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The Relation Between Average Monthly Cloudiness and the Average Number of Clear and Cloudy Days

65125

(None)

(Not known)

U.S. Army Air Forces, Directorate of Weather, Climatological Div.,*
U.S. Air Force, Air Weather Service, Washington, D. C.

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Oct 42 Unclass. U.S. English 7 table, graphs

A close relation exists between the number of clear and cloudy days and the average cloudiness over a monthly period. These relations have been found by plotting the number of clear and cloudy days against the average monthly cloudiness for representative stations in various parts of the world. A table shows the average monthly cloudiness, and the average number of clear, partly cloudy, and cloudy days for a 30-day month. Curves are given which represent the effects of day-to-day variation in the amount of cloudiness upon the average values of the quantities involved. Cyclonic conditions are usually attended by considerable scattered cloudiness as well as by clear and cloudy days, while convective forms of cloudiness also tend to vary from the average amount.

*Washington, D. C.

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TECHNICAL REPORT 105-20

THE RELATION BETWEEN AVERAGE MONTHLY CLOUDINESS AND THE AVERAGE NUMBER OF CLEAR AND CLOUDY DAYS

OCTOBER 1942

HEADQUARTERS
AIR WEATHER SERVICE
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THE RELATION BETWEEN AVERAGE MONTHLY CLOUDINESS AND THE AVERAGE NUMBER OF CLEAR AND CLOUDY DAYS

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THE RELATION BETWEEN AVERAGE MONTHLY CLOUDINESS AND THE AVERAGE NUMBER OF CLEAR AND CLOUDY DAYS

The record of cloudiness most commonly available expresses the degree of cloudiness in terms of the average percentage of the sky covered by clouds. More useful to aerial operations is the less common statement of cloudiness based on the character of the day, whether clear, partly cloudy, or cloudy. A close relation exists between the number of clear and cloudy days and the average cloudiness since the daily observations are made according to the following definitions[1]:

Type of Day	Average Daily Cloudiness
Clear day	0-20%
Partly cloudy day	30-70%
Cloudy day	80-100%

These relations are not preserved exactly in the monthly averages, which result from various frequencies of different degrees of cloudiness, but new relations appear which are consistent enough to be of practical use. These relations have been found by plotting the number of clear and cloudy days against the average monthly cloudiness for representative stations in various parts of the world. Curves have been drawn by inspection from these graphs

[1]The definitions used here have been decided by international agreement and consequently have been incorporated in the cloudiness records of nearly all countries. The United States is an exception, since its Weather Bureau defines a clear day by average daily cloudiness 0-30%. Airways stations use entirely different definitions which are suited to aerial operations, but the records are still too short and too limited in number to be of world application.

(See Fig. 1 and 2) which in turn have furnished the values for Table 1. This table also includes the number of partly cloudy days whose values represent the remainder of the month after the number of clear and cloudy days have been subtracted.

The curves shown in Figures 1 and 2 represent the effects of day-to-day variation in the amount of cloudiness upon the average values of the quantities involved. For example, a monthly average of 50% of the sky covered by cloud could result from fifteen days cloudiness 0% and fifteen days of cloudiness 100%, or it could result from thirty days of cloudiness 50%. The first case represents the extreme possible alternation between clear and cloudy days that might be experienced with a succession of cyclones and anticyclones, while the second case represents an ideal succession of days with scattered cloudiness that might result from convective activity under persistent air mass conditions.

Examination of the data shows that cyclonic conditions are usually attended by considerable scattered cloudiness as well as by clear and cloudy days, while convective forms of cloudiness also tend to vary from the average amount. Consequently the relation of the average number of clear and cloudy days to the average monthly cloudiness always lies somewhere between the possible extremes illustrated by the preceding examples. The effects of local conditions and those from systematic errors of observation on the part of individual observers (cloudiness

is estimated, not measured) also contribute to the variation that is so noticeable in the comparison of cloudiness data.

