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TERMINAL FORECAST REFERENCE FILE

DETACHMENT 20

24th WEATHER SQUADRON

LAUGHLIN AFB, TEXAS

25 JANUARY 1971

C O N T E N T S

Page No.

LIST OF ILLUSTRATIONS

SECTION I

LOCATION AND TOPOGRAPHY

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1000. LOCATION AND TOPOGRAPHY

1010. LOCATION OF LAUGHLIN AFB.

a. Laughlin Air Force Base is located at 29°22' North and 100°47' West, 6 miles east of Del Rio, Texas (See Figure 1-1). The field elevation is 1081 feet and a gentle slope extends southeast to the Gulf of Mexico. Laughlin is located in a broad valley between the Burro Mountains to the west and southwest and the Edwards Plateau to the north. (See Figure 1-2). The surrounding area is covered with subtropical dry land vegetation consisting of small trees, arid-land shrubs, cactus, weeds and grass.

b. Local Geographic Features: 45 miles west - southwest of Laughlin are the foothills of the Burro Mountains where the terrain rises abruptly to 3000 feet, becomes very irregular, and rises above 5000 feet at a distance of 63 miles. The maximum elevation of 9500 feet is 100 miles west - southwest of the base. (See Figure 1-2). The Edwards plateau begins 25 miles north of the airbase and has an average elevation of 2500 feet (See Figure 1-2). The altitude changes are apparent in the north-south and east-west terrain cross-sections in figures 1-4 and 1-5. The Gulf of Mexico, 225 miles southeast of Laughlin, provides a good source of moisture when the winds are from east through south -southeast. The effect of the Rio Grande River, which flows generally northwest to southeast about 8 miles east of the base produces little effect. 16 miles northwest of Laughlin is Amistad Reservoir. It currently (Jun 7Ø) contains 1,168,856 acre-feet of water with a surface of 28,651 acres or 44.07 square miles. By 1975, the water area should stand at normal conservation level of 3,500,000 acre-feet and cover about 137 square miles and under flood storage level could contain as much as 5,660,000 acre feet (See Figure 1-3). The influence of the lake on the local weather can only be surmised at this time.

1020. AIR POLLUTION SOURCES.

There is no major source of air pollution is this area. The city of Del Rio is not industrialized; therefore, no significant numbers of hygroscopic condensation nuclei are produced. The major source of such nuclei is salt from the Gulf of Mexico transported in on the prevailing southeasterlies. During prolonged droughts, dust becomes a problem due to lack of vegetation.

1030. SURFACE OBSERVATIONS.

a. Surface Observations are taken from the Representative Observing Site (ROS) which is located on the 5th floor of the Control Tower (See F Figure 1-6) at a height of 85 feet above ground level. The observer has a relatively unobstructed view from the east - northeast through the south to west quadrants but must leave the site to see the remainder of the horizon. Also his view above 60 degrees is completely obstructed. Overall, it is a poor observation site. The readouts for all remote instrument installations are located here.

b. Location of Instruments (Figure 1-6).

(1) Temperature and Humidity

The Temperature and Dew Point Transmitter (TMQ-11) is centered between runways 13R and 13L about the 5,000 feet mark or 150 feet south of the GCA cab (See D in Figure 1-6).

(2) Rain Guage

The Rain Guage (ML-17) is located on the roof of the Base Operations building (S-306) about 25 feet above ground level.

(3) Ceilometer

The Rotating Beam Ceilometer (GMQ-13) is located 3200 feet from the approach end of runway 13R (See A in Figure 1-6). The projector is 400 feet northwest of the detector.

(4) Wind Recorder

The Wind Speed and Direction Transmitter (GMQ-11) is adjacent to the TMQ-11 (See paragraph b above and E in Figure 1-6). There are readouts in the control tower (ID-751/GMQ), Base Weather Station (ID-751/GMQ), RAPCON (Model 133) and a recorder (RO-2) in the ROS.

(5) Storm Detection Radar

The Radar Console (FPS-77) is located in the Base Weather Station and the Remote Transmitter Module and antennae is about 600 feet west of the Base Weather Station (See C and G in Figure 1-6).

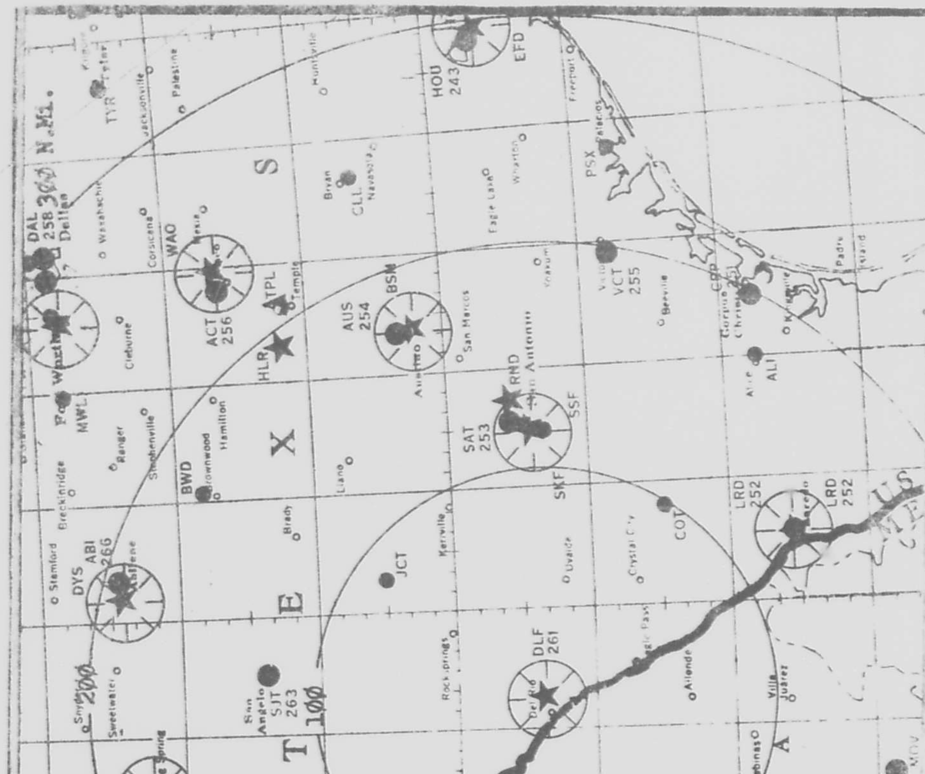


FIG. I-1 Area Map (1:5,000,000)

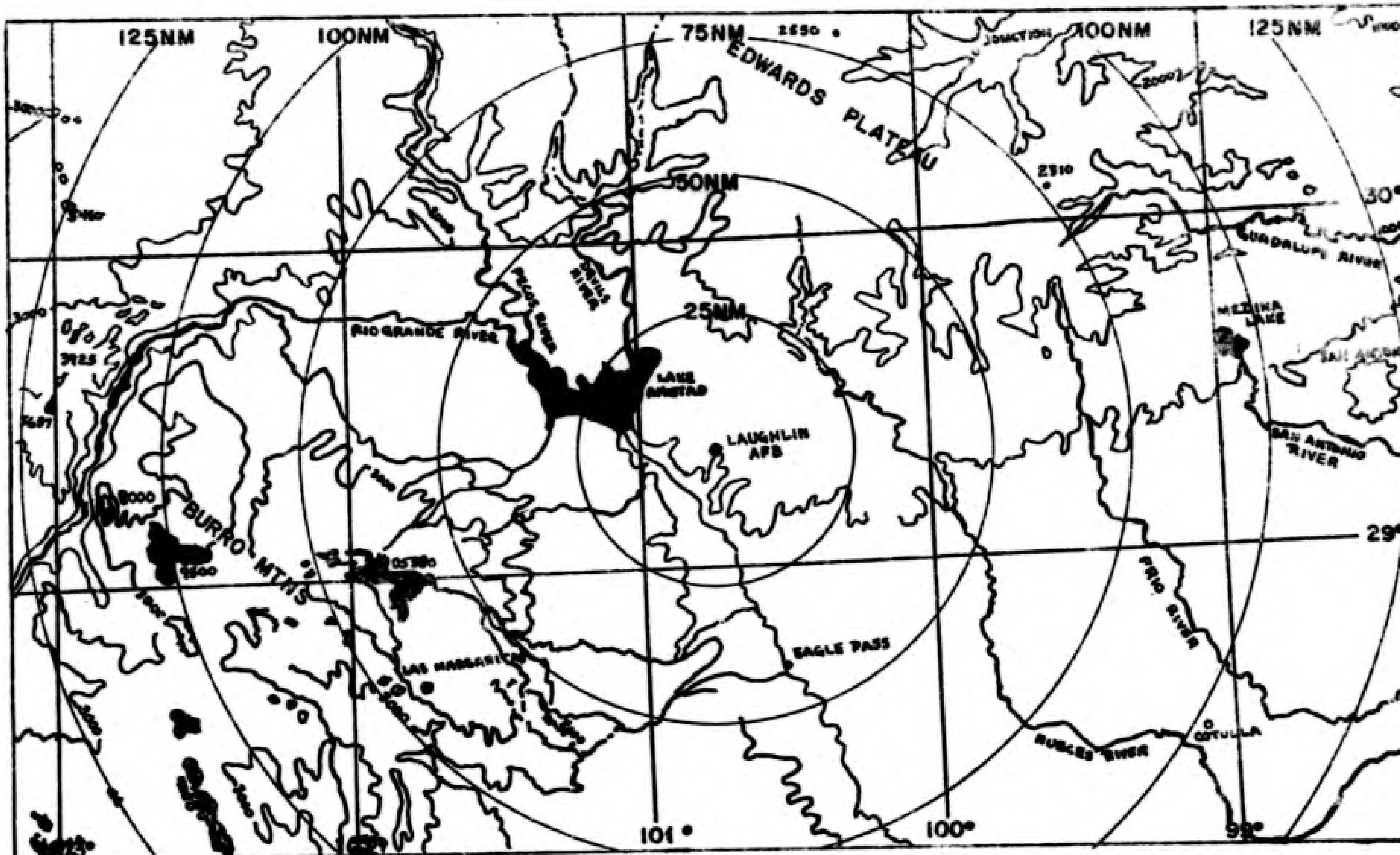


FIG. I-2 Topography Chart (1:2,000,000)

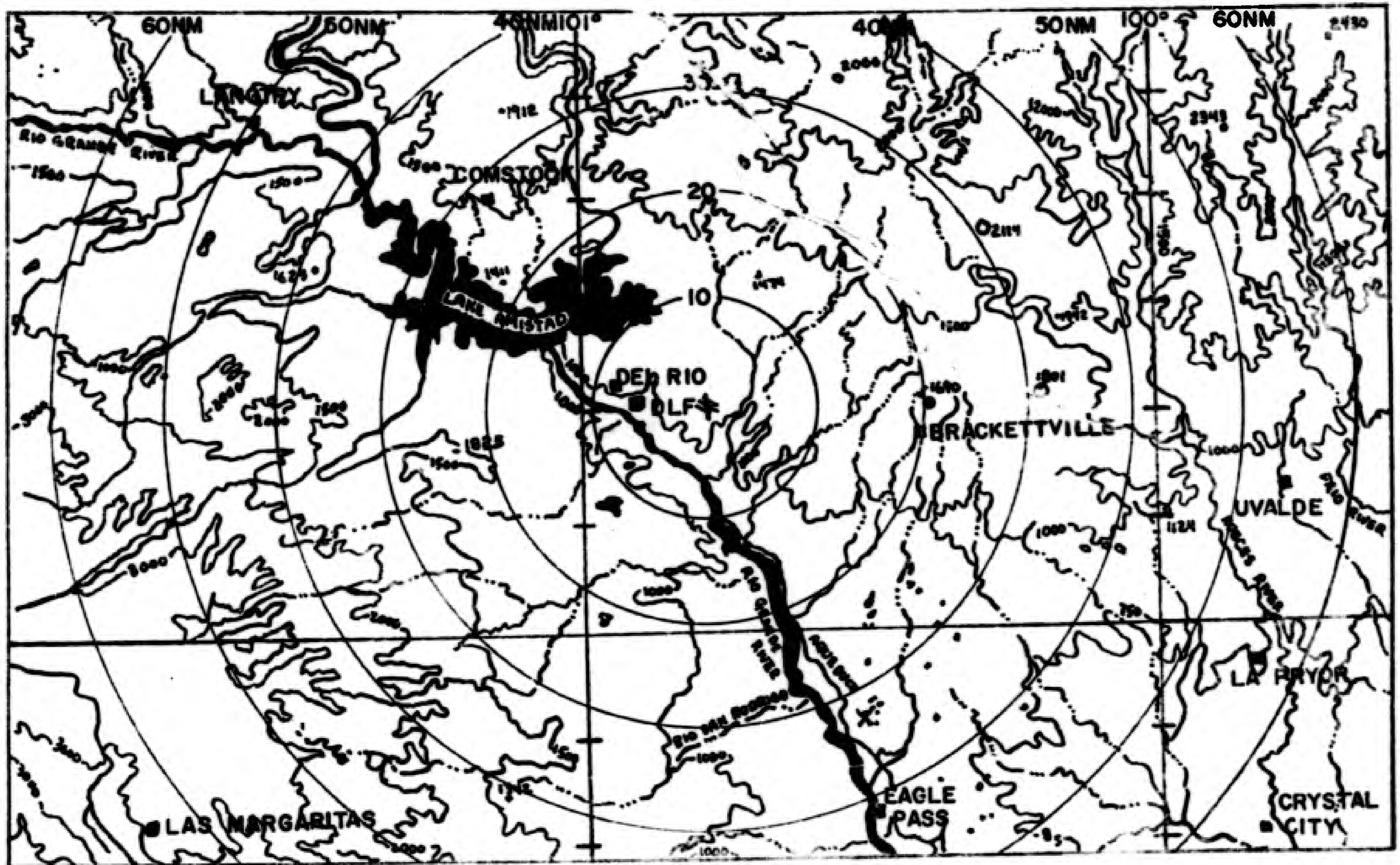


FIG. I-3 Topography Chart (1:1,000,000) (Depicting area of Amistad Lake at Maximum water level)

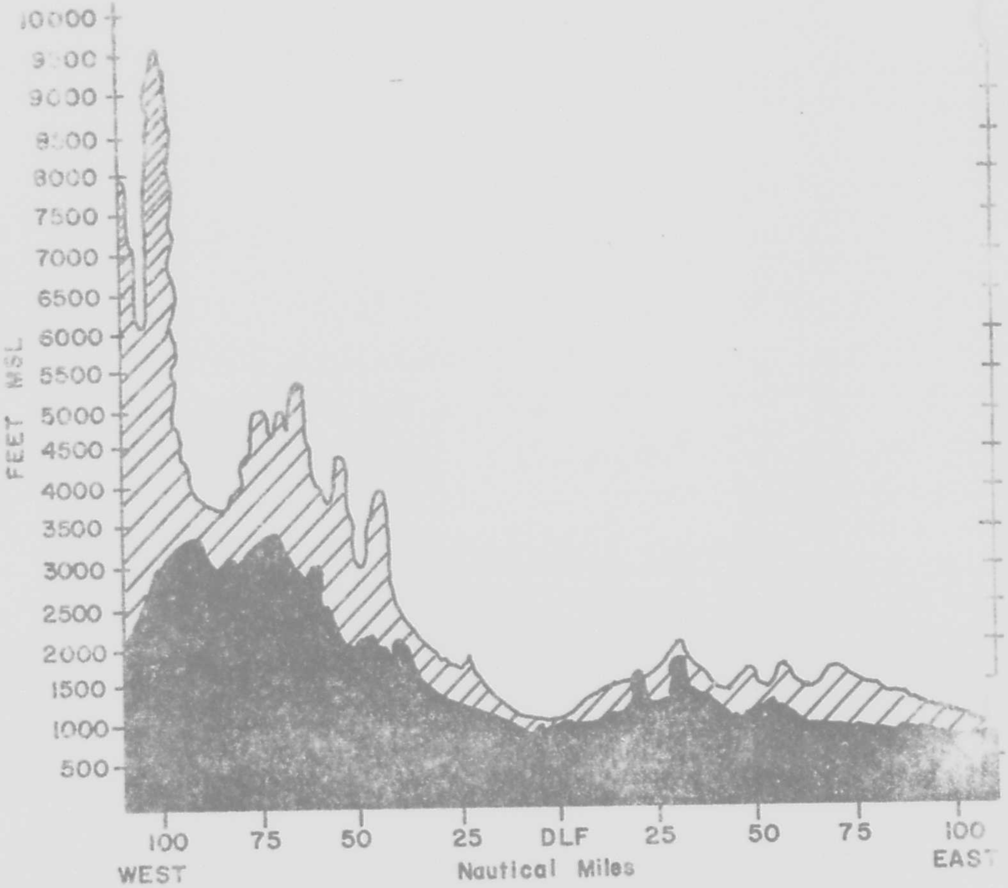


FIG. 1-4 West-East Terrain Cross-Section (Hatched area is highest terrain within 25 miles.)

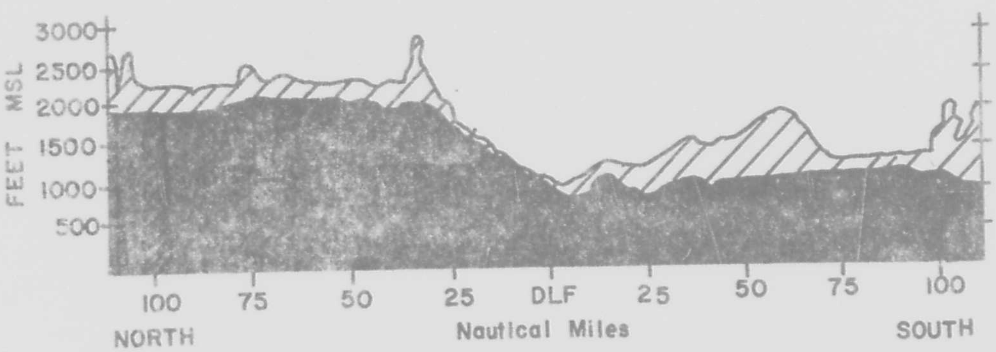


FIG. 1-5 North-South Terrain Cross-Section (Hatched area is highest terrain within 25 miles.)

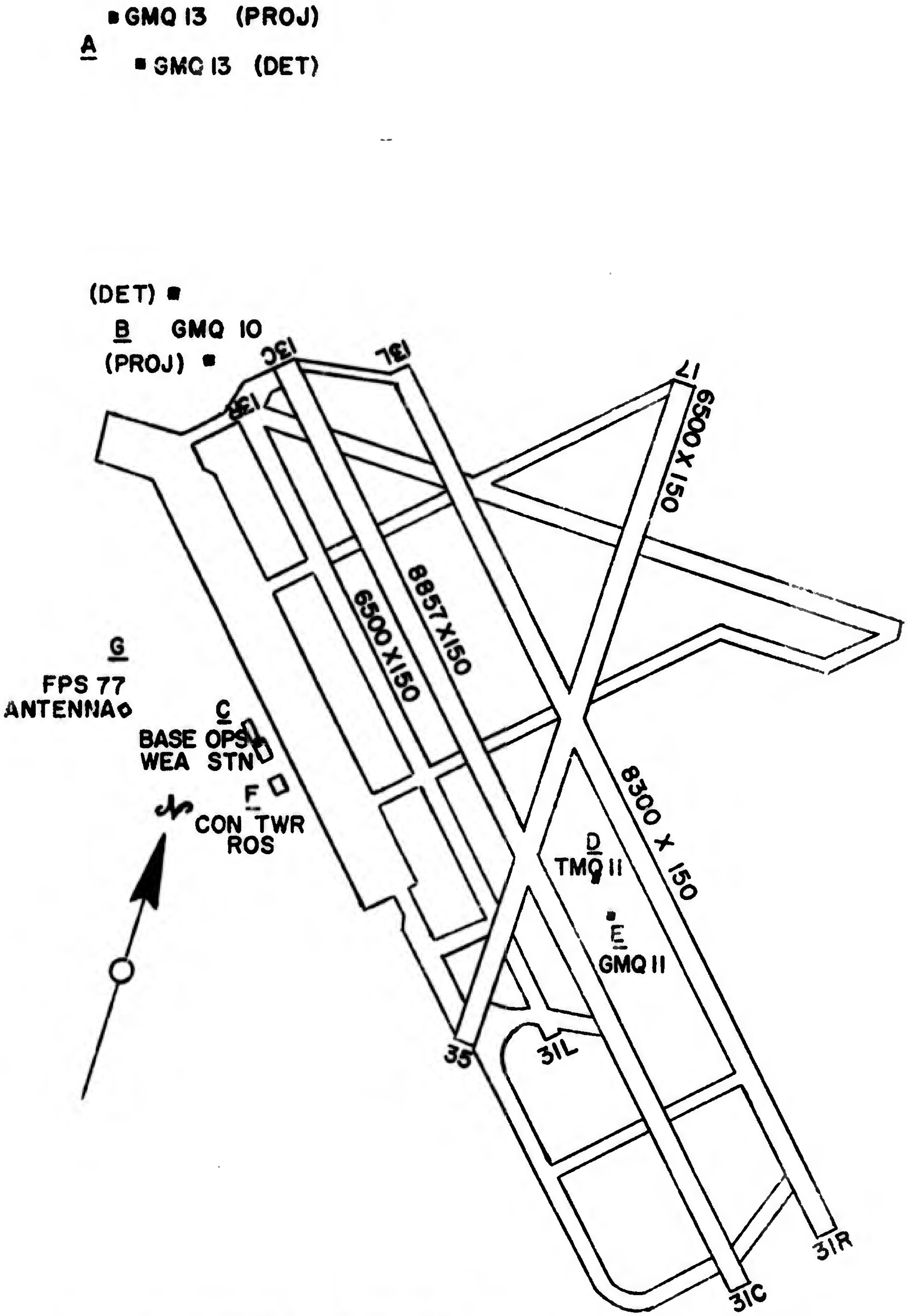


FIG. I-6 Location of Weather Equipment

SECTION II

WEATHER CONTROLS

2000. WEATHER CONTROLS

2010. CONTROLLING FEATURES.

The major synoptic features controlling the weather at Laughlin AFB are:

a. The Bermuda high -- this semi-permanent feature migrates west and north during the summer months and south and east during the winter. Its relative position and strength regulates the southeasterly flow through the local area and is our primary moisture source.

b. The Canadian high -- this feature produces frequent cold continental Polar outbreaks which dominate the area during the winter months.

c. The Great Basin high -- during the fall, late winter, and spring months, the Pacific high modifies over the Great Basin and brings frequent dry cool incursions of air into this area.

d. The Mexican Thermal Low -- this semi-permanent feature intensifies during the summer and weakens during the winter, occasionally disappearing completely for 2 to 3 days during very strong intrusions of Canadian air deep into southern Mexico.

e. Gulf Cyclogenesis -- cyclogenesis occurs several times during the winter months in the extreme western gulf when cold fronts become stationary through that region.

f. Tropical disturbances -- though in a dissipating stage as they arrive in this area, easterly waves, tropical storms and hurricanes produce significant moisture increases and resultant weather at Laughlin.

g. Upper Air systems -- the deep cold core 500mb lows which became stationary over the southern California coast produce strong southwesterly flow aloft and poor weather over this region for as long as 6 to 7 days. This situation occurs November through April.

h. Arctic highs -- true Arctic air masses penetrate into the Laughlin area only once or twice per year, generally in January or February.

2020. SYNOPTIC WEATHER AT LAUGHLIN.

a. Summer.

(1) Climatically, summer begins the first week of May and runs through the last week of September. Though the hottest temperatures occur during June, July and August, the months of May and September are hot months and are under the same basic weather regime.

(2) Upper air patterns during the summer become weak and diffuse. The Bermuda high increases in size and ridges northward and westward dominating all of the gulf of Mexico and Texas from the Pecos valley eastward. A light to moderate warm moist southeasterly flow prevails from the surface to 6,000 - 10,000 feet. This situation produces patchy low scattered stratus lifting into a few cumulus about 0900C and then clearing completely by 1200-1300C. If this flow becomes strong and persists for 12 hours or more, it produces a heavy 1200-1500 foot status deck moving in about sunrise, the low overcast ceilings often persisting to 1100C, then breaking into scattered afternoon cumulus and clearing with sunset.

(3) Air mass thunderstorms are frequent over the higher elevations in this region occurring almost daily in the Mexican and Texas Rockies just west of Laughlin. Convective thunderstorms over the flat terrain are infrequent, occurring only 3 to 5 times monthly in the local area and then seldom hitting the airbase proper. During May and early June, squall lines form west of the station and move though the area during the evening and early morning hours. These lines are generally associated with upper air troughs near the 500mb surface.

(4) Visibilities are usually 15 miles or greater with 85 miles commonly reported. The only obstructions during the summer are the rain showers and thunderstorms with restrictions to less than 1 mile lasting only a few minutes.

(5) Occasionally, dry hot tropical continental air from Mexico replaces the tropical maritime at the surface. This produces very hot periods when the maximum temperatures will soar to as much as 105 degrees for several consecutive days.

(6) Easterly waves, tropical storms, hurricanes, and other tropical disturbances are usually in state of dissipation this far inland (225 miles), however, a strong wave will bring a sufficient moisture increase to produce two days of scattered showers. Hurricane Celia did reach Laughlin in Aug 1970 with maximum winds of 74 knots.

b. Autumn.

(1) The fall season is one of extreme contrasts in this area. The entire area south of 35^{o} is still dominated by maritime tropical and continental tropical as in the summer season with warm to hot afternoon temperatures and muggy humid mornings. The water temperature over the gulf remains high and the resultant high dew points are advected inland. Gulf stratus still occurs and under the same conditions as in the summer except with shorter days and longer nights, it shows more persistency.

(2) As autumn progresses, the upper air patterns become better defined and a better correlation between them and surface weather is established. About the first week of October, maritime Polar fronts begin to push through the area bringing gusty southeasterly surface winds and stratus before frontal passage, a narrow band of showers with occasional thunderstorms with the front and rapid clearing and gusty northwesterly winds behind the front. As the mP air moves out over the gulf it is quickly modified and low stratus returns within 24 hours after the return southeasterly flow begins.

(3) Continental Polar fronts begin to invade the area in late November and early December and herald the arrival of the winter season. These cP fronts are generally oriented east-west and becomes stationary in the local area producing several days of low ceilings and light showery but persistent rain. As temperatures drop into the low 40's and high 30's in the cold air and icing begins to be a problem. Even though these fronts push well south of the local area, the easterlies behind them rapidly brings moisture in from the gulf producing low ceilings and drizzle. Complete clearing in cP air usually occurs only in the closed center of the migratory highs.

c. Winter.

