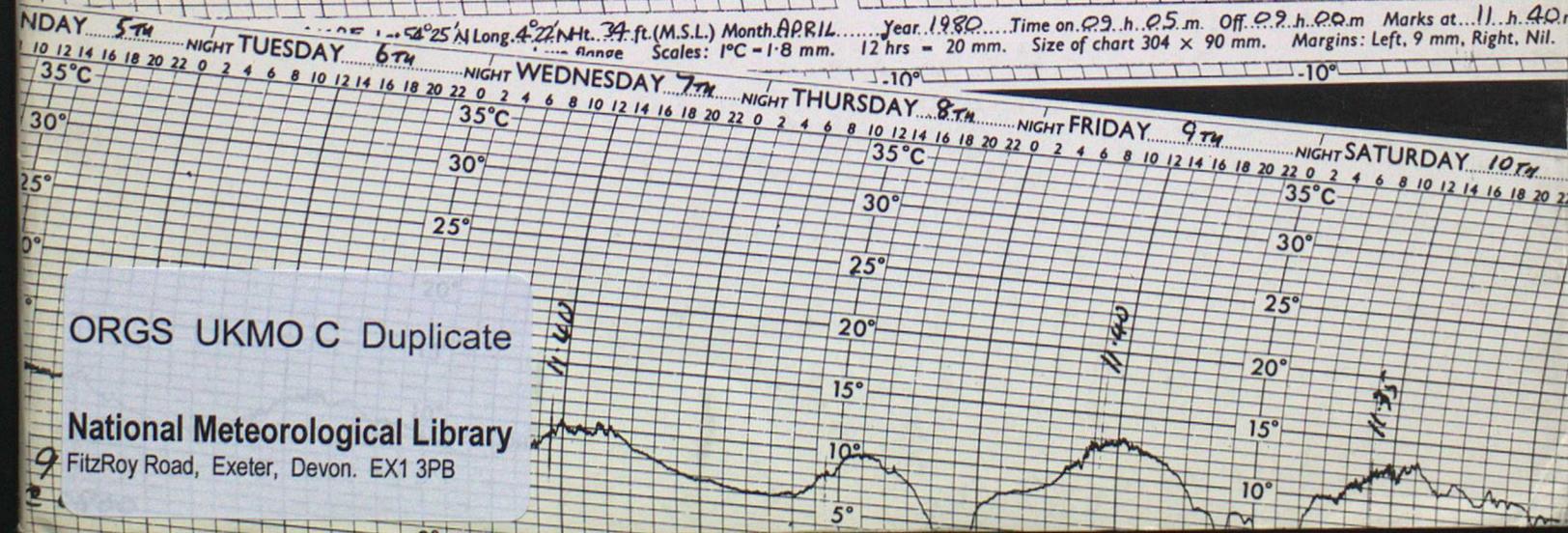
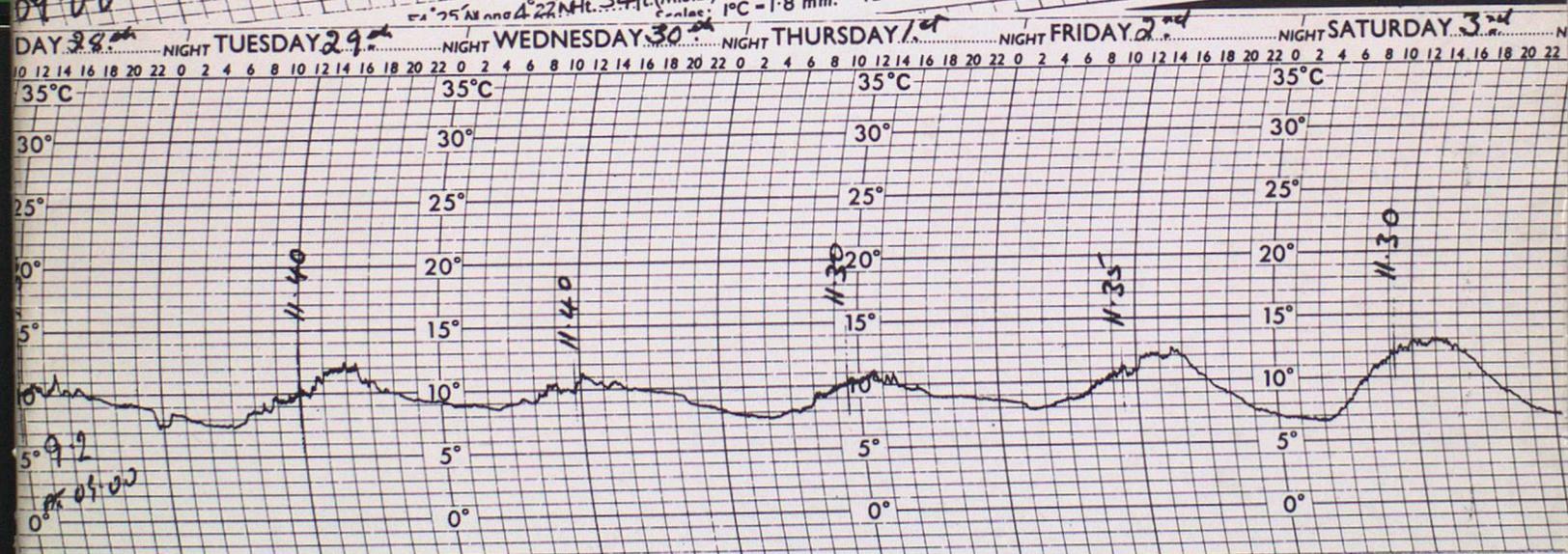
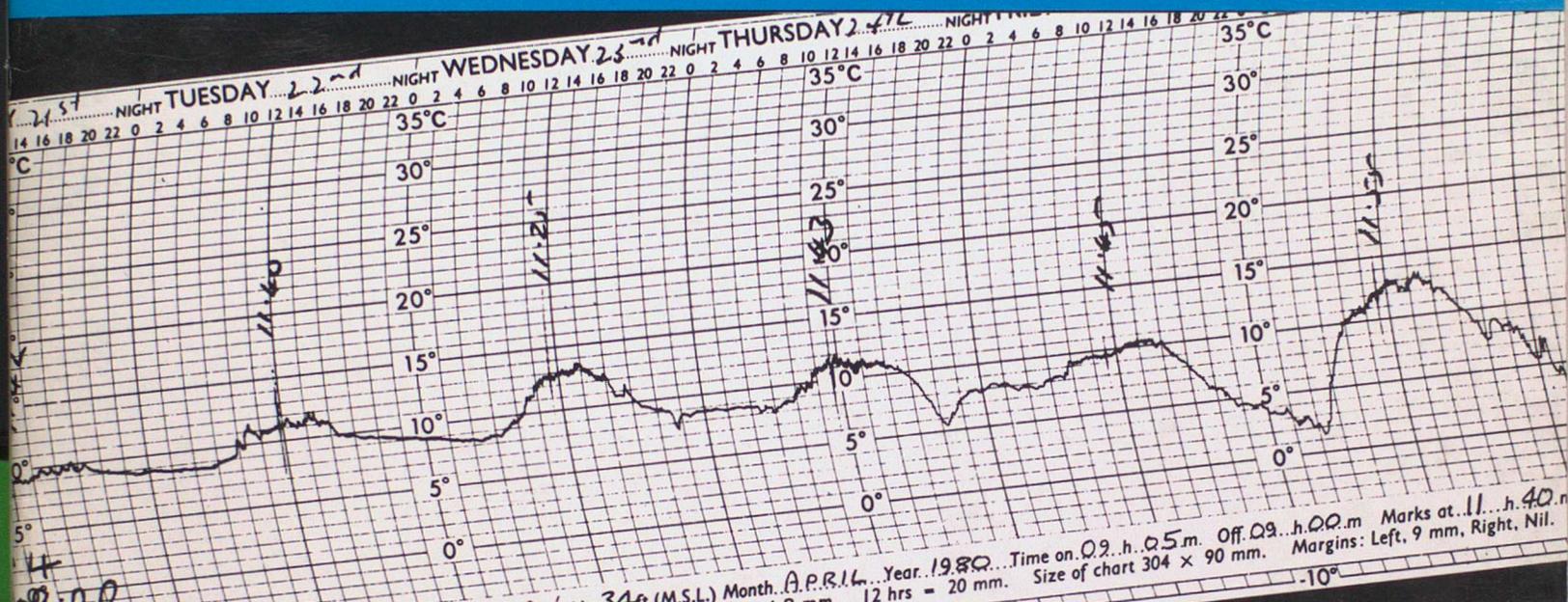




Climatological Memorandum No. 111

Rates of change of air temperature in the United Kingdom in time-scales of between 1 and 6 hours

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**Published by the Meteorological Office,  
London Road, Bracknell, Berkshire, RG12 2SZ**

UDC 551.524.31 (41-4)

ISBN 0 86180 041 9

RATES OF CHANGE OF AIR TEMPERATURE IN THE UNITED KINGDOM IN TIME-SCALES OF BETWEEN 1 AND 6 HOURS



Introduction

The Climatological Services have investigated the rates of change of temperature in time-scales of between 1 and 6 hours in the United Kingdom...

