THE CLIMATE OF GREAT BRITAIN

SOUTH-EAST ENGLAND

Climatological Memorandum 136

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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. South-east England had about 10 hours of sunshine with a few rain showers mainly in the afternoon and maximum temperatures about 12°C.

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Climatological Memorandum 136

South-east England

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 16.

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Met O 3 (Advisory Services)
March 1988

THE AREA

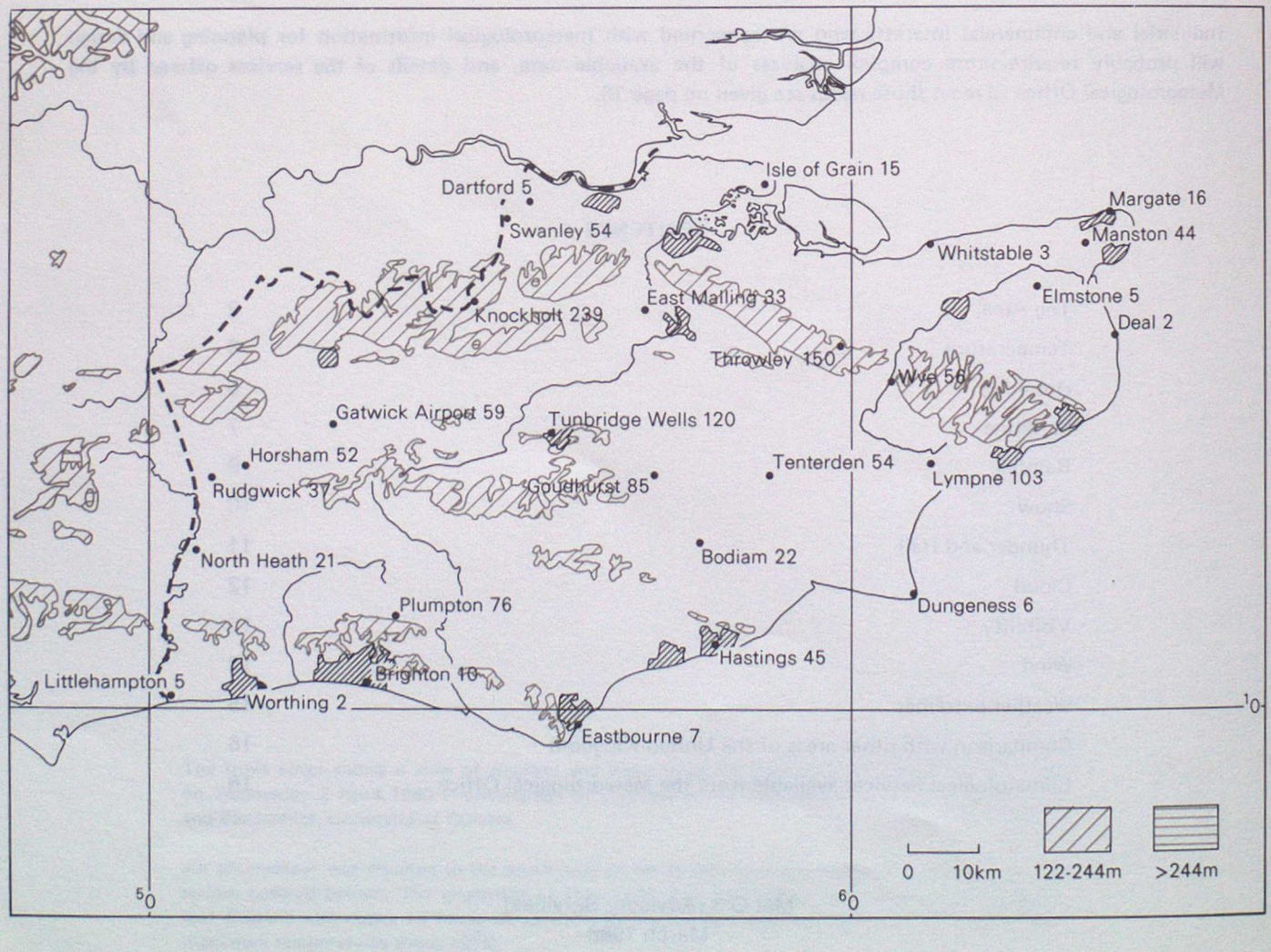
This memorandum describes the main features of the climate of south-east England. The area consists of Kent and those parts of Surrey and Sussex to the south of the North Downs and east of the Arun and Wey river valleys. The North Downs are across the north of the area and in the east are truncated by the English Channel ending in the famous White Cliffs. The highest point in south-east England is Leith Hill, 294 m, which is part of the Greensand Ridge which lies a few miles to the south of the North Downs. In the south of the area are the eastern part of the South Downs which end at Beachy Head. The central part of the area is known as the Weald, an elongated dome-shaped area with the rocks stripped from the centre by erosion. Most of the rivers of the area flow outward from the Weald and have cut gaps through the Downs which provide important routes between London and the coast.

Farming is intensive and it is the main fruit and hop growing district in England and Wales. Sheep-rearing which was once the main activity on the chalk downs is now in decline although Romney Marsh is probably the most densely stocked sheep-rearing district in the world. The south of England's only coalfield is in east Kent.

South-east England is one of the more densely populated parts of Britain and contains a number of large towns, Brighton being the biggest. Dover, which has an entirely man-made harbour, is the second largest port in the country after Heathrow Airport, based on the value of goods handled.

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.

Topography of south-east England and locations and altitudes (in metres) of the stations. Co-ordinates are National Grid references.



TEMPERATURE

The mean annual temperature over the region varies from around 9.5°C to 10.5°C. The higher values generally occur near the coasts with the lower values inland. Over the British Isles mean annual temperature ranges from about 7°C in the Shetlands 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 varying from over 2°C along the south coast to 0.5°C or less inland with a few locations having means 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 or February. For the locations shown in the map of the area the lowest recorded temperature was −21.1°C at Bodiam in January 1940. Along the coasts the lowest recorded temperatures have only been around −12°C.

Mean daily maximum temperatures are highest in July and range from around 20°C along the coasts to about 22°C well inland. This compares with the highest mean daily maximum temperatures of 22.5°C which occur in the London area and the lowest of around 15°C in the Shetlands. Maximum temperatures normally occur 2 to 3 hours after midday and extreme temperatures are most common in July but occur in June and August as well. The highest known temperature recorded in the area was 35.4°C at North Heath, Sussex on 26 June 1976.

The variation of mean maximum and mean minimum temperatures together with 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 have been recorded.

FIGURE 1 **Annual variation of maximum and minimum temperature over the period 1941–70 with extreme temperatures for the stated periods.**

