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THE USE OF WIND STRATIFIED CONDITIONAL CLIMATOLOGY TABLES. (U)
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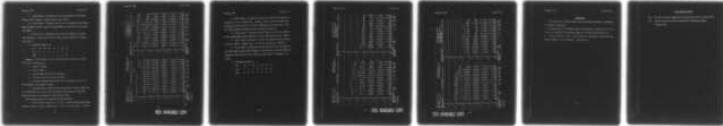
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5TH WEATHER WING

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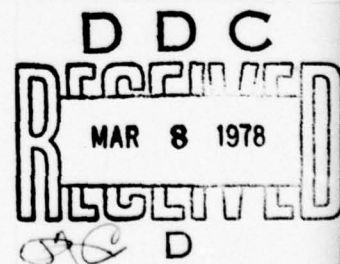
THE USE OF WIND STRATIFIED
CONDITIONAL CLIMATOLOGY TABLES

FEBRUARY 1978

PUBLISHED BY AEROSPACE SCIENCES DIVISION

FIFTH WEATHER WING

LANGLEY AFB, VIRGINIA 23665



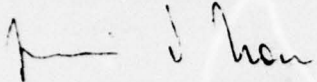
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This technical note supersedes 5 WW Technical Note 72-2.

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This technical note has been reviewed and is approved for publication.

FOR THE COMMANDER



JURI V. NOU, Colonel, USAF
Chief, Aerospace Sciences Division

10 February 1978

5TH WEATHER WING
TECHNICAL NOTE 78-1

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CONDITIONAL CLIMATOLOGY TABLES

FEBRUARY 1978

AEROSPACE SCIENCES DIVISION
FIFTH WEATHER WING
LANGLEY AIR FORCE BASE, VIRGINIA

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THE USE OF WIND STRATIFIED CONDITIONAL CLIMATOLOGY TABLES

PURPOSE

This technical note is a guide for the use of the conditional climatology (C-C) tables prepared by the USAF Environmental Technical Applications Center (USAFETAC). It is intended for use by weather forecasters who are not familiar with C-C tables.

INTRODUCTION

Most weather forecasters are acquainted with the term "persistence", which has been used as a performance standard in the Air Weather Service (AWS) terminal forecast (TF) verification program for some time. Persistence implies that the type of weather occurring at forecast time will continue throughout the forecast period without change. As long as the weather is unchanged, the persistence forecast verifies 100%, although it is evident that the persistence forecast will miss all the changes. Over a period of time, a skilled forecaster should be able to out-score persistence. This is particularly true if he or she normally forecasts persistent weather conditions, unless synoptic evidence (e.g., the approach of a cyclone, front, ridge, etc.) indicates that the weather will change.

Over the years we have accumulated a wealth of climatological data for most of our terminals. Conditional climatology summaries were developed to use these data for forecasting. These summaries were also used to establish performance standards by some AWS wings. A detachment's forecast was compared against the forecast derived from the summary by extracting the

category with the highest probability of occurrence at a designated verification time.

As a result of the AWS Centralized Terminal Forecast Program (CTFP), new C-C summaries were prepared by the USAFETAC for all AWS forecasting detachments in the United States. These are called Wind-Stratified Conditional Climatology (WSCC) Summaries. Given an initial wind direction sector and ceiling or visibility category, the summaries simply indicate the probability of a particular category remaining the same or changing, based on the past history of weather changes at the station. The addition of wind sector stratification provides a basis for judgement by the weather forecaster. Thus, another tool became available to formulate the forecast.

BASIC DESIGN OF C-C TABLES

About 1972, USAFETAC changed the format for the C-C tables. The tables produced prior to that time were normally stratified into six ceiling and six visibility categories for each of the three wind direction sectors, one of which included calm wind observations. The present tables can have any number of wind sectors, plus separate tables for Calm and All. In addition, the categories for ceiling and visibility are separated, so that the forecaster can determine which element may cause a forecast problem. The criteria used to determine the various categories are listed in Table 1.

The tables are normally limited to five wind sectors. This limitation allows for a sufficient number of cases for calculating meaningful probabilities. This limitation also keeps computer time and the number of pages printed to minimum. In special cases, additional sectors may be requested.