Inspection of the scattered points from which the curves of Figures 1 and 2 were drawn shows that a deviation of ± 2 days includes 75% of the points, while a deviation of ± 4 days includes 95% of them. Hence, the average number of clear and cloudy days per month can be determined within fairly close limits provided the average monthly cloudiness is known. The accuracy with which these average figures apply to any one month is of course subject to the same limitations that must be used with averages of other meteorological elements.

Differences in definitions of the clear and cloudy day, remarked upon before, also introduce discrepancies in the cloudiness record. In particular, comparisons of the number of clear days in the United States with other countries must be made with caution, since the clear day as defined by the U.S. Weather Bureau (0-30%) allows more cloudiness than with the international definition. This tends to increase the number of clear days recorded in the United States and its possessions by a variable factor that usually ranges from 1.0 to 2.0, depending upon the type of cloudiness prevailing.

Table 1

~~THE~~ AVERAGE MONTHLY CLOUDINESS AND THE AVERAGE NUMBER OF CLEAR, PARTLY CLOUDY, AND CLOUDY DAYS (30 Day Month)

Per Cent	Number			Per Cent	Number		
Av. mo. cloud.	Clear days (0-20)	Ptly cldy days (30-70)	Cloudy days (80-100)	Av. mo. cloud.	Clear days (0-20)	Ptly cldy days (30-70)	Cloudy days (80-100)
0	-	-	-	35	12	14	4
1	-	-	-	36	12	14	4
2	-	-	-	37	11	15	4
3	30	0	0	38	11	15	4
4	29	1	0	39	10	15	5
5	29	1	0	40	10	15	5
6	28	2	0	41	10	15	5
7	28	2	0	42	9	16	5
8	27	3	0	43	9	16	5
9	27	3	0	44	9	15	6
10	26	4	0	45	8	16	6
11	25	5	0	46	8	16	6
12	25	5	0	47	8	16	6
13	24	5	1	48	8	15	7
14	23	6	1	49	7	16	7
15	23	6	1	50	7	16	7
16	22	7	1	51	7	16	7
17	22	7	1	52	6	16	8
18	21	8	1	53	6	16	8
19	21	8	1	54	6	16	8
20	20	9	1	55	6	15	9
21	19	9	2	56	5	16	9
22	19	9	2	57	5	16	9
23	18	10	2	58	5	15	10
24	18	10	2	59	5	15	10
25	17	11	2	60	4	16	10
26	16	12	2	61	4	15	11
27	16	12	2	62	4	15	11
28	15	12	3	63	4	15	11
29	15	12	3	64	3	15	12
30	14	13	3	65	3	15	12
31	14	13	3	66	3	14	13
32	13	14	3	67	3	14	13
33	13	14	3	68	3	14	13
34	12	14	4	69	3	13	14

Table 1 (Cont.)

AVERAGE MONTHLY CLOUDINESS AND THE AVERAGE NUMBER OF CLEAR, PARTLY CLOUDY, AND CLOUDY DAYS (30 Day Month)

Per Cent	Number		
Av. mo. cloud.	Clear days (0-20)	Ptly cldy days (30-70)	Cloudy days (80-100)
70	2	14	14
71	2	13	15
72	2	13	15
73	2	12	16
74	2	12	16
75	1	12	17
76	1	12	17
77	1	11	18
78	1	10	19
79	1	10	19
80	1	9	20
81	1	9	20
82	1	8	21
83	1	8	21
84	1	7	22
85	0	7	23
86	0	7	23
87	0	6	24
88	0	5	25
89	0	4	26
90	0	4	26

