TERMINAL FORECAST
REFERENCE FILE

DET 11, 24TH WEATHER SQUADRON
JULY 1970

45

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SECTION I

Location and Topography

SECTION I

Reese AFB, Texas is located in Lubbock County, Texas approximately 10 miles west of the city of Lubbock. The station elevation is 3348 feet and its coordinate location is 33 degrees 36 minutes North latitude and 102 degrees 03 minutes West longitude. Lubbock County is located near the center of the South Plains area of Texas.

The South Plains of Texas is bounded by the Canadian River, 120 miles north; by the abrupt break in Topography often referred to as the "Caprock", 50 miles east; by the Pecos River approximately 150 miles to the southwest and the Texas-New Mexico boundary 60 miles to the west.

The South Plains area is virtually free of orographic obstruction and has a slight slope to the southeast (see Figure 1 for detail). Numerous undulation are present and become small circular shallow water lakes during periods of heavy rainfall. The break in topgraphy known as the "Caprock" is an abrupt drop in elevation of 1,000 to 2,000 feet from the extremely flat "South Plains" unto the "Rolling Red Plains" to the east and southeast. (See Figure 2 for more detail of Reese Area).

No major bodies of water are present in the immediate area. The rivers are dry throughout most of the year and only flow during periods of heavy rainfall. The Gulf of Mexico is the nearest constant body of water located approximately 500 miles to the southeast. This body of water is a major source of moisture for the lower atmosphere (below 10,000 feet mean sea level).

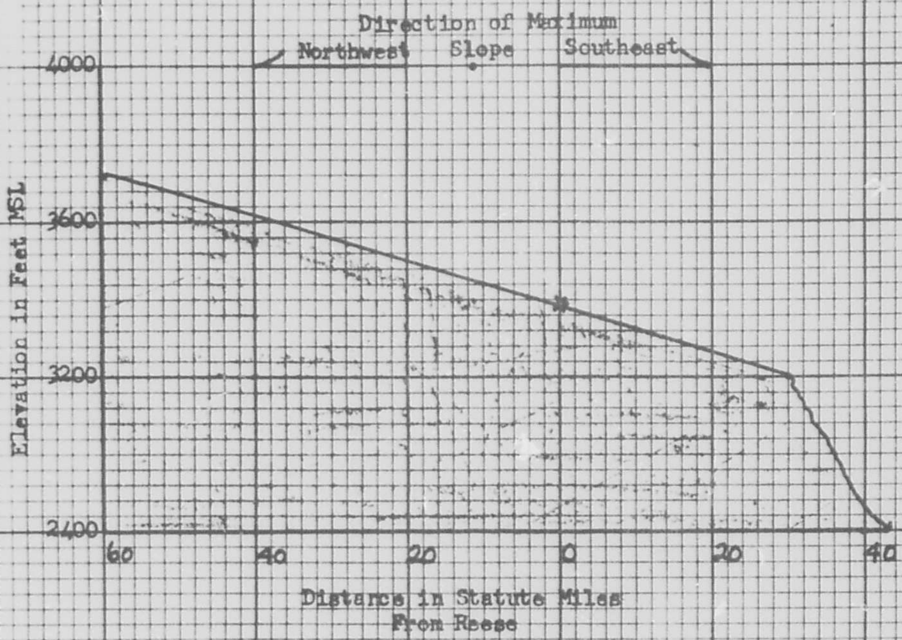
The wind flow is predominately from the south and southwest. During periods when wind flow is southeasterly, relative humidity increases substantially indicating that the Gulf of Mexico is a major source of moisture. Westerly winds produce downslope flow and when persisting over a period of time of approximately six hours or greater produce a Chinook effect which causes abnormal increases in temperature during daylight hours. The air is largely modified as it comes over the mountains in Central New Mexico and it is then advected into this area. The mountains in Central New Mexico and the Guadaloupe Mountains in West Texas produce a block against moisture sources to the southwest or west of Reese. Therefore, southwesterly to northwesterly lower atmosphere winds over the Reese area cause the lower atmosphere to dry out. Ceilings due to stratus and cumulus clouds rarely occur with these wind directions. Northeasterly through south-southwesterly winds cause upslope flow and when moisture is available upstream, low cloud ceilings are eventually formed as moist air is lifted over the "Caprock".

This region is primarily agricultural with cotton and grain sorghums being the predominate crops, approximately 100 miles southwest through 100 miles northwest in Eastern New Mexico the land is mostly range land. The soils are sandy and clay loams consisting of clay silts and sands of reddish hue. The agricultural crops are usually seeded in May and harvested by January. During this period the local area is covered with vegetation. In January the land is again being prepared for Spring planting, so during the period January until May the land is void of any vegetation. The range land in New Mexico is usually covered with range grasses. During periods of extreme drought, vegetation becomes scarce and offers little or no obstruction to blowing dust.

Blowing dust and sand constitutes the principal form of air pollution found in the Reese area with the primary source being the top soil. Some smoke particles and combustion by-products are introduced during the Fall cotton ginning season from nearby cotton gins. No other major industrial sources exist in the Reese Area.

The weather station is located in the north end of the Base Operations Bldg No. T-62 which is near the east edge of the aircraft parking ramp. A representative observing site with full observing capabilities is located 5/16ths of a mile north of the Base Weather Station. Observing operations are coordinated between the ROS and the weather station by means of Electrowriters and/or hot line telephone. Electrowriters are also located in the control tower, both training squadron operations, DCO, and Lubbock control approach. The Rotating Beam Ceilometer indicator is located in the ROS with the rotating beam transmitter and detector positioned at the north end of the center runway used for ground controlled approaches. The GMQ10 transmitter is located 1650 feet east of runway 17C and 2200 feet from the approach end of runway 17L. The TMQ11 Temperature/Humidity indicator is located in the ROS with the sensing unit located 150 feet north-northwest in an open area. The rain gauge is about 40 feet east of the ROS. The wind transmitter is located near the center point between the outside and center runways. It stands 16 feet above the surface and is clear of all obstructions. Located within the weather station proper are the teletype and facsimile machines and an FPS-77 radar console.

The radar tower is located some 500 feet southeast of the weather station.



TERRAIN CROSS SECTION

Figure 1

NOT REPRODUCIBLE

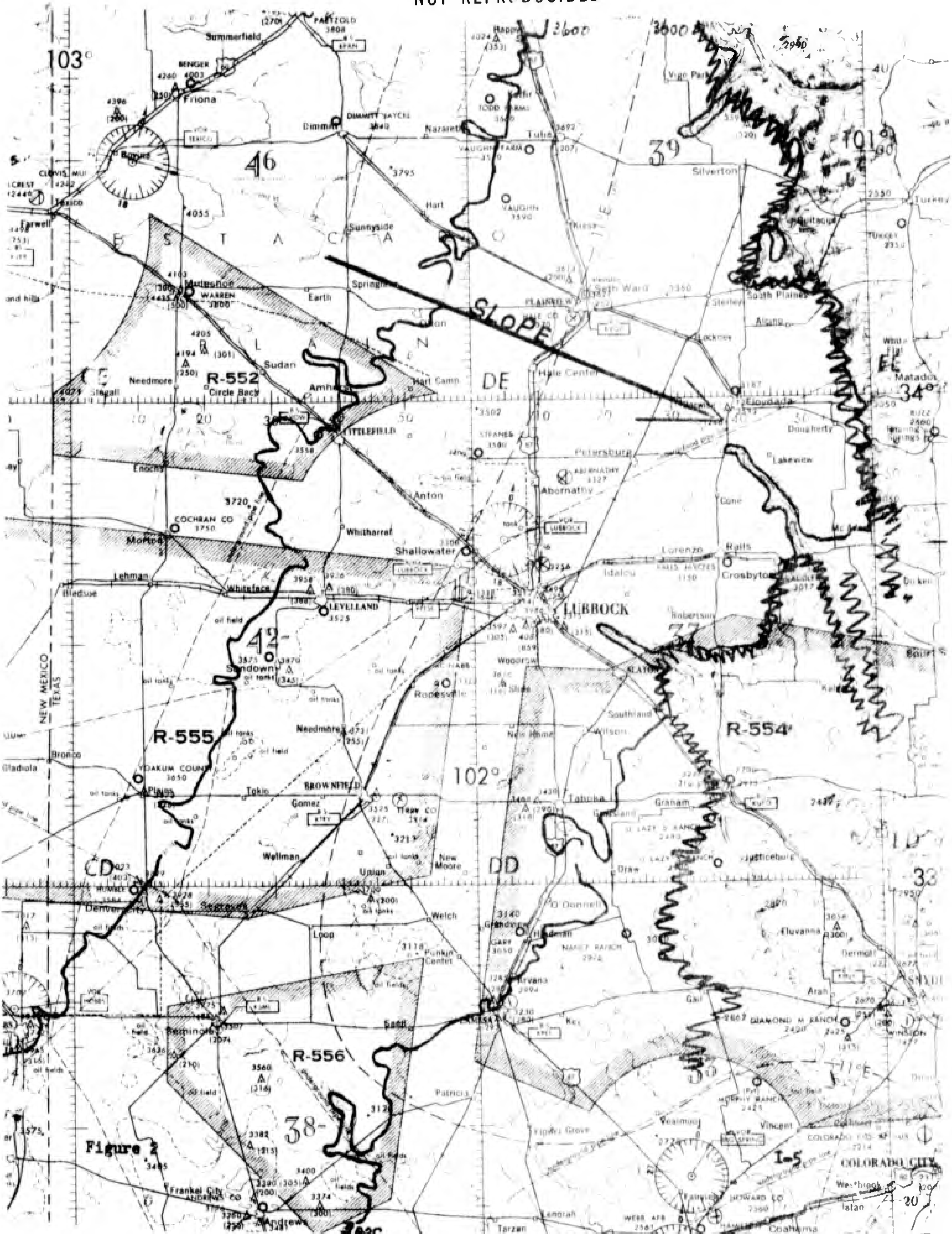


Figure 2

SECTION II

Weather Controls

SECTION II

Weather Controls:

Reese Air Force Base comes under the influence of four major air masses. During the winter season, December through February, the predominating air mass is MPk being replaced occasionally by the CPk and the MTw air mass. The MPk air mass is greatly modified before it reaches the Reese area as it comes over the Rocky Mountains. During the Spring and Fall the CTw, MTw, CPk and MPk air masses equally dominate this area. The Summer season is dominated by a tropical air mass divided equally between CTw and MTw.

Winter Pattern: The positions of the major troughs and ridges aloft which are generally well defined during the Winter (particular reference is made to the 500MB level) are the primary determining factors of weather at Reese. With the major trough axis located just west of the California coast and a major ridge over the Rocky Mountains (reference Figure 3) the weather at Reese is generally clear. This pattern dominates the weather more often than others. However, when the major trough axis is located over Utah and Arizona (reference Figure 4) low stratus, and light intermittent precipitations dominate the South Texas area and gradually reach the Reese area if the trough remains in this position for at least 24 hours or moves further east. An open wave as illustrated in Figure 4 usually gives low ceilings and light precipitation to the Reese area for about 2 days. A closed low, approximately in this position will usually remain in this position longer and produce low ceilings and moderate precipitation for 3 to 4 days. Beginning approximately the fourth week in January and until February this upper air system illustrated in Figure 4 with an associated surface low pressure area illustrated in Figure 7 causes severe dust storms and some thunderstorm activity at Reese as the surface low approaches the Eastern New Mexico area.

Associated with the upper air pattern illustrated in Figure 4 and discussed above is a high pressure area at the surface usually positioned near the Alabama area. This high causes southeasterly flow of moist Gulf air over Texas and the Reese area. An upper air pattern as shown in Figure 3 causes southwesterly to northerly surface winds with subsidence aloft and dries out the lower atmosphere. Upper pattern shown in Figure 6 occurs frequently enough to be mentioned. With such an upper air pattern, the winds at lower levels over Texas are from the southeast and advect moisture over Texas causing low stratus and light precipitation over Texas as far north as Reese. Cold fronts remain well defined and pass rather rapidly through the South Plains during the Winter. Most fronts approach from the north or northwest and seldom become stationary before reaching the Gulf coast of Texas.

<u>Spring Pattern</u>: The Spring season (March through May) is a season of low ceilings, severe thunderstorms, and strong surface winds. Dust storms and strong winds reach their greatest frequency in March with thunderstorms becoming more frequent and reaching their highest frequency during the summer. Here again the synoptic weather can generally be correlated with upper air patterns. An upper air pattern as illustrated in Figure 4 (open wave trough) causes low stratus during the morning and breaking by noon. As this trough moves eastward and is associated with a surface low (Figure 7) strong surface winds and blowing dust with some thunderstorm activity will dominate the Reese weather as the low moves into the New Mexico area. Often minor troughs precede the major trough and cause severe thunderstorm activity over the South Plains in the vicinity of the jet stream core.

Weather associated with upper air pattern illustrated in Figure 3 is generally fair with light surface winds.