(1) True winter is a short season in this area, beginning the last week of December and running through the middle of March. Maritime Polar fronts from the west begin to set off waves along the cP front lying along the eastern Rockies. As these storm centers move southeast and east they are followed by a succession of cP outbreaks from Canada; each succeeding outbreak colder and penetrating further south. The first sharp cP front, lying generally on an east-west line, passes Laughlin about mid-December and then is followed by a rapidly increasing succession of them until late January and early February. The frequency then decreases gradually with the last one near the middle of March. Occasionally during January or February, an arctic high will plunge into the local area with temperatures dropping to as low as 10°F.

(2) The east-west oriented continental Polar front produces the most persistently unfavorable weather at Laughlin. These shallow air-masses frequently stall between Laredo and Tampico and low status clouds are produced as a result of the overrunning of the warm tropical air or due to the orographic lifting produced by the shallow slope from near sea level to 1,000 feet in the local area. These low ceilings with fog, drizzle and low visibilities may persist for 4 to 6 days. One or two occurrence of freezing rain or sleet, and a trace of snow is likely during each season. Waves frequently develop in the western gulf at the juncture of this front and the coast line as it becomes quasistationary. If a 500mb trough line is over El Paso, wave development will occur on the front within 12 hours.

(3) During deep winter, the maritime Polar front, normally oriented northeast-southwest, is usually over taken by a cP front as it enters the panhandle of Texas and is absorbed in the stronger circulation before it gets to Del Rio. These mP fronts lose considerable moisture as they cross the Rockies and usually become stationary in the Laughlin area. With a moderate southeasterly flow, overrunning occurs and a slow moving shallow front or a stationary front may act much like a warm front with light precipitation and post-cold frontal stratus or fog.

d. Spring.

(1) Spring, like the fall season, is a season of extreme temperature contrasts but with one pronounced difference -- the waters of the gulf of Mexico are much cooler resulting in lower dew points and therefore no hot, muggy days as are experienced in September and October.

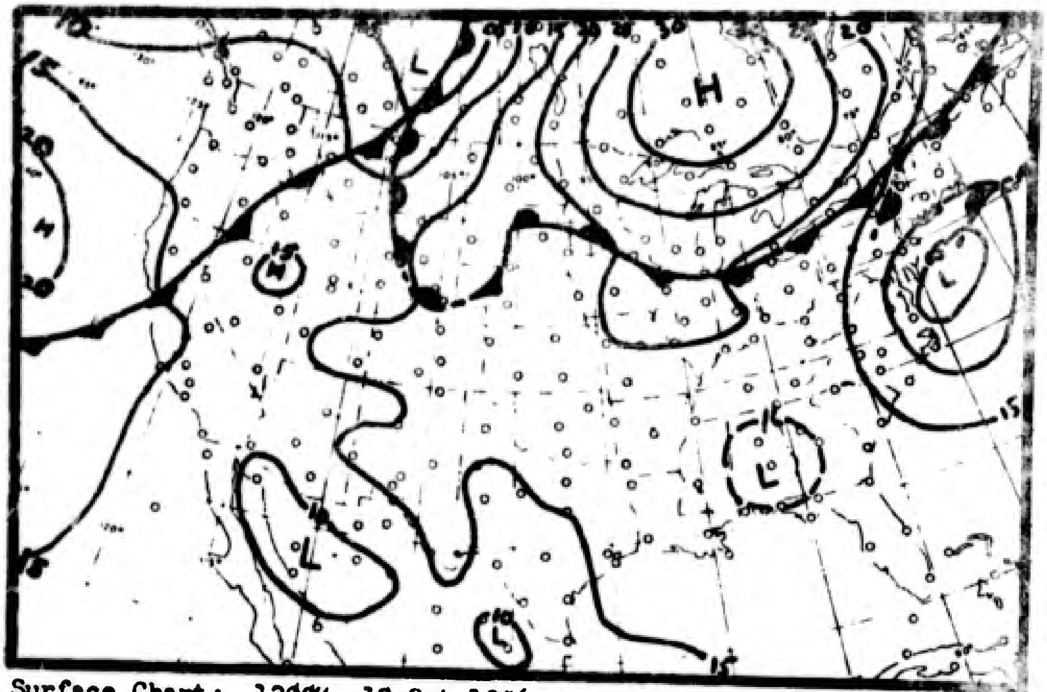
(2) The Bermuda high begins to build during March and ridges westward into the gulf. Continental Polar outbreaks begin to stall along a Midland-Waco line. Maritime Polar fronts again become the major front in the area producing many squall lines and heavy thunderstorms during April and May. By mid-May these fronts loose much of their upper air support and begin to go stationary and frontalize near Laughlin. If the flow aloft is southwesterly above 10,000 feet this situation can produce several days of low ceilings, thin cloud decks and icing problems above 8-10,000 feet.

2030. FRONTS.

a. Cold fronts.

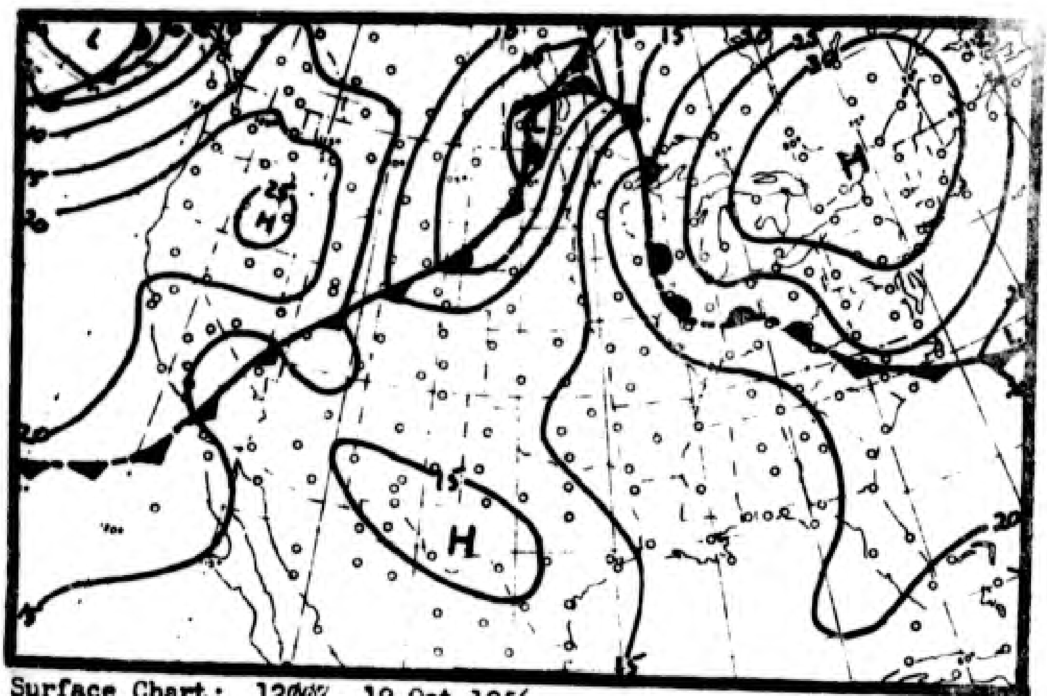
(1) Cold fronts in this area can be divided into two major patterns; the northeast-southwest oriented maritime front moving in from the west or northwest and the east-west oriented continental Polar front moving in from the north or northeast. Due to the rugged terrain and paucity of data west of Laughlin, neither of these fronts show a well defined pressure trough.

(2) Frequency of the northeast-southwest oriented mP front is the greatest in the spring and fall. The weather associated with them depends largely on the degree of development of the upper air troughs with them and the amount of moisture advected in ahead of the front, both from the gulf of Mexico in the lower levels and the gulf of California in the upper levels. To arrive in the local area from the northwest, considerable downslope motion and drying occurs behind the front however, occasionally the mP air follows a more southerly trajectory over lower California and brings in considerable moisture above 7-8000 feet. A typical maritime Polar frontal situation is shown in figures II-1 through II-4. Note the lack of a distinct pressure trough in southwestern Texas.



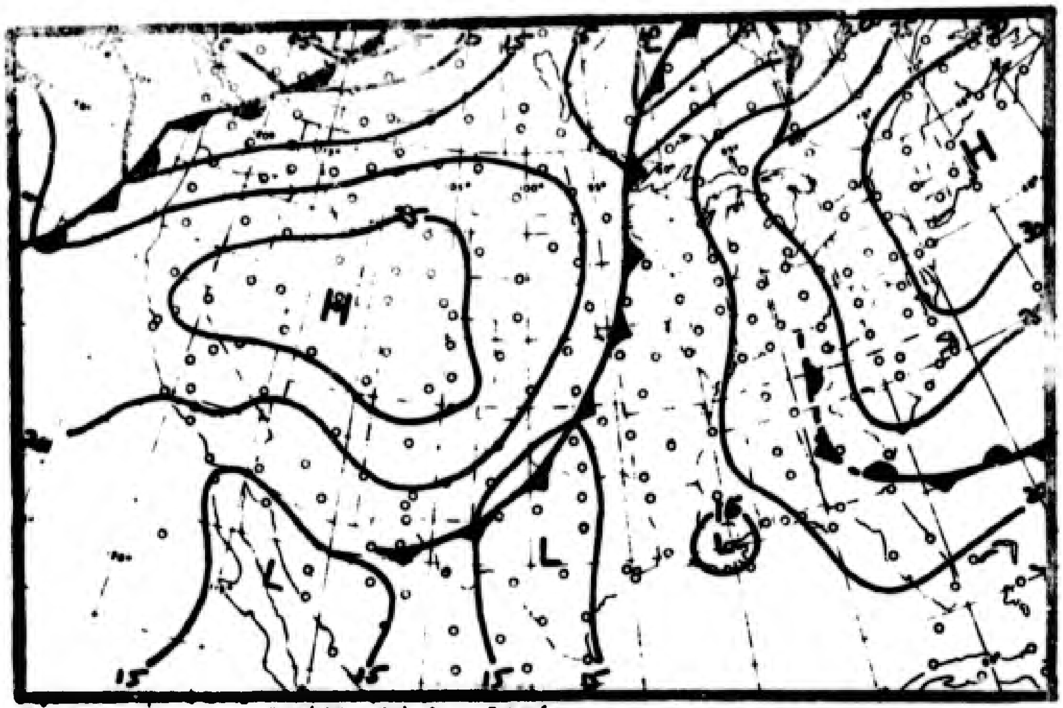
Surface Chart: 12ØØZ, 18 Oct 1956

FIG. II-1 Northeast-Southwest Cold Front



Surface Chart: 12ØØZ, 19 Oct 1956

FIG. II-2 Northeast-Southwest Cold Front



Surface Chart: 12ØØZ, 2Ø Oct 1956

FIG. II-3 Northeast-Southwest Cold Front

Surface Chart: 12ØØZ, 21 Oct 1956

FIG. II-4 Northeast-Southwest Cold Front

(3) The east-west cold front causes by an outbreak of continental Polar air is the dominate front and reaches highest frequency during January and February. Strong south to southeast surface winds with low stratus preceeds this front with winds shifting rapidly to north and gusting to 30 to 35 knots subsiding to 25 to 30 knots about 2 hours after frontal passage. As the front passes out over the gulf, winds rapidly become easterly and moisture is quickly advected back into the local area. A typical front of this type is depicted in figures II-5 through II-8.

b. Warm fronts and quasistationary fronts.

(1) Most of the precipitation and low ceilings in the Laughlin area during the winter are caused by cold fronts that become stationary in South Texas, Central Mexico, and the northwest gulf of Mexico with wave development just west of the Brownsville area. These waves over South Texas and the northwest gulf cause very poor flying conditions over all of Texas with considerable icing problems in the cloud decks over west and northwest Texas. A typical wave formation is shown in figures II-9 through II-12.

(2) Warm frontal passages in this area usually result from the eastward movement of a cP air mass that moved in previously from the north or northeast and formed a quasistationary front along the Mexican Rockies some 50 to 150 miles southwest of Laughlin. Broken to overcast altostratus at 8,000 to 10,000 feet with light rain can be expected. Occasionally low stratus moving in from the southeast will build and merge with these upper layers just prior to frontal passage. Rapid clearing follows frontal passage.

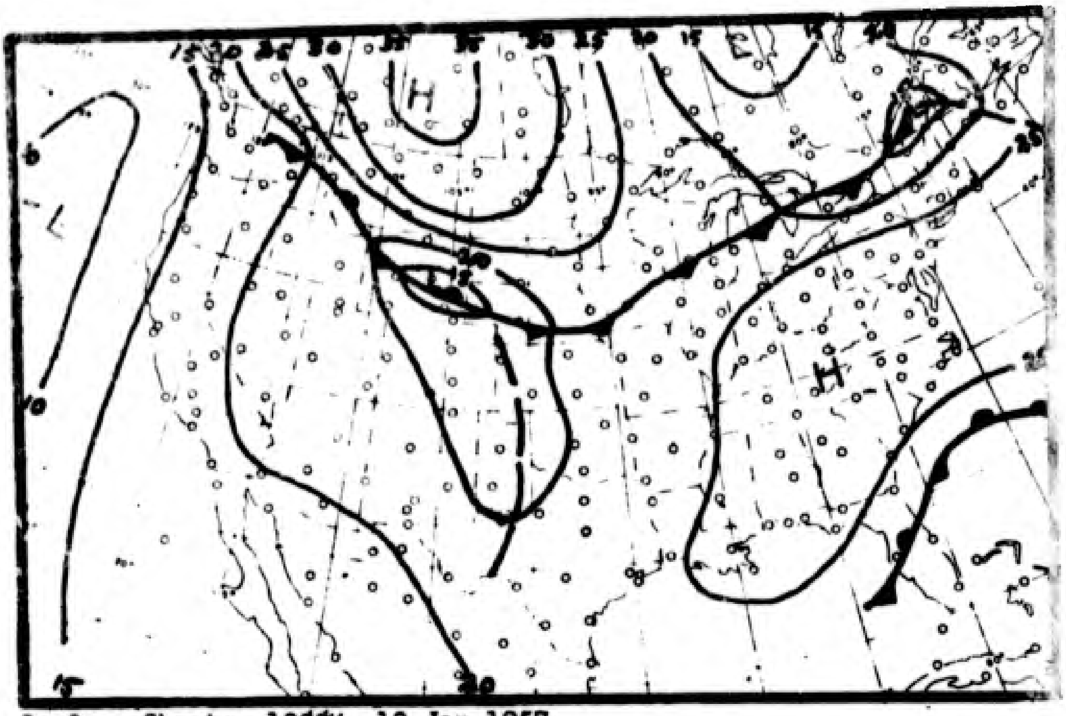
c. Occluded fronts.

Occluded fronts are infrequent through this area with only two or three a year passing Laughlin. They produce a warm type occlusion frontal weather with fog, stratus and drizzle continuing for as long as 48 hours. Clearing behind these fronts is very gradual taking from 12 to 18 hours.

2040. OBSTRUCTIONS TO VISIBILITY.

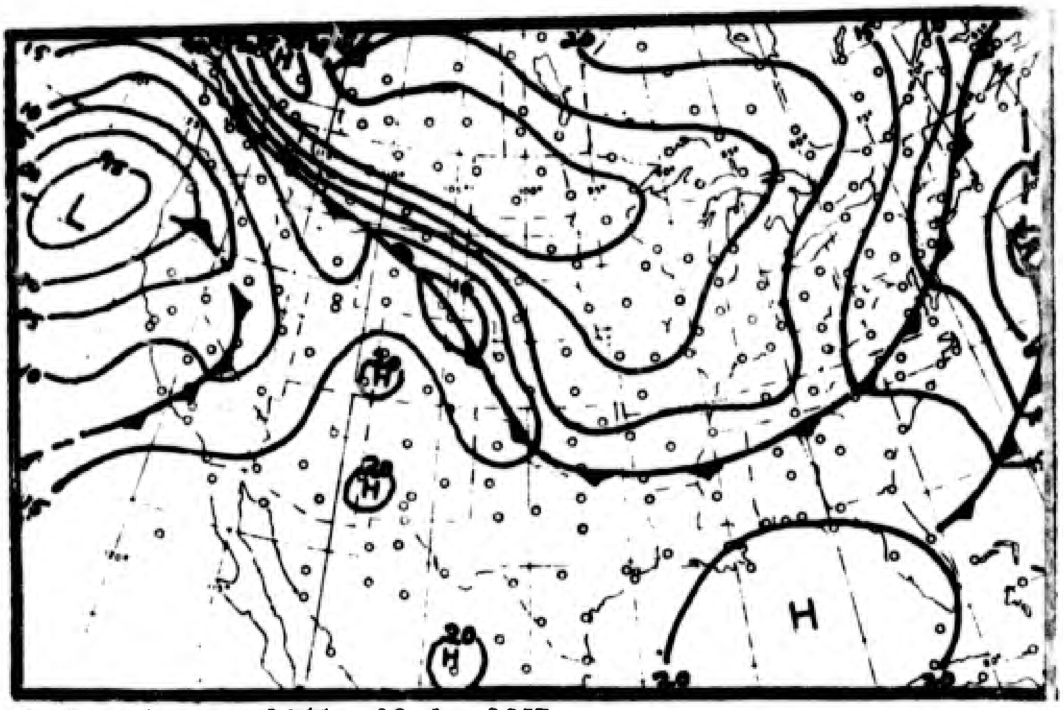
a. Fog.

Fog is the most significant phenomena affecting the visibility at Laughlin. It restricts the visibility to less than 1 mile for approximately 10 days per year, 9 of which occur during the months of November through February. Most of this occurs as a radiation-advection type forming in the low places on a clear night after heavy precipitation the day before. As the circulation picks up after sunrise, the fog is advected out of the valleys to the south into the local area. Radiation fog forming over the field only occurs 1 to 2 times per year.



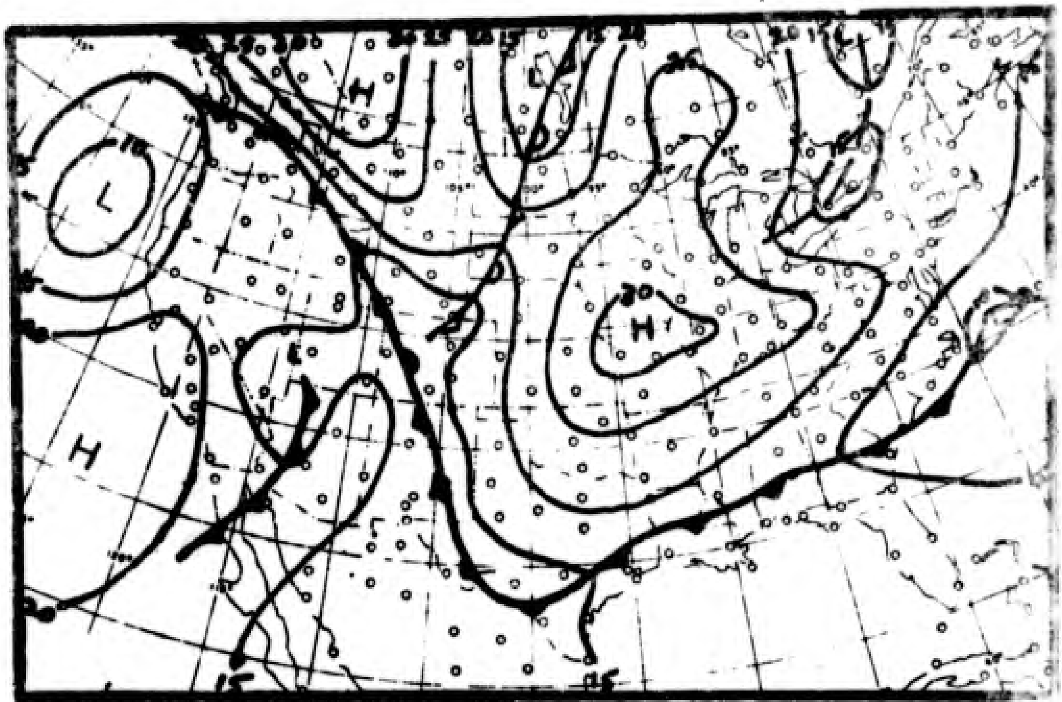
Surface Chart: 12ØØZ, 12 Jan 1957

FIG. II-5 East-West Cold Front



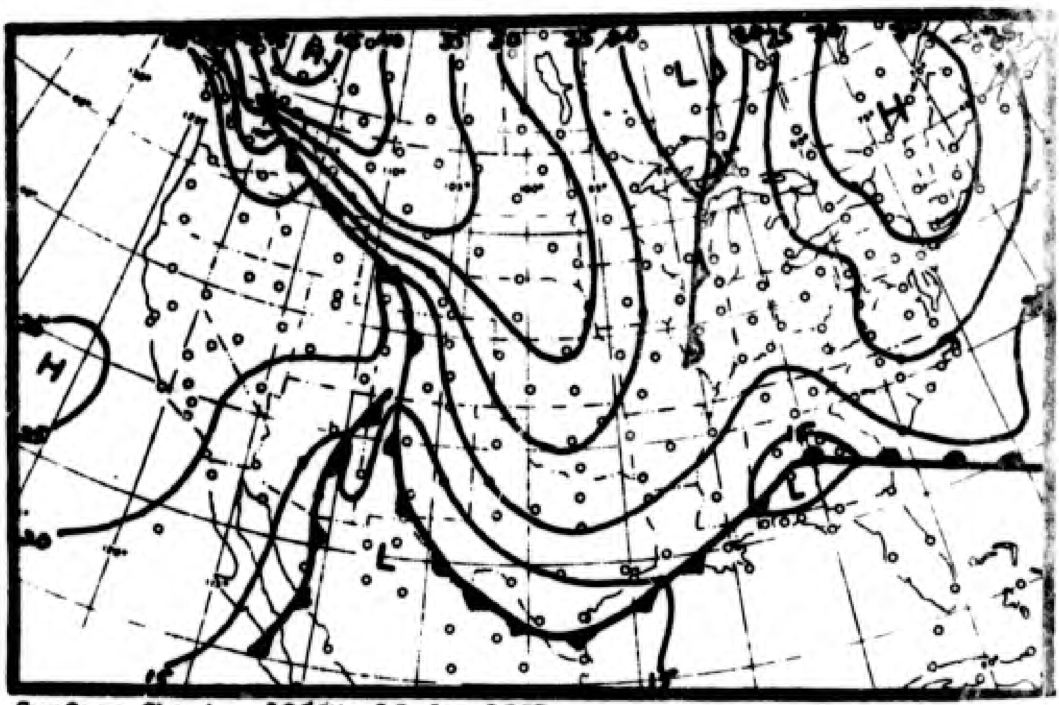
Surface Chart: 12ØØZ, 13 Jan 1957

FIG. II-6 East-West Cold Front



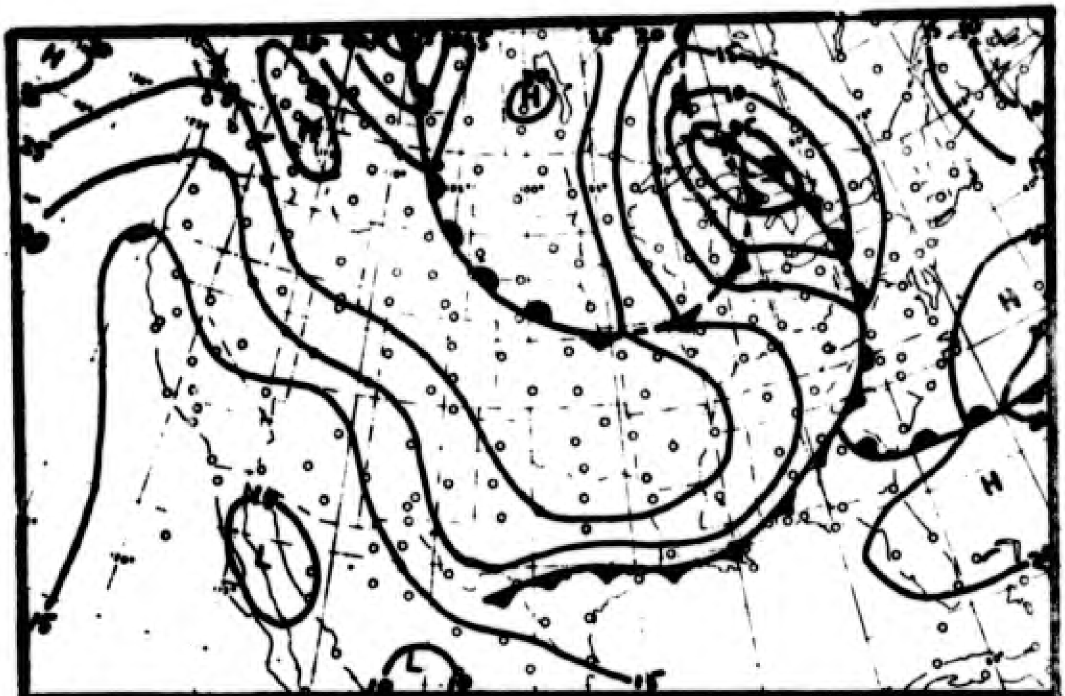
Surface Chart: 1200Z, 14 Jan 1957

FIG. II-7 **East-West Cold Front**



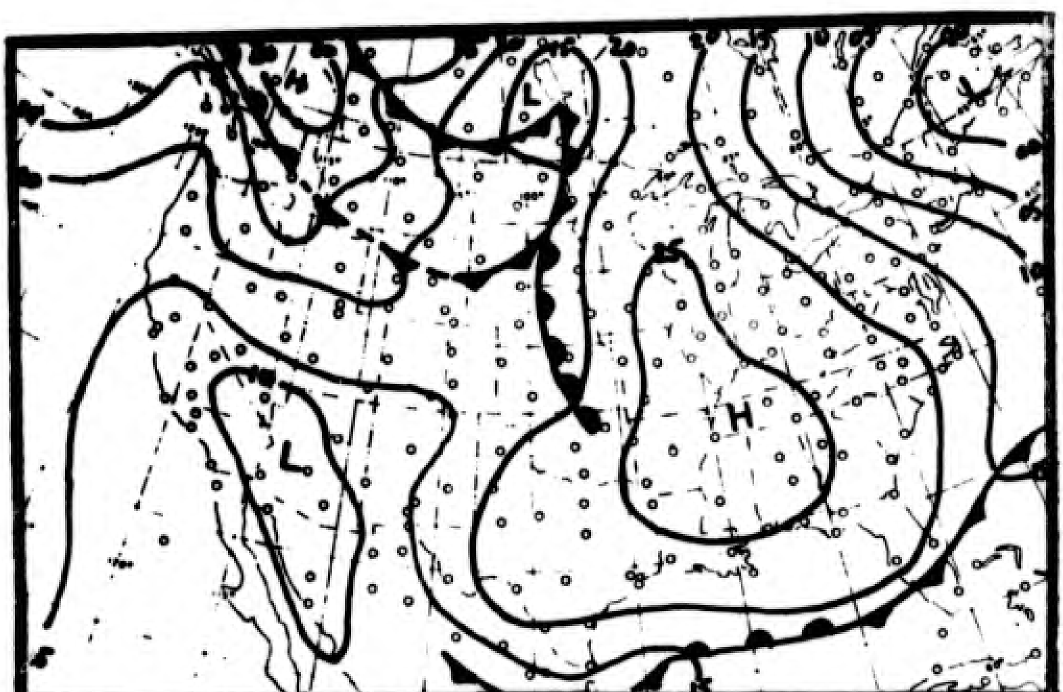
Surface Chart: 1200Z, 15 Jan 1957

FIG. II-8 **East-West Cold Front**



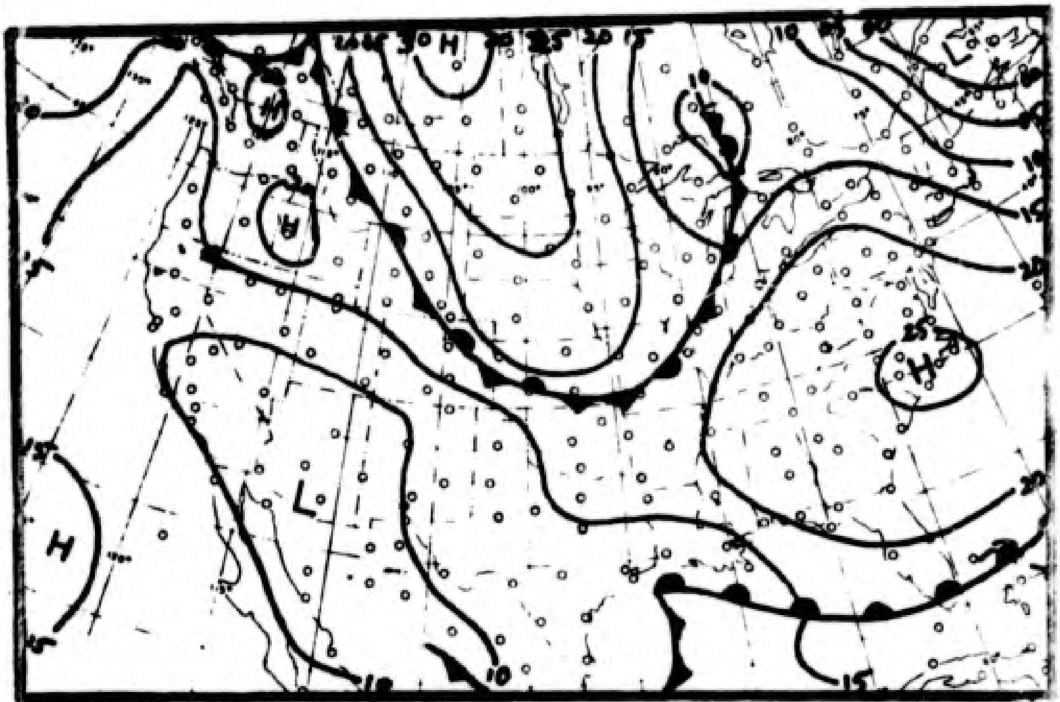
Surface Chart: 1200Z, 16 Feb 1957

FIG. II-9 Gulf Wave Formation



Surface Chart: 1200Z, 17 Feb 1957

FIG. II-10 Gulf Wave Formation



Surface Chart: 1200Z, 18 Feb 1957

FIG. II-11 Gulf Wave Formation

Surface Chart: 1200Z, 19 Feb 1957

FIG. II-12 Gulf Wave Formation

b. Smoke.