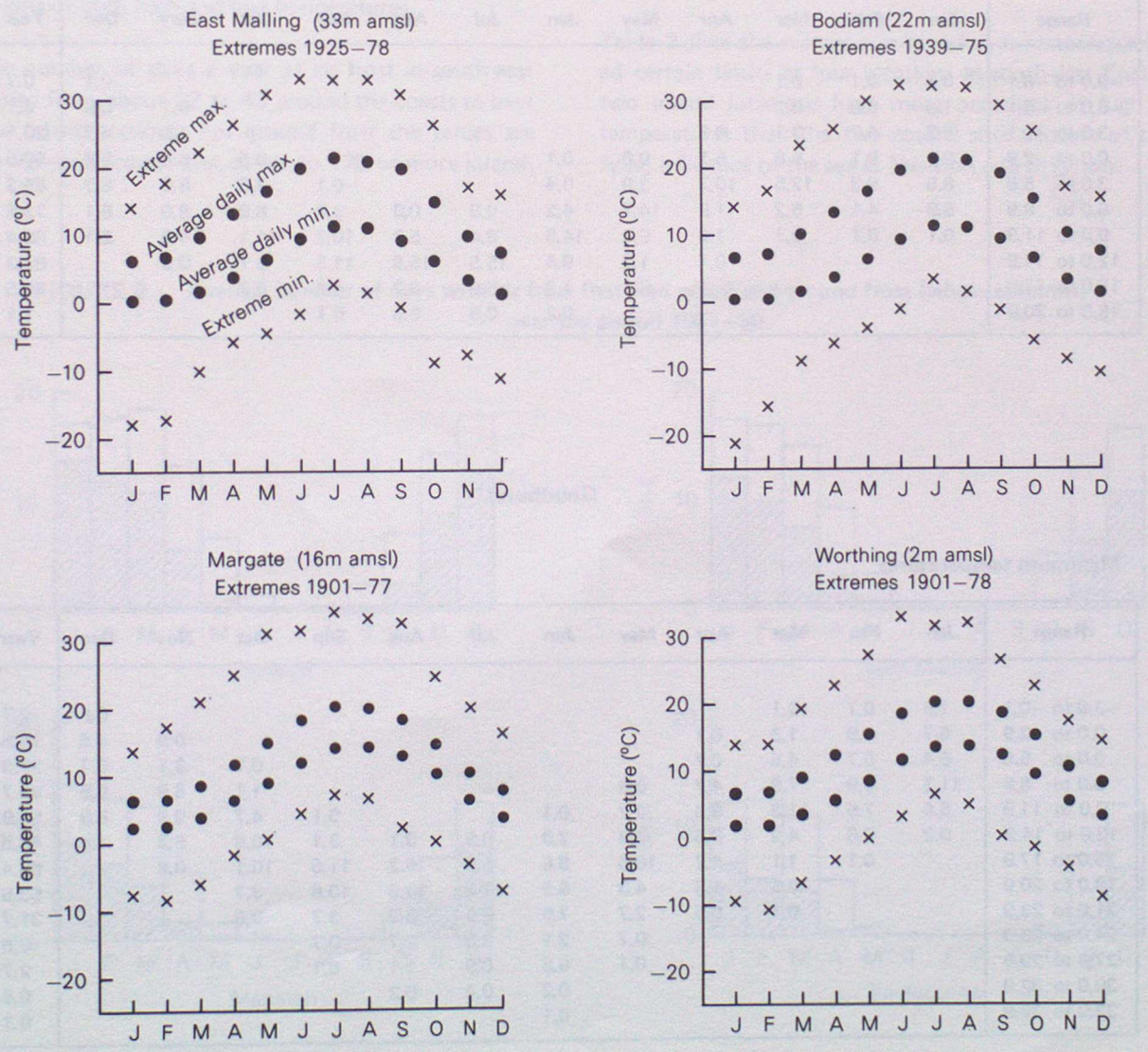


TABLE 1 Average number of days (1961–80) with maximum and minimum temperatures (°C) in the ranges specified

Hastings

Maximum temperatures

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
–3.0 to –0.1	1.1	0.5	0.1									0.3	1.9
0.0 to 2.9	3.5	3.0	0.9								0.3	2.5	10.2
3.0 to 5.9	6.9	5.3	3.5	0.5							2.3	6.0	24.3
6.0 to 8.9	12.5	11.9	11.7	5.1	0.3					0.4	7.3	10.5	59.5
9.0 to 11.9	7.1	7.5	12.5	13.0	4.0					3.7	10.8	10.6	69.3
12.0 to 14.9	0.1	0.1	1.5	8.7	13.7	3.6	0.3	0.1	1.7	10.5	8.3	1.2	49.5
15.0 to 17.9			0.5	2.1	8.3	14.3	9.1	5.5	13.5	13.5	1.1		67.7
18.0 to 20.9			0.3	0.7	3.3	8.2	15.1	18.2	12.8	2.7			61.3
21.0 to 23.9					1.3	2.9	4.5	5.1	1.8	0.2			15.9
24.0 to 26.9					0.2	0.7	1.5	1.6	0.3				4.2
27.0 to 29.9						0.2	0.3	0.4					0.9
30.0 to 32.9						0.1	0.2	0.1					0.5

Minimum temperatures

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
–9.0 to –6.1	0.5	0.1	0.1									0.1	0.7
–6.0 to –3.1	1.6	0.9	0.2								0.1	0.9	3.7
–3.0 to –0.1	5.2	4.7	3.1	0.8							1.8	4.7	20.1
0.0 to 2.9	9.3	9.1	9.8	5.1	0.6	0.1				0.5	6.6	9.5	50.5
3.0 to 5.9	8.5	9.3	12.5	10.7	3.9	0.4			0.1	3.3	8.0	8.7	65.3
6.0 to 8.9	5.9	4.1	5.2	11.8	14.7	4.2	0.8	0.9	3.9	8.9	8.0	5.1	73.5
9.0 to 11.9	0.1	0.1	0.3	1.5	9.9	14.5	8.4	5.7	10.3	11.1	4.5	2.1	68.4
12.0 to 14.9				0.1	1.7	9.4	15.5	15.8	11.3	6.7	0.9		61.3
15.0 to 17.9					0.1	1.3	5.9	8.2	4.3	0.7			20.5
18.0 to 20.9						0.2	0.5	0.5	0.1				1.1

Goudhurst

Maximum temperatures

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
–3.0 to –0.1	1.5	0.7	0.1									0.5	2.7
0.0 to 2.9	5.7	3.9	1.3	0.1							0.9	4.5	16.5
3.0 to 5.9	6.4	5.7	4.5	0.7						0.1	3.1	6.7	27.3
6.0 to 8.9	11.3	9.9	7.9	4.7	0.3					1.1	8.9	9.5	53.7
9.0 to 11.9	5.8	7.5	11.3	9.5	2.7	0.1			0.1	4.7	9.9	8.3	59.9
12.0 to 14.9	0.2	0.6	4.2	8.5	9.8	2.9	0.5	0.1	3.1	10.8	6.3	1.4	48.5
15.0 to 17.9		0.1	1.1	4.7	10.5	8.8	5.6	5.2	11.6	10.1	0.8		58.4
18.0 to 20.9			0.5	1.3	4.3	8.5	11.2	13.5	10.6	3.7			53.5
21.0 to 23.9			0.1	0.3	2.7	7.0	9.0	8.2	3.7	0.6			31.7
24.0 to 26.9					0.7	2.1	3.3	2.7	0.7				9.5
27.0 to 29.9					0.1	0.5	0.9	1.1	0.1				2.7
30.0 to 32.9						0.2	0.4	0.2					0.8
33.0 to 35.9						0.1							0.1

TABLE 1 CONTINUED

Minimum temperatures

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
−18.0 to −15.1			0.1										0.1
−15.0 to −12.1	0.2	0.1											0.3
−12.0 to −9.1	0.4	0.1										0.3	0.8
−9.0 to −6.1	1.9	0.8	0.6								0.1	1.4	4.9
−6.0 to −3.1	2.5	2.5	2.1	0.8	0.1						1.5	3.7	13.1
−3.0 to −0.1	8.3	8.6	6.8	4.4	1.2	0.2			0.1	1.4	6.1	6.9	43.9
0.0 to 2.9	8.5	8.7	10.1	7.1	3.3	1.0	0.1	0.2	0.9	3.9	7.2	8.3	59.3
3.0 to 5.9	6.1	5.3	8.7	10.1	7.9	3.1	1.3	1.6	4.7	7.8	7.5	5.7	69.9
6.0 to 8.9	3.1	2.1	2.5	6.9	13.9	9.7	6.1	5.7	8.3	9.1	5.3	3.6	76.3
9.0 to 11.9	0.1		0.1	0.8	4.1	11.1	10.9	10.7	9.3	6.7	1.8	1.3	57.0
12.0 to 14.9					0.3	4.5	9.9	10.3	6.0	1.9	0.4		33.3
15.0 to 17.9						0.3	2.7	2.4	0.9	0.1			6.3
18.0 to 20.9								0.1					0.1

Table 1 gives the average number of days during 1961–80 that maximum and minimum temperatures at Hastings and Goudhurst occurred in the ranges specified. The most striking feature of the Table is the wide range of maximum and minimum temperatures which can occur at any time of the year. The modifying influence of the sea means that the range of temperatures is less at Hastings than at Goudhurst which has more occasions of both high and low temperatures.

