FOR OFFICIAL USE.

M.O. 245f.

AIR MINISTRY.

METEOROLOGICAL OFFICE.

PROFESSIONAL NOTES NO. 26.

THE RELATION BETWEEN HAZE AND RELATIVE HUMIDITY OF THE SURFACE AIR.

BY

J. WADSWORTH, M.A.

Published by the Authority of the Meteorological Committee.

LONDON:
PRINTED AND PUBLISHED BY
HIS MAJESTY'S STATIONERY OFFICE.
To be purchased through any Bookseller or directly from
H.M. STATIONERY OFFICE at the following addresses:
IMPERIAL HOUSE, KINGSWAY, LONDON, W.C.2, and
28, ABINGDON STREET, LONDON, S.W.1;
37, PETER STREET, MANCHESTER;
1, ST. ANDREW'S CRESCENT, CARDIFF;
23, FORTH STREET, EDINBURGH;
or from EASON & SON, LTD., 40 & 41, LOWER SACKVILLE STREET, DUBLIN.

1921.

Price 4d. Net.

THE RELATION BETWEEN HAZE AND RELATIVE HUMIDITY OF THE SURFACE AIR.

BY J. WADSWORTH, M.A.

The following investigation was undertaken at the suggestion of Colonel Gold to discover whether a definite relation could be found between the occurrence of haze and the humidity of the air. The Meteorological Glossary recommends the restriction of the term haze to cases in which there is a large difference in the readings of the wet and dry bulb thermometers and many observers do not report haze unless the surface humidity is below 80 per cent. Webster's Dictionary states that haze occurs without dampness, contrasting the term in this respect with the term mist, and this is probably the distinction between the terms in ordinary language. On the other hand some observers maintain that even if the surface humidity is high this does not render the occurrence of haze impossible.

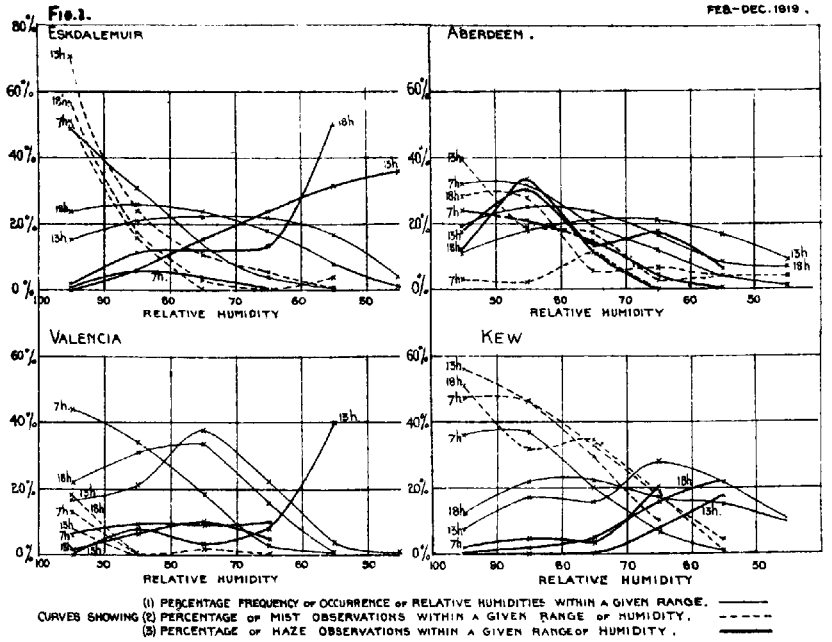
Tables shewing the frequency of haze for different hours of the day under varying conditions of humidity at Eskdalemuir, Valencia, Aberdeen and Kew were supplied by these Observatories for the period February–December, 1919, and used as the basis of the investigation. It was found that reports of haze were made under conditions of humidity ranging from 100 per cent to less than 40 per cent.

