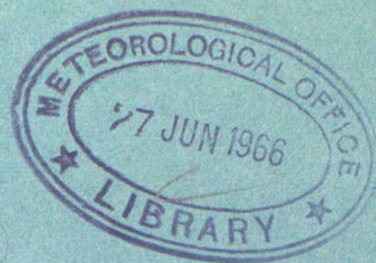


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METEOROLOGICAL OFFICE

CLIMATOLOGICAL SERVICES (Met 0 3)

CLIMATOLOGICAL MEMORANDUM NO. 54

THE CLIMATE OF EDINBURGH

by

J. A. PLANT

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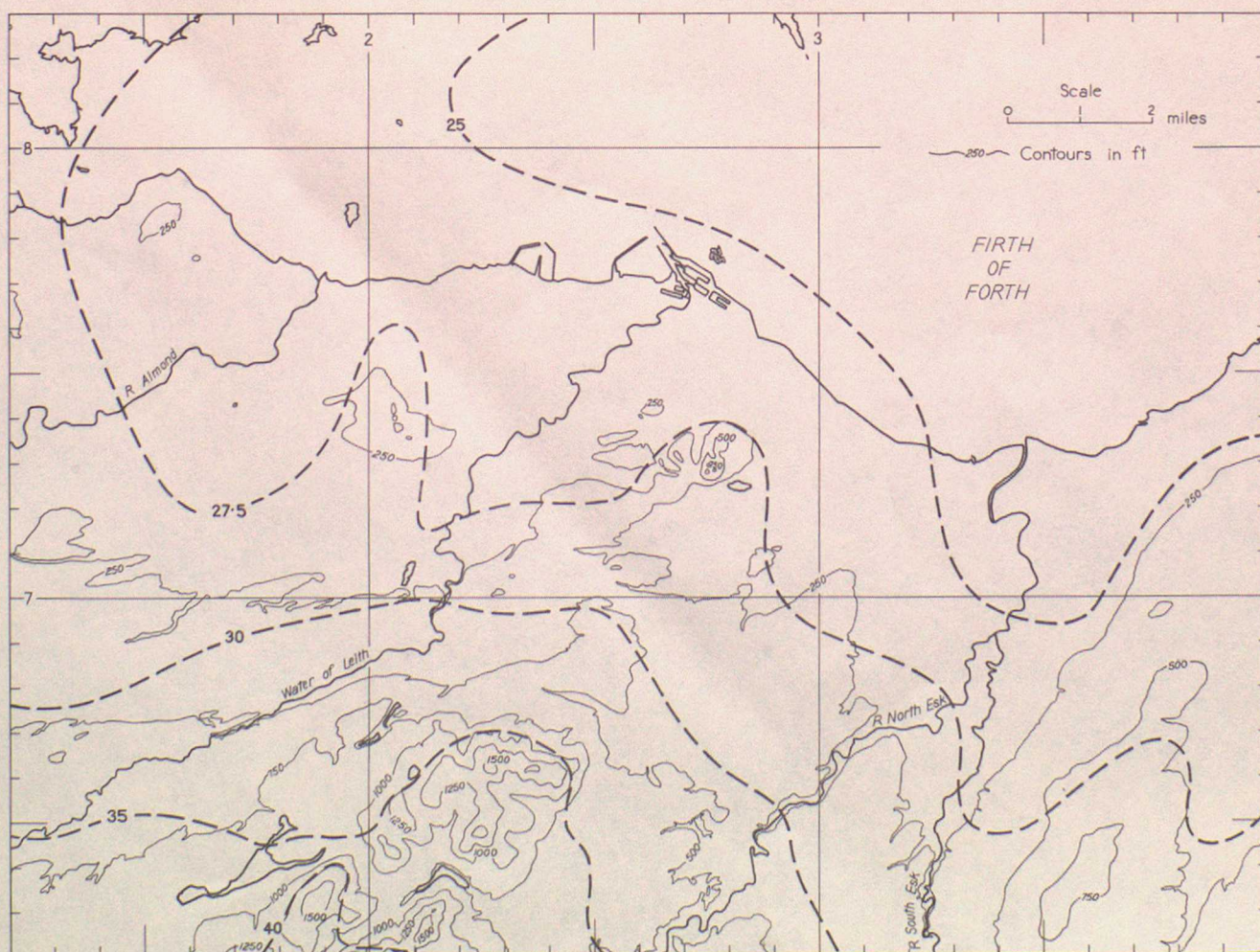
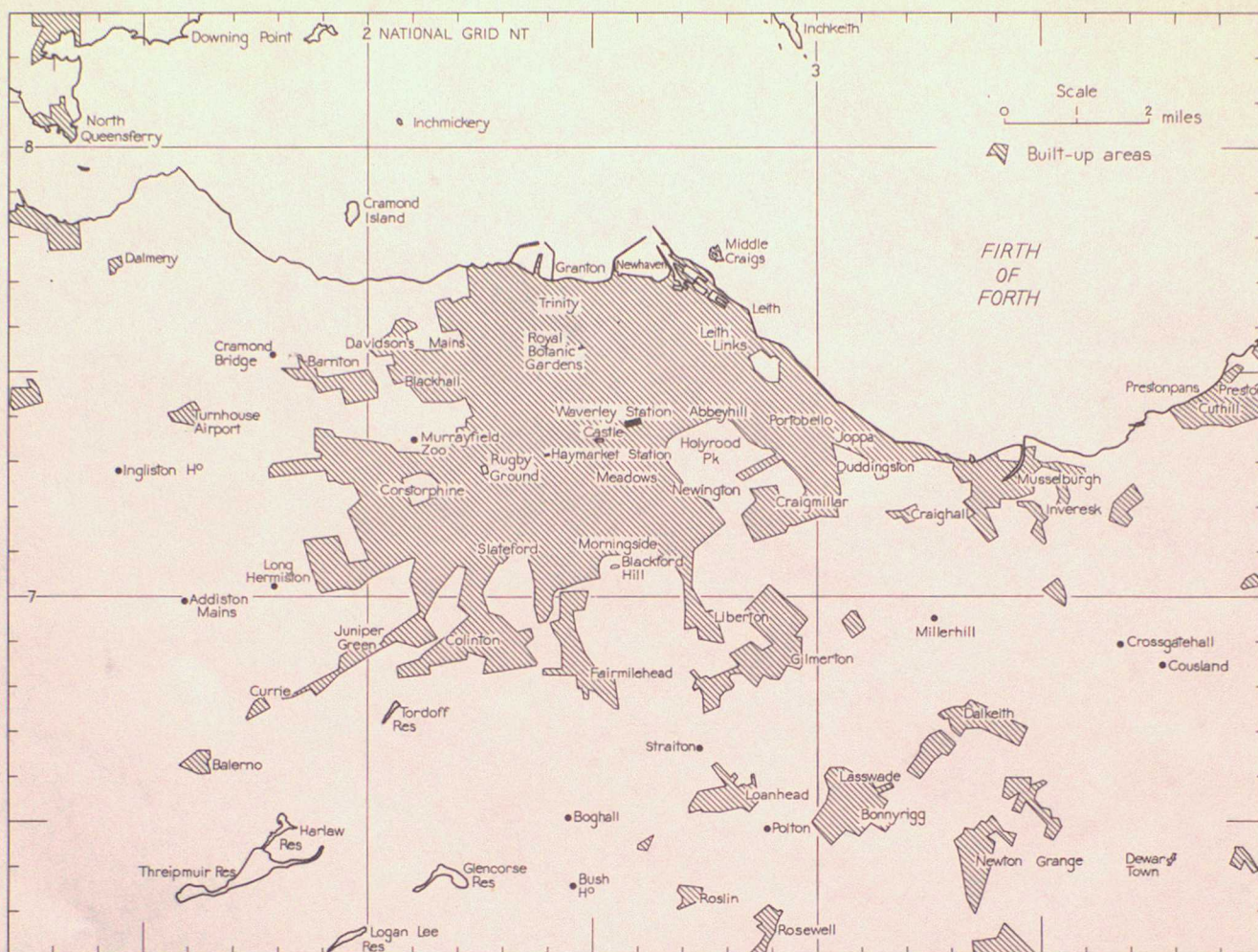


Fig 1. Average Annual Rainfall (inches) 1916-50

Contours and built up areas shown in these maps are based on Ordnance Survey Seventh Series.

THE CLIMATE OF EDINBURGH

by J. A. PLANT

In broad terms the climate of Edinburgh is typical of that of the east coast of Scotland. The hours of sunshine are high in relation to the latitude, and the average rainfall is well below the average for the United Kingdom as a whole. The sea breezes which penetrate as far as the city temper the summer maximum temperatures, and the proximity of the North Sea prevents the temperatures from being unduly low in winter when compared with, say, Kent, where very severe spells can result from winds from Central or Northern Europe crossing the Channel without appreciable warming. The most unpleasant aspect of the climate is perhaps the spells of easterly winds which occur in the Spring and early Summer. At best they are "raw", and they frequently bring with them the sea fog or very low cloud known as "haar". Most of the city lies open to the winds from south-west through north to south-east, and it might be euphemistically described as well-ventilated.

Within this general framework however Edinburgh must be almost unique in the range of local climates within its boundaries. There can be very few cities in which the built up area rises from sea level to 600 ft. A study of the vegetation in the Royal Botanic Garden and on the foothills of the Pentlands, or a journey from Fairmilehead to Granton on a wintry day will illustrate the effects of this. Some parts of the city which lie in local hollows or in the shelter of ridges enjoy relative immunity from the wind, but these same areas tend to be "frost hollows" and they are liable to much lower temperatures in still frosty conditions than are the more exposed parts. For example the lowest air temperatures ever recorded at Blackford Hill and Turnhouse Airport are 14° F. and 3° F. respectively. There is a decrease of about 1° F. in the mean monthly temperature for every 300 ft. increase in altitude, but this figure in itself may appear insignificant. It is the consequent decrease in the number of hours with temperatures above a given value, combined with the increased exposure to the wind, that is important for horticulture, the heating of buildings etc.

The separate aspects of the climate of Edinburgh are discussed in the following paragraphs under the headings of Rainfall, Temperature, Sunshine, Winds, Fog, Snow, Relative Humidity, and Thunderstorms.

1. RAINFALL

The annual average rainfall over the Edinburgh area (see annual average rainfall map at Figure 1) gradually increases with altitude from the flat coastal stretch along the Forth southwards to the high ground of the Pentland Hills. The average annual rainfall ranges from a value of less than 25 inches per year along the stretch of coast near Musselburgh to over 40 inches in the highest parts of the Pentlands southwest of Glencorse Reservoir. The more densely populated parts of the City have less than 27½ inches per year but some of the suburbs in the higher southern outskirts of the City nearer the Pentlands e.g. Fairmilehead, Colinton and Juniper Green have about 31 inches per year.

Broadly speaking, the average rainfall over most of the drier parts of the City is very similar to that in the London area but considerably less than say Glasgow which has about 40 inches per year.

Monthly and Annual Rainfall Averages for a number of rainfall measuring stations in Edinburgh and the Lothians are given in Tables 1 and 1A.

Accumulated Averages of Daily Rainfall for Blackford Hill from which the average rainfall over any particular period of the year can be calculated, are given in Table 1B.

/Accumulated

Accumulated Frequencies of Daily Rainfall for Blackford Hill which give the total number of days in 35 years having specified amounts of rain, are given in Table 1C.

Maximum Daily Rainfalls at Blackford Hill recorded in each month during the 66 year period from 1900 to 1965 are given in Table 1D.

The Number of Hours with Rain at Turnhouse Airport between the hours of 7 a.m. and 5 p.m. Greenwich Mean Time (8 a.m. and 6 p.m. British Summer Time) in each month and year during the 10 year period from 1955 to 1964 are given in Table 1E.

Intense Falls of Rain in Short Periods of Time

In general, the more intense the rainfall, the less likely it is to last for a given number of minutes or hours. The probability that rainfall of a certain intensity will last for a certain time is less in Edinburgh than in the upland parts of Scotland and the more thundery areas in Central and South West Scotland. It is appreciably less for the shorter durations than in the South of England and the Midlands which have a much higher incidence of thunderstorms and thundery downpours than Edinburgh.

In the absence of suitable long term records of rainfall intensities for the Edinburgh area, the values quoted in Table 1F have been computed from the well known Bilham Formula for rainfall intensities. The rainfall intensities obtained from the Bilham Formula for durations of up to a few hours are probably too high when related to Edinburgh and experience suggests that a 20 per cent reduction should be made to the amounts quoted in Table 1F to relate the intensities to sewer and culvert design purposes etc. in the Edinburgh area.

Driving Rain

Driving rain can be represented by an index which is proportional to the product of the wind speed and rainfall amount but there is an absence of suitable wind and rainfall data from the districts of Edinburgh which are most subject to driving rain viz. the districts sited on or near to the crests of the high ridges which traverse the City, particularly the ridges on the south side of the City. Owing to the complex topography, the worst winds will vary in direction from place to place depending on the siting of individual buildings and houses and the amount of local shelter. Depending on the exposure of the site and the amount of local shelter, driving rain in Edinburgh could be experienced from almost any point of the compass but the worst directions are likely to be from South-East round through South to West in the windier, hilly districts on the southern outskirts of the City.