Data available for which hourly values of air temperature are available over the 15 years 1961-75 were analysed to give a broad coverage of the country. London Heathrow Airport, Manchester Airport, Glasgow, Cardiff, Leeds, Luton, Newcastle, Preston, Covent Garden, Birmingham Airport (Edina), Newcastle Down, and Loughborough were included.

Climatological Memorandum No. 111

Rates of change of temperature in the United Kingdom in time-scales of between 1 and 6 hours

Tables

1. Changes of temperature over one hour

Table 1 shows the percentage frequency of hourly changes of temperature at each of the eight stations. The percentages are calculated from the number of hours in which the change occurred, divided by the total number of observations at the station over the 15 years. The values are calculated with what would be expected from a normal distribution. The standard deviation was taken as 0.75 °C at Heathrow and Luton, 0.5 °C at Birmingham and Newcastle Down. Table 1 shows the quoted frequency curve for Birmingham with what would be expected as an approximation to the actual distribution.

The two temperature ranges of 0 °C to +1 °C and 0.5 °C to 0.9 °C account for the vast majority of hourly changes at any one of all stations. In general, the differences in temperature over one hour are less than 2 °C though larger changes have been recorded.

Table 1 also shows the percentage frequencies of temperature changes exceeding or exceeding 1 °C according to the time of day. The values of 1 °C are chosen as being the amount which would correspond to 1 per cent of the number of observations in all stations (1975 unrounded). In fact, as can be seen from Table 1, the actual frequencies at Heathrow and Manchester only 40%.

As might be expected the greatest frequency of rises in temperature of 1 °C is observed during the morning and night, all changes are upwards and downwards. Table 2 shows the rates of temperature at Luton. Through the morning, the rate of rise is 0.5 °C per hour, in the afternoon the rate is 0.2 °C and in the evening the rate is 0.1 °C. The rate of fall is 0.1 °C per hour in the morning and 0.2 °C per hour in the afternoon and evening.

Table 3 gives the distribution of 1 hour and 1 hour to 6 hour temperature changes at Heathrow and Luton.

Table 4 shows the distribution of 1 hour and 1 hour to 6 hour temperature changes at Heathrow and Luton. Table 5 shows the distribution of 1 hour and 1 hour to 6 hour temperature changes at Heathrow and Luton.

Met O 3 (Climatological Services)

September 1980



RATES OF CHANGE OF AIR TEMPERATURE IN THE UNITED KINGDOM IN TIME-SCALES  
OF BETWEEN 1 AND 6 HOURS

Introduction

This *Climatological Memorandum* investigates the rates at which air temperature can change on time-scales between 1 and 6 hours in the United Kingdom.

Eight stations, for which hourly values of air temperature are available over the 15 years 1961–75, were selected to give a broad coverage of the country: London/Heathrow Airport, Manchester Airport (Ringway), Cardiff/Wales Airport (Rhoose), Plymouth/Mount Batten, Birmingham Airport (Elmdon), Boscombe Down, Wilts., Leeming, N. Yorks., and Edinburgh Airport (Turnhouse). Temperatures for Dishforth for 1961 to September 1965 have been added to the Leeming data to provide a full 15 years of record.

The differences in temperature over 1 hour (i.e. from 1 observational hour to the next), over 3 hours (i.e. 00–03 hours, 01–04 hours, 02–05 hours, etc.) and over 6 hours (00–06 hours, 01–07 hours etc.) were calculated by computer and the percentage frequencies of these changes in 1 °C ranges of temperature were compiled for each station. The tables presented here show the distribution of such changes. A negative value indicates a fall in temperature, a positive value a rise in temperature. The times quoted are the hours at which the periods in question end.

Tables

1. *Changes in temperature over one hour*

Table 1.1 shows the percentage frequency of hourly changes in temperature at each of the eight stations. The distributions are very similar in all cases, being examples of leptokurtosis, that is to say there is an excess number of observations in the central area of the distribution and in the tail compared with what would be expected from a normal distribution. The standard deviations vary from 0.79 °C at Plymouth to 0.98 °C at Birmingham and Boscombe Down. Figure 1 shows the plotted frequency curve for Birmingham data with the normal curve for the same mean and standard deviation superimposed.

The two temperature ranges  $-1.0$  °C to  $-0.1$  °C and  $0.0$  °C to  $0.9$  °C account for the vast majority of hourly changes, nearly 80 per cent of all occasions. In general, the differences in temperature over one hour are less than 7 °C though larger changes have been recorded.

Tables 1.2(a) and (b) give the percentage frequencies of temperature changes equalling or exceeding 3.0 °C according to the time of day. The value of 3 °C was chosen as being the closest whole number approximation to 1 per cent of the number of occurrences at all stations (1315 occurrences). In fact as can be seen Birmingham has 1493 such occasions and Manchester only 407.

As might be expected the greatest frequency of rises in temperature of 3 °C is greatest during the morning and falls off during the afternoon and evening. More than 25 per cent of the rises in temperature at London, Plymouth and Boscombe Down occurred in the hour ended at 10 GMT. The falls in temperature of 3 °C are more widely distributed, though reaching a maximum in the late afternoon and evening.

Table 1.3 gives the distribution of rises and falls in temperature equalling or exceeding 3.0 °C during each month.

Rises in temperature of 3.0 °C or more are most frequent in the spring and autumn and least frequent in January and December. The falls in temperature are most frequent in the summer months, although at Birmingham the highest frequency occurred in September.

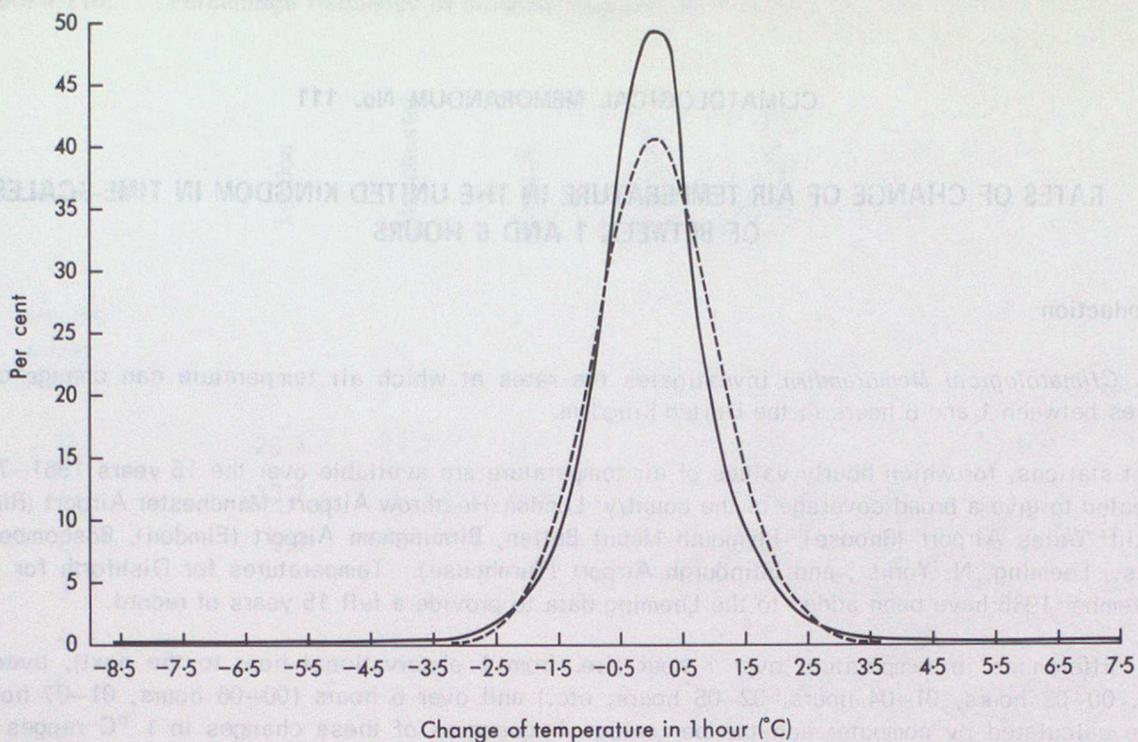


Figure 1. Distribution of 1-hourly changes in temperature at Birmingham Airport (Elmdon) for the period 1961-75  
The pecked curve shows the normal distribution; standard deviation 0.98, number of observations 131 471

Table 1.4 (a) is a combined frequency of the number of occasions of rises of  $3^{\circ}\text{C}$  or more as a function of the time of day in four separate months (December, March, June and September). Table 1.4 (b) gives similar information for falls of  $3^{\circ}\text{C}$  or more. This presentation shows that the most frequent time for large rises in temperature is about 3 to 4 hours after sunrise. There is also some evidence of a maximum in the frequency of large falls in temperature occurring around sunset but this is not so marked as the relationship between rises of temperature and sunrise.

