THE CLIMATE OF GREAT BRITAIN

EAST ANGLIA AND LINCOLNSHIRE

Climatological Memorandum 133

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The front cover shows a view of England and Wales from 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. East Anglia had around 9 hours of sunshine with maximum afternoon temperatures of about 12 ^{o}C. There were a few rain and hail showers and also isolated thunderstorms over Hertfordshire during the afternoon and early evening.

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Climatological Memorandum 133

East Anglia and Lincolnshire

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)

THE AREA

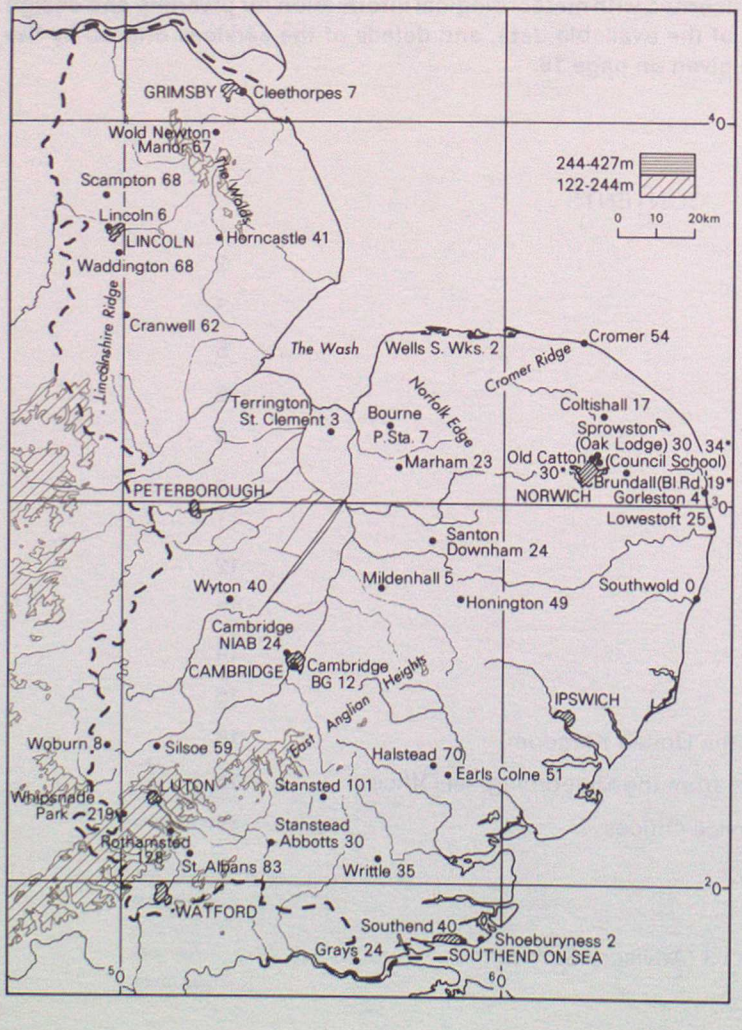
This memorandum describes the main features of the climate of East Anglia and Lincolnshire. This large area consists of Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Lincolnshire, Norfolk, Suffolk and most of south Humberside. Much of the ground of the area is below 61 metres (200 feet) and in the Fens it contains the largest tract of low, flat land in Britain. The highest ground is in the south-west of the area where the north-eastwards extension of the Chiltern Hills reaches nearly 244 metres continuing on as the East Anglian Heights. In the north of the area are the Lincolnshire Wolds with the only other high ground areas the Lincolnshire Ridge, the Norfolk Edge and the Cromer Ridge. The cliffs in north Norfolk are subject to erosion by the sea but deposition occurs in the area of Lowestoft and is the cause of the spit at the mouth of the River Yare at Great Yarmouth which diverts the river southwards. A number of the major rivers in the area drain into the Wash. Farming is an important activity in East Anglia and Lincolnshire and it is the chief cereal growing area of the British Isles, the main crops are barley, wheat and sugar beet. There is market gardening in the Fens, fruit growing in the Wisbech area, and the area around Spalding is noted for its daffodils and tulips. Fishing which was once a major industry has declined in recent years. Grimsby, which was the leading fishing port in the British Isles now handles only about one-fifth of the catch it handled ten years ago. Grimsby and Lowestoft are both among the top ten fishing ports.

The exploration of the North Sea has resulted in a number of gas pipelines coming ashore in the area. These are at Bacton, Theddlethorpe, and Easington in north Humberside. The Scunthorpe area is a major producer of steel and steel goods with a number of associated industries.

The area contains a number of large towns. Those in the south of the area come into the sphere of influence of Greater London and in effect are satellite or dormitory towns; among them are Luton, Watford, St Albans and Southend which is also a popular seaside resort. A number of new towns have been developed in the area mostly close to London but as far north as Peterborough.

The other major towns are mainly the respective county towns. Norwich, once the second city in England, situated at the confluence of the Yare and Wensum, is an industrial city generally related to farming. It is the major holiday centre for the Norfolk Broads. Ipswich, on the lowest bridging point of the Orwell, also has industries mainly related to farming. Cambridge, the chief town of the Fens, is known mainly as a university town. Lincoln, dating back to pre-Roman times and at one end of Ermine Street, situated on the River Witham, is a busy commercial centre.

The map 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 the area giving locations and altitudes (in metres) of the stations. Co-ordinates are national grid references

TEMPERATURE

The mean annual temperature over the region varies from just over 9 °C to around 10.5 °C. The lower values occur in the northern part of Lincolnshire and the higher values occur around the Essex coasts. Over the British Isles the mean annual temperature ranges from about 7 °C in Shetland to over 11 °C in the extreme south-west of England and the Channel Islands.

Temperatures show both seasonal and diurnal variations. January is on average the coldest month with mean daily minimum temperatures around zero in some inland locations to 1.5 °C or a little higher around the coasts. This compares with −1.0 °C in low-lying 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. The lowest temperature which has been recorded in the area is −20.6 °C. This value has been recorded at three locations at different times (see weather extremes in Table 10 for dates). 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 19.5 °C along coasts to 22 °C inland in the south of the area. 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 Shetland Maximum temperatures normally occur 2 to 3 hours after midday and extreme temperatures occur in the summer months. The highest known temperature recorded in the area was 36.1 °C at Halstead, Essex on 19 August 1932.

The variations 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 have been recorded.

Table 1 gives the average number of days during 1961–80 that maximum and minimum temperatures at Cranwell and Shoeburyness 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 Shoeburyness than at Cranwell which has more occasions of both high and low temperatures.

The average number of days a year of air frost in East Anglia and Lincolnshire varies from about 30 around the coasts to over 60 inland but with some locations (frost hollows) having as many as 90 days a year. For ground frost the average number of days a year ranges from 60 to 90 around coasts to over 150 at some inland sites. 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.

