DEPARTMENT OF INDUSTRY AND COMMERCE

METEOROLOGICAL SERVICE

TECHNICAL NOTE NO. 10
(Advance Issue)

Note on the occurrence of Non-frontal fog or mist at Dublin Airport during the period October to February

By

S.L. Tierney, B.A., B.Sc.

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N O T E

This note will be printed for circulation. As, however, supply difficulties necessitate postponement of printing, it has been decided to make an advance issue of a limited number of copies in the present stencilled form.

DUBLIN

1949

NOTE ON THE OCCURRENCE OF NON-FRONTAL FOG OR MIST AT DUBLIN AIRPORT DURING THE PERIOD OCTOBER TO FEBRUARY

In the preparation of this note, reference was made to hourly observations and to hourly charts for the periods October to February in the years 1939 to 1947, inclusive.

The consideration of the data was complicated by the fact that, prior to November 1941, a 24 hour service of observations was not in operation at the station. Where fog was present at the first morning observation and doubt existed as to its nature, its occurrence was included under 'Radiation Fog.'

Except in cases where specific mention is made of visibility limits, no strict attempt has been made to distinguish between mist and fog. Generally, the term 'fog' in the note, may be taken to indicate visibility of less than 2000 metres.

As a preliminary, it will be of advantage to consider the disposition of the landing field at Collinstown with reference to Dublin City and the sea and to derive some idea of the surrounding terrain.

Collinstown Airport lies on a plain, some 200 feet above sea level, about six miles due north of Dublin City and a similar distance from the sea to the east. To the south and east, the ground slopes gradually down to sea level, while to the north, a rather more rapid fall occurs into the valley of a small streamlet, the River Ward. Along the northern bank of the Ward lies an area which is normally water-logged in wet seasons, forming a fog source of restricted proportions. To the west, the surface continues at the same level as the Airport, eventually rising some 50 feet to where a number of rivulets, tributaries of the Ward, have their source. Still farther to the west, a rather undulating country ends finally in the northern limits of the Bog of Allen, about 15 to 20 miles inland.

On the basis of these remarks, the separate types of fog or mist likely to be experienced are listed as follows:

(1) Reduction of visibility due to smoke drift from Dublin City

(2) Sea fog

(3) Fog formed by the advection of air from sea to land

(4) Drifting for, i.e. fog which formed inland and subsequently drifted over

(5) Radiation fog

In the data considered, the following cases of fog or mist were available:-

October	25
November	36
December	27
January	25
February	12
Total:	125

In view of the meteorological situations at the times of occurrences, the above cases may be subdivided in order of progressive frequency, as follows:-

Type of Fog	Number of Cases
Sea	1
Advection	3
Smoke	7
Radiation	46
Drifting	68
Total:	125

These fog types will now be considered separately.

(1) Sea Fog

Sea fog is much more appropriate to the summer season, when its existence is more probable and the setting in of an easterly wind, either by a sea breeze effect or by the pressure distribution can cause it to be brought inland.

During the winter, sea fog in these latitude occurs in fresh outbreaks of tropical air. Most of these outbreaks occur from the south west and there is usually sufficient desiccation across Ireland to keep the east coast free. In exceptional cases, the tropical air outbreak can occur in a southerly current and in these conditions the sea fog can drift temporarily across the airfield.

In the period examined there was only one case of true sea fog which occurred in a southerly current of tropical air and drifted inland in a very light south easterly surface wind. A clearance occurred when the surface wind veered to off-shore but fog drifted in again with a wind shift to on-shore.

Such fog can prove troublesome from the point of view of forecasting a clearance. Its presence over the airfield depends solely on the surface wind, presupposedly light and very variable in direction in a slack southerly gradient. With a change of gradient to west of south and a probable 'fixing' of the surface wind to the same direction the fog clearance is immediate and final.

In certain cases, extensive radiation fog, which has drifted off-shore, clears during the day over the airfield but persists over the sea. Towards nightfall, the fog can begin to drift inland. Such fog, although actually moving in from the sea, has been included under 'Radiation Fog' in accordance with its original formation.

(2) Fog formed by the advection of air from sea to land

Fog, formed by the advection, in an easterly gradient, of warmer, moistened air from the sea over the colder land surface occurred three times in the period examined. The formation of such fog requires a very delicate balance of circumstances. Intense radiational cooling, as for example, in the presence of a surface of snow, is essential. Under these conditions, the ground temperaature can remain sub-freezing even at the time of maximum insolation and with such a great temperature difference between sea and land an easterly gradient can cause fog.

For the cases in point, the temperatures remained sub-freezing after protracted periods of snow. At no other observing station were there reports of fog. The actual duration of the fog at Collinstown was only a few hours and it is unlikely that such fog could persist longer in view of the short period of warming and moistening over the Irish Sea and the subsequent short cooling track from the sea to the station.