Table 1.5 gives the frequencies of rises and falls of temperature of  $5.0^{\circ}\text{C}$  or more in a similar manner to Tables 1.2 and 1.3.

Rises of  $5.0^{\circ}\text{C}$  or more are most likely to occur before noon although isolated cases have occurred in the late evening. Most stations seem to have their greatest frequency in the autumn although Plymouth has most occasions during the winter months.

The occurrences of falls in this temperature category, like those greater than  $3^{\circ}\text{C}$ , are even more scattered both in the hours and the months, but the most likely time of occurrence seems to be between 15 and 17 GMT and between March and August.

Table 1.6 gives the absolute extreme temperature changes over 1 hour at each station for the period 1961-75, together with the weather conditions at the time. The time of occurrence of the extremes is close to the peak frequency of large changes except for the extreme temperature fall at Boscombe Down which occurred at 09 GMT and the extreme temperature rise at Edinburgh which occurred at 16 GMT.

The weather associated with these extreme changes in temperature falls into three categories:

- (a) In slack pressure gradients where a fall or rise in temperature occurs before or after cold radiation nights. The majority of cases from the eight stations come within this category.
- (b) The passage of a front and/or a wind change. Cardiff and Boscombe Down were the only stations where a front caused an extreme change in temperature. The coastal stations, especially Plymouth, had large temperature changes because of a change of wind direction from land to sea and vice versa. The phenomenal rise of temperature at Edinburgh occurred on a day with a weak south-

westerly airstream. Local easterly winds during the day brought fog from the North Sea into Edinburgh, but by 15 GMT the wind had increased and by 16 GMT it shifted to southerly replacing the sea fog with heated inland air; there was probably also a föhn effect in the lee of the Pentland Hills.

- (c) A temporary change due to squalls or thunderstorms. Both the extreme rise and extreme fall of temperature at London were caused by squalls, as were the extreme falls at Manchester and Leeming.

## 2. Changes in temperature over 3-hourly intervals

Similar analyses to those described for temperature changes over 1 hour were made for temperature changes over 3-hourly intervals. Each hourly temperature was related to the observation 3 hours previously so that if, for example, there was a steady rise in temperature from 06 GMT to 14 GMT this would count as 6 occasions with a positive change because of the overlapping of the 3-hourly periods. Figure 2 shows the frequency curve for Plymouth with the normal distribution curve superimposed.

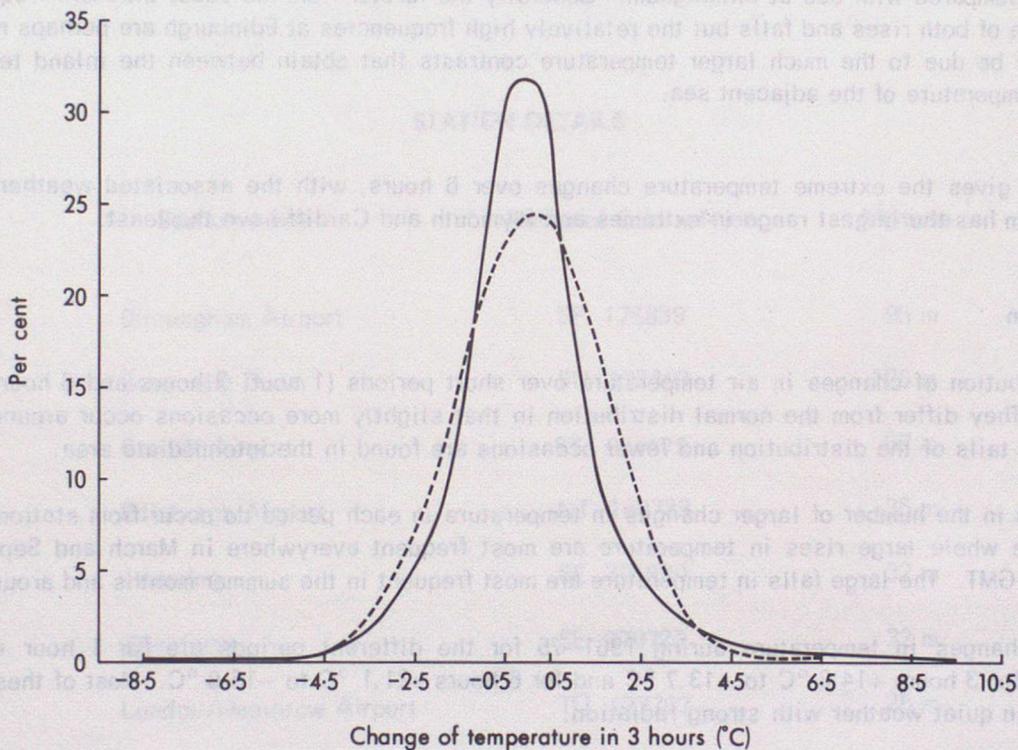


Figure 2. Distribution of 3-hourly changes in temperature at Plymouth/Mount Batten for the period 1961-75  
The pecked curve shows the normal distribution; standard deviation 1.62, number of observations 131 469

Table 2.1 gives the frequency of 3-hourly changes in temperature. The forms of distribution are similar to those of the 1-hourly changes.

Tables 2.2 to 2.4 give the diurnal and monthly frequencies of 3-hourly changes equal to or exceeding 6.0 °C (again generally about 1 per cent of all occasions) and 9.0 °C.

Table 2.5 lists the extreme values of temperature change over 3 hours for the period 1961-75 together with a brief description of the associated weather. At Manchester, Cardiff and Plymouth they range from about -9.0 °C to 11.0 °C; London has a slightly larger range and at Birmingham, Leeming, Boscombe Down and Edinburgh the range is from about -13.0 °C to 14.0 °C. The weather in the majority of cases was quiet, the extremes occurring before or after a cold radiation night. Only in two cases were the falls due to a passage of a cold front.

### 3. Changes in temperature over 6-hourly intervals

In a similar way to the tables for 3-hourly intervals frequency distributions have been compiled for 6-hourly changes in temperature.

Table 3.1 gives the distribution of 6-hourly changes in temperature at each of the eight stations.

Tables 3.2 and 3.3 give the diurnal and monthly frequencies of changes of 10 °C or more over 6-hourly intervals. These again constitute about 1 per cent of all occasions. No frequencies were produced for any larger temperature change in this time interval.

It will be seen that the variation across the country of the total number of occurrences of large temperature changes is much more marked than is the case with the changes in shorter time intervals. The ratio between the number of rises of 10 °C at Birmingham, the station with most occurrences (1515), and the number of rises at Cardiff, the station with least occurrences (196), is over 7.5. The variation in the frequency of falls of 10 °C in temperature is even more marked. There were only 3 occasions at Plymouth compared with 396 at Birmingham. Generally the farther from the coast the more frequent is the occurrence of both rises and falls but the relatively high frequencies at Edinburgh are perhaps noteworthy; these may be due to the much larger temperature contrasts that obtain between the inland temperatures and the temperature of the adjacent sea.

Table 3.4 gives the extreme temperature changes over 6 hours, with the associated weather situation. Birmingham has the largest range in extremes and Plymouth and Cardiff have the least.

### Conclusion

The distribution of changes in air temperature over short periods (1 hour, 3 hours and 6 hours) are very similar. They differ from the normal distribution in that slightly more occasions occur around the mean and at the tails of the distribution and fewer occasions are found in the intermediate area.

Variations in the number of larger changes in temperature in each period do occur from station to station but on the whole large rises in temperature are most frequent everywhere in March and September and around 10 GMT. The large falls in temperature are most frequent in the summer months and around 19 GMT.

Extreme changes in temperature during 1961–75 for the different periods are for 1 hour +12.4 °C to -8.7 °C; for 3 hours +15.1 °C to -13.7 °C and for 6 hours +21.1 °C to -15.8 °C. Most of these extremes occurred in quiet weather with strong radiation.