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

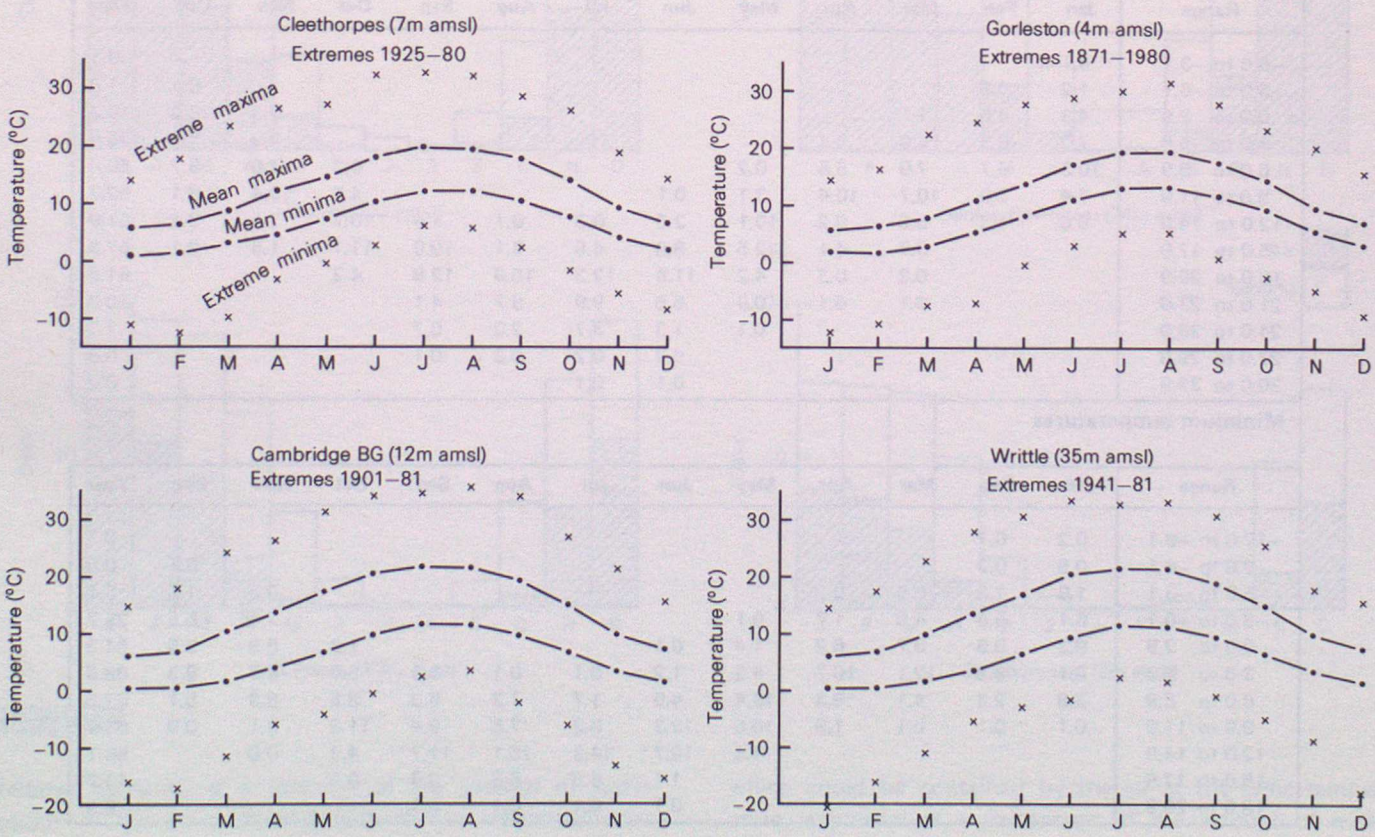


TABLE 1 Average number of days with maximum and minimum temperatures (°C) in the ranges specified

Cranwell

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	1.3	0.8	0.1								0.1	0.7	2.9
0.0 to 2.9	7.5	4.8	1.7	0.1							1.3	5.0	20.3
3.0 to 5.9	7.5	8.3	5.8	1.3						0.1	4.5	8.5	35.9
6.0 to 8.9	8.5	7.7	8.2	6.3	0.6				0.1	1.3	10.3	8.2	51.2
9.0 to 11.9	5.6	5.3	9.9	9.1	4.1	0.7			0.3	6.5	8.3	6.3	56.2
12.0 to 14.9	0.5	1.3	4.1	8.3	10.5	3.1	1.3	0.9	5.2	12.3	4.8	2.2	54.6
15.0 to 17.9			0.9	3.7	9.4	8.5	7.9	7.5	10.8	8.5	0.9		58.1
18.0 to 20.9			0.1	1.0	4.5	10.1	10.9	12.0	9.7	2.1			50.5
21.0 to 23.9			0.1	0.1	1.4	5.1	7.0	7.4	3.3	0.3			24.7
24.0 to 26.9					0.3	1.8	2.9	2.3	0.7	0.1			8.1
27.0 to 29.9						0.5	0.9	0.9					2.3
30.0 to 32.9						0.1	0.1	0.1					0.3

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											0.1
−12.0 to −9.1	0.3	0.1	0.1									0.3	0.7
−9.0 to −6.1	1.1	0.7	0.4								0.1	1.0	3.3
−6.0 to −3.1	3.1	3.0	1.5	0.3							1.1	2.5	11.5
−3.0 to −0.1	8.8	8.4	7.5	2.7	0.6					0.3	5.5	7.9	41.6
0.0 to 2.9	11.1	10.6	12.7	9.3	2.7	0.3			0.3	3.2	9.3	10.9	70.2
3.0 to 5.9	4.7	4.5	7.5	12.9	10.5	2.7	0.5	0.4	2.9	9.1	8.7	5.8	70.3
6.0 to 8.9	1.7	1.1	1.3	4.0	13.1	10.7	5.3	5.5	10.3	10.8	3.9	2.1	69.7
9.0 to 11.9			0.1	0.9	3.7	12.4	14.8	14.0	11.7	6.3	1.3	0.5	65.7
12.0 to 14.9					0.3	4.0	9.1	9.7	4.8	1.2	0.1		29.3
15.0 to 17.9							1.5	1.4	0.1				2.9

Shoeburyness

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
−3.0 to −0.1	1.2	0.5										0.1	1.8
0.0 to 2.9	4.3	3.5	1.1								0.3	3.2	12.3
3.0 to 5.9	7.2	6.3	4.8	0.4							2.9	7.0	28.5
6.0 to 8.9	10.3	8.7	7.9	5.5	0.2					0.3	7.8	9.7	50.4
9.0 to 11.9	7.4	7.9	10.7	10.4	3.1	0.1				4.5	10.4	8.1	62.7
12.0 to 14.9	0.6	1.3	5.5	9.2	10.1	2.5	0.3	0.1	1.6	10.7	7.1	2.8	51.9
15.0 to 17.9			0.7	4.1	12.5	8.8	4.5	3.1	10.9	11.1	1.5	0.1	57.3
18.0 to 20.9			0.3	0.3	4.2	11.5	12.3	15.9	12.8	4.3			61.5
21.0 to 23.9			0.1	0.1	0.9	5.5	9.9	9.7	4.1				30.3
24.0 to 26.9					0.1	1.3	3.7	2.0	0.7				7.7
27.0 to 29.9						0.3	0.2	0.3	0.1				0.8
30.0 to 32.9						0.1	0.1						0.2

Minimum temperatures

Range	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
−12.0 to −9.1	0.2	0.1											0.3
−9.0 to −6.1	0.5	0.2										0.1	0.8
−6.0 to −3.1	1.9	1.3	0.9	0.2							0.2	1.5	6.1
−3.0 to −0.1	6.1	5.8	4.0	1.7	0.1						2.4	5.5	25.7
0.0 to 2.9	9.3	9.9	9.7	6.2	1.4	0.1				1.3	6.9	9.5	54.3
3.0 to 5.9	9.1	8.8	12.1	10.7	4.2	1.2	0.1	0.1	0.9	5.0	8.5	8.3	68.8
6.0 to 8.9	3.8	2.3	4.1	9.3	13.4	4.5	1.7	1.3	5.3	8.5	8.3	5.1	67.5
9.0 to 11.9	0.1	0.1	0.1	1.9	10.6	12.3	8.2	7.5	9.4	11.3	3.1	0.9	65.7
12.0 to 14.9					1.3	10.7	14.3	15.1	11.7	4.3	0.6		58.1
15.0 to 17.9						1.1	6.6	6.8	2.7	0.5			17.7
18.0 to 20.9						0.1	0.1	0.1	0.1				0.3