Weather associated with upper pattern in Figure 5 is generally fair except when a minor trough forms as indicated and moves south. In this instance cyclongenisis occurs in Southeast Colorado or Eastern New Mexico causing snow shower or shower activity in this area. Cyclongenisis in Southeast Colorado at the surface will often cause strong surface winds at Reese (see Special Synoptic Study #2 for further details). During the Spring all three upper air patterns mentioned above control the Reese weather about equal, although some variance is noted from year to year.

Upper air patterns remain well defined and frontal systems are active during the early Spring. Beginning in April the upper air patterns begin to weaken; frontal systems become more sluggish. Frontal systems approaching from the west or northwest will generally pass the South Plains area. Cold fronts approaching from the north through northeast tend to stall in the Texas Panhandle and South Plains area during daylight hours.

Fair weather during the morning hours predominates during the Spring but not to a marked degree. When low stratus forms or is present at sunrise it generally dissipates by noon. Surface winds become gusty at about mid morning when the radiation inversion is dissipated. Blowing dust is frequently present during the afternoon when winds gust to 30 knots or greater. Thunderstorms occur frequently and accomodate most cold frontal passages and upper air trough passages.

<u>Summer Pattern:</u> During the Summer months the upper air patterns are generally weak and ill defined. Cold fronts generally stall in this general area and

their passage is infrequent during July and August. Fair weather and light winds prevail throughout this season. Low stratus forms occasionally during the early morning hours when moisture is available and the upper air pattern in Figure 4 is present. However, the stratus dissipates by mid morning. Air mass thunderstorms occur frequently during the afternoon hours (see Special Synoptic Study #4 for more detail). Occasional squall lines form and pass over the South Plains area and are usually associated with minor trough movement at the 700MB or 500MB level. Upper air pattern illustrated in Figure 5 will cause nocturnal thunderstorms in June as short waves move down the leading edge of the major ridge and cause cold air advection aloft. Otherwise, clear weather prevails during the daylight hours under this system.

Fall Season: As the Fall season begins the upper air patterns become more defined and a better correlation between them and the surface weather can be realized. The upper air pattern in Figure 3 and the fair weather associated with it prevail during the early Fall. Cold frontal passages begin to increase and usually reach Central Texas before becoming weak and stationary. Thunderstorm activity is less frequent and becomes rare by November. Frequency of low stratus begins to increase in late October and is usually associated with cold frontal systems which pass to the southeast and/or the upper air pattern illustrated in Figure 4.

