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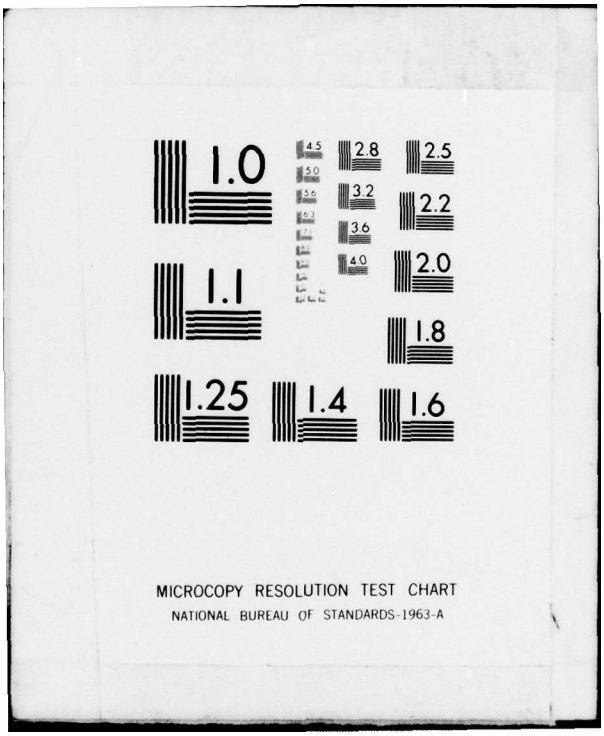
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CLIMATOLOGICAL NARRATIVES FOR U.S. AIR FORCE INSTALLATIONS

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December 1979

REVIEW AND APPROVAL STATEMENT

This report approved for public release. There is no objection to unlimited distribution of this document to the public at large, or by the Defense Technical Information Center (DTIC) to the National Technical Information Service (NTIS).

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

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25 JAN 1980

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Climatology	Andersen AFB Guam	Chanute AFB IL	Eielson AFB AK
Temperature	Avon Park Range FL	Charleston AFB SC	Elmendorf AFB AK
Topography	Barksdale AFB LA	Clark AB PI	England AFB LA
Wind Speed	Blytheville AFB AR	Dover AFB DE	Grand Forks AFB ND
Wind Direction	Carswell AFB TX	Eglin AFB FL	(Continued)

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report consists of climatological narratives for 44 USAF installations. They include descriptions of wind speed and direction; maximum, minimum, and mean temperatures; and other weather conditions. Discussions of topography include local terrain and its effect on local climate.

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Griffiss AFB NY	Langley AFB VA	Pope AFB NC
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Hill AFB UT	MacDill AFB FL	Robins AFB GA
Holloman AFB NM	McGuire AFB NJ	Scott AFB IL
Homestead AFB FL	Maxwell AFB AL	Seymour-Johnson AFB NC
Howard AFB Panama	Minor AFB ND	Shaw AFB SC
Incirlik AB Turkey	Moody AFB GA	Tyndall AFB FL
Keesler AFB MS	Mountain Home AFB ID	Whiteman AFB MO
Kirtland AFB NM	Patrick AFB FL	Wright-Patterson AFB OH
Lajes AFB Azores	Pease AFB NH	Wurtsmith AFB MI

PREFACE

The USAF Environmental Technical Applications Center (USAFETAC) prepared this report in answer to a request from the USAF School of Aerospace Medicine, Entomology Section at Brooks AFB, Texas. They have the responsibility for validating the use of aerial spray services for pest control at USAF installations. Validation studies, actual aerial spray operations, and other entomological surveys are dependent on knowing the local climatology and terrain.

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CLIMATOLOGICAL NARRATIVES FOR AERIAL SPRAY

Introduction

This report presents a compilation of 44 climatological narratives which contain descriptions of the local climate and topography of the different installations. The climate descriptions include discussions of wind speed and direction; maximum, minimum, and mean temperatures; and other weather conditions. The discussions of topography include the local terrain and its effect on local climate at the installation.

Andersen AFB, Guam

Andersen AFB is located on the northeastern tip of Guam, the largest and southernmost of the Mariana Islands (13.5°N, 145°E). The Philippine Sea borders on the west and the Pacific Ocean on the east. The island is 28 miles long, 4 to 8 miles wide, and oriented north-northeast by south-southwest.

Guam is shaped like a bow tie, and there are three topographic regions. The northern position of the island is a limestone plateau, bounded by steep cliffs that fall directly to the sea or to narrow beaches. The surface of the plateau is 300 to 600 feet above sea level. The southern portion of the island is mountainous with several peaks that rise above 1000 feet. The highest of these is Mount Lamlam which reaches 1334 feet. The third major region, the narrow waist between the northern and southern regions, is generally less than 200 feet in elevation. There are no streams or rivers in the northern part of the island because the porous coral subsoil absorbs rainfall before streams can form.

The climate of Guam is warm and humid throughout the year. Afternoon temperatures are typically in the middle or high 80's and nighttime temperatures fall to the low 70's or high 60's. Relative humidity commonly ranges from 65 to 75 percent in the afternoon increasing to 85 to 100 percent at night. Though temperatures and humidities vary slightly throughout the year, rainfall and wind conditions vary markedly. It is these latter variations that really define the seasons.

There are two primary seasons and two secondary seasons on Guam. The primary seasons are the 4-month dry season, January through April, and the 4-month rainy season, mid-July to mid-November. The secondary seasons are May to mid-July and mid-November through December. These are transitional seasons that may be either rainy or dry depending upon the nature of the particular year.

The mean annual rainfall on Guam varies from 95 inches on the windward (east) side of the higher mountains to 80 inches along the coast of the western side of the southern half of the higher mountains. About 15 percent of the annual rainfall occurs during the dry season and 55 percent during the rainy season.

The trade winds which blow from the east or northeast are the dominant winds on Guam. The trades are the strongest and most persistent during the dry season when wind speeds of 15 to 25 miles per hour are very common. During the rainy season there is often a breakdown of the trades. On some days the weather may be dominated by westerly-moving storm systems that bring heavy showers or sometimes, steady torrential rain. Occasional typhoons bring heavy rains and violent winds that may cause a surge of water onto low-lying coastal areas. Since 1908 typhoons have passed sufficiently close to Guam to produce high winds and heavy rains in every month, but their most frequent occurrence is during the latter half of the year. The chance of having one or more typhoons pass within this distance in any particular year is about one in three. However, the chance of having a typhoon move directly across Guam is only about one in 8 years.

Avon Park Range, Florida

Avon Park is located in the center of the Florida Peninsula. The Atlantic Ocean and the Gulf of Mexico are the major factors contributing to the climate of the area. In addition to these large sources of moisture, there are numerous lakes, swamps, and marshes which cover central Florida. The land between these small lakes

and swamps is composed of lightly forested grass pasture lands, numerous citrus groves, and large expanses of sandy fields. These areas are all moderately moist during the summer rainy season; they dry quickly in the fall and remain this way until the advent of the next summer rainy season. Field elevation is 65 feet above sea level.

The climate at Avon Park is subtropical with a mean annual temperature of 74°F. The months of May through September are the warmest with a mean average temperature of 80.6°F. November through March are the coldest months and have an average mean temperature of 65.9°F. Avon Park has a rainy season and a dry season. The average amount of precipitation during the rainy season, June through September, is 31.3 inches. The average amount of precipitation during the dry season, October through May, is 21.4 inches. Thunderstorms occur an average of 101 days per year, most frequently during the period June through August. The months of May through October usually exerience tropical storms and hurricanes which may affect the range.

Barksdale AFB, Louisiana

Barksdale AFB lies across the Red River from Shreveport in extreme northwest Louisiana, 175 miles north of the Gulf of Mexico. There are several local lakes and marshes with no significantly high terrain in the area except for the Ouachita Mountains in central and northern Arkansas over 100 miles to the north. Field elevation is 167 feet.

Barksdale lies in swampy country that is heavily urbanized with 200,000 people living mainly in the southwest and northwest quadrants. Land to the east is mainly agricultural. There are four man-made lakes within 25 miles, plus extensive wet bottomland associated with the Red River. These moisture sources present a significant forecast problem. Shreveport is a local pollution source, but does not affect local visibility.

The climate of Barksdale AFB is transitional between the subtropical humid type prevalent to the south and the continental climates of the Great Plains and Middle West to the north. During winter, masses of moderate to severely cold air move periodically through the area. Rainfall is abundant with the normal annual total near 45 inches. Amounts are substantial from late autumn to spring. There is a summer-early autumn minimum with monthly averages less than 3 inches in August, September, and October. The majority of rainfall is convective and air-mass types, showery and brief, except during winter when nearly continuous frontal rains may persist for a few days. Extremes of precipitation occur at all seasons.

The winter months are normally mild with cold spells generally of short duration. The typical pattern consists of turning cold one day, reaching the lowest temperature on the second day, and beginning of warming on the third day. Freezing temperatures are recorded on an average of 34 days during the year. The average date of the first freezing temperature in the autumn is 13 November and the average date of the last freeze in the spring is 5 March. These dates produce a mean freeze-free period of 252 days. Temperatures of freezing or below occur each winter but drop below 16°F only about one-half of the winter seasons. Snowfall averages less than 2 inches per year; measurable amounts occur on an average of only once every other year. Many consecutive years may pass with no measurable snow. More troublesome than snowfall are the occasional ice and sleet storms.

The summer months are consistently quite warm, with maximum temperatures exceeding 100°F about 10 days per year and exceeding 95°F about 45 days per year. Showers fall at any one place in the area on about 8 days during each of the summer months. The resulting point rainfall totals are usually less than one-half inch except on two or three days per month when heavier amounts are recorded.

The average relative humidity is high during all seasons. These humidities, 90 percent or higher, generally occur during the early morning hours. In contrast, more than half of the midafternoon hours have had relative humidity of less than 50 percent.

Thunderstorms occur each month, but are most frequent in spring and summer months. October has the fewest days with rain although the smallest normal rainfalls are in August and September. Severe local storms have occurred over small

areas in all seasons, but are most frequent during the spring months, with a secondary peak from late November through early January. Tropical cyclones are in the dissipating stages by the time they reach this portion of the State, and winds from them are usually not destructive. However, associated heavy rainfall can contribute to local flooding.

Blytheville AFB, Arkansas

Blytheville AFB lies in the lowlands on the west side of the Mississippi River near the common boundaries of Arkansas, Missouri, and Tennessee. The terrain features of any consequence are the Boston Mountains, 180 miles west of Blytheville, rising to over 2000 feet. The largest population center near the base is Memphis, Tennessee, 55 miles to the south. Field elevation is 254 feet.

The exceptional flatness of the bottomland near the Mississippi River eliminates local orographic effects. The Boston Mountains may interact with fast-moving cold fronts, spawning thunderstorms which may affect Blytheville. The wet bottomland is an excellent moisture source for fog in the winter. Local pollution sources are unimportant, except late in the fall when cotton gins to the east and west are in operation. In stable stagnating air, smoke at sunrise can cause limited visibility.

In winter, most migratory storms pass north or east of Blytheville exposing the area to squall-line activity. Occasional gulf storms move through to the east dropping heavy precipitation. As a result, Blytheville averages 11 inches of snow and 23 inches of rain from November through March.

In summer, moist maritime tropical air spawns isolated afternoon thunderstorms. Any nearby front will encourage squall lines or clusters of thunderstorms. In spite of this, summer is the dry half of the year averaging only 14 inches of rain between June and October. The best weather occurs in the fall. Precipitation in this area averages around 47.2 inches annually. The mean temperature varies from year to year but averages 69°F. The warmest months of the year are May through October, and the coldest months are December through March. Thunderstorm days average about 58 a year.

Carswell AFB, Texas

Carswell AFB is located in north central Texas 5 miles west-northwest of Fort Worth and 30 miles west of Dallas. Fort Worth has nearly surrounded Carswell, but there are some open spaces to the west. Lake Worth lies off the north end of the airfield. There are other reservoirs beyond 5 miles north and south. The Fort Worth-Dallas area has a large populace, so the base is not situated in a rural setting. These cities lie on the flat "Grand Prairie." Low hills begin at a point 25 miles west, and the land generally begins to rise beyond that. The Gulf of Mexico is 250 miles southeast at its closest point. Field elevation is 650 feet, with the rolling hills in the area ranging from 500 to 800 feet in elevation.

The Carswell AFB climate is humid, subtropical with hot summers. It is also continental, characterized by a wide range in annual temperature extremes. Precipitation averages near 32 inches annually, but varies considerably from year to year ranging from less than 20 to more than 50 inches.

Winters are mild, but "northers" occur about three times each month and often are accompanied by sudden drops in temperature. Periods of extreme cold that occasionally occur are shortlived, so that even in January mild weather occurs frequently. In an average year, temperature minima of 20°F or below occur on only 6 days.