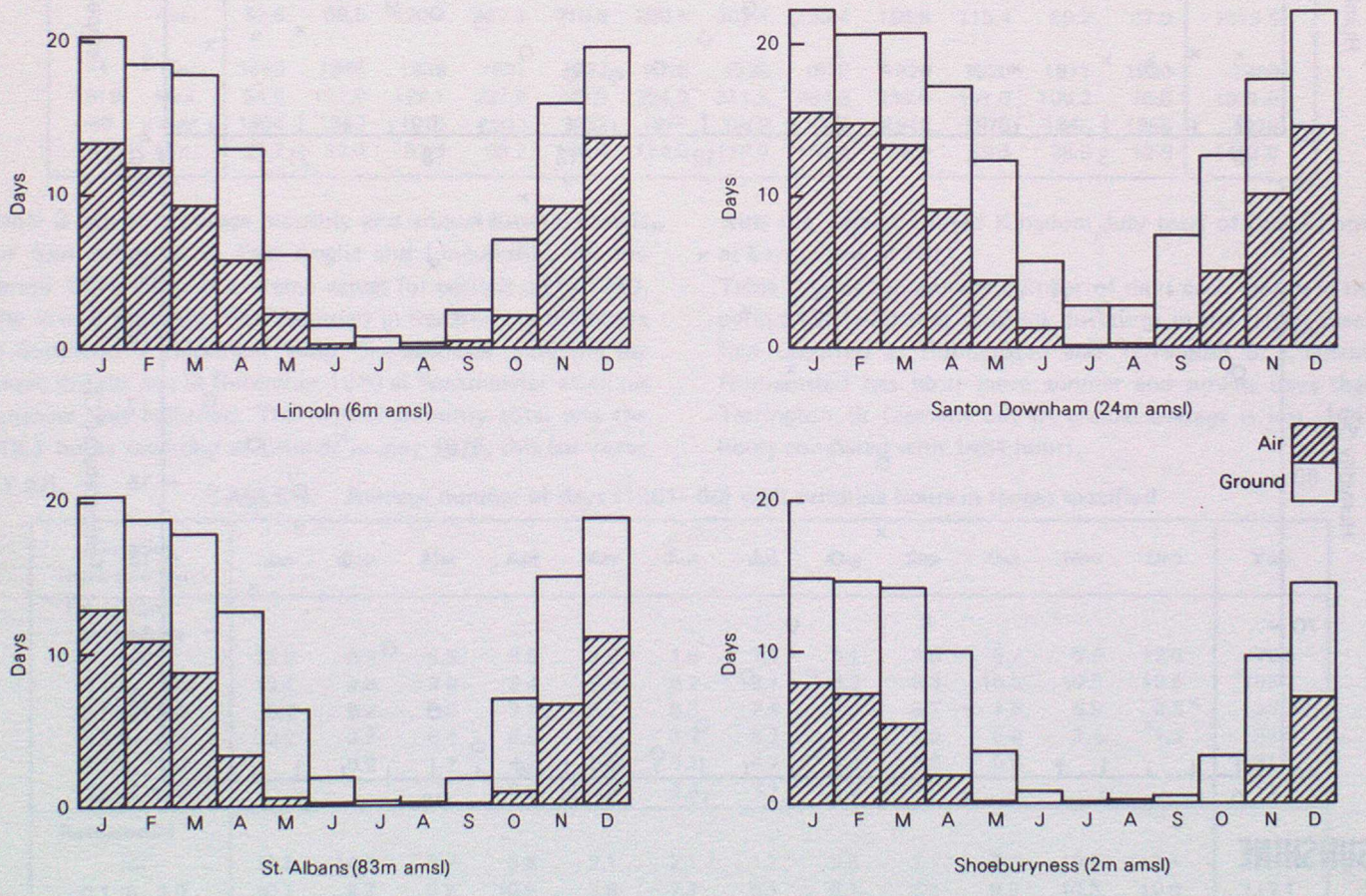
Table 2 gives the average number of days temperatures exceeded certain limits at four locations in East Anglia and Lincolnshire. The difference between an inland and a coastal site is clearly shown by comparing the data for Lowestoft and Santon Downham, the latter having more occasions of both high and low temperatures. The 25 °C value in March for Santon Downham was, in fact, 25.0 °C recorded on the 29th in 1968 and is the highest March temperature recorded in the UK. This value has been recorded on a number of occasions at locations in England including Cromer also on 29 March 1968.

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

Maximum temperature	25 °C or more								30 °C or more		
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Jun	Jul	Aug
Santon Downham	0.1	0.1	0.7	3.1	4.5	3.5	0.9	0.1	0.4	0.6	0.5
Lincoln			0.3	1.7	2.3	2.5	0.4		0.1	0.1	0.1
Silsoe			0.3	1.9	2.9	0.5	0.1		0.2	0.5	0.3
Lowestoft				0.5	1.1	0.3	0.3				

Minimum temperature	−5 °C or less										−10 °C or less				
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Nov	Dec	Jan	Feb	Mar
Santon Downham	0.1	0.1	2.2	4.7	5.1	4.0	3.7	1.5	0.5	0.1	0.1	0.9	1.3	0.5	0.5
Lincoln	0.1	0.2	1.9	3.5	4.1	2.9	1.7	0.5			0.2	0.3	0.9	0.3	0.1
Silsoe			0.5	2.6	3.1	1.9	1.3	0.3				0.1	0.9	0.1	0.1
Lowestoft			0.1	0.5	1.1	0.5	0.1					0.1	0.2		

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



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 more than 80 per cent over the year with higher values occurring in the winter and by night. Relative humidity equals or exceeds 95 per cent for some 15 to 20 per cent of the time in East Anglia and Lincolnshire, and 100 per cent can be reached in fog and persistent rain, snow or drizzle. Low humidities are less common as Figure 3 shows. This gives the percentage of time relative humidities occurred in the ranges specified at Wyton during the period 1971–80. The 16 to 20 per cent represents just 6 hours during the 10-year period. The lowest relative humidity recorded in the area in recent years was 8 per cent at Honington on 30 June 1976.

Figure 4 shows the diurnal variation of relative humidity and temperature at Stansted for the months of January and July. This illustrates a number of points made in the text.

Figure 3 The percentage of time relative humidity occurred in the ranges specified at Wyton

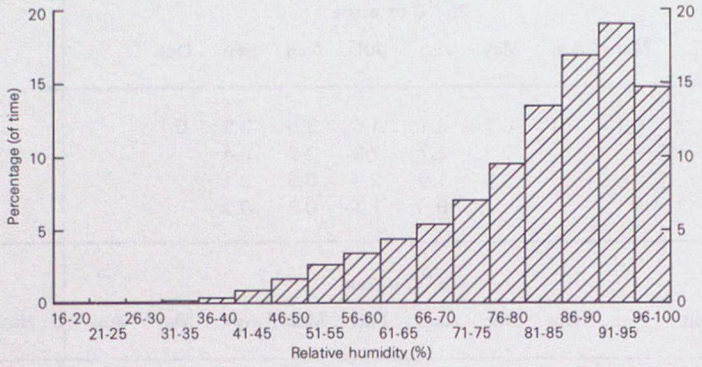
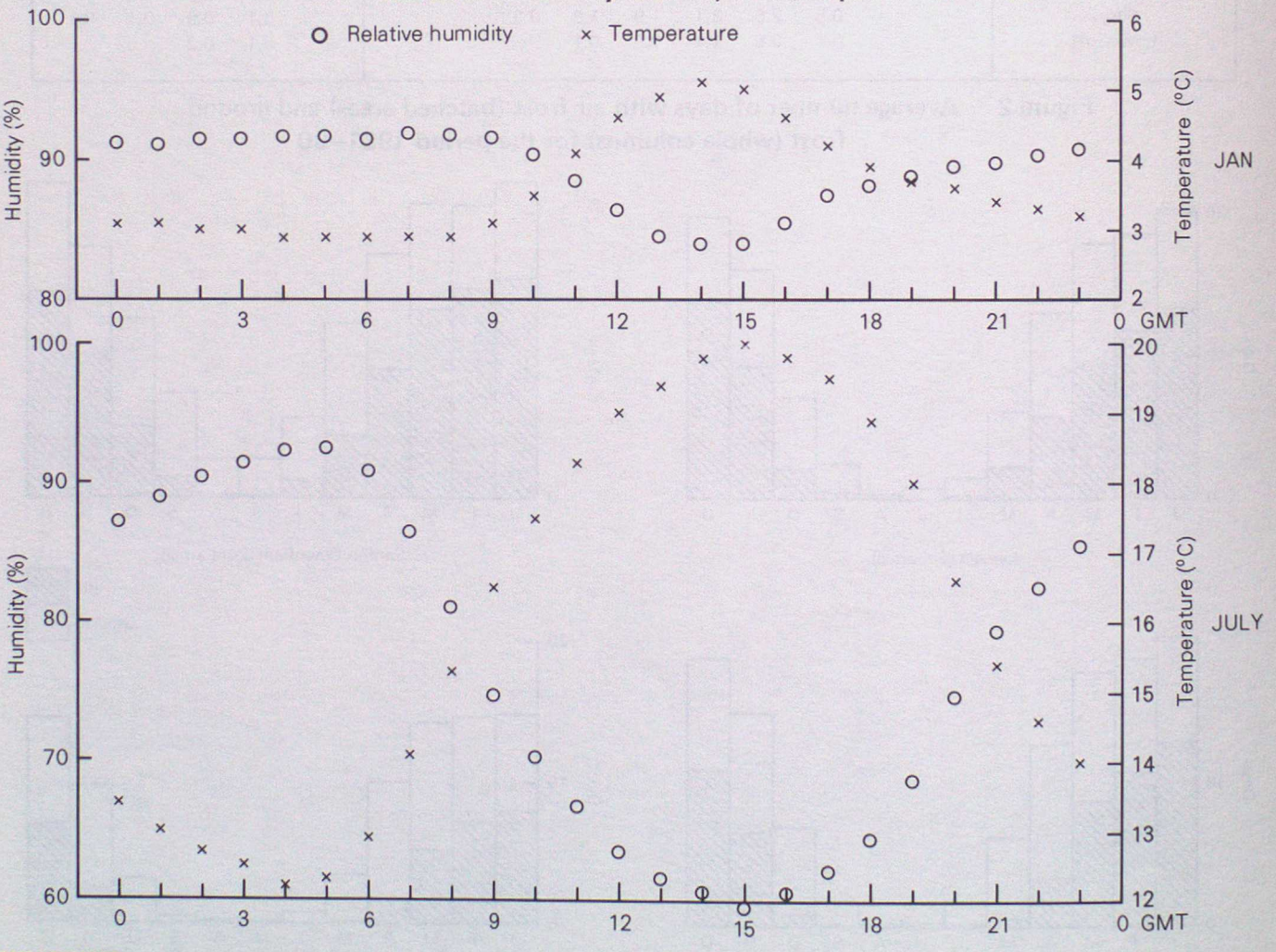


Figure 4 Average diurnal variation of temperature and relative humidity at Stansted for January and July over the period 1971–80



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 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 East Anglia and Lincolnshire vary from over 1600 hours along the Suffolk and Essex coasts to less than 1500 hours in the west of Bedfordshire and Hertfordshire and the northern part of Lincolnshire. The sunniest place in the British Isles is St Helier, Jersey with an annual average over the period 1951–80 of 1928 hours, and the least sunniest the Shetland Islands averaging less than 1100 hours.

