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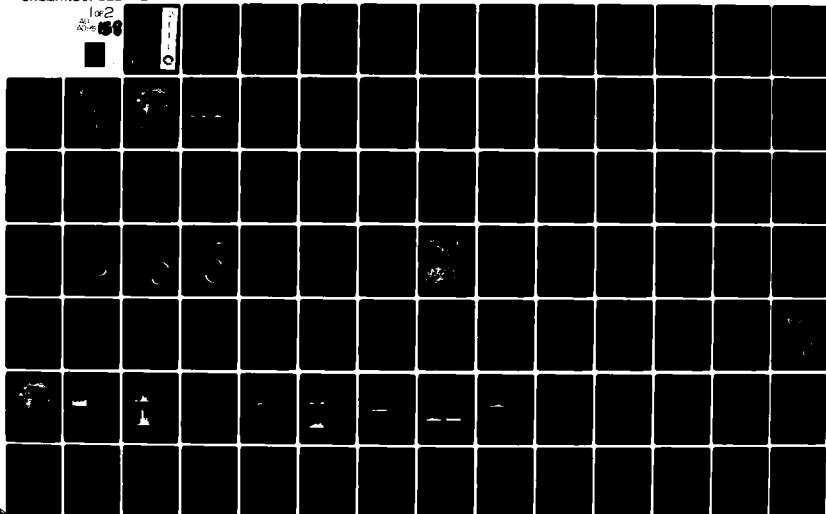
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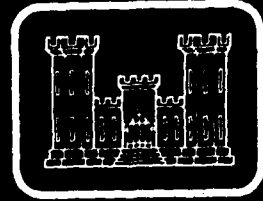
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  This procedural guide provides the Army Terrain Analyst with the methods and procedures necessary to generate a thematic or factor overlay with supportive tables for portraying climate. Seven potential sources of information are considered: climatic summaries; climatic studies and climatic atlases; geographic studies and atlases; maps (climatic); technical literature; aerial photography; and maps (topographic). Procedures for extracting climatic information (data elements) from these sources are presented. Appendices provide the analysts with additional		

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# PREFACE

This Procedural Guide for Climate, produced under authority contained in Project 4A762707A855, Task C, "Military Geographic Analysis Technology", is the fifth in a series of terrain analysis guides that will be produced in the next 2 years in support of the Military Geographic Information (MGI) subsystem of the Topographic Support System (TSS). Because these guides are intended to be published as Department of Defense Technical Manuals, critical comment and suggestions are requested by the author. This work was conducted under the supervision of Mr. Alexander R. Pearson, Chief, Topographic Products Design and Development Group, Mr. A. C. Elser, Chief, MGI Data Processing and Products Division, and Mr. Kent T. Yoritomo, Director, Geographic Sciences Laboratory, US Army Engineer Topographic Laboratories (ETL), Fort Belvoir, Virginia.

COL Daniel L. Lycan, CE, was Commander and Director and Mr. Robert P. Macchia was Technical Director of the Engineer Topographic Laboratories during the study and report preparation.

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	Full Size Climate Table No. 2	Pocket

## TERRAIN ANALYSIS PROCEDURAL GUIDE FOR CLIMATE

### I. INTRODUCTION

#### A. Purpose.

The purpose of this report is to provide terrain analysts with step-by-step procedures for collecting and analyzing climatic information and recording the results in the form of factor overlays. Procedures are provided for using eight types of sources: 1:250,000 scale topographic maps; climatic summaries; climatic studies and climatic atlases; geographic studies and atlases; climatic maps; technical literature; imagery; and large-scale topographic maps.

#### B. Background.

The first step in generating terrain intelligence and preparing special purpose products is to extract the data contained in a variety of source materials and reduce it to a uniform format. This first step of extracting data from available sources, then reducing and recording it in the desired form, is the most laborious and time-consuming step in the production cycle. If the extraction process is delayed until a production requirement is imposed, the response time would be increased. However, if the extracting, reducing, and recording is performed in advance and the preformatted results maintained in the data base, the time required to respond to a production requirement can be greatly reduced. One practical method of producing this information is the factor overlay concept, which records the results of the climate analysis for the data base.

In figure 1, the factor overlay concept for preformatting data is shown in the form of factor overlays registered to standard military topographic maps. Under this concept, data are extracted from various source materials and recorded on factor overlays and/or supporting data tables. Separate overlays and tables are prepared for each major terrain subject or data field, e.g. surface materials, surface configuration, vegetation, drainage, roads, and climate. Factor overlays and tables are intermediate data base products intended primarily as tools for the terrain analyst and are not customarily distributed outside of the topographic and intelligence community.

Factor overlays are used in various combinations to generate factor-complex maps that become, in effect, the manuscripts for special purpose products, such as cross-country movement, fields of fire, IPB (Intelligence Preparation of the Battlefield) graphics, etc. The data elements appearing on complex maps become inputs for analytical performance prediction models. For example, preparing a cross-country movement (CCM) map would begin by combining the overlays for surface configuration, surface materials, and vegetation into a complex map. Those data elements affecting CCM, i.e. slope, stem spacing, stem diameter, soil strength, etc., are then recorded in the complexed areas of the map. When processed by analytical models, these

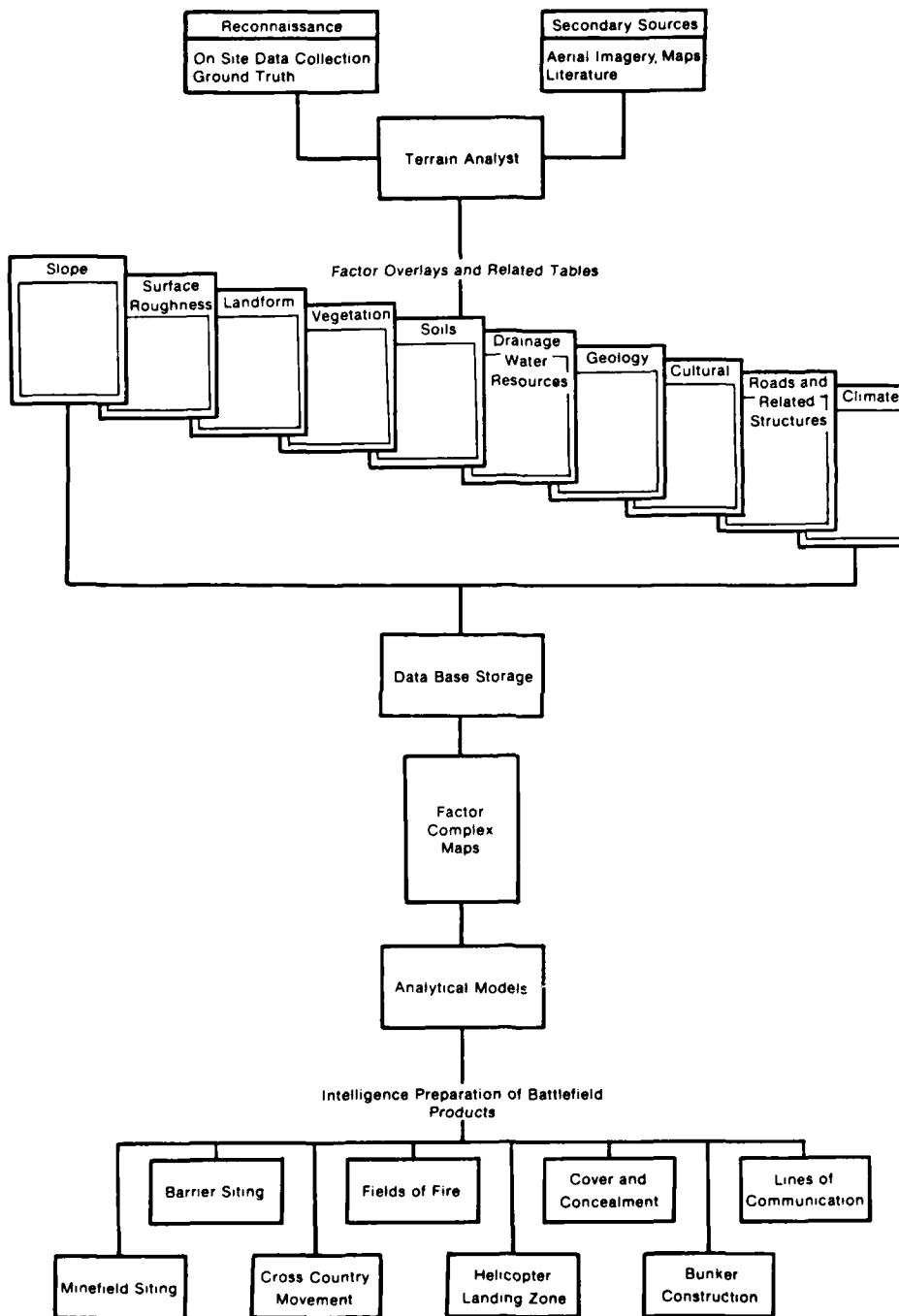


Figure 1. Production and Use of Factor Overlays and Data Tables.

elements are transformed into vehicle speed predictions for each complexed area.

The climate product, as envisioned by this guide, is a tabulation of climatic data, with a factor map overlay showing the location of weather stations documented in the tables. The climatic data will become part of the data base described above. However, the complexing, or stacking, of factor overlays will not apply to the climate product. There are two reasons for this. Firstly, unlike most factor maps, climate overlays are registered to 1:250,000 scale topographic maps. Secondly, because of the universal practice of recording climatic data on a month-by-month basis, it would be impractical to plot such data on factor overlays. It would entail preparing 12 separate sheets for each climatic element, involving hundreds of overlays. Therefore, information on the factor map for the climate data field will be limited to locating and identifying weather stations. However, pertinent climatic data will be recorded in the data tables. Although not a tool in the normal overlay complexing system, information describing the climate of a mapped area will be used in preparing battlefield graphics by identifying significant seasonal and monthly variations in such natural terrain elements as precipitation-soil moisture, stream levels, ice thickness, snow cover, obstructions to visibility, sky cover, etc.

The source materials used in preparing the factor overlay for climate will include those given in figure 1. The amount and type of data collected will depend on the analyst's training, amount of reference literature, availability of climatic data, geographic region, and the type and scale of the aerial imagery that can be obtained.

It is recommended that the analyst be familiar with the contents of the following training manuals, field manuals, and texts:

TM 5-1, Specifications for Military Maps, Department of the Army, Corps of Engineers, Army Map Service, Vol. I and Vol. II, 1973.

TM 5-248, Foreign Maps, Headquarters, Dept of the Army, 1963.

TM 30-245, Image Interpretation Handbook, Vol. I, Department of the Army, Navy, and Air Force, 1967.

FM 21-26, Map Reading, Headquarters, Department of the Army, 1969.

FM 21-31, Topographic Symbols, Headquarters, Department of the Army, 1961.

FM 30-5, Combat Intelligence, Headquarters, Department of the Army, 1973.

FM 30-10, Military Geographic Intelligence, Headquarters, Department of the Army, 1972.

FM 31-3 AFM 105-4, Weather Support for Field Army Tactical Operations,  
Department of the Army and the Air Force.

AR 115-10, AFR 105-3, Environmental Services Meteorological Support For  
The U.S. Army, Departments of the Army and the Air Force, June 1970.

AR 115-2, U.S. Army Requirements for Air Weather Service.

Interpretation of Aerial Photographs, 2nd Edition, Avery, T.E., Burgess  
Publishing Co., Minneapolis, Minnesota, 1968.

### C. Climate (Overview)

1. Introduction. The terms "weather" and "climate" are often used interchangeably. It is not uncommon to find climatic data, as well as climatic studies, listed as categories under the broad heading of "weather information." Generally speaking, the same information (basic data) is used in predicting current weather conditions and in predicting future climatic patterns. In the former, current weather data (temperature, precipitation, winds, pressure, etc.) occurring at a specific time and at a specific location are used to make assessments of weather conditions, up to about 5 days beyond the time of the basic observations. In this use of weather information, the time factor is very critical. The information is short lived from the point of view of its value for predicting day-by-day weather. However, such data, recorded and averaged over a period of years, become the raw material used in climatology. From the data, long term averages are formulated, enabling the user to establish what the climatic regime will be within a particular region, monthly and seasonally. Thus, because of the very limited time span associated with current weather-forecasting capabilities, the methods of climatology must be used in long range military planning.

Although it does not enable the analyst to predict whether rain will fall or a storm system will pass, climatic information will provide the best data for predicting general weather patterns during a specific future period.

Temperature, precipitation, humidity, winds, and air pressure are primary elements of weather and climate, and they in turn are the products of one or more climatic controls; (1) sun (latitude), (2) land and water masses, (3) semipermanent high and low pressure cells, (4) prevailing winds, (5) air masses, (6) altitude, (7) mountain barriers, (8) ocean currents, and (9) jet stream locations.

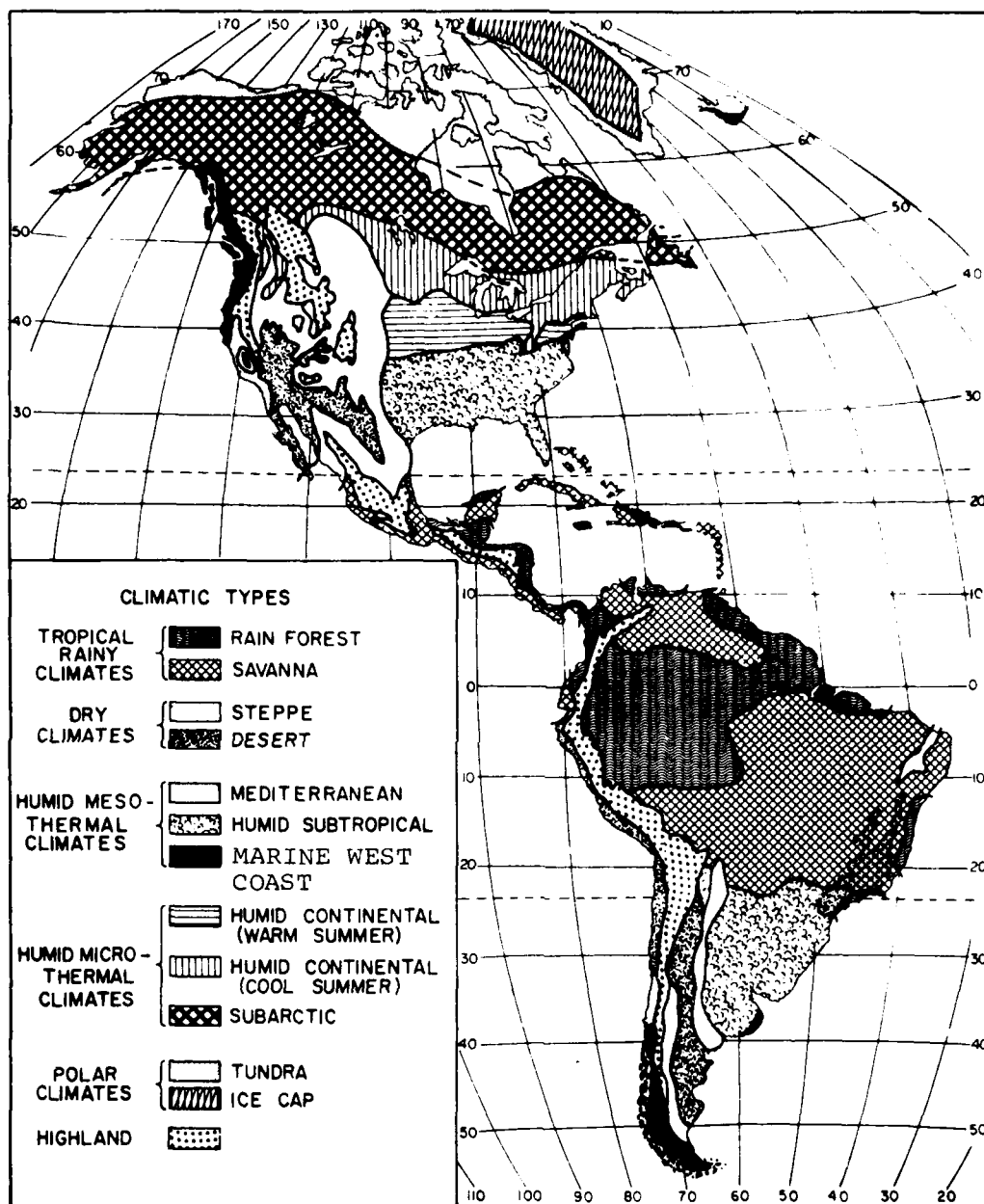
The accuracy of weather predictions, based on climatic records, will vary greatly from place to place. Certain areas along the equator experience daily weather that is so constant throughout the year that weather and climate are virtually the same. In other regions, particularly

in continental midlatitude areas (the belt of prevailing westerlies), the meeting of contrasting air masses spawn rapid and frequent weather changes that may be predicted only on the basis of estimated frequency of occurrence within each month.

2. Climatic Types and Their Distribution. Although global climate is made up of innumerable regional climates, climatologists have developed generalized systems that they have applied to world classifications. In figures 2 and 3 a worldwide classification is shown, with delineating boundaries of climatic regions, based on long term climatological averages of temperature and precipitation.

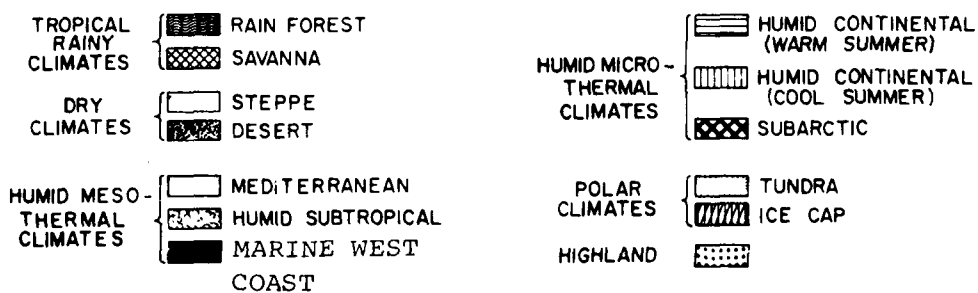
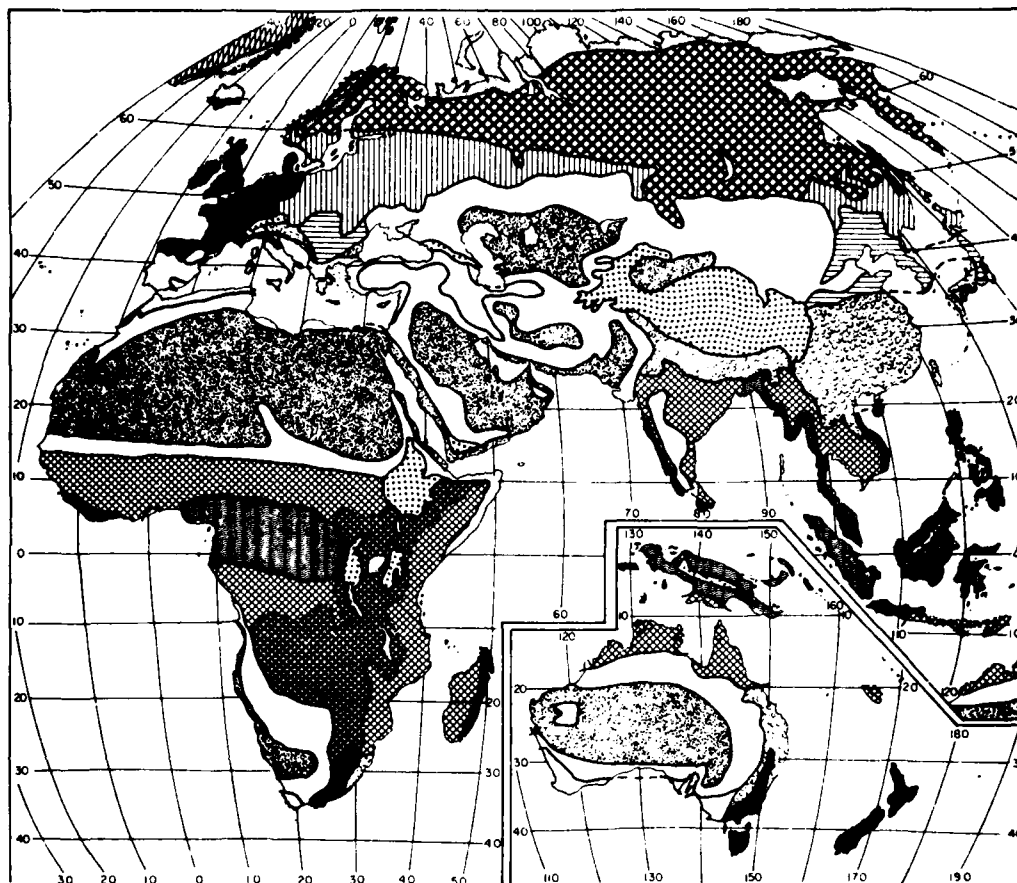
In collecting and tabulating climatic elements, the terrain analyst must acquire an understanding of the distribution and characteristics of major climatic types. In appendix B, each of the climatic regimes mapped in figures 2 and 3 are discussed briefly, with individual graphs depicting the temperature-precipitation regimes upon which the classifications are based. All of the climographs are for northern hemisphere stations. In this regard, it should be realized that the annual temperature at a southern location will be opposite that of a northern hemisphere location. Also, similar differences will be apparent in the precipitation data. Figure 4 depicts temperature and precipitation in identical climatic types, one location in the northern hemisphere and the other in the southern hemisphere.

Appendix B provides the analyst with information required to identify the climatic type for each station entered in the data tables.



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Figure 2. Western Hemisphere - Climatic Classifications.



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Figure 3. Eastern Hemisphere - Climatic Classifications.



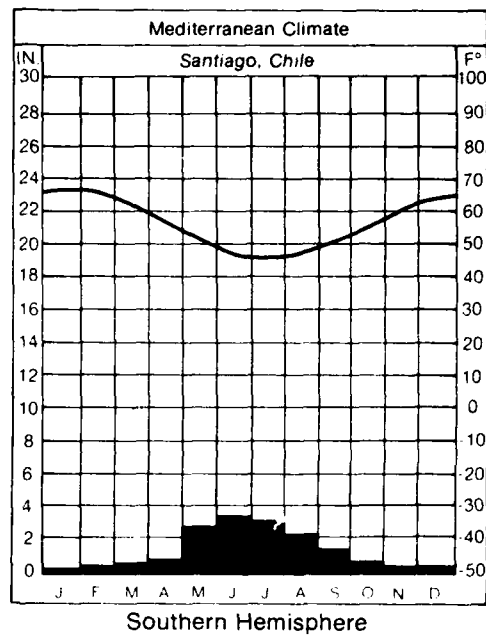
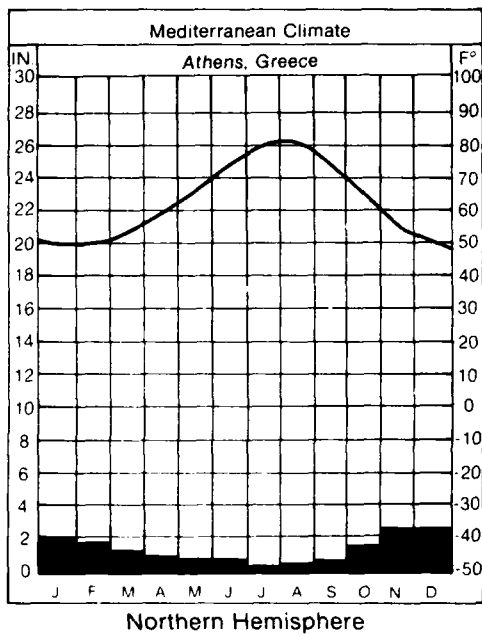


Figure 4. Comparison of Annual Climatic Regimes.

#### D. Data Elements.

The following list of data elements has been extracted from standard climatic summaries (appendix C) and represents most of the climatic data categories that the terrain analyst will encounter in a search for worldwide data. These elements make up the content of Data Tables 1 and 2 (figures 6 and 7) in a format providing for the entry of monthly and annual values for each data element. Wording, numerical values, and units of measurement have been retained as they appear in the summaries from which they have been extracted to facilitate the task of retrieving and entering climatic data in the tables.

Because this list of data elements includes items from many summaries that differ in the type and amount of climatic information recorded, the retrieved data for any single station will make up only a small percentage of the total possible entries listed in the data tables.

Figures 5, 6, and 7 illustrate the format of the Factor Overlay and the two Data Tables for Climate. For more detailed information on the overlay and data tables, see appendix A.

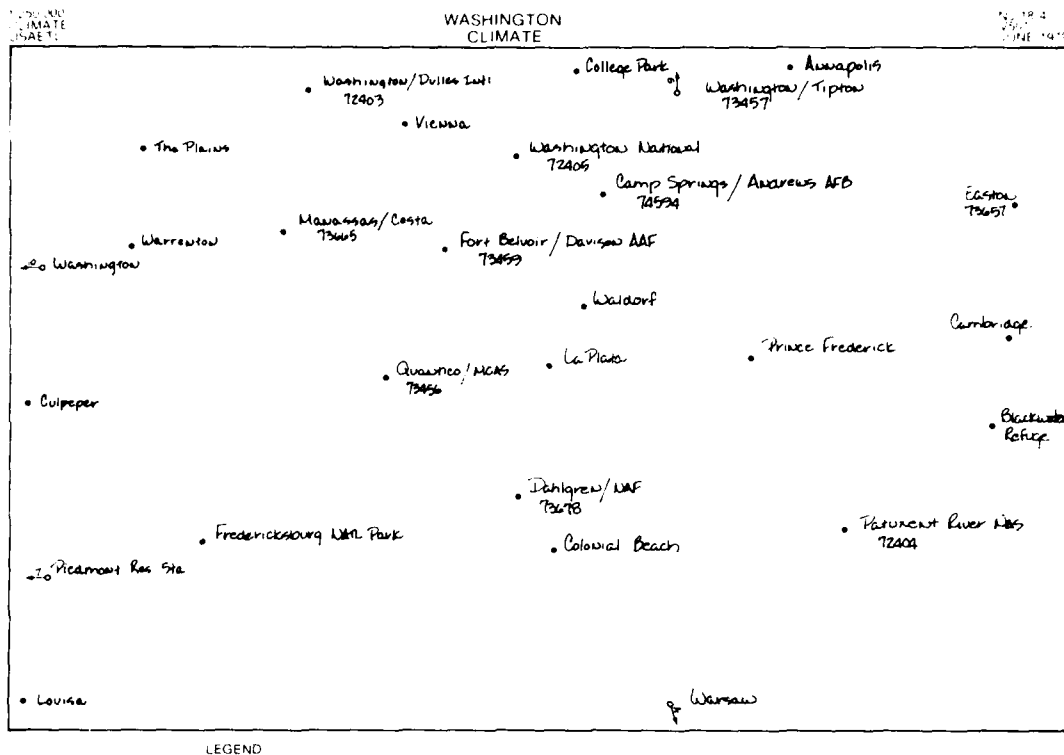


Figure 5. Format for Climatic Factor Overlays.

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Figure 6. Format for Climate Data Table No. 1.

## A large sheet of graph paper with a grid pattern. The grid consists of small squares. There are some faint markings and a small rectangular area highlighted in the upper right corner. The paper appears to be a standard sheet of graph paper used for drawing or calculations.

Figure 7. Format for Climate Data Table No. 2.

I REPORTING STATION/AREA

- A. Name/number
- B. Climatic Classification
- C. Location: Actual \_\_\_\_ or Contrived \_\_\_\_
  - 1. Latitude
  - 2. Longitude
  - 3. UTM Coordinates
- D. Years of record
- E. Elevation
- F. Control
  - 1. Country
  - 2. State/Province
  - 3. Type of Station
    - a. Automated
    - b. Observer
    - c. Status (permanent, seasonal, other)
- G. Data source(s)

II TEMPERATURE

- A. Mean daily maximum
- B. Mean
- C. Mean daily minimum
- D. Mean range:
  - 1. Maximum
  - 2. Minimum
- E. Mean number of days with maximum
  - 1.  $> 90^{\circ}\text{F.}$
  - 2.  $> 80^{\circ}\text{F.}$
  - 3.  $> 75^{\circ}\text{F.}$
  - 4.  $\leq 32^{\circ}\text{F.}$
- F. Mean number of days with minimum
  - 1.  $< 45^{\circ}\text{F.}$
  - 2.  $< 32^{\circ}\text{F.}$
  - 3.  $< 0^{\circ}\text{F.}$
- G. Mean dew point
- H. Cumulative percent frequency of occurrence:
  - 1. Mean daily maximum  
Increments ( $^{\circ}\text{F.}$ ) \_\_\_\_\_

2. Mean daily  
Increments (°F.) \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. Mean daily  
Minimum (°F.) \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### III RELATIVE HUMIDITY

A. Mean daily  
B. Mean hourly:

0300  
0400  
0600  
0730  
0900  
1200  
1300  
1430  
1500  
1800  
2100  
2400

### IV STATION PRESSURE

A. Mean daily  
B. Mean hourly:

0300  
0600  
0900  
1200  
1500

1800  
2100  
2400  
All

V. DEGREE DAYS

- A. Heating
- B. Cooling

VI PRECIPITATION

- A. Mean maximum
- B. Mean
- C. Mean minimum
- D. Maximum 24 hour
- E. Mean range
  - 1. Maximum
  - 2. Minimum
- F. Mean number of days with:
  - 1.  $\geq .01$  inch
  - 2.  $\geq .04$  inch
  - 3.  $\geq .5$  inch
  - 4.  $\geq 1.$  inch
  - 5.  $\geq .1$  mm
- G. Mean daily amounts
  - Increments - inches
    - .01
    - .02 - .05
    - .06 - .10
    - .11 - .25
    - .26 - .50
    - .51 - 1.00
    - 1.01 - 2.50
    - 2.51 - 5.00
    - 5.01 - 10.00
    - 10.01 - 20.00
    - > 20.00
- H. Mean number of days with measurable precipitation
- I. Mean number of days with amounts  $\geq .004$  inch (trace)
- J. Percent frequency of occurrence of rain and/or drizzle by month
- K. Percent frequency of occurrence of rain and/or drizzle
  - Hourly groups: 00 - 02
  - 03 - 05
  - 06 - 08
  - 09 - 11
  - 12 - 14
  - 15 - 17
  - 18 - 20
  - 21 - 23



L. Percent frequency of occurrence of freezing rain and/or drizzle  
by month

M. Percent frequency of occurrence of freezing rain and/or drizzle  
by hourly groups:

00 - 02  
03 - 05  
06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23

N. Mean number of days with amounts:

< .004 inch  
> .004 inch  
> .39 inch  
> .99 inch

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

O. Number of days with liquid precipitation

P. Snowfall

1. Mean maximum

2. Mean

3. Mean minimum

4. 24 hour maximum

5. Amount

a. > 0.1 inch

b. > 1.0 inch

c. > 1.5 inch

6. Mean date of first snowfall

7. Mean date of last snowfall

8. Mean number of days with measurable snowfall

9. Percent frequency of occurrence of snow and/or sleet by month

10. Percent frequency of occurrence of snow and/or sleet by

hourly groups:

00 - 02  
03 - 05  
06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23

11. Percent frequency of occurrence of blowing snow by month
12. Percent frequency of occurrence of blowing snow by hourly groups:
  - 00 - 02
  - 03 - 05
  - 06 - 08
  - 09 - 11
  - 12 - 14
  - 15 - 17
  - 18 - 20
  - 21 - 23

13. Mean daily amounts:
  - None
  - Trace
  - .1 - .4 inch
  - .5 - 1.4 inch
  - 1.5 - 2.4 inch
  - 2.5 - 3.4 inch
  - 3.5 - 4.4 inch
  - 4.5 - 6.4 inch
  - 6.5 - 10.4 inch
  - 10.5 - 15.4 inch
  - 15.5 - 25.4 inch
  - 25.5 - 50.4 inch
  - > 50.4 inch

Q. Snow depth (snow cover)

1. Mean date of first measurable snow cover
2. Mean date of last measurable snow cover
3. Mean depth at end of month
4. Number of days with snow cover (ground more than half covered)
5. Mean number of days with measurable snow depth by classes (inches).
  - 1
  - 2
  - 4 - 6
  - 7 - 12
  - 13 - 24
  - 25 - 36
  - 37 - 48
  - 49 - 60
  - 61 - 120
  - > 120
6. Mean number of days with
  - > 1.0 inch
  - > 6.0 inch
  - > 10.0 inch

R. Hail

1. Percent frequency of occurrence by month
2. Percent frequency of occurrence by hourly groups
  - 00 - 02
  - 03 - 05

06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23

3. Mean number of days occurrence

#### VII THUNDERSTORMS

- A. Mean number of days with thunderstorms
- B. Percent frequency of occurrence by month
- C. Percent frequency of occurrence by hourly groups:
  - 00 - 02
  - 03 - 05
  - 06 - 08
  - 09 - 11
  - 12 - 14
  - 15 - 17
  - 18 - 20
  - 21 - 23