It is hoped that the statistics contained in this memorandum will be of interest to engineers who are concerned with heating, air-conditioning and refrigeration; and also to those who are faced with the problem of assessing the effect of rapid rises or falls of temperature on the storage or transportation of perishable goods, foodstuffs and chemicals.

**TABLES**

**STATION DETAILS**

Station name	National Grid reference	Altitude
Birmingham Airport	SP 176839	96 m
Boscombe Down	SU 172403	126 m
Cardiff Airport	ST 064679	67 m
Edinburgh Airport	NT 159739	35 m
Leeming	SE 306890	32 m
Dishforth	SE 379723	32 m
London/Heathrow Airport	TQ 077767	25 m
Manchester Airport	SJ 821849	75 m
Plymouth/Mount Batten	SX 492529	27 m

Table 1.1 Percentage frequency of hourly changes in temperature, 1961-75

Temperature difference* (°C)	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
-9.0 to -8.1					0.00 <sup>+</sup>		0.00 <sup>+</sup>	0.00 <sup>+</sup>
-8.0 to -7.1	0.00 <sup>+</sup>				0.00 <sup>+</sup>			0.00 <sup>+</sup>
-7.0 to -6.1	0.00 <sup>+</sup>							
-6.0 to -5.1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
-5.0 to -4.1	0.03	0.03	0.03	0.02	0.06	0.03	0.03	0.05
-4.0 to -3.1	0.11	0.08	0.11	0.07	0.31	0.21	0.16	0.22
-3.0 to -2.1	0.69	0.55	0.87	0.41	1.6	1.3	1.1	1.4
-2.0 to -1.1	7.5	5.9	6.4	4.7	8.0	8.4	7.7	7.8
-1.0 to -0.1	41.5	41.6	39.1	42.2	37.4	38.1	39.2	38.2
0.0 to 0.9	38.1	42.1	43.5	44.8	40.4	39.0	40.2	40.8
1.0 to 1.9	9.6	8.2	8.2	6.3	9.6	9.9	8.9	8.9
2.0 to 2.9	2.1	1.3	1.5	1.2	2.0	2.5	2.1	2.0
3.0 to 3.9	0.27	0.15	0.22	0.24	0.51	0.44	0.48	0.51
4.0 to 4.9	0.03	0.02	0.03	0.05	0.13	0.07	0.08	0.10
5.0 to 5.9	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.02	0.03	0.01	0.02	0.02
6.0 to 6.9				0.01	0.01	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.01
7.0 to 7.9				0.00 <sup>+</sup>	0.00 <sup>+</sup>			0.00 <sup>+</sup>
8.0 to 8.9				0.00 <sup>+</sup>			0.00 <sup>+</sup>	
9.0 to 9.9				0.00 <sup>+</sup>				0.00 <sup>+</sup>
10.0 to 10.9								
11.0 to 11.9								
12.0 to 12.9								0.00 <sup>+</sup>

\* A negative value indicates a fall in temperature; a positive value a rise in temperature.

0.00<sup>+</sup> is less than 0.005 per cent but greater than zero.

Table 1.2 (a) Percentage frequency of 1-hourly temperature rises of 3.0 °C or more, 1961–75

Hour ended (GMT)	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
0			0.9	1.2	0.5	0.1	1.1	0.6
1		0.9	1.2	1.4	0.5		0.5	0.6
2	0.2		0.6	1.6	0.7		0.9	0.7
3	0.2		1.2	1.6	0.6	0.3	0.4	1.2
4			0.6	2.8	1.0	0.6	0.8	1.2
5		0.4	2.1	2.8	1.4		1.1	1.2
6			4.5	2.6	8.0	2.7	3.7	3.0
7	0.7	4.4	17.6	5.8	22.5	6.5	9.1	9.8
8	10.4	17.6	20.9	14.0	14.5	19.5	14.8	16.2
9	19.9	19.0	16.4	14.9	14.9	18.6	12.6	16.2
10	25.9	20.7	15.5	25.6	17.3	25.1	20.5	15.2
11	17.6	17.2	6.2	10.0	7.9	11.6	13.3	10.5
12	10.9	8.8	4.8	5.4	4.1	7.1	9.5	7.6
13	5.3	4.4	2.7	4.2	2.2	3.4	6.6	5.2
14	2.7	4.0	1.5	1.2	1.0	2.4	1.6	3.4
15	2.7	1.2	0.3	1.2	1.1	1.0	1.2	1.9
16	1.0	0.4	0.6	0.7	0.2	0.5	0.4	1.9
17	0.5		0.3	0.9	0.1		0.4	0.7
18	0.2		0.6	0.2	0.2	0.1	0.4	0.6
19		0.4		0.2	0.1			0.5
20	0.2		0.3		0.3		0.4	0.3
21				0.3	0.3	0.1		0.6
22		0.4	0.6	0.7	0.6	0.1	0.4	0.3
23			0.6	0.3	0.3	0.3	0.3	0.6
No. of occasions	411	227	335	429	880	674	756	853

Table 1.2(b) Percentage frequency of 1-hourly temperature falls of 3.0 °C or more, 1961–75

Hour ended (GMT)	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
0		0.6	4.5	1.3	3.4	1.2	2.2	1.6
1	0.5	2.8	1.4	2.0	4.2	1.4	1.0	1.9
2	0.5	2.2	1.8	4.0	4.6	2.4	1.0	1.2
3	1.8	1.1	2.7	2.0	1.6	1.9	1.0	1.2
4	0.9	1.1	4.5	0.7	1.3	0.7	1.3	0.5
5	0.9	1.1	1.8	0.7	1.3	1.9	1.9	1.6
6		1.7	0.9	2.0	1.6	1.0		0.2
7	0.5	1.7	1.3	2.0	0.2	1.2	1.3	
8	0.9	1.1	0.9	3.3	1.0	0.5	0.3	
9	0.9	2.2	0.9		0.7	0.5		0.5
10	2.3	1.7	0.9	2.7	0.2	0.7	0.6	0.5
11	2.8	2.2	1.4	2.7	0.3	1.4	1.6	0.9
12	2.8	2.2	2.7	6.7	2.6	2.7	3.5	2.3
13	4.1	8.9	1.8	6.0	3.3	4.6	4.1	3.3
14	8.7	6.1	4.1	8.1	2.4	5.3	7.3	6.1
15	13.8	10.6	7.7	8.7	4.7	6.3	8.9	6.7
16	12.9	10.0	7.7	8.1	5.1	7.2	10.5	7.2
17	12.0	12.2	10.0	12.1	5.9	6.0	10.5	10.3
18	11.5	7.2	7.7	10.1	8.3	10.6	9.9	10.9
19	6.5	10.6	14.0	7.4	14.5	16.9	15.6	13.5
20	6.5	5.6	9.1	4.0	11.1	13.3	9.6	13.3
21	2.3	3.3	6.3	3.4	7.0	5.8	4.1	8.4
22	4.6	3.3	3.6	2.0	10.3	3.6	2.5	4.9
23	2.3	0.5	2.3		4.4	2.9	1.3	3.0
No. of Occasions	217	180	221	149	613	415	314	429

**Table 1.3(a) Percentage frequency of 1-hourly temperature rises of 3.0 °C or more in each month, 1961-75**

	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
January	2.2	3.1	0.9	6.1	1.5	0.5	3.8	4.2
February	2.2	4.0	3.6	5.1	2.7	2.2	4.5	6.3
March	21.2	12.8	14.3	10.3	11.5	13.6	8.7	8.3
April	10.0	15.4	10.4	7.5	8.5	10.7	7.8	11.0
May	10.0	11.5	10.7	5.1	11.1	9.9	11.0	9.7
June	5.6	7.5	7.8	7.2	10.3	11.1	11.9	9.4
July	5.3	2.6	6.3	6.7	8.9	8.2	7.7	7.9
August	10.2	7.9	8.1	7.9	12.7	11.1	9.8	9.6
September	15.1	15.0	13.4	12.1	13.2	15.6	12.4	11.4
October	14.1	9.2	10.7	11.2	10.8	11.7	10.5	12.9
November	2.9	4.8	9.0	12.6	5.4	3.6	6.7	5.9
December	1.2	6.2	4.8	8.2	3.4	1.8	5.2	3.4
No. of occasions	411	227	335	429	880	674	756	853