TABLE 3 Sunshine averages (hours) for the period 1951–80 together with extremes for the stated years

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Cranwell														
	Ave.	56.4	67.3	108.4	144.4	195.0	199.3	178.0	165.9	141.2	104.4	67.4	54.4	1482.2
	Year	1952	1949	1967	1942	1922	1940	1935	1947	1964	1931	1978	1962	1921
1921	Max.	90.8	126.4	182.8	247.2	291.3	283.4	266.3	257.1	193.2	159.8	98.8	77.4	1801.3
–80	Year	1970	1947	1964	1937	1932	1953	1965	1954	1941	1960	1932	1958	1937
	Min.	26.1	22.7	54.3	84.1	99.4	124.1	91.2	107.9	76.9	61.1	38.2	27.9	1238.8
Lowestoft														
	Ave.	48.5	65.7	115.7	156.1	210.7	217.8	196.6	187.6	154.1	111.6	63.1	45.2	1572.7
	Year	1952	1934	1931	1942	1943	1976	1935	1947	1934	1959	1973	1962	1959
1931	Max.	84.3	122.7	204.4	239.1	286.1	314.4	313.8	295.1	202.6	165.2	93.8	80.1	1930.7
–80	Year	1942	1940	1964	1937	1932	1977	1965	1968	1945	1976	1945	1969	1968
	Min.	18.1	25.7	61.8	66.8	125.9	114.3	128.2	102.9	104.9	63.9	27.7	11.0	1328.0
Silsoe														
	Ave.	52.7	65.5	112.6	141.2	192.1	200.5	183.7	171.2	144.7	105.9	63.8	49.7	1483.6
	Year	1952	1970	1967	1969	1956	1957	1955	1949	1964	1959	1973	1962	1959
1949	Max.	82.2	105.4	181.4	209.6	241.2	293.4	271.8	237.8	190.7	157.7	97.0	85.4	1798.8
–80	Year	1970	1965	1964	1961	1951	1953	1965	1968	1967	1976	1962	1969	1968
	Min.	28.3	25.4	55.9	83.9	141.8	119.8	101.8	114.8	107.1	57.4	24.2	18.9	1207.1
Shoeburyness														
	Ave.	52.6	68.5	120.1	157.3	210.5	220.5	202.4	193.4	156.8	115.4	69.2	47.0	1613.8
	Year	1959	1949	1938	1921	1922	1976	1928	1976	1928	1920	1971	1936	1959
1919	Max.	94.8	121.9	179.1	227.0	289.9	304.2	311.5	284.6	236.6	191.0	105.2	76.6	1981.9
–80	Year	1966	1942	1975	1937	1932	1977	1919	1968	1945	1976	1945	1956	1978
	Min.	25.2	32.0	62.0	93.7	146.4	134.6	128.0	142.4	86.3	69.3	28.5	12.8	1403.5

Table 3 lists the average monthly and annual sunshine totals for four locations in East Anglia and Lincolnshire for the period 1951–80 plus extreme values for periods up to 1980. The lowest monthly total recorded in the area was 6.5 hours at Southend in December 1956. The absolute minimum for Great Britain was in December 1890 at Westminster when no sunshine was recorded. The highest monthly total was the 318.1 hours recorded at Cromer in July 1976; this compares with the highest United Kingdom July total of 383.9 hours at Eastbourne in 1911.

Table 4 gives the average number of days each month in the period 1961–80 that sunshine durations in the ranges specified occurred at Rothamsted and Terrington St Clement. Rothamsted has both more sunnier and sunless days than Terrington St Clement but its annual average is less, 1447 hours compared with 1484 hours.

TABLE 4 Average number of days (1961–80) with sunshine hours in ranges specified

Duration (Hours per day)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Terrington St Clement													
Nil	13.0	9.5	6.5	3.5	1.9	1.8	2.1	3.1	3.0	5.7	9.5	12.6	72.3
0.1 to 3.0	10.1	9.6	9.8	8.4	6.9	6.2	8.1	6.3	8.3	10.5	10.5	10.5	105.2
3.1 to 6.0	5.7	5.2	6.6	7.1	6.7	6.3	7.4	7.7	6.7	7.5	6.9	6.5	80.2
6.1 to 9.0	2.2	3.7	6.4	6.5	6.1	6.2	5.7	6.5	8.0	6.9	3.1	1.3	62.6
9.1 to 12.0		0.2	1.7	4.1	5.5	5.1	4.7	5.5	3.9	0.5			31.3
12.1 or more				0.5	3.9	4.4	3.1	1.8					13.5
Rothamsted													
Nil	13.8	10.3	6.7	3.8	2.1	2.1	1.7	2.5	3.1	6.8	10.1	13.1	76.1
0.1 to 3.0	10.1	9.7	9.8	10.5	7.9	7.3	9.1	8.1	8.3	9.9	10.3	10.9	112.1
3.1 to 6.0	4.8	4.3	6.1	5.9	6.4	4.9	6.1	7.9	7.2	6.6	5.8	5.7	71.8
6.1 to 9.0	2.3	3.7	5.4	5.3	6.0	5.6	6.1	5.3	6.9	6.7	3.7	1.4	58.3
9.1 to 12.0		0.1	2.9	3.5	4.7	4.8	4.7	5.1	4.5	1.1			31.3
12.1 or more				1.1	3.9	5.2	3.3	2.1	0.1				15.5

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 East Anglia and Lincolnshire; the influence of topography is clearly seen. East Anglia contains many of the areas in the British Isles which have the least rainfall, that is those parts with an average less than 600 millimetres a year.

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. 25 millimetres of rainfall are equivalent to about 200 tonnes of water on a football pitch.

Figure 5 shows the monthly variation of rainfall for six locations in East Anglia and Lincolnshire. There is a much more even distribution of rainfall throughout the year than in most other parts of England and Wales where there is a more pronounced difference between the wettest months and the driest months. This is due mainly to the lack of high ground in East Anglia and Lincolnshire and a rain-shadow effect of the high ground to the west from the prevailing rain-bearing winds.

Rainfall is extremely variable as the data in Table 5 show; this lists for three locations the extreme monthly and annual totals for periods up to 1981 with the 1941–70 averages for comparison.