#### VIII WIND

- A. Prevailing direction
- B. Speed
  - 1. Mean maximum
  - 2. Mean
  - 3. Mean peak gust
  - 4. Mean fastest mile
  - 5. Percent frequency of occurrence  $> 17$  knots
  - 6. Percent frequency of occurrence  $> 28$  knots
  - 7. Mean number of days with gale winds ( $\geq$  Beaufort 8 at any time during the day)
  - 8. Days with surface wind  $> 27$  knots (4-8 obs./day)

#### IX SKY CONDITIONS (sky cover)

- A. Mean cloudiness (percent/oktas)
- B. Number of days occurrence of sky cover (sunrise to sunset)
  - 1. Clear
  - 2. Partly cloudy
  - 3. Cloudy
- C. Bright Sunshine
  - 1. Mean monthly duration (hours)
  - 2. Mean percent of possible
  - 3. Maximum duration in one day (hours)
  - 4. Mean number of days with no sun

D. Percent frequency of mean cloudiness at specified hours:

03  
06  
09  
12  
15  
18  
21  
24

E. Percent frequency of occurrence by groups:

0 tenths  
1 - 2 tenths  
3 tenths  
4 - 5 tenths  
6 - 7 tenths  
8 - 9 tenths  
10 tenths

F. Mean number of days with sky cover (oktas)

0 - 1/8  
0 - 2/8  
3 - 5/8  
6 - 8/8

G. Mean number of days with low clouds (oktas)

0 - 1/8  
0 - 2/8  
3 - 5/8  
6 - 8/8

H. Mean cloudiness at specified hours

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

I. Mean number of days with total cloud cover  $\leq 2/8$  at specified hours

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

X VISIBILITY

- A. Mean number of days with fog  
B. Mean number of days with fog or visibility less than 7 miles  
C. Mean number of days with heavy fog with visibility 1/2 mile  
or less  
D. Mean number of days with fog with visibility < 5/8 mile  
5/8 - 2 1/4 miles  
> 2 1/4 miles

E. Percent frequency of occurrence of fog by month

F. Percent frequency of occurrence of fog by hourly groups:

00 - 02

03 - 05

06 - 08

09 - 11

12 - 14

15 - 17

18 - 20

21 - 23

G. Percent frequency of occurrence of visibility < 6 miles at  
specified hours:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

H. Percent frequency of occurrence of visibility < 2 1/2 miles at  
specified hours:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

I. Percent frequency of occurrence by visibility groups:

0, 1/16, 1/8 mile

3/16, 1/4

5/16, 3/8, 1/2

5/8, 3/4

1 - 2 1/4  
2 1/2  
3 - 6  
7 - 9  
> 10

- J. Mean number of days with smoke or haze  
K. Percent frequency of occurrence of smoke and haze by month  
L. Percent frequency of occurrence of smoke and haze by hourly  
groups: 00 - 02  
03 - 05  
06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23  
M. Mean number of days with dust (sand)  
N. Percent frequency of occurrence of dust (sand) by month  
O. Percent frequency of occurrence of dust (sand) by hourly  
groups: 00 - 02  
03 - 05  
06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23  
P. Frequency of observations with visibility < 1 mile caused by:  
Fog  
Smoke/haze  
Blowing snow and/or dust  
Precipitation  
Cause unknown  
Total obs. 1 mile

XI FROST

- A. Mean date of first frost  
B. Mean date of last frost

XII ICE

- A. Mean date of first total ice cover on lakes and rivers  
B. Mean date of last total ice cover on lakes and rivers (beginning  
of break-up)  
C. Mean thickness

XIII CEILING - CEILING AND VISIBILITY

- A. Percent frequency of ceiling 1000 feet at specified hours  
(ceiling  $\geq$  5/8 covered)

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- B. Percent frequency of ceiling < 3,300 feet at specified hours  
(ceiling  $\geq$  5/8 covered)

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- C. Percent frequency of ceiling less than 5000 feet and/or visibility  
less than 5 miles by hourly groups:

00 - 02  
03 - 05  
06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23  
All hours

- D. Percent frequency of ceiling less than 3000 feet and/or  
visibility less than 3 miles by hourly groups:

00 - 02  
03 - 05  
06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23  
All hours

E. Percent frequency of ceiling less than 1500 feet and/or visibility less than 3 miles by hourly groups:

00 - 02  
03 - 05  
06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23

All hours

F. Percent frequency of ceiling less than 1000 feet and/or visibility less than 3 miles by hourly groups:

00 - 02  
03 - 05  
06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23

All hours

G. Percent frequency of ceiling less than 1000 feet and/or visibility less than 2 miles by hourly groups:

00 - 02  
03 - 05  
06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23

All hours

H. Percent frequency of ceiling less than 1000 feet and/or visibility less than 1 mile by hourly groups:

00 - 02  
03 - 05  
06 - 08  
09 - 11  
12 - 14  
15 - 17  
18 - 20  
21 - 23

All hours



I. Percent frequency of ceiling less than 200 feet and/or visibility less than 1/2 mile by hourly groups: 00 - 02

03 - 05

06 - 08

09 - 11

12 - 14

15 - 17

18 - 20

21 - 23

All hours

J. Percent frequency of ceiling less than 100 feet and/or visibility less than 1/4 mile by hourly groups: 00 - 02

03 - 05

06 - 08

09 - 11

12 - 14

15 - 17

18 - 20

21 - 23

All hours

K. Mean number of days with ceiling greater than 10,000 feet and visibility greater than 3 miles

Hours: 06

12

18

24

L. Mean number of days with ceiling greater than 6,000 feet and visibility greater than 3 miles

Hours: 06

12

18

24

M. Mean number of days with ceiling greater than 2,500 feet and visibility greater than 3 miles

Hours: 06

12

18

24

N. Mean number of days with ceiling greater than 1,000 feet and visibility greater than 3 miles

Hours: 06

12

18

24

XIV DATA ELEMENT COMBINATIONS

A. Mean number of days with ceiling greater than 2,000 feet and visibility greater than 3 miles, with surface wind less than 10 knots

Hours: 06  
12  
18  
24

B. Mean number of days with sky cover less than 3/10 and visibility greater than 3 miles

Hours: 06  
12  
18  
24

C. Mean number of days with surface wind greater than 17 knots and no precipitation

Hours: 06  
12  
18  
24

D. Mean number of days with surface wind 4 - 10 knots, and temperature 33 - 89°F., and no precipitation

Hours: 06  
12  
18  
24

E. Mean number of days with low cloud amount 0 - 4/8 or ceiling 1000 feet or greater, visibility 2 1/2 miles or greater, and surface wind speed 10 knots or less at specified hours

Hours: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

F. Mean number of days with surface wind speed greater than 16 knots, no precipitation, and snow depth less than 6.1 inches, at specified hours

Hours: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

G. Mean number of days with surface wind speed 4 - 10 knots, temperature more than 30°F., but less than 90°F. and no precipitation, at specified hours

Hours: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

H. Mean number of days per month favorable for indicated military operations:\*

1. Flying condition A
2. Incendiary bombing
3. Parachute operations
4. Chemical warfare
5. Visual high level bombing

\*Description:

Flying condition A: Low cloud amount 0 - 4/8, or IF 5 - 8/8. Height must be 984 feet or greater, and visibility 2 1/2 miles or greater

Incendiary bombing: Surface wind 17 knots or greater with no precipitation occurring

Parachute operations: Flying condition "A" with surface wind speed 10 knots or less

Chemical warfare: Surface wind speed 4 - 10 knots, temperature 33 - 89°F. and no precipitation occurring

Visual high level bombing: Total sky cover 2/8 or less with visibility 2 1/2 miles or greater

XV NARRATIVE SUMMARY

#### E. Source Materials.

In the following paragraphs, the type of information from sources available to the analyst will be described, which will provide data essential to preparing factor overlays and data tables. Generally, the eight types of sources are listed in order of their probable importance in contributing to the end products of this guide. That is, for most areas, the analyst will be able to locate necessary climatic information in the types of source materials described in 2 through 5 (the 1:250,000-scale topographic map is listed first because it is essential to establishing the cartographic base and in the distribution of climatic stations).

1. 1:250,000-Scale Topographic Maps. The 1:250,000-scale topographic map series will be used as the cartographic base over which the climate factor overlays will be developed. They will serve as locators for plotting weather stations and with aerial photography and large-scale topographic maps, will provide terrain information for judging probable climatic contrasts within a region.

2. Climatic Summaries. Climatic summaries represent the primary source of climatic information for the terrain analyst. They are statistical expressions of weather elements in terms of averages, extremes, and frequencies of occurrence over a given period of time. The published records are generally in tabular form (figure 8), providing climatic data for each month and/or season of the year for specific station locations. Frequently included are brief narrative accounts of local weather conditions that can be expected during an average month.

Summaries vary greatly in the amount of information provided, in the number of stations included, and in the extent of geographical coverage. Some summaries contain data for selected stations worldwide; whereas others contain data for continents, countries, or lesser subregions. The data elements listed in the data tables (appendix A) have been extracted, for the most part, from 27 standard, readily available climatic summaries. The elements differ in the amount of information presented, length of records, units of measurement, and the geographical regions covered. In many cases, available data can not be converted to a uniform system; therefore, in the list of data elements, a rather lengthy tabulation of entries from many different climatic summaries must be included. Weather stations exist for which the analyst will be able to find only monthly averages for temperature and precipitation. Because climatic data consists of averages based on many years of record, numerical values cannot be determined by on-site collection efforts or by map and/or aerial photo analysis alone. As a result, interpolation techniques will have to be used to predict climate for areas without reporting stations. Methods for accomplishing this process are presented in the discussion on Aerial Photography (III, E, 7).

# PATUXENT RIVER NAS, MARYLAND

STA NO. 72404 (IN AREA NUMBER 16)

LATITUDE 3817N

LONGITUDE 07625W

ELEVATION(FT) 00038

PARAMETER DESCRIPTION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN	POR (YRS)	NO, OBS
ABS MAX TMP (F)	78	76	82	91	93	99	100	97	95	92	82	74	100	12	4380
MEAN MAX TMP (F)	45	47	52	64	73	81	86	84	78	68	56	46	65	12	4380
MEAN MIN TMP (F)	31	32	36	47	57	65	71	70	64	53	41	32	50	12	4380
ABS MIN TMP (F)	7	7	10	26	42	48	55	58	46	32	16	10	7	12	4380
MEAN NO DYS TMP = DR GTR 90(F)	0.0	0.0	0.0	0.1	0.3	4.7	7.8	4.9	1.1	0.2	0.0	0.0	19.3	12	4380
MEAN NO DYS TMP = DR LES 32(F)	18.8	14.6	9.3	0.8	0.0	0.0	0.0	0.0	0.0	0.1	4.0	16.0	63.8	12	4380
MEAN NO DYS TMP = DR LES 0(F)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12	4380
MEAN DEW PT TMP (F)	29	30	34	45	55	63	68	67	62	52	39	31	48	12	104880
MEAN REL HUM (PCT)	73	73	70	69	72	72	76	75	74	71	73	73	73	12	104851
MEAN PRESS ALT (FT)	-142	-113	-78	-36	-60	-53	-77	-66	-87	-114	-137	-137	-92	0	-50
MEAN PRECIP (IN)	2.86	2.89	3.89	3.62	3.33	2.82	4.31	5.64	2.57	2.86	3.91	3.18	41.9	10	3643
MEAN SNOW FALL (IN)	3.9	1.2	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.4	8.9	10	3603
MEAN NO DYS PRCP = DR GTR 0.1 IN	6.4	3.7	8.1	7.9	7.2	4.8	6.9	6.8	5.6	5.0	5.9	6.4	76.7	10	3643
MEAN NO DYS SNFL = DR GTR 1.5 IN	0.9	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	2.2	10	3603
MEAN NO DYS W/OCUR VSBY LES 1/2 MI	3.6	4.1	3.3	1.8	1.4	0.6	0.4	0.6	0.8	1.8	2.9	3.7	25.0	12	4381
MEAN NO DYS TSTMS	0.2	0.4	0.9	2.8	4.8	5.4	7.9	6.4	3.1	1.0	0.6	0.2	33.7	12	4380
P FREQ WND SPD = DR GTR 17 KTS	18.1	16.9	19.1	13.3	6.1	4.8	2.3	3.0	5.3	8.3	12.1	12.1	10.1	12	105021
P FREQ WND SPD = DR GTR 28 KTS	1.2	1.5	1.4	0.5	0.1	0.1	0.1	0.3	0.3	0.4	0.9	0.9	0.6	12	105021
P FREQ LES 5000 FT A/D LES 3 MI	30.0	28.6	30.3	26.4	25.9	22.6	18.8	24.8	25.9	26.8	28.0	26.9	26.4	12	105039
P FREQ LFS 1500 FT A/D LES 3 MI															
FOR 00-02 LST	16.8	17.4	16.2	14.1	16.7	10.4	5.7	10.2	13.0	12.5	12.9	14.9	13.4	12	13132
03-05 LST	17.5	18.1	18.6	17.3	18.4	13.3	7.9	14.0	14.6	17.5	15.4	14.3	15.6	12	13136
06-08 LST	18.7	19.6	19.7	18.8	19.9	14.6	11.0	16.3	18.5	21.5	16.6	14.8	17.5	12	13129
09-11 LST	16.5	18.6	18.3	14.0	15.1	11.4	9.8	14.6	13.7	16.0	15.4	15.3	14.9	12	15126
12-14 LST	13.5	14.9	15.8	10.5	10.9	8.1	3.6	8.6	9.4	11.7	11.2	15.1	11.3	12	13129
15-17 LST	14.9	14.8	14.2	9.1	8.3	7.6	3.8	5.7	9.4	10.5	10.7	15.2	10.4	12	13133
18-20 LST	14.1	14.6	14.4	9.7	10.6	7.1	3.5	5.7	9.7	8.7	10.2	14.4	10.2	12	13133
21-23 LST	15.5	16.0	16.1	11.3	12.9	8.3	4.9	8.3	10.9	9.6	11.4	14.3	11.6	12	13121
P FREQ LES 300 FT A/D LES 1 MI															
FOR 00-02 LST	5.5	7.6	5.3	3.2	4.7	0.9	0.2	0.4	0.8	1.3	5.1	4.5	3.3	12	13132
03-05 LST	5.9	8.0	6.8	3.4	4.8	1.3	0.2	0.9	0.7	2.9	6.4	6.0	4.0	12	13136
06-08 LST	6.5	8.6	5.1	3.2	3.3	1.6	0.4	0.5	1.5	3.2	6.2	5.1	3.8	12	13129
09-11 LST	4.3	5.4	4.0	1.2	0.6	0.5	0.2	0.1	0.1	1.5	3.1	4.8	2.2	12	13126
12-14 LST	3.9	4.2	3.1	0.6	0.4	0.1	0.2	0.3	0.0	0.8	1.1	4.3	1.6	12	13129
15-17 LST	4.4	5.0	3.0	0.5	0.6	0.2	0.4	0.4	0.2	0.3	1.9	4.0	1.7	12	13133
18-20 LST	3.6	4.8	4.1	1.9	0.7	0.3	0.4	0.4	0.3	0.8	2.6	4.4	2.0	12	13133
21-23 LST	4.4	6.2	4.1	2.2	2.8	0.2	0.2	0.5	0.4	1.2	3.2	4.6	2.5	12	13121

0124

Figure 8. Climatic Summary.

In conducting a search for climatic summaries, the analyst should attempt to locate records that may be available from local jurisdictions (state, county, provincial, etc.) and from educational institutions. The goal of the analyst should be to establish as dense a network of weather stations as possible within each 1:250,000-scale map. This approach will be the quickest way to assess climatic conditions and if successful, may significantly reduce the time required to complete the analysis of a region.

3. Climatic Studies and Climatic Atlases. These are considered together because often there is no clear distinction between the two. Although they primarily contain maps, climatic studies are not designated as atlases, and publications that are designated as atlases may contain much textual information. Climatic studies often duplicate information found in summaries, but they are generally more comprehensive in their interpretation of climatic elements. Whatever the nomenclature, these publications should be reviewed for pertinent climatic data, which may be presented in the form of graphs, tables, and maps. Like summaries, climatic studies and atlases may provide coverage varying from relatively small geographic areas to worldwide coverage.

4. Geographic Studies and Atlases. Much that has been said about climatic studies and climatic atlases relates to these publications. They may treat a particular geographic parameter or they may consider the total geographic complex of a region, including climate. They should not be overlooked as important source materials. These too will vary greatly in the extent of their aerial coverage.

5. Climatic Maps. This source consists of individual maps that differ from atlas maps only in that they are available as separate items (sheets), apart from any publication. Like other referenced sources, these maps are varied in their areal coverage and may be obtained from many different sources, such as libraries, government agencies, schools, etc. Such maps may be used for interpolating missing data in areas where no climatic stations exist.

6. Technical Literature. Although publications of this type may contain some pertinent climatic data, most applicable material will be found in the previous sources. Technical literature in the areas of weather and climate generally pertain to highly specialized analyses of specific meteorological or climatic parameters beyond the concern of this guide. However, in reviewing literature sources, the analyst should attempt to identify and retrieve technical literature that appears to describe the areal and annual distribution of those elements listed in the data tables.

7. Aerial Photography. No numerical climatic data can be extracted from aerial photography. However, in the absence of climatic data in a particular area, analogies can be made by comparing the area lacking climatic data with areas with known data and with similar terrain features (vegetation, drainage, culture, etc.).

8. Large-scale Topographic Maps. Large-scale topographic maps may be used, ideally in conjunction with aerial photographs, for comparing terrain features in regions lacking climatic data with terrain features in regions with known climatic data. As in number 7 above, this procedure will enable the analyst to use climatic "indicators" to make an assessment of climate.

F. Reliability and Accuracy of Source Materials.

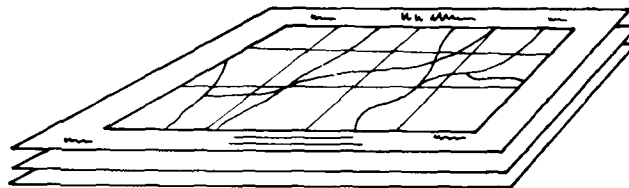
Climatic data are averages (means) derived from meteorological observations recorded over a period of time. Their reliability and accuracy are directly related to the length of record -- a period of years during which meteorological phenomena have been observed and recorded. For example, averages derived from 20 years of observations would be considered to be "good data," whereas, averages based on 3 years of record or less would be rated as only "fair."

## II PROCEDURAL OUTLINE

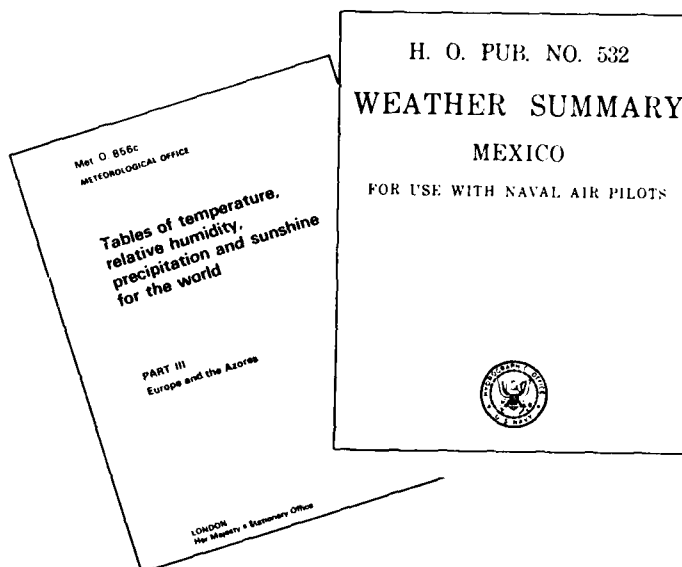
This section provides an overview of the step-by-step procedures required to perform a climatic analysis. The outline is presented in the form of a schematic flow diagram, showing what steps are required and the sequence in which they are normally performed. The diagram indicates what is to be done. How it is to be done is explained in the Analysis Procedures Section.

When adequate climatic information for an area is available in summaries, it will be unnecessary to proceed beyond step no. 5.

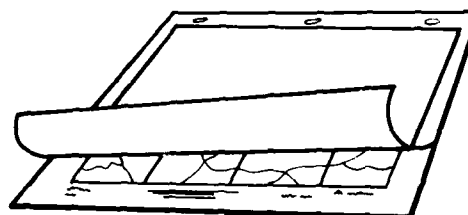
1. Obtain 1:250,000 scale topographic maps of area of interest.



2. Select climatic summaries covering area of interest.



3. Prepare factor overlays for each 1:250,000 scale sheet.





- 
- A hand-drawn illustration of a document. At the top, there are three binder holes. Below them, a list of names is written: "• SALEM 122" and "• LOGAN". A white strip is drawn across the middle, partially obscuring the text. Below the strip, a map is visible, showing a grid of land with wavy lines representing water or terrain. The entire drawing is done in a simple, sketchy style with black outlines.

5. Prepare work copies of Data Tables 1 and 2 for each station plotted, including narrative discussions.

- ative
- CLIMATIC ATLAS  
THE UNITED STATES
- PREFACE
- AD  
Reports Control Symbol  
DSG 1300
- RESEARCH AND DEVELOPMENT TECHNICAL REPORT  
ECOM 6053
- THE HUNTER LIGGETT MILITARY RESERVATION  
JOLON, CALIFORNIA CLIMATE REPORT  
1964-1970
- By  
James C. Devina
- 1LT Winsor H. Aylesworth SP7 Kenneth M. Hardy  
SP7 Townsend E. Saunders SP5 Stewart C. Koch
- Atmospheric Sciences Laboratory  
US Army Electronics Command  
White Sands Missile Range, New Mexico 88002
- December 1973
- Approved for public release; distribution unlimited
- \*\*\*\*\*  
ECOM  
HUNTER LIGGETT MILITARY RESERVATION JOLON, CALIFORNIA 94302 (4511) 67763
- udies  
a

- 

### CLIMATE DATA TABLE NO. 2

**1. Locality:**

**2. Station:**

**3. Elevation:**

**4. Coordinates:**

**5. Date of Report:**

**6. Name of Station:**

**7. Name of Observer:**

**8. Name of Institution:**

**9. Name of Country:**

**10. Name of Continent:**

**11. Name of Region:**

**12. Name of District:**

**13. Name of Sub-district:**

**14. Name of Village:**

**15. Name of Hamlet:**

**16. Name of Settlement:**

**17. Name of Road:**

**18. Name of River:**

**19. Name of Lake:**

**20. Name of Sea:**

**21. Name of Bay:**

**22. Name of Strait:**

**23. Name of Canal:**

**24. Name of Bridge:**

**25. Name of Tunnel:**

**26. Name of Dam:**

**27. Name of Power Station:**

**28. Name of Factory:**

**29. Name of Mine:**

**30. Name of Quarry:**

**31. Name of Field:**

**32. Name of Forest:**

**33. Name of Park:**

**34. Name of Garden:**

**35. Name of Zoo:**

**36. Name of Botanical Garden:**

**37. Name of Museum:**

**38. Name of Library:**

**39. Name of School:**

**40. Name of Hospital:**

**41. Name of Government Office:**

**42. Name of Religious Building:**

**43. Name of Public Building:**

**44. Name of Private Building:**

**45. Name of Industrial Building:**

**46. Name of Commercial Building:**

**47. Name of Residential Building:**

**48. Name of Agricultural Building:**

**49. Name of Industrial Area:**

**50. Name of Commercial Area:**

**51. Name of Residential Area:**

**52. Name of Agricultural Area:**

**53. Name of Industrial Zone:**

**54. Name of Commercial Zone:**

**55. Name of Residential Zone:**

**56. Name of Agricultural Zone:**

**57. Name of Industrial Park:**

**58. Name of Commercial Park:**

**59. Name of Residential Park:**

**60. Name of Agricultural Park:**

**61. Name of Industrial Estate:**

**62. Name of Commercial Estate:**

**63. Name of Residential Estate:**

**64. Name of Agricultural Estate:**

**65. Name of Industrial Estate:**

**66. Name of Commercial Estate:**

**67. Name of Residential Estate:**

**68. Name of Agricultural Estate:**

**69. Name of Industrial Estate:**

**70. Name of Commercial Estate:**

**71. Name of Residential Estate:**

**72. Name of Agricultural Estate:**

**73. Name of Industrial Estate:**

**74. Name of Commercial Estate:**

**75. Name of Residential Estate:**

**76. Name of Agricultural Estate:**

**77. Name of Industrial Estate:**

**78. Name of Commercial Estate:**

**79. Name of Residential Estate:**

**80. Name of Agricultural Estate:**

**81. Name of Industrial Estate:**

**82. Name of Commercial Estate:**

**83. Name of Residential Estate:**

**84. Name of Agricultural Estate:**

**85. Name of Industrial Estate:**

**86. Name of Commercial Estate:**

**87. Name of Residential Estate:**

**88. Name of Agricultural Estate:**

**89. Name of Industrial Estate:**

**90. Name of Commercial Estate:**

**91. Name of Residential Estate:**

**92. Name of Agricultural Estate:**

**93. Name of Industrial Estate:**

**94. Name of Commercial Estate:**

**95. Name of Residential Estate:**

**96. Name of Agricultural Estate:**

**97. Name of Industrial Estate:**

**98. Name of Commercial Estate:**

**99. Name of Residential Estate:**

**100. Name of Agricultural Estate:**

### CLIMATE DATA TABLE NO. 1

**1. Locality:**

**2. Station:**

**3. Elevation:**

**4. Coordinates:**

**5. Date of Report:**

**6. Name of Station:**

**7. Name of Observer:**

**8. Name of Institution:**

**9. Name of Country:**

**10. Name of Continent:**

**11. Name of Region:**

**12. Name of District:**

**13. Name of Sub-district:**

**14. Name of Village:**

**15. Name of Hamlet:**

**16. Name of Settlement:**

**17. Name of Road:**

**18. Name of River:**

**19. Name of Lake:**

**20. Name of Sea:**

**21. Name of Bay:**

**22. Name of Strait:**

**23. Name of Canal:**

**24. Name of Bridge:**

**25. Name of Tunnel:**

**26. Name of Dam:**

**27. Name of Power Station:**

**28. Name of Factory:**

**29. Name of Mine:**

**30. Name of Quarry:**

**31. Name of Field:**

**32. Name of Forest:**

**33. Name of Park:**

**34. Name of Garden:**

**35. Name of Zoo:**

**36. Name of Botanical Garden:**

**37. Name of Museum:**

**38. Name of Library:**

**39. Name of School:**

**40. Name of Hospital:**

**41. Name of Government Office:**

**42. Name of Religious Building:**

**43. Name of Public Building:**

**44. Name of Private Building:**

**45. Name of Industrial Building:**

**46. Name of Commercial Building:**

**47. Name of Residential Building:**

**48. Name of Agricultural Building:**

**49. Name of Industrial Area:**

**50. Name of Commercial Area:**

**51. Name of Residential Area:**

**52. Name of Agricultural Area:**

**53. Name of Industrial Zone:**

**54. Name of Commercial Zone:**

**55. Name of Residential Zone:**

**56. Name of Agricultural Zone:**

**57. Name of Industrial Park:**

**58. Name of Commercial Park:**

**59. Name of Residential Park:**

**60. Name of Agricultural Park:**

**61. Name of Industrial Estate:**

**62. Name of Commercial Estate:**

**63. Name of Residential Estate:**

**64. Name of Agricultural Estate:**

**65. Name of Industrial Estate:**

**66. Name of Commercial Estate:**

**67. Name of Residential Estate:**

**68. Name of Agricultural Estate:**

**69. Name of Industrial Estate:**

**70. Name of Commercial Estate:**

**71. Name of Residential Estate:**

**72. Name of Agricultural Estate:**

**73. Name of Industrial Estate:**

**74. Name of Commercial Estate:**

**75. Name of Residential Estate:**

**76. Name of Agricultural Estate:**

**77. Name of Industrial Estate:**

**78. Name of Commercial Estate:**

**79. Name of Residential Estate:**

**80. Name of Agricultural Estate:**

**81. Name of Industrial Estate:**

**82. Name of Commercial Estate:**

**83. Name of Residential Estate:**

**84. Name of Agricultural Estate:**

**85. Name of Industrial Estate:**

**86. Name of Commercial Estate:**

**87. Name of Residential Estate:**

**88. Name of Agricultural Estate:**

**89. Name of Industrial Estate:**

**90. Name of Commercial Estate:**

**91. Name of Residential Estate:**

**92. Name of Agricultural Estate:**

**93. Name of Industrial Estate:**

**94. Name of Commercial Estate:**

**95. Name of Residential Estate:**

**96. Name of Agricultural Estate:**

**97. Name of Industrial Estate:**

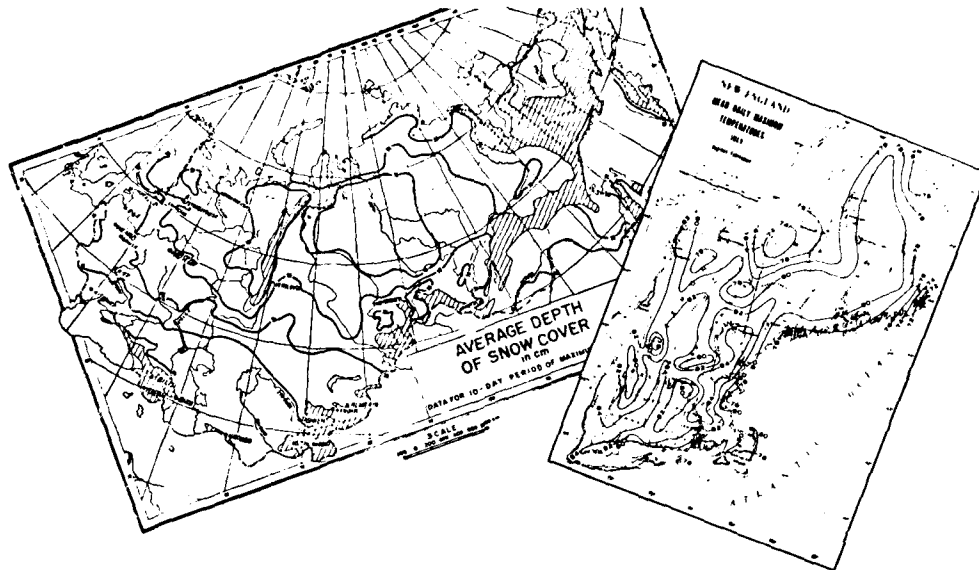
**98. Name of Commercial Estate:**

**99. Name of Residential Estate:**

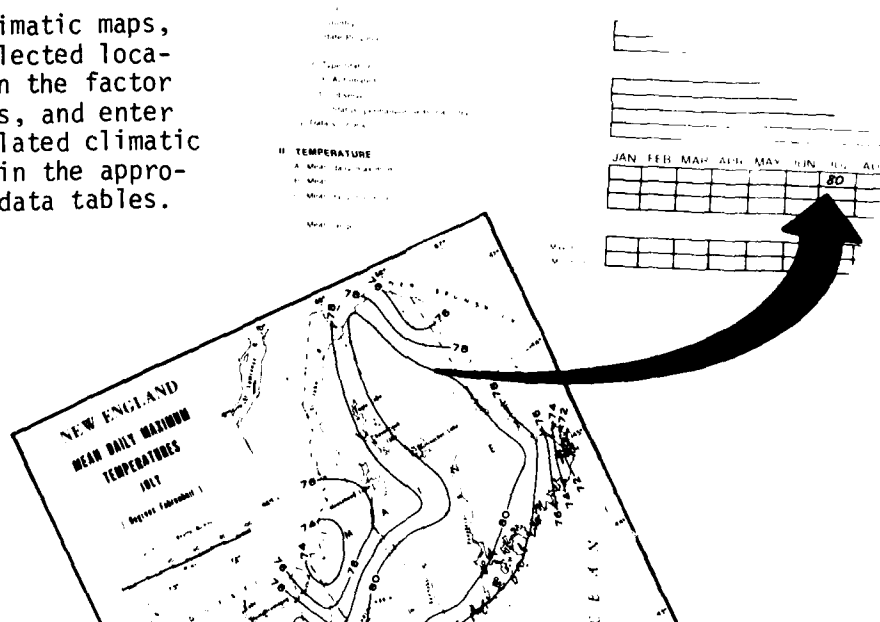
**100. Name of Agricultural Estate:**

- 
- CLIMATIC ATLAS OF  
THE UNITED STATES
- WEATHER SUMMARY
- THE HUNTER LIGGETT MILITARY RESERVATION  
JOLON, CALIFORNIA CLIMATE REPORT  
1964-1970

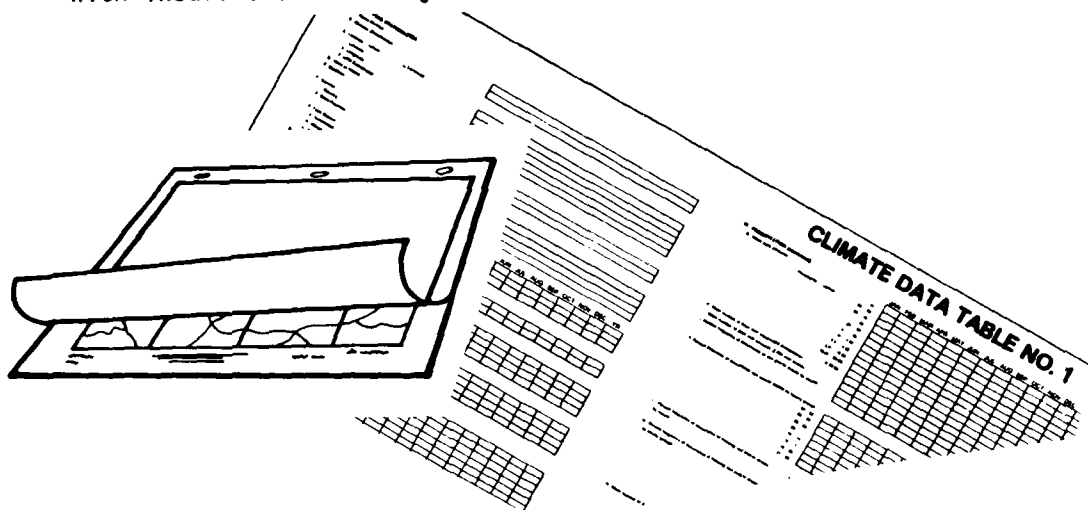
10. Repeat steps 6 through 9 for geographic studies and atlases.
11. Select climatic maps of the area of interest. Examine maps to determine if they can be used to interpolate data needed, but not available from other sources.