In one case, however, the clearance was only to mist, which persisted for 18 hours. These murky conditions were probably accentuated by industrial smoke from over England where visibilities were consistently poor in low humidities.

It is interesting to note in this connection, that although the surface wind was never reported stronger than Force 2 from an easterly point, the gradient wind was more than 25 m.p.h. - much stronger than normally associated with fog at Collinstown.

(3) Reduction of visibility due to smoke drift from Dublin City

In stable situations, light southerly winds can produce visibilities of less than 2000 metres due to smoke drift from Dublin City. There were seven such incidences in the period considered. The normal order of reduced visibility, usually occurring from one to two hours after mealtimes, is between 1000 and 2000 metres but with a sufficient volume of smoke, visibilities of less than 1000 metres can occur.

Hpwever, light southerly winds are of short duration at Dublin Airport, the general tendency for such winds being to deflect due to the Dublin mountains to the south. Smoke drift from the City then, is unlikely to persist for more than a few hours.

(4) Radiation Fog

Of the total observations of fog or mist, 46 cases may be considered as due to radiation. No attempt has been made to subdivide the cases on the basis of the intensity of solar heating in the different months since the following remarks apply equally well to all months. The remarks are classed under the heads of (i) Occurrence, (ii) Clearance.

(i) Occurrence

(a) No fog occurred with a gradient wind of greater than 25 m.p.h. and/or a surface wind of greater than Beaufort Force 4. In any case of pre-existing fog a clearance was effected immediately the above values were approached.

(b) For a gradient wind of 15/25 m.p.h. and/or a surface wind of Beaufort Force 4, the order of minimum visibility was 1000 to 2000 metres. Occasionally, visibility 500 to 1000 metres was reported but its occurrence was intermittent and did not persist for more than one hour.

(c) Most cases of fog occurred in light surface winds and with a gradient of less than 15 m.p.h.

(ii) Clearance

(d) As a general rule, fog did not persist after about mid-day. When the clearance occurred the improvement in visibility was rapid and well marked except where low cloud existed in appreciable amounts (4 plus, okta) above the fog. Under these conditions, the improvement in visibility was progressive but not necessarily later and the final visibility attained remained poor or moderate as long as the cloud persisted. Here, also, there was a tendency for the occurrence of fragments of lifted fog below the overlying cloud layer, the height of these fragments varying according to the height of the cloud layer.

(e) To the remarks under (d) there were two exceptions. That is, there were two cases where fog did not clear, even temporarily, in the afternoon. For the most part, the fogs observed occurred under conditions where the meteorological situation was in a state of transition. A high pressure system was building up or breaking down; ephemeral ridges, troughs or cols covered the country. The persistent fogs, however, occurred in well established anticyclones, stationary and of at least a few days existence with the attendant conditions of light winds and clear skies at night. Since such situations are more usual during December and January, persistent fog need be expected only in these months, as in the instances observed.

(5) Drifting Fog

Drifting fog, of which there were 68 instances in the period, can be extremely troublesome to the forecaster, either considered 'per se' or as an additive effect to pre-existing fog. Although its clearance can be definitely stated to occur within a few hours, its time of appearance is purely fortuitous. Not unusually, when radiation fog has cleared, the visibility again suddenly drops as banks of fog drift over from inland. The most favourable wind direction for the appearance of such fog is from the west. With light winds and a sky partly cloudy or clear, the fog may be plainly observed in its passage eastwards. The usual tendency is for the major portion of fog to be diverted along the lower ground to the north and south of the station. However, it can and does drift over the landing field. In these circumstances, even the very slight extra elevation of the station is sufficient to cause a drainage away from the summit and the fog never persists for any great length of time.

Although the Bog of Allen lies as much as 15 miles inland to the west, it is not unreasonable to suppose that it forms the source region of such fog.

With light northerly winds also, fog may on occasions drift south from north of the River Ward. Here, however, the fog normally confines itself to the low land to north of the station, draining along towards the sea. Any reduction of visibility from this point is likely to be very occasional and more in the nature of isolated patches.

In all instances of drifting fog the gradient wind never exceeded 15/20 m.p.h. and the surface wind Beaufort Force 3. Its clearance took place within a few hours of its appearance and it is reasonable to suppose that this will always be the case. With strengthening gradient and/or surface winds, the clearance will occur progressively quicker.

A consideration of landing conditions at any Airport must concern itself, not merely with the problem of improving visibility in cases of fog but also with the problem of the existence of lifted fog between the surface and 500 feet. This latter problem does not normally exist for Collinstown, in view, no doubt, of the comparative elevation of the station relative to the surrounding country. In general, when fog begins to clear the improvement in visibility is rapid and appreciable. An exception, however, can occur in the following case:-

> With LOW cloud above the fog, the improvement in visibility is usually more gradual and fragments of lifted fog can occur. If a front be approaching, then even with improving visibility, lifted fog can form a 8/8 layer at varying heights between the surface and 500 feet. Such a layer of stratus usually persists until after the passage of the front.
