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THE CLIMATE OF THE COASTAL REGION OF THE MORAY FIRTH

by

J. A. PLANT

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The area under consideration is the mainly flat L-shaped coastal strip of the Moray Firth extending from Duncansby Head in Caithness southwards to Inverness and then eastwards from Inverness to Kinnairds Head in the Buchan area of Aberdeenshire.

Northwards, between Inverness and Wick, the coastal strip is very narrow in places and from Loch Fleet to just north of Helmsdale where the coast is backed by steeply rising high ground, the coastal strip is less than half a mile wide and extends to the cliff edge overlooking the sea. Near the County border between Sutherland and Caithness, high ground rises steeply from the sea and there is no coastal strip but further north near Wick, the strip broadens out into the undulating lowland country of northeast Caithness.

For most of its length, the eastern coastal strip along the southern shore of the Moray Firth between Inverness and Kinnairds Head is both wider and flatter than the northern coastal strip between Inverness and Wick. However, the coasts of the counties of Nairn and Moray are also backed by high ground although the transition from the flat or gently undulating country near the coast to the high ground inland is considerably less abrupt than along the northern coast between Inverness and Wick. East of the counties of Nairn and Moray, the low ground along the coast of Banffshire has a rolling topography above the general level of which rise several isolated hills. This type of terrain continues across the county border into Aberdeenshire giving way eventually to the lowland area of the Buchan peninsula at the extreme southeastern end of the Moray Firth coastline.

The high ground backing almost the entire length of the Moray Firth coastline serves as a catchment area for numerous major river systems, e.g. the Oykell, Conon, Ness, Nairn, Findhorn, Spey and Deveron all of which are prone to flooding, especially in winter when a heavy downpour of rain on the snow covered hills in the inland catchment areas can cause a rapid thaw and a considerably increased run-off over ground which is usually saturated or frozen during the winter months.

In considering the climate of the Moray Firth coast, the high latitude of this region should be borne in mind. For example, it is not always realised when

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discussing the Moray Firth that the coastline of the counties of Nairn, Moray and Banff lies to the north of Moscow and coincides approximately with the latitude of Southern Alaska and Northern Labrador.

The claim is sometimes made that the Moray Firth region enjoys a climate as good as any other place in the Northern Hemisphere at the same latitude. This claim has a great deal of justification and indeed, when comparing the climates of places at a similar latitude, it is only perhaps the southern coast of Sweden which has a more favoured climate than that of the Inner Moray Firth.

In broad terms, the climate of the coastal region of the Moray Firth is typical of that of the east coast of Scotland in that the duration of sunshine is high in relation to the latitude, the average rainfall is well below the average for the United Kingdom as a whole and the proximity of the North Sea prevents the temperatures from being unduly low in winter when compared with, say Kent, in southeast England, where very bitter spells of cold weather can result from winds from Central or Northern Europe crossing the English Channel without appreciable warming. However, there is a distinct range in climate along the coast to the north and east of the Inner Moray Firth which depends to a very great extent on the degree to which a particular place is sheltered to winds from the north and east.

The sheltered Inner Moray Firth area from roughly Dornoch in the north to Elgin in the east and including the Black Isle has a remarkably genial climate evidenced by the highly productive agricultural land and orchards. Indeed, it is perhaps worthy of mention that in some favoured locations in this region, knowledgeable gardeners have had a fair degree of success with the outdoor growing of peaches, nectarines and figs. The most fertile tracts of agricultural land are often to be found some distance inland behind a sandy area flanking the coastline especially on the southern shore of the Moray Firth e.g. in the Culbin and Burghead areas. The Culbin and Burghead areas, formerly a sandy waste of barren dunes now support Forestry Commission plantations of trees except along a short stretch of coast to the east of Findhorn village. These plantations have greatly reduced the menace of blowing sand which was becoming an increasingly active hindrance to agriculture. The counties of Moray and Nairn and the adjacent coastal counties have long been

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noted for their stock raising but it can still be readily appreciated why in former times the Inner Moray Firth area was regarded as "The Granary of the North".

Northwards from Dornoch and eastwards from Elgin, the climate tends to become more rigorous because of the increasing exposure to the wind and, in many respects, the low lying windswept Caithness peninsula has a climate more similar to that of Orkney than the Inner Moray Firth.

A special mention should be made of the clear warm air sometimes found in the coastal region of the Moray Firth when moist southwest to west winds pass over the high ground of northern and central Scotland giving rise to the föhn effect. Not only do these winds deposit most of their moisture over the high ground but in their descent on the leeward side, the air is warmed and there is a reduction in relative humidity; the associated cloud sheets dissipate and may clear completely with consequent further warming by insolation. In the most favourable circumstances for föhn development, usually in the autumn and winter, temperatures in the coastal area of the Moray Firth can be the highest recorded in the British Isles. These outstanding occurrences are very transient and rather exceptional but nevertheless, the föhn effect in varying degrees is seldom absent and there is no doubt it does bring to the whole coastal region warmer, drier and sometimes sunnier weather with lower humidities than would otherwise prevail. From the agricultural viewpoint, strong and dry southwest to west winds associated with föhn conditions can be a nuisance, particularly in April and May when sandy topsoil is blown from newly sown fields.

The separate aspects of the climate of the coastal region of the Moray Firth are discussed in more detail in the following paragraphs under the headings of Rainfall, Temperature, Sunshine, Winds, Fog, Snow, Relative Humidity and Thunder-storms. However, this would seem to be an appropriate point at which to emphasise that the change of climate from the coastal region of the Moray Firth to the high ground often only a few miles inland can be surprisingly abrupt. Except perhaps near the broad Firths of Dornoch, Cromarty and Beauly, the moderating influence of the sea in winter does not penetrate very far inland and the temperature regime over the high ground or

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at low lying places shut off from the sea by hills bears little relation to the more equable temperature regime of the coastal region. Indeed, during a severe winter, the Firths of Dornoch, Cromarty and Beauly have been known to become at least partly frozen. Furthermore, there is a well marked increase of rainfall with increasing distance inland from the coast particularly over the high ground backing the northern coastal strip between Inverness and Wick and while snow in winter does not usually lie for very long at the coast, this is certainly not the case over the higher ground.

1. RAINFALL

Owing to the complex topography and the considerable extent of the coastal region under consideration, it is difficult to generalise about the direction of rain bearing winds in the Moray Firth. As mentioned earlier when discussing the föhn effect, winds from the southwest and west deposit most of their moisture over the high ground before reaching the coast of the Moray Firth and when belts of rain from the Atlantic are moving from west to east across Scotland, the winds in the Moray Firth are backed ahead of the troughs of low pressure and often blow from the sector between east and south. Much of the annual precipitation at places along the coastline of the Moray Firth comes from showers, particularly during the winter months, associated with winds from directions between northwest and northeast. At places well exposed to winds from the sector between northwest and northeast e.g. the northeastern part of Caithness and the eastern half of the southern coast of the Moray Firth, the showers can be heavy and prolonged.

A study of the hourly rainfall and wind records from the Meteorological Office at Kinloss reveals that rain falls quite frequently at Kinloss with winds from a southwesterly point which have a relatively uninterrupted passage up the Great Glen. Indeed, when warm moist southwesterly winds are blowing up the Great Glen, cloud has been observed to issue forth from the mouth of the Caledonian Canal near Inverness much in the same manner as steam from the spout of a kettle. However, the rain associated with southwesterly winds is usually slight and owing to the sheltering effect of the high ground is only a fraction of that which falls further to the west and southwest. It is interesting to note that nearly all cases of prolonged heavy rainfall at Kinloss, of the order of one inch or more in 24 hours, are usually

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associated with stationary or slow moving depressions in the North Sea; the rain bearing winds on these occasions blowing from a northeasterly direction slowly backing as the depression moves eastwards into Scandinavia to a northerly or even northwesterly direction. It is also interesting to note that at Kinloss, these prolonged heavy downpours of rain with winds from the sector between about northeast and northwest tend to occur more often in August than in any other month of the year.

The sheltering effect of the high ground to the west and south is much in evidence at places on the coast between Inverness and Wick and due to the configuration of the land in this region of the Moray Firth, the winds tend to back far more than would be expected with the approach of a frontal belt of rain from the west. At Wick for example, with winds from between southwest and south, the high ground affords considerable shelter and occasions with rain from this sector are much less frequent than at Kinloss. On the other hand, if the wind backs to southeast or east, i.e. with a track over the North Sea there can be a rapid deterioration in the weather at Wick. Therefore, it is of great local importance at Wick and other places on the coastal strip between about Golspie and Wick whether the centre of a depression approaching from the west moves to the south or north of a particular place. If the centre passes to the north then the high ground to the west gives good shelter but if the centre passes near or to the south, winds from the sea can bring prolonged rainfall. As at Kinloss, the most prolonged heavy downpours of rain at Wick are usually associated with winds from the sector between northeast through north round to northwest.

It can be seen from the rainfall map at Figure 1 that the annual average rainfall over the coastal region of the Moray Firth nowhere exceeds a value of 35 inches. Indeed, the greater part of the region has less than 30 inches per year and a considerable stretch of the coastline between approximately Tain in the North and the mouth of the Spey in the east has less than 25 inches and ranks with the area around Dunbar and North Berwick in East Lothian as the driest region in Scotland and one of the driest regions in the British Isles. Annual averages of rainfall for other places in the British Isles are given below for purposes of comparison:

/Blackford Hill

Blackford Hill, Edinburgh	= 27.53 inches
Botanic Gardens, Glasgow	= 40.09 inches
Mannofield, Aberdeen	= 32.93 inches
Camperdown, Dundee	= 31.14 inches
St. Pancras, London	= 25.15 inches
Penylan, Cardiff	= 42.10 inches
Edgbaston, Birmingham	= 30.70 inches
Queens Drive, Liverpool	= 35.06 inches
Whitworth Park, Manchester	= 33.79 inches
The Hoe, Plymouth	= 37.76 inches
Old Steyne, Brighton	= 27.07 inches
Botanic Gardens, Cambridge	= 21.72 inches

Monthly and Annual Averages of Rainfall for a number of rainfall measuring stations in the coastal region of the Moray Firth are given in Tables 1 and 1A. These show that nearly everywhere, March is the driest month of the year followed by a dry spring period from April to June. However, the wettest months seem to vary from place to place e.g. along the coasts of Caithness, Banff and northern Aberdeenshire, October and November are the wettest months but nearer the Inner Moray Firth area there is evidence of two peak wet periods, the first either in July or August followed by a second wet period usually during October. The heavier downpours during these wet periods sometimes cause the flooding of fields along the coastal strip of Moray and Nairn in July/August and again in October/November.

Frequencies of Specified Amounts of Rain falling in 24 hours are quoted for Wick, Inverness, Nairn and Gordon Castle in Table 1B.

One interesting point to note from Table 1B is the very high number of days on which rain falls at Wick. This is one of the most striking features of the weather in Caithness where in conjunction with the cool climate, low evaporation and the impermeability of large tracts of soil, even an annual average rainfall of 30 inches is excessive and tends to promote acid soil conditions, partly shown in the widespread occurrence of peat. It is also interesting to note that places in the Moray Firth to

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the South and east of Wick have an appreciably higher number of days with one inch or more of rain.

Maximum Daily (24 Hour) Rainfalls recorded at Wick, Inverness, Nairn and Gordon Castle are given in Table 1C.

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 the coastal region of the Moray Firth than in the upland parts of Scotland and the more thundery areas in central and southwest Scotland. It is appreciably less for the shorter durations than in the Midlands and South of England which have a higher incidence of thunder-storms and thundery downpours than the Moray Firth region.

In the absence of suitable long term records of rainfall intensities for the Moray Firth area, particularly long term records of intensities over very short periods of time, the values quoted in the upper table of Table 1D have been computed from the well known Bilham formula for rainfall intensities modified where necessary by Holland. The rainfall intensities obtained from the Bilham formula for durations of up to about 2 hours are probably too high when related to the coastal region of the Moray Firth and experience suggests that a 20 per cent reduction should be made to the amounts quoted in the upper table of Table 1D to relate the intensities to sewer and culvert design purposes etc. in the region.

The values quoted in the upper table of Table 1D refer to rainfall at a point, but areal rainfall is required for most design purposes. Because of the variability of rain in space and time, the areal rainfall for a given duration and return period is always smaller than the corresponding point rainfall. To obtain areal rainfall, the point rainfall should be multiplied by the appropriate factor in the lower table of Table 1D. These factors were derived from a formula by Holland, assuming a roughly circular area and a roughly equal contribution to the drainage system from all parts of the area. Advice on how to apply these factors to the more difficult cases can usually be given by the Meteorological Office or the Road Research Laboratory of the Ministry of Transport. The formula is based on results from an experimental rain-gauge network at Cardington near Bedford.

/Estimated

Estimated average values of Evapotranspiration (PT) in inches for the coastal strips of the counties bordering the Moray Firth are given in Table 1E. It should be borne in mind that such estimates of the water loss due to evaporation and transpiration can only be approximate and, as in the case of the other meteorological parameters, the actual values for a particular place will depend to some extent on the local topography.

Comparing the values in Table 1E with the averages of rainfall given in Tables 1 and 1A it can be seen that there is a risk of a soil water deficit in the spring and early summer. The risk would be greatest after a dry winter and the balance might not be restored until the rains of the late summer and autumn.

Rain as a Factor interrupting Outdoor Building Work

Tables 1F to 1I give frequencies of rain falling in the working part of the day which may be helpful in assessing the probable amount of time in which rainfall may hamper or interrupt outdoor building work at places along the coastline of the Moray Firth. These Tables have been prepared from hourly measurements of rainfall recorded at Wick and Kinloss during the 10 years from 1957 to 1966.

Tables 1F and 1G give the total number of days per month during the 10 years from 1957 to 1966 on which 0.1 millimetres or more of rain fell during the working part of the day i.e. between 07h and 17h Greenwich Mean Time (08h and 18h British Standard Time). Similarly, these Tables also give for the same 10 year period, the total number of hours per month between 07h and 17h GMT with a total of 0.1 millimetres or more of rain falling within the hour. Days and hours with only a few spots of rain amounting to less than 0.05 millimetres have not been included in the totals given in Tables 1F and 1G. However, it should be borne in mind that 0.1 millimetres is also a very small amount of rain and that the totals in Tables 1F and 1G include many working days and many working hours with very slight rain i.e. rain so slight that most types of outdoor work would not be affected.

It is, of course, extremely difficult to decide on a critical rate of rainfall above which, outdoor work would be seriously hampered or have to cease because this will depend to a great extent on the type of outdoor work, whether the building site is in an exposed place and other factors. There is practically no experimental evidence on this subject but in consultation with the Building Research Station, Ministry of Public Building and Works, it has been decided that the lower limit of precipitation

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contributing to time lost in the building industry should be set at a rate of 0.5 millimetres or more per hour. This critical rate of 0.5 millimetres or more per hour corresponds to the lower limit of the Meteorological Office classification of 'moderate' rainfall i.e. rain falling fast enough to form puddles rapidly and to accumulate in a raingauge at a rate between 0.5 millimetres and 4.0 millimetres per hour. 'Slight' rain accumulates in a raingauge at a rate less than 0.5 millimetres per hour and 'heavy' rain is rain falling at a rate of more than 4.0 millimetres per hour. Thus, occasions with rain falling at a rate of 0.5 millimetres or more per hour can be thought of more simply as occasions with 'moderate' or 'heavy' rain.

Perhaps it should be emphasised at this point that the actual amount of working time lost on a day with rain will seldom keep in step with the duration of moderate or heavy rain on that day. For example, if moderate or heavy rain fell continuously for a period of 30 minutes during part of the working day, the working time lost from the cessation to the resumption of work would almost certainly be considerably more than 30 minutes. It should also be borne in mind that, more often than not, a period of 'moderate' or 'heavy' rain is also preceded or followed by a period of 'slight' rain. Consider, for instance, a single working day of ten hours between 07h and 17h with intermittent rain, most of it quite light but increasing to the critical rate of 0.5 mm/hr (i.e. becoming moderate or heavy) for say a period of 12 minutes in each of the ten hours. The total duration of rain falling at a rate of 0.5 mm/hr throughout the whole ten hour period would be 10 times 12 minutes (or 10 times 0.2 hours) = 2 hours, whereas the actual amount of working time lost on this particular day might well be the whole period of ten hours.

Thus, it will be realised that on most working days with moderate or heavy rain, a more realistic alternative to figures showing the actual <u>duration</u> of the moderate or heavy rain are figures showing the number of hours during which moderate or heavy rain fell for some time during the hour.

Tables 1H and 1I give for Wick and Kinloss, the total number of days per month over the 10 years from 1957 to 1966 on which moderate or heavy rain fell at some time during the working day from 07h to 17h Greenwich Mean Time. Similarly, these Tables also give the number of "hours" per month between 07h and 17h GMT in which moderate or heavy rain fell at some time during the hour. The figures given in Tables 1H and 1I

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will tend to overestimate the actual time lost on outdoor work because of rain, although the reader will appreciate from what has already been said that these figures will undoubtedly provide a safer and perhaps more realistic guide for planning purposes than figures giving the actual durations of moderate or heavy rain.

Although the figures in Tables 1H and 1I do provide a guide to rain falling at the critical rate of 0.5 mm or more per hour, the reader should bear in mind that these figures do not provide a guide to the duration of the effects of the rain. This is a most important consideration because a localised heavy downpour of rain of short duration either during the working part of the day or during the night period could flood a building site (particularly at the excavation stage) bringing work to a standstill for several days. Similarly, a downpour of rain wetting the ground of a building site might prevent the use of machines particularly earth-moving machines for a considerable period of time.

As mentioned earlier in this report, the very high number of days on which rain falls in Caithness is one of the most striking features of the climate and it can be seen from Tables 1F to 1I that Wick has an appreciably higher number of occasions with rain than Kinloss. It is considered that the figures for Wick in Tables 1F and 1H should provide a reasonably reliable guide to the frequency of rain falling in the working day at places along the northern coastal strip between about Golspie in Sutherland northwards to Wick and perhaps along the eastern coastal strip between about Buckie and Fraserburgh. Similarly, the figures for Kinloss in Tables 1G and 1I should provide a guide to rain falling in the drier Inner Moray Firth area from about Dornoch in the North to the mouth of the Spey in the East.

Polythene shelters to cover the building site, or part of the site, obviate loss of working time due to inclement weather, and a study of the data in Tables 1F to 1I with a possible interpolation between the two sets of figures, may help building contractors to decide for particular jobs whether it is an economic proposition to use these shelters. When consulting Tables 1F to 1I, it should be borne in mind that the figures relate to a 7-day working week and not to a 5-day working week.

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 a marked absence of suitable wind

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and rainfall records from locations in the Moray Firth from which to assess both the exposure to driving rain and the worst wind directions from which driving rain is likely to blow. Indeed, there are only two locations along the whole of the coastal strip viz. Wick and Kinloss from which suitable records of winds and rainfalls are available.

It can be seen from the wind frequencies for Wick and Kinloss at Tables 4 and 4B that at these locations, very strong winds can be experienced from almost any point of the compass and this is probably broadly true of most other locations along the coast of the Moray Firth. However, a study of winds and rainfalls recorded at Kinloss reveals that the worst wind directions for driving rain at Kinloss are from the sector between northwest and northeast followed by winds blowing from the sector between south and west. This is probably also true of other places in the Inner Moray Firth region and places along the coastal strip between Inverness and Banff. At Wick, the greatest risk appears to be when winds are blowing from the sector between northwest and north and between southeast and south. Places between about Dornoch and the county border of Caithness are much more sheltered than Wick to strong winds from between northwest and north and along this stretch of coast the worst directions are likely to be from northeast, followed by winds from the sector between southeast and south. The worst directions for driving rain in the Buchan area to the east of Banff are likely to be from the sector between northwest and northeast followed by southeast.

2. TEMPERATURE

In winter, the surface temperature of the North Sea remains relatively high when compared with the ground surface temperatures over the adjacent coastal areas of Northern Europe and, because of the moderating influence of the North Sea, winter temperatures at places along the coastal strip of the Moray Firth are comparable with those of London and other places much further to the south. For example, it is interesting to compare the average daily temperatures in the winter months at a place as far north as Wick in Caithness with the average daily temperatures in Glasgow, Manchester, Birmingham and London:-

	Mean Daily Temperature °F (1931-1960)		
Place	December	January	February
Wick Airport	40.3	38.0	38.3
Glasgow Airport	40.0	37.6	39.0
Manchester Airport	40.1	38.1	38.7
Birmingham Airport	39.9	37.8	38.3
London Airport	40.8	38.8	39.7

Places on or near the coast of the Inner Moray Firth tend to escape the very low temperatures of severe winters (e.g. the winters of 1946/47 and 1962/63) which are characterized by bitterly cold easterly winds from the Continent affecting east and southeast England much more than the Moray Firth coastline. The reason for this is that these cold blasts from the Continent have a much longer track over the North Sea and thus have a better opportunity of taking up the sea surface temperature before reaching the Moray Firth. A glance at the map will show that in contrast, easterly winds from the Continent have a much shorter track over the sea before reaching Kent or East Anglia.

Because of the high latitude of the Moray Firth, the very slow rise in sea temperature at the end of winter 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. Consequently, the winters last longer in the Moray Firth than they do in the south and spring is later and cooler than in the south.

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In summer and early autumn, the effect of latitude on the heat received from the sun is the dominant factor and temperatures in the Moray Firth are several degrees lower than in the south of England.

Averages of Daily Maximum, Minimum and Mean Temperature in degrees Fahrenheit for temperature recording stations along the coastline of the Moray Firth are given in Table 2. The differences between the averages quoted for most of the stations in Table 2 may appear insignificant but it should be realised that averages of temperature do not fully reflect the exposure of a station to the wind. This is an important consideration because away from the Inner Moray Firth, the absence of shelter from the wind over large areas of coastline, particularly the tree-less moorland areas of Caithness in the extreme north and the Buchan region in the extreme east, contributes to the rawness of the climate in winter and spring. Moreover, even on warm sunny days in summer, the strength of the winds in unsheltered areas along the coast leads to the feeling that temperatures are much lower than they actually are.

When comparing the averages for the various stations listed in Table 2, it will be noticed that the averages for the former station at Strathpeffer show marked differences from the averages quoted for the other stations, the main difference being the much larger daily range of temperature at Strathpeffer. The reason for this is that although Strathpeffer lies only a few miles west of the waters of the Firth of Cromarty, it is hardly part of the "coastal" region being almost completely surrounded by sheltering hills and much more shut off from the cooling sea breezes during the day and the warming influence of the sea during the night. The net result of this is that Strathpeffer records higher temperatures during the day in summer but has cooler nights in summer and throughout the year. Owing to its sheltered location, the local weather at Strathpeffer is much less boisterous than at places on the coast and it is probably this aspect of the climate coupled with the day time warmth during the summer that contribute to the popularity of Strathpeffer as a holiday resort and spa.

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In complete contrast to the averages for Strathpeffer quoted in Table 2, the averages for Tarbat Ness and Fortrose show a small daily temperature range and a much more "equable" temperature regime with rather low maximum temperatures during the day offset by high minimum temperatures during the night. Perhaps the main benefit is that Tarbat Ness and Fortrose have remarkably mild winters with a comparative freedom from damaging frost. The reason for the low daily range of temperatures at Tarbat Ness and Fortrose is that both places are lighthouse stations lying at the tips of low lying peninsulas only a few yards from and fully open to the moderating influence of the sea. Thus, while the temperature regime at Strathpeffer shows certain "continental" characteristics, the temperatures at Tarbat Ness and Fortrose show a "maritime" influence.

Statistics of Annual Maximum and Minimum Temperatures for temperature recording stations with long term records, along or near the coast of the Moray Firth are quoted in Table 2A.

The high latitude of the northernmost station at Wick is reflected in the rather low maximum temperatures recorded at this station but it can be seen that at the remaining stations, there is not a great deal of difference from place to place in the maximum temperatures which depend to a large extent on the degree to which a particular location is exposed to cooling sea breezes on warm days during the summer. For example, Forres which lies a few miles inland has slightly higher maximum temperatures in the summer than the stations at Banff and Fortrose which lie on the coast.

A note is also included at the foot of Table 2A of the absolute highest and lowest temperatures recorded at Wick and Gordon Castle in each month during the 67 years from 1900 to 1966.

