

MISSILE GEOPHYSICS DIVISION

WEATHER ELEMENTS
IN THE TULAROSA BASIN

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SPECIAL REPORT 49

WHITE SANDS MISSILE RANGE
NEW MEXICO

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HEADQUARTERS
U. S. ARMY SIGNAL MISSILE SUPPORT AGENCY
WHITE SANDS MISSILE RANGE
NEW MEXICO

JULY 1960

1. SPECIAL REPORT NR 40 HAS BEEN PREPARED UNDER THE SUPERVISION OF THE MISSILE GEOPHYSICS DIVISION AND IS PUBLISHED FOR THE INFORMATION AND GUIDANCE OF ALL CONCERNED.

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FOR THE COMMANDER:

Donald E. Cliborn

DONALD E. CLIBORN
1ST LT SIGNAL CORPS
ADJUTANT

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MISSILE GEOPHYSICS DIVISION

WEATHER ELEMENTS IN

THE TULAROSA BASIN

BY: KENNETH R. JENKINS

PAUL H. TAFT

SPECIAL REPORT NR 40

JULY 1960

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U. S. ARMY SIGNAL MISSILE SUPPORT AGENCY
WHITE SANDS MISSILE RANGE
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ACKNOWLEDGMENT

THE AUTHORS ARE INDEBTED TO MR. G. F. VON ESCHER, STATE CLIMATOLOGIST, U. S. WEATHER BUREAU, ALBUQUERQUE, NEW MEXICO, WHO MADE AVAILABLE THE RECORDS FROM ALL OF THE NEW MEXICO WEATHER BUREAU STATIONS INCLUDED IN THIS REPORT.

ABSTRACT

THE PHYSICAL FEATURES OF THE TULAROSA BASIN AND THE LOCAL WIND EFFECTS IN THE BASIN ARE DISCUSSED. MONTHLY AND ANNUAL WIND ROSES FOR THREE WEATHER STATIONS IN THE BASIN AND A CASE HISTORY OF WIND VARIABILITY ON THE WHITE SANDS MISSILE RANGE ARE PRESENTED.

TABLES, GRAPHS, AND CHARTS SHOWING THE MEANS AND EXTREMES OF TEMPERATURE, PRECIPITATION AND OTHER WEATHER ELEMENTS ARE INCLUDED, GIVING A COMPREHENSIVE PICTURE OF WEATHER CONDITIONS WHICH MAY BE ENCOUNTERED IN THIS AREA.

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INTRODUCTION

THE WEATHER CONDITIONS ENCOUNTERED ON A MISSILE RANGE HAVE A PROFOUND EFFECT ON THE EFFICIENCY AND SUCCESS OF MANY OPERATIONS. THIS REPORT SETS FORTH THE FUNDAMENTAL CAUSES OF SURFACE WIND VARIABILITY IN THE TULAROSA BASIN AND PRESENTS DATA SHOWING THE MANY VARIABLES OF WEATHER WHICH CAN OCCUR IN THIS AREA. BECAUSE OF THE GREAT EXTENT OF THE REGION AND ITS IRREGULAR TOPOGRAPHY AND SINCE THERE ARE ONLY TWO WEATHER BUREAU STATIONS WITHIN THE LIMITS OF THE MISSILE RANGE, ALL OF THE AVAILABLE U. S. WEATHER BUREAU [17] TEMPERATURE AND RAINFALL RECORDS FOR THE ADJACENT AREAS HAVE BEEN USED (TABLE I, FIG. 1). WEATHER DATA FOR THE REGULARLY-SITTED STATIONS WITHIN THE BASIN ARE PRESENTED IN GRAPHICAL FORM. IN ADDITION, A SPATIAL VARIABILITY STUDY WAS CONDUCTED AT FOUR SITES ON THE WHITE SANDS MISSILE RANGE WITH RESULTANT DATA ILLUSTRATING THE SIGNIFICANCE OF TOPOGRAPHIC EFFECTS.

PHYSICAL FEATURES OF THE TULAROSA BASIN

THE TULAROSA BASIN LIES IN SOUTH-CENTRAL NEW MEXICO AND EXTENDS SOUTHWARD A SHORT DISTANCE INTO TEXAS, WITH A MAJOR NORTH-SOUTH AXIS (FIG. 2). THE BASIN IS APPROXIMATELY 140 MILES LONG AND 40 MILES WIDE WITH A SLIGHT UPSLOPE FROM SOUTH TO NORTH. THE FLOOR OF THE BASIN IS RELATIVELY FLAT. MOUNTAINS BOUNDING THE AREA ARE PRINCIPALLY TILTED SEDIMENTARY RANGES BUT GRANITIC UPTHURSTS FORM THE ORGAN MOUNTAINS. TO THE WEST OF THE MISSILE RANGE THE MAJOR MOUNTAIN CHAINS ARE THE ORGAN, SAN ANTONIO, AND FRANKLIN MOUNTAINS. THE EASTERN LIMITS OF THE BASIN ARE OUTLINED BY THE SACRAMENTO, SIERRA BLANCA, AND THE HUECO MOUNTAINS. THE BASIN IS BOUNDED ON THE NORTH BY THE SIERRA OSCURA MOUNTAINS. THE AVERAGE ELEVATIONS OF THE RANGES BORDERING THE AREA VARY FROM APPROXIMATELY 5,500 TO 9,000 FEET MSL, WITH SIERRA BLANCA PEAK NEAR RUIDOSO REACHING A HEIGHT OF 12,003 FEET MSL. THERE IS ONE SMALL RANGE IN THE BASIN, THE JARILLA MOUNTAINS, NEAR OROGRANDE, ABOUT 10 MILES LONG WITH A MAXIMUM ELEVATION OF 5,301 FEET MSL. THE ELEVATION OF THE BASIN FLOOR IS 3,900 FEET IN THE VICINITY OF EL PASO, AND IS GENERALLY ABOUT 4,000 FEET MSL FROM THE WHITE SANDS BLOCKHOUSE AREAS NORTHWARD TO THE FOOTHILLS OF THE SIERRA OSCURA MOUNTAINS. THE LOWEST ELEVATION IS 3,887 FEET MSL AT LAKE LUCERO (FIG. 3).

ABOUT THREE-FOURTHS OF THE MISSILE RANGE LIES IN THE TULAROSA BASIN, BUT THE NORTHWEST CORNER IS IN ANOTHER BASIN WITH SOMEWHAT SIMILAR TOPOGRAPHY, THE JORNADA DEL MUERTO.

TABLE 1, INDEX OF WEATHER STATIONS

STATION	LATITUDE	LONGITUDE	ELEVATION	COUNTY	PERIOD OF RECORD **
Afton *	32° 03'	106° 52'	4200 Ft.	Dona Ana	1942-58
Alamogordo	32 53	105 57	4350	Otero	1931-58
Ancho *	33 56	105 45	6112	Lincoln	1931-58
Bingham	33 53	106 22	5453	Socorro	1939-58
Bosque del Apache	33 46	106 54	4520	Socorro	1931-58
Cáballo Dam	32 54	107 18	4190	Sierra	1936-58
Capitan	33 33	105 34	6350	Lincoln	1931-58
Carrizozo	33 39	105 53	5438	Lincoln	1931-58
Cloudcroft R. S.	32 57	105 44	8700	Otero	1931-58
Engle	33 11	107 02	4770	Sierra	1931-52
Ft. Stanton	33 30	105 31	6230	Lincoln	1931-58
Hardin Ranch *	33 15	106 44	6000	Socorro	1942-52
Hatch	32 40	107 09	3855	Dona Ana	1931-58
Holloman AFB	32 51	106 06	4092	Otero	1944-57
Jornada Ex. Range	32 37	106 44	4265	Dona Ana	1931-58
Lulu *	32 26	105 37	5000	Otero	1942-58
Mayhill R. S.	32 55	105 28	6538	Otero	1931-58
Mescalero	33 10	105 46	6555	Otero	1931-58
Mountain Park	32 57	105 50	6720	Otero	1931-58
New Mexico State University	32 17	106 45	3909	Dona Ana	1931-58
Orogrande	32 22	106 05	4180	Otero	1931-58
Ruidoso	33 20	105 40	6875	Lincoln	1942-58
Tularosa	33 04	106 02	4450	Otero	1931-58
White Sands National Monument	32 47	106 10	3951	Otero	1939-58
WBR Air Weather "A" Station	32 23	106 29	4238	Dona Ana	1947-57
El Paso, Texas	31 48	106 24	3920	El Paso	1940-58
SUPPLEMENTARY WIND STATIONS					
NORTHWEST-30	32 53	106 30	4000	Dona Ana	
OSCURA RANGE CAMP	33 30	106 10	4515	Otero	
S R - VAN	32 38	106 24	3955	Dona Ana	
TULA	33 04	106 09	4130	Otero	

* Rainfall records only.

** In some cases periods of record are not continuous, and may differ in length for various elements.

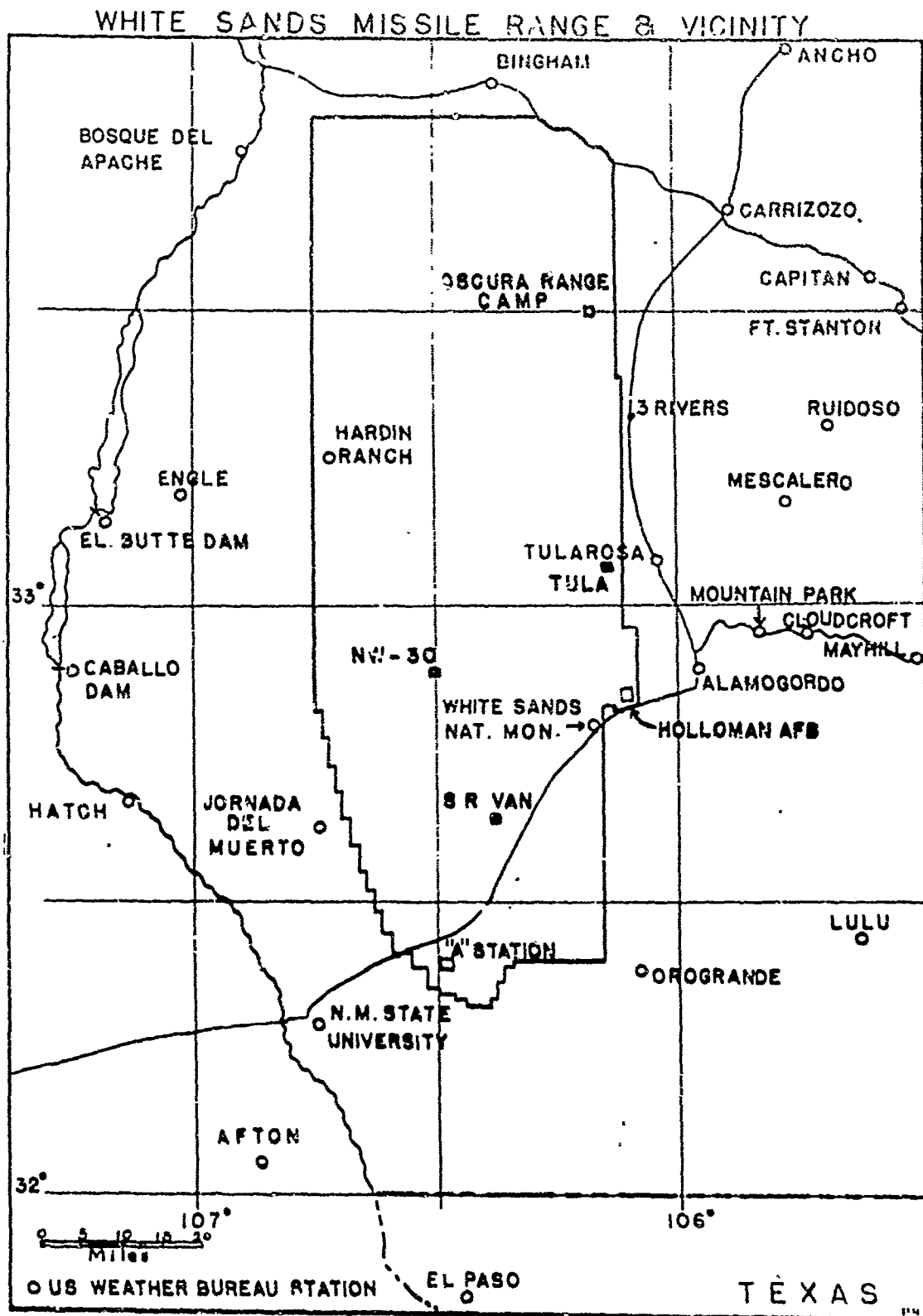


FIG. 1 MAP OF WEATHER STATIONS

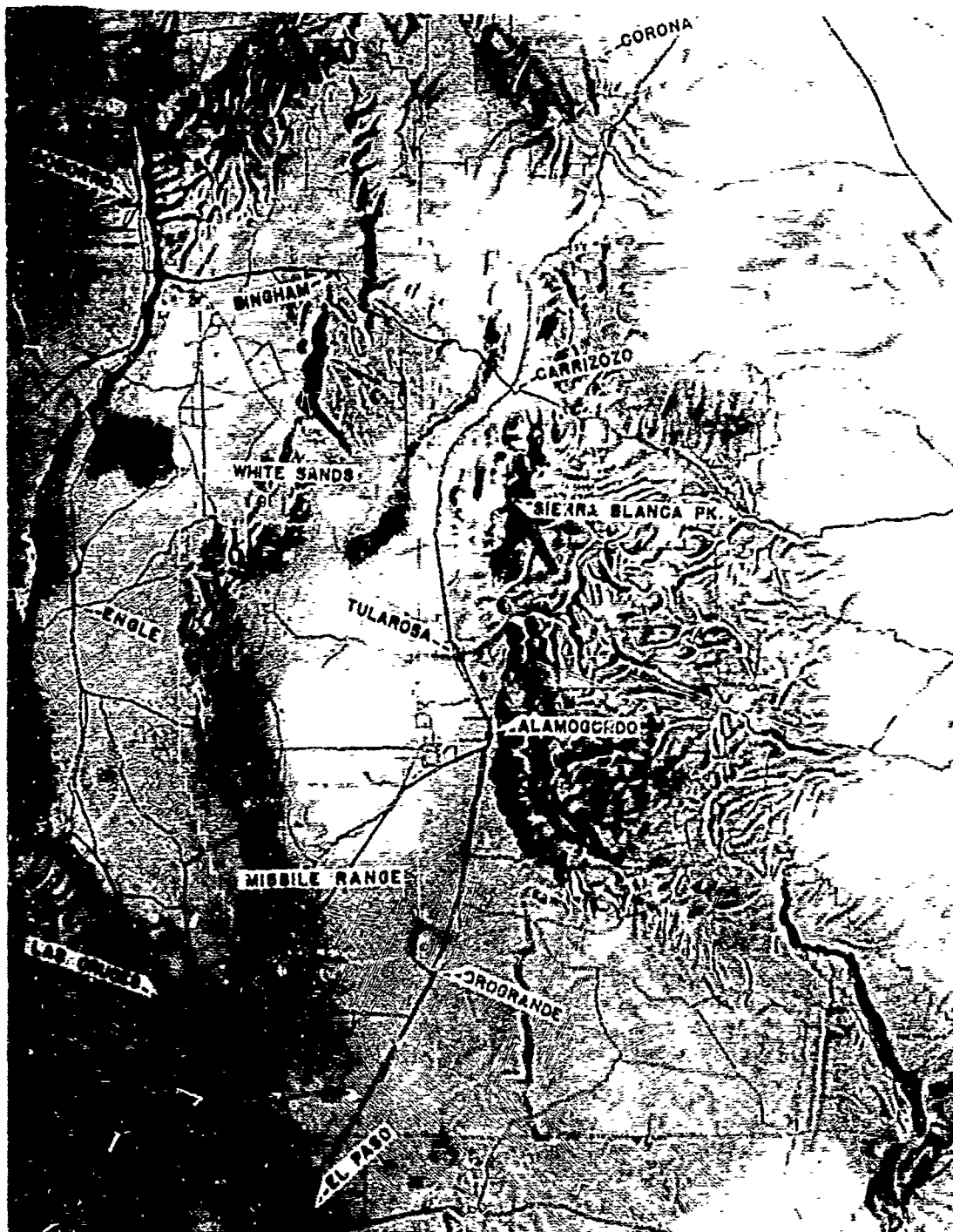


FIG. 2. TOPOGRAPHY OF TULAROSA BASIN & VICINITY

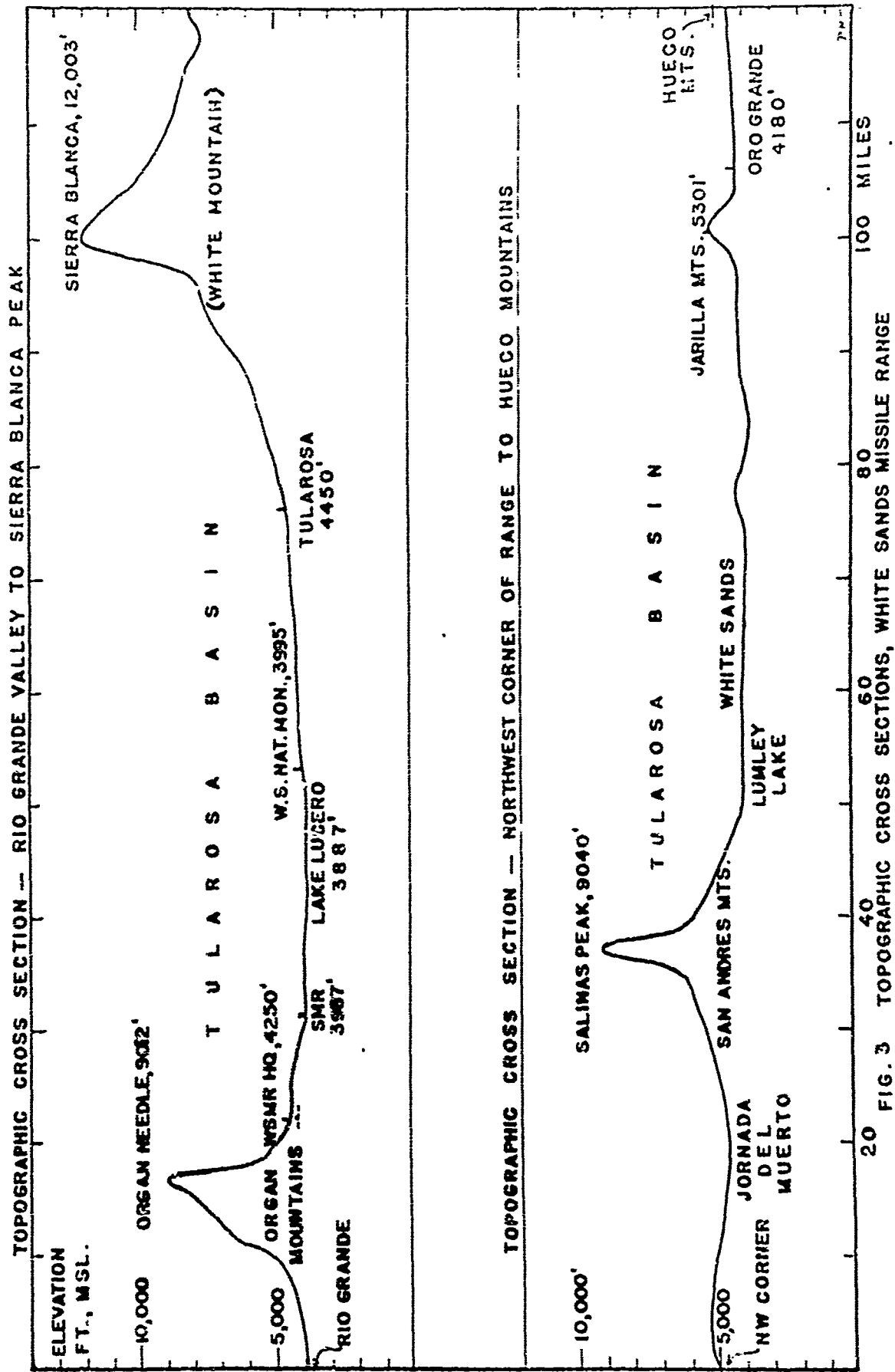


FIG. 3 TOPOGRAPHIC CROSS SECTIONS, WHITE SANDS MISSILE RANGE

THE UNIQUE FEATURE OF THE TULAROSA BASIN IS THE PRESENCE IN ITS CENTRAL PORTION OF EXTENSIVE DEPOSITS OF GYPSUM, DERIVED FROM THE WIND EROSION OF SELENITE CRYSTALS WHICH FORMED IN A LAKE BED AS THAT BODY OF WATER EVAPORATED OVER A PERIOD OF PERHAPS SEVERAL MILLIONS. THE PREDOMINATE CHARACTER OF THE SOIL IN THE REMAINDER OF THE BASIN IS SANDY, BUT IN THE NORTHERN PORTION THERE IS AN EXTENSIVE LAVA FLOW. AT THE LOWER ELEVATIONS VEGETATION CONSISTS MAINLY OF MESQUITE, GREASWOOD, SCRUB OAK, YULCA, CACTUS, MANY SPARSE GRASSES AND SMALL DESERT HERBS; ABOVE 7,000 FEET MSL RAINFALL IS SUFFICIENT TO SUPPORT CONSIDERABLE GROWTHS OF JUNPER, PINE, AND FIR. (THE ISOHYETS OF FIGURE 4 ARE BASED ON THE FACT THAT JUNPER AND CONIFERS REQUIRE ANNUAL RAINFALL OF AT LEAST 13 - 20 INCHES TO PRODUCE ANY GROWTH EXCEPT WHEN WIDELY SCATTERED (27.)

THE VARIATION IN TYPES OF SOIL AND IN DISTRIBUTION OF VEGETATION CONTRIBUTE A MARKED EFFECT ON SURFACE REFLECTIVITY AND ABSORPTION AND ON SMALL-SCALE PERTURBATIONS WHICH ARE DUE TO UNEQUAL HEATING.

THE BASIN HAS AN ARID CLIMATE WITH ANNUAL RAINFALL AVERAGING LESS THAN 10 INCHES (FIG. 4), AND A MEAN ANNUAL TEMPERATURE OF ABOUT 60 DEGREES. CONSIDERABLE DRAINAGE OCCURS FROM THE NEARBY MOUNTAINS DURING INFREQUENT BUT SOMETIMES PROLONGED WET SPELLS, OCCASIONALLY PRODUCING INTERMITTENT LAKES WHICH MAY PERSIST FOR SEVERAL MONTHS.

LOCAL WIND EFFECTS IN THE TULAROSA BASIN

SEVERAL FACTORS ENTER INTO THE VARIABILITY OF THE SURFACE WINDS IN THE TULAROSA BASIN. ONLY A SUMMARY OF THE INDIVIDUAL ITEMS WILL BE INCLUDED IN THIS STUDY DUE TO THE COMPLEX NATURE OF THE METEOROLOGICAL CONDITIONS WHICH CAUSE THE VARIATIONS IN THE WIND.

SEASONAL VARIATION IS LARGE, WITH THE STRONGEST SUSTAINED WINDS OCCURRING IN THE LATE WINTER AND SPRING MONTHS. THIS IS PRIMARILY BECAUSE OF ENTRAINMENT OF THE SURFACE WINDS BY THE STRONG WESTERLY WINDS ALOFT AND THE NATURE OF THE TERRAIN ON THE WESTERN BOUNDARY OF THE BASIN. IN THE SUMMER MONTHS THE SURFACE WINDS ARE LIGHTER EXCEPT FOR THE SHORT TERM VARIATIONS CAUSED BY THUNDERSTORMS AND DUST DEVILS.