2. TEMPERATURE

In winter, the surface temperature of the North Sea remains relatively high when compared with the ground surface temperatures over the adjacent land areas of Northern Europe. Because of this, Edinburgh's winter temperatures are comparable with those of London or other places on the east coast, and, as mentioned earlier, the City escapes the occasional blasts from the Continent which affect south east England. However, because of the high latitude of Edinburgh, the very slow rise in sea temperatures, and the onset of cold easterly winds in the spring, the rise of temperature at the end of winter is much more of an uphill struggle, and spring is later and cooler than it is in the South. In summer and early autumn the effect of latitude on the heat received from the sun is the dominant factor, and temperatures are several degrees lower than they are in the south of England.

The temperature regime with Edinburgh is rather complex. Generally speaking, day-time temperatures are highest on the lower ground, particularly

/in

in the more sheltered areas, but this is offset to some extent by a tendency to lower night temperatures in these same areas, except in the immediate vicinity of the Forth. This effect is most marked in still clear weather. It is the result of air which has been cooled by contact with the ground, and which has consequently become relatively dense, draining downhill and stagnating in the valleys and hollows. The cold air is replaced at the higher levels by rather warmer air which has not been in contact with the ground. As an illustration of the effect, the lowest air temperature recorded at the Royal Observatory, Blackford Hill (Altitude 450 ft.) over the last 70 years or so is 14 F., while at Turnhouse Airport (altitude 110 ft.), where records began as recently as 1948, the air temperature has been below 7 F. on several occasions, the lowest recorded to date (i.e. up to the end of 1965) being 3 F. The areas most likely to suffer from this "frost hollow" effect are the more sheltered and flatter parts of the basins of the various streams which flow through Edinburgh. In windy cloudy weather the surface of the ground cools less rapidly at night, and the air near the surface is too disturbed to show the effect.

It should perhaps be explained at this point that air ("shade") temperatures are read from thermometers exposed at a height of four feet above ground level and an 'air frost' occurs when the temperature at 4 feet falls to 32 F. or below.* However, at night-time and particularly on clear, calm nights the air in close contact with the ground is nearly always cooled to below the temperature at four feet. Consequently, the incidence of 'ground frost' is much higher than the incidence of 'air frost'. It is difficult to provide representative statistics of ground frost as conditions will vary considerably over quite short distances from place to place depending on the composition of the surface (e.g. grass, bare soil, tarmacadam or concrete) and whether a particular site lies in a sheltered place or is exposed to the wind. Because of its excellent insulating characteristics, a grass covered surface will normally have a higher frequency of ground frosts than the other surfaces mentioned. The average number of days of ground frost recorded by a thermometer lying one or two inches above a short grass covered surface at Blackford Hill is about 71 per year compared with 49 days with air frost per year at the same site. At a lower lying and more sheltered grass covered site in the Royal Botanic Garden the average number of days with ground frost per year is 120 compared with 66 days of air frost per year at the same site.

The picture is further complicated by the "heat island" effect which large built-up areas create particularly at night. This effect is the product of a number of factors including the heat released in artificially heating the buildings, the high thermal capacity of the buildings, the effect of pollution haze and tall buildings in cutting down the loss of heat by outward radiation at night, the general reduction in wind speed etc. Unfortunately, little is known about the effect in Edinburgh. Some of the most densely built-up areas are in hollows and the "frost-hollow" and "heat island" effects will tend to counter-act each other. This combined with the open, well ventilated nature of the city makes it probable that the total effect on temperature in Edinburgh is considerably less than in London and other major cities.

In dealing with problems involving heat loss, whether it is related to human comfort, heating of buildings or frost penetration, it is necessary to consider the combined effect of temperature and wind. As a general rule, the heat loss will be greatest in the higher windier suburbs, and in the upper storeys of high blocks of flats which are more exposed to the wind than their surroundings. The effect of wind on frost intensity is illustrated by the following table which is used by the Meteorological Office to define their descriptions of frost.

/Term

* Since 1st January 1963 an air frost has been defined as a day when the screen minimum falls below 32 F.

Term	Corresponding to air temperature (°F)	
	Wind Speed less than 11 m.p.h. (10 knots)	Wind Speed more than 11 m.p.h. (10 knots)
Slight Frost	32°-27°	32°-31°
Moderate Frost	26°-21°	30°-28°
Severe Frost	20°-11°	27°-23°
Very Severe Frost	Below 11°	Below 23°

Averages and Extremes of Air Temperature for several places in the Edinburgh Area are given in Tables 2, 2A and 2B. The standard period for temperature averages in current use in the Meteorological Office is the 30 years from 1931 to 1960. The averages quoted for Blackford Hill in Table 2 are actual averages over this period of 30 years but the averages quoted for the other places have been estimated from shorter period or broken periods of records.

The Percentage Amount of Time with Air Temperatures below Certain Limits at Turnhouse Airport is given in Table 2C.

The Numbers of Days with Maximum Air Temperatures exceeding 60°F., 65°F., 70°F., 75°F. and 80°F. at Turnhouse Airport are given in Table 2D.

The Actual and Average Numbers of Days with Air Frost are given for certain places in the Edinburgh district in Tables 2E and 2F together with the average and extreme dates of occurrence of the first and last air frosts in Table 2G. A note is also included of the longest period to date with air temperatures continuously below freezing point at Turnhouse Airport.

Temperature Statistics of Periods of Cold Weather in Edinburgh (and other cities) during the heating seasons 1925/26 to 1949/50 are given in Appendix 'C' to the H.M.S.O. publication "Post War Building Studies No. 33".

A Table for converting degrees Fahrenheit to degrees Centigrade is given at Table 2H.

3. SUNSHINE

In common with other places on the East Coast of Scotland, Edinburgh has a good sunshine record particularly when its northerly latitude is taken into account. The average duration of sunshine in Edinburgh per year is very similar to the average duration in London. For example, the annual average durations for Blackford Hill and the Royal Botanic Garden are 1,384 hours and 1,330 hours respectively, compared with the London districts of Kingsway and Regents Park which have 1,359 hours and 1,353 hours per year respectively. There is a seasonal difference between Edinburgh and London in that Edinburgh has a longer duration of sunshine during the winter and early spring but London has the better record during the summer.

Monthly Averages and Daily Mean Durations of Sunshine for a number of places in Edinburgh are given in Table 3. The standard period for sunshine averages in current use in the Meteorological Office is the 30 years from 1931 to 1960. The averages quoted for Blackford Hill in Table 3 are actual averages over this period of 30 years but the averages quoted for the other places have been estimated from shorter period or broken periods of records. In a hilly City like Edinburgh, it should be borne in mind that all the sunshine recorder sites for which averages are quoted in Table 3 have relatively free horizons with no obstructing hills, buildings or trees (with an elevation exceeding about 3 degrees) to cut off the sunshine.

/It

It will be seen from Table 3 that at unobstructed sites there is not a great deal of difference in the duration of sunshine between one place and another in the Edinburgh area. Local patches of low cloud enveloping the tops of the Pentland Hills are responsible for the lower durations at Boghall and Balerno but Blackford Hill at a lower elevation does not seem to suffer appreciably from this effect. Blackford Hill has a slightly longer duration of sunshine than lower lying places in Edinburgh. This is partly due to the fact that atmospheric pollution over the lower lying and more densely built-up parts of the City reduces the amount of sunshine particularly during the winter months. A secondary cause may be that the lower lying districts, particularly the districts near to the Firth of Forth, are rather more prone to the incidence of sea fog ("haar") than Blackford Hill.

The path of the sun across the sky depends on the latitude and the time of year. Figure 2 is a solar chart for Edinburgh (latitude 56 degrees North) which shows the elevation and azimuth of the sun at various times of day, for the solstices, equinoxes and for certain intermediate dates. For a given site the various obstructions can be plotted on the chart and their effect in cutting off the sun's radiation at various times can then be evaluated. In winter for example, a hill to the south in Edinburgh with an elevation greater than $10\frac{1}{2}$ degrees would cut off practically all the sunshine. A good example of this "cut-off" effect in winter is Swanston Village at the foot of the northern slopes of the Pentlands but there are several other places in the Edinburgh area where the sunshine is obstructed by nearby hills or ridges e.g. the area immediately to the north of Blackford Hill.

4. WINDS

At an open, level site in the Edinburgh area, the average wind speed is about 12 m.p.h. which is on the high side when compared with other cities in the British Isles. The topography of the City exposes much of it to the full effect of the wind and local increases in the general wind speed are experienced on ridges or where features of the landscape form a wind funnel. It is not surprising, therefore, that visitors to the City, especially city dwellers from the South find Edinburgh a "windy place".

It is difficult to generalise about the winds in the built-up area of any city as the winds near the ground tend to follow the directions of the streets being channelled up or down the streets between the buildings on either side and giving rise to gustiness at street intersections and corners. However, the picture in Edinburgh is even more complicated for in addition to the local effects produced by buildings and streets, there is a considerable variation in shelter to the wind from place to place depending on the lie and orientation of the high ground.

At Turnhouse Airport which is a fairly flat "open" site on the western boundary of the City, surface winds from directions between about South West and West are abnormally strong but the Pentlands Hills immediately to the south of the airport give some shelter to strong winds from the South. Considerably stronger winds are recorded at the Royal Observatory at Blackford Hill which lies on a very exposed ridge at an altitude of 450 feet on the south side of the City but the wind directions at Blackford Hill are broadly similar to those at Turnhouse Airport. However, there is one marked difference in that very strong winds from the South are experienced at Blackford Hill and some of the highest gusts on record at the Royal Observatory have been blown from a southerly point. This is no doubt due to the fact that the Pentland Hills end rather abruptly at Hillend just to the south of Blackford Hill and in contrast to Turnhouse Airport, winds from the south have a comparatively long uninterrupted fetch over undulating country.

/Annual

Annual wind direction frequencies for Turnhouse Airport and Blackford Hill show that about 45 to 50 per cent of all winds blow from directions in the quadrant between South and West. However, in common with other places on the East Coast of Scotland both places show a remarkably high frequency of winds from between North East and East in the spring and early summer and winds from this sector are in fact the prevailing winds during this period of the year.

A rather unpleasant characteristic of the winds in Edinburgh is the high gustiness particularly with winds from between South and West and fine sunny days in the summer are often marred by the boisterous nature of the winds. The gustiness is usually greatest in the middle of the afternoon when the speed reached in gusts is often about twice the average wind speed.

A statistical treatment of the highest mean hourly wind speeds (i.e. the highest wind speeds averaged over the 60 minutes between hours) and highest gusts recorded in each year over a long period of years at Blackford Hill gives the following results:

- A. Maximum Mean Hourly Wind Speeds at 33 feet above the ground likely to be exceeded only once in the stated number of years:

<u>10 years</u>	<u>20 years</u>	<u>50 years</u>	<u>100 years</u>
58 m.p.h.	60 m.p.h.	63 m.p.h.	67 m.p.h.

- B. Maximum Gust Speeds at 33 feet above the ground likely to be exceeded only once in the stated number of years:

<u>10 years</u>	<u>20 years</u>	<u>50 years</u>	<u>100 years</u>
99 m.p.h.	104 m.p.h.	109 m.p.h.	114 m.p.h.

There are many other exposed places like Blackford Hill in Edinburgh, particularly on the high ground on the south side of the City. Special care should be taken in the design of buildings and the specifications of glass window panes etc. and advice on extreme wind speeds for design purposes should be obtained from the Meteorological Office.

A gale is said to occur when the average wind speed near the ground reaches 39 m.p.h. or more. A gale becomes "severe" when the average wind speed exceeds 46 m.p.h. During a gale, gusts of over 50 m.p.h. are quite common and may exceed 100 m.p.h. in a severe gale. The duration of a high gust of wind is of the order of 3 to 5 seconds but nevertheless, gusts are usually responsible for the more common types of "gale damage" e.g. the removal of roof tiles and chimney pots, blown-down fences and hoardings, damage to trees, crops and glass window panes etc. Most gales in Edinburgh blow from directions between South and West but Easterly gales, although much less frequent, are not uncommon. A special mention should be made of strong winds from directions between about North West through North round to East-North-East as strong winds from these directions are sometimes responsible for flooding and other types of damage at low lying places along the southern coastline of the Firth of Forth, particularly when the strong winds from these directions coincide with the times of high water. The strip of coast from about Leith eastwards is likely to suffer most on these occasions as the north and easterly winds have a longer uninterrupted fetch over the widening part of the Firth of Forth. Gales can occur in any month of the year in Edinburgh but January has the highest frequency and July the lowest.

Annual and Seasonal Frequencies of Wind Direction and Speed for Turnhouse Airport are given in Tables 4 and 4A.