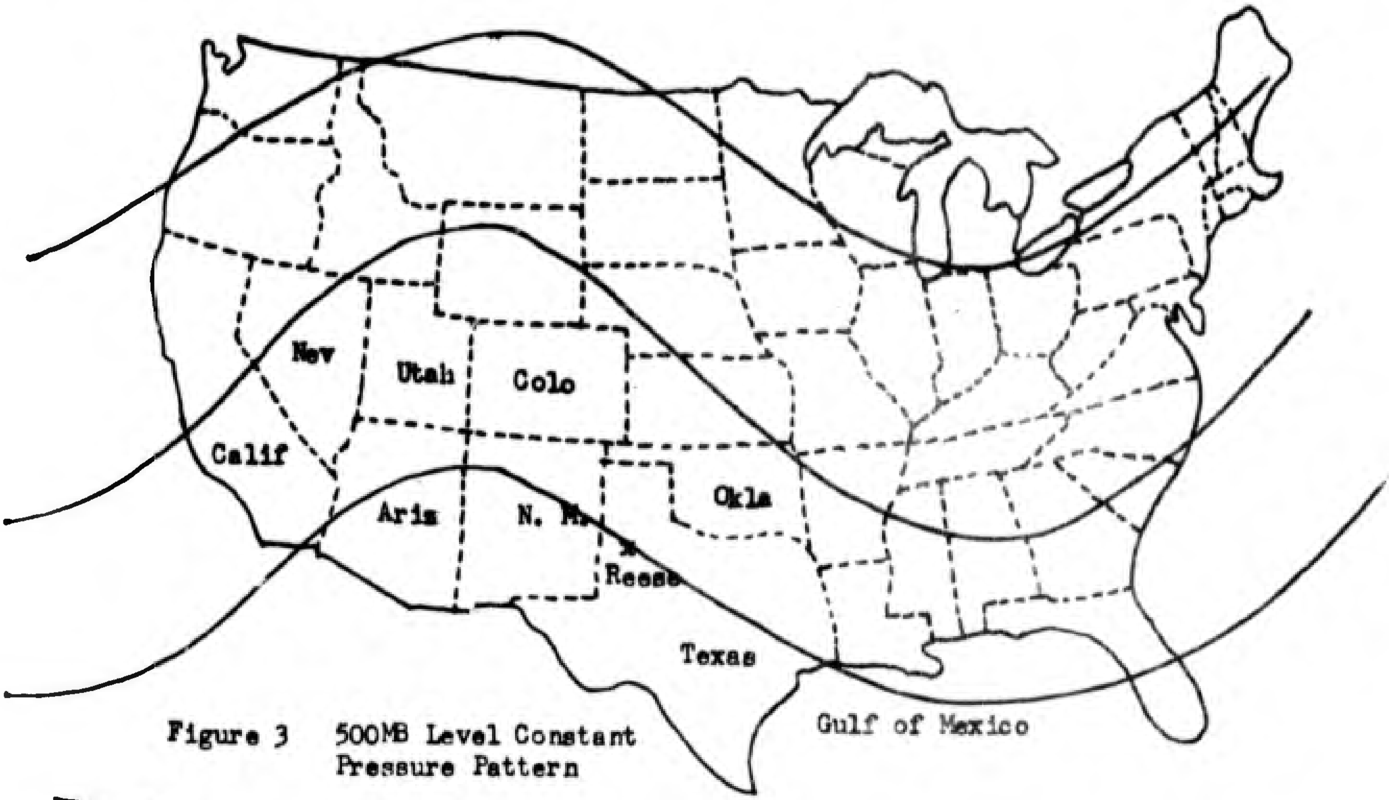


Figure 3 500MB Level Constant Pressure Pattern

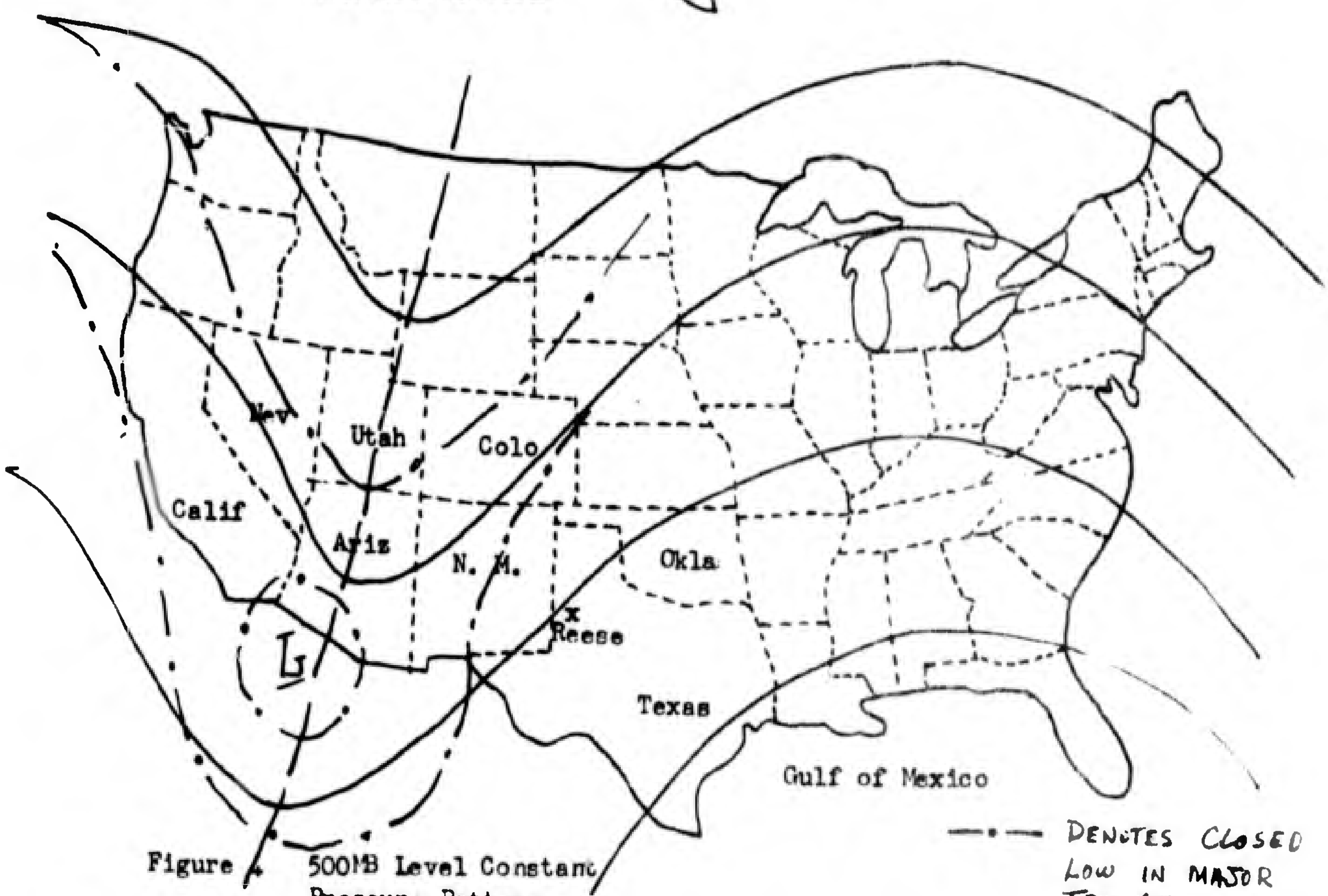


Figure 4 500MB Level Constant Pressure Pattern

—·— DENOTES CLOSED LOW IN MAJOR TROUGH

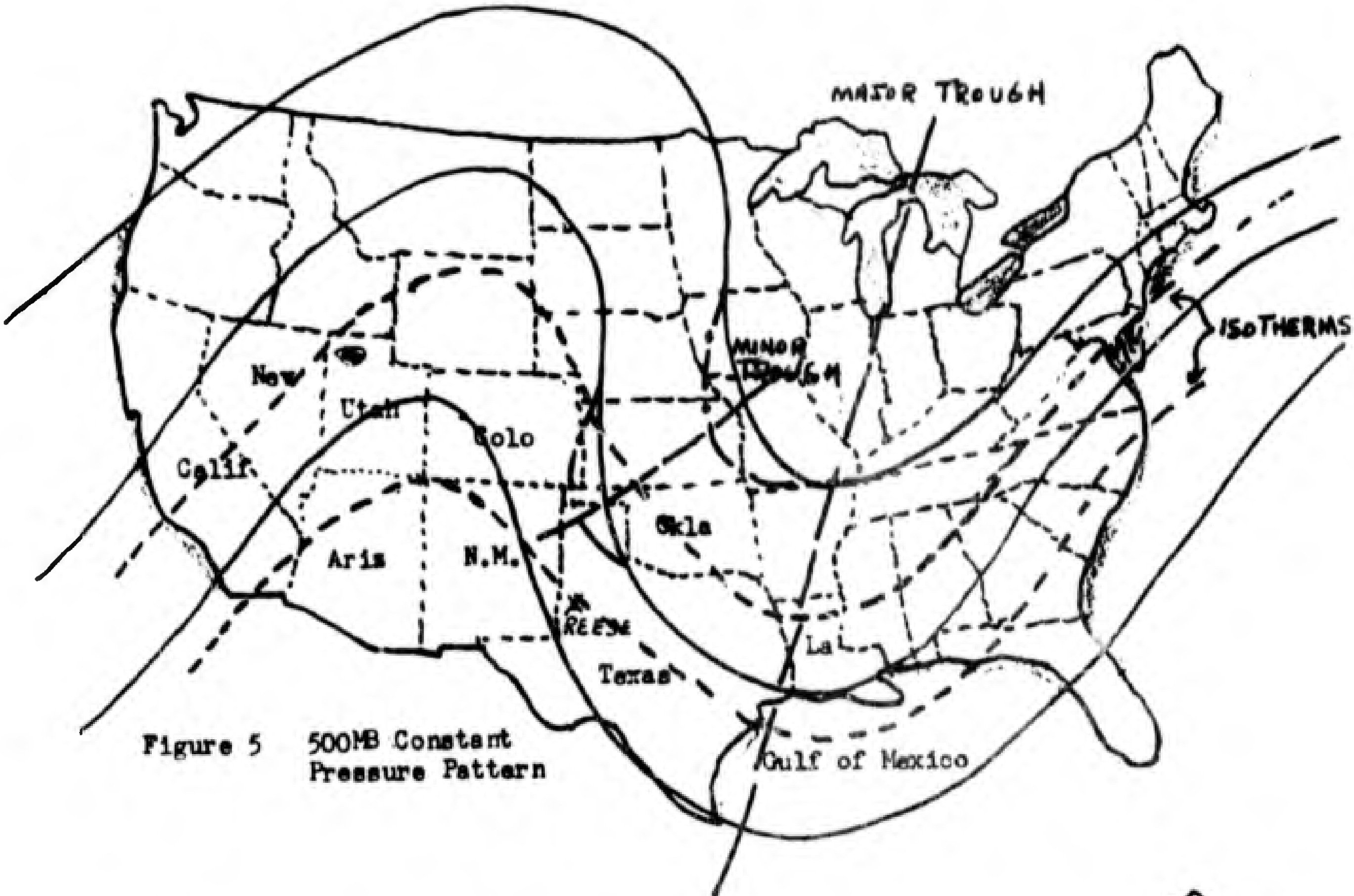


Figure 5 500MB Constant Pressure Pattern

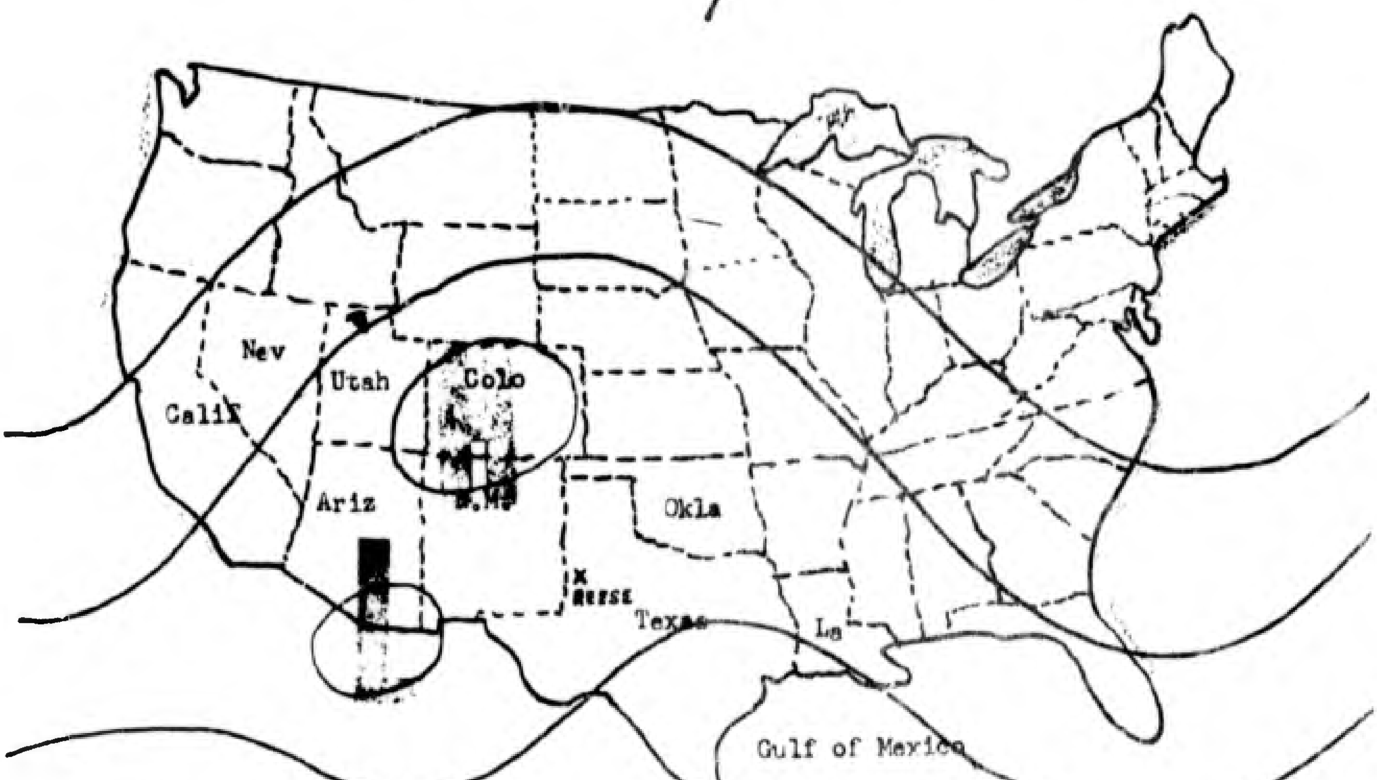


Figure 6 500MB Constant Pressure Pattern

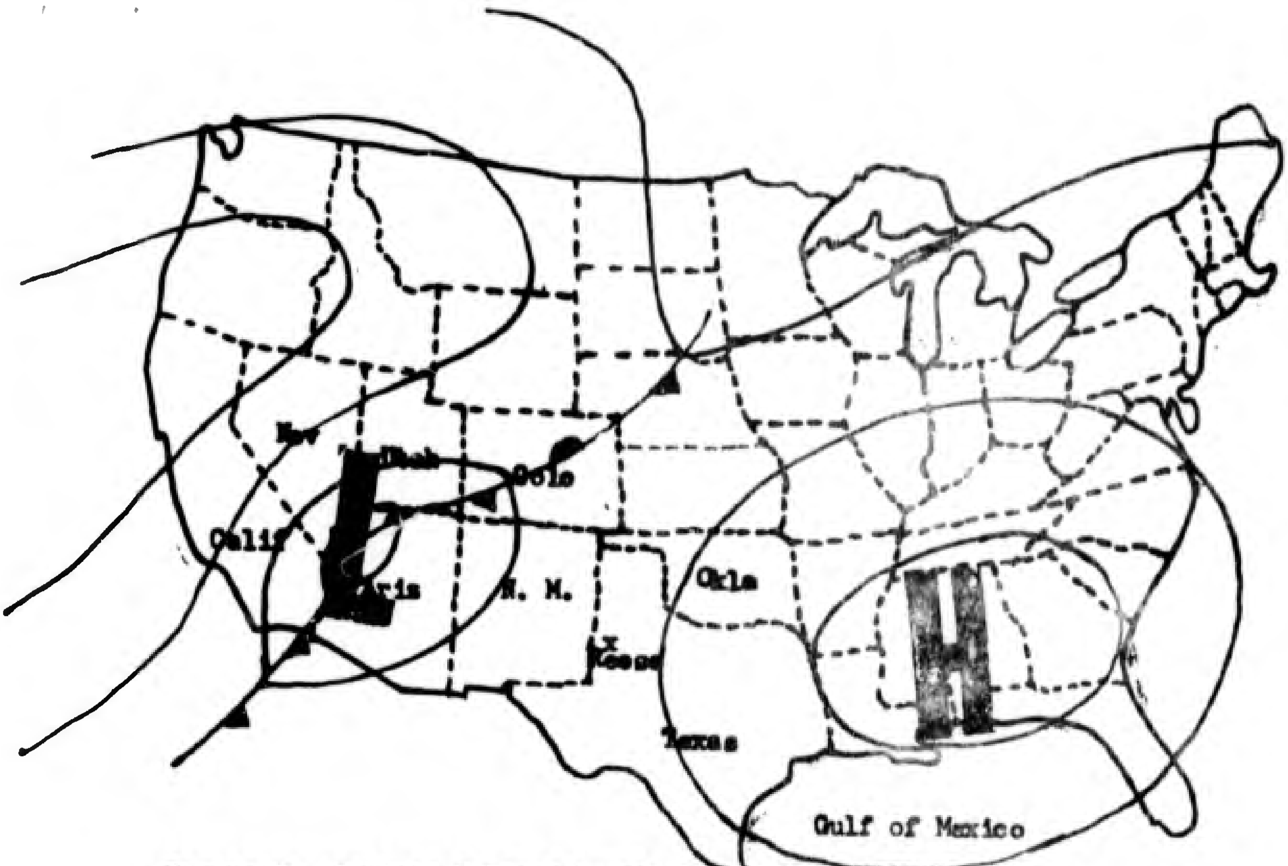


Figure 7 Surface Pattern Associated With Figure 4

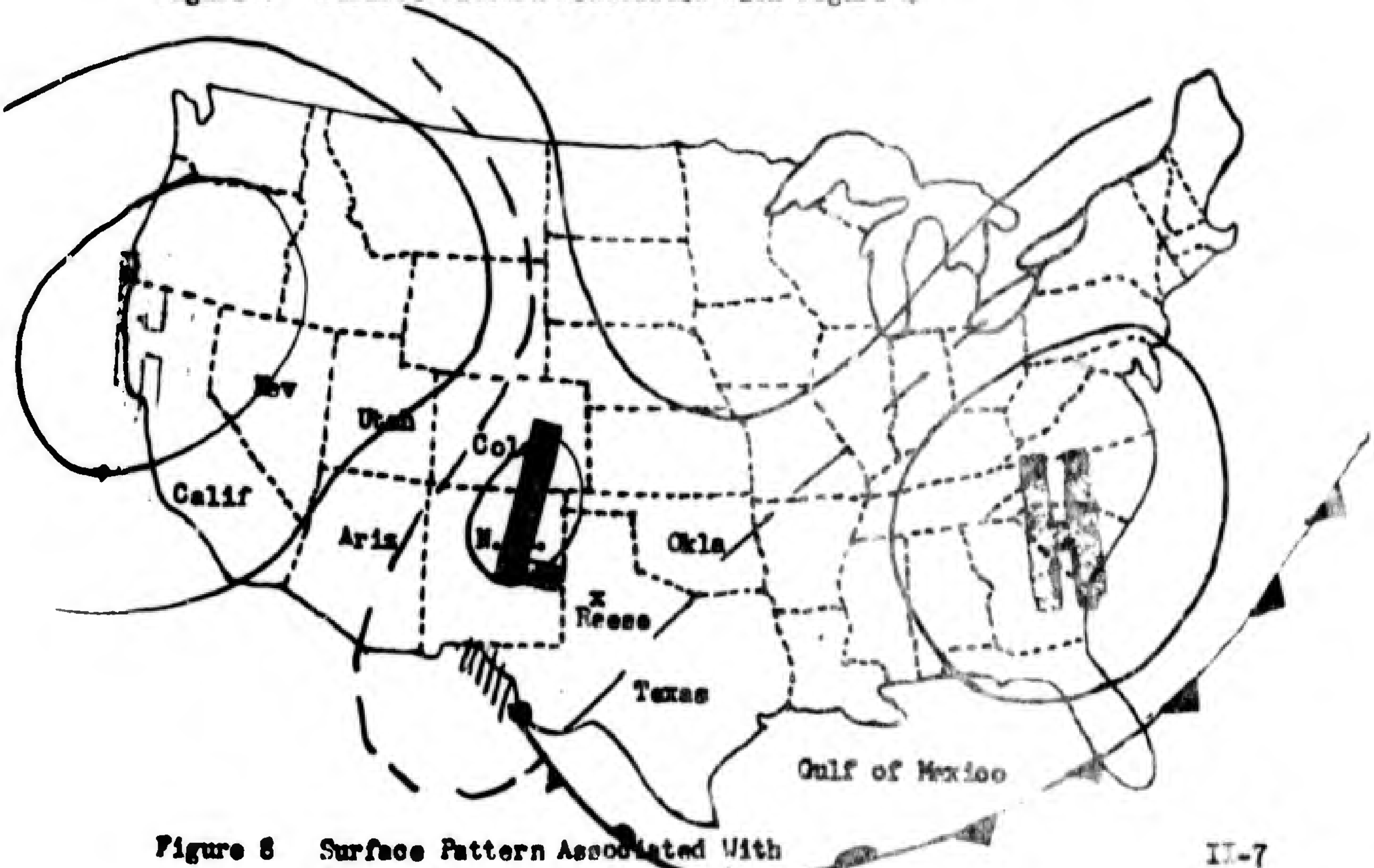


Figure 8 Surface Pattern Associated With Figure 5

SECTION III

Climatic Aids

SECTION III

CLIMATIC AIDS

Climatic Data Charts: The charts enclosed depict percentage frequency of occurrence of specific phenomena here at Reese. The graphs depict occurrence by month and hour of day. The charts include a temperature graph, precipitation graph, thunderstorm occurrence chart, dust occurrence chart, ceiling and visibility charts, and surface wind charts.

Ceiling and Visibilities: These charts illustrate the percentage frequency of occurrence of ceilings and visibilities which are considered operationally significant at Reese. Data presented on these graphs represents 21 years of data thru September 1967.

Temperatures: Temperature curves including absolute maximum, mean maximum, mean minimum, and absolute minimum monthly temperatures are presented in Figure 21. The average variation from the mean minimum to the mean maximum is approximately 26.5 degrees fahrenheit. The curves are based on 21 years of data thru September 1967.

Precipitation: Figure 22 is a chart of the monthly mean, maximum and minimum amounts of precipitation. The chart also includes the mean monthly snowfall. The monthly precipitation data was compiled from 15 years of data thru 1961. The mean monthly snowfall is based on 12 years of data thru 1961.