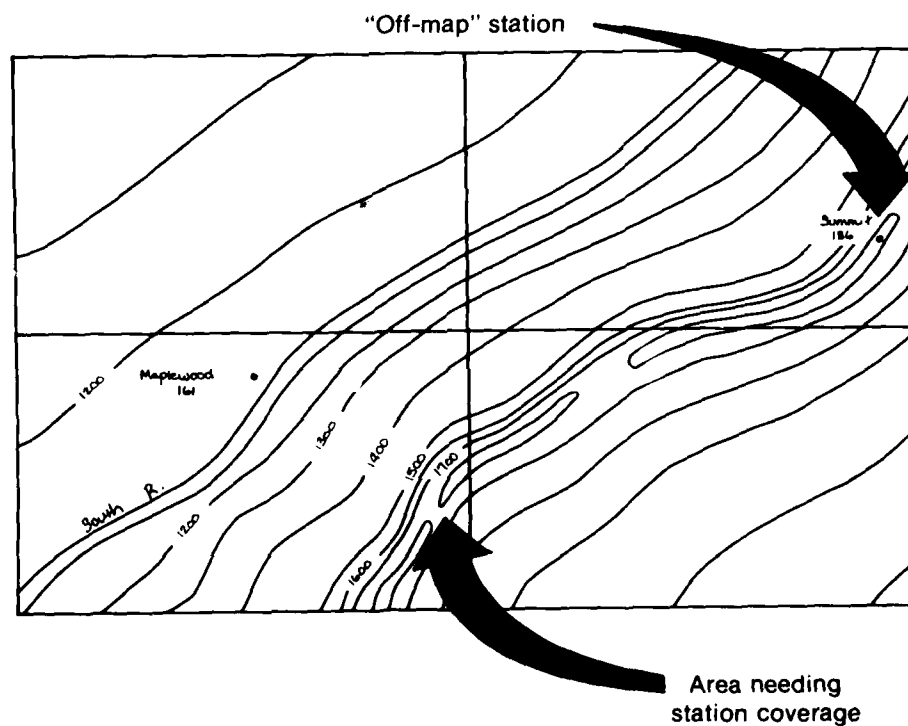
12. From climatic maps, plot selected locations on the factor overlays, and enter interpolated climatic values in the appropriate data tables.



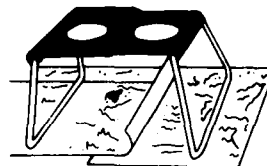
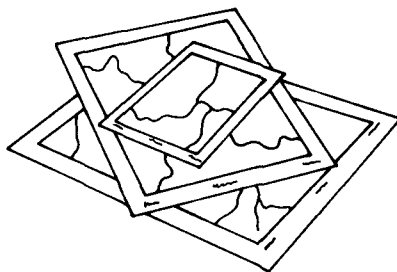
13. Review overlays and tables. Identify overlays with insufficient density of stations.



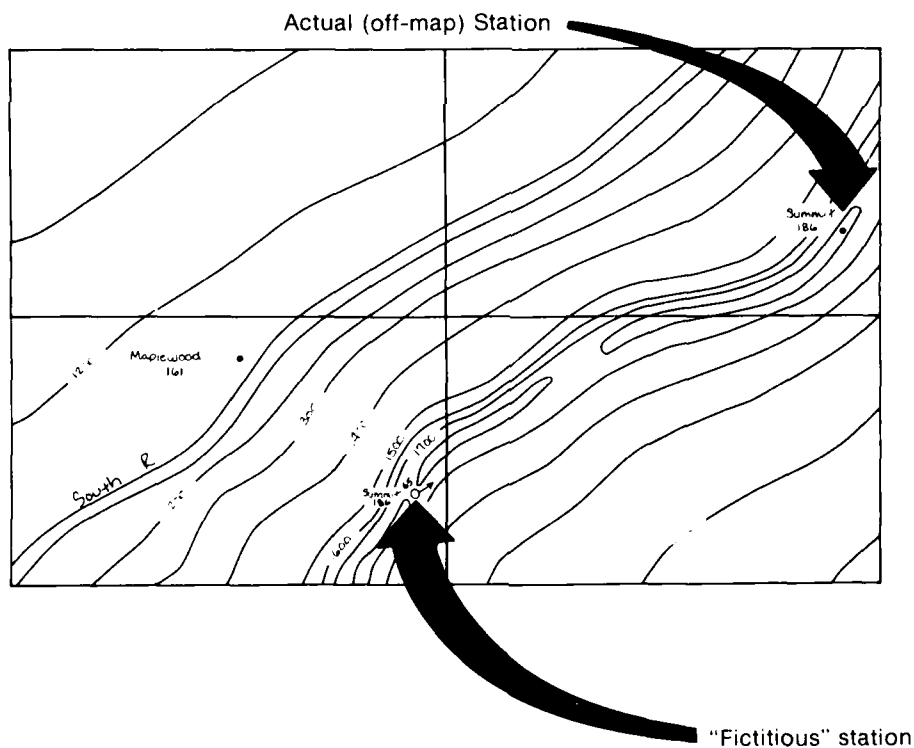
14. Locate "off-map" stations that appear to have similar features for the area that does not have a station.



15. Compare terrain features on large-scale topographic maps, and compare aerial photographs of the two areas.



16. If the areas are analogous, locate a "fictitious" station in the area of interest, and enter climatic data in the data tables from the actual (off-map) station records.



- 
- The image shows a technical manual page with two main sections, each containing a large grid for climate data. The top section is titled "CLIMATE DATA TABLE NO. 1" and the bottom section is titled "CLIMATE DATA TABLE NO. 2". Both sections include a header row with months (JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC) and a column for "LATITUDE". The grids are empty, intended for data entry. A small, rectangular, white object, possibly a piece of paper or a small container, is placed on the left side of the page, partially obscuring the first table. The page is oriented diagonally.

### III ANALYSIS

A. General. This section provides the detailed instructions for extracting the climatic data from each of the principal sources.

Because climatic analysis is dependent upon existing information -- data that cannot be derived from field reconnaissance -- the analyst must establish a knowledge of the network of weather stations in the region to be studied. Then, it will be possible to identify which 1:250,000-scale maps contain stations and pertinent data. First, factor overlays and data tables should be prepared for those sheets, followed by analysis of maps that do not have weather stations. This sequence is necessary so that climate for areas (maps) lacking stations may be predicted by comparative analysis (See III, E, 7). Although the analysis methods are listed in a logical sequence, much of the work described under separate headings will be developed concurrently.

B. Acquisition of Source Materials. In general, all materials that provide the analyst with information on climate of the area of interest are source materials. In addition to sources listed in the appendixes, climate information may be found by reviewing the data base file indices.

Review the materials obtained, and determine whether they are adequate to generate the climate factor overlays and the data tables. If they do not provide sufficient area coverage, initiate action to collect additional materials. However, start the analysis with materials on hand.

As indicated in the previous section, climatic summaries may provide all of the information required to document the climatic regime of a particular area. In this event, the analyst does not need to retrieve other sources of data.

#### C. Factor Overlay Preparation.

1. Fasten a clean, translucent sheet of Mylar or other transparent material to a printed copy of the 1:250,000-scale map. If no 1:250,000-scale map is available, select a map with a scale as near to 1:250,000 as possible. Where only very large or very small-scale maps are available, the base map may have to be photographically enlarged or reduced to the desired scale. Place registration ticks on the overlay at each of the four map sheet corners. Although it is not essential, it may be helpful at later stages if the map sheet neatlines and 10,000-meter grid lines are traced lightly in pencil.

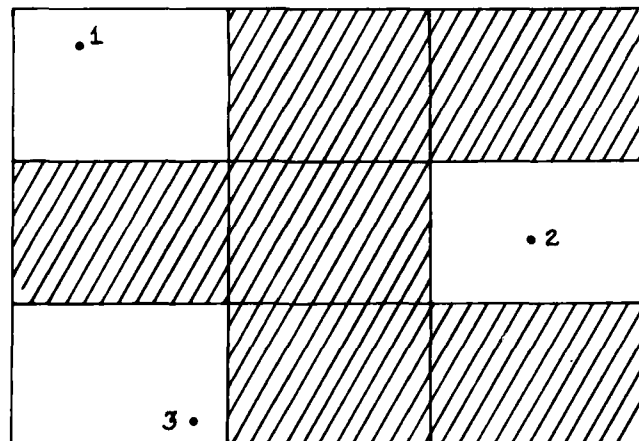
2. Add the map sheet name and number and other marginal information as required by appendix A.

D. Data Tables Preparation. Pre-printed reproducible data tables are included in an envelope attached to the back cover of this publication. Additional copies may be prepared from these sheets, using the Diazo reproduction process.

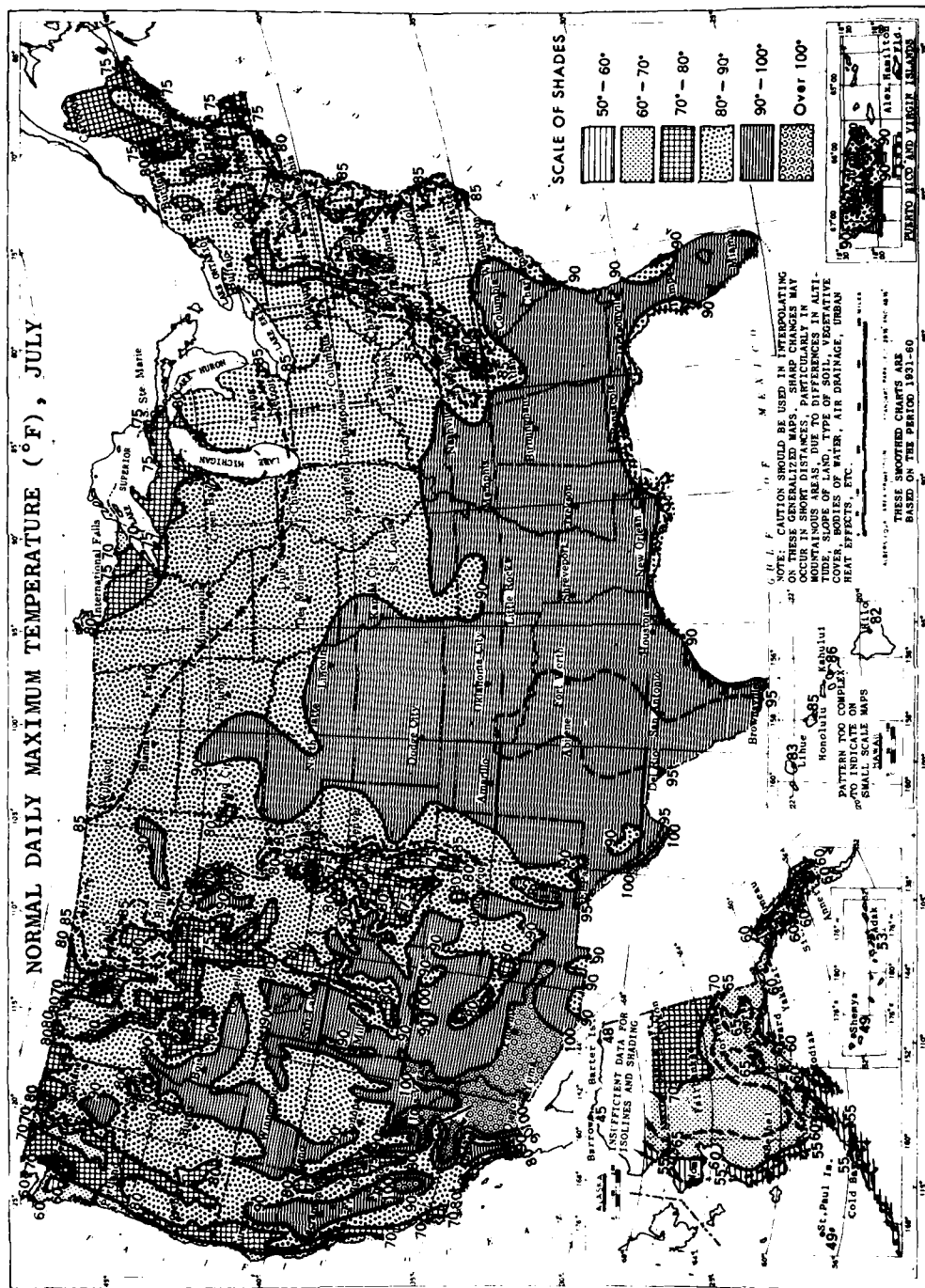
E. Analysis Procedures.

1. 1:250,000-Scale Topographic Maps. The 1:250,000-scale topographic map has been selected as the basic map product for development of the factor overlays for climate. The arbitrary grid that is formed by the 1:250,000 series (1 degree of latitude by 2 degrees of longitude) has no relationship to climatic classifications. However, as the unit of area for this study, it is required that each 1:250,000-scale map be analyzed individually, and its climate described. Ideally it is desirable to locate at least one weather station (data source) for each map. In reality, the analyst will find many world regions where this will be impossible, necessitating climatic assessment based on comparisons of terrain features and the extrapolation of climatic data from adjacent regions.

In general, the effort required to estimate climatic conditions will be proportional to the number of distinct topographic features occurring on a map. Figure 9 illustrates how large, relatively featureless continental areas reflect little contrast in climate over wide areas; whereas, in mountainous regions, significant differences exist over relatively short distances. The illustration below represents nine 1:250,000-scale maps, containing three weather stations. If this were a section of a continental area with no significant variation in landforms, climatic data for the three stations would be similar. Assessment of climate in the shaded areas (without stations) would then be relatively simple. Conversely, if the same coverage were in the Rocky Mountains, climatic analysis would require far more attention to significant changes occurring over relatively short distances.



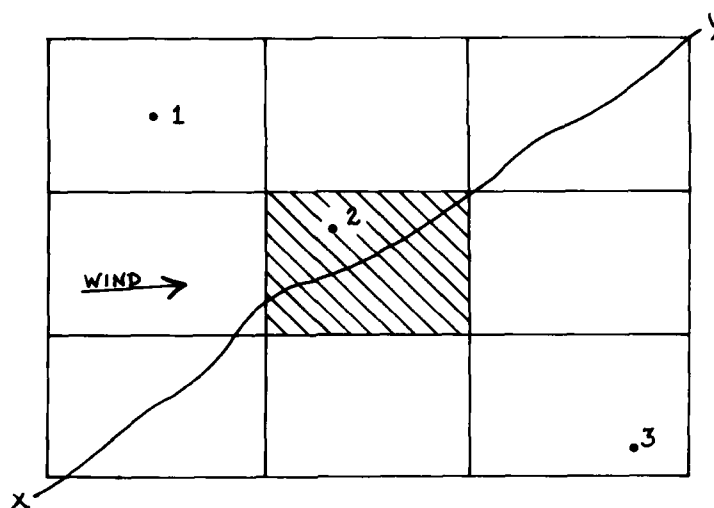




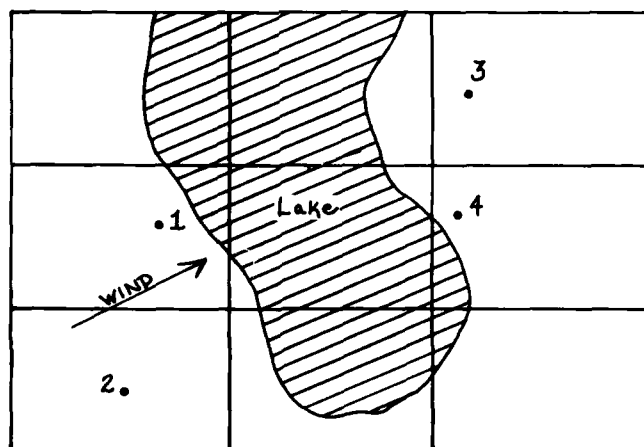
National Oceanic and Atmospheric Administration

Figure 9. Normal Daily Maximum Temperatures for July.

The following example illustrates the possible effects of a mountain range (X-Y) on local climate. Considering only the center map and assuming prevailing winds from the west, climate at station No. 2 would probably be typical of only the northwestern half of this sheet; whereas, station No. 3 would probably be more representative of conditions in the southeast portion.



Below is another nine-sheet area depicting the relationship of a large water body to regional climate. If southwest winds prevail, climate at stations 1 and 2 would vary considerably from the climate at stations 3 and 4 because of the modifying effect of the waters of the lake. However, if the lake were to freeze and become totally ice covered, this effect would be negated for that month or months.



The foregoing examples should be remembered by the analyst when predicting climate, particularly in regions where the distribution of stations and station data are sparse.

## 2. Climatic Summaries.

Step 1: Review the climatic summaries listed in appendix C, and retrieve those relating to the area being analyzed.

Step 2: As indicated earlier in this guide, climatic summaries differ in respect to the amount and type of data presented. To enter as much information as possible in the data tables, the analyst should study all summaries available for a region, including those offering multiple coverage for individual stations. As data are extracted from summaries, record this information in the appropriate data tables. Also, record the geographic location of each weather station on the factor overlay, using a black dot with the name and number of the station, for example:

Springfield  
201

Step 3: Enter station area information listed under I in the data table. Most of this information will be found in the climatic summaries.

The climatic classification will be determined by referring to appendix B. If it is uncertain from the maps in this appendix as to which climatic type is applicable, the related text and graphs will aid the analyst in making this decision. These are broad climatic classifications.

Because the nomenclature, units of measure, time periods, and other variables differ from summary to summary, the climatic tables for this guide have been designed to reflect these variations. This has been done so that information can be more readily extracted and entered in the tables under the climatic elements listed. For example, for Relative Humidity in the data tables, there are listed 12 possible recording times during the day (24-hours), which covers all hourly occurrences tabulated in the standard summaries. However, it is unlikely that values will be found for all of these hours for any one station.

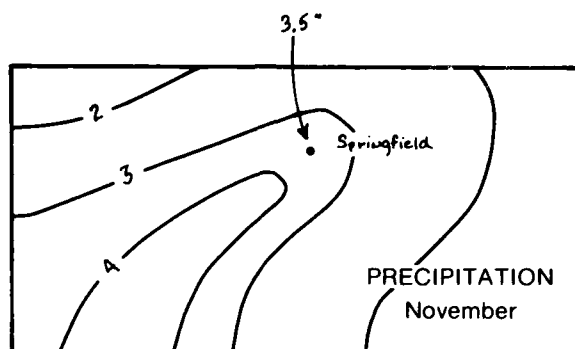
Step 4: When a narrative account of climate is part of a summary, it should be entered in section XV of the Data Tables. Examples of such accounts are included in appendix D.

## 3. Climatic Studies and Climatic Atlases.

Step 1: These publications often contain summarized climatic data that can be entered in the data tables. They may provide information not listed in standard summaries, and they may include data for stations

not appearing in other climatic records. Extract and enter such data in the appropriate data tables.

Step 2: Maps may be found in which isolines are used to depict monthly differences in selected climatic parameters (temperature, rainfall, snow depth, degree days, etc.). Such maps, in the absence of summaries, can be used for estimating numerical values for a specific location by interpolating between isolines, as shown in this example.



On the above map segment, the city of Springfield falls midway between the 3- and 4-inch isohyet (lines of equal rainfall); therefore, it can be said to have an average rainfall amount of 3.5 inches for the month of November. This value can then be entered in the precipitation column in the data tables, as indicated below.

**VI PRECIPITATION**

- A Mean maximum
- B Mean
- C Mean minimum
- D Maximum 24 hour

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YR
										3.5		

Step 3: Narrative descriptions of climate should be extracted from the source material and entered in section XV of the Data Tables.

4. Geographic Studies and Atlases. The same instructions pertaining to Climatic Studies and Climatic Atlases apply to these sources.

5. Climatic Maps. Maps in this category may be used for deriving estimated values for certain climatic elements (see 3, Step 2, above). Determine the numerical value from the map for the location being assessed, and enter it in the appropriate data table.

6. Technical Literature. When the above five sources fail to supply the required data, the technical literature may provide some input. This may be in the form of tables, graphs, and maps. Extract the data

from the source material, and enter it in the appropriate tables.

7. Aerial Photography. When climatic data is unavailable for an area, aerial photography may be used as an aid in predicting climate. If a vegetation analysis has been completed for the area being analyzed, it should be used with the photography in establishing climatic analogies.

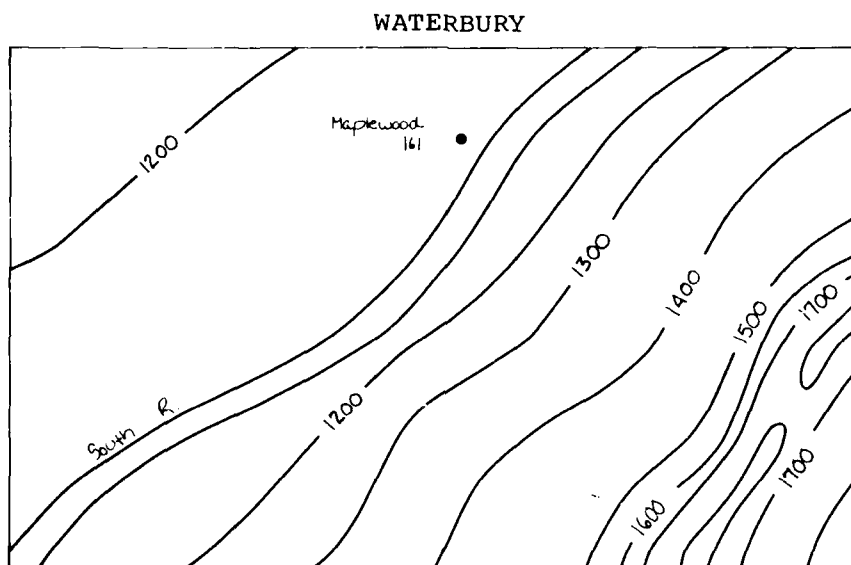
Vertical aerial photography is one of the more important sources for the Terrain Analyst. Photography is readily available for many areas, and it may be the most complete source of information available when acquired at a scale of 1:20,000 or larger. There are four types of aerial photography that are generally available through the Department of Defense, the Department of Army, and private industry. These include: color, color infrared, black and white infrared, and panchromatic photography.

During aerial acquisition flights, these films are exposed in such a manner that each exposure overlaps the preceeding exposure by 50 to 60 percent, with adjacent flight lines overlapping by 15 to 20 percent. This method of exposure enables the analyst to have complete coverage of an area and to view the photography under stereo conditions. Since the season of the year, sun angle, weather conditions, and film-filter type can affect not only the quality of the photography but also the tonal and color renditions of the image, the analyst should be aware of these characteristics if a correct analysis is to be produced. For example, the image tonal quality or color of soil and vegetation will vary with soil moisture and the type of film and film-filter combination. When using aerial photography to obtain climatic comparisons, the analyst must be aware of these film and environmental characteristics to produce an accurate analysis.

Stereo Overlap: This use of "stereo pairs" permits viewing the photography in such a manner that the terrain appears in three dimensions, with exaggeration of the vertical dimension. Viewing aerial photography in stereo enables the analyst to compare not only the density of vegetation but the relative height as well.

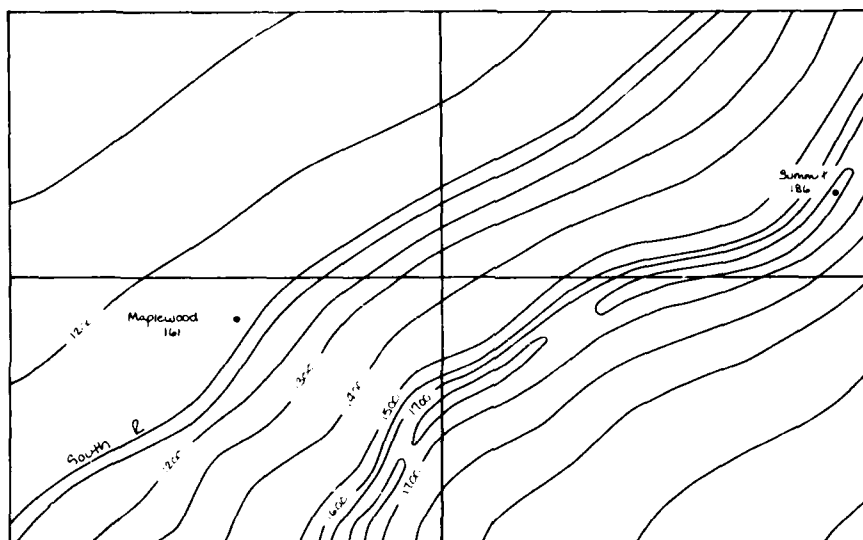
Step 1: Remembering the introductory information in this section, the analyst should study the 1:250,000-scale topographic map being evaluated and determine whether or not the mapped area is representative of more than one climatic regime. Generally, this can be done by identifying dominant terrain features such as mountain barriers, sheltered valleys, or large water bodies. If the total map area is relatively homogeneous in regard to terrain features and elevations and if climatic data is available for at least one station on the map, there will be no need to consider aerial photography as a research tool for estimating climatic conditions. However, if the terrain varies greatly and climatic data are not available for each landform unit, the analyst must describe climatically contrasting map segments.

Step 2: The illustration below is an example of contrasting landforms that could indicate significant climatic differences between a valley environment and adjacent uplands.



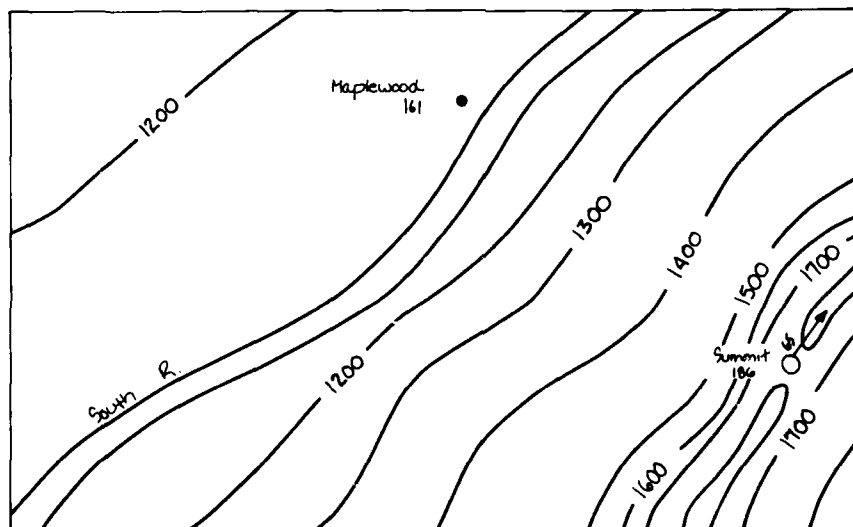
Assuming that such variations exist in this sample area, the analyst should look for climatic data for a station representative of the upland portion of the map. Such a station, or stations, may be found on adjacent or nearby 1:250,000 sheets. These should be analyzed to determine whether or not there is a similarity in terrain features. This should be done using aerial photographs and large-scale topographic maps.

The following illustration shows the Waterbury sheet and three adjacent 1:250,000 sheets. Assume that it has been determined that a distant climatic station, "Summit", is climatically analogous to the upland region on the Waterbury Map.



Step 3: Locate a fictitious station in the upland region of the Waterbury sheet as depicted. Identify the station, using an open circle symbol, and label it with the name and number of the actual station. Draw an arrow in the direction of the actual station and indicate the distance in miles over the arrow.

#### WATERBURY



Step 4: Prepare data tables for the "contrived" station, identifying it as such in Part I of the data tables. Enter all climatic data in the same manner as for the actual station. On the factor overlay, as on the above example, it will be apparent to the user that the two climatic zones have been established from analysis of a valley station (Maplewood), located on the map, and a "contrived" upland station (Summit), having data applicable to its plotted position, but in reality, situated 65 miles to the northeast.

8. Large-Scale Topographic Maps. When climatic data are unavailable for a particular area, large-scale topographic maps, such as aerial photography, may be used for establishing climatic analogies (see III, E, 7). These maps can provide terrain information that will enable the analyst to interpolate, with considerable accuracy, the climate for 1:250,000-scale factor overlays. The procedural steps for using large-scale topographic maps are the same as those for aerial photography, as described in III, E, 7.



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- U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Selective Guide to Published Climatic Data Sources, Key to Meteorological Records Documentation No. 4.11, U.S. Government Printing Office, Washington, D.C. 20402.

## V. APPENDIXES

### APPENDIX A. SPECIFICATIONS FOR THE PREPARATION OF FACTOR OVERLAYS

#### I. Objectives and Design Elements Common to All Factor Overlays

A. Objectives. The objectives of this section are to establish the operational concepts for the production of factor overlays and to prescribe the design and formats for those elements and components common to all factor overlays.

#### B. Operational Concepts.

1. Factor overlays are intended primarily for use within the mapping and intelligence community, and in addition as quick reaction terrain products for distribution to the user.

2. Factor overlays provide formatted geographic data that can be readily retrieved and used in various combinations for terrain analysis and for production of special terrain products.

3. Factor overlays will be prepared in the form of stable base overlays that will accept photographic reduction to 70 by 105 mm and retain their legibility when enlarged back.

4. Normally each data field will require several factor overlays for each area. Data elements to be portrayed on each factor overlay, the symbology to be employed, and unique formats are specified separately for each data field.

5. These specifications do not treat methods of collecting or reducing data. Their purpose is to specify the manner of graphically recording collected and reduced data.

#### C. Format.

1. General format specifications are indicated in Figures A-1 and A-2.

2. No single factor overlay will exceed 660 by 860 mm (26 by 34 inches), including titles, legends, and other marginal data. Where use of a base map exceeding these dimensions is desired, the base will be subdivided and separate factor overlays prepared for each part. When an oversized base is subdivided, each subdivision will be assigned an identification and an index of parts prepared as per Figure A-1 and A-2.

3. Whenever possible, factor overlays will be registered to a standard scale U.S. military map. Base maps other than U.S. military maps will be clearly identified in the upper right corner of the factor overlay.

4. Each factor overlay will be punch registered to the base map.

⑩ NJ 18-4 ⑪  
 V501-⑫  
 1979-⑬

NJ 17-3	NJ 18-1	NJ 18-2
NJ 17-6		NJ 18-5
NJ 17-9	NJ 18-7	NJ 18-8

① WASHINGTON  
 ② CLIMATE

③ 1:250,000  
 USAETL

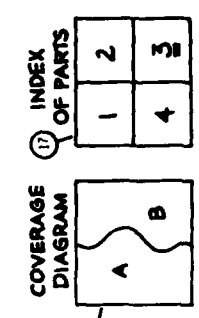
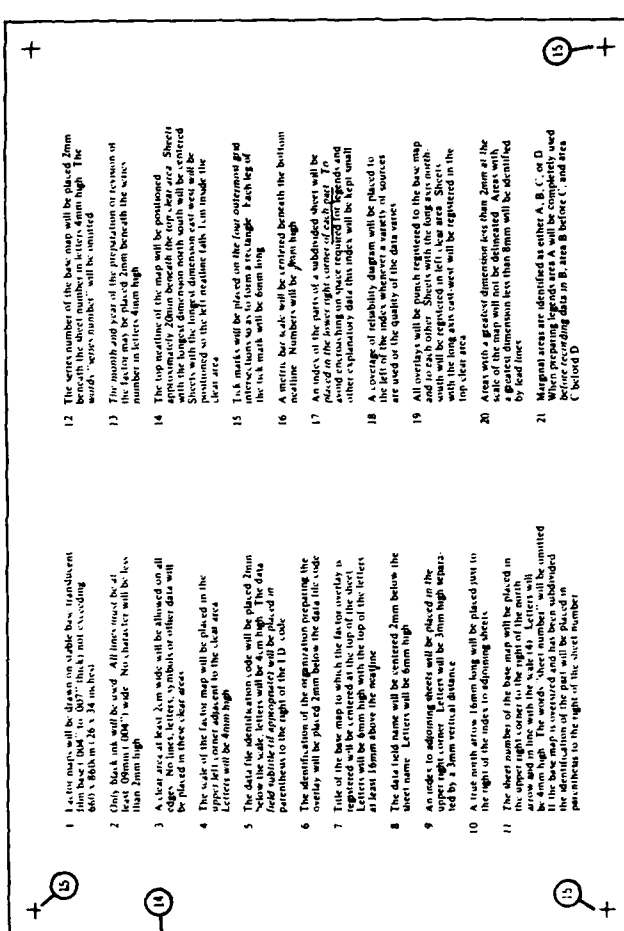


Figure A-1 Format for Factor Overlays with Long Axis E-W.

