1RB

Norwich (0603) 630164

Nottingham
Main Road
Watnall
Nottingham NG16 1HT

Nottingham (0602) 384094

Plymouth
Royal Air Force Mount Batten
Plymouth
Devon PL9 9SH

Plymouth (0752) 493377

Southampton
160 High Street-below-bar
Southampton SO1 0BT

Southampton (0703) 220646

Public Service Offices

Meteorological offices at:

Belfast International Airport
Belfast
Northern Ireland BT29 4AB

Crumlin (084 94) 22804

Birmingham Airport
Birmingham B26 3QN

021—782 6240

Kirkwall Airport
Kirkwall
Orkney KW15 1TH

Kirkwall (0856) 3802

Sella Ness
Port Admin Area
Craven, Mossbank
Shetland ZE2 9QR

Sullom Voe (0806) 242060

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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

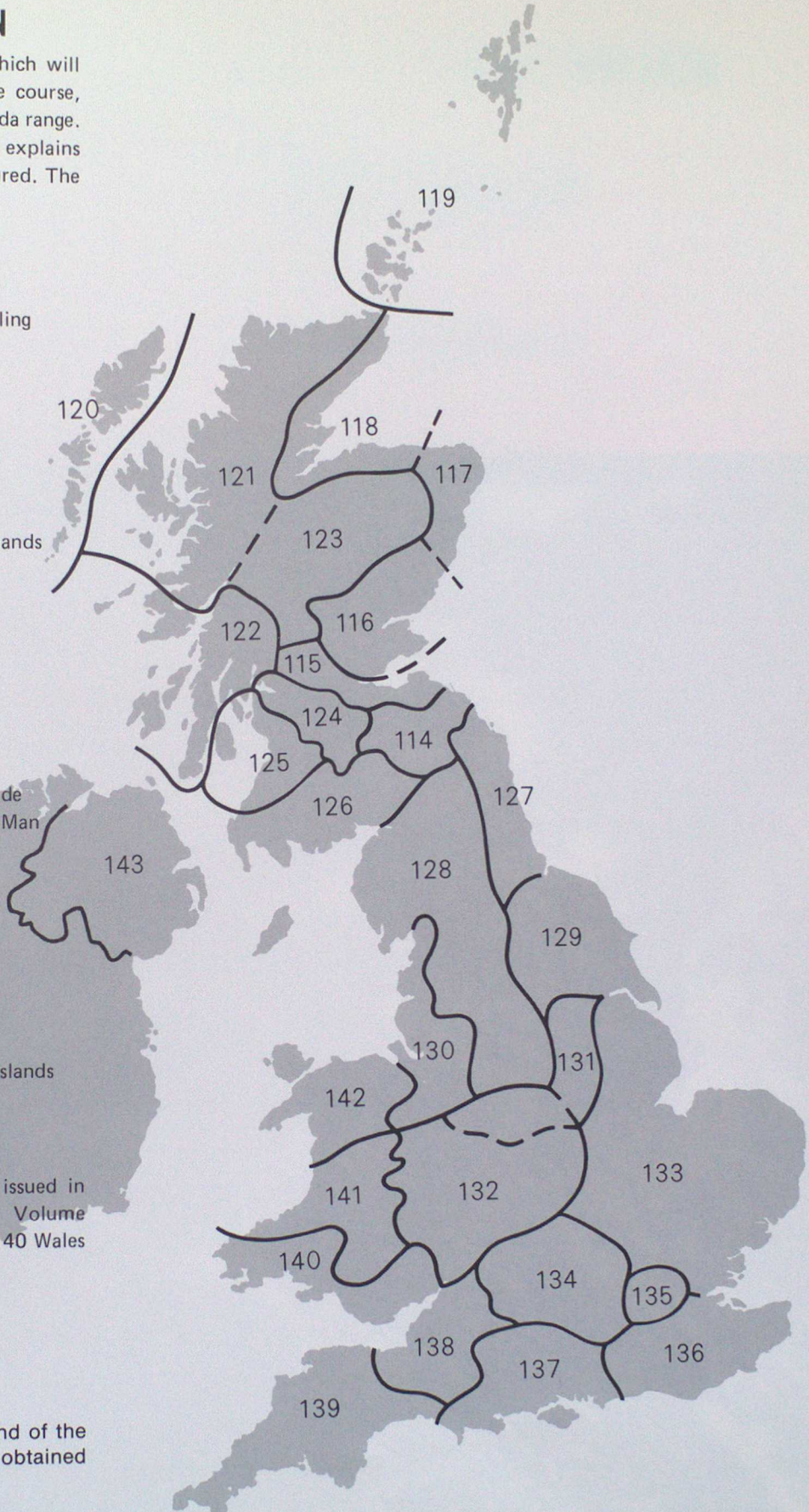
127 North-east England
128 Pennines and Lake District
129 East Yorkshire and North Humberside
130 Lancashire and Cheshire and Isle of Man
131 Trent Valley
132 Midlands
133 East Anglia and Lincolnshire
134 Thames Valley
135 London
136 South-east England
137 South England
138 Somerset and Avon
139 South-west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

WALES

140 South Wales
141 Mid Wales
142 North Wales and Anglesey

} Now issued in one Volume No. 140 Wales

Also available
143 The Climate of Northern Ireland



Further details of these memoranda and of the services mentioned of page 19 can be obtained from:

FOR ENGLAND AND WALES

Advisory Services
Meteorological Office (Met O 3b)
London Road
Bracknell
Berkshire RG12 2SZ

FOR SCOTLAND

The Superintendent
Meteorological Office
Saughton House
Broomhouse Drive
Edinburgh EH11 3XQ

FOR NORTHERN IRELAND

The Senior Meteorological Officer
Belfast Weather Centre
1 College Square East
Belfast BT1 6BQ