The highest temperatures of summer are associated with fair skies, westerly winds, and low humidities. Characteristically, hot spells in summer are broken into 3-5 day periods by thunderstorm activity. There are only a few nights each summer when the minimum temperature exceeds 80°F, but a year when the temperature does not exceed 100°F is rare. Refrigerated-type air conditioners are recommended for maximum comfort indoors and while traveling via automobile. Throughout the year, rainfall occurs more frequently during the night. Usually, periods of rainy weather last for only a day or two, and are followed by several days with fair skies. A large part of the annual precipitation results from thunderstorm activity, with an

occasional brief but heavy rainfall. Greatest amounts of rain occur during April and May while July and August are relatively dry months. Thunderstorms occur throughout the year but are most frequent in the spring. Hail falls on about two or three days a year, ordinarily with only slight and scattered damage. Windstorms occurring during thunderstorm activity are sometimes destructive. Snowfall is rare with a measurable fall occurring only once in an average year.

The average length of the warm season (freeze-free period) in the Carswell area is 249 days. The longest freeze-free period is 292 days in 1973; the shortest was 196 days in 1957. The average date of the first occurrence of 32°F or below in the fall is 21 November. The average last occurrence of 32°F and below is 16 March.

Chanute AFB, Illinois

Chanute AFB lies 100 miles southwest of Chicago in the center of the Midwest corn belt. The climate throughout the year is typically continental; the influence from Lake Michigan is very slight. The weather is active cyclonic and frontal type weather throughout a greater portion of the year. Chanute lies in the paths of the major portion of the cyclones and anticyclones affecting the United States east of the Rockies. The rainfall is fairly well-distributed throughout the year with a slight maximum occurring during April, May, and June in prewarm frontal showers. Air-mass thunderstorms are frequent during the months of June, July, and August. The mean annual rainfall for Chanute is 33.74 inches.

There are no orographic effects of any consequence at Chanute AFB. There is no upslope or downslope effect from any direction as the terrain does not vary more than 100 feet within a radius of 100 miles of the base. There are no rivers or bodies of water in the vicinity of Chanute. Occasionally, after the passage of a cold front with a high over Minnesota and Wisconsin, or a strong low moving eastward over the State of Michigan, Chanute will experience an effect from Lake Michigan during late October until the end of March. During this period and with east-northeast or northeast winds of at least 20 miles per hour, broken to overcast stratocumulus cloud decks will move in over Chanute. However, clear skies will be reported 25 to 35 miles to the south and southwest of the field.

Radiation fog will form from October to the latter part of March with light winds and clear skies. The fog reduces the visibility to as low as 1 mile by early morning but dissipates by midmorning. Post cold frontal fog is common at Chanute in the winter months when a cold air mass replaces a moist continental or maritime polar air mass.

The main obstruction to vision at Chanute is smoke, occurring on 60 percent of all observations taken from October through March. Smoke-bearing winds are those from a northerly, westerly, or southerly quadrant. The main sources of smoke are the city of Rantoul, the base power plant, the dumps at the southern edge of the base, and the cities of Urbana-Champaign. With a low inversion or a weak lapse rate and winds from any of the three quadrants, visibilities of 1 mile in smoke are not uncommon during the winter months. Chanute experiences its best visibilities with an east wind of 8 miles per hour or more.

Charleston AFB, South Carolina

Charleston AFB is located on a peninsula formed by the Ashley and Cooper Rivers 15 miles inland from the Atlantic Ocean. The coastal area surrounding Charleston is low and flat, averaging 15 to 25 feet above sea level. Swamps extend from the southwest to the north within 80 miles. The Gulf Stream lies about 80 miles offshore, and its warm waters moderate the coastal temperatures.

The major air pollution (smoke) source is a paper mill located about 3 miles east of the base. The plant operates 24 hours a day. Under stable atmospheric conditions, the smoke shows no tendency to diffuse and actually forms a streamer visible for many miles. With the average surface to 500 feet wind from a 080° to 100° direction and with a low inversion present, visibility generally is reduced by smoke to 3/4 to 1-1/2 miles. When the inversion breaks, visibility increases to 4 miles or greater depending on the wind and convective currents. A secondary smoke source

is the Stark Industrial area on the bank of the Ashley River 3 miles southeast of the base. The smoke reduces the visibility to about 5 miles when the lower 2000 to 3000 feet of the atmosphere is very stable, and a sea breeze is blowing.

The climate at Charleston is modified considerably by the nearness of the ocean. The prevailing winds are northerly in the fall and winter, southerly in the spring and summer. Summer is warm and humid. Temperatures of 100°F or higher are infrequent. Maximum temperatures are generally several degrees lower along the coast than inland due to the cooling effect of the sea breeze. Summer is the rainiest season with 41 percent of the annual rainfall. The rain, aside from occasional tropical storms, is generally of a shower or thundershower nature, producing variable amounts over scattered areas. The fall season passes through the warm "Indian Summer" period to the prewinter cold spells which begin late in November. The late September to early November weather is mostly sunny, and extremes of temperature are rare. However, summer and early fall is the period of maximum hurricane threat to the South Carolina coast.

The winter months, December through February, are mild with rainfall averaging 18 percent of the annual total. The winter rainfall is generally of a more uniform type, although a few thundershowers do occur. A significant amount of snow is rarely measured. The best probability of snow is in January. An average winter would experience less than one cold wave and severe freeze. Temperatures of 20°F or less on the peninsula and along the coast are very unusual.

Spring experiences rapid changes from windy and cold in March to warm and pleasant in May. The spring rainfall represents about 20 percent of the annual total. Severe local storms are most likely to occur in the spring. The average date of the first freeze in the fall is 10 December, and the average date of the last freeze before spring is 19 February. Temperatures below 32°F have been reported in the immediate inland areas as late as 16 April and as early as 24 October.

Clark AFB, Philippines

Clark AFB is located at the western edge of the Luzon Plain at an elevation of 508 feet above sea level. There are two mountain ranges: the Sierra Madre Mountains about 40 miles east of Clark AFB and the Zambales Mountains with its foothills about 5 miles to the west. The Zambales rise rapidly from these foothills to peaks of 6000 feet and the Sierra Madre Mountains to heights of 4000 feet above sea level. About 60 miles north of the base the mountainous terrain again rises rapidly, this time to peaks as high as 10,000 feet. The only obstruction in the Luzon Plain itself is Mount Arayat which lies 13 miles due east of Clark AFB and rises to twin peaks, 3400 feet above sea level. Clark AFB is under the influence of a maritime tropical air mass throughout the year, except for short periods following a weak cold frontal or a shear line passage during the period of January through April.

During the dry season (December through May) the normal flow is easterly and northeasterly over the Sierra Madre Mountains which act as a blockade. An overcast of stratus is formed along the eastern Luzon coast with considerable cumulonimbus forming over the mountains due to upslope flow. With this upslope effect there is considerable condensation over the mountains giving a modified dry air mass over the air base. The temperatures range from 92°F to 98°F in the daytime and 72°F to 77°F at night. The relative humidity at Clark ranges from 45 percent in the daytime to 80 percent at night. During the rainy season (June through November) Clark is affected by south to southwesterly monsoon flow. This air mass has a very high moisture content and is very unstable. This instability is increased by the flow of the air mass over the mountains of the Bataan Peninsula causing a large amount of precipitation over Clark AFB.

As in most low-latitude areas, Clark AFB is little effected by fronts. Frontal activity is limited to shear lines, easterly waves, or the intertropical convergence zone. Again, the topographical features influence their movement over the area. Temperature in this area over a 3-year period of study seems to have an equal monthly average. There is very little variation of temperature except for diurnal variations. There is an average range of 20 degrees between the day and night temperatures in the dry season compared to the average range of 10 degrees in the rainy season. Although the temperature averages over 90°F during the dry season, the dew point is comparatively low with an average of 65°F, and the relative humidity is

about 45 percent. However, when an overcast condition appears over the field during the late afternoon the temperature will remain high until midnight with a sharp rise of relative humidity.

Annual precipitation averages approximately 89 inches per year. The greatest rainfalls occur during the months of July, August, and September. The rainfall for these three months is about 70 percent of the total rainfall for the year. This can be attributed to the fact that the intertropical convergence zone is over or north of Clark AFB. When it is north of Clark, precipitation is at its greatest due to the monsoon flow. Precipitation totals are the lowest during January and February when only a trace is recorded. Rainfall during the months of March, April, and May can be attributed to local thunderstorms and moderate or intense easterly wave passages. November and December rainfall is associated with typhoons in the areas and the slow dissipation of the intertropical convergence zone.

Visibility throughout the dry season is very good. During the rainy season visibility is reduced in moderate and heavy showers to 2 miles or less. During typhoons visibility is occasionally reduced to less than 1 mile in heavy rain squalls. There are no smoke factors to be considered in this area. Haze is a very minor factor. During the rainy season fog will occasionally form at the base of Mount Arayat or at the foothills of the Zambales Mountains west of Clark AFB and move over the field. The fog dissipates before 1000 hours in the morning.

The typhoon season ranges from June through December, however, the main months are September through December. Clark AFB is protected to the north, east, and west by mountains. In order for a typhoon to seriously affect Clark AFB, the storm must take such a path as to cause wind flow from the south or the northwest.

Although thunderstorms in this area are usually associated with the intertropical convergence zone and easterly waves, dry thunderstorms that build up over the mountains are observed during the months of April and May. Strong, gusty surface winds occur without precipitation. These storms may easily be compared to the dry thunderstorms of Texas and Arizona in the United States. Dust devils are observed almost daily during the dry season. These are caused by instability due to heating of the flat land surrounding the base and can be seen to heights of 3000 or more feet above the surface. Tornadoes are rare but do occur in this area.

Dover AFB, Delaware

Dover AFB lies on the flat to gently rolling Atlantic Coastal Plain near the northeast end of Delmarva Peninsula, 3 miles west of Delaware Bay, and 35 miles east of Chesapeake Bay.

Dover's position in the middle latitudes favors a continental type of climate. However, the nearby large open bodies of water exert considerable modifying influences throughout the year. Winds off these bodies of water tend to raise the normal winter temperature and to lower the summer temperature. During the winter, alternate surges of cold dry air from the north and warm moist air from the south cause a variety in the weather from day to day. During the summer, this pattern breaks down as the warm moist air spreads northward from the south and southwest and remains over the area much of the time.

The warmest period of the year is the last half of July when the maximum afternoon temperature averages 89°F. Temperatures of 90°F or higher occur on an average of 31 days per year. The coldest period is the last part of January and the beginning of February when early morning minimum temperatures average near 24°F. The average number of days when the daily minimum temperature is 32°F or lower is 90. Temperatures of 0°F or lower are quite rare.

The annual precipitation at Dover averages 46 inches, but has ranged from 21.38 to 60.71 inches. While the middle of August is normally the wettest part of the year, the period between 21-27 June is the driest. The average seasonal (October through April) snowfall is 15.5 inches but has ranged from a trace to 45.2 inches. Thunderstorms occur on an average of 30 per year, almost three-fourths of these occur in the 4-month period of May through August. Hail is reported on the average of once a year. During the late summer and early fall, tropical storms or hurricanes occasionally cause heavy rainfall. Winds average around 9 miles per hour,

predominately from the west-northwest changing to the west-southwest during the summer. Fog prevails during early morning most of the year and will occur along the coast and inland well beyond Dover. Fog frequently reduces visibility to less than 1 mile between the months of October and May.

Eglin AFB, Florida

Eglin Field is located on the shore of Choctawhatchee Bay, 9 miles from the Gulf of Mexico. The numerous creeks, streams, and bayous surrounding the base add to the moisture content of the air over the area.

The climate of Eglin can be considered both temperate and tropical with mild winters and warm humid summers. The Gulf of Mexico, Choctawhatchee Bay, and the Bremuda high are the major factors controlling the climate. The nearby large bodies of water are slow to react to atmospheric changes and contribute greatly to the humid summers and mild winters.

Mean annual temperatures vary slightly from year to year but average near 76°F, similar to the average of other stations in this region. May through September are usually warm, each month having a few days with the temperature greater than or equal to 95°F. Daytime highs during the cold season are usually near 50°F with nighttime lows in the low 30's. Maximum temperatures in the upper 70's and minimum temperatures as low as 9°F are the extremes during the winter season. Daytime highs during summer are usually in the middle 80's and nighttime lows around 70°F. Maximum temperatures up to 104°F and minimum temperatures in the 60's are the extremes during July and August.

Precipitation is well-distributed throughout the year with the maximum in August and September and the minimum in October and November. Rainfall in summer is due mainly to showers and thundershowers. Nearly 75 days each year have thunderstorm activity. Annual precipitation is 59 inches, with the maximums occurring from July through September. Dense fog occurs from December through March reducing visibility.

Due to the land-sea interface, the predominant wind directions are north and south. The different wind directions generally reflect the progression of weather systems across the area. The average wind speed is from 5 to 7 knots with extreme gusts reaching 94 knots. Hurricanes and other tropical disturbances occasionally move close enough to affect the base and are usually accompanied by radical wind changes and heavy rainfall. While tornadoes are rare, thunderstorms are frequently accompanied by severe lightning, high winds, and heavy precipitation.