Actual and Average Numbers of Days with Gales at Turnhouse Airport are given in Table 4B.

5. FOG

This would appear to be an appropriate heading under which to discuss Edinburgh's nickname of "Auld Reekie". It is significant that the origin of this nickname dates back into history long before atmospheric pollution became the menace it is today. In early days, country folk travelling to Edinburgh had probably never seen another city of Edinburgh's size and the pall of haze and smoke hanging over their destination could well have been their first and lasting impression of the City. There is the further point that unlike many other cities, Edinburgh can be seen from a considerable distance across the Forth from places in Fife or from high vantage points in clear air particularly on the southern side of the City and this makes what smoke there is much more apparent. However, there is little doubt that if the nickname of "Auld Reekie" was being allocated on merit to a major city in the British Isles today, then Edinburgh would appear well down the list if not near the bottom.

On the whole, most of the east coast of Scotland experiences very good visibility and its remoteness from the industrial and populous areas of Great Britain and their smoke-soiled air means that smoke fogs are relatively unknown except in the immediate surroundings of Edinburgh, Dundee and Aberdeen. Although thick fogs (visibility less than 220 yards) do occur in Edinburgh on average about 19 days per year, the persistence of thick fog in the City for more than a few hours is a fairly rare event especially when Edinburgh is compared say with Glasgow, London or the Midlands of England.

Perhaps the most unpleasant fogs which occur in Edinburgh are not the smoke, radiation or sea fogs of winter but the haars (North Sea fogs) which occur from time to time during the period from April to September and which often ruin potentially brilliantly fine days during the Spring and Summer. The basic cause of these haars is the moistening and cooling of warm air from the Continent by the cold waters of the North Sea and the Firth of Forth. Haars are especially prevalent during the Spring and Summer following a particularly cold winter when the sea temperature of the coastal waters is well below average. The haar is normally fairly shallow. When it occurs at ground level in the lower parts of the city, the higher parts may be in sunshine above it. Frequently, by the time it reaches Edinburgh, it has lifted into an unbroken layer of low stratus cloud, obscuring the higher ground and higher buildings, but with reasonably good visibility beneath it. Where it reaches the ground visibilities of less than 25 yards are not unknown. Occasionally the haar may have sufficient depth to give rise to drizzle, particularly where it encounters rising ground. During daylight hours the sun's heat tends to "burn off" the haar. The thinner haars may disappear with dramatic suddenness leaving a cloudless sky, but they are likely to reform again towards sunset. The deeper haars may persist all day, a frustrating situation which is not helped by the knowledge that places a few miles further west or further inland are enjoying glorious sunshine. It was this particular aspect which led the unfortunate Robert Louis Stevenson to describe Edinburgh's climate as "a downright meteorological purgatory in the spring".

The areas most prone to winter fogs are the lower lying more densely built-up parts of the City particularly those near the Forth, and it is a fairly common experience in winter for commuters from the south side of the City not to encounter fog on their journey into the City until reaching the foot of the slopes to the high ground e.g. Morningside, Slateford, Meggetland etc. There are a few occasions in some winters when low cloud enveloping the Pentlands sometimes reduces visibility on the roads traversing the high ground on the southern side of the City particularly before 9 a.m. but visibility on these occasions is seldom bad enough to seriously impede the flow of traffic.

Thick fogs during the winter half-year are usually associated with calm or light easterly winds but light westerly winds sometimes thicken the fogs

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with industrial and domestic smoke from Glasgow and other places in the Forth-Clyde valley. Thick fogs during the summer half-year are nearly always associated with light easterly winds.

There is a fairly well marked diurnal variation in poor visibility in Edinburgh, the worst visibilities being experienced between about midnight and 9 a.m. The months of November and December usually have the highest frequency of thick fogs.

Percentage Frequencies of Occurrence of Visibilities less than 1,100 yards according to month and hour are given in Table 5.

The variation of poor visibilities with wind direction are given in Table 5A.

The number of days and hours with thick fog (visibility less than 220 yards) are given in Table 5B.

6. SNOW

In Edinburgh, as elsewhere in the British Isles, the incidence of snow falling and the persistence of snow cover are two of the most variable of all the meteorological elements. For example, in the severe winter of 1962/63 there were 39 mornings with snow lying on the ground at Turnhouse Airport compared with only 2 mornings during the following winter of 1963/64.

At Turnhouse Airport, there are, on average, about 28 days per year with snow or sleet falling. The highest number of days in a year during the 16 years from 1949 to 1964 with snow or sleet falling is 43 days during 1963 and the lowest number of days in a year is 11 days during 1953. Most of the days with snowfall occur in December, January, February and March but snow can fall on low ground in Edinburgh as late as May or as early as October although snow falling in May or October seldom lies on the ground for any length of time. Up to heights of about 200 feet, there is not much variation from place to place in the incidence of snowfall and therefore the Turnhouse Airport figures of the number of days of snow or sleet falling can be taken as reasonably representative of most of the lower lying and more densely built-up districts of Edinburgh. The Meteorological Office at Turnhouse Airport is the only weather station in the Edinburgh area keeping a 24 hour watch on the weather and is therefore the only weather station for which complete records of snow falling at any time of the day or night are available. However, the number of days with snow falling increases fairly rapidly with the height above sea level and as a good approximate rule, there is one day more per year with snow falling for each 50 feet of elevation above 200 feet.

Whether snow will lie, after it has fallen, in sufficient depth to cause difficulty to transport, depends on a number of complex factors but a greater height above sea level and a north or east facing aspect of the surface will certainly increase the number of days with snow lying. As the general lie of the ground in Edinburgh is on a north facing slope, down from the Pentlands, the persistence of snow cover can be a nuisance particularly in the high southern outskirts of the City.

During a severe winter with snow lying on the ground, the partial thaws during the daytime do little to clear the roads at higher levels on the south side of the City where the snow becomes compacted and even more treacherous to road users especially at night when the compacted snow or wet parts of the road have an icy surface. There is the further point that the daily expansion and contraction caused by the freezing and thawing processes plays havoc with the tarmacadam road surfaces which often need extensive repairs after a severe winter. Because of its penetration and other characteristics, rain is much the best thawing agent but it should be remembered that

/precipitation

precipitation falling in temperatures up to about 36 degrees Fahrenheit will almost certainly fall as snow.

After a fall of snow in Edinburgh, the variation in snow cover and depth between the lower lying flatter parts of the City near the Forth and the high suburbs in the southern outskirts is often quite remarkable. During the severe winter of 1962/63 for example, there were periods when only isolated thin patches of snow lay in the Granton and Newhaven districts whereas at Lothianburn Golf Course on the northern slopes of the Pentlands near Fairmilehead, there was a complete covering of snow in sufficient depth for skiing from about Christmas Day 1962 until near the end of the first week in March 1963. Similarly, the roads traversing the high ground on the south side of Edinburgh are sometimes affected by appreciable falls of snow when at the same time, rain or sleet is falling in the lower lying parts of the City.

It should perhaps be mentioned that in the Meteorological Office, a 'day with snow lying' is counted only when half or more of the ground surrounding the weather station is covered with snow and the snow depth is only measured on these occasions. The depths of snow measured daily at 9 a.m. relate to the uniform "undrifted" depth. The criterion "half or more than half the ground covered" is difficult to apply at stations where the view is restricted and small depths of snow may accumulate to cover more than half the ground locally in a sheltered site when it would not do so at an open airfield. This may well account for the occasional considerable differences between Turnhouse and the Royal Botanic Garden (see Table 6A) particularly in the smaller depths where general considerations would lead one to expect similar figures at both places.

The Actual and Average Numbers of Days with Snow or Sleet Falling are given in Table 6.

The Numbers of Mornings per Winter with Snow Lying at Specified Depths are given in Table 6A.

Monthly Frequencies of Snow Depths are given in Table 6B.

7. RELATIVE HUMIDITY

In the Edinburgh area as elsewhere in the British Isles, the relative humidity reaches 90 per cent or thereabouts on most nights of the year. As a good general rule, the highest values of relative humidity occur in association with the lowest air temperature of the day i.e. usually around dawn, while the lowest values of relative humidity occur in association with the highest air temperatures of the day i.e. usually in the middle of the afternoon. The main departures from this general rule occur in misty or foggy weather or when rain is falling.

In addition to the well marked diurnal range of relative humidity, there is also a change from season to season in that relative humidities are higher for a longer period of time during the winter months and lower for a longer period of time in the months of April, May and June.

When averaged over a long period, there is no significant difference in relative humidity from place to place in the Edinburgh area although considerable differences can exist at a particular time of day depending on the local weather prevailing at that time. For example, if as happens on some occasions, the lower lying parts of the City are shrouded in mist or fog while the higher southern outskirts are in sunshine, then clearly the relative humidity in the City will be higher than in the outskirts. The direction and penetration of local sea breezes is also a factor which should be borne in mind because the onset of a sea breeze, particularly during the Spring and Summer months, can lead to a marked drop in air temperature coinciding

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with a sharp rise in relative humidity.

Average Values of Relative Humidity and Corresponding Air Temperatures at certain times of the day are given in Table 7.

The Percentage Amount of Time with Wet Bulb Temperatures below certain limits is given in Table 7A.

The Absolute Highest Wet Bulb Temperatures and the Highest Wet Bulb Temperatures associated with Relative Humidities of 100 per cent are given in Table 7B.

8. THUNDERSTORMS

As mentioned previously in the section dealing with rainfall, Edinburgh has a low incidence of thunderstorms. The average number of days with thunderstorms at Turnhouse Airport is seven days per year but in some years a thunderstorm is a rare event. For example, only one thunderstorm occurred at Turnhouse Airport in each of the years 1955 and 1957. It is rather unusual for thunderstorms to occur in Edinburgh during the months from October to April and in the 17 years (1949 to 1965) for which records are available for Turnhouse Airport, it is interesting to note that a thunderstorm has never occurred in March. Most of the thunderstorms in Edinburgh occur during the months of May to September but the 17 year average for each of these months works out at only one day with a thunderstorm per month.

There are no detailed records of thunderstorms from the high ground to the south of the City but Edinburgh is fortunate in that it has a much lower incidence of thunderstorms than the nearby Pentland, Moorfoot and Lammermuir Hill areas.

Author's Note

The preparation of this Memorandum was originally undertaken at the request of the Town Planning Department of Edinburgh Corporation. However, numerous requests are received at the Meteorological Office in Edinburgh for the types of information contained in the Tables and it is hoped that the data and accompanying text will be of interest to students and helpful to architects, engineers and building contractors who have work to do in the City.

I am indebted to Mr. R. Cranna, Superintendent of the Meteorological Office in Edinburgh for his invaluable advice and assistance in the preparation of this paper and also the Mr. H. C. Shellard of the Climatological Branch of the Meteorological Office Headquarters at Bracknell, Berkshire, for his helpful comments and suggestions at the first draft stage.

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TABLE I MONTHLY AND ANNUAL AVERAGES OF RAINFALL (inches) 1916-1950 - EDINBURGH AND THE LOTHIANS

Station	Ht. (Ft.)	N.G.R.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year	Inch
Uphall No. 8	577	NT(36) 024708	3.52	2.38	2.21	2.09	2.52	2.29	3.17	3.45	3.18	3.67	3.29	2.98	34.75	Inch
Middleton Hall	350	NT(36) 061716	3.43	2.38	2.10	2.06	2.46	2.20	3.13	3.49	3.13	3.56	3.11	2.79	33.84	Inch
Harperrig	900	NT(36) 102613	4.17	2.90	2.70	2.63	2.90	2.58	3.42	4.03	3.60	4.18	3.80	3.72	40.63	Inch
Edinburgh, Blackford Hill	441	NT(36) 259706	2.45	1.68	1.60	1.62	2.21	1.88	3.03	3.15	2.55	2.83	2.42	2.11	27.53	Inch
Edinburgh, Astley Ainslie Hospital	270	NT(36) 251713	2.56	1.76	1.75	1.71	2.27	1.87	3.05	3.24	2.60	2.98	2.47	2.27	28.53	Inch
Fairmilehead Waterworks	590	NT(36) 249683	2.84	2.01	1.91	1.96	2.48	2.15	3.15	3.40	2.91	3.16	2.78	2.43	31.18	Inch
Liberton, Alnwick Hill	407	NT(36) 273690	2.77	1.83	1.78	1.73	2.27	1.94	2.96	3.06	2.65	2.94	2.58	2.24	28.75	Inch
Glen Cottage	739	NT(36) 223635	3.73	2.63	2.44	2.54	2.77	2.42	3.62	3.92	3.46	3.83	3.57	3.19	38.12	Inch
Glencorse Filters	638	NT(36) 225631	3.53	2.42	2.25	2.42	2.67	2.31	3.39	3.68	3.30	3.68	3.42	2.97	36.04	Inch
Martyr's Cross	750	NT(36) 229623	3.64	2.54	2.37	2.36	2.68	2.42	3.50	3.75	3.49	3.87	3.54	3.08	37.24	Inch
Gladhouse Res.	915	NT(36) 299544	3.71	2.68	2.71	2.46	2.74	2.32	3.52	3.68	3.25	3.79	3.59	3.22	37.67	Inch
Rosebery	750	NT(36) 308570	3.15	2.33	2.25	2.22	2.46	2.13	3.32	3.42	3.03	3.41	3.19	2.76	33.67	Inch
North Berwick	51	NT(36) 555852	2.12	1.48	1.61	1.45	2.11	1.94	2.68	3.06	2.43	2.65	2.34	1.82	25.69	Inch
West Calder, Addiewell	620	NT(36) 001626	4.00	2.61	2.28	2.29	2.58	2.36	3.34	3.60	3.63	3.98	3.52	3.50	37.69	Inch