THE VARIABILITY CAUSED BY FRONTAL ACTIVITY IS GENERALLY CONFINED TO THE WINTER AND SPRING MONTHS, CONTRIBUTING TO THE STRONGER WINDS OBSERVED DURING THESE MONTHS. THE MOST COMMON FRONTS ARE OF THE "COLD" TYPE, ENTERING THE BASIN FROM THE NORTHWEST AFTER AN EXTENSIVE TRAJECTORY OVER MOUNTAINOUS TERRAIN. OTHER COLD FRONTS ENTER THE BASIN FROM THE NORTH AND EAST, BUT THE ARCTIC AIR MASSES ARE USUALLY DEFLECTED TO THE EAST OF THE BASIN BY THE SACRAMENTO MOUNTAINS AND BY THE SANGRE DE CRISTO MOUNTAINS IN NORTHEASTERN NEW MEXICO.

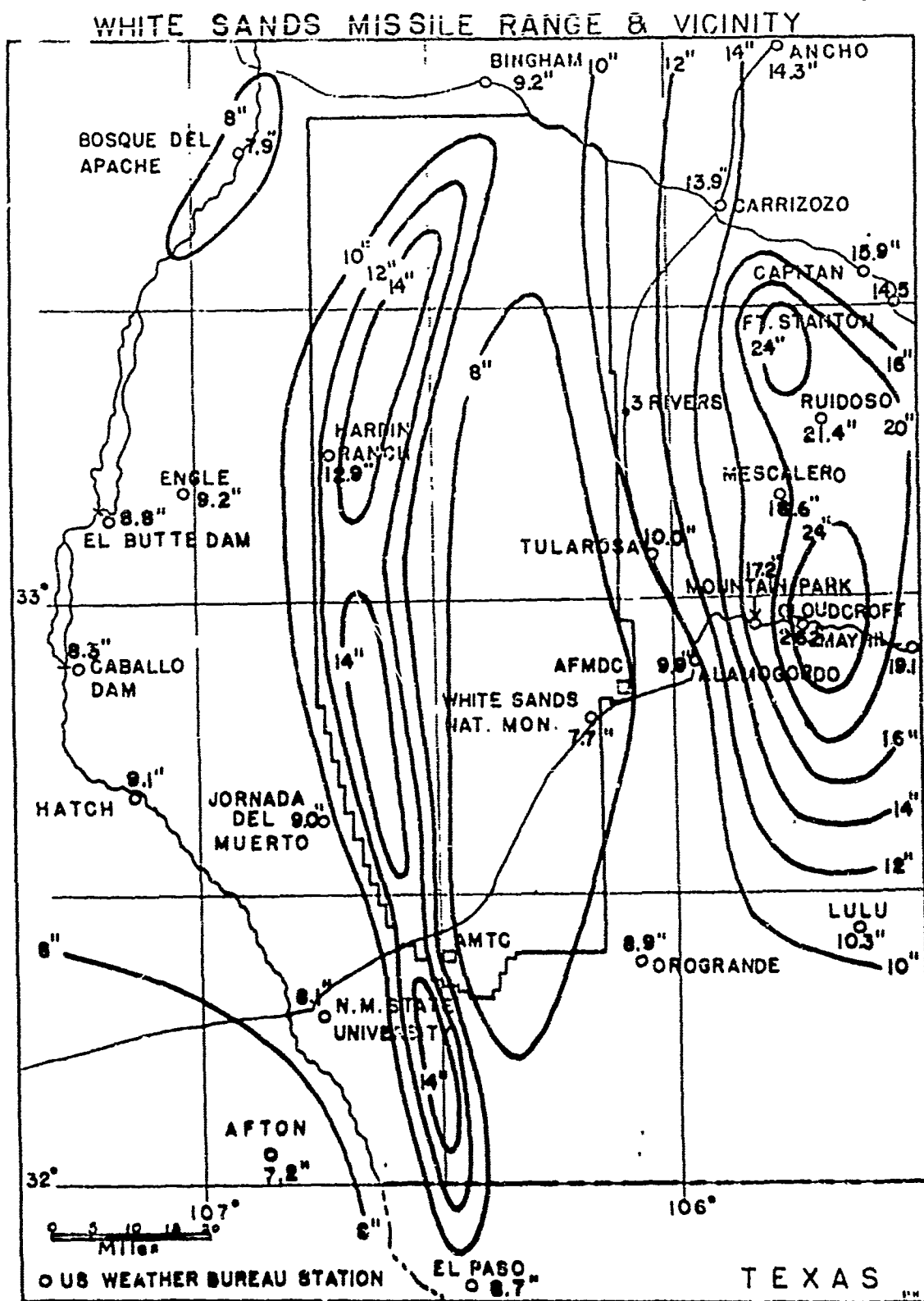


FIG. 4 MEAN ANNUAL PRECIPITATION, WSMR

IN THE LATE SPRING AND SUMMER MONTHS NUMEROUS DUST DEVILS OCCUR, AND IT IS NOT UNUSUAL TO SEE AS MANY AS TEN DUST COLUMNS IN THE BASIN AT ONE TIME. THE EFFECT OF THE DUST DEVILS ON THE SURFACE WIND AT ONE POINT USUALLY LASTS ONE MINUTE OR LESS, BUT THE DIRECTION OF THE WIND MAY SHIFT AS MUCH AS 360 DEGREES AND THE WIND SPEED MAY EXCEED 50 MILES PER HOUR. MAXIMUM RECORDED GUSTS WITH A DUST DEVIL AT THE WHITE SANDS MISSILE RANGE WEATHER STATION HAS BEEN 55 MILES PER HOUR. THE COMMON WIND PATTERN DURING THE DUST DEVIL SEASON CONSISTS OF SHORT PERIODS OF CALM FOLLOWED BY RANDOM LIGHT WINDS. HOWEVER, DUST DEVILS WITH VORTICES UP TO 200 FEET IN DIAMETER ARE NOT UNCOMMON WHEN GENERAL SURFACE WINDS EXCEED 40 MILES PER HOUR.

THUNDERSTORM ACTIVITY CONTRIBUTES CONSIDERABLY TO THE SURFACE WIND VARIABILITY, WITH THE SEASON OF MAXIMUM OCCURRENCE FROM JUNE THROUGH SEPTEMBER. THE MOST COMMON TYPE OF THUNDERSTORM IS CAUSED BY A COMBINATION OF OROGRAPHIC LIFTING AND CONVECTION, AND THE USUAL LIFE PERIOD EXTENDS FROM APPROXIMATELY 1200 TO 0200 MST. THIS TYPE OF THUNDERSTORM DEVELOPS OVER THE ADJACENT MOUNTAINS WITH SUBSEQUENT MOVEMENT DEPENDENT UPON THE WINDS ALOFT. UPDRAFTS AND DOWNDRAFTS ARE ALWAYS PRESENT WITH THUNDERSTORMS, AND FLOODING, DUST AND SAND ARE COMMON. HAIL AND MODERATE TO HEAVY RAIN FREQUENTLY ACCOMPANY THE THUNDERSTORMS AND CONTRIBUTE FURTHER TO THE SURFACE WIND VARIABILITY. DIFFERENTIAL COOLING OF THE MOUNTAINS AND PORTIONS OF THE BASIN. OTHER THUNDERSTORMS OCCUR WITH FRONTAL PASSAGES AND IN PERIODS OF MARKED CONVERGENCE ALOFT, BUT THESE STORMS ARE IN THE MINORITY.

THE SURFACE WINDS ARE AFFECTED ON THE MICRO SCALE BY THE ROUGH TERRAIN OF THE BASIN FLOOR. SURFACE FRICTION AND ROUGHNESS RESULT IN EXTENSIVE EDDY CURRENTS AND LOW-LEVEL TURBULENCE.

ONE OF THE MORE PREDOMINANT FEATURES AFFECTING WIND VARIABILITY IN THE BASIN LIES IN THE EFFECTS OF THE ADJACENT MOUNTAIN RANGES. DRAINAGE WINDS OF LESS THAN 15 MILES PER HOUR ARE COMMON ON THE SLOPES OF THE MOUNTAINS AND OVER THE FIRST FEW MILES OF THE BASIN FLOOR. THESE WINDS CAN REACH VELOCITIES AS HIGH AS 30 TO 40 MILES PER HOUR WHEN THE PRESSURE GRADIENT AND DRAINAGE SLOPE ARE IN THE SAME DIRECTION. THE DRAINAGE WINDS ARE OF A LOCAL IN NATURE, OCCURRING GENERALLY FROM MIDNIGHT UNTIL 4 OR 5 HOURS AFTER SUNRISE. AREAS ON THE SLOPES OF THE MOUNTAINS MAY EXPERIENCE THE WINDS AS EARLY AS THE ONSET OF DARKNESS AND LASTING UNTIL 4 OR 5 HOURS AFTER SUNSET.

FUNNEL EFFECT WINDS ARE COMMON DURING THE WINTER AND THROUGHOUT THE SPRING MONTHS IN THE LEE OF THE NUMEROUS BARRIERS ON THE WESTERN SIDE OF THE BASIN, WITH VELOCITIES OCCASIONALLY EXCEEDING 70 MILES PER HOUR. STRUCTURAL DAMAGE OF MINOR NATURE MAY RESULT FROM THESE WINDS, AND CONSIDERABLE BLINDING DUST AND SAND OCCURS OVER PERIODS OF FROM ONE TO THREE DAYS. THE EASTERN SIDE OF THE BASIN IS AFFECTED TO A LESSER EXTENT BY ALSO BY THE PREPONDANCE OF STRONG WESTERLY WINDS ALOFT.

FOEHN WINDS COMMONLY OCCUR BECAUSE OF THE EXTENSIVE MOUNTAIN BARRIERS ALONG THE WESTERN BOUNDARY OF THE BASIN. THE STRONG WESTERLY WINDS ALOFT IN WINTER AND SPRING MONTHS ARE FORCED OVER THE MOUNTAINS, CAUSING FREQUENT CLOUDINESS AND OCCASIONAL PRECIPITATION OVER THE PEAKS AND RIDGES. DURING WARM

DOWNSLOPE WINDS ON THE EAST SIDE OF THE RANGES. STANDING WAVES OFTEN FORM IN THE LEE OF THE WESTERN BARRIER, WITH PERTURBATIONS IN THE UPPER FLOW EXTENDING EASTWARD AS FAR AS THE SACRAMENTO MOUNTAINS SOME 50 MILES EAST. AS MANY AS NINE ROWS OF WAVE CLOUDS HAVE BEEN OBSERVED IN THE LEE OF THE SHARP RIDGE FORMED BY THE ORGAN MOUNTAINS. FREQUENTLY THE DRY AIR ALOFT PREVENTS THE FORMATION OF WAVE CLOUDS, BUT NUMEROUS BALLOON AScents HAVE REVEALED THE PRESENCE OF THE WAVES. THE LEE WAVE EFFECTS ALOFT ARE TRANSMITTED TO THE SURFACE WINDS THROUGH ENTRAINMENT AND TURBULENCE AND WILL CAUSE ONLY DERIVABLE VARIATION IN THE SURFACE WIND SPEED, PARTICULARLY IN THE WESTERN PORTION OF THE BASIN.

COLLECTION OF SURFACE WIND DATA AT REGULARLY-SERVED STATIONS IN THE TULAROSA BASIN

SURFACE WIND DATA FOR EACH OF THE THREE REGULARLY-SERVED WEATHER STATIONS IN THE TULAROSA BASIN ARE PRESENTED IN APPENDIX A AND ARE BASED ON PUBLICATIONS OF THE U. S. WEATHER BUREAU NATIONAL WEATHER RECORDS CENTER, ASHEVILLE, NORTH CAROLINA ⁴⁴, ⁵⁷ AND ON A SUMMARY PUBLISHED BY THE WEATHER STATION AT HOLLOMAN AIR DEVELOPMENT CENTER, NEW MEXICO ⁶⁷. THE PERIODS OF RECORD FOR THE STATIONS WERE:

AIR WEATHER "A" STATION

WHITE SANDS MISSILE RANGE, N. M. -- SEPTEMBER 1947 -- MARCH 1955

HOLLOMAN AIR DEVELOPMENT CENTER, N. M. -- SEPTEMBER 1942 -- OCTOBER 1956

WEATHER BUREAU AIRPORT STATION

EL PASO, TEXAS -- JANUARY 1950 -- DECEMBER 1955

INCLUDED IN THE DATA ARE

1. GRAPHICAL PRESENTATIONS OF PERCENTAGE FREQUENCY OF OCCURRENCE BY SPEED GROUPS, BY MONTHS, AND AN ANNUAL AVERAGE.

2. AVERAGE WIND SPEEDS IN MILES PER HOUR FROM SIXTEEN DIRECTIONS, BY MONTHS, AND AN ANNUAL AVERAGE. THESE ARE REFERRED TO AS WIND ROSES. HOLLOMAN AIR DEVELOPMENT CENTER AVERAGE SPEEDS ARE NOT INCLUDED.

THE SCALE OF PERCENTAGE ON THE WIND ROSES IS ONE INCH FOR ONE-FOURTH INCH. AVERAGE WIND SPEEDS IN MILES PER HOUR ARE ENTERED AT THE END OF THE PERCENTAGE BARS. PERCENTAGE OF OCCURRENCE OF CALM CONDITIONS ARE ENTERED

ABOVE THE ROSES. THE HIGH PERCENTAGE OF CALMS AT WHITE SANDS MISSILE RANGE AND AT HOLLOMAN IS PROBABLY DUE TO THE THRESHOLD CHARACTERISTICS OF THE WIND INSTRUMENTS IN USE AT THOSE STATIONS.

INSTRUMENTATION, AIR WEATHER "A" STATION
WSMR, N.M.

THE WIND EQUIPMENT IN USE AT THE AIR WEATHER "A" STATION DURING THE PERIOD OF RECORD WAS THE AN/GMQ-1 WIND MEASURING SYSTEM. IT CONSISTED OF A WIND TRANSMITTER ML-203-B AND A WIND PANEL ML-204-B. THE TRANSMITTER WAS A MEASURING AND TRANSMITTING INSTRUMENT IN WHICH AN ANEMOMETER AND WIND VANE WERE ASSEMBLED TO COMPRISE A SINGLE UNIT. THE ANEMOMETER CONSISTED OF A THREE-CUP ROTOR AND AN ANEMOMETER HEAD WHICH WAS AN ALTERNATING CURRENT GENERATOR DRIVEN BY MEANS OF THE CUP ROTOR THROUGH A SYSTEM OF GEARS. IT WAS PLUGGED INTO THE MAIN SHAFT OF THE WIND VANE AND HELD TIGHTLY IN PLACE BY A TILTSCREW. THE WIND VANE CONSISTED OF A TAIL AND COUNTERBALANCE ATTACHED TO AN ASSEMBLY CONTAINING A SYNCHRO-TYPE TRANSMITTER OPERATED ON DIRECT CURRENT. THE WIND PANEL, PROTECTING UNIT OF THE SET, WAS COMPOSED OF A SMALL WOODEN BOX WITH A HINGED PANEL ON WHICH WERE MOUNTED TWO INDICATORS AND TWO SWITCHES. THE DIRECT CURRENT INDICATION WAS A SYNCHRO-TYPE INSTRUMENT, WHILE THE SPEED INDICATOR WAS A RECTIFIER-TYPE AC MILLIAMMETER HAVING A ONE MILLI AMPERE DC MOVEMENT. THE SPEED INDICATOR WAS CALIBRATED IN TWO SCALES, ONE FROM 2 TO 30 MPH AND THE OTHER FROM 2 TO 150 MPH. THE OVERALL ACCURACY OF THE SET WAS AS FOLLOWS:

THRESHOLD SPEED TO 30 MPH ----- 1/2 MPH
30 TO 75 MPH ----- 2 MPH
75 TO 150 MPH ----- 4 PERCENT OF SCALE READING.

(THESE FIGURES WERE BASED ON WIND TUNNEL TESTS BY THE U. S. BUREAU OF STANDARDS.)

OBSERVATIONAL HOURS VARIED DURING THE SAMPLING PERIOD, HOWEVER FOR THE MOST PART THE OBSERVATIONS WERE MADE AT ONE-HOUR INTERVALS, 24 HOURS PER DAY. NEAR THE END OF THE PERIOD, THE OBSERVATIONAL PROGRAM WAS SHORTENED TO 16 HOURS PER DAY, BEGINNING AT 0000 HOURS MST. THE WIND VALUES ARE DAILY AVERAGES AS READ FROM THE INDICATOR DIALS. AN APPARENT BIAS TOWARD RECORDING CARDINAL WIND DIRECTIONS MAY BE SEEN IN THE STATION WIND RECORD.

EXPOSURE WAS SATISFACTORY, BUT SOME LOCAL EFFECTS WERE CAUSED BY THE WEATHER OBSERVATORY BUILDING UPON WHICH THE TRANSMITTERS WERE MOUNTED AND BY SEVERAL LARGE BUILDINGS TO THE SOUTHWEST AND NORTHWEST OF THE INSTRUMENTATION. THE TRANSMITTERS WERE MOUNTED AT A HEIGHT OF 27 FEET ON A STANDARD MAST ON THE ROOF OF "A" STATION. LOCAL EFFECTS WERE SIGNIFICANT BECAUSE OF THE PROXIMITY OF THE ORGAN MOUNTAINS WHOSE FOOTHILLS RISE 2-1/2 MILES TO THE NORTHWEST OF THE STATION. MARKED DRAINAGE WINDS, STRONG FUNNEL EFFECT WINDS, LEE WAVE FOEHN WINDS, AND DOWNDRAFTS FROM OROGRAPHIC THUNDERSTORMS WERE ALL SIGNIFICANT AT THIS STATION.

INSTRUMENTATION, HOLLOMAN AIR
DEVELOPMENT CENTER, NEW MEXICO

TWO SETS OF INSTRUMENTATION WERE UTILIZED AT HOLLOMAN AIR DEVELOPMENT CENTER DURING THE PERIOD SEPTEMBER, 1942 THROUGH OCTOBER, 1956. THE ORIGINAL INSTALLATION CONSISTED OF A BRITISH-TYPE WIND SYSTEM WITH SEPARATE WIND DIRECTION AND WIND SPEED TRANSMITTERS. THESE INSTRUMENTS WERE LOCATED ON INDIVIDUAL MOUNTS ON TOP OF THE BASE FIRE STATION AT A HEIGHT OF 55 FEET. THE INSTANTANEOUS WIND VALUES WERE TRANSMITTED TO AN R-33 REORDER. IN 1955 THE WIND EQUIPMENT IN USE WAS REPLACED BY A WIND MEASURING SET AN/GMQ-11 AND THE INSTALLATION WAS MOVED TO A SITE IN THE CENTER OF THE LANDING AREA.

THE WIND DIRECTION AND SPEED TRANSMITTER, T-420/GMQ-11 (AEROVANE) IS A DUAL PURPOSE INSTRUMENT WHICH MEASURES AND ELECTRICALLY TRANSMITS WIND SPEED AND DIRECTION. THE SPEED WAS MEASURED BY A THREE-BLADED IMPELLER FASTENED TO THE ARMATURE OF A TACHOMETER MAGNETO LOCATED IN THE NOSE OF THE VANE. (THE SPEED OF ROTATION OF THE IMPELLER IS DIRECTLY PROPORTIONAL TO THE SPEED OF THE WIND STRIKING THE BLADES, THUS, VOLTAGE GENERATED BY THE MAGNETO IS A FUNCTION OF WIND SPEED. WHEN THE GENERATED VOLTAGE IS MEASURED BY A VOLTMETER CALIBRATED IN TERMS OF WIND SPEED, THE SPEED OF THE WIND IS INDICATED.) WIND DIRECTION WAS MEASURED BY A STREAMLINED VANE COUPLED TO THE ROTOR OF A SYNCHRO MOTOR. THIS MOTOR ELECTRICALLY TRANSMITTED THE POSITION OF THE VANE TO A SIMILAR SYNCHRO MOTOR IN AN INDICATOR; THUS, ANGULAR DISPLACEMENTS WERE MEASURED, TRANSMITTED, AND INDICATED.

THE WIND DIRECTION AND SPEED INDICATOR D-373/GMQ-11 LOCATED IN THE WEATHER STATION CONSISTED OF TWO UNITS, THE PANEL ASSEMBLY AND THE RACK IN WHICH THE PANEL WAS MOUNTED. THE PANEL ASSEMBLY CONTAINED THE WIND DIRECTION AND WIND SPEED METERS THAT WERE ACTIVATED BY THE T-420/GMQ-11.

THE LOCATION OF THE WIND INSTRUMENTATION, NEAR THE INTERSECTION OF THE MAJOR RUNWAYS ON THE AIRFIELD WAS ONE-HALF MILE FROM THE NEAREST BUILDING AND THE EXPOSURE WAS EXCELLENT. THE STANDARD MOUNT SUPPORTED THE AEROVANE AT 15-1/2 FEET ABOVE THE GROUND. THE TERRAIN WAS VERY FLAT WITH VERY LOW VEGETATION FOR SEVERAL MILES IN EVERY DIRECTION. LOCAL WIND EFFECTS WERE PRIMARILY SURFACE FRICTION TURBULENCE, DOWNDRAFTS FROM OROGRAPHIC THUNDERSTORMS, AND DRAUGHT WINDS FROM THE SACRAMENTO MOUNTAINS WHICH RISE ELEVEN MILES EAST OF THE AIRPORT. LEE WAVES DUE TO STRONG WESTERLY WINDS CROSSING THE SAN ANDRES RANGE TWENTY-SIX MILES TO THE WEST WERE CONSIDERABLY MODIFIED, AND FOEHN WINDS AND FUNNEL EFFECT WINDS WERE NOT COMMON.

WIND INSTRUMENTATION
WEATHER BUREAU AIRPORT, STATION
EL PASO, TEXAS

THE WIND INSTRUMENTATION IN USE AT THE EL PASO MUNICIPAL AIRPORT DURING THE PERIOD 1950 THROUGH 1955 CONSISTED OF THE TRANSMITTER COMPONENTS OF A 420-A WIND SYSTEM. THE WIND SPEED INDICATOR WAS A TRIPLETT MODEL 626 METER AND THE WIND DIRECTION INDICATOR WAS A BENDIX-FRIEZ DIRECTION DIAL. THE TRANSMITTERS WERE LOCATED 100 FEET ABOVE THE GROUND ON THE CONTROL TOWER,

ATOP THE TERMINAL BUILDING. THE WIND DIRECTION TRANSMITTER WAS A SYNCHROTYPE INSTRUMENT; THE WIND SPEED TRANSMITTER WAS A MAGNETO-GENERATOR ANEMOMETER. THESE INSTRUMENTS ARE DESIGNED TO TRANSMIT INSTANTANEOUS VALUES TO REMOTE STATIONS. FOR RECORD PURPOSES, ONE-MINUTE AVERAGE WIND SPEED VALUES WERE COMPUTED AT ONE-HOUR INTERVALS, TWENTY-FOUR HOURS EACH DAY.

THE EXPOSURE OF THE WIND INSTRUMENTS WAS CONSIDERED TO BE AVERAGE, WITH SOME EFFECT ON WIND VALUES DUE TO EDU. CURRENTS OVER THE TERMINAL BUILDING AND NEARBY HANGARS. THE INSTRUMENTATION WAS MOUNTED ON A LEVEL, HIGHER HERE THAN THAT AT OTHER SITES UTILIZED IN THIS STUDY, RESULTING IN A SMALLER SURFACE FRICTION EFFECT AT THIS STATION. THE AREA IMMEDIATELY SURROUNDING THE EL PASO AIRPORT IS RATHER FLAT, WITH THE FRANKLIN MOUNTAINS RISING FIFTY MILES WEST OF THE TERMINAL BUILDING. LOCAL EFFECTS ON THE WINDS WERE DUE TO SURFACE FRICTION, FUNNEL EFFECT, FORM WINDS, DOWNDRAFT FROM CLOUDS, AND OTHER FORMS AND INDIRECT EFFECTS CAUSED BY LEE WAVES. THE EFFECTS OF THESE FACTORS WERE LESSENED CONSIDERABLY DUE TO THE DISTANCE BETWEEN THE WIND INSTRUMENTATION AND THE MOUNTAINS.

SPATIAL VARIABILITY OF SURFACE WIND AT WHITE SANDS MISSILE RANGE

TO OBTAIN A DETAILED STUDY OF SPATIAL VARIABILITY OF SURFACE WIND, STANDARD INSTRUMENTATION WAS INSTALLED AT FOUR SITES SELECTED TO REPRESENT VARIOUS PORTIONS OF THE MISSILE RANGE (FIG. 1).