1:250,000

USAETL

WASHINGTON

CLIMATE

NJ 17-3	NJ 18-1	NJ 18-2
NJ 17-6		NJ 18-5
NJ 17-9	NJ 18-7	NJ 18-8

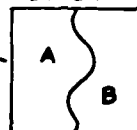
NJ 18-4

V 501

1979

- 1 Factor maps will be drawn on stable base translucent film base (.004" to .007" thick) not exceeding 660 x 860mm (26 x 34 inches).
- 2 Only black ink will be used. All lines must be at least .09mm (.004") wide. No character will be less than 2mm high.
- 3 A clear area at least 2cm wide will be allowed on all edges. No lines, letters, symbols or other data will be placed in these clear areas.
- 4 The scale of the factor map will be placed in the upper left corner adjacent to the clear area. Letters will be 4mm high.
- 5 The data file identification code will be placed 2mm below the scale. Letters will be 4mm high. The data field subtitle (if appropriate) will be placed in parenthesis to the right of the I.D. code.
- 6 The identification of the organization preparing the overlay will be placed 2mm below the data file code.
- 7 Title of the base map to which the factor overlay is registered will be centered at the top of the sheet. Letters will be 6mm high with the top of the letters at least 16mm above the neckline.
- 8 The data field name will be centered 2mm below the sheet name. Letters will be 6mm high.
- 9 An index to adjoining sheets will be placed in the upper right corner. Letters will be 3mm high separated by a 3mm vertical distance.
- 10 A true north arrow 16mm long will be placed just to the right of the index to adjoining sheets.
- 11 The sheet number of the base map will be placed in the upper right corner to the right of the north arrow and in line with the scale (4). Letters will be 4mm high. The words "sheet number" will be omitted. If the base map is oversized and has been subdivided the identification of the part will be placed in parenthesis to the right of the sheet number.
- 12 The series number of the base map will be placed 2mm beneath the sheet number in letters 4mm high. The words "series number" will be omitted.
- 13 The month and year of the preparation or revision of the factor map will be placed 2mm beneath the series number in letters 4mm high.
- 14 The top neckline of the map will be positioned approximately 20mm beneath the top clear area. Sheets with the longest dimension north-south will be centered. Sheets with the longest dimension east-west will be positioned so the left neckline falls 1cm inside the clear area.
- 15 Tick marks will be placed on the four outermost grid intersections so as to form a rectangle. Each leg of the tick mark will be 6mm long.
- 16 A metric bar scale will be centered beneath the bottom neckline. Numbers will be 2mm high.
- 17 An index of the parts of the subdivided sheet will be placed in the lower right corner of each part. To avoid encroaching on space required for legends and other explanations, data this index will be kept small.
- 18 A coverage or reliability diagram will be placed to the left of the index whenever a variety of sources are used or the quality of the data varies.
- 19 All overlays will be punch registered to the base map and to each other. Sheets with the long axis north-south will be registered in left clear area. Sheets with the long axis east-west will be registered in the top clear area.
- 20 Areas with a greatest dimension less than 2mm at the scale of the map will not be delineated. Areas with a greatest dimension less than 8mm will be identified by lead lines.
- 21 Marginal areas are identified as either A, B, C, or D. When preparing legends area A will be completely used before recording data in B, area B before C, and area C before D.

COVERAGE  
DIAGRAM



INDEX  
OF PARTS

1	2
4	3

Figure A-2 Format for Factor Overlays with Long Axis N-S.

5. A neat line 0.5 mm wide will be placed on each factor overlay. This neat line will normally coincide with the neat line of the base map.

6. Legend information will be placed on the areas identified as A, B, C, and D on Figures A-1 and A-2 in that sequence. Area A will be used first, B second, etc. Where the legend is too large to be accommodated in the areas provided, it will be placed on a second piece of overlay material. This legend overlay will be prepared in the same format as the factor overlay and will bear the same identification data.

D. Symbolization. Symbols are specified separately for each data field. However, the following general guidelines will be followed:

1. All lines will be at least 0.09 mm (0.004") wide with a minimum spacing of 0.18 mm (0.008") between lines. When adjacent linear features would overlap if symbolized in their true position, the least significant feature will be displaced to provide the 0.18 mm clearance.

2. All letters will be at least 3.2 mm (0.125") high (Elite typewriter type).

3. All letters, numbers, and symbols will be positioned so as to be readable from the bottom or right side of the sheet.

4. All symbols, letters, and numbers will be drawn in black (plastic for Mylar sheets) ink or black "Prisma" pencil.

5. Areas with a greatest dimension less than 2 mm will not be delineated. Areas with a greatest dimension less than 8 mm (.32") will be identified by lead lines.

6. Tick marks will be placed on the four outermost grid intersections so as to form a rectangle. Each leg of the tick marks will extend 3 mm from the intersection. These ticks are required to permit addition of the grid during the reproduction process.

## II. Specifications for the Preparation of Factor Overlays for Climate

### A. Introduction.

1. This section prescribes the format and symbols to be used to prepare factor overlays for the data field Climate.

2. It is not anticipated that all data required by these specifications will be available during the initial preparation of a factor map. Lack of complete data, however, should not preclude preparation of the factor overlay. The factor overlay concept envisions the systematic recording of data as it is acquired, periodic revision of the overlays, and the accumulation of data over a period of time.

B. General Description. The climate factor overlays will consist of two parts as follows:

1. An overlay registered to a 1:250,000 scale map with climatic stations located and identified by name and number.

2. Accompanying data tables in which climatic conditions at designated locales will be documented by numerical values (generally monthly averages), and by narrative descriptions.

C. Data Elements. Data elements are listed in I-D, and in the data tables, Figures A-4 and A-5.

D. Format.

1. Factor Overlay (Figure A-1): The general format for the factor overlay will be as prescribed in Section I of this appendix.

2. Data Tables (Figure A-4 and A-5):

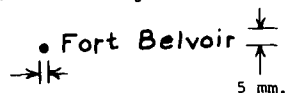
a. The general format for the data tables will be as prescribed in Section I of this Appendix.

b. Figures A-4 and A-5 are reduced copies of Climatic Data Tables 1 and 2. Full size tables are located in an envelope inside the back cover of this guide.

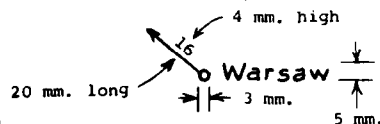
E. Symbolization.

1. Factor Overlay (Figure A-1)

a. Station actually located on the map.



b. Station located off-map.



Arrow and circle  
line width: .4 mm.

2. Data Tables

a. Data Table No. 1. Section I (See following illustration) requires entry of station location information. Explanation of items A - G in this section follows:





b. Data Table No. 2. Section X through XIV: These sections provide space for entering monthly and/or annual numerical values for designated climatic elements. Section XV (illustrated below): Space is provided for entering narrative climatic descriptions.

5 Visual High Level Bombing: Total sky cover 2/8 or less with visibility 2 1/2 mile or greater.

[illegible]

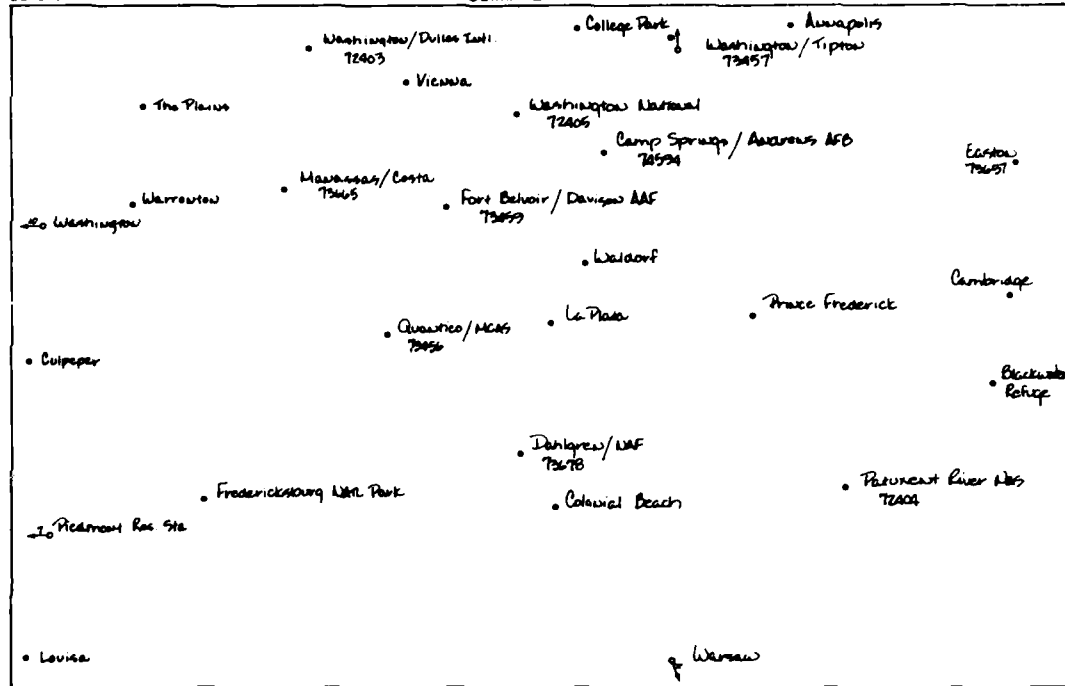
### XV NARRATIVE SUMMARY

Date	Time	Location	Weather	Wind	Sea	Remarks
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
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1967	1967	1967	1967	1967	1967	1967
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1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967	1967	1967	1967	1967	1967	1967
1967						

1:250,000  
CLIMATE  
USAETL

# WASHINGTON CLIMATE

NJ 19 4  
V501  
JUNE 19 79



## LEGEND

Station Location  
Washington National  
T2405  
Station Name  
ID Number (if available)

Distance to station  
Piedmont Res. Station  
Direction of station  
Identifies off-map station

Figure A-3 Format for Climate Factor Overlay.

CLIMATE DATA TABLE NO. 1

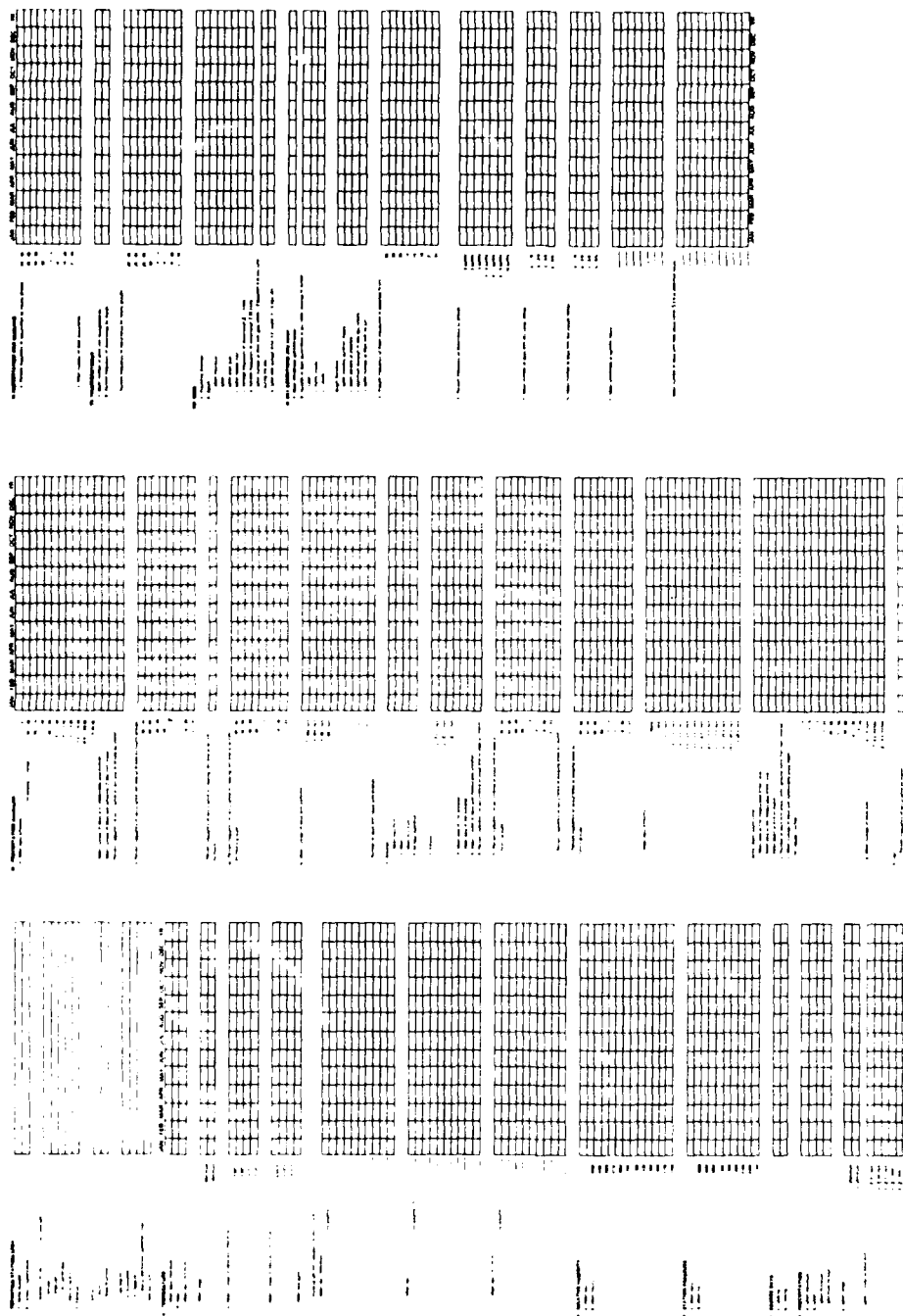
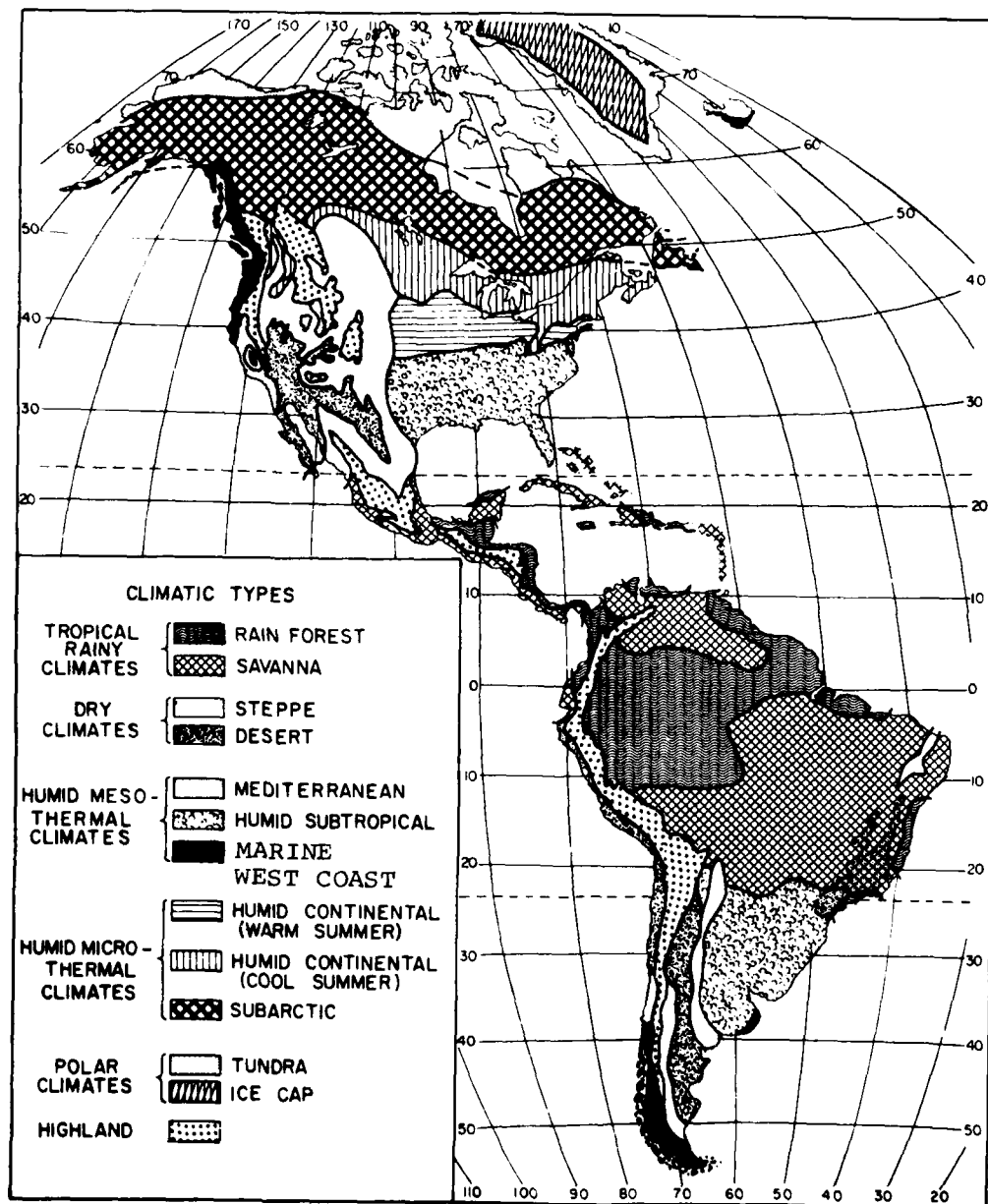


Figure A-4 Climate Data Table No. 1.

## This image shows a single sheet of graph paper. The page is filled with a uniform grid of small squares. There are no margins, text, or other markings on the paper. The grid extends across the entire area of the document.

Figure A-5 Climate Data Table No. 2.

# APPENDIX B. CLIMATIC TYPES AND THEIR DISTRIBUTION



FM 30-10

WESTERN HEMISPHERE



TROPICAL RAINY CLIMATES { RAIN FOREST  
SAVANNA

DRY CLIMATES { STEPPE  
DESERT

HUMID MESO-THERMAL CLIMATES { MEDITERRANEAN  
HUMID SUBTROPICAL  
MARINE WEST COAST

HUMID MICRO-THERMAL CLIMATES { HUMID CONTINENTAL (WARM SUMMER)  
HUMID CONTINENTAL (COOL SUMMER)  
SUBARCTIC

POLAR CLIMATES { TUNDRA  
ICE CAP

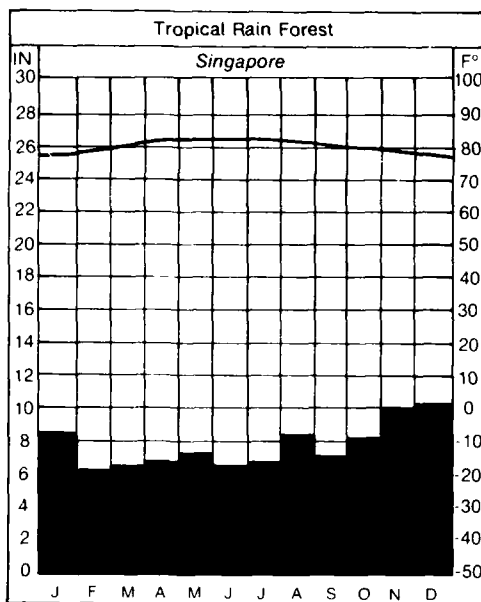
HIGHLAND {

FM 30-10

EASTERN HEMISPHERE

## A. TROPICAL RAINY CLIMATES

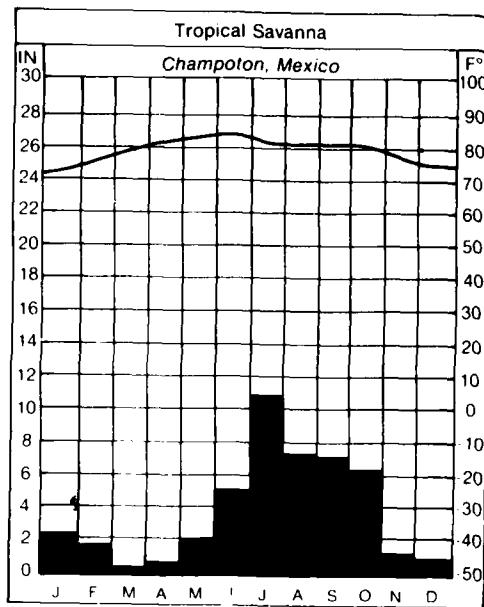
1. **Rain Forest Climate.** The tropical rain forest climate occurs in a belt generally extending from  $5^{\circ}$  to  $8^{\circ}$  on either side of the Equator.



In some regions, such as the Amazon Basin and the Congo Basin, the air is always hot and damp, there are frequent torrential rains of short duration, and the winds are feeble or absent for long periods of time. This climatic type is also found on windward coasts, where, between latitudes of  $5^{\circ}$  and  $25^{\circ}$ , easterly trade winds blow almost constantly over hills or mountains. The cooling of these winds as they rise over the barriers produces an extremely heavy rainfall. This occurs, for example, in portions of Hawaii, the Philippines, the eastern coasts of Central America, Brazil, Madagascar (Malagasy), and most of the islands in the southern Pacific Ocean. In this type of climate, the rays of the sun are nearly vertical most of the time, so that days and nights are practically equal in length through-

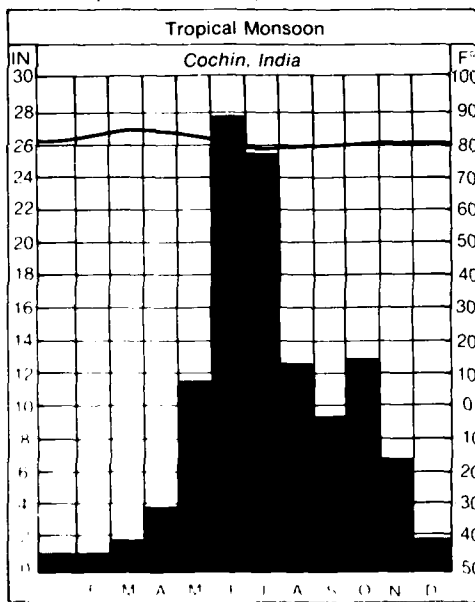
out the year. Night temperatures usually are a few degrees lower than daytime temperatures. There are no clearly marked seasons. Relative humidity is high at all times, and cloudy weather may prevail at times. There are heavy rains on at least 4 or 5 days each week during the rainiest months, with the greatest amounts during the periods when the sun is most directly overhead. The rains are torrential, often accompanied by thunder and lightning. Ordinarily the rain begins in the afternoon, when the heated air is rising most rapidly, and ends before nightfall, although occasionally a light rain will continue into the night.

2. **Savanna Climate.** The tropical savanna climate occurs generally in the regions from  $5^{\circ}$  to  $15^{\circ}$  on either side of the Equator, between the dry climates and the tropical rain forest regions. Instead of the dense forest typical of the tropical rain forest climate, the savanna regions have more open forests and large areas covered with tall grasses. Savanna regions have high temperatures, with annual ranges (difference between mean temperature of the warmest and coldest months of the year) varying between  $5^{\circ}$  and  $15^{\circ}$ F. The total amount of rainfall is less than that of the tropical rain forest climate. There are distinct wet and dry seasons, and usually the rainy season begins and ends with squally and violent thunderstorms. During the rainy season, periods of intensely hot sunshine



also alternate with brief, violent deluges of rain. The amount of rainfall varies considerably, so that there are years of drought and years of flood. In the dry season the weather resembles that of desert regions, with very little rainfall. Trees lose their leaves, many small streams are dry, and the soil becomes hard and cracked. Visibility is greatly reduced by dust and the smoke from grass fires.

### 3. Monsoon Climates. Monsoonal conditions are particularly well developed in Asia, and to a lesser extent in Australia, where intense



summer heating and winter cooling of the continental land masses cause an inflow of moisture bearing air from over adjacent seas during the summer months, and an outflow of dry continental air during the winter period. This distinct and predictable contrast in wind patterns accounts for marked seasonal differences in temperature, and extreme differences in rainfall. Some of the world's highest annual rainfall totals have been recorded in these regions, in spite of winter months with desert-like precipitation regimes.

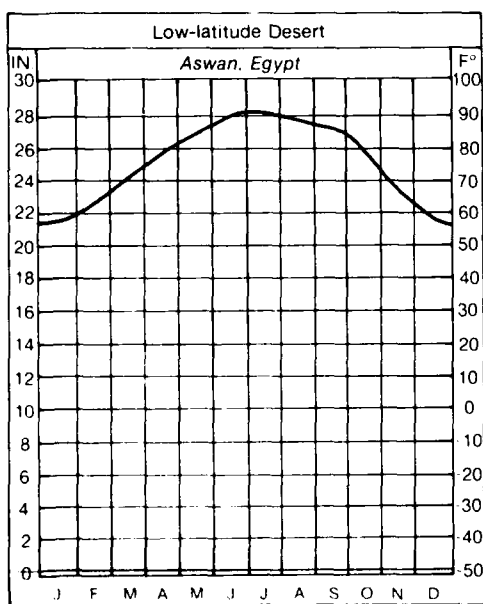
B. DRY CLIMATES. A dry climate is one in which the potential evaporation from the soil and vegetation exceeds the precipitation. There are two subtypes within this category; the semiarid or steppe, and the arid or



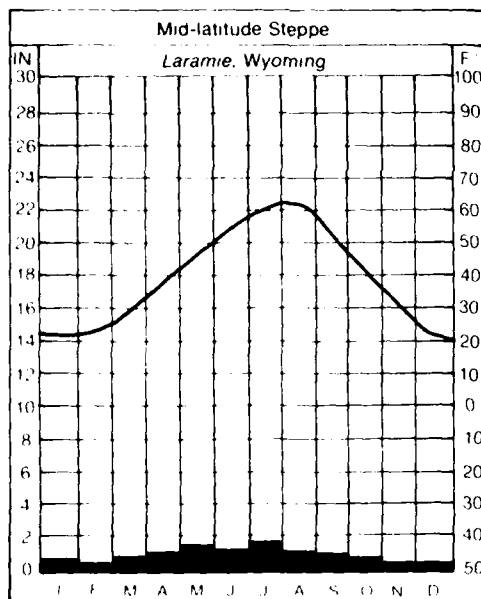
desert. In general, the steppe is a transitional region surrounding the desert and separating it from the humid regions. Although the boundary between the two subtypes is not rigidly defined, it is generally recognized as one-half the mean annual precipitation which forms the dividing line between steppe and humid climates. That is, if a mean annual precipitation amount of 20 inches represents the separation between the dry and humid climates in a region, then 10 inches would be considered as the boundary between steppe and desert. Dry climates are characterized by extreme seasonal temperatures, with large annual ranges. Daily ranges also are high. Humidity is relatively low, averaging from 12 to 30 percent around the middle of the day. Skies are usually clear and cloudless, causing rapid and intense heating of the barren surfaces. Nighttime cooling is equally rapid, contributing to great contrasts in both air and ground surface temperatures. Windy conditions are characteristic of regions with dry climates, and because of sparse vegetation, there is little to impede the flow of surface winds.

1. Low-latitude Steppes. These are semiarid, having a short period of rain-bearing winds and storms each year. Precipitation, however, is meager and erratic. Steppe regions on the poleward sides of deserts have almost all their annual rainfall in the cool season. Those adjoining savannas on the equatorward sides of deserts generally have a brief period of relatively heavy rains during the time when the sun is highest.

2. Low-latitude Desert. These occur in the vicinity of  $20^{\circ}$  to  $25^{\circ}$  north or south, with the average positions of their extreme margins at approximately  $15^{\circ}$  and  $30^{\circ}$ . The Sahara and Australian Deserts are typical examples of this type of climate. In these desert regions, rainfall is not only small in amount, but erratic and uncertain. However, infrequent heavy showers may turn dry streambeds into raging torrents. Often there is no rainfall for several years, and the skies are almost always clear and cloudless.



### 3. Middle-latitude Steppes. These climatic regimes occur principally

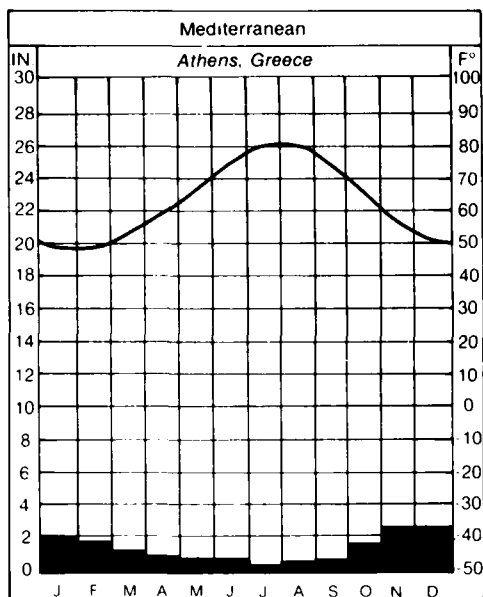


in the interior of the North American and Asiatic land masses. Mountain ranges effectively block the influx of maritime air, contributing to the aridity of both middle-latitude steppe and desert regions. Although having greater precipitation than desert areas, middle-latitude steppes experience years with marked departures from normal amounts. In North America rapid changes in temperatures are characteristic of steppe lands, and mean winter temperatures often vary greatly from year to year.

4. Middle-latitude Desert. This climate is characterized by lower temperatures and precipitation than low-latitude desert climates. They occur in the basinlike, low-altitude areas, surrounded by high-land rims, that exist in some continental interiors. The Great Basin of the U.S. and the Turkestan Basin of Asia have this type of climate. Summer temperatures are high. Middle-latitude steppes occupy intermediate locations between deserts and humid climates. They have small amounts of rainfall, which are usually unpredictable in amount or time of occurrence.

C. HUMID MESOTHERMAL CLIMATES. These climates are characterized by moderate temperatures that occur in a seasonal rhythm. They are divided into three general categories - Mediterranean climate, humid subtropical climate and marine west coast climate.

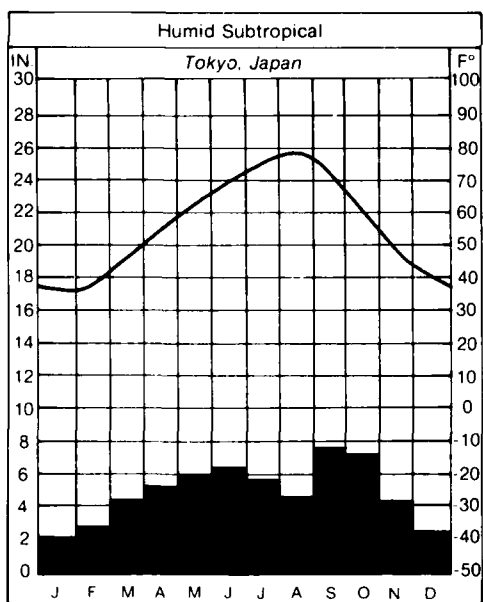
1. Mediterranean Climate. This climate has hot, dry summers and mild winters, during which most of the annual precipitation occurs. Annual rainfall usually ranges from 38 to 64 centimeters (15 to 25 inches). In the winter months, the average temperature is usually between 40° and 50°F.; in the summer, it ranges generally from 70° to 80°F. This type of climate occurs in five regions - the borderlands of the Mediterranean Sea, central and coastal Southern California, central Chile, the southern tip of South Africa, and parts of southern Australia. Coastal areas often have a modified type of Mediterranean climate, with cool summers accentuated in some



areas by the cool ocean currents offshore. There is apt to be a cool daily breeze along the seacoast and for a short distance inland. Relative humidity is high. Fogs are frequent, but usually are dissipated by the heat of the sun in the early morning hours. Winters are mild and frost infrequent, and the annual change in temperature at some locations is uncommonly small. Summer days in Mediterranean climates are warm to hot, with bright sunshine, low relative humidity, and nearly cloudless skies. Daily weather becomes erratic and unpredictable in autumn. The winds are less regular and there is occasional rain. Temperatures remain relatively high. Winters are mild and warm, with occasional frosts and relatively abundant rainfall.