TABLE 1A MONTHLY AND ANNUAL AVERAGES OF RAINFALL, 1916-1950, ESTIMATED FOR SHORT-TERM STATIONS - EDINBURGH AND THE LOTHIANS

Station	N.G.R.	Height (Feet)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year (inches)
West Calder, Westwood	NT(36) 014643	480	3.65	2.39	2.12	2.12	2.43	2.19	3.09	3.33	3.30	3.72	3.26	3.12	34.72
Pateshill Res.	NE(26) 982594	939	4.48	2.92	2.54	2.58	2.87	2.66	3.76	4.06	4.06	4.48	3.93	3.93	42.27
Uphall No. 7	NT(36) 018712	640	3.57	2.41	2.23	2.12	2.58	2.34	3.22	3.50	3.26	3.76	3.36	3.04	35.39
Midcalder	NT(36) 053676	400	3.37	2.25	2.09	2.02	2.42	2.12	3.15	3.21	3.08	3.40	3.05	2.95	33.11
Crosswood	NT(36) 056757	950	4.18	2.84	2.44	2.52	2.80	2.56	3.61	3.90	3.86	4.35	3.82	3.74	40.62
Morton	NT(36) 074632	749	3.89	2.65	2.38	2.38	2.77	2.46	3.54	3.73	3.66	3.97	3.46	3.45	38.45
Turnhouse	NT(36) 159739	114	2.43	1.65	1.56	1.59	2.16	1.86	2.91	3.10	2.54	2.78	2.37	2.02	26.97
East Craigs	NT(36) 183735	200	2.50	1.68	1.60	1.62	2.17	1.92	2.95	3.17	2.59	2.83	2.42	2.06	27.51
Davidson's Mains	NT(36) 199757	200	2.53	1.83	1.63	1.66	2.25	2.00	2.93	3.14	2.62	2.90	2.45	2.19	28.13
Balerno	NT(36) 147651	700	3.67	2.49	2.30	2.30	2.74	2.37	3.63	3.71	3.45	3.83	3.37	3.23	37.09
Colinton, Firhill Tank	NT(36) 226699	412	2.70	1.97	1.76	1.79	2.29	2.03	2.97	3.21	2.76	3.00	2.59	2.32	29.39
Craiglockart, Craig- lockart Avenue	NT(36) 224705	295	2.81	2.05	1.83	1.86	2.38	2.11	3.09	3.34	2.86	3.11	2.70	2.41	30.59
Edinburgh, Royal Botanic Garden	NT(36) 247756	74	2.38	1.71	1.55	1.57	2.19	1.90	2.75	2.96	2.52	2.75	2.35	2.08	26.71
Clubhouse Res.	NT(36) 203670	773	3.06	2.16	1.96	1.96	2.45	2.16	3.28	3.38	2.99	3.31	2.86	2.61	32.18
Liberton	NT(36) 273705	190	2.62	1.82	1.71	1.71	2.28	1.97	2.94	3.14	2.65	2.94	2.51	2.22	28.51
" , The Inch	NT(36) 277708	150	2.72	1.89	1.77	1.77	2.36	2.04	3.04	3.26	2.75	3.04	2.60	2.30	29.54
Edinburgh, Fountain- hall Road	NT(36) 262715	225	2.59	1.79	1.68	1.71	2.28	1.96	2.93	3.11	2.67	2.90	2.50	2.33	28.45
Portobello, Milton Road West	NT(36) 302728	100	2.40	1.68	1.57	1.57	2.16	1.90	2.78	3.04	2.48	2.75	2.32	2.06	26.71
North Esk Res.	NT(36) 154578	1150	4.28	3.01	2.67	2.54	3.05	2.71	3.94	4.11	3.94	4.37	3.90	3.86	42.38
Penicuik	NT(36) 233599	620	3.66	2.57	2.35	2.20	2.76	2.46	3.62	3.78	3.40	3.84	3.40	3.28	37.32

TABLE 1A (contd.)

Station	N.G.R.	Height (Feet)	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year (inches)
Harehill	NT(36) 183615	1297	3.86	2.69	2.38	2.42	2.85	2.50	3.78	3.90	3.59	4.03	3.55	3.47	39.02
Loganlea	NT(36) 199626	811	3.78	2.62	2.39	2.35	2.85	2.51	3.74	3.99	3.55	3.97	3.48	3.36	38.59
Bush House	NT(36) 244636	605	3.35	2.35	2.28	2.25	2.71	2.39	3.57	3.78	3.28	3.67	3.17	2.85	35.65
Portmore Res.	NT(36) 260507	1000	3.76	2.71	2.37	2.41	2.75	2.37	3.46	3.65	3.35	3.88	3.54	3.39	37.64
Gorebridge	NT(36) 344618	560	2.86	2.05	1.90	1.93	2.32	1.93	2.98	3.12	2.71	3.07	2.77	2.47	30.11
Newbattle	NT(36) 337649	300	2.56	1.81	1.71	1.71	2.15	1.84	2.81	2.96	2.47	2.83	2.45	2.20	27.50
East Fortune Hospital	NT(36) 553793	101	2.24	1.44	1.57	1.49	2.04	1.84	2.50	2.82	2.24	2.54	2.24	1.94	24.90
North Berwick, Netherheugh	NT(36) 562846	120	2.20	1.45	1.55	1.40	2.05	1.87	2.57	2.86	2.32	2.57	2.27	1.87	24.98
Ford	NT(36) 387644	420	2.53	1.79	1.73	1.73	2.15	1.79	2.78	2.93	2.45	2.89	2.51	2.26	27.54
West Hopes	NT(36) 551622	810	3.48	2.46	2.35	2.35	2.90	2.42	3.26	3.70	3.19	3.80	3.56	3.19	36.66
Lammerloch Res.	NT(36) 517634	900	3.21	2.23	2.20	2.16	2.63	2.30	3.04	3.45	3.01	3.51	3.21	2.84	33.79
Haddington	NT(36) 513736	161	2.25	1.56	1.61	1.56	2.07	1.79	2.59	2.90	2.25	2.67	2.35	2.00	25.60
East Linton, Smeaton	NT(36) 594786	100	2.28	1.58	1.63	1.58	2.10	1.82	2.63	2.95	2.28	2.72	2.39	2.03	25.99
Doreilly Res.	NT(36) 580690	532	2.82	1.93	1.96	1.93	2.44	2.08	2.82	3.34	2.73	3.19	2.88	2.51	30.63
Tincarter Res.	NT(36) 607695	725	2.75	1.91	1.97	1.91	2.39	2.09	2.81	3.30	2.66	3.15	2.84	2.48	30.26
Dunbar	NT(36) 672791	75	1.99	1.38	1.48	1.38	1.90	1.73	2.37	2.71	2.11	2.41	2.18	1.81	23.45

TABLE 1B

Accumulated Mean Daily Rainfall, in inches, 1916-1950

EDINBURGH, BLACKFORD HILL

Date	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1	.14	2.52	4.18	5.78	7.38	9.65	11.51	14.55	17.73	20.28	23.07	25.49
2	.23	2.59	4.21	5.83	7.41	9.73	11.60	14.61	17.81	20.37	23.19	25.58
3	.31	2.66	4.26	5.88	7.45	9.81	11.67	14.64	17.89	20.46	23.29	25.64
4	.42	2.73	4.31	5.92	7.59	9.88	11.85	14.69	17.97	20.54	23.39	25.69
5	.46	2.79	4.40	5.96	7.70	9.95	11.93	14.73	18.01	20.67	23.49	25.76
6	.54	2.85	4.43	5.99	7.78	10.03	12.05	14.87	18.09	20.76	23.59	25.82
7	.64	2.91	4.46	6.06	7.85	10.08	12.23	15.03	18.18	20.86	23.70	25.87
8	.70	2.99	4.50	6.10	7.92	10.14	12.31	15.19	18.22	20.98	23.77	25.93
9	.79	3.05	4.55	6.15	7.96	10.21	12.44	15.26	18.34	21.10	23.85	26.01
10	.87	3.11	4.58	6.20	8.00	10.28	12.55	15.32	18.39	21.21	23.90	26.06
11	.94	3.16	4.64	6.27	8.07	10.33	12.65	15.38	18.47	21.26	23.98	26.14
12	.99	3.19	4.69	6.32	8.13	10.39	12.69	15.57	18.53	21.33	24.06	26.19
13	1.07	3.22	4.74	6.36	8.21	10.45	12.88	15.64	18.63	21.40	24.13	26.26
14	1.16	3.29	4.77	6.43	8.26	10.54	12.95	15.81	18.71	21.43	24.22	26.31
15	1.22	3.37	4.81	6.48	8.37	10.59	13.03	15.92	18.79	21.47	24.30	26.36
16	1.30	3.40	4.91	6.54	8.40	10.63	13.15	16.02	18.91	21.53	24.37	26.43
17	1.38	3.43	4.96	6.62	8.50	10.68	13.32	16.23	19.04	21.64	24.49	26.48
18	1.46	3.51	5.02	6.66	8.56	10.74	13.44	16.33	19.13	21.72	24.60	26.50
19	1.53	3.57	5.07	6.72	8.59	10.78	13.53	16.43	19.28	21.76	24.66	26.59
20	1.61	3.63	5.12	6.77	8.68	10.84	13.60	16.59	19.39	21.84	24.71	26.68
21	1.70	3.68	5.17	6.83	8.76	10.93	13.68	16.68	19.49	21.97	24.78	26.76
22	1.76	3.74	5.21	6.91	8.87	11.02	13.72	16.74	19.62	22.08	24.83	26.83
23	1.85	3.78	5.26	6.98	8.94	11.06	13.76	16.80	19.66	22.25	24.92	26.87
24	1.93	3.81	5.28	7.04	9.02	11.12	13.81	16.90	19.75	22.35	24.97	26.93
25	2.01	3.85	5.34	7.09	9.08	11.17	13.86	17.00	19.81	22.50	25.06	27.04
26	2.07	3.93	5.39	7.14	9.15	11.21	13.95	17.10	19.89	22.58	25.13	27.11
27	2.12	4.00	5.45	7.20	9.23	11.29	14.12	17.21	19.97	22.64	25.16	27.16
28	2.21	4.05	5.52	7.26	9.34	11.35	14.24	17.35	20.07	22.72	25.28	27.25
29	2.30	4.13	5.59	7.31	9.38	11.41	14.33	17.48	20.10	22.83	25.34	27.38
30	2.34		5.66	7.35	9.48	11.44	14.40	17.56	20.17	22.92	25.42	27.47
31	2.45		5.73		9.56		14.47	17.62		23.00		27.53

NOTE:- The entry under any particular date is the mean rainfall from January 1st to the date in question.

TABLE 1C

Accumulated Frequencies of Daily Rainfall, in inches, 1916-1950

EDINBURGH, BLACKFORD HILL

Daily totals	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	All Months
2.90								1					1
2.80								2					2
2.70								2					2
2.60							1	2					3
2.50							1	2					3
2.40							1	2					3
2.30							1	3					4
2.20							1	3					4
2.10							1	3					4
2.00							1	3	1				5
1.90							1	3	1				5
1.80							2	3	1				6
1.70							2	3	1				6
1.60	1						3	5	1				10
1.50	1				1		4	7	2	2	1		18
1.40	1				2		5	9	4	2	1		24
1.30	1				3	1	7	9	5	2	2		30
1.20	1		1	1	5	1	8	10	8	2	2		39
1.10	1	1	2	1	5	2	9	12	8	3	2		46
1.00	1	1	2	1	6	3	12	14	9	4	3	1	57
0.90	2	1	2	3	8	6	19	16	13	6	6	2	84
0.80	2	1	3	5	12	10	25	19	15	10	11	3	116
0.70	7	5	6	9	17	12	27	28	24	14	13	4	166
0.60	15	7	10	11	20	16	39	39	27	26	17	9	236
0.50	29	12	15	16	26	23	59	57	38	41	27	19	362
0.40	41	24	28	21	41	37	73	72	57	72	44	36	546
0.30	76	45	48	38	72	60	106	105	90	108	74	59	881
0.20	143	87	75	77	121	110	162	157	136	165	133	117	1483
0.10	275	192	154	185	233	191	256	281	236	278	272	244	2797
0.005	696	592	605	589	577	529	607	622	601	661	668	651	7398
* ≤ 0.004	389	397	480	461	508	521	478	463	449	424	382	434	5386
Total No. of days	1085	989	1085	1050	1085	1050	1085	1085	1050	1085	1050	1085	12784

* Including rainless days

Example:-

The entry at 0.20 inch is the total number of days in the 35 years from 1916 to 1950 with falls of 0.20 inch or more.