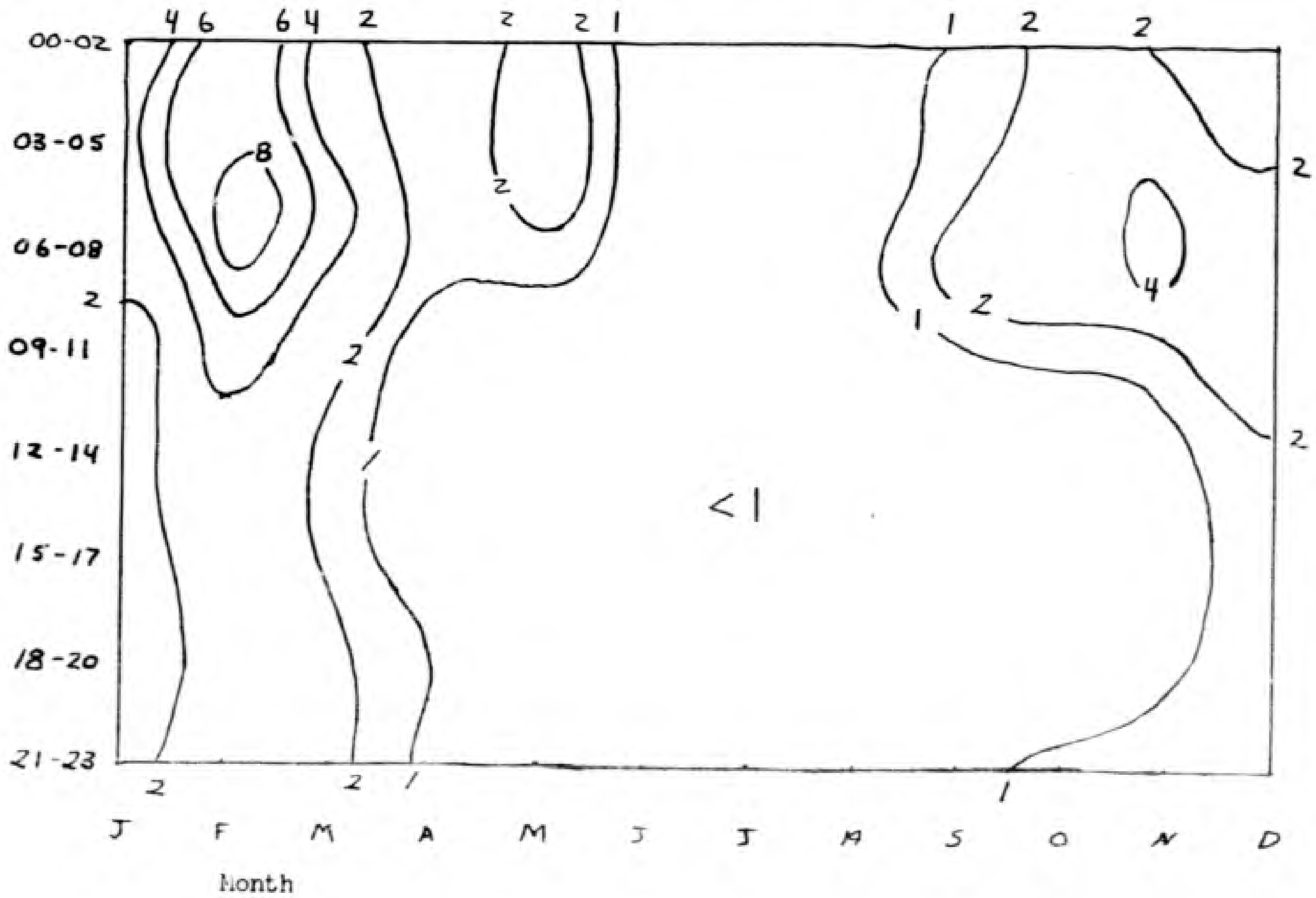
Winds: Charts illustrating the percentage of frequency of occurrence of surface winds are enclosed. The data was separated into 3 criteria and was based on 21 years of data thru September 1967.

Thunderstorms: The percentage of frequency of thunderstorm occurrence at Reese is illustrated by Figure 23. This is based on 21 years of data thru September 1967.

Dust: The percentage of frequency of occurrence of dust at Reese is illustrated by Figure 24. This is also based on 21 years of data thru September 1967.

Ceiling/Visibility less than or equal to 200/1/2

Based on 21 years data
(Mar 42-Jan 46, Jan 50-Sep 67)

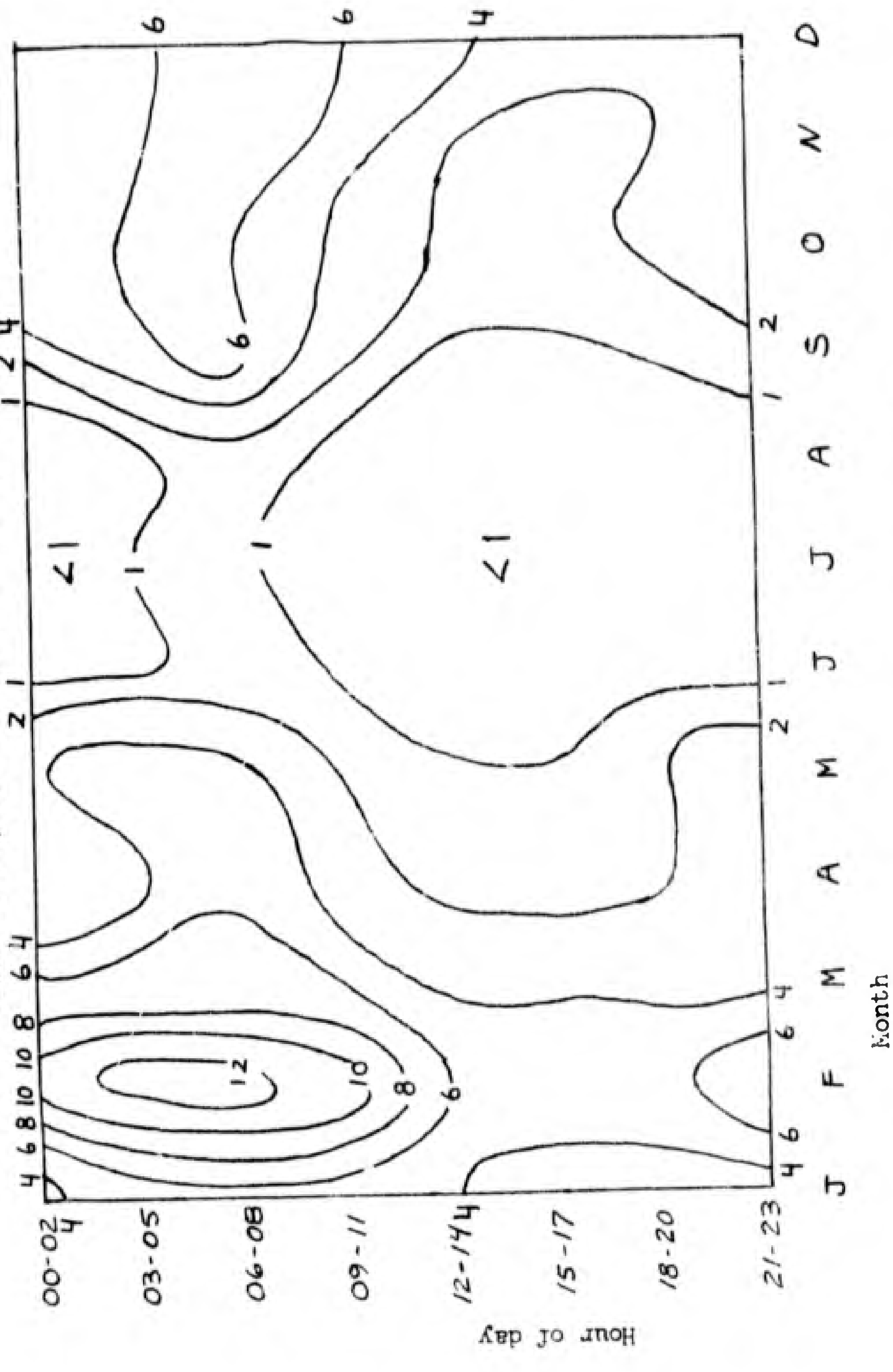


Percentage Frequency of Occurrence

Figure 9

Ceiling/Visibility less than or equal to 500/1

Based on 21 years data (Mar 42–Jan46, Jan 50–Sep 67)

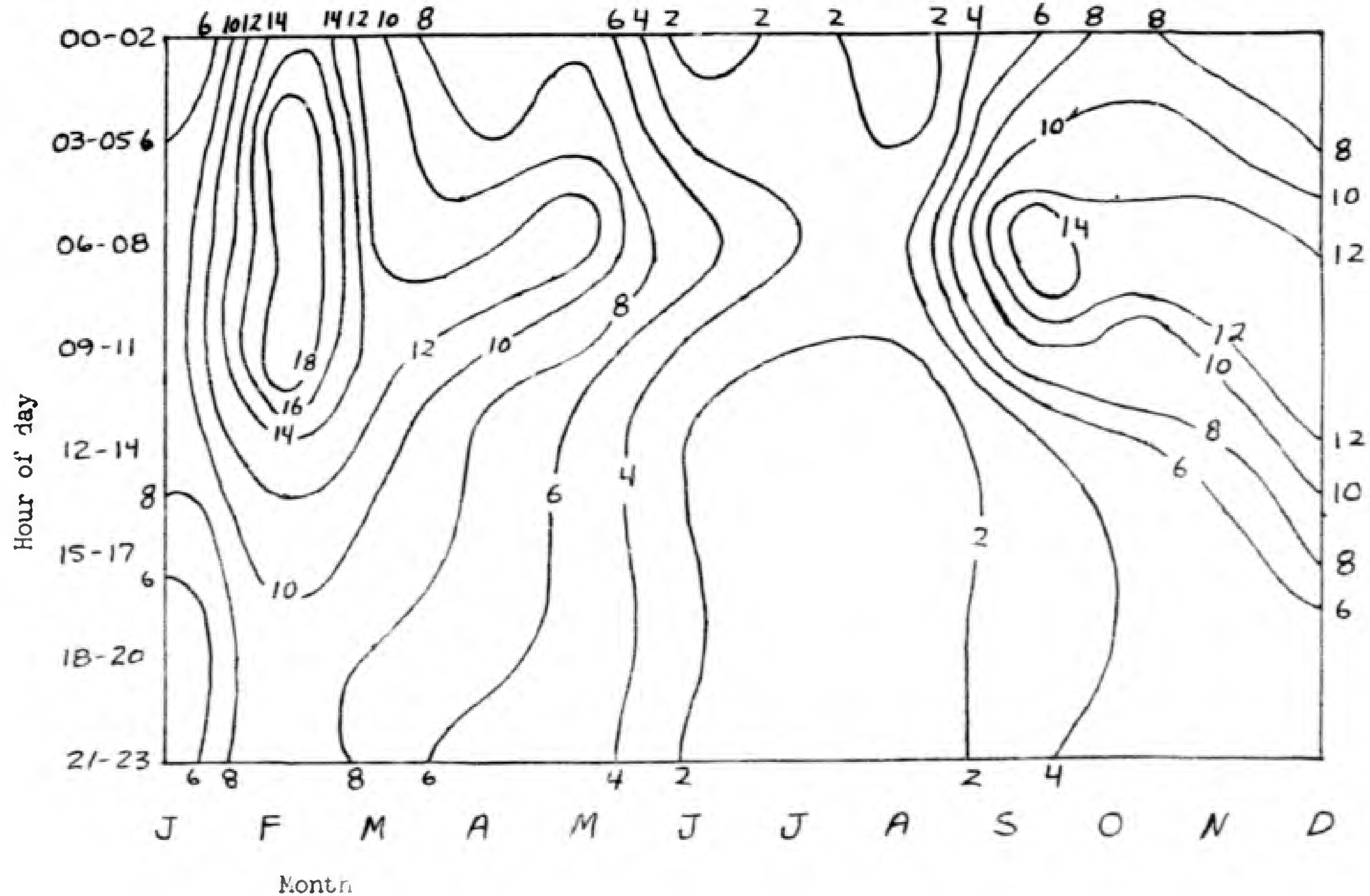


Percentage Frequency of Occurrence

Figure 10

Ceiling/Visibility less than or equal to 1000/3

Based on 21 years data (Mar 42–Jan 46, Jan 50–Sep 67)