The average number of days a year of air frost in south-east England varies from about 22 to 45 around the coasts to over 75 at some inland stations. For ground frost the values are from 45 to 75 days around the coasts to 120 or more inland.

At some of the more sheltered locations a ground frost may occur at any time of the year but the summer months are usually free from air frosts. Figure 2 gives the average number of days of air and ground frosts for four locations in the area over the period 1961–80. See also the Introduction to the series.

Table 2 gives the average number of days temperatures exceeded certain limits at four locations in south-east England. The two inland locations have more occasions of high and low temperatures than the two coastal sites because of the modifying influence of the sea at Manston and Brighton.

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

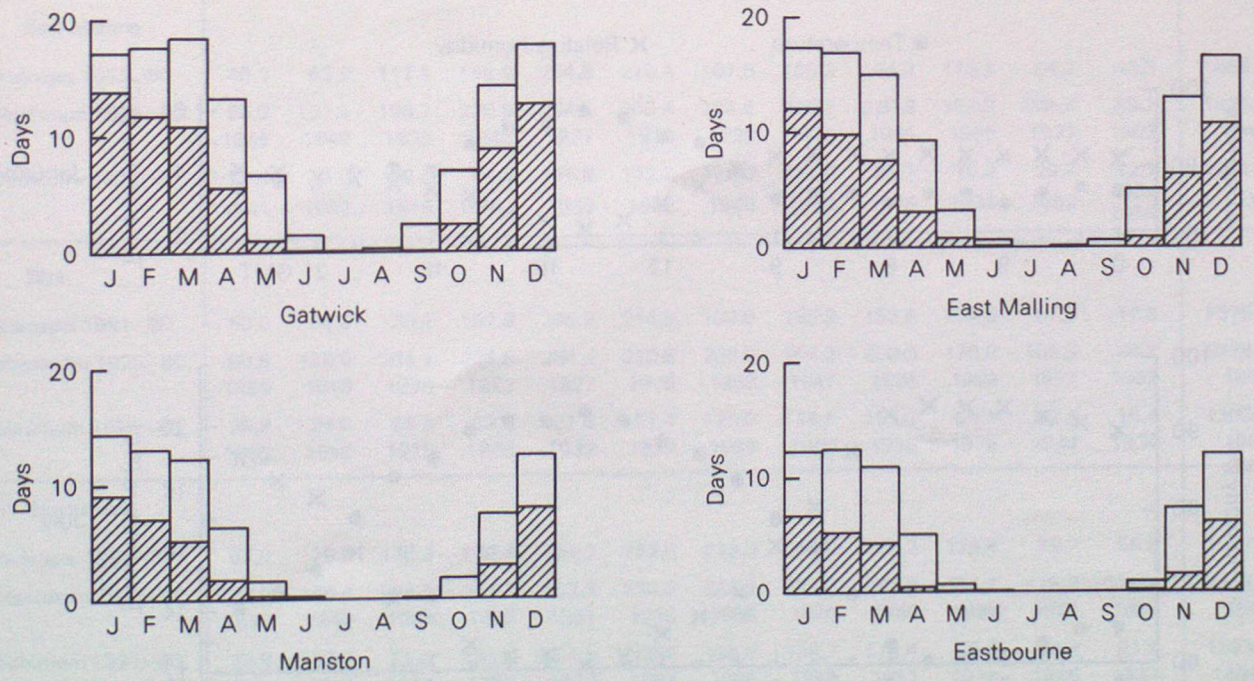


TABLE 2 Average number of days (1961–80) with maximum and minimum temperatures exceeding certain limits at selected sites in the area

Maximum temperature	25.0°C or more					30.0°C or more			
	May	Jun	Jul	Aug	Sep	Jun	Jul	Aug	Sep
Gatwick	0.5	2.3	3.9	3.3	0.8	0.3	0.4	0.2	0.1
Manston	0.1	0.9	2.1	1.9	0.5	0.1	0.1	0.2	
Brighton	0.1	0.9	1.6	1.7	0.1	0.1	0.2	0.1	
Wye	0.3	1.3	2.5	1.9	0.7	0.2	0.3	0.3	

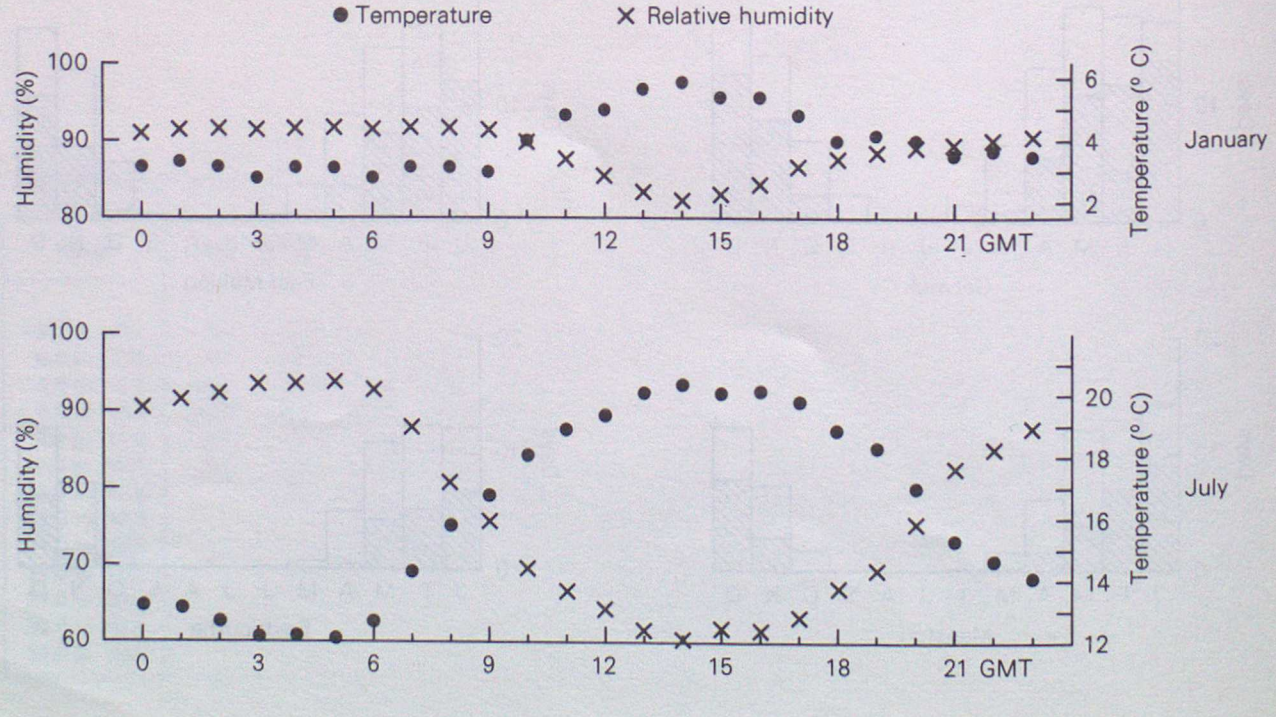
Minimum temperature	Less than −5.0°C						Less than −10.0°C			
	Nov	Dec	Jan	Feb	Mar	Apr	Dec	Jan	Feb	Mar
Gatwick	1.1	3.5	3.7	2.0	1.6	0.3	0.2	0.9	0.1	0.1
Manston		0.7	1.5	0.5	0.3			0.1	0.1	
Brighton		0.2	1.0	0.2	0.1					
Wye	0.1	1.5	2.4	1.1	0.5		0.1	0.3		0.1

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 averages around 80 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 20 to 25 per cent of the time in the area, and 100 per cent can be reached in fog and persistent rain, snow or drizzle. Low humidities are less common. The lowest relative humidity recorded in south-east England in recent years was 15 per cent at Gatwick on 22 August 1976. Figure 3 shows the diurnal variation of relative humidity and temperature at Gatwick for the months of January and July; this illustrates a number of the points made in the text.

FIGURE 3 Average diurnal variation of temperature and relative humidity at Gatwick for January and July over the period 1961–80.