The surrounding area has no sources of smoke pollution and it is not a problem.

c. Haze.

Haze only occurs a few days per year and never restricts the surface visibility under 7 miles. This occurs during prolonged periods of return southeasterly flow from migratory polar highs that have gone stationary in the central gulf coast area. Tops of the haze, which occasionally give in-flight visibilities of 3 to 4 miles, may go as high as 12-14,000 feet but generally is about 7-8,000 feet, the top associated with the trapping of the subsidence inversion.

d. Dust.

During prolonged periods of drought, dust may restrict visibilities to 1 to 3 miles with mP frontal passages and occasionally suspended dust with the appearance of haze will persist for 2 to 3 days after a major low in Colorado has created a severe duster on the plains. Visibilities will be 5 to 7 miles in this situation and dust tops have been reported to as high as 30,000 feet.

2050. SEVERE WEATHER.

a. Thunderstorms.

(1) Laughlin reports an average of 28 thunderstorms annually. Of these, 20 are reported during the period April through August. Small hail, 1/4 to 1/2 inch is reported about twice per year. Severe hail is reported about once each five years with the maximum reported 2 1/2 inches on 19 April 1949. Within our local flying area or a 120 mile radius of the base, thunderstorms occur on the order of about 100 days per year. During the spring and summer months the lapse rate is unstable. There is insufficient moisture to support more than isolated activity, but it is almost a daily occurrence, particularly in the extreme southeast and western portions of the area.

(2) The most severe storms occur with the passage of an mP front during the spring and early summer months and with squall line activity moving in from the west. Dozens of northeast-southwest oriented lines form each season in the panhandle and Big Bend country and move eastward dissipating during the night and early morning hours in the local area and to the north. The majority of these lines dissipate on the southern end, missing the local station by 50 to 60 miles to the north due to a downslope drying effect from the mountains west of Laughlin.

(3) Though Laughlin has not been struck by a tornado, two to three are reported each year within the local flying area. Due to the low population density, injuries and damage are almost negligible. In April 1927, the small community of Rocksprings about 60 miles northeast was totally destroyed with 74 deaths reported. In June of 1970, a Southern Pacific freight train was derailed about 14 miles east of Laughlin resulting in no injuries but considerable damage. Each season will bring many reports of isolated damage due to tornadoes, however careful checking indicates two or three per year within a 50 miles radius would be maximum. The same seems to hold true for severe hail storms and extremely heavy rain. In September 1969, a large thunderstorm dumped over ten inches of rain just south of Uvalde with 1 1/2 inch diameter hail preceding the downpour. Local flooding killed over 300 head of livestock on one ranch.

2060. SPECIAL SYNOPTIC FEATURES.

a. The dew Point Discontinuity Front.

(1) This front is the lee-side trough of low pressure which extends southward across West Texas in northern Mexico with a mean position along the western edge of the Texas panhandle south - southwestward through the Big Bend just east of Marfa. This trough marks the westward extend of moist air flowing from the gulf and is characterized by a rather sharp dew point discontinuity. It can exist during all seasons. In the summer, it marks the westward extension of the Bermuda High, while in the winter if forms behind the migratory high cells moving across central Texas following a Polar front. In the latter case, the discontinuity exists between the modified return flow from the gulf and dry fresh mP air to the west.

(2) The trough usually remains quasistationary until picked up by an upper short wave moving across from Arizona, and then the trough generally moves eastward ahead of the wave. Since the trough line is a true air mass boundary, it determines whether a cold front will be wet or dry in this area, when to forecast 100 plus temperatures and the formation and movement of squall lines in the spring.

SECTION III

CLIMATIC AIDS

3000. CLIMATIC AIDS.

The information contained in this section has been drawn from all sources available unless specifically stated on the graph or table. Sources were:

a. Data Processing Division Summaries.

b. ESSA Weather Bureau Climatic Data.

c. Original Weather Records from Laughlin and Del Rio Weather Bureau.

EXTREME WEATHER CONDITIONS Del Rio* and Laughlin AFB, Texas (Jan 1906–Nov 1970					
MONTH	MAXIMUM TEMPERATURE (°F)	MINIMUM TEMPERATURE (°F)	MAXIMUM PRECIPITATION (Inches)	MINIMUM PRECIPITATION (Inches)	MAXIMUM WIND (Knots)
JANUARY	92 (1911)	8 (1962)	4.32 (1958)	T (1912)	NW 40 (1918) (1958)
FEBRUARY	96 (1918)	11 (1951)	7.82 (1949)	0.00 (1925)	W 50 (1958)
MARCH	103 (1928)	19 (1922)	2.53 (1954)	T (1959)	W 54 (1935)
APRIL	106 (1907)	33 (1939)	9.91 (1957)	T (1953) (1955)	W 55 (1965) (1966)
MAY	109 (1912)	46 (1908)	8.91 (1914)	0.02 (1956)	NW 72 (1970)
JUNE	111 (1910)	49 (1919)	13.71 (1935)	T (1911)	SW 71 (1968)
JULY	110 (1954)	63 (1923)	8.89 (1906)	T (1951) (1957)	ESE 62 (1967)
AUGUST	109 (1969)	60 (1915)	5.89 (1932)	0.00 (1907)(1924) (1943)(1952)	ESE 77 (1970)*
SEPTEMBER	106 (1952)	43 (1908)	15.79 (1964)	T (1932)	N 51 (1960)
OCTOBER	102 (1951) (1956)	30 (1966)	11.69 (1930)	0.00 (1917)	NW 43 (1918)
NOVEMBER	95 (1949)	17 (1906)	4.54 (1913)	0.00 (1917)	NNW 46 (1970)
DECEMBER	89 (1955)	17 (1953) (1966)	3.93 (1937)	T (1950)	NW 39 (1952)

FIG. III-1 Table of Extreme Weather Conditions

3010. **TEMPERATURES.**

The curves for the monthly mean and extreme temperatures are shown on page 3-4. Source of data was Data Processing Summary for 1943 to 1963 on mean temperatures. For extremes, original records JAN 64 through JUN 1970 were also used.

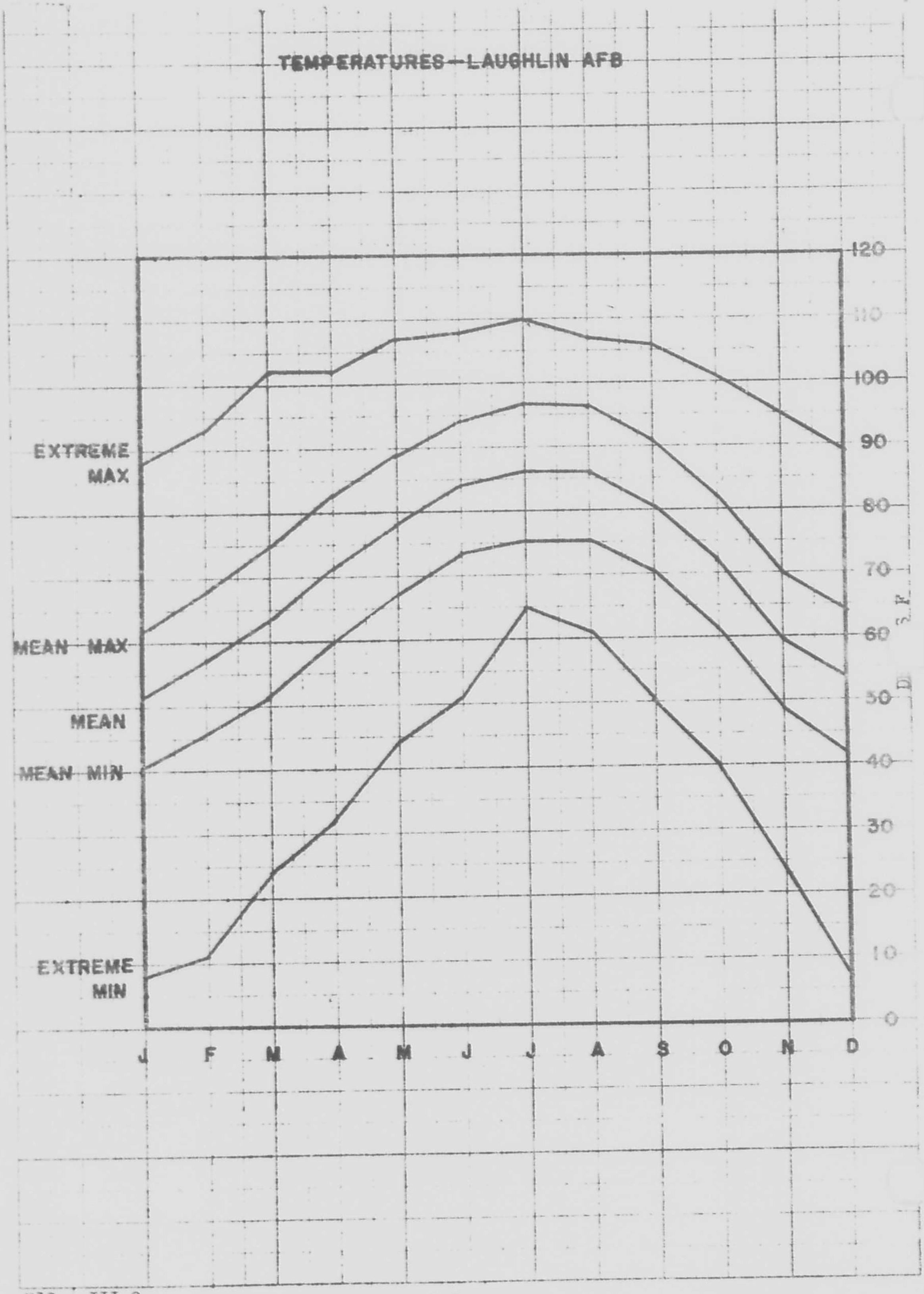
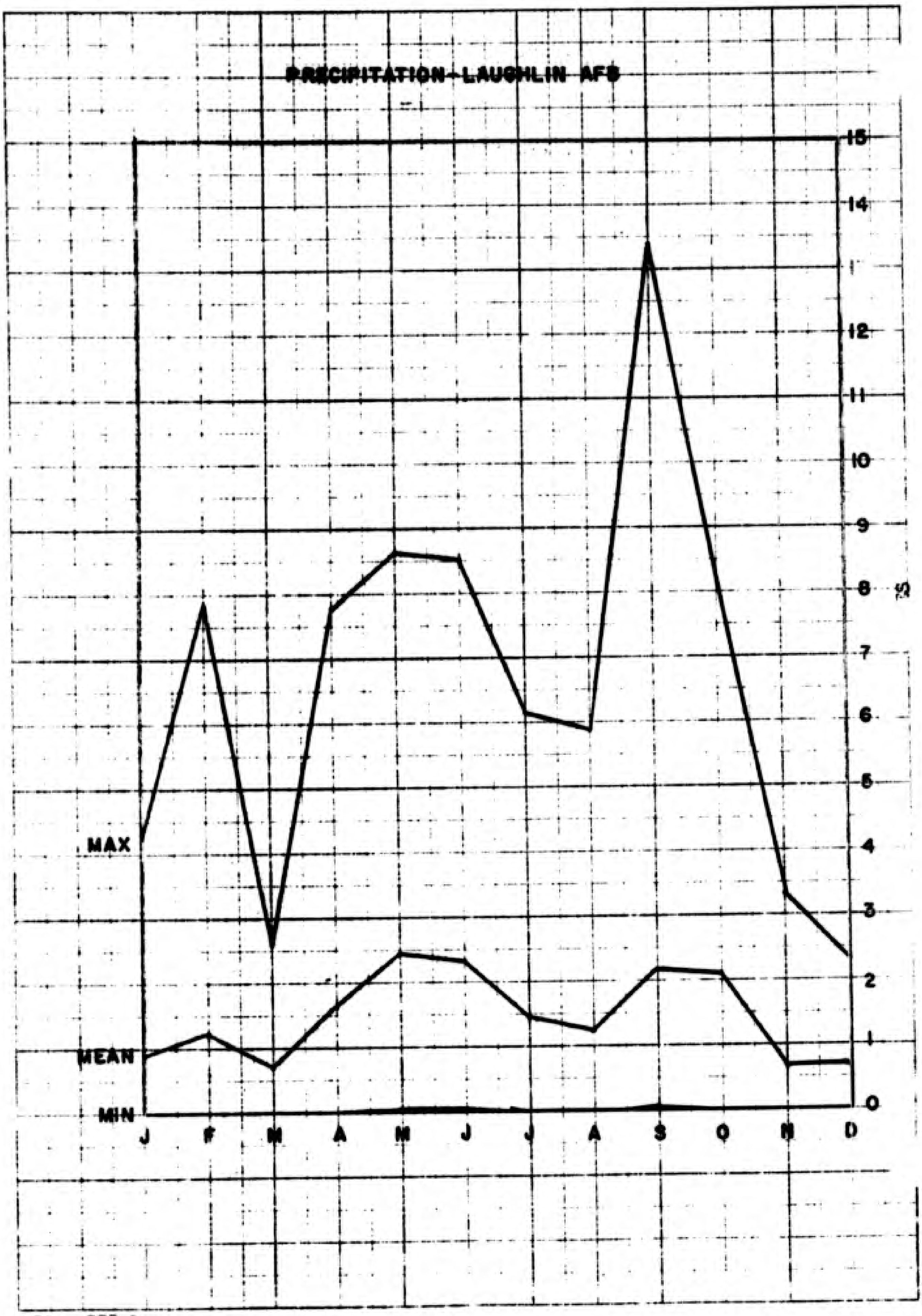

TEMPERATURES—LAUGHLIN AFB
EXTREME MAX
MEAN MAX
MEAN
MEAN MIN
EXTREME MIN
J F M A M J J A S O N D
120
110
100
90
80
70
60
50
40
30
20
10
0

FIG. III-2

3020. **PRECIPITATION.**

Mean annual precipitation monthly for Laughlin including extremes is shown on page 3-6. Mean is computed from 1943 through 1967. Extreme data valid from 1943 through June 1970. Mean annual total is 17.48 inches.


PRECIPITATION - LAUGHLIN AFB
MAX
MEAN
MIN
15
14
12
11
10
9
8
7
6
5
4
3
2
1
0
J
F
M
A
M
J
J
A
S
O
N
D

3030. <u>CEILING AND/OR VISIBILITY</u>.

Ceiling and/or visibility values are expressed in percentage of time and time of day on the following graphs. Source for these graphs was Part D of the revised Uniform Summary of Surface Observations for Laughlin. Data covers the periods Mar 43 to Sep 45 and Aug 46 to Aug 67.

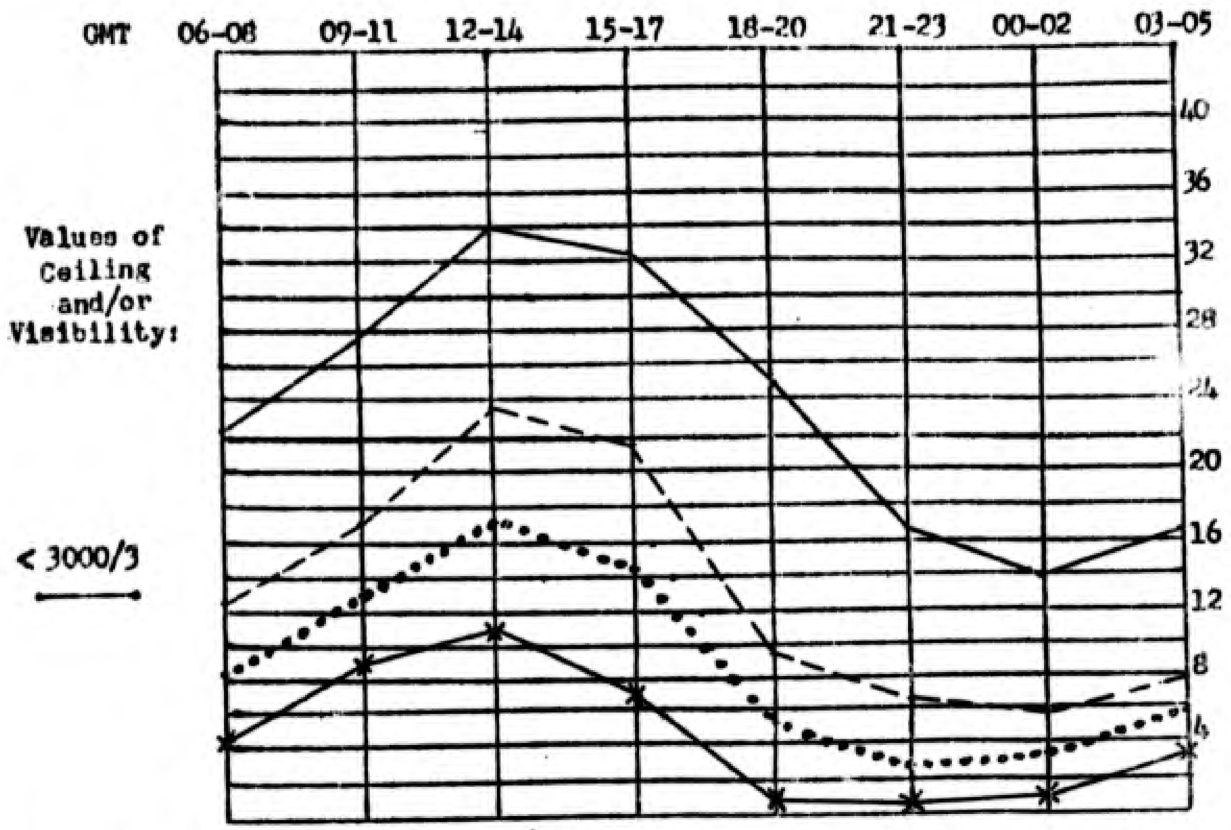


FIG. III-4 (January)

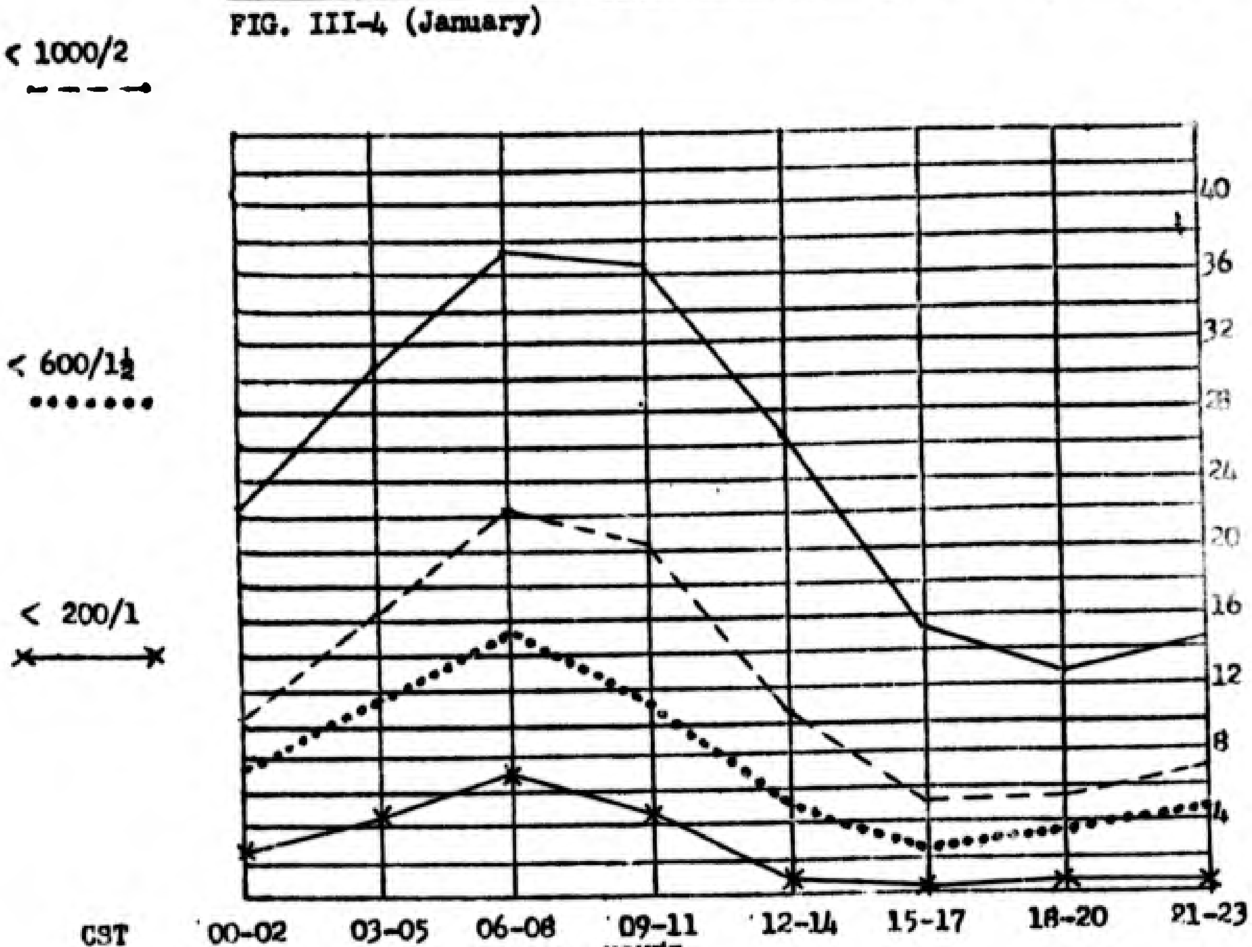


FIG. III-5 (February)

Frequency of Specific Ceilings and/or Visibilities at Laughlin AFB

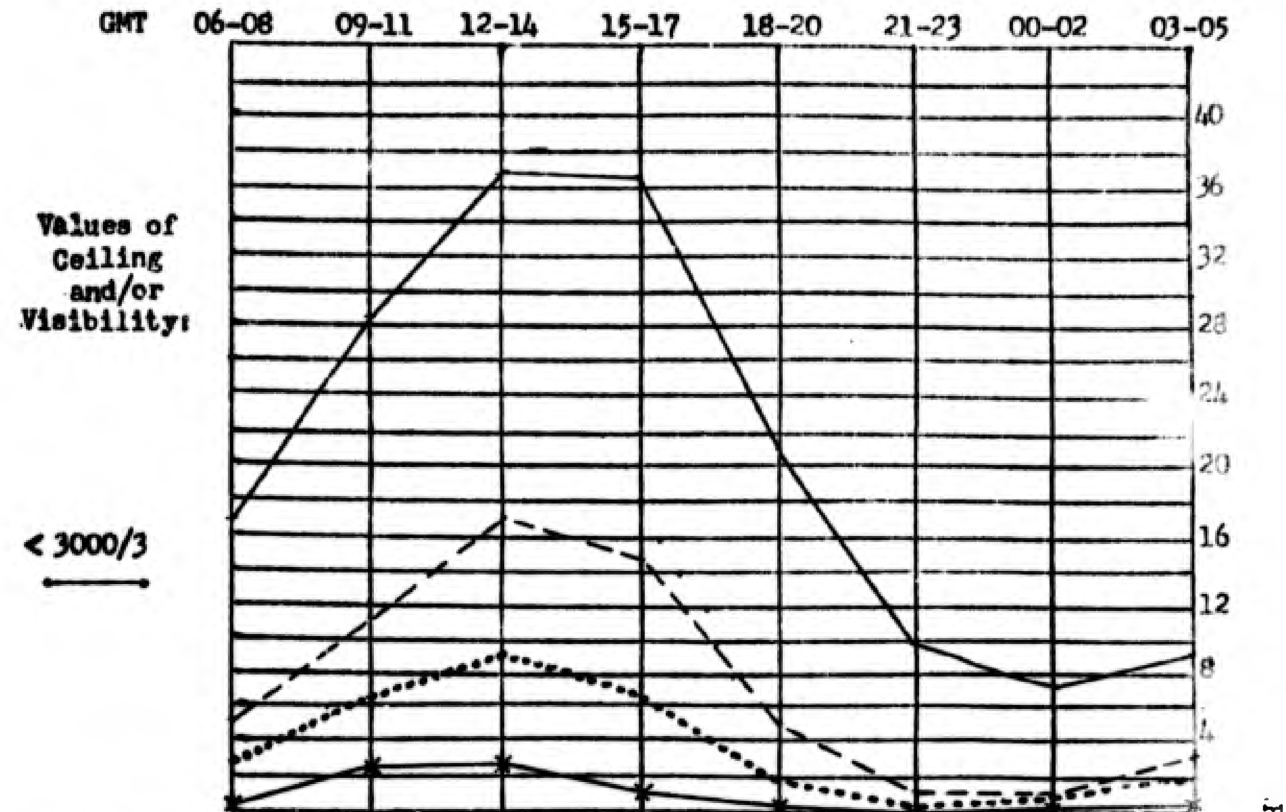


FIG. III-6 (March)