**Table 1.3(b) Percentage frequency of 1-hourly temperature falls of 3.0 °C or more in each month, 1961-75**

	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
January	1.4	5.0	5.4	6.7	2.9	2.7	4.8	3.3
February	3.7	4.4	3.6	4.7	3.1	2.7	6.4	4.7
March	8.3	5.6	11.7	6.0	9.0	10.8	6.7	7.5
April	12.9	8.9	10.0	9.4	10.1	8.4	11.8	10.9
May	12.9	16.1	13.6	12.1	10.1	11.3	16.9	13.3
June	17.5	20.0	9.5	16.8	12.6	15.2	9.6	10.3
July	10.6	6.1	10.8	14.8	8.3	9.9	10.5	11.6
August	12.0	13.3	11.3	6.7	12.4	12.5	12.1	12.1
September	7.4	6.7	10.9	6.0	12.7	11.1	8.9	10.3
October	4.1	3.9	5.0	4.7	9.8	7.0	6.4	9.3
November	5.5	4.4	5.9	6.7	4.4	4.3	2.2	4.2
December	3.7	5.6	2.3	5.4	4.6	4.1	3.8	2.5
No. of occasions	217	180	221	149	613	415	314	429

Table 1.4 (a) Number of occasions with hourly temperature rises of 3.0 °C or more, 1961-75, grouped according to season and time

	Time (GMT)																								
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
<b>London (Heathrow)</b>																									
Dec.							/			2			1												
Mar.				/				1	19	31	18	10	7												
June			/				1	4	9	2	1	1	2	1	2										
Sept.					/			3	14	24	18	4	1	1											
<b>Manchester (Ringway)</b>																									
Dec.	1							1/			6	3	1							1					1
Mar.				/				1	9	12	3	3		1											
June			/				5	5	2	1			2												
Sept.						1/			7	10	7	5	4												
<b>Cardiff (Rhoose)</b>																									
Dec.	1					1				2	5	1	1							1					1
Mar.				/				9	18	12	2	2	3	3											
June			/			1	5	11	1	1		3	1												
Sept.	1	1				2	1/	2	16	12	6	1	3	1	2										
<b>Plymouth (Mount Batten)</b>																									
Dec.	2	1	3	1	4	1	1	2	2/	3	4	3	2	3	1										1
Mar.			2	1	1		1/	2	1	12	19	3	1	3											
June				/			2	3	7	4	4	2	1	3											1
Sept.				2		4	/	1	4	22	17	1													

Table 1.4(a) — (continued)

	Time (GMT)																								
	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
Number of occasions																									
<b>Birmingham (Elmdon)</b>																									
Dec.	3	2				1	1	/		8	8	2	1			1									
Mar.			1	2	2	2	/	2	10	30	29	10	5	3	1										2
June			/			1	42	29	3	3	6	1	4	1	2		1								
Sept.	1	1	1	2	2	1	/	8	37	31	21	7	2	2											
<b>Boscombe Down</b>																									
Dec.							1	1	/	1	1	3	3	1											1
Mar.				1			1	/	4	19	35	14	3	9	5	1									
June			/				4	18	26	8	5	2	4	1	2	1		1							
Sept.			1	1	1		1	/	11	30	39	14	6	1	2										
<b>Leeming (Hudders)</b>																									
Dec.	4		3			1	1	1	/	2	1	8	6	1	3	1		2	1			1			1
Mar.					1	2	1	1	2	9	15	11	13	5	1										
June			/				9	16	25	14	16	6		4	2										
Sept.							2	1	17	25	28	12	5	1	1										
<b>Edinburgh (Turnhouse)</b>																									
Dec.	1			2	1	1	1	1	2	2	4	8	1	1				1	2			2		1	1
Mar.	1	1		1			1	2	4	20	23	6	3	3	1	1	3								1
June			/			3	6	29	12	3	5	3	3	5	4	2									
Sept.			2	3	3	1	1	26	37	14	10	3	1	1	2	1		1	18	1		1	1	1	1

/ denotes approximate time of sunrise

Table 1.4 (b) Number of occasions with hourly temperature falls of 3.0 °C or more, 1961-75 grouped according to season and time

		Time (GMT)																							
		00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		Number of occasions																							
<b>London (Heathrow)</b>																									
Dec.			1					1			1					1	/	1	1	1					1
Mar.					1			1		1			1		3	3			5/	2	2				
June		1						1		1			1		2	1	8	3	5	7	2	2/		3	2
Sept.													2		2	2	2	2	2	2/	2		1		
<b>Manchester (Ringway)</b>																									
Dec.							3	1						1		1	/	1	1	1				1	
Mar.														1		1	1	1	4	1/	1			1	
June		1				1							1		4	2	5	2	4	2	6	3/	3	2	
Sept.				1							1			1		2	2	3	/						
<b>Cardiff (Rhoose)</b>																									
Dec.								1		1				1			/								
Mar.					1		2			1			2		1		4	2	2/	5	1	1	1	1	
June		2													3	1	1	1	1	5	2	1/	3	1	
Sept.				1		3	3	1					2		2		2	1	/		4	3	3	2	1
<b>Plymouth (Mount Batten)</b>																									
Dec.		1		1				2		1			1		1		/								
Mar.				1						1			1		1			1	1/	1	1	3			
June		1		1						2		1	3		2	1	3	2	2	2	4	1/			
Sept.											1		1		1		1	1	2/	2	2	1/	3	1	

/ denotes approximate time of sunset

Table 1.4 (b) - (continued)

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23
<b>Birmingham (Elmdon)</b>																								
Dec.	2		3	1	1	1	1	5	1		1	1	1	1	1	1	/	5	2	2	1	1	2	
Mar.	3	3	2	1	2	1	1				2	2	2	4	1	6	6	4	3/	12	9	9	5	1
June	5	9	7	1	2			1			2	4	4	2	2	5	6	4	2	8/	2/	9	8	5
Sept.	2		2	3	1	1	1				2	2	2	2	2	2	3	3	8/	29	11	6	1	5
<b>Boscombe Down</b>																								
Dec.	1	1		2	1	1	2	1	1	2	1	1	1	2	1	2	/3	4	2	2	1	1	1	1
Mar.			2	2	1	1	1				1	1	2	1	1	3	2	1	10/	11	11	2	2	1
June		2	2	2	1	1	1	1			1	1	5	1	3	2	2	1	4	7	15/	8	6	3
Sept.	1	1	1	1	1	1	1	1			3	3	3	2	2	2	3	1	5/	16	2	2	2	1
<b>Leeming</b>																								
Dec.	3	2		2	1	1	2	2			2	1	1	1	2	3	/1	3	1	5	1	1	1	1
Mar.			2	2	1	1	1	1			1	1	1	1	2	3	3	4	1/	5	4/	2	3	1
June	1		1	1	1	1	1				1	1	1	1	1	4	1	4	3	3	4/	2	3	
Sept.											1	1	1	3	2	3	3	3	4/	11	2	2		
<b>Edinburgh (Turnhouse)</b>																								
Dec.	1		1	1	2	1	1	1	1	1		1	1	1	1	2	/	2	1	1	2	2	2	2
Mar.		2	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	2	3/	8	7	2	1	1
June		1	1	1	1	1	1	1	1	1	1	2	2	3	1	7	7	1	5	6	6/	6	4	1
Sept.			1	1	1	1	1	1	1	1	1	1	1	1	4	5	2	4	2/	12	7	1	2	2

/ denotes approximate time of sunset

Table 1.5 Number of occasions with 1-hourly temperature change 5.0 °C or more, 1961-75

Hour ended (GMT)	(a) Rises								(b) Falls							
	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
0							1	1					1			
1				2			3						2			1
2							1						2	1		
3			1	2					1	1			1			
4				5									2		1	
5				3	1						1				1	
6				5	1								1			
7			2	2	12		1	1		1	1					1
8		1		5	13	1	4	4	1							
9				3	8	1		9	1						1	
10	1	3		7	8	5	1	4	1	1						
11	2			5	5		6	4	1	1		1				
12	1				2		2	2	1			1				1
13				1			2	1		3		2	5	1		2
14										1			1	4	2	
15				1				3	4	2	2	3	3	4	5	1
16							1		5	1	1	1	2	2	2	3
17									1			6	3	1	4	3
18									1		2		1	1	1	1
19												1	3	1	2	2
20							1			1		2	1	1		
21						1		1					1	1		3
22				1						1		1	1	2		
23							1						2			
Total	4	4	3	42	50	8	23	36	17	13	8	18	32	20	20	16
Month																
Jan.				6	2		4		1	1	1		1	1		1
Feb.		1		4			2	2	1	1				1	1	
Mar.	2	1		1	6	5		2	1	1			4	1	2	1
Apr.	1	1		1	8		2	4	6		1	3	3	3	3	2
May					5		2	3	1	2	1	4	8	3	3	5
June				2			1		2	3	2	5	3	2	2	2
July								4	2	1		5	2	3	3	2
Aug.				2	3		2	4		2	2	1	1	1	3	3
Sept.	1	1	2	1	12		2	4			1		3	2	1	
Oct.				3	11		5	11		1						
Nov.				15		1	1		1				3	3	1	
Dec.			1	7	3		2	2	2	1			3		1	
Total	4	4	3	42	50	8	23	36	17	13	8	18	32	20	20	16