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 the sunniest. In general sunshine durations decrease with increasing altitude and increasing 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 area vary from over 1800 hours in some south coast resorts to less than 1600 hours at some inland sites. 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 the Shetlands with less than 1100 hours.

Table 3 lists the average monthly and annual sunshine totals for three locations in south-east England for the period 1951–80 plus extreme values for periods up to 1980. The lowest monthly total of sunshine recorded in the area was 7.7 hours at Swanley, Kent in December 1956. The absolute minimum for Great Britain was in December 1890 at Westminster when no sunshine at all was recorded. The highest monthly total in recent years was the 331.7 hours recorded at Eastbourne in August 1976 which has only been exceeded in August by the 332.6 hours at Ilfracombe also in 1976.

Table 4 gives the average number of days each month in the period 1959–80 that sunshine durations occurred in the ranges specified at East Malling and Eastbourne. As would be expected from the averages in Table 3 Eastbourne has more sunnier days than East Malling throughout the year.

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 stated years

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
East Malling													
Averages 1951–80	49.2	63.6	117.1	148.9	204.6	210.4	197.5	186.3	154.2	113.4	64.3	45.5	1554.9
Maximum 1925–80	85.0	121.1	196.7	225.9	254.2	305.4	304.5	288.7	220.3	169.0	105.8	89.1	1935.5
	1959	1949	1938	1948	1927	1976	1928	1976	1964	1959	1971	1962	1949
Minimum 1925–80	23.0	23.0	59.6	84.6	155.8	132.2	126.3	127.9	88.7	70.9	29.7	12.2	1341.4
	1941	1942	1975	1941	1962	1958	1965	1958	1945	1934	1962	1934 1956	1936
Wye													
Averages 1951–80	50.6	66.5	120.9	152.9	205.2	214.8	193.0	185.9	153.8	117.5	67.0	47.3	1575.2
Maximum 1925–80	90.6	135.0	204.1	234.6	264.4	310.8	298.8	304.3	230.8	176.0	106.9	89.1	2028.5
	1959	1949	1938	1942	1927	1976	1959	1947	1928	1959	1973	1962	1949
Minimum 1925–80	26.8	24.9	61.3	93.6	131.8	137.4	125.0	114.5	105.3	63.1	32.3	16.4	1303.5
	1955	1942	1975	1966	1932	1977	1965	1958	1936	1976	1934	1934	1968
Eastbourne													
Averages 1951–80	62.0	79.6	136.3	179.4	234.7	252.0	233.9	219.0	173.2	128.4	72.7	55.8	1827.1
Maximum 1931–80	103.9	145.4	206.5	243.7	282.3	330.0	333.0	331.7	265.8	171.7	116.2	116.5	2153.3
	1952	1949	1933	1976	1961	1975	1959	1976	1959	1959	1971	1962	1949
Minimum 1931–80	32.6	27.7	73.0	121.4	151.5	168.4	156.9	136.7	113.4	75.3	32.4	21.8	1593.4
	1955	1947	1975	1966	1932	1977	1965	1958	1932	1976	1936	1934	1958

TABLE 4 Average number of days of sunshine duration at East Malling and Eastbourne during the period 1959–80

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

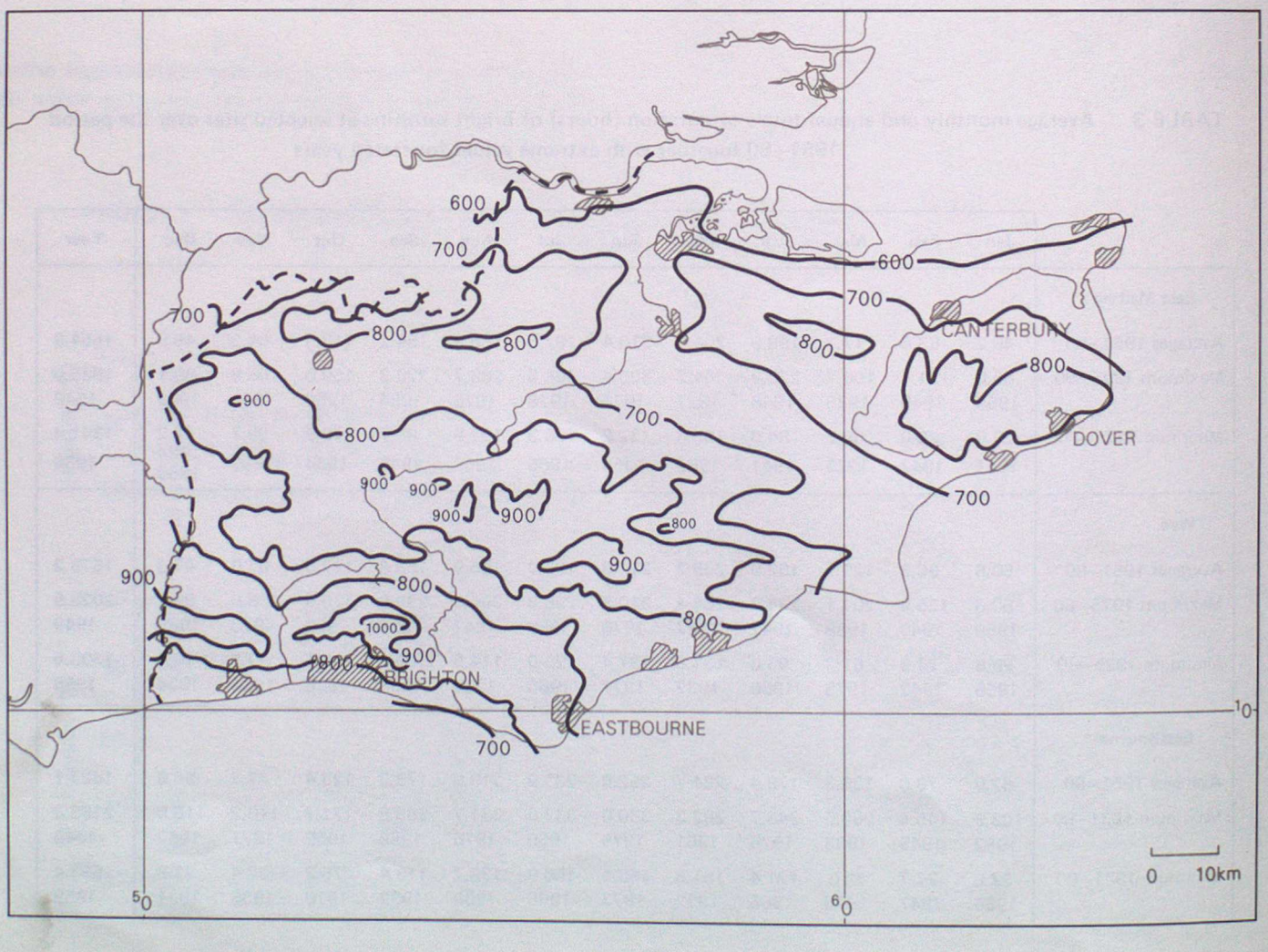
East Malling

Duration (Hours per day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
No sunshine	13.5	9.1	5.6	2.9	1.9	1.9	1.2	1.6	2.2	4.9	9.1	13.3	67.2
0.1 to 3.0	10.6	10.4	9.4	9.6	6.9	4.9	7.4	7.4	7.3	9.4	11.1	11.0	105.4
3.1 to 6.0	4.7	4.4	6.8	6.3	6.5	5.9	6.9	5.9	7.0	7.6	6.1	5.2	73.7
6.1 to 9.0	2.2	4.1	6.9	5.9	5.1	5.9	6.7	7.5	8.4	7.8	3.6	1.5	65.7
9.1 to 12.0		0.3	2.2	4.4	5.9	5.9	4.5	6.5	4.9	1.3			35.9
12.1 or more				0.9	4.7	5.4	4.2	2.0	0.1				17.4

Eastbourne

Duration (Hours per day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
No sunshine	12.3	8.8	4.5	3.2	1.9	2.0	1.1	1.3	2.2	4.8	8.8	12.4	63.4
0.1 to 3.0	10.0	8.5	8.8	6.8	5.4	3.5	5.6	5.2	6.5	8.7	10.3	9.9	89.2
3.1 to 6.0	5.7	5.0	6.6	6.1	4.5	3.8	5.4	5.5	5.4	7.0	5.9	5.6	66.6
6.1 to 9.0	2.9	5.2	6.6	5.7	5.7	5.1	5.7	6.5	7.5	7.9	5.0	3.0	67.0
9.1 to 12.0		0.8	4.5	6.0	6.6	6.5	6.2	7.5	8.2	2.4			48.7
12.1 or more				2.1	6.9	9.1	7.0	5.0	0.1				30.2

Average annual rainfall (mm) over south-east England.