Eielson AFB, Alaska

The interior of Alaska is a huge valley with mountain barriers on three sides. Eielson AFB is located in the eastern portion of this valley with the Brooks Range to the north, the Alaskan Range to the south, and the Mackenzie Mountains to the east. Foothills, with elevations varying from 2000 to 3000 feet above mean sea level, lie closest to the base in the eastern quadrant. West of the base is the unbroken flat terrain of the Tanana River Valley. This river meanders westsouthwestward to the Bering Sea and provides the only large, low-level opening to the interior of the State. The lower rises of the Alaskan Range begin about 35 miles to the south. The White Mountains, part of the Brooks Range, lie 17 miles to the north. Small depressions lie directly north and northwest of the base. The field is 548 feet above mean sea level.

This station is sheltered from migratory storms by mountain ranges on all sides except the west. Eielson is approximately 275 miles from the Gulf of Alaska, 325 miles from the Arctic Ocean, and 500 miles from the Bering Sea. Since these distances are not great, it would seem likely that the local climate would be strongly influenced by maritime air masses. This is not the case because the mountains serve as barriers between Eielson and the oceans. To the west, however, there is no high terrain to stop the moist air moving in from the Bering Sea. The Brooks Range and the Alaskan Range are so oriented that they form a funnel which causes westerly flow to converge as it flows up the Tanana Valley. This convergence, plus the lifting experienced from upslope movement, is sufficient to cause cloudiness and possibly

rain or snow at Eielson anytime there is a strong protracted westerly flow. Consequently, the area has a definite continental climate, conditioned in large measure by the ready response of the land mass to variations in solar heat received by the area throughout the year. The sun is above the horizon from 18 to 21 hours each day during the months of June and July. During this period average maximum temperatures reach the lower 70's, and extreme highs of 90°F or more have occurred in May, June, and July. Conversely, during the period from November to March when the sunshine period ranges from 10 to less than 4 hours per day, the temperature readings normally fall below zero quite regularly, and extremes of near or below -60°F have occurred in the three midwinter months. The surrounding upland areas tend to aid the drainage or settling of cold air into the Tanana Valley lowlands.

The persistent snow cover during the winter months is a major contributing factor to the extreme cold. The white surface prevents the absorption of heat from the rather limited amount of sunshine realized during the winter season. During December and January maximum temperatures are usually below zero. Ice, fog, and smoke conditions frequently occur with the extremely low temperatures during anticyclonic conditions, and these tend to persist for periods of a few days to 1 or 2 weeks.

Precipitation normally follows a regular pattern. The total annual precipitation is about 12 inches most of which occurs during May through August. There is a noticeable decline in precipitation from September through December. April, the driest month, has the greatest percentage of possible sunshine. The average freeze-free period averages 100 days.

Elmendorf AFB, Alaska

Elmendorf AFB is located 3 miles northeast of Anchorage, Alaska. Six miles to the east of the field, the Chugach Mountains rise abruptly to peaks ranging from 3000 to 6000 feet. The orientation of these mountains on a north-northeast to south-loutheast line forms a barrier in the northeast and southeast quadrants. In the remaining quadrants are two projections of Cook Inlet. These bodies of water are narrow and are not more than 4 or 5 miles at their widest points. They experience a 36-foot tide which is the second highest in the world. One mile to the north and extending on in a northeasterly direction is a 300-foot ridge which is approximately one-half mile in width. The northern slope of this ridge descends abruptly to mud flats. Elmendorf AFB is built upon a glacial shelf which slopes to the southwest. The elevation of the field is 210 feet. The Chugach Range acts as a barrier to the influx of warm moist air from the Gulf of Alaska. Therefore, the average annual precipitation is only 10 to 15 percent of that at stations located on the Gulf of Alaska side of the Chugach Range.

During the winter the Alaska Mountain Range is an effective barrier to the influx of very cold air from the northern side of the Range. Extreme cold winter weather, associated with a high-pressure system over interior Alaska, may lead to a succession of clear days at Elmendorf. There are some factors which tend to offset the sheltering effect of this mountain barrier. The cold-air entrapment in various areas during periods of light winds may occasionally result in temperatures as much as 15 to 20 degrees colder than observed at the official observation site.

The four seasons are well-marked in the area but differ in length and some major characteristics from the accepted standards in middle latitudes. Winter is considered to be the period during which the ponds, streams, and lakes are frozen; this normally extends from mid-October to mid-April. The shortest day of the year has 5 hours and 28 minutes of possible sunshine. Periods of clear, cold weather normally alternate with cloudy, mild weather during the winter. The clear cold weather is frequently accompanied by significant fog because of the important low-level moisture source provided by the arms of Cook Inlet which maintains some open water throughout the winter. Visibilities of one-half mile or less occur about 5 percent of the time during December and January, and most of these low visibilities are associated with fog. Snow visibilities generally range from 1 to 3 miles, though heavier snowfalls will restrict visibilities to less than a mile on a few occasions.

The first measurable snow occurs on or about 15 October; latest measurable snow in the spring occurs on or about 14 April. Snow occurs on 20 to 25 percent of the midwinter days and falls mostly in small daily amounts. The heavier snows occur with vigorous storm centers moving northward across south-central Alaska. The depth

of snowfall on the ground does not usually exceed 15 inches. Although normally an area of light winds, strong "Northerners" occasionally result from the rapid deepening of storms in the nearby Gulf of Alaska.

Spring is the period immediately following the famed Alaska "Break-up." This season is characterized by warm, pleasant days and chilly nights, rapid mean temperature rises, and small precipitation amounts.

Summer is the period from June through early September and is divided into two seasons of about equal length, the first dry, the second wet. At the time of the summer solstice, possible sunshine amounts to almost 19-1/2 hours. About the middle of July average cloudiness increases markedly, and the remainder of the summer usually accounts for about 40 percent of the annual precipitation.

Autumn is brief at Elmendorf, beginning shortly before mid-September and lasting until mid-October. The frequency of cloudy days and precipitation drops sharply in early October. Measurable amounts of snow are rare in September, but substantial snowfalls sometimes reaching 10 or 12 inches occasionally occur in mid-October. Some of the stronger southerly winds occur in the late summer or fall, these are post-frontal winds following the movement of a storm from the southern Bering Sea or Bristol Bay, northeastward across the Alaskan interior. Somewhat less frequent but more damaging are the southeasterly "Chugach" winds which are funneled down the creek canyons on the northwestern slopes of the Chugach Mountains. Gusts estimated at 80 to 100 miles per hour have occasionally caused considerable damage to roofs, power lines, and trailers. The average date for the last freezing temperature is 15 May and the average date of the first freeze in the fall is 16 September.

England AFB, Louisiana

England AFB lies 3 miles west of Alexandria, Louisiana, near the center of the State. The Gulf of Mexico is 110 miles south. The Mississippi River is 50 miles east and the Red River, with extensive bayous and marshland, is 3 miles northeast of the base. Terrain is low with no hills over 450 feet within 25 miles. Field elevation is 89 feet.

Much of the local land is cultivated except for the Alexandria area to the east. Extensive swamps lie along the large Coastal Plain over 50 miles to the south. The Atchafalaya Floodway is 30 miles east. Moisture sources are everywhere, and drainage is poor. There are many minor pollution sources such as fall crop burning, the city dump, and light industry. Light easterly breezes will bring in pollutants and reduce visibility one more category in radiation fog.

The climate of England AFB is generally subtropical and humid, but is also subject to moderate to severely cold air masses which periodically move across the Plains and the Mississippi Valley. Prevailing wind flow is from a southerly direction during much of the year. This movement of maritime air from the Gulf of Mexico helps to temper extremes of summer heat, to shorten the duration of winter cold spells, and provide a source of abundant moisture and rainfall.

Rainfall is heavy with the normal annual total more than 54 inches. Amounts are substantial in all seasons, although there is a late summer-early autumn minimum in August, September, and October. The fewest days with rain are in October. Almost all rainfall is of the convective and air-mass types, showery and brief, except occasionally during winter frontal rains that may persist for a few days. Extremes of precipitation occur in all seasons.

The winter months are normally mild with cold spells usually of short duration. The typical pattern is weather turning cold with rain one day, reaching the lowest temperatures after skies clear on the second day, and warming on the third. The average date of the first freezing temperature in autumn is 14 November, and the average date of the last freeze in the spring is 11 March. Individual years have from fewer than 20 to more than 60 days with freezing temperature.

Seasonal snowfall averages less than 1 inch per year, and many years pass with no measurable snow. Glaze and ice storms, although infrequent, are sometimes severe.

The summer months are consistently quite warm. Maximum temperatures rarely exceed 100°F because of the uniformly high humidity of the dominant maritime tropical air mass and the moderating effects of cloudiness, scattered afternoon convective showers, and thunderstorms. High humidity occurs mainly at night, 75 percent or more of the hours from late evening through early morning have relative humidities of 80 percent or higher. Readings of 50 percent or less occur about 2 hours per day, usually during afternoons, about 2% percent of the midafternoon hours have relative humidities of less than 50 percent.

Thunderstorms occur each month, however, they are most frequent in July and August. Severe local storms have occurred over small areas in all seasons but are most frequent during the spring months. Tropical cyclones are in dissipating stages by the time they reach this portion of the State and winds are usually not destructive. Associated heavy rainfall can contribute to local flooding.

Grand Forks AFB, North Dakota

Grand Forks AFB is located on the western bank of the Red River in northeastern North Dakota. The surrounding country is a flat, fertile river valley. The Red River Valley supports extensive agriculture. As the gradient of the river is small, 1.4 feet per mile, it is subject to flooding particularly in the spring when ice jams block the channel.

Grand Forks has a continental climate that is typified by cold snowy winters, warm summer days and cool summer nights, and a variety of weather systems both in summer and winter. Hot humid days are rare in the summer, but cold waves and blizzards may be expected each winter.

The annual precipitation at Grand Forks is 19.80 inches. Of this amount more than three-fourths falls during the growing season, April through September. Annual snowfall averages 34.6 inches. The maximum occurs in the 4-month period November through February with each month averaging slighly more than 6 inches.

The mean temperature for the winter months of December, January, and February is 7.7°F. Minimum temperatures drop to below zero on an average of 59 days each year. Temperatures above freezing occur more than 15 days during these winter months.

Summers are warm and pleasant. The average temperature for the three summer months, June, July, and August is 66.3°F with a variation of just a few degrees between the averages of these months. High temperatures above 90°F may be expected on an average of 14 days per year.

The area receives about 60 percent of the possible sunshine, ranging from 45 percent in the winter to over 70 percent in the summer. Average cloudiness is a little more than five-tenths, and more than 220 days each year are classified as either clear or partly cloudy. The humidity is sufficiently low throughout the summer that the combination of temperature and humidity rarely produces physical discomfort. Likewise the winter term of "dry cold" is the best description of the humidity factor.

The average monthly wind speeds range from 8 to 11 miles per hour.

Griffiss AFB, New York

Griffiss AFB is located in central New York State, 50 miles southeast of Lake Ontario. The Mowhawk Valley surrounding Griffiss AFB is an important agricultural area. Griffiss AFB is situated in a funnel-shaped east-west valley which merges on the west with the broad plain extending southeast from Lake Ontario and narrows appreciably about 10 miles east of the base. The topography in and around the base is flat to gently rolling hills with elevations of 450 to 500 feet. The terrain becomes more hilly a short distance east and northeast of Griffiss with the elevation increasing from 1000 to 1300 feet. Elevations of 1500 to 1600 feet begin about 15 miles to the north, marking the southern extremity of the Tug Hill plateau. Hilly topography occurs along the southern boundary of the valley.

The climate is classified as humid-continental. Air masses and weather systems affecting Griffiss have their origin primarily over the land areas of the North American Continent. The Atlantic Ocean contributes some maritime characteristics to the climate, although its role is temporary. Currents in the upper atmosphere transport considerable moisture to the local area from the Gulf of Mexico and Atlantic Ocean, providing the climate with its humidity.

Griffiss enjoys pleasant, warm summers with considerable sunshine. The winters are long and cold and feature abundant snowfall. The climate contributes to much cloudiness and unsettled weather during the colder months. Precipitation is uniform throughout the year as average monthly amounts range between 3.1 and 4.1 inches. There are no characteristic dry or wet seasons which are repeated regularly on an annual basis. In the summer the daily maximum temperature generally ranges from the mid 70's to the mid 80's. The freeze-free season in the valley around Griffiss has an average length of about 140 days. The average last date in the spring of temperatures 32°F or colder is 15 May and the average first date in the fall is 1 October.

Griffiss has a mean annual precipitation of 42 to 44 inches. In recent decades the annual total has ranged from a minimum of 35 inches to slightly over 50 inches in the wettest years. During the warmer months, May through September, the average rainfall totals approximately 17 inches. Severe droughts are rare. Precipitation of 1.0 inch or more in 24 hours may be expected on about 15 days per year. A few storms of 2.0 inches or more occur in most years.