## 2. Humid Subtropical Climate.

on the eastern sides of continents,

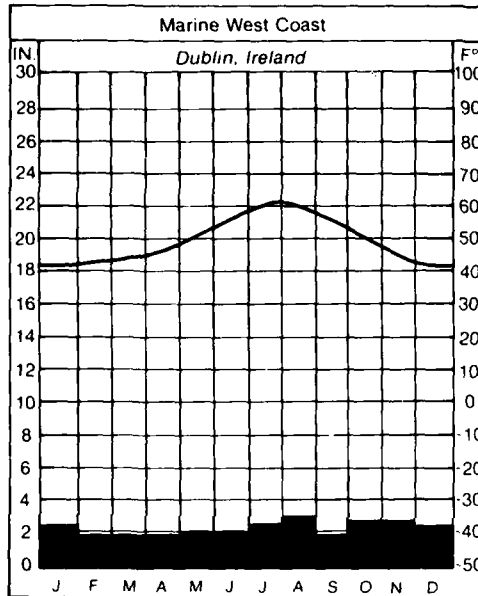


This climate occurs in regions located generally from about 25° poleward (north or south) to 35° or 40°. This type of climate is found, for example, in the American Gulf States. Temperatures are similar to those of the Mediterranean climate, with less contrast between regions on the coast and those located inland. Rainfall ranges from 75 to 165 centimeters (30 to 65 inches) a year at most locations. In the summer, humidity is high, temperatures average from about 75° to 80°F. in the hottest month, and there are frequent thundershowers. Nights are hot and sultry. There is no drought season, but normally there is less rain in winter than in summer. Severe tropical cyclones occur most frequently in the late summer and early fall. Winters are relatively mild in this type climate. Temperatures in the cool months usually average between 45° to 55°F. with the midday temperature

around 55° to 60°F. and the night temperature from 35° to 45°F. The high humidity, however, makes the nights chilly and uncomfortable. Snow may

fall occasionally, but it does not remain for more than 2 or 3 days. Day-time temperatures may be raised above 60° or 70°F. by the arrival of a tropical air mass, then be reduced by a subsequent polar wind as much as 30°F. in 24 hours, resulting in a severe freeze.

3. Marine West Coast Climate. This climate occurs on the western or windward sides of continents, poleward from about 40° latitude, and results

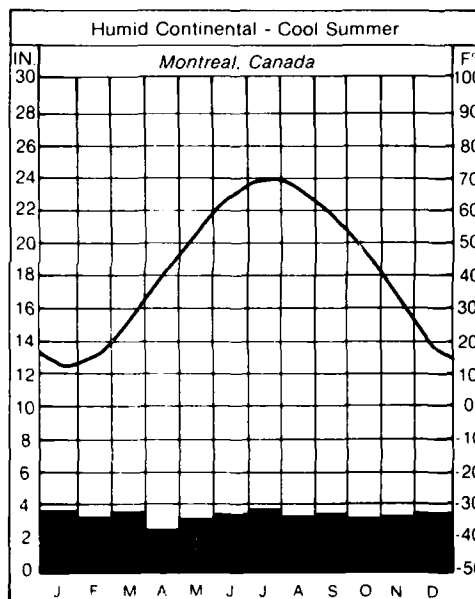
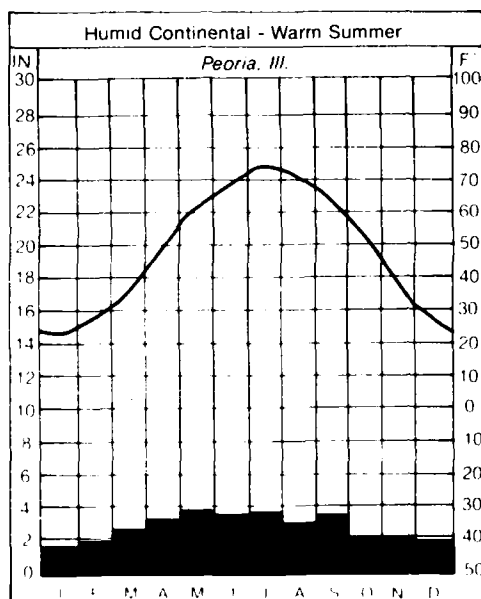


from onshore westerly winds that blow over the land from adjoining oceans. It borders the Mediterranean type on its equatorward margins, extends into the higher middle latitudes and ends at the subarctic or tundra climate. Where mountains are closely parallel to the west coast, as in Scandinavia, this type of climate is confined to a relatively narrow region on seaward side of the highlands. In parts of western Europe, where there are extensive lowland, the effects of the ocean conditions have an influence on the climate for many miles inland. Summers are cool with occasional hot days but no severe or prolonged heat waves. Rainfall is fairly abundant. Winters are mild particularly in western Europe, where a great mass of warm water known as the North Atlantic Drift lies offshore. Cloudy skies and a humid atmosphere are prevalent.

There are frequent severe frosts. The midday temperatures of most winter days are relatively high. During unusually cold periods, temperatures may remain below freezing for several days. The winter season is marked by severe storms, fogs, and mist. Where the western coasts are bordered by mountain ranges, as in Norway and Chile, precipitation may reach a total of 250 to 380 centimeters (100 to 150 inches) a year. In areas consisting predominantly of lowland, rainfall usually averages from 50 to 90 centimeters (20 to 35 inches) a year and may fall steadily for several days at a time. In mountainous regions, such as the Cascade Range or the Scandinavian Highlands, snowfall is very heavy. The marine west coast climate is cloudy and has mist or fog for at least 40 days a year at many locations.

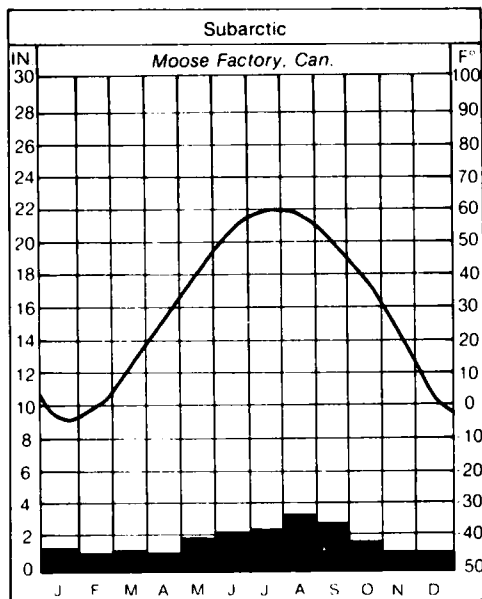
D. HUMID MICROTHERMAL CLIMATES. The humid microthermal climate occurs in the Northern Hemisphere northward from the subtropical climatic regions and in leeward interior locations. Latitudinal spread is from about 40°N to 60°N. It has colder winters than the mesothermal type, with larger annual changes of temperature, longer frost seasons and snow cover that lasts for considerable periods. Humid continental and subarctic are the principal types of microthermal climate.

1. Humid Continental Climates. These climates border the marine west coast climatic regions. Where there are mountain barriers, as in North America, the change between the two types of climate is abrupt, but it is very gradual where there are no barriers, as in the lowlands of western Europe. Seasonal differences are extreme, with very cold winters and warm to hot summers. Along the seaboard, the summer heat is oppressive and sultry because of the higher humidity, and the winter cold is more raw and penetrating than in the drier interior regions. Along the interior margins, humid continental climates border upon the dry climates and have subhumid characteristics. The prairies of North America and interior Eurasia are examples of such climatic regions. In these areas, the maximum rainfall usually occurs in late spring and early summer, rather than at the time of greatest heat. In winter, regions with a humid continental type of climate normally have a permanent snow cover that lasts a few weeks to several months. Summer rains usually occur in sharp showers accompanied by thunder and lightning. Winter in the prairie regions is characterized by frequent changes in weather conditions, with occasional blizzards, known as burans.



A blizzard is marked by violent gales, drifting snow, and extreme cold. Although there may be no precipitation falling, the air is filled to a height of several hundred feet by swirling masses of dry, finely pulverized snow. Afternoon thunderstorms frequently occur during summer in prairie regions. Regions on the southern margin of microthermal climates have long, hot and humid summers lasting from 150 to 200 days between the periods of frost. Winters are cold, with frequent intervals of mild, rainy weather. Winter is the dominant season on the poleward side of regions with this type of climate. Summers are relatively short, usually comprising a period of about 5 months. Temperature changes of as much as 40°F. in 24 hours are common in spring and autumn.

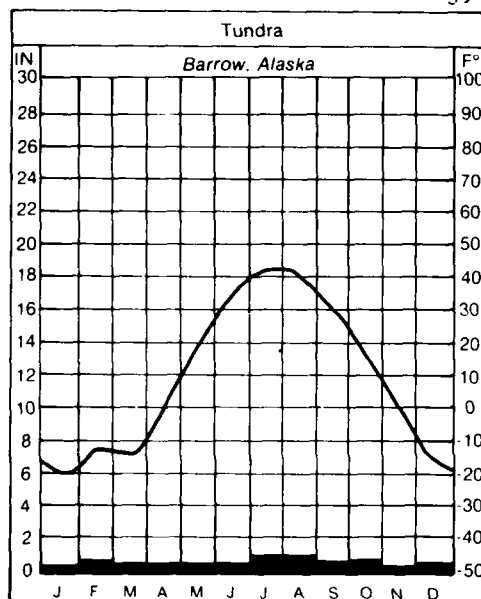
2. Subarctic Climate. This climate occurs in latitudes of  $50^{\circ}$  to  $60^{\circ}$  in the Northern Hemisphere. The Eurasian region extends from Finland and



Sweden to the Pacific coast of Siberia, and in North America, the subarctic stretches from Alaska to Labrador and Newfoundland. Long, extremely cold winters and very brief summers characterize this type of climate. Winter quickly follows summer, with only a short period of autumn intervening. A large part of these regions are frozen to a considerable depth, with only a few feet of the upper part thawing out in the summer. There is little precipitation in subarctic regions. No more than 40 centimeters (15 inches) annually. Precipitation exceeds 50 centimeters (20 inches) chiefly along the oceanic margins of Eurasia and North America.

E. POLAR CLIMATES. The poleward limit of forest growth usually is considered the dividing line between polar climates and those of intermediate latitudes coinciding with a line (isotherm) connecting points having a temperature of  $50^{\circ}\text{F.}$  for the warmest month. A mean annual temperature of  $32^{\circ}\text{F.}$  or below is also a distinguishing feature of polar climates. In the Southern Hemisphere, the only large land area with a Polar climate is the Antarctic continent. In the Northern Hemisphere, this climatic region includes the Arctic Sea, the borderlands of Eurasia and North America, with the island groups that are north of these continents, and ice-covered Greenland. The Arctic is almost a landlocked sea and the Antarctic is a seagirt land with important climatic differences between them. The climate has fewer wide variations in the Antarctic because it is a single land mass surrounded by oceans with a uniform temperature. Polar climates have the lowest mean annual and summer temperatures, and although summer days have up to 24 hours of sunshine, the rays are too oblique to raise the temperature significantly. Much of the energy from the sun is reflected by snow and ice, and is consumed in melting the snow cover and evaporating the water. As a result neither the land surface or the air adjacent to it becomes warm. Precipitation averages less than 25 centimeters (10 inches) a year over large parts of the Polar land areas. Because of the low evaporation and small amount of melting, permanent ice fields several thousand feet thick have accumulated on Greenland and the Antarctic continent. Polar climates usually are divided into two types - Tundra and Icecap.

1. Tundra. When one or more months in the warm season have an average temperature above  $32^{\circ}\text{F.}$ , but below  $50^{\circ}\text{F.}$ , the ground is free from snow for a short period, and low sparse vegetation is possible, the climate is designated tundra. It is less rigorous than that of the icecap regions. The warmest month isotherms of  $50^{\circ}$  on the equatorward side and  $32^{\circ}\text{F.}$  on the poleward side are considered to be the boundaries. Over land areas, tundra climate is confined largely to the Northern Hemisphere. Ocean prevails in those Antarctic areas where the tundra climate normally would be found. Summers warm enough to develop a tundra climate occur only in the most northerly fringes of the Antarctic and on certain small islands of the region. The most extensive tundra areas are on the Arctic Sea margins of Eurasia and North America. Long, cold winters and brief, cool summers



characterize the tundra climate. Average temperatures usually are above freezing for 2 to 4 months of the year, and killing frosts may occur at any time. Fog is prevalent along the coast, frequently lasting for days at a time. Snow cover disappears for 1 or 2 months during the summer season, and the lakes usually are free from ice. Drainage is poor because of the permafrost, resulting in many bogs and swamps. Summer temperatures do not differ greatly in the various tundra regions. There is, however, a considerable variation in winter temperatures. Average temperatures in the Arctic coastal areas of Siberia average about  $-35^{\circ}$  to  $-40^{\circ}\text{F.}$  in January and February, with even lower temperatures inland. Along the Arctic borders of North America, the temperature for comparable periods is higher, and winters

are less severe. Annual precipitation normally does not exceed 25 to 30 centimeters (10 to 12 inches) in the tundra region, although larger amounts are received in parts of eastern Canada, particularly in Labrador. Usually the most precipitation occurs in summer and autumn, the warmest seasons. Most of it is in the form of rain, with occasional snow. The winter snow is dry and powdery, forming a compact cover. Often it is accompanied by strong blizzard winds which pile up the snow on the lee sides of hills and in depressions, sweeping exposed surfaces bare. There is no vegetation to break the force of the wind and to hold the snow cover.

2. Icecap. Icecap climates are those where the average temperature of all months is below  $32^{\circ}\text{F.}$ , vegetation will not grow, and a permanent snow-and-ice cover prevails. This climate characterizes the permanent continental ice sheets of Greenland and Antarctica and the ocean in the vicinity of the North Pole. The average winter-month temperatures range from  $-35^{\circ}$  to  $-45^{\circ}\text{F.}$  Storms or violent winds do not occur as frequently in the inner portions of the icecaps as in other climatic regions, but in some marginal areas there are extreme gales caused by the precipitous descent of cold air from the continental ice plateau.

## APPENDIX C. CLIMATIC SUMMARIES

	<u>TITLE</u>
1	LOCAL CLIMATOLOGICAL DATA (Monthly Summary)
2	LOCAL CLIMATOLOGICAL DATA (Monthly Supplement)
3	LOCAL CLIMATOLOGICAL DATA (Annual Summary with Comparative Data)
4	CLIMATOLOGICAL DATA (Monthly)
5	CLIMATOLOGICAL DATA (Annual Summary)
6	CLIMATOLOGICAL SUMMARIES (Substations)
7	CLIMATOLOGICAL DATA (National Summary, monthly)
8	CLIMATOLOGICAL DATA (National Summary, annual)
9	MONTHLY CLIMATIC DATA FOR THE WORLD
10	CLIMATIC SUMMARY OF THE UNITED STATES (Supplement for 1951-1960)
11	CLIMATES OF THE STATES
12	CLIMATIC SUMMARY OF THE UNITED STATES (Supplement for 1931-1952)
13	DAILY NORMALS OF TEMPERATURE AND HEATING DEGREE DAYS
14	STORM DATA
15	HOURLY PRECIPITATION DATA (Monthly)
16	HOURLY PRECIPITATION DATA (Annual Summary)
17	SUMMARY OF HOURLY OBSERVATIONS-PRECIPITATION
18	MAXIMUM STATION PRECIPITATION for 1, 2, 3, 6, 12, and 24 Hours
19	MONTHLY NORMALS OF TEMPERATURE AND HEATING DEGREE DAYS



20	MONTHLY AVERAGES FOR STATE CLIMATIC DIVISIONS (1931-1960)
21	CLIMATIC SUMMARY OF THE UNITED STATES (pre-1931)
22	UNIFORM SUMMARY OF SURFACE OBSERVATIONS (Parts A - E)
23	SPECIAL SUMMARIES
24	WORLD-WIDE AIRFIELD SUMMARIES
25	WORLD WEATHER RECORDS
26	TABLES OF TEMPERATURE, RELATIVE HUMIDITY AND PRECIPITATION
27	WORLD SURVEY OF CLIMATOLOGY

NUMBER: 1

TITLE: LOCAL CLIMATOLOGICAL DATA (MONTHLY SUMMARY)

PUBLICATION INFORMATION: Monthly, by station

GEOGRAPHIC COVERAGE: UNITED STATES (50 states), Puerto Rico, and  
Pacific Islands

REPORTING STATIONS: 290 (approximate total)

TYPES OF DATA:

A. Daily values and averages, and monthly values and averages for: temperature (average, max., min., departure from normal), heating/cooling degree days, dew point, precipitation (amounts - liquid equivalent), snow/ice amounts and amount on ground, wind (resultant dir./speed, average speed, fastest mile (speed/dir.), sunshine, sky cover, pressure, weather types, ceiling, visibility.

B. Three-hour observations for each day of the month and monthly summation of all three hourly observations.

C. Hourly precipitation data for month, on a daily basis for each hour of the day.

NUMBER: 2

TITLE: LOCAL CLIMATOLOGICAL DATA (SUPPLEMENT)

PUBLICATION INFORMATION: NO LONGER PUBLISHED- Discontinued with 12/64 issue.

GEOGRAPHIC COVERAGE: UNITED STATES (50 states), Puerto Rico, and Pacific Islands.

REPORTING STATIONS: 290 (approximate total)

TYPES OF DATA:

A. Hourly observations for each day of the month. Data includes: sky cover, ceiling, visibility, current weather, pressure, dry bulb, wet bulb, R.H., dew point, wind (speed & direction); daily averages for these observations and averages by hours also included.

B. Six (6) additional matrices are included:

1. Temperature and wind speed and R.H. occurrences (hourly obs.).
2. Wind direction and speed occurrences (hourly obs.).
3. Hourly and daily occurrences of precipitation amounts (frequency of occurrence for each hour of the day).
4. Ceiling-visibility occurrences (hourly obs.).
5. Occurrences of weather by hour of the day.
6. Occurrences of weather by wind direction.

NUMBER: 3

TITLE: LOCAL CLIMATOLOGICAL DATA (Annual Summary with Comparative Data)

PUBLICATION INFORMATION: Annual, by station

GEOGRAPHIC COVERAGE: Same as NUMBER 1

REPORTING STATIONS: Same as NUMBER 1

TYPES OF DATA:

A. A narrative climatological summary which presents information on the station's location, topography, general climatic situation, and some of the more notable weather extremes.

B. Meteorological Data for the year on a monthly basis, as well as corresponding Normals, Means, and Extremes for comparative purposes.

C. Average temperature, precipitation, snowfall, and heating/cooling degree days are presented on a monthly basis (with annual totals) for various numbers of years for up to periods of about 50 years depending on the original length of the station record.

NUMBER: 4

TITLE: CLIMATOLOGICAL DATA

PUBLICATION INFORMATION: Monthly, by state

GEOGRAPHIC COVERAGE: Same as NUMBER 1

REPORTING STATIONS: All precipitation and temperature gathering stations in the state (1st and 2d order, substations, and cooperative stations)

TYPES OF DATA:

- A. Statewide temperature and precipitation extremes for the month.
- B. Supplemental wind, R.H., precipitation, sunshine, and sky cover data for all first-order reporting stations within the state for the month.
- C. For all stations within the state: monthly summarized temperature and precipitation data; on a daily basis - precipitation and max/min temperatures and monthly summaries, totals, and averages.
- D. For specialized stations only - daily soil temperatures and evaporation and wind data.
- E. A station index, which gives data on station location, times and types of observations made, and the name of the observer.

NUMBER: 5

TITLE: CLIMATOLOGICAL DATA (Annual Summary)

PUBLICATION INFORMATION: Annually, by state

GEOGRAPHIC COVERAGE: Same as NUMBER 1

REPORTING STATIONS: Same as NUMBER 4

TYPES OF DATA:

- A. Average temperature and departure from normal and total precipitation and departure from normal for each month and for the year for all stations.
- B. Temperature extremes and Freeze Data for all stations.
- C. Soil temperatures and Total Evaporation and Wind Movement on a monthly basis for selected stations.
- D. Station Index-station location, times and types of observations, and name of observer.

NUMBER: 6

TITLE: CLIMATOLOGICAL SUMMARIES (Substations)

PUBLICATION INFORMATION: Data sheet published for each substation in the U.S. Dates of publications vary. Information was collected as part of the Climatography of the United States program.

GEOGRAPHIC COVERAGE: United States (50 states)

REPORTING STATIONS: all substations

TYPES OF DATA:

A. Climatological Summary - presents means and extremes for various numbers of years on a monthly basis. Thirty-year periods are used if available. Data presented: temperature, precipitation, and degree days.

B. Narrative Climatological Summary - a description of the substation's climate written by the state climatologist.

C. Station History - a narrative history of the substation, incorporating site changes, instrumentation used and instrument relocation, and a list of the observers and/or organizations that have taken observations throughout the stations existence.

D. Monthly and yearly totals of average temperature and precipitation totals on a yearly basis for various numbers of years (from less than 5 to over 30) depending on the substation record.

NUMBER: 7

TITLE: CLIMATOLOGICAL DATA (National Summary)

PUBLICATION INFORMATION: Monthly, one issue

GEOGRAPHIC COVERAGE: Same as NUMBER 1

REPORTING STATIONS: All 1st-order stations (approximately 290)

TYPES OF DATA:

- A. Temperature extremes and precipitation extremes for the month by state.
- B. Monthly summaries of temperature, precipitation, dew point, R.H., wind, sky cover, and possible sunshine for all first-order stations in the U.S., Puerto Rico, and the Pacific Islands. (Metric Units)
- C. Heating and Cooling Degree Days for above stations.
- D. Storm Summary for month (tornadoes, hailstones, windstorms, lightning, heavy snowstorms, ice storms).
- E. Monthly summary of National Flood Events.
- F. Rawinsonde Data - monthly averages.
- G. Solar Radiation Data



NUMBER: 8

TITLE: CLIMATOLOGICAL DATA (National Summary)

PUBLICATION INFORMATION: Annual, one volume

GEOGRAPHIC COVERAGE: Same as NUMBER 1

REPORTING STATIONS: All first-order stations, same as NUMBER 1.

TYPES OF DATA:

- A. Maximum short duration precipitation (from 5 through 180 minutes) for all first order stations on a monthly basis.
- B. Sunshine amount and percent of possible sunshine for the month.
- C. Annual Climatological Data for all first order stations. Includes: annual summary of temperature (max/min, extremes), heating/cooling degree days, total liquid precipitation and snowfall, greatest liquid precipitation and snowfall in 24 hours and dates of occurrences, average R.H. at 6-hour intervals, wind (average, resultant, and fastest mile), average sky cover.
- D. The Normals, Means and Extremes for the above mentioned elements (C).
- E. Tornado, cyclone, hurricane, and Flood Summary.

NUMBER: 9

TITLE: MONTHLY CLIMATIC DATA FOR THE WORLD

PUBLICATION INFORMATION: monthly, one issue

GEOGRAPHIC COVERAGE: worldwide

REPORTING STATIONS: over 1200 surface observation reporting stations,  
over 400 upper air reporting stations

TYPES OF DATA: (ALL DATA EXPRESSED IN METRIC UNITS)

A. SURFACE DATA: summary for month, includes: station's longitude and latitude, elevation, pressure (mean station and mean sea level), temperature (mean & departure from normal), vapor pressure (mean & departure from normal), precipitation (total & departure from normal), percent possible sunshine (% of long term average).

B. UPPER AIR DATA: monthly averages at standard pressure surfaces (surface: 850, 700, 500, 300, 200, 150, 100, 50, and 30 mbs) of temperature, dew point depression, and wind vectors.

NUMBER: 10

TITLE: CLIMATIC SUMMARY OF THE UNITED STATES - Supplement for 1951-1960

PUBLICATION INFORMATION: published in 1964, one copy per state, part of  
Climatography of the United States, Series No. 86

GEOGRAPHIC COVERAGE: 50 U.S. states, Pacific Islands, and Caribbean

REPORTING STATIONS: all stations

TYPES OF DATA:

A. Total Precipitation - exact values for 1951-1960 period for each month with annual totals. Average precipitation for 10-year period for each month. Record monthly precipitation for entire station history.

B. Total snowfall (same presentation as in A.)

C. Mean number of days with precipitation  $\geq 0.10$ " or  $\leq 0.50$ " with presentation same as A.

D. Mean temperature and normals (by month and year), with presentation same as A.

E. Mean daily max/min temperatures - extreme values for each month and for year - for individual station's entire period of record.

F. Mean number of days with temperatures  $\geq 90^{\circ}\text{F}$  or  $\leq 32^{\circ}\text{F}$  - by month and year for 1951-1960 period.

G. Mean Evaporation - by month and year for station's entire history.

H. Station Index

NUMBER: 11

TITLE: CLIMATES OF THE STATES

PUBLICATION INFORMATION: Part of Climatology of the United States, Series No. 60, published in 1959 and 1960. One publication per state.

GEOGRAPHIC COVERAGE: 48 contiguous states, and Alaska. Hawaii omitted

REPORTING STATIONS: all stations within states

TYPES OF DATA:

- A. A Narrative Climatological Summary of the state.
- B. Freeze Data - mean dates of first fall and last spring freezes and mean number of days between the two.
- C. Mean temperature and precipitation - for 20-30 year periods, for each month and year.
- D. Normals, Means, and Extremes - for only 1st-order stations within the state (as of 1959 or 1960), this is the same data as is presented in NUMBER 3.

NUMBER: 12

TITLE: CLIMATIC SUMMARY OF THE UNITED STATES - Supplement for 1931-1952

PUBLICATION INFORMATION: part of Climatology of the United States,  
Series No. 11, by state and/or region

GEOGRAPHIC COVERAGE: 48 contiguous United States

REPORTING STATIONS: all stations

TYPES OF DATA:

A. Total Precipitation - by month and year for 1931-52, and mean values for same.

B. Mean Snowfall - mean and extreme values for month and year for entire 1931-52 period.

C. Mean temperature, max/min temperature for each month and year for entire station's period of operation.

D. Absolute max/min temperatures for each month for entire period of the station's operation.

E. Station Index and Station History

NUMBER: 13

TITLE: DAILY NORMALS OF TEMPERATURE AND HEATING DEGREE DAYS (1931-1960)

PUBLICATION INFORMATION: part of Climatology of the United States,  
Series No. 84, 1963

GEOGRAPHIC COVERAGE: 50 U.S. States, Caribbean, and Pacific Islands

REPORTING STATIONS: 1st-order stations only

TYPES OF DATA:

A. Temperature (max/min, average) and degree days by day for each month for all months. Normals based on 1931-1960 data base.

NUMBER: 14

TITLE: STORM DATA

PUBLICATION INFORMATION: monthly, one issue

GEOGRAPHIC COVERAGE: for 50 U.S. States

REPORTING STATIONS: cities/counties/regions in state where severe weather has been experienced.

TYPES OF DATA:

A. STORM DATA AND UNUSUAL WEATHER PHENOMENA -

1. location
2. time of occurrence (L.S.T.)
3. length and width of storm's path
4. number of persons killed or injured
5. property and crop damage
6. character of storm
7. narrative of storm occurrence

NUMBER: 15

TITLE: HOURLY PRECIPITATION DATA

PUBLICATION INFORMATION: monthly, by state

GEOGRAPHIC COVERAGE: 50 U.S. States, Puerto Rico

REPORTING STATIONS: all precipitation reporting stations within each state

TYPES OF DATA:

A. DAILY TOTALS of liquid precipitation and monthly total.

B. HOURLY PRECIPITATION - hourly amounts and maximum amounts for hours and 15-minute intervals (where applicable) for the month.

NUMBER: 16

TITLE: HOURLY PRECIPITATION DATA (Annual Summary)

PUBLICATION INFORMATION: annual, by state

GEOGRAPHIC COVERAGE: U.S. States (Alaska omitted) & Puerto Rico

REPORTING STATIONS: all precipitation reporting stations in each state

TYPES OF DATA:

A. Monthly Precipitation Totals and Yearly Totals

B. Annual Maximum Precipitation - hourly and minute maximums and dates of occurrence.

NUMBER: 17

TITLE: SUMMARY OF HOURLY OBSERVATIONS

PUBLICATION INFORMATION: part of Climatology of the United States,  
Series No. 30 & 82

GEOGRAPHIC COVERAGE: 152, 1st-order stations in the United States, all  
50 states included, Puerto Rico, and Pacific Island

REPORTING STATIONS: 152, 1st-order stations in the United States, Puerto  
Rico, and Pacific Islands

TYPES OF DATA:

A. For each month and annually, the following summarized data matrices  
are presented:

1. Temperature, wind speed, and R.H. occurrences.
2. Percentage frequencies of wind direction and speed.
3. Occurrences of precipitation amounts (hour of day vs. intensity).
4. Percentage frequencies of ceiling vs. visibility.
5. Percentage frequencies of sky cover, wind, and R.H. for each hour  
of the day.

NUMBER: 18

TITLE: MAXIMUM STATION PRECIPITATION FOR 1, 2, 3, 6, 12, and 24 HOURS

PUBLICATION INFORMATION: Technical Paper #15, 1955. One copy for each state or region in contiguous United States

GEOGRAPHIC COVERAGE: The 48 contiguous United States

REPORTING STATIONS: All precipitations reporting stations in each state

TYPES OF DATA:

A. Maximum Monthly Precipitation Amounts for each month for the station's period of record - includes: date of occurrence, amount and duration (1, 2, 3, 6, 12, and 24 hour periods).

B. Statewide Extremes - same presentation as in A.

C. Maps of Maximum Recorded Precipitation for state for 1, 2, 3, 6, 12, and 24 hour periods.

D. Summary of Precipitation Extremes - for each reporting station in the state for 1, 2, 3, 6, 12, 24 hour periods for each month and annually for the entire period of record of each reporting station.



NUMBER: 19

TITLE: Monthly Normals of Temperature, Precipitation, and Heating Degree Days

PUBLICATION INFORMATION: part of Climatology of the United States, Series No. 81, 1962. Published for each state and/or region

GEOGRAPHIC COVERAGE: 50 U.S. States, Pacific Islands, and Caribbean

REPORTING STATIONS: all stations

TYPES OF DATA:

A. Normals for 1st-order stations - based on 1931-1960 data base - by month and for year including: max/min temperatures, average temperature, degree days, and liquid precipitation amounts.

B. Normals for all stations - based on 1931-1960 data base - by month and for year for average temperature and average precipitation. This data is arranged by state climatological division.

NUMBER: 20

TITLE: MONTHLY AVERAGES FOR STATE CLIMATIC DIVISIONS

PUBLICATION INFORMATION: part of Climatology of the United States, Series No. 85, 1963

GEOGRAPHIC COVERAGE: United States (less Hawaii), Puerto Rico

REPORTING STATIONS: individual state climatological divisions

TYPES OF DATA:

A. Monthly and Annual Division Averages, arranged by State Climatological Divisions - for each year in the 1931-1960 period, for temperature (average) and precipitation.

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NUMBER: 21

TITLE: CLIMATIC SUMMARY OF THE UNITED STATES

PUBLICATION INFORMATION: publication date unknown (post 1930),  
106 summaries

GEOGRAPHIC COVERAGE: the 50 United States

TYPES OF DATA: 106 summaries cover sections of the United States determined by topography, climate, and state boundaries.

- A. Topographic Features of sections
- B. Climatic Characteristics of sections (temperature and precipitation)
- C. For selected stations in the sections - for entire length of record for month and annual summary:
  - 1. Temperature - avg., avg. max/min, absolute max/min, highest and lowest monthly average.
  - 2. Precipitation - avg., total amts. driest and wettest years, snow (avg. and greatest in 24 hours).
  - 3. Relative Humidity - avg. at 8 a.m., noon, and 8 p.m.
  - 4. Sunshine - average no. of hours, and percent of possible.
  - 5. Prevailing wind direction.
- D. For each month for the entire period of the station's record, the following:
  - 1. average temperature, average maximum temperature, average minimum temperature, highest temperature and lowest temperature.
- E. Excessive precipitation - for selected stations by dates of occurrence in 5 minute intervals for 5 minutes to 120 minutes.
- F. Precipitation - average, annual and monthly amounts for one or more stations in each county within the section, and for the same stations, average monthly and annual snowfall, average number of days with 0.01 or more of precipitation, average temperature, avg, max/min temperature, absolute max/min, prevailing wind direction, average hourly wind speed, max. wind velocity, dates of first and last frosts and length of growing season.

NUMBER: 22

TITLE: UNIFORM SUMMARY OF SURFACE OBSERVATIONS (PARTS A thru E)

PUBLICATION INFORMATION: Published by Air Weather Service, Ashville, NC

GEOGRAPHIC COVERAGE: worldwide

TYPES OF DATA: Part A Summary - the period of record of the A Summary is normally 10 years, however, this is not uniform for all stations in the data collection -- many stations present data summaries for 5 years of data.

PART A IS DERIVED FROM HOURLY OBSERVATIONS - % frequencies - year, month, hour

1. SURFACE WINDS - percentage frequency of occurrence for year, by month and by hour for each month.
  - A. Directions by Speed Groups
    1. mean speeds by 16 points of the compass.
2. FLYING WEATHER -
  - A. Weather classification
    1. Closed-ceiling less than 500' and/or visibility less than 1 mi.
    2. Instrument-ceiling 500-900', vsby greater than 1 mi., and/or vsby 1-2½ mi. with ceiling greater than 500'.
    3. Contact-ceiling greater than 1000' with visibility greater than 3 mi.
  - B. Observations with visibilities less than 1 mi. caused by:
    1. fog
    2. smoke and/or haze
    3. blowing snow and/or dust
    4. cause unknown
    5. total % of observations with visibilities less than 1 mile.
3. CEILING HEIGHT -
  - A. % frequency of observations with ceiling height:
    1. 0-400'
    2. 500-900'
    3. 1000-2000'
    4. 2100-3000'
    5. 3100-5000'
    6. 5500-9000'
    7. +10000 and above and unlimited

4. VISIBILITY (vsby)

A. % frequencies of observations with visibilities:

1. 0, 1/16, 1/8 mi.
2. 3/16, 3/4 mi.
3. 5/16, 3/8, 1/2 mi.
4. 5/8, 3/4 mi.
5. 1-2 1/4 mi.
6. 2 1/2 mi.
7. 3-6 mi.
8. 7-9 mi.
9. 10 and above

5. WEATHER CONDITIONS -

A. % frequencies and actual amounts of the following weather conditions:

1. thunderstorms
2. rain and drizzle
3. freezing rain
4. snow and/or sleet
5. hail
6. total observations with precipitation

6. SKY CONDITIONS -

A. % frequencies and actual amounts of the following sky conditions:

1. clear
2. scattered
3. high broken or high overcast with scattered or no low clouds
4. low broken
5. low overcast

7. SKY COVER -

A. % frequencies and actual occurrences of amounts of sky cover in tenths:

1. 0
2. 1-2
3. 3
4. 4-5
5. 6-7
6. 8-9
7. 10

B. Mean tenths of sky cover

8. EXTREME WIND DATA - by month

- A. direction and speed of maximum winds based on hourly observations
- B. direction and speed of peak gust based on hourly observations

TYPES OF DATA: Part B Summary - the period of record for the B Summary is normally 10 years, however this is not uniform for all the stations in the data collection -- many stations present data summaries for 5 years of data

PART B IS DERIVED FROM DAILY OBSERVATIONS -

1. DAILY TEMPERATURE -

- A. frequency of daily temperatures by 2°F increments, by month, for entire data collection period for maximum temperature, minimum temperature, and mean temperature.