AEROVANE TRANSMITTERS WERE USED TO RECORD WIND SPEED AND DIRECTION. MODIFIED RO-2/GMQ RECORDERS AT EACH OBSERVATIONAL STATION. THE RO-2/GMQ INSTRUMENTS WERE TWO-ELEMENT RECORDERS THAT SIMULTANEOUSLY PRODUCED TWO SEPARATE HAND-INKED TRACES OF WIND DIRECTION AND SPEED VALUES ON A CONTINUOUSLY MOVING PAPER CHART. THE OBSERVATIONAL PROGRAM WAS SUPERVISED BY RADIO WIND TELEGRAPHY INTER COMMUNICATION SYSTEM CONNECTING TO A REMOTE STATION.

GRAPHS OF WIND SPEED AND DIRECTION IS INCLUDED FOR EACH STATION AND ARE INCLUDED IN APPENDIX A. ON MOST DATES FEWER THAN THE FULL COMPLEMENT OF STATIONS WERE OPERATED. THE SAMPLING PERIODS WERE GENERALLY LIMITED TO THE EARLY MORNING HOURS WHEN THE ATMOSPHERE NEAR THE SURFACE WAS IN A MORE STABLE CONDITION. (SEASONAL VARIABILITY IS NOT SHOWN SINCE ONLY A RELATIVELY SHORT PERIOD WAS COVERED BY THIS STUDY.)

TEMPERATURES IN THE TULAROSA BASIN

TEMPERATURES ARE CHARACTERISTIC OF A CONTINENTAL TYPE CLIMATE WITH QUITE HIGH MAXIMA AND LOW MINIMA, RESULTING IN A LARGE DIURNAL TEMPERATURE RANGE. THE AVERAGE DAILY TEMPERATURE RANGE FOR WHITE SANDS NATIONAL MONUMENT (TABLE 11 AND FIG. 5) AMOUNTS TO 37.2° , FROM A MEAN DAILY MINIMUM FOR THE YEAR OF 41.2°F TO A MEAN MAXIMUM OF 78.4°F . THIS DIURNAL RANGE IS REMARKABLY CONSISTENT DURING THE ENTIRE YEAR, VARYING ONLY FROM 33.5°F IN JANUARY TO 40.8°F IN NOVEMBER. THE LOWEST AND HIGHEST TEMPERATURES OF RECORD FOR THIS STATION SHOW AN EXTREME RANGE OF 124° , FROM -14°F TO 110°F FOR ONLY EIGHTEEN YEARS OF RECORD. FIGURES 6 AND 7 ARE ISOTHERM CHARTS FOR JANUARY AND JULY FOR THE AREA.

RAINFALL FOR THE BASIN AREA

THE PRECIPITATION RECORDS (TABLE 11 AND FIG. 8) SHOW THE GREAT VARIABILITY IN RAINFALL FROM MONTH TO MONTH AND YEAR TO YEAR, WITH THE RAINFALL FOR WET YEARS AS MUCH AS SEVEN TIMES AS GREAT AS DURING DRY YEARS AT SOME STATIONS. THE GREATEST MONTHLY (OR EVEN THE GREATEST 24-HOUR) PRECIPITATION AT TIMES HAS EXCEEDED THE TOTAL ANNUAL RAINFALL DURING DROUGHT PERIODS AT SEVERAL LOCATIONS.

PRECIPITATION IS OF THE CONTINENTAL TYPE (FIG. 9, WITH 50 PERCENT OF THE ANNUAL TOTAL OCCURRING IN THE MONTHS OF JULY, AUGUST AND SEPTEMBER, AND 72 PERCENT IN THE WARM SEASON FROM MAY THROUGH OCTOBER. THIS SUMMER RAINFALL IS OCCASIONED BY THE ESTABLISHMENT DURING THOSE MONTHS OF A FLOW OF WARM MOIST AIR FROM THE GULF OF MEXICO TOWARD THE SEMI-PERMANENT LOW, CENTERED IN SOUTHERN ARIZONA. THE COMBINATION OF UPSLOPE FLOW, OROGRAPHIC LIFTING AND CONVECTIVE ACTIVITY, ALONG WITH THE HIGH AFTERNOON TEMPERATURES, SET OFF MANY AFTERNOON, EVENING AND NIGHTTIME THUNDERSHOWERS WHICH ACCOUNT FOR MOST OF THE RAINFALL OF THIS PERIOD. OCCASIONALLY, ADVECTIONAL THUNDERSTORMS OCCUR IN CONNECTION WITH COLD FRONTS WHICH INVADE THE AREA.

SEVERAL TIMES IN THE PAST, TROPICAL STORMS HAVE MOVED INTO SOUTHERN TEXAS OR NORTHERN MEXICO FROM THE GULF OF MEXICO, AND CONTINUING NORTHWESTWARD, HAVE INVADDED SOUTHERN NEW MEXICO, PRODUCING TORRENTIAL DOWNPOURS (FIGS. 10 AND 11) AND DESTRUCTIVE FLASH FLOODS ^{AS} IN SEPTEMBER 1941. (IT WILL BE NOTED IN TABLE 11 THAT A LARGE PROPORTION OF THE GREATEST 24-HOUR AND MONTHLY RAINFALL OCCURRED IN THAT MONTH.)

TABLE II
TEMPERATURE MEANS AND EXTREMES

STATION	YEARS	DATA	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	ANNUAL
ALAMOSORDO	24	MEAN:	42.5	46.7	52.5	59.9	69.5	78.3	79.9	79.1	73.1	62.5	49.0	45.2	61.5
		HIGHEST:	79	80	91	96	104	109	110	108	102	98	84	78	110
		LOWEST:	-8	1	10	20	30	41	49	48	33	23	8	-1	-5
HUNTERMAN	17	MEAN:	36.2	38.8	44.9	54.0	63.3	72.5	75.9	74.3	68.7	57.5	43.5	37.2	56.9
		HIGHEST:	70	72	82	89	98	101	103	100	98	89	80	70	100
		LOWEST:	-8	-8	8	13	26	30	45	47	25	15	7	-3	-9
BOSQUE DEL APACHE	24	MEAN:	38.2	43.1	49.9	58.5	66.0	74.5	78.5	76.5	69.6	58.5	45.4	35.7	55.1
		HIGHEST:	80	85	90	100	105	113	110	110	106	97	89	77	110
		LOWEST:	-9	-4	9	11	20	34	47	43	29	20	6	-6	-9
CAPALLO DAM	21	MEAN:	42.0	46.3	51.6	60.5	68.7	77.9	81.0	79.2	73.2	62.7	49.4	45.1	61.5
		HIGHEST:	86	80	90	95	105	108	108	105	103	92	86	78	100
		LOWEST:	-6	9	13	23	32	41	52	52	33	29	14	9	-
CAPTAN	11	MEAN:	30.4	33.9	40.2	47.7	56.8	65.1	67.7	65.0	60.0	49.9	36.4	33.3	49.2
		HIGHEST:	65	66	78	81	90	96	98	96	92	82	70	69	90
		LOWEST:	-10	-12	6	10	21	30	41	41	26	16	-1	-4	-13
CARRIZO	26	MEAN:	37.3	41.4	46.8	54.9	63.7	72.7	75.3	73.7	67.9	57.3	44.0	30.0	56.1
		HIGHEST:	72	76	86	92	98	106	110	102	100	98	90	75	110
		LOWEST:	-9	-5	4	15	24	36	40	46	30	19	2	-1	-10
CLOUDCROFT	25	MEAN:	30.6	32.5	36.7	43.7	51.5	59.7	60.4	59.3	55.6	41.3	27.3	23.3	45.5
		HIGHEST:	64	66	70	75	85	89	87	85	85	81	66	54	90
		LOWEST:	-10	-11	-2	6	16	27	36	34	23	12	-7	-8	-13
EWING	19	MEAN:	37.7	43.9	49.6	58.0	66.4	75.0	78.6	76.9	70.6	59.7	46.5	40.1	60.0
		HIGHEST:	76	77	87	93	101	108	110	105	99	93	68	83	110
		LOWEST:	-8	4	14	20	30	40	51	52	31	24	6	9	-
FT. STANTON	25	MEAN:	34.9	38.4	43.1	50.9	58.9	67.6	70.2	68.7	63.1	53.5	42.2	35.7	54.3
		HIGHEST:	76	75	84	86	94	105	101	96	95	90	82	73	100
		LOWEST:	-21	-19	-3	12	19	31	40	35	27	13	-3	-16	-21
HATCH	25	MEAN:	41.1	45.4	51.6	60.0	67.7	76.2	79.4	77.7	71.5	61.2	48.4	41.9	60.0
		HIGHEST:	77	81	90	97	102	108	110	105	103	99	89	78	110
		LOWEST:	-4	3	6	20	30	32	49	50	33	27	7	-1	-4
HOLLOWAY AFB*	14	MEAN:	41.8	45.1	52.1	61.6	69.7	79.0	81.2	80.3	74.0	62.3	49.0	42.0	61.5
		HIGHEST:	78	80	87	95	103	107	107	105	103	93	81	75	107
		LOWEST:	-5	0	14	22	30	44	54	56	38	30	12	2	-5

* From HEC Technical Report, TR 57-2

TABLE II--CONTINUED
TEMPERATURE MEANS AND EXTREMES

STATION	YEARS	DATA	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	ANNUAL
JORNADA EXPERIMENTAL RANGE	27	MEAN:	39.5	44.0	51.7	57.9	66.2	75.6	79.4	77.7	71.3	60.3	46.7	40.2	59.2
		HIGHEST:	79	85	88	94	104	109	110	105	102	94	88	74	110
		LOWEST:	-20	3	5	15	24	31	50	44	30	20	3	-4	-20
MAYHILL RANGER STATION	17	MEAN:	37.6	39.9	43.2	50.2	58.3	66.6	68.4	67.3	62.5	54.0	43.5	39.1	52.6
		HIGHEST:	77	74	80	85	93	98	97	94	94	84	78	74	98
		LOWEST:	-16	-13	-5	9	25	36	42	39	27	18	0	-6	-16
PESCALERO	23	MEAN:	34.1	37.5	41.6	49.3	56.6	64.7	66.8	65.5	61.3	52.6	42.1	36.0	51.5
		HIGHEST:	70	70	76	84	93	98	98	100	89	90	80	68	100
		LOWEST:	-10	-10	4	10	18	30	38	34	26	17	-2	-8	-10
MOUNTAIN PARK	26	MEAN:	36.4	38.8	43.7	51.7	59.0	67.5	68.7	67.3	63.3	54.6	44.0	38.7	52.7
		HIGHEST:	68	70	80	87	93	98	101	93	92	84	80	71	101
		LOWEST:	-6	-10	5	10	23	30	47	39	31	21	6	0	-10
NEW MEXICO STATE UNIVERSITY	28	MEAN:	40.9	45.5	50.9	59.2	67.2	76.3	79.5	77.7	71.4	61.0	47.6	42.0	59.8
		HIGHEST:	78	85	90	94	103	107	109	103	102	93	83	77	109
		LOWEST:	-8	2	12	20	27	36	42	44	30	22	5	7	-3
OROGRANDE	27	MEAN:	42.4	47.1	53.5	61.9	70.9	80.5	82.6	80.6	74.3	64.2	49.3	43.1	62.5
		HIGHEST:	76	80	92	94	105	110	110	110	105	94	81	76	110
		LOWEST:	-11	9	6	20	34	50	52	50	46	28	17	1	-11
RUIDOSO	15	MEAN:	33.3	35.3	39.5	46.5	53.8	62.4	65.1	63.0	58.1	49.2	38.8	34.0	46.8
		HIGHEST:	74	72	76	83	92	97	95	92	91	81	74	72	87
		LOWEST:	-21	-26	-8	5	16	25	36	32	22	11	-11	-14	-13
TULAROSA	25	MEAN:	43.6	47.4	52.6	60.8	69.2	78.3	80.5	78.6	73.3	63.0	49.8	44.6	61.6
		HIGHEST:	89	80	86	98	103	111	108	107	100	99	86	78	111
		LOWEST:	-4	5	12	18	28	42	50	42	32	22	11	0	-4
WHITE SANDS NATIONAL MONUMENT	18	MEAN:	39.9	44.1	50.4	59.1	68.1	77.3	80.4	78.8	72.4	60.4	46.5	40.0	59.8
		HIGHEST:	75	82	91	97	104	109	110	107	105	95	86	84	110
		MEAN MAX:	55.9	63.5	69.9	79.1	88.2	96.1	97.2	95.7	90.1	79.3	66.8	58.8	78.4
		LOWEST:	-8	-14	9	11	25	38	50	48	30	21	1	-8	-14
EL PASO AIRPORT STATION--U. S. WEATHER BUREAU	19	MEAN:	43.4	49.1	54.5	63.1	71.6	80.2	81.3	79.8	74.9	65.2	52.0	44.8	63.5
		HIGHEST:	75	81	88	95	104	107	107	103	103	93	84	76	107
		LOWEST:	-6	8	18	28	38	50	60	59	41	32	16	5	-6

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TABLE III PRECIPITATION MEANS AND EXTREMES

STATION	DATA	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	ANNUAL
AFTON 16	MONTHLY MEANS:	0.49	0.35	0.38	0.11	0.27	0.36	1.44	1.28	1.04	0.78	0.27	0.40	7.17
	* GREATEST MONTHLY:	1.77	1.28	2.52	0.67	1.27	1.84	3.28	2.83	4.50	1.92	1.00	1.40	15.47
	YEAR:	1949	1948	1958	1952	1958	1943	1955	1957	1958	1944	1943	1946	1948
	GREATEST 24-HOUR:	0.77	0.72	1.00	0.51	1.01	1.15	1.43	1.37	2.61	1.18	1.00	1.26	-----
	YEAR:	1947	1958	1958	1952	1941	1943	1953	1942	1958	1944	1943	1946	-----
ALAMOGORDO 28	LEAST ANNUAL:	IN 1956: 3.72												
	MONTHLY MEANS:	0.74	0.56	0.41	0.36	0.47	0.72	1.63	1.53	1.55	0.89	0.44	0.55	9.85
	GREATEST MONTHLY:	2.61	2.14	3.02	2.13	3.03	3.04	5.40	4.42	6.94	2.25	1.56	2.33	21.87
	YEAR:	1949	1931	1958	1942	1941	1933	1955	1942	1941	1957	1946	1942	1941
	GREATEST 24-HOUR:	1.10	0.86	1.16	1.00	1.23	2.01	1.80	1.85	2.60	1.34	1.38	1.45	-----
ANCHERO 28	YEAR:	1916	1957	1958	1919	1941	1953	1954	1942	1941	1928	1923	1942	-----
	LEAST ANNUAL:	IN 1956: 2.93												
	MONTHLY MEANS:	0.99	0.75	0.99	0.88	1.03	1.04	1.96	2.13	1.85	1.03	0.63	0.97	14.25
	GREATEST MONTHLY:	3.60	2.35	3.54	5.20	6.35	3.80	4.70	3.74	10.41	4.20	1.96	2.40	34.40
	YEAR:	1946	1948	1958	1942	1941	1937	1950	1942	1941	1932	1934	1943	1941
BINGHAM 19	GREATEST 24-HOUR:	1.00	1.12	1.10	1.55	2.75	3.25	3.25	1.90	2.90	2.21	1.05	1.20	-----
	YEAR:	1944	1937	1926	1942	1941	1937	1929	1935	1941	1939	1923	1943	-----
	LEAST ANNUAL:	IN 1956: 8.29												
	MONTHLY MEANS:	0.35	0.31	0.50	0.40	0.47	0.44	1.71	2.06	1.34	0.89	0.36	0.35	9.18
	GREATEST MONTHLY:	1.05	1.14	2.11	1.19	2.67	1.80	3.02	4.19	4.07	2.43	1.25	1.01	17.23
BOSQUE DEL APACHE 27	YEAR:	1944	1948	1958	1953	1941	1943	1955	1954	1949	1954	1944	1943	1941
	GREATEST 24-HOUR:	0.66	0.62	0.95	0.63	0.74	0.76	1.31	1.53	2.02	1.78	0.69	0.66	-----
	YEAR:	1944	1941	1945	1953	1943	1943	1942	1954	1941	1954	1944	1947	-----
	LEAST ANNUAL:	IN 1956: 2.84												
	MONTHLY MEANS:	0.42	0.40	0.29	0.28	0.39	0.75	1.06	1.49	1.37	0.89	0.20	0.34	7.88
APACHE 27	GREATEST MONTHLY:	1.62	1.76	1.78	2.17	1.84	2.42	2.87	3.37	3.65	2.96	0.82	1.37	14.77
	YEAR:	1941	1948	1958	1942	1958	1938	1957	1932	1941	1957	1935	1937	1941
	LEAST ANNUAL:	IN 1956: 2.72												

* GREATEST MONTHLY AND ANNUAL. FIGURES BELOW STATION NAMES SHOW NUMBER OF YEARS OF RECORD.

TABLE III, PRECIPITATION MEANS AND EXTREMES

STATION	DATA	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	ANNUAL
CABALLO DAM 22	MONTHLY MEANS:	0.36	0.46	0.32	0.28	0.40	0.58	1.62	1.62	1.45	0.68	0.21	0.34	8.32
	GREATEST MONTHLY:	2.13	1.84	1.49	0.97	2.33	2.52	3.33	4.31	4.76	4.02	2.74	1.16	18.82
	YEAR:	1941	1937	1958	1941	1937	1938	1957	1954	1941	1958	1958	1943	1941
	GREATEST 24-HOUR:	1.19	1.55	0.77	0.72	1.09	1.23	2.56	2.37	2.31	1.01	0.47	0.78	----
	YEAR:	1941	1937	1953	1941	1949	1938	1945	1941	1941	1951	1944	1943	----
	LEAST ANNUAL:													IN 1951: 4.72
CAPITAN 25	MONTHLY MEANS:	0.73	0.80	0.97	0.85	1.34	1.44	2.59	2.52	2.82	0.86	0.43	0.58	15.93
	GREATEST MONTHLY:	2.35	2.09	3.07	2.86	4.59	3.78	5.89	5.71	10.71	4.07	1.41	3.12	30.74
	YEAR:	1936	1939	1958	1942	1937	1938	1957	1932	1941	1957	1934	1931	1941
	GREATEST 24-HOUR:	1.20	0.91	2.36	1.12	2.16	2.05	2.67	2.32	4.81	1.23	0.90	1.10	----
	YEAR:	1926	1923	1941	1915	1937	1920	1950	1930	1941	1957	1913	1923	----
	LEAST ANNUAL:													IN 1951: 8.67
CARRIZO 27	MONTHLY MEANS:	0.74	0.76	0.81	0.70	0.92	1.16	2.21	2.28	1.95	1.00	0.57	0.75	13.85
	GREATEST MONTHLY:	2.90	3.51	2.75	4.87	2.83	4.08	4.07	7.93	9.69	4.02	1.76	3.05	35.60
	YEAR:	1936	1931	1958	1931	1936	1933	1931	1935	1941	1931	1931	1931	1931
	GREATEST 24-HOUR:	1.28	1.10	1.11	1.16	1.60	1.12	2.23	2.28	3.52	1.85	1.20	1.30	----
	YEAR:	1941	1915	1926	1931	1954	1919	1938	1932	1941	1931	1923	1914	----
	LEAST ANNUAL:													IN 1945: 5.00
CLOUDCROFT 27	MONTHLY MEANS:	1.84	1.73	1.72	0.93	1.12	1.87	5.64	4.74	2.58	1.70	0.89	1.44	26.20
	GREATEST MONTHLY:	5.24	4.75	7.31	3.49	5.20	6.17	10.75	9.69	11.62	4.72	3.95	3.74	48.10
	YEAR:	1946	1931	1958	1942	1941	1943	1950	1931	1941	1957	1931	1931	1941
	GREATEST 24-HOUR:	2.20	2.16	2.30	1.55	1.66	2.96	2.80	2.86	3.60	2.20	2.62	2.00	----
	YEAR:	1936	1931	1927	1942	1940	1943	1950	1931	1941	1926	1926	1948	----
	LEAST ANNUAL:													IN 1934: 17.15
EAGLE 27	MONTHLY MEANS:	0.40	0.54	0.30	0.36	0.61	0.62	1.69	1.92	1.36	0.75	0.21	0.41	9.15
	GREATEST MONTHLY:	1.78	2.03	1.97	2.52	3.20	2.88	5.93	5.08	3.62	2.46	0.85	1.41	16.02
	YEAR:	1941	1948	1958	1931	1937	1938	1933	1957	1958	1958	1957	1942	1941
	GREATEST 24-HOUR:	1.27	1.06	1.12	1.20	2.18	1.40	2.63	4.40	4.20	1.34	1.50	1.25	----
	YEAR:	1941	1948	1899	1931	1937	1948	1933	1898	1904	1945	1898	1896	----
	LEAST ANNUAL:													IN 1953: 4.54

TABLE III PRECIPITATION MEANS AND EXTREMES

STATION	DATA	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	ANNUAL
FT. STANTON 26	MONTHLY MEANS:	0.74	0.62	0.81	0.62	1.21	1.09	2.89	2.44	2.35	0.82	0.35	0.54	14.48
	GREATEST MONTHLY:	4.08	1.96	3.31	2.21	4.19	2.90	6.09	5.40	6.79	3.02	1.06	1.88	20.51
	YEAR:	1944	1931	1958	1931	1937	1938	1957	1957	1941	1957	1944	1943	1931
	GREATEST 24-HOUR:	3.83	1.06	1.53	1.86	1.97	2.00	2.10	2.09	3.65	1.81	1.60	1.15	----
	YEAR:	1944	1891	1941	1935	1954	1912	1940	1909	1900	1902	1901	1943	----
	LEAST ANNUAL:	IN 1945: 6.06												
HARDIN RANCH 9	MONTHLY MEANS:	1.00	0.60	0.22	0.37	0.34	1.13	2.63	2.78	1.53	0.89	0.44	0.94	12.87
	GREATEST MONTHLY:	2.92	2.57	0.56	0.93	0.80	5.74	5.23	4.27	3.66	1.51	1.90	2.82	20.13
	YEAR:	1949	1948	1951	1946	1947	1943	1949	1942	1942	1945	1944	1943	1949
	GREATEST 24-HOUR:	0.64	1.16	0.35	0.49	0.59	2.60	1.73	1.37	1.15	1.01	0.75	1.53	----
	YEAR:	1946	1948	1947	1946	1948	1943	1949	1946	1946	1945	1946	1943	----
	LEAST ANNUAL:	IN 1945: 7.77												
HATCH 21	MONTHLY MEANS:	0.47	0.43	0.29	0.37	0.31	0.54	1.73	1.77	1.42	0.99	0.23	0.50	9.05
	GREATEST MONTHLY:	2.51	2.01	1.13	3.28	1.18	3.38	6.32	5.80	5.34	3.94	1.15	1.66	18.22
	YEAR:	1941	1931	1941	1931	1937	1933	1950	1957	1938	1957	1936	1932	1941
	GREATEST 24-HOUR:	1.25	1.07	1.21	1.40	1.19	1.35	1.98	2.00	2.05	1.62	0.69	1.51	----
	YEAR:	1941	1948	1911	1931	1954	1905	1950	1941	1958	1957	1913	1906	----
	LEAST ANNUAL:	IN 1956: 4.03												
HOLLOMAN AIR FORCE BASE 14	MONTHLY MEANS:	0.49	0.37	0.12	0.18	0.38	0.83	0.96	0.79	0.96	0.61	0.22	0.40	6.31
	From HADC Report, TR 57-2													
JORNADU EXPERIMENTAL RANGE 28	MONTHLY MEANS:	0.56	0.44	0.29	0.26	0.30	0.56	1.61	1.54	1.54	0.94	0.40	0.51	8.95
	GREATEST MONTHLY:	1.68	1.57	2.17	2.02	1.24	2.84	5.80	4.75	4.49	2.26	1.40	1.50	17.74
	YEAR:	1941	1931	1958	1931	1934	1933	1938	1957	1941	1954	1944	1948	1941
	GREATEST 24-HOUR:	1.00	0.94	0.97	0.89	1.35	1.27	1.97	1.66	2.27	1.63	0.94	0.95	----
	YEAR:	1936	1949	1958	1941	1926	1952	1926	1932	1938	1922	1943	1948	----
	LEAST ANNUAL:	IN 1953: 3.10												