**Table 1.6 Extreme hourly changes in temperature, 1961–75**

	Date	From Time GMT	Temp. °C	To Time GMT	Temp °C	Temperature difference °C	Remarks
<b>London</b>							
Rise	13/4/69	11	2.8	12	8.4	5.6	NW'ly airstream; showers of rain and hail. A fall followed by a rise in a squall. 10 GMT: 8.0 °C.
Fall	11/6/70	17	25.9	18	18.6	-7.3	Slack gradient. Squall and heavy thunderstorm.
<b>Manchester</b>							
Rise	29/3/65	08	7.8	09	13.5	5.7	Ridge from SE. Heating after a cold, clear night. Min. temp. 3 °C.
Fall	3/7/63	15	19.5	16	13.2	-6.3	07 GMT: 3.6 °C. Low southern Ireland, slack gradient. Showers and thunderstorm.
<b>Cardiff</b>							
Rise	26/9/61	06	6.4	07	12.2	5.8	Ridge over southern England and Wales. Heating after cold, clear night.
Fall	29/8/61	15	27.2	16	20.5	-6.7	Cold front passing station.
<b>Plymouth</b>							
Rise	5/1/61	09	-0.8	10	8.4	9.2	Ridge ahead of warm front moving in from Atlantic. Min. temp. -2 °C.
Fall	10/6/63	16	23.8	17	16.9	-6.9	Wind change from 040/03 to 240/15. Col, 1/8 Cb. Wind change 070/10 to 210/09.
<b>Birmingham</b>							
Rise	24/1/63	07	-14.1	08	-6.3	7.8	Freezing fog lifting (with wind increase from calm to 5 knots) to low stratus
Fall	29/3/65	19	18.3	20	9.6	-8.7	Ridge from SE. Light wind falling to calm; small amounts of medium cloud. Further fall to 21 GMT 9.2 °C, 22 GMT 5.4 °C.
<b>Boscombe Down</b>							
Rise	16/3/72	08	2.9	08	9.5	6.6	Ridge across country. Rise after a clear night.
Fall	2/4/68	08	7.5	09	0.9	-6.6	Cold front moving from NW, with rain and snow.
<b>Dishforth/Leeming</b>							
Rise	21/12/63	10	-6.5	11	1.7	8.2	High to SW. Heating after cold, clear night.
Fall	11/8/69	15	26.2	16	18.1	-8.1	Col. Thunderstorms.
<b>Edinburgh</b>							
Rise	8/4/69	15	7.0	16	19.4	12.4	Slack SW'ly gradient. Change of wind from 030 ° to 190 °
Fall	20/7/72	17	25.5	18	17.4	-8.1	Easterly gradient wind change from 280 ° to 040 °.

Table 2.1 Percentage frequency of 3-hourly changes in temperature, 1961-75

Temperature difference* (°C)	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
-14.0 to -13.1								0.00 <sup>+</sup>
-13.0 to -12.1					0.00 <sup>+</sup>			
-12.0 to -11.1								0.00 <sup>+</sup>
-11.0 to -10.1					0.01	0.00 <sup>+</sup>		0.00 <sup>+</sup>
-10.0 to -9.1	0.00 <sup>+</sup>				0.01	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.00 <sup>+</sup>
-9.0 to -8.1	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.03	0.01	0.01	0.01
-8.0 to -7.1	0.01	0.01	0.01	0.01	0.08	0.05	0.05	0.04
-7.0 to -6.1	0.06	0.03	0.07	0.02	0.39	0.22	0.18	0.22
-6.0 to -5.1	0.31	0.19	0.27	0.07	0.81	0.76	0.58	0.59
-5.0 to -4.1	1.2	0.76	1.0	0.39	1.8	1.9	1.5	1.5
-4.0 to -3.1	3.9	2.5	2.5	1.7	3.7	4.0	3.3	3.3
-3.0 to -2.1	8.7	6.8	6.0	5.3	7.3	7.7	7.2	6.8
-2.0 to -1.1	15.1	15.2	13.4	13.7	13.5	13.9	13.8	13.2
-1.0 to -0.1	24.0	26.8	27.7	30.8	23.7	23.6	25.8	25.6
0.0 to 0.9	20.1	23.0	25.6	28.0	21.5	20.9	21.9	23.3
1.0 to 1.9	11.1	12.2	11.6	10.6	12.1	11.1	11.3	11.7
2.0 to 2.9	6.7	6.6	6.0	4.7	7.1	6.7	6.5	6.5
3.0 to 3.9	4.0	3.2	3.1	2.3	3.8	4.0	3.5	3.5
4.0 to 4.9	2.4	1.5	1.6	1.2	2.0	2.4	2.0	1.8
5.0 to 5.9	1.3	0.76	0.74	0.69	0.99	1.4	1.1	0.95
6.0 to 6.9	0.67	0.32	0.28	0.31	0.56	0.77	0.66	0.50
7.0 to 7.9	0.27	0.11	0.10	0.15	0.31	0.34	0.36	0.29
8.0 to 8.9	0.09	0.03	0.02	0.06	0.22	0.15	0.15	0.13
9.0 to 9.9	0.04	0.01	0.00 <sup>+</sup>	0.01	0.11	0.04	0.05	0.06
10.0 to 10.9	0.01	0.00 <sup>+</sup>		0.00 <sup>+</sup>	0.05	0.02	0.02	0.02
11.0 to 11.9	0.01	0.00 <sup>+</sup>			0.02	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.01
12.0 to 12.9		0.00 <sup>+</sup>			0.01	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.00 <sup>+</sup>
13.0 to 13.9	0.00 <sup>+</sup>				0.00 <sup>+</sup>			
14.0 to 14.9	0.00 <sup>+</sup>				0.00 <sup>+</sup>	0.00 <sup>+</sup>		0.00 <sup>+</sup>
15.0 to 15.9							0.00 <sup>+</sup>	

\* A negative value indicates a fall in temperature; a positive value a rise in temperature.

0.00<sup>+</sup> is less than 0.005 per cent but greater than zero.

Table 2.2(a) Percentage Frequency of 3-hourly temperature rises of 6.0°C or more, 1961-75

Hour ended (GMT)	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
0		0.1		0.4		0.1	0.1	0.3
1		0.1		0.3			0.1	0.2
2				0.8			0.2	
3	0.1			0.6			0.1	
4		0.2		1.3				0.3
5			0.2	1.7		0.1	0.1	0.3
6		0.2		2.0	0.3	0.1	0.1	2.2
7	0.1	5.4	1.3	8.7	5.1	0.3	0.9	12.5
8	4.3	19.0	14.9	17.7	16.2	9.4	9.4	21.6
9	16.0	30.1	27.0	24.6	22.1	20.7	18.3	21.7
10	27.8	23.5	26.6	21.4	20.6	28.4	21.0	19.2
11	23.5	12.5	17.7	13.8	17.5	22.0	19.9	12.5
12	16.6	6.9	9.1	5.4	12.1	13.1	15.4	6.3
13	8.0	1.3	2.1	1.0	4.7	4.6	8.8	1.6
14	2.9	0.5	0.7	0.1	1.1	1.0	3.9	0.3
15	0.6	0.2	0.2		0.1	0.3	1.0	0.2
16							0.1	0.3
17	0.1						0.1	0.2
18				0.1	0.1			0.1
19					0.1		0.1	0.1
20							0.1	
21							0.1	
22			0.2				0.1	0.1
23				0.1			0.1	
No. of occasions	1433	625	537	711	1675	1792	1643	1341

Table 2.2(b) Percentage frequency of 3-hourly temperature falls of 6.0 °C or more, 1961-75

Hour ended (GMT)	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
0	3.6		1.4	2.1	5.1	0.5	1.3	1.9
1	1.8		0.7		2.9	0.2	0.3	2.1
2		2.8			1.5		0.3	0.5
3		1.4			1.0	0.7	0.3	0.5
4		1.4	0.7		0.6	0.5		0.2
5		2.8	0.7		0.3		0.8	0.2
6			0.7		0.3		0.3	
7		1.4	0.7					
8	0.9	1.4	0.7		0.2		0.2	
9	0.9	4.2	0.7				0.2	
10	1.8	4.2						
11	0.9	1.4		2.1				
12				2.1				
13	1.8			2.1				0.2
14				2.1		0.3		0.2
15	1.8		0.7	2.2		0.5	0.8	0.2
16	2.7	1.4	2.1	6.4	0.3	1.0	1.8	0.5
17	2.7	5.5	6.9	14.9	1.1	1.9	3.1	2.1
18	8.0	8.3	6.2	14.9	2.7	3.7	4.2	7.9
19	12.5	12.5	15.3	17.0	11.7	16.0	11.5	14.8
20	14.3	15.3	23.6	12.8	21.1	28.4	23.6	20.1
21	18.7	11.1	22.9	12.8	21.9	32.5	26.2	19.9
22	18.7	18.0	11.8	8.5	20.1	12.1	20.4	20.1
23	8.9	6.9	4.2		9.2	1.7	4.7	8.6
No. of occasions	112	72	144	47	622	412	382	432