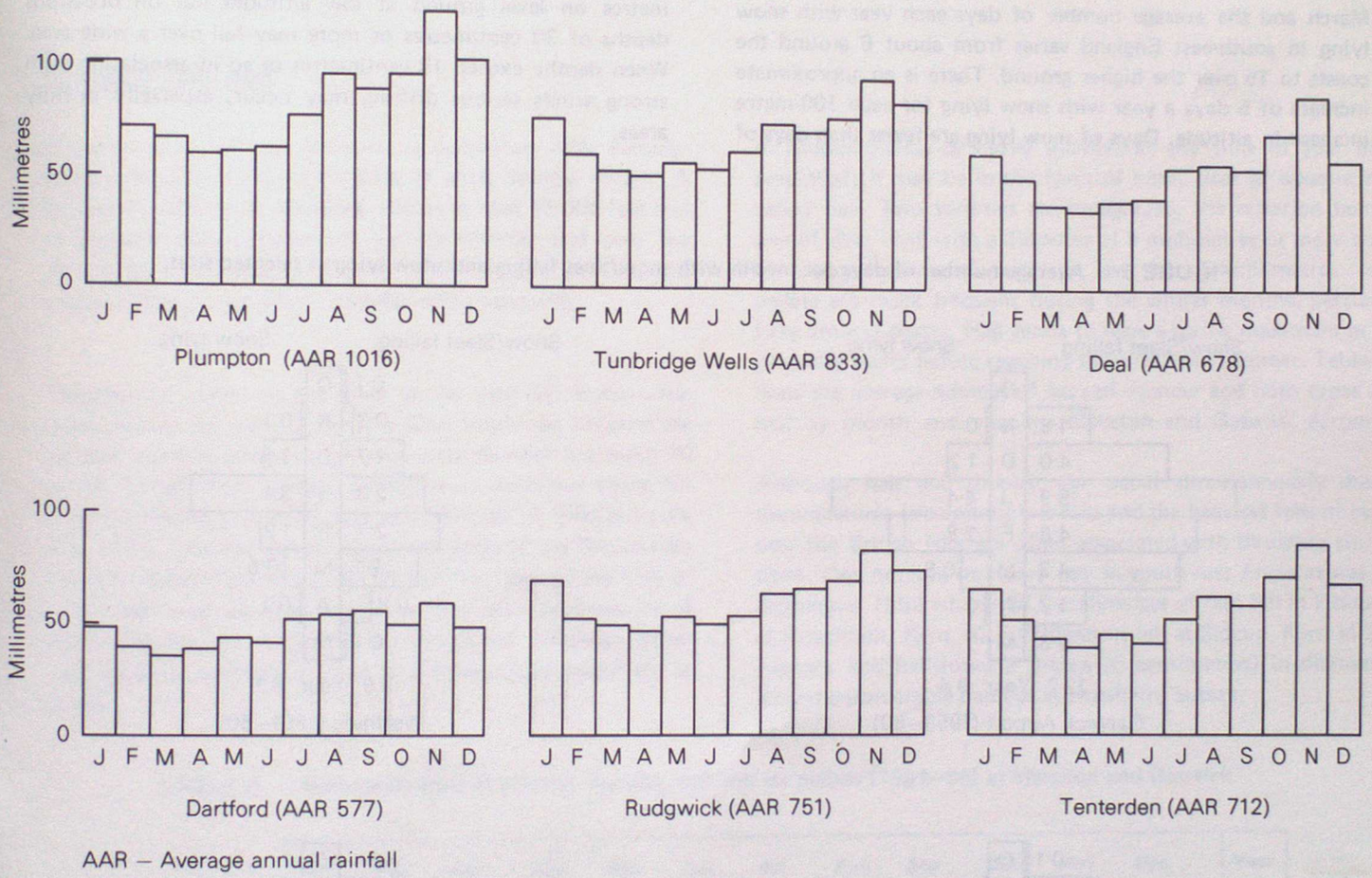
RAINFALL

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 south-east England; the influence of topography is clearly seen.

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 25 to 50 millimetres. Twenty-five millimetres of rainfall is equivalent to about 200 tonnes of water on a football pitch.

Figure 4 shows the monthly variation of rainfall for six locations in south-east England. Although the individual totals show a wide variation, the pattern throughout the year is similar with November being the wettest month and March and April the driest months on average. Over the British Isles generally December and January are the wettest months and the period February to April the driest. Rainfall is an extremely variable parameter as the data in Table 5 show; this lists for Littlehampton the extreme monthly and annual totals for 1941–79 with the 1941–70 averages for comparison.

FIGURE 4 Average monthly rainfall (mm) over the period 1941–70.



AAR – Average annual rainfall

TABLE 5 Average monthly and annual rainfall (mm) at Littlehampton together with extreme values for the periods stated

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average 1941–70	76	54	48	44	48	44	55	65	63	72	86	75	730
Maximum 1941–79	217.8	162.8	183.1	147.6	102.6	125.3	185.4	152.8	174.3	232.4	377.5	199.9	1143.0
Minimum 1941–79	10.7	3.3	1.3	2.5	9.9	3.7	5.6	0.8	3.0	3.1	4.1	20.3	531.3

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 also increases with increasing altitude and latitude. Falls of sleet or snow are normally confined to the months November to April but a few occasions occur in October and May on about two days over 10 years in south-east England. Snow also very rarely occurs in June and some wintry showers on 2 June 1975 were the first observed in the area in summer since 1888.

The average number of days each year when sleet or snow falls in south-east England ranges from about 10 around the coasts to more than 20 over high ground. Snowfall amounts are measured as the equivalent water content and are included as such in the rainfall statistics. As a rough guide 10 centimetres of snow is equivalent to 1 centimetre of rainfall.

Snow rarely lies on low ground before December or after March and the average number of days each year with snow lying in south-east England varies from about 6 around the coasts to 15 over the higher ground. There is an approximate increase of 5 days a year with snow lying 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 temperature of the air and the ground remain above freezing with the result that the snow never lies at all.

Figure 5 shows the average number of days with sleet or snow falling and with snow lying at four locations in the area. A day of snow lying is defined as one with snow covering at least half of the ground at 0900 GMT.

Figure 6 shows the number of days of snow in various depths at West/East Malling since the winter of 1946/47. This illustrates the great variability which occurs with the number of days with snow lying ranging from 57 in the winter of 1962/63 to none in 1960/61. 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 more 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 5 Average number of days per month with snow/sleet falling and snow lying at selected sites.