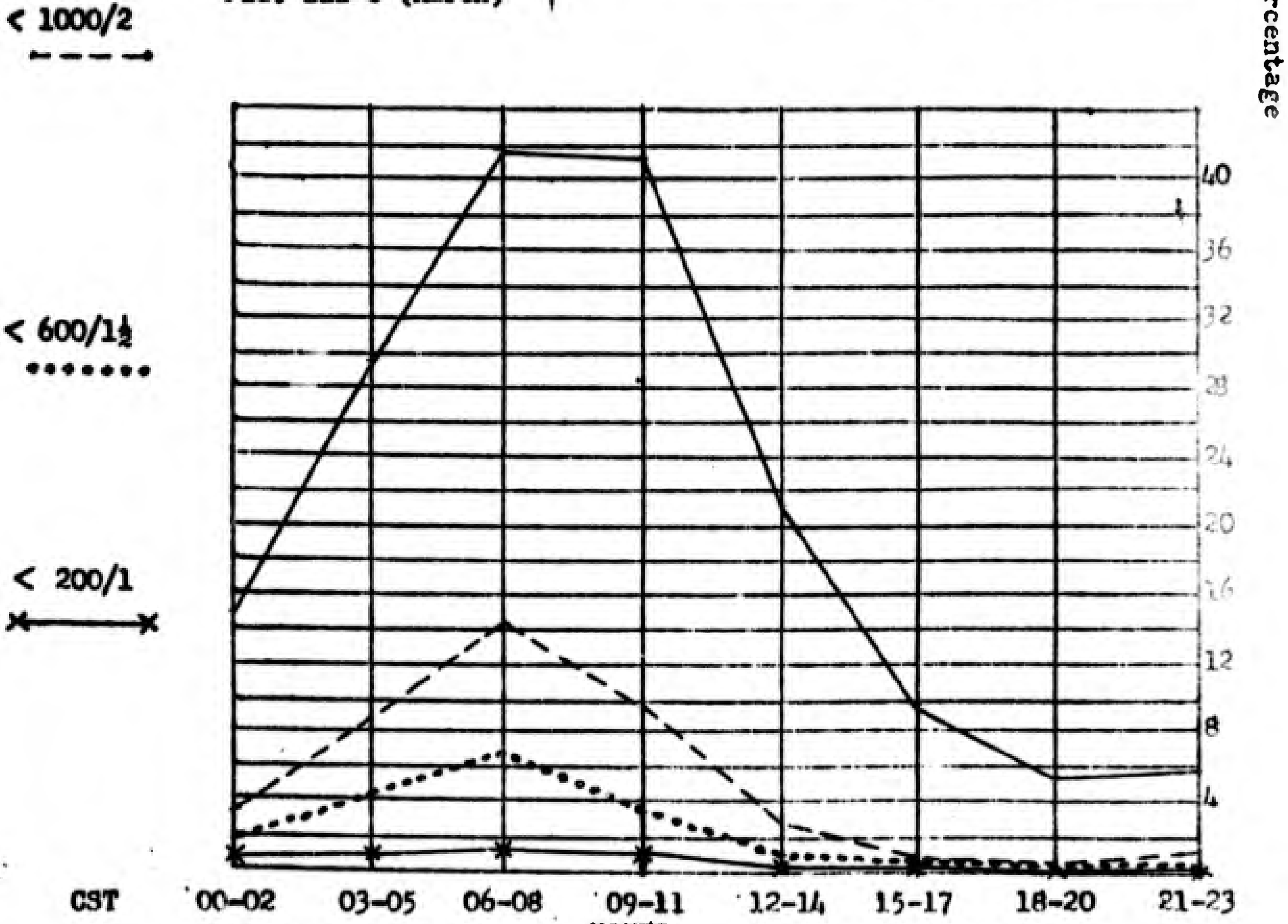


FIG. III-7 (April)

HOURS

Frequency of Specific Ceilings and/or Visibilities at Laughlin AFB

GMT

Values of Ceiling and/or Visibility:

< 3000/3 ———

< 1000/2 - - - -

< 600/1½ ••••••

< 200/1 ×——×

Percentage

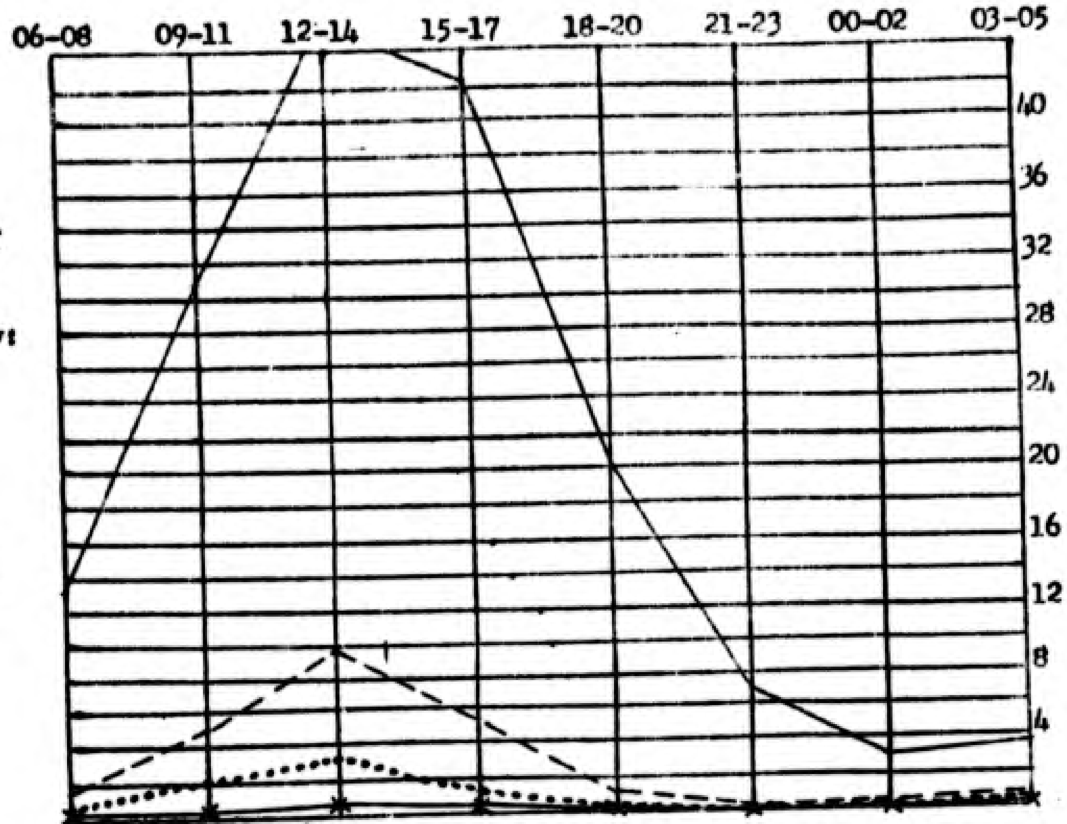
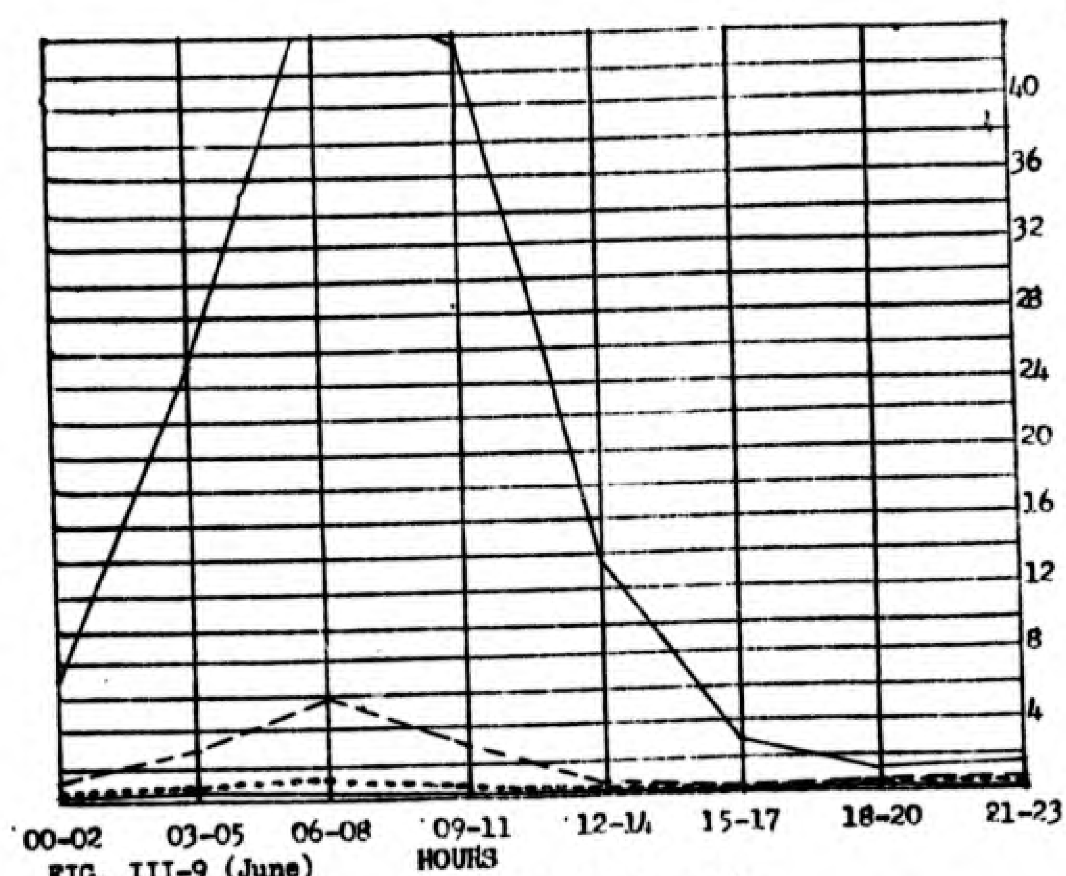


FIG. III-8 (May)



CST

FIG. III-9 (June)

Frequency of Specific Ceilings and/or Visibilities at Laughlin AFB

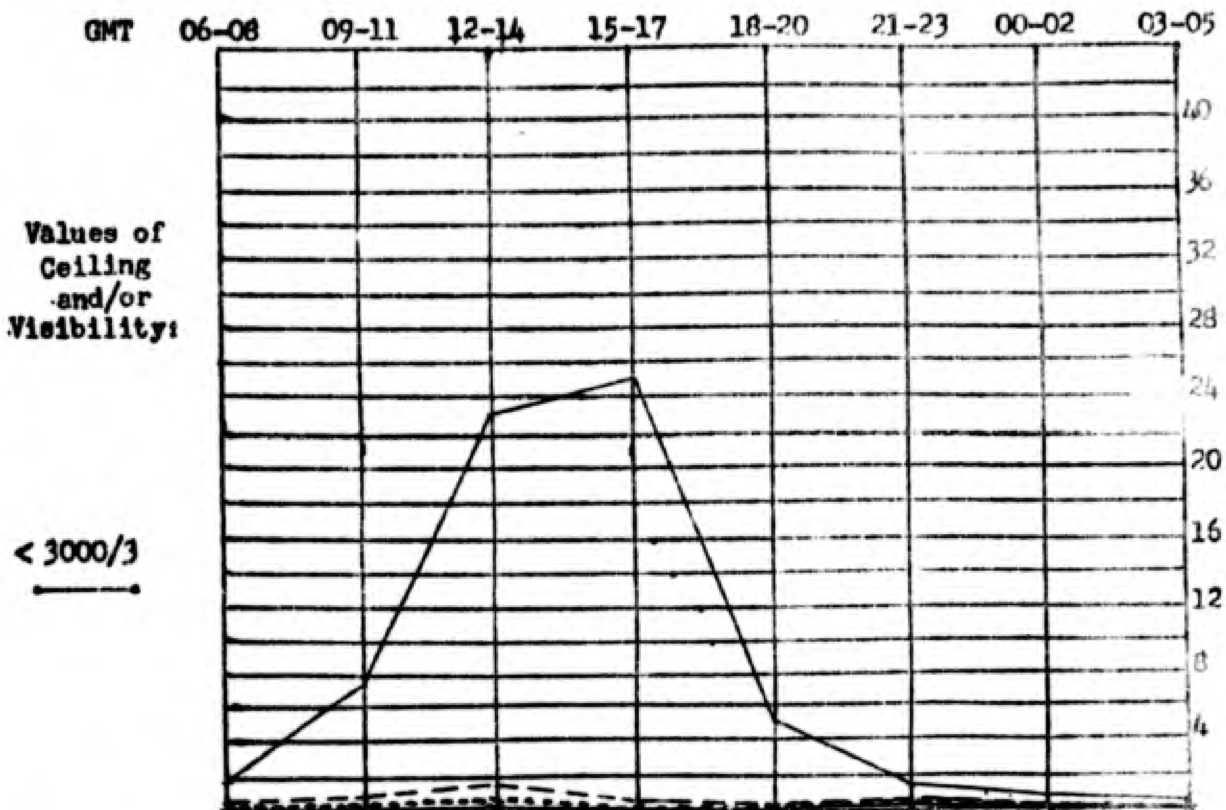


FIG. III-10 (July)

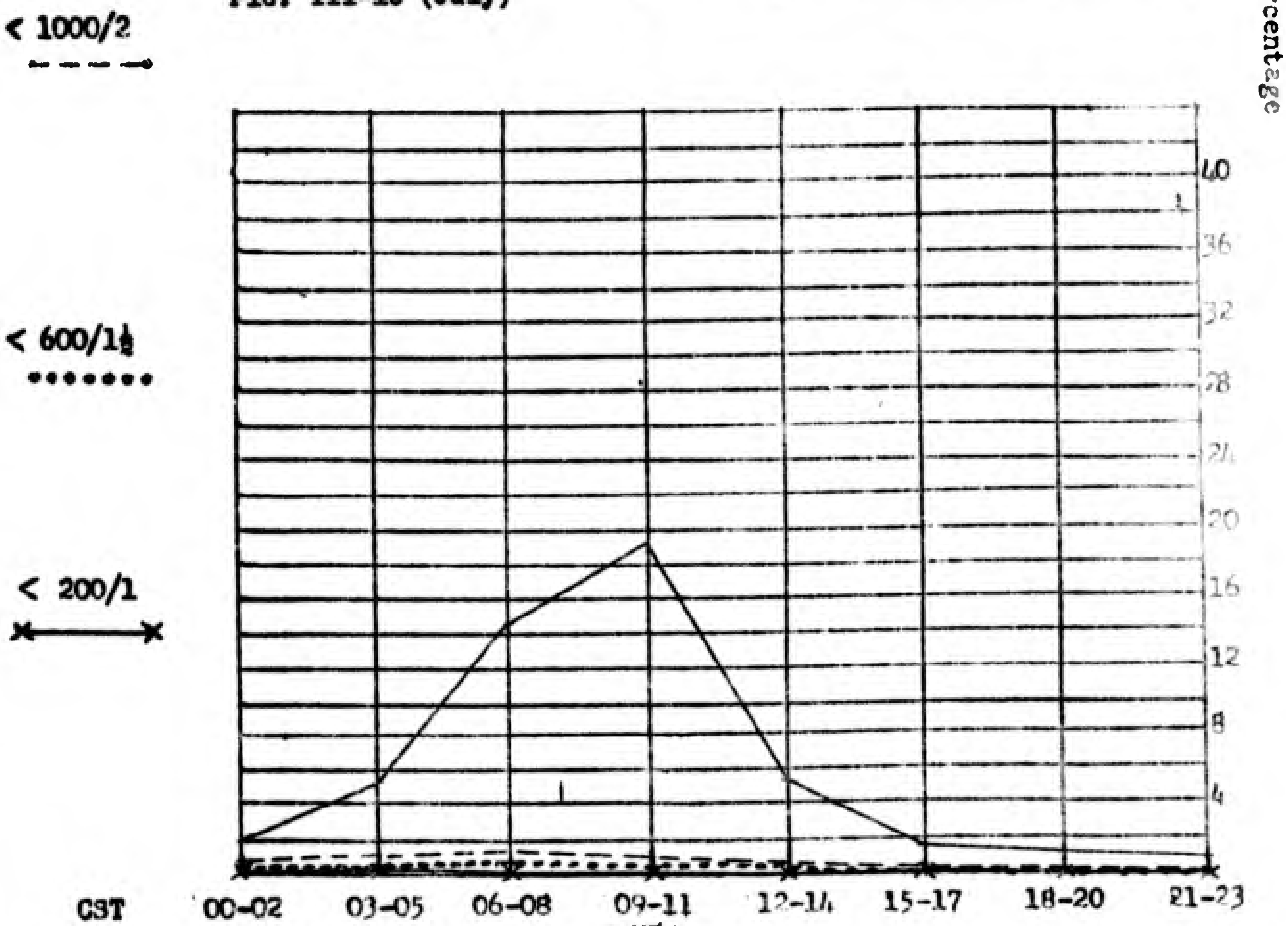


FIG. III-11 (August) HOURS

Frequency of Specific Ceilings and/or Visibilities at Laughlin AFB

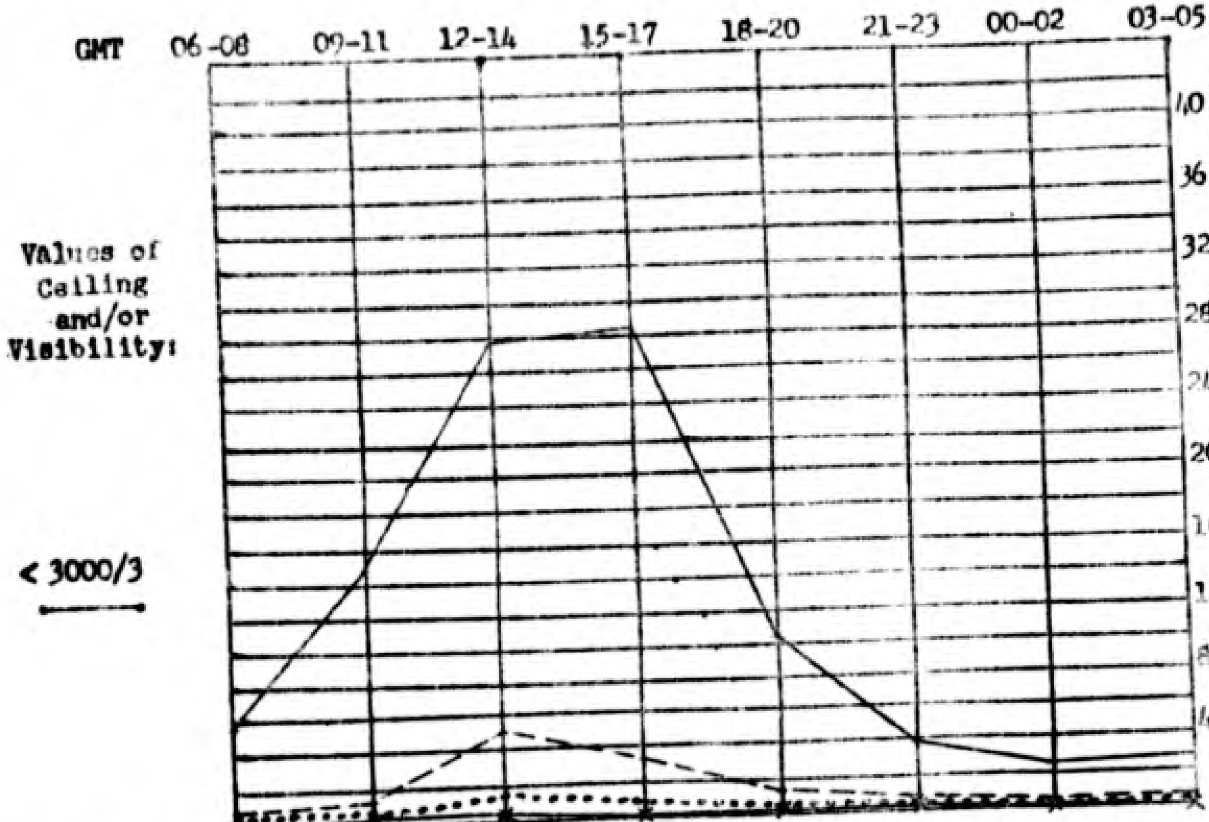


FIG. III-12 (September)

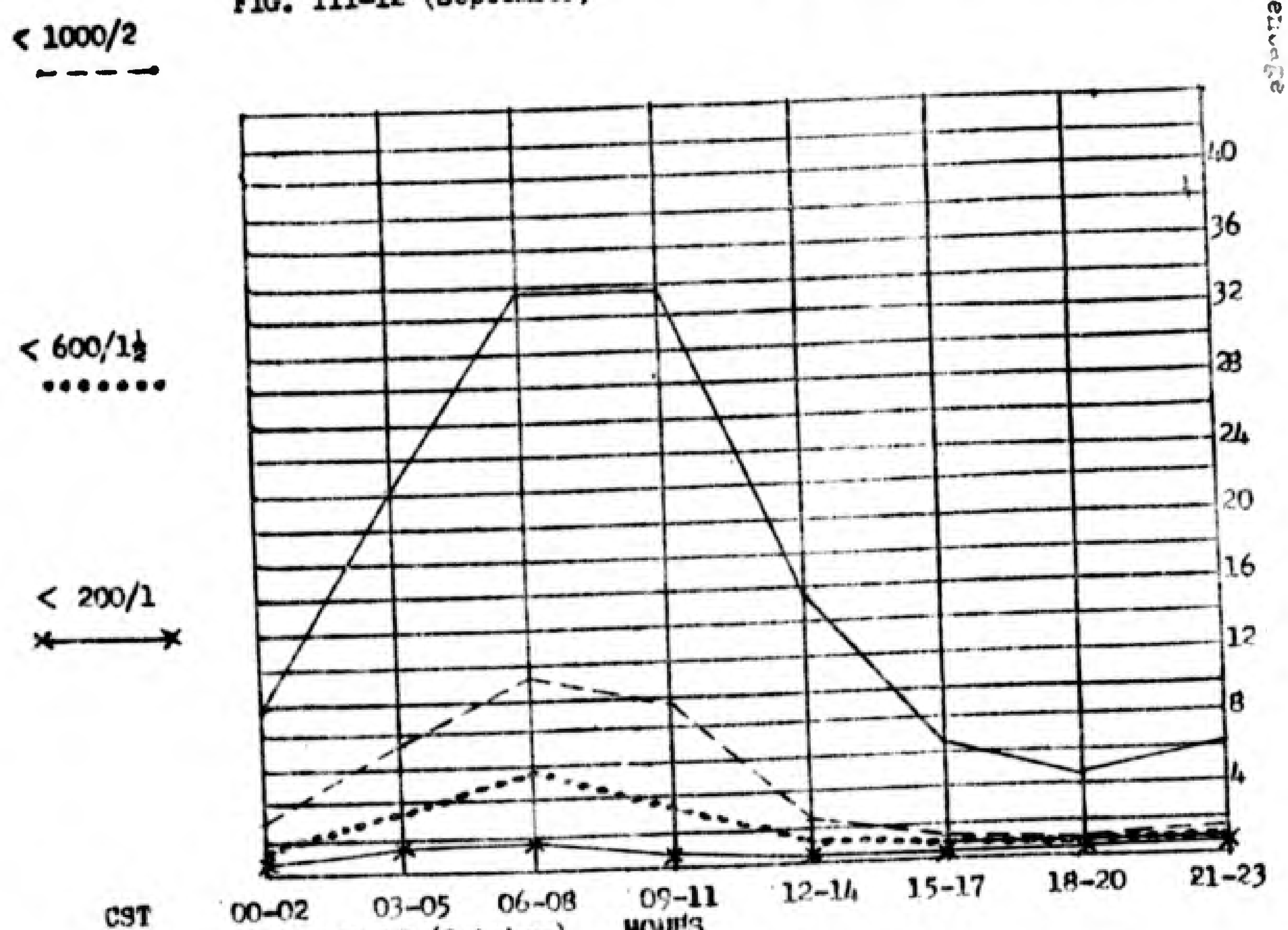


FIG. III-13 (October)

Frequency of Specific Ceilings and/or Visibilities at Laughlin AFB

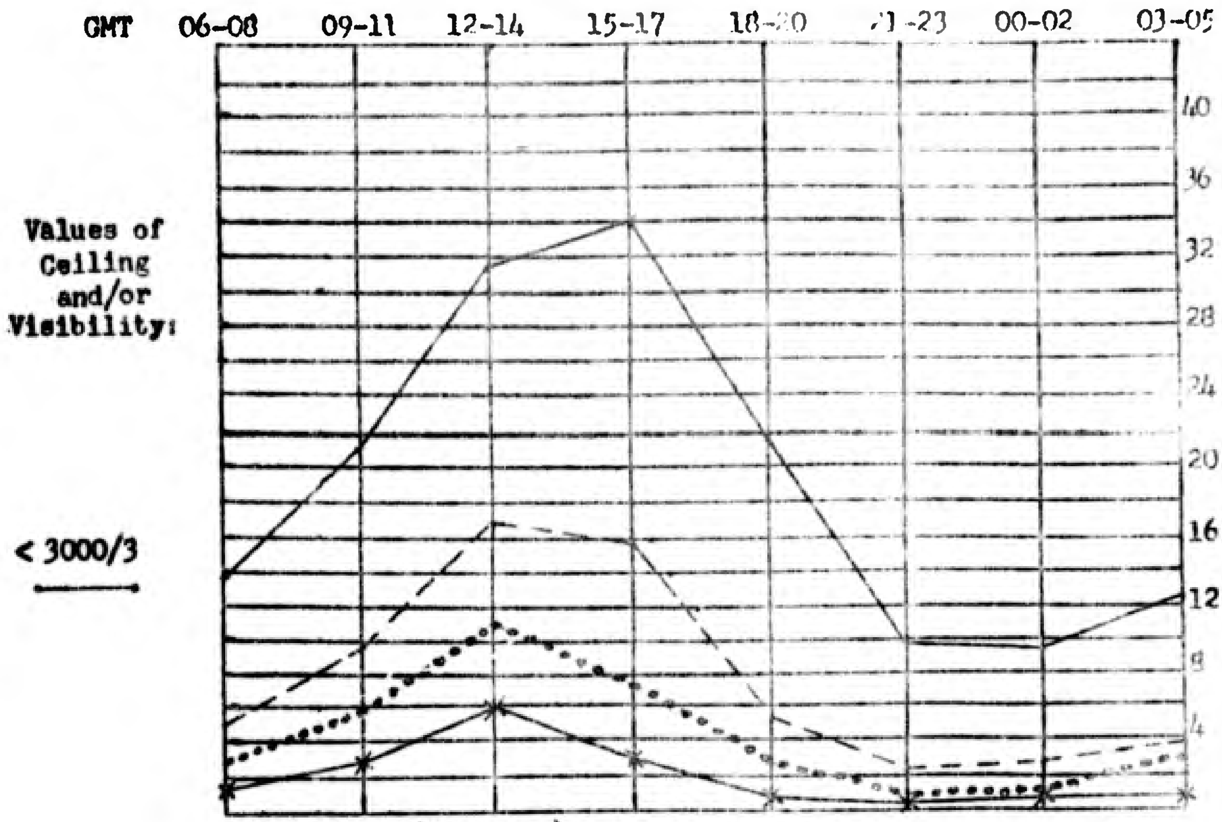


FIG. III-14 (November)