TABLE 1D

Maximum Daily Rainfall in inches - BLACKFORD HILL, EDINBURGH - 1900 to 1965

	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sep.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>
Maximum Daily Fall	1.65	1.43	1.24	1.29	1.54	1.32	2.68	3.00	2.08	3.13	1.63	1.67
Year of Occurrence	1942	1903	1925	1934	1938	1931	1916	1920	1927	1907	1962	1953

Example:-

The daily fall of 1.65 inches which occurred in January 1942 is the highest daily fall recorded at Blackford Hill in any January during the period from 1900 to 1965.

TABLE 1E

Number of Hours with Rain (Any Amount) between the hours of 07h. and 17h. Greenwich Mean Time (08h. and 18h. British Summer Time) in each month and year during the 10 years period from 1955 to 1964

at TURNHOUSE (EDINBURGH) AIRPORT

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
1955	67	63	59	18	63	56	26	30	36	58	37	101	614
1956	62	85	53	35	63	77	78	91	54	69	21	112	800
1957	95	63	97	46	69	42	81	87	86	67	97	93	923
1958	79	87	98	74	95	66	87	106	71	55	49	113	980
1959	35	62	62	75	35	70	68	20	26	62	123	105	743
1960	106	65	84	73	52	70	125	92	65	118	77	70	997
1961	83	85	67	91	48	62	54	107	99	94	79	99	968
1962	107	88	58	92	83	62	62	124	76	54	96	96	998
1963	83	71	100	102	116	90	79	123	68	70	133	64	1099
1964	64	57	101	110	101	62	65	115	82	50	90	100	997
10 years total	781	726	779	716	725	657	725	895	663	697	802	953	9119
10 years average	78.1	72.6	77.9	71.6	72.5	65.7	72.5	89.5	66.3	69.7	80.2	95.3	911.9

TABLE 1F

Computed amounts of rain falling in stated times from Bilham's formula

	5 mins. or less	10 mins. or less	15 mins. or less	20 mins. or less	30 mins. or less	45 mins. or less	1 hour or less	2 hours or less	3 hours or less	4 hours or less	5 hours or less	6 hours or less	9 hours or less	12 hours or less	18 hours or less	24 hours or less
1 day per annum	.18	.23	.28	.31	.36	.41	.46	.58	.66	.72	.77	.82	.93	1.02	1.16	1.26
1 day per 2 yrs.	.24	.31	.36	.40	.46	.52	.58	.72	.82	.90	.96	1.01	1.15	1.26	1.43	1.56
1 day per 5 yrs.	.33	.43	.49	.55	.62	.71	.78	.98	1.09	1.19	1.28	1.35	1.53	1.66	1.88	2.04
1 day per 10 yrs.	.43	.54	.62	.68	.77	.88	.97	1.20	1.35	1.47	1.57	1.66	1.87	2.04	2.31	2.51
1 day per 20 yrs.	.54	.68	.78	.85	.97	1.10	1.20	1.47	1.66	1.81	1.93	2.04	2.30	2.51	2.82	3.07
1 day per 40 yrs.	.68	.85	.97	1.06	1.19	1.35	1.48	1.82	2.04	2.22	2.37	2.50	2.82	3.07	3.45	3.75
1 day per 160 yrs.	1.06	1.31	1.49	1.61	1.82	2.06	2.24	2.73	3.07	3.34	2.56	3.75	4.22	4.58	5.15	5.60

The above values were computed from the formula $\log n = 0.0952 + \log t - 3.55 \log (r + 0.1)$ where t = time in hours r = rainfall in inches n = number of occurrences in 10 years

TABLE 2

Averages of Daily Maximum, Minimum and Mean Temperature in degrees Fahrenheit for Temperature Recording Stations in the Edinburgh Area
- 30 years period from 1931 to 1960

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
BLACKFORD HILL (altitude 441 feet)													
Maximum	41.8	42.7	46.4	51.5	56.4	62.1	65.2	64.0	60.2	53.7	47.7	44.3	53.0
Minimum	33.7	33.9	36.3	39.4	43.5	48.6	52.4	52.2	49.2	44.5	39.1	36.3	42.4
Mean	37.7	38.3	41.3	45.5	49.9	55.3	58.8	58.1	54.7	49.1	43.4	40.3	47.7
ROYAL BOTANIC GARDEN (altitude 74 feet)													
Maximum	42.9	44.6	48.2	53.2	58.1	63.7	66.6	65.6	62.1	55.4	48.9	45.0	54.5
Minimum	31.9	33.1	35.3	38.6	43.0	48.4	52.0	51.4	48.1	43.0	37.1	34.7	41.4
Mean	37.4	38.9	41.7	45.9	50.5	56.1	59.3	58.5	55.1	49.2	43.0	39.3	47.9
DAVIDSON'S MAINS (altitude 200 feet)													
Maximum	41.9	43.4	47.4	52.7	57.7	63.1	66.2	65.2	61.3	54.4	47.9	44.1	53.8
Minimum	32.4	32.9	35.6	38.4	43.0	48.5	51.7	51.1	48.0	43.1	37.5	35.3	41.5
Mean	37.1	38.1	41.5	45.6	50.4	55.8	58.9	58.1	54.7	48.7	42.7	39.7	47.7
TURNHOUSE AIRPORT (altitude 114 feet)													
Maximum	41.8	43.7	47.7	52.8	57.7	63.0	66.1	65.2	61.3	54.7	48.4	43.9	53.9
Minimum	32.1	32.6	35.0	37.5	42.2	47.5	51.2	50.3	47.2	42.6	37.3	35.1	40.9
Mean	36.9	38.1	41.3	45.1	49.9	55.3	58.7	57.7	54.3	48.7	42.9	35.5	47.4
LIBERTON (altitude 200 feet)													
Maximum	42.6	43.9	47.9	53.0	58.1	63.9	66.8	65.6	61.9	55.2	48.6	44.8	54.4
Minimum	32.7	33.4	35.4	38.5	42.4	47.8	51.5	50.7	47.7	42.5	37.8	35.2	41.3
Mean	37.7	38.6	41.6	45.7	50.3	55.9	59.2	58.2	54.8	48.8	43.2	40.0	47.8
BUSH HOUSE (altitude 605 feet)													
Maximum	41.2	42.2	45.7	50.4	55.5	60.9	64.3	63.0	59.2	53.1	46.1	43.2	52.1
Minimum	31.1	31.3	33.9	36.3	40.5	46.1	49.8	49.5	46.0	41.5	36.0	33.3	39.6
Mean	36.1	36.7	39.8	43.3	48.0	53.5	57.1	56.3	52.6	47.3	41.1	38.3	45.9
BOGHALL (altitude 639 feet)													
Maximum	41.0	41.7	45.7	50.9	56.7	62.2	64.4	63.7	59.7	53.1	46.8	43.2	52.3
Minimum	31.8	32.5	34.7	37.6	41.7	46.8	50.5	50.0	46.9	42.3	37.4	34.5	40.6
Mean	36.3	37.0	40.3	44.2	49.1	54.5	47.4	56.8	53.2	47.7	42.1	38.8	46.4

TABLE 2 (contd.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
PENICUIK (altitude 620 feet)													
Maximum	40.7	42.0	46.5	51.8	57.5	63.0	65.9	64.7	60.6	53.7	46.9	43.3	53.0
Minimum	30.5	31.1	33.4	36.5	40.9	46.3	50.1	49.5	46.3	41.3	35.9	33.1	39.6
Mean	35.6	36.5	39.9	44.1	49.2	54.7	58.0	57.1	53.5	47.5	41.4	38.1	46.3
HADDINGTON (altitude 162 feet)													
Maximum	41.7	43.4	47.3	53.1	57.6	63.7	66.6	65.3	62.0	54.8	48.0	43.8	53.9
Minimum	30.4	31.6	34.4	37.7	41.5	46.8	50.5	50.1	46.6	41.8	36.0	33.7	40.1
Mean	36.1	37.5	40.9	45.4	49.5	55.3	58.5	57.7	54.3	48.3	42.0	38.7	47.0
BALERNO (altitude 700 feet)													
Maximum	41.1	40.9	46.1	51.6	57.8	63.0	65.4	65.1	60.7	54.9	47.3	43.9	53.1
Minimum	30.1	30.0	33.1	36.0	40.3	45.6	48.6	48.9	47.5	43.0	37.1	34.0	39.5
Mean	35.6	35.5	39.6	43.8	49.1	54.3	57.0	57.0	54.1	48.9	42.2	38.9	46.3

TABLE 2A

Averages of the Highest and Lowest Temperatures in Each Month
in degrees Fahrenheit for Temperature Recording Stations
in EDINBURGH

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
<u>BLACKFORD HILL</u> (altitude 441 feet) 30 years from 1931-1960													
Average of the Highest each Month	52	52	57	63	69	74	75	73	69	63	56	53	78 *
Average of the Lowest each Month	24	25	28	31	35	42	46	45	41	34	31	27	22 **
<u>ROYAL BOTANIC GARDEN</u> (altitude 74 feet) 25 years from 1939-1963													
Average of the Highest each Month	52	54	58	64	70	75	75	74	71	65	58	54	79 *
Average of the Lowest each Month	19	21	24	28	33	39	43	43	37	30	26	22	16 **
<u>DAVIDSON'S MAINS</u> (altitude 200 feet) 30 years from 1934-1963													
Average of the Highest each Month	51	52	57	64	70	75	75	74	70	64	56	53	79 *
Average of the Lowest each Month	21	23	25	29	34	40	44	43	38	32	27	24	19 **
<u>TURNHOUSE AIRPORT</u> (altitude 114 feet) 15 years from 1949-1963													
Average of the Highest each Month	53	53	57	64	69	75	74	73	71	65	57	54	78 *
Average of the Lowest each Month	17	17	22	26	31	37	40	39	36	28	24	19	12 **

* = Average of the Highest each Year

** = Average of the Lowest each Year

TABLE 2B

Absolute Highest and Lowest Temperatures in degrees Fahrenheit
recorded in Each Month at Temperature Recording
Stations in EDINBURGH

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
<u>BLACKFORD HILL</u> (altitude 441 feet) 66 years from 1900 to 1965													
Absolute Highest in each Month	57	60	68	72	76	83	84	83	85	76	67	58	85*
Absolute Lowest in each Month	14	15	15	20	29	37	37	40	33	28	18	19	14**
<u>ROYAL BOTANIC GARDEN</u> (altitude 74 feet) 27 years from 1939 to 1965													
Absolute Highest in each Month	59	59	72	71	76	85	83	82	78	76	69	61	85*
Absolute Lowest in each Month	4	11	11	21	29	34	40	36	28	26	16	12	4**
<u>DAVIDSON'S MAINS</u> (altitude 200 feet) 32 years from 1934 to 1965													
Absolute Highest in each Month	57	58	69	72	76	86	82	83	77	76	67	59	86*
Absolute Lowest in each Month	13	11	12	25	29	35	39	38	30	27	19	14	11**
<u>TURNHOUSE AIRPORT</u> (altitude 114 feet) 17 years from 1949 to 1965													
Absolute Highest in each Month	58	59	69	68	75	82	81	83	77	76	59	58	83*
Absolute Lowest in each Month	5	3	13	22	29	32	37	35	27	23	16	8	3**

* = Absolute Highest During Whole Period

** = Absolute Lowest During Whole Period

TABLE 2C

Percentage Amount of Time with Air ("Shade") Temperatures below
certain limits - degrees Fahrenheit
at TURNHOUSE (EDINBURGH) AIRPORT 9 years 1952 to 1960

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
	%	%	%	%	%	%	%	%	%	%	%	%	%
32°F or below	24.8	21.9	7.3	3.3	0.2	0.0	0.0	0.0	0.1	1.6	7.1	12.9	6.5
36°F or below	44.9	46.2	19.4	9.1	2.1	0.1	0.0	0.0	0.5	4.4	13.5	26.3	13.7
40°F or below	67.8	67.4	42.2	20.7	6.9	0.9	0.1	0.3	2.0	9.9	28.1	49.1	24.5
46°F or below	88.3	87.1	77.9	51.8	24.1	7.3	1.8	2.9	10.4	27.6	64.1	81.1	43.5
50°F or below	97.0	96.1	92.0	73.1	49.8	23.5	7.0	9.9	23.4	51.8	86.9	93.0	58.3
56°F or below	99.9	99.9	99.3	94.5	80.3	60.7	38.2	41.7	61.3	87.5	99.2	99.7	80.1
60°F or below	100.0	100.0	99.9	98.8	91.5	82.1	66.6	69.4	83.3	96.1	100.0	100.0	90.5
66°F or below			100.0	99.9	98.5	95.3	91.8	92.9	96.4	99.7			97.7
70°F or below				100.0	99.6	98.7	97.2	98.2	99.1	99.9			99.3
76°F or below					100.0	99.9	99.5	99.8	100.0	100.0			99.7
80°F or below						100.0	99.9	100.0					99.9
82°F or below							100.0						100.0