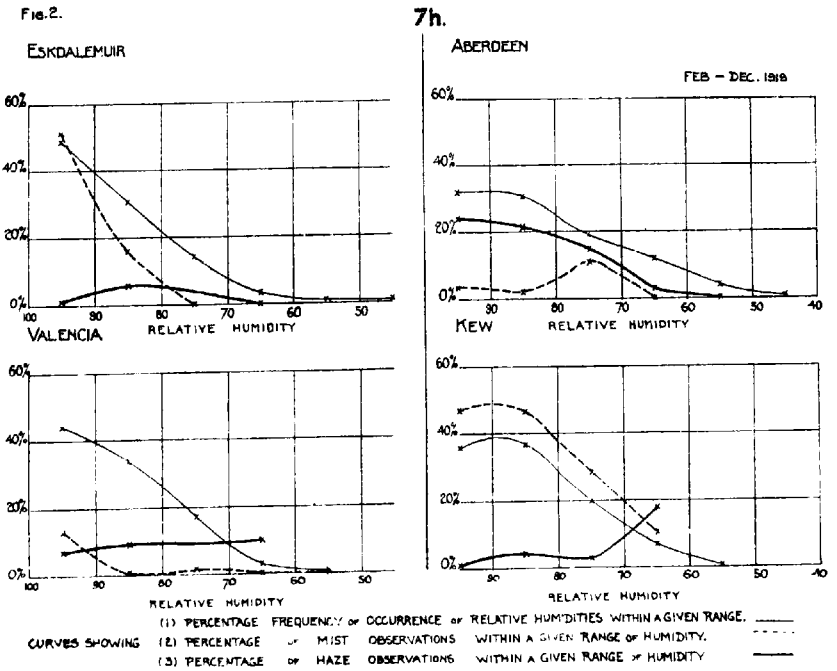
The actual frequencies of haze irrespective of the hygrometric state of the air are shown in the following table as percentages of the total number of observations at 7h., 13h. or 18h.

——	Eskdalemuir.	Valencia.	Aberdeen.	Kew.
	Per cent.	Per cent.	Per cent.	Per cent.
7h.	3	8	17	4
13h.... ...	17	6	15	9
18h.... ...	12	6	14	12
All hours ...	11	7	15	8

The average values of the relative humidity at 7h., 13h., 18h., for hazy conditions proved to be equal to or less than the corresponding values under non-hazy conditions, except at Aberdeen, and generally less than those under misty conditions, the values for which ranged from 79 per cent. to 93 per cent.

Professional Notes No.26.





THE RELATION BETWEEN HAZE AND RELATIVE HUMIDITY OF THE SURFACE AIR.

BY J. WADSWORTH, M.A.

The following investigation was undertaken at the suggestion of Colonel Gold to discover whether a definite relation could be found between the occurrence of haze and the humidity of the air. The Meteorological Glossary recommends the restriction of the term haze to cases in which there is a large difference in the readings of the wet and dry bulb thermometers and many observers do not report haze unless the surface humidity is below 80 per cent. Webster's Dictionary states that haze occurs without dampness, contrasting the term in this respect with the term mist, and this is probably the distinction between the terms in ordinary language. On the other hand some observers maintain that even if the surface humidity is high this does not render the occurrence of haze impossible.

Tables shewing the frequency of haze for different hours of the day under varying conditions of humidity at Eskdalemuir, Valencia, Aberdeen and Kew were supplied by these Observatories for the period February–December, 1919, and used as the basis of the investigation. It was found that reports of haze were made under conditions of humidity ranging from 100 per cent to less than 40 per cent.