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

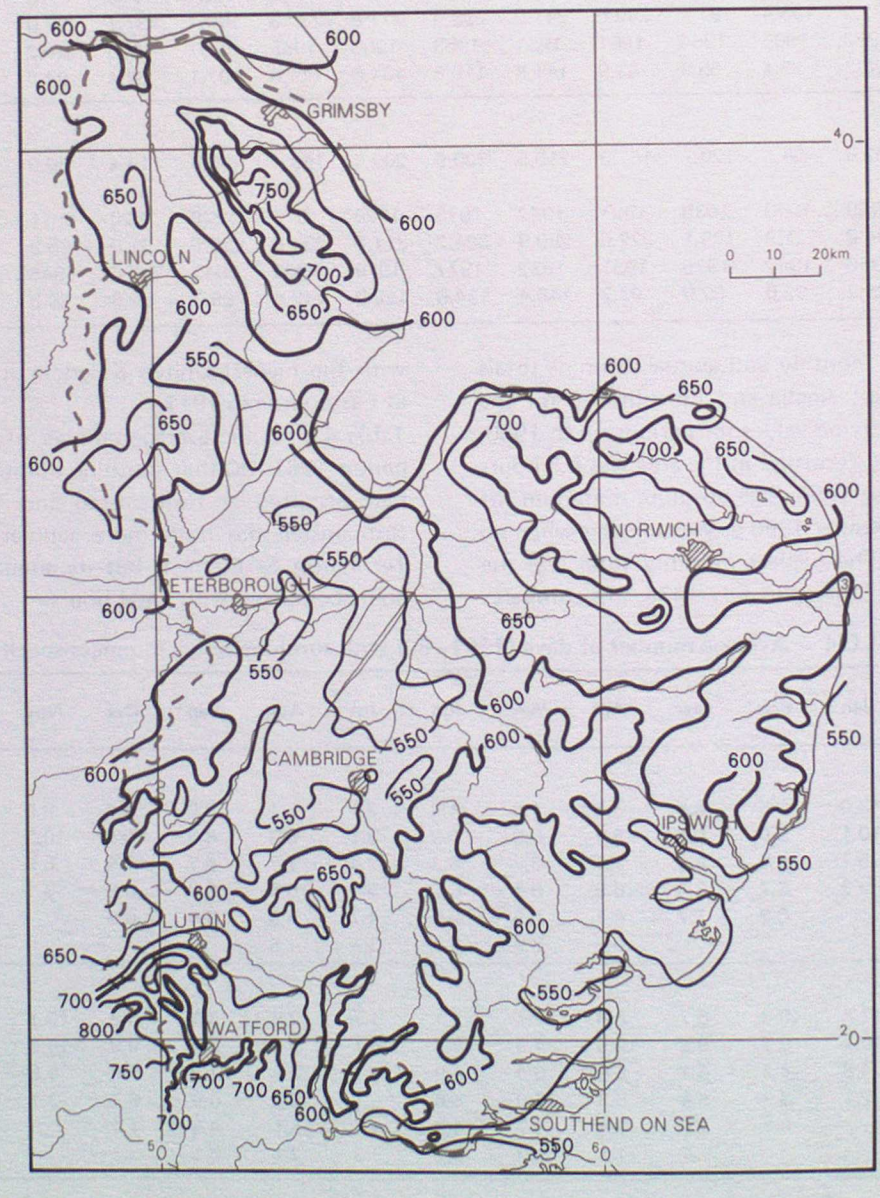


Figure 5 Average monthly rainfall (mm) over the period 1941–70

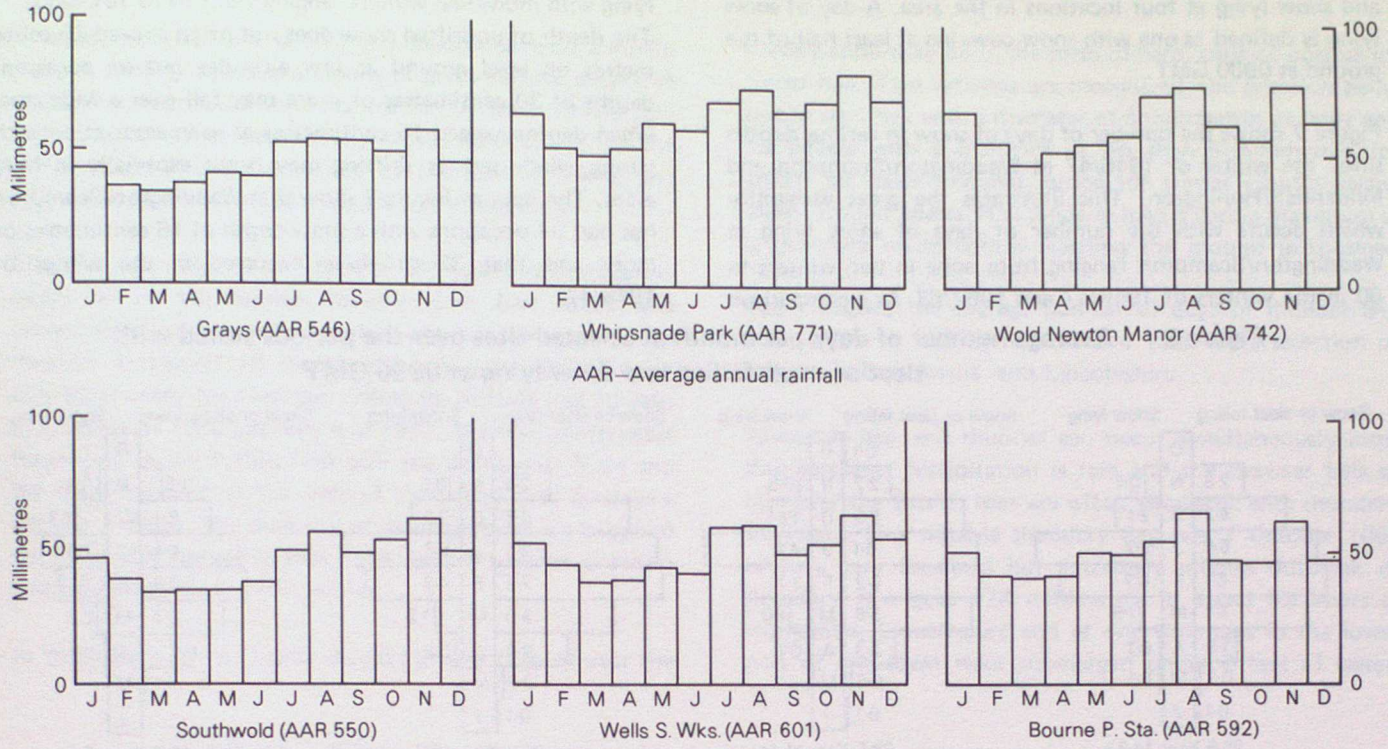


TABLE 5 Rainfall averages (millimetres) 1941–70 and monthly extremes during periods stated

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Shoeburyness														
	Average	43	35	35	33	41	41	48	61	53	49	55	45	539
Dec 1930	Wettest	92.8	105.0	92.0	76.3	101.1	107.8	102.8	116.6	165.4	173.1	138.1	93.7	772.2
–81	Driest	11.3	1.5	3.1	3.5	9.1	4.7	5.2	3.9	3.1	2.2	7.7	5.3	363.5
Rothamsted														
	Average	60	48	45	47	53	54	62	68	60	64	72	64	697
Dec 1930	Wettest	127.3	116.6	129.2	92.5	124.5	153.4	137.9	127.6	136.6	173.2	193.2	129.2	882.9
–81	Driest	21.0	1.4	2.1	2.9	11.4	6.4	5.1	1.8	3.3	1.1	8.8	10.8	517.7
Waddington														
	Average	52	43	41	41	46	47	54	67	49	46	64	48	598
1949	Wettest	118.6	132.6	108.8	139.6	113.3	121.9	126.1	217.5	136.0	131.8	121.9	163.2	801.1
–81	Driest	16.7	7.9	5.9	4.8	6.0	3.5	7.2	9.6	2.3	8.6	19.2	14.8	383.5

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 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 2 or 3 days over 10 years in East Anglia and Lincolnshire. Snow also very rarely occurs in June and some sleet and snow 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 East Anglia and Lincolnshire ranges from under 20 in the south-east of the area to over 30 on the Lincolnshire Wolds. 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 one centimetre of rainfall. Snow rarely lies on low ground before December or after March. The average number of days each year with snow lying in East Anglia and Lincolnshire varies from 7 to 15 with the lower values occurring near the coasts and the higher values inland over the higher ground. Days of snow lying are less 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 6 shows the 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 of the ground at 0900 GMT.

Figure 7 shows the number of days of snow in various depths since the winter of 1946/47 at Waddington/Scampton and Mildenhall/Honington. This illustrates the great variability which occurs with the number of days of snow lying at Waddington/Scampton ranging from none in two winters to 60 in the winters of 1946/47 and 1962/63. 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. The data in Figure 7 show that Waddington/Scampton has had 34 occasions with a snow depth of 16 centimetres or more and that 32 of these occurred in the winter of 1946/47.

Figure 6 Average number of days per month at selected sites over the periods stated with sleet or snow falling and snow lying at 0900 GMT