Snowfall is heavy with an average accumulation of 105 inches per winter. Virtually every winter has a recorded monthly total of more than 24 inches and accumulated total of more than 50 inches within two consecutive months. The abundance of snowfall is due largely to the direct exposure of the area to storms moving well inland from Lake Ontario. Cold, unstable air masses frequently move easterly across the lake, picking up heat and moisture. As these air masses sweep inland over rising elevations, they are subjected to meteorological processes which cause them to release moisture as heavy snowfall. These are the "lake-effect" snowstorms for which the eastern lee of Lake Ontario is famous. In most winters a snow cover prevails more or less continuously from early December until mid or late March and a depth of 1 to 2 feet is common during the mid and late winter.

With cloudy weather favored during the colder months the possible amount of sunshine in February and March decreases to about 25 to 30 percent. In the summer and early autumn months the sunshine averages from 60 to 65 percent of the possible amount. Griffiss experiences about 200 days of overcast skies per year, more than half of which normally occur from November through March. Approximately 65 to 70 bright, clear days are noted per year.

The mean wind speed is approximately 11 miles per hour in the winter and early spring, decreasing to about 9 miles per hour in the summer and early autumn. The prevailing direction is mostly west-northwest during the early half of the year, shifting to west-southwest in the latter half. In the summer season the relative humidity averages about 55 percent during the afternoon hours. Periods of sultry, uncomfortable weather are usually brief.

Thunderstorms average 30 days per year, occurring generally from May through September. Occasionally there may be locally damaging winds, heavy downpours of rain and/or hail. Tornadoes are possible but rare. Only four or five have been recorded in Oneida County during the last 100 years. While not in the usual path of Atlantic hurricanes, over the past 50 years a few of these storms have inflicted heavy rain and wind damage in the local area. A far more important storm hazard is that of heavy snows. With an average seasonal snowfall in excess of 100 inches, it is to be expected that individual storms of 6 inches or more will occur with some frequency.

Grissom AFB, Indiana

Grissom AFB lies in an agricultural area in north-central Indiana. The low rolling terrain is mostly cultivated. The following local features have some meteorological interest: a low range of hills (tops less than 300 feet) beginning 5 miles north and extending northeastward, the Wabash and Eel River systems, and a 3000-acre lake 13 miles east. The south end of Lake Michigan is 75 miles northwest of Grissom. In prolonged northwesterly flow in winter, a "Great Lakes effect" will be experienced along with industrial pollution. Field elevation is 813 feet.

Grissom AFB has an invigorating climate because of the frequent changes of the weather. These changes occur every few days with the passing of weather fronts and associated centers of low and high air-pressure systems. Records show that temperatures drop to zero or below zero on an average of 7 days a year during the cold season, and maximum temperatures remain as cold as 32 degrees or lower less than 30 to 32 days in most years. Maximum temperatures of 90°F or higher occur an average of 30 to 43 days per year. The annual mean temperature is 65°F.

There is a tendency for spring and early summer rains to exceed winter precipitation. The spring rains are very reliable insuring near maximum soil moisture going into summer when evaporation losses exceed rainfall and dry soils become more probable. A severe drought has never been experienced. Annual rainfall is 37.18 inches.

Snowfall is variable. Some winters have an abundance of snow while others have very little. The heaviest snow storms are those out of the southwest. As they swirl northeastward, they draw additional moisture from the Gulf of Mexico. A storm out of the northwest, with an inward flow of colder, drier air, leaves less snow.

Relative humidity varies on sunny summer days from the 40's in the early afternoon to the 90's about sunrise. Relative humidity rises and falls much as temperature does during a typical day with the highest percent usually occurring with the minimum temperature and the lowest percent with the maximum temperature. A cold front is next in importance in lowering the relative humidity.

Winds blow most frequently from the southwest; however, during the winter months prevailing winds are west-southwest. Damaging winds have three sources: lows passing through the region, thunderstorms, and tornadoes. Only eight tornadoes have been reported in the county since 1916. Very few were of sufficient size to cause injury to people and property. Thunderstorms occur about 46 days of the year. Most of these occur in the spring and early summer. They are seldom severe enough to cause loss of life, property, or crops.

Hill AFB, Utah

Hill AFB, 3 miles southeast of Ogden, is located at the base of the lofty Wasatch Mountains. Great Salt Lake, the largest body of water in the western United States, lies about 10 miles to the west. The Weber River, one of the larger streams in Utah, skirts the western edge of Ogden. The Ogden River emerges from the mountains northeast of Ogden and flows through the northern portion of the city. At an elevation of 4785 feet above sea level, Hill AFB is located on an area of flat land which extends to the west and south. To the east, mountains rise abruptly to more than 5000 feet above the valley floor. Ogden Peak, only 5 miles distant, extends to 9575 feet mean sea level. Five other peaks of the Wasatch Range, all about 9000 feet, are within a distance of 20 miles.

The proximity of the Wasatch Range has a marked influence on the climate of the area. Because of these mountains, rain and snow are substantially heavier along the eastern limits of Ogden than a few miles to the west. Two other important physiographic features affecting the climate are the Great Salt Lake and the Rocky Mountains. Because of the high salt content, the lake never freezes, thus moderating the temperatures throughout the year. The mountains acting as a barrier to continental arctic air masses, are usually effective in preventing extended periods of extremely cold weather.

Hill has a semiarid climate with four well-defined seasons. Summers are characterized by hot, dry weather. Low humidity during this season makes the high temperatures more bearable than in more humid climates. The average daily temperature span during the summer months is about 30 degrees with daily high readings generally in the 80's or low 90's and nighttime minimums in the 50's. Even after the hottest days, nights are usually cool. The average number of days of 90°F and above is 48. Winters are cold but usually not severe. Temperatures colder than -10°F can be expected in about one of every three years. The number of days between the first and last freeze averages 160 days.

Snowfall is generally light with about one-fourth of the annual precipitation falling in that form. The average snowfall is 43.1 inches per year. Precipitation

is more evenly distributed from October through May because of the frequency of Pacific storms moving through the area. July and August, the driest period, are the only months with an average precipitation of less than 1 inch. The wettest period usually occurs during April. The average annual amount of precipitation is 17 inches.

Wind velocities are generally light to moderate, normally ranging below 20 miles per hour. The strong damaging winds that do occur are usually associated with easterly winds blowing out of canyons of the Wasatch Mountains or with local thundershowers. Hail storms (although the hail is normally small) occasionally cause some damage to crops and property during the spring and summer months.

Holloman AFB, New Mexico

Holloman AFB is located on the eastern edge of the Tularosa Valley about 11 miles from the Sacramento Mountains, the eastern border of the valley. These mountains rise abruptly to elevations of 7000 to 8000 feet mean sea level with peaks above 12,000 feet. The Tularosa Valley is a closed basin about 35 miles wide at this point with the Organ and the San Andres Mountains forming its western border. Narrowing gradually, the Valley extends northward about 50 miles; to the south it opens onto a vast, rolling plain.

The Sacramento Mountains to the east strongly affect Holloman's climate and also furnish a more variable climate within a few miles of the base. Winds originating in the Gulf of Mexico bring much of the moisture that falls in southeastern New Mexico. Because the mountains both retard these air currents and also rob them of their moisture, the average annual rainfall at stations on the eastern slope is half again as heavy as on the leeward side. The mountains also tend to ward off many winter invasions of cold arctic air which sometimes sweep southward over the Great Plains and across the State's eastern section. Annual mean temperature averages are about 4 degrees higher at the base than at similar east-slope elevations. Also, the climate is markedly different higher in the mountains.

Hollomon's average annual rainfall is less than 10 inches, classifying the area as arid. Sixty percent of the year's moisture falls from July-October, most of it in brief but sometimes heavy thundershowers. Prolonged rainy periods are practically unknown. Even the summer, considered the "rainy season," averages only three or four days a month with as much as 0.1 inch of rain. Fall, winter, and spring average only one or two days a month with as much moisture. Winters bring a little snow, but it seldom lies on the ground 24 hours. Nearby mountains, however, are normally snow-covered during midwinter.

Moderately warm summers and mild winters are the rule at Holloman. Because of the elevation and the very dry air, summer temperature ranges normally exceed 30 degrees, usually rising above 90°F in the day but becoming comfortably cool at night, even during the warmer months. Winters are characterized by clear, sunny, mild, and dry weather. Minimum temperatures frequently are below freezing but rarely fall below zero. Winter daytime temperatures average well above 50°F.

Holloman averages a growing season of 216 days or 7 months. The base lies in that southwestern section of the country noted for its abundant sunshine. During the year, sunshine is enjoyed during approximately 80 percent of the hours from sunrise to sunset. Even the winter sun shines more than 75 percent of the possible hours. Typical of desert climates, humidities are always low with relative humidity usually ranging from 40-65 percent in the cool morning hours, dropping to 15-25 percent on spring afternoons, and from 30-35 percent in summer. Winds generally average about 10 miles per hour but are somewhat stronger in the spring. During late winter and spring there may be considerable blowing dust. Most of the stronger winds come from the west or the southwest.

Homestead AFB, Florida

Homestead AFB is located in southeastern Dade County, 8 miles inland from the Florida east coast and 15 miles south-southeast of the Miami area. This area is mostly swamp with citrus, mango, and avocado groves dotting the area. There are also farms producing large quantities of tender, winter-grown vegetables. The soil

is rocky, having been originally mostly coral. In cultivated areas the broken coral is mixed with a sandy topsoil.

The climate of Homestead is essentially subtropical, featuring long, warm summers with abundant rainfall and mild, dry winters. The daily range of temperature in inland areas is nearly twice that along Biscayne Bay, indicating a sharp reduction in the marine influence from the Atlantic Ocean. The average annual rainfall for Homestead, 63.04 inches, is one of the heaviest in the State. Unlike the beach areas, most of the rainfall in the Homestead area occurs as afternoon or evening showers and thundershowers. During the 6-month period from May through October, 79 percent of the annual total precipitation is recorded. Fog is rare at Homestead. It occurs on the average of 59 days per year and dissipates with the heat of the day.

Temperatures of 32°F and below occur about once a year, usually in January. Tropical hurricanes may occasionally effect the area during the months of September and October. However, studies show that hurricane-force winds may be expected in the area only about once in 7 years.

Howard AFB, Panama

Howard AFB is located on the Pacific side of Panama, 1-1/2 miles north of the Bay of Panama and 3 miles west of the Panama Canal. Field elevation is 26 feet above sea level. The airfield lies in a basin with rolling hills. Horsefly Ridge (280 feet) lies 1 mile east of the runway, Taboga Island (1000 feet) and Taboguilla 10 miles south-southeast of the runway in the Bay of Panama, Cerra Cabra (1608 feet) 3 miles west, and Cerra Galera (1205 feet) 2 miles west-northwest. Vegetation in the immediate vicinity consists of coarse grass and small trees with the surrounding hills covered with dense jungle growth.

To the northeast along the Atlantic side of the isthmus are low mountains with tops averaging over 2000 feet. The highest of these, Cerro Brewster, rises to 3019 feet above sea level. These ridges are very important, in their effect on the diurnal convective activity. Some low mountains with tops above 3000 feet and one top over 4000 feet are situated to the east, across the Bay of Panama. These latter ridges are of some importance. It is believed that with steering-level winds from the east at 15-20 miles per hour, storms that form over these mountains will occasionally affect the base in the late afternoon. The ridges northwest through southwest around the field are important for exerting a steering effect on storms when the winds aloft at the steering level are light.

The climate of Panama is divided into two distinct seasons: a wet season beginning in the latter part of April or early May and continuing through the middle or latter part of December, and a dry season which lasts for the remainder of the year. The number of hours with precipitation in the wet season is over six times that of the dry season; the total precipitation averages about seven times as much. The average number of hours of precipitation in the maximum month, October, is 89. The number of hours with thunderstorms reaches an average maximum of 35 in August, but precipitation during August is approximately 2 inches less than either October or November which have an average of only 20 hours with thunderstorms. This is because the intertropical convergence zone lies in a more northerly position during the latter part of the wet season and most of the rainfall for these months is due to its proximity. September records show an average of 2-1/2 inches less precipitation than August and 4-1/2 inches less than October. It has, however, approximately the same number of hours with precipitation and as many hours with thunderstorms as the preceding months. By September the intertropical convergence zone has started to move toward its more northerly average position and records indicate that this month has more middle cloudiness than the preceding months. This would tend to dampen convective activity to the extent that actual precipitation would be less in any given number of hours.

The intertropical convergence zone fluctuates during the season between 5-14°N latitude with an average position of 5-7°N latitude during the early part of the wet season and 6.5-8.5°N latitude during the latter part of the wet season. Occasionally the intertropical convergence zone dissipates in its most northerly position and a new zone of convergence forms at the average position to the south of the isthmus. The two zones may exist at the same time. Fog is very rare at Howard and

will only affect the base on the average of one morning per year. Visibility during the wet season is unlimited over 95 percent of the time and is only restricted by precipitation. Visibility is not usually reduced to less than 7 miles in continuous precipitation but is often reduced to 0-2 miles when showers pass over the terminal.