The Average Number of Days on which Maximum Air Temperatures reached certain levels at Wick and Gordon Castle during the 15 years from 1952 to 1966 are given in Table 2B, and, as an indication of "extreme conditions", Table 2C gives the actual

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number of days on which maximum temperatures reached certain levels at Wick and Gordon Castle during the very warm years of 1955 and 1959. The reader will notice the very striking differences between the figures quoted in these Tables for Wick and Gordon Castle. It is very difficult to assess how much of these differences is due to the "fohn warming effect but there is little doubt that because of the different wind regimes, Gordon Castle is much more subject to the benign influence of the "fohn effect than Wick. There is the further point that the temperature recording site at Gordon Castle lies in a well sheltered garden in contrast to the more open, windswept nature of the airfield site at Wick. It is unlikely that any location on or near the Moray Firth coastline will have an appreciably higher number of days than Gordon Castle with maximum temperatures exceeding 60°F., 65°F., 70°F., etc. Similarly, it is unlikely that any location will have an appreciably lower number of days than Wick with maximum temperatures exceeding the same levels. The figures quoted in Tables 2B and 2C for Gordon Castle will be rather on the high side when applied to the eastern coastal stretch between about Banff and Fraserburgh but should provide a reasonably good guide for planning purposes to the Inner Moray Firth area as far north as about Dornoch. The figures quoted for Wick should provide a good guide to the east coast of Caithness but may be on the low side when applied to the east coast of Sutherland.

It can be seen from the statistics of minimum temperatures that these vary considerably from place to place. Locations some distance from the coast like Forres and Gordon Castle which have high temperatures in summer experience low temperatures in winter, while places on the coast like Wick and Fortrose which record relatively low maximum temperatures in summer experience relatively high minimum temperatures in winter. The tempering influence of the sea on high temperatures in summer and low temperatures in winter has already been discussed but in the case of minimum temperatures it is also necessary to consider the very strong influence exerted during the night period by local topographical effects.

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One of the features of the topography of the region bordering the Moray Firth coastline is the "rolling" or undulating nature of the ground particularly along the eastern coastal stretch between Inverness and Kinnairds Head. There is no doubt that the "frost hollow" effect is widespread in these regions of undulating terrain. This effect is most marked on clear, calm nights during the winter months. It is the result of air which has been cooled by contact with the ground and which has become relatively dense (i.e. heavier) draining downhill and stagnating in valleys, hollows or shallow depressions at the foot of sloping ground. The cold air is replaced at higher levels by rather warmer air which has not been in contact with the ground. On a still clear frosty night in winter, the air temperature in the more sheltered and flatter parts of the basins and valleys of the numerous streams which flow through the coastal region of the Moray Firth could be more than 20 degrees Fahrenheit lower than on the crest of a nearby three or four hundred feet high ridge or knoll. In windy, cloudy weather, the surface of the ground cools less rapidly at night and the air near the surface is too well mixed for the frost hollow effect to develop.

It should perhaps be explained at this point that air ("shade") temperatures are read from thermometers exposed in louvred wooden screens at a height of four feet above ground level and an 'air frost' occurs when the temperature at four feet falls below 32.0 degrees Fahrenheit. 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 frost at the surface of the ground is much higher than the incidence of 'air frost'. It is difficult to provide representative statistics of frost at the surface of the ground as conditions will vary considerably over quite short distances from place to place depending on the composition of the surface (e.g. grass, sand, bare soil, tarmacadam or concrete) and whether a particular site lies in a sheltered place or is exposed to the wind. Owing to its excellent insulating characteristics, a grass covered surface will normally have a higher frequency of frosts than the other surfaces mentioned because it seals off the only source of heat during the night i.e. the soil. At a sheltered grass

/covered

covered site in the Moray Firth a few miles from the coast, grass minimum temperatures could fall to below freezing point in any month of the year and the average number of days per year with grass minimum temperatures below freezing point could be as high as twice the average number of days with air frosts. The Average Number of Days of Air Frosts and the Average and Extreme Dates of the First and Last Air Frosts at places along the coastal strip of the Moray Firth are given in Tables 2D and 2E.

When consulting Tables 2D and 2E it should be borne in mind that Tarbat Ness, Fortrose, Banff and Rattray Head are Lighthouses or Coastguard stations lying only a few yards from the sea. All the remaining weather stations lie a short distance from the sea where local topographical influences, type of soil etc. can often exert their full effect on temperatures during clear, calm nights. For example, the weather station at Kinloss lies only about one mile from the sea but like many other places along the coast, the soil at Kinloss is very sandy. Light coloured sandy soils reflect a great deal of the radiation received from the sun during the day-time in contrast to dark heavy soils which absorb most of the radiation falling on them. Moreover, sandy soils hold more air than other types of soil and as air is a very good insulator, more heat stays at the surface of sandy soil and very little penetrates into the ground. Thus, at night-time and particularly on clear calm nights, as very little heat is available from the ground, places with sandy soil like Kinloss tend to have appreciably lower air temperatures and a much higher incidence of air frost than places with more compact clayey soils. There is the further point that at Kinloss, the ground rises very gradually northwards across the airfield to a ridge of sandhills, 50 feet high in places, close to the edge of Burghead Bay, while to the south lie the foothill slopes of the Grampians, the nearest high ground being a ridge 500 to 800 feet high lying east to west about 3 to 4 miles south of the airfield. Thus, Kinloss, like many other places along the coasts of the counties of Nairn, Moray, Banff and Aberdeenshire is subject to the "frost hollow" effect on clear, calm nights

/in winter

in winter caused by cold air formed over the peat and grass covered slopes to the south draining downhill and stagnating in the saucer-shaped depression provided by the airfield.

The Growing Season

The growing season is sometimes defined as that period of the year during which on average the mean daily temperature is 42°F. (5.6°C.) or above. The growing season in the most favoured districts along the coast of the Inner Moray Firth is very similar to that in the coastal region of East Lothian and usually begins during the last week in March and lasts until well after the middle of November giving a length of from 225 to 250 days. At places on or near the coast outside the Inner Moray Firth region, the start is likely to be delayed until early April and the end will come early in November. It is interesting to note from the mean temperatures in Table 2 that the accumulation of warmth in the spring is very slow. On the other hand the mean temperatures also demonstrate the reluctance of autumn to give way to winter dormancy.

Earth and Soil Temperatures

It follows from what has been said earlier in this report about the influence of soil types on air temperatures that soil temperatures must have a significant bearing on crop growth and in some areas of the British Isles with sandy soil, there is evidence that the growing season may be shortened because of frost by as much as 6 to 8 weeks. Unfortunately, there are very few records of earth and soil temperatures for places in Scotland and the only station in the Moray Firth region for which long term records of earth temperatures are available is Forres where readings of earth thermometers sunk to depths of 1 foot and 4 feet under a grass covered surface are made once-daily at 09h. G.M.T. Averages and Extremes of the 1 foot and 4 feet readings are given in Table 2F.

/At

At the 1 foot depth, the range of the diurnal variation of temperature at Forres could amount to 5 degrees Fahrenheit in summer but at other places in the Moray Firth the diurnal range at 1 foot will depend very largely on the type of soil. In common with other places in the Moray Firth, the minimum temperature at Forres at a depth of 1 foot is most likely to occur around 09h. and the maximum at 20h.

The diurnal range at 4 feet is almost negligible when compared with the range at 1 foot but it can be seen from Table 2F that the annual variation is quite large at both 1 foot and 4 feet depths. At 1 foot, the highest and lowest temperatures in a year usually occur in the months with the highest and lowest air temperatures but at 4 feet, the extremes usually lag about one month behind.

The Percentage Amounts of Time with Air Temperatures below Certain Limits are given in Table 2G. Although these percentages have been calculated from hourly readings of air temperature made at Kinloss it is considered that they should provide a reasonably reliable guide for planning purposes to the durations of air temperatures over a considerable stretch of the more thickly populated part of the Moray Firth coastline from about Dornoch in the north through Inverness to Elgin in the east. As mentioned previously, when compared with other places along the coast of the Moray Firth, Kinloss tends to have a fairly high incidence of frost and therefore the percentage amounts of time with air temperatures 32°F. or below quoted in Table 2E will tend to overestimate the percentage amount of time with temperatures below freezing point at other locations less prone to frost than Kinloss.

At places along the coast of Sutherland and Caithness north of about Dornoch, the durations of air temperatures of 60°F. or below, 50°F. or below and 40°F. or below, are likely to be more similar to the durations at Wick rather than Kinloss. Estimates of the percentage amounts of time with temperatures at or below these thresholds for Wick are as follows:

/Jan.

	Jan. %	Feb. %	Mar. %	Apr. %	May %	June %	July %	Aug. %	Sept. %	Oct. %	Nov. %	Dec. %
40°F. or below	65	63	50	29	8	0	0	0	1	7	26	48
50°F or below	99	99	97	92	76	42	12	13	29	63	90	97
60°F. or below	100	100	100	100	99	95	88	91	96	100	100	100

The above estimates have been obtained by a statistical treatment of the averages of daily maximum and minimum temperature quoted for Wick in Table 2 (8).

Temperature as a Factor Interrupting Outdoor Building Work

Outdoor building work will be seriously hampered or have to cease when temperatures are somewhere near or below freezing point but it is difficult to decide a precise threshold temperature because this will obviously depend on the type of work, the materials being used and other factors. However, experience suggests that the temperature thresholds "below 32°F.", "below 34°F." and "below 36°F." are the thresholds of most interest to builders and thus the number of working days and working hours below these three limits should provide a good guide for estimating the time likely to be lost because of low temperatures on different kinds of outdoor work.

Tables 2H to 2M have been prepared from records of hourly readings of air temperature made at Wick and Kinloss between 07h. and 17h. Greenwich Mean Time (08h. and 18h. British Standard Time) on each day during the 10 years from 1957 to 1966. Owing to the convention formerly in use in the Meteorological Office whereby tenths of a degree Fahrenheit were rounded off and recorded in the records to the nearest whole degree, "below 31.6°F", "below 33.6°F." and "below 35.6°F." are the nearest precise values of temperature available from the records to the suggested thresholds of "below 32°F.", "below 34°F." and "below 36°F." respectively.

The Tables giving the total numbers of days in each month with hourly readings of air temperature less than 31.6°F., 33.6°F. and 35.6°F. include days on which only one hourly reading of air temperature was below these levels and therefore the figures in

/these

these Tables should not necessarily be taken to mean that these are days on which the air temperature was continuously below 31.6°F., 33.6°F. or 35.6°F. throughout the whole period of ten hours between 07h. and 17h. On the contrary, during the 10 years considered, there were many more days with two or three hourly readings of air temperature below 31.6°F., 33.6°F. or 35.6°F. than there were with ten hourly readings below these levels. The numbers of days quoted in these Tables slightly underestimate the true number of days on which the air temperature fell to below the stated levels because on several days the air temperature would have fallen to below these levels for a short time during the 60 minutes between the routine hourly readings, although the hourly readings themselves might have been above 31.6°F., 33.6°F. or 35.6°F.

The Tables showing the total number of hours during the ten hour period between 07h. and 17h. G.M.T. with air temperatures below 31.6°F., 33.6°F. and 35.6°F. at Wick and Kinloss have been determined by counting up the number of hourly readings below these limits between 07h. and 17h. on each day during the 10 years from 1957 to 1966.

It should be borne in mind when consulting Tables 2J to 2M that there will be occasions when the ground is frozen for several hours with an air temperature higher than 33.6°F. or 35.6°F.; perhaps the number of these occasions will be approximately counter-balanced by the number of occasions when outdoor building work is able to proceed even though the air temperature is below 33.6°F. or 35.6°F.

As mentioned previously, because of the sandy soil, local topographical effects etc., Kinloss has a high incidence of frost particularly when its nearness to the moderating influence of the sea is taken into account. Moreover, it can be seen from Tables 2H to 2M that Kinloss also has an appreciably higher number of working days and working hours than Wick with air temperatures below 31.6°F., 33.6°F. and 35.6°F. However, the reader should realise that the incidence of frost and low temperatures varies considerably from place to place, often over quite short distances, and it does not follow from Tables 2H to 2M that the Wick area in general has a lower

/frequency

frequency of low temperatures than Kinloss or that the frequency of low temperatures in the Moray Firth region decreases from South to North. Indeed, although no records are available, there is little doubt that low lying sheltered places near Wick, e.g. in the valley of the Wick Water, have frequencies of frost and low temperatures equal to or perhaps even exceeding the frequencies at Kinloss. For planning purposes, the figures quoted for Wick in Tables 2H, 2J and 2L should give a reasonably good guide to exposed places with a low incidence of frost on or very near to the coast of the Moray Firth while the figures for Kinloss in Tables 2I, 2K and 2M should provide a rough guide to the incidence of low temperatures at sheltered places with sandy soils on or near the coast. When consulting Tables 2H to 2M, it should be borne in mind that the figures relate to a 7-day working week and not to a 5-day working week.

3. SUNSHINE

In common with other places on the East Coast of Scotland, the coastal strip of the Moray Firth has a good sunshine record particularly when its northerly latitude is taken into account. Although very few records of sunshine durations are available, it is interesting to note that the durations at Forres and other sunny places on the Moray Firth coast compare very favourably with the durations recorded in Edinburgh and places much further to the south. For example, Forres has an annual average sunshine duration of 1,347 hours compared with the central London districts of Kingsway and Regent's Park which have 1,359 hours and 1,353 hours per year respectively. There is a seasonal difference between the Moray Firth and London in that the Moray Firth has a longer duration of sunshine during the winter but London has the better record during the summer. On the other hand, the whole of the Moray Firth region has considerably more daylight than London and places on the South coast of England during the months of April to September. For example, at midsummer, places in the Moray Firth have more than 18 hours of daylight compared with about 16½ hours of daylight at places on the South coast of England. The extra length of summer daylight has obvious benefits from the outdoor activity and recreational points of view but perhaps it should also be realised that certain crops, notably barley, are also able to benefit from the gentle stimulus to growth afforded by long daylight.

Monthly Averages and Daily Mean Durations of Sunshine for a number of sunshine recording stations along the coast of the Moray Firth are given in Table 3. The reader will note from Table 3 that at some stations, the duration of sunshine is reduced by trees or buildings obstructing the horizon of the sunshine recording instrument. Nevertheless, it is evident that there are still considerable variations from place to place in the recorded durations. The relatively low durations of sunshine at Inverness, Culduthel and Fortrose may be due to a higher frequency of moist southwesterly winds blowing up the Great Glen giving rise to a local increase in

/cloud

cloud cover at the northeastern exit of the Glen. However, it is still rather surprising to find that a place like Wick which almost certainly has more cloud and is more subject to sea fog ("haar") than places in the Inner Moray Firth, has a longer duration of sunshine than places like Inverness, Culduthel and Fortrose on the Black Isle. On general meteorological grounds it would be wrong to conclude from the very few records available that there is a gradual increase of sunshine duration northwards between Inverness and Wick. Indeed, there may well be other locations in the Inverness area and on the Black Isle with sunshine durations equal to or in excess of the durations recorded at Wick. For example, the sunshine recorder site at Nairn lies only a few miles from Inverness and the Black Isle and although somewhat obstructed, the site at Nairn has a slightly higher duration than Wick. Similarly, the stretch of coast between Dornoch and Brora is reputed to be very sunny although no actual records of sunshine duration are available from this region.

The smoke-soiled air of major cities like Glasgow, Birmingham and London can bring about a considerable reduction in sunshine duration whereas in the Moray Firth, atmospheric pollution is relatively unknown. Nevertheless, all parts of the Moray Firth coastline are affected to a varying degree by sea fog ("haar") particularly in the spring and early summer when the presence of sea fog can lead to a considerable reduction of sunshine duration at places on or near the coast. As mentioned previously, Wick is almost certainly more prone to sea fog than the Inner Moray Firth area and similarly, one would also expect Rattray Head to have more sea fog than places like Forres and Nairn. Nevertheless, it can be seen from Table 3 that Rattray Head has a longer duration of sunshine than any other recording station in the Moray Firth. However, it should be borne in mind that the coastline of the Moray Firth stretches for something like a distance of 200 miles and that records of sunshine duration are available from very few places. Thus, it is very much open to question whether Rattray Head is in fact the sunniest place on the Moray Firth coastline and there may well be sunnier locations on the Black Isle, on the Tarbatness

/peninsula

peninsula or between Dornoch and Brora.

The path of the sun across the sky depends on the latitude and the time of year. Figure 3 is a solar chart for the coastal region of the Moray Firth (latitude 58 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 mid-winter for example, a hill to the south of a place in the Moray Firth with an elevation greater than 8 degrees would cut off practically all the sunshine.

4. WINDS

It has already been stated that the coastal strip of the Moray Firth is dry and relatively sunny and therefore the windiness could be considered to be one of the most unpleasant features of the local climate.

People living on or near the coasts of Scotland are somewhat inured to windy weather and for this reason it is perhaps not always appreciated that the high level of windiness is one of the chief characteristics of the Scottish climate especially when Scotland is compared with England. Thus, a city dweller from the south might find the coastal area of the Moray Firth to be a "windy place" but it is doubtful whether a person from another part of the east coast of Scotland would attach the same importance to this aspect of the climate because except perhaps for Caithness and the Buchan peninsula, the Moray Firth is not a particularly windy place by east coast of Scotland standards and certainly not by west coast of Scotland standards.

Nevertheless, the preservation of sheltering woodland and the planting of large numbers of new trees is of the utmost importance in the Moray Firth region particularly in the more exposed parts of the coastal strip away from the less boisterous Inner Moray Firth.

The importance of sheltering trees has long been realised along certain parts of the coast where blown sand often becomes an active hindrance to agriculture. For example in Moray and Nairn, various plantations of conifers were established several years ago to shelter growing crops in general and to combat the menace of blowing sand in particular, even where this meant the sacrifice of arable land to add to the width of the shelter belts. However, apart from the agricultural aspect, the Moray Firth coastline has a very attractive rural appearance and in addition to sheltering buildings and houses in new development areas from wind and weather, absorbing the sound of traffic, screening the houses from the roads etc. and providing land marks in new housing estates, the trees would help to maintain the very desireable "country look".

/There

There is the further point that the absence of shelter from the wind coupled with high humidities and low temperatures contributes to the "rawness" of the climate during the winter and spring months and as mentioned earlier in this report, even on warm sunny days in the summer the strength of the wind in unsheltered places can create the feeling that temperatures are considerably lower than they actually are.

Monthly and Annual Percentage Frequencies of Wind Direction and Velocity at Wick and Kinloss are given in Tables 4 to 4C. These Tables show that Wick is appreciably windier than Kinloss but perhaps the most striking differences are concerned with wind directions rather than wind velocities. For example, the most frequent wind direction at Wick is from southeast while at Kinloss the most frequent direction is from southwest. As mentioned previously in the section dealing with rainfall, winds from the southwest have a relatively uninterrupted passage to Kinloss and other places in the Inner Moray Firth via the Great Glen while the configuration of the high ground to the south and west of Wick leads to an accentuated backing of the winds with the approach of troughs of low pressure from the west. One other feature of the winds both at Wick and Kinloss is the frequency of very strong winds from the sector between about northwest and northeast which is particularly well marked at Wick.

The wind regime at other places in the Moray Firth is complex and the general absence of detailed long period wind records does not help to define it. Places in the Inner Moray Firth area probably experience wind directions and speeds similar to those recorded at Kinloss. However, north of about Dornoch the wind regime is possibly more similar to the wind regime at Wick with a high frequency of southeasterly winds. On the other hand, places between Dornoch and the county border of Caithness are much more sheltered than Wick to strong winds from the sector between northwest and north. Along the southern stretch of the Moray Firth coastline east of Kinloss, the southwesterly winds experienced at Kinloss may be influenced by the orientation of the coastline and by the high ground backing the

/coastal

coastal strip and blow parallel to the coast from a direction nearer to west than southwest. In common with Caithness, the Buchan region to the east of Banff is relatively open to winds from the northwest and southeast and wind directions and speeds in the Buchan peninsula are probably similar to those at Wick.

It can be seen from the monthly frequencies that in common with other places on the East Coast of Scotland, Wick and Kinloss have a high frequency of cold easterly winds from the North Sea in the spring and early summer. Indeed, in some years, easterly winds in March, April and May can be more frequent in the Moray Firth than winds from a westerly point.

Terms used by the Meteorological Office for describing the wind strength

Term	Average Speed near the ground
Calm	less than 1 mph (1 Knot)
Light	1 to 12 mph (1 to 10 Knots)
Moderate	13 to 18 mph (11 to 16 Knots)
Fresh	19 to 24 mph (17 to 21 Knots)
Strong	25 to 38 mph (22 to 33 Knots)
Gale	39 to 46 mph (34 to 40 Knots)
Severe Gale	over 46 mph (over 40 Knots)

The average speeds quoted above would be considerably exceeded in gusts. For example, in a gale, gusts of over 50 mph are common and may exceed 100 mph in a severe gale. A gale warning is issued when the gusts are expected to reach 50 mph or more even if the average speed may be rather less than the limits shown in the above table.

The duration of a high gust of wind is about three to five seconds but nevertheless, gusts are usually responsible for the more common types of "gale damage" e.g. the removal of roof tiles, chimney pots, television aerials, blown-down fences and hoardings, damage to trees, crops and window panes etc.

The Actual and Average Numbers of Days of Gales at Wick and Kinloss during the 10 years from 1957 to 1966 are given in Table 4D.

/Highest

Highest Wind Speeds recorded at places on or near the coastline of the Moray Firth

The most detailed and satisfactory records of wind direction and speed are provided by an anemograph i.e. an instrument which provides a continuous record of wind direction and speed in the form of inked traces on a graduated chart. At Meteorological Office stations, the inked traces of wind direction and speed are analysed on a routine basis to obtain values of wind direction and speed averaged over each hour of the day and night together with certain information about the speed and frequency of high gusts of wind.

Unfortunately, there are no long period anemograph records available for any location in the Moray Firth although the Meteorological Office stations at Wick and Kinloss have observed and recorded average wind directions and speeds at each hour on the hour (from wind recording instruments registering directions and speeds on dials) over a fairly long period of years.

Anemographs have been installed very recently at Wick, Kinloss, and Dalcross near Inverness and slightly longer period records are available from an anemograph sited at Lossiemouth. The next nearest places to the Moray Firth equipped with anemographs are Dyce near Aberdeen and Dounreay near Thurso. The directions and speeds of the highest hourly winds and the directions and speeds of the highest gusts recorded at all these anemograph stations up to the end of December 1967 are given below with the dates when the anemographs were first brought into commission.

Anemograph Station	Month when Recordings first commenced	Highest Hourly Wind	Highest Gust
Dounreay	April 1958	From 320 degrees 62 mph	From 320 degrees 106 mph
Wick	June 1965	From 030 degrees 58 mph	From 300 degrees 90 mph
Dalcross	September 1967	From 240 degrees 35 mph	From 250 degrees 65 mph
Kinloss*	September 1963	From 360 degrees 53 mph	From 270 degrees 80 mph
Lossiemouth	June 1960	From 220 degrees 69 mph	From 220 degrees 103 mph
Dyce	January 1952	From 340 degrees 63 mph	From 340 degrees 101 mph

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The highest hourly wind is obtained by averaging the wind speed over each hour during the 24 hours and then selecting the highest of these values.

*During the exceptionally severe northwest to north gale of 31st January 1953, the date of the disastrous North Sea Floods, a highest average wind speed (averaged over a period of about 15 seconds) of 81 mph from direction 340 degrees (north-north-west) and a highest gust of 113 mph were recorded at Kinloss on the dials of a cup anemometer.

Extreme Wind Speeds for Building Design Purposes

Extreme wind speeds for building design purposes are obtained from a statistical treatment of the highest hourly mean wind speeds and highest gusts recorded by an anemograph in each year over a long period of years. In the absence of long period anemograph records from locations in the Moray Firth, the expectation of maximum wind speeds at the nearby longer established stations at Dounreay and Dyce are of interest. These are quoted below:-

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

	10 years	20 years	50 years	100 years
Dounreay	64 mph	67 mph	72 mph	76 mph
Dyce	56 mph	61 mph	68 mph	73 mph

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

	10 years	20 years	50 years	100 years
Dounreay	101 mph	106 mph	113 mph	121 mph
Dyce	92 mph	100 mph	112 mph	121 mph

It is considered that the extreme speeds quoted at "A" and "B" above for Dounreay should give a reasonably reliable guide to the expectation of extreme speeds at exposed places on or near the east coast of Caithness and along the southern stretch of the Moray Firth coastline between about Buckie and Fraserburgh. Similarly, the extreme speeds quoted at "A" and "B" above for Dyce should give a reasonably reliable guide to the speeds likely to be experienced at exposed places on or near the coast from Inverness northwards to

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the country border of Caithness (including the Black Isle) and exposed places on or near the coast eastwards from Inverness to Buckie.

With regard to wind directions and speeds in built-up areas, it is difficult to generalise about the winds in the built-up area of any city or town 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. The buildings act as wind breaks so reducing the mean speed of strong winds, and in the more densely built-up areas of a city or town, the mean hourly speeds may be of the order of 10 mph lower than in the more exposed outskirts. However, although the buildings tend to reduce the mean wind speed, the "rough" surface of a built-up area increases the gustiness and the maximum gust speeds may well approximate to those experienced at an open exposed site on the outskirts.