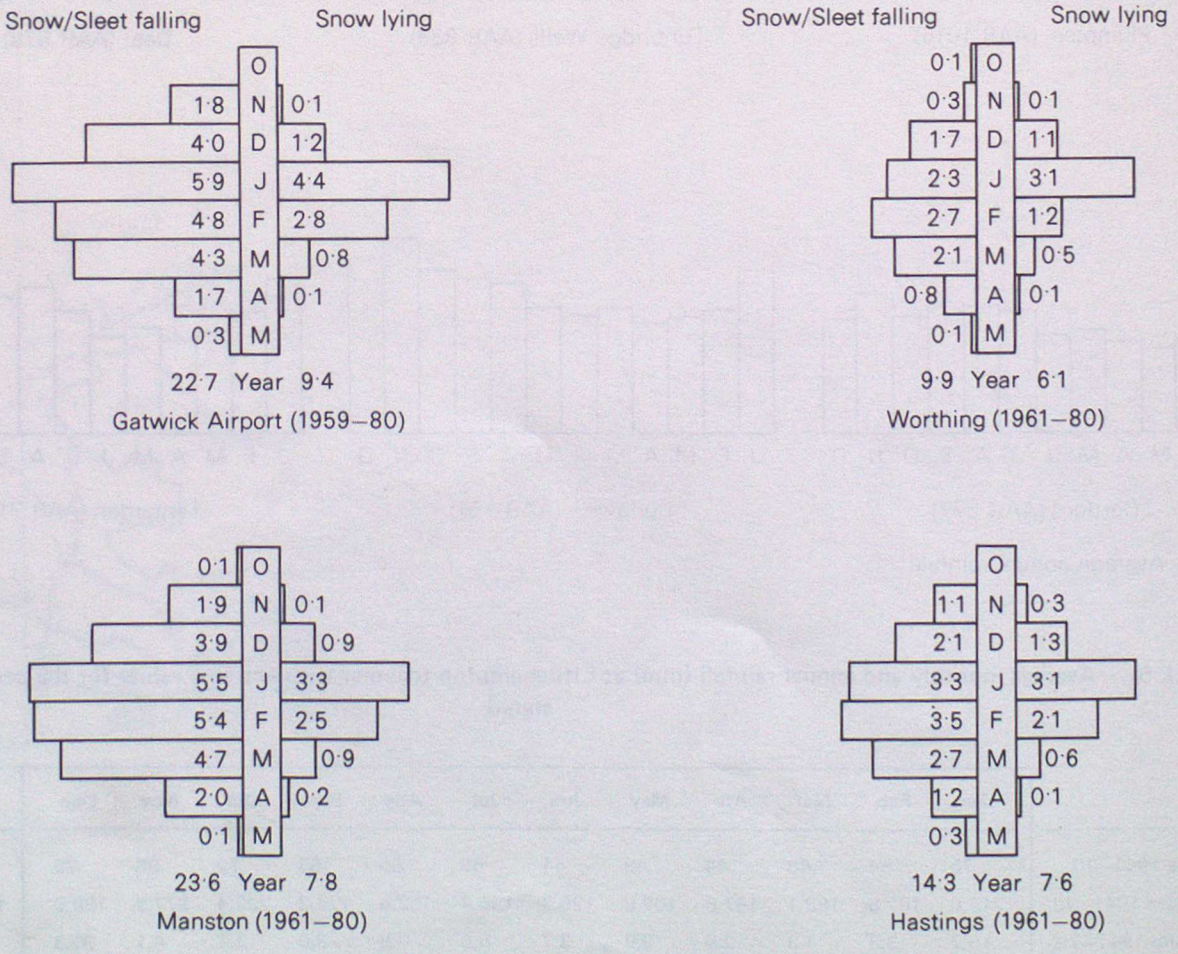
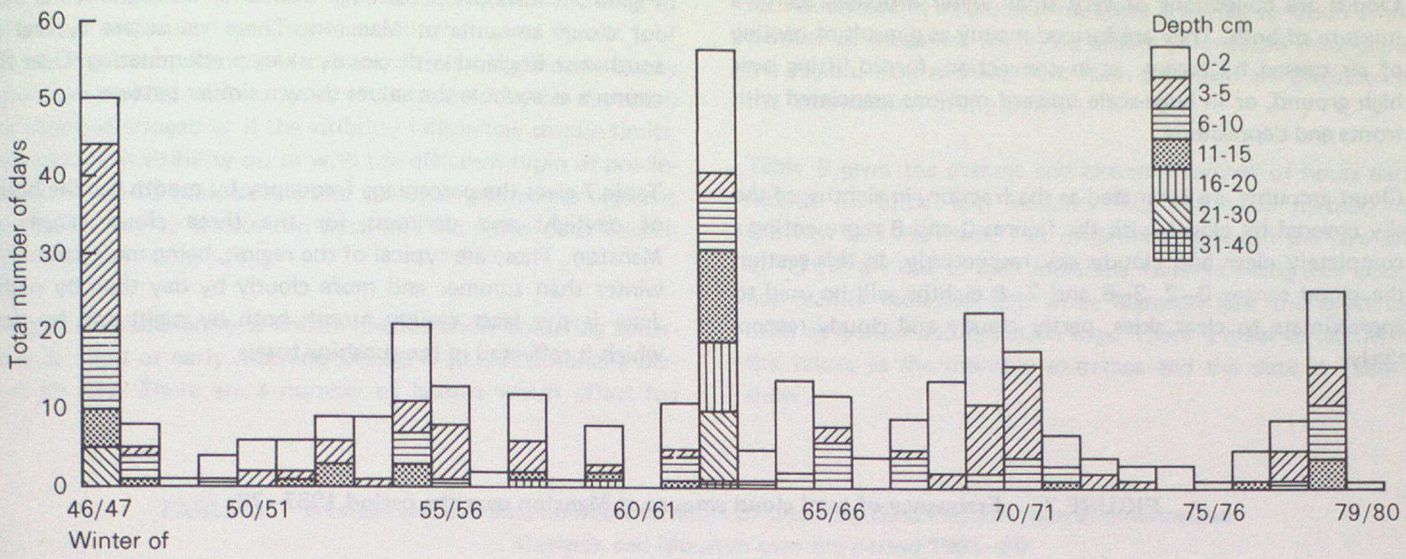


FIGURE 6 Number of days with total snow depth at 09 GMT in stated ranges at West/East Malling.



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 south-east England the average number of days each year with thunder is around 10 to 15 though there is great variability in individual years; for example, Manston had 30 days with thunder in 1969 but only 6 in 1971. 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 a 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 millimetres or more and ice pellets with a diameter of less than 5 millimetres. Ice pellets are more frequent during the winter months, particularly around coasts. 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 and both types of hail by month and year for Manston and Gatwick Airport.

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 thundery day in south-east England was 5 September 1958 when 130.5 millimetres of rain fell in 2 hours at Knockholt, Kent, 63.5 millimetres fell at Sidcup, Kent in 20 minutes and hailstones 2 inches (6 centimetres) in diameter caused considerable damage at Horsham, Sussex.

TABLE 6 Average number of days of thunder, hail and ice pellets (1961–80) at Manston and Gatwick

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Manston													
Thunder	0.2	0.1	0.2	0.7	1.5	2.3	2.5	2.7	1.9	0.9	0.6	0.4	14.1
Hail	0.3	0.5	0.7	0.7	0.3	0.3		0.1	0.3	0.5	0.7	0.7	5.0
Ice pellets	1.6	2.1	1.5	1.5	0.1			0.1		0.1	0.6	1.1	8.5
Gatwick													
Thunder	0.1	0.1	0.7	1.0	2.0	2.7	1.7	2.2	1.7	1.3	0.6	0.5	14.7
Hail	0.5	0.3	0.9	0.9	0.5	0.3	0.2	0.1	0.1	0.3	0.3	0.3	4.6
Ice pellets	1.1	1.7	1.3	0.4	0.2	0.1				0.1	0.4	0.7	5.9

CLOUD

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.

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.

Figure 7 shows the percentage frequency throughout the year for cloud amounts at Manston. These values are typical of south-east England with cloudy skies predominating. Over the country as a whole the values show a similar pattern.

Table 7 gives the percentage frequency by month for the hours of daylight and darkness for the three cloud ranges at Manston. 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 night and by day, which is reflected in the sunshine totals.

FIGURE 7 Frequency of total cloud amount at Manston over the period 1957–76.