Surface winds during the wet season are 340-020 degrees at 7-12 knots. Under normal conditions and light gradient winds a sea breeze from 160-180 degrees at 5-12 knots exists between 1000 and 1600 local time. Light, variable surface winds exist when the intertropical convergence zone is north of the isthmus. The only significant synoptic feature that affects this terminal during the dry season is the shear line. This far south an occasional westerly passage seems to be the most effective near the end of the dry season. Shear lines vary in occurrence of passage in this area. Three to four passages per year are considered average, with a maximum of eight to ten passages. Over 95 percent of dry-season precipitation is a result of shear line passage.

Visibility is unlimited for the first 6 weeks of the dry season, gradually diminishing in haze. It improves slightly with a shear line passage. During the last 8 weeks of the dry season, brush fires are a daily occurrence reducing the visibility to an even greater extent. Surface winds are 315-360 degrees at an average of 14 knots. Nocturnal winds are 8-14 knots and daytime winds are 15-20 knots, with gustiness by midmorning. Peak gusts frequently reach 30 knots. Due to the strong prevailing winds, sea breezes during this season are quite rare.

Incirlik, Turkey

Incirlik is located in the center of Cilician Coastal Plain. Adana, Turkey's fourth largest city, lies 5 miles to the west. Two river systems traverse the plain, the Seyhan 7 miles to the west of Incirlik and the Ceyhan 10 miles to the east. Field elevation is 232 feet above sea level.

The surrounding topography is quite complex. The Cilician Plain is approximately triangular in shape, with the Mediterranean Sea lying 30 miles southwest through southeast. To the northeast the plain rises to an elevation of about 1000-1500 feet to 50 miles from Incirlik where the Anti-Taurus Range rises abruptly. Minimum elevations along the Anti-Taurus Range average 5000 feet, with many peaks between 7000 and 13,000 feet. A short range of low-lying mountains oriented northeast to southwest is 13 miles southeast of the base. The range is about 13 miles long and averages 2000 feet in elevation. About 40 or 50 miles to the west through northeast of Incirlik lies the main Taurus Mountain Range, with average elevations of 8000 feet, and peaks to 13,000 feet. The plain slopes upward slowly to about 8 miles west through northeast of the base than rises abruptly to about 1000 feet.

Due to its location, Incirlik experiences a Mediterranean type climate with a short mild winter and a long hot summer. During the winter months the Taurus Range acts as a barrier blocking all but the most intense cold outbreaks. The intensity of fronts which move in from the northwest is greatly diminished when passing over the Taurus Mountains and down to the near sea-level elevation of the Cilician Plain. The air masses are warmed and dried, with the only effect being gusty surface winds from the northwest through northeast. The mountains which ring the plain from west through north to east form a basin in which the air often stagnates. This condition is more common during the summer months.

Cloudiness occurs during the winter months at Incirlik, reaching a maximum during December and January. Fog is not a problem at Incirlik. Conditions of less than 200 feet and one-half mile occur less than 0.1 percent of the time.

Summer is the dry period at Incirlik, with the mean monthly precipitation less than 1 inch from July through October. Measurable precipitation seldom occurs during July and August. Precipitation during the summer months results from thunderstorms building on the western mountains and then moving across the plain during the late afternoon hours. January and February, with an average of between 4 and 5 inches, are the months of heaviest precipitation. Thunderstorm activity occurs mainly with the seasonal passage of the polar front. It reaches a maximum of 4 thunderstorm days per month during April and May with the northward passage, and 4 with the southward passage in October. During spring and fall, thunderstorm activity

occurs more frequently over the mountains north through east of the base when the Cilician Plain is under a moist southwest flow. During the rainy season thunderstorms are confined mainly to the water areas and move onshore as heavy rain showers. Incirlik averages 2 thunderstorm days per month from November through March. Conversely, from June through September, the activity occurs mainly on the mountains northeast, with one to two thunderstorm days per month.

The surface wind at Incirlik generally varies as a function of the land-sea breeze effect. During the summer months the direction tends to be southwesterly from midmorning until early evening and northeasterly from near midnight until a few hours after sunrise. In the few hours between the two domains, the wind is either calm or light and variable. The northeast drainage flow predominates during the winter months, whereas a combination of the two prevails during transition period. The strongest winds occur with deepening lows approaching from the southwest or with cold outbreaks from the north.

Keesler AFB, Mississippi

Keesler AFB lies on the Biloxi Peninsula on the gulf coast. Land north of the peninsula is rural and heavily forested with low hills rising to 300 feet above mean sea level. Between the Biloxi Peninsula and mainland is the mile-wide Back Bay. Much of the bay's north shore is marshy, whereas the Biloxi Peninsula itself is sandy. The 10-mile wide Mississippi Sound, shallow but with no marshlands, lies to the south. A chain of small, narrow islands separate the sound from the Gulf of Mexico. Field elevation is 35 feet.

Complicated local terrain causes a wide variety of minor effects on the weather. Most local rivers drain into the Back Bay keeping its waters slightly cooler than other open water especially in winter. The extensive but very shallow Mississippi Sound becomes warmer than other coastal waters in summer but remains cooler than the Gulf of Mexico in winter. There is plenty of moisture available throughout the year for fog and precipitation. In fact, Keesler's average rainfall is almost 60 inches. Local onshore winds dissipate most urban haze. New Orleans and Mobile, the largest nearby cities, are not significant pollution sources.

As expected at a gulf coastal location, the windward water area exerts an ameliorating effect on the summer heat not experienced only a few miles farther inland. Although extreme temperatures exceeding 100°F have been recorded the average daytime high temperature in summer is less than 90°F. The first freeze in winter usually occurs in mid-December and the last freeze in late February.

Due to the proximity of cooler water surface in summer, showers are less frequent and lighter on the coast than they are 50-100 miles inland where the mean annual rainfall is 5-10 inches less. July is the wettest month; March and September with their storminess are a close second. October and November are the driest months and are characterized by numerous cloudless days and frequent cool nights. Measurable snow or sleet occurs an average of once in 13 years.

Tornadoes are infrequent as their normal movement from the southwest would bring them in from over Mississippi Sound where they do not develop readily. But waterspouts do occur and some may cause damage on moving inland. Squall lines moving from the west and northwest in the period from December to May occasionally develop damaging high-wind velocities. Tropical storms and hurricanes have moved inland over the Mississippi coast 13 times in the years since 1875. Perhaps the worst storm was the 27 September 1906 hurricane which caused great damage as far inland as Waynesboro and Brookhaven. Because of the less severe offshore northerly winds, hurricanes which move inland over Alabama and northwest Florida affect the Mississippi gulf coast only slightly. Hurricanes which move inland over southeast Louisiana are usually as damaging as those which cross directly over the Mississippi coast. This is especially true of hurricanes moving from the southeast because of the more severe winds in the northeast quadrant and of the tides which pile up due to the configuration of the coastline.

Kirtland AFB, New Mexico

Kirtland AFB is located in the Rio Grand Valley near the center of the State. A few miles to the east the Sandia and Manzano Mountains rise several thousand feet

forming an effective barrier to much of the arctic air that at times moves down over the eastern plains. Occasionally, the more intense cold air masses on the eastern side of the ranges flow westward through the Tijeras Pass and bring strong easterly winds to the area. West of the Rio Grande River, which runs in a north-south direction, the terrain rises gradually to the Continental Divide about 90 miles away.

"Arid Continental" characterizes the climate of Kirtland AFB and vicinity. With an average annual rainfall of nearly 8 inches there is generally insufficient natural moisture to maintain the growth of any but the most hardy desert vegetation. However, successful farming is carried on in the valley by irrigating, and considerable fruit and produce is raised. In the mountains east of Albuquerque precipitation is much heavier. At Tijeras Ranger Station, the average annual rainfall is around 15 inches. The average monthly precipitation varies from less than one-half inch during the winter months, November through March, to over an inch and a quarter during the months of July and August. With normally less than 2 inches of moisture, the winters are generally very dry. Most of this winter precipitation falls in the form of snow, but seldom does the monthly fall exceed 3 inches. Normally there are only four days a year when as much as 1 inch of snow occurs. Snow rarely remains on the ground in the valley for more than a day. In the nearby mountains snow cover is normal from the middle of December until early spring. The July-September period furnishes almost half of the annual moisture with most of the rain falling in the form of brief but at times heavy thundershowers. Prolonged rainy spells are practically unknown. These summer showers do not materially interfere with outdoor activities but do have a considerable moderating effect on summer daytime temperatures.

Temperatures at Kirtland are those characteristic of high altitude, dry continental climates. The average daily range of temperature is high, but extreme temperatures are rare. Daytime temperatures during the winter average near 50°F with only a few days when the temperature does not rise above the freezing mark. In the summer daytime maxima average less than 90°F except in July. With the large daily range, the nights are normally comfortably cool. The air is normally dry with an average annual relative humidity of approximately 43 percent. "Muggy" days are unknown, and the average humidity during the warmer part of the day is about 30 percent. The humidity drops to less than 20 percent in June, the least humid month of the year.

Another feature of the climate is the large number of clear days and the high percentage of sunshine. Sunshine is recorded during more than three-fourths of the hours from sunrise to sunset; this high percentage carries through the winter months when clear, sunny weather predominates. Wind speed throughout the year averages around 9 miles per hour; during the late winter and spring months the average is higher, with occasional windy and dusty days. These occasional dust storms are the most discomforting part of Kirtland's climate. However, there are only an average of 46 days during the year when the maximum wind speed reaches 32 miles per hour. Tornadoes rarely occur in the vicinity of Kirtland AFB.

Lajes AFB, Azores

Lajes Field is located on the northeast shore of Terceira Island which is centrally located in the Azores. Sao Miguel and Santa Maria Islands are to the southeast, the remaining islands are to the west and northwest. Terceira, as well as the other Azorean Islands, is bordered almost entirely by high cliffs. The rugged terrain throughout the islands plays an important role in the local area weather. Terceira is roughly elliptical in shape, its longitudinal axis is about 19 miles, and its transverse axis is about 10 miles. Lajes Field lies between two ranges of hills. The northeastern range rises to 427 feet; the southwestern range is 2648 feet at Pico Alto, 6 miles west of the weather station. Thirteen miles west of the field, Mt. Santa Barbara rises to 3356 feet.

Grass, shrubbery, and rocks cover most of the island. A few trees exist in the sheltered places. Northwest of the field is the open water of the Atlantic Ocean, and to the southeast the land slopes gently down to the town of Praia and Praia Bay. The hills and valleys of the island create turbulent and gusty surface winds by channeling the large-scale wind flow which creates a Venturi effect. This increases the low-level velocity and wind shear. Air pollution is not a significant factor at Lajes since the local communities are mainly agricultural.

The summer season is generally characterized by warm, sunny days, cool evenings, and infrequent high winds or rain showers. The rest of the year, however, is notable for extended periods of high winds, frequent rains, and predominant cloudiness. During this season, winds frequently reach gale force with driving rains. Occasionally, there are short periods of pleasant sunny days. However, the high humidity and winds make the deceptively mild winter temperatures seem much colder than they actually are. Temperatures for Lajes are mild. The coldest temperature on record is 40°F, and the warmest is 86°F, the latter occurred in the month of September. The diurnal temperature change is approximately 10 degrees for the entire year. The annual mean is 63°F with a mean maximum of 67°F and a mean minimum of 58°F. The annual average relative humidity is 79 percent.

Precipitation is primarily of the showery type with heavier showers associated with cold frontal activity. The maximum occurs in the winter months and the minimum during the summer season. The annual rainfall is approximately 45.2 inches. Thunderstorms are infrequent at Lajes, having occurred on the average of less than 0.1 percent of the time. Rain and/or drizzle and fog occur most frequently in the winter months with warm or stationary fronts. March is the wettest month with rain and/or drizzle occurring 16.8 percent of the time. November has the highest incidence of precipitation. The prevailing wind direction for the year is from the northwest quadrant. During the months of December, February, and March, the direction is more southerly. Mean wind speed is about 10 knots for the year.

Langley AFB, Virginia

Langley AFB is located on the Back River in the Coastal Plain between the York and James Rivers only a few miles from Chesapeake Bay. The topography in the area is generally level with the observation site at 10 feet above sea level. Elevation, air drainage, night radiation, and type of air mass are some of the factors controlling the minimum temperature, sometimes causing large differences in short distances.

The climate is modified continental with mild winters and warm and humid summers. The Appalachian Mountains, Chesapeake Bay, and Atlantic Ocean are the major factors controlling the climate. The mountains can cause blocking and have modifying effects on storms and air masses. The nearby bodies of water are slow to react to atmospheric changes and contribute greatly to the humid summers and mild winters.

Mean annual temperatures vary slightly from year to year but average near 59°F. May and September are usually warm, each having a few days with the temperature greater than or equal to 90°F. Daytime highs during the cold season are usually near 50°F with nighttime lows in the low 30's. Maximum temperatures in the upper 70's and minimum temperatures as low as 5°F are the extremes during the winter season. Daytime highs during summer are usually in the middle 80's and nighttime lows around 70°F. Maximum temperatures up to 102°F and minimum temperatures in the 50's are the extremes during July and August.