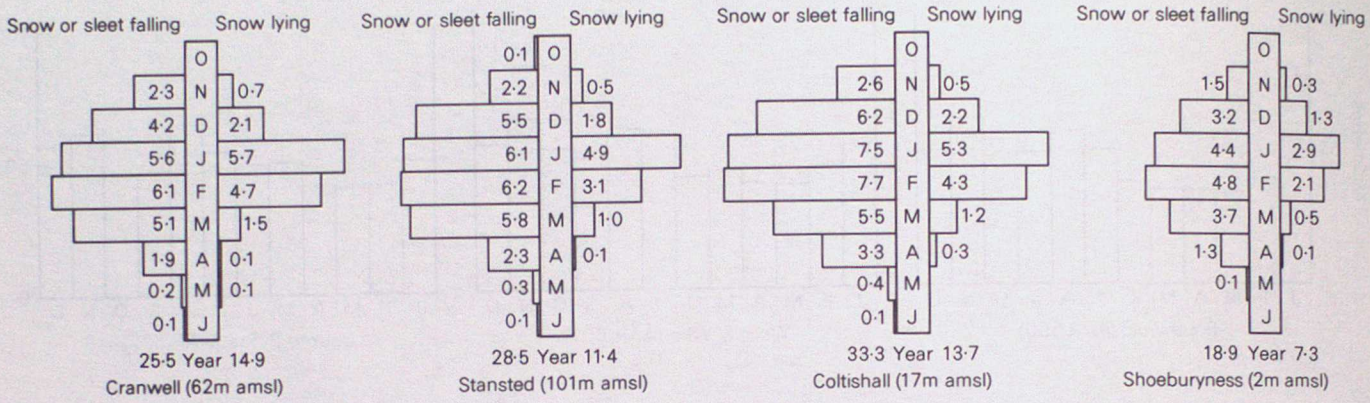
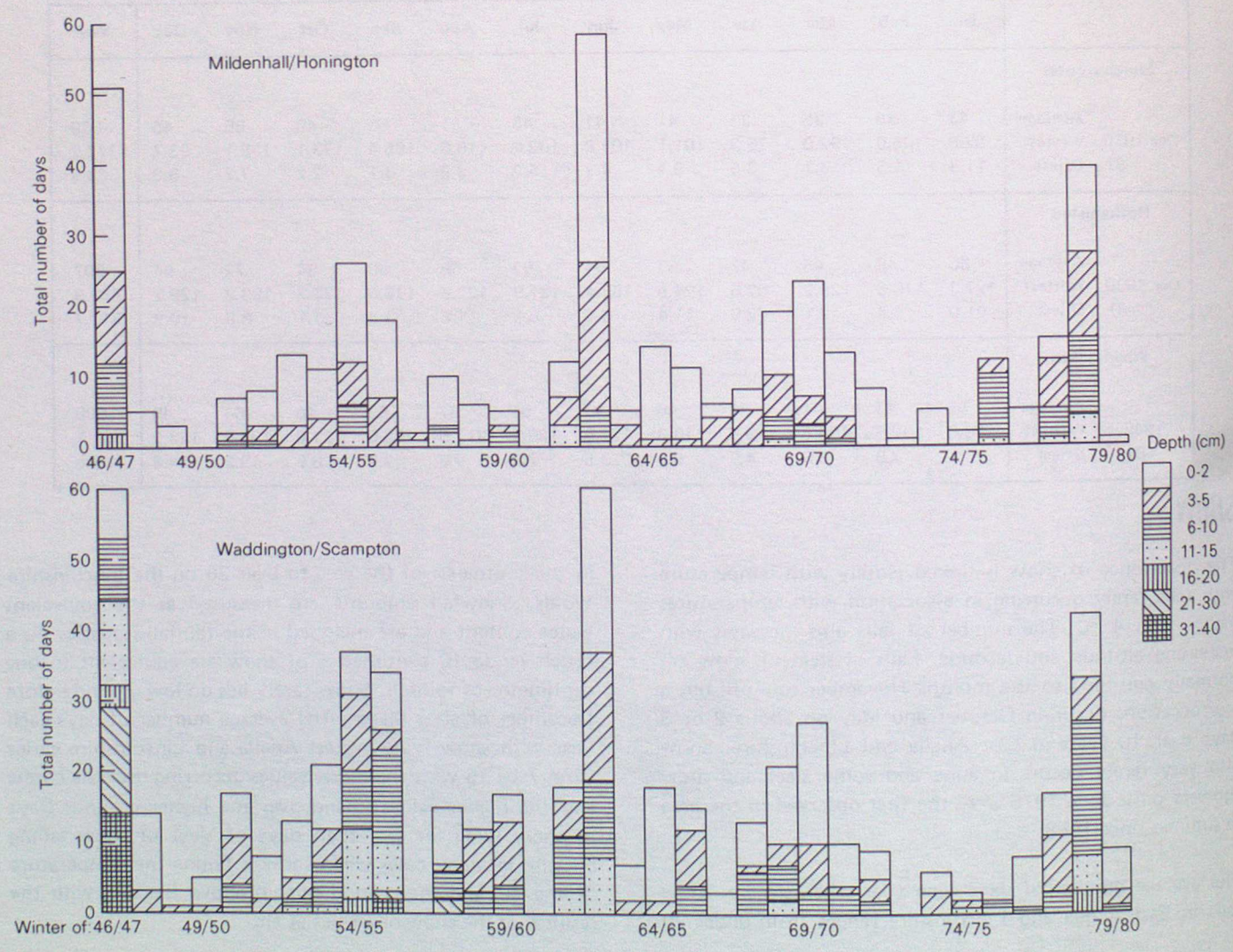


Figure 7 Number of days with total snow depth at 0900 GMT in stated ranges at Mildenhall/Honington and Waddington/Scampton



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 East Anglia and Lincolnshire the average number of days each year with thunder is around 15 though there is great variability in individual years; for example, Coltishall, Norfolk had 32 days of thunder in 1968 but only 5 in 1970. 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 a selection of stations in East Anglia and Lincolnshire.

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 was 7 October 1960 when a very localized but extremely intense outbreak of thundery rain gave 178 millimetres in about 5½ hours at Horncastle, Lincolnshire and at one time cars in the lower part of the town were submerged under 6 feet of water.

TABLE 6 Average numbers of days of thunder, hail and ice pellets during the specified periods

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Stansted (1957–81)													
Thunder	0.2	0.1	0.5	1.3	2.4	3.4	3.0	2.6	1.5	0.6	0.3	0.3	16.1
Hail	0.1	0.5	0.8	0.9	0.4	0.3		0.1	0.1		0.2	0.2	3.6
Ice pellets	1.1	1.5	1.0	1.1	0.2	0.1				0.1	0.3	0.5	5.9
Shoeburyness (1957–81)													
Thunder	0.2	0.3	0.5	1.0	2.1	2.8	2.7	2.3	1.8	0.7	0.4	0.1	14.9
Hail	0.2	0.2	0.7	0.7	0.3	0.2			0.1	0.2	0.2	0.1	2.8
Ice pellets	1.0	1.3	1.5	0.9	0.3	0.1		0.1			0.3	0.8	6.5
Wyton (1957–81)													
Thunder	0.2	0.1	0.4	0.8	2.6	2.6	2.5	2.5	1.4	0.5	0.3		13.9
Hail	0.2	0.1	0.2	0.3	0.5				0.1		0.1	0.1	1.7
Ice pellets	1.2	1.4	1.9	1.1	0.3	0.2	0.1	0.1			0.5	0.7	7.4
Marham (1957–81)													
Thunder	0.2	0.1	0.5	0.7	2.4	3.3	2.9	2.6	1.5	0.7	0.2		15.1
Hail		0.1	0.5	0.3	0.2	0.3		0.1		0.1	0.1	0.1	1.9
Ice pellets	1.3	2.0	1.5	1.3	0.6	0.4		0.1	0.1	0.3	0.9	1.1	9.6
Wattisham (1959–81)													
Thunder	0.1	0.3	0.7	1.2	2.6	2.5	3.2	1.9	1.4	0.6	0.2	0.1	14.7
Hail	0.2	0.1	0.8	0.9	0.7	0.1				0.1	0.2	0.3	3.6
Ice pellets	1.8	1.9	1.5	0.9	0.7	0.3					0.4	0.8	8.5
Coltishall (1963–81)													
Thunder	0.1	0.3	0.3	1.1	2.4	2.9	2.7	2.6	1.5	0.7	0.3	0.2	15.1
Hail	0.3	0.6	0.6	1.3	0.7	0.1	0.2	0.1	0.2	0.4	1.1	0.7	6.2
Ice pellets	3.5	3.0	2.3	1.8	0.3	0.1				0.2	1.3	2.4	14.8

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 8 shows the percentage frequency throughout the year for cloud amounts at Mildenhall/Honington. These values are typical of East Anglia and Lincolnshire with cloudy skies predominating. Over the country as a whole values show a similar pattern.

Figure 8 Frequency of total cloud amount at Mildenhall/Honington for the period 1957–76

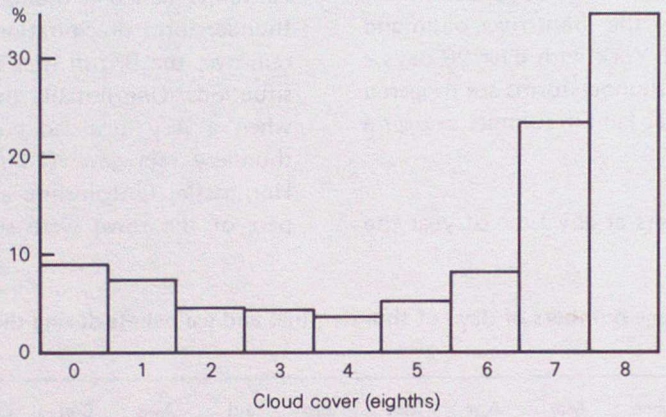


Table 7 gives the percentage frequency by month for the hours of daylight and darkness for the three cloud ranges at Waddington and Stansted. These are typical of the region being more cloudy in winter than summer and more cloudy by day than by night. June is the least cloudy month both by night and by day, which is reflected in the sunshine totals. Stansted has a higher percentage of clear skies and a lower percentage of cloudy skies than Waddington which again is reflected in lower sunshine values in north Lincolnshire.