2. PRECIPITATION -

- A. Summary of Daily Amounts for Months, frequency of occurrence:

1. none
2. trace
3. .01"
4. .02" - .05"
5. .06" - .10"
6. .11" - .25"
7. .26" - .50"
8. .51" - 1.00"
9. 1.01" - 2.50"
10. 2.51" - 5.00"
11. 5.01" - 10.00"
12. 10.01" - 20.00"
13. over 20.00"

- B. Mean Monthly Precipitation

- C. Mean Number of Days with Measurable Precipitation

3. SNOW DEPTH (at 0800 L.S.T.)

- A. Frequency of occurrence of snow depth on ground, by month, for depths:

1. none
2. trace
3. .1" to .5"
4. .6" to 1.0"
5. 1.1" to 2.0"
6. 2.1" to 6.0"
7. 6.1" to 12.0"
8. 1.1' to 2.0'
9. 2.1' to 3.0'
10. 3.1' to 4.0'
11. 4.1' to 5.0'
12. 5.1' to 10.0'
13. over 10 feet

- B. mean number of days with measurable snow depth by month

4. SNOW DEPTH (at 0300 GCT)

- A. Frequency and summary of daily amounts, by month, for amounts:

1. none
2. trace
3. 1"
4. 2"

5. 3"
6. 4" to 6"
7. 7" to 12"
8. 13" to 24"
9. 25" to 36"
10. 37" to 48"
11. 49" to 60"
12. 61" to 120"
13. over 120"

B. Mean Monthly Snow Depth

C. Mean Number of Days with Measurable Snow Depth

5. SNOWFALL -

A. Frequency and summary of daily amounts, by month, for amounts:

1. none
2. trace
3. .1" to .4"
4. .5" to 1.4"
5. 1.5" to 2.4"
6. 2.5" to 3.4"
7. 3.5" to 4.4"
8. 4.5" to 6.4"
9. 6.5" to 10.4"
10. 10.5" to 15.4"
11. 15.5" to 25.4"
12. 25.5" to 50.4"
13. over 50.4"

B. Mean Monthly Snowfall

C. Mean Number of Days with Measurable Snowfall

TYPES OF DATA: Part C - this summary presents Flying Weather Wind Roses, showing the percentage frequency of observations of various wind speeds from the 16 points of the compass, by month (knots or mph):

A. Wind speed groupings

1. 1-3 knots (1-3 mph)
2. 4-10 knots (4-12 mph)
3. 11-21 knots (13-24 mph)
4. 22-27 knots (25-31 mph)
5. 28-40 knots (32-46 mph)
6. 41 knots and over (47 mph and over)

B. Mean Wind Speed (knots or mph)

TYPES OF DATA: Part D - this summary presents Frequency of Occurrence of Ceiling vs Visibility. The data matrix is composed of percentage frequencies of ceiling vs visibility data.

A. Ceiling increments: all readings prefixed by "greater than or equal to...":

- |           |            |
|-----------|------------|
| 1. 0'     | 14. 1800'  |
| 2. 100'   | 15. 2000'  |
| 3. 200'   | 16. 2500'  |
| 4. 300'   | 17. 3000'  |
| 5. 400'   | 18. 3500'  |
| 6. 500'   | 19. 4000'  |
| 7. 600'   | 20. 4500'  |
| 8. 700'   | 21. 5000'  |
| 9. 800'   | 22. 6000'  |
| 10. 900'  | 23. 7000'  |
| 11. 1000' | 24. 8000'  |
| 12. 1200' | 25. 9000'  |
| 13. 1500' | 26. 10000' |

B. Visibility increments are given in statute miles. All readings are prefixed by "greater than or equal to...":

- |             |            |
|-------------|------------|
| 1. 0        | 9. 1½ mi.  |
| 2. 1/4 mi.  | 10. 2 mi.  |
| 3. 5/16 mi. | 11. 2½ mi. |
| 4. 1/2 mi.  | 12. 3 mi.  |
| 5. 5/8 mi.  | 13. 4 mi.  |
| 6. 3/4 mi.  | 14. 5 mi.  |
| 7. 1 mi.    | 15. 6 mi.  |
| 8. 1¼ mi.   | 16. 10 mi. |

The data is presented by month for every 2-, 3-, or 6-hour increments, depending on the station record, for each month, with a summary of all hours for each month, and a summary for all months.

TYPES OF DATA: Part E - this summary presents a Psychrometric Summary

A. A tabulation of wet bulb depressions versus dry bulb temperatures. In this tabulation, occurrences of the wet bulb depression are spread horizontally in 17 classes and vertically in 2°F intervals of dry bulb temperature. Row and column totals are provided. Tabulations for 3-hour groups, by month, are provided as raw frequencies; tabulations for all months, all hours combined, and for individual months, all hours combined, are shown as percentage frequencies.

B. A tabulation of occurrences of dry bulb, wet bulb, and dew point temperatures, separately, in 2°F intervals, presented in raw frequency and percentage frequency form as described above.

C. Statistical data for the individual elements of R.H., dry bulb, wet bulb, and dew point temperatures, consisting of sum of squares, sums of values, means, and standard deviations. The number of observations used in the computation of each element is also shown.



D. Mean numbers of hours of occurrence of six ranges of dry bulb, wet bulb and dew point temperatures, and total mean number of hours possible in the period represented by months and hours contained in that summary. Mean hours are shown to tenths in all instances; however the decimal point is omitted in all tabulation for all months, all hours combined.

NUMBER: 23

TITLE: SPECIAL SUMMARIES

PUBLICATION INFORMATION: published by AWS, Ashville, NC

GEOGRAPHIC COVERAGE: worldwide

TYPES OF DATA: Special Summaries may present up to 24 different categories of data. However, no station in the file holdings has data in all twenty-four categories. In the data category list below, the categories with an asterisk (\*) appear the most frequently. Periods of record range from 5 years to over 20 years. Data is summarized by 3-hour observations (most stations have gaps in record)

Data Category List (ACTUAL NUMBERS OF CATEGORIES VARY FROM STATION TO STATION)

- \*1. Surface winds by months
- \*2. Surface winds by seasons
- \*3. Precipitation
- \*4. Wet and dry spells
- 5. Frequency of hot and cold spells
- \*6. Mean frequency of daily max., mean max., and extreme max. temperature
- \*7. Mean frequency of daily min., mean min., and extreme min. temperature
- 8. Temperature vs dew point group distribution
- 9. Mean hourly temperature
- 10. Mean frequency of obstructions to vision, sky conditions
- \*11. Daily snow depth
- 12. Ceiling and visibility by months
- \*13. Mean freq. of days available for indicated military operations
- \*14. Miscellaneous data
- 15. Winds aloft by seasons
- 16. Percentage freqs. of temperatures and relative humidity
- \*17. Total and low cloud amounts
- \*18. Percentage freqs. of obs, with low cloud amounts and visibility reported
- 19. Mean frequency of the state of the ground in days
- 20. Mean frequency of diurnal temperature range
- \*21. Mean cloudiness
- \*22. Percentage frequencies of surface winds
- \*23. Sea level pressure
- \*24. Visibility and various atmospheric phenomena

Note: more categories may exist, but a random sample of the data holdings could only find the 24 listed above.

NUMBER: 24

TITLE: WORLD-WIDE AIRFIELD SUMMARIES

PUBLICATION INFORMATION: U.S. Naval Weather Service 1967-1971

GEOGRAPHIC COVERAGE: worldwide, less USSR, Eastern European countries,  
and China

TYPES OF DATA: see following pages

Published volumes of World-wide Airfield Summaries are available for the following areas:

<u>Volume</u>	<u>Name</u>	<u>NTIS Accession Number</u>
Volume I	Southeast Asia (Revised)	AD-706-355
Volume II (Parts 1 & 2)	Middle East	AD-662-425 & AD-662-427
Volume III	Far East	AD-662-426
Volume IV	Canada-Greenland-Iceland	AD-662-424
Volume V	Australia-Antarctica (including So. Pacific Is.)	AD-662-648
Volume VI (Parts 1 & 2)	South America	AD-664-828 & AD-664-829
Volume VII	Central America	AD-671-845
Volume VIII	United States of America	
	Part 1 West Coast, Western Mtns. and Great Basin	AD-688-472
	Part 2 Rocky Mtns. and Northwest Basin	AD-689-792
	Part 3 Central Plains	AD-693-491
	Part 4 Great Lakes	AD-696-971
	Part 5 Mississippi Valley	AD-699-917
	Part 6 Southeastern Region	AD-701-719
	Part 7 East Coast and Appalachian Region	AD-703-606
	Part 8 Alaska and Hawaii	AD-704-607
Volume IX	Africa	
	Part 1 Northern Half	AD-682-915
	Part 2 Southern Half	AD-682-915
Volume X	Europe	
	Part 1 Scandinavia & Northern Europe	
	Part 2 Low Countries & British Isles	
	Part 3 Alps & Southwest Europe	
	Part 4 Mediterranean	

## INTRODUCTION

This volume provides climatological summaries for airfields and climatic areas in the Mediterranean. Summaries are arranged according to numbered climatic areas, and by increasing WMO Station Index Numbers within the climatic areas. An arbitrary station number (indicated by "/") is used where WMO Index Numbers are not assigned. Maps are included to delineate areas and station locations.

Climatic areas have been selected as being nearly homogeneous climatologically, but considerable variation may exist between locations in an area at a specific time because of topography and other factors. Climatological summaries for these areas follow those for the included airfields.

The latitudes and longitudes of the approximate centers of the climatic areas are indicated in the summary headings. The climatic areas are delineated by straight line segments and the positions of the end points are listed.

Blank values in the tables indicate that no data are available, and "0" indicates record is unknown. Local Standard Time is that of the standard time zone, and no adjustment has been made where local deviations exist. Data sources are listed in detail by means of a number system described on the following pages.

The first page of each station summary provides data for the station, and the second page contains information for the airfield area. The values are in mean number of days. When observations were not available, the information consists of climatological estimates based on data for surrounding stations. In some instances tables may be based on relatively few observations or on somewhat doubtful data, and these should be used with caution.

## GLOSSARY OF GENERAL TERMS

### AIRFIELD DATA AND AIRFIELD AREA DATA

Climatological data applicable only to a specified airfield. The data consists of statistical parameters based on actual weather observations made at the airfield. If actual weather observations are not available the data consist of estimates of the statistical parameters, prepared by a climatologist, based on actual meteorological data from surrounding weather stations.

### CLIMATIC AREA DATA

Climatological data representative of a nearly homogeneous climatic area. The data are average (or representative) values based on a sample of climatological data available from weather stations within the area. The area data do not imply that the specific condition simultaneously exists at all locations within a country or large climatic area. In rolling and mountainous terrain there may be considerable variation in the data from one location to another within the climatic area.

### LOCAL STANDARD TIME

Standard time applicable to a 15 deg. meridional zone. (Zones proceed east and west from the zone centered on the prime meridian and extending from 00730E to 00730W.) No consideration is given to local deviations from the 15 deg. zone boundaries.

### AIRFIELD PARAMETERS

#### ABSOLUTE MAXIMUM (MINIMUM) TEMPERATURE-DEG. F.

The highest (lowest) temperature observed in the specified month during the whole period for which observations are available.

MEAN DAILY MAXIMUM (MINIMUM) TEMPERATURE-DEGREE F.

The average of all the daily maximum (minimum) temperatures observed in the specified month.

MEAN NO. DAYS WITH MAXIMUM TEMPERATURE GREATER THAN 90 DEGREE F.

The average of the number of days in the specified month on which the maximum temperature was observed to be equal to or greater than 90 degree F.

MEAN NO. DAYS WITH MINIMUM TEMPERATURE LESS THAN 32 DEGREE F. (LESS THAN 0 DEGREE C.).

The average of the number of days in the specified month on which the minimum temperature was observed to be equal to or less than 32 degree F. (0 degree C.).

MEAN DEW POINT TEMPERATURE-DEGREE F.

The average of all hourly dew point temperatures observed in the specified month.

MEAN RELATIVE HUMIDITY-PERCENT

The average of all hourly relative humidity values observed in a specified month.

MEAN PRESSURE ALTITUDE-FEET

The average station pressure observed at the airfield in the specified month converted to an altitude by using the U.S. Standard Atmosphere.

MEAN MONTHLY PRECIPITATION-INCHES

The average of the monthly total amount of all forms of precipitation, reduced to its liquid equivalent, observed in the specified month.

MEAN MONTHLY SNOWFALL-INCHES

The average of the monthly total amount of snowfall observed in the specified month.

MEAN NO. DAYS WITH PRECIPITATION GREATER THAN 0.1 INCH (SNOWFALL GREATER THAN 1.5 INCHES)

The average of the number of days in the specified month on which the daily amount of precipitation (snowfall) was observed to be equal to or greater than 0.1 inch (1.5 inches).

MEAN NO. DAYS WITH AN OCCURRENCE OF VISIBILITY LESS THAN 0.5 MILE

The average of the number of days in the specified month on which there was at least one observation of visibility less than 0.5 mile.

MEAN NO. DAYS WITH THUNDERSTORMS

The average of the number of days in the specified month on which the weather observer heard thunder.

PERCENT FREQUENCY SURFACE WIND SPEED GREATER THAN 16 KNOTS (GREATER THAN 27 ft/sec).

The frequency, expressed as a percent of the total number of hourly weather observations considered, during the specified month, in which the surface wind speed was observed to be greater than 16 knots (greater than 27 ft/sec).

PERCENT FREQUENCY CEILINGS LESS THAN 5,000 FEET OR VISIBILITY LESS THAN 5 MILES

The frequency, expressed as a percent of the total number of hourly weather observations considered, during the specified month, in which the ceiling was observed to be less than 5,000 feet and/or the visibility was observed to be less than 5 miles.

PERCENT FREQUENCY CEILING LESS THAN 1,500 FEET (LESS THAN 300 FEET) OR VISIBILITY LESS THAN 3 MILES (LESS THAN 1 MILE)

The frequency, expressed as a percent of all the hourly weather observations considered, in a specified three-hourly period during the day for a specified month in which the ceiling was observed to be less than 1,500 feet (300 feet) and/or the visibility was observed to be less than three miles (one mile).

PARAMETERS FOR AIRFIELD AREA AND CLIMATIC AREA

MEAN NO. DAYS WITH CEILING EQUAL TO OR GREATER THAN 1,000 FEET (EQUAL TO OR GREATER THAN 2,500 FEET, EQUAL TO OR GREATER THAN 6,000 FEET, EQUAL TO OR GREATER THAN 10,000 FEET) AND VISIBILITY EQUAL TO OR GREATER THAN 3 MILES

The average of the number of days when, at a specified hour during the day in the specified month, the ceiling was observed to be equal to or greater than 1,000 feet (2,500 feet, 6,000 feet, 10,000 feet) and the visibility was observed to be equal to or greater than three miles.

MEAN NO. DAYS WITH CEILING EQUAL TO OR GREATER THAN 2,000 FEET AND VISIBILITY EQUAL TO OR GREATER THAN 3 MILES AND SURFACE WIND LESS THAN 10 KNOTS

The average of the number of days when, at a specified hour during the day in the specified month, the ceiling was observed to be equal to or greater than 2,000 feet, the visibility was observed to be equal to or greater than three miles, and the surface wind speed less than ten knots.

MEAN NO. DAYS WITH SURFACE WIND EQUAL TO OR GREATER THAN 17 KNOTS AND NO PRECIPITATION

The average of the number of days when, at a specified hour during the day in the specified month, the surface wind speed was observed to be equal to or greater than 17 knots, and there was no precipitation.

MEAN NO. DAYS WITH SURFACE WIND 4-10 KNOTS AND TEMPERATURE 33-89 DEG. F AND NO PRECIPITATION

The average of the number of days when, at a specified hour during the day in the specified month, the surface wind speed was equal to or greater than four knots, but not greater than ten knots, the temperature was equal to or greater than 33 deg. F. but not greater than 89 deg. F. and there was no precipitation.

MEAN NO. DAYS WITH SKY COVER LESS THAN 0.3 AND VISIBILITY EQUAL TO OR GREATER THAN 3 MILES

The average of the number of days when, at a specified hour during the day in the specified month, the portion of the sky covered with clouds was observed to be less than 0.3 and the visibility was observed to be equal to or greater than three miles.

AREA PARAMETERS (CLIMATIC AREA ONLY)

MEAN DAILY TEMPERATURE RANGE-DEG. F.

Two temperatures for the specified month: (1) a representative mean daily maximum temperature observed in the area; (2) a representative mean daily minimum temperature observed in the area.

RANGE OF MEAN MONTHLY PRECIPITATION-INCHES

Two mean monthly precipitation amounts for the specified month: (1) the largest mean amount observed in the area; (2) the smallest mean amount observed in the area.

#### DATA SOURCES

The source from which values were taken can be determined from the column labeled "No. Obs."

(1) If the number in that column is positive, the data for that line were computer-summarized, and the number given is the number of observations used in the summarization.

(2) If the number is negative and of three digits or less, the data were hand-copied or estimated as indicated in the following source list.

(3) If the number is less than minus 500, part of the data are derived from computer-summarized data, and part from the source list number plus 500. For example, if the number is "-528," the source is the extreme of the computer-summarized data compared to source "-28."

(4) If the number is minus and a four or five digit number, the data were substituted from a representative station nearby and this number is the number of the source station.

(5) Statistical methods or meteorological relationships were used whenever possible to provide data not available at the National Weather Records Center or in yearbooks and summaries.

NUMBER: 25

TITLE: WORLD WEATHER RECORDS (1951-1960)

PUBLICATION INFORMATION: 1965 by U.S. Weather Bureau

GEOGRAPHIC COVERAGE: worldwide (selected WMO stations)

**"World Weather Records"**

This publication contains tables of mean temperatures, mean pressures and precipitation at all stations throughout the world for which complete data for the 10-year period are available. There are earlier issues covering every 10-year period back to about 1900.

TYPES OF DATA:

A. For each reporting station, the following information is given (where available):

station name

location (latitude and longitude)

number of years of data and years

height above sea level

height of barometer above sea level

height of thermometer above sea level

height of rim of precipitation gathering device above ground

information as to whether data was estimated due to incompleteness of data base

B. Data presented for each station: by month and year for the entire 1951-1960 period (if available):

monthly means (and yearly means) of:

1. temperature ( $^{\circ}\text{C}$ )
2. station pressure (mb)
3. sea level pressure (mb)
4. precipitation (actual amounts in mm)

\* Normals are also provided for temperature and precipitation by month and year where available.



Title of the 6 volumes:

- Vol. 1 --- North America
- Vol. 2 --- Europe
- Vol. 3 --- South America, Central America, West Indies, The Caribbean  
and Bermuda
- Vol. 4 --- Asia
- Vol. 5 --- Africa
- Vol. 6 --- Antarctica, Australia, Oceanic Islands, and Ocean Weather  
Stations

Note: Volumes are also available for 10-year periods prior to the 1951-1960 period going back to 1921. Another volume is available for the period prior to 1921.

NUMBER: 26

TITLE: TABLES OF TEMPERATURE, RELATIVE HUMIDITY AND PRECIPITATION FOR THE WORLD

PUBLICATION INFORMATION: 1958 and 1960, by Meteorological Office, Air Ministry, London

GEOGRAPHIC COVERAGE: worldwide (selected WMO stations)

TYPES OF DATA:

A. For each reporting station, the following information is presented:

1. station name
2. location (latitude and longitude)
3. elevation above mean sea level
4. number of years of record for each of the measured elements

B. Actual data: monthly values and yearly totals for station's entire period of record for all of the following elements:

1. average daily max/min temperature ( $^{\circ}\text{F}$ )
2. temperature - average of highest each month and average of lowest each month ( $^{\circ}\text{F}$ )
3. absolute max and min temperature
4. Relative Humidity - average of observations selected hours or all hours
5. Precipitation - average monthly fall (inches), maximum fall in 24 hours, and average number of days with 0.01" or more. (some stations give information on precipitation for average number of days with either 0.04 or 0.004 inches or more.)

Titles of the 6 parts are:

- Part 1 --- North America, Greenland and the North Pacific Ocean
- Part 2 --- Central and South America, the West Indies and Bermuda
- Part 3 --- Europe and the Atlantic Ocean north of  $35^{\circ}\text{N}$
- Part 4 --- Africa, the Atlantic Ocean south of  $35^{\circ}\text{N}$  and the Indian Ocean
- Part 5 --- Asia
- Part 6 --- Australasia and the Southern Pacific Ocean, including the corresponding sectors of Antarctica

\*\*\*\*Note: see next page for summary of revised and reprinted handbooks in this series

\*\*\*\*REVISED BRITISH HANDBOOKS

TITLE: TABLES OF TEMPERATURE, RELATIVE HUMIDITY AND PRECIPITATION FOR  
THE WORLD

PUBLICATION INFORMATION: 1975 thru 1977 by Meteorological Office, Air  
Ministry, London

GEOGRAPHIC COVERAGE: worldwide (selected WMO stations)

TYPES OF DATA: In general, the above documents are either revisions or  
reprints of the 1958-1960 versions. The format of data presentation  
remains unaltered. The exact nature of any revisions will be stated below:

Parts 1, 2, 5, and 6 --- NO CHANGES (REPRINTS ONLY)

Part 3 - Title changed to Europe and the Azores  
More recent data used in the summaries  
Stations added and some stations deleted  
Metric units used throughout the work  
Where possible, data base is for the period 1931-1960  
New data category added: Bright Sunshine, the subdivision of  
which are:  
    average monthly duration  
    average of percent of possible  
    maximum duration in one day  
    average number of days with no sun

Part 4 - Some stations added, whereas others deleted  
Stations grouped by grid zones (Note: this practice will be  
discontinued in later revisions, and the original practice of  
grouping stations by country will be continued)

Publication dates for latest documents in this series:

Part 1 --- 1975  
Part 2 --- 1977  
Part 3 --- 1973  
Part 4 --- 1975  
Part 5 --- 1976  
Part 6 --- 1976

NUMBER: 27

TITLE: WORLD SURVEY OF CLIMATOLOGY

PUBLICATION INFORMATION: Elsevier Publishing Co. Amsterdam. 1970

GEOGRAPHIC COVERAGE: World-wide, 15 volumes

TYPES OF DATA: \*Extensive textual discussion of weather and climate, with many tables, maps, and summaries. Among climatic elements presented are:

A. MONTHLY CLIMATIC SUMMARIES FOR SELECTED STATIONS

- Mean daily temperatures
- Mean daily temperature range
- Mean daily precipitation
- Maximum 24-hour precipitation
- Number of days with precipitation
- Mean station pressure
- Mean cloudiness
- Mean wind speed
- Prevailing wind direction

B. TABLES

- Mean monthly and annual hours of bright sunshine
- Average daily maximum and minimum temperature
- Frequency of days with snow or sleet
- Frequency of days with snow lying on the ground
- Average amount of cloud cover at selected hours
- Frequency of fog
- Frequency of cloudy days in winter

C. MAPS

- Normal date of beginning of the vegetative period
- Length of vegetative period
- Normal date of end of vegetative period
- Mean duration of frost-free period
- Mean annual rainfall

\* Varies from country to country

## APPENDIX D. CLIMATIC NARRATIVES

### BIRMINGHAM, ALABAMA

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#### Narrative Climatological Summary

For the period of record, Birmingham's monthly temperatures show a range from a January mean of near 44° to a July mean of near 80°. This 36° annual range reflects the effect of the station's location with respect to the warm body of water to the south and the invasions of relatively cold air from the continental north and west. The occurrence of very low temperatures, although quite rare, effectively prevents the growth of vegetation normally indigenous to subtropical climates.

Precipitation, with a minimum occurring during October, has two maxima each year, one during the winter months and another, slightly lower, in July. Summer precipitation is chiefly in the form of thunderstorms. Snowfall is seldom heavy enough to be important. Heavy falls occur occasionally, however, and when in excess of about 2 inches, they produce a real traffic problem. Very low temperatures in this area almost invariably occur under radiation conditions involving a particularly persistent snow cover.

Droughts are infrequent. One of the worst on record occurred in 1924 when no rain fell between September 29 and December 4 with the exception of 0.01 inch on November 21.

Birmingham's location nearly 300 miles from the Gulf of Mexico keeps it safe from the destructive winds of hurricanes passing inland from the Gulf of Mexico. Some very heavy rains have occurred in connection with these storms, however - for example, the three-day fall of 9.71 inches on July 6-8, 1916.

The length of the growing season averages 228 days, but has been as short as 192. The average date of the last minimum temperature of 32° or lower in spring is March 23, but it has occurred as late as April 17, and the first in autumn, averaging November 8, has occurred as early as October 17.

The topography of Birmingham is hilly. The City proper is located in a valley between a ridge of hills, extending from the northeast to the west, and the Red Mountain Range, which extends from the east to the southwest. This valley is approximately 8 miles long and 2 to 4 miles wide. The Red Mountain Range approaches a height of 600 feet above the valley level. Another ridge, The Shades Mountain Ridge, parallels the Red Mountain Range several miles to the southeast. Rolling terrain extends to the southwest and the west. The hills in the Birmingham area, which extend to the northeast and the north, are the foothills of the Appalachian Mountains and the Cumberland Plateau. The main climatic effect of the topography of Birmingham is that during the winter months, ideal radiation and pronounced cold air drainage produce extreme temperature inversions and rather low minimum temperatures.

noaa

NATIONAL OCEANIC AND  
ATMOSPHERIC ADMINISTRATION / ENVIRONMENTAL / NATIONAL CLIMATIC CENTER  
DATA SERVICE / ASHEVILLE, N.C.

### Climatic Brief on Southeast Asia

The climate of Southeast Asia is characterized as low latitude monsoon chiefly because of its tropical temperature regime and a well-established cycle of wet and dry seasons. In general, the southwest or wet monsoon prevails from mid-May to mid-September, and the northeast or dry monsoon predominates from mid-October to mid-March. Short transition periods in spring and fall separate the two principal monsoon seasons. The intensity and timing of the rainy season, however, varies considerably with location, so that local variations of climate are numerous and in some instances sharp. Topography is the chief cause for climatic modification, with the Annam Mountain Range, paralleling the Vietnamese coast on the east, and the peninsular ranges of Burma and Thailand on the west, being particularly significant relief features. Windward slopes of these ranges are characteristically cloudy and rainy, whereas leeward slopes are relatively cloud-free and rainless.

The southwest monsoon is typified by airflow from the subtropical high pressure cells of the southern hemisphere to a low pressure cell centered over interior Asia. The air transported into the region is warm, moist, and unstable, causing heavy local showers and thunderstorms in most sections of the region. For the most part, the showers occur during the afternoon hours, caused chiefly by the combined effects of orography and convection, and are especially heavy on the western and southwestern slopes of the major mountain ranges. Owing to the protection afforded by the Annam Mountain Range, the eastern coastal districts of Vietnam frequently experience periods of weather that are clear and dry. The heavy rains of summer may cause extensive flooding of low lying areas, particularly the flood plains of the major rivers in Cambodia, Thailand, Burma, and South Vietnam. Temperatures during the summer monsoon are not exceptionally high on the average, ranging from the high eighties or low nineties during the hottest part of the day to the high seventies or low eighties during the coolest part of the night in most sections of the region. In the mountains, temperatures are lower, decreasing at a rate of about 3 degrees Fahrenheit for every 1,000 feet increase in elevation.

The northeast or winter monsoon season is characterized by easterly or northeasterly airflow that brings comparatively cool and dry air into Southeast Asia, particularly the northernmost sections of the region. Temperatures during winter are not extreme, generally reaching into the high sixties or low seventies during the afternoon hours, and dropping to the mid-fifties at night in northern sections. In the south and in the peninsular portions of the region, temperatures are some 5 to 10 degrees higher both day and night. Occasional frosts have been experienced in the upland districts of the north, the coldest section in general. Snowfall is all but unknown throughout the region except perhaps at the higher elevations in the north. During the winter monsoon, precipitation is heavier and more frequent along the east coast of Vietnam and in the peninsular portions of Thailand and Malaysia than in other districts. In both these areas, the winter rains are caused by moisture-laden air arriving at the coasts after lengthy trajectories over relatively large and warm bodies of water. As the air ascends the slopes of the mountain ranges inland from the coasts, condensation takes place, and much cloudiness and rainy weather of the showery type results. Highest temperatures for the region in general occur during April, a transition month when skies are clear and the air dry. During April, daily maximum temperatures frequently exceed 100°F, and on some occasions 110°F at locations well removed from the coasts, particularly in Burma and Thailand. Extremes above 100°F are practically unknown at coastal sites where the maritime influence prevents undue heating of the atmosphere.