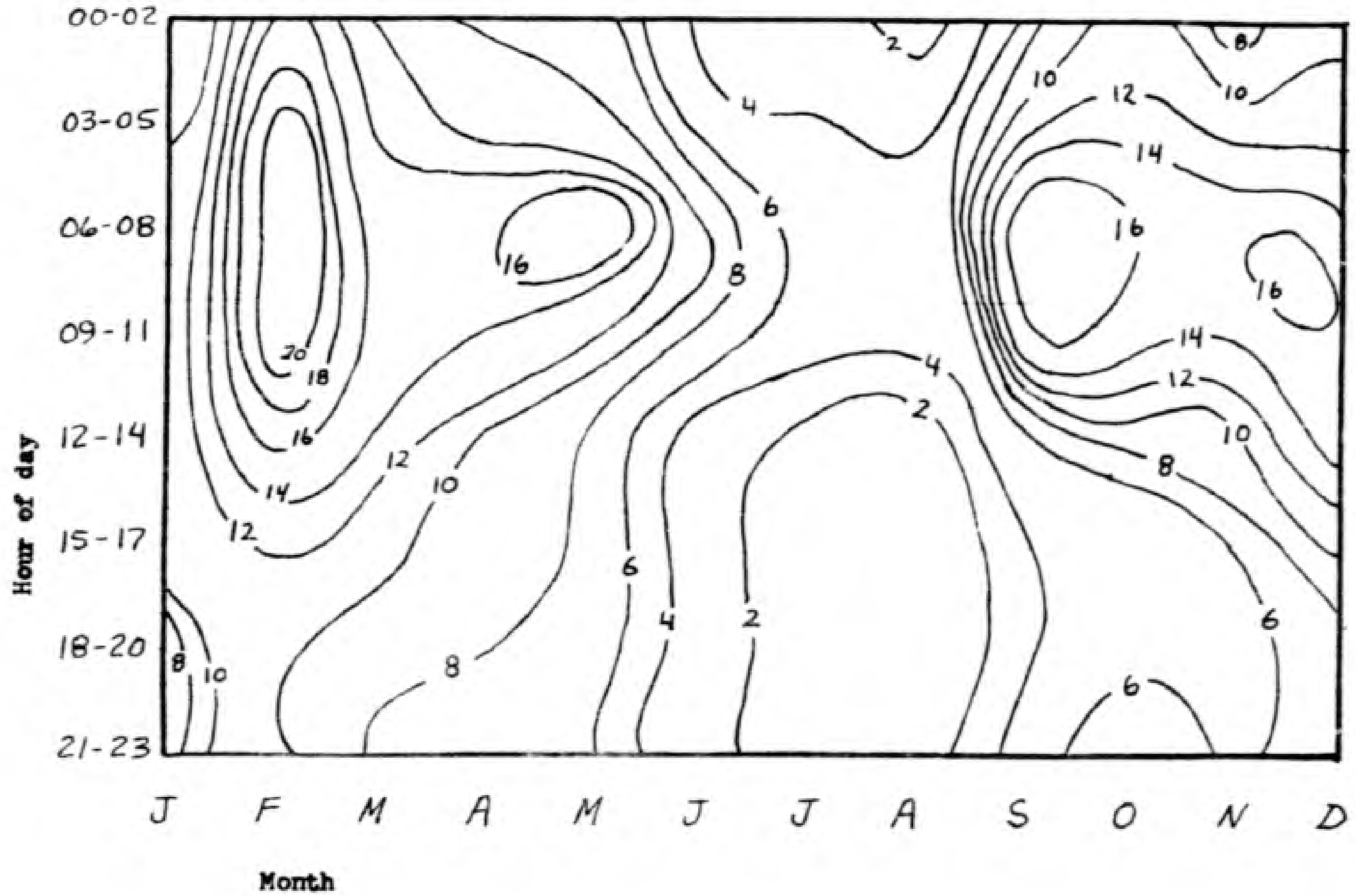


Percentage Frequency of Occurrence

Figure 11

Ceiling/Visibility less than or equal to 1500/3

Based on 21 years data (Mar 42–Jan 46, Jan 50–Sep 67)



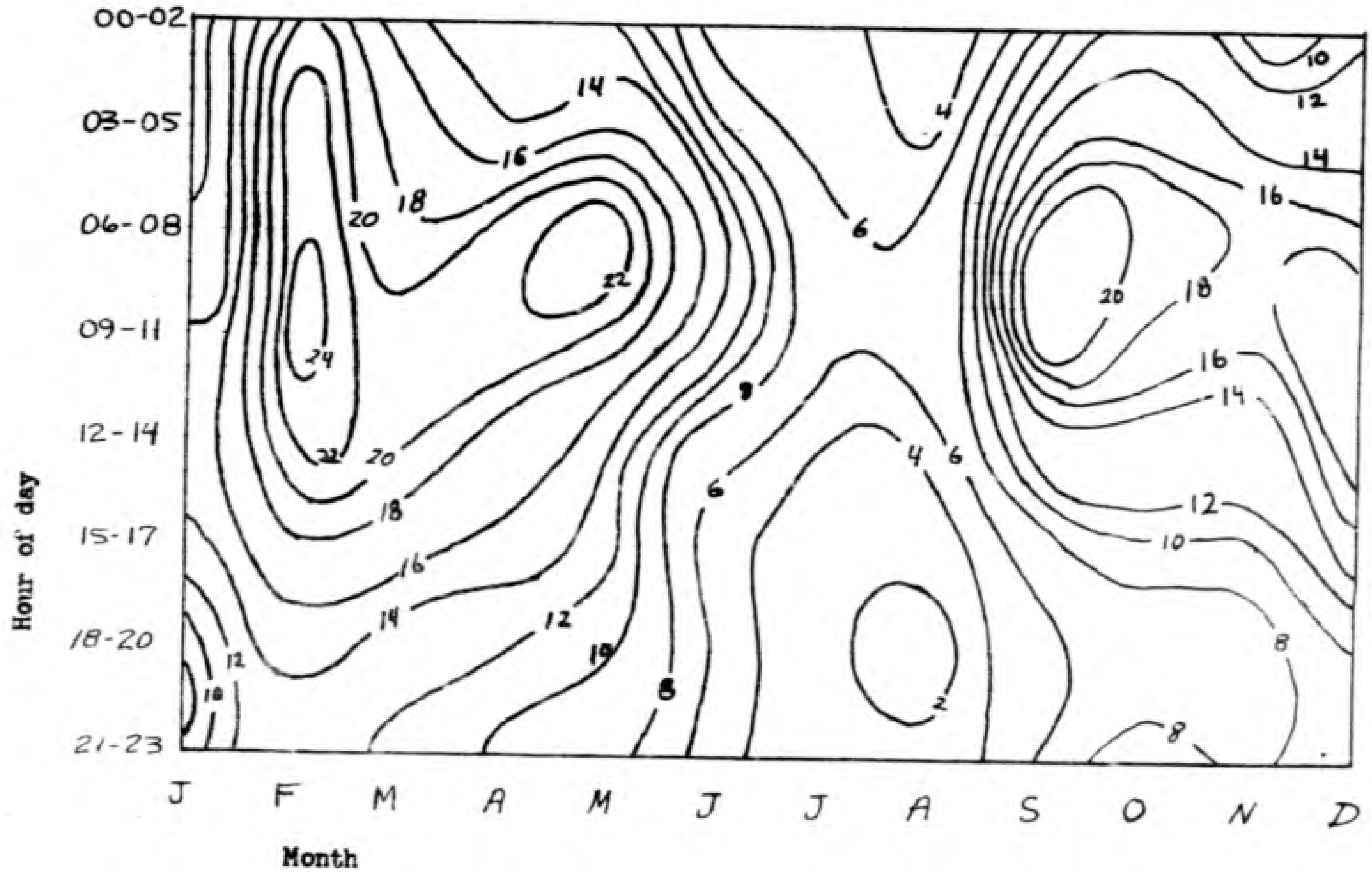
Percentage Frequency of Occurrence

Figure 12

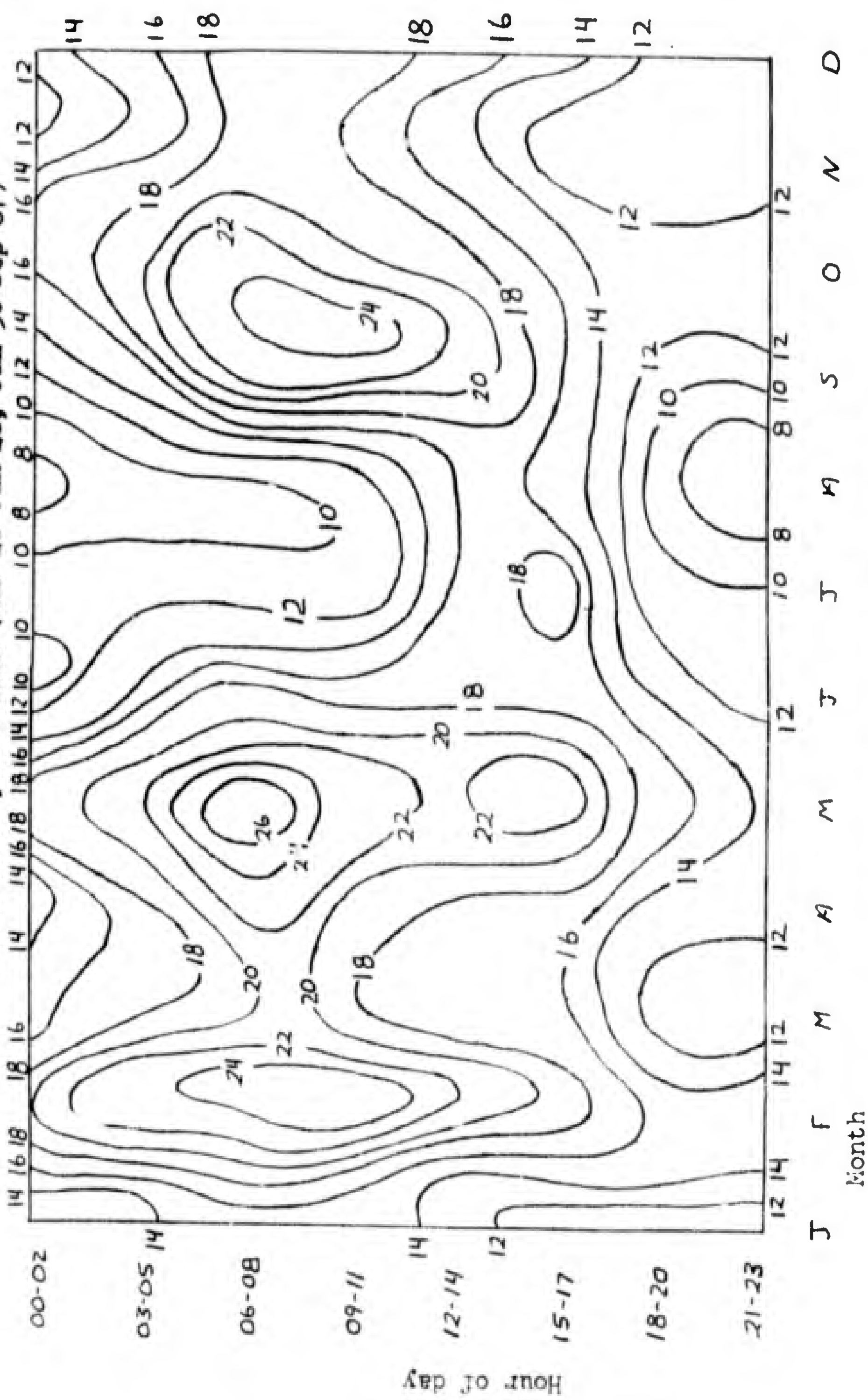
Figure 13

Ceiling/Visibility less than or equal to 2500/5

Based on 21 years data (Mar 42–Jan 46, Jan 50–Sep 67)



Percentage Frequency of Occurrence



Ceiling less than or equal to 7000

Based on 21 years data (Mar 42–Jan 46, Jan 50–Sep 67)