Estimation of Maximum Wind Speeds averaged over short periods of time

The current British Code of Practice concerned with the calculation of wind loads on buildings requires the basic design wind speed to be the highest expected wind speed averaged over one minute, and it is likely that the revised Code will specify the use of an average over a shorter period, probably 15 seconds, as a basic speed for the design of whole structures, with an even shorter period, probably 3 seconds, for the design of certain unclad structures or of individual members of a building. However, the records from standard anemographs have too close a time scale for mean speeds to be measured over periods of one minute or less, and the readily available statistics are limited to means over one hour and details of the highest gusts. The highest speeds averaged over periods of 1 minute and 15 seconds will clearly lie somewhere between the highest hourly mean speed and the highest gust, while the highest 3 second mean will approximate to the highest gust speed, since the gusts that are fully recorded by an anemograph have duration of 3 seconds or more.

Until more evidence is available from open-scale recordings of strong winds in urban and city exposures, it is suggested that the estimation of maximum wind

/speeds

speeds over periods between one hour and a few seconds should be related to the roughness of the terrain as reflected in the ratio of the maximum gust to the maximum hourly speed.

The reader will readily appreciate that the roughness of the terrain varies considerably from place to place along the coastline of the Moray Firth but nevertheless it is interesting to note that the ratio of the recorded maximum gusts to the recorded maximum hourly speeds at a height of 33 feet above the ground at anemograph stations in or near the Moray Firth works out at about 1.6 i.e. the maximum gust speed is about 160 per cent of the maximum hourly speed.

Suggested factors for estimating maximum speeds over short periods of time "t" from maximum hourly speeds for a ratio of 1.6 and for other ratios of from 1.9 to 1.4 are given below:-

Ratio of Maximum Gust to Maximum Hourly Speed	"t" = 10 minutes	1 minute	30 seconds	15 seconds	10 seconds
1.9	1.06	1.28	1.39	1.52	1.60
1.8	1.06	1.27	1.37	1.48	1.55
1.7	1.06	1.25	1.34	1.44	1.50
1.6	1.06	1.23	1.30	1.38	1.43
1.5	1.05	1.20	1.26	1.33	1.37
1.4	1.05	1.17	1.22	1.27	1.30

Thus, for example, with a ratio of maximum gust to maximum hourly speed of 1.6, the probable value of the maximum wind speed averaged over one minute would be 123 per cent of the maximum hourly speed.

Corrections to Extreme Wind Speeds for Heights in excess of 33 feet above ground Level

In the Meteorological Office, average wind speeds near the ground are often related to a standard height of 33 feet (10 metres) above the ground and it will be noticed that the extreme speeds quoted at "A" and "B" above refer to this height. The most satisfactory method of estimating extreme wind speeds at heights

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in excess of 33 feet above ground level is by use of the following power laws:-

For speeds meaned over one hour: $V_H = V_{33} \left(\frac{H}{33}\right)^{0.17}$

For gust speeds: $V_H = V_{33} \left(\frac{H}{33}\right)^{0.085}$

where:

V_H = the hourly mean speed or gust speed in mph at the required height H.

V_{33} = the extreme hourly mean speed or gust speed in mph at 33 feet above the ground (quoted at "A" and "B" above)

H = the required height in feet.

Applying these formulae to the extreme speeds quoted for Dounreay and Dyce at "A" and "B" above, the following estimates of the maximum hourly mean speeds and maximum gusts are obtained for heights ranging from 50 feet to 400 feet above ground level. When using these estimates, it should be borne in mind that the ratio of the maximum gust speed to the maximum hourly mean speed gradually decreases with increasing height above the ground. For example, it will be noticed from "C" and "D" below that at Dounreay, the ratio of the "maximum once-in-50 years gust" to the "maximum once-in-50 years hourly mean speed" at a height of 400 feet above the ground is $\frac{140}{110} = 1.3$. Thus if an average wind speed over a period of time shorter than one hour is required for a height in excess of 33 feet above the ground, it is necessary to calculate the appropriate ratio for that height and then to consult the "t" ratio table given previously in the section of the text dealing with the estimation of maximum wind speeds averaged over short periods of time.

/C.

C. Maximum Hourly Mean Wind Speeds at specified heights above the ground likely to be exceeded only once in the stated number of years:

		10 years	20 years	50 years	100 years
At 50 feet	Dounreay	69 mph	72 mph	77 mph	82 mph
	Dyce	60 mph	65 mph	73 mph	78 mph
At 100 feet	Dounreay	77 mph	81 mph	87 mph	92 mph
	Dyce	68 mph	74 mph	82 mph	88 mph
At 150 feet	Dounreay	83 mph	87 mph	93 mph	98 mph
	Dyce	73 mph	79 mph	88 mph	94 mph
At 200 feet	Dounreay	87 mph	91 mph	98 mph	103 mph
	Dyce	76 mph	83 mph	92 mph	99 mph
At 250 feet	Dounreay	90 mph	95 mph	102 mph	107 mph
	Dyce	79 mph	86 mph	96 mph	103 mph
At 300 feet	Dounreay	93 mph	97 mph	105 mph	111 mph
	Dyce	81 mph	89 mph	99 mph	106 mph
At 350 feet	Dounreay	96 mph	100 mph	108 mph	114 mph
	Dyce	84 mph	91 mph	102 mph	109 mph
At 400 feet	Dounreay	98 mph	102 mph	110 mph	116 mph
	Dyce	86 mph	93 mph	104 mph	111 mph

D. Maximum Gust Speeds at specified heights above the ground likely to be exceeded only once in the stated number of years:

		10 years	20 years	50 years	100 years
At 50 feet	Dounreay	105 mph	110 mph	117 mph	125 mph
	Dyce	95 mph	104 mph	116 mph	125 mph
At 100 feet	Dounreay	111 mph	117 mph	124 mph	133 mph
	Dyce	101 mph	110 mph	123 mph	133 mph
At 150 feet	Dounreay	115 mph	121 mph	129 mph	138 mph
	Dyce	105 mph	114 mph	127 mph	138 mph
At 200 feet	Dounreay	118 mph	123 mph	132 mph	141 mph
	Dyce	107 mph	117 mph	131 mph	141 mph
At 250 feet	Dounreay	120 mph	126 mph	134 mph	144 mph
	Dyce	109 mph	119 mph	133 mph	144 mph
At 300 feet	Dounreay	122 mph	128 mph	136 mph	146 mph
	Dyce	111 mph	121 mph	135 mph	146 mph
At 350 feet	Dounreay	123 mph	130 mph	138 mph	148 mph
	Dyce	113 mph	122 mph	137 mph	148 mph
At 400 feet	Dounreay	125 mph	131 mph	140 mph	150 mph
	Dyce	114 mph	124 mph	139 mph	150 mph

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As mentioned previously, the Moray Firth is in general a windy region and special care should be taken when using the speeds quoted in this report for the design of buildings or building components where there are unusual features either of exposure and local topography or of the structure itself. In such cases, advice may be sought from the Meteorological Office.

High Winds as a Factor interrupting Outdoor Building Work in the Coastal Area of the Moray Firth

Strong winds often lead to hazardous working conditions on building sites particularly at sites where men are working on ladders or have precarious hand and footholds above ground level. Perhaps equally dangerous are the risks to workmen who are handling materials which are likely to be snatched off or blown about by the wind.

With the increasing use of tower cranes in recent years, the incidence of strong winds has become an even more important factor affecting the time lost in building work, because when strong winds are blowing, the tower cranes have to cease operating, the hoisting of building materials is stopped and nearly all work may be brought to a standstill.

It is not possible to decide a precise threshold of wind speed above which work on a building site would be hampered or have to stop, because this will clearly depend on a number of factors including the exposure of the building site, e.g. whether it is sheltered from the wind by nearby buildings, the height above ground level at which men are working, the type of work, the materials being used etc. Similar consideration would have to be taken into account in trying to assess the probable amount of time in which the use of a tower crane would be restricted or have to cease.

During a gale (average wind speed near the ground of 39 mph or more with frequent gusts to 50 mph or more) tower cranes cannot operate and probably most other types of outdoor building work would be brought to a standstill. However, a gale represents extreme wind conditions and there is no doubt that high gusts of wind of say 40 mph or more associated with average speeds considerably less

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than 39 mph could also lead to dangerous working conditions and would also seriously restrict the use of tower cranes.

Records showing the incidence of gusts of 40 mph or more in each hour of the working part of the day are not available from the Moray Firth region. However, records of average wind speeds observed from anemometer dials at each hour on the hour, are available from Wick and Kinloss over a fairly long period of years.

As mentioned earlier in this Report, the available evidence suggests that at wind recording stations in or near the Moray Firth, the ratio of maximum gusts to maximum mean hourly wind speeds near the ground is of the order of 1.6 and thus it would seem reasonable to assume that gusts of 40 mph or more would become quite frequent with average speeds of 25 mph or more. Accordingly, statistics showing the incidence of average wind speeds of 25 mph or more should serve as a useful indication of fairly frequent gusts to 40 mph or more.

Tables 4E and 4F give the total number of days at Wick and Kinloss on which an average wind speed of 25 mph or more was recorded between 07h. and 17h. GMT. on each day during the 10 years from 1957 to 1966. Tables 4E and 4F also give the total number of hours in which average speeds of 25 mph or more were recorded between 07h. and 17h. on each day during the same 10 year period. It is considered that the values given in Tables 4E and 4F should provide a reasonably reliable guide for planning purposes to the probable amount of time in which outdoor work or the use of tower cranes might be hampered or have to cease at exposed places in the Moray Firth.

The windiness of Wick when compared with Kinloss, is once again reflected in the figures shown in Tables 4E and 4F. It is considered that the figures quoted for Wick in Table 4E should give a fairly good guide to the incidence of gusts to 40 mph or more at exposed places along the east coast of Caithness and possibly to the stretch of coast between Banff and Fraserburgh, while the figures for Kinloss in Table 4F should be reasonably representative of exposed places along the remainder of the Moray Firth coastline.

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It should be borne in mind when consulting Tables 4E and 4F that the average wind speeds of 25 mph or more at Wick and Kinloss were recorded at a height of 33 feet above ground level and that considerably higher speeds could be experienced at heights in excess of 33 feet above ground level, e.g. on exposed multi-storey buildings or high up on tower cranes. For example, using the power law corrections for height measured earlier, an hourly mean wind speed of 25 mph or more with gusts to 40 mph or more at a height of 33 feet above ground level would become something like an hourly mean speed of 30 mph or more with gusts to 45 mph or more at a height of 150 feet above the ground. When consulting Tables 4E and 4F, it should be noted that the figures relate to a 7-day working week and not to a 5-day working week.

5. FOG

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, Aberdeen and Dundee. However, visibility in the coastal region of the Moray Firth is good even by east coast of Scotland standards. Dirty smoke fogs are unknown in the Moray Firth but it is interesting to note that if winds from the sector between south and southwest are maintained over several days, smoke from the industrial areas well to the south may result in hazy conditions, although visibility on these occasions is seldom reduced to less than three or four miles.

On the relatively few occasions when poor visibility does occur in the coastal region of the Moray Firth, the cause is due more often than not to haar (North Sea fog). Haar occurs from time to time during the period from April to September and can ruin potentially brilliantly fine days during the spring and summer. The basic cause of these fogs is the moistening and cooling of warm air from the Continent by the relatively cold waters of the North Sea and Moray Firth. 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 near the coast, the higher districts further inland may be in sunshine above it. Frequently by the time it has reached the Inner Moray Firth region, the haar has lifted into an unbroken layer of stratus cloud, perhaps obscuring the higher ground and buildings, but with reasonably good visibility beneath it. When 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 when 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 further west or a few miles inland are

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enjoying glorious sunshine.

Higher ground or a long land track tend to break up the haar, and partly for this reason, the more sheltered Inner Moray Firth region, particularly the region to the lee of the Black Isle, suffers less from haar than do the more exposed stretches of coastline to the north and east.

The Meteorological Office weather stations at Wick and Kinloss keep a 24 hour watch on the weather and are the only locations in the Moray Firth region for which detailed visibility records are available. However, very brief visibility records are also available from a number of co-operating weather stations on or near the coast of the Moray Firth where the observers record the occurrence of fog (visibility less than 1,100 yards) in routine once-daily weather observations made at 09h GMT.

The Average Number of Mornings with Fog at 09h GMT are given in Table 5 for Wick and Kinloss and a number of co-operating weather stations along the Moray Firth coastline. The figures in this Table serve to emphasise the very low incidence of fog at places in the Moray Firth in general and in the Inner Moray Firth in particular. It is also worthy of note that the more exposed parts of the coastline at Wick, Rattray Head and Banff are much more prone to haar during the months of April to September than the more sheltered parts of the coastline and places like Elgin and Forres which lie a short distance inland from the coast. Although the figures in Table 5 relate to 09h GMT only, the conclusions reached above the places worst-affected by haar are almost certainly true of other times of the day.

At this point it should perhaps be explained that a fog is said to occur when the visibility falls to below 1,100 yards. A fog becomes "thick" when the visibility falls to less than 220 yards and "dense" when the visibility falls to less than 55 yards. Fogs with visibilities between 500 and 1,100 yards will certainly hamper the movements of aircraft and ships in the Moray Firth region, but will have little effect on land transport and the normal daily routine. However, when visibility falls to less than 220 yards the flow of road traffic is slowed down and with visibility less than 55 yards, the movement of road traffic is very seriously impeded especially at night time.

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The Number of Days and Hours with "Fog", "Thick Fog" and "Dense Fog" at Wick and Kinloss are quoted in Tables 5A to 5D. These data have been extracted from the detailed hourly records of visibilities available from Wick and Kinloss. It is important to note that the "days with fog" in Tables 5A and 5C refer to fog at any time of the day not just to 09h GMT.

In studying the visibility data for Kinloss in Table 5C and 5D it will be noticed that days with "thick fog" are most uncommon and that a "dense fog" is a fairly rare event. Moreover, "dense" fogs at Kinloss seldom last for more than an hour or two.

The occurrence of haar at Kinloss is reflected in the monthly totals for April to September and it is evident that haar usually occurs at Kinloss more frequently in May, June and July than in the remaining months of the year. Perhaps it should be mentioned that haar conditions along the east coast of Scotland often start with winds from the southeast. Kinloss and other places in the Inner Moray Firth then remain clear, being sheltered by the Grampians, although haar may be affecting the more exposed stretches of the coast and can often be seen from Kinloss over the more northern parts of the Moray Firth. Usually, haar only reaches Kinloss when the wind backs to north of east.

The reader may be surprised by the relatively high number of days with fog at Kinloss during the winter months and perhaps it should be emphasised therefore, that the totals for the winter months include a considerable number of occasions when the visibility at Kinloss deteriorated temporarily to less than 1,100 yards during snowfall. Indeed, if the number of occasions when the visibility deteriorated to less than 1,100 yards in snow had not been included in Table 5C, this would have meant a reduction of about 30 per cent to the ten year total of 267 days. There are also a few occasions in most winters when Kinloss and most other places along or near the coastline of the Moray Firth are affected by radiation fog. Radiation fog is a common type of fog which forms overland on nights characterized by light winds, clear skies and moist air in the lower levels. The moist air is cooled to below its dew point by contact with the cold ground giving rise to fog, "ground fog", or mist and

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it is worthy of note that at Kinloss, radiation fog in winter occurs most often and is thickest when temperatures are near or below freezing point. Occasions with radiation fog at Kinloss are usually associated with light winds from the quadrant between south and west bringing radiation fog often formed at some distance from the airfield, perhaps thickened a little with domestic smoke from Forres, Nairn or Inverness. Table 5 shows a relatively high incidence of fog at 09h at Inverness particularly during the winter months and in view of what has been said about the places most prone to haar, it would be reasonable to assume that Inverness has more radiation fogs than the other locations from which records are available and a contributory cause may be a higher output of domestic smoke from this most thickly populated part of the Moray Firth coastline.

The results of an investigation into the occurrence of fog at Kinloss carried out by Mr. S. M. Ross will be of interest to the reader. Mr. Ross examined the Kinloss records for the 10 years from 1951 to 1960 and the main findings of his investigation are as follows:

i The maximum frequency of radiation fog is in September and the minimum in April.

ii When shallow ground fog occurs, it thickens on only 25 per cent of occasions and on half of these occasions it is in patches only.

iii On 93 per cent of occasions of ground fog and radiation fog, the wind near the ground had been off the sea for at least one hour of the day.

iv In midwinter, radiation fog sometimes forms as late as midday and as early as mid-afternoon.

v One third of all radiation fogs had a fog point below 35°F.

vi On only 5 occasions in the ten years considered did radiation fog last for more than 8 hours. The longest duration was 13.6 hours.

vii June had the most sea fog ("haar") with the figures for May and July almost as high.

viii The average duration for each occasion of sea fog in June was 5½ hours.

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ix Once established in the Inner Moray Firth, sea fog is very persistent and can be advected back to Kinloss from the southwest, especially during the period after dawn.

x 27 per cent of sea fogs had visibilities below 220 yards.

In studying the visibility data for Wick in Tables 5A and 5B, the reader will notice the very striking increase between Kinloss and Wick in the number of days and hours with fog. The reason for this increase is due almost entirely to the fact that Wick is completely open to winds from an easterly point bringing in-shore and troublesome haar from the North Sea. The monthly totals give a good indication of the frequency of haar throughout the spring and summer months and the reader will notice the relatively high incidence during the months of May to August. On the other hand it can be seen that only about one third of all fogs at Wick become thick and that less than 5 per cent of all fogs become dense. As at Kinloss, the monthly totals quoted for Wick in Tables 5A and 5B include many occasions during the winter months when the visibility deteriorated temporarily during snowfall. However, Wick (i.e. the site of the airfield) is remarkably free from radiation fog although radiation fogs are by no means uncommon at lower lying places near Wick, e.g. in the nearby valley of the Wick Water.

A great deal has been said in the preceding paragraphs about frequencies of fog, different kinds of fog, fog investigations etc. In fairness to the coastal region of the Moray Firth and to avoid any possible misunderstanding, perhaps it should be re-emphasised that the whole of the Moray Firth coastline has a remarkably low frequency of fog.

/6. SNOW

6. SNOW

In the coastal region of the Moray Firth, 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 elements. For example, during the severe winter of 1962/63 there were forty mornings with snow lying on the ground at Kinloss compared with only three mornings during the following winter of 1963/64.

Considering its high latitude, the low-lying coastal region is remarkably snow-free especially when compared with the higher ground further inland. On the other hand, as far as "numbers of days with snow falling" are concerned, the coastal strip of the Moray Firth in general and Caithness in particular are the "snowiest" lowland areas on the mainland of the British Isles.

In Caithness, much of the winter precipitation is in the form of snow and severe snow storms with blocked roads and interrupted communications are by no means uncommon. A glance at the map will show that the coastal region of the Moray Firth is very open to the sector between northwest and northeast and it is hardly surprising that the greatest risk of heavy snowfalls occur when northerly winds bring polar air into the region. Although relatively infrequent, there are occasions after an influx of polar air, when heavy snow can completely disrupt communications, the most notable example in recent years being the heavy falls of January and February 1955 when an emergency air-drop "Operation-Snowdrop" was organised to supply food and medical supplies to marooned farmers and villagers, and hay to cattle and sheep. On this occasion, the areas worst affected by snow, which had drifted to 30 feet deep in places, were Caithness and Sutherland.

Falls of snow in the Moray Firth region are often accompanied by high winds and therefore even relatively light falls of snow can lead to severe local drifting particularly in the Caithness, Sutherland and Buchan areas. However, the coastal roads of the Inner Moray Firth region often escape the worst effects of blizzards affecting the roads to the north and east, particularly snowstorms associated with an airflow from the sector between northwest and north-north-west.

The Numbers of Days with Snow or Sleet Falling at Wick and Kinloss are given

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in Table 6. It will be noted from the figures in this Table that Wick has a higher number of days with "snow or sleet falling" than Kinloss but the differences between the two sets of figures are clearly not very great and therefore these figures should provide a good guide to the incidence of snow or sleet falling at other places in the coastal region below an altitude of about 200 feet. The Meteorological Office Weather stations at Wick and Kinloss are the only weather stations in the region keeping a 24 hour watch on the weather and are therefore the only weather stations for which complete records of snow falling at any time of the day or night are available. However, it should be borne in mind that Wick and Kinloss are both low-lying places and that the number of days with snow falling increases fairly rapidly with increasing height above sea level. For example, 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, a north or east facing aspect of the surface and a greater distance from the coast will certainly increase the number of days with snow lying. As the general lie of the ground in the coastal region of the Moray Firth is on a north or east facing slope, down from the higher ground backing the coastal strip, the persistence of snow cover can be a nuisance particularly over the higher parts of the coastal region.

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 where the snow becomes compacted and even more treacherous to road users especially at night time 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 coupled with the scrapings of snow-ploughs cause damage to 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 falling in temperatures up to about

36 degrees Fahrenheit will almost certainly fall as snow.

After a fall of snow in the Moray Firth region, the variation in snow cover and depth between the low lying ground at the coast and the higher ground, which in places lies only a short distance from the coast, is often quite remarkable. Moreover, the high ground is sometimes affected by appreciable falls of snow when at the same time, rain or sleet is falling at the coast.

It should perhaps be explained at this point 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 at 09h Greenwich Mean Time and the snow depth is only measured on these occasions. The depth of snow measured at 09h GMT relates 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 like Wick or Kinloss. This may well account in part for the occasional differences in the number of days with snow lying (Table 6A) between say Forres and the nearby airfield at Kinloss, although Forres does lie a little further than Kinloss from the moderating influence of the sea.

The Average Number of Days with Snow lying at Wick, Kinloss and other places in the Moray Firth for which records are available over a reasonably long period of years, are quoted in Table 6A.

The Number of Mornings per Winter with Snow lying at Specified Depths are given in Table 6B for Wick, Inverness, Kinloss, Forres and Elgin which are the only locations for which records of snow depths are available over a suitably long period.

/7. RELATIVE HUMIDITY

7. RELATIVE HUMIDITY

In the coastal region of the Moray Firth 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 temperatures of the day, i.e. usually around dawn, while the lowest values of relative humidity usually 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 of 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.

Conversely, one might expect that relative humidities in the Moray Firth region would be lower for a longer period of time in the summer months, but this is not the case, and relative humidities are in fact lower for a longer period of time in the spring months of March, April, May and June no doubt because of the relatively low rainfall in the spring and the high incidence of cold, dry easterly winds.

Average Values of Relative Humidity and Corresponding Air Temperatures at Wick and Kinloss at certain times of the day are given in Tables 7 and 7A. Wick and Kinloss are the only locations in the region for which detailed records of dry and wet bulb temperatures (from which values of relative humidity are obtained) are available. It is interesting to note from Tables 7 and 7A that the main differences in the humidity regime between Wick and Kinloss occur during the afternoon in the spring and summer months. The main reason for this is that during the afternoon in the spring and summer, air temperatures at Kinloss tend to be appreciably higher than at Wick. There is the further point that Kinloss is much less affected by haar (sea fog) during the spring and summer and as mentioned previously in this Report, the föhn effect leads to a significant increase in temperature and a reduction in relative humidity at Kinloss and other favourably situated places along the Moray Firth coastline.

Statistics of Wet Bulb Temperatures for Kinloss are given in Tables 7B and 7C. Similar statistics for Wick are not yet available but advice on wet bulb temperatures at Wick can be obtained from the Meteorological Office.

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8. THUNDERSTORMS

The major centres of population in Scotland have a much lower incidence of thunderstorms and damaging hail than places in England, particularly places in southern and central England and it is worthy of note that the frequency of thunderstorms and damaging hail is lower in the coastal region of the Moray Firth than anywhere else on the mainland of the British Isles. For example, on the long term average, places along the coastal strip of the Moray Firth have three to four days with thunderstorms per year while many places in England have 15 to 20 days per year with thunderstorms. Indeed, it is interesting to note that even Edinburgh and Glasgow have on average about twice the number of thunderstorms per year than places along the coast of the Moray Firth.

Although very few in number, thunderstorms can occur in the coastal region of the Moray Firth in any month of the year but are most likely to occur during the months of May to August and least likely to occur in February, March and April.

There are no detailed records of the incidence of thunderstorms over the higher ground backing the coastal region but the available evidence suggests that the frequency of thunderstorms over the hills and high moorland areas, particularly the high ground backing the southern coast of the Moray Firth, may be considerably higher than over the coastal region.