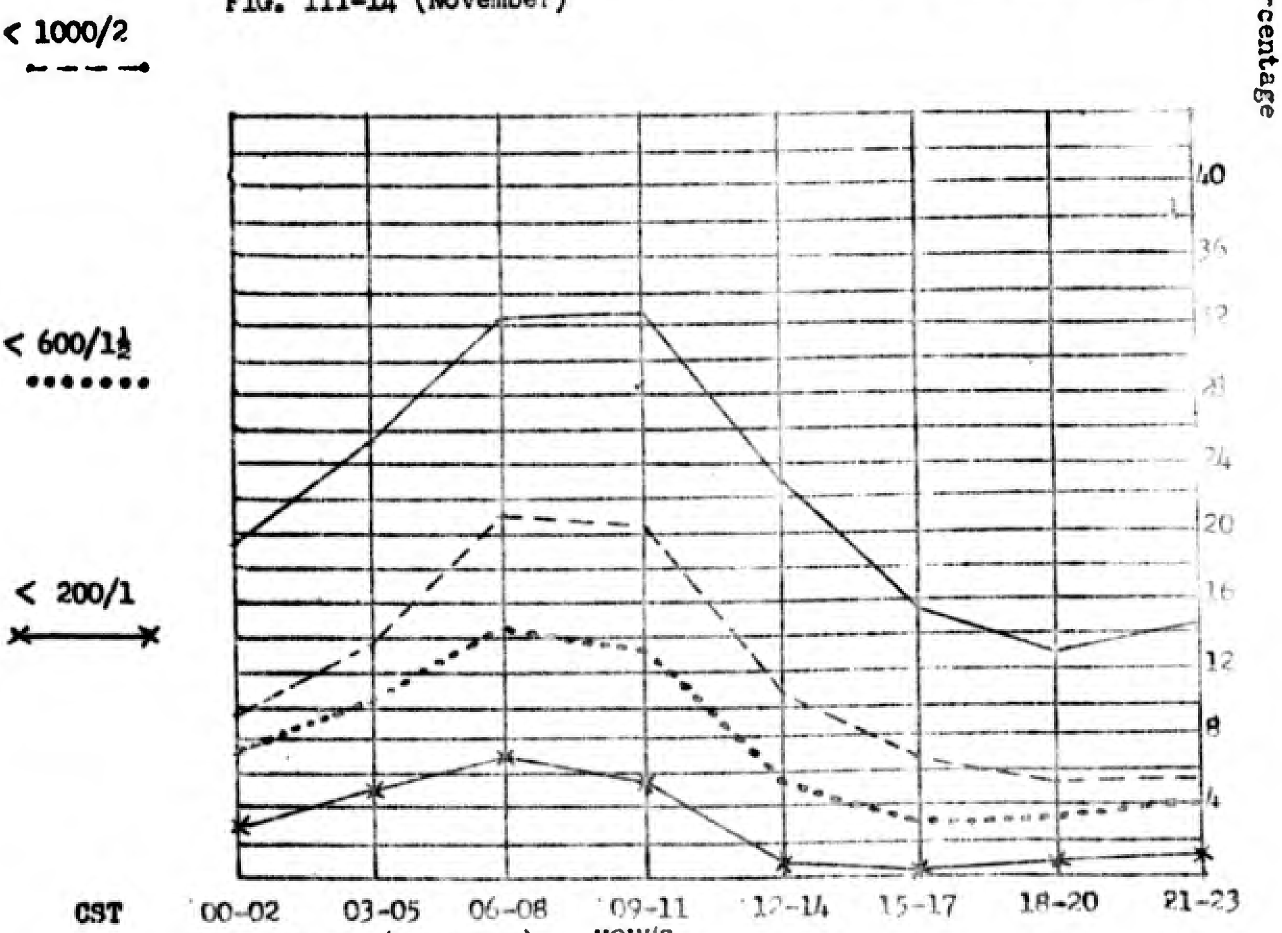


FIG. III-15 (December) HOURS

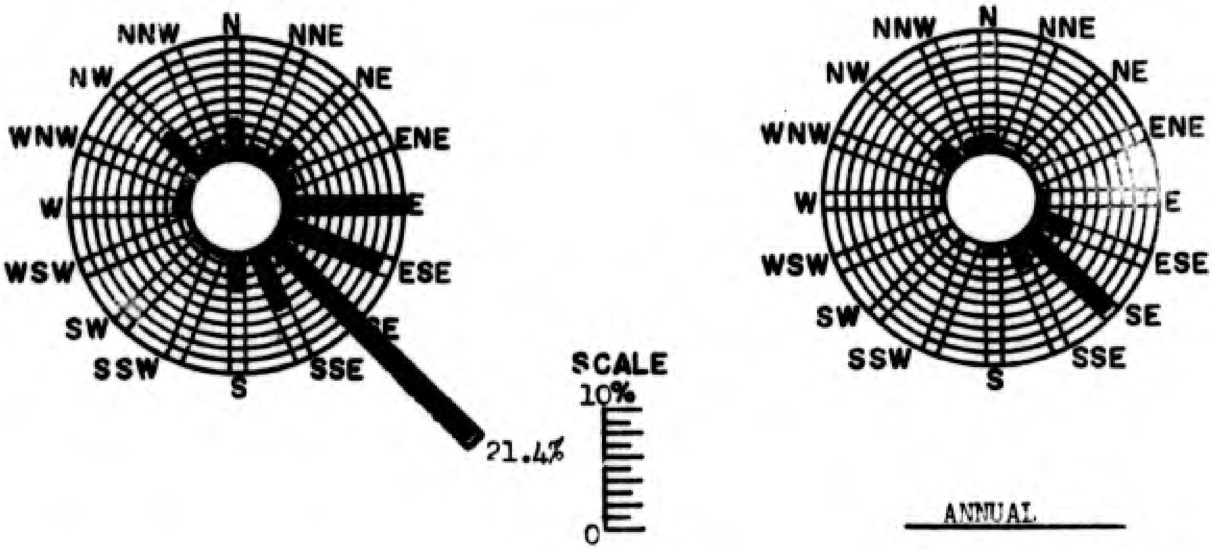
Frequency of Specific Ceilings and/or Visibilities at Laughlin AFB

3040. ANNUAL AND MONTHLY WIND ROSES.

These wind roses were constructed from data contained in Part C of the revised Uniform Summary of Surface Weather Observations for Laughlin.

SURFACE WINDS

CALM(9.1 %) LESS THAN 11 KTS(68.0 %) EQUAL TO GREATER THAN 11 KTS(22.9%

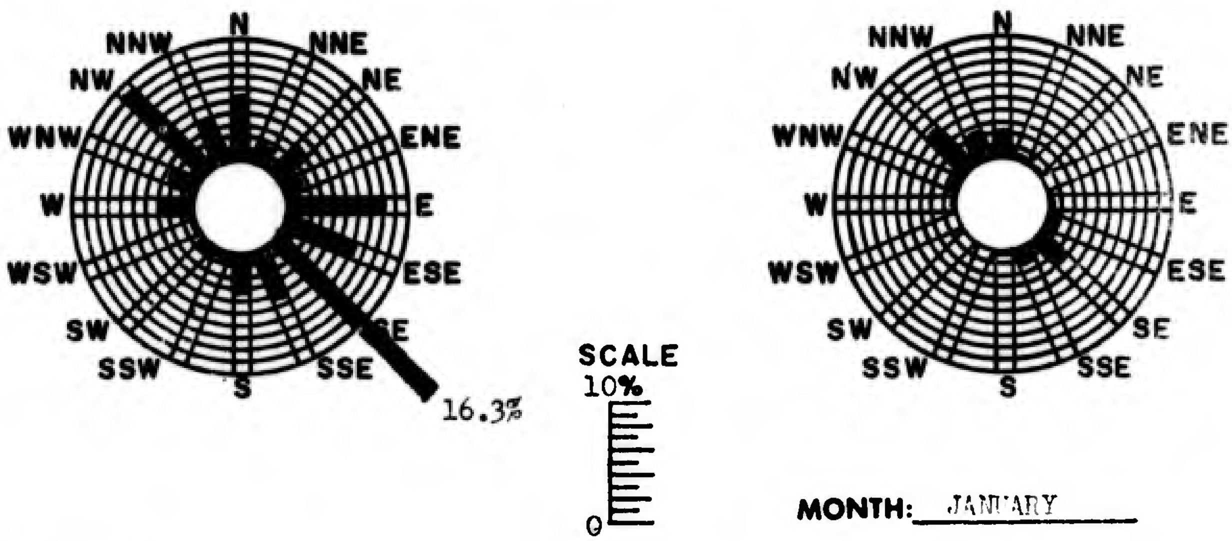


ANNUAL

FIG. III-16

SURFACE WINDS

CALM(14.1 %) LESS THAN 11 KTS(69.4 %) EQUAL TO GREATER THAN 11 KTS(16.5



MONTH: JANUARY

FIG. III-17

SURFACE WINDS

CALM(9.5 %) LESS THAN 11 KTS(66.8 %) EQUAL TO GREATER THAN 11 KTS(23.7

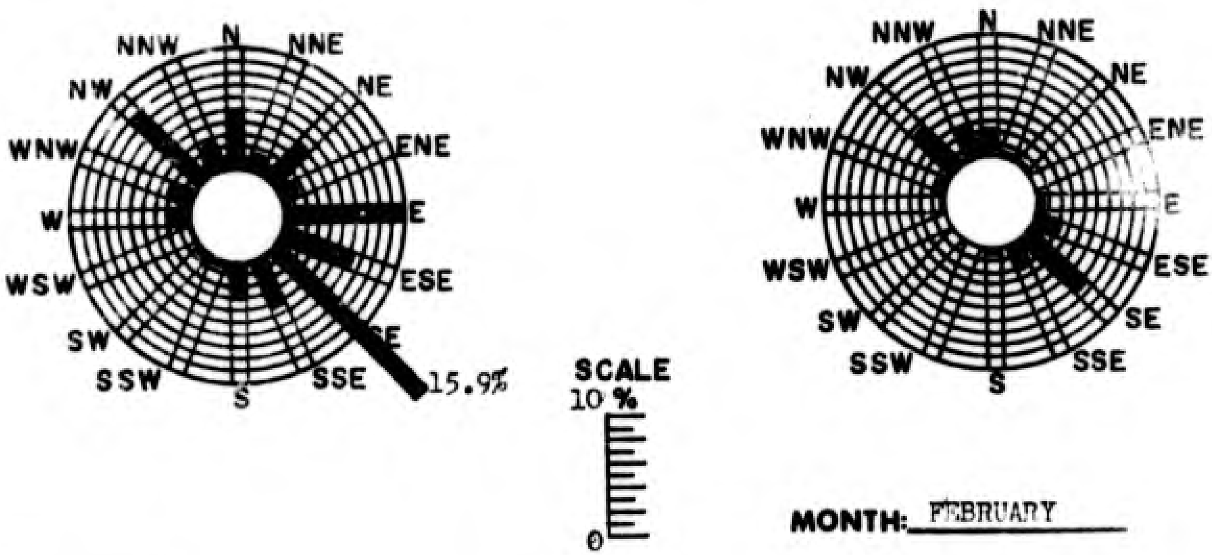


FIG. III-18

SURFACE WINDS

CALM(7.9 %) LESS THAN 11 KTS(63.9 %) EQUAL TO GREATER THAN 11 KTS(28.2

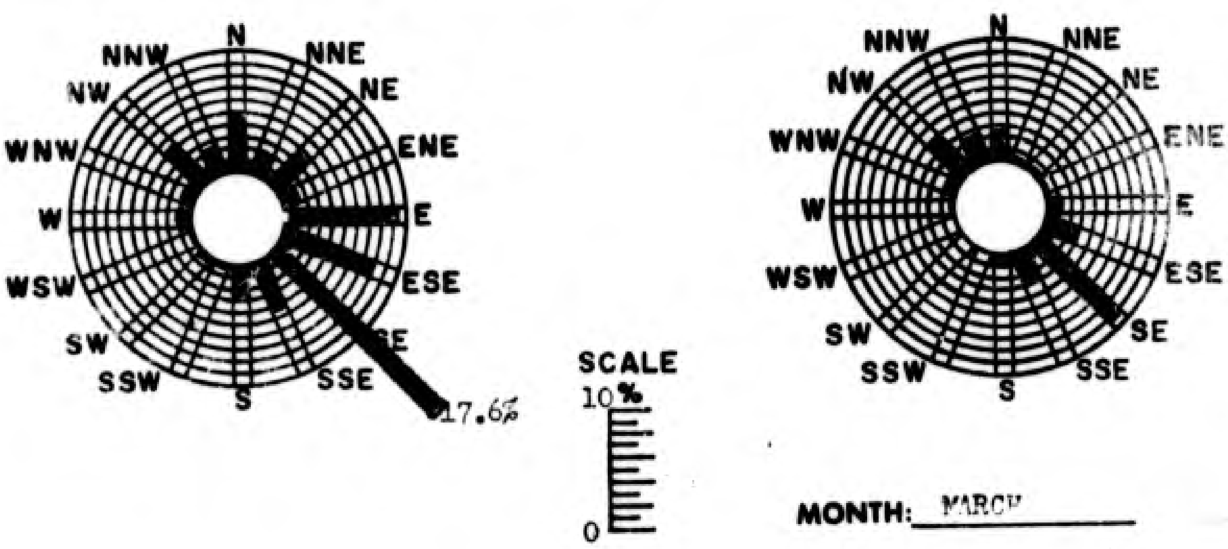


FIG. III-19

SURFACE WINDS

CALM(6.3 %) LESS THAN 11 KTS(61.6 %) EQUAL TO GREATER THAN 11 KTS(32.1%

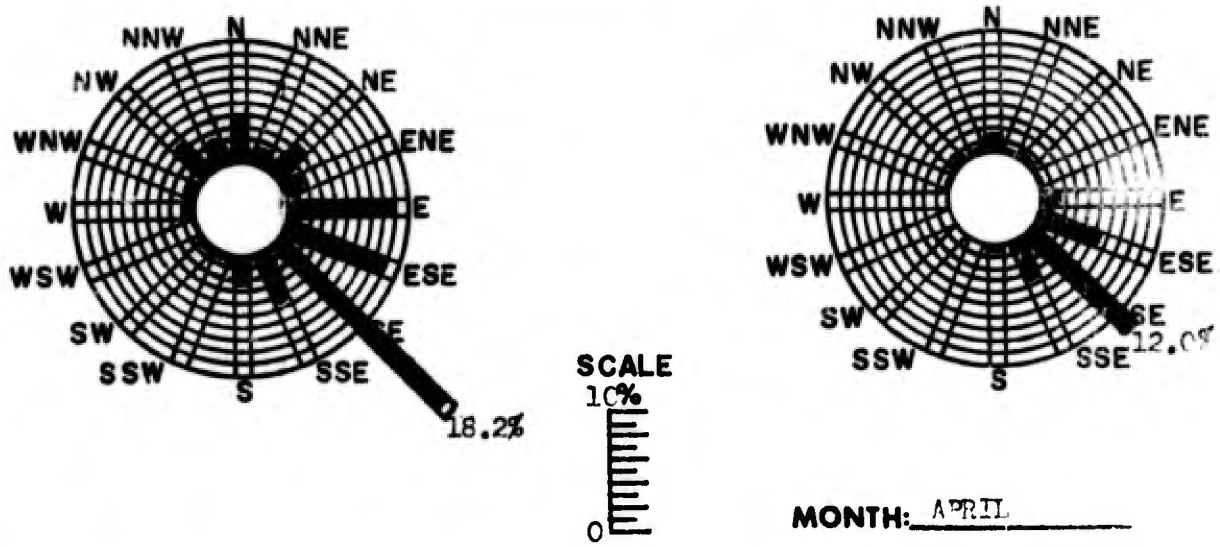


FIG. III-20

SURFACE WINDS

CALM(5.2 %) LESS THAN 11 KTS(62 %) EQUAL TO GREATER THAN 11 KTS(32.8

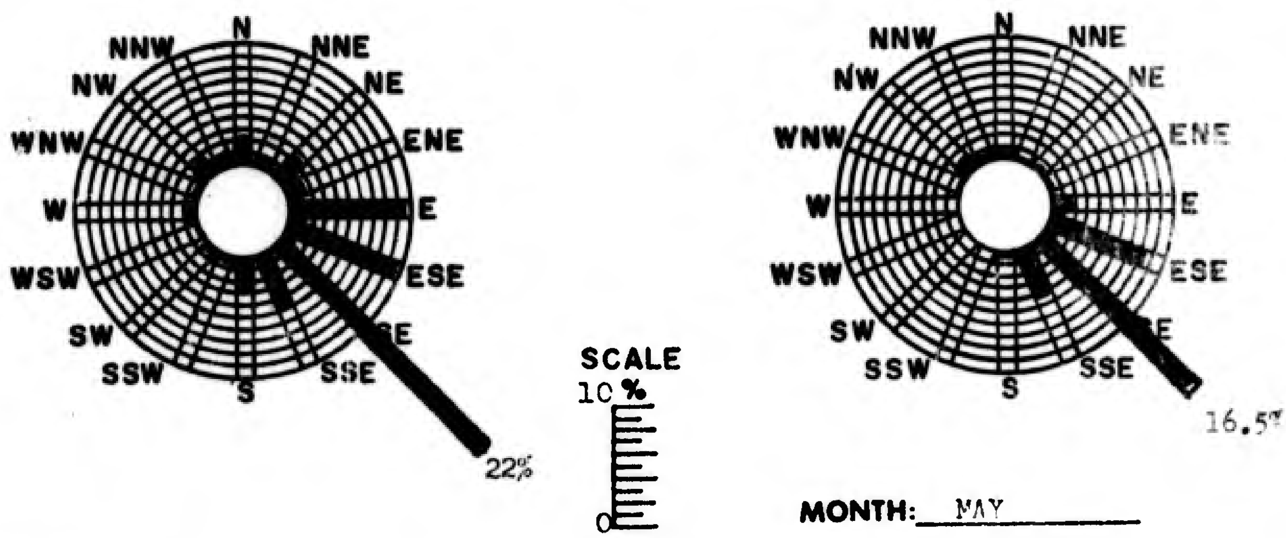


FIG. III-21

SURFACE WINDS

CALM(3.9% %)   LESS THAN 11 KTS(59.7 %)   EQUAL TO GREATER THAN 11 KTS(36.4%

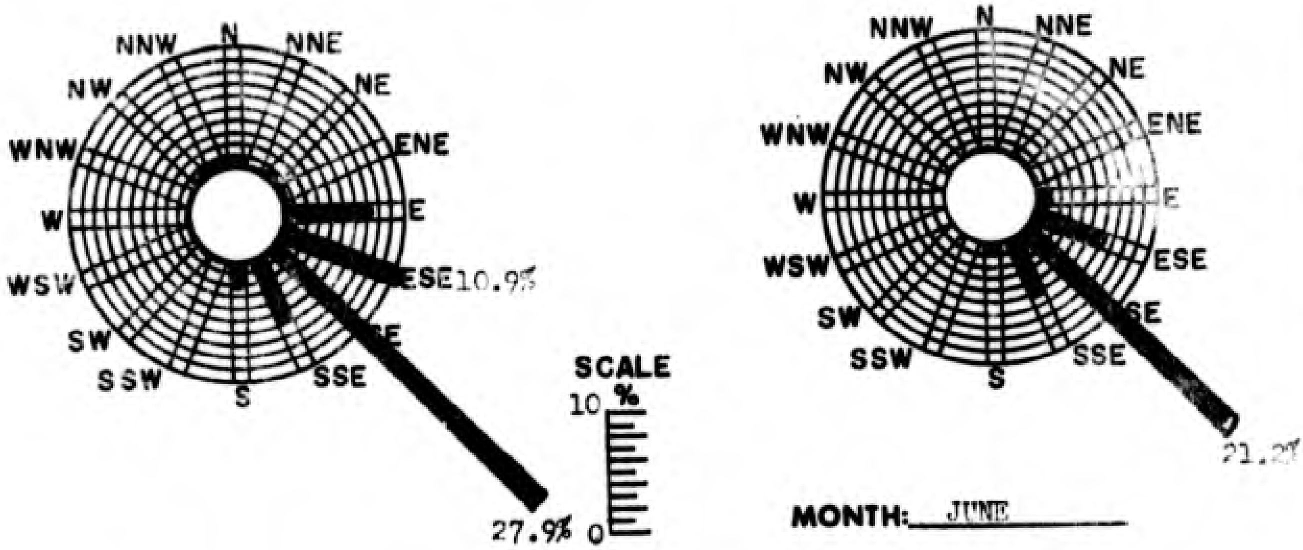


FIG. III-22

SURFACE WINDS

CALM(3.9 %)   LESS THAN 11 KTS (70.2 %)   EQUAL TO GREATER THAN 11 KTS(25.9%

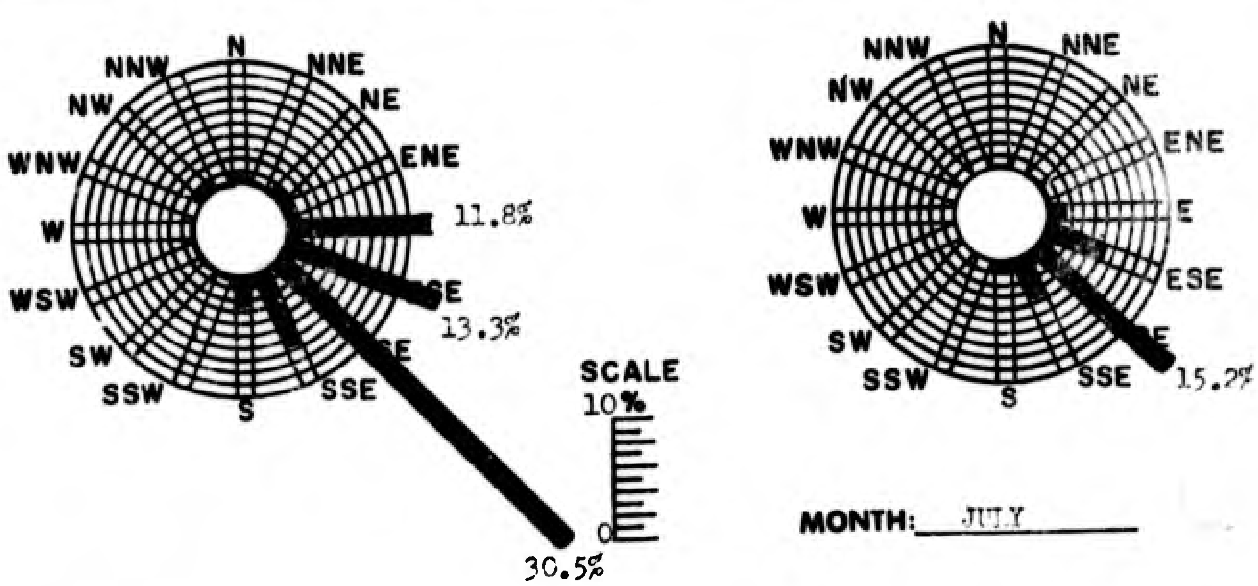
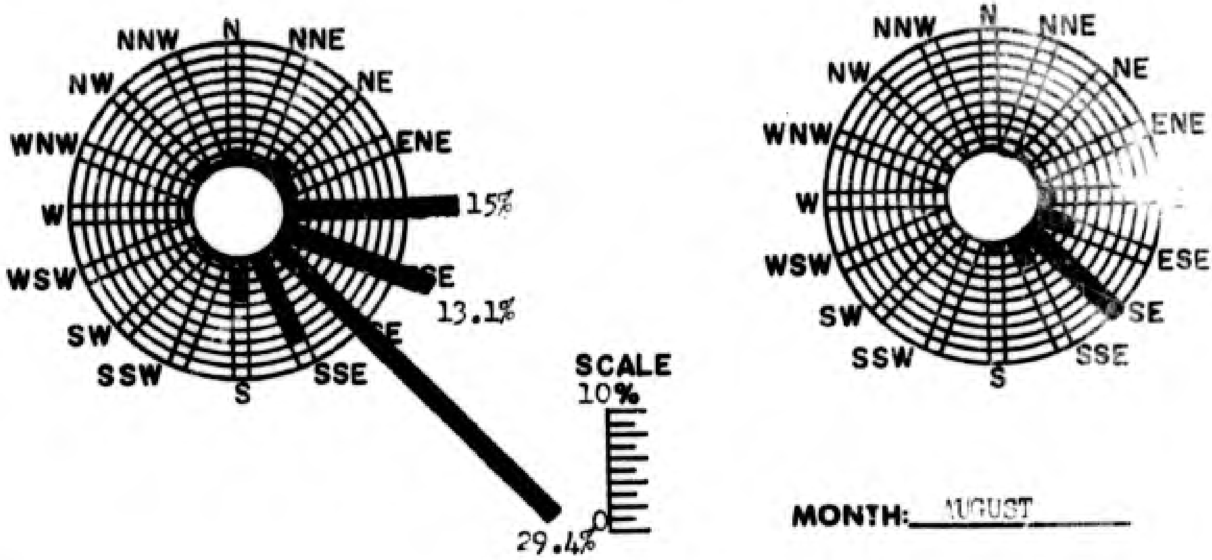


FIG. III-23

SURFACE WINDS

CALM(4.9 %)   LESS THAN 11 KTS(76.1 %)   EQUAL TO GREATER THAN 11 KTS (18.0%)