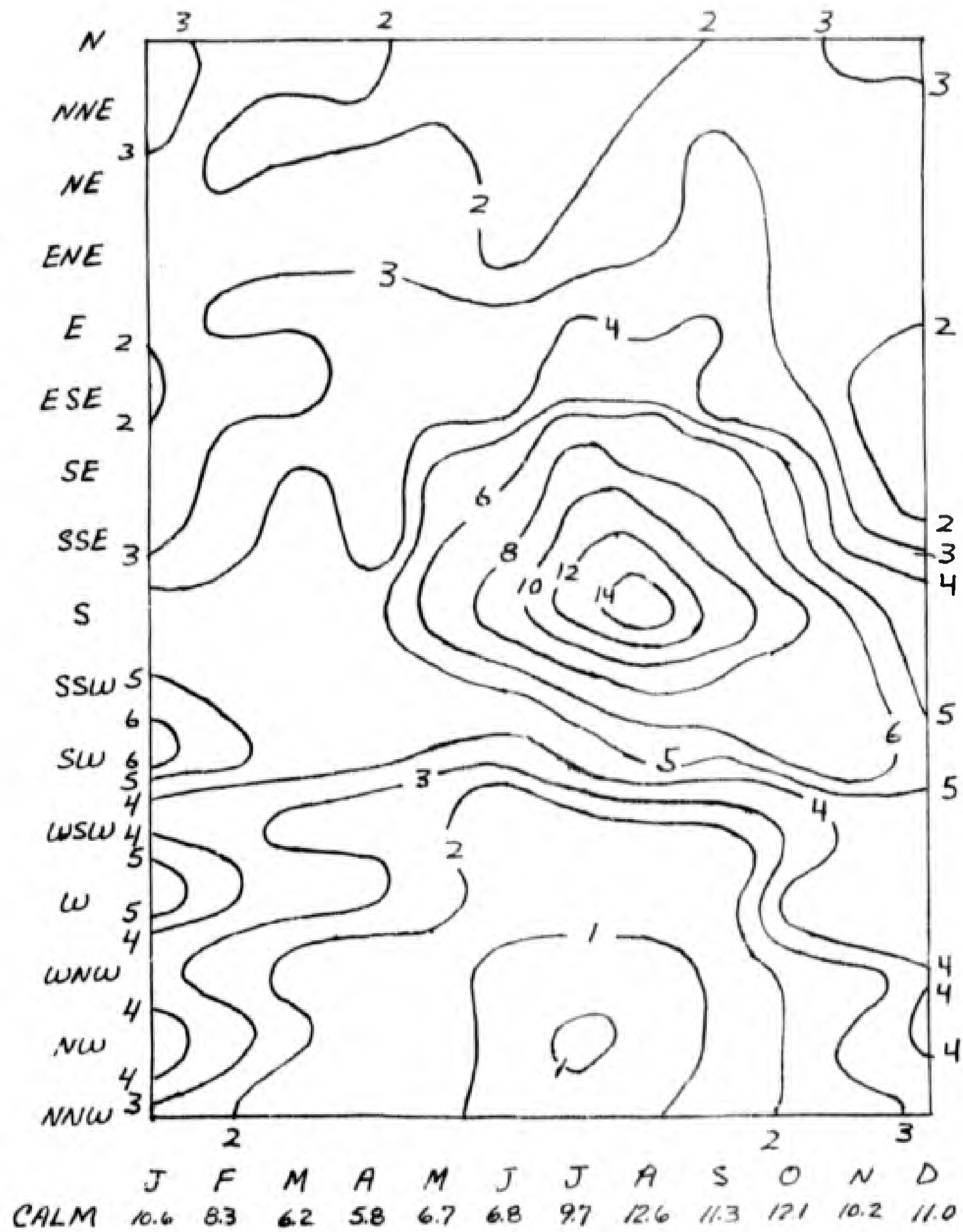
Percentage Frequency of Occurrence

Figure 14

SURFACE WINDS

1 to 11 Kts

Percentage Frequency of Occurrence

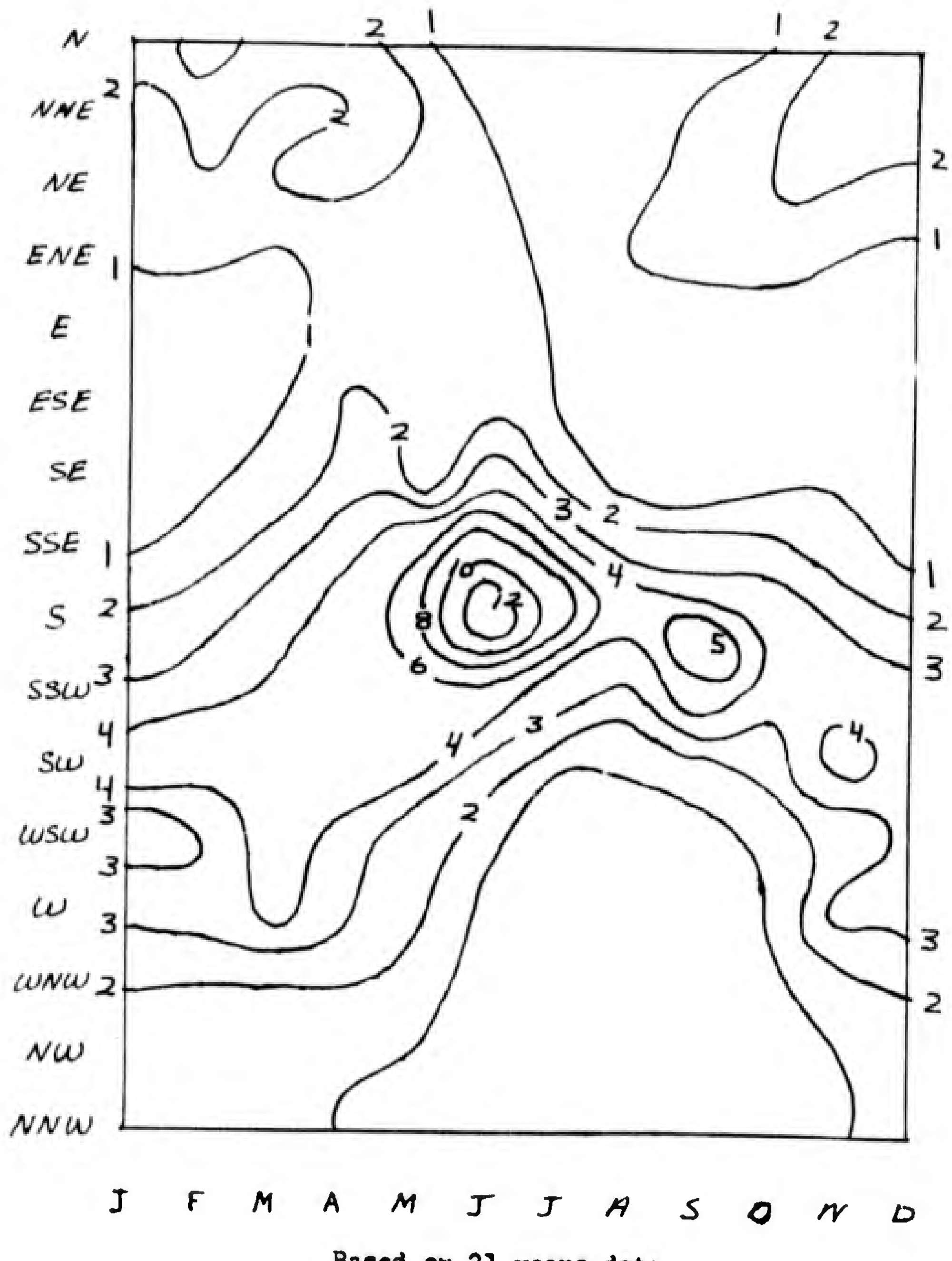


Based on 21 years data
(Mar 42-Jan 46, Jan 50-Sep 67)

SURFACE WINDS

11 to 21 Kts

Percentage Frequency of Occurrence



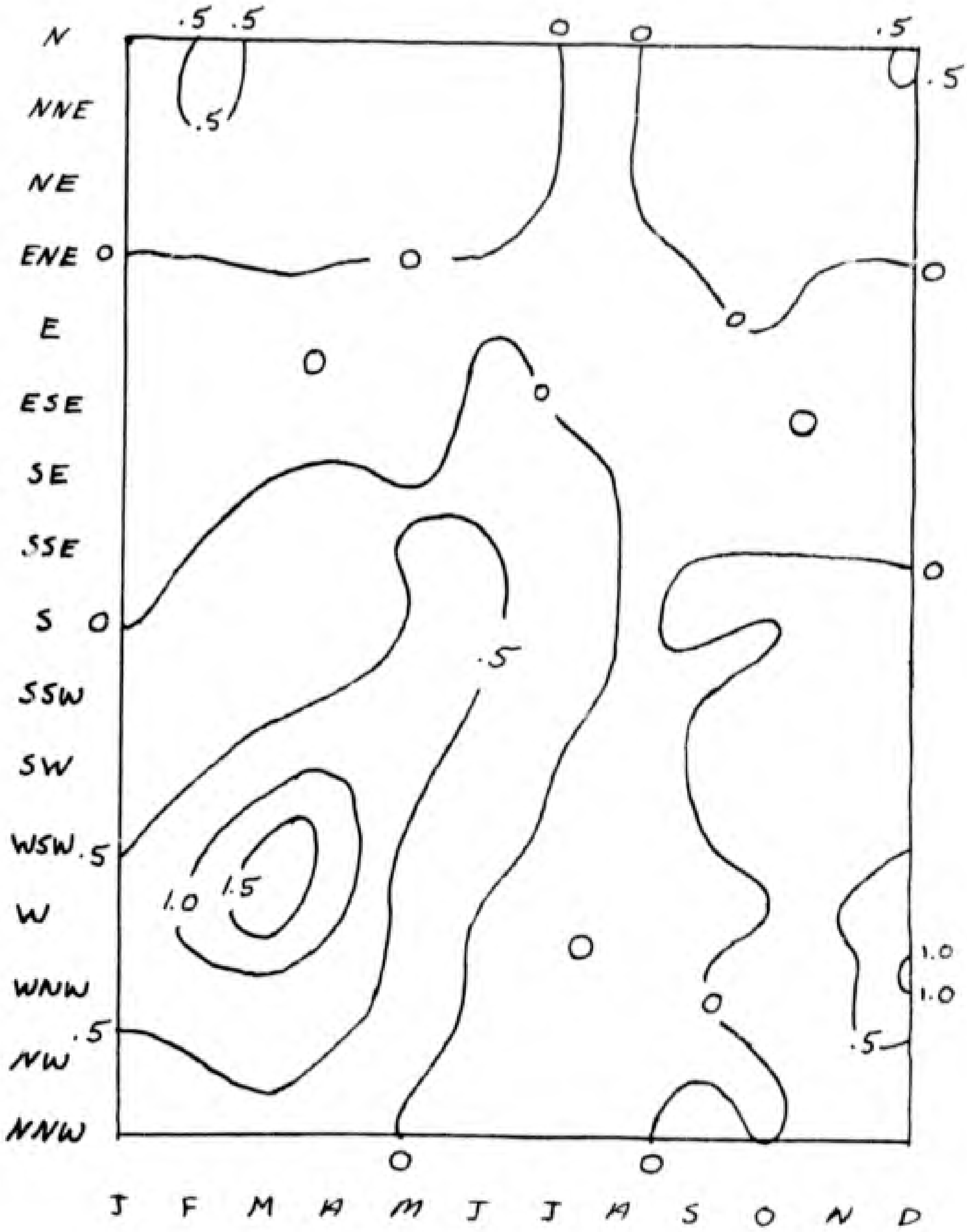
Based on 21 years data
(Mar 42–Jan 46, Jan 50–Sep 67)

Figure 16

SURFACE WINDS

Greater than 21 Kts

Percentage Frequency of Occurrence

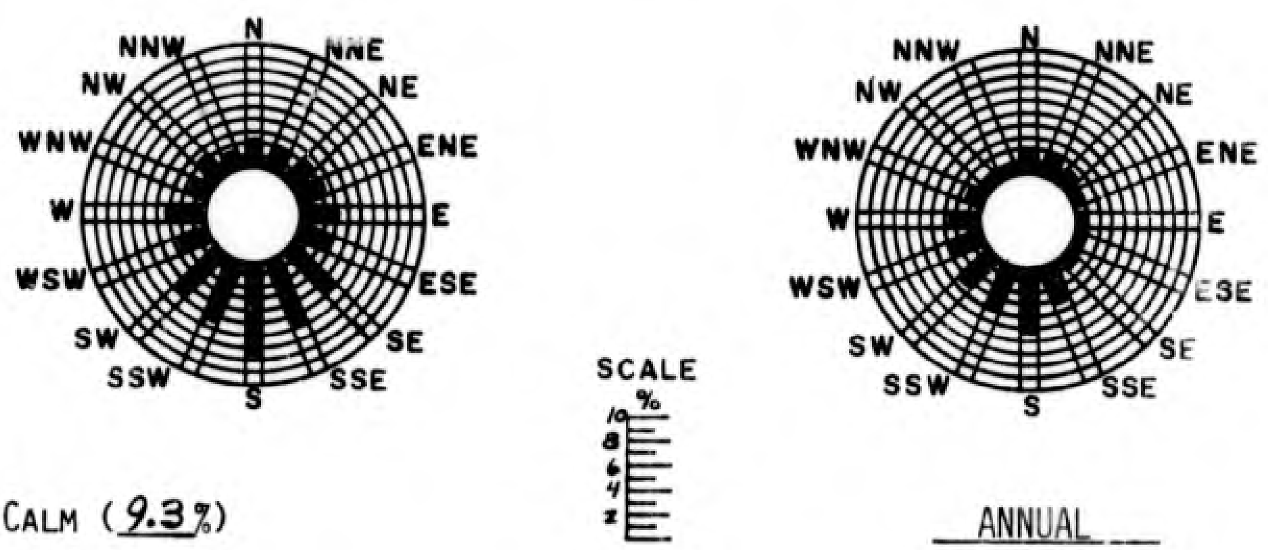


Based on 21 years data
(Mar 42–Jan 46, Jan 50–Sep 67)

Figure 17

SURFACE WINDS

LESS THAN 11 KTS (56.3%) EQUAL TO/GREATER THAN 11 KTS (34.4%)