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Table 1

MONTHLY AND ANNUAL AVERAGES OF RAINFALL (INCHES) 1916-1950 FOR PLACES IN THE COASTAL AREA OF THE MORAY FIRTH

Station	Height (Feet)	N.G.R.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Wick	119	ND (39) 366523	2.93	2.00	1.81	2.03	1.81	2.04	2.57	2.63	2.90	3.12	3.16	2.97	29.97
Clythness	133	ND (39) 291363	2.91	2.01	1.90	2.21	1.90	1.92	2.70	2.55	2.82	3.05	3.06	2.64	29.67
Geanies House	200	NH (28) 895793	1.88	1.32	1.24	1.47	2.01	1.80	2.68	2.49	2.25	2.59	2.04	1.82	23.59
Fortrose	15	NH (28) 749557	2.26	1.70	1.49	1.66	1.92	1.79	2.74	2.57	2.21	2.81	2.23	2.05	25.43
Culduthel Res.	242	NH (28) 665412	2.74	1.91	1.51	1.78	2.12	1.97	2.94	3.09	2.64	2.94	2.49	2.31	28.44
Achareidh	59	NH (28) 868565	2.10	1.54	1.41	1.69	2.11	2.05	2.96	2.94	2.47	2.84	2.30	1.95	26.36
Cawdor Castle	225	NH (28) 847498	2.84	2.07	1.74	2.07	2.46	2.34	3.31	3.36	2.91	3.37	2.84	2.41	31.72
Forres (Drum Duan)	120	NY (38) 046576	2.05	1.58	1.48	1.72	2.10	2.22	3.15	2.99	2.64	2.98	2.36	1.93	27.20
Gordon Castle	104	NY (38) 350595	2.36	1.84	1.69	1.83	2.09	2.26	3.08	3.11	3.05	3.14	2.89	2.23	29.57
Banff	9	NY (38) 684638	2.45	1.92	1.63	1.79	2.03	2.08	2.88	2.99	2.99	2.94	3.12	2.47	29.29

Table 1A

MONTHLY AND ANNUAL AVERAGES OF RAINFALL (INCHES) 1916-1950, ESTIMATED FOR SHORT TERM STATIONS IN THE COASTAL AREA OF THE MORAY FIRTH

Station	Height (Feet)	N.G.R.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Uppat	220	NC (29) 870025	3.13	2.32	2.02	2.32	2.29	2.25	3.19	3.16	3.02	3.73	3.19	2.99	33.61
Ospisdale House	100	NH (28) 713898	3.08	2.23	1.94	2.17	2.01	2.01	2.92	2.92	2.79	3.58	2.89	2.86	31.40
Tarbatness	60	NH (28) 947875	1.84	1.32	1.16	1.43	1.78	1.60	2.37	2.26	2.04	2.42	1.97	1.76	21.95
Ardross School	495	NH (28) 644736	3.13	2.32	1.89	2.08	2.05	1.92	2.88	2.88	2.76	3.50	2.76	2.82	30.99
Fairburn House	500	NH (28) 455528	4.54	3.08	2.47	2.51	1.87	2.14	2.89	2.96	3.26	4.24	3.68	3.86	37.50
Muir of Ord	150	NH (28) 527500	3.27	2.32	1.79	1.99	1.85	1.75	2.65	2.62	2.62	3.30	2.71	2.89	29.76
Blackstand	520	NH (28) 716612	2.89	2.13	1.82	2.07	2.29	2.20	3.20	3.17	2.79	3.48	2.73	2.60	31.37
Inverness	13	NH (28) 668462	2.49	1.74	1.38	1.64	1.95	1.79	2.68	2.83	2.42	2.67	2.29	2.10	25.98
Dalcross	35	NM (28) 766520	2.31	1.61	1.39	1.67	2.00	1.85	2.69	2.77	2.33	2.79	2.21	2.03	25.65
Nairn	20	NH (28) 862566	2.00	1.50	1.38	1.60	1.97	1.88	2.75	2.77	2.32	2.72	2.20	1.90	24.99
Balblair	94	NH (28) 873553	2.29	1.69	1.52	1.86	2.32	2.21	3.18	3.22	2.64	3.07	2.47	2.21	28.68
Auchindoune	425	NH (28) 838479	2.87	1.96	1.74	2.16	2.48	2.45	3.48	3.48	2.93	3.48	2.70	2.48	32.21
Forres	155	NJ (38) 047587	1.84	1.43	1.33	1.55	1.89	2.02	2.85	2.71	2.39	2.71	2.14	1.75	24.61
Findhorn	20	NJ (38) 039644	1.80	1.35	1.26	1.56	1.90	1.95	2.76	2.69	2.31	2.62	2.11	1.71	24.02
Kinloss	15	NJ (38) 069625	1.81	1.35	1.28	1.57	1.89	1.98	2.78	2.71	2.32	2.66	2.13	1.69	24.17
Lossiemouth	21	NJ (38) 211701	1.87	1.42	1.37	1.59	1.87	1.99	2.74	2.67	2.49	2.69	2.29	1.92	24.91

Table 1A (Contd.)

Station	Height (Feet)	N.G.R.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Elgin, Kirkhill	35	NJ (38) 249628	2.02	1.54	1.48	1.78	2.02	2.25	2.98	2.96	2.74	2.93	2.47	1.95	27.12
Lesmurdie House	114	NJ (38) 226636	2.13	1.55	1.47	1.83	2.04	2.23	2.98	2.94	2.73	2.92	2.45	1.99	27.26
Elgin	92	NJ (38) 226617	1.97	1.45	1.37	1.74	1.95	2.13	2.85	2.83	2.62	2.80	2.36	1.87	25.94
Blackhills House	310	NJ (38) 271586	2.44	1.87	1.67	2.15	2.34	2.47	3.42	3.42	3.23	3.39	2.91	2.34	31.65
Newton	75	NJ (38) 162637	1.92	1.44	1.36	1.72	1.97	2.10	2.91	2.82	2.51	2.77	2.26	1.87	25.65
Rochomie Reservoir	287	NJ (38) 442632	2.25	1.75	1.54	1.75	1.94	2.11	2.91	2.91	2.86	2.91	2.69	2.14	27.76
Cullen House	150	NJ (38) 503656	2.48	1.87	1.69	1.90	2.12	2.27	3.11	3.11	3.11	3.19	3.02	3.26	30.23
Rattray Head	85	NK (48) 093582	2.49	1.81	1.67	1.79	1.96	1.81	2.69	2.61	2.89	2.98	3.09	2.55	28.34

NOTES:

1. The standard period for rainfall averages in current use in the Meteorological Office is the 35 year period from 1916 to 1950.

2. The averages quoted in Table 1 are actual averages over the 35 years from 1916 to 1950.

3. The averages quoted in Table 1A have been estimated from short term records.

TABLE 1B

FREQUENCIES OF SPECIFIED AMOUNTS OF RAIN FALLING IN 24 HOURS AT WICK, INVERNESS, NAIRN AND GORDON CASTLE - TOTAL NUMBER OF OCCASIONS IN 35 YEAR PERIOD FROM 1916 TO 1950

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	All Months
0.005 inches or more in 24 hours													
Wick	805	705	724	729	620	640	673	692	748	795	804	810	8745
Inverness	585	516	499	540	514	487	591	561	587	628	581	587	6676
Nairn	663	563	591	645	613	612	682	684	687	713	668	660	7781
Gordon Castle	618	531	543	539	520	520	609	563	607	666	667	625	7008
0.10 inches or more in 24 hours													
Wick	346	263	208	249	239	238	258	275	317	363	369	363	3488
Inverness	304	222	173	192	216	200	284	275	255	301	260	263	2945
Nairn	248	193	163	189	212	220	285	287	256	307	260	233	2853
Gordon Castle	284	202	207	215	232	230	309	285	294	338	314	259	3169
0.20 inches or more in 24 hours													
Wick	159	104	77	97	92	105	140	144	170	178	180	178	1624
Inverness	161	107	73	87	110	100	173	160	145	174	148	140	1578
Nairn	122	77	68	76	106	105	163	148	134	170	120	118	1407
Gordon Castle	144	99	81	109	112	121	186	177	158	188	173	127	1675
0.50 inches or more in 24 hours													
Wick	26	7	12	15	11	17	35	38	33	51	39	24	308
Inverness	29	13	6	11	23	22	43	54	38	44	29	26	338
Nairn	15	4	6	13	25	20	40	45	29	33	23	11	264
Gordon Castle	22	18	10	14	28	32	45	51	43	42	35	20	360
1.00 inches or more in 24 hours													
Wick	1			2	1	4	3	3	3	3	2	1	23
Inverness	5			2	6	4	9	10	9	6	3	1	55
Nairn				2	4	4	8	9	5	4	5		41
Gordon Castle	1	1	1	2	4	6	9	14	12	7	4	1	62
1.50 inches or more in 24 hours													
Wick				1		2		1					4
Inverness	1				1	1	2	2	3	1	1		12
Nairn					1	1	1	3	1	1			8
Gordon Castle						1		2	5				8
2.00 inches or more in 24 hours													
Wick				1									1
Inverness								1	1				2
Nairn								1		1			2
Gordon Castle						1		1	1				3

Example: During the 35 year period from 1916 to 1950, there was a total of 23 occasions at Wick on which 1.00 inches or more of rain fell in 24 hours.

TABLE 1C

MAXIMUM DAILY (24 HOURS FROM 09h. ON ONE DAY TO 09h. ON THE NEXT DAY) RAINFALLS IN INCHES AND YEAR OF OCCURRENCE

Place	Period	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Wick	1907-1966	1959 1.18	1955 1.26	1908 0.95	1934 2.27	1912 1.63	1917 1.85	1956 1.95	1964 2.16	1908 1.90	1966 1.16	1909 2.10	1966 1.36
Inverness *	1900-1966	1949 1.67	1950 0.94	1908 0.79	1948 1.37	1914 1.68	1966 2.30	1956 3.53	1937 3.31	1915 3.64	1954 2.02	1932 1.74	1966 1.27
Achareidh, Nairn **	1900-1966	1949 0.96	1950 0.81	1905 1.49	1948 1.40	1941 1.62	1966 1.90	1956 2.25	1937 2.72	1924 3.29	1924 2.26	1915 1.85	1966 1.18
Gordon Castle	1900-1966	1903 1.08	1900 1.40	1940 1.30	1910) 1948) 1.04	1912 1.64	1947 2.15	1901 1.98	1948 2.44	1915 2.65	1906 2.12	1915 1.80	1957 1.75

* From records at various sites in Inverness, no records available for 1922 and from August 1957 to June 1958.

** No records available from Achareidh for year 1902.

Example: The daily fall of 1.18 inches which occurred at Wick in January 1959 is the highest daily fall recorded at Wick in any January during the period from 1907 to 1966.

TABLE 1D

Maximum Rainfall in Inches from modified Bilham formula

Duration (minutes)	Return Period (years)						
	1 day per annum	1 day per 2 years	1 day per 5 years	1 day per 10 years	1 day per 20 years	1 day per 50 years	1 day per 100 years
2 minutes or less	0.09	0.11	0.14	0.16	0.19	0.22	0.24
4 " " "	0.15	0.18	0.23	0.27	0.31	0.36	0.40
6 " " "	0.18	0.23	0.30	0.35	0.40	0.48	0.54
8 " " "	0.21	0.27	0.35	0.41	0.48	0.58	0.65
10 " " "	0.24	0.30	0.39	0.47	0.55	0.66	0.75
15 " " "	0.28	0.36	0.48	0.58	0.68	0.83	0.96
20 " " "	0.31	0.40	0.54	0.66	0.79	0.97	1.12
25 " " "	0.34	0.43	0.58	0.72	0.87	1.09	1.27
30 " " "	0.36	0.46	0.62	0.77	0.94	1.18	1.39
40 " " "	0.40	0.50	0.68	0.85	1.05	1.34	1.59
50 " " "	0.43	0.54	0.73	0.91	1.13	1.46	1.75
60 " " "	0.46	0.58	0.78	0.96	1.19	1.56	1.88
90 " " "	0.52	0.66	0.88	1.09	1.35	1.78	2.18
120 " " "	0.58	0.72	0.96	1.19	1.47	1.94	2.38

Example: The maximum rainfall in 60 minutes or less on one day in 50 years = 1.56 inches.

Factors for converting point rainfalls into areal rainfalls

Area (acres)	Duration (minutes)						
	2	6	10	15	30	60	120
100	0.94	0.95	0.96	-	-	-	-
150	0.92	0.94	0.95	0.95	0.96	-	-
200	0.91	0.93	0.94	0.94	0.95	0.95	0.96
300	0.89	0.91	0.92	0.93	0.94	0.94	0.95
500	0.86	0.89	0.90	0.91	0.92	0.92	0.93
700	0.83	0.87	0.88	0.89	0.90	0.91	0.92
1000	0.80	0.85	0.86	0.87	0.88	0.89	0.90
1500	0.75	0.81	0.83	0.84	0.86	0.87	0.88
2000	-	-	0.80	0.82	0.83	0.85	0.86
3000	-	-	-	0.78	0.80	0.82	0.83
5000	-	-	-	-	0.74	0.76	0.77
7000	-	-	-	-	-	0.72	0.73

TABLE 1E

ESTIMATED AVERAGE VALUES OF EVAPOTRANSPIRATION (P.T.) IN INCHES FOR THE COASTAL REGION OF THE MORAY FIRTH

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Summer Total April to September	Winter Total October to March
Coastal Strip of:-														
East Caithness	0.15	0.40	1.15	2.15	2.90	3.25	3.00	2.35	1.65	0.85	0.15	0.10	15.30	2.80
East Sutherland	0.20	0.45	1.20	2.20	2.95	3.35	3.10	2.40	1.65	0.90	0.20	0.15	15.65	3.10
East Ross and Cromarty	0.20	0.45	1.20	2.30	3.15	3.50	3.30	2.45	1.70	0.95	0.25	0.20	16.40	3.25
Nairn	0.25	0.50	1.25	2.35	3.25	3.65	3.40	2.45	1.70	1.05	0.30	0.25	16.80	3.60
Moray	0.25	0.50	1.25	2.35	3.25	3.65	3.40	2.45	1.70	1.00	0.30	0.25	16.80	3.55
Banff	0.25	0.50	1.25	2.25	3.15	3.50	3.30	2.45	1.75	1.05	0.30	0.25	16.40	3.60
North Aberdeenshire	0.25	0.50	1.25	2.20	3.00	3.30	3.20	2.50	1.80	1.05	0.35	0.25	16.00	3.65

TABLE 1F

NUMBER OF DAYS WITH 0.1 MILLIMETRES OR MORE OF RAIN FALLING AT SOME TIME DURING THE 10 HOUR PERIOD BETWEEN 07h. AND 17h. GREENWICH MEAN TIME, IN EACH MONTH AND YEAR DURING THE 10 YEARS FROM 1957 TO 1966 AT WICK, CAITHNESS

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Days							
1957	13	11	13	13	10	16	17	14	21	16	13	17	174
1958	19	19	10	16	16	5	11	15	5	17	9	21	163
1959	23	8	8	16	10	13	13	17	6	12	17	14	157
1960	17	15	9	13	6	9	16	19	11	20	22	12	169
1961	14	15	14	11	8	15	16	16	12	15	13	20	169
1962	16	16	20	13	19	14	11	20	14	11	19	22	195
1963	19	7	15	11	20	10	13	12	16	15	21	16	175
1964	13	12	8	14	11	13	12	14	16	14	18	16	161
1965	15	14	9	13	15	17	16	14	15	12	17	23	180
1966	15	15	20	7	13	12	16	9	13	21	22	21	184
10 year mean	16.4	13.2	12.6	12.7	12.8	12.4	14.1	15.0	12.9	15.3	17.1	18.2	172.7

NUMBER OF HOURS DURING THE 10 HOUR PERIOD BETWEEN 07h. AND 17h. GREENWICH MEAN TIME WITH 0.1 MILLIMETRES OR MORE OF RAIN FALLING AT SOME TIME DURING THE HOUR, IN EACH MONTH AND YEAR DURING THE 10 YEARS FROM 1957 TO 1966 AT WICK, CAITHNESS

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Hours							
1957	37	25	42	38	21	63	51	39	76	48	56	73	569
1958	86	86	45	40	59	10	32	47	17	57	30	59	568
1959	101	18	28	46	33	30	41	47	19	45	61	51	520
1960	81	64	27	31	16	29	51	66	40	67	57	31	560
1961	40	51	39	30	22	43	43	45	30	57	43	74	517
1962	41	55	70	42	55	31	27	71	43	36	70	78	619
1963	54	23	52	27	56	31	34	59	51	45	100	42	574
1964	31	35	25	29	24	43	27	56	65	42	56	67	500
1965	43	48	17	47	48	59	57	35	39	40	76	92	601
1966	51	54	80	23	41	32	45	32	34	70	86	84	632
10 year mean	56.5	45.9	42.5	35.3	37.5	37.1	40.8	49.7	41.4	50.7	63.5	65.1	566.0

Table IG

Number of Days with 0.1 millimetres or more of rain falling at some time during the 10 hour period between 07h. and 17h. Greenwich Mean Time, in each month and year during the 10 years from 1957 to 1966 at KINLOSS, Morayshire

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Days							
1957	12	13	15	5	6	11	17	9	17	9	10	9	133
1958	14	18	10	14	18	8	12	16	10	13	9	13	155
1959	14	4	6	15	4	11	9	7	7	10	9	13	109
1960	11	12	4	9	9	13	16	19	10	18	13	6	140
1961	13	13	12	8	8	12	12	16	11	17	10	14	146
1962	12	13	16	8	14	9	11	18	12	9	17	18	157
1963	16	8	7	8	18	14	12	17	12	8	17	13	150
1964	8	10	7	15	12	14	6	13	15	13	13	17	143
1965	20	14	4	14	15	14	12	9	12	10	14	15	153
1966	7	12	19	4	12	16	10	9	12	18	17	20	156
10 year mean	12.7	11.7	10.0	10.0	11.6	12.2	11.7	13.3	11.8	12.5	12.9	13.8	144.2

Number of Hours during the 10 hour period between 07h. and 17h. Greenwich Mean Time with 0.1 millimetres or more of rain falling at some time during the hour, in each month and year during the 10 years from 1957 to 1966 at KINLOSS, Morayshire

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Hours							
1957	36	34	51	8	13	35	51	31	43	16	36	25	379
1958	47	70	22	33	42	32	51	52	20	37	20	47	473
1959	49	17	15	34	9	30	20	10	26	30	28	26	294
1960	58	23	15	26	11	39	37	75	27	58	33	11	413
1961	37	41	25	18	17	30	34	41	23	58	26	51	401
1962	32	41	42	20	37	13	30	58	42	21	45	72	453
1963	39	20	16	19	44	34	41	69	40	23	81	25	451
1964	27	19	20	37	30	31	14	42	53	32	38	39	382
1965	38	41	8	29	52	40	56	22	39	29	48	50	452
1966	22	41	48	9	28	51	37	36	32	46	53	71	474
10 year mean	38.5	34.7	26.2	23.3	28.3	33.5	37.1	43.6	34.5	35.0	40.8	41.7	417.2

TABLE 1H

NUMBER OF DAYS WITH MODERATE OR HEAVY RAIN FALLING AT SOME TIME 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 1957 TO 1966 AT WICK AIRPORT, CAITHNESS

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
						Number of Days							
1957	12	9	13	13	9	14	14	13	20	14	13	15	159
1958	17	18	9	16	16	3	10	15	5	17	9	20	155
1959	21	6	8	14	9	13	12	17	4	12	17	13	146
1960	17	13	8	11	5	9	14	18	9	19	17	10	150
1961	13	14	13	11	8	13	15	14	12	15	12	19	159
1962	15	14	20	11	16	14	9	17	13	10	18	20	177
1963	18	7	14	11	18	9	10	11	15	14	20	16	163
1964	13	11	6	14	9	10	9	13	15	14	15	15	144
1965	13	13	9	13	11	13	16	13	12	10	17	20	160
1966	15	10	19	4	11	9	16	9	10	21	22	20	166
10 year total	154	115	119	118	112	107	125	140	115	146	160	168	1579
10 year mean	15.4	11.5	11.9	11.8	11.2	10.7	12.5	14.0	11.5	14.6	16.0	16.8	157.9

NUMBER OF HOURS WITH MODERATE OR HEAVY RAIN FALLING AT SOME TIME DURING THE HOUR, 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 FROM 1957 TO 1966 AT WICK, AIRPORT, CAITHNESS

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
						Number of Hours							
1957	34	20	31	29	17	56	33	32	61	36	48	57	454
1958	67	74	32	35	51	6	27	41	13	54	22	51	473
1959	94	15	21	32	29	29	34	40	16	41	54	38	443
1960	76	59	19	23	9	26	44	51	29	50	47	24	457
1961	28	46	30	23	20	33	34	35	27	54	35	69	434
1962	38	48	46	33	38	30	17	60	35	31	55	61	492
1963	46	16	35	23	48	27	26	41	44	36	69	37	448
1964	25	32	17	24	21	33	20	41	52	36	46	48	395
1965	39	44	16	39	31	35	49	32	22	28	71	68	474
1966	33	36	73	14	32	19	37	22	29	63	80	70	508
10 year total	480	390	320	275	296	294	321	395	328	429	527	523	4578
10 year mean	48.0	39.0	32.0	27.5	29.6	29.4	32.1	39.5	32.8	42.9	52.7	52.3	457.8

Note: The 'days' and 'hours' counted in arriving at the monthly totals quoted above were 'days' and 'hours' in which rain fell at a rate of 0.5 millimetres per hour or more at some time during a day between 07h and 17h GMT or at some time during an hour between 07h and 17h GMT. Rain falling at a rate of 0.5 millimetres per hour corresponds to the lower limit of the Meteorological Office classification of 'moderate' rainfall i.e. rain falling fast enough to form puddles rapidly and to accumulate in a raingauge at a rate between 0.5 mm and 4 mm per hour. Rain falling at a rate of more than 4 mm per hour is classified as 'heavy' rain.

TABLE 1I

NUMBER OF DAYS WITH MODERATE OR HEAVY RAIN FALLING AT SOME TIME 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 FROM 1957 TO 1966 AT KINLOSS, MORAYSHIRE

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Days							
1957	12	12	15	4	6	11	16	9	16	8	8	7	124
1958	13	18	10	13	18	7	11	16	9	12	6	11	144
1959	14	4	3	13	3	11	9	6	6	9	8	9	95
1960	11	12	3	9	9	11	15	17	10	17	11	5	130
1961	11	13	11	7	7	11	11	14	10	17	9	12	133
1962	10	13	12	6	14	7	11	17	11	9	13	18	141
1963	13	7	7	8	18	10	11	16	12	7	16	12	137
1964	8	8	6	14	11	14	5	12	13	11	12	13	127
1965	17	13	4	14	15	14	12	8	11	8	13	13	142
1966	7	11	19	2	11	12	9	9	11	18	17	19	145
10 year total	116	111	90	90	112	108	110	124	109	116	113	119	1318
10 year mean	11.6	11.1	9.0	9.0	11.2	10.8	11.0	12.4	10.9	11.6	11.3	11.9	131.8

NUMBER OF HOURS WITH MODERATE OR HEAVY RAIN FALLING AT SOME TIME DURING THE HOUR, 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 FROM 1957 TO 1966 AT KINLOSS, MORAYSHIRE

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Hours							
1957	32	28	41	5	12	34	42	26	39	14	26	21	320
1958	45	58	21	27	39	27	43	43	19	32	12	30	396
1959	47	12	7	29	7	24	20	8	19	23	24	17	237
1960	44	20	9	23	10	35	30	67	21	48	21	10	338
1961	28	37	24	13	15	22	28	35	18	51	20	38	329
1962	24	37	29	11	34	11	29	50	33	20	36	51	365
1963	24	15	10	17	39	25	32	58	38	17	64	20	359
1964	24	17	14	29	24	30	11	40	40	26	32	29	316
1965	29	35	5	26	43	36	48	21	32	23	45	41	384
1966	21	37	43	5	24	35	31	28	23	42	49	57	395
10 year total	318	296	203	185	247	279	314	376	282	296	329	314	3439
10 year mean	31.8	29.6	20.3	18.5	24.7	27.9	31.4	37.6	28.2	29.6	32.9	31.4	343.9

Note: The 'days' and 'hours' counted in arriving at the monthly totals quoted above were 'days' and 'hours' in which rain fell at a rate of 0.5 millimetres per hour or more at some time during a day between 07h. and 17h. G.M.T. or at some time during an hour between 07h. and 17h. G.M.T. Rain falling at a rate of 0.5 millimetres per hour corresponds to the lower limit of the Meteorological Office classification of 'moderate' rainfall i.e. rain falling fast enough to form puddles rapidly and to accumulate in a raingauge at a rate between 0.5 mm. and 4 mm. per hour. Rain falling at a rate of more than 4mm. per hour is classified as 'heavy' rain.