TABLE 2D

Number of Days with Maximum Air Temperatures exceeding 60°F
at TURNHOUSE AIRPORT - 15 years from 1949 to 1963

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
1949				5	12	23	27	31	25	12			135
1950					6	26	28	28	12	2			102
1951					3	19	28	26	20	7			103
1952				3	13	18	29	25	7				95
1953			2	1	19	16	30	29	17	2			116
1954					9	15	27	19	12	5			87
1955				3	4	18	28	30	22	6			111
1956				2	17	14	22	16	12	2			85
1957			1	3	12	22	28	25	12	4			107
1958				4	6	16	25	27	27	2			107
1959				3	13	22	31	30	24	13			136
1960				5	22	28	28	26	14	2			125
1961			1	5	8	25	28	27	23	7			124
1962				3	3	25	16	25	8	7			87
1963				2	4	16	21	21	12	4			80
15 year average	0	0	<1	3	10	20	26	26	16	5	0	0	107

Number of Days with Maximum Air Temperatures exceeding 65°F
at TURNHOUSE AIRPORT - 15 years from 1949 to 1963

1949				2	5	10	22	17	14	5			75
1950					1	17	18	16	1				53
1951						6	21	8	4				39
1952				1	7	8	18	13					47
1953				1	5	7	14	17	4				48
1954					4	1	5	7	3				20
1955				1	2	9	24	24	10	1			71
1956					3	7	10	1	4				25
1957					1	13	13	10	1				38
1958				1	1	6	12	13	10				43
1959				1	3	9	24	23	14	7			81
1960					11	19	17	12	6				65
1961					2	6	9	14	10	1			42
1962				1	1	10	11	5	2				30
1963						3	8	5	3				19
15 year Average	0	0	0	1	3	9	15	12	6	1	0	0	47

TABLE 2D (cont.)

Number of Days with Maximum Air Temperatures exceeding 70°F
at TURNHOUSE AIRPORT - 15 years from 1949 to 1963

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
1949					2	4	14	5	2				27
1950						10	4	3					17
1951							2	2	1				5
1952					5	4	8	1					18
1953					2	3	0	4	3				12
1954									1				1
1955							14	11	1				26
1956					1	2	1						4
1957						6	5	1					12
1958					1	0	4	1	2				8
1959						3	10	13	8	1			35
1960					1	5	1	2					9
1961						2	0	3	1				6
1962						3							3
1963						1	4	1					6
15 year average	0	0	0	0	1	3	4	3	1	<1	0	0	13

Number of Days with Maximum Air Temperatures exceeding 75°F
at TURNHOUSE AIRPORT - 15 years from 1949 to 1963

1949						1	3	2	1				7
1950						5							5
1951													0
1952							2						2
1953						1	0	1					2
1954													0
1955							6	3					9
1956						1							1
1957						1							1
1958							1						1
1959						1	2	3	2	1			9
1960						3							3
1961								1					1
1962						3							3
1963							1						1
15 year average	0	0	0	0	0	1	1	1	<1	<1	0	0	3

NOTE: During the 15 year period from 1949 to 1963, there was a total of only four days with temperatures exceeding 80°F viz. one day in June 1950, one day in July 1949, one day in July 1955 and one day in August 1961.

TABLE 2E

Numbers of Days of Air Frost (Minimum Air Temperature 32°F or less)
at BLACKFORD HILL and TURNHOUSE AIRPORT
during 10 years from 1955 to 1964

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year total
<u>BLACKFORD HILL - Altitude 441 feet</u>													
1955	17	21	12	0	1	0	0	0	0	4	2	11	68
1956	17	20	7	1	0	0	0	0	0	0	3	5	53
1957	5	13	0	0	1	0	0	0	0	0	1	8	28
1958	16	13	18	5	0	0	0	0	0	0	2	6	60
1959	23	9	0	0	0	0	0	0	0	0	1	3	36
1960	10	16	2	0	0	0	0	0	0	0	1	12	41
1961	12	3	1	2	0	0	0	0	0	0	5	21	44
1962	5	8	15	4	0	0	0	0	0	0	9	12	53
1963	23	27	6	2	0	0	0	0	0	0	5	7	70
1964	7	7	7	0	0	0	0	0	0	1	2	10	34
10 year total	135	137	68	14	2	0	0	0	0	5	31	95	487

TURNHOUSE AIRPORT - Altitude 114 feet

1955	17	24	23	9	6	0	0	0	0	10	6	12	107
1956	18	21	7	11	3	0	0	0	0	3	8	6	77
1957	15	15	3	4	1	0	0	0	1	0	9	12	60
1958	18	13	17	7	3	0	0	0	0	1	6	12	77
1959	26	11	5	4	3	0	0	0	0	1	6	6	62
1960	18	21	6	2	1	0	0	0	0	2	10	15	75
1961	18	8	3	4	1	0	0	0	0	0	10	22	66
1962	9	7	18	7	0	1	0	0	0	3	11	17	73
1963	22	25	5	1	0	0	0	0	0	2	8	13	76
1964	9	9	8	2	0	0	0	0	1	5	9	14	57
10 year total	170	154	95	51	18	1	0	0	2	27	83	129	730

TABLE 2F

Average Number of Days of Air Frost (Minimum Air Temperature 32°F or less)
at Temperature Recording Stations in
the EDINBURGH district - 10 years 1955 to 1964

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
<u>BLACKFORD HILL</u> - altitude 441 feet	13	14	7	1	<1	0	0	0	0	1	3	9	49
<u>ROYAL BOTANIC GARDEN</u> - altitude 74 feet	15	15	9	4	1	0	0	0	0	2	7	13	66
<u>TURNHOUSE AIRPORT</u> - altitude 114 feet	17	15	9	5	2	<1	0	0	<1	3	8	13	73
<u>DAVIDSON'S MAINS</u> - altitude 200 feet	16	15	8	3	1	0	0	0	0	1	7	13	64
<u>PENICUIK</u> - altitude 620 feet	19	18	13	7	2	<1	0	0	<1	3	9	15	86
<u>BUSH HOUSE</u> - altitude 605 feet	18	18	11	6	2	<1	0	0	<1	2	9	16	82

NOTE: Temperature records commenced at Turnhouse Airport in the winter of 1948/49 and the longest period on record in which temperatures did not rise above freezing point is $6\frac{1}{2}$ days in January 1955 i.e. for $6\frac{1}{2}$ days, air temperatures were continuously below freezing point.

TABLE 2G

Average and Extreme Dates of First and Last Air Frosts at Temperature Recording Stations in the EDINBURGH Area during the 10 years 1955-1964

		<u>Average Date of First Air Frost</u>	<u>Average Date of Last Air Frost</u>
Blackford Hill	=	8th November	7th April
Royal Botanic Garden	=	25th October	21st April
Turnhouse Airport	=	15th October	9th May
Davidson's Mains	=	30th October	17th April
Bush House	=	22nd October	8th May
Penicuik	=	16th October	12th May

		<u>Earliest Date of First Air Frost</u>	<u>Latest Date of Last Air Frost</u>
Blackford Hill	=	10th October	16th May
Royal Botanic Garden	=	10th October	21st May
Turnhouse Airport	=	21st September	1st June
Davidson's Mains	=	15th October	21st May
Bush House	=	21st September	1st June
Penicuik	=	22nd September	31st May

Table 2H

Table for Converting Degrees Fahrenheit to Degrees Centigrade

<u>°F.</u>	<u>°C.</u>	<u>°F.</u>	<u>°C.</u>	<u>°F.</u>	<u>°C.</u>
0	minus 17.8	30	minus 1.1	60	15.6
2	minus 16.7	32	0.0	62	16.7
4	minus 15.6	34	1.1	64	17.8
6	minus 14.4	36	2.2	66	18.9
8	minus 13.3	38	3.3	68	20.0
10	minus 12.2	40	4.4	70	21.1
12	minus 11.1	42	5.6	72	22.2
14	minus 10.0	44	6.7	74	23.3
16	minus 8.9	46	7.8	76	24.4
18	minus 7.8	48	8.9	78	25.6
20	minus 6.7	50	10.0	80	26.7
22	minus 5.6	52	11.1	82	27.8
24	minus 4.4	54	12.2	84	28.9
26	minus 3.3	56	13.3	86	30.0
28	minus 2.2	58	14.4	88	31.1

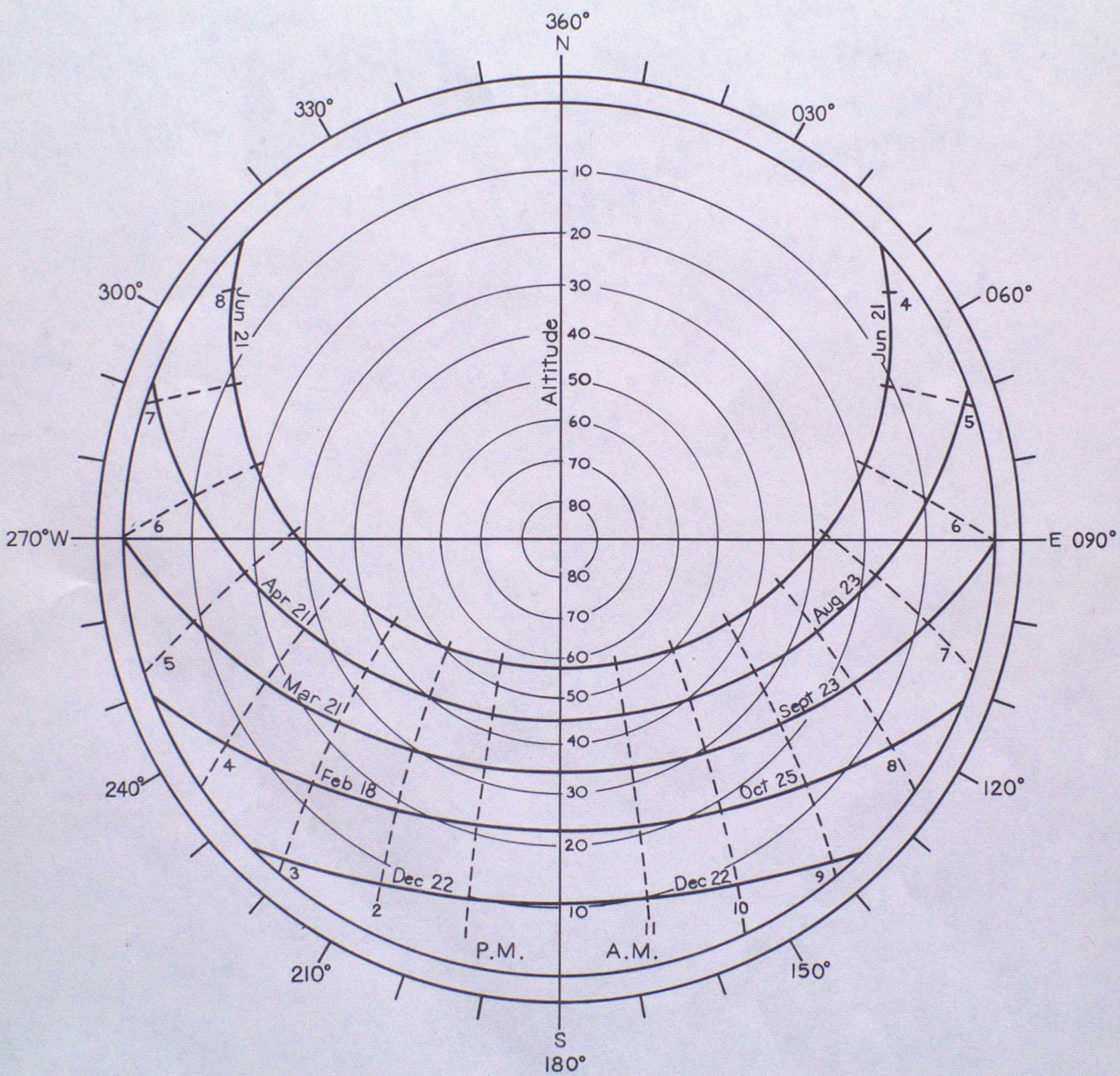


Fig 2. SOLAR CHART FOR EDINBURGH Latitude 56°N

TABLE 3

Averages of Sunshine Duration in Hours - Monthly Totals and Daily Means over 30 year period from 1931 to 1960 at places in the EDINBURGH Area