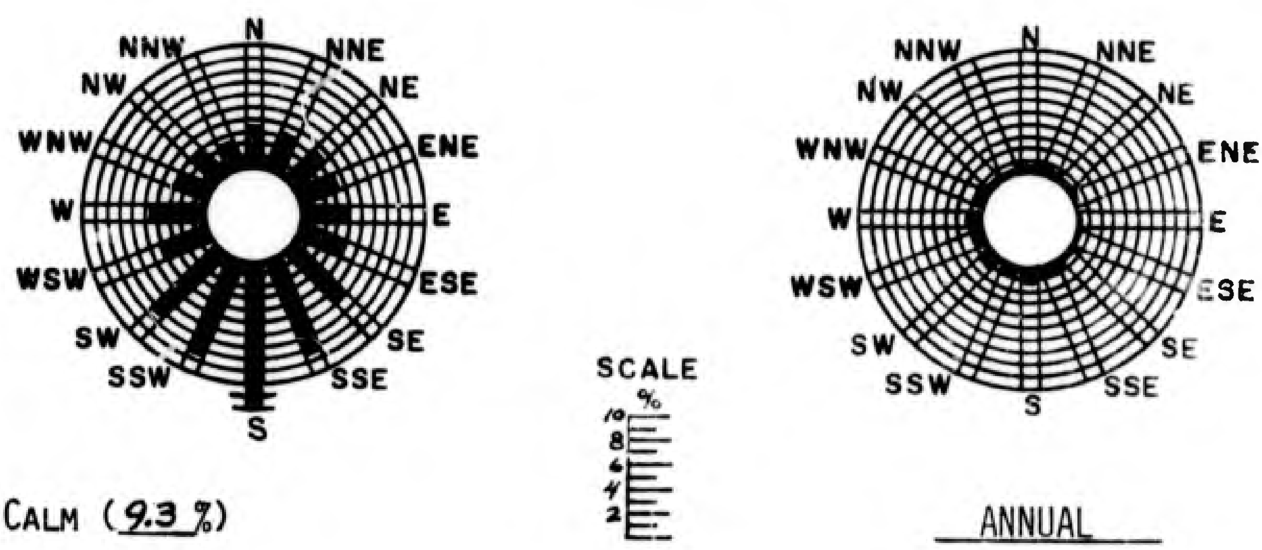


CALM (9.3%)

ANNUAL

SURFACE WINDS

LESS THAN 17 KTS (80.2%) EQUAL TO/GREATER THAN 17 KTS (10.5%)

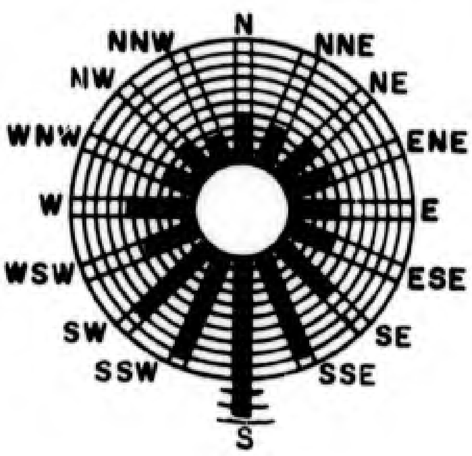


CALM (9.3 %)

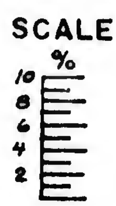
ANNUAL

SURFACE WINDS

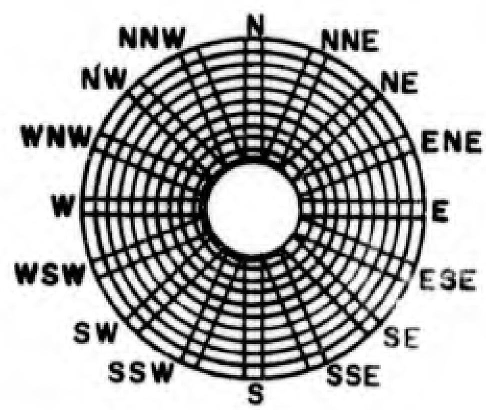
LESS THAN 22 KTS (87.4%)



CALM (9.3%)

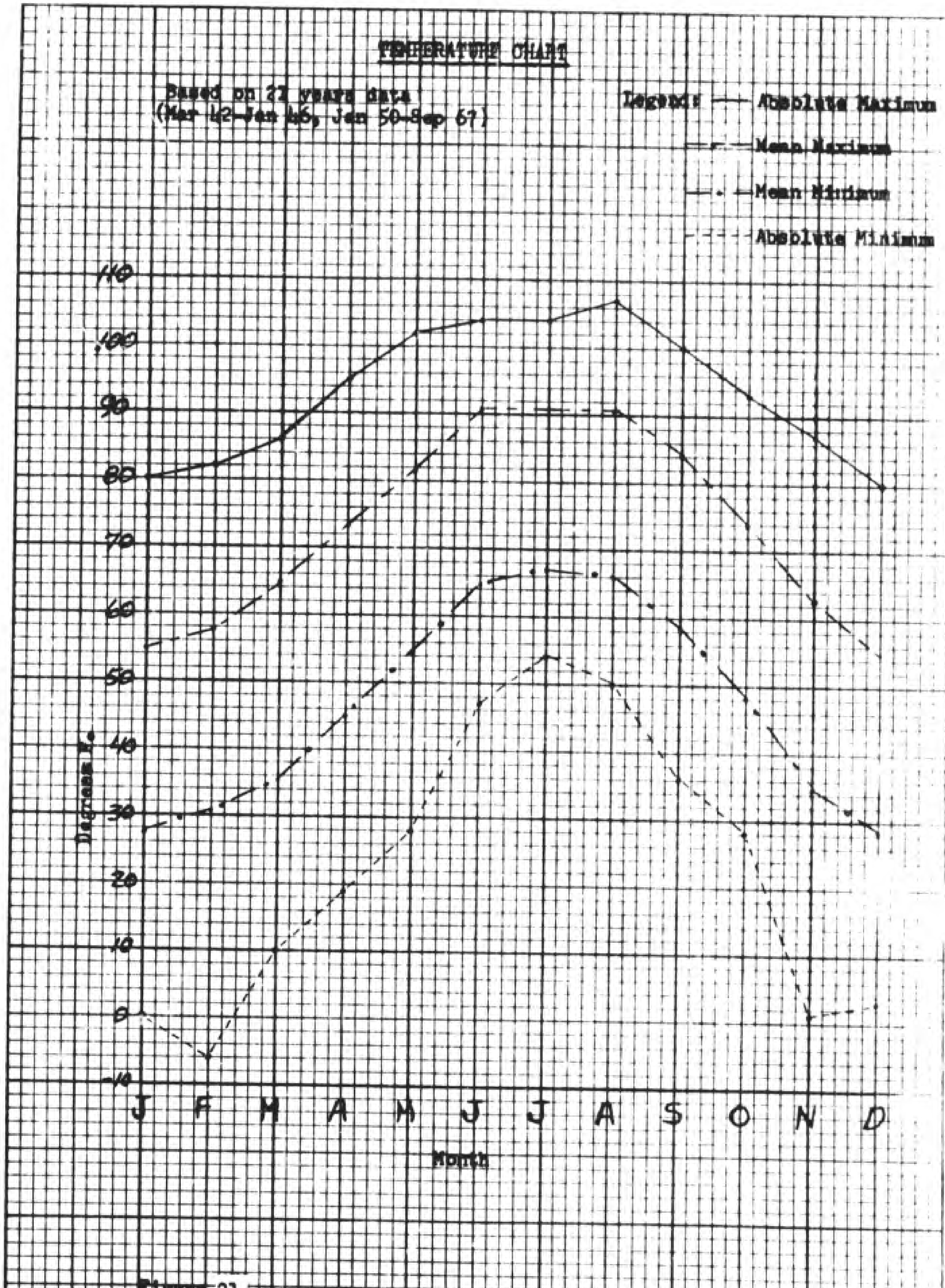


EQUAL TO/GREATER THAN 22 KTS (3.3%)



ANNUAL

Figure 20



TEMPERATURE CHART
Based on 22 years data
(Mar 42-Jan 46, Jan 50-Sep 67)
Legend:
Absolute Maximum
Mean Maximum
Mean Minimum
Absolute Minimum
110
100
90
80
70
60
50
40
30
20
10
0
-10
Degrees F.
J F M A M J J A S O N D
Month

Figure 21

PRECIPITATION CHART

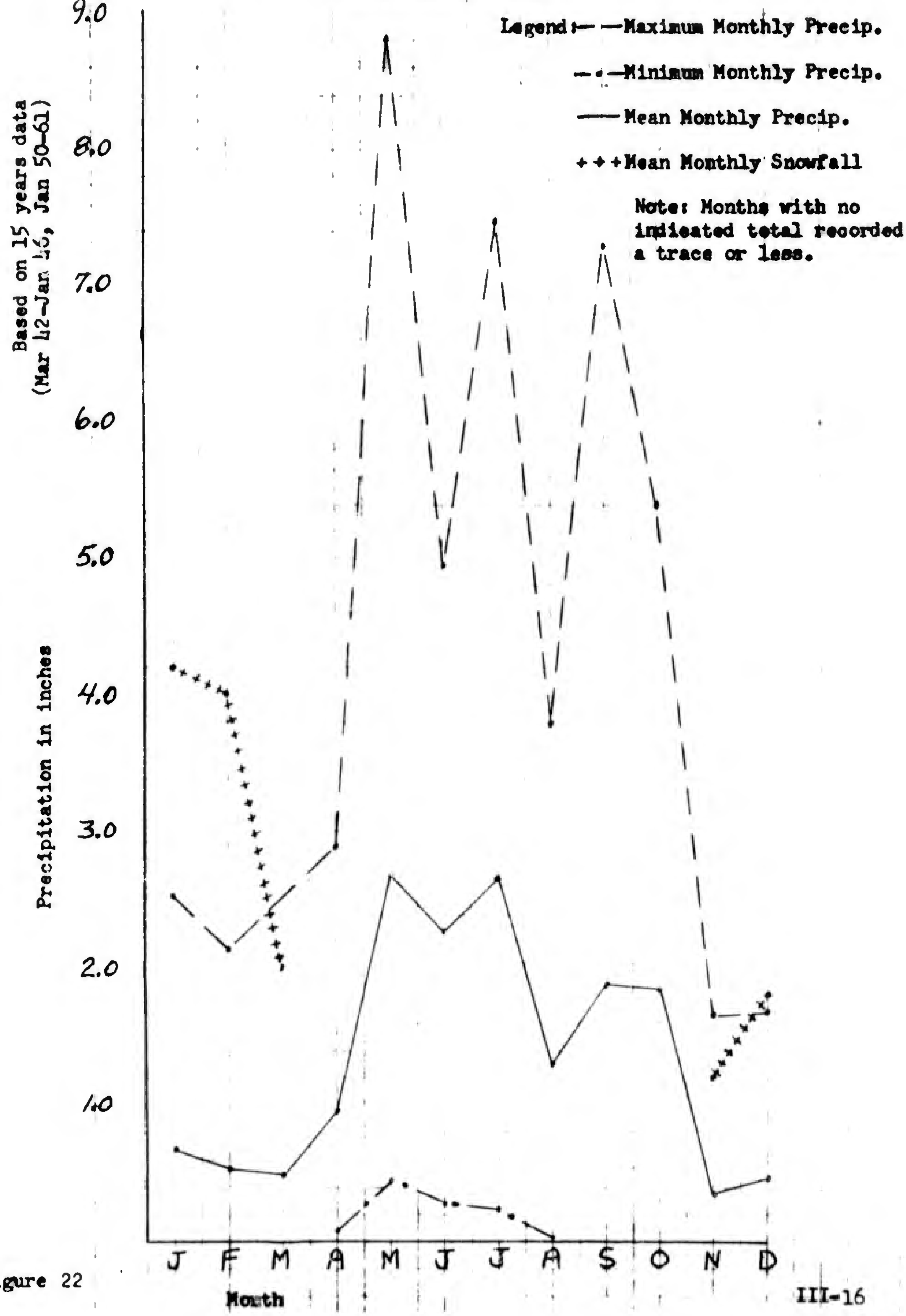
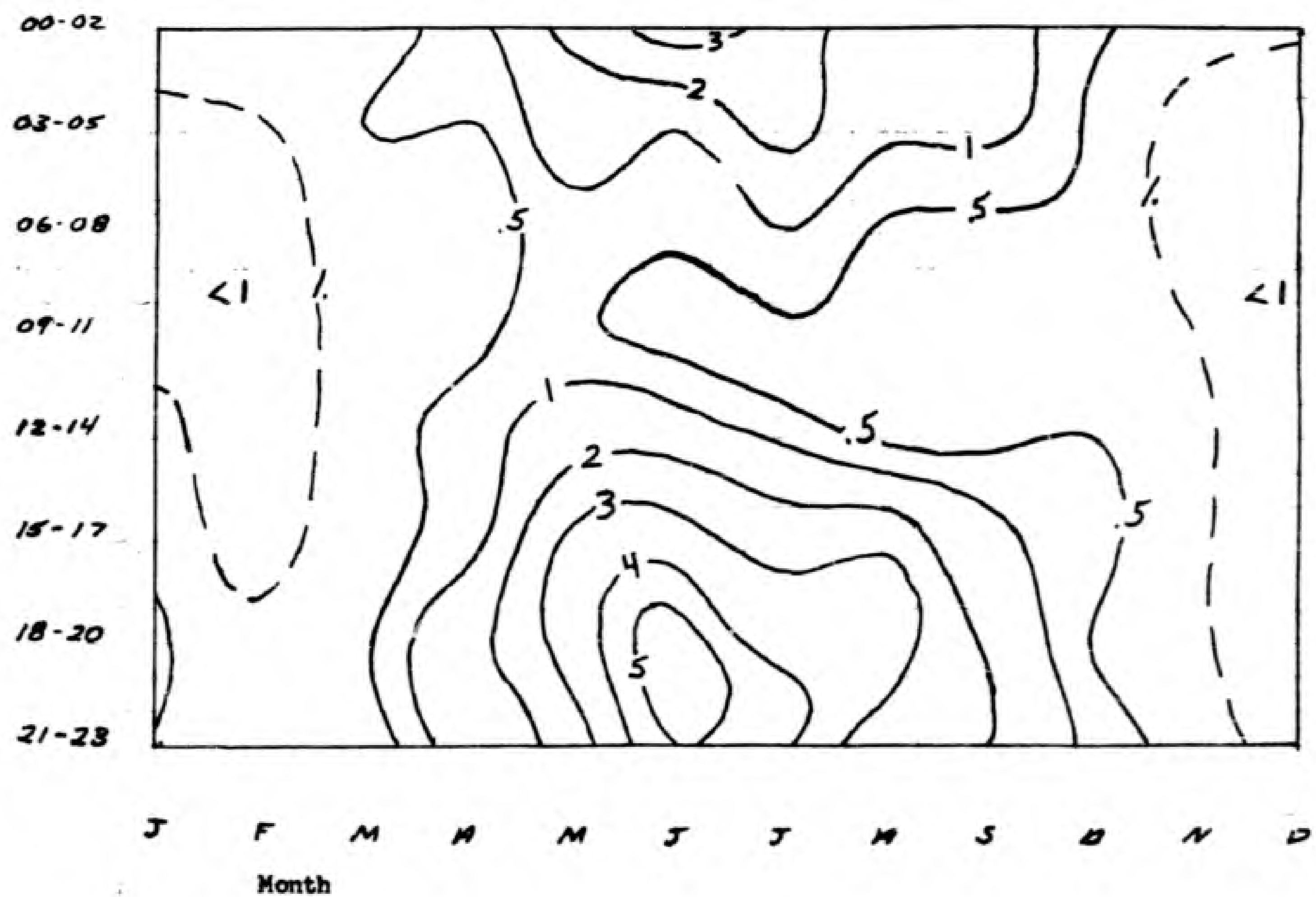