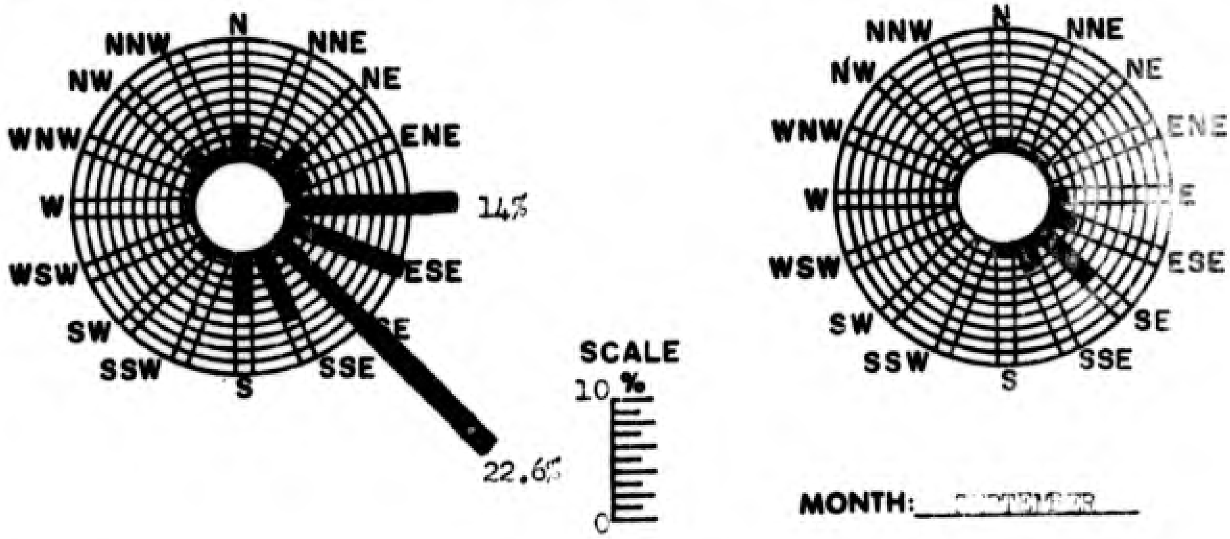


MONTH: AUGUST

FIG. III-24

SURFACE WINDS

CALM(10.3 %)   LESS THAN 11 KTS (73 %)   EQUAL TO GREATER THAN 11 KTS (15.7%



MONTH: [illegible]

FIG. III-25

SURFACE WINDS

CALM(11.6 %) LESS THAN 11KTS(73.1 %) EQUAL TO GREATER THAN 11 KTS(15.3%

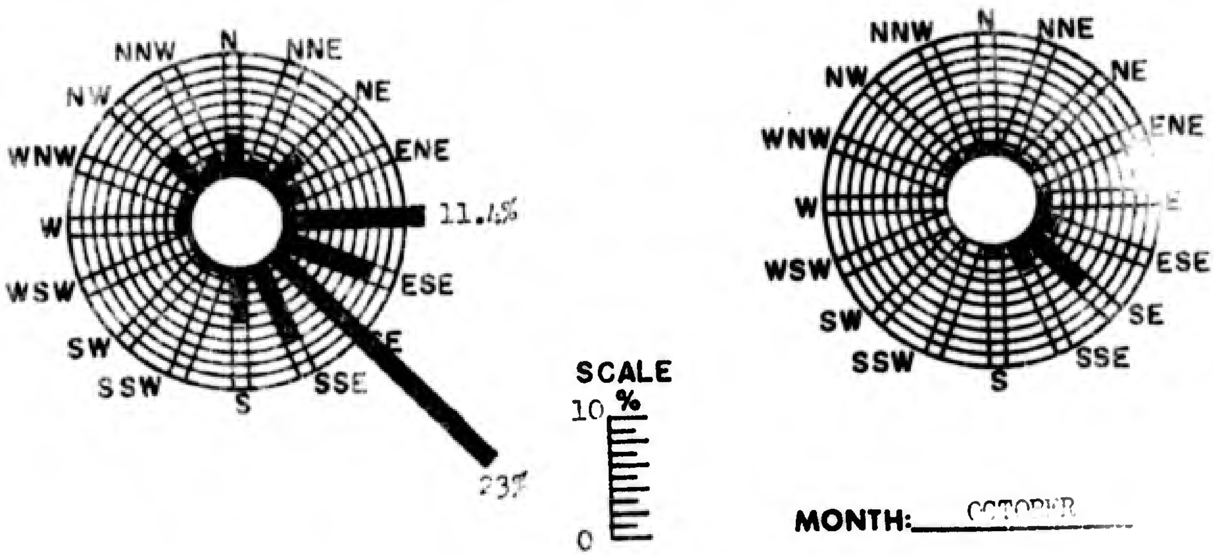


FIG. III-26

SURFACE WINDS

CALM(15.9 %) LESS THAN 11 KTS (70.7 %) EQUAL TO GREATER THAN 11 KTS(13.4%

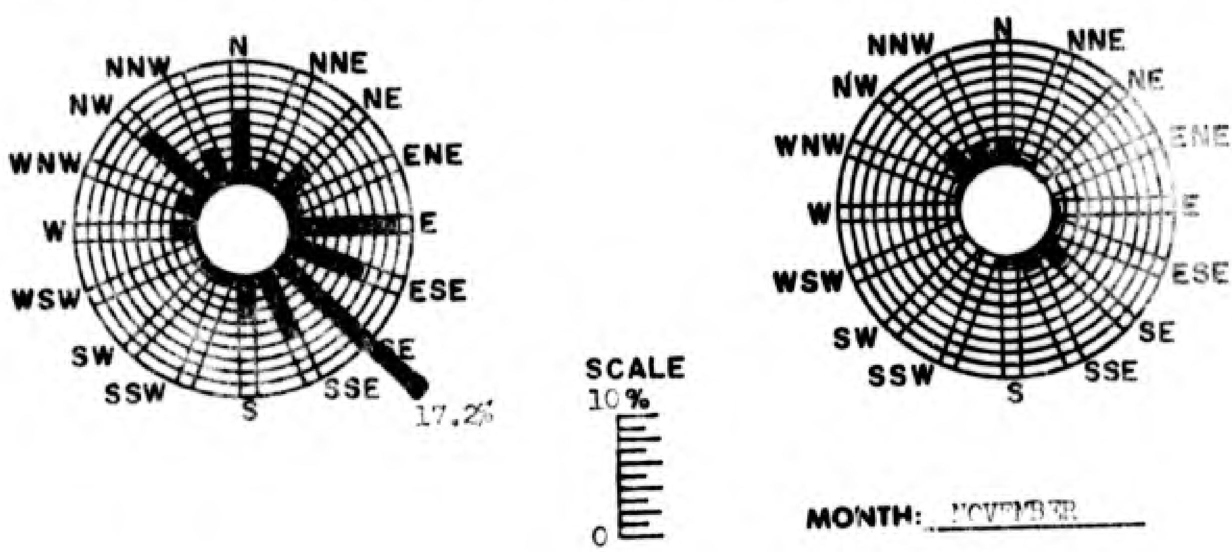


FIG. III-27

SURFACE WINDS

CALM(17.0 %) LESS THAN 11 KTS(70.0 %) EQUAL TO GREATER THAN 11 KTS(13.0%

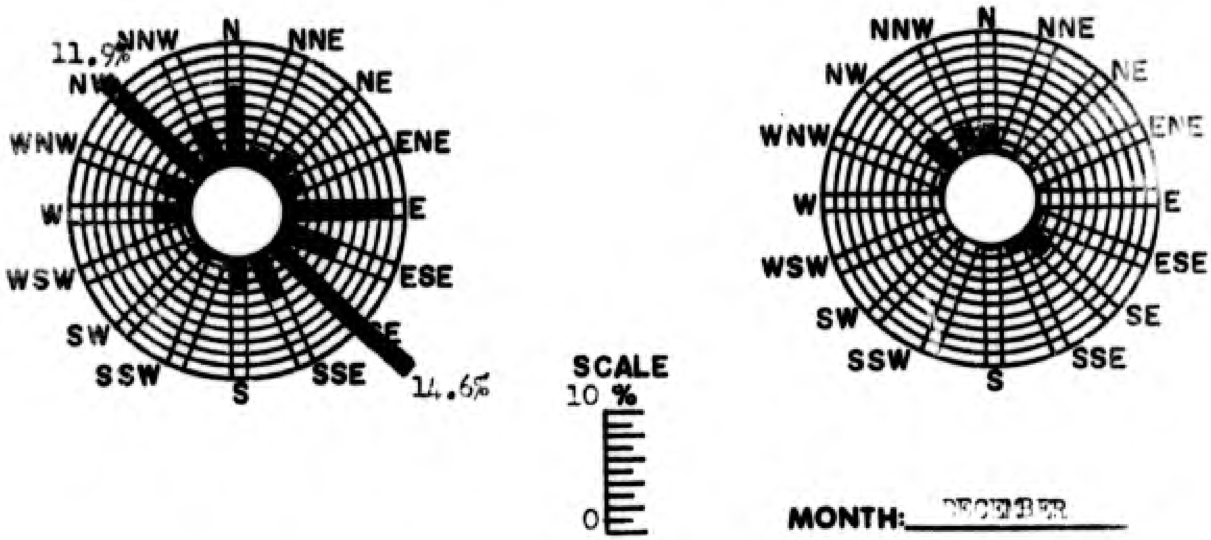


FIG. III-28

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LAUGHLIN AFB, TEXAS

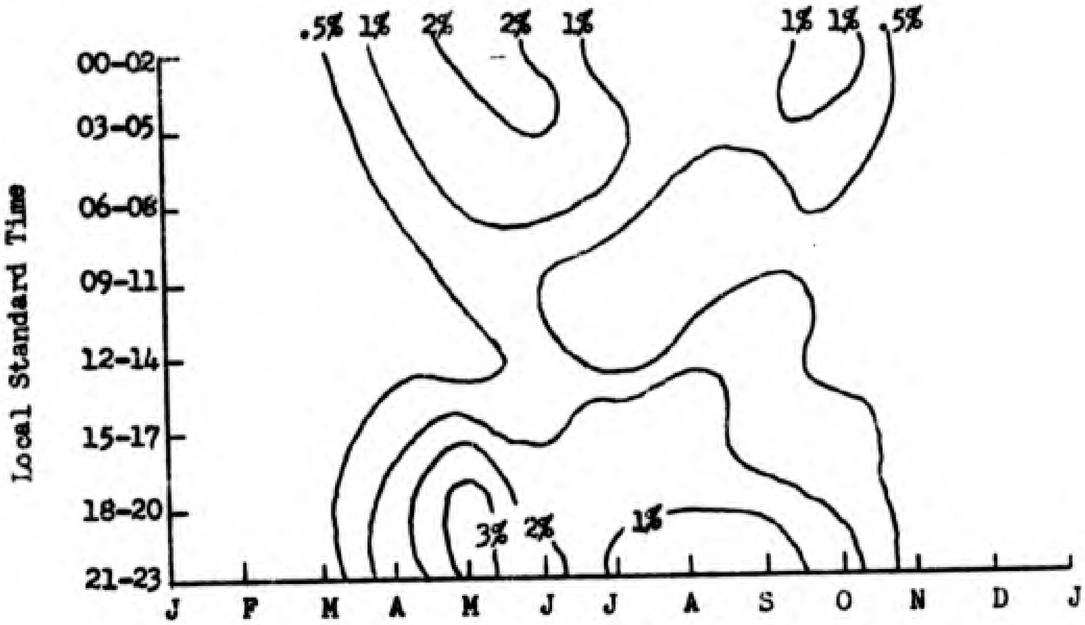


FIG III-29 Percent Frequency of Occurrence of Thunderstorms from hourly observations by hour and month.

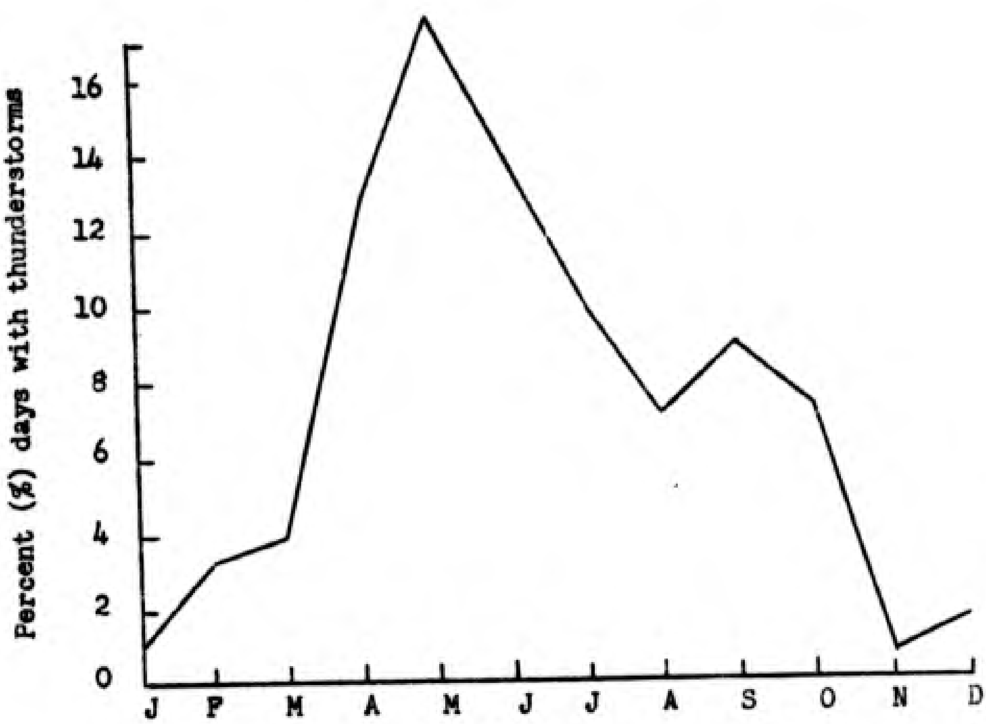
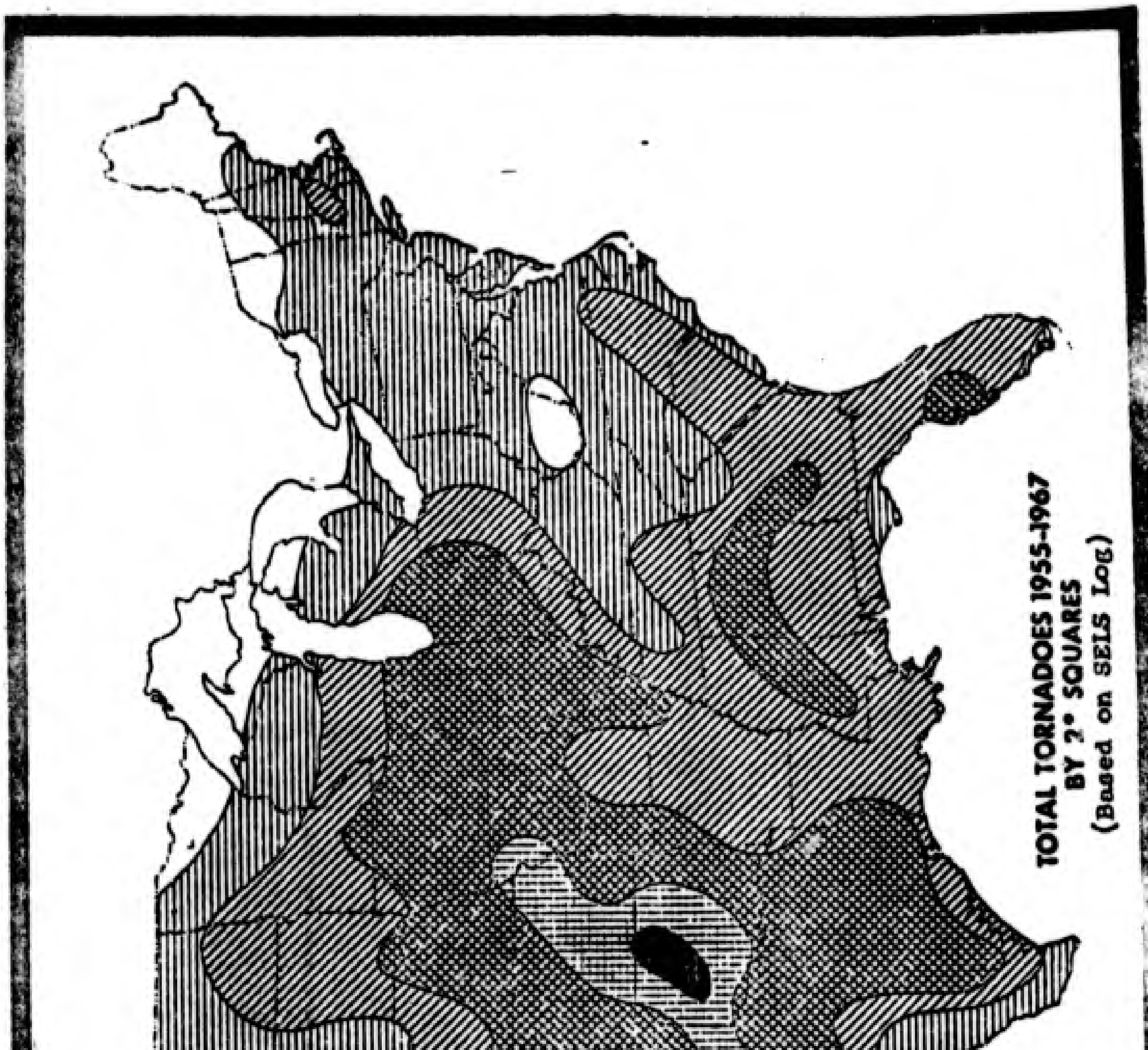


FIG III-30 Percent of days with Thunderstorms from daily observations.

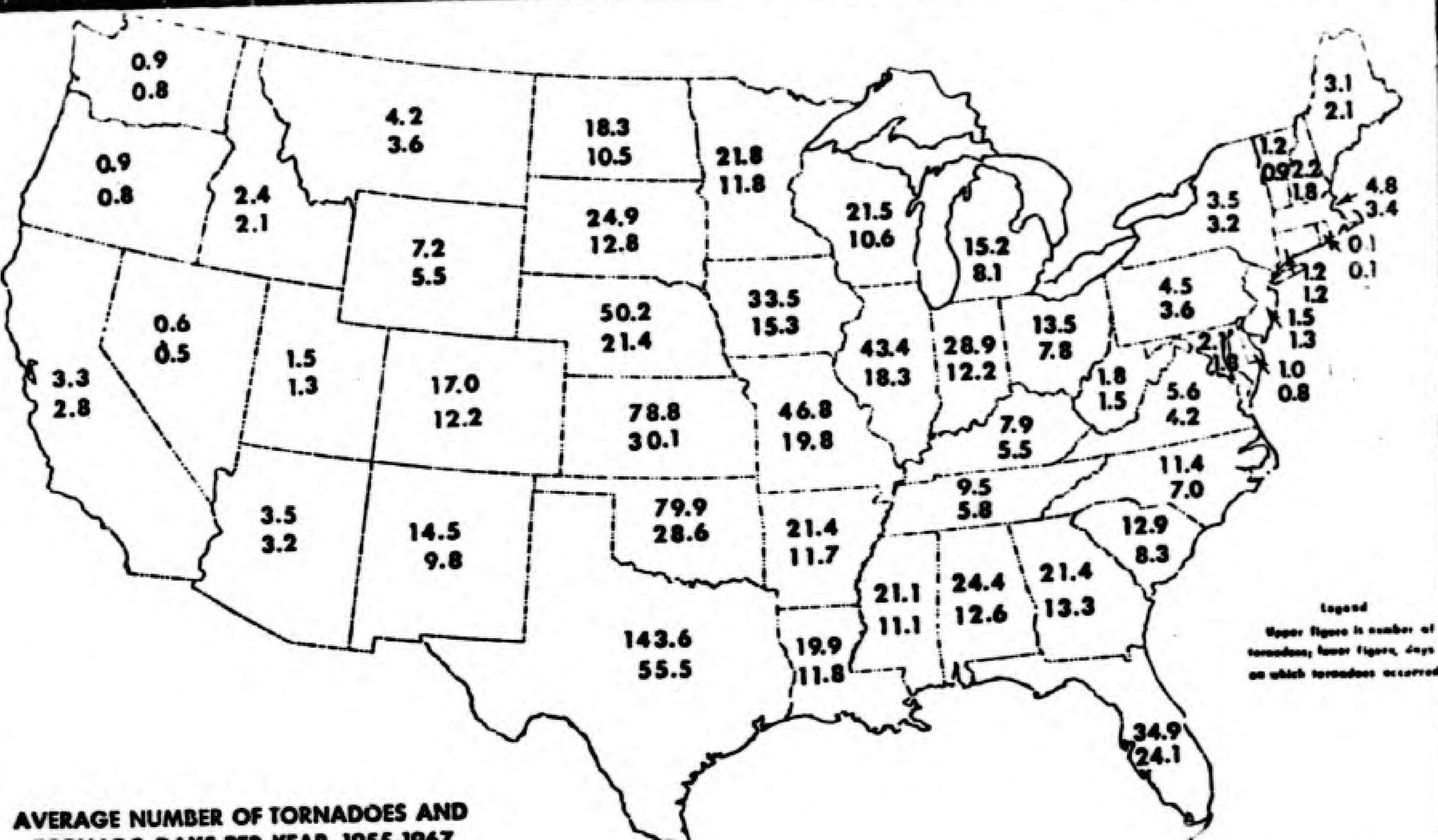
3060. <u>FREQUENCY OF TORNADOES</u>.

These tornado statistics are taken from ESSA Technical Memorandum WBTM FCST 12, Sep 1969. The data covers the period 1955-1967.



(from ESSA Technical Memorandum WBTM
 12, Sep 1969)

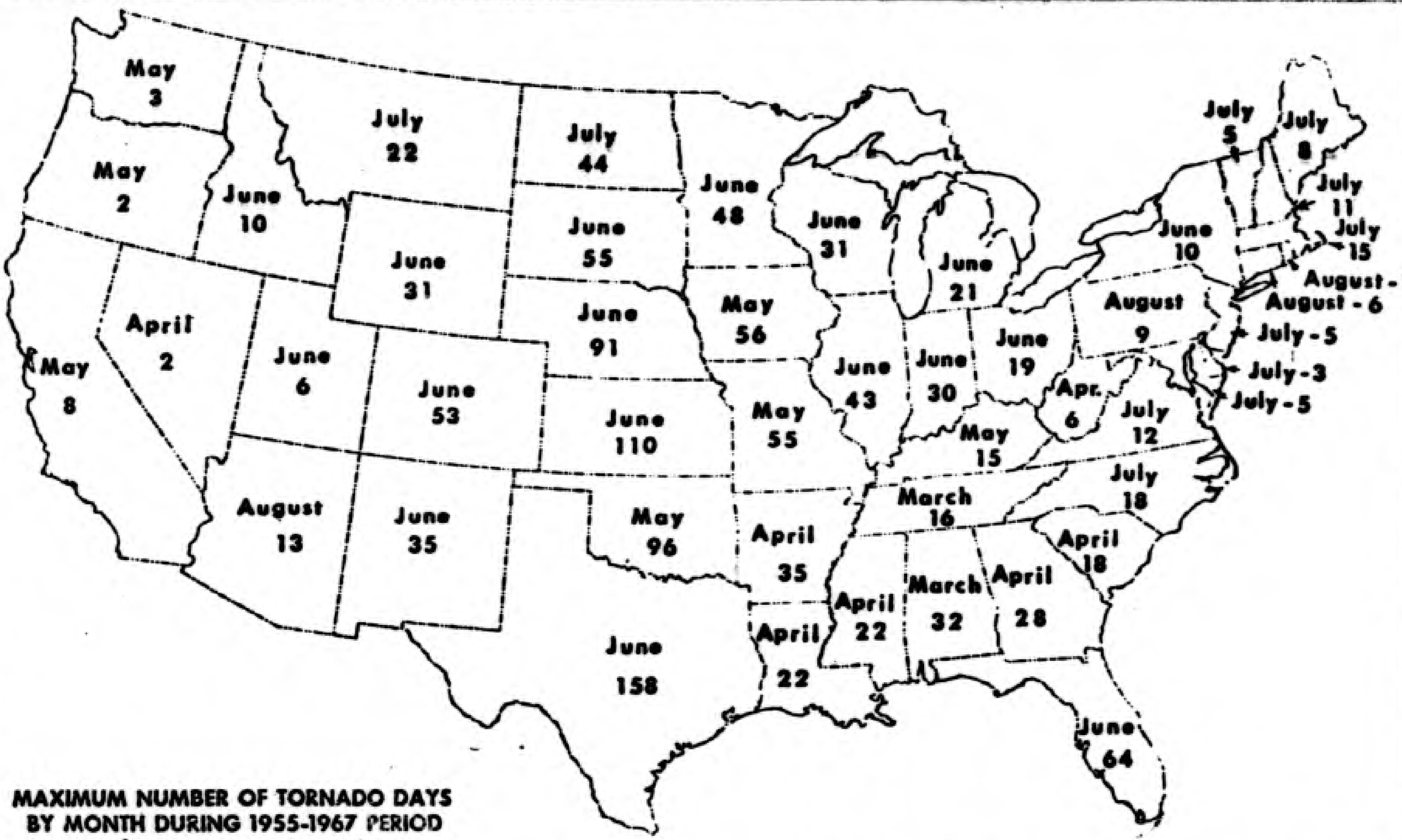
FIG III-31



AVERAGE NUMBER OF TORNADOES AND TORNADO DAYS PER YEAR, 1955-1967
(Based on SELS Log)

(from ESSA Technical Memorandum WBTM FCST 12, Sep 1969)