TABLE III PRECIPITATION MEANS AND EXTREMES

STATION	DATA	JAN.	FEB.	MAR.	ARR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	ANNUAL
LULU 16	MONTHLY MEANS:	0.49	0.52	0.39	0.29	0.46	1.46	1.92	1.46	1.28	1.21	0.28	0.56	10.32
	GREATEST MONTHLY:	2.05	1.13	2.07	1.45	1.64	7.60	6.16	5.00	4.13	3.95	0.82	1.91	17.65
	YEAR:	1946	1949	1958	1942	1944	1950	1950	1958	1946	1955	1943	1949	1950
	GREATEST 24-HOUR:	0.80	0.80	0.40	0.84	0.70	6.50	2.50	2.40	1.35	2.16	0.50	0.80	----
	YEAR:	1948	1955	1951	1952	1954	1950	1955	1957	1949	1947	1957	1951	----
	LEAST ANNUAL:											IN 1954:		3.79
MAYHILL RANGER STATION 28	MONTHLY MEANS:	0.76	0.76	0.83	0.62	1.24	1.83	3.47	3.82	3.13	1.45	0.40	0.74	19.05
	GREATEST MONTHLY:	3.39	2.28	3.15	4.23	5.08	4.30	8.72	9.30	13.43	4.24	1.43	2.70	42.96
	YEAR:	1949	1931	1958	1931	1936	1943	1950	1931	1941	1957	1957	1943	1941
	GREATEST 24-HOUR:	1.16	1.24	1.70	1.37	2.14	2.51	2.40	2.59	3.46	2.35	1.11	1.01	----
	YEAR:	1938	1931	1937	1922	1940	1938	1924	1945	1932	1932	1926	1943	----
	LEAST ANNUAL:											IN 1956:		8.03
MESCALERO 25	MONTHLY MEANS:	0.88	1.00	0.96	0.75	0.95	1.39	3.56	3.78	2.32	1.27	0.70	1.00	18.56
	GREATEST MONTHLY:	2.62	3.42	3.97	3.60	4.10	4.67	7.06	9.50	6.17	3.86	1.98	3.01	35.19
	YEAR:	1936	1931	1958	1942	1941	1943	1931	1942	1941	1941	1941	1943	1941
	GREATEST 24-HOUR:	1.90	1.26	1.32	1.46	1.61	1.98	1.90	2.16	2.35	1.50	1.35	1.22	----
	YEAR:	1936	1940	1916	1942	1937	1913	1927	1939	1936	1928	1934	1938	----
	LEAST ANNUAL											IN 1946:		9.56
MOUNTAIN PARK 27	MONTHLY MEANS:	1.07	1.11	1.04	0.60	0.72	1.31	3.13	3.14	2.02	1.49	0.64	0.88	17.15
	GREATEST MONTHLY:	3.34	3.95	4.91	2.98	3.61	6.91	9.76	6.05	9.26	4.61	1.59	3.15	41.44
	YEAR:	1949	1931	1958	1931	1940	1933	1955	1954	1941	1941	1944	1942	1941
	GREATEST 24-HOUR:	1.75	1.60	1.61	1.32	3.05	3.50	2.18	2.26	3.80	2.20	1.65	1.40	----
	YEAR:	1935	1931	1958	1942	1940	1933	1918	1921	1936	1928	1923	1942	----
	LEAST ANNUAL											IN 1934:		5.23
NEW MEXICO STATE UNIVERSITY 28	MONTHLY MEANS:	0.47	0.53	0.31	0.18	0.31	0.54	1.26	1.66	1.29	0.74	0.32	0.46	8.08
	GREATEST MONTHLY:	1.85	1.48	1.84	1.04	1.07	1.75	3.65	7.41	7.53	2.10	1.02	1.38	19.60
	YEAR:	1949	1957	1958	1941	1935	1940	1938	1935	1941	1955	1936	1931	1941
	GREATEST 24-HOUR:	0.66	1.25	1.13	1.20	0.97	2.43	1.55	6.49	4.11	1.38	1.20	0.99	----
	YEAR:	1936	1893	1900	1905	1916	1903	1955	1935	1941	1928	1899	1931	----
	LEAST ANNUAL:											IN 1953:		3.81

TABLE III PRECIPITATION MEANS AND EXTREMES

STATION	DATA	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	ANNUAL
GROGANDE 26	MONTHLY MEANS:	0.51	0.42	0.30	0.36	0.44	0.84	1.44	1.59	1.33	0.54	0.32	0.42	5.91
	GREATEST MONTHLY:	1.80	1.40	1.65	1.92	1.92	3.95	7.19	4.15	6.55	2.70	1.60	1.35	19.43
	YEAR:	1938	1940	1958	1942	1941	1943	1955	1931	1941	1945	1931	1943	1941
	GREATEST 24-HOUR:	1.10	1.25	1.29	1.40	1.40	2.02	3.50	3.30	1.35	2.06	1.10	0.94	---
	YEAR:	1938	1911	1905	1939	1936	1920	1926	1931	1927	1929	1931	1926	---
RITTOGO 16	LEAST ANNUAL:	In 1934: 2.93												
	MONTHLY MEANS:	1.07	1.10	1.37	0.58	0.88	1.76	4.60	4.21	2.11	1.27	0.65	1.37	21.37
	GREATEST MONTHLY:	2.52	2.61	4.58	3.49	2.42	3.75	10.86	7.37	5.15	3.24	1.70	3.35	27.95
	YEAR:	1949	1948	1958	1942	1954	1944	1950	1942	1958	1957	1957	1942	1942
	GREATEST 24-HOUR:	0.58	1.25	1.49	1.29	1.78	3.75	2.85	2.23	1.48	1.20	1.27	1.33	---
TULACSA 25	YEAR:	1943	1948	1955	1942	1954	1944	1946	1946	1944	1955	1951	1948	---
	LEAST ANNUAL:	In 1947: 14.50												
	MONTHLY MEANS:	0.57	0.57	0.48	0.42	0.41	0.76	1.26	1.55	1.97	0.1	0.42	0.39	10.13
	GREATEST MONTHLY:	1.54	1.73	2.59	1.03	1.62	4.00	4.52	3.79	9.82	0.80	1.59	2.28	20.23
	YEAR:	1936	1931	1958	1953	1940	1943	1950	1953	1941	1957	1971	1947	1941
TULACSA 30	GREATEST 24-HOUR:	1.50	2.00	1.44	1.20	1.10	2.00	1.80	2.51	4.75	1.90	1.57	1.30	---
	YEAR:	1941	1915	1958	1953	1940	1943	1925	1937	1941	1956	1947	1943	---
	LEAST ANNUAL:	In 1934: 3.89												
	MONTHLY MEANS:	0.56	0.33	0.32	0.36	0.32	0.47	1.28	1.26	1.26	0.38	0.23	0.74	7.97
	GREATEST MONTHLY:	2.15	0.93	2.65	2.39	1.51	1.58	2.97	3.06	9.68	3.79	0.90	1.93	20.00
TULACSA 34	YEAR:	1949	1948	1958	1942	1940	1943	1957	1948	1941	1957	1947	1947	1941
	GREATEST 24-HOUR:	0.75	0.52	1.55	1.11	1.10	1.22	1.61	1.40	5.30	1.00	0.60	0.90	---
	YEAR:	1939	1946	1956	1942	1940	1943	1957	---	1941	1958	1959	1943	---
	LEAST ANNUAL:	In 1916: 3.80												
	MONTHLY MEANS:	0.45	0.41	0.35	0.27	0.35	0.64	1.72	1.54	1.19	0.84	0.45	0.50	6.72
TULACSA 34	GREATEST MONTHLY:	1.84	1.88	2.26	2.24	1.92	2.82	4.51	4.39	5.29	4.31	2.50	3.54	17.00
	YEAR:	1949	1905	1958	1931	1941	1938	1914	1917	1958	1945	1906	1914	1941
	GREATEST 24-HOUR:	0.60	0.87	1.72	0.89	1.23	1.13	1.35	2.00	2.89	1.77	1.17	1.05	---
	YEAR:	1949	1956	1941	1952	1941	1958	1957	1957	1941	1945	1945	1946	---
	LEAST ANNUAL:	In 1934: 2.73												

GREATEST 24-HOUR RAINFALL IS FROM 1940 to 1958 AT THE AIRPORT STATION.

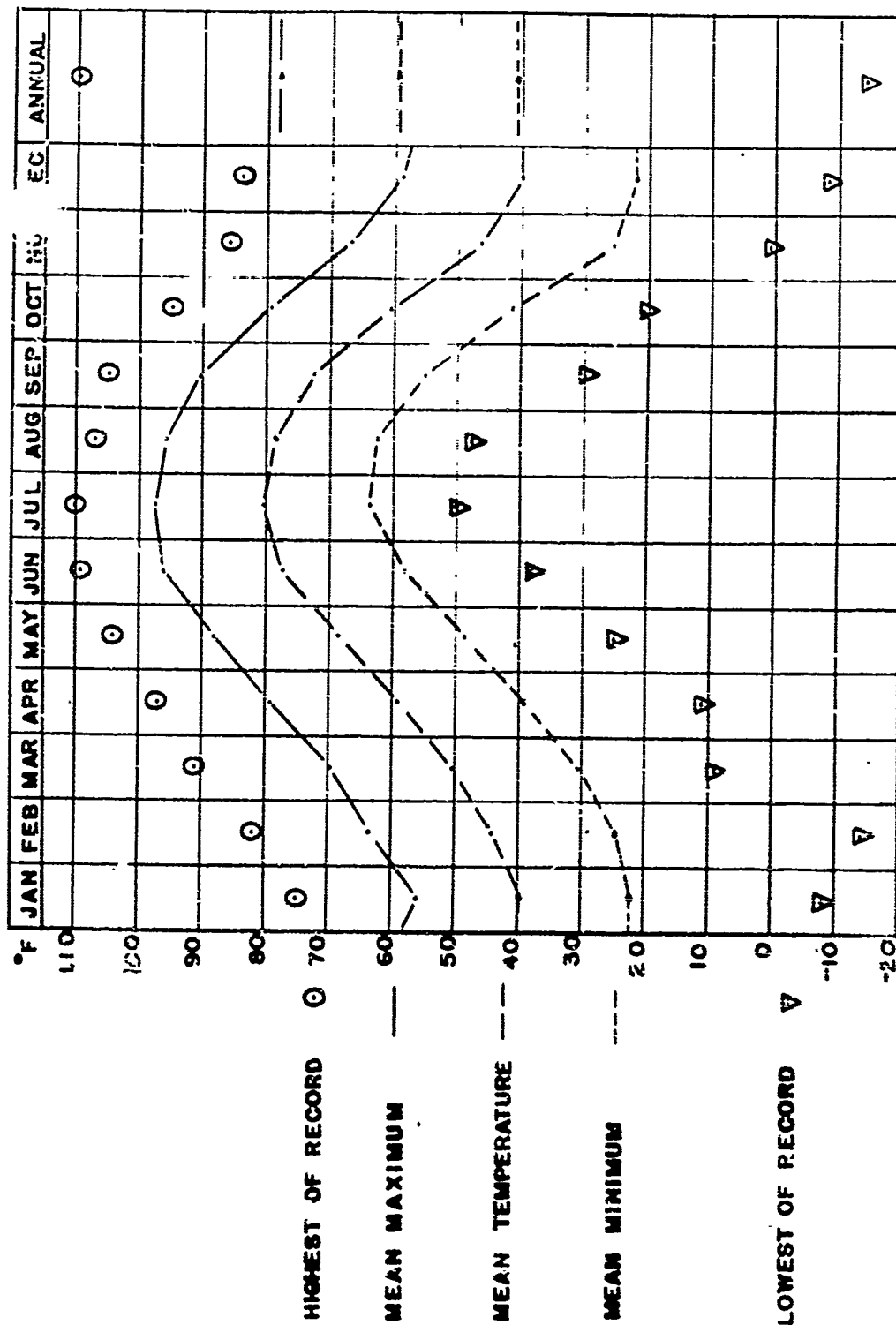


FIG. 5. TEMPERATURE MEANS AND EXTREMES, WHITE SANDS NATIONAL MONUMENT

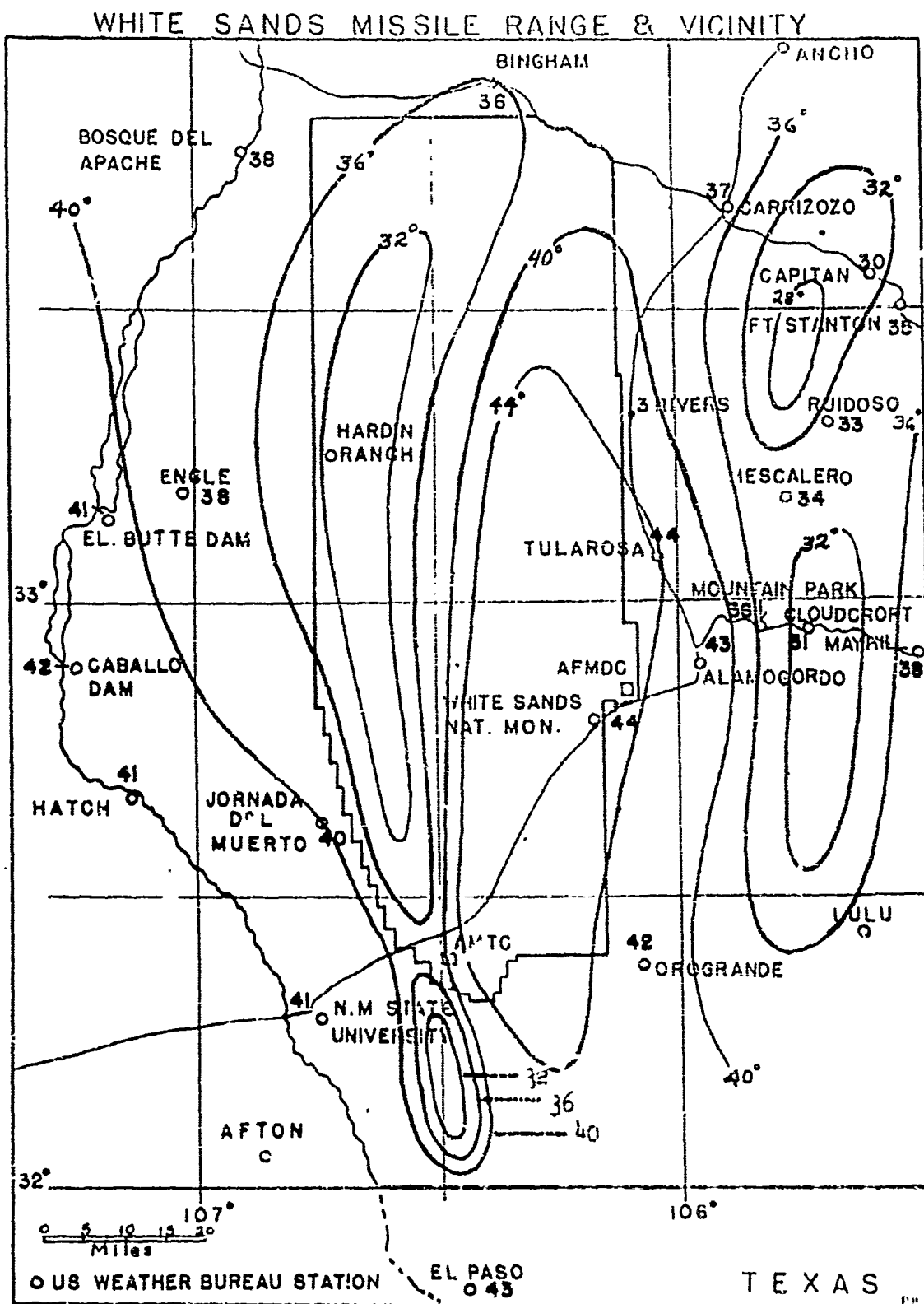


FIG. 6. MEAN TEMPERATURE, JANUARY - WSMR

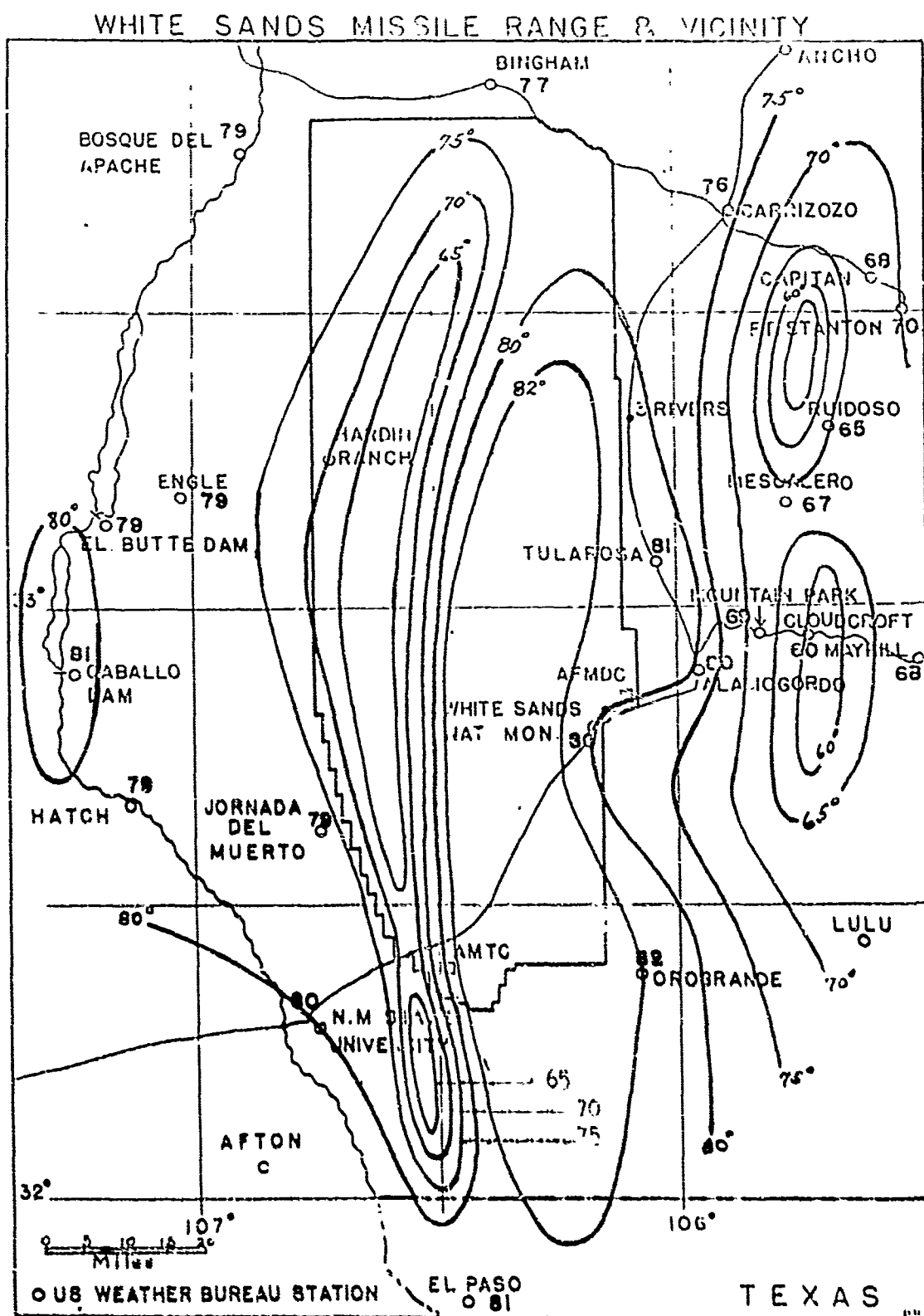
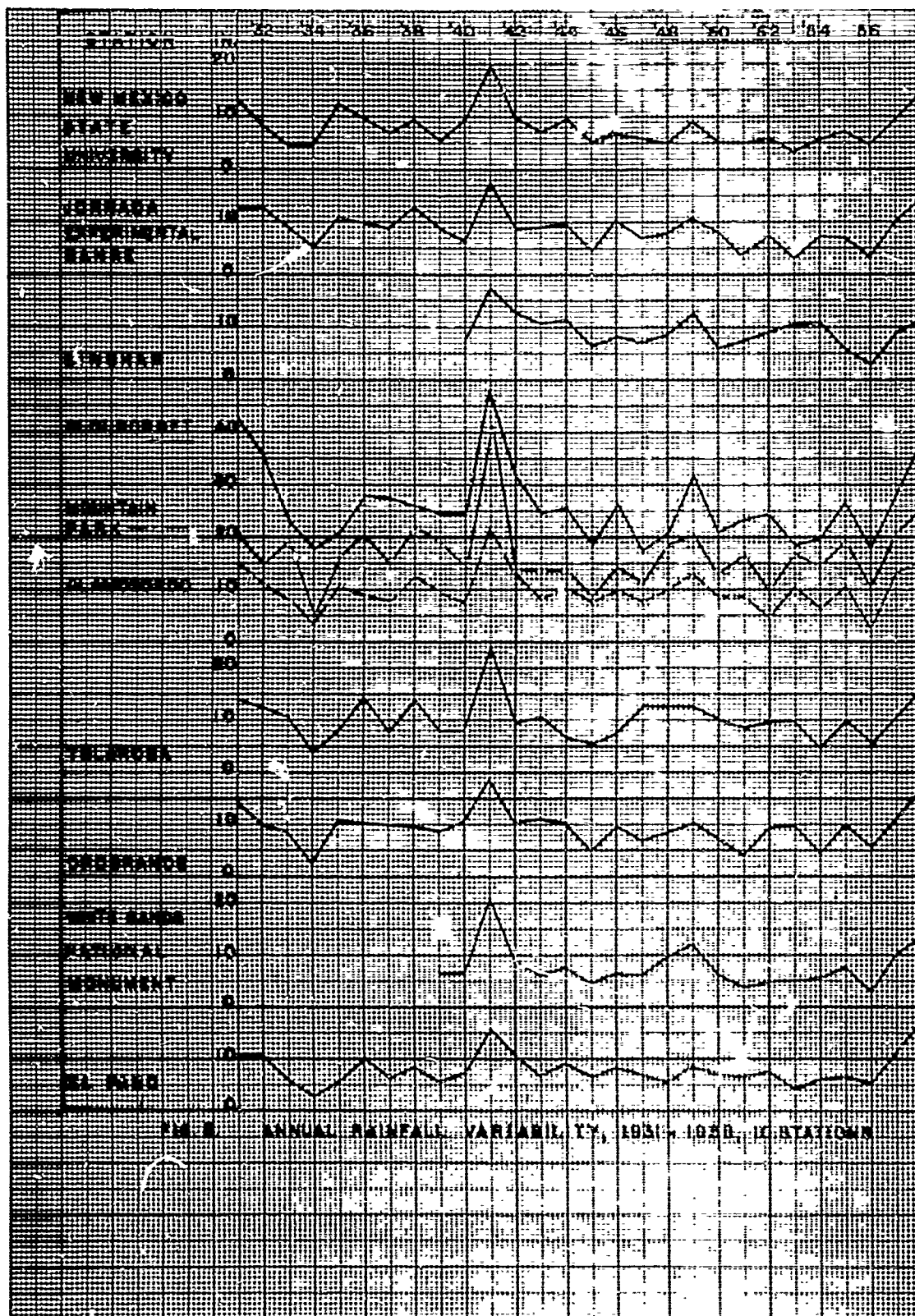
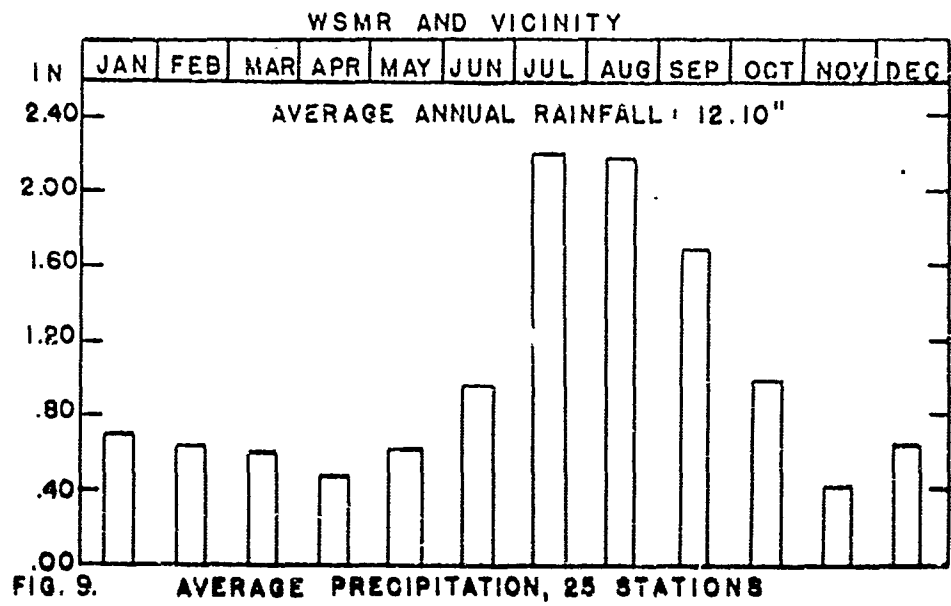
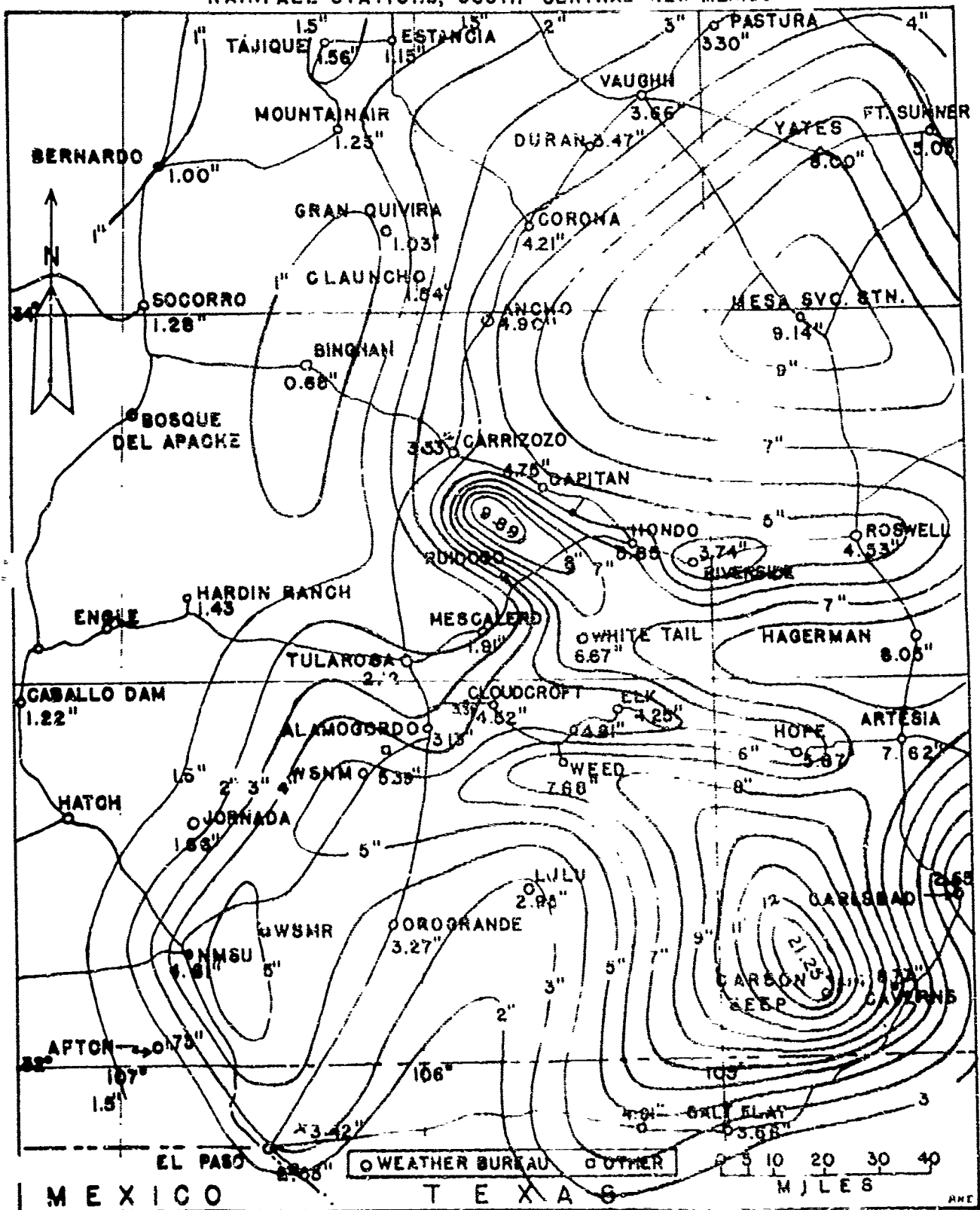