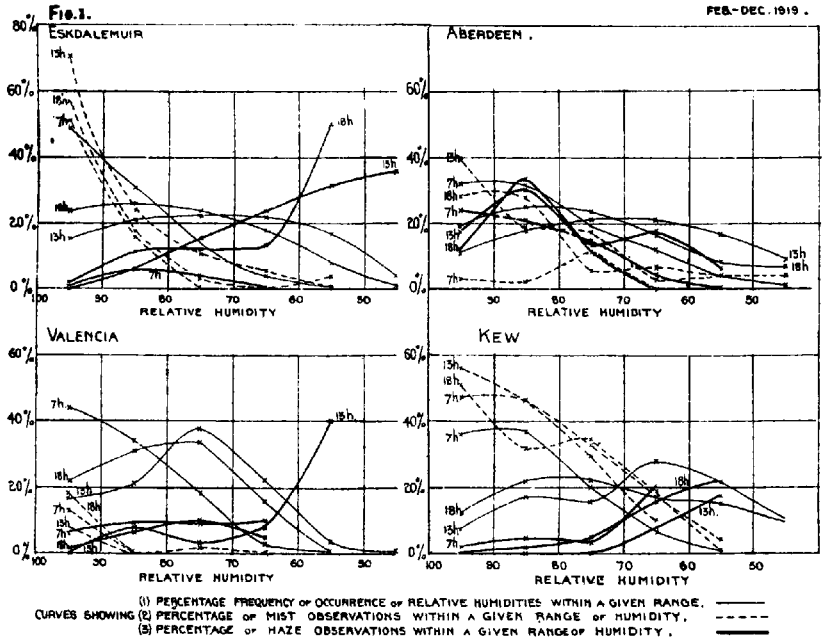
The actual frequencies of haze irrespective of the hygrometric state of the air are shown in the following table as percentages of the total number of observations at 7h., 13h. or 18h.

——	Eskdalemuir.	Valencia.	Aberdeen.	Kew.
	Per cent.	Per cent.	Per cent.	Per cent.
7h.	3	8	17	4
13h.... ...	17	6	15	9
18h.... ...	12	6	14	12
All hours ...	11	7	15	8

The average values of the relative humidity at 7h., 13h., 18h., for hazy conditions proved to be equal to or less than the corresponding values under non-hazy conditions, except at Aberdeen, and generally less than those under misty conditions, the values for which ranged from 79 per cent. to 93 per cent.

To face page 56.

Professional Notes No.26.



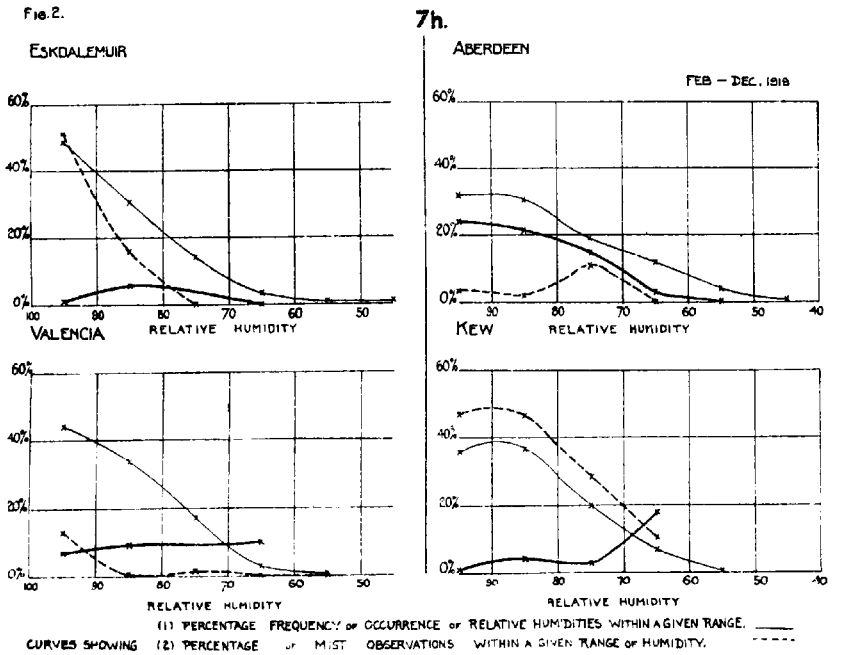


FIG. 3.