Precipitation is well-distributed throughout the year with maximums in July and August and the minimums November and April. Rainfall in summer is due mainly to showers and thundershowers with an average of 40 days each year having thunderstorm activity. In winter, some of the precipitation usually occurs as snow. Average snowfall is about 9 inches a year but is extremely variable, ranging from none to nearly 24 inches. Dense fog also occurs during the winter months of December, January, and February.

South to southwest winds predominate with a secondary maximum frequency from the north. The average wind speed is from 7 to 10 knots with extreme gusts reaching 45 to 85 knots. Hurricanes and other tropical disturbances occasionally move close enough to affect Langley Field. While tornadoes are a rare occurrence in the lower peninsula, thunderstorms accompanied by severe lightning, high winds, and hail are more frequent.

Little Rock AFB, Arkansas

Little Rock AFB lies 12 miles north-northeast of Little Rock in central Arkansas. Although the immediate terrain is low, the hills of the Ouachita and

Boston Mountains rise to a height of 1500 feet within 50 miles west and north of the base. The Arkansas River is located 10 miles southwest of the base, and there are several reservoirs in the area. The Gulf of Mexico is 375 miles south. Field elevation is 311 feet. Little Rock AFB is in a rural setting except to the south towards the city. There are several local creeks and ponds to supply moisture. The mountains to the northwest retard fronts and reduce precipitation and squall-line activity. In summer, thunderstorms develop and tend to remain over the mountains. Because there are no mountain barriers to the south and southwest, moisture bearing storms from these directions are not weakened or diverted. Local urbanization from Little Rock and industry at Pine Bluff, 40 miles south, cause some haze.

The modified continental climate of Little Rock includes exposure to all of the North American air-mass types. However, with its proximity to the Gulf of Mexico the summer season is marked by prolonged periods of warm and humid weather. The growing season averages 233 days. Sixty-two percent of the annual precipitation, 48.14 inches, occurs during this time. Winters are mild, and snowfall averages 5.1 inches per year but occurs only in depths of 1 inch or more on the average of one out of every four or five winters. Glaze and ice storms, although infrequent, are severe at times. The driest period occurs in late summer and early fall.

MacDill AFB, Florida

MacDill AFB is located at the south end of the Interbay Peninsula between Tampa and St. Petersburg. The base is almost surrounded by water, open to Hillsborough Bay to the east, Old Tampa Bay to the west, and Tampa Bay to the south.

The large open bodies of water have a pronounced effect upon the weather at MacDill and account for the very mild winters and warm humid summers. Annual precipitation is about 50 inches; the majority is received from June through September. Snowfall is negligible and freezing temperatures are rare. Thunderstorms frequent the area approximately 90 days a year and are accompanied by heavy rains. This area is unique in its summer thundershower season. These storms have a great impact on the temperature and usually cause the temperature to drop as much as 20 degrees. The annual temperature spans about 22 degrees from a mean of near 60°F in January to near 82°F in August. Tropical storms and hurricanes have a pronounced effect on the MacDill area and the greatest risk of these storms occurs from June to October.

Because of the flat terrain, nighttime ground fog occurs frequently during the cool weather season. Due to the location of the base, there is no dominant wind direction at MacDill AFB.

McGuire AFB, New Jersey

McGuire AFB is located 60 miles southwest of New York City with a field elevation of 133 feet. The station is 16 miles south-southeast of Trenton, New Jersey. Ground cover in the immediate area of the base is approximately 60 percent wooded country and 40 percent open fields. Most of the surrounding area is relatively flat. Delaware Bay is 60 miles to the south-southwest, and the Chesapeake Bay lies further to the southwest. These are the major water bodies affecting the local area. Major air pollution sources are the industrial complexes at Trenton, Camden-Philadelphia, and Newark-New York City. Anytime there is a low-level inversion and the trajectory of the wind is west-southwest through northeast, pollution may be a problem. Although smoke alone may not lower the visibility, plenty of condensation nuclei are present which increases the possibility of haze and fog.

The Appalachian Mountains to the west exert a moderating influence on the climate, protecting this area from the many outbreaks of arctic air that sweep southeastwards across central Canada and the United States. The coldest weather in winter is experienced when the cold high-pressure systems move or develop over eastern Canada, allowing a more north-south flow of air into this area not influenced by the Appalachian Mountains and/or the Great Lakes. The hottest summer weather occurs with a west-to-southwest flow of air, reflecting the effects of its long trajectory over land. These heat waves of summer are not normally as severe or extended as those experienced in the interior of the United States. However, intervals of high temperature and humidity do occur and cause considerable discomfort for short periods. The moderating influences of the Appalachian Mountains, the Atlantic

Ocean and the Great Lakes are clearly exhibited and are further emphasized by the relatively mild extremes of temperatures that have been recorded at McGuire. Zero degrees or below has been recorded on the average only one winter in eight, and 100°F or above has been recorded on the average only one summer in five. The average annual temperature for the area is 53.9°F.

Precipitation averages 43.8 inches and is well-distributed throughout the year; summer totals are only slightly higher than those of winter. During the warm months most of the precipitation is produced by showers and thunderstorms. In the cool season the precipitation is associated with more widespread storms. A considerable amount of precipitation results from coastal storms which are most common during the cool season. These "northeasters" often last for 1 to 2 days and account for most of the average 23 inches of snowfall in this area.

Winds normally are of moderate strength and not often strong enough to be damaging. The most destructive winds occur with "northeasters," tropical storms, and the occasional severe thunderstorms of the summer months. The mean annual sunshine is about 60 percent of the possible amount. It is relatively constant with the winter percentages only slightly lower than those of summer. This is apparent in the comparatively large number of clear or partly cloudy days during the year.

Maxwell AFB, Alabama

Maxwell AFB is located in south-central Alabama just northwest of Montgomery. Maxwell lies in the very shallow Alabama River Valley which flows just to the north of the base. The surrounding countryside is wooded and partly cultivated, but the base proper is nearly surrounded by urbanization. The city of Montgomery is east and south, while scattered light industry rings the west and northwest. The Gulf of Mexico is 140 miles south, and the Appalachian foothills rise to a height of 2000 feet 80 miles to the northeast. Field elevation is 169 feet.

The Alabama River is a source of moisture for radiation/advection fog. Low hills to the north appear to initiate cold air drainage under calm conditions, and a weak wind flow crosses the river bringing moisture to the base. These same hills appear to have a frequency of air-mass thunderstorms higher in summer than the surrounding area. Pollution results from local industry and general urbanization, but visibility restriction rarely occurs from pollution alone.

The temperature of 65.5°F is the annual mean average. Temperatures of 32°F and below occur from October to March. During the months of June through September, temperature and humidity conditions generally show little change from day to day. During the coldest months, December-February, there are frequent shifts between mild and moist air from the Gulf of Mexico and dry, cool continental air. Hard freezes are infrequent during winter months, and 100°F readings are rare during summer.

Precipitation averages 51.03 inches per year. From late June through the first half of August most precipitation is from local afternoon thundershowers, and there are apt to be considerable differences in day-to-day amounts of rainfall in different parts of the area. In late August and in September, summer conditions of temperature and humidity persist as air continues to drift in from the gulf. Local thundershowers become less frequent because of the shorter days and the decrease in the amount of heat received from the sun. As this late summer season progresses, the local heat thundershowers are replaced by thundershowers occurring ahead of the late summer drops in temperature and by occasional general rains associated with storms on the gulf. Rains during October and November are nearly always showers or thundershowers occurring ahead of the temperature drops which become more frequent and more pronounced as winter approaches. All types and intensities of rain, except the heat thundershowers of summer, may occur at any time from December through March or early April. Floods in the rivers are correspondingly most frequent during this period. Most rain from late April through early June is in the form of showers or thundershowers occurring in advance of approaching cool waves. These cool waves become weaker and less frequent as summer approaches. It is during this spring season, the late summer, and early autumn that droughts sometimes occur. Snow at Maxwell is important only as a curiosity.

Minot AFB, North Dakota

Minot AFB is located 12 miles north-northwest of Minot, North Dakota at a field elevation of 1678 feet. The local area within 100 miles is nearly flat, undulating terrain interrupted only by a small range of hills 50 miles to the northeast. South through west are rolling hills and occasional buttes. Garrison Reservoir, 50 to 60 miles southwest of the base, is the primary local source of moisture. Secondary sources include a large number of streams and glacial lakes. None of these sources have any real effect on the weather except possibly when the low-level flow is from an easterly quadrant. There are no significant pollution sources. The topographic features exert only a minor influence on the weather patterns.

Basically the climate of Minot is classified as continental in character. This is enhanced by the presence of the Rocky Mountains far to the west which effectively limit the modifying influence of maritime air masses from the Pacific Ocean. There are no obstacles to air movement from the north or from the south. Consequently, summers tend to be quite warm with occasional hot spells, but very few days that can be described as humid. Winters tend to be cold although there is a great deal of variation from day to day, month to month, and even year to year. Cold arctic outbreaks can be expected several times every winter, but there are compensating periods of mild weather which can be very pleasant.

The average temperature during the summer is about 66°F. July is the warmest month and will normally have 7 days when the temperature reaches or exceeds 90°F. There is a total of 18 days each year when the temperature reaches 90°F or higher. The average temperature during the winter months of December, January, and February is about 11°F. The temperature will drop to zero or below on about 55 days each year. However, the temperature climbs to above 32°F about 24 days during the winter months.

The average annual precipitation at Minot is 15.62 inches. Of this amount nearly 50 percent falls during May, June, and July, and more than 75 percent falls in April through September. Precipitation of 0.10 inch or more can be expected to occur on an average of 39 days each year, and 1 inch or more can be expected on 2 or 3 days each year. Summertime precipitation is usually in the form of thunderstorms which can be expected on about 30 days each year. June is normally the wettest month of the year. The likelihood of receiving 1 inch or more in a 7-day period is greatest during the latter part of June. The probability of a dry 7-day period, trace or less, is greatest in late October and early November. On the average, about 32 inches of snow falls each year. The ground is usually covered with snow from early in December to the middle of March. Although the prevailing wind direction is northwest in all months, in the summer the winds are from a southerly direction an equal amount of time. The average wind speed throughout the year is about 12 miles per hour. The strongest winds are usually from the northwest. April is the windiest month with an average wind speed of nearly 14 miles per hour.

Area sunshine and humidity data indicate that possible sunshine during the year averages a little over 60 percent, ranging from about 75 percent in July to 45 to 50 percent in November and December. The average sky cover during the year is six-tenths. About 230 days each year would be classified clear or partly cloudy. During the early morning hours, relative humidity averages nearly 80 percent. In summer the relative humidity will fall to less than 50 percent during most afternoons. In the winter it will average about 70 percent during the afternoon.

Moody AFB, Georgia

Moody AFB is located in extreme southern Georgia 11 miles northeast of Valdosta. Though well inland, swamps lie throughout the local area from northeast through south to southwest. The land to the northwest is low and rolling, and the Appalachian foothills lie 150 miles in that direction. The Atlantic Ocean is 100 miles east and the Gulf of Mexico 75 miles southwest. Field elevation is 233 feet.

Local swamps are not low enough below the field to prevent light winds from carrying advection fog. Throughout the winter season, warm moist southerly flow will be cooled by the ground, and fog or stratus forms late at night and in the mornings. Less persistent conditions may develop in the summer as well. Moody is

too far inland to be affected by thundershowers that develop along the coast. However, air-mass thunderstorm occurrences are fairly high compared to other southeast stations. Moody is marginally affected by weak tropical disturbances such as easterly waves. There is no significant upslope with northwest flow. Pollution sources include the base complex and smoke from field burning late in the summer.

The low latitude and nearness to the warm waters of the Gulf of Mexico and Atlantic Ocean combine to produce a warm and rather humid climate. Summers are hot, winters are short and mild, and the maximum rainfall occurs during the warm season. Summertime conditions usually arrive by mid-May and continue through most of September. There is little variation in temperature from day to day. The maximum is 90°F or higher on 3 out of 5 days in June and 4 of 5 days in July and August. However, periods of extremely hot weather are rare due mainly to the frequent afternoon showers and thundershowers. Summer nights are usually pleasant. Long periods with warm, sunny days and mild to cool nights are typical from early October through mid-November. The first freeze usually occurs before the middle of November, and short periods of cold weather can be expected at fairly regular intervals through mid-March. Winter "cold spells" normally last only 2 or 3 days and are followed by longer periods of mild weather. Cold air masses moderate considerably before reaching south Georgia, and extremely cold weather is very rare. Freezing occurs on just over one-third of the days from December through February, but the temperature drops below 15°F in only about 1 year out of 4. Daytime temperatures usually warm up to comfortable levels, and most outside activities can be carried on throughout the winter with little interruption. The average maximum temperature for the three winter months is 64.7°F, and afternoon readings in the 70's are quite common in midwinter. Spring is characterized by rapidly changing weather, and most springs bring one or more warnings of potential wind storms. The threat of tornadoes is greatest at this time, and thunderstorm activity begins increasing towards a summer peak. The average freeze-free period is 229 days.