FIG. 7. MEAN TEMPERATURE: JULY-WSMR





RAINFALL STATIONS, SOUTH-CENTRAL NEW MEXICO



TOTAL RAINFALL, STORM OF SEPT. 20-24, 1941 - (TOTALS FROM WEATHER BUREAU RECORDS)
FIG. 10.

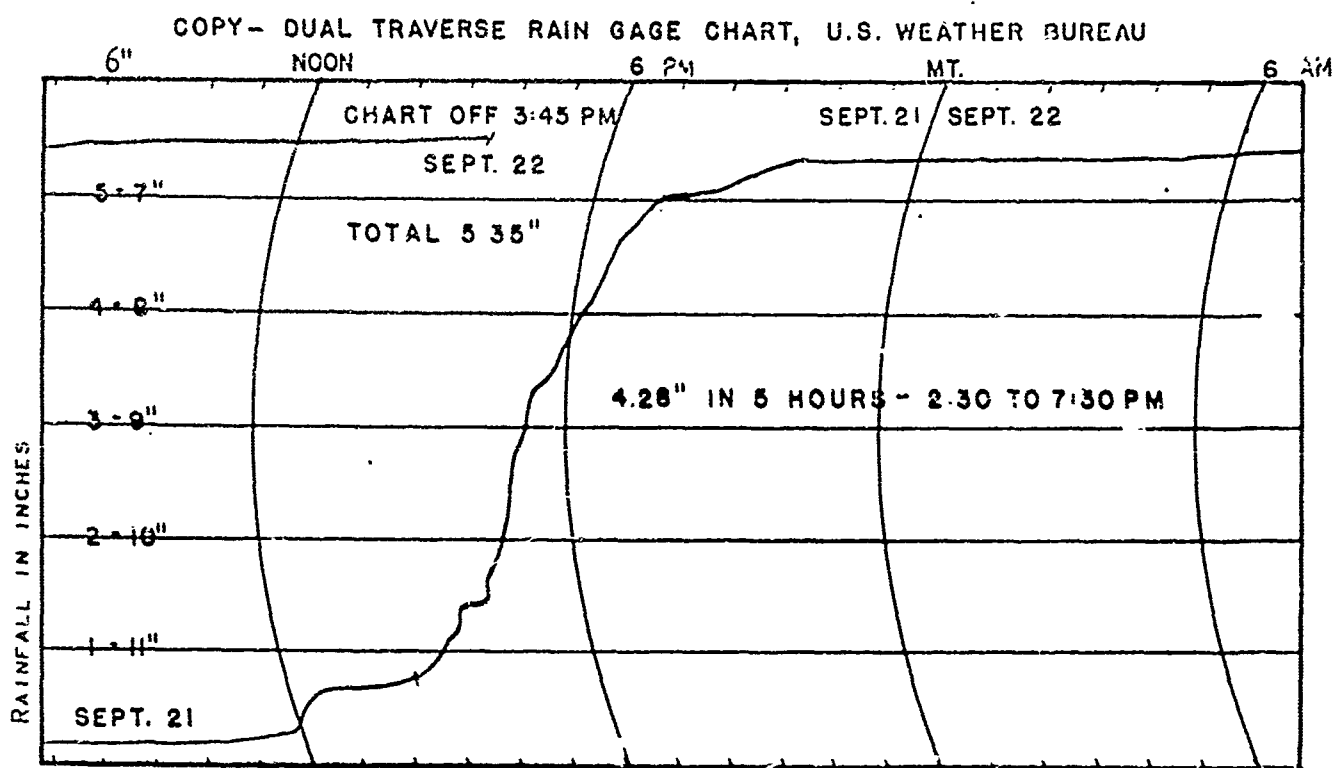


FIG. II. WHITE SANDS NATIONAL MONUMENT RAINFALL, 21-22 SEPT., 1941

PRECIPITATION DURING THE WINTER MONTHS, THOUGH GENERALLY OF LITTLE CONSEQUENCE IN THE BASIN, IS SOMETIMES CONSIDERABLE IN THE MOUNTAIN AREAS, (TABLES III AND IV). THE PRINCIPAL SOURCE OF MOISTURE DURING THIS SEASON IS THE PACIFIC OCEAN, THE MOISTURE BEING BROUGHT IN BY THE WESTERLY FLOW OF THAT PERIOD AND SET OFF BY THE MOVEMENT OF COLD FRONTS DOWN FROM THE NORTH.

AVERAGE ANNUAL SNOWFALL

SNOWFALL AT THE LOWER ELEVATIONS IS GENERALLY LIGHT (TABLE IV), OF INFREQUENT OCCURRENCE, AND MELTS RAPIDLY. WHITE SANDS NATIONAL MONUMENT, A REPRESENTATIVE STATION FOR THE BASIN, AVERAGES ONLY 2.4 INCHES OF SNOW PER YEAR. HARDIN RANCH, AT AN ELEVATION OF 6,000 FEET MSL AND THE ONLY MOUNTAIN STATION ON THE RESERVATION, AVERAGES 19 INCHES PER YEAR. SNOW AT THE MOUNTAIN STATIONS ON THE EAST SIDE OF THE BASIN IS CONSIDERABLY HEAVIER, RANGING FROM 25 INCHES AT MOUNTAIN PARK TO 75 INCHES AT CLOUDCROFT, AND MUCH OF IT REMAINS ON THE GROUND FOR PROLONGED PERIODS.

SEVERE LOCAL STORMS AND OTHER WEATHER ELEMENTS

TORNADOES ARE RARE IN THIS AREA, BUT TWO OR THREE HAVE BEEN OBSERVED WITHIN THE PAST FEW YEARS. THUNDERSTORMS ARE OCCASIONALLY SEVERE AND HAVE DAMAGED COMMUNICATION LINES ON THE RANGE, AND MANY LOCAL ROADS HAVE BEEN IMPASSABLE FOR DAYS OR WEEKS AT A TIME. FOR THE TEN-YEAR PERIOD 1948-1957 AT THE AIR WEATHER "A" STATION, WSMR, (TABLE V) THUNDERSTORMS AVERAGED 63 PER YEAR, WITH 53 OF THEM OCCURRING IN THE FOUR MONTHS, JUNE THROUGH SEPTEMBER, AND 43 IN JULY AND AUGUST.

TABULATED SUMMARIES FOR AIR WEATHER "A" STATION FOR TEMPERATURE, PRECIPITATION, SNOWFALL, THUNDERSTORMS, CLOUDINESS, RELATIVE HUMIDITY, AND VISIBILITY ARE INCLUDED IN TABLE V. THESE DATA WERE OBTAINED FROM "CLIMATIC DATA FOR THE WHITE SANDS MISSILE AREA," OCTOBER, 1958, COMPILED BY DETACHMENT 24, 4TH WEATHER GROUP, WHITE SANDS MISSILE RANGE.

TABLE IV AVERAGE SNOWFALL

STATION	YEARS	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	ANNUAL
APTON	8	5.0	0.5	0.5	0	T	0*	T*	0*	0	0	0.2	0.5	7.5
ALAMOGORDO	49	1.9	1.2	0.6	0.1	T	0	0	0	0	T	0.3	1.1	5.2
ANCHERO	20	8.8	5.9	5.4	3.4	1.0	T	0	T	0.4	0	2.7	5.1	32.7
BINGHAM	12	3.2	0.9	0.9	1.1	T	0	0	0	T	0	0.6	2.2	8.9
BOSQUE DEL APACHE	54	1.3	0.6	0.7	0.1	0	0	T	0	T	T	0.6	2.2	5.5
CARILLO DAM	13	0.5	0.5	0.1	0	T	0	0	0	0	0	0.1	0.2	1.4
CAPITAN	39	7.6	7.6	5.5	2.3	0.5	T	T	T	0.4	0.6	2.1	7.0	55.6
CARRIZOZO	20	5.8	2.8	2.3	1.0	T	0	T	T	T	0	1.1	2.4	17.4
CLOUDCROFT	47	15.6	15.3	13.7	5.2	1.3	T	T	T	0.2	2.1	7.7	13.8	74.9
ENGLE	20	1.5	0.5	0.2	T	T	0.1	0	0	T	0	0.3	0.8	3.4
FT. STATION	51	4.7	4.9	3.5	1.1	0.1	T	T	0	0.1	0.5	2.1	4.1	21.1
HARDIN PARK	8	10.9	0.9	1.7	1.3	0	0	0	0	0	0	1.5	2.7	19.0
HATCH	21	1.4	0.2	0.1	0	0	0	0	0	0	0	T	0.7	2.7
JORNADA DEL MUERTO	31	1.2	0.1	0.1	0.1	0	T	0	0	0	T	0.3	0.7	2.7
LAYHILL RANGER STN.	22	8.4	5.6	5.7	1.7	0.5	T	T	T	0.3	0.4	2.9	5.5	31.5
MESCALERO	35	5.2	5.9	5.3	1.1	0.2	0	0	0	0.2	0.5	2.0	5.7	23.1
MOUNTAIN PARK	34	5.9	5.8	4.4	1.2	0.2	T	0	T	0.1	0.3	2.3	5.2	25.3
N.M. STATE UNIVERSITY	52	0.5	0.3	0.3	T	0	0	0	0	0	0	0.4	0.9	2.5
GRUENARDE	41	1.2	0.4	0.3	T	0	0	0	0	0	0	0.2	1.2	3.7
AMIDOSO	9	12.6	6.7	9.4	4.7	0.3	T	T	T	0.3	0.1	3.9	11.0	69.0
TAJICROCA	40	1.7	0.8	0.8	0.1	T	0	0	0	0	T	0.5	1.0	5.5
WHITE SANDS NAT. MON.	11	1.5	T	0.1	T	T	T	0	0	0	0	T	0.5	3.7
EL PASO AIRPORT (USRB)	19	1.7	0.6	0.6	T	0	0	0	0	0	0	0.5	0.7	4.2

* Snowfall records prior to 1956 included hail.

TABLE V AIR WEATHER STATION "A", WHITE SANDS MISSILE RANGE

TEMPERATURE MEANS AND EXTREMES, 1948 TO 1957													
DATA	JAN.	FEB.	MAR.	APR.	MAY.	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	ANNUAL
MONTHLY MEANS:	45.7	48.5	54.8	64.7	71.9	81.7	81.6	80.7	76.1	65.9	52.2	45.5	63.5
HIGHEST:	73	77	83	94	103	107	107	101	103	91	85	73	107
LOWEST:	4	8	20	32	38	54	58	60	50	34	20	8	4
AVERAGE PRECIPITATION, 1948 TO 1957													
MONTHLY MEANS:	0.55	0.63	0.40	0.35	0.32	0.40	1.67	1.14	0.70	1.02	0.10	0.77	8.05
AVERAGE SNOWFALL, 1948 TO 1957													
MONTHLY MEANS:	1.4	1.3	0.1	T	T	0	T	0	0	0	0.1	1.1	4.3
TOTAL NUMBER OF THUNDERSTORMS, 1948 TO 1957													
TOTALS:	2	4	5	15	50	67	225	19%	40	20	0	2	651
TENTHS OF SKY COVER, 1948 TO 1957													
AVERAGES:	4.1	3.5	4.0	3.5	3.1	3.1	5.0	4.2	2.4	2.5	2.3	3.4	3.4
RELATIVE HUMIDITY AT 1400H, 1948 TO 1955													
AVERAGES:	37%	25%	22%	18%	22%	27%	34%	34%	19%	22%	39%	37%	28%
PERCENTAGE OF VISIBILITY FREQUENCIES, 1948 TO 1955													
0 to 2½ MILES:	2	1	2	1	0	0	0	0	0	0	0	1	1
3 to 6 MILES:	2	4	5	3	1	1	1	0	1	1	1	3	2
7 to 9 MILES:	1	2	3	3	2	1	1	1	1	1	1	1	1
10 MILES OR MORE:	95	93	90	93	97	98	98	99	96	98	98	95	96

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A P P E N D I X A

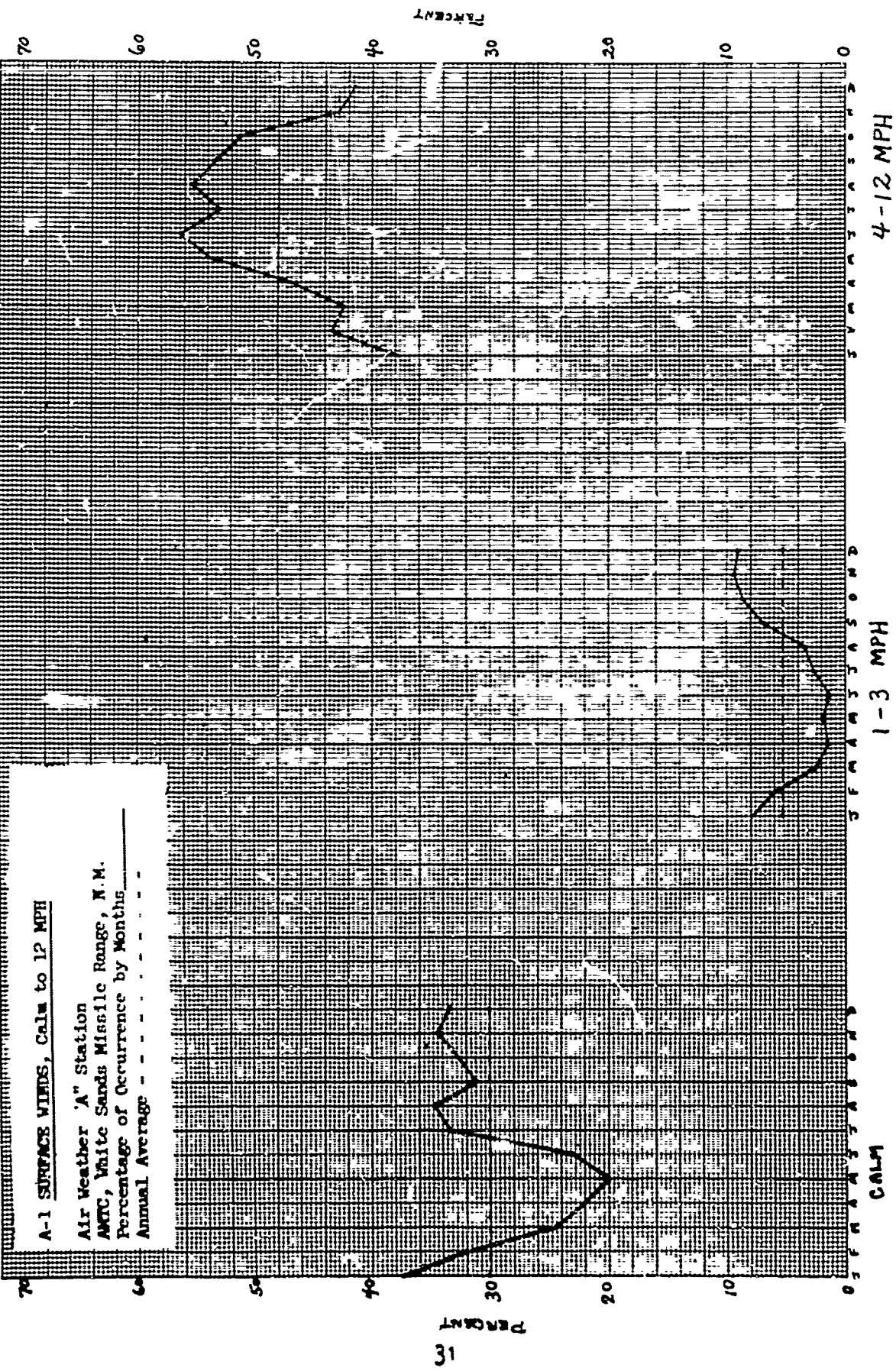
GRAPHICAL PRESENTATION OF SURFACE WIND DATA