Figure 22

THUNDERSTORMS
Based on 21 years data
(Mar 42–Jan 46, Jan 50–Sep 67)

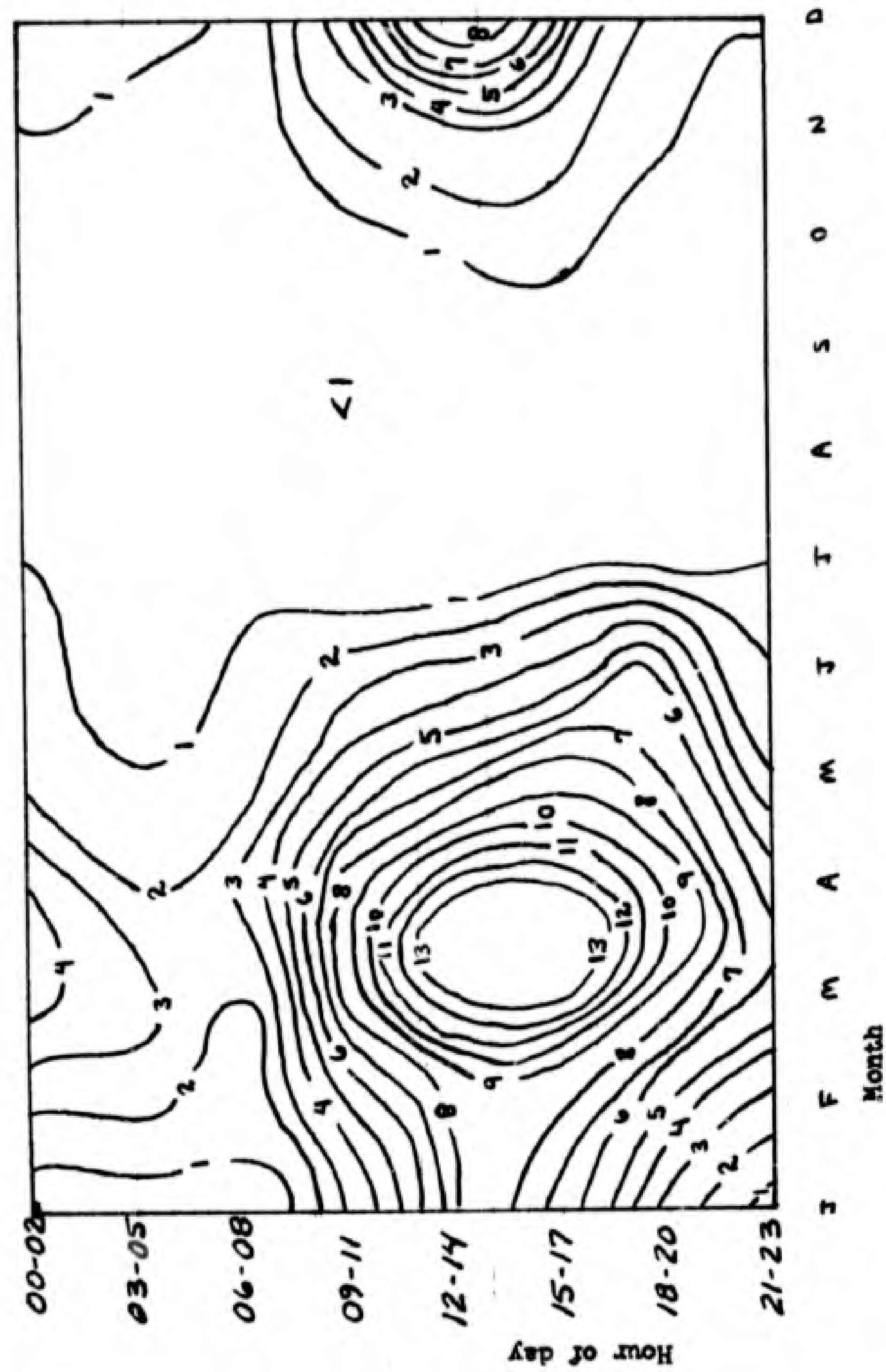


Percentage Frequency of Occurrence

Figure 23

DUST

Based on 21 years data
(Mar 42–Jan 46, Jan 50–Sep67)



Percentage Frequency of Occurrence

Figure 24

SECTION IV

Local Forecast Studies

Special Synoptic Studies

1. Cold Fronts (Stalling)
2. Gusty Winds
3. Stratus Formation and Dissipation
4. Thunderstorms
5. Temperatures (Forecasting Minimum)

COLD FRONTS (STALLING)

Cold fronts moving into the Reese area from the north indulge in a seemingly reasonless stagnation in the Canyon, Texas area south of Amarillo. In studying these cases, a quasi-objective method of determining when these fronts will stall has been derived by Captain Morris.

The Canyon, Texas area is situated at the head of the Palo Duro Canyon which is a 1000 foot cut in the high plains leading to the Red River Valley. Cold air behind a slow moving front tends to drain off the high plains down Palo Duro stalling the cold front in this area.

A qualitative analysis has shown the following:

1. Rate of frontal movement prior to reaching Amarillo has no bearing on movement after passing Amarillo.

2. An APP rise of 2.5 MBS or more over normal at Amarillo on the next 3 hourly observations after FROPA indicates stalling should not occur.

3. With an approximate rise of less than 25 MBS at AMA stalling should occur when:

   a. FROPA at AMA occurs between 0200-1600C.

   b. The high behind the front is centered east of a line from Fargo North Dakota to Witchita Falls, Texas.

4. When stalling occurs, FROPA at Reese can be expected: (Winter).

   a. In "a" above between midnight and 0600C that evening.

   b. In "b" above between midnight and 0600C 24-36 hours after stalling occurs.

   c. Late Spring or Summer between 18-21C.

5. Normally the type of front that stalls has a fairly weak push and the warm air gradient ahead of the front combined with the cold air drain behind the front prevents movement during the heated portions of the day.

GUSTY WINDS

Gusty surface winds are the predominate conditions affecting Reese during late Winter, Spring, and early Summer. Causative factors leading to this condition are threefold: Pressure gradient (primary); cold fronts (secondary); and thunderstorms.

Experience has shown that the following objective criteria will give a high accuracy in gusty wind forecasting:

a. Gusty winds due to pressure gradient factors:

(1) When a low pressure area is centered over the Texas or Oklahoma panhandles, West Kansas or Eastern Colorado or a N-S oriented trough lies west of Reese, gusty winds should be forecast.

(2) With low centered over Texas panhandle at 0600C with a pressure differential of 4MBS or more between LBB and AMA, 45K will verify.

(3) With low centered over Oklahoma panhandle, extreme Southeast Colorado or Southwest Kansas at 0600C and a pressure gradient differential of 4MB or more between LBB-pressure center, 35K will verify.

(4) With low over Eastern Colorado or West Kansas at 0600C a differential of 4MB or more LBB-pressure center, 25K will verify.

(5) When a N-S oriented trough is located west of Reese at 0600C 25-35K gusts should be forecast based on the following:

(a) Differential LBB-trough center pressure 2-4MB forecast 25K.

(b) 3-5MB forecast 30K.

(c) 4-6MB forecast 35K.

(d) 6MB forecast 35K.

NOTE 3: Wind direction will be plus/minus 20 degrees of 850MB isotherm orientation.

NOTE: Gusty winds will begin at temperature breaking the 5000 ft MSL AMA sounding point plus 2 degrees.

NOTE 2: If 8-10000 wind Reese area are light and variable gusty winds will decrease at temperature breaking the 8-10000 ft MSL AMA sounding point plus 2 degrees.

2. Gusty winds due to cold fronts - E-W fronts only:

a. Normally gusty winds 25-30K will prevail until about 2 hours prior to FROPA; at that time a lull can be expected.

b. Max gusts at FROPA will be the 5000 ft wind speed 6 hours prior to FROPA plus 15K. NOTE: If "fine line" is noted on FPS-77 forecast at least 45K.

3. Gusty winds associated with air mass thunderstorms: Gusty winds associated with air mass thunderstorms will be 5000 ft wind speed 6 hours prior to TRW occurrence plus 30K.

STRATUS FORMATION & DISSIPATION

Stratus occurrence is predominately a Spring phenomena with Winter a close second. Stratus types are predominately post frontal and upslope types.

1. Post frontal - East-west oriented fronts only.

   a. Usually forms or is advected in, 2-4 hours after frontal passage. The time of occurence at AMA in relation to FROPA is an excellent guide.

   b. Generally dissipates (goes scattered) 2-4 hours after winds have shifted to south of east.

2. Upslope:

   a. Normally forms or is advected in, between 06-08C when wind direction is SSE-ESE provided SJT had stratus the previous morning.

   b. Generally dissipates (goes scattered):

      (1) 09-10C when clear skies are above.

      (2) 10-12C when Ci or Cs ceiling above.

      (3) 12-14C (50%) when AS-AC ceiling above. (Normally 2 hrs after middle ceiling has moved out.)

THUNDERSTORMS

The Marfa or Dew Point front is the key to forecasting thunderstorms in the Reese area (air mass or squall line type). I will not cover frontal type here. Thunderstorms in the Reese area can usually be forecast yes when this Dew Point front lies west of Reese at 0900C and generally no when it lies east of Reese. Due to minor movement between 06-09C the position of the front at 06C is not a very accurate parameter.

The following rules should be used:

a. When the Marfa front is west of CVS a scattered line of MDT to severe TRW should pass Reese during the late afternoon or early evening.

b. When the Marfa front is between Reese and CVS a broken to solid line of severe TRW should pass Reese between the middle and late afternoon.

c. When the front is east of Reese, generally, no activity should be forecast for Reese proper.

TEMPERATURES (FORECASTING MINIMUM)

The problem of forecasting minimum temperatures at Reese has been with us for some time. Several methods have been derived for forecasting minimums. These are as follows:

a. For a north or south wind take the minimum temperature today for AMA or MAF respectively and:

(1) Add 5 degrees to the AMA or subtract 5 degrees from the MAF minimum temperature today for the Reese minimum temperature tomorrow with these refinements.

(a) If stratus is forecast add 4 degrees to the forecast minimum.

(b) If FROPA (cold) is expected before 0400C subtract 3 degrees from the forecast minimum. If cold FROPA is expected before 1800C subtract 8 degrees from the forecast minimum.

b. Take the 750MB AMA temperature and add 5 degrees and the MAF 750MB temperature and subtract 5 degrees. Use refinements (a) and (b) in a above.

c. Take the Reese minimum temperature today and adjust as follows:

(1) Add 2 degrees for increased southerly flow (decreased northerly flow).

(2) Subtract 2 degrees for decrease southerly flow (increased northerly flow).

(3) Subtract 8 degrees for cold FROPA before midnight regardless of stratus forecast.

(4) Add 8 degrees for stratus or warm FROPA.

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13. ABSTRACT

This reference file discusses factors affecting the weather at Reese AFB, TX. Included are location and topography, weather controls, climatic aids, and special synoptic studies.

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