**Table 2.3 (a)** Percentage frequency of monthly values of 3-hourly temperature rises of 6.0 °C or more, 1961–75

	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
January	0.7	1.0	1.1	3.2	1.2	0.3	1.4	2.0
February	1.8	3.2	2.8	4.1	2.0	1.9	3.2	6.0
March	13.8	13.1	14.5	11.0	10.0	11.6	8.0	8.1
April	10.6	13.7	9.5	7.6	9.3	10.0	9.4	12.2
May	11.4	11.5	9.5	7.0	12.5	10.0	12.8	9.7
June	12.8	13.9	9.9	6.6	13.6	11.8	14.7	10.1
July	7.5	5.4	10.2	5.6	9.4	10.3	8.0	8.5
August	12.6	9.9	11.5	8.7	13.1	13.2	13.9	11.7
September	15.4	14.4	15.1	15.4	14.2	18.1	14.1	12.7
October	10.7	9.4	9.3	12.9	10.0	9.1	9.9	11.9
November	2.1	2.6	4.7	12.1	3.0	3.1	3.5	5.2
December	0.6	1.9	1.9	5.8	1.7	0.6	1.1	1.9
No. of occasions	1433	625	537	711	1675	1792	1643	1341

**Table 2.3 (b)** Percentage frequency of monthly values of 3-hourly temperature falls of 6.0 °C or more, 1961–75

	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
January		1.4			0.5	0.5	1.3	2.8
February	0.9	11.1	0.7		0.8	0.7	3.4	4.9
March	13.4	8.3	6.3	6.4	8.5	12.6	6.5	7.2
April	4.5	6.9	11.8	8.5	6.3	6.3	7.9	10.4
May	15.2	13.9	11.8	14.9	8.8	11.2	16.8	10.6
June	25.9	25.0	20.8	31.9	6.4	16.7	18.6	14.1
July	7.1	6.9	13.2	23.4	9.3	14.6	14.4	13.2
August	17.0	11.1	15.3	10.7	14.5	17.0	13.9	11.3
September	4.5	2.8	12.5	2.1	17.7	11.7	9.9	11.1
October	4.4	5.6	5.5		13.3	6.3	4.7	9.7
November	6.2	4.2	2.1	2.1	2.6	2.4	1.8	3.5
December	0.9	2.8			1.3		0.8	1.2
No. of occasions	112	72	144	47	622	412	382	432

Table 2.4 Number of occasions with 3-hourly temperature change of 9.0 °C or more, 1961-75

3 hours ended (GMT)	(a) Rises								(b) Falls							
	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
0																
1				1												
2								1					1			
3							1						1			
4				1												
5				1												
6				1									2			
7					3											
8					32		5	4								
9	2	1		1	64	5	13	17		1						
10	13	9	2	6	69	24	26	39								
11	29	8	1	9	52	28	25	37	1					1		
12	19	3		4	26	21	21	16								
13	13	1			5	5	11	5								
14	2				1	2	3	1								
15	1															
16								1								
17								1	1							
18																1
19													2			2
20									1				8			1
21													6	2		3
22													2	1		2
23																1
Total	79	22	3	24	252	85	105	123	3	0	1	0	22	2	2	10
Month																
Jan.				3	2		1									
Feb.	2	2			1	1	2	11								
Mar.	37	5	2	5	43	26	8	11					4			
Apr.	2	7	1		21	6	10	19	1		1		2	1		1
May	4	1			32		9	8								
June	2				22	4	17	3	1				1	1		2
July	1				5	1	4	9								3
Aug.	2	1			30	11	10	16					2		1	2
Sept.	15	4		4	52	18	20	23					6			2
Oct.	14	1		4	40	17	18	21	1				5			
Nov.				4	3	1	3	1					2			
Dec.		1		4	1		3	1								
Total	79	22	3	24	252	85	105	123	3	0	1	0	22	2	2	10

Table 2.5 Extreme 3-hourly changes in temperature, 1961-75

	Date	From Time GMT	Temp. °C	To Time GMT	Temp. °C	Temperature difference °C	Remarks
<b>London</b>							
Rise	29/3/65	08	1.7	11	16.0	14.3	Ridge from SE. Heating after cold, clear night.
Fall	2/4/68	08	9.5	11	-0.3	-9.8	Cold front crossing station from NW.
<b>Manchester</b>							
Rise	29/3/65	07	3.6	10	16.0	12.4	Ridge from SE. Heating after cold, clear night.
Fall	14/6/69	16	23.9	19	15.6	-8.3	Col.
<b>Cardiff</b>							
Rise	8/3/69	08	-1.8	11	7.7	9.5	High pressure area. Heating after clear night.
Fall	2/4/68	06	7.5	09	-1.5	-9.0	Cold front crossing station from NW.
<b>Plymouth</b>							
Rise	29/12/64	01	-4.8	04	5.8	10.6	Ridge. Warm front approaching.
Fall	7/6/70	17	22.9	20	14.8	-8.1	Slack low pressure area.
<b>Birmingham</b>							
Rise	29/3/65	07	0.7	10	14.8	14.1	Ridge from SE. Heating after cold, clear night.
Fall	29/3/65	19	18.3	22	5.4	-12.9	Ridge from SE. Cold, clear night.
<b>Boscombe Down</b>							
Rise	29/3/65	07	-0.4	10	14.0	14.4	Ridge from SE. Heating after cold clear, night.
Fall	8/6/62	19	21.5	22	11.3	-10.2	High pressure area. Cold, clear night.
<b>Dishforth/Leeming</b>							
Rise	2/4/65	10	1.1	13	16.2	15.1	Ridge. Heating after cold, clear night.
Fall	14/8/73	17	26.2	20	16.6	-9.6	SE'ly gradient. Cold, clear night. Fog.
<b>Edinburgh</b>							
Rise	8/4/69	13	5.2	16	19.4	14.2	SW'ly gradient.
Fall	20/7/72	16	28.2	19	14.5	-13.7	Easterly gradient. Fog from North Sea.