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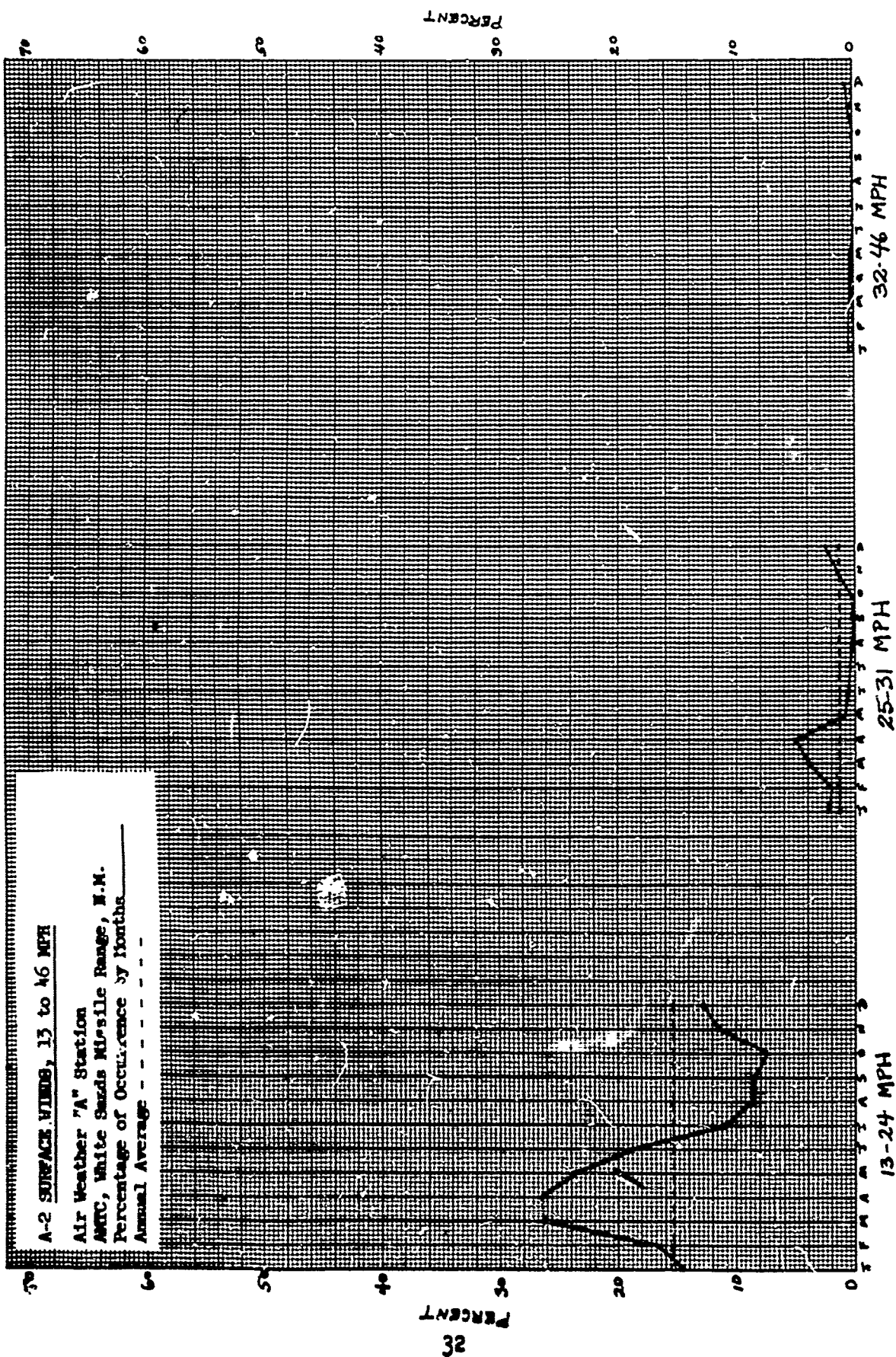
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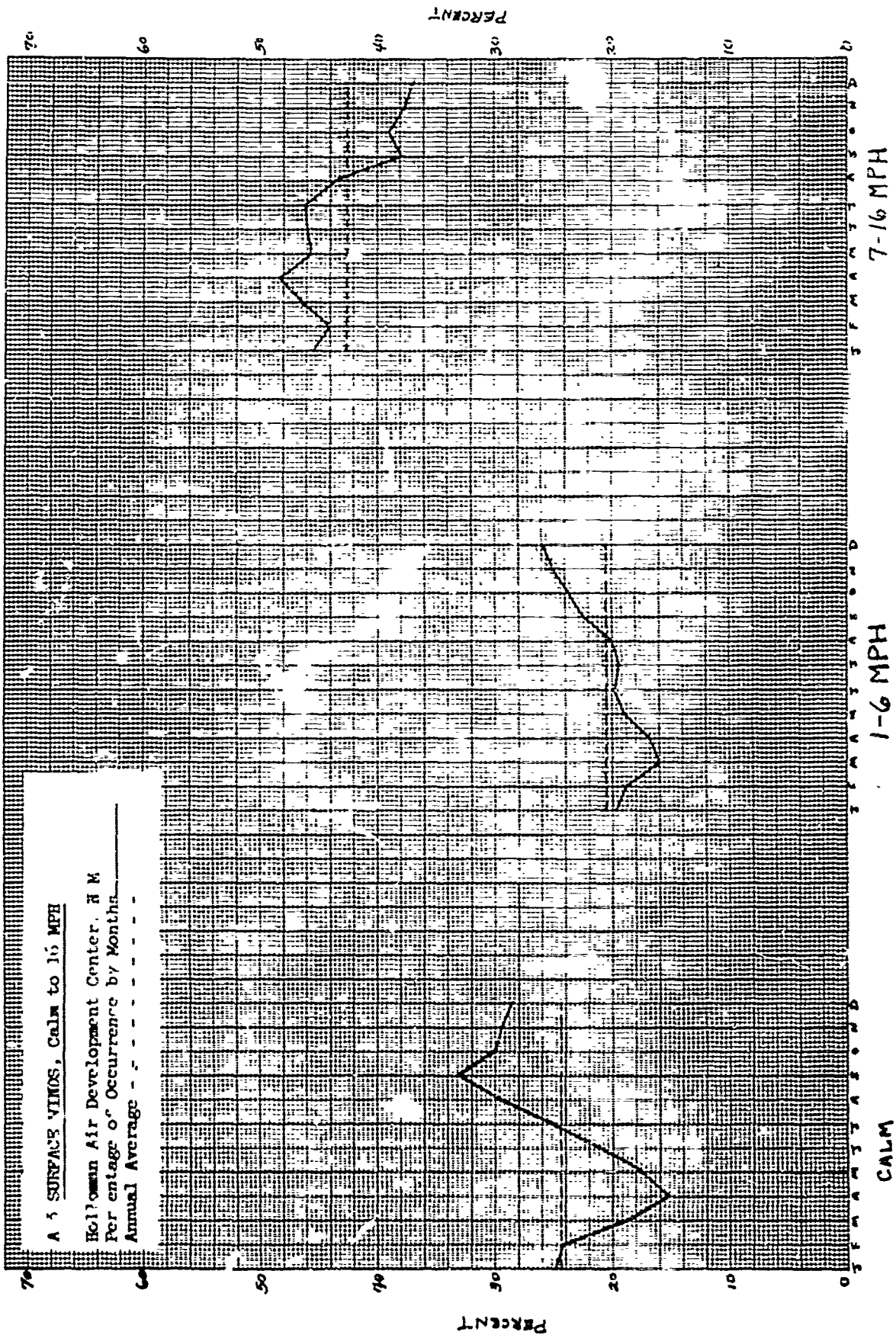
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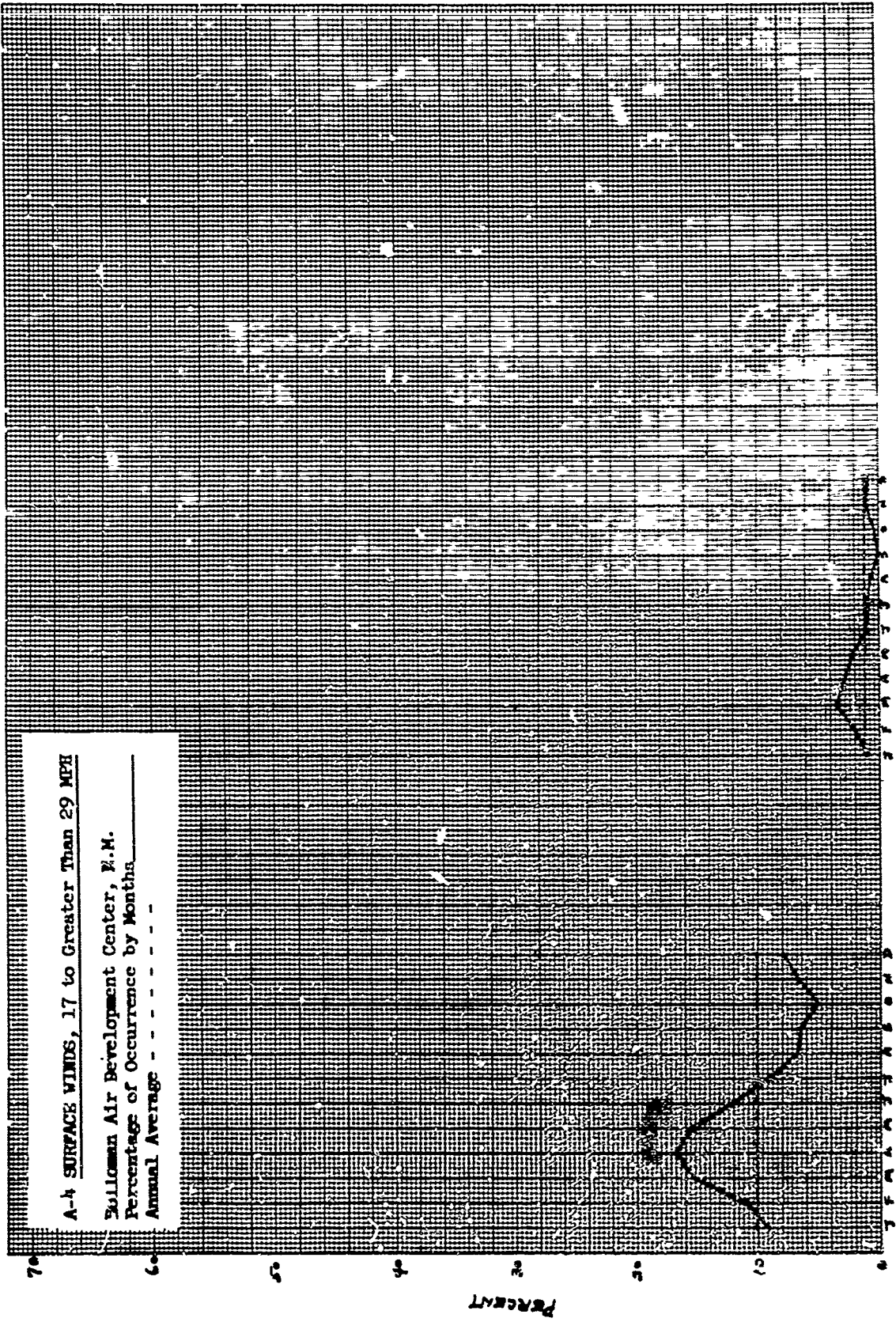
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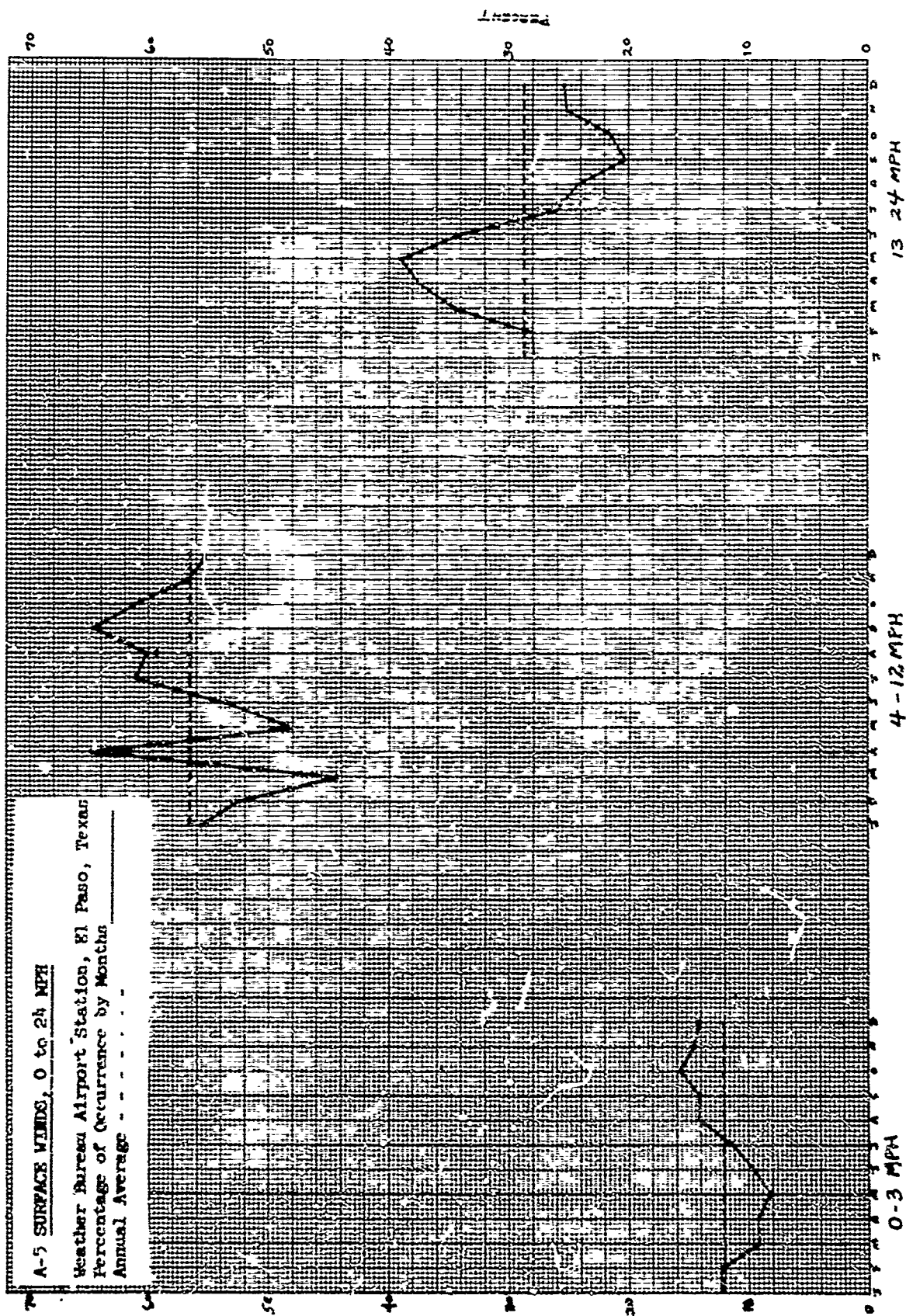
Air Weather "A" Station
AWTC, White Sands Missile Range, N.M.
Percentage of Occurrence by Months
Annual Average

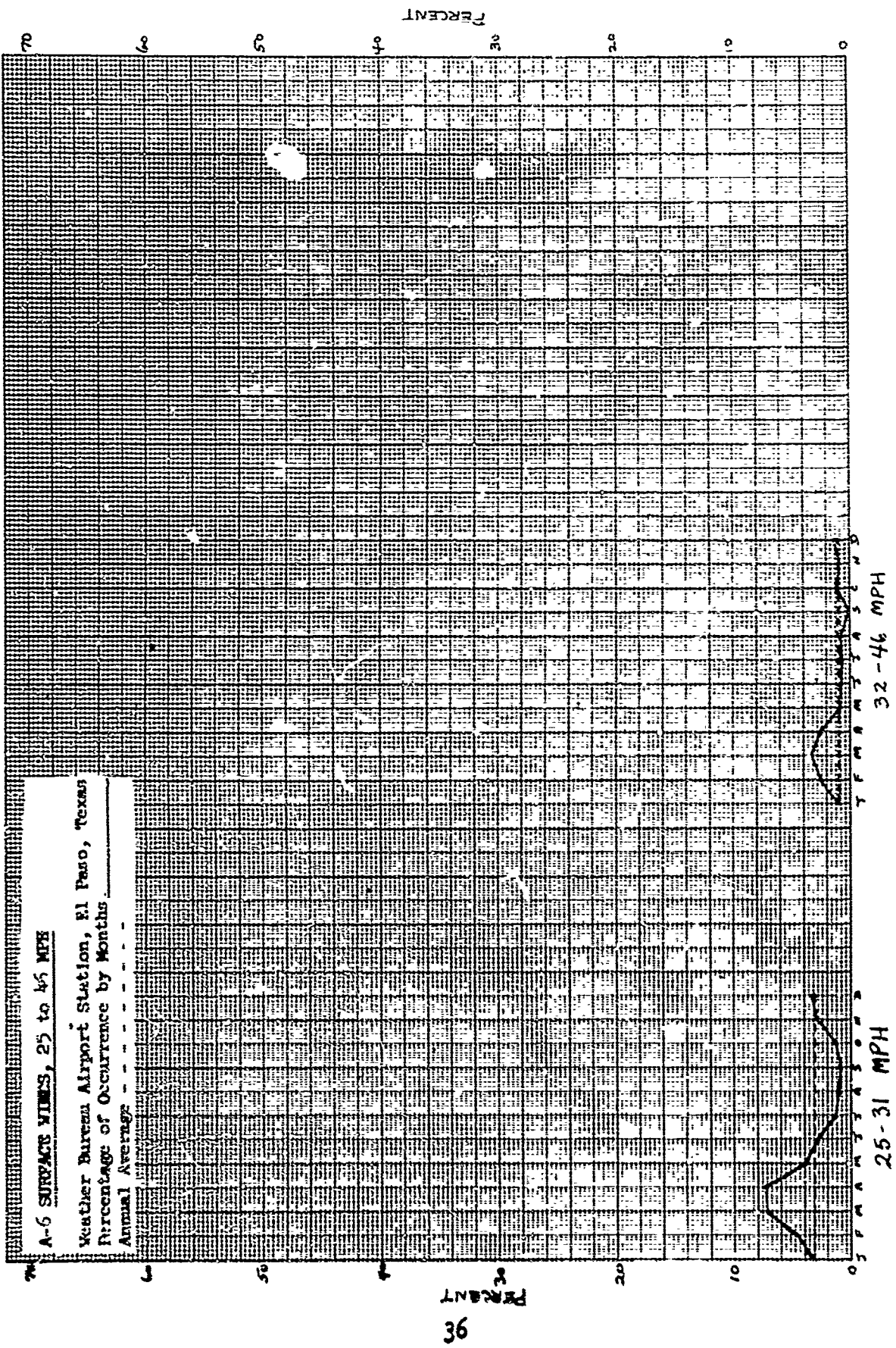


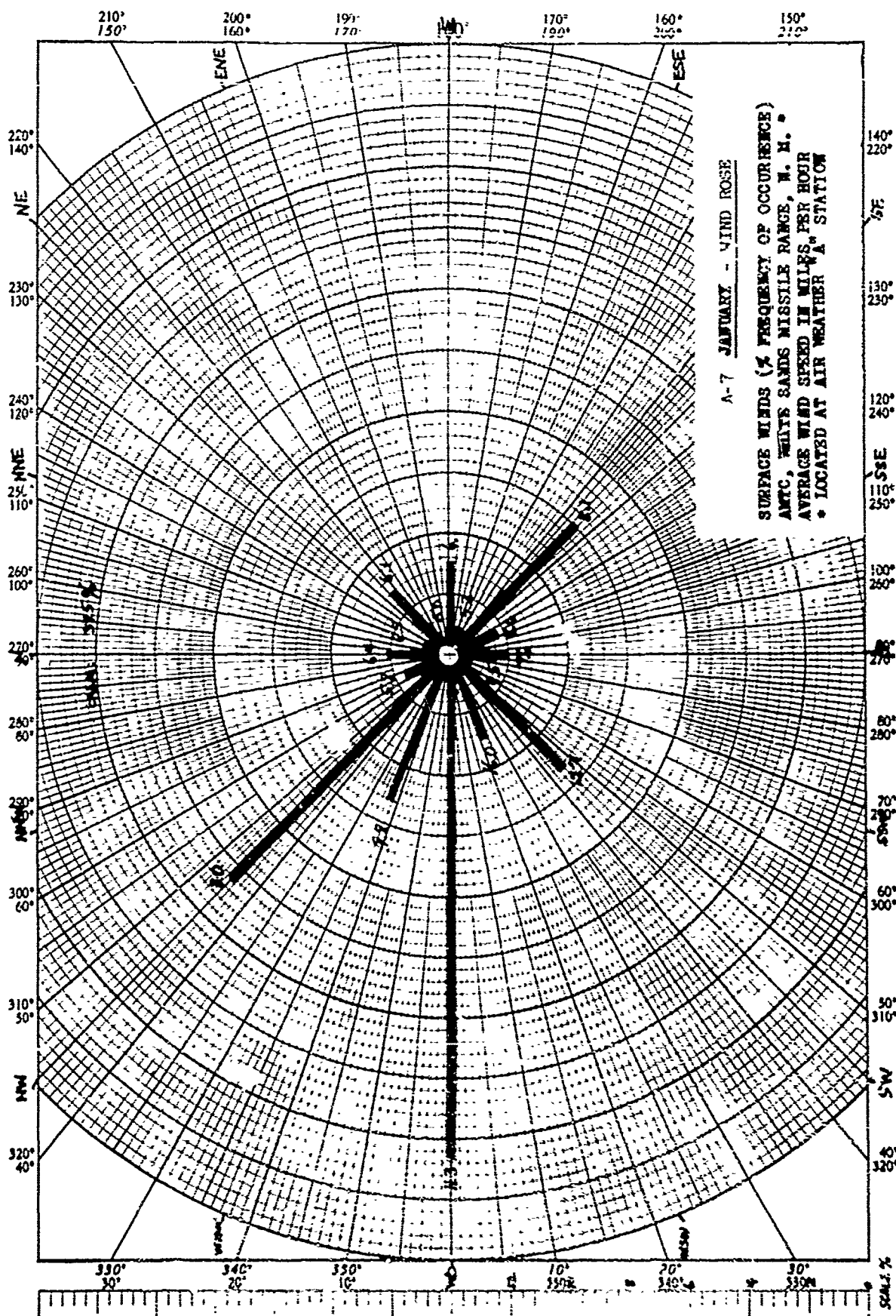


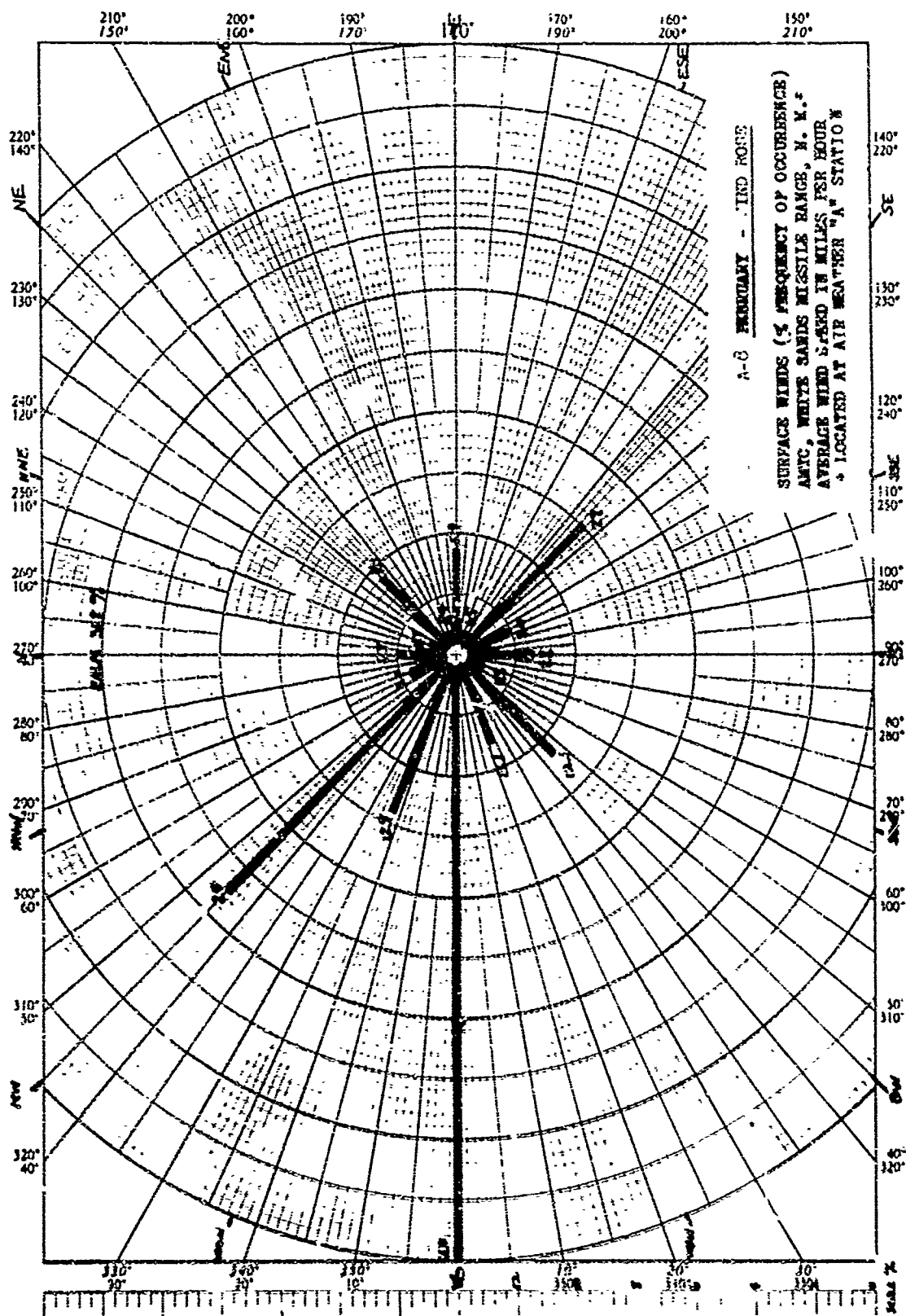


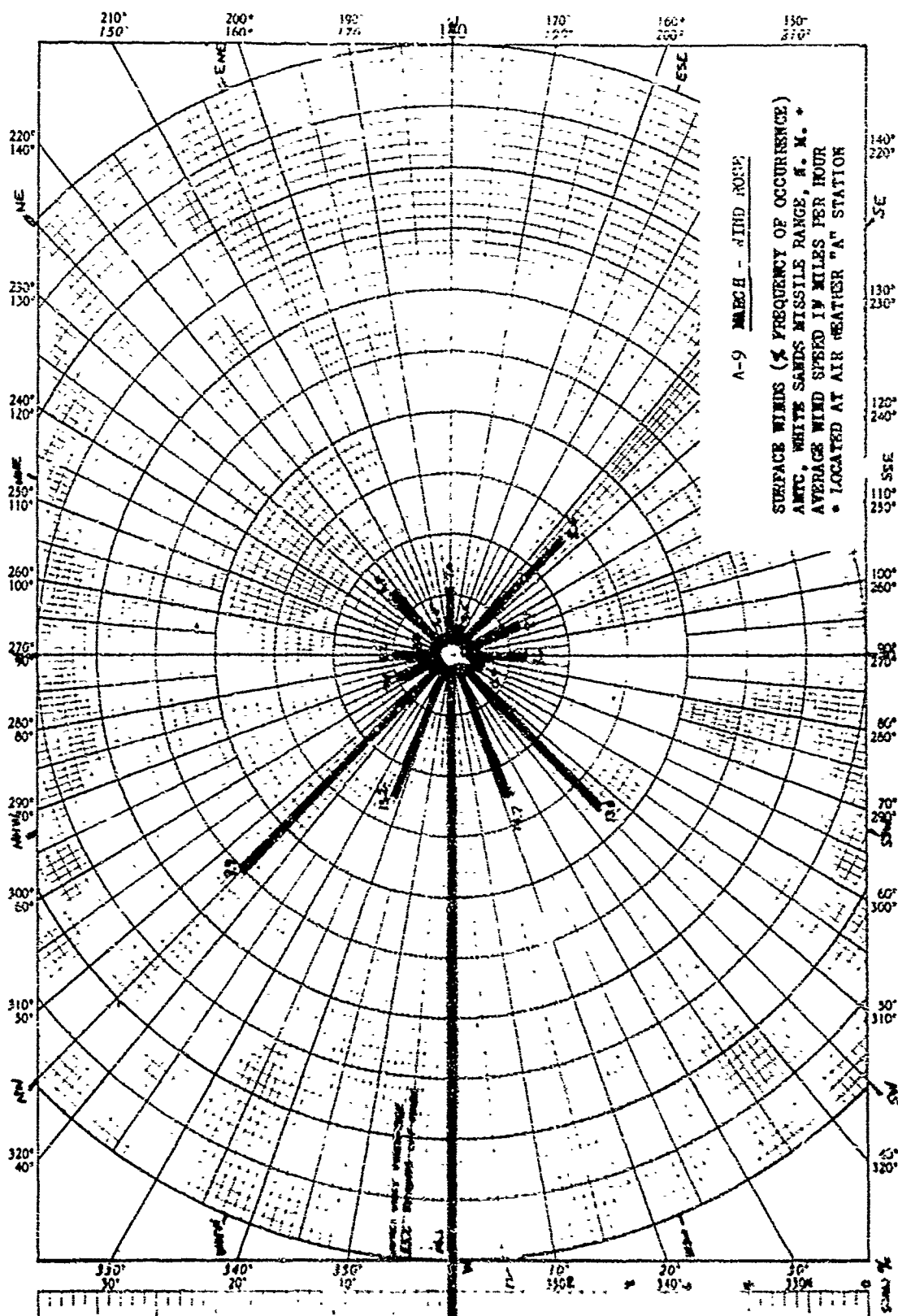
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 Percentage of Occurrence by Month
 Annual Average - - - - -