	Jan. hr.	Feb. hr.	Mar. hr.	Apr. hr.	May hr.	June hr.	July hr.	Aug. hr.	Sep. hr.	Oct. hr.	Nov. hr.	Dec. hr.	Year hr.
<u>BLACKFORD HILL</u> - altitude 441 feet													
Monthly Total	54	76	111	146	181	188	162	143	126	96	57	44	1,384
Daily Mean	1.75	2.69	3.57	4.85	5.84	6.26	5.23	4.62	4.21	3.10	1.91	1.41	3.79
<u>BOGHALL</u> - altitude 639 feet													
Monthly Total	49	70	100	136	168	173	147	133	114	87	54	37	1,268
Daily Mean	1.58	2.48	3.23	4.53	5.41	5.78	4.74	4.30	3.80	2.82	1.80	1.19	3.48
<u>ROYAL BOTANIC GARDEN</u> - altitude 74 feet													
Monthly Total	44	65	97	145	181	188	169	146	125	88	50	32	1,330
Daily Mean	1.42	2.31	3.14	4.83	5.85	6.27	5.44	4.70	4.17	2.83	1.66	1.03	3.64
<u>DAVIDSON'S MAINS</u> - altitude 200 feet													
Monthly Total	47	71	101	142	174	175	151	135	117	87	54	39	1,293
Daily Mean	1.52	2.54	3.26	4.72	5.60	5.85	4.88	4.35	3.89	2.82	1.79	1.24	3.54
<u>TURNHOUSE AIRPORT</u> - altitude 114 feet													
Monthly Total	47	71	101	142	181	183	159	135	119	87	54	36	1,315
Daily Mean	1.53	2.53	3.26	4.72	5.85	6.09	5.14	4.36	3.96	2.79	1.81	1.17	3.60
<u>LIBERTON</u> - altitude 200 feet													
Monthly Total	51	78	110	141	166	172	151	146	124	95	54	26	1,315
Daily Mean	1.63	2.78	3.55	4.70	5.35	5.74	4.88	4.70	4.15	3.06	1.81	.85	3.60
<u>BALERNO</u> - altitude 700 feet													
Monthly Total	46	69	101	140	183	187	158	139	115	88	51	37	1,315
Daily Mean	1.48	2.48	3.27	4.67	5.91	6.24	5.10	4.48	3.82	2.84	1.72	1.18	3.60

TABLE 4

Annual Percentage Frequency of Wind Direction and Velocity at
TURNHOUSE (EDINBURGH) AIRPORT

Mean Wind Speed	Wind Directions in Degrees (true)												All Directions
	350- 10	20- 40	50- 70	80- 100	110- 130	140- 160	170- 190	200- 220	230- 250	260- 280	290- 310	320- 340	
0 m.p.h.	-	-	-	-	-	-	-	-	-	-	-	-	16.7%
1- 3 "	0.3	0.7	0.7	0.5	0.3	0.2	0.2	0.3	0.7	0.9	0.3	0.2	5.3%
4- 7 "	0.6	1.1	2.8	1.9	0.7	0.4	0.5	0.6	2.0	2.4	0.8	0.4	14.2%
8-12 "	0.7	1.4	5.9	2.8	1.5	0.8	0.8	1.7	5.8	4.3	1.1	1.4	28.2%
13-18 "	0.4	0.4	2.7	1.0	1.0	0.5	0.6	2.8	6.5	4.4	0.6	0.4	21.3%
19-24 "	0.1	0+	0.3	0.1	0.2	0.1	0.3	1.7	3.0	2.4	0.2	0.1	8.5%
25-31 "		0+	0+	0+	0.1	0+	0.1	1.0	2.0	1.1	0+	0+	4.3%
32-38 "					0+		0+	0.5	0.5	0.2	0+		1.2%
39-46 "							0+	0.1	0.2	0+			0.3%
47-54 "								0+					0+
55-63 "													0.0%

Total 4-12 m.p.h.	1.3	2.5	8.7	4.7	2.2	1.2	1.3	2.3	7.8	6.7	1.9	1.8	42.4%
Total 13-24 m.p.h.	0.5	0.4	3.0	1.1	1.2	0.6	0.9	4.5	9.5	6.8	0.8	0.5	29.8%
Total 25-38 m.p.h.		0+	0+	0+	0.1	0+	0.1	1.5	2.5	1.3	0+	0+	5.5%
Total 39 mph. or more							0+	0.1	0.2	0+			0.3%

Total 4 mph. or more	1.8	2.9	11.7	5.8	3.5	1.8	2.3	8.4	20.0	14.8	2.7	2.3	78.0%
----------------------	-----	-----	------	-----	-----	-----	-----	-----	------	------	-----	-----	-------

Notes:- 0+ = less than 0.05%

Under 4 m.p.h. 22.0%

Total 100.0%

The above frequencies have been computed from recordings made 8 times daily at 00h., 03h., 06h., 09h., 12h., 15h., 18h., and 21h. G.M.T. during the 5 year period from 1957 to 1961.

TABLE 4A

Percentage Frequency of Wind Direction and Velocity by Seasons at
TURNHOUSE (EDINBURGH) AIRPORT

S P R I N G

Wind Directions in Degrees (true)

Mean Wind Speed	350- 10	20- 40	50- 70	80- 100	110- 130	140- 160	170- 190	200- 220	230- 250	260- 280	290- 310	320- 340	All Directions
Under 4 m.p.h.	-	-	-	-	-	-	-	-	-	-	-	-	18.2%
4-12 m.p.h.	1.8	3.1	12.2	6.8	3.0	1.3	1.0	1.7	6.0	4.6	1.9	1.3	44.7%
13-24 m.p.h.	0.5	0.3	5.6	1.3	2.3	0.5	1.0	4.5	7.0	6.9	1.1	0.4	31.4%
25-38 m.p.h.		0+	0+		0.1		0.1	1.5	2.2	1.6			5.5%
39 m.p.h. or more									0.1	0.1			0.2%
Total 4 m.p.h. or more	2.3	3.4	17.8	8.1	5.4	1.8	2.1	7.7	15.3	13.2	3.0	1.7	81.8%

S U M M E R

Under 4 m.p.h.	-	-	-	-	-	-	-	-	-	-	-	-	18.7%
4-12 m.p.h.	1.1	3.4	12.9	3.8	1.5	0.5	0.9	2.3	8.7	8.1	2.2	1.5	46.9%
13-24 m.p.h.	0.4	0.5	3.5	0.3	0.2	0.2	0.6	3.4	9.4	10.6	0.8	0.4	30.3%
25-38 m.p.h.							0.1	0.6	1.8	1.5	0+	0+	4.0%
39 m.p.h. or more								0+	0.1	0+			0.1%
Total 4 m.p.h. or more	1.5	3.9	16.4	4.1	1.7	0.7	1.6	6.3	20.0	20.2	3.0	1.9	81.3%

A U T U M N

Under 4 m.p.h.	-	-	-	-	-	-	-	-	-	-	-	-	24.3%
4-12 m.p.h.	1.1	2.1	6.6	4.5	2.1	1.4	2.1	3.3	8.9	6.4	1.7	1.1	41.3%
13-24 m.p.h.	0.5	0.4	2.2	1.4	0.9	1.0	1.0	5.3	10.6	5.4	0.5	0.7	29.9%
25-38 m.p.h.			0+		0+	0.1	0+	1.3	1.9	0.9	0+	0.1	4.3%
39 m.p.h.								0.1	0.1				0.2%
Total 4 m.p.h. or more	1.6	2.5	8.8	5.9	3.0	2.5	3.1	10.0	21.5	12.7	2.2	1.9	75.7%

W I N T E R

Under 4 m.p.h.	-	-	-	-	-	-	-	-	-	-	-	-	27.2%
4-12 m.p.h.	1.4	1.8	2.9	3.7	2.1	1.6	1.0	2.2	7.5	8.0	1.7	1.0	34.9%
13-24 m.p.h.	0.6	0.6	1.1	1.3	1.4	0.8	1.1	4.9	11.2	4.5	0.6	0.5	28.6%
25-38 m.p.h.			0.1	0+	0.1	0.1	0.3	2.3	4.2	1.2	0.1		8.4%
39 m.p.h. or more							0+	0.5	0.4	0+			0.9%
Total 4 m.p.h. or more	2.0	2.4	4.1	5.0	3.6	2.5	2.4	9.9	23.3	13.7	2.4	1.5	72.8%

Notes:- The above frequencies have been computed from recordings made 8 times daily at 00h., 03h., 06h., 09h., 12h., 15h., 18h., and 21h. G.M.T. during the 5 year period from 1957 to 1961.

0+ = less than 0.05%

TABLE 4B

Actual and Average Number of Days with Gales during
the 16 years from 1949 to 1964
at TURNHOUSE (EDINBURGH) AIRPORT

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
1949	6	4	2	2	0	1	0	1	0	1	0	1	18
1950	0	2	0	0	1	0	0	0	1	2	1	0	7
1951	0	1	0	2	0	0	0	0	0	0	0	4	7
1952	3	1	0	0	0	0	0	1	2	3	0	1	11
1953	3	1	0	2	0	0	0	0	1	0	1	0	8
1954	6	2	0	0	0	0	0	0	0	2	6	7	23
1955	1	2	1	0	1	1	0	0	0	0	0	6	12
1956	3	0	2	0	0	1	0	1	1	0	2	4	14
1957	8	2	1	1	0	0	0	1	1	2	1	3	20
1958	2	2	1	0	2	0	0	0	1	1	0	1	10
1959	1	4	0	0	0	1	0	0	0	0	2	3	11
1960	0	2	0	2	0	1	0	0	0	0	1	1	7
1961	2	3	2	0	0	1	1	1	2	1	0	0	13
1962	5	4	0	1	2	1	0	1	0	0	0	3	17
1963	1	0	2	1	0	0	0	0	1	2	1	1	9
1964	1	2	0	0	2	0	1	0	0	0	0	3	9
16 years total	42	32	11	11	8	7	2	6	10	14	15	38	196
16 years average	3	2	1	1	<1	<1	<1	<1	1	1	1	2	12

TABLE 5

Percentage Frequency of Occurrence of Visibilities less than
1,100 yards according to month and hour
at TURNHOUSE (EDINBURGH) AIRPORT

Time G.M.T.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
	%	%	%	%	%	%	%	%	%	%	%	%	%
00h. midnight	5	6	0.6	3	3	3	1	3	3	5	5	7	3.7
01h.	5	6	0.6	3	0.6	4	3	3	2	5	5	7	3.6
02h.	4	6	1	3	1	6	3	3	1	6	4	5	3.7
03h.	4	8	2	3	3	6	5	2	3	6	4	7	4.2
04h.	5	9	3	3	5	9	3	3	3	5	3	5	4.6
05h.	3	8	4	1	5	6	2	4	5	8	3	5	4.4
06h.	1	7	4	2	2	6	2	2	6	6	2	5	3.7
07h.	3	7	6	4	0.6	5	2	2	4	5	4	5	3.9
08h.	3	7	3	1	0.6	3	0.6	1	5	4	7	5	3.3
09h.	3	9	2	0.6	0.6	3	0.6	2	0.6	1	8	7	3.1
10h.	2	10	0.6	0.6	0.6	0.6	0	0.6	0.6	0.6	9	7	2.6
11h.	3	9	0.6	0.6	0.6	1	0	0.6	0.6	0	6	7	2.3
12h. noon	5	7	0	0.6	0	0.6	0	0	0.6	0	3	9	2.1
13h.	2	6	0.6	0.6	0.6	0	0	0	0.6	0	3	12	2.1
14h.	1	5	0	0.6	0	0	0	0.6	0	0	5	10	1.8
15h.	2	3	0	1	0	0	0	0	0	1	6	13	2.2
16h.	3	4	0	0.6	0	0.6	0.6	0	0.6	1	6	14	2.6
17h.	5	5	0.6	1	0	1	0.6	0.6	0.6	1	8	13	3.1
18h.	3	6	1	0.6	0	1	2	1	1	1	7	10	2.9
19h.	3	4	1	1	0.6	1	2	1	0.6	1	7	9	2.7
20h.	2	4	0.6	1	1	3	1	0	0.6	3	7	9	2.7
21h.	1	4	0.6	0.6	2	2	1	0.6	1	3	6	7	2.5
22h.	5	6	1	1	3	3	0.6	1	1	3	8	7	3.2
23h.	4	5	0.6	1	3	3	0	2	2	5	7	8	3.3

Percentage Amount of Total Time in each month with
Visibilities less than 1,100 yards at
TURNHOUSE (EDINBURGH) AIRPORT

3.1 6.3 1.4 1.5 1.4 2.8 1.2 1.4 1.7 2.9 5.4 8.0 3.1

Note: The above frequencies have been computed from hourly observations of
visibility made during the 5 year period from 1957 to 1961

TABLE 5A

Visibility at TURNHOUSE (EDINBURGH) AIRPORT During the Winter half-year
(October to March) and the Summer half-year (April-September),
According to Wind Direction*