APPENDIX E. GOVERNMENT AND OTHER SOURCES

DEPARTMENT OF COMMERCE

Climatic Data	National Oceanic and Atmospheric Administration Environmental Data Service Washington, D.C. 20235
Climatic Data	National Weather Records Center Federal Building Ashville, N.C. 28801

LIBRARY OF CONGRESS

Misc. Maps	Chief, Photo Duplications Service Library of Congress 10 First Street, S. E. Washington, DC 20540
Misc. Maps	Geography and Maps Division Library of Congress Washington, DC 20540 Telephone: (202) 370-1261

NATIONAL ARCHIVES AND RECORDS SERVICES

Maps & Cartographic Records	Cartographic Archives Division National Archives and Records Services Washington, DC 20408 Telephone: (202) 523-3062
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U. S. GEOLOGICAL SURVEY

Current & Historical Topographic Maps	National Cartographic Information Center U. S. Geological Survey 507 National Center Reston, VA 22092 Telephone: (703) 860-6045
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(Topographic maps, historical topographic maps)

APPENDIX F. IMAGERY SOURCES

AERIAL IMAGERY

U.S. GOVERNMENT AGENCIES

Aerial Photography Field Office

Agricultural Stabilization and Conservation Service  
Department of Agriculture  
Western Laboratory  
2505 Parleys Way  
Salt Lake City, Utah 84109 (Source for all states)

Defense Intelligence Agency  
ATTN: DIAAP-10  
Washington, D. C. 20315

World wide survey photography held by DMAHC  
6500 Brooks Lane  
Washington, D.C. 20335

Bureau of Land Management  
Department of Interior  
Washington, D.C. 20240

Cartographic Archives Division  
National Archives (GSA)  
Washington, D.C. 20408

EROS Data Center  
U.S. Geological Survey  
Sioux Falls, South Dakota 57198

National Cartographic Information Center (Headquarters)  
Geological Survey  
Department of Interior  
Reston, VA 22090

NCIC-Mid-Continent  
USGS, 1400 Independence Rd.  
Rolla, Missouri 65401

NCIC-Rocky Mountain  
USGS, Topographic Division  
Stop 510, Box 25046  
Denver Federal Center  
Denver, Colorado 80225



NCIC-Western  
USGS, 345 Middlefield Rd.  
Menlo Park, California 94025

National Ocean Survey  
Department of Commerce  
Washington Science Center  
Rockville, Maryland 20852

Soil Conservation Service  
Department of Agriculture  
Federal Center Building  
East-West Highway and Belcrest Rd.  
Hyattsville, Maryland 20781

Tennessee Valley Authority  
Maps and Surveys Branch  
210 Haney Building  
Chattanooga, Tennessee 37401

EASTERN US FOREST SERVICE PHOTOGRAPHY

Chief Forest Service  
U.S. Department of Agriculture  
Washington, D.C. 20250

WESTERN U.S. FOREST SERVICE PHOTOGRAPHY

Region

- 1 Federal Building, Missoula, MT 59801
- 2 Federal Center, Building 85, Denver, CO 80025
- 3 Federal Building, 517 Gold Ave. SW, Albuquerque, NM 87101
- 4 Forest Service Building, Ogden, UT 84403
- 5 630 Sansome St., San Francisco, CA 94111
- 6 P.O. Box 8623, Portland, OR 97208
- 10 Regional Forester, U.S. Forest Service, P.O. Box 1628,  
Juneau, AK 99801

Technology Application Center  
The University of New Mexico, Code 11  
Albuquerque, New Mexico 87131

## STATE AGENCIES

Arizona Highway Department  
Administrative Services Division  
206 South 17th Avenue  
Phoenix, Arizona 85007

State of Arkansas Highway Department  
Surveys, 9500 New Denton Highway  
P.O. Box 2261  
Little Rock, Arkansas

State of Nebraska  
Department of Roads  
14th & Burnham Streets  
Lincoln, Nebraska

State of Ohio  
Department of Highways  
Columbus, Ohio 43216

Oregon State Highway Division  
Salem, Oregon 97310

Virginia Department of Highways  
Location and Design Engineer  
1401 East Broad Street  
Richmond, Virginia 23219

State of Washington  
Department of Natural Resources  
600 North Capitol Way  
Olympia, Washington 98501

Southeast Michigan  
Council of Governments  
1249 Washington Blvd.  
Detroit, Michigan 48226

Illinois Department of Transportation  
2300 South - 31st Street  
Springfield, Illinois 62734

Southeastern Wisconsin  
Regional Planning Commission  
916 North East Avenue  
Waukesha, Wisconsin 53186

Wisconsin Department of Transportation  
Engineering Services  
4802 Sheboygan Avenue  
Madison, Wisconsin 53702

Indiana Highway Department  
608 State Office Building  
Indianapolis, Indiana 46204

# COMMERCIAL FIRMS

Aerial Data Services  
10338 East 21st Street  
Tulsa, Oklahoma 74129

Aero Service Corporation  
4219 Van Kirk Street  
Philadelphia, Pennsylvania 19135

Air Photographics Inc.  
P.O. Box 786  
Purcellville, Virginia 23132

Alster and Associates, Inc.  
6135 Kansas Avenue, NE  
Washington, D.C. 20011

Ammann International Base Map  
and Air Photo Library  
223 Tenth Street  
San Antonio, Texas 78215

Burlington Northern Inc.  
650 Central Building  
Seattle, Washington 98104

Cartwright Aerial Surveys Inc.  
Executive Airport  
6151 Freeport Boulevard  
Sacramento, California 95822

L. Robert Kimball  
615 West Highland Avenue  
Ebensburg, Pennsylvania 15931

Lockwood, Kessler & Bartlett, Inc.  
One Aerial Way  
Syosset, New York 11791

Mark Hurd Aerial Surveys, Inc.  
345 Pennsylvania Avenue South  
Minneapolis, Minnesota 55426

Merrick and Company  
Consulting Engineers  
2700 West Evans  
Denver, Colorado 80219

H. G. Chickering, Jr.  
Consulting Photogrammetrist, Inc  
P.O. Box 2767  
1190 West 7th Avenue  
Eugene, Oregon 97402

Fairchild Aeromaps Inc.  
14437 North 73rd Street  
Scottsdale, Arizona 85254

Grumman Ecosystems Corp.  
Bethpage, New York 11714

Henderson Aerial Surveys Inc.  
5125 West Broad Street  
Columbus, Ohio 43228

Walker and Associates Inc.  
310 Prefontaine Building  
Seattle, Washington 98104

Western Aerial Contractors Inc.  
Mahlon Sweet Airport  
Route 1, Box 740  
Eugene, Oregon 97401

Murry - McCormick  
Aerial Surveys Inc  
6220 24th Street  
Sacramento, California 95822

Photographic Interpretation Corp.  
Box 868  
Hanover, New Hampshire 03755

Quinn and Associates  
460 Caredean Drive  
Horsham, Pennsylvania 13044

Sanborn Map Company, Inc.  
P.O. Box 61  
629 Fifth Avenue  
Pelham, New York 10803

The Sidwell Company  
Sidwell Park  
28 W 240 North Avenue  
West Chicago, Illinois 60185

Surdex Corporation  
25 Mercury Boulevard  
Chesterfield, Missouri 63017

United Aerial Mapping  
5411 Jackwood Drive  
San Antonio, Texas 78238

Teledyne Geotronics  
725 East Third Street  
Long Beach, California 90812

CANADA

National Air Photo Library  
Surveys and Mapping Building  
615 Booth St.  
Ottawa, Canada K1A 0E9

#### GROUND IMAGERY SOURCES

U.S. Army Imagery Interpretation Group  
Building 213  
Washington Navy Yard  
Washington, D.C.

Defense Intelligence Agency  
ATTN: RPP-3  
Washington, D.C. 20301

U.S. Army DARCOM Service Support Activity  
Audio-Visual Presentations Division  
Room 1C13, Pentagon  
Washington, D.C.

## APPENDIX G. CONVERSIONS AND EQUIVALENTS

### LENGTH \*

#### English

1 inch	= 1,000 mils
1 hand	= 4 inches (in.)
1 Gunter's or surveyor's link	= 0.56 feet = 7.92 inches
1 foot	= 12 inches
1 yard	= 3 feet (ft.)
1 fathom	= 6 feet
1 rod, pole, or perch	= 5.5 yards (yd.)
1 chain	= 4 rods = 22 yards = 100 links
1 furlong	= 10 chains = 220 yards
1 mile	= 8 furlongs = 1,760 yards = 5,280 feet
1 international nautical mile	= 1.150,779.45 miles = 6,076.115.49 feet

#### Metric

1 millimicron	= 10 ångströms (Å)
1 micron	= 1,000 millimicrons (mμ)
1 millimetre	= 1,000 microns (μ)
1 centimetre	= 10 millimetres (mm.)
1 decimetre	= 10 centimetres (cm.)
1 metre	= 10 decimetres (dm.)
1 decametre	= 10 metres (m.)
1 hectometre	= 10 decametres (dam.)
1 kilometre	= 10 hectometres (hm.) = 1,000 metres
1 myriametre (mam.)	= 10 kilometres (km.)

#### Conversions

##### Basic relationship:

1 inch	= 2.54 centimetres (exactly)
1 international nautical mile	= 1.852 kilometres (exactly)
1 inch	= 2.54 centimetres (exactly)
1 centimetre	= 0.393,700.8 inches
1 hand	= 10.16 centimetres (exactly)
1 link	= 20.116.8 centimetres (exactly)
1 centimetre	= 0.049,709.70 links
1 foot	= 30.48 centimetres (exactly)
1 metre	= 3.280,840 feet
1 yard	= 0.914.4 metres (exactly)
1 metre	= 1.093,613 yards
1 fathom	= 1.828.8 metres (exactly)
1 metre	= 0.546,806.6 fathoms
1 rod, pole, or perch	= 5.029.2 metres (exactly)
1 metre	= 0.198,838.8 rods, poles, or perches
1 chain	= 20.116.8 metres (exactly)
1 metre	= 0.049,709.70 chains
1 furlong	= 201.168 metres (exactly)
1 metre	= 0.004,970.970 furlongs
1 mile	= 1.609,344 kilometres (exactly)
1 kilometre	= 0.621,371.2 miles
1 international nautical mile	= 1.852 kilometres (exactly)
1 kilometre	= 0.539,956.8 nautical miles

\*Rennie, P. J., "Measure for Measure," Canada Dept. of Forestry and Rural Development, Publication No. 1195, 1967.

## AREA

### *English*

1 square link	= 0.435,6 square feet
	= 62.726,4 square inches
1 square foot	= 144 square inches
1 square yard	= 9 square feet
	= 1,296 square inches
1 mil-acre	= 4.84 square yards
	= 100 square links
1 square rod, pole, or perch	= 30.25 square yards
	= 625 square links
1 square chain	= 16 square rods
	= 484 square yards
	= 10,000 square links
1 rood	= 40 square rods
1 acre	= 4 roods = 10 square chains
	= 160 square rods
1 acre	= 4,840 square yards
	= 43,560 square feet
	= 100,000 square links
1 square mile	= 640 acres
	= 3,097,600 square yards
	= 27,878,400 square feet

### *Metric*

1 square centimetre	= 100 square millimetres
1 square metre (centiare)	= 10,000 square centimetres
1 square decametre (are)	= 100 square metres
1 hectare	= 100 ares (a.)
	= 10,000 square metres
1 square kilometre	= 100 hectares (ha.)
	= 1,000,000 square metres

### *Conversions*

#### Basic relationship:

1 inch	= 2.54 centimetres (exactly)
1 square inch	= 6.451,6 square centimetres (exactly)
1 square centimetre	= 0.155,000,3 square inches
1 square link	= 404.685,642,24 square centimetres (exactly)
1 square centimetre	= 0.002,471,054 square links
1 square foot	= 0.092,903,04 square metres (exactly)
1 square metre	= 10.763,910 square feet
1 square yard	= 0.836,127,36 square metres (exactly)
1 square metre	= 1.195,990 square yards
1 mil-acre	= 4.046,856,422,4 square metres (exactly)
1 square metre	= 0.247,105,4 mil-acres
1 square rod, pole, or perch	= 5.292,852,64 square metres (exactly)
1 square metre	= 0.039,536,86 square rods
1 square chain	= 404.685,642,24 square metres (exactly)
1 square metre	= 0.002,471,054 square chains
1 acre	= 0.404,685,642,24 hectares (exactly)
1 hectare	= 2.471,054 acres
1 square mile	= 2.589,988,110,336 square kilometres (exactly)
1 square kilometre	= 0.386,102,2 square miles

Map	Ratio scale *	Feet per inch	Inches per 1,000 feet	Inches per mile	Miles per inch	Meters per inch	Acres per square inch	Square inches per acre	Square miles per square inch
1:	500	41.667	24.00	126.72	0.008	12.700	0.0399	25.091	0.00006
1:	600	50.00	20.00	105.60	.009	15.240	.0574	17.424	.00009
1:	1,000	83.333	12.00	63.36	.016	25.400	.1594	6.273	.00025
1:	1,200	100.00	10.00	52.80	.019	30.480	.2296	4.356	.00036
1:	1,500	125.00	8.00	42.24	.024	38.100	.3587	2.788	.00056
1:	2,000	166.667	6.00	31.68	.032	50.800	.6377	1.568	.00100
1:	2,400	200.00	5.00	26.40	.038	60.960	.9183	1.089	.0014
1:	2,500	208.333	4.80	25.344	.039	63.500	.9964	1.004	.0016
1:	3,000	250.00	4.00	21.12	.047	76.200	1.4348	.697	.0022
1:	3,600	300.00	3.333	17.60	.057	91.440	2.0661	.484	.0032
1:	4,000	333.333	3.00	15.84	.063	101.600	2.5508	.392	.0040
1:	4,800	400.00	2.50	13.20	.076	121.920	3.6731	.272	.0057
1:	5,000	416.667	2.40	12.672	.079	127.000	3.9856	.251	.0062
1:	6,000	500.00	2.00	10.56	.095	152.400	5.7392	.174	.0090
1:	7,000	583.333	1.714	9.051	.110	177.800	7.8117	.128	.0122
1:	7,200	600.00	1.667	8.80	.114	182.880	8.2645	.121	.0129
1:	7,920	660.00	1.515	8.00	.125	201.168	10.00	.100	.0156
1:	8,000	666.667	1.500	7.92	.126	203.200	10.203	.098	.0159
1:	8,400	700.00	1.429	7.543	.133	213.360	11.249	.089	.0176
1:	9,000	750.00	1.333	7.041	.142	228.600	12.913	.077	.0202
1:	9,600	800.00	1.250	6.60	.152	243.840	14.692	.068	.0230
1:	10,000	833.333	1.200	6.336	.158	254.000	15.942	.063	.0249
1:	10,800	900.00	1.111	5.867	.170	274.321	18.595	.054	.0291
1:	12,000	1,000.00	1.0	5.280	.189	304.801	22.957	.044	.0359
1:	13,200	1,100.00	.909	4.800	.208	335.281	27.778	.036	.0434
1:	14,400	1,200.00	.833	4.400	.227	365.761	33.058	.030	.0517
1:	15,000	1,250.00	.80	4.224	.237	381.001	35.870	.028	.0560
1:	15,600	1,300.00	.769	4.062	.246	396.241	38.797	.026	.0606
1:	15,840	1,320.00	.758	4.00	.250	402.337	40.000	.025	.0625
1:	16,000	1,333.333	.750	3.96	.253	406.400	40.812	.024	.0638
1:	16,800	1,400.00	.714	3.771	.265	426.721	44.995	.022	.0703
1:	18,000	1,500.00	.667	3.52	.284	457.201	51.653	.019	.0807
1:	19,200	1,600.00	.625	3.30	.303	487.681	58.770	.017	.0918
1:	20,000	1,666.667	.60	3.168	.316	508.002	63.769	.016	.0996
1:	20,400	1,700.00	.588	3.106	.322	518.161	66.345	.015	.1037
1:	21,120	1,780.00	.568	3.00	.333	536.449	71.111	.014	.1111
1:	21,600	1,800.00	.556	2.933	.341	548.641	74.380	.013	.1162
1:	22,800	1,900.00	.526	2.779	.360	579.121	82.874	.012	.1295
1:	24,000	2,000.00	.50	2.640	.379	609.601	91.827	.011	.1435
1:	25,000	2,083.333	.480	2.534	.395	635.001	99.639	.010	.1557
1:	31,680	2,640.00	.379	2.000	.500	804.674	160.000	.006	.2500
1:	48,000	4,000.00	.250	1.320	.758	1,219.202	367.309	.003	.5739
1:	62,500	5,208.333	.192	1.014	.986	1,587.503	622.744	.0016	.9730
1:	63,360	5,280.00	.189	1.000	1.000	1,609.347	640.00	.0016	1.0000
1:	96,000	8,000.00	.125	.660	1.515	2,438.405	1,469.24	.0007	2.2957
1:	125,000	10,416.667	.096	.507	1.973	3,175.006	2,490.98	.0004	3.8922
1:	126,720	10,560.00	.095	.500	2.00	3,218.694	2,560.00	.0004	4.00
1:	250,000	20,833.333	.048	.253	3.946	6,350.012	9,963.907	.0001	15.5686
1:	253,440	21,120.00	.047	.250	4.00	6,437.389	10,244.202	.0001	16.00
1:	500,000	41,666.667	.024	.127	7.891	12,700.025	39,855.627	.000025	62.2744
1:	1,000,000	83,333.333	.012	.063	15.783	25,400.050	159,422.507	.0000062	249.0977

\*Soil Conservation Service, Aerial-Photo Interpretation in Classifying and Mapping Soils, USDA Handbook 294, 1966



## APPENDIX H. EQUIPMENT LIST

Stereoscope, folding pocket type  
Masking tape  
Mylar, roll 4 ft. wide  
Magnification tube  
Stapler  
Prisma color pencils  
Felt tip pens  
Ink solvent  
Writing pads  
Erasers  
Pencils  
Light table  
Reflecting projector  
Large copy camera  
Paper cutter  
Pre-printed forms (data tables)

## VI. GLOSSARY

Entries in this section have been selected from MIL-STD-1165, GLOSSARY OF ENVIRONMENTAL TERMS (TERRESTRIAL). Abbreviations, such as (AMS), following the definition of a term, identify the organization providing the authoritative definition. Definitions for which no source is cited are based on the draft ENVIRONMENTAL TERMINOLOGY PREPARED by the Department of the Navy in 1963, or on comments submitted by military agencies that reviewed various drafts on MIL-STD-1165.

Abbreviations appearing in this glossary are as follows:

- AD**—Department of the Army. *Dictionary of United States Army Terms*, Army Regulation 320-5, Washington, D.C., April 1965.
- ADT**—Arctic, Desert, Tropic Information Center, Research Studies Institute, Air University. *Glossary of Arctic and Subarctic Terms*, ADTIC Pub. A-105, Maxwell AFB, Ala., Sept 1955.
- AF**—Department of the Air Force. *Air Force Glossary of Standardized Terms and Definitions*, Air Force Manual No. 11-1, Washington, D.C., 1 May 1965.
- AFD**—Air University, Research Studies Institute. *The U.S. Air Force Dictionary*, edited by W. A. Heflin, Air University Press, 1956.
- AMS**—American Meteorological Society. *Glossary of Meteorology*, edited by R. B. Huschke, Boston, Mass., 1959.
- GS**—Geological Survey, U.S. Department of the Interior. *Glossary of Names for Topographic Forms*, in: *Topographic Instructions*, Book 6, Part 6A, Washington, August 1954.
- JD**—Joint Chiefs of Staff. *Dictionary of United States Military Terms for Joint Usage*, JCS Pub. 1, G.P.O., Washington, D.C., 1 Jan 1966.
- MH**—Geological Survey, U.S. Department of the Interior. *General Introduction and Hydrologic Definitions*, by W. B. Langbein and Kathleen T. Iseri, in: *Manual of Hydrology: Part 1. General Surface-Water Techniques*, Geological Survey Water-Supply Paper 1541-A, G.P.O., Washington, 1960.
- NASA**—National Aeronautics and Space Agency. *Aeronautical Dictionary*, by Frank D. Adams, G.P.O., Washington, D.C., 1959.
- ND**—Department of the Navy. *Navigation Dictionary*, H.O. Pub. 220, Washington, D.C., 1956.
- NOO**—Department of the Navy. *Glossary of Oceanographic Terms*, Naval Oceanographic Office, SP-35, 2d ed., Washington, D.C., 1966.
- WMO**—World Meteorological Organization. *International Cloud Atlas*, vol. I, Geneva, 1956.

\* Definition paraphrased, or source not quoted entirely.

**ABSOLUTE MAXIMUM (MINIMUM) TEMPERATURE**—The highest (lowest) temperature recorded during the period of record at a station.

**ABSOLUTE RANGE OF TEMPERATURE**—The difference between the highest and lowest temperatures on record at a station.

**ADVECTION FOG**—Fog resulting from the movement of moist air over a cold surface and the consequent cooling of this air to below its dew point. See Sea Fog (AMS).

**AIR, n.**—The mixture of gases comprising the earth's atmosphere. Since the composition of the atmosphere is slightly variable with respect to certain components, the term "pure air" has no precise meaning, but it is commonly used to imply freedom from non-gaseous suspensoids (dust, hydrometeors) and also freedom from such gaseous contaminants as industrial effluents. (AMS)\*

**AIRBORNE DUST**—Particles of mineral and other substances, usually of silt size, suspended in the air, such as those raised by operation of equipment over dry, loessial terrain, or those resulting from dust storms.

**AIR MASS**—A widespread body of air that is approximately homogeneous in its horizontal extent, particularly with reference to temperature and moisture distribution; in addition, the vertical temperature and moisture variations are approximately the same over its horizontal extent. (AMS)\*

**AIR-MASS CLASSIFICATION**—A system used to identify and to characterize the different air masses according to a basic scheme. A number of systems have been proposed, but the Bergeron classification has been the most widely accepted. In this system, air masses are designated according to the thermal properties of their source regions: tropical (*T*); polar (*P*); and less frequently, arctic or antarctic (*A*). For characterizing the moisture distribution, air masses are distinguished as to continental (*c*) and maritime (*m*) source regions. Further classification according to whether the air is cold (*k*) or warm (*w*) relative to the surface over which it is moving indicates the low-level stability conditions of the air, the type of modification from below, and is also related to the weather occurring within the air mass. This outline of classification yields the following identifiers for air masses: *cTk*, *cTw*, *mTk*, *mTw*, *cPk*, *cPw*, *mPk*, *mPw*, *cAk*, *cAw*, *mAk*, *MAw*; the last of which is never used. (AMS)\*

**AIR, MOIST**—1. In atmospheric thermodynamics, air that is a mixture of dry air and any amount of water vapor. (AMS) 2. Generally, air with a high relative humidity. (AMS) 3. In environmental engineering, a mixture of air and condensed or entrained beads of airborne water, specifically air containing water in the liquid state.

**AIR PRESSURE**—The static pressure exerted by air. Although this is a very general term, it is best used in cases where a limited volume of air is concerned, as within an enclosed space. This term should never be used to denote a dynamic effect such as wind pressure. (AMS)\*

**AMBIENT TEMPERATURE**—The temperature of the air or other medium surrounding an object. (NOO)\*

**ANEMOMETER, n.** — The general name for instruments designed to measure the speed (or force) of the wind. These instruments may be classified according to the means of transduction employed: those used in meteorology include the rotation anemometer, pressure-plate anemometer, pressure-tube anemometer, bridled-cup anemometer, contact anemometer, cooling-power anemometer, and sonic anemometer. (AMS)

**ANNUAL RANGE OF TEMPERATURE** — The difference between the highest and lowest temperatures recorded at a station in any given year.

**APPLIED CLIMATOLOGY** — The scientific analysis of climatic data in the light of a useful application for an operational purpose. "Operational" is interpreted as any specialized endeavor, within such as industrial, manufacturing, agricultural or technical pursuits. This is the general term for all such work and includes agricultural climatology, aviation climatology, bioclimatology, industrial climatology, and probably others. (AMS)

**APPLIED METEOROLOGY** — The application of current weather data, analyses, and forecasts to specific practical problems. It is distinguished from applied climatology, which deals with the similar application of long-period, statistically treated weather data. (AMS)

**ARCTIC AIR** — A type of air whose characteristics are developed mostly in winter over arctic surfaces of ice and snow. Arctic air is cold aloft and it extends to great heights, but the surface temperatures are often higher than those of polar air. For two or three months in summer arctic air masses are shallow and rapidly lose their characteristics as they move southward. (AMS)

**ARCTIC REGIONS** — That portion of the northern hemisphere which is characterized by having an average temperature for the warmest month of between 32 degrees Fahrenheit and 50 degrees Fahrenheit. These areas generally correspond with those seasonally frozen lands which do not support forest vegetation and include the adjacent lakes, seas or oceans. (AD)

**ARIDITY, n.** — The degree to which a climate lacks effective, life-promoting moisture; the opposite of humidity, in the climatic sense of the term. (AMS) \*

**ATMOSPHERE, STANDARD** — A hypothetical vertical distribution of atmospheric temperature, pressure, and density which, by international agreement, is taken to be representative of the atmosphere for purposes of pressure altimeter calibrations, aircraft performance calculations, aircraft and missile design, ballistic tables, etc. The current standard atmosphere is that which was adopted on 15 March 1962 by the United States Committee on Extension to the Standard Atmosphere (COESA). The U. S. Standard Atmosphere, 1962, up to 32 km, has been adopted by the International Civil Aeronautical Organization (ICAO). (AMS) \*

**ATMOSPHERE, n.** — 1. *Meteorol.* The envelope of air surrounding the earth and bound to it more or less permanently by virtue of the earth's gravitational attraction. The earth's atmosphere extends from the solid or liquid surface of the earth to an indefinite height, its density asymptotically approaching that of interplanetary space. (AMS) \* 2. *Physics.* A unit of pressure equal to 101,325 newtons per square meter (14.70 pounds per square inch), representing the atmospheric pressure of mean sea level under standard conditions.

**ATMOSPHERIC DENSITY** — The ratio of the mass of the atmosphere (or any part of it) to the volume occupied by it. This ratio is greatest at sea level and decreases with increasing altitude; it also may vary horizontally depending on conditions of **ATMOSPHERIC TEMPERATURE** and **ATMOSPHERIC PRESSURE**. It is usually expressed in grams per cubic meter, although any other unit system may be used. (AMS)\*

**ATMOSPHERIC PRESSURE** — The pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the "column" of air lying directly above the point in question. (AMS)\* Pressure is usually given in millibars (mbs), inches of mercury, pounds per square inch, or pounds per square foot. Its standard value at sea level is about 14.7 pounds per square inch (101,325 newtons per sq. m.).

**ATMOSPHERIC TEMPERATURE** — The degree of heat or cold in the envelope of air surrounding the earth as measured on some definite temperature scale (usually **CELSIUS** or **FAHRENHEIT**) by means of any of various types of thermometers. (AMS)\*

**BAROMETRIC PRESSURE** — Atmospheric pressure as indicated by a barometer. This atmospheric pressure is the pressure exerted by the atmosphere as a consequence of gravitational attraction exerted upon the "column" of air lying directly above the point in question. (AMS)\*

**BEAUFORT WIND SCALE** — A system of estimating and reporting wind speeds, invented in the early nineteenth century by Admiral Beaufort of the British Navy. In its present form for international meteorological use it equates (a) Beaufort force (or Beaufort number), (b) wind speed, (c) descriptive term, and (d) visible effects upon land objects or sea surface. As originally given, Beaufort numbers ranged from 0, calm, to 12, hurricane. They have now been extended to 17. (AMS)\*

**BLACK-BULB THERMOMETER** — A thermometer whose sensitive element has been made to approximate a black body by covering it with lamp black. The thermometer is placed in an evacuated transparent chamber which is maintained at constant temperature. The instrument responds to insolation, modified by the transmission characteristics of its container. (AMS)

**BLACK FROST** — 1. A dry freeze, with respect to its effects upon vegetation, that is, the internal freezing of vegetation unaccompanied by the protective formation of hoarfrost. A black frost is always a killing frost, and its name derives from the resulting blackened appearance of affected vegetation. (AMS)

**BLIZZARD**, n. — A severe weather condition characterized by low temperatures and by strong winds bearing a great amount of snow (mostly fine, dry snow picked up from the ground). The U.S. Weather Bureau specifies, for blizzard, a wind of 32 mph or higher, low temperatures, and sufficient snow in the air to reduce visibility to less than 500 ft; and for severe blizzard, wind speeds exceeding 45 mph, temperature near or below 10°F, and visibility reduced by snow to near zero. (AMS)\*

**BLOWING DUST** — Dust picked up locally from the surface of the earth and blown about in clouds or sheets. It may completely obscure the sky; in its extreme form it is a dust storm. (AMS)\*

**BLOWING SAND** — Sand picked up from the surface of the earth by the wind and blown about in clouds or sheets. In its extreme form, blowing sand constitutes a sand storm. (AMS)\*

**BLOWING SNOW** — Snow lifted from the surface of the earth by the wind to a height of six feet or more above the surface (higher than drifting snow), and blown about in such quantities that horizontal visibility is restricted at and above that height. Blowing snow is one of the classic requirements for a blizzard. (AMS)\*

**BREEZE**, n. — 1. Wind of force 2 to 6 (4-31 miles per hour or 4-27 knots) on the Beaufort scale. Wind of force 2 (4-7 miles per hour or 4-6 knots) is classified as a *light breeze*; wind of force 3 (8-12 miles per hour or 7-10 knots), a *gentle breeze*; wind of force 4 (13-18 miles per hour or 11-16 knots), a *moderate breeze*; wind of force 5 (19-24 miles per hour or 17-21 knots) a *fresh breeze*; and wind of force 6 (25-31 miles per hour or 22-27 knots), a strong breeze. 2. Any light wind. A *land breeze* flows from the land to the sea, and usually alternates with a *sea breeze* blowing in the opposite direction. A *mountain breeze* blows down a mountain slope due to gravity flow of cooled air, and a *valley breeze* blows up a valley or mountain slope because of the warming of the mountainside and valley floor by the sun. A puff of wind, or light breeze affecting a small area, may be called a *cat's paw*. Absence of wind is sometimes called *ash breeze*. (ND)

**CALM**, n. — The absence of apparent motion of the air. In the Beaufort wind scale, this condition is reported when smoke is observed to rise vertically, or the surface of the sea is smooth and mirror-like. In United States weather observing practice, the wind is reported as calm if it is determined to have a speed of less than one mile per hour (or one knot). (AMS)

**CEILING**, n. — The height above the earth's surface of the lowest layer of the clouds or obscuring phenomena that is reported as broken, overcast, or obscuration, and not classified as thin or partial. (ND)

**CEILING LIGHT** — A type of cloud-height indicator which uses a searchlight to project vertically a narrow beam of light onto a cloud base. The height of the cloud base is determined by using a clinometer, located at a known distance from the ceiling light, to measure the angle included by the illuminated spot on the cloud, the observer, and the ceiling light. (AMS)

**CELSIUS TEMPERATURE SCALE**—Same as **CENTIGRADE TEMPERATURE SCALE**, by recent convention. The Ninth General Conference on Weights and Measures (1948) replaced the designation "degree centigrade" by "degree Celsius." (Originally, Celsius took the boiling point as 0 degrees and the ice point as 100 degrees.) (AMS)

**CENTIGRADE TEMPERATURE SCALE** — A temperature scale with the ice point at 0 degrees and the boiling point of water at 100 degrees. Conversion to the Fahrenheit temperature scale is according to the formula

$$^{\circ}\text{C} = \frac{5}{9} (^{\circ}\text{F} - 32). \quad (\text{AMS})$$

**CLIMATE**, n. — The long-term manifestations of **WEATHER**, however they may be expressed. More rigorously, the climate of a specified area is represented by the statistical collective of its weather conditions during a specified interval of time (usually several decades). (AMS)\*

**CLIMATIC SNOW LINE** — The altitude above which snow accumulates in excess of wastage. Also called *regional snow line*, and *firn line* when referable to a glider or ice cap. The climatic snow line specifically applies to flat surfaces fully exposed to sun and wind; however, most glaciologists consider the precise application as theoretical, rarely observable in nature. (ADT).

**CLIMATOLOGY**, n. — The scientific study of climate. In addition to the presentation of climatic data (climatography), it includes the analysis of the causes of differences of climate (*physical climatology*), and the ap-

**CLOUD**, n. — 1. A hydrometeor consisting of a visible aggregate of minute water and/or ice particles in the atmosphere above the earth's surface. Cloud differs from **FOG** only in that the latter is, by definition, in contact with the earth's surface. (AMS)\* 2. Any collection of particulate matter in the atmosphere dense enough to be perceptible to the eye, as a *dust cloud* or a *smoke cloud*. (AMS)

**CLOUD BANK** — Generally, a fairly well defined mass of cloud observed at a distance; it covers an appreciable portion of the horizon sky, but does not extend overhead. (AMS)

**CLOUDBURST**, n. — A sudden and extremely heavy downpour of rain. (ND)

**COLD DRY** — In military climatology, a weather condition in which cold, or very cold temperatures are unaccompanied by wet precipitation or wetness on the ground, except that dry snow may be falling or dry snow or ice may be underfoot. (ADT)\*

**COLD SOAK** — The effect of exposing equipment to low temperatures for an extended period of time. Cold soak of engines sometimes necessitates preheating before their use, as lubricants have thickened, metal has become brittle, and tolerances have diminished. (ADT)\*

**COLD WET** — 1. *Military climatology*. A weather condition in which cool, cold, or very cold temperatures are accompanied by rain, fog, or wet snow in the air and by the presence of water, wind, slush, or wet snow on the ground. (ADT)\* 2. *Physiol.* An environmental condition in which clothing is essential to prevent the loss of body heat from exceeding the production of metabolic heat when the problem is complicated by the presence of moisture in the air or underfoot which wets clothing, especially footwear. (ADT)\*

**CONDENSATION**, n. — The physical process by which a vapor becomes a liquid or solid; the opposite of evaporation. In meteorological usage, this term is applied only to the transformation from vapor to liquid; any process in which a solid forms directly from its vapor is termed sublimation, as is the reverse process. In meteorology, condensation is considered almost exclusively with reference to water vapor which changes to dew, fog, or cloud. It is indispensable to avoid confusing condensation with precipitation, for the former is by no means equivalent to the latter, though it must always precede the latter. (AMS)\*

**CONDUCTION**, n. — The transfer of energy within and through a conductor by means of internal particle or molecular activity, and without any net external motion. Conduction is to be distinguished from convection (of heat) and radiation (or all electromagnetic energy). Heat is conducted by molecular motion within a few centimeters of the heat source (e.g., the earth's surface). The distribution of heat away from that source is accomplished by convection and (in analogy to molecular conduction) by eddy heat conduction. (AMS)\*

**CONTINENTAL AIR** — A type of air whose characteristics are developed over a large land area and which, therefore, has the basic continental characteristic of relatively low moisture content. (AMS)

**CONTINENTAL CLIMATE** — The climate that is characteristic of the interior of a land mass of continental size. It is marked by large annual, daily, and day-to-day ranges of temperature, low relative humidity, and (generally) by a moderate or small and irregular rainfall. The annual extremes of temperature occur soon after the solstices. (AMS)\*

**CONVECTION**, n. — 1. Mass motions within a fluid resulting in transport and mixing of the properties of that fluid. Convection, along with conduction and radiation, is a principal means of energy transfer. (AMS)\* 2. *Meteorol.* Atmospheric motions that are predominantly vertical, resulting in vertical transport and mixing of atmospheric properties; distinguished from advection. (AMS)\* 3. *Atmospheric Electricity*. A process of vertical charge transfer by transport of air containing a net space charge, or by motion of other media (e.g. rain) carrying net charge. Eddy diffusion of air containing a net charge gradient may also yield a convection current. (AMS)

COOLING PROCESSES, MAJOR — Air temperature is decreased by all or any of the following processes:

(1) *nocturnal cooling*. The earth continuously radiates its heat outward toward space. During the night (or at any time when outgoing radiation from the earth exceeds incoming solar radiation) the loss of radiant energy lowers the temperature of the earth's surface. The air temperature is thereafter reduced by conduction.

(2) *advective cooling*.

a. When the windflow is such that cold air moves into an area previously occupied by warmer air, the temperature of the air over the area is decreased. With a strong, cold wind prevailing, the advective cooling may be sufficient to cause a temperature decrease in an area even though the surface is absorbing solar radiation.

b. Warm air advection over a colder surface will result in conductive cooling of the lower air layers.

(3) *evaporative cooling*. When rain or drizzle falls from clouds, the evaporation of the water drops cools the air through which these drops are falling. Similar evaporative cooling occurs whenever liquid water is changing to vapor, thereby taking latent heat energy from the environment.