Table 3.1 Percentage frequency of 6-hourly changes in temperature, 1961-75

Temperature difference* (°C)	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
-16.0 to -15.1					0.00 <sup>+</sup>			
-15.0 to -14.1					0.00 <sup>+</sup>		0.00 <sup>+</sup>	0.00 <sup>+</sup>
-14.0 to -13.1					0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.00 <sup>+</sup>
-13.0 to -12.1	0.00 <sup>+</sup>		0.00 <sup>+</sup>		0.02	0.00 <sup>+</sup>	0.01	0.01
-12.0 to -11.1	0.00 <sup>+</sup>		0.01		0.06	0.01	0.03	0.02
-11.0 to -10.1	0.02	0.01	0.02	0.00 <sup>+</sup>	0.19	0.06	0.12	0.07
-10.0 to -9.1	0.09	0.04	0.05	0.01	0.40	0.20	0.24	0.22
-9.0 to -8.1	0.38	0.15	0.15	0.03	0.71	0.60	0.50	0.44
-8.0 to -7.1	0.80	0.42	0.47	0.13	1.1	1.2	0.91	0.89
-7.0 to -6.1	1.8	0.92	1.0	0.52	1.7	2.0	1.5	1.5
-6.0 to -5.1	3.3	1.9	2.0	1.3	2.8	3.3	2.5	2.4
-5.0 to -4.1	5.1	3.7	3.2	2.8	4.1	4.7	4.1	3.9
-4.0 to -3.1	6.9	6.2	5.3	4.9	6.0	6.3	6.1	5.7
-3.0 to -2.1	9.1	9.6	8.3	8.3	8.4	8.6	8.7	8.2
-2.0 to -1.1	11.9	13.2	13.0	13.6	11.6	11.2	12.1	11.8
-1.0 to -0.1	14.2	16.7	18.5	20.9	14.7	14.4	16.0	16.7
0.0 to 0.9	12.4	14.3	16.7	19.3	13.2	12.7	13.9	14.9
1.0 to 1.9	9.1	10.5	10.6	10.6	9.8	9.2	9.6	10.2
2.0 to 2.9	6.8	7.7	7.2	6.5	7.5	6.8	7.1	7.3
3.0 to 3.9	5.3	5.3	4.8	3.9	5.7	5.2	5.2	5.2
4.0 to 4.9	3.9	3.6	3.2	2.7	3.9	4.0	3.6	3.7
5.0 to 5.9	2.9	2.2	2.1	1.7	2.7	2.9	2.5	2.5
6.0 to 6.9	2.1	1.5	1.5	1.2	1.7	2.1	1.7	1.6
7.0 to 7.9	1.4	0.93	1.0	0.81	1.2	1.6	1.2	1.0
8.0 to 8.9	1.1	0.57	0.53	0.43	0.81	1.2	0.86	0.67
9.0 to 9.9	0.68	0.35	0.24	0.24	0.59	0.77	0.63	0.44
10.0 to 10.9	0.43	0.18	0.09	0.09	0.41	0.47	0.38	0.38
11.0 to 11.9	0.23	0.08	0.04	0.04	0.29	0.25	0.25	0.19
12.0 to 12.9	0.10	0.03	0.01	0.01	0.19	0.12	0.15	0.09
13.0 to 13.9	0.06	0.01	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.14	0.04	0.09	0.06
14.0 to 14.9	0.02	0.00 <sup>+</sup>			0.07	0.02	0.04	0.03
15.0 to 15.9	0.01	0.00 <sup>+</sup>			0.02	0.01	0.01	0.02
16.0 to 16.9	0.00 <sup>+</sup>	0.00 <sup>+</sup>			0.01	0.01	0.00 <sup>+</sup>	0.01
17.0 to 17.9	0.00 <sup>+</sup>	0.00 <sup>+</sup>			0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.00 <sup>+</sup>
18.0 to 18.9	0.00 <sup>+</sup>					0.00 <sup>+</sup>	0.00 <sup>+</sup>	
19.0 to 19.9	0.00 <sup>+</sup>				0.00 <sup>+</sup>	0.00 <sup>+</sup>	0.00 <sup>+</sup>	
> 19.9	0.00 <sup>+</sup>				0.00 <sup>+</sup>			

\* A negative value indicates a fall in temperature; a positive value a rise in temperature.

0.00<sup>+</sup> is less than 0.005 per cent but greater than zero.

Table 3.2(a) Percentage frequency of 6-hourly temperature rises of 10.0 °C or more, 1961–75

6-hours ended (GMT)	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
0								
1								
2								
3								
4				0.5				0.1
5				0.5				0.1
6				0.5				
7				0.5		0.1		
8				1.0	0.3	0.1		
9	0.2	0.5		1.0	3.6	0.2	0.9	1.9
10	4.5	5.1	7.1	7.6	13.9	7.5	9.0	11.8
11	19.5	22.7	27.6	24.3	24.9	23.5	20.8	23.1
12	28.5	31.6	35.2	29.3	24.4	30.1	24.7	27.2
13	25.6	25.2	19.4	22.7	17.6	23.5	22.7	20.2
14	15.2	10.3	9.2	11.1	10.8	10.9	13.9	11.3
15	5.4	4.4	1.5	1.0	3.7	3.4	6.2	3.4
16	1.1	0.2			0.7	0.7	1.6	0.5
17					0.1		0.2	0.1
18								0.1
19								0.1
20								
21								
22								
23								
No. of occasions	1129	409	196	198	1515	1198	1205	878

Table 3.2(b) Percentage frequency of 6-hourly temperature falls of 10.0 °C or more, 1961–75

6-hours ended (GMT)	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
0	26.3	27.2	18.4		22.9	19.2	24.1	22.6
1	13.2	9.1	15.8		14.7	6.7	7.1	12.5
2	5.3				5.5		0.9	3.0
3					1.8	0.8		0.6
4					0.8	0.8		
5					0.3			0.6
6					0.3			0.6
7					0.3			
8					0.2			
9					0.2			
10								
11								
12								
13								
14								
15								
16								
17						0.8		
18			2.6			0.8	0.5	
19	2.6				0.3	0.8	0.9	1.2
20	2.6	9.1	13.2		2.0	6.7	3.6	4.8
21	2.6	9.1	13.2	33.3	9.6	11.7	7.1	13.7
22	21.1	27.3	21.0	33.4	16.9	26.7	27.2	17.8
23	26.3	18.2	15.8	33.3	24.2	25.0	28.6	22.6
No. of occasions	38	11	38	3	396	120	224	168

**Table 3.3 (a) Percentage frequency of monthly values of 6-hourly temperature rise of 10.0 °C or more, 1961–75**

	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
January			0.5	1.0	0.3		0.5	0.1
February	1.3	2.2	1.0	1.5	1.0	0.7	1.8	4.8
March	13.7	12.7	20.9	13.6	11.3	12.6	8.2	7.6
April	10.7	17.6	6.6	7.6	8.8	11.4	9.1	13.1
May	12.1	12.2	9.2	11.6	12.5	10.8	15.1	11.0
June	15.3	18.4	12.3	7.6	15.2	13.9	17.3	13.0
July	7.8	5.1	11.2	6.6	9.6	11.3	9.1	10.5
August	13.2	12.0	19.4	5.1	14.3	14.6	14.8	13.8
September	16.3	13.9	13.8	22.2	15.1	16.1	14.3	13.8
October	9.1	4.9	4.6	13.6	10.1	7.9	7.8	9.7
November	0.4		0.5	5.6	1.4	0.5	1.5	1.7
December		1.0		4.0	0.4	0.2	0.3	0.9
No. of occasions	1129	409	196	198	1515	1198	1205	878

**Table 3.3 (b) Percentage frequency of monthly values of 6-hourly temperature falls of 10.0 °C or more, 1961–75**

	London	Manchester	Cardiff	Plymouth	Birmingham	Boscombe Down	Leeming	Edinburgh
January					0.2			1.2
February					0.2		2.2	7.1
March	21.0	18.2	5.2	66.7	7.1	15.8	6.7	4.2
April	2.6	9.1	5.3		6.1	4.2	4.5	8.9
May	23.7	27.2	7.9		9.1	8.3	18.7	10.7
June	23.7	18.2	31.6		23.0	24.2	29.0	17.3
July	10.5	9.1	26.3	33.3	8.1	20.0	13.4	17.9
August	5.3	18.2	21.0		15.4	15.8	14.7	9.5
September	7.9				18.2	1.7	7.6	13.7
October	5.3				12.1	6.7	1.8	8.3
November			2.7		0.5	3.3	0.9	1.2
December							0.5	
No. of occasions	38	11	38	3	396	120	224	168

Table 3.4 Extreme 6-hourly changes in temperature, 1961-75

	Date	From		To		Temperature difference °C	Remarks
		Time GMT	Temp. °C	Time GMT	Temp. °C		
<b>London</b>							
Rise	29/3/65	08	1.7	14	21.7	20.0	Heating after cold, clear night.
Fall	8-9/5/70	18	22.0	00	9.4	-12.6	Slack low pressure area. Thunderstorm 18 GMT.
<b>Manchester</b>							
Rise	29/3/65	07	3.6	13	21.1	17.5	Heating after cold, clear night.
Fall	29/8/61	16	28.8	22	17.8	-11.0	Cold front crossing station from W.
<b>Cardiff</b>							
Rise	23/3/73	07	0.8	13	14.4	13.6	SW'ly gradient. Warm sector.
Fall	7/8/75	16	28.0	22	15.9	-12.1	Trough from low over western France.
<b>Plymouth</b>							
Rise	7/10/71	07	3.6	13	17.0	13.4	Ridge. Heating after clear night.
Fall	7/3/69	16	11.8	22	1.4	-10.4	Cooling after warm day.
<b>Birmingham</b>							
Rise	29/3/65	06	-1.7	12	19.4	21.1	Heating after cold, clear night.
Fall	29/3/65	16	21.2	22	5.4	-15.8	Cooling after warm day.
<b>Boscombe Down</b>							
Rise	29/3/65	07	-0.4	13	19.1	19.5	Heating after cold, clear night.
Fall	28/3/65	15	20.4	21	6.7	-13.7	Cooling after warm day.
<b>Dishforth/Leeming</b>							
Rise	29/3/65	06	0.7	12	20.5	19.8	Heating after cold, clear night.
Fall	29/3/65	16	23.0	22	8.7	-14.3	Cooling after warm day.
<b>Edinburgh</b>							
Rise	1/5/66	06	3.8	12	21.1	17.3	Heating after cold, clear night.
Fall	20/7/72	15	28.1	21	13.4	-14.7	Wind change from 280° to 040°.