Table 1

CATEGORIES AND CRITERIA

| <u>TAFVER CATEGORY</u> | <u>WSSC CATEGORY</u> | <u>CRITERIA</u> |
|------------------------|----------------------|---|
| A | A | Less than 200 ft |
| B | B | Equal to or greater than 200 ft but less than 500 ft |
| | C | Equal to or greater than 500 ft but less than 1,000 ft |
| C | D | Equal to or greater than 1,000 ft but less than 3,000 ft |
| D | E | Equal to or greater than 3,000 ft but less than 10,000 ft |
| | F | Equal to or greater than 10,000 ft |

| <u>TAFVER CATEGORY</u> | <u>WSSC CATEGORY</u> | <u>CRITERIA (In Statute Miles)</u> |
|------------------------|----------------------|--|
| A | J | Less than ½ mile |
| B | K | Equal to or greater than ½ mile but less than 1 mile |
| | L | Equal to or greater than 1 mile but less than 2 miles |
| C | M | Equal to or greater than 2 miles but less than 3 miles |
| D | N | Equal to or greater than 3 miles but less than 6 miles |
| | O | Equal to or greater than 6 miles |

If a station chief does request a new set of tables, (s)he must subjectively classify wind direction sectors to identify the most desirable wind stratification for that particular location. All requests must follow AWSR 105-18 procedures and should only be made if current tables are unsatisfactory.

FORMAT OF WSCC SUMMARIES

The WSCC Summaries are set up as follows (see Figures 1 through 4):

1. The tables are stratified by month, two-hourly time block, and wind sector.
2. The individual tables are further stratified into six categories for ceiling and six categories for visibility. These categories do not directly correspond to the forecast verification categories used by AWS. Table 1 lists both sets of categories for comparison.
3. Statistics are given hourly up to the 6 hour point, 3 hourly up to the 18 hour point, 6 hourly up to the 24 hour point, and 12 hourly up to the 48 hour point.

INFORMATION CONTAINED IN THE C-C TABLES

The C-C tables contain:

1. The probability of occurrence of a ceiling or a visibility category for the specified hour subsequent to the initial time.
2. The percentage frequency of occurrence of a given category over the period of record used to formulate the C-C tables.
3. The number of times that a specific category was observed under a given set of initial conditions (i.e., month, hour, and wind sector).

The statistics in the C-C table are probabilities of occurrence based on past events. The tables will, in most cases, narrow the range of possible events and prevent the forecast of a category that has little chance of occurring. However, attempts to use the exact percentages at any time should be avoided. The most significant information is the hour-by-hour trend indicated by the table. The trend is significant, provided that the wind direction is not expected to change. If the wind is forecast to change, the appropriate C-C table should be used from that time on.

The number of occurrences of the category simply shows how much data were available to calculate the probabilities listed. Naturally, the statistics are more meaningful when based on one hundred occurrences rather than on ten.

The percentage frequency of occurrence can be used as a subjective measure of confidence. The higher the percentage frequency of a given category, the more confidence one can place in a forecast for that event. A percentage frequency of less than twenty has a small likelihood of verifying. Statistically, if a given condition occurs 20 percent of the time, then--conversely--it does not occur 80 percent of the time. It should be emphasized, however, that using only this kind of reasoning could also cause a forecaster to miss forecasting the occurrence of a rare event.

Another factor, of which the forecaster should be aware, is that the C-C tables are skewed toward good weather. Thus, over-reliance on the tables will cause a forecaster to be too optimistic. In situations when deteriorating conditions are expected, the forecaster should rely more

heavily on other forecasting aids. The C-C tables can then be used as a guide to determine the extent of deterioration of the existing conditions.

EXAMPLES

To illustrate the use of WSCC Summaries, two examples for Langley AFB, VA are provided.

Example 1. The forecast is for a six-hour period, starting at 0700L. The initial conditions are:

1. Month is October.
2. Time is 0630L.
3. Surface winds are from the south.
4. Ceiling is overcast at 300 feet.
5. Visibility is 3/8 of a mile in fog.
6. A cold front is approaching the station and the wind is forecast to shift from the south to northwest by 0900L.

The following steps will determine the WSCC forecast:

1. Using the initial conditions 1, 2, and 3, locate the appropriate WSCC summary. E.g., the upper right hand corner of Figure 1 shows month (October), hour (06-07 LST), and wind sector (169-281).
2. Using Table 1 and initial conditions 4 and 5, note the ceiling and visibility categories (a ceiling at 300 feet corresponds to Category B; visibility of 3/8 of a mile corresponds to Category J).
3. Using Figure 1, determine the ceiling probabilities through 0900L (Category B should persist until 0800L and then improve to Category C by 0900L).
4. Using initial condition 6, locate the appropriate WSCC summary (Figure 2; month: October, hour: 08-09 LST, wind sector: 282-011).

5. Using Figure 2, determine the ceiling probability from 0900L through 1300L (Category C should persist until 1300L).

6. Using Figure 1, determine the visibility probabilities through 0900L (Category J should persist through 0800L and then improve to Category L by 0900L).

7. Using Figure 2, determine the visibility probability through 1300L (Category L should persist until 1000L and then improve to Category N by 1100L).

8. The WSCC forecast is:

| | | | | | | | |
|------|----|----|----|----|----|----|----|
| LST | 07 | 08 | 09 | 10 | 11 | 12 | 13 |
| CIG | B | B | C | C | C | C | C |
| VSBY | J | J | L | L | N | N | N |

Example 2. The forecast is for a six-hour period, starting at 1600L.