TABLE 7 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
Waddington													
						Daylight hours							
Eighths													
0–2	15.4	13.2	14.1	13.1	15.4	20.9	13.8	15.9	15.4	17.3	15.9	18.9	15.8
3–6	16.9	18.3	22.2	24.5	29.9	29.3	27.8	28.3	28.3	22.5	20.1	17.1	25.0
7–8	67.6	68.4	63.7	62.4	54.8	49.9	58.3	55.8	56.3	60.3	64.0	63.9	59.3
						Hours of darkness							
0–2	21.2	22.3	25.5	25.6	28.4	30.7	23.6	30.4	31.0	26.8	25.7	21.8	25.5
3–6	15.0	16.3	16.6	18.9	25.4	23.7	25.9	23.2	21.6	17.4	17.0	17.4	18.9
7–8	63.9	61.4	57.9	55.7	46.1	45.6	50.4	46.4	47.3	55.6	57.4	60.9	55.7
Stansted													
						Daylight hours							
Eighths													
0–2	13.6	12.5	15.6	13.8	16.1	20.5	15.5	17.6	17.4	18.4	15.1	15.2	16.2
3–6	18.0	19.2	25.1	27.3	32.5	34.8	32.1	31.1	33.6	26.0	22.6	18.1	28.0
7–8	68.4	68.3	59.4	58.8	51.4	44.6	52.4	51.3	49.1	55.7	62.4	66.6	55.9
						Hours of darkness							
0–2	20.3	22.8	30.2	32.2	33.4	36.6	29.9	36.0	35.2	28.7	26.4	24.2	28.7
3–6	12.7	15.3	16.2	18.5	24.4	23.8	27.3	21.6	21.5	19.2	18.0	15.5	18.7
7–8	67.1	61.7	53.5	49.5	42.2	39.5	42.9	42.2	43.3	52.1	55.5	60.4	52.6

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.

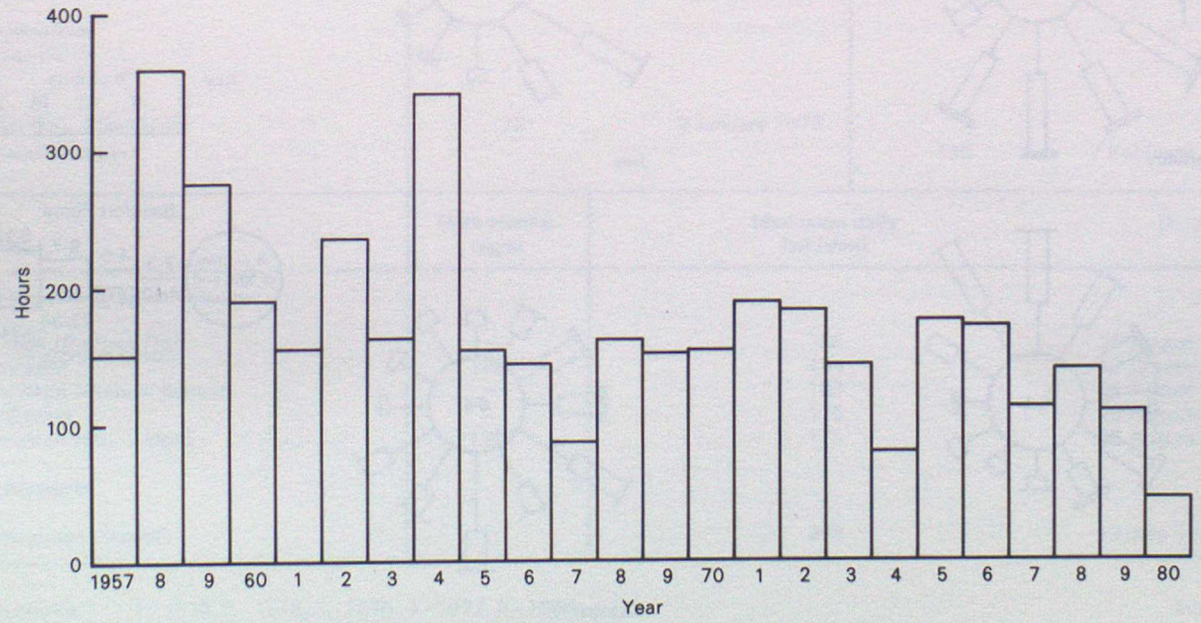
Fog is predominantly a winter phenomenon occurring generally at night or early morning though it does occasionally persist all day. There are a number of factors which affect fog formation and as a consequence there is a wide variation in the number of occasions when fog occurs at locations throughout East Anglia and Lincolnshire. 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 Shoeburyness, Stansted and Waddington. Fog is much more frequent at the two inland sites than at Shoeburyness which has predominantly advection fogs. Waddington has a higher occurrence of fog than Stansted as it is prone to upslope fog forming in light winds with an easterly component.

There is great variability in the occurrence of fog as the data in Table 8 show and this is further illustrated in Figure 9 which gives the number of hours of thick fog each year at Waddington over the period 1957–80, the annual average being 169 hours.

TABLE 8 Average and extreme numbers of hours of thick fog

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Shoeburyness (1957–80)													
Average	3.5	3.7	1.2	1.0	0.3	0.1	0.1	0.5	0.7	3.9	3.4	4.6	23.0
Maximum	12	29	11	11	2	2	2	5	6	19	18	13	70
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	2
Stansted (1959–80)													
Average	15.5	12.1	4.3	3.1	1.8	1.0	1.0	2.6	4.6	14.1	12.0	14.4	86.5
Maximum	46	47	15	21	7	7	5	9	11	51	44	59	167
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	19
Waddington (1957–80)													
Average	31.2	19.0	10.6	7.1	3.0	2.0	2.7	4.1	7.5	27.1	24.4	30.6	169.4
Maximum	97	83	34	37	21	7	12	15	25	82	100	104	358
Minimum	0	0	0	0	0	0	0	0	0	0	0	0	44

Figure 9 Number of hours each year of thick fog (visibility <200 m) at Waddington over the period 1957–80



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 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. Much of East Anglia and Lincolnshire has on average 2 days or fewer each year with gales the only exceptions being the exposed coastal regions of Lincolnshire, Norfolk and Suffolk which average 5 days or so each year. As a comparison the Shetland Islands have on average 50 days of gale a year.

Table 9 gives the annual percentage frequency of hourly mean wind speed and direction for Waddington for the period 1970–80. These data are representative of inland East Anglia and Lincolnshire. Along the exposed coasts the total percentages for the wind directions will be similar but the wind speeds will be higher.

The wind roses for Wattisham illustrate how the wind varies throughout the year. The high incidence of north to north-easterly winds in April is due to the weather patterns which predominate during this month.

TABLE 9 Annual percentage frequencies of hourly mean wind speed and direction for Waddington 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													0.3
1– 3	1	0.4	0.4	0.4	0.5	0.7	0.8	0.5	0.4	0.6	0.8	0.6	0.5	7.1
4–10	2–3	2.9	3.6	3.1	2.9	3.5	3.3	2.5	7.3	8.9	5.4	5.0	5.0	53.6
11–21	4–5	1.7	3.0	2.5	1.6	1.9	2.5	2.7	6.1	7.6	3.6	1.9	2.0	37.1
22–33	6–7	+	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.5	0.2	0.1	+	1.7
≥34	≥8								+	+	+			+
Total ≥4		4.7	6.7	5.8	4.6	5.6	5.9	5.4	13.7	16.9	9.3	7.0	7.0	92.3