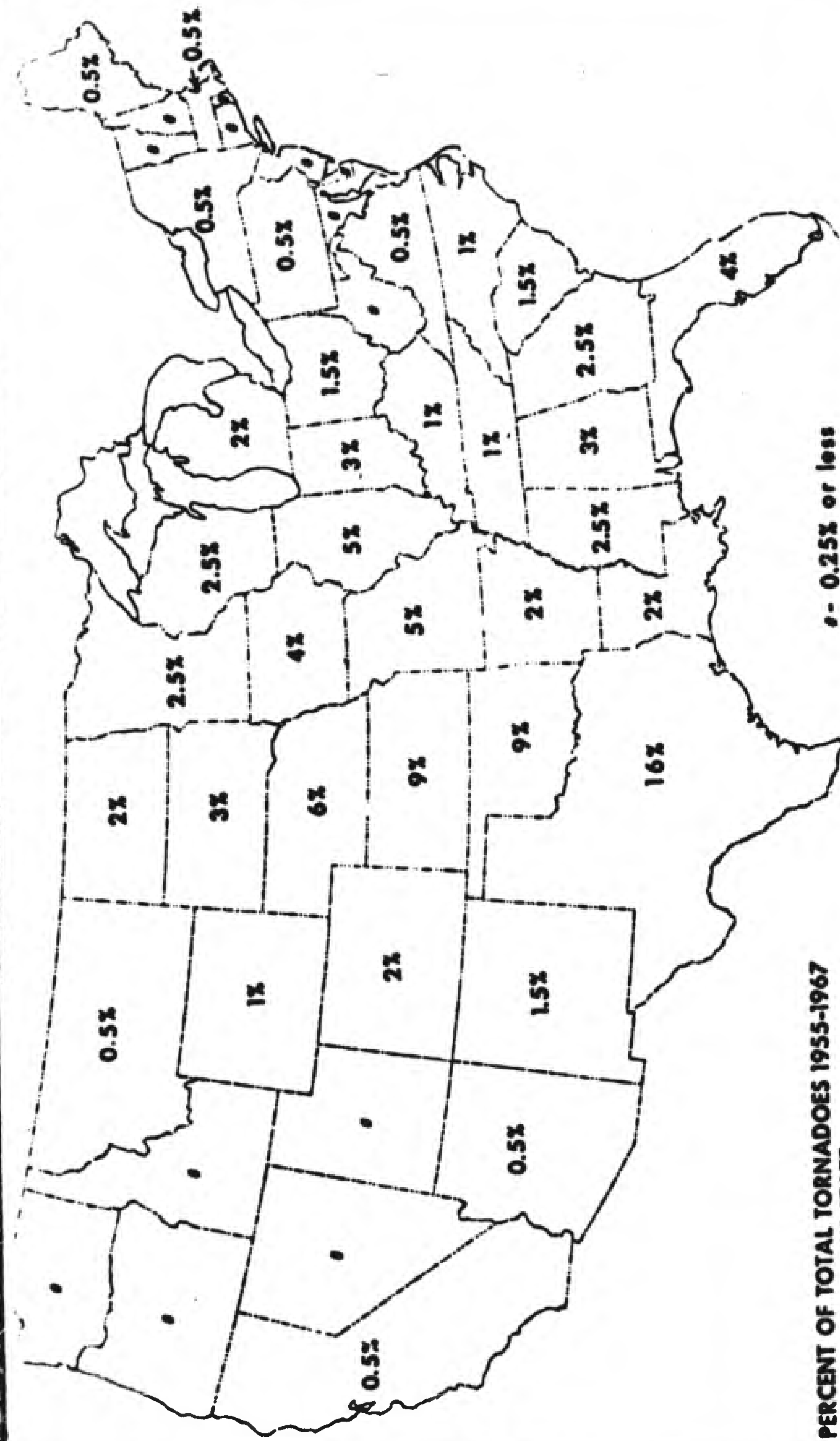
FIG III-32



MAXIMUM NUMBER OF TORNADO DAYS BY MONTH DURING 1955-1967 PERIOD
(Based on SEIS Log)

(from ESSA Technical Memorandum WBTM FCST 12, Sep 69)

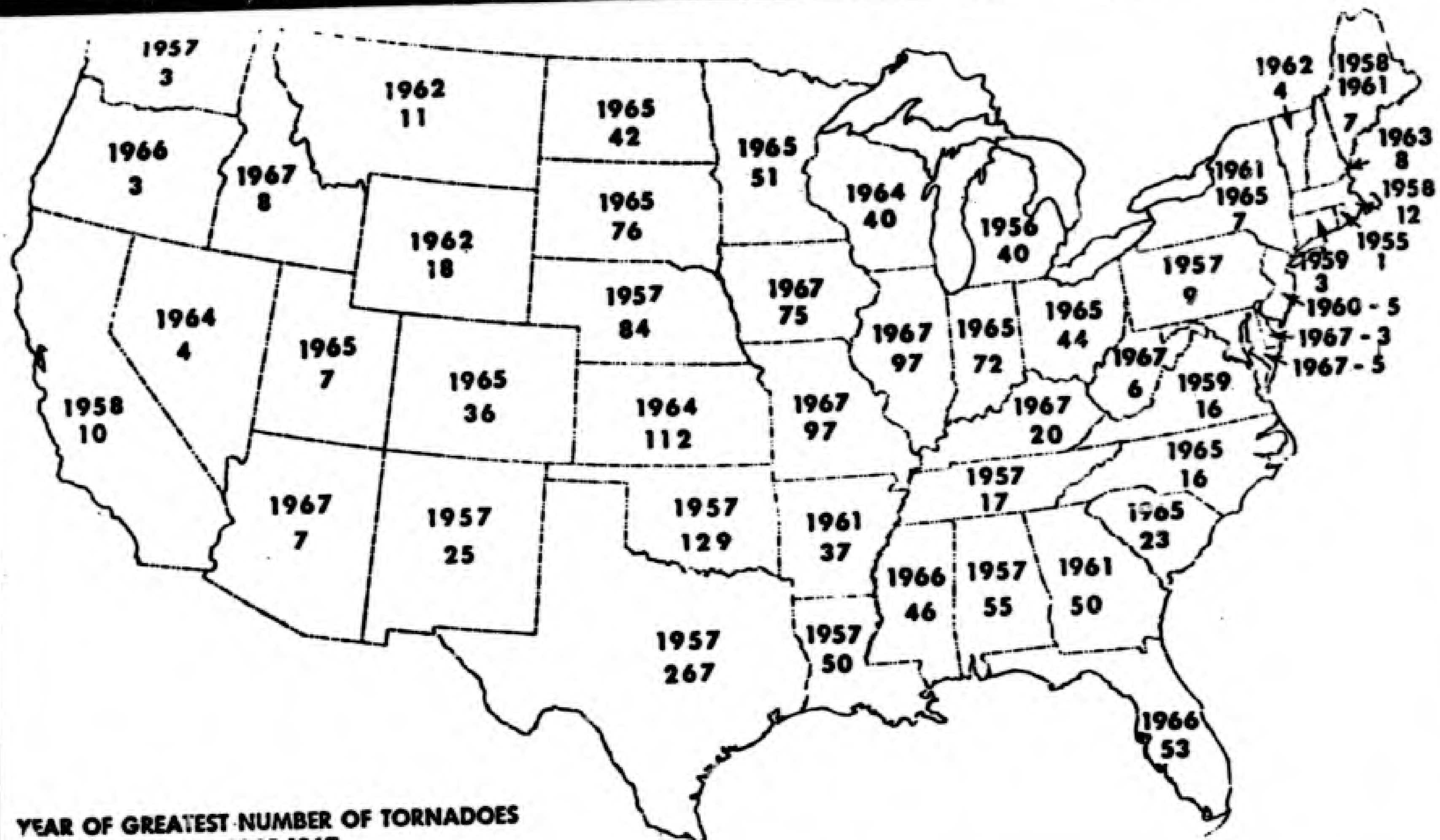
FIG III-33



PERCENT OF TOTAL TORNADOES 1955-1967
BY STATE
(Based on SELS Log)

(from ESSA Technical Memorandum WBTM FCST 12, Sep 1969)

FIG III-34

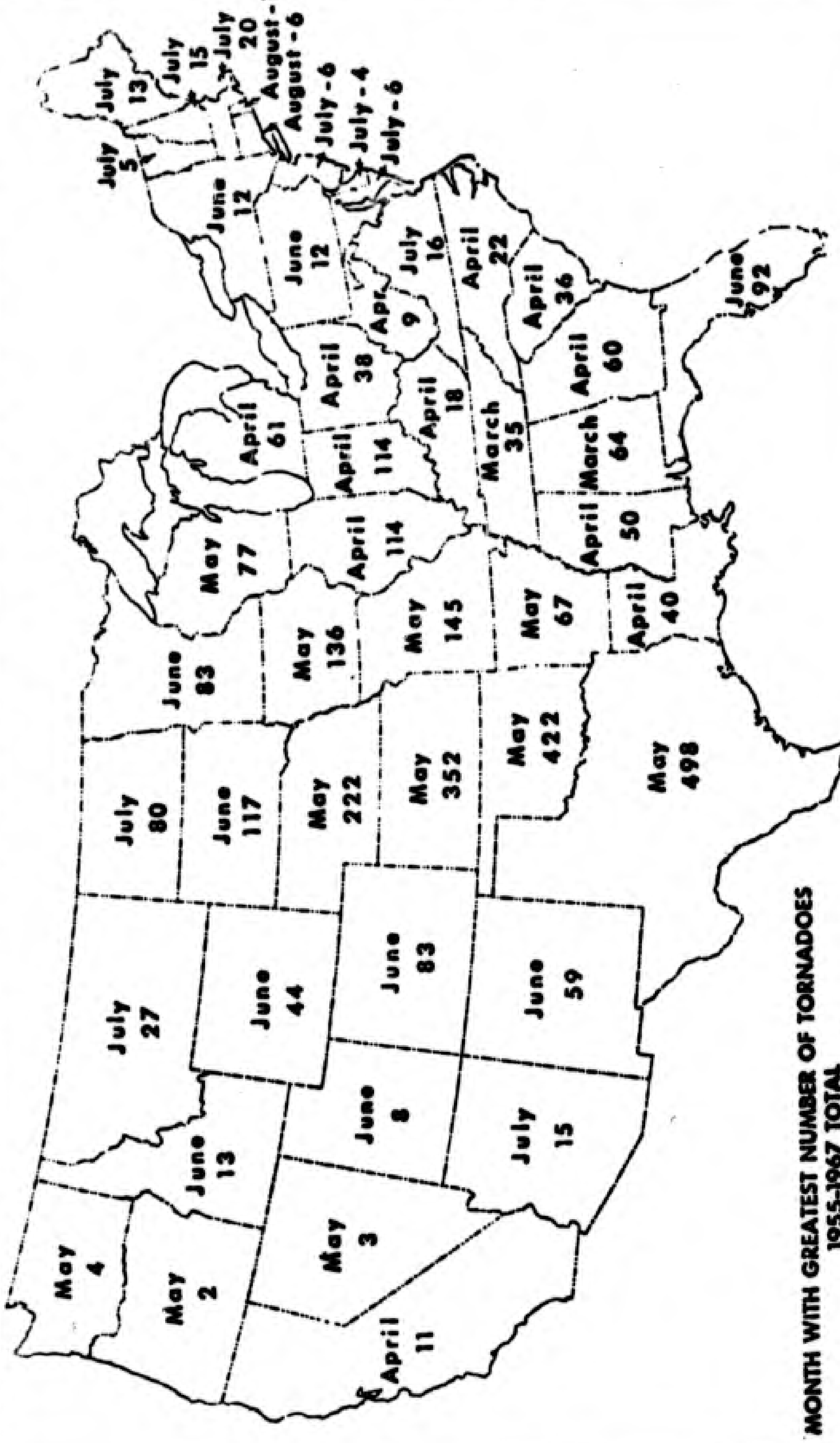


YEAR OF GREATEST NUMBER OF TORNADOES 1955-1967

(Based on SELS Log)

(from ESSA Technical Memorandum WBTM FCST 12, Sep 1969)

FIG III-35



MONTH WITH GREATEST NUMBER OF TORNADOES
1955-1967 TOTAL
(Based on SELS Log)

(from ESSA Technical Memorandum WBTM FCST 12, Sep 1969)

FIG III-36

SECTION IV

LOCAL FORECAST STUDIES

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4000. LOCAL FORECAST STUDIES.

4010. OPERATIONAL WEATHER REQUIREMENTS.

Conditions which restrict or curtail local flying operations are listed below. The weather conditions are of significant operational interest to the agencies shown. A general map of the local flying area is shown in Figure IV-1 on page 4-2.

Conditions	3646	3645	RAPCON	Tower	MCMC	Basops	Rescue	T41	Hosp
3000 ft and/ or 3 mi	X	X	X	X	X	X			
1000 ft and/ or 2 mi	X	X	X	X	X	X	X	X	X
600 ft and/ or 1 1/2 mi	X	X	X	X	X	X	X	X	
500 ft									X
400 ft						X			
200 ft and/ or 1 mi	X	X	X	X	X	X	X		
Icing	X	X	X	X	X	X	X	X	
Thunder- storms	X	X	X	X	X	X	X	X	
Winds 15 kts or more	X	X	X	X	X	X	X	X	
Lightning					*a				X

*a. Of interest to refueling and computer operations.

4020. SPECIAL SYNOPTIC REMINDERS.

The following synoptic reminders have been found of value at this station.

a. Fronts.

(1) If a cold front moving out of Canada has a wind band of low ceilings and weather for about 100 miles to the north and San Angelo, Lubbock, Abilene and Midland report low conditions with frontal passage, then forecast low ceilings (generally above 1500 feet) beginning

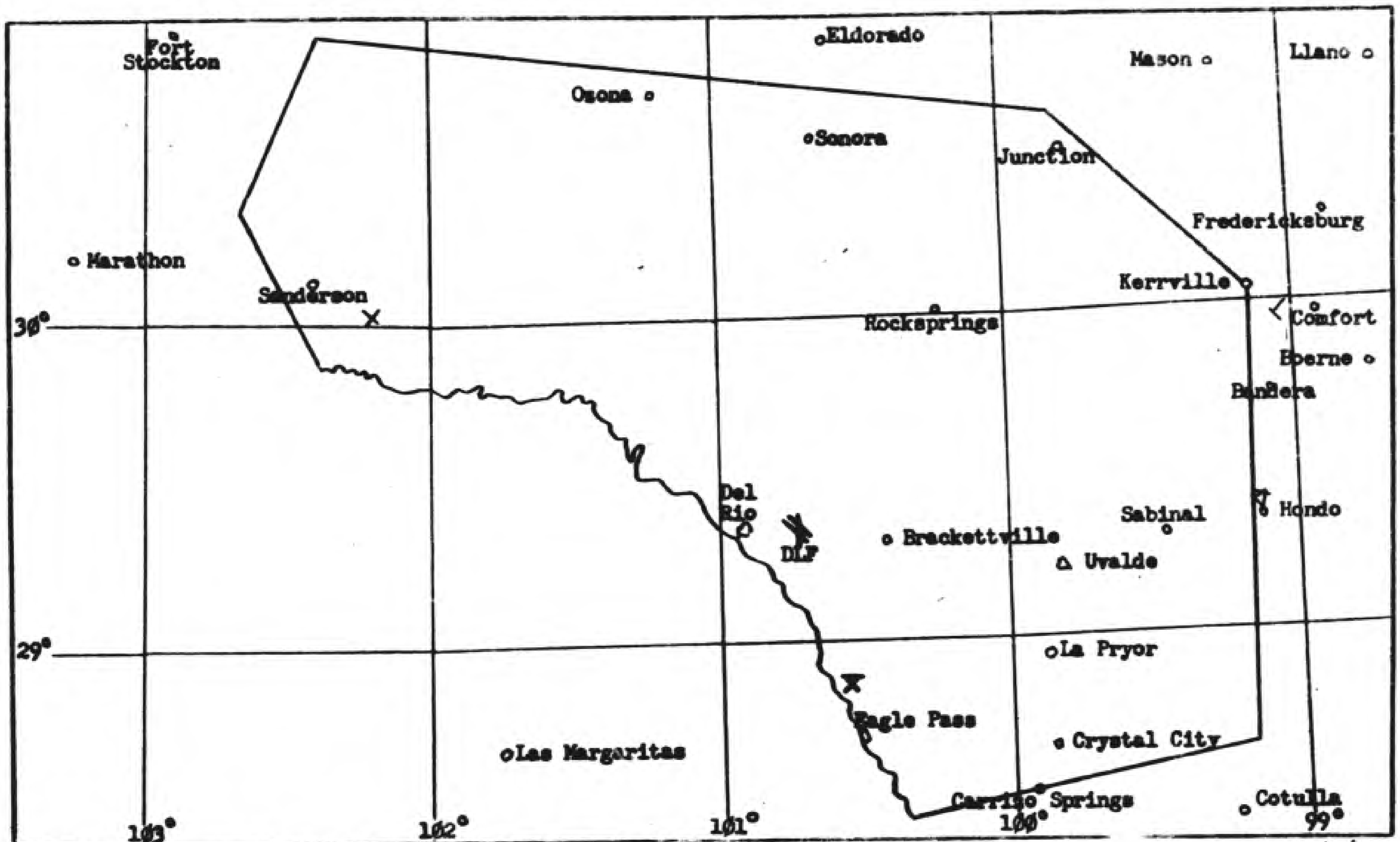


FIG IV-1 LOCAL FLYING AREA (Laughlin Air Force Base, Texas)

2 to 3 hours after frontal passage to last for 24 hours. Winds behind this type of front are usually northerly to northeasterly. This holds true September through May.

b. Thunderstorms.

(1) During the summer months, air mass cumulonimbus cells that develop southeast of Laughlin will move with the low level southeasterly flow toward the northwest but will dissipate very rapidly with sunset. Formation will be spotty, few in amount at most and not in lines.

(2) Old Faithful (the thunderstorm that forms over the Burro mountains in Mexico almost daily from late March through September) will generally remain stationary over the orographic source producing them. Identifiable exceptions are:

(a) The Marfa or dew point front which generally lies NNE-SSW through a Midland-Marfa line starts moving rapidly eastward mid-day and when passing through the local area late evening or early morning will pull TSTMS over the station along with the trough line as it passes.

(b) If the Marfa or dew point front is picked up by a sharp upper air short wave trough at the 500 mb level, Old Faithful, in addition to being pulled eastward with the trough as it passes, intensifies rapidly and gusts as high as 72 knots have been recorded with this situation. Gusts in this situation are usually between 35 and 45 knots.

(3) With the approach of a line or area of thunderstorms with multiple cells, if the "Storm Front" is 50 miles or more long, expect gusts of at least 35 knots. The longer such a system has been in existence, the greater the probability of this occurring.

c. Surface Winds.

(1) Southerly Winds: The following situations hold true only when a dry adiabatic lapse rate exists from the surface to 3000 feet MSL.

(a) The surface wind speed will not exceed 1/2 of the gradient (3000 ft) wind speed unless the 4000 feet wind speed is equal to or greater than the gradient wind speed and in this case the surface wind speed will be 2/3 of the gradient.

(b) The surface wind direction will be 10 degrees less than the gradient direction except in light and variable conditions.

(c) When the gradient wind is southwesterly, even though its speed exceeds 15 knots, the surface wind is usually light and variable; however, moderate turbulence will exist from the surface to 3000 feet.

(2) Northerly winds: The following holds true only when a dry adiabatic lapse rate exists from the surface to 3000 feet MSL.

(a) If the gradient wind is from 300 to 350 degrees, the surface wind speed will be 1/3 greater than the gradient.

(b) After a frontal passage, the maximum surface wind speed will equal the gradient wind speed if the gradient wind direction is other than 300 to 350 degrees.

(c) If the gradient wind direction is from 290 to 320 degrees, the surface wind direction will average 310 degrees.

(d) If the gradient wind direction is 330 to 070 degrees, the surface wind direction will average 330 to 340 degrees.

(3) After a dry cold frontal passage, the maximum wind is usually 5 to 10 knots lower than those reported at San Angelo and the direction usually 310 to 330 degrees.

d. Dust.

During periods of prolonged drought, strong gusty surface winds will produce blowing dust to reduce visibilities from 4 to 6 miles during daylight hours lowering to 1 to 3 miles after dark. This situation occurs in spring and early fall.

e. Stratus.

(1) If the stratus is broken or overcast at or before daylight and goes scattered or clear around 0700c, it will always come back in before 0900C. This situation occurs all year.

(2) If any clouds are seen to the south-southeast to south at dawn to 0800C and conditions are favorable for stratus, always forecast stratus to move over the field within 30 minutes after observing the clouds.

(3) If the stratus deck is 1000-1200 feet thick and the wind flow weak to moderate, the stratus will become broken by 1300C-1400C in the winter and by 0930-1030C in the summer. If the flow is strong, a 3 to 4 hour delay will result.

(4) The following method (after J.J. George), using the Skew-T Log P Diagram is a simple way to forecast the dissipation of fog or stratus.

(a) Draw a line parallel to the moist adiabat, from the surface dew point. (Line AB, Figure IV-2).

(b) At the top of the dew point inversion draw a horizontal line to line AB. (Line CD, Figure IV-2).

(c) For every isotherm crossed by line CD add one hour to sunrise and forecast fog (or stratus) to break at this time.

FIG. IV-2 **Example of Fog Dissipation Forecast**

4-30. SPECIAL SYNOPTIC STUDIES

a. "Thunderstorm Formation over the Burro Mountains" by MSgt C. E. Reed, 1956.

(1) During periods of Southeasterly flow (MT air), from April through October, a large thunderstorm develops generally every afternoon 65 to 100 miles west-southwest of Laughlin on the eastern slopes of the Burro Mountains. The top of this storm exceeds 50,000 feet. It has occurred so often that it is known locally as "Old Faithful".

(2) If development begins before noon the storm will split into many cells by afternoon with increasing middle and high clouds. The middle and high clouds will drift over the field if the upper air flow is directed from the clouds to the field.

(3) When these thunderstorms develop, they normally remain stationary during their entire life cycle. When the 20,000 foot winds are from the southwest at 25 to 50 knots these storms have moved into the Laughlin area very rapidly. They will also move with the passage of an north-south oriented 500 mb trough. Severe weather has been observed at Laughlin with heavy rain showers, large 1-2" hail and gusty surface winds as high as 72 knots as a result of these thunderstorms.

b. "Stationary Weak Cold Fronts over the Texas Gulf Coast" by MSgt C. E. Reed, 1956.

(1) Many times a slow moving cold front with a weak pressure gradient behind it will become stationary over the gulf coast of Texas. Within 24 hours a broad band of rain and multi-layered clouds develops north of this front.

(2) Almost without exception a jet stream is found over Central to South Texas. The jet wind direction is 240 to 250 degrees with speeds from 50 knots at 20,000 feet increasing to 120 knots at 40,000 feet. This strong flow is usually associated with a longwave trough located west of Texas. Along with this strong flow aloft the high level temperatures are 5 to 12 degrees cooler than normal.

(3) Clouds continue thickening until the flow aloft decreases. Rain falls intermittently in the area covered by the clouds. Drizzle and low stratus are present in the local area after the second day.

(4) These weather conditions will prevail until the high pressure cell moves far enough south to push the moist air out of the area or until the upper air trough moves east of Laughlin.

c. "Advection Stratus at Laughlin AFB, Texas" by MSgt C. E. Reed, 1956.

(1) The advection of stratus in the Laughlin AFB area presents one of the challenging problems for the forecasters.

(2) The main flow of moisture from the Gulf into the Del Rio area depends upon the wind flow in lower levels up to 4000 feet. Stratus has been observed with 12 to 24 hours after the wind shifts to a southeast flow when sufficient moisture is present. Many times stratus has come as far north as Laredo and did not reach Laughlin. Under similar conditions, on other days, the depth of the stratus layer was much the same and stratus occurred. The only difference noted was an increase in moisture content along the Gulf Coast the previous 6 to 12 hours. The slow increase shows a definite stratus pattern. After the southeast gradient flow stabilizes a definite moisture line can be drawn from northeast to southwest from Bryan, Texas to Laredo, Texas. This moisture line (locally named a "dew point front"), is thought to be one of the controlling factors of stratus formation here at Laughlin AFB. When the winds from surface through 4000 feet are from the southeast (090° to 190°) and are expected to continue from 1500C through 0600C the next morring, the dew point line will move into the Del Rio area. The complexing problem is whether the gradient winds will push the dew point line into Laughlin area or decrease during the night and move the stratus only as far as Uvalde or Bracketville.

(3) Another stratus situation occurs in the winter if the high following the cold front becomes stationary near the Tennessee Valley. When this situation occurs, the gradient wind and even the winds up to 10,000 feet average an easterly or east southeasterly direction. If the winds are sufficiently strong (generally over 20 knots), the stratus will not break during the entire day. Usually a small improvement is noticed in the morning until 1000C, which is followed by gradual deterioration until the field is at or below minimums. When this condition occurs the field may remain near or below minimums for as long as three days.

4040. CASE STUDIES.

a. "Hurricane Alice" by MSgt C. E. Reed, 1956.

(1) A small tropical distrubance was observed in the Gulf of Mexico on the 24th of June, 1954. It appeared to be moving in a west-northwesterly direction. During the next 12 hours, the intensity increased rapidly, with winds reaching a maximum speed of 45-55 m.p.h. The drift of the tropical cyclone was slow, between 10 and 15 m.p.h. On the morning of the 25th the disturbance was maintaining the same direction, and was now a full fledged tropical storm named "Alice".

(2) On the 1830Z Surface Chart, the storm was centered on the Mexican coast about 40-50 miles south of Brownsville. Surface winds had increased to 60-65 m.p.h. At 0900C the upper air winds at Brownsville were:

2,000 ft.	130/70
4,000 ft.	140/140
7,000 ft.	140/90
10,000 ft.	140/80
850 Mb.	140/100
700 Mb.	140/80

(3) There was a closed isotherm at 850 Mb. and a closed low pressure cell at 700 Mb. The winds aloft over Laughlin AFB were:

2,000 ft.	090/20
5,000 ft.	110/20
10,000 ft.	090/15

(4) By 1830C on the 25th the winds at Brownsville had veered to the south-southwest. Harlingen AFB reported a gust of 65 knots. The upper air winds at Brownsville were then:

850 Mb.	180/40
700 Mb.	180/30
500 Mb.	170/30

These winds may be slightly in error because of lack of data.

(5) Over the San Antonio region the winds were shifting slowly from the east-southeasterly direction to the South and increasing in speed. The shifting winds showed the cell to be moving northwest and decreasing in movement to 5-10 m.p.h. The maximum gusts were estimated to be 75-80 m.p.h. the 300 Mb. winds over Del Rio and San Antonio showed an east and south direction respectively, thus giving an indication that the cell sloped to the northwest.

(6) The morning of the 25th showed a continued movement to the northwest at approximately 10 m.p.h., and a continued decrease in intensity (See Figure IV-3). In the Del Rio area the maximum gust was 40 knots. The movement continued slowly to the northwest, about 50/60 miles west of the Rio Grande, and the center of low pressure became quasistationary approximately 50 miles west-northwest of Del Rio (See Figure IV-4) and the surface winds decreased to 25-30 m.p.h.

(7) The cyclonic flow of air riding over the higher terrain caused a large increase in the amount of rainfall. The 300 Mb. chart showed a cold flow of air moving from a high pressure cell located over the Pacific. The rainfall was increased more by convergence aloft in the region of the near dissipated hurricane. The continued flow of warm moist air from the Gulf, and the steady flow of cold air aloft, deepened the convergence area.