The initial conditions are:

1. Month is October.
2. Time is 1530L.
3. Surface winds are from the southwest.
4. Ceiling and visibility are unlimited.
5. A front is approaching and the wind is forecast to shift from the southwest to northwest by 1800L.

6. Stations west of Langley AFB are reporting ceilings at 2000 feet and visibilities of 4 miles, with rainshowers associated with the front.

These conditions are expected at Langley AFB by 1700L.

The following steps will determine the WSCC forecast:

1. Using initial conditions 1, 2, and 3, locate the appropriate WSCC Summary (Figure 3; month: October, hour: 16-17 LST, wind sector: 169-281).

| DATA PROCESSING BRANCH | | STATION 13722 | | CONDITIONAL CLIMATOLOGY | | | | | | | | | | | | |
|-------------------------|-------|------------------------|-----|-------------------------|------|------|------|-----|-----|-----|-----|-----|---|---|---|---|
| USAF ETAC | | HAMPTON VA/LANGLEY AFB | | MONTH OCTOBER | | | | | | | | | | | | |
| AIR WEATHER SERVICE/MAC | | PCR FEB 37-JAN 72 | | HOUR 08-09 LST, 13-14 Z | | | | | | | | | | | | |
| SIGHTING CATEGORY | | FOLDS SWEETENED | | WIND SECTOR 782-011 | | | | | | | | | | | | |
| INIT SUBS | | VISIBILITY CATEGORY | | HOURS SUBSEQUENT | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 9 | 12 | 15 | 18 | 24 | 36 | 48 | | | | |
| A | 100 | 100 | 100 | 100 | 100 | J | K | 33 | 33 | 33 | 33 | 33 | | | | |
| B | 100 | 100 | 100 | 100 | 100 | L | M | 33 | 33 | 33 | 33 | 33 | | | | |
| C | 100 | 100 | 100 | 100 | 100 | N | O | 33 | 33 | 33 | 33 | 33 | | | | |
| D | 100 | 100 | 100 | 100 | 100 | P | Q | 33 | 33 | 33 | 33 | 33 | | | | |
| E | 100 | 100 | 100 | 100 | 100 | R | S | 33 | 33 | 33 | 33 | 33 | | | | |
| F | 100 | 100 | 100 | 100 | 100 | T | U | 33 | 33 | 33 | 33 | 33 | | | | |
| OBS | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| B | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | | |
| C | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | | | |
| D | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | | | | |
| E | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | | | | |
| F | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | | | | |
| OBS | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | 31 | | | | |
| C | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | |
| D | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | | |
| E | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | | | |
| F | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | | | | |
| OBS | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | 52 | | | | |
| D | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | | |
| E | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | | | | |
| F | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | | | | |
| OBS | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | | | | |
| E | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | | | |
| F | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | | | | |
| OBS | 423 | 423 | 423 | 423 | 423 | 423 | 423 | 423 | 423 | 423 | 423 | 423 | | | | |
| A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| B | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| C | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| E | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| F | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| OBS | 423 | 423 | 423 | 423 | 423 | 423 | 423 | 423 | 423 | 423 | 423 | 423 | | | | |
| INITIAL CATEGORY | ALL | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
| PERCENTAGE | 100.0 | 2 | 47 | 0 | 12.1 | 10.3 | 04.8 | | | | | | | | | |
| TOTAL OBS | 633 | 1 | 31 | 52 | 79 | 67 | 423 | | | | | | | | | |

Figure 2

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2. Using Table 1, unlimited ceiling and visibility correspond to Categories F and 0, respectively. However, since a ceiling at 2000 feet (Category D) and visibility of 4 miles (Category N) are expected by 1700 LST, these categories should be used, starting at 1700 LST.

3. Using Figure 3, determine the ceiling and visibility probabilities through 1800L (both Categories D and N should persist until 1800L).

4. Using initial condition 5, locate the appropriate WSCC summary (Figure 4; month: October, hour: 18-19 LST, wind sector: 282-011).

5. Using Figure 4, determine the ceiling and visibility probabilities from 1800L through 2200L (Category D should persist through 2200L and Category N should persist until 2000L and then improve to Category 0 by 2100L).