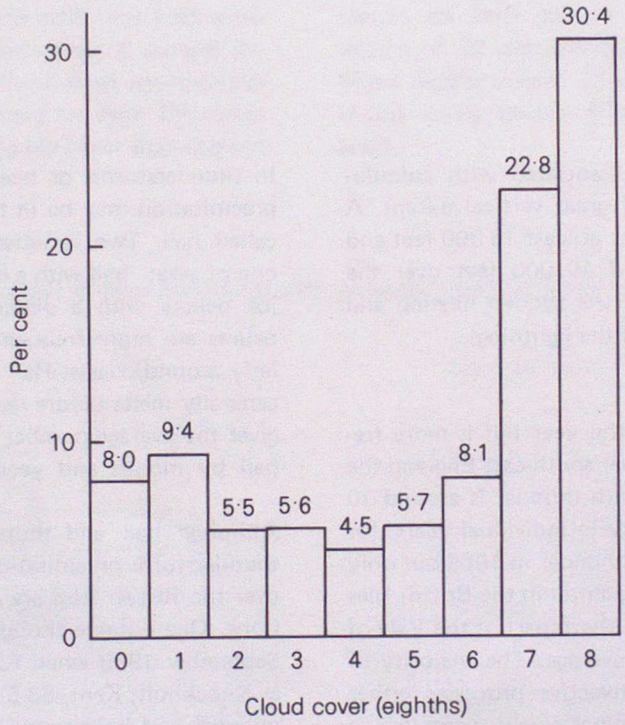


TABLE 7 Percentage frequency of hours with total cloud amount in selected ranges at Manston over the period 1957–76

Eighths	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daylight hours													
0–2	13.4	16.1	19.8	17.9	20.5	25.7	20.3	21.9	20.3	21.2	14.5	15.3	19.5
3–6	16.5	18.2	23.1	26.0	27.1	29.6	29.8	29.5	32.0	25.1	20.1	17.2	25.5
7–8	70.1	65.6	57.2	56.0	52.6	44.7	49.7	48.5	47.8	53.8	65.5	67.8	54.7
Hours of darkness													
0–2	19.0	23.0	28.1	26.1	29.8	34.7	29.7	35.6	31.6	28.3	21.8	20.5	26.3
3–6	17.0	17.1	20.5	23.8	25.5	26.6	28.3	25.4	26.8	22.5	22.3	20.0	22.3
7–8	63.8	60.0	51.3	50.2	44.7	38.9	42.2	38.9	41.4	49.1	56.2	59.7	51.5

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 early morning though it does occasionally persist all day. There are a number of factors which affect fog formation and as a consequence there is a wide variation in the number of occasions when fog occurs at locations throughout the region. Fog and fog formation processes are discussed in the Introduction to the series.

Table 8 gives the average and extreme number of hours each month of thick fog, visibility less than 200 metres, for Gatwick and Manston. The differences between the two sets of figures are due to their locations; Gatwick being well inland has mainly radiation fogs while Manston near the coast has both advection and radiation fogs. There is great variability in the values as the monthly extremes and the data in Table 9 show.

TABLE 8 Average and extreme numbers of hours of thick fog (visibility less than 200 metres) at Gatwick and Manston over the period 1961–80

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Gatwick													
Average	10.9	9.5	6.1	3.7	4.8	2.5	3.1	7.3	14.1	26.3	15.3	12.5	116.3
Maximum	51	30	29	9	15	7	11	32	42	76	46	61	290
Minimum	0	0	0	0	0	0	0	0	2	1	0	0	44
Manston													
Average	14.1	10.7	5.1	6.3	4.0	2.1	1.2	2.7	7.4	10.6	8.1	11.1	83.3
Maximum	77	52	20	28	16	15	9	16	46	34	28	37	196
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	21

TABLE 9 Number of hours of thick fog per year at Gatwick and Manston

Year	1961	62	63	64	65	66	67	68	69	1970	71	72	73	74	75	76	77	78	79	1980
Gatwick	74	81	60	103	90	66	44	51	65	62	272	290	204	94	138	125	130	188	118	71
Manston	137	100	121	196	91	63	61	75	98	74	135	92	76	46	80	47	23	89	41	21

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 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 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 than by night due to increased turbulence caused by temperature rise 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. In south-east England gales are most

frequent along the coastal section from South Foreland to Beachy Head with 5 to 10 gales a year on average. Away from this exposed coastal section gales are less frequent with most of the area having on average 2 days or less of gale a year. As a comparison the Shetlands have on average 50 days of gale a year.

Table 10 gives the annual percentage frequency of hourly mean wind speeds and direction for Dungeness for the period 1971–80. These data are representative of the exposed coastal section of south-east England. Inland the total percentages for the wind directions will be similar with the south-westerlies predominating but the wind speeds will be lower.

The wind roses for Gatwick Airport illustrate how the wind varies throughout the year. The relatively high percentage of calm or light winds compared with Dungeness is apparent. The high incidence of north-easterly winds in April is due to the weather patterns which predominate during this month. Katabatic winds at Gatwick Airport give a relatively high incidence of east to north-east winds in October and cause, in part, the high incidence of fog in that month.

The strongest wind recorded in south-east England in recent years was at Manston on 12 January 1978 when northerly winds reached an hourly mean speed of 48 knots (storm force) with a maximum gust of 75 knots.

TABLE 10 Annual percentage frequencies of hourly mean wind speed and direction for Dungeness over the period 1971–80

Knots	Beaufort force equivalent	30° sectors centred on 360°	030°	060°	090°	120°	150°	180°	210°	240°	270°	300°	330°	All directions
Calm	0													0.8
1–3	1	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.9	0.7	4.7
4–10	2–3	2.4	1.8	2.5	2.6	2.0	1.7	2.0	2.9	3.6	4.1	5.3	3.9	34.7
11–21	4–5	2.3	3.9	5.9	3.1	1.5	2.4	3.0	4.8	9.2	7.9	3.1	2.7	50.3
22–33	6–7	0.2	0.5	0.7	0.3	0.2	0.4	0.8	1.6	1.5	0.7	0.3	0.2	7.5
≥34	≥8	+		+	+		+	0.1	0.2	0.1	+	+	+	0.3
Total ≥4	≥2	4.9	6.2	9.1	6.0	3.7	4.5	5.9	9.5	14.4	12.7	8.7	6.8	92.8

\+ Observations recorded in these categories but for less than 0.05 per cent of the time. NB Because of rounding errors, totals may not agree exactly.

FIGURE 8 Wind roses for Gatwick Airport over the period 1970–79.