TABLE 2

AVERAGES OF DAILY MAXIMUM, MINIMUM AND MEAN TEMPERATURES IN DEGREES FAHRENHEIT AT TEMPERATURE RECORDING STATIONS IN THE COASTAL AREA OF THE MORAY FIRTH (30YEARS PERIOD 1931-1960)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
WICK (altitude 119 feet)													
Maximum	41.5	42.4	45.0	48.7	52.2	56.8	60.1	59.7	57.6	52.5	47.3	43.7	50.7
Minimum	34.5	34.3	36.1	38.1	42.1	46.2	50.2	50.0	47.7	43.9	39.7	37.0	41.7
Mean	38.0	38.3	40.5	43.4	47.1	51.5	55.1	54.9	52.7	48.2	43.5	40.3	46.2
DUNROBIN CASTLE near GOLSPIE (altitude 12 feet)													
Maximum	42.0	43.3	45.9	49.3	53.1	57.8	60.8	60.3	58.3	53.3	47.7	43.7	51.3
Minimum	34.5	34.7	36.6	38.9	43.2	47.8	51.7	51.5	48.4	44.3	39.7	36.5	42.3
Mean	38.3	39.0	41.3	44.1	48.1	52.8	56.3	55.9	53.3	48.8	43.7	40.1	46.8
STRATHPEFFER (altitude 200 feet)													
Maximum	41.6	42.3	46.6	51.3	57.4	63.2	65.2	63.9	59.4	53.0	46.4	43.5	52.8
Minimum	30.8	31.4	33.9	36.9	41.1	46.1	50.5	49.8	45.6	40.8	35.5	32.9	39.6
Mean	36.2	36.9	40.3	44.1	49.3	54.7	57.9	56.9	52.5	46.9	40.9	38.2	46.2
TARBAT NESS (altitude 60 feet)													
Maximum	41.4	42.2	45.3	49.8	53.2	58.9	61.2	61.4	58.3	52.9	47.1	43.4	51.3
Minimum	34.8	35.1	36.7	39.6	43.9	48.5	52.0	52.1	49.1	44.6	39.7	36.6	42.7
Mean	38.1	38.7	41.0	44.7	48.5	53.7	56.6	56.7	53.7	48.7	43.4	40.0	47.0
FORTROSE (altitude 69 feet)													
Maximum	42.4	43.2	45.8	49.7	53.9	59.2	61.9	62.1	59.1	53.3	47.7	44.8	51.9
Minimum	34.8	35.6	37.6	40.9	44.8	49.7	53.6	53.1	50.9	45.5	40.9	37.9	43.8
Mean	38.6	39.4	41.7	45.3	49.3	54.5	57.7	57.6	55.0	49.4	44.3	41.3	47.8
INVERNESS (altitude 13 feet)													
Maximum	42.9	44.1	47.3	51.9	56.5	61.9	64.3	64.4	60.5	54.3	48.1	44.1	53.4
Minimum	32.8	33.6	35.5	40.4	44.9	49.2	52.6	51.8	48.8	43.2	38.3	34.2	42.1
Mean	37.9	38.9	41.4	46.1	50.7	55.5	58.5	58.1	54.7	48.7	43.2	39.1	47.7
CULLODTHEL near INVERNESS (altitude 242 feet)													
Maximum	41.9	42.8	46.8	51.1	56.2	61.1	63.7	63.3	59.6	53.3	47.3	43.9	52.6
Minimum	32.8	32.9	35.4	38.3	42.5	47.5	51.4	51.2	47.6	42.7	37.5	35.1	41.2
Mean	37.3	37.8	41.1	44.7	49.4	54.3	57.6	57.2	53.6	48.0	42.4	39.5	46.9
NAIRN (altitude 20 feet)													
Maximum	42.6	43.9	47.8	52.0	56.7	61.9	64.4	63.9	60.6	54.5	48.2	44.6	53.4
Minimum	32.4	33.1	35.2	38.3	42.6	47.7	51.3	50.9	47.5	42.8	37.4	34.5	41.2
Mean	37.5	38.5	41.5	45.1	49.7	54.8	57.9	57.4	54.1	48.7	42.8	39.5	47.3

TABLE 2 (Contd.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
FORRES (altitude 155 feet)													
Maximum	42.5	43.8	48.4	52.8	58.1	63.1	65.8	64.8	61.2	54.6	48.0	44.4	54.0
Minimum	31.8	32.2	34.6	37.3	41.6	46.7	50.2	49.9	46.8	41.9	36.7	34.0	40.3
Mean	37.1	38.0	41.5	45.1	49.9	54.9	58.0	57.3	54.0	48.3	42.3	39.2	47.1
KINLOSS (altitude 15 feet)													
Maximum	42.2	43.5	47.6	52.0	56.9	62.1	64.6	64.2	61.0	54.6	48.2	44.0	53.4
Minimum	32.9	33.1	34.7	37.4	41.9	46.9	50.5	50.1	47.1	42.4	37.3	34.9	40.8
Mean	37.5	38.3	41.1	44.7	49.4	54.5	57.5	57.1	54.1	48.5	42.7	39.5	47.1
ELGIN (altitude 92 feet)													
Maximum	43.0	44.2	47.9	52.3	57.5	62.4	66.5	64.6	60.6	54.5	48.3	44.8	53.9
Minimum	33.3	33.6	35.7	38.8	43.2	48.2	51.9	51.7	48.7	43.2	38.3	35.2	41.8
Mean	38.1	38.9	41.8	45.5	50.3	55.3	59.2	58.1	54.7	48.9	43.3	40.0	47.8
LOSSIEMOUTH (altitude 21 feet)													
Maximum	42.2	43.3	47.5	51.5	56.3	61.6	64.3	63.7	60.3	54.6	48.2	44.3	53.1
Minimum	32.1	32.2	35.0	37.9	42.3	47.5	51.1	50.4	47.0	42.3	36.7	34.4	40.7
Mean	37.1	37.8	41.3	44.7	49.3	54.5	57.7	57.1	53.7	48.4	42.5	39.3	46.9
GORDON CASTLE near FOCHABERS (altitude 104 feet)													
Maximum	42.6	44.0	48.0	52.5	58.1	63.0	65.5	65.1	61.2	54.9	48.1	44.4	54.0
Minimum	32.5	32.7	35.2	38.0	42.4	47.3	50.9	50.3	46.8	42.1	37.3	34.8	40.9
Mean	37.5	38.4	41.6	45.2	50.2	55.2	58.2	57.7	54.0	48.5	42.7	39.6	47.4
BANFF (altitude 130 feet)													
Maximum	41.7	43.0	46.2	50.7	55.6	60.6	63.7	63.1	59.7	53.6	47.3	43.9	52.3
Minimum	33.3	34.0	36.3	39.4	43.5	48.4	52.0	51.4	48.7	43.9	39.0	35.8	42.1
Mean	37.5	38.5	41.3	45.1	49.5	54.5	57.9	57.3	54.2	48.7	43.1	39.9	47.2
RATTRAY HEAD (altitude 85 feet)													
Maximum	41.3	42.3	44.8	48.6	52.3	56.8	60.8	60.9	58.3	52.5	47.2	43.5	50.8
Minimum	33.9	34.6	36.2	38.8	42.9	47.4	51.2	50.9	48.3	43.9	40.1	37.1	42.1
Mean	37.6	38.5	40.5	43.7	47.6	52.1	56.0	55.9	53.3	48.2	43.7	40.3	46.4

NOTES

1. The standard period for temperature averages in current use in the Meteorological Office is the 30 year period from 1931 to 1960.

2. The averages quoted above for Wick, Fortrose, Culduthel, Nairn, Gordon Castle and Banff are actual averages of readings made during the standard 30 year period from 1931 to 1960.

3. The 1931 to 1960 averages quoted for Dunrobin Castle have been estimated from temperature readings made during the 35 years from 1881 to 1915. The averages quoted for Strathpeffer have been estimated from temperature readings made during the 30 years from 1901 to 1930.

4. All the 1931 to 1960 averages quoted for the remaining stations have been estimated from short term or broken periods of records.

TABLE 2A

STATISTICS OF ANNUAL MAXIMUM AND MINIMUM TEMPERATURES IN DEGREES FAHRENHEIT

Annual Maximum Temperatures

Station	Period of Record (years)	Highest °F	Seldom* above °F	Median °F	Seldom* below °F	Lowest °F	Root mean square≠ °F
Wick	56	80	73	70	67	64	3.3
Fortrose	49	83	79	76	72	69	3.5
Culduthel near Inverness	43	87	81	77	73	70	4.1
Nairn	57	86	82	78	75	72	3.6
Forres	30	87	82	79	75	74	3.8
Gordon Castle	67	90	83	79	77	71	3.7
Banff	41	84	81	77	74	70	3.4

Annual Minimum Temperatures

Station	Period of Record (years)	Lowest °F	Seldom* below °F	Median °F	Highest °F	Root mean square≠ °F
Wick	60	8	13	18	28	3.8
Fortrose	50	13	18	22	30	3.6
Culduthel near Inverness	58	9	13	19	26	4.5
Nairn	60	2	9	16	25	5.2
Forres	34	2	11	16	25	5.1
Gordon Castle	60	-1	12	18	26	6.0
Banff	44	5	15	20	29	5.2

Notes

*"Seldom" = 20 per cent of occasions or 1 year in 5; the figures given are the upper and lower quintiles.

Median = the "middle" value i.e. half the records exceed it and half fall below it.

≠ = root mean square of the variation from the median.

ABSOLUTE HIGHEST AND LOWEST TEMPERATURES IN DEGREES FAHRENHEIT RECORDED AT WICK AND GORDON CASTLE IN EACH MONTH DURING THE 67 YEARS FROM 1900 TO 1966

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
WICK													
Absolute Highest in each month	56	58	63	67	69	80	80	78	75	70	62	58	80
Absolute Lowest in each month	8	9	14	19	25	30	34	31	29	21	12	10	8
GORDON CASTLE													
Absolute Highest in each month	61	61	72	75	80	86	86	86	90	78	67	60	90
Absolute Lowest in each month	1	-1	10	18	26	31	35	31	30	26	11	3	-1

Note

The absolute maximum temperature of 90.0°F was recorded at Gordon Castle on 1st September 1906. By Scottish standards, this is a remarkably high temperature and it is even more remarkable that a temperature of 90°F should be recorded so late in the year. Very high temperatures were recorded at other places in east and northeast Scotland on 1st September 1906. For example:

Kingussie (altitude 828 feet) = 86.6°F
Inverness (altitude 114 feet) = 85.0°F
Balmoral (altitude 927 feet) = 87.5°F

Very high temperatures were also recorded in east and northeast Scotland on 2nd September 1906.

TABLE 2B

AVERAGE NUMBER OF DAYS WITH MAXIMUM AIR TEMPERATURES REACHING CERTAIN LEVELS AT WICK AND GORDON CASTLE (15 YEARS FROM 1952 TO 1966)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Average Number of Days							
60°F. or more													
WICK	0	0	<1	<1	2	8	13	13	8	1	0	0	45
GORDON CASTLE	0	<1	1	4	12	21	24	23	17	8	<1	0	110
65°F. or more													
WICK	0	0	0	0	<1	2	3	3	1	<1	0	0	10
GORDON CASTLE	0	0	<1	<1	5	12	15	12	8	2	0	0	54
70°F. or more													
WICK	0	0	0	0	0	<1	1	1	<1	0	0	0	2
GORDON CASTLE	0	0	<1	<1	1	5	6	5	3	<1	0	0	20
75°F. or more													
WICK	0	0	0	0	0	0	<1	0	<1	0	0	0	<1
GORDON CASTLE	0	0	0	0	<1	2	2	1	1	<1	0	0	6
80°F. or more													
WICK	0	0	0	0	0	0	0	0	0	0	0	0	0
GORDON CASTLE	0	0	0	0	0	<1	<1	<1	0	0	0	0	1

ABSOLUTE HIGHEST MAXIMUM AIR TEMPERATURES RECORDED AT WICK AND GORDON CASTLE DURING THE 15 YEARS FROM 1952 TO 1966

WICK = 78°F on 16th July 1955

GORDON CASTLE = 86°F on 23rd August 1955

TABLE 2C

ACTUAL NUMBER OF DAYS DURING THE VERY WARM YEARS OF 1955 AND 1959 WITH MAXIMUM AIR TEMPERATURES REACHING CERTAIN LEVELS AT WICK AND GORDON CASTLE

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Actual Number of Days in 1955							
60°F. or more													
WICK	0	0	0	1	0	9	22	21	15	3	0	0	71
GORDON CASTLE	0	0	0	5	8	24	28	29	23	9	1	0	127
65°F. or more													
WICK	0	0	0	0	0	0	13	10	5	1	0	0	29
GORDON CASTLE	0	0	0	1	3	15	25	23	14	3	0	0	84
70°F. or more													
WICK	0	0	0	0	0	0	6	4	2	0	0	0	12
GORDON CASTLE	0	0	0	0	3	3	20	15	4	0	0	0	45
75°F. or more													
WICK	0	0	0	0	0	0	2	0	0	0	0	0	2
GORDON CASTLE	0	0	0	0	0	0	15	6	1	0	0	0	22
80°F. or more													
WICK	0	0	0	0	0	0	0	0	0	0	0	0	0
GORDON CASTLE	0	0	0	0	0	0	3	3	0	0	0	0	6
						Actual Number of Days in 1959							
60°F. or more													
WICK	0	0	0	0	4	8	23	23	18	4	0	0	80
GORDON CASTLE	0	1	1	7	16	25	29	29	21	20	1	0	150
65°F. or more													
WICK	0	0	0	0	0	2	7	10	4	0	0	0	23
GORDON CASTLE	0	0	0	0	10	15	25	23	13	7	0	0	93
70°F. or more													
WICK	0	0	0	0	0	1	0	3	0	0	0	0	4
GORDON CASTLE	0	0	0	0	2	8	12	14	10	4	0	0	50
75°F. or more													
WICK	0	0	0	0	0	0	0	0	0	0	0	0	0
GORDON CASTLE	0	0	0	0	0	1	4	7	2	1	0	0	15
80°F. or more													
WICK	0	0	0	0	0	0	0	0	0	0	0	0	0
GORDON CASTLE	0	0	0	0	0	0	0	2	0	0	0	0	2

TABLE 2D

AVERAGE NUMBER OF DAYS OF AIR FROST (MINIMUM AIR TEMPERATURE 32.0°F. OR LESS) DURING THE 11 YEARS FROM 1956 TO 1966

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Wick	13	12	7	6	1	<1	0	0	0	<1	6	10	55
Tarbat Ness	10	9	4	1	<1	0	0	0	0	<1	4	7	35
Fortrose	10	10	5	2	<1	0	0	0	0	<1	2	7	36
Inverness	15	13	7	4	1	0	0	0	<1	1	8	12	61
Nairn	15	14	10	6	1	<1	0	0	<1	1	9	13	69
Forres	17	16	9	6	1	<1	0	0	0	1	9	14	73
Kinloss	16	14	9	6	1	0	0	0	<1	1	8	14	69
Elgin	13	13	7	5	<1	0	0	0	0	<1	7	9	54
Gordon Castle	15	14	8	5	1	<1	0	0	0	<1	7	11	61
Banff	11	10	4	2	<1	0	0	0	0	0	4	8	39
Rattray Head	11	10	5	2	0	0	0	0	0	<1	3	8	39

TABLE 2E

AVERAGE AND EXTREME DATES OF FIRST AND LAST AIR FROSTS DURING THE 11 YEARS FROM 1956 TO 1966

Station	Average Date of First Air Frost	Average Date of Last Air Frost
Wick	1st November	6th May
Tarbatness	13th November	3rd April
Fortrose	24th November	30th March
Inverness	27th October	24th April
Nairn	31st October	8th May
Forres	28th October	11th May
Kinloss	23rd October	5th May
Elgin	3rd November	7th April
Gordon Castle	5th November	30th April
Banff	18th November	3rd April
Rattray Head	13th November	31st March

	Earliest Date of First Air Frost	Latest Date of Last Air Frost
Wick	4th October	1st June
Tarbatness	5th October	6th May
Fortrose	26th October	27th May
Inverness	29th September	27th May
Nairn	1st October	1st June
Forres	4th October	1st June
Kinloss	27th September	30th May
Elgin	5th October	7th May
Gordon Castle	5th October	1st June
Banff	8th November	7th May
Rattray Head	20th October	22nd April

TABLE 2F

AVERAGES AND EXTREMES OF EARTH TEMPERATURE READINGS IN DEGREES FAHRENHEIT MADE ONCE-DAILY AT 09H. GREENWICH MEAN TIME FROM THERMOMETERS EXPOSED AT DEPTHS OF ONE FOOT AND FOUR FEET UNDER A SHORT GRASS SURFACE AT FORRES, MORAYSHIRE (PERIOD OF RECORD 14 YEARS FROM 1951 TO 1956; 1958 TO 1965)

(Soil: Sandy Loam above sandy subsoil)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
AT ONE FOOT													
Monthly Mean of Daily Readings	35.8	36.1	39.7	44.8	51.4	56.8	59.5	58.6	55.0	49.3	42.6	37.9	47.3
Highest Monthly Mean of Daily Readings	38.1	39.2	43.9	46.8	54.1	59.0	62.8	62.2	58.3	51.3	44.6	41.0	62.8
Lowest Monthly Mean of Daily Readings	32.7	32.2	33.6	41.2	49.5	55.6	57.4	57.2	53.2	46.0	40.3	35.1	32.2
Absolute Highest Daily Reading	42.3	45.0	46.9	51.8	58.8	64.6	66.2	66.6	60.8	56.5	48.2	46.0	66.6
Absolute Lowest Daily Reading	30.7	32.0	32.2	37.8	45.0	48.9	53.1	53.2	47.8	42.3	35.1	32.7	30.7
AT FOUR FEET													
Monthly Mean of Daily Readings	39.9	39.0	40.1	43.0	47.5	51.6	54.7	55.8	54.7	51.4	46.9	42.6	47.3
Highest Monthly Mean of Daily Readings	42.3	40.5	43.0	44.8	48.9	53.2	56.3	57.0	56.7	53.4	48.6	45.1	57.0
Lowest Monthly Mean of Daily Readings	38.1	36.7	37.9	40.6	45.3	50.5	53.2	53.6	52.9	49.5	45.5	39.7	36.7
Absolute Highest Daily Reading	43.7	42.1	44.1	48.2	52.2	55.9	56.7	57.7	57.0	55.2	51.1	46.9	57.7
Absolute Lowest Daily Reading	37.0	36.5	36.0	38.5	42.8	48.0	52.0	53.1	51.6	47.8	41.9	38.8	36.0

Notes

1. The 'Monthly Means of Daily Readings' are monthly means of readings taken on each day during the 14 years from 1951 to 1956; 1958 to 1965.

2. The 'Highest and Lowest Monthly Means of Daily Readings' relate to the single January, February, March, April etc. during the 14 years which has the highest or lowest monthly mean of daily readings.

3. The 'Absolute Highest and Lowest Daily Readings' are the absolute highest and lowest daily readings recorded during the 14 years.

TABLE 2G

PERCENTAGE AMOUNT OF TIME WITH AIR ("SHADE") TEMPERATURES BELOW CERTAIN LIMITS AT KINLOSS, MORAYSHIRE.

(calculated from hourly readings made during the 10 year period from February 1951 to January 1961).

Degrees Fahrenheit	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
	%	%	%	%	%	%	%	%	%	%	%	%	%
20°F or below	1.6	1.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.4
26°F or below	6.4	6.7	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.7	2.6	1.5
32°F or below	20.4	22.3	7.6	2.4	0.2	0.0	0.0	0.0	0.1	0.3	4.6	9.6	5.5
34°F or below	30.8	32.6	13.4	5.1	0.5	0.1	0.0	0.0	0.2	0.8	7.4	15.3	8.7
36°F or below	43.4	44.1	20.9	8.4	1.4	0.3	0.0	0.0	0.5	1.7	11.3	24.4	12.8
38°F or below	56.7	58.2	31.5	15.3	3.6	0.5	0.1	0.1	1.1	3.9	17.6	37.1	18.5
40°F or below	67.6	69.4	44.1	25.1	7.6	0.9	0.1	0.2	2.4	7.2	26.4	52.0	24.9
42°F or below	77.2	77.1	56.1	34.4	12.2	1.9	0.3	0.4	4.3	12.2	37.0	65.3	31.2
44°F or below	84.3	82.7	67.1	46.5	20.1	4.2	0.6	0.8	6.8	19.5	49.2	76.4	37.9
46°F or below	88.8	88.9	77.4	59.3	30.8	9.2	1.3	1.6	10.4	30.2	63.2	84.6	45.2
48°F or below	93.7	93.2	85.2	69.3	42.5	17.1	2.9	3.9	16.6	43.3	76.2	90.5	52.6
50°F or below	96.6	96.0	90.9	79.0	54.2	27.7	7.0	9.2	27.0	56.4	86.6	94.0	60.1
52°F or below	98.3	98.1	95.0	86.6	65.6	41.5	15.7	18.9	39.3	67.2	93.8	97.2	67.8
54°F or below	99.2	99.1	97.3	92.5	75.1	54.1	30.4	34.0	53.2	77.5	97.6	99.3	75.5
56°F or below	99.7	99.7	98.6	96.2	82.8	64.9	47.2	50.6	65.7	86.1	98.9	99.9	82.3
58°F or below	100.0	99.9	99.4	98.6	88.3	75.0	61.5	64.9	76.3	91.6	99.7	100.0	87.7
60°F or below		100.0	99.7	99.5	93.0	82.4	72.9	76.3	84.7	95.6	100.0		91.8
62°F or below			99.7	99.9	96.1	88.0	81.8	84.6	90.6	97.5			94.7
64°F or below			99.8	99.9	97.9	91.9	88.7	90.4	94.0	98.7			96.7
66°F or below			100.0	99.9	98.8	94.4	92.9	93.7	96.9	99.3			97.9
68°F or below				99.9	99.4	96.2	96.1	96.0	98.1	99.6			98.7
70°F or below				100.0	99.9	97.6	97.8	97.5	99.1	99.7			99.2
72°F or below					100.0	98.4	98.4	98.4	99.5	99.8			99.5
74°F or below						98.9	99.0	98.9	99.7	100.0			99.7
76°F or below						99.4	99.5	99.1	99.8				99.8
78°F or below						99.7	99.7	99.3	100.0				99.9
80°F or below						99.8	99.9	99.4					99.9
82°F or below						99.8	99.9	99.5					99.9
84°F or below						100.0	100.0	99.6					99.9
86°F or below								100.0					100.0

TABLE 2H

TOTAL NUMBER OF DAYS IN EACH MONTH WITH AN HOURLY AIR TEMPERATURE READING OF LESS THAN 31.6°F. BETWEEN 07H. AND 17H. GREENWICH MEAN TIME AT WICK CAITHNESS
(10 YEARS 1957 TO 1966)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
						Number of days							
1957	1	5	1	0	0	0	0	0	0	0	0	5	12
1958	11	12	7	1	0	0	0	0	0	0	2	3	36
1959	15	3	2	0	0	0	0	0	0	0	1	0	21
1960	3	10	2	0	0	0	0	0	0	0	0	4	19
1961	3	3	2	2	0	0	0	0	0	0	4	13	27
1962	3	2	11	0	0	0	0	0	0	0	6	3	25
1963	13	11	0	1	0	0	0	0	0	0	5	6	36
1964	0	1	1	2	0	0	0	0	0	1	0	6	11
1965	8	1	7	1	0	0	0	0	0	0	7	7	31
1966	6	7	4	4	0	0	0	0	0	0	3	6	30
10 year mean	6.3	5.5	3.7	1.1	0	0	0	0	0	0.1	2.8	5.3	24.8

TOTAL NUMBER OF HOURS BETWEEN 07H. AND 17H. GREENWICH MEAN TIME IN EACH MONTH WITH AIR TEMPERATURES LESS THAN 31.6°F. AT WICK, CAITHNESS
(10 YEARS 1957 TO 1966)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
						Number of Hours							
1957	2	12	2	0	0	0	0	0	0	0	0	17	33
1958	58	50	32	1	0	0	0	0	0	0	3	25	169
1959	89	14	2	0	0	0	0	0	0	0	2	0	107
1960	16	75	3	0	0	0	0	0	0	0	0	18	112
1961	10	6	3	3	0	0	0	0	0	0	7	89	118
1962	12	7	39	0	0	0	0	0	0	0	17	19	94
1963	84	38	0	1	0	0	0	0	0	0	12	17	152
1964	0	2	2	2	0	0	0	0	0	1	0	33	40
1965	20	6	25	1	0	0	0	0	0	0	42	36	130
1966	12	13	10	8	0	0	0	0	0	0	9	20	72
10 year mean	30.3	22.3	11.8	1.6	0	0	0	0	0	0.1	9.2	27.4	102.7

TABLE 2I

TOTAL NUMBER OF DAYS IN EACH MONTH WITH AN HOURLY AIR TEMPERATURE READING OF LESS THAN 31.6°F. BETWEEN 07H AND 17H GREENWICH MEAN TIME AT KINLOSS, MORAYSHIRE
(10 YEARS 1957 TO 1966)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
						Number of Days							
1957	2	9	0	0	0	0	0	0	0	0	4	6	21
1958	11	10	9	4	0	0	0	0	0	0	3	6	43
1959	17	11	2	0	0	0	0	0	0	0	1	5	36
1960	10	14	5	0	0	0	0	0	0	0	4	11	44
1961	8	4	0	3	0	0	0	0	0	0	8	18	41
1962	3	6	10	2	0	0	0	0	0	0	2	5	28
1963	16	16	3	2	0	0	0	0	0	1	5	6	49
1964	4	5	2	1	0	0	0	0	0	0	2	8	22
1965	10	4	9	1	0	0	0	0	0	1	10	10	45
1966	12	10	1	8	0	0	0	0	0	1	5	4	41
10 year mean	9.3	8.9	4.1	2.1	0	0	0	0	0	0.3	4.4	7.9	37.0