The average annual rainfall is about 50 inches. Rainfall is heaviest in summer when moisture requirements are greatest. About 32 percent of the annual total normally falls from June through August with each of the three months averaging more than 5 inches. Late fall is the driest season. Less than 18 percent of the annual rainfall occurs in autumn. November, the driest month, has less than 2 inches in an average year. Most summer rain occurs as showers and thunderstorms, and amounts show large variations from place to place. Cool season rain usually comes from large weather systems and is more uniformly distributed. Snowfall is rare.

Tornadoes have been reported in the Moody area; several of these have caused heavy property damage. Thunderstorms occur about 70 days during an average year, and a few bring hail and damaging winds. Relative humidity ranges between 80 and 90 percent in early morning and afternoon averages are lower in spring and higher in late summer.

Mountain Home AFB, Idaho

Mountain Home AFB is located 40 miles southeast of Boise, Idaho, approximately in the center of a 45-mile wide neck of the Snake River Valley. Field elevation is 3004 feet. The base lies at the narrowest part of the valley which is oriented east-southeast to west-northwest. The massive Sawtooth Mountains (averaging 9000 feet) begin as rolling hills 20 miles northeast of the base, and the smaller Owyhee Range (averaging 6500 feet) lies 30 miles to the southwest. The Snake River Valley has a slight drainage toward Boise, and this condition also occurs from the base to the river. The Strike Reservoir is just south and southeast of the base and is the only local moisture source. The Cascades to the west shelter Mountain Home from the direct effects of maritime air masses, and the Rockies to the northwest shelter the station from strong continental outbreaks. However, shallow outbreaks moving southward out of Canada are possible. The Mountain Home area is semiarid with mild winters. Local vegetation is primarily sagebrush and sparse desert grasses. Atmospheric pollution is not a problem as Mountain Home is too far from any industrial areas and the base itself produces none.

Temperature extremes range from a high of 110°F to a low of -36°F. On the average, there are 63 days each year when the temperature falls to zero or lower. The freeze-free period averages 127 days. Annual precipitation averages near 9.5 inches with 37 percent occurring from November through January. Nearly 50 percent is recorded February through June. July is the driest month.

Fog, low visibility, and low clouds are wintertime phenomena with their greatest frequency in December. The most sunshine occurs in June through September, 80-85 percent of possible sunshine can be expected in July and August. Mean sky cover averages 0.26 for July through September and 0.70 for December and January. Wind speeds average 6 miles per hour or less 39 percent of the time and 7-16 miles per hour 41 percent of the time. Damaging winds are rare. Wind directions are quite variable in the area but most predominant from the northwest. Strongest winds are generally from the west to the northwest. Thunderstorms occur in May through September. Tornadoes seldom occur in this section of Idaho. No confirmed tornadoes have been reported in the Mountain Home area.

Patrick AFB, Florida

Patrick AFB is located on the Atlantic Coast of central Florida on a narrow strip of land just off the mainland. The largest local city is Melbourne, 5 miles southwest of the base. Field elevation is 8 feet.

The base lies on a narrow north-south strip of sand and scrub which has been slightly developed. The mainland includes swamps and timber. The general absence of cold weather this far south reduces the fog potential. In the summer, the major terrain influence is air-mass thunderstorms. Since Patrick is on the coast, it is influenced by the sea breeze and generally easterly flow. Therefore, air-mass activity is usually several miles to the west. During the winter dry season and subsequent months, there is high fire potential. Smoke from brush and forest fires has been known to be an infrequent but serious problem. Annual precipitation is 46 inches. The annual mean temperature varies by 15 degrees. The mean maximum temperature is 79°F, and the mean minimum temperature is 64°F. The months with the highest amount of precipitation are July, August, and September. These months account for 42 percent of the annual precipitation.

Pease AFB, New Hampshire

Pease AFB is located on the southeast coast of New Hampshire 3 miles west of Portsmouth. The Atlantic Ocean is located just east of Portsmouth, and the Piscataque River lies to the east-northeast. The air base is located on a peninsula bordered to the west and north by Great Bay and Little Bay. The land between the base and the Atlantic Ocean is mostly marshland. On the west side of the bays, rolling hills rise immediately from the water's edge and then slope downward to the Merrimac River and Concord, New Hampshire. Twenty to 35 miles west of Concord lie the Appalachian Mountains. This mountain chain forms an effective barrier of considerable meteorological significance to the base. Systems moving from the west or northwest affect Pease less than stations to the west of the mountains. When systems pass to the south or southeast of the base, rapid clearing is normally experienced as the winds change to the northwest.

The fact that the base is almost surrounded by water has little apparent effect on weather phenomena other than radiation fog. Part of this is caused by the effect of downslope winds from southwest through north competing with the addition of moisture to the lower layers locally. During summer and early fall, the addition of heat from the nocturnal radiation of these water bodies slows or inhibits the formation of radiation fog.

Precipitation in this area averages around 44 inches annually. The greatest amount of percipitation, predominately snow, occurs during the fall and winter months. The mean temperature varies from year to year but averages about 61°F. The warmest months of the year are June through September, and the coldest months are December through February. Thunderstorms average 18 days a year; tornadoes and hail are very rare.

Pope AFB, North Carolina

Pope AFB is located in central North Carolina, 9 miles northwest of Fayetteville. The base is in the northeast corner of the Fort Bragg Military Reservation, 2 miles from the main post area. The Atlantic Ocean lies east through south of Pope, its nearest point being just under 100 miles southeast. There is slight rise

in terrain from the ocean to the Appalachians which are more than 125 miles west and northwest of the base, but in general the land is low and slightly hilly. Field elevation is 218 feet with low and rolling local terrain. The land is heavily forested and has many small lakes and streams which contribute to area moisture. Most of the moisture is advected in from the Atlantic. There are no nearby land features of particular concern.

Occasionally near dawn, under a low inversion, a south or east wind may bring in smoke from Fort Bragg. There is no danger of pollution affecting the base in westerly flow.

Temperatures in the Pope AFB area average 61°F. Highs in the 90's average 54 times a year, primarily during the period of April through October. Lows of 32°F and below occur an average of 69 times during the months of October through May. Precipitation averages 46.6 inches per year. Snow occurs during the months of November through March and averages 3 inches. The summer months of June through August have the greatest amount of precipitation, averaging 5.4 inches; otherwise precipitation is evenly spread throughout the rest of the year. Thunderstorms occur on an average of 43 days per year. Fog occurs frequently and is observed on the average of 172 days a year with visibilities below 7 miles. Winds are predominately out of the southwest shifting to northeast during the months of September and October. Tropical storms occasionally pass through the area and dump vast amount of rain which may cause flooding. These storms occur during late summer and early fall.

Rickenbacker AFB, Ohio

Rickenbacker AFB is located 10 miles south-southeast of Columbus, Ohio in a shallow north-south oriented valley. Rickenbacker lies on the east side of the valley with the Scioto River 2 miles west and ridges up to 400 feet above the base on both sides. The base itself sits on a low knoll. Major land features include the Appalachians 175 miles east, Lake Erie 100 miles north, and the Ohio River 75 miles southeast.

The slight knoll, upon which the runway lies, is sufficiently high to reduce the effect of ground fog. However, fog remains a forecast problem throughout the year when the surrounding farmland is wet. The Great Lakes and Appalachian Mountains are important in certain synoptic patterns. The lakes provide some modifying influence, and a weak lake effect is possible with winter northwesterly flow. East coast storms are blunted by the Appalachian Mountains, helping to keep ceilings high. In summer, continental air mixes with maritime tropical air and encourages air-mass thunderstorms. With additional upper-air support, especially in spring, severe weather occurs.

The warmest period of the year is June through August with an average temperature of 73°F. The recorded high and low temperatures for these months are 85°F and 61°F, respectively. The coldest period of the year is December through February with the highs of 40°F and lows of 22°F. The average temperature for this period is 30°F. The average annual temperature at Rickenbacker is 53°F.

The majority of precipitation in the cold season is snow. The months with the greatest amounts of precipitation are March through August. The prevailing wind direction is northwesterly.

Robins AFB, Georgia

Located near the geographical center of Georgia, Robins is well-situated to escape rigorous climatic extremes. The climate is a blend of the maritime and continental types. Rarely does either type dominate for long unbroken periods. The prevailing northwesterly winds of winter and early spring are frequently superseded by southerly flows of warm, moist tropical air. The southern extremity of the Appalachians presents an effective barrier to the rapid flow of cold air in winter. In summertime the prevailing southerlies frequently give way to the drier westerly and northerly winds.

Severe storms are infrequent in this locality. There have been few tornadoes; the most recent was in 1955. Thunderstorms occur on approximately two days out of five from June through August. Occasionally, thunderstorms are accompanied by severe squalls, but property damage from this cause has been heavy in only a few instances. Since Robins is approximately 200 miles from both the Atlantic Ocean and the Gulf of Mexico, hurricanes offer no direct threat and secondary effects are generally milder than those produced by heavier thunderstorms.

Snow occurs at some time during most winters, but amounts of snow are usually quite small. Only 6 days received 1 inch or more of snowfall in the 25-year period, 1949-1973. However, on rare occasions, heavy snow does occur in this area. The two heaviest snowstorms (24-hour amounts) on record are 6.9 inches in February 1914 and 16.5 inches in February 1973. The last killing freeze in spring occurs usually around 15 March, with the first in autumn occurring around 16 November.

Robins AFB is surrounded by predominantly flat terrain. Most of the countryside is well-wooded, except for a few farms. Much of the outlying area is swampy, especially in the river and creek bottoms. Besides the swamps, the only body of water in the vicinity is the Ocmulgee River, nearest point 2 miles east. These have little influence on the climate. However, when other conditions are favorable, the bodies of water are conducive to fog formations.

Scott AFB, Illinois

Scott AFB is located 20 miles southeast of the confluence of the Missouri and Mississippi Rivers and near the geographical center of the United States. Thus, with a somewhat modified continental climate, Scott AFB enjoys a four-season climate without the undue hardships of prolonged periods of extreme cold, extreme heat, or high humidity. Warm, moist air from the Gulf of Mexico and cold-air masses from Canada alternately invade Scott. The conflict along the frontal zones where the air masses meet produces a variety of weather conditions.

Winters are brisk and stimulating, seldom severe. Records show that temperatures drop to zero or below an average of two or three days per year. Maximum winter temperatures remain as cold as 32°F or lower less than 20 to 25 days in most years. Snowfall averages 20 inches per winter and can vary from 0.7 inch to 42.4 inches. Snowfall of 1 inch or more is received between 5 to 10 days in most winters. However, there have been seasons when less than an inch fell, and other years when there were 15 days or more with 1 inch or more snowfall. Snowfall of an inch or more has occurred as late as 2 May and as early as 5 November.

The long-term record for Scott AFB indicates that maximum temperatures of 90°F or higher occur an average of 35 to 40 days per year. Extremely hot days of 100°F or more are expected on no more than about 5 days per year. The last freezing temperature in the spring has occurred as early as 8 March and as late as 10 May, while the first occurrence of a freezing temperature in the fall has been as early as 28 September and as late as 27 November. There is an average of approximately 190 days between the last freezing temperature in the spring and the first such temperature in the fall, but this can vary from 150 to 230 days. The average date of the last freeze in the spring is 15 April, and the average date of the first freeze in the fall is 20 October.

Normal annual precipitation for the Scott area is a little over 35 inches. The three winter months are the driest, with average precipitation of about 6 inches. The spring months of April to June are the wettest with a normal total precipitation of nearly 12 inches. From the middle of summer in July into the fall, it is not unusual to have extended periods of 1 to 2 weeks or more without appreciable rainfall. Thunderstorms occur on the average between 40 to 50 days per year. During any year there are usually a few thunderstorms that can be classified as severe with hail and damaging winds. Tornadoes are fairly frequent throughout the year, but because of the large amount of agriculture in the area, there is usually little damage associated with these storms.

Seymour-Johnson AFB, North Carolina

Seymour-Johnson AFB is located in east-central North Carolina just south of Goldsboro. The base lies 150 miles due west of Cape Hatteras and is 75 miles

northwest of the closest portion of the Atlantic Ocean. The local area is partly cultivated with scattered small towns and areas of woods and swamps. The Appalachians lie 200 miles west and northwest. The terrain slopes down towards the base from those directions and is low and rolling. Field elevation is 109 feet.

Since the local area is a complex assortment of hills, swamps, fields, and towns, it is best called rural. The population of Goldsboro is about 30,000, and there is little industry. At the west end of the runway lies the Neuse River, a good source of moisture. The base is lower than much of the surrounding terrain. Upslope flow is considered a significant factor in stratus formation as is the case with other Carolina stations. There is actually little uplifting close to the ocean, but local sources of moisture are plentiful enough to compensate for the lack of lift. Downslope from the west and northwest is significant, for the land begins to rise a few miles west of the base. Local pollution sources are negligible. Reduced visibility occurs only under periods of stagnation.