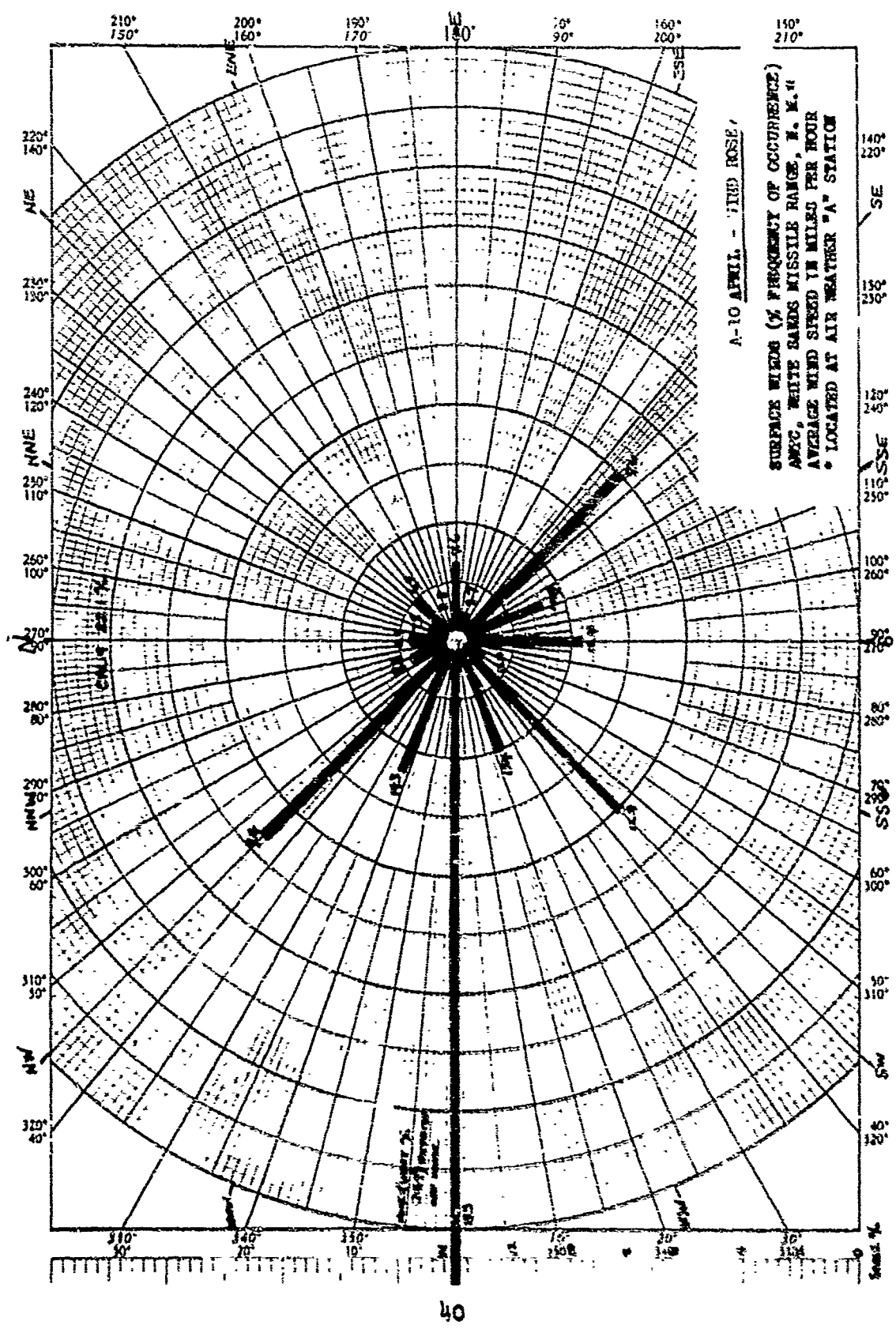


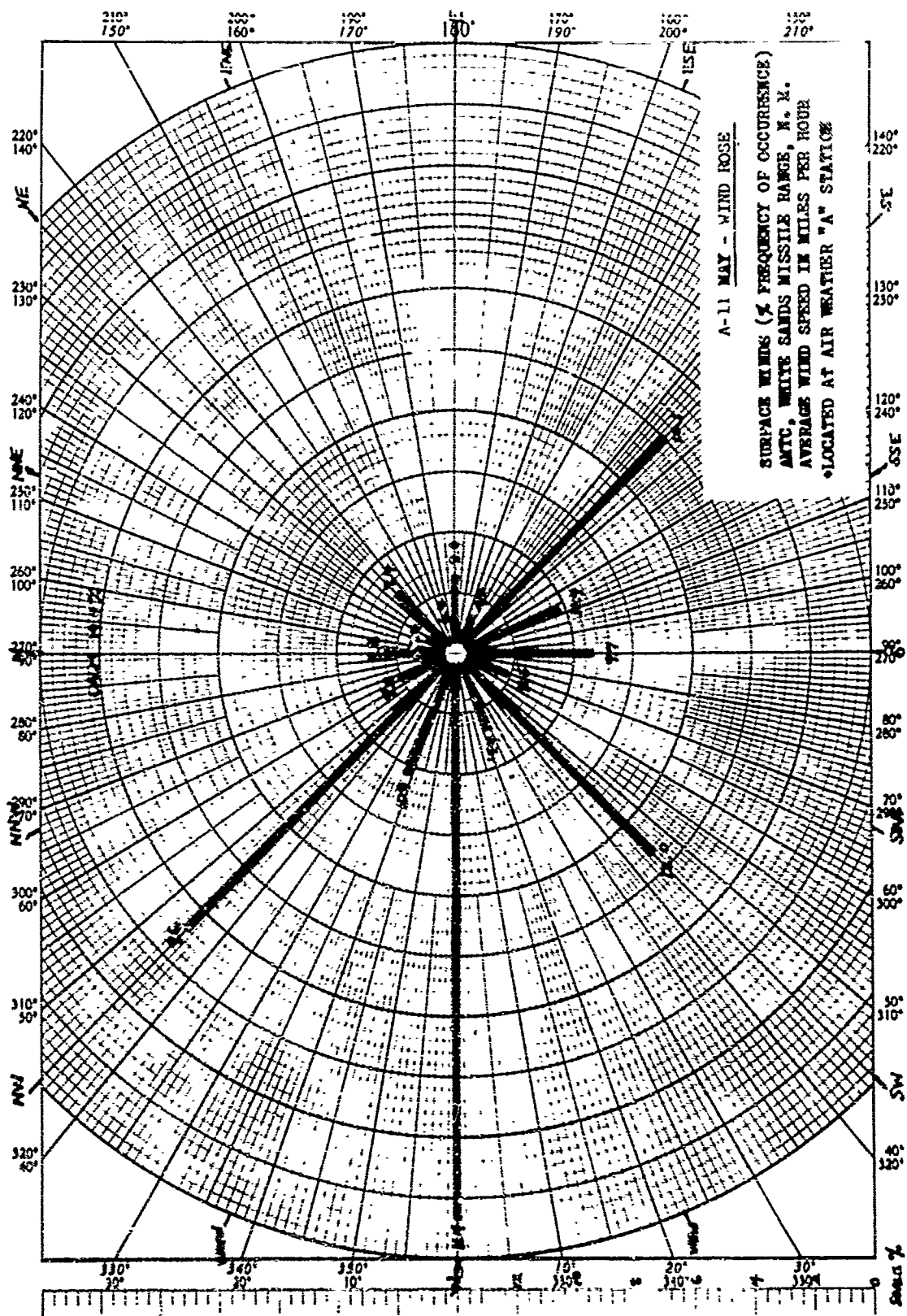


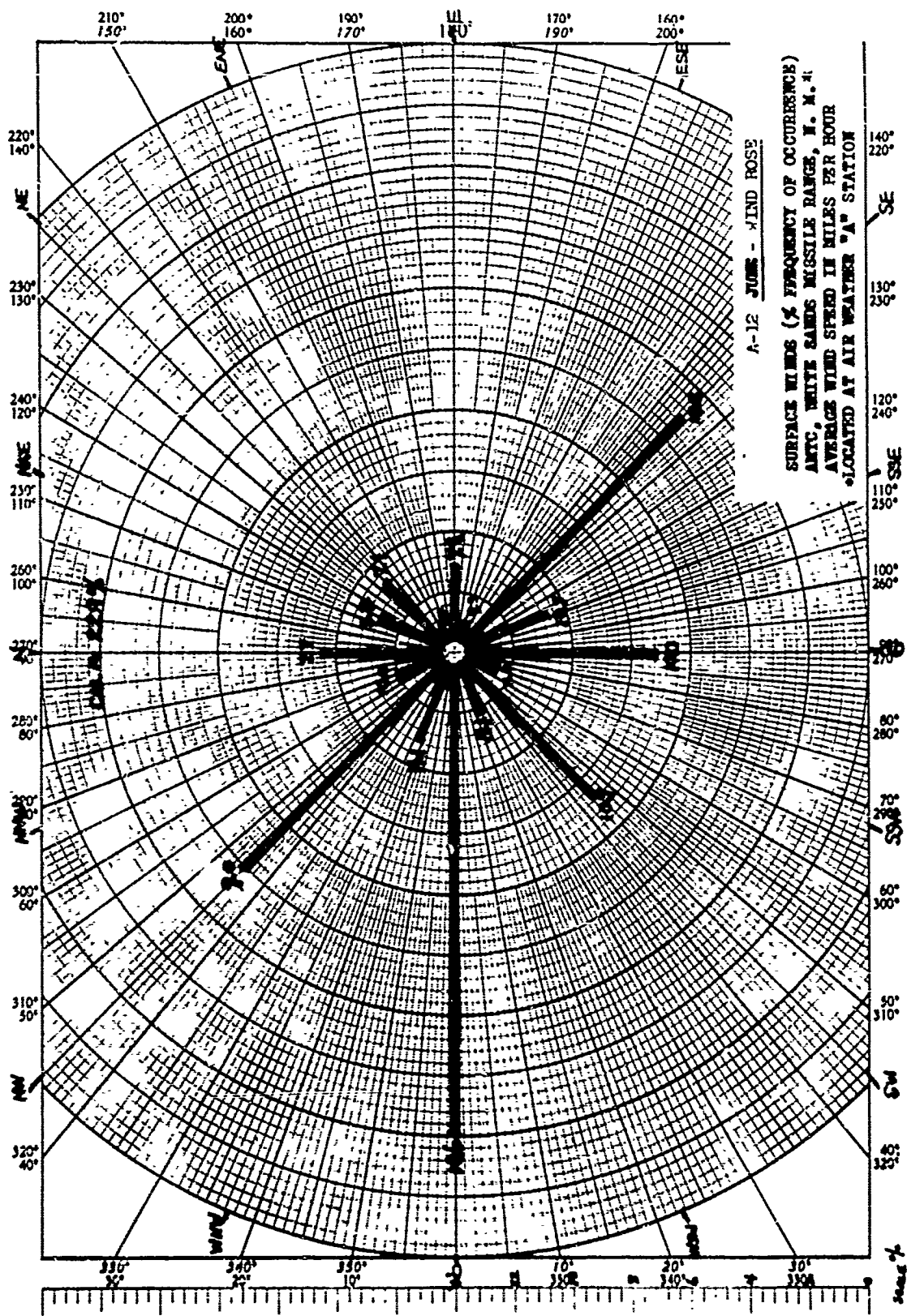


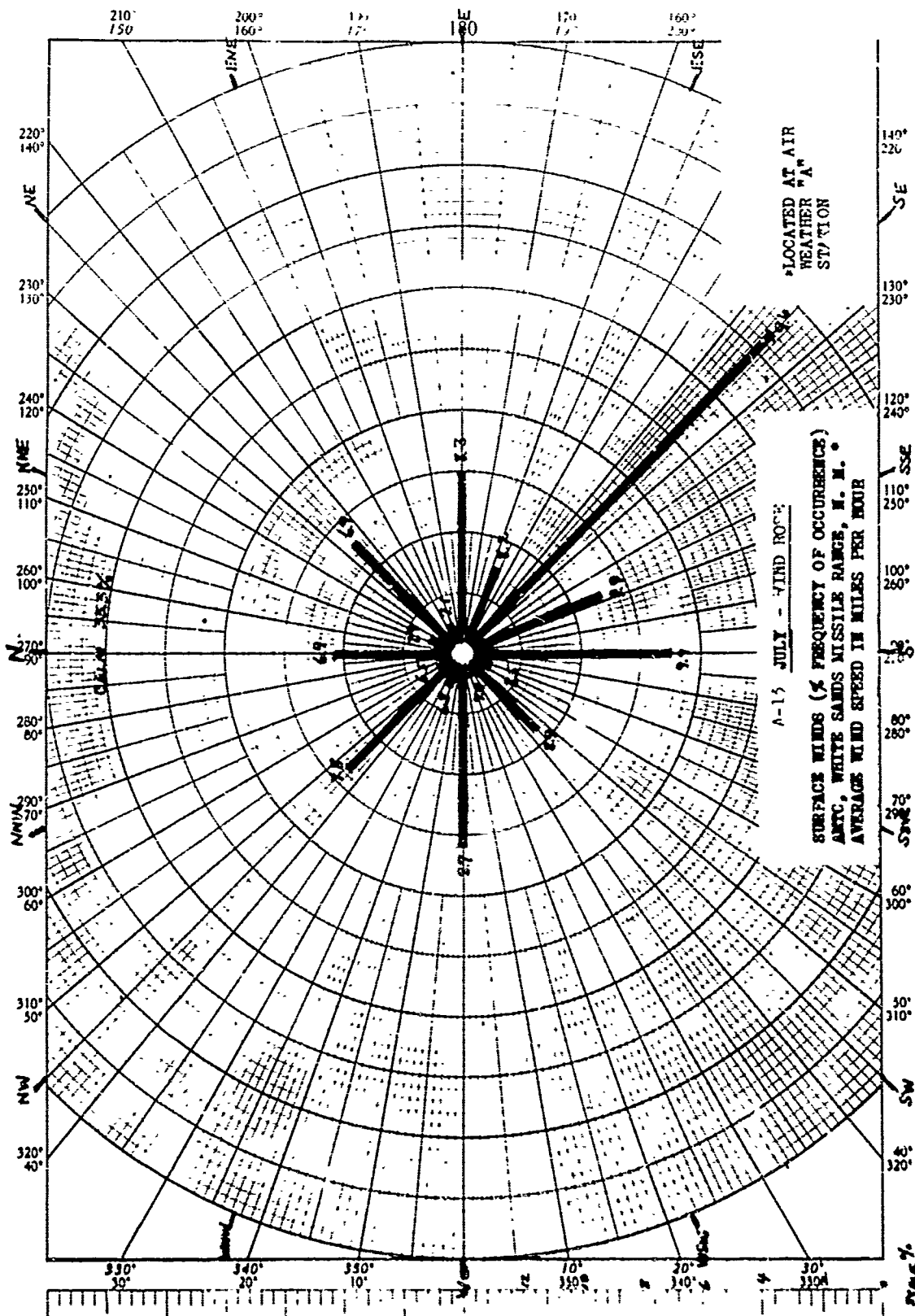


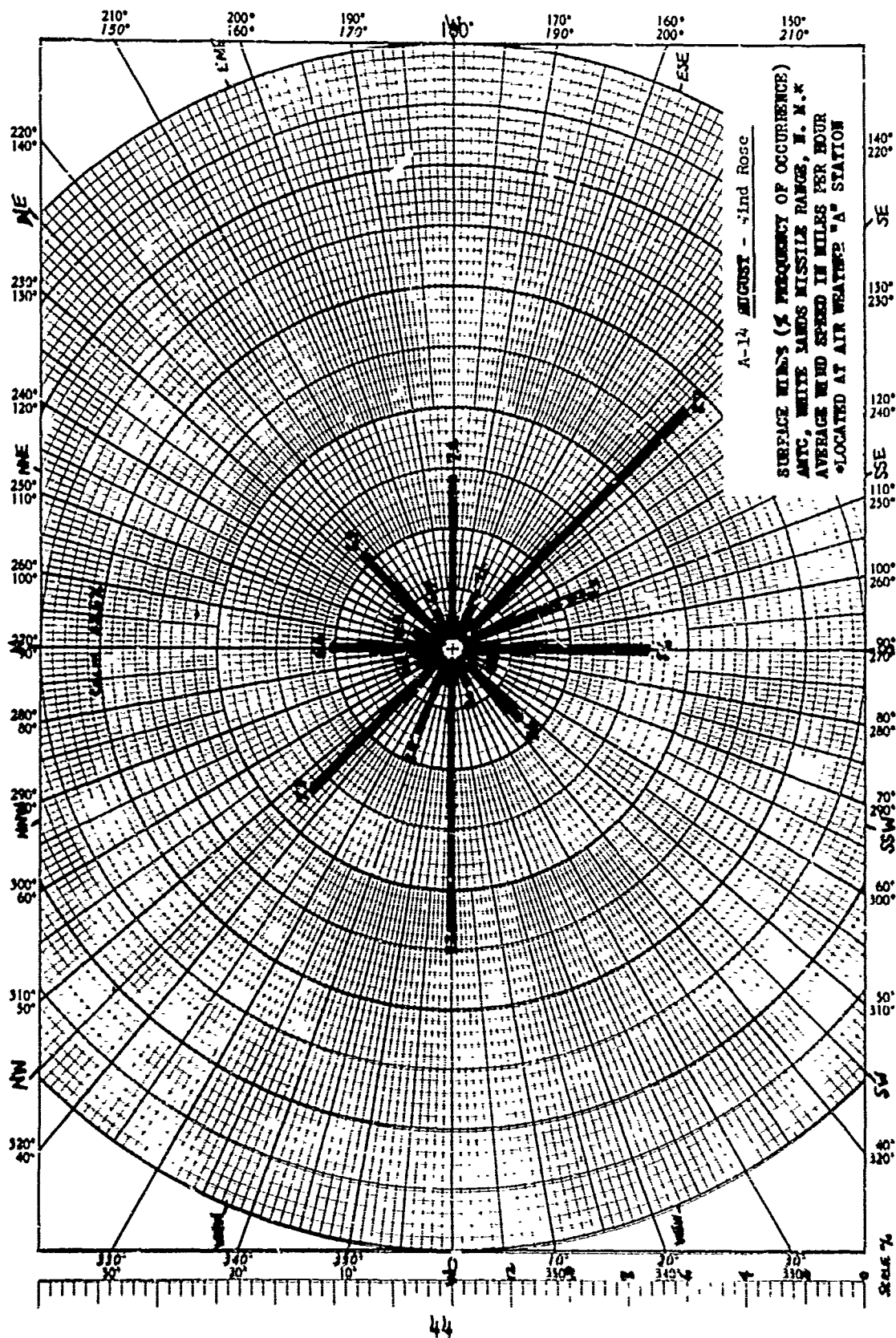


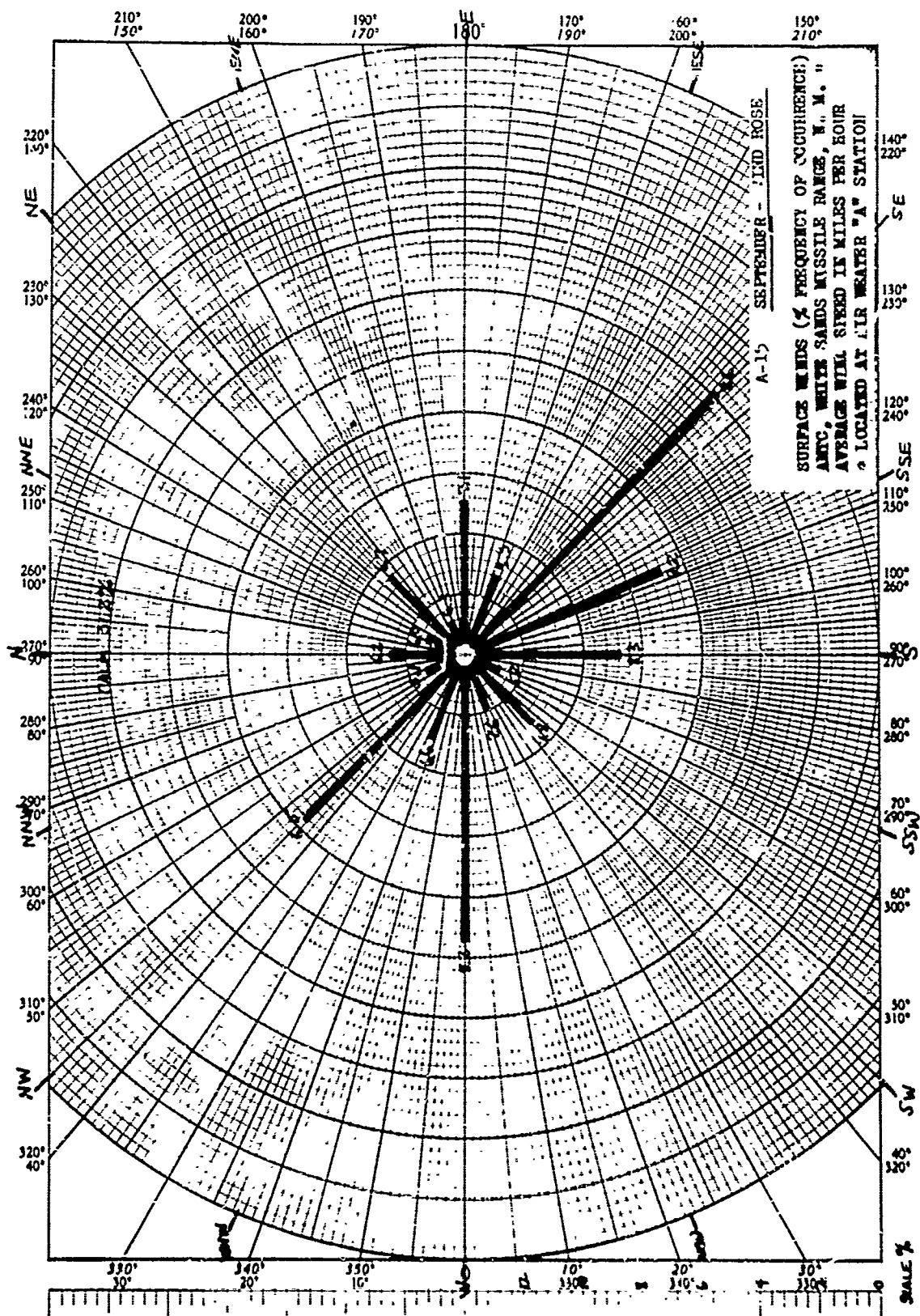


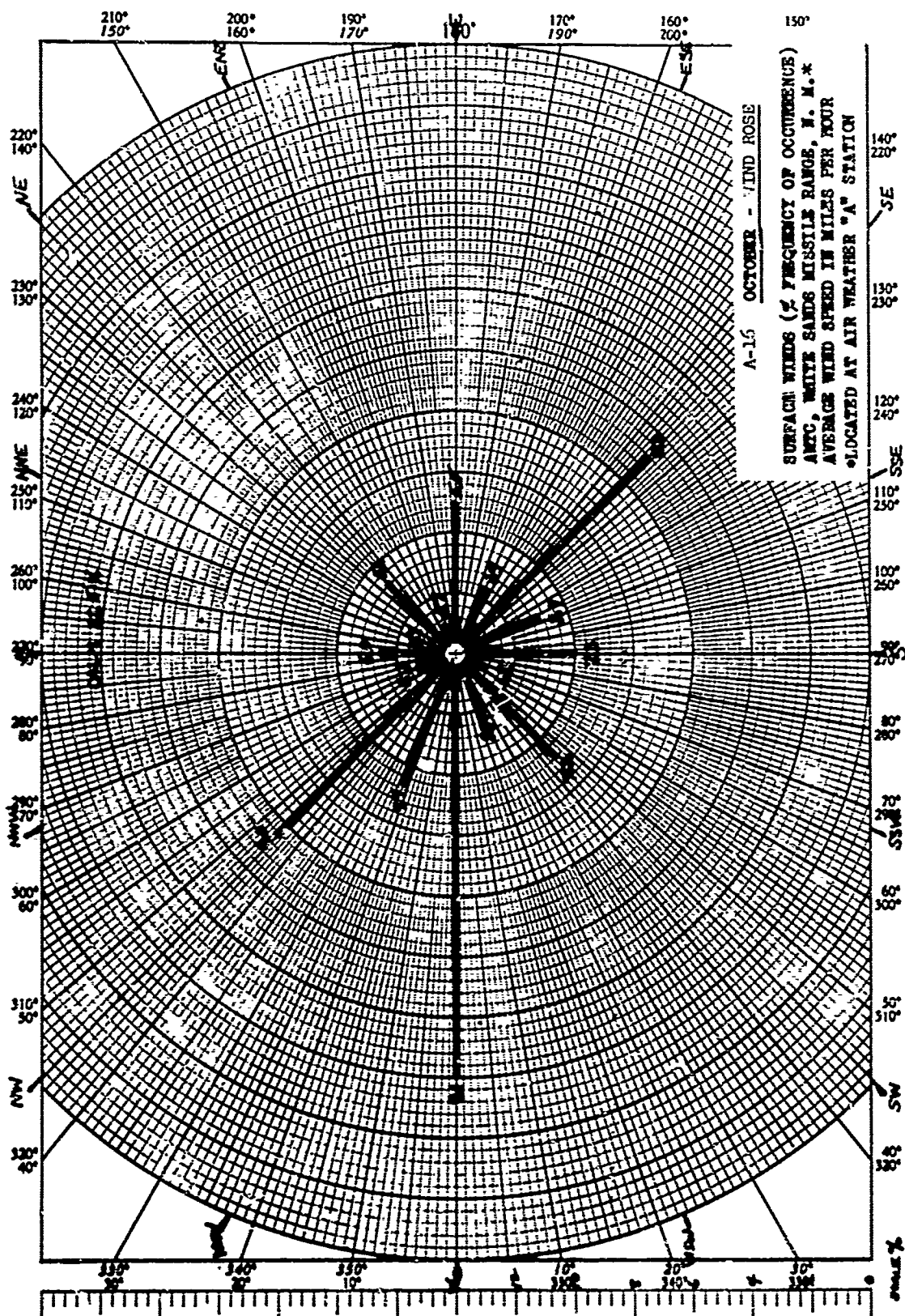