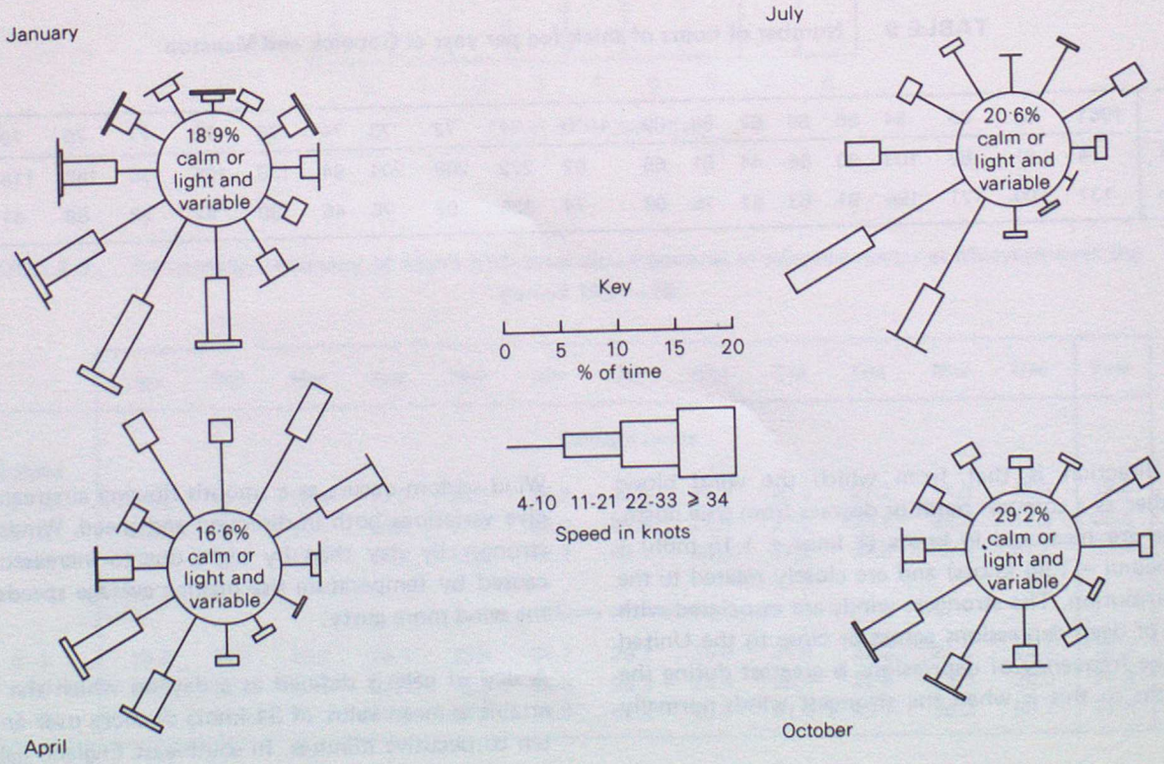


TABLE 11 Weather extremes

TEMPERATURE	Date records began	Maximum daily temperature (°C)	Date	Minimum daily temperature (°C)	Date
South-east England					
Dartford	1950[2]	34.4	29 June 1957	−13.3	13, 23 January 1963
Margate	1882	34.4	22 August 1911 27 July 1933	−8.3	14 February 1901
Whitstable	1904[3]	32.2	On 3 occasions	−19.4	20 January 1940
Bodiam	1939[3]	32.2	On 3 occasions	−21.1	20 January 1940
North Heath	1968	35.4	26 June 1976	−14.8	14 January 1982
United Kingdom					
Raunds Epsom Canterbury	–	36.7	9 August 1911		
Braemar	–			−27.2	11 February 1895 10 January 1982

SUNSHINE	Date records began	Maximum monthly duration (hours)	Date	Minimum monthly duration (hours)	Date
South-east England					
Eastbourne	1887[4]	383.9	July 1911	21.8	December 1934
Hastings	1880[4]	383.6	July 1911	–	–
Gatwick	1958	313.0	July 1959	10.8	December 1969
Swanley		–	–	7.7	December 1956
United Kingdom					
Eastbourne	–	383.9	July 1911		
London (Westminster)	–			0	December 1890

WIND	Date records began	Maximum mean wind speed (knots)	Date	Maximum gust speed (knots)	Date
South-east England					
Manston	1939[6] 1968	48	12 January 1978	75	12 January 1978
Lympne	1922[7]	47	16 November 1928	75	1 January 1949
Dungeness	1971	46	13 January 1977	66	16 January 1974
Isle of Grain	1956	39	19 January 1963 24 December 1977	73	11 December 1974
United Kingdom					
(Low level sites)					
South Gare (Cleveland)	—	70	2 January 1976		
Kirkwall (Orkney)	—			118	7 February 1969

RAINFALL	Date records began	Maximum daily fall (mm)	Date
South-east England			
Manston	1928	161	20 September 1973
Elmstone	1938[5]	149	20 September 1973
Knockholt	1889[5]	131	5 September 1958
Throwley	1950[3]	129	20 September 1973
United Kingdom			
Martinstown (Dorset)	–	279	18 July 1955

Records ceased: [2], 1970; [3], 1975; [4], 1930; [5], 1965; [6], 1955; [7], 1954

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) # 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 the back cover or, if more convenient, initially to your local weather centre (see opposite). 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 7)
London Road
Bracknell
Berkshire RG12 2SZ

or from your local weather centre.

WEATHER CENTRES AND PUBLIC SERVICE OFFICES

Weather Centres

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) 457703

London
284–286 High Holborn
London WC1V 7HX

01—430 5627

Manchester
Exchange Street
Stockport SK3 0ER

061—477 1017

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

Tyneside 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:

Aberdeen (Dyce) Airport
Aberdeen, Grampian AB2 0DU

Aberdeen (0224) 724986

Belfast (Aldergrove) Airport
Belfast
Northern Ireland BT29 4AB

Crumlin (084 94) 22804

Birmingham Airport
Birmingham B26 3QN

021—743 6240

Kirkwall Airport
Kirkwall
Orkney KW15 1TH

Kirkwall (0856) 3802

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

(0806) 242069

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

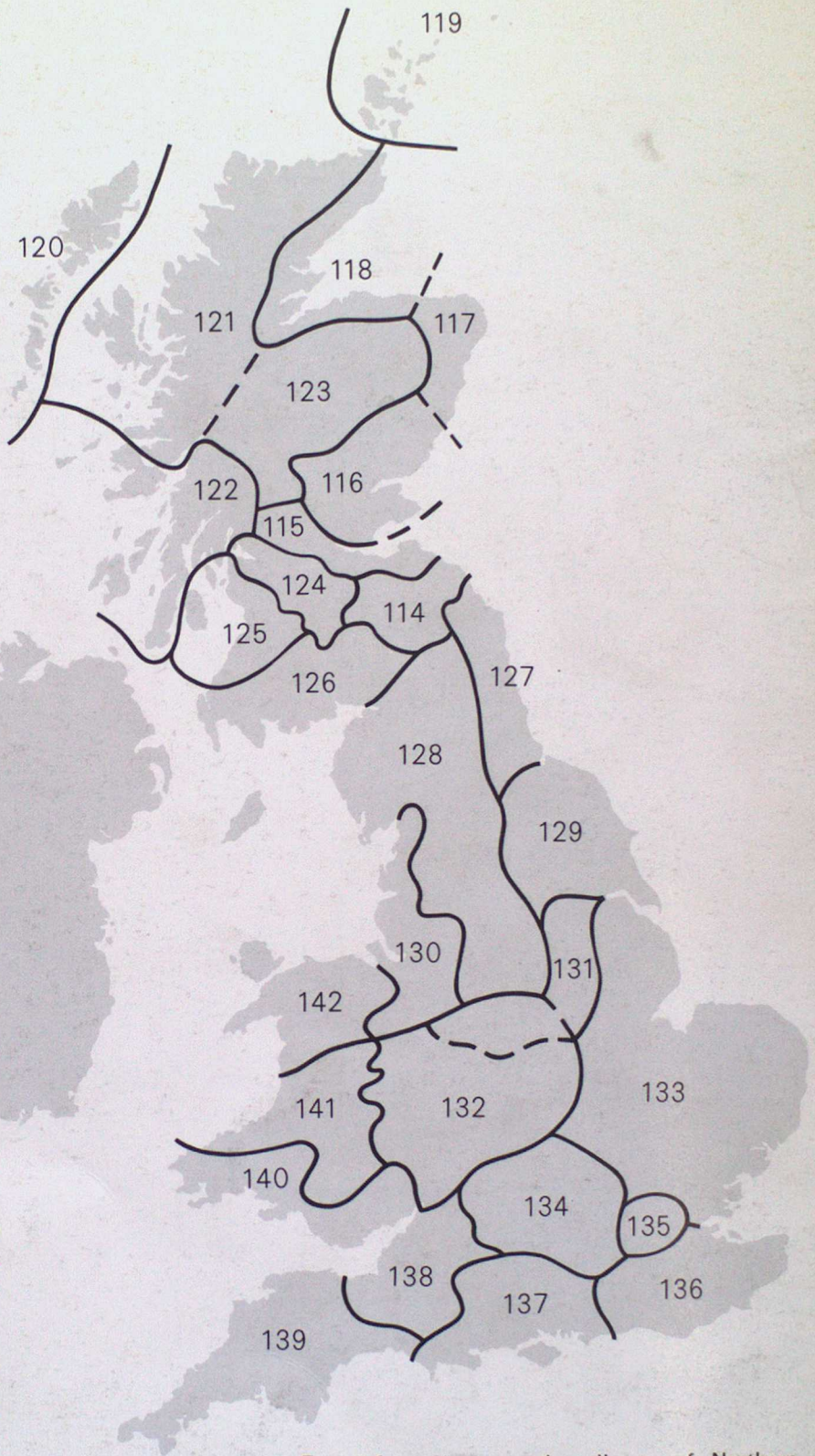
ENGLAND

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



Further details of these memoranda and of the services mentioned on page 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 information on the climate of Northern Ireland please contact:

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