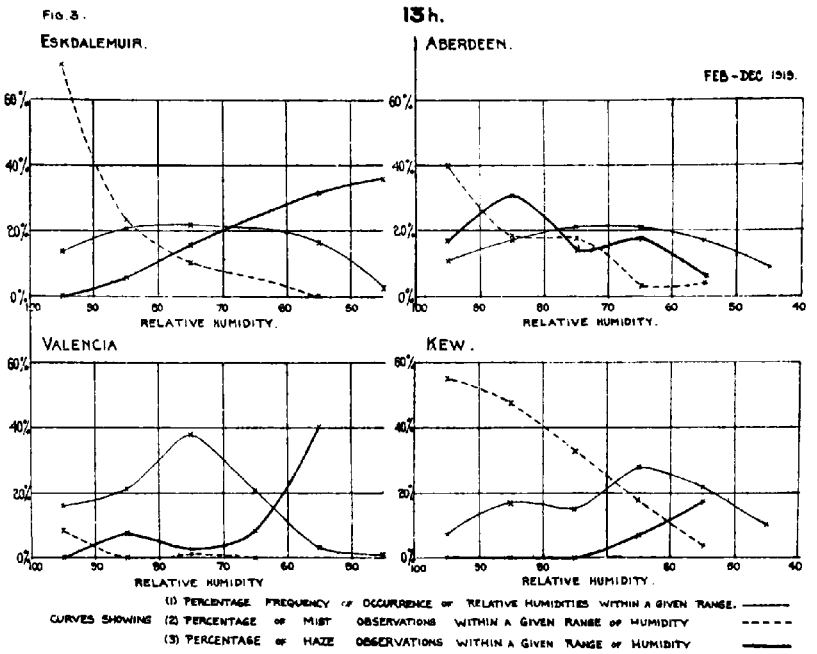
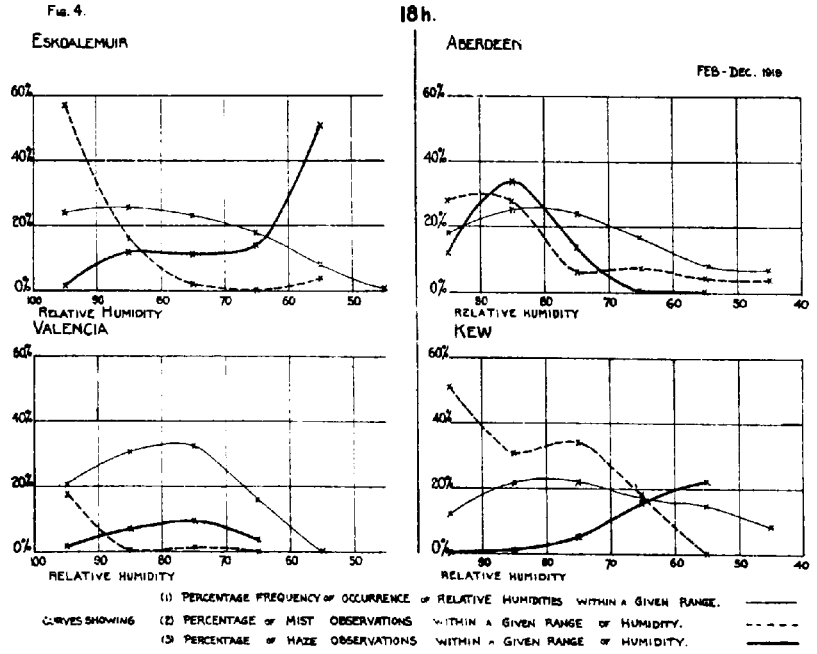

13h.
ESKDALEMUIR.
ABERDEEN.
FEB - DEC 1919.
60%
40%
20%
0%
100 90 80 70 60 50 40
RELATIVE HUMIDITY.
VALENCIA
KEW.
CURVES SHOWING (1) PERCENTAGE FREQUENCY OF OCCURRENCE OF RELATIVE HUMIDITIES WITHIN A GIVEN RANGE.
(2) PERCENTAGE OF MIST OBSERVATIONS WITHIN A GIVEN RANGE OF HUMIDITY
(3) PERCENTAGE OF HAZE OBSERVATIONS WITHIN A GIVEN RANGE OF HUMIDITY

FIG. 4.