(4) *adiabatic cooling*. The process by which air cools due to decrease in pressure. If air is forced upward in the atmosphere, the resulting decrease in atmospheric pressure surrounding the rising air allows the air to expand and cool adiabatically. Weather produced by lifting processes is the result of adiabatic cooling; e.g., frontal weather, convective, and orographic thunderstorms, and upslope fog.

**CYCLONE, n.** — A closed system of low atmospheric pressure around which the winds blow counterclockwise in the northern hemisphere, and clockwise in the southern hemisphere. Because cyclones nearly always are accompanied by inclement weather, they are frequently referred to simply as storms. (AMS)\*

**DAILY MEAN** — 1. The average value of a meteorological element over a period of twenty-four hours. The "true daily mean" is usually taken as the mean of twenty-four hourly values between midnight and midnight, either as continuous values taken from an autographic record or as point readings at hourly intervals. When hourly values are not available, approximations must be made from observations at fixed hours. (AMS)\* 2. The long-period mean value of a climatic element on a given day of the year. (AMS)\*

**DAY WITH PRECIPITATION** — A day in which the total precipitation received equals or exceeds a specified amount (in U.S., water equivalency — .01 in.).

**DEGREE DAY** — 1. Generally, a measure of the departure of the mean daily temperature from a given standard: one degree day

**DEGREE HOUR** — As used by the U. S. Army Corps of Engineers, the departure (in °F) of the hourly temperature from a standard of 32°F, positive if above and negative if below. Degree hours may be accumulated (summed) over any period of time, depending upon the use to which they are applied. (AMS)

**DEGREES OF FROST** — The number of degrees that the temperature falls below 32°F or 0°C, the freezing point. (ADT)

**DENSITY ALTITUDE** — The height above sea level at which the existing density of the atmosphere would be duplicated in the standard atmosphere; atmospheric density expressed as height according to a standard scale. (ND)



**DEPRESSION, n.** — 1. *Meteorol.* An area of low pressure; a low or a trough. This is usually applied to a certain stage in the development of a tropical cyclone, to migratory lows, and troughs, and to upper-level lows and troughs that are only weakly developed. (AMS)\* 2. *Geomorph.* A low place of any size on a plain surface, with drainage underground or by evaporation; a hollow completely surrounded by higher ground and having no natural outlet for surface drainage. (GS)

**DESERT, n.** — A region where precipitation is insufficient to support any plant life except xerophilous vegetation; a region of extreme aridity. W. Koeppen, in his climatic classification, defines a desert CLIMATE (designated BW) by assigning maximum values of annual precipitation as follows: for precipitation mainly in cold season,  
 $p = 0.22 (t - 32)$ ;  
for evenly distributed precipitation,  
 $p = 0.22 (t - 19.4)$ ;  
for precipitation mainly in the hot season,  
 $p = 0.22 (t - 6.8)$ ;  
where  $p$  is the mean annual precipitation in inches, and  $t$  is the mean annual temperature in °F. (AMS)\*

**DEW, n.** — Water condensed onto grass and other objects near the ground, the temperatures of which have fallen below the DEW POINT of the surface air due to radiational cooling during the night, but are still above freezing. If the temperature falls below freezing after dew has formed, the frozen dew is known as *white dew*. (AMS)\*

**DEW POINT** — The temperature to which a given weight of air must be cooled at constant pressure and constant water-vapor content in order for SATURATION to occur. When this temperature is below 0°C, it is sometimes called the *frost point*. (AMS)\*

**DIRECTION OF WIND** — The direction from which a wind is blowing. (ND)

**DIURNAL, adj.** — Daily, especially pertaining to actions which are completed within twenty-four hours and which recur every twenty-four hours; thus, most reference is made to diurnal cycles, variations, ranges, maxima, etc. (AMS)\*

**DOWNWIND, adj. & adv.** — In the direction toward which the wind is blowing. The term applies particularly to the situation of moving in this direction, whether desired or not. *Before the wind* implies assistance from the wind in making progress in a desired direction. *Leeward* applies to the direction toward which the wind blows, without implying motion. The opposite is *upwind*. (ND)

**DRIFTING SAND** — An ensemble of particles of dust or sand raised from the ground to small or moderate height by a sufficiently strong and turbulent wind. (WMO)\*

**DRIFTING SNOW** — Snow particles being blown about close to the ground (less than 6 feet above the surface), differing from blowing snow in that vertical visibility is not appreciably affected. (ADT)\*

**DRIZZLE, n.** — Fairly uniform precipitation composed exclusively of fine drops of water (diameter less than 0.5 mm or 0.02 in.), very close to one another. (WMO)\*

**DROPLET (or DROP)** — A small spherical particle of any liquid; in meteorology, particularly a water droplet. There is no defined size limit separating droplets from drops of water, but it is sometimes convenient to denote two disparate size ranges, such as the oft-used distinction of liquid cloud particles (droplets) from liquid precipitation (drops), thereby implying that a maximum diameter of 0.2 mm is the limit for droplets. (AMS)

**DUST**, n. — 1. Solid materials suspended in the atmosphere in the form of small irregular particles, many of which are microscopic size. Dust is due to many natural and artificial sources: volcanic eruptions, salt spray from the seas, blowing solid particles, plant pollen and bacteria, smoke and ashes of forest fires and industrial combustion processes, etc. (AMS)\* 2. Particles smaller than 75 microns in diameter.

**DUST STORM** — An unusual, frequently severe weather condition characterized by strong winds and dust-filled air over an extensive area. A thick mass of airborne dust may obscure the atmosphere to the extent that it reduces visibility very considerably — sometimes practically to zero. (AMS)\*

**DUST WHIRL** — A rapidly rotating column of air, usually about 100 to 300 feet in height, carrying dust, straw, leaves, or other light material. It has no direct relationship to a dust storm, and usually develops on a calm, hot afternoon with clear skies, mostly in desert regions. (ND)\* Also called *dust devil*.

**EXTREME**, n. — In climatology, the highest and, in some cases, the lowest value of a climatic element observed during a given period or during a given month or season of that period. If this is the whole period for which observations are available, it is the *absolute extreme*. (AMS)

**FIRST-ORDER CLIMATOLOGICAL STATION** — As defined by the World Meteorological Organization (1956), a meteorological station at which autographic records or hourly readings of atmospheric pressure, temperature, humidity, wind, sunshine, and precipitation are made, together with observations at fixed hours of the amount and form of clouds and notes on the weather. (AMS)

**FISHTAIL WIND** — Wind that is constantly changing direction back and forth. (AD)

**FLURRY**, n. — A brief shower of snow accompanied by a gust of wind, or a sudden, brief wind squall. (ND)

**FOEHN** (or **FOHN**), n. — A warm, dry wind on the lee side of a mountain range, the warmth and dryness of the air being due to adiabatic compression upon descending the mountain slopes. The foehn is characteristic of nearly all mountain areas. It is associated with cyclonic-scale motions, being produced only when the circulation is sufficiently strong and deep to force air completely across a major mountain range in a short period of time. In different mountain regions the foehn has a variety of names, as the **CHINOOK** of the Rocky Mountains. (AMS)\*

**FOG**, n. — A hydrometeor consisting of a visible aggregate of minute water droplets suspended in the atmosphere near the earth's surface. According to international definition, fog reduces visibility below one kilometer (0.62 mile). Fog differs from cloud only in that the base of fog is at the earth's surface while clouds are above the surface. When composed of ice crystals, it is termed *ice fog*. (AMS)\* See also **ADVECTION FOG**, **GROUND FOG**, **RADIATION FOG**.

**FRONT**, n. — In meteorology, generally, the interface or transition zone between two **AIR MASSES** of different density. Since the temperature distribution is the most important regulator of atmospheric density, a front almost invariably separates air masses of different temperature. Along with the basic density criterion and the common temperature criterion, many other features may distinguish a front, such as a pressure trough, a change in wind direction, a moisture discontinuity, and certain characteristic cloud and precipitation forms. (AMS)\*

**FROST, n.** — 1. A feathery deposit of minute ice crystals or grains upon a surface or object, formed directly from vapor in the air. (AFD) 2. The process by which such ice crystals are formed. (AFD) 3. Any temperature at which frost forms. Frost often forms when the close lying air is above 32° F, especially in calm, clear weather when radiation or evaporation reduces a surface temperature to a point of freezing or below. (AFD)

**FROST LINE** — The maximum depth of frozen ground during the winter. The term may refer to an individual winter, to the average over a number of years, or to the greatest depth recorded since observations began. The frost line varies with the nature of the soil and the protection afforded by vegetal ground cover and snow cover, as well as with the amount of seasonal cooling. (AMS)

**GALE, n.** — 1. In general, and in popular use, an unusually strong wind. (AMS) 2. In storm-warning terminology: moderate gale, 28 to 33 knots; fresh gale, 34 to 40 knots; strong gale, 41 to 47 knots; and whole gale, 48 to 55 knots. (AMS)\*

**GLAZE, n.** — A coating of ice, generally clear and smooth but usually containing some air pockets, formed on exposed objects by the freezing of a film of supercooled water deposited by rain, drizzle, fog, or possibly condensed from supercooled water vapor. Glaze is denser, harder and more transparent than either RIME or HOARFROST. Its density may be as high as 0.8 or 0.9 gm per cm<sup>3</sup>. Factors which favor glaze formation are large drop size, rapid accretion,

**GROUND FOG** — According to United States weather observing practice, a fog that hides less than 0.6 of the sky, and does not extend to the base of any clouds that may lie above it. (AMS)\*

**GROUND FROST** — A freezing condition injurious to vegetation, which is considered to have occurred when a thermometer exposed to the sky at a point just above a grass surface records a minimum temperature (grass temperature) of 30.4° F. or below. (AMS)\*

**GUST, n.** — A sudden brief increase in the speed of the wind. It is of a more transient character than a SQUALL and is followed by a lull or slackening in the wind speed. Generally, winds are least gusty over large water surfaces and most gusty over rough land and near high buildings. According to United States weather observing prac-

**HAIL, n.** — Precipitation in the form of small balls or pieces of ice (hailstones) with a diameter ranging from 5 to 50 mm (0.2 to 2.0 in.) or sometimes more, falling either separately or agglomerated into irregular lumps. Hail falls are generally observed during heavy thunderstorms. (WMO)

**HAILSTONE, n.** — A single unit of hail, ranging in size from that of a pea to that of a grapefruit (i.e., from less than 1/4 inch to more than 5 inches diameter). Hailstones may be spheroidal, conical, or generally irregular in shape. The spheroidal stones, the most common form, typically exhibit a layered interior structure resembling an onion, with alternate layers composed of GLAZE and RIME. (AMS)\*

**HEAT WAVE**—A period of abnormally and uncomfortably hot and usually humid weather. To be a "heat wave" such a period should last at least one day, but conventionally it lasts from several days to several weeks. (AMS)

**HIGH**, n.—In meteorology, elliptical for "area of high pressure" referring to a maximum of atmospheric pressure in two dimensions (closed isobars) in the synoptic surface chart, or a maximum of height (closed contours) in the constant-pressure chart. Since a high is, on the synoptic chart, always associated with anticyclonic circulation, the term is used interchangeably with **ANTICYCLONE**. Compare **LOW**. (AMS)

**HOARFROST**, n.—A deposit of interlocking ice crystals formed by direct **SUBLIMATION** on objects, usually those of small diameter freely exposed to the air, such as tree branches, plant stems and leaf edges, wires, poles, etc. Also, frost may form on the skin of an aircraft when a cold aircraft flies into the air which is warm and moist or when it passes through air that is supersaturated with water vapor. The deposition of hoarfrost is similar to the process by which **DEW** is formed, except that the temperature of the befrosted object must be below freezing. (AMS)\*

**HUMID TROPICS** — Those areas in which the average temperature of the coldest month is above 64.4 degrees Fahrenheit and the annual rainfall rate exceeds the annual evaporation rate. These lands are characterized by rainforest, jungle, and savanna vegetation. (AD)

**HUMIDITY**, n.—The amount of water vapor in the air. (ND) See **ABSOLUTE HUMIDITY**, **RELATIVE HUMIDITY**, and **SPECIFIC HUMIDITY**.

**HYDROMETEOR**, n. — Any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particles blown by the wind from the earth's surface. (AMS)\*

**ICE FOG** — A type of fog, composed of suspended particles of ice, partly ice crystals 20 to 100 microns in diameter but chiefly, especially with dense, tiny ice particles 12 to 20 microns in diameter. It occurs at very low temperatures, and usually in clear, calm weather in high latitudes. Also called *frozen fog*, *pogonip*, etc. (AMS)\*

**ICE FROST** — Specifically, a thickness of ice that gathers on the outside of a rocket vehicle over surfaces supercooled by liquid oxygen inside the vehicle. This ice frost is quickly shaken loose and falls to the ground once the vehicle begins its ascent. (AF)

**ICE PELLETS** — Precipitation of transparent or translucent pellets of ice, which are spherical or irregular, rarely conical, and which have a diameter of 5 mm (0.2 in.) or less. Ice pellets include **SLEET** (U. S. definition) and **SMALL HAIL**. (WMO)\*

**INSOLATION**, n.—1. In general, solar radiation received at the earth's surface. (AMS) 2. The rate at which direct solar radiation is incident upon a unit horizontal surface at any point on or above the surface of the earth. (AMS)

**INSTRUMENT SHELTER** — A box-like structure designed to protect certain meteorological instruments from exposure to direct sunshine, precipitation, and condensation, while at the same time providing adequate ventilation. Instrument shelters are painted white, have louvred sides, usually a double roof, and are mounted on a stand several feet above the ground with the door side facing poleward. (AMS)\*

**INTERTROPICAL CONVERGENCE ZONE**

— The axis, or a portion thereof, of the broad trade-wind current of the tropics. This axis is the dividing line between the southeast trades and the northeast trades (of the Southern and Northern Hemisphere, respectively). (AMS)\*

**ISALLOBAR, n.** — A line of equal change in atmospheric pressure during a specified time interval; an isopleth of pressure tendency. (AMS)\*

**ISOBAR, n.** — A line of equal or constant pressure; an isopleth of pressure. In meteorology, it most often refers to a line drawn through all points of equal atmospheric pressure along a given reference surface, such as a constant-height surface (notably mean-sea-level on surface charts). (AMS)\*

**ISOHYET, n.** — A line drawn through geographical points recording equal amounts of precipitation during a given time period or for a particular storm. (AMS)

**ISOPLETH, n.** — 1. A line of equal or constant value of a given quantity, with respect to either space or time. (AMS)\* 2. A line drawn through points on a graph at which a given quantity has the same numerical value (or occurs with the same frequency) as a function of the two coordinate variables. (AMS) 3. A straight line along which lie corresponding values of a dependent and independent variable. (AMS)

**ISOTHERM, n.** — A line of equal or constant temperature. (AMS)\*

**KATABATIC WIND** — 1. Any wind blowing down an incline; the opposite of anabatic wind. If the wind is warm, it is called a *FOEHN*; if cold, it may be a *fall wind* (such as the *bora*), or a *gravity or drainage wind* (such as a mountain wind). (AMS)\*

**KNOT, n.** — The unit of speed in the nautical system; one nautical mile per hour. It is equal to 1.1508 statute miles per hour or 0.5144 meters per second. (AMS)

**LAPSE RATE** — The decrease of an atmospheric variable with height, the variable being temperature, unless otherwise specified. (AMS)\*

**LENGTH OF RECORD** — The period during

which observations have been maintained at a meteorological station, and which serves as the frame of reference for climatic data at that station. The standard length of record for the purpose of a normal has been fixed by the World Meteorological Organization as thirty years, which is a fair practical average for the length of a homogeneous record desirable for most of the meteorological elements. (AMS)\*

**MARITIME AIR** — A type of air whose characteristics are developed over an extensive water surface and which, therefore, has the basic maritime quality of high moisture content in at least its lower levels. (AMS)

**MEAN ANNUAL RANGE OF TEMPERATURE** — The difference between the absolute maximum and minimum temperatures for a year, averaged over a given number of years.

**MEAN DAILY MAXIMUM (MINIMUM) TEMPERATURE** — Average of the maximum (minimum) temperatures for each day within a given period, usually a month, over a period of years.

**MEAN HOURLY TEMPERATURE** — Average of the daily temperatures at a given hour for an indicated period, generally a month, averaged over a period of years.

**MEAN MONTHLY CLOUDINESS** — Average of the mean cloud cover of each day within a month, averaged over a period of years.

**MEAN MONTHLY DEWPOINT**—Average of the mean dewpoints of each day (generally computed from observations taken at equal time periods of 6 hours or less apart) within a month, averaged over a period of years.

**MEAN MONTHLY MAXIMUM (MINIMUM) TEMPERATURE**—The highest (lowest) temperature for a month, averaged over a period of years.

**MEAN MONTHLY RELATIVE HUMIDITY**—Average of the mean relative humidities for each day of the month, averaged over a period of years.

**MEAN MONTHLY TEMPERATURE**—Average of the mean temperatures of each day within a month, averaged over a period of years. Some weather services require that a prescribed length of record be available before "mean" is used.

**METEOROLOGICAL DATA**—Meteorological facts pertaining to the atmosphere, such as wind, temperature, air density and other phenomena which affect military operations. (JD)

**METEOROLOGY, n.**—The study dealing with the phenomena of the atmosphere. This includes not only the physics, chemistry, and dynamics of the atmosphere, but is extended to include many of the direct effects of the atmosphere upon the earth's surface, the oceans, and life in general. The goals often ascribed to meteorology are the complete understanding, accurate prediction, and artificial control of atmospheric phenomena. (AMS)\*

**MILLIBAR, n.**—A unit of pressure equal to 1,000 dynes per square centimeter, or 1/1,000 of a BAR. The millibar is used as a unit of measure of atmospheric pressure, a standard pressure, a standard atmosphere being equal to 1,013.25 millibars or 22.92 inches of mercury. (ND)

**MIST, n.**—1. According to international definition: a **HYDROMETEOR** consisting of an aggregate of microscopic and more-or-less **HYGROSCOPIC** water droplets suspended in the atmosphere. It produces, generally, a thin grayish veil over the landscape. It reduces visibility to a lesser extent than **FOG**. **RELATIVE HUMIDITY** with mist is often less than 95 percent. Mist is intermediate in all respects between **HAZE** and fog. 2. In popular usage in the United States, same as **DRIZZLE**. (AMS)\*

**MONSOON, n.**—A name for seasonal winds (derived from Arabic *mausim*, a season). It was first applied to the winds over the Arabian Sea, which blow for six months from northeast and for six months from southwest, but it has been extended to similar winds in other parts of the world. The primary cause is the much greater annual variation of temperature over large land areas compared with neighboring ocean surfaces, causing an excess of pressure over the continents in winter and a deficit in summer, but other factors such as the relief features of the land have a considerable effect. In India the term is popularly applied chiefly to the southwest monsoon and, by extension, to the rains which it brings. (AMS)\*

**MOUNTAIN AND VALLEY WINDS**—A system of diurnal winds along the axis of a valley, blowing uphill and upvalley by day, and downhill and downvalley by night; they prevail mostly in calm, clear weather. The upvalley component or *valley wind* is due to the temperature difference between the air heated over the slopes and that at the same height in the free air. The downvalley component or *mountain wind* at night is due to nocturnal cooling and is somewhat weaker, up to 9 mph. (AMS)\*

**OROGRAPHIC PRECIPITATION** — Precipitation which results from the lifting of moist air over an orographic barrier such as a mountain range. Strictly, the amount so designated should not include that part of the precipitation, which would be expected from the dynamics of the associated weather disturbance, were the disturbance over flat terrain. (AMS)\*

**POLAR REGIONS** — Those parts of the earth's surface which have an average temperature of the warmest month of less than 32 degrees Fahrenheit. (AD)

**PREVAILING WIND DIRECTION** — The wind direction most frequently observed during a given period. The periods most frequently used are the observational day, month, season, and year. (AMS)\*

**RADIATIONAL COOLING** — In meteorology, the cooling of the earth's surface and adjacent air, accomplished (mainly at night) whenever the earth's surface suffers a net loss of heat due to **TERRESTRIAL RADIATION**. (AMS)

**RADIATION FOG** — A major type of **FOG**, produced over a land area when **RADIATIONAL COOLING** reduces the air temperature to or below its **DEW POINT**. Thus, a strict radiation fog is a nighttime occurrence, although it may begin to form by evening twilight and often does not dissipate until after sunrise. (AMS)\*

**RAIN, n.** — **PRECIPITATION** of liquid water particles, either in the form of drops of more than 0.5 mm. (0.02 in.) diameter or of smaller widely scattered drops. See **HYDROMETEOR**. (WMO)

**RAINDROP, n.** — A drop of water of diameter greater than 0.5 mm falling through the atmosphere. In careful usage, falling drops with diameters lying in the interval 0.2 to 0.5 mm are called *drizzle drops* rather than raindrops. (AMS)\*

**RAINFALL FREQUENCY** — The number of times, during a specified period of years, that precipitation of a certain magnitude or greater occurs or will occur at a station. (AMS)\*

**RAIN, FREEZING** — Rain that falls in liquid form but freezes upon impact to form a coating of **GLAZE** upon the ground and on exposed objects. When encountered by an aircraft in flight, freezing rain can cause a dangerous accretion of **CLEAR ICING**. (AMS)\*

**RAIN SHADOW** — The region, on the lee side of a mountain or mountain range, where the precipitation is noticeably less than on the windward side. (AMS)\*

**RELATIVE HUMIDITY** — 1. The ratio, expressed in percent, of the amount of water vapor in a given volume of air to the amount the volume of air would contain if saturated. (MIL-STD 210A) 2. The ratio, expressed in percent, of the actual partial pressure of the water vapor in a given mixture of air and water vapor to the saturation pressure of pure water at the same temperature. (NASA)

**RESULTANT WIND** — In climatology, the vectorial average of all wind directions and speeds for a given level at a given place for a certain period, as a month. (AMS)\*

**RIME, n.** — A white or milky and opaque granular deposit of ice formed by the rapid freezing of supercooled water drops as they impinge upon an exposed object. (AMS)\*

RIME, HARD - Opaque, granular masses of RIME deposited chiefly on vertical surfaces by a dense supercooled fog. Hard rime is more compact and amorphous than SOFT RIME, and may build out into the wind as glazed cones or feathers. (AMS)\*

RIME, SOFT - A white, opaque coating of fine RIME deposited chiefly on vertical surfaces, especially on points and edges of objects, generally in supercooled fog. (AMS)\*

SEA BREEZE - A coastal local wind that blows from sea to land, caused by the temperature difference when the sea surface is colder than the adjacent land. Therefore, it usually blows on relatively calm, sunny days, and alternates with the oppositely directed, a nighttime land breeze. (AMS)\*

SEA FOG - A type of ADVECTION FOG formed when air that has been lying over a warm water surface is transported over a colder water surface, resulting in cooling of the lower layer of air below its dew point. (AMS)

SEA-LEVEL PRESSURE - The ATMOSPHERIC PRESSURE at MEAN SEA LEVEL, either directly measured or, most commonly, empirically determined from the observed station pressure. (AMS)\*

SHOWER, n. - Precipitation from a convective cloud. Showers are characterized by the suddenness with which they start and stop, by the rapid changes of intensity, and usually by rapid changes in the appearance of the sky. (AMS)\*

SMOG, n. - A natural FOG contaminated by industrial or other pollutants, often occurring over urban areas during the prevalence of TEMPERATURE INVERSIONS.

*Note:* Smog, a term coined in 1905 by Des Voeux, originally meant a mixture of fog and smoke. Although the term has experienced a recent rise in acceptance, so far it has not been given precise definition. (AMS)\*

SMOKE, n. - Foreign particulate matter in the atmosphere resulting from combustion processes; a type of LITHOMETEOR. When smoke is present, the disk of the sun at sunrise and sunset appears very red, and during the daytime has a reddish tinge. (AMS)\*

SNOW, n. - PRECIPITATION composed of white or translucent ICE CRYSTALS, chiefly in complex branched hexagonal form and often agglomerated into SNOW-FLAKES. See HYDROMETEOR. (AMS)\*

SNOW ACCUMULATION (or SNOW DEPTH) The actual depth of snow on the ground at any instant during a storm, or after any single snowstorm or series of storms. (AMS)

SNOW COVER - 1. The areal extent of snow-covered ground, usually expressed as percent of total area in a given region. (AMS)  
2. In general, a layer of snow on the ground surface. (AMS)  
3. The depth of snow on the ground, usually expressed in inches or centimeters. (AMS)

SNOW DENSITY - The ratio between the volume of melt water derived from a sample of snow and the initial volume of the sample. This is numerically equal to the specific gravity of the snow. See WATER EQUIVALENT OF SNOW. (MH)



SNOW DRIFT, n. - Snow deposited behind or in front of obstacles or irregularities of the surface, or collected in heaps by eddies in the wind. (AMS)\*

SNOWFIELD, n. - 1. Generally, an extensive area of snow-covered ground or ice, relatively smooth and uniform in appearance and composition. This term is often used to describe such an area in otherwise coarse, mountainous, or glacial terrain. (AMS)  
2. In glaciology, a region of permanent snow cover, more specifically applied to the ACCUMULATION AREA of glaciers. (AMS)

SNOWFLAKE, n. - An ICE CRYSTAL or, much more commonly, an aggregation of many crystals which falls from a cloud. Simple snowflakes (single crystals) exhibit beautiful variety of form, but the symmetrical shapes reproduced so often in photomicrographs are not actually found frequently in snowfalls. (AMS)\*

SNOW GRAINS-PRECIPITATION in the form of very small, white opaque particles of ice; the solid equivalent of DRIZZLE. They resemble SNOW PELLETS in external appearance, but are more flattened and elongated, and generally have diameters of less than 1mm; they neither shatter nor bounce when they hit a hard surface. (AMS)\*

SNOW, HARD PACKED - Snow which has been packed by vehicular or other traffic or possibly by the forces of nature.

SNOW LINE - In general, the outer boundary of a snow-covered area. It has at least two specific applications: (a) the ever-changing equatorward limit of SNOW COVER,

particularly in the Northern Hemisphere winter. (AMS)

SNOW PELLETS - Precipitation consisting of white, opaque, approximately round (sometimes conical) ice particles having a snow-like structure, and about 2 to 5 mm in diameter. Snow pellets are crisp and easily crushed, differing in this respect from SNOW GRAINS. (AMS)\*

SNOW, POWDER - A dry snow composed of crystals or grains which lie loosely, e.g., new powder snow, settling powder snow, and settled powder snow.

SPOUT, n. - A phenomenon consisting of an often violent whirlwind, revealed by the presence of a cloud column or inverted cloud cone (funnel cloud), protruding from the base of a cumulonimbus, and of a "bush" composed of water droplets raised from the surface of the sea or of dust, sand or litter, raised from the ground. (WMO)\*  
Spout includes both TORNADO and WATERSPOUT.

SQUALL, n. - 1. A strong wind characterized by a sudden onset, a duration of the order of minutes, and a rather sudden decrease in speed. (AMS)\* 2. A severe local storm considered as a whole, that is winds and cloud mass and (if any) precipitation, thunder, and lightning. (AMS)\*

SQUALL LINE - Any non-frontal line or narrow band of active THUNDERSTORMS (with or without SQUALLS); a mature instability line. (AMS)\*

SUBARCTIC, n.- 1. A region of variable width immediately south of the arctic. Within this area the mean temperature of the warmest 4-month period is less than 50 degrees Fahrenheit. (AD)  
2. Those land areas which extend south from the northern limit of forest to the northern limit of the developed transportation net are considered operationally to be sub-arctic. Although treeless, such coastal areas as the Aleutians are subarctic rather than arctic.

SYNOPTIC METEOROLOGY - The study and analysis of synoptic weather information (synoptic charts, synoptic weather observations. (AMS)

SYNOPTIC WEATHER CHART - A chart of any extended portion of the earth's surface on which are delineated the weather conditions at different points observed at the same moment of actual time. (AD)

TEMPERATE CLIMATE - Very generally, the climate of the "middle" latitudes; the variable climate between the extremes or tropical climate and polar climate. (AMS)\*

**Note:** This term has no precise meaning and cannot be used to delimit a particular range of climatic conditions.

TEMPERATURE LAG - 1. Although the sun is directly overhead at noon, incoming radiation continues to exceed reradiation from the earth until after 1400 hours local standard time. Thus, the diurnal surface temperature increases reaches a maximum in the midafternoon. 2. Seasonally, the sun is highest in the Northern Hemisphere at the summer solstice (June 22), but the long hours of daylight and relatively direct incident

radiation cause the summer temperatures to continue increasing into July and August.

TORNADO, n. - A violent rotating column of air, pendant from a cumulonimbus cloud, and nearly always observable as a "funnel cloud" or tuba. On a local scale it is the most destructive of all atmospheric phenomena. (AMS)\*

TOWN FOG - An ICE FOG created by extremely low temperatures (minus 50 to 65 degrees Fahrenheit), usually noticeable over more or less densely inhabited places, because of the conflict between locally generated warm moist air and the surrounding cold air. At extremely low temperatures such a fog may appear over a body of troops, herd of cattle, gasoline powered vehicles, artillery fire, etc. (AD)\*

TROPICAL CYCLONE - The general term for a CYCLONE that originates over the tropical oceans. By international agreement, tropical cyclones have been classified according to their intensity, as TROPICAL DEPRESSIONS, TROPICAL STORMS, and HURRICANES or TYPHOONS (AMS)\*

TROPICAL DEPRESSIONS - A TROPICAL CYCLONE in which the surface wind speed is less than 34 knots (38 miles per hour).

TROPICAL STORM - A TROPICAL CYCLONE in which the surface wind speed is at least 34, but not more than 63 knots. (JD)

TWILIGHT, n. - The periods of incomplete darkness following sunset (evening twilight) or preceeding sunrise (morning twilight). Twilight is designated as civil, nautical, or astronomical, as the darker limit occurs when the center of the sun is 6°, 12°, or 18° below the celestial horizon, respectively. (ND)

TYPHOON, n. - A severe TROPICAL CYCLONE in the western Pacific. (see HURRICANE) (AMS)\*

UPSLOPE FOG - A type of FOG formed when air flows upward over rising terrain and is, consequently, adiabatically cooled to or below its dewpoint. (AMS)

WATERSPOUT, n. - Usually, a TORNADO occurring over water; rarely, a lesser whirlwind over water, comparable in intensity to a DUST DEVIL over land. (AMS)\*

WBGT INDEX (Abbrev. for: WET BULB, GLOBE TEMPERATURE INDEX) - A measure of the severity of a hot climate by taking into account relative humidity and radiant heat load as well as the dry-bulb temperature. The WBGT Index is made up by weighting the wet-bulb temperature by 0.7 (for relative humidity) the black globe temperature by 0.2 (for radiant temperature), and the dry bulb temperature by 0.1 (shade temperature).

WEATHER, n. - 1. The state of the atmosphere, mainly with respect to its effects upon life and human activities. (AMS)\* 2. As used in the making of surface weather observations, a category of individual and combined atmospheric phenomena which must be drawn upon to describe the local atmospheric activity at the time of observation. (AMS)\*

WEATHER INTELLIGENCE - Weather information interpreted in relation to its effects upon personnel, materiel and the area of operations. (AD)

WEATHER MAP - A map showing weather conditions prevailing or predicted over a considerable area. Usually, the map is based upon weather observations taken at the same time at a number of stations. (JD)

WEATHER STATION - An installation or facility which provides meteorological observations and may also provide medium range weather forecasts for limited geographical areas on a full or part time schedule. (AD)

WET-BULB DEPRESSION - The difference in degrees between the DRY-BULB TEMPERATURE, and the WET-BULB TEMPERATURE. (AMS)

WET-BULB TEMPERATURE - The lowest temperature to which air can be cooled at any given time by evaporating water into it at constant pressure, when the heat required for evaporation is supplied by the cooling of the air. This temperature is indicated by a well-ventilated WET-BULB THERMOMETER. (ND)

WET-BULB THERMOMETER - A thermometer having the bulb covered with a cloth, usually muslin or cambric, saturated with water. (ND)

WET SNOW - In the International Snow Classification, snow which is saturated or almost saturated with water. If free water entirely fills the air spaces in the snow it is classified as "very wet snow". (ADT)

WHITEOUT, n. - A weather condition in the polar regions in which no object casts a shadow, the horizon becomes indistinguishable, and light-colored objects are very difficult to see. Also called milky weather. A whiteout occurs when there is complete snow cover, and the clouds are so thick and uniform that light reflected by the snow is about the same intensity as that from the sky. (ADT)\*

WILLIWAW, n. - 1. A sudden violent gust of cold land air, common along mountainous coasts of high latitudes (AD) 2. A very violent squall in the Straits of Magellan. They may occur in any month but are most frequent in winter. (AMS)

WIND, n. - Air in motion relative to the surface of the earth. Since vertical components of atmospheric motion are relatively small especially near the surface of the earth, meteorologists use the term to denote almost exclusively the horizontal component. (AMS)\*

WINDCHILL, n. - The combined cooling effect of wind and air temperature on heated bodies. Windchill is expressed in kilogram calories per square meter per hour. (AD)

WIND ROSE - Any one of a class of diagrams designed to show the distribution of wind direction experienced at a given location over a considerable period; it thus shows the prevailing wind direction. (AMS)\*

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