(8) A pilot report showed bases of clouds to be at 800 feet and tops at 35,000 feet. Some turbulence was encountered in the lower layers up to 15,000 feet. Moderate to heavy turbulence was reported between 15,000-30,000 feet. Turbulence decreased above that level. Rainfall became heavy in the upper water sheds of the Pecos and Devils River. Some of the amounts of rainfall were as follows:

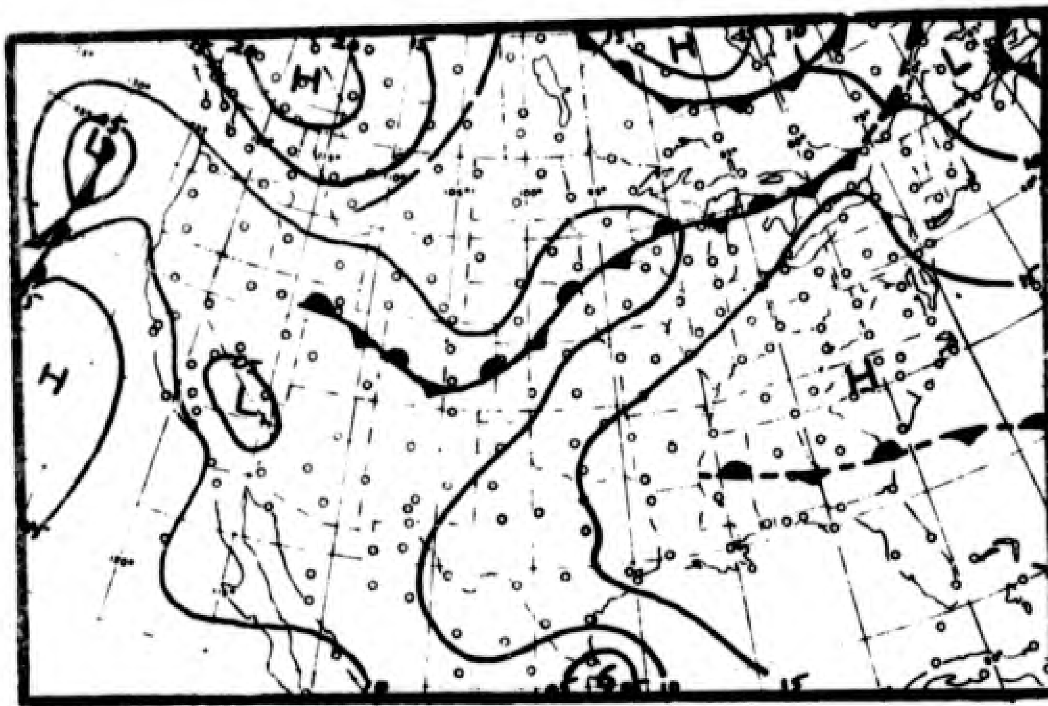
Pandale - 24.07 inches

Ozona - 14.00 inches

Langtry - 18.00 inches

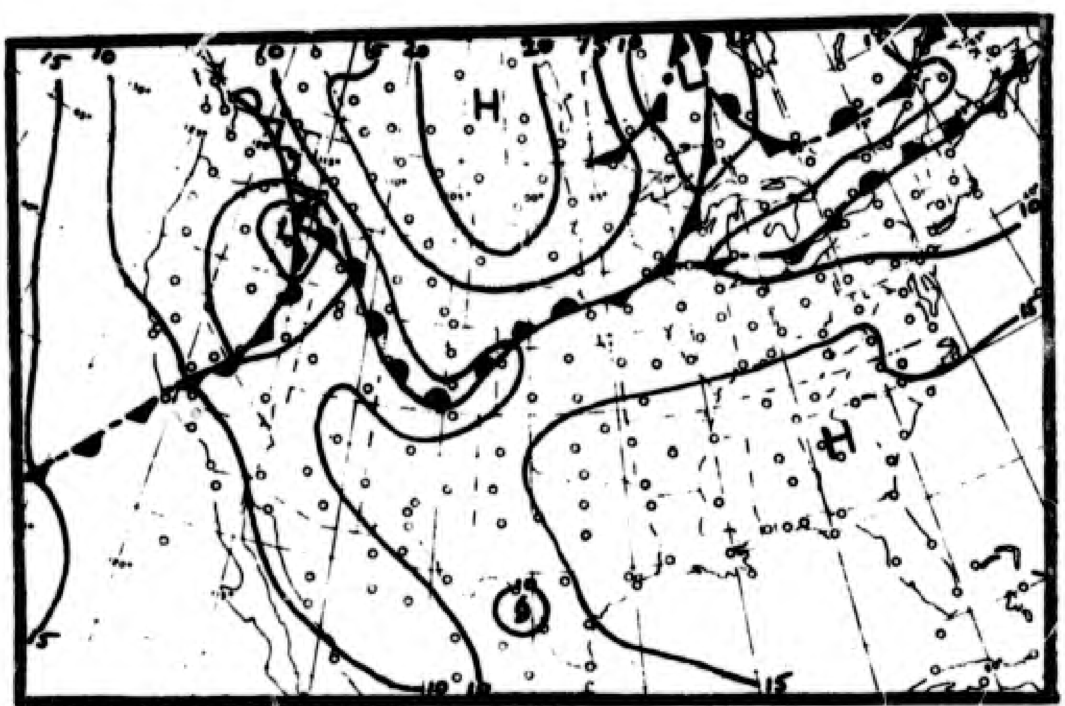
Pecos - 22.00 inches

(9) Severe flooding occured on the Rio Grande, and Devils and Pecos Rivers, rising 43 feet, 34 feet, and 97.8 feet respectively. The damages and deaths during this time is well known. Only an unusual condition, such as a hurricane, could cause this heavy a rainfall in this region.



Surface Chart: 12ØØZ, 25 Jun 1954

FIG. IV-3 **Tropical Storm Alice**



Surface Chart: 12ØØZ, 26 Jun 1954

FIG. IV-4 **Tropical Storm Alice**

b. "Unique Gusty Surface Winds at Laughlin AFB, Texas" by Major H. F. Kunkel, 1962.

(1) A unique wind situation occurred at Laughlin AFB between 1900 and 2000CST, 24 May 1962. The surface winds became strong and gusty for no apparent reason. These winds were restricted to the area of Laughlin AFB and Del Rio, Texas. The winds at Del Rio, Texas were estimated to have been 35 knots and at Bracketville, Texas (24 miles east) the winds were estimated to have been of much less magnitude. Eagle Pass, Texas, 50 miles southeast of Laughlin experienced no abnormal winds. This narrow band of strong winds might be attributed partically to thunderstorm activity and the unstable nature of the air mass.

(2) From the data at hand there was no reason to suppose that we would have anything more than the normal conditions encountered in high level thunderstorms occurring in this area. The following were conditions prior to and during the period of peak gusts:

(a) Mammatus clouds over the base at 10,000 feet.

(b) Strongest winds were from 160 degrees to 180 degrees with peak gusts to 48 knots.

(c) There was a moderate thunderstorm at 210 degrees from the base and at a distance of 37 miles. It appeared to be building.

(d) General wind pattern was from the east southeast.

(e) At 2257Z the temperature was 91 degrees.

(f) At 2355Z the temperature was 95 degrees and PRESFR.

(g) At 0056Z the temperature was 97 degrees and PRESFR.

(h) The temperature had fallen to 93 degrees at 0155Z observation.

(3) The above data concerning the temperature would indicate a down slope action but the current surface and millibar charts gave no clue to any such occurrence. Up to this time the phenomena was not forecastable. By 0500Z the 850MB and 700MB charts were received and after adding our local rawinsonde data to these charts and upon reanalyzing, a ridge of high pressure appeared at the 850MB level and a closed high at the 700MB level. This was a bubble high and indicative of the thunderstorm activity that had been forecast.

(4) These thunderstorms had a source region over terrain of 6,000 to 9,000 feet and were moving in an easterly direction to lower elevations but at the same time were maintaining their relatively high bases. As the downrush of air left the thunderstorm it was encountering moist air but at some level, apparently at about the 850MB level, the air became very dry, dissipating its moisture, and proceeding dry adiabatically to the surface. This air was guided toward Laughlin by terrain features and the general flow of air from the southeast.

(5) To the best of my knowledge winds of this origin have never before been encountered at Laughlin AFB. Therefore the chances of forecasting these winds with any degree of accuracy is very slight.

c. "Hurricane Celia" by Lt J. D. Ward, 1970.

(1) On 1 August, 1970, tropical storm Celia entered the eastern part of the Gulf of Mexico. The storm was expected to increase to hurricane force and move west northwestward in the general direction of the Texas and Louisana coast.

(2) By 1300Z, 2 August, Celia had become a hurricane and was gaining strength rapidly. She was located 300 miles south of New Orleans. A 200mb low located over south Texas was to steer Celia northward. However, the 200mb low moved into central Mexico and was allowing Celia to remain on a west northwest path. The Miami hurricane center expected Celia to enter the Victoria, Texas area and move toward San Antonio and Junction. At 1600Z, 2 August, hurricane warnings were issued from Palacios, Texas to Port Arthur, Texas. A hurricane watch was issued from Corpus Christi, Texas to Morgan City, Louisiana.

(3) At 2100Z, hurricane warnings were extended south to Rockport, Texas as a result of the 200mb low moving to central Mexico. By 0900Z, 3 August, hurricane warnings were extended southward to Corpus Christi, Texas with the hurricane watch extended to Brownsville, Texas. Celia was now expected to move inland just north of Corpus Christi and move toward Del Rio, Texas, with max winds of 25 knots when Celia reached the Del Rio area.

(4) By 1600Z, 3 August, New Orleans hurricane center expected Celia to hit Corpus Christi with max winds of 100 knots and to move toward Del Rio with max winds of 40 knots at Del Rio. Celia then intensified rapidly and moved inland between Corpus Christi and Aransas Pass with winds in excess of 150 knots. Communication with Corpus Christi was lost.

(5) Celia continued on a direct path from Corpus Christi to Del Rio during the night. Laughlin was able to follow Celia on radar and report an excellent eye fix during most of the night. Spiral bands were quite prominant. The eye finally became indiscernible around 0830Z, although distinct circulation was still evident. The center of the circulation passed no farther than 10 miles southwest of Laughlin around 1200Z.

(6) The altimeter setting fell to 29.29" with max winds of 73 knots from the ESE at 1209Z. The lowest condition was at 0100Z with overcast skies at 300 feet, visibility 1/2 mile. Heavy rain was also reported, although less than one and one half inches of rain fell during the storm.

(7) No injuries were reported. Three T-37 jet training aircraft sustained slight damage. Many trees were uprooted, trailers overturned, and one barracks was unroofed. Power lines were blown down, and power was not restored until late afternoon. Damage was estimated at $300,000 at Laughlin AFB.

(8) Celia had traveled in a nearly straight line toward the west northwest for three days. Celia proved that even after a hurricane has traveled 200 miles inland, damaging winds can still be maintained. Such a fact should certainly be considered in the event that another hurricane approaches the Del Rio area.

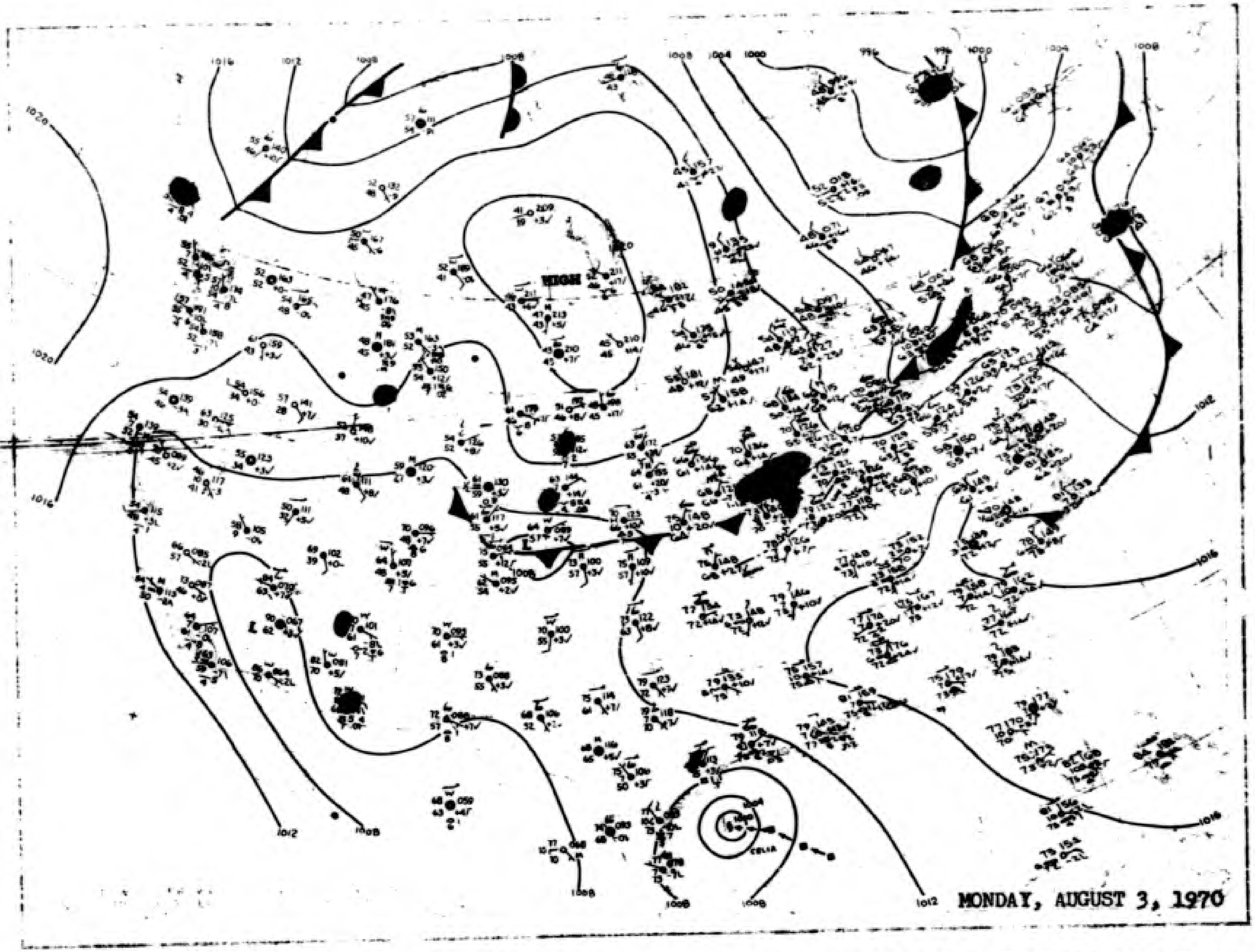


FIG. IV-5 1200Z Surface Map: Taken from U.S. Department of Commerce Publication "Daily Weather Maps", Weekly Series August , 1970.

Tropical Storm Celia

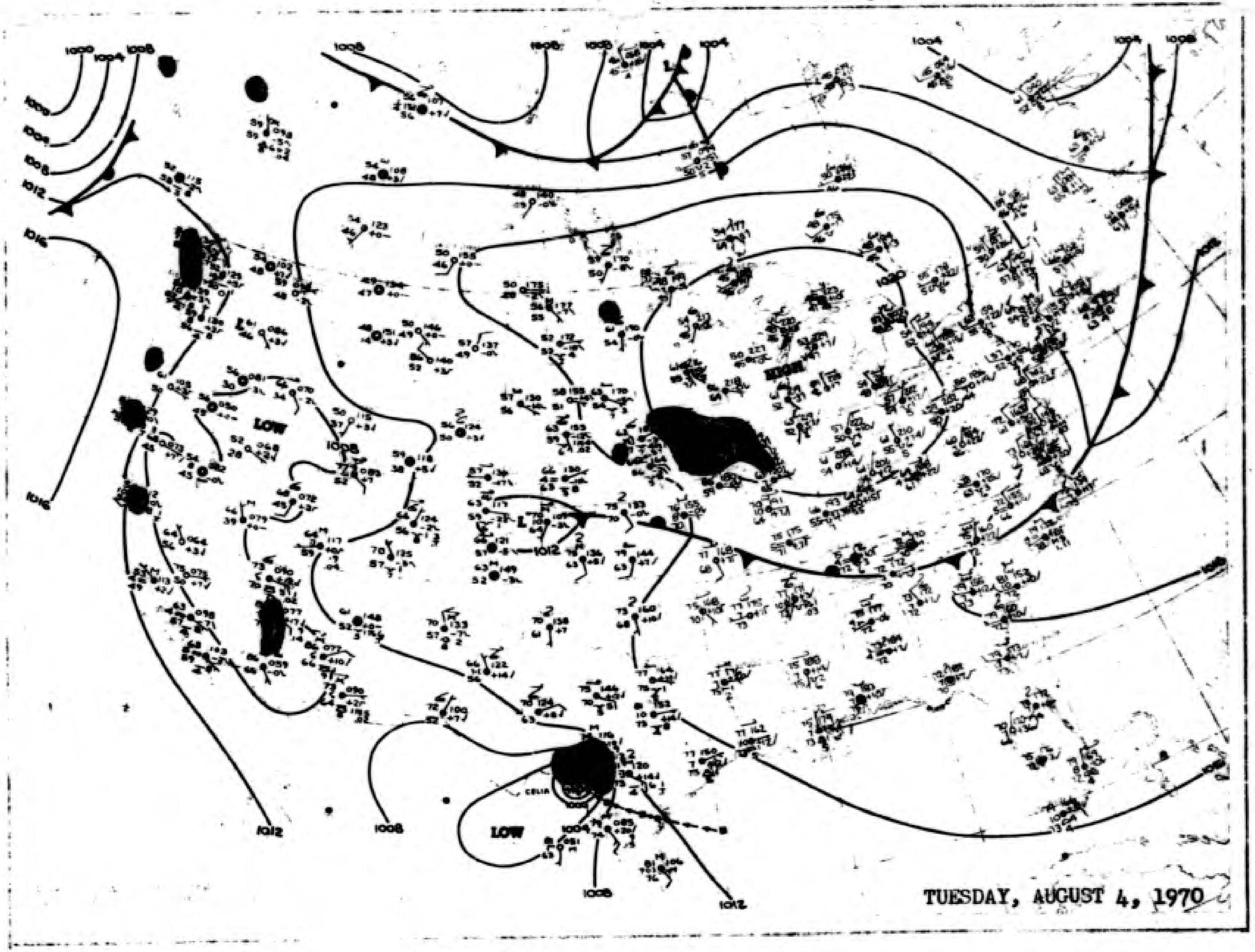


FIG IV-6 1200Z Surface Map: Taken from U.S. Department of Commerce Publication "Daily Weather Maps", Weekly Series August 3-9, 1970.

Tropical Storm Celia

4050. OBJECTIVE FORECASTING METHODS AND AIDS.

a. Approved studies. Objective forecast methods and aids will be filed in this subsection when they are of proven value. None are available at this time.

b. Disapproved Studies. Forecast studies that have been tested and have been found to be of no value to this station.

(1) Forecasting the time of arrival of Gulf coast stratus. The parameters used were the time the surface wind shifted to southeast quadrant at Laughlin AFB and the actual time of arrival of stratus. This was limited to the first day of occurrence of southeasterly flow only. Using four years of data it was found that the stratus would form 2 hours to 54 hours after the wind shift, the maximum arrival time being 18 to 24 hours and a secondary maximum 39 to 48 hours. This wide variation in time made the value of the study doubtful.

406C. REFERENCE TO OTHER FORECAST STUDIES.

A useful tool in forecasting the movement of an east-west oriented cold front is the objective study for forecasting the movement of the Great Plains Wedge-front. This study is included in the Geophysical Research Papers number 23, Forecasting Relationships Between Upper Level and Surface Meteorological Process, pages 135-147, edited by J. J. George, August 1953.

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13. ABSTRACT

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

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14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Meteorology						
Climatic Data						
Laughlin AFB, TX						
Special Synoptic Studies						
Case Studies						

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AD 718 119

DEPARTMENT OF THE AIR FORCE
DETACHMENT 20, 24th WEATHER SQUADRON (MAC)
LAUGHLIN AIR FORCE BASE, TEXAS 78840

FROM: WE/Capt Braguglia/2229 18 April 1972

SUBJ: Change #1 to Terminal Forecast Reference File (TFRF), Laughlin AFB, Texas, dated January 1971.

TO: Distribution

1. Insert new pages 4-18 and 4-19 to Laughlin AFB, Texas TFRF.

2. Make the following pen and ink changes:

a. Page iii, Table of Contents, add

"4070. Hail Producing Thunderstorm ....4-18"

b. Page V, List of Illustrations, add

"IV-7 15/1200Z 500MB CHART 4-19"

"IV-8 16/0000Z 500MB CHART 4-19"

"IV-9 15/1200Z SURFACE CHART 4-19"

"IV-10 16/0000Z SURFACE CHART 4-19"

3. After posting, file this change in back of the TFRF.

RAYMOND J. BRAGUGLIA, Capt, USAF
Commander

4070. HAIL PRODUCING THUNDERSTORM.

1. On 16 April 1971 at 0220Z, a severe thunderstorm passed over the city of Del Rio, Texas dropping two-inch hail for approximately 30 minutes. The storm was about five miles wide and moved to the northeast of the city, missing Laughlin AFB. Moderate damage, however, occurred to the T-41 aircraft parked at the International Airport in Del Rio.

2. The synoptic situation had indicated that the severe weather would occur in the lower panhandle area near Big Springs, Texas. Since a severe storm did form in this area, a review of the situation should be helpful.

a. A surface low was located over southeastern Arizona, with troughing extending southeastward into Mexico. Another low formed in this trough and moved northeast to combine with the low that had moved from southeast Arizona (See Fig. 1). A sharp wave was formed on the cold front that extended from southeast New Mexico into Mexico and southwesterly through the Baja Peninsula (See Fig. 2).

b. In the upper air, a closed low centered over southwestern Arizona was evident, and most significant at 500 mb. It moved to the Arizona, New Mexico, Mexico border with abnormally cold temperatures of -20°C or less. Even though the contour lines and isotherms were apparently moving into phase, the low did not fill as would be expected (See Figs. 3 and 4).

c. Strong southeasterly flow bringing warm moist air from the Gulf of Mexico at the surface and lower levels ahead of the cold front in west Texas created a very unstable situation and thunderstorms were kicked off near Wink, Texas and just to the west of Del Rio, Texas.

d. One storm that formed a few miles to the west of Del Rio, Texas with tops to 40,000 feet built within a quarter of an hour to 60,000 feet. Winds at Laughlin remained southeasterly, while those at Del Rio shifted to northwesterly from the downdrafts of the thunderstorm. These downdrafts, combined with the southeasterly winds fed from southeast Texas, produced strong surface winds in Del Rio. These winds, together with the two-inch hail, caused moderate to heavy damage throughout the city on a southwest to northeast line.

e. Radar proved to be the only useful tool at the time of this storm and only then to show what was already in progress. The storm built so rapidly that none of the severe weather indices proved useful in forecasting a storm of this magnitude.

f. Past records show that the Del Rio/Laughlin AFB area experiences a storm of this intensity at least once each year. Continuing research is our only hope to obtain a more useful indicator of these storms. Further information on this storm giving more detailed synoptic information can be found in the case study of the storm, located in the detachment Administrative Office.

FIG. IV-7 15/1200Z 500MB CHART

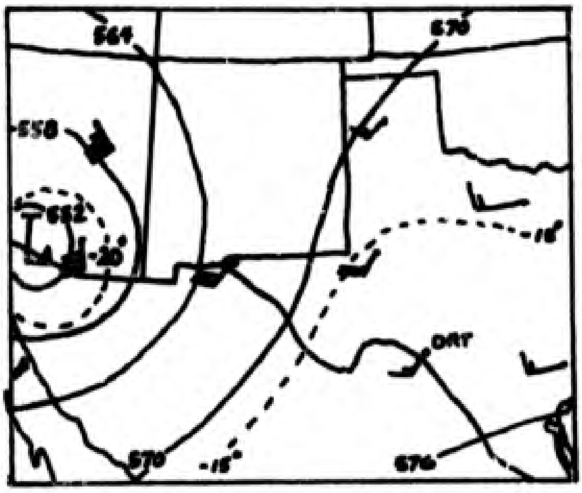
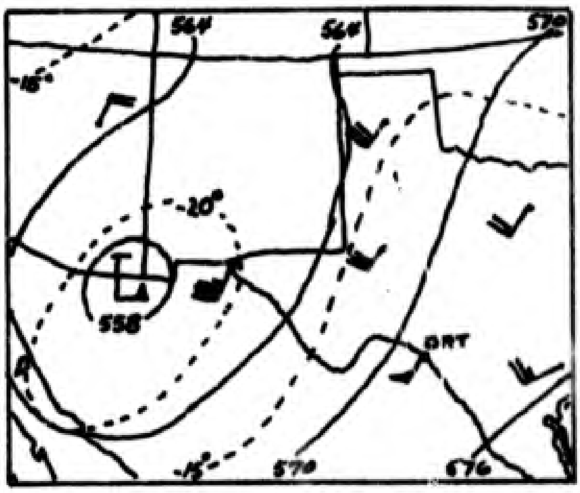


FIG. IV-8 16/0000Z 500MB CHART



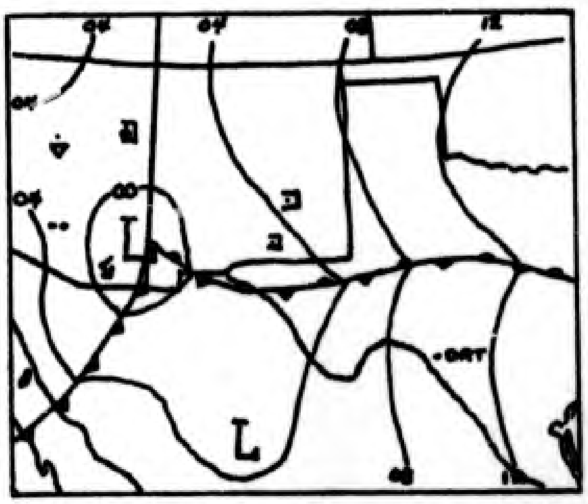


FIG. IV-9 15/1200Z SURFACE CHART

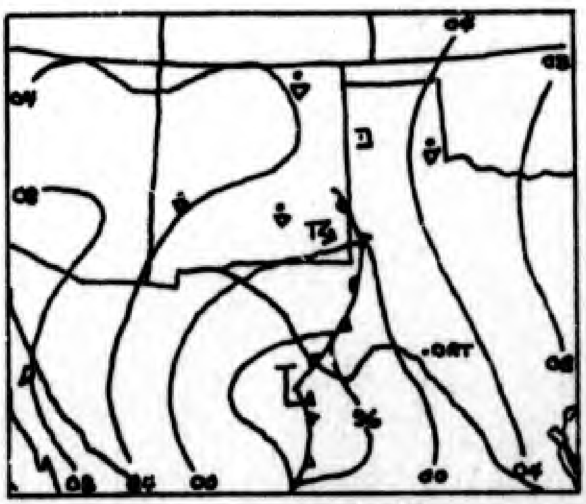


FIG. IV-10 16/0000Z SURFACE CHART

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13. ABSTRACT

HAIL PRODUCING THUNDERSTORM

This change adds 2 additional pages to the Terminal Forecast Reference File published 25 January 1971.

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