TOTAL NUMBER OF HOURS BETWEEN 07H. AND 17H. GREENWICH MEAN TIME IN EACH MONTH WITH AIR TEMPERATURES LESS THAN 31.6°F. AT KINLOSS, MORAYSHIRE
(10 YEARS 1957 TO 1966)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
						Number of Hours							
1957	4	22	0	0	0	0	0	0	0	0	8	14	48
1958	78	56	33	5	0	0	0	0	0	0	8	31	211
1959	78	57	2	0	0	0	0	0	0	0	4	13	154
1960	37	65	11	0	0	0	0	0	0	0	11	52	176
1961	16	10	0	4	0	0	0	0	0	0	23	102	155
1962	10	12	41	2	0	0	0	0	0	0	5	39	109
1963	119	73	8	2	0	0	0	0	0	3	14	21	240
1964	16	16	3	1	0	0	0	0	0	0	7	24	67
1965	52	10	25	1	0	0	0	0	0	1	38	31	158
1966	43	52	2	12	0	0	0	0	0	2	13	24	148
10 year mean	45.3	37.3	12.5	2.7	0	0	0	0	0	0.6	13.1	35.1	146.6

TABLE 2J

TOTAL NUMBER OF DAYS IN EACH MONTH WITH AN HOURLY AIR TEMPERATURE READING OF LESS THAN 33.6°F. BETWEEN 07H AND 17H GREENWICH MEAN TIME AT WICK, CAITHNESS
(10 YEARS 1957 TO 1966)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Days							
1957	5	8	1	0	0	0	0	0	0	0	2	7	23
1958	14	13	11	1	0	0	0	0	0	0	2	4	45
1959	21	4	2	0	0	0	0	0	0	0	1	2	30
1960	10	16	3	0	0	0	0	0	0	0	2	8	39
1961	5	4	3	4	0	0	0	0	0	0	6	15	37
1962	4	7	12	3	0	0	0	0	0	1	8	6	41
1963	15	15	0	2	0	0	0	0	0	0	6	7	45
1964	1	4	3	2	0	0	0	0	0	1	2	11	24
1965	13	5	11	2	0	0	0	0	0	0	10	9	50
1966	9	12	9	7	0	0	0	0	0	0	4	8	49
10 year mean	9.7	8.8	5.5	2.1	0.0	0.0	0.0	0.0	0.0	0.2	4.3	7.7	38.3

TOTAL NUMBER OF HOURS BETWEEN 07H. AND 17H. GREENWICH MEAN TIME IN EACH MONTH WITH AIR TEMPERATURES LESS THAN 33.6°F. AT WICK, CAITHNESS
(10 YEARS 1957 TO 1966)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Hours							
1957	12	22	2	0	0	0	0	0	0	0	3	32	71
1958	84	94	49	1	0	0	0	0	0	0	7	29	264
1959	134	20	5	0	0	0	0	0	0	0	2	5	166
1960	34	105	8	0	0	0	0	0	0	0	3	28	178
1961	15	10	7	8	0	0	0	0	0	0	19	119	178
1962	20	22	69	4	0	0	0	0	0	1	42	41	199
1963	97	52	0	3	0	0	0	0	0	0	17	41	210
1964	4	20	4	2	0	0	0	0	0	1	3	50	84
1965	43	19	39	2	0	0	0	0	0	0	65	54	222
1966	33	41	25	12	0	0	0	0	0	0	18	45	174
10 year mean	47.6	40.5	20.8	3.2	0.0	0.0	0.0	0.0	0.0	0.2	17.9	44.4	174.6

TABLE 2K

TOTAL NUMBER OF DAYS IN EACH MONTH WITH AN HOURLY AIR TEMPERATURE READING OF LESS THAN 33.6°F. BETWEEN 07H. AND 17H. GREENWICH MEAN TIME AT KINLOSS, MORAYSHIRE (10 YEARS 1957 TO 1966)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Days							
1957	5	13	1	0	0	0	0	0	0	0	4	11	34
1958	13	14	14	4	0	0	0	0	0	0	4	11	60
1959	21	11	5	0	0	0	0	0	0	0	3	10	50
1960	14	16	6	0	0	0	0	0	1	0	5	12	54
1961	12	6	2	4	0	0	0	0	0	0	9	22	55
1962	5	11	15	3	0	0	0	0	0	0	8	8	50
1963	20	20	4	4	0	0	0	0	0	2	7	11	68
1964	6	9	4	2	0	0	0	0	0	2	5	15	43
1965	14	5	14	1	0	0	0	0	0	1	13	14	62
1966	16	12	5	10	0	0	0	0	0	1	7	9	60
10 year mean	12.6	11.7	7.0	2.8	0.0	0.0	0.0	0.0	0.1	0.6	6.5	12.3	53.6

TOTAL NUMBER OF HOURS BETWEEN 07H. AND 17H. GREENWICH MEAN TIME IN EACH MONTH WITH AIR TEMPERATURES LESS THAN 33.6°F. AT KINLOSS, MORAYSHIRE (10 YEARS 1957 TO 1966)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Hours							
1957	20	38	1	0	0	0	0	0	0	0	11	34	104
1958	94	79	60	6	0	0	0	0	0	0	12	50	301
1959	129	72	5	0	0	0	0	0	0	0	6	31	243
1960	62	111	15	0	0	0	0	0	1	0	17	76	282
1961	50	25	2	6	0	0	0	0	0	0	30	144	257
1962	21	30	70	4	0	0	0	0	0	0	23	46	194
1963	150	106	10	5	0	0	0	0	0	4	25	38	338
1964	25	25	7	3	0	0	0	0	0	2	12	55	129
1965	80	22	46	2	0	0	0	0	0	2	58	66	276
1966	94	85	9	17	0	0	0	0	0	2	29	44	280
10 year mean	72.5	59.3	22.5	4.3	0.0	0.0	0.0	0.0	0.1	1.0	22.3	58.4	240.4

TABLE 2L

TOTAL NUMBER OF DAYS IN EACH MONTH WITH AN HOURLY AIR TEMPERATURE READING OF LESS THAN 35.6°F. BETWEEN 07H. AND 17H. GREENWICH MEAN TIME AT WICK, CAITHNESS
(10 YEARS 1957 TO 1966)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Days							
1957	7	10	1	2	2	0	0	0	0	1	4	9	36
1958	17	15	15	2	0	0	0	0	0	0	4	8	61
1959	23	8	3	0	0	0	0	0	0	0	1	2	37
1960	18	17	4	0	0	0	0	0	0	0	3	13	55
1961	10	5	5	4	0	0	0	0	0	0	12	17	53
1962	13	11	19	5	0	0	0	0	0	1	10	13	72
1963	23	20	1	2	0	0	0	0	0	0	8	9	63
1964	6	8	4	2	0	0	0	0	0	3	4	14	41
1965	17	7	14	4	0	0	0	0	0	0	12	15	69
1966	13	13	12	9	0	0	0	0	0	0	7	15	69
10 year mean	14.7	11.4	7.8	3.0	0.2	0.0	0.0	0.0	0.0	0.5	6.5	11.5	55.6

TOTAL NUMBER OF HOURS BETWEEN 07H. AND 17H. GREENWICH MEAN TIME IN EACH MONTH WITH AIR TEMPERATURES LESS THAN 35.6°F. AT WICK, CAITHNESS
(10 YEARS 1957 TO 1966)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year Total
						Number of Hours							
1957	31	41	2	2	2	0	0	0	0	1	9	56	144
1958	115	112	79	4	0	0	0	0	0	0	14	39	363
1959	167	29	7	0	0	0	0	0	0	0	3	8	214
1960	81	127	13	0	0	0	0	0	0	0	5	74	300
1961	38	29	11	15	0	0	0	0	0	0	39	140	272
1962	43	52	105	11	0	0	0	0	0	2	73	78	364
1963	163	93	1	6	0	0	0	0	0	0	35	63	361
1964	15	41	11	2	0	0	0	0	0	5	11	89	174
1965	97	33	67	5	0	0	0	0	0	0	85	87	374
1966	66	82	49	23	0	0	0	0	0	0	28	87	335
10 year mean	81.6	63.9	34.5	6.8	0.2	0.0	0.0	0.0	0.0	0.8	30.2	72.1	290.1

TABLE 2M

TOTAL NUMBER OF DAYS IN EACH MONTH WITH AN HOURLY AIR TEMPERATURE READING OF LESS THAN 35.6°F BETWEEN 07H AND 17H GREENWICH MEAN TIME AT KINLOSS, MORAYSHIRE
(10 YEARS 1957 TO 1966)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
						Number of Days.							
1957	10	16	1	0	0	0	0	0	1	0	8	11	47
1958	15	16	19	5	0	0	0	0	1	1	7	12	76
1959	26	14	8	1	0	0	0	0	0	1	5	13	68
1960	20	19	7	0	0	0	0	0	1	0	7	17	71
1961	16	10	3	6	0	0	0	0	0	0	11	24	70
1962	10	17	19	6	0	0	0	0	0	1	9	14	76
1963	24	26	8	6	0	0	0	0	0	2	9	12	87
1964	10	13	7	2	0	0	0	0	0	4	9	18	63
1965	21	10	17	1	0	0	0	0	0	2	15	19	85
1966	17	14	8	13	0	0	0	0	0	1	9	12	74
10-year mean	16.9	15.5	9.7	4.0	0.0	0.0	0.0	0.0	0.3	1.2	8.9	15.2	71.7

TOTAL NUMBER OF HOURS BETWEEN 07H AND 17H GREENWICH MEAN TIME IN EACH MONTH WITH AIR TEMPERATURES LESS THAN 35.6°F AT KINLOSS MORAYSHIRE
(10 YEARS 1957 TO 1966)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
						Number of Hours							
1957	40	58	1	0	0	0	0	0	1	0	21	62	183
1958	110	115	91	9	0	0	0	0	1	1	24	67	418
1959	171	80	10	1	0	0	0	0	0	1	15	59	337
1960	101	139	18	0	0	0	0	0	1	0	25	95	379
1961	91	39	5	12	0	0	0	0	0	0	45	190	382
1962	40	66	105	9	0	0	0	0	0	1	58	68	347
1963	198	160	14	8	0	0	0	0	0	6	38	55	479
1964	38	43	13	3	0	0	0	0	0	6	23	104	230
1965	124	40	70	2	0	0	0	0	0	4	96	92	428
1966	140	121	28	27	0	0	0	0	0	2	37	70	425
10-year mean	105.3	86.1	35.5	7.1	0.0	0.0	0.0	0.0	0.3	2.1	38.2	86.2	360.8

TABLE 3

AVERAGES OF SUNSHINE DURATION IN HOURS - MONTHLY TOTALS AND DAILY MEANS FOR SUNSHINE RECORDING STATIONS IN THE COASTAL AREA OF THE MORAY FIRTH (30 YEARS PERIOD 1931-1960)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
WICK													
Monthly Total	44	72	111	152	175	165	147	135	120	87	52	34	1,294
Daily Mean	1.43	2.52	3.59	5.07	5.66	5.51	4.73	4.34	4.01	2.81	1.74	1.09	3.54
FORTROSE													
Monthly Total	48	70	108	139	173	171	141	132	117	86	51	35	1,271
Daily Mean	1.56	2.48	3.50	4.64	5.57	5.71	4.55	4.27	3.89	2.77	1.70	1.14	3.48
INVERNESS													
Monthly Total	42	68	107	137	174	171	140	130	121	89	47	30	1,256
Daily Mean	1.35	2.35	3.45	4.58	5.60	5.75	4.53	4.20	4.01	2.88	1.58	0.98	3.44
CULDUTHEL NEAR INVERNESS													
Monthly Total	44	66	107	134	169	166	136	130	113	86	47	30	1,228
Daily Mean	1.43	2.34	3.45	4.47	5.44	5.55	4.38	4.20	3.78	2.78	1.57	0.98	3.37
NAIRN													
Monthly Total	49	72	113	142	173	171	139	133	123	93	53	37	1,298
Daily Mean	1.59	2.56	3.66	4.73	5.58	5.68	4.50	4.30	4.10	2.99	1.77	1.21	3.56
FORRES													
Monthly Total	54	74	114	139	179	179	149	144	120	93	58	44	1,347
Daily Mean	1.74	2.66	3.67	4.64	5.76	5.98	4.79	4.64	4.01	3.01	1.92	1.43	3.69
GORDON CASTLE NEAR FOCHABERS													
Monthly Total	45	71	109	137	176	169	144	142	119	89	51	35	1,287
Daily Mean	1.45	2.49	3.52	4.56	5.67	5.64	4.64	4.56	3.96	2.87	1.69	1.11	3.52

/BANFF

TABLE 3 (Contd.)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
BANFF													
Monthly Total	45	70	108	144	176	173	147	142	122	86	50	33	1,296
Daily Mean	1.45	2.47	3.47	4.81	5.68	5.77	4.75	4.60	4.06	2.79	1.65	1.06	3.55
RATTRAY HEAD													
Monthly Total	46	75	113	154	191	172	157	166	131	88	51	42	1,386
Daily Mean	1.50	2.68	3.66	5.13	6.18	5.73	5.05	5.36	4.37	2.84	1.68	1.35	3.80

Notes: 1. The standard period for sunshine averages in current use in the Meteorological Office is the 30 years period from 1931 to 1960.

2. The average quoted above for Fortrose, Culduthel, Nairn, Forres, Gordon Castle and Banff are actual averages of durations recorded during the standard 30 years period from 1931 to 1960.

3. Trees or other obstacles near the sunshine recorder sites at Nairn, Gordon Castle and Banff cause a slight "cut-off" in sunshine duration particularly during the winter months. However, the horizons of all the remaining sunshine recording stations for which averages are quoted above are completely unobstructed.

TABLE 4

ANNUAL PERCENTAGE FREQUENCY OF WIND DIRECTION AND VELOCITY AT

WICK, CAITHNESS (10 YEARS 1957 TO 1966)

Mean Wind Speed	Wind Directions in Degrees (true)												
	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
0 mph	-	-	-	-	-	-	-	-	-	-	-	-	3.7%
1- 3 "	0.2	0.2	0.2	0.3	0.3	0.4	0.5	0.5	0.7	0.9	0.4	0.3	4.9%
4- 7 "	0.4	0.4	0.4	0.7	0.9	1.2	1.2	0.9	1.1	1.8	0.9	0.7	10.6%
8-12 "	1.2	1.2	1.2	1.7	2.7	3.9	3.9	2.2	2.1	3.2	2.2	2.1	27.6%
13-18 "	1.4	1.1	0.9	1.3	2.6	3.9	3.7	2.6	2.0	2.3	2.2	2.3	26.3%
19-24 "	1.2	0.6	0.6	0.8	1.6	2.8	2.1	1.5	1.3	1.7	1.9	1.8	17.9%
25-31 "	0.5	0.2	0.2	0.3	0.6	0.9	0.5	0.5	0.5	0.8	0.9	0.8	6.7%
32-38 "	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.2	1.8%
39-46 "	0+	0+	0+	0+	0+	0+	0+	0+	0+	0.1	0.1	0+	0.2%
47-54 "	0+	0+		0+			0+	0+	0+	0+	0+	0+	0.0+%
55-63 "	0+	0+						0+	0+	0+	0+	0+	0.0+%
64-72 "								0+	0+				0.0+%
Total	5.0	3.8	3.6	5.2	8.9	13.3	12.0	8.3	7.9	11.0	8.8	8.2	99.7%

Notes

1. Wind directions are measured in degrees from True North and relate to the direction from which the wind is blowing. For example:

Direction 360 degrees = wind blowing from North
Direction 090 degrees = wind blowing from East
Direction 180 degrees = wind blowing from South
Direction 270 degrees = wind blowing from West

2. Adding the columns of the above table vertically gives the percentage amount of time in the year with winds from the stated directions.

3. Adding the columns of the above table horizontally gives the percentage amount of time in the year with winds in the stated speed ranges.

TABLE 4A

MONTHLY PERCENTAGE FREQUENCIES OF WIND DIRECTION AND VELOCITY AT WICK AIRPORT, CAITHNESS (10 YEARS 1957 TO 1966)

Mean Wind Speed	Wind Directions in Degrees (true)												
	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
JANUARY													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	7.8%
4-12 mph	1.0	0.6	0.8	1.0	1.1	2.4	4.3	3.0	4.0	7.6	3.0	2.7	31.5%
13-24 mph	3.2	1.9	1.7	3.1	2.7	7.1	6.7	5.7	4.7	5.0	1.9	3.7	47.4%
25-38 mph	0.7	0.6	0.4	0.8	1.3	3.0	1.2	1.0	0.9	1.2	0.6	0.6	12.3%
39 mph or more	0.1	0+			0+	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8%
Total	5.0	3.1	2.9	4.9	5.1	12.6	12.3	9.8	9.7	13.9	5.6	7.1	99.8%
FEBRUARY													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	6.7%
4-12 mph	1.3	0.8	0.8	1.4	1.9	4.0	4.6	3.0	3.3	5.5	2.9	2.8	32.3%
13-24 mph	3.3	1.2	1.4	2.4	4.6	7.7	7.3	3.7	3.1	5.0	3.4	3.9	47.0%
25-38 mph	1.1	0.4	0.4	0.5	1.7	2.1	0.9	1.1	0.7	1.3	1.3	1.2	12.7%
39 mph or more	0+	0+				0+	0+	0.1	0.2	0.4	0.3	0.1	1.1%
Total	5.7	2.4	2.6	4.3	8.2	13.8	12.8	7.9	7.3	12.2	7.9	8.0	99.8%
MARCH													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	6.4%
4-12 mph	1.6	1.5	1.2	1.2	2.5	5.3	5.3	2.1	2.0	3.0	2.0	1.8	29.5%
13-24 mph	1.8	1.9	1.5	1.2	4.8	15.2	7.6	3.8	2.9	3.3	2.9	2.4	49.3%
25-38 mph	0.4	0.4	0+	0.3	2.2	4.1	1.2	0.5	0.7	1.6	1.3	1.3	14.0%
39 mph or more	0+	0+			0.1	0.1			0+	0+	0.1	0.1	0.4%
Total	3.8	3.8	2.7	2.7	9.6	24.7	14.1	6.4	5.6	7.9	6.3	5.6	99.6%
APRIL													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	9.4%
4-12 mph	1.3	1.8	2.5	3.5	3.8	5.6	4.9	2.3	2.3	3.7	1.6	2.5	35.8%
13-24 mph	2.5	2.3	1.8	3.1	6.9	6.4	5.3	4.2	2.3	4.7	4.3	3.3	47.1%
25-38 mph	0.4	0.2	0.2	0.2	0.7	0.8	0.2	0.7	0.4	1.3	1.7	0.4	7.2%
39 mph or more								0.1	0.1	0.1	0.1		0.4%
Total	4.2	4.3	4.5	6.8	11.4	12.8	10.4	7.3	5.1	9.8	7.7	6.2	99.9%
MAY													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	8.9%
4-12 mph	2.6	3.0	3.0	4.8	7.3	7.0	3.4	1.7	2.0	2.9	2.5	2.7	42.9%
13-24 mph	2.7	1.9	1.0	2.5	7.6	4.9	3.8	2.9	1.9	3.3	4.9	5.1	42.5%
25-38 mph	0.3	0.1	0.1		0.1	0.1	0.3	0.3	0.5	1.0	1.4	1.3	5.5%
39 mph or more	0+	0+									0+	0+	0.0+%
Total	5.6	5.0	4.1	7.3	15.0	12.0	7.5	4.9	4.4	7.2	8.8	9.1	99.8%

TABLE 4A (CONTD)

Mean Wind Speed	Wind Directions in Degrees (true)												
	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
JUNE													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	8.4%
4-12 mph	1.7	2.6	2.8	5.3	7.4	7.7	5.0	2.2	2.7	3.3	2.9	2.6	46.2%
13-24 mph	2.9	2.1	2.0	1.9	4.5	4.5	3.2	2.5	3.5	3.6	5.3	4.4	40.4%
25-38 mph	0.3	0.1	0.2	0+	0.1	0+	0.2	0.4	0.9	0.9	1.3	0.6	5.0%
39 mph or more													0.0%
Total	4.9	4.8	5.0	7.2	12.0	12.2	8.4	5.1	7.1	7.8	9.5	7.6	100 .0%
JULY													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	9.3%
4-12 mph	2.1	3.4	3.0	4.4	5.4	5.9	4.1	2.4	2.6	4.2	4.4	4.1	46.0%
13-24 mph	3.1	2.2	2.0	2.1	2.7	3.2	2.9	2.0	1.9	3.2	7.9	7.6	40.8%
25-38 mph	0.2	0.1	0.1	0+		0.1	0.1	0.1	0.5	0.6	1.3	0.6	3.7%
39 mph or more										0.1			0.1%
Total	5.4	5.7	5.1	6.5	8.1	9.2	7.1	4.5	5.0	8.1	13.6	12.3	99.9%
AUGUST													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	10.9%
4-12 mph	2.3	2.1	2.0	3.0	4.7	5.9	3.7	1.9	3.0	5.2	5.0	4.6	43.4%
13-24 mph	2.6	1.7	1.9	1.6	3.2	4.8	3.8	2.7	2.2	3.6	6.6	6.5	41.2%
25-38 mph	0.4	0.3	0.3	0.1	0.2	0.1	0.2	0.2	0.3	1.0	0.9	0.5	4.5%
39 mph or more		0+	0+		0+				0+				0.0+
Total	5.3	4.1	4.2	4.7	8.1	10.8	7.7	4.8	5.5	9.8	12.5	11.6	100.0%
SEPTEMBER													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	10.7%
4-12 mph	2.1	1.7	1.1	1.3	3.2	6.4	7.2	3.3	3.0	5.3	3.6	2.9	41.1%
13-24 mph	2.4	1.5	1.4	1.4	3.0	6.1	6.7	4.2	3.3	3.7	4.2	4.1	42.0%
25-38 mph	0.2	0.1		0.1	0.2	0.5	0.4	0.5	0.6	1.0	1.3	1.0	5.9%
39 mph or more						0.1	0+	0+	0.1	0.1	0+		0.3%
Total	4.7	3.3	2.5	2.8	6.4	13.1	14.3	8.0	7.0	10.1	9.1	8.0	100.0%
OCTOBER													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	7.8%
4-12 mph	0.7	0.2	0.4	1.3	2.3	5.5	6.7	4.7	4.3	4.9	2.2	1.8	35.0%
13-24 mph	2.0	0.6	0.9	3.1	4.3	8.4	6.7	6.8	4.9	4.6	3.0	2.7	48.0%
25-38 mph	0.8	0.4	0+	0.6	0.3	0.8	0.6	1.0	1.0	0.9	0.6	1.0	8.0%
39 mph or more	0.2	0+				0+		0.1	0.1	0.2	0.1	0.1	0.8%
Total	3.7	1.2	1.3	5.0	6.9	14.7	14.0	12.6	10.3	10.6	5.9	5.6	99.6%

TABLE 4A (CONTD)

Mean Wind Speed	Wind Directions in Degrees (true)												
	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
NOVEMBER													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	8.1%
4-12 mph	1.4	0.5	0.6	1.0	1.5	3.1	6.5	5.7	4.6	7.2	3.1	2.7	37.9%
13-24 mph	2.9	1.2	1.5	1.7	3.8	5.6	7.0	4.7	4.7	4.7	2.2	2.5	42.5%
25-38 mph	1.5	0.5	0.3	1.4	1.4	0.8	0.8	0.4	0.5	1.0	0.7	1.6	10.9%
39 mph or more	0+	0+		0.2	0+		0+			0+	0+	0.1	0.3%
Total	5.8	2.2	2.4	4.3	6.7	9.5	14.3	10.8	9.8	12.9	6.0	6.9	99.7%
DECEMBER													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	7.8%
4-12 mph	0.8	0.4	0.5	0.9	1.1	2.4	5.9	4.7	4.7	6.6	2.8	2.1	32.9%
13-24 mph	2.2	1.5	1.3	1.7	2.1	6.1	8.6	6.2	5.2	4.2	2.6	3.6	45.3%
25-38 mph	1.1	0.6	0.7	1.0	1.4	1.5	1.4	1.0	1.3	0.9	0.8	1.2	12.9%
39 mph or more	0.1	0.2	0+	0.1	0.2	0.1	0+		0+	0.1	0.1	0+	0.9%
Total	4.2	2.7	2.5	3.7	4.8	10.1	15.9	11.9	11.2	11.8	6.3	6.9	99.8%

TABLE 4B

ANNUAL PERCENTAGE FREQUENCY OF WIND DIRECTION AND VELOCITY AT KINLOSS, MORAYSHIRE (8 YEARS 1959 TO 1966)

Mean Wind Speed	Wind Directions in Degrees (true)												
	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
0 mph	-	-	-	-	-	-	-	-	-	-	-	-	2.6%
1- 3 "	0.5	0.4	0.8	1.4	1.1	0.8	1.3	2.0	1.7	0.7	0.4	0.4	11.5%
4-7 "	0.8	0.7	1.0	1.7	1.0	0.8	1.6	3.9	2.6	0.7	0.5	0.5	15.8%
8-12 "	1.4	1.5	1.9	3.2	1.3	1.1	2.4	5.9	4.6	1.5	1.4	1.0	27.2%
13-18 "	1.0	1.0	1.4	2.2	1.1	1.0	1.3	3.6	5.5	2.0	2.4	1.0	23.5%
19-24 "	0.7	0.3	0.4	0.6	0.6	0.5	0.4	1.6	4.4	1.6	1.4	0.8	13.3%
25-31 "	0.4	0.1	0+	0.1	0.2	0.1	0.1	0.5	1.8	0.6	0.4	0.3	4.6%
32-38 "	0.1	0+	0+	0+	0+	0+	0+	0.1	0.5	0.2	0.1	0.1	1.1%
39-46 "	0+	0+			0+	0+	0+	0+	0.1	0.1	0+	0+	0.2%
47-54 "	0+						0+	0+	0+	0+	0+		0.0+%
55-63 "	0+						0+	0+	0+	0+	0+		0.0+%
Total	4.9	4.0	5.5	9.2	5.3	4.3	7.1	17.6	21.2	7.4	6.6	4.1	99.8%

Notes

1. Wind directions are measured in degrees from True North and relate to the direction from which the wind is blowing. For example:

   Direction 360 degrees = wind blowing from North
   Direction 090 degrees = wind blowing from East
   Direction 180 degrees = wind blowing from South
   Direction 270 degrees = wind blowing from West

2. Adding the columns of the above table vertically gives the percentage amount of time in the year with winds from the stated directions.