6. The WSCC forecast is:

| | | | | | | | |
|------|----|----|----|----|----|----|----|
| LST | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| CIG | F | D | D | D | D | D | D |
| VSBY | 0 | N | N | N | N | 0 | 0 |

| DATA PROCESSING BRANCH | | STATION 13702 | | CONDITIONAL CLIMATOLOGY | |
|-------------------------|---|------------------------|---------------------------------|---|---|
| USAF ETAC | | HAMPTON VA/LANGLEY AFB | | MONTH OCTOBER | |
| AFR WEATHER SERVICE/MAC | | PER FEB 37-JAN 72 | | HOUR 18-19 LST, 23-00 Z | |
| CEILING CATEGORY | | HOURS SUBSEQUENT | | WIND SECTOR 282-011 | |
| INIT SUBS | 1 2 3 4 5 6 9 12 13 16 24 36 48 | VISIBILITY CATEGORY | | HOURS SUBSEQUENT | |
| INIT SUBS | 1 2 3 4 5 6 9 12 15 18 24 36 48 | INIT SUBS | 1 2 3 4 5 6 9 12 15 18 24 36 48 | | |
| A | 9 16 9 9 16 27 9 27 | J | J | | |
| B | 72 54 55 64 64 45 18 27 9 27 | K | K | | |
| C | 9 18 18 18 18 27 18 36 36 36 | L | L | | |
| D | 9 18 18 18 18 27 18 36 36 36 | M | M | | |
| E | 18 9 | N | N | | |
| F | 27 27 55 91 100 | O | O | | |
| OBS | 11 11 11 11 11 11 11 11 11 11 | | | | |
| B | 14 14 5 5 5 9 9 5 5 5 10 5 | L | L | | |
| C | 62 36 34 32 35 36 36 23 23 18 5 23 5 | K | K | 17 17 17 | 17 17 17 33 33 17 |
| D | 19 41 48 50 41 36 29 32 41 32 29 19 27 | L | L | 17 17 17 | 17 17 17 33 33 17 |
| E | 5 5 5 5 9 14 14 14 14 11 7 19 | M | M | 67 33 30 33 17 17 17 | 50 50 17 17 |
| F | 5 5 9 9 14 19 23 32 36 29 41 50 | N | N | 17 33 17 33 50 67 67 | 50 67 67 83 83 100 |
| OBS | 21 22 21 22 22 22 21 22 22 21 22 22 | | | 6 6 6 6 6 6 6 6 6 6 6 6 | 6 6 6 6 6 6 6 6 6 6 6 6 |
| C | 1 2 2 2 2 2 2 1 4 4 4 4 5 3 | M | M | 11 22 11 22 33 22 | 11 |
| D | 9 13 12 15 16 15 13 14 17 13 6 9 4 | K | K | 11 11 11 11 22 33 22 | 11 |
| E | 67 52 45 40 34 34 33 26 24 24 26 18 10 | L | L | 44 11 11 11 11 11 11 | 11 11 |
| F | 11 18 23 24 22 20 12 16 14 11 11 7 19 | N | N | 22 44 36 44 44 44 44 | 33 33 11 11 |
| OBS | 12 14 17 21 26 29 35 38 40 47 51 60 73 | | | 11 11 22 22 22 22 22 22 22 22 44 67 100 100 100 | 11 22 67 78 9 9 9 9 9 9 9 9 9 9 9 9 |
| E | 1 2 2 2 2 2 2 1 2 2 2 2 2 2 | N | N | 4 4 5 2 2 2 2 2 2 2 2 2 2 2 | 2 2 2 2 2 2 2 2 2 2 2 2 2 2 |
| C | 11 14 14 12 14 9 20 16 13 17 11 6 6 | L | L | 4 4 2 4 5 5 4 | 4 4 4 4 4 4 4 4 4 4 4 4 4 4 |
| D | 72 56 44 38 34 34 19 17 11 18 19 11 13 | M | M | 67 53 45 36 25 25 33 29 16 21 18 21 14 | 16 21 18 21 14 14 14 14 14 14 14 14 14 14 14 |
| F | 16 27 39 48 51 52 58 62 69 61 68 77 72 | O | O | 20 40 47 57 63 61 56 50 64 66 73 61 80 | 61 80 80 80 80 80 80 80 80 80 80 80 80 80 80 |
| OBS | 50 50 90 89 50 90 90 90 90 90 90 90 90 | | | 54 55 55 56 56 56 56 56 56 56 56 56 56 56 56 | 56 56 56 56 56 56 56 56 56 56 56 56 56 56 56 |
| F | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | O | O | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| B | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | K | K | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| C | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | L | L | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| D | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | M | M | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| E | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | N | N | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| F | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | O | O | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 |
| OBS | 216 216 216 216 214 214 214 214 214 214 214 214 215 216 | | | 359 359 360 359 358 358 358 358 358 358 358 358 358 359 360 | 358 358 358 358 358 358 358 358 358 358 358 358 358 359 360 |
| INITIAL CATEGORY | ALL 100% | INITIAL CATEGORY | ALL 100% | | |
| PERCENTAGE | 100% | PERCENTAGE | 100% | | |
| TOTAL OBS | 431 | TOTAL OBS | 431 | | |

Figure 4

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