Visibility Wind Direction (degrees)	<u>Winter Half-Year</u> % Probability			<u>Summer Half-Year</u> % Probability		
	Less than 440 yards	Less than 1100 yards	Less than 2200 yards	Less than 440 yards	Less than 1100 yards	Less than 2200 yards
350-010	0.2	1	7	0	0.2	0.9
020-040	0.9	2	13	0.8	2	6
050-070	1	3	14	1	4	9
080-100	0.3	2	10	0.5	1	5
110-130	0.5	2	5	0.5	1	3
140-160	0.7	2	4	0	0	0.3
170-190	0.6	0.6	0.9	0	0.4	0.9
200-220	0	0.1	0.3	0	0.1	0.1
230-250	0.2	0.4	2	0.1	0.1	0.3
260-280	0.5	2	5	0.1	0.1	0.3
290-310	0.7	1	5	0	0	0.3
320-340	1	2	5	0	0	0
Calms	11	19	39	3	6	11

* Results derived from hourly observations during the 5 years, 1957-1961

TABLE 5B

Number of Days During the 8 years from 1957 to 1964 on
which Visibility Fell to Below 220 yards (Thick Fog)
at TURNHOUSE (EDINBURGH) AIRPORT

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
1957	0	1	1	1	1	0	2	1	0	2	0	0	9
1958	0	0	1	1	1	5	1	1	4	1	6	2	23
1959	3	7	0	0	2	1	0	0	3	6	3	1	26
1960	1	3	1	0	1	0	1	2	0	5	5	6	25
1961	1	1	0	3	1	0	0	0	0	1	4	7	18
1962	4	0	1	2	0	0	0	0	1	3	0	2	13
1963	1	3	2	0	0	3	0	0	0	3	2	2	16
1964	3	1	1	3	1	2	1	0	3	3	5	0	23
8 year total	13	16	7	10	7	11	4	4	11	24	25	20	153
8 year average	2	2	1	1	1	1	1	1	1	3	3	3	19

Number of Hours During the 8 years from 1957 to 1964
in which the Visibility was Below 220 yards
(Thick Fog) at TURNHOUSE (EDINBURGH) AIRPORT

1957	0	2	3	1	1	0	5	2	0	4	0	0	18
1958	0	0	1	4	1	16	1	2	14	3	16	21	79
1959	8	70	0	0	3	1	0	0	10	26	11	1	130
1960	2	13	6	0	1	0	1	6	0	10	21	97	157
1961	4	1	0	8	1	0	0	0	0	1	25	31	71
1962	34	0	1	9	0	0	0	0	2	18	0	12	76
1963	3	8	7	0	0	12	0	0	0	24	10	18	82
1964	9	3	7	13	4	3	1	0	19	8	38	0	105
8 year total	60	97	25	35	11	32	8	10	45	94	121	180	718
8 year average	8	12	3	4	1	4	1	1	6	12	15	23	90

TABLE 6

Actual and Average Number of Days with Snow or Sleet Falling
at TURNHOUSE (EDINBURGH) AIRPORT - 16 years from 1949 to 1964

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
1949	2	2	4	1							1	5	15
1950	3	5	2	3	1						3	9	26
1951	8	8	10	7								5	38
1952	13	3	5								3	10	34
1953	2	7	0	1								1	11
1954	5	7	3	1	1						2	3	22
1955	7	14	8	0	3					1	0	6	39
1956	8	14	4	1	1						3	4	35
1957	7	7	1								1	4	20
1958	9	8	13	2								7	39
1959	7	1	1							1	2	1	13
1960	9	10	2									2	23
1961	5	4	2	1							3	10	25
1962	3	8	6	4							2	9	32
1963	17	16	0	1							4	5	43
1964	3	6	6	1	1						1	8	26
16 years total	108	120	67	23	7					2	25	89	441
16 years average	7	7	4	1	<1					<1	2	6	28

TABLE 6A

Number of Days with Snow Lying at 9 a.m. at Depths
Between Specified Limits - at Places in the EDINBURGH Area

TURNHOUSE AIRPORT - Altitude 114 feet									Maximum Depth = 6 inches
Depth - Inches	0-1	2	3-4	5-6	7-8	9-12	13-16	Over 16	Total
Winter of:									
1956-57	4								4
1957-58	11	1	1	2					15
1958-59	10	1							11
1959-60	1	4	6	2					13
1960-61	1	1							2
1961-62	7	2	4						13
1962-63	17	11	6	5					39
1963-64	1	1							2
1964-65	7	8	3						18
Total	59	29	20	9					117
% Total	50.4	24.8	17.1	7.7					100%

ROYAL BOTANIC GARDEN - Altitude 74 feet									Maximum Depth = 9 inches
Winter of:									
1949-50	2								2
1950-51	14	4	3						21
1951-52	20	3	4						27
1952-53	5								5
1953-54	6								6
1954-55	8	4	15		4	2			33
1955-56	18		5						23
1956-57	1								1
1957-58	18		2						20
1958-59	11								11
1959-60	14	2	3						19
1960-61	2	1							3
1961-62	15		1						16
1962-63	34	14	8						56
1963-64	1								1
1964-65	12	6	4						22
Total	181	34	45		4	2			266
% Total	68.0	12.8	16.9		1.5	0.8			100%

TABLE 6A (contd.)

BUSH HOUSE - Altitude 605 feet					Maximum Depth = 11 inches				
Depth - Inches	0-1	2	3-4	5-6	7-8	9-12	13-16	Over 16	Total
Winter of:									
1956-57	7		2						9
1957-58	22	3	7	2					34
1958-59		1	16						17
1959-60	6	7	6	2	2	1			24
1960-61	2	2	2						6
1961-62	16	6	6	1					29
1962-63	7	1	5	17	20	26			76
1963-64	9								9
1964-65	13	2	6	7	1				29
Total	82	22	50	29	23	27			233
% Total	35.2	9.5	21.4	12.4	9.9	11.6			100%

PENICUIK - Altitude 620 feet

Maximum Depth = 12 inches

Winter of:									
1956-57	6	3	1						10
1957-58	15	4	11	1	3				34
1958-59	5	1	15						21
1959-60	7	2	10	3	3	2			27
1960-61	8	4							12
1961-62	21	9	8						38
1962-63	9	5	4	19	31	16			84
1963-64	10	1	2						13
1964-65	10	10	7	4	1				32
Total	91	39	58	27	38	18			271
% Total	33.6	14.4	21.4	10.0	14.0	6.6			100%

TABLE 6B

ROYAL BOTANIC GARDEN - Altitude 74 feet

Monthly Frequencies for Each Year During the Sixteen Years from 1950 to 1965 of Days with Snow Lying at 9 a.m.
at Depths Between the Specified Limits

DEPTH : Inches	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	Total
NOVEMBER																	
0-1													1			6	7
2																1	1
3-4																	0
5-6																	0
7-8																	0
9-12																	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	7	8
DECEMBER																	
0-1	5	1	3			4	1					10	2		3	4	33
2	2												2				4
3-4	2				1							1	2				5
5-6													1				0
7-8																	0
9-12																	0
TOTAL	9	1	3	0	1	4	1	0	0	0	0	11	5	0	3	4	42
JANUARY																	
0-1	2	8	15	1	3	2	3		8	11	3	1	4	23		2	86
2		1	3			2					1			1		3	8
3-4		1	4			10								1			19
5-6																	0
7-8																	0
9-12																	0
TOTAL	2	10	22	1	3	14	3	0	8	11	4	1	4	25	0	5	113
FEBRUARY																	
0-1		1	3	1	3	3	11		5		10	1	1	8	1	1	49
2											1	1		11		4	18
3-4									2		3			6			20
5-6																	0
7-8																	4
9-12																	2
TOTAL	0	1	3	1	3	14	16	0	7	0	14	2	1	25	1	5	93

TABLE 6B (contd.)

DEPTH : Inches	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	Total
MARCH																	
0-1			1			3			5		1					6	16
2						1										2	4
3-4																1	1
5-6																	0
7-8																	0
9-12																	0
TOTAL	0	1	1	0	0	4	0	0	5	0	1	0	0	0	0	9	21
APRIL - ALL DEPTHS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 7

Average Values of Relative Humidity and Dry Bulb Temperature at 03h., 09h.,
15h., and 21h. G.M.T. at TURNHOUSE (EDINBURGH) AIRPORT -
11 years from 1952 to 1962

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
<u>At 03h. G.M.T.</u>													
Average Relative Humidity per cent	87	87	87	88	89	90	92	92	91	89	89	88	89%
Average Dry Bulb Temperature °F.	35.8	36.0	38.2	40.3	44.6	49.0	52.3	52.3	50.1	46.6	41.1	38.1	43.7°F
<u>At 09h. G.M.T.</u>													
Average Relative Humidity per cent	87	86	82	76	74	75	78	81	83	86	89	87	82%
Average Dry Bulb Temperature °F.	35.7	36.3	40.5	46.5	51.5	56.2	58.7	58.1	54.5	48.9	41.3	38.3	47.2°F
<u>At 15h. G.M.T.</u>													
Average Relative Humidity per cent	81	76	70	64	64	67	70	71	72	75	81	84	73%
Average Dry Bulb Temperature °F.	39.8	41.9	46.0	51.5	56.3	60.1	62.9	62.5	59.1	53.6	46.1	41.1	51.7°F
<u>At 21h. G.M.T.</u>													
Average Relative Humidity per cent	86	86	83	82	81	82	85	87	87	87	88	87	85%
Average Dry Bulb Temperature °F.	36.2	37.2	40.5	44.3	49.0	54.3	56.6	55.8	52.5	47.9	42.0	38.8	46.3°F

TABLE 7A

Percentage Amount of Time with Wet Bulb Temperatures below certain limits
 - degrees Fahrenheit
 at TURNHOUSE (EDINBURGH) AIRPORT - 9 years 1952-1960

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
	%	%	%	%	%	%	%	%	%	%	%	%	%
32°F. or below	31.3	30.2	10.8	4.1	0.6	0.0	0.0	0.0	0.3	2.1	8.3	16.3	8.6
34°F. or below	43.0	44.2	18.8	7.6	1.6	0.0	0.0	0.0	0.5	3.8	11.8	23.9	12.8
36°F. or below	55.6	57.0	29.1	12.3	3.3	0.1	0.0	0.0	0.7	5.4	17.2	33.5	17.7
38°F. or below	66.5	66.9	42.1	20.9	6.2	0.5	0.0	0.1	1.5	9.1	24.9	46.7	23.6
40°F. or below	75.4	74.4	56.3	31.9	10.4	1.4	0.2	0.4	3.1	14.3	36.4	60.3	30.2
42°F. or below	82.2	81.1	69.1	45.5	16.6	3.4	0.5	1.0	5.9	20.0	49.3	71.9	37.0
44°F. or below	88.2	87.1	81.3	58.5	26.1	6.6	1.3	2.0	9.5	28.3	64.5	80.9	44.3
46°F. or below	92.8	92.2	89.9	72.3	38.8	14.0	2.6	4.0	15.1	40.2	77.2	87.3	52.0
48°F. or below	96.8	96.8	95.2	83.4	55.0	25.4	5.8	8.1	24.7	53.6	87.3	92.5	60.2
50°F. or below	99.2	99.3	97.8	92.2	72.2	40.1	12.6	16.4	37.1	68.2	95.0	96.7	68.8
52°F. or below	99.9	99.9	99.5	97.4	83.8	54.8	23.5	29.9	52.7	80.8	98.4	98.7	76.5
54°F. or below	100.0	100.0	99.8	99.2	91.6	70.5	41.4	44.7	66.9	89.8	99.9	99.7	83.6
56°F. or below			100.0	99.7	96.1	83.5	62.6	66.2	79.3	95.2	100.0	100.0	89.9
58°F. or below				99.8	97.9	91.4	80.3	78.9	89.5	97.7			94.7
60°F. or below				100.0	99.3	95.1	89.6	89.1	95.5	99.2			97.4
62°F. or below					99.9	97.9	94.9	95.7	98.1	99.9			99.0
64°F. or below					99.9	99.4	97.5	97.9	99.3	100.0			99.6
66°F. or below					100.0	99.9	99.0	99.4	99.7				99.9
68°F. or below						99.9	99.7	99.8	99.9				99.9
70°F. or below						100.0	99.9	100.0	100.0				99.9
72°F. or below							99.9						99.9
74°F. or below							100.0						100.0

TABLE 7B

Absolute Highest Values of Wet Bulb Temperature and Highest Values
of Wet Bulb Temperature Associated with Relative Humidities of
100 per cent extracted from Hourly Readings of Wet Bulb
Temperature made at TURNHOUSE (EDINBURGH) AIRPORT
during the 9 years from 1952 to 1960 -
(degrees Fahrenheit)

	<u>Absolute Highest</u> <u>Value of Wet</u> <u>Bulb Temperature</u> °F.	<u>Highest Value of</u> <u>Wet Bulb Temperature</u> <u>Associated with Relative</u> <u>Humidity of 100 per cent</u> °F.
January	54	52
February	54	52
March	56	54
April	60	54
May	66	62
June	70	66
July	74	66
August	70	66
September	70	66
October	64	62
November	56	56
December	56	56
Year	74	66