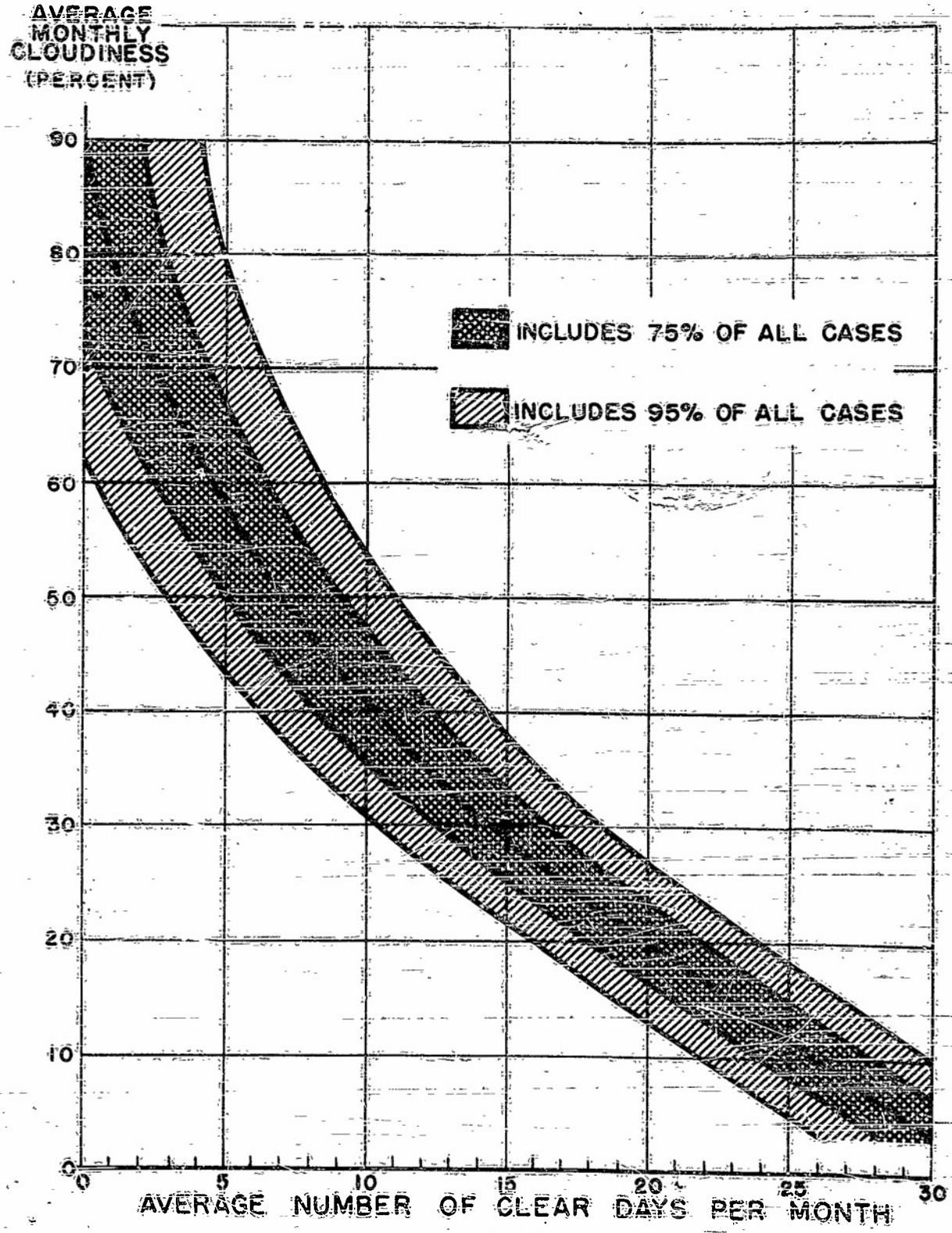
AVERAGE MONTHLY CLOUDINESS (PERCENT)
90
80
70
60
50
40
30
20
10
0
INCLUDES 75% OF ALL CASES
INCLUDES 95% OF ALL CASES
0
5
10
15
20
25
30
AVERAGE NUMBER OF CLEAR DAYS PER MONTH