Mild winters and warm sunshine are characteristic of the Seymour-Johnson area. Easterly-to-southerly winds bring a modifying maritime influence to the climate. The Appalachian Mountains provide some protection from the severity of west and northwest winds in winter. Temperatures as low as 10°F are exceedingly rare, and there is no record of temperatures as low as zero. On the average, freezing weather occurs on less than half the winter days, and entire winter months have passed without the occurrence of freezing weather. Temperatures as high as 80°F have been recorded in every month of the year, but in the hottest weather the mercury never exceeds 100°F by more than a few degrees. Temperatures as high as 100°F have occurred in every month from May through September, but in mild years entire summers have passed without any 100°F readings. July and August are the hottest months of the year. Even in these months the average temperature at sunrise is below 70°F.

Rainfall is usually plentiful and well-distributed throughout the year. The variation in average rainfall from season to season corresponds very closely with water requirements; in summer the rainfall is normally the heaviest. Winter precipitation is usually considerably lighter. The driest month is usually October. Winter rainfall usually results from slow-moving storm systems and comes in intermittent rainy periods lasting from 1 to 3 days. Summer rains usually come from brief showers and thunderstorms, generally of not more than a few hours duration. Since thundershowers are often quite local in character, limited areas may go for several days without rain in spring or summer. However, prolonged or severe drought is very rare. An occasional period of excessive rainfall may result from a series of closely-spaced thundershowers or from a storm moving northward in the coastal area. Some snow falls in the area during most winters, but it is usually very light, often melting as it falls. No month receives an average of more than an inch and a half of snow per winter. Heavy snowfalls have occurred, but are rare. Seldom does any appreciable amount of snow stay on the ground more than a few days.

Tropical storms moving up the Atlantic Coast occasionally pass close enough to cause rainy, windy periods, but rarely reach destructive force. The highest winds are most likely to come from thunderstorms. Such winds are very local and of brief duration. Surface wind directions are variable during all seasons, but the prevailing winds are from the southwest. The average surface wind speed is about 8 miles per hour.

Protracted periods of cloudy weather are rare in the area. The sun shines nearly two-thirds of the daylight hours. The average relative humidity is around 85 percent at sunrise, dropping to nearly 50 percent by midafternoon.

Shaw AFB, South Carolina

Shaw AFB is located in east-central South Carolina, 30 miles east of Columbia. The northeast-southwest Atlantic coastline is as close as 100 miles to the southeast, and the Appalachians are 100 miles to the northwest. The base is located on the Atlantic Coastal Plain with low hills and some swampland. There is only a slight rise in the land from the ocean. The rise increases more rapidly west of Shaw to the Appalachians. Field elevation is 251 feet. The base lies on a low ridge that rises in elevation to 500 feet 10 miles to the north. Seven miles away on the west side is the Wateree Swamp, and other swamps lie further to the southeast

on the other side of the ridge. The ridge itself lowers to the south and all swamps and creeks drain into Lake Marion 20 miles south southeast of the base.

Local terrain may influence both fog and thunderstorm formation. Thunderstorms build over the Wateree Swamp. Fog also forms in the swampy lowlands which are about 100 feet lower than the base. When the fog rises, the stratus deck may affect the base. Synoptic-scale stratus off the Atlantic is also a problem. Lake Marion is a favored source of air-mass thunderstorms, and with southeast flow, Shaw is likely to be near much of the activity. The ridge on which Shaw lies appears to deflect to the north thunderstorms that are moving in from the west. Downslope action from the Appalachians may weaken cold fronts and cause divergence in the low-level flow pattern. Thunderstorms moving from the north will traverse the ridge to the base. There are no significant pollution sources locally. Haze from pollution occurs only during extended periods of stagnation.

The prevailing climate is temperate and is controlled largely by the characteristics of the air masses and pressure systems that move across the country throughout the year. There is an occasional inflow of maritime air for short periods during the winter. However, the biggest exception to the continental-type weather is during the summer when the pressure systems slow down, and maritime air invasions persist over the area for longer periods of time. During the late summer and fall it is not unusual to receive fringe effects from the passage of tropical storms from the Carribean, the Atlantic Ocean, or the Gulf of Mexico. The prevailing winds are from the northeast about 8 miles per hour. Nighttime and early morning humidities are generally over 80 percent and in the evenings the humidity is in the 70's.

The summer temperatures are warm, characteristic of the South. On the average, there are 4 days with values of 100 or more. Summer is the rainiest season with 34 percent of the recorded annual rainfall. Except for rains which might occur in connection with tropical storms, the summer precipitation is in the form of showers. Annual precipitation averages 43.15 inches per year.

The fall season partakes of summer weather early in September, then passes through the "Indian Summer" period to the prewinter cold spells in late November. The "Indian Summer" period is the most pleasant time of year. During this period rainfall is at a minimum, sunshine is at a relative maximum, and temperature extremes are practically nonexistent. The jarring note in the fall is the relative frequency of hurricane warnings. Since September is the month of greatest hurricane activity in the Atlantic Ocean and the Gulf of Mexico, frequent warnings are issued along the coastline. The fall rainfall is 20 pecent of the annual total.

The winter season at Shaw is relatively mild. Cold outbreaks occur from time to time broken by longer periods of above freezing temperatures. On the average, there are about 46 days with a minimum of 32°F or below. Snowfall occasionally occurs during mid or late winter although it is unusual to have a sustained cover for a day or longer. Winter rainfall represents about 22 percent of the annual total.

Spring is marked by rapid changes from windy and cold days in March to generally warm and pleasant days in May. However, this is the time of the year when tornado alerts are most often issued. Several tornadoes have been observed in Sumter county, all during May. About 25 percent of the annual rainfall takes place in the spring. Shaw has an average growing season of 233 days.

Tyndall AFB, Florida

Tyndall AFB is located on a peninsula on the gulf coast 8 miles southeast of Panama City, Florida. East St. Andrew Bay, about 4 miles wide, separates the similarly sized peninsula from the mainland. Surrounding country is flat, marshy, and wooded. Panama City, the only large urban area, is on the mainland. Field elevation is 17 feet.

The relatively dry and sandy peninsula on which Tyndall lies inhibits ground fog. In winter, however, the cold river waters discharge into the bay and the cooled marshes aid in the generation of radiation/advection fog when moist marine air is drawn in. Air-mass thunderstorms build on the mainland north and east of Tyndall in summer. The annual precipitation of 55 inches is somewhat lower than

other stations on the gulf coast. The only local pollution source is a paper mill 5 miles northwest in Panama City.

Summers are long, warm, and relatively humid. Winters, although punctuated by periodic invasions of cold air, are mild. The moderating influence of the waters of the Gulf of Mexico on the daily maximum temperatures in the summer is quite strong. Refreshing sea breezes, although their influence diminishes rapidly inland, usually keep the summer maximums in the low 90's. Although summer daytime temperatures reach 90°F or higher with great regularity, temperatures of 100°F or higher are quite rare, averaging only about one per summer. Only 1 percent of the hourly temperatures in the four warmest months (June-September) are 92°F or above. Minimum temperatures in summer display little day-to-day variation and range mostly between 70°F and 75°F during June, July, and August. Winter temperatures display considerable day-to-day variation. Daily maximums in winter range mostly between the middle 70's to an occasional reading near 40°F. Daily minimums generally range between the low 30's and the low 50's. Below-freezing temperatures occur about 14 times per winter, and temperatures below 25°F occasionally occur from November through March. Even on the colder days, temperatures almost always rise above the freezing mark. Only 1 percent of the hourly temperatures in the coldest months (December-February) are 32°F or below. Freezing temperatures have been noted as early as November and as late as March.

Precipitation varies greatly for any one month from year to year. There are two maximum rainfall periods during the year, one in March and April and another from June through September. October is the driest month. The six wettest months account for nearly two-thirds of the annual rainfall in an average year. Summer rainfall comes mostly from short-duration afternoon or evening local showers or thundershowers which occur on about one-half of the summer days. Summer showers lower temperatures to comfortable levels very quickly. Thundershowers occur in all seasons, but the majority occur in summer. Day-long rains in summer are usually associated with tropical storms, which are infrequent. Precipitation during the fall, winter, and spring is usually associated with large-scale weather developments.

Tropical storms bring hazardous conditions to this area at irregular intervals. The chances for hurricane-force winds to be observed in any given year have been estimated to be about one in 12. Thunderstorms occasionally develop to severe proportions and may include one or more of the destructive elements such as hail, excessive rainfall, strong winds, or vivid lightning. Tornadic winds have been reported in the area, and waterspouts are sometimes seen over the Gulf of Mexico.

Prevailing winds are southerly in summer and northerly in winter. Wind speeds by day usually range between 10 and 20 miles per hour but nearly always drop below 10 miles per hour at night. Early morning humidities average 85-90 percent in all seasons. Early afternoon humidities average 60-70 percent and early evening humidities 70-80 percent. Heavy fog is observed 20-30 times per year, usually forming late at night and dissipating soon after sunrise. About three-fourths of the fogs are observed during the December through March period. Tyndall AFB receives considerable sunshine. Representative records taken at Pensacola indicate the sun shines about 60 percent of the time.

Whiteman AFB, Missouri

Whiteman AFB, 869 feet above sea level, is located in rolling terrain in western Missouri. Within a 50-mile radius, the elevation varies from 800 to 1400 feet. The terrain features do not significantly affect the weather. The only important source of industrial pollution is Kansas City, Missouri. When the surface winds are steady from 290 degrees, there will be a belt of smoke pollution about 20 miles wide, decreasing the visibility by 2 or 3 miles.

December, January, and February are the coldest months at Whiteman with an average low of 23°F to 26°F. Due to the rapid movement of systems, the daily temperature variations are often extreme during the winter months. The second night after a frontal passage is generally the coldest, except when an intense arctic push moves into the area and persists.

Extremely high temperatures occur during the summer when the Bermuda high builds from the south-southeast and persists over the area. June, July, and August are the warmest months. The average maximum for the warmest month, July, is 91°F.

Maximum precipitation occurs during August and September. This second maximum is a result of increased thunderstorm activity throughout these months. Average annual precipitation is 36.4 inches. The autumn and winter months show a decrease in the amount of precipitation. Snow, sleet, or freezing rain are observed nearly 50 percent of the time during the winter months. The average annual snowfall is 23 inches.

Wright-Patterson AFB, Ohio

Wright-Patterson AFB lies in the Miami River Valley 8 miles northeast of Dayton, Ohio. The wide valley floor is ringed in all directions by low hills (up to 500 feet higher) to over 10 miles away except southwest where the valley is open. Major land features of forecast interest are the Appalachian Mountains which are 200 miles east and the Great Lakes. The closest of the lakes, Lake Erie, is 110 miles northeast and Lake Michigan is 170 miles northwest. Local forecast problems arise from pollution and the nearby Mad River. The river flows along the west boundary of the base and is a moisture source. This moisture and the pollution from Dayton combine to give Wright-Patterson AFB an average of 174 days of fog per year.

Migrating cyclones pass both north and south of the base, and strongly contrasting air masses may present important forecasting problems. Northwesterly flow behind cold fronts on the leading edge of continental polar or continental arctic air will be accompanied by a modified lake effect. Associated stratocumulus ceilings and snow flurries are possibly aided by gentle upsloping terrain to the northwest of the base. These add little to the total snowfall. The greatest depth of snow on the ground was 16.4 inches. Continental air in summer is greatly modified but dry enough to limit air-mass thunderstorms, except when both vertical motion and moisture are present. Stagnant anticyclones and moderate pollution sources cause a significant deterioration of visibility.

Precipitation is evenly distributed throughout the year and averages 36.4 inches annually. The months of May and June experience the greatest amount of precipitation. Thunderstorms average 41 a year with the months of April through August having the highest percentage frequency of occurrence. The average date for the last freezing temperature is 19 April, with the range from 23 March to 10 May. The first freezing temperature in the fall generally occurs in October, with the range here being from 23 September to 25 November.

Wurtsmith AFB, Michigan

Wurtsmith AFB is located near the east-central Michigan coastline of Lake Huron, (west side) just northeast of Oscoda and Saginaw Bay. Terrain is mostly flat and rising slowly to the west about 1000 feet in 70 miles. Lake Huron moderately influences the local climate even though the prevailing wind does not blow from the direction of Lake Huron. Lakes Michigan and Superior also exert some influence. Field elevation is 634 feet. Wurtsmith is situated such that the cyclonically curved northwest flow passes over Lakes Michigan and Superior and occasionally adds additional winter precipitation. Annual snowfall is 58 inches, significantly more than stations to the south, but much less than stations which experience the full lake effect. Instability showers do occur off Lake Huron occasionally. In summer, the lake is a source of cooling breezes in the afternoon.

A slight downslope from the west may cause some divergence in the flow. Industrial pollution from Chicago and Detroit will reach the base in prolonged southerly and southwesterly flow. Occasionally haze will reduce visibility. Additional polution comes from local population centers to the south and southwest.

Annual precipitation averages 28.7 inches per year and is well-distributed throughout the year. Snow averages 58 inches per winter. The average annual temperature is 44.8°F. Maximum temperatures of 90°F or more occur on the average of 7 times per year during the months of June, July, August, and September. Minimum temperatures of 32°F and below occur on the average of 161 times per year during the months of November through April and have occurred as late as June and as early as September. Thunderstorms average 33 per year and have been recorded in every month except February. Fog is predominant throughout the year and occurs an average of 137 times per year.