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

Figure 10 Wind-roses for Wattisham 1971–80

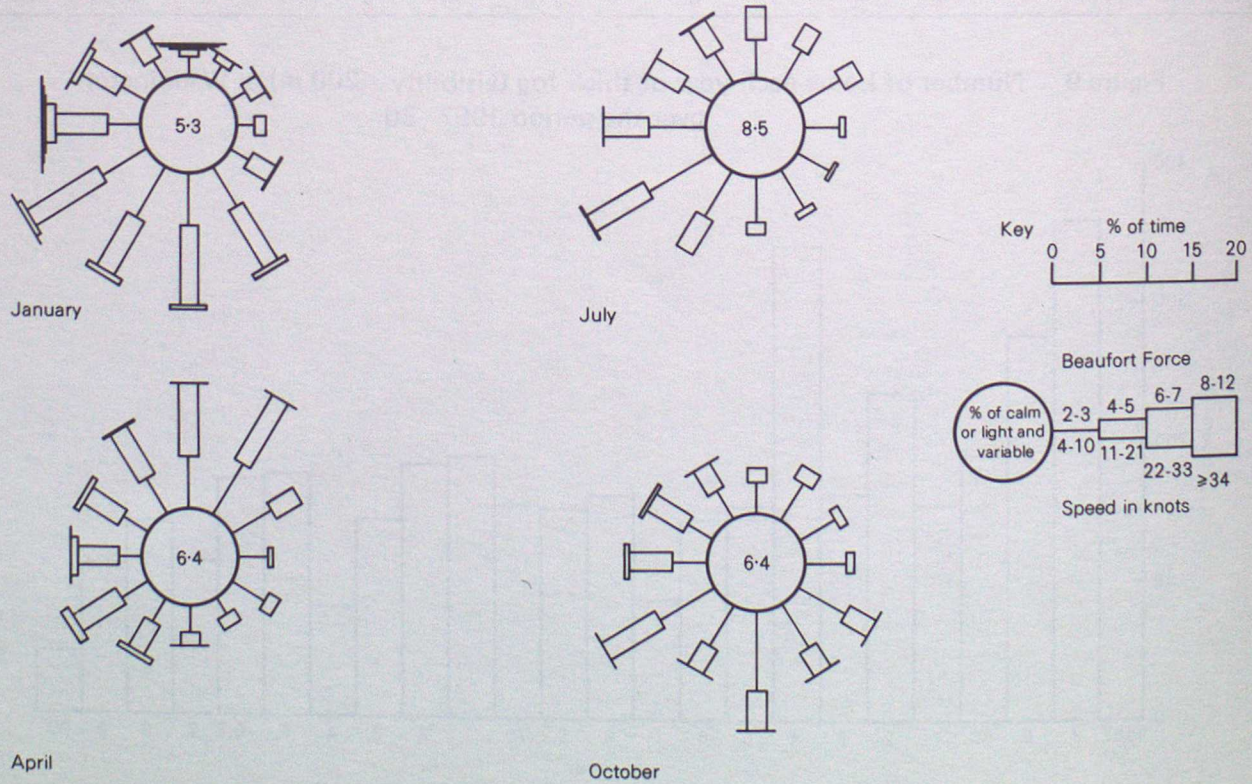


TABLE 10 Weather extremes

TEMPERATURE	Date records began	Maximum daily temperature (°C)	Date	Minimum daily temperature (°C)	Date
East Anglia and Lincolnshire					
Cambridge BG	1901	35.6	9 August 1911 19 August 1932	−17.2	24 February 1947 25 February 1947
Earls Colne	1923[1]	35.6	19 August 1932	−16.1	23 January 1963
Norwich	1901[2]	35.6	19 August 1932	−12.8	7 February 1917
Writtle	1941	33.6	26 June 1976	−20.6	29 January 1947
Stanstead Abbotts	1958	34.2	8 August 1975	−20.6	23 January 1963
Woburn	1901	34.4	9 August 1911	−20.6	25 February 1947
Halstead	1901	36.1	19 August 1932	−17.2	16 February 1902
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
East Anglia and Lincolnshire					
Cromer	1931	318.1	July 1976	11.7	December 1969
Lowestoft	1931	314.4 313.8	June 1976 July 1935	11.0	December 1969
Southend	1931[3]	306.5	July 1935	6.5	December 1956
Writtle	1946	269.9	June 1976	9.0	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
East Anglia and Lincolnshire					
Cardington	1932	55	16 March 1947	83	2 January 1976
Shoeburyness	1913	55	11 January 1952	77	11 February 1974
Gorleston	1913	53	11 January 1978	74	3 January 1976 11 January 1978
Coltishall	1968	48	2 January 1976	85	2 January 1976
Cranwell	1921	48	2 January 1976	96	17 December 1952
Wattisham	1970	49	2 January 1976	84	2 January 1976
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
East Anglia and Lincolnshire			
Brundall (Blofield Rd)	–	186	26 August 1912
Horncastle	1903[4]	184	7 October 1960
Sprowston (Council School)	–	183	26 August 1912
Old Catton	–	175	26 August 1912
Sprowston (Oak Lodge)	1912[5]	175	26 August 1912
United Kingdom			
Martinstown (Dorset)	–	279	18 July 1955

Records ceased:– 1 - 1975, 2 - 1948, 3 - 1976, 4 - 1973, 5 - 1956

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 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 7a)
London Road
Bracknell
Berkshire RG12 2SZ

or from your local weather centre.

WEATHER CENTRES AND PUBLIC SERVICE OFFICES

Weather Centres

Aberdeen
Seaforth Centre
Lime 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

01—430 5627

Manchester
Applicon House
Exchange Street
Stockport SK3 0ER

061—477 0130

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

(0806) 242060

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

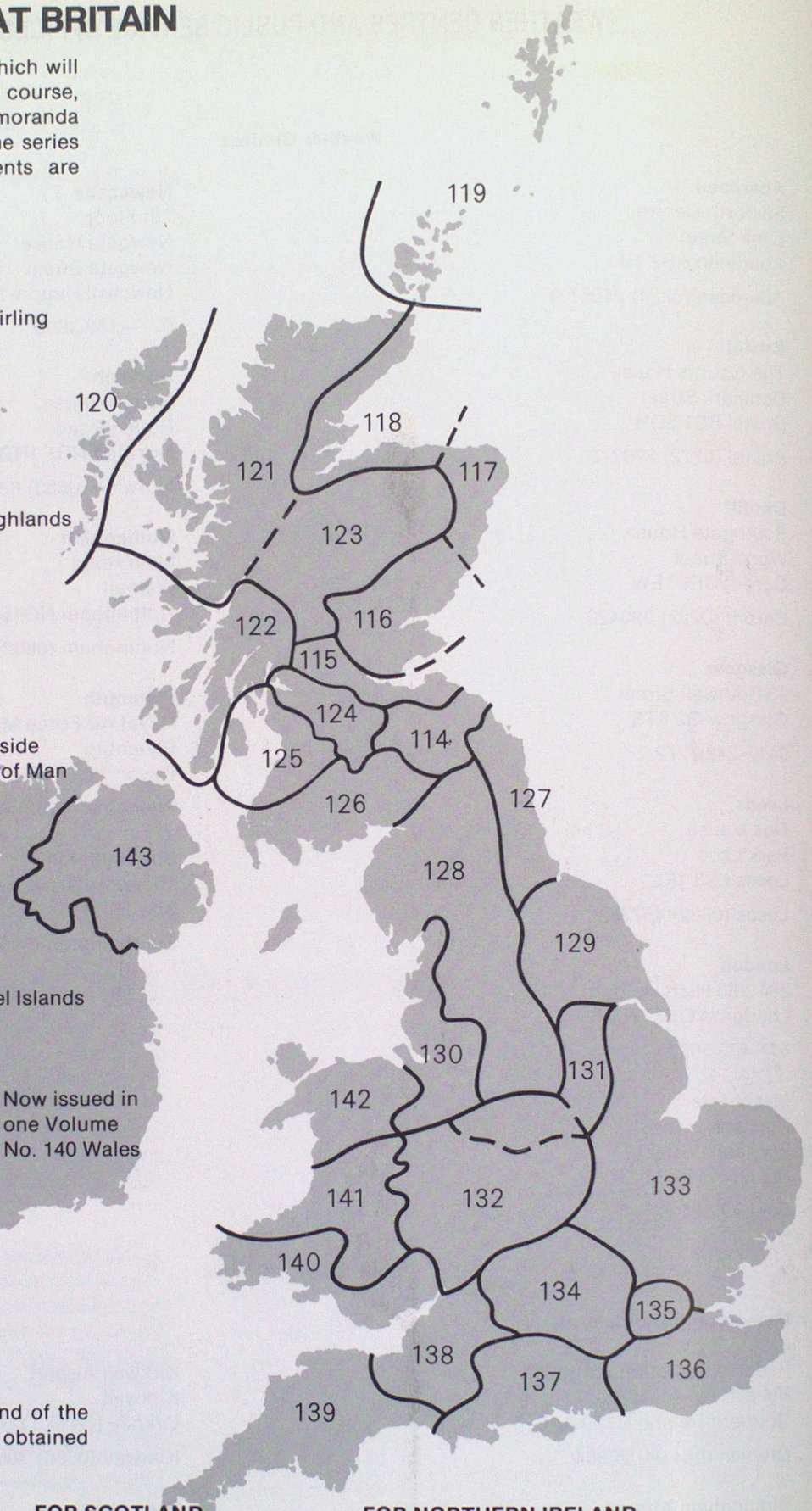
127 North-east England
128 Pennines and Lake District
129 East Yorkshire and North Humberside
130 Lancashire and Cheshire and Isle of Man
131 Trent Valley
132 Midlands
133 East Anglia and Lincolnshire
134 Thames Valley
135 London
136 South-east England
137 South England
138 Somerset and Avon
139 South-west 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 on page 16 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