FIG. I

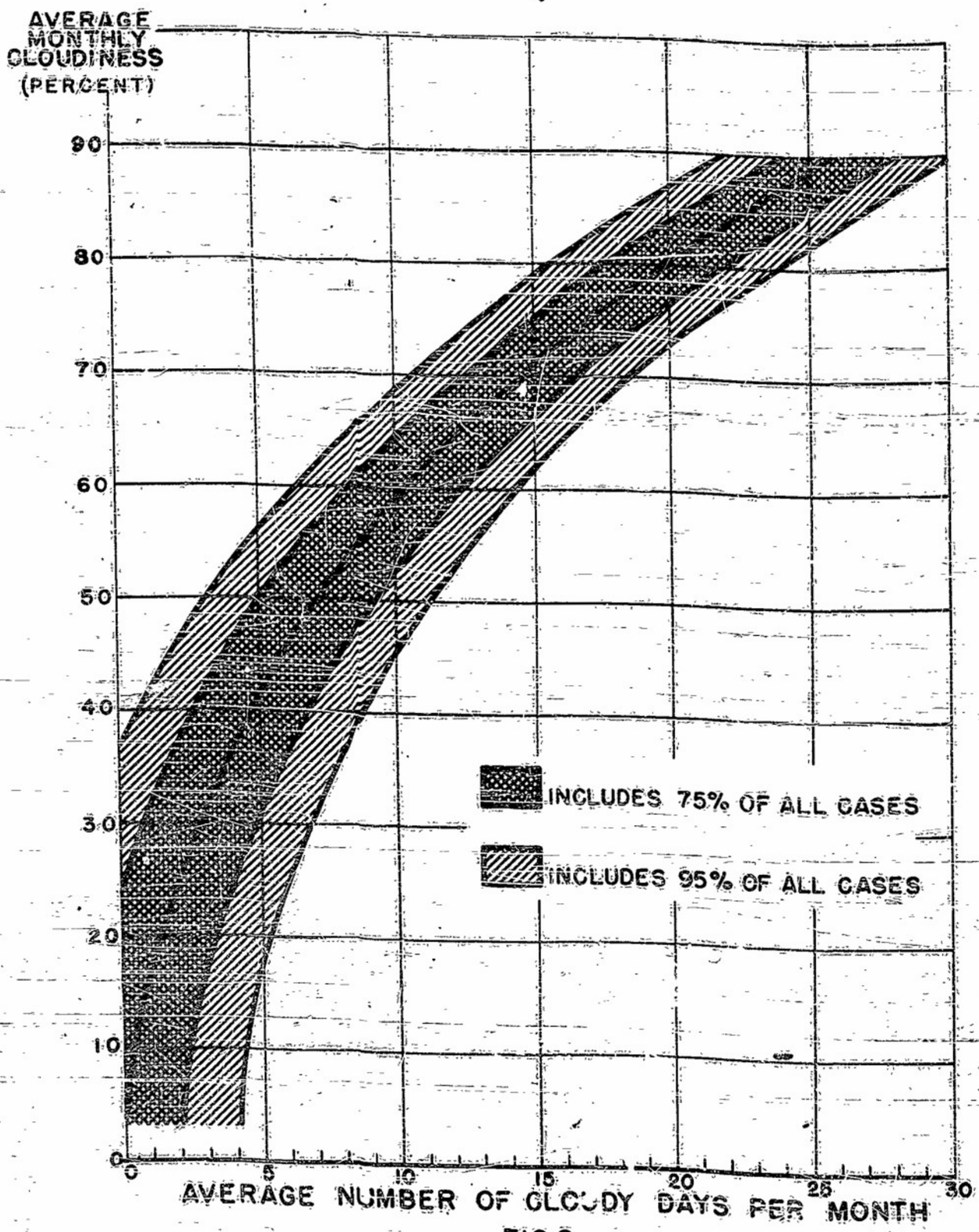
AVERAGE MONTHLY CLOUDINESS (PERCENT)
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
INCLUDES 75% OF ALL CASES
INCLUDES 95% OF ALL CASES
AVERAGE NUMBER OF CLOUDY DAYS PER MONTH

FIG. 2