3. Adding the columns of the above table horizontally gives the percentage amount of time in the year with winds in the stated speed ranges.

TABLE 4C

MONTHLY PERCENTAGE FREQUENCIES OF WIND DIRECTION AND VELOCITY AT KINLOSS, MORAYSHIRE (8 YEARS 1959 TO 1966)

	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
JANUARY													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	14.0%
4-12 mph	0.2	0.5	1.4	5.2	2.6	1.9	4.4	14.1	11.5	1.7	1.2	0.5	45.2%
13-24 mph	1.9	1.0	0.9	2.4	1.5	1.1	2.2	7.0	10.2	2.1	3.8	1.5	35.6%
25-38 mph	0.5	0.1	0.1	0.1	0.3	0.2	0.2	0.8	1.4	0.5	0.3	0.5	5.0%
39 mph or more	0+						0+	0+	0+	0+	0.1	0+	0.1%
Total	2.6	1.6	2.4	7.7	4.4	3.2	6.8	21.9	23.1	4.3	5.4	2.5	99.9%
FEBRUARY													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	15.8%
4-12 mph	0.7	0.9	1.7	4.6	2.6	1.9	3.9	10.5	8.4	1.6	1.5	0.8	39.1%
13-24 mph	1.0	0.5	0.9	3.8	2.4	1.6	1.9	6.6	10.7	3.4	3.6	1.4	37.8%
25-38 mph	0.2	0.1	0+	0.1	0.3	0.1	0.1	0.8	2.1	0.9	0.8	0.7	6.2%
39 mph or more							0+	0+	0.3	0.5	0.2	0+	1.0%
Total	1.9	1.5	2.6	8.5	5.3	3.6	5.9	17.9	21.5	6.4	6.1	2.9	99.9%
MARCH													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	12.4%
4-12 mph	1.4	1.2	2.0	5.5	3.8	3.2	5.0	8.8	5.0	1.9	1.2	1.2	40.2%
13-24 mph	1.4	0.8	1.4	3.1	4.9	4.2	1.7	4.5	8.6	3.2	3.7	1.4	38.9%
25-38 mph	0.3	0+	0+	0+	1.1	0.6	0.1	0.8	2.8	1.3	0.7	0.3	8.0%
39 mph or more					0.1				0+	0.1	0+		0.2%
Total	3.1	2.0	3.4	8.6	9.9	8.0	6.8	14.1	16.4	6.5	5.6	2.9	99.7%
APRIL													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	12.6%
4-12 mph	3.3	2.7	3.7	5.4	2.3	1.9	3.0	6.6	5.4	2.4	2.0	2.6	41.3%
13-24 mph	1.1	2.3	3.3	4.8	3.1	2.3	1.9	4.7	9.1	4.5	2.6	1.1	40.8%
25-38 mph	0.1	0.1		0.2	0.2	0.2	0+	0.7	2.5	1.1	0.4	0.1	5.6%
39 mph or more								0+	0+				0+%
Total	4.5	5.1	7.0	10.4	5.6	4.4	4.9	12.0	17.0	8.0	5.0	3.8	100.3%
MAY													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	13.0%
4-12 mph	4.5	4.2	5.3	5.9	1.9	1.5	2.8	5.7	4.9	2.3	2.7	2.3	44.0%
13-24 mph	2.4	1.8	3.7	3.1	1.8	1.6	2.1	3.6	7.3	4.2	4.0	2.6	38.2%
25-38 mph	0+		0.1	0.1	0.2	0.3	0.1	0.4	2.1	0.7	0.4	0.2	4.6%
39 mph or more								0+	0.2	0+	0.1	0+	0.3%
Total	6.9	6.0	9.1	9.1	3.9	3.4	5.0	9.7	14.5	7.2	7.2	5.1	100.1%

TABLE 4C (Contd.)

Mean Wind Speed	Wind Directions in Degrees (true)												
	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
JUNE													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	14.5%
4-12 mph	3.8	3.7	3.6	4.2	1.6	1.5	3.2	5.8	6.0	2.9	2.2	2.1	40.6%
13-24 mph	2.8	1.8	2.6	1.8	0.9	1.3	0.9	2.8	13.2	4.9	4.1	2.1	39.2%
25-38 mph	0.2	0+		0+		0.1	0+	0.3	3.3	0.9	0.3	0.2	5.3%
39 mph or more									0.1	0+			0.1%
Total	6.8	5.5	6.2	6.0	2.5	2.9	4.1	8.9	22.6	8.7	6.6	4.4	99.7%
JULY													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	11.2%
4-12 mph	4.3	4.3	4.5	4.8	1.6	1.1	3.0	6.7	6.5	3.6	3.8	3.0	47.2%
13-24 mph	1.8	2.2	3.0	2.1	0.8	0.4	1.0	2.9	9.8	5.6	5.3	2.5	37.4%
25-38 mph	0.1	0.1					0+	0.4	2.0	0.9	0.4	0.1	4.0%
39 mph or more								0+	0.1	0.1			0.2%
Total	6.2	6.6	7.5	6.9	2.4	1.5	4.0	10.0	18.4	10.2	9.5	5.6	100.0%
AUGUST													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	15.4%
4-12 mph	4.3	3.6	3.8	4.7	1.6	1.2	3.0	8.4	7.0	2.7	2.9	2.5	45.7%
13-24 mph	1.2	1.7	2.2	2.0	0.8	0.9	1.0	4.0	9.2	4.6	5.1	2.4	35.1%
25-38 mph	0.2	0.1	0.1	0+	0.1	0.1	0.1	0.4	1.9	0.9	0.2	0.1	4.2%
39 mph or more									0+				0+%
Total	5.7	5.4	6.1	6.7	2.5	2.2	4.1	12.8	18.1	8.2	8.2	5.0	100.4%
SEPTEMBER													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	17.8%
4-12 mph	2.3	2.6	2.4	4.2	1.7	2.0	4.3	11.2	7.5	3.0	2.2	1.9	45.3%
13-24 mph	1.2	1.5	1.3	1.2	0.9	0.9	1.4	5.3	9.1	3.4	3.4	2.2	31.8%
25-38 mph	0.1	0.1			0.1	0.1	0+	0.5	2.5	0.8	0.2	0.1	4.5%
39 mph or more		0+			0+		0+	0.1	0.2	0.1			0.4%
Total	3.6	4.2	3.7	5.4	2.7	3.0	5.7	17.1	19.3	7.3	5.8	4.2	99.8%
OCTOBER													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	17.3%
4-12 mph	0.8	1.0	2.3	5.3	2.9	2.8	5.8	11.0	6.5	1.8	0.9	0.5	41.6%
13-24 mph	1.7	0.4	1.0	3.8	1.6	1.6	1.6	6.7	9.7	2.1	2.6	1.6	34.4%
25-38 mph	1.4			0+	0.2	0.1	0.1	0.6	2.4	0.5	0.4	0.8	6.5%
39 mph or more	0.1				0+	0+		0+	0.1	0+	0+	0.2	0.4%
Total	4.0	1.4	3.3	9.1	4.7	4.5	7.5	18.3	18.7	4.4	3.9	3.1	100.2%

TABLE 4C (Contd.)

Mean Wind Speed	Wind Directions in Degrees (true)												
	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
NOVEMBER													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	13.2%
4-12 mph	0.3	0.7	2.7	5.8	2.5	1.9	4.7	13.9	8.7	1.6	1.0	0.6	44.4%
13-24 mph	1.8	0.8	1.2	3.7	1.5	0.8	1.7	6.2	9.8	2.2	3.1	1.7	34.5%
25-38 mph	1.5	0.2	0.1	0.4	0+	0.1	0+	0.4	1.9	0.9	0.9	0.9	7.3%
39 mph or more	0.1								0.1		0.2	0+	0.4%
Total	3.7	1.7	4.0	9.9	4.0	2.8	6.4	20.5	20.5	4.7	5.2	3.2	99.8%
DECEMBER													
Under 4 mph	-	-	-	-	-	-	-	-	-	-	-	-	14.0%
4-12 mph	0.3	0.4	1.5	3.4	2.0	2.2	4.9	15.9	9.1	1.1	0.7	0.3	41.8%
13-24 mph	1.6	0.9	0.5	1.7	0.8	0.7	2.3	8.0	11.8	3.1	4.1	1.0	36.5%
25-38 mph	1.0	0.2	0+	0.1	0.5	0.1	0.2	1.1	1.8	0.8	0.7	0.7	7.2%
39 mph or more	0.1	0.1				0+	0+	0+	0.1	0.2			0.5%
Total	3.0	1.6	2.0	5.2	3.3	3.0	7.4	25.0	22.8	5.2	5.5	2.0	100.0%

TABLE 4D

NUMBER OF DAYS WITH GALES AT WICK AND KINLOSS (10 YEARS 1957 TO 1966)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
	(Number of Days with Gales - Average wind speed near the ground of 39 mph or more)												
WICK													
1957	8	2	0	1	0	0	0	2	1	2	0	5	21
1958	3	2	3	0	0	0	0	0	0	1	0	1	10
1959	4	4	0	0	0	0	0	0	0	2	4	4	18
1960	2	3	1	3	0	0	0	0	0	0	1	0	10
1961	1	2	3	0	0	0	0	0	2	4	1	2	15
1962	4	5	3	2	1	0	0	0	1	1	1	3	21
1963	0	0	1	0	0	0	0	0	1	2	1	1	6
1964	0	2	1	0	0	0	1	2	0	0	0	0	6
1965	1	2	0	0	0	0	0	0	1	3	2	0	9
1966	0	0	1	0	1	0	0	0	1	0	2	4	9
10 year mean	2.3	2.2	1.3	0.6	0.2	0.0	0.1	0.4	0.7	1.5	1.2	2.0	12.5
KINLOSS													
1957	7	1	0	1	0	0	0	2	0	1	0	2	14
1958	0	2	1	0	1	0	0	0	0	0	0	0	4
1959	3	4	0	0	0	2	0	0	0	2	1	3	15
1960	0	1	0	2	0	0	0	0	0	0	0	2	5
1961	3	2	1	0	0	0	0	0	2	1	0	1	10
1962	1	3	0	1	2	1	0	2	1	1	0	1	13
1963	0	0	0	0	0	0	0	0	2	6	2	2	12
1964	2	2	1	0	2	0	4	0	1	1	1	2	16
1965	1	2	1	0	0	1	0	0	0	2	1	0	8
1966	0	1	2	0	1	0	0	0	2	0	3	4	13
10 year mean	1.7	1.8	0.6	0.4	0.6	0.4	0.4	0.4	0.8	1.4	0.8	1.7	11.0

TABLE 4E

NUMBER OF DAYS ON WHICH THE AVERAGE WIND SPEED REACHED 25 MPH OR MORE BETWEEN 07H AND 17H GREENWICH MEAN TIME AT WICK, CAITHNESS
(10 YEARS 1957 TO 1966)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
						Number of Days							
1957	15	9	7	7	7	4	4	9	12	10	6	15	105
1958	16	14	14	15	8	1	6	2	4	8	5	13	106
1959	13	9	12	7	4	8	6	4	3	10	11	14	101
1960	6	11	11	11	1	10	1	1	1	13	9	3	78
1961	7	11	17	4	8	8	7	7	5	17	7	10	108
1962	13	16	10	10	8	11	6	13	6	6	7	12	118
1963	7	7	11	10	12	1	3	3	7	14	9	7	91
1964	7	9	12	9	7	9	16	10	4	2	11	12	108
1965	5	6	5	7	5	9	4	9	8	9	16	12	95
1966	14	9	19	5	2	0	1	2	8	3	10	12	85
10-year mean	10.3	10.1	11.8	8.5	6.2	6.1	5.4	6.0	5.8	9.2	9.1	11.0	99.5

NUMBER OF HOURS BETWEEN 07H AND 17H GREENWICH MEAN TIME DURING WHICH THE AVERAGE WIND SPEED REACHED 25 MPH OR MORE AT WICK, CAITHNESS
(10 YEARS 1957 TO 1966)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
						Number of Hours							
1957	65	28	25	26	33	12	13	36	65	30	23	62	418
1958	53	62	62	50	33	6	23	9	17	32	7	45	399
1959	47	44	37	21	10	36	16	19	10	40	55	74	409
1960	34	62	59	63	9	35	1	1	6	44	27	13	354
1961	31	37	92	15	23	28	25	15	10	65	23	28	392
1962	40	65	52	38	46	39	23	51	20	19	30	38	461
1963	41	46	49	38	53	3	3	10	28	50	38	30	389
1964	31	34	60	22	39	45	65	44	23	4	24	37	428
1965	17	24	23	30	11	28	10	31	39	39	75	54	381
1966	64	45	73	12	11	0	1	2	30	6	53	55	352
10-year mean	42.3	44.7	53.2	31.5	26.8	23.2	18.0	21.8	24.8	32.9	35.5	43.6	398.3

TABLE 4F

NUMBER OF DAYS ON WHICH THE AVERAGE WIND SPEED REACHED 25 MPH OR MORE BETWEEN 07H AND 17H GREENWICH MEAN TIME AT KINLOSS, MORAYSHIRE
(10 YEARS 1957 TO 1966)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
						Number of Days							
1957	14	4	4	4	6	1	2	4	8	10	8	12	77
1958	8	9	9	7	9	2	3	4	3	12	0	5	71
1959	9	9	6	3	5	9	6	8	2	6	6	9	78
1960	4	9	5	8	8	6	1	1	1	2	1	2	48
1961	2	6	18	3	4	10	6	8	6	11	4	3	81
1962	12	12	4	7	24	10	3	8	3	11	2	5	101
1963	2	4	6	7	6	1	2	2	10	13	4	8	65
1964	9	7	9	8	12	7	18	6	7	2	13	7	105
1965	7	5	6	8	6	8	2	8	6	5	8	2	71
1966	3	2	20	6	6	2	4	1	10	3	11	14	82
10-year mean	7.0	6.7	8.7	6.1	8.6	5.6	4.7	5.0	5.6	7.5	5.7	6.7	77.9

NUMBER OF HOURS BETWEEN 07H AND 17H GREENWICH MEAN TIME DURING WHICH THE AVERAGE WIND SPEED REACHED 25 MPH OR MORE AT KINLOSS, MORAYSHIRE
(10 YEARS 1957 TO 1966)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
						Number of Hours							
1957	56	13	10	10	13	2	5	24	41	25	23	35	257
1958	34	30	28	19	30	7	9	11	4	21	0	11	204
1959	23	38	9	12	12	41	14	23	8	30	19	42	271
1960	16	23	16	38	19	15	2	2	5	13	1	8	158
1961	4	21	69	4	13	40	18	14	23	53	9	14	282
1962	34	51	15	28	4	45	8	35	4	21	9	18	272
1963	10	8	19	20	14	6	3	6	38	53	22	24	223
1964	24	33	39	35	54	29	74	32	19	11	37	19	406
1965	16	23	27	32	21	26	7	33	27	19	17	4	252
1966	5	7	78	20	33	3	11	1	37	9	68	56	328
10-year mean	22.2	24.7	31.0	21.8	21.3	21.4	15.1	18.1	20.6	25.5	20.5	23.1	265.3
10-year mean expressed as percentage of average working day	% 7.2	% 8.8	% 10.0	% 7.3	% 6.9	% 7.4	% 4.9	% 5.8	% 6.9	% 8.2	% 6.8	% 7.4	% 7.3

TABLE 5

AVERAGE NUMBER OF MORNINGS WITH FOG (VISIBILITY LESS THAN 1,100 YARDS) AT 09H GREENWICH MEAN TIME AT PLACES ALONG THE COASTLINE OF THE MORAY FIRTH (10 YEARS 1957 TO 1966)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
Wick	0	1	<1	1	2	2	1	1	1	<1	<1	<1	9
Tarbatness	0	<1	<1	1	<1	1	1	<1	<1	1	1	<1	5
Fortrose	1	<1	<1	<1	0	1	<1	<1	<1	<1	<1	<1	3
Inverness	1	<1	<1	<1	1	1	0	<1	1	1	2	1	8
Nairn	<1	<1	<1	<1	0	1	<1	<1	<1	<1	1	1	4
Forres	1	<1	0	0	0	<1	0	<1	0	<1	<1	0	1
Kinloss	1	<1	0	0	0	<1	<1	<1	0	<1	<1	<1	2
Elgin	0	0	0	<1	0	<1	0	0	0	0	0	0	<1
Lossiemouth	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3
Banff	<1	1	<1	1	1	1	1	<1	<1	<1	<1	<1	7
Rattray Head	<1	1	1	1	2	2	1	1	1	1	<1	0	11

TABLE 5A

NUMBER OF DAYS WITH "FOG", "THICK FOG" AND "DENSE FOG" AT ANY TIME OF DAY* AT WICK, CAITHNESS DURING 10-YEAR PERIOD FROM 1957 TO 1966

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
Number of Days with "Fog" - Visibility less than 1,100 yards													
1957	0	0	4	2	6	6	12	5	0	0	1	3	39
1958	5	9	4	1	4	9	11	11	11	0	3	1	69
1959	9	2	1	2	7	6	3	4	6	3	0	1	44
1960	3	8	2	1	6	6	9	12	5	1	2	0	55
1961	0	1	1	10	1	0	4	0	4	3	1	8	33
1962	0	4	6	4	8	3	8	2	2	1	3	1	42
1963	0	0	2	4	3	13	5	5	2	5	2	2	43
1964	0	3	1	7	8	5	3	3	4	1	0	3	38
1965	0	2	2	4	7	5	7	5	2	2	3	2	41
1966	1	5	3	2	6	16	4	5	2	3	1	3	51
10-year mean	1.8	3.4	2.6	3.7	5.6	6.9	6.6	5.2	3.8	1.9	1.6	2.4	45.5
Number of Days with "Thick Fog" - Visibility less than 220 yards													
1957	0	0	1	1	3	3	6	0	0	0	0	1	15
1958	3	3	0	0	1	4	5	5	7	0	1	1	30
1959	0	0	0	1	4	3	2	1	4	1	0	0	16
1960	0	0	1	0	3	3	5	4	1	0	0	0	17
1961	0	0	0	2	1	0	3	0	2	1	0	3	12
1962	0	1	1	0	5	2	3	2	2	1	0	0	17
1963	0	0	0	1	2	6	0	1	0	1	1	0	12
1964	0	1	0	4	4	3	1	2	1	0	0	0	16
1965	0	1	1	1	5	4	5	1	1	2	0	0	21
1966	0	1	0	0	1	7	0	2	1	2	1	0	15
10-year mean	0.3	0.7	0.4	1.0	2.9	3.5	3.0	1.8	1.9	0.8	0.3	0.5	17.1
Number of Days with "Dense Fog" - Visibility less than 55 yards													
1957	0	0	0	0	1	0	0	0	0	0	0	0	1
1958	0	0	0	0	1	1	1	1	0	0	0	0	4
1959	0	0	0	0	0	1	0	0	4	0	0	0	5
1960	0	0	0	0	2	0	1	0	1	0	0	0	4
1961	0	0	0	0	0	0	0	0	0	1	0	0	1
1962	0	0	1	0	1	1	0	0	0	1	0	0	4
1963	0	0	0	0	1	0	0	0	0	0	0	0	1
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	1	0	0	0	0	1	0	0	0	0	0	2
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
10-year mean	0.0	0.1	0.1	0.0	0.6	0.3	0.3	0.1	0.5	0.2	0.0	0.0	2.2

*Calculated from hourly observations made at each hour on the hour

TABLE 5B

NUMBER OF HOURS* WITH "THICK" AND "DENSE" FOGS, AT WICK, CAITHNESS
(10YEARS 1957 TO 1966)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
Number of Hours with "Thick Fog" - Visibility less than 220 yards													
1957	0	0	1	3	16	5	24	0	0	0	0	2	51
1958	5	3	0	0	8	29	13	27	42	0	5	1	133
1959	0	0	0	5	11	11	4	1	15	2	0	0	49
1960	0	0	1	0	9	6	10	11	4	0	0	0	41
1961	0	0	0	14	2	0	4	0	2	5	0	4	31
1962	0	2	5	0	30	4	8	3	7	7	0	0	66
1963	0	0	0	1	3	32	0	4	0	3	3	0	46
1964	0	6	0	20	26	4	6	4	2	0	0	0	68
1965	0	2	1	1	20	19	21	4	1	8	0	0	77
1966	0	1	0	0	2	19	0	4	5	2	1	0	34
10-year mean	0.5	1.4	0.8	4.4	12.7	12.9	9.0	5.8	7.8	2.7	0.9	0.7	59.6
Number of Hours with "Dense Fog" - Visibility less than 55 yards													
1957	0	0	0	0	2	0	0	0	0	0	0	0	2
1958	0	0	0	0	4	2	1	2	0	0	0	0	9
1959	0	0	0	0	0	1	0	0	8	0	0	0	9
1960	0	0	0	0	5	0	1	0	2	0	0	0	8
1961	0	0	0	0	0	0	0	0	0	1	0	0	1
1962	0	0	1	0	2	1	0	0	0	3	0	0	7
1963	0	0	0	0	2	0	0	0	0	0	0	0	2
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	1	0	0	0	0	1	0	0	0	0	0	2
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
10-year mean	0.0	0.1	0.1	0.0	1.5	0.4	0.3	0.2	1.0	0.4	0.0	0.0	4.0

*Calculated from hourly observations of visibility made at each hour on the hour

TABLE 5C

NUMBER OF DAYS WITH "FOG", "THICK FOG" AND "DENSE FOG" AT ANY TIME OF DAY* AT KINLOSS, MORAYSHIRE DURING 10-YEAR PERIOD FROM 1957 TO 1966

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
Number of Days with "Fog" - Visibility less than 1,100 yards													
1957	1	2	2	3	2	4	4	4	0	0	1	0	23
1958	9	8	4	1	2	6	3	2	7	0	4	1	47
1959	3	2	1	1	7	2	1	0	0	2	2	0	21
1960	5	4	2	0	2	3	1	2	0	4	2	3	28
1961	5	2	0	2	0	0	0	0	1	0	3	9	22
1962	0	1	3	0	5	1	3	0	1	1	0	3	18
1963	7	6	1	0	3	6	0	3	0	3	1	2	32
1964	2	2	0	4	5	1	2	5	2	2	1	3	29
1965	6	5	0	2	5	2	3	0	0	3	2	0	28
1966	1	3	0	1	1	9	1	0	1	1	1	0	19
10-year mean	3.9	3.5	1.3	1.4	3.2	3.4	1.8	1.6	1.2	1.6	1.7	2.1	26.7
Number of Days with "Thick Fog" - Visibility less than 220 yards													
1957	0	0	0	0	1	1	1	2	0	0	0	0	5
1958	2	3	0	0	0	0	0	0	5	0	1	0	11
1959	0	1	0	0	2	0	0	0	0	0	0	0	3
1960	0	0	0	0	1	1	0	0	0	0	0	0	2
1961	0	1	0	0	0	0	0	0	0	0	2	3	6
1962	0	0	0	0	2	1	0	0	0	1	0	1	5
1963	2	2	1	0	0	1	0	0	0	2	1	0	9
1964	0	1	0	1	2	0	0	1	0	0	0	0	5
1965	2	0	0	0	1	2	0	0	0	2	0	0	7
1966	0	2	0	0	0	3	1	0	1	0	0	0	7
10-year mean	0.6	1.0	0.1	0.1	0.9	0.9	0.2	0.3	0.6	0.5	0.4	0.4	6.0
Number of Days with "Dense Fog" - Visibility less than 55 yards													
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	1	1	0	0	0	0	0	0	2	0	0	0	4
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	1	0	0	0	0	0	0	0	0	0	0	1
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	1	0	0	1
1966	0	0	0	0	0	1	0	0	0	0	0	0	1
10-year mean	0.1	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.7