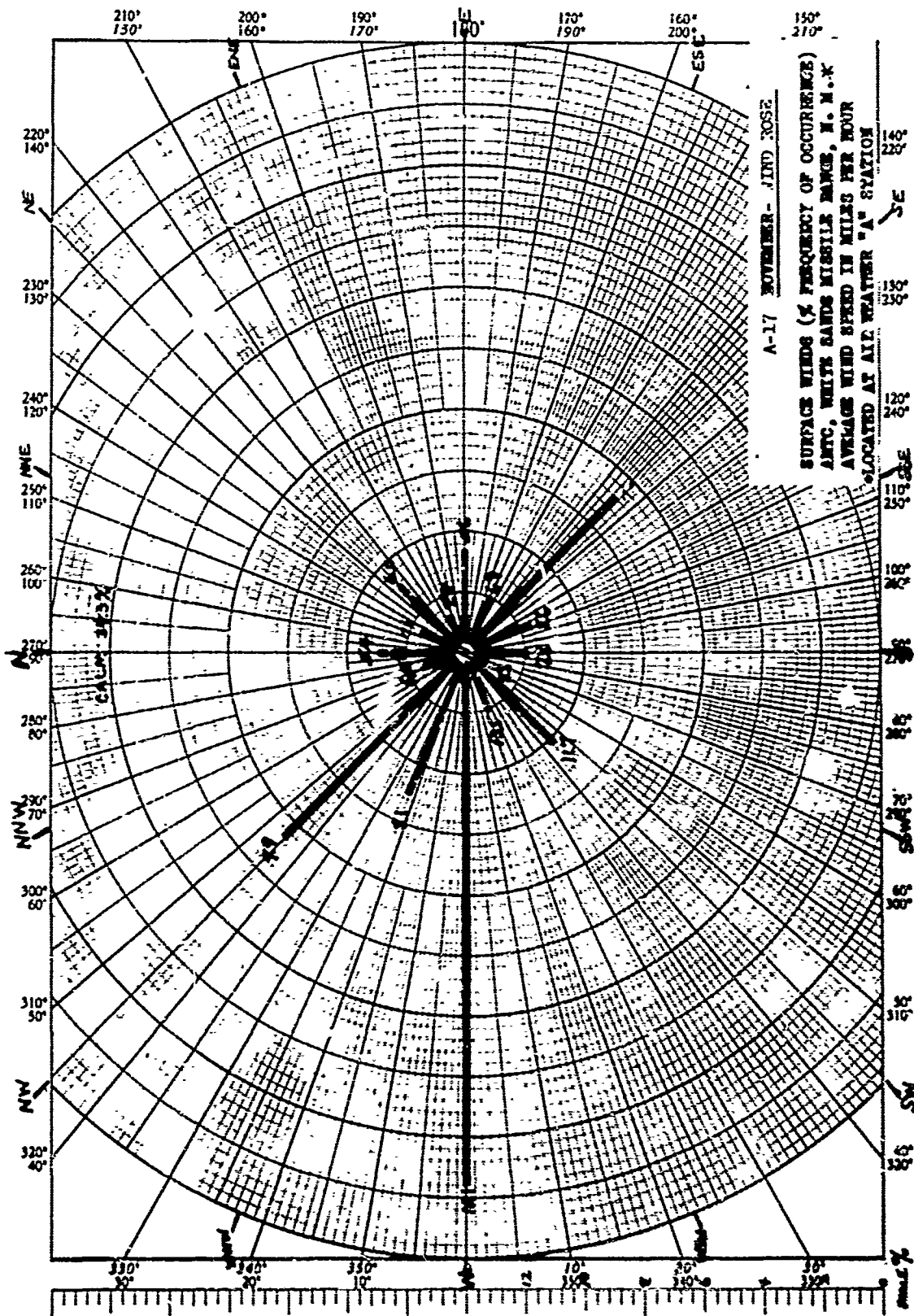


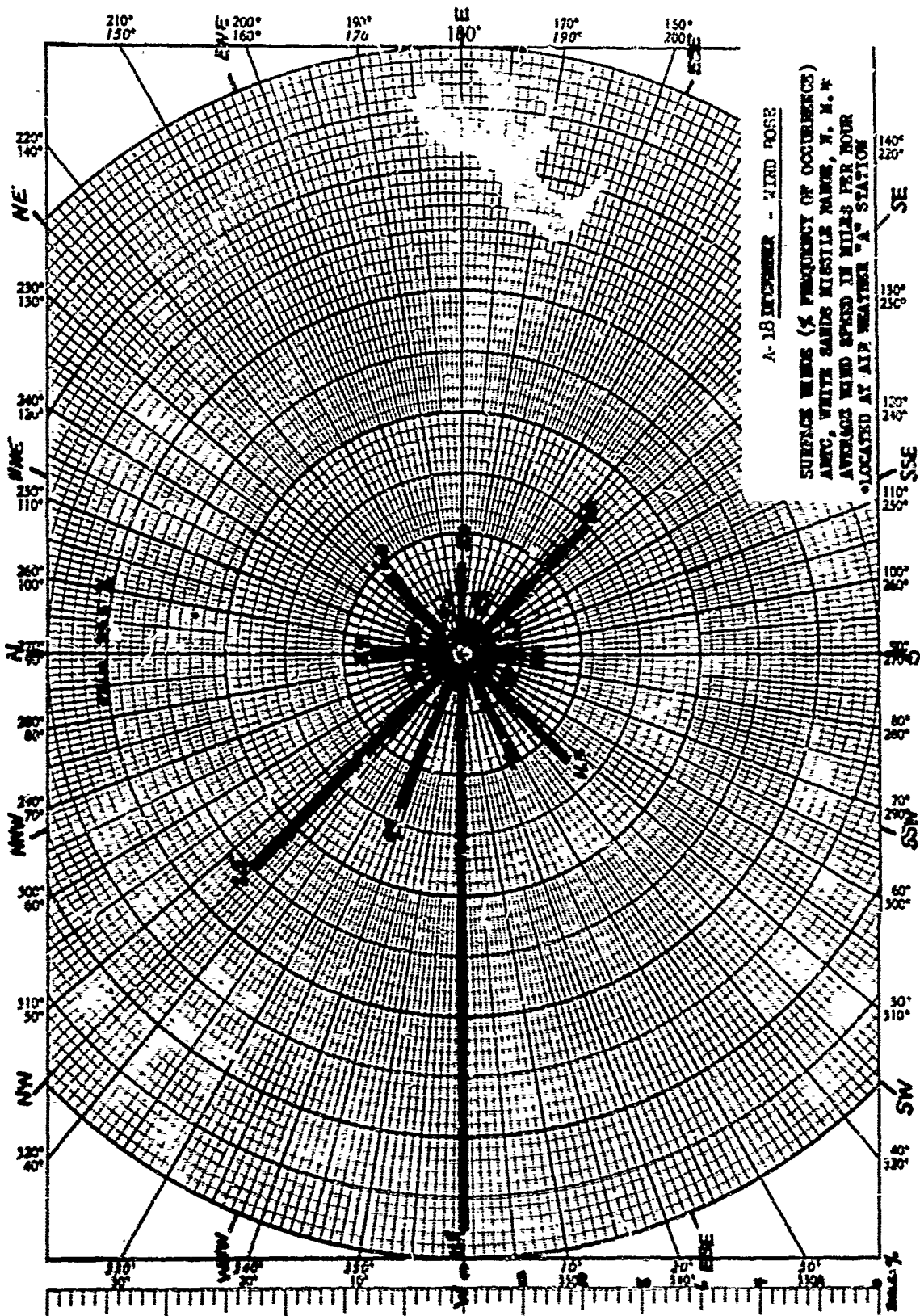


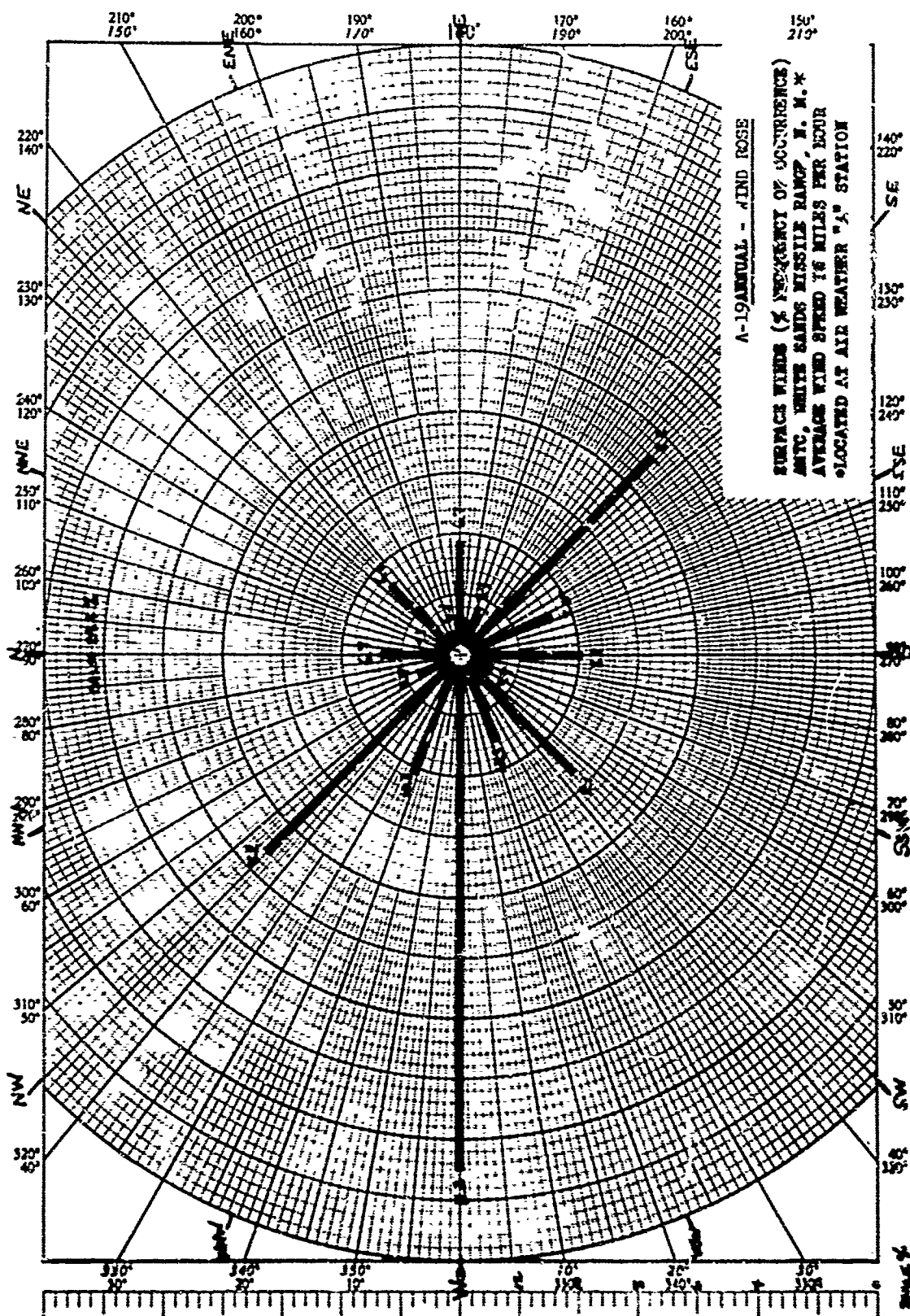


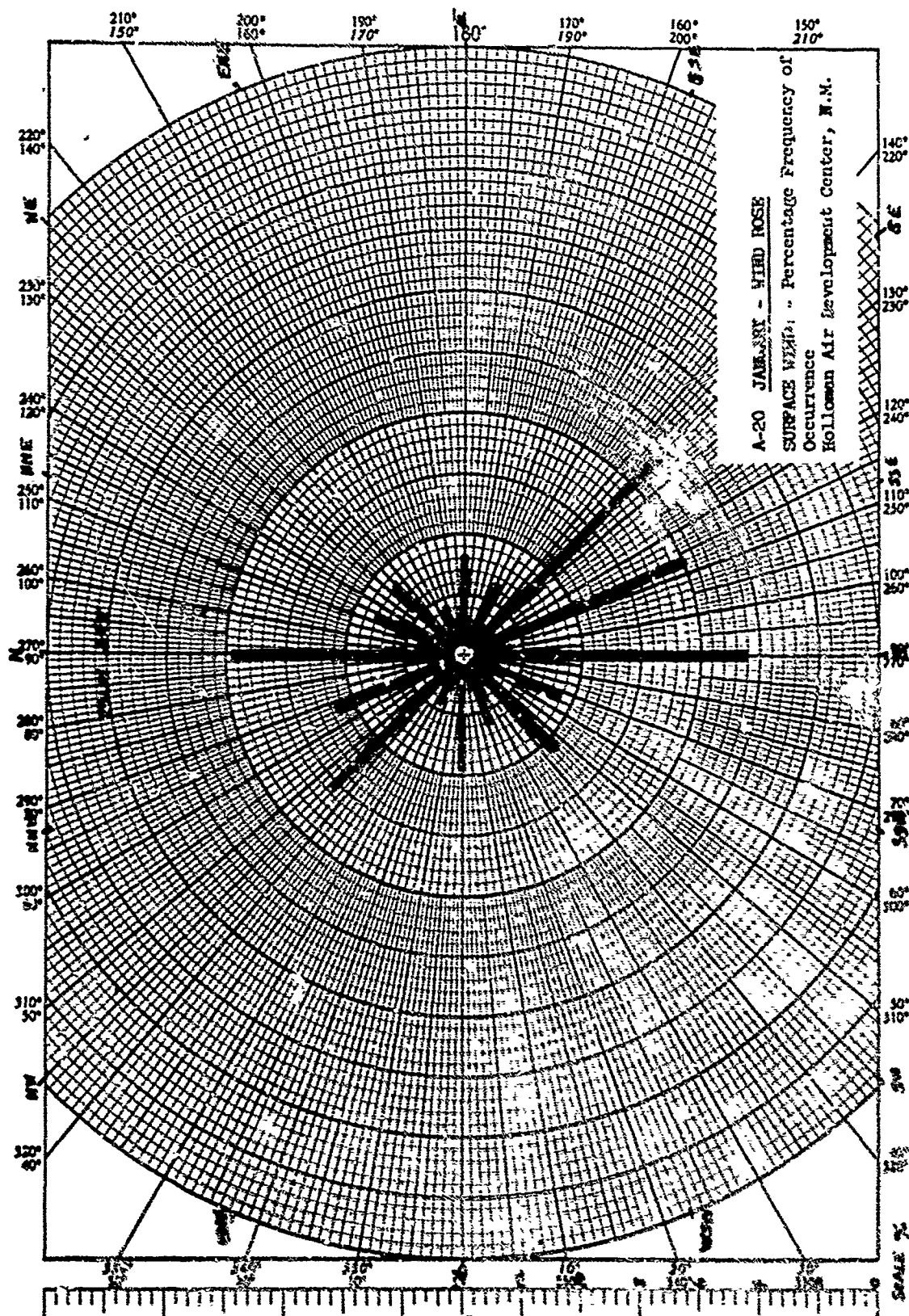


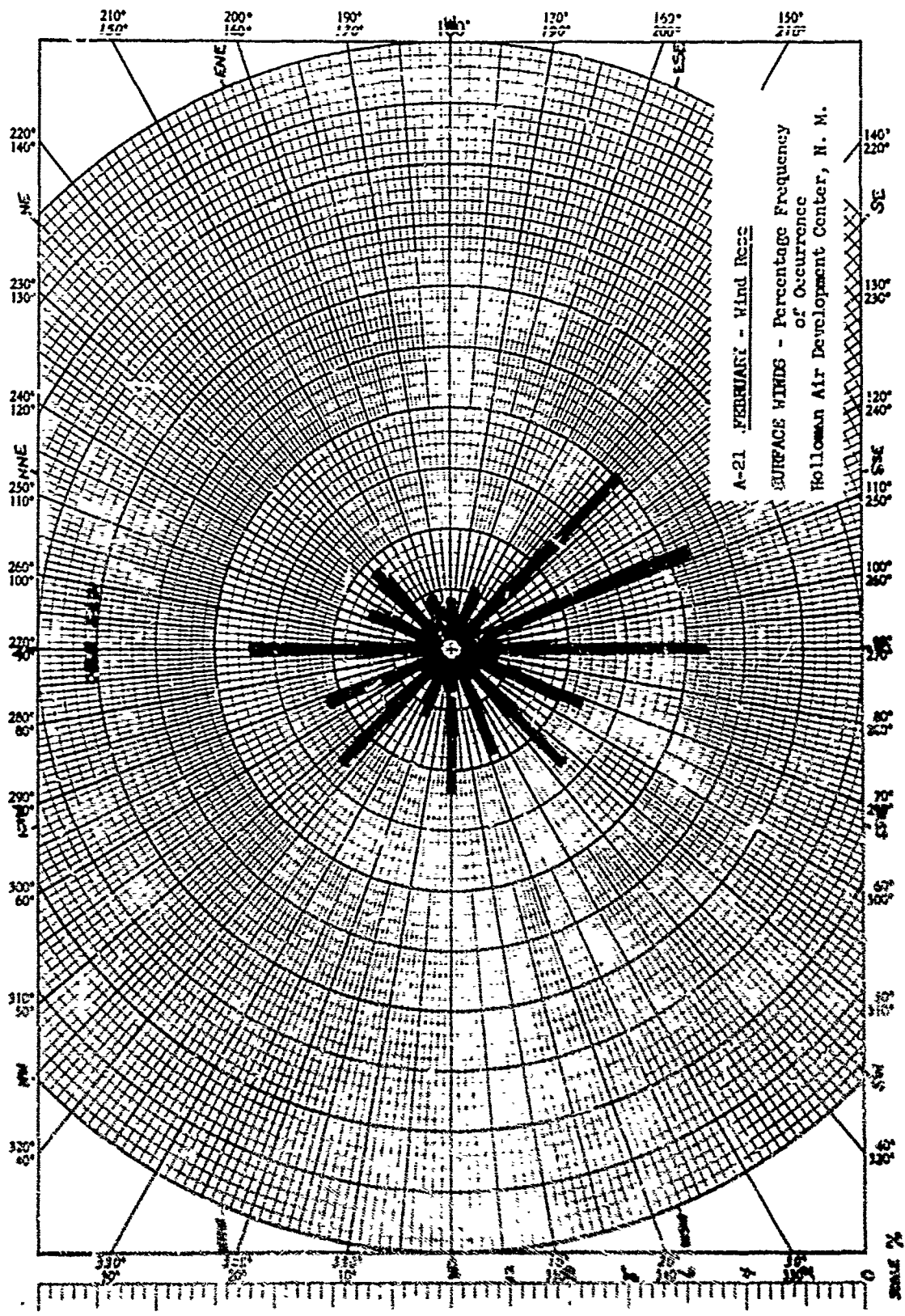












A-21 FEBRUARY - Wind Rose
SURFACE WINDS - Percentage Frequency
of Occurrence
Holloman Air Development Center, N. M.