18h.
ESKDALEMUIR
ABERDEEN
FEB - DEC. 1919
60%
40%
20%
0%
100 90 80 70 60 50 40
RELATIVE HUMIDITY
VALENCIA
KEW
CURVES SHOWING (1) PERCENTAGE FREQUENCY OF OCCURRENCE OF RELATIVE HUMIDITIES WITHIN A GIVEN RANGE.
(2) PERCENTAGE OF MIST OBSERVATIONS WITHIN A GIVEN RANGE OF HUMIDITY.
(3) PERCENTAGE OF HAZE OBSERVATIONS WITHIN A GIVEN RANGE OF HUMIDITY.

The results are set out below :—

—	Eskdalemuir.			Valencia.			Aberdeen.			Kew.		
	Haze.	No Haze.	Mist.	Haze.	No Haze.	Mist.	Haze.	No Haze.	Mist.	Haze.	No Haze.	Mist.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
7h. ...	84	87	92	85	86	93	87	81	88	77	85	88
13h. ...	64	75	88	71	78	88	77	72	83	58	72	79
18h. ...	69	80	92	78	81	93	84	77	82	63	75	82

The column headed "No haze" includes all cases not described as hazy.

High humidities were most frequent at 7h. at all the observatories and least frequent at 13h. Low values were rare at all hours, especially at 7h. The following table gives the number of days during a period of 275 days from April to December, 1919, on which the relative humidity at 7h. fell below 80 per cent. :—

Eskdalemuir	51	Aberdeen	103
Valencia	57	Kew	76

Note the exceptional position of Aberdeen. The values of the relative humidity which occurred during the period considered varied from about 40 % to 100 %. The points used in plotting the frequency curves were obtained by erecting ordinates at points whose abscissæ corresponded to relative humidities of 95 %, 85 %, 75 %, 65 %, 55 %, and 45 %, the lengths of the ordinates representing the appropriate frequencies for ranges of humidity of 100 %–90 %, 89 %–80 %, 79 %–70 %, 69 %–60 %, 59 %–50 %, and 49 %–40 %.

The thin curves show the percentage frequency of occurrence of humidities of given value at 7h., 13h. and 18h. and therefore also give a measure of the weight to be attached to different portions of the other curves. The thick curves were obtained by taking ordinates representing the percentage of haze observations in each range of humidity, while the dotted curves were drawn in exactly the same way using mist observations instead of haze, the frequencies obtained for each range being referred to the mean humidity of the range. In Fig. 1 the results for all hours are shown collectively ; in Figs. 2, 3 and 4 the results for 7h., 13h. and 18h. are shown separately.

The diagrams show a rapid decrease in the frequency of mist at Eskdalemuir and Valencia as the humidity decreases, and a less rapid decrease at Kew. Haze tends to become more frequent as the humidity decreases at all hours at Kew, a result which is also true for Eskdalemuir at 13h. and 18h. The 13h. Valencia curve shows a similar tendency, but this curve is not based on many observations of low humidity. The Aberdeen curves are very different from the others and suggest a tendency for both haze and mist to disappear in dry air.

(33794–12) Wt. 8273–6215/P.F. 816/275 625 10/21 H. St. G. 3

The divergence in the results for the different observatories suggests that either there has been some confusion in the use of the terms haze and mist or else other causes are at work which have not been taken into account. The observatories are differently situated in relation to manufacturing centres or large towns and therefore vary in their liability to hazy conditions due to smoke. Valencia observatory is on the South-West coast of Ireland and far removed from smoky districts; there are no towns or manufacturing districts in the immediate vicinity of Eskdalemuir, but Glasgow with its large industrial area lies 60 miles to the North-West, Newcastle 65 miles to the East-South-East and Carlisle about 30 miles to the South; Kew observatory is just to the West of London; the observatory at Aberdeen is within the town, which lies on the East coast of Scotland away from large manufacturing centres.