*Calculated from hourly observations made at each hour on the hour

TABLE 5D

NUMBER OF HOURS* WITH "THICK" AND "DENSE" FOGS AT KINLOSS, MORAYSHIRE
(10 YEARS 1957 TO 1966)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
Number of Hours with "Thick Fog" - Visibility less than 220 yards													
1957	0	0	0	0	1	1	1	3	0	0	0	0	6
1958	6	7	0	0	0	0	0	0	12	0	4	0	29
1959	0	2	0	0	4	0	0	0	0	0	0	0	6
1960	0	0	0	0	1	1	0	0	0	0	0	0	2
1961	0	1	0	0	0	0	0	0	0	0	7	18	26
1962	0	0	0	0	3	1	0	0	0	1	0	1	6
1963	3	4	1	0	0	1	0	0	0	19	2	0	30
1964	0	1	0	5	3	0	0	1	0	0	0	0	10
1965	2	0	0	0	1	4	0	0	0	3	0	0	10
1966	0	4	0	0	0	9	1	0	1	0	0	0	15
10-year mean	1.1	1.9	0.1	0.5	1.3	1.7	0.2	0.4	1.3	2.3	1.3	1.9	14.0
Number of Hours with "Dense Fog" - Visibility less than 55 yards													
1957	0	0	0	0	0	0	0	0	0	0	0	0	0
1958	1	1	0	0	0	0	0	0	4	0	0	0	6
1959	0	0	0	0	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0	0	0	0	0	0	0
1963	0	2	0	0	0	0	0	0	0	0	0	0	2
1964	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	0	0	0	0	0	0	0	0	0	1	0	0	1
1966	0	0	0	0	0	1	0	0	0	0	0	0	1
10-year mean	0.1	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.1	0.0	0.0	1.0

*Calculated from hourly observations of visibility made at each hour on the hour

TABLE 6

NUMBER OF DAYS WITH SNOW OR SLEET FALLING AT ANY TIME OF DAY AT WICK AND KINLOSS
(15 years from 1952 to 1966)

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	YEAR Total
WICK													
1952	20	15	7	2	1	1	0	0	0	0	6	8	60
1953	5	9	5	10	0	0	0	0	0	0	0	2	31
1954	13	13	7	4	1	0	0	0	1	0	5	11	55
1955	11	21	13	0	3	0	0	0	0	4	0	12	64
1956	19	14	7	8	0	0	0	0	0	1	4	2	55
1957	4	7	0	2	2	0	0	0	0	0	1	5	21
1958	14	16	11	4	0	0	0	0	0	1	0	8	54
1959	21	3	1	1	0	0	0	0	0	0	2	0	28
1960	12	13	3	0	0	0	0	0	0	0	0	6	34
1961	7	5	6	4	1	0	0	0	0	1	4	15	43
1962	2	13	4	7	0	0	0	0	0	1	7	13	47
1963	17	16	0	1	0	0	0	0	0	0	3	6	43
1964	2	6	4	0	0	0	0	0	0	2	4	11	29
1965	19	6	9	3	0	0	0	0	0	0	13	13	63
1966	10	9	12	7	0	0	0	0	0	0	5	13	56
15-year mean	11.7	11.1	5.9	3.5	0.5	0.1	0.0	0.0	0.1	0.7	3.6	8.3	45.5
KINLOSS													
1952	17	8	5	2	0	0	0	0	0	0	6	5	43
1953	4	8	3	4	0	0	0	0	0	0	0	0	19
1954	12	7	3	1	1	0	0	0	0	0	1	6	31
1955	12	17	11	0	4	0	0	0	0	4	0	11	59
1956	16	14	5	3	0	0	0	0	0	1	3	4	46
1957	4	9	0	0	2	0	0	0	0	0	0	7	22
1958	10	13	13	3	1	0	0	0	0	0	0	6	46
1959	21	2	1	2	0	0	0	0	0	0	0	0	26
1960	9	11	3	1	0	0	0	0	0	0	0	2	26
1961	7	6	3	4	0	0	0	0	0	0	4	14	38
1962	6	16	16	7	1	0	0	0	0	5	8	12	71
1963	20	17	0	3	1	0	0	0	0	0	5	5	51
1964	2	5	5	1	0	0	0	0	0	2	3	14	32
1965	17	9	11	2	3	0	0	0	0	0	13	10	65
1966	8	12	11	6	0	0	0	0	0	2	8	13	60
15-year mean	11.0	10.3	6.0	2.6	0.9	0.0	0.0	0.0	0.0	0.9	3.4	7.3	42.4

TABLE 6A

AVERAGE NUMBER OF DAYS WITH SNOW LYING ON THE GROUND AT 09H GREENWICH MEAN TIME AT PLACES ALONG THE COASTLINE OF THE MORAY FIRTH
(15 years from 1952 to 1966)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year Total
Wick	7	5	3	1	0	0	0	0	0	0	1	3	19
Tarbatness	4	3	1	1	0	0	0	0	0	0	1	2	11
Fortrose	5	4	1	1	0	0	0	0	0	0	1	2	13
Inverness	8	6	1	1	1	0	0	0	0	1	1	3	19
Nairn	8	6	2	1	0	0	0	0	0	0	1	4	21
Forres	9	7	4	1	1	0	0	0	0	1	2	4	26
Kinloss	7	6	2	1	0	0	0	0	0	0	1	2	18
Elgin	7	5	2	1	1	0	0	0	0	0	1	2	17
Banff	7	5	2	1	0	0	0	0	0	0	1	2	17

Note: A day of "snow-lying" is counted when half or more of the ground surrounding the weather station is covered with snow at 09h GMT

TABLE 6B

NUMBER OF DAYS WITH SNOW LYING AT 09H GREENWICH MEAN TIME AT DEPTHS BETWEEN SPECIFIED LIMITS

WICK AIRPORT - Altitude 119 feet								Maximum Depth - 12 inches	
Depth - Inches	0-1	2	3-4	5-6	7-8	9-12	13-16	Over 16	Total
Winter of:									
1956-57	1			1					2
1957-58	7	9	5	3	5	3			32
1958-59	6	10	1	1	1	2			21
1959-60	2	3	3	3	7	3			21
1960-61	1	2							3
1961-62	6	10	9	3	1				29
1962-63	15	9	2						26
1963-64	2	1	4						7
1964-65	11	2	5		2				20
1965-66	10	3	6	1					20
1966-67	5	5	3	2					15
Total	66	54	38	14	16	8			196
% Total	33.7	27.5	19.4	7.1	8.2	4.1			100%

INVERNESS - Altitude 13 feet								Maximum Depth = 21 inches	
Winter of:									
1957-58	6	4	6	4					20
1958-59	4	1	1	1		1			8
1959-60	5	6	2	6	1		1	1	22
1960-61	4	1							5
1961-62	7	5	1		8	6			27
1962-63	17	14	5	4					40
1963-64	1								1
1964-65	17								17
1965-66	20	1	1						22
1966-67	3		1						4
Total	84	32	17	15	9	7	1	1	166
% Total	50.6	19.3	10.2	9.1	5.4	4.2	0.6	0.6	100%

TABLE 6B (Contd.)

KINLOSS - Altitude 15 feet								Maximum Depth = 12 inches	
Depth - Inches	0-1	2	3-4	5-6	7-8	9-12	13-16	Over 16	Total
Winter of:									
1953-54	7								7
1954-55	9	5	9	6	3				32
1955-56	13	5	1						19
1956-57	1	1							2
1957-58	8	2	5	1	4	2			22
1958-59	7	9	2						18
1959-60	3	3	10	2	2				20
1960-61	3								3
1961-62	19	3	4	2	4	3			35
1962-63	17	14	7	2					40
1963-64	3								3
1964-65	16	6	3						25
1965-66	17	3	2						22
1966-67	4		2						6
Total	127	51	45	13	13	5			254
% Total	50.0	20.1	17.7	5.1	5.1	2.0			100%

FORRES - Altitude 155 feet								Maximum Depth = 16 inches	
Winter of:									
1956-57	2								2
1957-58	26	1	4	2					33
1958-59	12	4	5						21
1959-60	10	2	7	1					20
1960-61	6								6
1961-62	19	5	9	5	2	7	3		50
1962-63	21	3	21	5	3	2			55
1963-64	5	1							6
1964-65	27	3	1						31
1965-66	12	4	3	1	2				22
1966-67	10	3	2						15
Total	150	26	52	14	7	9	3		261
% Total	57.5	10.0	19.9	5.4	2.7	3.4	1.1		100%

TABLE 6B (Contd.)

ELGIN - Altitude 92 feet								Maximum Depth = 13 inches	
Depth - Inches	0-1	2	3-4	5-6	7-8	9-12	13-16	Over 16	Total
Winter of:									
1956-57	1								1
1957-58	6	2	7	1	4	3			23
1958-59	10	2	3	1					16
1959-60	4	2	3	3		7	1		20
1960-61	1	1	1						3
1961-62	15	9	5	5	1	1			36
1962-63	14	6	7	3	8	5			43
1963-64	1								1
1964-65	21	2	1						24
1965-66	12	4							16
1966-67	5	2	1						8
Total	90	30	28	13	13	16	1		191
% Total	47.1	15.7	14.7	6.8	6.8	8.4	0.5		100%

TABLE 7

AVERAGE VALUES OF RELATIVE HUMIDITY AND DRY BULB TEMPERATURE AT 03H, 09H, 15H AND 21H GREENWICH MEAN TIME AT WICK, CAITHNESS - (10 years from 1957 to 1966)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
At 03h GMT													
Average Relative Humidity per cent	85	85	86	88	90	91	92	92	90	88	85	85	88
Average Dry Bulb Temperature °F	37.1	37.4	38.8	40.4	43.8	48.5	50.3	50.8	49.9	47.8	41.7	38.2	43.7
At 09h GMT													
Average Relative Humidity per cent	85	85	83	80	81	82	83	85	85	86	85	85	84
Average Dry Bulb Temperature °F	37.2	37.8	40.5	44.5	48.3	53.2	54.7	54.9	53.2	49.2	42.2	38.3	46.2
At 15h GMT													
Average Relative Humidity per cent	83	80	77	74	77	77	79	81	79	81	84	84	80
Average Dry Bulb Temperature °F	38.9	40.7	43.2	46.8	50.0	55.2	56.4	56.8	55.3	51.2	44.0	39.4	48.2
At 21h GMT													
Average Relative Humidity per cent	85	85	85	85	87	86	88	90	88	87	85	85	86
Average Dry Bulb Temperature °F	37.4	37.9	39.8	42.2	45.7	51.0	52.5	52.3	51.1	48.2	42.1	38.5	44.9

TABLE 7A

AVERAGE VALUES OF RELATIVE HUMIDITY AND DRY BULB TEMPERATURE AT 03H, 09H, 15H AND 21H GREENWICH MEAN TIME AT KINLOSS, MORAYSHIRE
(10 years from 1957 to 1966)

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
At 03h GMT													
Average Relative Humidity per cent	84	84	83	85	86	87	88	89	87	85	86	84	86
Average Dry Bulb Temperature °F	35.9	36.1	38.9	40.9	44.5	49.9	51.7	52.0	50.6	47.1	40.8	37.3	43.8
At 09h GMT													
Average Relative Humidity per cent	83	83	78	74	74	75	77	80	80	83	86	85	80
Average Dry Bulb Temperature °F	36.1	36.5	41.3	46.0	50.8	56.1	57.0	56.8	54.5	49.2	41.0	37.1	46.9
At 15h GMT													
Average Relative Humidity per cent	80	74	68	65	66	67	70	72	71	75	81	82	73
Average Dry Bulb Temperature °F	39.2	41.8	46.0	49.9	54.3	59.9	60.5	60.5	58.4	53.4	44.7	39.4	50.7
At 21h GMT													
Average Relative Humidity per cent	83	84	80	81	81	80	82	85	84	83	85	84	83
Average Dry Bulb Temperature °F	36.7	37.2	40.5	43.7	48.0	54.1	55.1	54.6	52.5	48.5	41.5	37.8	45.8

TABLE 7B

PERCENTAGE AMOUNT OF TIME WITH WET BULB TEMPERATURES BELOW CERTAIN LIMITS AT KINLOSS, MORAYSHIRE

(calculated from hourly readings made during the 10-year period from February 1951 to January 1961)

Degrees Fahrenheit	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Year
	%	%	%	%	%	%	%	%	%	%	%	%	%
20°F or below	2.0	2.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4
26°F or below	7.4	8.1	1.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.8	3.0	1.8
32°F or below	27.2	30.1	12.2	3.6	0.3	0.0	0.0	0.0	0.1	0.5	5.7	13.0	7.7
34°F or below	40.9	40.9	21.5	6.9	1.1	0.1	0.0	0.0	0.2	1.1	9.5	21.5	12.0
36°F or below	54.9	56.0	31.5	13.8	3.3	0.4	0.0	0.0	0.7	2.9	15.7	35.1	17.8
38°F or below	68.4	68.7	44.9	25.0	7.3	0.6	0.1	0.1	1.7	6.9	24.7	50.8	24.9
40°F or below	78.1	78.0	58.0	37.1	13.2	1.7	0.3	0.3	3.6	12.4	36.5	65.9	32.0
42°F or below	85.3	85.2	70.9	51.4	21.4	4.3	0.5	0.5	6.3	20.0	50.9	77.5	39.4
44°F or below	90.4	91.2	82.5	66.1	32.1	9.9	0.9	1.2	10.7	32.4	65.6	86.4	47.3
46°F or below	95.0	94.9	90.6	79.6	46.2	19.4	2.7	3.6	17.7	46.6	79.3	91.7	55.5
48°F or below	97.4	97.6	95.5	89.6	59.9	32.5	7.1	8.9	29.3	61.0	89.7	95.8	63.6
50°F or below	99.3	99.1	98.5	96.6	74.2	48.0	16.1	20.5	45.3	72.9	95.9	98.5	72.0
52°F or below	100.0	99.7	99.5	98.8	85.6	62.1	32.1	37.3	61.4	82.9	99.0	99.9	79.8
54°F or below		99.9	99.8	99.6	93.1	74.8	52.3	56.3	74.8	92.3	99.9	100.0	86.9
56°F or below		100.0	99.9	99.9	96.7	85.1	72.9	74.1	85.4	97.1	100.0		92.6
58°F or below			100.0	100.0	98.7	91.7	85.7	86.2	93.4	98.8			96.2
60°F or below					99.7	95.7	92.9	92.9	97.0	99.6			98.2
62°F or below					99.9	97.8	96.9	97.0	98.9	99.9			99.3
64°F or below					100.0	99.1	98.7	98.8	99.6	100.0			99.8
66°F or below						99.7	99.9	99.5	99.8				99.9
68°F or below						99.9	99.9	99.8	99.9				99.9
70°F or below						100.0	100.0	99.9	100.0				99.9
72°F or below								100.0					100.0

TABLE 7C

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 KINLOSS, MORAYSHIRE DURING THE 10 YEARS FROM 1951 TO 1960 (DEGREES FAHRENHEIT)

	Absolute Highest Value of Wet Bulb Temperature	Highest Value of Wet Bulb Temperature Associated with Relative Humidity of 100 per cent
	°F	°F
January	52	52
February	56	52
March	58	54
April	58	56
May	64	62
June	70	64
July	70	64
August	72	64
September	70	64
October	64	60
November	56	54
December	54	54
Year	72	64

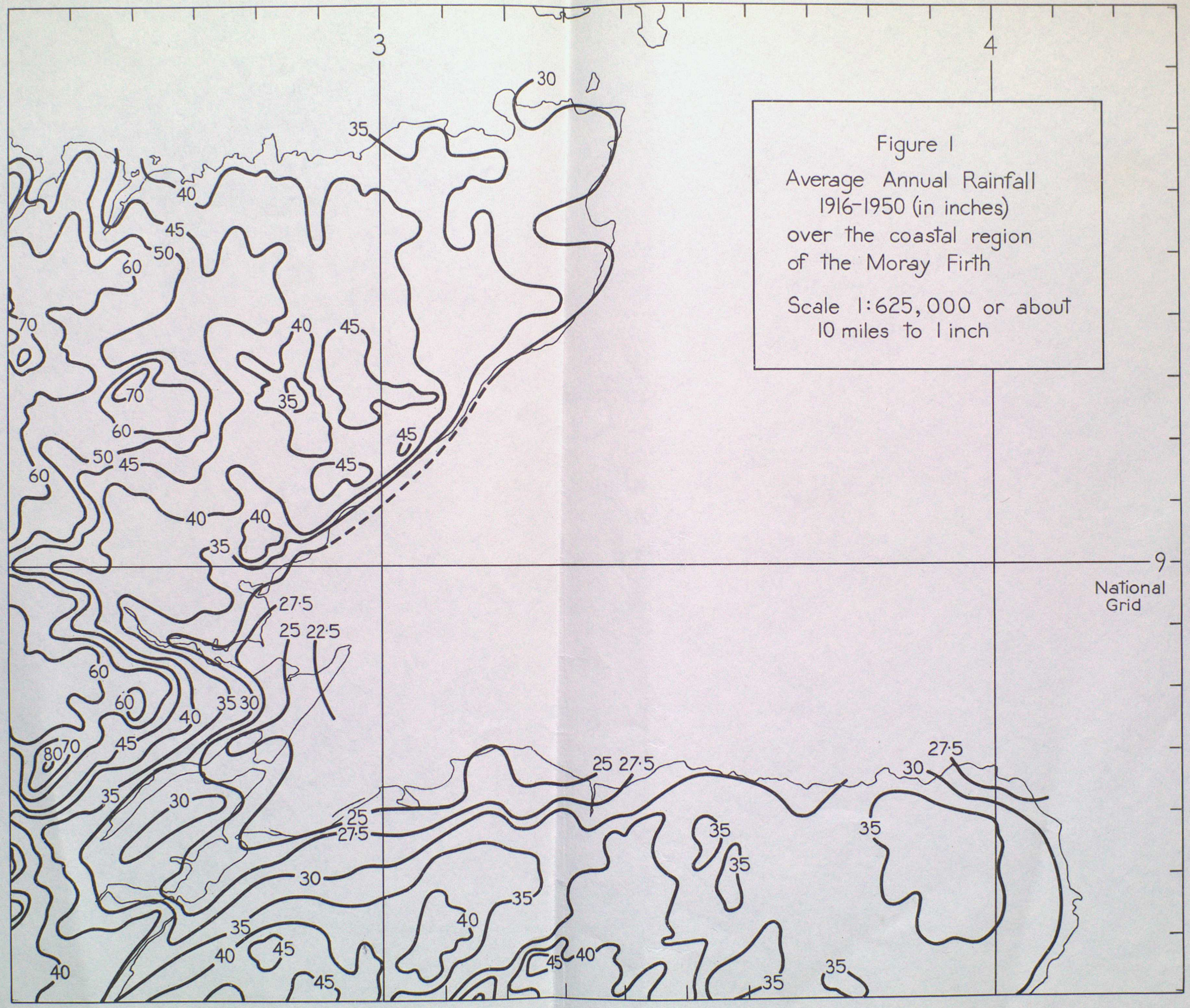

Figure 1

Average Annual Rainfall 1916–1950 (in inches) over the coastal region of the Moray Firth

Scale 1:625,000 or about 10 miles to 1 inch

Met. O./Carto/D.O./1186

4°
3°
2°W
58°N
SOUTH RONALDSAY
PENTLAND FIRTH
DUNNET HEAD
DUNCANSBY HEAD
Whiten Hd
Strathy Pt
Armadale
Strathy
Dounreay
Thurso
Bettyhill
Halkirk
Noss Hd
Wick
Achavanich
Lybster
Altnaharra
Kinbrace
Dunbeath
Borgue
Berriedale
Helmsdale
Loch Shin
Lairg
Rogart
Brora
Altassmore
Golspie
Loch Fleet
Bonar Bridge
Dornoch
DORNOCH FIRTH
Tarbat Ness
Tain
MORAY FIRTH
Alness
Invergordon
Cromarty
CROMARTY FIRTH
BLACK ISLE
Evanton
Dingwall
Strathpeffer
Fortrose
Cononbridge
Muir of Ord
Beauly
BEAULY FIRTH
INVERNESS
Canal
Nairn
Cawdor
Balloch
Lochindorb
Burghead
Kinloss
Forres
Elgin
Lossiemouth
Buckie
Portknockie
Cullen
Portsoy
Banff
Macduff
Gordon Castle
Fochabers
Cornhill
Aberchirder
Keith
Rothes
Dufftown
Huntly
Troup Hd
Rosehearty
KINNAIRDS HEAD
Fraserburgh
Rattray Head
Strichen
Turriff
New Deer
Old Deer
Peterhead
Kirktown of Auchterless
Fyvie
Port Erroll

Height of land

feet
1400
800
400

Figure 2

Relief and Drainage over the coastal region of the Moray Firth

Scale 1:625,000 or about 10 miles to 1 inch

Met. O./Carto/D.O./1186

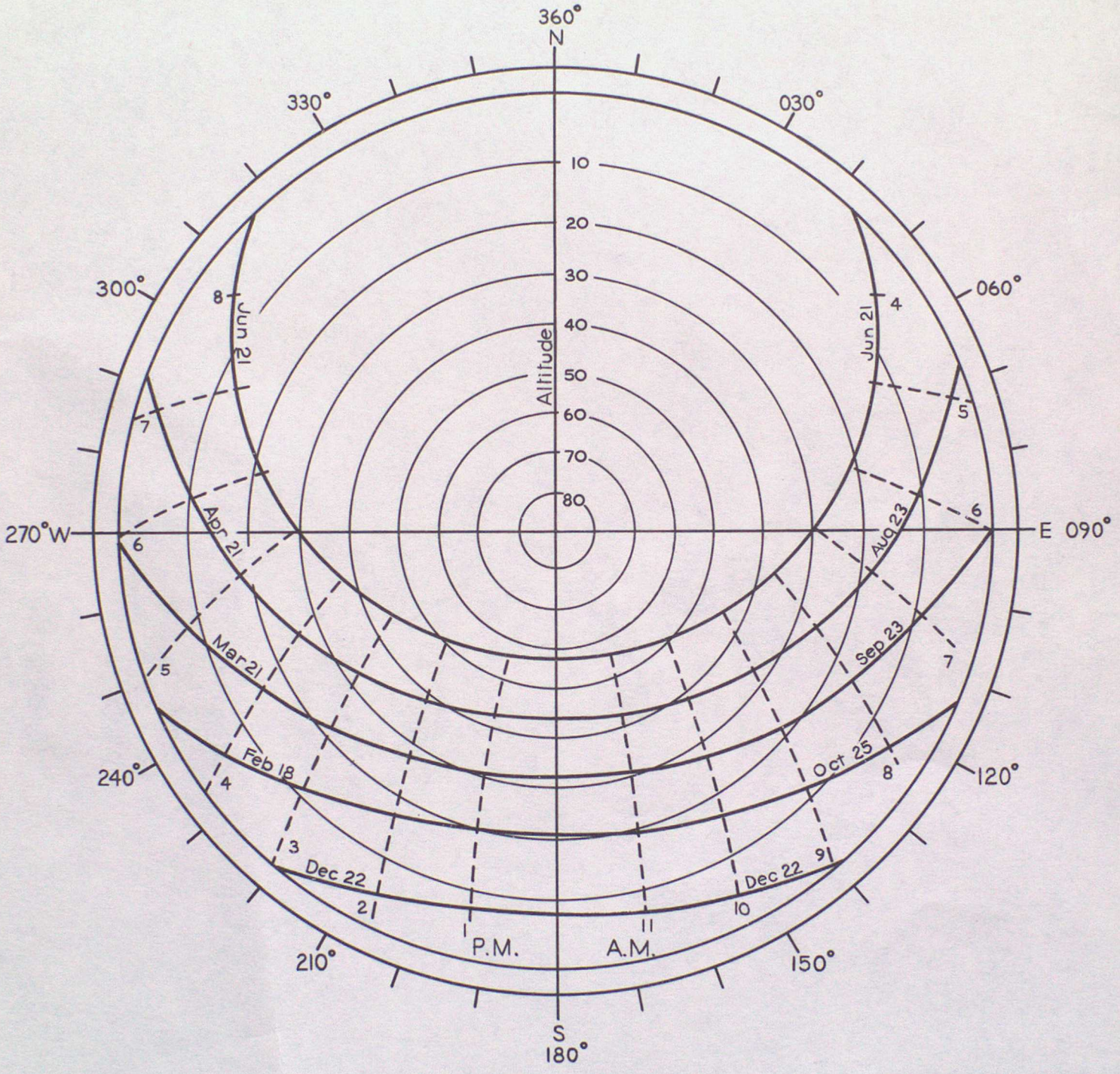

Fig 3. SOLAR CHART FOR Latitude 58°N